Electronic Supplementary Material (ESI) for Chemical Science

A Copper-Catalyzed Arylation of Tryptamines for the Synthesis of Pyrroloindolines

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Supporting Information 1 (Experimental Procedures):

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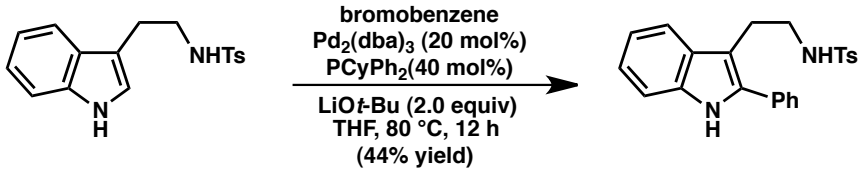
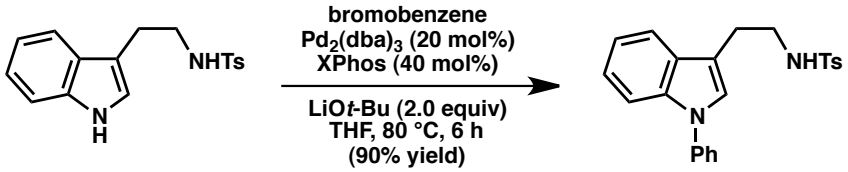
1. General Considerations. Unless otherwise stated, reactions were performed under a nitrogen atmosphere using freshly dried solvents. Tetrahydrofuran (THF), methylene chloride (CH_2Cl_2), acetonitrile (MeCN), dimethylformamide (DMF), and toluene (PhMe) were dried by passing through activated alumina columns. Triethylamine (Et_3N) was distilled over calcium hydride prior to use. Unless otherwise stated, chemicals and reagents were used as received. All reactions were monitored by thin-layer chromatography using EMD/Merck silica gel 60 F254 pre-coated plates (0.25 mm) and were visualized by UV, *p*-anisaldehyde, or $KMnO_4$ staining. Reaction samples were analyzed on an Agilent 1290 Series LC/MS using an Eclipse Plus C18 column (RRHD 1.8 μm, 2.1 x 50 mm, 11,072 plates). Flash column chromatography was performed either as described by Still et al.[1] using silica gel (partical size 0.032-0.063) purchased from Silicycle or using pre-packaged RediSep®Rf columns on a CombiFlash Rf system (Teledyne ISCO Inc.). Alumina was purchased from Sigma-Aldrich (Aluminum oxide, ~150 mesh, 58Å pore size, activated, basic, Brockmann I) and deactivated with 3% v/w H2O (30.0 mL / 970 g). ^1H and ^{13}C NMR spectra were recorded on a Varian 400 MR (at 400 MHz and 101 MHz, respectively), a Varian Inova 500 (at 500 MHz and 126 MHz, respectively), or a Varian Inova 600 (at 600 MHz and 150 MHz, respectively), and are reported relative to internal $CHCl_3$ (^1H, δ = 7.26) or DMSO (^1H, δ = 2.50), and $CDCl_3$ (^{13}C, δ = 77.0), or DMSO (^{13}C, δ = 40.0). Data for ^1H NMR spectra are reported as follows: chemical shift (δ ppm) (multiplicity, coupling constant (Hz), integration). Multiplicity and qualifier abbreviations are as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. IR spectra were recorded on a Perkin Elmer Paragon 1000 spectrometer and are reported in frequency of absorption (cm^{-1}). HRMS were acquired using an Agilent 6200 Series TOF with an Agilent G1978A Multimode source in electrospray ionization (ESI), atmospheric pressure chemical ionization (APCI), or mixed (MM) ionization mode.

2. Optimization of Reaction Parameters

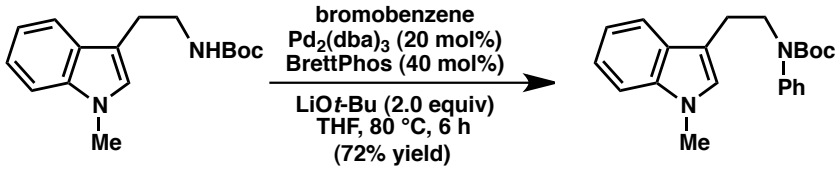
A. Palladium-Catalyzed Reaction Screens



To a flame-dried vial in the glove box was charged $PCyPh_2$ (11 mg, 0.04 mmol), $Pd_2(dba)_3$ (11 mg, 0.02 mmol), N-tosyltryptamine (31 mg, 0.1 mmol), bromobenzene (51 μL, 0.5 mmol), LiOtBu (16 mg, 0.2 mmol) and THF (1 mL). The vial was sealed and heated to 80 ^oC for 12 hours. The reaction mixture was filtered through a plug of silica and concentrated *in vacuo*. The crude residue was purified by silica gel flash chromatography (20% EtoAc in hexanes) to afford 2-phenyl tryptamine **17** (16.9 mg, 0.04 mmol, 44%). ^1H NMR ($CDCl_3$, 500 MHz) δ 8.11 (s, 1H), 7.58 (d, J = 8.2 Hz, 2H), 7.52 – 7.42 (m, 5H), 7.40 (ddd, J = 4.1, 1.5, 1.5 Hz, 1H), 7.37 (d, J = 8.1 Hz, 1H), 7.20 (dd, J = 16.1, 7.8 Hz, 3H), 7.09 (dd, J = 7.8, 7.2 Hz, 1H), 4.35 (t, J = 5.8 Hz, 1H), 3.28 (dd, J = 13.3, 6.8 Hz, 2H), 3.08 (dd, J = 7.1, 7.1 Hz, 2H), 2.40 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.2, 136.7, 135.8, 132.5, 129.6, 129.0, 128.5, 128.10, 128.09, 127.0, 122.6, 120.0, 118.8, 110.9, 108.3, 43.2, 25.0, 21.5;HRMS (MM) calc'd for $[M+H]^+$ 391.1475, found 391.1491.



To a flame-dried vial in the glove box was charged XPhos (19 mg, 0.04 mmol), $Pd_2(dba)_3$ (11 mg, 0.02 mmol), N-tosyltryptamine (31 mg, 0.1 mmol), bromobenzene (51 μL, 0.5 mmol), LiOtBu (16 mg, 0.2 mmol) and THF (1 mL). The vial was sealed and heated to 80 ^oC for 6 hours. The reaction mixture was filtered through a plug of silica and concentrated *in vacuo*. The crude residue was purified by silica gel flash chromatography (20% EtoAc in hexanes) to afford N-phenyl tryptamine **16** (35.2 mg, 0.09 mmol, 90%). ^1H NMR ($CDCl_3$, 500 MHz) δ 7.70 – 7.65 (m, 2H), 7.57 – 7.43 (m, 6H), 7.39 – 7.32 (m, 1H), 7.23 (dd, J = 11.6, 4.5 Hz, 3H), 7.16 – 7.10 (m, 1H), 7.09 (s, 1H), 4.54 (t, J = 6.1 Hz, 1H), 3.34 (q, J = 6.6 Hz, 2H), 2.99 (t, J = 6.7 Hz, 2H), 2.38 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.3, 139.4, 136.8, 136.1, 129.6, 128.3, 127.0, 126.4, 126.2, 124.1, 122.7, 120.1, 118.8, 112.7, 110.7, 43.1, 25.4, 21.5. HRMS (MM) calc'd for $[M+H]^+$ 391.1475, found 391.1470.

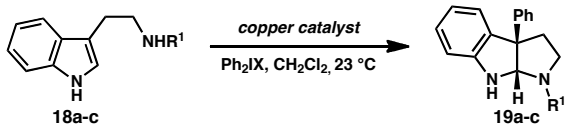


To a flame-dried vial in the glove box was charged BrettPhos (6.4 mg, 0.012 mmol), $Pd_2(dba)_3$ (3.5 mg, 0.006 mmol), *N*-Boc-*N'*-methyltryptamine (8 mg, 0.1 mmol), bromobenzene (16 μL, 0.15 mmol), LiOtBu (4.8 mg, 0.06 mmol) and THF (1 mL). The vial was sealed and heated to 80 °C for 6 hours. The reaction mixture was filtered through a plug of silica and concentrated *in vacuo*. The crude residue was purified by silica gel flash chromatography (20% EtoAc in hexanes) to afford N-phenyl tryptamine **15** (28.0 mg, 0.02 mmol, 72%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.54 (d, *J* = 7.9 Hz, 1H), 7.34 (dd, *J* = 10.7, 4.9 Hz, 2H), 7.28 (d, *J* = 8.2 Hz, 1H), 7.24 – 7.18 (m, 4H), 7.07 (ddd, *J* = 7.9, 7.0, 1.0 Hz, 1H), 6.85 (s, 1H), 3.97 – 3.87 (m, 2H), 3.72 (s, 3H), 3.06 – 2.95 (m, 2H), 1.42 (s, 10H). ^{13}C NMR ($CDCl_3$, 126 MHz) 148.4, 143.5, 139.4, 136.4, 135.6, 132.6, 131.9, 129.6, 128.5, 127.2, 127.1, 127.0, 125.7, 124.3, 119.2, 109.4, 84.4, 62.1, 47.4, 37.9, 21.4, 20.8. FTIR (NaCl, thin film): 3056, 3027, 2949, 2891, 2827, 1762, 1605, 1491, 1347, 1160, 1092, 1022. HRMS (MM) calc'd for $[M+H]^+$ 409.1381, found 409.1363.

B. Copper-Catalyzed Reaction Screen

General Procedure – To a flame-dried, 1-dram vial was charged the appropriate tryptamine (0.10 mmol), 4,4'-di-*tert*-butylbiphenyl, diaryl iodonium salt (0.11 mmol), copper catalyst (0.010 mmol), and additive (0.10 mmol, if applicable). Anhydrous CH_2Cl_2 (1.0 mL) was then added and the reaction stirred under inert atmosphere and monitored by UHPLC-MS for optimal yield.

The following response factors relative to an internal standard of 4,4'-di-*tert*-butylbiphenyl were measured and calculated based on three runs of varied concentration at λ = 254 nm:
N-Tosyltryptamine **18a** (Starting Material): Response Factor = 0.117
N-Tosylpyrroloindoline **19a** (Product): Response Factor = 0.253
UHPLC samples were analyzed at λ = 254 nm and yields calculated based on the above factors.



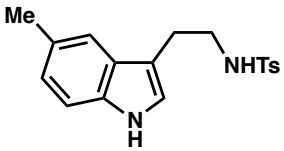
entry	R	Cu source	X	additive	pdt	yield (%)[a]
1	Ts	$Cu(OTf)_2$	BF_4	–	**19a**	62[b]

2	Ts	–	BF_4	–	**19a**	0
3	Boc	$Cu(OTf)_2$	BF_4	–	**19b**	<5
4	Ac	$Cu(OTf)_2$	BF_4	–	**19c**	<5
5	Ts	$(CuOTf)_2$•PhMe	BF_4	–	**19a**	64
6	Ts	CuI	BF_4	–	**19a**	0
7	Ts	$Cu(MeCN)PF_6$	BF_4	–	**19a**	0
8	Ts	$Cu(OAc)_2$	BF_4	–	**19a**	64
9	Ts	$Cu(OTf)_2$	PF_6	–	**19a**	28
10	Ts	$Cu(OTf)_2$	OTf	–	**19a**	32
11	Ts	$Cu(OTf)_2$	Cl	–	**19a**	0
12	Ts	$Cu(OTf)_2$	BF_4	dtbpy	**19a**	<5
13	Ts	$Cu(OTf)_2$	BF_4	$NaHCO_3$	**19a**	55
14	Ts	$Cu(OTf)_2$	BF_4	AcOH	**19a**	62
15	Ts	$Cu(OTf)_2$	BF_4	–[c]	**19a**	65

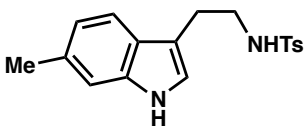
[a] Determined by HPLC versus an internal standard. [b] Isolated yield. [c] [Ph-I-Mes]BF_4 was employed as the electrophile

3. Preparation of *N*-tosyltryptamine derivatives (20a – 20j):

General Procedure A – To a solution of tryptamine (1.00 equiv) in CH_2Cl_2 (0.1 M) was added Et_3N (1.50 equiv). The solution was cooled to 0 °C in an ice bath and *p*-toluenesulfonyl chloride (1.01 equiv) added in one portion as solid against a positive steam of nitrogen. The solution was stirred for 15 minutes, then the ice bath removed and allowed to warm up to ambient temperature (20 to 25 °C) and stirred for an additional 4 hours. The reaction was then quenched with 1 N aq. HCl (equal volume to CH_2Cl_2 used) and the organic layer separated and washed with another portion of 1N aq. HCl. The combined aqueous layers were then combined and back extracted with CH_2Cl_2 (20 mL), then the organic layers combined, dried over anhydrous Na_2SO_4, filtered, and concentrated *in vacuo*. The resulting crude residue was purified by flash chromatography (SiO_2) to afford *N*-tosyltryptamine as a white or off-white solid.



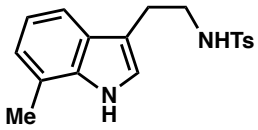
***N*-Tosyltryptamine 20b**: Prepared according to General Procedure A. Reaction run on 6.40 mmol (1.30 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20b** as a white, amorphous solid (1.58 g, 4.81 mmol, 75 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.98 (s, 1H), 7.67 – 7.60 (m, 2H), 7.25 – 7.19 (m, 3H), 7.17 (dd, *J* = 1.5, 0.7 Hz, 1H), 7.01 (dd, *J* = 8.3, 1.6 Hz, 1H), 6.92 (d, *J* = 2.3 Hz, 1H), 4.46 (t, *J* = 6.0 Hz, 1H), 3.26 (q, *J* = 6.5 Hz, 2H), 2.89 (dd, *J* = 6.9, 6.3 Hz, 2H), 2.41 (s, 3H), 2.40 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) 143.2, 136.7, 134.7, 129.6, 128.7, 127.0, 127.0, 123.8, 122.7, 118.1, 110.9, 110.9, 42.9, 25.4, 21.5, 21.4; FTIR (NaCl, thin film): 3401, 3290, 3042, 2919, 2864, 1597, 1423, 1320, 1303, 1157, 1093. HRMS (MM) calc'd for $[M+H]^+$ 329.1318, found 329.1316.



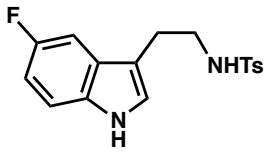
***N*-Tosyltryptamine 20c**: Prepared according to General Procedure A. Reaction run on 3.68 mmol (641 mg) scale. The crude material was purified by silica gel

chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20c** as a white, amorphous solid (940 mg, 2.87 mmol, 78 % yield).

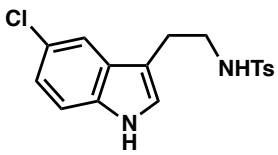
^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.94 (s, 1H), 7.67 – 7.59 (m, 2H), 7.29 (d, *J* = 8.1 Hz, 1H), 7.21 (d, *J* = 8.0 Hz, 2H), 7.14 (s, 1H), 6.92 – 6.86 (m, 2H), 4.46 (t, *J* = 6.1 Hz, 1H), 3.25 (q, *J* = 6.5 Hz, 2H), 2.90 (t, *J* = 6.6 Hz, 2H), 2.45 (s, 3H), 2.40 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.2, 136.8, 136.7, 132.1, 129.6, 127.0, 124.7, 121.9, 121.3, 118.1, 111.3, 111.2, 43.0, 25.5, 21.6, 21.5. FTIR (NaCl, thin film): 3401, 3280, 2913, 2859, 1456, 1404, 1320, 1301, 1157, 1093. HRMS (MM) calc'd for $[M+H]^+$ 329.1318, found 329.1307.



***N*-Tosyltryptamine 20d**: Prepared according to General Procedure A. Reaction run on 3.84 mmol (669 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20d** as a white, amorphous solid (1.02g, 3.11 mmol, 81 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.27 (s, 1H), 7.90 (d, *J* = 8.2 Hz, 2H), 7.57 – 7.50 (m, 1H), 7.48 (d, *J* = 8.5 Hz, 2H), 7.24 (dd, *J* = 9.7, 2.0 Hz, 3H), 4.75 (t, *J* = 6.1 Hz, 1H), 3.53 (q, *J* = 6.5 Hz, 2H), 3.18 (t, *J* = 6.6 Hz, 2H), 2.73 (s, 3H), 2.66 (s, 3H); ^{13}C NMR (126 MHz, cdcl$_3$) δ 143.3, 136.7, 136.0, 129.6, 127.0, 126.3, 122.7, 122.3, 120.5, 119.7, 116.2, 112.0, 43.0, 25.6, 21.5, 16.6l FTIR (NaCl, thin film): 3400, 3275, 3047, 2908, 2849, 1436, 1320, 1303, 1157, 1093, 1063. HRMS (MM) calc'd for $[M+H]^+$ 329.1318, found 329.1307.

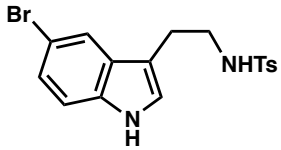


***N*-Tosyltryptamine 20e:** Prepared according to General Procedure A. Reaction run on 3.43 mmol (610 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20e** as an off-white, amorphous solid (940 mg, 2.83 mmol, 82 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.12 (s, 1H), 7.64 – 7.60 (m, 2H), 7.28 – 7.24 (m, 1H), 7.22 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.02 (d, *J* = 2.4 Hz, 1H), 6.99 – 6.89 (m, 2H), 4.45 (t, *J* = 6.0 Hz, 1H), 3.24 (q, *J* = 6.6 Hz, 2H), 2.87 (dd, *J* = 6.8, 6.4 Hz, 2H), 2.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.6 (d, J_{C-F} = 233.8 Hz), 143.5, 136.4, 132.8, 129.6, 127.1 (d, J_{C-F} = 10.0 Hz), 127.0, 124.4, 111.9 (d, J_{C-F} = 8.8 Hz), 111.6 (d, J_{C-F} = 5.0 Hz), 110.6 (d, J_{C-F} = 26.3 Hz), 103.4 (d, J_{C-F} = 22.5 Hz), 42.71, 25.32, 21.47; FTIR (NaCl, thin film): 3392, 3275, 2933, 2864, 1486, 1457, 1319, 1301, 1157, 1093 cm^{-1}. HRMS (MM) calc'd for $[M+H]^+$ 333.1068, found 333.1058.

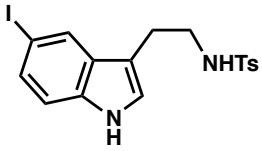


***N*-Tosyltryptamine 20f**: Prepared according to General Procedure A. Reaction run on 3.34 mmol (650 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20f** as an off-

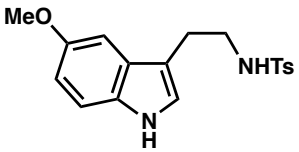
white, amorphous solid (1.08 g, 3.10 mmol, 92 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.18 (s, 1H), 7.65 – 7.57 (m, 2H), 7.28 (d, *J* = 2.0 Hz, 1H), 7.24 (d, *J* = 0.5 Hz, 1H), 7.21 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.11 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.00 (d, *J* = 2.3 Hz, 1H), 4.49 (t, *J* = 6.0 Hz, 1H), 3.23 (q, *J* = 6.6 Hz, 2H), 2.86 (td, *J* = 6.7, 0.6 Hz, 2H), 2.40 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.5, 136.4, 134.7, 129.7, 127.9, 126.9, 125.2, 124.1, 122.5, 117.9, 112.3, 111.2, 42.7, 25.2, 21.5; FTIR (NaCl, thin film): 3385, 3275, 2913, 2859, 1464, 1422, 1319, 1156, 1093 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 349.0772, found 349.0766.



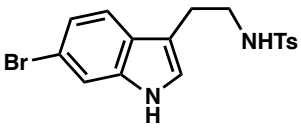
5-Bromo-*N*-Tosyltryptamine 20g: Reaction run on 7.99 mmol (1.91 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20g** as a white amorphous solid (2.63g, 6.69 mmol, 84% yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.17 (s, 1H), 7.68 – 7.65 (m, 1H), 7.63 – 7.59 (m, 2H), 7.41 (dd, *J* = 8.5, 1.6 Hz, 1H), 7.23 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.12 (dd, *J* = 8.5, 0.4 Hz, 1H), 6.95 (d, *J* = 2.3 Hz, 1H), 4.48 (t, *J* = 6.0 Hz, 1H), 3.23 (q, *J* = 6.5 Hz, 2H), 2.85 (t, *J* = 6.6 Hz, 2H), 2.41 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.5, 136.4, 135.4, 130.5, 129.7, 129.4, 127.3, 126.9, 123.5, 113.3, 110.9, 82.9, 42.8, 25.2, 21.6; FTIR (NaCl, thin film): 3376, 3290, 2922, 2864, 1598, 1460, 1420, 1320, 1157, 1093 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 393.0267, found 393.0260.



5-Iodo-*N*-tosyltryptamine 20h: To a 50-mL Schlenk tube was charged 5-bromo-*N*-tosyltryptamine **20g** (858 mg, 2.18 mmol, 1.00 equiv), CuI (42.0 mg, 0.220 mmol, 0.10 equiv), and NaI (654 mg, 4.36 mmol, 2.00 equiv). The vessel was then evacuated and backfilled with N_2 three times, and *N,N'*-dimethylethylene diamine (47 µL, 0.44 mmol, 0.20 equiv) and 1,4-dioxane (2.2 mL) added. The vessel was then sealed and heated to 100 °C for 23 hours, then cooled to room temperature, and quenched with concentrated aqueous NH_4OH (10 mL), then diluted with H_2O (30 mL). The mixture was then extracted with CH_2Cl_2 (3 x 30 mL), the organic layers combined, dried over anhydrous Na_2SO_4, filtered, and concentrated *in vacuo*. Flash chromatography (gradient elution, 10-60% EtOAc in Hexanes) afforded 5-iodo-N-tosyltryptamine as a white solid (900 mg, 2.04 mmol, 94% yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.27 (s, 1H), 7.63 – 7.57 (m, 2H), 7.44 (d, *J* = 1.8 Hz, 1H), 7.24 – 7.17 (m, 4H), 6.96 (d, *J* = 2.4 Hz, 1H), 4.62 (t, *J* = 6.0 Hz, 1H), 3.22 (q, *J* = 6.6 Hz, 2H), 2.83 (t, *J* = 6.6 Hz, 2H), 2.40 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.5, 136.3, 134.9, 129.7, 128.5, 126.9, 124.9, 124.0, 120.9, 112.8, 112.6, 111.0, 42.7, 25.1, 21.5; FTIR (NaCl, thin film): 3391, 3290, 2928, 2854, 1598, 1456, 1417, 1319, 1288, 1157, 1093 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 441.0128, found 441.0130.



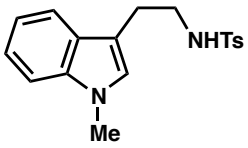
5-Methoxy-*N*-Tosyltryptamine 20i: Prepared according to General Procedure A. Reaction run on 5.94 mmol (1.13 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20i** as a white amorphous solid (1.68g, 4.88 mmol, 82 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.98 (s, 1H), 7.64 – 7.58 (m, 2H), 7.24 (dd, *J* = 8.7, 0.5 Hz, 1H), 7.20 (d, *J* = 7.9 Hz, 2H), 6.95 (d, *J* = 2.3 Hz, 1H), 6.87 – 6.81 (m, 2H), 4.45 (t, *J* = 6.0 Hz, 1H), 3.80 (s, 3H), 3.25 (q, *J* = 6.5 Hz, 2H), 2.91 (t, *J* = 6.6 Hz, 2H), 2.40 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 154.0, 143.3, 136.6, 131.6, 129.6, 127.2, 127.0, 123.3, 112.5, 112.0, 111.2, 100.2, 55.8, 42.8, 25.4, 21.5; FTIR (NaCl, thin film): 3390, 3285, 2928, 2824, 1486, 1459, 1437, 1319, 1215, 1156, 1092 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 345.1267, found 345.1266.



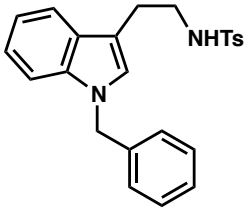
***N*-Tosyltryptamine 20j**: Prepared according to General Procedure A. Reaction run on 10.90 mmol (2.61 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 10-60% EtOAc in Hexane) to afford **20j** as a white, amorphous solid (3.42g, 8.70 mmol, 80 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.11 (s, 1H), 7.63 – 7.56 (m, 2H), 7.49 (dd, *J* = 1.7, 0.5 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 1H), 7.21 – 7.18 (m, 2H), 7.13 (dd, *J* = 8.4, 1.7 Hz, 1H), 6.95 (d, *J* = 2.4 Hz, 1H), 4.44 (t, *J* = 6.1 Hz, 1H), 3.24 (q, *J* = 6.5 Hz, 2H), 2.89 (t, *J* = 6.4 Hz, 2H), 2.40 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.4, 137.1, 36.5, 129.6, 126.9, 125.8, 123.2, 122.8, 119.7, 115.8, 114.2, 111.8, 42.9, 25.3, 21.5; FTIR (NaCl, thin film): 3368, 3270, 2933, 2864, 1457, 1399, 1319, 1156, 1092. HRMS (MM) calc'd for $[M+H]^+$ 393.0267, found 393.0252.

4. Preparation of *N*-tosyl-*N'*-alkyltryptamines (20k - 20l):

General procedure B – To a solution of *N*-tosyltryptamine (1.57 g, 5.00 mmol, 1.00 equiv) in DMF (17 mL) at 20 °C was added NaH (60% dispersion in mineral oil, 0.700 g, 17.5 mmol, 3.5 equiv) slowly, with vigorous stirring, and stirring continued at 20 °C. After 30 minutes, the solution was cooled to 0 °C in an ice bath, and the appropriate alkyl halide (5.00 mmol, 1.00 equiv) was added dropwise by syringe over three minutes. Stirring was continued at 0 °C for two hours, and the reaction allowed to warm to 20 °C and stirring continued for 13 hours. The reaction was then carefully quenched by the dropwise addition of saturated, aqueous ammonium chloride (10 mL), and the mixture diluted with EtOAc (100 mL), and washed with brine (2 x 50 mL). The organic layer was then dried over anhydrous Na_2SO_4, filtered, and concentrated *in vacuo*. Flash chromatography (SiO_2) afforded *N'*-alkylated tryptamines as a white solid.



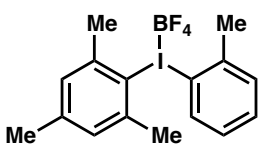
***N*-tosyl-*N'*-methyltryptamines 20k**: Prepared according to General Procedure B. Reaction run on 5.00 mmol (1.57 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 20-40% EtOAc in Hexane) to afford **20k** as a white, amorphous solid (1.18 g, 3.59 mmol, 72 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.64 (d, *J* = 8.3 Hz, 2H), 7.40 (d, *J* = 7.9 Hz, 1H), 7.29 (d, *J* = 8.2 Hz, 1H), 7.25 – 7.19 (m, 3H), 7.05 (dd, *J* = 7.4, 7.4 Hz, 1H), 6.82 (s, 1H), 4.41 (t, *J* = 6.0 Hz, 1H), 3.73 (s, 3H), 3.26 (q, *J* = 6.5 Hz, 2H), 2.92 (t, *J* = 6.6 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.1, 143.1, 137.0, 136.8, 129.6, 129.5, 129.5, 129.5, 129.5, 129.5, 127.3, 127.2, 126.9, 121.7, 118.9, 118.9, 118.5, 109.9, 109.9, 109.3, 109.3, 43.2, 43.2, 32.6, 32.5, 25.3, 25.3, 21.5, 21.4, 14.1; FTIR (NaCl, thin film):3292, 3051, 2929, 1616, 1473, 1325, 1158, 1093 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 329.1318, found 329.1314.



***N*-tosyl-*N'*-benzyltryptamines**: Prepared according to General Procedure B. Reaction run on 5.00 mmol (1.57 g) scale. The crude material was purified by silica gel chromatography (gradient elution, 20-30% EtOAc in Hexane) to afford **20l** as a white, amorphous solid (1.52 g, 3.76 mmol, 75 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.62 (d, *J* = 8.3 Hz, 2H), 7.41 (d, *J* = 7.9 Hz, 1H), 7.33 – 7.22 (m, 4H), 7.21 – 7.13 (m, 3H), 7.12 – 7.07 (m, 2H), 7.06 – 7.01 (m, 1H), 6.85 (s, 1H), 5.23 (s, 2H), 4.44 (t, *J* = 6.1 Hz, 1H), 3.27 (q, *J* = 6.6 Hz, 2H), 2.91 (t, *J* = 6.7 Hz, 2H), 2.38 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 143.2, 137.3, 136.8, 136.8, 129.6, 128.8, 127.7, 127.5, 127.0, 126.8, 126.5, 122.0, 119.3, 118.7, 110.7, 109.8, 49.9, 43.1, 25.5, 21.5; FTIR (NaCl, thin film): 3284, 3057, 3029, 2922, 1597, 1466, 1326, 1159, 1094, 1076 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1557, found 405.1630.

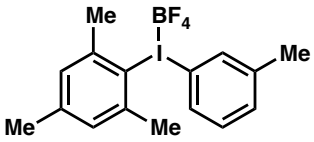
5. Preparation of diaryliodonium tetrafluoroborates:

General Procedure C – To a solution of aryl iodide (1.00 equiv) in Ac_2O (0.5 M) was added *m*CPBA (1.50 equiv). After stirring 1 hour at 23 °C, the mixture was cooled to 0 °C and mesitylene (1.10 equiv) was added followed by dropwise addition of HBF_4 (50% *aq* solution, 2.00 equiv). The reaction continued stirring at 0 °C for 30 minutes, followed by 6 hours at 23 °C. The mixture was diluted with water, extracted with CH_2Cl_2, dried over $MgSO_4$, filtered and concentrated *in vacuo*. Crude reaction mixtures were dissolved in minimal CH_2Cl_2 and precipated with Et_2O to yield fine, white powders. The precipitate was filtered and dried overnight under high vacuum at 100 °C.

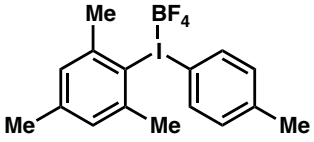


(2-Methylphenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-1): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.18 g) scale.

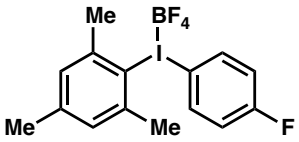
Trituration afforded **S-1** as a white powder (3.0 g, 7.1 mmol, 71 % yield). ^{1}H NMR (500 MHz, DMSO) δ 7.96 (d, J = 7.8 Hz, 1H), 7.56 – 7.54 (m, 2H), 7.29 – 7.23 (m, 1H), 7.21 (s, 2H), 2.56 (s, 6H), 2.56 (s, 3H), 2.29 (s, 3H). ^{13}C NMR (DMSO, 125 MHz) δ 143.5, 142.1, 141.2, 137.2, 132.9, 132.4, 130.4, 129.8, 122.3, 119.1, 26.6, 24.9, 21.0. FTIR (NaCl, thin film): 1587, 1558, 1457, 1382, 1301, 1064, 1024. HRMS (MM) calc'd for $[M]^+$ 337.0448, found 337.0443.



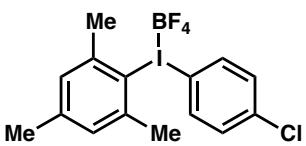
(3-Methylphenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-2): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.18 g) scale. Trituration afforded **S-2** as a white powder (3.9 g, 9.2 mmol, 92 % yield). ^{1}H NMR (500 MHz, DMSO) δ 7.85 (s, 1H), 7.76 (d, J = 8.0 Hz, 1H), 7.45 (d, J = 7.6 Hz, 1H), 7.38 (t, J = 7.8 Hz, 1H), 7.22 (s, 2H), 2.60 (s, 6H), 2.32 (s, 3H), 2.29 (s, 3H); ^{13}C NMR (DMSO, 126 MHz) δ 143.5, 142.45, 142.1, 135.1, 133.0, 132.2, 132.0, 130.3, 122.9, 114.8, 26.8, 21.2, 21.0. FTIR (NaCl, thin film): 2913, 1595, 1558, 1452, 1301, 1063, 1024 cm^{-1}; HRMS (MM) calc'd for $[M]^+$ 337.0448, found 337.0443.



(4-Methylphenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-3): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.18 g) scale. Trituration afforded **S-3** as a white powder (3.4 g, 8.2 mmol, 80 % yield). ^{1}H NMR (500 MHz, DMSO) δ 7.90 – 7.84 (m, 2H), 7.31 (dd, J = 8.5, 0.6 Hz, 2H), 7.20 (s, 2H), 2.60 (s, 6H), 2.33 (s, 3H), 2.29 (s, 3H). ^{13}C NMR (DMSO, 125 MHz) δ 143.5, 142.7, 141.9, 135.0, 133.0, 130.2, 123.2, 111.4, 26.8, 21.7, 21.0. FTIR (NaCl, thin film): 1586, 1451, 1381, 1064, 1024. HRMS (MM) calc'd for $[M]^+$ 337.0448, found 447.0446.

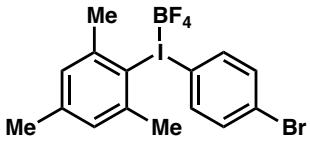


(4-Fluorophenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-4): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.22 g) scale. Trituration afforded **S-4** as a white powder (1.7 g, 4.1 mmol, 40 % yield). ^{1}H NMR (500 MHz, DMSO) δ 8.08 – 8.01 (m, 2H), 7.40 – 7.34 (m, 2H), 7.22 (s, 2H), 2.60 (s, 6H), 2.30 (s, 3H). ^{13}C NMR (DMSO, 125 MHz) δ 164.2 (d, $J_{C\text{-}F}$ = 250.0 Hz), 143.7, 142.00, 137.8 (d, $J_{C\text{-}F}$ = 8.75 Hz), 130.3, 123.4, 119.7 (d, $J_{C\text{-}F}$ = 22.5 Hz), 109.1, 26.8, 21.0; FTIR (NaCl, thin film): 1576, 1482, 1301, 1237, 1165, 1064, 1024 cm^{-1}; HRMS (MM) calc'd for $[M–BF_4]^+$ 341.0197, found 341.0188.

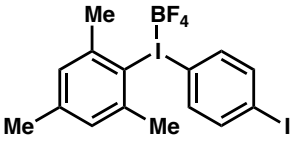


(4-Chlorophenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-5): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.39 g) scale. Trituration afforded **S-5** as a white powder (1.92 g, 4.3 mmol, 44 % yield). ^{1}H

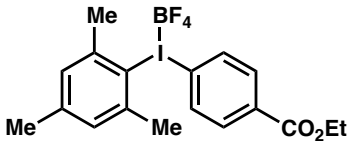
NMR (500 MHz, DMSO) δ 7.99 – 7.93 (m, 2H), 7.60 – 7.55 (m, 2H), 7.23 (d, *J* = 0.5 Hz, 2H), 2.59 (s, 6H), 2.30 (s, 3H); ^{13}C NMR (DMSO, 125 MHz) δ 143.7, 142.1, 137.5, 136.7, 132.3, 130.3, 123.3, 112.8, 26.77, 21.02; FTIR (NaCl, thin film): 1469, 1380, 1301, 1064, 1027 cm^{-1}; HRMS (MM) calc'd for $[M–BF_4]^+$ 356.9901, found 356.9895.



(4-Bromophenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-6): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.83 g) scale. Trituration afforded **S-6** as a white powder (2.67 g, 5.5 mmol, 55 % yield). ^{1}H NMR (500 MHz, DMSO) δ 7.91 – 7.86 (m, 2H), 7.73 – 7.68 (m, 2H), 7.23 (d, *J* = 0.5 Hz, 2H), 2.59 (s, 6H), 2.30 (s, 3H). ^{13}C NMR (DMSO, 126 MHz) δ 143.8, 142.1, 136.8, 135.2, 130.3, 126.3, 123.2, 113.5, 26.8, 21.0; FTIR (NaCl, thin film): 1085, 1469, 1388, 1303, 1064 1024 cm^{-1}; HRMS (MM) calc'd for $[M–BF_4]^+$ 400.9396, found 400.9392.



(4-iodophenyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-7): Prepared according to General Procedure C. Reaction run on 5.0 mmol (1.24 g) scale. Trituration afforded **S-7** as a white powder (1.59 g, 3.0 mmol, 30 % yield). ^{1}H NMR (500 MHz, DMSO) δ 7.88 – 7.82 (m, 2H), 7.73 – 7.69 (m, 2H), 7.22 (s, 2H), 2.58 (s, 6H), 2.30 (s, 3H); ^{13}C NMR (DMSO, 125 MHz) δ 143.71, 142.06, 140.93, 136.50, 130.31, 123.13, 114.38, 100.25, 26.77, 21.02; FTIR (NaCl, thin film): 1464, 1380, 1303, 1064, 1024, 984 cm^{-1}; HRMS (MM) calc'd for $[M–BF_4]^+$ 448.9258, found 448.9248.

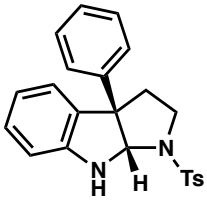


(4-ethoxycarbonyl)(2,4,6-trimethylphenyl)iodonium tetrafluoroborate (S-8): Prepared according to General Procedure C. Reaction run on 10.0 mmol (2.76 g) scale. Trituration afforded **S-8** as a white powder (2.20 g, 4.6 mmol, 46 % yield). ^{1}H NMR (500 MHz, DMSO) δ 8.11 – 8.05 (m, 2H), 8.02 – 7.96 (m, 2H), 7.24 (d, *J* = 0.5 Hz, 2H), 4.32 (q, *J* = 7.1 Hz, 2H), 2.59 (s, 6H), 2.30 (s, 3H), 1.30 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (DMSO, 125 MHz) δ 165.03, 143.8, 142.2, 135.2, 133.1, 132.4, 130.4, 123.2, 119.8, 62.0, 26.8, 21.0, 14.5; FTIR (NaCl, thin film): 2984, 1719, 1583, 1449, 1395, 1365, 1277, 1064, 1024 cm^{-1}; HRMS (MM) calc'd for $[M–BF_4]^+$ 395.0502, found 395.0493.

5. Preparation of *N*-tosylpyrroloindolines (19, 21-22):

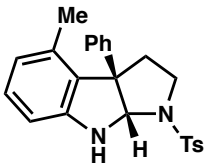
General Procedure D – To a flame-dried flask was charged the appropriate *N*-tosyltryptamine derivative (0.300 mmol, 1.0 equiv), the appropriate iodonium (0.330 mmol, 1.1 equiv), $Cu(OAc)_2$ or $Cu(OTf)_2$ (0.030 mmol or 0.060 mmol, 0.10 equiv or 0.20 mmol) and CH_2Cl_2 (3.0 mL). The reaction was stirred for the time indicated, at

which point the reaction was diluted with CH_2Cl_2 (10 mL), and quenched with saturated aq. $NaHCO_3$ (15 mL). The organic layer was separated and washed with additional $NaHCO_3$ (2 x 15 mL) and the resulting aqueous layers were then combined and back extracted with CH_2Cl_2 (15 mL). The organic layers were combined, dried over anhydrous Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by flash chromatography (SiO_2 or basic alumina) to afford the *N*-tosylpyrroloindoline as a white or off-white solid.



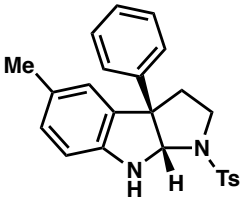
Pyrroloindoline 19a: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 4 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in hexanes) to afford **19a** as a white, amorphous solid (72.6 mg, 0.19 mmol, 62 % yield).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.76 – 7.71 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.25 – 7.15 (m, 3H), 7.14 – 7.09 (m, 3H), 7.00 (ddd, *J* = 7.4, 1.1, 0.5 Hz, 1H), 6.80 – 6.74 (m, 1H), 6.70 (dd, *J* = 7.8, 0.6 Hz, 1H), 5.43 (s, 1H), 4.91 (s, 1H), 3.65 (ddd, *J* = 10.6, 7.8, 1.4 Hz, 1H), 3.25 (td, *J* = 11.0, 5.6 Hz, 1H), 2.48 (ddd, *J* = 12.4, 5.6, 1.0 Hz, 1H), 2.44 (s, 3H), 2.34 (ddd, *J* = 12.4, 11.3, 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.8, 143.6, 143.0, 136.3, 131.4, 129.8, 128.8, 128.6, 127.0, 127.0, 125.7, 123.9, 119.6, 110.1, 85.6, 61.8, 48.1, 37.3, 21.5. FTIR (NaCl, thin film): 3366, 2978, 2878, 1610, 1595, 1491, 1466, 1332, 1318, 1303, 1159, 1094. HRMS (MM) calc'd for $[M+H]^+$ 391.1475, found 391.1473.



Pyrroloindoline 21a: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 6 hours. Reaction run on 0.30 mmol (98.5 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21a** as a white foam (99.4 mg, 0.25 mmol, 82 % yield).

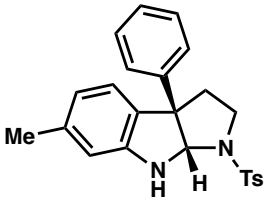
^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.78 – 7.70 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.24 – 7.15 (m, 3H), 7.12 – 7.08 (m, 2H), 6.95 (dd, *J* = 6.5, 0.8 Hz, 1H), 6.89 – 6.82 (m, 1H), 6.72 (dd, *J* = 7.4, 7.4 Hz, 1H), 5.47 (s, 1H), 4.70 (s, 1H), 3.67 (ddd, *J* = 10.5, 7.8, 1.5 Hz, 1H), 3.24 (ddd, *J* = 10.9, 10.9, 5.6 Hz, 1H), 2.47 (ddd, *J* = 12.4, 5.6, 1.1 Hz, 1H), 2.44 (s, 3H), 2.35 (ddd, *J* = 12.4, 11.2, 7.8 Hz, 1H), 2.16 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ147.4, 143.6, 143.1, 136.5, 130.8, 129.8, 129.7, 128.6, 126.98, 126.94, 125.7, 121.4, 119.7, 119.5, 85.5, 62.2, 48.2, 37.6, 21.5, 16.7. FTIR (NaCl, thin film): 3351, 3059, 2892, 1595, 1447, 1332, 1153, 1089. HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1629.



Pyrroloindoline 21b: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 6 hours. Reaction run on 0.30 mmol (98.5 mg) scale. The crude material

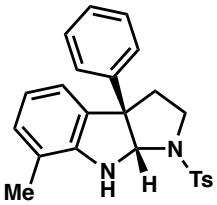
was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21b** as a white, amorphous solid (76.6 mg, 0.19 mmol, 63 % yield).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.73 (d, *J* = 8.3 Hz, 2H), 7.29 (d, *J* = 8.0 Hz, 2H), 7.25 – 7.16 (m, 3H), 7.15 – 7.10 (m, 2H), 6.91 (dd, *J* = 7.9, 1.0 Hz, 1H), 6.79 (d, *J* = 0.4 Hz, 1H), 6.61 (d, *J* = 7.9 Hz, 1H), 5.41 (s, 1H), 3.64 (ddd, *J* = 10.5, 7.8, 1.3 Hz, 1H), 3.25 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.50 – 2.38 (m, 1H), 2.43 (s, 3H), 2.32 (ddd, *J* = 12.3, 11.3, 7.9 Hz, 1H), 2.22 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 146.4, 143.5, 143.1, 136.3, 131.7, 129.8, 129.2, 129.0, 128.6, 126.97, 126.95, 125.7, 124.4, 110.1, 85.9, 61.8, 48.1, 37.1, 21.5, 20.9. FTIR (NaCl, thin film): 3385, 2922, 1617, 1597, 1496, 1448, 1340, 1159, 1093. HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1644.



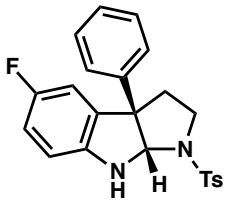
Pyrroloindoline 21c: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 6 hours. Reaction run on 0.30 mmol (98.5 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21c** as a white foam (61.0 mg, 0.15 mmol, 50 % yield).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.77 – 7.70 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.25 – 7.14 (m, 3H), 7.13 – 7.07 (m, 2H), 6.88 (d, *J* = 7.6 Hz, 1H), 6.59 (ddd, *J* = 7.6, 1.4, 0.7 Hz, 1H), 6.55 – 6.51 (m, 1H), 5.41 (s, 1H), 4.83 (s, 1H), 3.64 (ddd, *J* = 10.6, 7.8, 1.4 Hz, 1H), 3.27 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.49 – 2.41 (m, 1H), 2.44 (s, 3H), 2.31 (ddd, *J* = 7.9, 6.9, 5.7 Hz, 1H), 2.28 (s, 3H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 149.0, 143.6, 143.2, 138.8, 136.4, 129.8, 128.6, 128.6, 127.0, 126.9, 125.7, 123.6, 120.4, 111.0, 85.9, 61.6, 48.2, 37.3, 21.5, 21.5. FTIR (NaCl, thin film): 3353, 2889, 1595, 1490, 1448, 1331, 1307, 1159, 1119, 1092. HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1609.

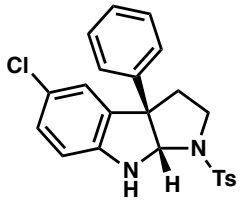


Pyrroloindoline 21d: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 6 hours. Reaction run on 0.30 mmol (98.5 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21d** as a white, crystalline solid (69.2 mg, 0.17 mmol, 57% yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.81 – 7.70 (m, 2H), 7.30 (d, *J* = 7.9 Hz, 2H), 7.25 – 7.15 (m, 3H), 7.13 – 7.07 (m, 2H), 6.95 (d, *J* = 7.4 Hz, 1H), 6.86 (d, *J* = 7.1 Hz, 1H), 6.72 (dd, *J* = 7.4, 7.4 Hz, 1H), 5.47 (s, 1H), 4.70 (s, 1H), 3.67 (ddd, *J* = 10.5, 7.8, 1.4 Hz, 1H), 3.24 (ddd, *J* = 10.9, 10.9, 5.6 Hz, 1H), 2.47 (ddd, *J* = 12.4, 5.6, 1.1 Hz, 1H), 2.44 (s, 3H), 2.35 (ddd, *J* = 12.4, 11.2, 7.8 Hz, 1H), 2.16 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 147.4, 143.6, 143.1, 136.5, 130.8, 129.8, 129.7, 128.6, 127.0, 126.9, 125.7, 121.4, 119.7, 119.5, 85.5, 62.2, 48.2, 37.6, 21.5, 16.7; FTIR (NaCl, thin film): 3350, 2892, 1594, 1490,

1465, 1448, 1331, 1319, 1305, 1243, 1151, 1109, 1089 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1590.

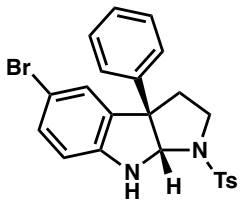


Pyrroloindoline 21e: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (99.7 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21e** as a white, crystalline solid (80.1 mg, 0.20 mmol, 65 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.73 (d, J = 8.3 Hz, 2H), 7.30 (d, J = 8.0 Hz, 2H), 7.26 – 7.17 (m, 3H), 7.15 – 7.08 (m, 2H), 6.82 (ddd, J = 8.9, 8.9, 2.6 Hz, 1H), 6.71 (dd, J = 8.2, 2.6 Hz, 1H), 6.63 (dd, J = 8.5, 4.2 Hz, 1H), 5.43 (s, 1H), 3.65 (ddd, J = 10.5, 7.8, 1.4 Hz, 1H), 3.27 (ddd, J = 10.9, 10.9, 5.7 Hz, 1H), 2.48 – 2.39 (m, 1H), 2.44 (s, 3H), 2.33 (ddd, J = 12.5, 11.2, 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 157.4 (d, J_{C-F} = 235.0 Hz), 144.7, 143.7, 142.3, 136.1, 133.3 (d, J_{C-F} = 7.5 Hz), 129.9, 128.7, 127.3, 127.0, 125.6, 115.2 (d, J_{C-F} = 22.5 Hz), 111.2 (d, J_{C-F} = 23.8 Hz), 110.8 (d, J_{C-F} = 7.5 Hz), 86.2, 62.0, 48.0, 37.0, 21.5. FTIR (NaCl, thin film): 3365, 2891, 1996, 1593, 1488, 1448, 1329, 1306, 1154, 1091. HRMS (MM) calc'd for $[M+H]^+$ 409.1381, found 409.1375.



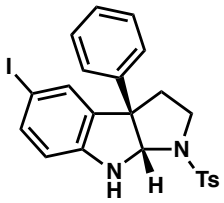
Pyrroloindoline 21f: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (105 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21f** as a white, crystalline solid (81.7 mg, 0.19 mmol, 64 % yield).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.74 – 7.69 (m, 2H), 7.29 (dd, J = 8.5, 0.6 Hz, 2H), 7.27 – 7.19 (m, 3H), 7.13 – 7.09 (m, 2H), 7.06 (dd, J = 8.3, 2.1 Hz, 1H), 6.93 (d, J = 2.1 Hz, 1H), 6.62 (d, J = 8.3 Hz, 1H), 5.44 (s, 1H), 4.95 (s, 1H), 3.64 (ddd, J = 10.6, 7.8, 1.5 Hz, 1H), 3.27 (ddd, J = 11.0, 11.0, 5.6 Hz, 1H), 2.50 – 2.40 (m, 1H), 2.43 (s, 3H), 2.33 (ddd, J = 12.5, 11.2, 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$, 126 MHz) δ 147.3, 143.8, 142.3, 136.1, 133.6, 129.9, 128.8, 128.7, 127.3, 126.9, 125.5, 124.1, 111.0, 85.8, 61.8, 48.0, 37.0, 21.5. FTIR (NaCl, thin film): 3386, 3059, 2971, 1598, 1481, 1447, 1336, 1258, 1158, 1090 1037. HRMS (MM) calc'd for $[M+H]^+$ 425.1085, found 425.1083.

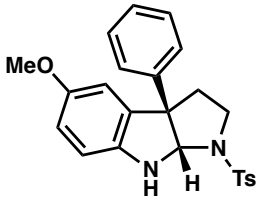


Pyrroloindoline 21g: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (118.0 g) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21g** as a white, crystalline solid (82.1 mg, 0.18 mmol, 58 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.75 – 7.69 (m, 2H), 7.29 (dd, J = 8.5, 0.6 Hz, 2H), 7.27 – 7.18 (m, 4H), 7.10 (dd, J = 8.1, 1.5 Hz, 2H), 7.06 (d, J = 2.0 Hz, 1H), 6.58 (d, J = 8.3 Hz, 1H), 5.43 (s, 1H), 4.96 (s, 1H), 3.64 (ddd, J = 10.7, 7.8, 1.5 Hz, 1H), 3.27 (ddd,

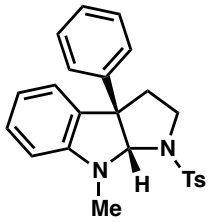
J = 11.0, 11.0, 5.6 Hz, 1H), 2.48 – 2.44 (m, 1H), 2.43 (s, 3H), 2.33 (ddd, *J* = 8.2, 6.4, 4.8 Hz, 1H). ^{13}C NMR ($CDCl_3$, 126 MHz) 147.8, 143.8, 142.3, 136.1, 134.1, 131.5, 129.9, 128.7, 127.3, 126.9, 126.9, 125.5, 111.5, 111.1, 85.7, 61.8, 48.0, 37.0, 21.5. FTIR (NaCl, thin film): 3386, 3059, 2971, 1598, 1477, 1336, 1258, 1093, 1037. HRMS (MM) calc'd for $[M+H]^+$ 469.0580, found 469.0578.



Pyrroloindoline 21h: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (132.1 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21h** as a white, amorphous solid (92.6 mg, 0.19 mmol, 62 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.67 (d, *J* = 8.3 Hz, 2H), 7.33 (dd, *J* = 8.2, 1.8 Hz, 1H), 7.25 (d, *J* = 7.9 Hz, 2H), 7.23 – 7.15 (m, 4H), 7.08 – 7.03 (m, 2H), 6.45 (d, *J* = 8.3 Hz, 1H), 5.38 (d, *J* = 6.8 Hz, 1H), 4.93 (s, 1H), 3.59 (ddd, *J* = 10.6, 7.8, 1.5 Hz, 1H), 3.23 (ddd, *J* = 10.9, 10.9, 5.6 Hz, 1H), 2.45 – 2.35 (m, 1H), 2.39 (s, 3H), 2.28 (ddd, *J* = 12.5, 11.2, 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.4, 143.6, 142.4, 137.4, 136.1, 134.6, 132.6, 129.9, 128.7, 127.3, 126.9, 125.5, 112.2, 85.5, 80.3, 61.6, 48.0, 37.0, 21.5. FTIR (NaCl, thin film): 3385, 3057, 2968, 1597, 1476, 1446, 1420, 1334, 1260, 1159, 1093 cm $^{-1}$; HRMS (MM) calc'd for $[M+H]^+$ 517.0441, found 517.0436.

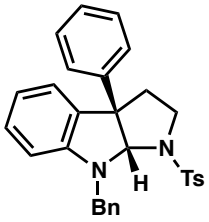


Pyrroloindoline 21i: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 6 hours. Reaction run on 0.30 mmol (103.3 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **21i** as a white, amorphous solid (72.6 mg, 0.19 mmol, 62 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.76 – 7.70 (m, 2H), 7.30 (d, *J* = 7.9 Hz, 2H), 7.25 – 7.15 (m, 3H), 7.15 – 7.08 (m, 2H), 6.69 (dd, *J* = 8.5, 2.5 Hz, 1H), 6.64 (d, *J* = 8.4 Hz, 1H), 6.60 (d, *J* = 2.5 Hz, 1H), 5.40 (s, 1H), 4.71 (s, 1H), 3.71 (s, 3H), 3.65 (ddd, *J* = 10.5, 7.8, 1.3 Hz, 1H), 3.25 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.49 – 2.44 (m, 1H), 2.43 (s, 3H), 2.32 (ddd, *J* = 12.4, 11.3, 7.9 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) 153.9, 143.6, 142.7, 142.6, 136.3, 133.0, 129.8, 128.6, 127.1, 127.0, 125.7, 113.6, 110.8, 110.6, 86.3, 62.1, 55.8, 48.1, 37.0, 21.5; FTIR (NaCl, thin film): 3380, 3057, 3025, 2947, 2832, 1598, 1492, 1336, 1159, 1093, 1035; HRMS (MM) calc'd for $[M+H]^+$ 421.1580, found 421.1577.

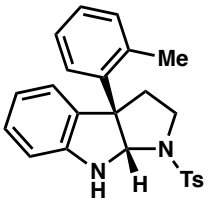


Pyrroloindoline 21k: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (98.5 mg) scale. The crude material was purified on basic alumina (gradient elution, 20 – 25% THF in Hexane) to afford **21k** as a white, solid (65.1 mg, 0.16 mmol, 54% yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.71 – 7.65 (m, 2H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.20 – 7.17 (m, 3H), 7.17 – 7.13 (m, 1H), 6.96 – 6.89 (m, 2H), 6.85 (dd, *J*

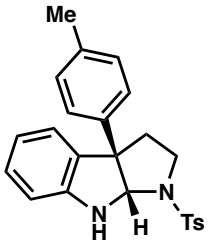
= 7.3, 1.1 Hz, 1H), 6.67 (ddd, *J* = 7.4, 7.4, 0.8 Hz, 1H), 6.50 (d, *J* = 7.9 Hz, 1H), 5.53 (s, 1H), 3.76 (ddd, *J* = 12.1, 7.0, 1.0 Hz, 1H), 3.13 (ddd, *J* = 11.9, 11.9, 5.2 Hz, 1H), 3.06 (s, 3H), 2.44 (s, 3H), 2.21 (ddd, *J* = 12.2, 5.0, 1.2 Hz, 1H), 2.05 (ddd, *J* = 12.0, 12.0, 7.1 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) 150.5, 143.6, 143.0, 136.5, 132.2, 129.7, 128.8, 128.4, 127.2, 126.7, 125.9, 123.62, 117.8, 106.2, 91.9, 61.1, 48.8, 38.0, 31.2, 21.5; FTIR (NaCl, thin film): 3056, 3027, 2949, 2891, 2827, 1762, 1605, 1491, 1347, 1160, 1092, 1022 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1600.



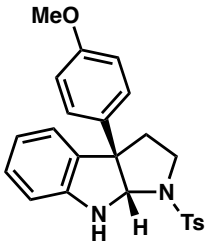
Pyrroloindoline 21l: Prepared according to General Procedure D using 10 mol% $Cu(OAc)_2$ for 24 hours. Reaction run on 0.30 mmol (121 mg) scale. The crude material was purified on basic alumina (gradient elution, 20 – 25% THF in Hexane) to afford **21l** as a white foam (83.4 mg, 0.17 mmol, 58% yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.64 – 7.52 (m, 2H), 7.41 – 7.36 (m, 2H), 7.36 – 7.30 (m, 2H), 7.29 – 7.24 (m, 1H), 7.19 – 7.12 (m, 5H), 7.09 – 7.02 (m, 1H), 6.89 – 6.81 (m, 3H), 6.64 (ddd, *J* = 7.4, 7.4, 0.9 Hz, 1H), 6.42 (d, *J* = 7.8 Hz, 1H), 5.69 (s, 1H), 4.89 (d, *J* = 16.4 Hz, 1H), 4.63 (d, *J* = 16.4 Hz, 1H), 3.82 (dd, *J* = 12.5, 6.8 Hz, 1H), 3.25 (ddd, *J* = 12.2, 12.2, 5.1 Hz, 1H), 2.41 (s, 3H), 2.24 (dd, *J* = 11.9, 4.7 Hz, 1H), 2.06 (ddd, *J* = 12.1, 12.1, 7.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 149.7, 143.6, 143.5, 138.5, 136.4, 132.2, 129.7, 128.7, 128.4, 128.4, 127.3, 127.2, 126.9, 126.7, 125.8, 123.9, 117.9, 106.5, 90.7, 61.3, 48.5, 48.1, 38.2, 21.5; FTIR (NaCl, thin film): 3062, 3027, 2898, 1604, 1493, 1346, 1158, 1089 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 481.1944, found 481.1947.



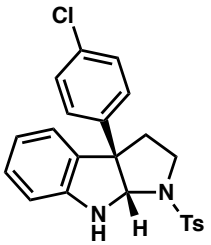
Pyrroloindoline 22a: Prepared according to General Procedure D using 20 mol% $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale with the symmetric di-*o*-tolyliodonium tetrafluoroborate. The crude material was purified by silica gel chromatography (gradient elution, 20% EtOAc in Hexane) to afford **22a** as a white, amorphous solid (60.6 mg, 0.15 mmol, 50 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.69 – 7.63 (m, 2H), 7.20 (d, *J* = 7.9 Hz, 2H), 7.14 – 7.04 (m, 4H), 7.03 – 6.98 (m, 1H), 6.92 (dd, *J* = 7.4, 0.8 Hz, 1H), 6.76 (ddd, *J* = 7.4, 7.4, 1.0 Hz, 1H), 6.65 (d, *J* = 7.8 Hz, 1H), 5.67 (s, 1H), 4.94 (s, 1H), 3.59 (ddd, *J* = 10.1, 7.7, 4.0 Hz, 1H), 3.36 (ddd, *J* = 10.1, 8.6, 6.6 Hz, 1H), 2.69 (ddd, *J* = 12.9, 7.9, 7.9 Hz, 1H), 2.40 (s, 3H), 2.39 – 2.34 (m, 1H), 2.03 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.4, 143.5, 139.4, 136.4, 135.6, 132.6, 131.9, 129.6, 128.5, 127.2, 127.1, 127.0, 125.7, 124.3, 119.2, 109.4, 84.4, 62.1, 47.4, 37.9, 21.4, 20.8; FTIR (NaCl, thin film): 3390, 3057, 2975, 2883, 1606, 1485, 1338, 1158 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1633.



Pyrroloindoline 22b: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 20% EtOAc in Hexane) to afford **22b** as a white, amorphous solid (90.0 mg, 0.22 mmol, 74 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.76 – 7.71 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.11 (ddd, *J* = 7.7, 7.7, 1.3 Hz, 1H), 7.04 (dd, *J* = 4.7, 4.0 Hz, 2H), 6.99 (ddd, *J* = 3.8, 3.8, 1.6 Hz, 3H), 6.77 (ddd, *J* = 7.4, 1.0 Hz, 1H), 6.70 (d, *J* = 7.8 Hz, 1H), 5.39 (s, 1H), 3.64 (ddd, *J* = 10.6, 7.8, 1.4 Hz, 1H), 3.25 (ddd, *J* = 10.9, 10.9, 5.6 Hz, 1H), 2.51 – 2.40 (m, 1H), 2.44 (s, 3H), 2.37 – 2.29 (m, 1H), 2.28 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.7, 143.6, 140.0, 136.7, 136.31, 131.6, 129.8, 129.2, 128.7, 127.0, 125.6, 123.8, 120.0, 110.1, 85.7, 61.5, 48.1, 37.3, 21.5, 20.9; FTIR (NaCl, thin film): 3395, 3052, 3022, 2913, 1607, 1465, 1336, 1159, 1094, 1035 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1624.

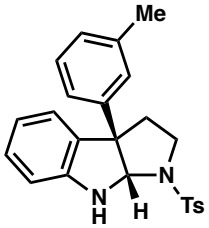


Pyrroloindoline 22c: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 4 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 6:3:1 Hexanes:CH_2Cl_2:Acetone) to afford **22c** as a white foam (88.1 mg, 0.21 mmol, 70 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.75 – 7.70 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.11 (ddd, *J* = 7.9, 7.4, 1.3 Hz, 1H), 7.04 – 6.96 (m, 3H), 6.80 – 6.72 (m, 3H), 6.71 – 6.67 (m, 1H), 5.36 (s, 1H), 4.89 (br s, 1H), 3.74 (s, 3H), 3.63 (ddd, *J* = 10.6, 7.8, 1.5 Hz, 1H), 3.23 (td, *J* = 10.9, 5.6 Hz, 1H), 2.47 – 2.40 (m, 1H), 3.2.44 (s, 3H) 2.32 (ddd, *J* = 12.4, 11.2, 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 158.5, 148.77, 143.6, 136.3, 135.0, 131.7, 129.8, 128.7, 127.0, 126.8, 123.8, 119.6, 113.9, 110.1, 85.8, 61.2, 55.2, 48.2, 37.3, 21.5; FTIR (NaCl, thin film): 3390, 3047, 2953, 2834, 1608, 1512, 1483, 1466, 1336, 1251, 1183, 1159, 1094 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 421.1580, found 421.1580.

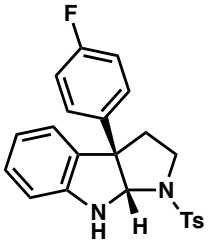


Pyrroloindoline 22d: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **22d** as a white, amorphous solid (86.5 mg, 0.20 mmol, 68 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.76 – 7.69 (m, 2H), 7.30 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.21 – 7.15 (m, 2H), 7.15 – 7.09 (m, 1H), 7.06 – 7.00 (m, 2H), 6.95 (ddd, *J* = 7.4, 1.2, 0.5 Hz, 1H), 6.77 (ddd, *J* = 7.4, 7.4, 1.0 Hz, 1H), 6.70 (dd, *J* = 4.5, 4.0 Hz, 1H), 5.37 (s, 1H), 4.91 (br s, 1H), 3.65 (ddd, *J* = 10.7, 7.8, 1.5 Hz, 1H), 3.24 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.51 – 2.40 (m, 1H), 2.44 (s, 3H), 2.28 (ddd, *J* = 12.4, 11.2, 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.7, 143.7, 141.5, 136.2, 132.9, 131.0, 129.9, 129.0, 128.7, 127.1, 126.9, 123.7, 119.7, 110.2, 85.6, 61.3, 48.1, 37.1, 21.5; FTIR

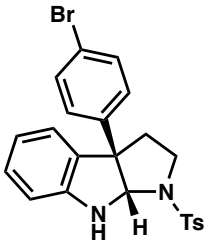
(NaCl, thin film): 3386, 3051, 2970, 2893, 1607, 1493, 1466, 1483, 1399, 1336, 1159, 1093 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 425.1085, found 425.1077.



Pyrroloindoline 22e: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 20% EtOAc in Hexane) to afford **22e** as a white, amorphous solid (75.2 mg, 0.19 mmol, 63% yield). ^1H NMR ($CDCl_3$, 500 MHz) δ 7.77 – 7.72 (m, 2H), 7.31 (d, J = 7.9 Hz, 2H), 7.14 – 7.08 (m, 2H), 7.02 – 6.97 (m, 2H), 6.92 – 6.86 (m, 2H), 6.77 (ddd, J = 7.4, 7.4, 1.0 Hz, 1H), 6.70 (d, J = 7.8 Hz, 1H), 5.42 (s, 1H), 3.66 (ddd, J = 10.6, 7.8, 1.4 Hz, 1H), 3.25 (ddd, J = 11.0, 11.0, 5.6 Hz, 1H), 2.49 – 2.45 (m, 1H), 2.44 (s, 3H), 2.32 (ddd, J = 12.5, 11.4, 7.9 Hz, 1H), 2.25 (s, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.8, 143.6, 143.0, 138.2, 136.4, 131.4, 129.9, 128.7, 128.4, 127.8, 127.0, 126.3, 124.0, 122.8, 119.6, 110.1, 85.7, 61.8, 48.2, 37.6, 21.5, 21.5; FTIR (NaCl, thin film): 3390, 2047, 2970, 1607, 1483, 1466, 1340, 1159, 1094 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 405.1631, found 405.1626.

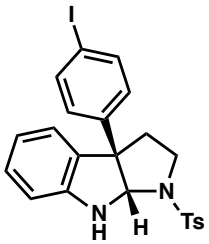


Pyrroloindoline 22f: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **22f** as a white, amorphous solid (80.3 mg, 0.20 mmol, 66 % yield). ^1H NMR ($CDCl_3$, 500 MHz) δ 7.77 – 7.70 (m, 2H), 7.30 (dd, J = 8.5, 0.6 Hz, 2H), 7.16 – 7.09 (m, 1H), 7.09 – 7.04 (m, 2H), 6.97 (ddd, J = 7.4, 1.2, 0.5 Hz, 1H), 6.93 – 6.86 (m, 2H), 6.78 (ddd, J = 7.4, 7.4, 1.0 Hz, 1H), 6.70 (d, J = 7.8 Hz, 1H), 5.38 (s, 1H), 3.66 (ddd, J = 10.6, 7.8, 1.4 Hz, 1H), 3.24 (ddd, J = 11.0, 11.0, 5.6 Hz, 1H), 2.49 – 2.42 (m, 1H), 2.44 (s, 3H), 2.30 (ddd, J = 12.4, 11.2, 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 161.6 (d, $J_{C\text{-}F}$ = 245.0 Hz), 148.7, 143.7, 138.7, 138.7, 136.2, 131.3, 129.8, 128.9, 127.3 (d, $J_{C\text{-}F}$ = 7.5 Hz), 126.9, 123.7, 119.7, 115.3 (d, $J_{C\text{-}F}$ = 20.0 Hz), 110.2, 109.9, 85.7, 61.2, 48.1, 37.3, 21.5; FTIR (NaCl, thin film): 3391, 3051, 2970, 2892, 1607, 1510, 1483, 1466, 1400, 1336, 1233, 1160, 1095 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 409.1381, found 409.1363.

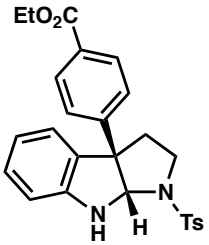


Pyrroloindoline 22g: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexane) to afford **22g** as a white, amorphous solid (83.4 mg, 0.19 mmol, 59 % yield). ^1H NMR ($CDCl_3$, 500 MHz) δ 7.76 – 7.69 (m, 2H), 7.36 – 7.28 (m, 4H), 7.12 (ddd, J = 7.7, 7.7, 1.2 Hz, 1H), 7.00 – 6.92 (m, 3H), 6.77 (ddd, J = 7.4, 7.4, 1.0 Hz, 1H), 6.70 (d, J = 7.8 Hz, 1H), 5.37 (s, 1H), 4.91

(s, 1H), 3.65 (ddd, *J* = 10.7, 7.8, 1.4 Hz, 1H), 3.24 (ddd, *J* = 10.9, 10.9, 5.6 Hz, 1H), 2.49 – 2.40 (m, 1H), 2.44 (s, 3H), 2.27 (ddd, *J* = 12.4, 11.2, 7.9 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.6, 143.7, 142.0, 136.1, 131.6, 130.9, 129.9, 129.0, 127.5, 126.9, 123.71, 121.0, 119.7, 110.2, 85.5, 61.4, 48.1, 37.0, 21.5; FTIR (NaCl, thin film): 3391, 3051, 2970, 2892, 1608, 1597, 1484, 1466, 1396, 1336, 1159, 1095 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 469.0580, found 469.0553.

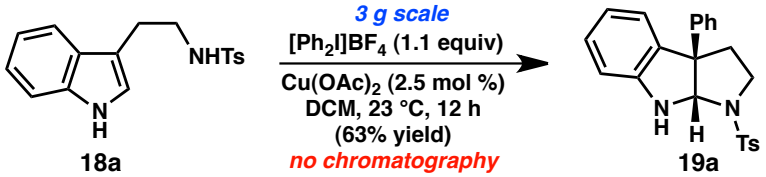


Pyrroloindoline 22h: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94 mg) scale. The crude material was purified on basic alumina (gradient elution, 40% THF in Hexanes) to afford **22h** as a white, amorphous solid (95.8 mg, 0.19 mmol, 62 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.75 – 7.69 (m, 2H), 7.55 – 7.51 (m, 2H), 7.30 (d, *J* = 7.9 Hz, 2H), 7.12 (ddd, *J* = 7.7, 7.7, 1.2 Hz, 1H), 6.96 – 6.92 (m, 1H), 6.88 – 6.83 (m, 2H), 6.76 (ddd, *J* = 7.4, 7.4, 1.0 Hz, 1H), 6.70 (d, *J* = 7.8 Hz, 1H), 5.35 (s, 1H), 3.64 (ddd, *J* = 10.7, 7.8, 1.4 Hz, 1H), 3.24 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.49 – 2.39 (m, 1H), 2.44 (s, 3H), 2.26 (ddd, *J* = 12.4, 11.2, 7.9 Hz, 1H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 148.7, 143.8, 142.8, 137.6, 136.2, 130.9, 129.9, 129.0, 127.7, 126.9, 123.7, 119.8, 110.3, 92.5, 85.5, 61.5, 48.1, 36.9, 21.6; FTIR (NaCl, thin film): 3390, 3047, 2948, 2878, 1612, 1486, 1336, 1158, 1005 cm^{-1}; HRMS (MM) calc'd for $[M+H]^+$ 517.0441, found 517.0424.



Pyrroloindoline 22i: Prepared according to General Procedure D using 20 mol % $Cu(OTf)_2$ for 12 hours. Reaction run on 0.30 mmol (94.0 mg) scale. The crude material was purified by silica gel chromatography (gradient elution, 6:3:1 Hexanes:DCM:Acetone) to afford **22i** as a colorless oil (78.2 mg, 0.17 mmol, 56 % yield). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.91 – 7.85 (m, 2H), 7.75 – 7.69 (m, 2H), 7.29 (dd, *J* = 8.5, 0.6 Hz, 2H), 7.21 – 7.15 (m, 2H), 7.14 – 7.08 (m, 1H), 6.96 (ddd, *J* = 7.4, 1.2, 0.5 Hz, 1H), 6.76 (ddd, *J* = 7.5, 7.5, 1.0 Hz, 1H), 6.71 (dd, *J* = 7.2, 0.7 Hz, 1H), 5.43 (s, 1H), 4.92 (s, 1H), 4.34 (q, *J* = 7.1 Hz, 2H), 3.66 (ddd, *J* = 10.7, 7.8, 1.4 Hz, 1H), 3.26 (ddd, *J* = 11.0, 11.0, 5.6 Hz, 1H), 2.49 (ddd, *J* = 12.3, 5.5, 1.0 Hz, 1H), 2.43 (s, 3H), 2.31 (ddd, *J* = 12.4, 11.3, 7.9 Hz, 1H), 1.36 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR ($CDCl_3$, 126 MHz) δ 166.1, 148.7, 148.0, 143.8, 136.2, 130.9, 129.9, 129.9, 129.7, 129.0, 126.9, 125.63, 123.8, 119.7, 110.2, 85.4, 61.8, 60.9, 48.1, 37.1, 21.5, 14.3; FTIR (NaCl, thin film): 3387, 3052, 2979, 2895, 1713, 1610, 1483, 1467, 1343, 1278, 1160, 1110 cm^{-1}. HRMS (MM) calc'd for $[M+H]^+$ 463.1686, found 463.1666.

6. Catalyst Efficiency and Scalability



To a flame-dried, 100 mL flask was charged *N*-tosyltryptamine (3.15 g, 10.0 mmol, 1.0 equiv), Ph_2IBF_4 (4.04 g, 11.0 mmol, 1.1 equiv) and $Cu(OAc)_2$ (45.4 mg, 0.25 mmol, 0.025 equiv). The dissolved in 50 mL CH_2Cl_2 and allowed to stir at room temperature for 12 hours at which point the reaction was diluted with CH_2Cl_2 (100 mL), washed with saturated aqueous $NaHCO_3$ (2 x 50 mL) and the resulting aqueous layers were then combined and back extracted with CH_2Cl_2 (50 mL). The organic layers were combined, dried over anhydrous Na_2SO_4, filtered, and concentrated *in vacuo*. The resultant yellow solid was dissolved in 50 mL CH_2Cl_2, 100 mL Et_2O and 200 mL hexanes to afford a light yellow powder. The powder was filtered and dried under vacuum to give **19a** (2.55g, 6.5 mmol, 65% yield).

References

[1] Still, W. C., Kahn, M. & Mitra, A. Rapid chromatographic technique for preparative separations with moderate resolution. *J. Org. Chem*. **43**, 2923-2925 (1978).

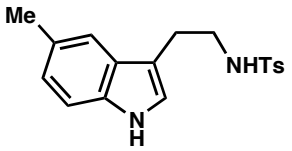
KVC12-161

Sample Name:
KVC12-161
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-161
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #9, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



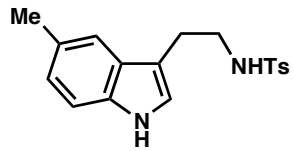
KVC12-161

Sample Name:
KVC12-161
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-161
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #9, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528748 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



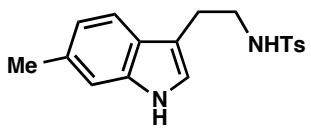
KVC12-221

Sample Name:
KVC12-221
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-221
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #7, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



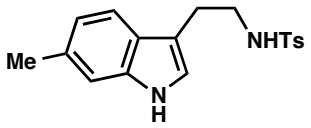
KVC12-221

Sample Name:
KVC12-221
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-221
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #7, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528739 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



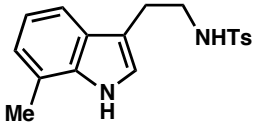
KVC12-223

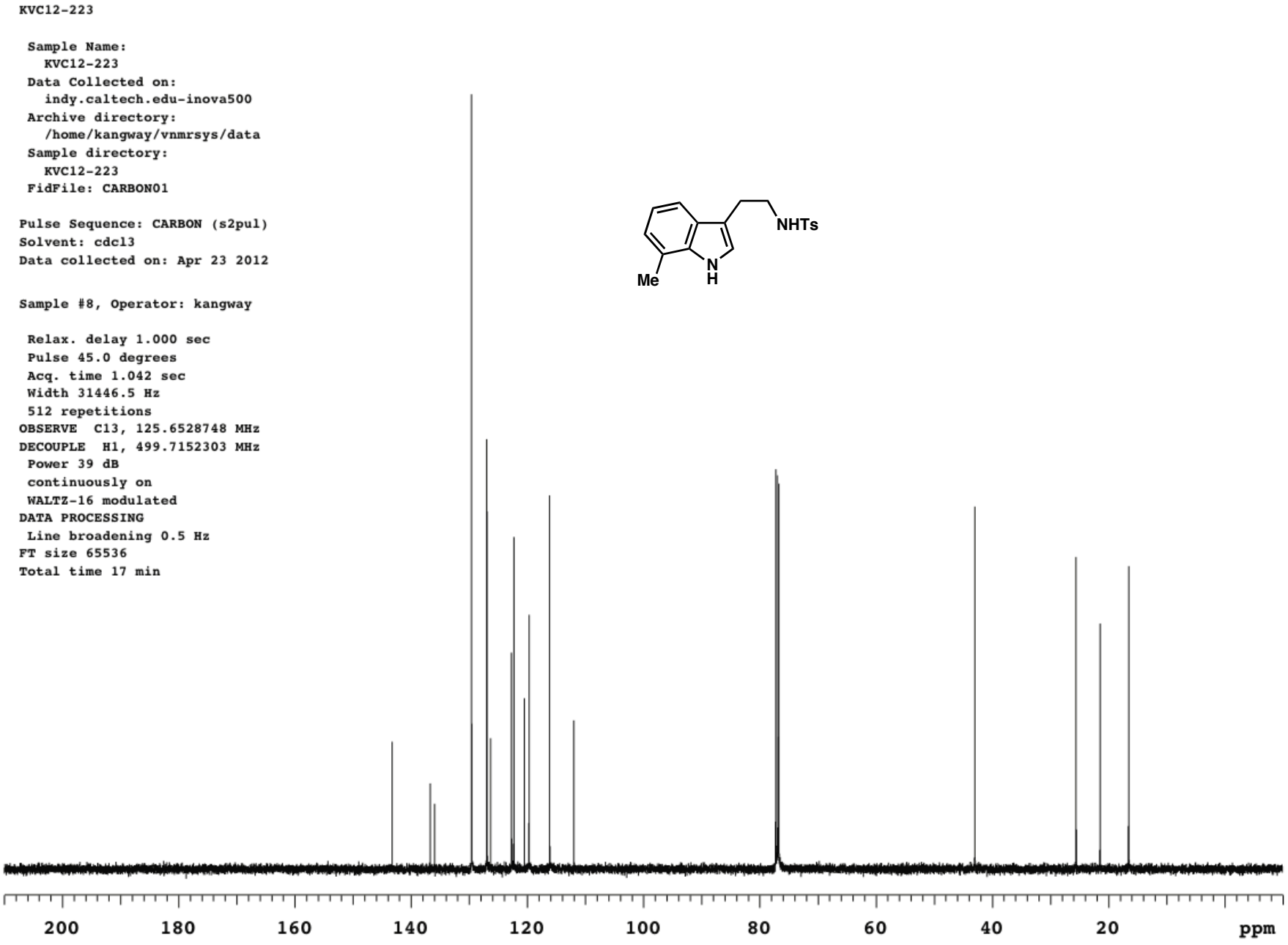
Sample Name:
KVC12-223
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-223
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #8, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec




KVC12-223
Sample Name:
KVC12-223
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-223
FidFile: CARBON01
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012
Sample #8, Operator: kangway
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528748 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min
NHTs
Me
N
H
200
180
160
140
120
100
80
60
40
20
ppm

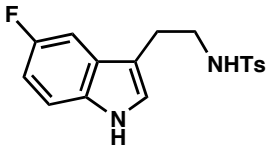
KVC12-275

Sample Name:
KVC12-275
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-275
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #10, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



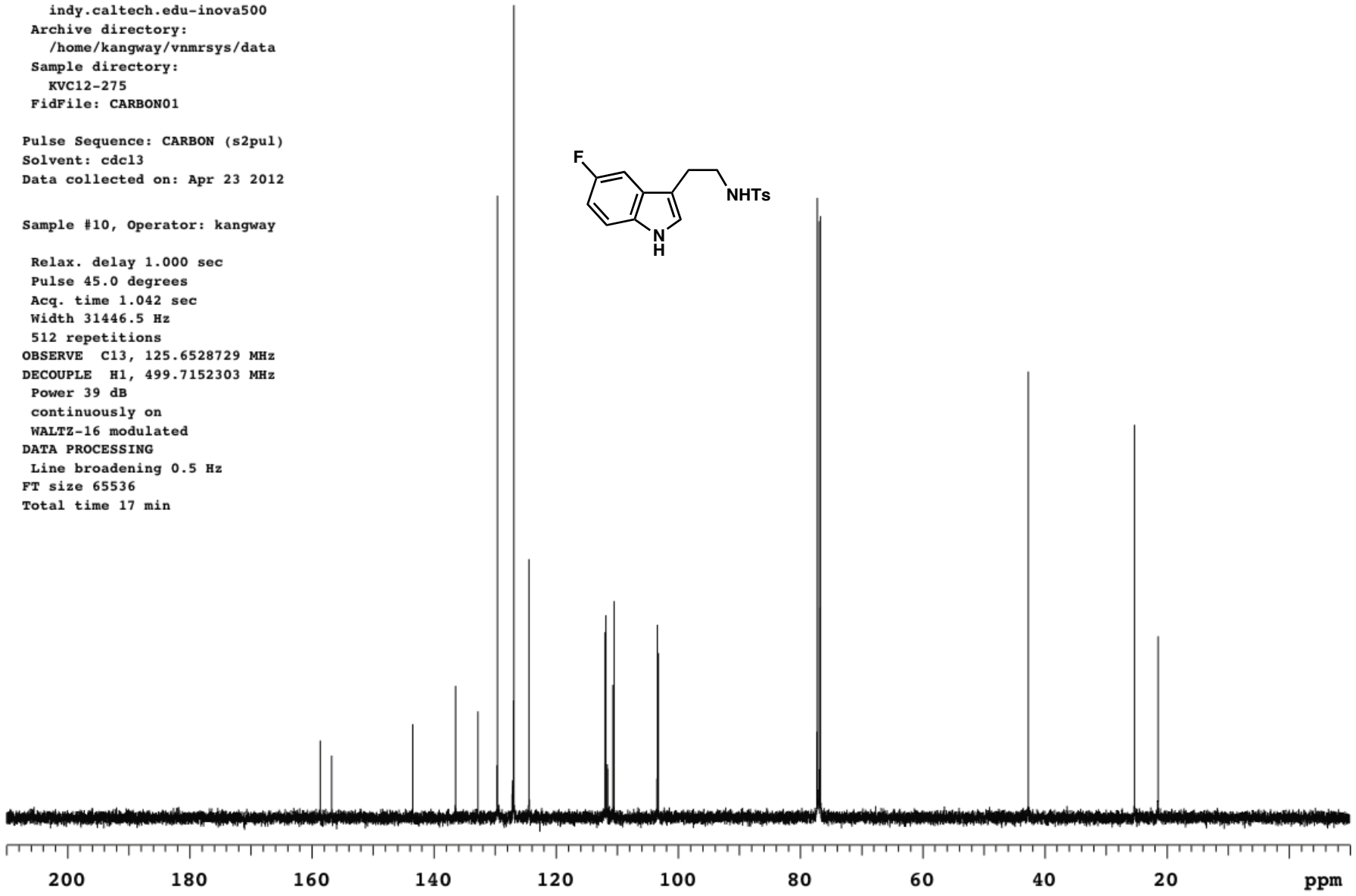
KVC12-275

Sample Name:
KVC12-275
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-275
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #10, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



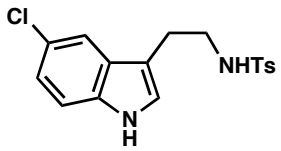
KVC12-273

Sample Name:
KVC12-273
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-273
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #13, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



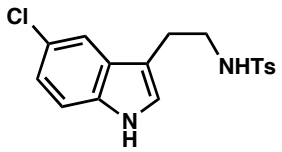
KVC12-273

Sample Name:
KVC12-273
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-273
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #13, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



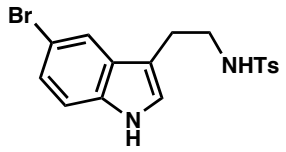
KVC12-133

Sample Name:
KVC12-133
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-133
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 20 2012

Sample #21, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



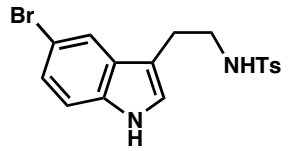
KVC12-133

Sample Name:
KVC12-133
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-133
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 20 2012

Sample #21, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528767 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



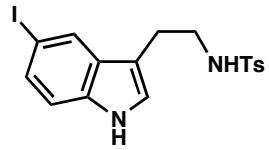
KVC12-139

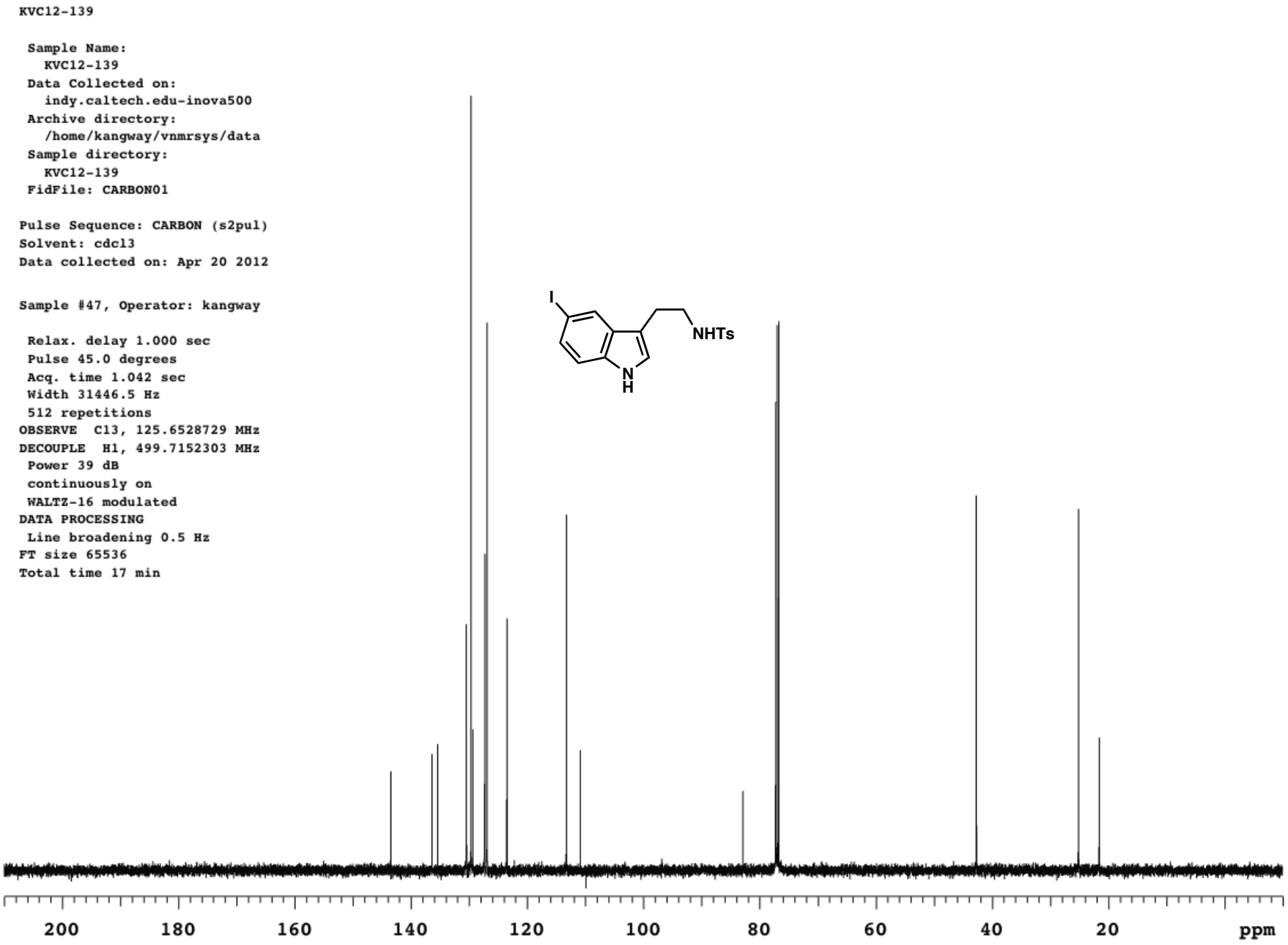
Sample Name:
KVC12-139
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-139
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 20 2012

Sample #47, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec




KVC12-139
Sample Name:
KVC12-139
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-139
FidFile: CARBON01
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 20 2012
Sample #47, Operator: kangway
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min
I
NHTs
N
H
200
180
160
140
120
100
80
60
40
20
ppm

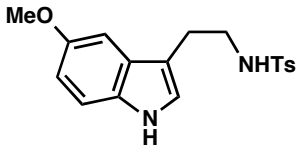
KVC12-155

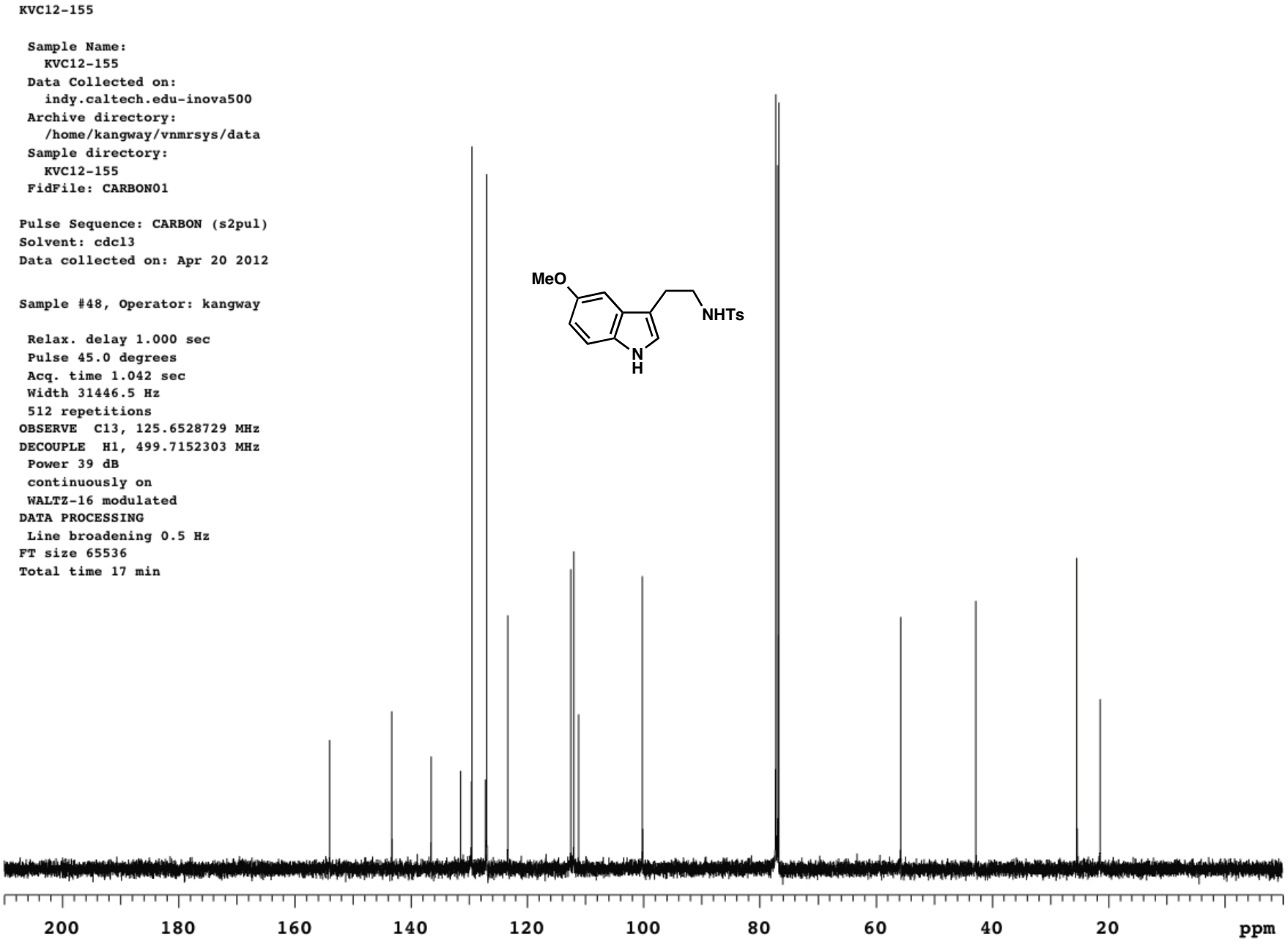
Sample Name:
KVC12-155
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-155
FidFile: PROTON01

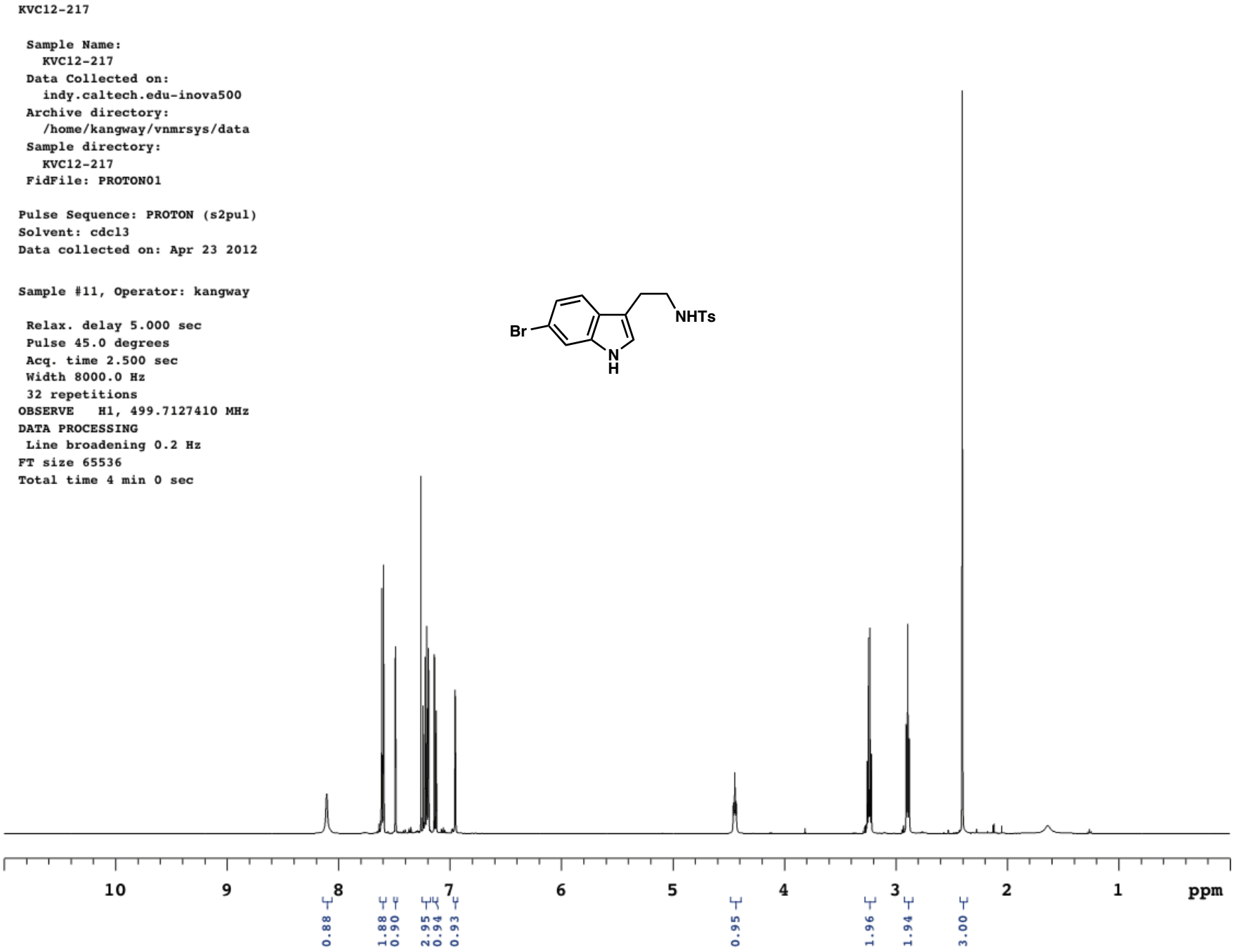
Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 20 2012

Sample #48, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec






KVC12-217
Sample Name:
KVC12-217
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-217
FidFile: PROTON01
Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012
Sample #11, Operator: kangway
Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec
Br
NHTs
N
H
10
9
8
7
6
5
4
3
2
1
ppm
0.88
1.88
0.90
2.95
0.94
0.93
0.95
1.96
1.94
3.00

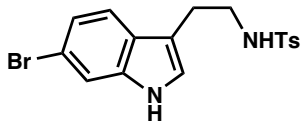
KVC12-217

Sample Name:
KVC12-217
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-217
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 23 2012

Sample #11, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528719 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



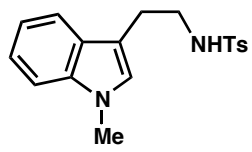
KVC12-203

Sample Name:
KVC12-203
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-203
FidFile: PROTON02

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 10 2012

Sample #48, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127432 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



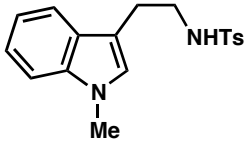
KVC12-203

Sample Name:
KVC12-203
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-203
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 10 2012

Sample #47, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528825 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



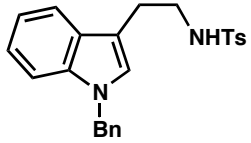
KVC12-199

Sample Name:
KVC12-199
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-199
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 9 2012

Sample #49, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7225033 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



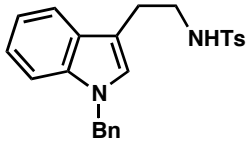
KVC12-199

Sample Name:
KVC12-199
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-199
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 9 2012

Sample #49, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6553300 MHz
DECOUPLE H1, 499.7250019 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



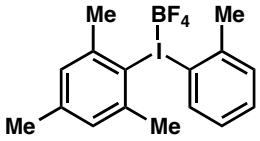
KVC11-215

Sample Name:
KVC11-215
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-215
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #7, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151044 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



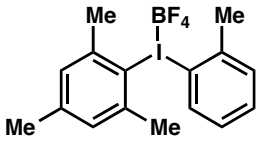
KVC11-215

Sample Name:
KVC11-215
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-215
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #7, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534597 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



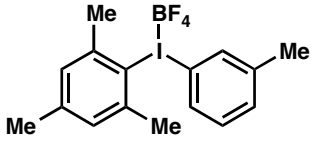
KVC11-231

Sample Name:
KVC11-231
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-231
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #10, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



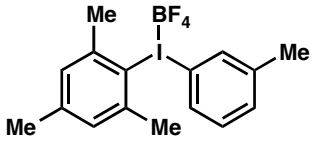
KVC11-231

Sample Name:
KVC11-231
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-231
FidFile: CARBON02

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #47, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534588 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



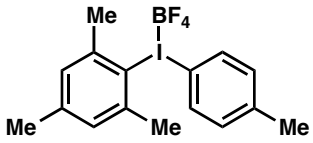
KVC11-217

Sample Name:
KVC11-217
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-217
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #9, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



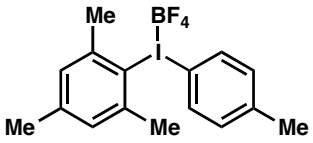
KVC11-217

Sample Name:
KVC11-217
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-217
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #9, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534588 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



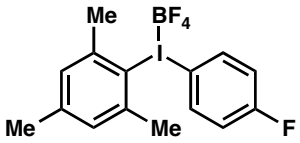
KVC11-251

Sample Name:
KVC11-251
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-251
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 23 2012

Sample #2, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151044 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



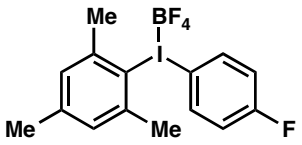
KVC11-251

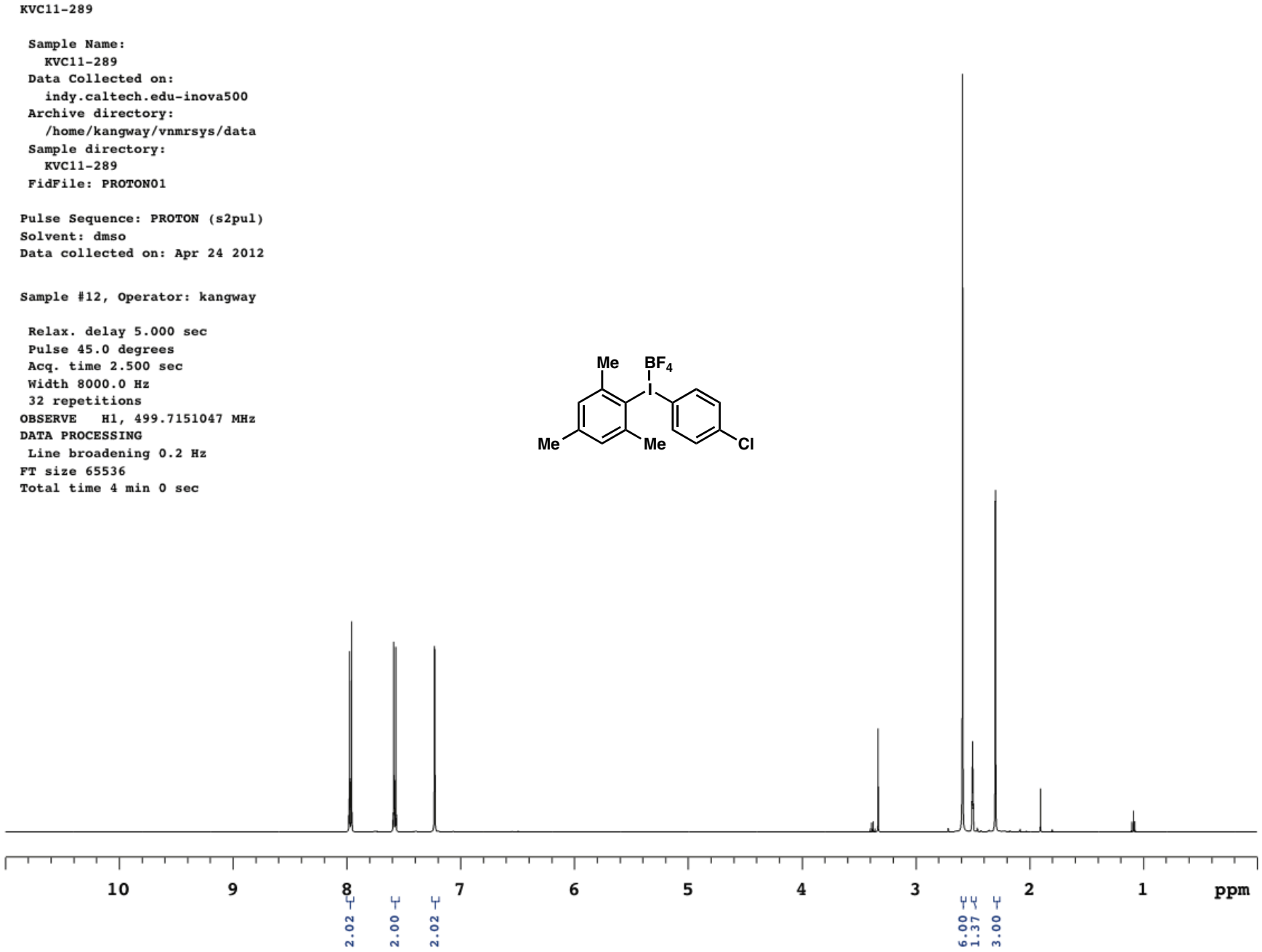
Sample Name:
KVC11-251
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-251
FidFile: CARBON02

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #48, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534588 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min




KVC11-289
Sample Name:
KVC11-289
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-289
FidFile: PROTON01
Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012
Sample #12, Operator: kangway
Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec
Me
BF4
I
Me
Me
Cl
10
9
8
7
6
5
4
3
2
1
ppm
2.02
2.00
2.02
6.00
1.37
3.00

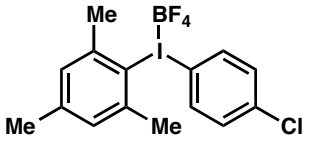
KVC11-289

Sample Name:
KVC11-289
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-289
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #12, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534597 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



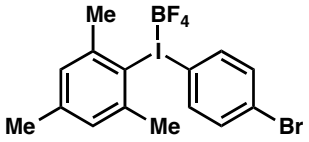
KVC11-287

Sample Name:
KVC11-287
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-287
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #13, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



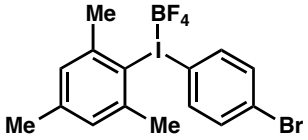
KVC11-287

Sample Name:
KVC11-287
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-287
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #13, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534588 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



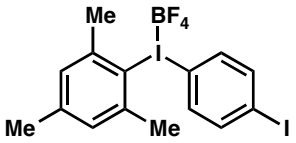
KVC12-109

Sample Name:
KVC12-109
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-109
FidFile: PROTON02

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #45, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
8 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 0 min 28 sec



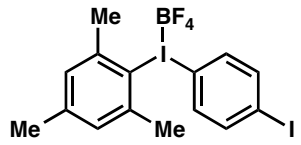
KVC12-109

Sample Name:
KVC12-109
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC12-109
FidFile: CARBON02

Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #45, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534597 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



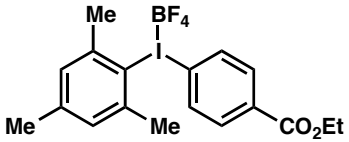
KVC11-253

Sample Name:
KVC11-253
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-253
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

Sample #11, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7151047 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



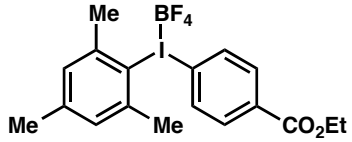
KVC11-253

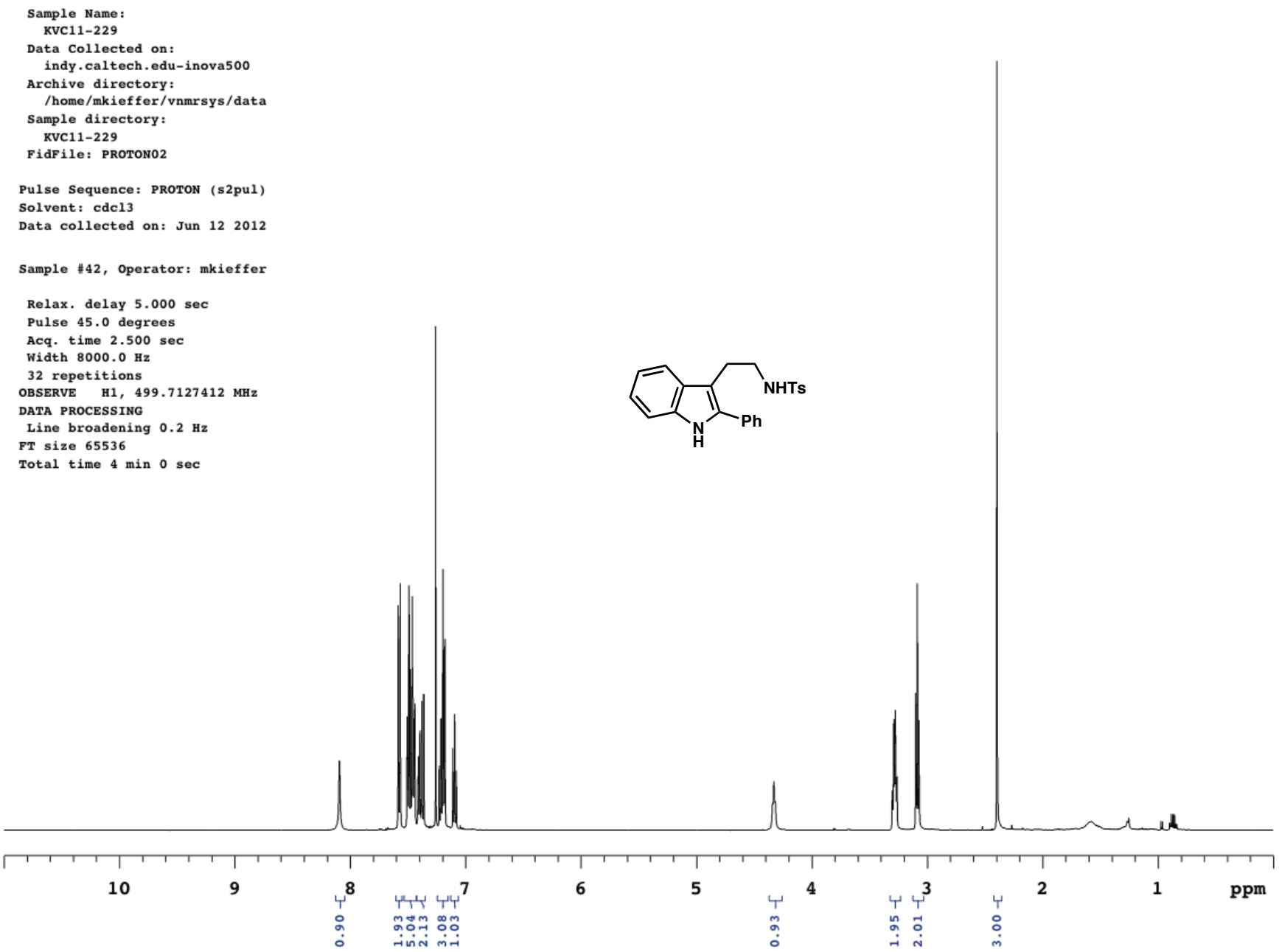
Sample Name:
KVC11-253
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC11-253
FidFile: CARBON01

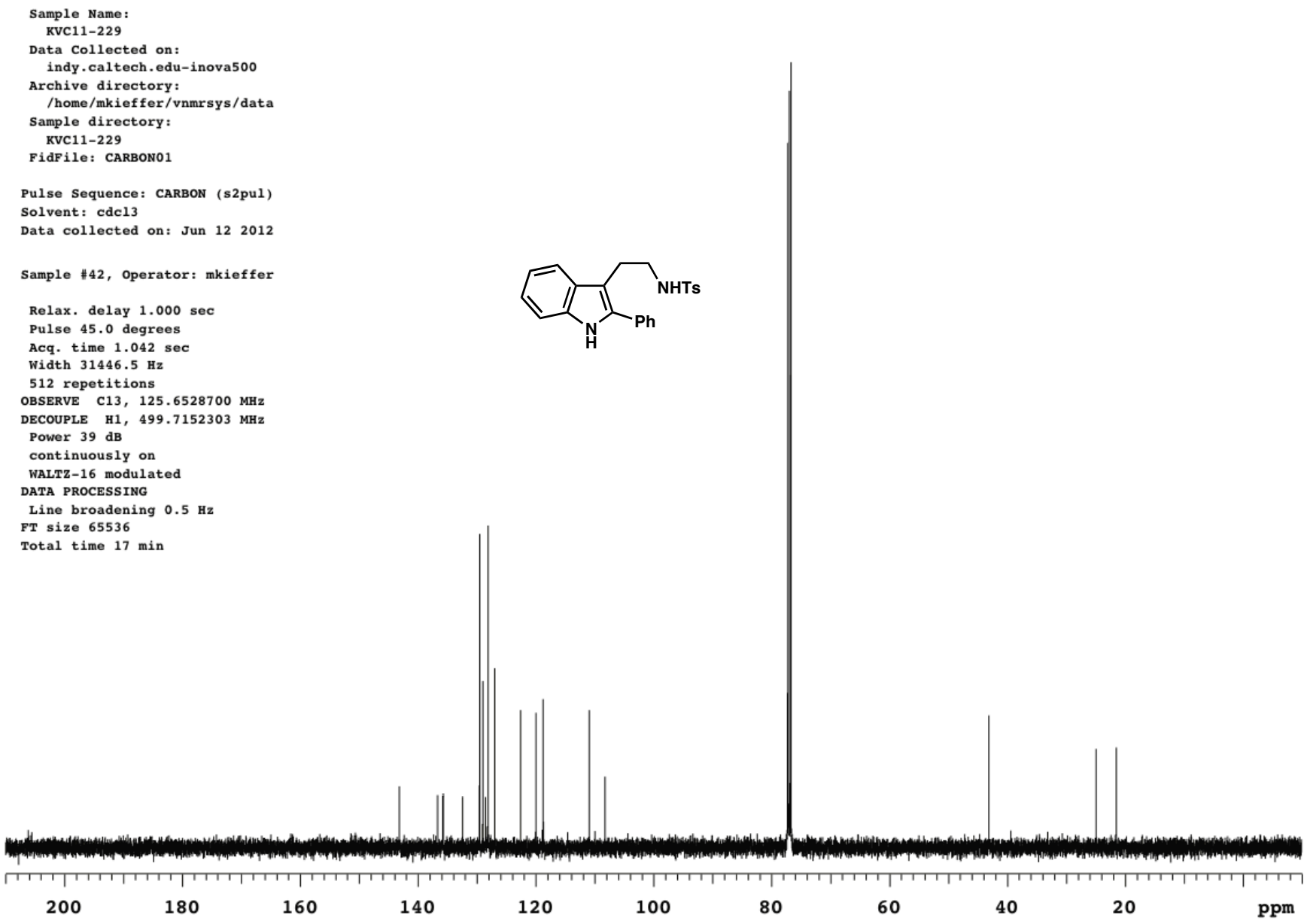
Pulse Sequence: CARBON (s2pul)
Solvent: dmso
Data collected on: Apr 24 2012

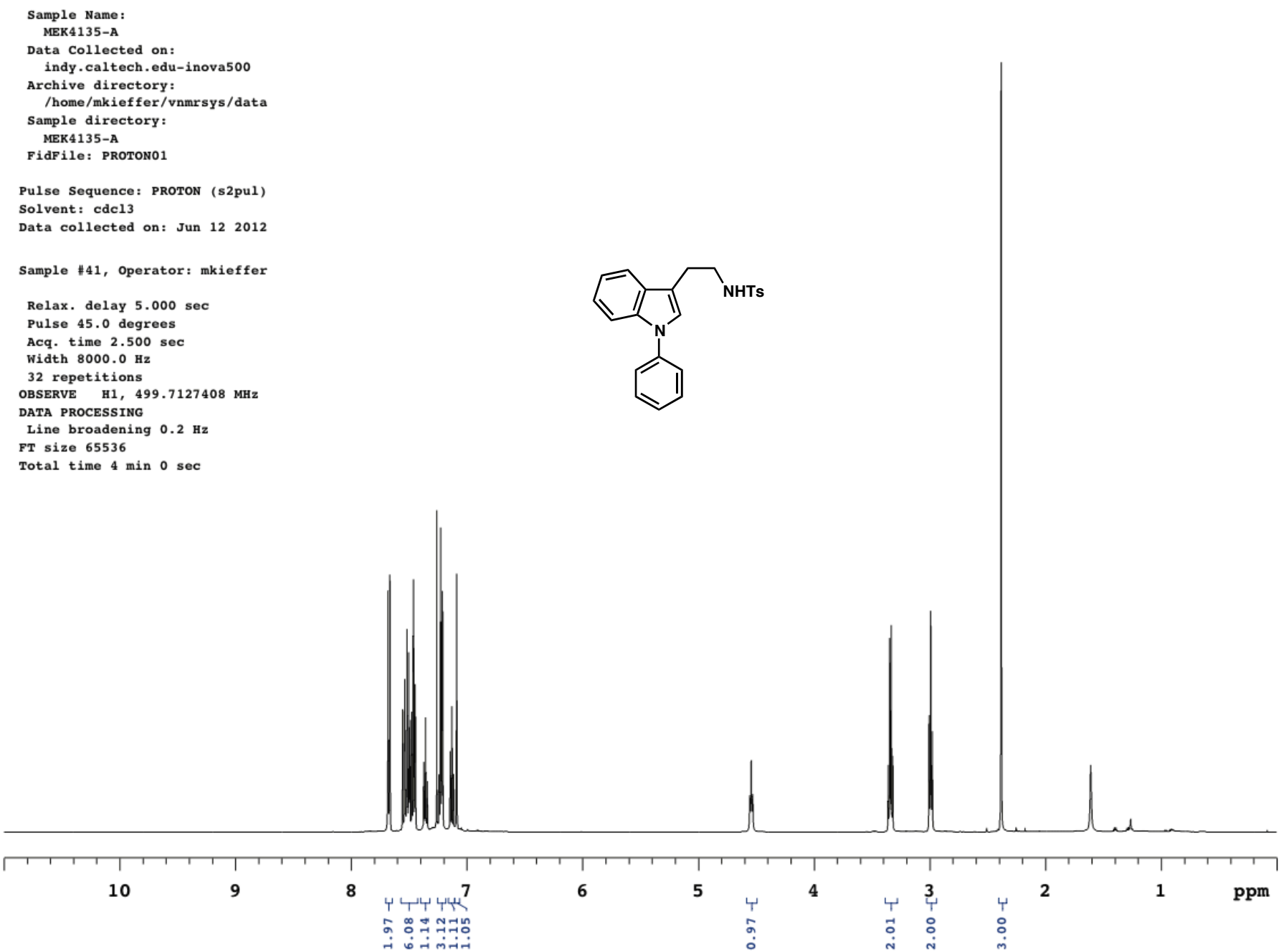
Sample #11, Operator: kangway

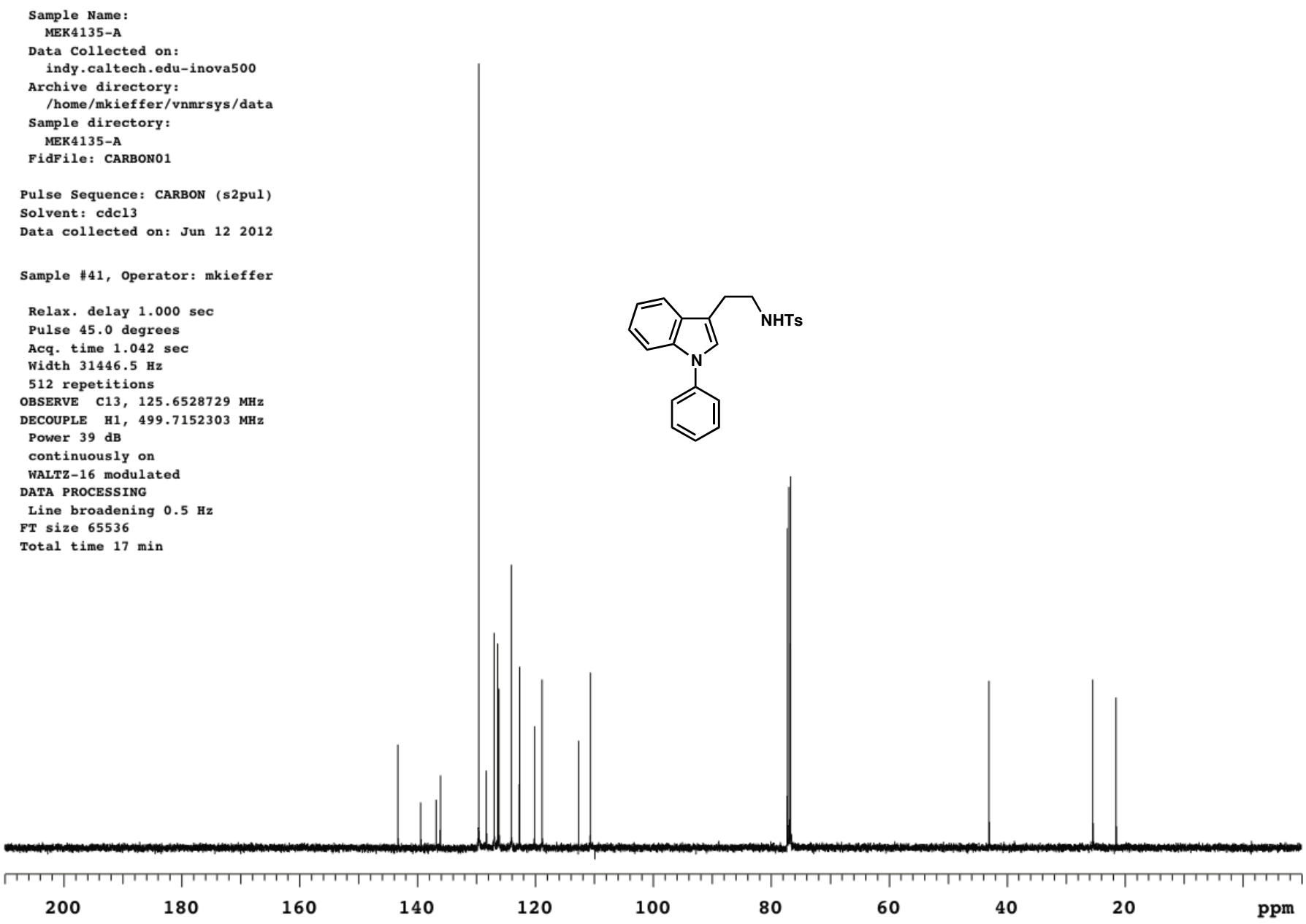
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6534597 MHz
DECOUPLE H1, 499.7176040 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min











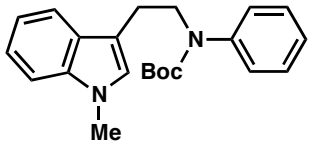
MEK3301-6

Sample Name:
MEK3301-6
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK3301-6
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Oct 25 2011

Sample #14, Operator: mkieffer

Relax. delay 2.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
16 repetitions
OBSERVE H1, 499.7225125 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 1 min 12 sec



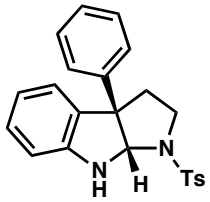
MEK4100

Sample Name:
MEK4100
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
MEK4100
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 18 2012

Sample #48, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



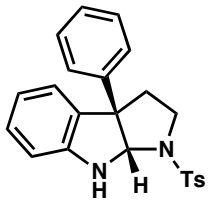
MEK4100

Sample Name:
MEK4100
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
MEK4100
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 18 2012

Sample #48, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528719 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



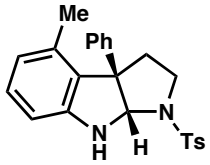
KVC13-059-A

Sample Name:
KVC13-059-A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-A
FidFile: PROTON02

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #48, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



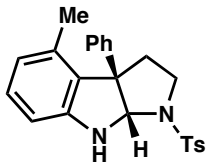
KVC13-059-A

Sample Name:
KVC13-059-A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-A
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #40, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528719 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



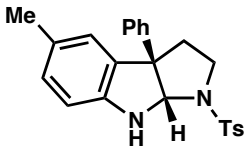
KVC13-069-A

Sample Name:
KVC13-069-A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-A
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 12 2012

Sample #40, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



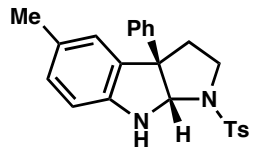
KVC13-069-A

Sample Name:
KVC13-069-A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-A
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 12 2012

Sample #40, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



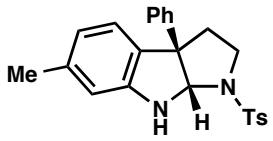
KVC13-059-B

Sample Name:
KVC13-059-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-B
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #40, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



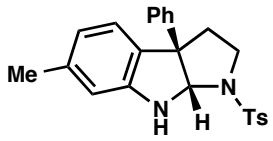
KVC13-059-B

Sample Name:
KVC13-059-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-B
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #40, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



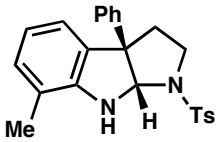
KVC13-059-C

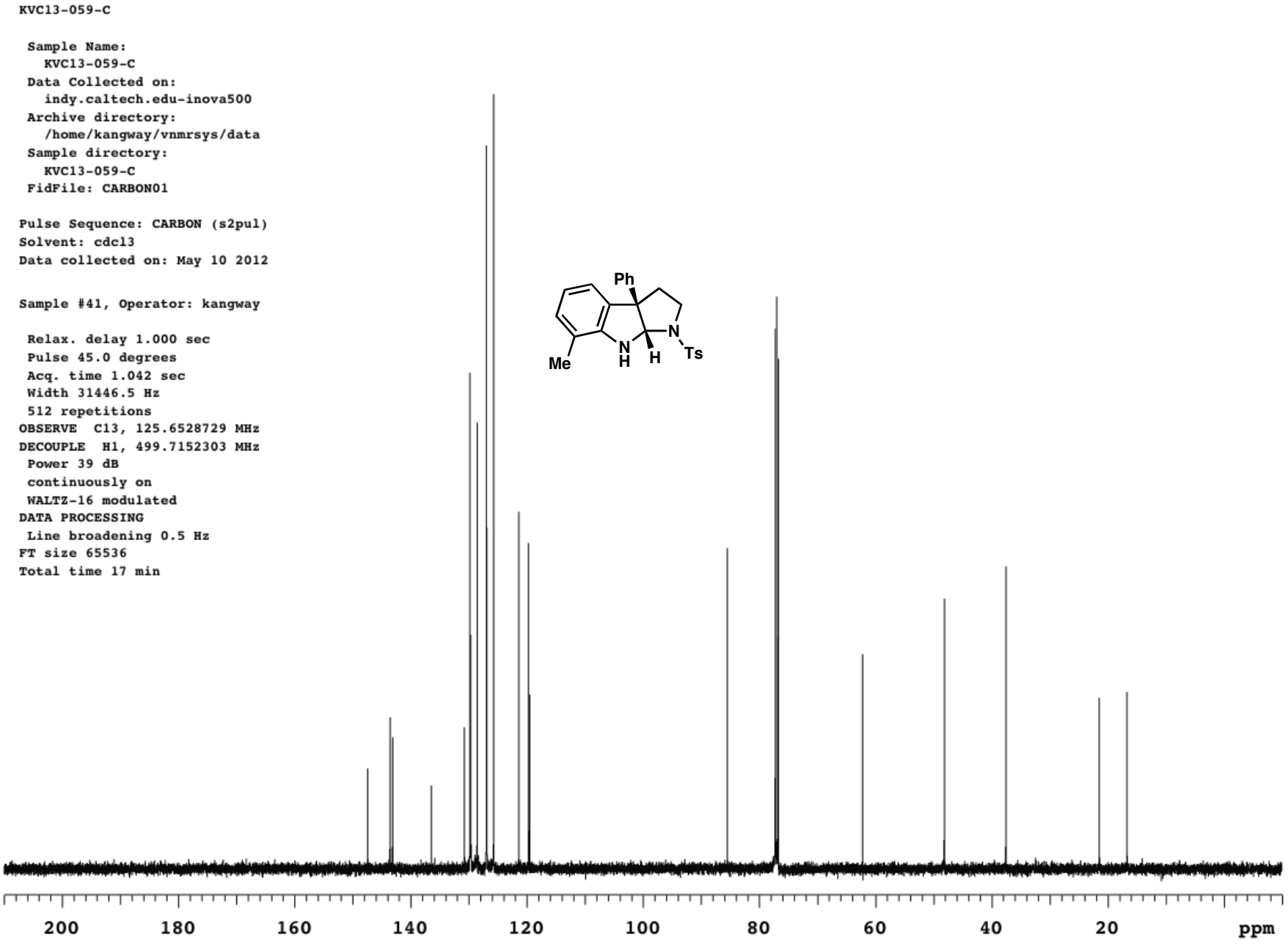
Sample Name:
KVC13-059-C
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-C
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #41, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec





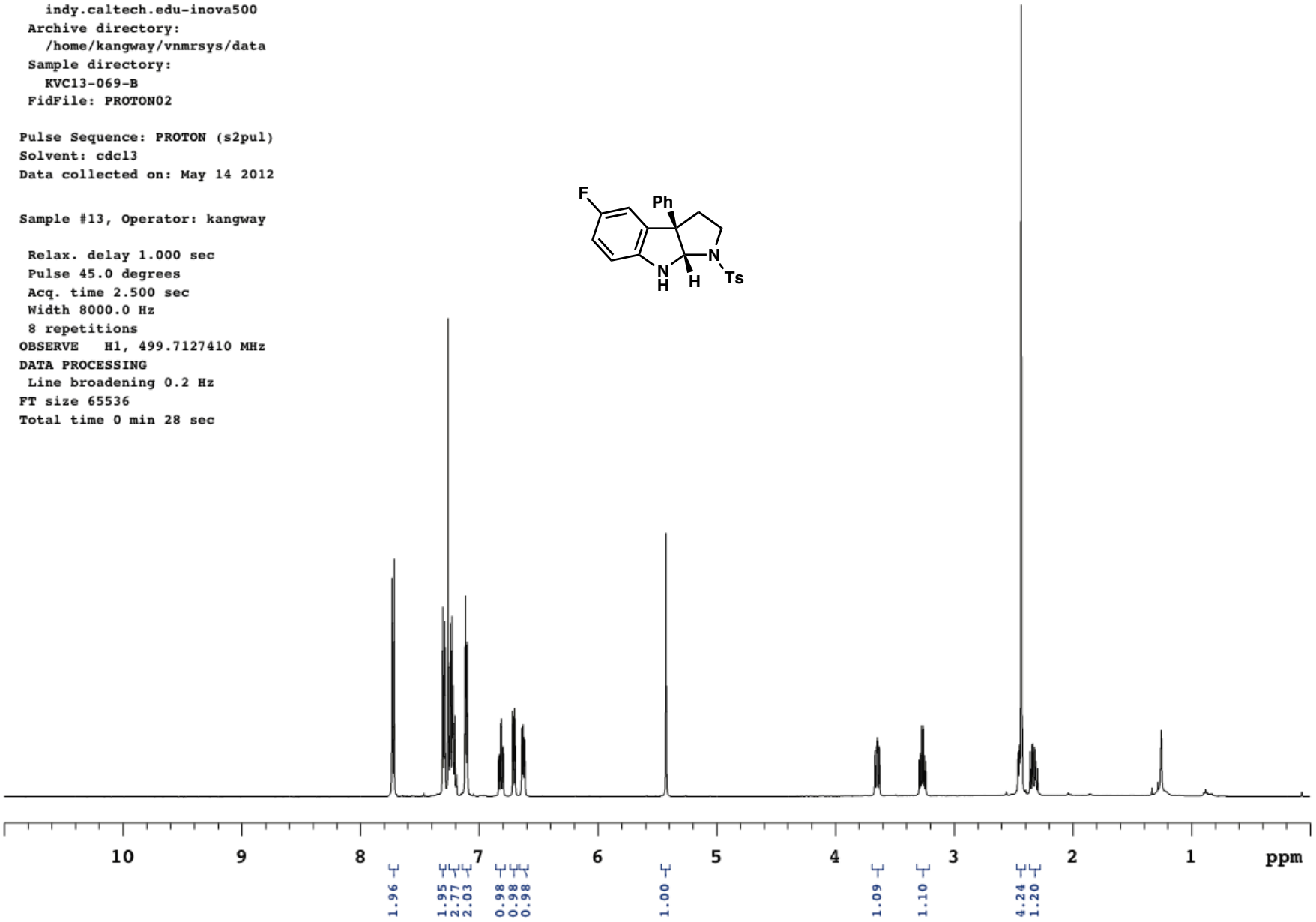
KVC13-069-B

Sample Name:
KVC13-069-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-B
FidFile: PROTON02

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 14 2012

Sample #13, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
8 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 0 min 28 sec



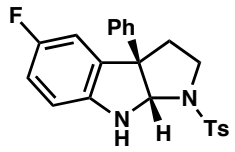
KVC13-069-B

Sample Name:
KVC13-069-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-B
FidFile: CARBON02

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 14 2012

Sample #13, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
1600 repetitions
OBSERVE C13, 125.6528700 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 54 min



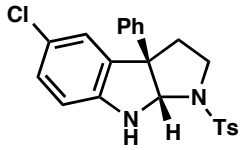
KVC13-069-C

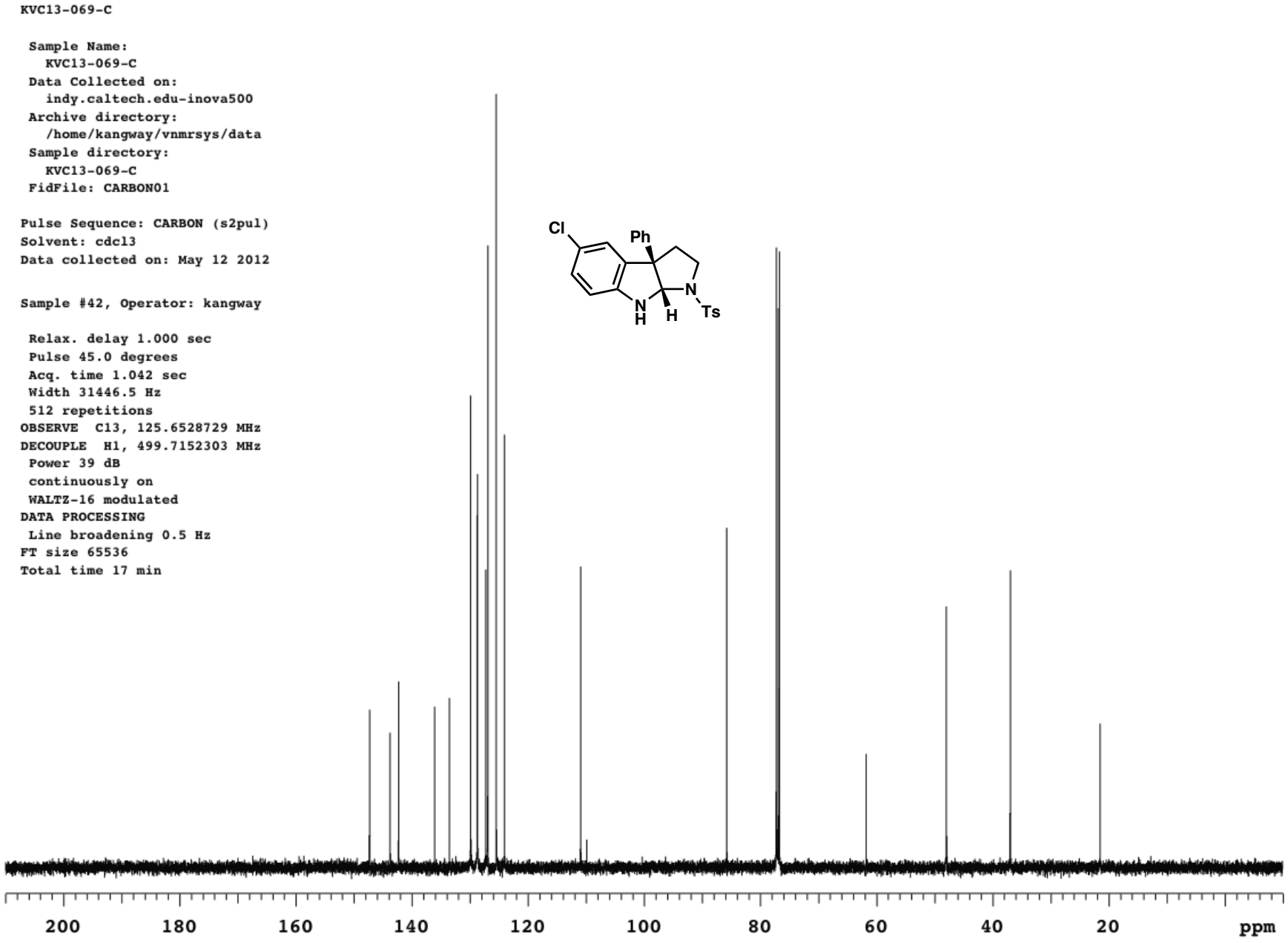
Sample Name:
KVC13-069-C
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-C
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 12 2012

Sample #42, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec





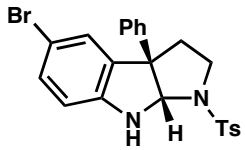
KVC13-059-D

Sample Name:
KVC13-059-D
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-D
FidFile: PROTON02

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #49, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



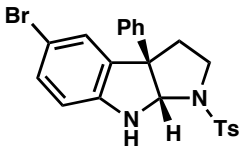
KVC13-059-D

Sample Name:
KVC13-059-D
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-D
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #41, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528739 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



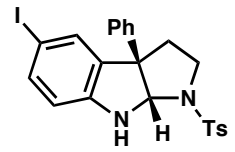
KVC13-069-D

Sample Name:
KVC13-069-D
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-D
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 12 2012

Sample #43, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



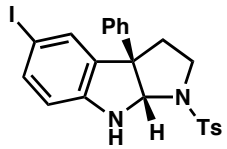
KVC13-069-D

Sample Name:
KVC13-069-D
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-069-D
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 12 2012

Sample #43, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528739 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



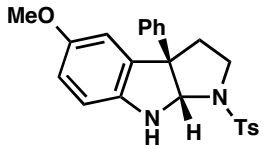
KVC13-059-E

Sample Name:
KVC13-059-E
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-E
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #42, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127410 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



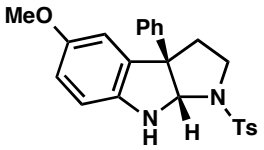
KVC13-059-E

Sample Name:
KVC13-059-E
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-059-E
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 10 2012

Sample #42, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min



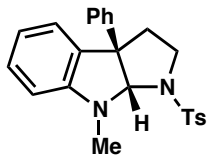
KVC13-037A

Sample Name:
KVC13-037A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-037A
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: May 3 2012

Sample #47, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127405 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 1 min 52 sec



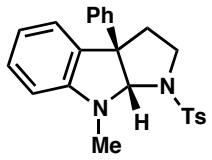
KVC13-037A

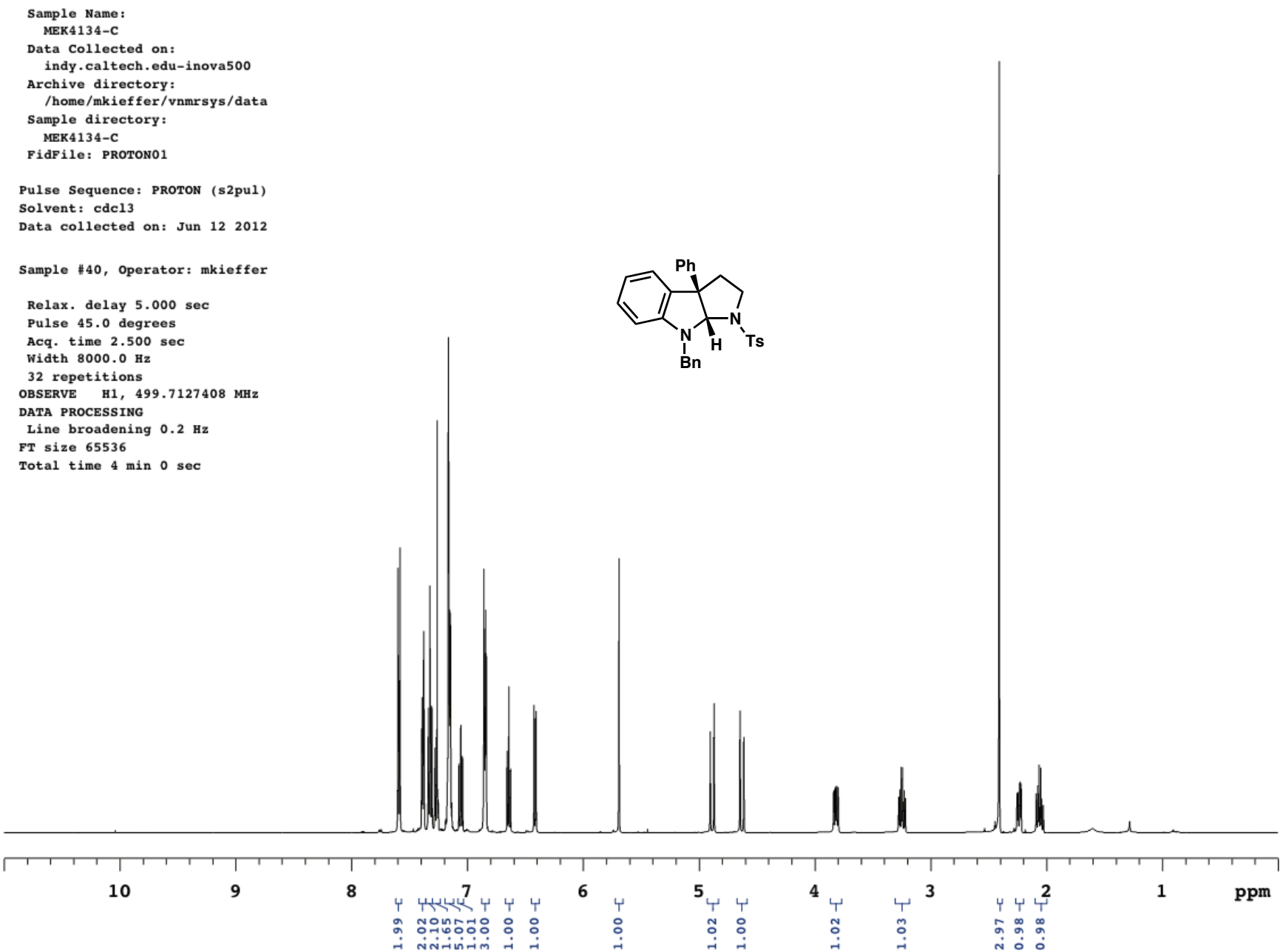
Sample Name:
KVC13-037A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
KVC13-037A
FidFile: CARBON01

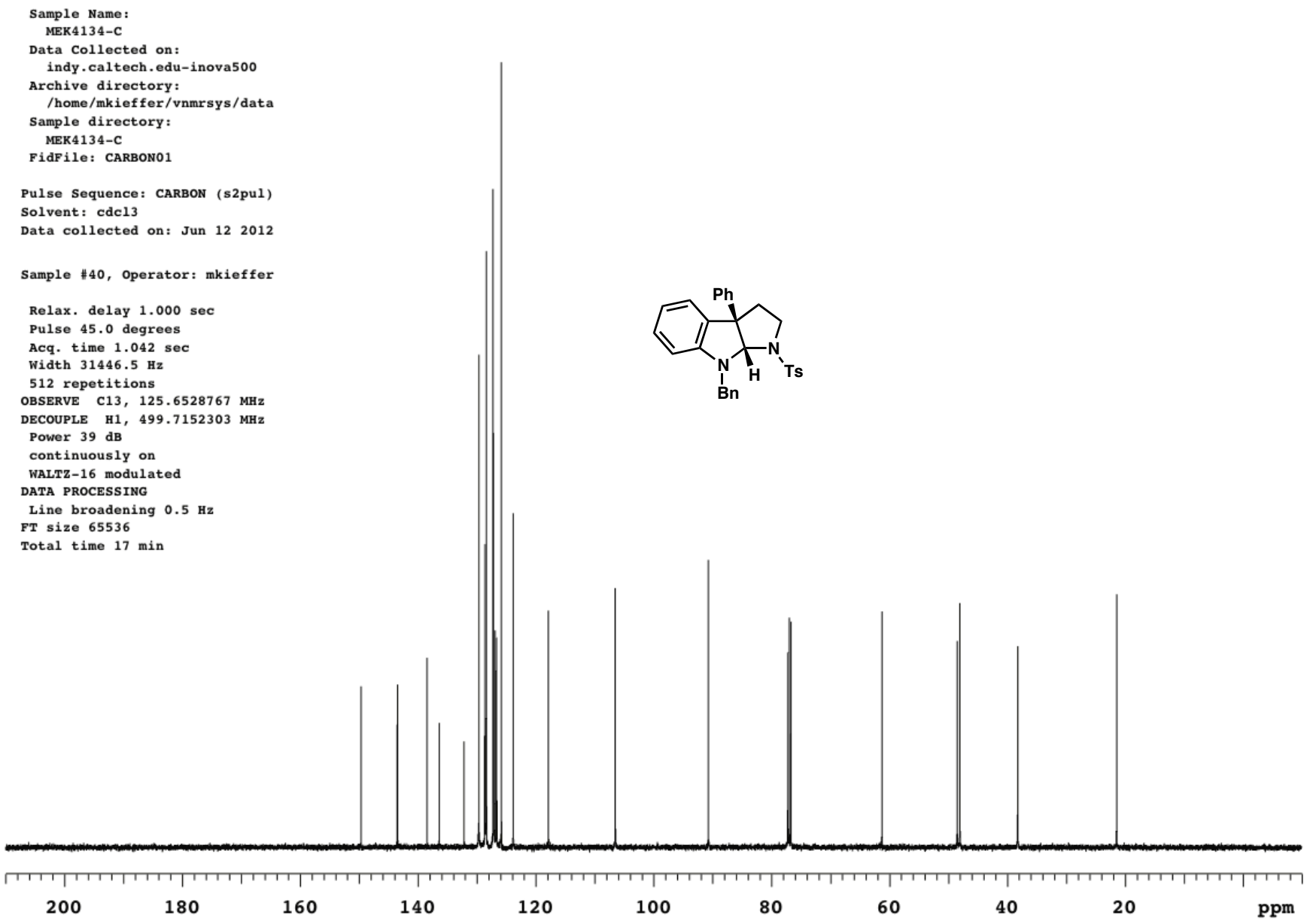
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 3 2012

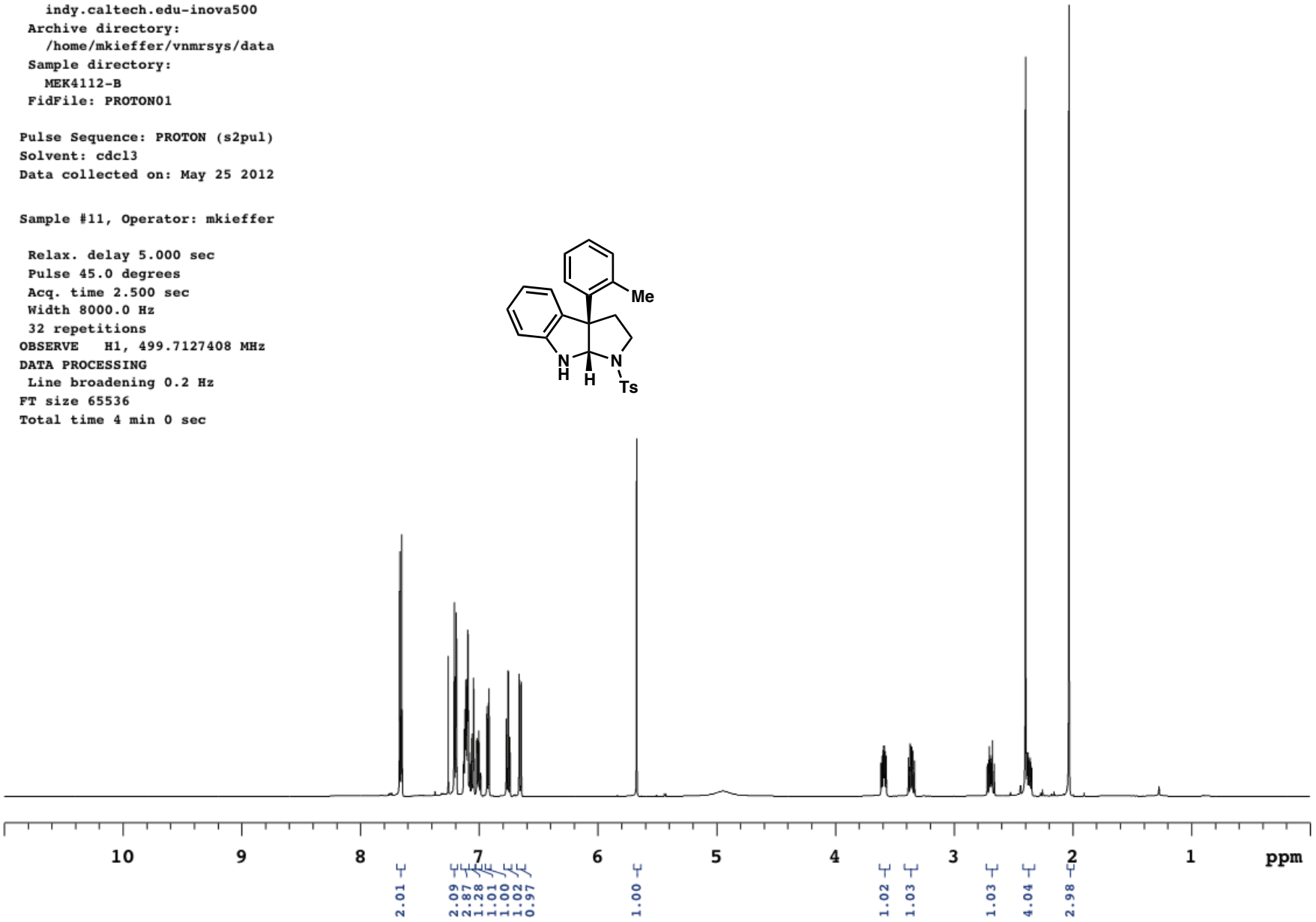
Sample #47, Operator: kangway

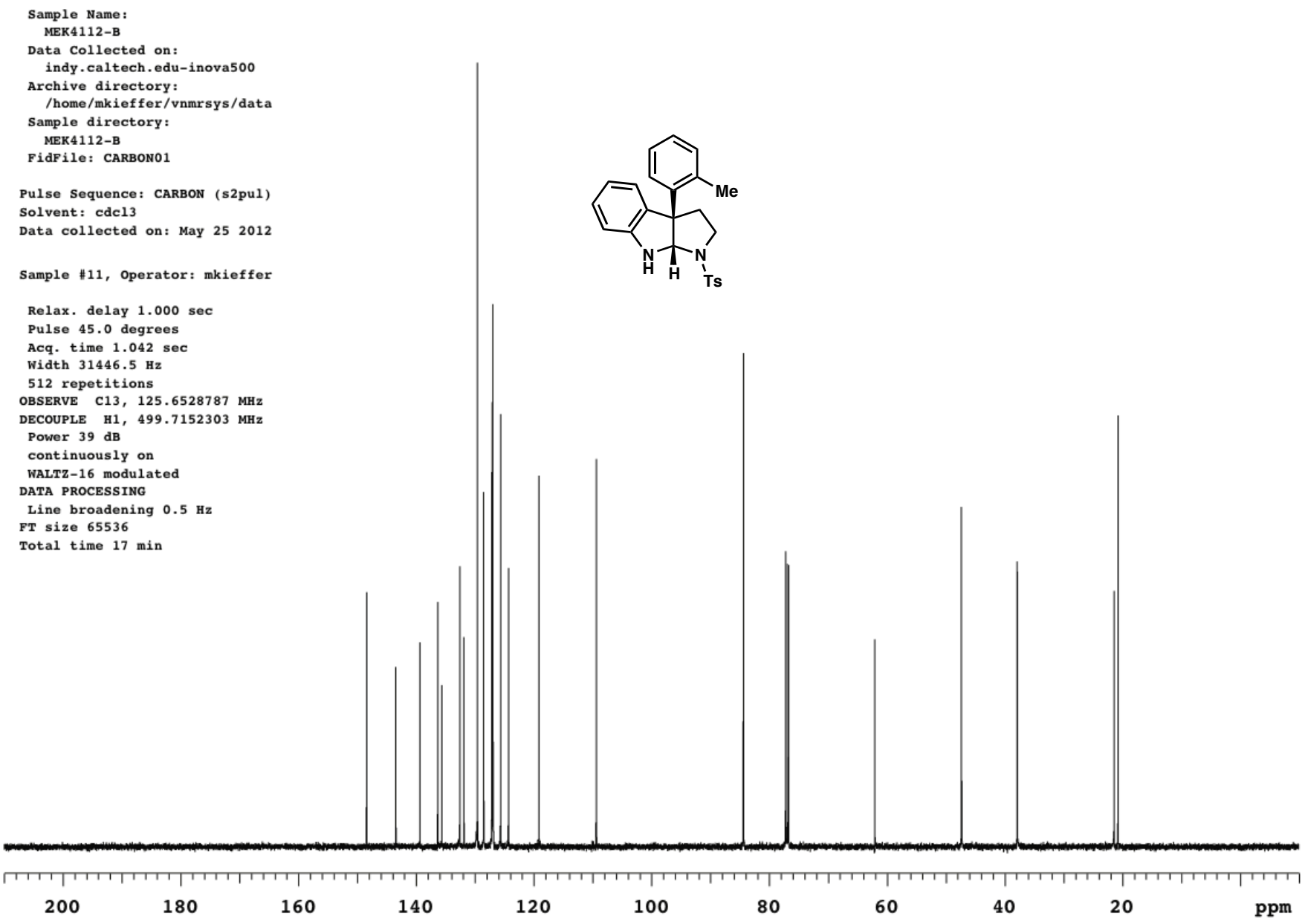
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
1000 repetitions
OBSERVE C13, 125.6528806 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 34 min






Sample Name:
MEK4134-C
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4134-C
FidFile: CARBON01
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Jun 12 2012
Sample #40, Operator: mkieffer
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528767 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min
Ph
N
Ts
N
H
Bn
200
180
160
140
120
100
80
60
40
20
ppm




Sample Name:
MEK4112-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4112-B
FidFile: CARBON01
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 25 2012
Sample #11, Operator: mkieffer
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528787 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min
Me
N
H
H
N
Ts
200
180
160
140
120
100
80
60
40
20
ppm

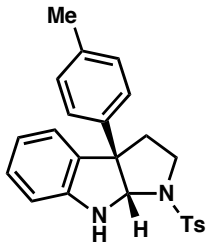
MEK4105A

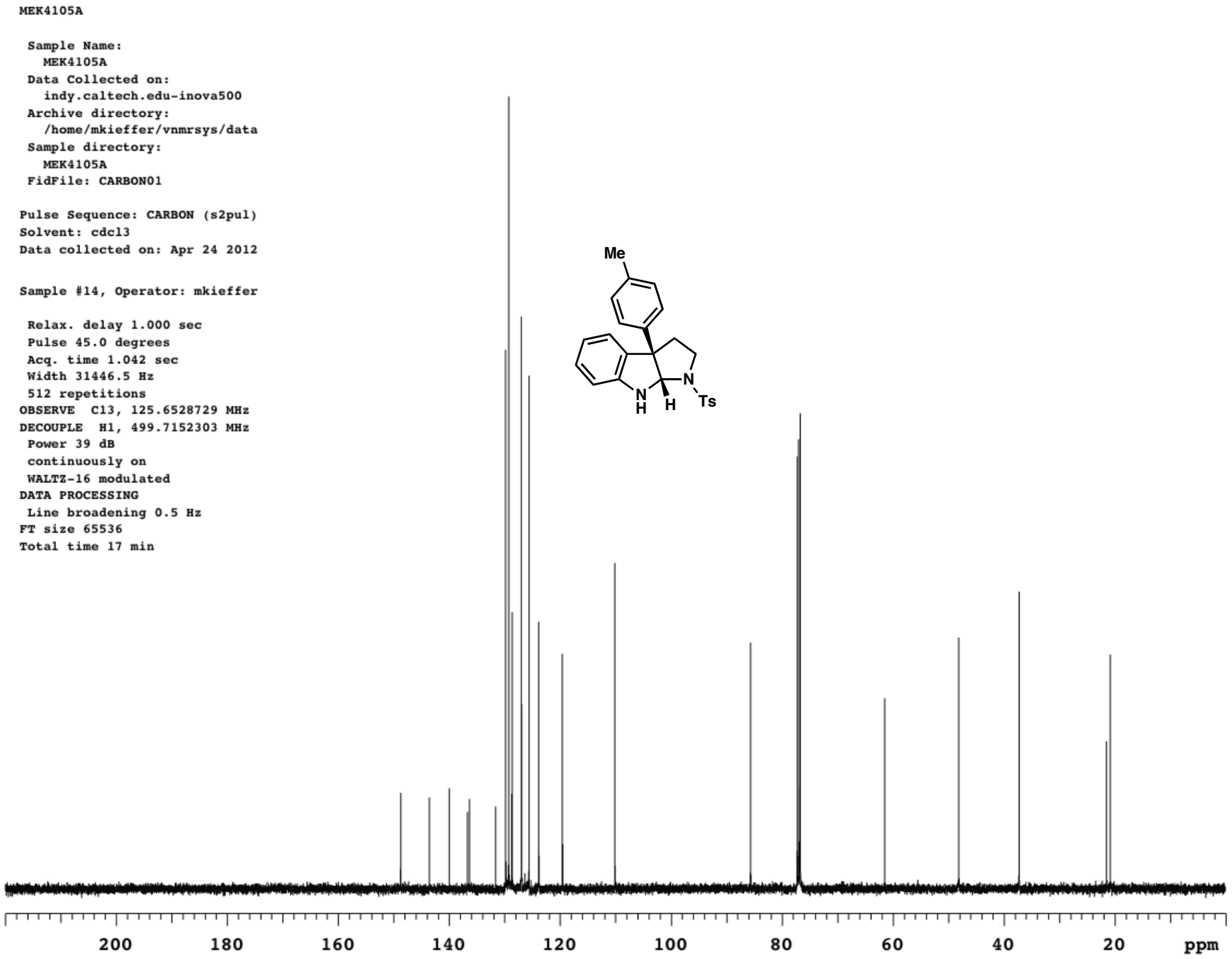
Sample Name:
MEK4105A
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4105A
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 24 2012

Sample #14, Operator: mkieffer

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127408 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec





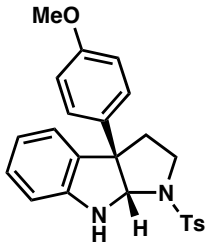
MEK4096

Sample Name:
MEK4096
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
MEK4096
FidFile: PROTON01

Pulse Sequence: PROTON (s2pul)
Solvent: cdcl3
Data collected on: Apr 18 2012

Sample #47, Operator: kangway

Relax. delay 5.000 sec
Pulse 45.0 degrees
Acq. time 2.500 sec
Width 8000.0 Hz
32 repetitions
OBSERVE H1, 499.7127394 MHz
DATA PROCESSING
Line broadening 0.2 Hz
FT size 65536
Total time 4 min 0 sec



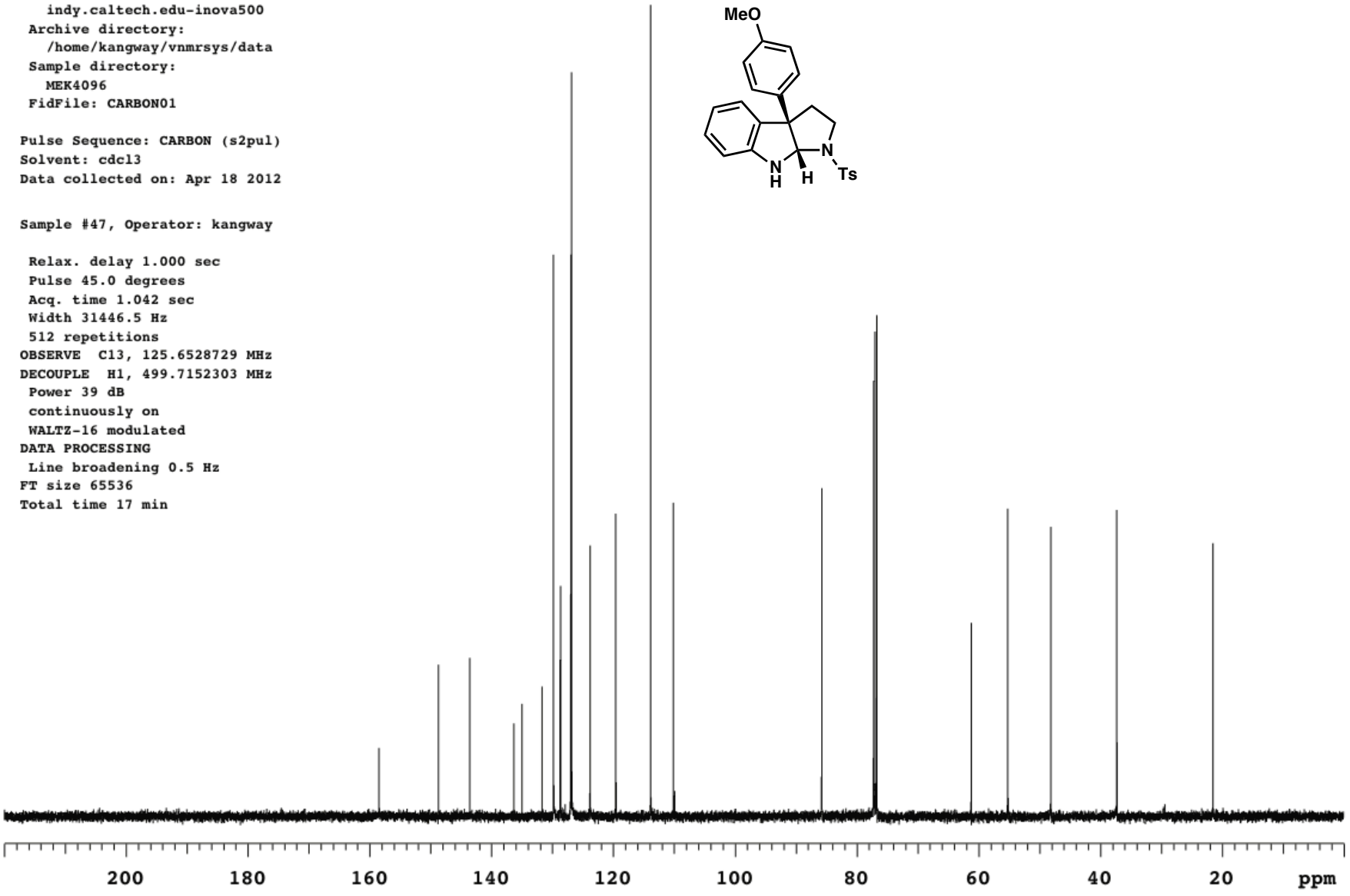
MEK4096

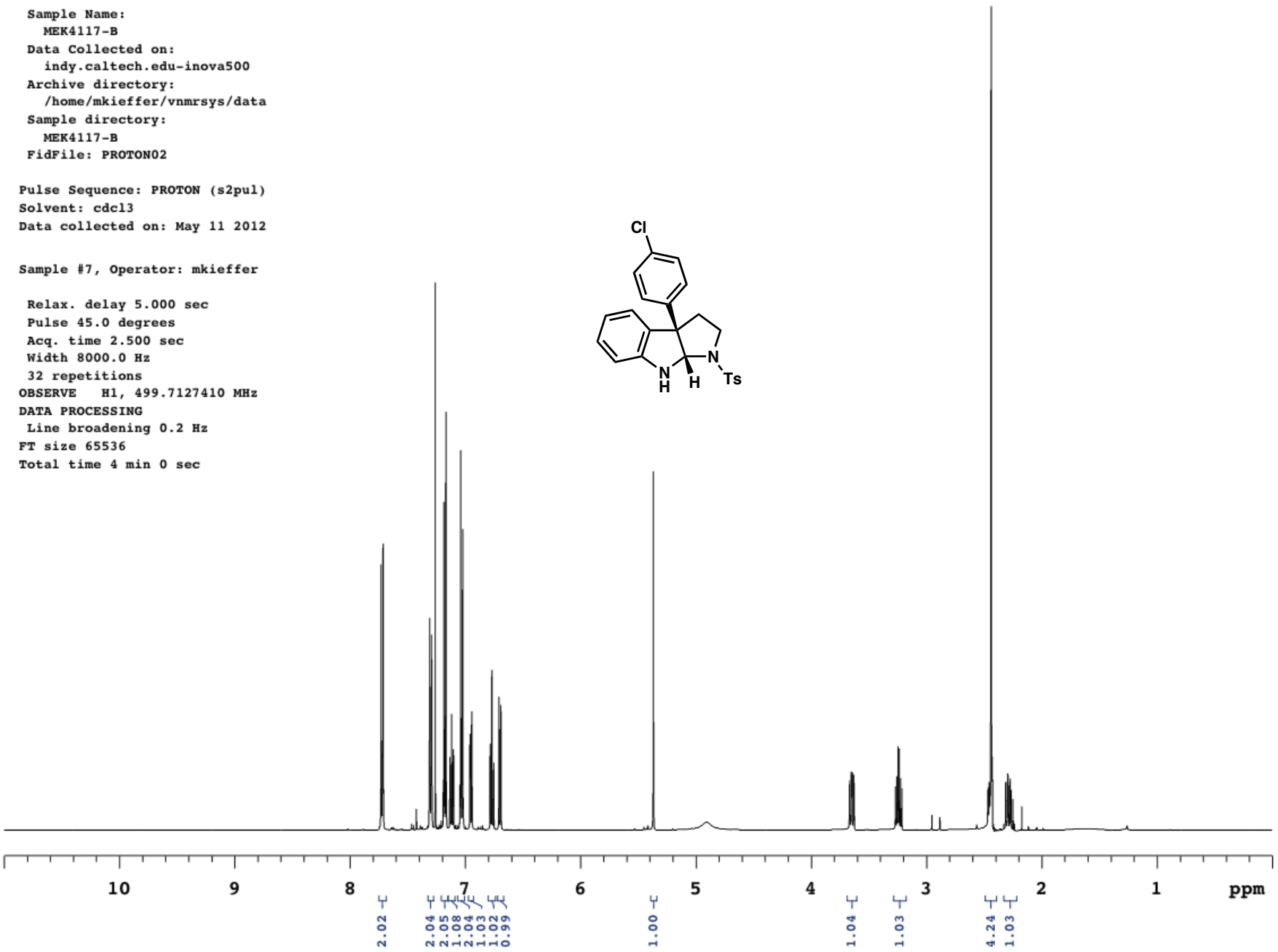
Sample Name:
MEK4096
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/kangway/vnmrsys/data
Sample directory:
MEK4096
FidFile: CARBON01

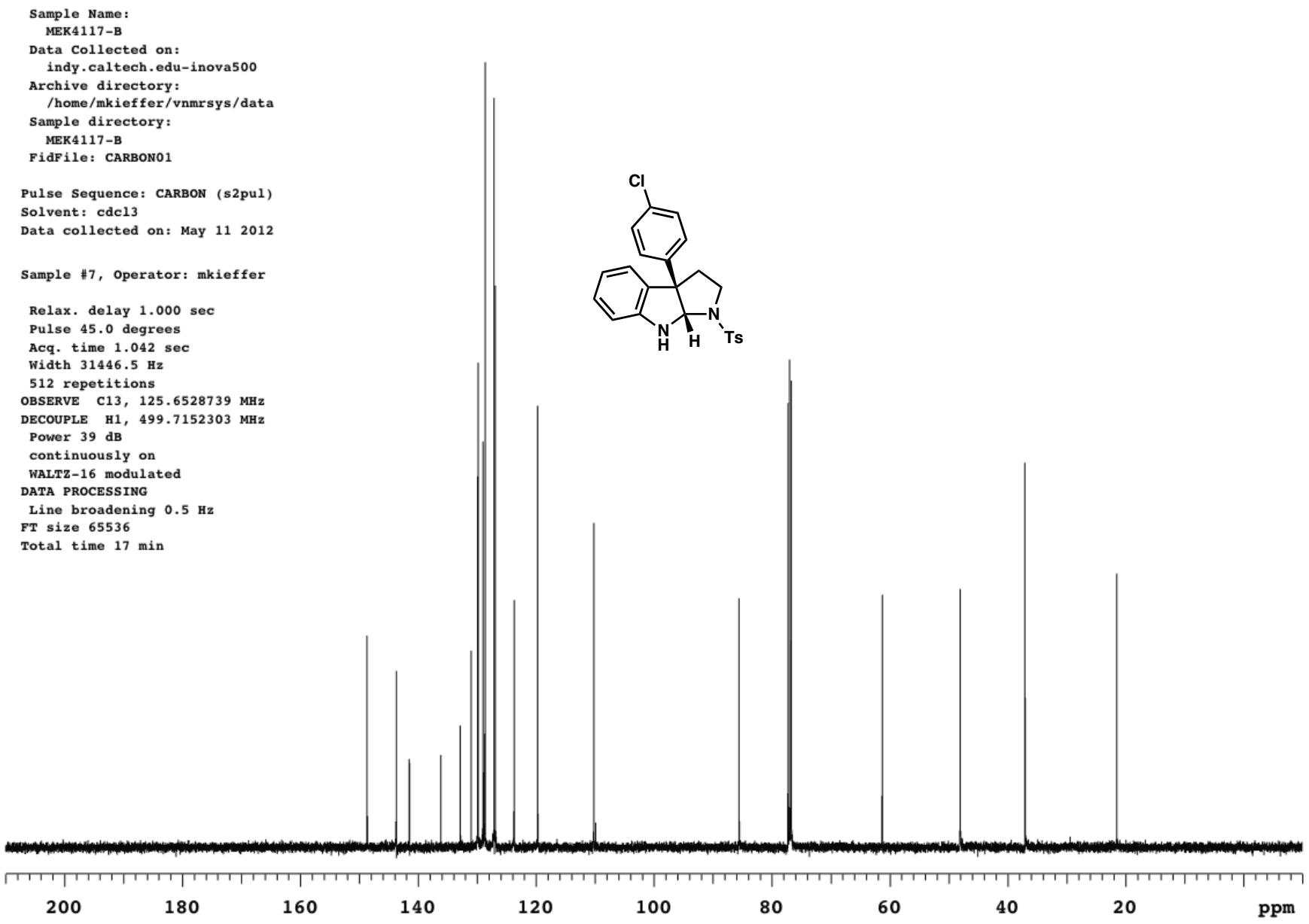
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 18 2012

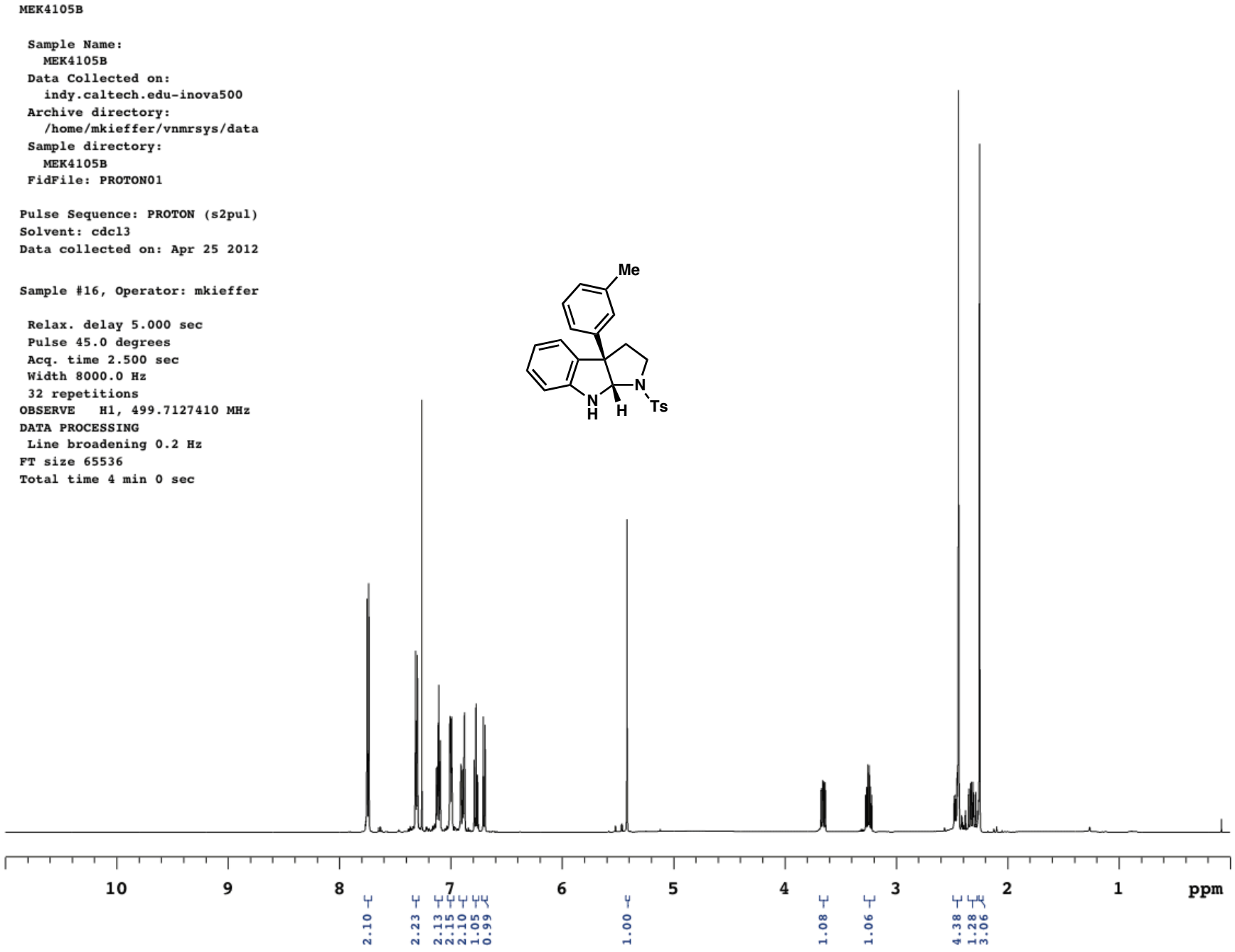
Sample #47, Operator: kangway

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min






Sample Name:
MEK4117-B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4117-B
FidFile: CARBON01
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 11 2012
Sample #7, Operator: mkieffer
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528739 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min
Cl
N
H
H
N
Ts
200
180
160
140
120
100
80
60
40
20
ppm



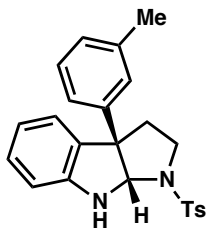
MEK4105B

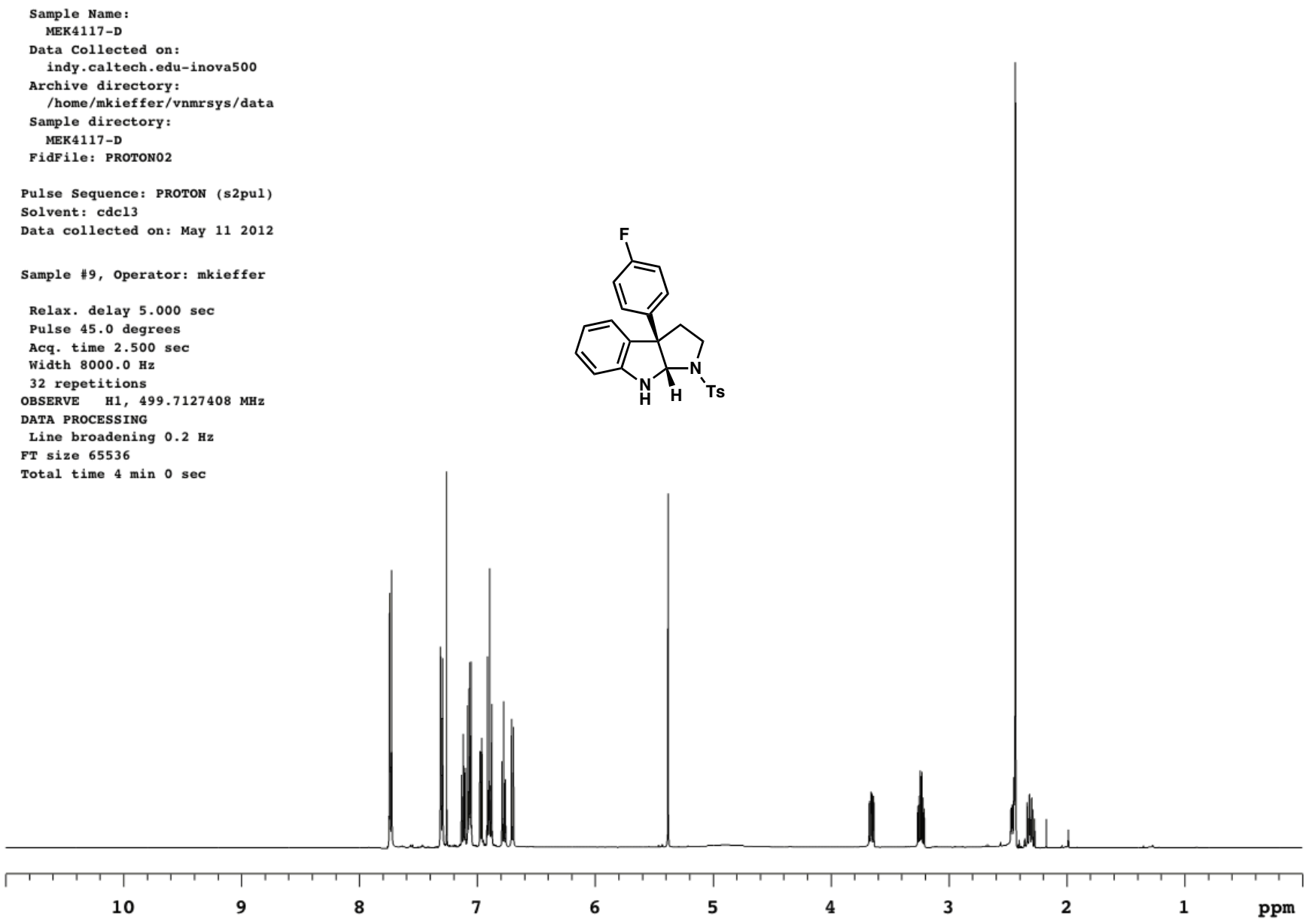
Sample Name:
MEK4105B
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4105B
FidFile: CARBON01

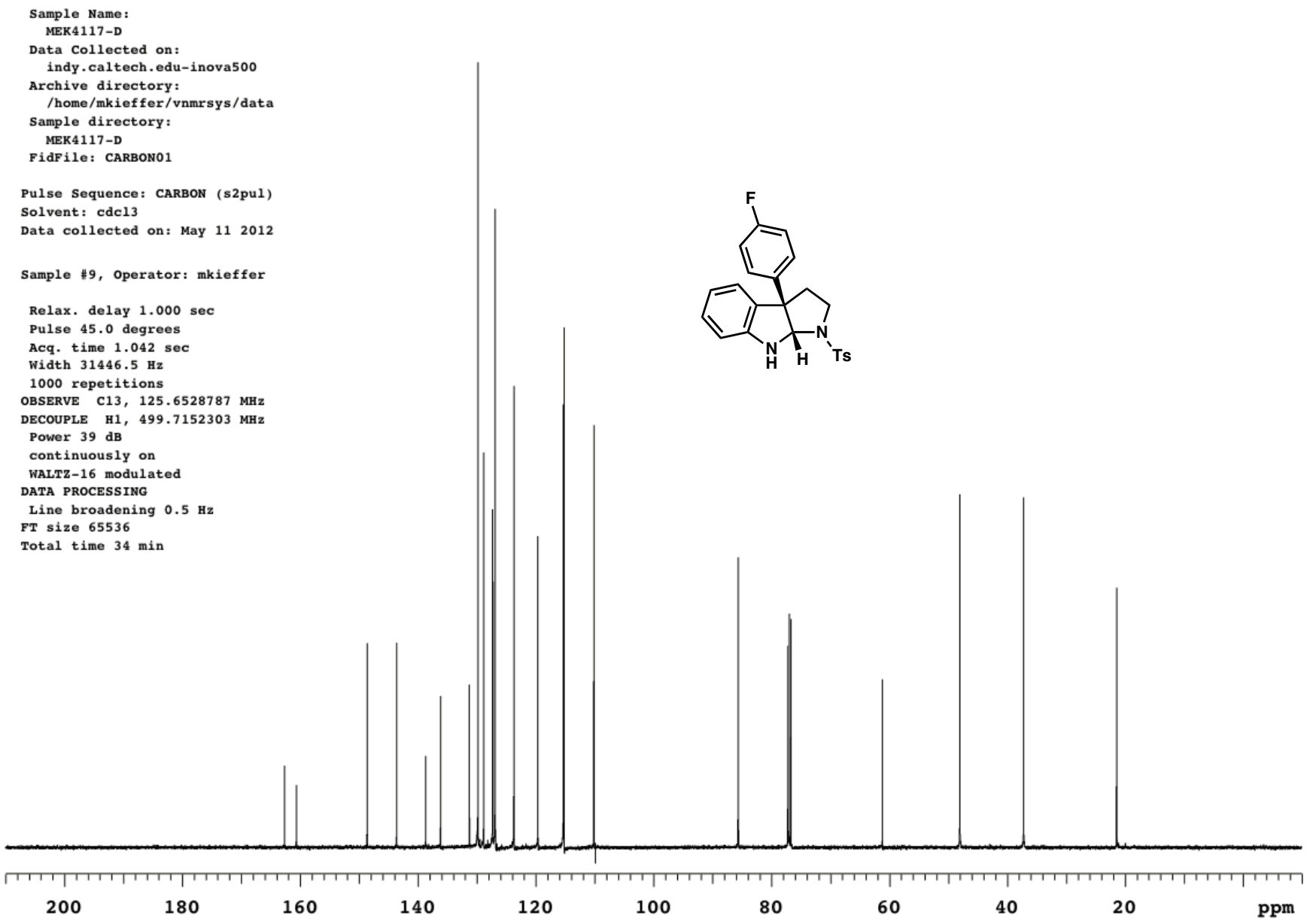
Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 25 2012

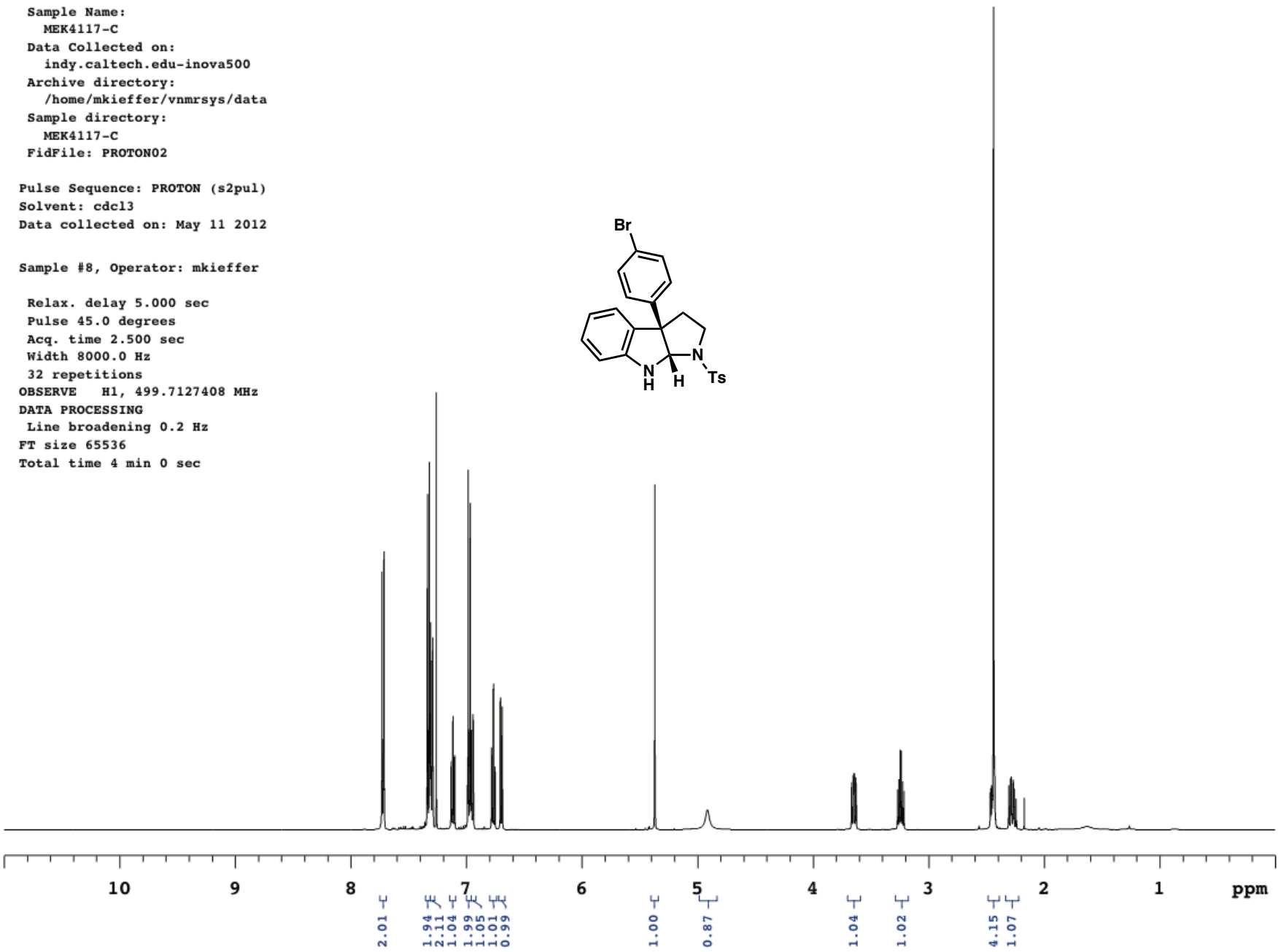
Sample #16, Operator: mkieffer

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
512 repetitions
OBSERVE C13, 125.6528729 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 17 min

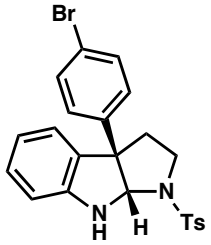


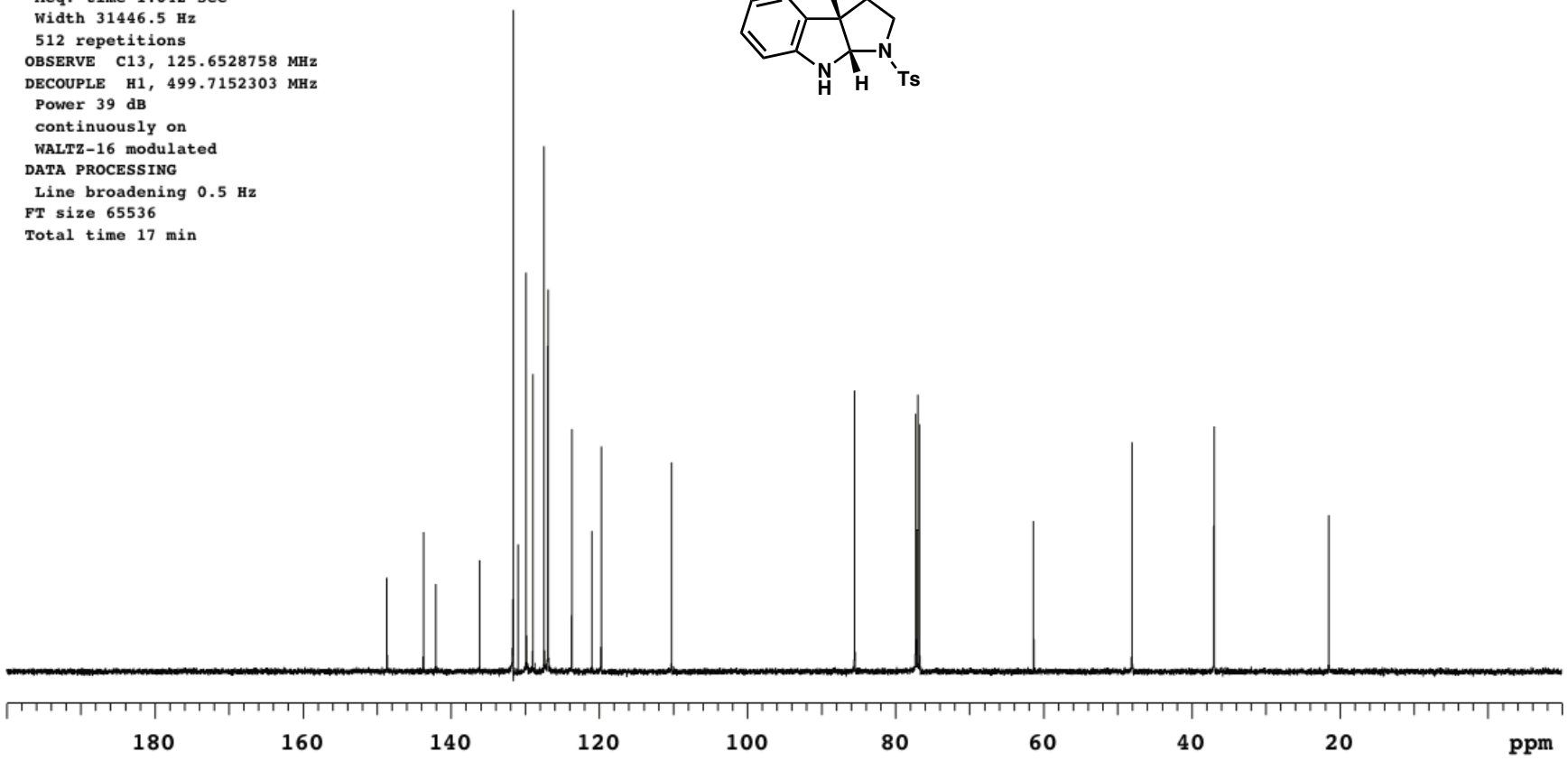


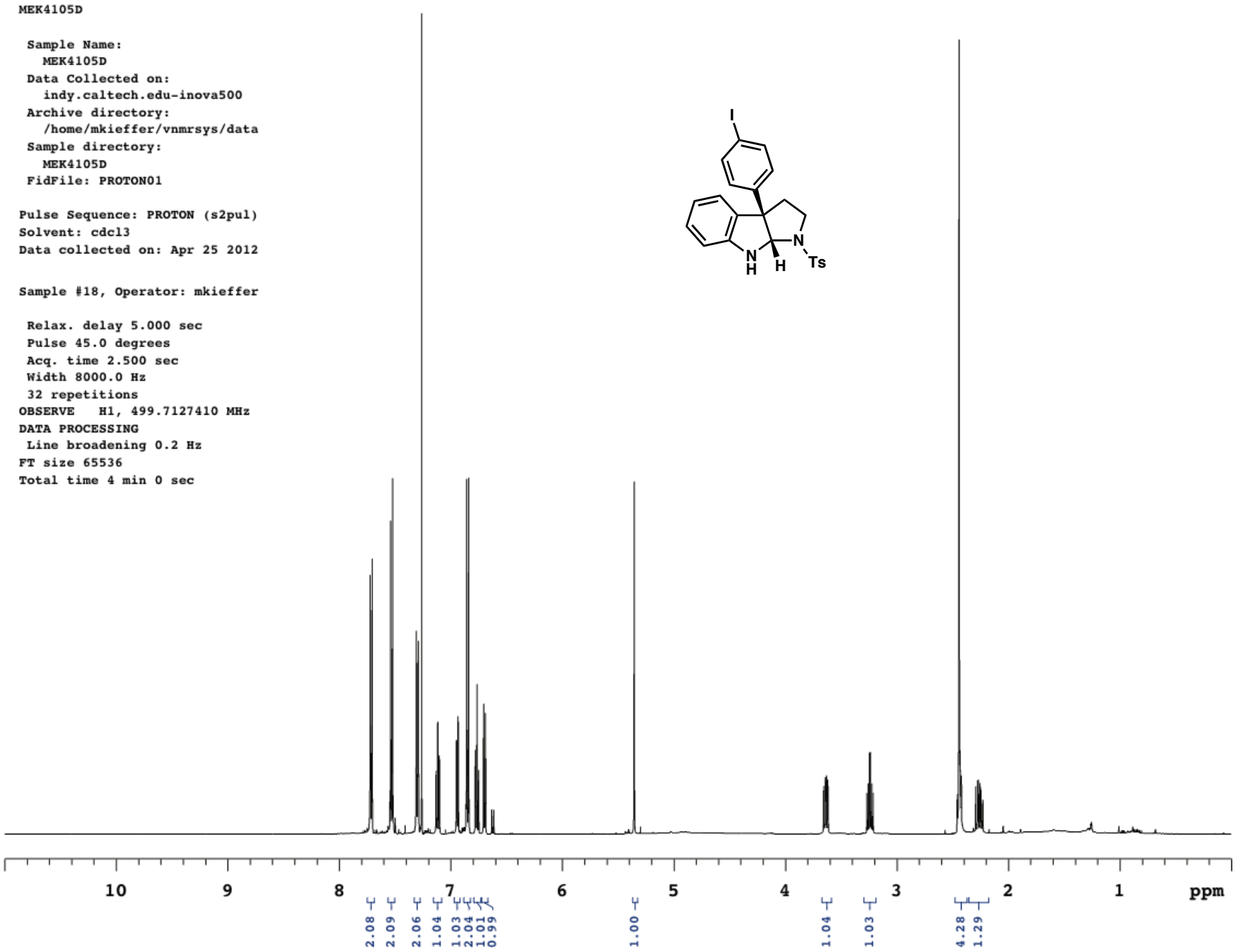




```
 Sample Name:
   MEK4117-C
 Data Collected on:
   indy.caltech.edu-inova500
 Archive directory:
   /home/mkieffer/vnmrsys/data
 Sample directory:
   MEK4117-C
 FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: May 11 2012


Sample #8, Operator: mkieffer

 Relax. delay 1.000 sec
 Pulse 45.0 degrees
 Acq. time 1.042 sec
 Width 31446.5 Hz
 512 repetitions
OBSERVE  C13, 125.6528758 MHz
DECOUPLE  H1, 499.7152303 MHz
 Power 39 dB
 continuously on
 WALTZ-16 modulated
DATA PROCESSING
 Line broadening 0.5 Hz
FT size 65536
Total time 17 min
```







MEK4105D

Sample Name:
MEK4105D
Data Collected on:
indy.caltech.edu-inova500
Archive directory:
/home/mkieffer/vnmrsys/data
Sample directory:
MEK4105D
FidFile: CARBON01

Pulse Sequence: CARBON (s2pul)
Solvent: cdcl3
Data collected on: Apr 25 2012

Sample #18, Operator: mkieffer

Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.042 sec
Width 31446.5 Hz
2000 repetitions
OBSERVE C13, 125.6528700 MHz
DECOUPLE H1, 499.7152303 MHz
Power 39 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 1 hr, 8 min