Diversity-oriented synthesis of chromenopyrrolidines from azomethine ylides and 2-hydoxybenzylidineindenediones *via* base controlled regio-divergent (3+2) cycloaddition.

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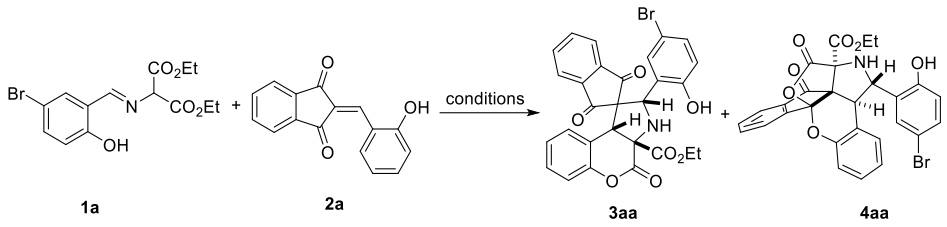
1. General Information

All solvents and reagents were used as purchased from commercial suppliers without further purification. Starting materials and catalysts which were not commercially available were synthesized by the previously reported methods. Analytical thin layer chromatography (TLC) was performed on precoated alumina-backed silica gel plates (Merck 60 F254, 0.2 mm thickness) which were developed using UV florescence and iodine. Flash-chromatography was performed on silica gel (Merck Kieselgel 60Å 230-400 mesh). Melting points were measured on a hotstage meting point apparatus and are uncorrected. IR spectra were recorded on a Perkin Elmer 500 spectrometer and only selected peaks are shown. ^{1}H-NMR spectra were recorded on a Bruker Avance 400 MHz spectrometer, while ^{13}C-NMR spectra were recorded on a 100 MHz instrument. Chemical shifts are reported in δ ppm referenced to an internal TMS standard for ^{1}H-NMR and chloroform-d (δ = 77.0 ppm) for ^{13}C-NMR. In some cases, while the chloroform-d couldn't dissolve the analyst well, the acetone-d_6 was applied instead. The chemical shifts refer to an internal acetone-d_6 standard for ^{1}H-NMR (δ = 2.05 ppm) and for ^{13}C-NMR (δ = 29.8 ppm). HRMS spectra were recorded on JEOL SX-102A. For transferring liquids on a microliter scale, a micropipette (VITLAB C121) of 2-20 µL capacity was used. The X-ray diffraction measurements were carried out at 298 K on a KAPPA APEX II CCD area detector system equipped with a graphite monochromator and a Mo-Kα fine-focus sealed tube (k = 0.71073 Å). Optical rotations were measured in CH_2Cl_2 on a JASCO co. DIP-1000 digital polarimeter with a 50 mm cell (c given in g/100 mL). The known iminodiesters **1a**, **1b**, **1c**, **1d** and **1f** were synthesized following the procedure reported earlier by Xu et al[1] and the iminodiesters **1e** and **1g** were synthesized following the procedure reported by our group.[2] Similarly, the known 2-hydroxybenzylidene indanediones **2a** and **2e** were synthesized following the procedure reported by our group.[3] The iminodiester **1h** and the other 2-hydroxybenzylidene indandione substrates **2b**, **2c**, **2d**, **2f**, **2g** and **2h** were synthesized following the procedure mentioned in this supporting information.

2. Optimization of reaction conditions for the generation of 3aa and 4aa

Table 1. Optimization of the reaction conditions[a]



1a 2a 3aa 4aa

Entry	Base	Solvent	T [°C]	t [h]	**3aa**/**4aa** Yield[b] [%]
1	DMAP	$CHCl_3$	30	12	65/trace
2	DMAP	CH_2Cl_2	30	18	66/trace
3	DMAP	toluene	30	12	61/trace
4	DMAP	THF	30	12	trace/trace
5	DMAP	EtOAc	30	12	30/trace
6	DMAP	$CHCl_3$	40	9	65/trace
7	DMAP	$CHCl_3$	50	6	66/trace
8[c]	DMAP	$CHCl_3$	30	18	71/trace
9	TMG	$CHCl_3$	30	12	20/60
10	TMG	CH_2Cl_2	30	12	18/59
11	TMG	toluene	30	12	20/58
12	TMG	EtOAc	30	12	11/56
13	TMG	CH_3CN	30	12	11/35
14	TMG	THF	30	12	10/57
15	TMG	THF	40	3	trace/64
16	TMG	THF	50	2	trace/67
17[d]	TMG	THF	50	4	trace/82

[a] Unless otherwise specified, all the reactions were carried out with **1a** (0.1 mmol), **2a** (1.0 equiv.), 4Å MS (100 mg) and base (20 mol%) in the given solvent (0.5 mL). [b] Determined by ^{1}H NMR analysis of crude reaction mixture using Ph_3CH as internal standard. [c] 4Å MS (30 mg) were used. [d] Reaction was carried out with **1a** (0.2 mmol), **2a** (1.2 equiv.), 4Å MS (200 mg), TMG (20 mol%) in THF (0.5 mL).

After establishing DMAP and TMG as suitable bases to preferentially result in **3aa** and **4aa** respectively, the effect of other parameters such as solvent, temperature, additives, and molar ratio of substrates were examined. Eventually, it was found that (i) solvents such as DCM and $CHCl_3$ that resulted in good solubility of **1** and **2** provided better yields of **3aa** as compared to THF and EtOAc (Table 1, entries 1, 2 Vs 4, 5) (ii) slight warming to 50 °C enhanced the reaction rate, although yield did not improve (entries 6 & 7) (iii) addition of molecular sieves improved the yield of **3aa** by effective trapping of generated EtOH (entry 8) (iv) optimal solvent for the formation of **4aa** is THF (entries 14-17) and (v) reaction temperature and molar ratio of **1** and **2** has significant effect on the yield of **4aa**. Based on our observations, it was deduced that the optimal conditions to carry out the reaction for selective synthesis of **3aa** and **4aa** were as listed in entries 8 and 17 respectively.

3. Determination of rotamers

The existence of adducts **3** as a mixture of rotamers was confirmed by the rapid exchange of CH_3 protons of ethyl group of **3aa** in different deuterated solvents as shown below.

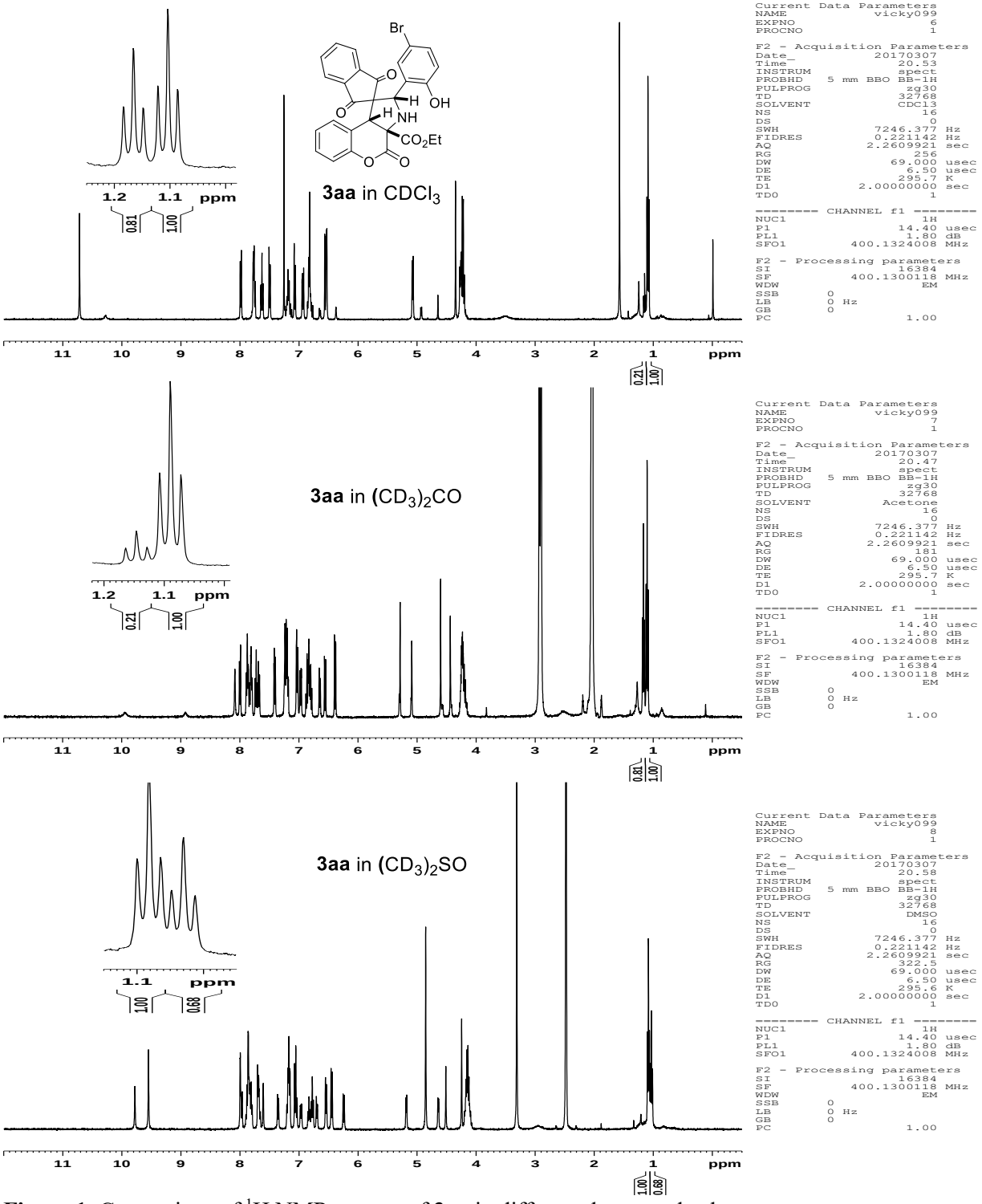


Figure 1. Comparison of ^{1}H NMR spectra of **3aa** in different deuterated solvents

In case of **3ha**, mixture of three rotamers could be seen. For clear understanding please refer to the ^{13}C NMR spectrum of **3ha** (page S100).

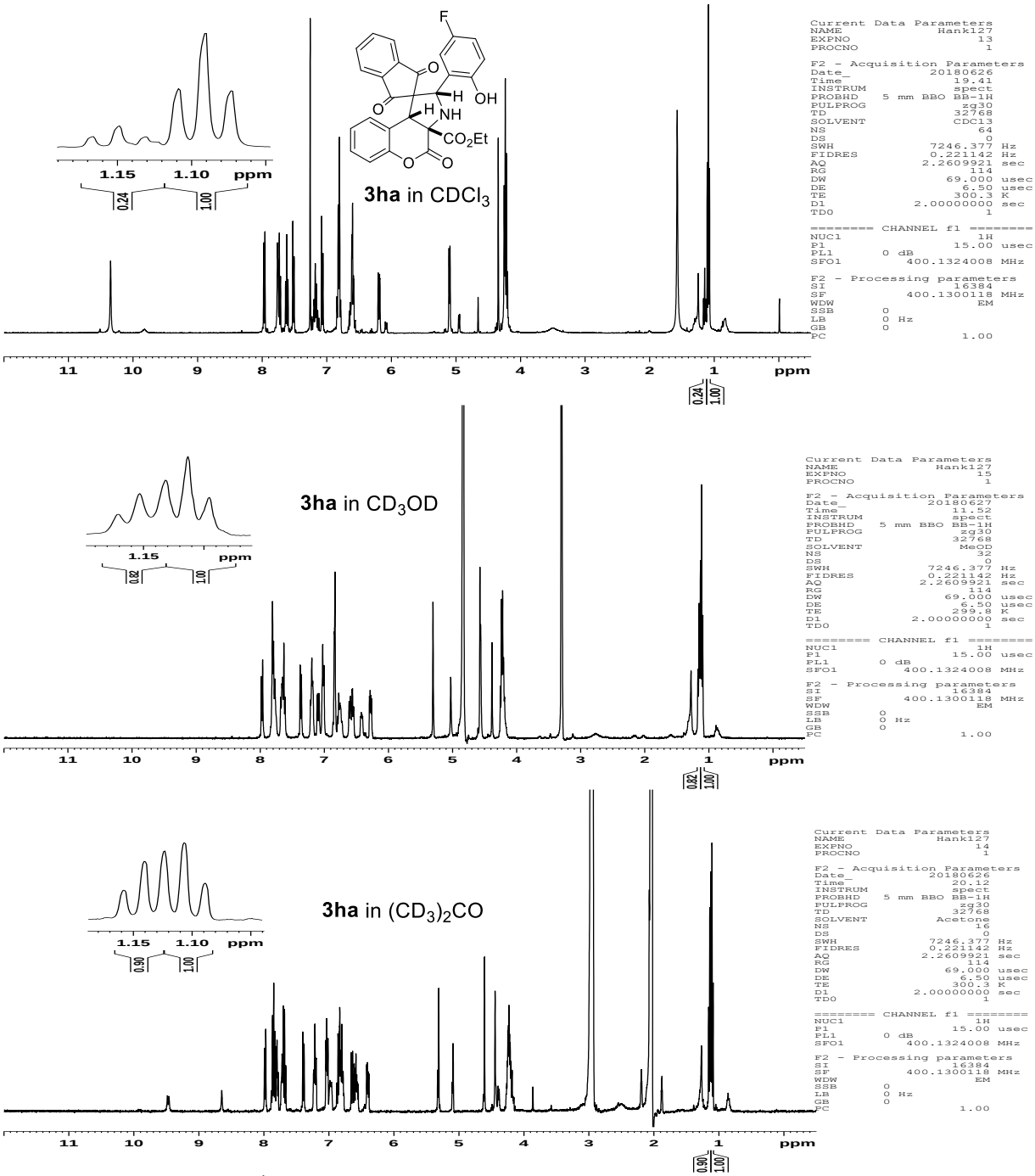
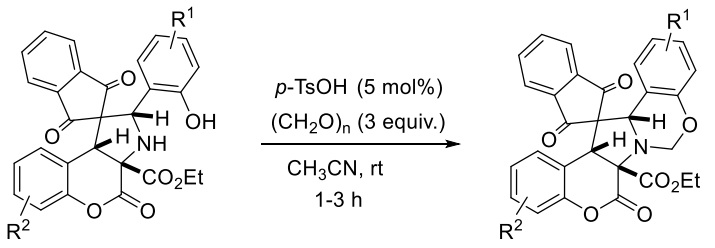
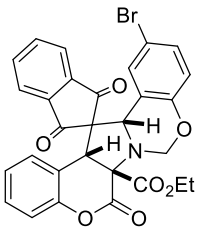


Figure 2. Comparison of ^{1}H NMR spectra of **3ha** in different deuterated solvents

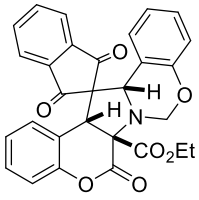
4. Derivatization of adducts 3



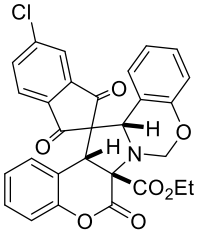
3 **5** (20:1 d.r.)



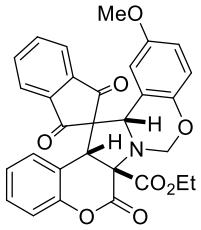
5aa (85%, 1 h)



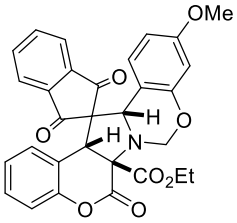
5ba (82%, 2 h)



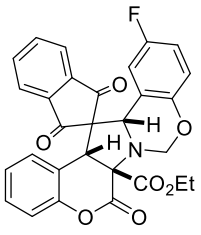
5ca (94%, 1 h)



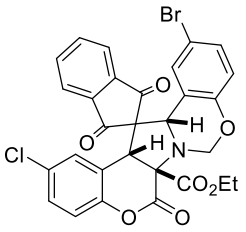
5ea (83%, 1 h)



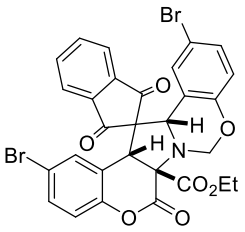
5fa (70%, 1 h)



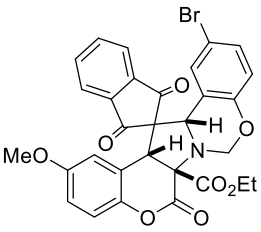
5ha (86%, 1 h)



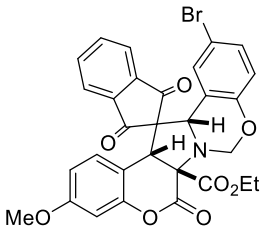
5ab (94%, 1 h)



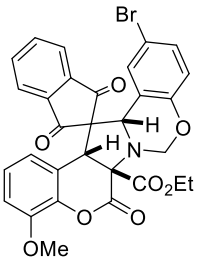
5ac (93%, 3 h)



5ae (88%, 1 h)



5af (88%, 3 h)

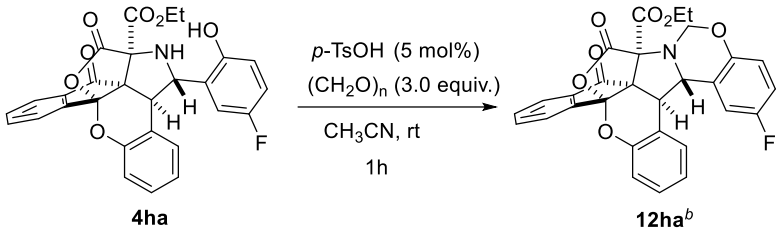


5ag (91%, 1 h)

Scheme 1. Hemiaminalization of adducts[a]

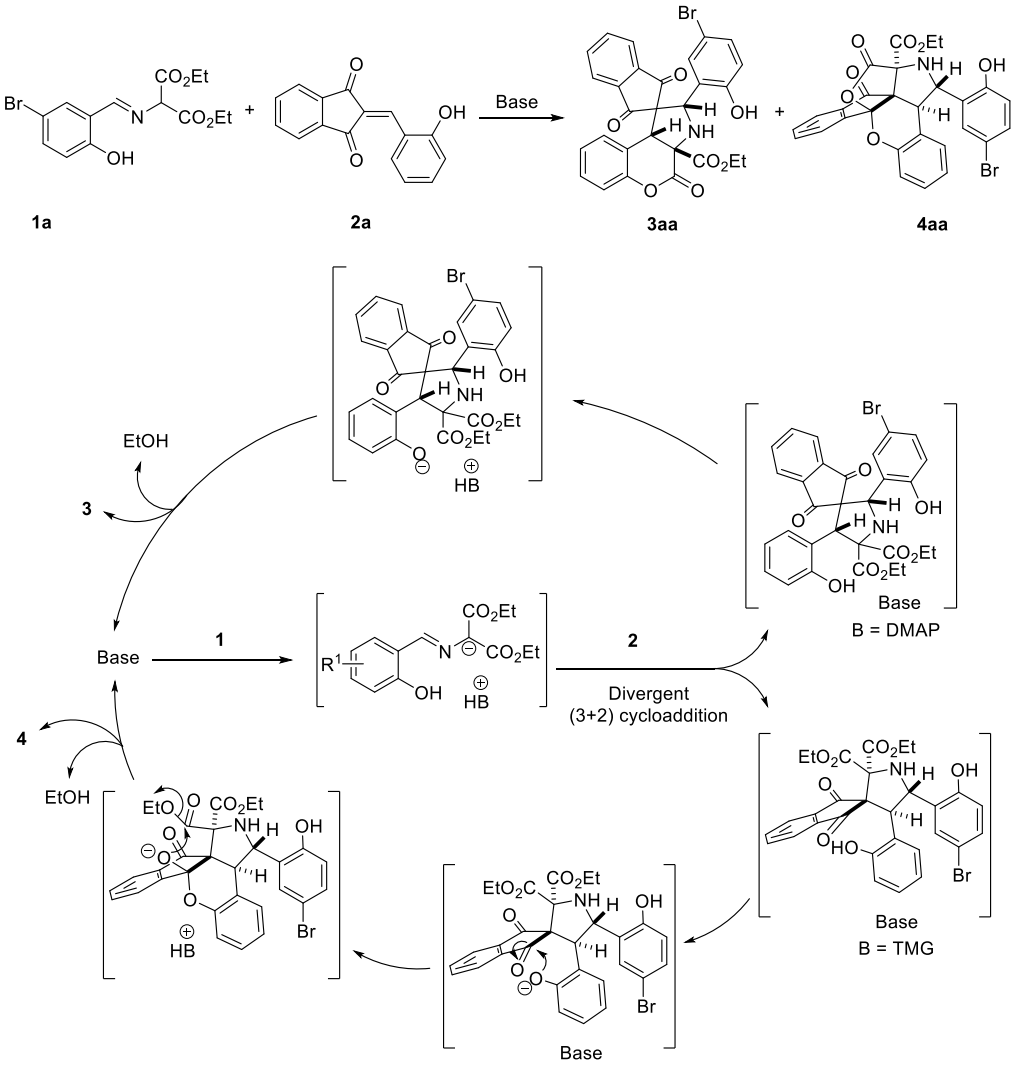
[a] **3** (0.1 mmol), PTSA (5 mol%) and paraformaldehyde (3.0 equiv.) in CH_3CN (0.5 mL). Reported yields are for the isolated product.

5. Derivatization of 4ha



Scheme 2. Hemiaminalization of **4ha**[a]
[a] Reaction was performed with **4ha** (0.05 mmol) in CH_3CN (0.25 mL). [b] **12ha** was contaminated with very minor amount of some impurity that could not be separated.

6. Plausible reaction mechanism



Scheme 3. Plausible mechanism for the formation of **3** and **4**

7. Control experiments

To understand the fate of the azomethine ylide in the presence of bases DMAP and TMG, two separate experiments were conducted. Accordingly, **1a** (0.1 mmol) and DMAP (1.0 equiv.) were mixed in $CDCl_3$ (0.5 mL) and the NMR was recorded immediately. The NMR spectrum revealed the broadening of signals of the phenolic proton (H_c) as well as the proton flanked by the diester (H_a) while the imine proton (H_b)was unchanged. Similar experiment was conducted with TMG (1 equiv) and the NMR spectrum surprisingly revealed the diminishing of the intensity of the imine proton (H_b) along with the proton flanked by the diester (H_a) while the phenolic proton (H_c) could not be observed. These observations revealed that the configuration of the azomethine ylide is indeed different in the presence of DMAP and TMG.

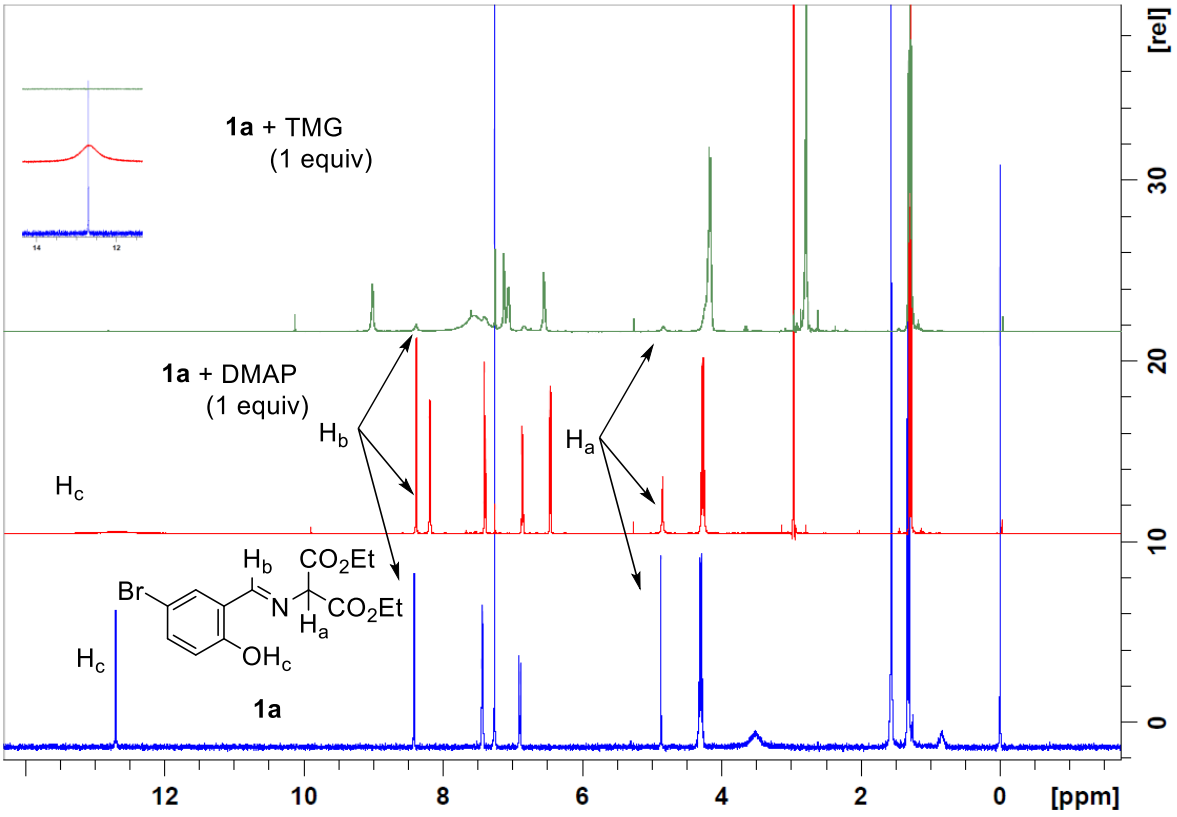


Figure 3. NMR behavior of azomethine ylide in the presence of DMAP and TMG

8. Chiral bases screened for the reaction between 1a and 2a

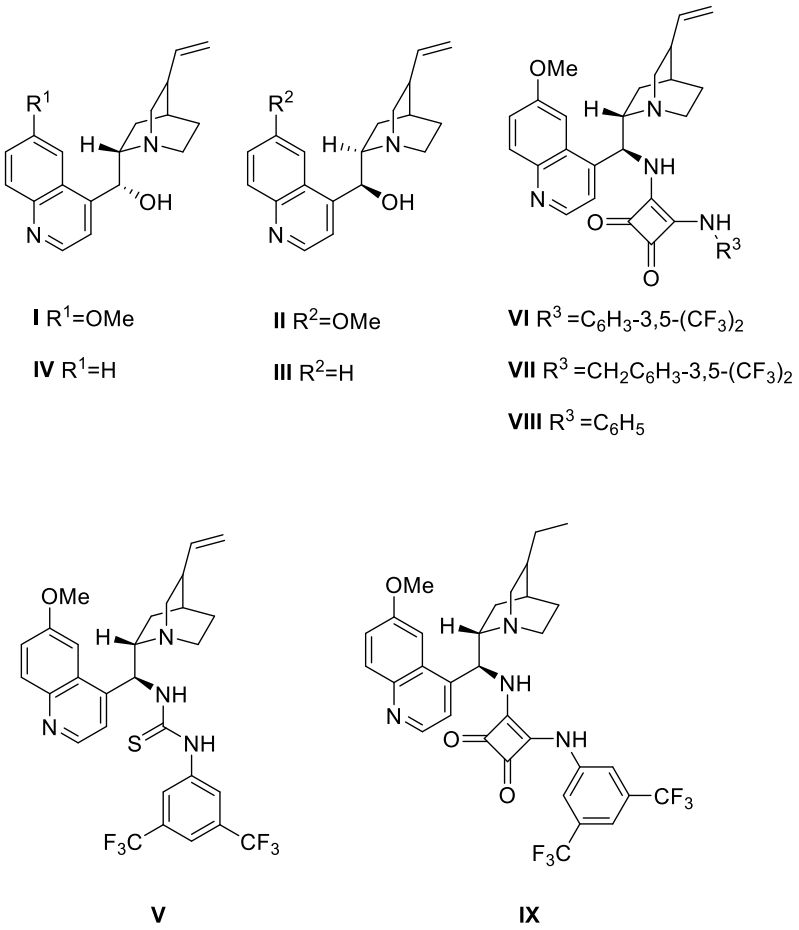
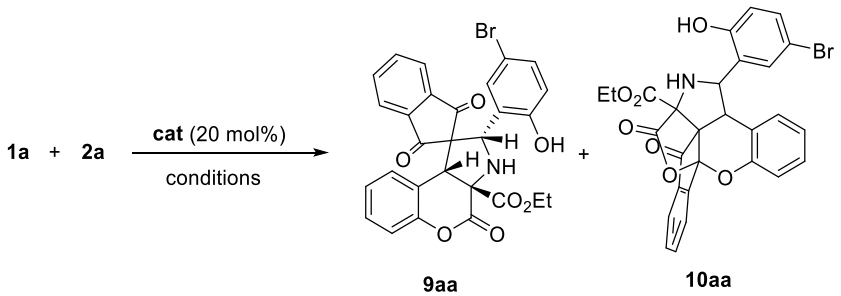


Figure 4. Catalysts screened for the cascade reaction

9. Optimization of reaction conditions for the generation of chiral adducts 9

Table 2. Optimization of reaction conditions[a]

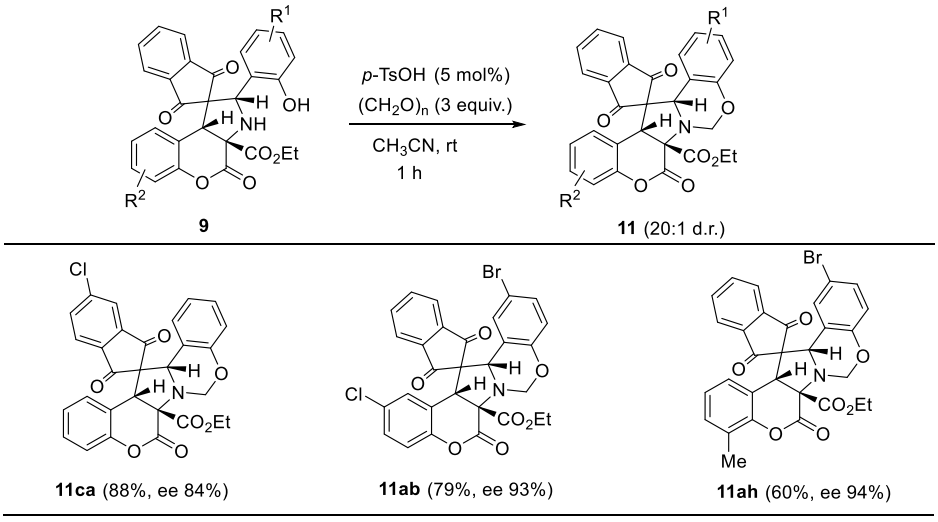


Entry	**Cat.**	Solvent	T [°C]	t [b][h]	Yield [c][%] **9aa/10aa**	**9aa** ee [d][%]
1	**I**	$CHCl_3$	30	42	43/32	39(*ent*)
2	**II**	$CHCl_3$	30	35	42/30	29
3	**III**	$CHCl_3$	30	42	48/37	19(*ent*)

4	**IV**	$CHCl_3$	30	24	36/34	17
5	**V**	$CHCl_3$	30	36	35/0	17(*ent*)
6	**VI**	$CHCl_3$	30	12	71/0	73
7	**VII**	$CHCl_3$	30	12	43/0	47
8	**VIII**	$CHCl_3$	30	24	50/0	54
9	**IX**	$CHCl_3$	30	8	72/0	76
10	**IX**	THF	0	48	12/0	n.d[e]
11	**IX**	EtOAc	0	48	29/0	88
12	**IX**	CH_3CN	0	48	trace/0	n.d[e]
13	**IX**	toluene	0	48	29/0	80
14	**IX**	PhCl	0	48	39/0	87
15	**IX**	CH_2Cl_2	0	48	35/0	84
16	**IX**	DCE	0	48	12/0	n.d[e]
17	**IX**	$CHCl_3$	0	48	67/0	85
18	**IX**	$CHCl_3$	-5	216	50/0	87
19[f]	**IX**	$CHCl_3$	-5	216	70/0	88
20[f,g]	**IX**	$CHCl_3$	-5	144	68/0	89
21[g,h]	**IX**	$CHCl_3$	-5	144	76/0	89

[a] Unless otherwise specified, all reactions were carried out with **1a** (0.1 mmol), **2a** (1.0 equiv.) and 0.5 mL solvent was used. [b] Indicates the time after which no considerable improvement in the yield of **9aa**/**10aa** was observed. [c] Determined by ^{1}H NMR analysis of crude reaction mixture using Ph_3CH as internal standard. [d] Determined by HPLC analysis on chiral stationary phase. [e] n.d. = not determined. [f] Equivalents of **2a**: **1a** is 1: 1.2. [g] Reaction was carried out with **2a** (0.2 mmol) and **1a** (1.2 equiv.) in 0.5 mL $CHCl_3$. [h] 4Å MS (50 mg) were used.

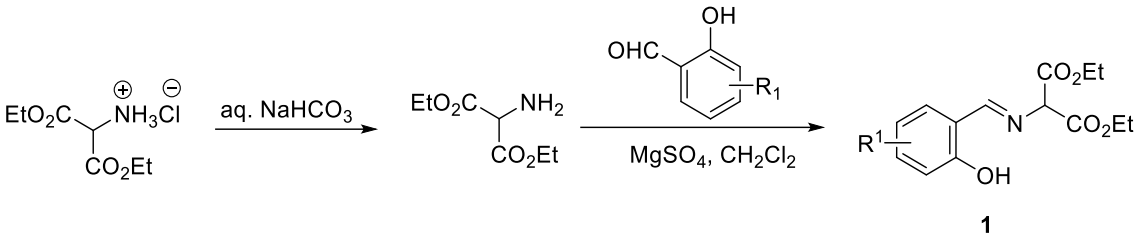
10. Derivatization of adducts 9



Scheme 4. Hemiaminalization of adducts **9**[a,b]
[a] **9** (0.1 mmol), PTSA (5 mol%) and paraformaldehyde (3.0 equiv.) in CH_3CN (0.5 mL). [b] Reported yields are for the isolated product.

11. Experimental Procedures

Typical procedure (TP-A) for the preparation of iminodiesters 1.

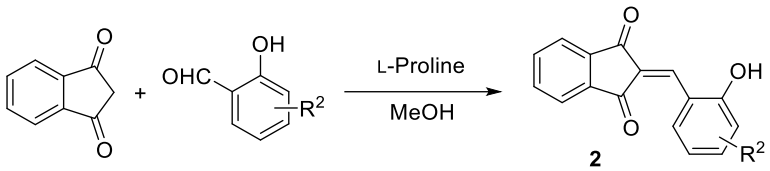


1

To a stirred solution of diethyl aminomalonate hydrochloride (3.0 g, 14.2 mmol) and H_2O (30 mL) in a round-bottomed flask was added $NaHCO_3$ (1.1 equiv.) and stirred for 15 min. Thereafter, the reaction mixture was extracted with EtOAc (3 x 50 mL) and the combined organic layers were dried over $MgSO_4$, filtered and concentrated under vacuum to afford crude diethyl aminomalonate (2.302 g, 13.1 mmol) which was used without further purification.

Substituted salicylaldehyde (1.0 equiv.) was added to a solution of diethyl aminomalonate (2.302 g, 13.1 mmol) and $MgSO_4$ (5.0 equiv) in CH_2Cl_2 (30 mL) and the resulting mixture was stirred for 48 h. Afterwards, $MgSO_4$ was removed by filtration and the filtrate was concentrated under reduced pressure to obtain crude **1**. If the product was solid, it was recrystallized from DCM/Hex to afford pure **1**. In case of liquids, the crude product was directly used without further purification.

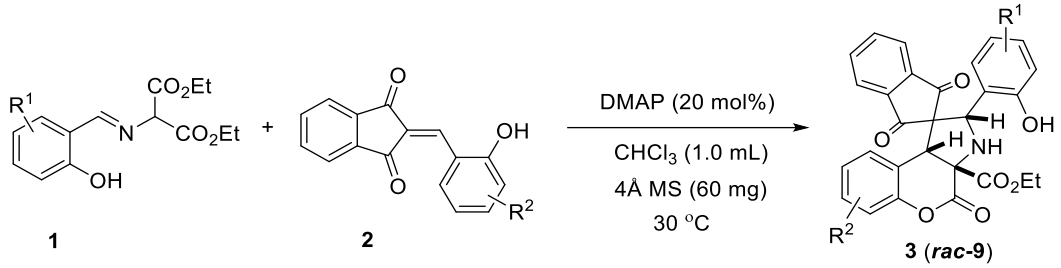
Typical procedure (TP-B) for the preparation of 2-hydroxybenzylidene indandiones 2.



2

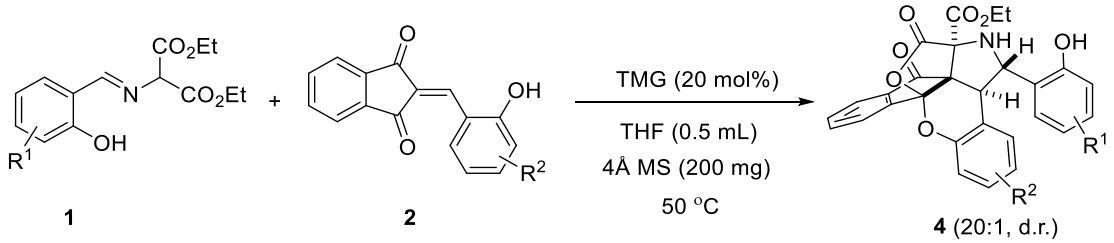
A 50-mL Schlenk flask, equipped with a magnetic stirring bar, was sequentially charged with a solution of 1,3-indanedione (1.5 g, 10 mmol), L-proline (0.3 equiv.) and salicylaldehyde (1.1 equiv) in methanol (20 mL). The reaction mixture was stirred for 12 h at room temperature. Thereafter, the resulting mixture was filtered under vacuum and the residue was washed with methanol and ethyl ether for several times to yield the corresponding products **2** as yellow solid.

Typical procedure (TP-C) for the generation of Chromeno[3,4-*b*]pyrrolidines 3 (*rac*-9).



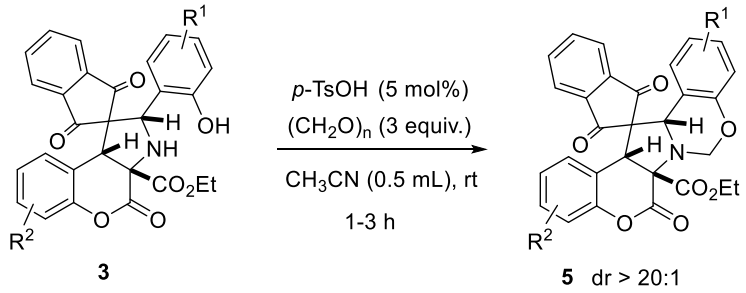
1 (0.2 mmol), **2** (1.0 equiv.), 4Å MS (60 mg), $CHCl_3$ (1.0 mL) and DMAP (20 mol %) were sequentially charged in a screw-capped glass vial equipped with a magnetic stirring bar and the resulting mixture was stirred at 30 °C. After the completion of reaction as indicated by TLC, solvent was removed *in vacuo* and the residue was subjected to flash column chromatography on silica gel to obtain the corresponding adducts **3**.

Typical procedure (TP-D) for the generation of Chromeno[3,4-*c*]pyrrolidines 4.



A screw-capped glass vial equipped with a magnetic stirring bar was sequentially charged with **2** (0.2 mmol), **1** (1.2 equiv.), 4Å MS (200 mg), THF (0.5 mL) and TMG (20 mol %) and the resulting mixture was stirred at 50 °C. After the completion of reaction as indicated by TLC, solvent was removed *in vacuo* and the residue was subjected to flash column chromatography on silica gel to obtain the adducts **4**.

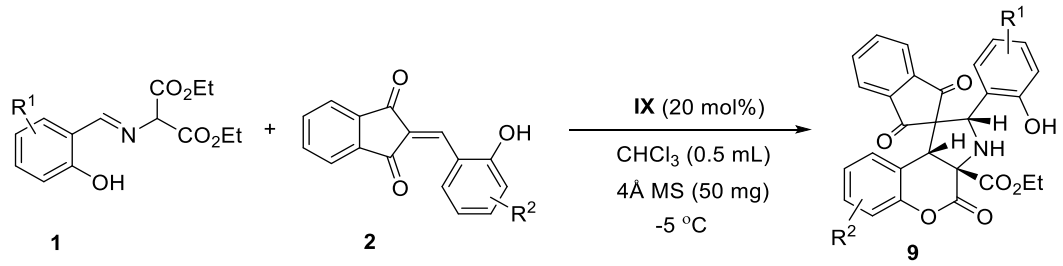
Typical procedure (TP-E) for the hemiaminalization of Chromeno[3,4-*b*]pyrrolidines 3.



A screw-capped glass vial equipped with a magnetic stirring bar was sequentially charged with **3** (0.1 mmol), paraformaldehyde (9.2 mg, 3 equiv.), MeCN (0.5 mL) and PTSA (5 mol %) and

the resulting mixture was stirred at 30 °C until the reaction was complete. Thereafter the mixture was diluted with saturated aqueous $NaHCO_3$ and extracted with DCM. Evaporation of the solvent *in vacuo* gave a residue which upon flash column chromatography on silica gel afforded the corresponding oxazinane adducts **5**.

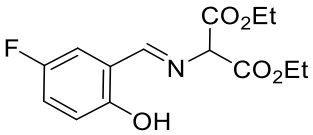
Typical procedure (TP-F) for the generation of chiral Chromeno[3,4-*b*]pyrrolidines 9.



A screw-capped glass vial equipped with a magnetic stirring bar was sequentially charged with **2** (0.2 mmol), **1** (1.2 equiv.), 4Å MS (50 mg), $CHCl_3$ (0.5 mL) and **IX** (20 mol %) and the resulting mixture was stirred at -5 °C for appropriate time. After the completion of reaction, solvent was removed *in vacuo* and the residue was subjected to flash column chromatography on silica gel to obtain the chiral adducts **9**.

12. Analytical data for all new compounds

(*E*)-Diethyl 2-((5-fluoro-2-hydroxybenzylidene)amino)malonate (1h).



Following the TP-A, **1h** was obtained from 5-fluoro-2-hydroxybenzaldehyde (1.57 g, 1.0 equiv.) as a yellow oil (1.276 g, 38.2%).

R_f = 0.325 (EA:Hex = 1:6).

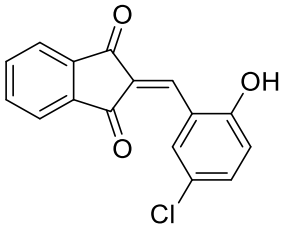
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 12.47 (s, 1H), 8.43 (s, 1H), 7.09 (td, J = 8.0, 3.0 Hz, 1H), 7.02 (dd, J = 8.0, 3.0 Hz, 1H), 6.94 (dd, J = 8.0, 4.4 Hz, 1H), 4.88 (s, 1H), 4.30 (q, J = 7.1 Hz, 4H), 1.32 (t, J = 7.1 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 168.7 (d, J = 2.5 Hz), 165.9, 157.2 (d, J = 1.2 Hz), 155.3 (d, J = 237.3 Hz), 120.6 (d, J = 23.3 Hz), 118.5 (d, J = 7.4 Hz), 118.1 (d, J = 7.2 Hz), 117.1 (d, J = 23.3 Hz), 72.5, 62.5, 14.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3363, 3275, 2949, 2920, 2362, 2343, 1736, 1643, 1489, 1467, 1375, 1204.

HRMS (ESI) for $C_{14}H_{16}FNO_5$, $[M+H]^+$ (298.1085) found: 298.1092.

2-(5-Chloro-2-hydroxybenzylidene)-1*H*-indene-1,3(2*H*)-dione (2b).



Following the **TP-B**, **2b** was obtained from 2-hydroxy-5-chlorobenzaldehyde (1.76 g, 1.1 equiv.) as a yellow solid (2.41 g, 85%).

R_f = 0.150 (DCM:Hex = 3:1).

mp.: 250.1-251.1 ℃.

^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: 9.88 (s, 1H), 9.15 (d, J = 2.7 Hz, 1H), 8.38 (s, 1H), 8.09-7.93 (m, 4H), 7.47 (dd, J = 8.8, 2.7 Hz, 1H), 7.09 (d, J = 8.8 Hz, 1H).

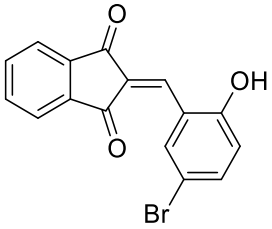
^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: 190.2, 189.9, 158.9, 143.4, 141.0, 139.0, 136.6, 136.5, 135.6, 133.3, 129.8, 124.8, 124.0, 123.8, 122.6, 118.4.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3160, 3098, 1722, 1681, 1594, 1489, 821, 734, 610.

HRMS (ESI) for $C_{16}H_8{}^{35}ClO_3$, $[M-H]^-$ (283.0167) found: 283.0160.

HRMS (ESI) for $C_{16}H_8{}^{37}ClO_3$, $[M-H]^-$ (285.0138) found: 285.0134.

2-(5-Bromo-2-hydroxybenzylidene)-1*H*-indene-1,3(2*H*)-dione (2c).



Following the TP-B, **2c** was obtained from 2-hydroxy-5-bromobenzaldehyde (2.26 g, 1.1 equiv.) as a yellow solid (2.70 g, 82%).

R_f = 0.125 (DCM:Hex = 3:1).

mp.: 250.2-251.2 ℃.

^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: 9.91 (s, 1H), 9.28 (d, J = 2.4 Hz, 1H), 8.37 (s, 1H), 8.06-7.92 (m, 4H), 7.59 (dd, J = 8.8, 2.4 Hz, 1H), 7.04 (d, J = 8.8 Hz, 1H).

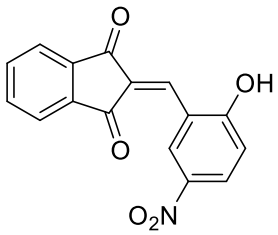
^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: 190.2, 189.9, 159.5, 143.4, 141.0, 138.9, 138.4, 136.6, 136.5, 136.3, 129.8, 124.0, 123.8, 123.2, 118.8, 111.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3468, 3179, 1722, 1681, 1583, 1484, 812, 734, 636.

HRMS (ESI) for $C_{16}H_{10}{}^{79}BrO_3$, $[M+H]^+$ (328.9808) found: 328.9812.

HRMS (ESI) for $C_{16}H_{10}{}^{81}BrO_3$, $[M+H]^+$ (330.9787) found: 330.9797.

2-(2-Hydroxy-5-nitrobenzylidene)-1*H*-indene-1,3(2*H*)-dione (2d).



Following the TP-B, **2d** was obtained from 2-hydroxy-3-methoxybenzaldehyde (1.86 g, 1.1 equiv.) as a green solid (2.24 g, 76%)

R_f = 0.375 (DCM:Hex:EA = 1:5:1).

mp.: 133.4-134.9 °C.

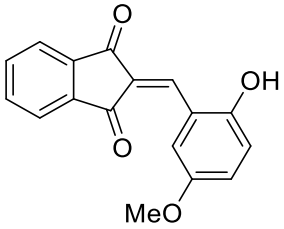
^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 12.42 (s, 1H), 9.91 (d, J = 2.8 Hz, 1H), 8.32 (dd, J = 9.1, 2.8 Hz, 1H), 8.18 (s, 1H), 8.08-7.95 (m, 4H), 7.16 (d, J = 9.2 Hz, 1H).

^{13}C NMR (100 MHz, $(CD_3)_2CO$, 50 °C) δ/ppm: 188.9, 188.5, 164.6, 141.7, 139.5, 139.1, 136.9, 135.8, 135.7, 129.6, 129.4, 128.8, 123.0, 122.9, 119.4, 116.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3318, 3059, 2918, 2850, 2362, 2338, 1656, 1603, 1586, 1455, 1317, 1302, 1250, 1230.

HRMS (ESI) for $C_{16}H_8NO_5$, $[M-H]^-$ (294.0408) found: 294.0404.

2-(2-Hydroxy-5-methoxybenzylidene)-1*H*-indene-1,3(2*H*)-dione (2e).



Following the TP-B, **2e** was obtained from 2-hydroxy-5-methoxybenzaldehyde (1.71 g, 1.1 equiv.) as a yellow solid (2.02 g, 72%).

R_f = 0.075 (DCM:Hex = 3:1).

mp.: 220.1-221.1 °C.

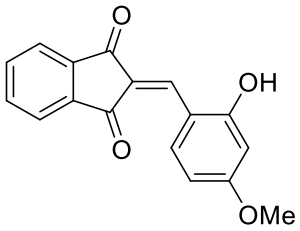
^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 9.27 (s, 1H), 8.86 (d, J = 3.1 Hz, 1H), 8.52 (s, 1H), 8.08-7.92 (m, 4H), 7.10 (dd, J = 8.9, 3.1 Hz, 1H), 7.00 (d, J = 8.9 Hz, 1H), 3.89 (s, 3H).

^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 190.7, 190.2, 155.2, 153.5, 143.4, 141.1, 140.8, 136.3, 136.2, 128.4, 124.9, 123.8, 123.6, 121.6, 117.8, 116.6, 56.1.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3299, 3125, 2959, 1719, 1671, 1581, 1498, 1168, 816, 734.

HRMS (ESI) for $C_{17}H_{11}O_4$, $[M-H]^-$ (279.0663) found: 279.0657.

2-(2-Hydroxy-4-methoxybenzylidene)-1H-indene-1,3(2H)-dione (2f).



Following the TP-B, **2f** was obtained from 2-hydroxy-4-methoxybenzaldehyde (1.71 g, 1.1 equiv.) as a yellow solid (2.13 g, 76%).

R_f = 0.125 (DCM:Hex = 3:1).

mp.: 240.4-241.4 °C.

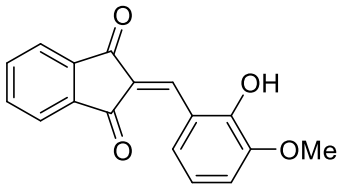
^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 9.93 (s, 1H), 9.27 (d, J = 9.0 Hz, 1H), 8.48 (s, 1H), 8.02-7.86 (m, 4H), 6.65 (dd, J = 9.0, 2.4 Hz, 1H), 6.60 (d, J = 2.4 Hz, 1H), 3.90 (s, 3H).

^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 191.1, 190.3, 167.5, 143.1, 140.9, 140.7, 136.9, 135.9, 135.7, 125.3, 123.4, 123.3, 115.5, 107.8, 101.3, 56.0.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3258, 3087, 2826, 1708, 1667, 1594, 1488, 1075, 809, 735.

HRMS (ESI) for $C_{17}H_{13}O_4$, $[M+H]^+$ (281.0808) found: 281.0815.

2-(2-Hydroxy-3-methoxybenzylidene)-1H-indene-1,3(2H)-dione (2g).



Following the TP-B, **2g** was obtained from 2-hydroxy-3-methoxybenzaldehyde (1.71 g, 1.1 equiv.) as a yellow solid (2.19 g, 78%).

R_f = 0.300 (DCM:Hex = 3:1).

mp.: 233.8-234.8 °C.

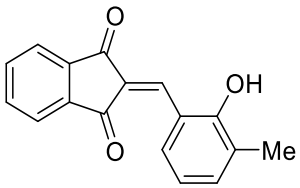
^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 8.81 (s, 1H), 8.66 (d, J = 8.1 Hz, 1H), 8.55 (s, 1H), 8.08-7.90 (m, 4H), 7.22 (d, J = 8.1 Hz, 1H), 6.95 (t, J = 8.1 Hz, 1H), 3.92 (s, 3H).

^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 °C) δ/ppm: 190.6, 189.7, 150.5, 148.4, 143.4, 140.9, 140.4, 136.4, 136.2, 128.9, 125.8, 123.8, 123.7, 121.1, 119.7, 117.2, 56.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3374, 3100, 2941, 1717, 1673, 1601, 1222, 832, 747.

HRMS (ESI) for $C_{17}H_{13}O_4$, $[M+H]^+$ (281.0808) found: 281.0815.

2-(2-Hydroxy-3-methylbenzylidene)-1H-indene-1,3(2H)-dione (2h).



Following the TP-B, **2h** was obtained from 2-hydroxy-3-methylbenzaldehyde (1.52 g, 1.1 equiv.) as a yellow solid (1.85 g, 70%).

R_f = 0.350 (DCM:Hex = 3:1).

mp.: 211-212 °C.

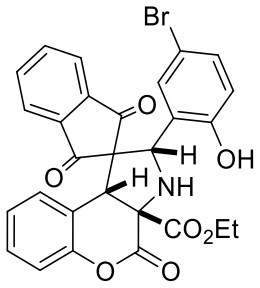
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.80 (s, 1H), 8.05-8.02 (m, 3H), 7.85 (m, 2H), 7.59 (d, J = 7.9 Hz, 1H), 7.39 (d, J = 7.2 Hz, 1H), 6.93 (t, J = 7.6 Hz, 1H), 2.36 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 193.9, 189.4, 158.0, 144.7, 142.1, 139.9, 137.2, 136.1, 135.9, 135.3, 129.2, 125.4, 123.7, 123.5, 122.3, 120.5, 16.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3354, 1711, 1672, 1582, 1466, 1150, 992, 736.

HRMS (ESI) for $C_{17}H_{13}O_3$, $[M+H]^+$ (265.0859) found: 265.0866.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3aa).



Following the TP-C, **3aa** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2a** (50.0 mg, 1.0 equiv.) as a pale yellow solid (77.6 mg, 69%).

R_f = 0.200 (DCM:Hex = 3:1).

mp.: 118.5-119.5 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: (mixture of rotamers) 10.71 (s, 1H), 10.26 (s, 1H'), 7.99 (d, J = 7.7 Hz, 1H), 7.81-7.73 (m, 3H'+1H), 7.63 (t, J = 7.5 Hz, 1H), 7.51 (d, J = 7.7 Hz, 1H), 7.25-7.16 (m, 2H'+1H), 7.14 (d, J = 8.2 Hz, 1H'), 7.08 (d, J = 8.2 Hz, 1H), 6.94 (dd, J = 8.8, 2.0 Hz, 1H), 6.88-6.80 (m, 1H'+2H), 6.78 (d, J = 8.8 Hz, 1H'), 6.65 (d, J = 7.5 Hz, 1H'), 6.57 (d, J = 8.8 Hz, 1H), 6.54 (d, J = 1.4 Hz, 1H), 6.39 (s, 1H'), 5.08 (d, J = 6.9 Hz, 1H), 4.94

(d, *J* = 6.2 Hz, 1H'), 4.66 (s, 1H'), 4.36 (s, 1H) , 4.24 (q, *J* = 7.2 Hz, 4H'+3H), 1.16 (t, *J* = 7.0 Hz, 3H'), 1.10 (t, *J* = 7.0 Hz, 3H).

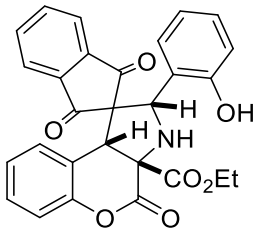
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 197.7, 198.7 (C'), 196.9, 196.0 (C'), 168.7, 167.1 (C'), 164.6, 165.9 (C'), 156.6, 156.9 (C'), 151.5 (C'), 150.9, 143.1 (C'), 142.5, 141.3 (C'), 142.3, 136.6, 136.2 (C'), 136.1, 132.8 (C'), 132.5, 130.1, 130.3 (C'), 130.0 (C'), 129.8, 127.8 (C'), 127.2, 124.8 (C'), 124.5, 123.8 (C'), 123.7 (C'), 123.4, 123.2, 121.9 (C'), 120.3, 119.9 (C'), 118.3, 117.4 (C'), 117.6, 116.4 (C'), 115.7, 110.7 (C'), 110.1, 71.0, 69.7 (C'), 68.6, 68.2 (C'), 67.7, 67.5 (C'), 64.1, 63.6 (C'), 50.1 (C'), 49.3, 13.7 (C'), 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3317, 2922, 1771, 1742, 1708, 1591, 1178, 1108, 761.

HRMS (ESI) for $C_{28}H_{21}{}^{79}BrNO_7$, $[M+H]^+$ (562.0496) found: 562.0504.

HRMS (ESI) for $C_{28}H_{21}{}^{81}BrNO_7$, $[M+H]^+$ (564.0475) found: 564.0488.

Ethyl-2-(2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*] pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ba).



Following the TP-C, **3ba** was obtained from **1b** (55.9 mg, 0.2 mmol) and **2a** (50.0 mg, 1.0 equiv.) as a pale yellow solid (60.0 mg, 62%).

R_f = 0.325 (DCM:Hex:EA = 1:3:1).

mp.: 110.0-111.0 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.55 (s, 1H), 10.23 (s, 1H'), 7.94 (d, *J* = 7.6 Hz, 1H), 7.79-7.73 (m, 3H'), 7.70 (t, *J* = 7.6 Hz, 1H'+1H), 7.59 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.26-7.14 (m, 2H'+1H), 7.11 (d, *J* = 8.3 Hz, 1H'), 7.06 (d, *J* = 8.2 Hz, 1H), 6.91-6.79 (m, 2H'+3H), 6.69-6.62 (m, 1H'+1H), 6.48 (d, *J* = 7.5 Hz, 1H), 6.44 (t, *J* = 7.5 Hz, 1H'), 6.32 (t, *J* = 7.5 Hz, 1H), 6.27 (d, *J* = 7.5 Hz, 1H'), 5.18 (d, *J* = 5.8 Hz, 1H), 5.01 (d, *J* = 5.9 Hz, 1H'), 4.71 (s, 1H'), 4.38 (s, 1H), 4.23 (q, *J* = 7.1 Hz, 3H'+3H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

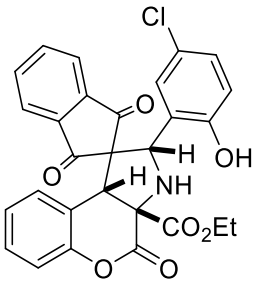
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 199.0 (C'), 198.1, 197.2, 196.2 (C'), 168.9, 167.1 (C'), 166.1 (C'), 164.8, 157.6 (C'), 157.2, 151.5 (C'), 150.8, 143.2 (C'), 142.53, 142.47, 141.5 (C'), 136.4, 135.9 (C'), 135.8, 130.2 (C'), 130.0 (C'), 129.9, 129.6, 127.7 (C'), 127.5 (C'), 127.4, 127.1, 124.7 (C'), 124.4, 123.6 (C'), 123.5 (C'), 123.3, 123.0, 119.5 (C'),

118.9 (C'), 118.6, 118.3, 118.0 (C'), 117.5, 117.3 (C'), 116.7 (C'), 116.3, 115.9, 71.0, 69.8 (C'), 69.3, 68.5 (C'), 68.2 (C'), 67.6, 63.9, 63.5 (C'), 49.9 (C'), 49.4, 13.7 (C'), 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3318, 3068, 2985, 1774, 1742, 1708, 1592, 1492, 1179, 1126.

HRMS (ESI) for $C_{28}H_{22}NO_7$, $[M+H]^+$ (484.1391) found: 484.1401.

Ethyl-2-(5-chloro-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-2*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ca).



Following the TP-C, **3ca** was obtained from **1c** (62.7 mg, 0.2 mmol) and **2a** (50.0 mg, 1.0 equiv.) as a pale yellow solid (70.5 mg, 70%).

R_f = 0.200 (DCM:Hex = 3:1).

mp.: 219.1-220.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.66 (s, 1H), 10.14 (s, 1H'), 7.99 (d, J = 7.7 Hz, 1H), 7.84-7.73 (m, 4H'+1H), 7.63 (td, J = 8.0, 0.9 Hz, 1H), 7.51 (d, J = 7.7 Hz, 1H), 7.26-7.16 (m, 1H'+1H), 7.13 (dd, J = 8.2, 0.9 Hz, 1H'), 7.07 (d, J = 8.0 Hz, 1H), 7.04 (d, J = 2.6 Hz, 1H'), 6.88-6.78 (m, 2H'+3H), 6.65 (dd, J = 7.5, 1.7 Hz, 1H'), 6.60 (d, J = 8.8 Hz, 1H), 6.43 (d, J = 2.6 Hz, 1H), 6.32 (d, J = 1.7 Hz, 1H'), 5.10 (d, J = 6.5 Hz, 1H), 4.96 (d, J = 6.2 Hz, 1H'), 4.65 (s, 1H'), 4.36 (s, 1H) , 4.29 (d, J = 6.8 Hz, 1H), 4.23 (q, J = 7.1 Hz, 3H'+2H), 1.16 (t, J = 7.1 Hz, 3H'), 1.10 (t, J = 7.2 Hz, 3H).

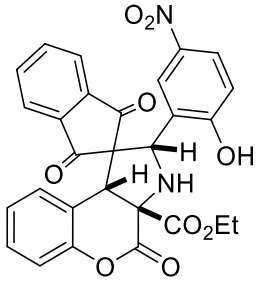
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 198.9 (C'), 197.8, 196.9, 196.1 (C'), 168.7, 167.2 (C'), 166.0 (C'), 164.7, 156.3 (C'), 156.0, 151.5 (C'), 150.9, 143.1 (C'), 142.5, 142.3, 141.4 (C'), 136.7, 136.23 (C'), 136.17, 130.4 (C'), 130.1, 129.9 (C'), 129.6, 127.8 (C'), 127.2, 127.1 (C'), 126.9, 124.8 (C'), 124.5, 123.8 (C'), 123.7 (C'), 123.5, 123.2, 123.1, 121.6 (C'), 119.9, 119.3 (C'), 117.8, 117.6, 117.4 (C'), 116.4 (C'), 115.7, 70.9, 69.7 (C'), 68.6, 68.1 (C'), 67.7, 67.4 (C'), 64.1, 63.7 (C'), 50.2 (C'), 49.5, 13.72 (C'), 13.68.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3324, 2926, 1770, 1742, 1708, 1592, 1488, 1177, 1108, 762, 703.

HRMS (ESI) for $C_{28}H_{21}{}^{79}ClNO_7$, $[M+H]^+$ (518.1001) found: 518.1009.

HRMS (ESI) for $C_{28}H_{21}{}^{81}ClNO_7$, $[M+H]^+$ (520.0972) found: 520.0994.

Ethyl-2-(2-hydroxy-5-nitrophenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3da).



Following the TP-C, **3da** was obtained from **1d** (61.9 mg, 0.2 mmol) and **2a** (50.0 mg, 1.0 equiv.) as a pale yellow solid (61.3 mg, 58%).

R_f = 0.3.75 (DCM:Hex:EA = 1:3:1).

mp.: 227.2-228.1 ℃.

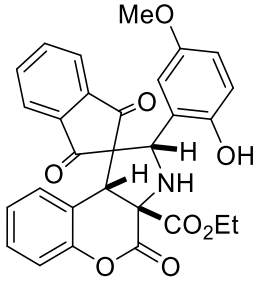
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 11.93 (s, 1H), 8.01 (d, J = 7.6 Hz, 1H'+1H), 7.85-7.70 (m, 5H'+2H), 7.62 (t, J = 7.4 Hz, 1H), 7.48 (d, J = 7.6 Hz, 1H), 7.40 (s, 1H), 7.25-7.13 (m, 1H'+1H), 7.09 (d, J = 8.2 Hz, 1H), 6.99 (d, J = 9.2 Hz, 1H'), 6.94-6.79 (m, 2H'+2H), 6.67 (d, J = 9.1 Hz, 1H), 6.62 (d, J = 6.9 Hz, 1H'), 5.26 (s, 1H), 5.12 (s, 1H'), 4.61 (s, 1H'), 4.39 (s, 1H), 4.25 (q, J = 7.1 Hz, 2H'+2H), 3.45 (s, 1H), 1.10 (t, J = 7.1 Hz, 3H'+3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 198.4 (C'), 197.2, 197.0, 168.3, 167.1 (C'), 164.4, 163.8, 151.4 (C'), 150.8, 142.7 (C'), 142.4, 142.0, 141.4 (C'), 139.8 (C'), 139.2, 136.9, 136.7 (C'), 136.6, 130.6 (C'), 130.3, 127.8 (C'), 127.2, 126.2 (C'), 125.6, 124.9 (C'), 124.7, 124.1 (C'), 123.7, 123.6, 123.5, 119.1, 118.6 (C'), 117.7, 117.6 (C'), 116.9, 115.8 (C'), 115.2, 70.9, 69.7 (C'), 68.00, 67.99, 67.0 (C'), 64.4, 63.9 (C'), 50.8 (C'), 49.7, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3319, 2924, 1786, 1743, 1707, 1592, 1485, 1252, 1174.

HRMS (ESI) for $C_{28}H_{21}N_2O_9$, $[M+H]^+$ (529.1242) found: 529.1249.

Ethyl-2-(2-hydroxy-5-methoxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ea).



Following the TP-C, **3ea** was obtained from **1e** (61.9 mg, 0.2 mmol) and **2a** (50.0 mg, 1.0 equiv.) as a pale yellow solid (59.6 mg, 59%).

R_f = 0.125 (DCM:Hex = 3:1).

mp.: 126.5-127.3 ℃.

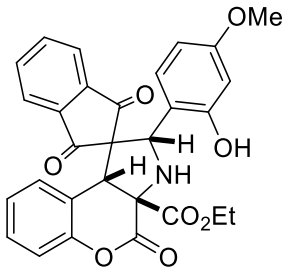
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) (mixture of rotamers) δ/ppm: 10.06 (s, 1H), 9.58 (s, 1H'), 7.95 (d, J = 7.7 Hz, 1H), 7.78-7.74 (m, 4H'), 7.71 (t, J = 7.5 Hz, 1H), 7.61 (t, J = 7.3 Hz, 1H), 7.50 (d, J = 7.7 Hz, 1H), 7.26-7.10 (m, 2H'+1H), 7.07 (d, J = 8.2 Hz, 1H), 6.87-6.77 (m, 2H'+2H), 6.67 (dd, J = 8.5, 2.4 Hz, 2H'), 6.59 (d, J = 8.9 Hz, 1H), 6.46 (dd, J = 8.9, 3.0 Hz, 1H), 6.01 (d, J = 3.0 Hz, 1H), 5.89 (d, J = 2.4 Hz, 1H'), 5.12 (d, J = 4.8 Hz, 1H), 4.95 (d, J = 5.9 Hz, 1H'), 4.70 (s, 1H'), 4.38 (s, 1H), 4.23 (q, J = 7.1 Hz, 3H'+3H), 3.42 (s, 3H), 3.37 (s, 3H'), 1.16 (t, J = 7.1 Hz, 3H'), 1.10 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 199.1 (C'), 198.0, 196.9, 196.0 (C'), 168.8, 167.2 (C'), 166.2 (C'), 164.8, 155.7 (C'), 152.0 (C'), 151.7, 151.4 (C'), 150.8, 150.7, 144.6 (C'), 143.2 (C'), 142.5, 142.4, 141.2 (C'), 136.4, 135.8, 130.1 (C'), 129.8, 127.7 (C'), 127.1, 124.6 (C'), 124.4, 123.5 (C'), 123.4 (C'), 123.3, 122.9, 120.5 (C'), 119.0, 118.3 (C'), 118.2 (C'), 117.4, 117.2 (C'), 116.6 (C'), 116.5, 116.2, 115.8, 115.7 (C'), 115.3 (C'), 112.3 (C'), 111.6, 70.8, 69.7 (C'), 69.0, 68.1 (C'), 67.6, 63.8, 63.3 (C'), 55.5, 55.4 (C'), 49.7 (C'), 49.3, 13.60 (C'), 13.56.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3317, 2929, 2855, 1774, 1742, 1708, 1591, 1492, 1252, 1161.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1503.

Ethyl-2-(2-hydroxy-4-methoxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3fa).



Following the TP-C, **3fa** was obtained from **1f** (76.5 mg, 0.2 mmol) and **2b** (50.0 mg, 1.0 equiv.) as a pale yellow solid (72.9 mg, 71%).

R_f = 0.150 (DCM:Hex = 3:1).

mp.: 123.9-124.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.63 (s, 1H), 10.44 (s, 1H'),

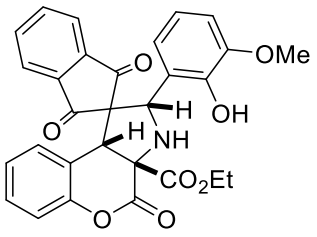
7.93 (d, *J* = 7.6 Hz, 1H), 7.78-7.66 (m, 3H'+1H), 7.61 (t, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 8.1 Hz, 1H'), 7.21-7.12 (m, 2H'+1H), 7.07 (d, *J* = 8.2 Hz, 1H), 6.89-6.77 (m, 1H'+2H), 6.67 (d, *J* = 7.4 Hz, 1H'), 6.44(d, *J* = 1.9 Hz, 1H'), 6.37 (d, *J* = 8.6 Hz, 1H), 6.21 (d, *J* = 1.9 Hz, 1H), 6.09 (d, *J* = 8.3 Hz, 1H'), 5.98 (dd, *J* = 8.3, 1.9 Hz, 1H'), 5.91 (dd, *J* = 8.3, 1.9 Hz, 1H), 5.14 (d, *J* = 6.3 Hz, 1H), 4.96 (d, *J* = 5.8 Hz, 1H'), 4.72 (s, 1H'), 4.35 (s, 1H) , 4.30-4.15 (m, 3H'+3H), 3.71 (s, 3H'), 3.58 (s, 3H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: (mixture of rotamers) 199.1 (C'), 198.3, 197.5, 196.3 (C'), 169.0, 167.1 (C'), 166.2 (C'), 164.9, 161.2 (C'), 160.7, 159.2 (C'), 158.6, 151.6 (C'), 150.9, 143.3 (C'), 142.61, 142.58, 141.6 (C'), 136.44, 136.37 (C'), 135.9 (C'), 135.8, 130.2 (C'), 129.9, 128.35 (C'), 128.27, 127.8 (C'), 127.1, 124.8 (C'), 124.4, 123.7 (C'), 123.6 (C'), 123.4, 123.1, 117.6, 117.3 (C'), 116.9 (C'), 116.0, 111.4 (C'), 108.5, 106.0, 105.8 (C'), 102.6 (C'), 102.5, 71.0, 69.7 (C'), 69.2, 68.7 (C'), 68.3 (C'), 67.5, 64.0, 63.5 (C'), 55.1 (C'), 55.0, 49.7 (C'), 49.5, 13.73 (C'), 13.69.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3324, 2925, 2854, 1775, 1742, 1708, 1591, 1501, 1251,1180.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1506.

Ethyl-2-(2-hydroxy-3-methoxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ga).



Following the TP-C, **3ga** was obtained from **1g** (76.5 mg, 0.2 mmol) and **2b** (50.0 mg, 1.0 equiv.) as a pale yellow solid (81.1 mg, 79%).

R_f = 0.138 (DCM:Hex:EA = 1:3:1).

mp.: 142.5-143.5 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: (mixture of rotamers) 7.92 (d, *J* = 7.6 Hz, 1H), 7.79-7.69 (m, 1H+2H'), 7.67 (t, *J* = 7.5 Hz, 1H), 7.54 (t, *J* = 7.5 Hz, 1H), 7.42 (d, *J* = 7.6 Hz, 1H), 7.22-7.11 (m, 4H'), 7.08 (t, *J* = 7.7 Hz, 1H+1H'), 6.89-6.74 (m, 3H'+2H), 6.68-6.62 (m, 1H'+1H), 6.55-6.47 (m, 2H), 5.35 (s, 1H), 5.14 (s, 1H'), 4.58 (s, 1H'), 4.54 (s, 1H) , 4.23 (q, *J* = 7.1 Hz, 2H'+2H), 3.80 (s, 3H'), 3.67 (s, 3H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.13 (t, *J* = 7.2 Hz, 3H).

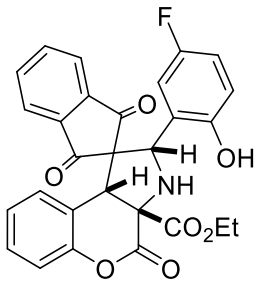
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: (mixture of rotamers) 199.8 (C'), 197.7, 196.8 (C'), 197.2, 169.4, 168.0 (C'), 166.8 (C'), 165.6, 151.4 (C'), 150.9, 147.0, 146.5 (C'), 144.9, 143.4

(C'), 143.2 (C'), 142.7, 141.2 (C'), 142.1, 135.7, 135.5 (C'), 135.4, 129.8 (C'), 129.6, 127.8 (C'), 127.4, 124.4 (C'), 124.3, 123.9 (C'), 123.3 (C'), 123.0 (C'), 122.9, 122.8, 120.1 (C'), 119.6, 119.3 (C'), 119.0, 118.8, 117.4, 117.2 (C'), 116.9 (C'), 116.4, 111.0, 110.5 (C'), 70.9, 69.8 (C'), 67.9, 66.0, 63.6 (C'), 63.5, 63.0 (C'), 56.0, 55.9 (C'), 50.1 (C'), 49.8, 13.8 (C'), 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3324, 2925, 2854, 1775, 1742, 1708, 1591, 1501, 1251,1180.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1503.

Ethyl-2-(5-fluoro-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ha).



Following the TP-C, **3ha** was obtained from **1h** (59.5 mg, 0.2 mmol) and **2b** (50.0 mg, 1.0 equiv.) as a pale yellow solid (46.1 mg, 46%).

R_f = 0.350 (DCM:Hex:EA = 1:5:1).

mp.: 164.8-165.3 ℃.

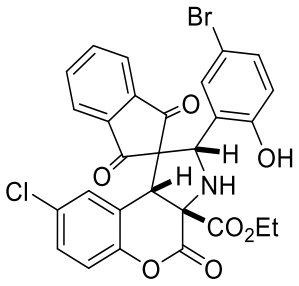
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of 3 rotamers) 7.98 (d, J = 7.6 Hz, 1H''+1H), 7.84-7.71 (m, 4H'+1H), 7.63 (t, J = 7.4 Hz, 1H''+1H), 7.52 (d, J = 7.6 Hz, 1H''+1H), 7.26-7.16 (m, 1H+1H'+1H''), 7.13 (d, J = 8.2 Hz, 1H'), 7.07 (d, J = 8.2 Hz, 1H+1H''), 6.93-6.77 (m, 2H+2H'+2H''), 6.68-6.51(m, 2H+2H'+2H''), 6.21 (dd, J = 2.5, 8.4 Hz, 1H+1H''), 6.13 (d, J = 8.3 Hz, 1H'), 5.11 (s, 1H), 5.08 (s, 1H''), 4.96 (s, 1H'), 4.66 (s, 1H'), 4.36 (s, 1H), 4.32 (s, 1H''), 4.23 (q, J = 7.1 Hz, 2H+2H'+2H''), 1.19-1.02 (m, 3H''+3H'+3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of 3 rotamers) 198.9, 197.8, 197.4, 196.8, 196.6, 196.1, 168.8, 168.6, 167.2, 166.0, 164.7, 164.4, 157.4, 156.8, 156.3, 154.4, 154.0, 153.5 (d, J = 1.6 Hz), 153.3 (d, J = 1.6 Hz), 153.2 (d, J = 2.4 Hz), 151.5, 150.9, 143.1, 142.5, 142.4, 142.4, 142.3, 141.3, 136.7, 136.5, 136.3, 136.1, 136.1, 130.3, 130.0, 127.8, 127.2, 124.7, 124.5, 123.7 (d, J = 14.6 Hz), 123.3 (d, J = 21.5 Hz), 119.4 (d, J = 7.6 Hz), 119.1 (d, J = 8.5 Hz), 118.8 (d, J = 7.7 Hz), 117.6, 117.4, 117.0, 117.0, 116.6, 116.4, 116.4, 115.7, 113.8 (d, J = 23.7 Hz), 113.3 (d, J = 23.5 Hz), 77.3, 77.0, 76.7, 70.8, 69.7, 68.8, 68.6, 68.0, 67.7, 67.4, 67.2, 64.2, 64.0, 63.6, 50.3, 49.6, 49.1, 13.7, 13.6. (major and minor rotamers could not be identified)

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3318, 3072.6, 2986, 1774, 1742, 1708, 1591, 1497, 1176.

HRMS (ESI) for $C_{28}H_{21}FNO_7$, $[M+H]^+$ (502.1297) found: 502.1302.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-8-chloro-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ab).



Following the TP-C, **3ab** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2b** (57.0 mg, 1.0 equiv.) as a white solid (89.5 mg, 75%).

R_f = 0.438 (Hex:DCM:EA = 3:1:1).

mp.: 277.1-278.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.59 (s, 1H), 9.97 (s, 1H'), 8.02 (d, J = 7.6 Hz, 1H), 7.86-7.76 (m, 1H+4H'), 7.67 (t, J = 7.6 Hz, 1H), 7.52 (d, J = 7.6 Hz, 1H), 7.17 (dd, J = 8.8, 2.4 Hz, 1H+2H'), 7.10 (d, J = 8.9 Hz, 1H'), 7.04 (d, J = 8.8 Hz, 1H), 6.94 (dd, J = 8.8, 2.0 Hz, 1H), 6.83 (d, J = 2.1 Hz, 1H), 6.76 (d, J = 8.9 Hz, 1H'), 6.67 (d, J = 2.3 Hz, 1H'), 6.58-6.49 (m, 2H), 6.43 (s, 1H'), 5.05 (d, J = 7.0 Hz, 1H), 4.88 (d, J = 5.9 Hz, 1H'), 4.62 (s, 1H'), 4.33-4.19 (m, 4H+3H'), 1.20 (t, J = 7.1 Hz, 3H'), 1.14 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 198.4 (C'), 197.2, 196.7, 195.6 (C'), 168.3, 166.8 (C'), 165.5 (C'), 164.2, 156.5 (C'), 156.4, 150.1 (C'), 149.5, 143.1 (C'), 142.4, 142.1, 141.2 (C'), 136.8, 136.4, 132.8 (C'), 132.5, 130.4 (C'), 130.3, 130.2 (C'), 129.9, 129.6, 127.5 (C'), 127.0, 123.9 (C'), 123.8 (C'), 123.5, 123.4, 121.8 (C'), 120.3, 119.7 (C'), 119.0, 118.7 (C'), 118.3 (C'), 118.1, 117.5, 110.8 (C'), 110.2, 71.0, 69.4 (C'), 68.7, 68.2 (C'), 67.6 (C'), 67.4, 64.3, 63.8 (C'), 49.0 (C'), 48.5, 13.74 (C'), 13.69.

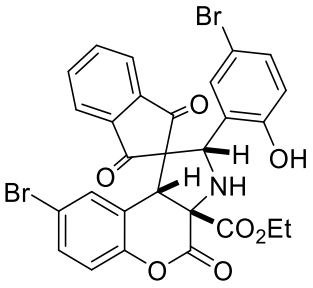
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3316, 2985, 1778, 1742, 1707, 1591, 1484, 1253, 1174.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br^{35}ClNO_7$, $[M+H]^+$ (596.0106) found: 596.0114.

HRMS (ESI) for $C_{28}H_{20}{}^{81}Br^{35}ClNO_7$, $[M+H]^+$ (598.0086) found: 598.0095.

HRMS (ESI) for $C_{28}H_{20}{}^{81}Br^{37}ClNO_7$, $[M+H]^+$ (600.0057) found: 600.0122.

Ethyl-8-bromo-2-(5-bromo-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ac).



Following the TP-C, **3ac** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2c** (65.9 mg, 1.0 equiv.) as a white solid (92.3 mg, 72%).

R_f= 0.450 (Hex:DCM:EA = 3:1:1).

mp.: 285.7-286.7 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.59 (s, 1H), 10.02 (s, 1H'), 8.02 (d, *J* = 7.5 Hz, 1H), 7.88-7.74 (m, 1H+4H'), 7.68 (t, *J* = 7.5 Hz, 1H), 7.53 (d, *J* = 7.5 Hz, 1H), 7.36 (dd, *J* = 8.6, 2.0 Hz, 1H'), 7.32 (dd, *J* = 8.6, 2.1 Hz, 1H), 7.18 (dd, *J* = 8.6, 2.0 Hz, 1H'), 7.04 (d, *J* = 8.8 Hz, 1H'), 7.00-6.96 (m, 2H), 6.94 (dd, *J* = 8.9, 2.2 Hz, 1H), 6.82 (d, *J* = 2.2 Hz, 1H'), 6.76 (d, *J* = 8.8 Hz, 1H'), 6.55 (d, *J* = 8.9 Hz, 1H), 6.52 (d, *J* = 2.2 Hz, 1H), 6.38 (s, 1H'), 5.05 (d, *J* = 6.9 Hz, 1H), 4.88 (d, *J* = 6.2 Hz, 1H'), 4.62 (s, 1H'), 4.34-4.18 (m, 4H+3H'), 1.21 (t, *J* = 7.1 Hz, 3H'), 1.14 (t, *J* = 7.0 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 198.4 (C'), 197.2, 196.7, 195.5(C'), 168.3, 166.8 (C'), 165.4 (C'), 164.1, 156.6 (C'), 156.4, 150.7 (C'), 150.1, 143.1 (C'), 142.5, 142.2, 141.2 (C'), 136.9 (C'), 136.8, 136.4, 133.4 (C'), 133.2, 132.9 (C'), 132.6, 130.4 (C'), 130.1 (C'), 129.90, 129.87, 124.0 (C'), 123.8 (C'), 123.5, 123.4, 121.5 (C'), 120.3, 119.8 (C'), 119.4, 119.1 (C'), 118.8(C'), 118.05, 117.98, 117.3 (C'), 116.9, 110.7 (C'), 110.2, 71.1, 69.5 (C'), 68.8, 68.2 (C'), 67.7 (C'), 67.4, 64.3, 63.8 (C'), 48.9(C'), 48.5, 13.75 (C'), 13.70.

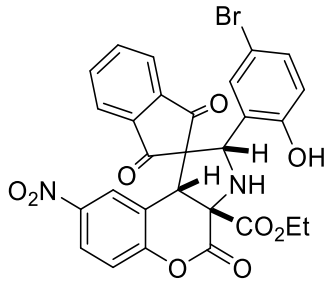
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3315, 2981, 1777, 1742, 1707, 1591, 1482, 1252, 1174.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br_2NO_7$, $[M+H]^+$ (639.9601) found: 639.9609.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br^{81}BrNO_7$, $[M+H]^+$ (641.9581) found: 641.9592.

HRMS (ESI) for $C_{28}H_{20}{}^{81}Br_2NO_7$, $[M+H]^+$ (643.9561) found: 643.9577.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-8-nitro-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (**3ad**).



Following the TP-C, **3ad** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2d** (65.9 mg, 1.0 equiv.) as a white solid (87.5 mg, 72%).

R_f= 0.225 (DCM:Hex:EA = 1:3:1).

mp.: 230.9-231.4 ℃.

^{1}H NMR (400 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: (mixture of rotamers) 9.75 (s, 1H), 9.18 (s, 1H'), 8.18-8.08 (m, 1H+2H'), 8.00 (d, J = 7.7 Hz, 1H), 7.93-7.79 (m, 2H+2H'), 7.75 (d, J = 2.7 Hz, 1H), 7.73-7.67 (m, 1H+1H'), 7.58 (d, J = 2.6 Hz, 1H'), 7.53-7.47 (m, 1H), 7.42-7.29 (m, 3H'+1H), 7.20 (dd, J = 8.5, 2.5 Hz, 1H'), 6.97 (dd, J = 8.6, 2.5 Hz, 1H), 6.57 (d, J = 8.5 Hz, 1H'), 6.36 (d, J = 8.6 Hz, 1H), 5.40-5.33 (m, 1H), 5.15-5.07 (m, 1H'), 4.84 (s,1H), 4.60 (s, 1H'), 4.56-4.45 (m, 1H), 4.32-4.16 (m, 2H+2H'), 1.18 (t, J = 7.1 Hz, 3H'), 1.12 (t, J = 7.1 Hz, 3H).

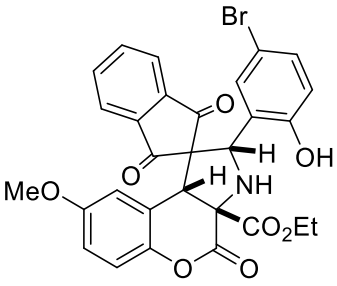
^{13}C NMR (100 MHz, $(CD_3)_2CO$, 25 ℃) δ/ppm: (mixture of rotamers) 200.8, 198.4, 197.4, 197.0, 169.7, 169.7, 168.9, 166.3, 165.6, 156.9, 156.5, 155.4, 154.1, 144.5, 144.1, 142.2, 141.7, 137.4, 137.3, 137.2, 136.9, 132.3, 132.2, 131.9, 131.7, 129.8, 126.5, 126.3, 125.1, 124.8, 124.3, 124.0, 123.8, 123.7, 123.2, 119.7, 119.1, 117.7, 117.0, 111.9, 111.3, 71.4, 70.3, 70.2, 68.5, 68.5, 68.3, 64.8, 64.7, 64.3, 63.9, 62.8, 62.7, 50.6, 50.1, 14.1, 13.9. (major and minor rotamers could not be identified)

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3319, 3086, 2926, 2362, 2344, 1786, 1742, 1709, 1592, 1484, 1252, 1170.

HRMS (ESI) for $C_{28}H_{20}{}^{79}BrN_2O_9$, $[M+H]^+$ (607.0347) found: 607.0352.

HRMS (ESI) for $C_{28}H_{20}{}^{81}BrN_2O_9$, $[M+H]^+$ (609.0326) found: 609.0335.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-8-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ae).



Following the TP-C, **3ae** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2e** (56.1 mg, 1.0 equiv.) as a pale yellow solid (85.3 mg, 72%).

R_f = 0.150 (DCM:Hex = 3:1).

mp.: 269.3-270.3 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.73 (s, 1H), 10.24 (s, 1H'), 8.00 (d, J = 7.7 Hz, 1H), 7.77 (t, J = 7.8 Hz, 4H'+1H), 7.65 (t, J = 7.5 Hz, 1H), 7.52 (d, J = 7.7 Hz, 1H), 7.18 (dd, J = 8.6, 2.4 Hz, 1H'), 7.07 (d, J = 9.1 Hz, 1H'), 7.01 (d, J = 9.1 Hz, 1H), 7.00 (d, J = 9.1 Hz, 1H), 6.94 (dd, J = 8.8, 2.3 Hz, 1H), 6.80-6.74 (m, 2H'), 6.72 (dd, J = 9.0, 2.9 Hz, 1H), 6.55 (d, J = 8.8 Hz, 1H) 6.54 (d, J = 2.3 Hz, 1H), 6.40 (s, 1H'), 6.29 (d, J = 2.9 Hz, 1H), 6.13 (d, J = 2.9 Hz, 1H'), 5.07 (d, J = 6.9 Hz, 1H), 4.92 (d, J = 6.3 Hz, 1H'), 4.60 (s, 1H'), 4.31 (s, 1H), 4.30-4.16 (m, 3H'+2H), 3.55 (s, 3H), 3.50 (s, 3H'), 1.19 (t, J = 7.1 Hz, 3H'), 1.13 (t, J = 7.1 Hz, 3H).

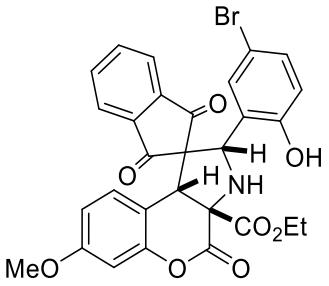
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 198.5 (C'), 197.7, 196.7, 196.0 (C'), 168.8, 167.2 (C'), 166.0 (C'), 164.8, 156.8 (C'), 156.6, 156.1 (C'), 155.9, 145.4 (C'), 144.8, 143.0 (C'), 142.5, 142.4, 141.4 (C'), 136.7, 136.6 (C'), 136.23 (C'), 136.15, 132.8 (C'), 132.5, 130.0 (C'), 129.8, 123.9 (C'), 123.6, (C') 123.5, 123.2, 121.9 (C'), 120.3, 119.8 (C'), 118.5, 118.3, 117.1 (C'), 116.3, 115.6 (C'), 115.5, 112.5 (C'), 111.7, 110.7 (C'), 110.1, 71.0, 69.6 (C'), 68.6, 68.1 (C'), 67.5, 64.1, 63.6 (C'), 55.5, 50.2 (C'), 49.5, 13.75 (C'), 13.71.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3318, 2986, 2938, 2835, 1769, 1741, 1708, 1592, 1499, 1250, 1181.

HRMS (ESI) for $C_{29}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (592.0602) found: 592.0607.

HRMS (ESI) for $C_{29}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (594.0581) found: 594.0591.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-7-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3af).



Following the TP-C, **3af** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2f** (56.1 mg, 1.0 equiv.) as a pale yellow solid (72.3 mg, 61%).

R_f = 0.175 (DCM:Hex = 4:1).

mp.: 132.7-133.0 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.74 (s, 1H), 10.26 (s, 1H'), 7.98 (d, J = 7.6 Hz, 1H), 7.84-7.72 (m, 4H'+1H), 7.65 (td, J = 7.6, 0.6 Hz, 1H), 7.52 (d, J = 7.6 Hz, 1H), 7.18 (dd, J = 8.7, 1.2 Hz, 1H'), 6.94 (dd, J = 8.8, 2.4 Hz, 1H), 6.78 (d, J = 8.7 Hz, 1H'), 6.70 (d, J = 8.8 Hz, 1H), 6.67 (d, J = 2.4 Hz, 1H'), 6.60 (d, J = 2.5 Hz, 1H), 6.58-6.51 (m, 1H'+2H), 6.43 (s, 1H'), 6.41-6.34 (m, 1H+1H'), 5.07 (d, J = 6.7 Hz, 1H), 4.94 (d, J = 6.3 Hz, 1H'), 4.60 (s, 1H'), 4.31 (s, 1H), 4.24 (q, J = 7.1 Hz, 3H+3H'), 3.73 (s, 3H'), 3.71 (s, 3H), 1.19 (t, J = 7.1 Hz, 3H'), 1.13 (t, J = 7.1 Hz, 3H).

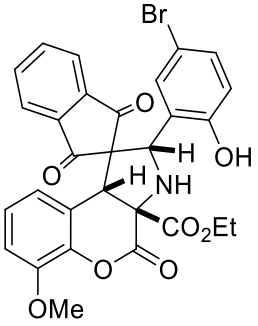
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 199.1 (C'), 197.9, 197.2, 196.2 (C'), 168.8, 167.3 (C'), 166.1 (C'), 161.0 (C'), 164.8, 160.8, 156.9 (C'), 156.6, 152.4 (C'), 151.8, 143.1 (C'), 142.6, 142.4, 141.4 (C'), 136.6, 136.2 (C'), 136.1, 132.8 (C'), 132.4, 129.9 (C'), 129.8, 128.5 (C'), 127.9, 123.9 (C'), 123.7 (C'), 123.5, 123.2, 122.2 (C'), 120.3, 119.8 (C'), 118.5, 111.3, 110.7 (C'), 110.1, 107.9 (C'), 107.4, 102.5 (C'), 102.4, 70.9, 69.8 (C'), 68.5, 68.1 (C'), 67.7, 67.3 (C'), 64.1, 63.7 (C'), 55.5 (C'), 55.4, 50.1 (C'), 49.2, 13.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3318, 2936, 1771, 1708, 1627, 1590, 1484, 1162, 1109, 738, 630.

HRMS (ESI) for $C_{29}H_{23}{}^{79}BrNO_8$**,** $[M+H]^+$ (592.0602) found: 592.0610.

HRMS (ESI) for $C_{29}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (594.0581) found: 594.0594.

Ethyl-2-(5-bromo-2-hydroxyphenyl)-6-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (3ag).



Following the TP-C, **3ag** was obtained from **1a** (71.6 mg, 0.2 mmol) and **2g** (56.1 mg, 1.0 equiv.) as a pale yellow solid (56.9 mg, 48%).

R_f = 0.225 (Hex:DCM:EA = 3:1:1).

mp.: 243.8-244.8 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.67 (s, 1H), 10.28 (s, 1H'), 7.99 (d, J = 7.6 Hz, 1H), 7.77 (t, J = 7.6 Hz, 1H+4H'), 7.64 (t, J = 7.6 Hz, 1H), 7.52 (d, J = 7.6 Hz, 1H), 7.18 (d, J = 8.6 Hz, 1H'), 6.94 (dd, J = 8.8, 2.3 Hz, 1H), 6.84-6.74 (m, 2H+3H'), 6.58-6.52 (m, 2H), 6.42-6.35 (m, 1H+1H'), 6.21 (d, J = 7.4 Hz, 1H'), 5.07 (d, J = 7.1 Hz, 1H), 4.94

(d, J = 6.2 Hz, 1H'), 4.66 (s, 1H'), 4.36 (s, 1H), 4.32-4.17 (m, 3H+3H'), 3.89 (s, 3H'), 3.85 (s, 3H), 1.18 (t, J = 7.0 Hz, 3H'), 1.13 (t, J = 7.1 Hz, 3H).

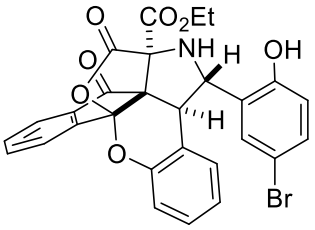
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 198.6 (C'), 197.7, 196.8, 196.1 (C'), 168.7, 167.1 (C'), 165.4 (C'), 164.1, 156.5 (C'), 156.4, 147.7, 147.6 (C'), 143.0 (C'), 142.5, 142.2, 141.3 (C'), 140.8 (C'), 140.3, 136.5, 136.4 (C'), 135.8 (C'), 136.1, 132.6 (C'), 132.3, 130.0 (C'), 129.8, 127.1 (C'), 124.7 (C'), 124.4, 123.7 (C'), 123.4, 123.5 (C'), 123.1, 122.2 (C'), 120.2, 119.5 (C'), 118.8 (C'), 118.4, 118.2, 117.2 (C'), 116.5, 112.8 (C'), 112.6, 110.7 (C'), 110.0, 70.9, 69.5 (C'), 68.4, 68.0 (C'), 67.4, 67.0 (C'), 64.0, 63.5 (C'), 56.1, 50.1 (C'), 49.4, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3317, 2981, 2937, 1769, 1742, 1707, 1589, 1485, 1254, 1180.

HRMS (ESI) for $C_{29}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (592.0602) found: 592.0610.

HRMS (ESI) for $C_{29}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (594.0581) found: 594.0594.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano) indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4aa).



Following the TP-D, **4aa** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (88.9 mg, 79%).

R_f = 0.375 (Hex:DCM = 1:1).

mp.: 155.4-156.4 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 10.2 (s, 1H), 8.04 (d, J = 7.6 Hz, 1H), 7.85 (t, J = 7.6 Hz, 1H), 7.70 (d, J = 7.6 Hz, 1H), 7.61 (t, J = 7.6 Hz, 1H), 7.30 (dd, J = 8.7, 1.4 Hz, 1H), 7.17 (d, J = 7.8 Hz, 1H), 6.97 (d, J = 8.1 Hz, 1H), 6.93-6.81 (m, 2H), 6.56-6.43 (m, 2H), 4.39 (d, J = 8.1 Hz, 1H), 4.24-4.07 (m, 2H), 3.97 (d, J = 10.2 Hz, 1H), 3.89 (s, 1H), 1.08 (t, J = 7.1 Hz, 3H).

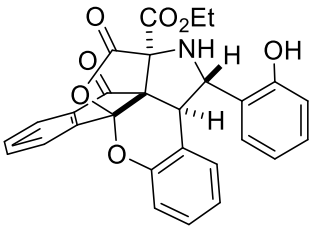
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 196.0, 171.9, 165.7, 156.3, 149.6, 146.3, 137.4, 136.6, 132.6, 132.4, 131.6, 130.1, 129.5, 125.0, 124.2, 123.4, 122.4, 120.9, 119.8, 118.6, 110.8, 110.1, 75.4, 68.1, 67.4, 63.5, 50.6, 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3314, 2923, 2358, 1802, 1763, 1731, 1603, 1482, 1278, 1196.

HRMS (ESI) for $C_{28}H_{21}{}^{79}BrNO_7$, $[M+H]^+$ (562.0496) found: 562.0501.

HRMS (ESI) for $C_{28}H_{21}{}^{81}BrNO_7$, $[M+H]^+$ (564.0475) found: 564.0501.

Ethyl-3-(2-hydroxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno [1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ba).



Following the TP-D, **4ba** was obtained from **1b** (55.9 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (62.9 mg, 65 %).

R_f = 0.463 (EA:Hex:DCM = 1:3:1).

mp.: 253.0-254.0 ℃.

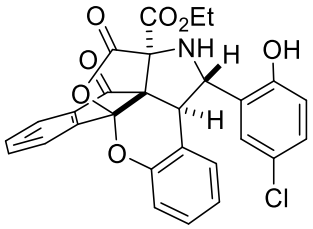
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.03 (d, J = 7.8 Hz, 1H), 7.84 (t, J = 7.4 Hz, 1H), 7.70 (d, J = 7.7 Hz, 1H), 7.60 (t, J = 7.4 Hz, 1H), 7.21 (t, J = 7.7 Hz, 1H), 7.13 (t, J = 7.7 Hz, 1H), 6.99 (d, J = 8.1 Hz, 1H), 6.96 (d, J = 8.2 Hz, 1H), 6.79 (t, J = 7.3 Hz, 1H), 6.63 (t, J = 7.3 Hz, 1H), 6.46 (d, J = 7.4 Hz, 1H), 6.35 (d, J = 7.4 Hz, 1H), 4.46 (d, J = 10.3 Hz, 1H), 4.28-4.08 (m, 2H), 3.99 (d, J = 10.3 Hz, 1H), 1.10 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 196.0, 172.1, 165.8, 157.1, 149.7, 146.3, 137.2, 136.6, 132.3, 129.9, 129.8, 129.6, 129.2, 125.0, 124.0, 123.4, 121.1, 120.1, 119.1, 118.4, 118.0, 110.1, 75.3, 68.0, 67.8, 63.4, 50.4, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3314, 3080, 2927, 2985, 2857, 1798, 1765, 1729, 1601, 1590, 1487, 1486.

HRMS (ESI) for $C_{28}H_{22}NO_7$, $[M+H]^+$ (484.1391) found: 484.1393.

Ethyl-3-(5-chloro-2-hydroxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano) indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ca).



Following the TP-D, **4ca** was obtained from **1c** (62.7 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (73.8 mg, 71%).

R_f = 0.463 (EA:Hex:DCM = 1:3:1)

mp.: 237.3-238.0 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 10.19 (s, 1H), 8.03 (d, J = 7.7 Hz, 1H), 7.84 (t, J = 7.4 Hz, 1H), 7.70 (d, J = 7.7 Hz, 1H), 7.60 (t, J = 7.4 Hz, 1H), 7.22-7.11 (m, 2H), 6.95 (t, J

= 10.1 Hz, 2H), 6.85 (t, *J* = 7.4 Hz, 1H), 6.51 (d, *J* = 7.3 Hz, 1H), 6.34 (s, 1H), 4.42 (d, *J* = 10.2 Hz, 1H), 4.26-4.07 (m, 2H), 3.96 (d, *J* = 10.2 Hz, 1H), 3.80 (s, 1H), 1.08 (t, *J* = 7.1 Hz, 3H).

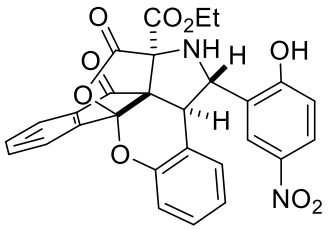
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 195.8, 171.8, 165.7, 155.8, 149.6, 146.2, 137.3, 136.6, 132.4, 130.1, 129.7, 129.4, 128.6, 125.0, 124.2, 123.6, 123.4, 121.7, 120.8, 119.4, 118.6, 110.1, 75.2, 68.0, 67.3, 63.5, 50.4, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3313, 3068, 2986, 2360, 1803, 1764, 1730, 1603, 1485, 1463.

HRMS (ESI) for $C_{28}H_{21}{}^{35}Cl\,NO_7$, $[M+H]^+$ (518.1001) found: 518.1006.

HRMS (ESI) for $C_{28}H_{21}{}^{37}Cl\,NO_7$, $[M+H]^+$ (520.0972) found: 520.1000.

Ethyl-3-(2-hydroxy-5-nitrophenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano) indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4da).



Following the TP-D, **4da** was obtained from **1d** (64.9 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (52.9 mg, 50%).

R_f = 0.388 (EA:Hex:DCM = 1:3:1)

mp.: 253.2-254.7 ℃.

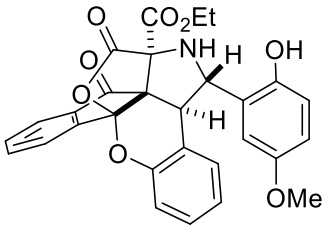
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 11.38 (s, 1H), 8.15 (dd, *J* = 8.0, 2.7 Hz, 1H), 8.05 (d, *J* = 7.8 Hz, 1H), 7.87 (t, *J* = 7.5 Hz, 1H), 7.71 (d, *J* = 7.7 Hz, 1H), 7.63 (t, *J* = 7.5 Hz, 1H), 7.33 (d, *J* = 2.6 Hz, 1H), 7.19 (t, *J* = 7.5 Hz, 1H), 7.08 (d, *J* = 9.0 Hz, 1H), 7.00 (d, *J* = 8.0 Hz, 1H), 6.84 (t, *J* = 7.5 Hz, 1H), 6.45 (d, *J* = 7.0 Hz, 1H), 4.61 (d, *J* = 10.3 Hz, 1H), 4.28-4.10 (m, 2H), 3.92 (s, 1H), 3.90 (s, 1H), 1.09 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 195.5, 171.5, 165.5, 163.4, 149.6, 146.1, 139.9, 137.5, 136.5, 132.5, 130.6, 129.1, 126.0, 125.1, 125.1, 124.5, 123.5, 120.6, 120.3, 118.9, 118.6, 110.1, 75.0, 68.0, 67.2, 63.7, 50.7, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3314, 2927, 2853, 1802, 1763, 1733, 1587, 1520, 1486, 1461.

HRMS (ESI) for $C_{28}H_{21}N_2O_9$, $[M+H]^+$ (529.1242) found: 529.1248.

Ethyl-3-(2-hydroxy-5-methoxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ea).



Following the TP-D, **4ea** was obtained from **1e** (63.1 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (27.2 mg, 26%).

R_f = 0.450 (EA:Hex:DCM = 1:3:1)

mp.: 186.8-187.8 ℃.

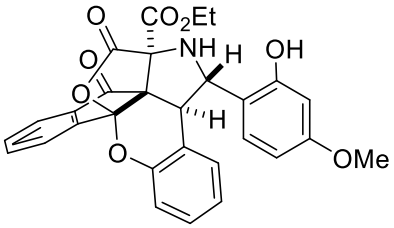
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 10.17 (s, 1H), 8.04 (d, J = 7.8 Hz, 1H), 7.85 (t, J = 7.5 Hz, 1H), 7.71 (d, J = 7.7 Hz, 1H), 7.60 (t, J = 7.5 Hz, 1H), 7.14 (t, J = 7.7 Hz, 1H), 6.95 (d, J = 8.0 Hz, 1H), 6.81 (t, J = 7.4 Hz, 1H), 6.56 (d, J = 2.2 Hz, 1H), 6.51 (d, J = 7.4 Hz, 1H), 6.25 (d, J = 8.4 Hz, 1H), 6.20 (dd, J = 8.0, 2.3 Hz, 1H), 4.42 (d, J = 10.2 Hz, 1H), 4.27-4.10 (m, 2H), 3.94 (d, J = 10.2 Hz, 1H), 3.78 (s, 3H), 3.53 (s, 1H), 1.10 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 196.1, 172.2, 165.8, 161.2, 158.4, 149.7, 146.4, 137.3, 136.7, 132.3, 129.9, 129.8, 129.7, 125.0, 124.0, 123.4, 121.2, 118.4, 112.3, 110.1, 105.5, 103.1, 75.1, 68.0, 67.5, 63.4, 55.2, 50.5, 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3309, 2920, 2851, 1800, 1760, 1728, 1603, 1588, 1487, 1464.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1498.

Ethyl-3-(2-hydroxy-4-methoxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4fa).



Following the TP-D, **4fa** was obtained from **1f** (63.1 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (10.5 mg, 10%).

R_f = 0.375 (EA:Hex:DCM = 1:3:1)

mp.: 261.8-262.3 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.03 (d, J = 7.8 Hz, 1H), 7.84 (t, J = 7.5 Hz, 1H), 7.70 (d, J = 7.7 Hz, 1H), 7.60 (t, J = 7.5 Hz, 1H), 7.13 (t, J = 7.7 Hz, 1H), 6.95 (d, J = 8.0 Hz, 1H), 6.81 (t, J = 7.5 Hz, 1H), 6.56 (s, 1H), 6.51 (d, J = 7.4 Hz, 1H), 6.25 (d, J = 8.4 Hz, 1H), 6.19 (d, J = 8.4 Hz, 1H), 4.41 (d, J = 10.2 Hz, 1H), 4.27-4.08 (m, 2H), 3.94 (d, J = 10.2 Hz,

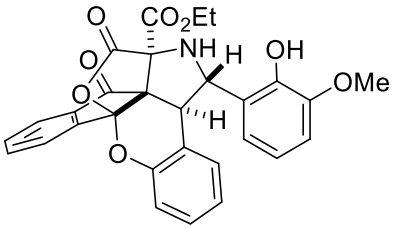
1H), 3.77 (s, 3H), 1.10 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 196.0, 172.2, 165.8, 161.2, 158.4, 149.7, 146.4, 137.2, 136.7, 132.3, 129.9, 129.8, 129.7, 125.0, 124.0, 123.4, 121.3, 118.4, 112.3, 110.1, 105.5, 103.1, 75.1, 68.0, 67.5, 63.4, 55.2, 50.5, 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3295, 3081, 2991, 1802, 1766, 1730, 1626, 1589, 1511, 1487, 1459.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1496.

Ethyl-3-(2-hydroxy-3-methoxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ga).



Following the TP-D, **4ga** was obtained from **1g** (63.1 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (49.2 mg, 47%).

R_f = 0.275 (EA:Hex:DCM = 1:3:1)

mp.: 228.7-229.5 ℃.

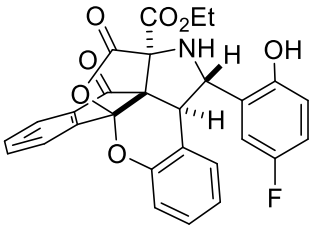
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.10 (s, 1H), 8.04 (d, J = 7.8 Hz, 1H), 7.83 (t, J = 7.5 Hz, 1H), 7.70 (d, J = 7.7 Hz, 1H), 7.59 (t, J = 7.5 Hz, 1H), 7.10 (t, J = 7.7 Hz, 1H), 6.94 (d, J = 8.0 Hz, 1H), 6.85 (d, J = 8.0 Hz, 1H), 6.76 (t, J = 7.4 Hz, 1H), 6.67 (t, J = 7.9 Hz, 1H), 6.50 (d, J = 7.4 Hz, 1H), 6.30 (d, J = 7.6 Hz, 1H), 4.43 (dd, J = 8.2, 8.0 Hz, 1H), 4.30-4.05 (m, 4H), 3.92 (s, 3H), 1.06 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 197.1, 172.0, 165.5, 149.7, 147.7, 146.6, 145.3, 137.0, 136.7, 132.1, 129.4, 129.3, 124.9, 123.7, 123.2, 121.7, 121.6, 120.9, 119.2, 118.2, 111.4, 109.9, 69.0, 67.5, 63.3, 56.1, 52.0, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3448, 3311, 3062, 2982, 2940, 2843, 1805, 1760, 1728, 1603, 1588, 1486.

HRMS (ESI) for $C_{29}H_{24}NO_8$, $[M+H]^+$ (514.1496) found: 514.1501.

Ethyl-3-(5-fluoro-2-hydroxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano) indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ha).



Following the TP-D, **4ha** was obtained from **1h** (61.3 mg, 0.2 mmol) and **2a** (60.0 mg, 1.2 equiv.) as a pale yellow solid (54.8 mg, 53%).

R_f = 0.500 (EA:Hex:DCM = 1:4:1)

mp.: 265.9-266.4 ℃.

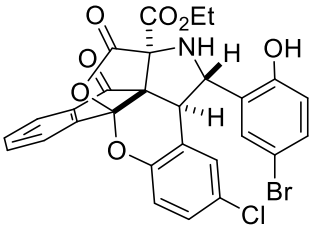
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 9.88 (s, 1H), 9.74 (s, 1H'), 8.04 (d, *J* = 7.8 Hz, 1H+1H'), 7.85 (t, *J* = 7.4 Hz, 1H+1H'), 7.71 (d, *J* = 7.6 Hz, 1H+1H'), 7.61 (t, *J* = 7.5 Hz, 1H+1H'), 7.16 (t, *J* = 7.7 Hz, 1H+1H'), 7.03-6.91 (m, 3H+1H'), 6.84 (t, *J* = 7.4 Hz, 1H+1H'), 6.51 (d, *J* = 7.4 Hz, 1H+1H'), 6.33 (d, *J* = 2.0 Hz, 1H'), 6.30-6.24 (m, 1H'), 6.19-6.14 (m, 1H'), 6.10 (d, *J* = 7.4 Hz, 1H), 4.41 (d, *J* = 10.2 Hz, 1H+1H'), 4.28-4.10 (m, 2H+2H'), 3.99 (d, *J* = 10.2 Hz, 1H), 3.95 (s, 1H'), 3.69 (s, 1H+1H'), 1.17 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 195.8, 172.0, 165.7, 155.6 (d, *J* = 237.7 Hz), 153.1 (d, *J* = 2.0 Hz), 149.7, 146.3, 137.3, 136.7, 132.6 (C'), 132.4, 130.2 (C'), 130.1, 129.5, 125.2 (C'), 125.0, 124.6 (C'), 124.2, 124.3, 123.5, 121.0 (d, *J* = 6.8 Hz), 120.9, 118.9 (d, *J* = 7.6 Hz), 118.6, 116.3 (d, *J* =22.7 Hz), 115.3 (d, *J* = 23.6 Hz), 110.1, 75.2, 68.0, 67.5, 63.6 (C'), 63.5, 50.4 (C'), 50.3, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3319, 3099, 2919, 2848, 2360, 2334, 1798, 1761, 1731,1603, 1485, 1470.

HRMS (ESI) for $C_{28}H_{20}FNNaO_7$, $[M+Na]^+$ (524.1116) found: 524.1123.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-5-chloro-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ab).



Following the TP-E, **4ab** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2b** (68.4 mg, 1.2 equiv.) as a pale yellow solid (90.0 mg, 75%).

R_f = 0.488 (EA:Hex:DCM = 1:3:1)

mp.: 241.0-241.8 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.02 (d, J = 7.7 Hz, 1H), 7.87 (t, J = 7.5 Hz, 1H), 7.73 (d, J = 7.7 Hz, 1H), 7.64 (t, J = 7.5 Hz, 1H), 7.34 (dd, J = 10.0, 2.2 Hz, 1H), 7.14 (dd, J = 8.0, 2.4 Hz, 1H), 6.91 (dd, J = 8.0, 5.4 Hz, 2H), 6.52 (dd, J = 6.0, 2.3 Hz, 2H), 4.39 (d, J = 10.3 Hz, 1H), 4.27-4.08 (m, 2H), 3.91 (d, J = 10.2 Hz, 1H), 1.09 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 195.3, 171.6, 165.5, 156.2, 148.2, 145.9, 137.5, 136.5, 132.9, 132.6, 131.4, 130.2, 129.3, 129.1, 124.9, 123.6, 122.6, 121.8, 120.05, 119.98, 111.0, 110.1, 75.1, 67.7, 67.1, 63.6, 50,2, 13.5.

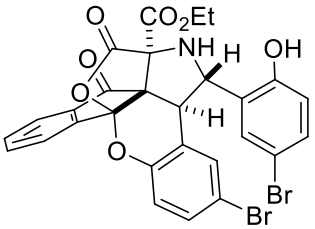
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3310, 2927, 2857, 1801, 1764, 1731, 1603, 1481.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br\ {}^{35}Cl\ NO_7$, $[M+H]^+$ (596.0106) found: 596.0112.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br\ {}^{37}Cl\ NO_7$, $[M+H]^+$ (598.0077) found: 598.0081.

HRMS (ESI) for $C_{28}H_{20}{}^{81}Br\ {}^{37}Cl\ NO_7$, $[M+H]^+$ (600.0056) found: 600.0086.

Ethyl-5-bromo-3-(5-bromo-2-hydroxyphenyl)-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ac).



Following the TP-D, **4ac** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2c** (79.0 mg, 1.2 equiv.) as a pale yellow solid (101.8 mg, 79%).

R_f = 0.475 (EA:Hex:DCM = 1:3:1)

mp.: 255.0-255.8 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 10.08 (s, 1H), 8.01 (d, J = 7.7 Hz, 1H), 7.86 (t, J = 7.4 Hz, 1H), 7.72 (d, J = 7.6 Hz, 1H), 7.63 (t, J = 7.4 Hz, 1H), 7.34 (d, J = 8.3 Hz, 1H), 7.28 (d, J = 9.3 Hz, 1H), 6.90 (d, J = 8.7 Hz, 1H), 6.86 (d, J = 8.6 Hz, 1H), 6.64 (s, 1H), 6.53 (s, 1H), 4.39 (d, J = 10.0 Hz, 1H), 4.26-4.07 (m, 2H), 3.89 (d, J = 10.2 Hz, 1H), 3.83 (s, 1H), 1.08 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 195.3, 171.5, 165.5, 156.2, 148.7, 145.9, 137.5, 136.5, 133.2, 132.9, 132.6, 132.0, 131.4, 124.9, 123.6, 123.0, 121.9, 120.3, 120.0, 116.6, 110.9, 110.0, 75.1, 67.7, 67.1, 63.6, 50.1, 13.5.

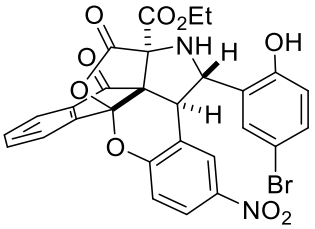
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3315, 3075, 2984, 2927, 2853, 1803, 1764, 1730, 1603, 1578, 1478, 1420.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br_2NO_7$, $[M+H]^+$ (639.9601) found: 639.9601.

HRMS (ESI) for $C_{28}H_{20}{}^{79}Br^{81}BrNO_7$, $[M+H]^+$ (641.9581) found: 641.9578.

HRMS (ESI) for $C_{28}H_{20}{}^{81}Br_2NO_7$, $[M+H]^+$ (643.9560) found: 643.9583.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-5-nitro-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ad).



Following the TP-D, **4ad** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2d** (70.9 mg, 1.2 equiv.) as a pale yellow solid (68.4 mg, 56%).

R_f = 0.325 (EA:Hex:DCM = 1:3:1)

mp.: 269.2-270.0 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 9.76 (s, 1H), 8.10 (dd, J = 8.0, 2.1 Hz, 1H), 8.05 (d, J = 7.8 Hz, 1H), 7.91 (t, J = 7.5 Hz, 1H), 7.75 (d, J = 7.7 Hz, 1H), 7.67 (t, J = 7.4 Hz, 1H), 7.44 (s, 1H), 7.36 (d, J = 8.7 Hz, 1H), 7.14 (d, J = 8.9 Hz, 1H), 6.93 (d, J = 8.7 Hz, 1H), 6.50 (s, 1H), 4.35 (dd, J = 8.0, 4.4 Hz, 1H), 4.27-4.11 (m, 2H) , 4.09 (d, J = 10.2 Hz, 1H), 3.81 (d, J = 4.2 Hz, 1H), 1.09 (t, J = 7.1 Hz, 3H).

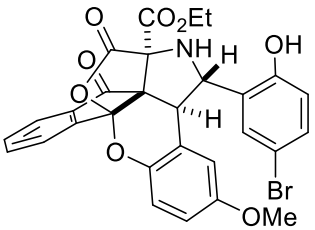
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 194.8, 171.2, 165.1, 156.0, 154.4, 145.6, 143.6, 137.7, 136.2, 133.4, 132.9, 131.2, 126.1, 125.1, 124.9, 123.8, 121.8, 121.3, 120.3, 119.4, 111.3, 110.0, 75.3, 67.1, 67.1, 63.8, 49.6, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3460, 3323, 2932, 2359, 1806, 1763, 1733, 1625, 1603, 1529, 1482.

HRMS (ESI) for $C_{28}H_{18}{}^{79}BrN_2O_9$, $[M-H]^-$ (605.0201) found: 605.0196.

HRMS (ESI) for $C_{28}H_{18}{}^{81}BrN_2O_9$, $[M-H]^-$ (607.0181) found: 607.0179.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-5-methoxy-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ae).



Following the TP-E, **4ae** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2e** (67.3 mg, 1.2 equiv.) as a pale yellow solid (83.4 mg, 70%).

R_f = 0.475 (EA:Hex:DCM = 1:3:1).

mp.: 165.4-166.2 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.02 (d, J = 7.7 Hz, 1H), 7.85 (t, J = 7.4 Hz, 1H), 7.70 (d, J = 7.6 Hz, 1H), 7.60 (t, J = 7.4 Hz, 1H), 7.31 (d, J = 8.1 Hz, 1H), 6.95-6.82 (m, 2H), 6.68 (dd, J = 10.0, 2.2 Hz, 1H), 6.53 (s, 1H), 6.01 (d, J = 2.0 Hz, 1H), 4.44 (d, J = 10.2 Hz, 1H), 4.26-4.07 (m, 2H), 3.88 (d, J = 10.2 Hz, 1H), 3.53 (s, 3H), 1.08 (t, J = 7.1 Hz, 3H).

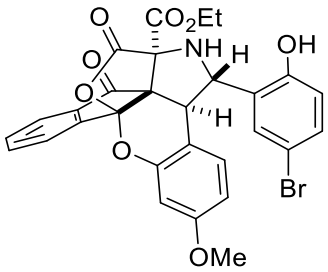
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 195.8, 171.8, 165.7, 156.3, 155.8, 146.3, 143.1, 137.3, 136.6, 132.6, 132.4, 131.5, 125.0, 123.4, 122.3, 121.7, 119.9, 119.5, 116.2, 113.6, 110.6, 110.2, 75.1, 67.8, 67.1, 63.5, 55.6, 51.0, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3455, 3313, 2985, 2936, 2835, 1802, 1764, 1731, 1624, 1601, 1590, 1509, 1481.

HRMS (ESI) for $C_{29}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (592.0602) found: 592.0604.

HRMS (ESI) for $C_{29}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (594.0581) found: 594.0579.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-6-methoxy-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4af).



Following the TP-D, **4af** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2f** (67.3 mg, 1.2 equiv.) as a pale yellow solid (90.5 mg, 76%).

R_f = 0.465 (EA:Hex:DCM = 1:3:1)

mp.: 234.5-235.5 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.03 (d, J = 7.7 Hz, 1H), 7.86 (t, J = 7.3 Hz, 1H), 7.71 (d, J = 7.7 Hz, 1H), 7.62 (t, J = 7.4 Hz, 1H), 7.31 (d, J = 8.6 Hz, 1H), 6.88 (d, J = 8.6 Hz, 1H), 6.52 (d, J = 7.9 Hz, 2H), 6.41 (s, 2H), 4.34 (d, J = 10.2 Hz, 1H), 4.26-4.08 (m, 2H), 3.91 (d, J = 10.2 Hz, 1H), 3.70 (s, 3H), 1.09 (t, J = 7.1 Hz, 3H).

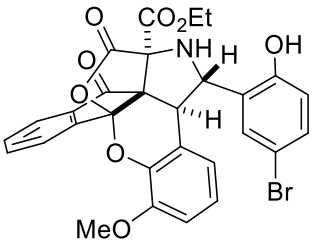
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 195.9, 171.9, 165.7, 161.0, 156.3, 150.5, 146.2, 137.3, 136.6, 132.6, 132.4, 131.5, 129.9, 125.0, 123.4, 122.3, 119.9, 112.4, 110.8, 110.0, 109.7, 104.7, 75.0, 67.9, 67.3, 63.5, 55.4, 49.9, 13.5.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3310, 3095, 2957, 1802, 1764, 1731, 1624, 1601, 1590, 1509, 1481.

HRMS (ESI) for $C_{29}H_{23}{}^{79}Br\ NO_8$, $[M+H]^+$ (592.0602) found: 592.0600.

HRMS (ESI) for $C_{29}H_{23}{}^{81}Br\ NO_8$, $[M+H]^+$ (594.0581) found: 594.0587.

Ethyl-3-(5-bromo-2-hydroxyphenyl)-7-methoxy-13,15-dioxo-3,3a-dihydro-13*H*-8a,1-(epoxymethano)indeno[1',2':2,3]chromeno[3,4-*c*]pyrrole-1(2*H*)-carboxylate (4ag).



Following the TP-D, **4ag** was obtained from **1a** (72.0 mg, 0.2 mmol) and **2g** (67.3 mg, 1.2 equiv.) as a pale yellow solid (82.2 mg, 69%).

R_f = 0.450 (EA:Hex:DCM = 1:3:1)

mp.: 253.5-254.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 10.30 (s, 1H), 8.12 (d, J = 7.8 Hz, 1H), 7.83 (t, J = 7.5 Hz, 1H), 7.69 (d, J = 7.6 Hz, 1H), 7.60 (t, J = 7.5 Hz, 1H), 7.30 (dd, J = 8.0, 2.2 Hz, 1H), 6.88 (d, J = 8.7 Hz, 1H), 6.80 (t, J = 7.9 Hz, 1H), 6.74 (d, J = 8.0 Hz, 1H), 6.51 (d, J = 2.2 Hz, 1H), 6.12 (d, J = 7.3 Hz, 1H), 4.49 (dd, J = 10.0, 2.2 Hz, 1H), 4.29-4.10 (m, 2H), 3.92 (d, J = 10.2 Hz, 1H), 3.79 (s, 3H), 3.78 (s, 1H), 1.10 (t, J = 7.1 Hz, 3H).

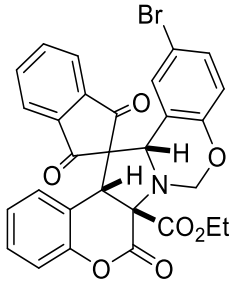
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 195.8, 171.9, 165.9, 156.4, 149.6, 146.2, 138.4, 137.2, 136.8, 132.6, 132.4, 131.5, 125.4, 124.3, 123.3, 122.7, 122.5, 120.8, 119.9, 112.7, 110.7, 110.5, 74.9, 68.5, 67.1, 63.5, 55.9, 50.9, 13.6.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3316, 3062, 2917, 2850, 1802, 1765, 1731, 1684, 1602, 1590, 1482.

HRMS (ESI) for $C_{29}H_{23}{}^{79}Br\,NO_8$, $[M+H]^+$ (592.0602) found: 592.0601.

HRMS (ESI) for $C_{29}H_{23}{}^{81}Br\,NO_8$, $[M+H]^+$ (594.0581) found: 594.0584.

Ethyl-12-bromo-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5aa).



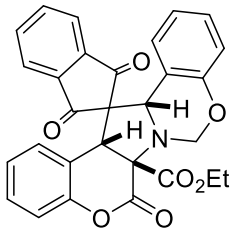
Following the TP-E, **5aa** was obtained from **3aa** (56.2 mg, 0.1 mmol) as a pale yellow solid (48.8 mg, 85%).

R_f = 0.375 (DCM:Hex = 3:1).

mp.: 174.8-175.3 ℃.

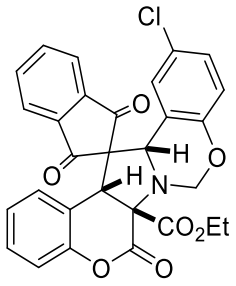
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.10 (d, J = 7.7 Hz, 1H), 7.84 (t, J = 7.5 Hz, 1H), 7.70 (t, J = 7.5 Hz, 1H), 7.45 (d, J = 7.7 Hz, 1H), 7.14 (td, J = 6.8, 1.8 Hz, 1H), 7.01 (d, J = 8.0 Hz, 2H), 6.88-6.73 (m, 3H), 6.19 (d, J = 1.8 Hz, 1H), 5.81 (d, J = 10.6 Hz, 1H), 5.37 (s, 1H), 5.04 (d, J = 10.6 Hz, 1H), 4.53 (s, 1H), 4.28-4.08 (m, 2H), 1.08 (t, J = 7.1 Hz, 3H).
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 198.4, 196.5, 168.9, 163.7, 155.4, 150.9, 143.0, 142.4, 136.7, 136.2, 131.3, 130.0, 128.0, 127.2, 124.4, 123.42, 123.37, 121.4, 120.5, 117.5, 115.7, 112.2, 76.4, 68.5, 68.3, 63.8, 63.2, 51.2, 13.7.
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2922, 2854, 1775, 1743, 1708, 1592, 1484, 1157, 1124, 761, 614.
HRMS (ESI) for $C_{29}H_{21}{}^{79}NO_7$, $[M+H]^+$ (574.0496) found: 574.0504.
HRMS (ESI) for $C_{29}H_{21}{}^{81}NO_7$, $[M+H]^+$ (576.0475) found: 576.0490.

Ethyl-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno[4',3':4,5] pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ba).



Following the TP-E, **5ba** was obtained from **3ba** (48.4 mg, 0.1 mmol) as a pale yellow solid (40.6 mg, 82%).
R_f = 0.250 (DCM:Hex = 3:1).
mp.: 238.9-239.5 °C.
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.06 (d, J = 7.6 Hz, 1H), 7.79 (td, J = 7.4, 0.7 Hz, 1H), 7.63 (td, J = 7.4, 0.7 Hz, 1H), 7.39 (dd, J = 7.1, 0.7 Hz, 1H), 7.12 (td, J = 7.8, 1.6 Hz, 1H), 7.00 (d, J = 8.2 Hz, 1H), 6.96-6.84 (m, 2H), 6.84-6.74 (m, 2H), 6.33 (td, J = 6.9, 1.2 Hz, 1H), 6.13 (d, J = 7.8 Hz, 1H), 5.81 (dd, J = 10.5, 1.2 Hz, 1H), 5.5 (s, 1H), 5.08 (d, J = 10.5 Hz, 1H), 4.54 (s, 1H), 4.26-4.10 (m, 2H), 1.09 (t, J = 7.1 Hz, 3H).
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 198.8, 196.6, 169.2, 163.8, 156.3, 150.9, 143.1, 142.5, 136.4, 135.9, 129.9, 128.4, 127.2, 125.0, 124.2, 123.3, 123.2, 120.1, 119.6, 118.8, 117.5, 115.8, 76.3, 68.6, 68.3, 64.3, 63.1, 51.6, 13.8.
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2984, 2920, 1774, 1743, 1708, 1592, 1491, 1159, 1114, 759.
HRMS (ESI) for $C_{29}H_{22}NO_7$, $[M+H]^+$ (496.1391) found: 496.1400.

Ethyl-12-chloro-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno [4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ca).



Following the TP-E, **5ca** was obtained from **3ca** (51.7 mg, 0.1 mmol) as a yellow solid (49.8 mg, 94%).

R_f = 0.375 (EA:Hex = 1:3).

mp.: 102.8-103.6 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.09 (d, J = 7.7 Hz, 1H), 7.83 (t, J = 7.5 Hz, 1H), 7.69 (t, J = 7.5 Hz, 1H), 7.44 (d, J = 7.7 Hz, 1H), 7.14 (td, J = 7.6, 1.7 Hz, 1H), 7.01 (d, J = 8.2 Hz, 1H), 6.89 (dd, J = 8.8, 2.0 Hz, 1H), 6.86-6.74 (m, 3H), 6.06 (d, J = 2.0 Hz, 1H), 5.81 (d, J = 10.5 Hz, 1H), 5.38 (s, 1H), 5.05 (d, J = 10.5 Hz, 1H), 4.53 (s, 1H), 4.27-4.09 (m, 2H), 1.09 (t, J = 7.1 Hz, 3H).

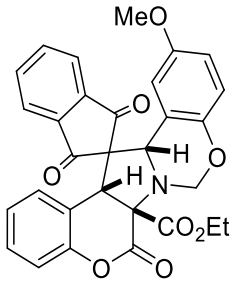
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.4, 196.4, 168.9, 163.6, 154.9, 150.9, 143.0, 142.4, 136.7, 136.1, 130.0, 128.5, 127.2, 125.0, 124.9, 124.3, 123.4, 123.3, 120.9, 120.2, 117.5, 115.6, 76.5, 68.5, 68.2, 63.8, 63.2, 51.4, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2922, 1774, 1743, 1708, 1592, 1488, 1159, 1116, 830, 761, 738.

HRMS (ESI) for $C_{29}H_{21}{}^{35}ClNO_7$, $[M+H]^+$ (530.1001) found: 530.1009.

HRMS (ESI) for $C_{29}H_{21}{}^{37}ClNO_7$, $[M+H]^+$ (532.0972) found: 532.0991.

Ethyl-12-methoxy-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno [4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ea).



Following the TP-E, **5ea** was obtained from **3ea** (51.4 mg, 0.1 mmol) as a pale yellow solid (43.6 mg, 83%).

R_f = 0.450 (DCM:Hex = 3:1).

mp.: 108.4-109.3 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.06 (d, J = 7.6 Hz, 1H), 7.79 (t, J = 7.5 Hz, 1H),

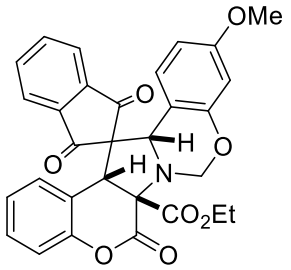
7.66 (t, *J* = 7.5 Hz, 1H), 7.45 (d, *J* = 7.6 Hz, 1H), 7.13 (t, *J* = 7.7 Hz, 1H), 7.02 (d, *J* = 8.2 Hz, 1H), 6.86-6.74 (m, 3H), 6.52 (dd, *J* = 9.0, 2.6 Hz, 1H), 5.78 (d, *J* = 10.5 Hz, 1H), 5.60 (d, *J* = 2.6 Hz, 1H), 5.42 (s, 1H), 5.03 (d, *J* = 10.5 Hz, 1H), 4.54 (s, 1H), 4.25-4.10 (m, 2H), 3.10 (s, 3H), 1.09 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 198.9, 196.4, 169.2, 163.7, 152.9, 143.3, 142.6, 136.4, 135.7, 129.9, 127.2, 124.2, 123.5, 123.0, 119.7, 119.6, 117.5, 115.8, 115.7, 108.9, 77.3, 77.0, 76.7, 68.6, 68.3, 64.6, 63.1, 55.1, 51.5, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3436, 2926, 2855, 1775, 1743, 1708, 1592, 1500, 1245, 1164.

HRMS (ESI) for $C_{30}H_{24}NO_8$, $[M+H]^+$ (526.1496) found: 526.1506.

Ethyl-11-methoxy-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno [4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5fa).



Following the TP-E, **5fa** was obtained from **3fa** (51.4 mg, 0.1 mmol) as a pale yellow solid (36.8 mg, 70% yield).

R_f = 0.375 (DCM:Hex = 3:1).

mp.: 150.6-151.7 °C.

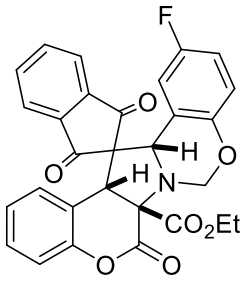
^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.06 (d, *J* = 7.7 Hz, 1H), 7.81 (t, *J* = 7.5 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.41 (d, *J* = 7.7 Hz, 1H), 7.12 (t, *J* = 7.6 Hz, 1H), 7.00 (d, *J* = 8.2 Hz, 1H), 6.84-6.74 (m, 2H), 6.42 (d, *J* = 2.3 Hz, 1H), 6.02 (d, *J* = 8.6 Hz, 1H), 5.92 (dd, *J* = 8.6, 2.3 Hz, 1H), 5.80 (d, *J* = 10.4 Hz, 1H), 5.41 (s, 1H), 5.06 (d, *J* = 10.4 Hz, 1H), 4.53 (s, 1H), 4.26-4.11 (m, 2H), 3.61 (s, 3H), 1.09 (t, *J* = 7.1 Hz, 3H)

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 198.8, 196.7, 169.1, 163.7, 159.4, 157.3, 150.8, 143.0, 142.4, 136.4, 135.8, 129.7, 127.1, 125.6, 124.1, 123.2, 123.1, 117.3, 115.8, 111.5, 107.8, 102.8, 76.3, 68.5, 68.3, 64.1, 63.0, 55.0, 51.3, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3429, 2920, 2853, 1772, 1742, 1708, 1592, 1494, 1249, 1158.

HRMS (ESI) for $C_{30}H_{24}NO_8$, $[M+H]^+$ (526.1496) found: 526.1501.

Ethyl-12-fluoro-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro [benzo[*e*]chromeno [4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ha).



Following the TP-E, **5ha** was obtained from **3ha** (50.1 mg, 0.1 mmol) as a white solid (44.2 mg, 86%).

R_f = 0.325 (DCM:Hex EA=1:3:1).

mp.: 168.8-173.8 ℃.

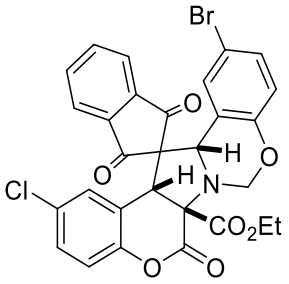
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.07 (d, J = 7.6 Hz, 1H), 7.82 (t, J = 7.5 Hz, 1H), 7.67 (t, J = 7.5 Hz, 1H), 7.45 (d, J = 7.7 Hz, 1H), 7.13 (td, J = 7.3, 1.8 Hz, 1H), 7.01 (d, J = 8.2 Hz, 2H), 6.88-6.73 (m, 3H), 6.66 (td, J = 8.5, 2.5 Hz, 1H), 5.84 (dd, J = 8.5, 2.6 Hz, 1H), 5.80 (d, J = 10.6 Hz, 1H), 5.41 (s, 1H), 5.04 (d, J = 10.5 Hz, 1H), 4.51 (s, 1H), 4.29-4.09 (m, 2H), 1.09 (t, J = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.5, 196.4, 169.0, 163.6, 157.4, 155.0, 152.4 (d, J = 1.8 Hz), 150.9, 142.7 (d, J = 61.5 Hz), 136.6, 136.1, 128.6 (d, J = 277.5 Hz), 124.3, 123.5 (d, J = 6.1 Hz), 120.5, 120.4, 120.1, 120.0, 117.5, 115.6, 115.3, 111.1, 110.9, 68.6, 68.1, 63.8, 63.2, 51.7, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3468.0, 2953, 2922, 2853, 1794, 1763, 1735, 1492, 1463, 1279, 1211,1022

HRMS (ESI) for $C_{29}H_{21}FNO_7$, $[M+H]^+$ (514.1297) found: 514.1301.

Ethyl-12-bromo-2-chloro-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e] chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ab).



Following the TP-D, **5ab** was obtained from **3ab** (59.8 mg, 0.1 mmol) as a white solid (57.2 mg, 94%).

R_f = 0.313 (Hex:EA = 4:1).

mp.: 169.5-170.5 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.14 (d, J = 7.5 Hz, 1H), 7.89 (t, J = 7.5 Hz, 1H),

7.75 (t, *J* = 7.5 Hz, 1H), 7.47 (d, *J* = 7.5 Hz, 1H,), 7.12 (dd, *J* = 8.8, 2.4 Hz, 1H), 7.02 (dd, *J* = 8.9, 2.2 Hz, 1H), 6.97 (d, *J* = 8.8 Hz, 1H), 6.84 (d, *J* = 2.4 Hz, 1H), 6.76 (d, *J* = 8.8 Hz, 1H), 6.18 (s, 1H), 5.80 (d, *J* = 10.6 Hz, 1H), 5.34 (s, 1H), 5.01 (d, *J* = 10.6 Hz, 1H), 4.50 (s, 1H), 4.27-4.13 (m, 2H), 1.13 (t, *J* = 7.1 Hz, 3H).

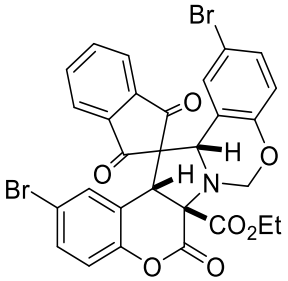
^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.8, 196.3, 168.6, 163.1, 155.4, 149.5, 142.9, 142.4, 137.0, 136.5, 131.4, 130.2, 129.4, 128.2, 127.0, 123.6, 123.5, 121.0, 120.5, 118.9, 117.5, 112.2, 76.3, 68.3, 68.2, 64.0, 63.4, 50.5, 13.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2922, 1778, 1742, 1708, 1591, 1484, 1215, 1154.

HRMS (ESI) for $C_{29}H_{20}{}^{79}Br^{35}ClNO_7$, $[M+H]^+$ (608.0106) found: 608.0114.

HRMS (ESI) for $C_{29}H_{20}{}^{81}Br^{35}ClNO_7$, $[M+H]^+$ (610.0086) found: 610.0098.

Ethyl-2,12-dibromo-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno [4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ac).



Following the TP-E, **5ac** was obtained from **3ac** (64.2 mg, 0.1 mmol) as a white solid (60.8 mg, 93%).

R_f = 0.300 (Hex:EA = 4:1).

mp.: 128.2-129.2 °C.

^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 8.14 (d, *J* = 7.6 Hz, 1H), 7.89 (t, *J* = 7.6 Hz, 1H), 7.75 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.26 (d, *J* = 8.7 Hz, 1H), 7.06-6.97 (m, 2H), 6.91 (d, *J* = 8.9 Hz, 1H), 6.75 (d, *J* = 8.8 Hz, 1H), 6.18 (s, 1H), 5.80 (d, *J* = 10.6 Hz, 1H), 5.34 (s, 1H), 5.01 (d, *J* = 10.6 Hz, 1H), 4.49 (s, 1H), 4.27-4.14 (m, 2H), 1.13 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) *δ*/ppm: 197.8, 196.2, 168.5, 163.0, 155.4, 150.0, 142.9, 142.4, 136.9, 136.5, 133.1, 131.4, 129.9, 128.1, 123.5, 123.4, 121.0, 120.5, 119.2, 117.9, 116.7, 112.2, 76.3, 68.3, 68.2, 63.9, 63.4, 50.4, 13.8.

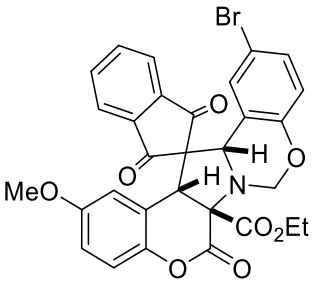
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2982, 2921, 1778, 1743, 1707, 1591, 1483, 1214, 1154.

HRMS (ESI) for $C_{29}H_{20}{}^{79}Br_2NO_7$, $[M+H]^+$ (651.9601) found: 651.9609.

HRMS (ESI) for $C_{29}H_{20}{}^{79}Br^{81}BrNO_7$, $[M+H]^+$ (653.9581) found: 653.9592.

HRMS (ESI) for $C_{29}H_{20}{}^{81}Br_2NO_7$, $[M+H]^+$ (655.9561) found: 655.9577.

Ethyl-12-bromo-2-methoxy-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e] chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ae).



Following the TP-E, **5ae** was obtained from **3ae** (59.2 mg, 0.1 mmol) as a pale yellow solid (53.2 mg, 88%).

R_f = 0.100 (DCM:Hex = 3:1).

mp.: 126.7-127.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.10 (d, J = 7.6 Hz, 1H), 7.85 (t, J = 7.5 Hz, 1H), 7.72 (t, J = 7.5 Hz, 1H), 7.47 (d, J = 7.6 Hz, 1H), 7.02 (dd, J = 8.9, 1.8 Hz, 1H), 6.95 (d, J = 8.9 Hz, 1H), 6.76 (d, J = 8.9 Hz, 1H), 6.67 (dd, J = 8.9, 2.8 Hz, 1H), 6.31 (d, J = 2.8 Hz, 1H), 6.19 (s, 1H), 5.82 (d, J = 10.5 Hz, 1H), 5.35 (s, 1H), 5.03 (d, J = 10.5 Hz, 1H), 4.49 (s, 1H), 4.26-4.12 (m, 2H), 3.54 (s, 3H), 1.12 (t, J = 7.1 Hz, 3H).

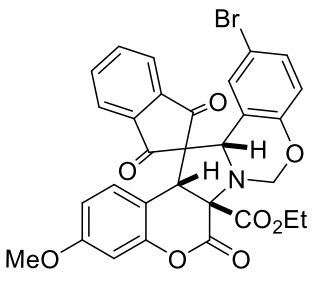
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.4, 196.2, 169.0, 163.8, 155.8, 155.4, 144.8, 143.1, 142.5 ,136.8, 136.2, 131.3, 128.0, 123.5, 123.3, 121.4, 120.5, 118.4, 116.3, 115.7, 112.1, 111.5, 76.4, 68.3, 68.2, 63.8, 63.2, 55.5, 51.4, 13.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3424, 2928, 2854, 1770, 1742, 1707, 1593, 1500, 1250,1164.

HRMS (ESI) for $C_{30}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (604.0602) found: 604.0608.

HRMS (ESI) for $C_{30}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (606.0581) found: 606.0593.

Ethyl-12-bromo-3-methoxy-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e] chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5af).



Following the TP-D, **5af** was obtained from **3af** (59.2 mg, 0.1 mmol) as a yellow solid (53.2 mg, 88%).

R_f = 0.250 (DCM:Hex = 3:1).

mp.: 199.0-200.0 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.09 (d, J = 7.6 Hz, 1H), 7.83 (td, J = 7.4, 1.0 Hz, 1H), 7.71 (td, J = 7.4, 1.0 Hz, 1H), 7.47 (d, J = 7.6 Hz, 1H), 7.01 (dd, J = 8.8, 2.5 Hz, 1H), 6.76 (d, J = 8.8 Hz, 1H), 6.71 (d, J = 8.6 Hz, 1H), 6.55 (d, J = 2.4 Hz, 1H), 6.35 (dd, J = 8.6, 2.5 Hz, 1H), 6.18 (d, J = 2.4 Hz, 1H), 5.79 (d, J = 10.5 Hz, 1H), 5.35 (s, 1H), 5.03 (d, J = 10.5 Hz, 1H), 4.48 (s, 1H), 4.28-4.11 (m, 2H), 3.68 (s, 3H), 1.12 (t, J = 7.1 Hz, 3H).

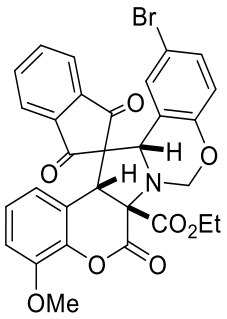
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.5, 196.7, 169.0, 163.8, 160.7, 155.4, 151.8, 143.1, 142.5, 136.7, 136.1, 131.3, 128.0, 127.9, 123.4, 123.3, 121.5, 120.5, 112.1, 111.2, 107.4, 102.3, 76.4, 68.5, 68.2, 63.7, 63.2, 55.4, 51.0, 13.8.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2925, 1775, 1743, 1708, 1627, 1591, 1484, 1163, 1129, 737, 616.

HRMS (ESI) for $C_{30}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (604.0608) found: 604.0609.

HRMS (ESI) for $C_{30}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (606.0581) found: 606.0593.

Ethyl-12-bromo-4-methoxy-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e] chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (5ag).



Following the TP-E, **5ag** was obtained from **3ag** (59.4 mg, 0.1 mmol) as a pale yellow solid (55.0 mg, 91%).

R_f = 0.088 (Hex:EA = 4:1).

mp.: 254.2-255.2 ℃.

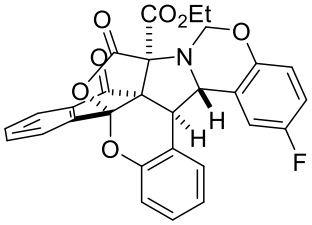
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.10 (d, J = 7.6 Hz, 1H), 7.86 (t, J = 7.6 Hz, 1H), 7.72 (t, J = 7.6 Hz, 1H), 7.45 (d, J = 7.6 Hz, 1H), 7.0 (dd, J = 8.8, 2.1 Hz, 1H), 6.76-6.68 (m, 3H), 6.40 (dd, J = 7.1, 1.7 Hz, 1H), 6.19 (d, J = 2.1 Hz, 1H), 5.82 (d, J = 10.5 Hz, 1H), 5.35 (s, 1H), 5.02 (d, J = 10.5 Hz, 1H), 4.56 (s, 1H), 4.29-4.10 (m, 2H), 3.78 (s, 3H), 1.12 (t, J = 7.1 Hz, 3H**)**.

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.3, 196.3, 168.8, 162.8, 155.2, 147.5, 142.9, 142.3, 140.2, 136.7, 136.1, 131.1, 127.9, 124.2, 123.32, 123.26, 121.3, 120.4, 118.2, 116.4, 112.4, 112.0, 76.3, 68.1, 68.0, 63.6, 63.1, 55.9, 51.2, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2981, 2937, 1770, 1742, 1707, 1590, 1486, 1213.

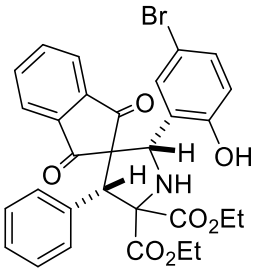
HRMS (ESI) for $C_{30}H_{23}{}^{79}BrNO_8$, $[M+H]^+$ (604.0608) found: 604.0609.
HRMS (ESI) for $C_{30}H_{23}{}^{81}BrNO_8$, $[M+H]^+$ (606.0581) found: 606.0594.

Ethyl-3-fluoro-14,19-dioxo-4b,4c-dihydro-14*H*,15*H*,17*H*-9a,15-(epoxymethano) benzo[e]indeno[1'',2'':2',3']chromeno[4',3':3,4]pyrrolo[1,2-*c*][1,3]oxazine-15-carboxylate (12ha).



Following the TP-E, **12ha** was obtained from **4ha** (25.1 mg, 0.05 mmol) as a yellow solid (19.3 mg, 75%);
R_f = 0.500 (EA:Hex = 1:3).
mp.: 171.0-172.0 ℃.
^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 8.02 (d, J = 7.7 Hz, 1H), 7.84 (t, J = 7.3 Hz, 1H), 7.67 (d, J = 7.8 Hz, 1H), 7.59 (t, J = 7.5 Hz, 1H), 7.28-7.20 (m, 2H), 7.08 (t, J = 7.5 Hz, 1H), 7.00 (d, J = 8.0 Hz, 1H), 6.94-6.86 (m, 2H), 6.54 (d, J = 9.2 Hz, 1H), 5.37 (d, J = 8.5 Hz, 1H), 4.85 (d, J = 8.5 Hz, 1H), 4.57 (d, J = 9.5 Hz, 1H), 4.25-4.15 (m, 1H), 4.12-4.01 (m, 1H), 3.82 (d, J = 9.5 Hz, 1H), 1.01 (t, J = 7.1 Hz, 3H).
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 196.1, 169.6, 164.5, 156.7 (d, J = 239.1 Hz), 150.4, 149.5 (d, J = 2.1 Hz), 146.2, 137.2, 136.9, 131.3 (d, J = 189.9 Hz), 130.0, 125.0, 124.7, 123.2, 122.7, 119.3, 119.0 (d, J = 8.0 Hz), 115.6, 115.3, 111.5, 111.3, 110.5, 76.5, 75.3, 70.3, 63.0, 60.7 (d, J = 1.2 Hz), 50.3, 13.4.
IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3626, 3530, 2954, 2923, 2852, 1774, 1743, 1708, 1592, 1495, 1459, 1347.
HRMS (ESI) for $C_{29}H_{21}FNO_7$, $[M+H]^+$ (514.1297) found: 514.1307.

Diethyl-2'-(5-bromo-2-hydroxyphenyl)-1,3-dioxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5',5'-dicarboxylate (7a).



Following the TP-C, **7a** was obtained from **1a** (71.6 mg, 0.2 mmol) and **6** (46.9 mg, 1.0 equiv.) as a pale yellow solid (69.9 mg, 59%).

R_f = 0.325 (DCM:Hex:EA = 1:3:1).

mp.: 159.0-160.5 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) (mixture of rotamers) δ/ppm: 7.88-7.78 (m, 1H+1H'), 7.74 (d, J = 3.0 Hz, 3H), 7.67-7.63 (m, 3H'), 7.31 (t, J = 2.9 Hz, 3H+1H'), 7.18-7.11 (m, 2H+2H'), 7.11-7.06 (m, 2H'), 7.01 (dd, J = 8.8, 2.2 Hz, 1H), 6.69 (d, J = 2.0 Hz, 1H'+1H), 6.64 (d, J = 8.8 Hz, 1H), 6.55 (d, J = 2.2 Hz, 1H'), 5.64 (s, 1H), 4.91 (s, 1H'), 4.85 (s, 1H'), 4.66 (s, 1H), 4.58-4.48 (m, 1H), 4.44-4.33 (m, 1H+1H'), 4.33-4.28 (m, 1H'), 4.22-4.14 (m, 1H'), 3.98-3.89 (m, 1H'), 3.87-3.67 (m, 1H'+2H), 1.46 (t, J = 7.1 Hz, 3H), 1.31 (t, J = 7.1 Hz, 3H'), 1.01 (t, J = 7.1 Hz, 3H'), 0.66 (t, J = 7.1 Hz, 3H).

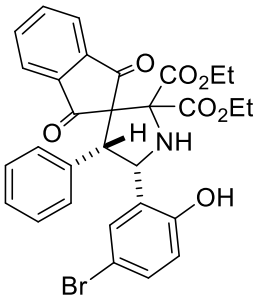
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 198.9 (C'), 198.1, 197.7 (C'), 195.9, 170.3 (C'), 168.9, 168.7, 167.8 (C'), 157.1, 156.6 (C'), 147.0, 142.8 (C'), 142.5, 141.7 (C'), 140.9, 136.3 (C'), 136.0, 135.4 (C'), 135.6, 135.2 (C'), 135.0, 134.3 (C'), 134.1, 132.3 (C'), 132.1, 130.5 (C'), 130.0, 129.9 (C'), 129.7, 128.8 (C'), 128.3, 128.1, 124.0, 123.4 (C'), 123.4, 123.2 (C'), 120.4 (C'), 119.9, 110.2, 110.2 (C'), 78.3, 69.3 (C'), 68.3, 67.2 (C'), 66.5, 63.3, 63.2 (C'), 63.1, 62.5 (C'), 62.4 (C'), 62.4, 58.2 (C'), 57.2, 14.0 (C'), 14.0, 13.5 (C'), 13.1

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3304, 2982, 2362, 2338, 1727, 1709, 1597, 1485, 1243, 1169.

HRMS (ESI) for $C_{30}H_{27}{}^{79}BrNO_7$, $[M+H]^+$ (592.0965) found: 592.0977.

HRMS (ESI) for $C_{30}H_{27}{}^{81}BrNO_7$, $[M+H]^+$ (594.0945) found: 594.0962.

Diethyl-5'-(5-bromo-2-hydroxyphenyl)-1,3-dioxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-2',2'-dicarboxylate (8a).



Following the TP-D, **8a** was obtained from **1a** (72.0 mg, 0.2 mmol) and **6** (56.2 mg, 1.2 equiv.) as a pale yellow solid (70.9 mg, 60%).

R_f = 0.500 (EA:Hex:DCM = 1:4:1)

mp.: 174.3-175.2 ℃.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: 7.84-7-77 (m, 1H), 7.76-7-70 (m, 1H), 7.70-7.64 (m, 2H), 7.13 (dd, *J* = 8.0, 2.2 Hz, 1H), 7.02-6-91 (m, 6H), 6.74 (d, *J* = 8.7 Hz, 1H), 5.56 (d, *J* = 11.4 Hz, 1H), 4.48-4.33 (m, 2H), 4.29 (d, *J* = 11.4 Hz, 1H), 4.05 (q, *J* = 7.1 Hz, 2H), 1.34 (t, *J* = 7.2 Hz, 3H), 0.90 (t, *J* = 7.1 Hz, 3H).

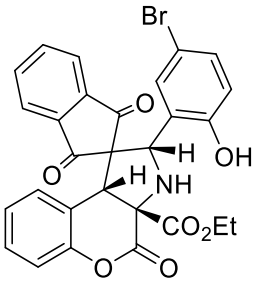
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) δ/ppm: 199.7, 196.5, 169.5, 168.3, 156.5, 141.9, 141.7, 135.8, 135.6, 132.4, 131.9, 131.1, 128.9, 128.4, 128.2, 123.3, 123.2, 122.7, 119.5, 110.3, 74.7, 67.4, 63.7, 63.2, 62.8, 57.6, 13.8, 13.2.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3327, 2954, 2919, 2851, 2361, 2338, 1736, 1708, 1467.

HRMS (ESI) for $C_{30}H_{27}{}^{79}BrNO_7$, $[M+H]^+$ (592.0965) found: 592.0972.

HRMS (ESI) for $C_{30}H_{27}{}^{81}BrNO_7$, $[M+H]^+$ (594.0945) found: 594.0956.

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9aa).



Following the TP-F, **9aa** was obtained from **2a** (50.0 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a pale yellow solid (85.1 mg, 76%).

R_f = 0.200 (DCM:Hex = 3:1).

mp.: 96.3-97.3 ℃.

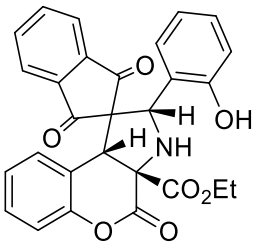
$[\alpha]_D^{24}$ = 347.0º (c = 0.50, CH_2Cl_2).

HPLC: 89% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 23.61 min, t_{major} = 38.14 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) δ/ppm: (mixture of rotamers) 10.70 (s, 1H), 10.24 (s, 1H'), 7.99 (d, *J* = 7.5 Hz, 1H), 7.84-7.73 (m, 3H'+1H), 7.63 (t, *J* = 7.5 Hz, 1H), 7.50 (d, *J* = 7.5 Hz, 1H), 7.25-7.16 (m, 2H'+1H), 7.14 (d, *J* = 8.2 Hz, 1H'), 7.08 (d, *J* = 8.2 Hz, 1H), 6.94 (d, *J* = 8.8 Hz, 1H), 6.89-6.80 (m, 1H'+2H), 6.78 (d, *J* = 8.7 Hz, 1H'), 6.65 (d, *J* = 7.7 Hz, 1H'), 6.60-

6.51 (m, 2H), 6.40 (s, 1H'), 5.08 (d, *J* = 6.8 Hz, 1H), 4.94 (d, *J* = 6.2 Hz, 1H'), 4.66 (s, 1H'), 4.36 (s, 1H) , 4.32-4.26 (m, 1H'+1H), 4.23 (q, *J* = 7.1 Hz, 2H+3H'), 1.15 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H*-spiro [chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ba).



Following the TP-F, **9ba** was obtained from **2a** (50.0 mg, 0.2 mmol) and **1b** (67.0 mg, 1.2 equiv.) as a pale yellow solid (73.9 mg, 76%).

R_f = 0.325 (DCM:Hex:EA = 3:1:0.1).

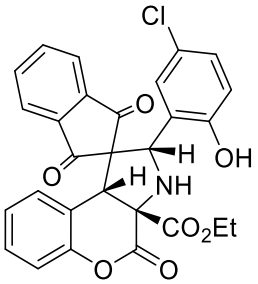
mp.: 100.1-101.1 ℃.

$[\alpha]_D^{22}$ = 38.4º (c = 0.50, CH_2Cl_2).

HPLC: 68% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 27.94 min, t_{major} = 50.71 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.53 (s, 1H), 10.22 (s, 1H'), 7.94 (d, *J* = 7.6 Hz, 1H), 7.79-7.73 (m, 3H'), 7.70 (td, *J* = 7.6, 1.1 Hz, 1H'+1H), 7.59 (td, *J* = 7.6, 1.1 Hz, 1H), 7.48 (d, *J* = 7.6 Hz, 1H), 7.24 (td, *J* = 7.6, 1.6 Hz, 1H'), 7.21-7.15 (m, 1H), 7.14 (d, *J* = 1.6 Hz, 1H'), 7.11-7.05 (m, 1H'+1H), 6.90-6.80 (m, 2H'+3H), 6.68 (d, *J* = 1.5 Hz, 1H'), 6.65 (dd, *J* = 8.2, 1.0 Hz, 1H), 6.48 (dd, *J* = 8.0, 1.5 Hz, 1H), 6.44 (td, *J* = 7.5, 1.1 Hz, 1H'), 6.32 (td, *J* = 7.5, 1.2 Hz, 1H), 6.28, (dd, *J* = 7.5, 1.2 Hz, 1H'), 5.18 (d, *J* = 5.8 Hz, 1H), 5.01 (d, *J* = 5.9 Hz, 1H'), 4.71 (s, 1H'), 4.39 (s, 1H), 4.23 (q, *J* = 7.1 Hz , 3H'+3H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-chloro-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ca).



Following the TP-F, **9ca** was obtained from and **2a** (50.0 mg, 0.2 mmol) and **1c** (75.3 mg, 1.2 equiv.) as a pale yellow solid (54.8 mg, 46%).

R_f = 0.200 (DCM:Hex = 3:1).

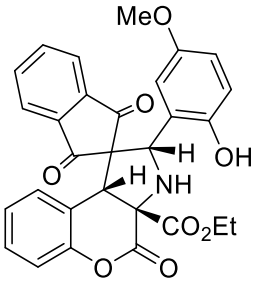
mp.: 92.8-93.8 ℃.

$[\alpha]_D^{22}$ = 129.7º (c = 0.50, CH_2Cl_2).

HPLC: 87% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 24.01 min, t_{major} = 39.06 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.66 (s, 1H), 10.15 (s, 1H'), 7.99 (d, *J* = 7.6 Hz, 1H), 7.84-7.72 (m, 4H'+1H), 7.63 (t, *J* = 7.6 Hz, 1H), 7.51 (d, *J* = 7.6 Hz, 1H), 7.26-7.16 (m, 1H'+1H), 7.13 (d, *J* = 8.1 Hz, 1H'), 7.07 (d, *J* = 8.1 Hz, 1H), 7.04 (d, *J* = 2.3 Hz, 1H'), 6.87-6.79 (m, 2H'+3H), 6.65 (d, *J* = 7.7 Hz, 1H'), 6.60 (d, *J* = 8.8 Hz, 1H), 6.43 (d, *J* = 2.2 Hz, 1H), 6.31 (s, 1H'), 5.10 (d, *J* = 6.6 Hz, 1H), 4.95 (d, *J* = 6.2 Hz, 1H'), 4.65 (s, 1H'), 4.36 (s, 1H) , 4.29 (d, *J* = 7.1 Hz, 1H), 4.23 (q, *J* = 7.1 Hz, 3H'+2H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(2-hydroxy-5-methoxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ea).



Following the TP-F, **9ea** was obtained from **2a** (50.0 mg, 0.2 mmol) and **1e** (79.8 mg, 1.2 equiv.) as a pale yellow solid (88.1 mg, 86%).

R_f = 0.125 (DCM:Hex = 3:1).

mp.: 114.2-115.2 ℃.

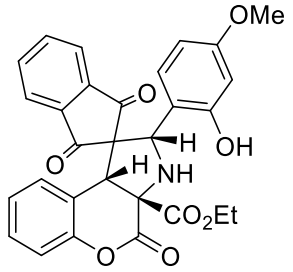
$[\alpha]_D^{22}$ = 76.7º (c = 0.50, CH_2Cl_2).

HPLC: 82% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 43.20 min, t_{major} = 62.84 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 7.95 (d, *J* = 7.6 Hz, 1H), 7.79-7.74 (m, 4H'), 7.71 (t, *J* = 7.6 Hz, 1H), 7.60 (t, *J* = 7.6 Hz, 1H), 7.51 (d, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 8.1 Hz, 1H'), 7.21-7.12 (m, 1H'+1H), 7.07 (d, *J* = 8.2 Hz, 1H), 6.87-6.79 (m, 2H+2H'), 6.71-6.65 (m, 2H'), 6.60 (d, *J* = 8.9 Hz, 1H), 6.47 (dd, *J* = 8.9, 2.8 Hz, 1H), 6.00 (d,

J = 2.8 Hz, 1H), 5.85 (s, 1H'), 5.12 (s, 1H), 4.95 (s, 1H'), 4.70 (s, 1H'), 4.37 (s, 1H), 4.23 (q, *J* = 7.1 Hz, 2H+2H'), 3.42 (s, 3H), 3.37 (s, 3H'), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.11 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(2-hydroxy-4-methoxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9fa).



Following the TP-F, **9fa** was obtained from **2a** (50.0 mg, 0.2 mmol) and **1f** (76.5 mg, 1.2 equiv.) as a pale yellow solid (72.8 mg, 71%).

R_f = 0.150 (DCM:Hex = 3:1).

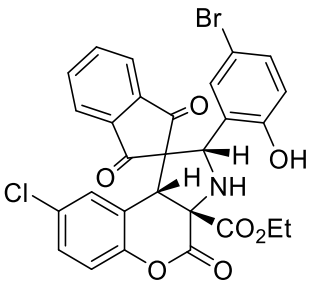
mp.: 119.4-120.4 ℃.

$[\alpha]_D^{23}$ = 26.6º (c = 0.50, CH_2Cl_2).

HPLC: 75% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 41.90 min, t_{major} = 89.65 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.65 (s, 1H), 10.46 (s, 1H'), 7.94 (d, *J* = 7.6 Hz, 1H), 7.79-7.73 (m, 3H'), 7.70 (t, *J* = 7.6 Hz, 1H), 7.61 (t, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 1H'), 7.21-7.12 (m, 1H'+1H), 7.07 (d, *J* = 8.2 Hz, 1H), 6.91-6.78 (m, 1H'+2H), 6.71-6.64 (m, 2H'), 6.44 (d, *J* = 2.5 Hz, 1H'), 6.37 (d, *J* = 8.6 Hz, 1H), 6.21 (d, *J* = 2.5 Hz, 1H), 6.09 (d, *J* = 8.4 Hz, 1H'), 5.98 (dd, *J* = 8.5, 2.5 Hz, 1H'), 5.90 (dd, *J* = 8.5, 2.5 Hz, 1H), 5.14 (d, *J* = 5.0 Hz, 1H), 4.96 (d, *J* = 5.7 Hz, 1H'), 4.72 (s, 1H'), 4.36 (s, 1H) , 4.23 (q, *J* = 7.1 Hz, 3H'+3H), 3.71 (s, 3H'), 3.58 (s, 3H), 1.17 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

Ethyl(2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-8-chloro-1',3',4-trioxo-1',2,3, 3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ab).



Following the TP-F, **9ab** was obtained from **2b** (57.0 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2

equiv.) as a white solid (79.7 mg, 67%).

R_f = 0.438 (Hex:DCM:EA = 3:1:1).

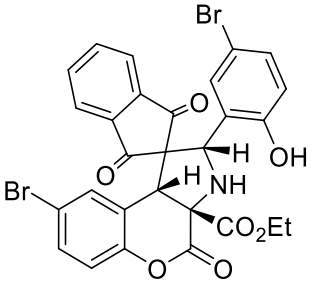
mp .: 110.7-111.7 ℃.

$[\alpha]_D^{23}$ = 62.5º (c = 0.50, CH_2Cl_2).

HPLC: 91% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 26.14 min, t_{major} = 31.91 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.59 (s, 1H), 10.01 (s, 1H'), 8.02 (d, *J* = 7.6 Hz, 1H), 7.87-7.75 (m, 1H+4H'), 7.67 (t, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 7.6 Hz, 1H), 7.23 (dd, *J* = 8.8, 2.4 Hz, 1H'), 7.17 (dd, *J* = 8.8, 2.4 Hz, 1H+1H'), 7.09 (d, *J* = 8.8 Hz, 1H'), 7.04 (d, *J* = 8.8 Hz, 1H), 6.95 (dd, *J* = 8.8, 2.3 Hz, 1H), 6.83 (d, *J* = 2.3 Hz, 1H), 6.76 (d, *J* = 8.8 Hz, 1H'), 6.67 (d, *J* = 2.2 Hz, 1H'), 6.54 (d, *J* = 8.8 Hz, 1H), 6.52 (d, *J* = 2.4 Hz, 1H), 6.41 (s, 1H'), 5.05 (d, *J* = 6.7 Hz, 1H), 4.89 (d, *J* = 6.1 Hz, 1H'), 4.62 (s, 1H'), 4.36-4.17 (m, 4H+3H'), 1.19 (t, *J* = 7.1 Hz, 3H'), 1.14 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-8-bromo-2-(5-bromo-2-hydroxyphenyl)-1',3',4-trioxo-1',2,3,3'-tetra hydro-4*H* -spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ac)



Following the TP-F, **9ac** was obtained from **2c** (65.9 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a white solid (97.4 mg, 76%).

R_f = 0.450 (Hex:DCM:EA = 3:1:1).

mp.: 109.5-110.5 ℃.

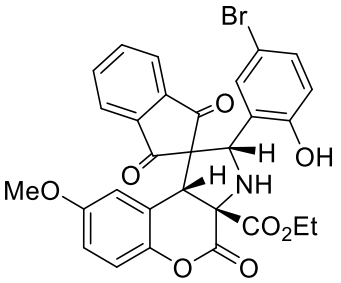
$[\alpha]_D^{23}$ = 37.8º (c = 0.50, CH_2Cl_2).

HPLC: 89% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 26.71 min, t_{major} = 35.00 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 8.02 (d, *J* = 7.6 Hz, 1H), 7.89-7.74 (m, 1H+4H'), 7.67 (t, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 1H), 7.36 (dd, *J* = 8.7, 2.0 Hz, 1H'), 7.32 (dd, *J* = 8.7, 2.0 Hz, 1H), 7.18 (dd, *J* = 8.7, 2.2 Hz, 1H'), 7.04 (d, *J* = 8.8 Hz, 1H'), 7.02-6.90 (m, 3H), 6.81 (d, *J* = 1.7 Hz, 1H'), 6.76 (d, *J* = 8.7 Hz, 1H'), 6.55 (d, *J* = 8.8 Hz, 1H), 6.52 (d, *J* = 2.0 Hz, 1H), 6.38 (s,1H'), 5.05 (s, 1H), 4.88 (s, 1H'), 4.62 (s, 1H'), 4.34-4.17

(m, 3H+2H'), 1.21 (t, *J* = 7.1 Hz, 3H'), 1.14 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-8-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ae).



Following the TP-F, **9ae** was obtained from **2e** (56.1 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a pale yellow solid (100.2 mg, 84%).

R_f = 0.150 (DCM:Hex = 3:1).

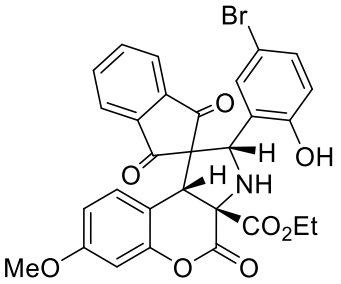
mp.: 235.5-236.5 ℃.

$[\alpha]_D^{23}$ = 16.1° (c = 0.50, CH_2Cl_2).

HPLC: 96% ee, Chiralpak IB column, *n*-hexane/EtOH = 85:15, flow rate = 1.0 mL/min, λ= 245 nm, t_{minor} = 37.96 min, t_{major} = 41.87 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 8.0 (d, *J* = 7.5 Hz, 1H), 7.88-7.74 (m, 4H'+1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.52 (d, *J* = 7.5 Hz, 1H), 7.18 (dd, *J* = 8.7, 2.2 Hz, 1H'), 7.07 (d, *J* = 9.0 Hz, 1H'), 7.01 (d, *J* = 9.0 Hz, 1H), 6.94 (dd, *J* = 8.8, 2.2 Hz, 1H), 6.81-6.69 (m, 2H'+1H), 6.56, (d, *J* = 9.0 Hz, 1H), 6.54 (d, *J* = 2.1 Hz, 1H), 6.40 (s, 1H'), 6.30 (d, *J* = 2.7 Hz, 1H), 6.13 (d, *J* = 2.7 Hz, 1H'), 5.07 (s, 1H), 4.92 (s, 1H'), 4.61 (s, 1H'), 4.31 (s, 1H), 4.24 (q, *J* = 6.8 Hz, 2H'+2H), 3.55 (s, 3H), 3.50 (s, 3H'), 1.19 (t, *J* = 7.2 Hz, 3H'), 1.13 (t, *J* = 7.2 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-7-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9af).



Following the TP-F, **9af** was obtained from **2f** (56.1 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a pale yellow solid (70.2 mg, 59%).

R_f = 0.175 (DCM:Hex = 4:1).

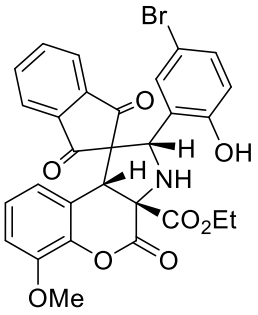
mp.: 131.1-132.1 ℃.

$[\alpha]_D^{23}$ = 111.3º (c = 0.50, CH_2Cl_2).

HPLC: 69% ee, Chiralpak IB column, *n*-hexane/*i*-PrOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 32.37 min, t_{major} = 44.34 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.73 (s, 1H), 10.29 (s, 1H'), 7.99 (d, *J* = 7.6 Hz, 1H), 7.83-7.73 (m, 4H'+1H), 7.64 (t, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 1H), 7.18 (d, *J* = 8.4 Hz, 1H'), 6.94 (dd, *J* = 8.8, 2.0 Hz, 1H), 6.78 (d, *J* = 8.7 Hz, 1H'), 6.70 (d, *J* = 8.5 Hz, 1H), 6.67 (d, *J* = 2.0 Hz, 1H'), 6.64-6.50 (m, 1H'+3H), 6.42-6.34 (m, 1H+2H'), 5.07 (d, *J* = 6.9 Hz, 1H), 4.94 (d, *J* = 5.0 Hz, 1H'), 4.60 (s, 1H'), 4.30 (s, 1H), 4.24 (q, *J* = 7.1 Hz, 3H+3H'), 3.73 (s, 3H'), 3.71 (s, 3H), 1.19 (t, *J* = 7.1 Hz, 3H'), 1.13 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-6-methoxy-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ag).



Following the TP-F, **9ag** was obtained from **2g** (56.1 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a pale yellow solid (90.0 mg, 76%).

R_f= 0.225 (Hex:DCM:EA = 3:1:1).

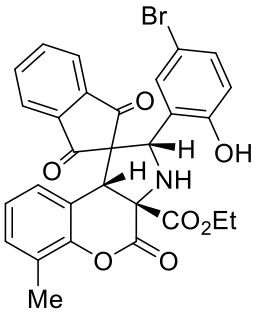
mp.: 129.4-130.4 ℃.

$[\alpha]_D^{23}$ = -115.2º (c = 0.50, CH_2Cl_2).

HPLC: 58% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 32.68 min, t_{major} = 51.94 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.67 (s, 1H), 10.29 (s, 1H'), 7.99 (d, *J* = 7.6 Hz, 1H), 7.76 (t, *J* = 7.54 Hz, 1H+4H'), 7.63 (t, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 7.6 Hz, 1H), 7.18 (d, *J* = 8.1 Hz, 1H'), 6.94 (dd, *J* = 8.8 , 2.3 Hz, 1H), 6.82-6.73 (m, 2H+3H'), 6.60-6.52 (m, 2H), 6.41-6.34 (m, 1H+1H'), 6.21 (d, *J* = 8.2 Hz, 1H'), 5.06 (d, *J* = 6.9 Hz, 1H), 4.94 (d, *J* = 6.4 Hz, 1H'), 4.66 (s, 1H'), 4.36 (s, 1H), 4.31-4.20 (m, 3H+3H'), 3.90 (s, 3H'), 3.85 (s, 3H), 1.18 (t, *J* = 7.1 Hz, 3H'), 1.13 (t, *J* = 7.1 Hz, 3H).

Ethyl (2*S*,3a*R*,9b*R*)-2-(5-bromo-2-hydroxyphenyl)-6-methyl-1',3',4-trioxo-1',2,3,3'-tetrahydro-4*H*-spiro[chromeno[3,4-*b*]pyrrole-1,2'-indene]-3a(9b*H*)-carboxylate (9ah).



Following the TP-F, **9ah** was obtained from **2h** (52.9 mg, 0.2 mmol) and **1a** (86.0 mg, 1.2 equiv.) as a pale yellow solid (39.2 mg, 34%).

R_f= 0.413 (Hex:DCM:EA = 3:1:1).

mp.: 95.0-96.0 ℃.

$[\alpha]_D^{23}$ = 174.6º (c = 0.50, CH_2Cl_2).

HPLC: 95% ee, Chiralpak IB column, *n*-hexane/*i*-PrOH = 85:15, flow rate = 0.70 mL/min, λ= 245 nm, t_{minor} = 29.80 min, t_{major} = 35.08 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 10.77 (s, 1H), 10.22 (s, 1H'), 7.99 (d, *J* = 7.6 Hz, 1H), 7.85-7.71 (m, 1H+4H'), 7.63 (t, *J* = 7.6 Hz, 1H), 7.49 (d, *J* = 7.6 Hz, 1H), 7.17 (d, *J* = 8.6 Hz, 1H'), 7.06 (d, *J* = 7.6 Hz, 1H'), 7.03 (d, *J* = 7.4 Hz, 1H), 6.93 (dd, *J* = 8.7, 1.9 Hz, 1H), 6.82-6.68 (m, 1H+2H'), 6.65 (d, *J* = 7.6 Hz, 1H), 6.61-6.40 (m, 2H+2H'), 5.10 (d, *J* = 6.6 Hz, 1H), 4.95 (d, *J* = 6.1 Hz, 1H'), 4.63 (s, 1H'), 4.37 (s, 1H), 4.35-4.11 (m, 3H+3H'), 2.36 (s, 3H'), 2.31 (s, 3H), 1.16 (t, *J* = 7.1 Hz, 3H'), 1.10 (t, *J* = 7.1 Hz, 3H).

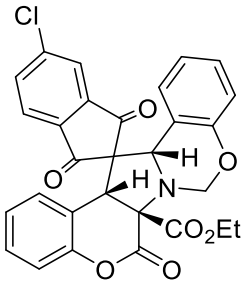
^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: (mixture of rotamers) 198.8, 197.8, 196.9, 196.1, 168.7, 167.2, 166.0, 164.8, 156.6, 156.5, 149.7, 149.0, 143.0, 142.5, 142.2, 141.3, 136.5, 136.1, 132.6, 132.3, 131.7, 131.4, 129.9, 129.7, 126.8, 126.7, 125.2, 124.6, 123.9, 123.7, 123.5, 123.3, 123.1, 122.2, 120.2, 119.6, 118.5, 115.9, 115.2, 110.6, 110.0, 71.0, 69.6, 68.4, 68.1, 67.6, 67.1, 63.9, 63.5, 50.3, 49.4, 15.9, 15.8, 13.62, 13.58.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 3316, 2926, 1767, 1742, 1707, 1592, 1482, 1255, 1183.

HRMS (ESI) for $C_{29}H_{23}{}^{79}BrNO_7$, $[M+H]^+$ (576.0652) found: 576.0657.

HRMS (ESI) for $C_{29}H_{23}{}^{81}BrNO_7$, $[M+H]^+$ (578.0632) found: 578.0641

Ethyl (6a*R*,13b*S*,14a*R*)-5'-chloro-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*,13b*H*-spiro[benzo[e]chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (11ca).



Following the TP-D, **11ca** was obtained from **9ca** (51.7 mg, 0.1 mmol) as a yellow solid (46.6 mg, 88%); R_f = 0.375 (EA:Hex = 1:3).

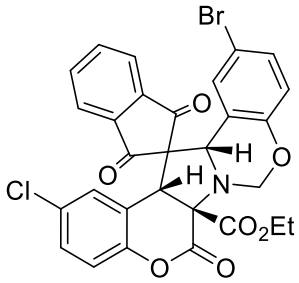
mp.: 211.4-212.4 ℃.

$[\alpha]_D^{24}$ = 204.5º (c = 0.50, CH_2Cl_2).

HPLC: 84% ee, Chiralpak IA column, *n*-hexane/EtOH = 80:20, flow rate = 1.0 mL/min, λ= 248 nm, t_{minor} = 13.53 min, t_{major} = 20.74 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 8.09 (d, *J* = 7.6 Hz, 1H), 7.84 (t, *J* = 7.6 Hz, 1H), 7.70 (t, *J* = 7.6 Hz, 1H), 7.45 (d, *J* = 7.6 Hz, 1H), 7.14 (td, *J* = 7.5, 1.9 Hz, 1H), 7.01 (d, *J* = 8.2 Hz, 1H), 6.89 (dd, *J* = 8.8, 2.0 Hz, 1H), 6.86-6.76 (m, 3H), 6.06 (d, *J* = 2.2 Hz, 1H), 5.81 (d, *J* = 10.6 Hz, 1H), 5.38 (s, 1H), 5.05 (d, *J* = 10.5 Hz, 1H), 4.53 (s, 1H), 4.26-4.10 (m, 2H), 1.09 (t, *J* = 7.1 Hz, 3H).

Ethyl (6a*R*,13b*S*,14a*R*)-12-bromo-2-chloro-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*, 13b*H*-spiro[benzo[e]chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (11ab).



Following the TP-D, **11ab** was obtained from **9ab** (59.8 mg, 0.1 mmol) as a white solid (48.1 mg, 79%).

R_f = 0.313 (Hex:EA = 4:1).

mp.: 118.3-119.3 ℃.

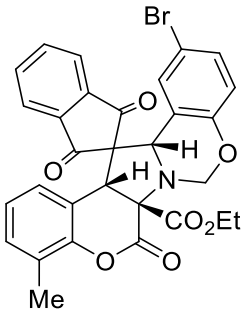
$[\alpha]_D^{25}$ = 80.2º (c = 0.50, CH_2Cl_2).

HPLC: 93% ee, Chiralpak IA column, *n*-hexane/EtOH = 90:10, flow rate = 1.0 mL/min, λ= 248 nm, t_{minor} = 27.86 min, t_{major} = 35.69 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 8.14 (d, *J* = 7.6 Hz, 1H), 7.89 (t, *J* = 7.6 Hz, 1H),

7.75 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.12 (dd, *J* = 8.8, 2.2 Hz, 1H), 7.02 (dd, *J* = 8.8, 2.1 Hz, 1H), 6.97 (d, *J* = 8.8 Hz, 1H), 6.84 (d, *J* = 2.2 Hz, 1H), 6.76 (d, *J* = 8.8 Hz, 1H), 6.18 (s, 1H), 5.80 (d, *J* = 10.6 Hz, 1H), 5.34 (s, 1H), 5.01 (d, *J* = 10.6 Hz, 1H), 4.49 (s, 1H), 4.27-4.16 (m, 2H), 1.13 (t, *J* = 7.1 Hz, 3H).

Ethyl (6a*R*,13b*S*,14a*R*)-12-bromo-4-methyl-1',3',6-trioxo-1',3'-dihydro-6*H*,8*H*, 13b*H*-spiro[benzo[e]chromeno[4',3':4,5]pyrrolo[1,2-*c*][1,3]oxazine-14,2'-indene]-6a(14a*H*)-carboxylate (11ah).



Following the TP-D, **11ah** was obtained from **9ah** (57.8 mg, 0.1 mmol) as a pale yellow solid (35.3 mg, 60%).

R_f = 0.263 (Hex:EA = 4:1).

mp.: 201.6-202.6 ℃.

$[\alpha]_D^{24}$ = 462.6° (c = 0.50, CH_2Cl_2).

HPLC: 94% ee, Chiralpak IA column, *n*-hexane/EtOH = 90:10, flow rate = 1.0 mL/min, λ= 248 nm, t_{minor} = 24.54 min, t_{major} = 33.35 min.

^{1}H NMR (400 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 8.09 (d, *J* = 7.6 Hz, 1H), 7.83 (t, *J* = 7.6 Hz, 1H), 7.70 (t, *J* = 7.6 Hz, 1H), 7.45 (d, *J* = 7.6 Hz, 1H), 7.01 (dd, *J* = 8.8, 2.1 Hz, 1H), 6.97 (d, *J* = 7.0 Hz, 1H), 6.75 (d, *J* = 8.8 Hz, 1H), 6.72-6.63 (m, 2H), 6.19 (d, *J* = 1.8 Hz, 1H), 5.83 (d, *J* = 10.5 Hz, 1H), 5.36 (s, 1H), 5.03 (d, *J* = 10.5 Hz, 1H), 4.53 (s, 1H), 4.25-4.11 (m, 2H), 2.27 (s, 3H), 1.10 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$, 25 ℃) *δ*/ppm: 198.4, 196.5, 169.0, 163.6, 155.5, 149.1, 143.0, 142.5, 136.7, 136.1, 131.4,131.2, 128.0, 126.8, 124.7, 123.8, 123.4, 123.3, 121.5, 120.5, 115.3, 112.1, 76.5, 68.5, 68.4, 63.8, 63.1, 51.3, 16.0, 13.7.

IR (KBr) $\tilde{\nu}$ (cm^{-1}): 2922, 1769, 1743, 1708, 1592, 1471, 1242, 1212, 1159.

HRMS (ESI) for $C_{30}H_{22}{}^{79}BrNO_7$, $[M+H]^+$ (588.0652) found: 588.0659.

HRMS (ESI) for $C_{30}H_{22}{}^{81}BrNO_7$, $[M+H]^+$ (590.0632) found: 590.0643.

13. References

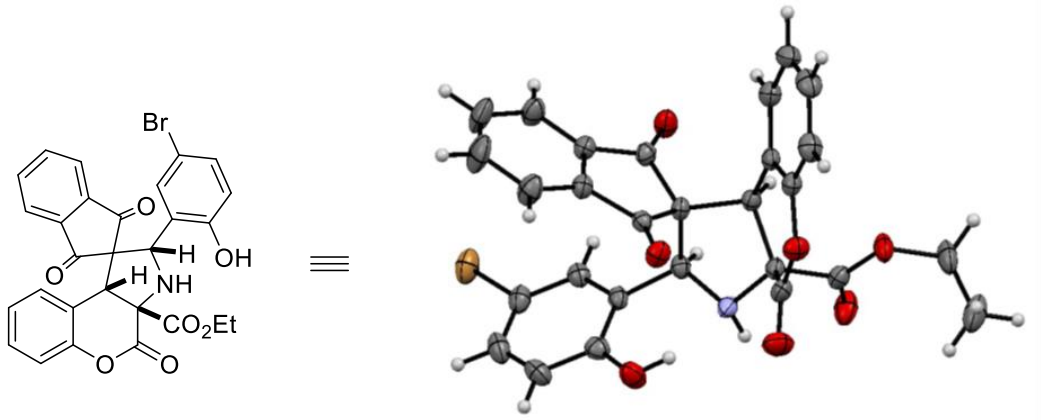
(1) L. Tian, G.-Q. Xu, Y.-H. Li, Y.-M. Liang, P.-F. Xu, *Chem. Commun.* 2014, **50**, 2428.

(2) S.-M. Yang, Y.-L. Tsai, G. M. Reddy, L. Möehlmann, W. Lin, *J. Org. Chem.* 2017, **82**, 9182

(3) G.-H. Chang, C.-Y. Wang, G. M. Reddy, Y.-L. Tsai, W. Lin, *J. Org. Chem.* 2016, **81**, 10071.

14. X-ray crystallographic data for selected compounds

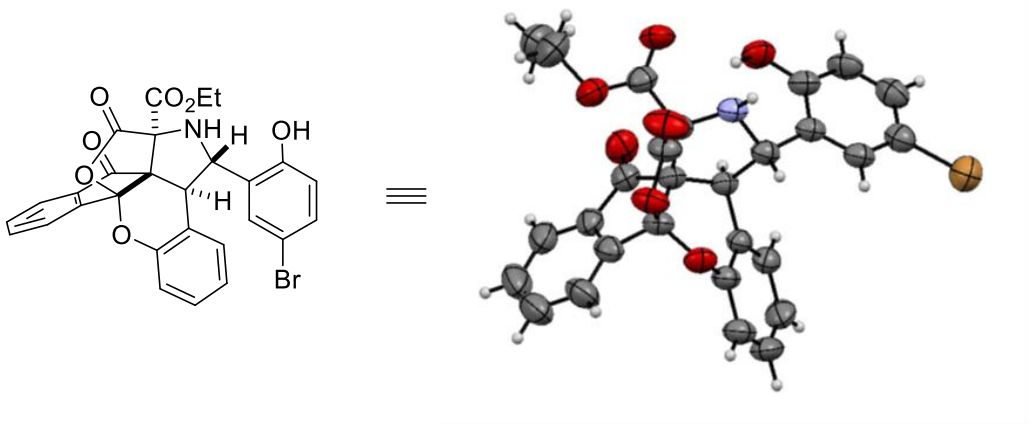
a) **3aa (**CCDC no. 1841899): The thermal ellipsoid drawn at 30% probability level.



Empirical formula	C28 H20 Br N O7	
Formula weight	562.36	
Temperature	200(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P -1	
Unit cell dimensions	a = 9.0255(3) Å	α= 80.012(2)°.
	b = 10.5951(3) Å	β= 77.0370(10)°.
	c = 13.5639(4) Å	γ = 72.6250(10)°.
Volume	1198.40(6) $Å^3$	
Z	2	
Density (calculated)	1.558 Mg/m^3	
Absorption coefficient	1.766 mm^{-1}	
F(000)	572	
Crystal size	0.28 x 0.25 x 0.06 mm^3	
Theta range for data collection	1.55 to 25.09°.	

Index ranges	-10<=h<=10, -12<=k<=12, -16<=l<=15
Reflections collected	10500
Independent reflections	4238 [R(int) = 0.0230]
Completeness to theta = 25.09°	99.2 %
Absorption correction	multi-scan
Max. and min. transmission	0.9014 and 0.6376
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4238 / 0 / 334
Goodness-of-fit on F^2	1.082
Final R indices [I>2sigma(I)]	R1 = 0.0366, wR2 = 0.1112
R indices (all data)	R1 = 0.0470, wR2 = 0.1261
Largest diff. peak and hole	0.445 and -0.463 e.$Å^{-3}$

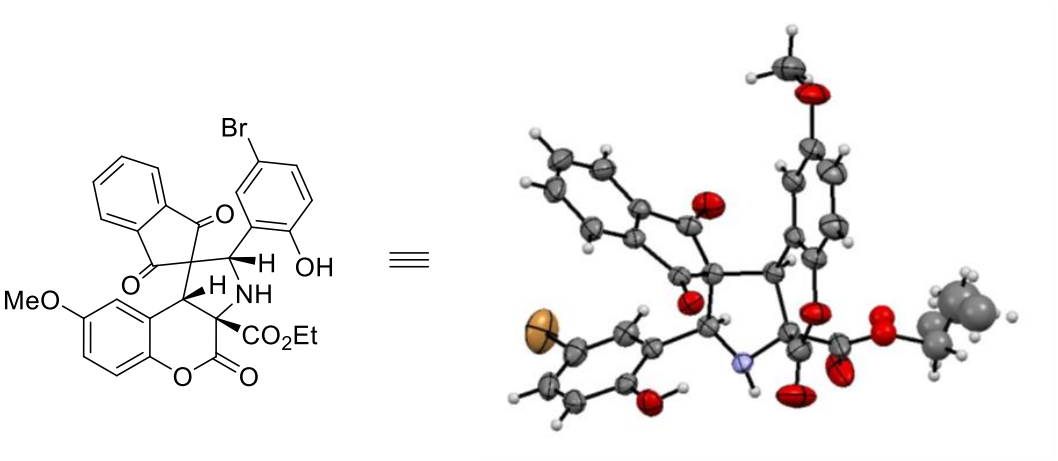
b) **4aa** (CCDC no. 1551249): The thermal ellipsoid drawn at 30% probability level.



Empirical formula	C28 H20 Br N O7	
Formula weight	562.36	
Temperature	295(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P -1	
Unit cell dimensions	a = 9.4700(5) Å	α= 76.892(2)°.
	b = 10.6706(6) Å	β= 69.377(2)°.
	c = 13.3664(8) Å	γ = 76.410(2)°.
Volume	1213.24(12) $Å^3$	
Z	2	
Density (calculated)	1.539 Mg/m^3	
Absorption coefficient	1.744 mm^{-1}	

F(000)	572
Crystal size	0.20 x 0.18 x 0.12 mm^3
Theta range for data collection	2.33 to 25.39°.
Index ranges	-11<=h<=11, -12<=k<=12, -16<=l<=16
Reflections collected	34687
Independent reflections	4438 [R(int) = 0.1158]
Completeness to theta = 25.39°	99.4 %
Absorption correction	multi-scan
Max. and min. transmission	0.8180 and 0.7217
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4438 / 0 / 335
Goodness-of-fit on F^2	1.019
Final R indices [I>2sigma(I)]	R1 = 0.0526, wR2 = 0.1158
R indices (all data)	R1 = 0.1228, wR2 = 0.1500
Largest diff. peak and hole	0.560 and -0.389 e.$Å^{-3}$

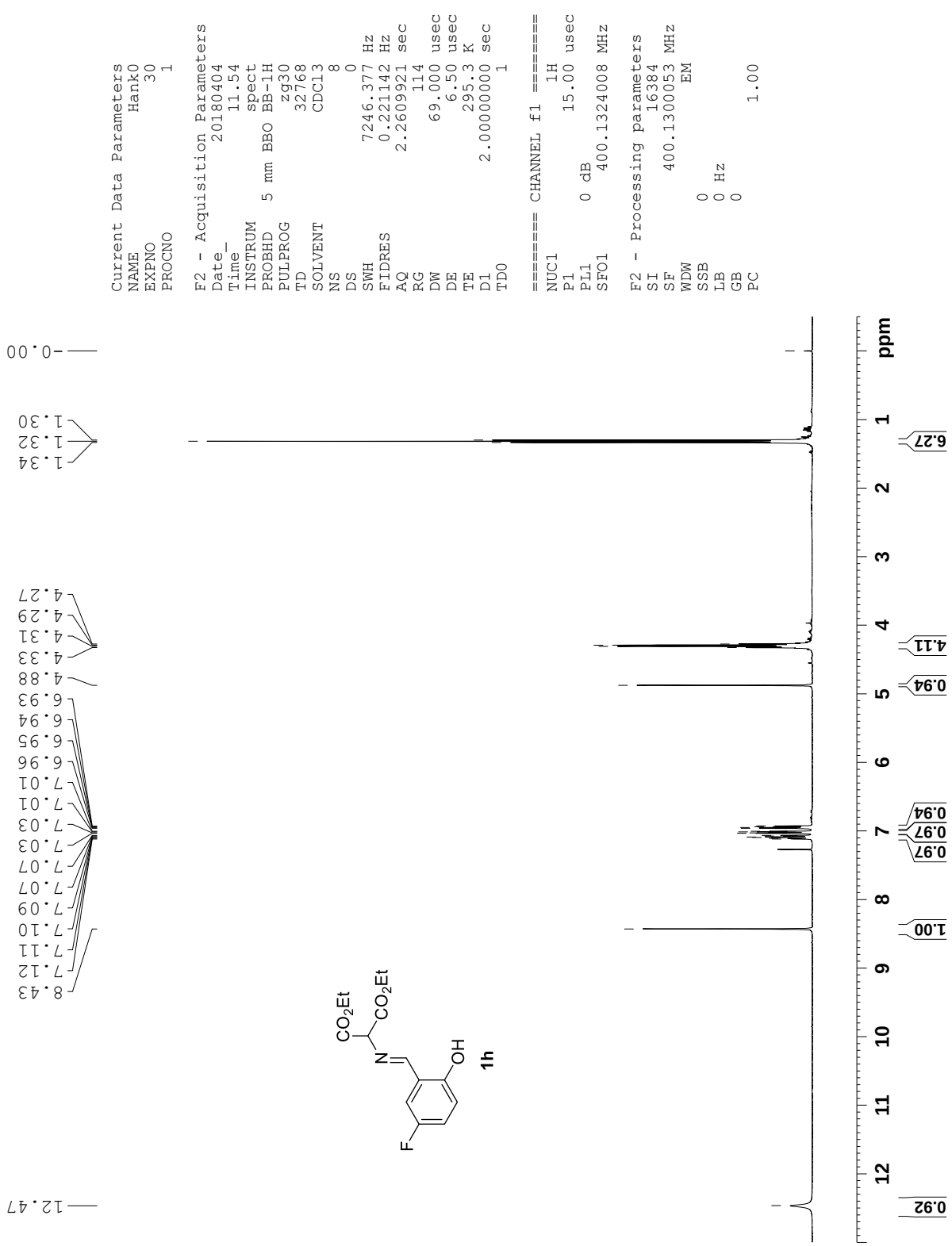
c) **9ae** (CCDC no. 1551248): The thermal ellipsoid drawn at 30% probability level.

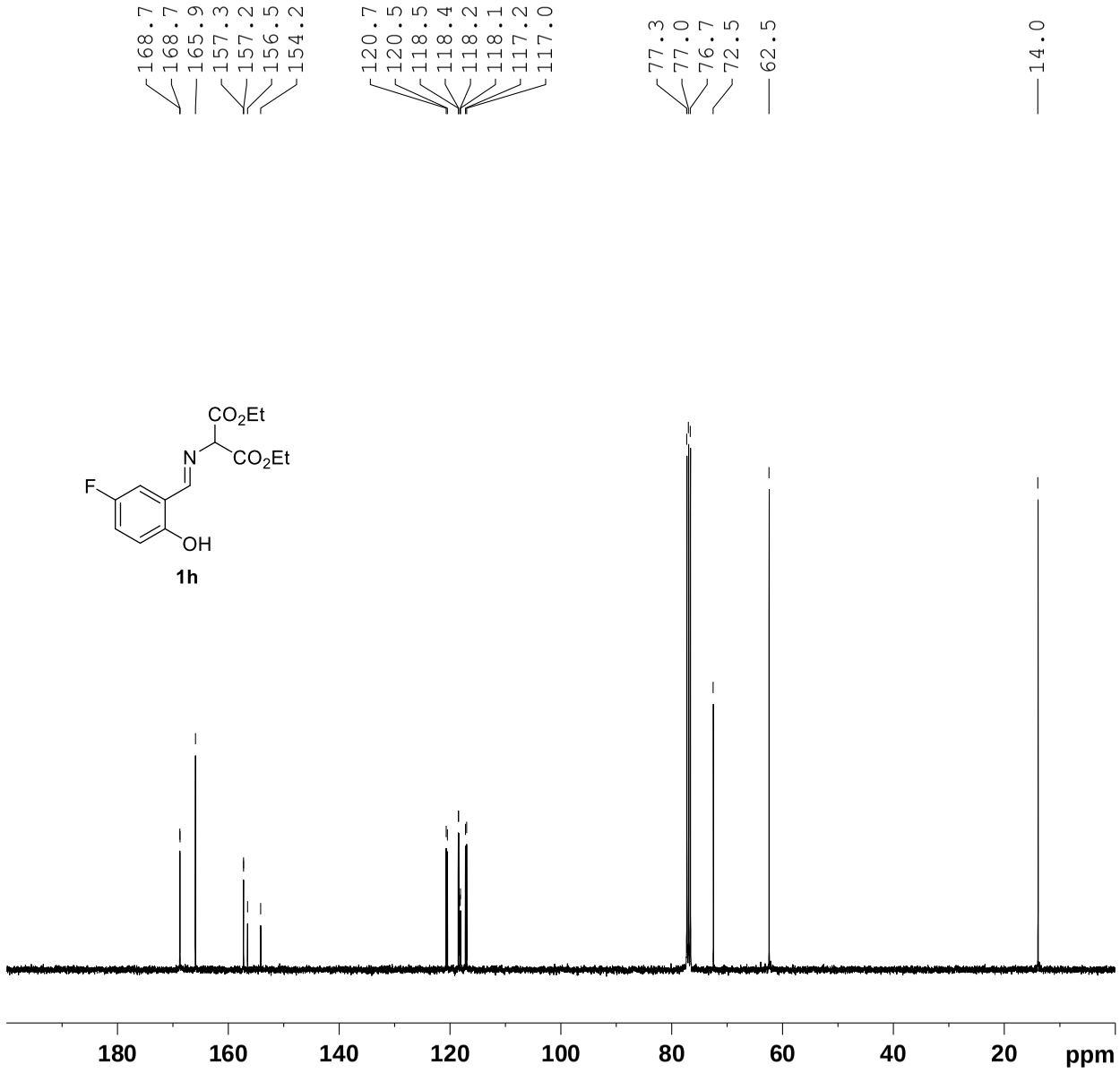


Empirical formula	C29 H22 Br N O8	
Formula weight	592.39	
Temperature	250(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P -1	
Unit cell dimensions	a = 9.3617(8) Å	α= 63.828(2)°.
	b = 12.1176(10) Å	β= 82.131(3)°.
	c = 13.2597(10) Å	γ = 76.526(3)°.
Volume	1311.82(18) $Å^3$	

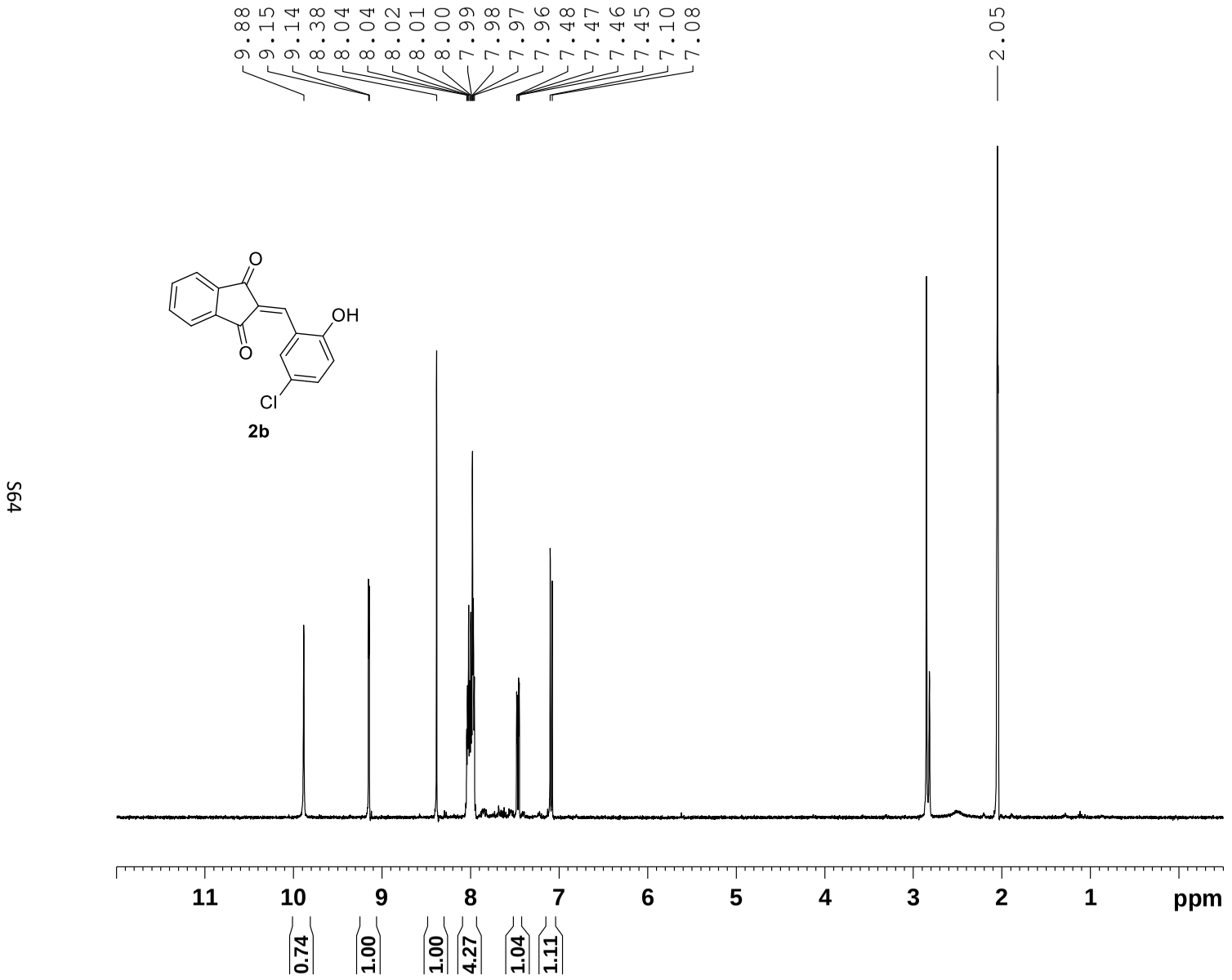
Z	2
Density (calculated)	1.500 Mg/m^3
Absorption coefficient	1.620 mm^{-1}
F(000)	604
Crystal size	0.20 x 0.07 x 0.03 mm^3
Theta range for data collection	2.24 to 25.07°.
Index ranges	-11<=h<=11, -14<=k<=14, -15<=l<=15
Reflections collected	25308
Independent reflections	4630 [R(int) = 0.0518]
Completeness to theta = 25.07°	99.5 %
Absorption correction	multi-scan
Max. and min. transmission	0.9530 and 0.7376
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4630 / 1 / 349
Goodness-of-fit on F^2	1.024
Final R indices [I>2sigma(I)]	R1 = 0.0526, wR2 = 0.1166
R indices (all data)	R1 = 0.0780, wR2 = 0.1285
Largest diff. peak and hole	0.620 and -0.853 $e.Å^{-3}$

15. ^{1}H NMR and ^{13}C NMR spectra for all new compounds

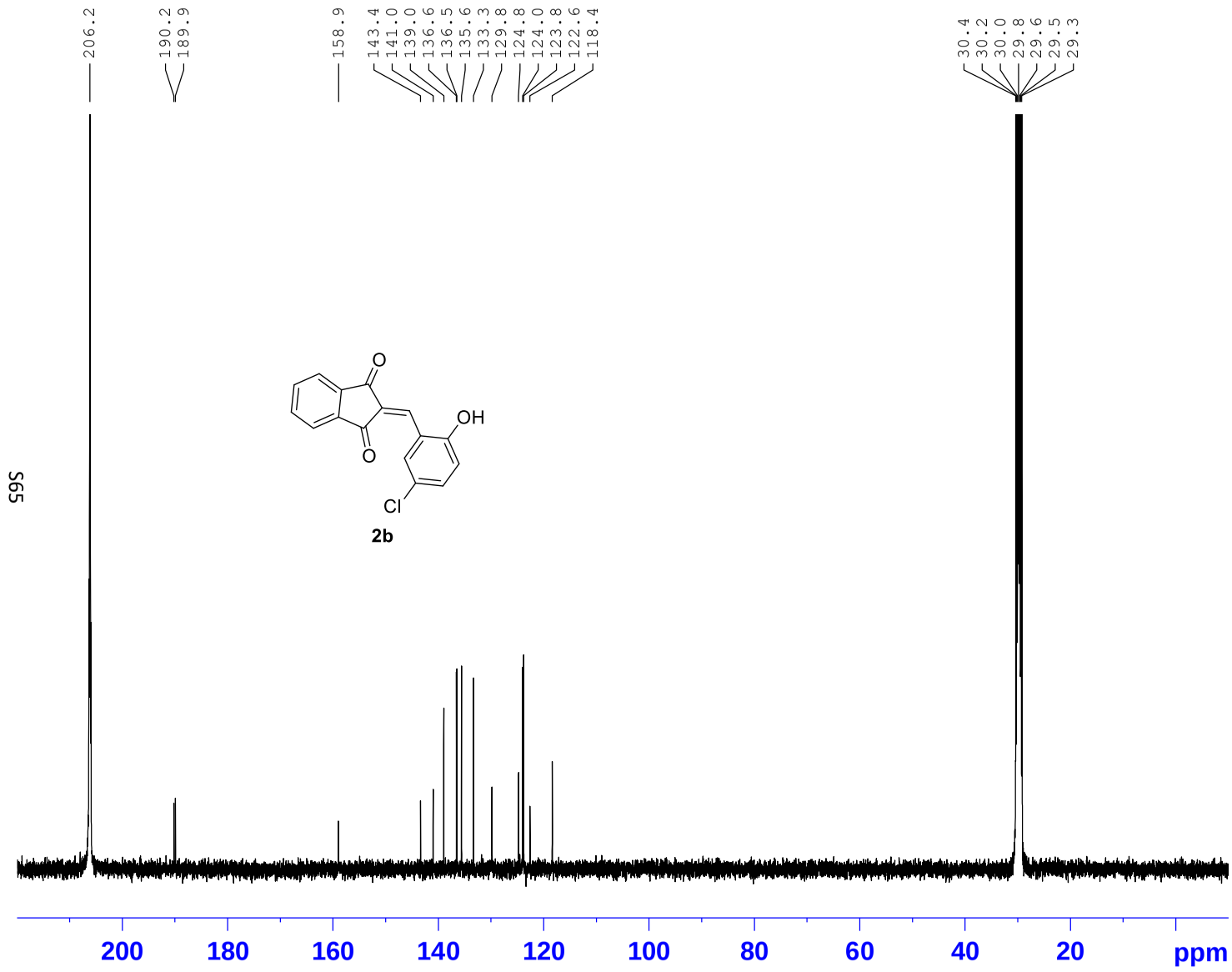




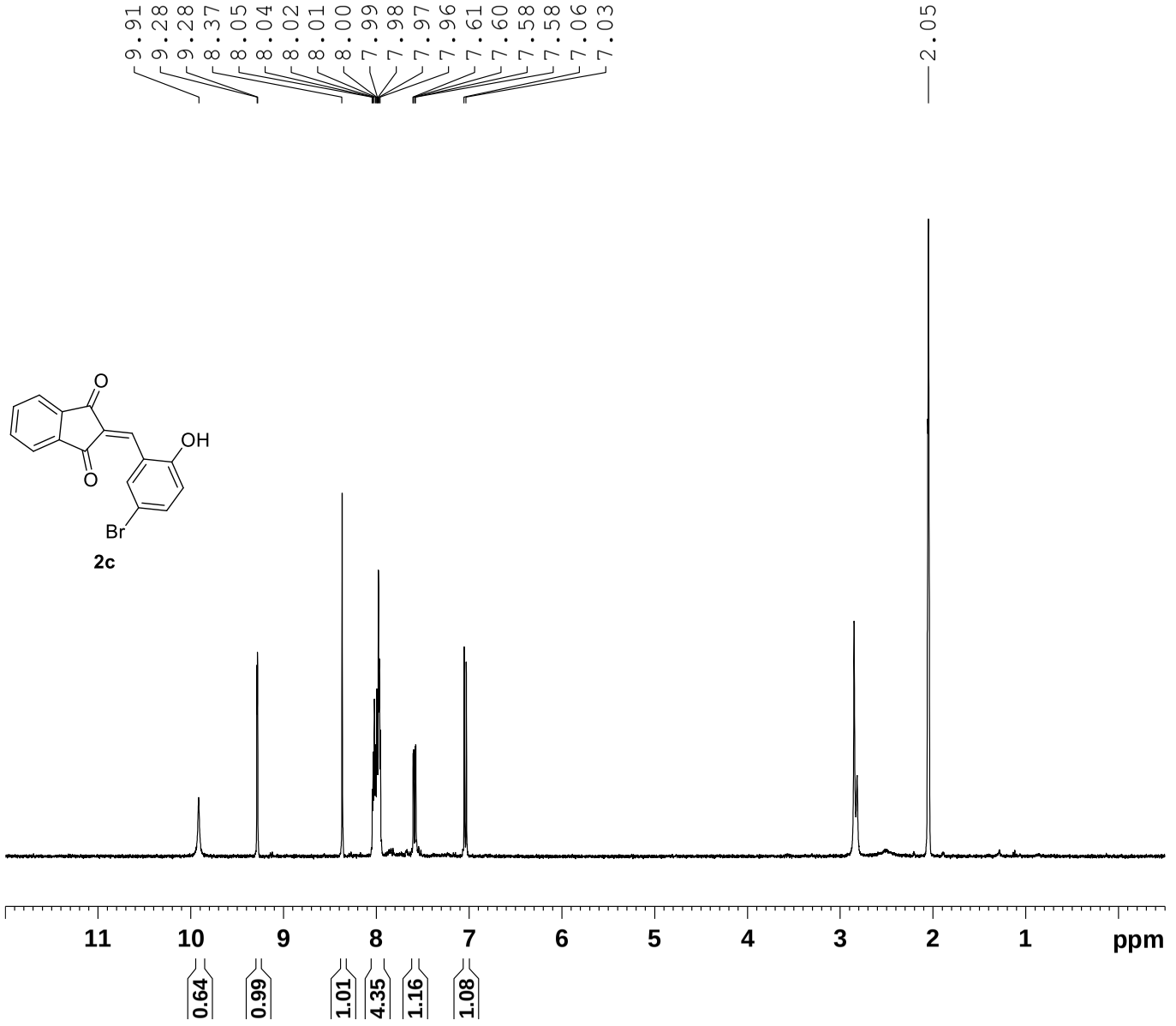

```
Current Data Parameters
NAME                  Hank0
EXPNO                    31
PROCNO                    1

F2 - Acquisition Parameters
Date_              20180404
Time                  11.56
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1000
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   295.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127724 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



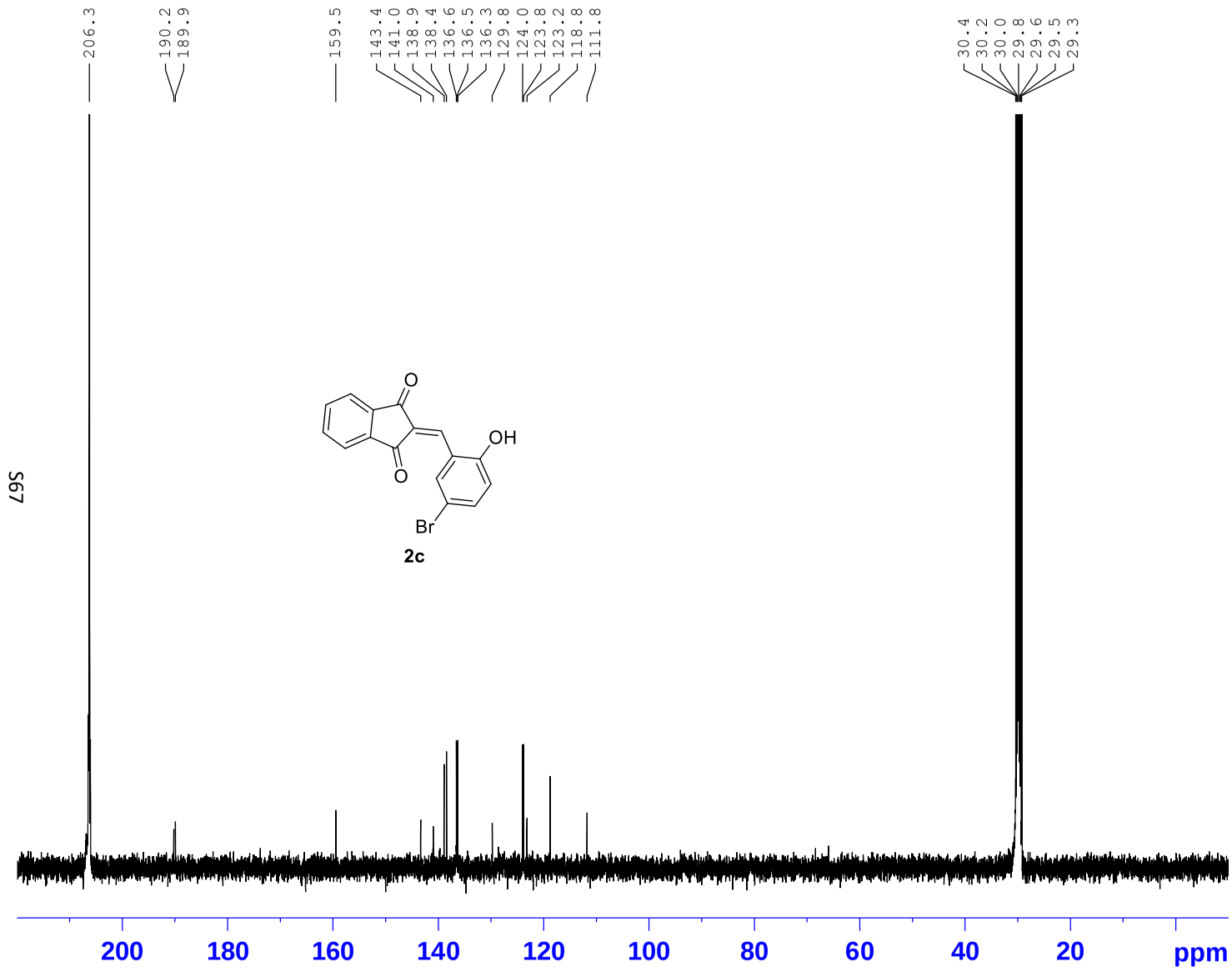

```
Current Data Parameters
NAME                 liu051
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170511
Time                 17.06
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT            Acetone
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                   456.1
DW                  69.000 usec
DE                   6.50 usec
TE                  297.1 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  14.40 usec
PL1                  1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300069 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



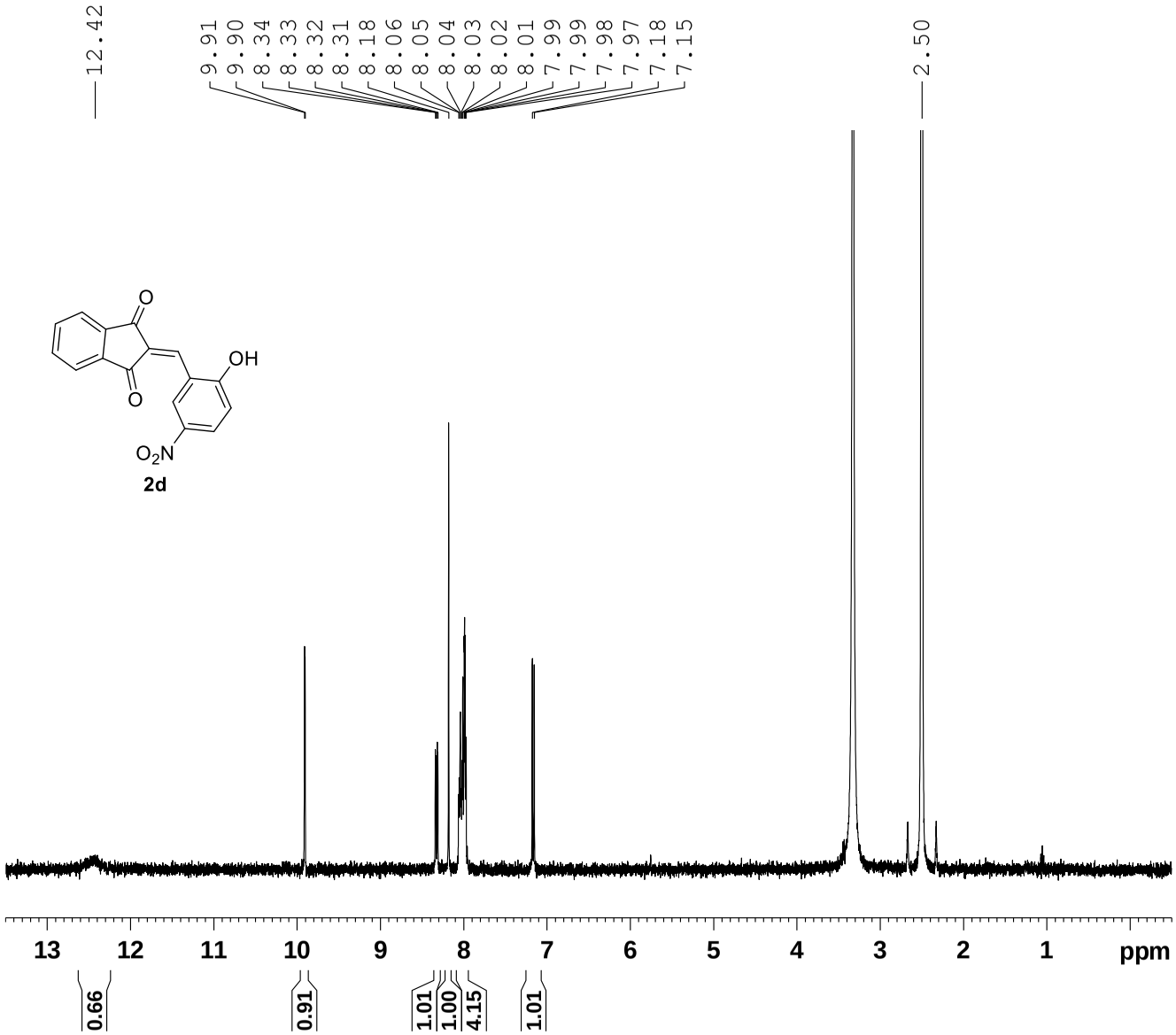

```
Current Data Parameters
NAME                  liu051
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170522
Time                   0.34
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                  32768
SOLVENT           Acetone
NS                  10966
DS                      0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   8192
DW                  20.800 usec
DE                   6.50 usec
TE                  295.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                  1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6126778 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



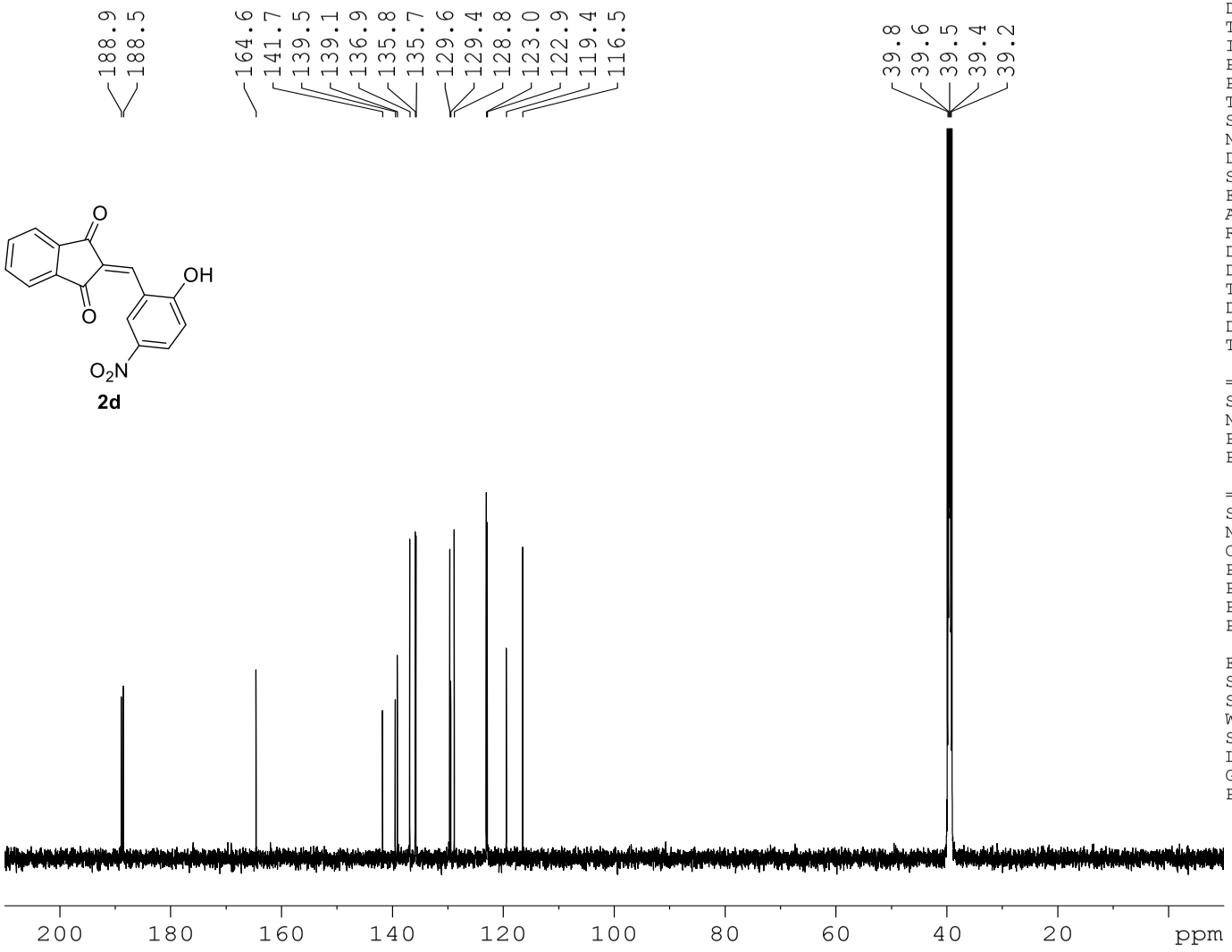

```
Current Data Parameters
NAME                  liu050
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170511
Time                  14.35
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT            Acetone
NS                        16
DS                         0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                 2.2609921 sec
RG                     456.1
DW                    69.000 usec
DE                     6.50 usec
TE                    297.1 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF             400.1300068 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```



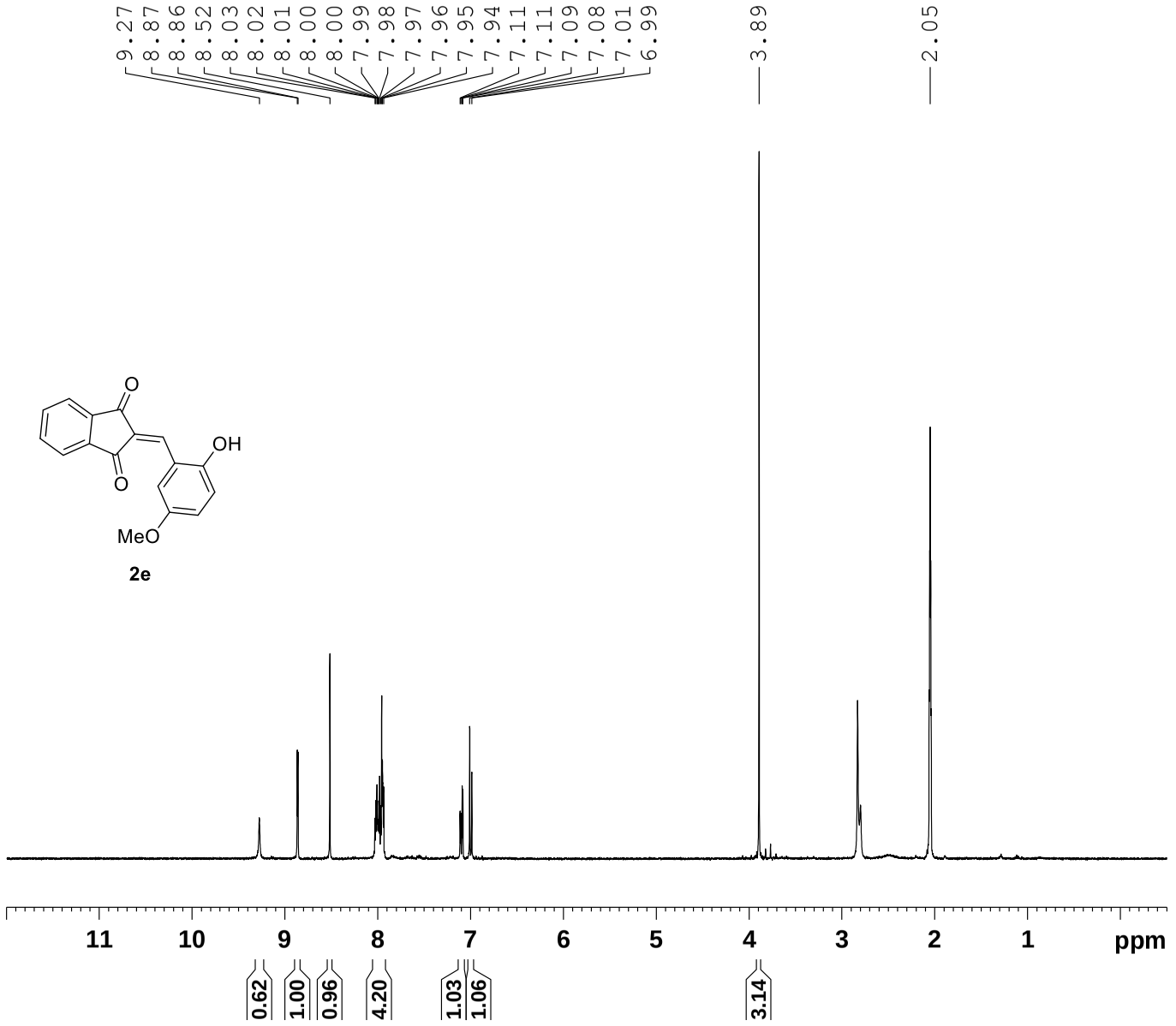

```
Current Data Parameters
NAME                  liu050
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170518
Time                  12.20
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT           Acetone
NS                     1509
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  11585.2
DW                   20.800 usec
DE                    6.50 usec
TE                   294.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                     9.00 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6126795 MHz
WDW                       EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



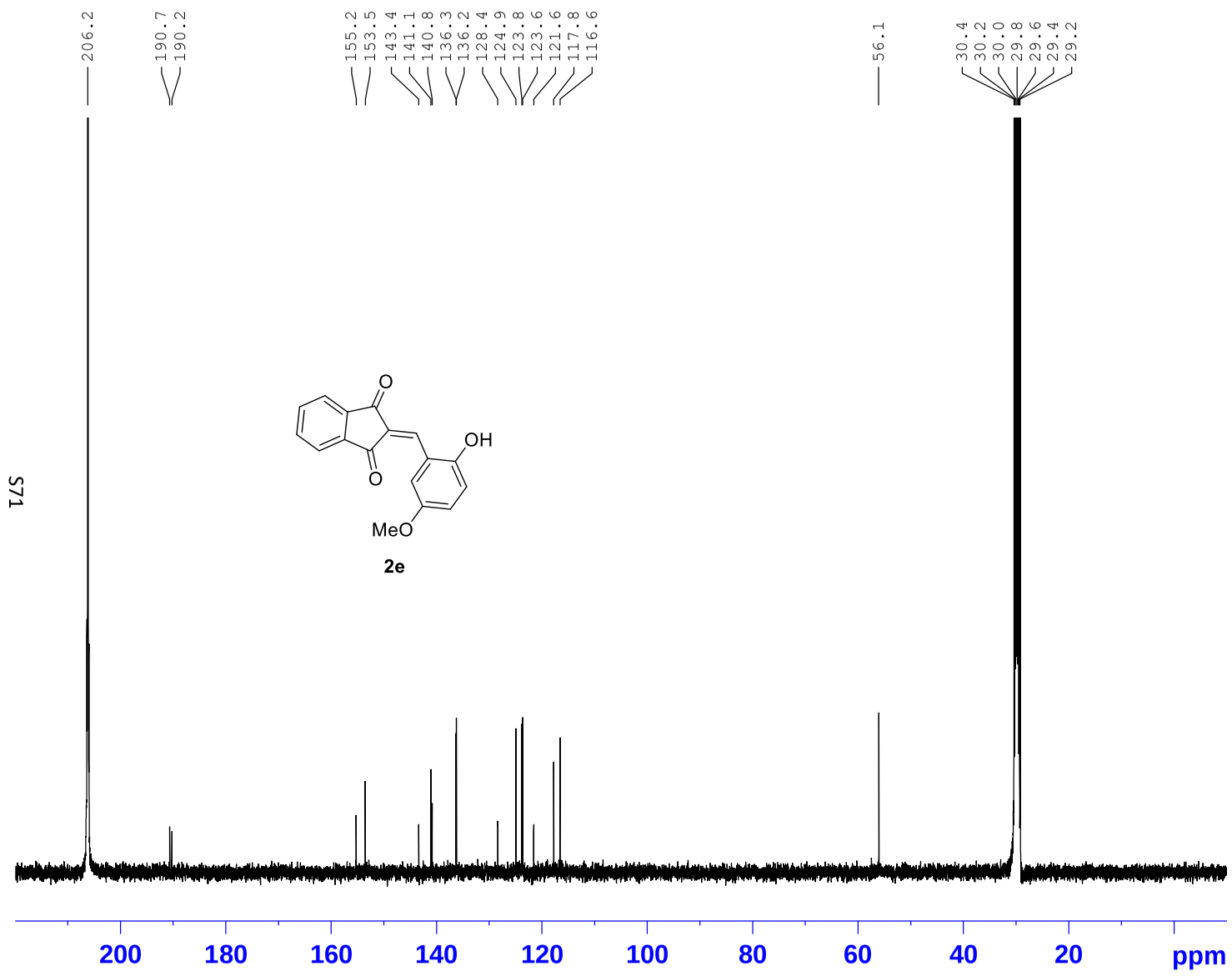

```
Current Data Parameters
NAME                  B06
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20180618
Time                11.08
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT              DMSO
NS                     16
DS                      0
SWH             7211.539 Hz
FIDRES           0.220079 Hz
AQ              2.2719147 sec
RG                 198.09
DW                69.333 usec
DE                10.50 usec
TE                297.9 K
D1             2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                   1H
P1                  12.90 usec
PLW1          15.00000000 W

F2 - Processing parameters
SI                  16384
SF            400.1300033 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME                      12
EXPNO                     12
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180611
Time                  12.07
INSTRUM               spect
PROBHD   5 mm PATBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT                DMSO
NS                      1200
DS                         0
SWH              36057.691 Hz
FIDRES            0.550197 Hz
AQ               0.9087659 sec
RG                    2050
DW                  13.867 usec
DE                    6.50 usec
TE                   323.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1          150.9287115 MHz
NUC1                    13C
P1                    10.80 usec
PLW1          50.00000000 W

======== CHANNEL f2 ========
SFO2          600.1724007 MHz
NUC2                    1H
CPDPRG[2           waltz64
PCPD2                 70.00 usec
PLW2          30.00000000 W
PLW12          1.03470004 W
PLW13          0.50700003 W

F2 - Processing parameters
SI                     32768
SF            150.9129726 MHz
WDW                       EM
SSB       0
LB                     2.00 Hz
GB        0
PC                     1.00
```

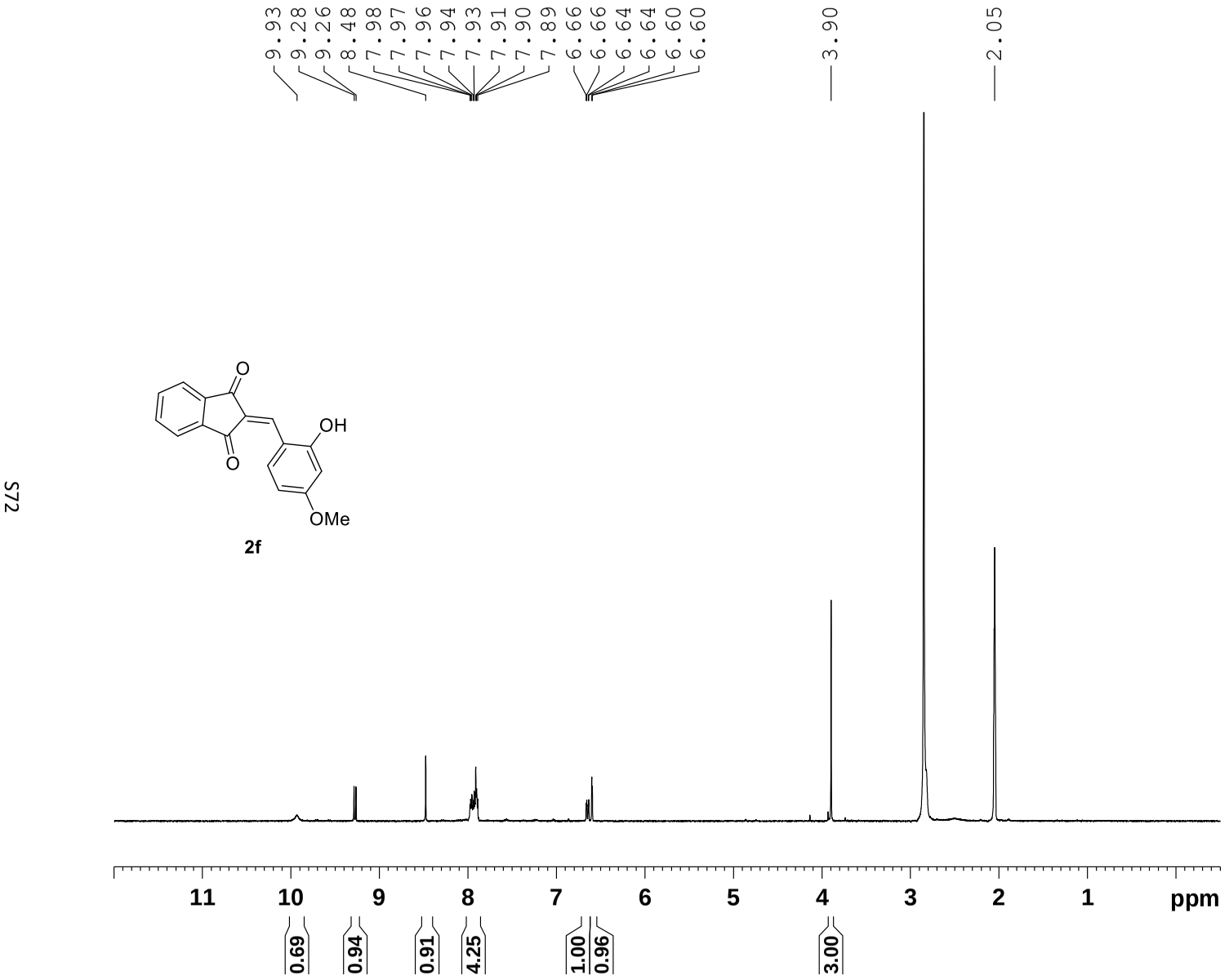



```
Current Data Parameters
NAME                  liu048
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170511
Time                  15.17
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT            Acetone
NS                        16
DS                         0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                 2.2609921 sec
RG                     456.1
DW                    69.000 usec
DE                     6.50 usec
TE                    297.1 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                        16384
SF             400.1300069 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```

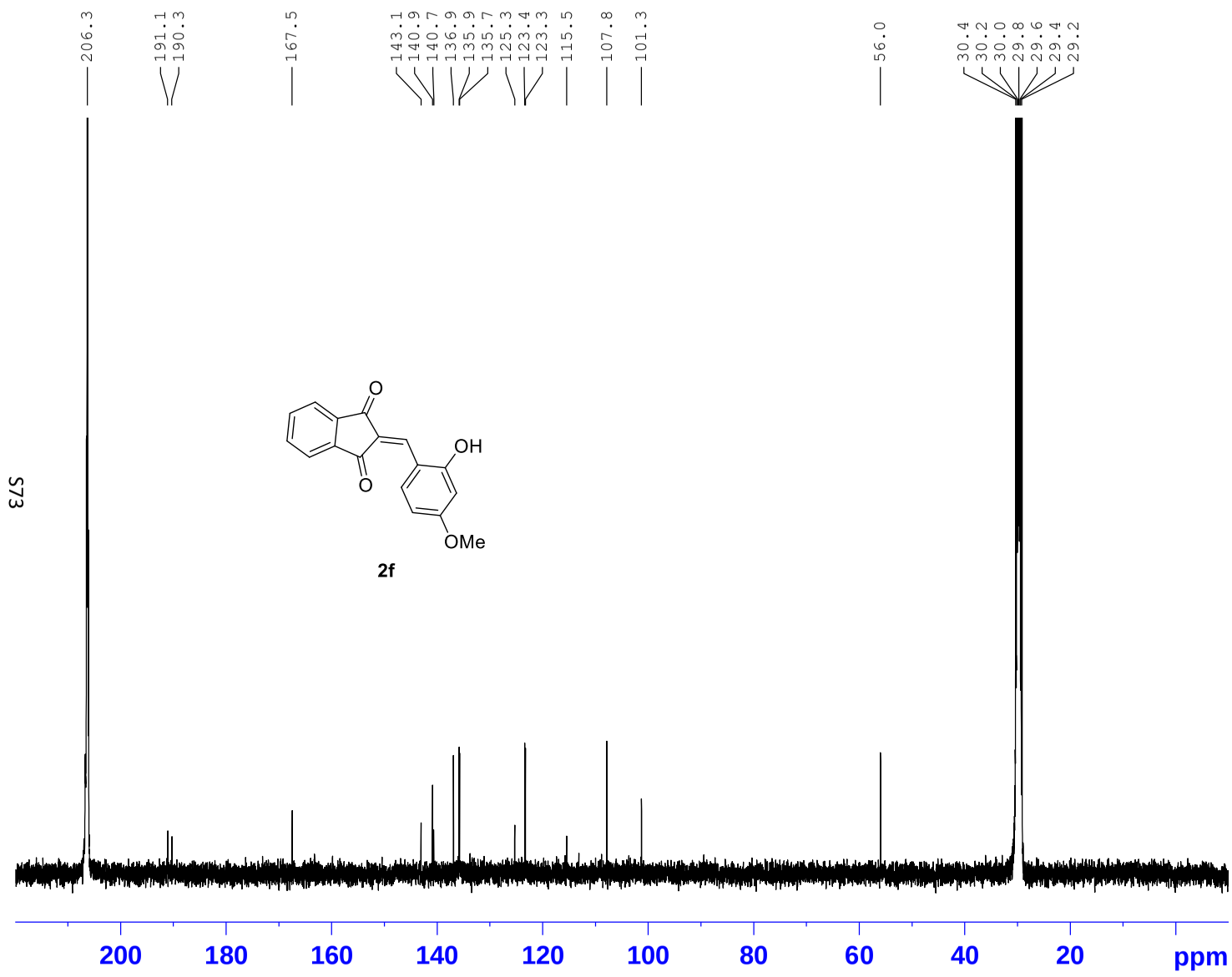


2e

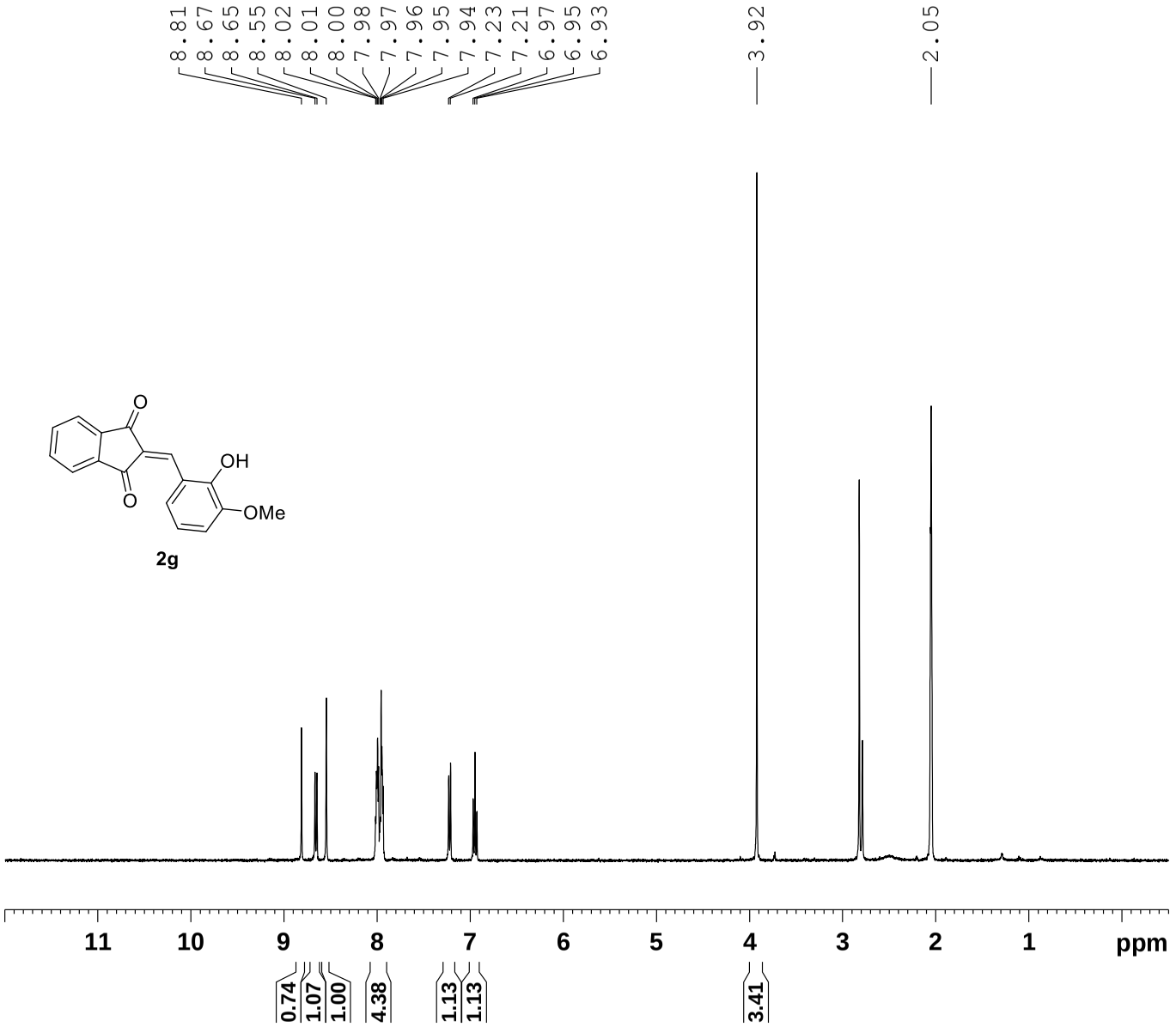

```
Current Data Parameters
NAME                  liu048
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170528
Time                  10.17
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT           Acetone
NS                    11248
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   9195.2
DW                  20.800 usec
DE                   6.50 usec
TE                  298.5 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6126785 MHz
WDW                      EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



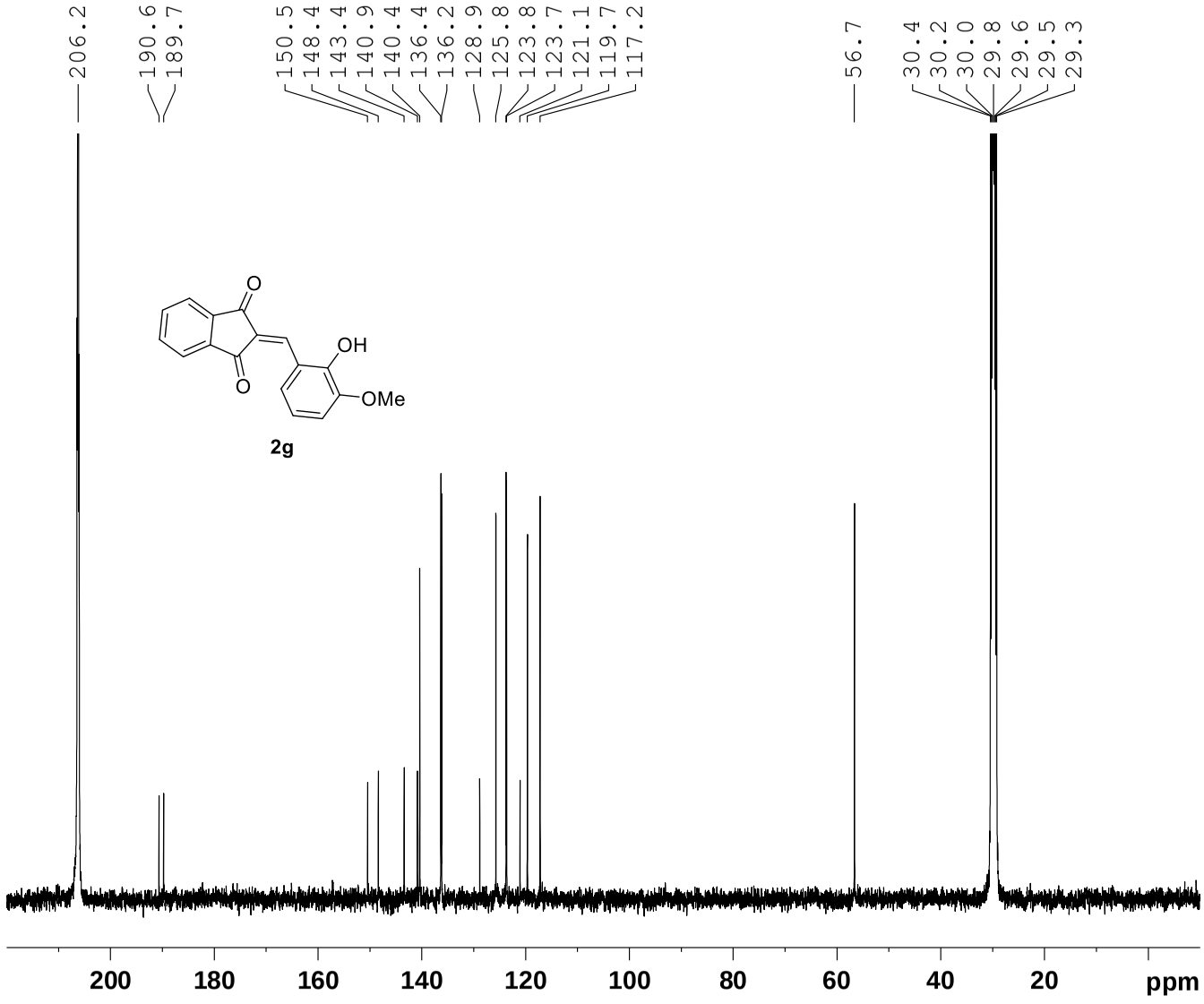

```
Current Data Parameters
NAME                  liu047
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170511
Time                  17.12
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT           Acetone
NS                        16
DS                         0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                2.2609921 sec
RG                       362
DW                  69.000 usec
DE                   6.50 usec
TE                   297.1 K
D1               2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF            400.1300069 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```



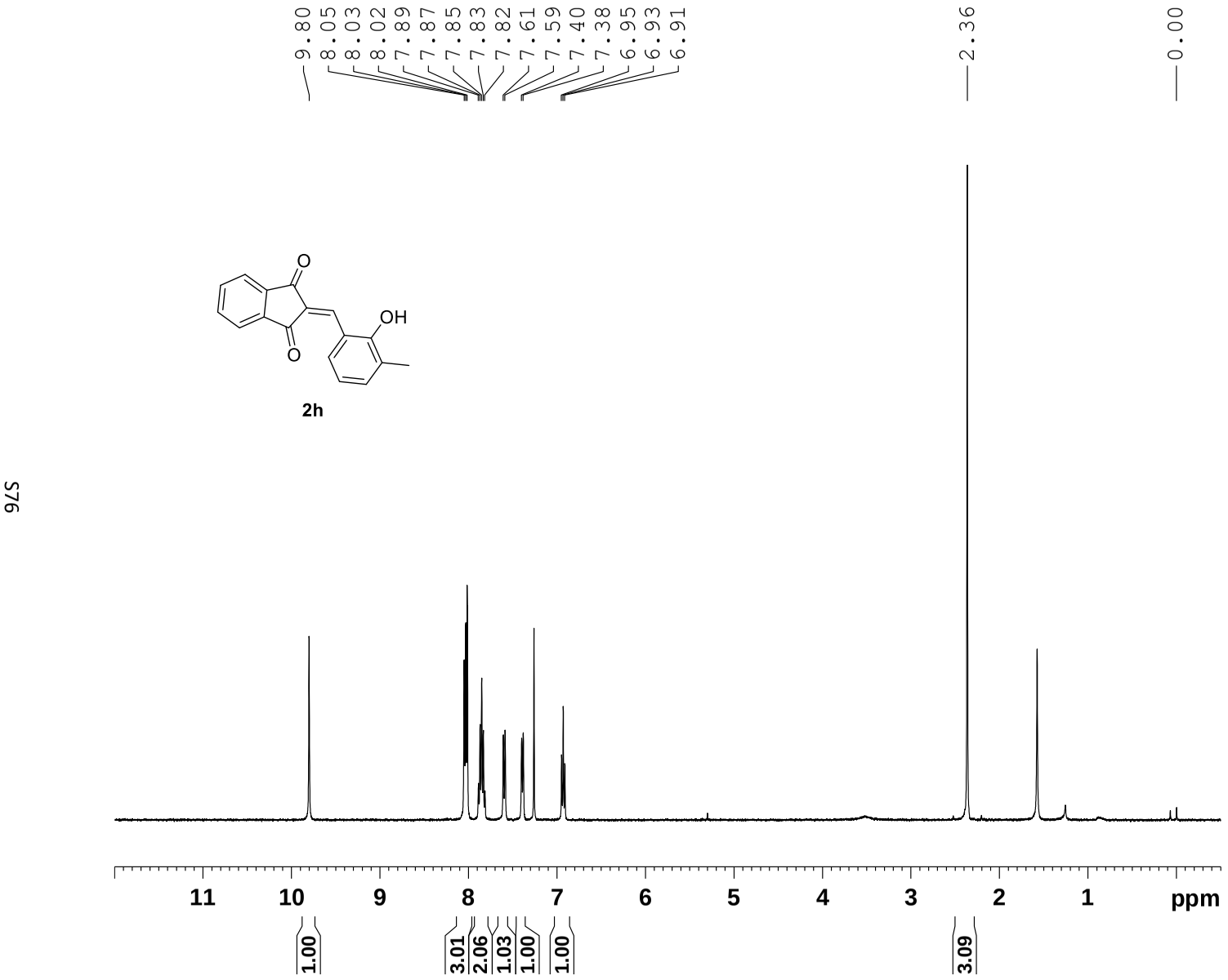

```
Current Data Parameters
NAME                  liu047
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170528
Time                 23.11
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT            Acetone
NS                   15173
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  11585.2
DW                   20.800 usec
DE                    6.50 usec
TE                   299.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6126842 MHz
WDW                       EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



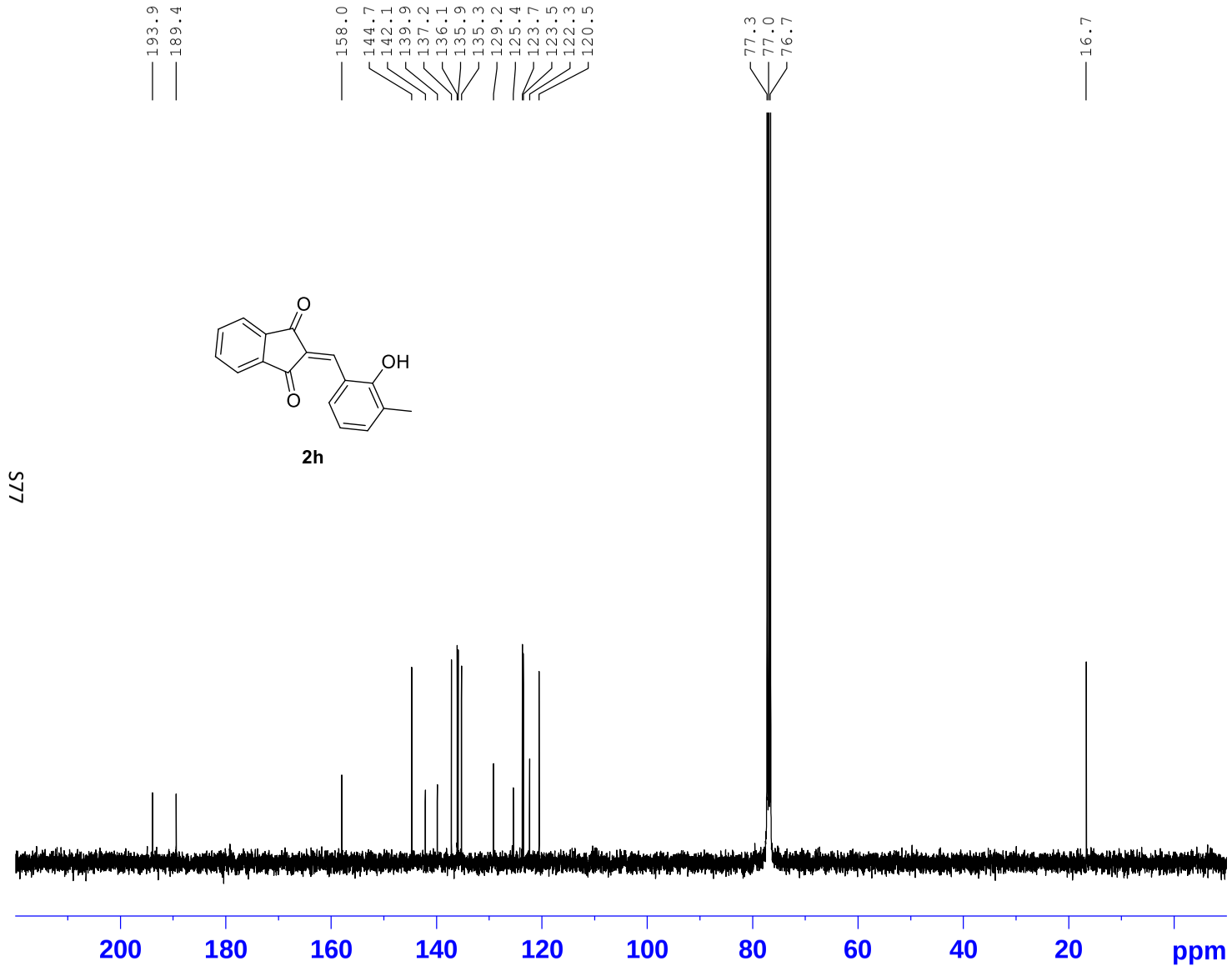

```
Current Data Parameters
NAME                  liu046
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170511
Time                  15.24
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT            Acetone
NS                        16
DS                         0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                 2.2609921 sec
RG                     456.1
DW                    69.000 usec
DE                     6.50 usec
TE                    297.2 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                        16384
SF             400.1300068 MHz
WDW                       EM
SSB          0
LB           0 Hz
GB           0
PC                     1.00
```



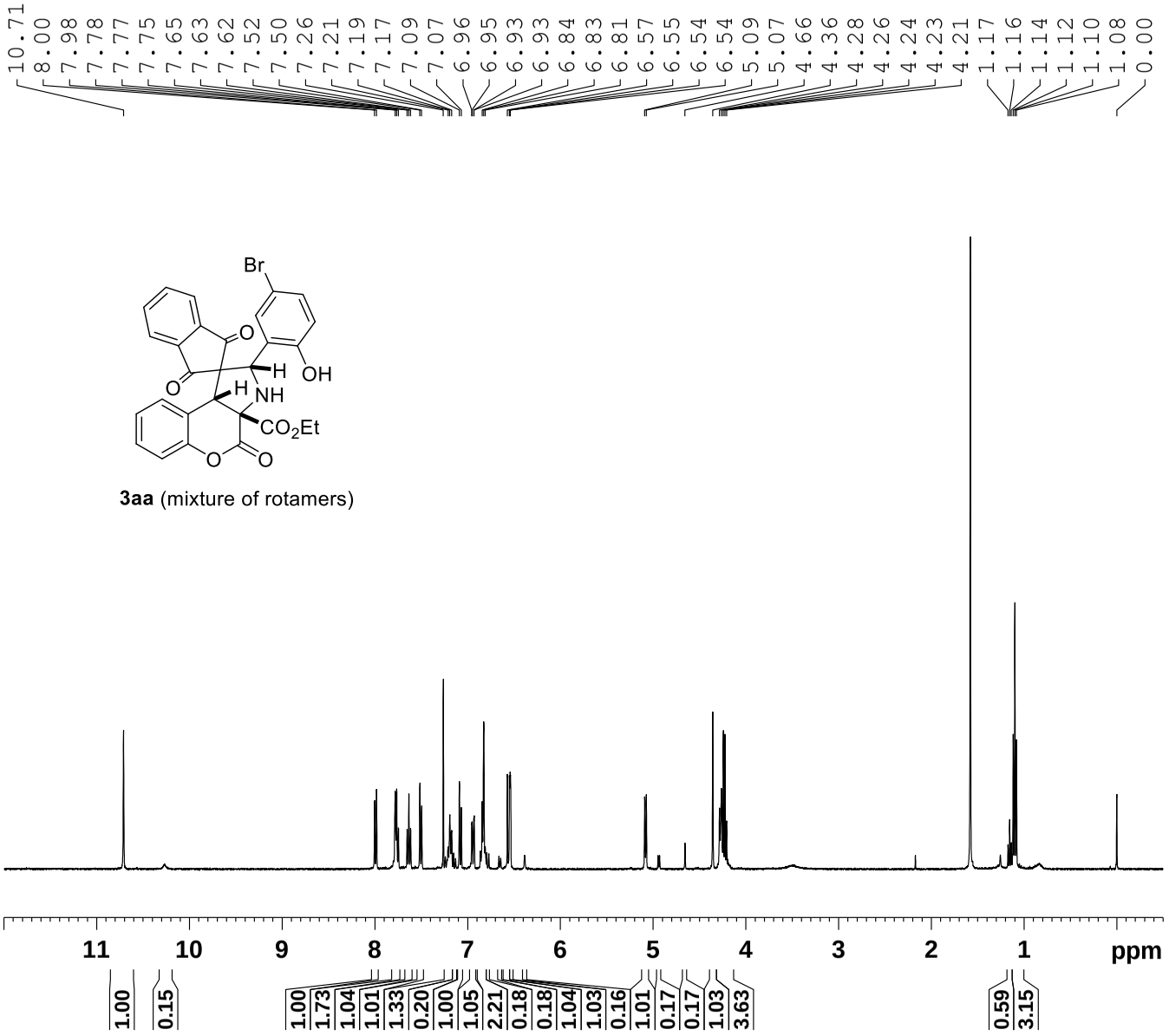

```
Current Data Parameters
NAME                  liu046
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170521
Time                  22.54
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG              zgpg30
TD                    32768
SOLVENT             Acetone
NS                    12802
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                   198.09
DW                   20.800 usec
DE                    6.50 usec
TE                   299.5 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1            100.6228298 MHz
NUC1                    13C
P1                   10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2            400.1316005 MHz
NUC2                    1H
CPDPRG[2             waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                    32768
SF              100.6126777 MHz
WDW                     EM
SSB          0
LB                    2.00 Hz
GB           0
PC                    1.00
```




```
Current Data Parameters
NAME            vicky157
EXPNO                  5
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170520
Time               16.11
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ             2.2609921 sec
RG                   362
DW                69.000 usec
DE                 6.50 usec
TE                295.0 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF          400.1300086 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```

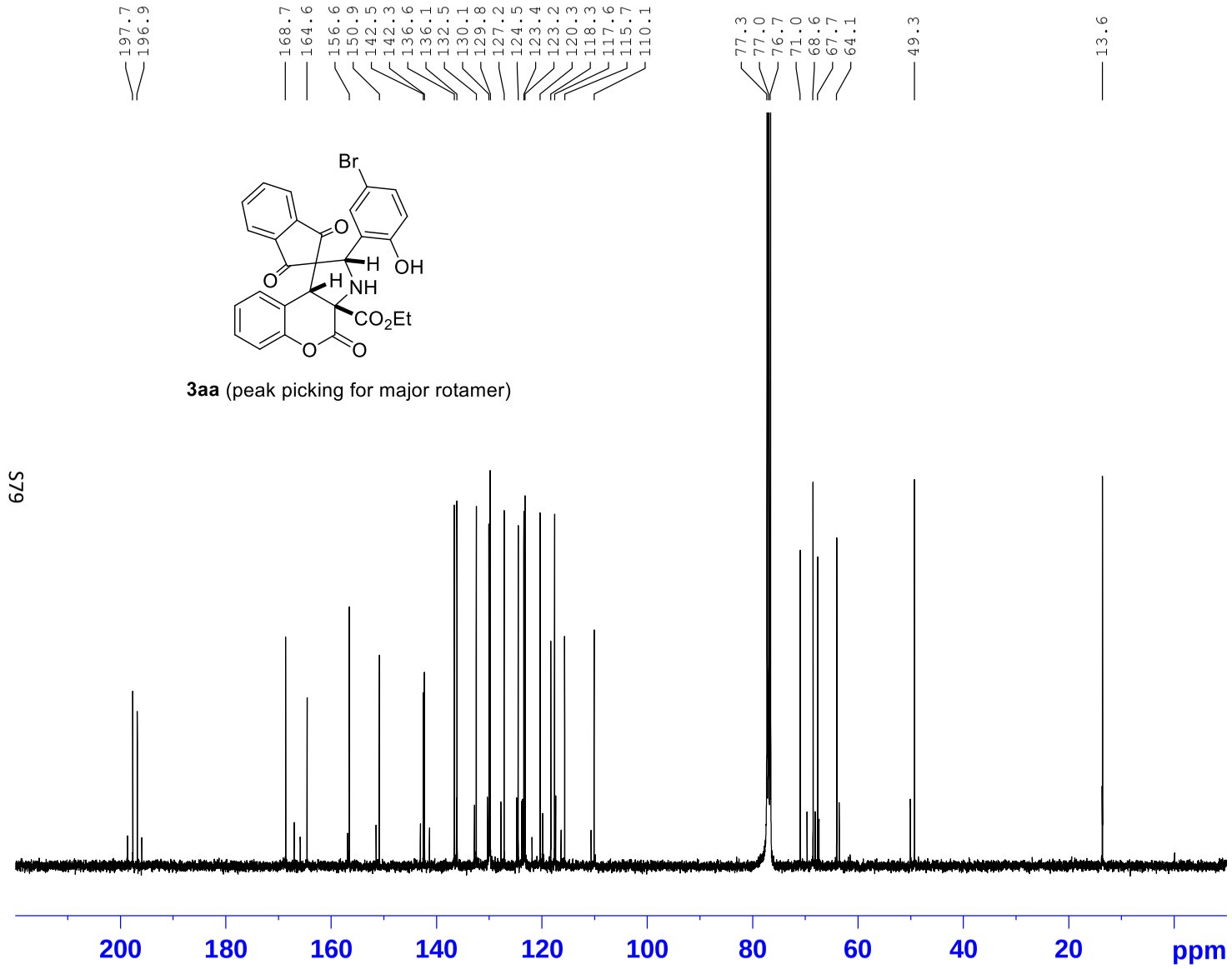



```
Current Data Parameters
NAME            vicky157
EXPNO                  8
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170529
Time               11.49
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  4377
DS                     0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               9195.2
DW                20.800 usec
DE                 6.50 usec
TE                298.7 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127713 MHz
WDW                  EM
SSB      0
LB                  1.00 Hz
GB       0
PC                  1.00
```



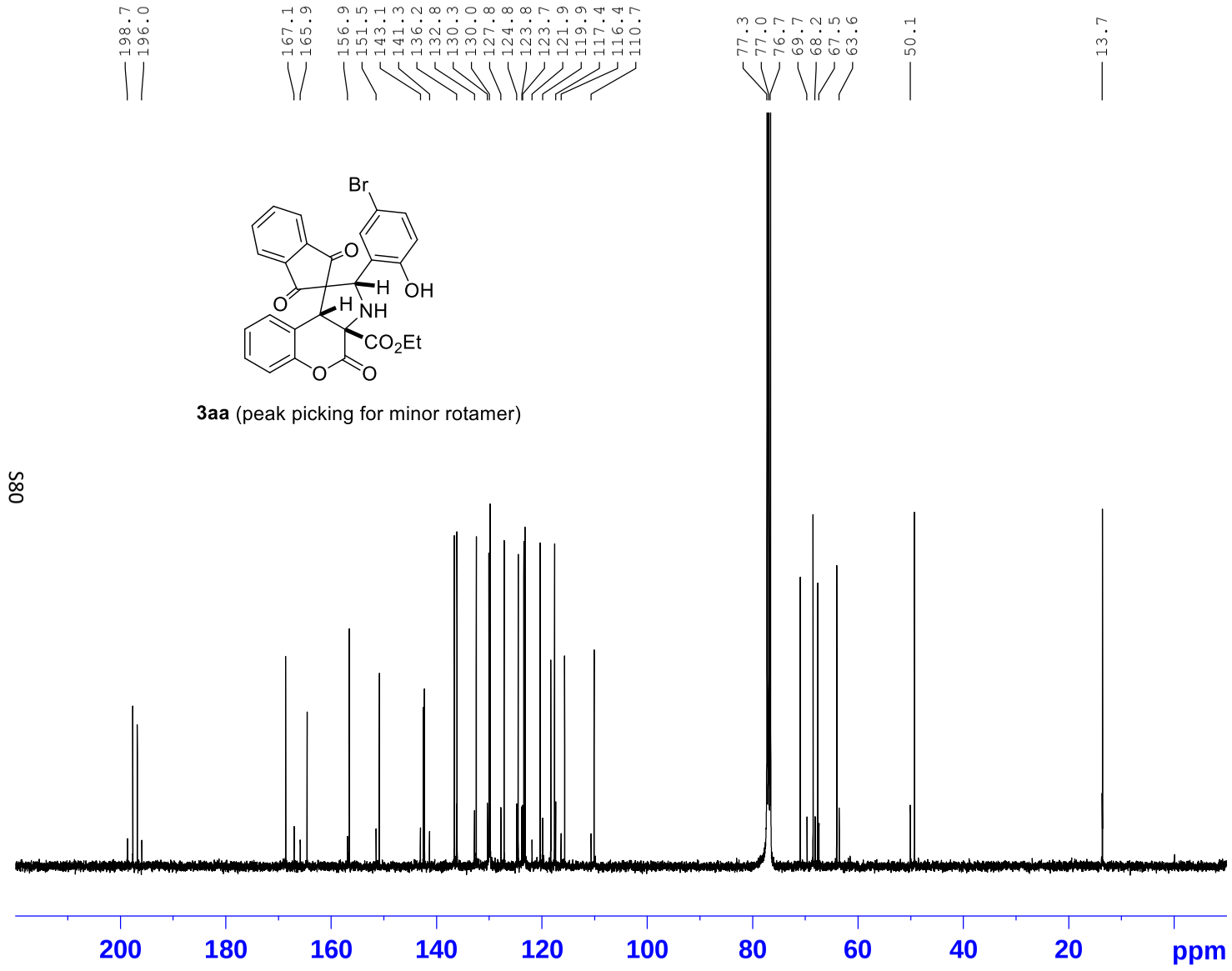
3aa (mixture of rotamers)

```
Current Data Parameters
NAME                  3aa
EXPNO                   3
PROCNO                  1

F2 - Acquisition Parameters
Date_            20170429
Time                15.02
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                  322.5
DW                 69.000 usec
DE                  6.50 usec
TE                 298.6 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  14.40 usec
PL1                  1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF            400.1300082 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



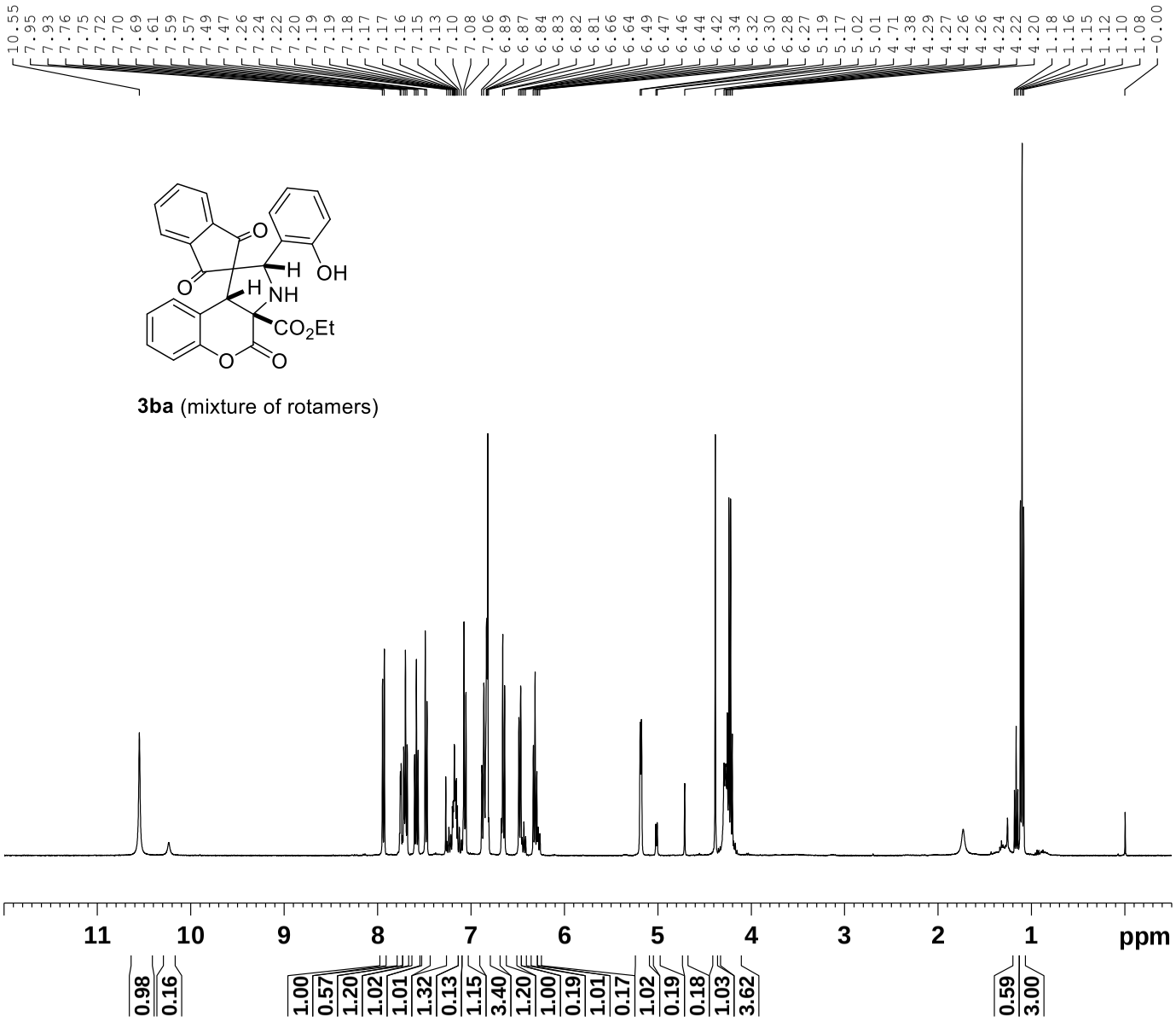
3aa (peak picking for major rotamer)


```
Current Data Parameters
NAME                  check
EXPNO                    19
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170529
Time                 16.54
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   21287
DS                       0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 7298.2
DW                20.800 usec
DE                 6.50 usec
TE                299.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                  13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127715 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



3aa (peak picking for minor rotamer)

```
Current Data Parameters
NAME                  check
EXPNO                    19
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170529
Time                 16.54
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   21287
DS                       0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 7298.2
DW                20.800 usec
DE                 6.50 usec
TE                299.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127715 MHz
WDW                     EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

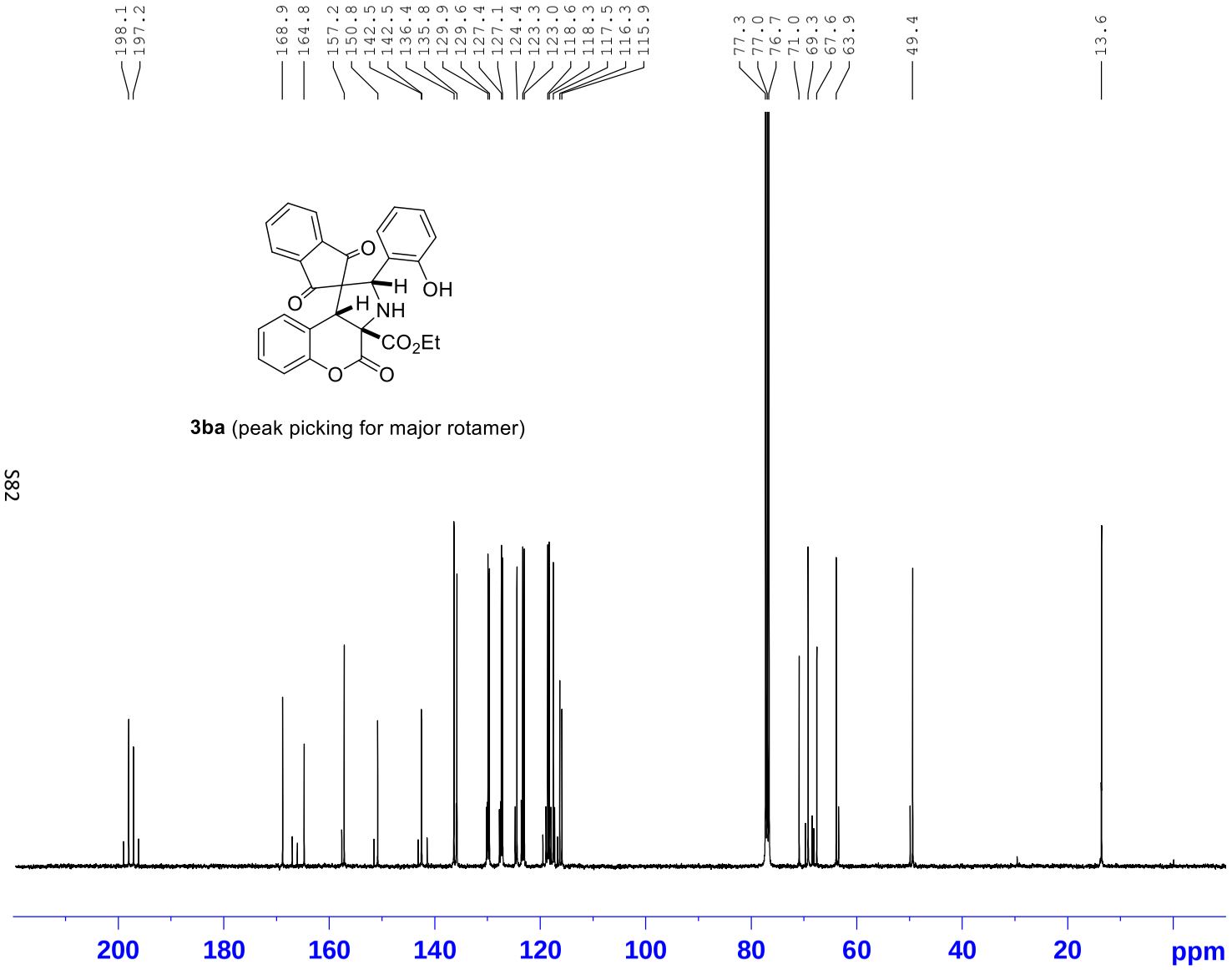


Current Data Parameters
NAME liu075
EXPNO 5
PROCNO 1

F2 - Acquisition Parameters
Date_ 20170410
Time 16.05
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 296.0 K
D1 2.00000000 sec
TD0 1

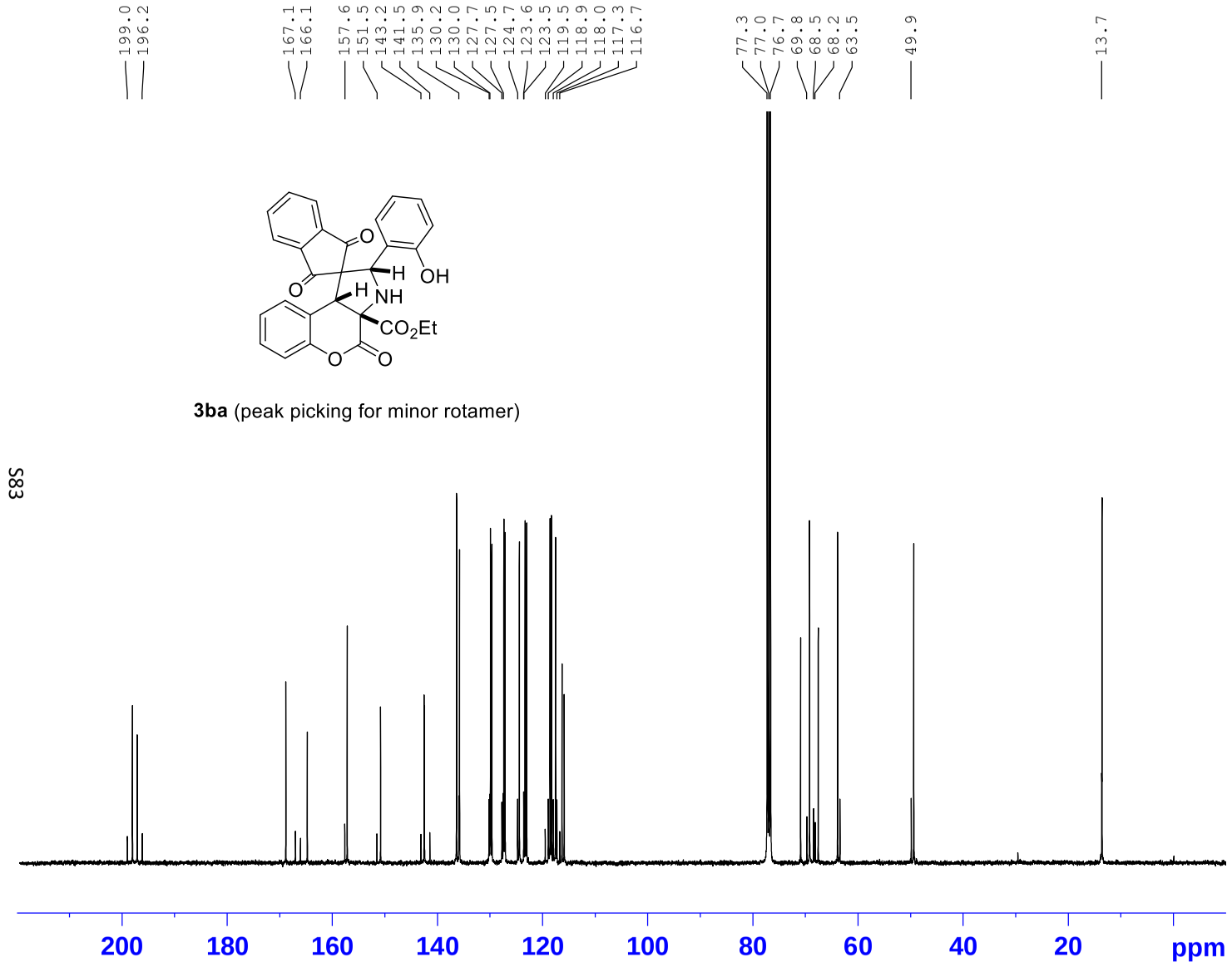
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300044 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00



3ba (peak picking for major rotamer)

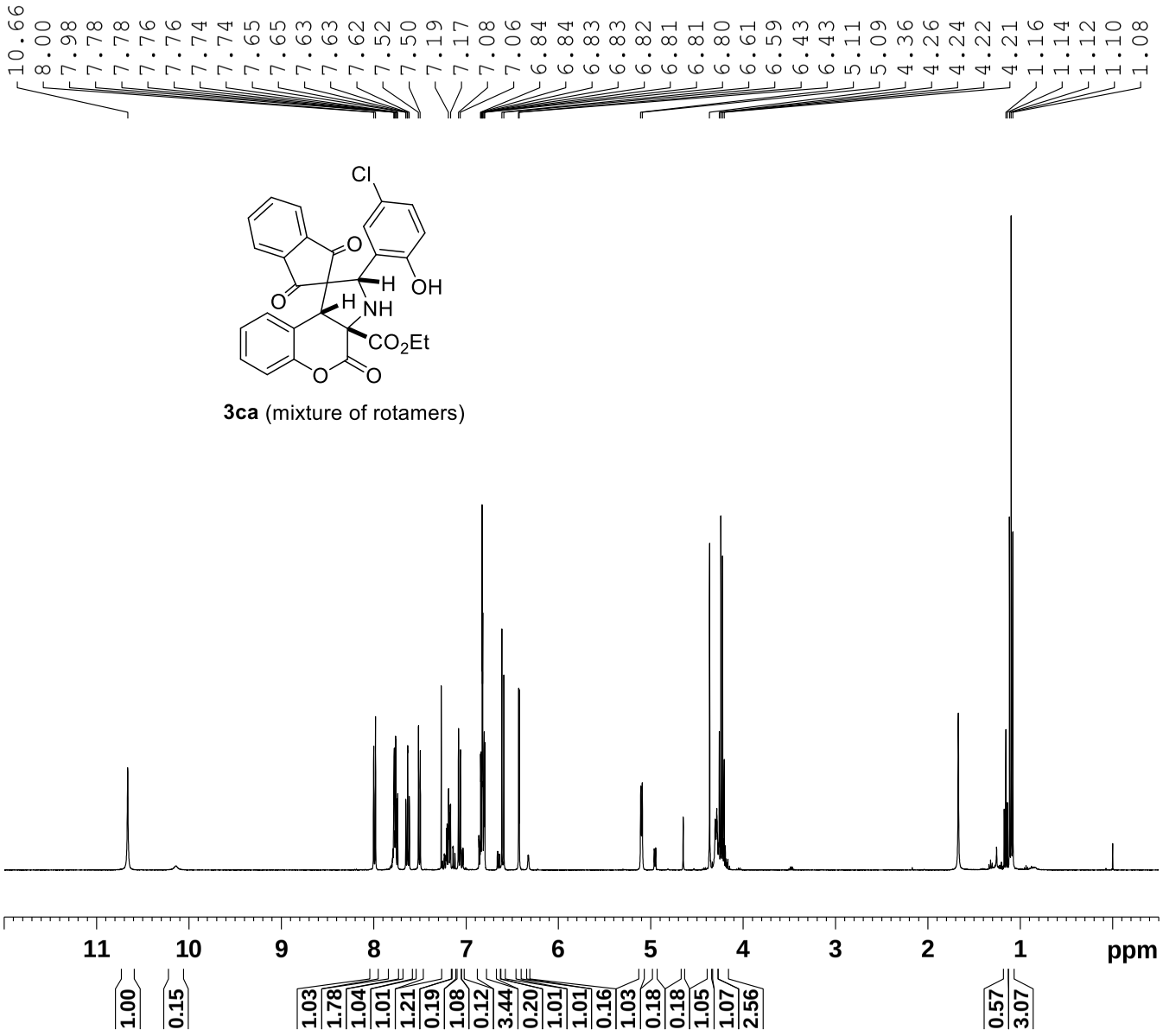

```
Current Data Parameters
NAME                  Liu75
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170410
Time                 22.14
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    5800
DS                       0
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                    32768
SF             100.6127743 MHz
WDW                     EM
SSB       0
LB                   2.00 Hz
GB        0
PC                   1.00
```



3ba (peak picking for minor rotamer)

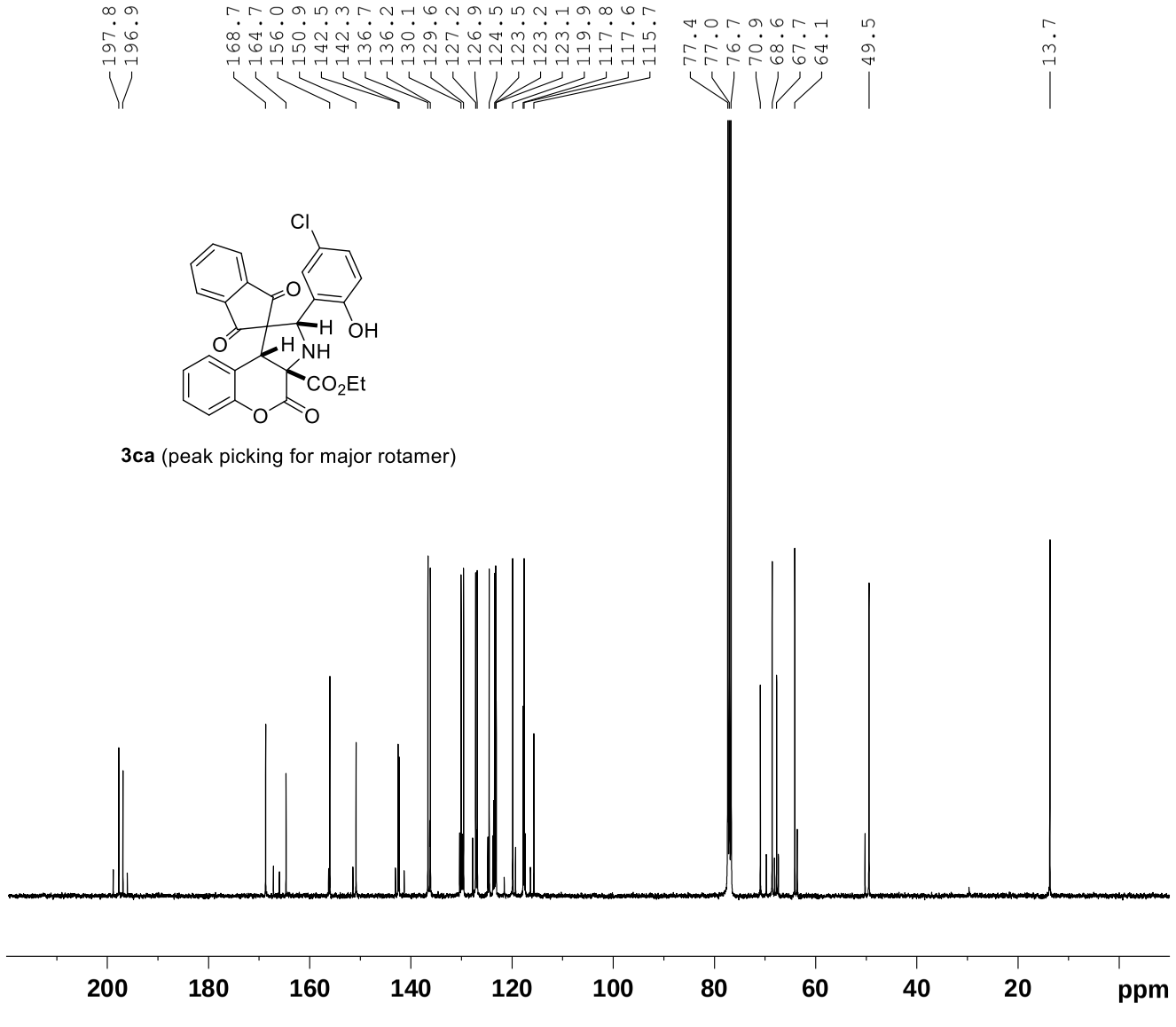
S83

```
Current Data Parameters
NAME                  Liu75
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170410
Time                 22.14
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    5800
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.3 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                    32768
SF             100.6127743 MHz
WDW                     EM
SSB          0
LB                    2.00 Hz
GB           0
PC                    1.00
```



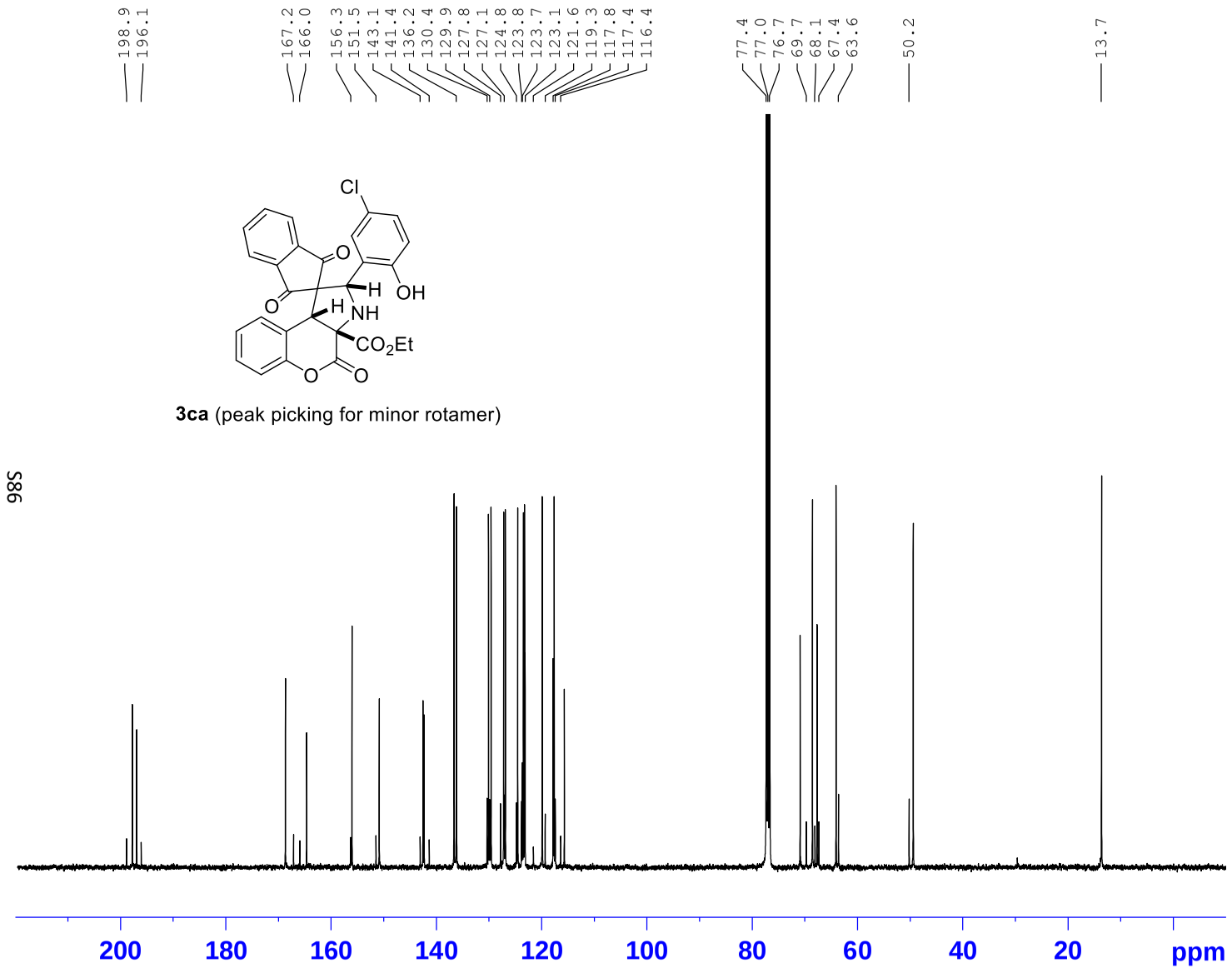
3ca (mixture of rotamers)

```
Current Data Parameters
NAME                  3ca
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20170411
Time                2.43
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH              7211.539 Hz
FIDRES           0.220079 Hz
AQ               2.2719147 sec
RG                  89.08
DW                69.333 usec
DE                10.50 usec
TE                298.2 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                  1H
P1                 12.90 usec
PLW1          15.00000000 W

F2 - Processing parameters
SI                 16384
SF            400.1300056 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



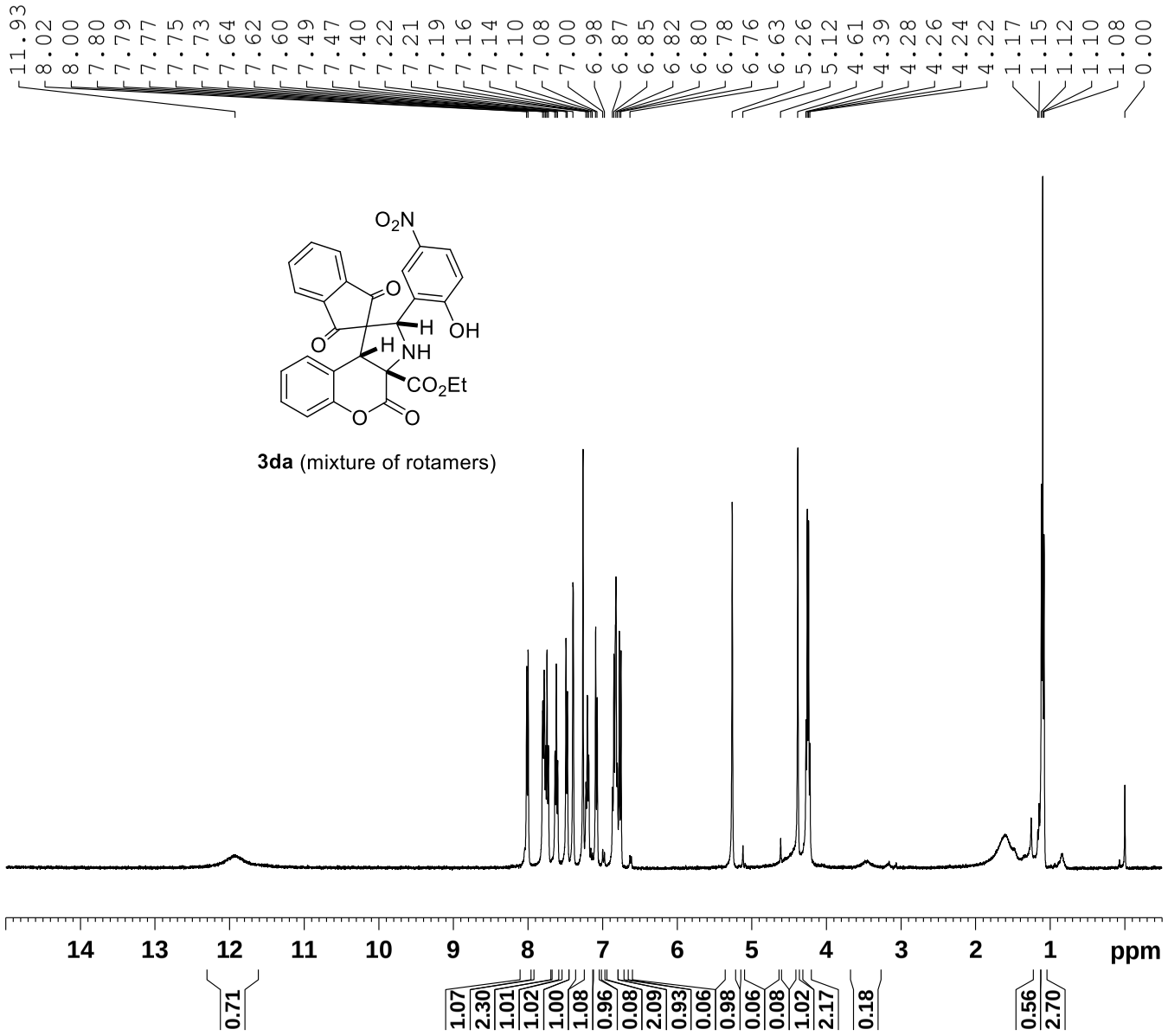
3ca (peak picking for major rotamer)

```
Current Data Parameters
NAME                  Liu74
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170411
Time                  2.45
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    9666
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                   1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127685 MHz
WDW                    EM
SSB       0
LB                  2.00 Hz
GB        0
PC                  1.00
```



3ca (peak picking for minor rotamer)

```
Current Data Parameters
NAME                  Liu74
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170411
Time                  2.45
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    9666
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.2 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                  13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                  1H
CPDPRG[2           waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127685 MHz
WDW                    EM
SSB          0
LB                   2.00 Hz
GB           0
PC                   1.00
```

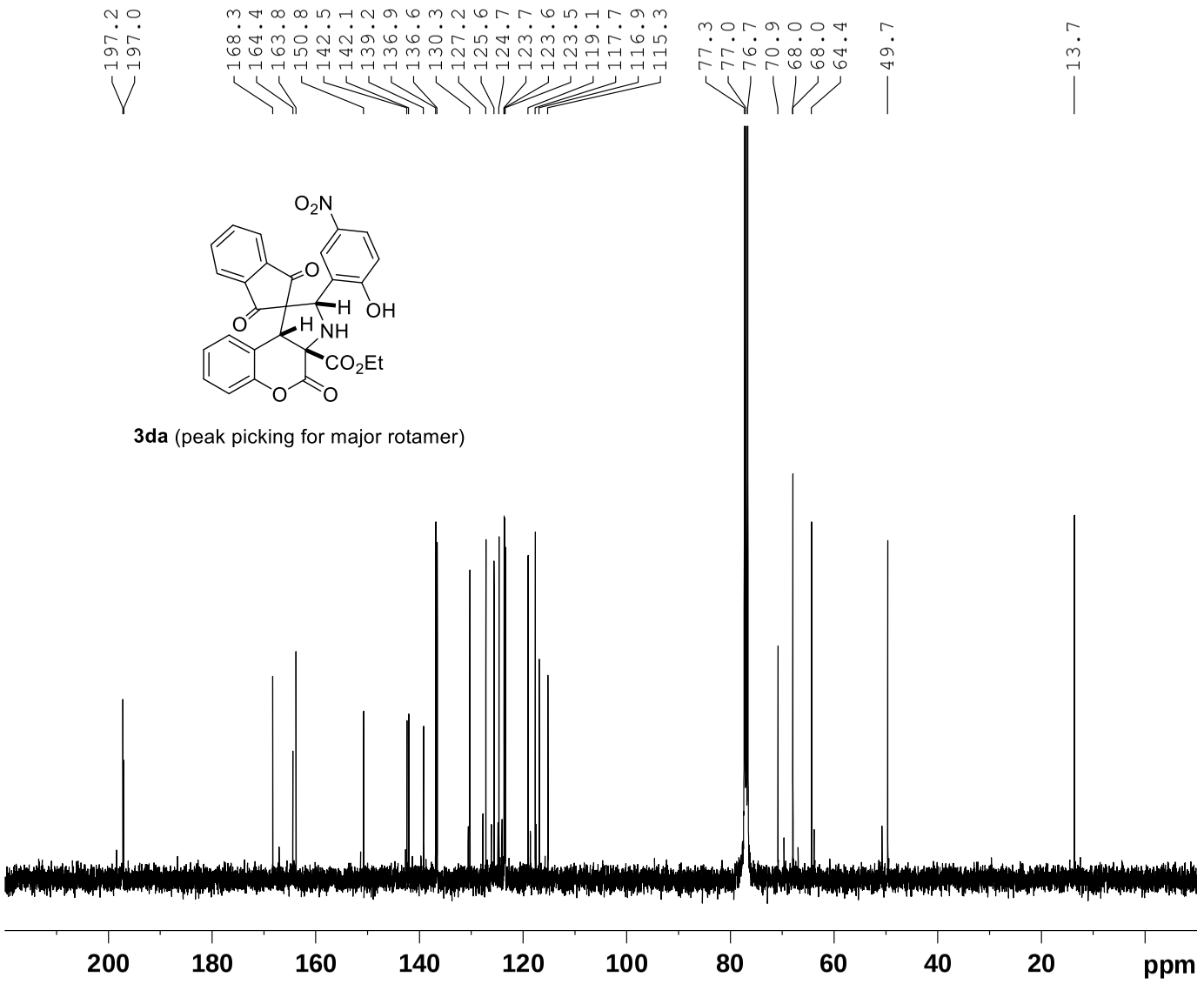


Current Data Parameters
NAME 274-2
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20180426
Time 12.10
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 673.2 K
D1 2.00000000 sec
TD0 1

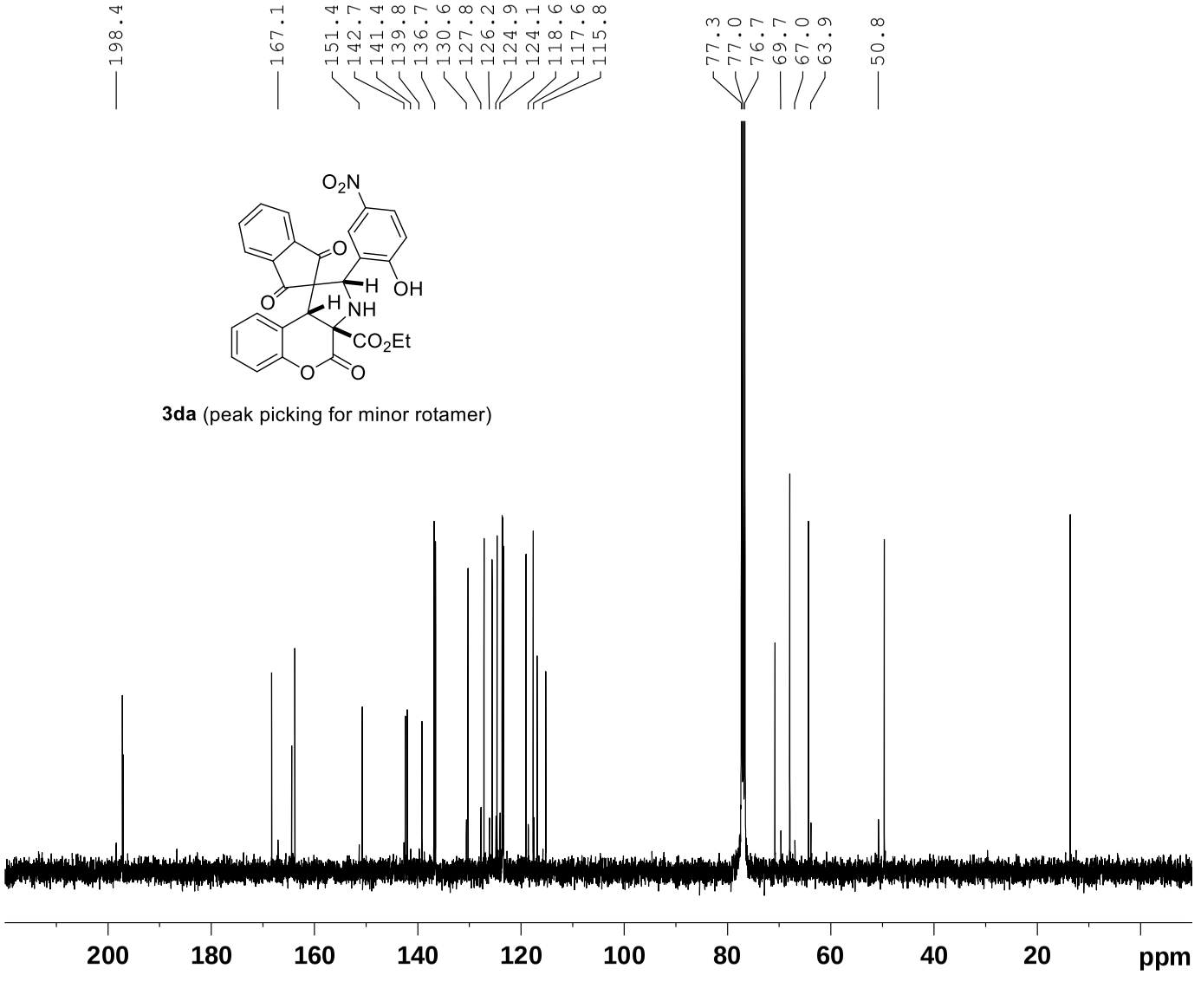
======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300078 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00



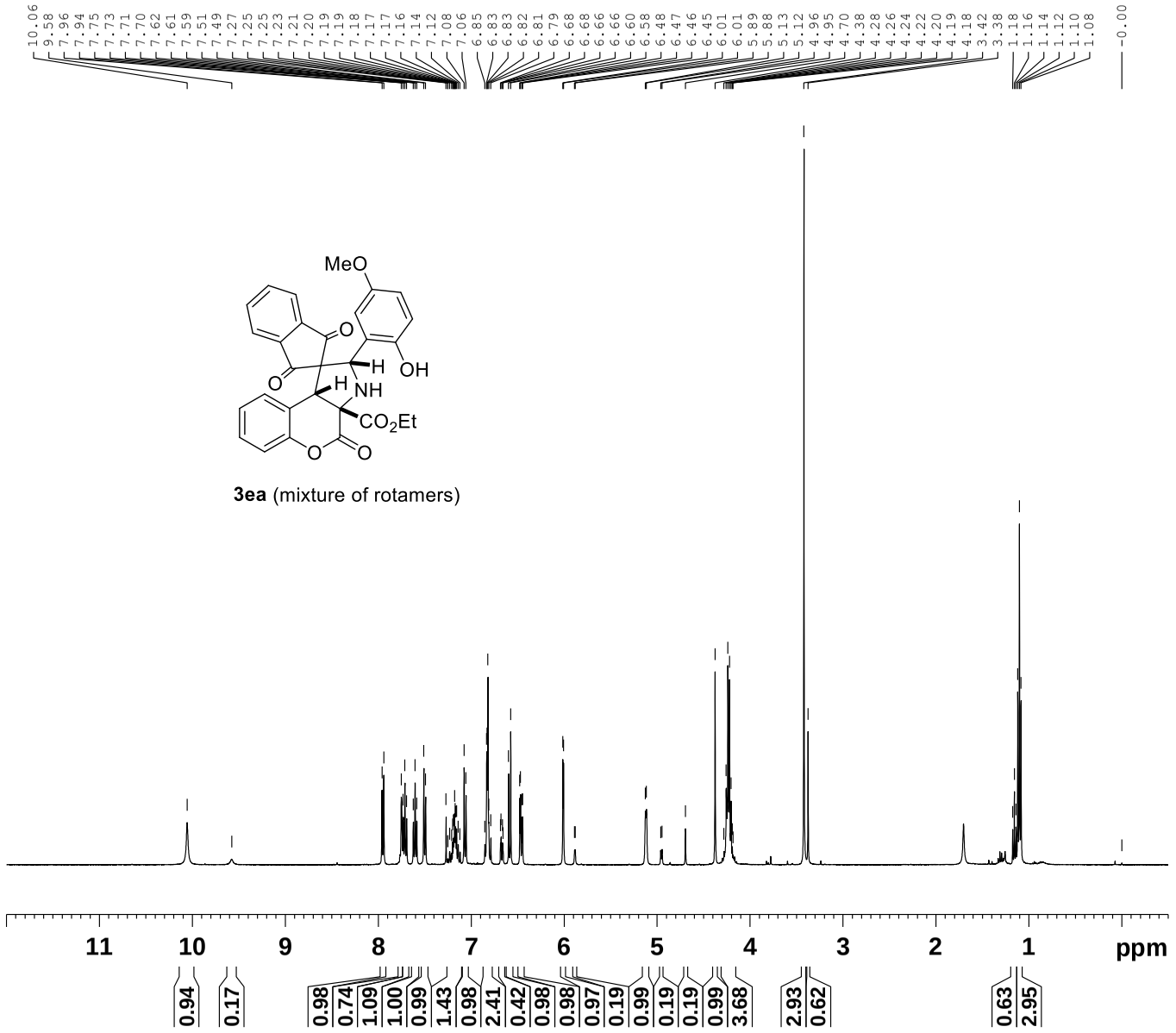
3da (peak picking for major rotamer)


```
Current Data Parameters
NAME                  B274
EXPNO                    6
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180501
Time                  8.16
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     4941
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                     8192
DW                  20.800 usec
DE                   6.50 usec
TE                  673.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127690 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

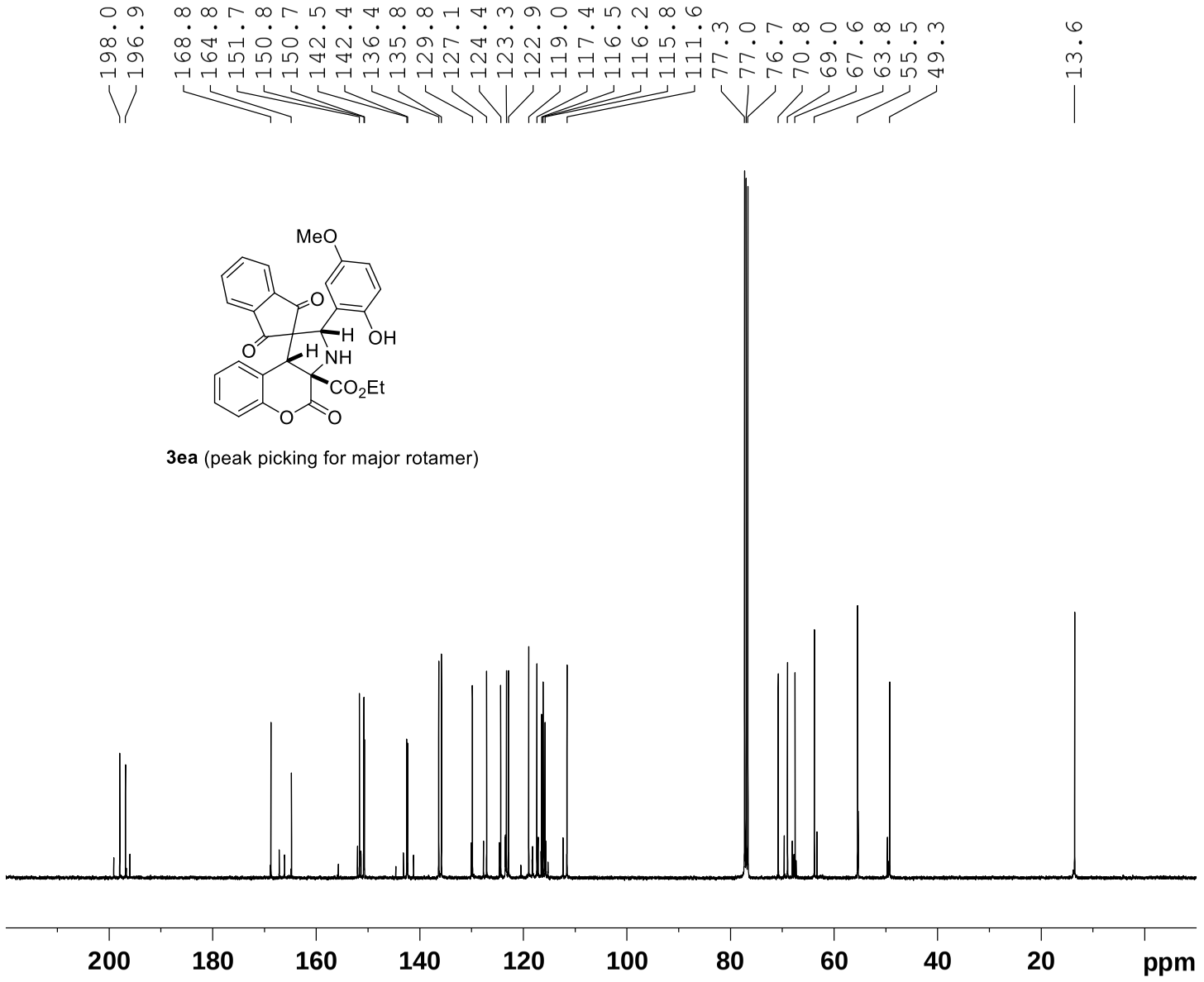


3da (peak picking for minor rotamer)

```
Current Data Parameters
NAME                  B274
EXPNO                    6
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180501
Time                  8.16
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     4941
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                     8192
DW                  20.800 usec
DE                   6.50 usec
TE                  673.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127690 MHz
WDW                     EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```

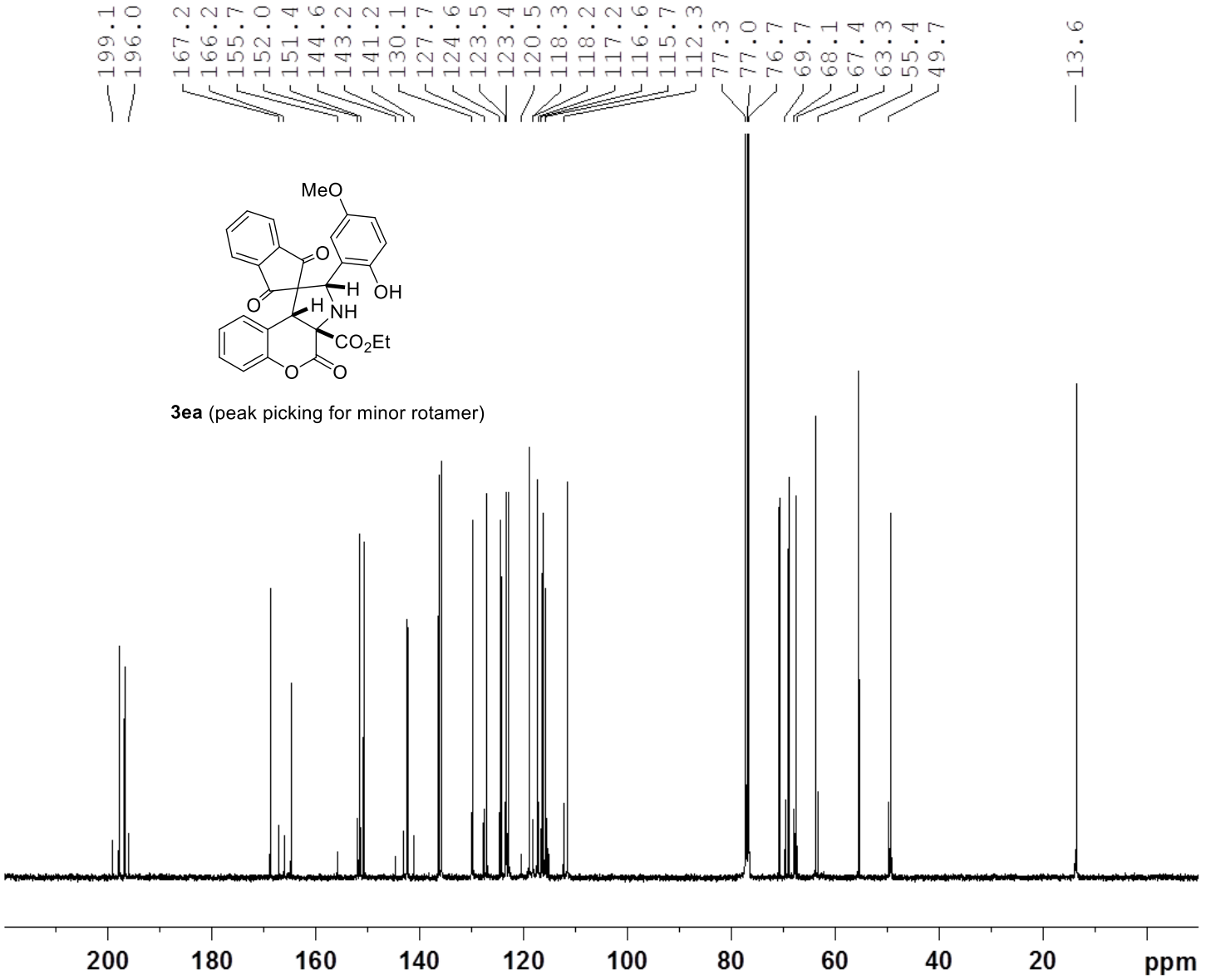



```
Current Data Parameters
NAME                 Bony110
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_               20170515
Time                   17.01
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7211.539 Hz
FIDRES             0.220079 Hz
AQ                2.2719147 sec
RG                     78.51
DW                    69.333 usec
DE                    10.50 usec
TE                    298.7 K
D1               2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1            400.1324008 MHz
NUC1                      1H
P1                     12.90 usec
PLW1            15.00000000 W

F2 - Processing parameters
SI                        16384
SF              400.1300053 MHz
WDW                       EM
SSB          0
LB           0 Hz
GB           0
PC                      1.00
```



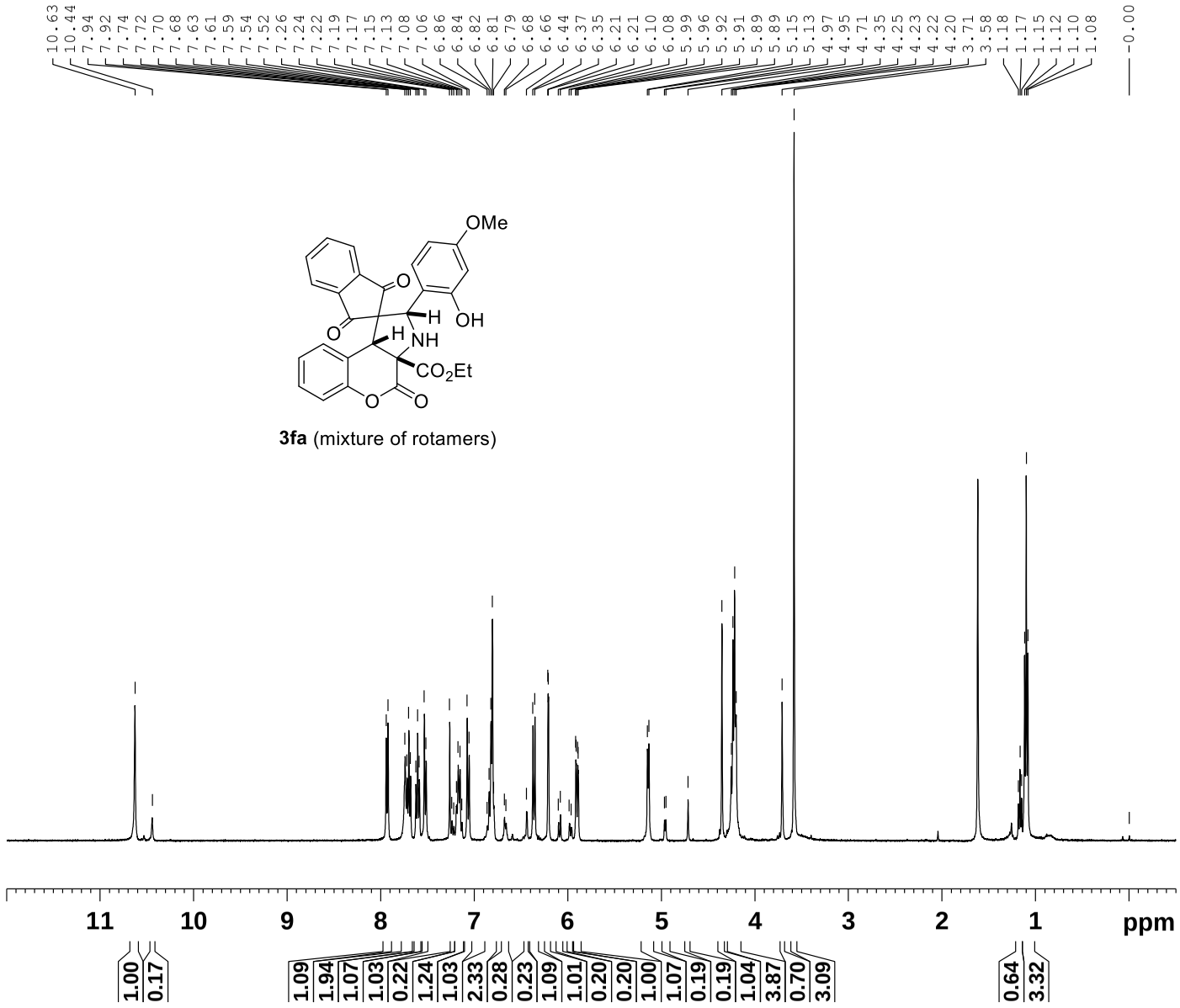
3ea (peak picking for major rotamer)


```
Current Data Parameters
NAME                  B110
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170411
Time                  2.55
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    5718
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   32768
DW                  20.800 usec
DE                   6.50 usec
TE                  295.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127815 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



3ea (peak picking for minor rotamer)


```
Current Data Parameters
NAME                  B110
EXPNO                    5
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170411
Time                 2.55
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   5718
DS                      0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                  32768
DW                20.800 usec
DE                 6.50 usec
TE                295.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127815 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

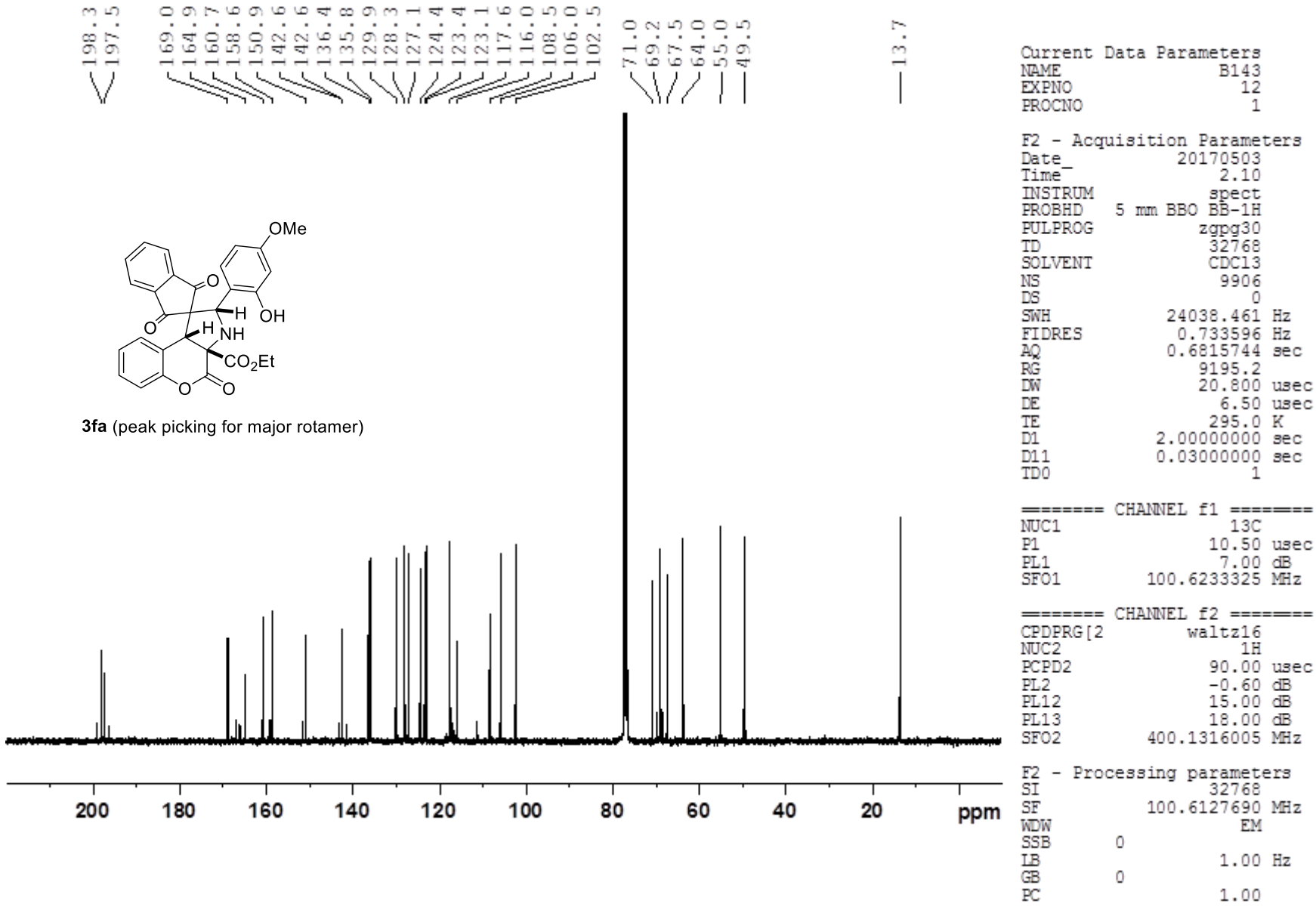


Current Data Parameters
NAME B143
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20170428
Time 19.56
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 228.1
DW 69.000 usec
DE 6.50 usec
TE 298.8 K
D1 2.00000000 sec
TD0 1

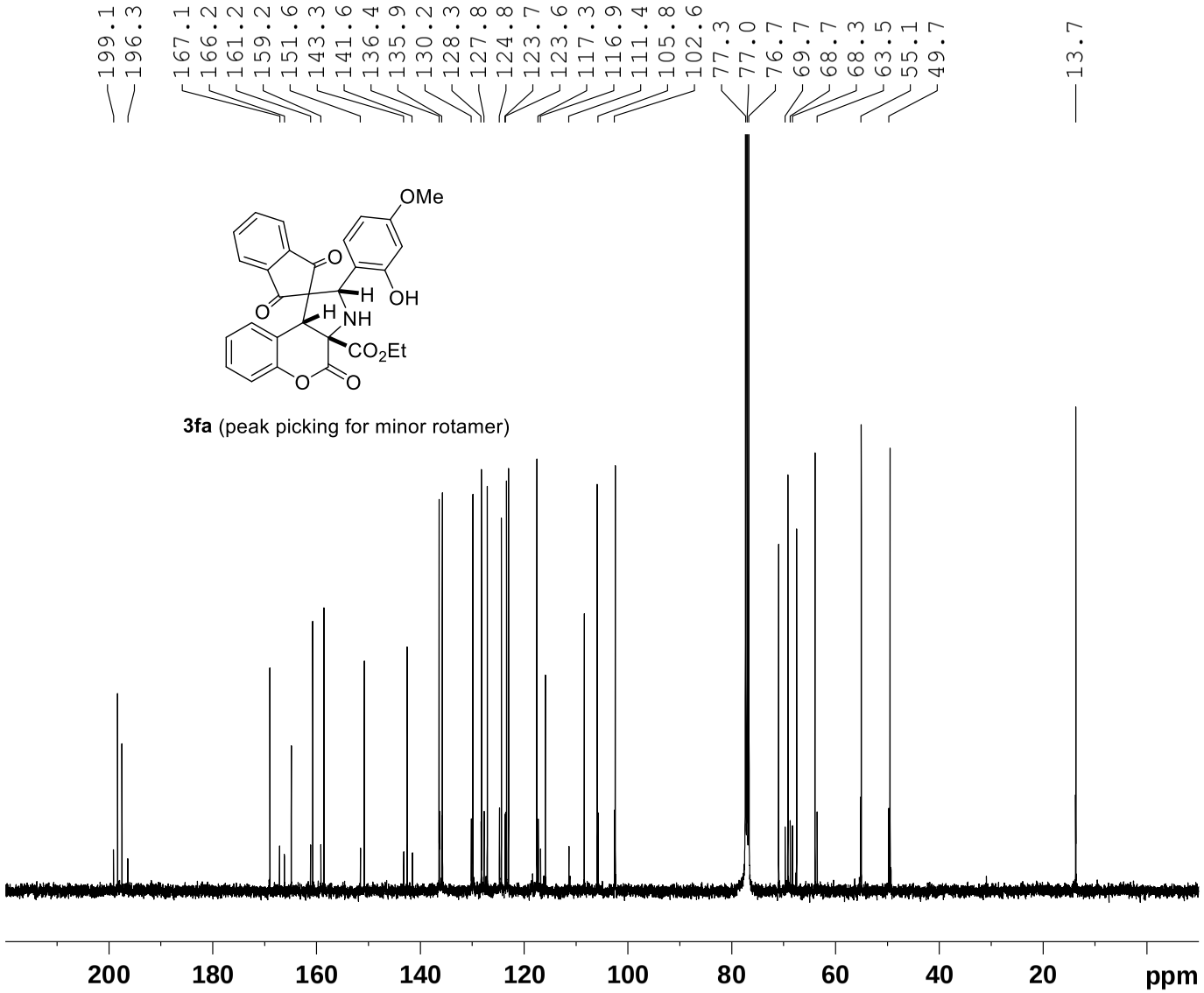
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300077 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00



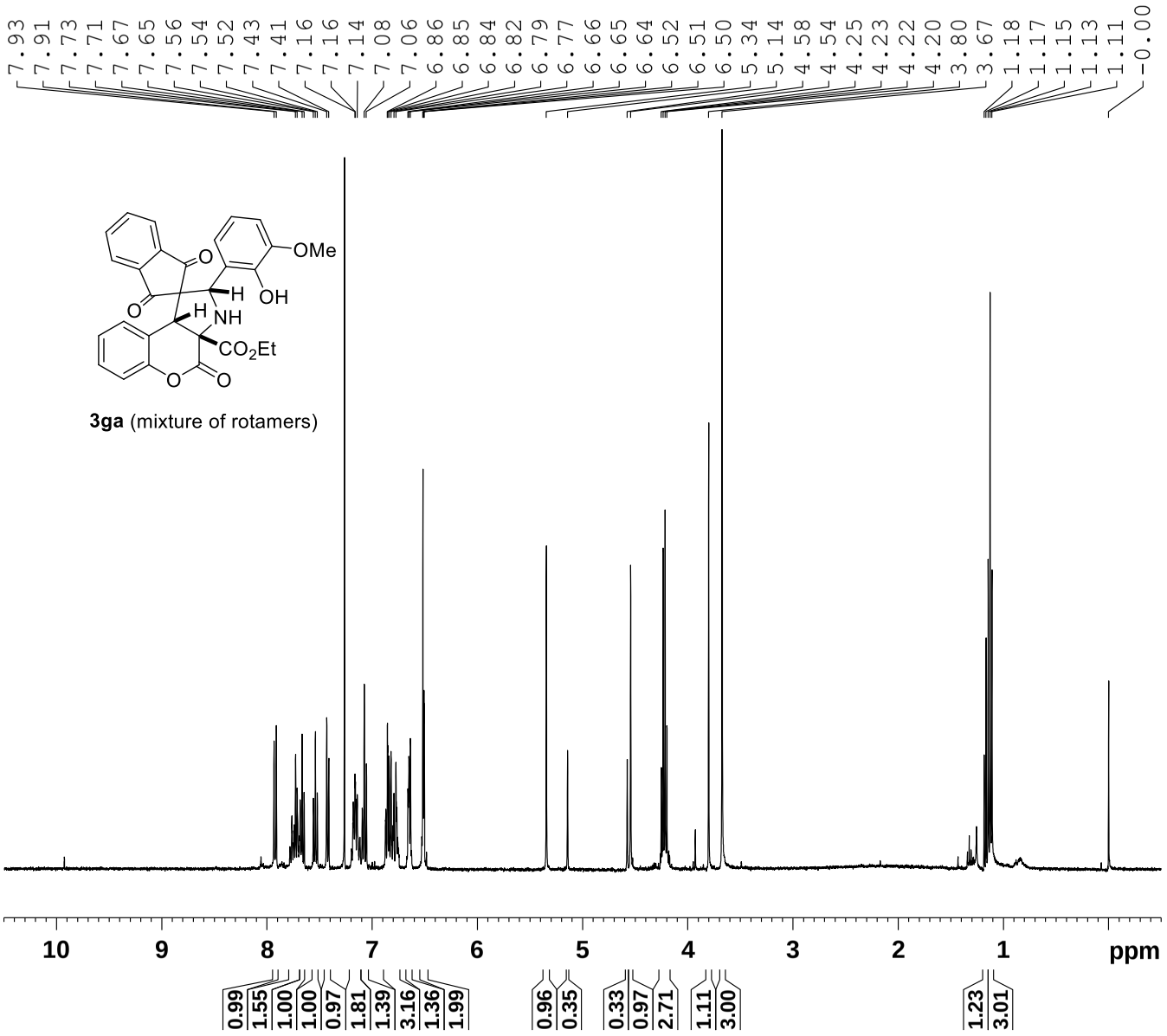
3fa (peak picking for major rotamer)

```
Current Data Parameters
NAME                  B143
EXPNO                   12
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170503
Time                   2.10
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    9906
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  9195.2
DW                 20.800 usec
DE                  6.50 usec
TE                 295.0 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.50 usec
PL1                  7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2                 -0.60 dB
PL12                15.00 dB
PL13                18.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127690 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```

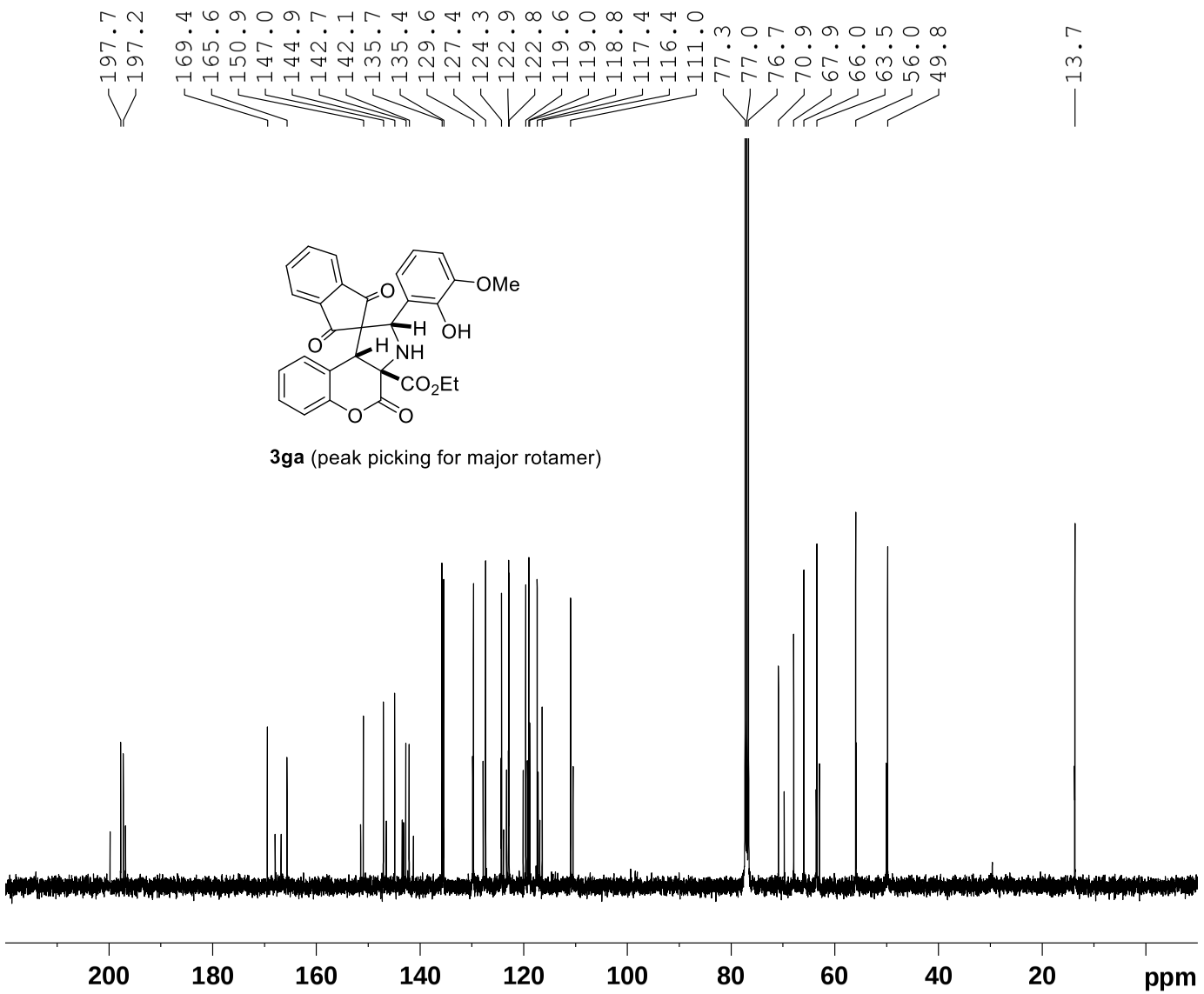


3fa (peak picking for minor rotamer)

```
Current Data Parameters
NAME                  B143
EXPNO                   12
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170503
Time                  2.10
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    9906
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   9195.2
DW                  20.800 usec
DE                   6.50 usec
TE                  295.0 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.50 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                  -0.60 dB
PL12                 15.00 dB
PL13                 18.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6127690 MHz
WDW                       EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

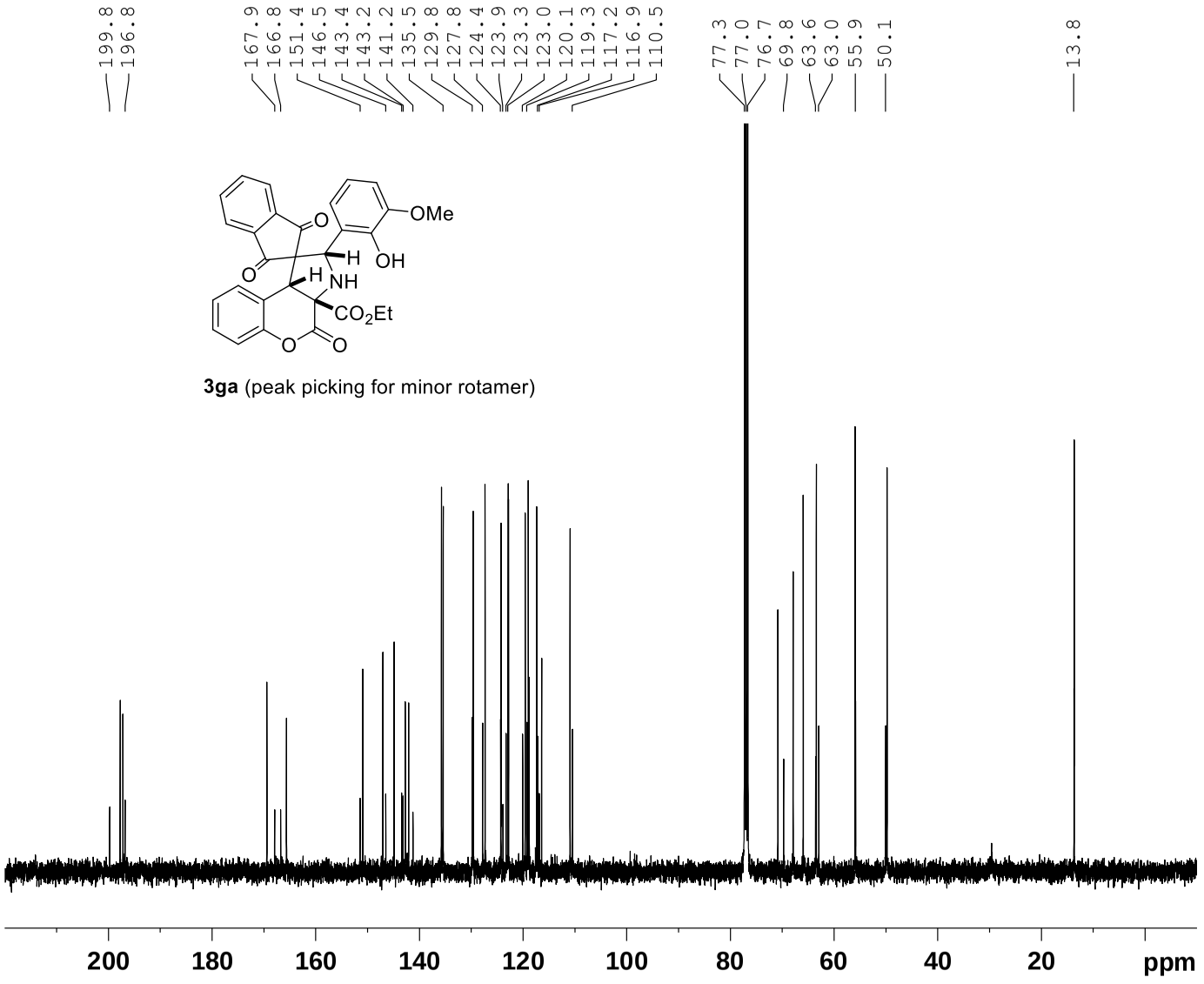



```
Current Data Parameters
NAME                  3ga
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20180404
Time                22.16
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7211.539 Hz
FIDRES           0.220079 Hz
AQ               2.2719147 sec
RG                   4.01
DW                 69.333 usec
DE                 10.50 usec
TE                 298.5 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.1324008 MHz
NUC1                   1H
P1                  12.90 usec
PLW1          15.00000000 W

F2 - Processing parameters
SI                  16384
SF            400.1300079 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



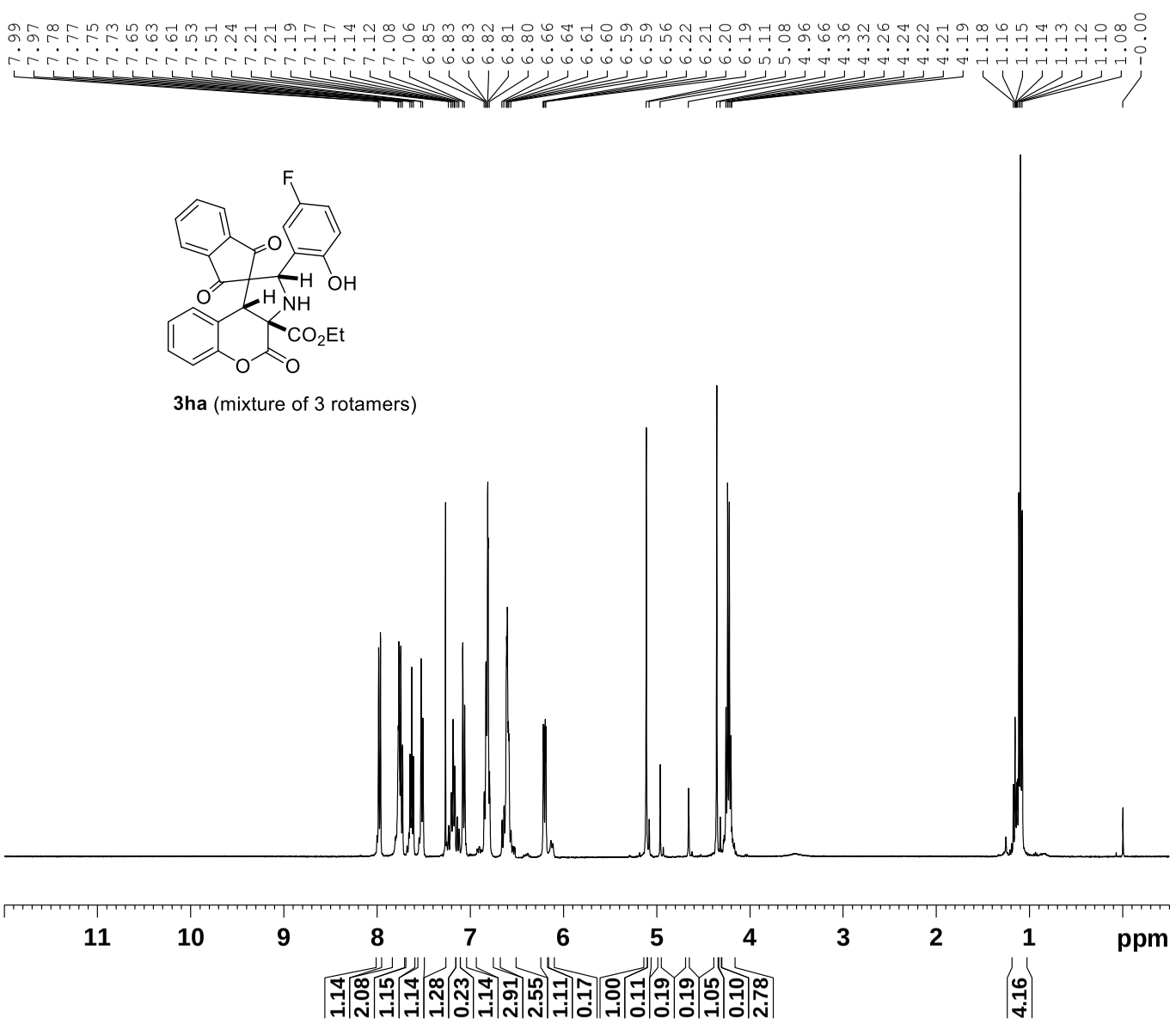
3ga (peak picking for major rotamer)

```
Current Data Parameters
NAME                  B315
EXPNO                    9
PROCNO                   1

F2 - Acquisition Parameters
Date_            20180506
Time                10.34
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   1903
DS                      0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               2298.8
DW                20.800 usec
DE                 6.50 usec
TE                673.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF          100.6127747 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

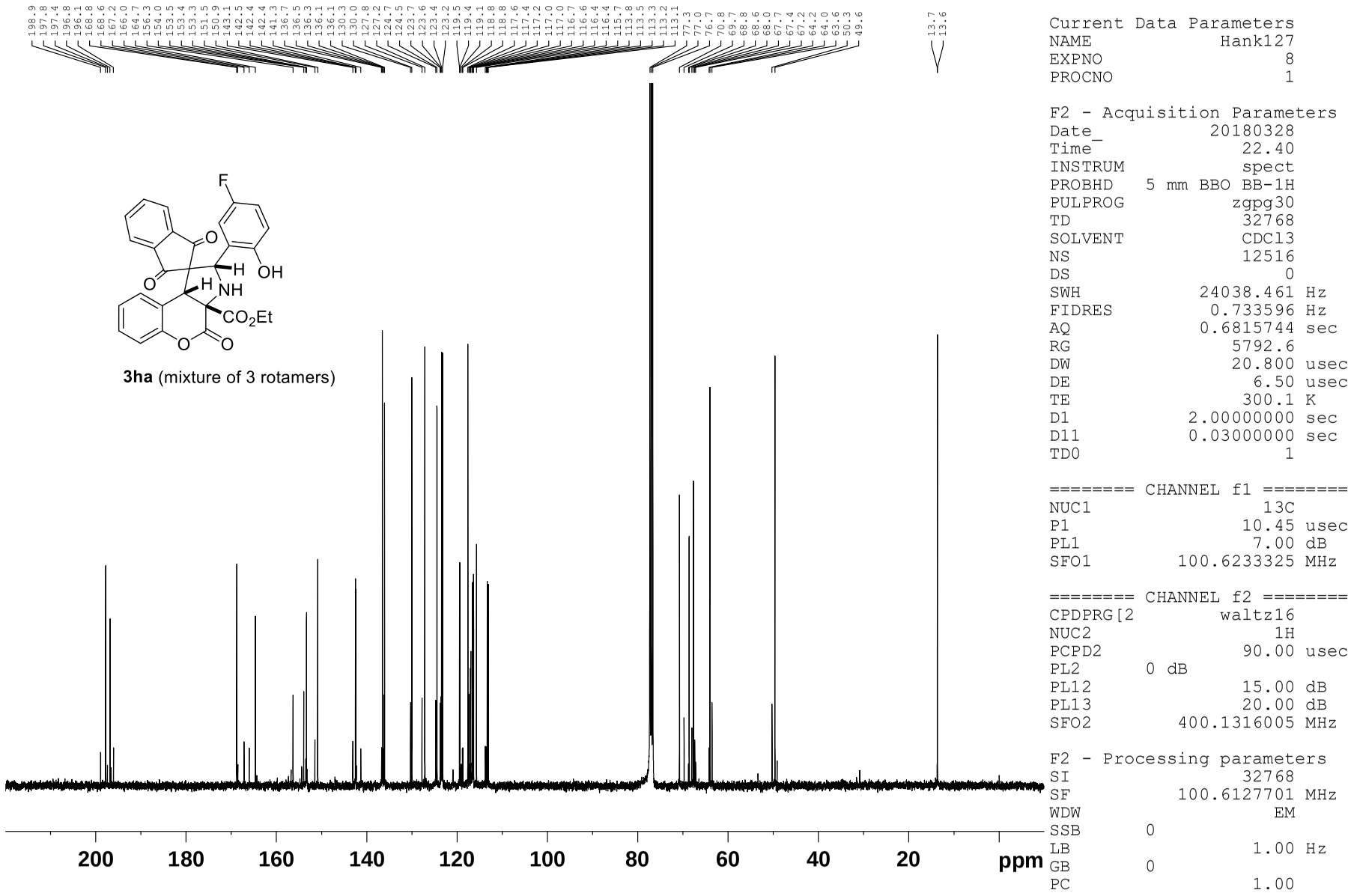


3ga (peak picking for minor rotamer)

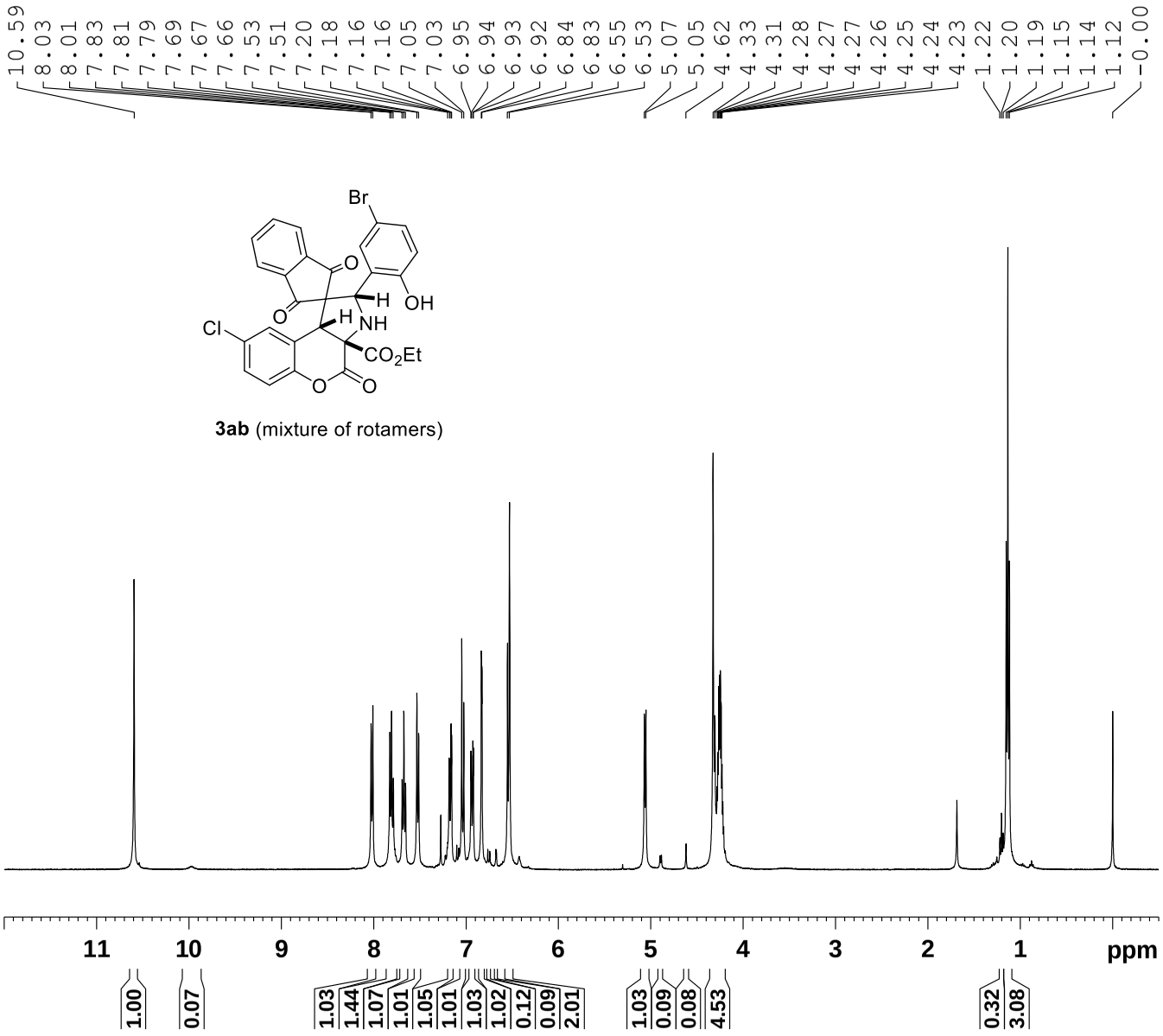
```
Current Data Parameters
NAME                  B315
EXPNO                    9
PROCNO                   1

F2 - Acquisition Parameters
Date_             20180506
Time                 10.34
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1903
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  2298.8
DW                  20.800 usec
DE                   6.50 usec
TE                  673.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.45 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2       0 dB
PL12                15.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127725 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



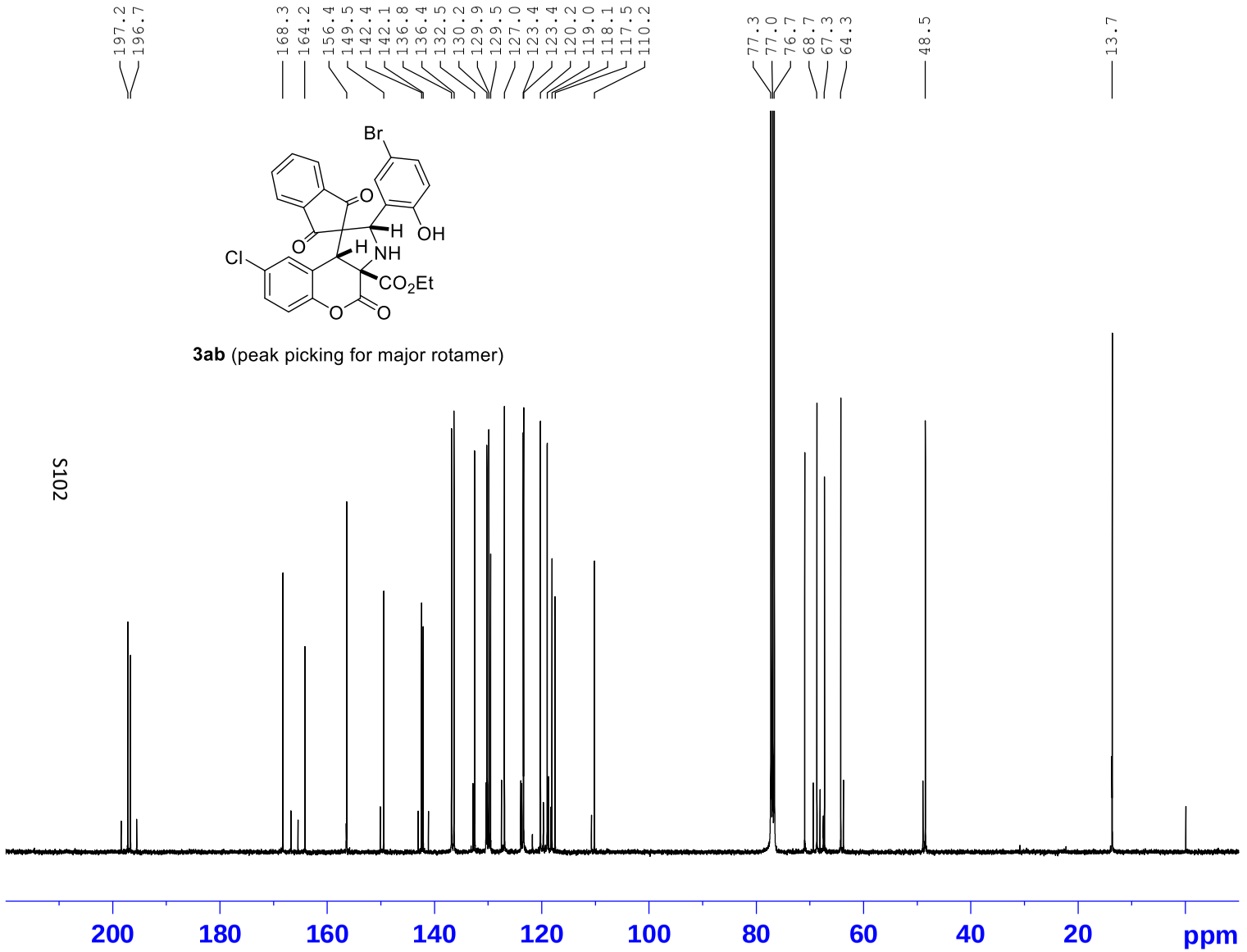

```
Current Data Parameters
NAME                  Hank127
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180501
Time                   17.58
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                     673.2 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF                400.1300060 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                      1.00
```




```
Current Data Parameters
NAME                 Hank127
EXPNO                      8
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180328
Time                  22.40
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                    32768
SOLVENT               CDCl3
NS                    12516
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   300.1 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1           100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2        0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                      32768
SF             100.6127701 MHz
WDW                        EM
SSB        0
LB                     1.00 Hz
GB         0
PC                     1.00
```

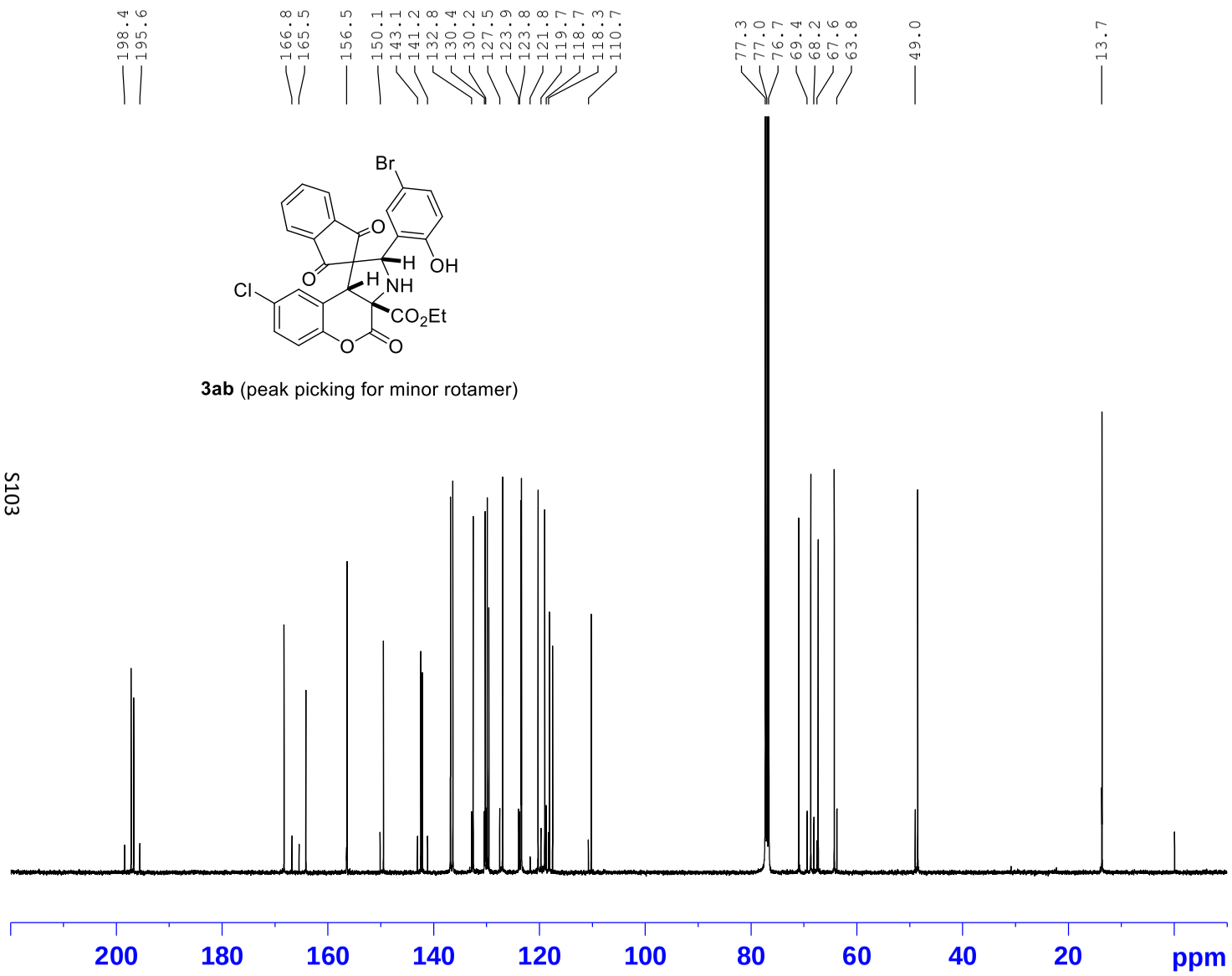



```
Current Data Parameters
NAME                  3ab
EXPNO                   3
PROCNO                  1

F2 - Acquisition Parameters
Date_            20170304
Time                22.14
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 295.7 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.40 usec
PL1                 1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF           400.1300034 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



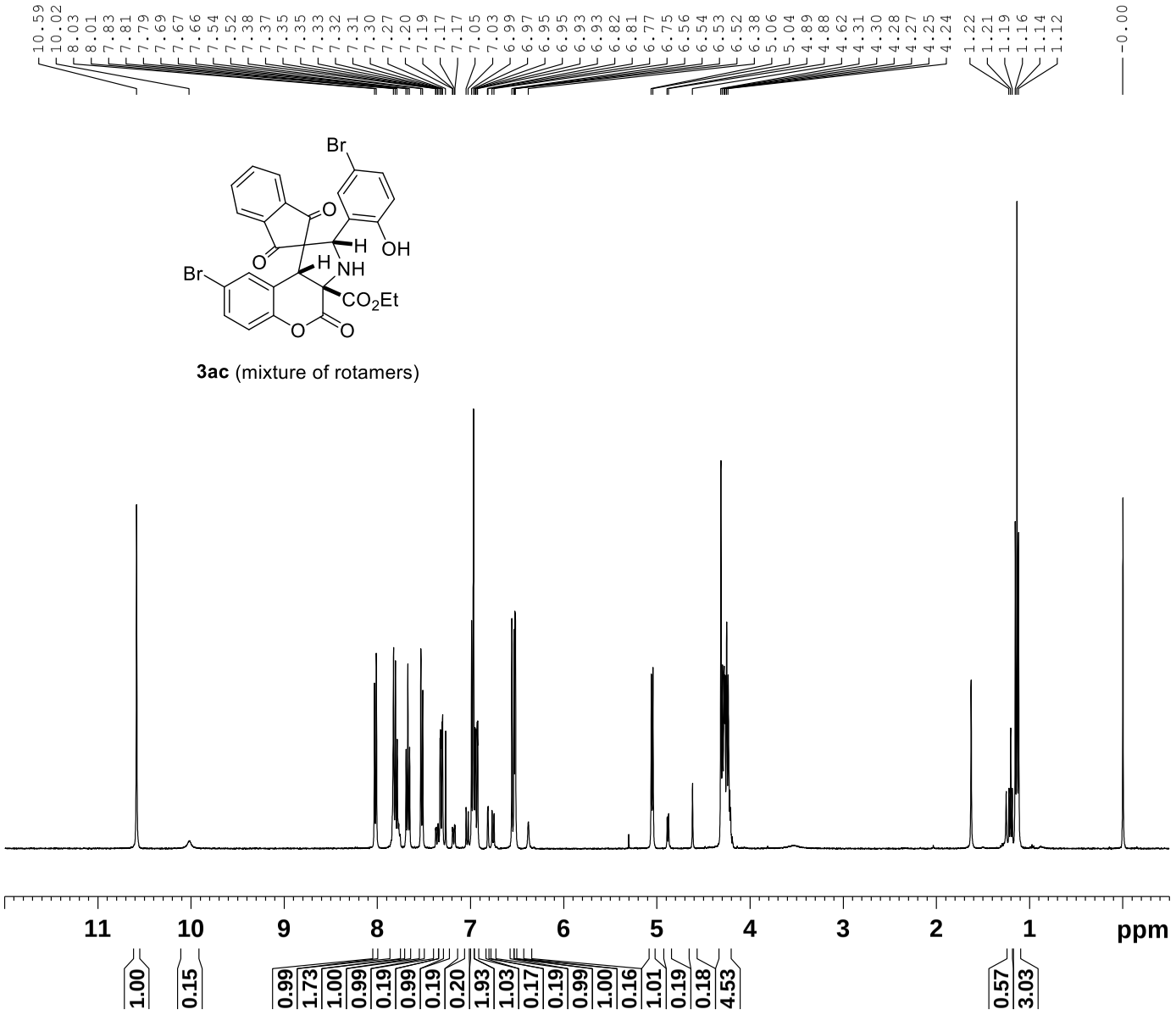
3ab (peak picking for major rotamer)


```
Current Data Parameters
NAME                  liu145
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170304
Time                  22.18
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG               zgpg30
TD                    32768
SOLVENT               CDCl3
NS                    25262
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  295.9 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127742 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



3ab (peak picking for minor rotamer)


```
Current Data Parameters
NAME                  liu145
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170304
Time                  22.18
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                    25262
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  295.9 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127727 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

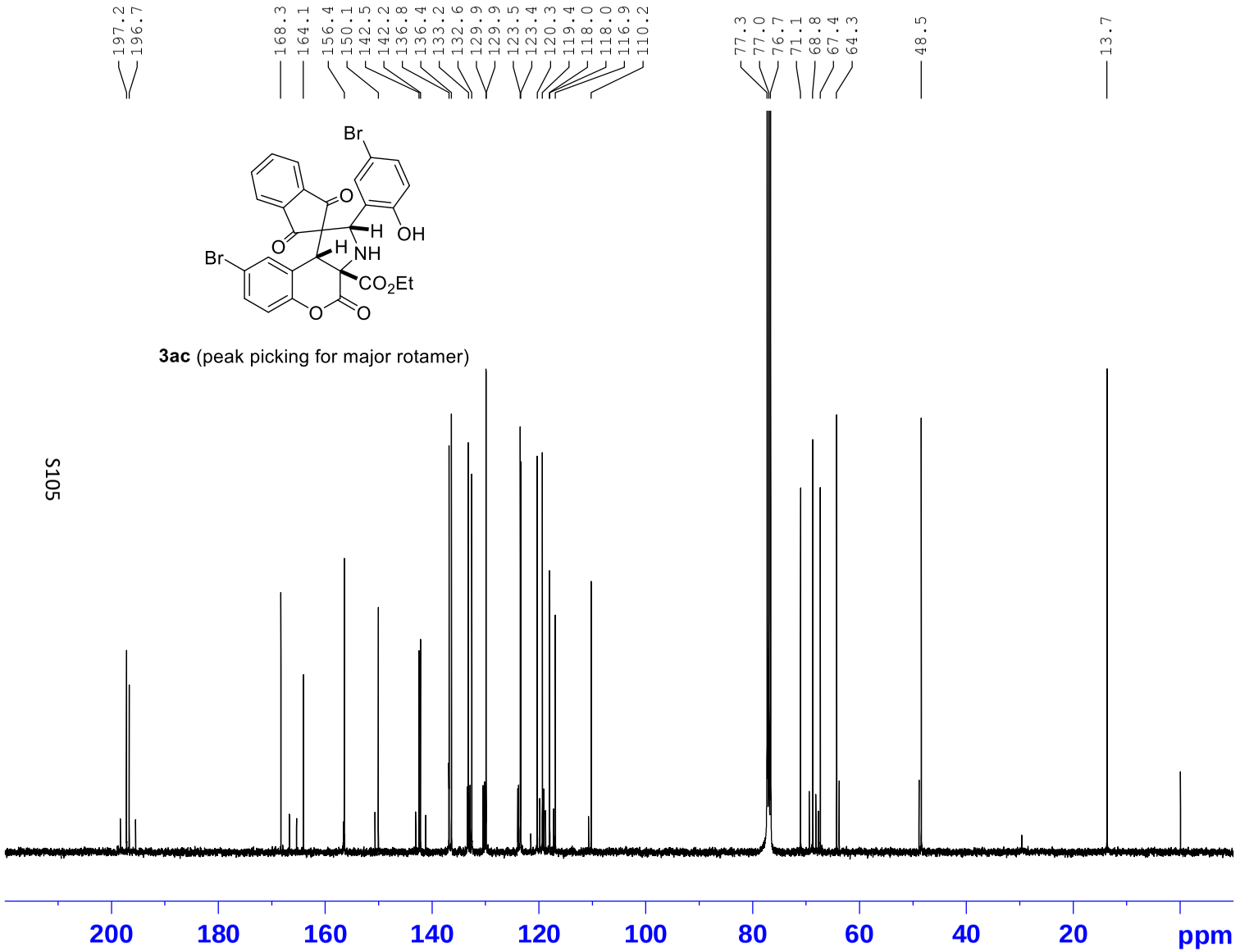


Current Data Parameters
NAME 3ac
EXPNO 5
PROCNO 1

F2 - Acquisition Parameters
Date_ 20170306
Time 22.04
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 161.3
DW 69.000 usec
DE 6.50 usec
TE 295.8 K
D1 2.00000000 sec
TD0 1

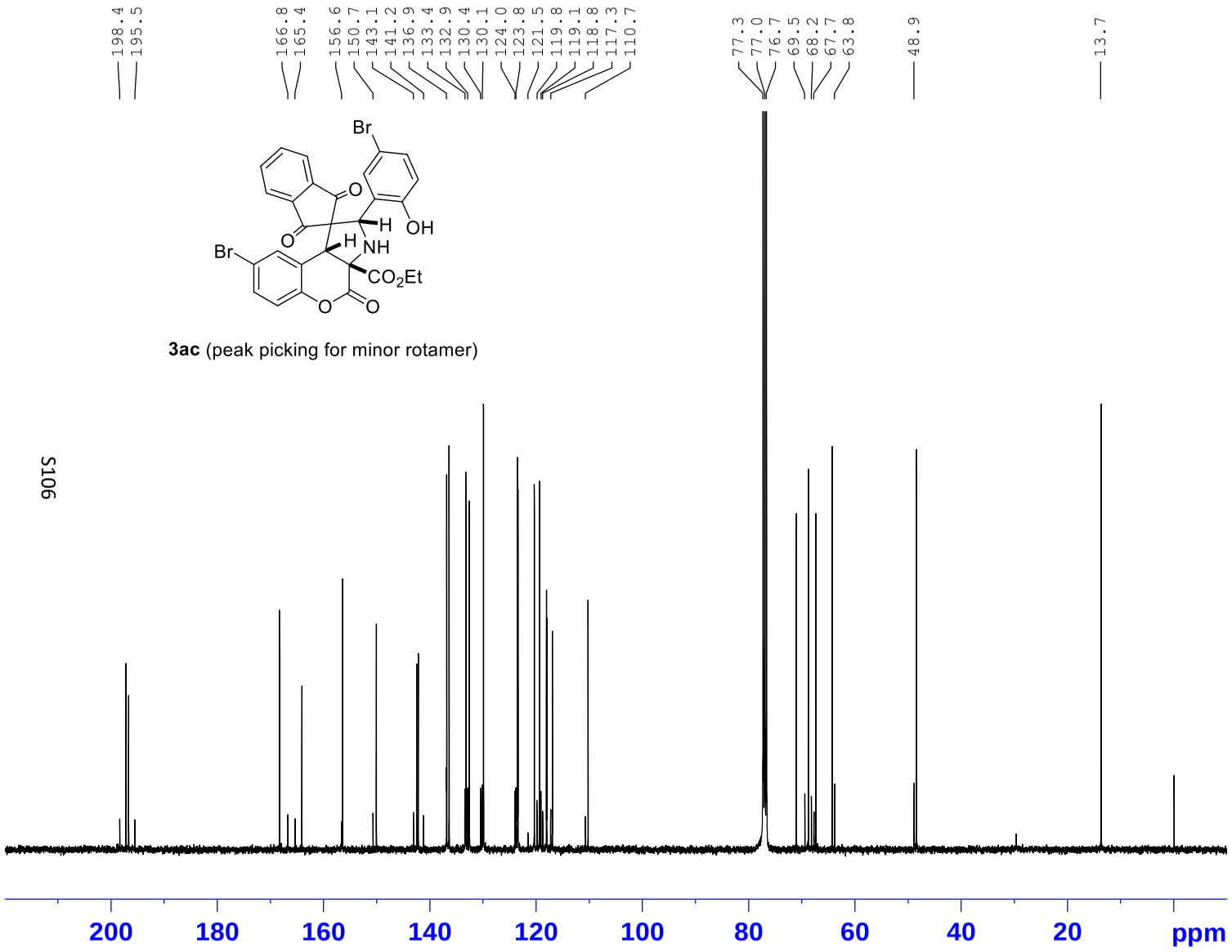
======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300057 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00



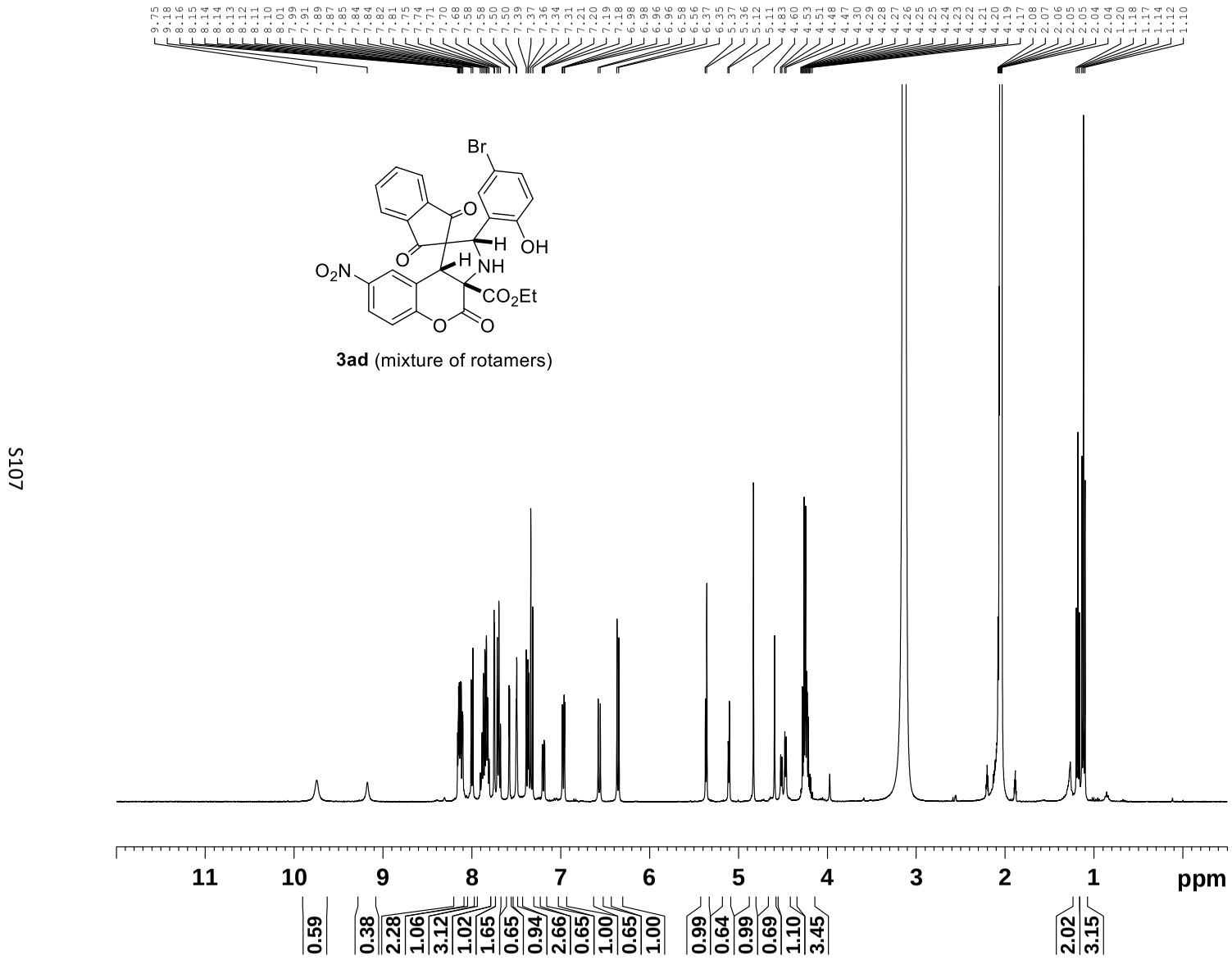
3ac (peak picking for major rotamer)


```
Current Data Parameters
NAME                  liu146
EXPNO                      6
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170306
Time                 22.06
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   14161
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   295.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.50 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2            waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                  -0.60 dB
PL12                 15.00 dB
PL13                 18.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6127720 MHz
WDW                       EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



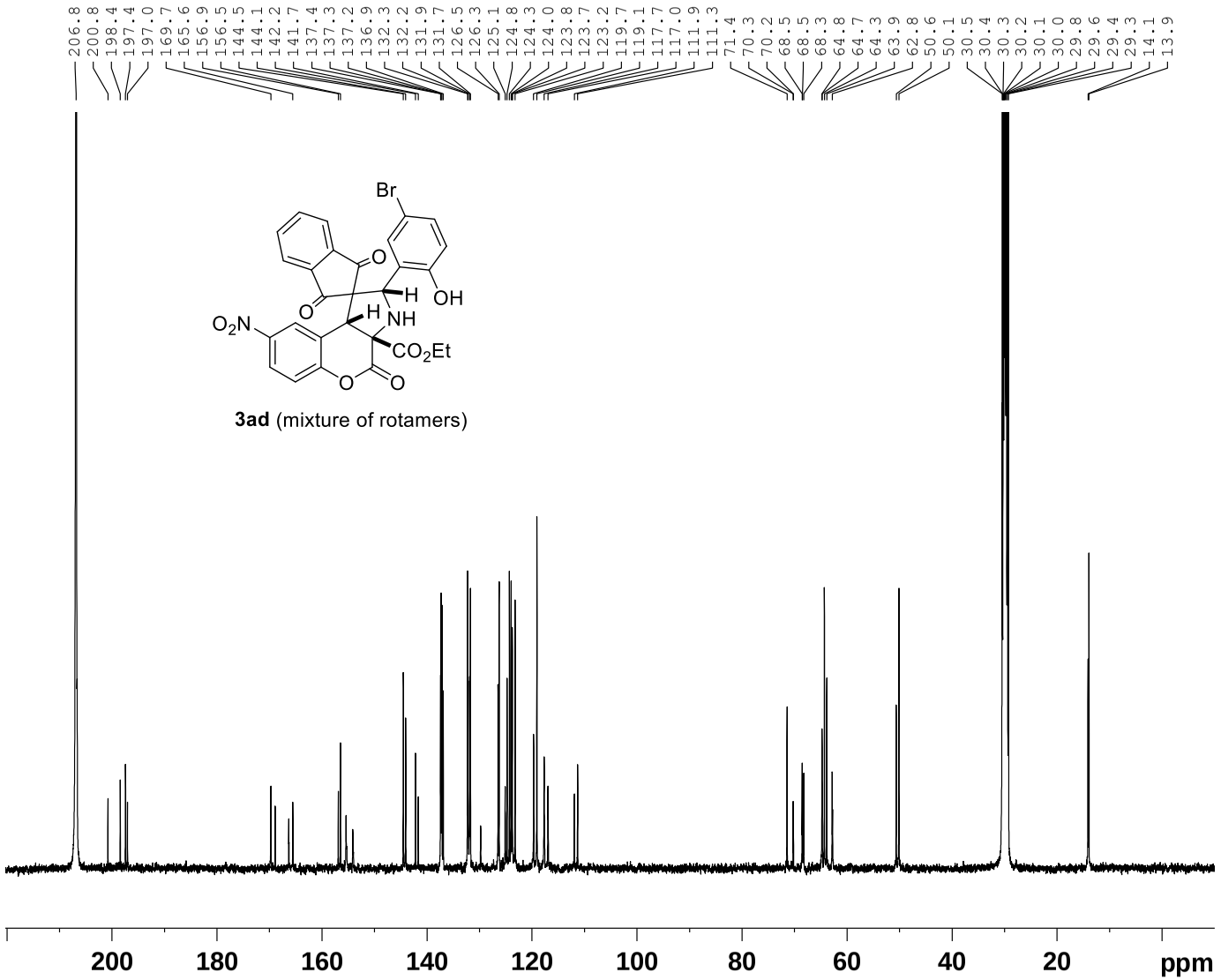
3ac (peak picking for minor rotamer)

```
Current Data Parameters
NAME                  liu146
EXPNO                      6
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170306
Time                  22.06
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG               zgpg30
TD                    32768
SOLVENT               CDCl3
NS                    14161
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                    20.800 usec
DE                     6.50 usec
TE                    295.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.50 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                  -0.60 dB
PL12                 15.00 dB
PL13                 18.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127720 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



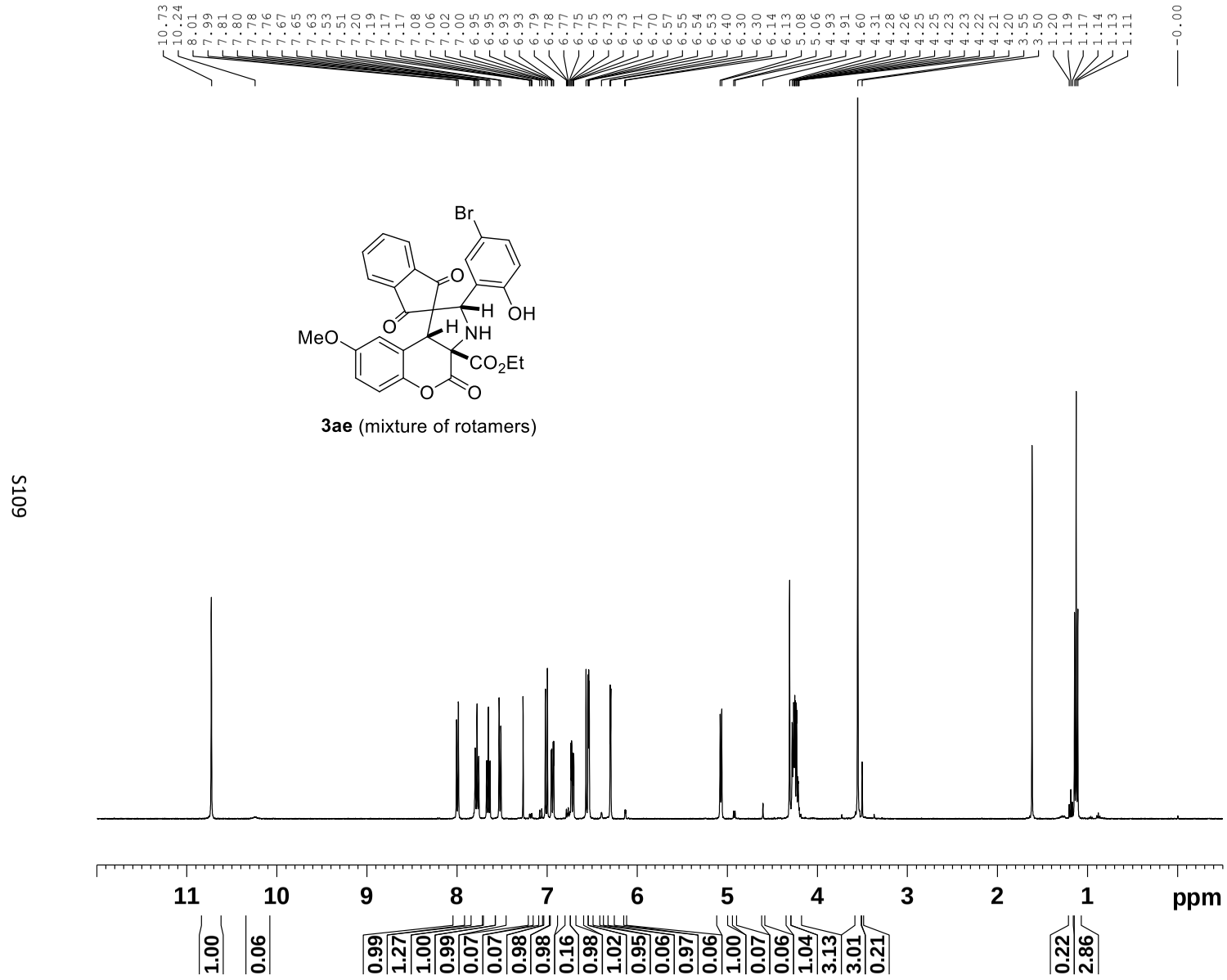
3ad (mixture of rotamers)

```
Current Data Parameters
NAME                 Bony271
EXPNO                      1
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180501
Time                 22.31
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT            Acetone
NS                        32
DS                         0
SWH                7211.539 Hz
FIDRES             0.220079 Hz
AQ                2.2719147 sec
RG                     51.8
DW                   69.333 usec
DE                    10.50 usec
TE                    298.1 K
D1              2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1           400.1324008 MHz
NUC1                     1H
P1                    12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                       16384
SF             400.1300074 MHz
WDW                      EM
SSB          0
LB           0 Hz
GB           0
PC                     1.00
```

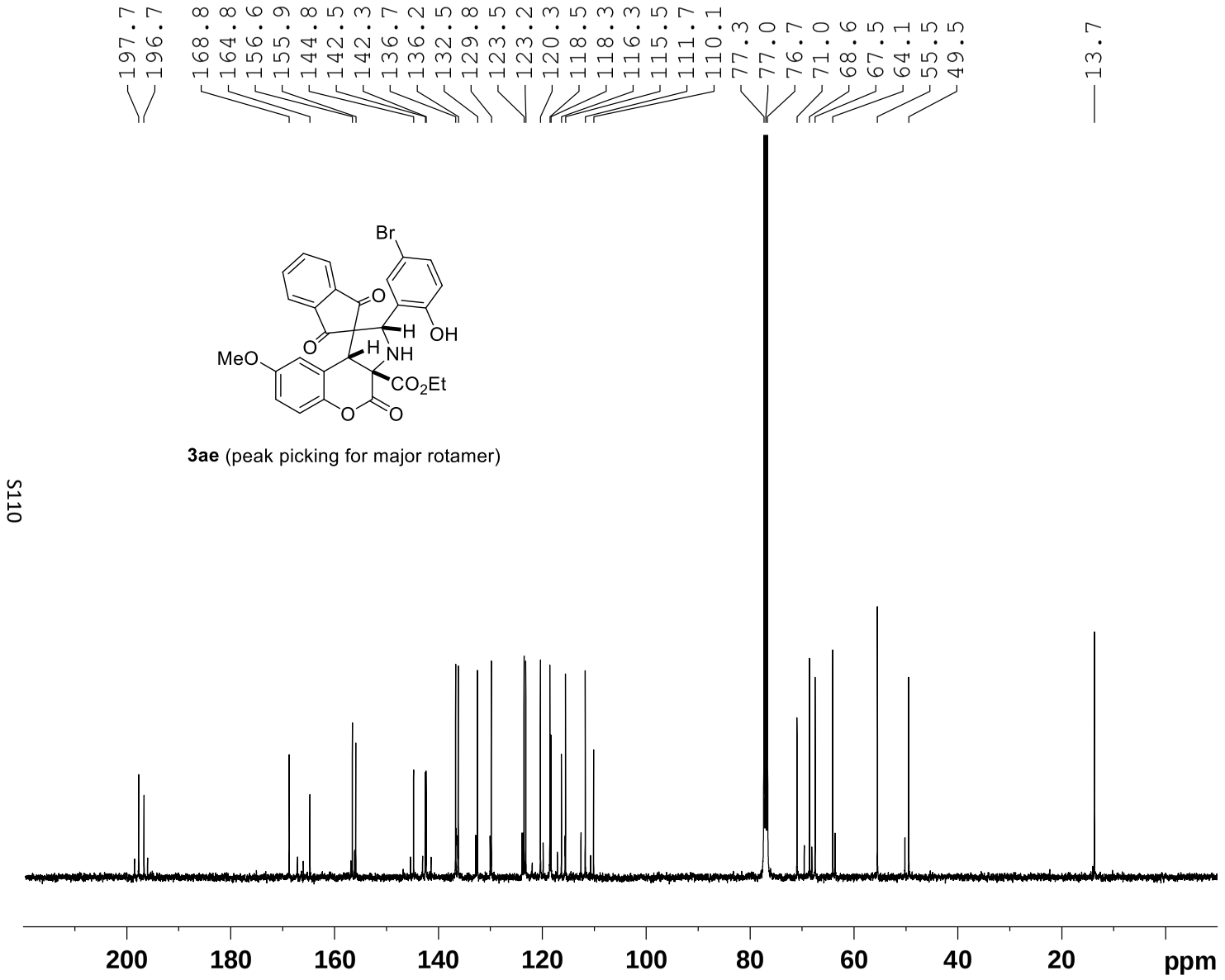


3ad (mixture of rotamers)


```
Current Data Parameters
NAME                  Bony271
EXPNO                       2
PROCNO                      1

F2 - Acquisition Parameters
Date_                20180501
Time                    22.34
INSTRUM                 spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT               Acetone
NS                      12829
DS                          0
SWH                 24038.461 Hz
FIDRES               0.733596 Hz
AQ                   0.6815744 sec
RG                      198.09
DW                      20.800 usec
DE                       6.50 usec
TE                      298.9 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1             100.6228298 MHz
NUC1                     13C
P1                     10.00 usec
PLW1             47.50000000 W

======== CHANNEL f2 ========
SFO2             400.1316005 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                  90.00 usec
PLW2             15.00000000 W
PLW12             0.33750001 W
PLW13             0.27338001 W

F2 - Processing parameters
SI                      32768
SF               100.6126843 MHz
WDW                        EM
SSB          0
LB                      2.00 Hz
GB           0
PC                      1.00
```



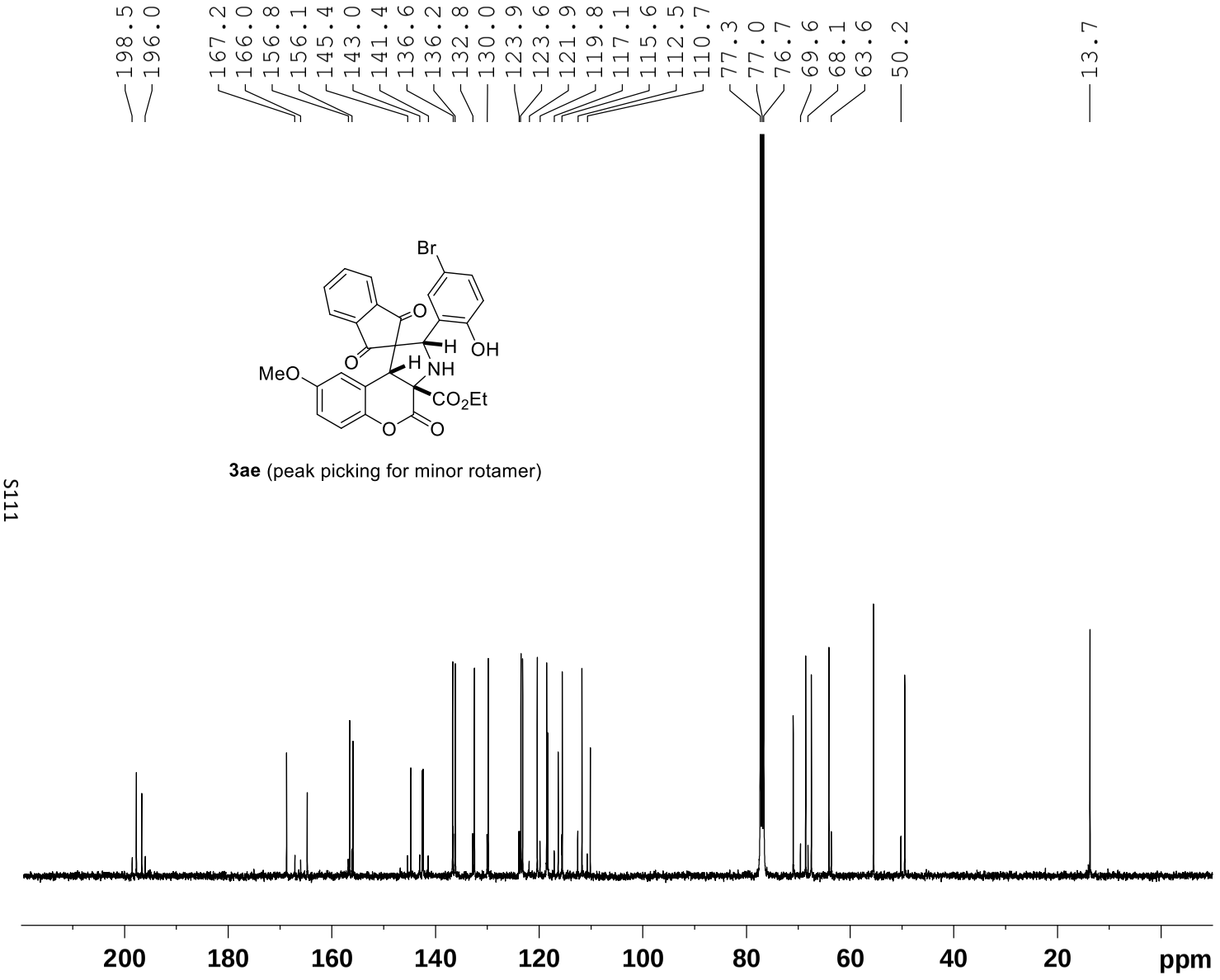

```
Current Data Parameters
NAME                      3ae
EXPNO                       4
PROCNO                      1

F2 - Acquisition Parameters
Date_              20170420
Time                  14.14
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                    228.1
DW                   69.000 usec
DE                    6.50 usec
TE                   294.6 K
D1              2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF             400.1300067 MHz
WDW                      EM
SSB          0
LB           0 Hz
GB           0
PC                    1.00
```



3ae (peak picking for major rotamer)

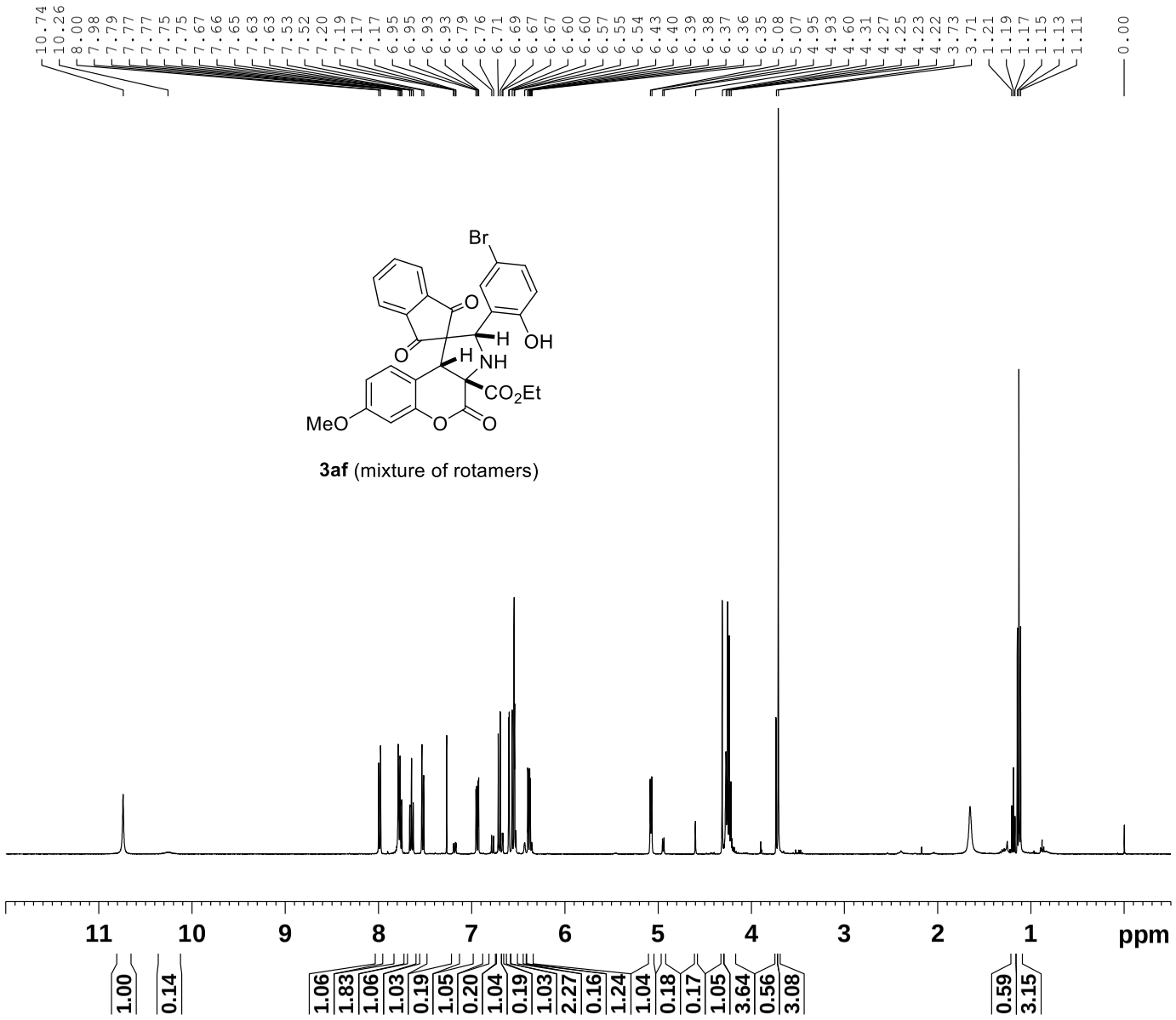
S110

```
Current Data Parameters
NAME                  Bony139
EXPNO                       2
PROCNO                      1

F2 - Acquisition Parameters
Date_                20170421
Time                    22.56
INSTRUM                 spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                       5015
DS                          0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                     198.09
DW                     20.800 usec
DE                      6.50 usec
TE                     297.2 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1             100.6228298 MHz
NUC1                     13C
P1                     10.00 usec
PLW1            47.50000000 W

======== CHANNEL f2 ========
SFO2             400.1316005 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                  90.00 usec
PLW2            15.00000000 W
PLW12            0.33750001 W
PLW13            0.27338001 W

F2 - Processing parameters
SI                       32768
SF               100.6127717 MHz
WDW                         EM
SSB          0
LB                      2.00 Hz
GB           0
PC                      1.00
```

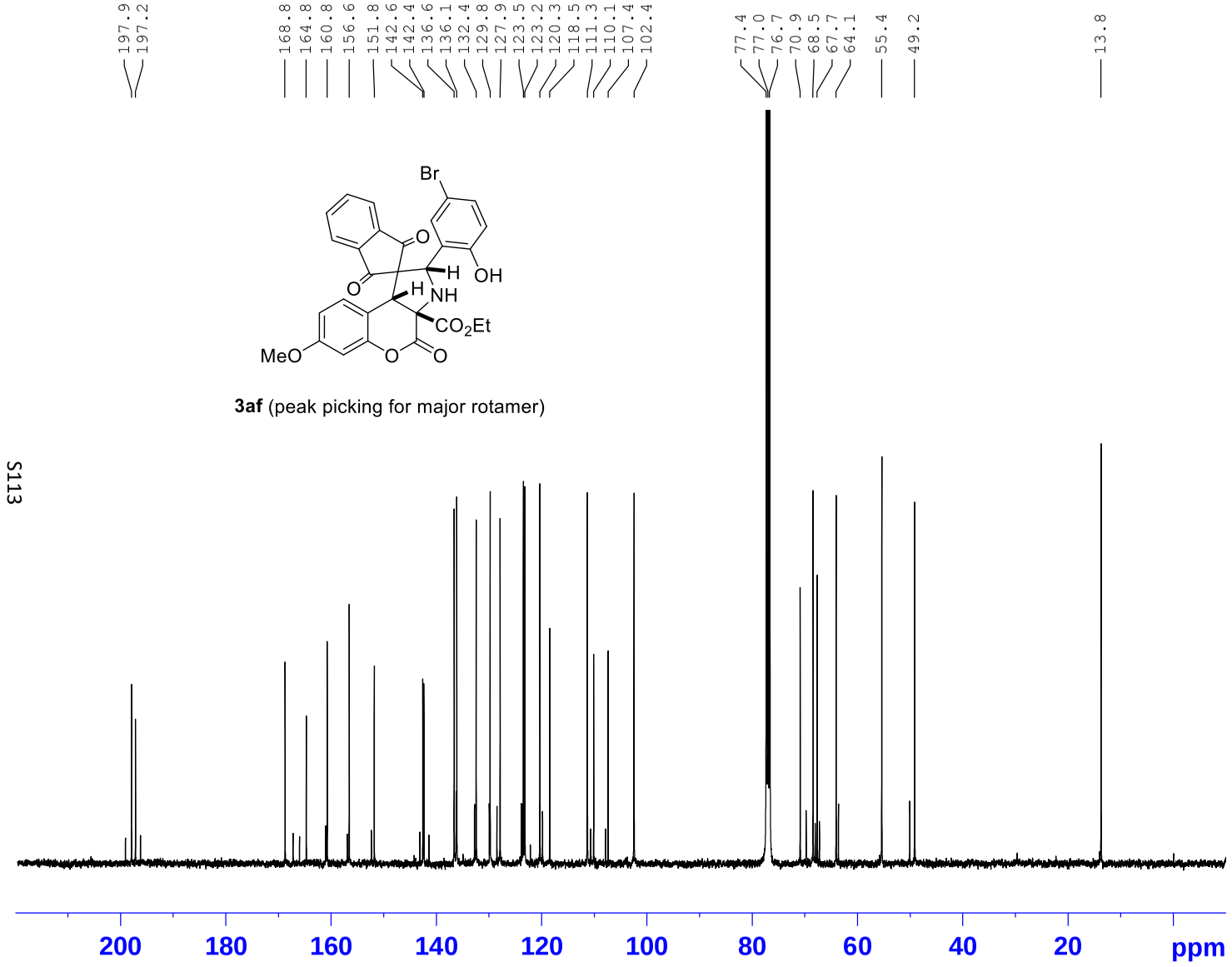


3ae (peak picking for minor rotamer)


```
Current Data Parameters
NAME                  Bony139
EXPNO                       2
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170421
Time                   22.56
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                       5015
DS                          0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                     198.09
DW                     20.800 usec
DE                      6.50 usec
TE                     297.2 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1             100.6228298 MHz
NUC1                     13C
P1                     10.00 usec
PLW1            47.50000000 W

======== CHANNEL f2 ========
SFO2             400.1316005 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                  90.00 usec
PLW2            15.00000000 W
PLW12            0.33750001 W
PLW13            0.27338001 W

F2 - Processing parameters
SI                      32768
SF               100.6127717 MHz
WDW                        EM
SSB          0
LB                      2.00 Hz
GB           0
PC                      1.00
```

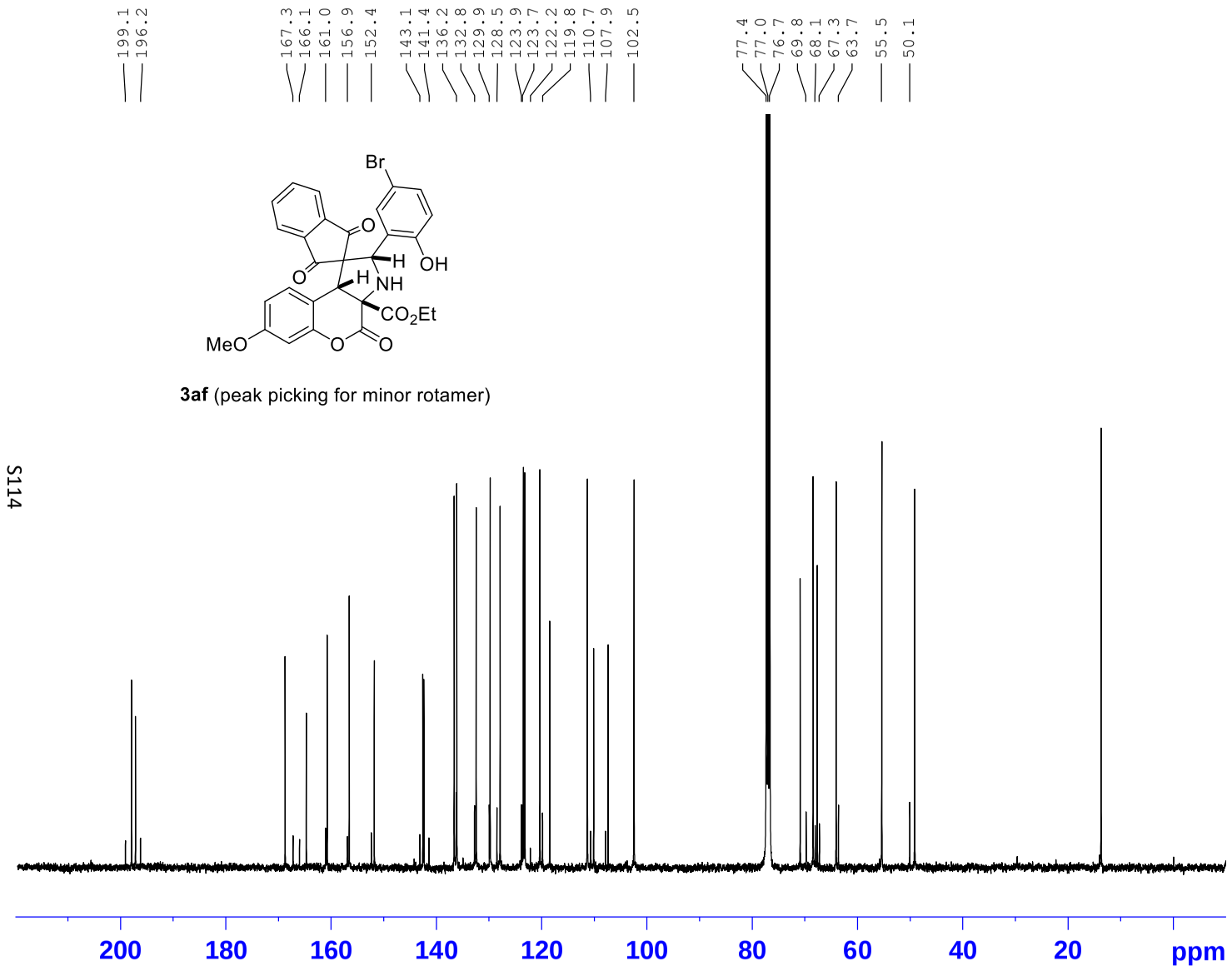



```
Current Data Parameters
NAME                 vicky174
EXPNO                       3
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170503
Time                    0.26
INSTRUM                spect
PROBHD   5 mm PABBO BB/
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7211.539 Hz
FIDRES              0.220079 Hz
AQ                  2.2719147 sec
RG                      99.72
DW                     69.333 usec
DE                     10.50 usec
TE                     297.0 K
D1                 2.00000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1            400.1324008 MHz
NUC1                      1H
P1                     12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                      16384
SF              400.1300062 MHz
WDW                        EM
SSB          0
LB           0 Hz
GB           0
PC                      1.00
```



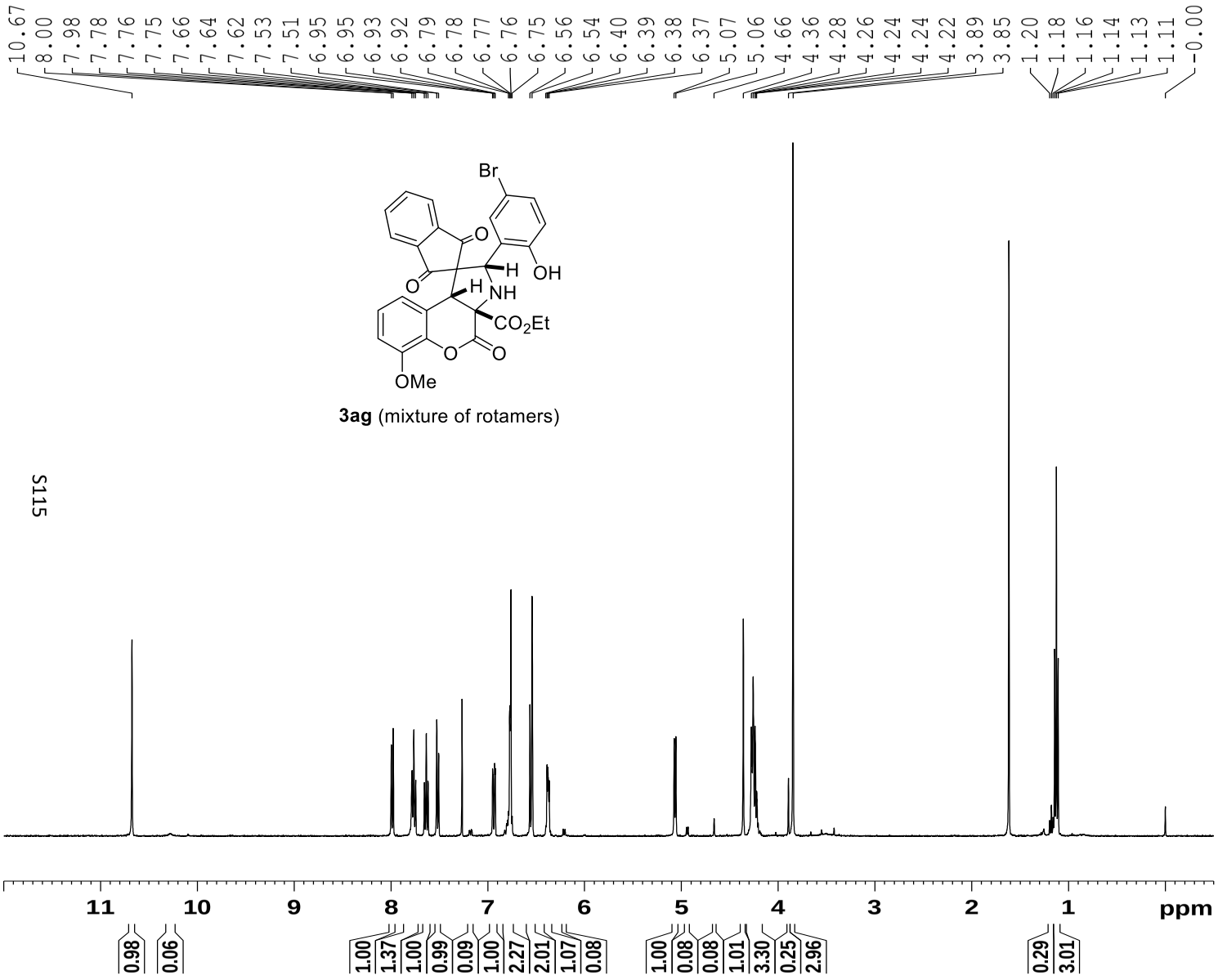
3af (peak picking for major rotamer)


```
Current Data Parameters
NAME            vicky174
EXPNO                  4
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170503
Time                0.27
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                 11807
DS                     0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                198.09
DW                20.800 usec
DE                 6.50 usec
TE                297.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6228298 MHz
NUC1                  13C
P1                 10.00 usec
PLW1         47.50000000 W

======== CHANNEL f2 ========
SFO2         400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2         15.00000000 W
PLW12         0.33750001 W
PLW13         0.27338001 W

F2 - Processing parameters
SI                 32768
SF           100.6127685 MHz
WDW                   EM
SSB       0
LB                 2.00 Hz
GB        0
PC                 1.00
```



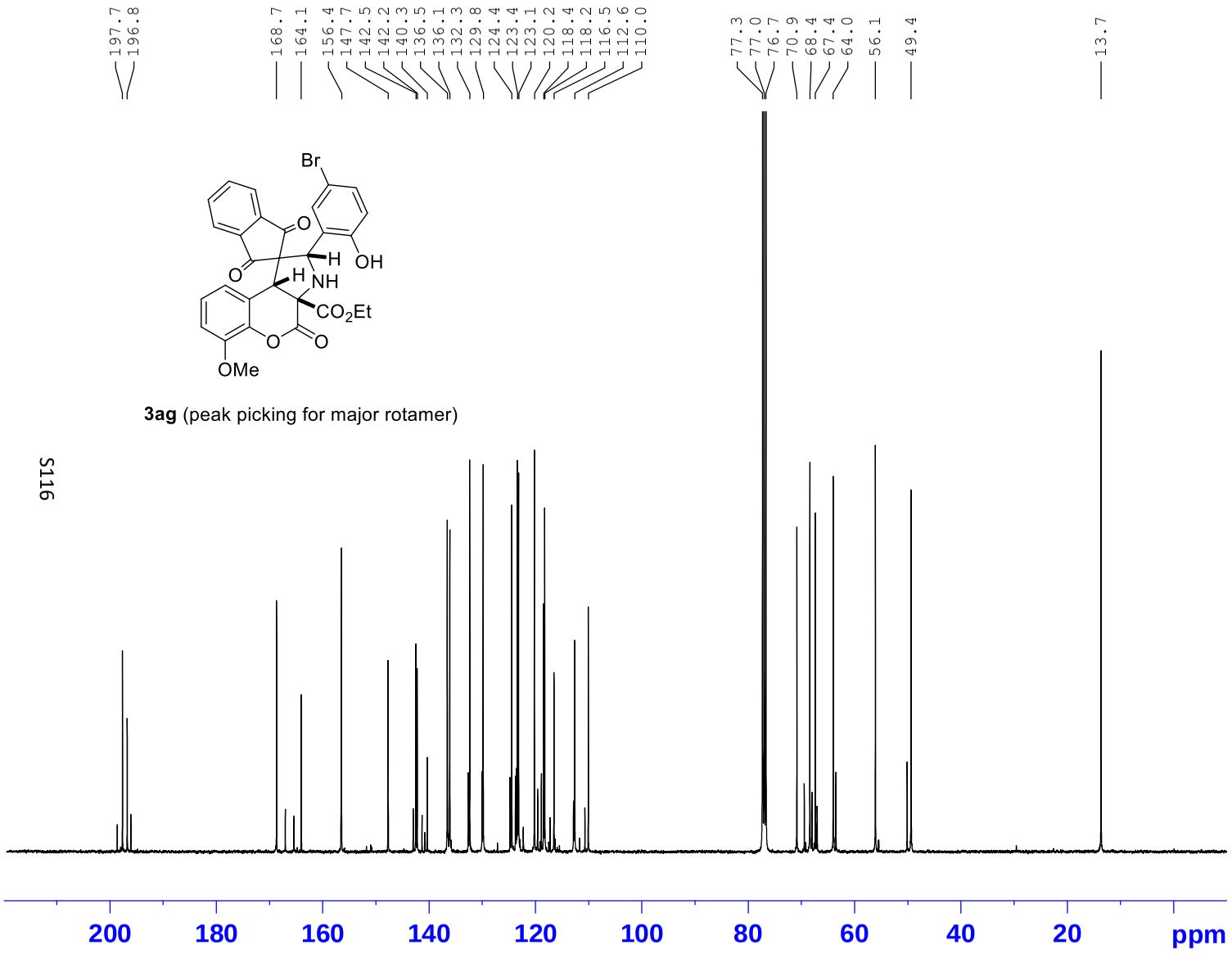
3af (peak picking for minor rotamer)


```
Current Data Parameters
NAME                 vicky174
EXPNO                       4
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170503
Time                    0.27
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                      11807
DS                          0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                     198.09
DW                     20.800 usec
DE                      6.50 usec
TE                     297.0 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1            100.6228298 MHz
NUC1                    13C
P1                    10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2            400.1316005 MHz
NUC2                    1H
CPDPRG[2             waltz16
PCPD2                 90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                      32768
SF              100.6127685 MHz
WDW                        EM
SSB          0
LB                     2.00 Hz
GB           0
PC                     1.00
```



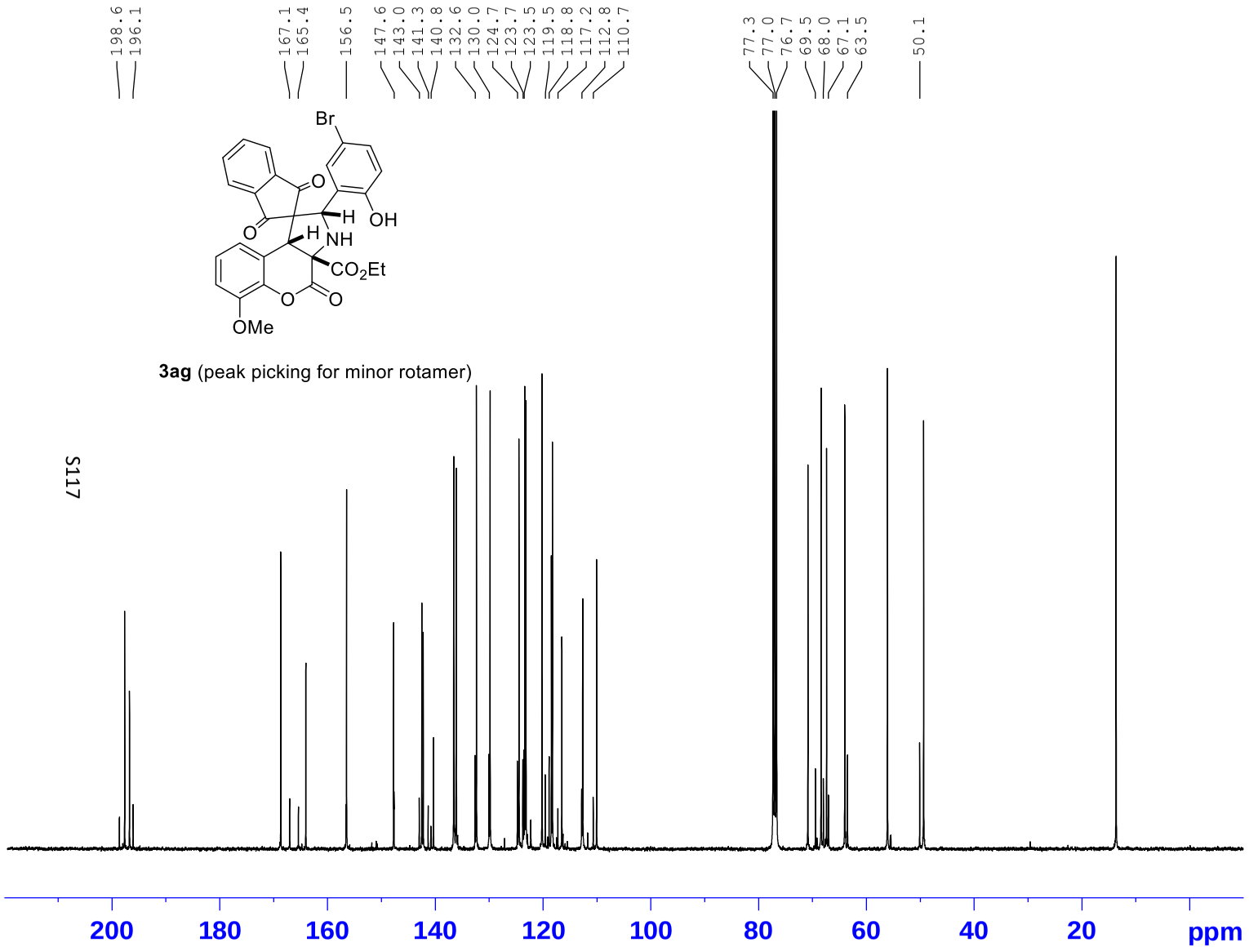
3ag (mixture of rotamers)

```
Current Data Parameters
NAME                   3OMe
EXPNO                     2
PROCNO                    1

F2 - Acquisition Parameters
Date_               20170421
Time                   14.35
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                      256
DW                   69.000 usec
DE                    6.50 usec
TE                   295.1 K
D1                2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300068 MHz
WDW                      EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



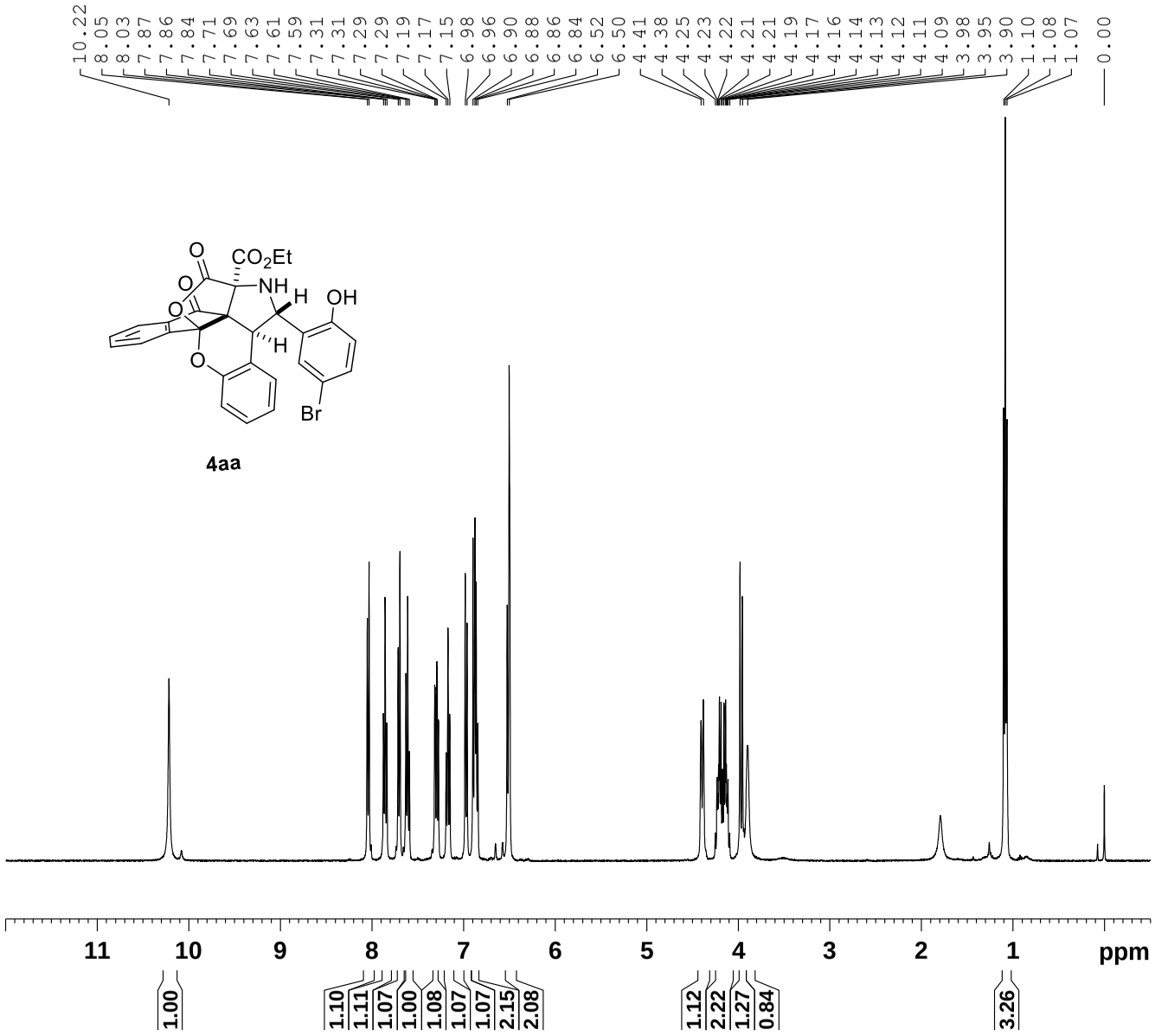
3ag (peak picking for major rotamer)


```
Current Data Parameters
NAME                  3OMe
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170416
Time                 21.19
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   16774
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  299.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                  13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                   32768
SF            100.6127765 MHz
WDW                    EM
SSB       0
LB                   2.00 Hz
GB        0
PC                   1.00
```

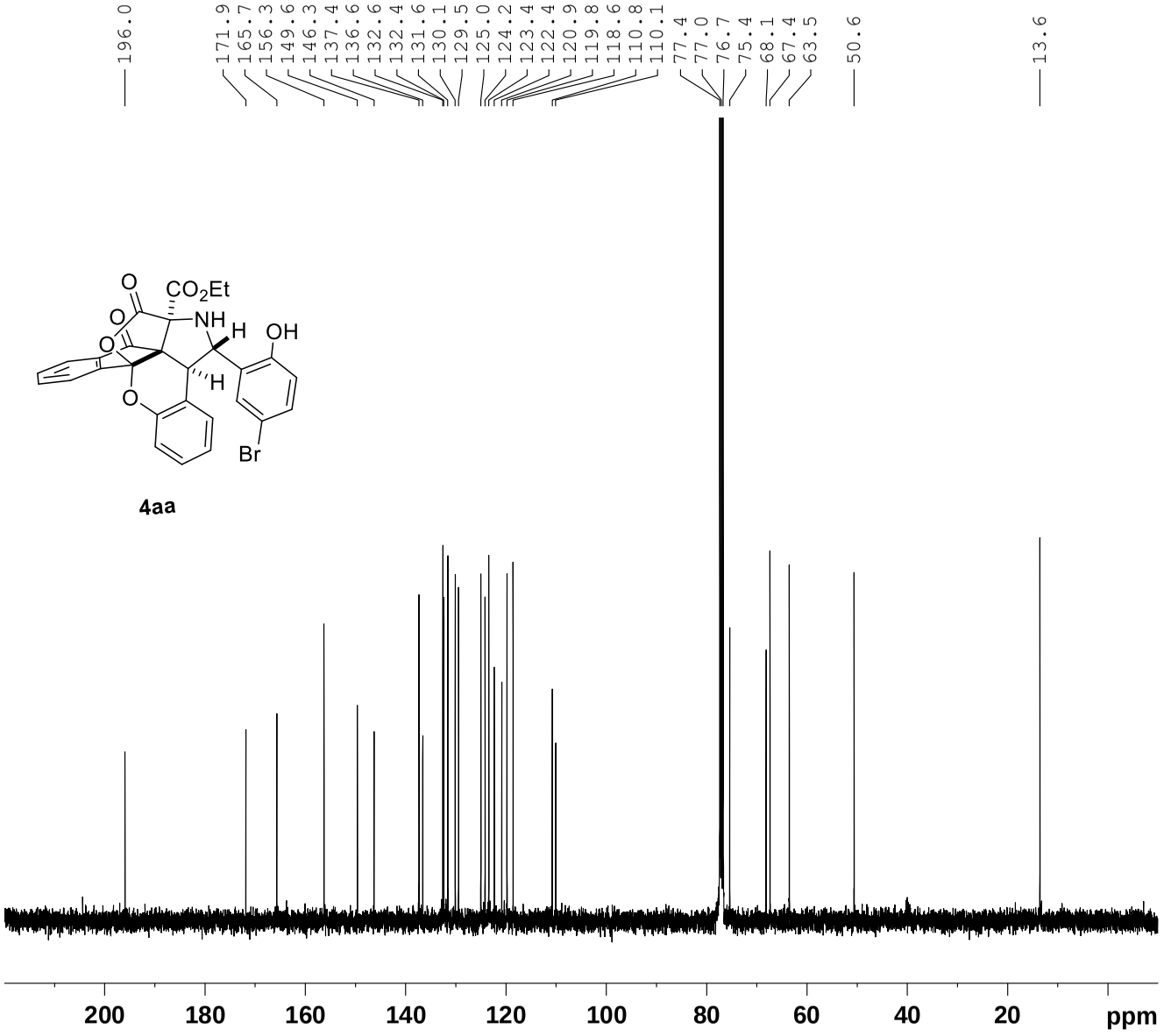


3ag (peak picking for minor rotamer)

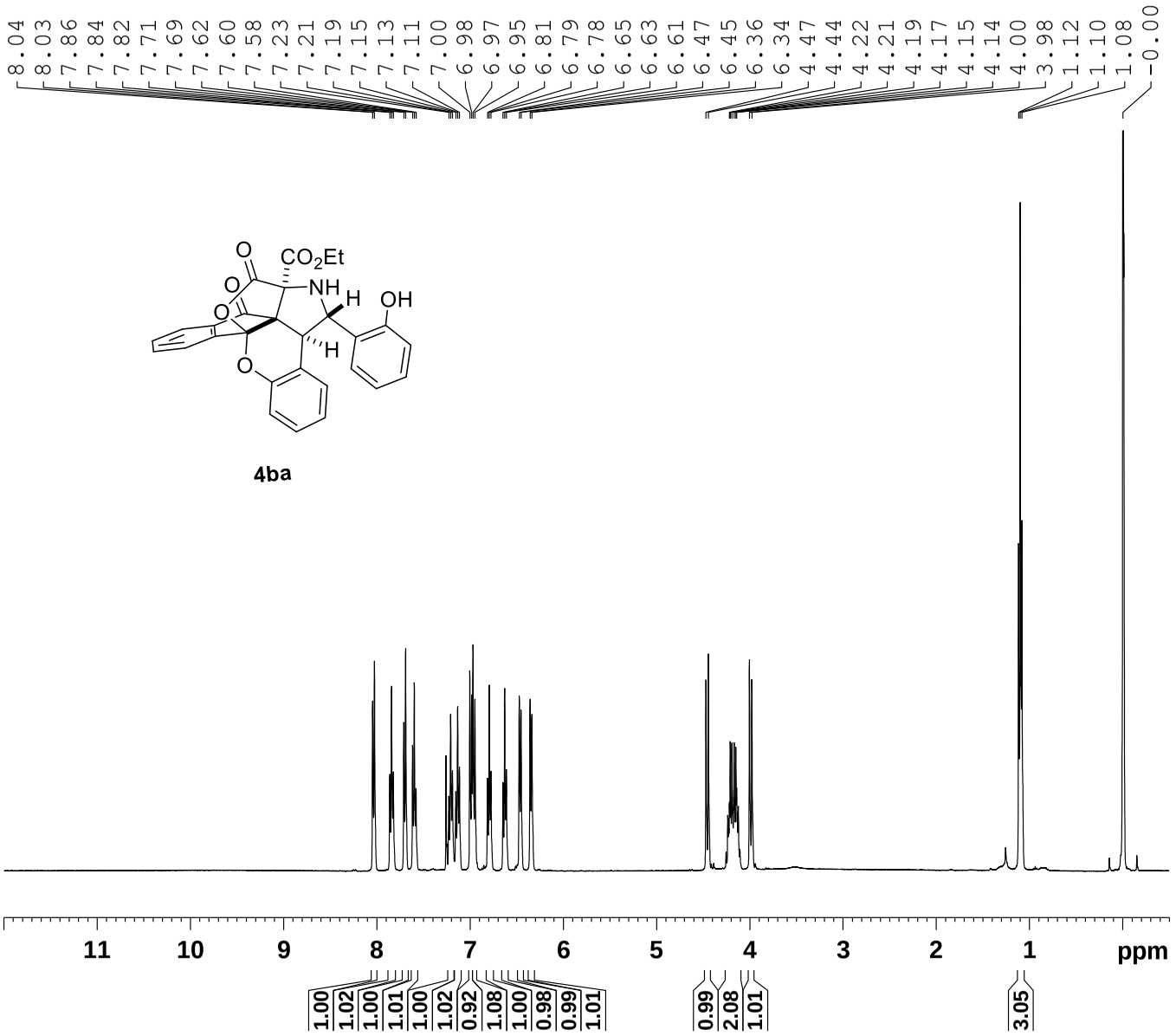

```
Current Data Parameters
NAME                  3OMe
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170416
Time                 21.19
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG              zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   16774
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  299.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6228298 MHz
NUC1                   13C
P1                  10.00 usec
PLW1           47.50000000 W

======== CHANNEL f2 ========
SFO2           400.1316005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2               90.00 usec
PLW2           15.00000000 W
PLW12           0.33750001 W
PLW13           0.27338001 W

F2 - Processing parameters
SI                   32768
SF             100.6127769 MHz
WDW                    EM
SSB          0
LB                  2.00 Hz
GB           0
PC                  1.00
```



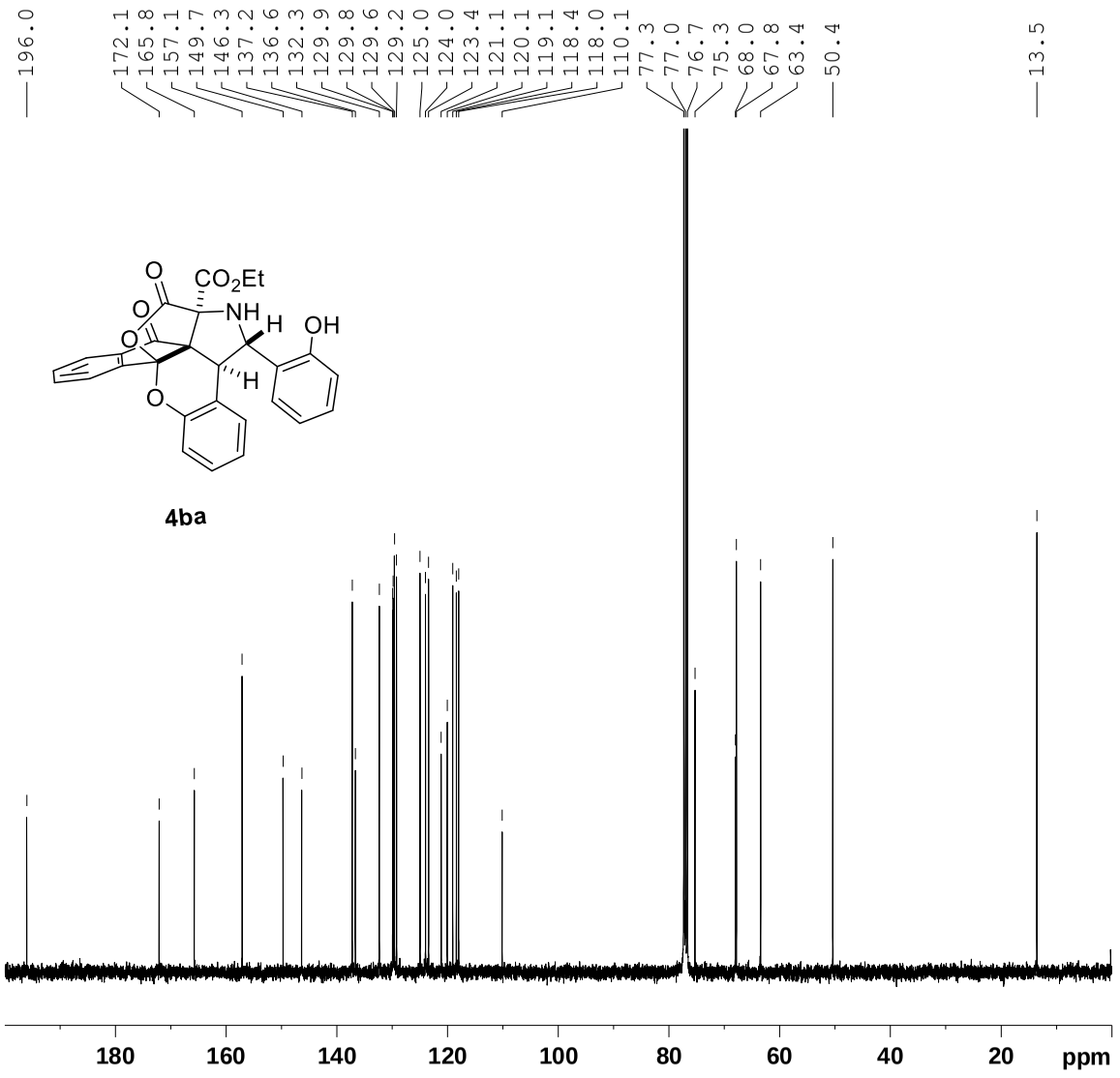

```
Current Data Parameters
NAME                  B097
EXPNO                   15
PROCNO                   1

F2 - Acquisition Parameters
Date_           20170601
Time                9.40
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   114
DW                69.000 usec
DE                 6.50 usec
TE                295.8 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF          400.1300040 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME                  B097
EXPNO                   16
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170601
Time                  9.42
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1411
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                    8192
DW                 20.800 usec
DE                  6.50 usec
TE                 295.9 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                  13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127690 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

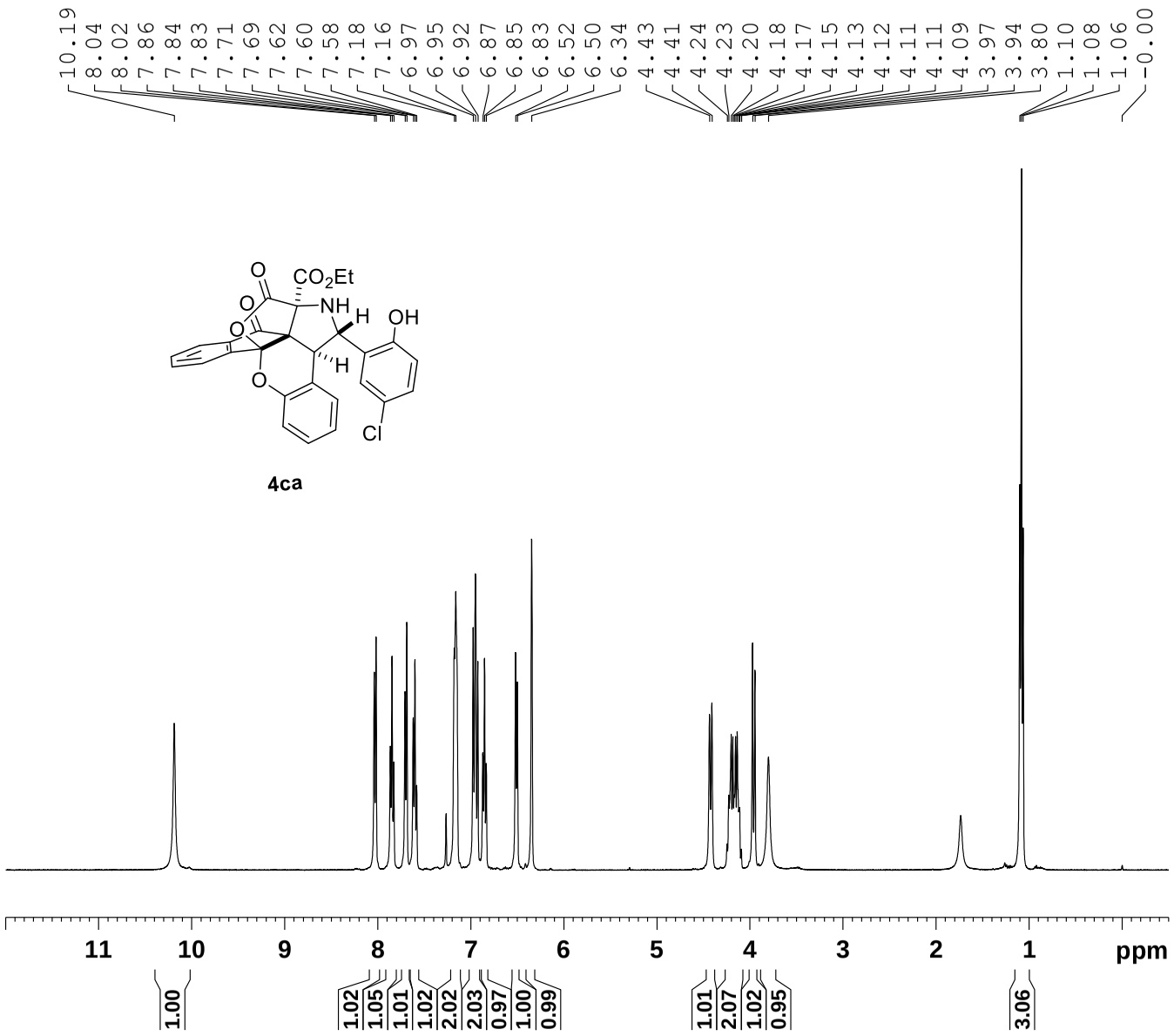



```
Current Data Parameters
NAME                 hank097
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_               20171021
Time                   15.48
INSTRUM                spect
PROBHD   5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDC13
NS                        32
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                     298.1 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    15.00 usec
PL1          0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF               400.1300105 MHz
WDW                       EM
SSB          0
LB           0 Hz
GB           0
PC                     1.00
```

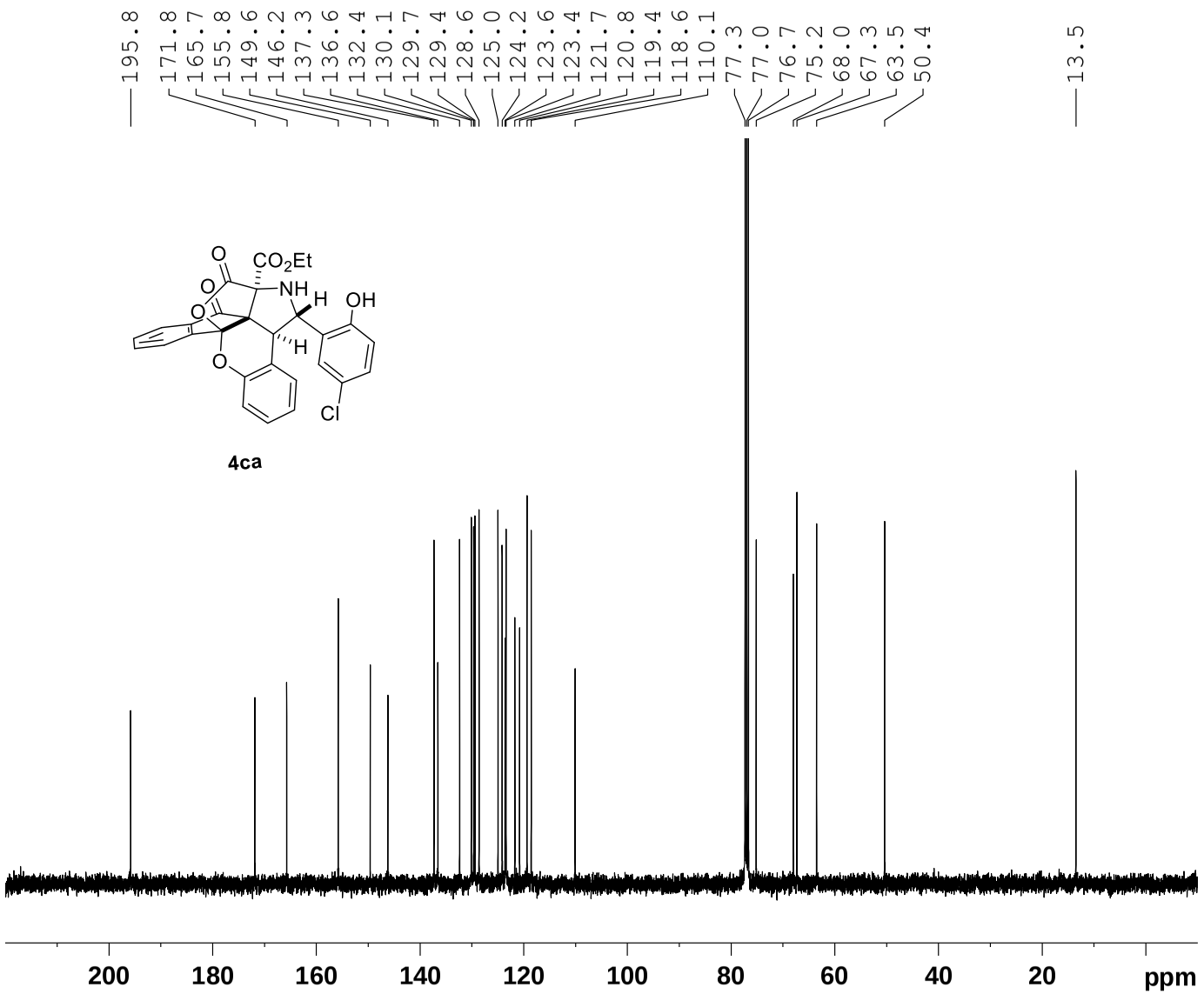


4ba

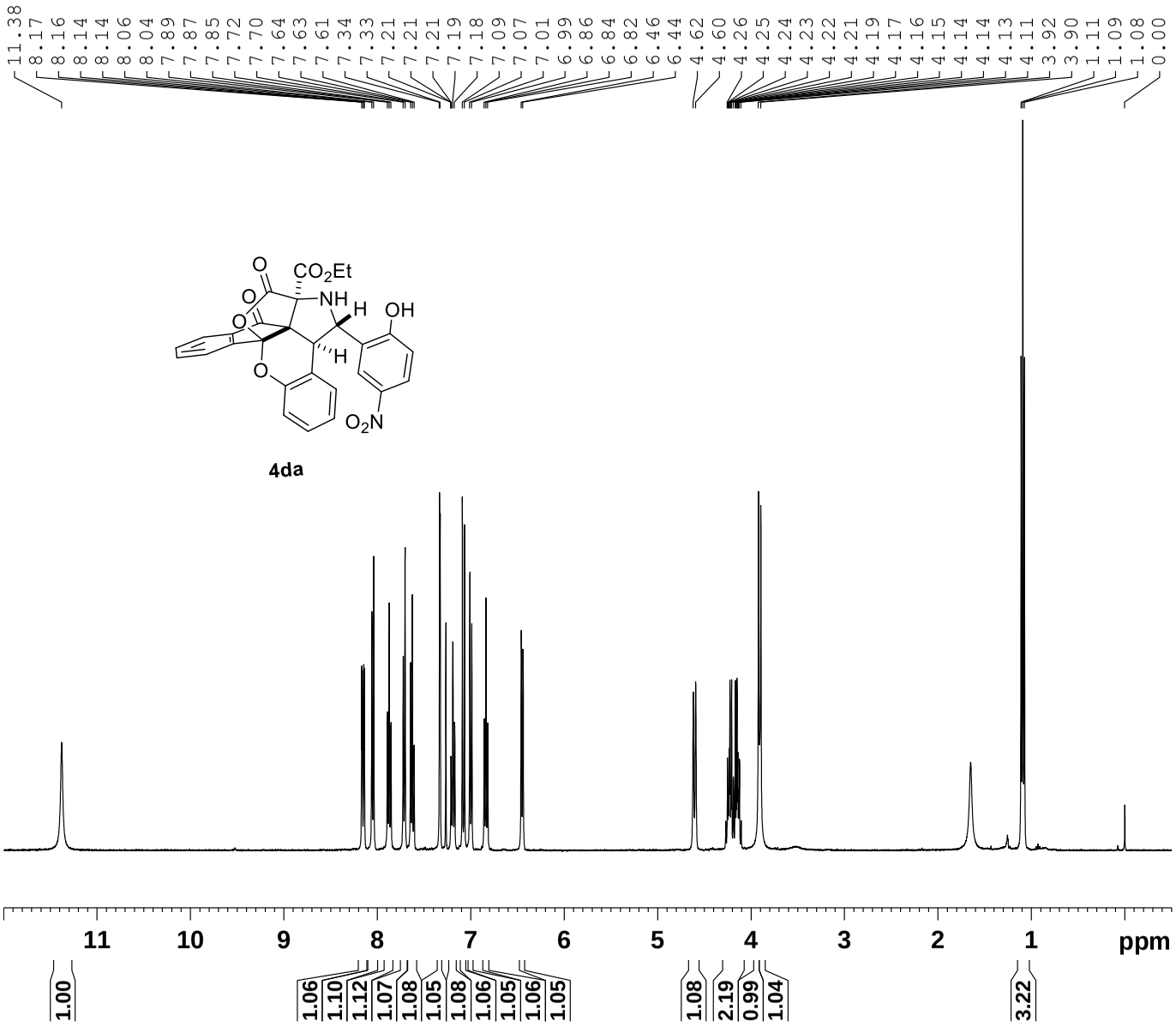
```
Current Data Parameters
NAME             hank097
EXPNO                  5
PROCNO                 1

F2 - Acquisition Parameters
Date_           20171021
Time               17.14
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                  1330
DS                     0
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ            0.6815744 sec
RG               5792.6
DW                20.800 usec
DE                 6.50 usec
TE                298.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12              15.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127727 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME                  hank102
EXPNO                       7
PROCNO                      1

F2 - Acquisition Parameters
Date_                20171117
Time                    21.22
INSTRUM                 spect
PROBHD   5 mm BBO BB-1H
PULPROG                  zg30
TD                      32768
SOLVENT                 CDCl3
NS                         16
DS                          0
SWH                  7246.377 Hz
FIDRES               0.221142 Hz
AQ                   2.2609921 sec
RG                       71.8
DW                     69.000 usec
DE                      6.50 usec
TE                     300.1 K
D1                2.00000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                       1H
P1                     15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                      16384
SF               400.1300080 MHz
WDW                        EM
SSB       0
LB        0 Hz
GB        0
PC                      1.00
```




```
Current Data Parameters
NAME                  hank102
EXPNO                       8
PROCNO                      1

F2 - Acquisition Parameters
Date_                20171117
Time                    21.23
INSTRUM                 spect
PROBHD   5 mm BBO BB-1H
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                       1151
DS                          0
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                       4096
DW                     20.800 usec
DE                      6.50 usec
TE                     300.2 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                      13C
P1                      10.50 usec
PL1                      7.00 dB
SFO1             100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2              waltz16
NUC2                      1H
PCPD2                  90.00 usec
PL2                    -0.60 dB
PL12                   15.00 dB
PL13                   18.00 dB
SFO2             400.1316005 MHz

F2 - Processing parameters
SI                        32768
SF               100.6127749 MHz
WDW                          EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.00
```

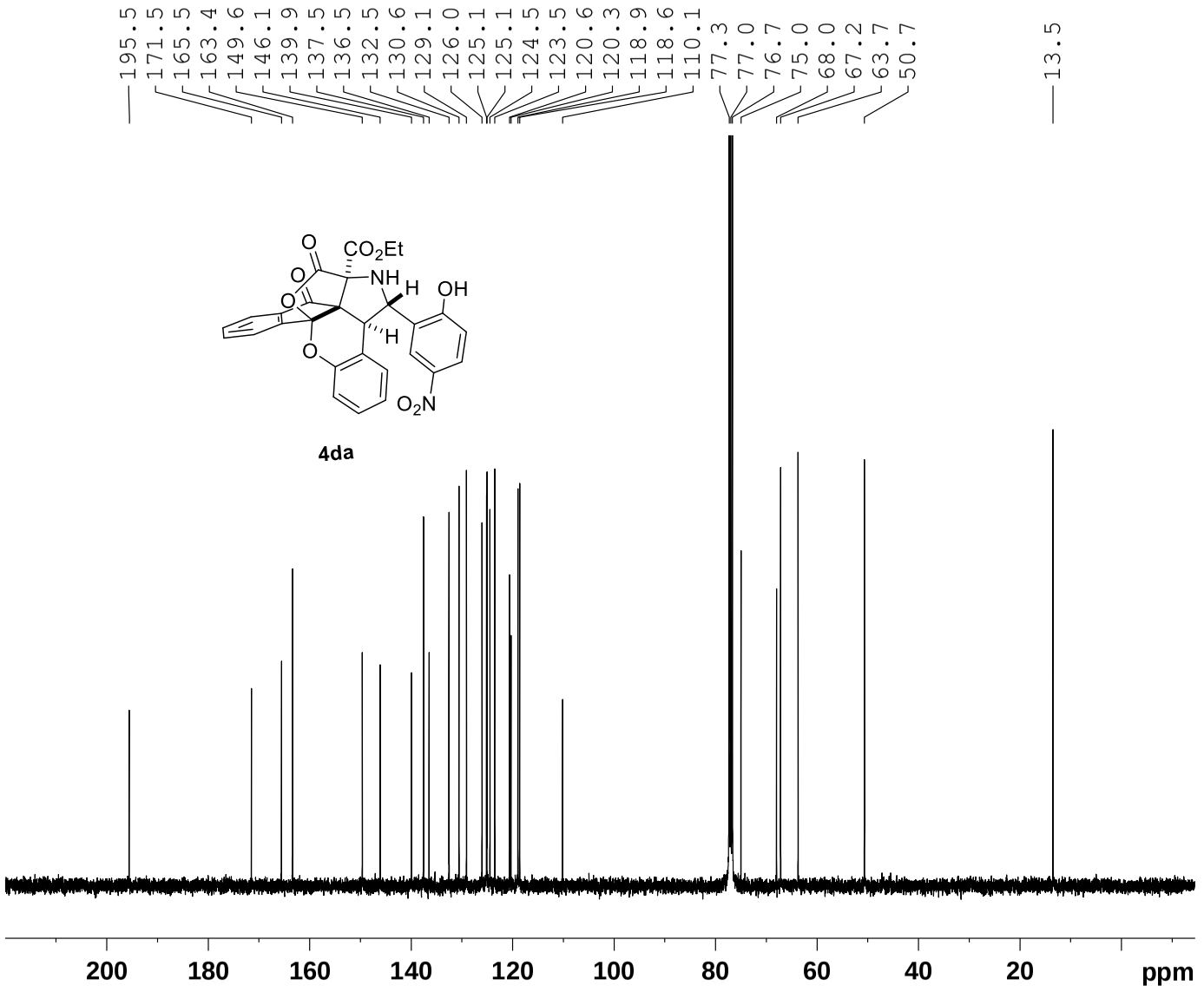


Current Data Parameters
NAME hank103
EXPNO 20
PROCNO 1

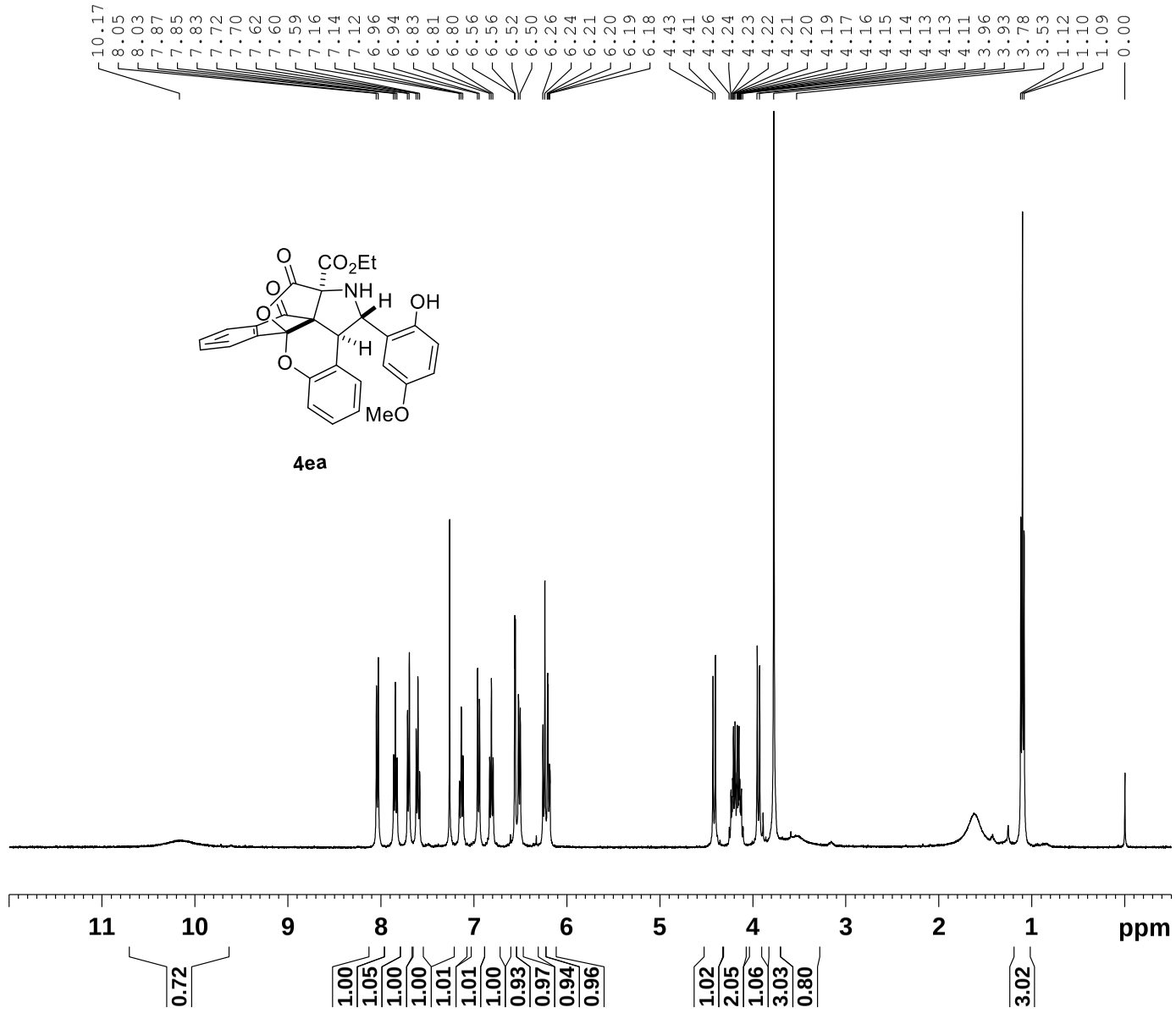
F2 - Acquisition Parameters
Date_ 20180222
Time 11.55
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 295.3 K
D1 2.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300059 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00




```
Current Data Parameters
NAME                 hank103
EXPNO                     21
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180222
Time                  11.59
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG               zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     2500
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   295.6 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                      32768
SF            100.6127736 MHz
WDW                       EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```

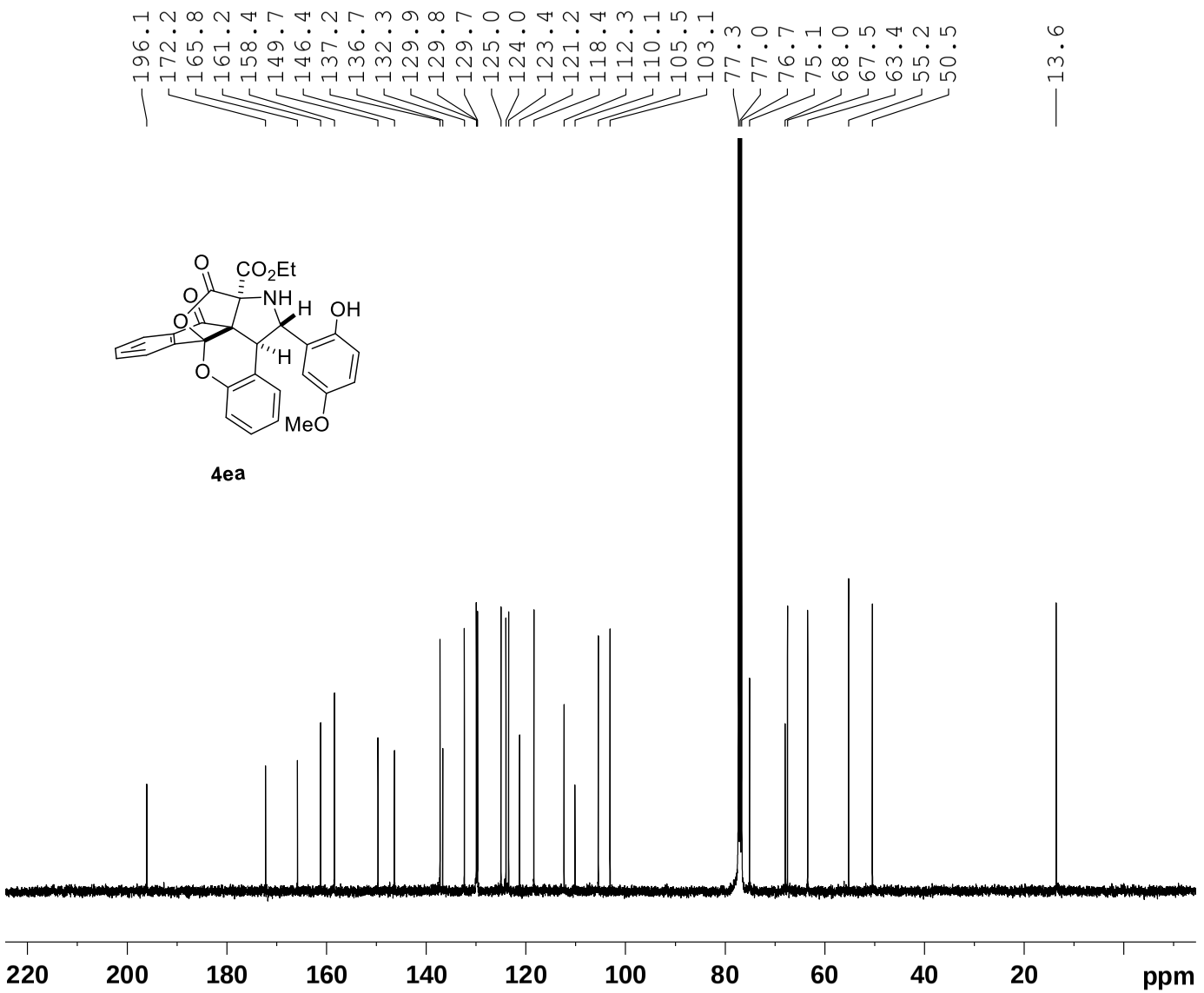


Current Data Parameters
NAME B301
EXPNO 9
PROCNO 1

F2 - Acquisition Parameters
Date_ 20180221
Time 15.44
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 295.1 K
D1 2.00000000 sec
TD0 1

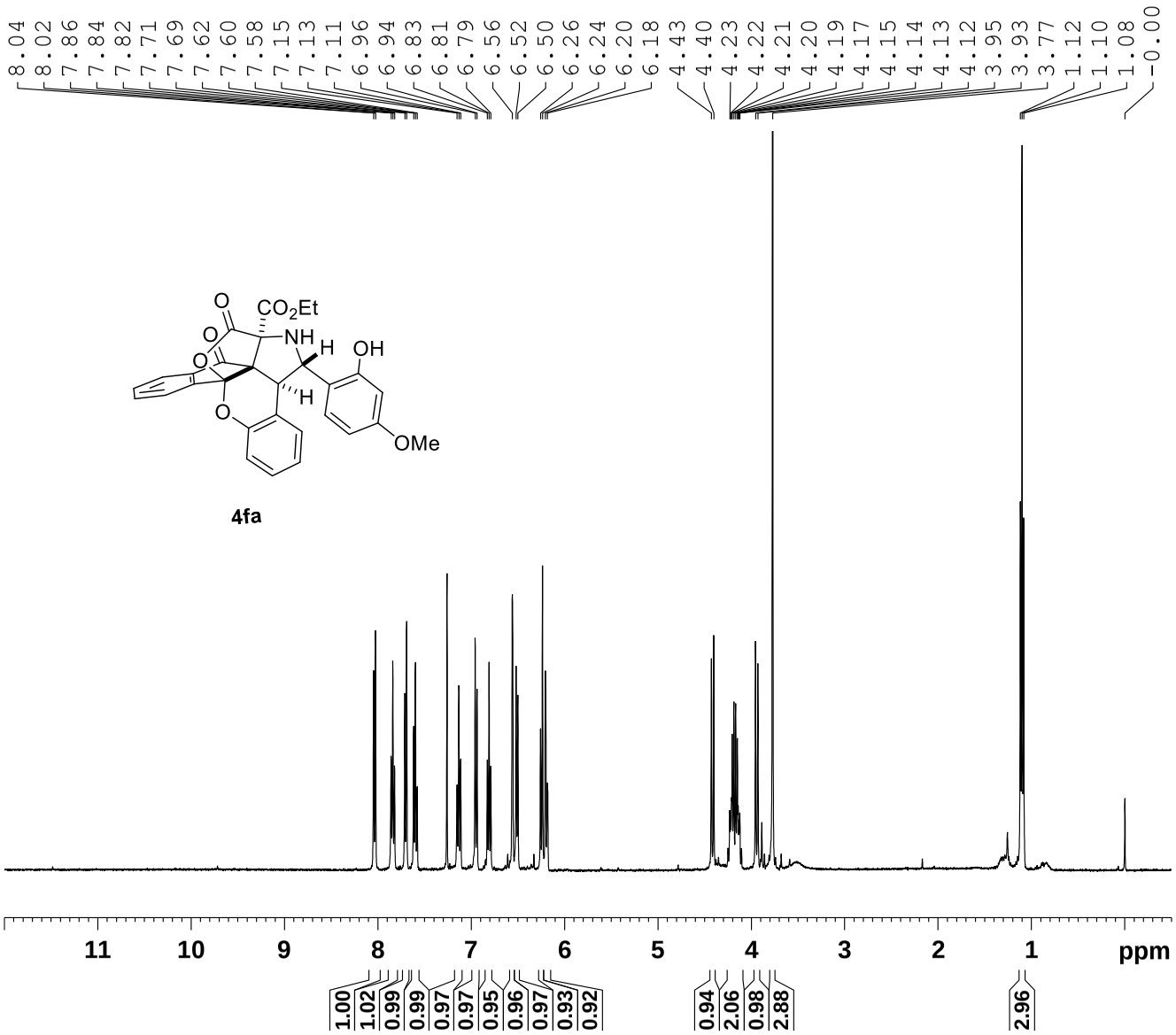
======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 0 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300078 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00

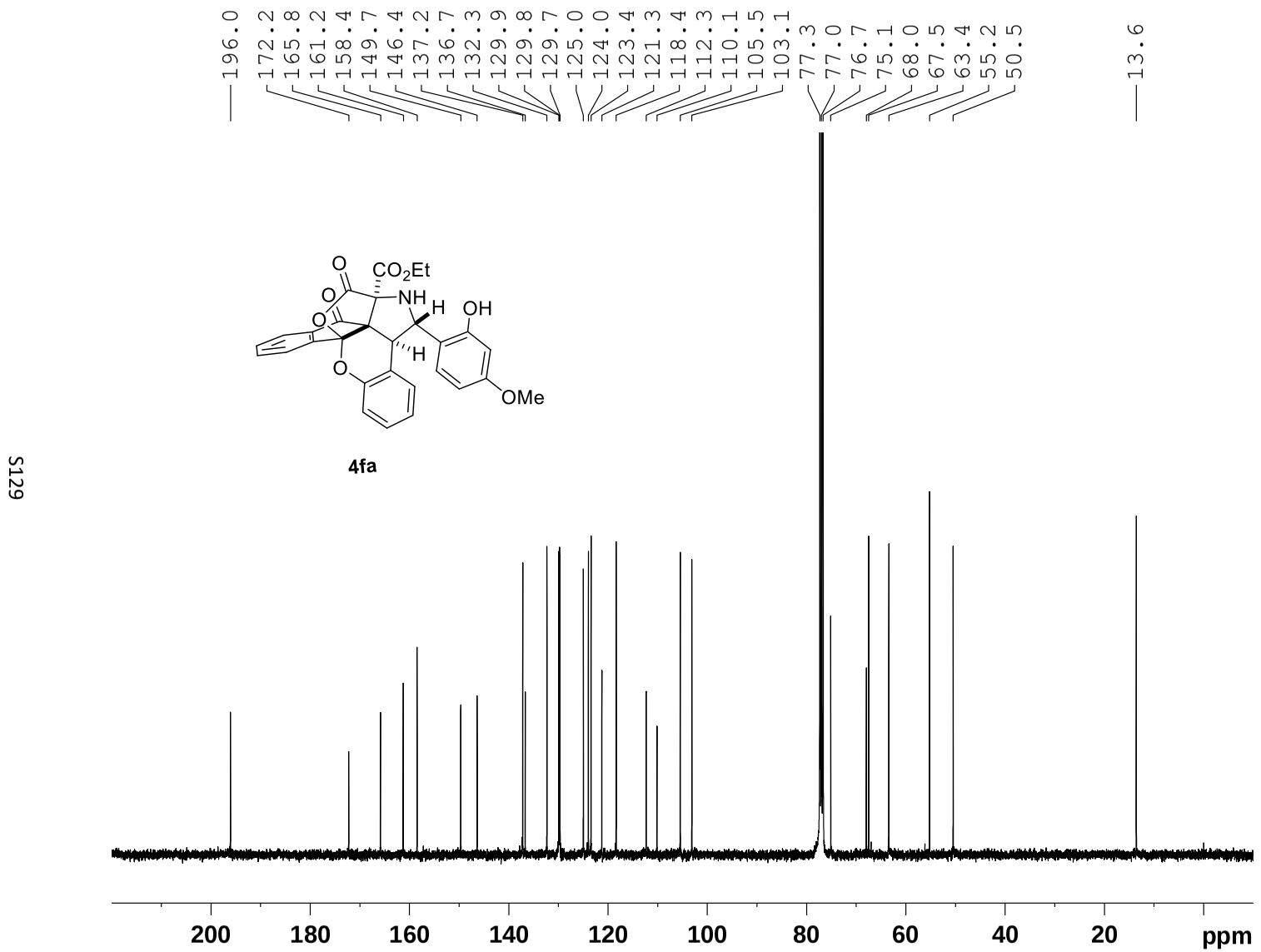


4ea

```
Current Data Parameters
NAME                  B301
EXPNO                   13
PROCNO                   1

F2 - Acquisition Parameters
Date_           20180221
Time              21.58
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG           zgpg30
TD                32768
SOLVENT           CDCl3
NS                13599
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                5792.6
DW                20.800 usec
DE                 6.50 usec
TE                295.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.45 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2       0 dB
PL12              15.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127690 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME                  B3
EXPNO                  4
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180302
Time              21.57
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            7246.377 Hz
FIDRES         0.221142 Hz
AQ             2.2609921 sec
RG                  181
DW               69.000 usec
DE                6.50 usec
TE                299.9 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1       0 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                16384
SF          400.1300101 MHz
WDW                  EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



4fa

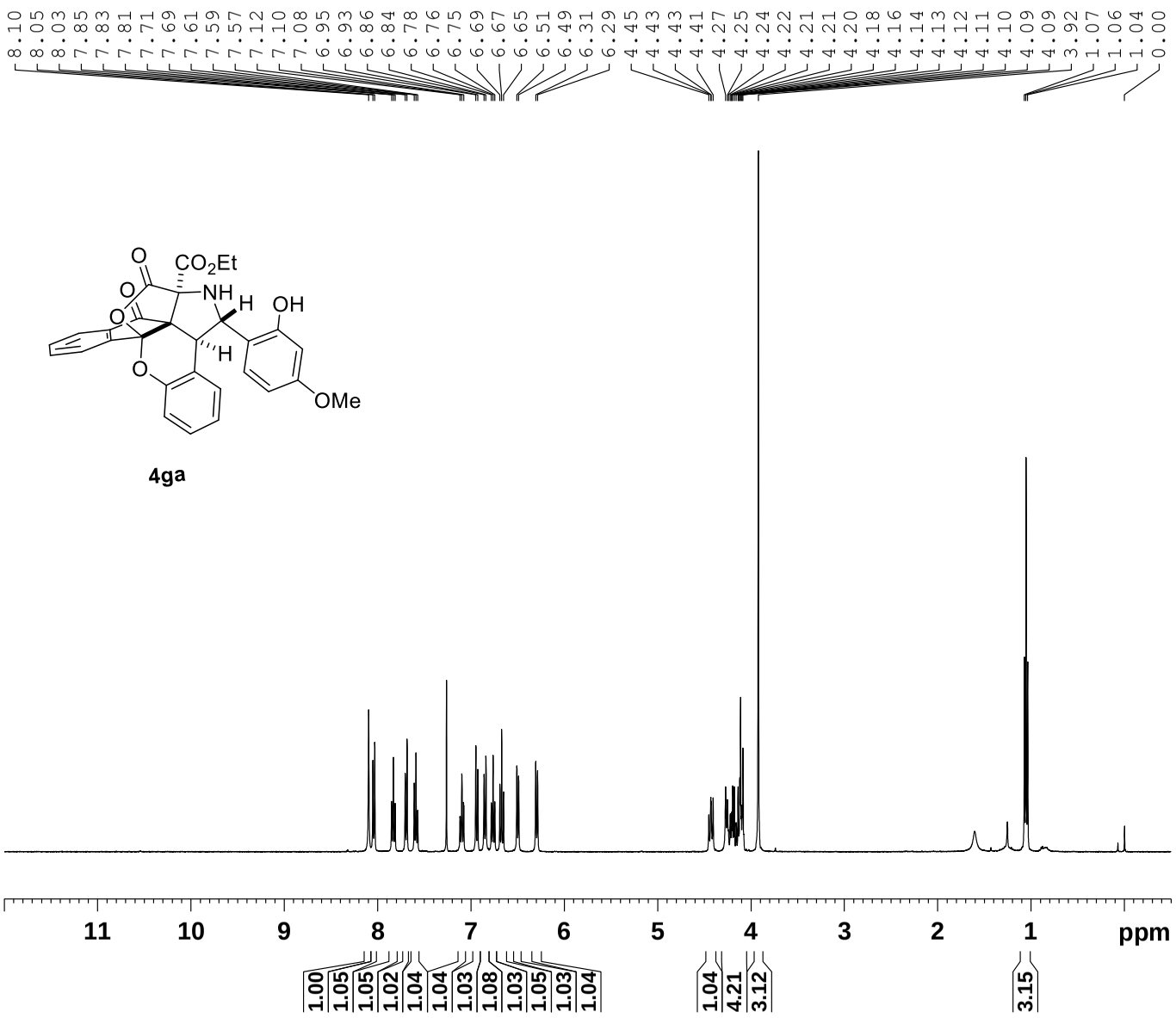
Current Data Parameters
NAME B3
EXPNO 5
PROCNO 1

F2 - Acquisition Parameters
Date_ 20180302
Time 21.58
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 15315
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 300.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 10.45 usec
PL1 7.00 dB
SFO1 100.6233325 MHz

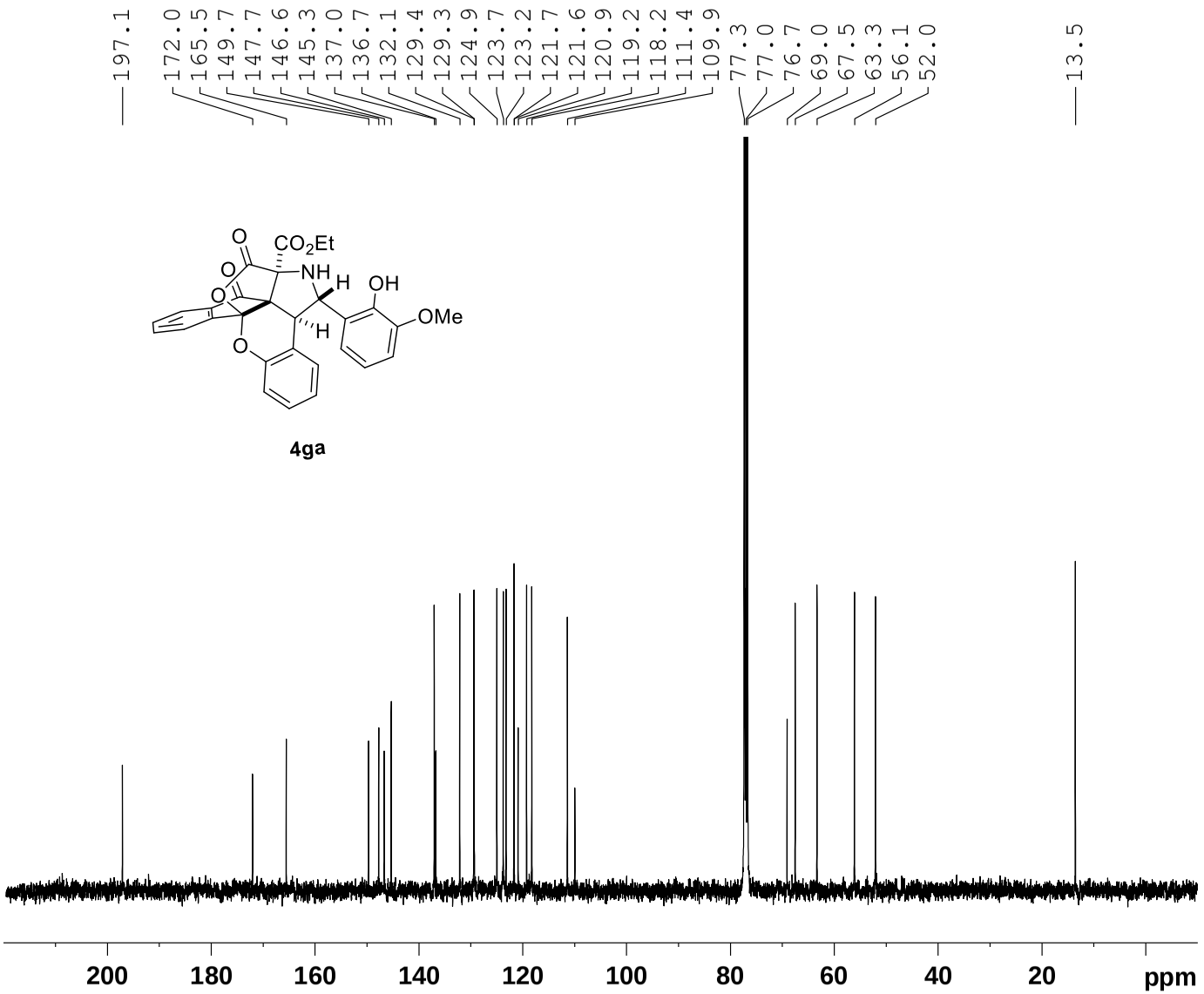
======== CHANNEL f2 ========
CPDPRG[2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0 dB
PL12 15.00 dB
PL13 20.00 dB
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00



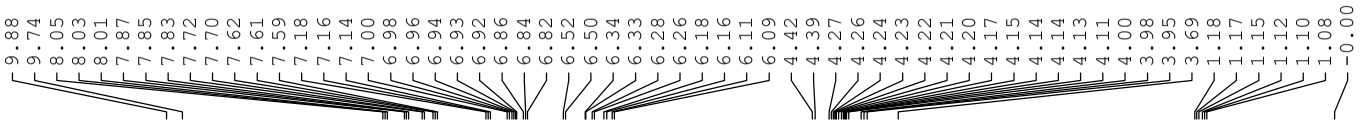
4ga

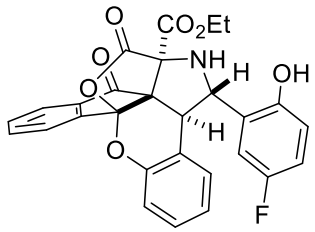
```
Current Data Parameters
NAME                  Bony302
EXPNO                       4
PROCNO                      1

F2 - Acquisition Parameters
Date_              20180224
Time                  16.00
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7211.539 Hz
FIDRES             0.220079 Hz
AQ                 2.2719147 sec
RG                    198.09
DW                   69.333 usec
DE                   10.50 usec
TE                   297.4 K
D1               2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1            400.1324008 MHz
NUC1                    1H
P1                   12.90 usec
PLW1            15.00000000 W

F2 - Processing parameters
SI                    16384
SF              400.1300084 MHz
WDW                     EM
SSB          0
LB           0 Hz
GB           0
PC                    1.00
```



4ga

```
Current Data Parameters
NAME                  Bony302
EXPNO                       5
PROCNO                      1

F2 - Acquisition Parameters
Date_                20180224
Time                    16.02
INSTRUM                 spect
PROBHD   5 mm PABBO BB/
PULPROG                 zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                       1600
DS                          0
SWH                 24038.461 Hz
FIDRES               0.733596 Hz
AQ                   0.6815744 sec
RG                      198.09
DW                      20.800 usec
DE                       6.50 usec
TE                      297.5 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                      10.00 usec
PLW1               47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                   90.00 usec
PLW2               15.00000000 W
PLW12               0.33750001 W
PLW13               0.27338001 W

F2 - Processing parameters
SI                         32768
SF                 100.6127726 MHz
WDW                        EM
SSB             0
LB                       2.00 Hz
GB              0
PC                       1.00
```

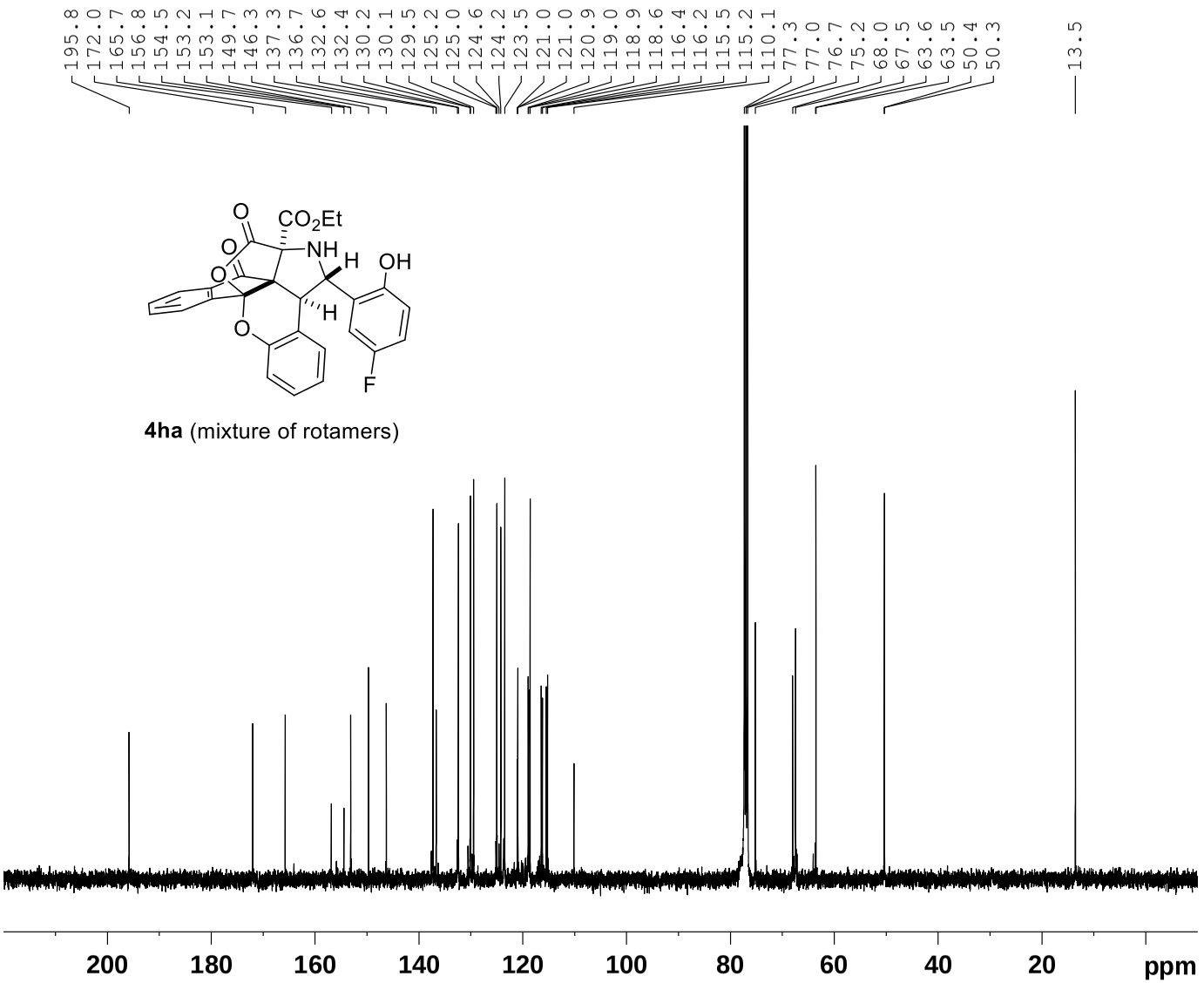




4ha (mixture of rotamers)

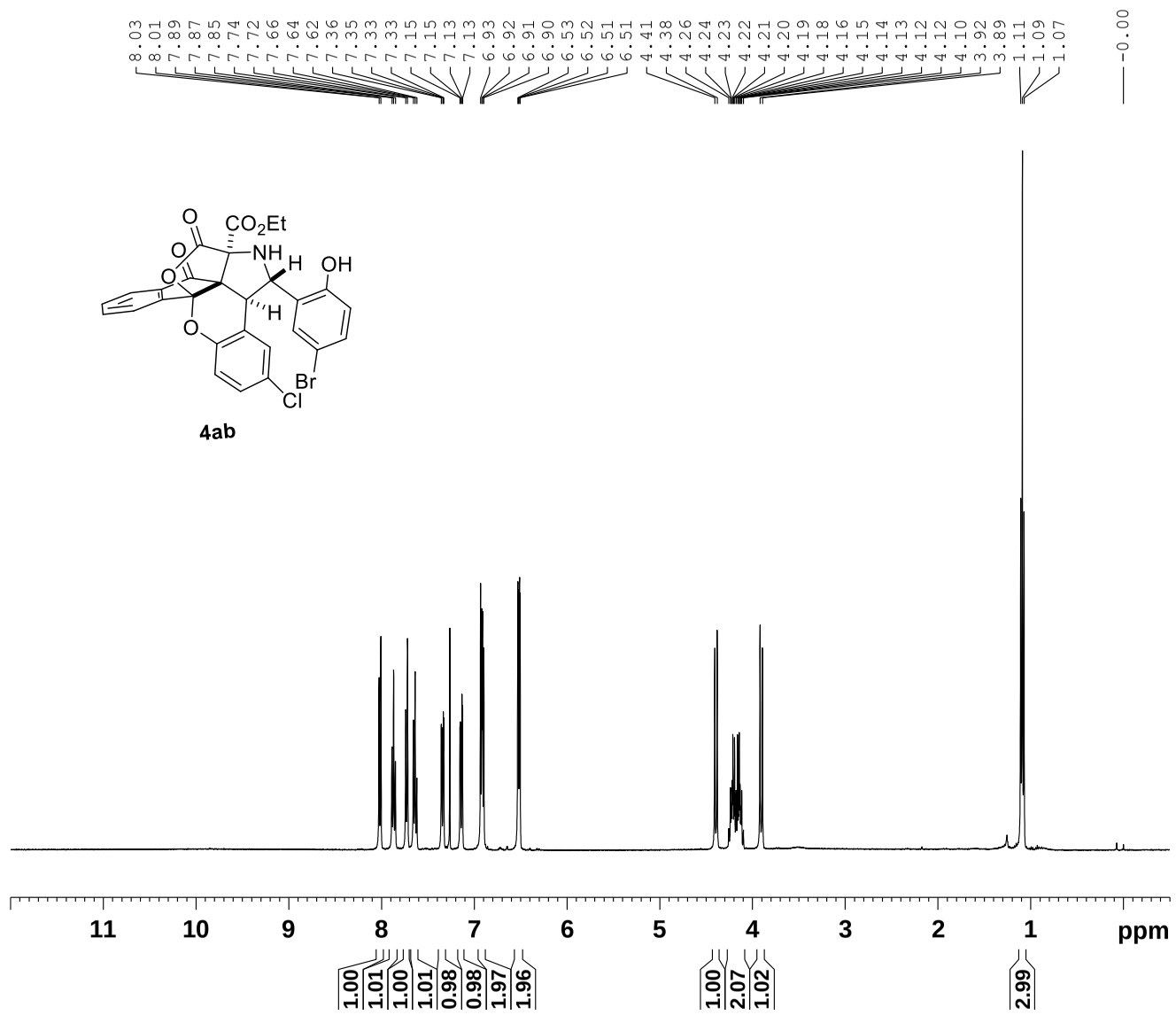
S132


```
Current Data Parameters
NAME                 hank123
EXPNO                     27
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180518
Time                   0.12
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                    161.3
DW                   69.000 usec
DE                    6.50 usec
TE                   673.2 K
D1              2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF             400.1300118 MHz
WDW                      EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```

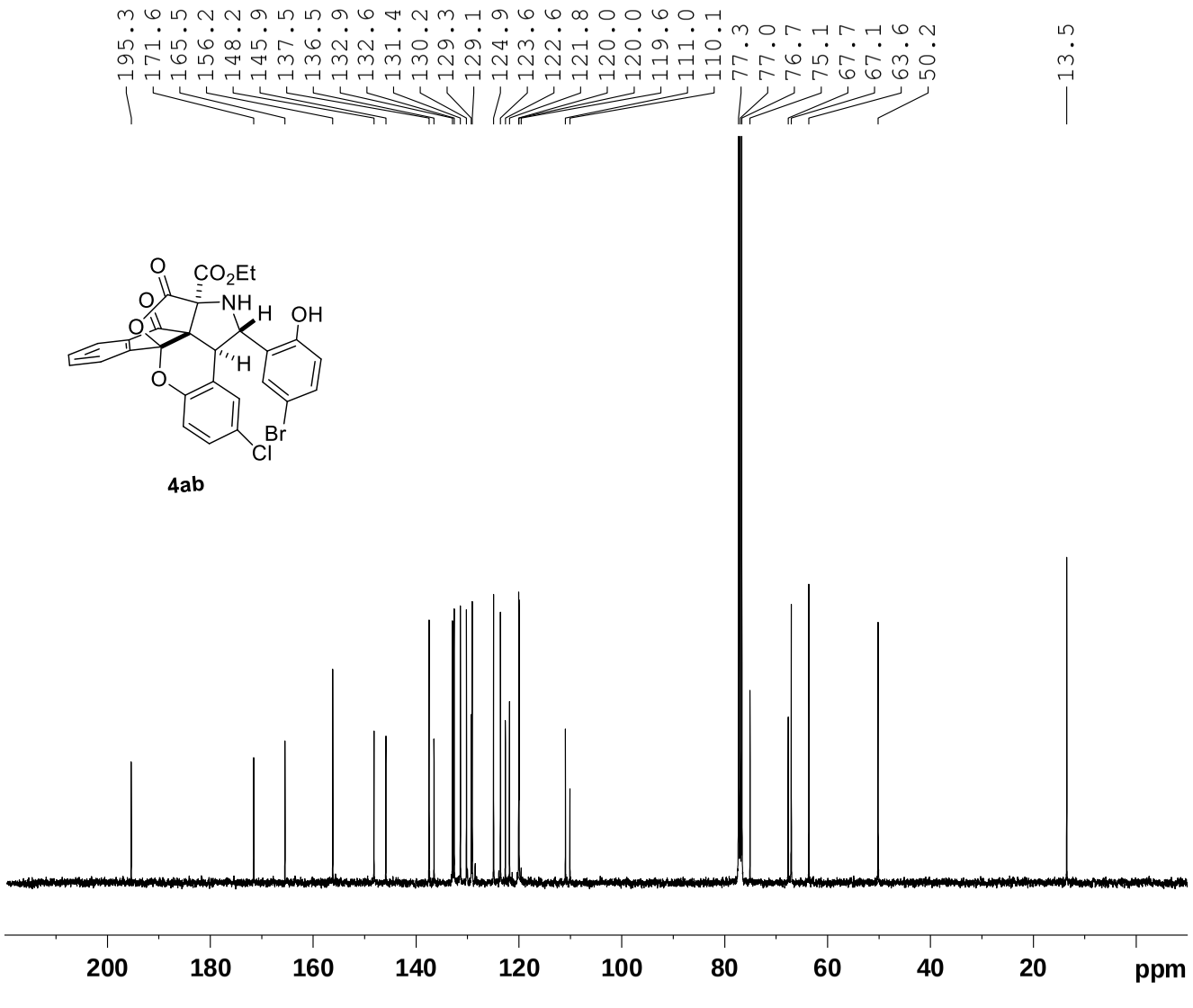


4ha (mixture of rotamers)

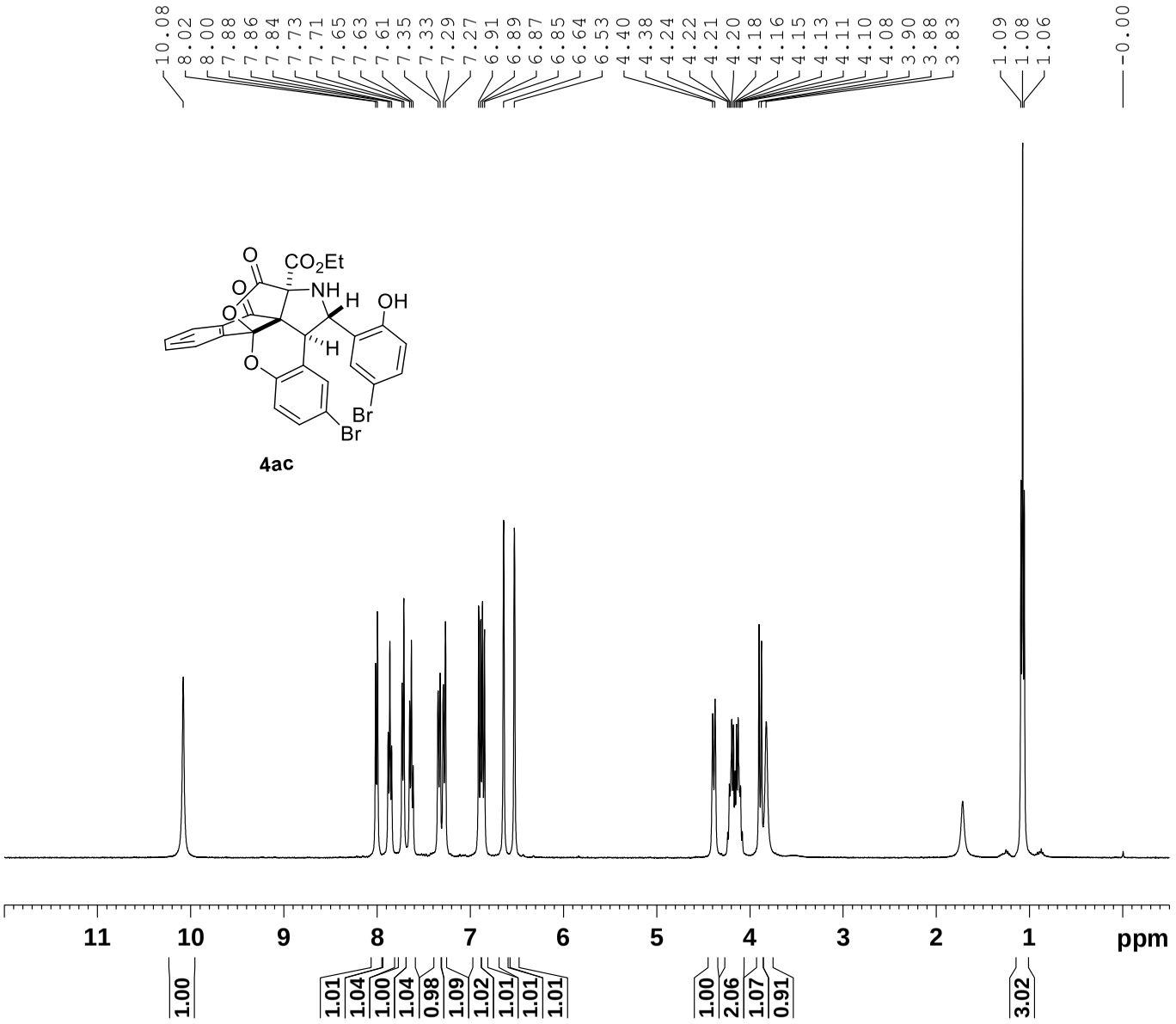
```
Current Data Parameters
NAME              hank123
EXPNO                  28
PROCNO                  1

F2 - Acquisition Parameters
Date_            20180518
Time                 0.14
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   9096
DS                      0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ             0.6815744 sec
RG                5792.6
DW                20.800 usec
DE                 6.50 usec
TE                673.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                  10.45 usec
PL1                  7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2               90.00 usec
PL2       0 dB
PL12                15.00 dB
PL13                20.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127690 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



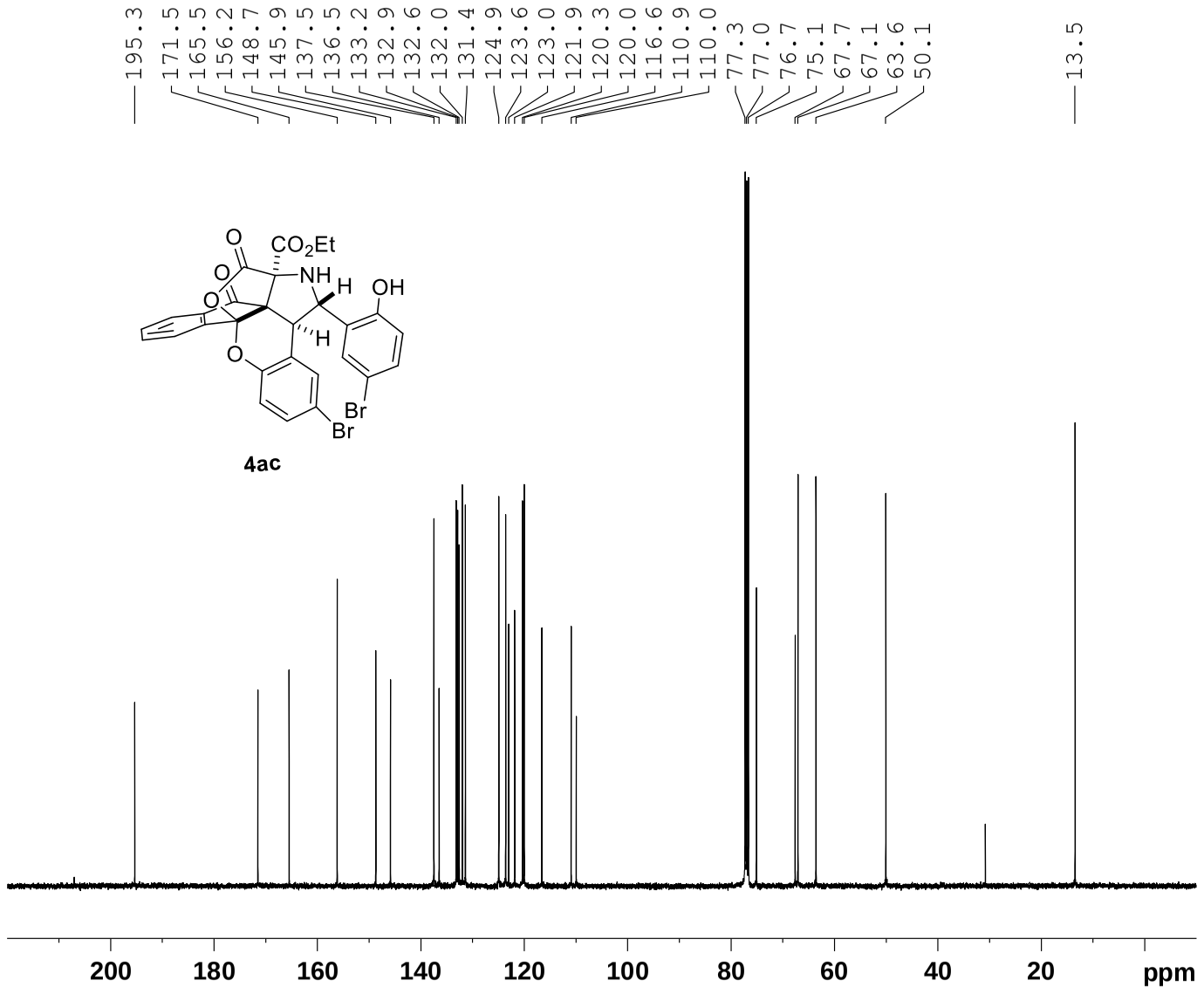

```
Current Data Parameters
NAME                  Hank145
EXPNO                       2
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180508
Time                   19.33
INSTRUM                spect
PROBHD   5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                2.2609921 sec
RG                       114
DW                  69.000 usec
DE                   6.50 usec
TE                   673.2 K
D1              2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                  15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF            400.1300080 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```



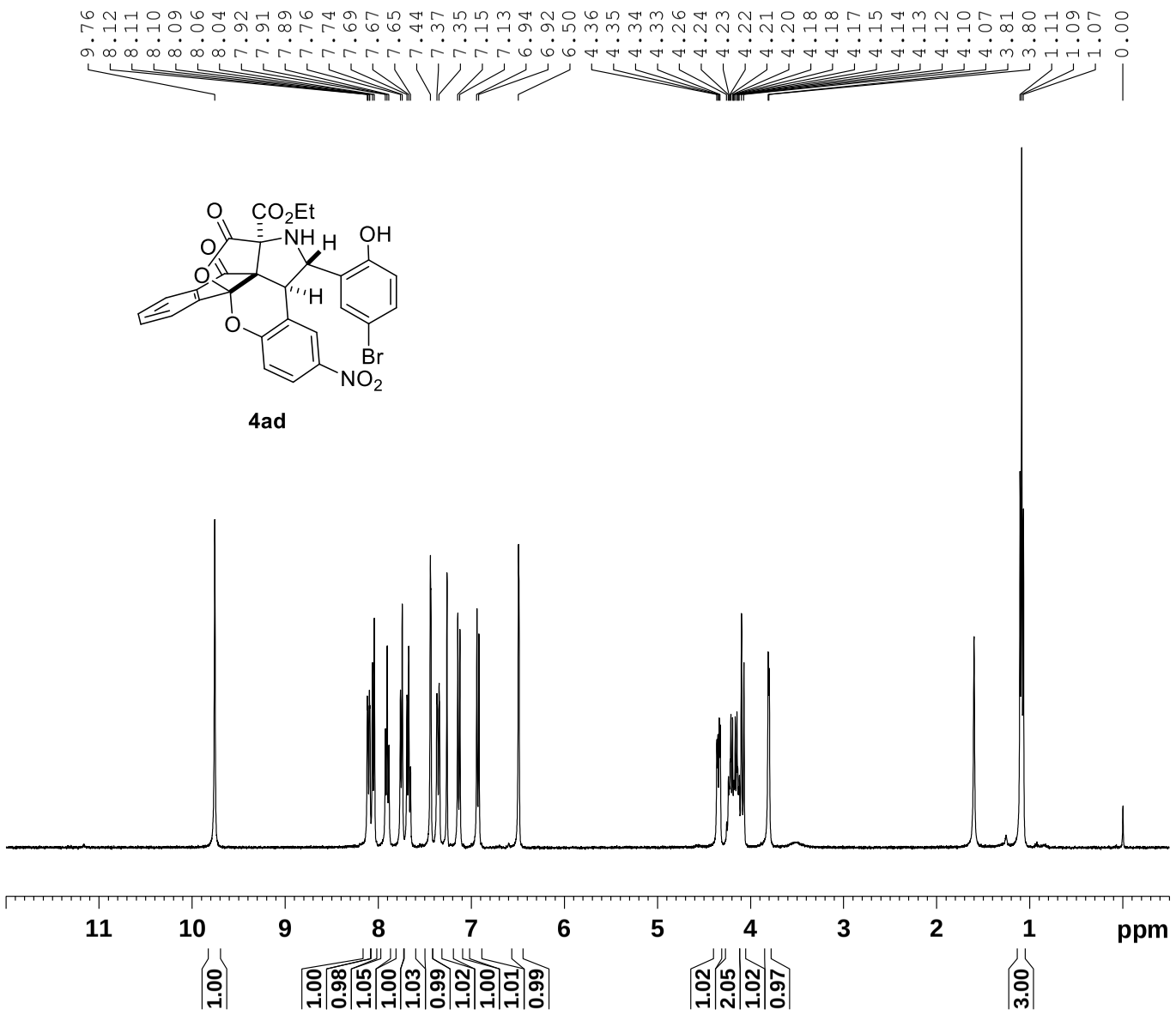

```
Current Data Parameters
NAME                  h095
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20171018
Time                 17.15
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   1109
DS                      0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  198.09
DW                  20.800 usec
DE                   6.50 usec
TE                  298.7 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6228298 MHz
NUC1                  13C
P1                  10.00 usec
PLW1          47.50000000 W

======== CHANNEL f2 ========
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          15.00000000 W
PLW12          0.33750001 W
PLW13          0.27338001 W

F2 - Processing parameters
SI                  32768
SF            100.6127737 MHz
WDW                   EM
SSB       0
LB                  2.00 Hz
GB        0
PC                  1.00
```



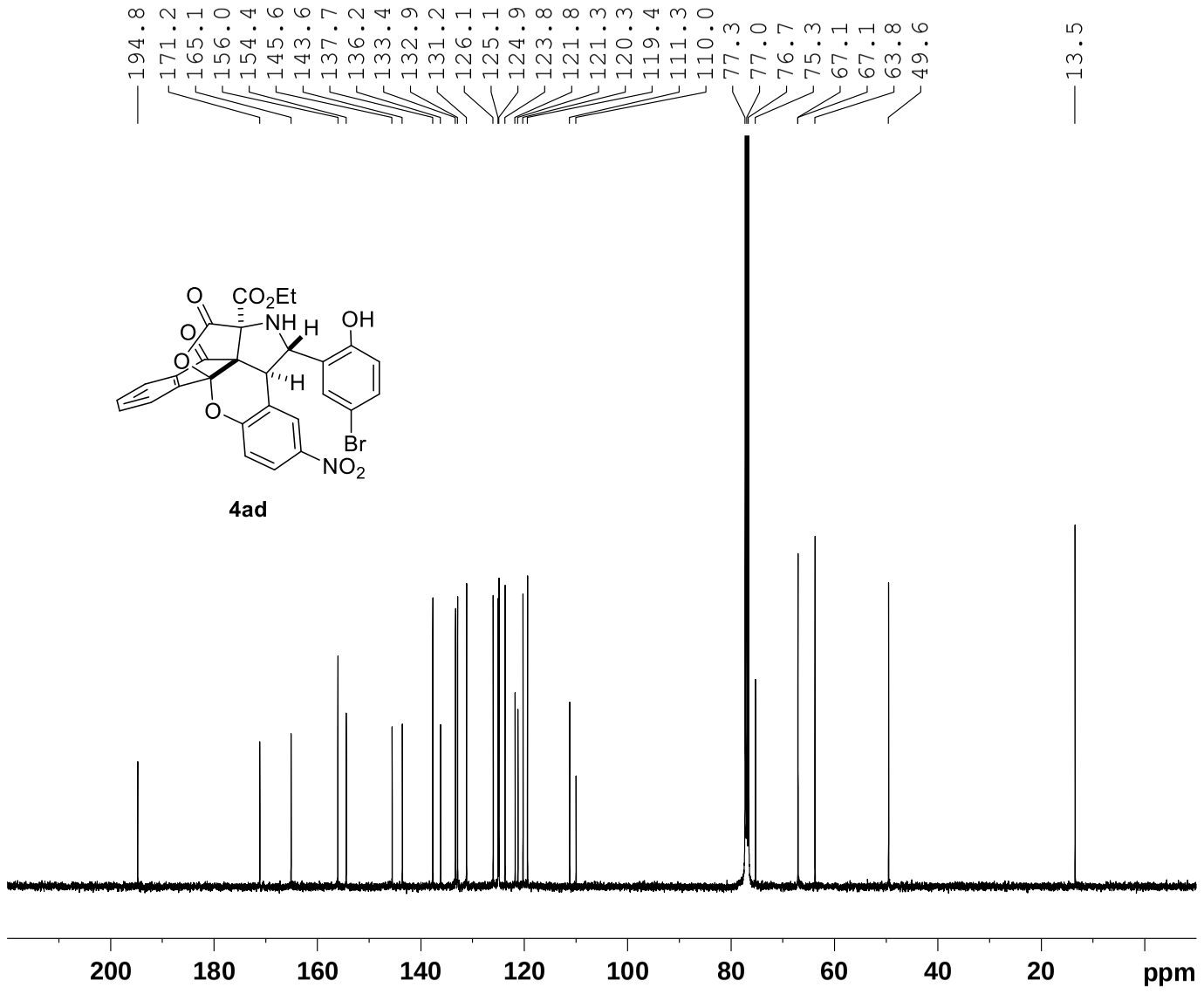

```
Current Data Parameters
NAME                  hank092
EXPNO                      14
PROCNO                      1

F2 - Acquisition Parameters
Date_               20171107
Time                   15.30
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                     298.5 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                       1H
P1                    15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF                400.1300075 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                      1.00
```



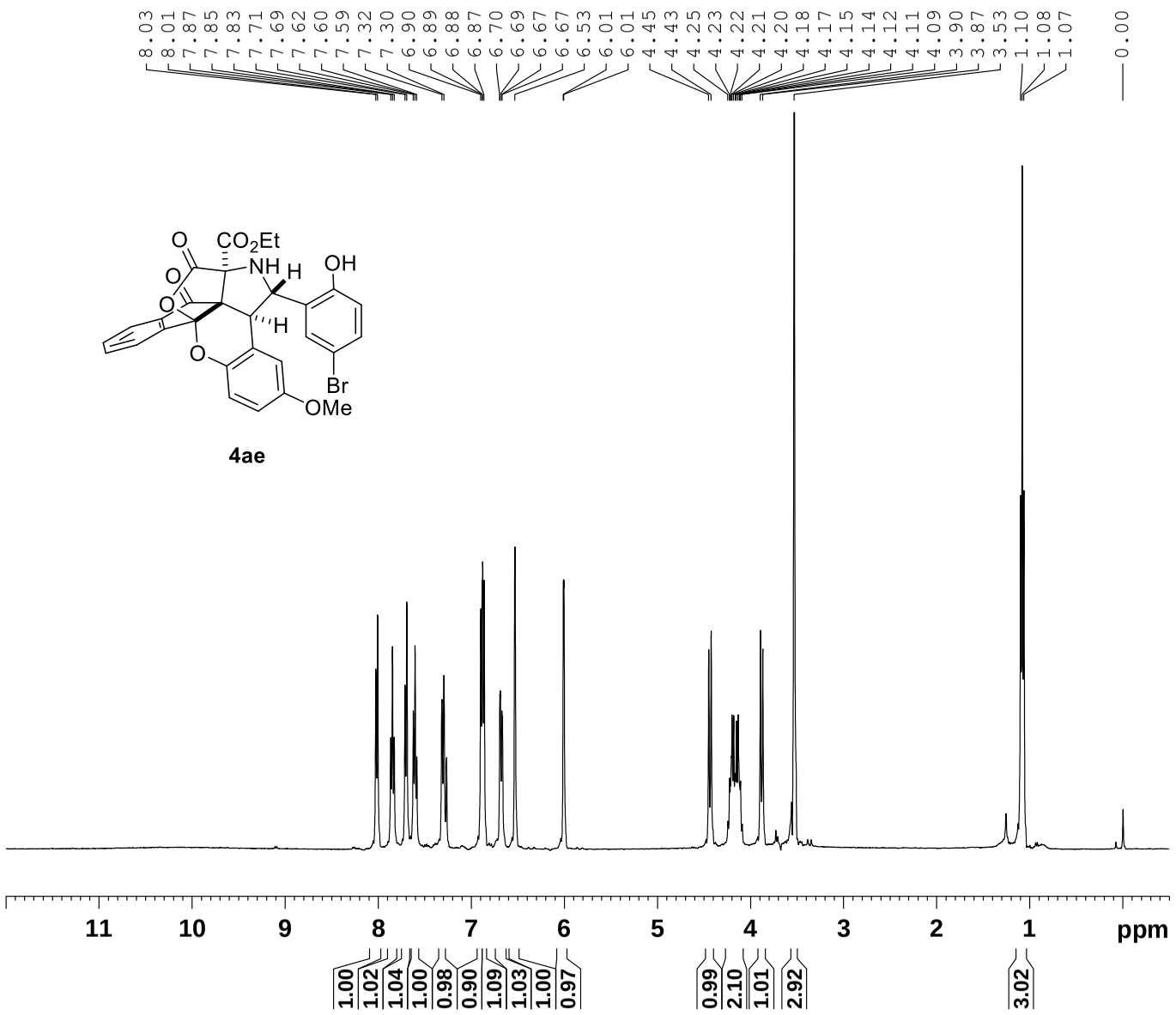

```
Current Data Parameters
NAME                 hank092
EXPNO                     15
PROCNO                     1

F2 - Acquisition Parameters
Date_              20171107
Time                  15.32
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     5264
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   298.6 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127738 MHz
WDW                     EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```



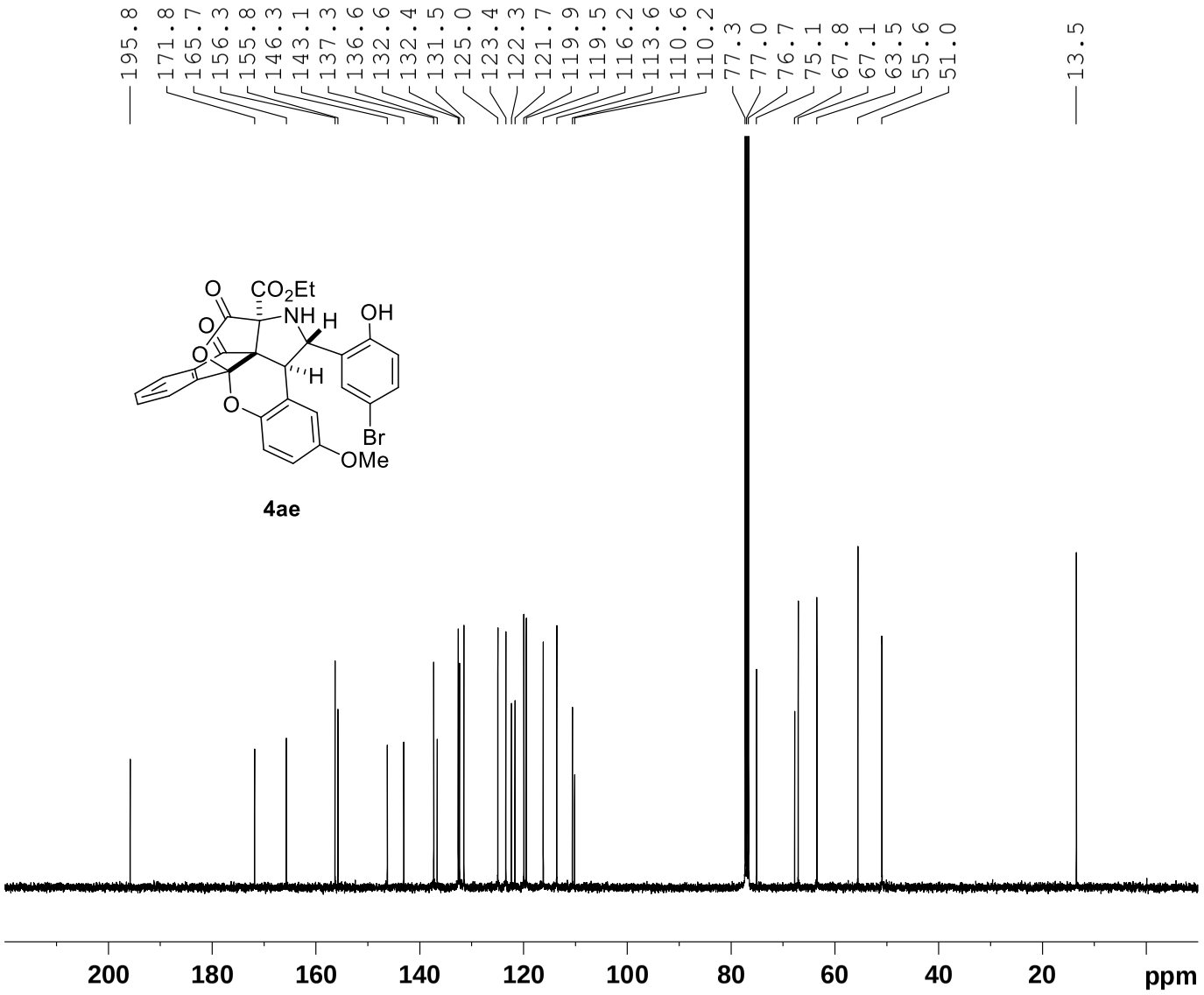

```
Current Data Parameters
NAME                  Hank111
EXPNO                      33
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180224
Time                   12.05
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                         8
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       181
DW                    69.000 usec
DE                     6.50 usec
TE                     295.2 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF               400.1300077 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                      1.00
```



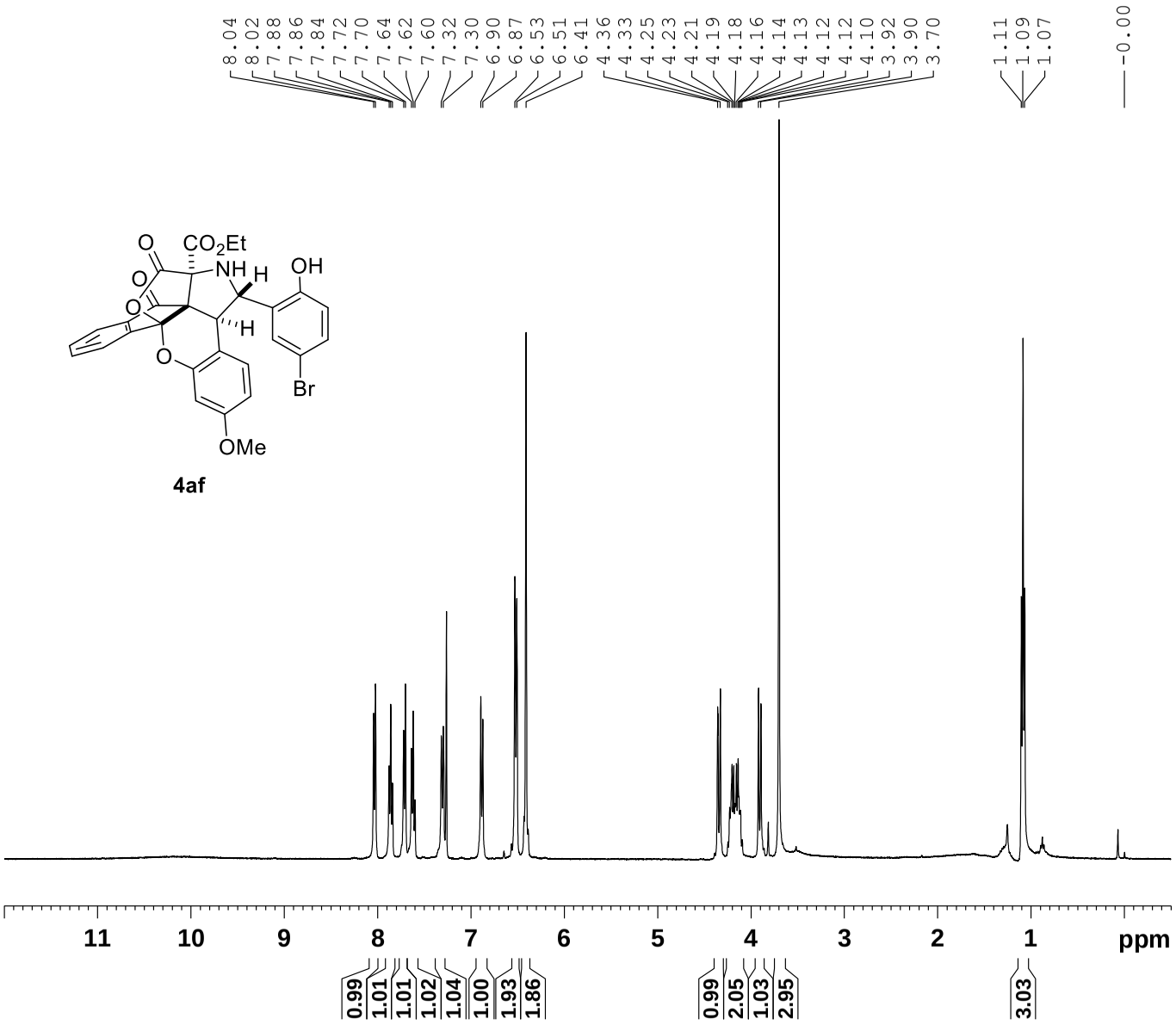

```
Current Data Parameters
NAME                 Hank111
EXPNO                     34
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180224
Time                  12.07
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                    32768
SOLVENT               CDCl3
NS                    15003
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   295.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127729 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



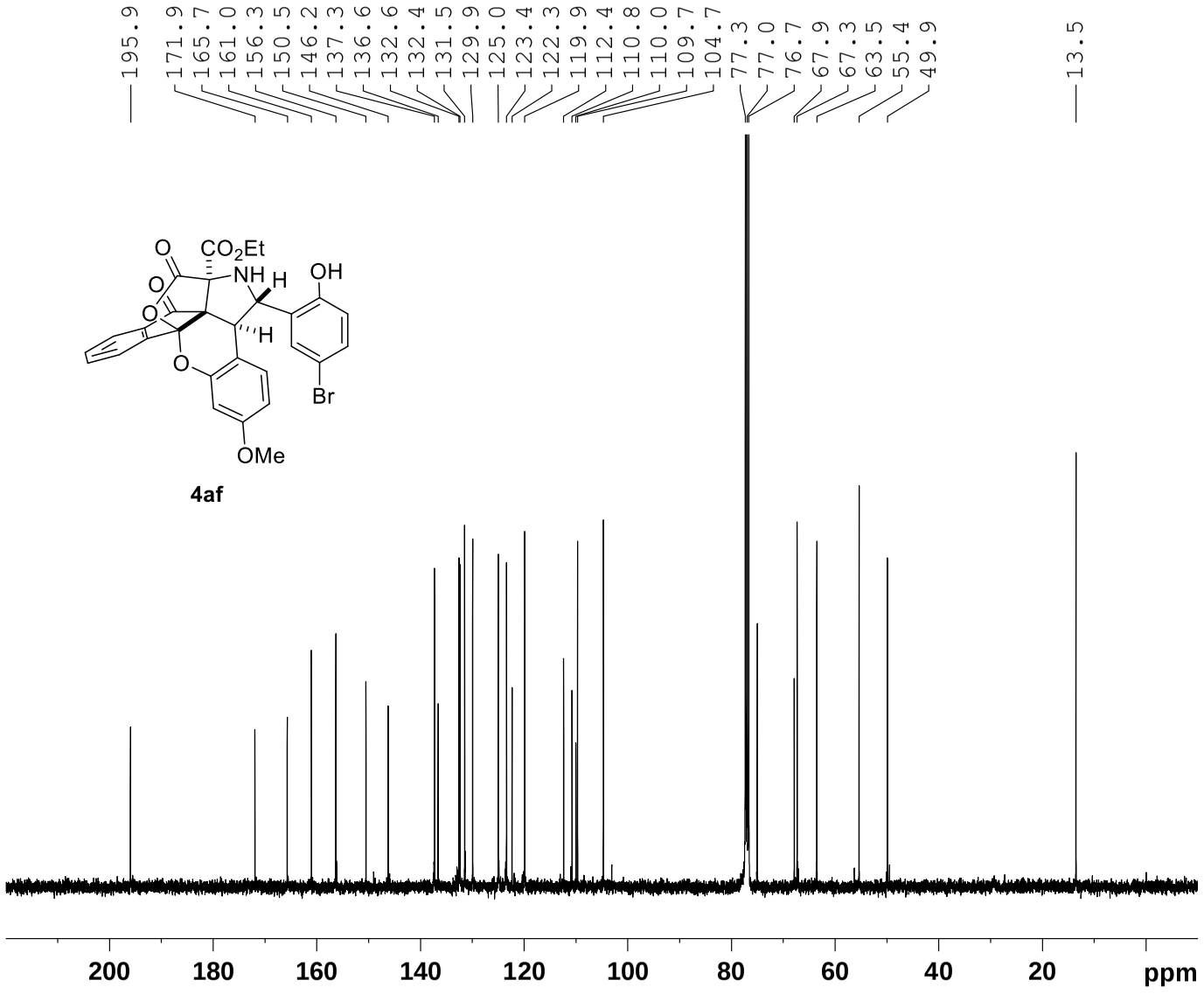

```
Current Data Parameters
NAME                  hank091
EXPNO                       6
PROCNO                      1

F2 - Acquisition Parameters
Date_              20171019
Time                   20.27
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                          1
DS                          0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                        114
DW                   69.000 usec
DE                    6.50 usec
TE                    297.6 K
D1                2.00000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                       1H
P1                    15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                      16384
SF             400.1300069 MHz
WDW                        EM
SSB       0
LB                     2.00 Hz
GB        0
PC                     1.00
```



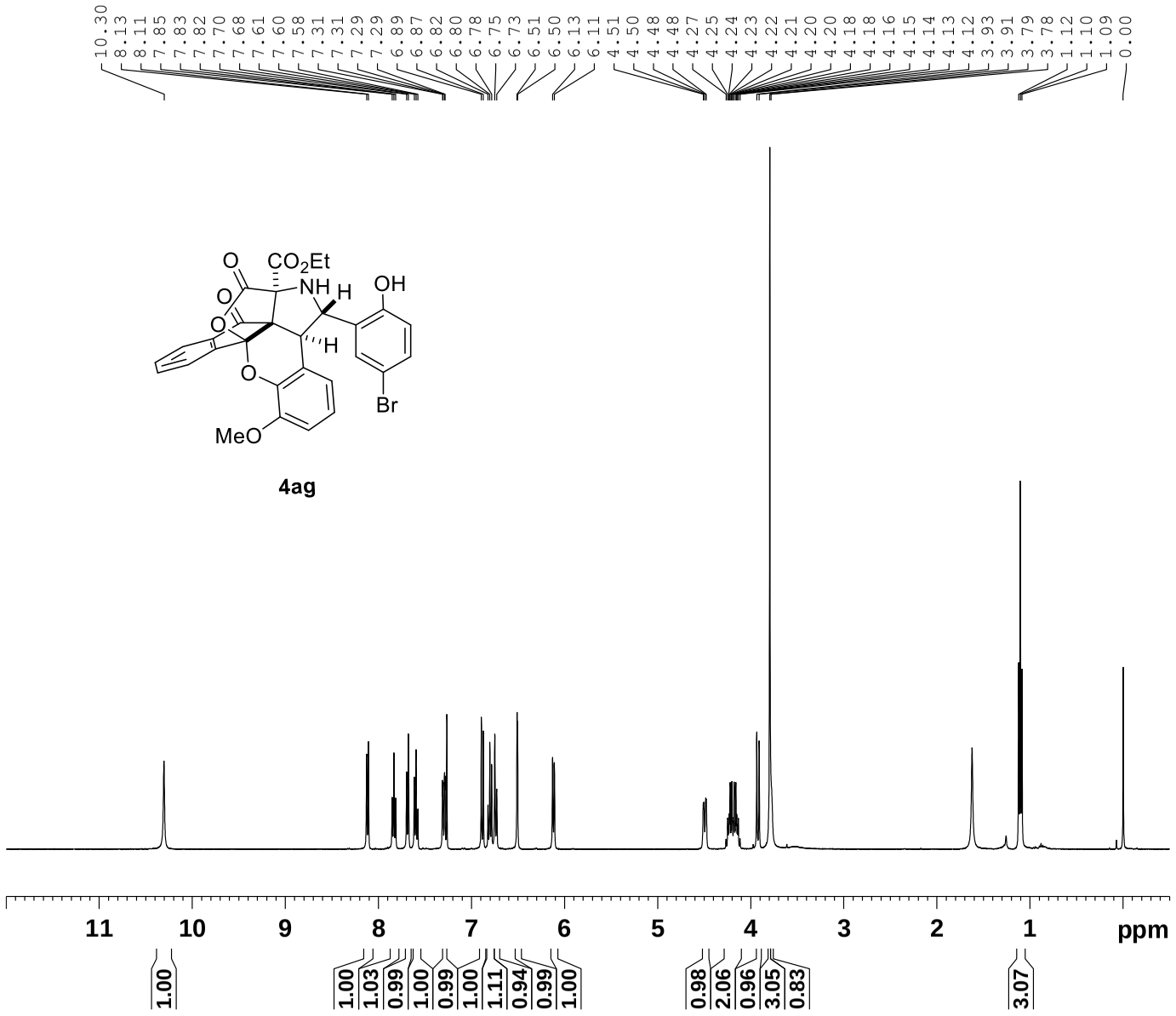

```
Current Data Parameters
NAME                 hank091
EXPNO                      8
PROCNO                     1

F2 - Acquisition Parameters
Date_              20171020
Time                   5.14
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                  32768
SOLVENT               CDCl3
NS                     1200
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  297.9 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                      32768
SF            100.6127738 MHz
WDW                        EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



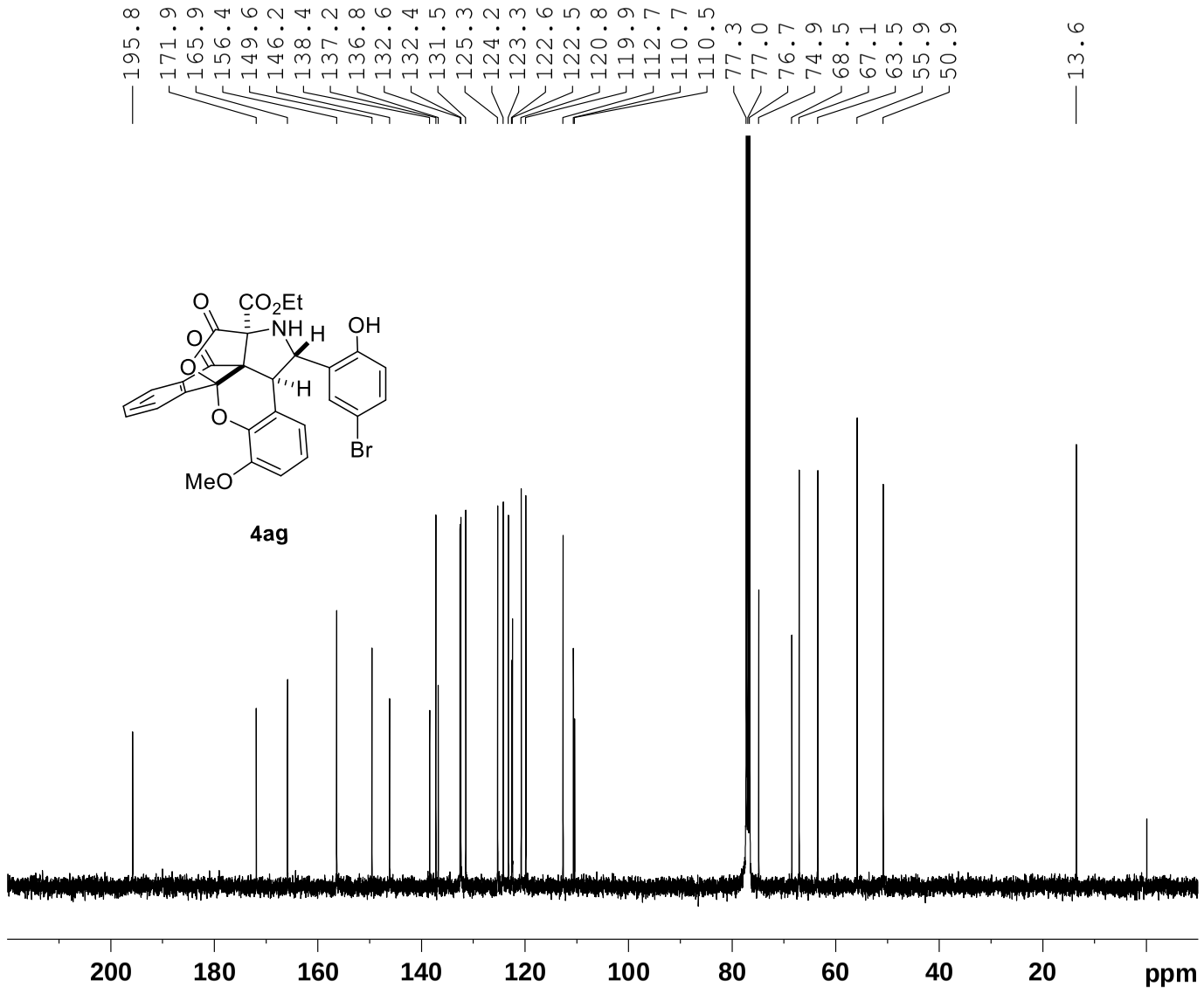

```
Current Data Parameters
NAME                  Hank144
EXPNO                       3
PROCNO                      1

F2 - Acquisition Parameters
Date_              20180508
Time                   17.34
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        32
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                    673.2 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     15.00 usec
PL1       0 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF               400.1300079 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```



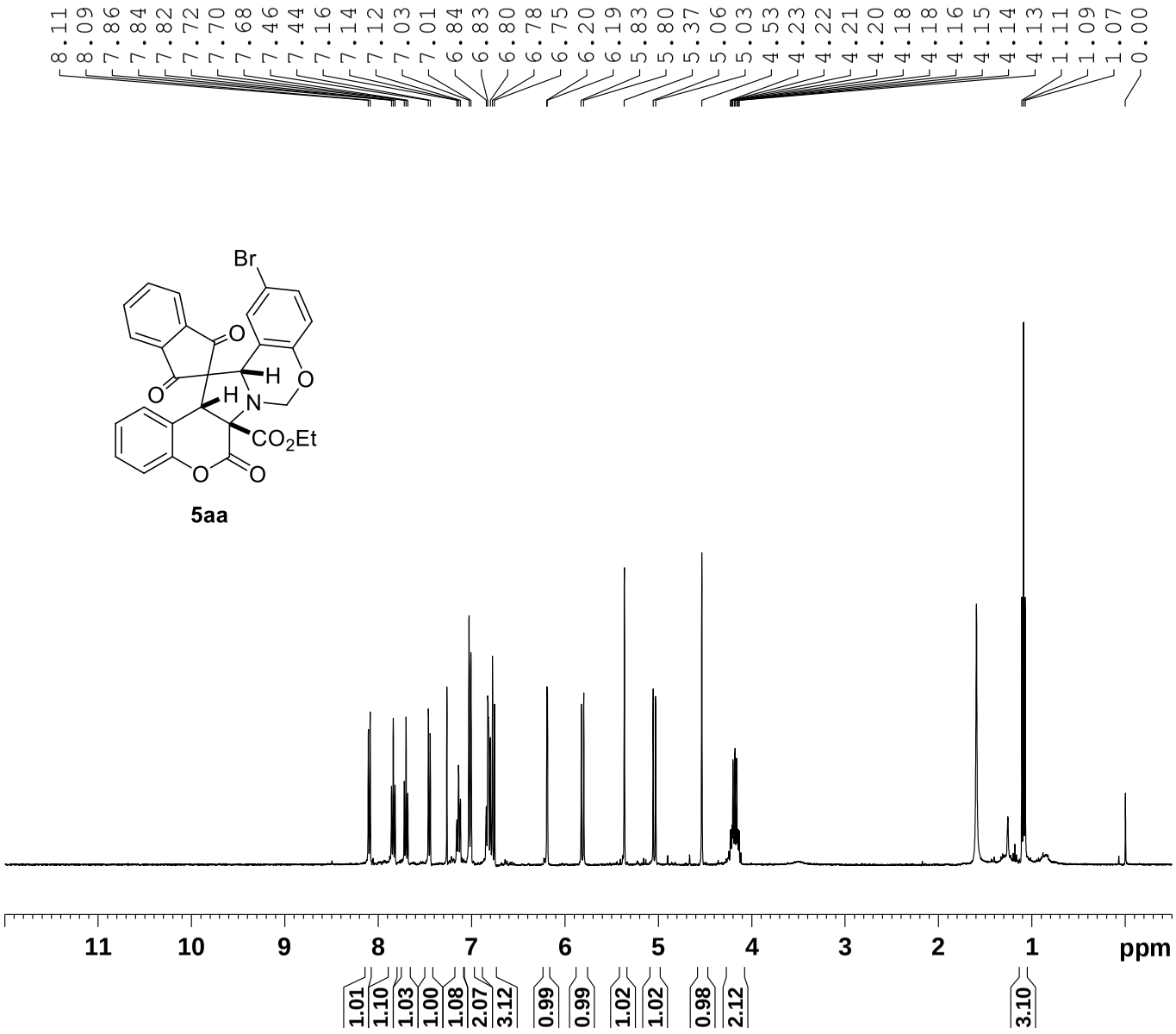

```
Current Data Parameters
NAME                 hank072
EXPNO                     24
PROCNO                     1

F2 - Acquisition Parameters
Date_               20171028
Time                    8.14
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     4632
DS                        0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   298.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.45 usec
PL1                    7.00 dB
SFO1           100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF             100.6127720 MHz
WDW                      EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.00
```



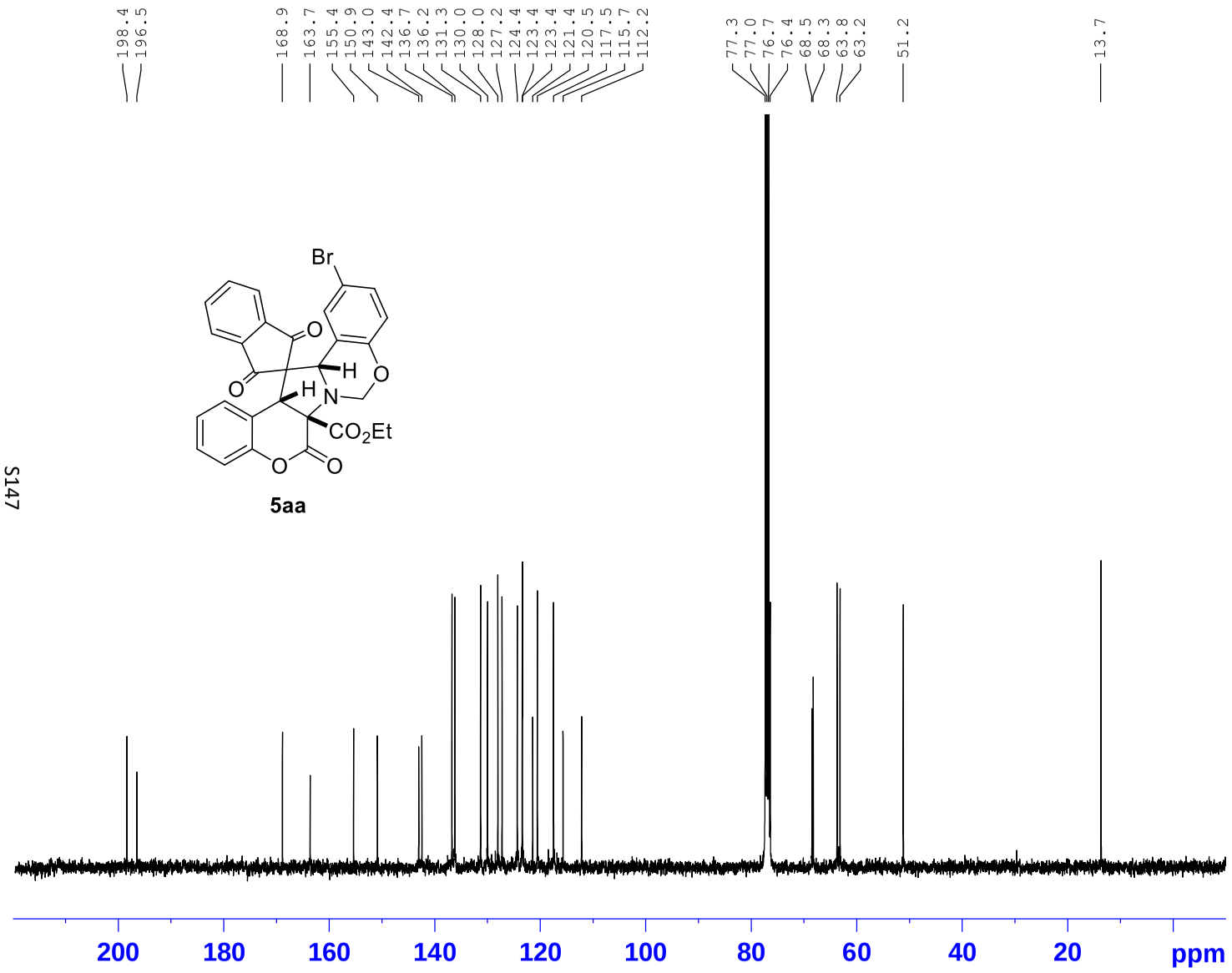

```
Current Data Parameters
NAME                  hank090
EXPNO                      14
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180221
Time                   17.49
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                     295.1 K
D1                2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF                400.1300076 MHz
WDW                       EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```




```
Current Data Parameters
NAME                 hank090
EXPNO                     13
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180221
Time                  11.44
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     5749
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   1625.5
DW                   20.800 usec
DE                    6.50 usec
TE                   295.6 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127721 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

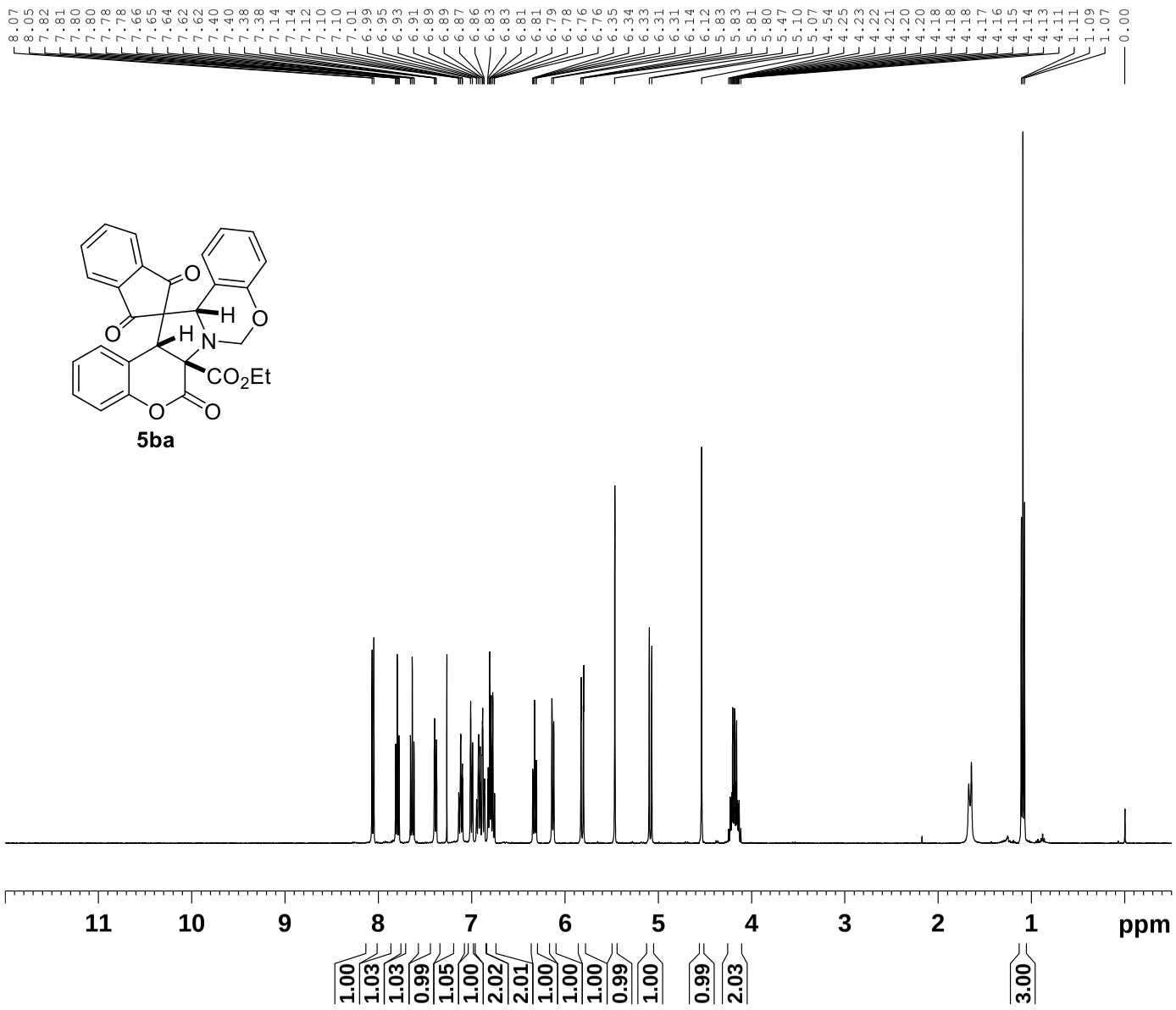



```
Current Data Parameters
NAME            vicky188
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170429
Time               15.07
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   256
DW                69.000 usec
DE                 6.50 usec
TE                298.6 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300076 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



5aa


```
Current Data Parameters
NAME                  vicky188
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170502
Time                     22.16
INSTRUM                  spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                        2738
DS                           0
SWH                  24038.461 Hz
FIDRES                0.733596 Hz
AQ                    0.6815744 sec
RG                       198.09
DW                       20.800 usec
DE                        6.50 usec
TE                       297.0 K
D1                   2.00000000 sec
D11                  0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                       10.00 usec
PLW1                47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                15.00000000 W
PLW12                0.33750001 W
PLW13                0.27338001 W

F2 - Processing parameters
SI                       32768
SF                 100.6127685 MHz
WDW                        EM
SSB                  0
LB                        2.00 Hz
GB                   0
PC                        1.00
```

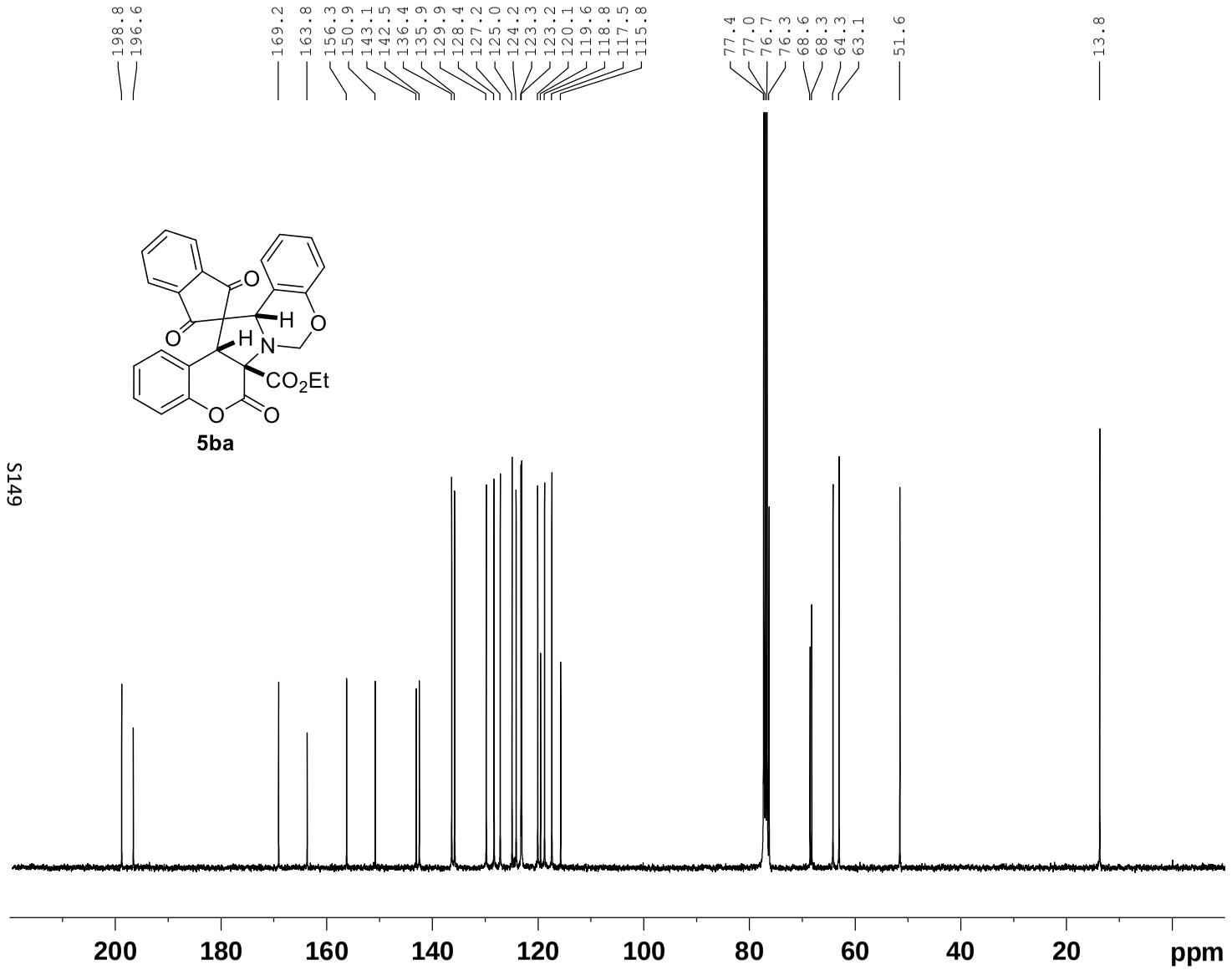


Current Data Parameters
NAME vicky180
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20170422
Time 2.54
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7211.539 Hz
FIDRES 0.220079 Hz
AQ 2.2719147 sec
RG 99.72
DW 69.333 usec
DE 10.50 usec
TE 297.1 K
D1 2.00000000 sec
TD0 1

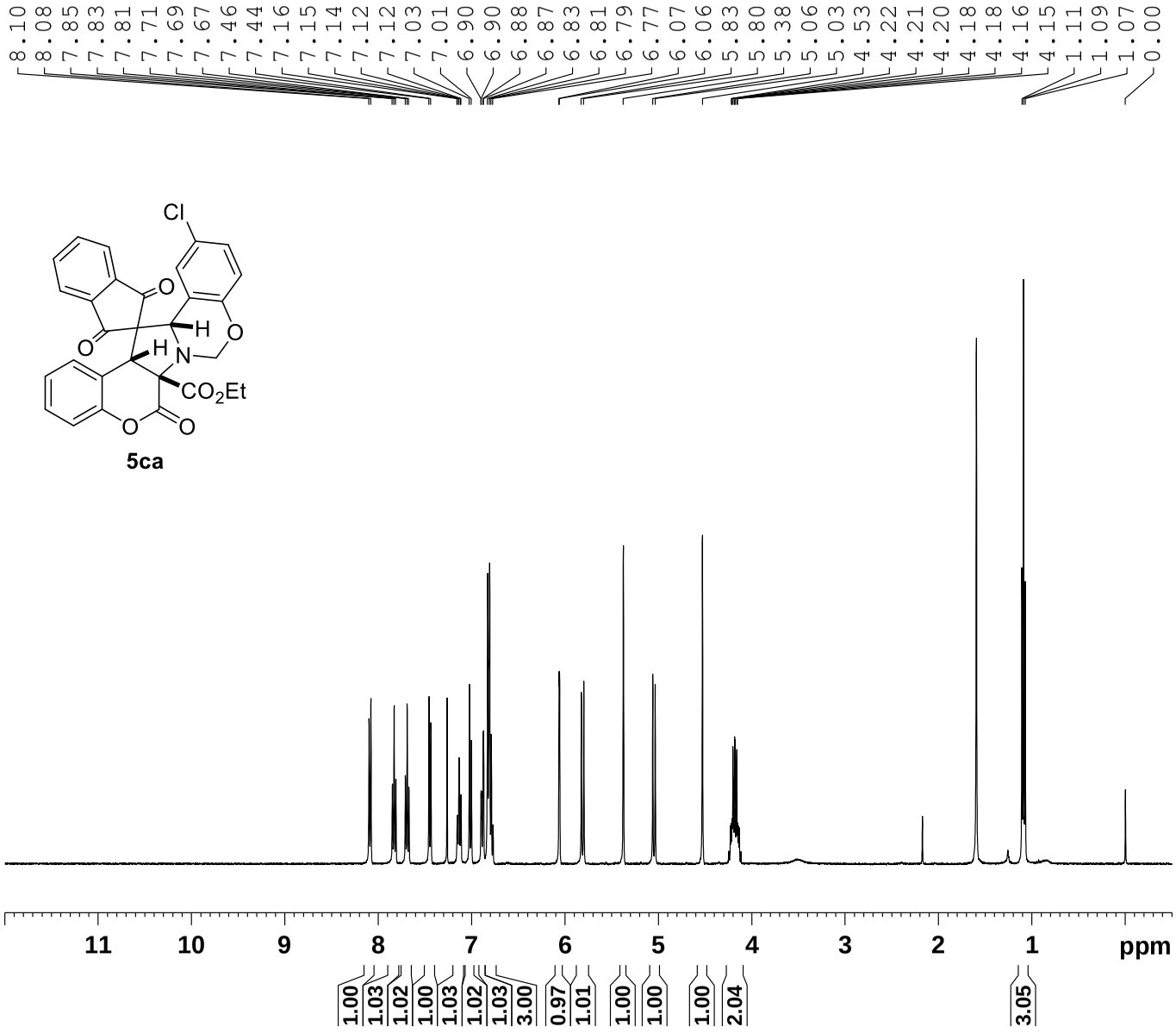
======== CHANNEL f1 ========
SFO1 400.1324008 MHz
NUC1 1H
P1 12.90 usec
PLW1 15.00000000 W

F2 - Processing parameters
SI 16384
SF 400.1300063 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00

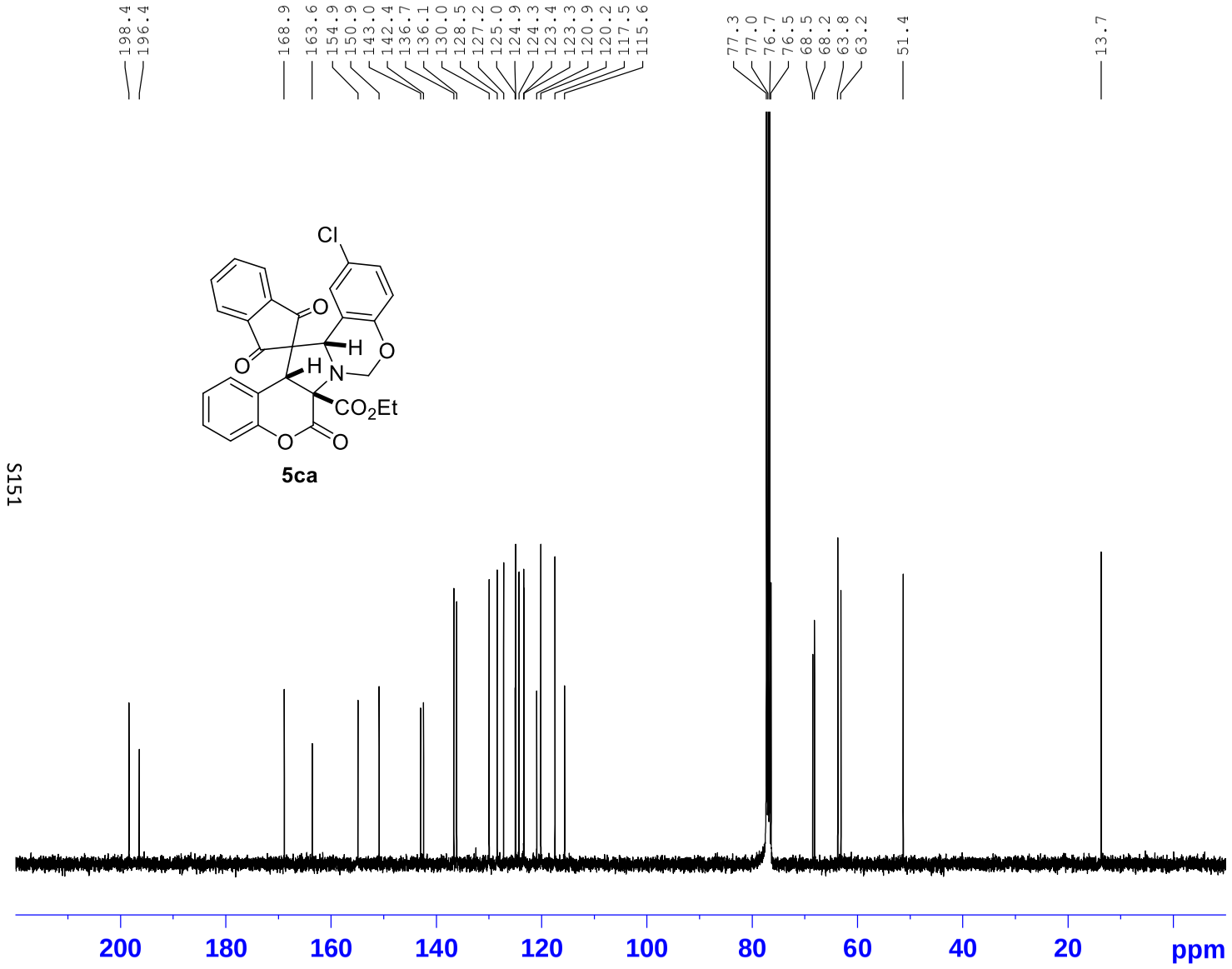


5ba


```
Current Data Parameters
NAME                  vicky180
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170422
Time                      2.56
INSTRUM                  spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                        8858
DS                           0
SWH                  24038.461 Hz
FIDRES                0.733596 Hz
AQ                    0.6815744 sec
RG                       198.09
DW                       20.800 usec
DE                        6.50 usec
TE                       297.2 K
D1                   2.00000000 sec
D11                  0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                       10.00 usec
PLW1                47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                15.00000000 W
PLW12                0.33750001 W
PLW13                0.27338001 W

F2 - Processing parameters
SI                       32768
SF                 100.6127685 MHz
WDW                        EM
SSB             0
LB                        2.00 Hz
GB              0
PC                        1.00
```



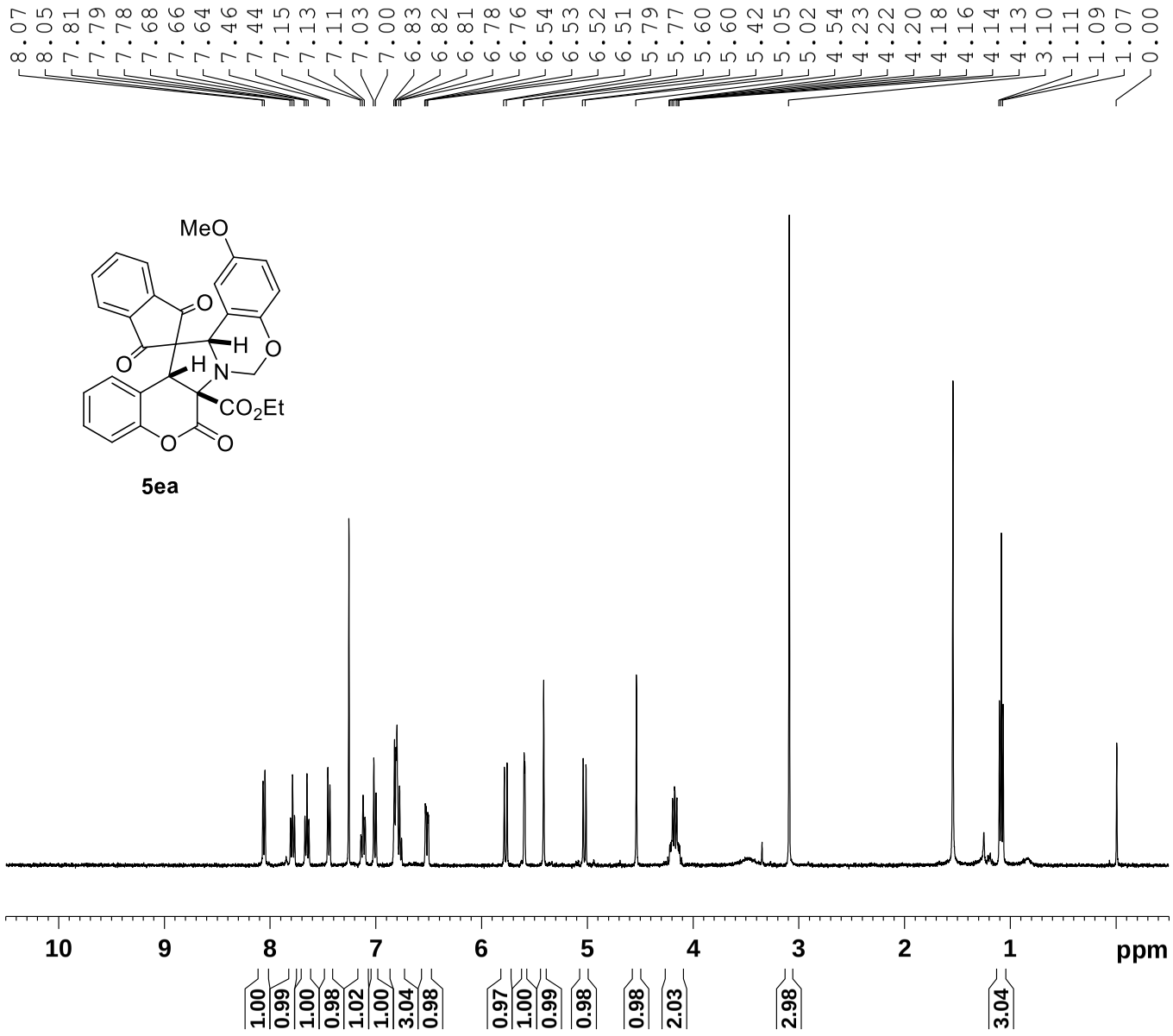

```
Current Data Parameters
NAME            vicky176
EXPNO                  9
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170426
Time               22.18
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   256
DW                69.000 usec
DE                 6.50 usec
TE                298.7 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300074 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



5ca

S151

```
Current Data Parameters
NAME                  vicky176
EXPNO                       10
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170426
Time                     22.22
INSTRUM                  spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                        5181
DS                           0
SWH                 24038.461 Hz
FIDRES               0.733596 Hz
AQ                   0.6815744 sec
RG                        6502
DW                      20.800 usec
DE                       6.50 usec
TE                      298.7 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                       13C
P1                        9.00 usec
PL1                       7.00 dB
SFO1               100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2                waltz16
NUC2                       1H
PCPD2                    90.00 usec
PL2                       1.80 dB
PL12                     17.00 dB
PL13                     20.00 dB
SFO2               400.1316005 MHz

F2 - Processing parameters
SI                       32768
SF                 100.6127690 MHz
WDW                         EM
SSB          0
LB                        1.00 Hz
GB           0
PC                        1.00
```



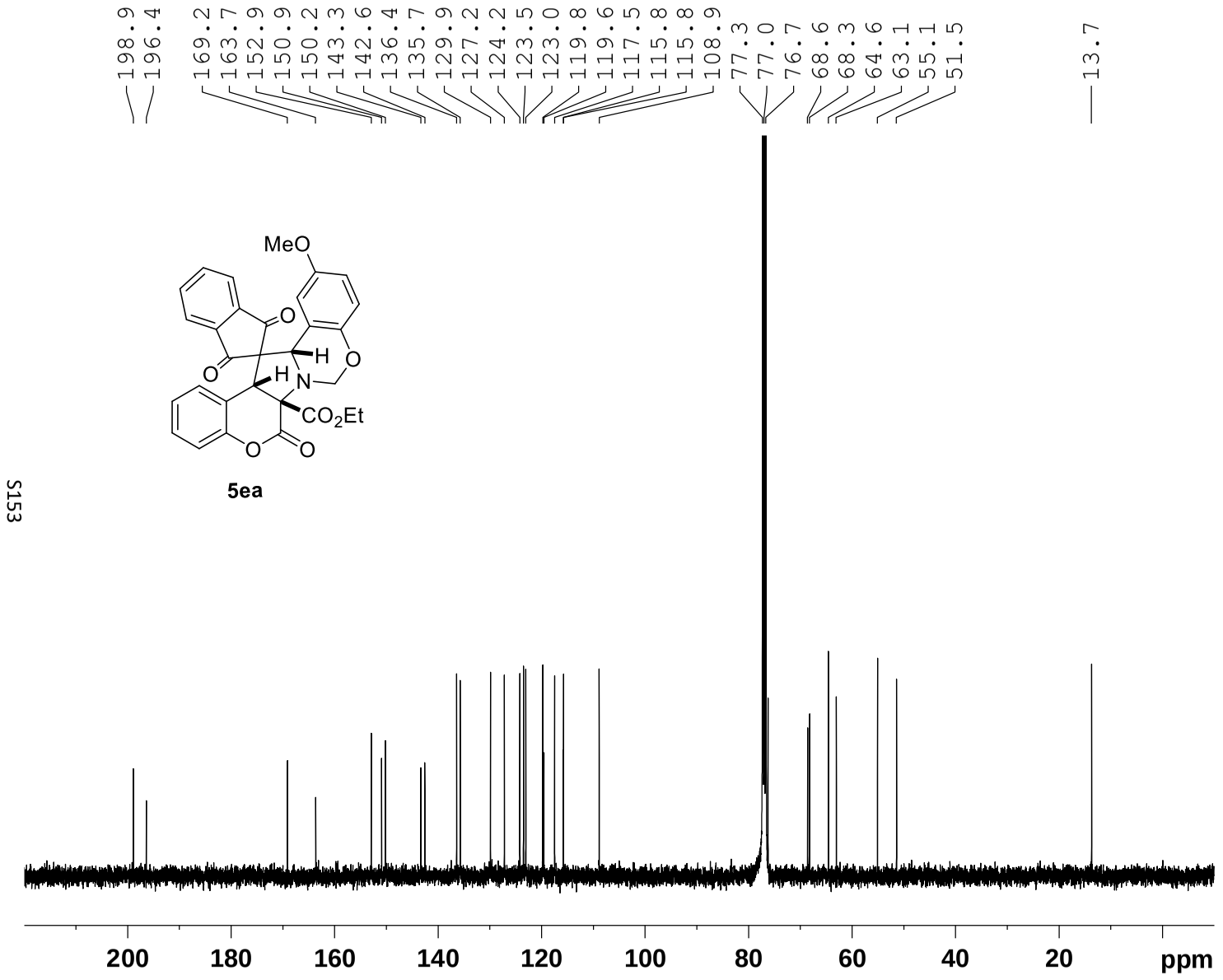
5ea

Current Data Parameters
NAME B141
EXPNO 13
PROCNO 1

F2 - Acquisition Parameters
Date_ 20170516
Time 19.16
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 574.7
DW 69.000 usec
DE 6.50 usec
TE 299.9 K
D1 2.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz

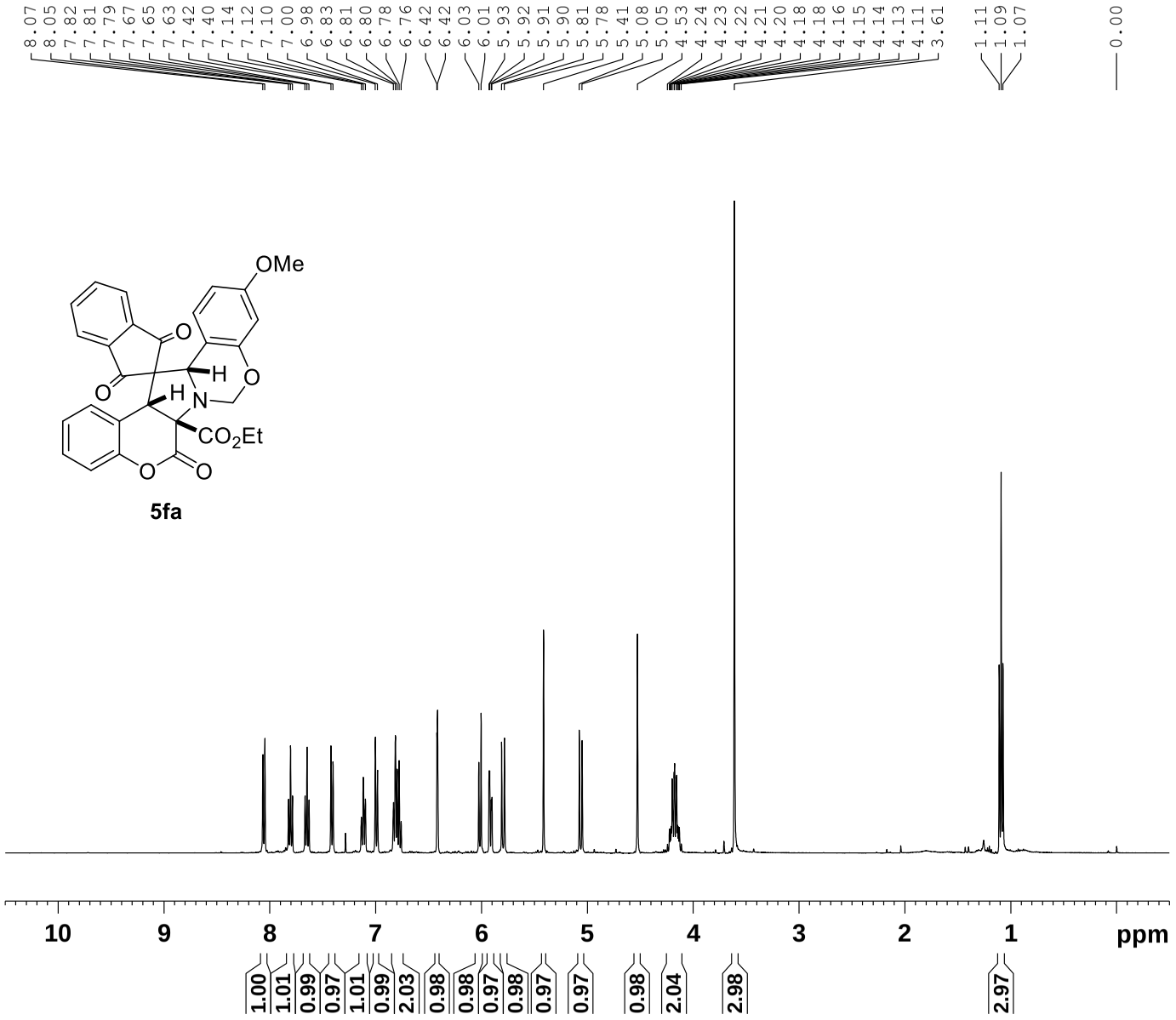
F2 - Processing parameters
SI 16384
SF 400.1300118 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00



5ea

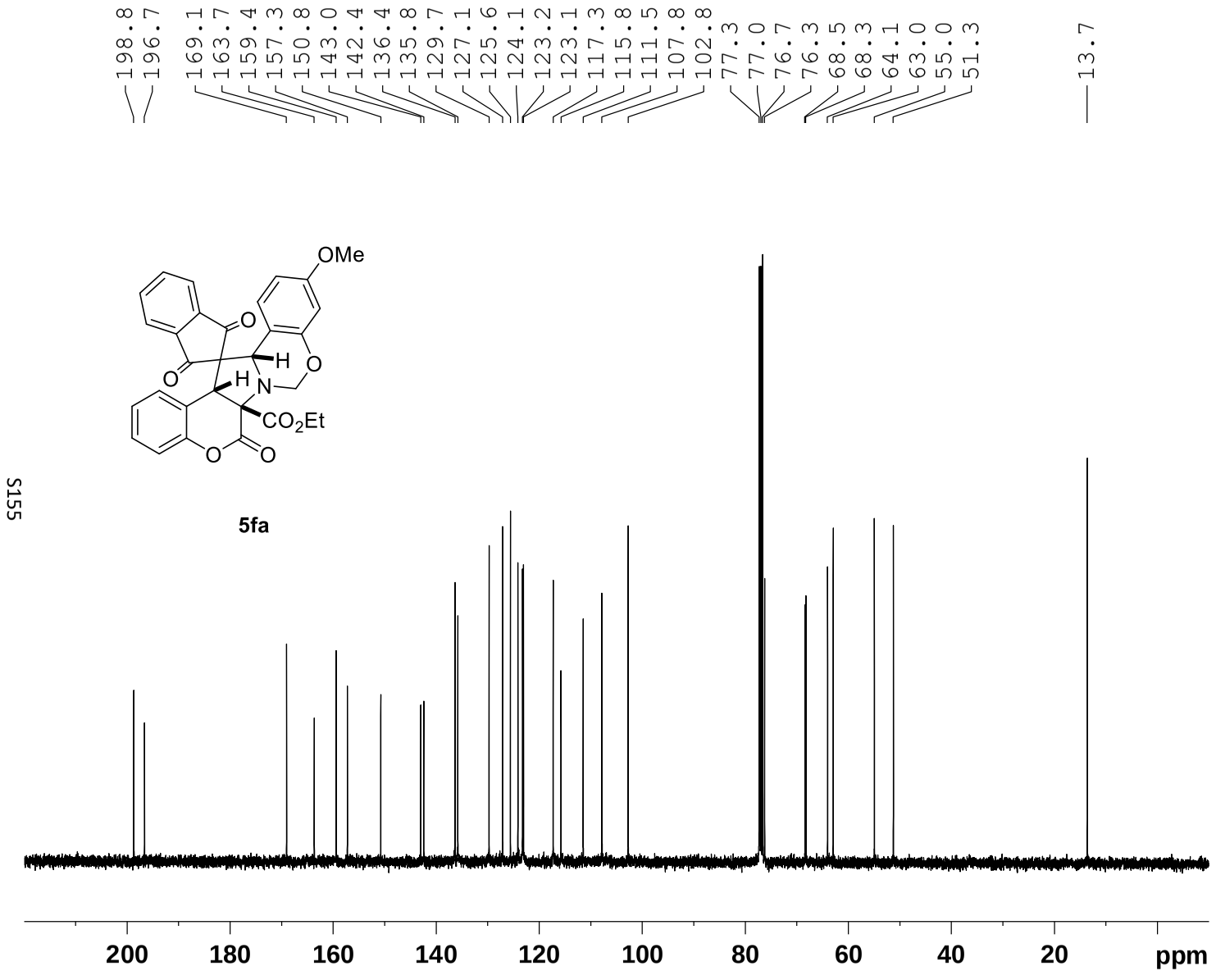
S153

```
Current Data Parameters
NAME                  B141
EXPNO                   20
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170516
Time                 22.50
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   10754
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   16384
DW                 20.800 usec
DE                  6.50 usec
TE                 299.8 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127690 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```

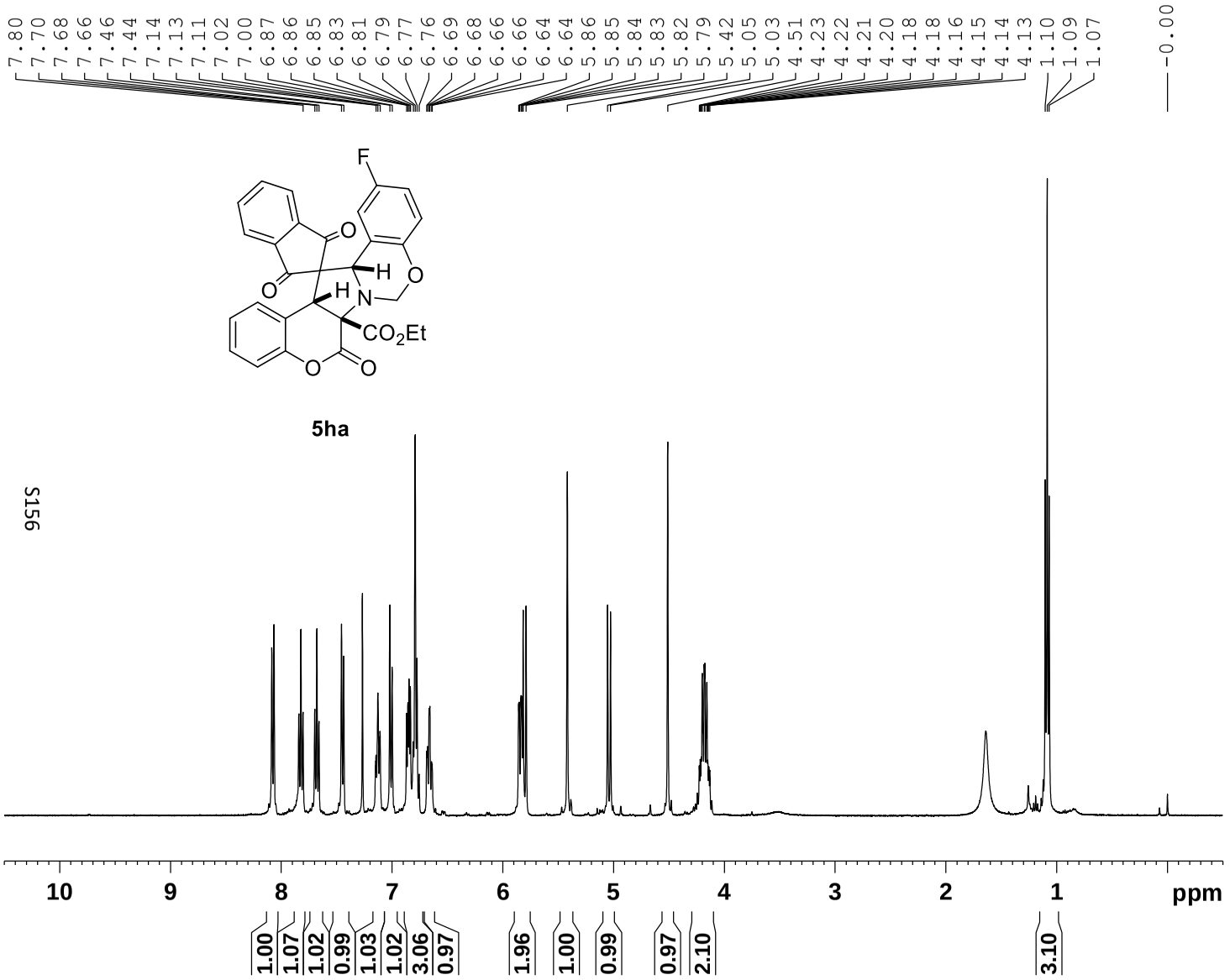


5fa

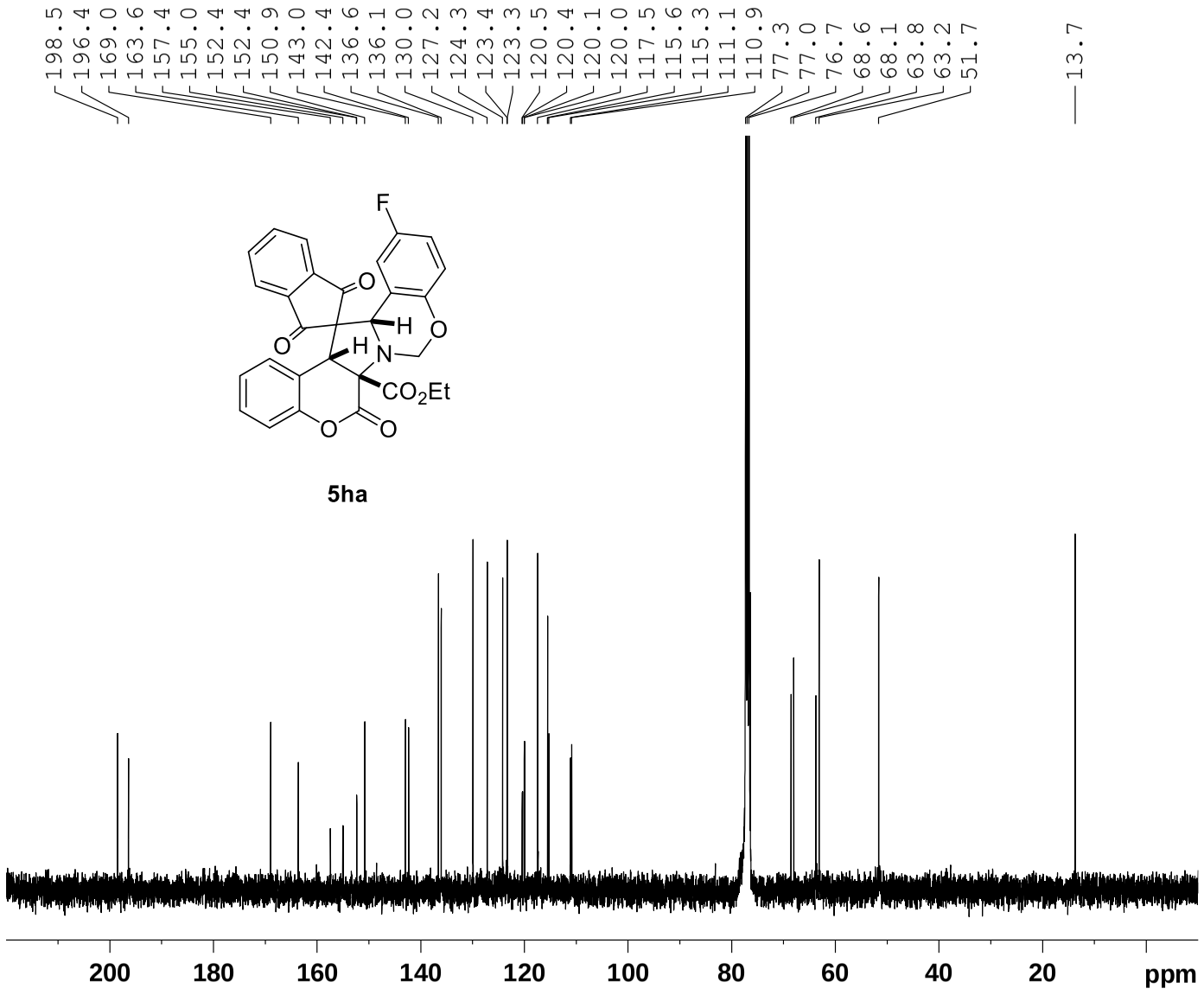
```
Current Data Parameters
NAME                  B146
EXPNO                   20
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170527
Time                   7.15
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                       57
DW                  69.000 usec
DE                   6.50 usec
TE                   298.6 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                     1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1299990 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```




```
Current Data Parameters
NAME                  B146
EXPNO                   21
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170527
Time                   7.20
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     627
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   298.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                    9.00 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2                   1.80 dB
PL12                 17.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127781 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

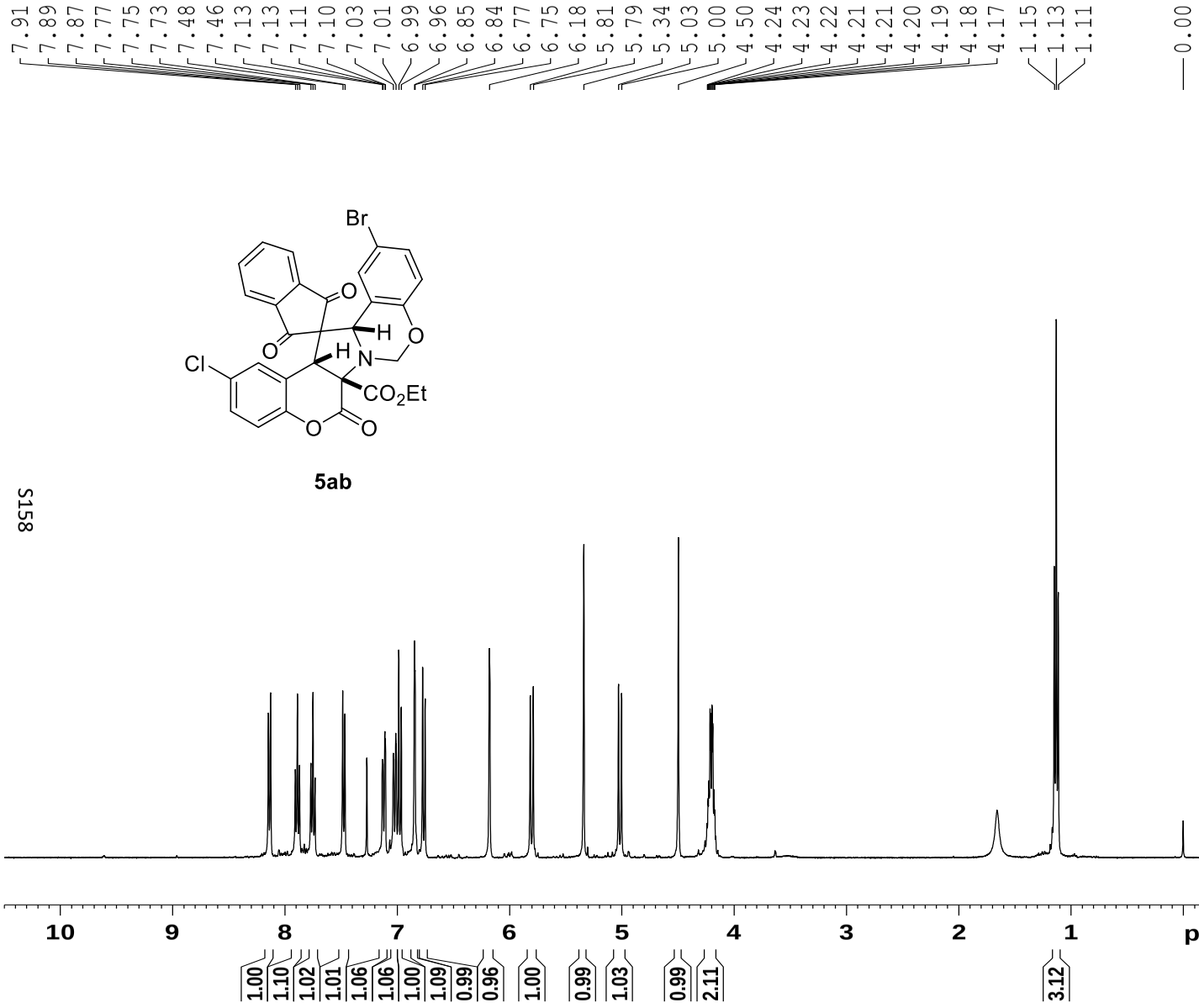



```
Current Data Parameters
NAME                  B357
EXPNO                    3
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180526
Time                 11.54
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                   228.1
DW                  69.000 usec
DE                   6.50 usec
TE                  673.2 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300069 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```

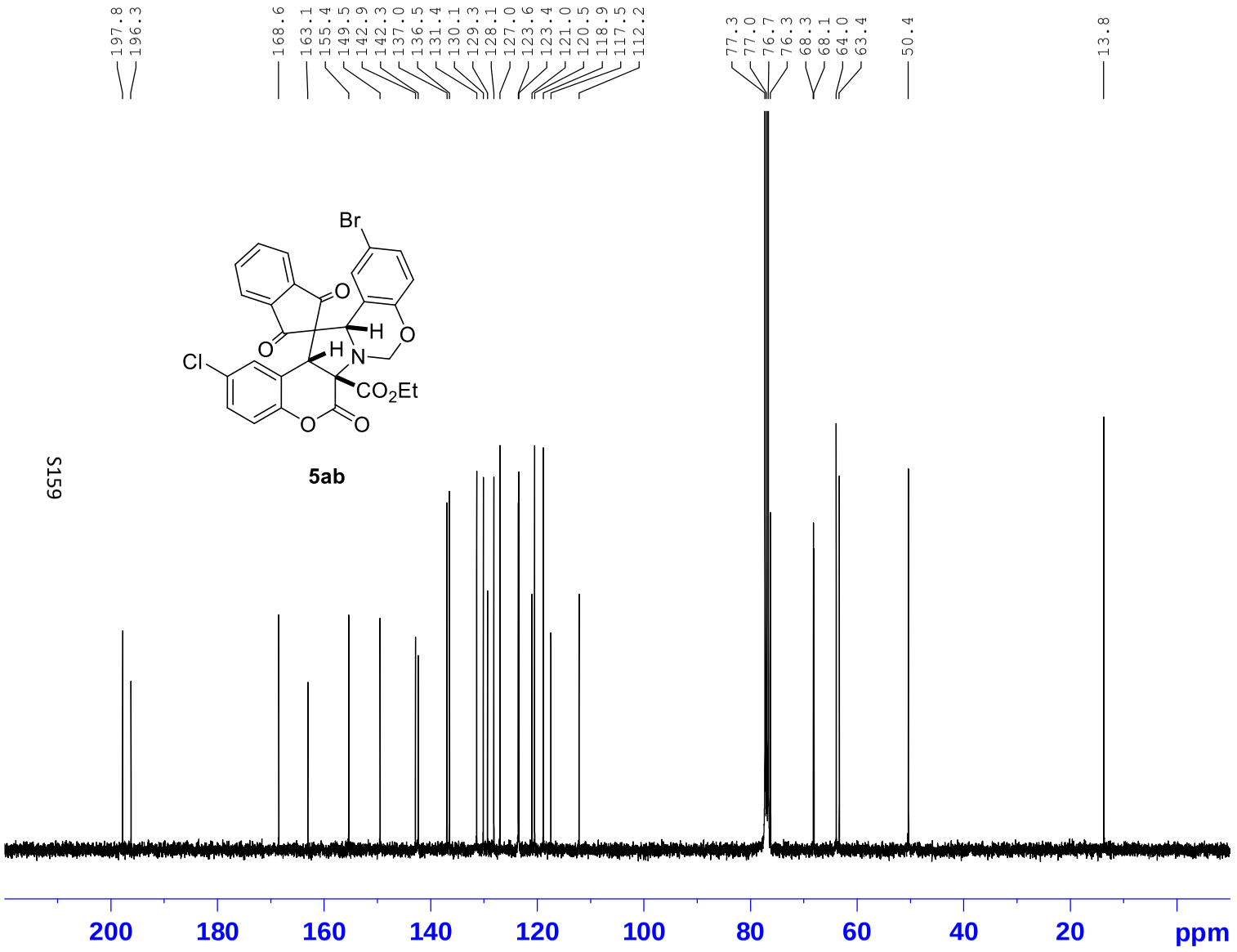


5ha

```
Current Data Parameters
NAME                  B357
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180509
Time                 22.29
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDC13
NS                   14044
DS                       0
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  673.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127690 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```



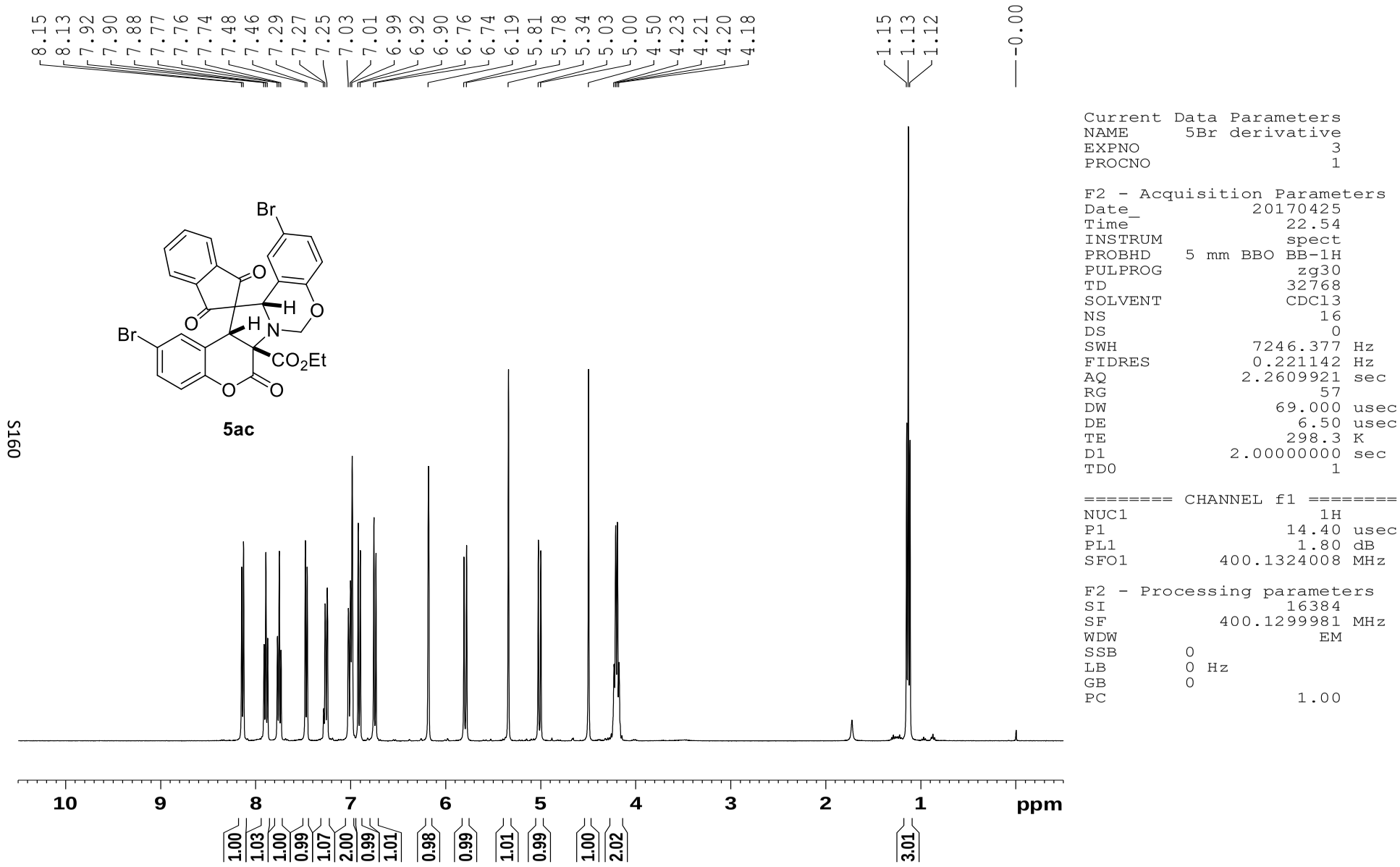

```
Current Data Parameters
NAME      5Cl derivative
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170511
Time                9.44
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                   181
DW                69.000 usec
DE                 6.50 usec
TE                296.0 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF          400.1300058 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



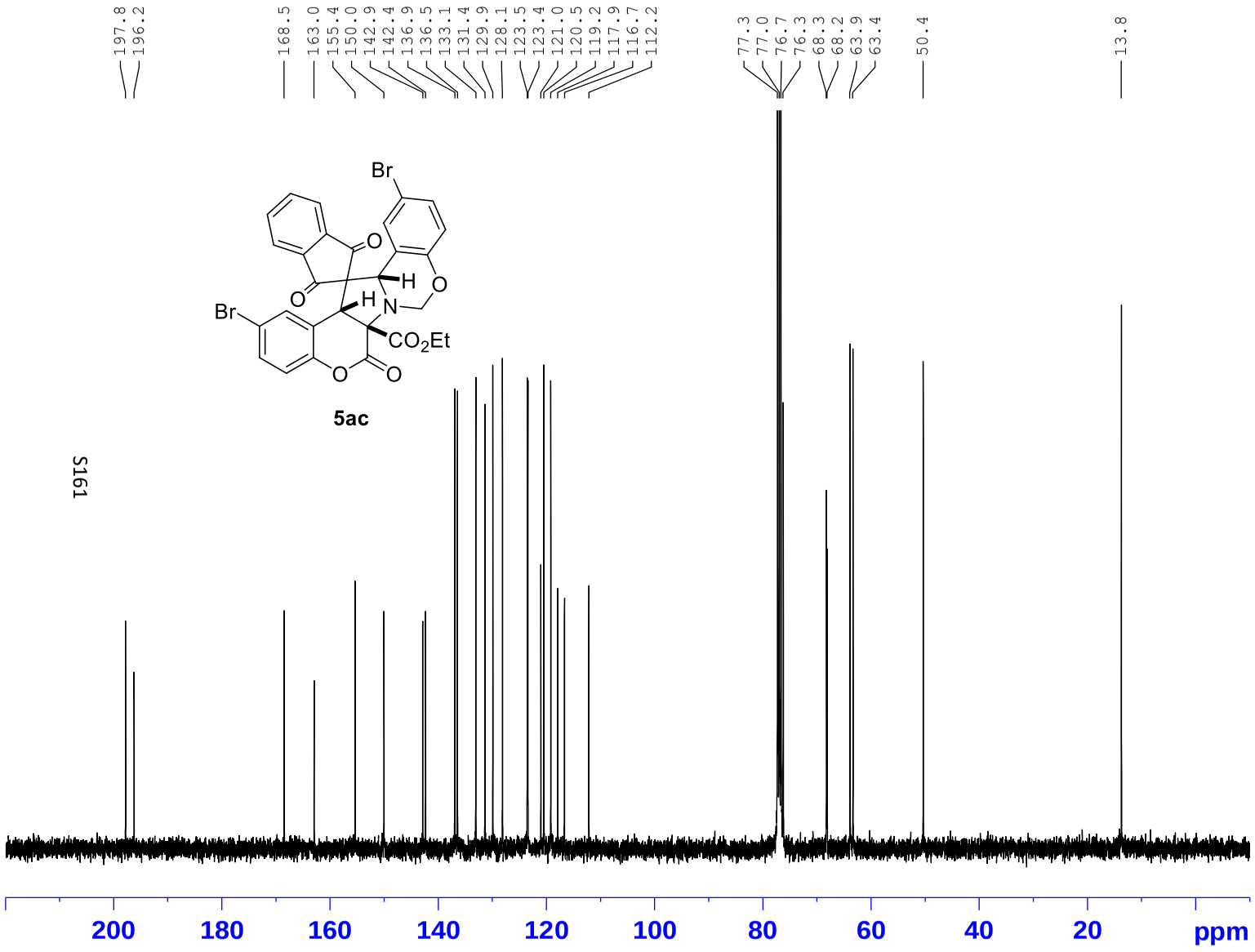
S159

5ab

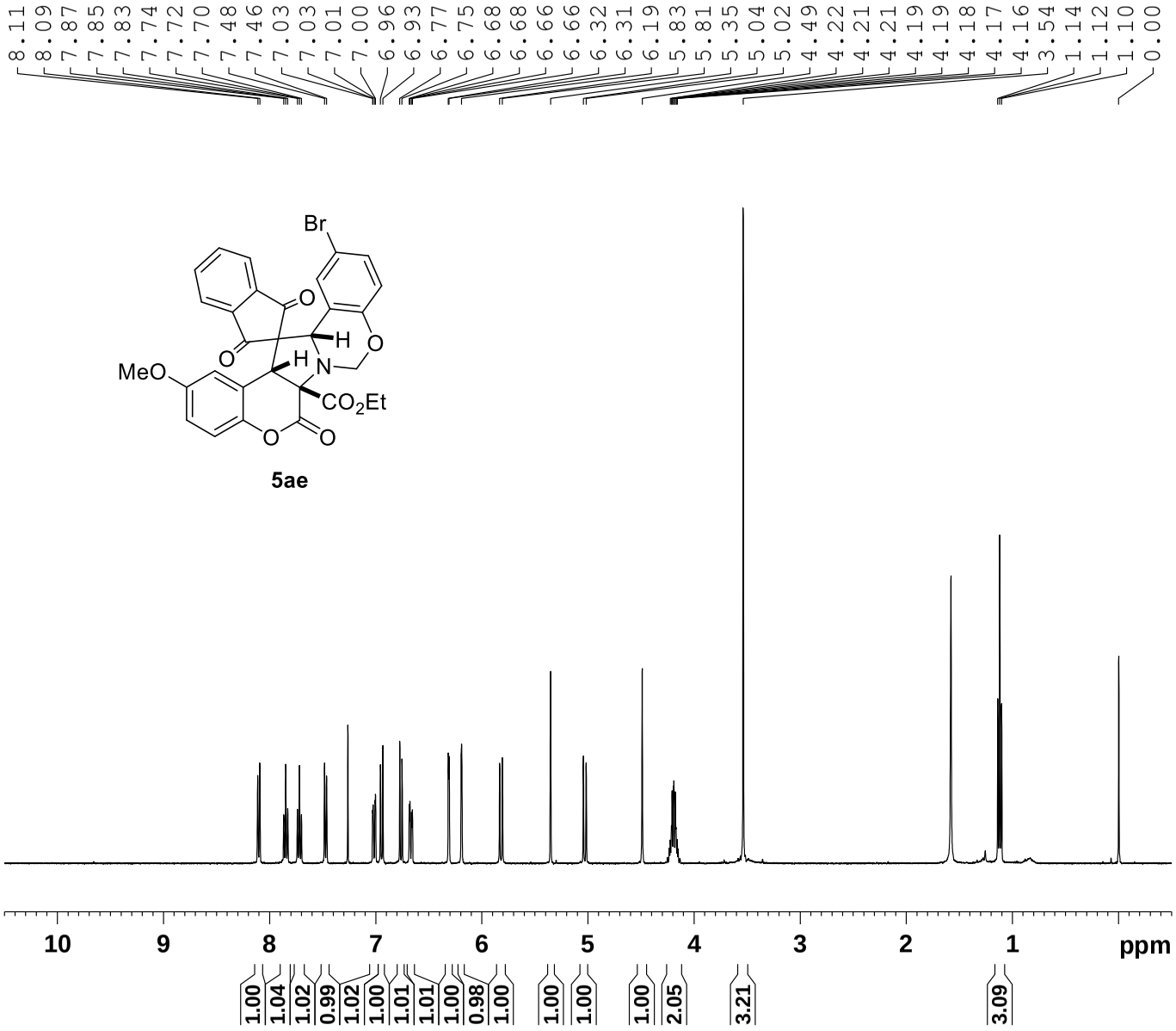
```
Current Data Parameters
NAME      5Cl derivative
EXPNO                  7
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170423
Time              17.57
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                 2663
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                 8192
DW                20.800 usec
DE                 6.50 usec
TE                295.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.00 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2              90.00 usec
PL2                 1.80 dB
PL12               17.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127730 MHz
WDW                  EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```




```
Current Data Parameters
NAME      5Br derivative
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170425
Time               22.54
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                    57
DW                69.000 usec
DE                 6.50 usec
TE                298.3 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF          400.1299981 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME                  liu157
EXPNO                      8
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170325
Time                  22.15
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1740
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   9195.2
DW                  20.800 usec
DE                   6.50 usec
TE                  298.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.50 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                  -0.60 dB
PL12                 15.00 dB
PL13                 18.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                    32768
SF            100.6127734 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

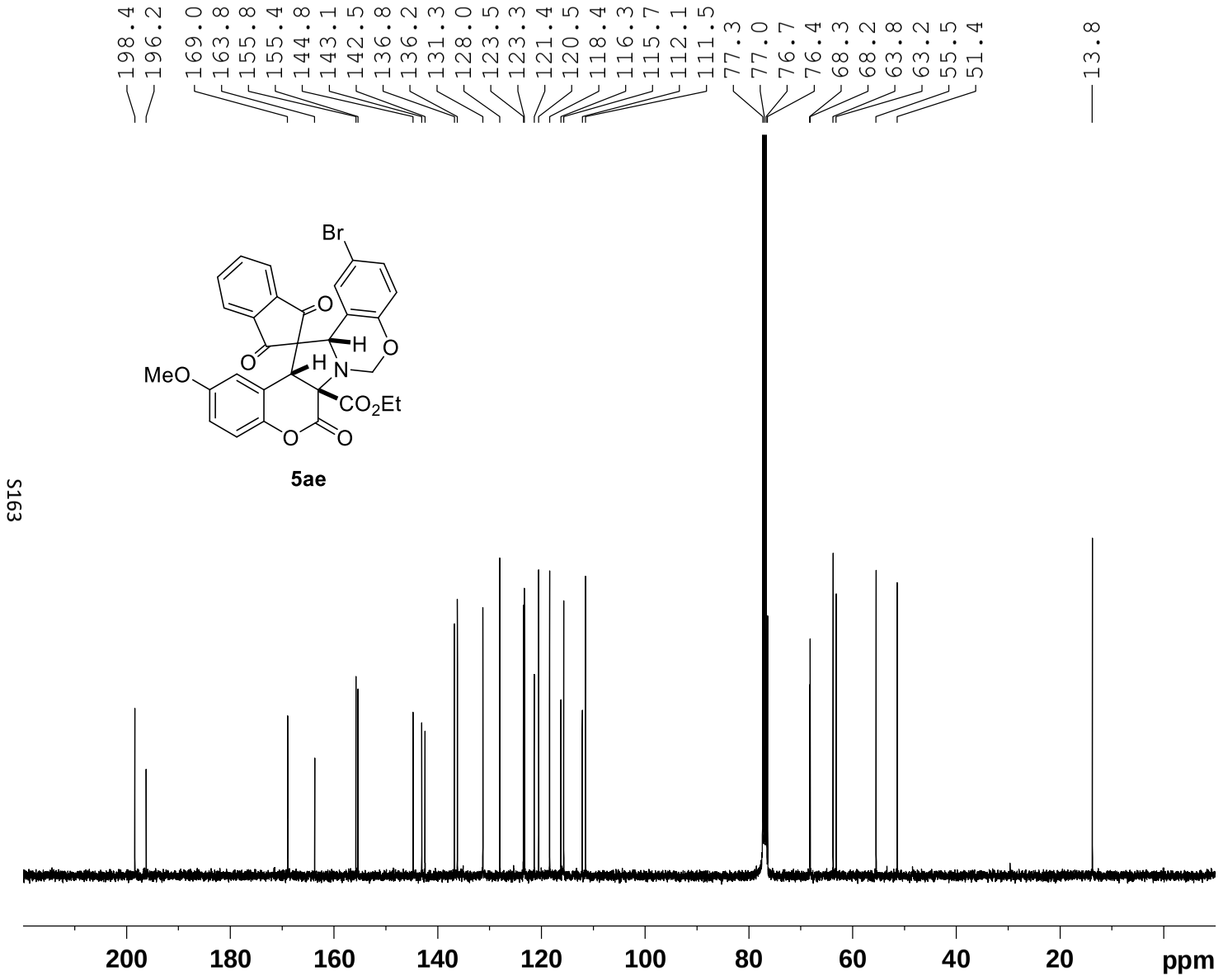


Current Data Parameters
NAME B144
EXPNO 4
PROCNO 1

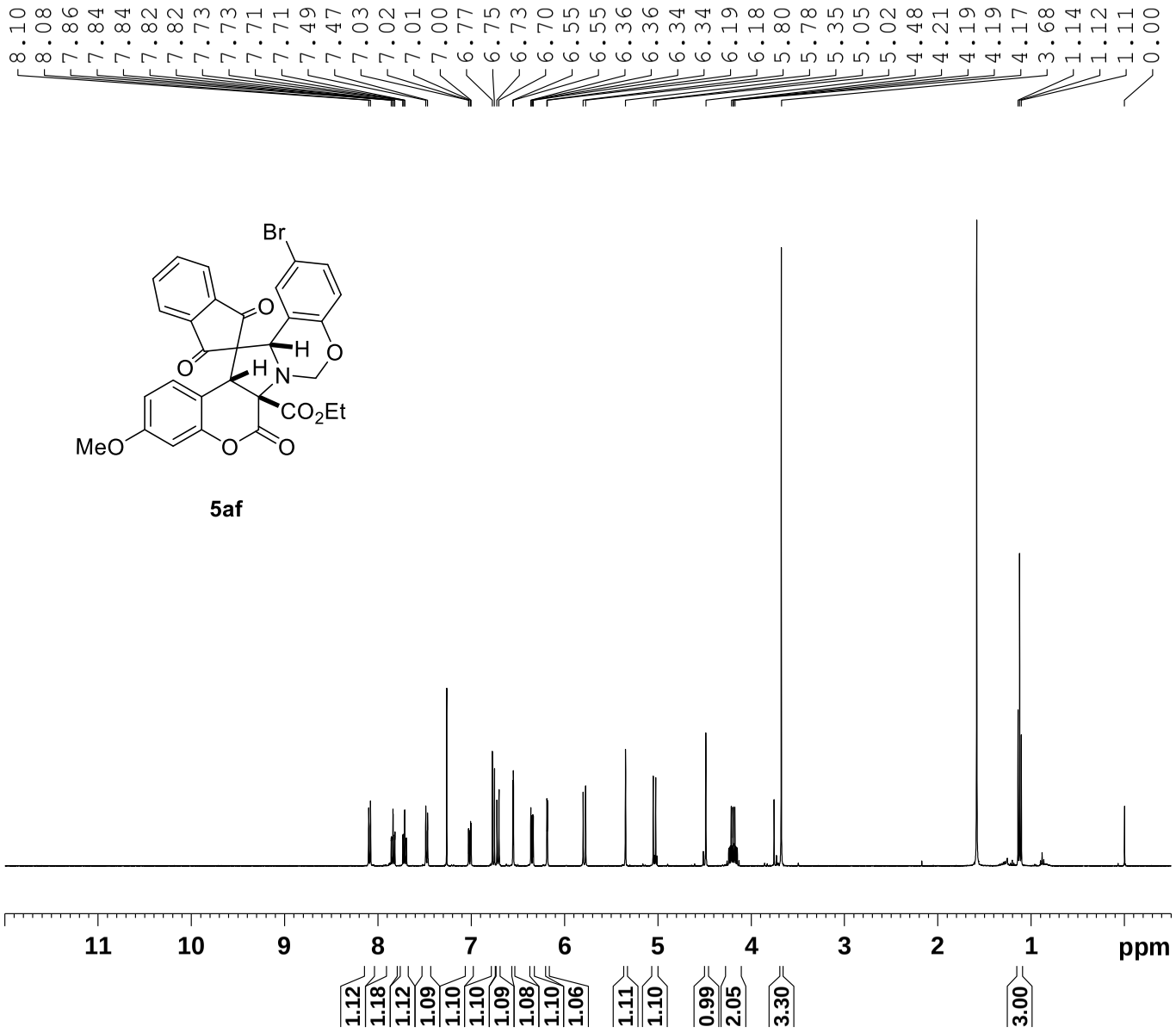
F2 - Acquisition Parameters
Date_ 20170429
Time 16.14
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2609921 sec
RG 256
DW 69.000 usec
DE 6.50 usec
TE 298.8 K
D1 2.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.40 usec
PL1 1.80 dB
SFO1 400.1324008 MHz

F2 - Processing parameters
SI 16384
SF 400.1300082 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00

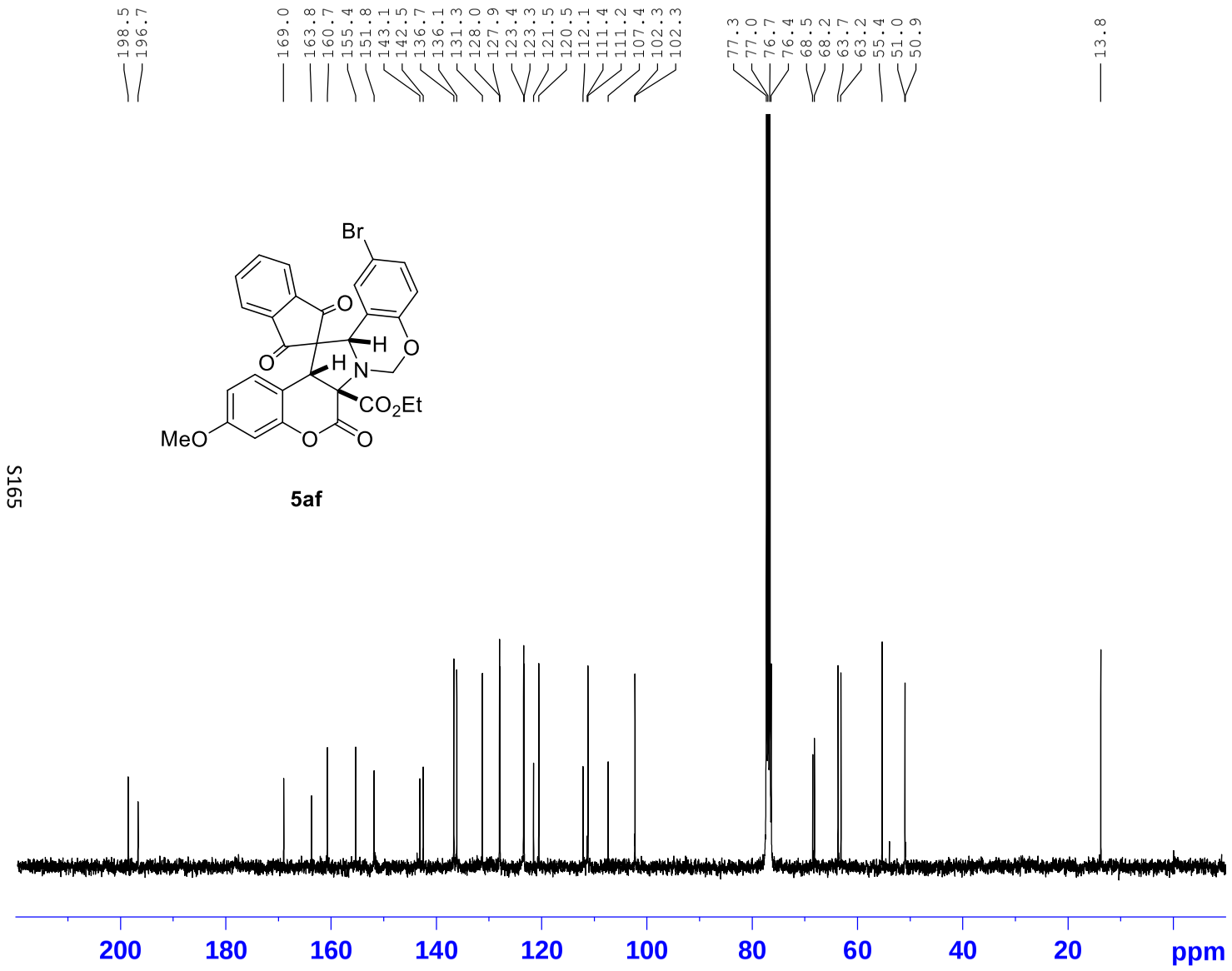



```
Current Data Parameters
NAME                   B144
EXPNO                     7
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170502
Time                 21.54
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   5407
DS                      0
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 9195.2
DW                20.800 usec
DE                 6.50 usec
TE                295.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.50 usec
PL1                 7.00 dB
SFO1         100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2                -0.60 dB
PL12               15.00 dB
PL13               18.00 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF           100.6127690 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```



5af

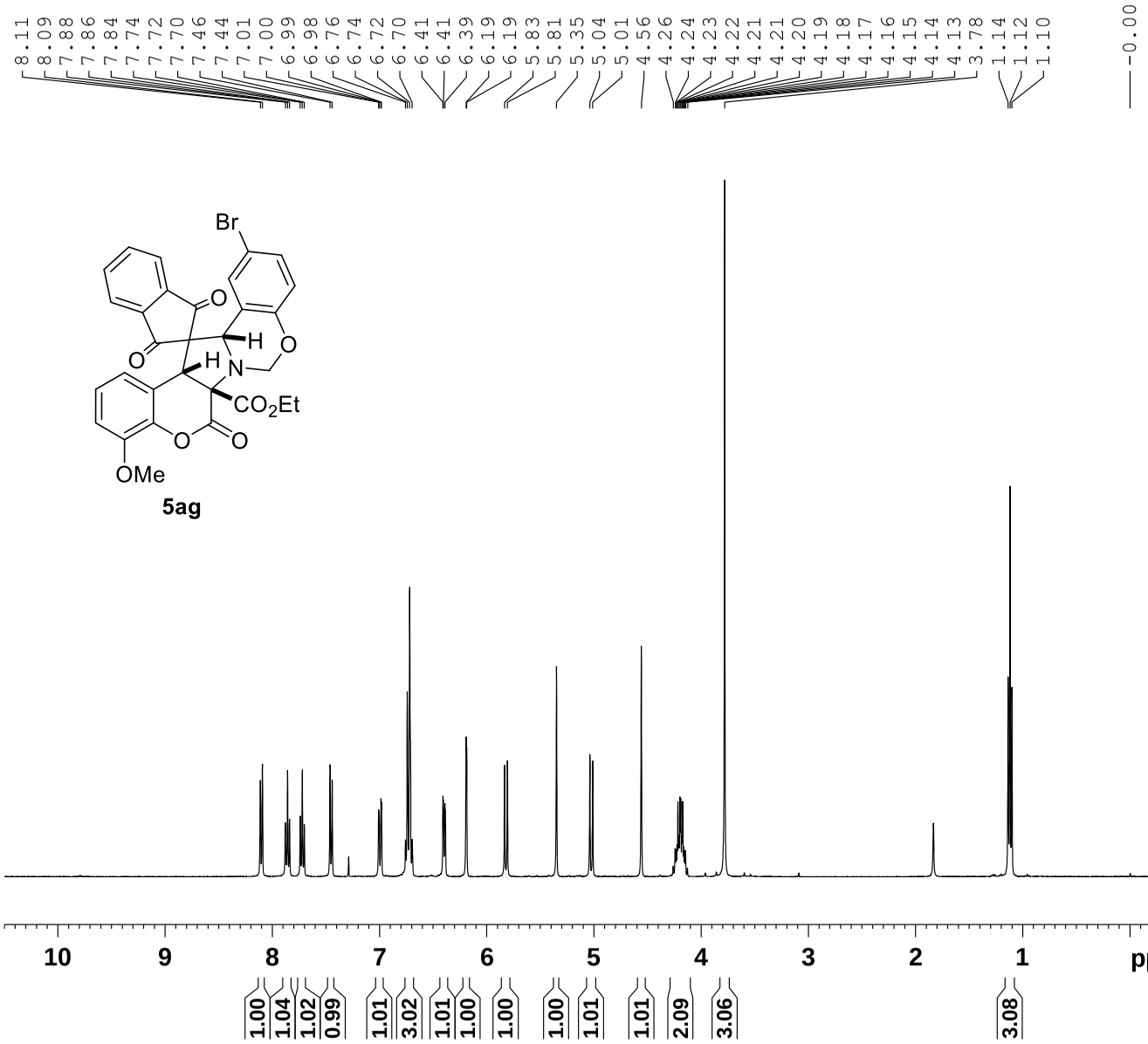
```
Current Data Parameters
NAME            vicky189
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170511
Time                2.26
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7211.539 Hz
FIDRES          0.220079 Hz
AQ             2.2719147 sec
RG                158.74
DW                69.333 usec
DE                10.50 usec
TE                298.6 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1324008 MHz
NUC1                   1H
P1                 12.90 usec
PLW1         15.00000000 W

F2 - Processing parameters
SI                 16384
SF           400.1300083 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                  1.00
```



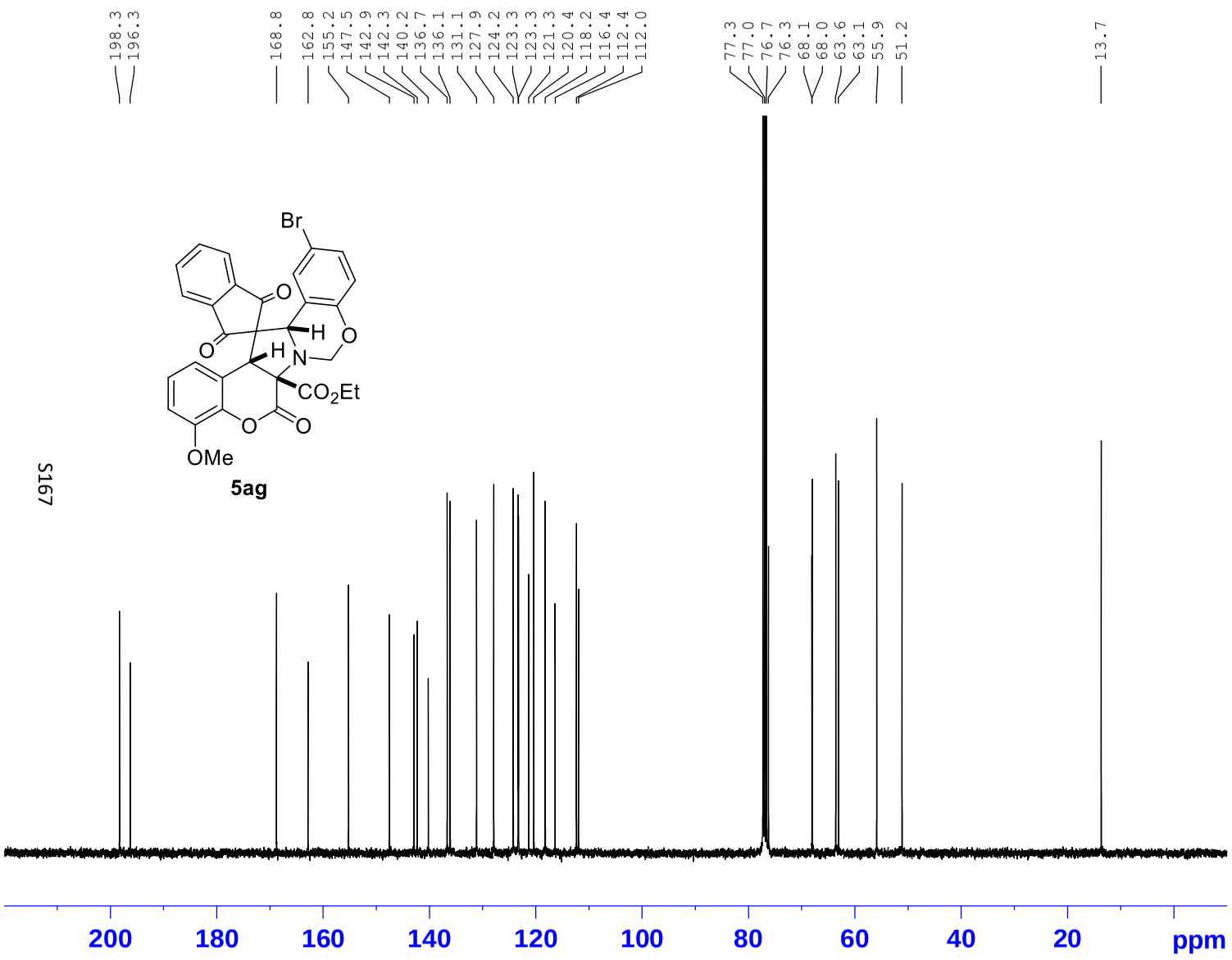
5af

S165

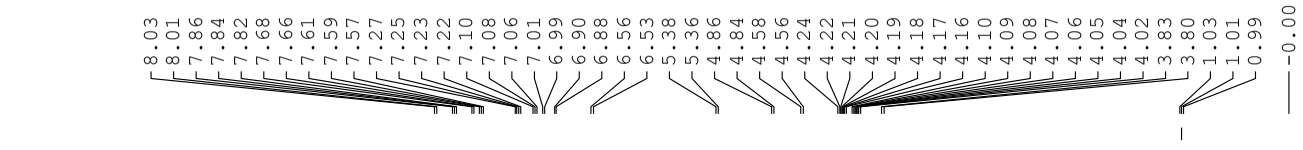
```
Current Data Parameters
NAME                  vicky189
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20170511
Time                      3.42
INSTRUM                  spect
PROBHD    5 mm PABBO BB/
PULPROG                 zgpg30
TD                       32768
SOLVENT                  CDCl3
NS                        6390
DS                           0
SWH                  24038.461 Hz
FIDRES                0.733596 Hz
AQ                    0.6815744 sec
RG                       198.09
DW                       20.800 usec
DE                        6.50 usec
TE                       299.0 K
D1                   2.00000000 sec
D11                  0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               100.6228298 MHz
NUC1                       13C
P1                       10.00 usec
PLW1                47.50000000 W

======== CHANNEL f2 ========
SFO2               400.1316005 MHz
NUC2                       1H
CPDPRG[2                waltz16
PCPD2                    90.00 usec
PLW2                15.00000000 W
PLW12                0.33750001 W
PLW13                0.27338001 W

F2 - Processing parameters
SI                       32768
SF                 100.6127685 MHz
WDW                        EM
SSB                  0
LB                        2.00 Hz
GB                   0
PC                        1.00
```

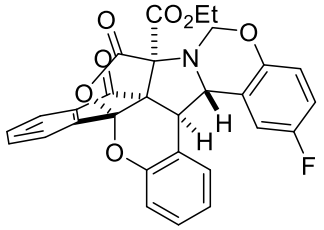



```
Current Data Parameters
NAME      3OMe-derivative
EXPNO                   2
PROCNO                  1

F2 - Acquisition Parameters
Date_           20170424
Time              11.58
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            7246.377 Hz
FIDRES          0.221142 Hz
AQ             2.2609921 sec
RG                   57
DW                69.000 usec
DE                 6.50 usec
TE                295.3 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                16384
SF          400.1299978 MHz
WDW                  EM
SSB       0
LB        0 Hz
GB        0
PC                1.00
```

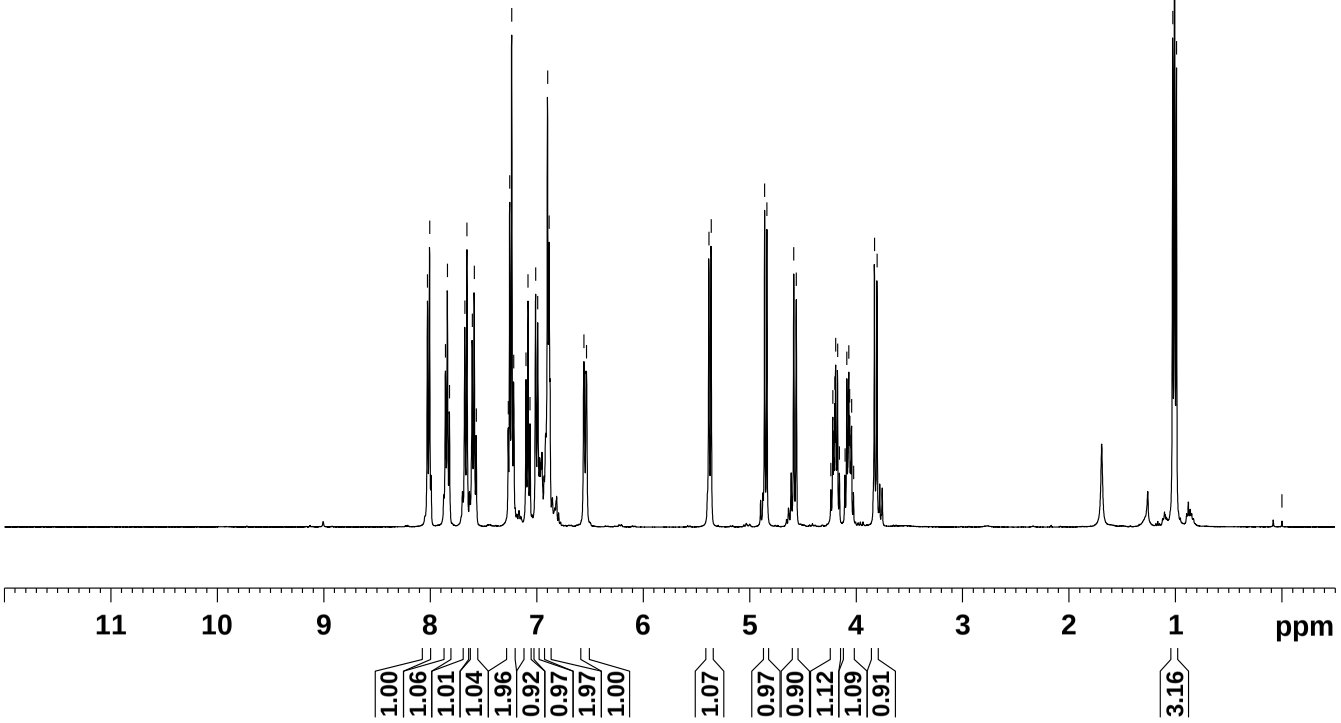



```
Current Data Parameters
NAME      3OMe-derivative
EXPNO                   3
PROCNO                  1

F2 - Acquisition Parameters
Date_           20170424
Time              12.01
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                 1389
DS                    0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               5792.6
DW                20.800 usec
DE                 6.50 usec
TE                295.3 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                 9.00 usec
PL1                7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2                1.80 dB
PL12              17.00 dB
PL13              20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127791 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

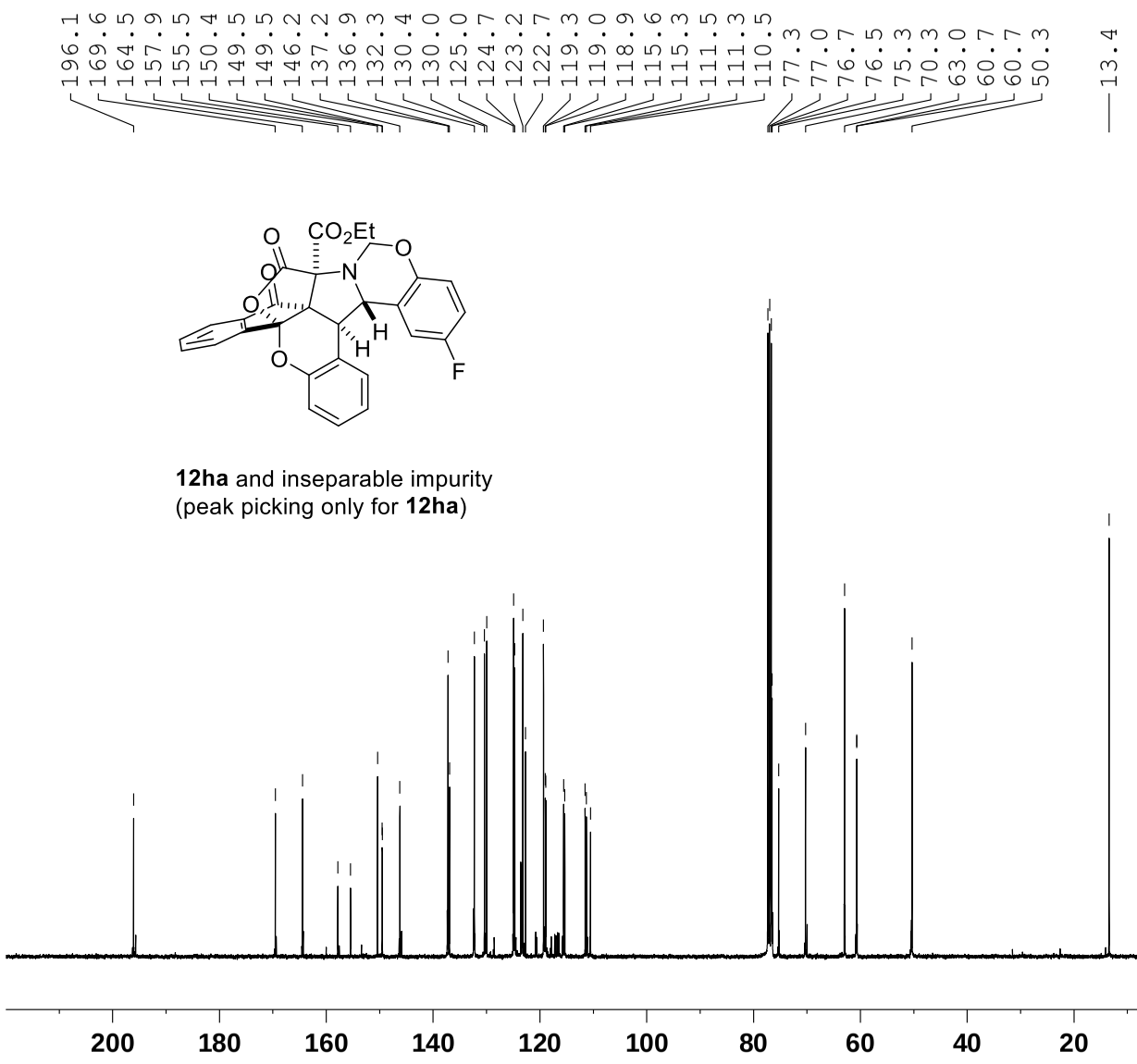




12ha and inseparable impurity

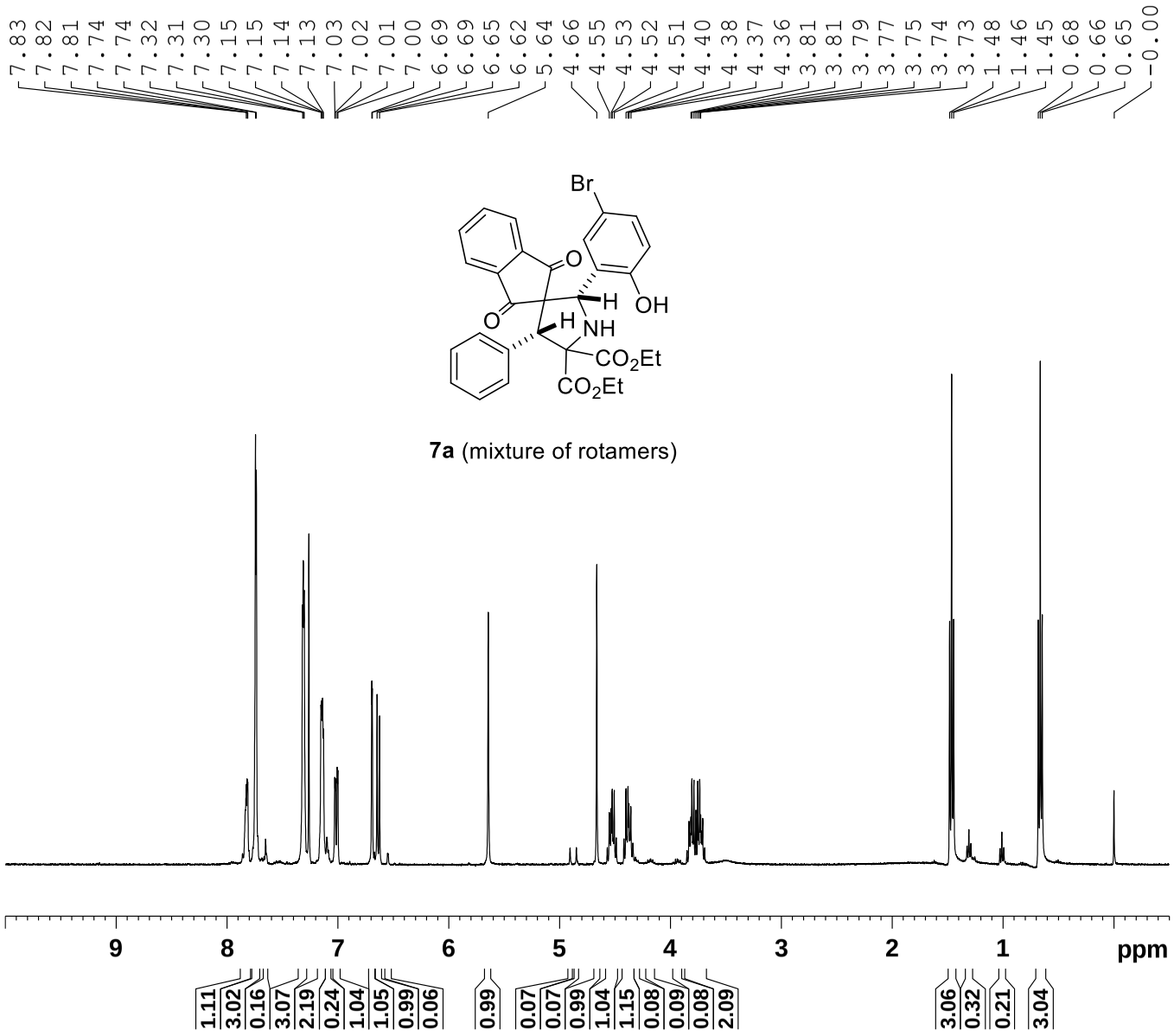



```
Current Data Parameters
NAME             Hank153
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180527
Time                4.49
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDC13
NS                    32
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ             2.2609921 sec
RG                    57
DW                69.000 usec
DE                 6.50 usec
TE                673.2 K
D1           2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1       0 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300065 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



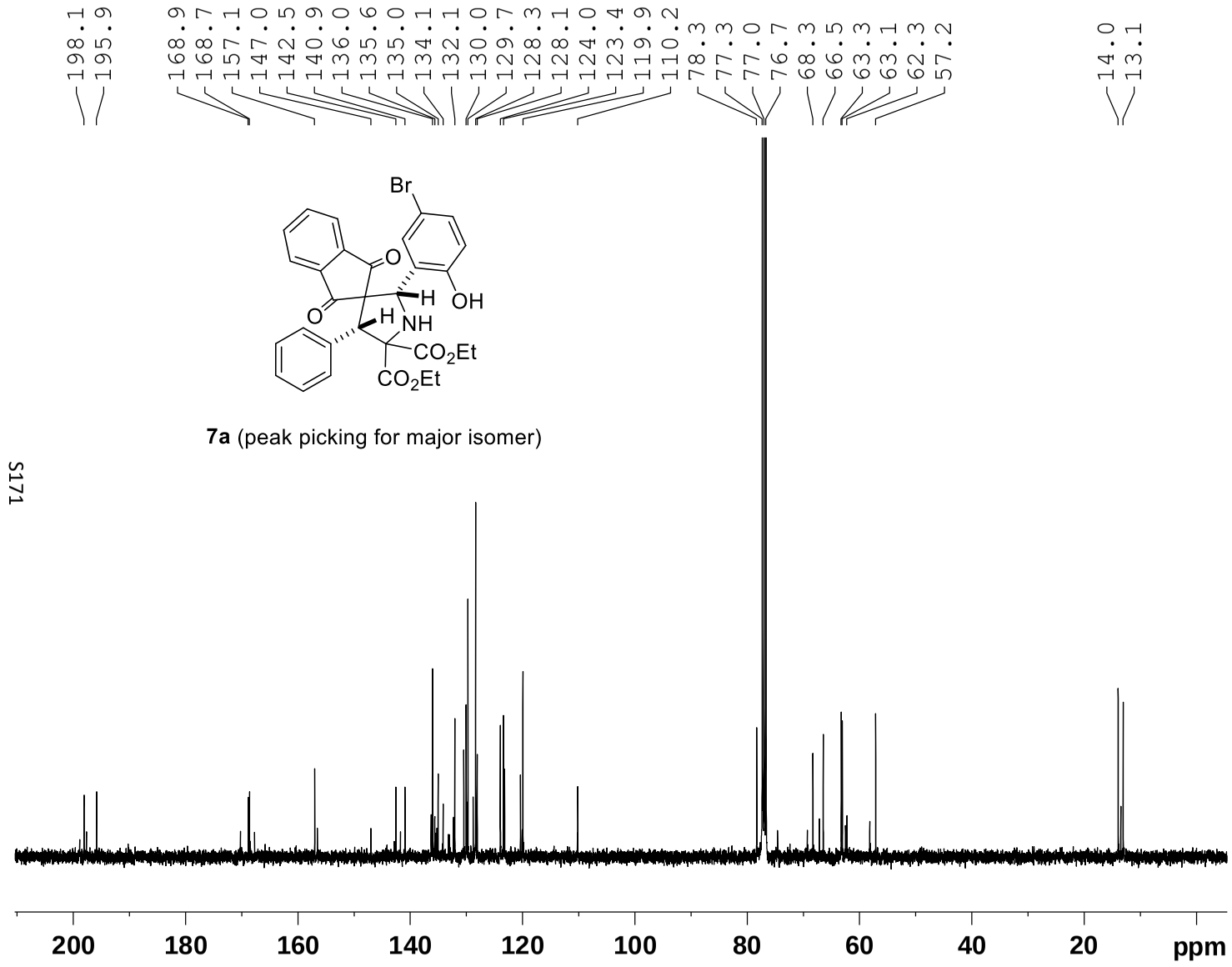
12ha and inseparable impurity
(peak picking only for **12ha**)


```
Current Data Parameters
NAME                  Hank153
EXPNO                      11
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180527
Time                    4.52
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG               zgpg30
TD                     32768
SOLVENT                CDCl3
NS                      6293
DS                         0
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    5792.6
DW                    20.800 usec
DE                     6.50 usec
TE                    673.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                     13C
P1                     10.45 usec
PL1                     7.00 dB
SFO1           100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2            waltz16
NUC2                     1H
PCPD2                 90.00 usec
PL2         0 dB
PL12                  15.00 dB
PL13                  20.00 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF             100.6127740 MHz
WDW                       EM
SSB         0
LB                     1.00 Hz
GB          0
PC                     1.00
```



7a (mixture of rotamers)

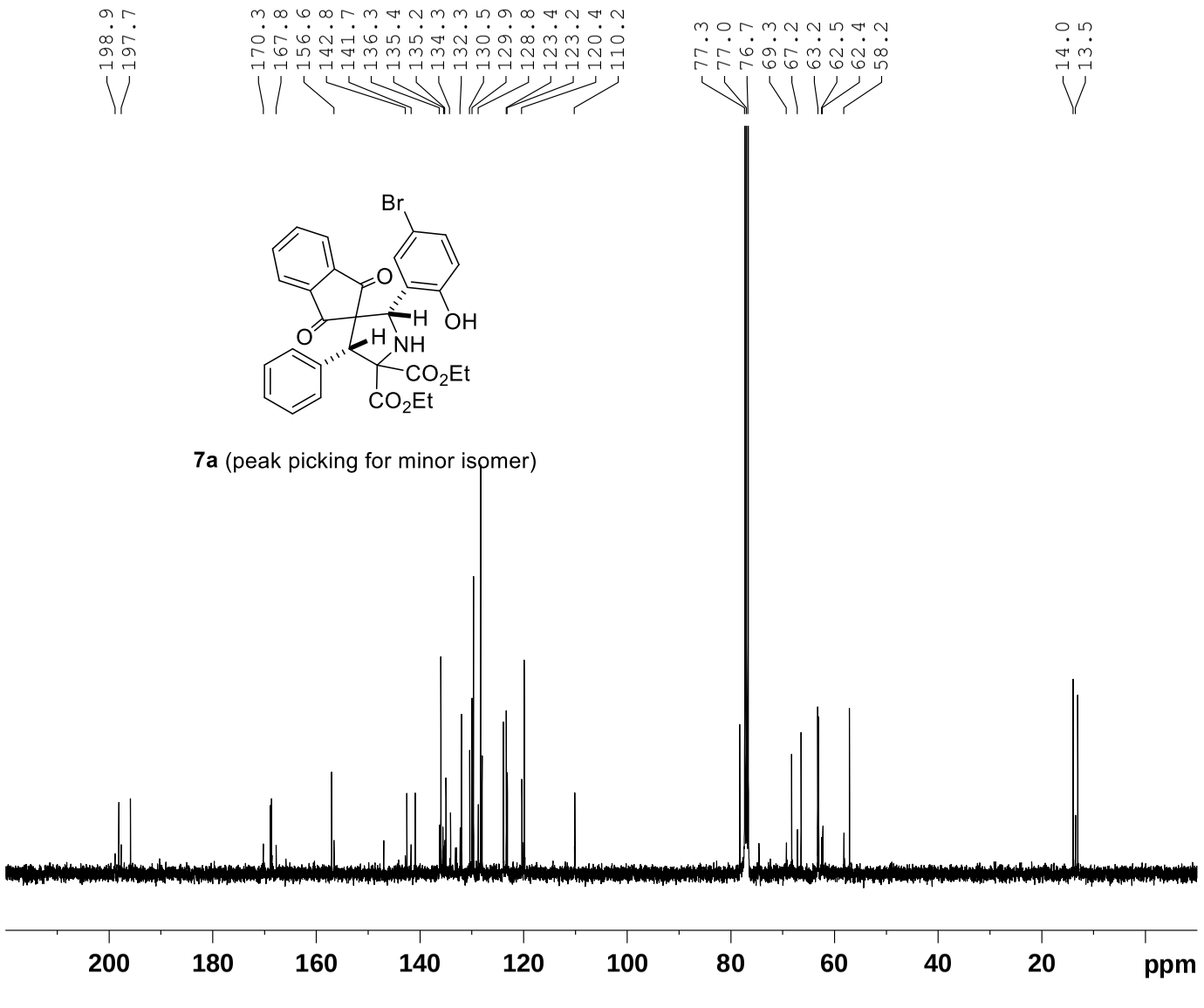
```
Current Data Parameters
NAME                  B350
EXPNO                    2
PROCNO                   1

F2 - Acquisition Parameters
Date_           20180425
Time               20.22
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES             0.221142 Hz
AQ              2.2609921 sec
RG                   114
DW                69.000 usec
DE                 6.50 usec
TE                673.2 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                 15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF            400.1300091 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



7a (peak picking for major isomer)

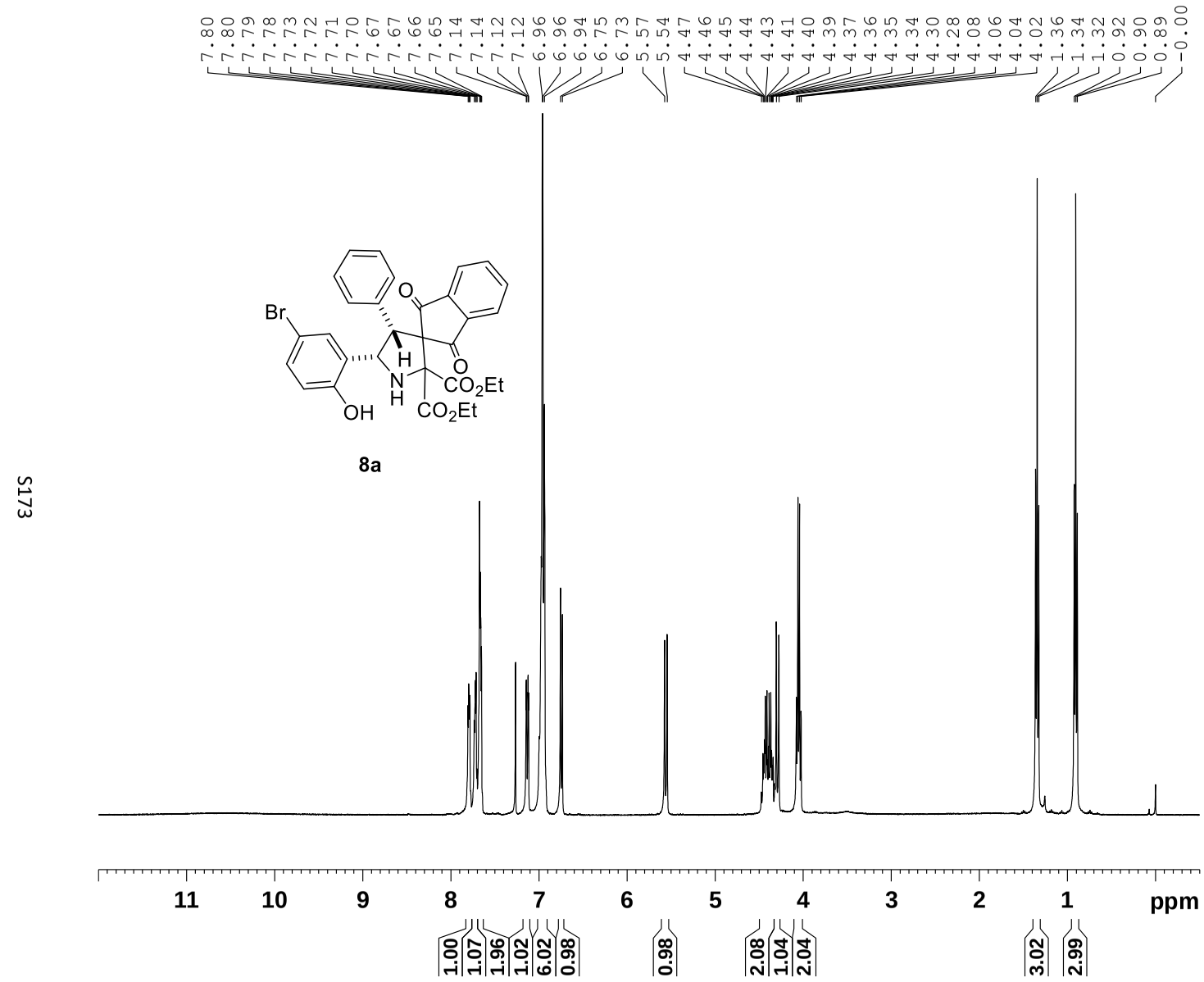
S171

```
Current Data Parameters
NAME                  B350
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_              20180502
Time                  8.32
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                    1486
DS                       0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6816244 sec
RG               2298.8
DW                20.800 usec
DE                 6.50 usec
TE                673.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF          100.6127690 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
```

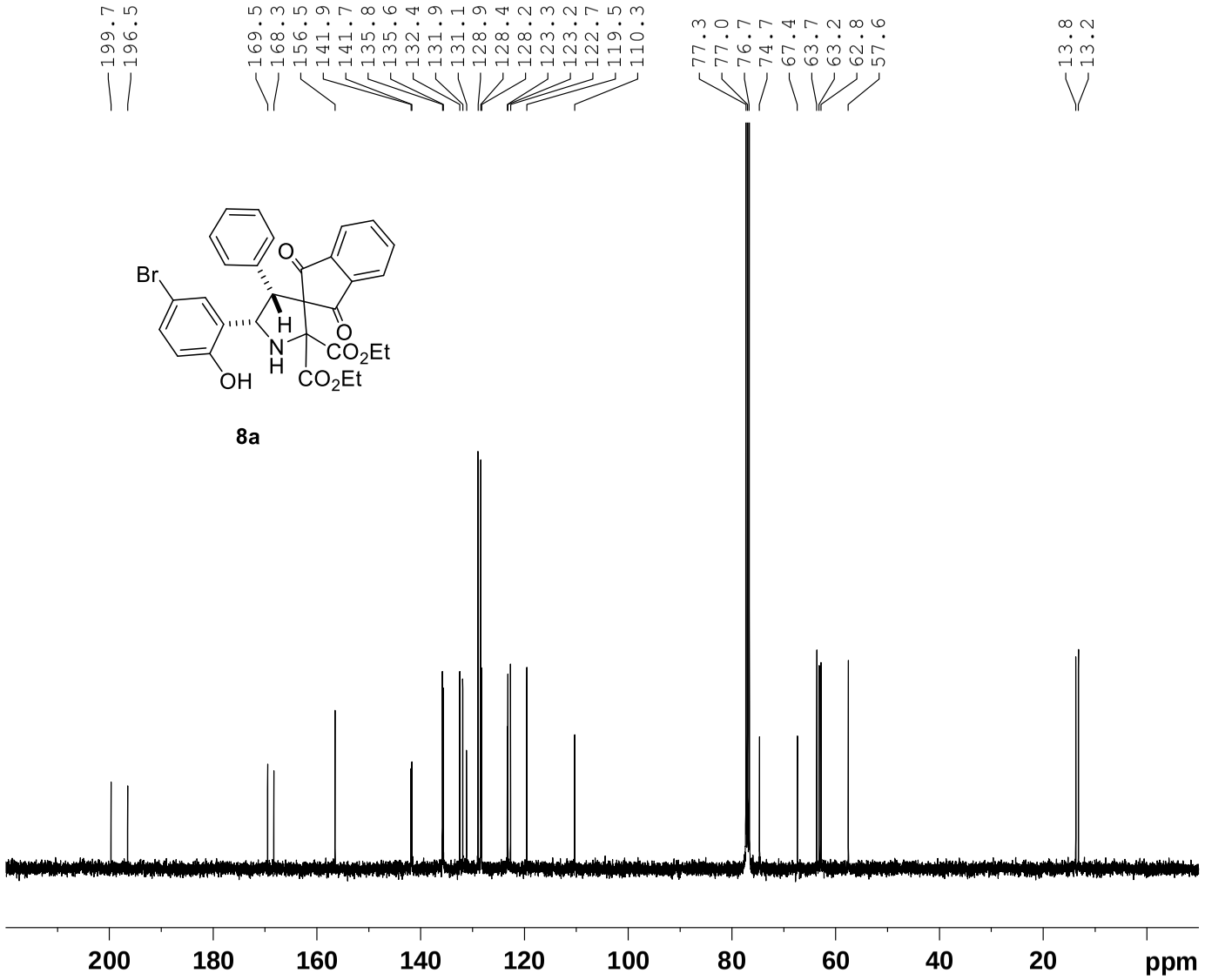


7a (peak picking for minor isomer)

```
Current Data Parameters
NAME                  B350
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_           20180502
Time                8.32
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                   1486
DS                      0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ            0.6815744 sec
RG               2298.8
DW                20.800 usec
DE                 6.50 usec
TE                673.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.45 usec
PL1                 7.00 dB
SFO1        100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2         waltz16
NUC2                  1H
PCPD2              90.00 usec
PL2       0 dB
PL12               15.00 dB
PL13               20.00 dB
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF          100.6127689 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```

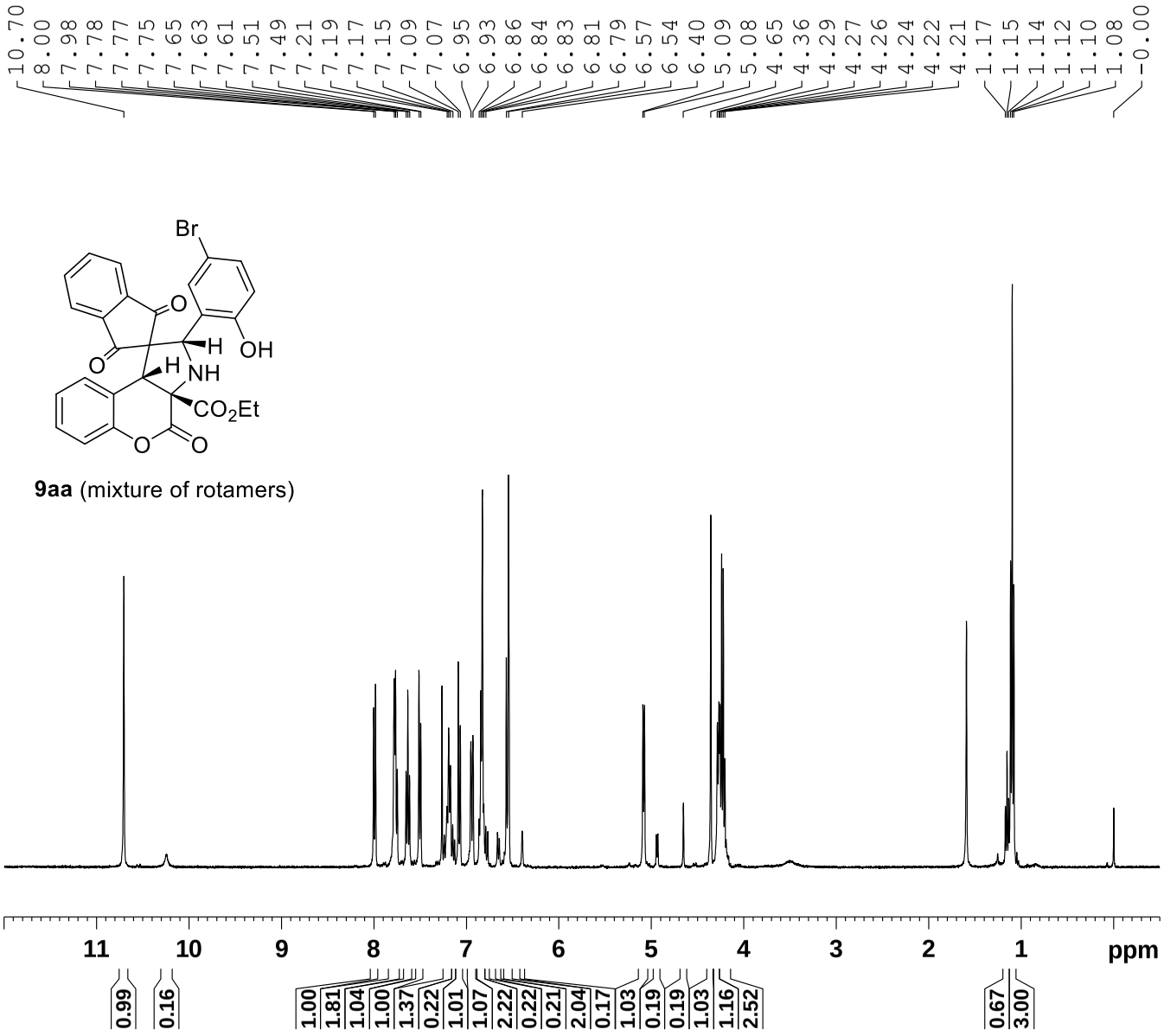



```
Current Data Parameters
NAME                  Hank140
EXPNO                       3
PROCNO                      1

F2 - Acquisition Parameters
Date_               20180430
Time                   12.02
INSTRUM                spect
PROBHD   5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       114
DW                    69.000 usec
DE                     6.50 usec
TE                     673.2 K
D1                 2.00000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                       1H
P1                     15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                      16384
SF            400.1300073 MHz
WDW                        EM
SSB       0
LB        0 Hz
GB        0
PC                      1.00
```

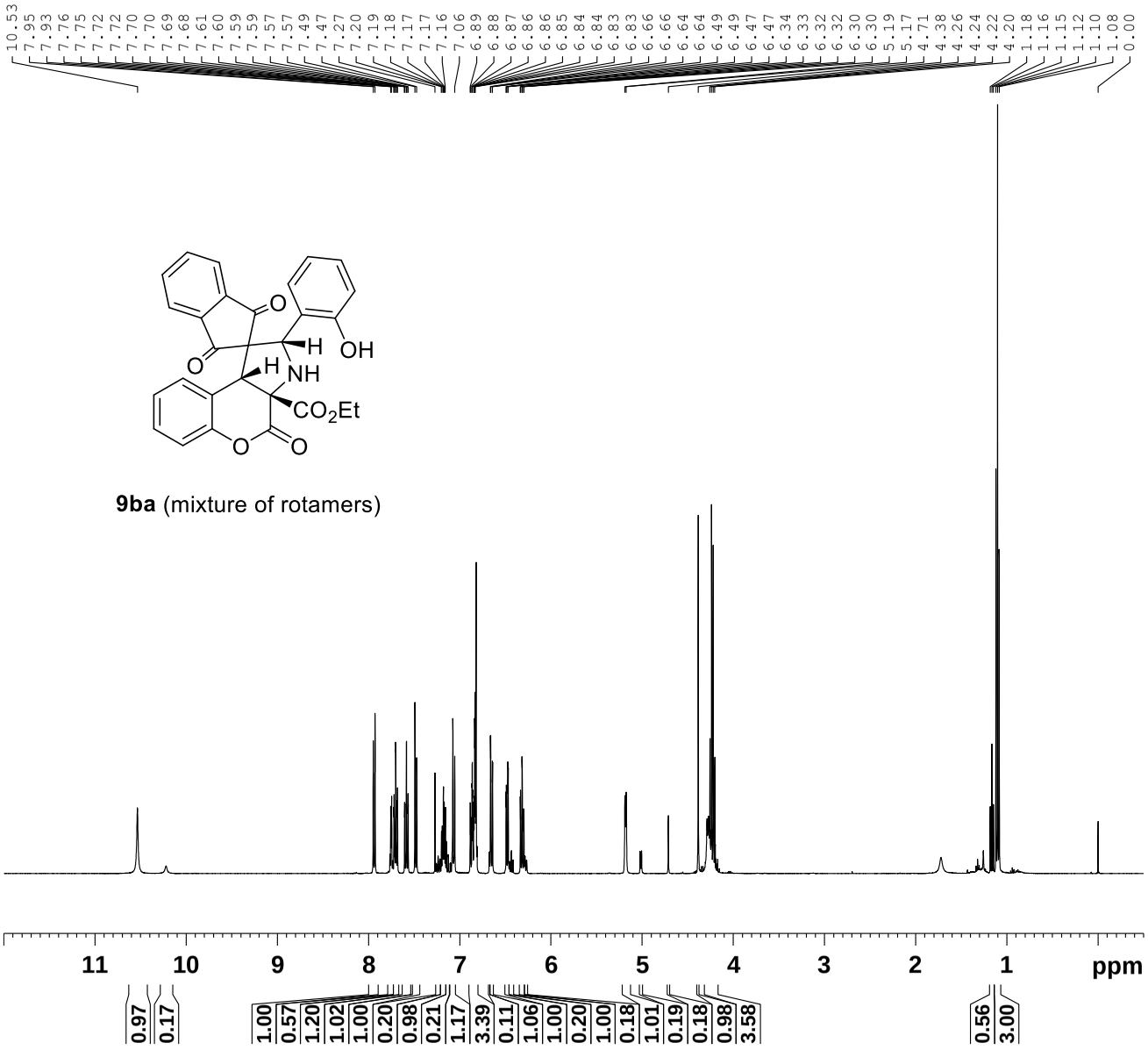


8a

```
Current Data Parameters
NAME                 Hank140
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20180430
Time                  12.04
INSTRUM               spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     1257
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                   20.800 usec
DE                    6.50 usec
TE                   673.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   10.45 usec
PL1                   7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2       0 dB
PL12                 15.00 dB
PL13                 20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                      32768
SF            100.6127716 MHz
WDW                        EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```

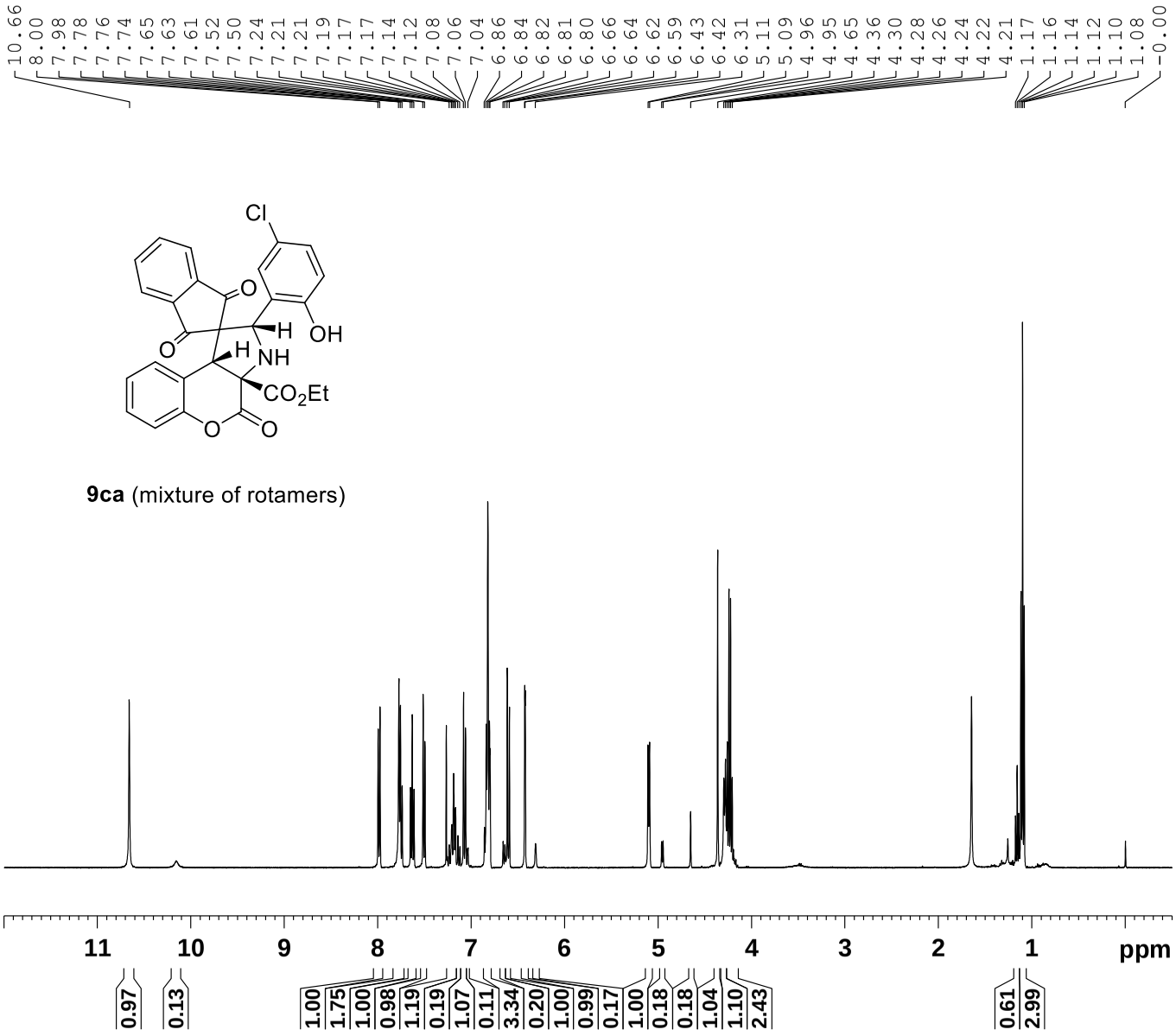



```
Current Data Parameters
NAME                  check
EXPNO                    17
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170529
Time                 16.21
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                   228.1
DW                  69.000 usec
DE                   6.50 usec
TE                  298.8 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300084 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```

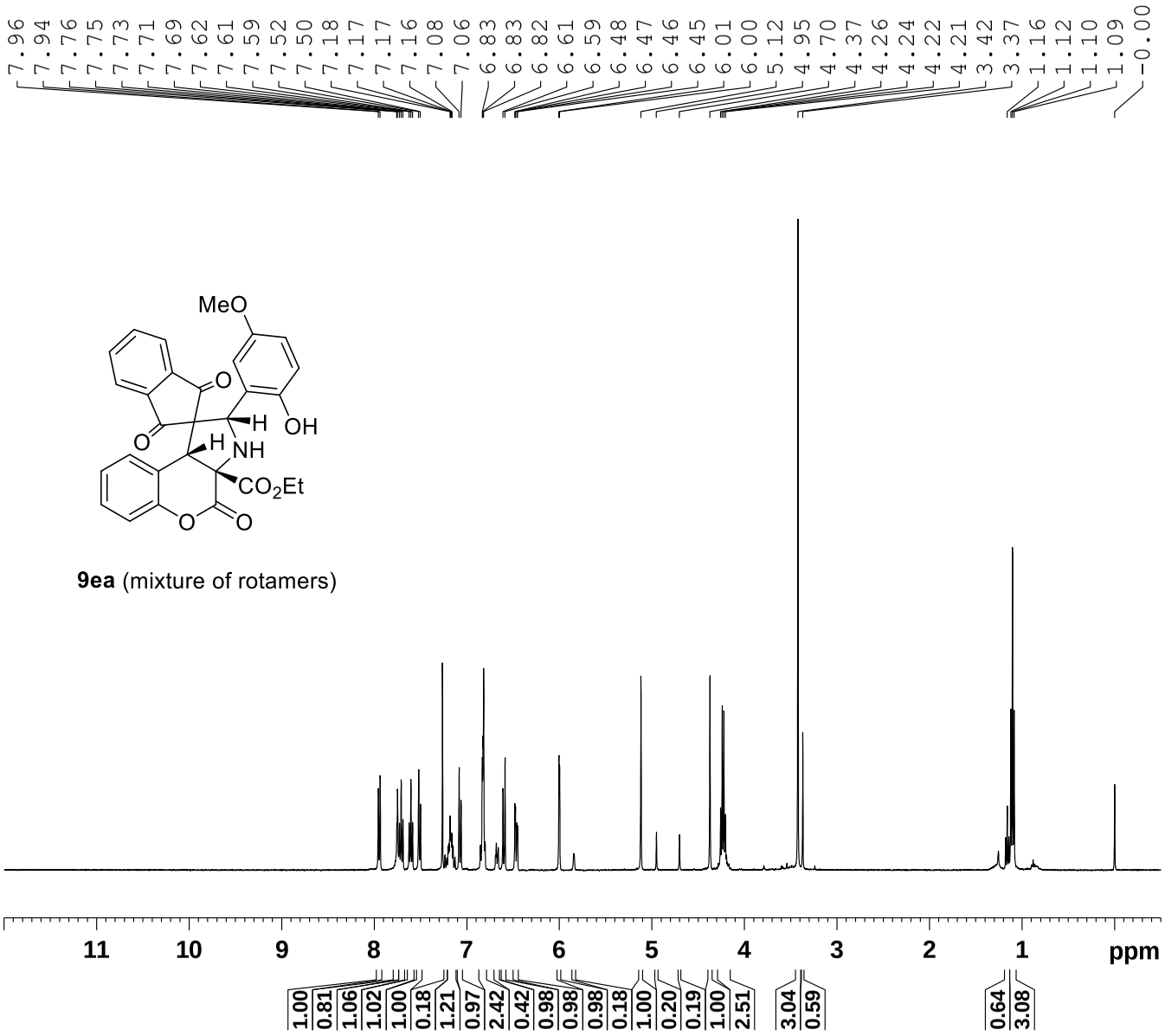


9ba (mixture of rotamers)

```
Current Data Parameters
NAME                  Liu75
EXPNO                     1
PROCNO                    1

F2 - Acquisition Parameters
Date_              20170410
Time                  22.14
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7211.539 Hz
FIDRES             0.220079 Hz
AQ                2.2719147 sec
RG                    71.42
DW                   69.333 usec
DE                    10.50 usec
TE                    298.2 K
D1              2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1           400.1324008 MHz
NUC1                   1H
P1                    12.90 usec
PLW1           15.00000000 W

F2 - Processing parameters
SI                    16384
SF             400.1300048 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```

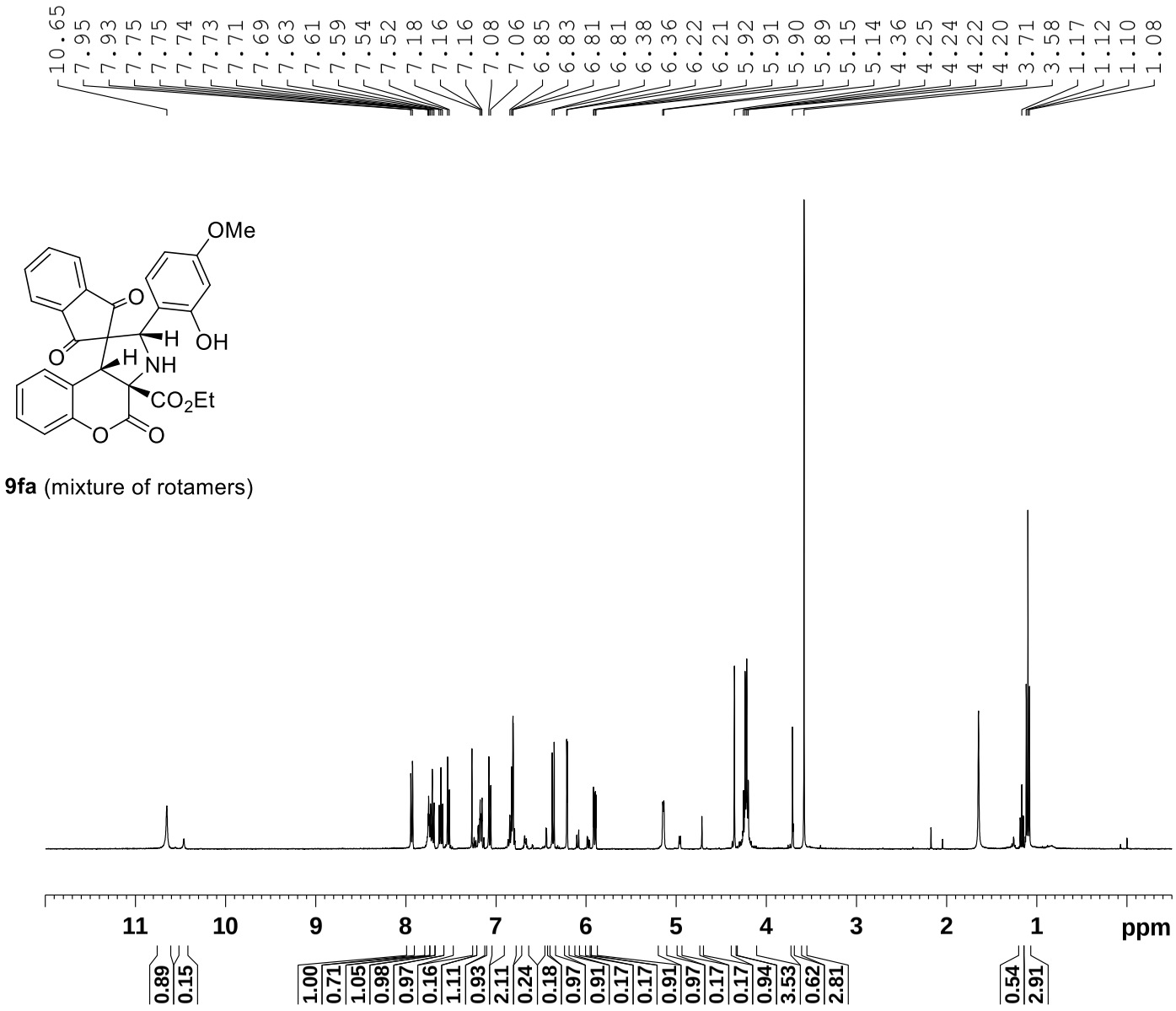



```
Current Data Parameters
NAME                  liu074
EXPNO                      5
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170408
Time                 14.15
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                   161.3
DW                  69.000 usec
DE                   6.50 usec
TE                  299.0 K
D1               2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                     1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300061 MHz
WDW                      EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



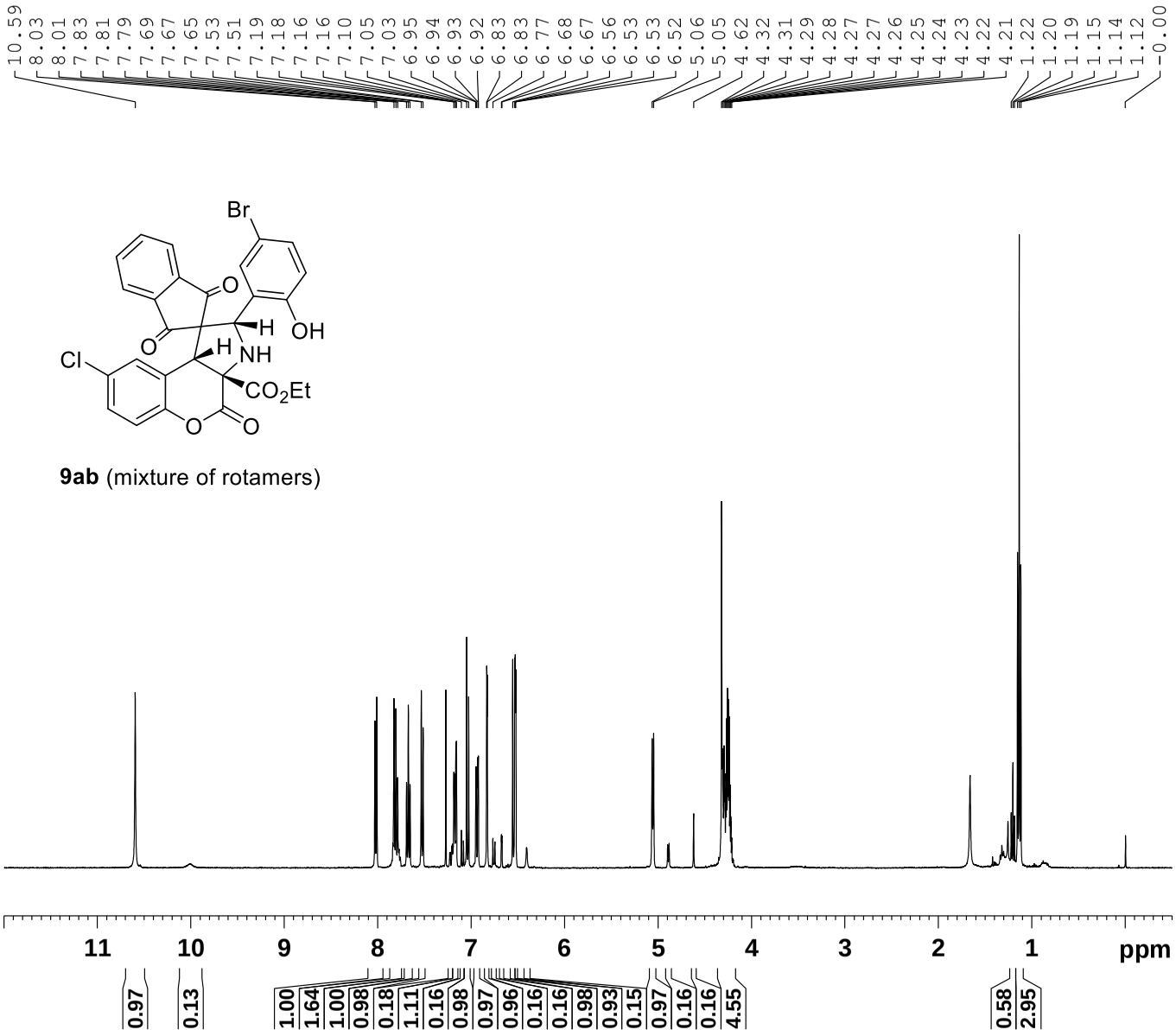
9ea (mixture of rotamers)

```
Current Data Parameters
NAME          5-OMe imine
EXPNO                   8
PROCNO                  1

F2 - Acquisition Parameters
Date_            20180512
Time                13.35
INSTRUM             spect
PROBHD    5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ               2.2609921 sec
RG                    181
DW                 69.000 usec
DE                  6.50 usec
TE                 673.2 K
D1              2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF            400.1300078 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



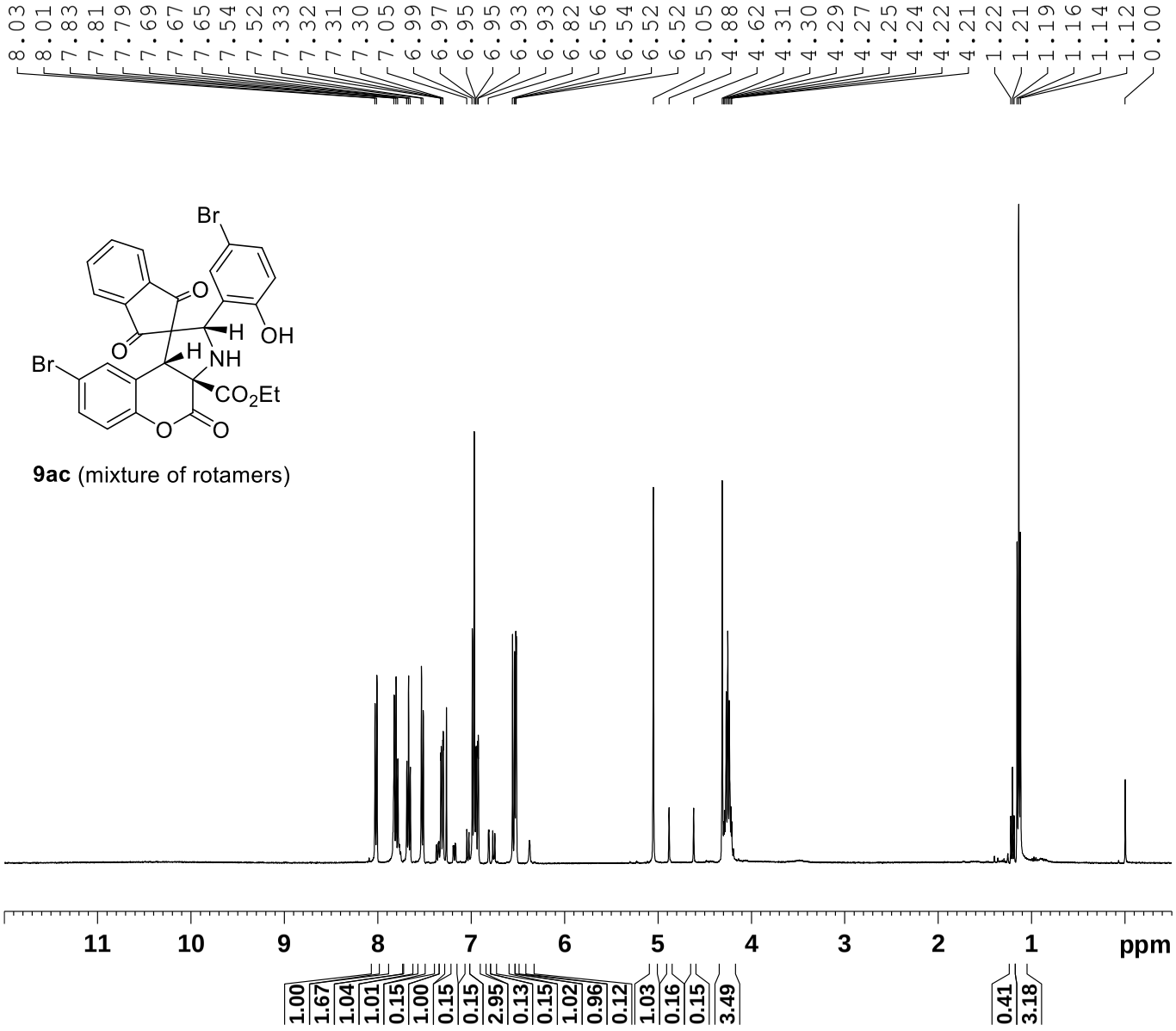
9fa (mixture of rotamers)

```
Current Data Parameters
NAME                  B143
EXPNO                   11
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170503
Time                   2.06
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                      181
DW                   69.000 usec
DE                    6.50 usec
TE                   295.2 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                      16384
SF            400.1300061 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```

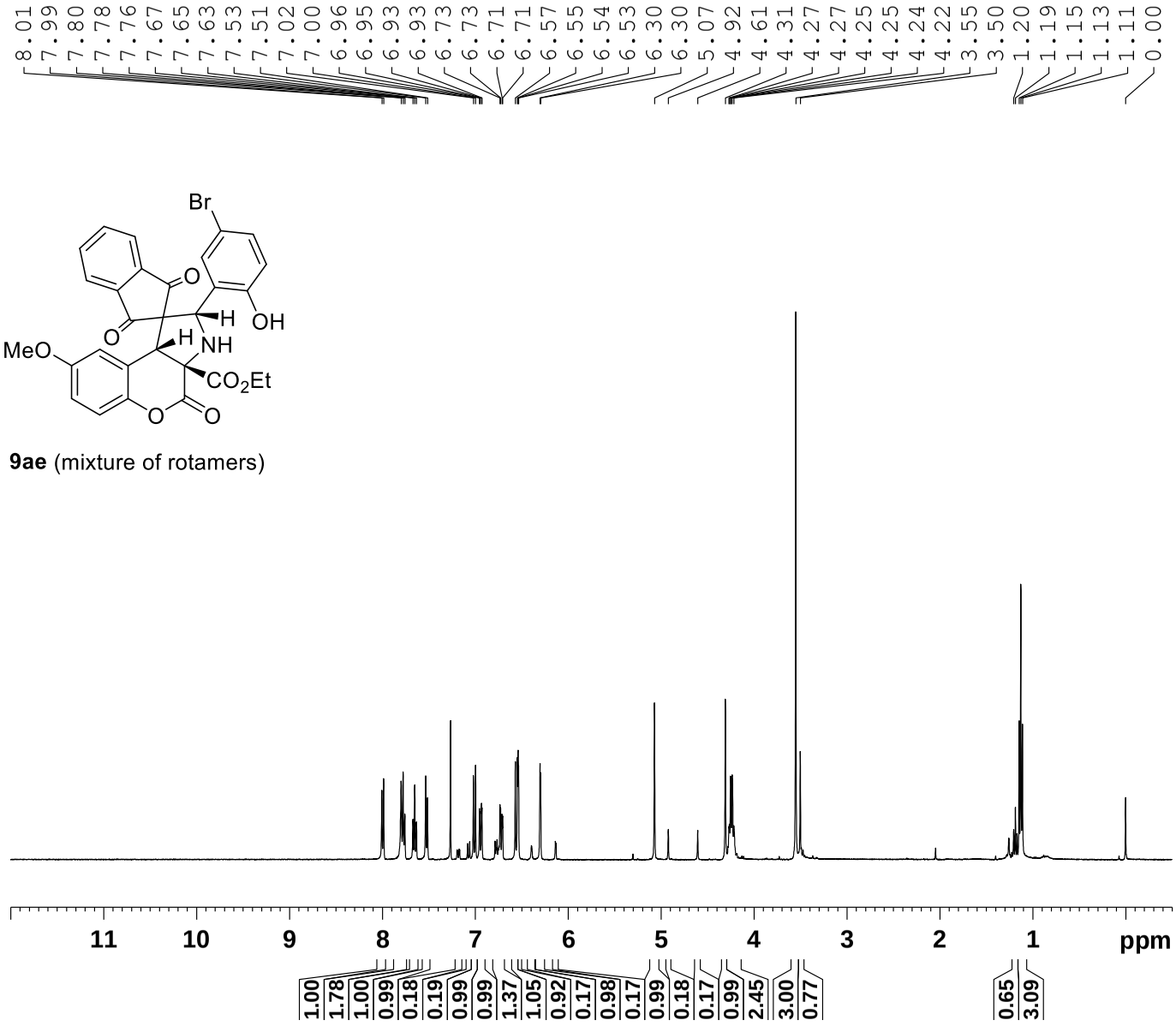


9ab (mixture of rotamers)

```
Current Data Parameters
NAME                liu145
EXPNO                    8
PROCNO                   1

F2 - Acquisition Parameters
Date_             20170406
Time                 15.05
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                      114
DW                   69.000 usec
DE                    6.50 usec
TE                   295.5 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300051 MHz
WDW                      EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```

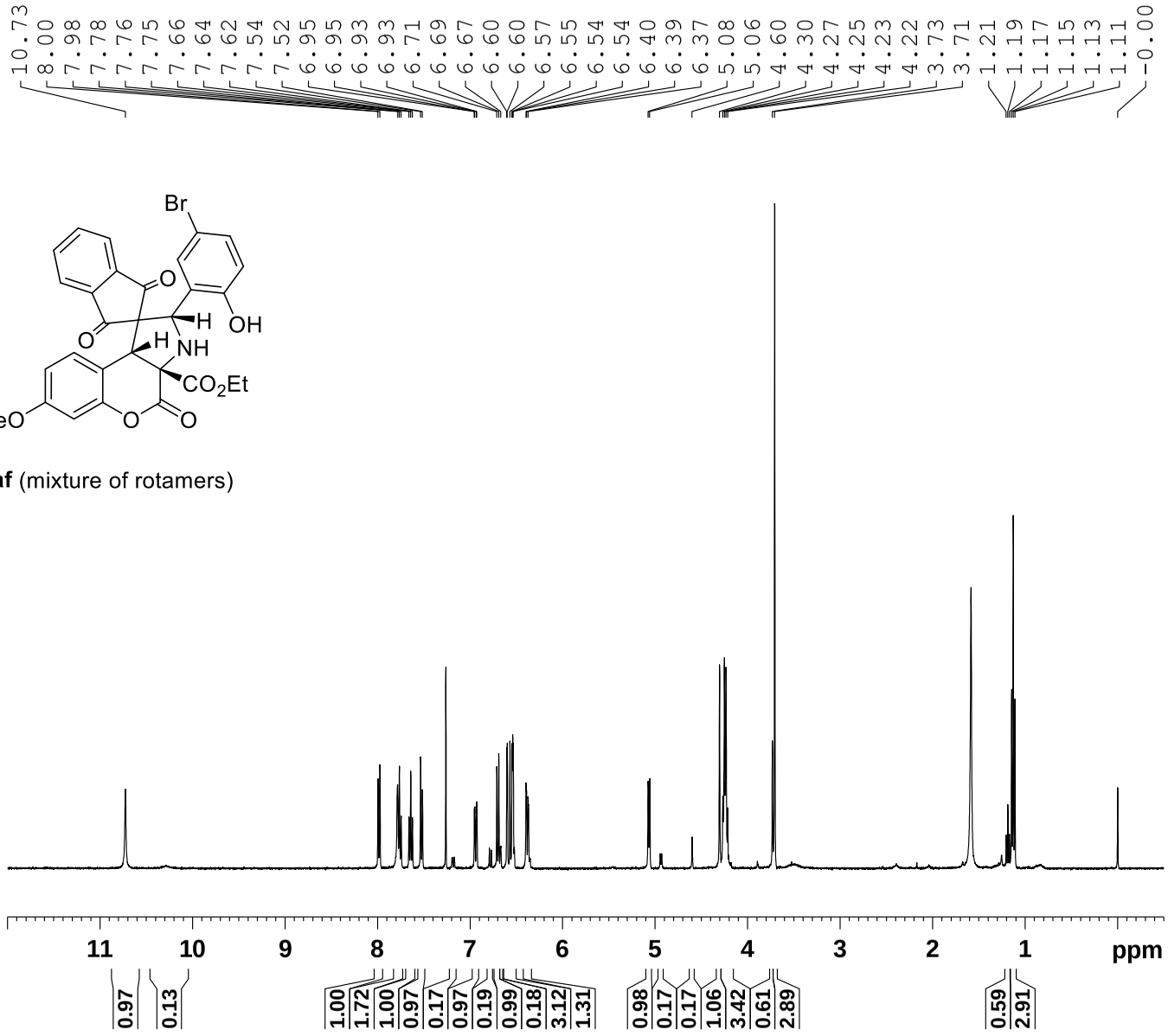



```
Current Data Parameters
NAME      5-Br imine, 5-Br in
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_             20180511
Time                 14.04
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ               2.2609921 sec
RG                     114
DW                  69.000 usec
DE                   6.50 usec
TE                  673.2 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  15.00 usec
PL1       0 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300065 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



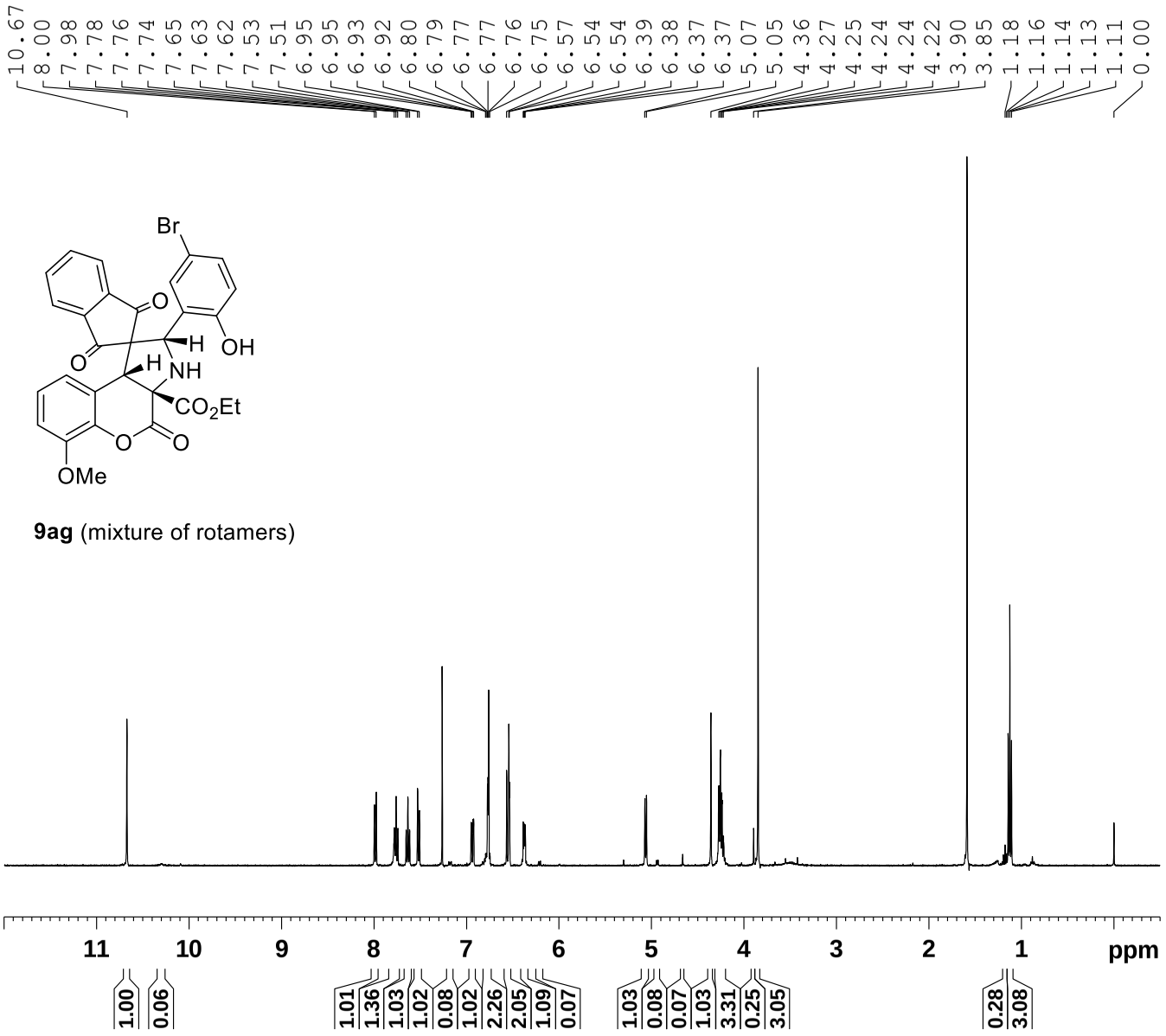
9ae (mixture of rotamers)

```
Current Data Parameters
NAME      5-Br imine, 5-OMe in
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_            20180511
Time                15.27
INSTRUM             spect
PROBHD   5 mm BBO BB-1H
PULPROG              zg30
TD                  32768
SOLVENT             CDC13
NS                     16
DS                      0
SWH              7246.377 Hz
FIDRES           0.221142 Hz
AQ              2.2609921 sec
RG                    114
DW                 69.000 usec
DE                  6.50 usec
TE                 673.2 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 15.00 usec
PL1       0 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                  16384
SF            400.1300070 MHz
WDW                    EM
SSB       0
LB        0 Hz
GB        0
PC                   1.00
```



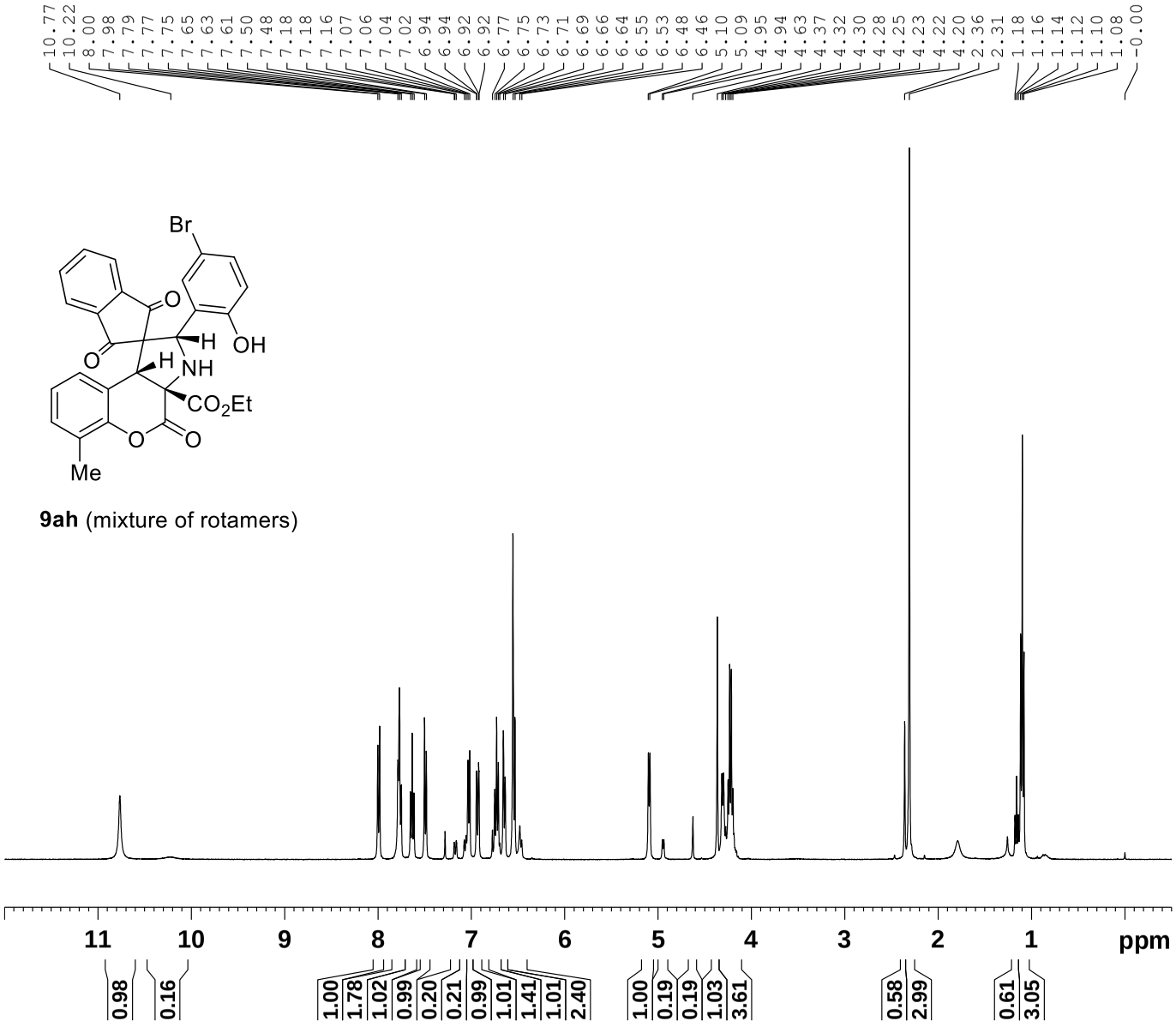
9af (mixture of rotamers)

```
Current Data Parameters
NAME                 vicky174
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_               20170429
Time                   14.51
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        16
DS                         0
SWH                 7246.377 Hz
FIDRES              0.221142 Hz
AQ                  2.2609921 sec
RG                       256
DW                    69.000 usec
DE                     6.50 usec
TE                    298.7 K
D1                 2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.40 usec
PL1                     1.80 dB
SFO1             400.1324008 MHz

F2 - Processing parameters
SI                     16384
SF               400.1300083 MHz
WDW                       EM
SSB          0
LB           0 Hz
GB           0
PC                     1.00
```



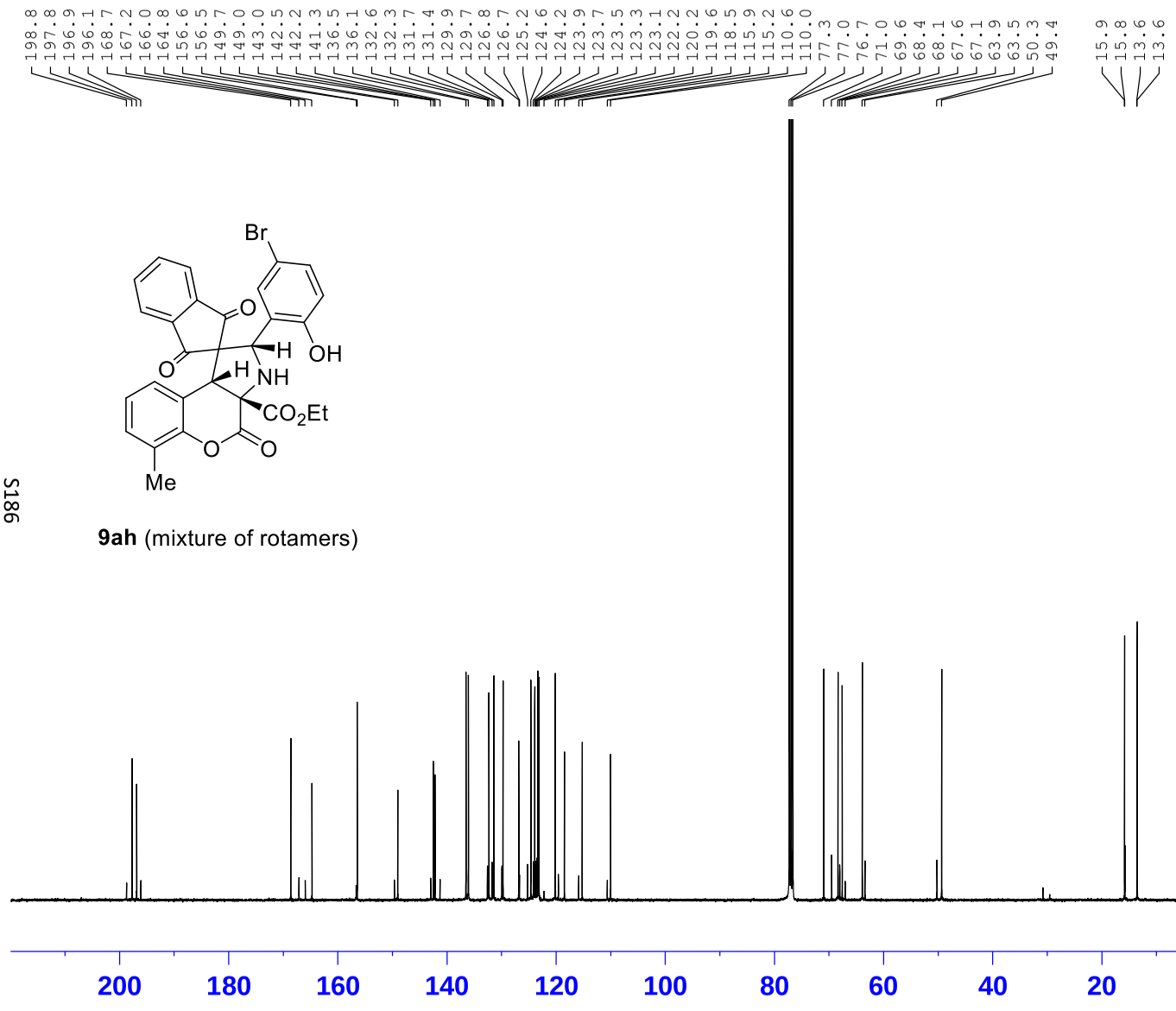
9ag (mixture of rotamers)

```
Current Data Parameters
NAME                  3OMe
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_              20170416
Time                 14.30
INSTRUM              spect
PROBHD    5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES               0.221142 Hz
AQ                2.2609921 sec
RG                   322.5
DW                  69.000 usec
DE                   6.50 usec
TE                  295.2 K
D1             2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.40 usec
PL1                   1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300078 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



9ah (mixture of rotamers)

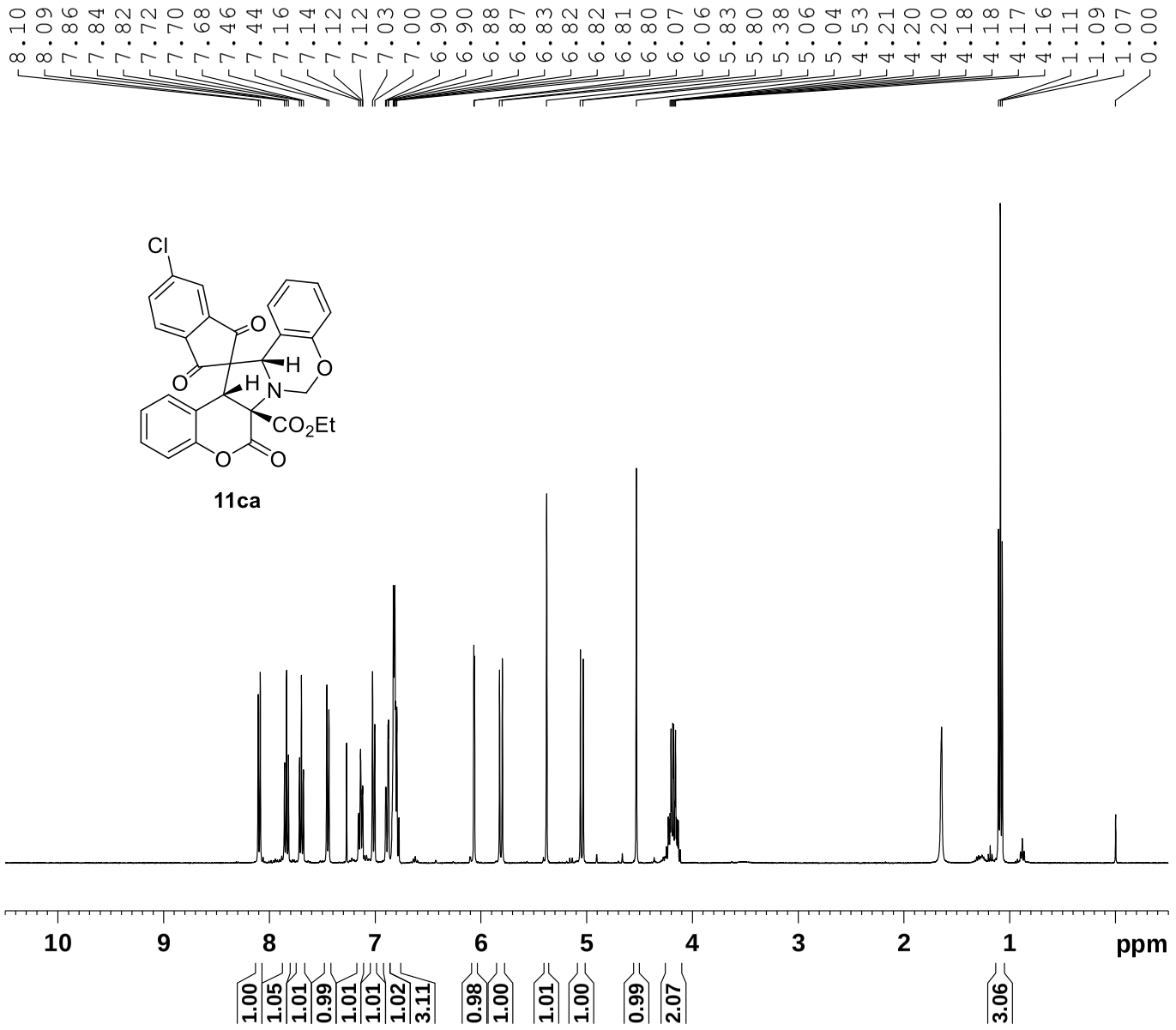
```
Current Data Parameters
NAME                   3Me
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_             20170414
Time                 21.14
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG               zg30
TD                   32768
SOLVENT              CDC13
NS                      16
DS                       0
SWH               7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                     114
DW                  69.000 usec
DE                   6.50 usec
TE                  295.2 K
D1              2.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                  14.40 usec
PL1                  1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                   16384
SF            400.1300010 MHz
WDW                     EM
SSB       0
LB        0 Hz
GB        0
PC                    1.00
```



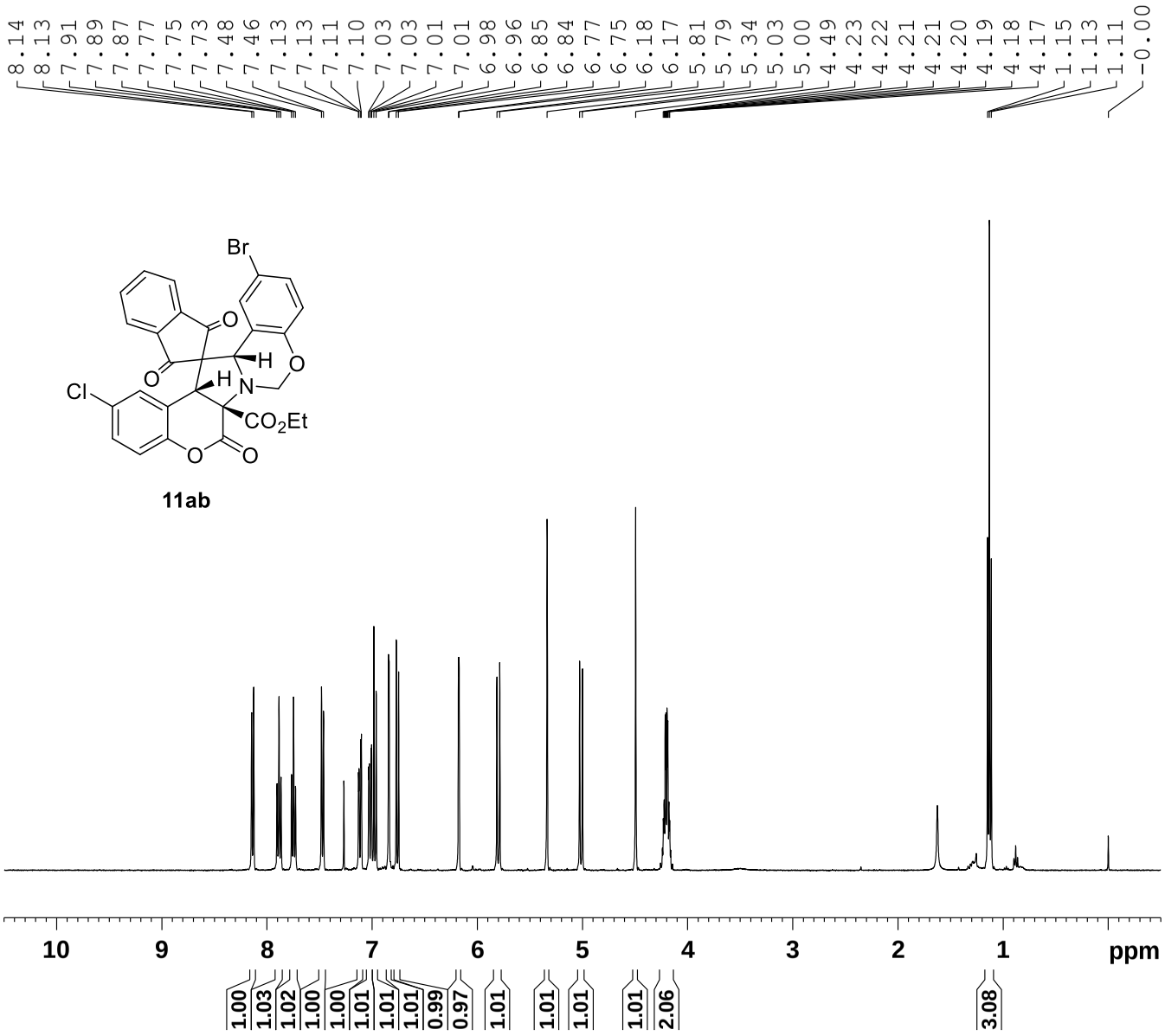
S186

9ah (mixture of rotamers)

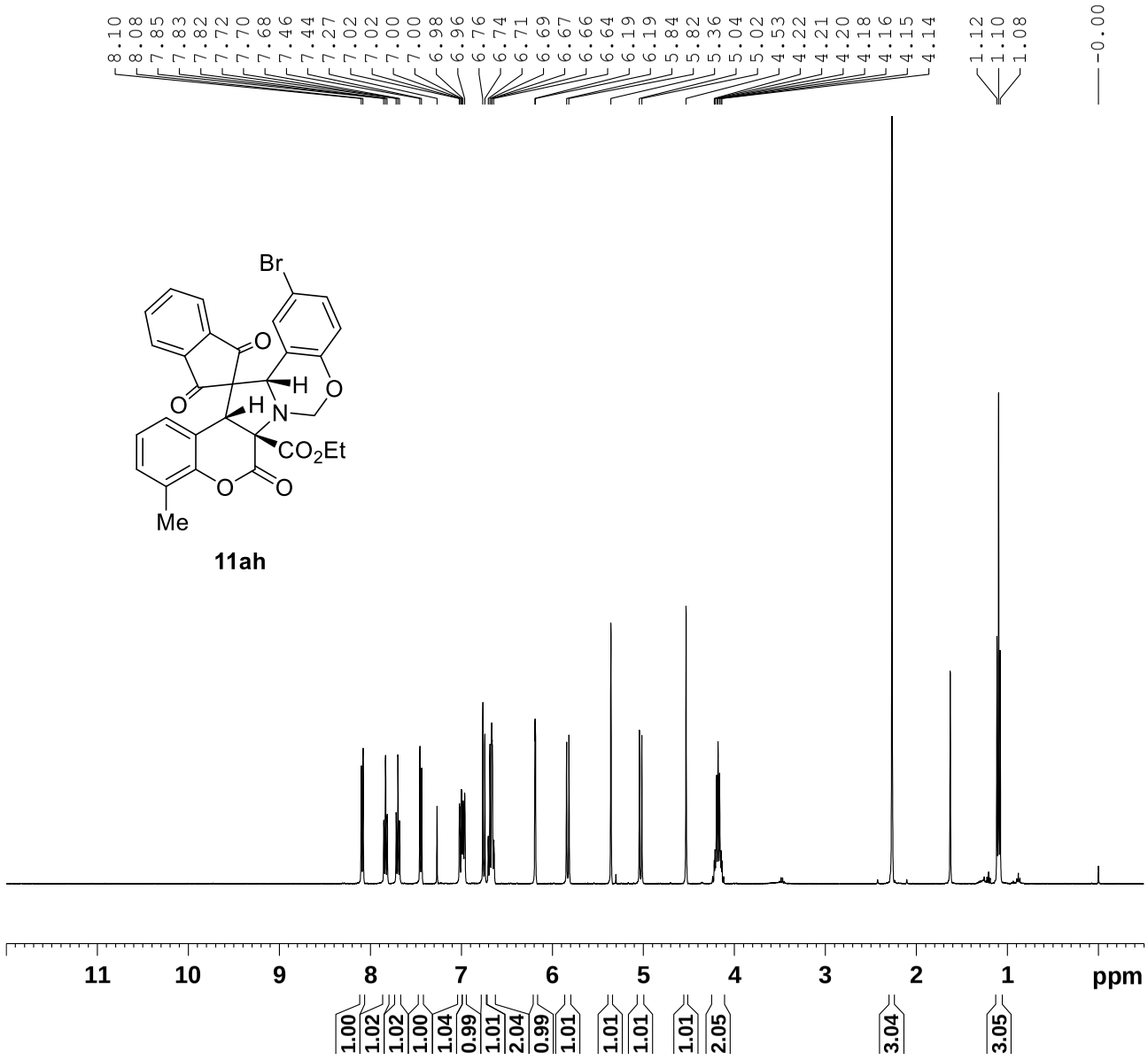
```
Current Data Parameters
NAME                  3Me
EXPNO                    3
PROCNO                   1

F2 - Acquisition Parameters
Date_             20170414
Time                 22.06
INSTRUM              spect
PROBHD   5 mm BBO BB-1H
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                   15008
DS                       0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   5792.6
DW                  20.800 usec
DE                   6.50 usec
TE                  295.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2          waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF            100.6127774 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```



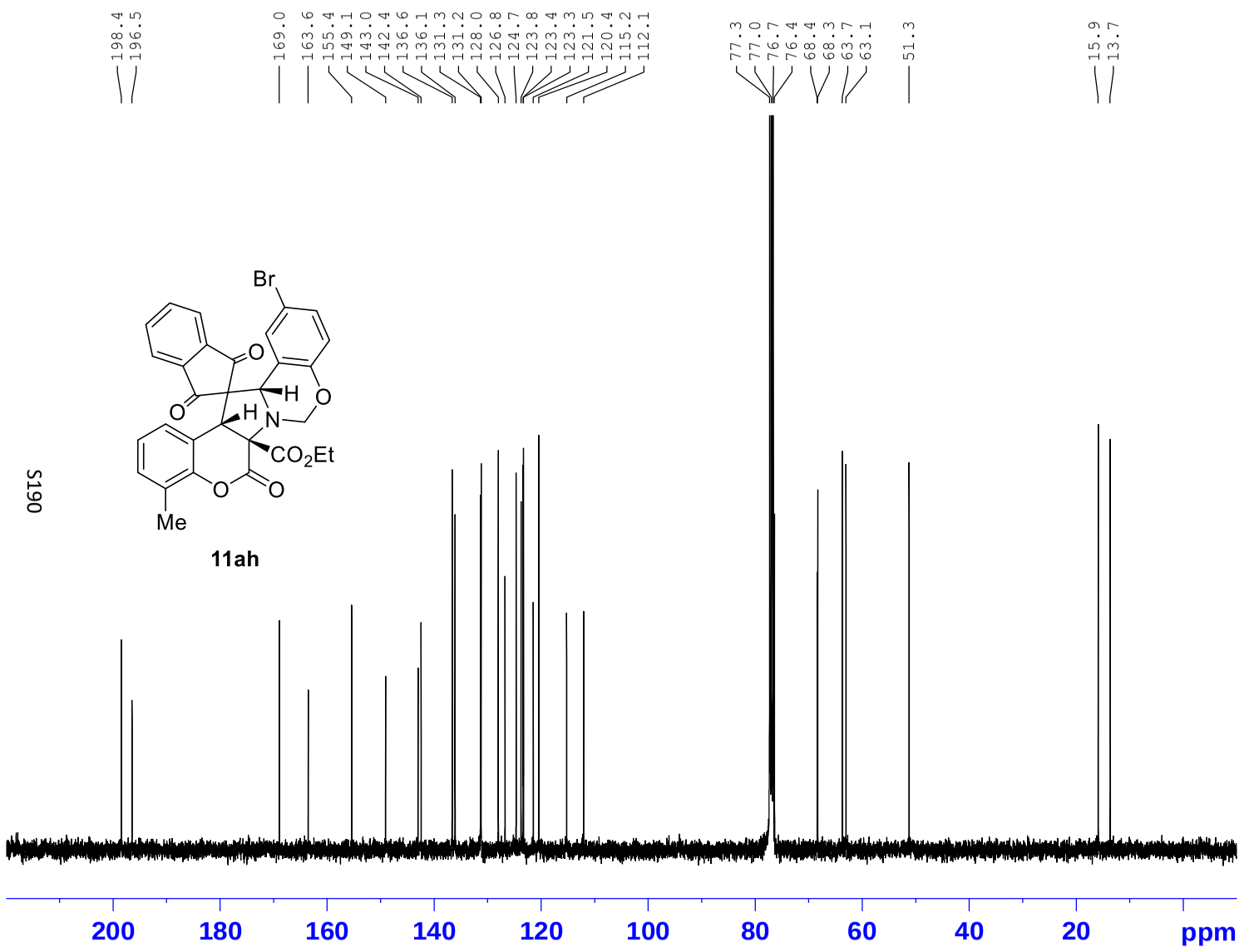

```
Current Data Parameters
NAME            vicky176
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170419
Time               16.14
INSTRUM            spect
PROBHD   5 mm BBO BB-1H
PULPROG             zg30
TD                 32768
SOLVENT            CDCl3
NS                    16
DS                     0
SWH             7246.377 Hz
FIDRES          0.221142 Hz
AQ              2.2609921 sec
RG                 161.3
DW                69.000 usec
DE                 6.50 usec
TE                295.4 K
D1             2.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1         400.1324008 MHz

F2 - Processing parameters
SI                 16384
SF           400.1300052 MHz
WDW                   EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME      5Cl derivative
EXPNO                  9
PROCNO                 1

F2 - Acquisition Parameters
Date_           20170425
Time              19.27
INSTRUM           spect
PROBHD   5 mm BBO BB-1H
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            7246.377 Hz
FIDRES        0.221142 Hz
AQ            2.2609921 sec
RG                161.3
DW               69.000 usec
DE                6.50 usec
TE                297.3 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.40 usec
PL1                1.80 dB
SFO1        400.1324008 MHz

F2 - Processing parameters
SI                16384
SF          400.1300055 MHz
WDW                  EM
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```




```
Current Data Parameters
NAME                  Liu160
EXPNO                      3
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170410
Time                  18.08
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       16
DS                        0
SWH                7246.377 Hz
FIDRES            0.221142 Hz
AQ                2.2609921 sec
RG                    161.3
DW                   69.000 usec
DE                    6.50 usec
TE                   296.2 K
D1              2.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.40 usec
PL1                    1.80 dB
SFO1          400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF            400.1300061 MHz
WDW                      EM
SSB       0
LB        0 Hz
GB        0
PC                     1.00
```

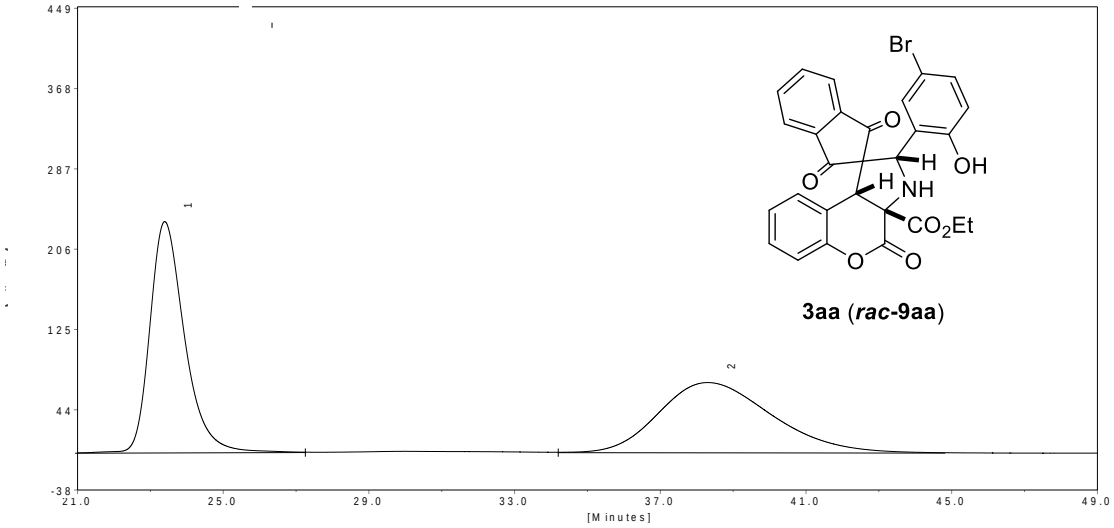



```
Current Data Parameters
NAME                  Liu160
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20170410
Time                  18.11
INSTRUM               spect
PROBHD    5 mm BBO BB-1H
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                     2608
DS                        0
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                     8192
DW                  20.800 usec
DE                   6.50 usec
TE                  296.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                    13C
P1                   9.00 usec
PL1                  7.00 dB
SFO1          100.6233325 MHz

======== CHANNEL f2 ========
CPDPRG[2           waltz16
NUC2                    1H
PCPD2               90.00 usec
PL2                  1.80 dB
PL12                17.00 dB
PL13                20.00 dB
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6127727 MHz
WDW                       EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.00
```

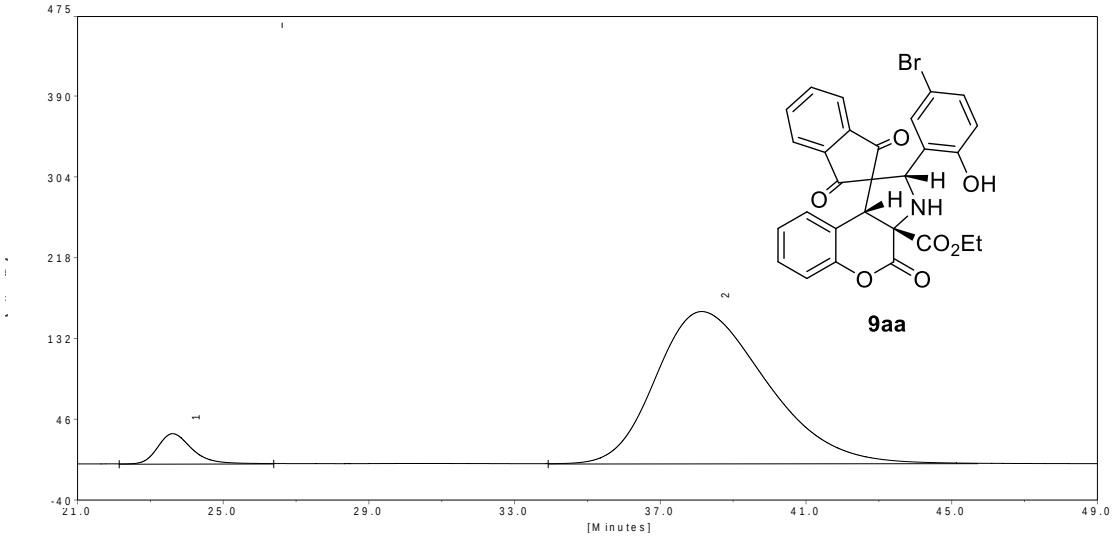
16. HPLC chromatograms of adducts 9

HPLC chromatogram for **9aa**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 245 nm



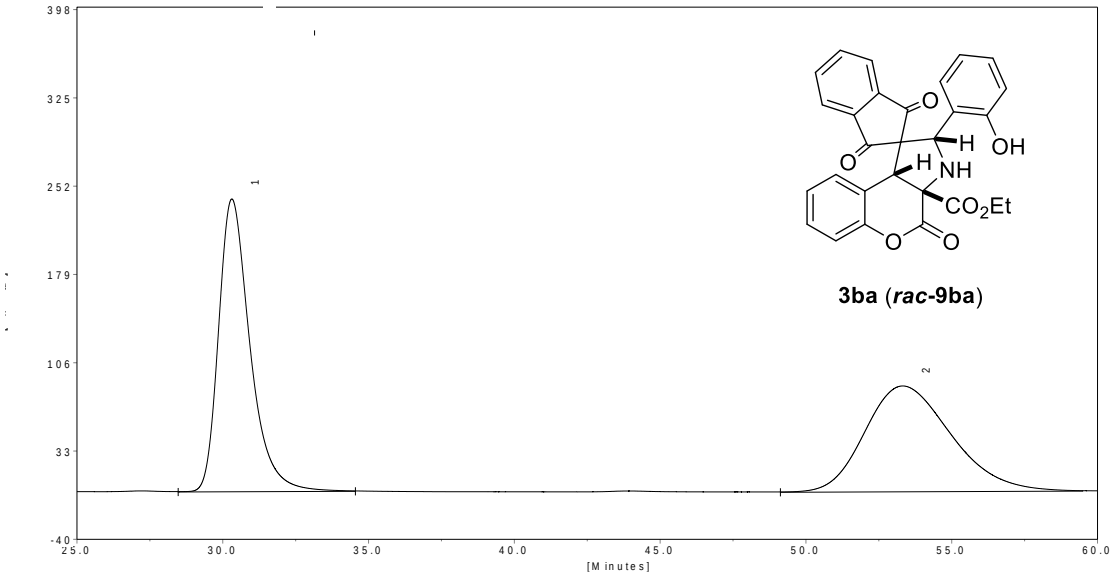
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
23.39	233.04	15351.91	50.3951
38.31	70.49	15111.22	49.6049



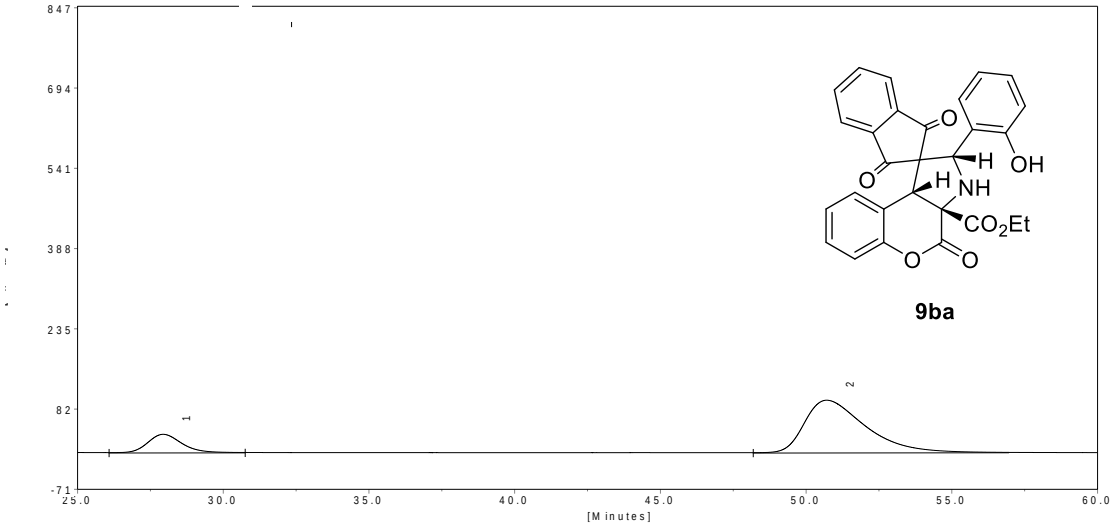
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
23.61	32.01	2061.08	5.6761
38.14	161.74	34250.14	94.3239

HPLC chromatogram for **9ba**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 245 nm



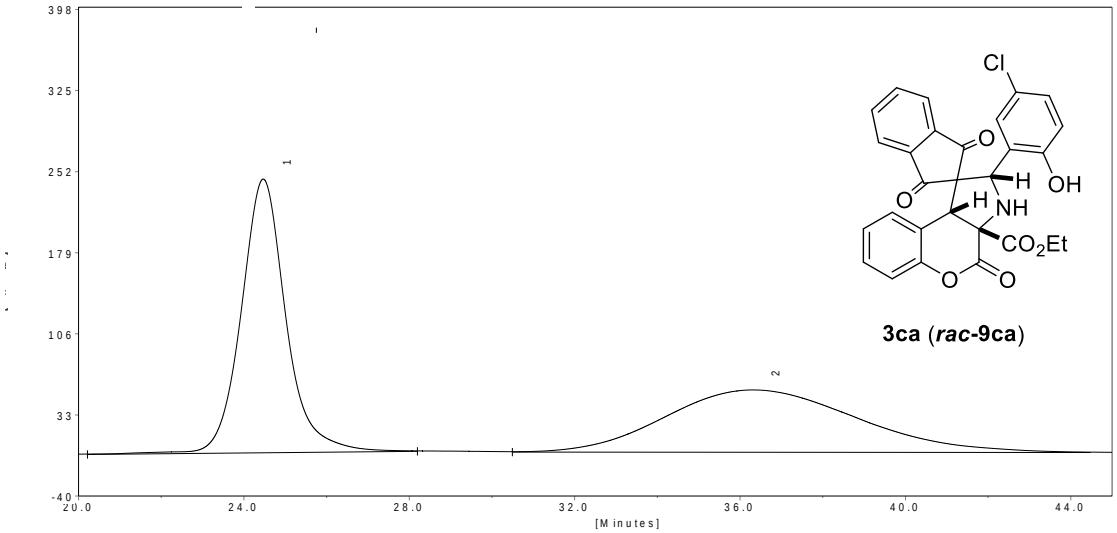
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
30.31	241.83	18045.84	50.2331
53.32	87.20	17878.35	49.7669



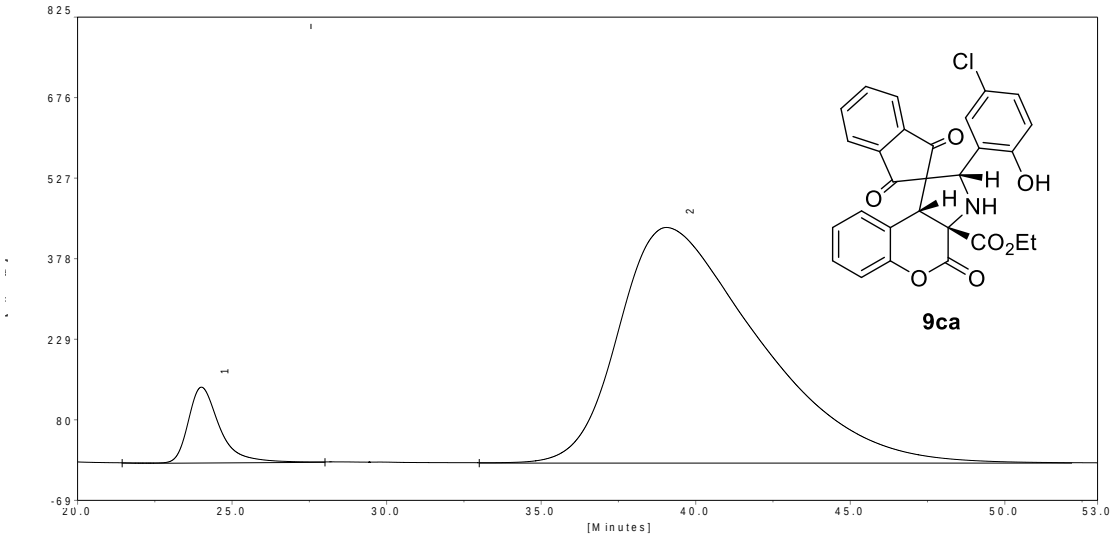
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
27.94	34.79	2765.17	16.0978
50.71	99.85	14412.13	83.9022

HPLC chromatogram for **9ca**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 245 nm



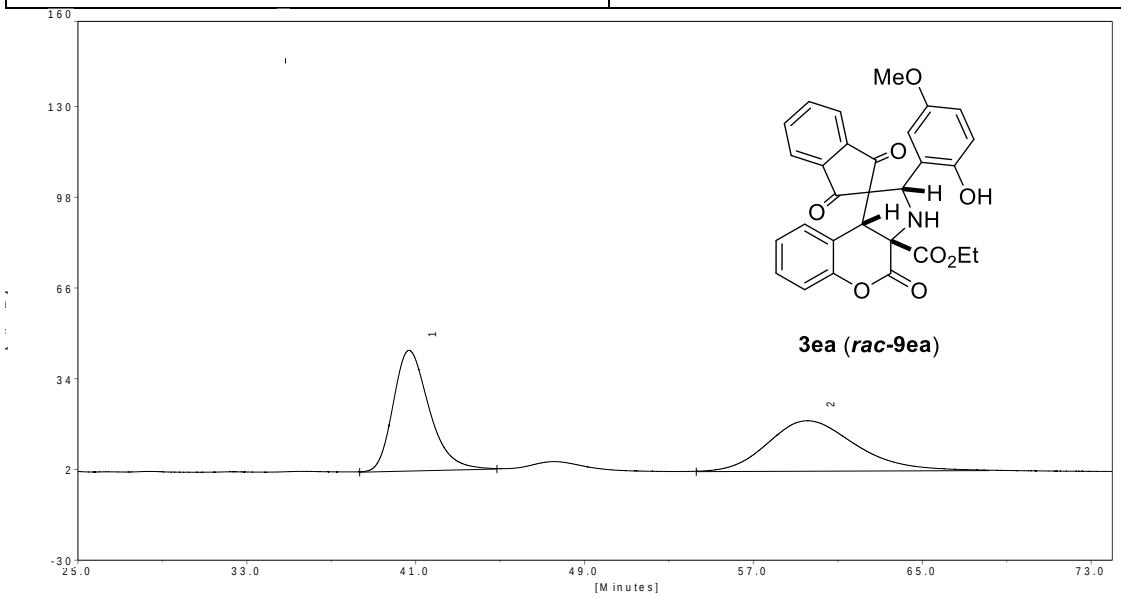
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
24.47	246.06	18397.71	50.8580
36.29	55.74	17776.93	49.1420



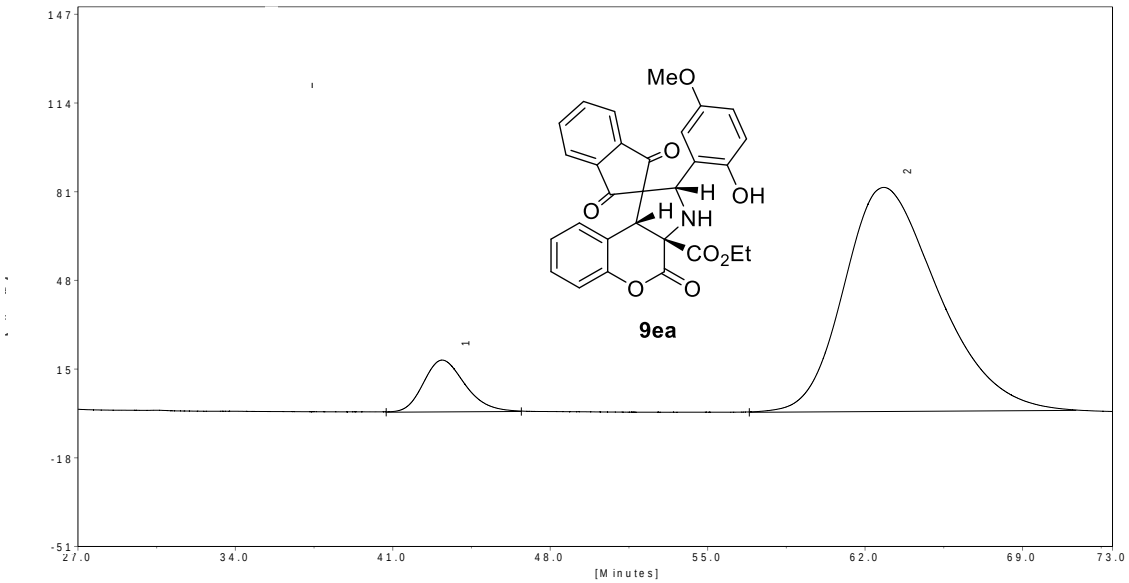
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
24.01	139.20	9597.82	6.5248
39.06	435.05	137499.40	93.4752

HPLC chromatogram for **9ea**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 245 nm



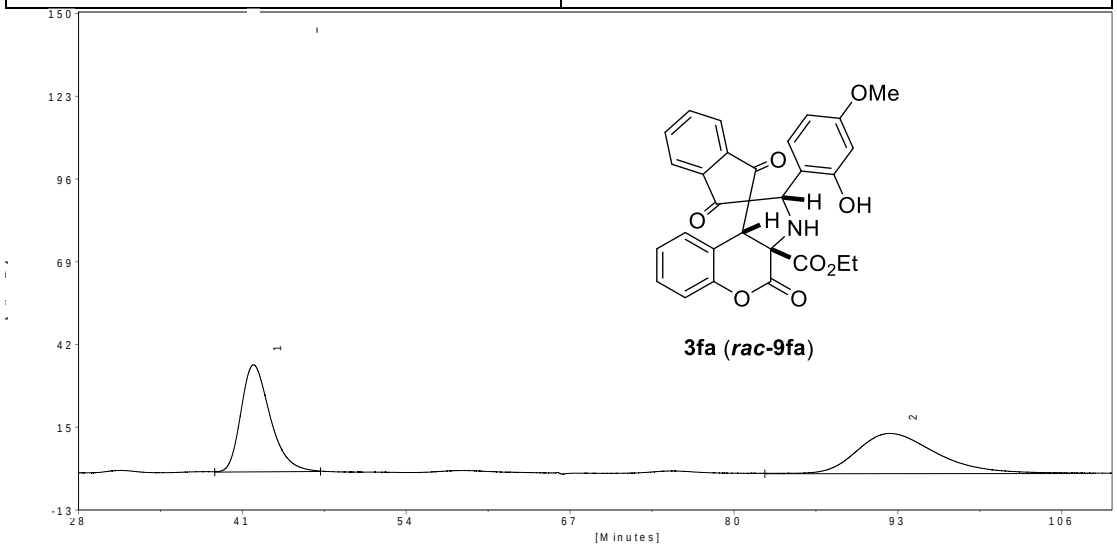
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
40.69	42.43	4999.48	49.6542
59.55	17.66	5069.12	50.3458



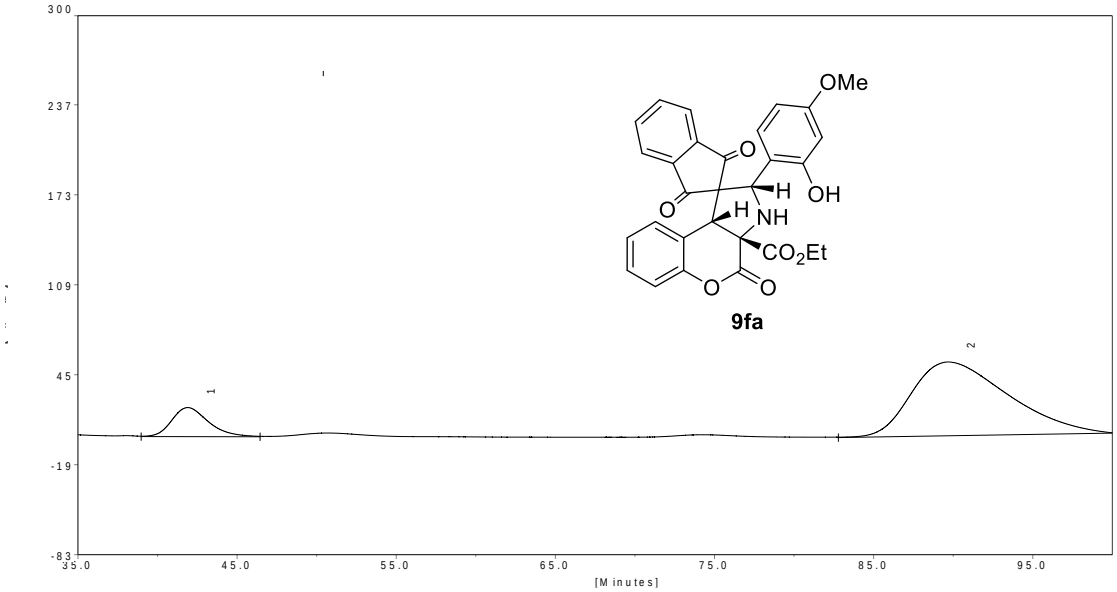
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
43.20	19.14	2431.42	9.1001
62.84	83.23	24287.13	90.8999

HPLC chromatogram for **9fa**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 245 nm



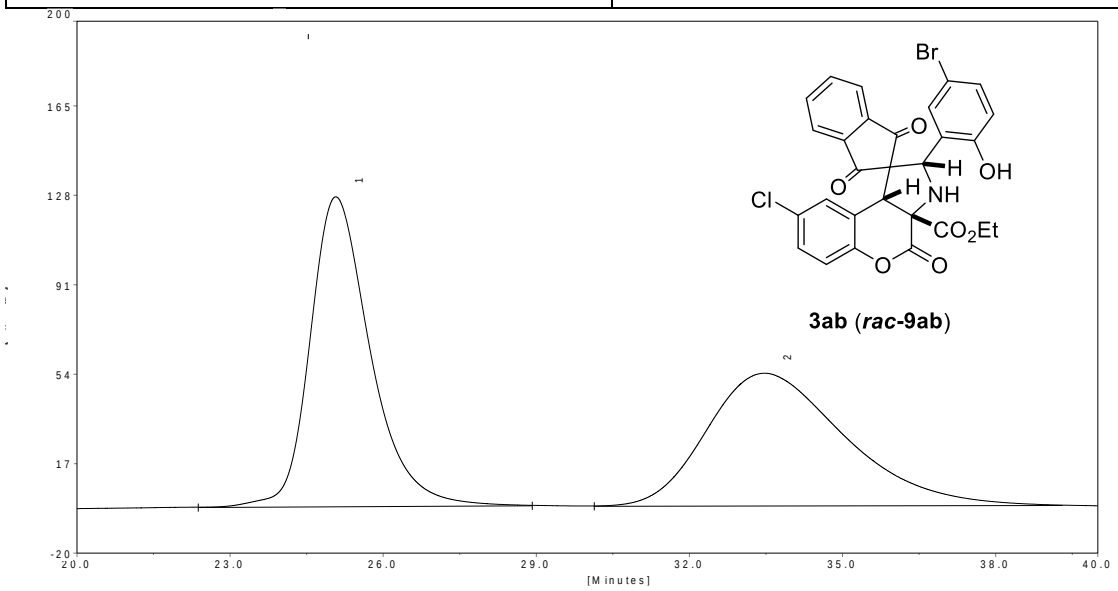
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
41.90	34.81	5568.92	49.8442
92.33	12.99	5603.73	50.1558



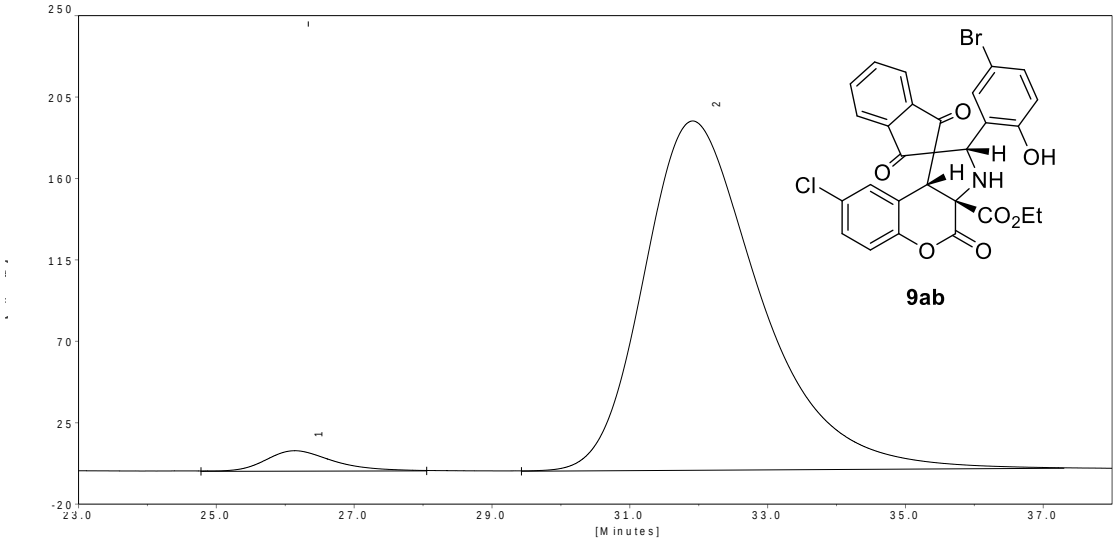
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
41.90	20.40	3191.36	12.7666
89.65	52.20	21806.46	87.2334

HPLC chromatogram for **9ab**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80:20	Detector: UV 245 nm



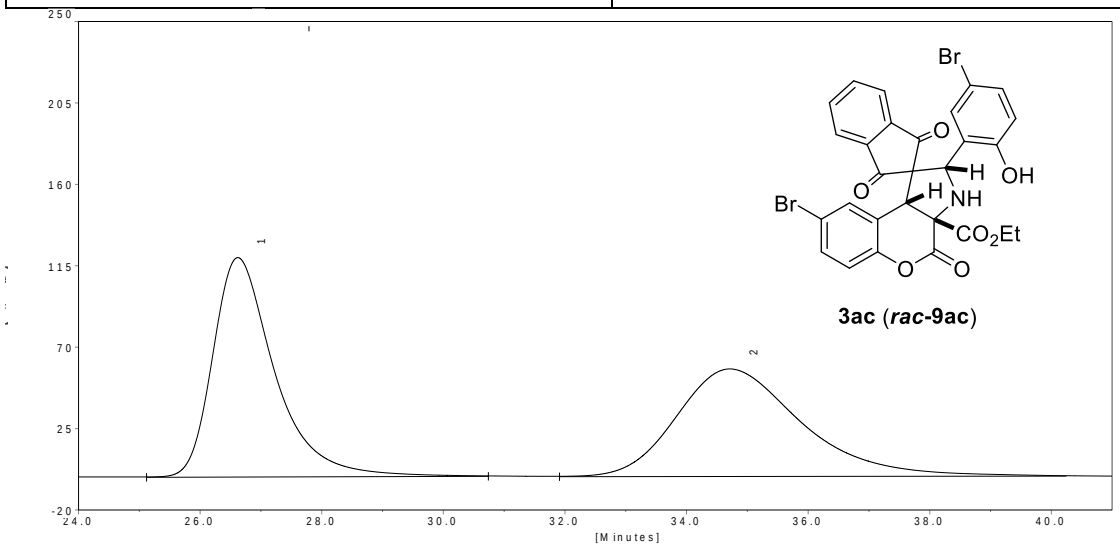
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
25.07	128.05	10485.75	50.5154
33.47	54.77	10271.78	49.4846



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
26.14	11.07	726.80	3.1104
31.91	192.86	22640.39	96.8896

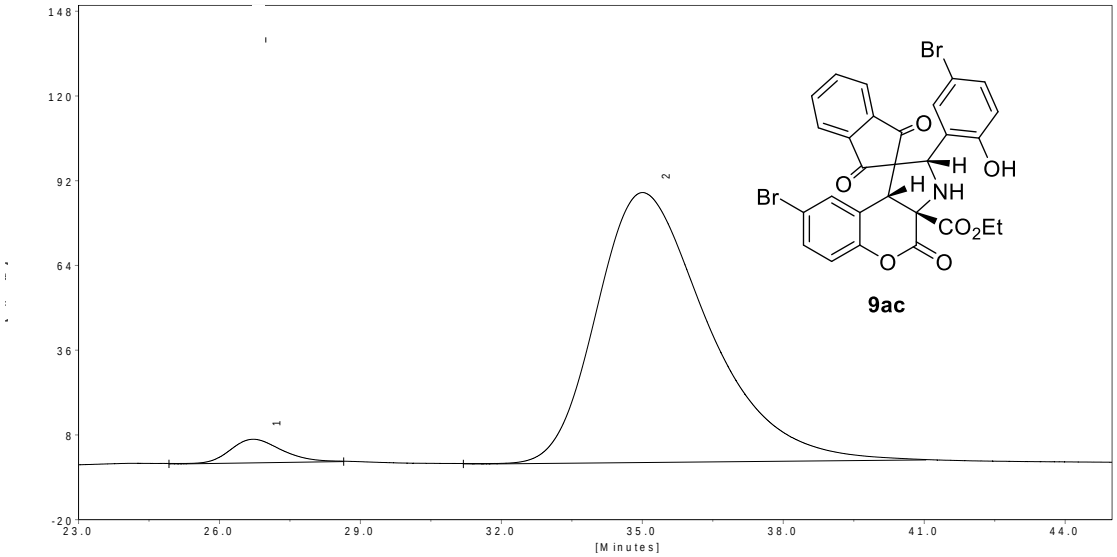
HPLC chromatogram for **9ac**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80:20	Detector: UV 245 nm



3ac (***rac*-9ac**)

Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
26.62	121.08	8525.40	50.3847
34.71	59.25	8395.20	49.6153

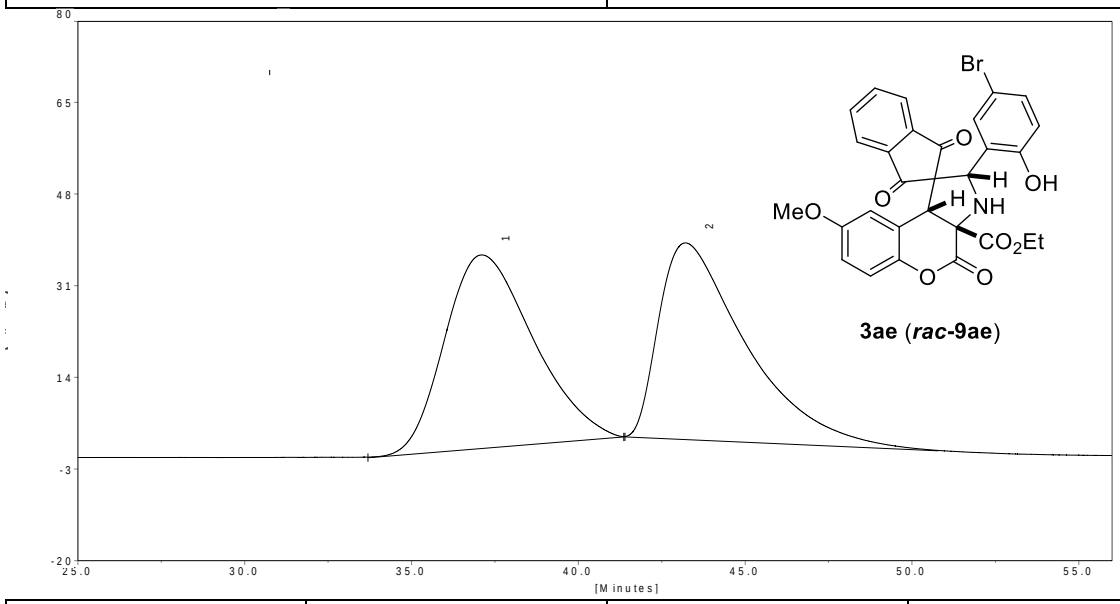


9ac

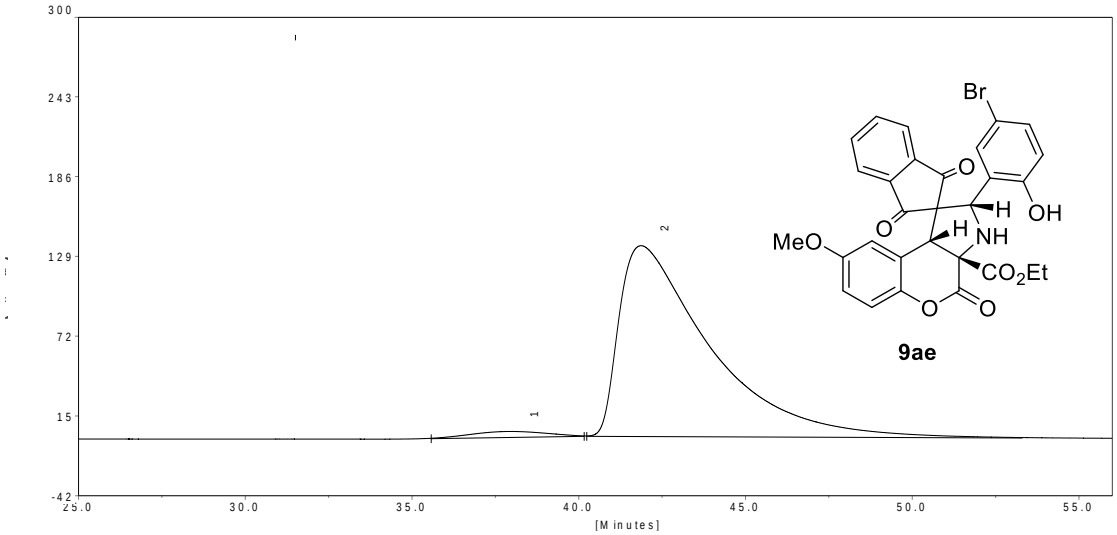
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
26.71	7.62	559.62	3.6857
35.00	89.02	14624.01	96.3143

HPLC chromatogram for **9ae**

Column: CHIRALPAK IB	Flow rate: 1.0 ml/min
Solvent: Hex:EtOH = 85: 15	Detector: UV 245 nm



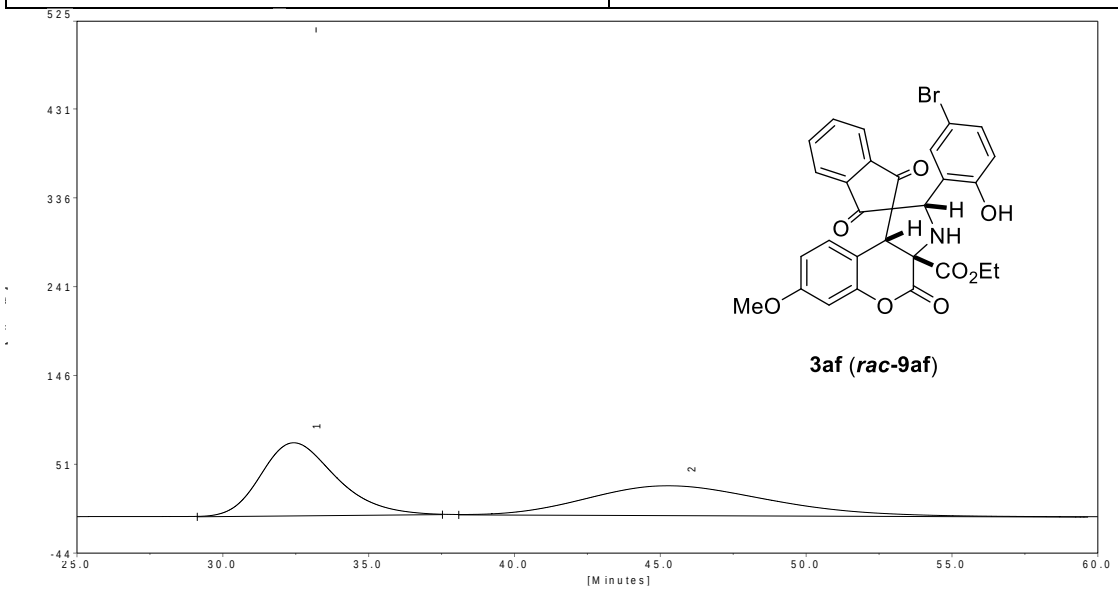
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
37.11	35.79	6578.72	49.8725
43.22	36.40	6612.34	50.1275



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
37.96	3.99	603.02	2.2956
41.87	136.02	25665.39	97.7044

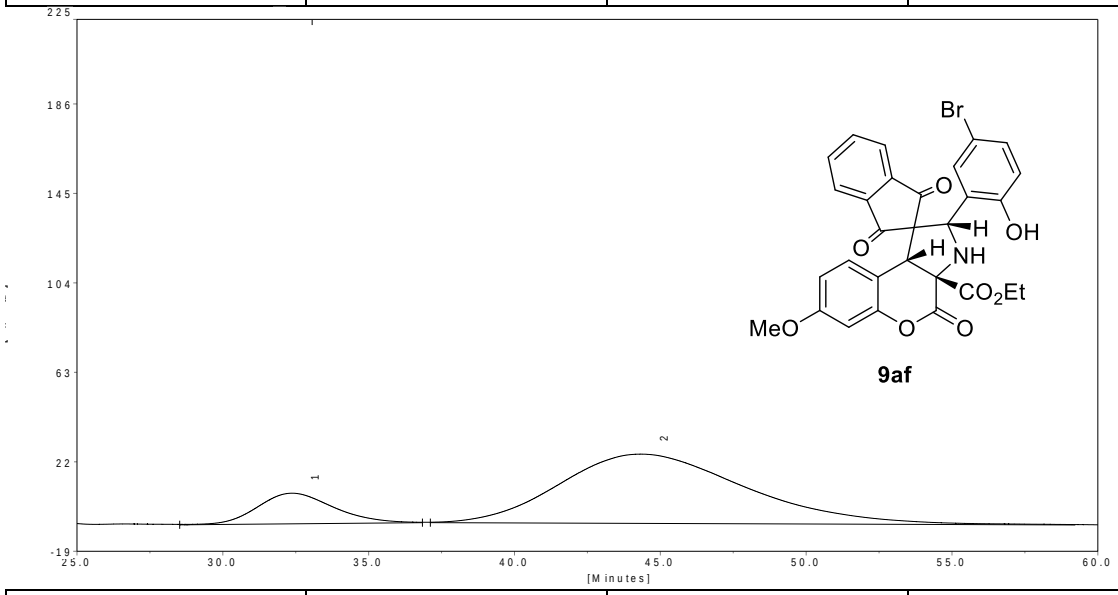
HPLC chromatogram for **9af**

Column: CHIRALPAK IB	Flow rate: 0.7 ml/min
Solvent: Hex:IPA = 80: 20	Detector: UV 245 nm



3af (***rac*-9af**)

Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
32.43	77.82	13921.01	50.8612
45.29	31.50	13449.61	49.1388

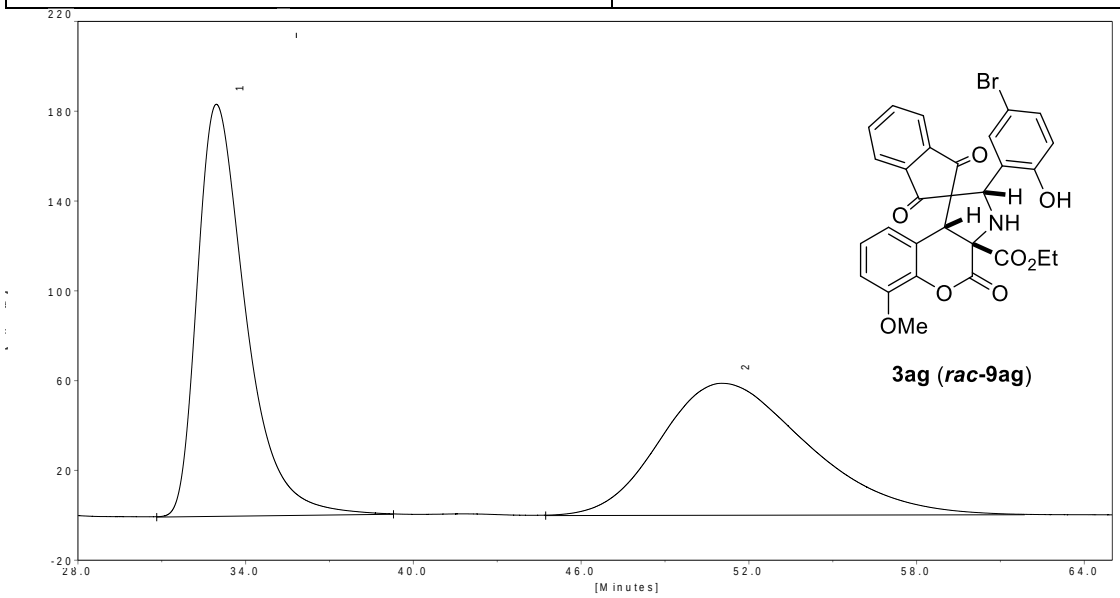


9af

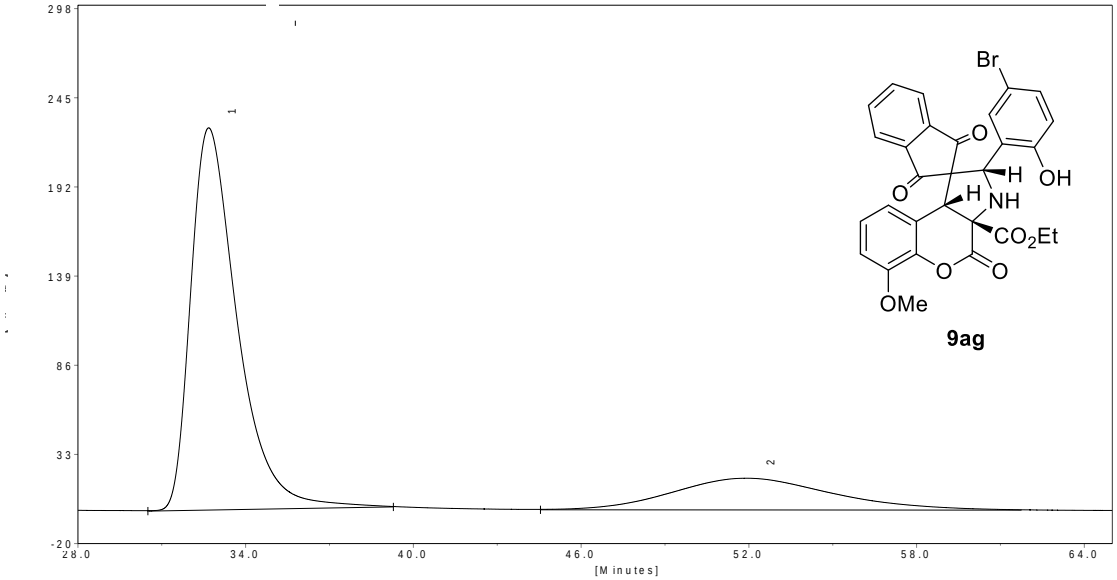
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
32.37	13.84	2445.19	15.0386
44.34	31.55	13814.23	84.9614

HPLC chromatogram for **9ag**

Column: CHIRALPAK IA	Flow rate: 0.7 ml/min
Solvent: Hex:EtOH = 80:20	Detector: UV 245 nm



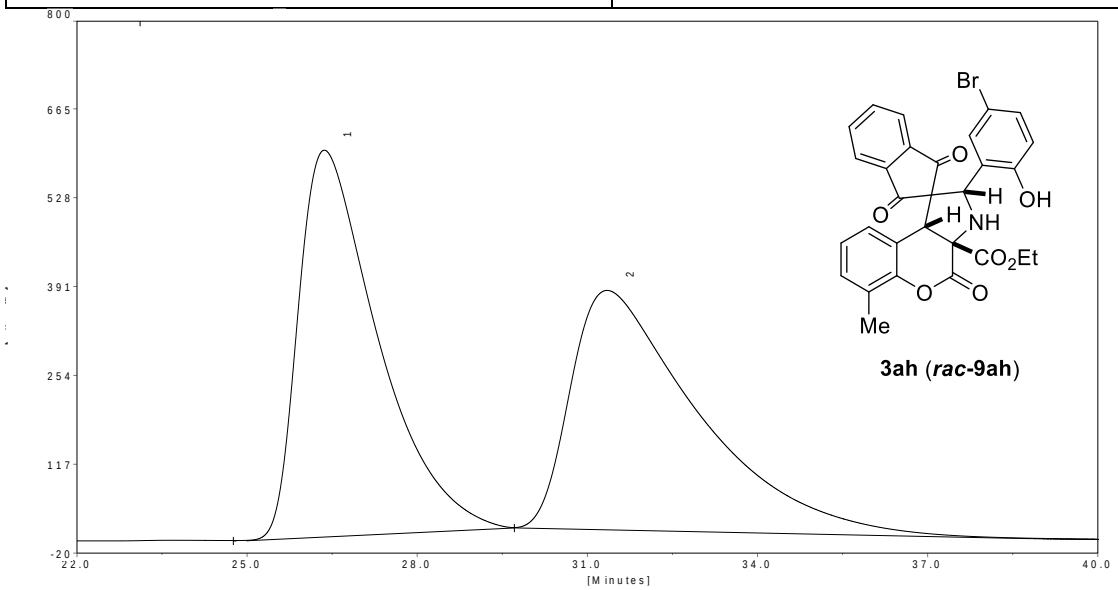
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
32.95	183.41	22037.57	50.5947
51.03	58.59	21519.52	49.4053



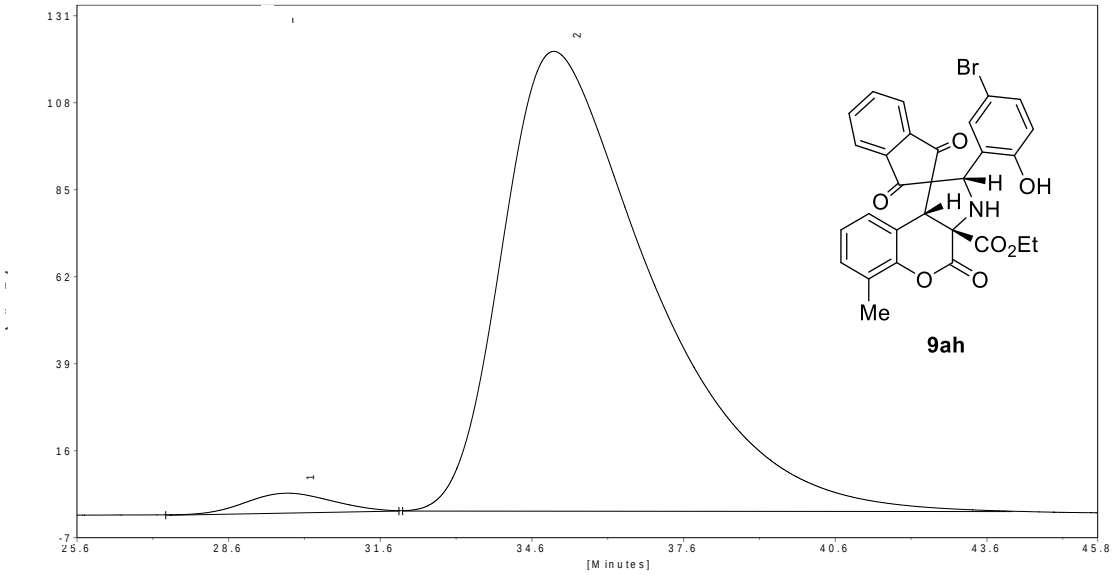
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
32.68	226.95	26215.93	78.2696
51.94	18.61	7278.45	21.7304

HPLC chromatogram for **9ah**

Column: CHIRALPAK IB	Flow rate: 0.7 ml/min
Solvent: Hex: IPA = 85:15	Detector: UV 245 nm



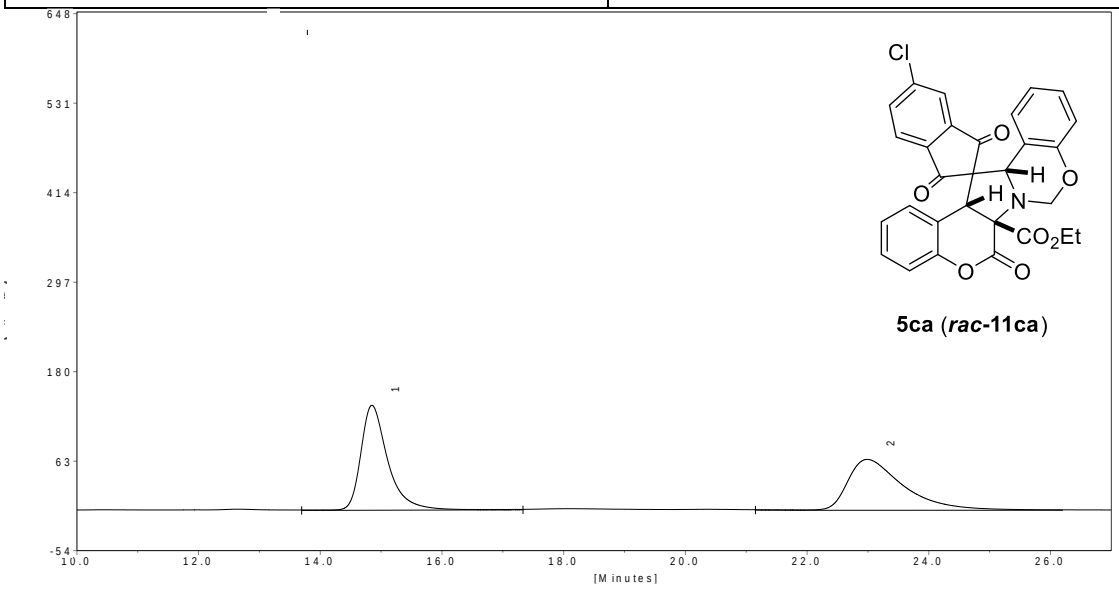
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
26.36	595.26	57840.16	50.2760
31.35	368.36	57205.00	49.7240



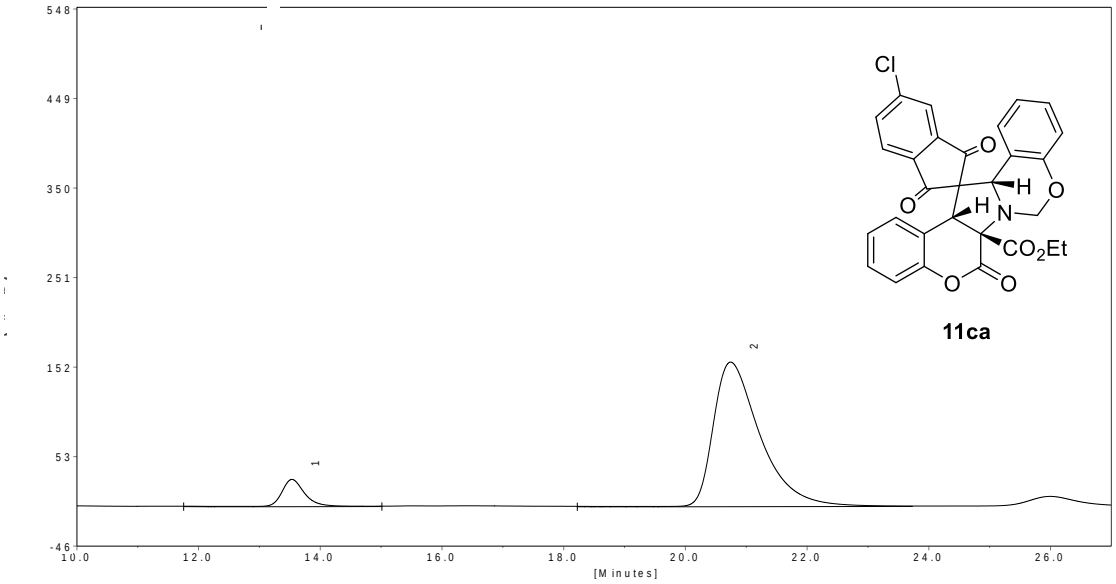
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
29.80	5.15	599.97	2.3274
35.08	121.47	25178.17	97.6726

HPLC chromatogram for **11ca**

Column: CHIRALPAK IA	Flow rate: 1.0 ml/min
Solvent: Hex:EtOH = 80: 20	Detector: UV 248 nm



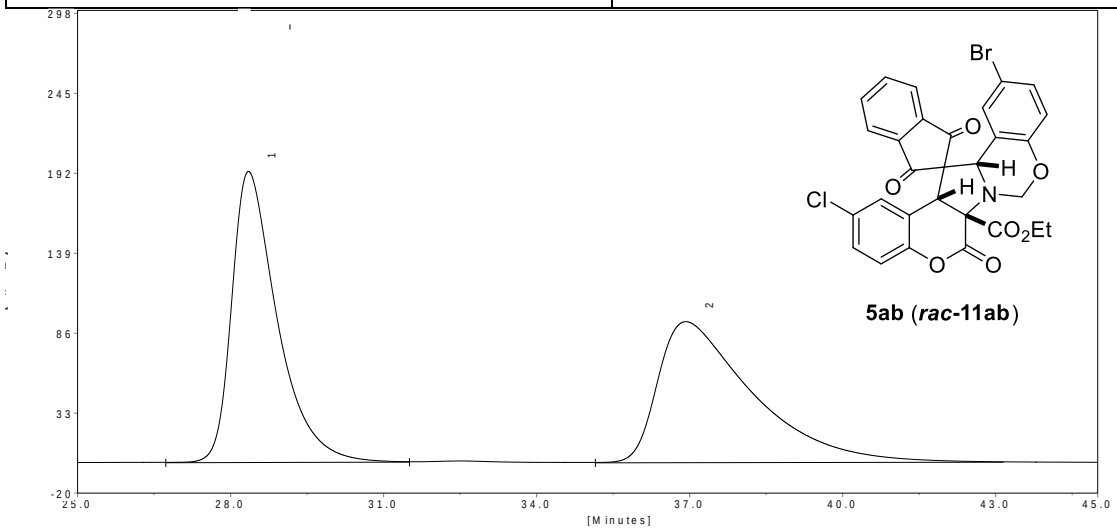
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
14.85	136.67	4132.89	50.3024
22.99	65.83	4083.19	49.6976



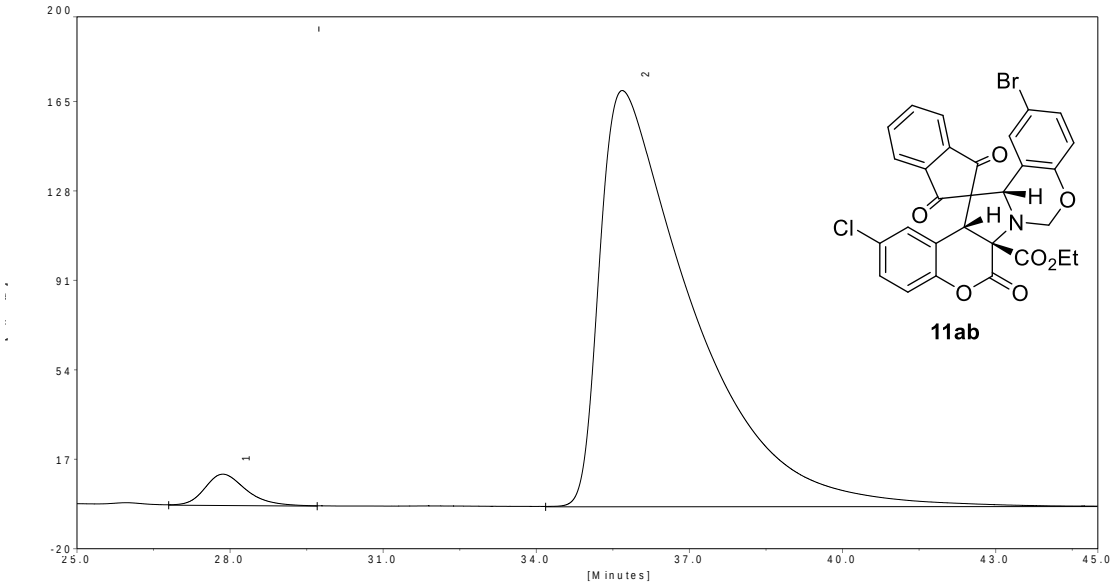
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
13.53	29.63	729.85	7.9769
20.74	159.38	8419.72	92.0231

HPLC chromatogram for **11ab**

Column: CHIRALPAK IA	Flow rate: 1.0 ml/min
Solvent: Hex:EtOH = 90:10	Detector: UV 248 nm



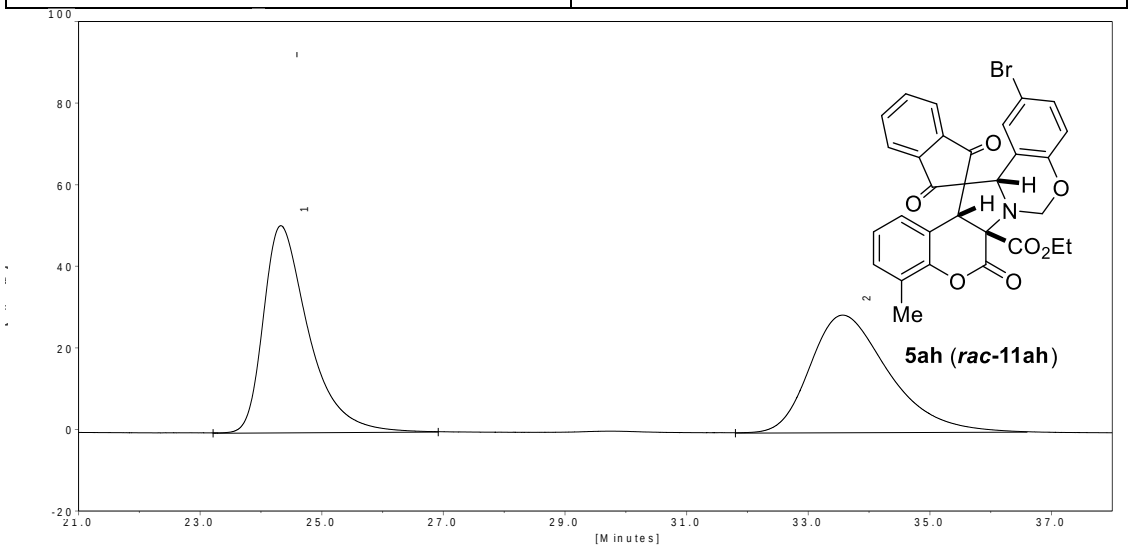
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
28.35	192.73	11925.96	49.8796
36.93	93.26	11983.53	50.1204



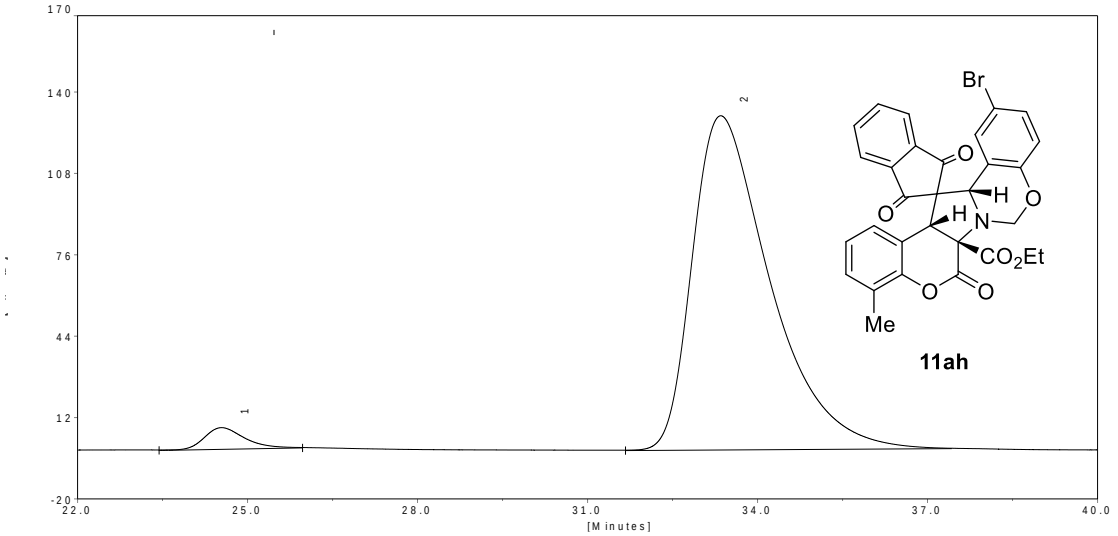
Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
27.86	12.82	708.76	3.1473
35.69	171.99	21810.75	96.8527

HPLC chromatogram for **11ah**

Column: CHIRALPAK IA	Flow rate: 1 ml/min
Solvent: Hex:EtOH = 90:10	Detector: UV 248 nm



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
24.33	50.70	2606.81	50.2428
33.57	28.74	2581.61	49.7572



Ret. time (min)	Height (mv)	Area (mv.sec)	Rel. area (%)
24.54	8.33	396.40	3.0742
33.35	131.27	12497.89	96.9258