Supporting Information for

Enantioselective Synthesis of Tunable Chiral Pyridine–Aminophosphine Ligands and Their Application in Asymmetric Hydrogenation

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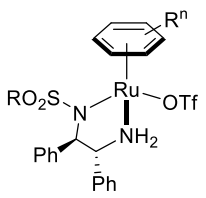
Contents

1. General information

Unless otherwise noted, all experiments were carried out under an atmosphere of nitrogen using standard Schlenk techniques or in a nitrogen-filled glovebox. ^{1}H NMR and ^{13}C NMR spectras were recorded on Bruker Model Avance DMX 300 Spectrometer (^{1}H 300 MHz and ^{13}C 75 MHz, respectively), Bruker Model Avance DMX 400 Spectrometer (^{1}H 400 MHz and ^{13}C 100 MHz, respectively) and Bruker Model Avance DMX 500 Spectrometer (^{1}H 500 MHz and ^{13}C 125 MHz, respectively). Chemical shifts (δ) were given in ppm and were referenced to residual solvent or TMS peaks. Optical rotations were measured with Rudolph Autopl VI polarimeter. High resolution mass spectras (P-ESI HRMS) were obtained on Thermo Fisher Q Exactive Mass Spectrometer. HPLC analyses were performed on a Varian Prostar 210 liqiud chromatograph. The single crystal X-ray analyses were measured with MM007HF Saturn724+ and XtaLAB Synergy-R. All organic solvents were dried using standard, published methods and were distilled before use. All other chemicals were used as received from Aldrich or Acros without further purification. The Ru-catalysts,[1] 2-(pyridin-2-yl) quinolines,[2] P,N-ligands and Ir-catalysts,[3] benzoazepines and benzodiazepines[6] were synthesized according to the modified literature methods.

2. Optimization of conditions for asymmetric hydrogenation

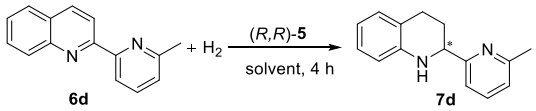
All ruthenium catalysts used for this study were prepared according to the reported methods.[1]



5a-i

(*R,R*)-**5a**: R^n-Ar = p-cymene; R = 4-$CH_3C_6H_4$;
(*R,R*)-**5b**: R^n-Ar = p-cymene; R = CH_3;
(*R,R*)-**5c**: R^n-Ar = p-cymene; R = C_6H_5;
(*R,R*)-**5d**: R^n-Ar = p-cymene; R = 2,4,6-triisopropylphenyl;
(*R,R*)-**5e**: R^n-Ar = p-cymene; R = CF_3;
(*R,R*)-**5f**: R^n-Ar = p-cymene; R = 4-$CF_3C_6H_4$;
(*R,R*)-**5g**: R^n-Ar = benzene; R^1= 4-$CH_3C_6H_4$;
(*R,R*)-**5h**: R^n-Ar = hexamethylbenzene; R = 4-$CH_3C_6H_4$;
(*R,R*)-**5i**: R^n-Ar = hexamethylbenzene; R = CH_3;

Table S1. Optimization of the reaction conditions for asymmetric hydrogenation of **6d**[a]



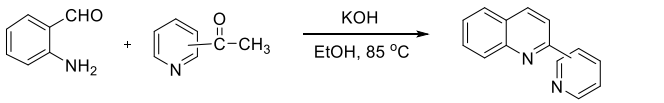
entry	catalyst	solvent	temp (°C)	H_2 (atm)	conv. (%)[b]	ee. (%)[c]
1	(*R,R*)-**5a**	toulene	25	50	70	52
2	(*R,R*)-**5a**	DCM	25	50	90	72
3	(*R,R*)-**5a**	THF	25	50	8	68
4	(*R,R*)-**5a**	MeOH	25	50	72	79
5	(*R,R*)-**5a**	EtOH	25	50	77	86
6	(*R,R*)-**5a**	*i*-PrOH	25	50	>99	87
7	(*R,R*)-**5a**	*n*-BuOH	25	50	65	87
8	(*R,R*)-**5h**	*i*-PrOH	25	30	86	97
9	(*R,R*)-**5h**	*i*-PrOH	25	10	50	95
10	(*R,R*)-**5h**	*i*-PrOH	50	50	>99	93

[a]Reaction conditions: substrate **6d** (0.2 mmol) in solvent (2.0 mL), Ru-catalyst **5** (2.0 mol %), H_2 (50 atm), stirred at 25 °C for 4 h. [b]The conversions were determined by ^{1}H NMR spectroscopy of the crude reaction mixtures. [c]The enantiomeric excesses were determined by HPLC with a chiral OB-H column.

3. General procedure for the synthesis of 2-(pyridin-2-yl)quinolines

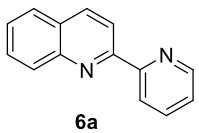
(1) Compounds: **6a-c**

The corresponding quinolines **6a-c** were synthesized according to the previously reported procedures.[2a-b]



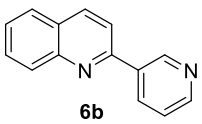
6a: 2-(pyridin-2-yl)quinoline
6b: 2-(pyridin-3-yl)quinoline
6c: 2-(pyridin-4-yl)quinoline

To a stirred solution of 2-aminobenzaldehyde (4.2 g, 0.035 mol) in EtOH (100 mL) at 25 °C was added acetylpyridine (5.0 g, 0.042 mol) and KOH (0.4 g, 0.007 mol). The reaction mixture was stirred at 85 °C for 3 h. After cooling to room tempreture, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum=1/8, *v*/*v*) to give yellow solids **2a-c**. The analytical data of the products are summarized below.



6a

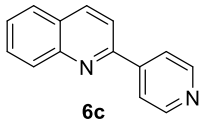
2-(pyridin-2-yl)quinoline (6a): (Known compound, see: R. Wang, H. Fan, W. Zhao and F. Li, *Org. Lett*. 2016, **18**, 3558); yellow solid, m.p. 98-100 °C, 72% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.75 (d, *J* = 3.0 Hz, 1H), 8.67 (d, *J* = 8.0 Hz, 1H), 8.57 (d, *J* = 8.5 Hz, 1H), 8.29 (d, *J* = 8.5 Hz, 1H), 8.19 (d, *J* = 8.0 Hz, 1H), 7.90-7.85 (m, 2H), 7.74 (t, *J* = 7.5 Hz, 1H), 7.56 (t, *J* = 7.5 Hz, 1H), 7.37 (t, *J* = 5.5 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 156.5, 156.3, 149.3, 148.0, 137.1, 136.9, 129.9, 129.7, 128.4, 127.7, 126.9, 124.2, 122.0, 119.1.



6b

2-(pyridin-3-yl)quinoline (6b): (Known compound, see: L.-Y. Xi, R.-Y. Zhang, L. Zhang, S.-Y. Chen and X.-Q. Yu, *Org. Biomol. Chem*. 2015, **13**, 3942); yellow solid, m.p. 65-67 °C, 65% yield; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 9.36 (d, *J* = 1.6 Hz, 1H), 8.70 (dd, J_1 = 4.4 Hz, J_2 = 1.2 Hz, 1H), 8.52-8.49 (m, 1H), 8.25 (d, *J* = 8.8 Hz, 1H), 8.17 (d, *J* = 8.4 Hz, 1H), 7.88-7.83 (m, 2H), 7.77-7.73 (m, 1H), 7.57-7.53 (m, 1H), 7.45 (dd, J_1 = 8.0 Hz, J_2 =

4.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 154.7, 150.3, 148.9, 148.5, 137.3, 135.2, 135.1, 130.1, 129.9, 127.7, 127.5, 126.9, 123.8, 118.6.

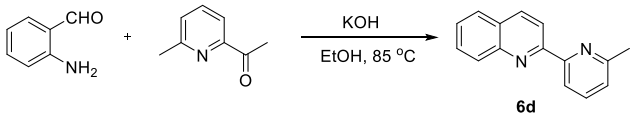


6c

2-(pyridin-4-yl)quinoline (6c): (Known compound, see: L.-Y. Xi, R.-Y. Zhang, L. Zhang, S.-Y. Chen and X.-Q. Yu, *Org. Biomol. Chem.* 2015, **13**, 3942); yellow solid, m.p. 96-98 °C, 82% yield; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.78 (d, J = 5.2 Hz, 2H), 8.28 (d, J = 8.4 Hz, 1H), 8.19 (d, J = 8.8 Hz, 1H), 8.06 (dd, J_1 = 4.4 Hz, J_2 = 1.6 Hz, 2H), 7.91-7.85 (m, 2H), 7.79-7.75 (m, 1H), 7.60-7.56 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 154.5, 150.6, 148.4, 146.7, 137.3, 130.2, 130.1, 127.9, 127.6, 127.3, 121.7, 118.5.

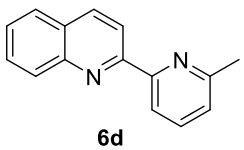
(2) Compound: **6d**

The corresponding 2-(pyridin-2-yl)quinoline **6d** was synthesized according to the previously reported procedure.[2c]



6d

To a stirred solution of 2-aminobenzaldehyde (0.7 g, 0.006 mol) in EtOH (50 mL) at 25 °C was added acetylpyridine (1.2 eq, 0.007 mol) and KOH (0.2 eq, 0.001 mol). The reaction mixture was stirred at 85 °C for 3 h. After cooling to room tempreture, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum=1/8, *v*/*v*) to give the yellow solid **6d**. The analytical data of the product are summarized below.



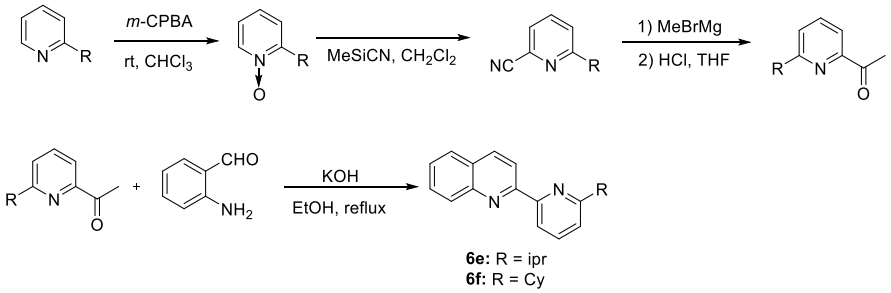
6d

2-(6-methylpyridin-2-yl)quinoline (6d): (Known compound, see: J. Uenishi, T. Tanaka, K. Nishiwaki, W. Wakabayashi, S. Oae and H. Tsukube, *J. Org. Chem.* 1993, **58**, 4382); yellow solid, m.p. 97-99 °C, 57% yield; ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm) 8.61 (d, J = 8.7 Hz, 1H), 8.46 (d, J = 7.8 Hz, 1H), 8.27 (d, J = 8.7 Hz, 1H), 8.19 (d, J = 8.4 Hz, 1H), 7.85 (d, J = 8.1 Hz, 1H), 7.79-7.70 (m, 2H), 7.57-7.52 (m, 1H), 7.23 (d, J = 7.5 Hz, 1H), 2.68 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ (ppm) 158.1, 156.6, 155.8, 148.0,

137.3, 136.9, 129.9, 129.6, 128.4, 127.7, 126.8, 123.7, 119.3, 119.0, 24.8.

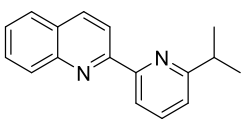
(3) Compounds: **6e-f**

The corresponding intermediates were synthesized according to the previously reported procedures.[2d-e]



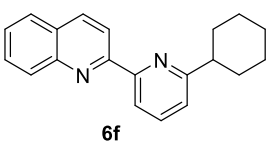
To a stirred solution of 2-substitued-pyridine in $CHCl_3$ (0.5 M) at 0 °C was added a solution of 3-chloroperoxybenzoic acid in $CHCl_3$ (1.5 eq). The resultant yellow solution was stirred at 0 °C for 10 min and stirred at room temperature for 3 h. Then, an aqueous solution of saturated sodium sulfite (50 mL) was added to quench the reaction, and then an aqueous solution of saturated sodium hydrogencarbonat (100 mL) was added to neutralize the reaction. The organic layer was removed, and the aqueous layer was extracted with EtOAc (3 × 20 mL). The extracts were combined, dried over Na_2SO_4, and evaporated under reduced pressure to yield the pyridine-1-oxide. And then to a stirred solution of pyridine-1-oxide in CH_2Cl_2 (0.5 M) at 25 °C, trimethylsilyl cyanide (1.3 eq) and dimethylcarbamyl chloride (1.3 eq) were added. The reaction was stirred at 25 °C for 12 h. Then, an aqueous solution of saturated sodium hydrogencarbonat (100 mL) was added to neutralize the reaction. The orgnic layer was removed, and the aqueous layer was extracted with EtOAc (3 × 20 mL). The extracts were combined, dried over Na_2SO_4, and evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to yield the corresponding cyanopyridine. And then to a stirred solution of cyanopyridine in dry THF (1.0 M) at -25 °C under nitrogen, a solution of 3.0 M methylmagnesium bromidein in diethyl ether (1.5 eq) were added. The reaction was stirred at -25 °C for 1 h and stirred at room temperature overnight until all of the cyanopyridine was consumed as indicated by TLC. Then, an aqueous

solution of hydrochloric acid (37%, 20 mL) at 0 °C was added to the reaction. The reaction mixture was stirred at 0 °C for 10 min and stirred at room temperature for 4 h, and then washed with aqueous solution of saturated sodium hydrogencarbonat. The orgnic layer was removed, and the aqueous layer was extracted with EtOAc (3 × 20 mL). The extracts were combined, dried over Na_2SO_4, and evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to yield the corresponding 2-acetylpyridine. And then to a stirred solution of 2-aminobenzyl aldehyde in EtOH (1.0 M) at 25 °C, 2-acetylpyridine (1.2 eq) and KOH (0.2 eq) were added. The reaction mixture was stirred at 85 °C for 3 h. After cooling to room tempreture, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to give yellow solids **6e-f**. The analytical data of the products are summarized below.



6e

2-(6-isopropylpyridin-2-yl)quinoline (6e): (New compoud); yellow solid, m.p. 49-50 °C, 65% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.69 (d, *J* = 8.5 Hz, 1H), 8.48 (d, *J* = 8.0 Hz, 1H), 8.26 (d, *J* = 8.5 Hz, 1H), 8.19 (d, J = 8.5 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.78 (t, *J* = 7.8 Hz, 1H), 7.73 (t, *J* = 7.5 Hz, 1H), 7.54 (t, *J* = 7.3 Hz, 1H), 7.24 (d, *J* = 7.5 Hz, 1H), 3.19 (sep, *J* = 6.8 Hz, 1H), 1.41 (d, *J* = 7.0 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.8, 157.0, 155.4, 148.0, 137.3, 136.7, 129.9, 129.5, 128.4, 127.7, 126.7, 121.2, 119.4, 119.1, 36.5, 22.8. HRMS-ESI exact mass calcd. for $C_{17}H_{17}N_2^+$ ($[M+H]^+$) requires m/z 249.13863, found m/z 249.13850.



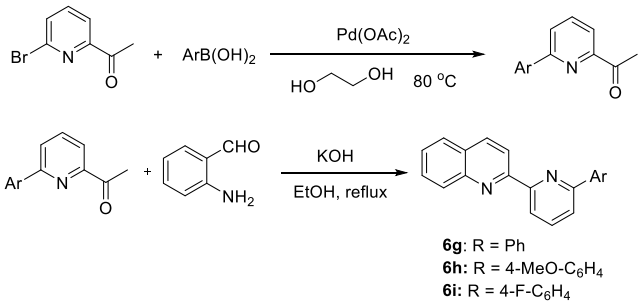
6f

2-(6-cyclohexylpyridin-2-yl)quinoline (6f): (New compoud); white solid, m.p. 37-38 °C, 53% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.67 (d, *J* = 8.5 Hz, 1H), 8.46 (d, *J* = 7.5 Hz, 1H), 8.26 (d, *J* = 8.5 Hz, 1H), 8.17 (d, *J* = 8.5 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 1H), 7.78 (t, *J* = 7.8 Hz, 1H), 7.72 (t, *J* = 7.5 Hz, 1H), 7.54 (t, *J* = 7.3 Hz, 1H), 7.21 (d, *J* = 8.0 Hz, 1H), 2.85-2.80 (m, 1H), 2.08-2.05 (m, 2H), 1.92-1.89 (m, 2H) , 1.81-1.79 (m, 1H),

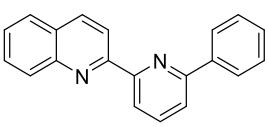
1.70-1.62 (m, 2H), 1.52-1.44 (m, 2H), 1.38-1.37 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.0, 157.0, 155.5, 148.1, 137.2, 136.7, 129.9, 129.5, 128.4, 127.7, 126.6, 121.5, 119.5, 119.1, 46.6, 33.1, 26.8, 26.4. HRMS-ESI exact mass calcd. for $C_{20}H_{21}N_2^+$ ([M+H]$^+$) requires m/z 289.16993, found m/z 289.16952.

(4) Compounds: **6g-j**

The corresponding intermediates were synthesized according to the previously reported procedures.[2f]



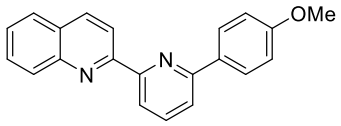
To a stirred solution of 2-acetyl-6-bromopyridine in ethylene glycol (0.5 M) at 25 °C was added corresponding boric acid (1.5 eq), palladiumdiacetate (0.5% eq) and tripotassium phosphate (2.0 eq). The reaction was stirred at 80 °C for 12 h. After cooling to room tempreture, the orgnic layer was extracted with EtOAc (10 × 50 mL). The extracts were combined, and evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to yield the corresponding 2-acetylpyridine. And to a stirred solution of 2-aminobenzyl aldehyde in EtOH (1.0 M) at 25 °C, 2-acetylpyridine (1.2 eq) and KOH (0.2 eq) were added. The reaction mixture was stirred at 85 °C for 3 h. After cooling to room tempreture, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to give yellow solids **6g-i**. The analytical data of the products are summarized below.



6g

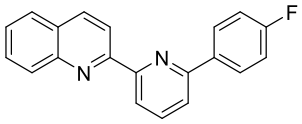
2-(6-phenylpyridin-2-yl)quinoline (6g): (Known compound, see: C. T. Carver and P. L. Diaconescu, *J. Am. Chem. Soc.* 2008, **130**, 7558); white solid, m.p. 121-123 °C, 40% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.82 (d, *J* = 8.5 Hz, 1H), 8.65 (d, *J* = 7.5 Hz, 1H),

8.31 (d, J = 8.5 Hz, 1H), 8.21 (d, J = 7.5 Hz, 3H), 7.95 (t, J = 7.8 Hz, 1H), 7.85 (dd, J_1 = 22.0 Hz, J_2 = 8.0 Hz, 2H), 7.75 (t, J = 7.5 Hz, 1H), 7.58-7.53 (m, 3H), 7.48-7.45 (m, 1H), ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 156.6, 156.4, 155.8, 147.8, 139.4, 137.9, 137.0, 129.8, 129.7, 129.2, 128.9, 128.5, 127.8, 127.1, 126.9, 120.8, 120.3, 119.4.



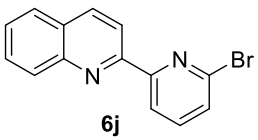
6h

2-(6-(4-methoxyphenyl)pyridin-2-yl)quinoline (6h): (New compoud); yellow solid, m.p. 122-123 °C, 72% yield; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.80 (d, J = 8.4 Hz, 1H), 8.59 (d, J = 7.6 Hz, 1H), 8.30 (d, J = 8.8 Hz, 1H), 8.21-8.15 (m, 3H), 7.92-7.86 (m, 2H), 7.77-7.72 (m, 2H), 7.58-7.54 (m, 1H), 7.06 (d, J = 8.8 Hz, 2H), 3.90 (s, 3H), ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 160.7, 156.6, 156.3, 155.9, 148.1, 137.8, 136.7, 132.2, 130.0, 129.6, 128.5, 128.4, 127.8, 126,8, 120.0, 119.5, 119.4, 114.3, 55.5. HRMS-ESI exact mass calcd. for $C_{21}H_{17}ON_2^+$ ($[M+H]^+$) requires m/z 313.13354, found m/z 313.13348.



6i

2-(6-(4-fluorophenyl)pyridin-2-yl)quinoline (6i): (New compoud); yellow solid, m.p. 135-137 °C, 78% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.77 (d, J = 9.0 Hz, 1H), 8.64 (d, J = 8.0 Hz, 1H), 8.30 (d, J = 8.5 Hz, 1H), 8.21-8.17 (m, 3H), 7.93 (t, J = 7.8 Hz, 1H), 7.87 (d, J = 8.0 Hz, 1H), 7.77-7.73 (m, 2H), 7.57 (t, J = 7.5 Hz, 1H), 7.21 (t, J = 8.5 Hz, 2H), ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 163.7 (d, $^1J_{FC}$ = 246.3 Hz), 156.4, 156.1, 155.5, 148.1, 137.9, 136.8, 135.6 (d, $^4J_{FC}$ = 2.5 Hz), 130.0, 129.7, 128.9 (d, $^3J_{FC}$ = 8.8 Hz), 128.5, 127.8, 126.9, 120.4, 120.1, 119.2, 115.8 (d, $^2J_{FC}$ = 22.5 Hz). HRMS-ESI exact mass calcd. for $C_{20}H_{14}FN_2^+$ ($[M+H]^+$) requires m/z 301.11355, found m/z 301.11362.



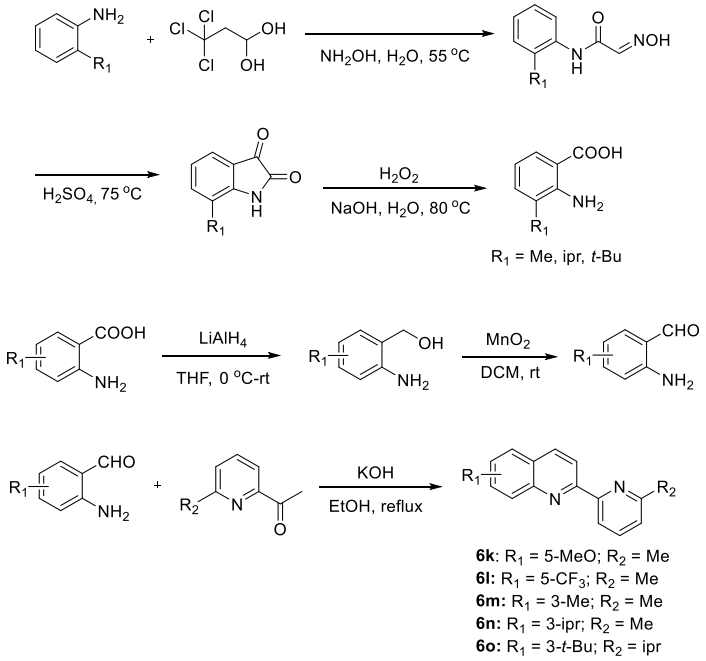
6j

2-(6-bromopyridin-2-yl)quinoline (6j): (New compoud); **6j** was synthesized according to the procedures as compound **6d**.[2c] yellow solid, m.p. 52-53 °C, 80% yield; ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm) 8.65 (dd, J_1 = 7.8 Hz, J_2 = 0.9 Hz, 1H), 8.56 (d, J = 8.7 Hz, 1H), 8.28 (d, J = 8.7 Hz,

1H), 8.15 (d, *J* = 8.4 Hz, 1H), 7.86 (d, *J* = 8.1 Hz, 1H), 7.77-7.70 (m, 2H), 7.59-7.53 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 157.5, 154.6, 147.8, 141.7, 139.3, 137.2, 129.9, 129.9, 128.6, 128.5, 127.8, 127.3, 120.7, 119.2. HRMS-ESI exact mass calcd. for $C_{14}H_{10}BrN_2^+$ ([M+H]$^+$) requires m/z 285.00219, found m/z 285.00235.

(5) Compounds: **6k-o**

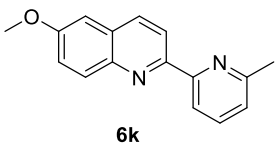
First, the corresponding 2-aminobenzoic acids were synthesized according to the previously reported procedures.[2g-h]



To a stirred solution of aniline in H_2O (0.1 M) at 25 °C, chloral hydrate solution (1.2 eq), hydroxylamine hydrochloride (3.6 eq), sodium sulfate (1.0 eq) and hydrochloric acid (12.5 mL) were added. The reaction was stirred at 55 °C for 12 h. After cooling to room tempreture, the reaction mixture was filtered, and the filter cake was wash with water (3 × 50 mL) to yield yellow soild. To the soild at 55 °C was added H_2SO_4 (45.0 mL, 18.4 M) dropwise during 0.5 h. Then, the reaction was stirred at 80 °C for 10 min. After cooling to room temperature and pouring into ice water for 30 min, the mixture was filtered. The obtained filter cake was wash with water (3 × 50 mL) to yield brown soild. To a stirred solution of brown soild in saturated sodium hydroxide at 80 °C was added H_2O_2 (33.0 mL, 15%) dropwise during 0.5 h. The reaction was stirred at 80 °C for 5 h. After cooling to room temperature and adding

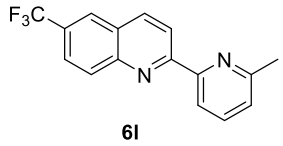
activated carbon, the reaction mixture was washed with aqueous solution of hydrochloric acid, filtered, and washed with EtOH. The organic layers were combined, and evaporated under reduced pressure to yield the corresponding 2-aminobenzoic acid.

To a stirred suspension of lithium aluminium hydride in dry THF (0.5 M, 1.5 eq) at 0 ºC under nitrogen was added a solution of 2-aminobenzoic acid (1.0 eq) in dry THF (1.0 M). The reaction was then stirred at 25 ºC for another 12 h. Then, sodium sulfate decahydrate (1.0 M) was added to quench the reaction, filtered with celite, and the filtrate was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to yield the corresponding 2-aminobenzyl alcohol. And to a stirred solution of 2-aminobenzyl alcohol in DCM (1.0 M) at 25 ºC was added manganese dioxide (5.0 eq). The reaction was stirred at 25 ºC for 12 h，filtered with celite, and the filtrate was evaporated under reduced pressure (< 25 ºC) to yield the corresponding 2-aminobenzyl aldehyde. And to a stirred solution of 2-aminobenzyl aldehyde in EtOH (1.0 M) at 25 ºC was added 2-acetylpyridine (1.2 eq) and KOH (0.2 eq). The reaction mixture was stirred at 85 ºC for 3 h. After cooling to room temperature, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to give yellow solids **6k-o**. The analytical data of the products are summarized below.



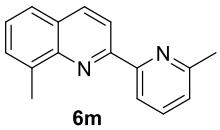
6k

6-methoxy-2-(6-methylpyridin-2-yl)quinoline (6k): (New compoud); white solid, m.p. 163-164 ºC, 58% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.63 (d, *J* = 9.0 Hz, 1H), 8.55 (d, *J* = 8.0 Hz, 1H), 8.23 (d, *J* = 8.5 Hz, 1H), 7.75 (t, *J* = 7.8 Hz, 1H), 7.68 (d, *J* = 8.0 Hz, 1H), 7.57 (d, *J* = 7.0 Hz, 1H), 7.43 (t, *J* = 7.5 Hz, 1H), 7.21 (d, *J* = 7.5 Hz, 1H), 2.92 (s, 3H), 2.68 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 157.9, 156.3, 155.1, 147.0, 137.8, 137.1, 137.0, 129.6, 128.3, 126.5, 125.7, 123.5, 118.9, 118.7, 24.8, 18.0. HRMS-ESI exact mass calcd. for $C_{16}H_{15}ON_2^+$ ($[M+H]^+$) requires m/z 251.11789, found m/z 251.11751.



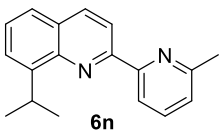
6l

2-(6-methylpyridin-2-yl)-6-(trifluoromethyl)quinoline (6l): (New compoud); white solid, m.p. 153-154 °C, 54% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.74 (d, *J* = 8.5 Hz, 1H), 8.48 (d, *J* = 8.0 Hz, 1H), 8.36 (d, *J* = 8.5 Hz, 1H), 8.28 (d, *J* = 9.0 Hz, 1H), 8.17 (s, 1H), 7.89 (dd, J_1 = 9.0 Hz, J_2 = 1.5 Hz, 1H), 7.79 (t, *J* = 7.8 Hz, 1H), 7.28-7.26 (m, 1H), 2.70 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 158.4, 158.2, 155.0, 149.0, 137.6, 131.0, 128.5 (q, $^{2}J_{FC}$ = 32.5 Hz), 127.3, 125.7 (q, $^{3}J_{FC}$ = 4.6 Hz), 125.3, 125.3, 124.4, 124.2 (q, $^{1}J_{FC}$ = 270.9 Hz), 120.6, 119.4, 24.7. HRMS-ESI exact mass calcd. for $C_{16}H_{12}F_3N_2^+$ ([M+H]$^+$) requires m/z 289.09471, found m/z 289.09460.



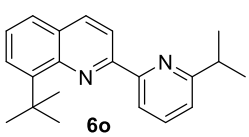
6m

8-methyl-2-(6-methylpyridin-2-yl)quinoline (6m): (New compoud); yellow solid, m.p. 64-66 °C, 48% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.63 (d, *J* = 9.0 Hz, 1H), 8.55 (d, *J* = 8.0 Hz, 1H), 8.23 (d, *J* = 8.5 Hz, 1H), 7.75 (t, *J* = 7.8 Hz, 1H), 7.68 (d, *J* = 8.0 Hz, 1H), 7.58 (d, *J* = 7.0 Hz, 1H), 7.43 (t, *J* = 7.5 Hz, 1H), 7.21 (d, *J* = 7.5 Hz, 1H), 2.92 (s, 3H), 2.68 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ(ppm) 157.9, 156.3, 155.1, 147.0, 137.8, 137.1, 137.0, 129.6, 128.3, 126.5, 125.7, 123.5, 118.9, 118.7, 24.8, 18.0. HRMS-ESI exact mass calcd. for $C_{16}H_{15}N_2^+$ ([M+H]$^+$) requires m/z 235.12298, found m/z 235.12282.



6n

8-isopropyl-2-(6-methylpyridin-2-yl)quinoline (6n): (New compoud); yellow oil, 32% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.61 (d, *J* = 8.5 Hz, 1H), 8.52 (d, *J* = 8.0 Hz, 1H), 8.18 (d, *J* = 8.5 Hz, 1H), 7.69 (t, *J* = 7.5 Hz, 1H), 7.62 (d, *J* = 7.5 Hz, 1H), 7.57 (d, *J* = 7.0 Hz, 1H), 7.45 (t, *J* = 7.5 Hz, 1H), 7.13 (d, *J* = 7.5 Hz, 1H), 4.51-4.46 (m, 1H), 2.64 (s, 3H), 1.45 (d, *J* = 7.0 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ(ppm) 157.7, 156.3, 154.8, 147.7, 145.7, 137.0, 128.4, 126.7, 125.4, 125.2, 123.4, 118.8, 118.5, 27.8, 24.8, 23.7. HRMS-ESI exact mass calcd. for $C_{18}H_{19}N_2^+$ ([M+H]$^+$) requires m/z 263.15428, found m/z 263.15404.

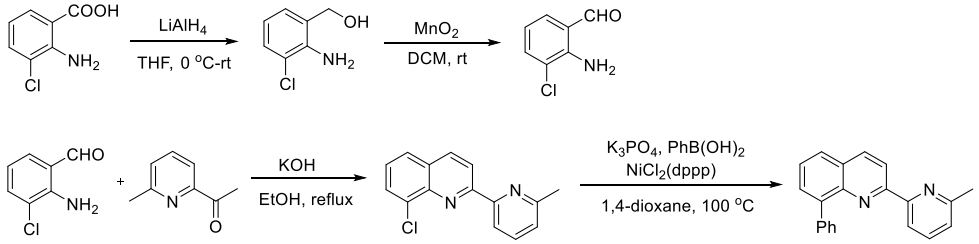


6o

8-(*t*-butyl)-2-(6-isopropylpyridin-2-yl)quinoline (6o): (New compoud); oil, 42% yield; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.72 (d, J = 8.8 Hz, 1H), 8.51 (dd, J_1 = 8.0 Hz, J_2 = 0.8 Hz, 1H), 8.24 (d, J = 8.8 Hz, 1H), 7.82 (t, J = 7.8 Hz, 1H), 7.72-7.69 (m, 2H), 7.46 (t, J = 7.8 Hz, 1H), 7.24 (d, J = 7.6 Hz, 1H), 3.25-3.16 (m, 1H), 1.80 (s, 9H), 1.44 (d, J = 7.2 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 166.6, 156.0, 153.9, 148.3, 146.7, 137.4, 137.3, 129.3, 126.7, 126.2, 126.2, 120.9, 119.0, 118.1, 36.8, 36.5, 31.5, 22.9. HRMS-ESI exact mass calcd. for $C_{21}H_{25}N_2^+$ ([M+H]$^+$) requires m/z 305.20123, found m/z 305.20084.

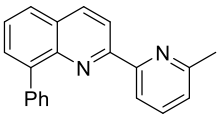
(6) Compound: **6p**

The corresponding intermediates were synthesized according to the previously reported procedures.[2i]



To a stirred suspension of lithium aluminium hydride in dry THF (0.5 M, 1.5 eq) at 0 °C under nitrogen was added a solution of 2-aminobenzoic acid (1.0 eq) in dry THF (1.0 M). The reaction was stirred at 25 °C for 12 h. Then, sodium sulfate decahydrate (1.0 M) was added to quench the reaction, filtered with celite, and the filtrate was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to yield the corresponding 2-aminobenzyl alcohol. And to a stirred solution of 2-aminobenzyl alcohol in DCM (1.0 M) at 25 °C was added manganese dioxide (5.0 eq). The reaction was stirred at 25 °C for 12 h，filtered with celite, and the filtrate was evaporated under reduced pressure (< 25 °C) to yield the corresponding 2-aminobenzyl aldehyde. And to a stirred solution of 2-aminobenzyl aldehyde in EtOH (1.0 M) at 25 °C was added

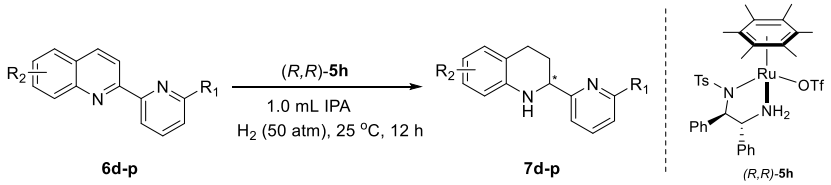
2-acetylpydine (1.2 eq) and KOH (0.2 eq). The reaction mixture was stirred at 85 ºC for 3 h. After cooling to room temperature, the mixture was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum) to give a yellow solid. To a stirred solution of yellow soild in 1,4-dioxane (0.1 M) at 25 ºC was added phenylboronic acid (2.0 eq), K_3PO_4 (3.0 eq) and $NiCl_2$(dppp) (1% eq). The reaction was stirred at 100 ºC for 12 h. After cooling to room temperature, the organic layer was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: ethyl acetate/petroleum = 1:50, *v*/*v*) to yield the white soild.



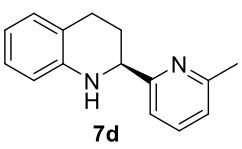
6p

2-(6-methylpyridin-2-yl)-8-phenylquinoline (6p): (New compoud); white solid, m.p. 105-107 ºC, 40% yield; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.70 (d, *J* = 8.8 Hz, 1H), 8.33-8.27 (m, 2H), 7.89-7.80 (m, 4H), 7.68-7.54 (m, 4H), 7.49-7.45 (m, 1H), 7.17 (d, *J* = 7.6 Hz, 1H), 2.67 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 157.7, 155.9, 155.8, 145.4, 140.9, 139.7, 137.2, 137.1, 131.3, 130.3, 128.8, 127.8, 127.4, 127.3, 126.6, 123.6, 119.1, 118.7, 24.8. HRMS-ESI exact mass calcd. for $C_{21}H_{17}N_2^+$ ($[M+H]^+$) requires m/z 297.13863, found m/z 297.13858.

4. General procedure for asymmetric hydrogenation

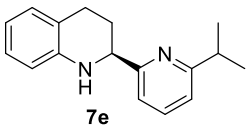


Typical procedure: A 30 mL glass-lined stainless-steel reactor equipped with a magnetic stirrer bar was charged with substrates **6** (0.2 mmol) and catalyst (*R,R*)-**5h** (0.004 mmol) in 2.0 mL IPA under N_2 atmosphere in a glove box. The autoclave was closed, and the final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The mixture was stirred at room temperature for 12 h. Then the hydrogen gas was carefully released and the conversions were determined by ^{1}H NMR. The reaction mixture was filtered through a short pad of silica eluted with EA and PE to give the isolated pure product. The enantiomeric excesses of the product were determined by HPLC with a chiral column.


7d

(*S*)-2-(6-methylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (7d): (New compoud); pale yellow oil, 92% yield, 98% ee; $[\alpha]_D^{20}$ = -104.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.57 (t, *J* = 7.8 Hz, 1H), 7.24 (d, *J* = 8.0 Hz, 1H), 7.06-6.98 (m, 3H), 6.66-6.61 (m, 2H), 4.57 (dd, J_1 = 8.8 Hz, J_2 = 3.6 Hz, 1H), 2.95-2.87 (m, 1H), 2.72-2.65 (m, 1H), 2.58 (s, 3H), 2.29-2.23 (m, 1H), 2.05-1.95 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 162.5, 157.8, 144.3, 137.3, 129.3, 127.1, 121.9, 121.2, 117.6, 117.3, 114.6, 56.9, 28.9, 26.1, 24.5. HRMS-ESI exact mass calcd. for $C_{15}H_{17}N_2^+$ ($[M+H]^+$) requires m/z 225.13863, found m/z 225.13826.

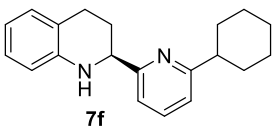
The enantiomeric excess was determined by HPLC on Chiralcel OB-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 10.6 min (minor), t_{R2} = 12.8 min (major).


7e

(*S*)-2-(6-isopropylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (7e): (New compoud); pale yellow oil, 90% yield, 97% ee;

$[\alpha]_D^{20}$ = -165.0 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.59 (t, *J* = 7.8 Hz, 1H), 7.21 (d, *J* = 8.0 Hz, 1H), 7.07-6.98 (m, 3H), 6.65-6.62 (m, 2H), 4.55 (dd, J_1 = 9.0 Hz, J_2 = 3.0 Hz, 1H), 3.09-3.06 (m, 1H), 2.96-2.89 (m, 1H), 2.73-2.68 (m, 1H), 2.29-2.25 (m, 1H), 2.00-1.95 (m, 1H), 1.31 (d, *J* = 7.0 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.8, 161.9, 144.5, 137.2, 129.3, 127.0, 121.3, 118.8, 117.8, 117.2, 114.6, 56.8, 36.4, 28.9, 26.4, 22.8. HRMS-ESI exact mass calcd. for $C_{17}H_{21}N_2^+$ ($[M+H]^+$) requires m/z 253.16993, found m/z 253.16977.

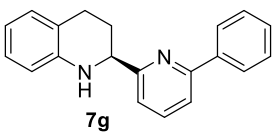
The enantiomeric excess was determined by HPLC on Chiralcel OB-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.5 min (minor), t_{R2} = 7.5 min (major).



7f

(*S*)-2-(6-cyclohexylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (7f): (New compoud); pale yellow oil, 91% yield, 96% ee; $[\alpha]_D^{20}$ = -124.8 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.59 (t, *J* = 7.8 Hz, 1H), 7.21 (d, *J* = 7.5 Hz, 1H), 7.05-6.98 (m, 3H), 6.66-6.62 (m, 2H), 4.65 (s, 1H), 4.56-4.54 (m, 1H), 2.95-2.89 (m, 1H), 2.73-2.68 (m, 2H), 2.29-2.24 (m, 1H), 2.01-1.94 (m, 3H), 1.87-1.84 (m, 2H), 1.77-1.75 (m, 1H), 1.54-1.39 (m, 4H), 1.32-1.25 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.0, 162.0, 144.5, 137.1, 129.3, 127.0, 121.3, 119.2, 117.8, 117.2, 114.6, 56.9, 46.6, 33.2, 33.1, 28.9, 26.7, 26.3. HRMS-ESI exact mass calcd. for $C_{20}H_{25}N_2^+$ ($[M+H]^+$) requires m/z 293.20123, found m/z 293.20093.

The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.5 min (minor), t_{R2} = 7.1 min (major).

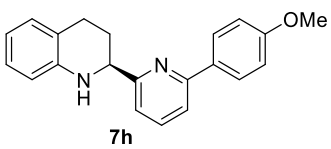


7g

(*S*)-2-(6-phenylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (7g): (New compoud); yellow oil, 90% yield, 96% ee; $[\alpha]_D^{20}$ = -159.0 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.02 (d, *J* = 7.5 Hz, 2H), 7.72 (t, *J* = 7.8 Hz, 1H), 7.62 (d, *J* = 8.0 Hz, 1H), 7.49-7.40 (m, 3H), 7.34 (d, *J* = 8.0 Hz, 1H), 7.05-7.00 (m, 2H), 6.67-6.64 (m, 2H),

4.72 (s, 1H), 4.66 (dd, J_1 = 9.0 Hz, J_2 = 3.5 Hz, 1H), 2.96-2.90 (m, 1H), 2.75-2.70 (m, 1H), 2.35-2.29 (m, 1H), 2.13-2.05 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 162.9, 156.7, 144.3, 139.5, 137.5, 129.4, 129.1, 128.9, 127.1, 121.3, 119.0, 118.9, 117.3, 114.6, 56.9, 28.7, 26.2. HRMS-ESI exact mass calcd. for $C_{20}H_{19}N_2^+$ ([M+H]$^+$) requires m/z 287.15428, found m/z 287.15387.

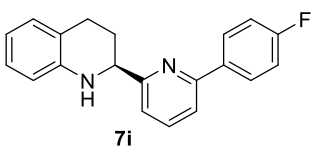
The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 23.7 min (minor), t_{R2} = 30.6 min (major).



7h

(*S*)-2-(6-(4-methoxyphenyl)pyridin-2-yl)-1,2,3,4-tetrah -ydroquinoline (7h): (New compoud); colorless oil, 83% yield, 96% ee; $[\alpha]_D^{20}$ = -104.8 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.99 (d, *J* = 9.0 Hz, 2H), 7.69 (t, *J* = 7.8 Hz, 1H), 7.56 (d, *J* = 7.5 Hz, 1H), 7.29 (d, *J* = 7.5 Hz, 1H), 7.05-6.99 (m, 4H), 6.67-6.64 (m, 2H), 4.64 (dd, J_1 = 9.0 Hz, J_2 = 3.5 Hz, 1H), 3.87 (s, 3H), 2.95-2.90 (m, 1H), 2.76-2.70 (m, 1H), 2.33-2.29 (m, 1H), 2.12-2.06 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.6, 160.6, 156.4, 144.4, 137.5, 132.1, 129.4, 128.4, 127.1, 121.4, 118.3, 118.2, 117.3, 114.6, 114.3, 56.9, 55.5, 28.7, 26.2. HRMS-ESI exact mass calcd. for $C_{21}H_{21}ON_2^+$ ([M+H]$^+$) requires m/z 317.16484, found m/z 317.16479.

The enantiomeric excess was determined by HPLC on Chiralcel OB-H column (hexane : isopropanol = 80 : 20, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 52.2 min (minor), t_{R2} = 91.4 min (major).

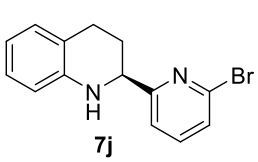


7i

(*S*)-2-(6-(4-fluorophenyl)pyridin-2-yl)-1,2,3,4-tetrahydro quinoline (7i): (New compoud); colorless oil, 93% yield, 97% ee; $[\alpha]_D^{20}$ = -127.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.03-7.99 (m, 2H), 7.73 (t, *J* = 7.8 Hz, 1H), 7.57 (d, *J* = 7.6 Hz, 1H), 7.35 (d, *J* = 7.6 Hz, 1H), 7.15 (t, *J* = 8.6 Hz, 2H), 7.06-6.99 (m, 2H), 6.68-6.65 (m, 2H), 4.66 (dd, J_1 = 8.8 Hz, J_2 = 3.6 Hz, 1H), 2.97-2.87 (m, 1H), 2.75-2.68 (m, 1H), 2.35-2.28 (m, 1H), 2.16-2.04 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 163.7 (d,

$^{1}J_{FC}$ = 247.0 Hz), 162.9, 155.7, 144.2, 137.7, 135.6, 129.4, 128.9 (d, $^{3}J_{FC}$ = 8.0 Hz), 127.1, 121.4, 119.1, 118.7, 117.5, 115.8 (d, $^{2}J_{FC}$ = 21.0 Hz), 114.7, 56.9, 28.7, 26.1. HRMS-ESI exact mass calcd. for $C_{20}H_{18}FN_2^+$ ([M+H]$^+$) requires m/z 305.14485, found m/z 305.14474.

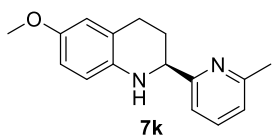
The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 25.2 min (major), t_{R2} = 43.9 min (minor).



7j

(*S*)-2-(6-bromopyridin-2-yl)-1,2,3,4-tetrahydroquinoline (7j): (New compoud); pale yellow oil, 52% yield, 95% ee; $[\alpha]_D^{20}$ = -108.5 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.53 (t, *J* = 7.8 Hz, 1H), 7.41-7.37 (m, 2H), 7.04 (t, *J* = 7.5 Hz, 1H), 6.99 (d, *J* = 7.0 Hz, 1H), 6.69 (t, *J* = 7.5 Hz, 1H), 6.65 (d, *J* = 8.0 Hz, 1H), 4.60 (dd, J_1 = 8.0 Hz, J_2 = 4.0 Hz, 1H), 2.90-2.84 (m, 1H), 2.67-2.61 (m, 1H), 2.28-2.22 (m, 1H), 2.10-2.03 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 165.3, 143.7, 141.7, 139.2, 129.4, 127.2, 126.6, 121.2, 119.5, 117.7, 114.6, 56.5, 28.5, 25.5. HRMS-ESI exact mass calcd. for $C_{14}H_{14}BrN_2^+$ ([M+H]$^+$) requires m/z 289.03349, found m/z 289.03323.

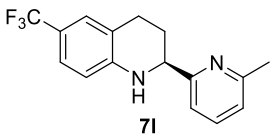
The enantiomeric excess was determined by HPLC on Chiralcel OB-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 23.4 min (minor), t_{R2} = 28.2 min (major).



7k

(*S*)-6-methoxy-2-(6-methylpyridin-2-yl)-1,2,3,4-tetrahydro q-uinoline (7k): (New compoud); pale yellow oil, 80% yield, 95% ee; $[\alpha]_D^{20}$ = -82.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.56 (t, *J* = 7.8 Hz, 1H), 7.24 (t, *J* = 7.5 Hz, 1H), 7.04 (d, *J* = 7.5 Hz, 1H), 6.66-6.58 (m, 3H), 4.48 (dd, J_1 = 9.3 Hz, J_2 = 2.8 Hz, 1H), 3.74 (s, 3H), 2.97-2.90 (m, 1H), 2.72-2.67 (m, 1H), 2.56 (s, 3H), 2.27-2.22 (m, 1H), 2.01-1.97 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.7, 157.8, 152.1, 138.5, 137.1, 122.6, 121.9, 117.5, 115.9, 114.7, 113.2, 57.4, 56.0, 29.3, 26.7, 24.6. HRMS-ESI exact mass calcd. for $C_{16}H_{19}ON_2^+$ ([M+H]$^+$) requires m/z 255.14919, found m/z 255.14882.

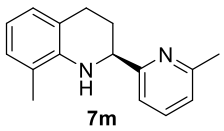
The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 15.8 min (minor), t_{R2} = 18.2 min (major).



7l

(*S*)-2-(6-methylpyridin-2-yl)-6-trifluoromethyl-1,2,3,4-tetra hydroquinoline (7l): (New compoud); colorless oil, 65% yield, 89% ee; $[\alpha]_D^{20}$ = -69.2 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.49 (t, *J* = 7.6 Hz, 1H), 7.18-7.14 (m, 2H), 7.08 (d, *J* = 8.0 Hz, 1H), 6.98 (d, *J* = 7.6 Hz, 1H), 6.54 (d, *J* = 8.0 Hz, 1H), 4.93 (s, 1H), 4.50 (d, *J* = 6.0 Hz, 1H), 2.87-2.79 (m, 1H), 2.67-2.61 (m, 1H), 2.49 (s, 3H), 2.24-2.15 (m, 1H), 1.96-1.87 (m, 1H), ^{13}C NMR (100 MHz, $CDCl_3$): δ(ppm) 161.4, 158.1, 147.0, 137.1, 126.4 (q, $^3J_{FC}$ = 3.7 Hz), 125.2 (q, $^1J_{FC}$ = 268.0 Hz), 124.3 (q, $^3J_{FC}$ = 4.0 Hz), 122.0, 121.8, 120.6, 118.5 (q, $^2J_{FC}$ = 32.3 Hz), 117.4, 113.6, 56.5, 28.1, 26.0, 24.6. HRMS-ESI exact mass calcd. for $C_{16}H_{16}N_2F_3^+$ ($[M+H]^+$) requires m/z 293.12601, found m/z 293.12570.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 9.9 min (major), t_{R2} = 11.4 min (minor).

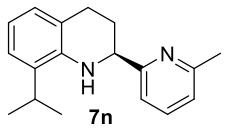


7m

(*S*)-8-methyl-2-(6-methylpyridin-2-yl)-1,2,3,4-tetrahydroquinol -ine (7m): (New compoud); pale yellow oil, 79% yield, 98% ee; $[\alpha]_D^{20}$ = -93.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.57 (t, *J* = 7.8 Hz, 1H), 7.25 (d, *J* = 7.0 Hz, 1H), 7.05 (d, *J* = 7.5 Hz, 1H), 6.94 (d, *J* = 7.0 Hz, 1H), 6.89 (d, *J* = 7.0 Hz, 1H), 6.60 (t, J_1 = 7.3 Hz, 1H), 4.60 (d, *J* = 7.0 Hz, 1H), 4.42 (s, 1H), 2.98-2.92 (m, 1H), 2.74-2.69 (m, 1H), 2.57 (s, 3H), 2.30-2.25 (m, 1H), 2.17 (s, 3H), 2.01-1.95 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.8, 157.8, 142.3, 137.2, 128.2, 127.2, 121.9, 121.6, 120.7, 117.5, 116.7, 57.3, 29.0, 26.5, 24.6, 17.4. HRMS-ESI exact mass calcd. for $C_{16}H_{19}N_2^+$ ($[M+H]^+$) requires m/z 239.15428, found m/z 239.15413.

The enantiomeric excess was determined by HPLC on Chiralcel AD-H column

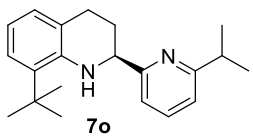
(hexane : isopropanol = 99 : 1, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 10.1 min (minor), t_{R2} = 11.1 min (major).



7n

(*S*)-8-isopropyl-2-(6-methylpyridin-2-yl)-1,2,3,4-tetrahydroqui-noline (7n): (New compoud); pale yellow oil, 83% yield, 86% ee; $[\alpha]_D^{20}$ = -190.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.57 (t, *J* = 7.5 Hz, 1H), 7.24-7.22 (m, 1H), 7.04 (t, *J* = 8.0 Hz, 2H), 6.88 (d, *J* = 7.0 Hz, 1H), 6.67 (t, *J* = 7.3 Hz, 1H), 4.68 (s, 1H), 4.60-4.59 (m, 1H), 3.00-2.90 (m, 2H), 2.75-2.70 (m, 1H), 2.57 (s, 3H), 2.28-2.25 (m, 1H), 1.98-1.90 (m, 1H), 1.30 (t, *J* = 7.3 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.8, 157.7, 141.0, 137.1, 131.8, 127.0, 123.1, 121.8, 121.1, 117.5, 116.9, 57.2, 28.9, 27.3, 26.9, 24.6, 22.4. HRMS-ESI exact mass calcd. for $C_{18}H_{23}N_2^+$ ($[M+H]^+$) requires m/z 267.18558, found m/z 267.18528.

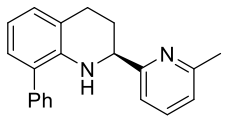
The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 4.5 min (major), t_{R2} = 5.0 min (minor).



7o

(*S*)-8-(*t*-butyl)-2-(6-isopropylpyridin-2-yl)-1,2,3,4-tetrahydro-quinoline (7o): (New compoud); pale yellow oil, 88% yield, 77% ee; $[\alpha]_D^{20}$ = -150.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.60 (t, *J* = 7.8 Hz, 1H), 7.19 (d, *J* = 7.6 Hz, 1H), 7.13 (d, *J* = 7.2 Hz, 1H), 7.06 (d, *J* = 7.6 Hz, 1H), 6.91 (d, *J* = 7.2 Hz, 1H), 6.60 (t, *J* = 7.6 Hz, 1H), 5.62 (s, 1H), 4.57 (d, *J* = 8.8 Hz, 1H), 3.11-3.03 (m, 2H), 2.87-2.81 (m, 1H), 2.37-2.31 (m, 1H), 1.91-1.82 (m, 1H), 1.50 (s, 9H), 1.32 (dd, J_1 = 7.0 Hz, J_2 = 1.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 166.4, 161.1, 142.6, 137.1, 132.9, 127.7, 124.4, 121.3, 119.0, 117.7, 116.1, 56.4, 36.5, 34.4, 30.0, 28.4, 22.8, 22.7. HRMS-ESI exact mass calcd. for $C_{21}H_{29}N_2^+$ ($[M+H]^+$) requires m/z 309.23253, found m/z 309.23193.

The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 99.5 : 0.5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 17.6 min (major), t_{R2} = 18.9 min (minor).



7p

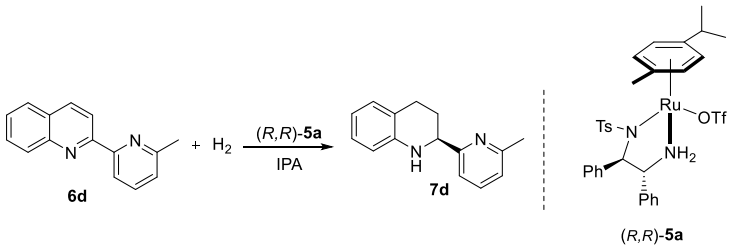
(*S*)-2-(6-methylpyridin-2-yl)-8-phenyl-1,2,3,4-tetrahydroquinol -ine (7p): (New compoud); pale yellow oil, 90% yield, 80% ee; $[\alpha]_D^{20}$ = -137.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.54-7.50 (m, 3H), 7.43 (t, *J* = 7.8 Hz, 2H), 7.31 (t, *J* = 7.5 Hz, 1H), 7.16 (d, *J* = 7.5 Hz, 1H), 7.01-6.99 (m, 3H), 6.71 (t, *J* = 7.3 Hz, 1H), 4.81 (s, 1H), 4.53 (d, *J* = 4.5 Hz, 1H), 2.98-2.92 (m, 1H), 2.76-2.71 (m, 1H), 2.51 (s, 3H), 2.30-2.24 (m, 1H), 2.06-1.99 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.9, 157.8, 141.1, 139.7, 137.1, 129.5, 128.9, 128.7, 128.4, 127.2, 126.8, 121.7, 121.1, 117.3, 116.6, 57.0, 28.7, 26.3, 24.5. HRMS-ESI exact mass calcd. for $C_{21}H_{21}N_2^+$ ($[M+H]^+$) requires m/z 301.16993, found m/z 301.17010.

The enantiomeric excess was determined by HPLC on Chiralcel AD-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 5.5 min (major), t_{R2} = 6.1 min (minor).

5. General procedure for the synthesis of P,N-ligands

(1) Gram-scale asymmetric hydrogenation

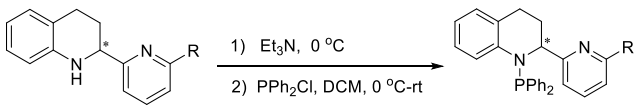
Table S2. Optimization of the reaction conditions for gram-scale asymmetric hydrogenation of **6d**[a]



entry	**6d** (mg/mmol)	solvent (mL)	time (h)	conv. (%)[b]	ee (%)[c]
1	11.5/0.05	0.5	4	96	89
2	110/0.5	5.0	4	96	88
3	110/0.5	2.5	4	>99	89
4	220/1.0	5.0	4	>99	89
5	330/1.5	5.0	4	>99	89
6	1100/5.0	5.0	12	>99	89
7	1320/6.0	5.0	12	>99	89
8	2200/10	6.0	24	>99	88
9	3300/15	6.0	48	>99	88

[a]Reaction conditions: substrate **6d** in IPA, Ru-catalyst **5a** (2.0 mol %), H_2 (50 atm), stirred at 25 °C. [b]The conversions were determined by ^{1}H NMR spectroscopy of the crude reaction mixtures. [c]The enantiomeric excesses were determined by HPLC with a chiral OB-H column.

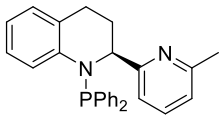
(2) The synthesis of P,N-ligands 4



To a stirred solution of tetrahydroquinoline (1.0 eq) in anhydrous DCM (0.5 M) at 0 °C under nitrogen was added anhydrous triethylamine (3.0 eq). After the reaction mixture was stirred at 0 °C for 1 h, chlorodiphenylphosphine (1.0 eq) was added. The

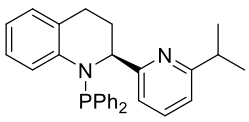
reaction mixture was stirred at 0 ºC for 1 h and stirred at room temperature overnight. Then, anhydrous basic aluminum oxide was added to the solution, and the solvent was evaporated under reduced pressure to provide the powder. The powder was eluted by anhydrous petroleum quickly to give the spumy solid. Then, recrystallization from anhydrous methanol yielded the corresponding white soild. The analytical data of the products **4d-g** are summarized below.

Determination of enantiomeric excess: The synthesized ligands were dissolved in DCM and hydrolyzed by adding dilute hydrochloric acid, affording chiral 1,2,3,4-tetrahydroquinolines which were used for the determination of enantiomeric excess.



4d

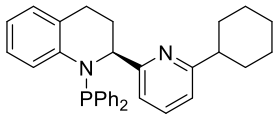
(*S*)-1-(diphenylphosphanyl)-2-(6-methylpyridin-2-yl)-1,2,3,4-te-trahydroquinoline (4d): (New compoud); white solid, m.p. 110-111 ºC, 60% yield, 99% ee; $[\alpha]_D^{20}$ = -72.4 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.08-8.05 (m, 1H), 7.44-7.31 (m, 7H), 7.17 (t, *J* = 7.8 Hz, 1H), 7.10-7.01 (m, 4H), 6.97 (d, *J* = 7.5 Hz, 1H), 6.78 (t, *J* = 7.5 Hz, 1H), 6.69 (d, *J* = 7.5 Hz, 1H), 6.61 (d, *J* = 7.0 Hz, 1H), 4.95 (s, 1H), 2.59-2.56 (m, 1H), 2.34 (s, 3H), 2.31-2.25 (m, 2H), 2.10-2.04 (m, 1H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 50.7 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 161.9, 156.9, 145.8 (d, $J_{C\text{-}P}$ = 22.5 Hz), 137.5 (d, $J_{C\text{-}P}$ = 16.3 Hz), 135.8, 135.6 (d, $J_{C\text{-}P}$ = 11.3 Hz), 134.4 (d, $J_{C\text{-}P}$ = 23.8 Hz), 131.2 (d, $J_{C\text{-}P}$ = 18.8 Hz), 130.0, 129.4, 128.6 (d, $J_{C\text{-}P}$ = 5.0 Hz), 127.9 (d, $J_{C\text{-}P}$ = 7.5 Hz), 127.0, 124.8 (d, $J_{C\text{-}P}$ = 3.8 Hz), 120.4, 118.9, 118.8, 117.5, 117.2, 61.0 (d, $J_{C\text{-}P}$ = 7.5 Hz), 27.3, 24.3, 23.5. HRMS-ESI exact mass calcd. for $C_{27}H_{26}N_2P^+$ ($[M+H]^+$) requires m/z 409.18281, found m/z 409.18286.



4e

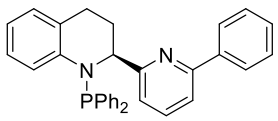
(*S*)-1-(diphenylphosphanyl)-2-(6-isopropylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (4e): (New compoud); white solid, m.p. 85-87 ºC, 58% yield, 99% ee; $[\alpha]_D^{20}$ = -116.8 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 8.06 (t, *J* = 7.8 Hz, 1H), 7.44-7.31 (m, 7H), 7.15 (t, *J* = 7.8 Hz, 1H), 7.11-7.05 (m, 2H), 7.00 (t, *J* = 7.0 Hz, 2H), 6.96 (d, *J* = 7.5

Hz, 1H), 6.77 (t, *J* = 7.5 Hz, 1H), 6.70 (d, *J* = 7.5 Hz, 1H), 6.59 (d, *J* = 7.5 Hz, 1H), 4.95 (s, 1H), 2.83 (sept, *J* = 6.8 Hz, 1H), 2.58-2.54 (m, 1H), 2.29-2.22 (m, 2H), 2.11-2.03 (m, 1H), 1.16 (d, *J* = 7.0 Hz, 3H), 1.15 (d, *J* = 7.0 Hz, 3H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 50.4 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.1, 161.5, 145.9 (d, J_{C-P} = 22.5 Hz), 137.7 (d, J_{C-P} = 16.3 Hz), 135.8, 135.6 (d, J_{C-P} = 12.5 Hz), 134.4 (d, J_{C-P} = 25.0 Hz), 131.2 (d, J_{C-P} = 18.8 Hz), 130.0, 129.5, 128.6 (d, J_{C-P} = 5.0 Hz), 127.9 (d, J_{C-P} = 8.8 Hz), 126.9, 126.9, 124.9 (d, J_{C-P} = 3.8 Hz), 119.0, 118.8, 117.4, 117.1, 61.0 (d, J_{C-P} = 6.3 Hz), 36.4, 27.4, 23.6, 22.7. HRMS-ESI exact mass calcd. for $C_{27}H_{30}N_2P^+$ ($[M+H]^+$) requires m/z 437.21411, found m/z 437.21396.



4f

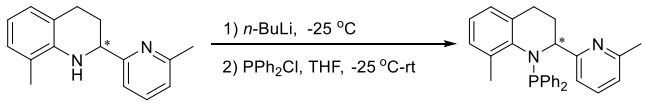
(*S*)-2-(6-cyclohexylpyridin-2-yl)-1-(diphenylphosphanyl)-1, 2,3,4-tetrahydroquinoline (4f): (New compoud); white solid, m.p. 92-93 °C, 63% yield, 99% ee; $[\alpha]_D^{20}$ = -60.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.99 (t, *J* = 7.6 Hz, 1H), 7.34-7.25 (m, 7H), 7.07 (t, *J* = 7.4 Hz, 1H), 7.01-6.86 (m, 5H), 6.68 (t, *J* = 7.0 Hz, 1H), 6.60 (d, *J* = 7.6 Hz, 1H), 6.50 (d, *J* = 7.2 Hz, 1H), 4.88 (s, 1H), 2.49-2.40 (m, 2H), 2.20-2.13 (m, 2H), 2.02-1.99 (m, 1H), 1.71-1.61 (m, 5H), 1.27-1.12 (m, 5H); ^{31}P NMR (162 MHz, $CDCl_3$): δ (ppm) 50.3 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 165.3, 161.5, 145.9 (d, J_{C-P} = 22.5 Hz), 137.7 (d, J_{C-P} = 16.3 Hz), 135.8, 135.6 (d, J_{C-P} = 11.3 Hz), 134.4 (d, J_{C-P} = 23.8 Hz), 131.2 (d, J_{C-P} = 18.8 Hz), 130.0, 129.5, 128.6 (d, J_{C-P} = 5.0 Hz), 127.9 (d, J_{C-P} = 7.5 Hz), 126.9, 124.9 (d, J_{C-P} = 3.8 Hz), 119.1, 118.8, 117.5, 117.4, 117.1, 61.0 (d, J_{C-P} = 6.3 Hz), 46.6, 33.1, 27.4, 26.7, 26.2, 23.6. HRMS-ESI exact mass calcd. for $C_{32}H_{34}N_2P^+$ ($[M+H]^+$) requires m/z 477.24541, found m/z 477.24521.



4g

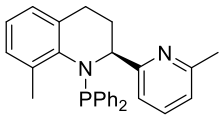
(*S*)-1-(diphenylphosphanyl)-2-(6-phenylpyridin-2-yl)-1,2,3, 4-tetrahydroquinoline (4g): (New compoud); white solid, m.p. 93-94 °C, 65% yield, 99% ee; $[\alpha]_D^{20}$ = -99.2 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 8.05 (t, *J* = 7.4 Hz, 1H), 7.82-7.80 (m, 2H), 7.46-7.35 (m, 10H), 7.29-7.16 (m, 3H), 7.05-6.96 (m, 4H), 6.81-6.74 (m, 2H), 5.05 (s, 1H), 2.61-2.56 (m, 1H), 2.43-2.28 (m, 2H), 2.10-2.02 (m, 1H); ^{31}P NMR (162

MHz, $CDCl_3$): δ (ppm) 51.8 (s); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 162.4, 156.2, 145.9 (d, J_{C-P} = 22.0 Hz), 139.8, 137.7 (d, J_{C-P} = 17.0 Hz), 136.2, 135.9 (d, J_{C-P} = 12.0 Hz), 134.1 (d, J_{C-P} = 23.0 Hz), 131.5 (d, J_{C-P} = 18.0 Hz), 130.0, 129.5, 128.7, 128.7, 128.6 (d, J_{C-P} = 5.0 Hz), 128.0 (d, J_{C-P} = 7.0 Hz), 127.0, 126.9, 125.1 (d, J_{C-P} = 4.0 Hz), 120.2, 119.1, 117.9, 117.7, 117.6, 61.1 (d, J_{C-P} = 6.0 Hz), 27.3, 23.6. HRMS-ESI exact mass calcd. for $C_{32}H_{28}N_2P^+$ ($[M+H]^+$) requires m/z 471.19846, found m/z 471.19861.



4m

To a stirred solution of tetrahydroquinoline (1.0 eq) in anhydrous THF (0.5 M) at -25 °C under nitrogen was added *n*-BuLi (1.2 eq). After the reaction mixture was stirred at -25 °C for 1 h, chlorodiphenylphosphine (1.0 eq) was added. The reaction mixture was stirred at -25 °C for 1 h and stirred at room temperature overnight. Then, anhydrous basic aluminum oxide was added to the solution and the solvent was evaporated under reduced pressure to provide the powder. The powder was eluted by anhydrous petroleum quickly to give the spumy solid. Then, recrystallization from anhydrous methanol yielded **4m** as a white soild. The analytical data of the product are summarized below.

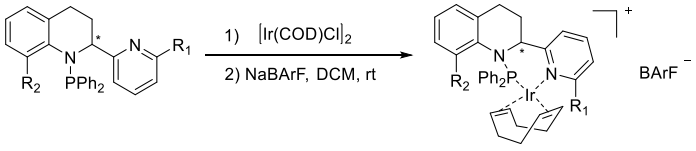


4m

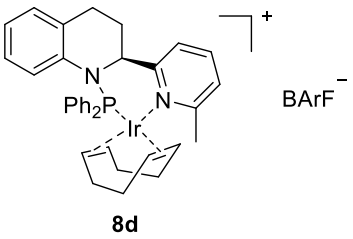
(*S*)-1-(diphenylphosphanyl)-8-methyl-2-(6-methylpyridin-2-yl)-1,2,3,4-tetrahydroquinoline (4m): (New compoud); white solid, m.p. 100-101 °C, 43% yield, 99% ee; $[\alpha]_D^{20}$ = -113.5 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.50 (t, *J* = 7.0 Hz, 2H), 7.45-7.33 (m, 6H), 7.24-7.19 (m, 3H), 7.12 (d, *J* = 7.5 Hz, 1H), 6.94 (d, *J* = 7.5 Hz, 1H), 6.90-6.86 (m, 2H), 6.74 (d, *J* = 7.0 Hz, 1H), 4.77 (s, 1H), 2.62 (s, 3H), 2.45 (s, 3H), 2.33-2.28 (m, 1H), 2.08-2.01 (m, 1H), 1.94-1.89 (m, 1H), 1.18-1.12 (m, 1H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 63.0 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 163.0, 157.5, 144.5 (d, J_{C-P} = 20.0 Hz), 138.1 (d, J_{C-P} = 18.8 Hz), 137.9 (d, J_{C-P} = 5.0 Hz), 136.7, 134.8 (d, J_{C-P} = 23.8 Hz), 131.2 (d, J_{C-P} = 5.0 Hz), 131.0 (d, J_{C-P} = 5.0 Hz), 130.8 (d,

$J_{C\text{-}P}$ = 18.8 Hz), 130.1, 129.7, 128.7 (d, $J_{C\text{-}P}$ = 6.3 Hz), 128.2 (d, $J_{C\text{-}P}$ = 5.0 Hz), 127.9, 126.8, 120.0 (d, $J_{C\text{-}P}$ = 2.5 Hz), 120.8, 118.4, 60.8 (d, $J_{C\text{-}P}$ = 8.8 Hz), 26.6, 24.7, 23.8, 20.5 (d, $J_{C\text{-}P}$ = 18.8 Hz). HRMS-ESI exact mass calcd. for $C_{28}H_{28}N_2P^+$ ($[M+H]^+$) requires m/z 423.19846, found m/z 423.19785.

6. General procedure for the synthesis of Ir-P,N-catalysts



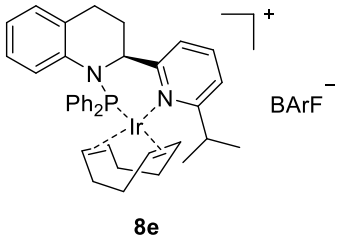
General procudure:[3] To a stirred solution of P,N-ligands (1.0 eq) in anhydrous DCM (0.5 M) at 25 °C under nitrogen was added $[Ir(COD)Cl]_2$ (0.5 eq). After the reaction mixture was stirred at 25 °C for 2 h, sodium tetrakis[3,5-bis(trifluoromethyl) phenyl]borate (1.5 eq) was added. The reaction mixture was stirred at room temperature for another 2 h. Then, the solvent was evaporated under reduced pressure. The residue was purified by silica gel column chromatography (eluent: DCM) to yield the red soild. The analytical data of the products are summarized below.



8d

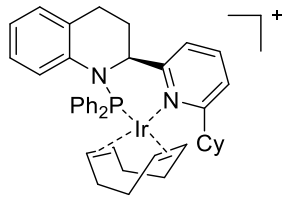
(*S*)-8d: (New compoud); red solid, m.p. 185-187 °C, 83% yield; $[\alpha]_D^{20}$ = -56.0 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, CD_2Cl_2): δ (ppm) 7.73 (s, 8H), 7.56 (s, 4H), 7.49-7.43 (m, 2H), 7.39-7.29 (m, 7H), 7.22-7.18 (m, 2H), 7.10-7.05 (m, 2H), 6.92-6.87 (m, 1H), 6.67 (t, *J* = 7.5 Hz, 1H), 6.48 (t, *J* = 7.8 Hz, 1H), 6.21 (d, *J* = 8.0 Hz, 1H), 5.02 (m, 1H), 4.13-4.07 (m, 2H), 3.36-3.35 (m, 1H), 3.07-2.99 (m, 2H), 2.86-2.84 (m, 1H), 2.60-2.42 (m, 4H), 2.37-2.27 (m, 5H), 2.20-2.04 (m, 2H), 1.73-1.55 (m, 2H); ^{31}P NMR (162 MHz, CD_2Cl_2): δ (ppm) 59.6 (s); ^{13}C NMR (125 MHz, CD_2Cl_2): δ (ppm) 162.2 (q, $^1J_{C\text{-}B}$= 49.2 Hz, 4C; BArF quat. C *ipso* to B), 161.1, 160.1, 140.3, 139.1 (d, $J_{C\text{-}P}$ = 5.0 Hz), 135.2 (br, $^2J_{C\text{-}B}$, $^3J_{C\text{-}F}$, 8C; BArF *ortho* CH), 132.3, 132.2 (d, $J_{C\text{-}P}$ = 2.5 Hz), 132.1 (d, $J_{C\text{-}P}$ = 11.3 Hz), 132.0 (d, $J_{C\text{-}P}$ = 2.5 Hz), 131.8, 131.4 (d, $J_{C\text{-}P}$ = 2.5 Hz), 130.5 (d, $J_{C\text{-}P}$

= 12.5 Hz), 129.3 (qq, $^{3}J_{C\text{-}B}$, $^{2}J_{C\text{-}F}$, 8C; BArF C *ipso* to CF_3), 128.3, 127.9, 126.6, 125.0 (q, $^{1}J_{C\text{-}F}$ = 270.8 Hz, 8C; BArF CF_3), 122.7, 122.6, 122.2, 120.9 (d, $J_{C\text{-}P}$ = 3.8 Hz), 119.6, 117.9 (sept, $^{3}J_{C\text{-}F}$ = 3.8 Hz, 4C; BArF *para* CH), 98.0 (d, $J_{C\text{-}P}$ = 10.0 Hz), 89.5 (d, $J_{C\text{-}P}$ = 13.8 Hz), 67.8 (d, $J_{C\text{-}P}$ = 13.8 Hz), 66.7, 64.4, 37.1 (d, $J_{C\text{-}P}$ = 2.5 Hz), 34.1, 31.0, 29.1, 28.0 (d, $J_{C\text{-}P}$ = 7.5 Hz), 27.7, 26.0 (d, $J_{C\text{-}P}$ = 18.8 Hz). FTMS-ESI exact mass calcd. for $C_{35}H_{37}IrN_2P^+$ ([M-BArF]$^+$) requires m/z 709.23181, found m/z 709.23151.



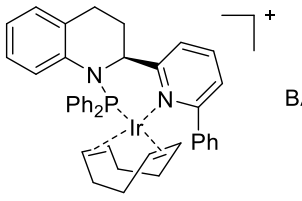
8e

(*S*)-8e: (New compoud); red solid, m.p. 150-152 °C, 85% yield; $[\alpha]_D^{20}$ = -35.2 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.59 (t, *J* = 7.8 Hz, 1H), 7.52 (s, 8H), 7.33 (s, 4H), 7.26 (d, *J* = 8.0 Hz, 1H), 7.22-7.17 (m, 3H), 7.14-7.07 (m, 4H), 7.00 (t, *J* = 8.0 Hz, 3H), 6.81 (d, *J* = 7.5 Hz, 1H), 6.69 (qui, *J* = 6.0 Hz, 1H), 6.46 (t, *J* = 7.5 Hz, 1H), 6.25 (t, *J* = 7.8 Hz, 1H), 5.91 (d, *J* = 8.0 Hz, 1H), 4.90 (m, 1H), 4.09 (m, 1H), 3.85-3.83 (m, 1H), 3.66 (qui, *J* = 6.7 Hz, 1H), 3.08 (m, 1H), 2.85-2.76 (m, 2H), 2.57-2.55 (m, 1H), 2.42-2.35 (m, 1H), 2.28-2.18 (m, 2H), 2.12-2.07 (m, 2H), 1.92-1.78 (m, 2H), 1.46-1.32(m, 3H), 1.14-1.07(m, 6H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 59.0 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 171.0, 161.8 (q, $^{1}J_{C\text{-}B}$= 49.6 Hz, 4C; BArF quat. C *ipso* to B), 159.0, 140.7, 138.9 (d, $J_{C\text{-}P}$ = 5.0 Hz), 134.9 (br, $^{2}J_{C\text{-}B}$, $^{3}J_{C\text{-}F}$, 8C; BArF *ortho* CH), 132.0 (d, $J_{C\text{-}P}$ = 2.5 Hz), 131.8 (d, $J_{C\text{-}P}$ = 10.0 Hz), 131.5 (d, $J_{C\text{-}P}$ = 2.5 Hz), 131.2, 130.9 (d, $J_{C\text{-}P}$ = 2.5 Hz), 130.8, 130.1 (d, $J_{C\text{-}P}$ = 12.5 Hz), 129.7 (d, $J_{C\text{-}P}$ = 10.0 Hz), 129.0 (qq, $^{3}J_{C\text{-}B}$, $^{2}J_{C\text{-}F}$, 8C; BArF C *ipso* to CF_3), 128.2, 126.6, 124.7 (q, $^{1}J_{C\text{-}F}$ = 270.8 Hz, 8C; BArF CF_3), 124.4, 123.0, 122.6, 120.8 (d, $J_{C\text{-}P}$ = 3.8 Hz), 119.5, 117.6 (sept, $^{3}J_{C\text{-}F}$ = 3.8 Hz, 4C; BArF *para* CH), 97.1 (d, $J_{C\text{-}P}$ = 8.8 Hz), 86.4 (d, $J_{C\text{-}P}$ = 16.3 Hz), 67.3, 66.8 (d, $J_{C\text{-}P}$ = 13.8 Hz), 65.1, 39.9, 37.7 (d, $J_{C\text{-}P}$ = 2.5 Hz), 34.9, 28.2, 27.9 (d, $J_{C\text{-}P}$ = 7.5 Hz), 27.7, 25.0 (d, $J_{C\text{-}P}$ = 2.5 Hz), 23.7, 22.4. FTMS-ESI exact mass calcd. for $C_{37}H_{41}IrN_2P^+$ ([M-BArF]$^+$) requires m/z 737.26311, found m/z 737.26355.



8f

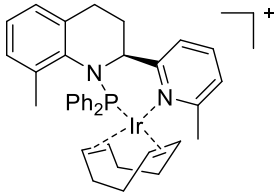
(*S*)-8f: (New compoud); red solid, m.p. 180-182 °C, 75% yield; $[\alpha]_D^{20}$ = -33.2 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.77-7.71 (m, 9H), 7.51 (m, 4H), 7.43 (t, *J* = 6.8 Hz, 1H), 7.38-7.37 (m, 3H), 7.31-7.24 (m, 4H), 7.22-7.18 (m, 2H), 7.13 (t, *J* = 7.0 Hz, 1H), 6.98 (t, *J* = 6.3 Hz, 1H), 6.87-6.82 (m, 1H), 6.66-6.61 (m, 1H), 6.45-6.41 (m, 1H), 6.11 (t, *J* = 7.0 Hz, 1H), 5.09 (m, 1H), 4.36 (m, 1H), 3.94-3.93 (m, 1H), 3.65-3.63 (m, 1H), 3.24 (m, 1H), 3.03-3.00 (m, 1H), 2.72 (m, 1H), 2.60-2.30 (m, 5H), 2.08-2.01 (m, 2H), 1.91 (m, 2H), 1.72-1.43 (m, 7H), 1.26-1.16 (m, 3H), 0.96-0.93 (m, 1H), 0.56-0.54 (m, 1H); ^{31}P NMR (162 MHz, $CDCl_3$): δ (ppm) 58.3 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 169.4, 161.9 (q, $^1J_{C\text{-}B}$= 49.2 Hz, 4C; BArF quat. C *ipso* to B), 159.2, 140.6, 138.9 (d, $J_{C\text{-}P}$ = 3.8 Hz), 135.0 (br, $^2J_{C\text{-}B}$, $^3J_{C\text{-}F}$, 8C; BArF *ortho* CH), 132.0, 131.8 (d, $J_{C\text{-}P}$ = 10.0 Hz), 131.4, 131.3, 131.0, 130.9, 130.1 (d, $J_{C\text{-}P}$ = 12.5 Hz), 129.6 (d, $J_{C\text{-}P}$ = 10.0 Hz), 128.9 (qq, $^3J_{C\text{-}B}$, $^2J_{C\text{-}F}$, 8C; BArF C *ipso* to CF_3), 128.2, 126.6, 125.0, 124.8 (q, $^1J_{C\text{-}F}$ = 282.1 Hz, 8C; BArF CF_3), 123.1, 122.6, 120.8, 119.4, 117.6 (sept, $^3J_{C\text{-}F,}$ 4C; BArF *para* CH), 97.1 (d, $J_{C\text{-}P}$ = 8.8 Hz), 86.0 (d, $J_{C\text{-}P}$ = 15.0 Hz), 67.6, 66.7 (d, $J_{C\text{-}P}$ = 13.8 Hz), 65.4, 53.6, 51.1, 38.3, 35.4, 34.0, 33.1, 29.9, 27.9 (d, $J_{C\text{-}P}$ = 12.5 Hz), 27.7 (d, $J_{C\text{-}P}$ = 16.3 Hz), 26.5, 25.5, 25.2. FTMS-ESI exact mass calcd. for $C_{40}H_{45}IrN_2P^+$ ([M-BArF]$^+$) requires m/z 777.29441, found m/z 777.29352.



8g

(*S*)-8g: (New compoud); red solid, m.p. 188-189 °C, 87% yield; $[\alpha]_D^{20}$ = -68.8 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.97-7.93 (m, 1H), 7.73-7.68 (m, 9H), 7.55-7.47 (m, 10H), 7.39-7.29 (m, 7H), 7.06 (d, *J* = 7.5 Hz, 2H), 6.99 (d, *J* = 7.5 Hz, 1H), 6.86-6.81 (m, 1H), 6.67 (t, *J* = 7.3 Hz, 1H), 6.51 (t, *J* = 7.8 Hz, 1H), 6.31 (d, *J* = 8.0 Hz, 1H), 4.63 (m, 1H), 4.16 (m, 1H), 3.41 (m, 1H), 3.06-2.98 (m, 2H), 2.79-2.62 (m, 3H), 2.39-2.26 (m, 2H), 2.10-1.89 (m, 4H), 1.26-1.25 (m, 1H), 1.12-1.11 (m, 1H), 0.97-0.93 (m, 1H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 58.8 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.3, 161.9 (q, $^1J_{C\text{-}B}$= 49.6 Hz, 4C; BArF quat. C *ipso* to B), 160.5, 140.4, 139.0 (d,

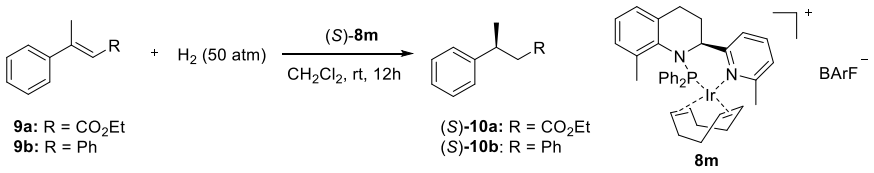
$J_{C\text{-}P}$ = 5.0 Hz), 138.6, 135.0 (br, $^{2}J_{C\text{-}B}$, $^{3}J_{C\text{-}F}$, 8C; BArF *ortho* CH), 133.9, 133.5, 132.1, 131.9 (d, $J_{C\text{-}P}$ = 10.0 Hz), 131.6, 131.4, 131.1, 129.9 (d, $J_{C\text{-}P}$ = 12.5 Hz), 129.7 (d, $J_{C\text{-}P}$ = 10.0 Hz), 129.0 (qq, $^{3}J_{C\text{-}B}$, $^{2}J_{C\text{-}F}$, 8C; BArF C *ipso* to CF_3), 128.2, 128.0,127.3, 126.7, 124.7 (q, $^{1}J_{C\text{-}F}$ = 270.8 Hz, 8C; BArF CF_3), 123.1, 122.8, 122.7, 121.0, 120.2, 117.6 (sept, $^{3}J_{C\text{-}F}$, 4C; BArF *para* CH), 94.0 (d, $J_{C\text{-}P}$ = 8.8 Hz), 85.7 (d, $J_{C\text{-}P}$ = 15.0 Hz), 67.3 (d, $J_{C\text{-}P}$ = 15.0 Hz), 66.8, 65.6, 36.2, 34.7, 29.9, 28.2 (d, $J_{C\text{-}P}$ = 8.8 Hz), 27.6, 24.5. FTMS-ESI exact mass calcd. for $C_{40}H_{39}IrN_2P^+$ ([M-BArF]$^+$) requires m/z 771.24746, found m/z 771.24725.



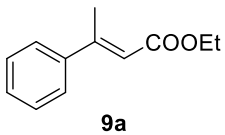
8m

(*S*)-8m: (New compoud); red solid, m.p. 192-193 °C, 84% yield; $[\alpha]_D^{20}$ = -44.8 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.72 (s, 8H), 7.52 (s, 4H), 7.35-7.25 (m, 8H), 7.14-6.97 (m, 6H), 6.84-6.81 (m, 1H), 6.48 (d, *J* = 7.0 Hz, 1H), 5.05 (m, 1H), 4.68-4.54 (m, 2H), 4.12 (m, 1H), 3.97-3.96 (m, 1H), 3.68-3.63 (m, 1H), 3.41-3.36 (m, 1H), 3.27 (m, 1H), 2.99-2.87 (m, 1H), 2.44-2.16 (m, 8H), 2.01-1.95 (m, 1H), 1.56 (m, 5H); ^{31}P NMR (202 MHz, $CDCl_3$): δ (ppm) 58.9 (s); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 162.0, 161.8 (q, $^{1}J_{C\text{-}B}$= 49.6 Hz, 4C; BArF quat. C *ipso* to B), 159.8, 142.4, 139.2, 135.0 (br, $^{2}J_{C\text{-}B}$, $^{3}J_{C\text{-}F}$, 8C; BArF *ortho* CH), 133.8, 133.2 (d, $J_{C\text{-}P}$ = 11.3 Hz), 132.8, 132.5, 132.2, 132.0, 131.0, 129.9 (d, $J_{C\text{-}P}$ = 12.5 Hz), 128.9 (qq, $^{3}J_{C\text{-}B}$, $^{2}J_{C\text{-}F}$, 8C; BArF C *ipso* to CF_3), 128.0 (d, $J_{C\text{-}P}$ = 11.3 Hz), 127.4 (d, $J_{C\text{-}P}$ = 20.0 Hz), 125.9, 125.1, 123.6 (q, $^{1}J_{C\text{-}F}$ = 270.6 Hz, 8C; BArF CF_3), 120.6, 120.2, 117.6 (sept, $^{3}J_{C\text{-}F}$, 4C; BArF *para* CH), 95.4 (d, $J_{C\text{-}P}$ = 10.0 Hz), 92.1 (d, $J_{C\text{-}P}$ = 13.8 Hz), 69.9 (d, $J_{C\text{-}P}$ = 7.5 Hz), 65.8, 59.2, 37.2 (d, $J_{C\text{-}P}$ = 32.5 Hz), 34.0, 29.9, 28.6, 28.3, 27.2, 24.8, 20.8. FTMS-ESI exact mass calcd. for $C_{36}H_{39}IrN_2P^+$ ([M-BArF]$^+$) requires m/z 723.24746, found m/z 723.24579.

7. General procedure for asymmetric hydrogenation of olefins

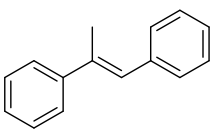


A 30 mL glass-lined stainless-steel reactor equipped with a magnetic stirrer bar was charged with Ir-catalyst (*S*)-**8m** (3.4 mg, 2.0 mol %) and substrate **6** (0.1 mmol) in DCM (1.0 mL) under nitrogen atmosphere in a glove box. The autoclave was closed, and the final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The reaction mixture was stirred at 25 °C for 12 h. Then the hydrogen gas was carefully released and the conversion was determined by ^{1}H NMR. The reaction mixture was filtered through a short pad of silica (petroleum/DCM, 2/1, *v*/*v*) to give the pure product. The enatiomeric excess of the product was determined by HPLC with a chiral column. The analytical data of the products are summarized below.

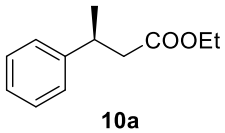


9a

Ethyl *trans*-beta-methylcinnamate (9a): (Known compound, see: A. Lightfoot, P. Schnider and A. Pfaltz, *Angew. Chem., Int. Ed.* 1998, **37**, 2897); colourless oil; ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm) 7.49-7.45 (m, 2H), 7.38-7.34 (m, 3H), 6.13 (m, 1H), 4.21 (q, *J* = 7.1 Hz, 2H), 2.57 (s, 3H), 1.31 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 166.9, 155.5, 142.3, 129.0, 128.5, 126.4, 117.3, 59.9, 18.0, 14.4.


9b

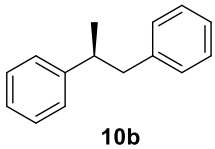
***E*-1,2-diphenylpropene (9b):** (Known compound, see: A. Lightfoot, P. Schnider and A. Pfaltz, *Angew. Chem., Int. Ed.* 1998, **37**, 2897); colourless oil; ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm) 7.54-7.52 (m, 2H), 7.40-7.35 (m, 6H), 7.31-7.21 (m, 2H), 6.84 (m, 1H), 2.29 (s, 3 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 144.1, 138.5, 137.6, 129.3, 128.5, 128.3, 127.8, 127.3, 126.6, 126.1, 17.6.



10a

Ethyl (*S*)-3-phenylbutanoate (10a): (Known compound, see: A. Lightfoot, P. Schnider and A. Pfaltz, *Angew. Chem., Int. Ed.* 1998, **37**, 2897); colourless oil, 94% yield, 99% ee; $[\alpha]_D^{20}$ = +40 (*c* = 0.25, $CHCl_3$), [Lit.[4] $[\alpha]_D^{20}$ = +9.3 (*c* = 1.43, $CHCl_3$), 82% ee for (*S*) enantiomer]; ^1H NMR (300 MHz, $CDCl_3$): δ (ppm) 7.31-7.20 (m, 5H), 4.06 (q, *J* = 7.2 Hz, 2H), 3.27 (q, *J* = 7.1 Hz, 1H),, 2.64-2.48 (m, 2H), 1.29 (d, *J* = 6.9 Hz, 3H), 1.16 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 172.4, 145.8, 128.5, 126.8, 126.4, 60.2, 43.0, 36.6, 21.8, 14.2.

The enantiomeric excess was determined by HPLC on Chiralcel OB-H column (hexane : isopropanol = 99.5 : 0.5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 7.4 min (minor), t_{R2} = 9.3 min (major).



10b

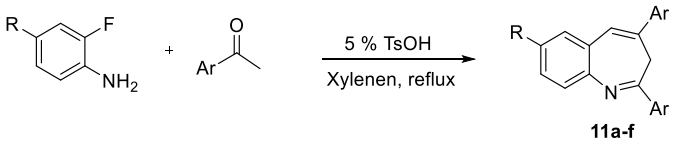
(*S*)-1,2-Diphenylpropane (10b): (Known compound, see: A. Lightfoot, P. Schnider and A. Pfaltz, *Angew. Chem., Int. Ed.* 1998, **37**, 2897); colourless oil, 95% yield, 99% ee; $[\alpha]_D^{20}$ = +37 (*c* = 0.25, $CHCl_3$), [Lit.[5] $[\alpha]_D^{23.5}$ = -80.5 (*c* = 2.07, $CHCl_3$), >99% ee for (*R*) enantiomer]; ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.27-7.13 (m, 7H), 7.07-7.06 (m, 2H), 3.01-2.91 (m, 2H), 2.77-2.73 (m, 1H), 1.23 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 147.1, 140.9, 129.3, 128.4, 128.2, 127.2, 126.1, 126.0, 45.2, 42.0, 21.3.

The enantiomeric excess was determined by HPLC on Chiralcel OJ-H column (hexane : isopropanol = 95 : 5, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 5.5 min (minor), t_{R2} = 8.5 min (major).

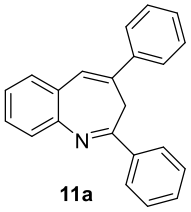
8. General procedure for the synthesis of benzoazepines and benzodiazepines

(1) The procedure for the synthesis of 2,4-diaryl-3*H*-benzo[*b*]azepines

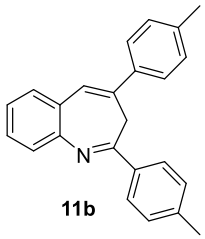
The corresponding substrates were synthesized according to the previously reported procedures.[6a]



A solution of of 2-fluoroaniline (6.0 mmol, 1.0 equiv), aryl methyl ketone (6.0 mmol, 1.0 equiv) and *p*-toluenesulfonic acid (0.05 g, 0.3 mmol, 0.05 equiv) in 30 mL of xylene was heated to reflux for 24 h. After cooling to room tempreture, the solution was washed with saturated $NaHCO_3$ solution, and dried over Na_2SO_4. Removal of the solvent under reduced pressure gave dark oil or solid, which was purified by crystallization using EtOH as solvent. The analytical data of the products are summarized below.

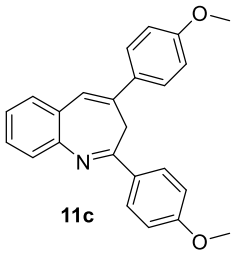


2,4-diphenyl-3*H*-benzo[*b*]azepine (**11a)**: (Known compound, see: K. Ramig, S. Alli, M. Cheng, M. Leung, R. Razi, M. Washington and L. Kudzma, *Synlett* 2007, **18**, 2868); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.89-7.87 (m, 2H), 7.60-7.59 (m, 1H), 7.55-7.54 (m, 2H), 7.48 (d, *J* = 8.0 Hz, 1H), 7.40-7.32 (m, 7H), 7.23-7.20 (m, 1H), 7.08 (s, 1H), 3.40 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 157.6, 146.8, 140.0, 138.2, 135.0, 130.7, 130.4, 129.7, 128.9, 128.7, 128.2, 128.1, 128.0, 127.1, 127.0, 126.9, 124.2, 34.0.



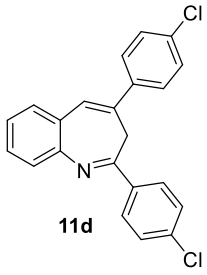
2,4-di-p-tolyl-3*H*-benzo[*b*]azepine (**11b)**: (Known compound, see: K. Ramig, S. Alli, M. Cheng, M. Leung, R. Razi, M. Washington and L. Kudzma, *Synlett* 2007, **18**, 2868); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.81-7.78 (m, 2H), 7.61-7.57 (m, 1H), 7.47-7.43 (m, 3H), 7.38-7.35 (m, 1H), 7.23-7.04 (m, 5H), 7.04 (s, 1H), 3.36 (s, 2H), 2.36 (s, 3H),

2.32 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 157.7, 146.5, 140.8, 137.9, 137.1, 135.0, 130.6, 129.9, 129.6, 129.4, 128.3, 128.2, 128.0, 127.0, 126.8, 126.2, 124.1, 33.8, 21.5, 21.3.



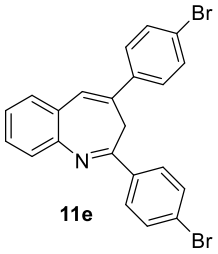
11c

2,4-bis(4-methoxyphenyl)-3*H*-benzo[*b*]azepine (**11c**): (Known compound, see: K. Ramig, S. Alli, M. Cheng, M. Leung, R. Razi, M. Washington and L. Kudzma, *Synlett* 2007, **18**, 2868); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.87-7.85 (m, 2H), 7.56-7.55 (m, 1H), 7.51-7.45 (m, 3H), 7.38-7.34 (m, 1H), 7.20-7.17 (m, 1H), 6.99 (s, 1H), 6.93-6.90 (m, 2H), 6.86-6.83 (m, 2H), 3.83 (s, 3H), 3.79 (s, 3H), 3.33 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 161.4, 159.5, 156.5, 146.9, 134.5, 132.7, 130.9, 130.6, 129.9, 128.2, 128.0, 126.8, 125.4, 123.7, 114.2, 114.0, 55.5, 33.8.



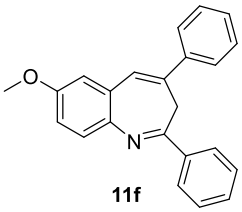
11d

2,4-bis(4-chlorophenyl)-3*H*-benzo[*b*]azepine (11d): (Known compound, see: K. Ramig, S. Alli, M. Cheng, M. Leung, R. Razi, M. Washington and L. Kudzma, *Synlett* 2007, **18**, 2868); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.86-7.85 (m, 2H), 7.74 (s, 1H), 7.61-7.26 (m, 9H), 7.10 (s, 1H), 3.40 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 142.5, 140.1, 137.7, 134.5, 133.5, 130.7, 130.1, 129.3, 128.8, 128.2, 127.9, 127.8, 127.7, 126.1, 33.9.



11e

2,4-bis(4-bromophenyl)-3*H*-benzo[*b*]azepine (11e): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.74-7.72 (m, 2H), 7.59-7.48 (m, 6H), 7.43-7.38 (m, 3H), 7.26-7.23 (m, 1H), 7.06-7.05 (m, 1H), 3.32 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 156.0, 146.5, 138.7, 136.7, 133.4, 132.2, 132.0, 130.7, 129.7, 129.4, 128.5, 128.1, 127.5, 127.5, 125.3, 124.5, 122.4, 33.6.

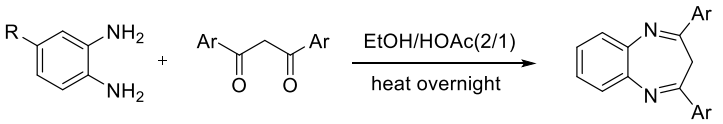


11f

7-methoxy-2,4-diphenyl-3*H*-benzo[*b*]azepine (**11f**): **(**Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.86-7.85 (m, 2H), 7.53-7.52 (m, 3H), 7.37-7.28 (m, 6H), 7.02-7.00 (m, 2H), 6.91 (s, 1H), 3.83 (s, 3H), 3.39 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 155.9, 141.3, 139.9, 138.5, 134.8, 130.7, 130.0, 129.9, 128.8, 128.6, 128.0, 127.9, 126.9, 126.7, 115.6, 112.5, 55.5, 33.8.

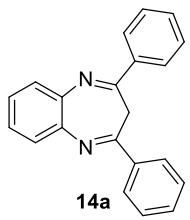
(2) The procedure for the synthesis of 2,4-diaryl-3*H*-benzodiazepines

The corresponding substrates were synthesized according to the previously reported procedures.[6b]



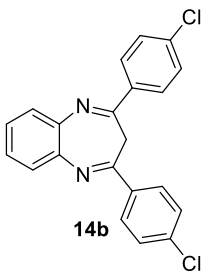
14a-f

2,4-Diaryl-substituted-3*H*-1,5-benzodiazepines **14a-f** were prepared according to the method previously reported in the literature. o-Phenylenediamine (5 mmol) and 1,3-diarypropane-1,3-dione (5 mmol) in a mixture of ethanol (5 mL) and acetic acid (2.5 mL) were heated overnight. The mixture was cooled, neutralized by NaOH and then recrystallized from ethanol. The analytical data of the products are summarized below.



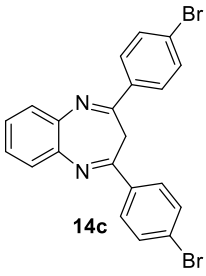
14a

2,4-diphenyl-3*H*-1,5-benzodiazepine (14a): (Known compound, see: I. L. Finar, *J. Chem. Soc.,* 1958, 4904); white solid, m.p. 156-159 °C, 65% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.98-7.96 (m, 4H), 7.64-7.60 (m, 2H), 7.44-7.39 (m, 6H), 7.37-7.33 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 154.3, 140.8, 137.4, 130.7, 128.9, 128.8, 128.2, 125.6, 35.1.



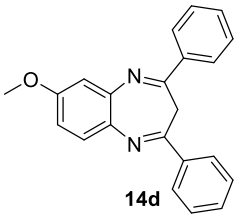
14b

2,4-bis(4-chlorophenyl)-3*H*-1,5-benzozepine (14b): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); white solid, m.p. 220-222 ^{o}C, 63% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.89-7.87 (m, 4H), 7.59-7.57 (m, 2H), 7.39-7.33 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 152.5, 140.6, 137.2, 135.6, 129.5, 129.1, 128.9, 125.9, 34.7.



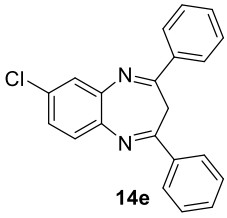
14c

2,4-bis(4-bromophenyl)-3*H*-1,5-benzozepine (14c): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); white solid, m.p. 223-225 ^{o}C, 84% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.83-7.81 (m, 4H), 7.59-7.55 (m, 6H), 7.37-7.35 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 152.6, 140.6, 136.1, 132.2, 129.8, 128.9, 126.0, 125.8, 34.6.



14d

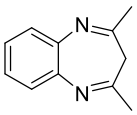
7-methoxy-2,4-diphenyl-3*H*-1,5-benzodiapine (14d): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); yellow solid, m.p. 169-172 ^{o}C, 78% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.97-7.96 (m, 4H), 7.55-7.53 (m, 1H), 7.43-7.40 (m, 6H), 7.09-7.07 (m, 1H), 7.00-6.97 (m, 1H); 3.90 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 157.1, 153.7, 151.8, 141.8, 137.6, 137.4, 135.1, 130.8, 130.5, 130.3, 128.9, 128.8, 128.3, 128.1, 115.1, 110.1, 55.7, 35.3.



14e

7-chloro-2,4-Diphenyl-3*H*-1,5-benzodiazepine (14e): (Known compound, see: M. Takahashi, T. Takada and T. Sakagami, *J. Heterocyclic Chem.* 1987, **24**, 797); white solid, m.p. 178-180 ^{o}C, 69% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.97-7.96 (m,

4H), 7.61 (d, J = 2.0 Hz, 1H), 7.53 (d, J = 8.5 Hz, 1H), 7.45-7.40 (m, 6H), 7.31-7.28 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 155.1, 154.5, 141.6, 139.4, 137.2, 137.0, 131.1, 131.0, 130.6, 130.2, 128.9, 128.4, 128.3, 128.2, 125.9, 35.3.

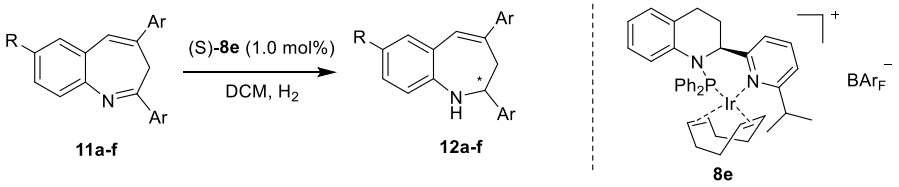


14f

2,4-dimethyl-3*H*-1,5-benzodiazepine (14f): (Known compound, see: I. L. Finar, *J. Chem. Soc.,* 1958, 4904); white solid, m.p. 146-147 °C, 79% yield; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.36-7.35 (m, 2H), 7.22-7.20 (m, 2H), 2.81 (s, 2H), 2.34 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 157.8, 140.4, 127.6, 125.0, 43.3, 27.8.

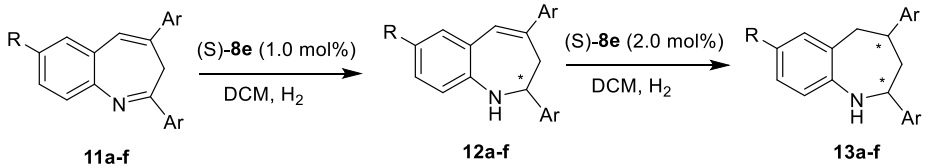
9. General procedure for asymmetric hydrogenation of cyclic imines

(1) Asymmetric hydrogenation of 2,4-diaryl-3*H*-benzo[*b*]azepines



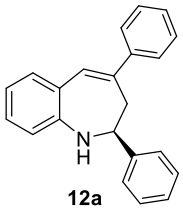
11a-f 12a-f 8e

For 12 a-f: A 30 mL glass-lined stainless-steel reactor equipped with a magnetic stirrer bar was charged with Ir-catalyst (*S*)-**8e** (3.4 mg, 1.0 mol %) and substrate **11** (0.2 mmol) in DCM (2 mL) under nitrogen atmosphere in a glove box. The autoclave was closed, and the final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The reaction mixture was stirred at 25 °C for 12 h. Then, the hydrogen gas was carefully released and the conversion was determined by ^{1}H NMR. The reaction mixture was filtered through a short pad of silica (petroleum/DCM, 2/1, *v*/*v*) to give the pure products. The enatiomeric excess of the product was determined by HPLC with a chiral column. The analytical data of the products are summarized below.



11a-f 12a-f 13a-f

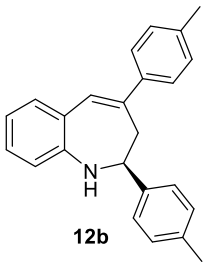
For 13a-f (one-pot and two-step): A 30 mL glass-lined stainless-steel reactor equipped with a magnetic stirrer bar was charged with Ir-catalyst (*S*)-**8e** (3.4 mg, 1.0 mol %) and substrate **11** (0.2 mmol) in DCM (2 mL) under nitrogen atmosphere in a glove box. The autoclave was closed, and the final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The reaction mixture was stirred at 25 °C for 12 h. Then, the hydrogen gas was carefully released, and another Ir-catalyst (*S*)-**8e** (6.8 mg, 2.0 mol %) in DCM (2 mL) was added. The final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The reaction mixture was stirred at 25 °C for 12 h. Then, the hydrogen gas was carefully released and the conversion was determined by ^{1}H NMR. The reaction mixture was filtered through a short pad of silica (petroleum/acetone, 45/1, *v*/*v*) to give the pure products. The enantiomeric excess of the product was determined by HPLC with a chiral column. The analytical data of the products are summarized below.



12a

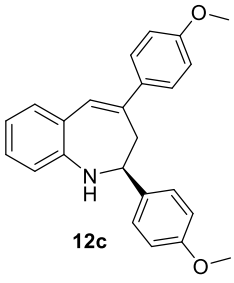
(*S*)-2,4-diphenyl-2,3-dihydro-1*H*-benzo[*b*]azepine (12a): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); white solid, 94% yield, 87% ee; $[\alpha]_D^{20}$ = -260.2 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.44-7.42 (m, 2H), 7.39-7.38 (m, 4H), 7.34-7.29 (m, 3H), 7.24-7.21 (m, 2H), 7.04-7.00 (m, 1H), 6.83-6.80 (m, 1H), 6.76 (d, *J* = 2.5 Hz, 1H), 6.61 (d, *J* = 7.5Hz, 1H), 4.40 (dd, J_1 = 9.5 Hz, J_2 = 1.5 Hz, 1H), 3.33-3.27 (m, 1H), 3.02 (dd, J_1 = 17.5 Hz, J_2 = 1.5 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 147.2, 144.7, 144.6, 139.0, 134.1, 129.2, 128.4, 128.0, 127.9, 127.0, 126.9, 126.2, 123.2, 119.6, 117.9, 59.7, 44.8.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.9 min (major), t_{R2} = 9.6 min (minor).



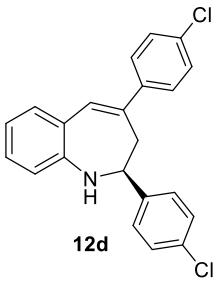
(*S*)-2,4-di-p-tolyl-2,3-dihydro-1*H*-benzo[*b*]azepine (12b): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); white solid, 91% yield, 90% ee; $[\alpha]_D^{20}$ = -213.0 (*c* = 1.0, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.33 (d, *J* = 8.5 Hz, 2H), 7.27 (d, *J* = 7.5 Hz, 2H), 7.21-7.16 (m, 3H), 7.11 (d, *J* = 7.5 Hz, 2H), 6.99 (t, *J* = 7.3 Hz, 1H), 6.79 (t, *J* = 7.3 Hz, 1H), 6.74 (d, *J* = 1.5 Hz, 1H), 6.57 (d, *J* = 8.0 Hz, 1H), 4.34 (d, *J* = 9.5 Hz, 1H), 3.29-3.23 (m, 1H), 3.00 (d, *J* = 17.5 Hz, 1H), 2.35 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 147.3, 141.9, 141.8, 138.9, 137.6, 136.7, 134.0, 129.8, 129.1, 128.5, 127.7, 126.7, 126.0, 123.3, 119.5, 117.8, 59.3, 44.9, 21.2, 21.2.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.1 min (major), t_{R2} = 12.3 min (minor).



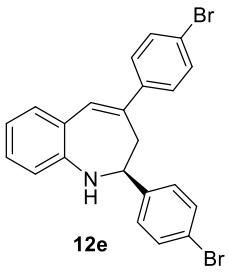
(*S*)-2,4-bis(4-methoxyphenyl)-2,3-dihydro-1*H*-benzo[*b*]azepine (12c): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); white solid, 90% yield, 95% ee; $[\alpha]_D^{20}$ = -237.6 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.39-7.37 (m, 2H), 7.33-7.30 (m, 2H), 7.25-7.21 (m, 2H), 7.03-7.00 (m, 1H), 6.93-6.91 (m, 2H), 6.87-6.81 (m, 3H), 6.70 (d, *J* = 2.0 Hz, 1H), 6.63 (d, *J* = 6.0 Hz, 1H), 4.37 (d, *J* = 9.0 Hz, 1H), 3.85-3.76 (m, 5H), 3.28-3.22 (m, 1H), 2.98 (d, *J* = 17.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 159.3, 158.8, 147.0, 138.6, 137.2, 137.0, 133.9, 128.0, 127.8, 127.6, 127.3, 123.6, 119.7, 118.0, 114.5, 113.8, 59.2, 55.5, 44.9, 29.9.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 12.1 min (major), t_{R2} = 40.1 min (minor).



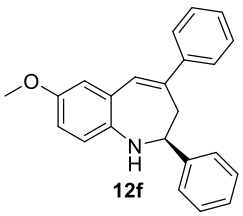
(*S*)-2,4-bis(4-chlorophenyl)-2,3-dihydro-1*H*-benzo[*b*]azepine (12d): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); yellow solid, 89% yield, 92% ee; $[\alpha]_D^{20}$ = -210.6 (*c* = 0.25, $CHCl_3$), [Lit.[7] $[\alpha]_D^{20}$ = -218.4 (c = 1.0, $CHCl_3$), 89% ee for (*S*) enantiomer]; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.37-7.21 (m, 9H), 7.06 (t, *J* = 7.6 Hz, 1H), 6.84 (t, *J* = 7.6 Hz, 1H), 6.73 (s, 1H), 6.65 (d, *J* = 7.6 Hz, 1H), 4.42 (d, *J* = 8.8 Hz, 1H), 3.27-3.20 (m, 1H), 2.94 (d, *J* = 16.8 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 147.1, 142.9, 137.3, 134.2, 133.8, 132.8, 129.7, 129.4, 129.2, 128.8, 128.5, 128.2, 128.2, 127.4, 122.9, 119.8, 118.0, 59.1, 44.4.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 8.5 min (major), t_{R2} = 13.2 min (minor).



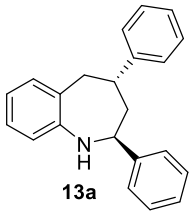
(*S*)-2,4-bis(4-bromophenyl)-2,3-dihydro-1*H*-benzo[*b*]azepine (12e): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); yellow solid, 55% yield, 88% ee; $[\alpha]_D^{20}$ = -207.6 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.47 (d, *J* = 8.4 Hz, 2H), 7.41-7.38 (m, 2H), 7.24-7.18 (m, 5H), 7.05-7.00 (m, 1H), 6.81 (t, *J* = 7.4 Hz, 1H), 6.71 (d, *J* = 1.6 Hz, 1H), 6.60 (d, *J* = 8.0 Hz, 1H), 4.35 (d, *J* = 8.0 Hz, 1H), 3.22-3.15 (m, 1H), 2.90 (dd, J_1 = 17.0 Hz, J_2 = 1.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 146.9, 143.3, 143.2, 137.2, 134.2, 132.2, 131.4, 129.7, 128.5, 128.2, 127.7, 122.8, 121.8, 120.9, 119.8, 118.0, 59.0, 44.1.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 9.4 min (major), t_{R2} = 14.9 min (minor).



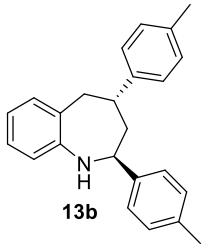
(*S*)-7-methoxy-2,4-diphenyl-2,3-dihydro-1*H*-benzo[*b*]azepine (12f): (Known compound, see: Z.-S. Yang, Z.-Y. Ding, F. Chen, Y.-M. He, N.-F. Yang and Q.-H. Fan, *Eur. J. Org. Chem.,* 2017, 1973); white solid, 65% yield, 90% ee; $[\alpha]_D^{20}$ = -278.0 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.44-7.43 (m, 2H), 7.38-7.37 (m, 4H), 7.32-7.29 (m, 3H), 7.22 (d, *J* = 7.5 Hz, 1H), 6.78 (d, *J* = 3.0 Hz, 1H), 6.71 (s, 1H), 6.66-6.63 (m, 1H), 6.55 (d, *J* = 8.5 Hz, 1H), 4.34 (d, *J* = 9.0 Hz, 1H), 3.75 (s, 3H), 3.31-3.25 (m, 1H), 2.99 (d, *J* = 17.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 153.4, 144.8, 144.5, 141.6, 140.0, 129.1, 128.8, 128.4, 127.9, 127.1, 126.8, 126.2, 124.6, 119.1, 117.8, 114.5, 60.4, 55.8, 45.0.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 7.7 min (major), t_{R2} = 8.5 min (minor).



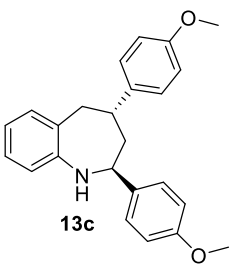
(2*S*,4*S*)-2,4-diphenyl-2,3,4,5-tetrahydro-1*H*-benzo[*b*]azepine (13a): (New compoud); white solid, m.p. 107-108 °C, 90% yield, dr = 11:1, 88% ee; $[\alpha]_D^{20}$ = +25.2 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.45-7.44 (m, 2H), 7.37-7.32 (m, 2H), 7.30-7.27 (m, 5H), 7.21-7.18 (m, 1H), 7.15 (d, *J* = 7.5 Hz, 1H), 7.09 (t, *J* = 7.5 Hz, 2H), 6.90 (t, *J* = 7.3 Hz, 1H), 6.77 (d, *J* = 7.5 Hz, 1H), 3.94 (d, *J* = 11.0 Hz, 1H), 3.78 (s, 1H), 3.29 (t, *J* = 12.5 Hz, 1H), 2.95 (d, *J* = 13.5 Hz, 1H), 2.80 (t, *J* = 11.5 Hz, 1H), 2.26-2.10 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 149.4, 148.0, 145.7, 132.9, 131.1, 129.0, 128.7, 127.8, 127.3, 126.8, 126.6, 125.3, 121.9, 120.4, 63.7, 49.1, 44.7, 43.2. HRMS-ESI exact mass calcd. for $C_{22}H_{22}N^+$ ($[M+H]^+$) requires m/z 300.17468, found m/z 300.17505.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 5.3 min (major), t_{R2} = 6.3 min (minor).



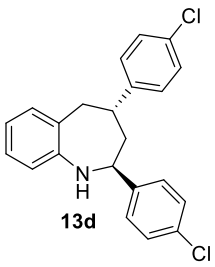
(2*S*,4*S*)-2,4-di-p-tolyl-2,3,4,5-tetrahydro-1*H*-benzo[*b*]azepine (13b): (New compoud); white solid, m.p. 127-129 °C, 93% yield, dr = 12:1, 90% ee; $[\alpha]_D^{20}$ = +31.6 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.32 (d, *J* = 8.0 Hz, 2H), 7.18-7.06 (m, 8H), 6.88 (t, *J* = 7.0 Hz, 1H), 6.74 (d, *J* = 7.0 Hz, 1H), 3.89 (d, *J* = 10.5 Hz, 1H), 3.72 (s, 1H), 3.25 (t, *J* = 12.5 Hz, 1H), 2.91 (d, *J* = 13.5 Hz, 1H), 2.76 (t, *J* = 11.5 Hz, 1H), 2.33 (s, 3H), 2.31 (s, 3H), 2.22-2.15 (m, 1H), 2.07 (d, *J* = 13.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 149.4, 145.1, 142.8, 137.4, 135.7, 133.0, 131.1, 129.5, 129.3, 127.2, 126.7, 126.5, 121.8, 120.4, 63.4, 49.0, 44.2, 43.4, 21.2, 21.1. HRMS-ESI exact mass calcd. for $C_{24}H_{26}N^+$ ($[M+H]^+$) requires m/z 328.20598, found m/z 328.20609.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 4.6 min (major), t_{R2} = 5.8 min (minor).



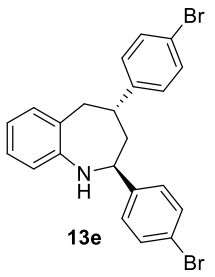
(*2S,4S*)-2,4-bis(4-methoxyphenyl)-2,3,4,5-tetrahydro-1*H*-benzo-[*b*]azepine (13c): (New compoud); white solid, m.p. 134-135 °C, 87% yield, dr = 16:1, 99% ee; $[\alpha]_D^{20}$ = +11.6 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.36 (d, *J* = 8.5 Hz, 2H), 7.23-7.20 (m, 2H), 7.13 (d, *J* = 7.5 Hz, 1H), 7.09 (t, *J* = 7.5 Hz, 1H), 6.88-6.84 (m, 5H), 6.77 (s, 1H), 3.89 (d, *J* = 11.0 Hz, 1H), 3.79 (s, 3H), 3.78 (s, 1H), 3.24 (s, 1H), 2.91 (d, *J* = 14.0 Hz, 1H), 2.75 (t, *J* = 11.5 Hz, 1H), 2.19 (d, *J* = 9.5 Hz, 1H), 2.07-2.04 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 159.1, 158.0, 149.4, 140.3, 138.1, 132.9, 131.1, 128.4, 127.7, 127.2, 121.8, 120.4, 114.2, 114.0, 63.1, 55.4, 55.4, 49.1, 43.8, 43.5. HRMS-ESI exact mass calcd. for $C_{24}H_{26}NO_2^+$ ($[M+H]^+$) requires m/z 360.19581, found m/z 360.19580.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 0.5 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 38.8 min (major), t_{R2} = 66.6 min (minor).



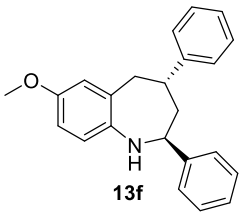
(*2S,4S*)-2,4-bis(4-chlorophenyl)-2,3,4,5-tetrahydro-1*H*-benzo[*b*] azepine (13d): (New compoud); white solid, m.p. 203-204 °C, 95% yield, dr = 20:1, 96% ee; $[\alpha]_D^{20}$ = +27.6 (*c* = 0.25, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.38-7.36 (m, 2H), 7.32-7.30 (m, 2H), 7.27-7.25 (m, 2H), 7.23-7.21 (m, 2H), 7.18-7.08 (m, 2H), 6.92 (t, *J* = 7.0 Hz, 1H), 6.78 (s, 1H), 3.90 (d, *J* = 11.6 Hz, 1H), 3.23 (t, *J* = 11.6 Hz, 1H), 2.88 (d, *J* = 14.0 Hz, 1H), 2.76 (t, *J* = 11.6 Hz, 1H), 2.16-2.13 (m, 1H), 2.02 (d, *J* = 12.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 149.0, 146.2, 143.9, 133.5, 132.5, 132.0, 131.2, 129.0, 128.8, 128.1, 127.9, 127.5, 122.1, 120.5, 62.9, 48.8, 44.0, 43.0. HRMS-ESI exact mass calcd. for $C_{22}H_{20}NCl_2^+$ ($[M+H]^+$) requires m/z 368.09673, found m/z 368.09700.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.9 min (major), t_{R2} = 9.6 min (minor).



(*2S,4S*)-2,4-bis(4-bromophenyl)-2,3,4,5-tetrahydro-1*H*-benzo[*b*] azepine (13e): (New compoud); white solid, m.p. 204-205 °C, 92% yield, dr = 5:1, 90% ee; $[\alpha]_D^{20}$ = +25.6 (*c* = 0.25, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.46-7.45 (m, 2H), 7.35-7.26 (m, 8H), 7.21-7.11 (m, 3H), 6.92 (s, 1H), 6.79 (s, 1H), 3.96 (d, *J* = 10.0 Hz, 1H), 3.80 (s, 1H), 3.30 (s, 1H), 2.95 (d, *J* = 13.5 Hz, 1H), 2.84-2.79 (m, 1H), 2.23 (s, 1H), 2.12 (d, *J* = 13.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 149.0, 146.7, 144.4, 132.1, 131.8, 131.2, 129.1, 128.6, 128.3, 127.5, 122.1, 121.7, 120.6, 120.1, 63.0, 48.7, 44.0, 42.9. HRMS-ESI exact mass calcd. for $C_{22}H_{19}NBr_2^+$ ($[M+H]^+$) requires m/z 455.99570, found m/z 455.99600.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 7.4 min (major), t_{R2} = 10.0 min (minor).

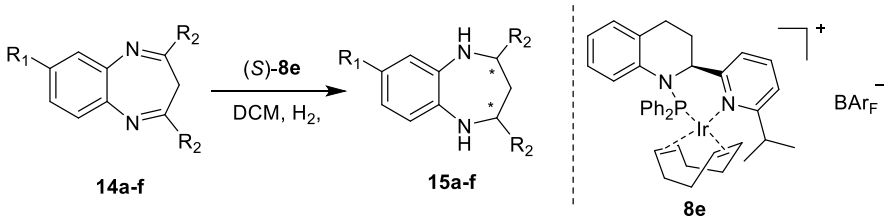


13f

(*2S,4S*)-7-methoxy-2,4-diphenyl-2,3,4,5-tetrahydro-1*H*-benzo-[*b*]azepi-ne (13f): (New compoud); yellow solid, m.p. 119-120 ^{o}C, 60% yield, dr = 11:1, 83% ee; $[\alpha]_D^{20}$ = +17.6 (*c* = 0.25, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.44-7.42 (m, 2H), 7.39-7.25 (m, 7H), 7.20-7.17 (m, 1H), 6.73-6.70 (m, 2H), 6.65-6.63 (m, 1H), 3.87 (d, *J* = 11.0 Hz, 1H), 3.74 (s, 3H), 3.33 (t, *J* = 12.0 Hz, 1H), 2.86 (d, *J* = 13.5 Hz, 1H), 2.79 (t, *J* = 10.5 Hz, 1H), 2.24-2.17 (m, 1H), 2.09 (d, *J* = 13.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 154.8, 148.0, 145.7, 142.8, 134.6, 128.9, 128.7, 127.7, 126.8, 126.5, 126.3, 121.3, 116.5, 112.0, 64.1, 55.6, 49.3, 44.7, 43.0. HRMS-ESI exact mass calcd. for $C_{23}H_{24}NO^+$ ($[M+H]^+$) requires m/z 330.18524, found m/z 330.18550.

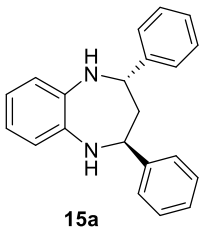
The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 90 : 10, flowing rate = 0.5 mL/min, 25 ^{o}C, UV detection at λ = 254 nm), t_{R1} = 25.0 min (major), t_{R2} = 28.2 min (minor).

(2) Asymmetric hydrogenation of 2,4-diaryl-3*H*-benzodiazepines



14a-f 15a-f 8e

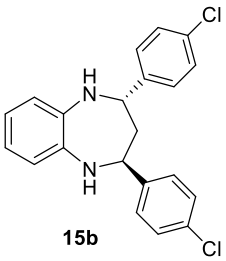
A 30 mL glass-lined stainless-steel reactor equipped with a magnetic stirrer bar was charged with Ir-catalyst (*S*)-**8e** (13.6 mg, 4.0 mol %) and substrate **14** (0.2 mmol) in DCM (2 mL) under nitrogen atmosphere in a glove box. The autoclave was closed, and the final pressure of the hydrogen gas was adjusted to 50 atm after purging the autoclave with hydrogen gas several times. The reaction mixture was stirred at 25 ^{o}C for 12 h. Then the hydrogen gas was carefully released and the conversion was determined by ^{1}H NMR. The reaction mixture was filtered through a short pad of silica (petroleum/DCM, 2/1, *v*/*v*) to give the pure products. The enatiomeric excess of the product was determined by HPLC with a chiral column. The analytical data of the product are summarized below.



15a

(2*S*,4*S*)-2,4-diphenyl-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15a): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); yellow solid, m.p. 137-141 °C, 95% yield, dr = 16:1, 99% ee; $[\alpha]_D^{20}$ = -127.6 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -136.5 (*c* = 1.0, $CHCl_3$), 99% ee for (*S*,*S*) enantiomer]; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 7.42 (d, *J* = 7.0 Hz, 4H), 7.33 (t, *J* = 7.5 Hz, 4H), 7.28-7.25 (m, 2H), 6.68-6.65 (m, 2H), 6.55-6.52 (m, 2H), 5.06 (t, *J* = 7.3 Hz, 2H), 3.44 (s, 2H), 2.29 (t, *J* = 7.5 Hz, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ (ppm) 144.1, 138.2, 128.9, 127.7, 126.9, 120.7, 118.8, 59.1, 45.6.

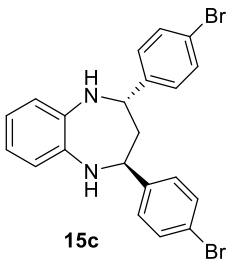
The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 75 : 25, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.5 min (major), t_{R2} = 15.2 min (minor).



15b

(2*S*,4*S*)-2,4-bis(4-chlorophenyl)-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15b): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); yellow solid, m.p. 172-176 °C, 92% yield, dr = 10:1, 97% ee; $[\alpha]_D^{20}$ = -105.0 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -109.8 (*c* = 1.0, $CHCl_3$), >99% ee for (*S*,*S*) enantiomer]; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.36-7.29 (m, 8H), 6.71-6.68 (m, 2H), 6.59-6.56 (m, 2H), 4.96 (t, *J* = 7.2 Hz, 2H), 3.40 (s, 2H), 2.22 (t, *J* = 7.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 142.5, 137.8, 133.4, 129.0, 128.3, 121.1, 119.1, 58.1, 45.2.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 75 : 25, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 8.6 min (major), t_{R2} = 28.3 min (minor).

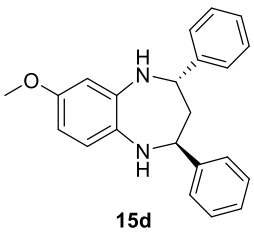


15c

(2*S*,4*S*)-2,4-bis(4-bromophenyl)-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15c): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**,

5706); yellow solid, m.p. 140-143 °C, 95% yield, dr > 20:1, 99% ee; $[\alpha]_D^{20}$ = -115.2 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -106.2 (*c* = 1.0, $CHCl_3$), 99% ee for (*S*,*S*) enantiomer]; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.46 (d, *J* = 8.4 Hz, 4H), 7.29 (d, *J* = 8.4 Hz, 4H), 6.72-6.70 (m, 2H), 6.58-6.56 (m, 2H), 4.94 (t, *J* = 7.2 Hz, 2H), 3.41 (s, 2H), 2.22 (t, *J* = 7.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 143.0, 137.8, 132.2, 128.7, 121.5, 121.1, 119.2, 58.2, 45.1.

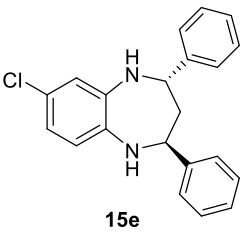
The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 60 : 40, flowing rate = 0.9 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 9.8 min (major), t_{R2} = 35.2 min (minor).



15d

(2*S*,4*S*)-7-methoxy-2,4-diphenyl-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15d): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); yellow solid, m.p. 102-104 °C, 90% yield, dr > 20:1, 99% ee; $[\alpha]_D^{20}$ = -63.1 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -76.1 (*c* = 1.0, $CHCl_3$), 97% ee for (*S*,*S*) enantiomer]; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.41 (d, *J* = 7.2 Hz, 4H), 7.33 (t, *J* = 7.2 Hz, 4H), 7.27-7.24 (m, 2H), 6.48 (d, *J* = 8.4 Hz, 1H), 6.26-6.24 (m, 1H), 6.15 (d, *J* = 2.0 Hz, 1H), 5.06 (dd, J_1 = 10.0 Hz, J_2 = 4.4 Hz, 1H), 4.88 (dd, J_1 = 9.2 Hz, J_2 = 4.8 Hz, 1H), 3.67 (s, 3H), 3.35 (s, 2H), 2.36-2.22 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 154.6, 144.4, 144.2, 139.5, 131.7, 128.9, 128.9, 127.7, 127.6, 126.9, 126.9, 119.9, 105.3, 104.7, 59.5, 58.5, 55.6, 45.6.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 60 : 40, flowing rate = 0.9 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 8.5 min (major), t_{R2} = 24.8 min (minor).

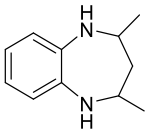


15e

(2*S*,4*S*)-7-chloro-2,4-diphenyl-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15e): (Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**,

5706); yellow solid, m.p. 118-120 °C, 93% yield, dr > 20:1, 99% ee; $[\alpha]_D^{20}$ = -75.2 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -79.8 (*c* = 1.0, $CHCl_3$), 99% ee for (*S*,*S*) enantiomer]; ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.39-7.26 (m, 11H), 6.59 (d, *J* = 8.0 Hz, 1H), 6.48 (d, *J* = 1.6 Hz, 1H), 6.41 (d, *J* = 8.4 Hz, 1H), 5.04-4.95 (m, 2H), 3.41 (s, 2H), 2.29-2.26 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 143.8, 143.7, 139.4, 136.8, 129.0, 129.0, 127.9, 127.9, 126.9, 125.1, 120.1, 119.7, 118.3, 59.0, 58.8, 45.2.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 85 : 15, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 7.7 min (major), t_{R2} = 15.9 min (minor).



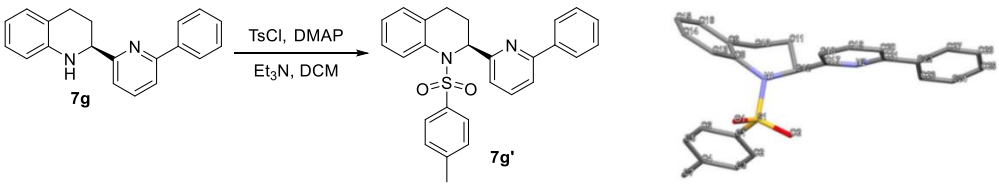
15f

2,4-dimethyl-2,3,4,5-tetrahydro-1*H*-1,5-benzodiazepine (15f): **(**Known compound, see: Z.-Y. Ding, F. Chen, J. Qin, Y.-M. He and Q.-H. Fan, A*ngew. Chem., Int. Ed.* 2012, **51**, 5706); yellow oil, 94% yield, dr = 2:1 (*cis* : *trans*), 10% ee; $[\alpha]_D^{20}$ = -9.1 (*c* = 0.25, $CHCl_3$), [Lit.[8] $[\alpha]_D^{20}$ = -32.4 (*c* = 0.25, $CHCl_3$), 99% ee for (*R*,*R*) enantiomer]; ^{1}H NMR (500 MHz, $CDCl_3$): δ (ppm) 6.78-6.72 (m, 4H), 6.67-6.65 (m, 1H), 6.57-6.55 (m, 1H), 3.79-3.75 (m, 1H), 3.34 (s, 3H), 2.85-2.79 (m, 2H), 1.71-1.64 (m, 2H), 1.46-1.39 (m, 1H), 1.29 (d, *J* = 6.5 Hz, 6H), 1.17 (d, *J* = 6.5 Hz, 4H); ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 140.3, 138.5, 121.5, 120.6, 120.5, 119.1, 52.8, 49.0, 48.2, 46.0, 24.1, 22.1.

The enantiomeric excess was determined by HPLC on Chiralcel OD-H column (hexane : isopropanol = 75 : 25, flowing rate = 1.0 mL/min, 25 °C, UV detection at λ = 254 nm), t_{R1} = 6.9 min (minor), t_{R2} = 10.7 min (major).

10. Determination of absolute configuration

The absolute configuration of **7g** was determined to be (*S*) based on single crystal X-ray analysis *(Scheme S1).* The configuration of the other chiral products are assigned by analogy.



Scheme S1: Single crystal structure of **7g'**

The absolute configuration of **8f-g** and **8m** were determined to be (*S*) based on single crystal X-ray analysis (*Figure S1*). The configuration of the other chiral products (**8d, 8e)** are assigned by analogy.

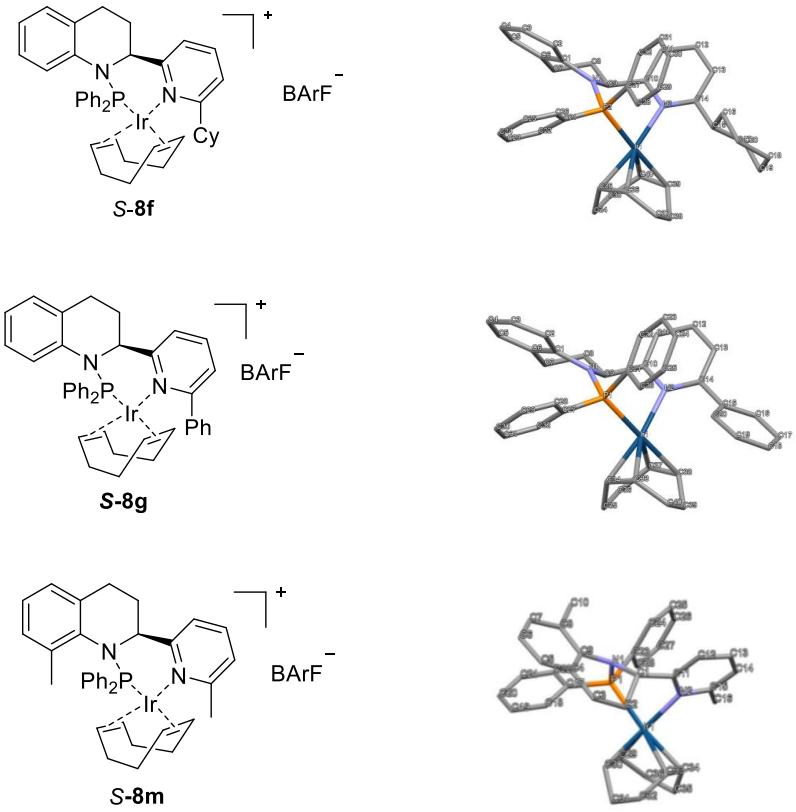


Figure S1. Single crystal structure of **8f-g** and **8m**

The absolute configuration of **12c** was determined to be (*2S*) based on single crystal X-ray analysis (*Figure S2*). The configuration of the other chiral products (**12a, 12b, 12d, 12e, 12f)** are assigned by analogy.

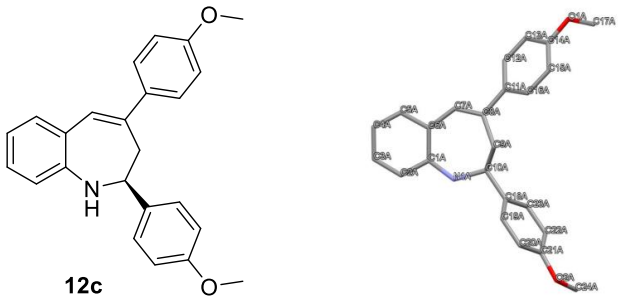
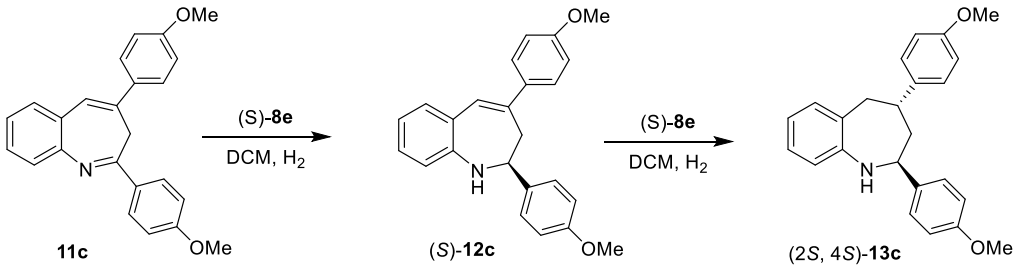
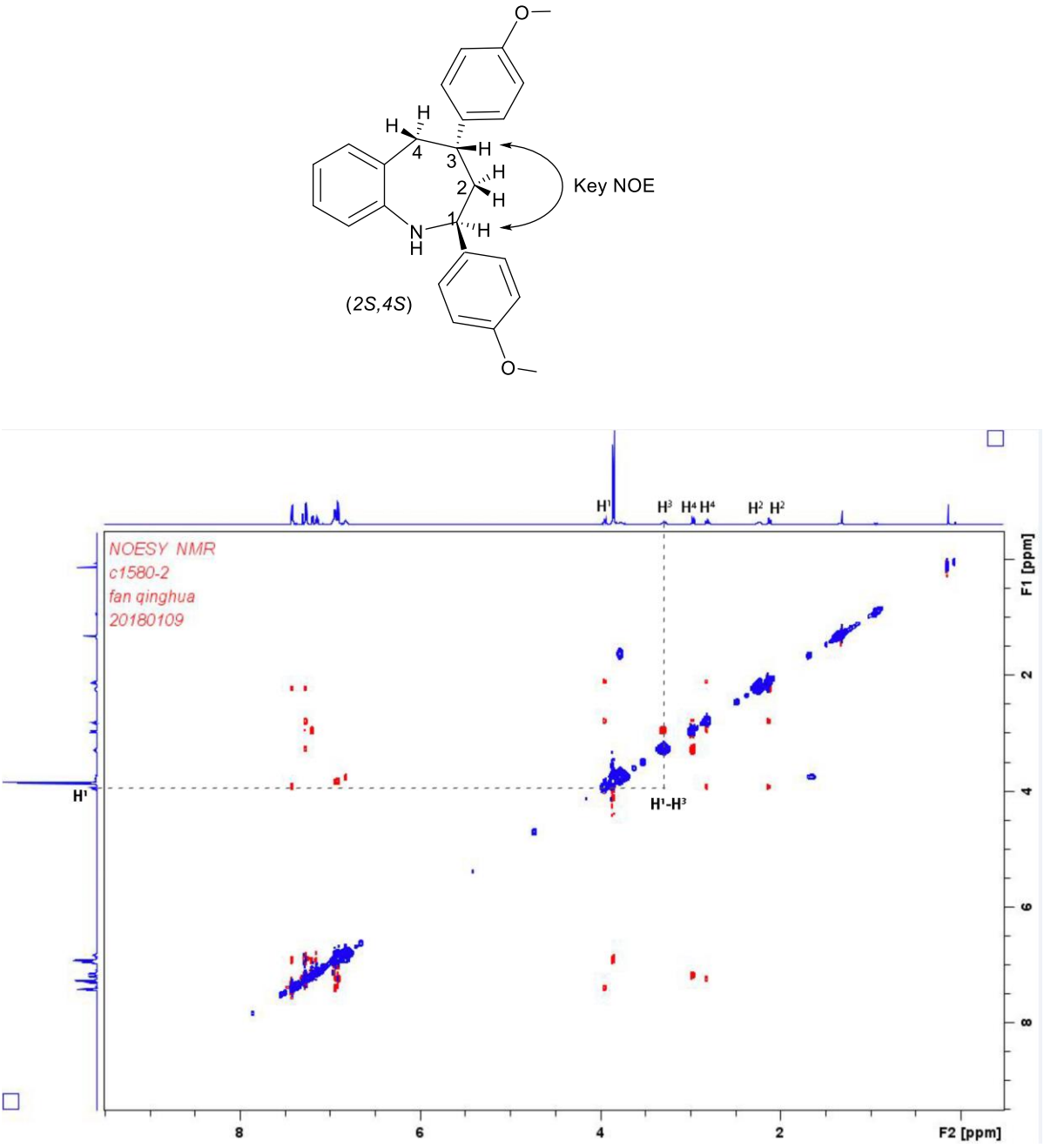


Figure S2. Single crystal structure of **12c**

The absolute configuration of **13c** was determined to be (2*S*,4*S*) based on the absolute configuration of **12c** in combination with 2D-NOESY spectrum (*Scheme S2*). The configuration of the other chiral products (**13a, 13b, 13d, 13e, 13f)** are assigned by analogy.





Scheme S2. The 2D-NOESY Spectrum of **13c**

11. References

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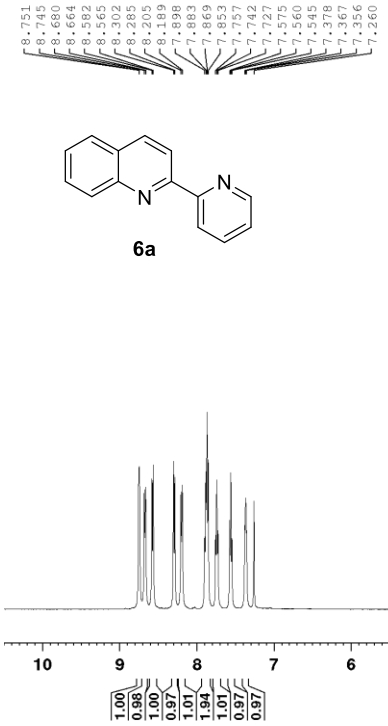
12. Copy of NMR spectra

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PROCNO                 1

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NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 55.37
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
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SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
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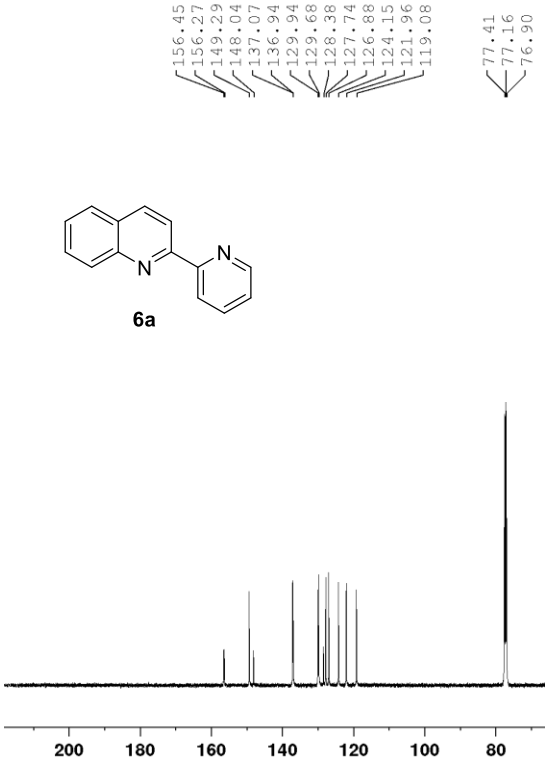


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EXPNO                 39
PROCNO                 1

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Date_           20180301
Time                9.29
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   252
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

F2 - Processing parameters
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WDW                   EM
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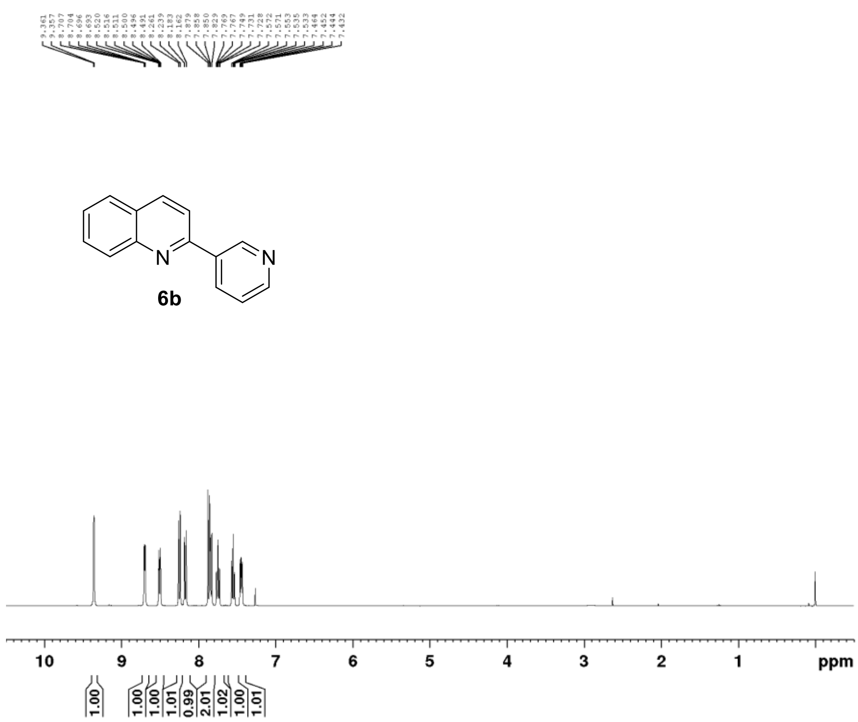


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EXPNO                 123
PROCNO                  1

F2 - Acquisition Parameters
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Time                11.13
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              8012.820 Hz
FIDRES           0.244532 Hz
AQ              2.0447233 sec
RG                 140.59
DW                 62.400 usec
DE                   6.50 usec
TE                  299.5 K
D1             2.00000000 sec
TD0                     1
SFO1          400.2424716 MHz
NUC1                   1H
P1                  14.80 usec
PLW1          12.00000000 W

F2 - Processing parameters
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WDW                    EM
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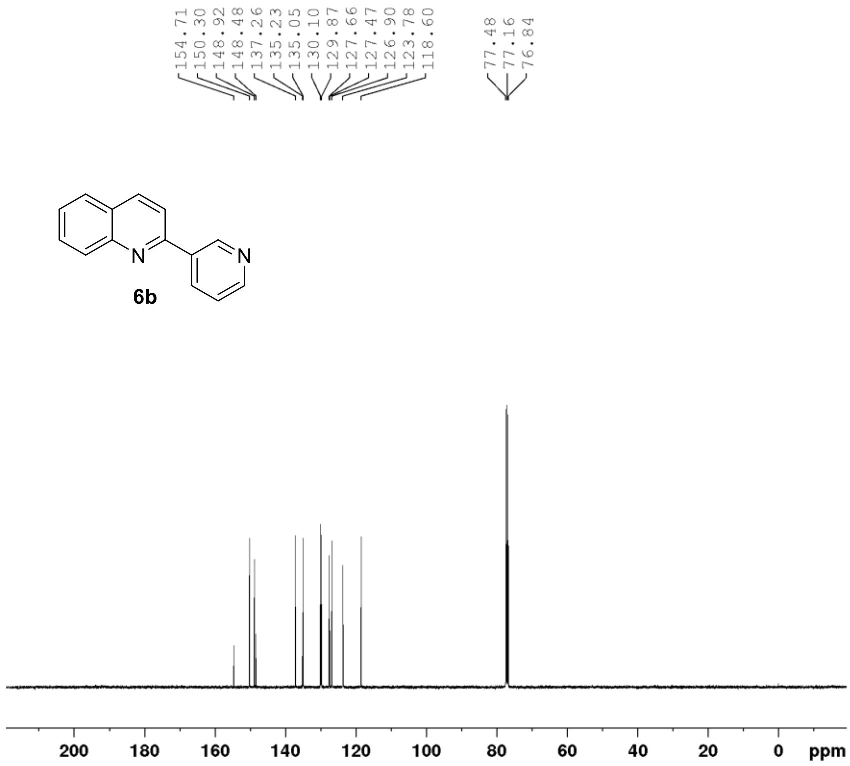


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EXPNO                 124
PROCNO                  1

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Time                11.14
INSTRUM             spect
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PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    638
DS                      4
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ              1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                   6.50 usec
TE                  300.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                     1
SFO1          100.6504916 MHz
NUC1                  13C
P1                  10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

F2 - Processing parameters
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LB                   1.00 Hz
GB       0
PC                   1.40
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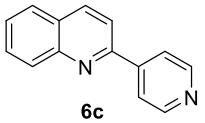

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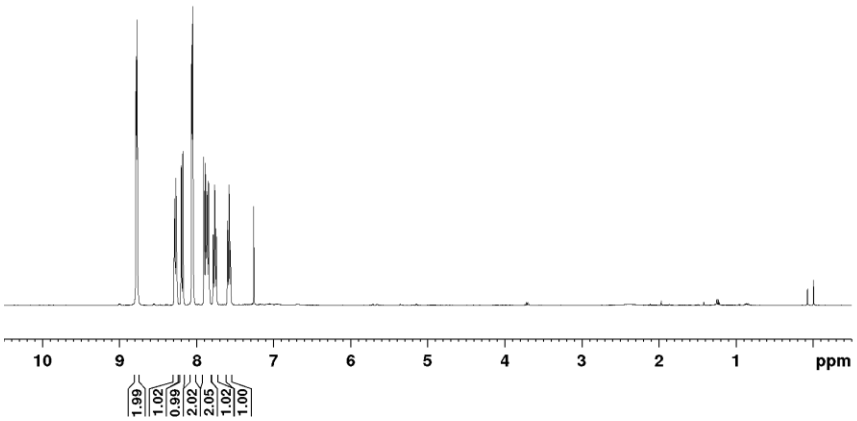


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EXPNO                319
PROCNO                 1

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Time                9.35
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              8012.820 Hz
FIDRES           0.244532 Hz
AQ               2.0447233 sec
RG                 206.33
DW                 62.400 usec
DE                  6.50 usec
TE                 297.9 K
D1              2.00000000 sec
TD0                    1
SFO1           400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1           12.00000000 W

F2 - Processing parameters
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SF            400.2400100 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
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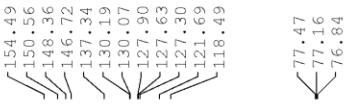

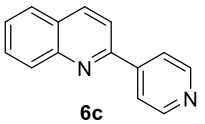

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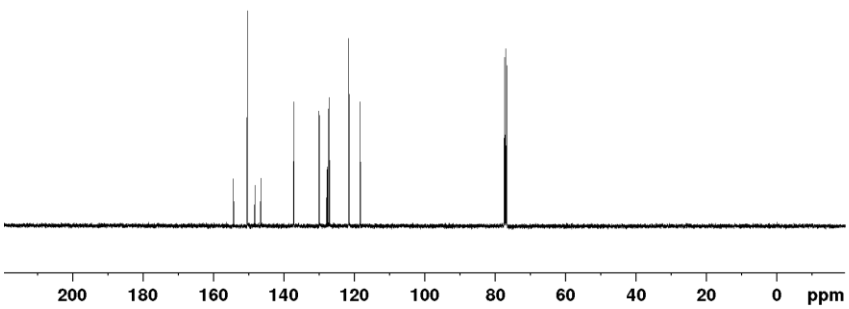


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NAME           400M2017
EXPNO                126
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170511
Time               11.54
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT             CDCl3
NS                   101
DS                     4
SWH            24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                  6.50 usec
TE                 299.6 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                    1
SFO1           100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1           54.00000000 W
SFO2           400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

F2 - Processing parameters
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SF            100.6404205 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
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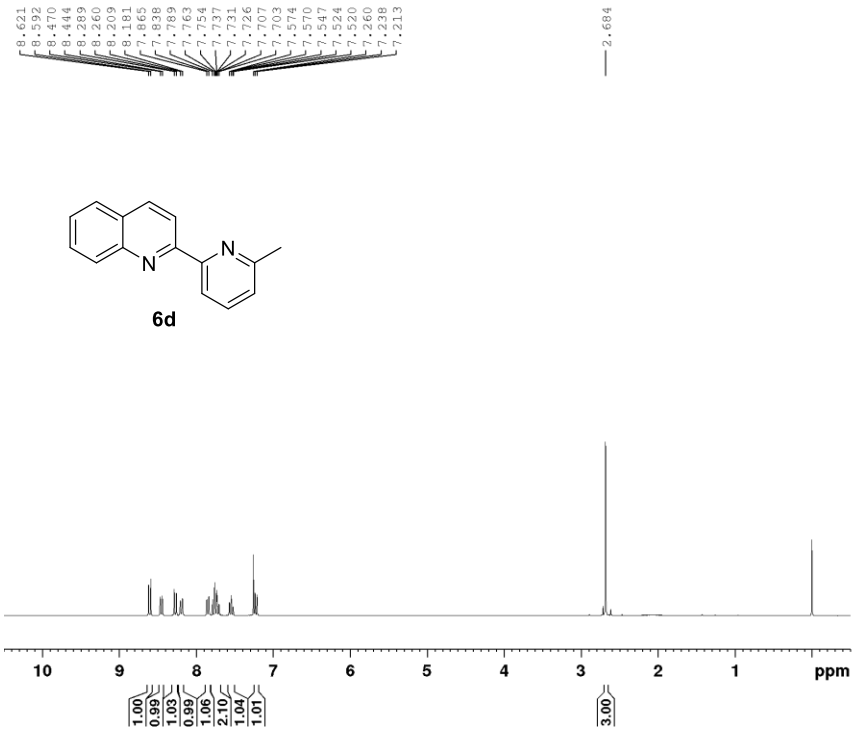


```
Current Data Parameters
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EXPNO                        40
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20150623
Time                     19.14
INSTRUM                  spect
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PULPROG                   zg30
TD                       65536
SOLVENT                  CDCl3
NS                           8
DS                           2
SWH                   6009.615 Hz
FIDRES                0.091699 Hz
AQ                    5.4525952 sec
RG                       209.09
DW                       83.200 usec
DE                         6.50 usec
TE                        300.1 K
D1                    1.00000000 sec
TD0                          1
SFO1                300.1318534 MHz
NUC1                         1H
P1                         8.00 usec
PLW1                18.00000000 W

F2 - Processing parameters
SI                       65536
SF                  300.1300073 MHz
WDW                         EM
SSB                  0
LB                         0.30 Hz
GB                   0
PC                         1.00
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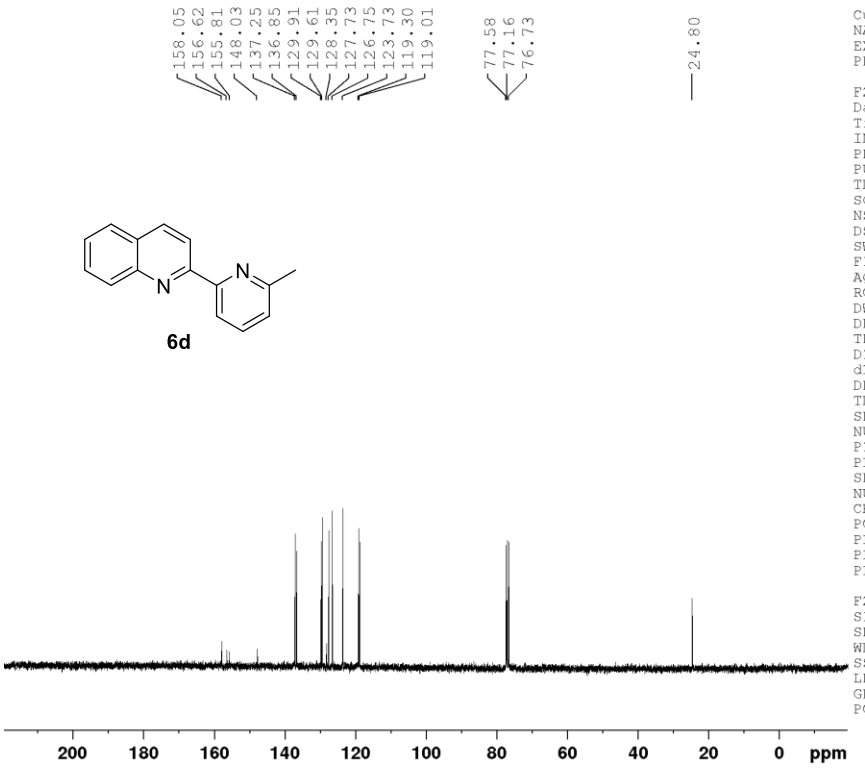


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Current Data Parameters
NAME                  300M 2015
EXPNO                        49
PROCNO                        1

F2 - Acquisition Parameters
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Time                     11.05
INSTRUM                  spect
PROBHD    5 mm DUL 13C-1
PULPROG                zgpg30
TD                       65536
SOLVENT                  CDCl3
NS                         165
DS                           4
SWH                  18028.846 Hz
FIDRES                0.275098 Hz
AQ                    1.8175317 sec
RG                       209.09
DW                       27.733 usec
DE                         6.50 usec
TE                        300.2 K
D1                    2.00000000 sec
d11                   0.03000000 sec
DELTA                 1.89999998 sec
TD0                          1
SFO1                 75.4752949 MHz
NUC1                        13C
P1                        11.00 usec
PLW1                195.00000000 W
SFO2                300.1312005 MHz
NUC2                         1H
CPDPRG[2                waltz16
PCPD2                     90.00 usec
PLW2                 14.00000000 W
PLW12                 0.17284000 W
PLW13                 0.14000000 W

F2 - Processing parameters
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SF                   75.4677393 MHz
WDW                         EM
SSB                  0
LB                         1.00 Hz
GB                   0
PC                         1.40
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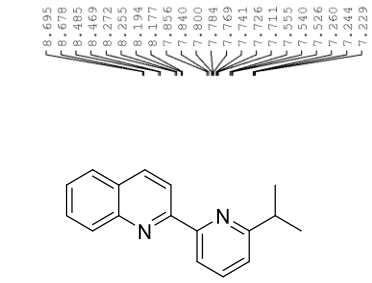

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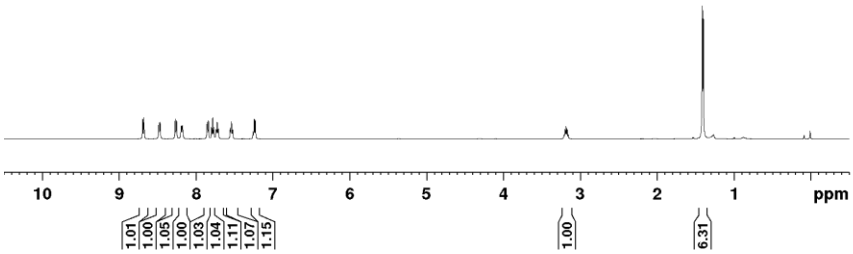


```
Current Data Parameters
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EXPNO                        3
PROCNO                       1

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Time                    20.49
INSTRUM                 spect
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PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                      31.72
DW                     50.000 usec
DE                      6.50 usec
TE                     298.0 K
D1                 1.00000000 sec
TD0                        1
SFO1               500.1330885 MHz
NUC1                       1H
P1                     10.60 usec
PLW1               20.00000000 W

F2 - Processing parameters
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SF                 500.1300121 MHz
WDW                       EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
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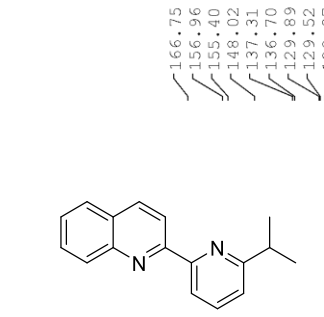

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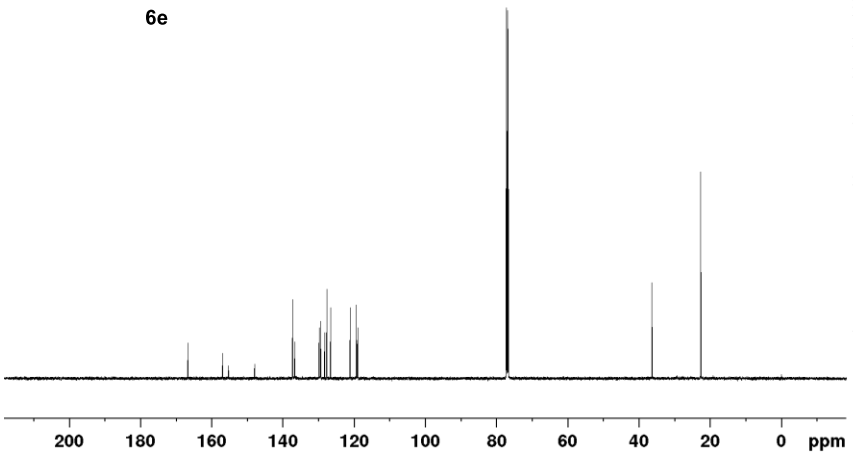


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EXPNO                        4
PROCNO                       1

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PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       176
DS                         4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                     192.89
DW                     16.800 usec
DE                      18.00 usec
TE                     298.0 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                        1
SFO1               125.7703637 MHz
NUC1                       13C
P1                      9.80 usec
PLW1               57.00000000 W
SFO2               500.1320005 MHz
NUC2                       1H
CPDPRG[2            waltz16
PCPD2                  80.00 usec
PLW2               20.00000000 W
PLW12               0.35778001 W
PLW13               0.22898000 W

F2 - Processing parameters
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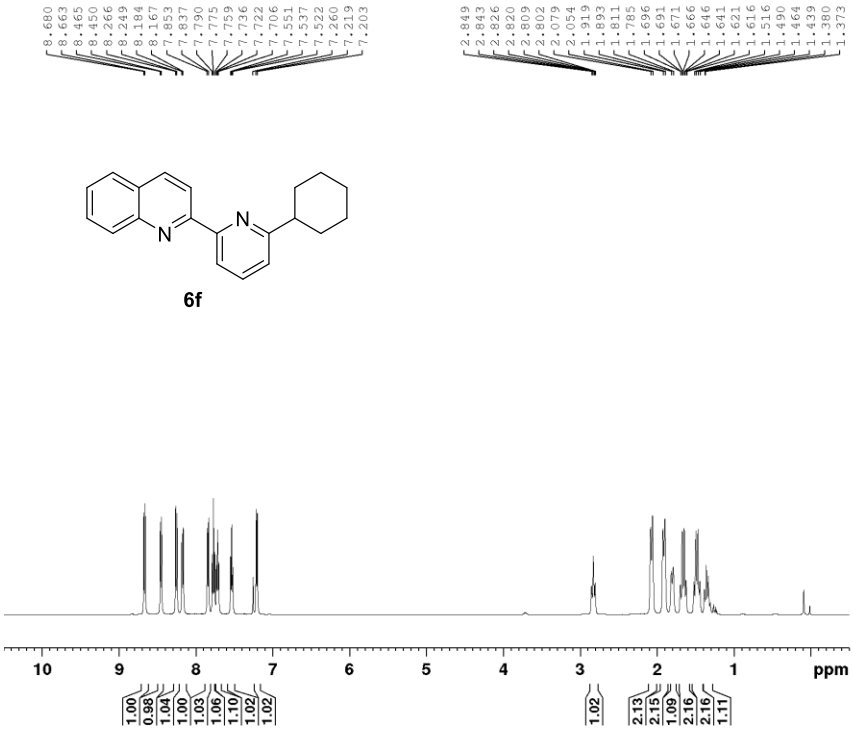
SF                 125.7577734 MHz
WDW                       EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
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PROCNO                  1

F2 - Acquisition Parameters
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PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
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WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
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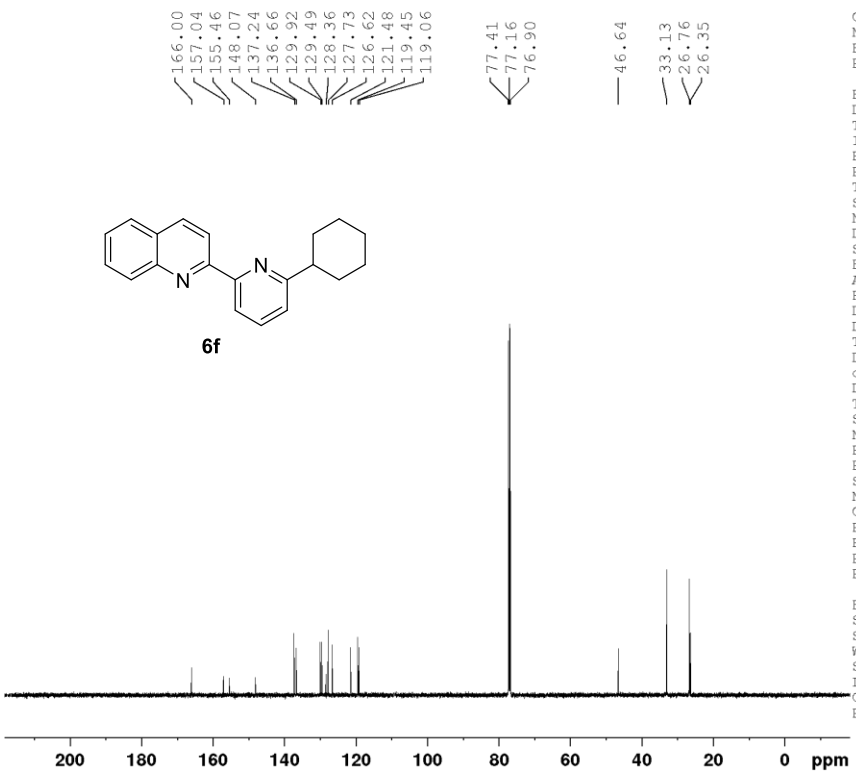


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EXPNO                  54
PROCNO                  1

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Time               21.42
INSTRUM            spect
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PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    30
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

F2 - Processing parameters
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SF            125.7577729 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
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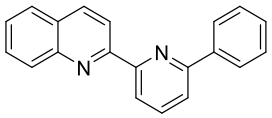

6g

```
Current Data Parameters
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EXPNO                  61
PROCNO                  1

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Time                9.05
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
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SF            500.1300115 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
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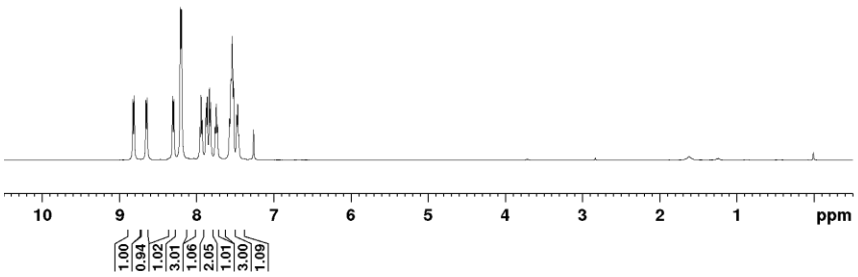
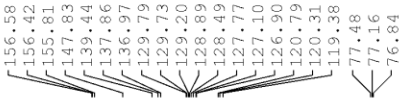
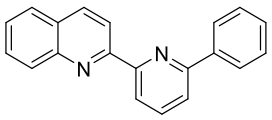




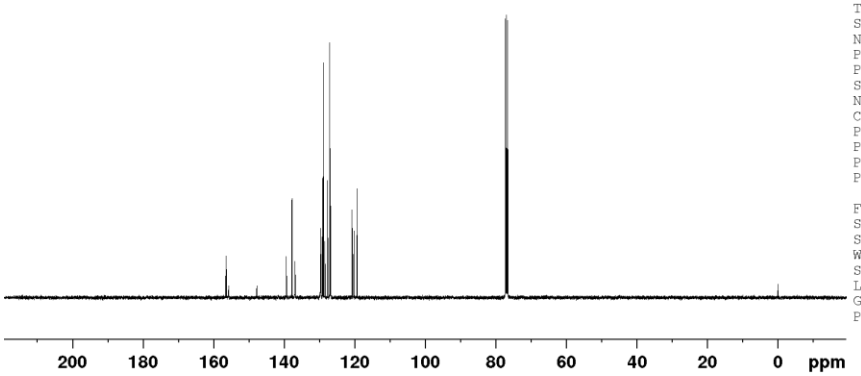


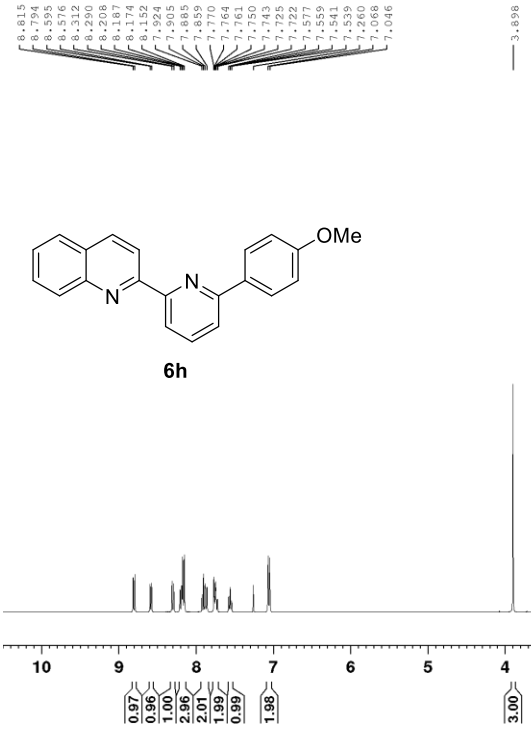
6g

```
Current Data Parameters
NAME          400M2015-2
EXPNO                 426
PROCNO                  1

F2 - Acquisition Parameters
Date_           20150910
Time                9.29
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   478
DS                     4
SWH           24038.461 Hz
FIDRES            0.366798 Hz
AQ             1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                  6.50 usec
TE                299.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

F2 - Processing parameters
SI                 32768
SF            100.6404176 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

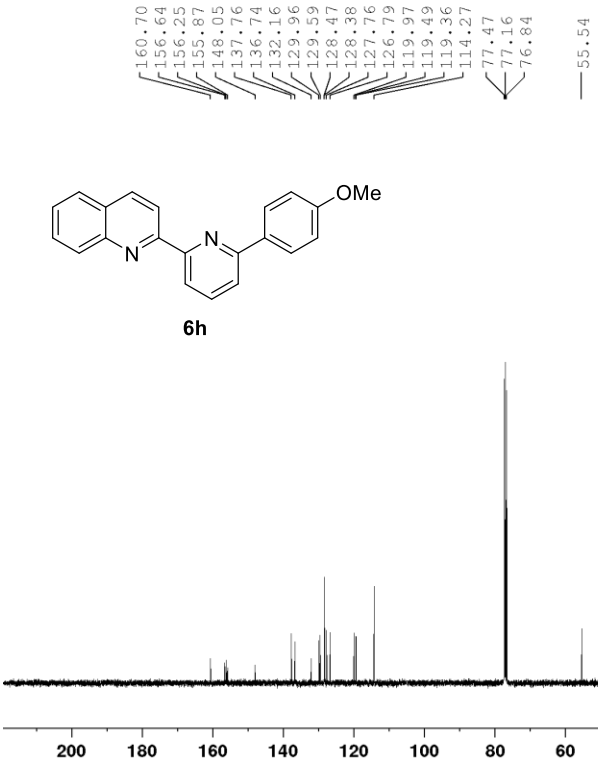





```
Current Data Parameters
NAME          400M2015-2
EXPNO                452
PROCNO                 1

F2 - Acquisition Parameters
Date_           20151014
Time               21.10
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             8012.820 Hz
FIDRES             0.244532 Hz
AQ              2.0447233 sec
RG                 206.33
DW                 62.400 usec
DE                  6.50 usec
TE                 298.4 K
D1              2.00000000 sec
TD0                    1
SFO1          400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1           12.00000000 W

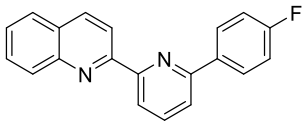
F2 - Processing parameters
SI                 65536
SF            400.2400100 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



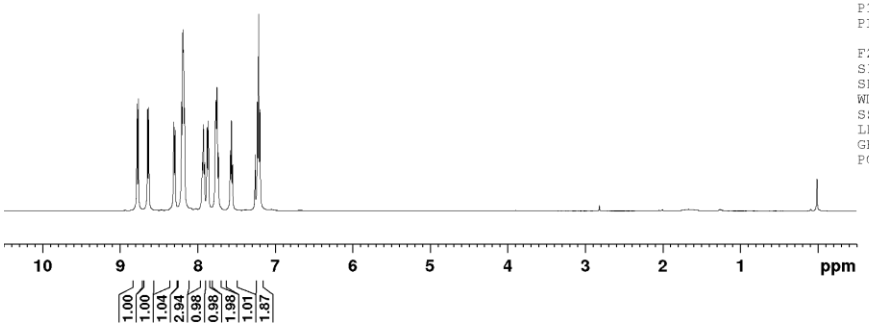

```
Current Data Parameters
NAME          400M2015-2
EXPNO                453
PROCNO                 1

F2 - Acquisition Parameters
Date_           20151014
Time               21.14
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   139
DS                     4
SWH            24038.461 Hz
FIDRES             0.366798 Hz
AQ              1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                  6.50 usec
TE                 298.9 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1           54.00000000 W
SFO2          400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

F2 - Processing parameters
SI                 32768
SF            100.6404154 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```



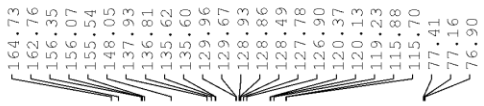
6i

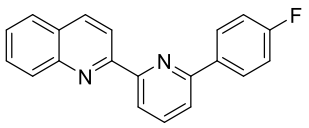



```
Current Data Parameters
NAME         500M 2016Ç°
EXPNO                 48
PROCNO                 1

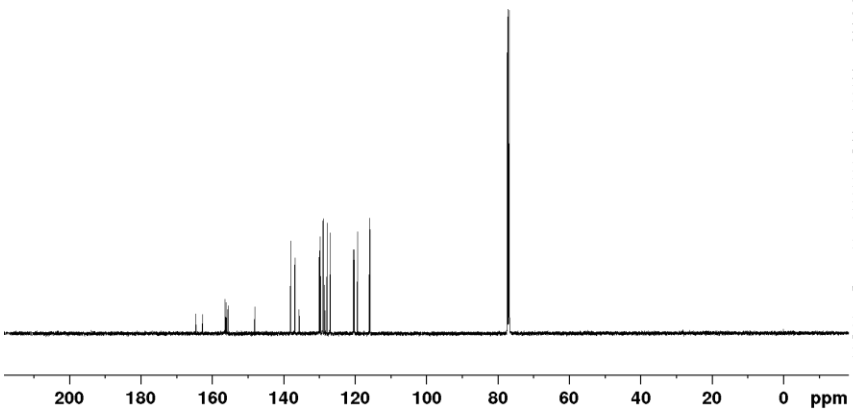
F2 - Acquisition Parameters
Date_           20151017
Time               15.49
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.0 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                10.60 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300121 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```





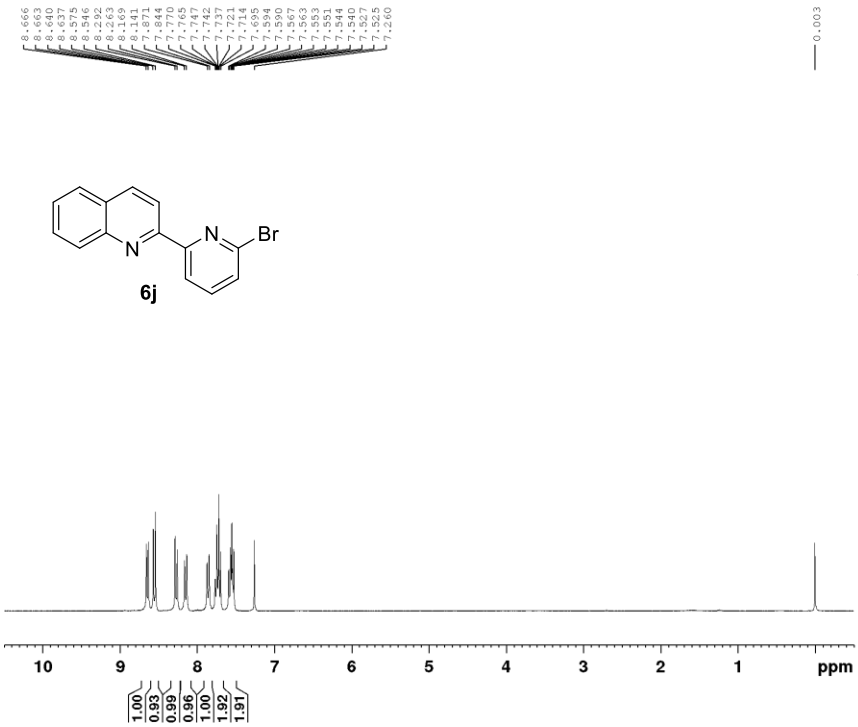
6i




```
Current Data Parameters
NAME         500M 2016Ç°
EXPNO                 49
PROCNO                 1

F2 - Acquisition Parameters
Date_           20151017
Time               15.53
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    97
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.0 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

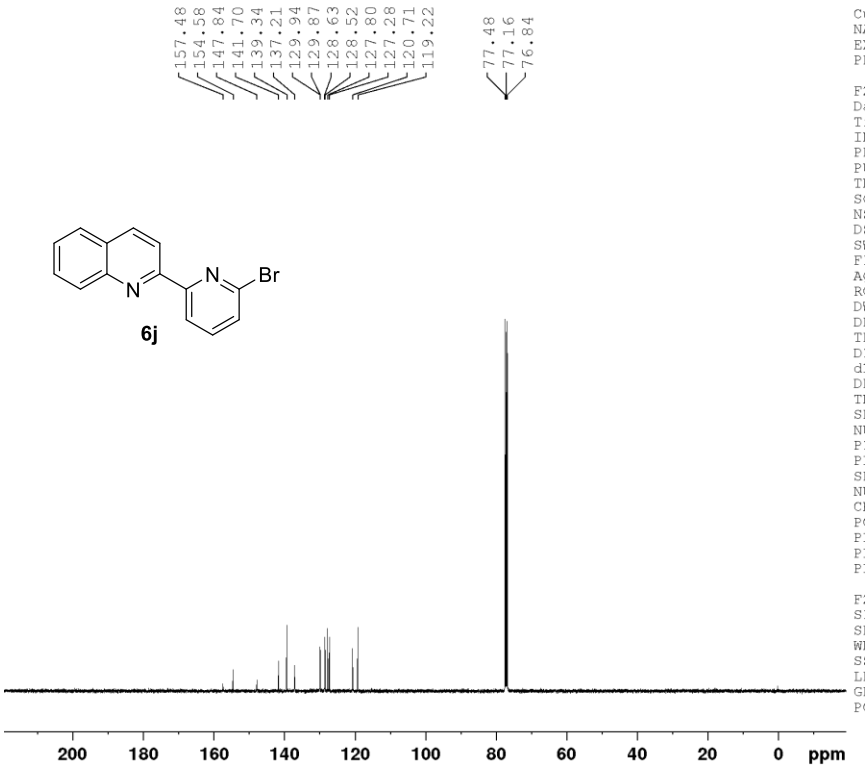
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME          300M 2015
EXPNO               112
PROCNO                1

F2 - Acquisition Parameters
Date_          20151125
Time              19.25
INSTRUM           spect
PROBHD   5 mm DUL 13C-1
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    10
DS                     2
SWH             6009.615 Hz
FIDRES          0.091699 Hz
AQ              5.4525952 sec
RG                 209.09
DW                 83.200 usec
DE                   6.50 usec
TE                 298.2 K
D1            1.00000000 sec
TD0                    1
SFO1          300.1318534 MHz
NUC1                  1H
P1                 8.00 usec
PLW1         18.00000000 W

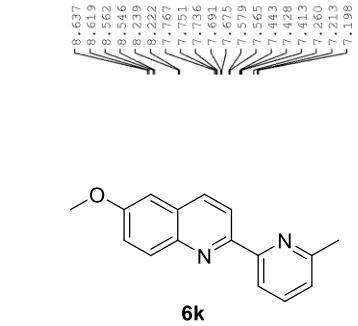
F2 - Processing parameters
SI                 65536
SF            300.1300073 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

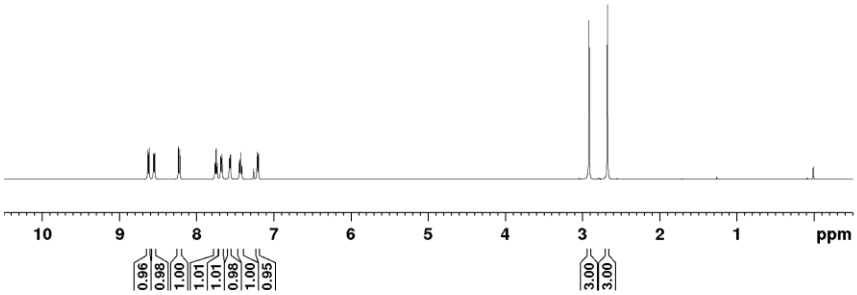



```
Current Data Parameters
NAME             xinheci
EXPNO                 76
PROCNO                 1

F2 - Acquisition Parameters
Date_          20170401
Time              17.42
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                   6.50 usec
TE                 302.0 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA         1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                  1H
CPDPRG[2         waltz16
PCPD2              90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

F2 - Processing parameters
SI                 32768
SF            100.6404132 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

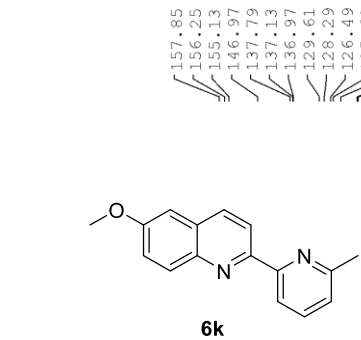


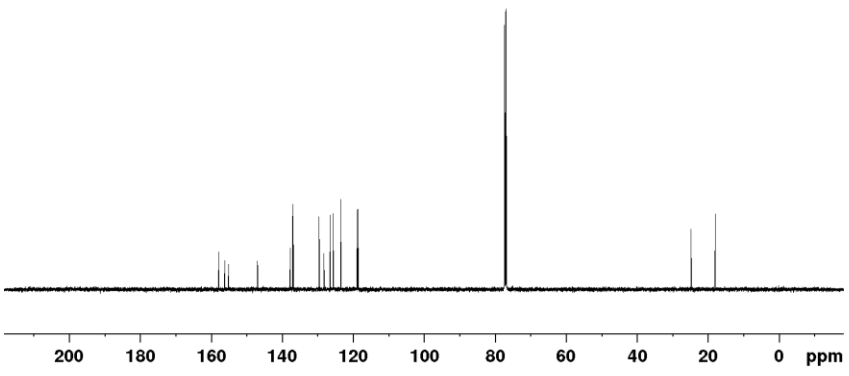



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 76
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180319
Time               18.46
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300124 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

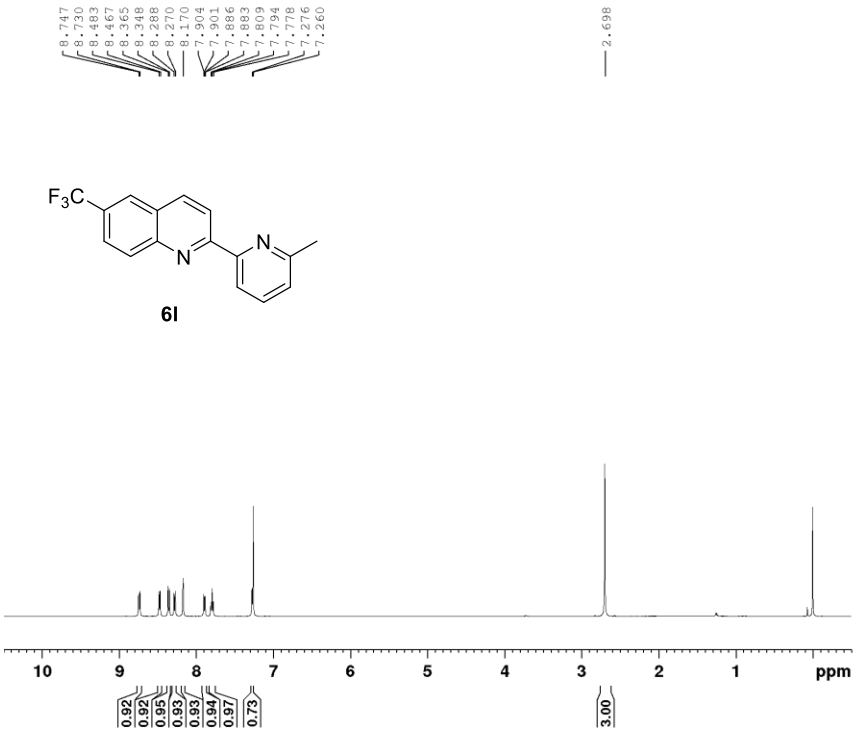





```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 77
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180319
Time               18.49
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    31
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

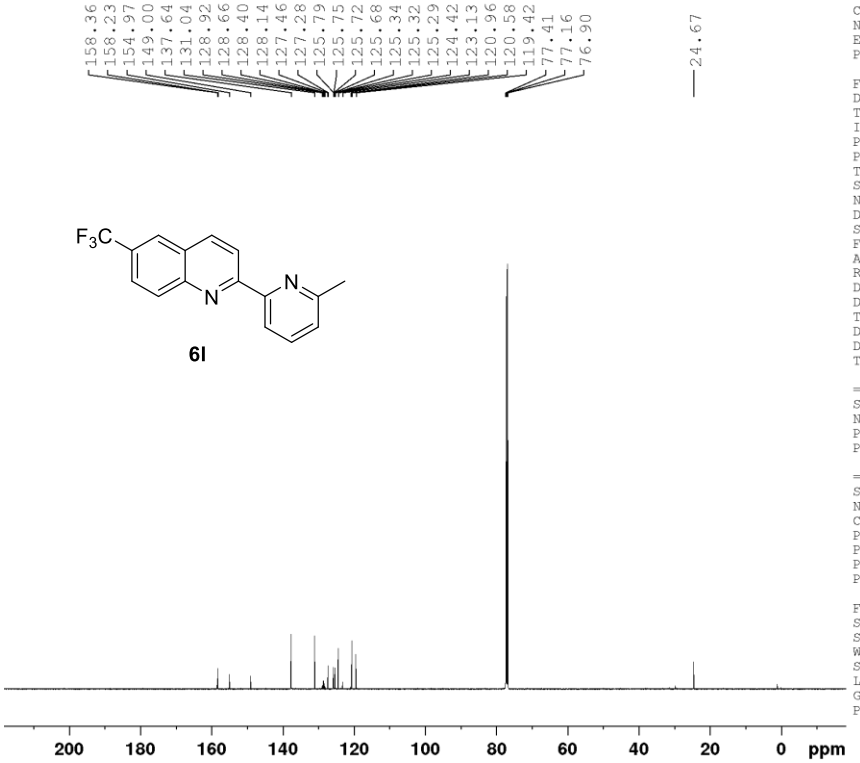
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 78
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180321
Time               15.02
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1         20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300119 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



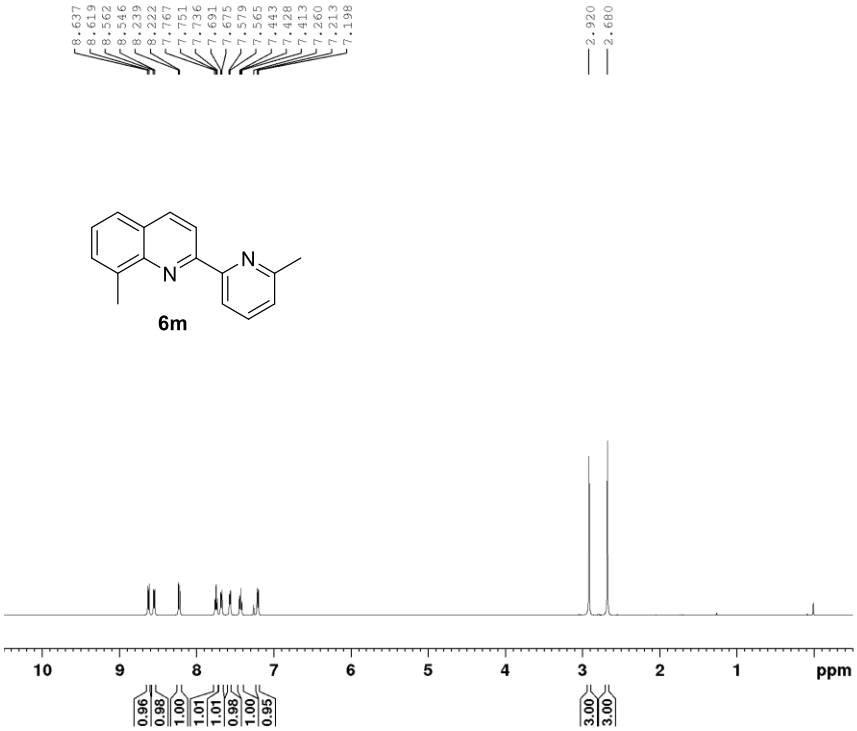

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                157
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180723
Time               12.02
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1         57.00000000 W

======== CHANNEL f2 ========
SFO2         500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

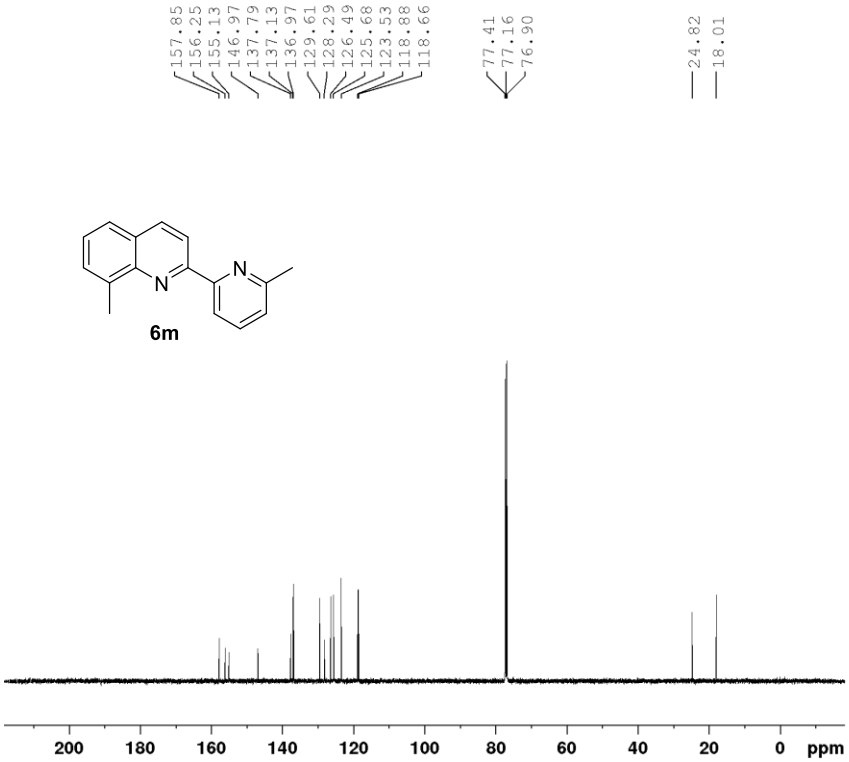
F2 - Processing parameters
SI                 32768
SF           125.7577720 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  76
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180319
Time               18.46
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1          20.00000000 W

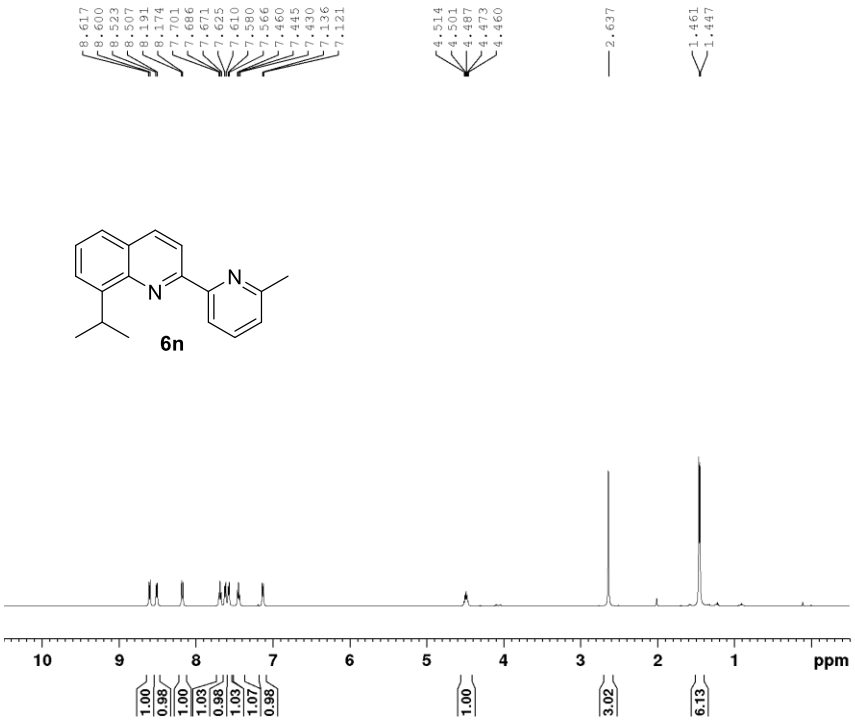
F2 - Processing parameters
SI                 65536
SF            500.1300124 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  77
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180319
Time               18.49
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    31
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

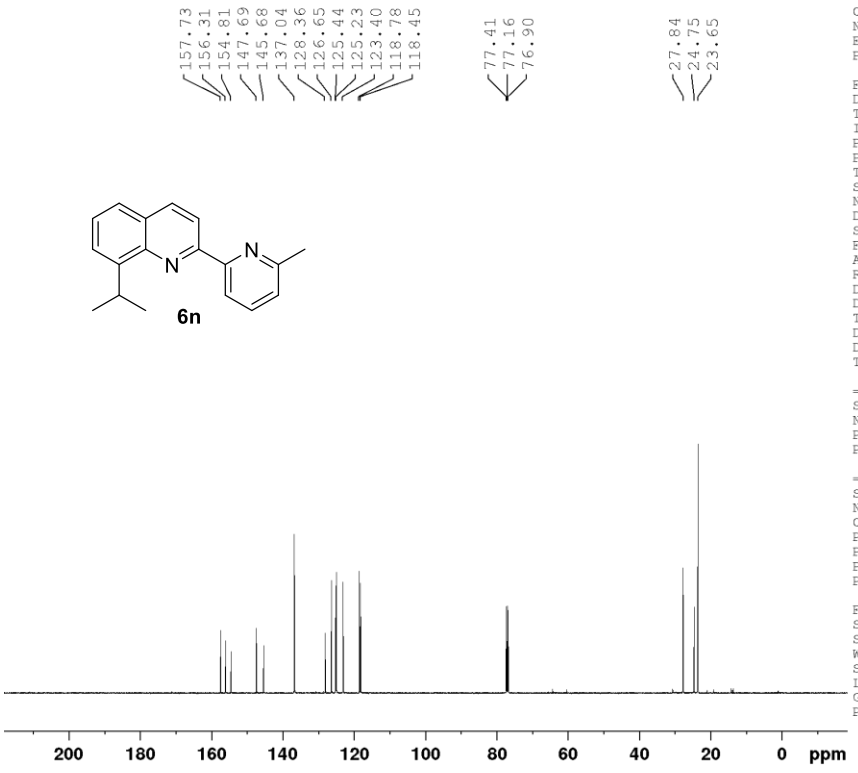



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                107
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180417
Time               20.50
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ            3.2767999 sec
RG                  22.1
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         500.1330885 MHz
NUC1                   1H
P1                 11.50 usec
PLW1         20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300466 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



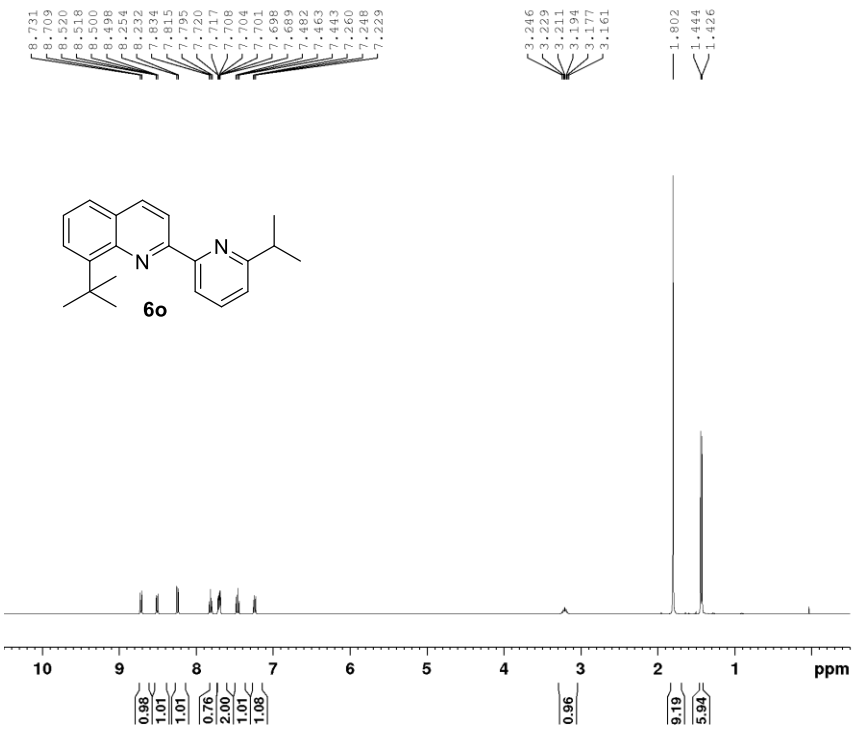

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                108
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180417
Time               20.52
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    56
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ            1.1010048 sec
RG                 192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        125.7703637 MHz
NUC1                   13C
P1                  9.80 usec
PLW1         57.00000000 W

======== CHANNEL f2 ========
SFO2         500.1320005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

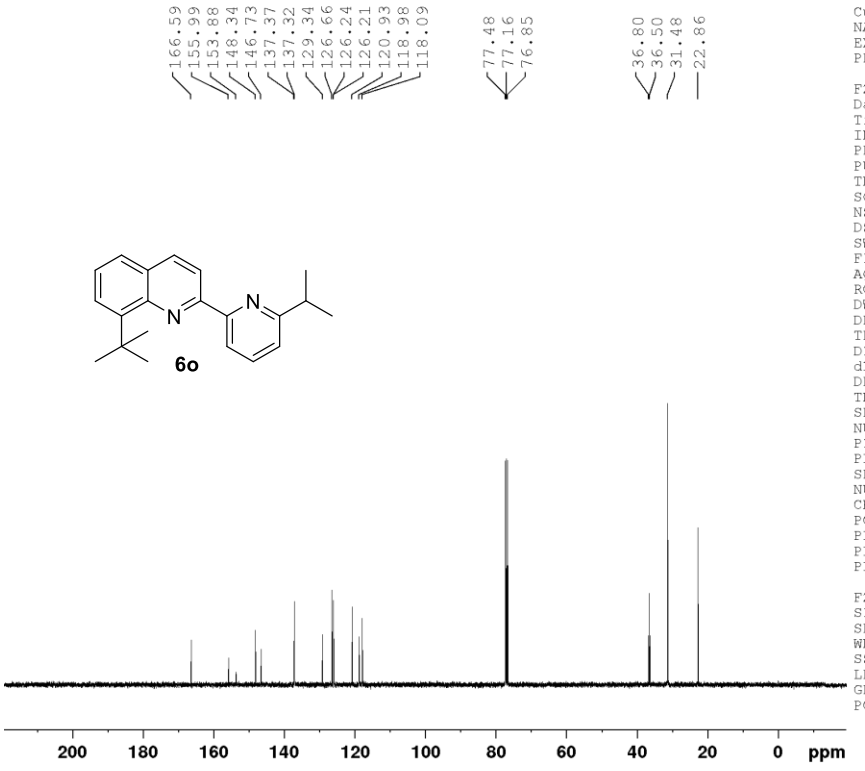
F2 - Processing parameters
SI                 32768
SF           125.7577856 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  qltq
EXPNO                   80
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161125
Time                 16.24
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH                8012.820 Hz
FIDRES                0.244532 Hz
AQ                 2.0447233 sec
RG                      43.5
DW                    62.400 usec
DE                     6.50 usec
TE                    298.0 K
D1                 2.00000000 sec
TD0                      1
SFO1              400.2424716 MHz
NUC1                    1H
P1                    14.80 usec
PLW1              12.00000000 W

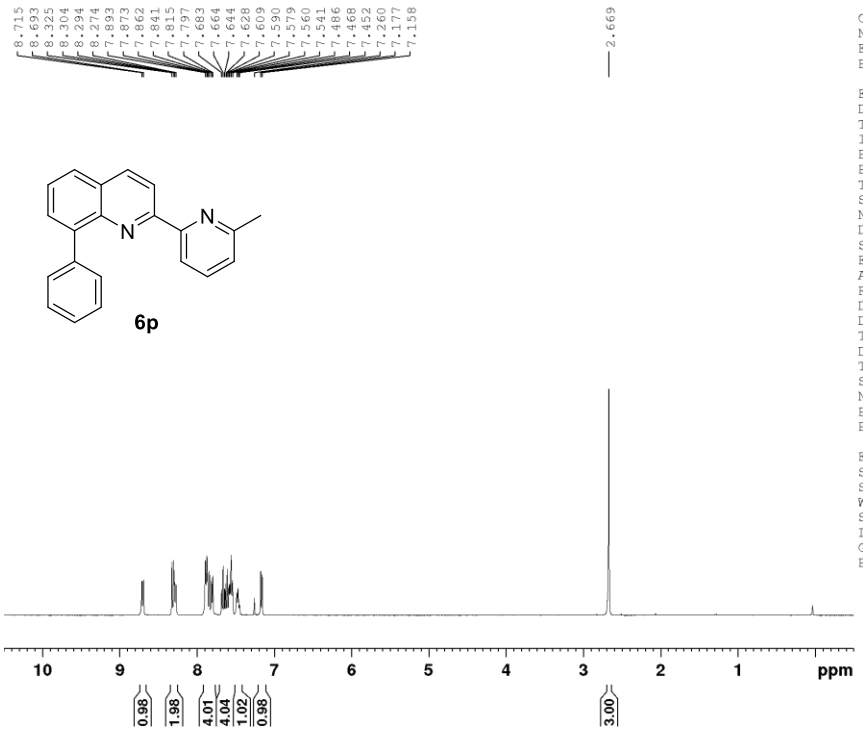
F2 - Processing parameters
SI                    65536
SF                400.2400096 MHz
WDW                     EM
SSB          0
LB                     0.30 Hz
GB           0
PC                     1.00
```




```
Current Data Parameters
NAME                  qltq
EXPNO                   81
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161125
Time                 16.32
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     128
DS                       4
SWH               24038.461 Hz
FIDRES                0.366798 Hz
AQ                 1.3631488 sec
RG                     206.33
DW                    20.800 usec
DE                     6.50 usec
TE                    299.1 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                      1
SFO1              100.6504916 MHz
NUC1                    13C
P1                    10.00 usec
PLW1              54.00000000 W
SFO2              400.2416010 MHz
NUC2                    1H
CPDPRG[2          waltz16
PCPD2                 90.00 usec
PLW2              12.00000000 W
PLW12              0.34680000 W
PLW13              0.28090999 W

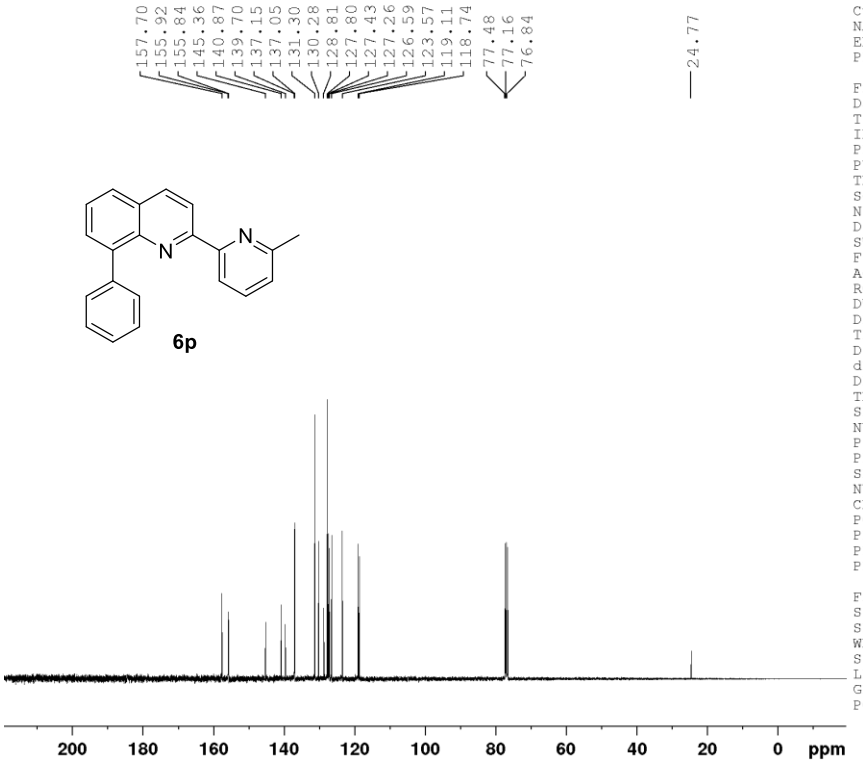
F2 - Processing parameters
SI                    32768
SF                100.6404166 MHz
WDW                     EM
SSB          0
LB                     1.00 Hz
GB           0
PC                     1.40
```




```
Current Data Parameters
NAME          400M 2016
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20151222
Time              15.06
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES        0.244532 Hz
AQ            2.0447233 sec
RG               102.73
DW               62.400 usec
DE                6.50 usec
TE                298.0 K
D1           2.00000000 sec
TD0                   1
SFO1         400.2424716 MHz
NUC1                 1H
P1                14.80 usec
PLW1         12.00000000 W

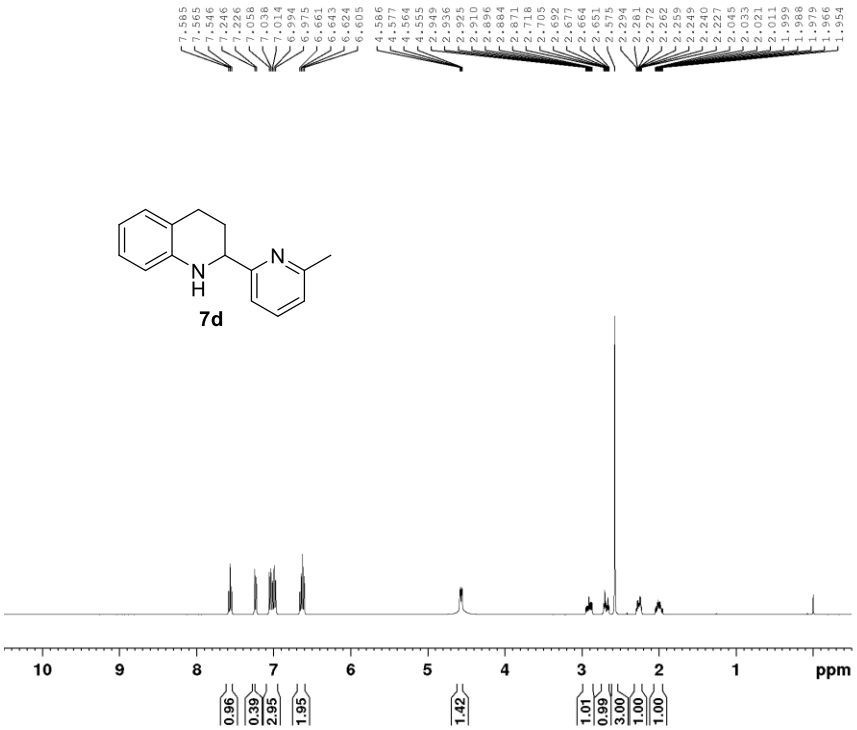
F2 - Processing parameters
SI                65536
SF           400.2400098 MHz
WDW                  EM
SSB      0
LB                0.30 Hz
GB       0
PC                1.00
```




```
Current Data Parameters
NAME          400M 2016
EXPNO                 3
PROCNO                1

F2 - Acquisition Parameters
Date_          20151222
Time              15.10
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  244
DS                    4
SWH           24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631488 sec
RG               206.33
DW               20.800 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
TD0                   1
SFO1         100.6504916 MHz
NUC1                 13C
P1               10.00 usec
PLW1         54.00000000 W
SFO2         400.2416010 MHz
NUC2                 1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2         12.00000000 W
PLW12         0.34680000 W
PLW13         0.28090999 W

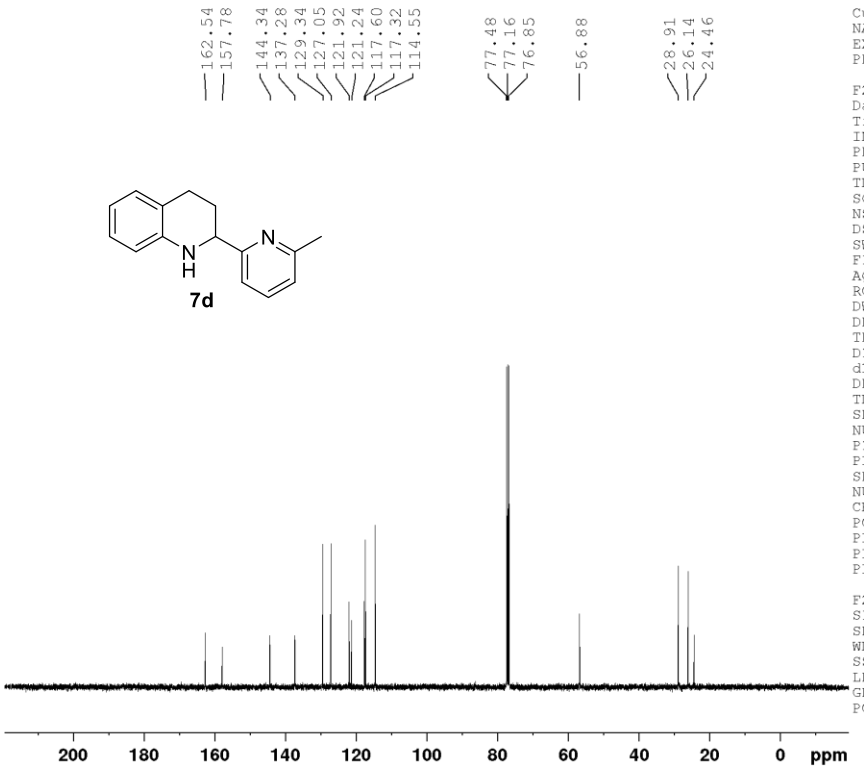
F2 - Processing parameters
SI                32768
SF           100.6404190 MHz
WDW                  EM
SSB      0
LB                1.00 Hz
GB       0
PC                1.40
```




```
Current Data Parameters
NAME                  400M2017
EXPNO                       73
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170327
Time                   16.47
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 8012.820 Hz
FIDRES                0.244532 Hz
AQ                 2.0447233 sec
RG                     125.02
DW                     62.400 usec
DE                      6.50 usec
TE                     299.7 K
D1                 2.00000000 sec
TD0                        1
SFO1               400.2424716 MHz
NUC1                       1H
P1                     14.80 usec
PLW1              12.00000000 W

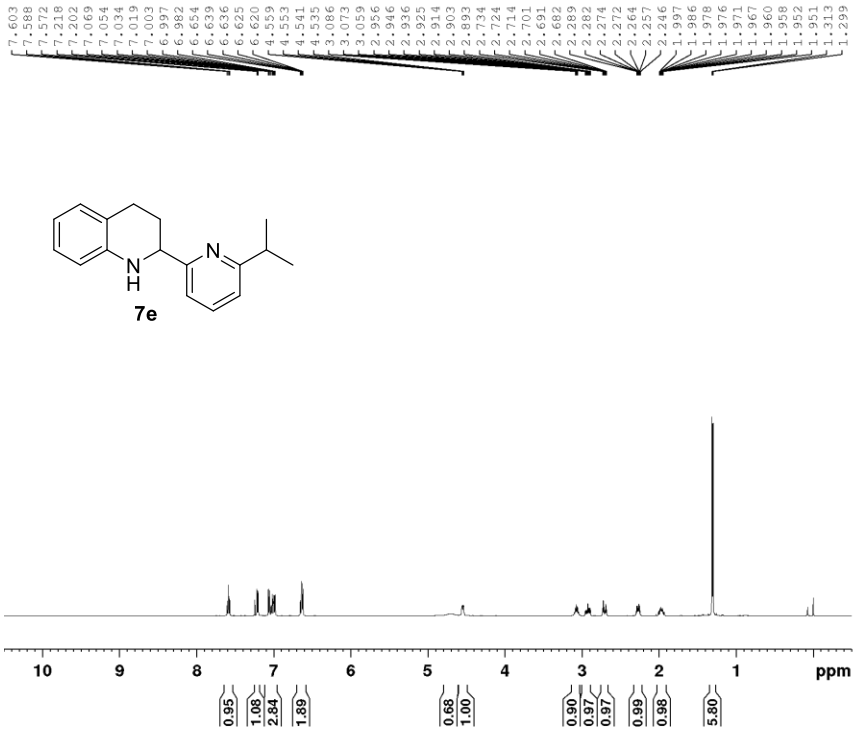
F2 - Processing parameters
SI                         65536
SF                 400.2400139 MHz
WDW                        EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```




```
Current Data Parameters
NAME                  400M2017
EXPNO                       74
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170327
Time                   16.51
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG               zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       223
DS                         4
SWH                24038.461 Hz
FIDRES                0.366798 Hz
AQ                 1.3631488 sec
RG                     206.33
DW                     20.800 usec
DE                      6.50 usec
TE                     300.5 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                        1
SFO1               100.6504916 MHz
NUC1                       13C
P1                     10.00 usec
PLW1               54.00000000 W
SFO2               400.2416010 MHz
NUC2                       1H
CPDPRG[2            waltz16
PCPD2                  90.00 usec
PLW2               12.00000000 W
PLW12               0.34680000 W
PLW13               0.28090999 W

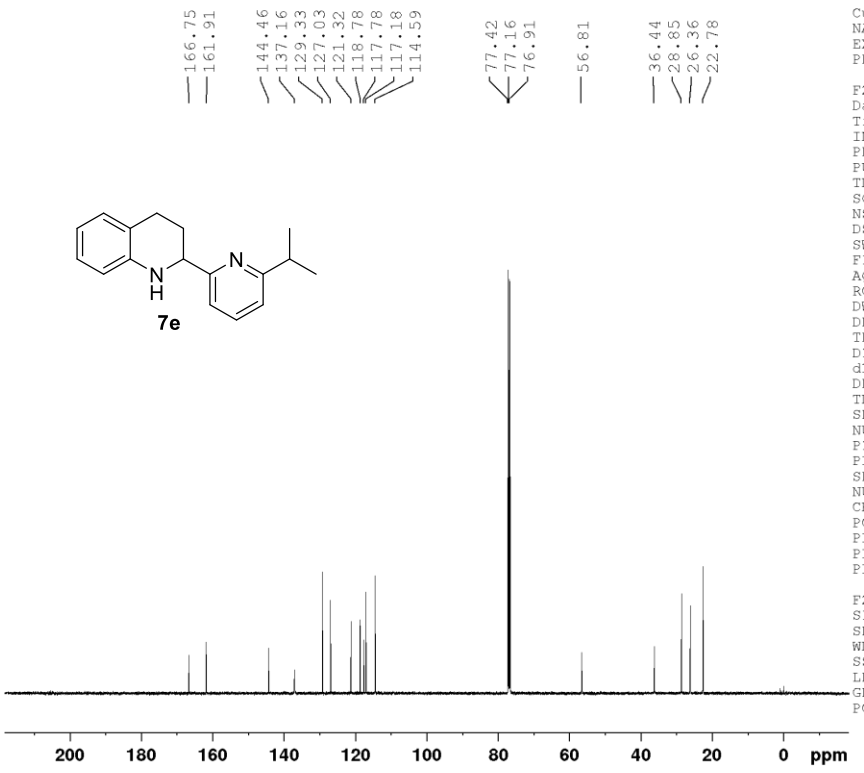
F2 - Processing parameters
SI                         32768
SF                 100.6404158 MHz
WDW                        EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                        5
PROCNO                       1

F2 - Acquisition Parameters
Date_              20161206
Time                    21.02
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                      31.72
DW                     50.000 usec
DE                      6.50 usec
TE                     298.0 K
D1                 1.00000000 sec
TD0                        1
SFO1               500.1330885 MHz
NUC1                       1H
P1                     10.60 usec
PLW1               20.00000000 W

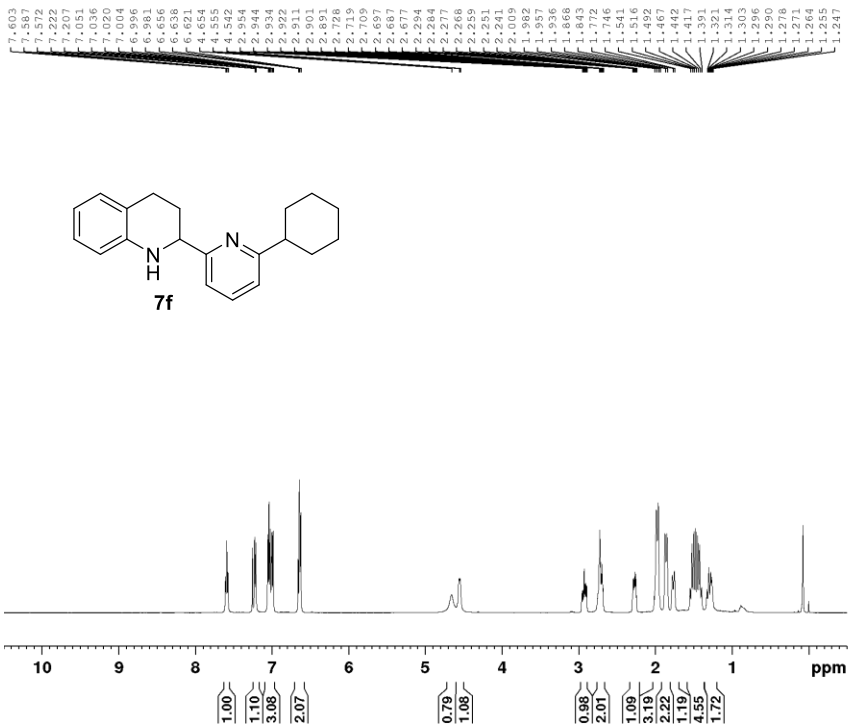
F2 - Processing parameters
SI                     65536
SF                 500.1300197 MHz
WDW                       EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                        6
PROCNO                       1

F2 - Acquisition Parameters
Date_              20161206
Time                    21.06
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       201
DS                         4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                     192.89
DW                     16.800 usec
DE                      18.00 usec
TE                     298.0 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                        1
SFO1               125.7703637 MHz
NUC1                       13C
P1                      9.80 usec
PLW1               57.00000000 W
SFO2               500.1320005 MHz
NUC2                       1H
CPDPRG[2            waltz16
PCPD2                  80.00 usec
PLW2               20.00000000 W
PLW12               0.35778001 W
PLW13               0.22898000 W

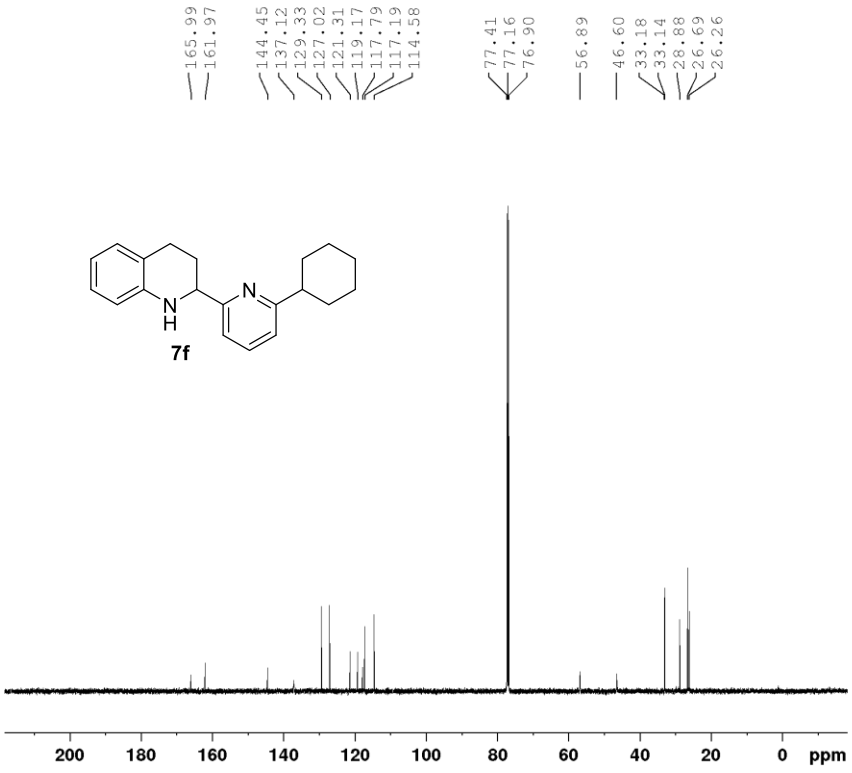
F2 - Processing parameters
SI                     32768
SF                 125.7577743 MHz
WDW                       EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 64
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180313
Time                9.15
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

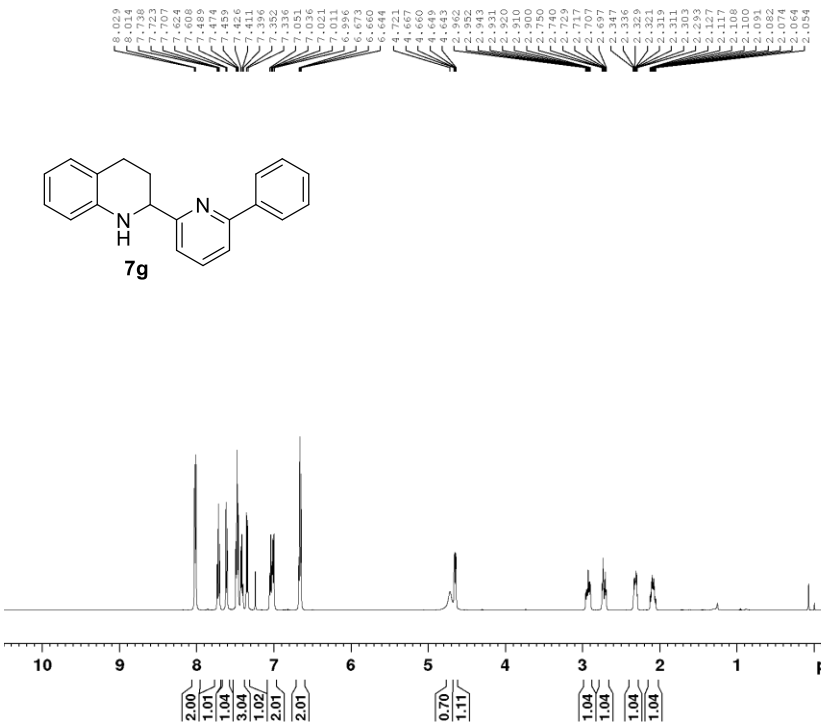
F2 - Processing parameters
SI                 65536
SF            500.1300158 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 65
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180313
Time                9.18
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    45
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

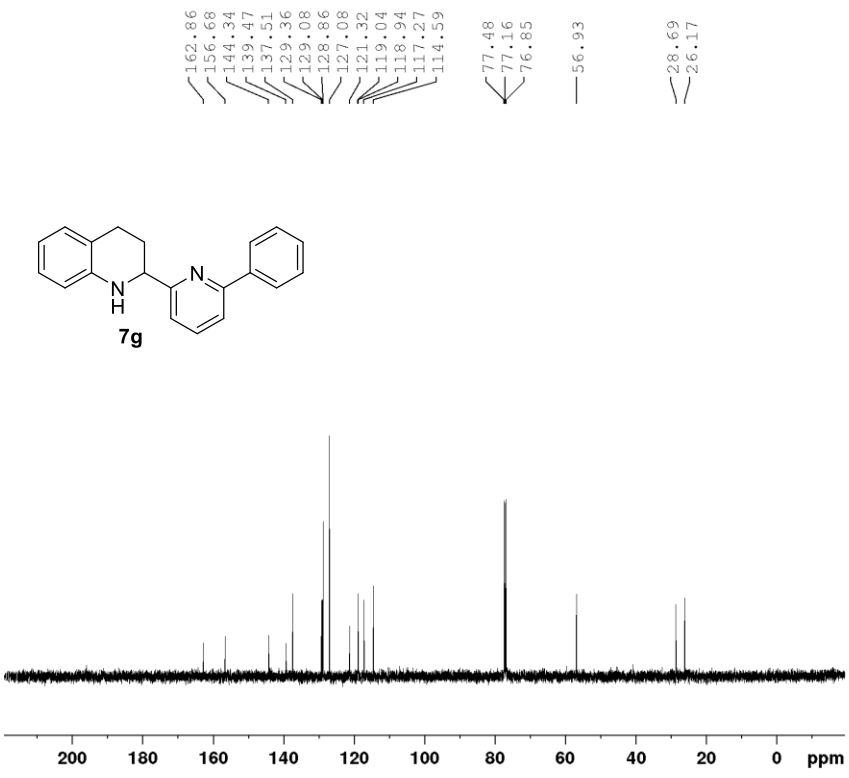
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  50
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180307
Time               21.50
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH            10000.000 Hz
FIDRES             0.152588 Hz
AQ              3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1           500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

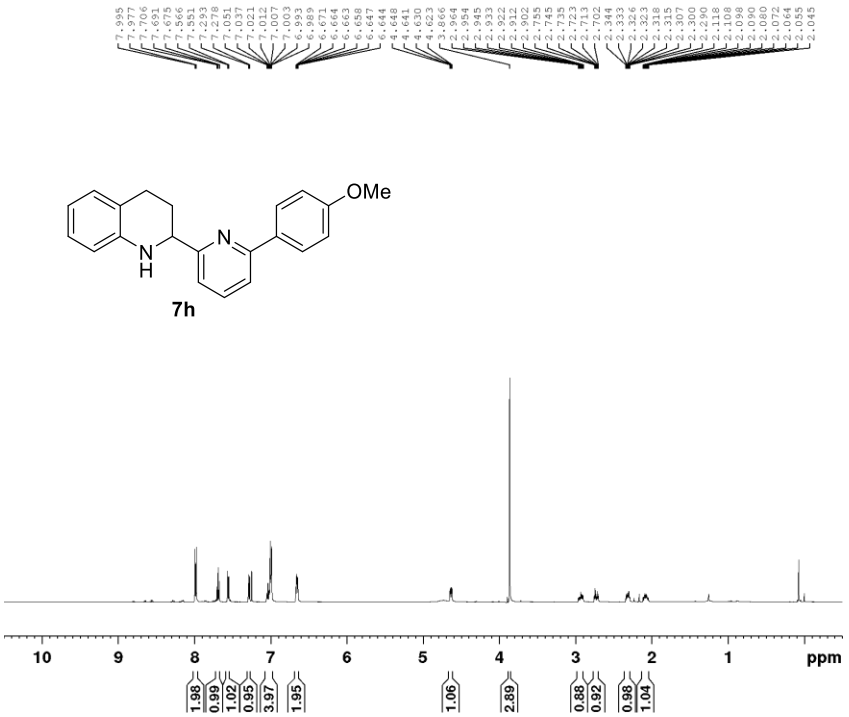
F2 - Processing parameters
SI                 65536
SF            500.1300235 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME           400M 2018
EXPNO                325
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180305
Time               15.05
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                     9
DS                     4
SWH            24038.461 Hz
FIDRES             0.366798 Hz
AQ              1.3631488 sec
RG                206.33
DW                 20.800 usec
DE                  6.50 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1           100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1           54.00000000 W
SFO2           400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

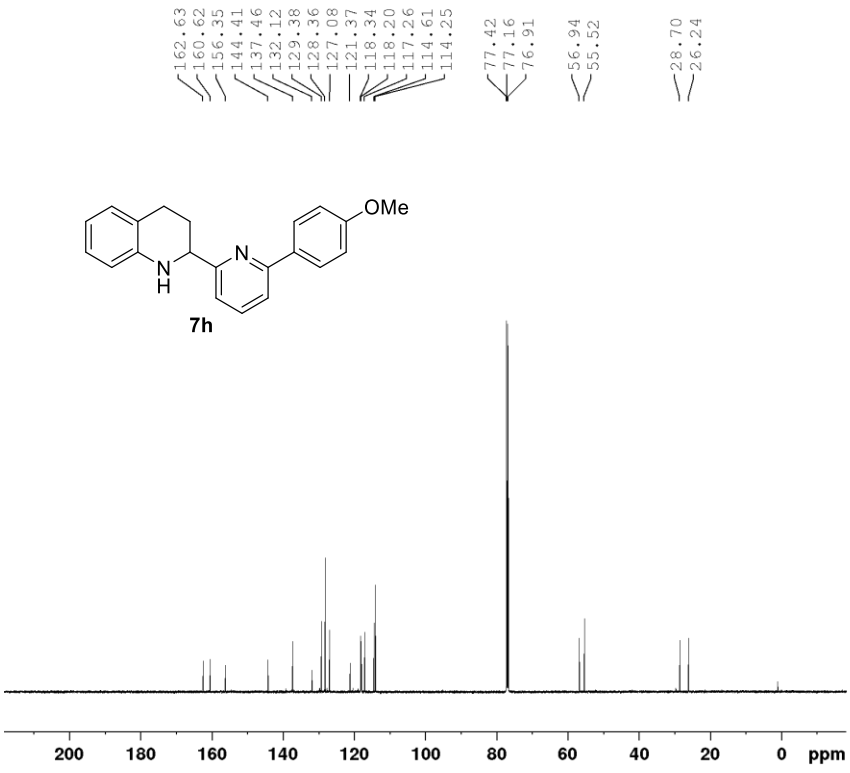
F2 - Processing parameters
SI                 32768
SF            100.6404202 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  500M 2016
EXPNO                        60
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20160303
Time                     16.02
INSTRUM                  spect
PROBHD   5 mm CPPBBO BB
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                         16
DS                          2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                       55.37
DW                      50.000 usec
DE                       6.50 usec
TE                      298.0 K
D1                 1.00000000 sec
TD0                         1
SFO1               500.1330885 MHz
NUC1                       1H
P1                      10.60 usec
PLW1               20.00000000 W

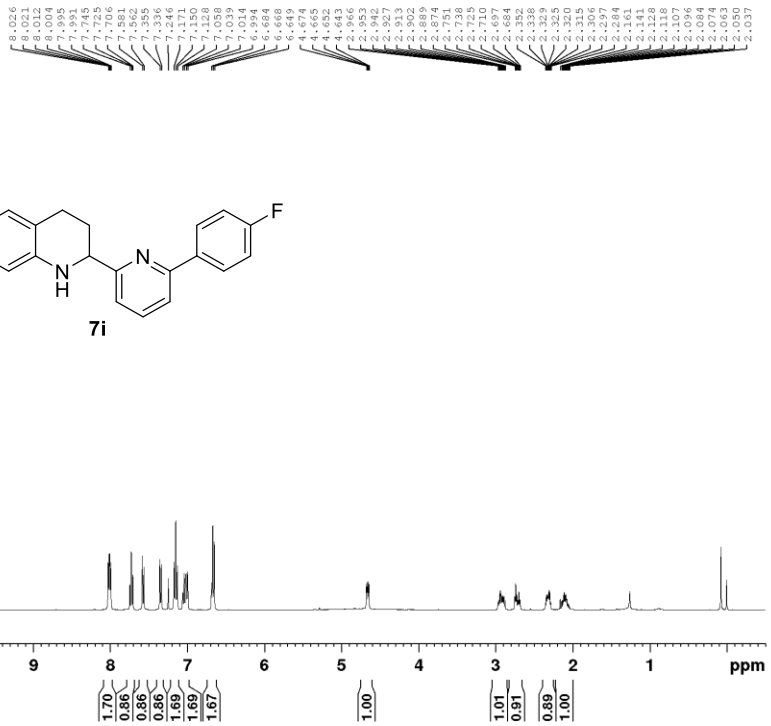
F2 - Processing parameters
SI                      65536
SF                 500.1300166 MHz
WDW                        EM
SSB                 0
LB                       0.30 Hz
GB                  0
PC                       1.00
```




```
Current Data Parameters
NAME                  500M 2016
EXPNO                        62
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20160303
Time                     16.05
INSTRUM                  spect
PROBHD   5 mm CPPBBO BB
PULPROG                zgpg30
TD                      65536
SOLVENT                 CDCl3
NS                        221
DS                          4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                      192.89
DW                      16.800 usec
DE                      18.00 usec
TE                      298.0 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                         1
SFO1               125.7703637 MHz
NUC1                       13C
P1                       9.80 usec
PLW1               57.00000000 W
SFO2               500.1320005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                   80.00 usec
PLW2               20.00000000 W
PLW12               0.35778001 W
PLW13               0.22898000 W

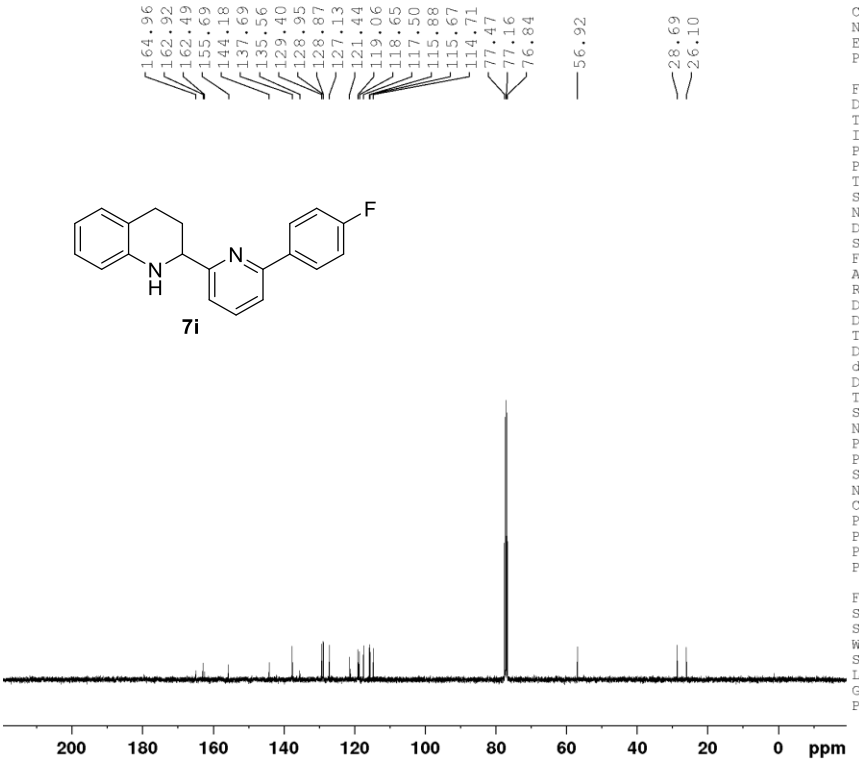
F2 - Processing parameters
SI                      32768
SF                 125.7577725 MHz
WDW                        EM
SSB                 0
LB                       1.00 Hz
GB                  0
PC                       1.40
```




```
Current Data Parameters
NAME                 400M2017
EXPNO                      78
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170401
Time                   18.55
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 8012.820 Hz
FIDRES                0.244532 Hz
AQ                    2.0447233 sec
RG                      206.33
DW                      62.400 usec
DE                       6.50 usec
TE                      302.8 K
D1                    2.00000000 sec
TD0                         1
SFO1                400.2424716 MHz
NUC1                       1H
P1                       14.80 usec
PLW1                12.00000000 W

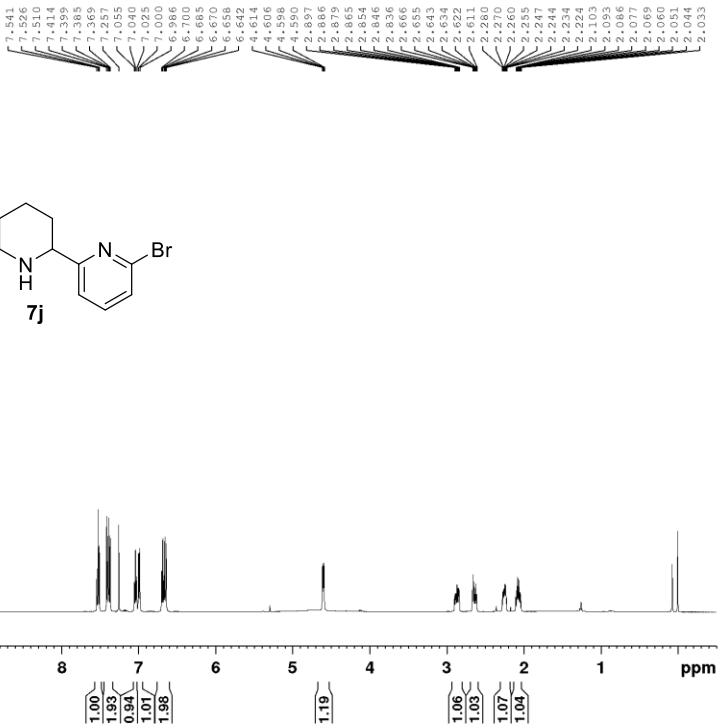
F2 - Processing parameters
SI                        65536
SF                  400.2400151 MHz
WDW                          EM
SSB          0
LB                        0.30 Hz
GB           0
PC                        1.00
```




```
Current Data Parameters
NAME                 400M2017
EXPNO                      79
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170401
Time                   18.59
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG              zgpg30
TD                    65536
SOLVENT                CDCl3
NS                       224
DS                         4
SWH                24038.461 Hz
FIDRES                0.366798 Hz
AQ                    1.3631488 sec
RG                      206.33
DW                      20.800 usec
DE                       6.50 usec
TE                      303.4 K
D1                    2.00000000 sec
d11                   0.03000000 sec
DELTA                 1.89999998 sec
TD0                         1
SFO1                100.6504916 MHz
NUC1                       13C
P1                       10.00 usec
PLW1                54.00000000 W
SFO2                400.2416010 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                12.00000000 W
PLW12                 0.34680000 W
PLW13                 0.28090999 W

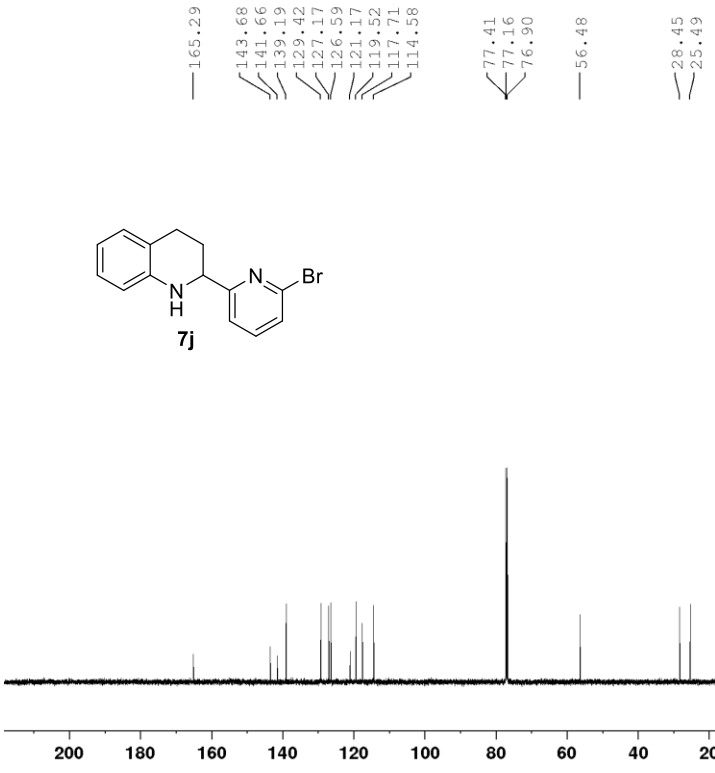
F2 - Processing parameters
SI                        32768
SF                  100.6404139 MHz
WDW                          EM
SSB          0
LB                        1.00 Hz
GB           0
PC                        1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 67
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180314
Time               11.10
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    31
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

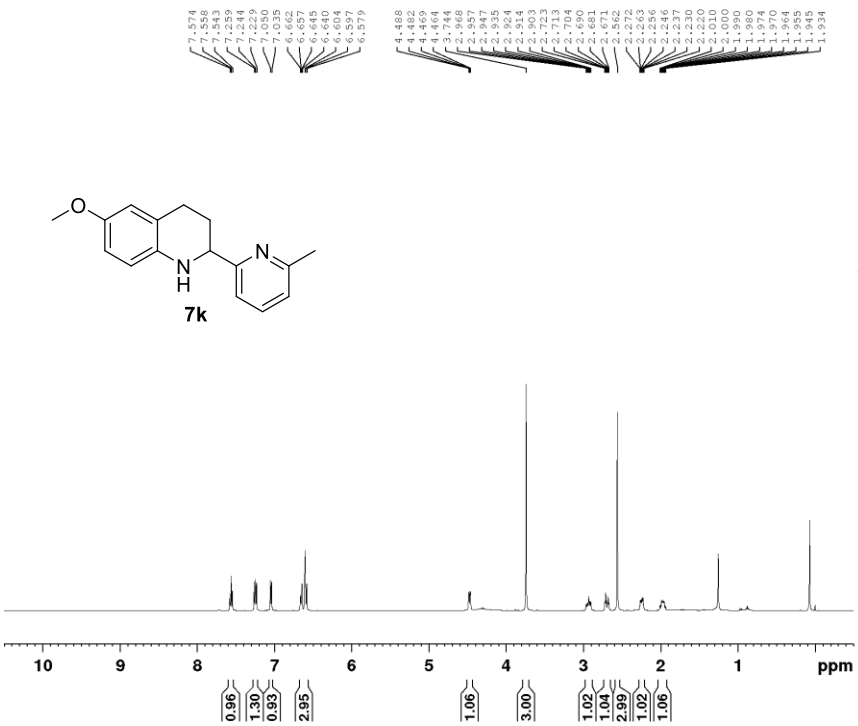
F2 - Processing parameters
SI                 65536
SF            500.1300137 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 48
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180302
Time                9.01
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    10
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

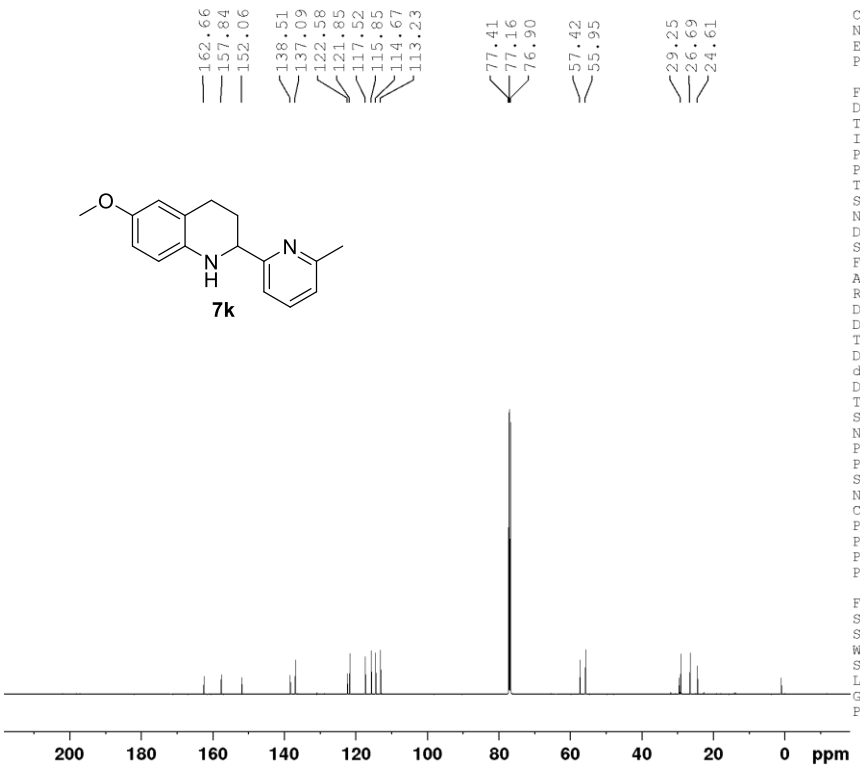
F2 - Processing parameters
SI                 32768
SF            125.7577747 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  84
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180327
Time                0.46
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

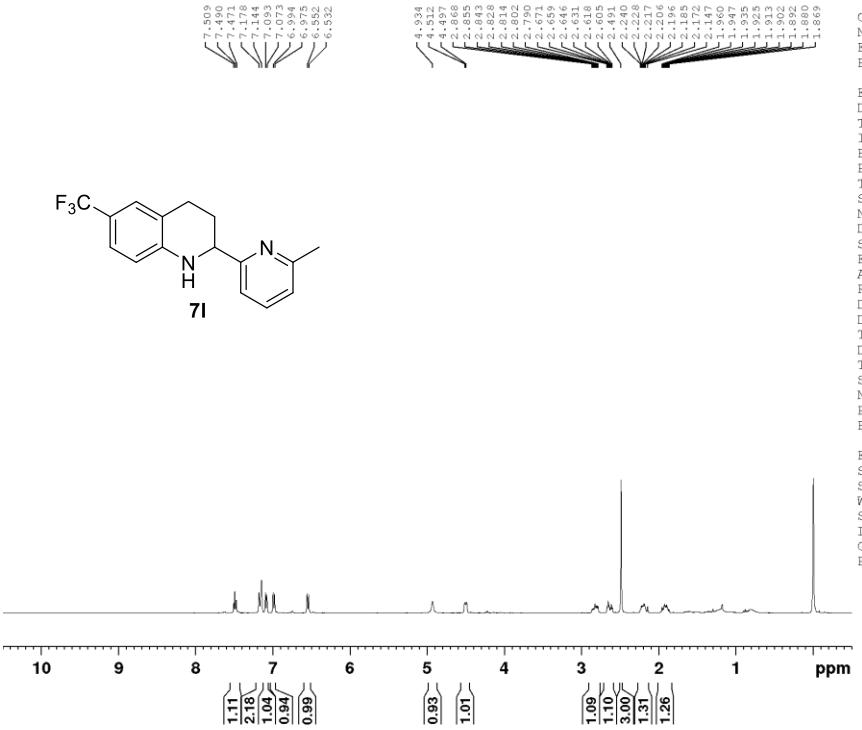
F2 - Processing parameters
SI                 65536
SF            500.1300125 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  85
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180327
Time                1.40
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

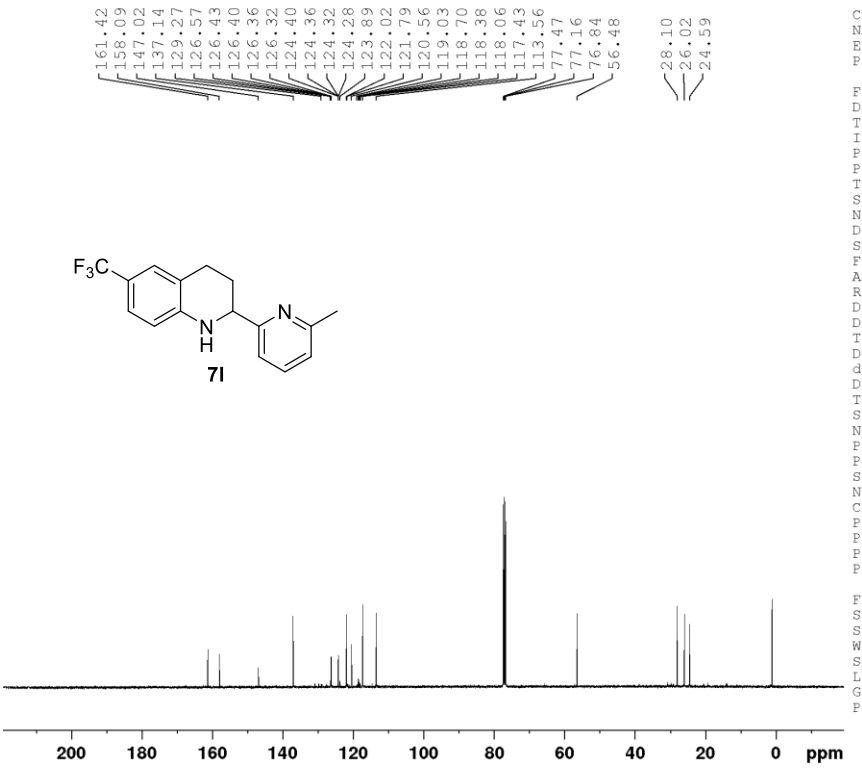
F2 - Processing parameters
SI                 32768
SF            125.7577729 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                 400M 2016
EXPNO                       74
PROCNO                       1

F2 - Acquisition Parameters
Date_               20160822
Time                   17.03
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 8012.820 Hz
FIDRES                0.244532 Hz
AQ                  2.0447233 sec
RG                     92.09
DW                    62.400 usec
DE                     6.50 usec
TE                    301.3 K
D1                  2.00000000 sec
TD0                         1
SFO1               400.2424716 MHz
NUC1                       1H
P1                    14.80 usec
PLW1               12.00000000 W

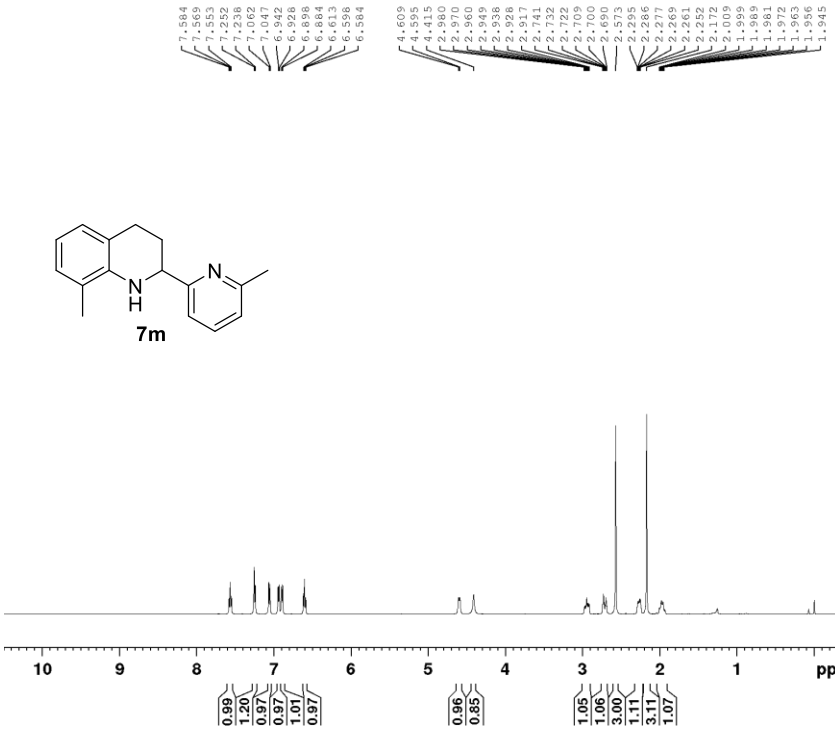
F2 - Processing parameters
SI                         65536
SF                 400.2400422 MHz
WDW                           EM
SSB           0
LB                     0.30 Hz
GB            0
PC                     1.00
```




```
Current Data Parameters
NAME                 400M 2016
EXPNO                       75
PROCNO                       1

F2 - Acquisition Parameters
Date_               20160822
Time                   17.05
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                      1024
DS                         4
SWH                24038.461 Hz
FIDRES                0.366798 Hz
AQ                  1.3631488 sec
RG                    206.33
DW                    20.800 usec
DE                     6.50 usec
TE                    301.6 K
D1                  2.00000000 sec
d11                 0.03000000 sec
DELTA               1.89999998 sec
TD0                         1
SFO1               100.6504916 MHz
NUC1                       13C
P1                    10.00 usec
PLW1               54.00000000 W
SFO2               400.2416010 MHz
NUC2                       1H
CPDPRG[2            waltz16
PCPD2                 90.00 usec
PLW2               12.00000000 W
PLW12               0.34680000 W
PLW13               0.28090999 W

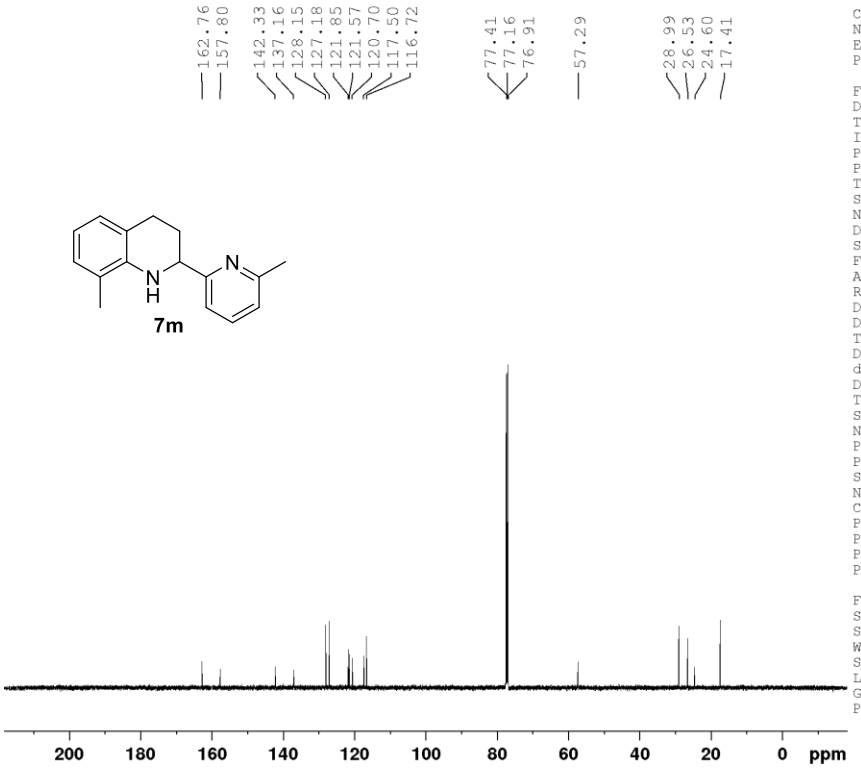
F2 - Processing parameters
SI                         32768
SF                 100.6404139 MHz
WDW                           EM
SSB           0
LB                     1.00 Hz
GB            0
PC                     1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  51
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180307
Time               21.53
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH            10000.000 Hz
FIDRES             0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1           500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1           20.00000000 W

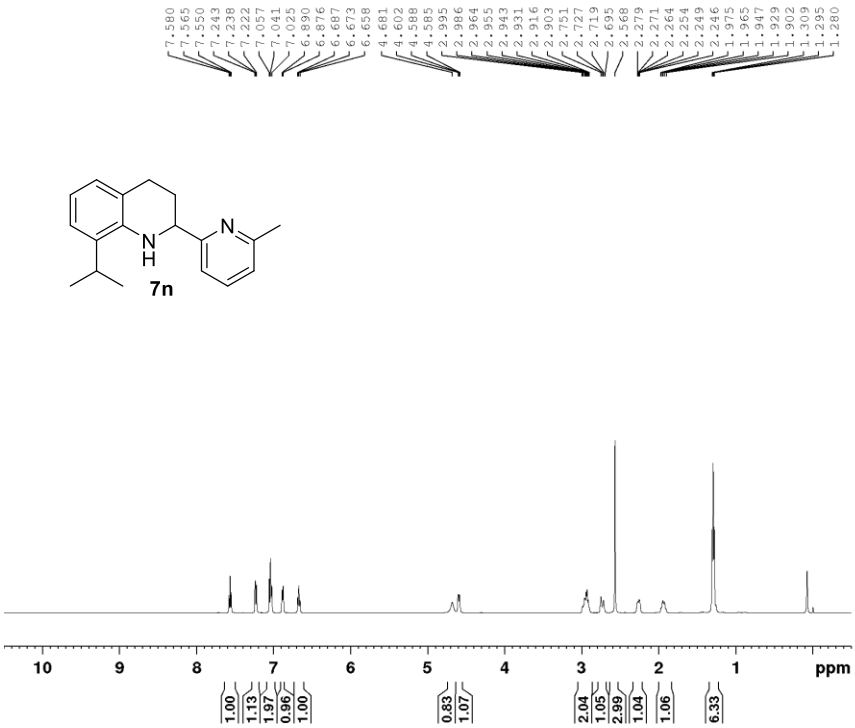
F2 - Processing parameters
SI                 65536
SF             500.1300163 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                  52
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180307
Time               21.55
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    30
DS                     4
SWH            29761.904 Hz
FIDRES             0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1           125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1           57.00000000 W
SFO2           500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2           20.00000000 W
PLW12           0.35778001 W
PLW13           0.22898000 W

F2 - Processing parameters
SI                 32768
SF             125.7577738 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```

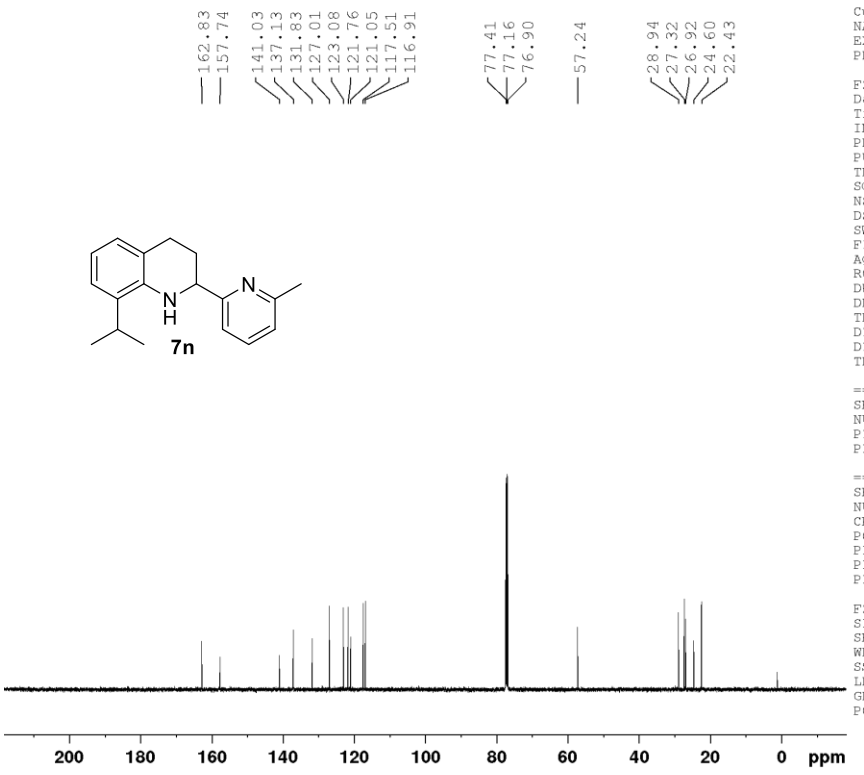



```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 113
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180424
Time               20.38
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          500.1330885 MHz
NUC1                   1H
P1                 11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300204 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



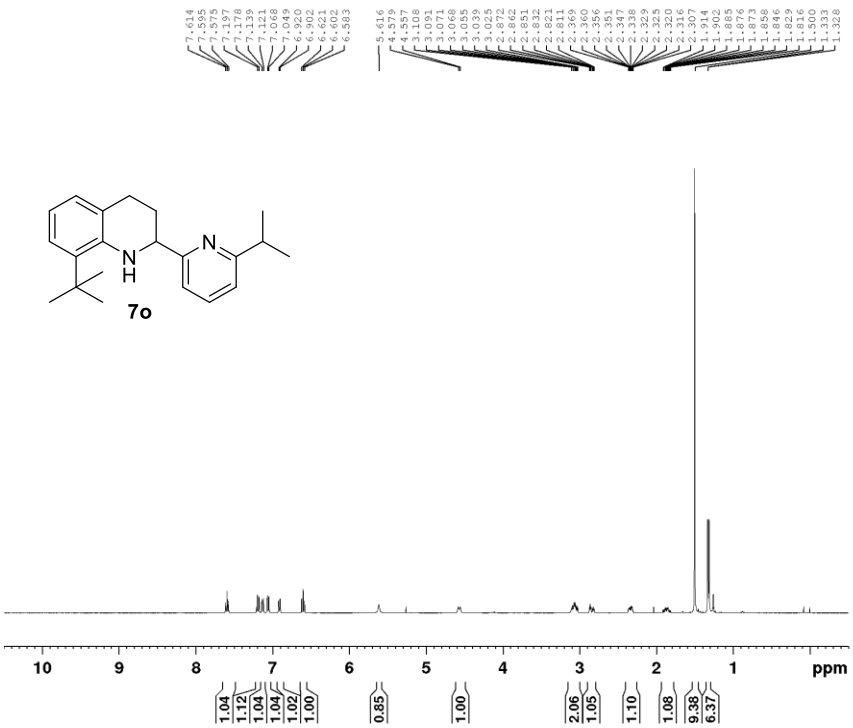

```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 114
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180424
Time               20.41
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    34
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          125.7703637 MHz
NUC1                   13C
P1                  9.80 usec
PLW1          57.00000000 W

======== CHANNEL f2 ========
SFO2          500.1320005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

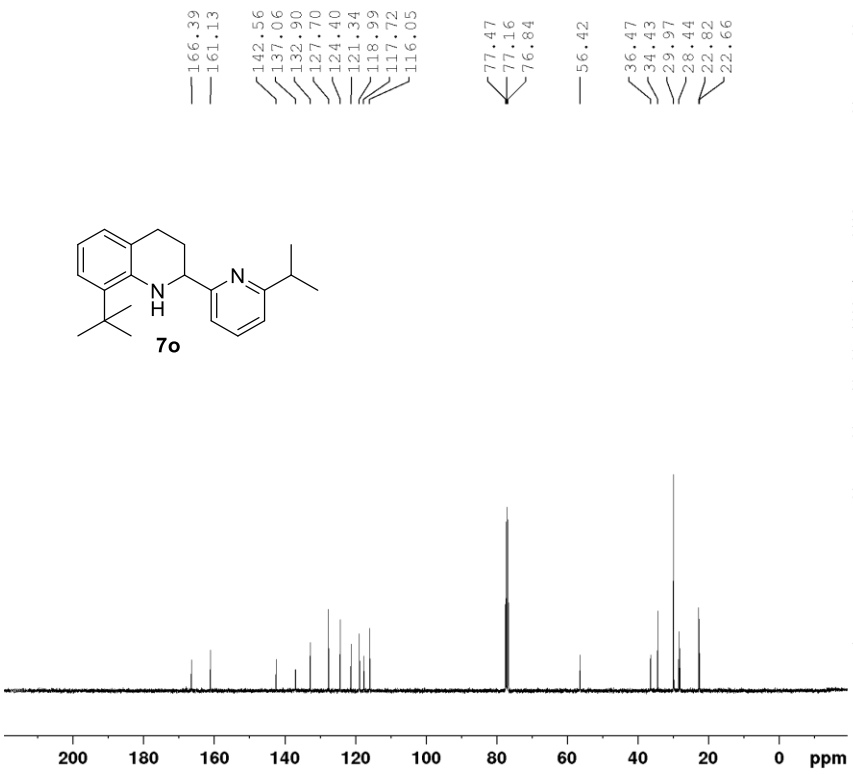
F2 - Processing parameters
SI                 32768
SF            125.7577756 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  qitq
EXPNO                   82
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161125
Time                 16.35
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH               8012.820 Hz
FIDRES               0.244532 Hz
AQ                2.0447233 sec
RG                   39.92
DW                   62.400 usec
DE                    6.50 usec
TE                   298.2 K
D1             2.00000000 sec
TD0                     1
SFO1           400.2424716 MHz
NUC1                   1H
P1                   14.80 usec
PLW1           12.00000000 W

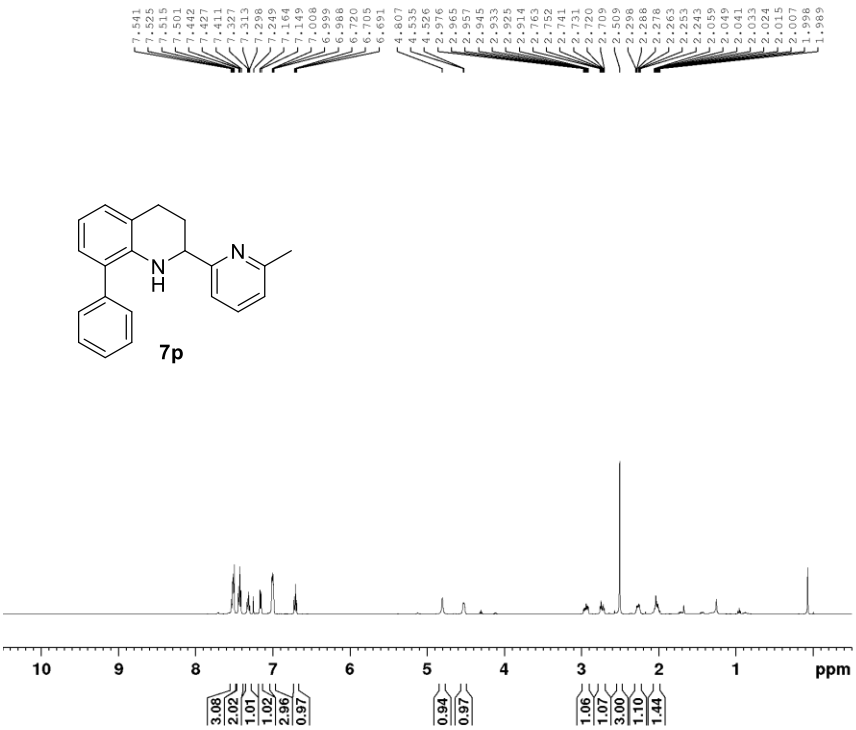
F2 - Processing parameters
SI                  65536
SF             400.2400284 MHz
WDW                    EM
SSB       0
LB                    0.30 Hz
GB        0
PC                    1.00
```




```
Current Data Parameters
NAME                  qitq
EXPNO                   83
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161125
Time                 16.43
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    128
DS                      4
SWH              24038.461 Hz
FIDRES               0.366798 Hz
AQ                1.3631488 sec
RG                  206.33
DW                   20.800 usec
DE                    6.50 usec
TE                   299.4 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                     1
SFO1           100.6504916 MHz
NUC1                   13C
P1                   10.00 usec
PLW1           54.00000000 W
SFO2           400.2416010 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2                90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

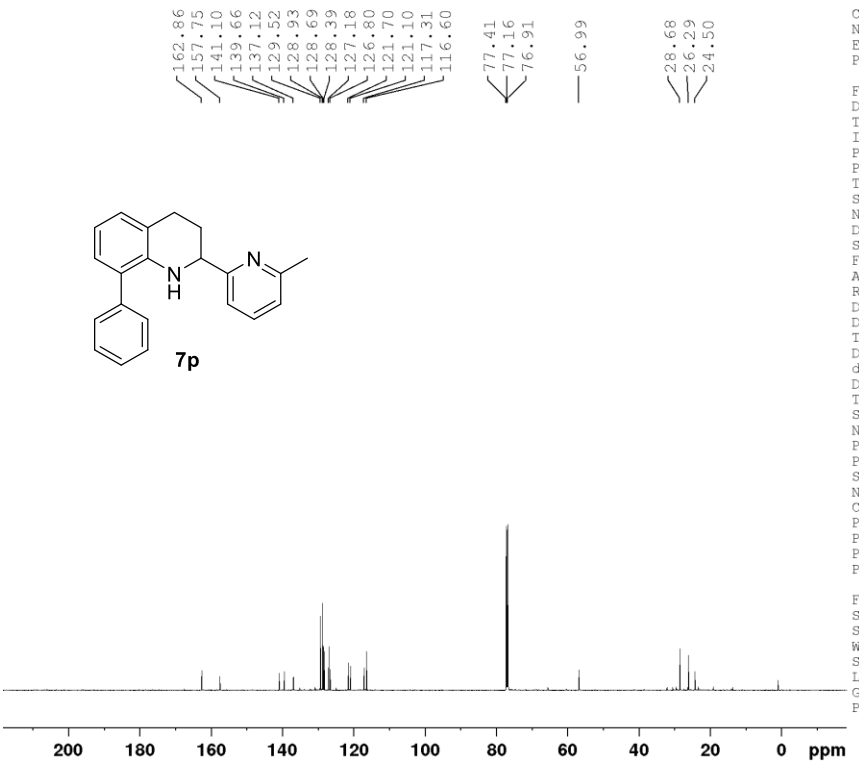
F2 - Processing parameters
SI                  32768
SF             100.6404205 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 86
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180327
Time                1.43
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ              3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

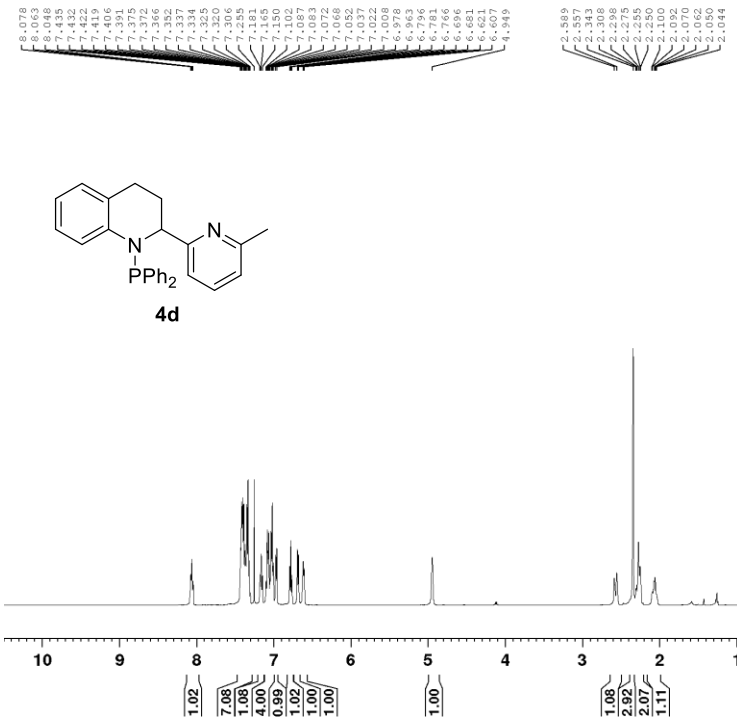
F2 - Processing parameters
SI                 65536
SF            500.1300175 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                 87
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180327
Time                2.38
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ              1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

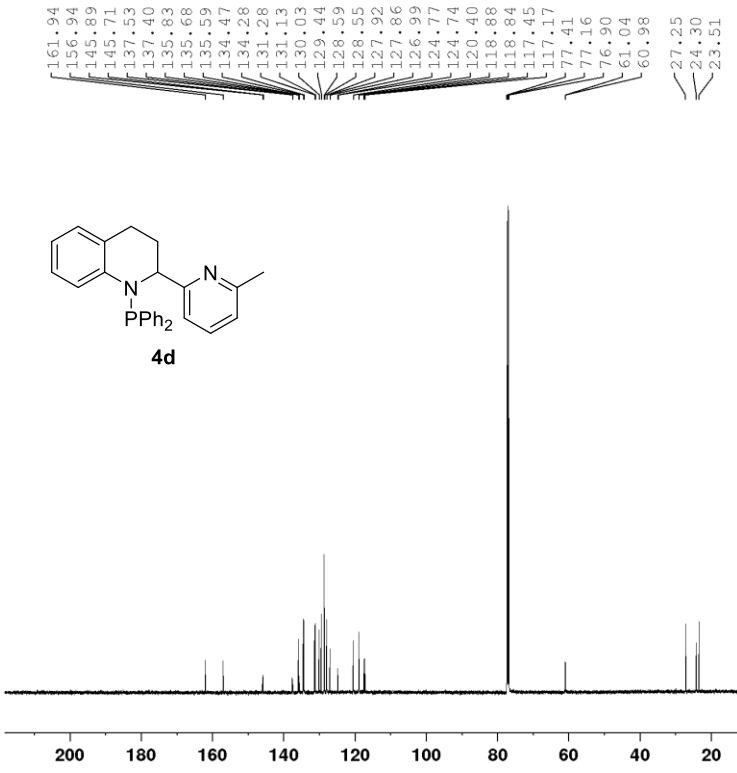
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```



Current Data Parameters
NAME 500M2017
EXPNO 11
PROCNO 1

F2 - Acquisition Parameters
Date_ 20161213
Time 16.39
INSTRUM spect
PROBHD 5 mm CPPBBO BB
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 10000.000 Hz
FIDRES 0.152588 Hz
AQ 3.2767999 sec
RG 39.43
DW 50.000 usec
DE 6.50 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1
SFO1 500.1330885 MHz
NUC1 1H
P1 10.60 usec
PLW1 20.00000000 W

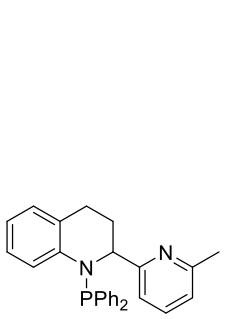
F2 - Processing parameters
SI 65536
SF 500.1300143 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



Current Data Parameters
NAME 500M2017
EXPNO 12
PROCNO 1

F2 - Acquisition Parameters
Date_ 20161213
Time 16.43
INSTRUM spect
PROBHD 5 mm CPPBBO BB
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 436
DS 4
SWH 29761.904 Hz
FIDRES 0.454131 Hz
AQ 1.1010048 sec
RG 192.89
DW 16.800 usec
DE 18.00 usec
TE 298.0 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1
SFO1 125.7703637 MHz
NUC1 13C
P1 9.80 usec
PLW1 57.00000000 W
SFO2 500.1320005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 80.00 usec
PLW2 20.00000000 W
PLW12 0.35778001 W
PLW13 0.22898000 W

F2 - Processing parameters
SI 32768
SF 125.7577729 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

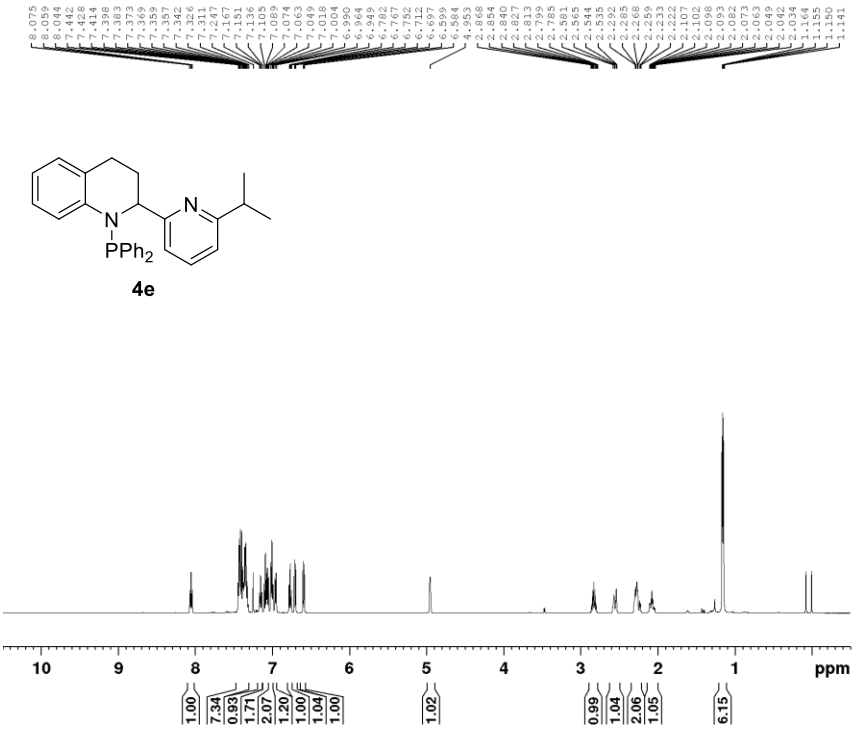


4d


```
Current Data Parameters
NAME            500M P31
EXPNO                  7
PROCNO                 1

F2 - Acquisition Parameters
Date_           20161213
Time               16.34
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zgpg
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     4
SWH           100000.000 Hz
FIDRES          1.525879 Hz
AQ              0.3276800 sec
RG                192.89
DW                  5.000 usec
DE                 18.00 usec
TE                298.0 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA         1.89999998 sec
TD0                    1
SFO1         202.4664578 MHz
NUC1                31P
P1                 11.50 usec
PLW1         52.96599960 W
SFO2         500.1320005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

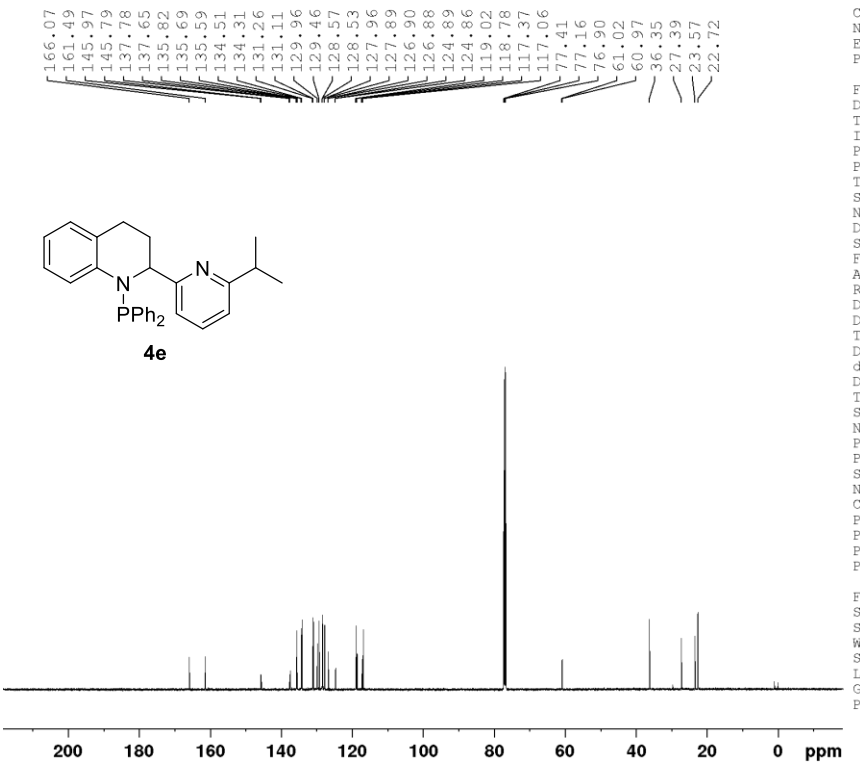
F2 - Processing parameters
SI                 32768
SF           202.4563350 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME            500M2017
EXPNO                 31
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170301
Time                9.41
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH            10000.000 Hz
FIDRES             0.152588 Hz
AQ              3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.0 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 10.60 usec
PLW1          20.00000000 W

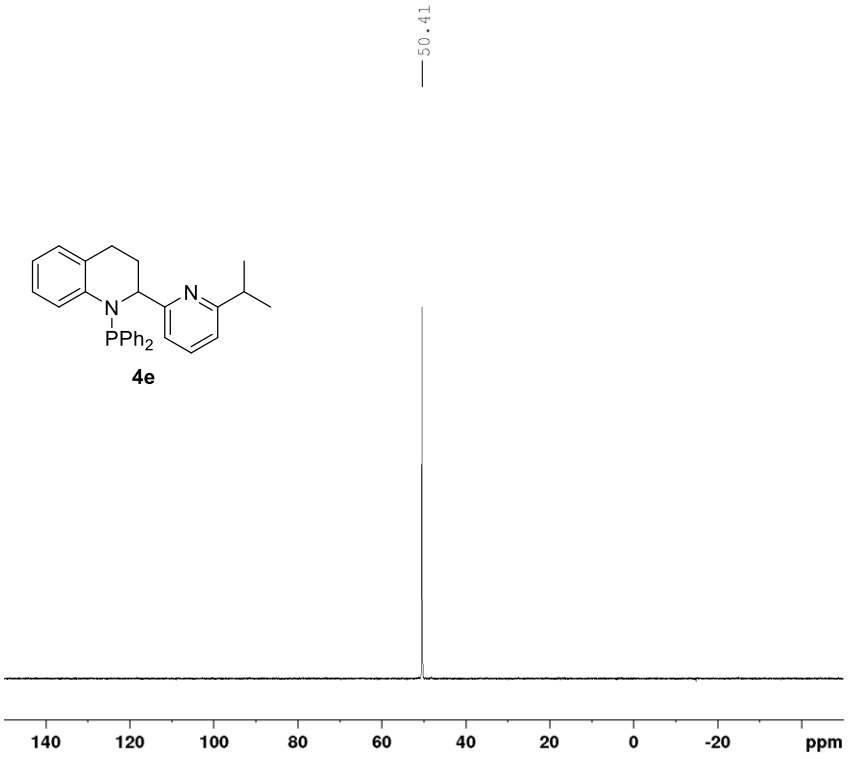
F2 - Processing parameters
SI                 65536
SF            500.1300180 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME            500M2017
EXPNO                 32
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170301
Time                9.45
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   151
DS                     4
SWH            29761.904 Hz
FIDRES             0.454131 Hz
AQ              1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.0 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

F2 - Processing parameters
SI                 32768
SF            125.7577747 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

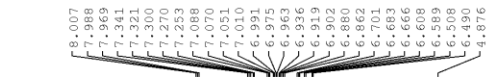


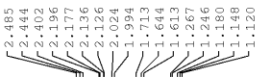
4e

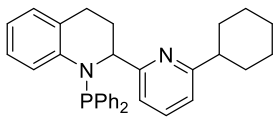
```
Current Data Parameters
NAME            500M P31
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170301
Time                9.36
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zgpg
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     4
SWH           100000.000 Hz
FIDRES          1.525879 Hz
AQ              0.3276800 sec
RG                 192.89
DW                  5.000 usec
DE                 18.00 usec
TE                 298.0 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA         1.89999998 sec
TD0                    1
SFO1         202.4664578 MHz
NUC1                31P
P1                 11.50 usec
PLW1         52.96599960 W
SFO2         500.1320005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

F2 - Processing parameters
SI                 32768
SF           202.4563350 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```







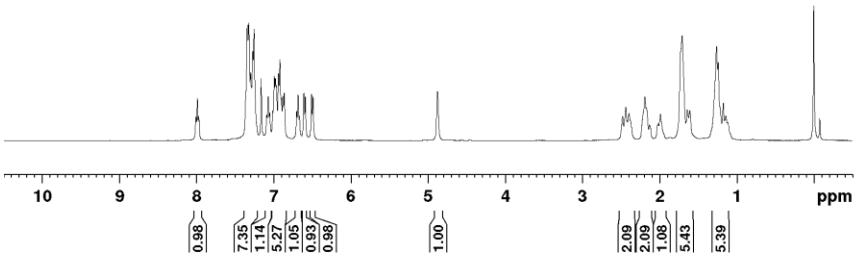
4f

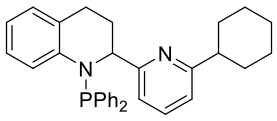
```
Current Data Parameters
NAME          400M 2018
EXPNO              472
PROCNO               1

F2 - Acquisition Parameters
Date_          20180816
Time              19.10
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             8012.820 Hz
FIDRES             0.244532 Hz
AQ              2.0447233 sec
RG                49.81
DW                62.400 usec
DE                 6.50 usec
TE                299.8 K
D1             2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1          400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1          12.00000000 W

F2 - Processing parameters
SI                 65536
SF            400.2400496 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```





4f

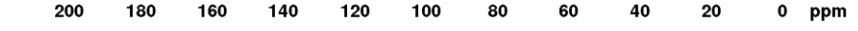
```
Current Data Parameters
NAME         500M 2018-2
EXPNO              185
PROCNO               1

F2 - Acquisition Parameters
Date_          20180816
Time              16.56
INSTRUM           spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                65536
SOLVENT            CDCl3
NS                  151
DS                    4
SWH            29761.904 Hz
FIDRES             0.454131 Hz
AQ              1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1          125.7703637 MHz
NUC1                 13C
P1                  9.80 usec
PLW1          57.00000000 W

======== CHANNEL f2 ========
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

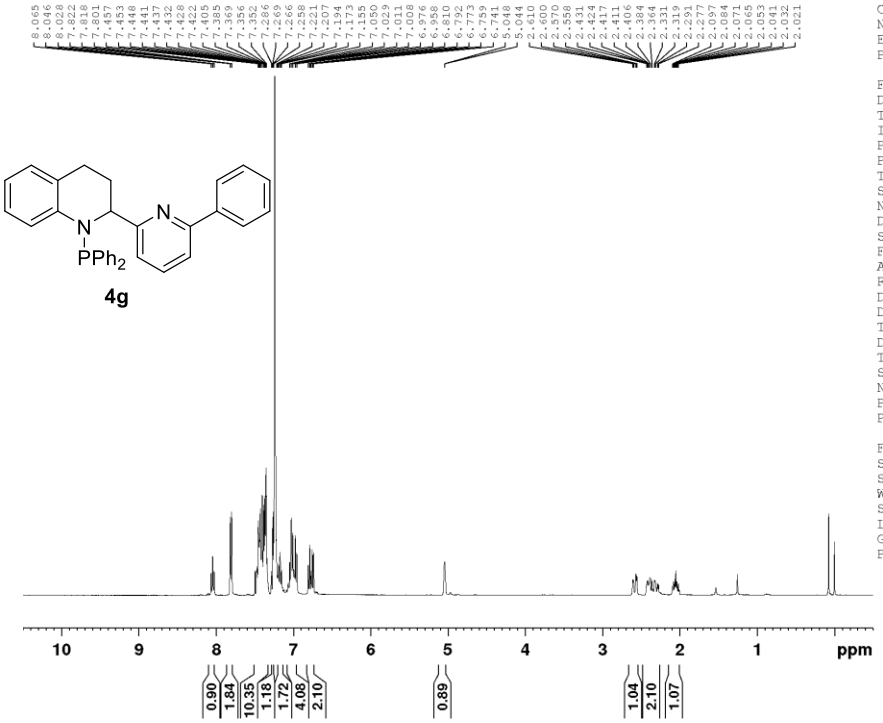
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  400 M P31
EXPNO                         4
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20171211
Time                      17.15
INSTRUM                   spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       65536
SOLVENT                  CDCl3
NS                          16
DS                           4
SWH                  64102.563 Hz
FIDRES                0.978127 Hz
AQ                    0.5111808 sec
RG                       206.33
DW                        7.800 usec
DE                        6.50 usec
TE                       298.6 K
D1                   2.00000000 sec
d11                  0.03000000 sec
DELTA                1.89999998 sec
TD0                           1
SFO1               162.0120208 MHz
NUC1                        31P
P1                       14.60 usec
PLW1                13.00000000 W
SFO2               400.2416010 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                12.00000000 W
PLW12                0.34680000 W
PLW13                0.28090999 W

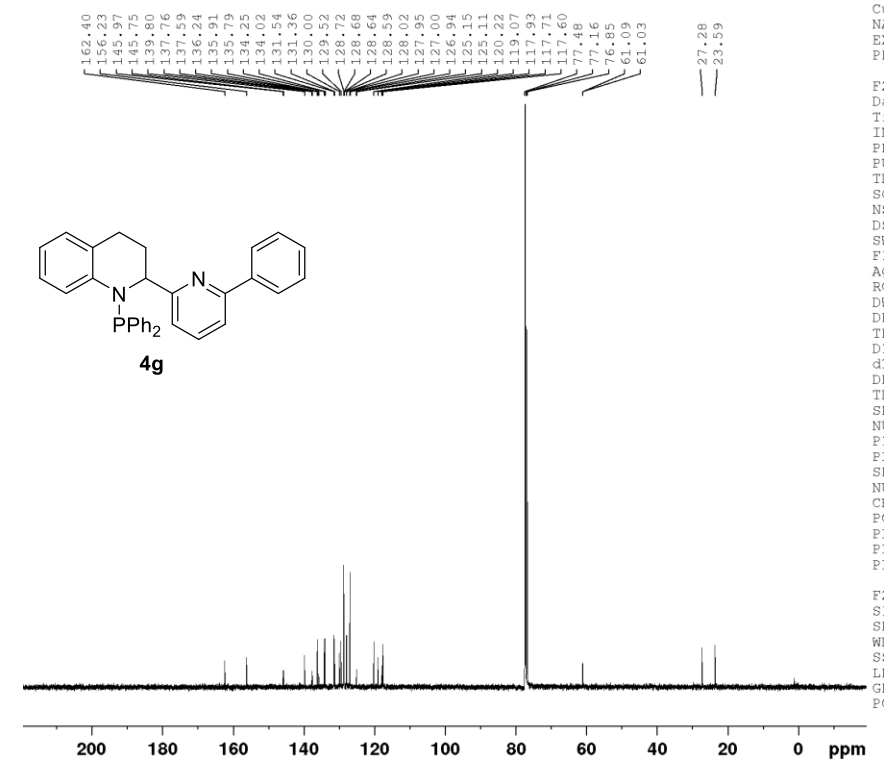
F2 - Processing parameters
SI                        32768
SF                 162.0201218 MHz
WDW                          EM
SSB       0
LB                        1.00 Hz
GB        0
PC                        1.40
```




```
Current Data Parameters
NAME            400M2017
EXPNO                290
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171211
Time               15.43
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             8012.820 Hz
FIDRES             0.244532 Hz
AQ              2.0447233 sec
RG                 49.81
DW                 62.400 usec
DE                  6.50 usec
TE                 298.6 K
D1              2.00000000 sec
TD0                    1
SFO1          400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1           12.00000000 W

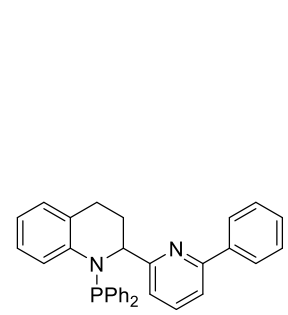
F2 - Processing parameters
SI                 65536
SF            400.2400178 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME            400M2017
EXPNO                291
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171211
Time               15.46
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   470
DS                     4
SWH            24038.461 Hz
FIDRES             0.366798 Hz
AQ              1.3631488 sec
RG                 206.33
DW                 20.800 usec
DE                  6.50 usec
TE                 298.8 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1           54.00000000 W
SFO2          400.2416010 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

F2 - Processing parameters
SI                 32768
SF            100.6404151 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```

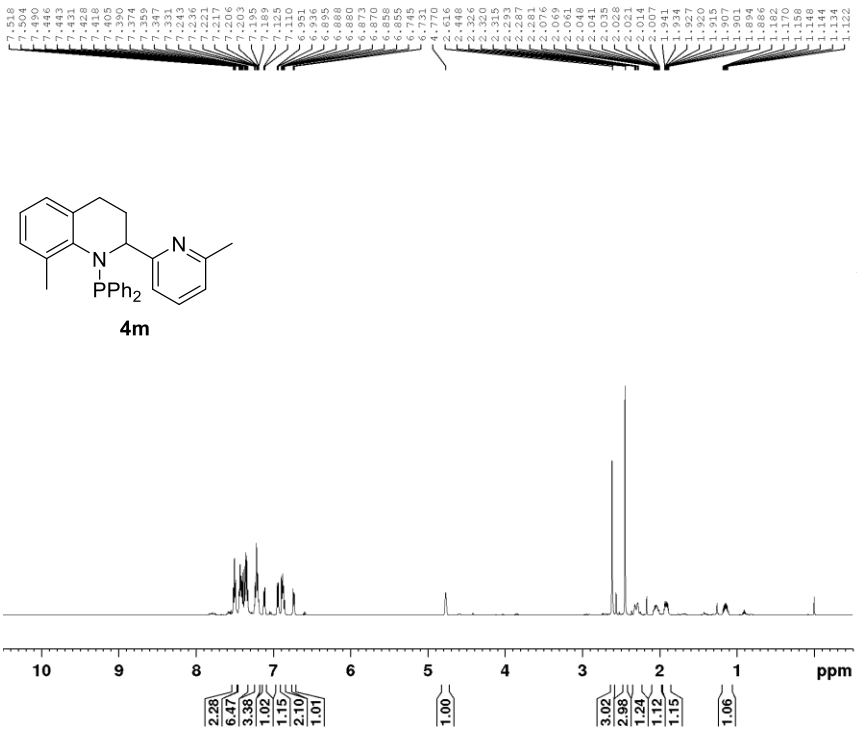


4g


```
Current Data Parameters
NAME          400 M P31
EXPNO                 5
PROCNO                1

F2 - Acquisition Parameters
Date_          20171211
Time              17.18
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    4
SWH           64102.563 Hz
FIDRES         0.978127 Hz
AQ            0.5111808 sec
RG               206.33
DW                7.800 usec
DE                6.50 usec
TE               298.7 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
TD0                   1
SFO1        162.0120208 MHz
NUC1                31P
P1                14.60 usec
PLW1        13.00000000 W
SFO2        400.2416010 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.34680000 W
PLW13        0.28090999 W

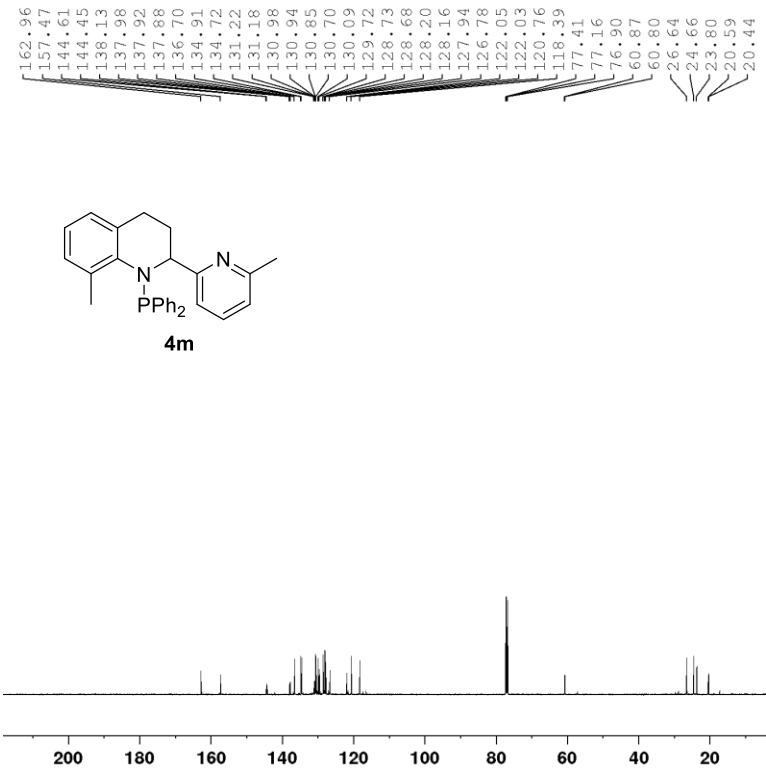
F2 - Processing parameters
SI                32768
SF          162.0201218 MHz
WDW                 EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME              500M2017
EXPNO                    7
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161207
Time                 16.25
INSTRUM              spect
PROBHD   5 mm CPPBBO BB
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH             10000.000 Hz
FIDRES              0.152588 Hz
AQ               3.2767999 sec
RG                   31.72
DW                 50.000 usec
DE                  6.50 usec
TE                 298.1 K
D1              1.00000000 sec
TD0                     1
SFO1           500.1330885 MHz
NUC1                   1H
P1                  10.60 usec
PLW1           20.00000000 W

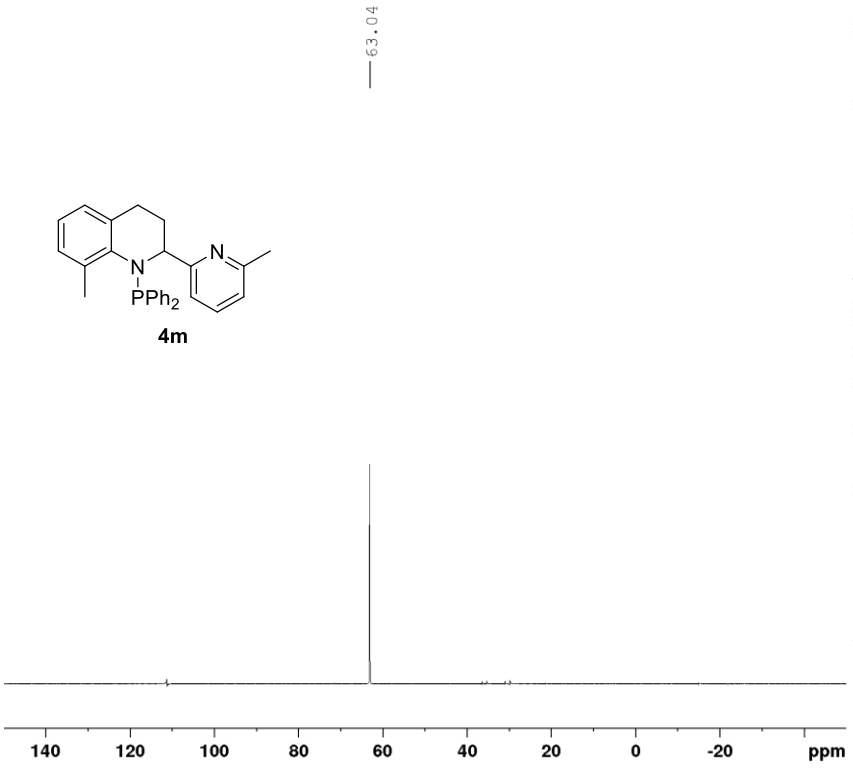
F2 - Processing parameters
SI                  65536
SF             500.1300239 MHz
WDW                    EM
SSB       0
LB                   0.30 Hz
GB        0
PC                   1.00
```




```
Current Data Parameters
NAME              500M2017
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_              20161207
Time                 16.28
INSTRUM              spect
PROBHD   5 mm CPPBBO BB
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    113
DS                      4
SWH            29761.904 Hz
FIDRES              0.454131 Hz
AQ               1.1010048 sec
RG                  192.89
DW                 16.800 usec
DE                  18.00 usec
TE                 298.1 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                     1
SFO1           125.7703637 MHz
NUC1                   13C
P1                   9.80 usec
PLW1           57.00000000 W
SFO2           500.1320005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2                80.00 usec
PLW2           20.00000000 W
PLW12           0.35778001 W
PLW13           0.22898000 W

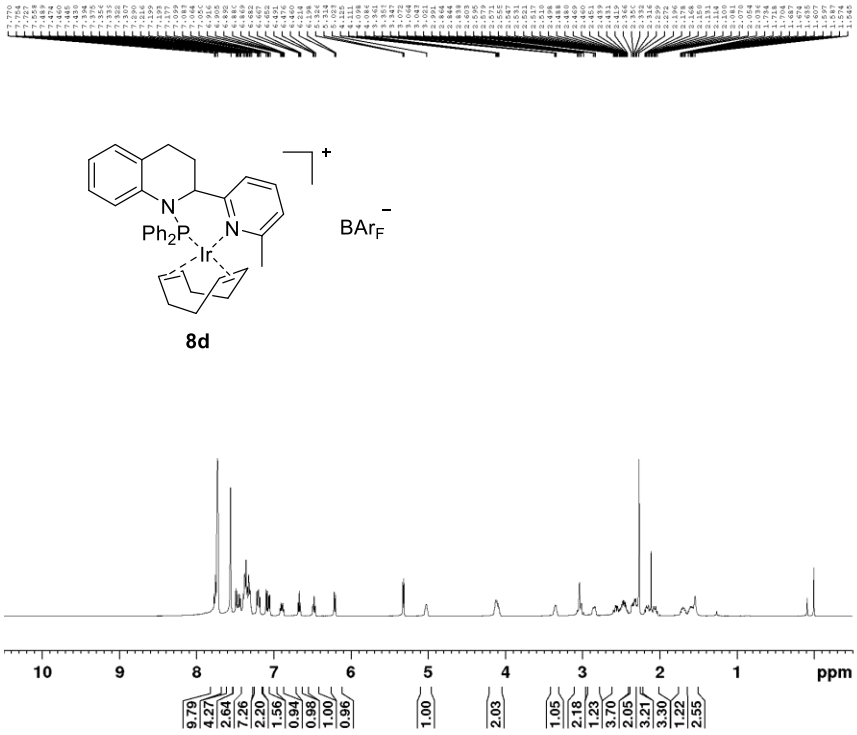
F2 - Processing parameters
SI                  32768
SF             125.7577783 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```




```
Current Data Parameters
NAME                  500M P31
EXPNO                        5
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20161207
Time                     16.13
INSTRUM                  spect
PROBHD    5 mm CPPBBO BB
PULPROG                  zgpg
TD                      65536
SOLVENT                  CDCl3
NS                          16
DS                           4
SWH                100000.000 Hz
FIDRES               1.525879 Hz
AQ                 0.3276800 sec
RG                      192.89
DW                       5.000 usec
DE                      18.00 usec
TE                      298.0 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                          1
SFO1             202.4664578 MHz
NUC1                      31P
P1                      11.50 usec
PLW1              52.96599960 W
SFO2             500.1320005 MHz
NUC2                      1H
CPDPRG[2               waltz16
PCPD2                   80.00 usec
PLW2              20.00000000 W
PLW12              0.35778001 W
PLW13              0.22898000 W

F2 - Processing parameters
SI                       32768
SF               202.4563350 MHz
WDW                         EM
SSB          0
LB                       1.00 Hz
GB           0
PC                       1.40
```

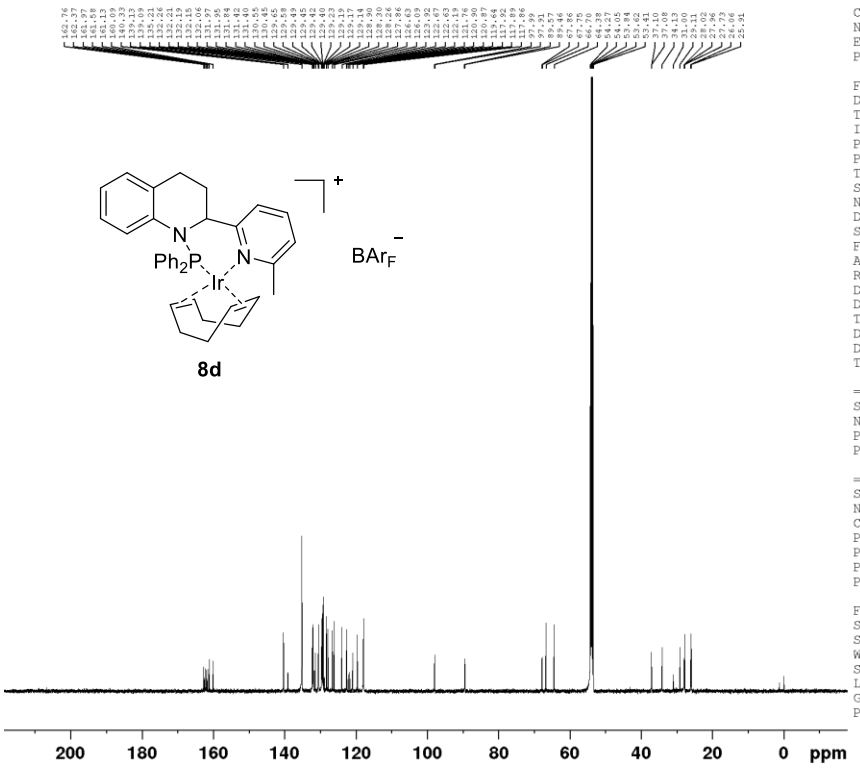



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                192
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180818
Time               18.12
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT           CD2Cl2
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES         0.152588 Hz
AQ            3.2767999 sec
RG                 31.72
DW                50.000 usec
DE                 6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         500.1330885 MHz
NUC1                   1H
P1                 11.50 usec
PLW1        20.00000000 W

F2 - Processing parameters
SI                 65536
SF           500.1300230 MHz
WDW                   EM
SSB      0
LB                 0.30 Hz
GB       0
PC                 1.00
```



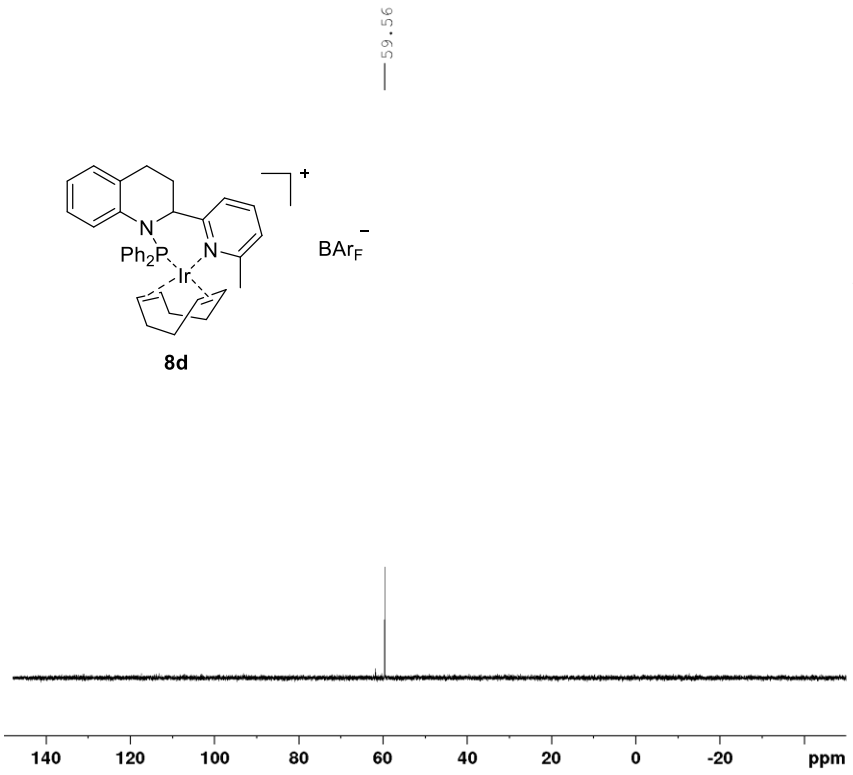

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                193
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180818
Time               18.17
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT           CD2Cl2
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES         0.454131 Hz
AQ            1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1        57.00000000 W

======== CHANNEL f2 ========
SFO2         500.1320005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2        20.00000000 W
PLW12        0.35778001 W
PLW13        0.22898000 W

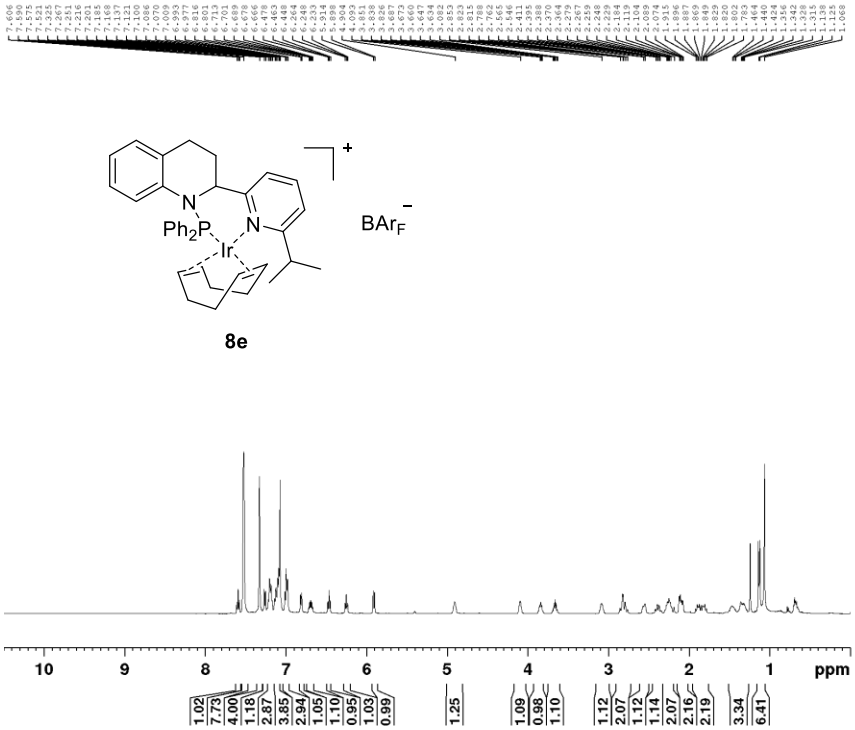
F2 - Processing parameters
SI                 32768
SF           125.7577346 MHz
WDW                   EM
SSB      0
LB                 1.00 Hz
GB       0
PC                 1.40
```




```
Current Data Parameters
NAME          400 M P31
EXPNO                11
PROCNO                1

F2 - Acquisition Parameters
Date_          20171211
Time              21.08
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT         Acetone
NS                   16
DS                    4
SWH           64102.563 Hz
FIDRES         0.978127 Hz
AQ            0.5111808 sec
RG               206.33
DW                7.800 usec
DE                6.50 usec
TE               298.3 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
TD0                   1
SFO1        162.0120208 MHz
NUC1                31P
P1                14.60 usec
PLW1        13.00000000 W
SFO2        400.2416010 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.34680000 W
PLW13        0.28090999 W

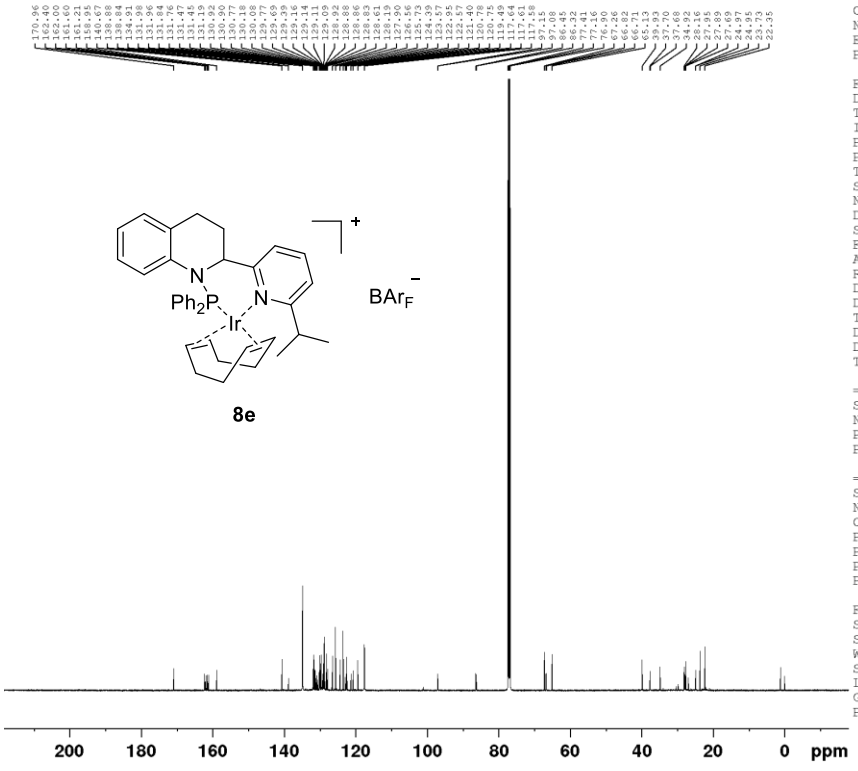
F2 - Processing parameters
SI                32768
SF          162.0201218 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       35
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170302
Time                     17.09
INSTRUM                  spect
PROBHD    5 mm CPPBBO BB
PULPROG                  zg30
TD                      65536
SOLVENT                  CDCl3
NS                          16
DS                           2
SWH                 10000.000 Hz
FIDRES                0.152588 Hz
AQ                  3.2767999 sec
RG                       62.06
DW                      50.000 usec
DE                       6.50 usec
TE                      298.0 K
D1                  1.00000000 sec
TD0                          1
SFO1                500.1330885 MHz
NUC1                        1H
P1                      10.60 usec
PLW1                20.00000000 W

F2 - Processing parameters
SI                      65536
SF                  500.1301071 MHz
WDW                        EM
SSB          0
LB                       0.30 Hz
GB           0
PC                       1.00
```



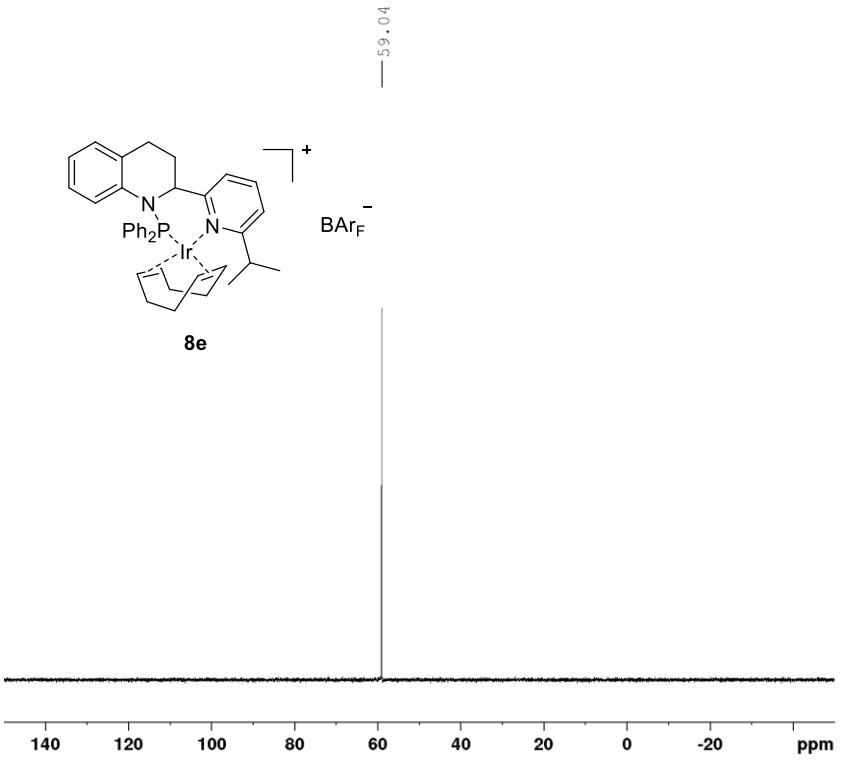

```
Current Data Parameters
NAME              500M 2018-2
EXPNO                     123
PROCNO                      1

F2 - Acquisition Parameters
Date_                 20180506
Time                     3.00
INSTRUM                  spect
PROBHD    5 mm CPPBBO BB
PULPROG                zgpg30
TD                      65536
SOLVENT                  CDCl3
NS                        4096
DS                           4
SWH                 29761.904 Hz
FIDRES                0.454131 Hz
AQ                  1.1010048 sec
RG                      192.89
DW                      16.800 usec
DE                       18.00 usec
TE                      288.8 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1                125.7703637 MHz
NUC1                        13C
P1                       9.80 usec
PLW1                57.00000000 W

======== CHANNEL f2 ========
SFO2                500.1320005 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                    80.00 usec
PLW2                20.00000000 W
PLW12                0.35778001 W
PLW13                0.22898000 W

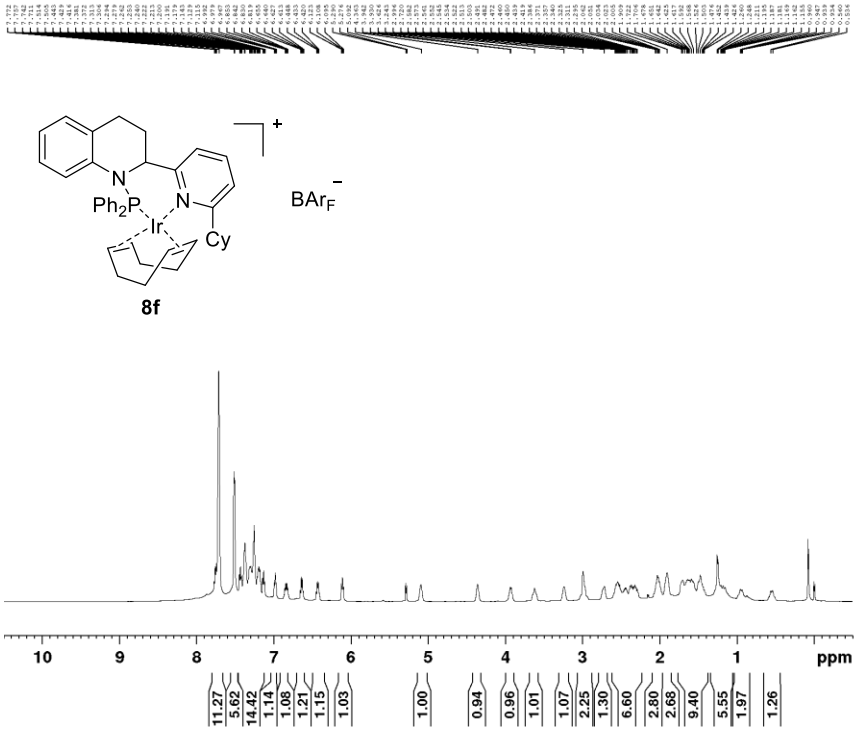
F2 - Processing parameters
SI                      32768
SF                  125.7577738 MHz
WDW                        EM
SSB          0
LB                       1.00 Hz
GB           0
PC                       1.40
```




```
Current Data Parameters
NAME            500M P31
EXPNO                 17
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170302
Time               17.05
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zgpg
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     4
SWH          100000.000 Hz
FIDRES         1.525879 Hz
AQ            0.3276800 sec
RG               192.89
DW                 5.000 usec
DE                18.00 usec
TE                298.0 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA         1.89999998 sec
TD0                    1
SF01         202.4664578 MHz
NUC1                31P
P1                 11.50 usec
PLW1         52.96599960 W
SF02         500.1320005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

F2 - Processing parameters
SI                 32768
SF           202.4563350 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

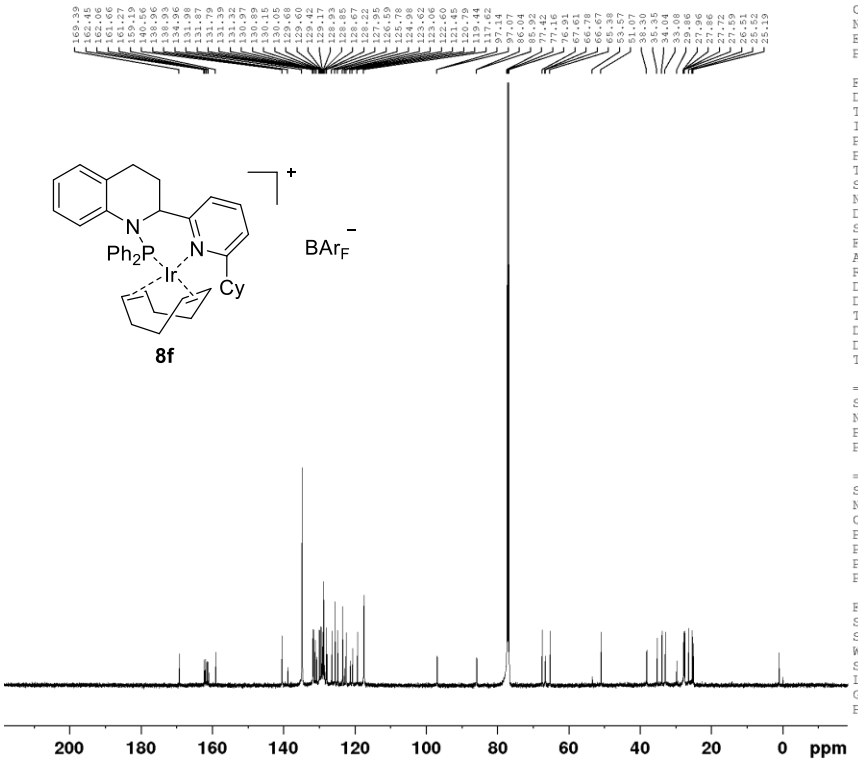



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                186
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180817
Time               21.50
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ            3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         500.1330885 MHz
NUC1                   1H
P1                 11.50 usec
PLW1         20.00000000 W

F2 - Processing parameters
SI                 65536
SF           500.1300202 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



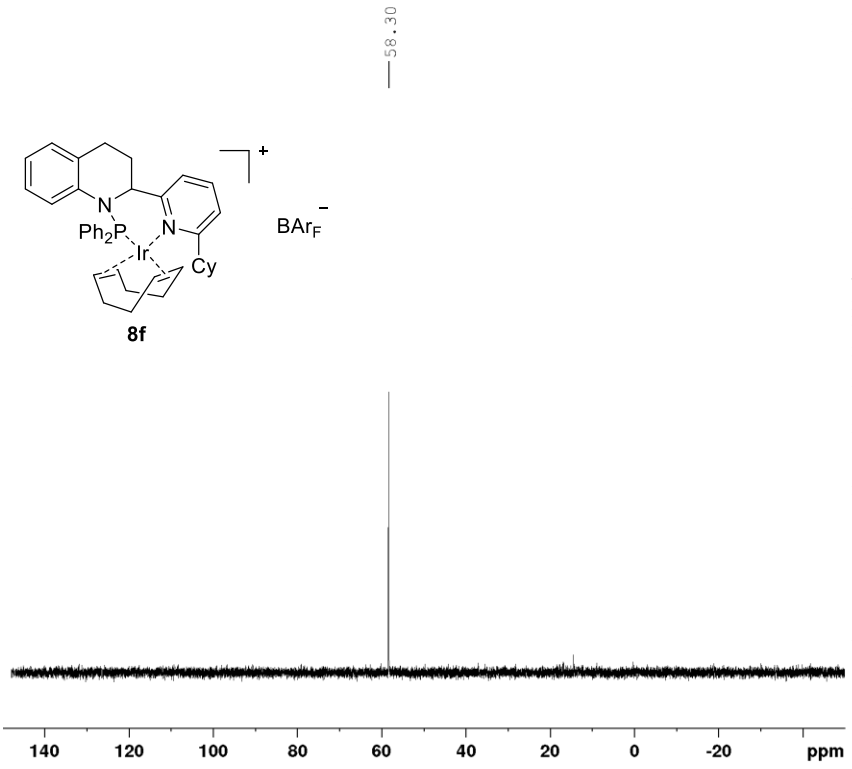

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                187
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180817
Time               21.54
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG            zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ            1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1         57.00000000 W

======== CHANNEL f2 ========
SFO2         500.1320005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

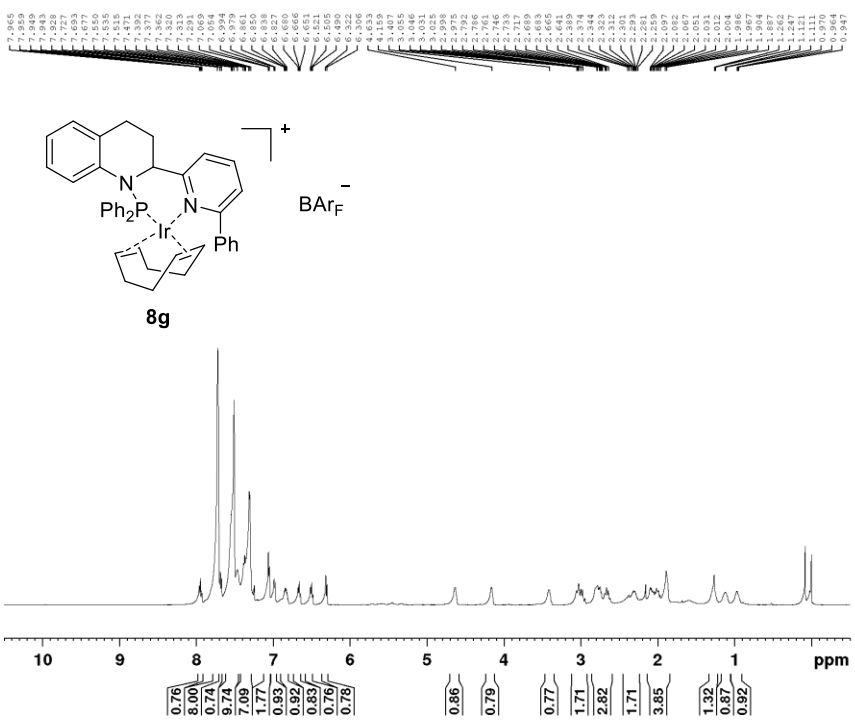
F2 - Processing parameters
SI                 32768
SF           125.7577707 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  400 M P31
EXPNO                        12
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20171211
Time                     21.10
INSTRUM                  spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      65536
SOLVENT                Acetone
NS                           16
DS                            4
SWH                  64102.563 Hz
FIDRES                0.978127 Hz
AQ                    0.5111808 sec
RG                       206.33
DW                        7.800 usec
DE                        6.50 usec
TE                       298.5 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                           1
SFO1             162.0120208 MHz
NUC1                        31P
P1                       14.60 usec
PLW1              13.00000000 W
SFO2             400.2416010 MHz
NUC2                        1H
CPDPRG[2               waltz16
PCPD2                    90.00 usec
PLW2              12.00000000 W
PLW12              0.34680000 W
PLW13              0.28090999 W

F2 - Processing parameters
SI                        32768
SF               162.0201218 MHz
WDW                          EM
SSB          0
LB                        1.00 Hz
GB           0
PC                        1.40
```

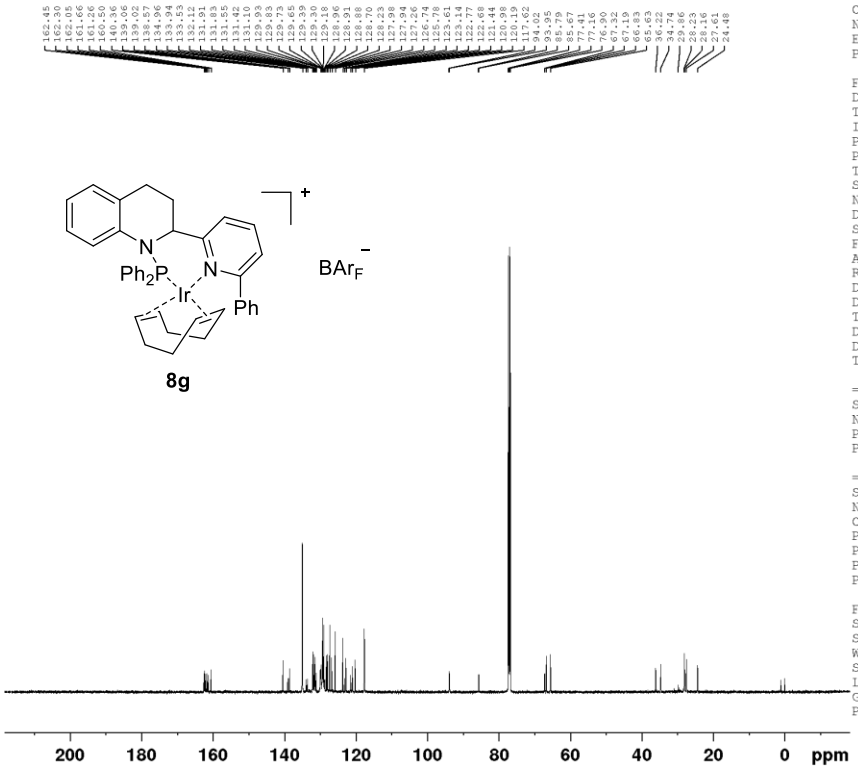



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                200
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180822
Time               12.17
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 62.06
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300157 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



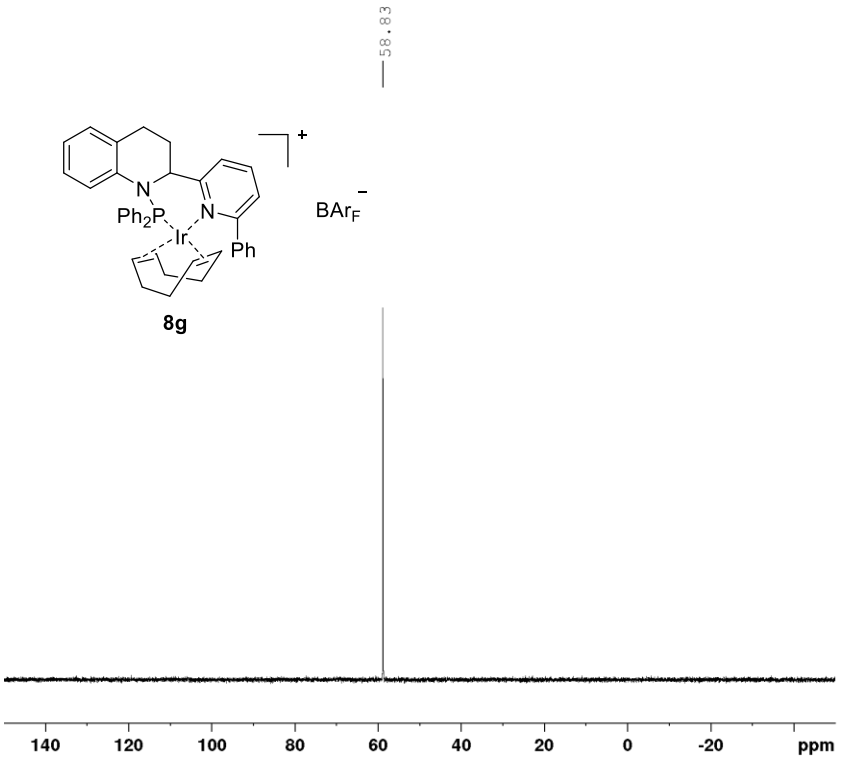

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                201
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180822
Time               13.11
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W

======== CHANNEL f2 ========
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

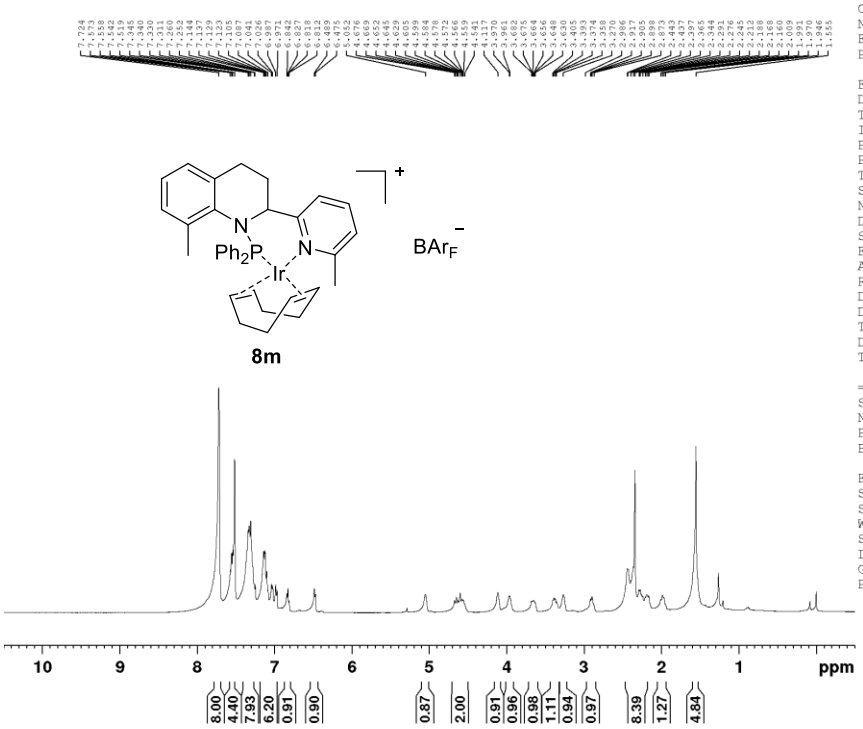
F2 - Processing parameters
SI                 32768
SF            125.7577711 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME            500M P31
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20161228
Time                9.38
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zgpg
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     4
SWH          100000.000 Hz
FIDRES         1.525879 Hz
AQ            0.3276800 sec
RG               192.89
DW                 5.000 usec
DE                18.00 usec
TE                298.0 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
TD0                    1
SF01        202.4664578 MHz
NUC1                31P
P1                 11.50 usec
PLW1        52.96599960 W
SFO2        500.1320005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2        20.00000000 W
PLW12        0.35778001 W
PLW13        0.22898000 W

F2 - Processing parameters
SI                 32768
SF          202.4563350 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

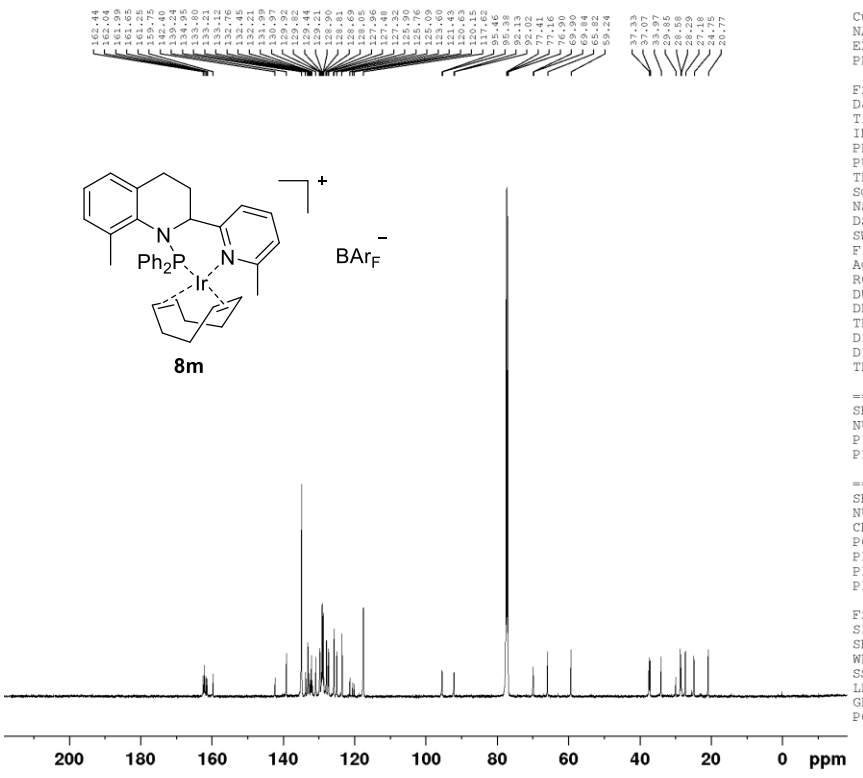



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                194
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180820
Time               16.23
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH           10000.000 Hz
FIDRES        0.152588 Hz
AQ            3.2767999 sec
RG                55.37
DW               50.000 usec
DE                6.50 usec
TE               298.1 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         500.1330885 MHz
NUC1                   1H
P1                 11.50 usec
PLW1        20.00000000 W

F2 - Processing parameters
SI                65536
SF           500.1299600 MHz
WDW                   EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```



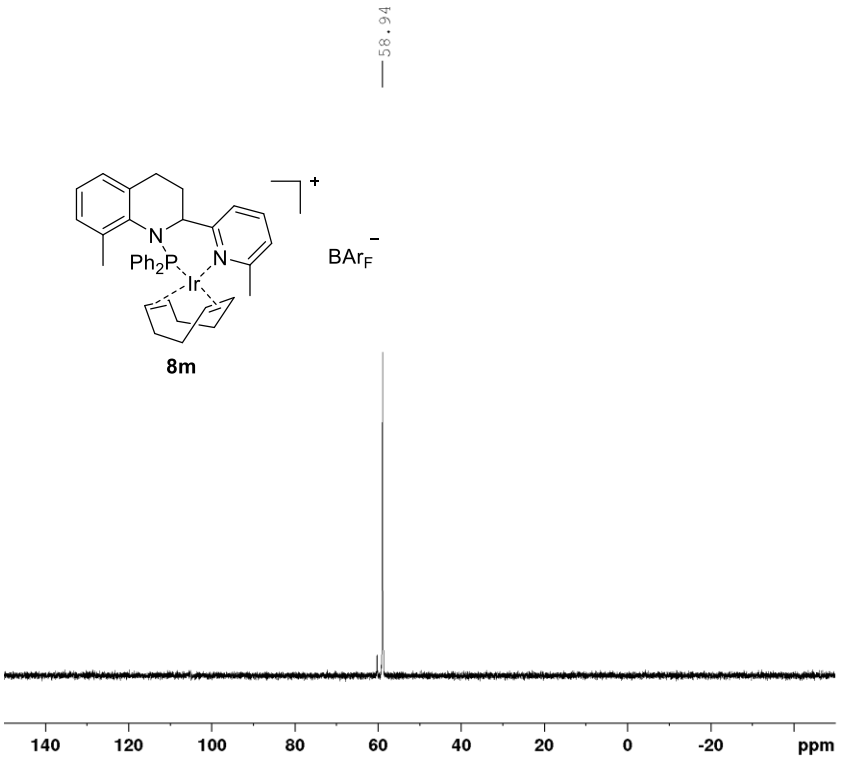

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                195
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180820
Time               17.06
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 1024
DS                    4
SWH           29761.904 Hz
FIDRES        0.454131 Hz
AQ            1.1010048 sec
RG                192.89
DW               16.800 usec
DE                18.00 usec
TE               298.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1        57.00000000 W

======== CHANNEL f2 ========
SFO2         500.1320005 MHz
NUC2                   1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2        20.00000000 W
PLW12        0.35778001 W
PLW13        0.22898000 W

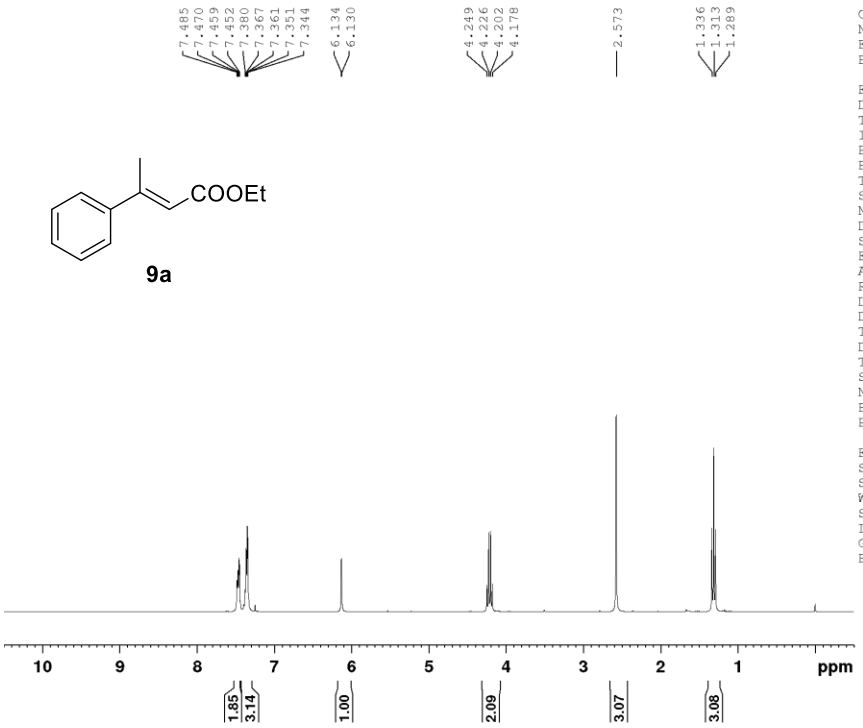
F2 - Processing parameters
SI                32768
SF           125.7577720 MHz
WDW                   EM
SSB       0
LB                2.00 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME            500M P31
EXPNO                  6
PROCNO                 1

F2 - Acquisition Parameters
Date_           20161207
Time               16.15
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zgpg
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     4
SWH          100000.000 Hz
FIDRES         1.525879 Hz
AQ            0.3276800 sec
RG               192.89
DW                 5.000 usec
DE                18.00 usec
TE                298.0 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
TD0                    1
SF01        202.4664578 MHz
NUC1                31P
P1                11.50 usec
PLW1        52.96599960 W
SF02        500.1320005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             80.00 usec
PLW2        20.00000000 W
PLW12        0.35778001 W
PLW13        0.22898000 W

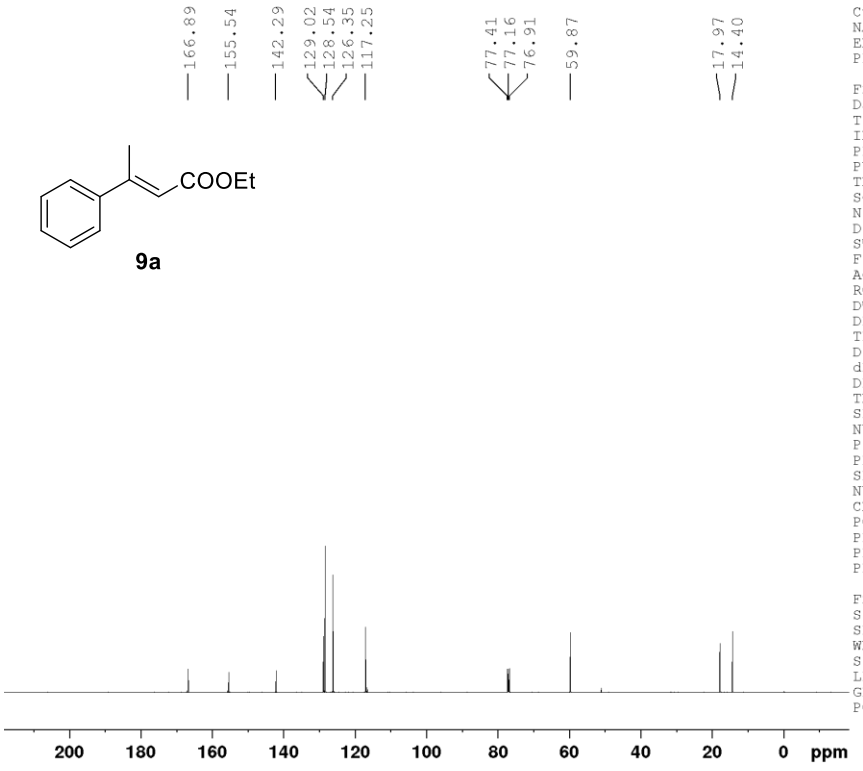
F2 - Processing parameters
SI                 32768
SF          202.4563350 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  300M 2016
EXPNO                        58
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20160621
Time                     21.08
INSTRUM                  spect
PROBHD    5 mm DUL 13C-1
PULPROG                   zg30
TD                       65536
SOLVENT                  CDCl3
NS                          16
DS                           2
SWH                   6009.615 Hz
FIDRES                0.091699 Hz
AQ                    5.4525952 sec
RG                       142.81
DW                       83.200 usec
DE                         6.50 usec
TE                        301.2 K
D1                    1.00000000 sec
TD0                          1
SFO1                300.1318534 MHz
NUC1                        1H
P1                         8.00 usec
PLW1                18.00000000 W

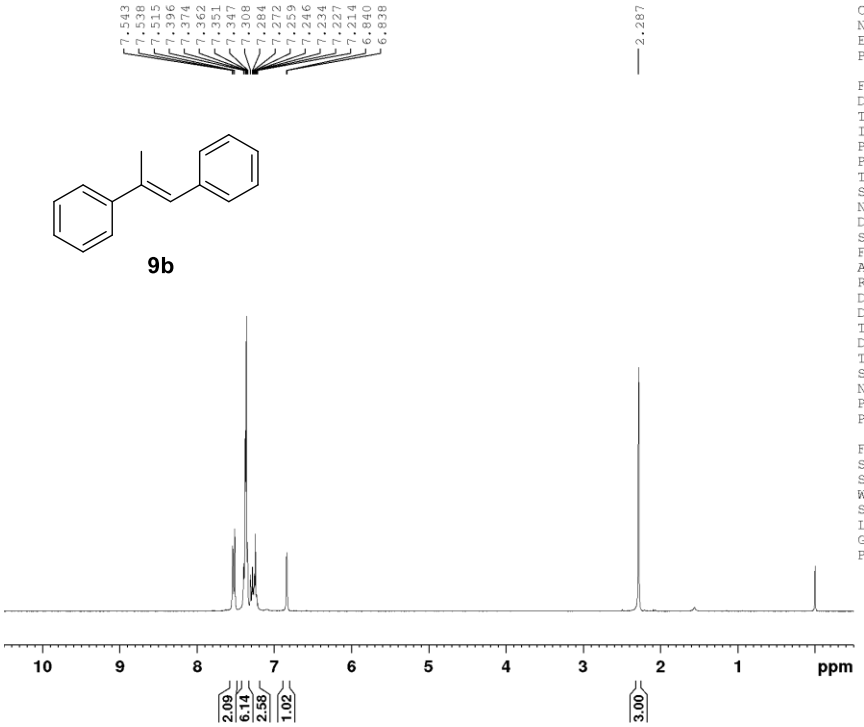
F2 - Processing parameters
SI                       65536
SF                  300.1300103 MHz
WDW                         EM
SSB                  0
LB                         0.30 Hz
GB                   0
PC                         1.00
```




```
Current Data Parameters
NAME                  500M 2018-2
EXPNO                        293
PROCNO                         1

F2 - Acquisition Parameters
Date_                 20181103
Time                     12.38
INSTRUM                  spect
PROBHD    5 mm CPPBBO BB
PULPROG                 zgpg30
TD                       65536
SOLVENT                  CDCl3
NS                          64
DS                           4
SWH                  29761.904 Hz
FIDRES                0.454131 Hz
AQ                    1.1010048 sec
RG                       192.89
DW                       16.800 usec
DE                         18.00 usec
TE                        298.2 K
D1                    2.00000000 sec
d11                   0.03000000 sec
DELTA                 1.89999998 sec
TD0                          1
SFO1                125.7703637 MHz
NUC1                        13C
P1                         9.80 usec
PLW1                57.00000000 W
SFO2                500.1320005 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                     80.00 usec
PLW2                20.00000000 W
PLW12                0.35778001 W
PLW13                0.22898000 W

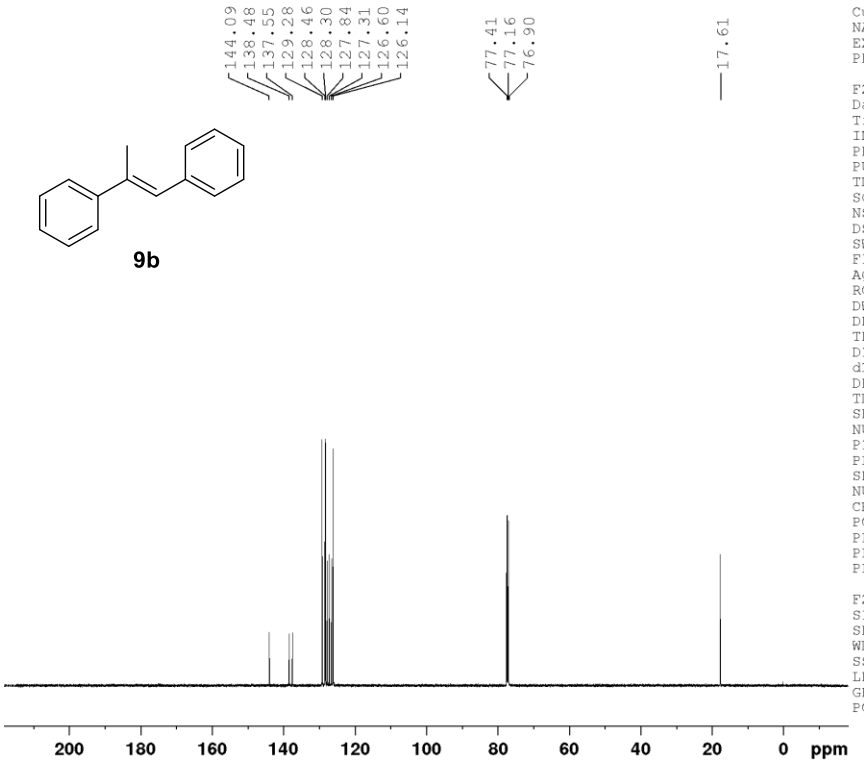
F2 - Processing parameters
SI                       32768
SF                  125.7577838 MHz
WDW                         EM
SSB                  0
LB                         1.00 Hz
GB                   0
PC                         1.40
```




```
Current Data Parameters
NAME                  300M 2016
EXPNO                        18
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20160126
Time                     17.52
INSTRUM                  spect
PROBHD    5 mm DUL 13C-1
PULPROG                   zg30
TD                       65536
SOLVENT                  CDCl3
NS                           5
DS                           2
SWH                   6009.615 Hz
FIDRES                0.091699 Hz
AQ                    5.4525952 sec
RG                       209.09
DW                       83.200 usec
DE                        6.50 usec
TE                       298.2 K
D1                    1.00000000 sec
TD0                          1
SFO1                300.1318534 MHz
NUC1                         1H
P1                        8.00 usec
PLW1                 18.00000000 W

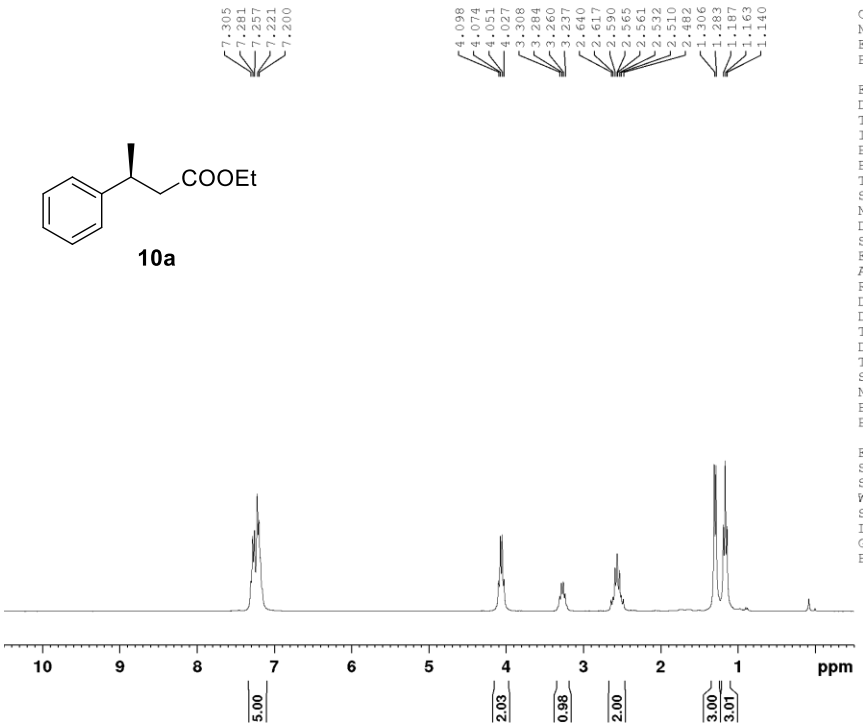
F2 - Processing parameters
SI                       65536
SF                  300.1300113 MHz
WDW                         EM
SSB                  0
LB                        0.30 Hz
GB                   0
PC                        1.00
```




```
Current Data Parameters
NAME                  500M 2018-2
EXPNO                         291
PROCNO                        1

F2 - Acquisition Parameters
Date_                 20181103
Time                     12.31
INSTRUM                  spect
PROBHD    5 mm CPPBBO BB
PULPROG                zgpg30
TD                       65536
SOLVENT                  CDCl3
NS                          64
DS                           4
SWH                  29761.904 Hz
FIDRES                0.454131 Hz
AQ                    1.1010048 sec
RG                       192.89
DW                       16.800 usec
DE                        18.00 usec
TE                       298.2 K
D1                    2.00000000 sec
d11                   0.03000000 sec
DELTA                 1.89999998 sec
TD0                          1
SFO1                125.7703637 MHz
NUC1                        13C
P1                        9.80 usec
PLW1                 57.00000000 W
SFO2                500.1320005 MHz
NUC2                         1H
CPDPRG[2                waltz16
PCPD2                    80.00 usec
PLW2                 20.00000000 W
PLW12                 0.35778001 W
PLW13                 0.22898000 W

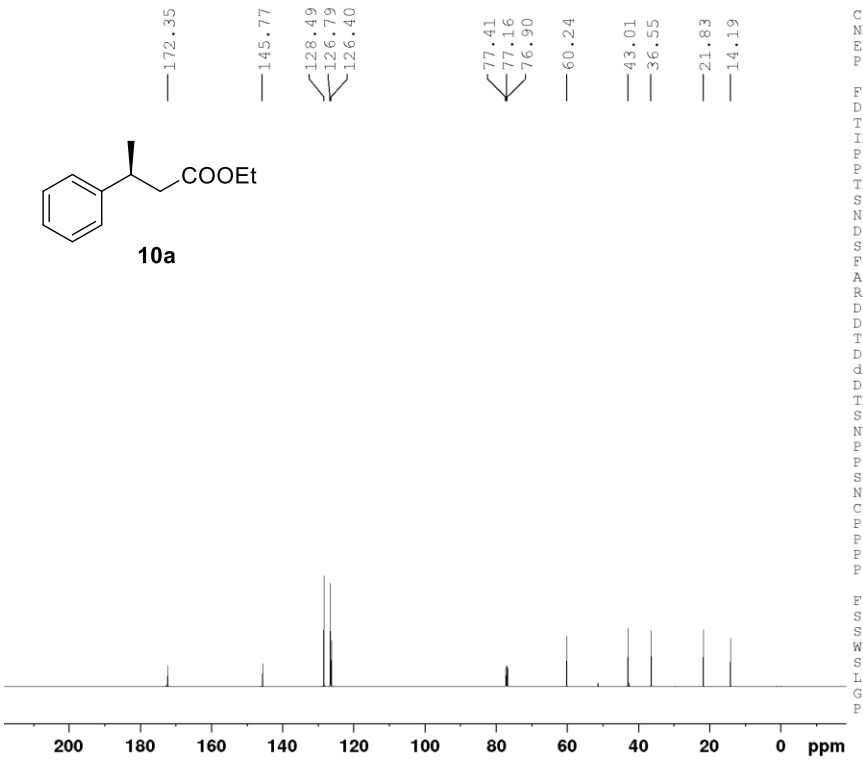
F2 - Processing parameters
SI                       32768
SF                  125.7577792 MHz
WDW                         EM
SSB                  0
LB                        1.00 Hz
GB                   0
PC                        1.40
```




```
Current Data Parameters
NAME          300M 2016
EXPNO                53
PROCNO                1

F2 - Acquisition Parameters
Date_          20160614
Time              10.54
INSTRUM           spect
PROBHD   5 mm DUL 13C-1
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     6
DS                     2
SWH             6009.615 Hz
FIDRES          0.091699 Hz
AQ              5.4525952 sec
RG                    44
DW                83.200 usec
DE                 6.50 usec
TE                299.1 K
D1             1.00000000 sec
TD0                    1
SFO1          300.1318534 MHz
NUC1                  1H
P1                 8.00 usec
PLW1          18.00000000 W

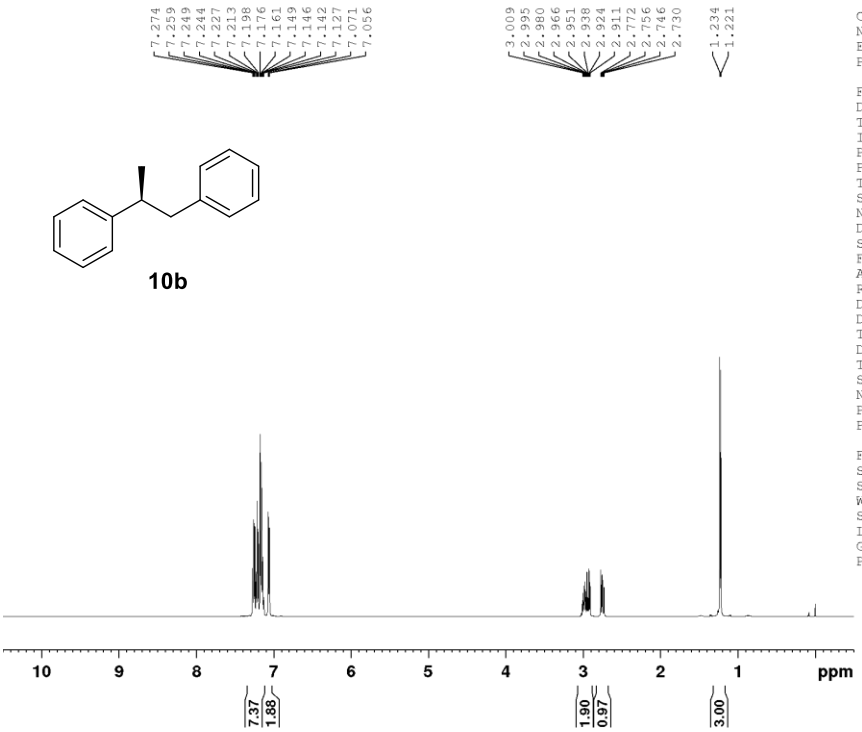
F2 - Processing parameters
SI                 65536
SF            300.1300156 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                289
PROCNO                1

F2 - Acquisition Parameters
Date_          20181103
Time              12.24
INSTRUM           spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    64
DS                     4
SWH            29761.904 Hz
FIDRES          0.454131 Hz
AQ              1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                 13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

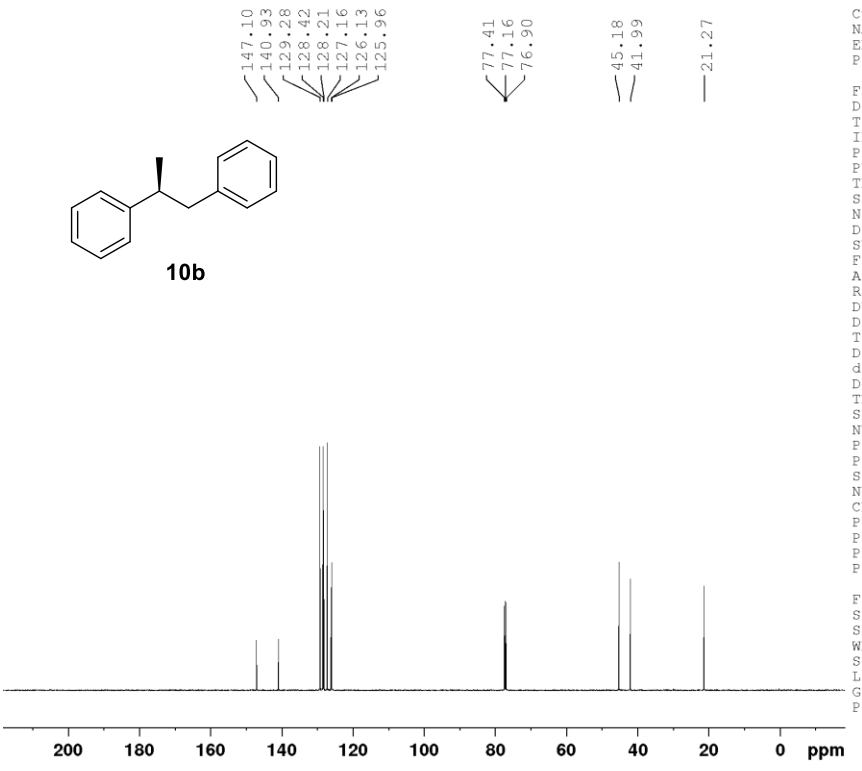
F2 - Processing parameters
SI                 32768
SF            125.7577892 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                286
PROCNO                 1

F2 - Acquisition Parameters
Date_           20181103
Time               12.13
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                  22.1
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

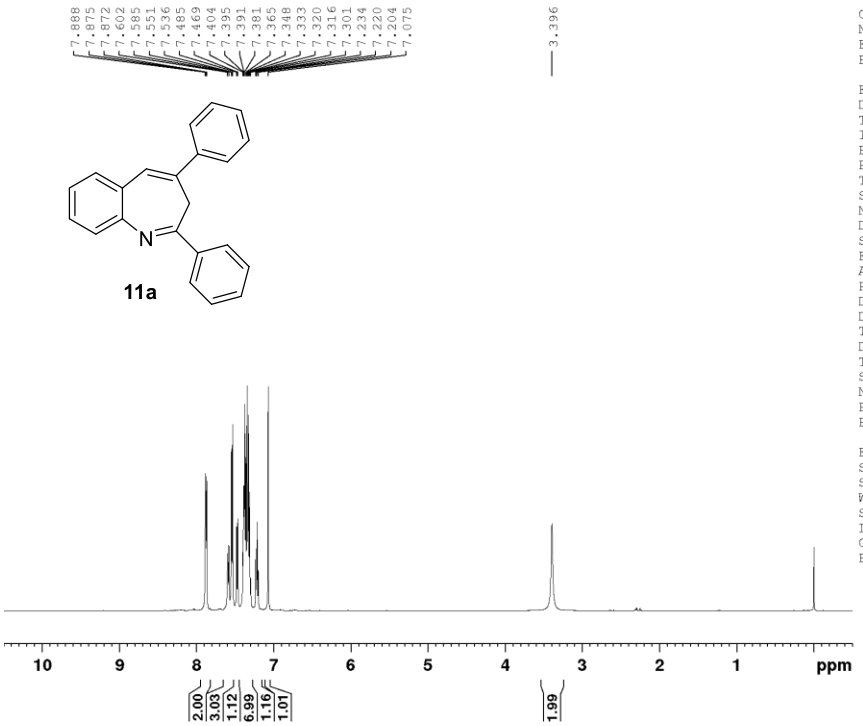
F2 - Processing parameters
SI                 65536
SF            500.1300614 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                287
PROCNO                 1

F2 - Acquisition Parameters
Date_           20181103
Time               12.17
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    64
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                 192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

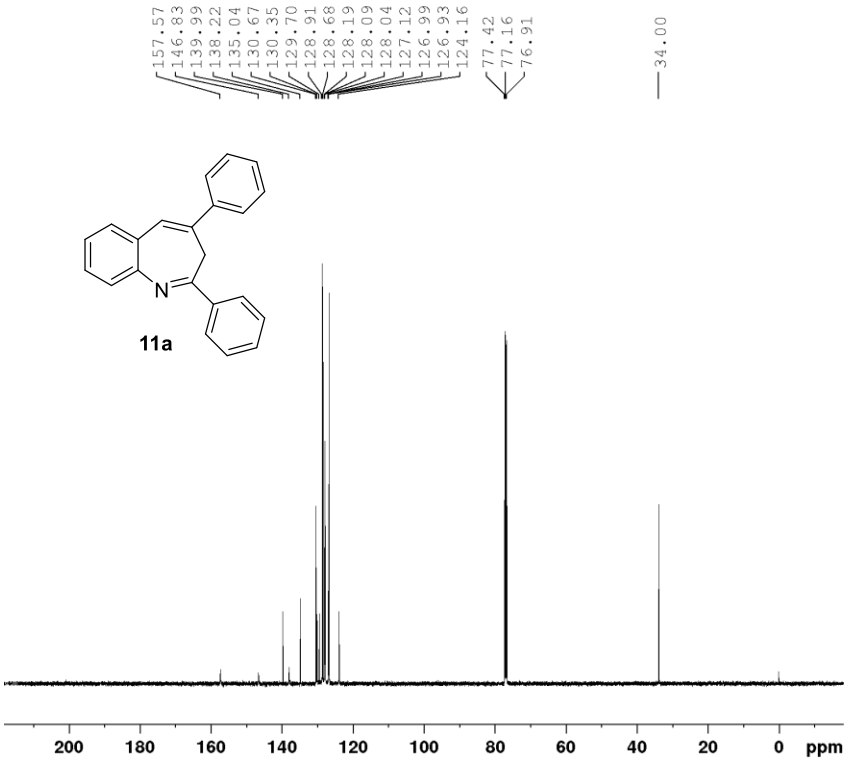
F2 - Processing parameters
SI                 32768
SF            125.7577847 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                234
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               16.40
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

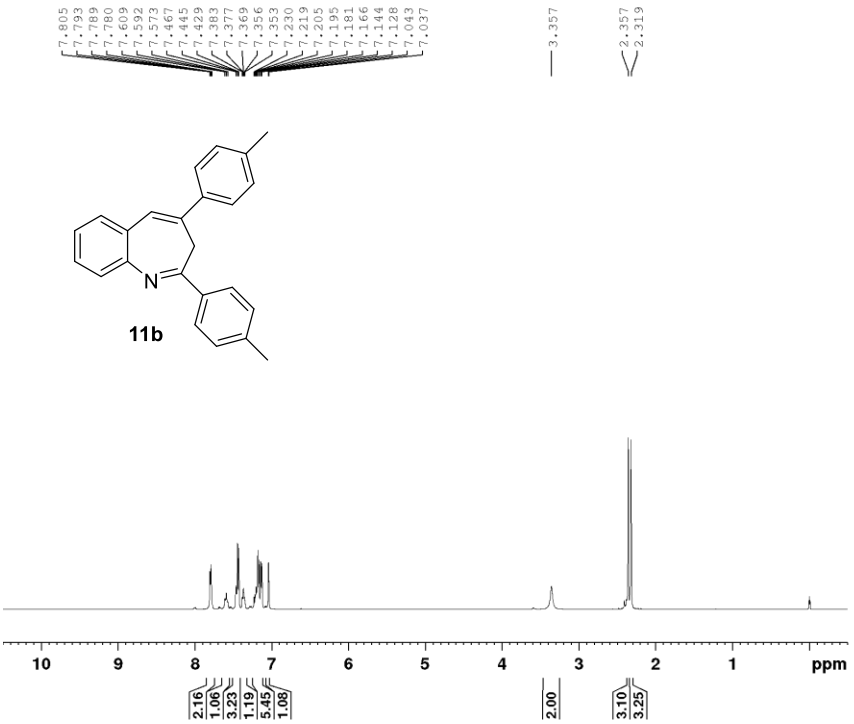
F2 - Processing parameters
SI                 65536
SF            500.1300265 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                235
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               16.42
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   100
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

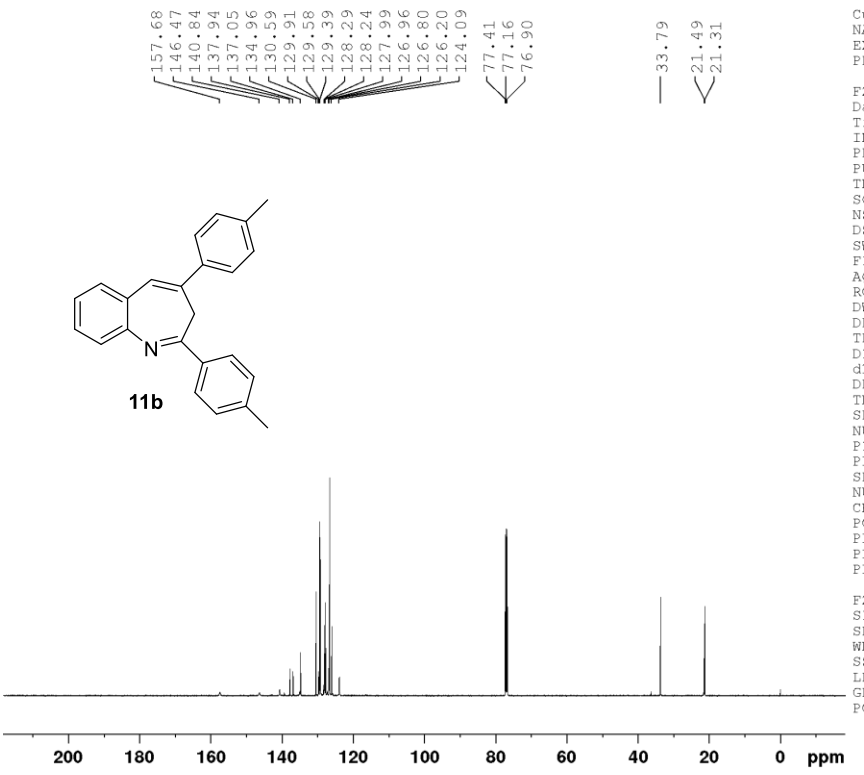
F2 - Processing parameters
SI                 32768
SF            125.7577753 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                236
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               16.49
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

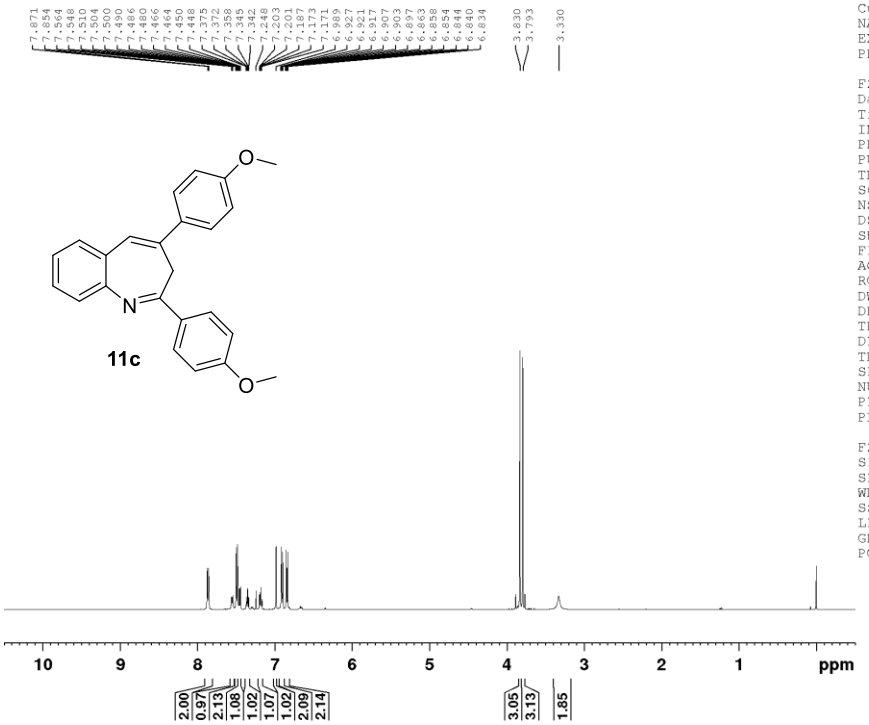
F2 - Processing parameters
SI                 65536
SF            500.1300272 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                246
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               18.04
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2         waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

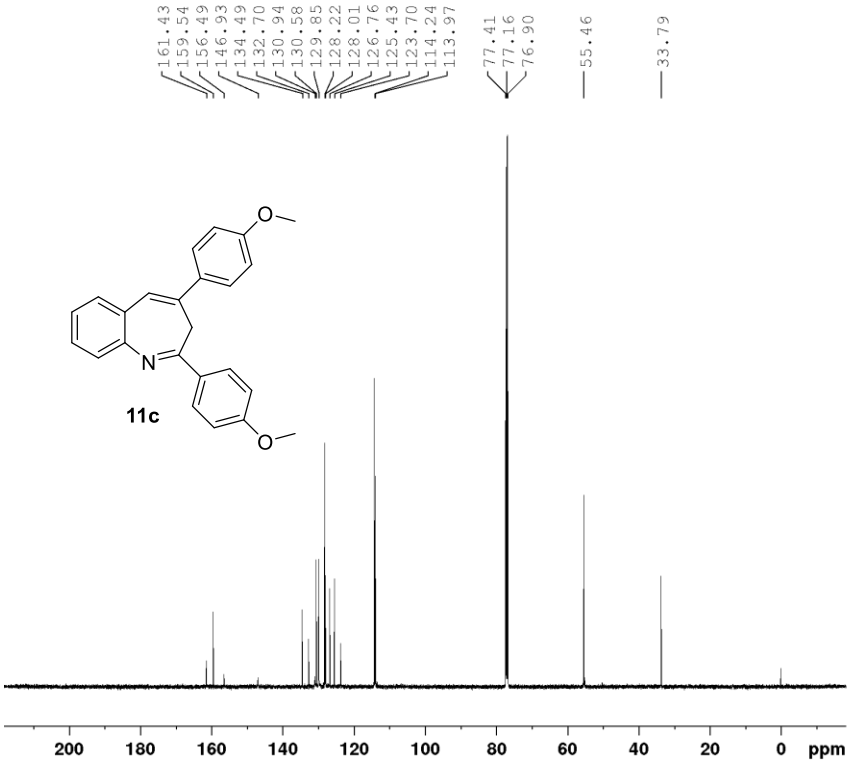
F2 - Processing parameters
SI                 32768
SF            125.7577765 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                242
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               17.26
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1          20.00000000 W

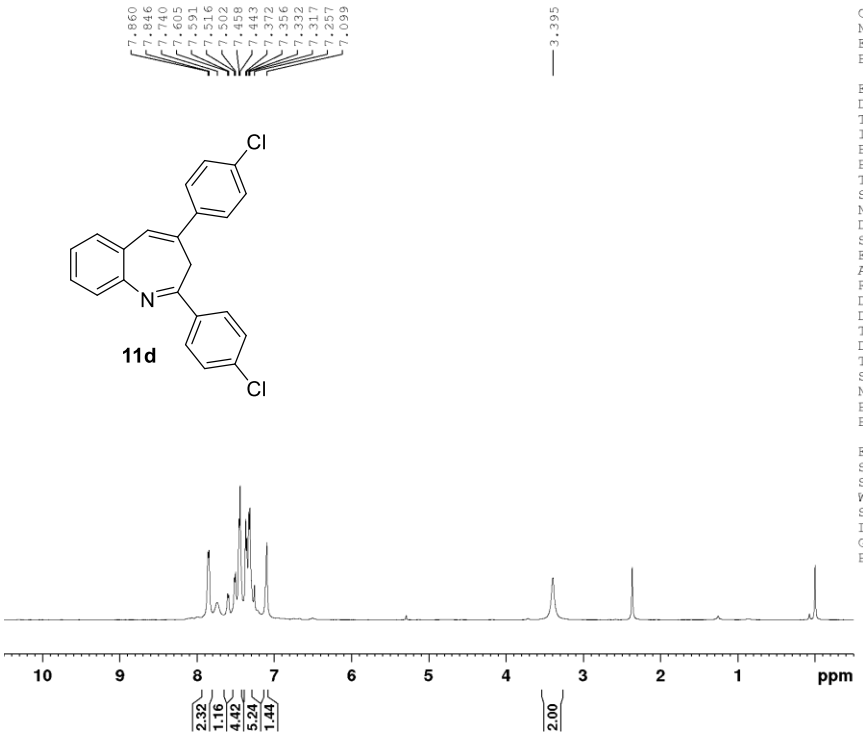
F2 - Processing parameters
SI                 65536
SF            500.1300182 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                243
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               17.29
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   190
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

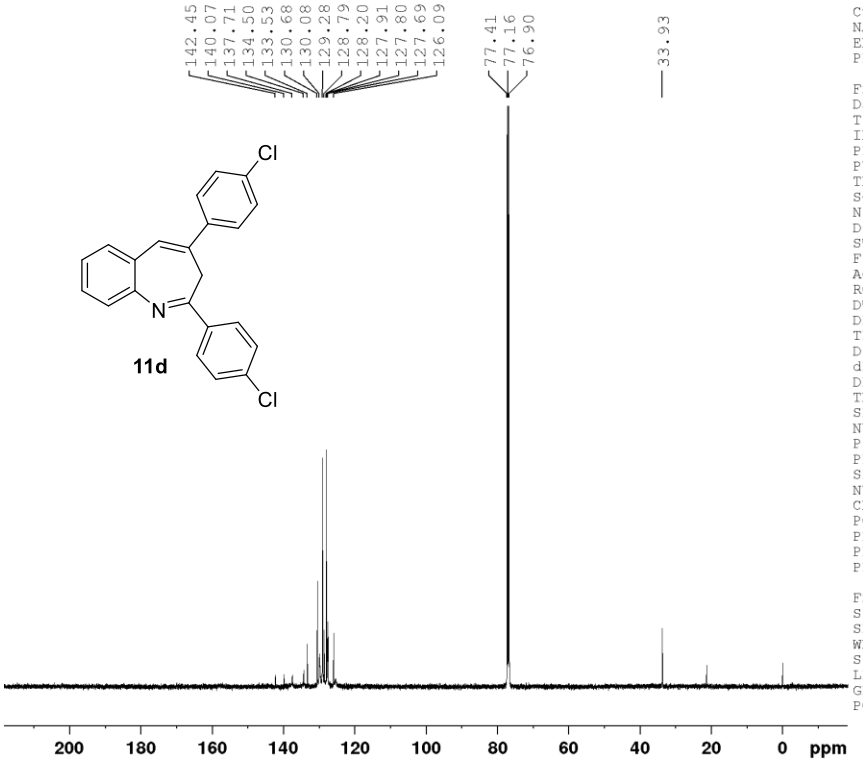
F2 - Processing parameters
SI                 32768
SF            125.7577738 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                274
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180906
Time               15.27
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES         0.152588 Hz
AQ            3.2767999 sec
RG                 31.72
DW                50.000 usec
DE                 6.50 usec
TE                298.2 K
D1            1.00000000 sec
TD0                    1
SFO1         500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1         20.00000000 W

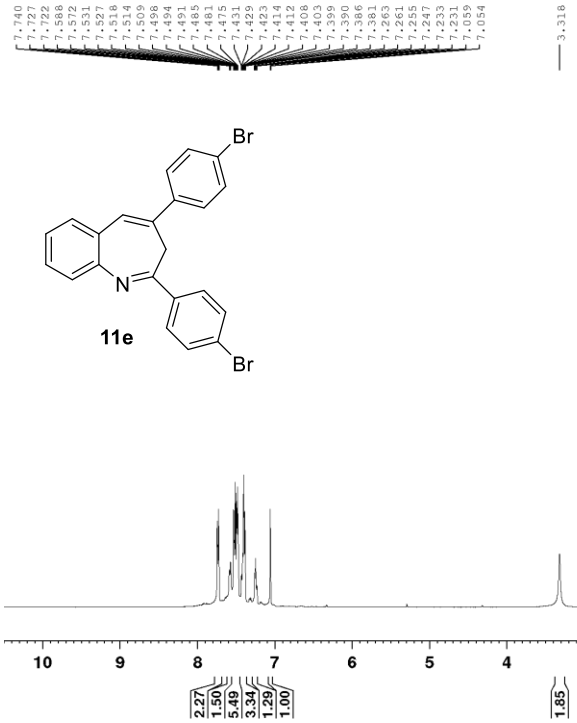
F2 - Processing parameters
SI                 65536
SF           500.1300137 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                275
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180906
Time               15.29
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   610
DS                     4
SWH           29761.904 Hz
FIDRES         0.454131 Hz
AQ            1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.1 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA         1.89999998 sec
TD0                    1
SFO1         125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1         57.00000000 W
SFO2         500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2         20.00000000 W
PLW12         0.35778001 W
PLW13         0.22898000 W

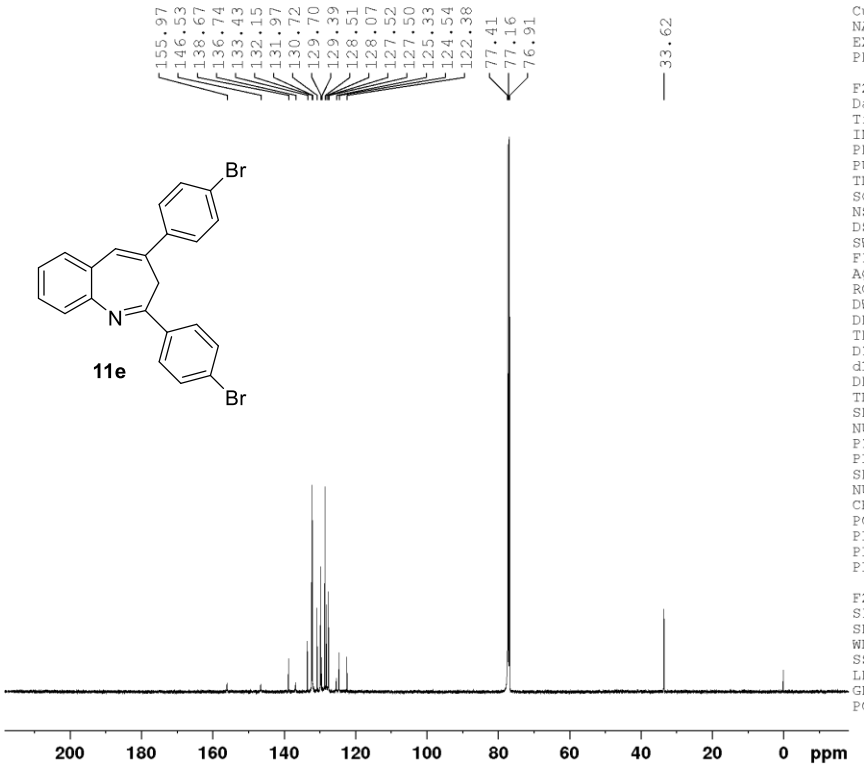
F2 - Processing parameters
SI                 32768
SF           125.7577729 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                249
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               19.36
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

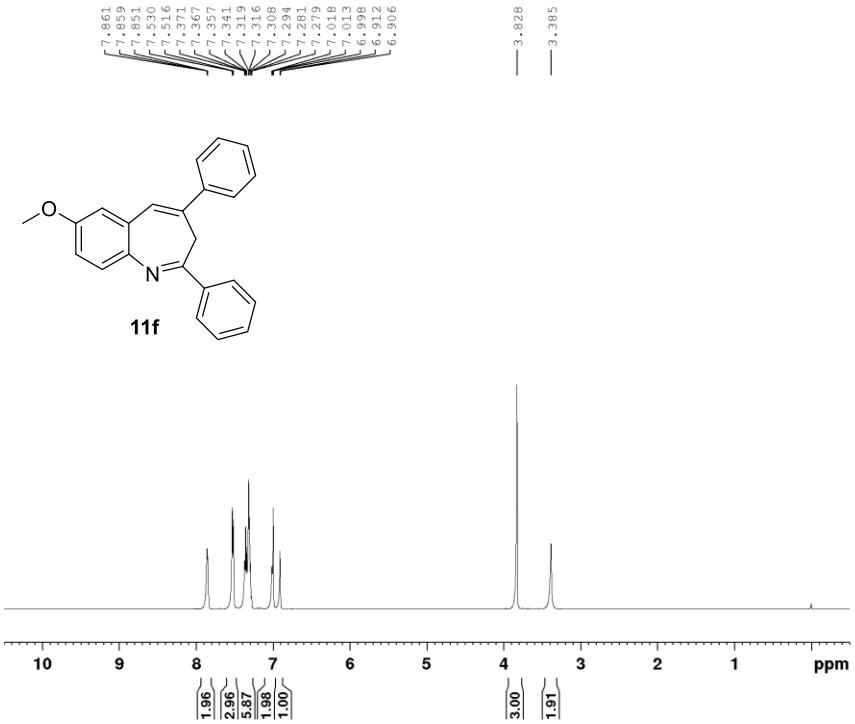
F2 - Processing parameters
SI                 65536
SF            500.1300152 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                250
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               20.31
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

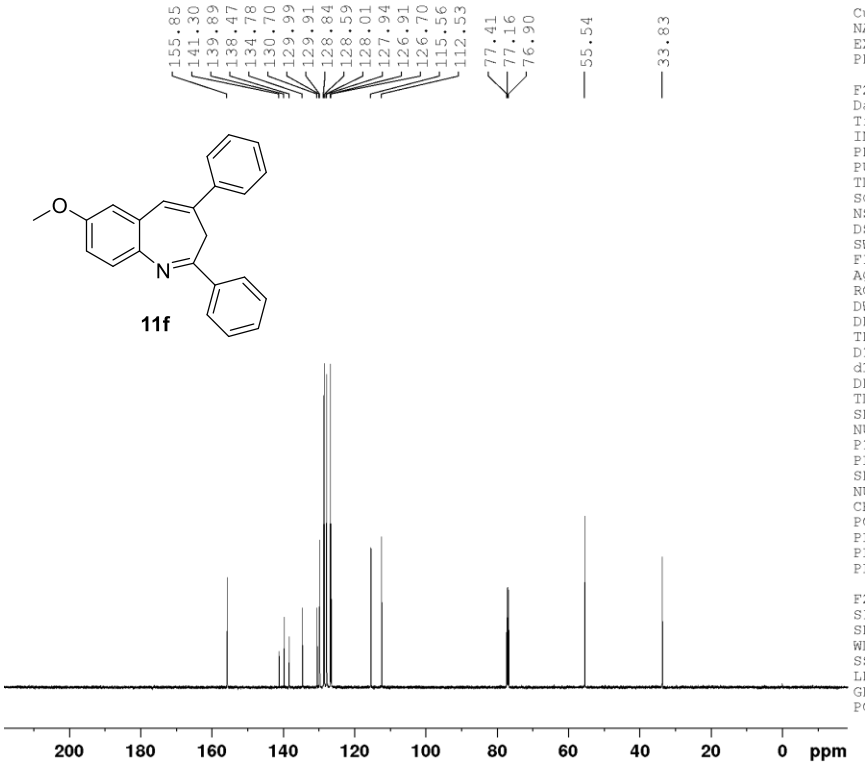
F2 - Processing parameters
SI                 32768
SF            125.7577711 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                244
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               17.39
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH            10000.000 Hz
FIDRES             0.152588 Hz
AQ              3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                 298.1 K
D1              1.00000000 sec
TD0                    1
SFO1           500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1           20.00000000 W

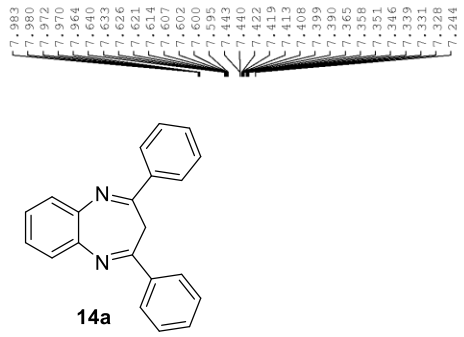
F2 - Processing parameters
SI                 65536
SF            500.1300410 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```



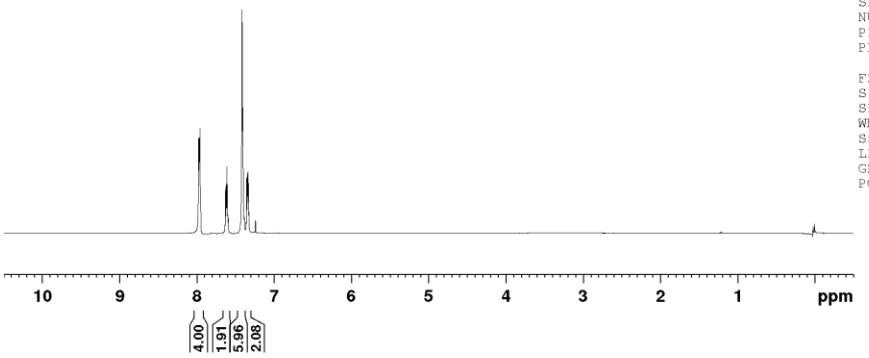

```
Current Data Parameters
NAME         500M 2018-2
EXPNO                245
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               17.40
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    53
DS                     4
SWH            29761.904 Hz
FIDRES             0.454131 Hz
AQ              1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                 298.1 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                    1
SFO1           125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1           57.00000000 W
SFO2           500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2           20.00000000 W
PLW12           0.35778001 W
PLW13           0.22898000 W

F2 - Processing parameters
SI                 32768
SF            125.7577847 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```



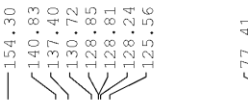
14a

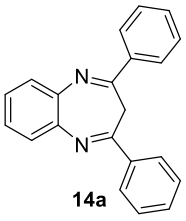



```
Current Data Parameters
NAME         500M 2018-2
EXPNO                257
PROCNO                 1

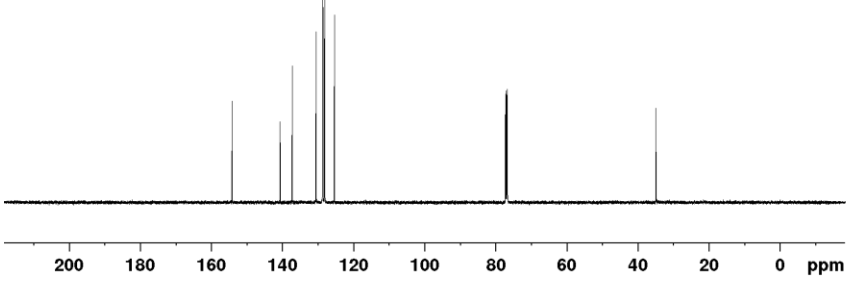
F2 - Acquisition Parameters
Date_           20180904
Time                9.58
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300199 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```





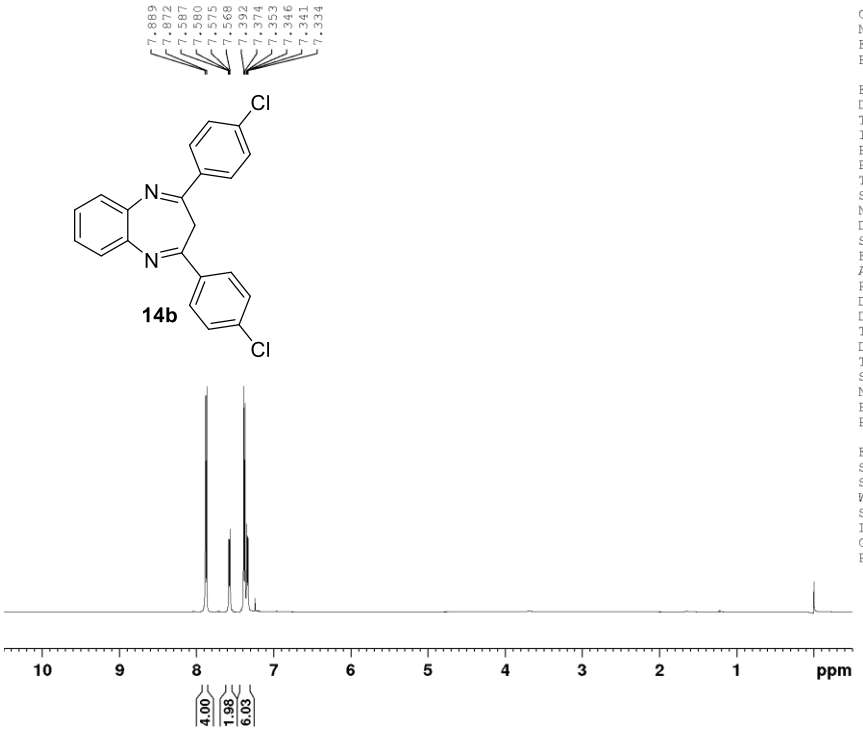
14a




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                258
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time               10.00
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    37
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

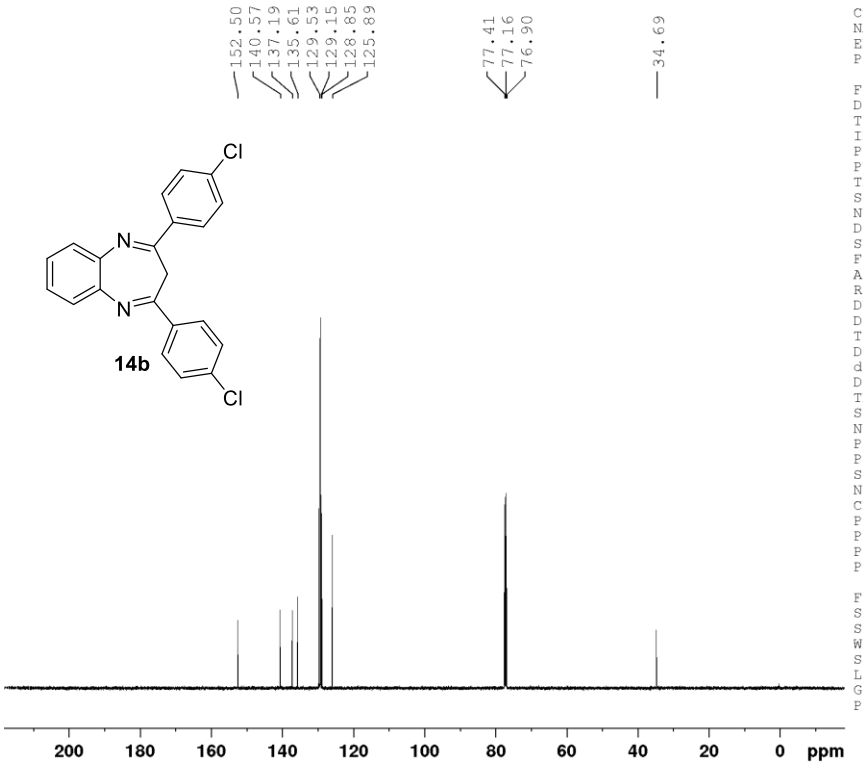
F2 - Processing parameters
SI                 32768
SF            125.7577820 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                259
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time               10.05
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

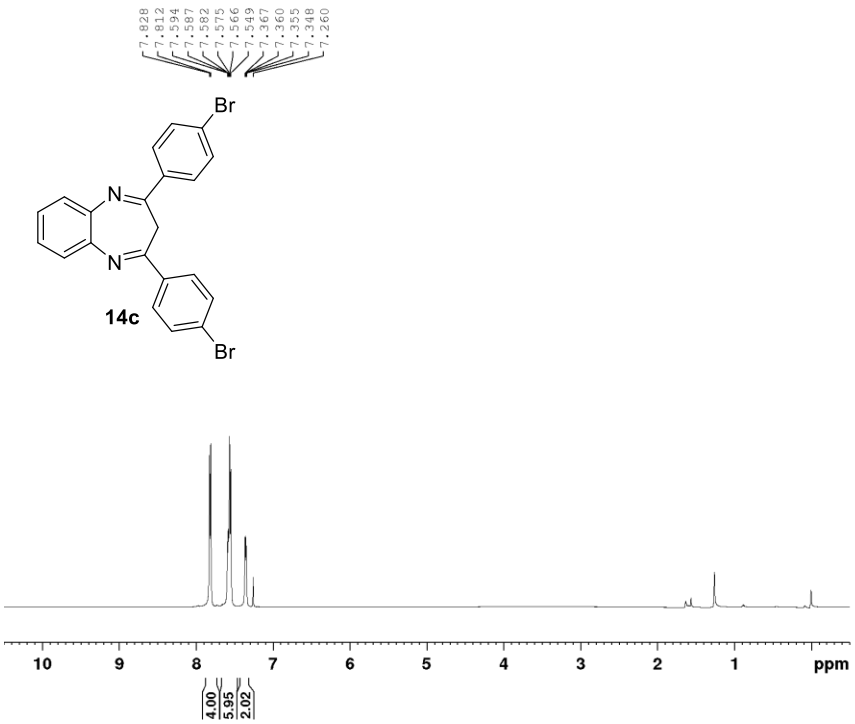
F2 - Processing parameters
SI                 65536
SF            500.1300190 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                260
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time               10.06
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    20
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                 13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

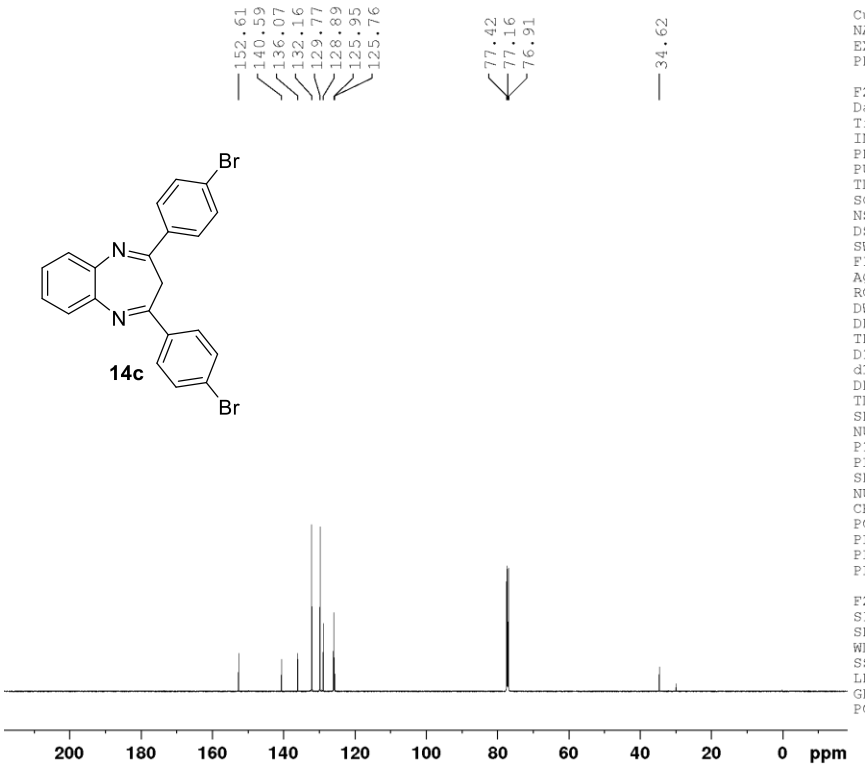
F2 - Processing parameters
SI                 32768
SF            125.7577765 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       80
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170808
Time                   12.34
INSTRUM                spect
PROBHD   5 mm CPPBBO BB
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                     31.72
DW                     50.000 usec
DE                      6.50 usec
TE                     298.1 K
D1                 1.00000000 sec
TD0                         1
SFO1               500.1330885 MHz
NUC1                       1H
P1                     11.50 usec
PLW1              20.00000000 W

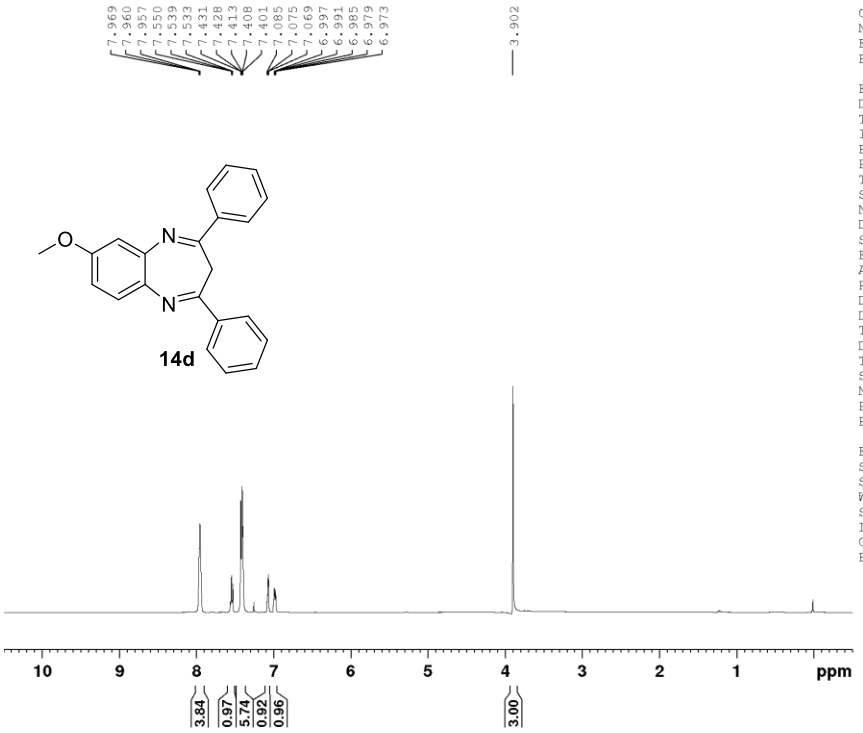
F2 - Processing parameters
SI                     65536
SF                 500.1300120 MHz
WDW                       EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       81
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170808
Time                   12.48
INSTRUM                spect
PROBHD   5 mm CPPBBO BB
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       256
DS                         4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                     192.89
DW                     16.800 usec
DE                      18.00 usec
TE                     298.2 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                         1
SFO1               125.7703637 MHz
NUC1                       13C
P1                      9.80 usec
PLW1              57.00000000 W
SFO2               500.1320005 MHz
NUC2                       1H
CPDPRG[2             waltz16
PCPD2                  80.00 usec
PLW2              20.00000000 W
PLW12              0.35778001 W
PLW13              0.22898000 W

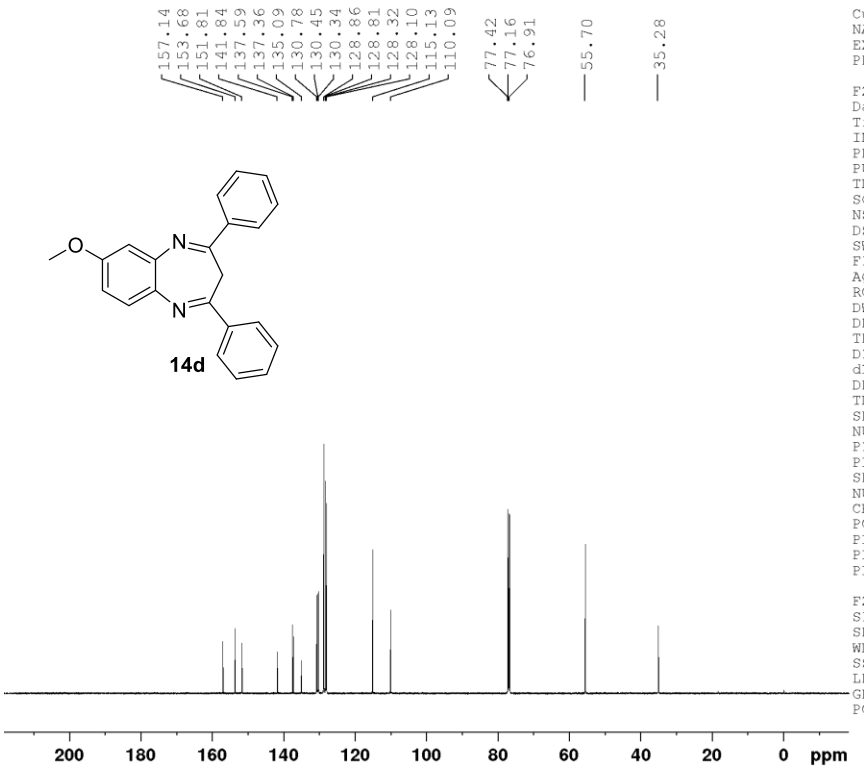
F2 - Processing parameters
SI                     32768
SF                 125.7577716 MHz
WDW                       EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       78
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170808
Time                   12.17
INSTRUM                spect
PROBHD    5 mm CPPBBO BB
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH               10000.000 Hz
FIDRES                0.152588 Hz
AQ                 3.2767999 sec
RG                     31.72
DW                    50.000 usec
DE                     6.50 usec
TE                    298.2 K
D1                 1.00000000 sec
TD0                        1
SFO1              500.1330885 MHz
NUC1                       1H
P1                    11.50 usec
PLW1              20.00000000 W

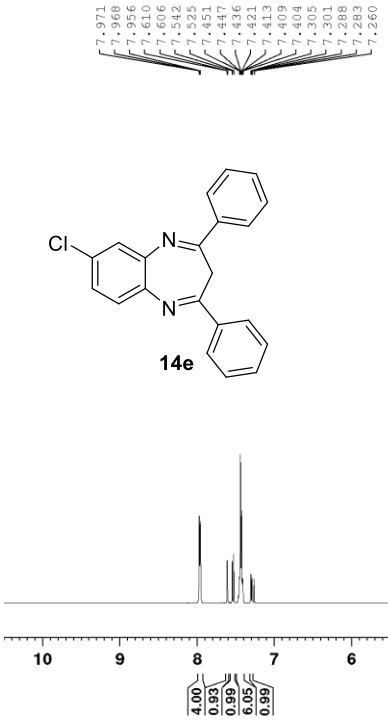
F2 - Processing parameters
SI                     65536
SF                500.1300119 MHz
WDW                       EM
SSB          0
LB                     0.30 Hz
GB           0
PC                     1.00
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       79
PROCNO                       1

F2 - Acquisition Parameters
Date_               20170808
Time                   12.31
INSTRUM                spect
PROBHD    5 mm CPPBBO BB
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       256
DS                         4
SWH               29761.904 Hz
FIDRES                0.454131 Hz
AQ                 1.1010048 sec
RG                    192.89
DW                    16.800 usec
DE                     18.00 usec
TE                    298.1 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                        1
SFO1              125.7703637 MHz
NUC1                      13C
P1                     9.80 usec
PLW1              57.00000000 W
SFO2              500.1320005 MHz
NUC2                       1H
CPDPRG[2            waltz16
PCPD2                 80.00 usec
PLW2              20.00000000 W
PLW12              0.35778001 W
PLW13              0.22898000 W

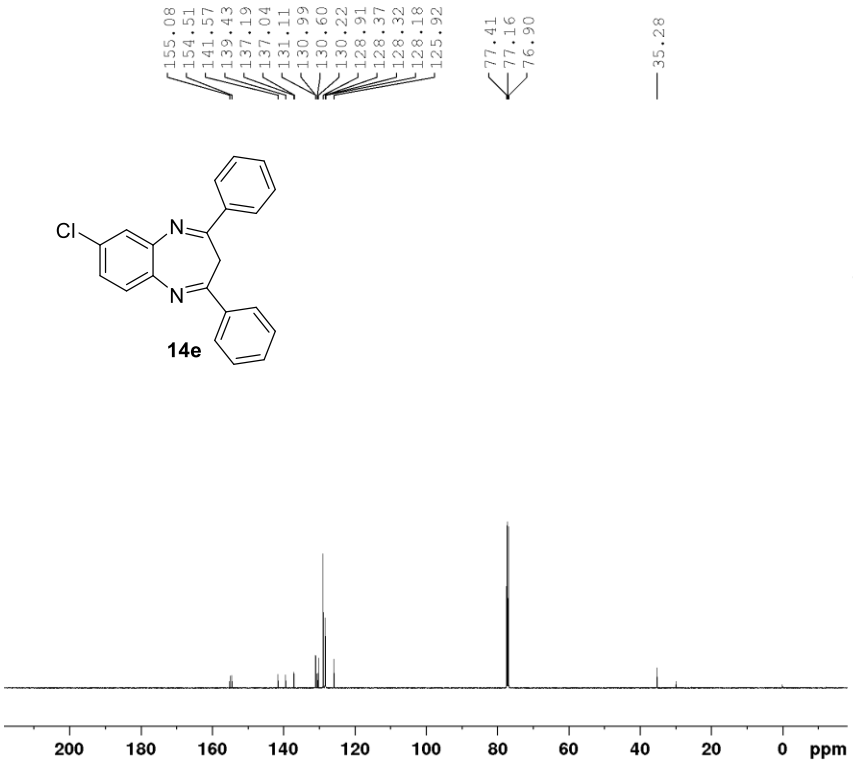
F2 - Processing parameters
SI                     32768
SF                125.7577753 MHz
WDW                       EM
SSB          0
LB                     1.00 Hz
GB           0
PC                     1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       76
PROCNO                       1

F2 - Acquisition Parameters
Date_                20170808
Time                    12.00
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                         16
DS                          2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                      49.27
DW                     50.000 usec
DE                      6.50 usec
TE                     298.1 K
D1                 1.00000000 sec
TD0                         1
SFO1               500.1330885 MHz
NUC1                       1H
P1                     11.50 usec
PLW1               20.00000000 W

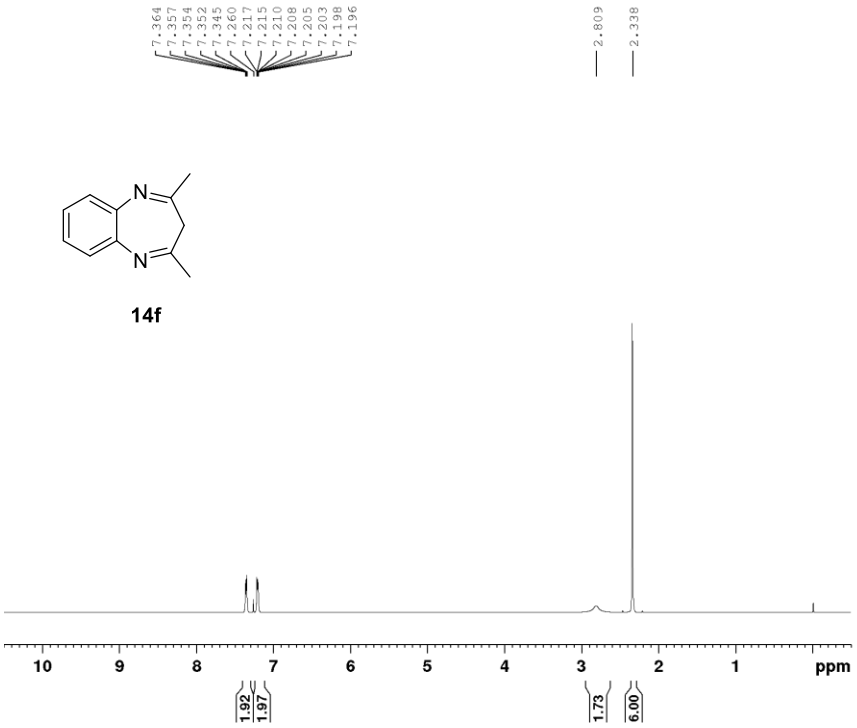
F2 - Processing parameters
SI                      65536
SF                 500.1300122 MHz
WDW                        EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                       77
PROCNO                       1

F2 - Acquisition Parameters
Date_                20170808
Time                    12.14
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG                zgpg30
TD                      65536
SOLVENT                 CDCl3
NS                        256
DS                          4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                     192.89
DW                     16.800 usec
DE                      18.00 usec
TE                     298.1 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                         1
SFO1               125.7703637 MHz
NUC1                       13C
P1                      9.80 usec
PLW1               57.00000000 W
SFO2               500.1320005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                   80.00 usec
PLW2               20.00000000 W
PLW12               0.35778001 W
PLW13               0.22898000 W

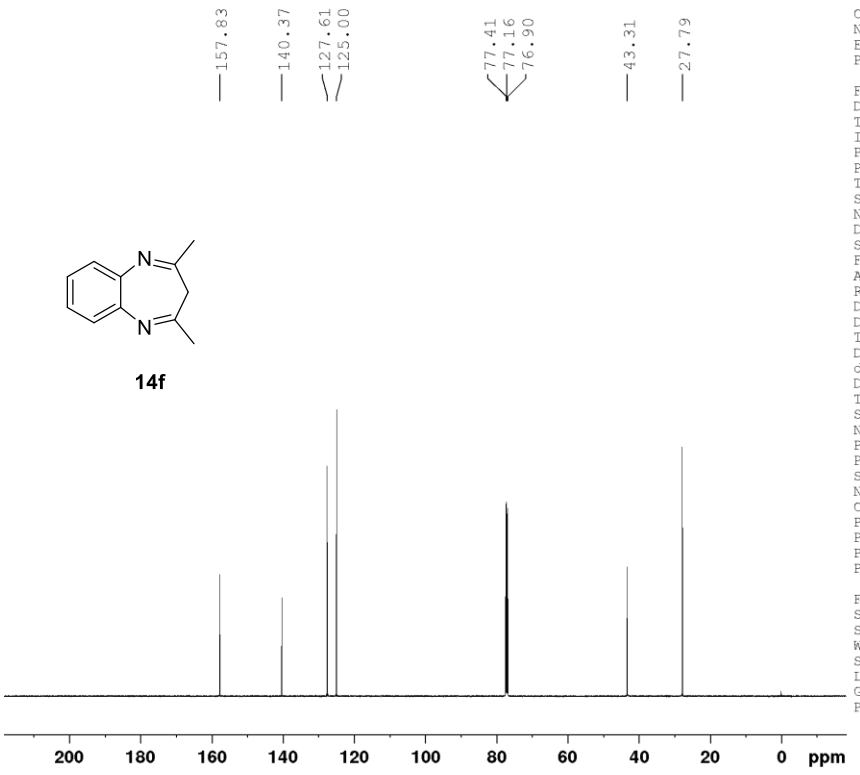
F2 - Processing parameters
SI                      32768
SF                 125.7577729 MHz
WDW                        EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME            500M2017
EXPNO                 74
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170808
Time               11.43
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

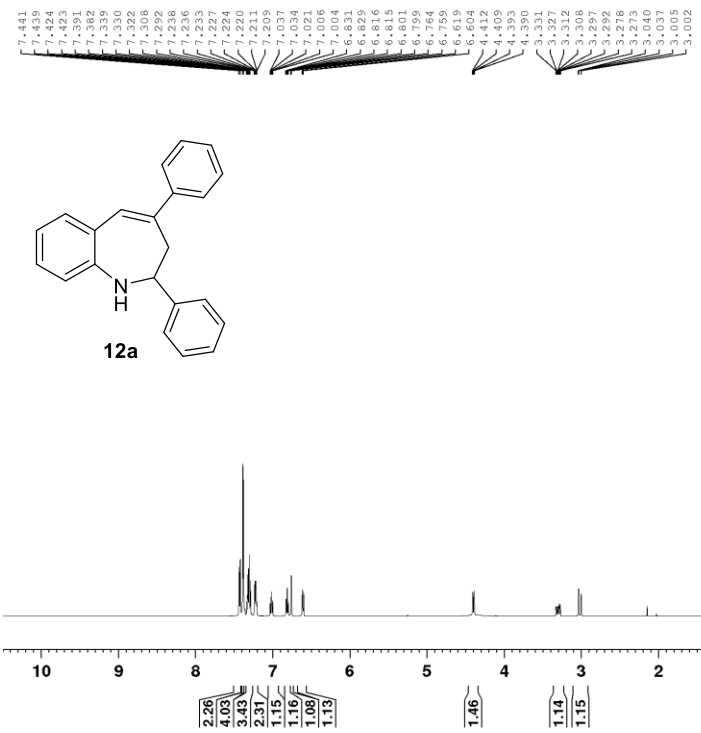
F2 - Processing parameters
SI                 65536
SF            500.1300122 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME            500M2017
EXPNO                 75
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170808
Time               11.57
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   256
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

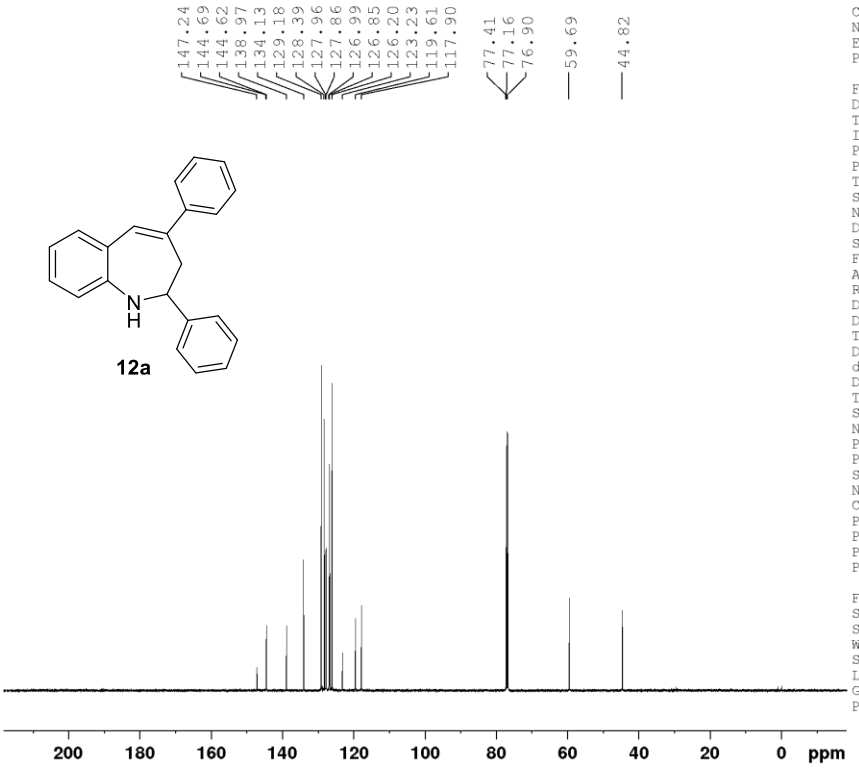
F2 - Processing parameters
SI                 32768
SF            125.7577765 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                228
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               15.23
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

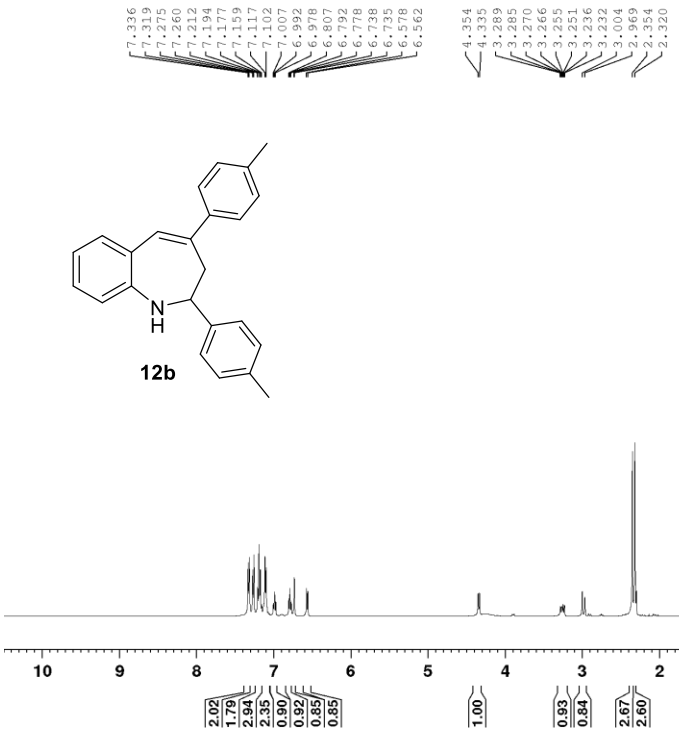
F2 - Processing parameters
SI                 65536
SF            500.1300366 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                229
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180903
Time               15.26
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    68
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

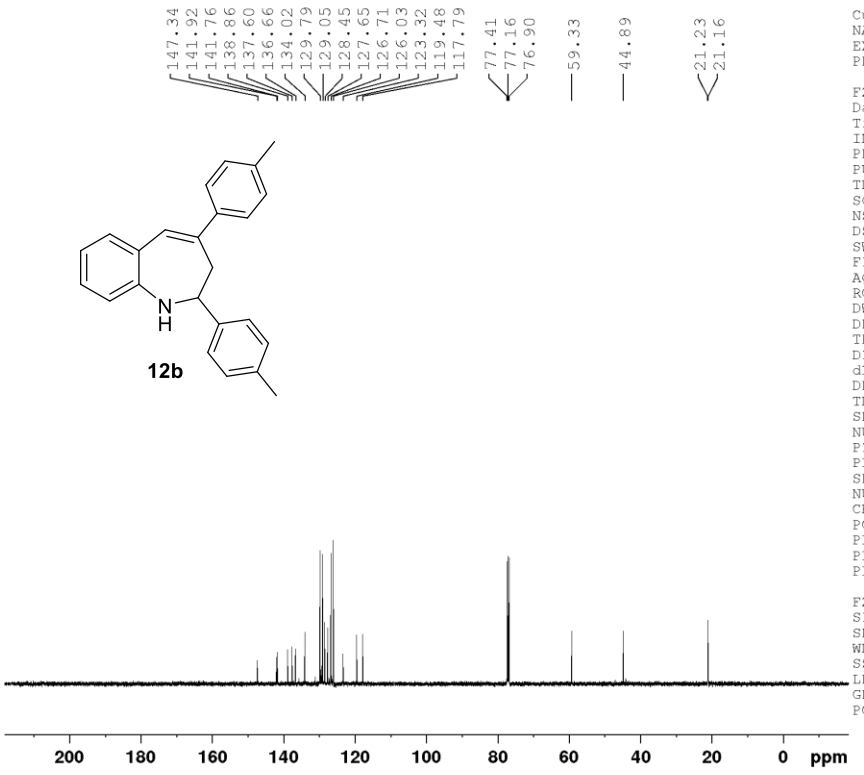
F2 - Processing parameters
SI                 32768
SF            125.7577801 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 204
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180827
Time               20.30
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 25.06
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

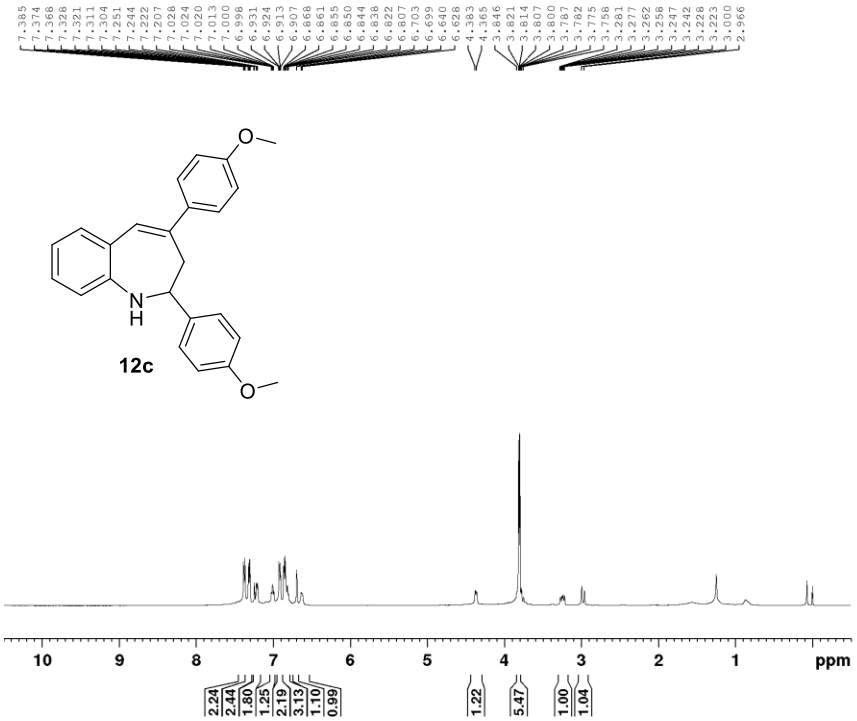
F2 - Processing parameters
SI                 65536
SF            500.1300549 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 209
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180827
Time               20.44
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                     5
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

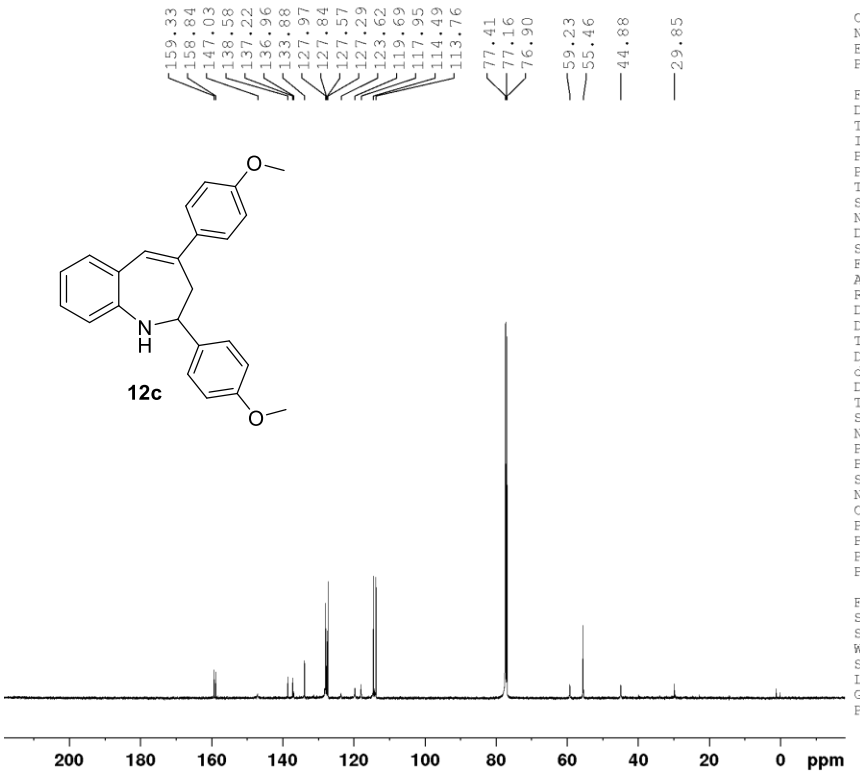
F2 - Processing parameters
SI                 32768
SF            125.7577865 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                263
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time               11.11
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

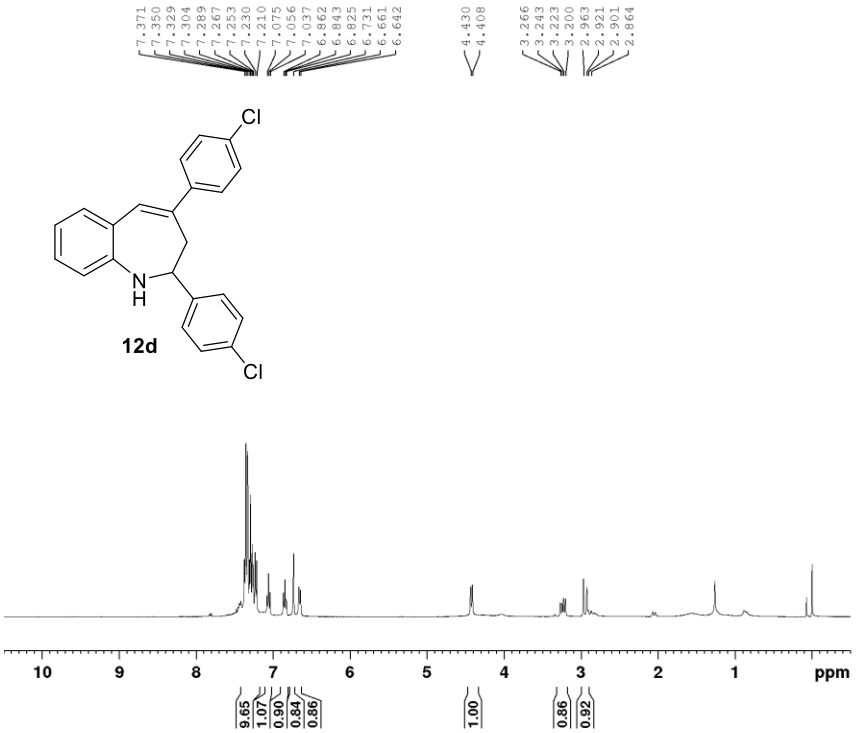
F2 - Processing parameters
SI                 65536
SF            500.1300186 MHz
WDW                   EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                265
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time               11.25
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

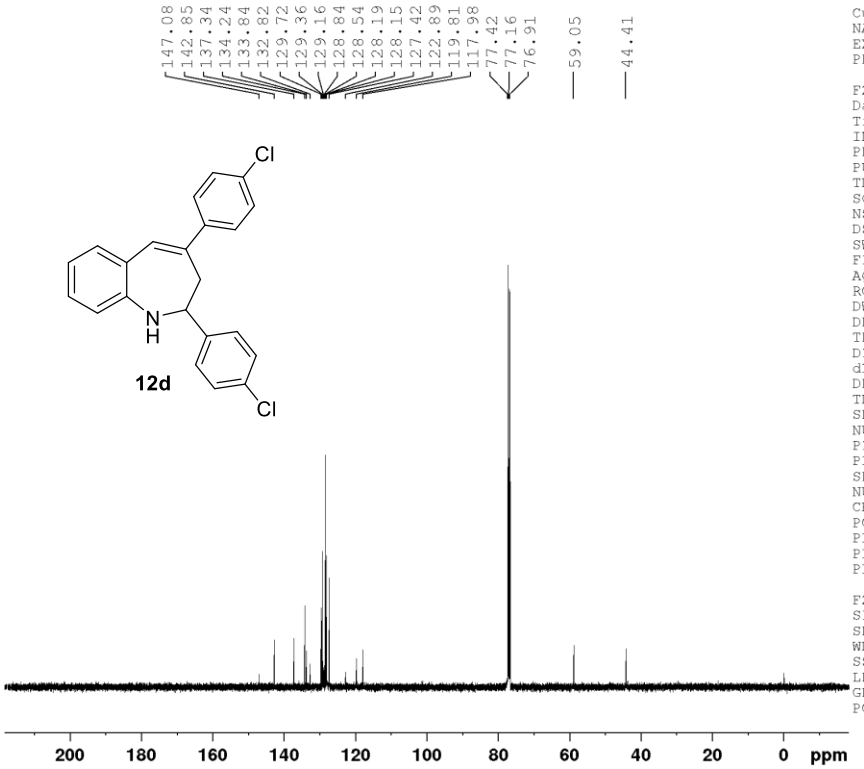
F2 - Processing parameters
SI                 32768
SF            125.7577729 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               501
PROCNO                1

F2 - Acquisition Parameters
Date_          20180905
Time              10.24
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES            0.244532 Hz
AQ             2.0447233 sec
RG                206.33
DW                62.400 usec
DE                 6.50 usec
TE                299.2 K
D1             2.00000000 sec
TD0                   1
SFO1          400.2424716 MHz
NUC1                 1H
P1                14.80 usec
PLW1          12.00000000 W

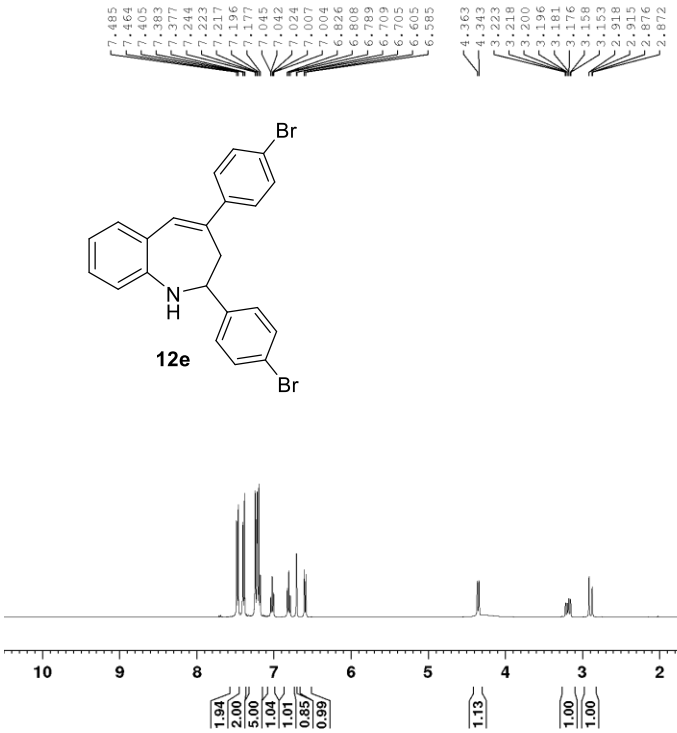
F2 - Processing parameters
SI                65536
SF            400.2400125 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO               256
PROCNO                1

F2 - Acquisition Parameters
Date_          20180904
Time              9.49
INSTRUM           spect
PROBHD   5 mm CPPBBO BB
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  135
DS                    4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                   1
SFO1          125.7703637 MHz
NUC1                 13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

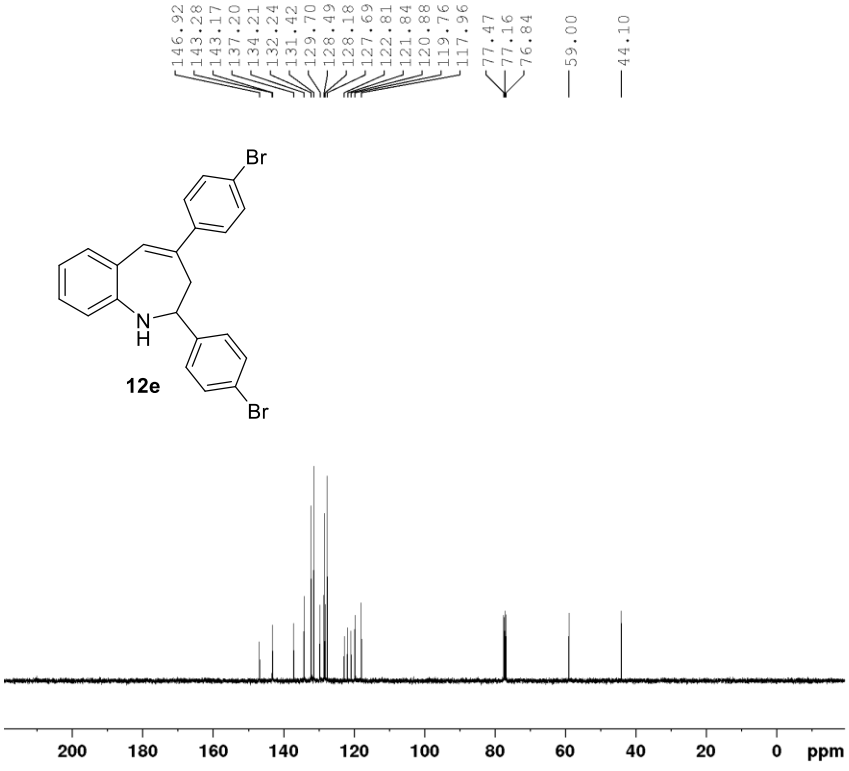
F2 - Processing parameters
SI                32768
SF            125.7577725 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               497
PROCNO                1

F2 - Acquisition Parameters
Date_          20180904
Time              19.19
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             8012.820 Hz
FIDRES             0.244532 Hz
AQ              2.0447233 sec
RG                  43.5
DW                62.400 usec
DE                 6.50 usec
TE                298.0 K
D1             2.00000000 sec
TD0                    1
SFO1          400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1          12.00000000 W

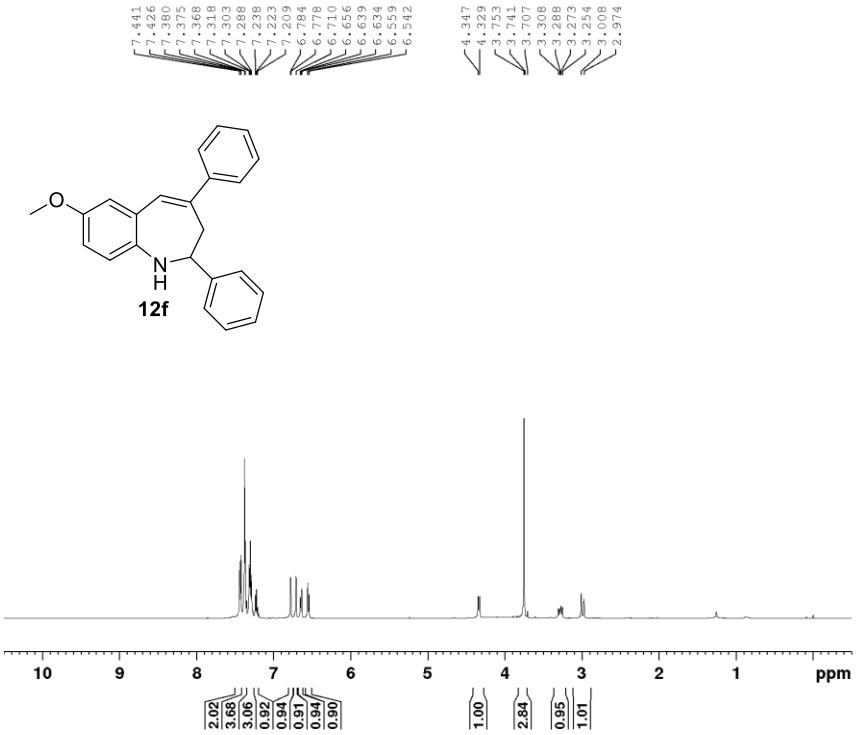
F2 - Processing parameters
SI                 65536
SF            400.2400341 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               498
PROCNO                1

F2 - Acquisition Parameters
Date_          20180904
Time              19.21
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    23
DS                     4
SWH            24038.461 Hz
FIDRES             0.366798 Hz
AQ              1.3631488 sec
RG                 206.33
DW                20.800 usec
DE                 6.50 usec
TE                298.5 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

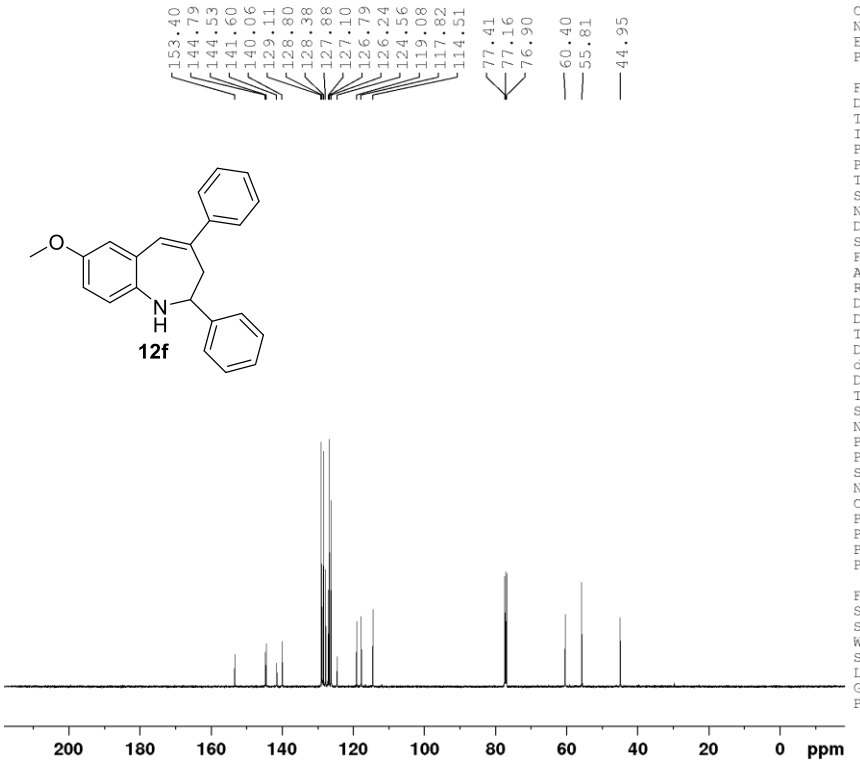
F2 - Processing parameters
SI                 32768
SF            100.6404271 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 230
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180903
Time               15.31
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

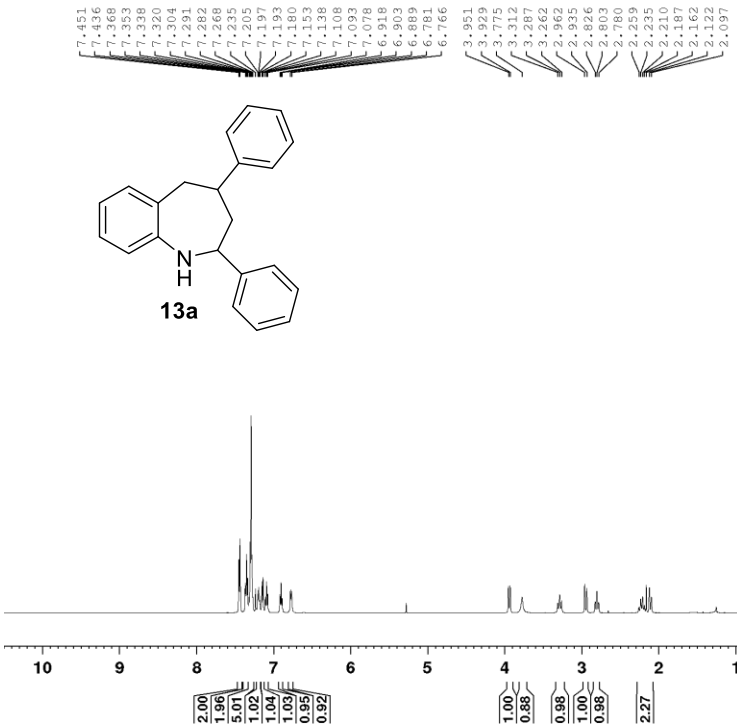
F2 - Processing parameters
SI                 65536
SF            500.1300437 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 231
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180903
Time               15.34
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    55
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

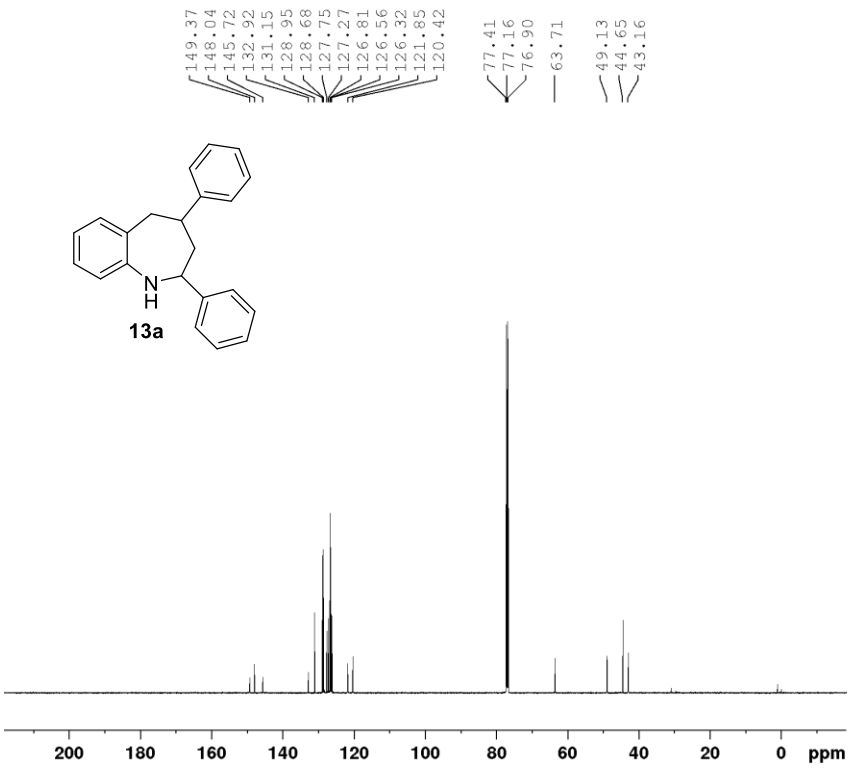
F2 - Processing parameters
SI                 32768
SF            125.7577847 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                      156
PROCNO                       1

F2 - Acquisition Parameters
Date_               20171128
Time                    16.39
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                10000.000 Hz
FIDRES                 0.152588 Hz
AQ                 3.2767999 sec
RG                      31.72
DW                     50.000 usec
DE                      6.50 usec
TE                     298.2 K
D1                 1.00000000 sec
TD0                          1
SFO1               500.1330885 MHz
NUC1                        1H
P1                     11.50 usec
PLW1               20.00000000 W

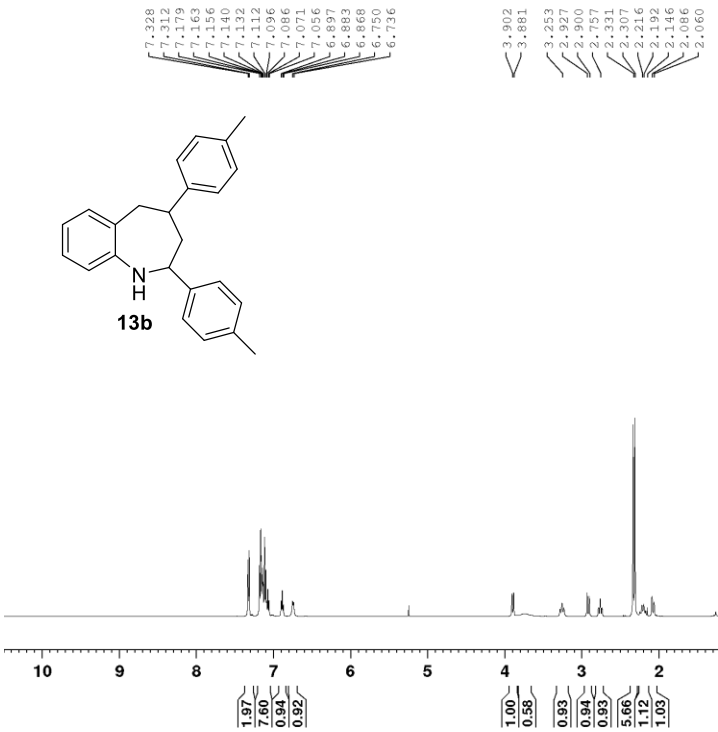
F2 - Processing parameters
SI                     65536
SF                 500.1300246 MHz
WDW                        EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```




```
Current Data Parameters
NAME                  500M2017
EXPNO                      157
PROCNO                       1

F2 - Acquisition Parameters
Date_               20171128
Time                    16.52
INSTRUM                 spect
PROBHD   5 mm CPPBBO BB
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       544
DS                         4
SWH                29761.904 Hz
FIDRES                 0.454131 Hz
AQ                 1.1010048 sec
RG                     192.89
DW                     16.800 usec
DE                      18.00 usec
TE                     298.1 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
TD0                          1
SFO1               125.7703637 MHz
NUC1                        13C
P1                      9.80 usec
PLW1               57.00000000 W
SFO2               500.1320005 MHz
NUC2                        1H
CPDPRG[2             waltz16
PCPD2                  80.00 usec
PLW2               20.00000000 W
PLW12               0.35778001 W
PLW13               0.22898000 W

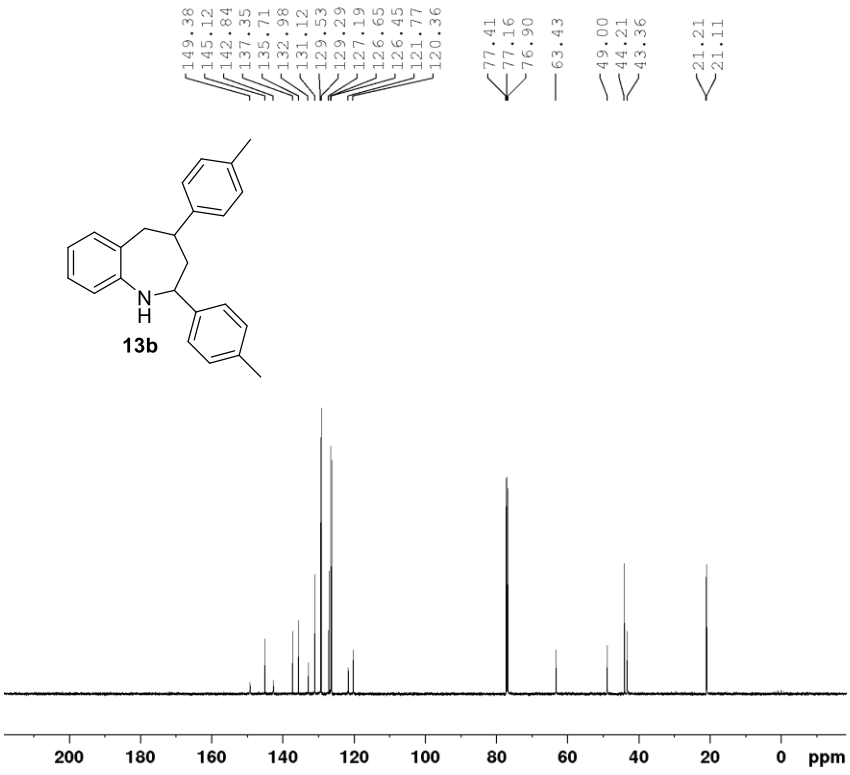
F2 - Processing parameters
SI                     32768
SF                 125.7577756 MHz
WDW                        EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 226
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180903
Time               15.19
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

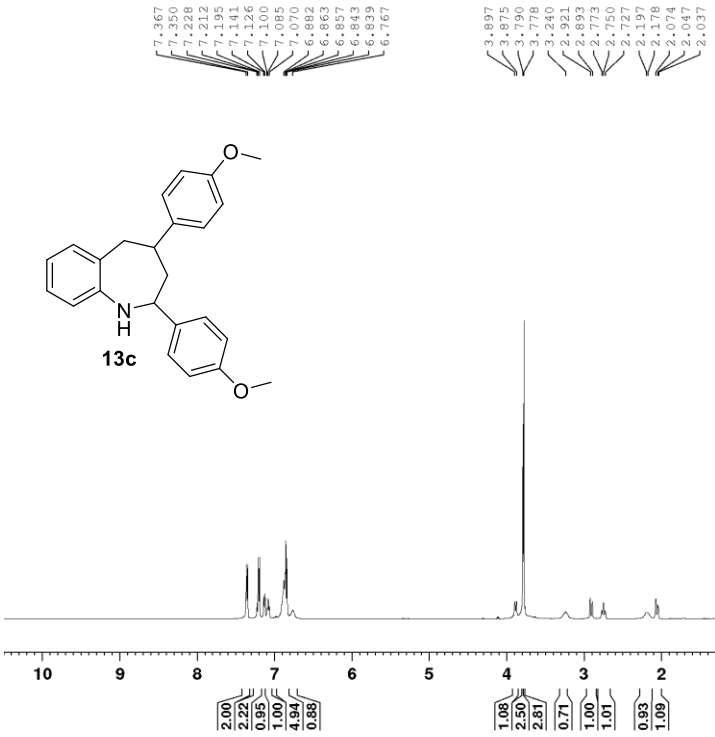
F2 - Processing parameters
SI                 65536
SF            500.1300494 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 227
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180903
Time               15.20
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    39
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

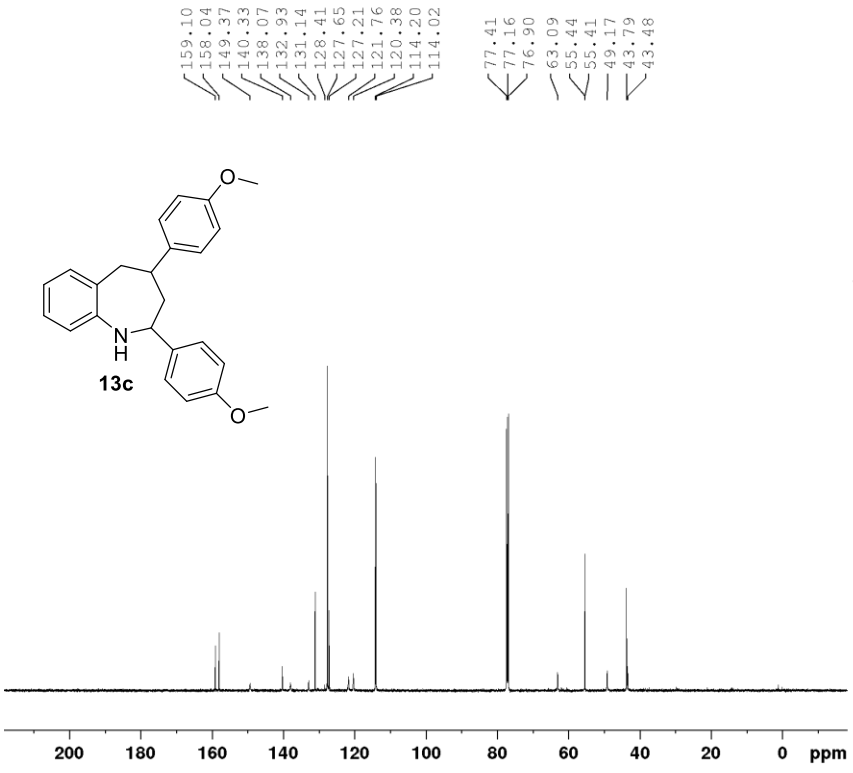
F2 - Processing parameters
SI                 32768
SF            125.7577838 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                211
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180829
Time               16.25
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

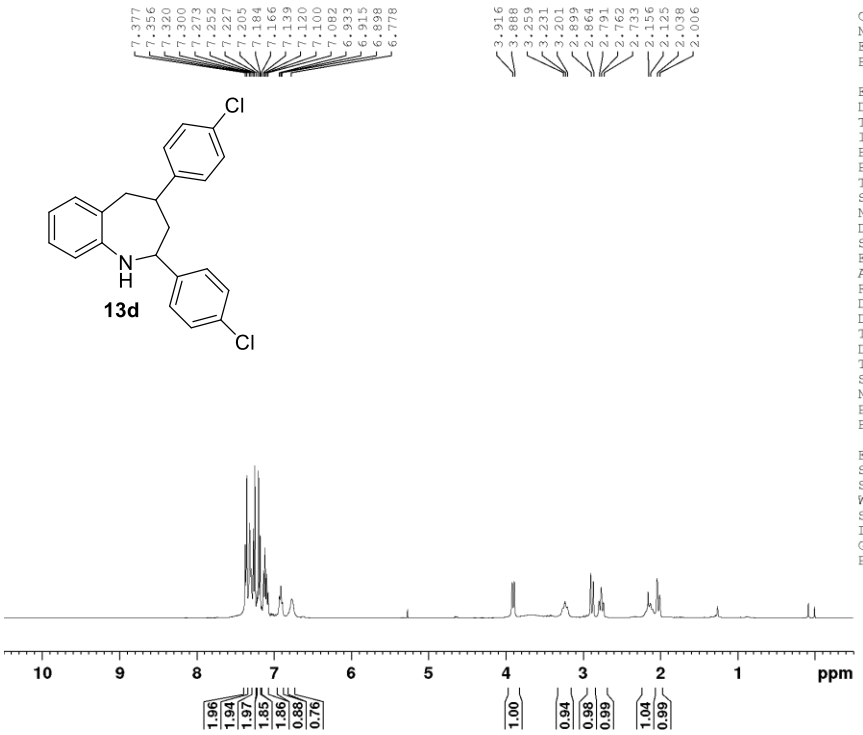
F2 - Processing parameters
SI                 65536
SF            500.1300280 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                212
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180829
Time               16.27
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   155
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

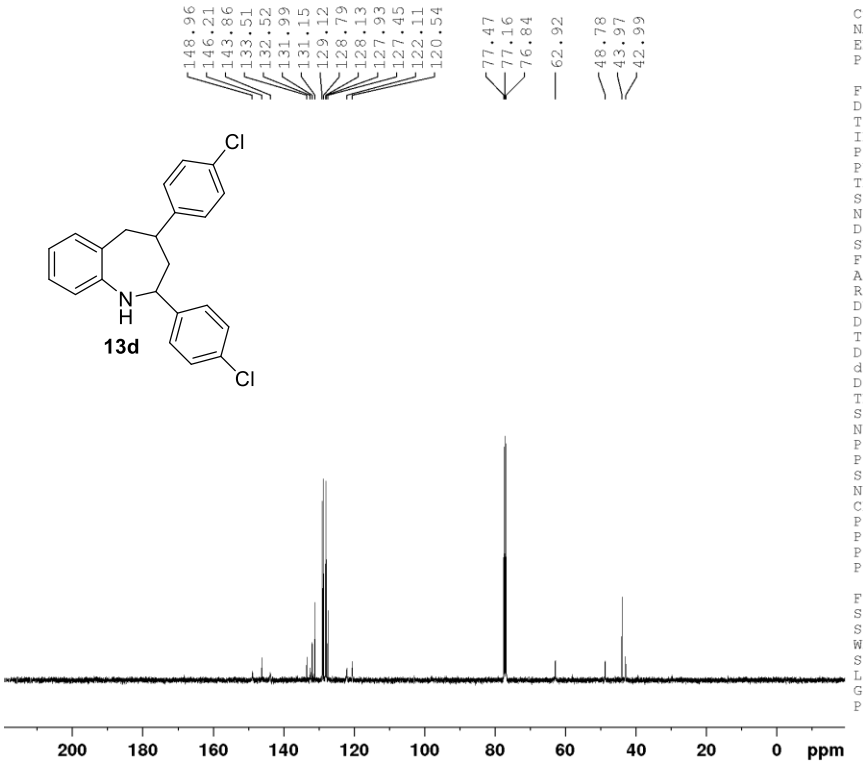
F2 - Processing parameters
SI                 32768
SF            125.7577783 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME           400M 2018
EXPNO                486
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180828
Time               15.40
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT             CDCl3
NS                    16
DS                     0
SWH             8012.820 Hz
FIDRES             0.244532 Hz
AQ              2.0447233 sec
RG                 55.55
DW                 62.400 usec
DE                  6.50 usec
TE                 299.7 K
D1              2.00000000 sec
TD0                    1
SFO1          400.2424716 MHz
NUC1                  1H
P1                 14.80 usec
PLW1           12.00000000 W

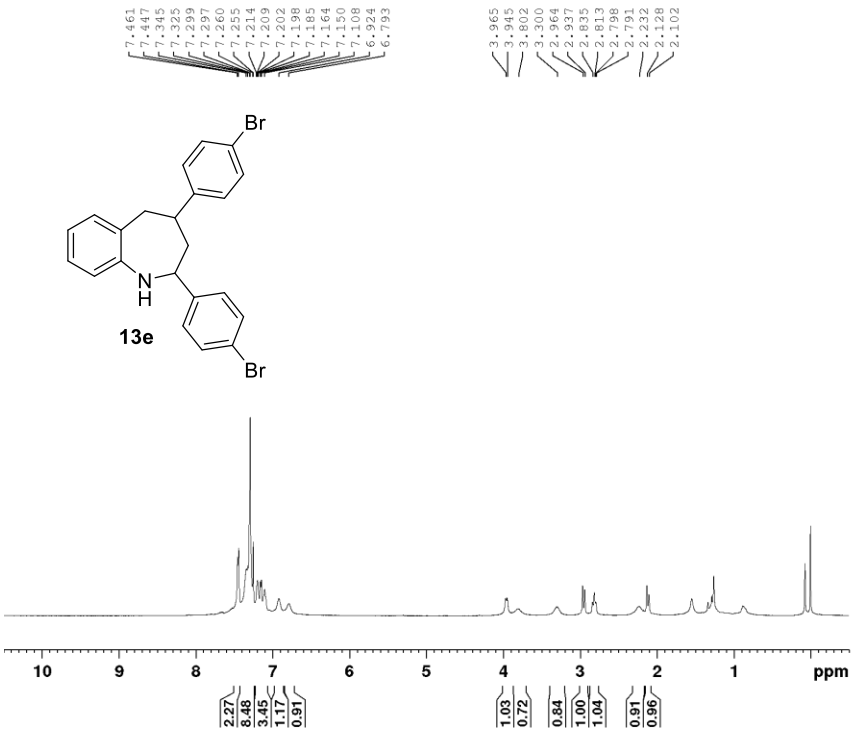
F2 - Processing parameters
SI                 65536
SF            400.2400230 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME           400M 2018
EXPNO                487
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180828
Time               15.42
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT             CDCl3
NS                   212
DS                     4
SWH            24038.461 Hz
FIDRES             0.366798 Hz
AQ              1.3631488 sec
RG                206.33
DW                 20.800 usec
DE                  6.50 usec
TE                 300.2 K
D1              2.00000000 sec
d11             0.03000000 sec
DELTA           1.89999998 sec
TD0                    1
SFO1          100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
PLW1           54.00000000 W
SFO2          400.2416010 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2           12.00000000 W
PLW12           0.34680000 W
PLW13           0.28090999 W

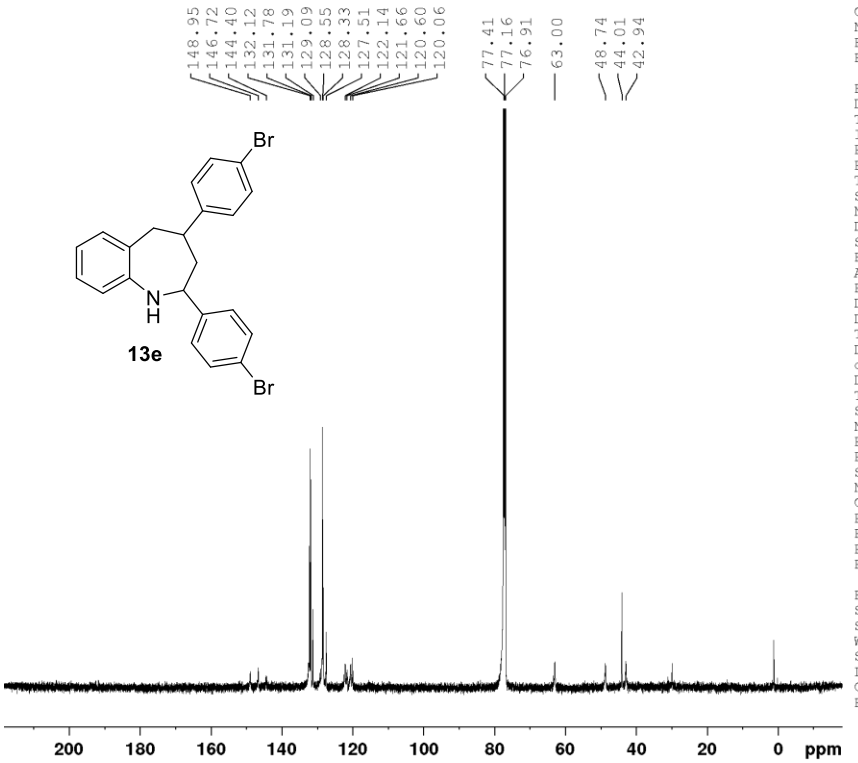
F2 - Processing parameters
SI                 32768
SF            100.6404198 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                284
PROCNO                 1

F2 - Acquisition Parameters
Date_           20181030
Time               18.45
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 49.27
DW                50.000 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

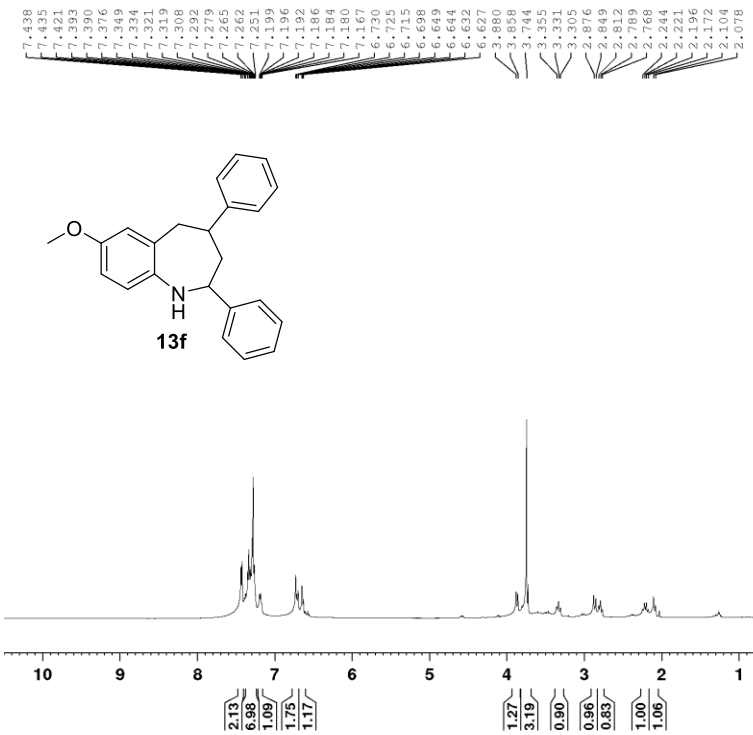
F2 - Processing parameters
SI                 65536
SF            500.1300136 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                223
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180831
Time               11.50
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

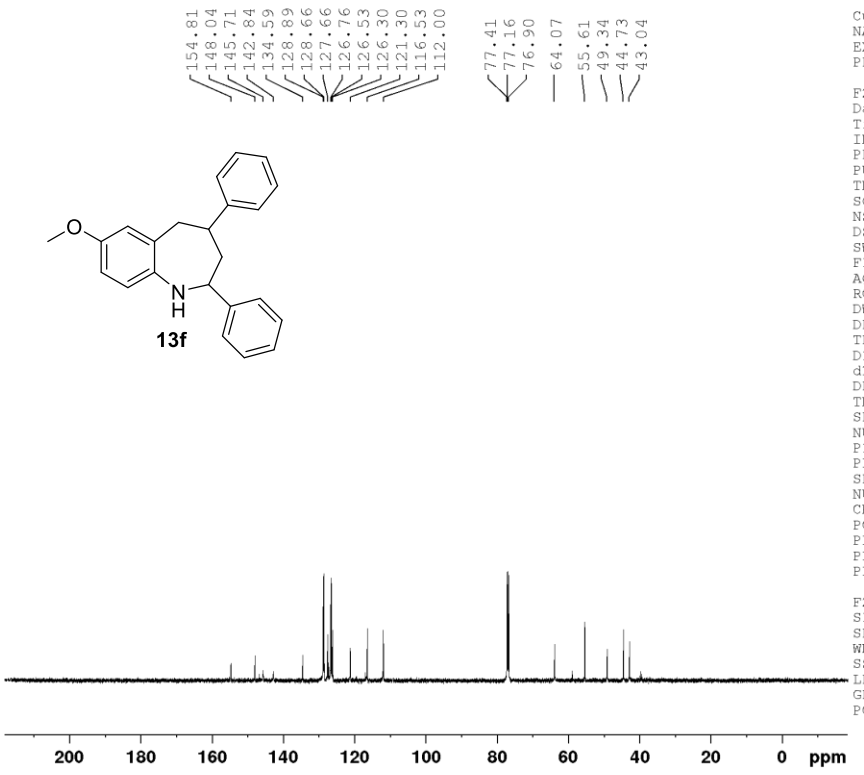
F2 - Processing parameters
SI                 32768
SF            125.7577729 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                268
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180905
Time               19.06
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                  22.1
DW                50.000 usec
DE                 6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

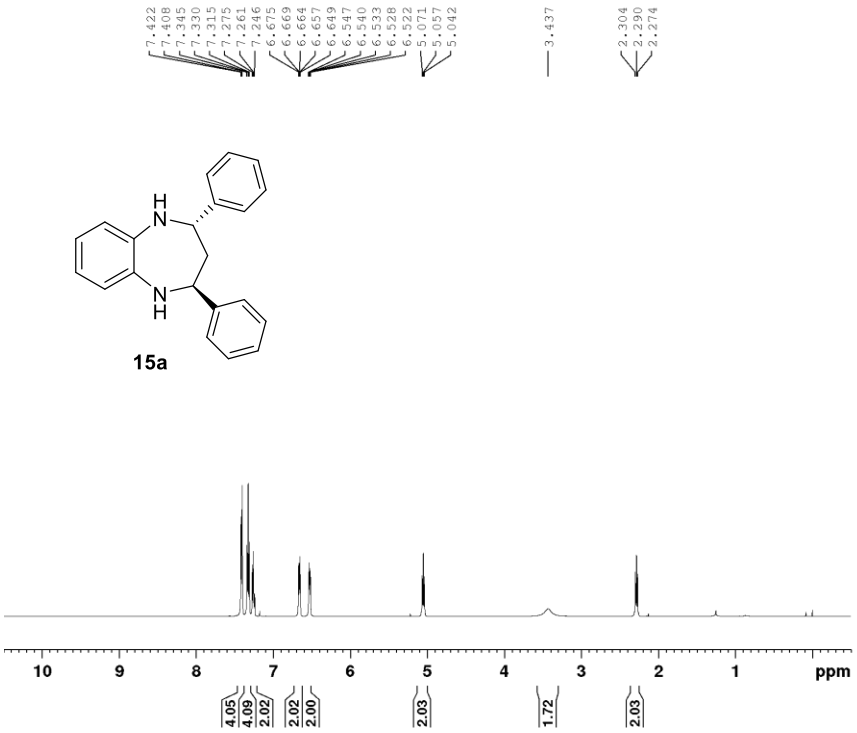
F2 - Processing parameters
SI                 65536
SF            500.1300422 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME         500M 2018-2
EXPNO                269
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180905
Time               19.07
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    14
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

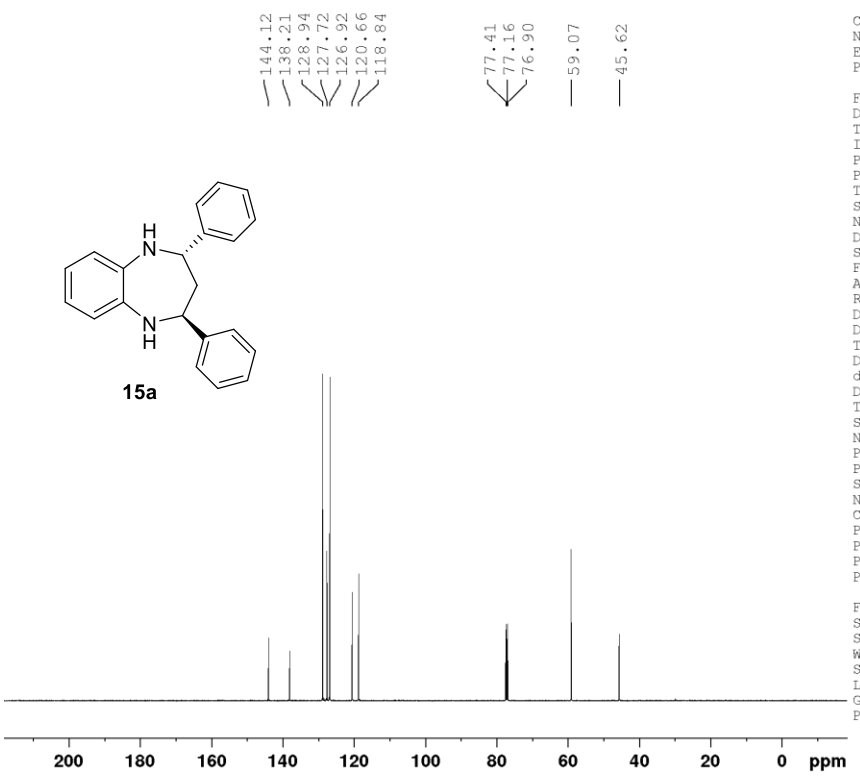
F2 - Processing parameters
SI                 32768
SF            125.7577838 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 270
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180905
Time               19.11
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 25.06
DW                50.000 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

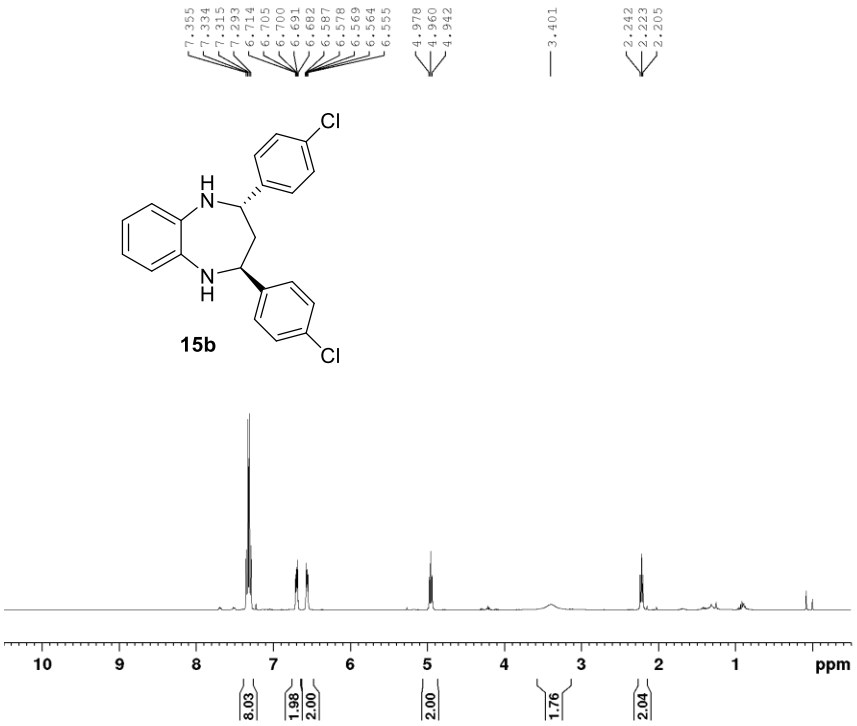
F2 - Processing parameters
SI                 65536
SF            500.1300523 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 271
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180905
Time               19.12
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    52
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                16.800 usec
DE                18.00 usec
TE                298.2 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                 9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

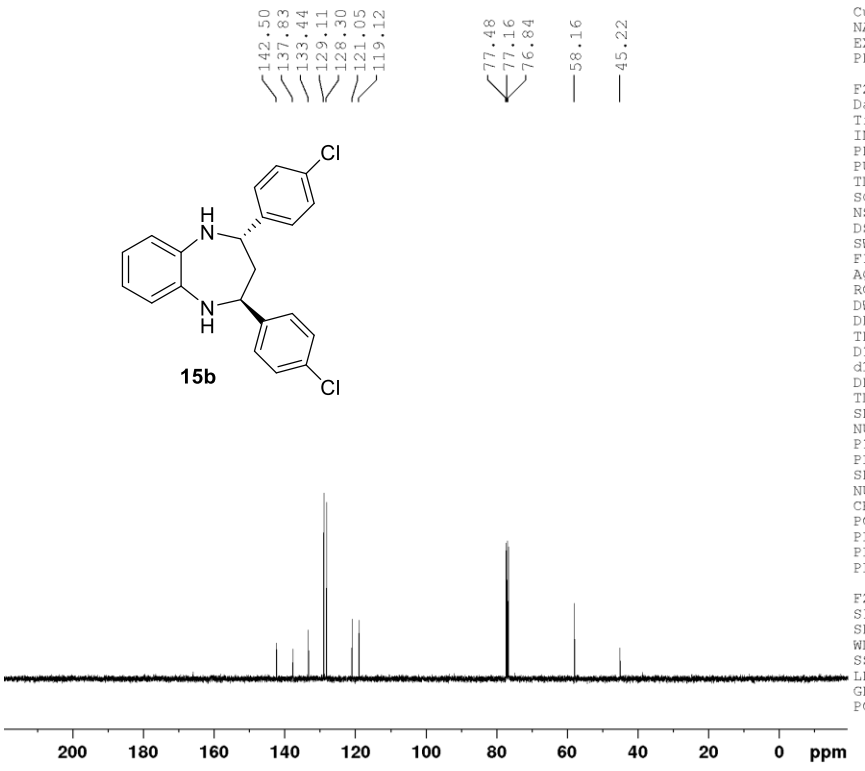
F2 - Processing parameters
SI                 32768
SF            125.7577883 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```




```
Current Data Parameters
NAME                  400M 2018
EXPNO                       503
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20180906
Time                      10.57
INSTRUM                   spect
PROBHD    5 mm PABBO BB/
PULPROG                   zg30
TD                       32768
SOLVENT                  CDCl3
NS                          16
DS                           0
SWH                   8012.820 Hz
FIDRES                0.244532 Hz
AQ                    2.0447233 sec
RG                        65.71
DW                       62.400 usec
DE                        6.50 usec
TE                       300.1 K
D1                    2.00000000 sec
TD0                          1
SFO1                400.2424716 MHz
NUC1                        1H
P1                       14.80 usec
PLW1                12.00000000 W

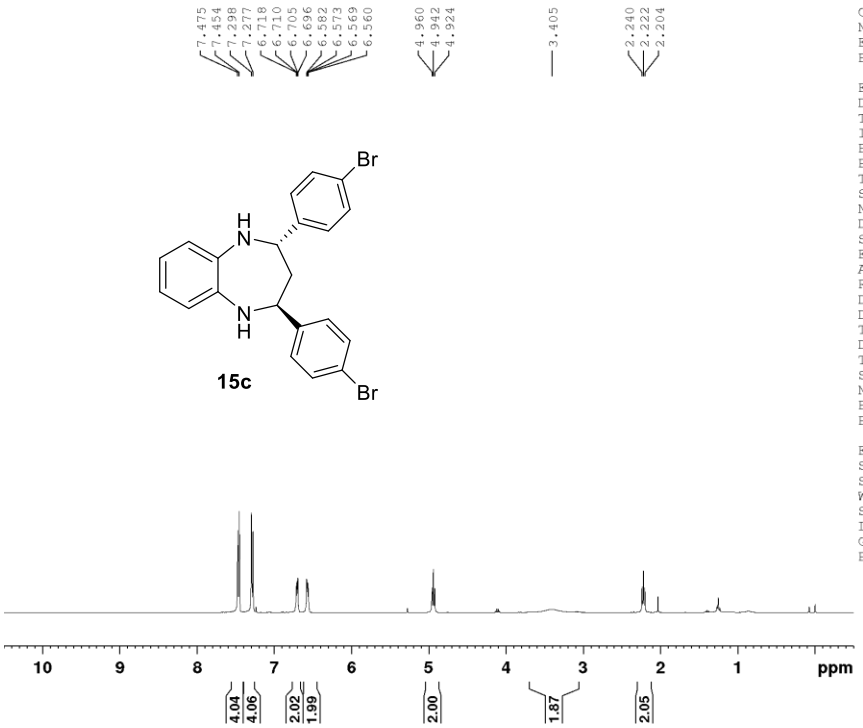
F2 - Processing parameters
SI                       65536
SF                  400.2400222 MHz
WDW                         EM
SSB                  0
LB                        0.30 Hz
GB                   0
PC                        1.00
```




```
Current Data Parameters
NAME                  400M 2018
EXPNO                       504
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20180906
Time                      11.00
INSTRUM                   spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       65536
SOLVENT                  CDCl3
NS                          29
DS                           4
SWH                  24038.461 Hz
FIDRES                0.366798 Hz
AQ                    1.3631488 sec
RG                       206.33
DW                       20.800 usec
DE                        6.50 usec
TE                       300.7 K
D1                    2.00000000 sec
d11                   0.03000000 sec
DELTA                 1.89999998 sec
TD0                          1
SFO1                100.6504916 MHz
NUC1                        13C
P1                       10.00 usec
PLW1                54.00000000 W
SFO2                400.2416010 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                12.00000000 W
PLW12                0.34680000 W
PLW13                0.28090999 W

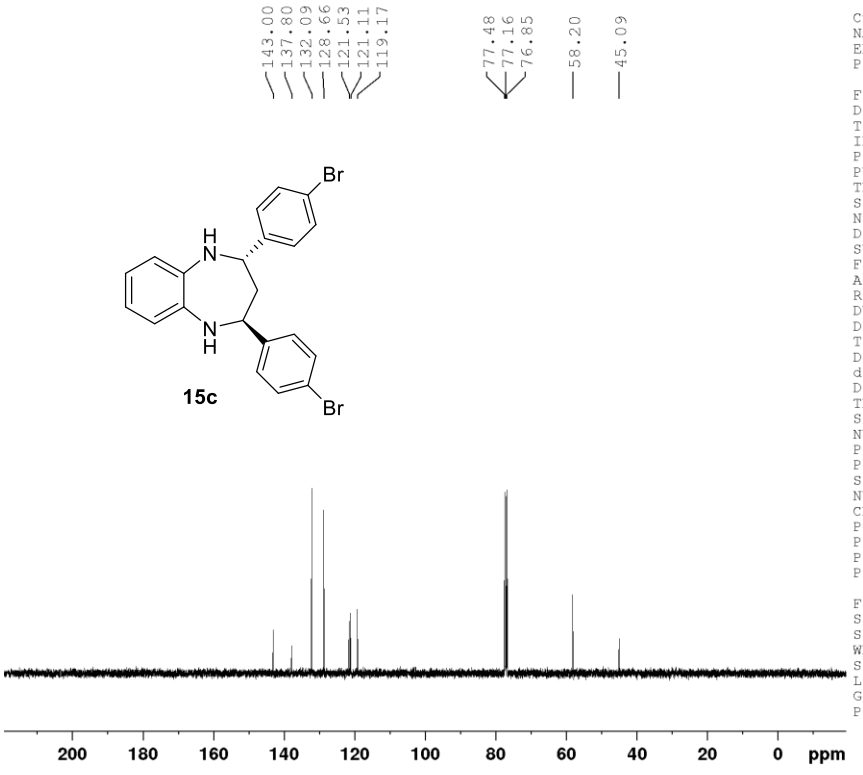
F2 - Processing parameters
SI                       32768
SF                  100.6404205 MHz
WDW                         EM
SSB                  0
LB                        1.00 Hz
GB                   0
PC                        1.40
```




```
Current Data Parameters
NAME                 400M 2018
EXPNO                      505
PROCNO                       1

F2 - Acquisition Parameters
Date_               20180906
Time                    11.03
INSTRUM                 spect
PROBHD   5 mm PABBO BB/
PULPROG                 zg30
TD                     32768
SOLVENT                 CDCl3
NS                         16
DS                          0
SWH                  8012.820 Hz
FIDRES               0.244532 Hz
AQ                   2.0447233 sec
RG                        73.9
DW                      62.400 usec
DE                       6.50 usec
TE                      300.1 K
D1                   2.00000000 sec
TD0                         1
SFO1               400.2424716 MHz
NUC1                       1H
P1                      14.80 usec
PLW1               12.00000000 W

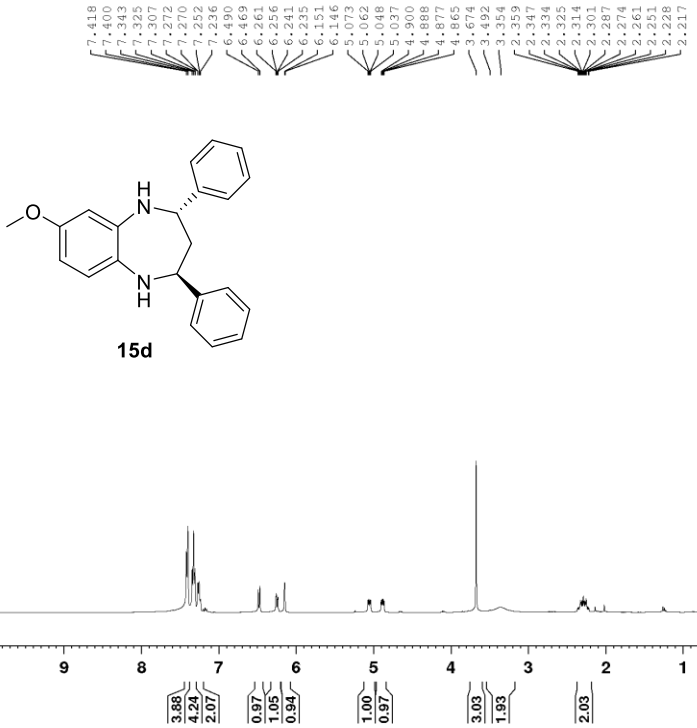
F2 - Processing parameters
SI                         65536
SF                 400.2400184 MHz
WDW                           EM
SSB          0
LB                       0.30 Hz
GB           0
PC                       1.00
```




```
Current Data Parameters
NAME                 400M 2018
EXPNO                      506
PROCNO                       1

F2 - Acquisition Parameters
Date_               20180906
Time                    11.05
INSTRUM                 spect
PROBHD   5 mm PABBO BB/
PULPROG                zgpg30
TD                     65536
SOLVENT                 CDCl3
NS                         35
DS                          4
SWH                 24038.461 Hz
FIDRES               0.366798 Hz
AQ                   1.3631488 sec
RG                      206.33
DW                      20.800 usec
DE                       6.50 usec
TE                      300.9 K
D1                   2.00000000 sec
d11                  0.03000000 sec
DELTA                1.89999998 sec
TD0                         1
SFO1               100.6504916 MHz
NUC1                       13C
P1                      10.00 usec
PLW1                54.00000000 W
SFO2               400.2416010 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                   90.00 usec
PLW2               12.00000000 W
PLW12                0.34680000 W
PLW13                0.28090999 W

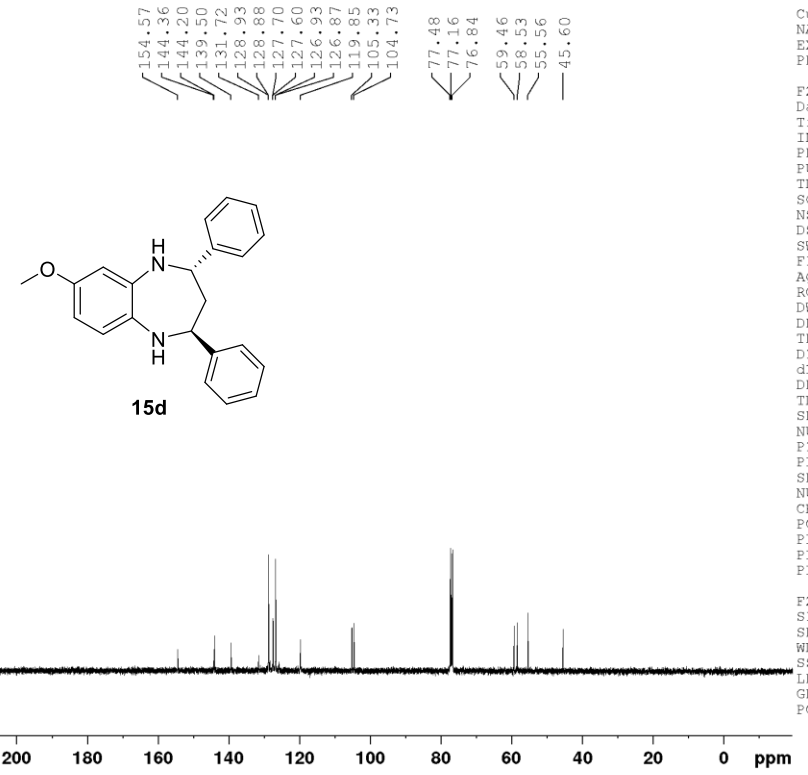
F2 - Processing parameters
SI                         32768
SF                 100.6404188 MHz
WDW                           EM
SSB          0
LB                       1.00 Hz
GB           0
PC                       1.40
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               509
PROCNO                1

F2 - Acquisition Parameters
Date_          20180906
Time              11.20
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES            0.244532 Hz
AQ             2.0447233 sec
RG                 43.5
DW                62.400 usec
DE                 6.50 usec
TE                300.2 K
D1             2.00000000 sec
TD0                   1
SFO1          400.2424716 MHz
NUC1                 1H
P1                14.80 usec
PLW1          12.00000000 W

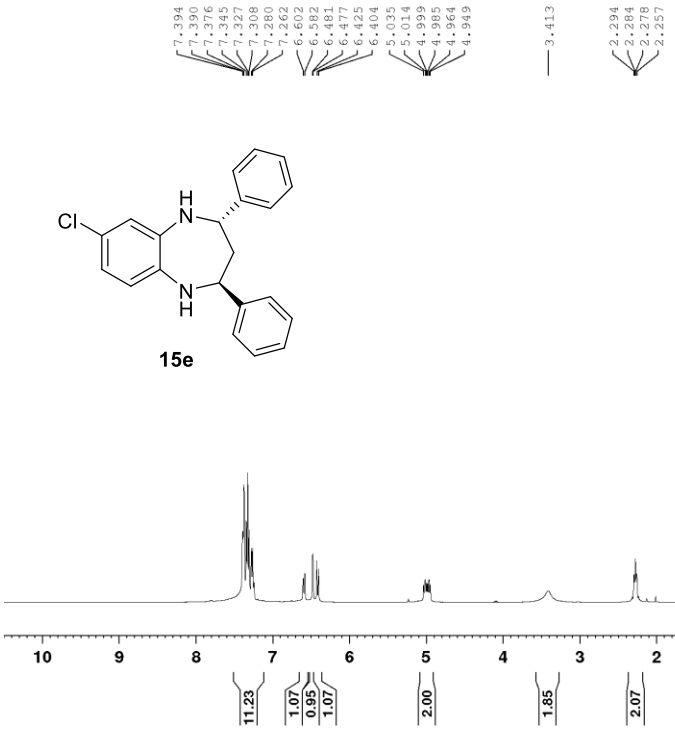
F2 - Processing parameters
SI                65536
SF            400.2400337 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               510
PROCNO                1

F2 - Acquisition Parameters
Date_          20180906
Time              11.22
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                   50
DS                    4
SWH           24038.461 Hz
FIDRES            0.366798 Hz
AQ             1.3631488 sec
RG                206.33
DW                20.800 usec
DE                 6.50 usec
TE                300.8 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                   1
SFO1          100.6504916 MHz
NUC1                 13C
P1                10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                 1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

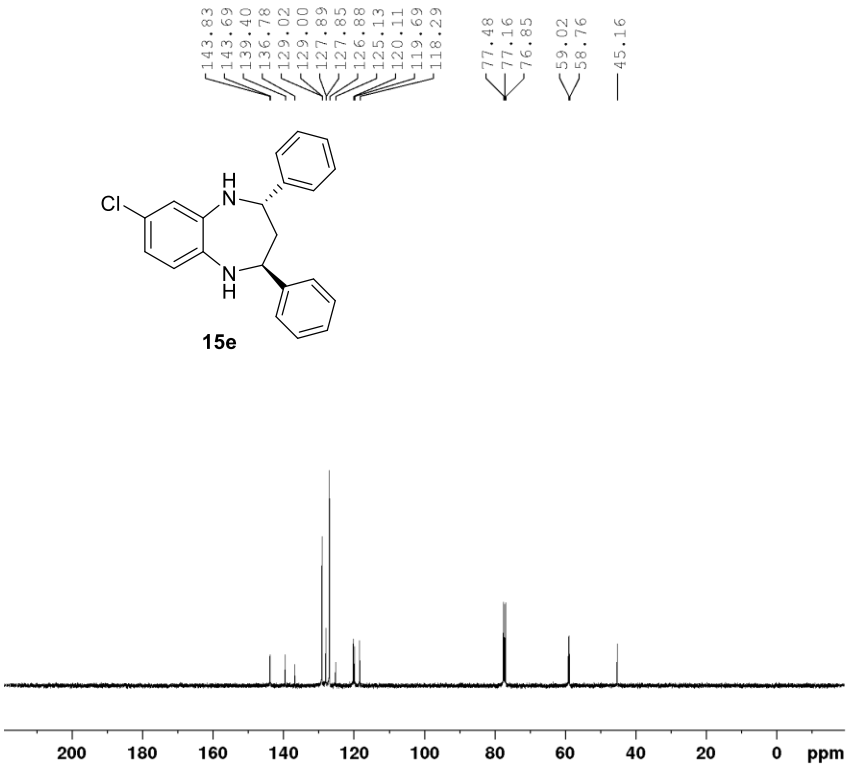
F2 - Processing parameters
SI                32768
SF            100.6404254 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               507
PROCNO                1

F2 - Acquisition Parameters
Date_          20180906
Time              11.10
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT            CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES            0.244532 Hz
AQ             2.0447233 sec
RG                 43.5
DW                62.400 usec
DE                 6.50 usec
TE                300.1 K
D1             2.00000000 sec
TD0                   1
SFO1          400.2424716 MHz
NUC1                 1H
P1                14.80 usec
PLW1          12.00000000 W

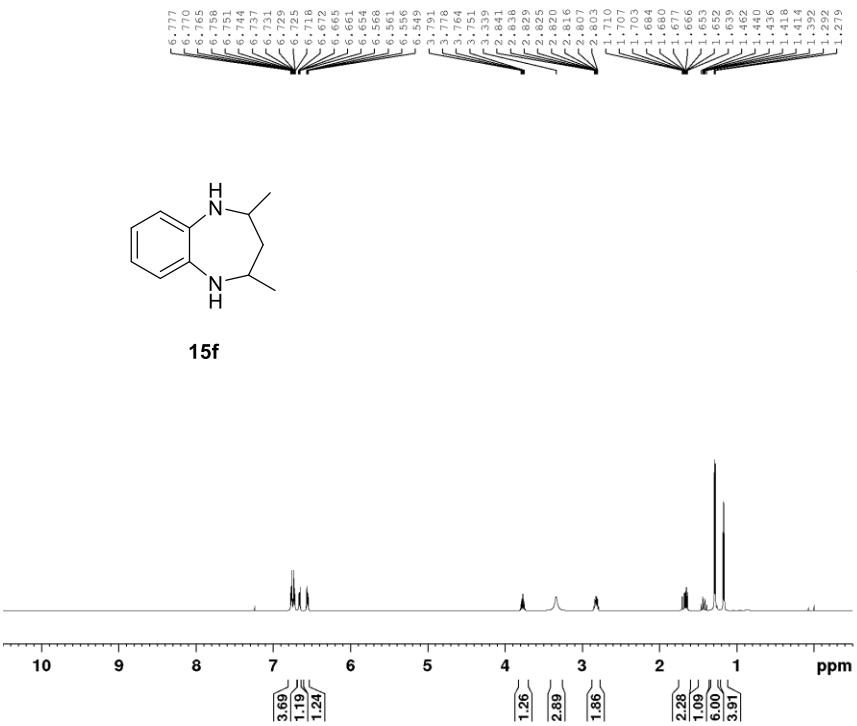
F2 - Processing parameters
SI                65536
SF            400.2400358 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```




```
Current Data Parameters
NAME          400M 2018
EXPNO               508
PROCNO                1

F2 - Acquisition Parameters
Date_          20180906
Time              11.12
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT            CDCl3
NS                  126
DS                    4
SWH           24038.461 Hz
FIDRES            0.366798 Hz
AQ             1.3631488 sec
RG                206.33
DW                20.800 usec
DE                 6.50 usec
TE                300.8 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                   1
SFO1          100.6504916 MHz
NUC1                 13C
P1                10.00 usec
PLW1          54.00000000 W
SFO2          400.2416010 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2             90.00 usec
PLW2          12.00000000 W
PLW12          0.34680000 W
PLW13          0.28090999 W

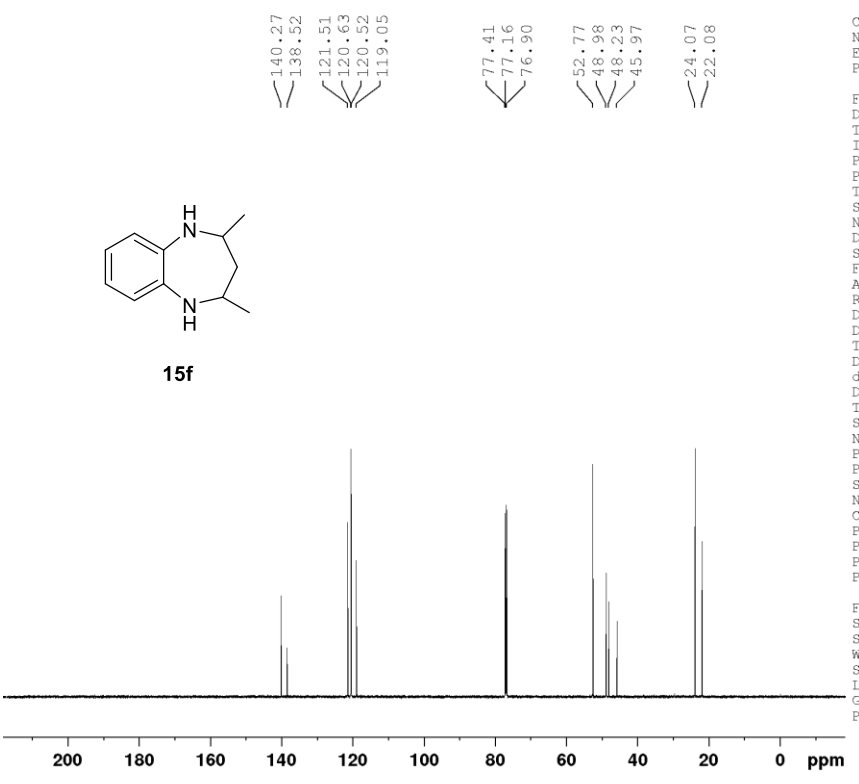
F2 - Processing parameters
SI                32768
SF            100.6404239 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```




```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 272
PROCNO                  1

F2 - Acquisition Parameters
Date_           20180905
Time               19.17
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           10000.000 Hz
FIDRES            0.152588 Hz
AQ             3.2767999 sec
RG                 31.72
DW                 50.000 usec
DE                  6.50 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1
SFO1          500.1330885 MHz
NUC1                  1H
P1                 11.50 usec
PLW1          20.00000000 W

F2 - Processing parameters
SI                 65536
SF            500.1300218 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

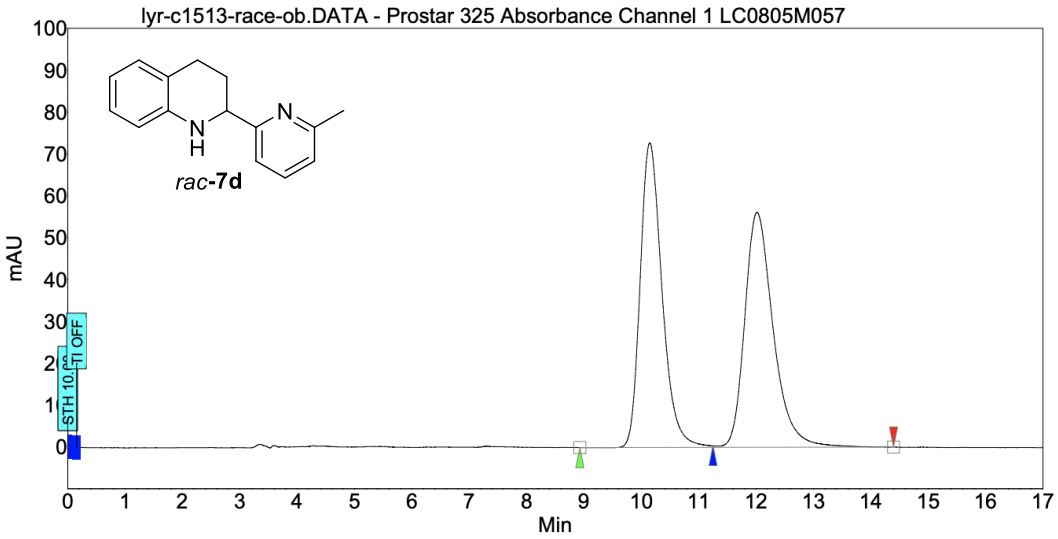



```
Current Data Parameters
NAME          500M 2018-2
EXPNO                 273
PROCNO                  1

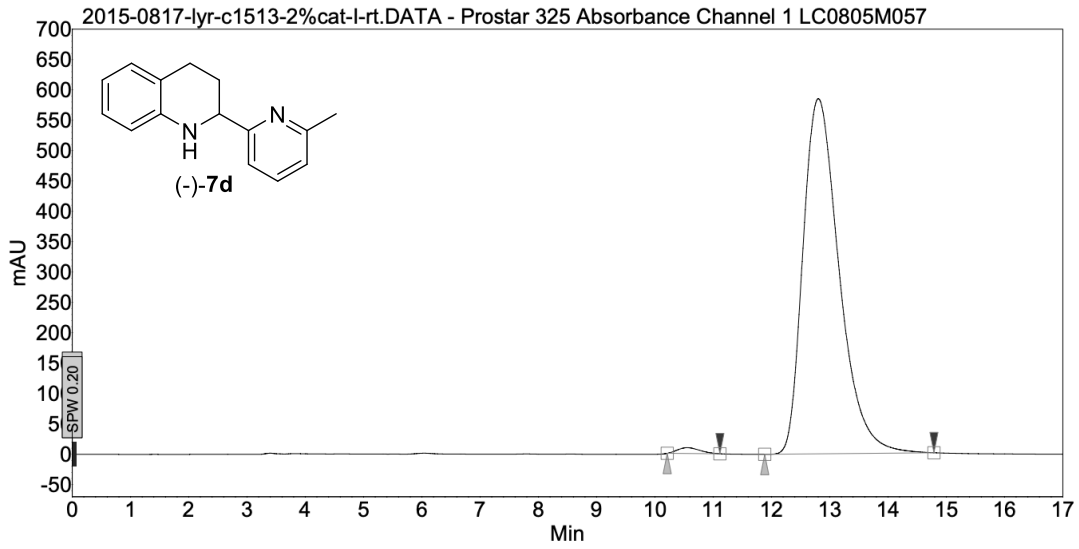
F2 - Acquisition Parameters
Date_           20180905
Time               19.19
INSTRUM            spect
PROBHD   5 mm CPPBBO BB
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    30
DS                     4
SWH           29761.904 Hz
FIDRES            0.454131 Hz
AQ             1.1010048 sec
RG                192.89
DW                 16.800 usec
DE                 18.00 usec
TE                298.1 K
D1             2.00000000 sec
d11            0.03000000 sec
DELTA          1.89999998 sec
TD0                    1
SFO1          125.7703637 MHz
NUC1                  13C
P1                  9.80 usec
PLW1          57.00000000 W
SFO2          500.1320005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              80.00 usec
PLW2          20.00000000 W
PLW12          0.35778001 W
PLW13          0.22898000 W

F2 - Processing parameters
SI                 32768
SF            125.7577838 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

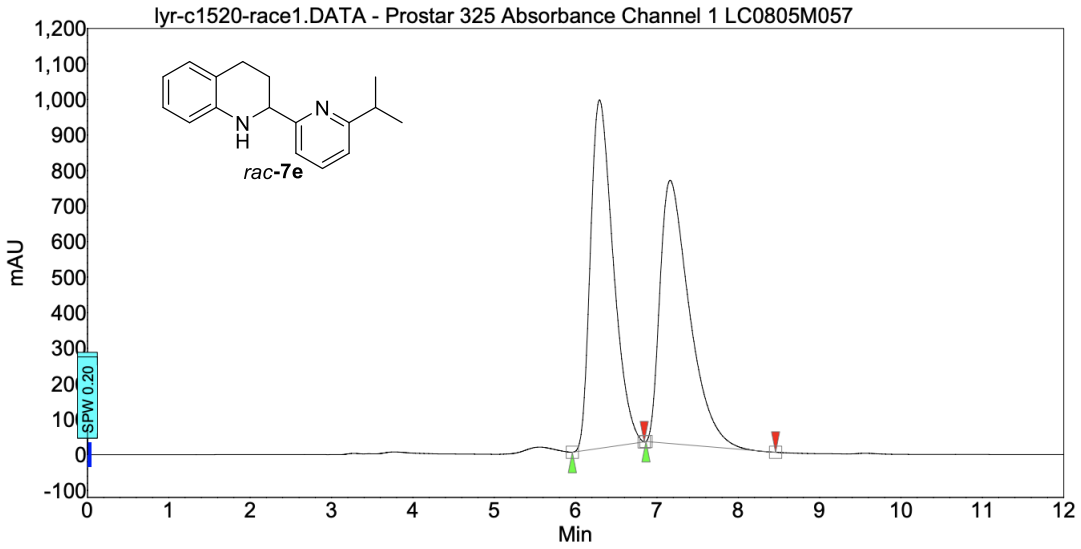
13. Copy of HPLC spectra



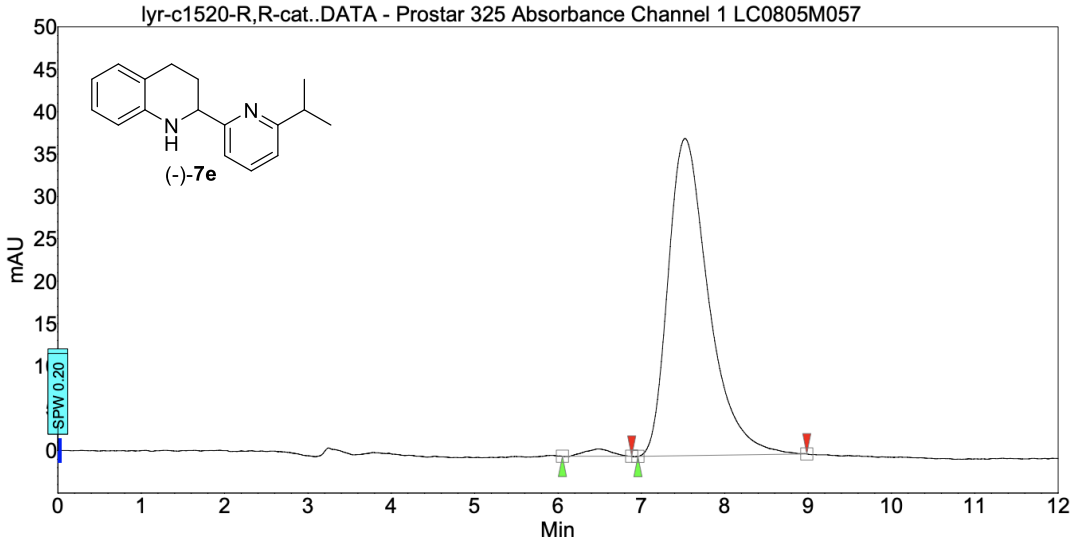
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	10.15	49.87	72.8	32.1	49.872
2	未知	12.01	50.13	56.1	32.3	50.128
Total			100.00	128.9	64.5	100.000



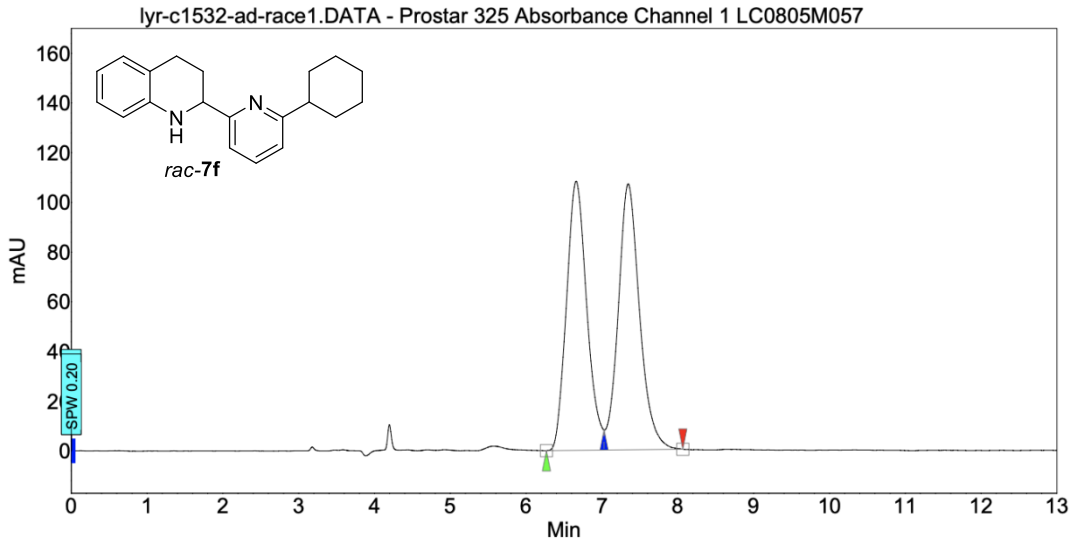
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	10.55	0.99	9.6	4.2	0.994
1	未知	12.80	99.01	584.9	420.4	99.006
Total			100.00	594.5	424.6	100.000



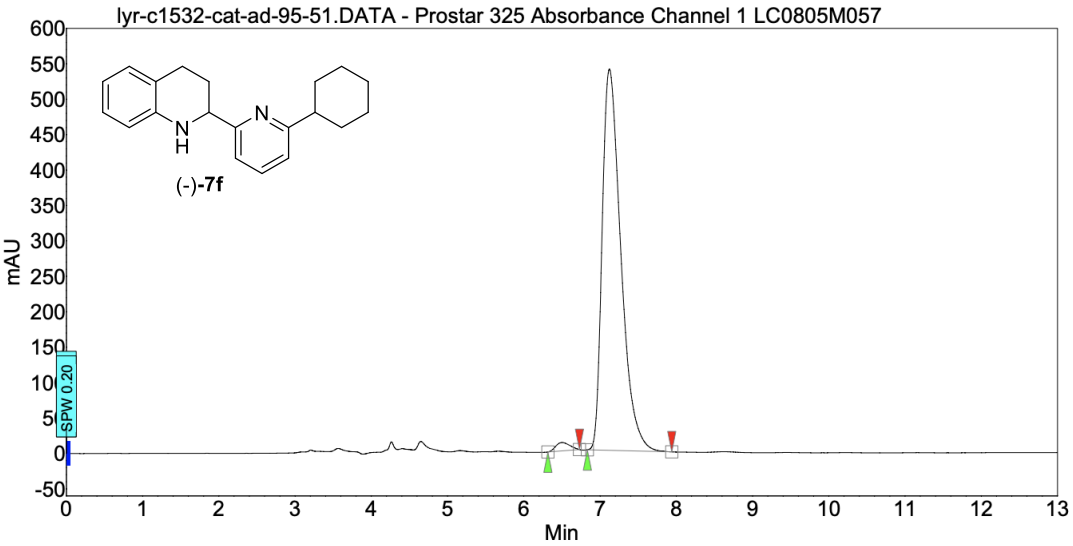
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.29	50.62	980.9	318.3	50.615
2	未知	7.16	49.38	740.7	310.6	49.385
Total			100.00	1721.6	628.9	100.000



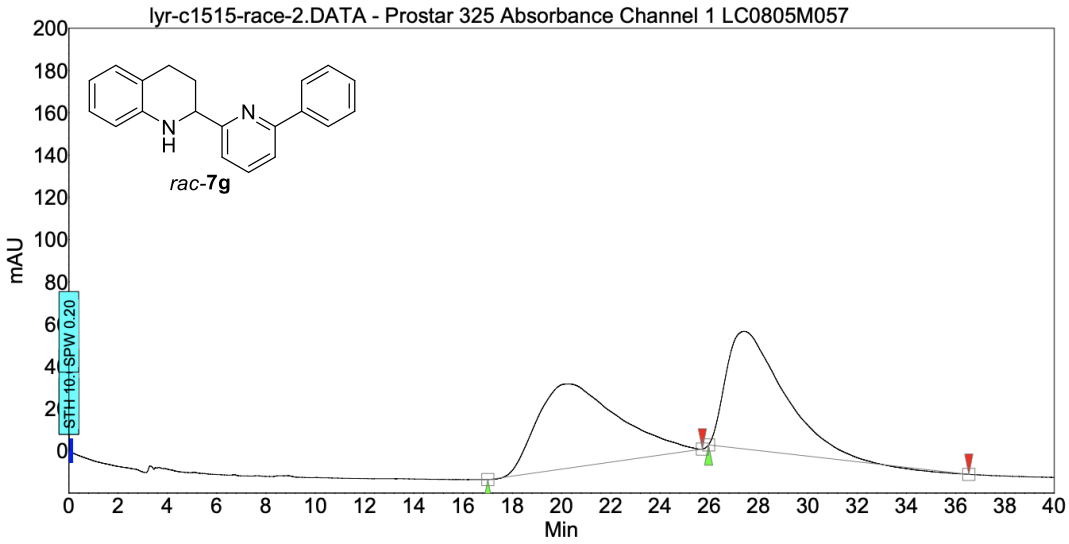
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.48	1.48	0.9	0.3	1.480
2	未知	7.52	98.52	37.4	21.1	98.520
Total			100.00	38.3	21.4	100.000



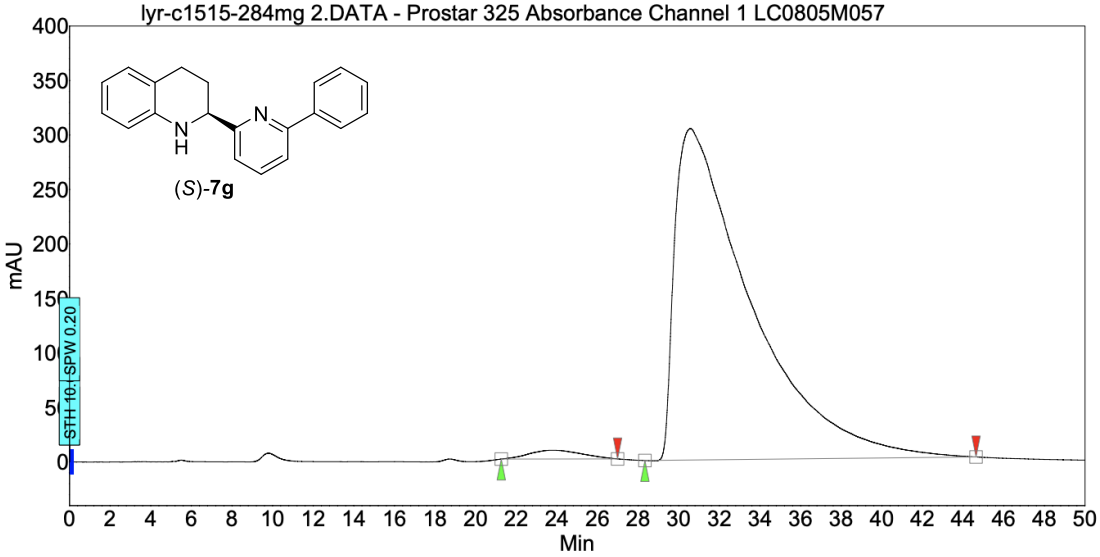
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.66	49.02	108.3	33.6	49.018
2	未知	7.35	50.98	107.0	35.0	50.982
Total			100.00	215.3	68.6	100.000



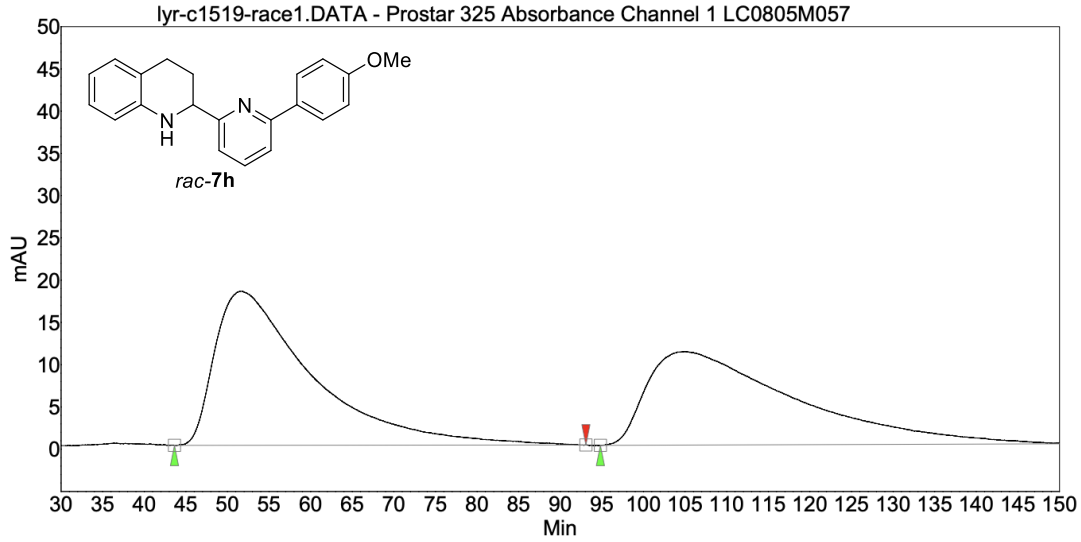
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.49	1.63	11.9	2.5	1.631
2	未知	7.12	98.37	538.3	152.5	98.369
Total			100.00	550.1	155.0	100.000



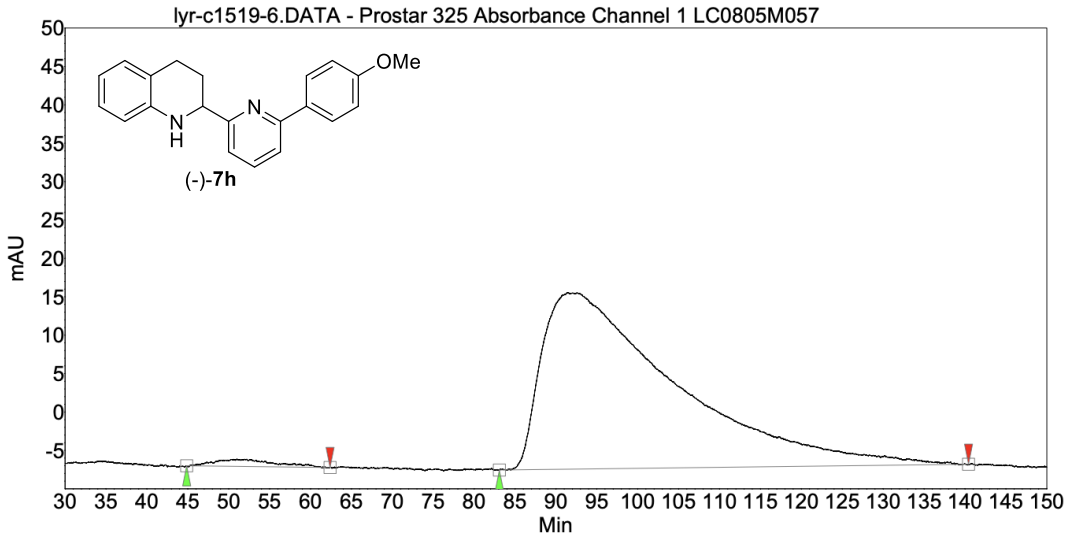
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	20.10	50.21	40.0	151.9	50.213
2	未知	27.43	49.79	55.7	150.7	49.787
Total			100.00	95.7	302.6	100.000



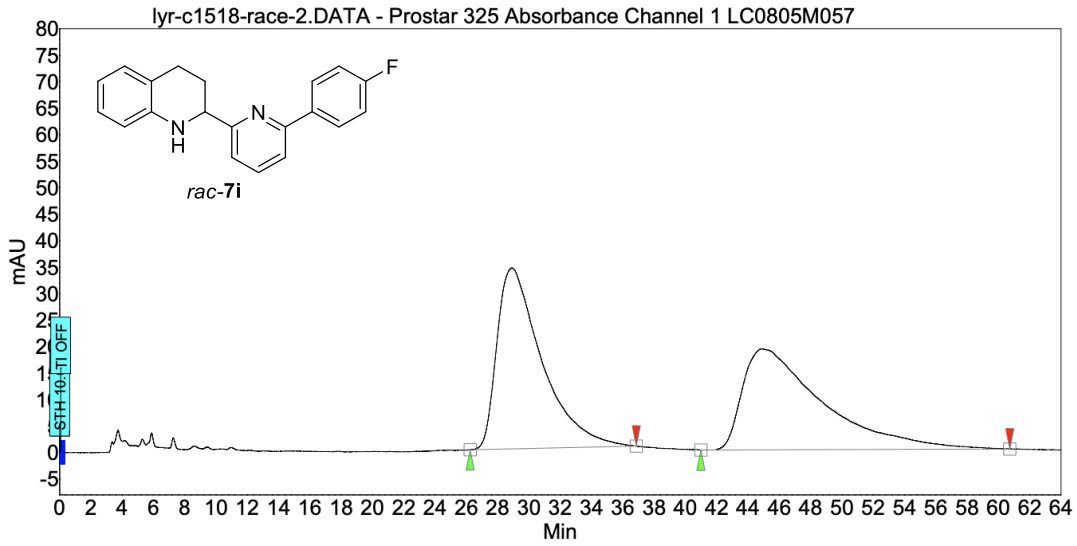
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	23.66	1.78	8.0	23.9	1.777
2	未知	30.57	98.22	304.1	1321.2	98.223
Total			100.00	312.0	1345.1	100.000



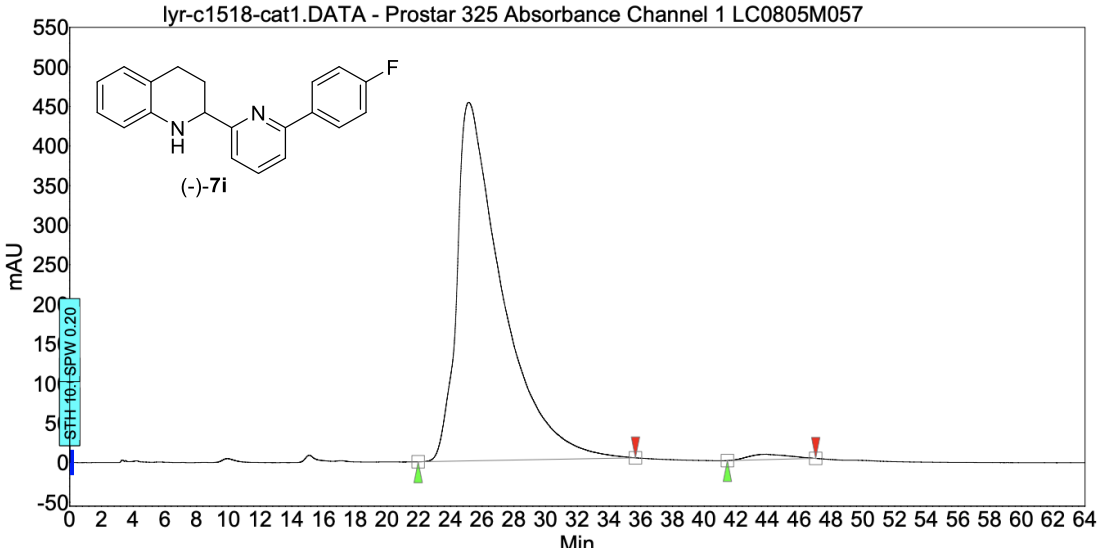
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	51.64	51.94	18.2	246.5	51.936
2	未知	104.92	48.06	11.1	228.1	48.064
Total			100.00	29.3	474.5	100.000



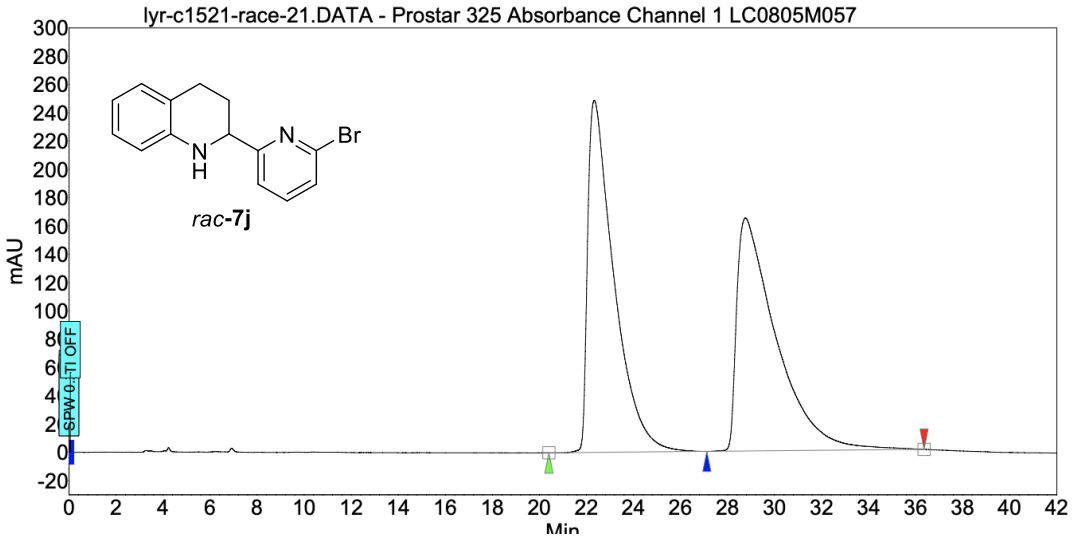
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	52.21	1.78	0.9	7.9	1.776
2	未知	91.40	98.22	23.0	434.6	98.224
Total			100.00	24.0	442.5	100.000



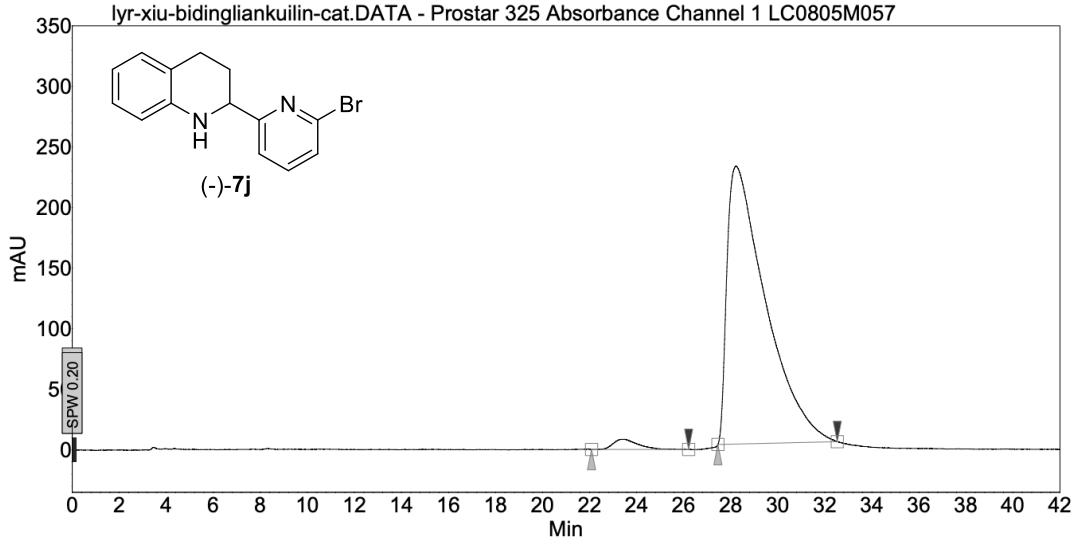
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	28.91	50.21	34.2	113.4	50.209
2	未知	44.86	49.79	19.1	112.4	49.791
Total			100.00	53.2	225.8	100.000



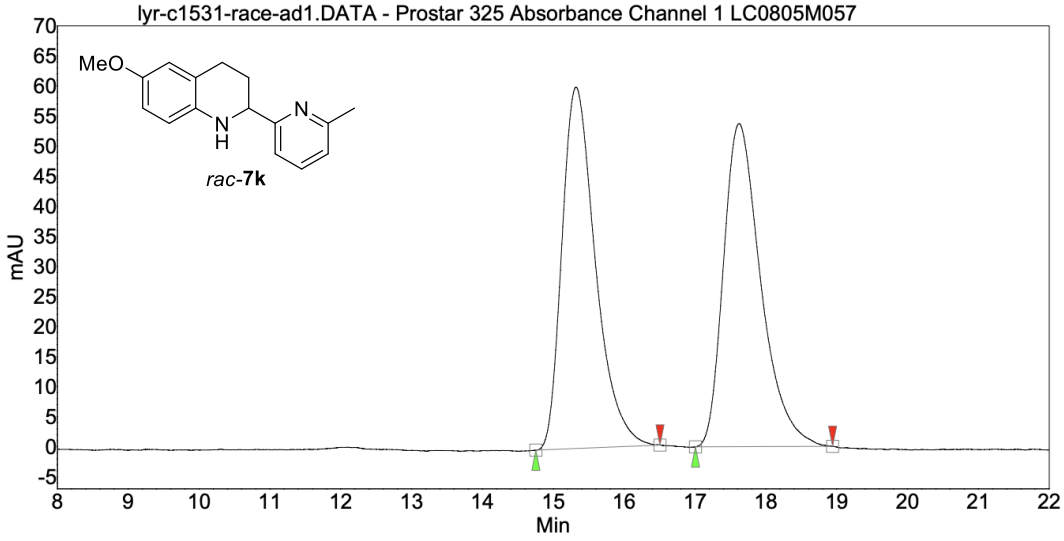
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	25.15	98.69	453.1	1498.5	98.693
2	未知	43.85	1.31	6.8	19.8	1.307
Total			100.00	459.9	1518.3	100.000



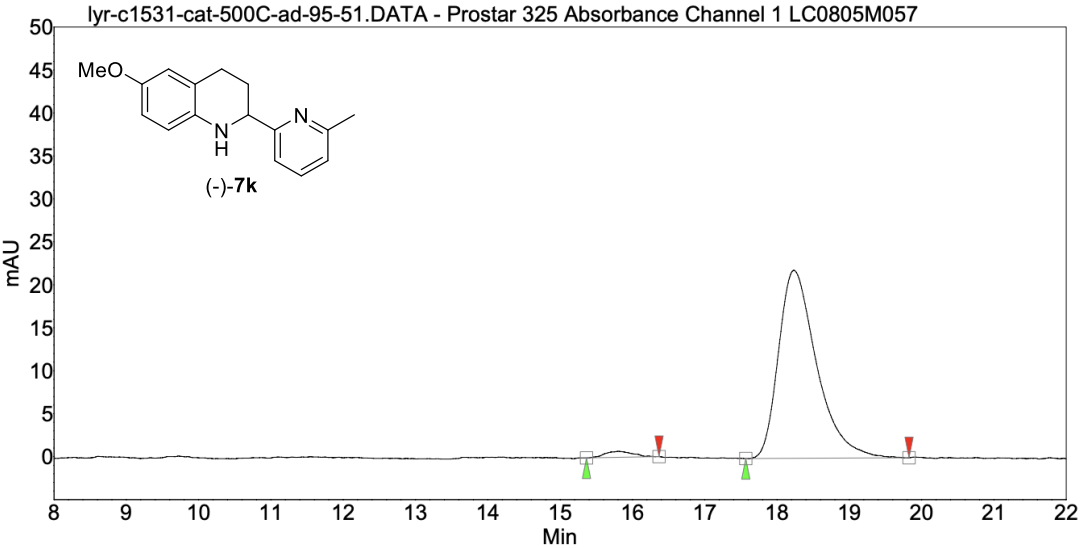
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	22.33	50.11	248.9	321.5	50.113
2	未知	28.77	49.89	164.7	320.0	49.887
Total			100.00	413.6	641.5	100.000



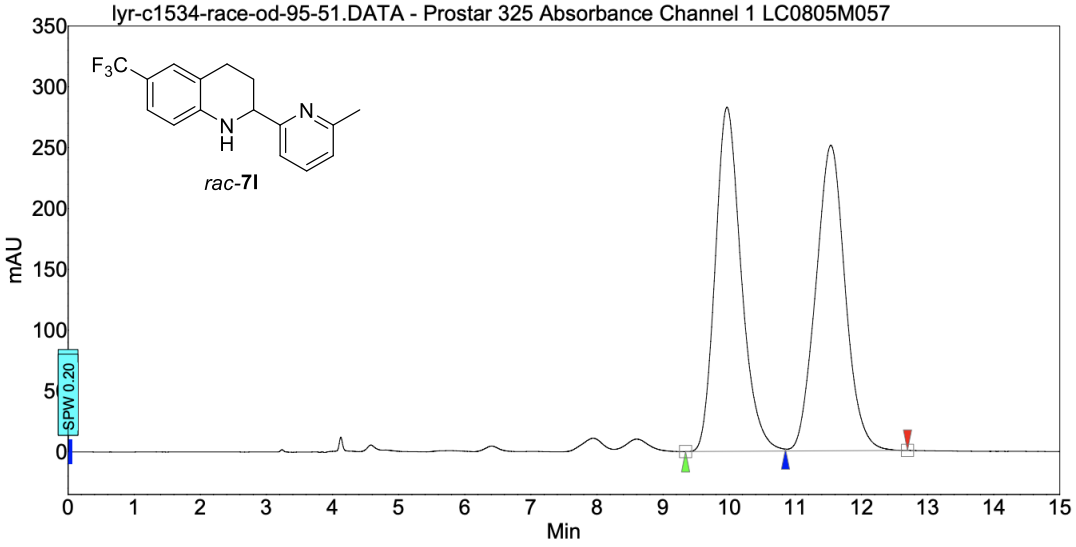
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	23.37	2.34	8.4	10.4	2.336
1	未知	28.23	97.66	229.4	436.8	97.664
Total			100.00	237.8	447.2	100.000



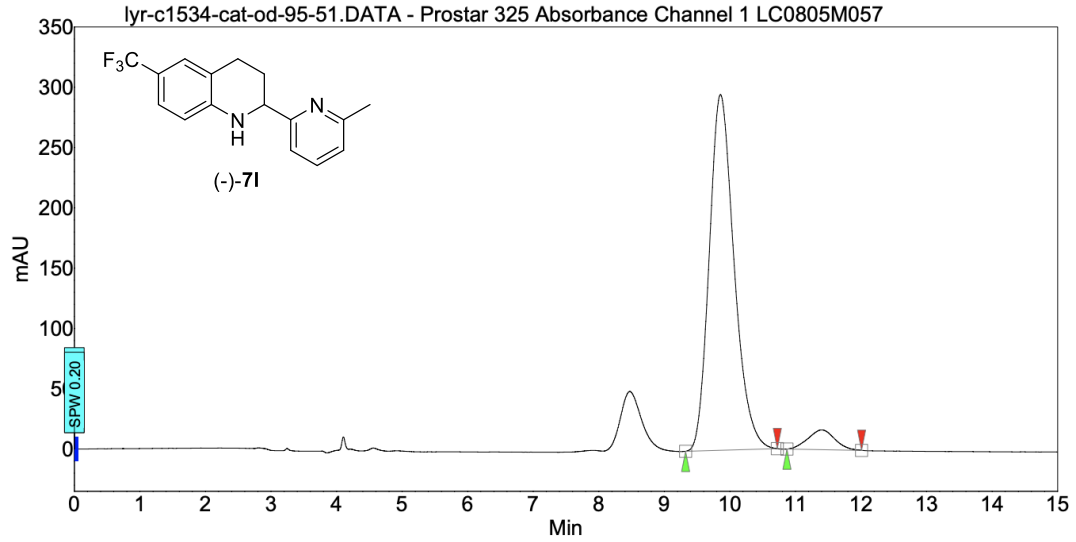
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	15.32	50.11	60.1	32.9	50.109
1	未知	17.62	49.89	53.7	32.8	49.891
Total			100.00	113.8	65.7	100.000



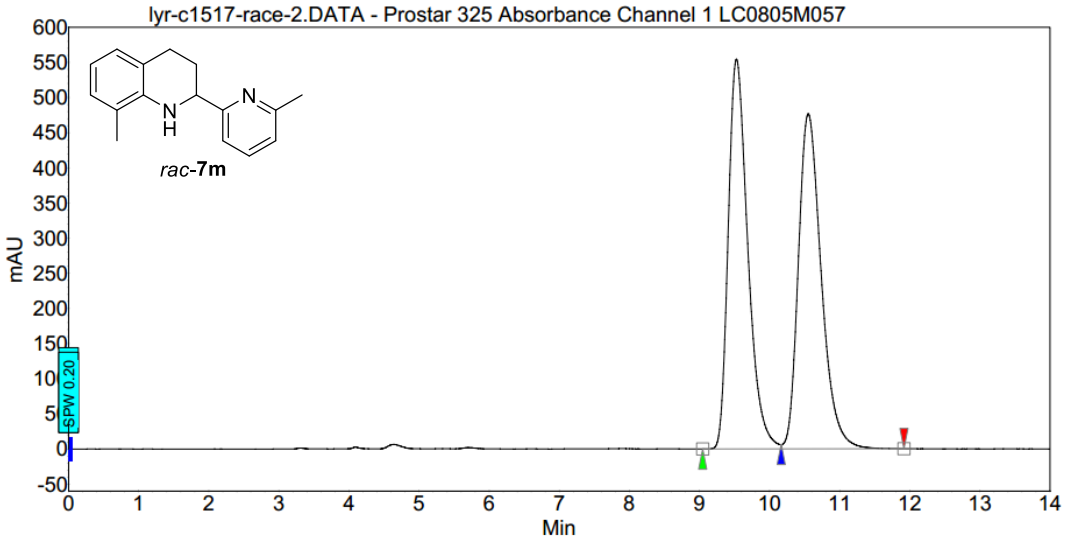
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	15.80	2.28	0.7	0.3	2.283
2	未知	18.23	97.72	21.9	13.4	97.717
Total			100.00	22.6	13.7	100.000



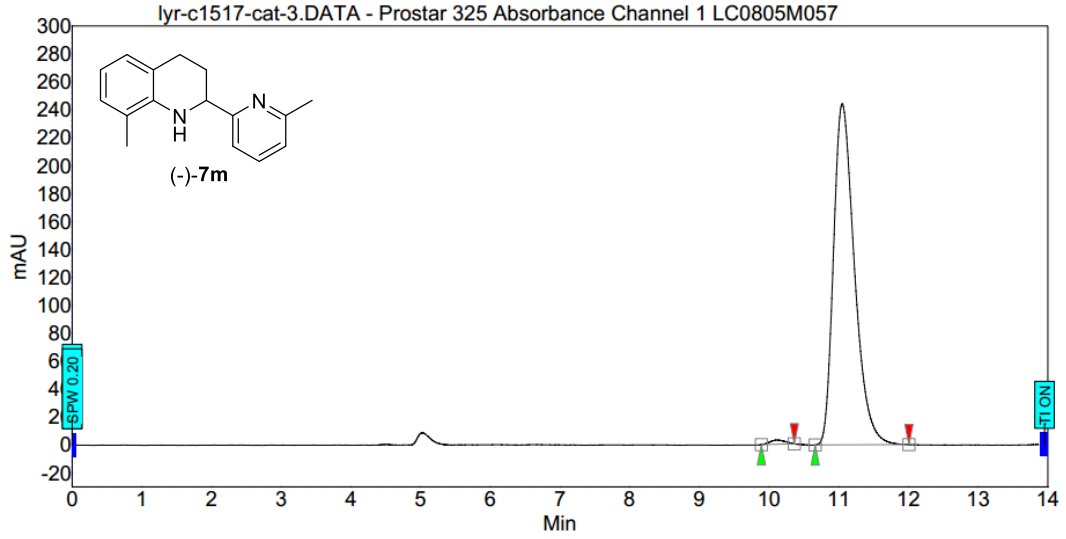
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.97	49.90	283.0	129.1	49.902
2	未知	11.54	50.10	251.1	129.6	50.098
Total			100.00	534.1	258.6	100.000



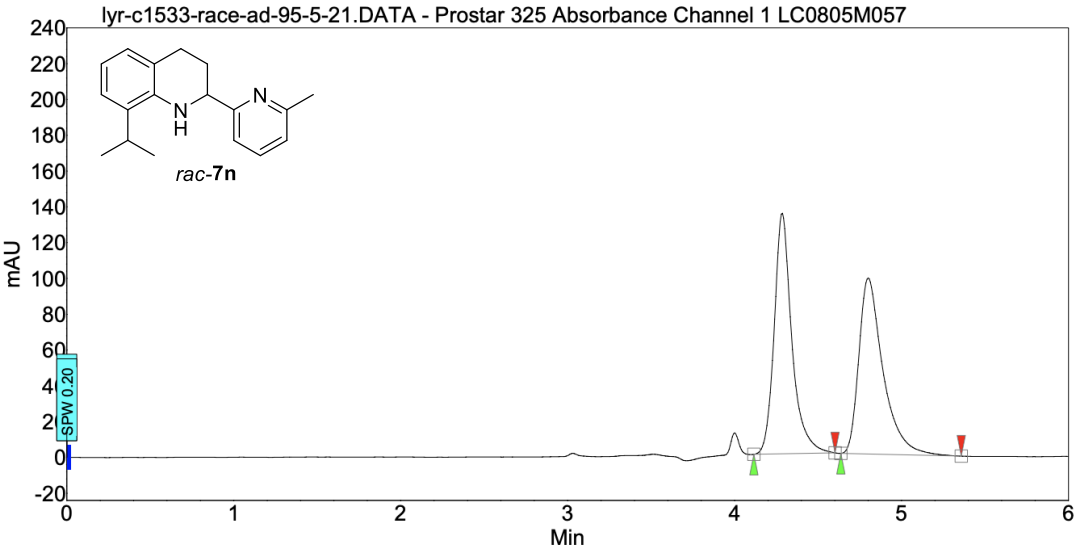
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.85	94.37	294.9	129.6	94.367
2	未知	11.40	5.63	16.3	7.7	5.633
Total			100.00	311.2	137.4	100.000



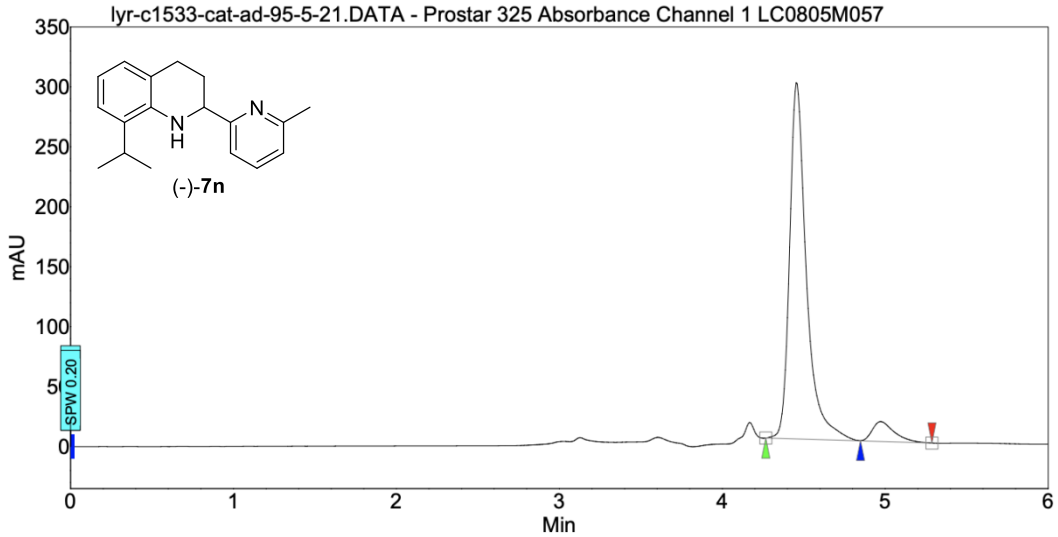
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.53	49.86	554.6	179.4	49.860
2	未知	10.55	50.14	476.8	180.4	50.140
Total			100.00	1031.4	359.8	100.000



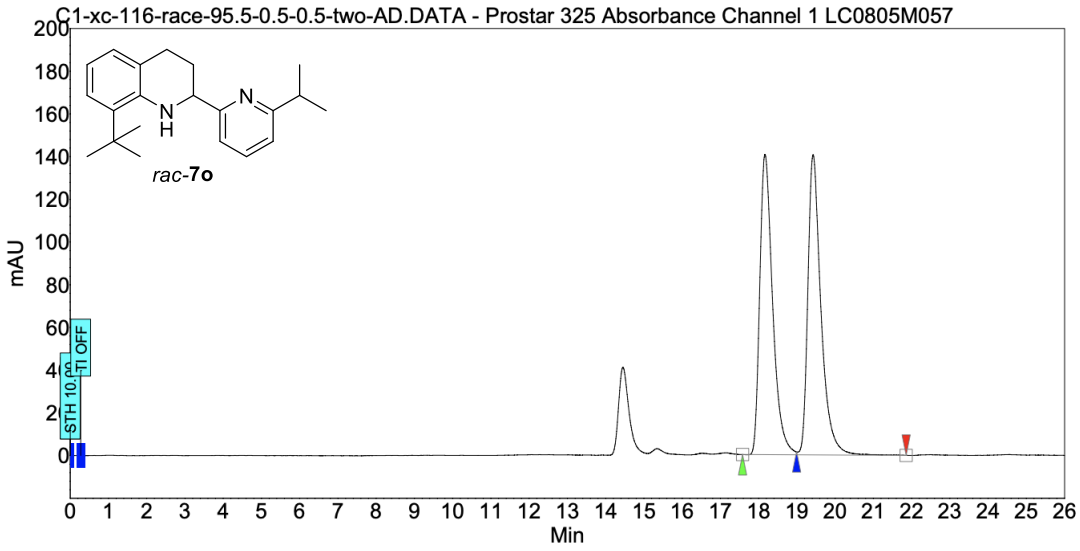
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	10.11	0.90	3.0	0.8	0.899
2	未知	11.05	99.10	244.2	85.1	99.101
Total			100.00	247.2	85.9	100.000



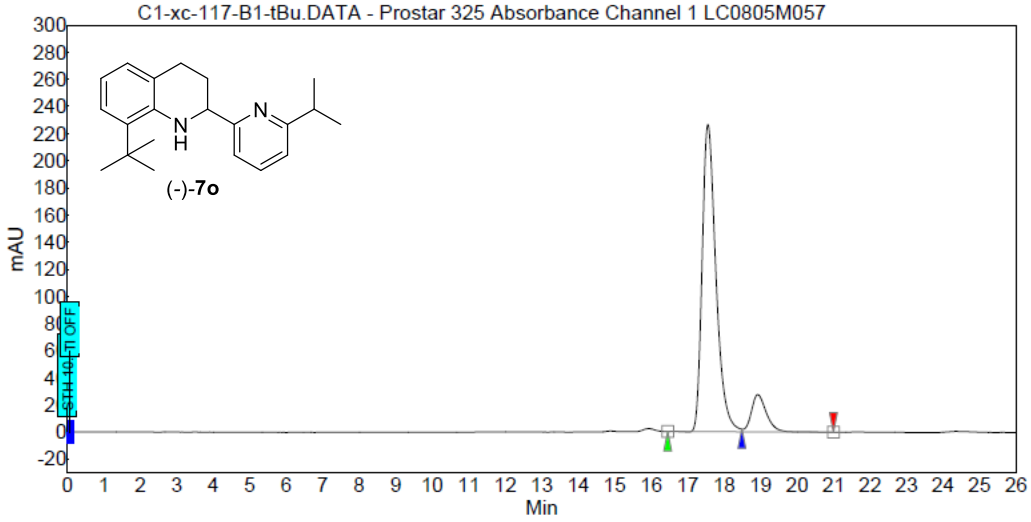
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	4.29	49.89	134.5	16.4	49.892
2	未知	4.80	50.11	98.4	16.5	50.108
Total			100.00	232.9	32.9	100.000



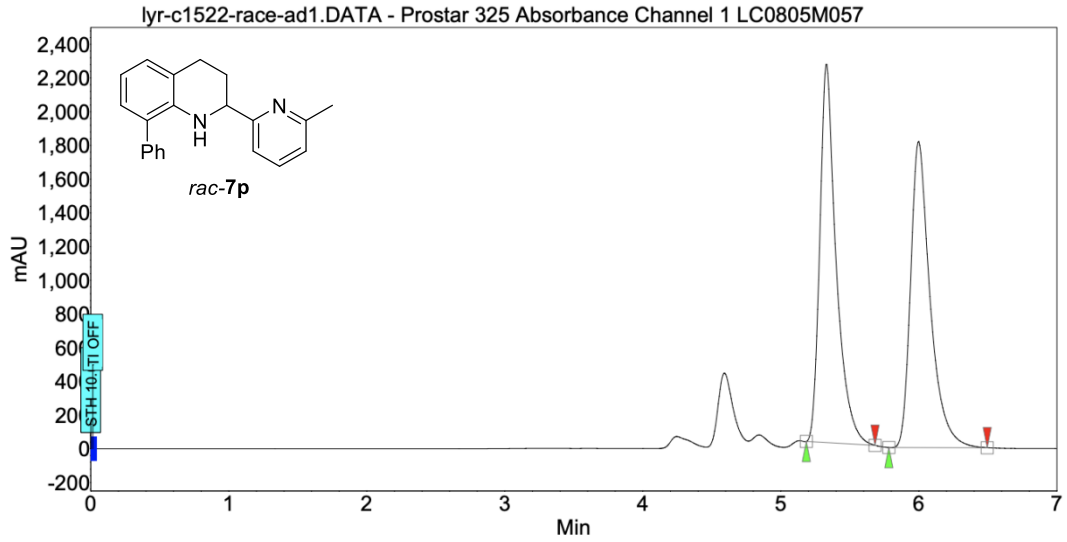
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	4.45	93.25	297.1	35.6	93.250
2	未知	4.97	6.75	16.6	2.6	6.750
Total			100.00	313.7	38.1	100.000



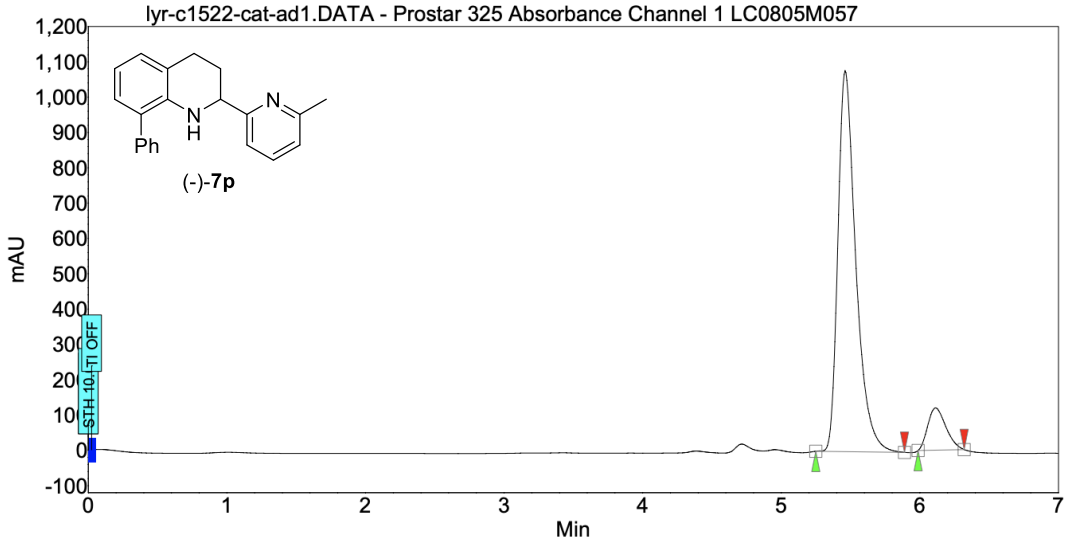
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	18.17	49.45	140.6	54.9	49.448
2	未知	19.42	50.55	140.6	56.1	50.552
Total			100.00	281.2	111.0	100.000



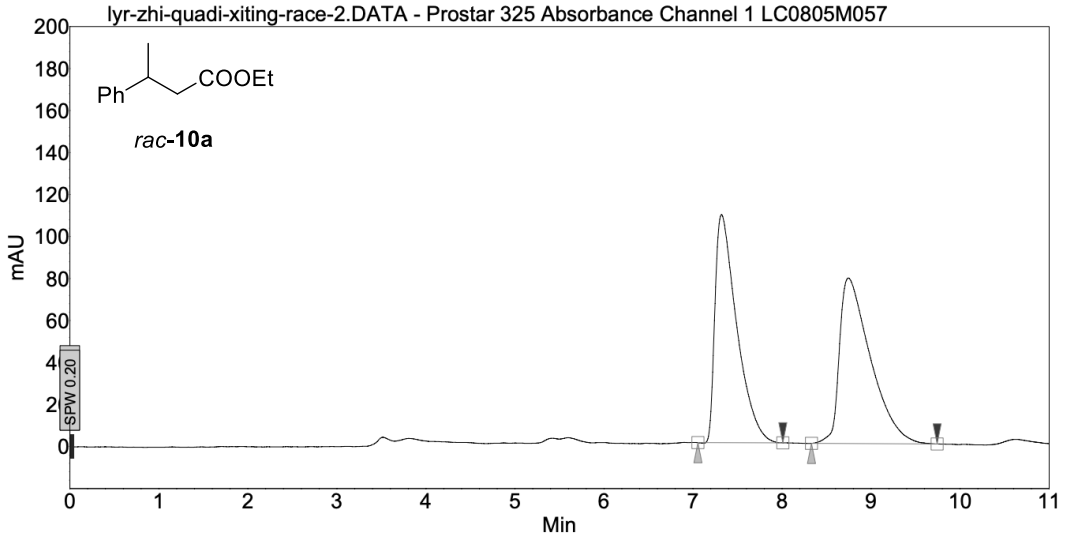
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	17.55	88.34	226.5	99.4	88.342
2	未知	18.92	11.66	27.5	13.1	11.658
Total			100.00	254.0	112.5	100.000



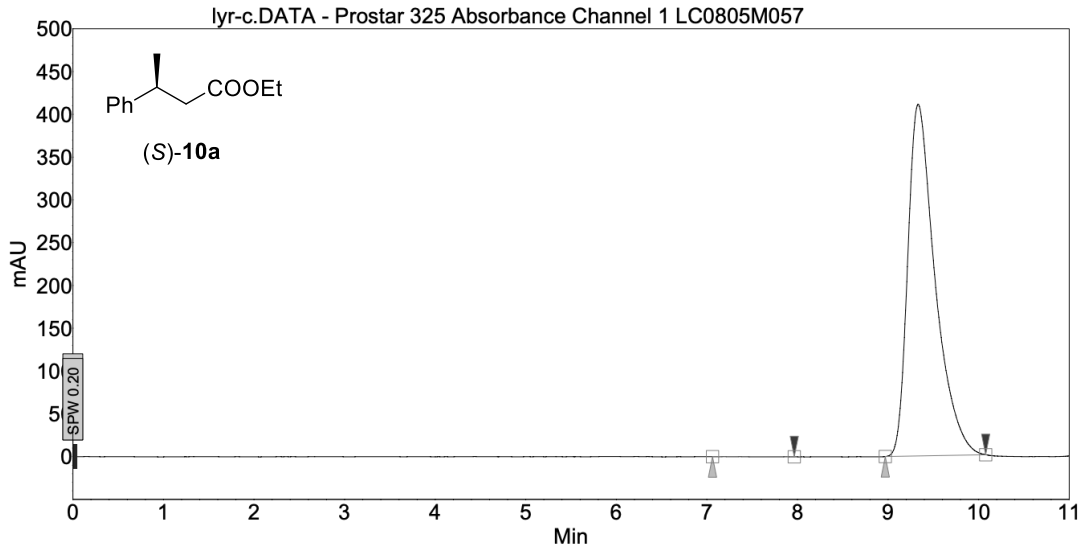
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	5.33	50.81	2244.4	308.1	50.810
2	未知	6.00	49.19	1816.2	298.3	49.190
Total			100.00	4060.6	606.3	100.000



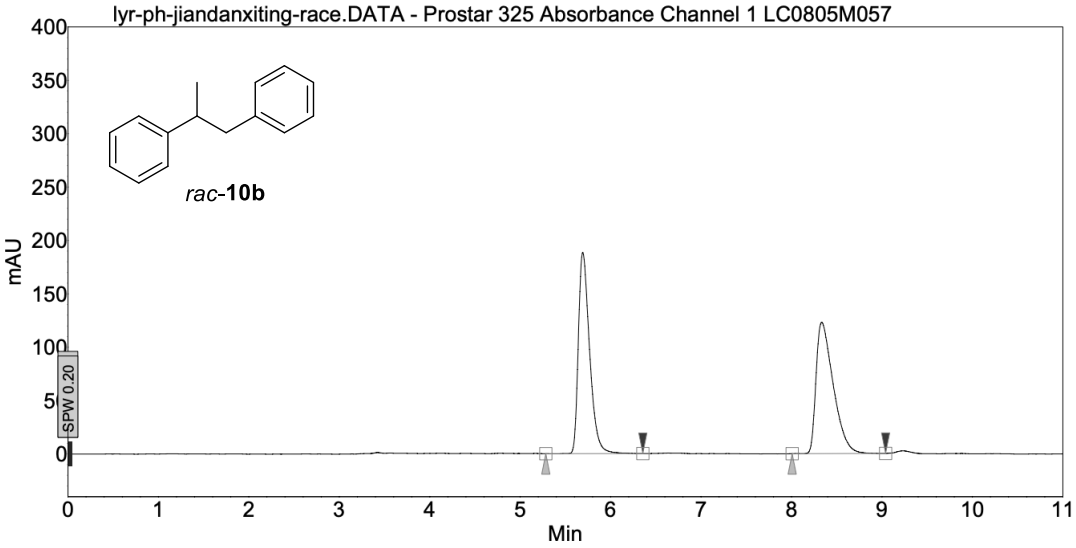
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	5.46	89.91	1078.7	161.5	89.914
2	未知	6.11	10.09	119.7	18.1	10.086
Total			100.00	1198.4	179.6	100.000



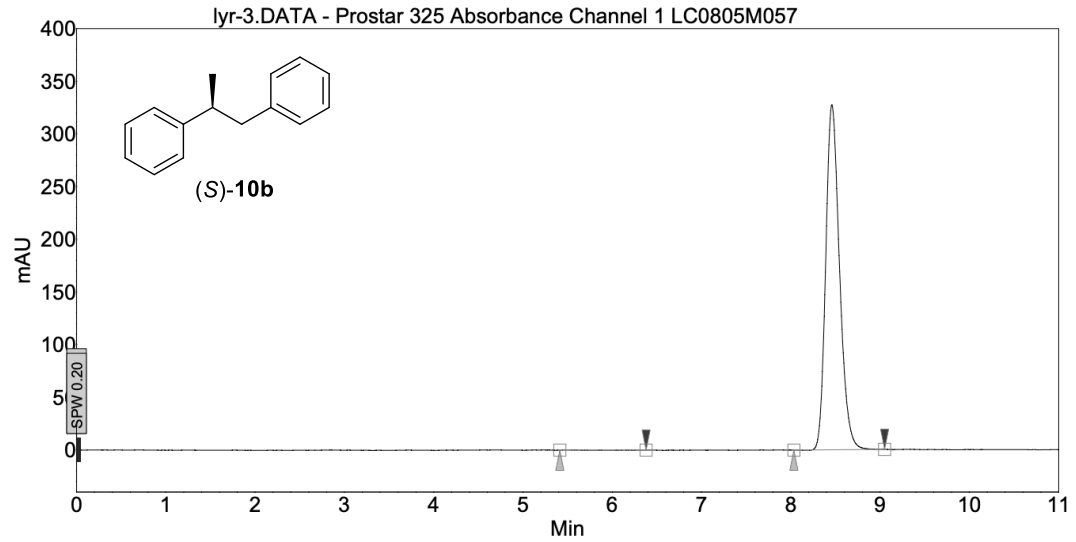
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.32	49.10	108.6	30.7	49.095
2	未知	8.75	50.90	78.8	31.9	50.905
Total			100.00	187.5	62.6	100.000



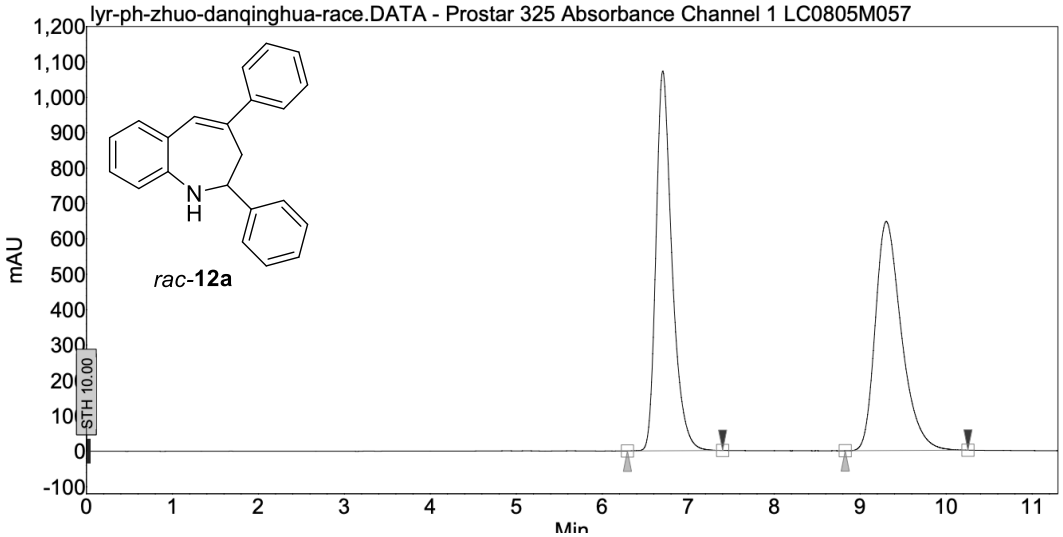
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	7.37	0.04	0.2	0.1	0.042
1	未知	9.33	99.96	411.1	143.6	99.958
Total			100.00	411.3	143.7	100.000



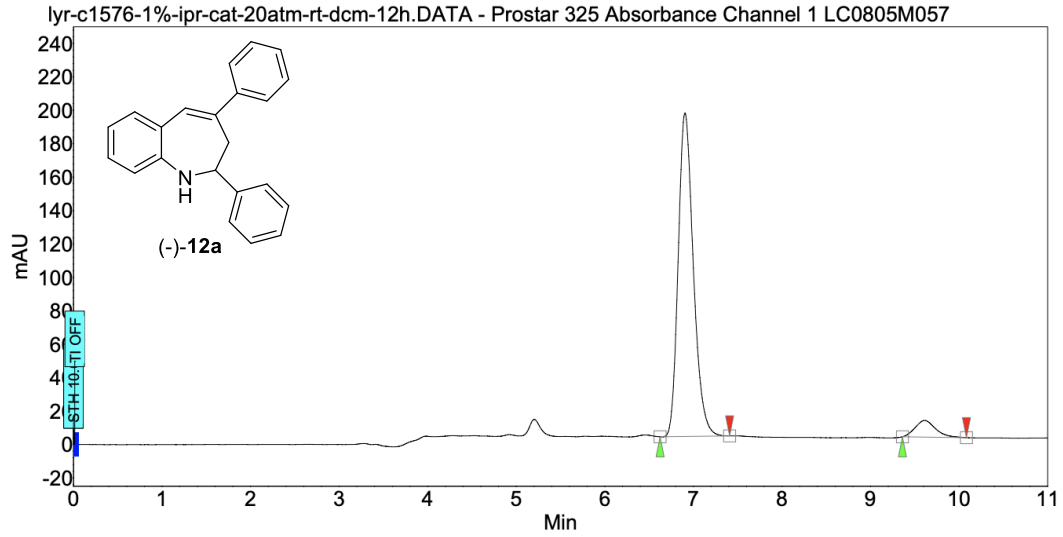
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	5.69	50.09	188.6	27.1	50.095
2	未知	8.33	49.91	123.1	27.0	49.905
Total			100.00	311.7	54.1	100.000



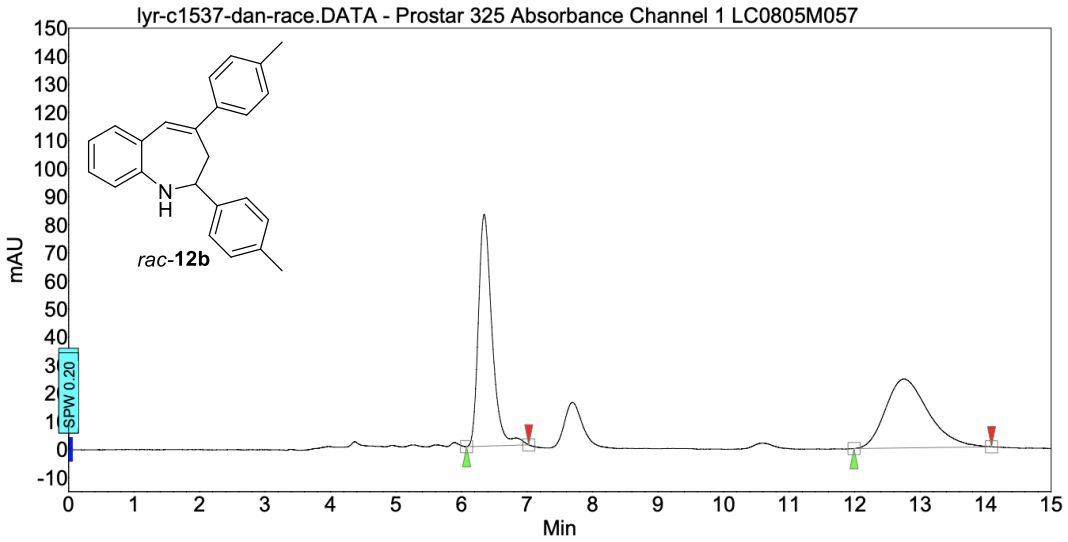
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	5.49	0.03	0.2	0.0	0.032
1	未知	8.46	99.97	327.5	58.6	99.968
Total			100.00	327.7	58.6	100.000



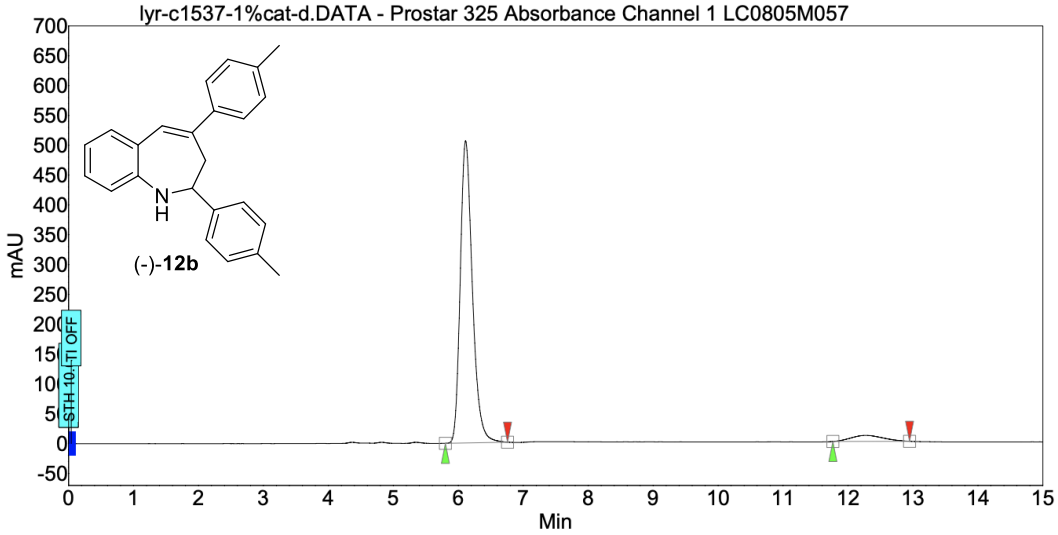
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.71	50.38	1073.3	231.7	50.382
2	未知	9.31	49.62	647.1	228.2	49.618
Total			100.00	1720.4	459.9	100.000



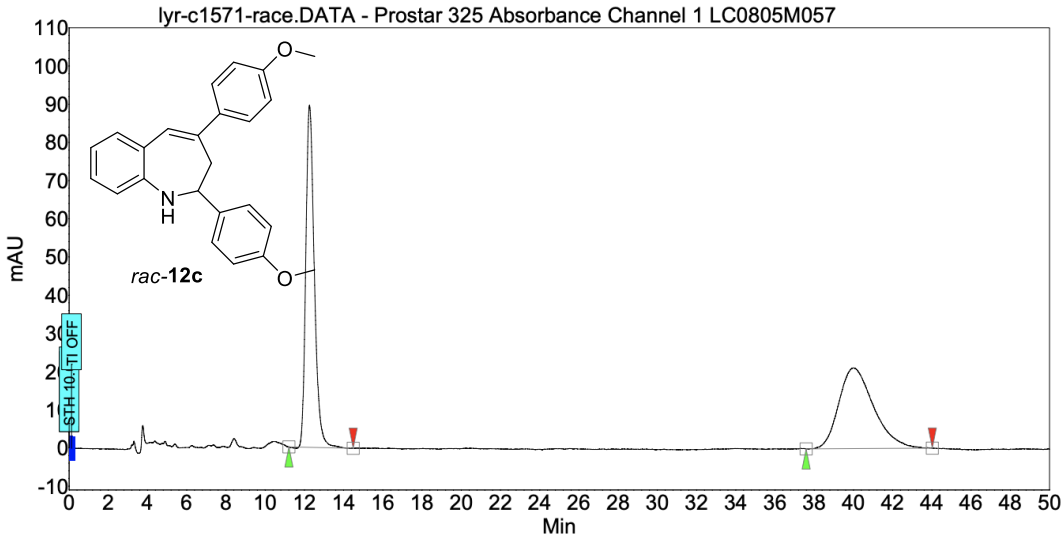
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.91	93.54	193.7	38.4	93.539
2	未知	9.61	6.46	9.9	2.6	6.461
Total			100.00	203.6	41.0	100.000



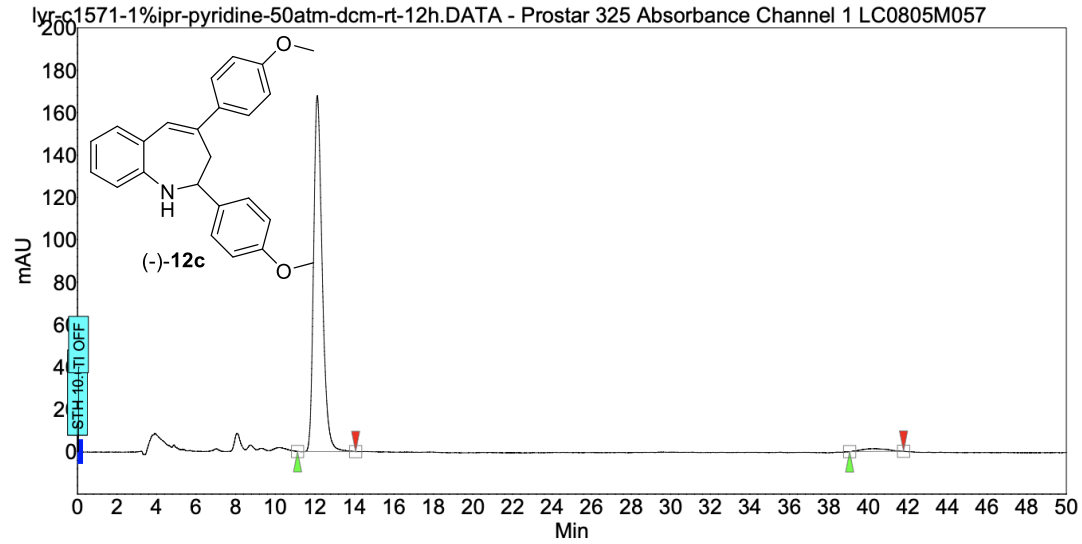
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	6.35	51.83	82.5	19.9	51.831
1	未知	12.75	48.17	24.5	18.5	48.169
Total			100.00	107.0	38.4	100.000



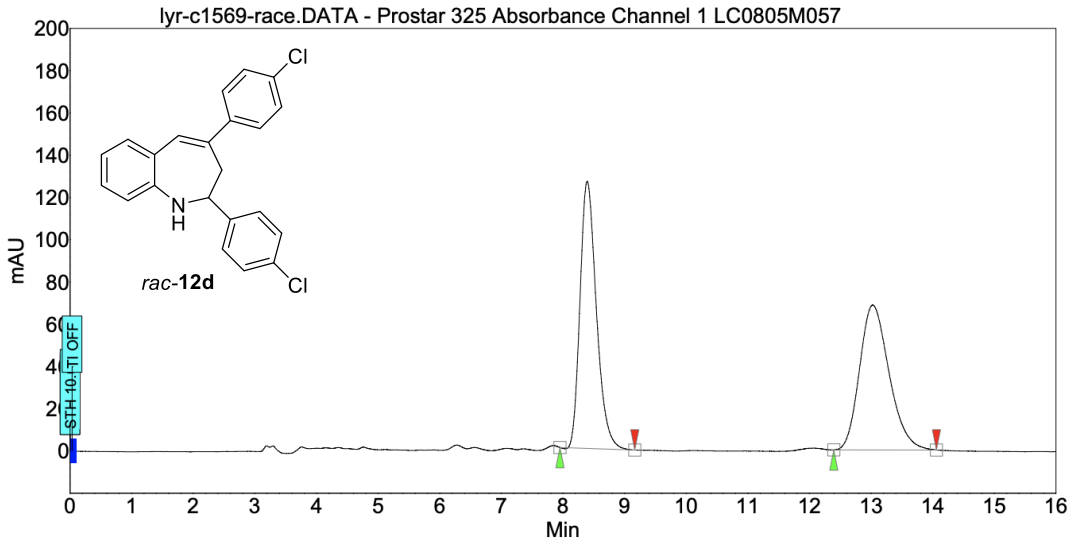
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.11	95.03	506.4	109.5	95.027
2	未知	12.27	4.97	10.0	5.7	4.973
Total			100.00	516.5	115.2	100.000



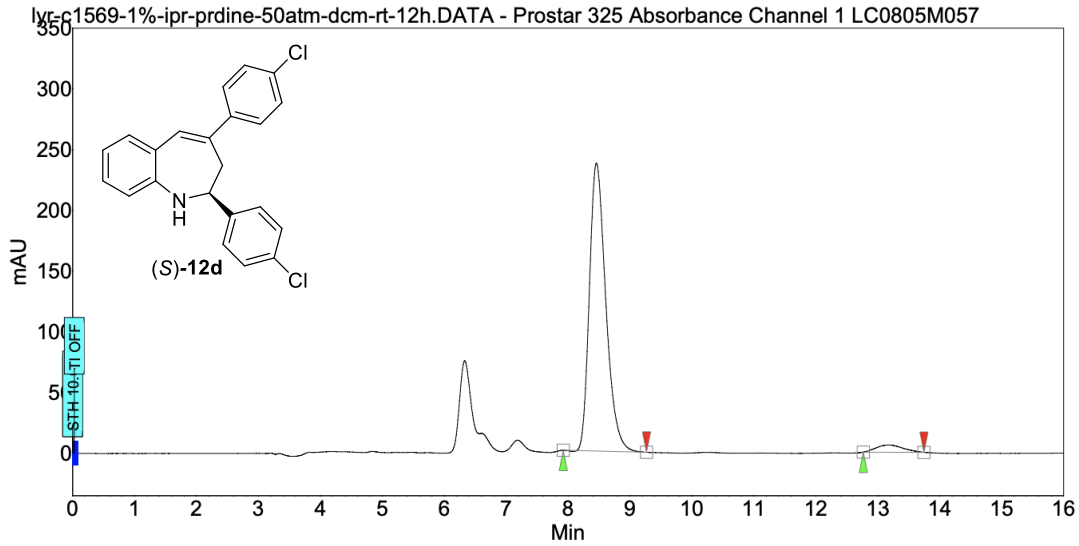
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	12.26	50.95	89.5	45.0	50.953
1	未知	39.99	49.05	21.1	43.3	49.047
Total			100.00	110.6	88.4	100.000



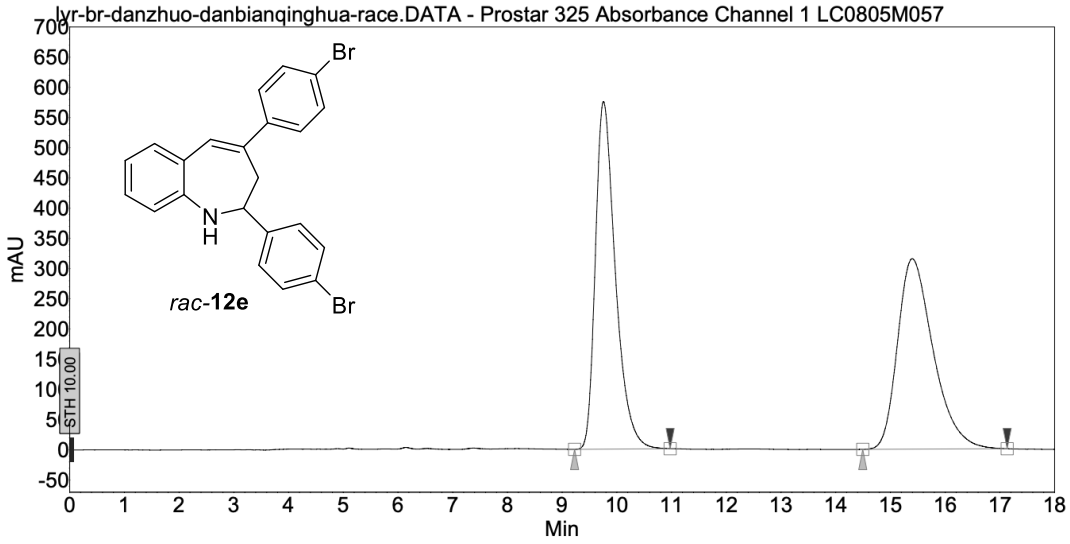
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	12.13	97.71	167.9	84.6	97.713
2	未知	40.13	2.29	1.3	2.0	2.287
Total			100.00	169.2	86.6	100.000



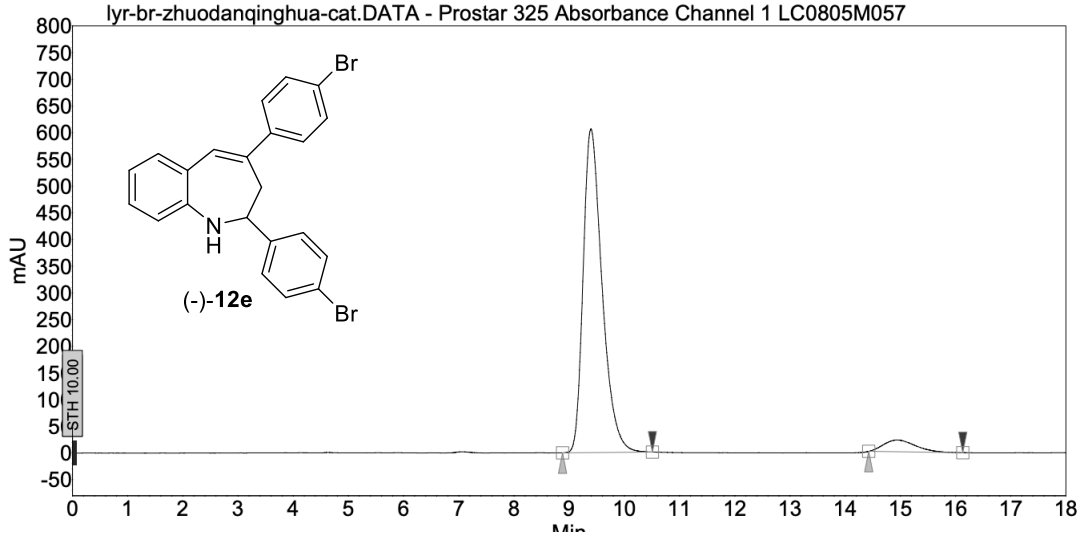
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	8.39	50.49	126.5	38.8	50.493
2	未知	13.03	49.51	68.6	38.1	49.507
Total			100.00	195.1	76.9	100.000



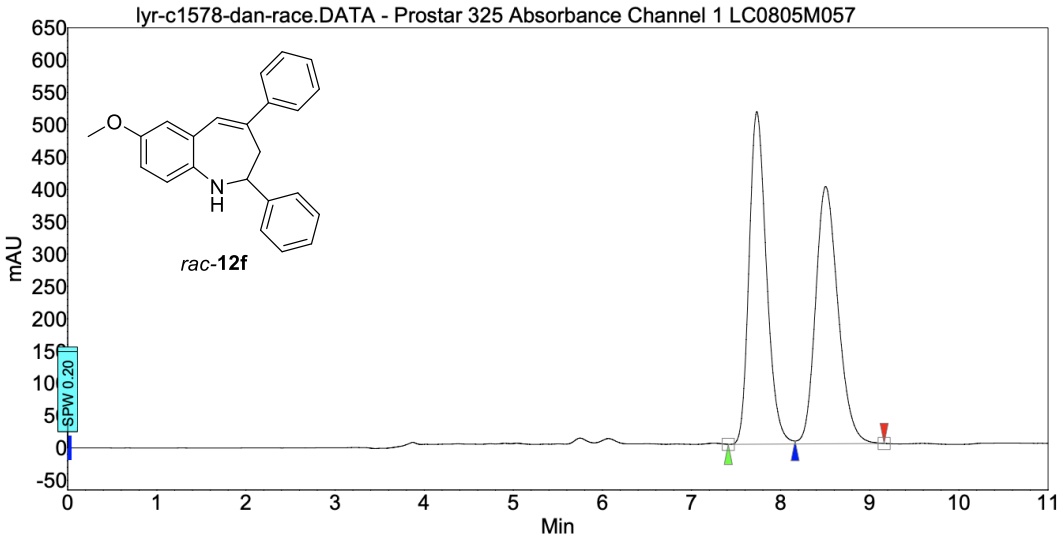
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	8.46	96.05	237.0	72.7	96.052
1	未知	13.17	3.95	6.0	3.0	3.948
Total			100.00	243.0	75.7	100.000



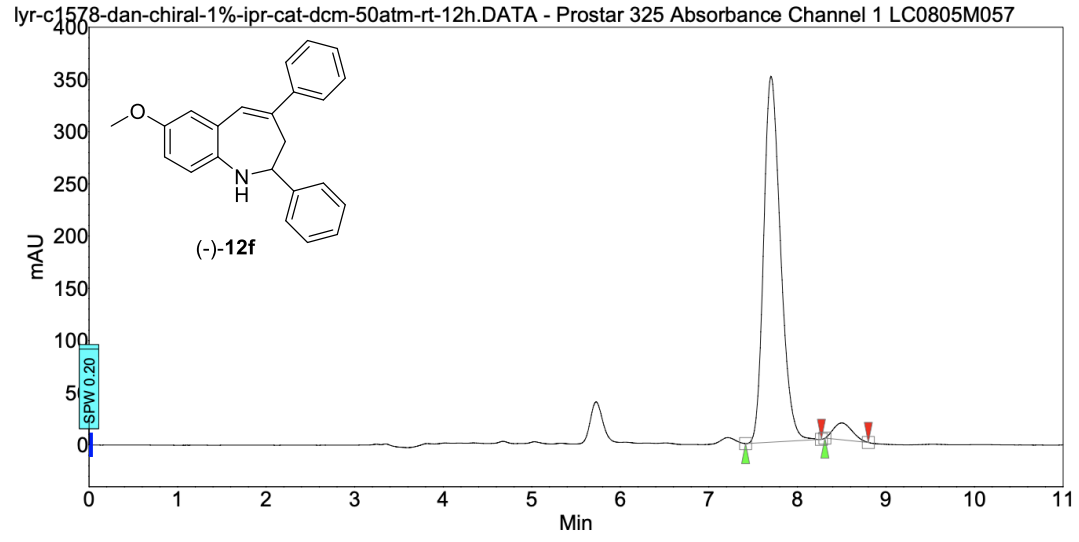
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.75	50.59	575.4	243.6	50.589
2	未知	15.40	49.41	315.2	237.9	49.411
Total			100.00	890.6	481.4	100.000



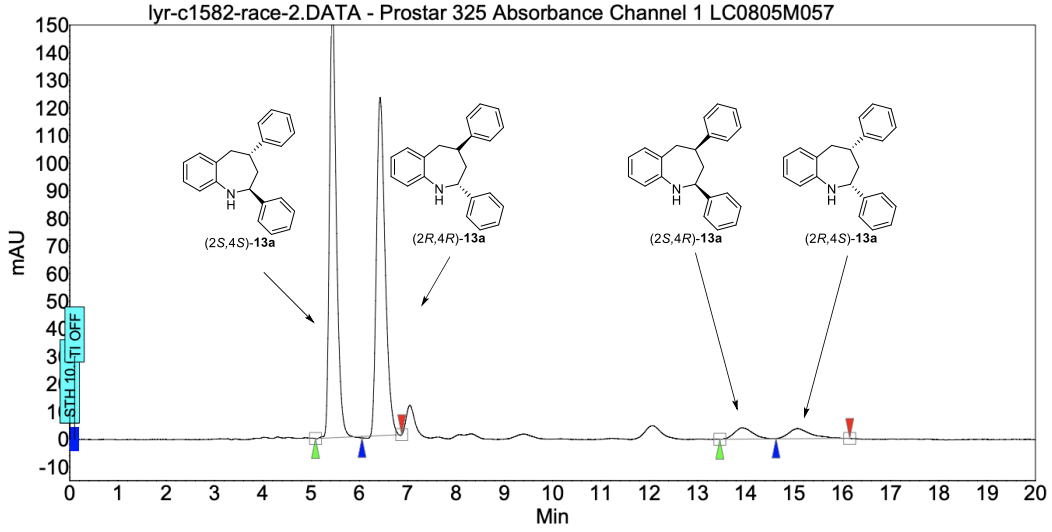
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.39	94.25	606.5	240.8	94.248
2	未知	14.94	5.75	22.1	14.7	5.752
Total			100.00	628.6	255.5	100.000



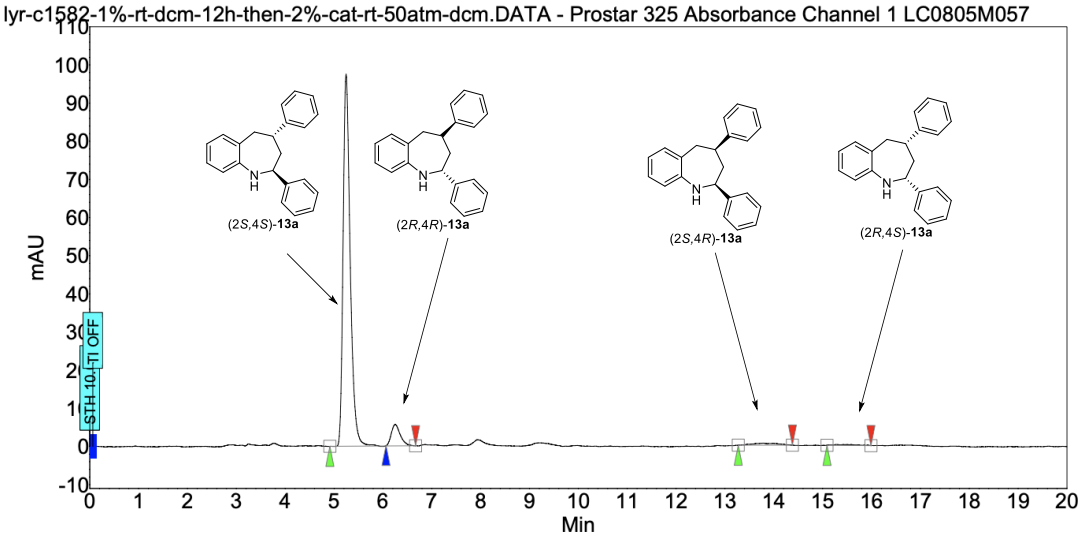
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.73	49.98	514.6	116.3	49.983
2	未知	8.51	50.02	398.2	116.4	50.017
Total			100.00	912.8	232.8	100.000



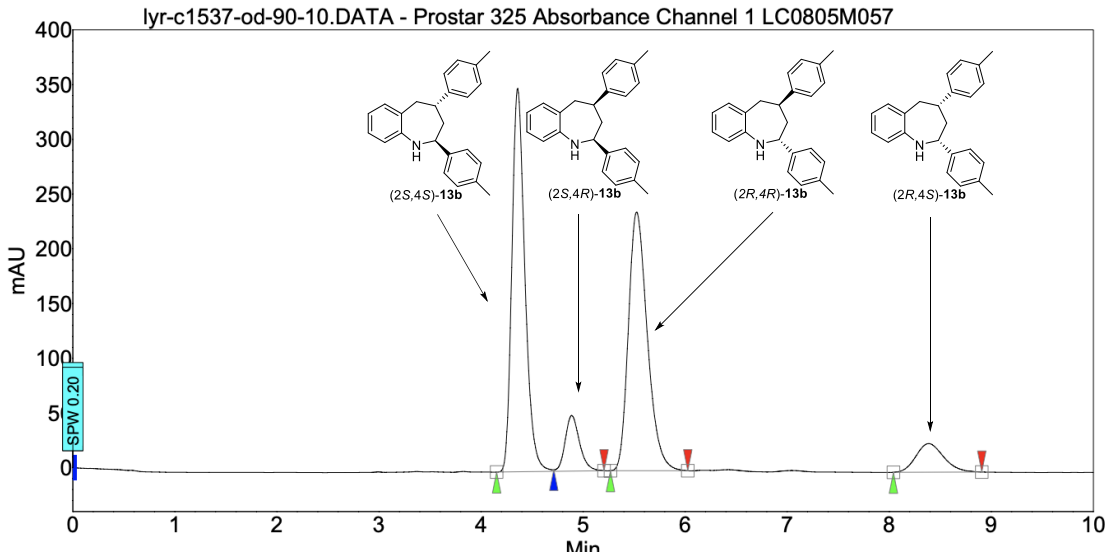
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.70	95.16	350.5	77.5	95.162
2	未知	8.51	4.84	16.2	3.9	4.838
Total			100.00	366.6	81.4	100.000



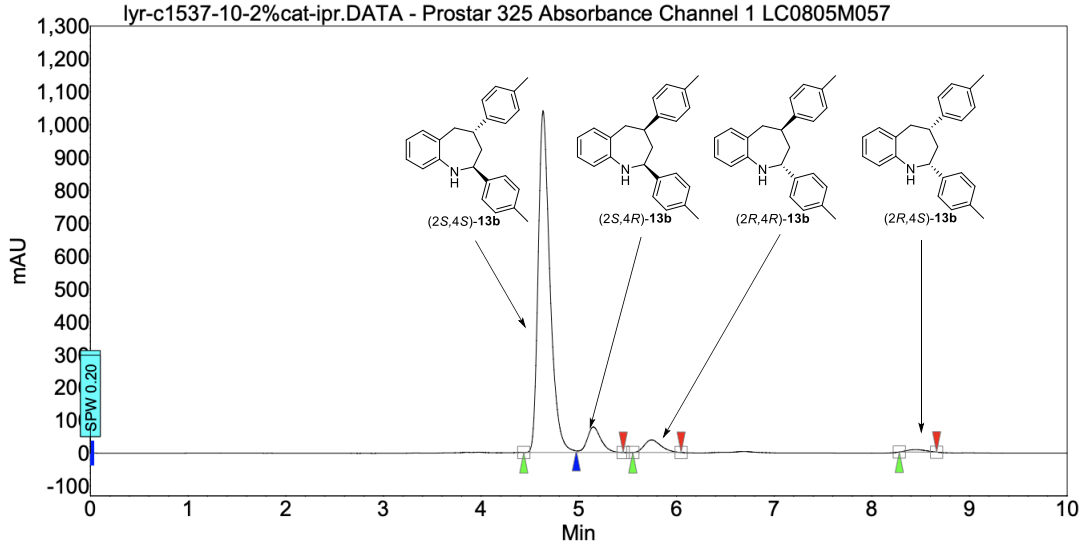
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	5.44	47.30	159.0	26.1	47.296
2	未知	6.43	45.86	122.5	25.3	45.861
3	未知	13.93	3.26	4.1	1.8	3.256
4	未知	15.07	3.59	3.7	2.0	3.587
Total			100.00	289.3	55.2	100.000



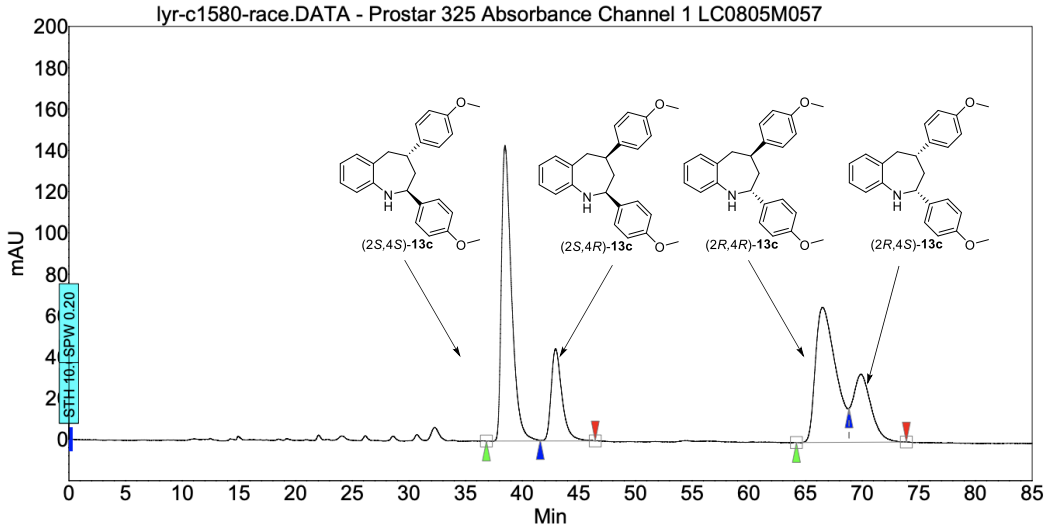
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	5.25	90.82	97.5	16.4	90.818
2	未知	6.25	6.71	5.6	1.2	6.710
3	未知	13.79	1.80	0.5	0.3	1.798
4	未知	15.50	0.67	0.2	0.1	0.674
Total			100.00	103.9	18.0	100.000



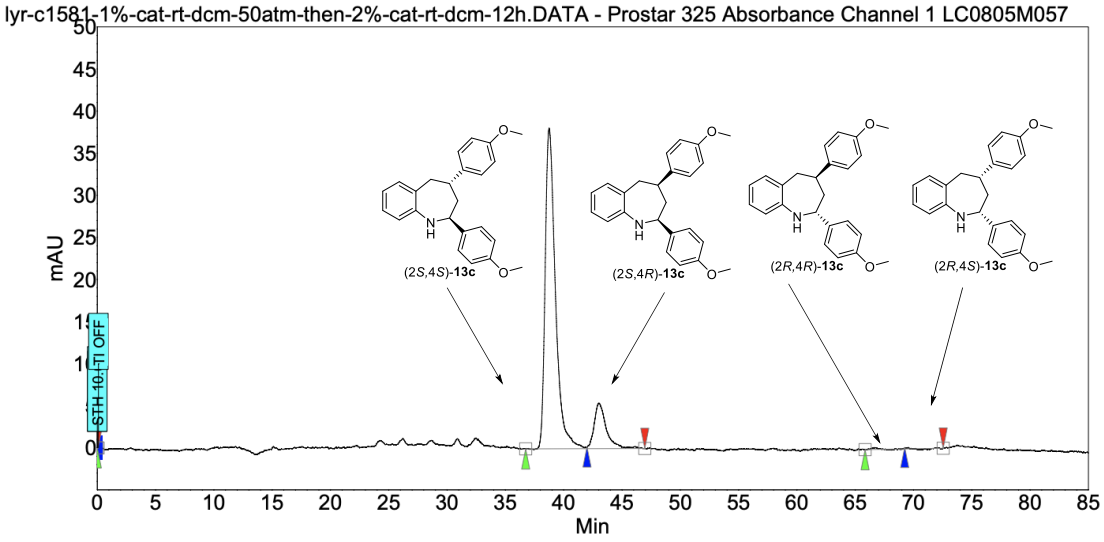
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	4.36	43.51	350.3	51.8	43.508
4	未知	4.89	6.95	50.9	8.3	6.953
2	未知	5.53	42.64	236.2	50.8	42.642
3	未知	8.39	6.90	26.1	8.2	6.897
Total			100.00	663.5	119.1	100.000



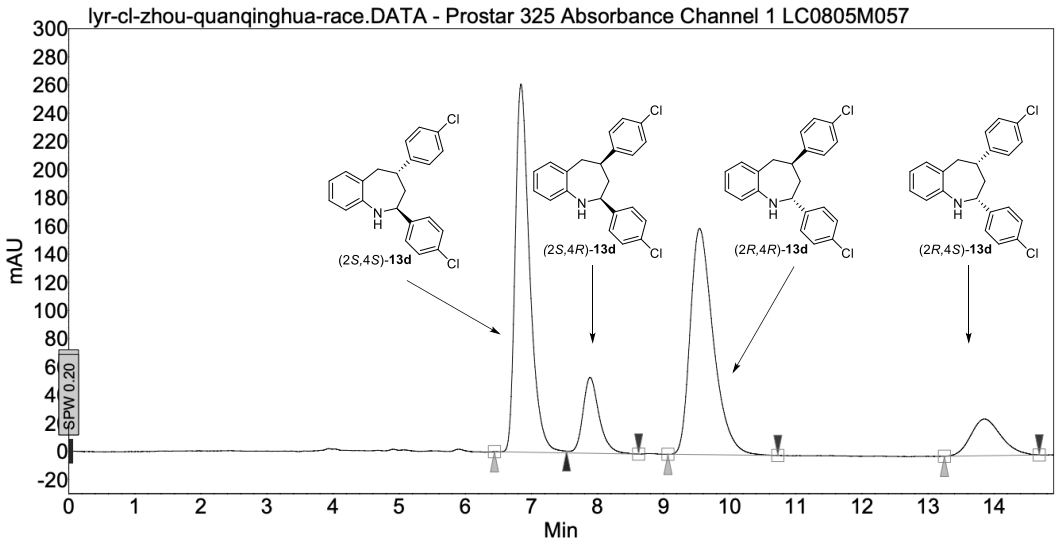
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	4.63	86.80	1040.3	145.1	86.800
4	未知	5.15	7.60	77.9	12.7	7.602
2	未知	5.75	4.61	38.6	7.7	4.612
3	未知	8.45	0.99	7.5	1.6	0.986
Total			100.00	1164.3	167.1	100.000



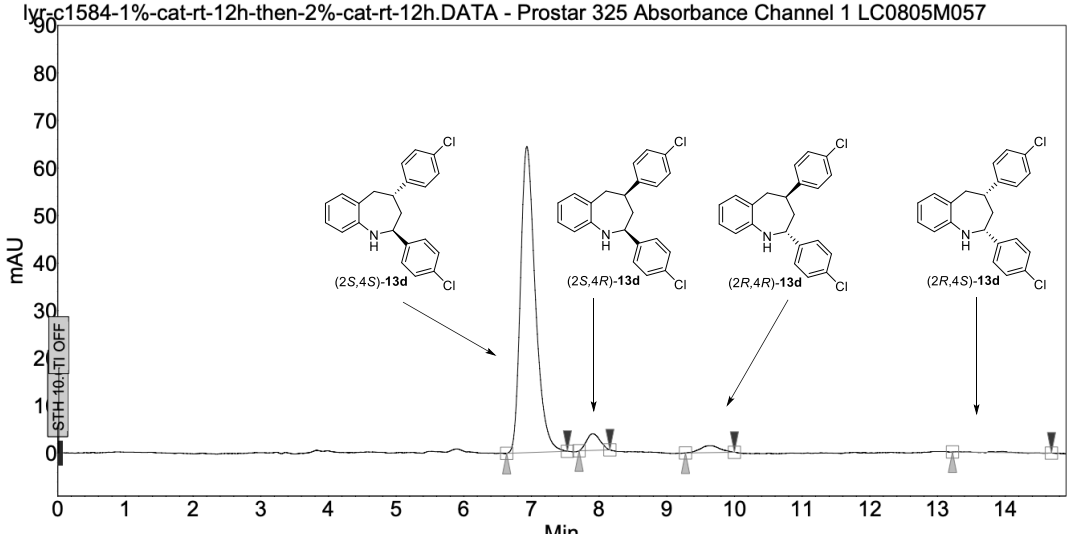
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	38.48	37.54	143.1	148.4	37.536
2	未知	42.95	12.55	44.6	49.6	12.550
3	未知	66.51	34.44	65.4	136.1	34.438
4	未知	69.91	15.48	32.9	61.2	15.476
Total			100.00	286.0	395.3	100.000



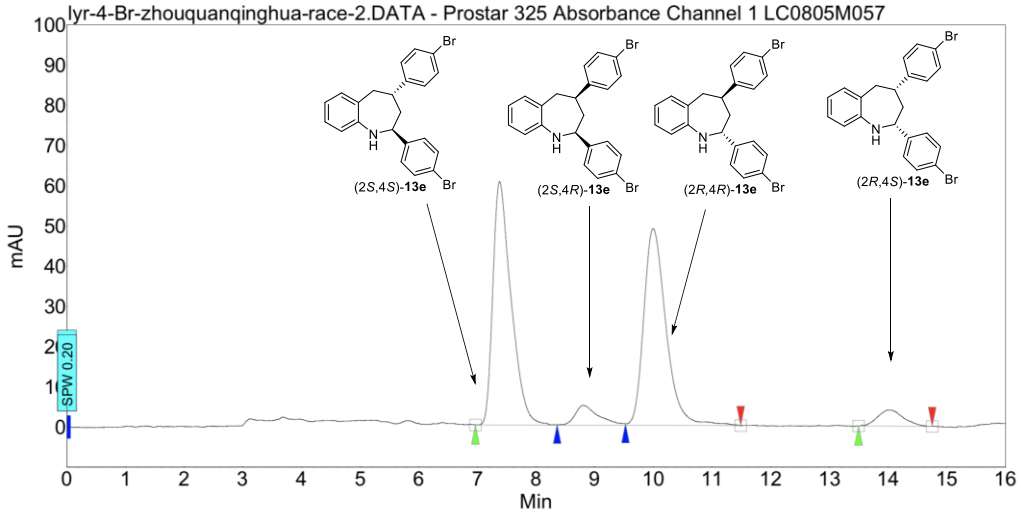
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	38.75	85.29	38.1	38.8	85.293
2	未知	43.03	14.40	5.4	6.5	14.395
3	未知	66.64	0.18	0.2	0.1	0.179
4	未知	70.78	0.13	0.2	0.1	0.133
Total			100.00	43.9	45.5	100.000



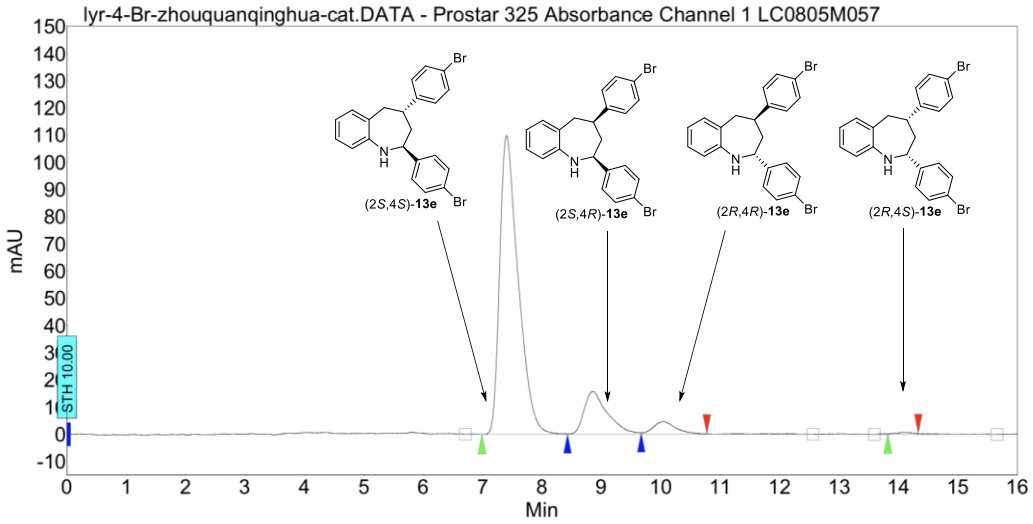
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	6.84	41.23	261.3	66.2	41.229
3	未知	7.89	9.56	53.9	15.3	9.559
1	未知	9.54	40.59	160.4	65.1	40.591
4	未知	13.85	8.62	26.0	13.8	8.621
Total			100.00	501.7	160.5	100.000



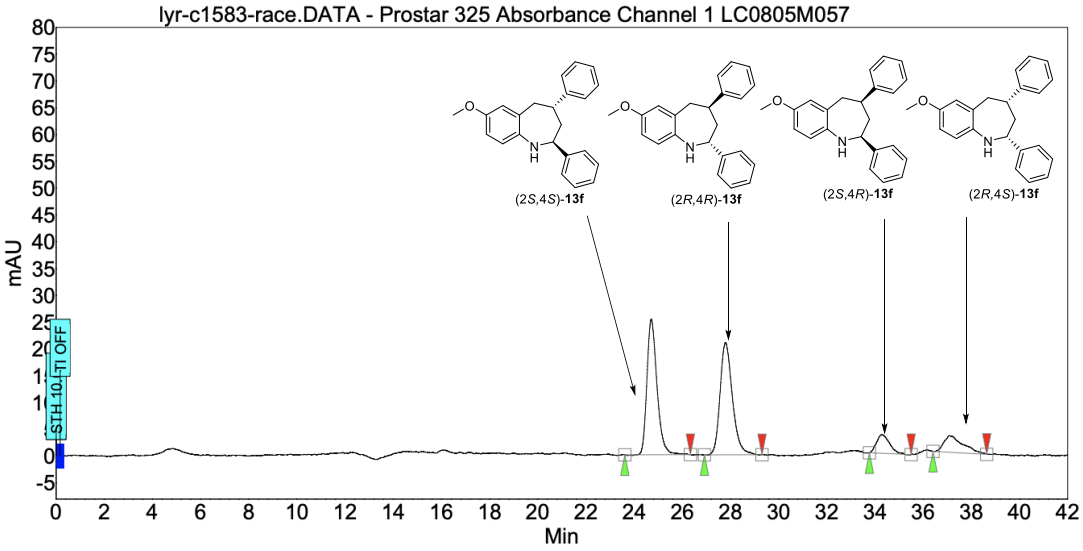
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.93	92.39	64.4	16.3	92.394
2	未知	7.91	4.56	3.5	0.8	4.563
3	未知	9.62	2.79	1.4	0.5	2.790
4	未知	13.96	0.25	0.2	0.0	0.253
Total			100.00	69.6	17.7	100.000



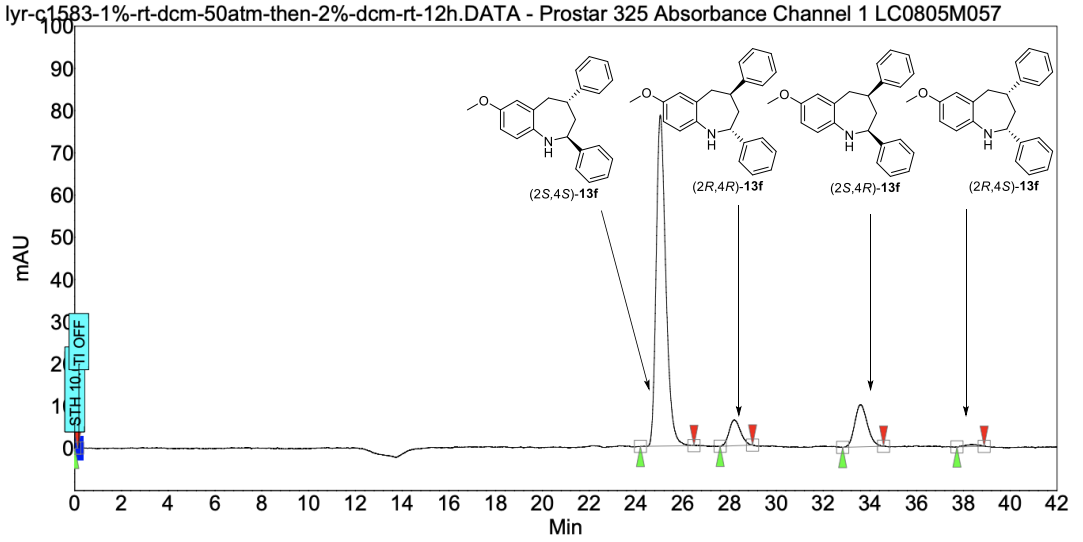
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
2	未知	7.37	45.72	60.6	21.8	45.717
3	未知	8.80	4.78	4.9	2.3	4.784
4	未知	9.99	45.21	49.0	21.6	45.212
1	未知	14.05	4.29	4.0	2.0	4.287
Total			100.00	118.5	47.7	100.000



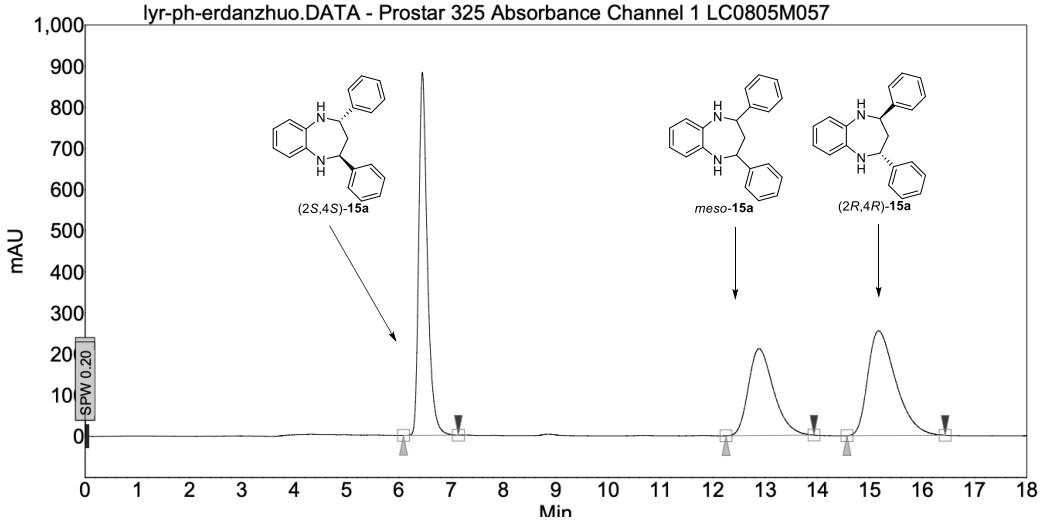
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.40	80.49	109.9	39.7	80.487
2	未知	8.85	14.63	15.8	7.2	14.629
3	未知	10.03	4.32	4.7	2.1	4.318
4	未知	14.11	0.57	0.7	0.3	0.565
Total			100.00	131.1	49.3	100.000



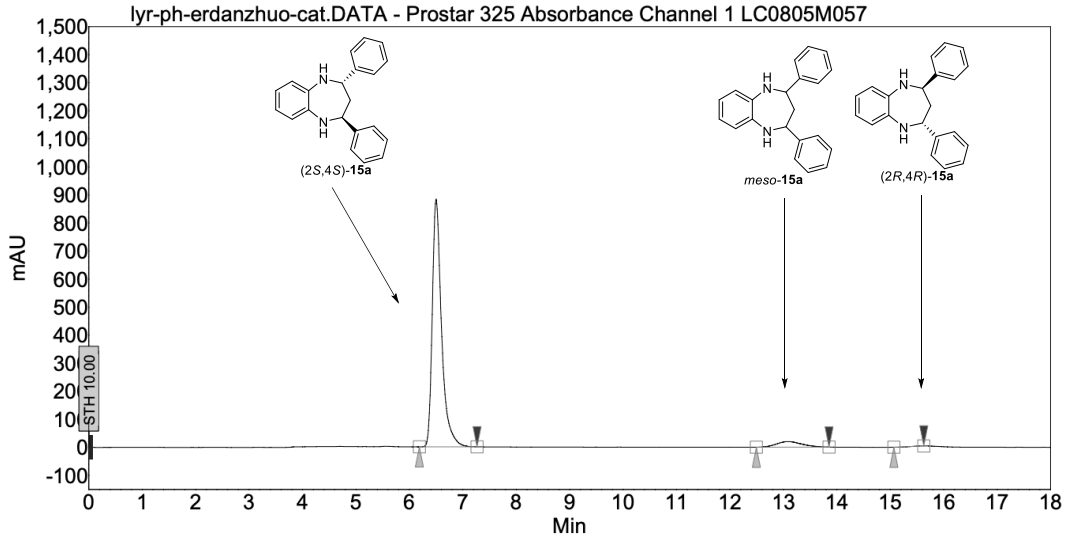
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	24.71	41.14	25.3	12.2	41.141
2	未知	27.79	41.85	20.9	12.4	41.847
3	未知	34.27	7.30	3.5	2.2	7.299
4	未知	37.09	9.71	3.1	2.9	9.713
Total			100.00	52.8	29.7	100.000



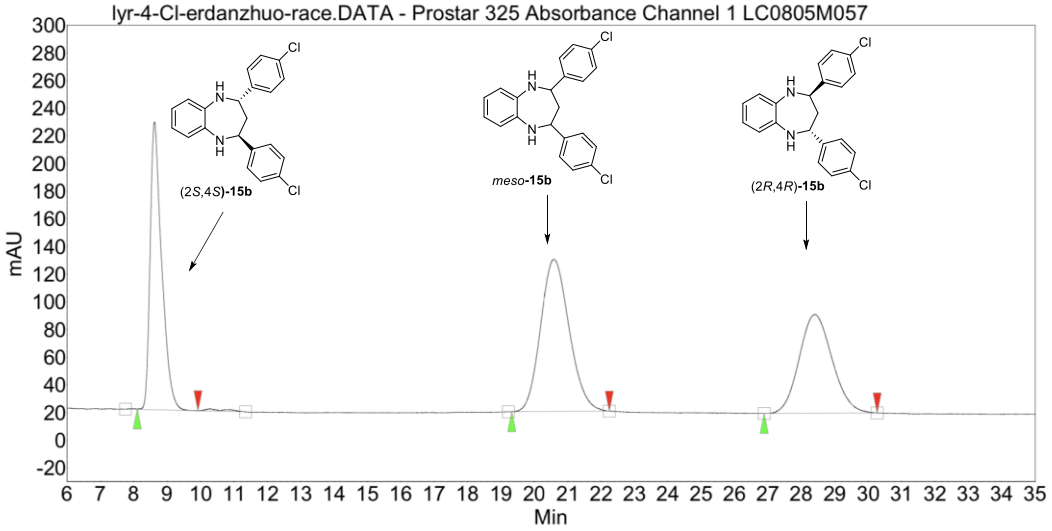
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	25.03	78.85	78.4	37.3	78.852
2	未知	28.20	7.28	6.1	3.4	7.278
3	未知	33.60	13.20	10.0	6.2	13.199
4	未知	38.31	0.67	0.5	0.3	0.671
Total			100.00	95.0	47.3	100.000



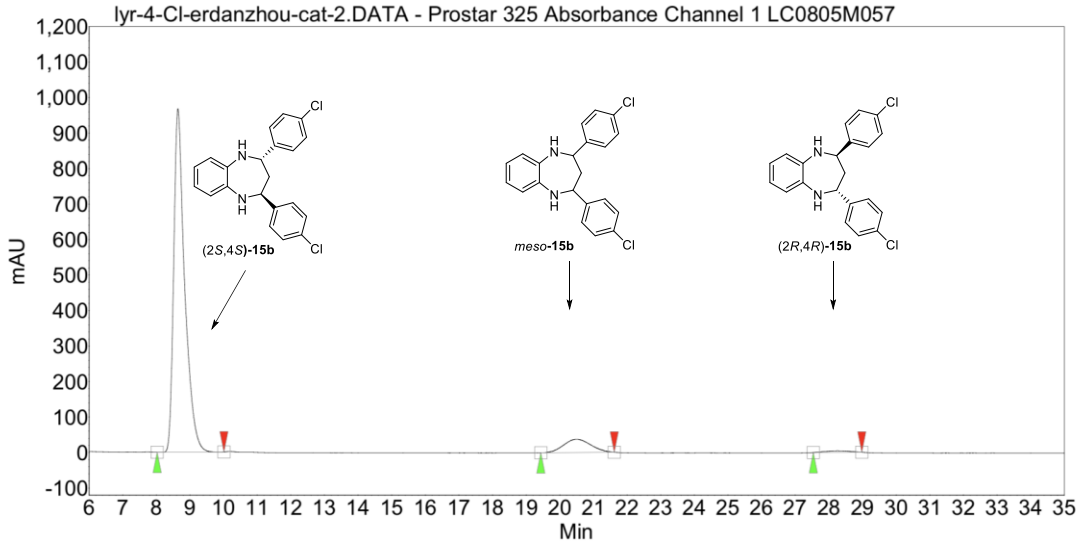
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.45	37.89	882.6	168.0	37.890
2	未知	12.88	26.54	211.1	117.7	26.541
3	未知	15.17	35.57	254.7	157.8	35.570
Total			100.00	1348.4	443.5	100.000



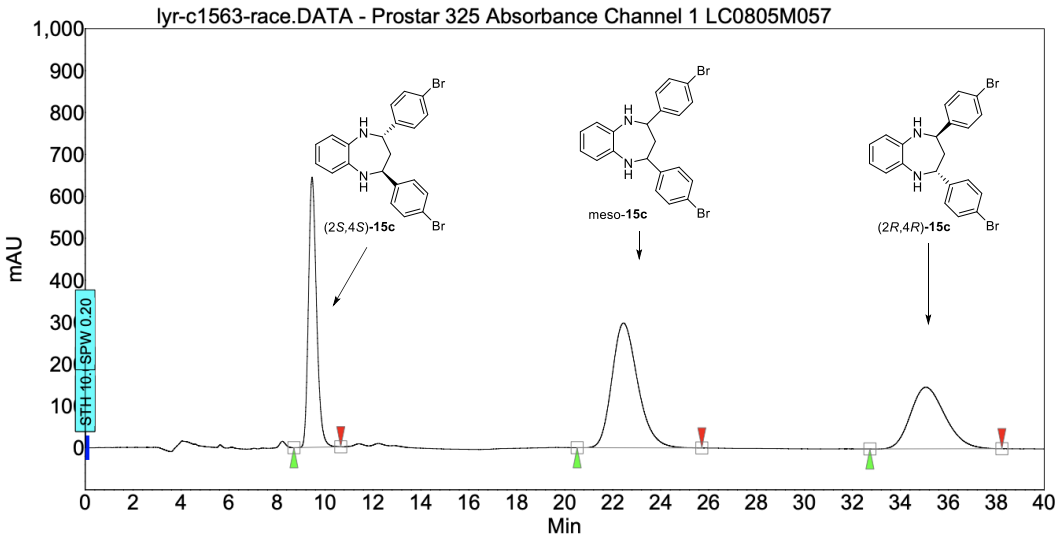
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.50	94.13	883.0	177.7	94.133
2	未知	13.08	5.81	19.8	11.0	5.812
3	未知	15.24	0.05	0.7	0.1	0.055
Total			100.00	903.5	188.8	100.000



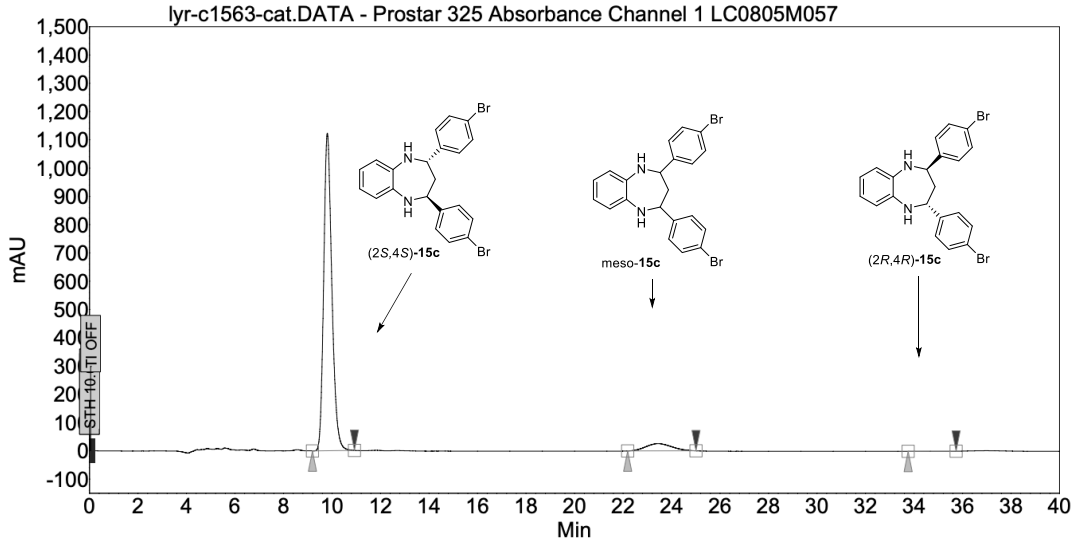
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	8.61	30.41	208.1	83.4	30.406
2	未知	20.58	39.83	109.9	109.3	39.832
3	未知	28.40	29.76	71.3	81.6	29.762
Total			100.00	389.3	274.3	100.000



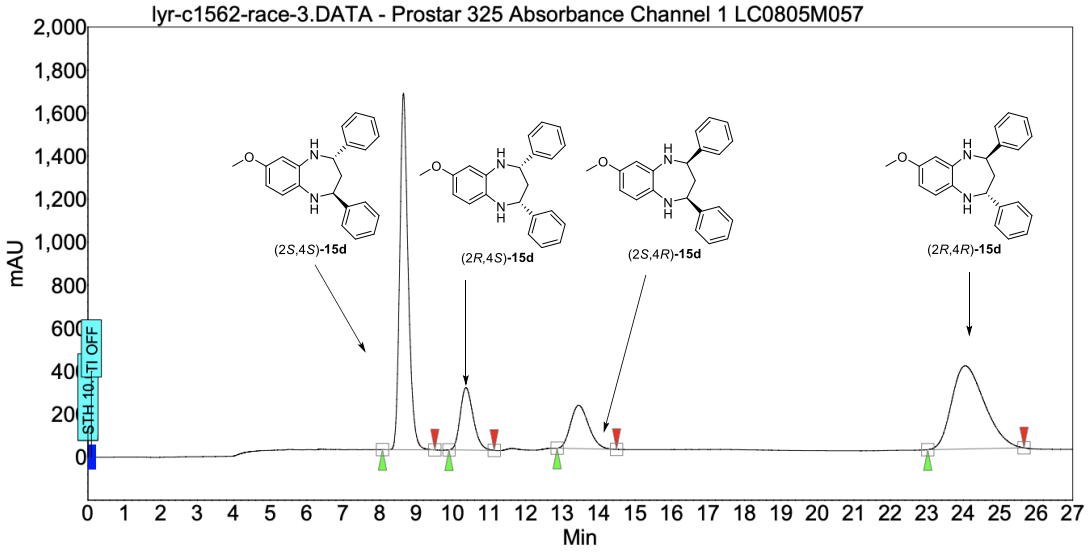
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	8.64	90.42	967.9	366.2	90.417
2	未知	20.49	8.65	37.4	35.0	8.647
3	未知	28.26	0.94	4.6	3.8	0.936
Total			100.00	1010.0	405.0	100.000



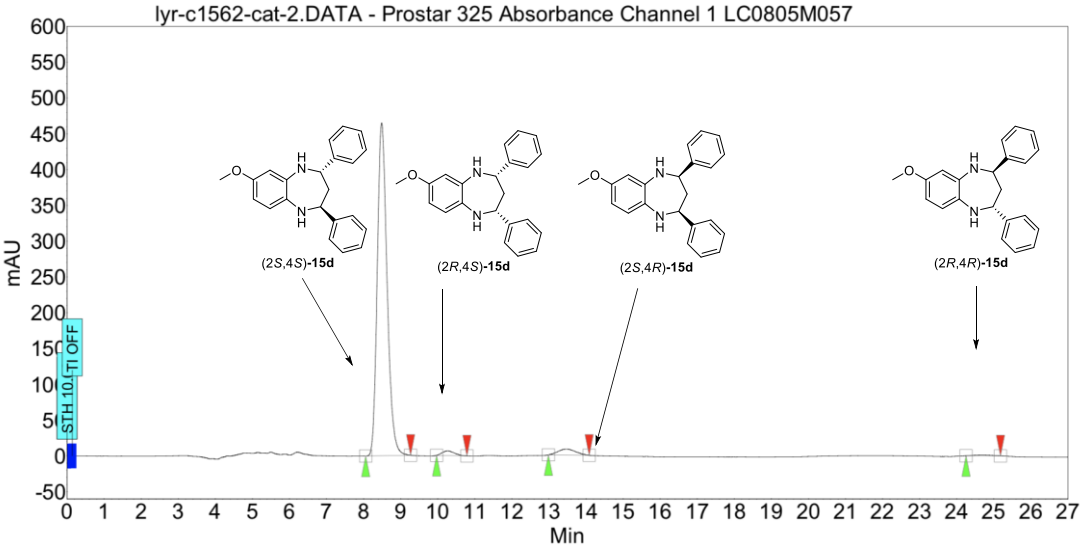
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
3	未知	9.46	28.98	644.8	251.9	28.977
1	未知	22.45	42.76	297.7	371.7	42.764
2	未知	35.07	28.26	147.0	245.7	28.259
Total			100.00	1089.5	869.3	100.000



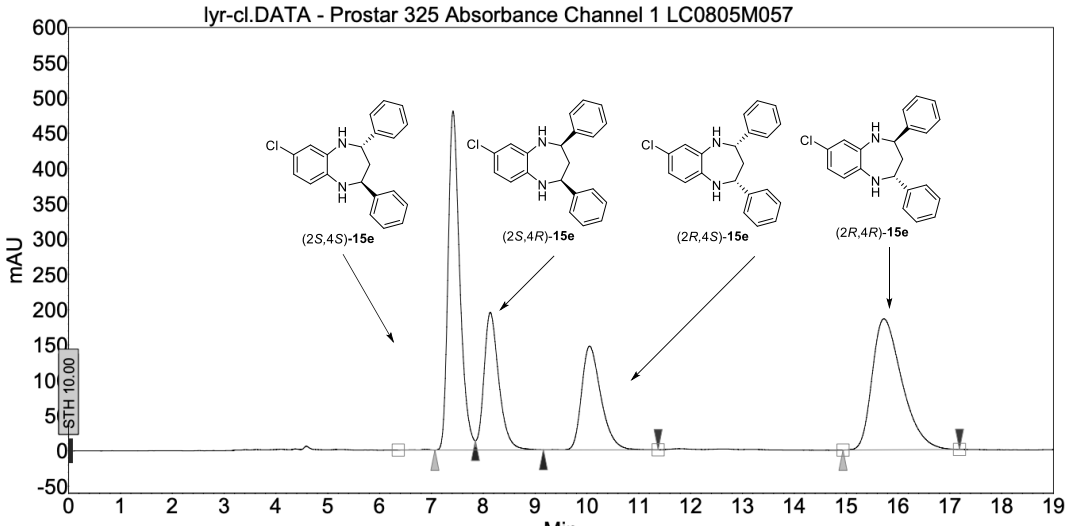
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	9.81	93.13	1123.0	436.8	93.126
2	未知	23.44	6.83	25.7	32.0	6.828
3	未知	35.23	0.05	0.2	0.2	0.045
Total			100.00	1149.0	469.0	100.000



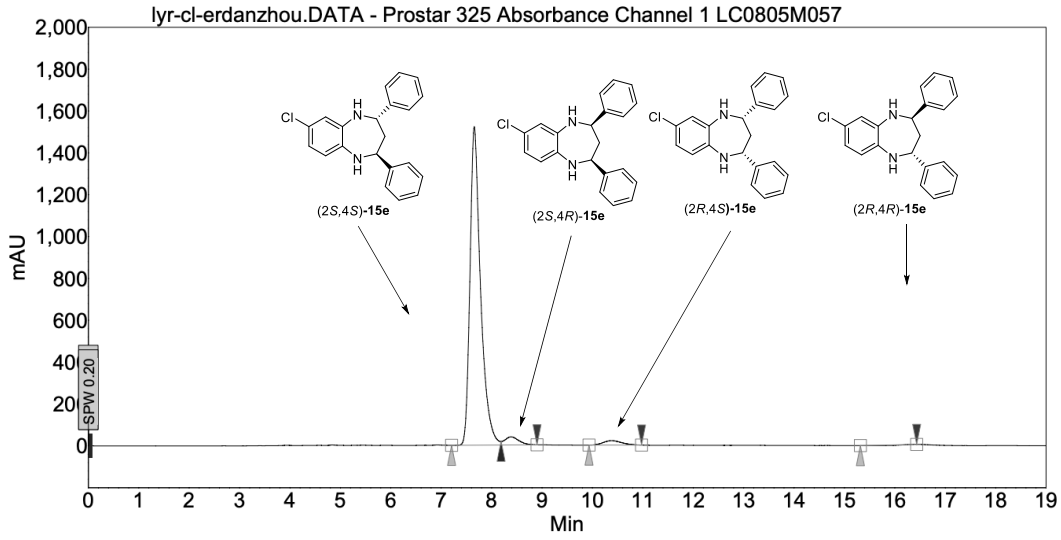
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	8.65	40.84	1658.6	441.9	40.841
3	未知	10.37	11.10	290.5	120.1	11.096
4	未知	13.45	10.70	201.8	115.7	10.696
2	未知	24.05	37.37	386.9	404.3	37.368
Total			100.00	2537.9	1082.0	100.000



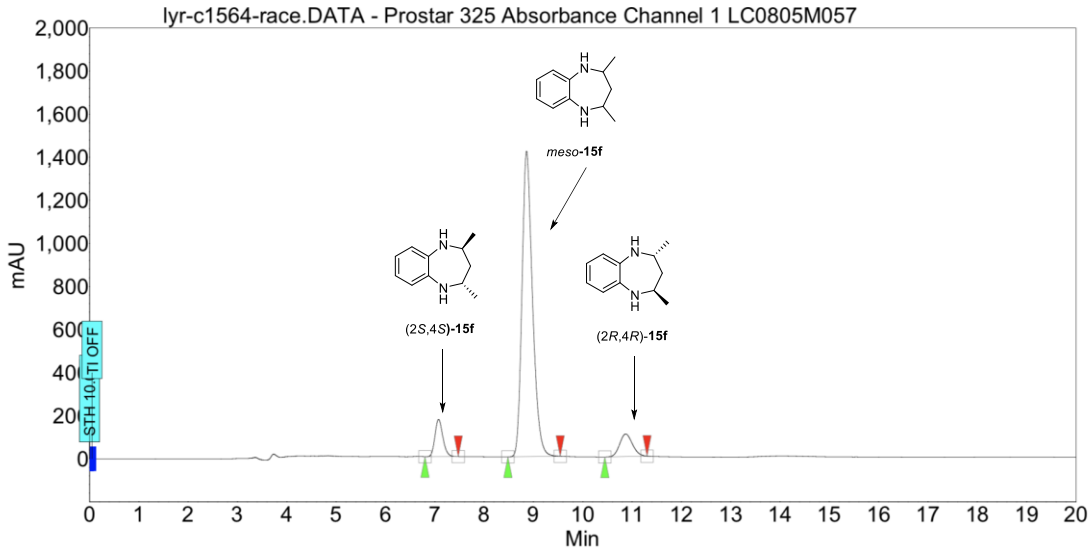
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	8.49	94.85	464.9	142.4	94.850
2	未知	10.27	1.64	6.4	2.5	1.638
3	未知	13.48	3.08	8.3	4.6	3.077
4	未知	24.68	0.43	1.1	0.7	0.435
Total			100.00	480.7	150.2	100.000



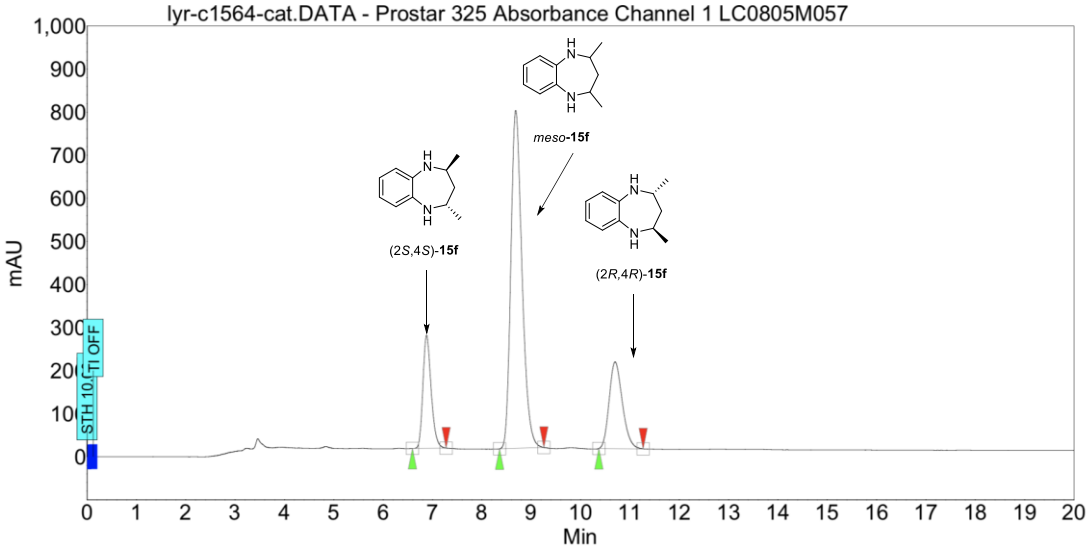
Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.41	33.28	480.2	125.7	33.275
2	未知	8.13	17.19	195.0	64.9	17.187
3	未知	10.05	16.81	147.0	63.5	16.812
4	未知	15.73	32.73	185.7	123.7	32.725
Total			100.00	1007.9	377.9	100.000



Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.65	94.12	1521.8	370.7	94.119
2	未知	8.39	3.19	38.8	12.6	3.193
3	未知	10.38	2.34	21.3	9.2	2.336
4	未知	15.90	0.35	2.5	1.4	0.352
Total			100.00	1584.4	393.9	100.000



Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	7.07	7.80	173.3	32.3	7.798
2	未知	8.86	84.59	1419.2	349.9	84.589
3	未知	10.87	7.61	104.9	31.5	7.614
Total			100.00	1697.3	413.7	100.000



Index	文件名	时间 [Min]	数量 [% 面积]	高度 [mAU]	Area [mAU.Min]	Area % [%]
1	未知	6.88	15.89	262.4	50.6	15.889
2	未知	8.69	64.57	784.9	205.7	64.567
3	未知	10.70	19.54	201.4	62.3	19.544
Total			100.00	1248.7	318.6	100.000