Nickel-Catalyzed Cross Couplings of Benzylic Pivalates with Arylboroxines: Stereospecific Formation of Diarylalkanes and Triarylmethanes

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Supporting Information

General Information

Reactions were performed either in a N_2-atmosphere glovebox in oven-dried 1-dram vials with Teflon-lined caps or in oven-dried round-bottomed flasks unless otherwise noted. Flasks were fitted with rubber septa, and reactions were conducted under a positive pressure of N_2. Stainless steel syringes or cannulae were used to transfer air- and moisture-sensitive liquids. Flash chromatography was performed on silica gel 60 (40-63 μm, 60Å). Thin layer chromatography (TLC) was performed on glass plates coated with silica gel 60 with F254 indicator. Commercial reagents were purchased from Sigma Aldrich, Acros, Fisher, Strem, TCI, Combi Blocks, Alfa Aesar, or Cambridge Isotopes Laboratories and used as received with the following exceptions: toluene, CH_2Cl_2, dioxane, and Et_2O were dried by passing through drying columns.[1] Toluene was then degassed by sparging with N_2 and stored over activated 4Å MS in a N_2-atmosphere glovebox. Anhydrous K_3PO_4 was purchased from Acros and used as received. Pivaloyl chloride was purchased from Sigma Aldrich, and used as received. Boronic acids were purchased from Combi Blocks and were converted to the boroxines according to literature procedure.[2] $CDCl_3$ was stored over oven-dried potassium carbonate. Proton nuclear magnetic resonance (^{1}H NMR) spectra and carbon nuclear magnetic resonance (^{13}C NMR) spectra were recorded on both 400 MHz and 600 MHz spectrometers. Chemical shifts for protons are reported in parts per million downfield from tetramethylsilane and are referenced to residual protium in the NMR solvent ($CHCl_3$ = δ 7.28). Chemical shifts for carbon are reported in parts per million downfield from tetramethylsilane and are referenced to the carbon resonances of the solvent ($CDCl_3$ =

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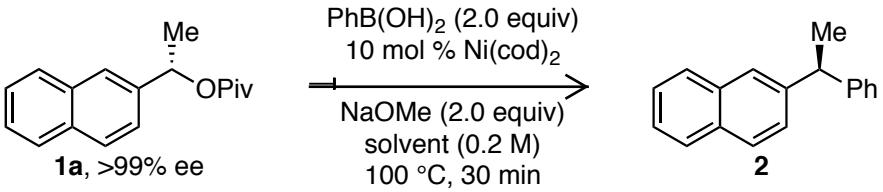
[1] Pangborn, A. B.; Giardello, M. A.; Grubbs, R. H.; Rosen, R. K.; Timmers, F. J. *Organometallics* **1996**, *15*, 1518.

[2] Xiao, Q.; Tian, L.; Tan, R.; Xia, Y.; Qiu, D.; Zhang, Y.; Wang, J. *Org. Lett.* **2012**, *14,* 4230.

δ 77.07). Data are represented as follows: chemical shift, multiplicity (br = broad, s = singlet, d = doublet, t = triplet, q = quartet, p = pentet, m = multiplet, dd = doublet of doublets, h = heptet), coupling constants in Hertz (Hz), integration. Infrared (IR) spectra were obtained using FTIR spectrophotometers with material loaded onto a NaCl plate. The mass spectral data were obtained at the University of Illinois, Urbana–Champagne, mass spectrometry facility and the University of Delaware mass spectrometry facility. Optical rotations were measured using a 2.5 mL cell with a 1 dm path length. Melting points were taken on a Stuart SMP10 instrument.

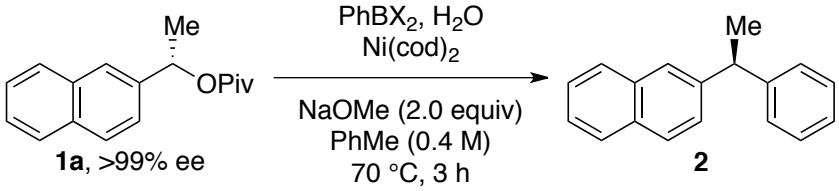
Effect of Solvent



entry	solvent	yield (%)[a]	ee (%)[b]
1	C_6H_6	89	94
2	PhMe	87	94
3	THF/PhMe (1:1)	56	16
4	DME	24	10
5	Dioxane	63	7

[a] Determined by ^{1}H NMR analysis using 1,3,5-trimethoxybenzene as internal standard. [b] Determined by chiral HPLC analysis.

Effect of Water

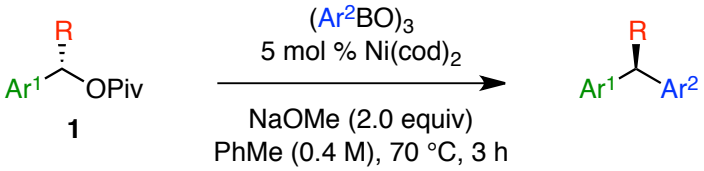


entry	mol % Ni	$PhBX_2$ (equiv)	equiv H_2O	yield (%)[a]	ee (%)[b]
1	10	$PhB(OH)_2$ (3.0)	0.5	80	98
2	10	$PhB(OH)_2$ (3.0)	1.0	49	94
3	5	$(PhBO)_3$ (0.83)	0.5	74	96
4	5	$(PhBO)_3$ (0.83)	1.0	59	94
5	5	$(PhBO)_3$ (0.83)	2.5	55	92

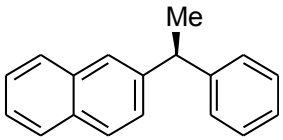
[a] Determined by ^1H NMR analysis using 1,3,5-trimethoxybenzene as internal standard. [b] Determined by chiral HPLC analysis.

Stereospecific Cross Couplings of Benzyl Pivalates to Give Diarylalkanes and Triarylmethanes

General Procedure

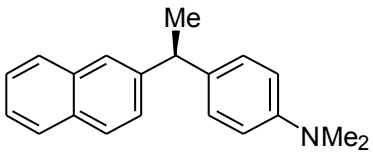


In a N_2-atmosphere glovebox, $Ni(cod)_2$ (2.8 mg, 0.01 mmol, 5 mol %) and NaOMe (21.6 mg, 0.4 mmol, 2.0 equiv) were weighed into a 1-dram vial. Benzylic pivalate (0.2 mmol, 1.0 equiv) and boroxine (0.167 mmol, 0.83 equiv) were added, followed by toluene (0.5 mL, 0.4 M). The vial was capped with a Teflon-lined cap and removed from the glovebox. The mixture was heated for 3 h at 70 °C. The reaction mixture was then diluted with Et_2O (1.5 mL) and filtered through a plug of silica gel, which was rinsed with Et_2O (10 mL). The filtrate was concentrated and purified by silica gel chromatography to give the diaryl- or triarylmethane product.



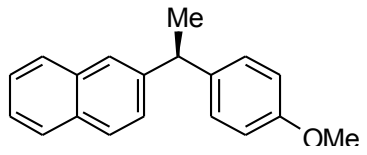
(*S*)-2-(1-Phenylethyl)naphthalene (2). Diarylethane **2** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (2–3% Et_2O/hexanes) to give compound **2** (run 1: 41.8 mg, 90%; run 2: 40.4 mg, 87%) as a colorless oil. The enantiomeric excess was determined to be 98% ee (run 1: 98% ee; run 2: 98% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=21.40 min, t_R(minor)=27.35 min. $[\alpha]_D^{24}$ =

+21.0° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.80 (m, 2H), 7.78 (d, *J* = 8.5 Hz, 1H), 7.75 – 7.72 (m, 1H), 7.55 – 7.41 (m, 2H), 7.37 – 7.27 (m, 5H), 7.26 – 7.19 (m, 1H), 4.36 (q, *J* = 7.2 Hz, 1H), 1.78 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.2, 143.8, 133.5, 132.1, 128.4, 127.9, 127.8, 127.7, 127.6, 126.9, 126.1, 125.9, 125.4, 125.3, 44.9, 21.8. The spectral data for this compound matches that reported in the literature. [3]

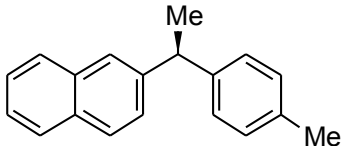


(*S*)-*N*,*N*-Dimethyl-4-(1-(naphthalen-2-yl)ethyl)aniline (3). Diarylethane **3** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee), except that 10 mol% $Ni(cod)_2$ was used and the reaction mixture was heated at 90 °C for 12 h. The crude material was purified by silica gel chromatography (5–6% Et_2O/hexanes) to give compound **3** (run 1: 35.2 mg, 64%; run 2: 34.1 mg, 62%) as a colorless oil. The enantiomeric excess was determined to be 86% ee (run 1: 86% ee; run 2: 86% ee) by chiral HPLC analysis (CHIRAlPAK 1A, 1.0 mL/min, 0.3% *i*-PrOH/hexane, λ=254 nm); t_R(major)=10.87 min, t_R(minor)=9.35 min. $[\alpha]_D^{24}$ = –62.5° (c 0.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 – 7.76 (m, 2H), 7.73 (d, *J* = 8.5 Hz, 1H), 7.69 (d, *J* = 1.9 Hz, 1H), 7.48 – 7.38 (m, 2H), 7.32 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.16 – 7.11 (m, 2H), 6.73 – 6.67 (m, 2H), 4.24 (q, *J* = 7.2 Hz, 1H), 2.91 (s, 6H), 1.70 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.1, 144.7, 134.4, 133.5, 132.1, 128.3, 127.8, 127.7, 127.5, 126.9, 125.8, 125.2, 125.1, 112.8, 43.9, 40.8, 21.9; FTIR (NaCl/thin film) 3051, 2962, 2925, 2852, 2799, 1614, 1520, 1479, 1445, 1348, 1163, 1126, 948, 855, 816 cm^{-1}; HRMS (ESI) $[M]^+$ calculated for $C_{20}H_{22}N$: 276.1752, found: 276.1751.

[3] López-Pérez, A.; Adrio, J.; Carretero, J. C. *Org. Lett.* **2009**, *11,* 5514.



(*S*)-2-(1-(4-Methoxyphenyl)ethyl)naphthalene (4). Diarylethane **4** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **4** (run 1: 49.3 mg, 94%; run 2: 50.1 mg, 95%) as a colorless oil. The enantiomeric excess was determined to be 96% ee (run 1: 96% ee; run 2: 96% ee) by chiral HPLC analysis (CHIRAlPAK 1A, 1.0 mL/min, 0.2% *i*-PrOH/hexane, λ=254 nm); t_R(major)=8.64 min, t_R(minor)=8.09 min. $[\alpha]_D^{24}$ = –14.0° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 – 7.81 (m, 2H), 7.78 (d, *J* = 8.5 Hz, 1H), 7.73 (s, 1H), 7.54 – 7.43 (m, 2H), 7.34 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.25 – 7.17 (m, 2H), 6.94 – 6.81 (m, 2H), 4.31 (q, *J* = 7.2 Hz, 1H), 3.82 (s, 3H), 1.75 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.9, 144.2, 138.4, 133.5, 132.1, 128.7, 127.9, 127.7, 127.6, 126.8, 125.9, 125.3, 125.2, 113.8, 55.3, 44.0, 22.0. The spectral data for this compound matches that reported in the literature.[4]

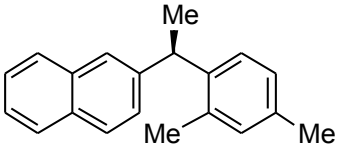


(*S*)-2-(1-(*p*-Tolyl)ethyl)naphthalene (5). Diarylethane **5** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (2% Et_2O/hexanes) to give compound **5** (run 1: 43.1 mg, 87%; run 2: 41.4 mg, 84%) as a colorless oil. The enantiomeric excess was determined to be 97% ee (run 1: 97% ee; run 2: 97% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=20.43 min, t_R(minor)=23.63 min. $[\alpha]_D^{24}$ =

[4] Noji, M.; Ohno, T.; Fuji, K.; Futaba, N.; Tajima, H.; Ishii, K. *J. Org. Chem.* **2003**, *68*, 9340.

+51.2° (c 0.80, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.80 (m, 2H), 7.78 (d, 1H), 7.76 – 7.72 (m, 1H), 7.52 – 7.43 (m, 2H), 7.34 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.22 – 7.11 (m, 4H), 4.32 (q, *J* = 7.2 Hz, 1H), 2.35 (s, 3H), 1.76 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.0, 143.3, 135.6, 133.5, 132.1, 129.1, 127.9, 127.7, 127.6, 127.6, 126.9, 125.9, 125.3, 125.3, 44.5, 21.9, 21.0. The spectral data for this compound matches that reported in the literature.[5]

The absolute configuration of this compound was assigned as *S* by comparison of the HPLC of this compound to an authentic sample previously prepared in our group via a different method.[6]



(*R*)-2-(1-(2,4-Dimethylphenyl)ethyl)naphthalene (6). Diarylethane **6** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **6** (run 1: 49.1 mg, 93%; run 2: 49.3 mg, 96%) as a colorless oil. The enantiomeric excess was determined to be 96% ee (run 1: 96% ee; run 2: 96% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=17.61 min, t_R(minor)=14.35 min. $[\alpha]_D^{24}$ = +11.0° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.79 (m, 2H), 7.76 (d, *J* = 8.5 Hz, 1H), 7.68 – 7.64 (m, 1H), 7.51 – 7.41 (m, 2H), 7.31 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.22 (d, *J* = 7.8 Hz, 1H), 7.10 – 7.04 (m, 1H), 7.02 (s, 1H), 4.49 (q, *J* = 7.2 Hz, 1H), 2.35 (s, 3H), 2.29 (s, 3H), 1.72 (d, *J* = 7.1 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.9, 140.9, 136.0, 135.6, 133.5, 131.9, 131.3, 127.9, 127.7, 127.6, 126.9, 126.9, 126.7, 125.9, 125.4, 125.3, 40.8, 22.0, 20.9, 19.8;

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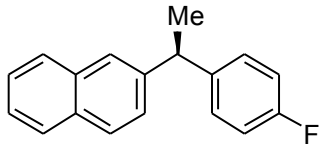
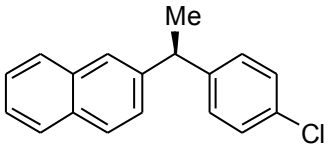
[5] Clark, P. D.; McKinnon, D. M. *Can. J. Chem.* **1981**, *59,* 1297.

[6] Maity, P.; Shacklady-McAtee, D. M.; Yap, G. P. A.; Sirianni, E. R.; Watson, M. P. *J. Am. Chem. Soc.* **2012**, accepted.

FTIR (NaCl/thin film) 3052, 3015, 2965, 2922, 1600, 1500, 1451, 1373, 1043, 855 cm^{-1}; HRMS (EI+) $[M]^+$calculated for $C_{20}H_{20}$: 260.1565, found: 260.1573.

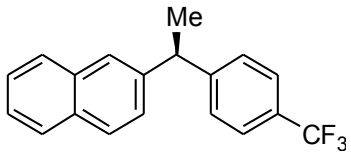


(*S*)-2-(1-(4-Fluorophenyl)ethyl)naphthalene (7). Diarylethane **7** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (2–2.5% Et_2O/hexanes) to give compound **7** (run 1: 44.2 mg, 88%; run 2: 42.8 mg, 85%) as a white solid (mp 57–61 °C). The enantiomeric excess was determined to be 96% ee (run 1: 97% ee; run 2: 95% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=26.20 min, t_R(minor)=34.62 min. $[\alpha]_D^{24}$ = –31.0° (c 1.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 – 7.81 (m, 2H), 7.78 (d, *J* = 8.5 Hz, 1H), 7.72 – 7.68 (m, 1H), 7.53 – 7.44 (m, 2H), 7.31 (dd, *J* = 8.4, 1.8 Hz, 1H), 7.27 – 7.22 (m, 2H), 7.05 – 6.97 (m, 2H), 4.33 (q, *J* = 7.2 Hz, 1H), 1.75 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.3 (d, J_{C-F} = 245.4 Hz), 143.6, 141.9 (d, J_{C-F} = 3.0 Hz), 133.5, 132.1, 129.1 (d, J_{C-F} = 8.1 Hz), 128.1, 127.7, 127.6, 126.7, 126.1, 125.5, 125.3, 115.1 (d, J_{C-F} = 21.2 Hz), 44.1, 22.0. The spectral data for this compound matches that reported in the literature.[6]

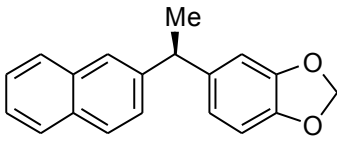


(*S*)-2-(1-(4-Chlorophenyl)ethyl)naphthalene (8). Diarylethane **8** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee) except that the reaction was done at 40 °C for 24 h. The crude material was purified by silica gel chromatography (100% petroleum ether) to give compound **8** (run 1: 34.5 mg, 65%; run 2: 32.5 mg, 61%) as a colorless oil. The enantiomeric excess was determined to be 94% ee (run 1: 94% ee;

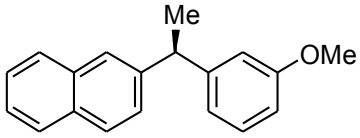
run 2: 94% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=25.82 min, t_R(minor)=34.31 min. $[\alpha]_D^{24}$ = –27.7° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 8.4 Hz, 2H), 7.77 (d, *J* = 8.5 Hz, 1H), 7.69 (s, 1H), 7.51 – 7.44 (m, 2H), 7.31 – 7.26 (m, 3H), 7.23 – 7.18 (m, 2H), 4.31 (q, *J* = 7.2 Hz, 1H), 1.74 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.7, 143.2, 133.5, 132.2, 131.8, 129.2, 128.5, 128.1, 127.7, 127.6, 126.7, 126.1, 125.6, 125.4, 44.3, 21.8; FTIR (NaCl/thin film) 3054, 2966, 2925, 2851, 1600, 1491, 1375, 1092, 1014, 856 cm^{-1}; HRMS (EI+) $[M]^+$calculated for $C_{18}H_{15}Cl$: 266.0862, found: 266.0855.



(*S*)-2-(1-(4-(Trifluoromethyl)phenyl)ethyl)naphthalene (9). Diarylethane **9** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **9** (run 1: 59.4 mg, 99%; run 2: 60.0 mg, 100%) as a colorless oil. The enantiomeric excess was determined to be 97% ee (run 1: 96% ee; run 2: 97% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=28.30 min, t_R(minor)=39.14 min. $[\alpha]_D^{24}$ = +36.4° (c 1.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.82 (m, 2H), 7.80 (d, *J* = 8.5 Hz, 1H), 7.75 – 7.72 (m, 1H), 7.58 (d, *J* = 8.1 Hz, 2H), 7.54 – 7.46 (m, 2H), 7.42 – 7.38 (m, 2H), 7.31 (dd, *J* = 8.6, 1.8 Hz, 1H), 4.41 (q, *J* = 7.2 Hz, 1H), 1.79 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.3 (q, J_{C-F} = 1.1 Hz), 142.6, 133.5, 132.2, 128.4 (q, J_{C-F} = 32.3 Hz), 128.3 (q, J_{C-F} = 1.0 Hz), 128.1, 127.8, 127.6, 126.6, 126.2, 125.7, 125.5, 125.4 (q, J_{C-F} = 4.0 Hz), 124.8 (q, J_{C-F} = 272.7 Hz), 44.7, 21.6; FTIR (NaCl/thin film) 3056, 2970, 2932, 2876, 1919, 1618, 1600, 1416, 1326, 1164, 1118, 1071, 1017, 842 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{15}F_3$: 300.1126, found: 300.1129.

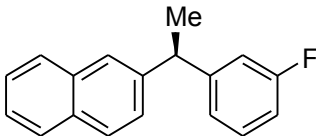


(*R*)-5-(1-(Naphthalen-2-yl)ethyl)benzo[*d*][1,3]dioxole (10). Diarylethane **10** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (2% Et_2O/hexanes) to give compound **10** (run 1: 48.2 mg, 88%; run 2: 47.1 mg, 85%) as a colorless oil. The enantiomeric excess was determined to be 97% ee (run 1: 97% ee; run 2: 96% ee) by chiral HPLC analysis (CHIRAlPAK 1B, 1.0 mL/min, 0.3% *i*-PrOH/hexane, λ=254 nm); t_R(major)=9.30 min, t_R(minor)=10.14 min. $[\alpha]_D^{24}$ = –10.8° (c 1.20, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.77 (m, 2H), 7.75 (d, *J* = 8.5 Hz, 1H), 7.71 – 7.66 (m, 1H), 7.52 – 7.39 (m, 2H), 7.30 (dd, *J* = 8.5, 1.8 Hz, 1H), 6.78 – 7.66 (m, 3H), 5.91 (s, 2H), 4.24 (q, *J* = 7.2 Hz, 1H), 1.70 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.7, 145.8, 143.8, 140.3, 133.5, 132.1, 127.9, 127.7, 127.6, 126.7, 125.9, 125.4, 125.2, 120.5, 108.4, 108.1, 100.9, 44.6, 21.9; FTIR (NaCl/thin film) 3065, 2964, 2919, 1726, 1603, 1507, 1484, 1435, 1370, 1231, 1036, 940, 861 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{16}O_2$: 276.1150, found: 276.1154.

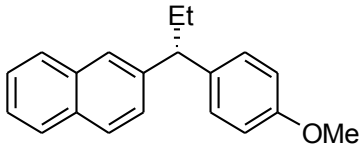


(*R*)-2-(1-(3-Methoxyphenyl)ethyl)naphthalene (11). Diarylethane **11** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (2% Et_2O/hexanes) to give compound **11** (run 1: 49.5 mg, 94%; run 2: 51.2 mg, 97%) as a white solid (mp 88–91 °C). The enantiomeric excess was determined to be 98% ee (run 1: 97% ee; run 2: 98% ee) by chiral HPLC analysis (CHIRAlPAK 1A, 1.0 mL/min, 0.2% *i*-PrOH/hexane, λ=254 nm); t_R(major)=7.54 min, t_R(minor)=8.69 min. $[\alpha]_D^{24}$ = –23.3° (c 1.20, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 – 7.80 (m, 2H), 7.77 (d, *J* = 8.5 Hz, 1H), 7.74 – 7.72 (m, 1H), 7.52 – 7.42 (m, 2H), 7.35 (dd, *J* = 8.5, 1.8 Hz,

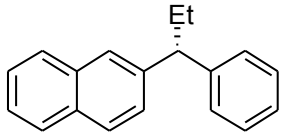
1H), 7.24 (t, J = 7.9 Hz, 1H), 6.89 – 6.87 (m, 1H), 6.85 (t, J = 2.1 Hz, 1H), 6.77 (dd, 1H), 4.32 (q, J = 7.2 Hz, 1H), 3.79 (s, 3H), 1.76 (d, J = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.6, 147.9, 143.6, 133.5, 132.1, 129.4, 128.0, 127.8, 127.6, 126.8, 126.0, 125.4, 125.3, 120.3, 113.9, 111.0, 55.2, 44.9, 21.7; FTIR (NaCl/thin film) 3052, 2963, 2926, 1598, 1485, 1150, 1039, 818 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{18}O$: 262.1358, found: 262.1366.



(*R*)-2-(1-(3-Fluorophenyl)ethyl)naphthalene (12). Diarylethane **12** was prepared via the General Procedure using pivalate **1a** (prepared in >99% ee). The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **12** (run 1: 44.3 mg, 88%; run 2: 45.5 mg, 91%) as a colorless oil. The enantiomeric excess was determined to be 94% ee (run 1: 94% ee; run 2: 94% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexane, λ=220 nm); t_R(major)=24.61 min, t_R(minor)=35.64 min. $[\alpha]_D^{24}$ = +22.5° (c 1.20, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.81 (m, 2H), 7.79 (d, J = 8.5 Hz, 1H), 7.75 – 7.71 (m, 1H), 7.54 – 7.45 (m, 2H), 7.36 – 7.30 (m, 1H), 7.29 – 7.24 (m, 1H), 7.10 – 7.05 (m, 1H), 7.02 – 6.97 (m, 1H), 6.95 – 6.89 (m, 1H), 4.34 (q, J = 7.2 Hz, 1H), 1.76 (d, J = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.0 (d, J_{C-F} = 246.4 Hz), 148.9 (d, J_{C-F} = 6.1 Hz), 143.0, 133.5, 132.2, 129.8 (d, J_{C-F} = 8.1 Hz), 128.1, 127.8, 127.6, 126.6, 126.1, 125.6, 125.4, 123.5 (d, J_{C-F} = 3.0 Hz), 114.6 (d, J_{C-F} = 22.2 Hz), 113.0 (d, J_{C-F} = 21.2 Hz), 44.6, 21.6; FTIR (NaCl/thin film) 3055, 2967, 2928, 2873, 1726, 1613, 1559, 1487, 912, 818 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{18}H_{15}F$: 250.1158, found: 250.1164.

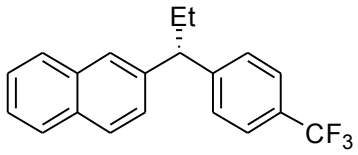


(*R*)-2-(1-(4-methoxyphenyl)propyl)naphthalene (13). Diarylpropane **13** was prepared via the General Procedure using pivalate **1b** (prepared in >99% ee) except that 10 mol % $Ni(cod)_2$ and 1.2 equiv of boroxine were used, and the reaction mixture was heated at 80 °C. The crude material was purified by silica gel chromatography (2.5% Et_2O/hexanes) to give compound **13** (run 1: 38.1 mg, 69%; run 2: 40.2 mg, 73%) as a colorless oil. The enantiomeric excess was determined to be 94% ee (run 1: 94% ee; run 2: 94% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 0.1% *i*-PrOH/hexane, λ=254 nm); t_R(major)=14.00 min, t_R(minor)=13.23 min. $[\alpha]_D^{24}$ = –19.0° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.69 (m, 4H), 7.55 – 7.39 (m, 2H), 7.34 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.26 – 7.18 (m, 2H), 6.91 – 6.79 (m, 2H), 3.93 (t, *J* = 7.7 Hz, 1H), 3.79 (s, 3H), 2.30 – 2.05 (m, 2H), 0.95 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.8, 142.9, 137.2, 133.5, 132.1, 128.9, 127.9, 127.7, 127.6, 126.8, 125.9, 125.8, 125.3, 113.7, 55.2, 52.4, 28.5, 12.9; FTIR (NaCl/thin film) 3050, 2959, 2929, 2872, 2834, 1726, 1609, 1510, 1462, 1249, 1178, 1038, 815 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{20}H_{20}O$: 276.1514, found: 276.1505.

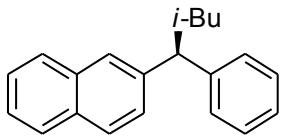


(*R*)-2-(1-Phenylpropyl)naphthalene (14). Diarylpropane **14** was prepared via the General Procedure using pivalate **1b** (prepared in >99% ee) except that 1.2 equiv of boroxine was used and the reaction mixture was heated at 80 °C. The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **14** (run 1: 44.6 mg, 91%; run 2: 47.2 mg, 94%) as a colorless oil. The enantiomeric excess was determined to be 97% ee (run 1: 96% ee; run 2: 98% ee) by chiral HPLC analysis (CHIRACEL OD-H, 1.0 mL/min, 100% hexanes, λ=220 nm); t_R(major)=19.18 min, t_R(minor)=14.40 min. $[\alpha]_D^{24}$ = –32.5° (c 0.80, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.72 (m, 4H), 7.54 – 7.41 (m, 3H), 7.37 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.35 – 7.29 (m, 3H), 7.26 – 7.16 (m, 1H),

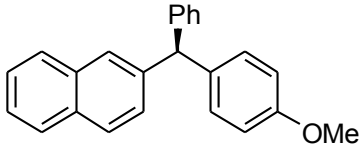
4.00 (t, J = 7.7 Hz, 1H), 2.28 – 2.15 (m, 2H), 0.98 (t, J = 7.3 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.0, 142.6, 133.5, 132.1, 128.4, 128.1, 128.0, 127.7, 127.6, 126.9, 126.1, 125.9, 125.9, 125.3, 53.3, 28.4, 12.9; FTIR (NaCl/thin film) 3056, 3025, 2962, 2928, 2872, 1727, 1599, 1506, 1493, 1377, 1155, 855 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{18}$: 246.1409, found: 246.1414.



(*R*)-2-(1-(4-(Trifluoromethyl)phenyl)propyl)naphthalene (15). Diarylpropane **15** was prepared via the General Procedure using pivalate **1b** (prepared in >99% ee) except that 1.2 equiv of boroxine was used and the reaction mixture was heated at 80 °C. The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **15** (run 1: 58.4 mg, 93%; run 2: 59.2 mg, 94%) as a colorless oil. The enantiomeric excess was determined to be 96% ee (run 1: 96% ee; run 2: 96% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexanes, λ=220 nm); t_R(major)=31.94 min, t_R(minor)=19.93 min. $[\alpha]_D^{24}$ = –78.3° (c 0.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.81 (m, 2H), 7.80 (d, J = 8.5 Hz, 1H), 7.76 – 7.73 (m, 1H), 7.57 (d, J = 8.1 Hz, 2H), 7.54 – 7.45 (m, 2H), 7.43 (d, J = 8.0 Hz, 2H), 7.34 (dd, J = 8.5, 1.8 Hz, 1H), 4.06 (t, J = 7.7 Hz, 1H), 2.35 – 2.11 (m, 2H), 0.99 (t, J = 7.3 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.1 (q, J_{C-F} = 1.1 Hz), 141.5, 133.5, 133.2, 128.4 (q, J_{C-F} = 32.3 Hz), 128.4 (q, J_{C-F} = 1.0 Hz), 128.3, 127.8, 127.6, 126.7, 125.2, 125.1, 125.6, 125.4 (q, J_{C-F} = 4.0 Hz), 124.3 (q, J_{C-F} = 272.7 Hz), 53.1, 28.2, 12.7; FTIR (NaCl/thin film) 3056, 2965, 2932, 2875, 1921, 1766, 1618, 1417, 1326, 1164, 1120, 1068, 1018, 815 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{20}H_{17}F_3$: 314.1282, found: 314.1287.

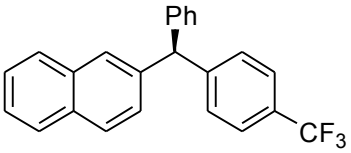


(*S*)-2-(3-Methyl-1-phenylbutyl)naphthalene (16). Diarylmethane **16** was prepared via the General Procedure using pivalate **1c** (prepared in 93% ee) except that 1.3 equiv of boroxine was used and the reaction time was 12 h. The crude material was purified by silica gel chromatography (1–2% Et_2O/hexanes) to give compound **16** (run 1: 40.2 mg, 73%; run 2: 39.0 mg, 71%) as a colorless oil. The enantiomeric excess was determined to be 91% ee (run 1: 90% ee; run 2: 91% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 100% hexanes, λ=220 nm); t_R(major)=15.47 min, t_R(minor)=25.37 min. $[\alpha]_D^{24} = -32.8°$ (c 0.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 12.7, 8.0 Hz, 2H), 7.66 (d, *J* = 8.5 Hz, 1H), 7.64 – 7.62 (m, 1H), 7.39 – 7.31 (m, 2H), 7.28 (dd, *J* = 8.6, 1.8 Hz, 1H), 7.24 – 7.17 (m, 4H), 7.11 – 7.07 (m, 1H), 4.11 (t, *J* = 8.0 Hz, 1H), 2.02 – 1.88 (m, 2H), 1.46 – 1.37 (m, 1H), 0.87 (d, *J* = 2.4 Hz, 3H), 0.87 (d, *J* = 2.4 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 145.1, 142.7, 133.5, 132.1, 128.4, 128.01, 128.0, 127.6, 127.5, 126.8, 126.07, 125.8, 125.8, 125.3, 48.9, 44.7, 25.5, 22.7, 22.6; FTIR (NaCl/thin film) 3056, 2965, 2932, 2875, 1921, 1766, 1618, 1417, 1326, 1164, 1120, 1068, 1018, 815 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{21}H_{22}$: 274.1722, found: 274.1717.



(*S*)-2-((4-Methoxyphenyl)(phenyl)methyl)naphthalene (17). Triarylmethane **17** was prepared via the General Procedure using pivalate **1d** (prepared in >99% ee) except that 10 mol % of $Ni(cod)_2$ and 1.0 equiv of boroxine were used and the reaction mixture was heated at 90 °C. The crude material was purified by silica gel chromatography (5% Et_2O/hexanes) to give compound **17** (run 1: 55.2 mg, 85%; run 2: 54.3 mg, 84%) as a colorless oil. The enantiomeric excess was determined to be 86% ee (run 1: 86% ee; run 2: 86% ee) by chiral HPLC analysis (CHIRACEL OD-H, 0.8 mL/min, 0.1% *i*-PrOH/hexane, λ=254 nm);

t_R(major)=24.00 min, t_R(minor)=22.03 min. $[\alpha]_D^{24}$ = +3.7° (c 1.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.81 (m, 1H), 7.79 (d, *J* = 8.5 Hz, 1H), 7.76 – 7.71 (m, 1H), 7.50 – 7.44 (m, 3H), 7.35 – 7.30 (m, 3H), 7.28 – 7.23 (m, 1H), 7.21 – 7.16 (m, 2H), 7.13 – 7.08 (m, 2H), 6.90 – 6.84 (m, 2H), 5.69 (s, 1H), 3.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.1, 144.0, 141.9, 135.9, 133.4, 132.1, 130.5, 129.5, 128.4, 128.1, 127.9, 127.9, 127.7, 127.6, 126.3, 125.9, 125.6, 113.7, 56.1, 55.3. The spectral data for this compound matches that reported in the literature.[7]



(*S*)-2-(Phenyl(4-(trifluoromethyl)phenyl)methyl)naphthalene (18). Triarylmethane **18** was prepared via the General Procedure using pivalate **1d** (prepared in >99% ee) except that 10 mol % of $Ni(cod)_2$ and 1.0 equiv of boroxine were used and the reaction mixture was heated at 90 °C. The crude material was purified by silica gel chromatography (1% Et_2O/hexanes) to give compound **18** (70.4 mg, 96%) as a colorless oil. The enantiomeric excess was determined to be 80% ee by chiral HPLC analysis (CHIRAlPAK 1B, 0.6 mL/min, 100% hexane, λ=254 nm); t_R(major)= 21.44 min, t_R(minor)= 23.27 min. $[\alpha]_D^{24}$ = –8.8° (c 1.92, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.72 (m, 1H), 7.71 (d, *J* = 8.5 Hz, 1H), 7.66 – 7.62 (m, 1H), 7.48 (d, *J* = 8.1 Hz, 2H), 7.40 – 7.36 (m, 3H), 7.27 – 7.22 (m, 2H), 7.22 – 7.16 (m, 4H), 7.07 (dd, *J* = 7.2, 1.7 Hz, 2H), 5.68 (s, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 147.8, 142.8, 140.5, 133.4, 132.3, 129.9, 129.0, 128.8 (q, J_{C-F} = 32.1 Hz), 128.6, 128.5, 128.2, 128.9 (q, J_{C-F} = 1.5 Hz), 127.8, 127.6, 126.8, 126.2, 125.9, 125.4 (q, J_{C-F} = 3.9 Hz), 124.3 (q, J_{C-F} = 273. 5), 56.8; FTIR (NaCl/thin film) 3058, 3027, 2926, 1924, 1600, 1494, 1416, 1326, 1165, 1068, 814 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{24}H_{17}F_3$: 362.1824, found: 362.1276.

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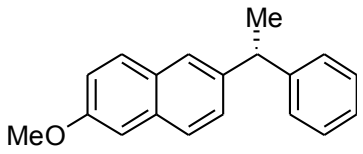
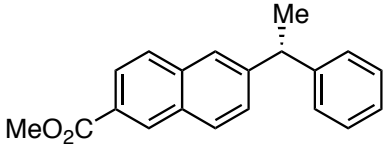
[7] Taylor, B. L. H.; Harris, R. M.; Jarvo, E. R. *Angew. Chem. Int. Ed.* **2012**, *24*, 7910.



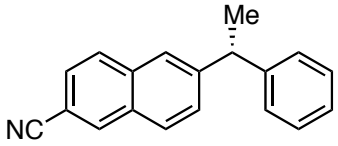
(*R*)-2-Methoxy-6-(1-phenylethyl)naphthalene (19). Diarylethane **19** was prepared via the General Procedure using pivalate **1e** (prepared in >99% ee) except that 1.0 equiv of boroxine was used and the reaction mixture was heated at 50 °C. The crude material was purified by silica gel chromatography (1–2% Et_2O/hexanes) to give compound **19** (run 1: 45.6 mg, 87%; run 2: 45.5 mg, 87%) as a white solid (mp 97–101 °C). The enantiomeric excess was determined to be 93% ee (run 1: 93% ee; run 2: 93% ee) by chiral HPLC analysis (CHIRALPAK 1B, 0.6 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=11.29 min, t_R(minor)=9.83 min. $[\alpha]_D^{24}$ = –28.2° (c 1.00, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 8.9 Hz, 1H), 7.69 (s, 1H), 7.68 – 7.66 (m, 1H), 7.36 – 7.28 (m, 5H), 7.26 – 7.20 (m, 1H), 7.17 (dd, *J* = 8.8, 2.6 Hz, 1H), 7.15 – 7.12 (m, 1H), 4.32 (q, *J* = 7.2 Hz, 1H), 3.94 (s, 3H), 1.76 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.3, 146.5, 141.5, 133.1, 129.2, 128.9, 128.4, 127.8, 127.4, 126.9, 126.1, 125.2, 118.7, 105.6, 55.3, 44.7, 21.9; FTIR (NaCl/thin film) 3026, 2965, 2935, 2871, 1605, 1489, 1451, 1266, 1166, 1034, 851 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{18}O$: 262.1358, found: 262.1353. The spectral data for this compound matches that reported in the literature.[8]



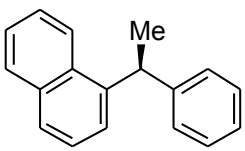
(*R*)-Methyl 6-(1-phenylethyl)-2-naphthoate (20). Diarylethane **20** was prepared via the General Procedure using pivalate **1f** (prepared in 98% ee). The crude material was purified by silica gel chromatography (5–6% Et_2O/hexanes) to give compound **20** (run 1: 49.2 mg, 85%; run 2: 47.4 mg, 82%) as viscous colorless oil. The enantiomeric excess was determined to be 94% ee (run 1: 93% ee; run 2: 94% ee) by chiral HPLC analysis (CHIRALPAK 1B, 1.0 mL/min, 2.0% *i*-PrOH/hexane, λ=254 nm);

[8] Gayral, M.; Brown, J. M. *Synlett.* **2007**, *18*, 2823.

t_R(minor)=6.75 min, t_R(major)=7.40 min. $[\alpha]_D^{24}$ = –31.8° (c 1.92, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.55 (s, 1H), 8.04 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.84 (dd, *J* = 8.5, 5.4 Hz, 2H), 7.73 (s, 1H), 7.38 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.33 – 7.24 (m, 4H), 7.23 – 7.18 (m, 1H), 4.33 (q, *J* = 7.2 Hz, 1H), 3.97 (s, 3H), 1.74 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 167.4, 146.6, 145.7, 135.7, 131.1, 130.8, 129.4, 128.5, 128.0, 127.8, 127.7, 126.9, 126.3, 125.4, 125.2, 52.2, 45.0, 21.7; FTIR (NaCl/thin film) 2966, 2929, 1719, 1632, 1494, 1437, 1289, 1237, 1201, 1097, 912 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{15}H_{19}N_2O_4$: 291.1385, found: 291.1387.

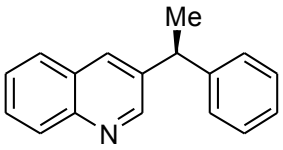


(*R*)-6-(1-Phenylethyl)-2-naphthonitrile (21). Diarylethane **21** was prepared via the General Procedure using pivalate **1g** (prepared in 95% ee). The crude material was purified by silica gel chromatography (5–10% EtOAc/hexanes) to give compound **21** (run 1: 23.6 mg, 46%; run 2: 22.1 mg, 43%) as viscous colorless oil. The enantiomeric excess was determined to be 90% ee (run 1: 89% ee; run 2: 89% ee) by chiral HPLC analysis (CHIRALPAK 1A, 1.0 mL/min, 0.5% *i*-PrOH/hexane, λ=254 nm); t_R(minor)=34.2 min, t_R(major)=37.2 min. $[\alpha]_D^{24}$ = –75.0° (c 0.40, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.86 (d, *J* = 8.5 Hz, 1H), 7.79 (d, *J* = 8.5 Hz, 1H), 7.73 (s, 1H), 7.58 (dd, *J* = 8.5, 1.6 Hz, 1H), 7.44 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.33 – 7.28 (m, 2H), 7.25 – 7.20 (m, 3H), 4.34 (q, *J* = 7.2 Hz, 1H), 1.74 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 147.6, 145.3, 134.9, 133.8, 131.0, 129.0, 128.7, 128.6, 128.5, 127.7, 126.6, 126.5, 125.5, 119.4, 108.8, 45.0, 21.6; FTIR (NaCl/thin film) 3025, 2967, 2929, 2226, 1629, 1600, 1493, 1451, 1377, 1158, 894 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{16}H_{18}O_3$: 258.1283, found: 258.1277.



(*S*)-1-(1-phenylethyl)naphthalene (22). Diarylethane **22** was prepared via the General Procedure using pivalate **1h** (prepared in

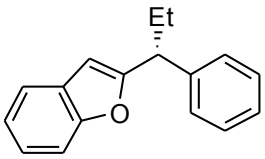
86% ee). The crude material was purified by silica gel chromatography (3% Et_2O/hexanes) to give compound **22** (run 1: 34.3 mg, 74%; run 2: 32.9 mg, 71%) as a colorless oil. The enantiomeric excess was determined to be 73% ee (run 1: 73% ee; run 2: 72% ee) by chiral HPLC analysis (CHIRALPAK 1B, 0.8 mL/min, 100% hexanes, λ=220 nm); t_R(major)=19.13 min, t_R(minor)=26.13 min. $[\alpha]_D^{24}$ = –23.3° (c 0.60, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 – 7.94 (m, 1H), 7.78 – 7.75 (m, 1H), 7.66 (dd, *J* = 7.8, 1.3 Hz, 1H), 7.41 – 7.31 (m, 4H), 7.20 – 7.14 (m, 4H), 7.10 – 7.06 (m, 1H), 4.85 (q, *J* = 7.1 Hz, 1H), 1.69 (d, *J* = 7.1 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 146.7, 141.6, 134.0, 131.7, 128.8, 128.4, 127.6, 127.0, 126.0, 125.9, 125.5, 125.3, 124.4, 124.0, 40.6, 22.6; FTIR (NaCl/thin film) 3058, 2966, 2929, 2872, 1597, 1508, 1493, 1449, 1396, 1372, 1026, 800 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{18}H_{16}$: 232.1252, found: 232.1255. The spectral data for this compound matches that reported in the literature.[9]



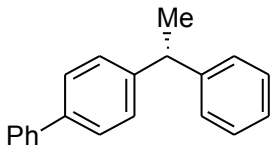
(*S*)-3-(1-Phenylethyl)quinoline (23). Diarylethane **23** was prepared via the General Procedure using pivalate **1i** (prepared in 82% ee). The crude material was purified by silica gel chromatography (20% EtOAc/hexanes) to give compound **23** (run 1: 43.2 mg, 93%; run 2: 44.3 mg, 94%) as pale yellow oil. The enantiomeric excess was determined to be 58% ee (run 1: 58% ee; run 2: 57% ee) by chiral HPLC analysis (CHIRALPAK 1C, 1.0 mL/min, 3.0% *i*-PrOH/hexane, λ=210 nm); t_R(minor)=14.95 min, t_R(major)=16.50 min. $[\alpha]_D^{24}$ = +12.1° (c 0.98, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.80 (d, *J* = 2.3 Hz, 1H), 8.07 (d, *J* = 8.5 Hz, 1H), 7.94 (d, *J* = 2.3 Hz, 1H), 7.77 (dd, *J* = 8.1, 1.6 Hz, 1H), 7.69 – 7.63 (m, 1H), 7.56 – 7.47 (m, 1H), 7.36 – 7.29 (m, 2H), 7.29 – 7.20 (m, 3H), 4.37 (q, *J* =

[9] (a) Mazuela, J.; Verendel, J. J.; Coll, M.; Schaffner, B.; Borner, A.; Anderson, P. G.; Pamies, O.; Dieguez, M. *J. Am. Chem. Soc.* **2009**, *131*, 12344. (b) Gomez, E. D.; Albert, D.; Mattiza, J.; Duddeck, H.; Chojnowski, J.; Cypryk, M. *Tetrahedron Asym.* **2006**, *17,* 1743.

7.2 Hz, 1H), 1.77 (d, J = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 151.8, 146.8, 144.9, 138.9, 133.0, 129.1, 128.8, 128.7, 128.1, 127.7, 127.6, 126.6, 126.5, 42.6, 21.6; FTIR (NaCl/thin film) 3060, 3026, 2967, 2930, 2873, 1602, 1570, 1494, 1380, 1333, 1125, 1028, 961 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{17}H_{15}N$: 233.1204, found: 233.1198.



(*R*)-2-(1-Phenylpropyl)benzofuran (24). Diarylpropane **24** was prepared via the General Procedure using pivalate **1j** (prepared in 82% ee) except that 1.2 equiv of boroxine was used and the reaction mixture was heated at 32 °C for 24 h. The crude material was purified by silica gel chromatography (4% Et_2O/hexanes) to give compound **24** (run 1: 24.0 mg, 51%; run 2: 22.2 mg, 47%) as a colorless oil. The enantiomeric excess was determined to be 72% ee (run 1: 72% ee; run 2: 72% ee) by chiral HPLC analysis (CHIRALPAK 1B, 1.0 mL/min, 0.2% *i*-PrOH/hexane, λ=254 nm); t_R(major)=37.28 min, t_R(minor)=34.31 min. $[\alpha]_D^{24}$ = –38.1° (c 0.80, $CHCl_3$): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.40 (m, 1H), 7.33 – 7.30 (m, 1H), 7.26 – 7.21 (m, 4H), 7.18 – 7.14 (m, 1H), 7.14 – 7.07 (m, 2H), 6.38 (s, 1H), 3.88 (t, J = 7.7 Hz, 1H), 2.24 – 2.14 (m, 1H), 1.99 – 1.88 (m, 1H), 0.88 (t, J = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.2, 154.8, 141.9, 128.7, 128.5, 128.0, 126.7, 123.3, 122.4, 120.4, 110.9, 102.4, 47.6, 27.6, 12.4; HRMS (EI+) $[M]^+$calculated for $C_{17}H_{16}O$: 236.1201, found: 236.1195. The spectral data for this compound matches that reported in the literature.[10]



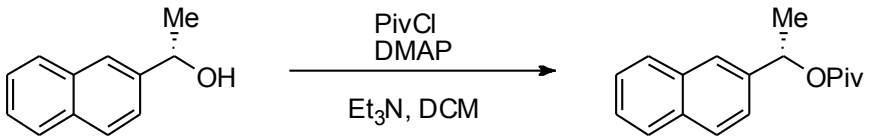
(*S*)-4-(1-Phenylethyl)biphenyl (25). Diarylethane **25** was prepared via the General Procedure using pivalate **1k** (prepared in 93% ee) except that 10 mol % $Ni(cod)_2$ and 1.0 equiv of boroxine were used and the reaction mixture was heated at 100 °C for 24 h. The crude material was purified by silica gel chromatography (100% petroleum ether) to give

[10] DeLuca, L.; Nieddu, G.; Giacomelli, G. *J. Org. Chem.* **2007**, *72*, 3955.

compound **25** (run 1: 17.0 mg, 33%; run 2: 17.2 mg, 33%) as a white solid (mp 37–41 °C). The enantiomeric excess was determined to be 84% ee (run 1: 84% ee; run 2: 84% ee) by chiral HPLC analysis (CHIRALPAK 1B, 1.0 mL/min, 100% hexane, λ=254 nm); t_R(minor)=15.34 min, t_R(major)=24.22 min. $[\alpha]_D^{24}$ = –51.6° (c 0.60, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.63 – 7.57 (m, 2H), 7.57 – 7.52 (m, 2H), 7.47 – 7.43 (m, 2H), 7.38 – 7.29 (m, 7H), 7.25 – 7.12 (m, 1H), 4.23 (q, *J* = 7.3 Hz, 1H), 1.71 (d, *J* = 7.3 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 146.3, 145.5, 141.0, 139.0, 128.7, 128.4, 128.0, 127.6, 127.11, 127.05, 127.0, 126.1, 44.5, 21.9. The spectral data for this compound matches that reported in the literature.[3]

Preparation of Benzyl Pivalates

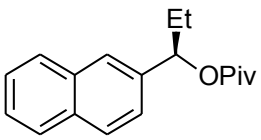
General Procedure for the Preparation of Benzyl Pivalates: Preparation of (*S*)-1-(Naphthalen-2-yl)ethyl Pivalate (1a)



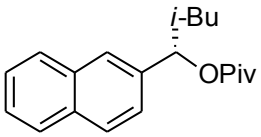
S-1a **1a**

(*S*)-1-(Naphthalen-2-yl)ethanol (**S-1a**, 1.17 g, 6.8 mmol, 1.0 equiv) and DMAP (83 mg, 0.68 mmol, 0.10 equiv) were dissolved in CH_2Cl_2 (10 mL, 0.68 M). Et_3N (1.94 mL, 1.35 mmol, 2.0 equiv) and pivaloyl chloride (1.02 mL, 8.15 mmol, 1.2 equiv) were then added. The reaction mixture was then stirred for 12 h at room temperature, before H_2O (20 mL) was added. The organic layer was extracted with CH_2Cl_2 (2 x 20 mL). The combined organic layers were washed with 10% aq. KOH (20 mL), dried ($MgSO_4$), filtered and concentrated. The resulting residue was purified by silica gel chromatography (5% Et_2O/hexanes) to give compound **1a** (1.58 g, 91%) as a white solid. The enantiomeric excess was determined to be >99% ee by chiral HPLC analysis

(CHIRALPAK IA, 0.6 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(minor)=8.23 min, t_R(major)=10.31 min. $[\alpha]_D^{24}$ = –82.1° (c 0.80, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.85 – 7.81 (m, 3H), 7.80 – 7.77 (m, 1H), 7.50 – 7.45 (m, 3H), 6.02 (q, *J* = 6.6 Hz, 1H), 1.60 (d, *J* = 6.6 Hz, 3H), 1.23 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 139.5, 133.2, 132.9, 128.3, 128.0, 127.7, 126.2, 126.0, 124.7, 124.0, 72.1, 38.8, 27.2, 22.3; HRMS (EI+) $[M]^+$ calculated for $C_{17}H_{20}O_2$: 256.1463, found: 256.1469. The spectral data for this compound matches that reported in the literature for the racemic compound. [11]



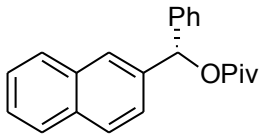
(*R*)-1-(Naphthalen-2-yl)propyl pivalate (1b). Prepared according to the General Procedure on a 4.03 mmol scale to give **1b** (900 mg, 83%) as a colorless oil. The enantiomeric excess was determined to be >99% ee by chiral HPLC analysis (CHIRALPAK IA, 0.6 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=8.26 min, t_R(minor)=10.45 min. $[\alpha]_D^{24}$ = +160.9° (c 4.20, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.88 – 7.75 (m, 4H), 7.54 – 7.44 (m, 3H), 5.83 (t, *J* = 7.0 Hz, 1H), 2.07 – 1.87 (m, 2H), 1.27 (s, 9H), 0.95 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 138.4, 133.2, 133.0, 128.2, 128.0, 127.7, 126.1, 125.9, 125.4, 124.2, 38.9, 29.5, 27.2, 26.5, 10.0; FTIR (NaCl/thin film) 3057, 2971, 2934, 2875, 1728, 1479, 1396, 1153, 817 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{18}H_{22}O_2$: 270.1620, found: 270.1626.



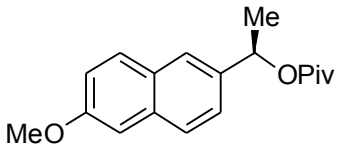
(*S*)-3-Methyl-1-(naphthalen-2-yl)butyl pivalate (1c). Prepared according to the General Procedure on a 1.17 mmol scale to give **1c** (302 mg, 87%) as a colorless oil. The enantiomeric excess was determined to be 93% ee by chiral HPLC analysis (CHIRALPAK 1A, 0.8 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=8.22 min, t_R(minor)=10.31 min. $[\alpha]_D^{24}$ = –77.8° (c 0.84, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.84 – 7.79 (m, 3H), 7.78 – 7.75 (m, 1H),

[11] Katsumata, H.; Yamada, S. *J. Org. Chem.* **2007**, *72*, 3955.

7.50 – 7.43 (m, 3H), 5.93 (m, 1H), 1.95 (dd, *J* = 8.9, 7.8 Hz, 1H), 1.68 – 1.61 (m, 2H), 1.21 (s, 9H), 0.98 (d, *J* = 6.6 Hz, 3H), 0.95 (d, *J* = 6.0 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 138.9, 133.2, 132.9, 128.3, 128.0, 127.7, 126.1, 125.9, 125.4, 124.2, 74.4, 45.7, 38.2, 27.1, 24.8, 22.9, 22.3; FTIR (NaCl/thin film) 2958, 2360, 1728, 1652, 1558, 1506, 1457, 1282, 1164 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{20}H_{26}O_2$: 298.1933, found: 298.1938.

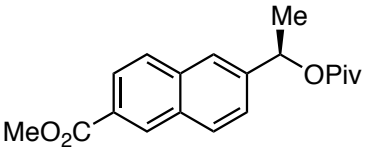


(*S*)-naphthalen-2-yl(phenyl)methyl pivalate (1d). Prepared according to the General Procedure on a 6.40 mmol scale to give **1d** (1.18 g, 88%) as a colorless oil. The enantiomeric excess was determined to be >99% ee by chiral HPLC analysis (CHIRALPAK 1B, 0.8 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=7.06 min, t_R(minor)=6.43 min. $[\alpha]_D^{24}$ = –46.2° (c 0.80, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.87 – 7.80 (m, 4H), 7.53 – 7.48 (m, 2H), 7.45 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.43 – 7.34 (m, 4H), 7.33 – 7.30 (m, 1H), 7.02 (s, 1H), 1.30 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.3, 140.4, 137.9, 133.1, 132.9, 128.5, 128.4, 128.1, 127.8, 127.7, 126.9, 126.3, 126.2, 126.0, 124.9, 77.2, 38.9, 27.2; FTIR (NaCl/thin film) 2971, 1727, 1478, 1278, 1147, 1123, 1031, 818 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{22}H_{22}O_2$: 318.1620, found: 318.1617.

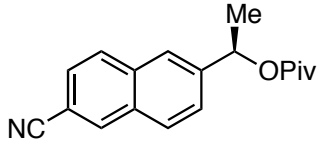


(*R*)-1-(6-Methoxynaphthalen-2-yl)ethyl pivalate (1e). Prepared according to the General Procedure on a 1.89 mmol scale to give **1e** (460 mg, 85%) as a white solid (mp 78–82°C). The enantiomeric excess was determined to be >99% ee by chiral HPLC analysis (CHIRALPAK IA, 0.8 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=6.88 min, t_R(minor)=6.02 min. $[\alpha]_D^{24}$ = +81.2° (c 0.80, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.75 – 7.69 (m, 3H), 7.43 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.17 – 7.11 (m, 2H), 5.99 (q, *J* = 6.6 Hz, 1H), 3.92 (s, 3H), 1.59 (d, *J* = 6.6 Hz, 3H), 1.22 (s, 9H); ^{13}C NMR

(151 MHz, $CDCl_3$) δ 177.7, 157.8, 137.2, 134.1, 129.5, 128.6, 127.1, 124.7, 124.6, 118.9, 105.7, 72.1, 55.3, 38.8, 27.2, 22.2; FTIR (NaCl/thin film) 2979, 1724, 1608, 1506, 1487, 1391, 1284, 1237, 1166, 1031, 859 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{18}H_{22}O_3$: 286.1569, found: 286.1561.

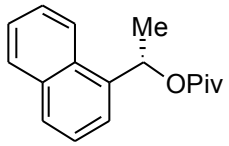


(*R*)-Methyl 6-(1-(pivaloyloxy)ethyl)-2-naphthoate (1f). Prepared according to the General Procedure on a 1.84 mmol scale to give **1f** (470 mg, 81%) as a white solid (mp 85–88°C). The enantiomeric excess was determined to be 98% ee by chiral HPLC analysis (CHIRALPAK IA, 1.0 mL/min, 2.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=8.99 min, t_R(minor)=13.21 min. $[\alpha]_D^{24}$ = +40.9° (c 0.62, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.59 (s, 1H), 8.06 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.94 (d, *J* = 8.5 Hz, 1H), 7.87 (d, *J* = 8.6 Hz, 1H), 7.82 (s, 1H), 7.52 (dd, *J* = 8.5, 1.7 Hz, 1H), 6.01 (q, *J* = 6.6 Hz, 1H), 3.98 (s, 3H), 1.60 (d, *J* = 6.6 Hz, 3H), 1.24 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 167.2, 142.2, 135.4, 132.0, 130.8, 129.8, 128.3, 127.5, 125.6, 124.7, 124.44, 71.9, 52.3, 38.8, 27.1, 22.3; FTIR (NaCl/thin film) 2977, 2872, 1724, 1635, 1480, 1436, 1281, 1156, 1097 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{19}H_{23}O_4$: 315.1596, found: 315.1593.

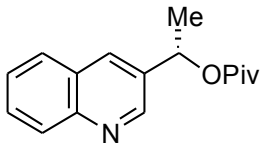


(*R*)-1-(6-Cyanonaphthalen-2-yl)ethyl pivalate (1g). Prepared according to the General Procedure on a 0.89 mmol scale to give **1g** (170 mg, 67%) as a white solid (mp 74–76°C). The enantiomeric excess was determined to be 95% ee by chiral HPLC analysis (CHIRALPAK IA, 1.0 mL/min, 2.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=9.71 min, t_R(minor)=14.42 min. $[\alpha]_D^{24}$ = +78.6° (c 0.90, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.91 (d, *J* = 4.0 Hz, 1H), 7.89 (d, *J* = 4.1 Hz, 1H), 7.83 (s, 1H), 7.63 – 7.57 (m, 2H), 6.00 (q, *J* = 6.6 Hz, 1H), 1.60 (d, *J* = 6.6 Hz, 3H), 1.23 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.6, 143.1, 134.6, 133.9, 131.7, 129.3, 128.9, 126.8, 125.7, 124.7,

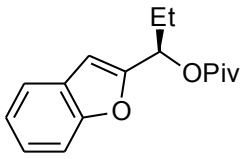
119.2, 109.4, 71.7, 38.8, 27.1, 22.3; FTIR (NaCl/thin film) 3059, 2977, 2227, 1727, 1634, 1470, 1281, 1157, 1133, 1064 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{18}H_{20}NO_2$: 282.1494, found: 282.1491.



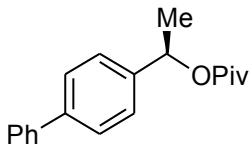
(*S*)-1-(Naphthalene-1yl)ethyl pivalate (1h). Prepared according to the General Procedure on a 2.33 mmol scale to give **1h** (580 mg, 97%) as a colorless oil. The enantiomeric excess was determined to be 86% ee by chiral HPLC analysis (CHIRALPAK IA, 0.6 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(major)=9.52 min, t_R(minor)=8.00 min. $[\alpha]_D^{24}$ = –39.2° (c 3.80, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.6 Hz, 1H), 7.87 (d, *J* = 8.3 Hz, 1H), 7.79 (d, *J* = 8.2 Hz, 1H), 7.59 (d, *J* = 7.0 Hz, 1H), 7.55 – 7.46 (m, 3H), 6.61 (q, *J* = 6.6 Hz, 1H), 1.68 (d, *J* = 6.6 Hz, 3H), 1.24 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 137.9, 133.8, 130.2, 128.9, 128.3, 126.2, 125.6, 125.4, 123.3, 123.0, 69.3, 38.9, 27.2, 21.8; FTIR (NaCl/thin film) 2977, 2932, 1728, 1479, 1458, 1397, 1368, 1283, 1157, 1068, 1045 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{17}H_{20}O_2$: 256.1463, found: 256.1467.



(*S*)-1-(Quinolin-3-yl)ethyl pivalate (1i). Prepared according to the General Procedure on a 1.60 mmol scale to give **1i** (132.7 mg, 30%) as pale yellow oil. The enantiomeric excess was determined to be 82% ee by chiral HPLC analysis (CHIRALPAK IA, 1.0 mL/min, 1.0% *i*-PrOH/hexane, λ=254 nm); t_R(minor)=29.83 min, t_R(major)=33.26 min. $[\alpha]_D^{24}$ = –96.8° (c 0.96, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.96 (d, *J* = 2.2 Hz, 1H), 8.13 (d, *J* = 8.5 Hz, 1H), 8.11 (d, *J* = 2.1 Hz, 1H), 7.85 (d, *J* = 8.1 Hz, 1H), 7.63 – 7.53 (m, 1H), 6.09 (q, *J* = 6.6 Hz,1H), 1.68 (d, *J* = 6.7 Hz, 3H), 1.26 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.6, 149.2, 147.8, 134.6, 132.9, 129.5, 129.3, 127.9, 127.7, 126.9, 70.1, 38.8, 27.1, 22.0; FTIR (NaCl/thin film) 2977, 2933, 2872, 1728, 1497, 1480, 1281, 1154, 1126, 1067, 909 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{16}H_{19}O_2N$: 257.1416, found: 257.1411.

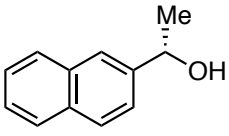


(*R*)-1-(Benzofuran-2-yl)propyl pivalate (1j). Prepared according to the General Procedure on a 1.66 mmol scale to give **1j** (320 mg, 74%) as a colorless oil. The enantiomeric excess was determined to be 82% ee by chiral HPLC analysis (CHIRALPAK IC, 1.0 mL/min, 0.3% *i*-PrOH/hexane, λ=254 nm); t_R(major)=9.25 min, t_R(minor)=8.49 min. $[\alpha]_D^{24}$ = +172.7° (c 1.30, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.58 – 7.54 (m, 1H), 7.51 – 7.46 (m, 1H), 7.33 – 7.21 (m, 2H), 6.67 (s, 1H), 5.91 (t, *J* = 12.0 Hz, 1H), 2.13 – 2.03 (m, 2H), 1.25 (s, 9H), 0.99 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 155.7, 154.8, 127.9, 124.2, 122.7, 121.1, 111.3, 104.2, 70.2, 38.9, 27.1, 26.0, 9.6; FTIR (NaCl/thin film) 2793, 2936, 2877, 1732, 1454, 1396, 1279, 1151, 1083, 1031, 950, 807 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{16}H_{20}O_3$: 260.1413, found: 260.1411.

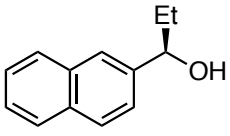


(*R*)-1-([1,1'-Biphenyl]-4-yl)ethyl pivalate (1k). Prepared according to the General Procedure on a 1.5 mmol scale to give **1k** (295 mg, 70%) as a white solid (mp 78–82°C). The enantiomeric excess was determined to be 93% ee by chiral HPLC analysis (CHIRALPAK IA, 1.0 mL/min, 0.3% *i*-PrOH/hexane, λ=254 nm); t_R(major)=9.02 min, t_R(minor)=10.74 min. $[\alpha]_D^{24}$ = +68.7° (c 0.82, $CHCl_3$): ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.64 – 7.57 (m, 4H), 7.50 – 7.42 (m, 4H), 7.41 – 7.35 (m, 1H), 5.92 (q, *J* = 6.6 Hz, 1H), 1.58 (d, *J* = 6.6 Hz, 3H), 1.26 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 141.2, 140.8, 140.6, 128.8, 127.3, 127.2, 127.1, 126.2, 71.7, 38.8, 27.2, 22.4; FTIR (NaCl/thin film) 3029, 2981, 1720, 1486, 1367, 1284, 1176, 1071, 1009, 836 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{19}H_{22}O_2$: 282.1620, found: 282.1629.

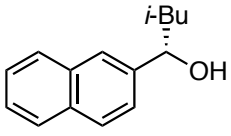
Preparation of Benzyl Alcohols



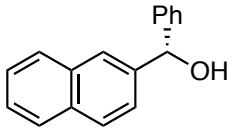
S-1a



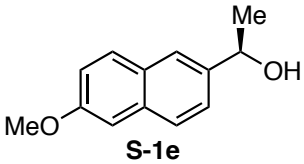
S-1b



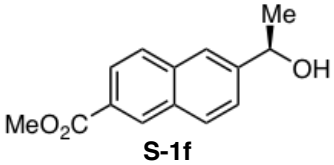
S-1c



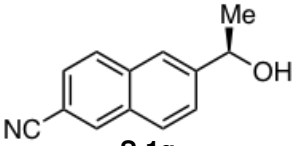
S-1d



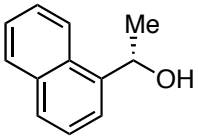
S-1e



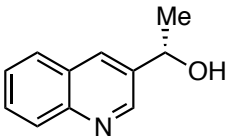
S-1f



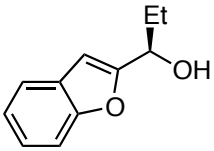
S-1g



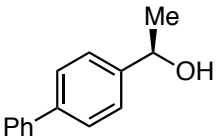
S-1h



S-1i



S-1j



S-1k

(*S*)-1-(Naphthalen-2-yl)ethanol (**S-1a**) was purchased from Sigma Aldrich. Alcohols **S-1b**,[12] **S-1d**,[7] and **S-1j**[12] were prepared according to literature procedures using asymmetric addition of diethyl zinc to the aldehydes. The enantiomeric excesses of crystalline compounds **S-1b** and **S-1d** were then increased via recrystallization from hexanes. Alcohols **S-1e**, **S-1f**, **S-1g**, and **S-1k** were prepared via Corey-Bakshi-Shibata reduction of ketones.[13] The enantiomeric excess of known alcohol **S-1e**[13] was then increased via trituration with 5% Et_2O/hexanes. Alcohols **S-1c**, **S-1h**,[14] and **S-1i** were prepared by asymmetric transfer hydrogenation of ketones.[14] Because alcohols **S-1c**, **S-1f**, **S-1g**, **S-1i**,

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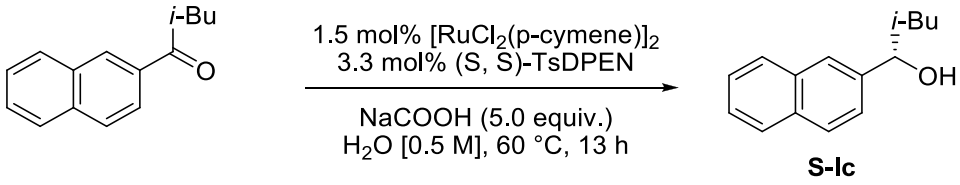
[12] Taylor, B. L. H.; Swift, E. C.; Waetzig, J. D.; Jarvo, E. R. *J. Am. Chem. Soc.* **2011**, *133*, 389.

[13] Bakshi, R. K.; Shibata, S.; Chen, C.; Singh, V. K.; Corey, E. J. *J. Am. Chem. Soc.* **1987**, *109*, 7925.

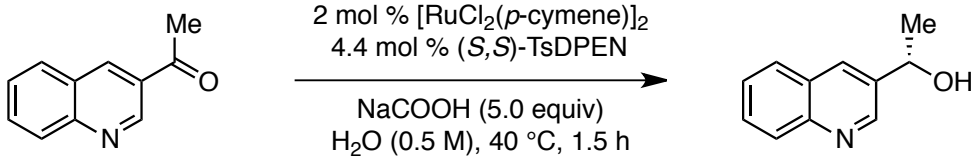
[14] Wu, X.-F.; Li, X.-G.; Hems, W.; King, F.; Xiao, J.-L. *Org. Biomol. Chem.* **2004**, *2*, 1818.

and **S-1k** have not been prepared via these methods previously, we have included experimentals for our procedures below.



S-Ic

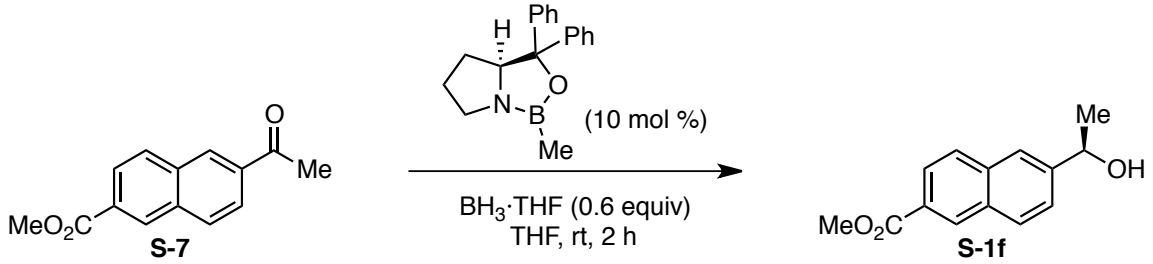
(*S*)-3-Methyl-1-(naphthalene-2-yl)butan-1-ol (S-1c). The following procedure is adapted from the literature.[14] In a N_2-atmosphere glovebox, $[RuCl_2(p\text{-cymene})]_2$ (21.9 mg, 0.0358 mmol, 1.5 mol %) and (*S,S*)-TsDPEN (28.8 mg, 0.0787 mmol, 3.3 mol %) were weighed into a vial. The vial was then capped and removed from glovebox. H_2O (degassed by sparging with N_2, 6.0 mL) was added, and the resulting mixture was stirred at 40 °C for 1 h. 3-Methyl-1-(naphthalene-2-yl)butan-1-one (387.0 mg, 2.39 mmol, 1.0 equiv) and NaCOOH (811.4 mg, 11.9 mmol, 5.0 equiv) were added. The vial was evacuated and refilled with N_2 three times and then heated at 60 °C for 13 h. The reaction mixture was diluted with Et_2O (10 mL) and filtered through silica gel, which was then rinsed with additional Et_2O (10 mL x 2). The combined organic layers were concentrated. The resulting residue was purified by silica gel chromatography (15% Et_2O/hexanes) and then recrystallized (hexanes) to give compound **S-1c** (238.3 mg, 61%, 93% ee) as a white solid. The spectral data for this compound matches that reported in literature.[15]



S-1i

[15] Da, C.; Wang, J.; Yin, X.; Fan, X.; Liu, Y.; Yu, S. *Org. Lett.* **2009**, *24,* 5578.

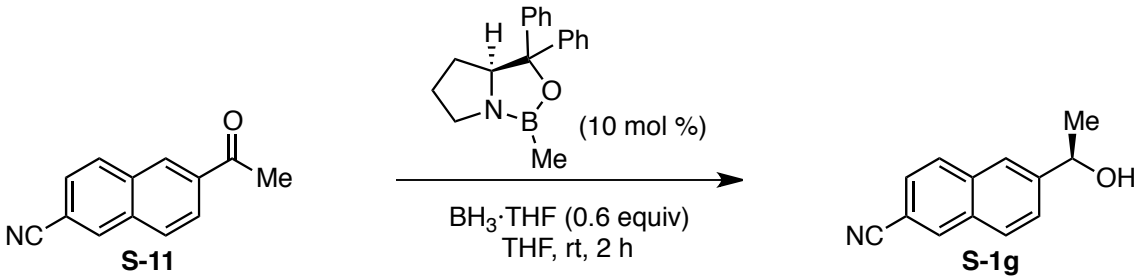
(*S*)-1-(Quinolin-3-yl)ethanol (S-1i). The following procedure is adapted from the literature.[14] In a N_2-atmosphere glovebox, $[RuCl_2(p\text{-cymene})]_2$ (3.58 mg, 0.0058 mmol, 2.0 mol %) and (*S*,*S*)-TsDPEN (4.71 mg, 0.0129 mmol, 4.4 mol %) were weighed into a vial. The vial was then capped and removed from glovebox. H_2O (degassed by sparging with N_2, 0.6 mL) was added, and the resulting mixture was stirred at 40 °C for 1 h. 3-Acetylquinoline (50.0 mg, 0.292 mmol, 1.0 equiv) and NaCOOH (99.3 mg, 1.46 mmol, 5.0 equiv) were added. The vial was evacuated and refilled with N_2 three times and then heated at 40 °C for 1.5 h. The reaction mixture was diluted with Et_2O (1 mL) and filtered through silica gel, which was then rinsed with additional Et_2O (1 mL x 2). The combined organic layers were concentrated. The resulting residue was purified by silica gel chromatography (50–90% EtOAc/hexanes) to give compound **S-1i** (45.7 mg, 90%, 85% ee) as a light brown oil. The spectral data for this compound matches to that reported in literature.[16]



(*R*)-Methyl 6-(1-hydroxyethyl)-2-naphthoate (S-1f). The following procedure is adapted from the literature.[13] A solution of CBS catalyst (83.2 mg, 0.30 mmol, 10 mol %) and THF (5.0 mL) was slowly added to a solution of ketone **S-7** (685 mg, 3.0 mmol, 1.0 equiv), BH_3·THF (1 M in THF, 1.8 mL, 1.8 mmol, 0.60 equiv), and THF (55 mL). After stirring at room temperature for 2 h, H_2O (30 mL) was added. The mixture was extracted

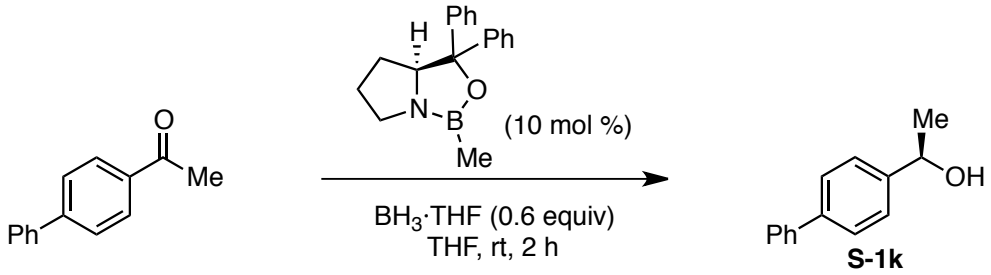
[16] Legros, J.; Toffano, M.; Drayton, S. K.; Rivard, M.; Fiaud, J. *Tetrahedron Lett.* **1997**, 38, 1915.

with Et_2O (30 mL x 3). The combined organic layers were then dried ($MgSO_4$), filtered, concentrated. The resulting residue was purified by by silica gel chromatography (40% EtOAc/hexanes) to give alcohol **S-1f** (460 mg, 67%) as a white solid (mp 74–77 °C): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.58 (s, 1H), 8.05 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.93 (d, *J* = 8.5 Hz, 1H), 7.87 (s, 1H), 7.85 (s, 1H), 7.56 (dd, *J* = 8.5, 1.7 Hz, 1H), 5.16 – 5.06 (m, 1H), 3.97 (s, 3H), 1.96 (d, *J* = 3.5 Hz, 1H), 1.58 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 167.3, 145.8, 135.5, 131.9, 130.8, 129.8, 128.2, 127.3, 125.6, 124.7, 123.6, 70.4, 52.3, 25.3; FTIR (NaCl/thin film) 3279, 2974, 2887, 1715, 1632, 1437, 1290, 1202, 1130, 1073, 898 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{14}H_{15}O_3$: 231.1021, found: 231.1019.



(*R*)-6-(1-Hydroxyethyl)-2-naphthonitrile (S-1g). The following procedure is adapted from the literature.[13] A solution of CBS catalyst (30.7 mg, 0.11 mmol, 10 mol %) and THF (2.0 mL) was slowly added to a solution of ketone **S-11** (216.3 mg, 1.1 mmol, 1.0 equiv), BH_3·THF (1 M in THF, 0.66 mL, 0.66 mmol, 0.60 equiv), and THF (20 mL). After stirring at room temperature for 2 h, H_2O (20 mL) was added. The mixture was extracted with Et_2O (15 mL x 3). The combined organic layers were then dried ($MgSO_4$), filtered, concentrated. The resulting residue was purified by silica gel chromatography (60% EtOAc/hexanes) to give alcohol **S-1g** (202 mg, 93%) as a white solid (mp 75–77 °C): ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (s, 1H), 7.93 – 7.88 (m, 3H), 7.67 – 7.60 (m, 2H), 5.09 (q, *J* = 6.5 Hz, 1H), 2.10 (s, 1H), 1.57 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (100 MHz,

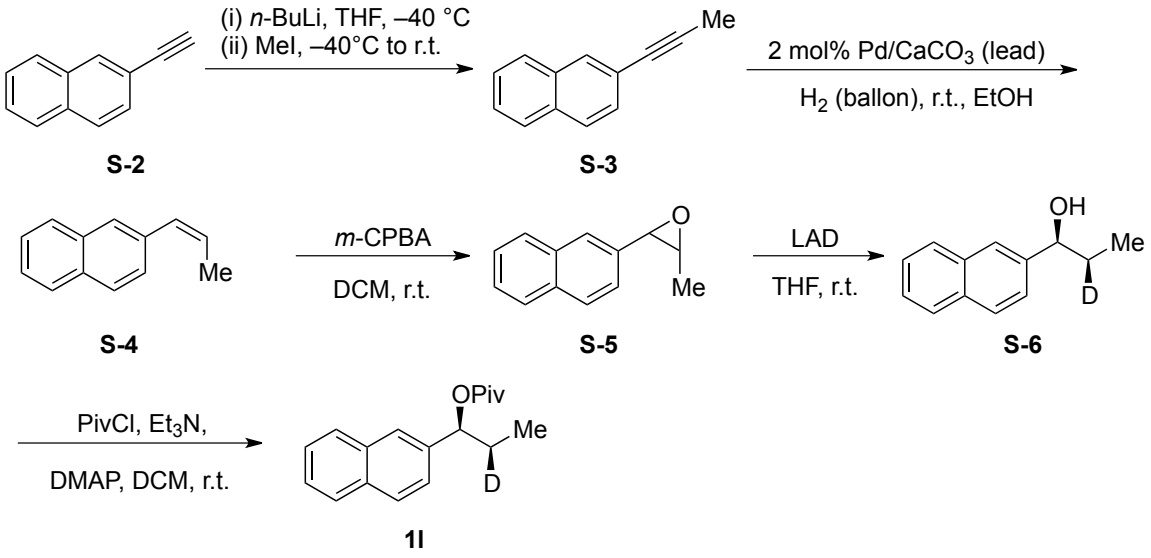
$CDCl_3$) δ 146.8, 134.7, 133.9, 131.7, 129.2, 128.8, 126.7, 125.8, 123.8, 119.3, 109.1, 70.2, 25.4; FTIR (NaCl/thin film) 3445, 2973, 2926, 2872, 2227, 1632, 1369, 1272, 1159, 1088, 895 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{13}H_{12}$ NO: 198.0919, found: 198.0917.



(*R*)-1-(Biphenyl-4-yl)ethanol (S-1k). The following procedure is adapted from the literature.[13] A solution of CBS catalyst (97.0 mg, 0.35 mmol, 10 mol %) and THF (5.0 mL) was slowly added to a solution of 4-acetylbiphenyl (687.0 mg, 3.50 mmol, 1.0 equiv), BH_3·THF (1 M in THF, 2.1 mL, 2.1 mmol, 0.60 equiv), and THF (70 mL). After stirring at room temperature for 2 h, H_2O (50 mL) was added. The mixture was extracted with Et_2O (30 mL x 3). The combined organic layers were then dried ($MgSO_4$), filtered, concentrated. The resulting residue was purified by recrystallization (hexanes) to give compound **S-1k** (640.7 mg, 92%, 93% ee) as a white solid. The spectral data for this compound matches that reported in the literature for the racemic compound.[17]

[17] Inagaki, T.; Phong, L.; Furuta, A.; Ito, J.; Nishiyama, H. *Chem Eur. J.* **2010**, *16*, 3090.

Preparation of Pivalate 1l



2-(Prop-1-ynyl)naphthalene (S-3). The following procedure is adapted from the literature.[18] A solution of terminal alkyne **S-2** (507.8 mg, 3.38 mmol, 1.0 equiv) and THF (20 mL) was cooled to –40 °C in a 50-mL round-bottomed flask. *n*-BuLi (2.5 M in Hexanes, 2.7 mL, 6.76 mmol, 2.0 equiv) was added. After stirring at –40 °C for 1 h, a solution of iodomethane (0.44 mL, 7.10 mmol, 2.1 equiv) and THF (2.5 mL) was added. The mixture was then stirred for 1 h at room temperature. Sat. aq. NH_4Cl (2 mL) and then water (40 mL) was added, and the mixture was extracted with Et_2O (30 mL x 3). The combined organic layers were then dried ($MgSO_4$), filtered, and concentrated. The resulting residue was purified by silica gel chromatography (100% petroleum ether) to give compound **S-3** (457.0 mg, 81%) as a colorless oil. The spectral data for compound **S-3** matches that reported in literature. [19]

[18] Stuart, D. R.; Bertrand-Laperle, M.; Burgess, K. M. N.; Fagnou, K. *J. Am. Chem. Soc.* **2008**, *130*, 16474.

[19] An, D.-L.; Zhang, Z.-Y.; Orita, A.; Mineyama, H.; Otera, J. *Synlett* **2007**, *12*, 1909.

(*Z*)-2-(Prop-1-enyl)naphthalene (**S-4**). The following procedure is adapted from the literature.[20] In a 25-mL flask, Pd/$CaCO_3$ (5%, poisoned with lead, 80.4 mg, 0.0378 mmol 2 mol %) and ethanol (5.0 mL) were combined. The flask was evacuated and refilled with H_2 (balloon) three times, then a solution of alkyne **S-3** (314.1 mg, 1.89 mmol, 1.0 equiv) and ethanol (4.5 mL) was added slowly. The reaction mixture was stirred at room temperature for 40 minutes. It was then filtered through Celite and concentrated. The resulting residue was purified by silica gel chromatography (100% petroleum ether) to give **S-4** (282.3 mg, 89%) as colorless oil. The ratio of *Z:E* olefins was 19:1, as determined by ^{1}H NMR analysis.[21] This mixture was directly used in next step.

***Cis*-2-methyl-3-(naphtha-2-yl)oxirane (S-5)**. The following procedure is adapted from the epoxidation of (*E*)-2-(prop-1-enyl)naphthalene in literature.[22] In a 50-mL flask, olefin **S-4** (247.8 mg, 1.34 mmol, 1.0 equiv) and CH_2Cl_2 (5.0 mL) were combined. A solution of *meta*-chloroperoxybenzoic acid (400.0 mg, 1.62 mmol, 1.2 equiv) and CH_2Cl_2 (10 mL) was added. After stirring at 35 °C for 30 min, sat. Na_2SO_3 (6 mL), water (10 mL) and then sat. NaCl were added. The organic layer was separated, dried (Na_2SO_4), filtered, concentrated. The resulting residue was purified by silica gel chromatography (5% Et_2O/hexanes) to give compound **S-5** (182.9 mg, 74%) as a colorless oil. The ^{1}H NMR showed that the ratio of *cis:trans* was 17:1.[23] This mixture was directly used in next step.

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[20] Brunet, J.-J.; Caubere, P. *J. Org. Chem.* **1984**, *49*, 4058.

[21] The assignment of olefins was done according to the reported spectral data, see: Dong, D.-J.; Li, Y.; Wang, J.-Q.; Tian, S.-K. *Chem. Comm.* **2011**, *47*, 2158.

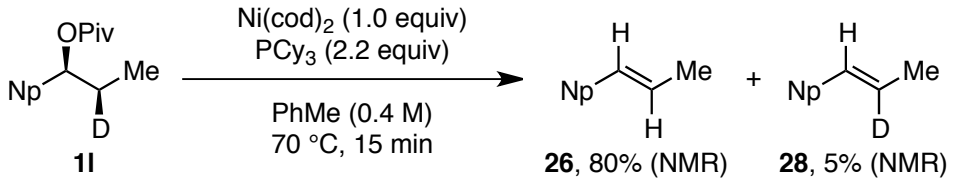
[22] Kulasegaram, S.; Kulawiec, R. J. *J. Org. Chem.* **1997**, *62*, 6547.

[23] The assignment of epoxides was done according to the reported spectral data. For *cis*-2-methyl-3-(naphtha-2-yl)oxirane, see: Tian, H.-Q.; She, X.-G.; Shu, L.-H.; Yu, H.-W.; Shi, Y.-A. *J. Am. Soc. Chem.* **2000**, 122, 11551. For *trans*-2-methyl-3-(naphtha-2-yl)oxirane, see reference 22.

1-(Naphthalene-2-yl)-2-deuterio-propan-1-ol (**S-6**). In a 10-mL flask, lithium aluminum deuteride (105 mg, 2.5 mmol, 2.5 equiv) and THF (2 mL) were combined and cooled to 0 °C. A solution of **S-5** (183.0 mg, 1.0 mmol, 1.0 equiv) and THF (8 mL) was slowly added via addition funnel. After the addition was complete, the reaction mixture was warmed to room temperature and stirred for 2 hours. The reaction was then quenched by the addition of 1 N aq. HCl (5 mL). The organic layer was washed with sat. NaCl, dried ($MgSO_4$), filtered and concentrated. The resulting residue was purified by silica gel chromatography (17% Et_2O/hexanes) to give compound **S-6** (80.0 mg, 73%) as a colorless oil: ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.89 – 7.84 (m, 3H), 7.81 (s, 1H), 7.54 – 7.47 (m, 3H), 4.80 (d, *J* = 5.8 Hz, 1H), 1.96 (s, 1H), 1.91 – 1.83 (m, 1H), 0.97 (d, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 141.9, 133.3, 133.0, 128.3, 127.9, 127.7, 126.1, 125.8, 124.7, 124.2, 76.1, 31.4 (t, J = 19.6 Hz), 10.0; FTIR (NaCl/thin film) 3357 (br), 3055, 2962, 2931, 2874, 1602, 1508, 1457, 1376, 1270, 1124, 1059, 1017, 857 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{13}H_{13}OD$: 187.1106, found: 187.1114.

1-(Naphthalene-2-yl)-2-deuterio-propyl pivalate (**1l**). Prepared according to the General Procedure for pivalate synthesis (see above) on a 0.176 mmol scale to give **1l** (38.2 mg, 80%) as a colorless oil: ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.77 – 7.72 (m, 3H), 7.68 (s, 1H), 7.43 – 7.35 (m, 3H), 5.72 (d, J = 6.0 Hz, 1H), 1.81 (p, *J* = 7.3 Hz, 1H), 1.16 (s, 9H), 0.85 (d, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.8, 138.4, 133.2, 133.0, 128.2, 128.0, 127.7, 126.1, 125.9, 125.4, 124.2, 77.2, 38.9, 29.2 (t, *J* = 16.5 Hz), 27.2, 9.9; FTIR (NaCl/thin film) 3057, 2971, 2934, 2874, 1728, 1479, 1459, 1283, 1154, 1125, 856 cm^{-1}; HRMS (EI+) $[M]^+$ calculated for $C_{18}H_{21}O_2D$: 271.1683, found: 271.1675.

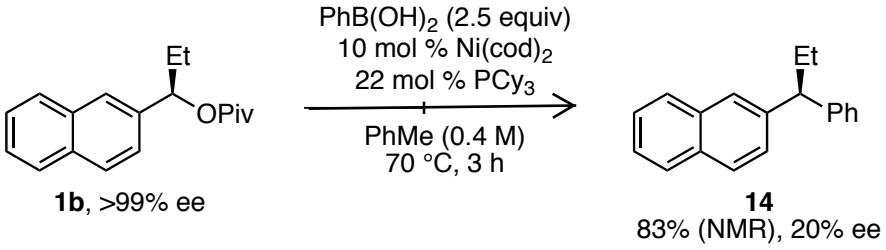
β-Hydride Elimination Experiment



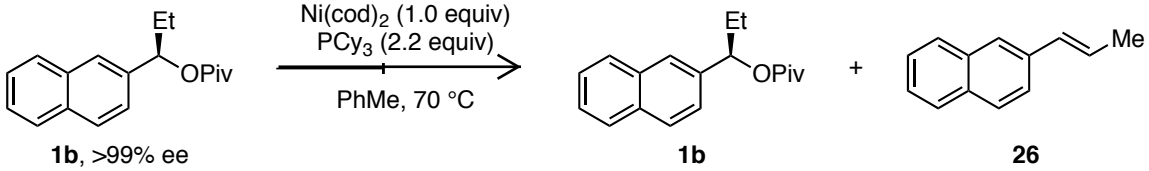
In a N_2-atmosphere glovebox, $Ni(cod)_2$ (45.7 mg, 0.166 mmol, 1.0 equiv) and PCy_3 (102.3 mg, 0.365 mmol, 2.2 equiv) were weighed into a 1-dram vial. Pivalate **1l** (45.0 mg, 0.166 mmol, 1.0 equiv) was added, followed by toluene (0.41 mL, 0.4 M). The vial was capped with a Teflon-lined cap and removed from the glovebox. The mixture was heated for 15 minutes at 70 °C. The reaction mixture was then diluted with Et_2O (2.0 mL) and filtered through a plug of silica gel, which was rinsed with Et_2O (15 mL). The solution was concentrated. Then 1,3,5-trimethoxybenzene (27.9 mg, 0.166 mmol, 1.0 equiv) was added as an internal standard for ^1H NMR analysis. Based on the ^1H NMR spectrum, pivalate **1l** underwent quantitative conversion to give products **26**[21] (80%) and **28**[24] (5%).

Control Experiments for β-Hydride Elimination Experiment

Although the cross coupling proceeds with low levels of chirality transfer using a Ni/PCy_3 catalyst, we have determined that the starting material does not epimerize to a significant extent under the conditions used in the β-hydride elimination experiment.



[24] Kulasegaram, S.; Kulawiec, R. J. *Tetrahedron* **1998**, *54*, 1361.

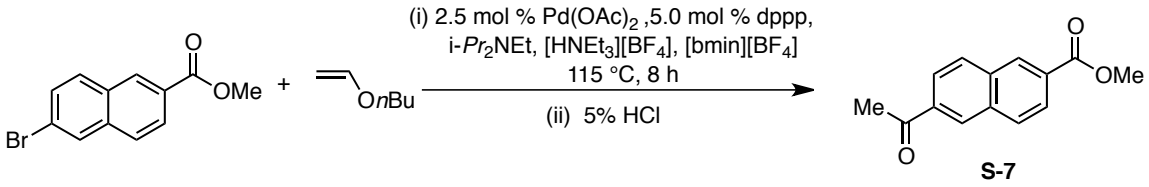


1b, >99% ee **1b** **26**

entry	time (min)	yield of 1b (%)[a]	ee of 1b (%)[b]	yield of 26 (%)[a]
1	15	0	n.d.	>95
2	1.5	19	95	81

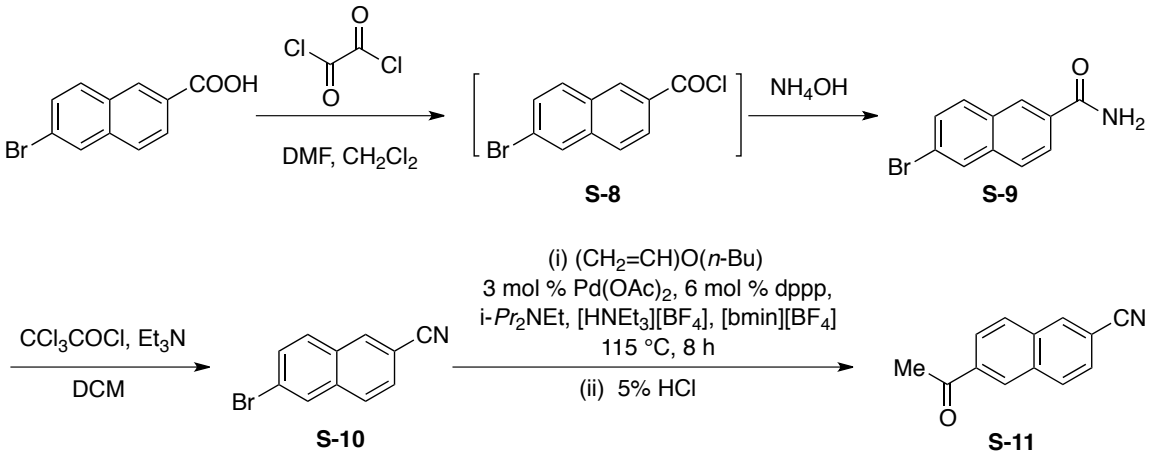
[a] Determined by ^{1}H NMR analysis using 1,3,5-trimethoxybenzene as an internal standard. [b] Determined by chiral HPLC analysis.

Preparation of Ketones S-7 and S-11



Methyl 6-acetyle-2-naphtoate (S-7). The following procedure is adapted from the literature.[25] An oven-dried, two-necked round-bottomed flask was charged with methyl 6-bromo-2-naphthoate (1.25 g, 4.72 mmol, 1.0 equiv), $Pd(OAc)_2$ (26.4 mg, 0.12 mmol, 2.5 mol %), dppp (97.0 mg, 0.24 mmol, 5 mol %), $[HNEt_3][BF_4]$ (1.38 g, 7.06 mmol, 1.5 equiv) and [bmin]][BF_4] (10 mL). The flask was then evacuated and refilled with N_2 three times. 1-(Vinyloxy)butane (1.27 mL, 9.43 mmol, 2.0 equiv) and then *i*-Pr_2NEt (1.3 mL, 7.06 mmol, 1.5 equiv) were added via syringe. The reaction mixture heated at 115 °C. After 8 h, the mixture was cooled to room temperature. Aq. HCl (5%, 15 mL) was added, and the mixture was stirred at room temperature for 0.5 h. CH_2Cl_2 (30 mL) was then added, and the layers were separated. The aqueous layer was then extracted with CH_2Cl_2 (2 x 30 mL). The combined organic layers were washed with H_2O until neutral, dried (Na_2SO_4), filtered, and concentrated. The crude material was purified by silica gel chromatography (12% EtOAc/hexanes) to give compound **S-7** (700.0 mg, 65%) as a white solid (mp 147–150 °C): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.62 (s, 1H), 8.48 (s, 1H), 8.13 (dd, *J* = 8.6, 1.6 Hz, 1H), 8.08 (dd, *J* = 8.6, 1.7 Hz, 1H), 8.01 (dd, *J* = 8.6, 2.5 Hz, 2H), 4.00 (s, 3H), 2.74 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.8, 166.8, 136.3, 134.7, 134.6 130.6, 129.9, 129.8, 129.7, 129.6, 126.2, 124.7, 52.4, 26.8; FTIR (NaCl/thin film) 3058, 2952, 1711, 1608, 1438, 1360, 1338, 1291, 1264, 1180, 1097, 956 cm^{-1}; HRMS (CI+) $[M+H]^+$ calculated for $C_{14}H_{13}O_3$: 229.0865, found: 229.0869.

[25] Mo, J.; Xiao, J.-L. *Angew. Chem. Int. Ed.* **2006**, *45*, 4152.



6-Acetyl 2-naphthonitrile (S-11). In a round-bottomed flask equipped with a nitrogen inlet and an oil bubbler to monitor gas flow, a solution of 6-bromo-2-naphthoic acid (4.0 g, 15.9 mmol, 1.0 equiv), DMF (0.25 mL, 3.18 mmol, 0.2 equiv) and CH_2Cl_2 (40.0 mL) was cooled to 0 °C. Oxalyl chloride (2.05 mL, 23.9 mmol, 1.5 equiv) was then added dropwise via syringe, and the immediate evolution of gas was observed by increased flow through the bubbler. The reaction mixture was stirred at 0 °C until gas flow slowed and was then stirred at room temperature for 1 hour. The resulting solution of acid chloride **S-8** was used in the subsequent step without purification.

After the oil bubbler was removed, the solution of acid chloride **S-8** was cooled to 0 °C. A solution of aq. NH_4OH (25%, 2.15 mL, 55.7 mmol, 3.5 equiv) was added dropwise via syringe. A precipitate immediately formed. The reaction mixture was then stirred at room temperature for 30 min. H_2O (40 mL) was added. The mixture was extracted with EtOAc (60 mL). The organic layer was washed with sat. NaCl (30 mL), dried ($MgSO_4$), filtered, and concentrated to give amide **S-9** (2.5g, 63%) as a white solid: ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.35 – 8.28 (m, 1H), 8.06 (d, J = 1.9 Hz, 1H), 7.89 (d, J = 1.7 Hz, 1H), 7.87 (d, J = 1.8 Hz, 1H), 7.85 – 7.78 (m, 1H), 7.63 (dd, J = 8.7, 2.0 Hz, 1H),

6.20 (s, 1H), 5.72 (s, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.8, 135.9, 131.0, 130.9, 130.6, 130.4, 129.9, 128.1, 127.7, 124.8, 122.3. Amide **S-9** was used in the subsequent step without further purification.

The following procedure is adapted from the literature.[26] A mixture of amide **S-9** (2.5 g, 10 mmol, 1.0 equiv), triethylamine (2.3 mL, 22 mmol, 2.2 equiv) and CH_2Cl_2 (30 mL) was cooled to 0 °C. A solution of trichloroacetyl chloride (2.3 mL, 20 mmol, 2.2 equiv) and CH_2Cl_2 (20 mL) was added, while the bath temperature was maintained between 0–5 °C. After the addition was finished, ice-cooled water (25 mL) was added and the layers were separated. The aqueous layer was extracted with CH_2Cl_2 (10 mL). The combined organic layers were then washed with aq. KOH (5%, 30 mL), and the resulting aqueous layer was extracted with CH_2Cl_2 (10 mL). The combined organic layers were then washed with aq. H_2SO_4 (5%, 30 mL), and the resulting aqueous layer was extracted with CH_2Cl_2 (10 mL). Finally, the combined organic layers were washed with H_2O (30 mL), and the resulting aqueous layer was extracted with CH_2Cl_2 (10 mL). The combined organic layers were dried (Na_2SO_4), filtered, and concentrated. The resulting residue was recrystallized (1:1 Et_2O/hexanes) to give **S-10** (1.81 g, 78%) as orange crystals: ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20 (s, 1H), 8.07 (d, J = 1.2 Hz, 1H), 7.83 (d, J = 8.5 Hz, 1H), 7.77 (d, J = 8.8 Hz, 1H), 7.69 (dd, J = 8.8, 1.9 Hz, 1H), 7.64 (dd, J = 8.5, 1.6 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 135.5, 134.0, 131.3, 130.7, 130.2, 129.9, 128.3, 127.5, 123.6, 118.8, 109.9.

The following procedure is adapted from the literature.[25] An oven-dried, two-necked round-bottomed flask was charged with aryl halide **S-10** (348.0 mg, 1.50 mmol, 1.0 equiv), $Pd(OAc)_2$ (6.7 mg, 0.09 mmol, 3 mol %), dppp (74.2 mg, 0.18 mmol, 6 mol

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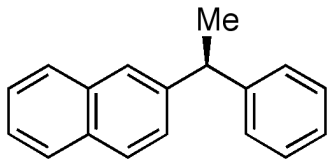
[26]Saednya, A. *Synthesis* **1985**, 184.

%), [$HNEt_3$][BF_4] (439 mg, 2.25 mmol, 1.5 equiv) and [bmin][BF_4] (2.5 mL). The flask was then evacuated and refilled with N_2 three times. 1-(Vinyloxy)butane (0.33 mL, 3.0 mmol, 2.0 equiv) and then *i*-Pr_2NEt (0.37 mL, 2.25 mmol, 1.5 equiv) were added via syringe. The reaction mixture was heated at 115 °C. After 8 h, the mixture was cooled to room temperature. Aq. HCl (5%, 5 mL) was added, and the mixture was stirred at room temperature for 0.5 h. CH_2Cl_2 (20 mL) was added, and the layers were separated. The aqueous layer was extracted with CH_2Cl_2 (2 x 20 mL). The combined organic layers were washed with H_2O until neutral, dried (Na_2SO_4), filtered, and concentrated. The crude material was purified by silica gel chromatography (20% Et_2O/hexanes) to give compound **S-11** (235.0 mg, 40%) as a yellow solid (mp 134–136 °C): ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.49 (s, 1H), 8.27 (s, 1H), 8.15 (dd, *J* = 8.6, 1.6 Hz, 1H), 8.07 (d, *J* = 8.5 Hz, 1H), 7.98 (d, *J* = 8.6 Hz, 1H), 7.69 (dd, *J* = 8.4, 1.5 Hz, 1H), 2.75 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.4, 136.9, 134.3, 134.0, 133.8, 130.7, 129.7, 129.0, 127.3, 125.8, 118.7, 111.9, 26.8; FTIR (NaCl/thin film) 3057, 2225, 1686, 1476, 1374, 1368, 1273, 1238, 1189, 902 cm^{-1}; HRMS (CI+) [M+H]+ calculated for $C_{13}H_{10}NO$: 196.0762, found: 196.0762.

compound 2 1HNMR

7.850 7.847 7.837 7.832 7.828 7.818 7.814 7.789 7.768 7.745 7.743 7.516 7.513 7.499 7.495 7.481 7.476 7.462 7.458 7.363 7.358 7.354 7.352 7.341 7.337 7.333 7.322 7.314 7.308 7.301 7.291 7.284 7.254 7.250 7.244 7.236 7.233 7.216 4.367 4.349 1.786 1.768



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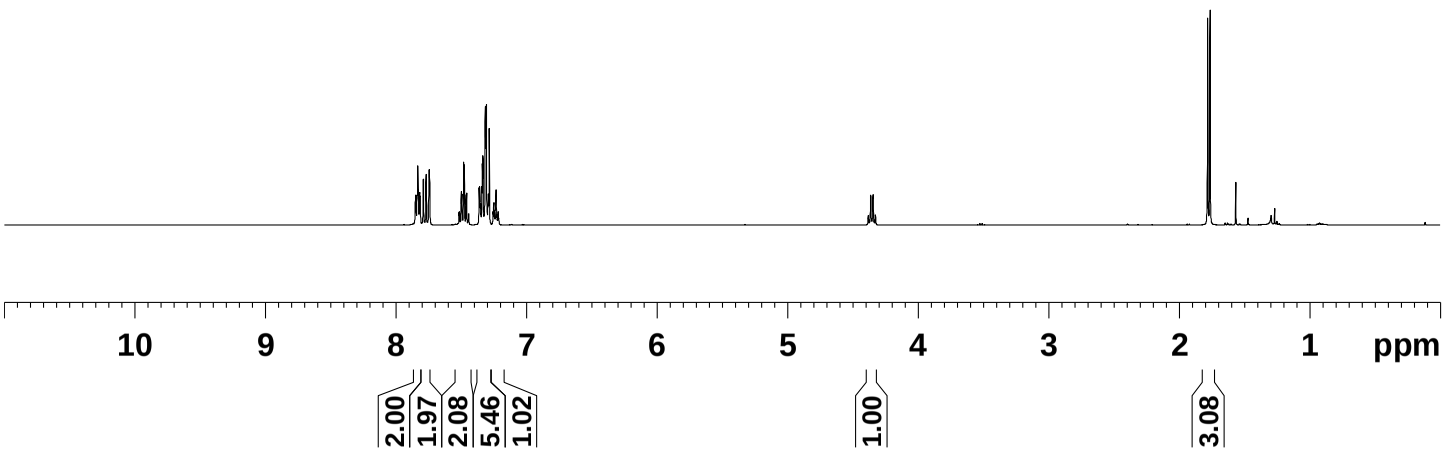


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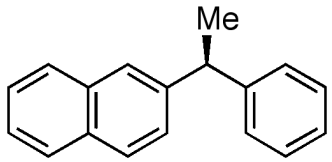

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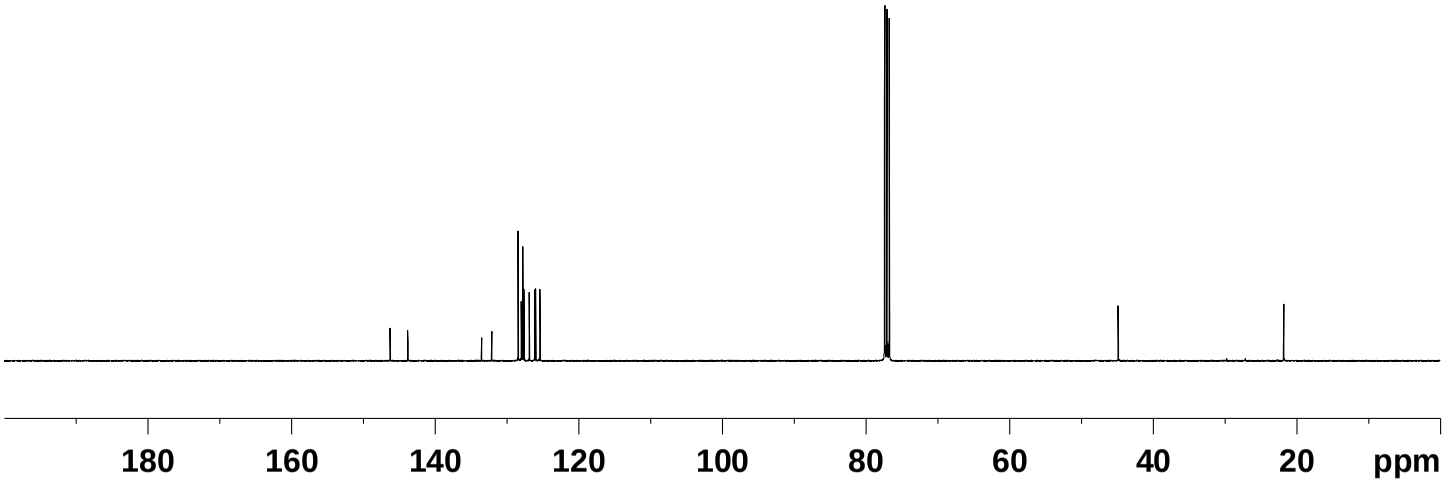


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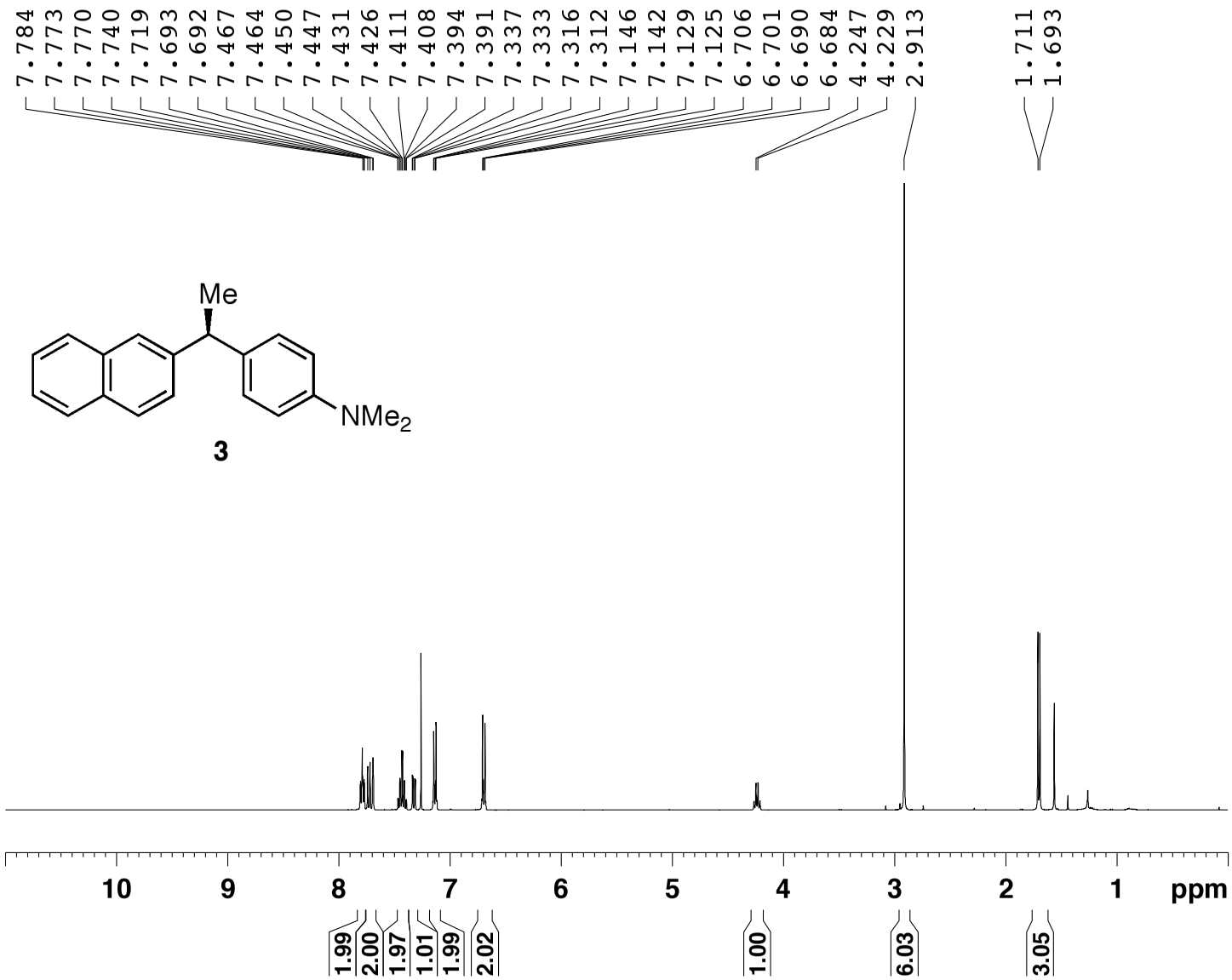


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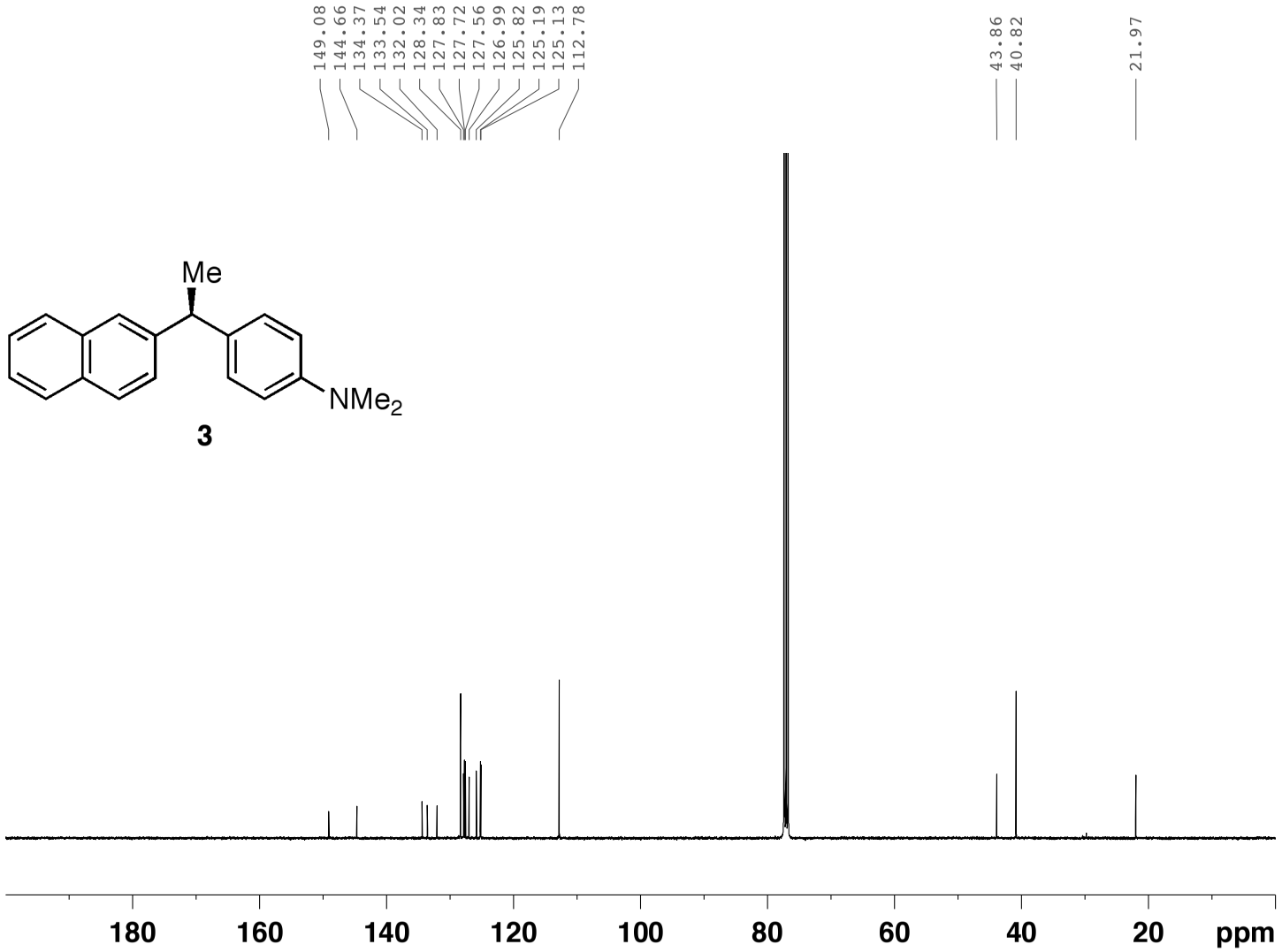


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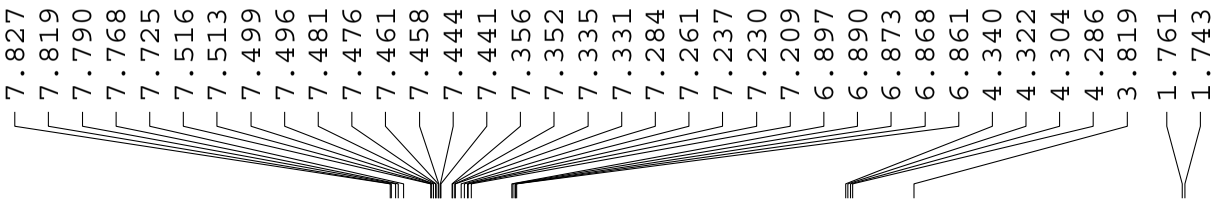

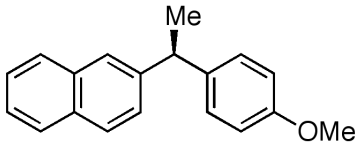

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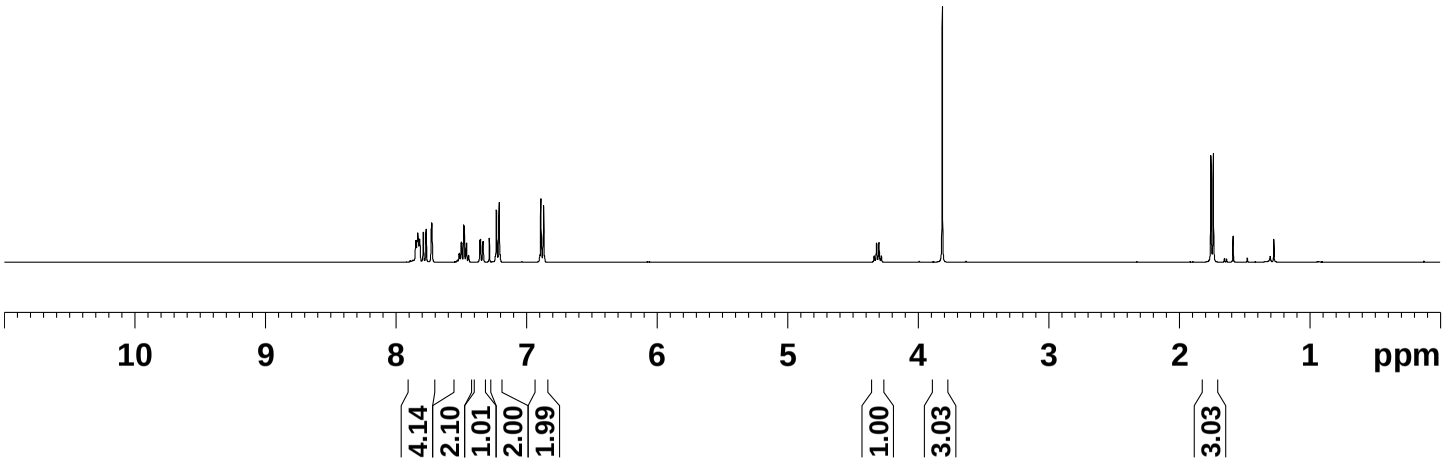

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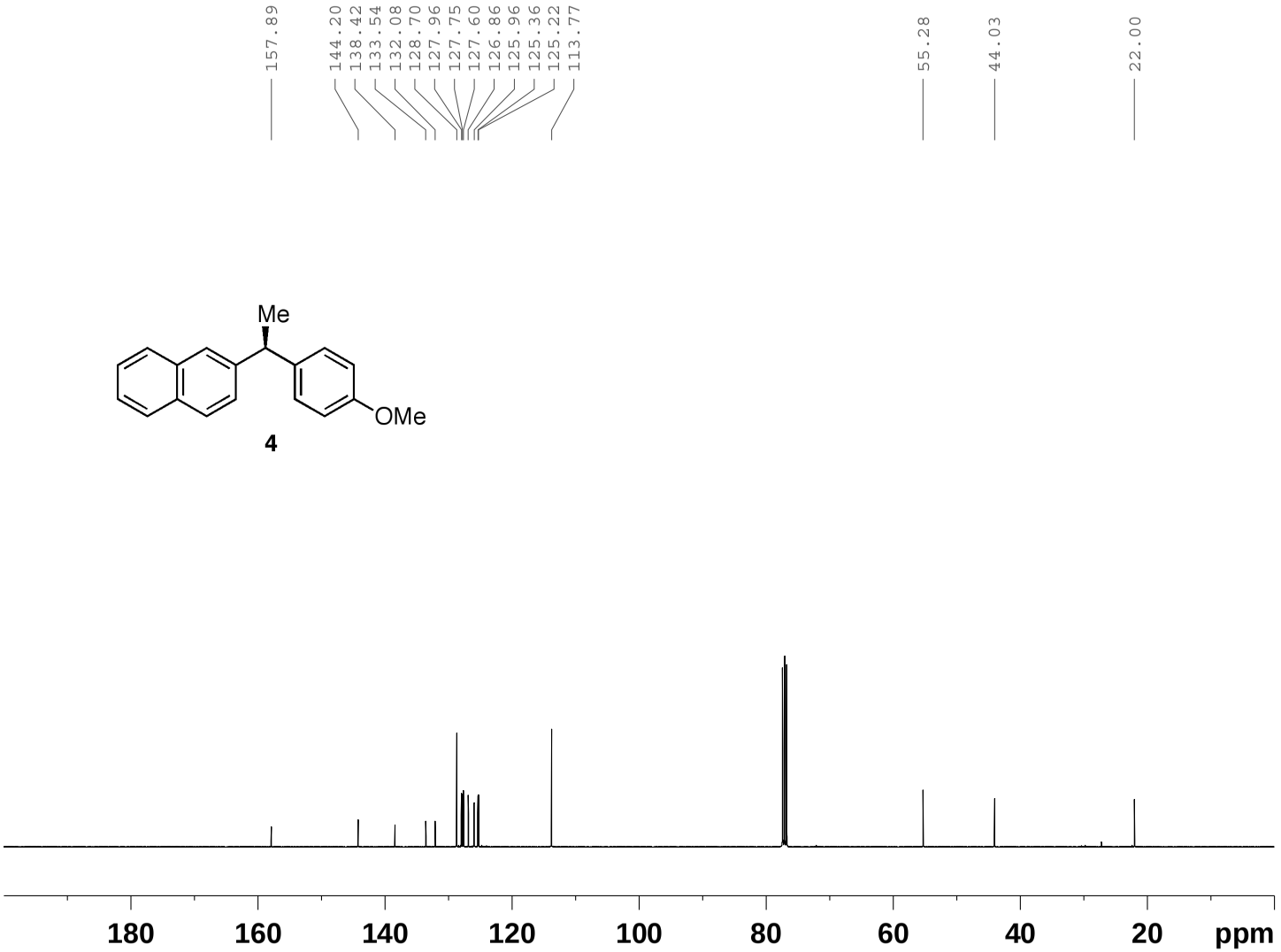
Date_ 20121115
Time 16.26
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 9
DW 60.400 usec
DE 6.00 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 4.90 dB
PL1W 3.30822015 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

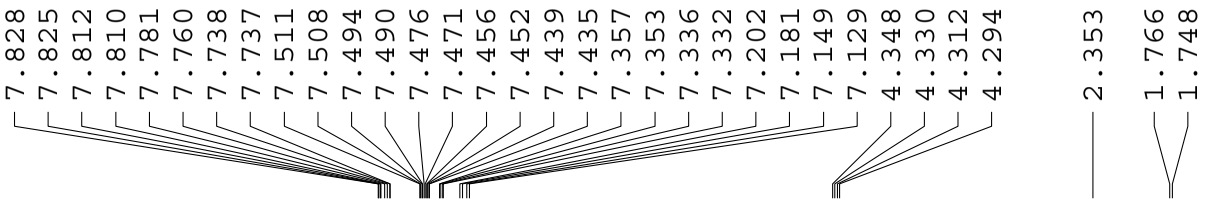
Compound 4 13CNMR

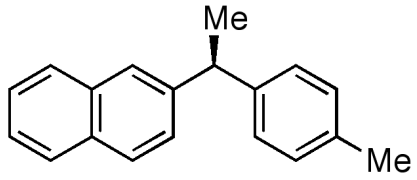


BRUKER

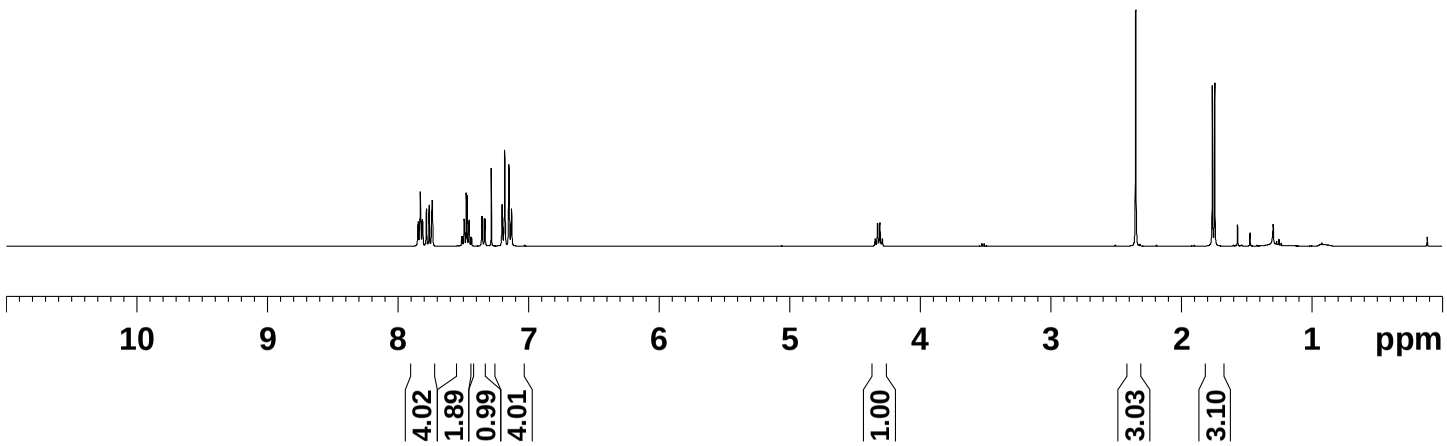

```
Current Data Parameters
NAME          HH-4-049A
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121115
Time              23.19
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ             1.3664756 sec
RG                  512
DW               20.850 usec
DE               18.00 usec
TE               298.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                9.25 usec
PL1               0.55 dB
PL1W        35.18820572 W
SFO1       100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                1H
PCPD2            90.00 usec
PL2               4.90 dB
PL12              20.46 dB
PL13              21.00 dB
PL2W         3.30822015 W
PL12W        0.09195905 W
PL13W        0.08120718 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127690 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 5 1HNMR



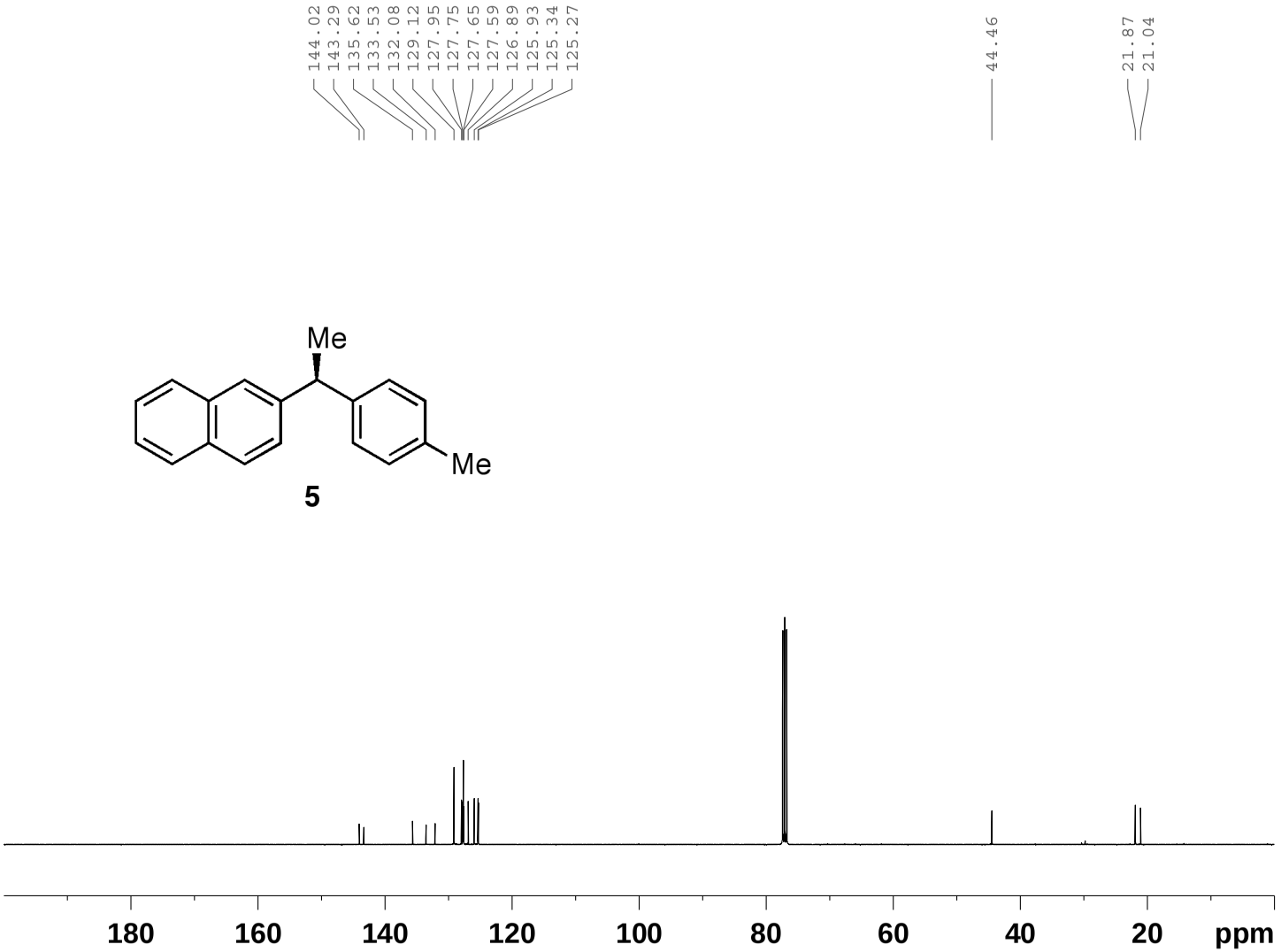


5




```
Current Data Parameters
NAME            HH-4-047A
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20121104
Time                20.43
INSTRUM             spect
PROBHD   5 mm CPQNP 1H/
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH              8278.146 Hz
FIDRES           0.126314 Hz
AQ               3.9584243 sec
RG                   11.3
DW                 60.400 usec
DE                  6.00 usec
TE                 298.2 K
D1              1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  15.00 usec
PL1                  4.90 dB
PL1W          3.30822015 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                  32768
SF           400.1300000 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

Compound 5 13CNMR



Current Data Parameters
NAME HH-4-047A
EXPNO 2
PROCNO 1

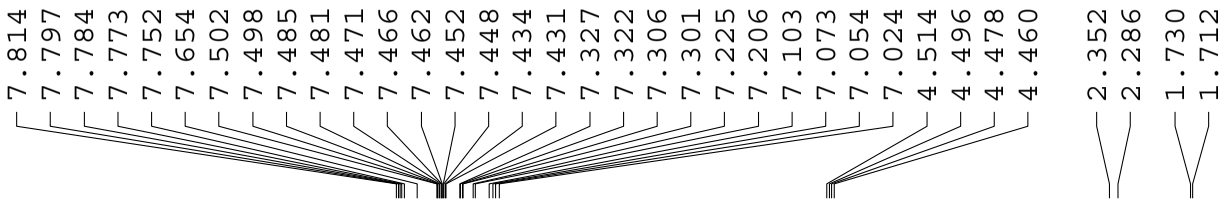
F2 - Acquisition Parameters
Date_ 20121104
Time 20.59
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

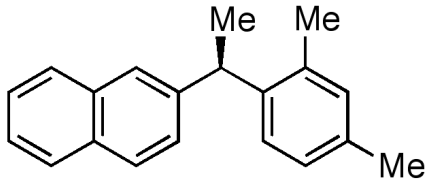
======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

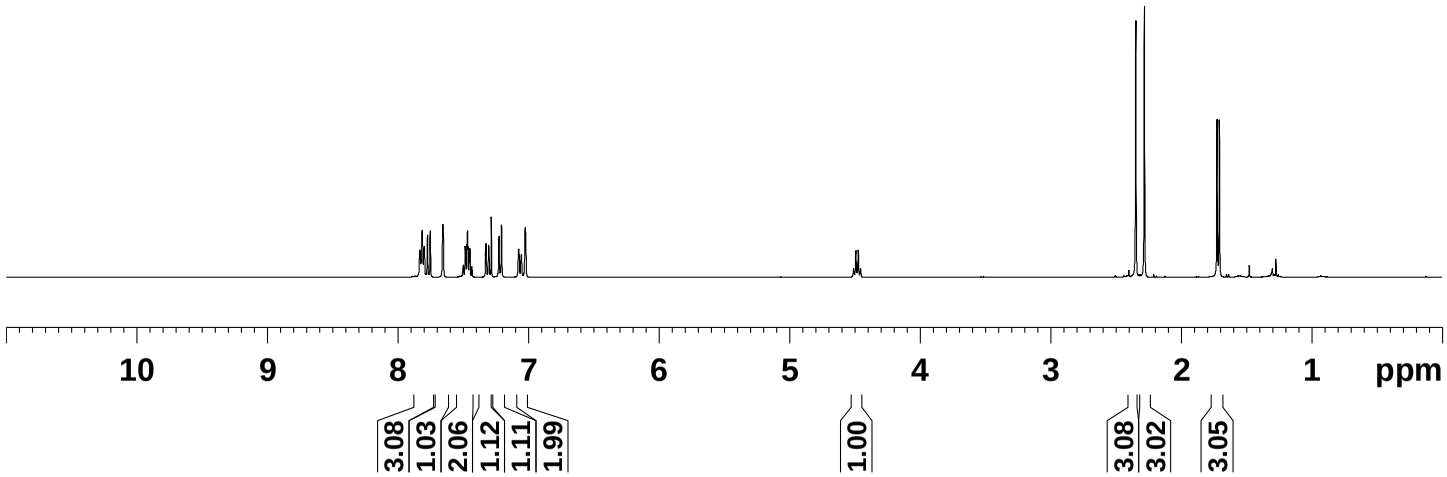
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 6 1HNMR



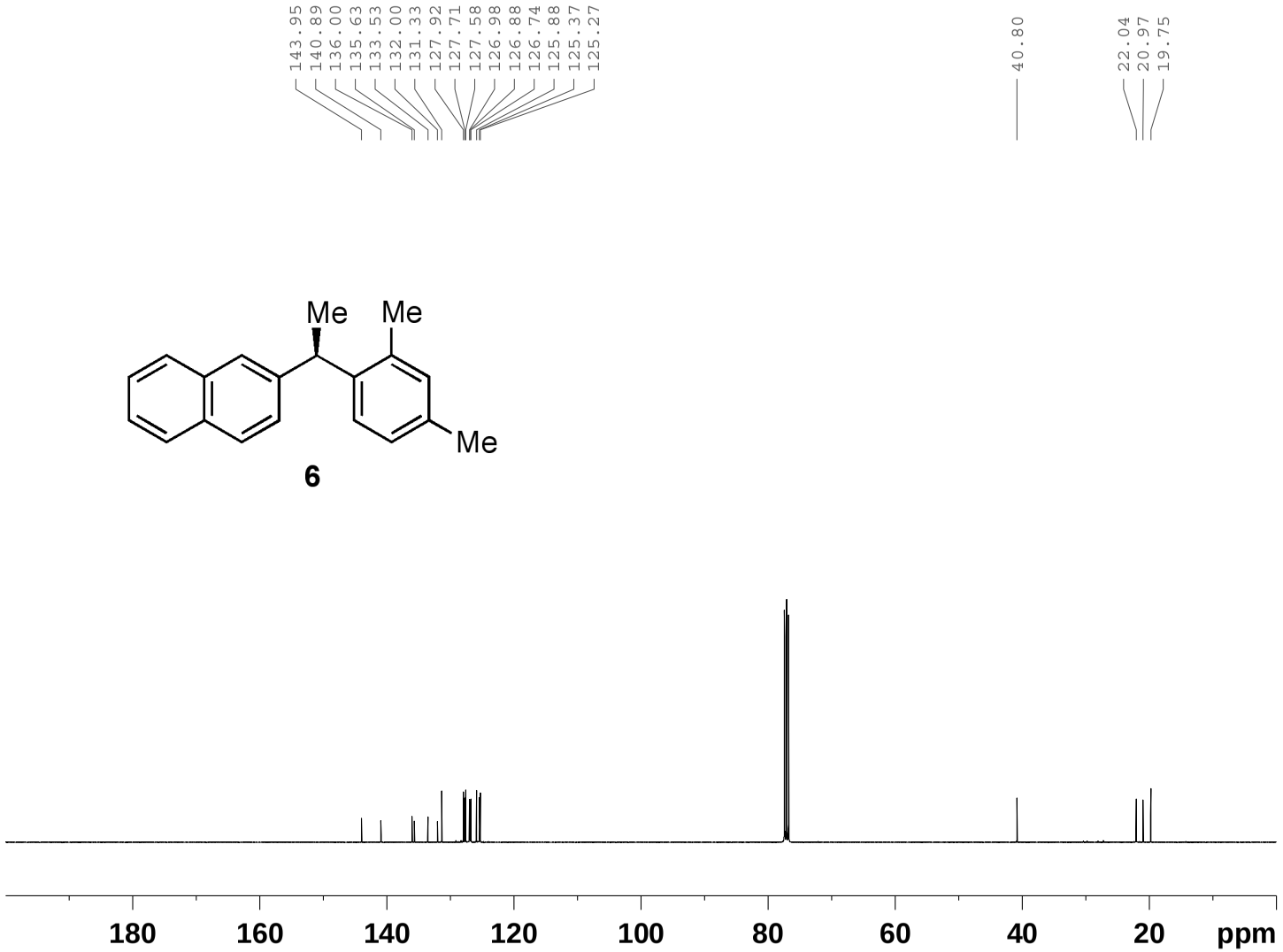


6



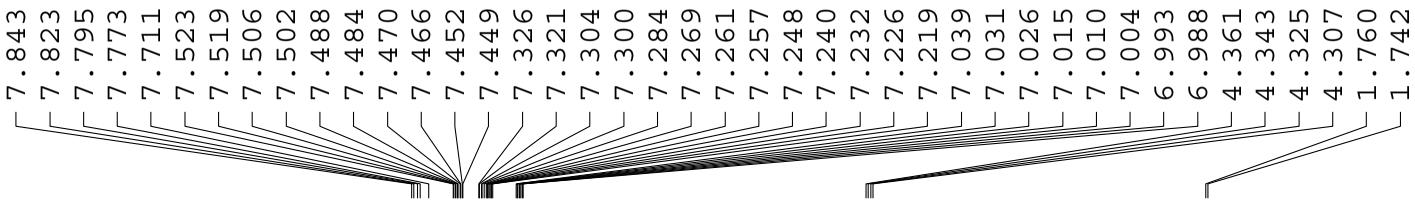

```
Current Data Parameters
NAME                  QZ-3-060A
EXPNO                         1
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20121104
Time                      21.27
INSTRUM                   spect
PROBHD    5 mm CPQNP 1H/
PULPROG                    zg30
TD                        65536
SOLVENT                   CDCl3
NS                           16
DS                            2
SWH                    8278.146 Hz
FIDRES                 0.126314 Hz
AQ                     3.9584243 sec
RG                           11.3
DW                        60.400 usec
DE                         6.00 usec
TE                        298.2 K
D1                     1.00000000 sec
TD0                           1

======== CHANNEL f1 ========
NUC1                         1H
P1                        15.00 usec
PL1                        4.90 dB
PL1W                  3.30822015 W
SFO1                400.1324710 MHz

F2 - Processing parameters
SI                        32768
SF                  400.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

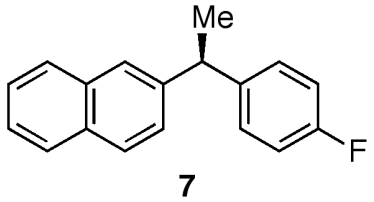
Compound 6 13CNMR



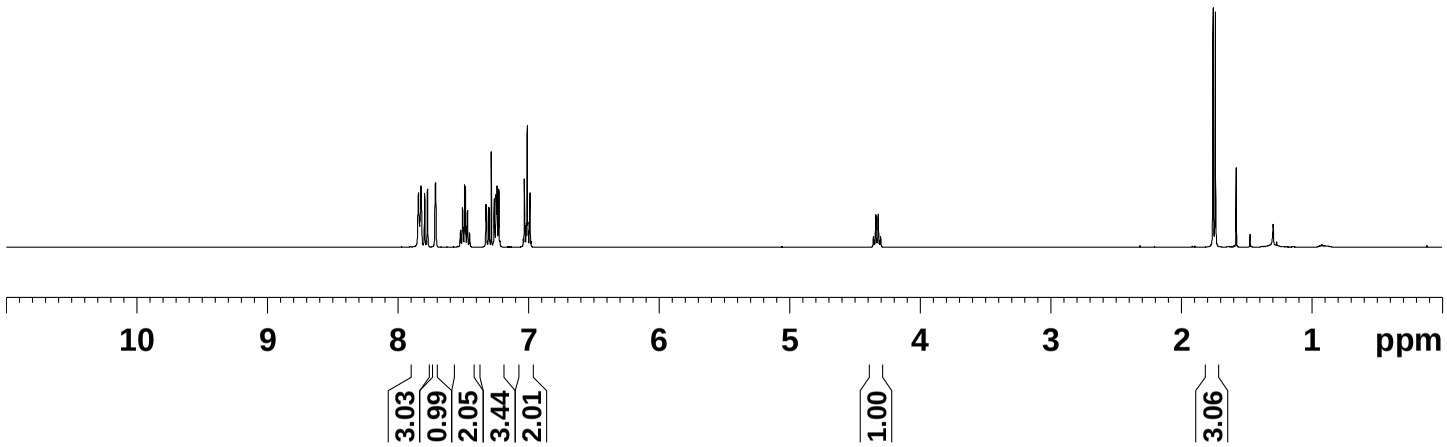

```
Current Data Parameters
NAME          QZ-3-060A
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121104
Time              21.43
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ            1.3664756 sec
RG                  512
DW               20.850 usec
DE               18.00 usec
TE               298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                9.25 usec
PL1               0.55 dB
PL1W       35.18820572 W
SFO1       100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                1H
PCPD2            90.00 usec
PL2               4.90 dB
PL12              20.46 dB
PL13              21.00 dB
PL2W        3.30822015 W
PL12W       0.09195905 W
PL13W       0.08120718 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127690 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 7 1HNMR



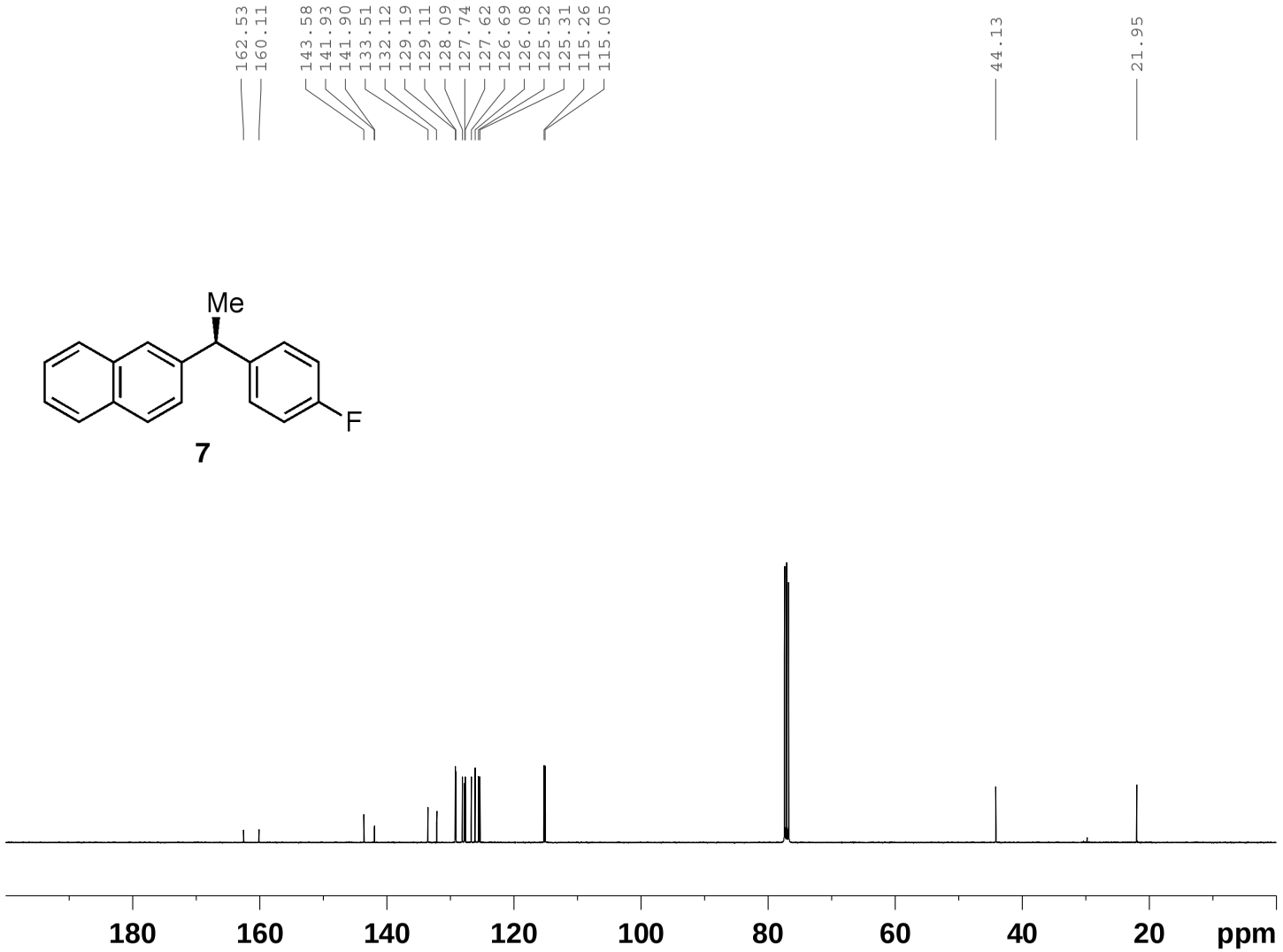


7




```
Current Data Parameters
NAME                 HH-4-69 A
EXPNO                        1
PROCNO                       1

F2 - Acquisition Parameters
Date_               20121117
Time                    5.15
INSTRUM                spect
PROBHD    5 mm CPQNP 1H/
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                 8278.146 Hz
FIDRES              0.126314 Hz
AQ                  3.9584243 sec
RG                       11.3
DW                     60.400 usec
DE                      6.00 usec
TE                     298.1 K
D1                1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                        1H
P1                      15.00 usec
PL1                      4.90 dB
PL1W               3.30822015 W
SFO1             400.1324710 MHz

F2 - Processing parameters
SI                       32768
SF               400.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

Compound 7 13CNMR



Current Data Parameters

NAME	HH-4-69 A
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121117
Time	5.32
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.2 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

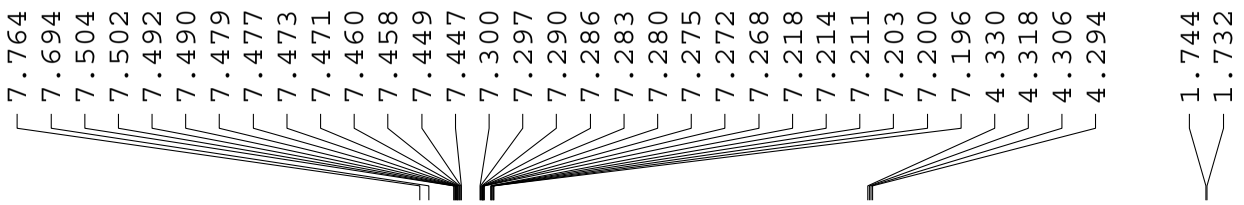
======== CHANNEL f2 ========

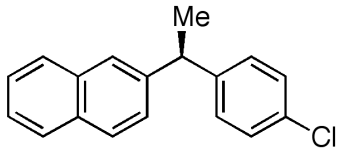
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

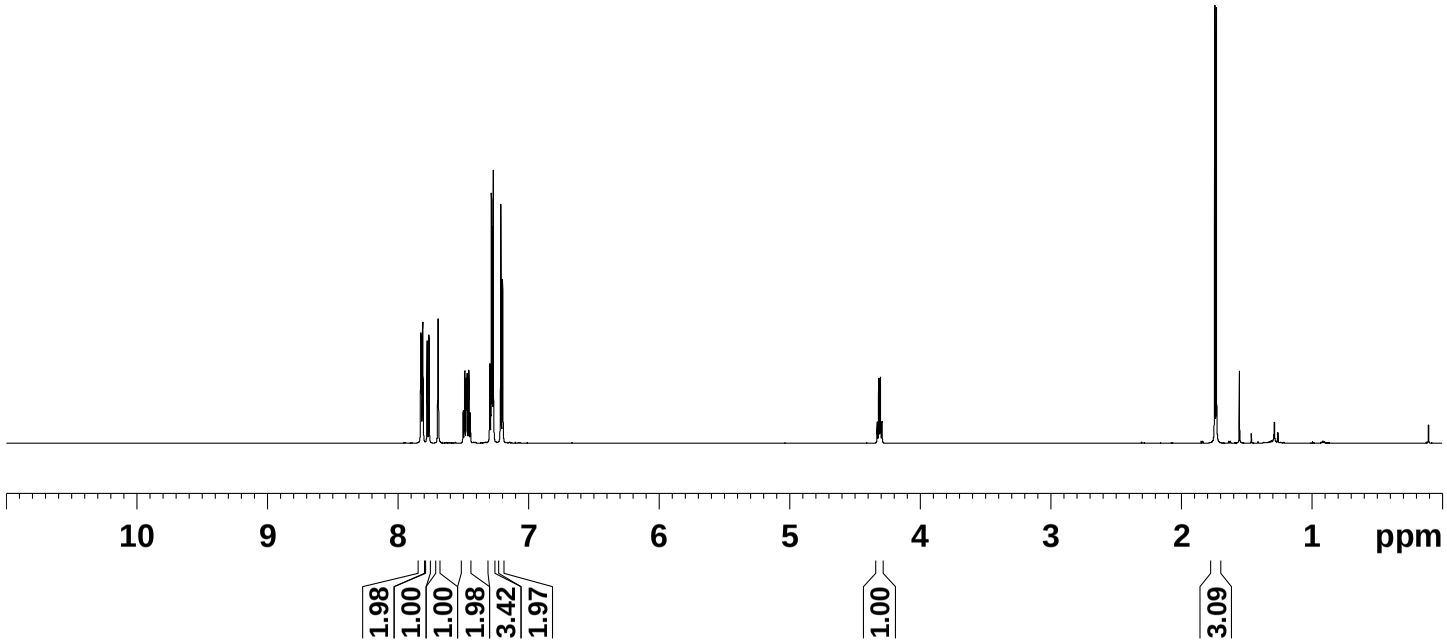
SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 8 1HNMR



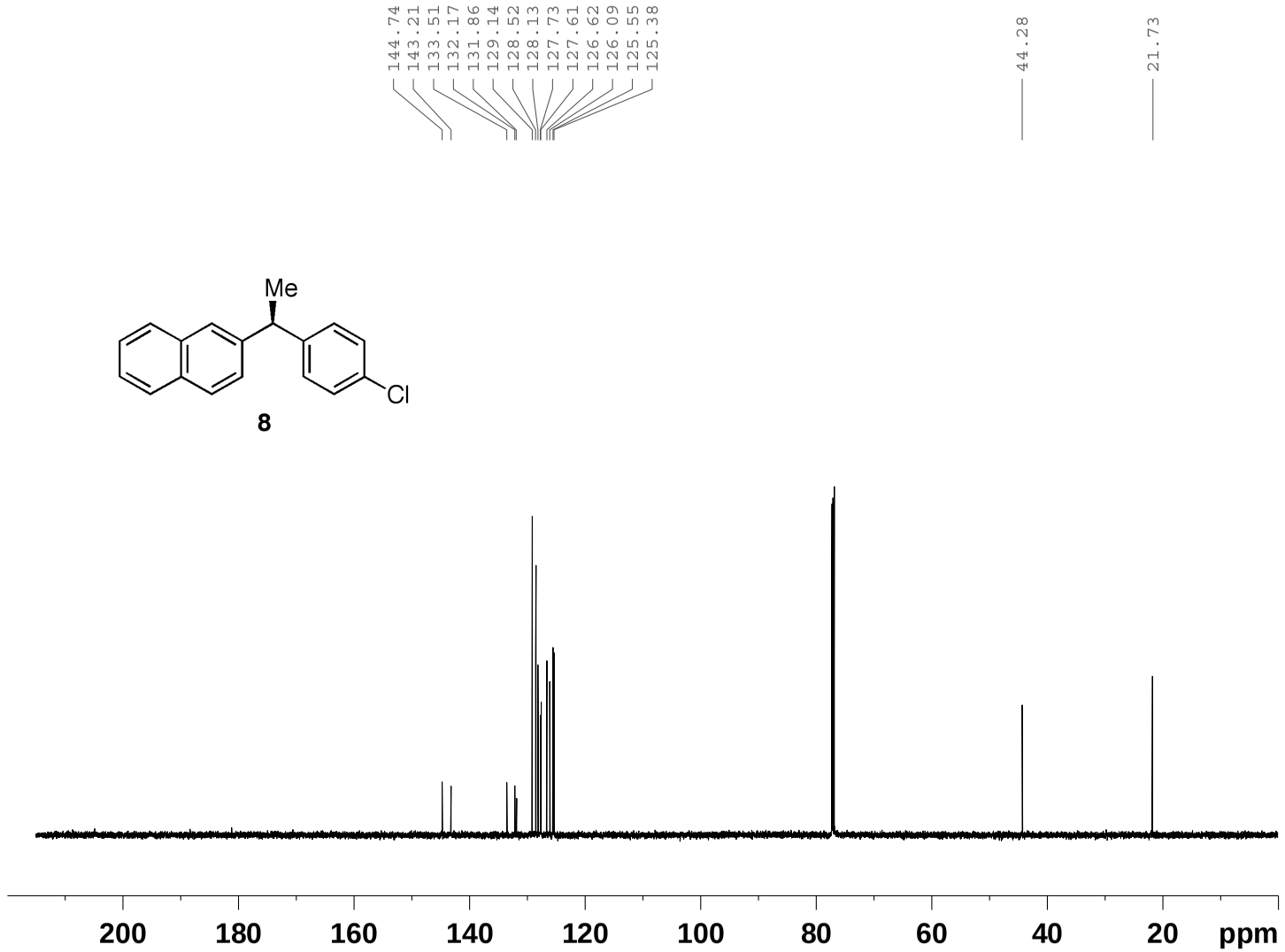


8



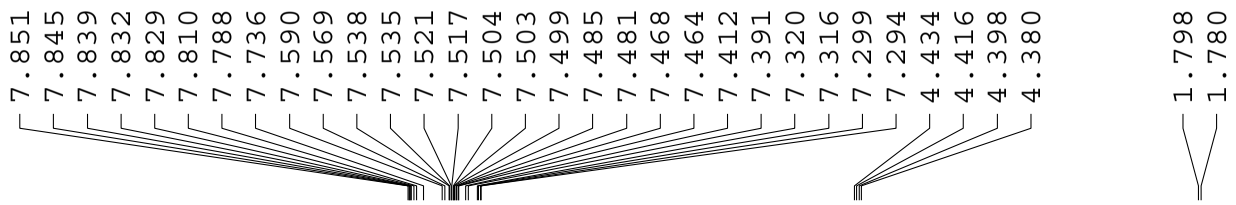

```
Current Data Parameters
NAME       QZ-Compound 8
EXPNO                 1
PROCNO                1

F2 - Acquisition Parameters
Date_          20121209
Time               13.13
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   144
DW                59.500 usec
DE                17.39 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                 10.77 usec

F2 - Processing parameters
SI                 65536
SF          600.3200047 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

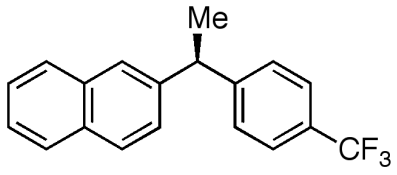
Compound 8 13CNMR



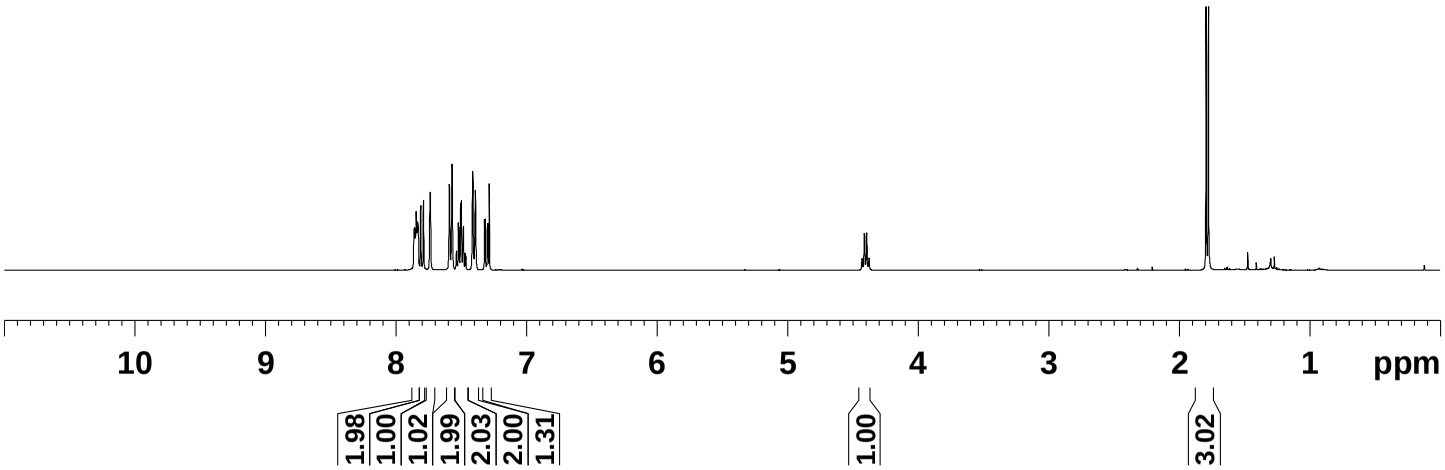

```
Current Data Parameters
NAME       QZ-Compound 8
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121209
Time              13.23
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg55
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE               19.34 usec
TE               298.1 K
D1            1.10000002 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1               13C
P1               10.63 usec

F2 - Processing parameters
SI                32768
SF          150.9505840 MHz
WDW                EM
SSB                 0
LB               1.00 Hz
GB                  0
PC               1.40
```

Compound 9 1HNMR



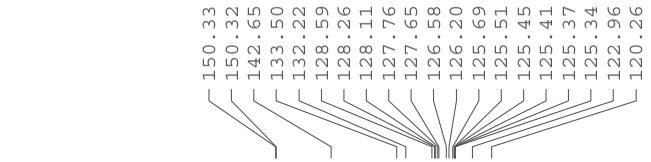


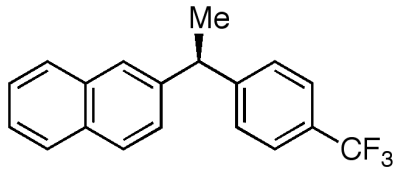
9



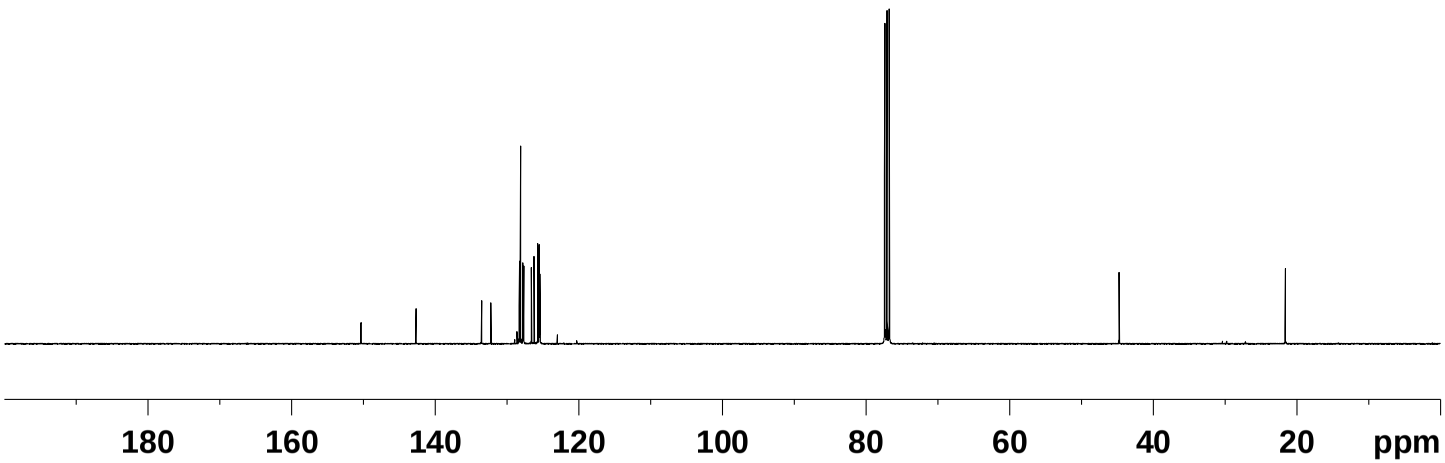

```
Current Data Parameters
NAME                  QZ-3-061A
EXPNO                         1
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20121104
Time                      22.11
INSTRUM                   spect
PROBHD    5 mm CPQNP 1H/
PULPROG                    zg30
TD                        65536
SOLVENT                   CDCl3
NS                           16
DS                            2
SWH                    8278.146 Hz
FIDRES                 0.126314 Hz
AQ                     3.9584243 sec
RG                           11.3
DW                        60.400 usec
DE                         6.00 usec
TE                        298.2 K
D1                    1.00000000 sec
TD0                           1

======== CHANNEL f1 ========
NUC1                         1H
P1                        15.00 usec
PL1                        4.90 dB
PL1W                  3.30822015 W
SFO1                400.1324710 MHz

F2 - Processing parameters
SI                        32768
SF                  400.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

Compound 9 13CNMR



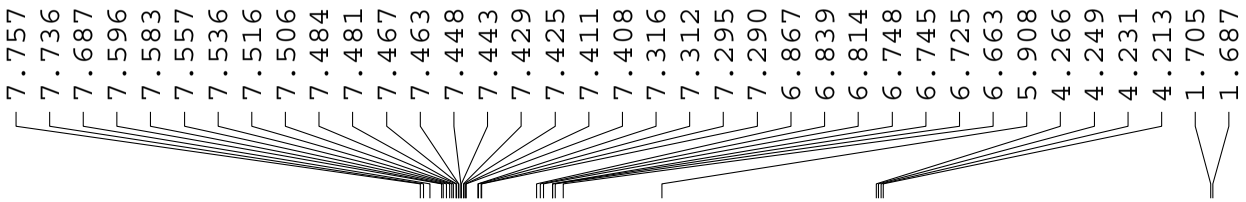


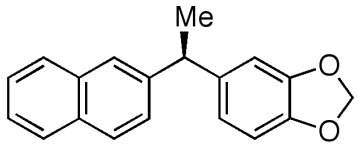
9



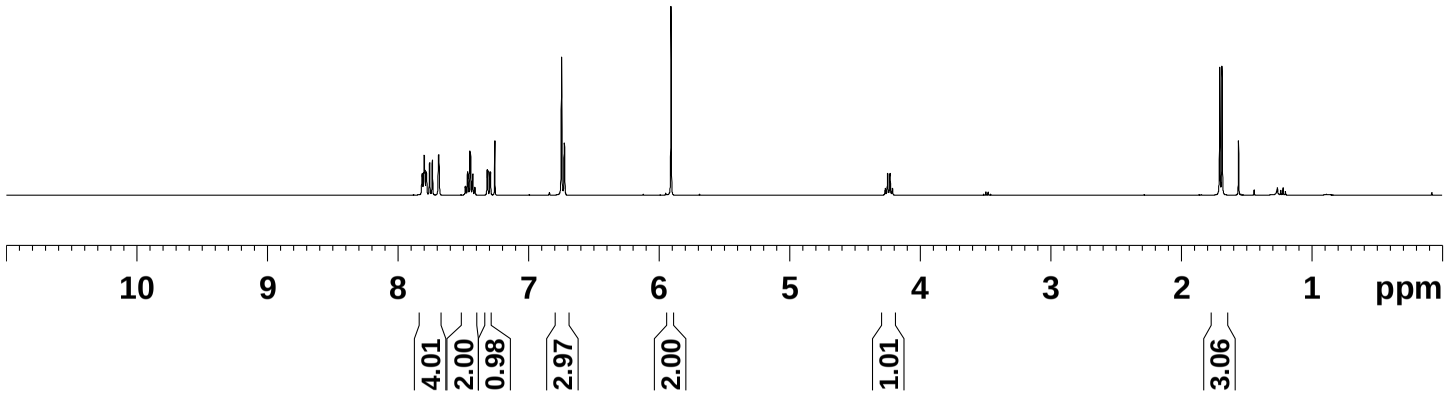

```
Current Data Parameters
NAME          QZ-3-061A
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121104
Time              22.27
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ            1.3664756 sec
RG                  512
DW               20.850 usec
DE               18.00 usec
TE               298.1 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                 9.25 usec
PL1                0.55 dB
PL1W       35.18820572 W
SFO1       100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PL2                4.90 dB
PL12              20.46 dB
PL13              21.00 dB
PL2W        3.30822015 W
PL12W       0.09195905 W
PL13W       0.08120718 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127690 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 10 1HNMR



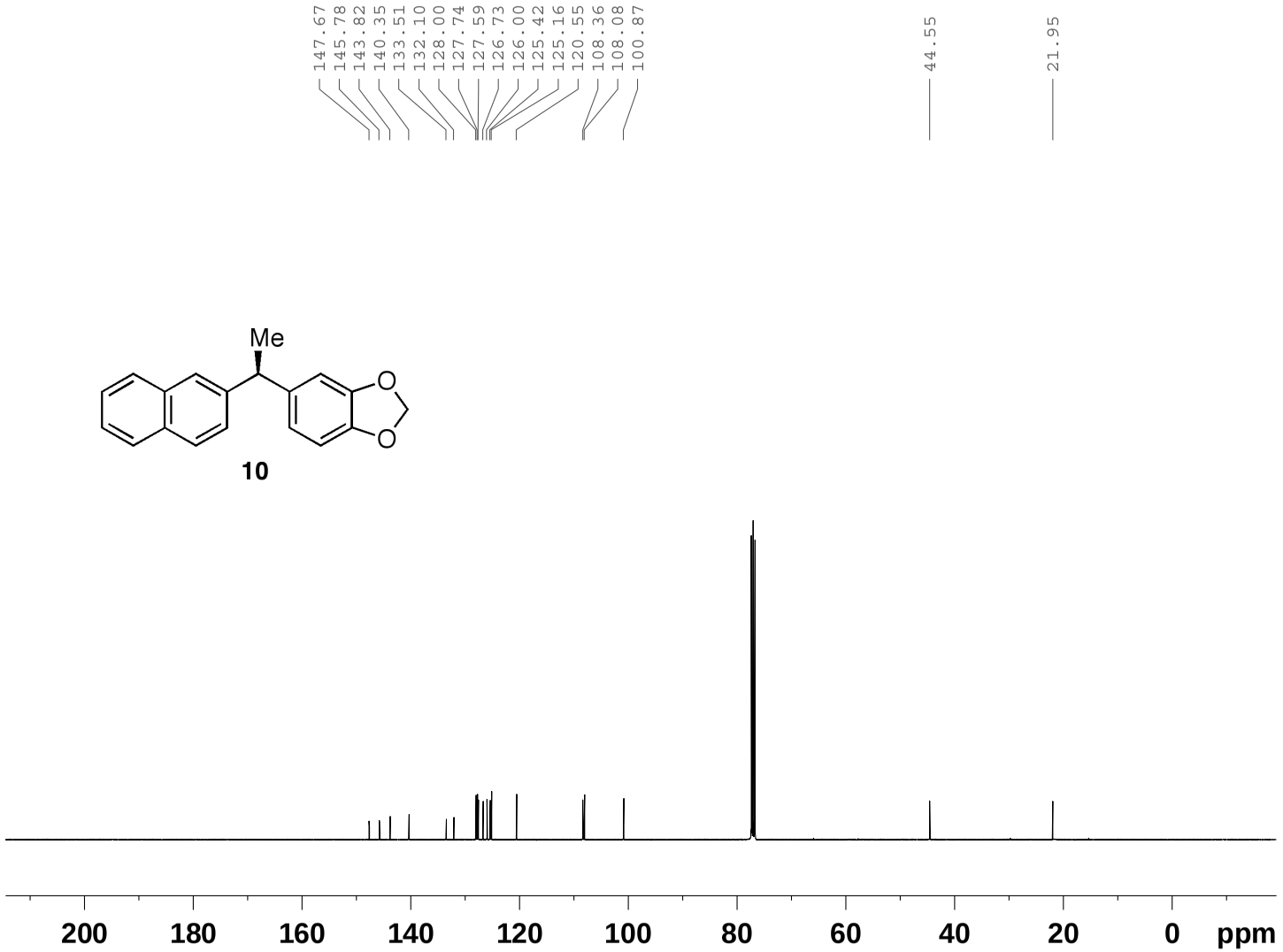


10




```
Current Data Parameters
NAME         SDG-2-177B1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121118
Time               9.13
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            8278.146 Hz
FIDRES         0.126314 Hz
AQ             3.9584243 sec
RG                 12.7
DW                60.400 usec
DE                 6.00 usec
TE                298.2 K
D1             1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1                4.90 dB
PL1W          3.30822015 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                32768
SF           400.1300105 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

Compound 10 13CNMR



Current Data Parameters
NAME SDG-2-177B1
EXPNO 2
PROCNO 1

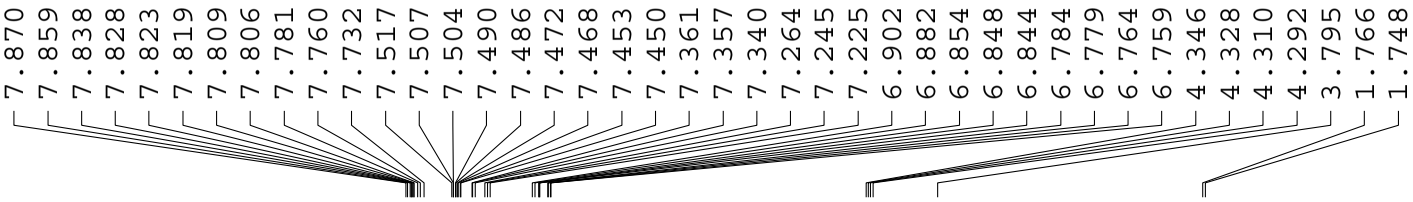
F2 - Acquisition Parameters
Date_ 20121118
Time 9.29
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

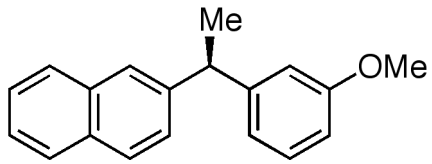
======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

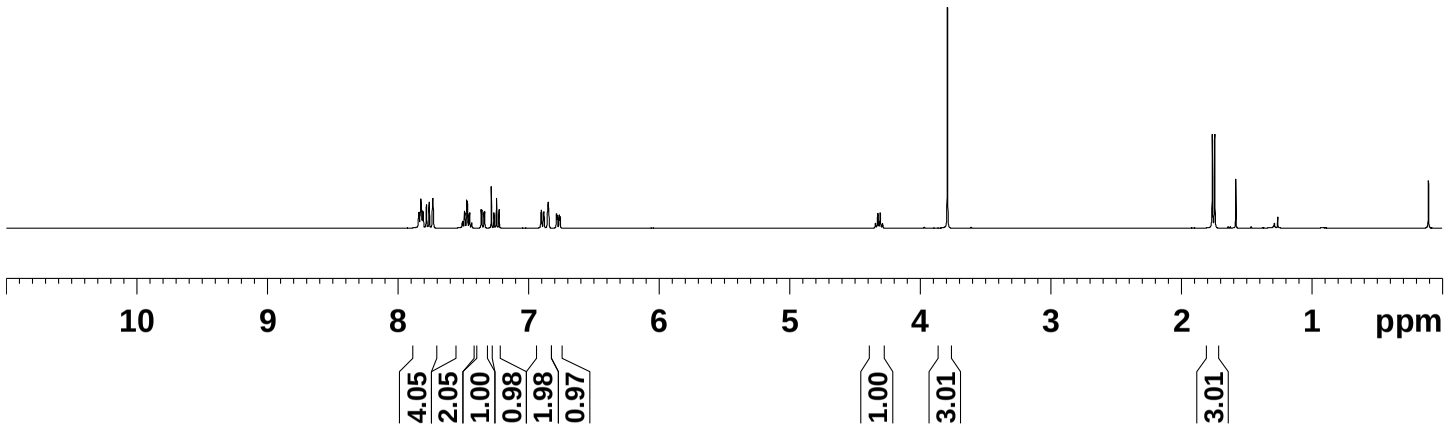
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 11 1HNMR



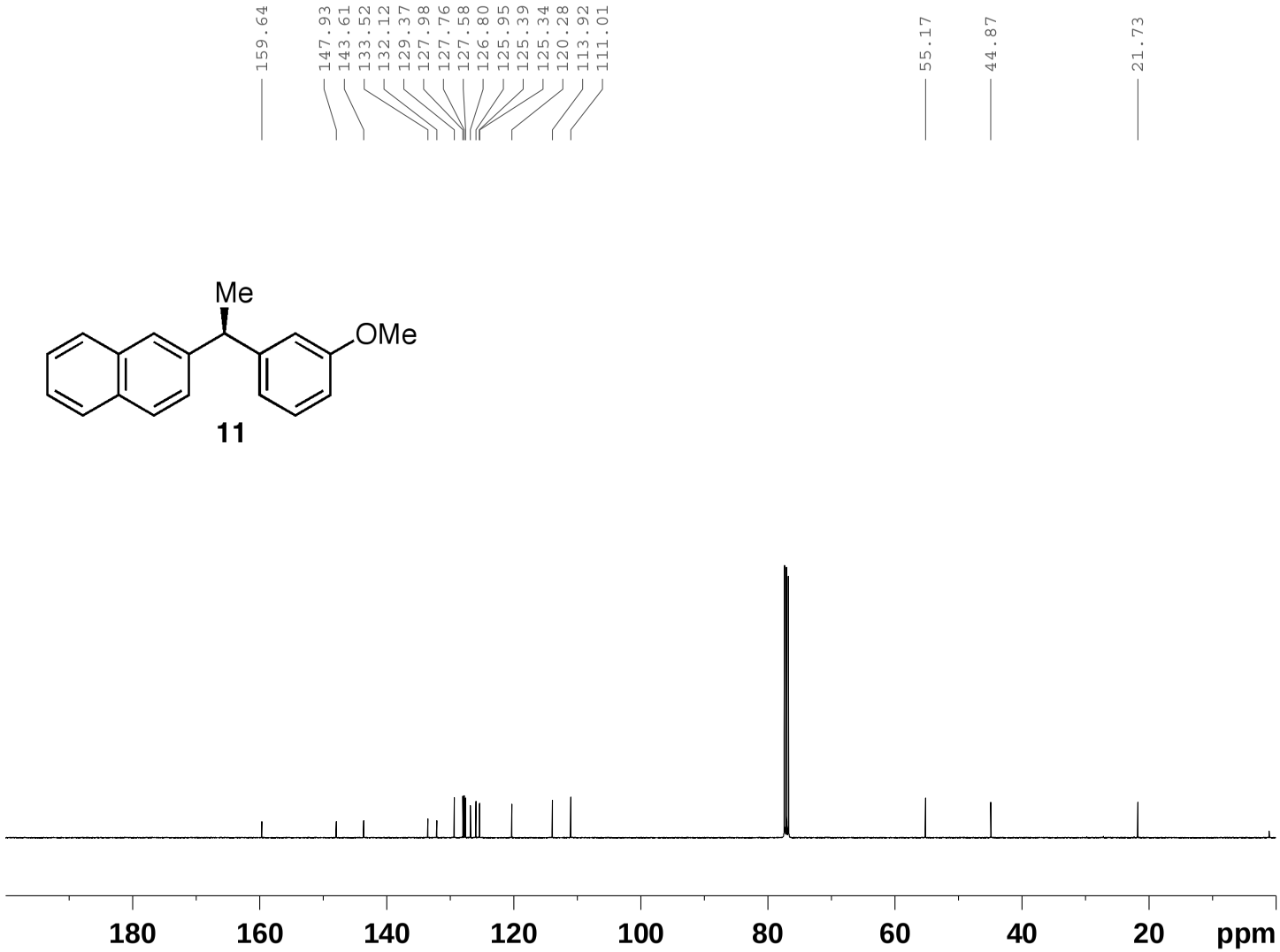


11



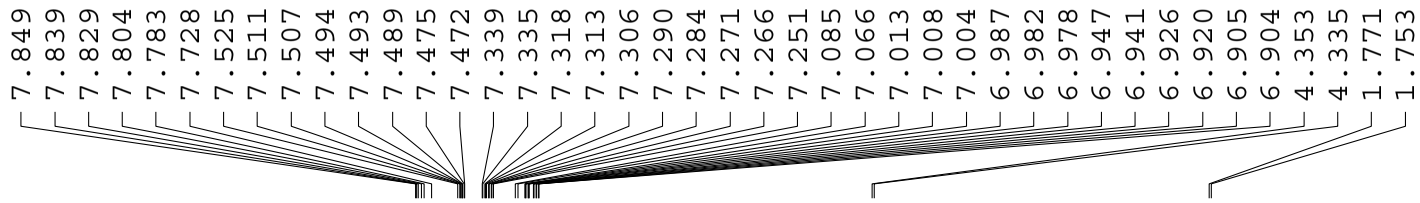

```
Current Data Parameters
NAME                  HH-4-050A
EXPNO                         1
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20121115
Time                      16.38
INSTRUM                   spect
PROBHD    5 mm CPQNP 1H/
PULPROG                    zg30
TD                        65536
SOLVENT                   CDCl3
NS                           16
DS                            2
SWH                    8278.146 Hz
FIDRES                 0.126314 Hz
AQ                     3.9584243 sec
RG                            9
DW                        60.400 usec
DE                         6.00 usec
TE                        298.1 K
D1                     1.00000000 sec
TD0                           1

======== CHANNEL f1 ========
NUC1                         1H
P1                        15.00 usec
PL1                        4.90 dB
PL1W                  3.30822015 W
SFO1                400.1324710 MHz

F2 - Processing parameters
SI                        32768
SF                  400.1300000 MHz
WDW                          EM
SSB                           0
LB                         0.30 Hz
GB                            0
PC                         1.00
```

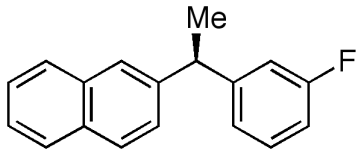
Compound 11 13CNMR



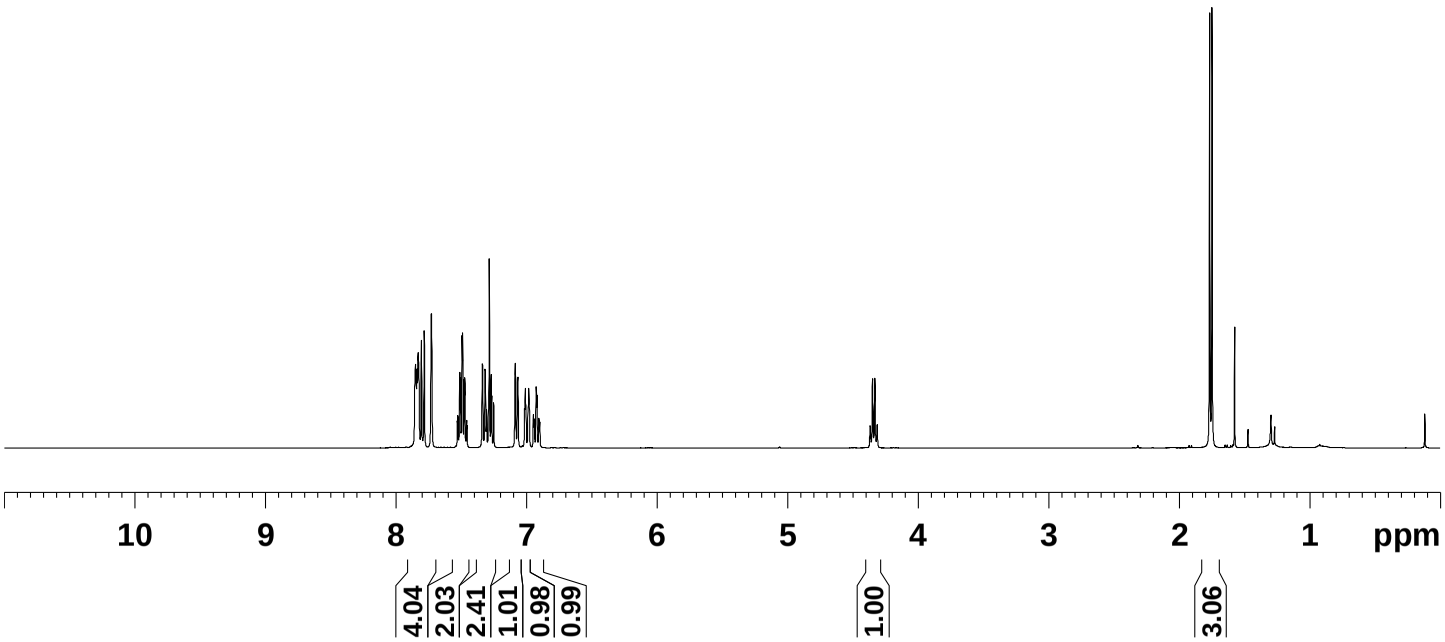

```
Current Data Parameters
NAME          HH-4-050A
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121115
Time              23.39
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ             1.3664756 sec
RG                  512
DW               20.850 usec
DE               18.00 usec
TE               298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                9.25 usec
PL1               0.55 dB
PL1W        35.18820572 W
SFO1       100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                1H
PCPD2            90.00 usec
PL2               4.90 dB
PL12             20.46 dB
PL13             21.00 dB
PL2W         3.30822015 W
PL12W        0.09195905 W
PL13W        0.08120718 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127690 MHz
WDW                EM
SSB                 0
LB               1.00 Hz
GB                  0
PC               1.40
```

Compound 12 1HNMR



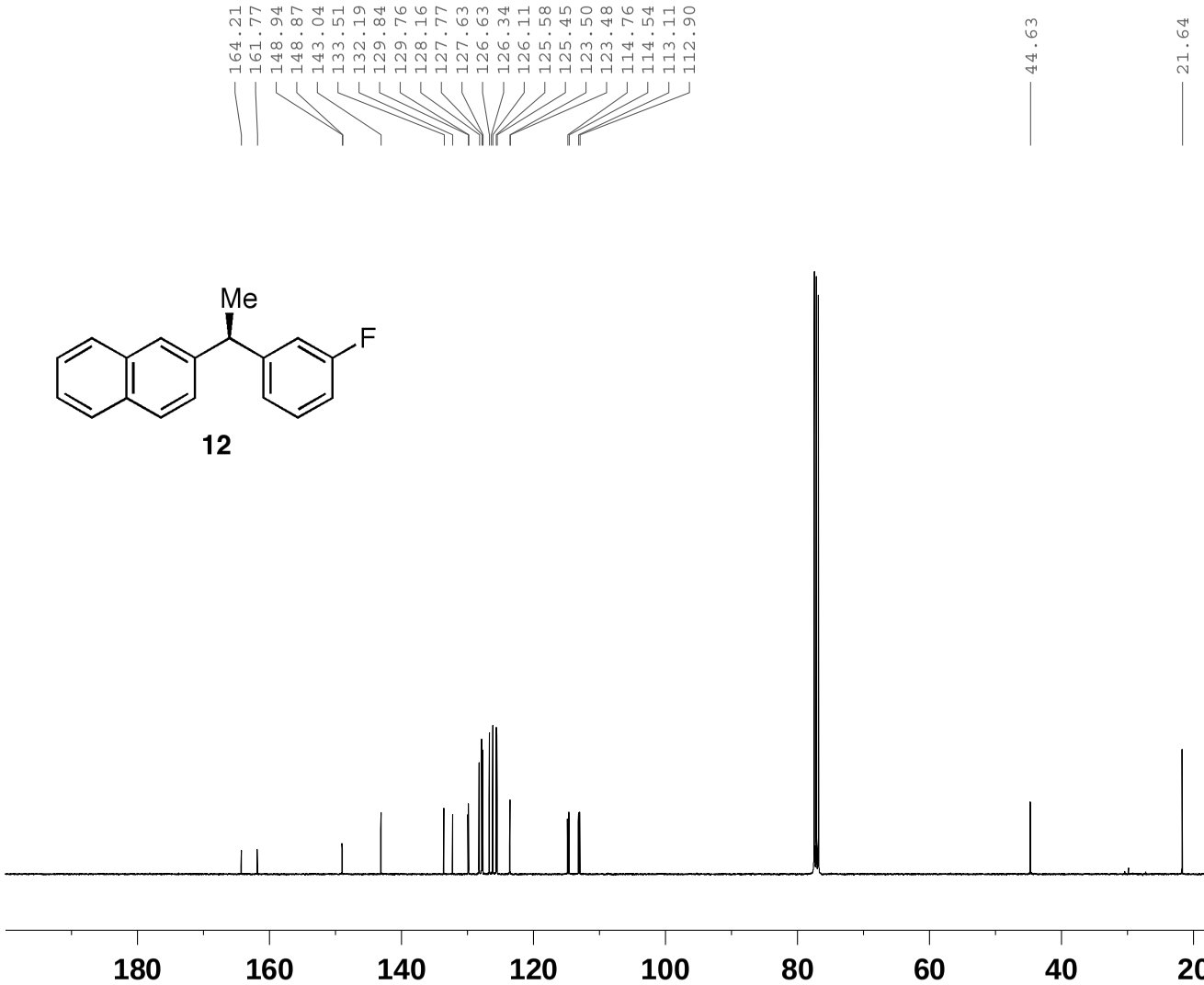


12



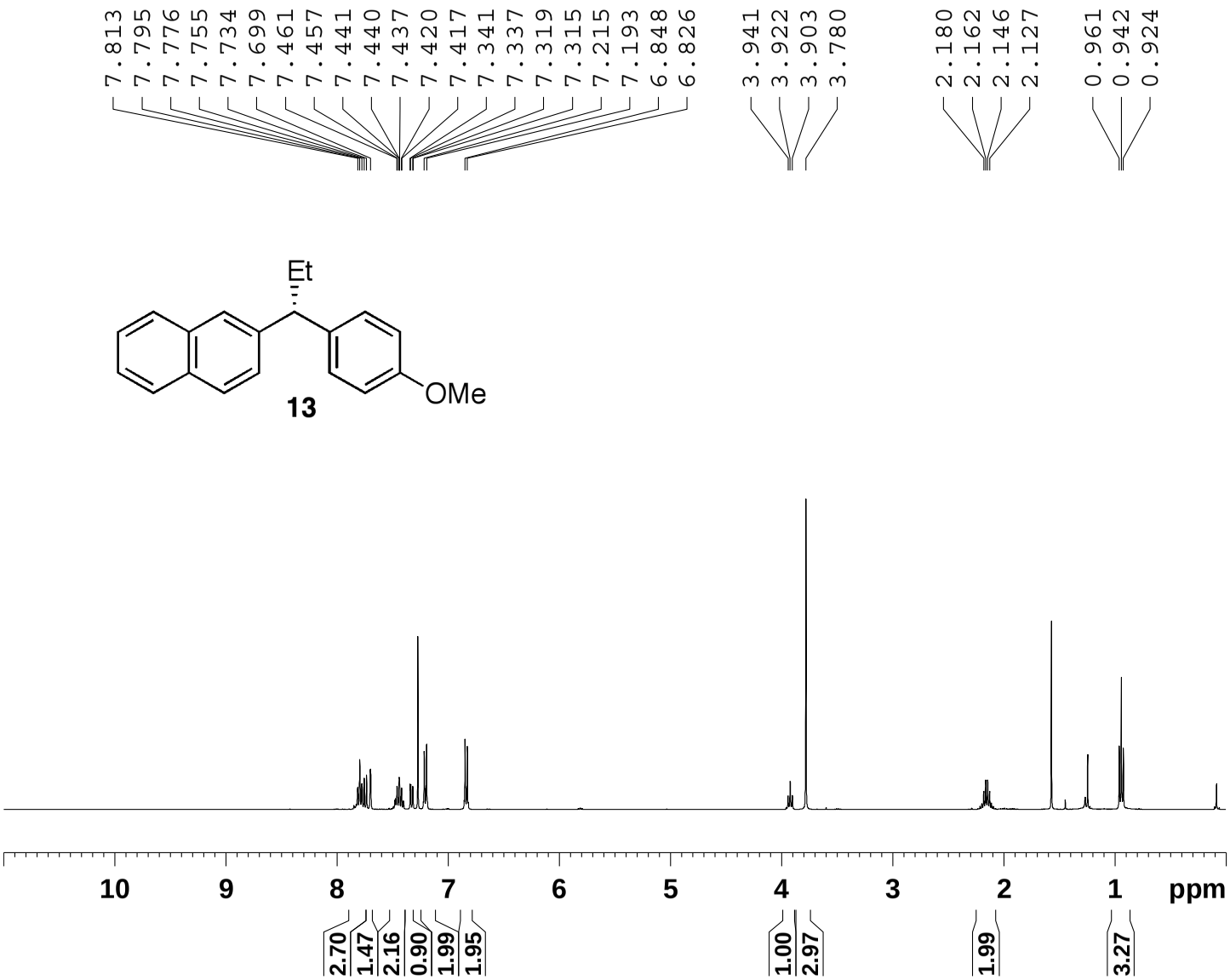

```
Current Data Parameters
NAME            HH-4-51 B
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20121117
Time                4.31
INSTRUM            spect
PROBHD   5 mm CPQNP 1H/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8278.146 Hz
FIDRES          0.126314 Hz
AQ              3.9584243 sec
RG                  11.3
DW                60.400 usec
DE                 6.00 usec
TE                298.1 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1                4.90 dB
PL1W         3.30822015 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                 32768
SF          400.1300000 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                1.00
```

Compound 12 13CNMR




```
Current Data Parameters
NAME          HH-4-51 B
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121117
Time               4.47
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ             1.3664756 sec
RG                  512
DW               20.850 usec
DE               18.00 usec
TE               298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                9.25 usec
PL1               0.55 dB
PL1W        35.18820572 W
SFO1        100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                1H
PCPD2            90.00 usec
PL2               4.90 dB
PL12             20.46 dB
PL13             21.00 dB
PL2W         3.30822015 W
PL12W        0.09195905 W
PL13W        0.08120718 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127690 MHz
WDW                   EM
SSB                    0
LB                1.00 Hz
GB                     0
PC                 1.40
```

Compound 13 1HNMR



Current Data Parameters

NAME	SDG-2-164A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20121118
Time	6.09
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	100
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	9
DW	60.400 usec
DE	6.00 usec
TE	298.2 K
D1	1.00000000 sec
TD0	1

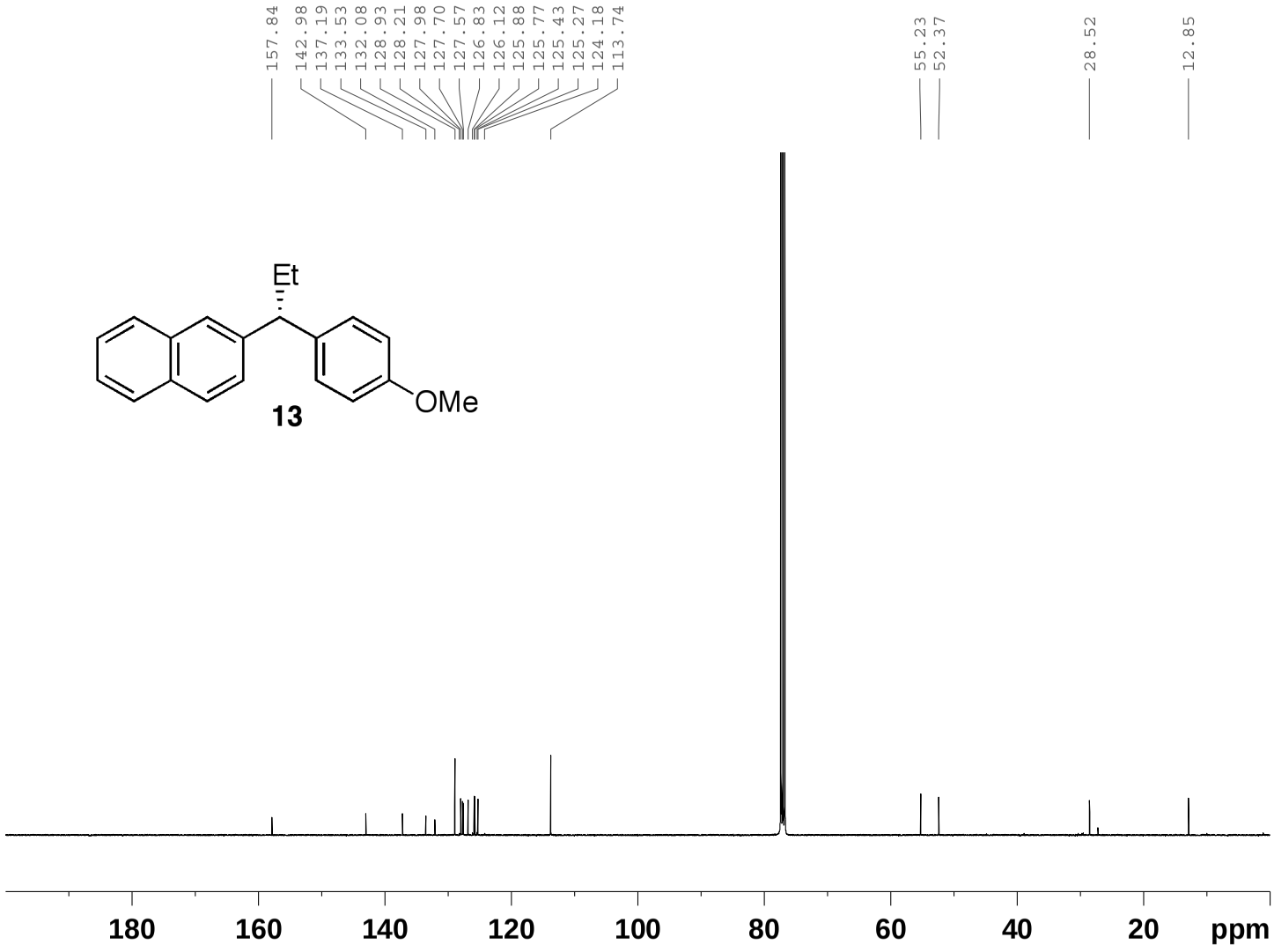
======== CHANNEL f1 ========

NUC1	1H
P1	15.00 usec
PL1	4.90 dB
PL1W	3.30822015 W
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	32768
SF	400.1300049 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

Compound 13 13CNMR



Current Data Parameters

NAME	SDG-2-164A
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121118
Time	7.09
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.1 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

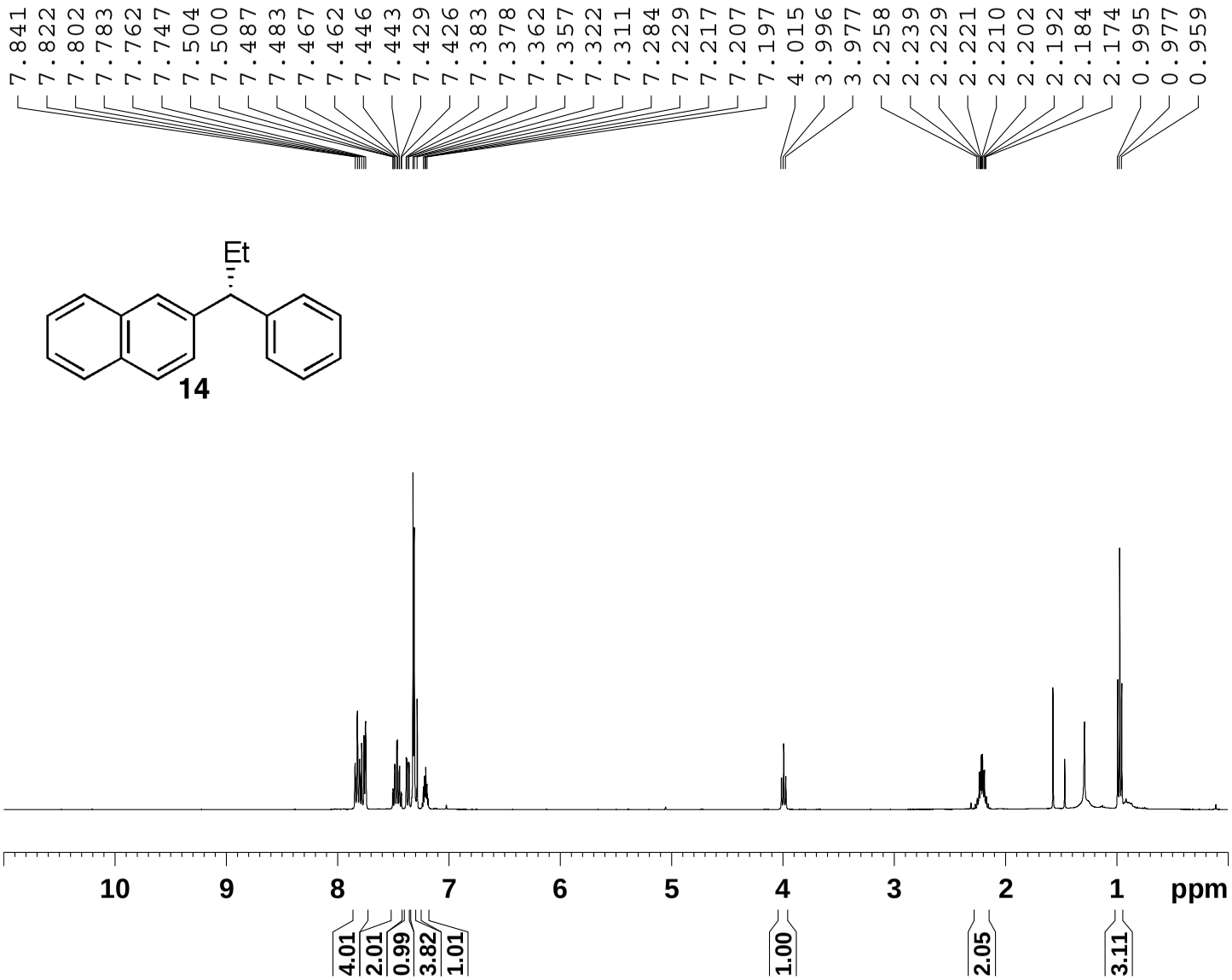
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

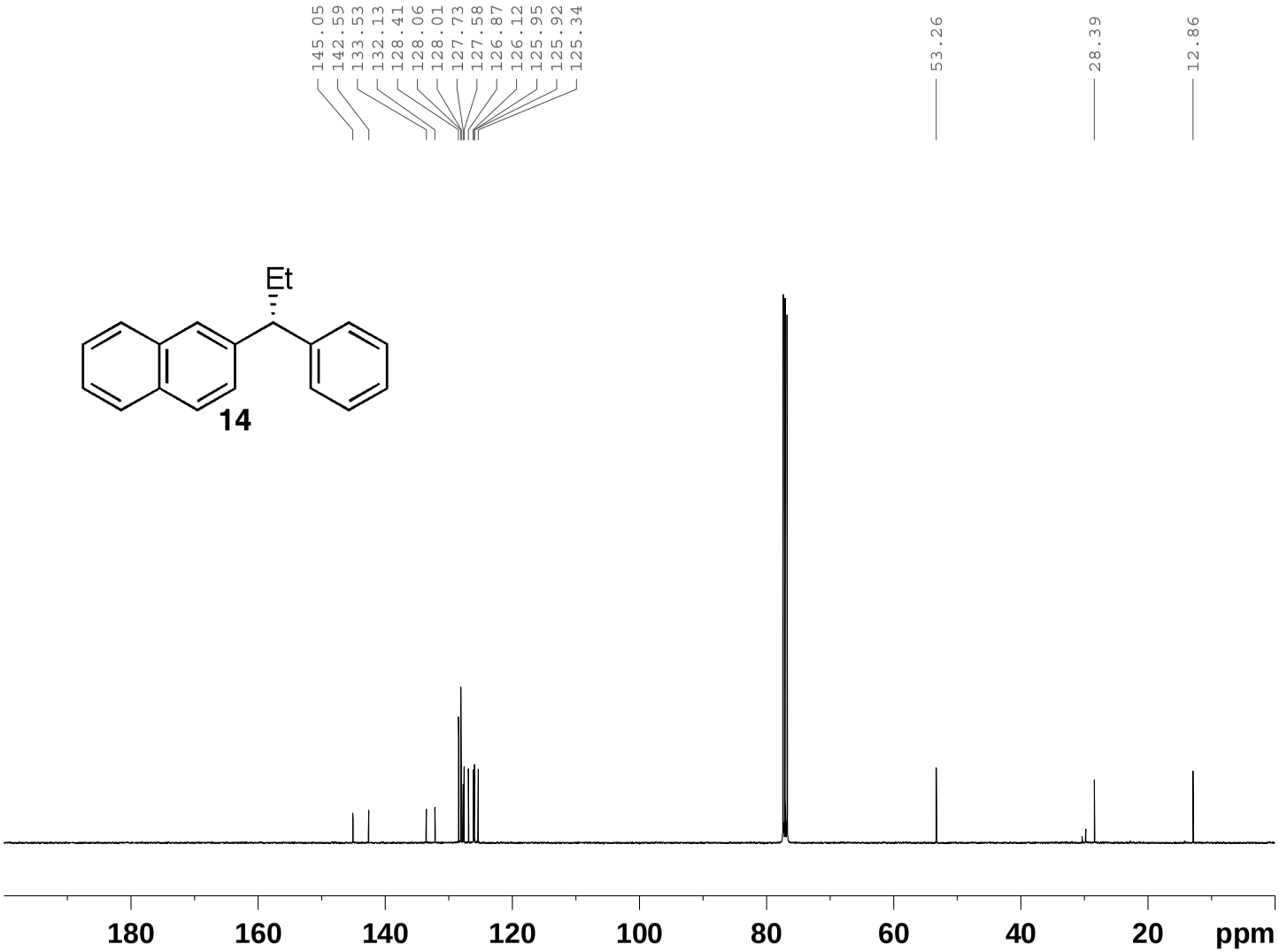
SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 14 1HNMR




```
Current Data Parameters
NAME         SDG-2-165-1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121115
Time               16.14
INSTRUM            spect
PROBHD   5 mm CPQNP 1H/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8278.146 Hz
FIDRES          0.126314 Hz
AQ              3.9584243 sec
RG                     9
DW                60.400 usec
DE                 6.00 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1                4.90 dB
PL1W          3.30822015 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 32768
SF           400.1300000 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                1.00
```

Compound 14 13CNMR



Current Data Parameters
NAME SDG-2-165-1
EXPNO 2
PROCNO 1

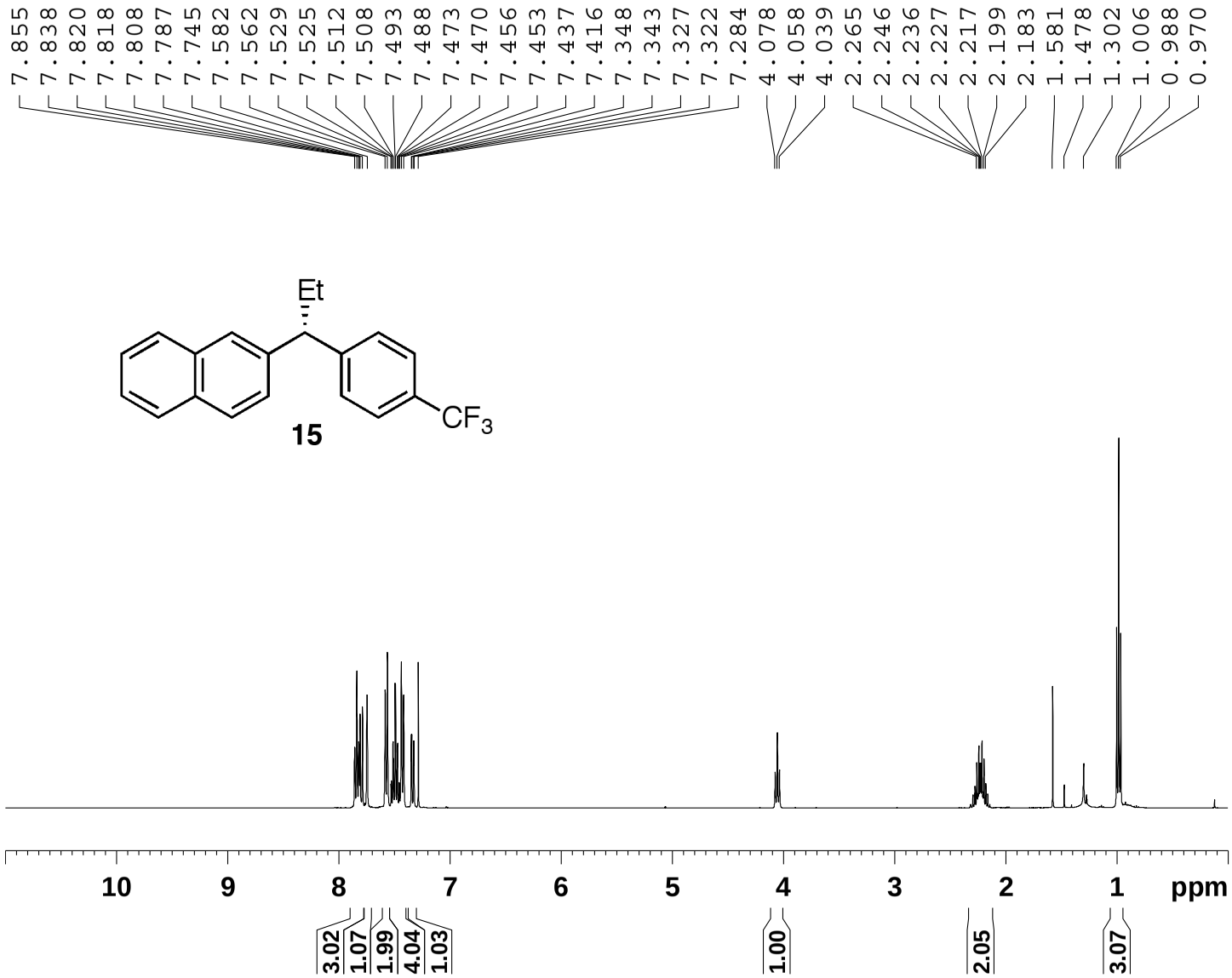
F2 - Acquisition Parameters
Date_ 20121115
Time 22.41
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 15 1HNMR



Current Data Parameters

NAME	HH-4-52
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20121117
Time	4.53
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	12.7
DW	60.400 usec
DE	6.00 usec
TE	298.1 K
D1	1.00000000 sec
TD0	1

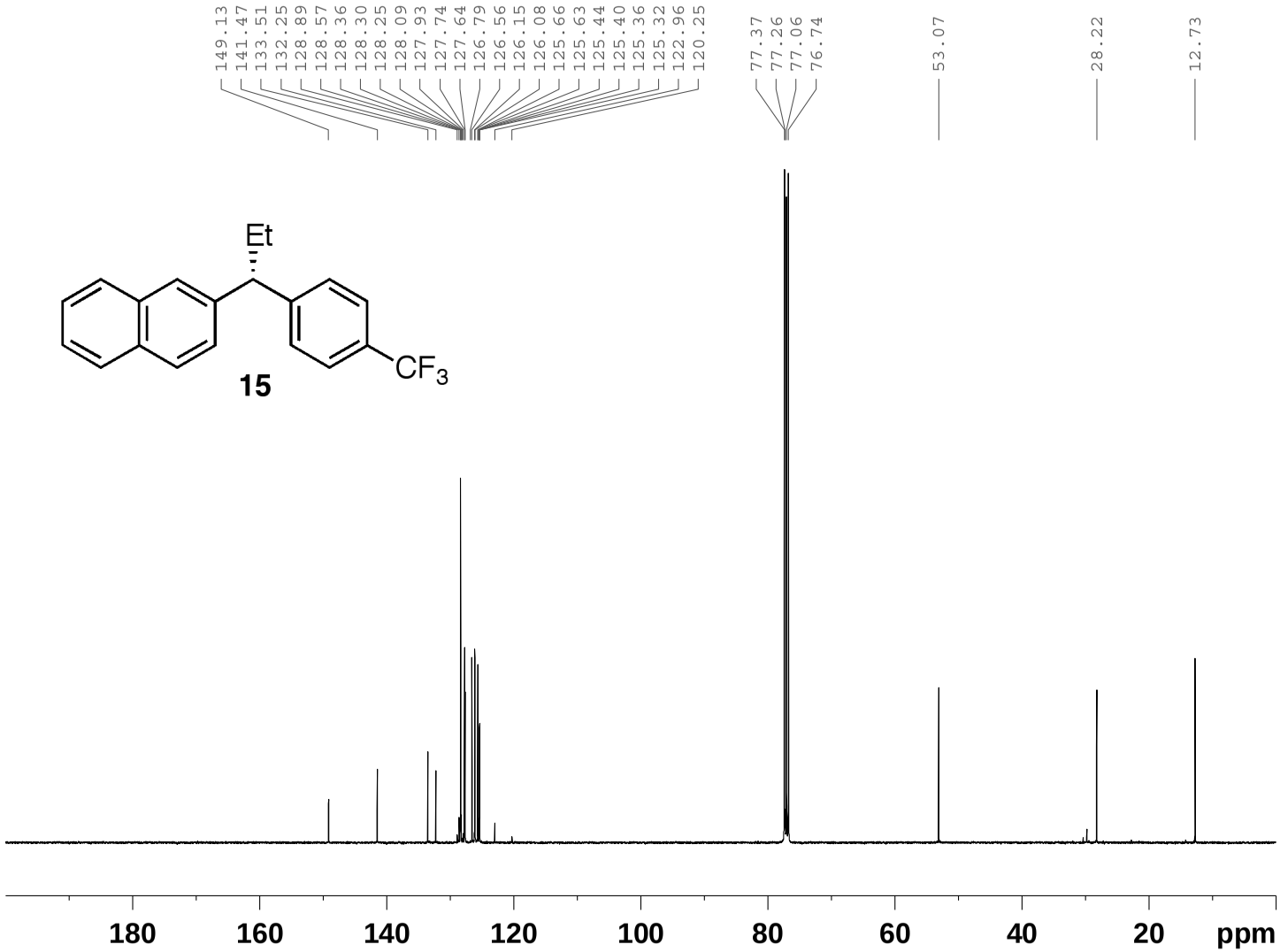
======== CHANNEL f1 ========

NUC1	1H
P1	15.00 usec
PL1	4.90 dB
PL1W	3.30822015 W
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	32768
SF	400.1300000 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

Compound 15 13CNMR



Current Data Parameters

NAME	HH-4-52
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121117
Time	5.09
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.2 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

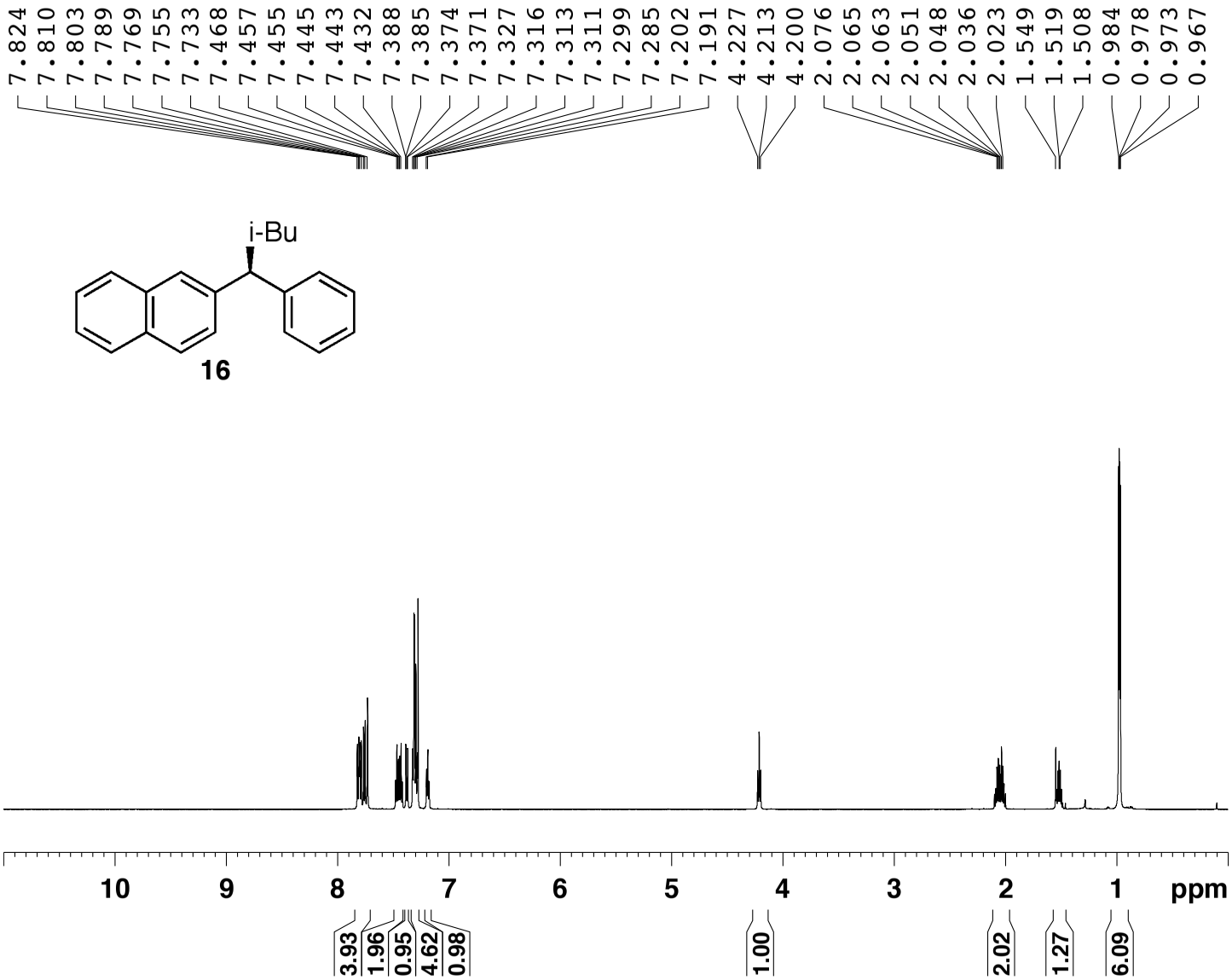
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

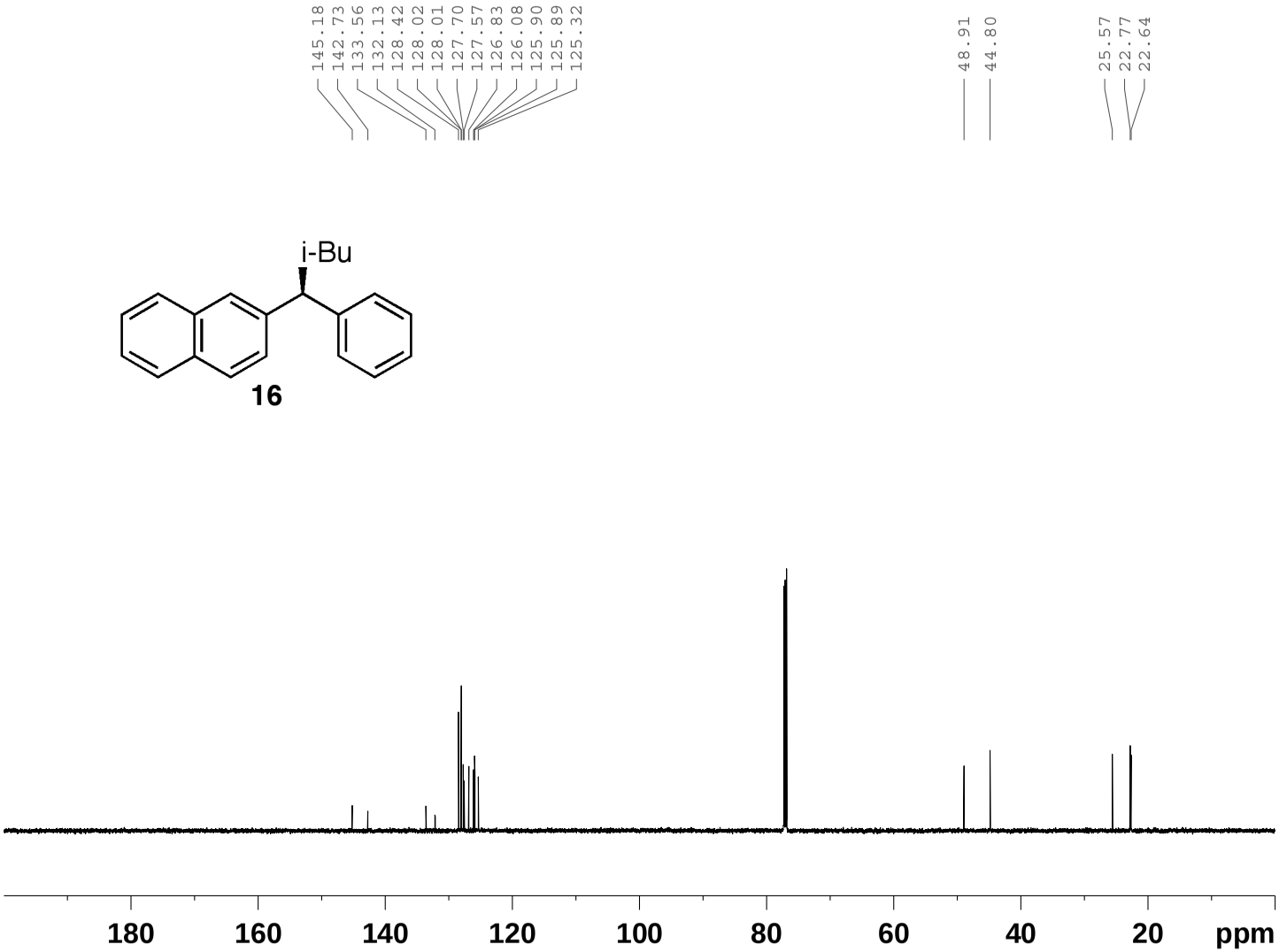
SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 16 1HNMR




```
Current Data Parameters
NAME            HH-4-087B
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20121129
Time                11.12
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                      8
DS                      2
SWH              8403.361 Hz
FIDRES           0.128225 Hz
AQ               3.8994420 sec
RG                    256
DW                 59.500 usec
DE                  9.10 usec
TE                 298.1 K
D1            1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                 14.80 usec

F2 - Processing parameters
SI                  65536
SF           600.3200044 MHz
WDW                    EM
SSB                     0
LB                 0.30 Hz
GB                      0
PC                   1.00
```

Compound 16 13CNMR



Current Data Parameters

NAME	HH-4-087B
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121129
Time	11.22
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg55
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	34722.223 Hz
FIDRES	0.529819 Hz
AQ	0.9437684 sec
RG	2050
DW	14.400 usec
DE	8.88 usec
TE	298.1 K
D1	1.10000002 sec
D11	0.03000000 sec
TD0	1

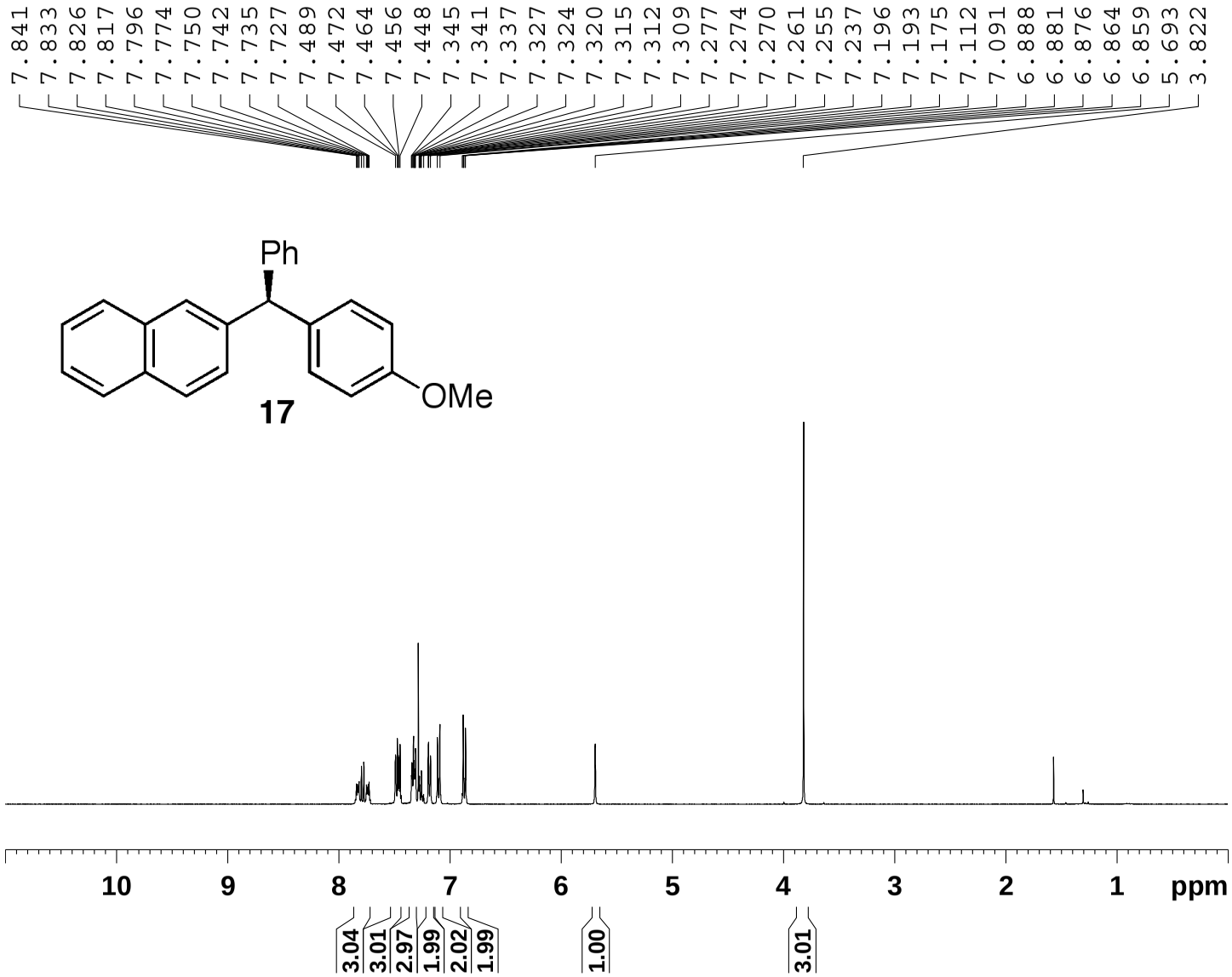
======== CHANNEL f1 ========

SFO1	150.9656784 MHz
NUC1	13C
P1	9.00 usec

F2 - Processing parameters

SI	32768
SF	150.9505840 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 17 1HNMR



Current Data Parameters

NAME	HH-4-082A
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20121122
Time	18.07
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	2
SWH	8278.146 Hz
FIDRES	0.126314 Hz
AQ	3.9584243 sec
RG	4
DW	60.400 usec
DE	6.00 usec
TE	298.2 K
D1	1.00000000 sec
TD0	1

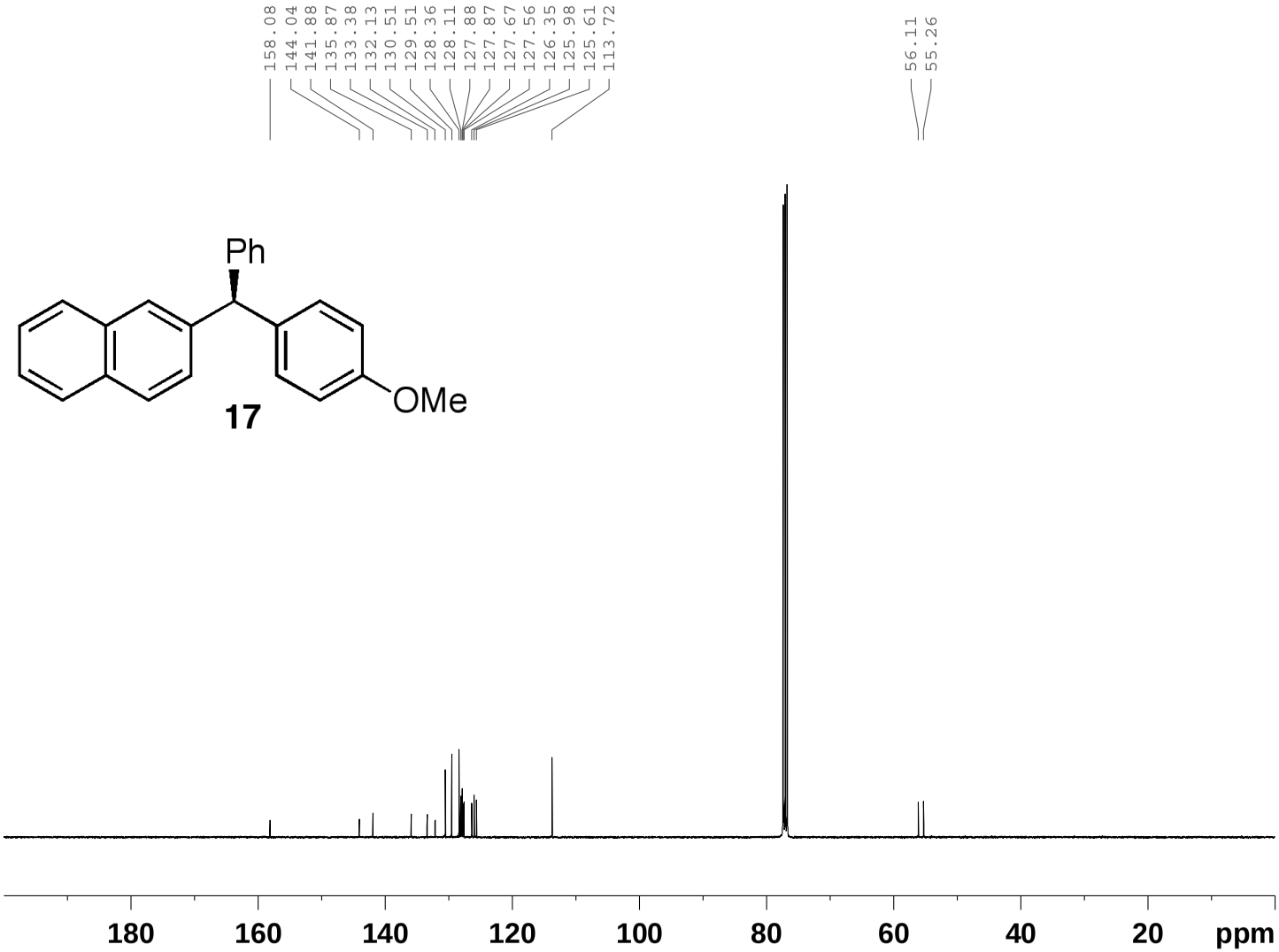
======== CHANNEL f1 ========

NUC1	1H
P1	15.00 usec
PL1	4.90 dB
PL1W	3.30822015 W
SFO1	400.1324710 MHz

F2 - Processing parameters

SI	32768
SF	400.1300000 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

Compound 17 13CNMR



Current Data Parameters

NAME	HH-4-082A
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121122
Time	18.28
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.1 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

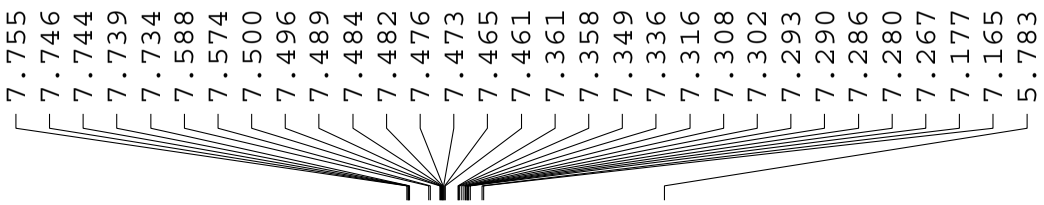
======== CHANNEL f2 ========

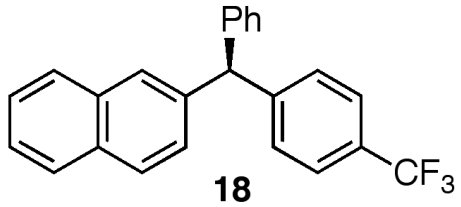
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

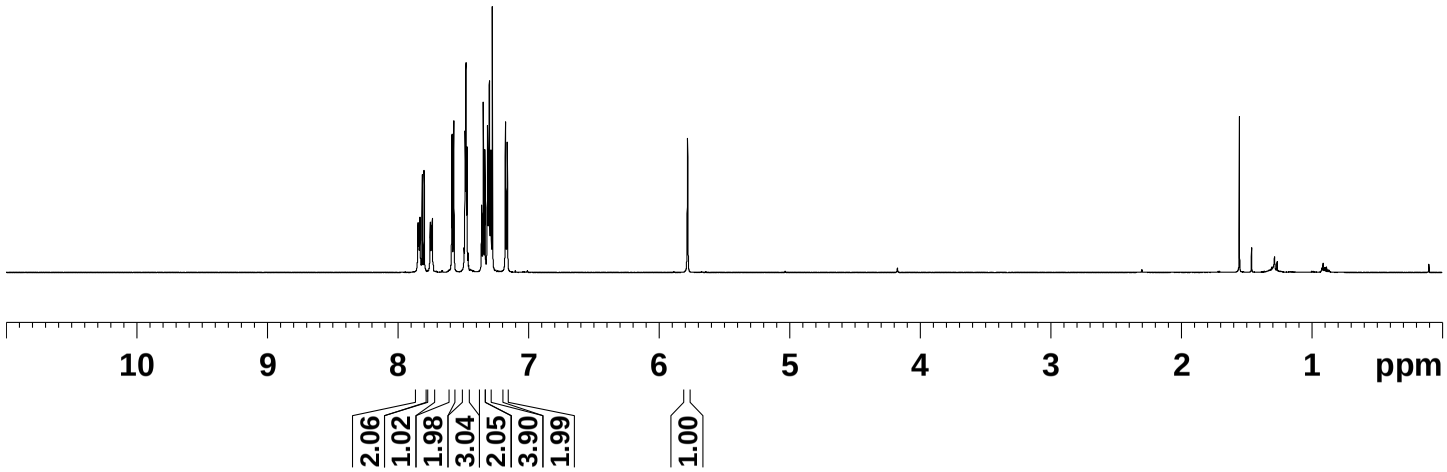
SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 18 1HNMR



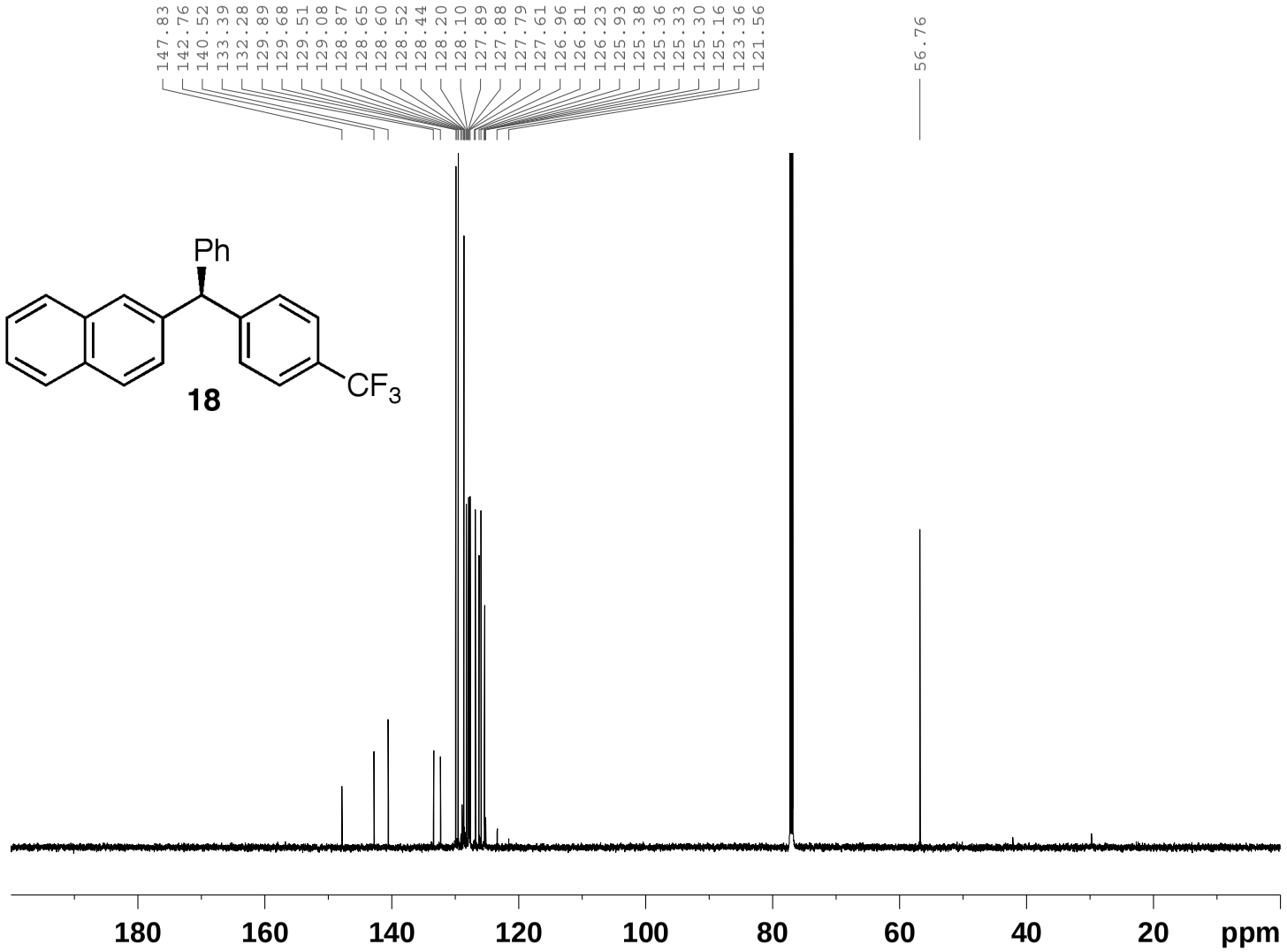


18




```
Current Data Parameters
NAME          QZ-3-139rs
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121130
Time               11.35
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   256
DW                59.500 usec
DE                 9.10 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                14.80 usec

F2 - Processing parameters
SI                 65536
SF          600.3200039 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                1.00
```

Compound 18 13CNMR



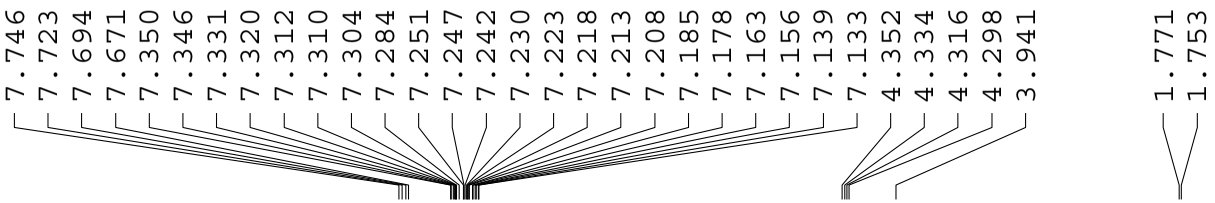
Current Data Parameters
NAME QZ-3-139 3rd tim
EXPNO 2
PROCNO 1

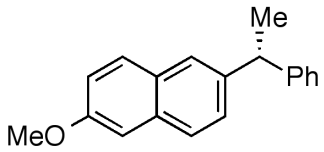
F2 - Acquisition Parameters
Date_ 20121210
Time 18.42
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 1024
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 19.34 usec
TE 298.1 K
D1 2.50000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 10.63 usec

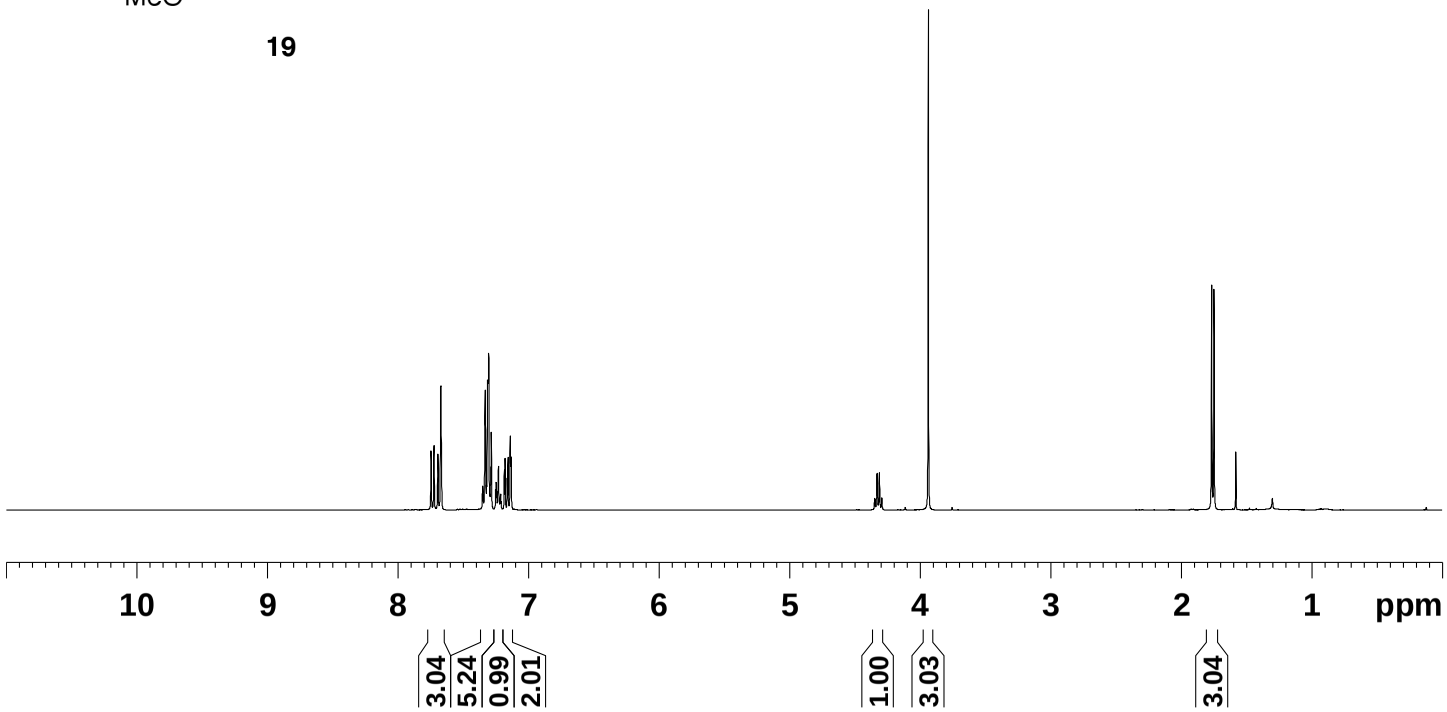
F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 19 1HNMR



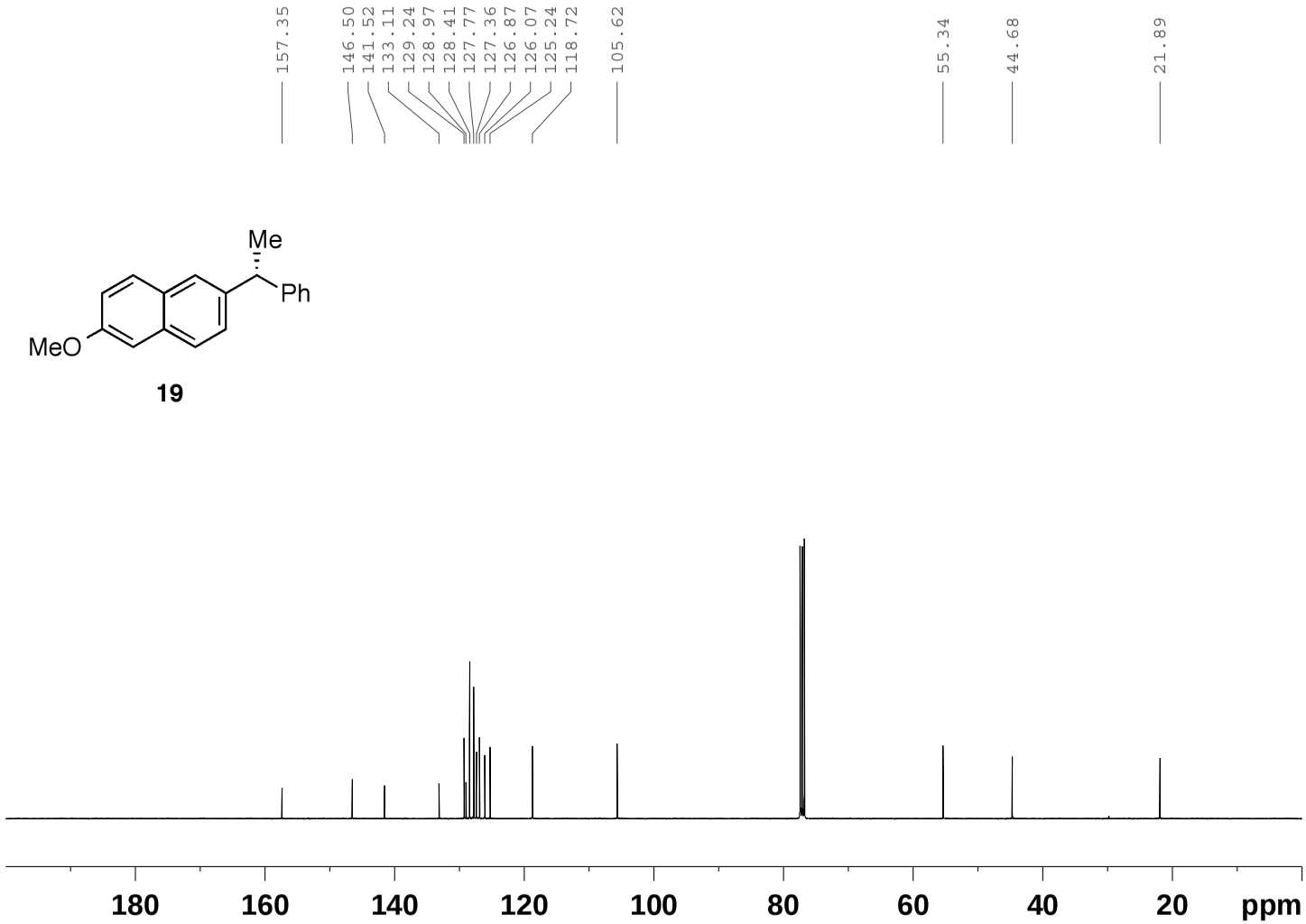


19




```
Current Data Parameters
NAME         SDG-2-167-1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121115
Time               16.02
INSTRUM            spect
PROBHD   5 mm CPQNP 1H/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8278.146 Hz
FIDRES          0.126314 Hz
AQ              3.9584243 sec
RG                     8
DW                60.400 usec
DE                 6.00 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                 15.00 usec
PL1                 4.90 dB
PL1W          3.30822015 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 32768
SF           400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

Compound 19 13CNMR



Current Data Parameters
NAME SDG-2-167-1
EXPNO 2
PROCNO 1

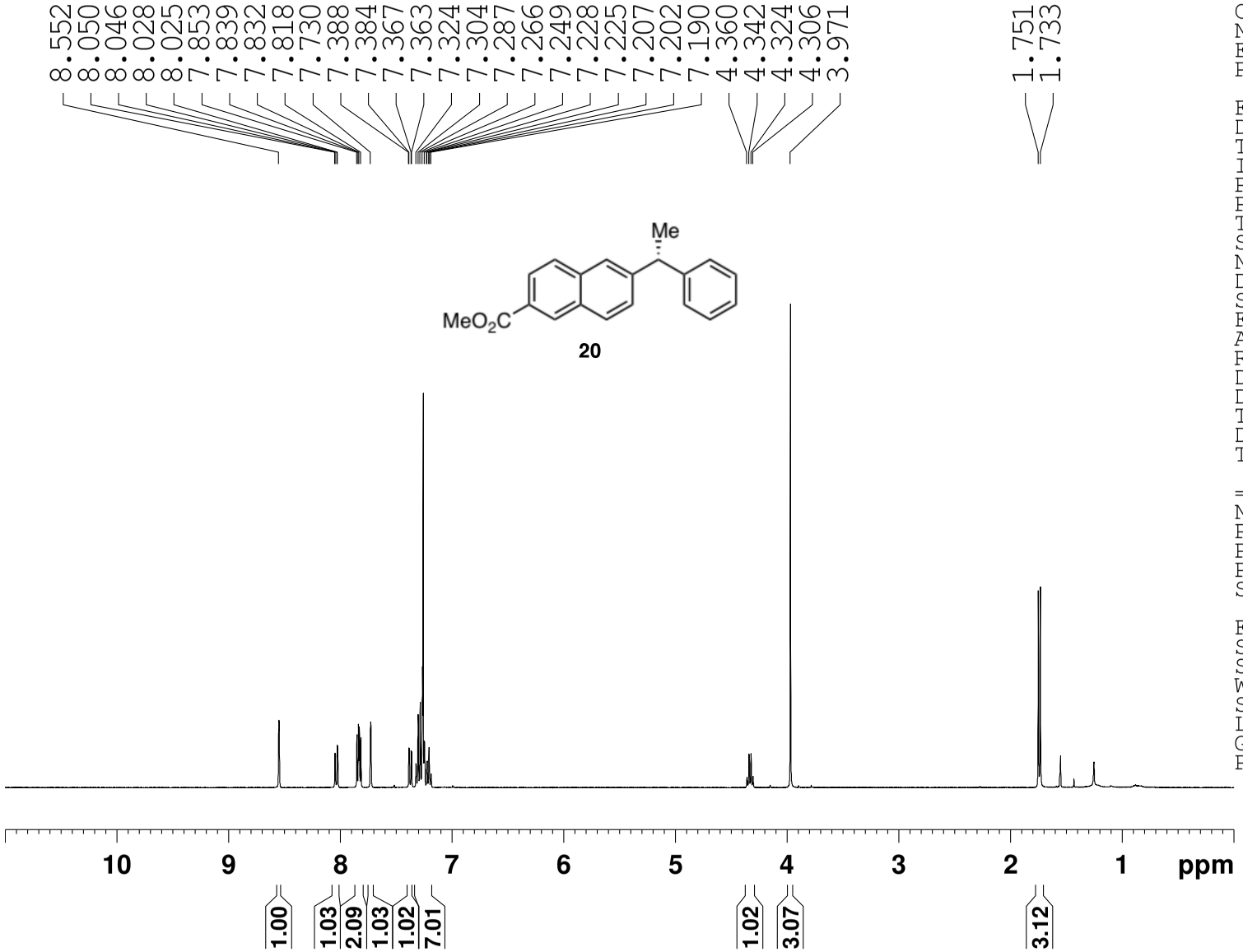
F2 - Acquisition Parameters
Date_ 20121115
Time 22.03
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

compound 20 1HNMR



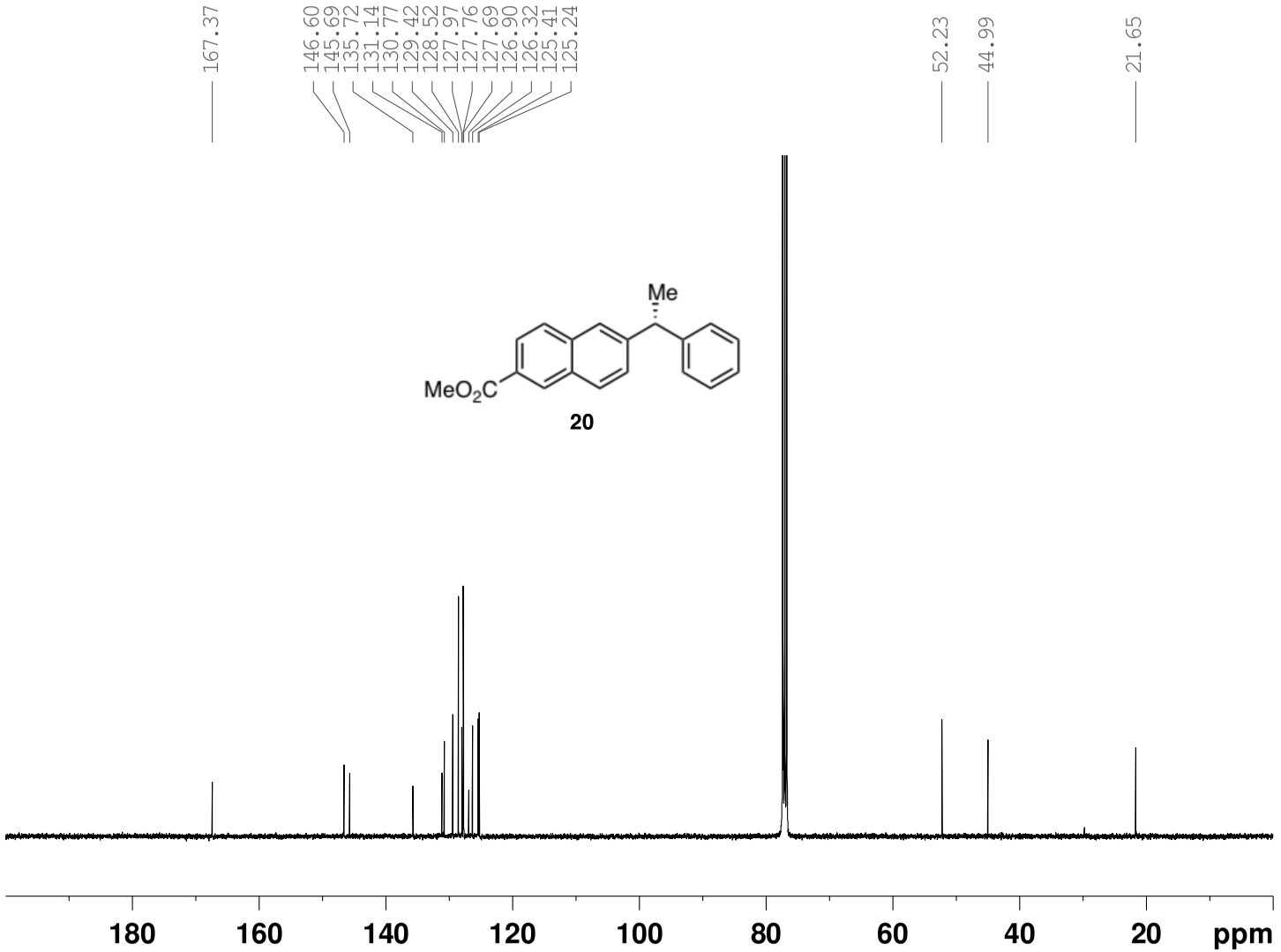
Current Data Parameters
NAME HH-4-143A
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130124
Time 14.48
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 9
DW 60.400 usec
DE 6.00 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 4.90 dB
PL1W 3.30822015 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 32768
SF 400.1300104 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

Compound 20 13C NMR



BRUKER

Current Data Parameters
NAME HH-4-143A
EXPNO 2
PROCNO 1

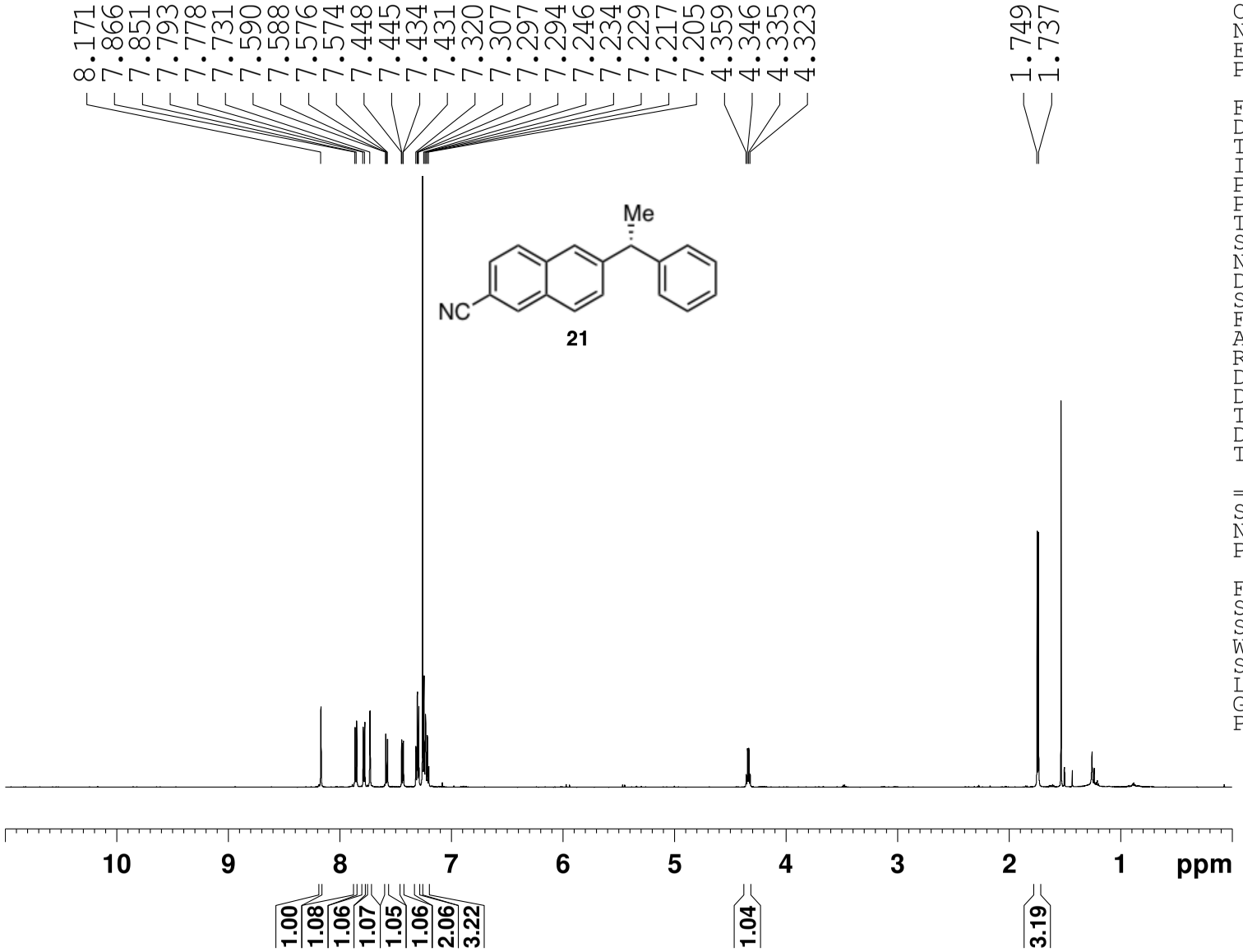
F2 - Acquisition Parameters
Date_ 20130124
Time 23.45
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1024
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

compound 21 1HNMR



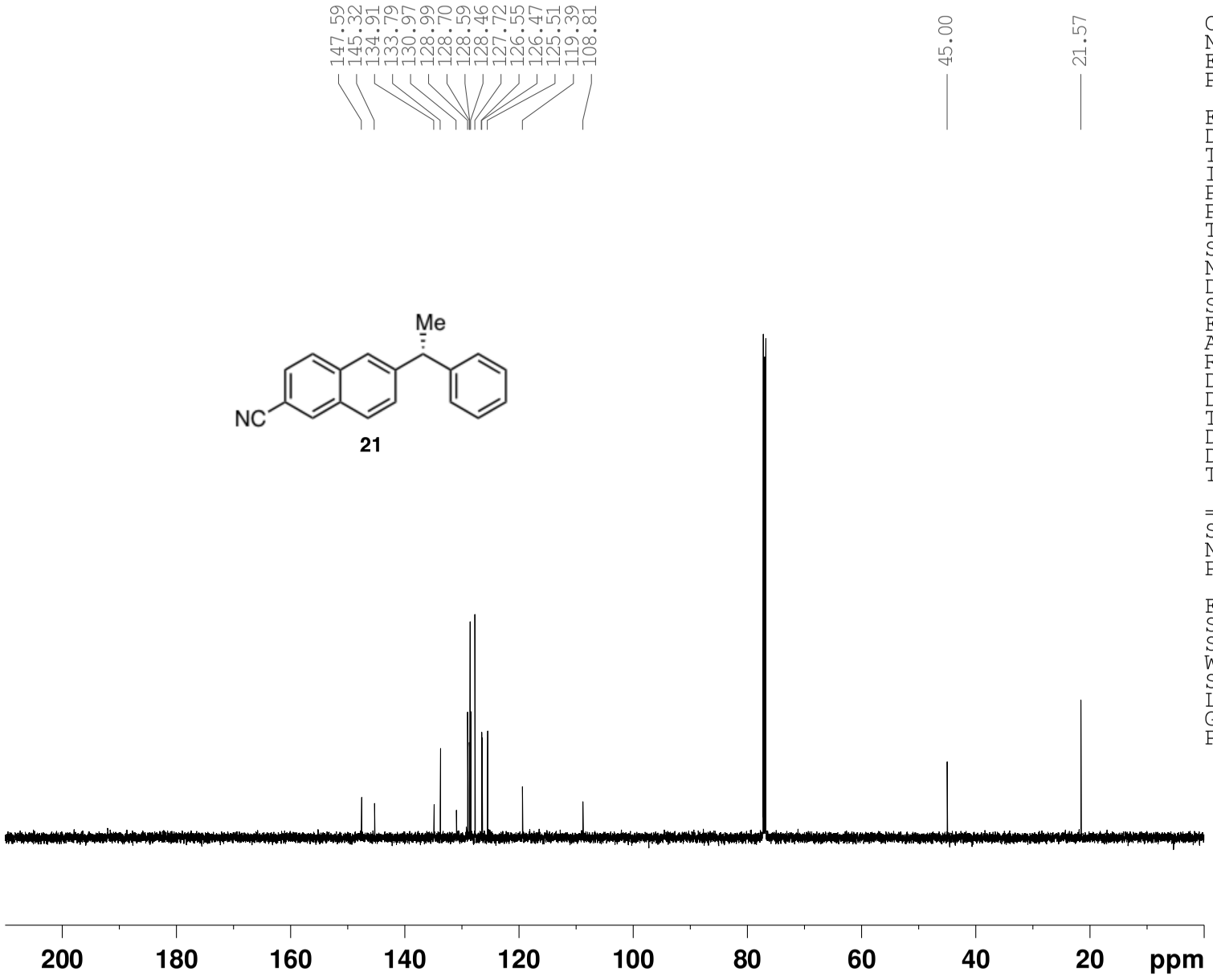
Current Data Parameters
NAME QZ-3-219-2
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130125
Time 23.24
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 228
DW 59.500 usec
DE 17.39 usec
TE 300.0 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 10.77 usec

F2 - Processing parameters
SI 65536
SF 600.3200168 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

compopund 21 13NMR



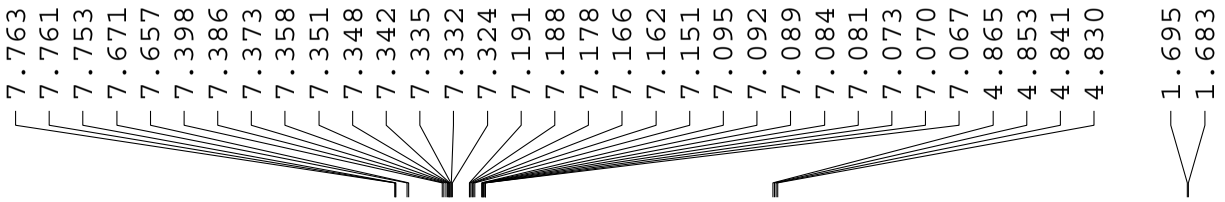
Current Data Parameters
NAME QZ-3-219-B-1
EXPNO 2
PROCNO 1

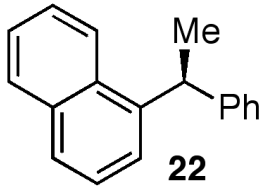
F2 - Acquisition Parameters
Date_ 20130126
Time 1.08
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 19.34 usec
TE 300.0 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 10.63 usec

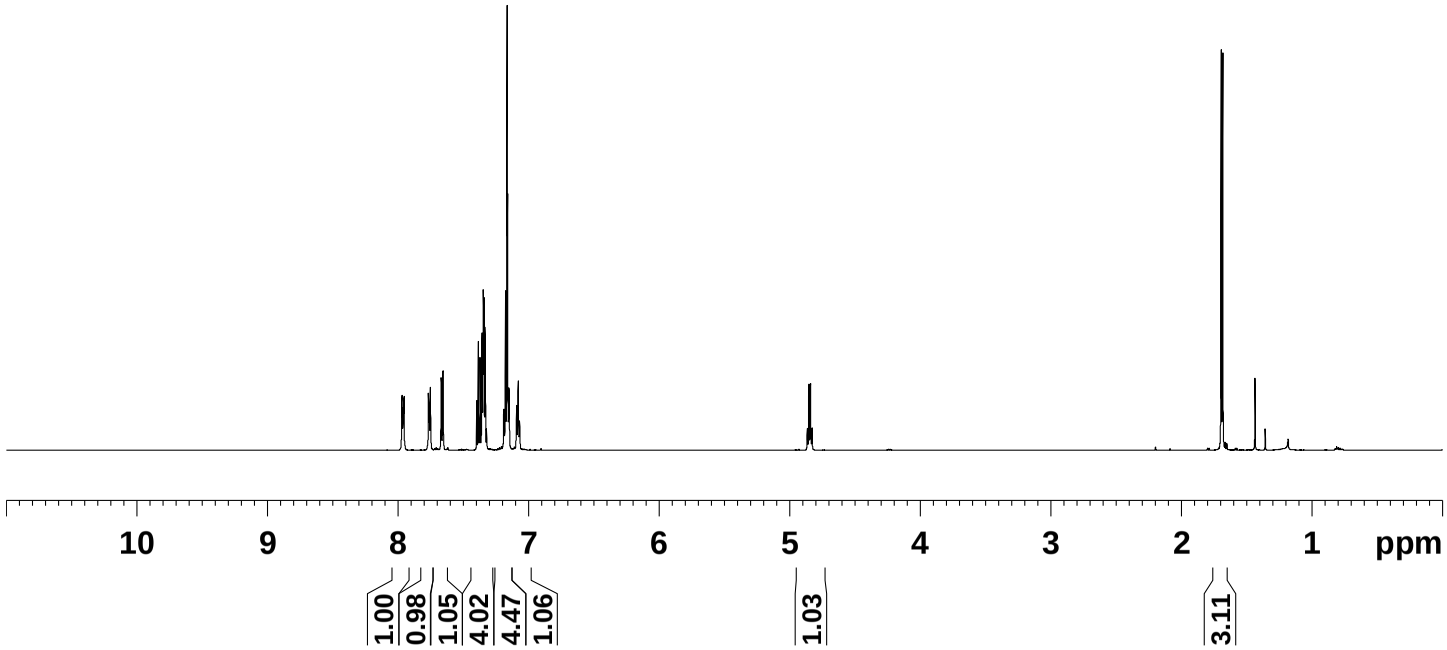
F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 22 1HNMR



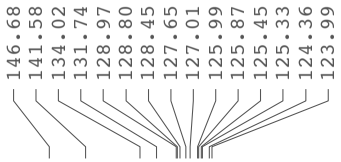


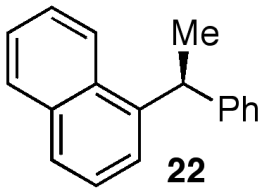
22



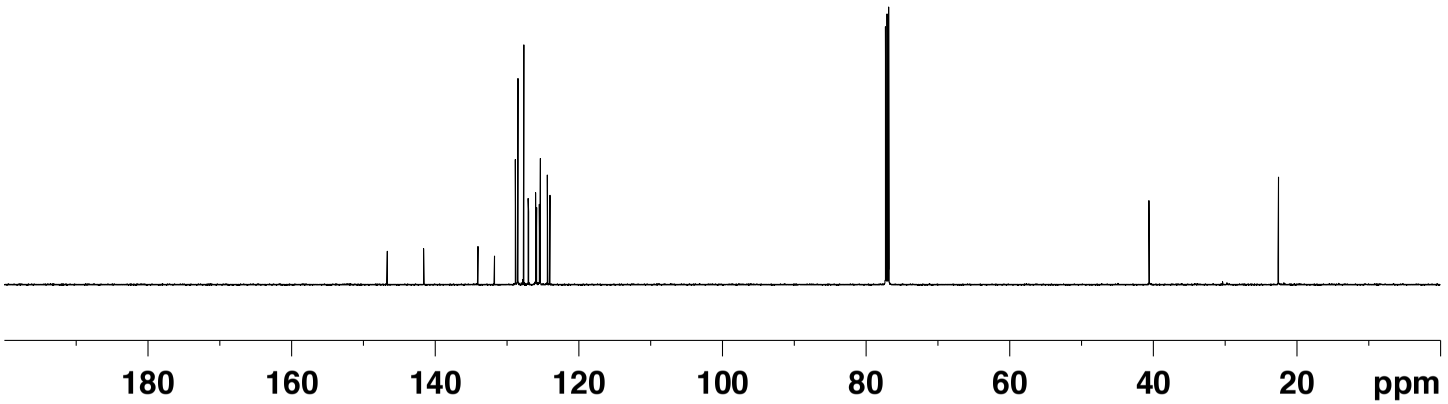

```
Current Data Parameters
NAME            HH-4-088A
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20121129
Time                18.26
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                      8
DS                      2
SWH              8403.361 Hz
FIDRES           0.128225 Hz
AQ               3.8994420 sec
RG                    203
DW                 59.500 usec
DE                  9.10 usec
TE                 298.1 K
D1              1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          600.3233018 MHz
NUC1                   1H
P1                  14.80 usec

F2 - Processing parameters
SI                  65536
SF            600.3200718 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

Compound 22 13CNMR



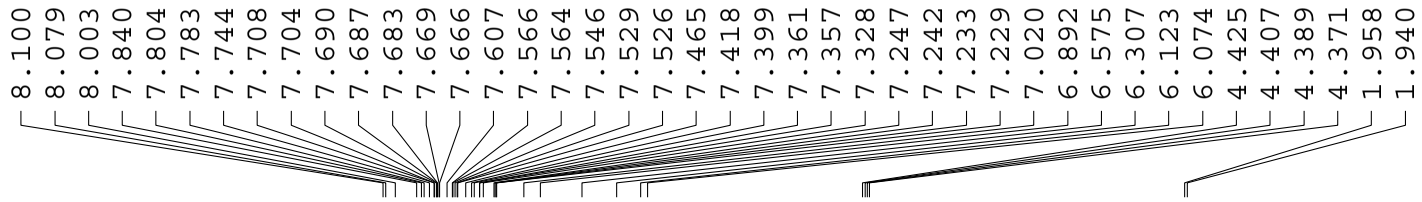


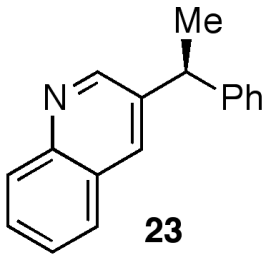
22



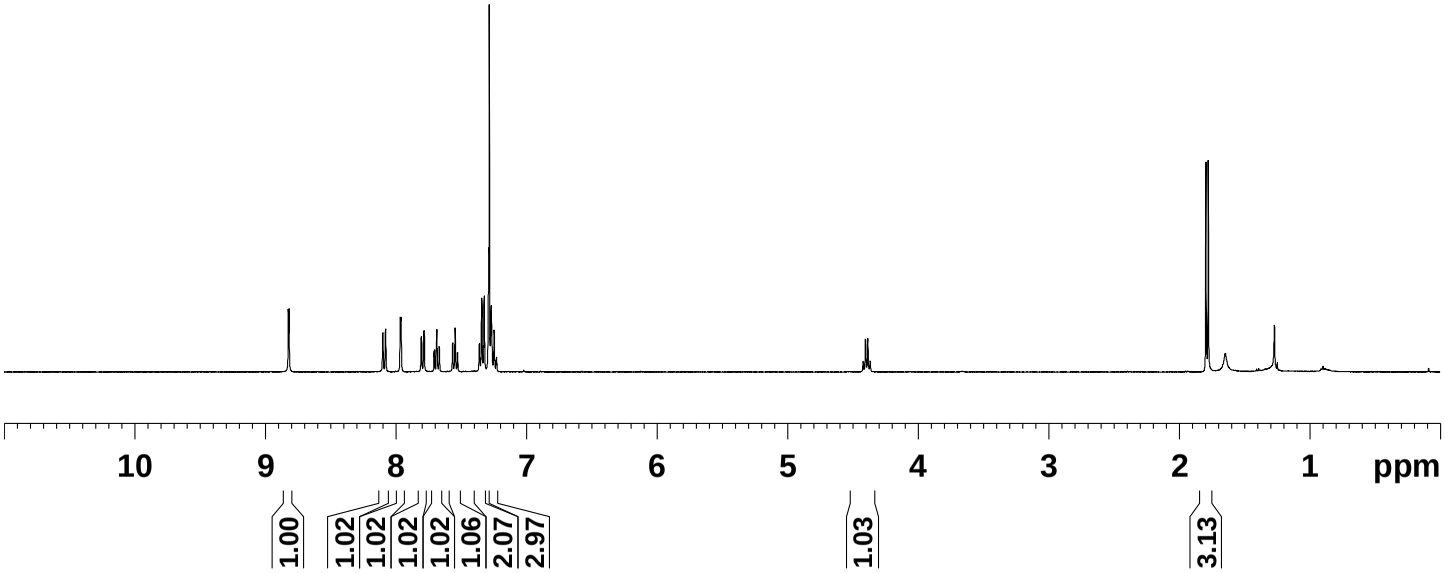

```
Current Data Parameters
NAME                  HH-4-088A
EXPNO                         2
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20121129
Time                      22.39
INSTRUM                   spect
PROBHD    5 mm PABBO BB-
PULPROG                  zgpg55
TD                        65536
SOLVENT                   CDCl3
NS                         3000
DS                            4
SWH                   34722.223 Hz
FIDRES                 0.529819 Hz
AQ                     0.9437684 sec
RG                         2050
DW                       14.400 usec
DE                        8.88 usec
TE                       298.1 K
D1                    1.10000002 sec
D11                   0.03000000 sec
TD0                           1

======== CHANNEL f1 ========
SFO1                150.9656784 MHz
NUC1                        13C
P1                        9.00 usec

F2 - Processing parameters
SI                        32768
SF                  150.9505840 MHz
WDW                          EM
SSB                           0
LB                        1.00 Hz
GB                            0
PC                        1.40
```

Compound 23 1HNMR



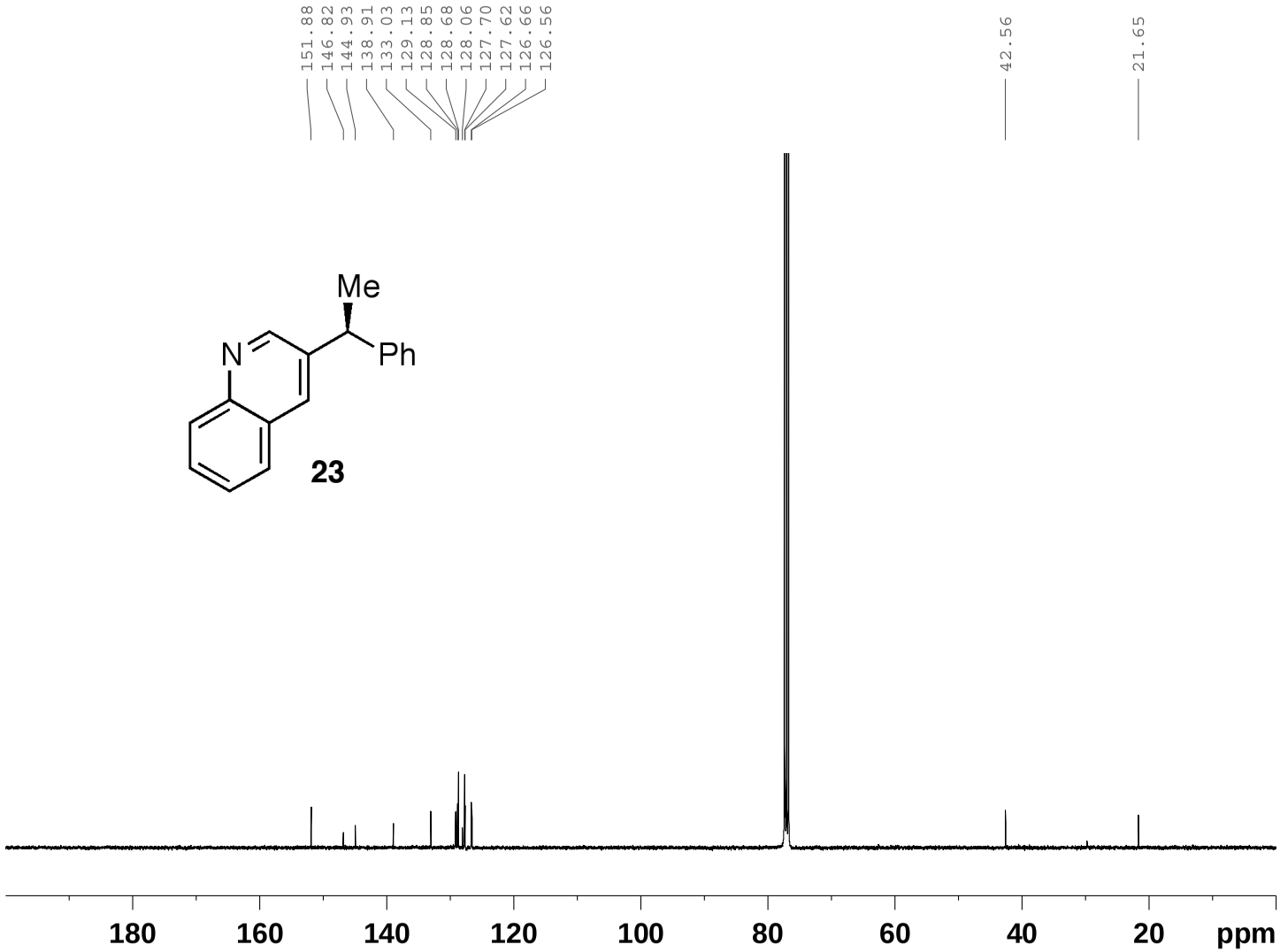


23




```
Current Data Parameters
NAME          QZ-3-157rs
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121207
Time              10.02
INSTRUM           spect
PROBHD   5 mm CPQNP 1H/
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            8278.146 Hz
FIDRES         0.126314 Hz
AQ             3.9584243 sec
RG                   6.3
DW                60.400 usec
DE                 6.00 usec
TE                298.2 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.00 usec
PL1                4.90 dB
PL1W         3.30822015 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                 32768
SF          400.1300000 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
```

Compound 23 13CNMR



Current Data Parameters
NAME QZ-3-157rs
EXPNO 2
PROCNO 1

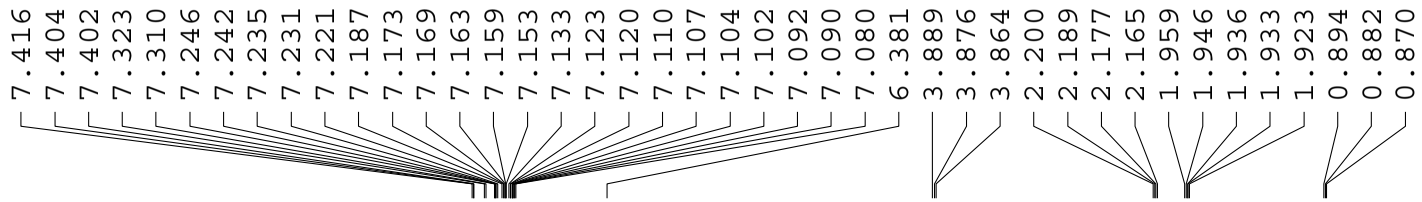
F2 - Acquisition Parameters
Date_ 20121207
Time 23.46
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 23980.814 Hz
FIDRES 0.365918 Hz
AQ 1.3664756 sec
RG 512
DW 20.850 usec
DE 18.00 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

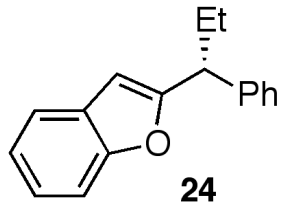
======== CHANNEL f1 ========
NUC1 13C
P1 9.25 usec
PL1 0.55 dB
PL1W 35.18820572 W
SFO1 100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 4.90 dB
PL12 20.46 dB
PL13 21.00 dB
PL2W 3.30822015 W
PL12W 0.09195905 W
PL13W 0.08120718 W
SFO2 400.1316005 MHz

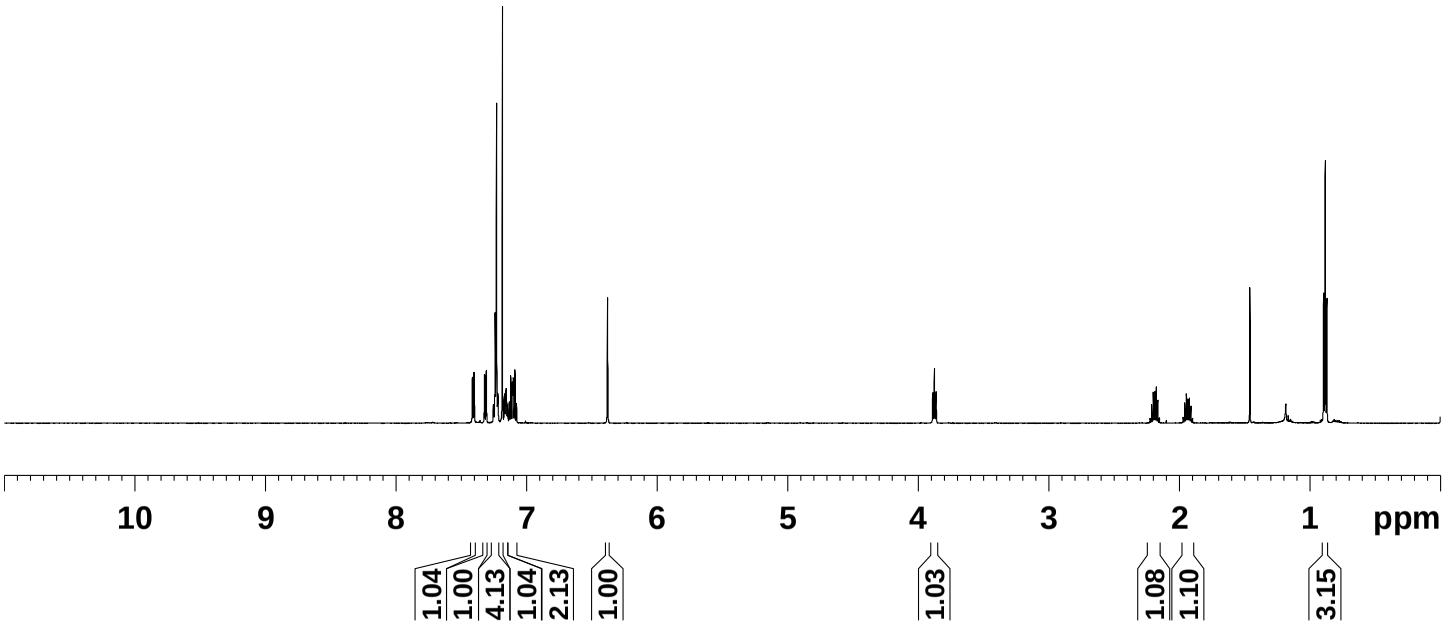
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 24 1HNMR



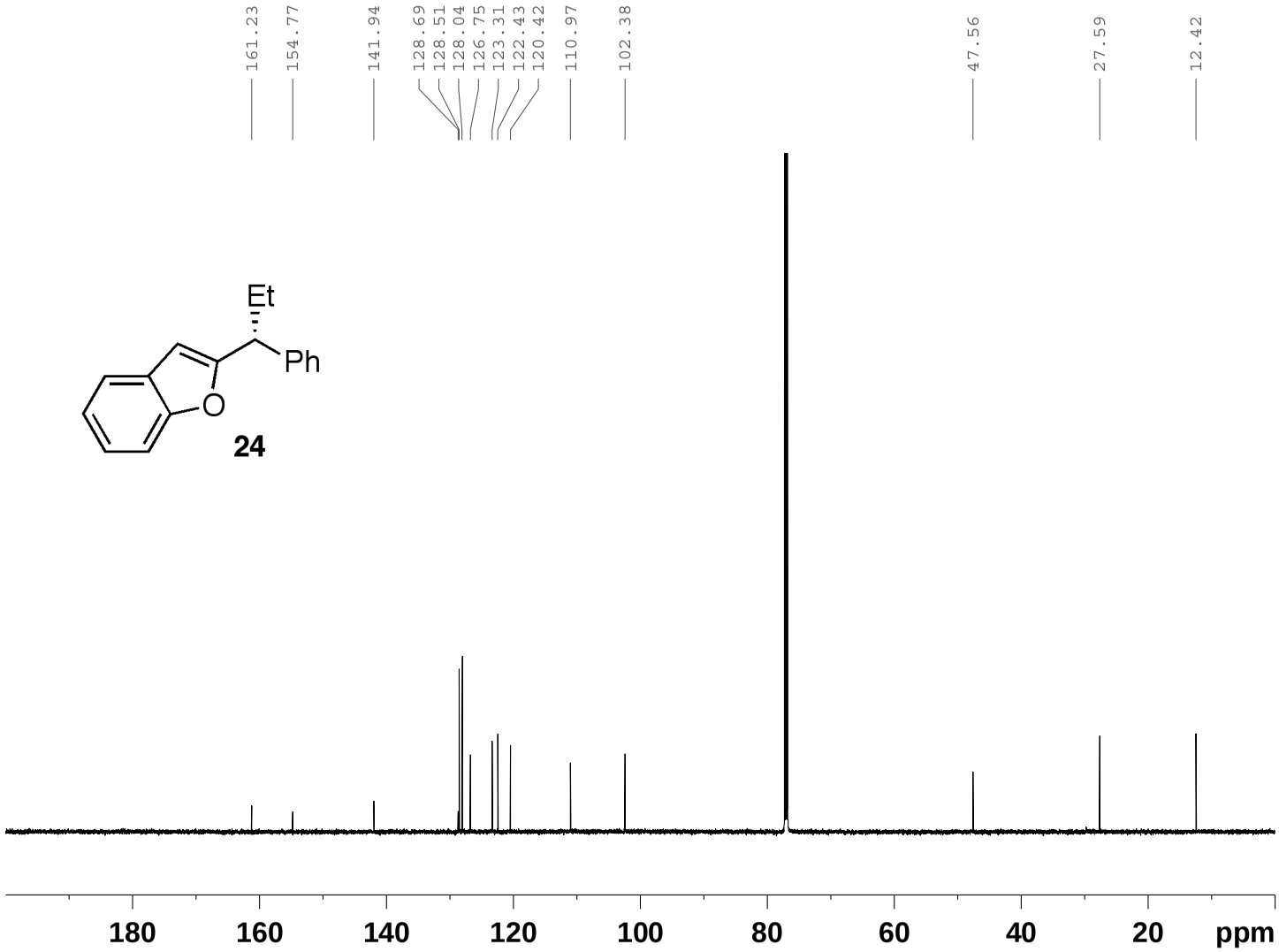


24




```
Current Data Parameters
NAME      HH-4-083 3rd time
EXPNO                    1
PROCNO                   1

F2 - Acquisition Parameters
Date_             20121126
Time                  1.46
INSTRUM              spect
PROBHD   5 mm PABBO BB-
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       2
SWH              8403.361 Hz
FIDRES           0.128225 Hz
AQ               3.8994420 sec
RG                     362
DW                59.500 usec
DE                 9.10 usec
TE                 298.1 K
D1             1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          600.3233018 MHz
NUC1                    1H
P1                 14.80 usec

F2 - Processing parameters
SI                   65536
SF            600.3200598 MHz
WDW                     EM
SSB                      0
LB                  0.30 Hz
GB                       0
PC                    1.00
```

Compound 24 13CNMR



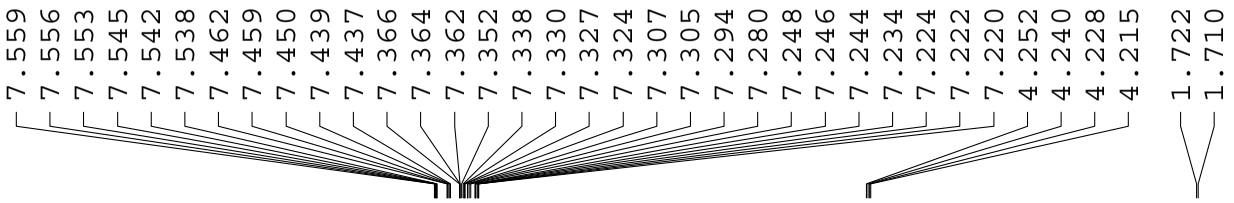
Current Data Parameters
NAME HH-4-083 3rd time
EXPNO 2
PROCNO 1

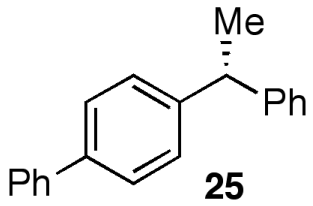
F2 - Acquisition Parameters
Date_ 20121126
Time 3.32
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 3000
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 8.88 usec
TE 298.1 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 9.00 usec

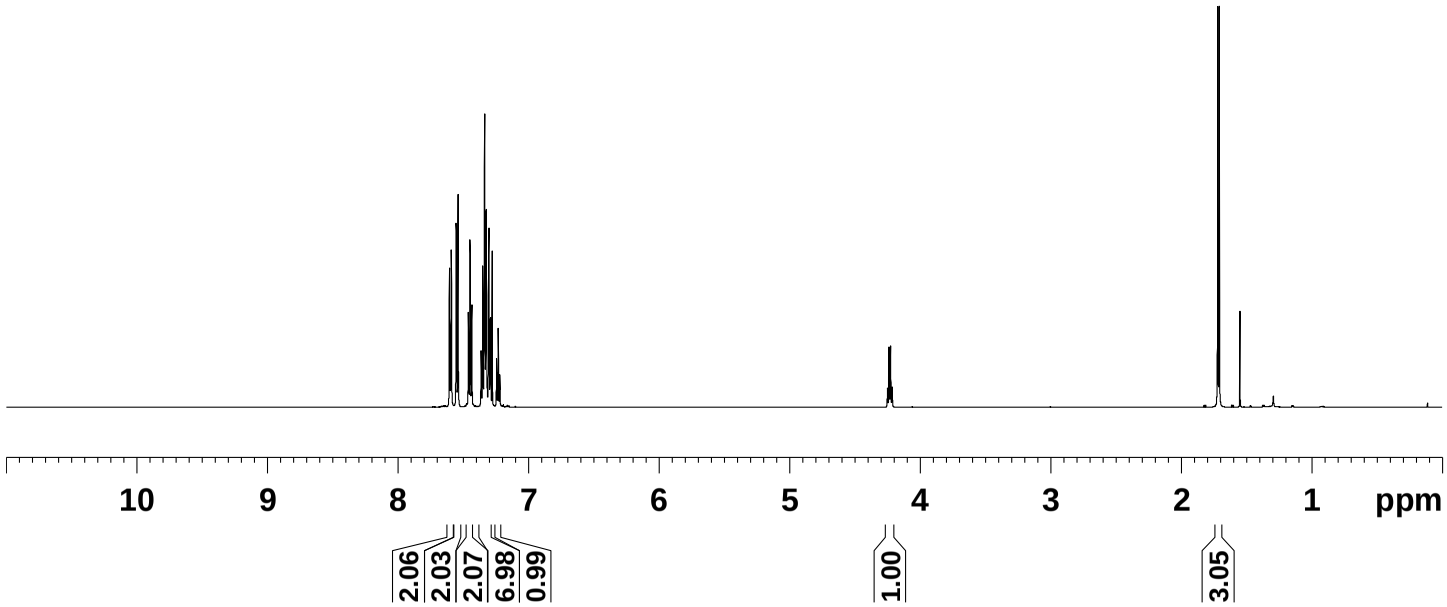
F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 25 1HNMR





25



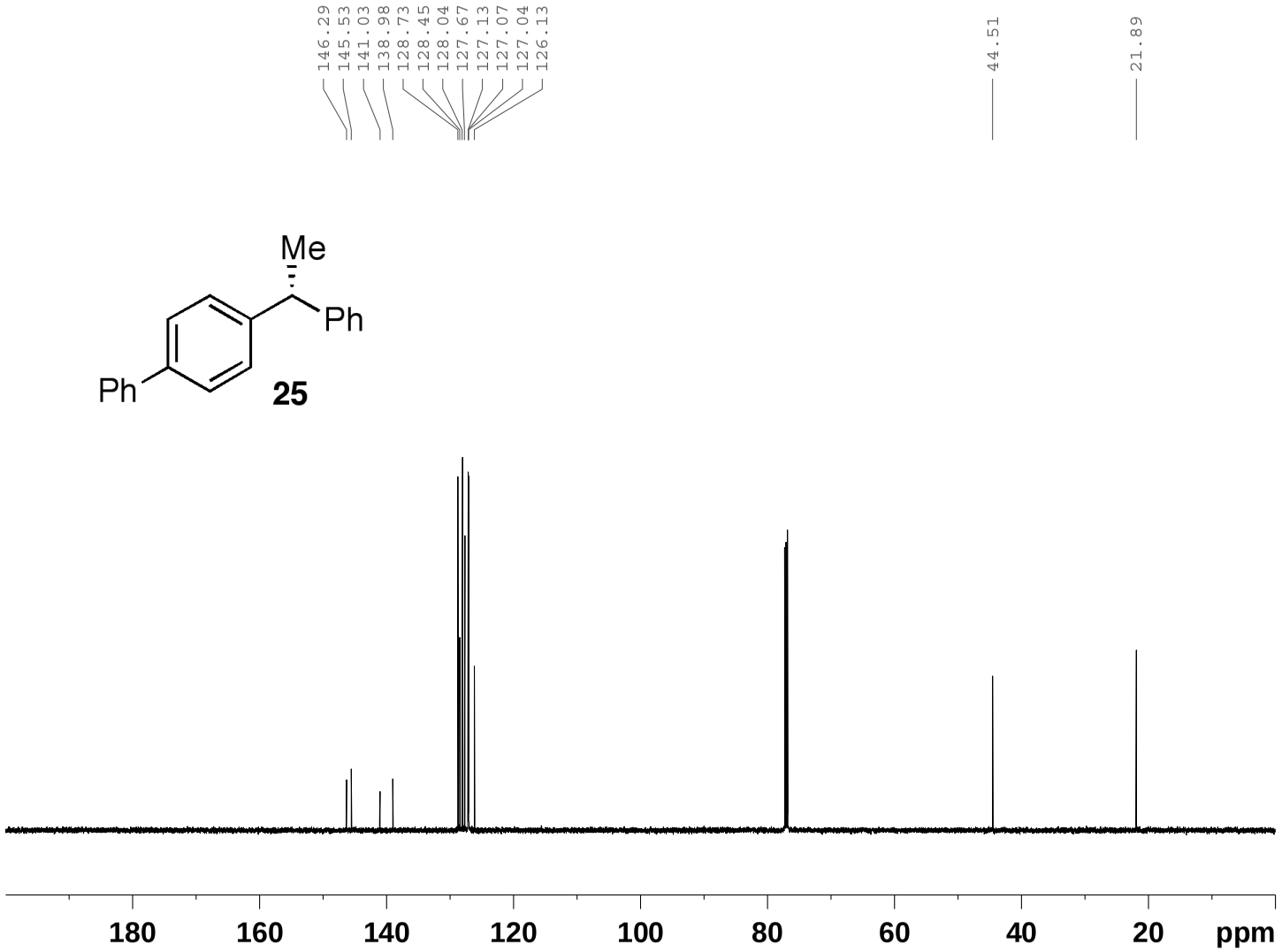
Current Data Parameters
NAME QZ-Compound 23
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121209
Time 14.07
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 114
DW 59.500 usec
DE 17.39 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 10.77 usec

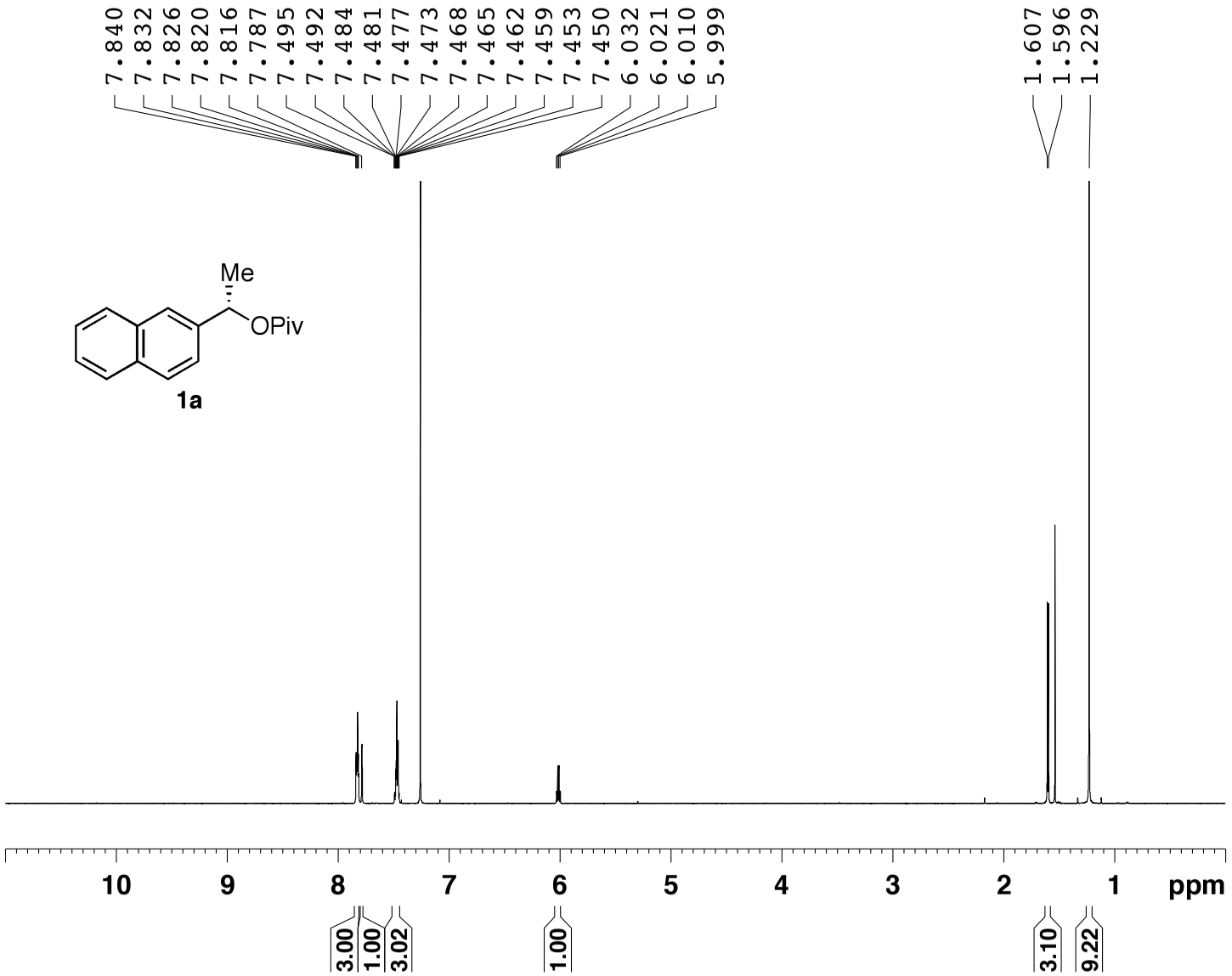
F2 - Processing parameters
SI 65536
SF 600.3200047 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

Compound 25 13CNMR




```
Current Data Parameters
NAME      QZ-Compound 23
EXPNO                 2
PROCNO                1

F2 - Acquisition Parameters
Date_          20121209
Time              14.18
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg55
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE                19.34 usec
TE                298.1 K
D1           1.10000002 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1                13C
P1                10.63 usec

F2 - Processing parameters
SI                32768
SF          150.9505840 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 1a 1HNMR



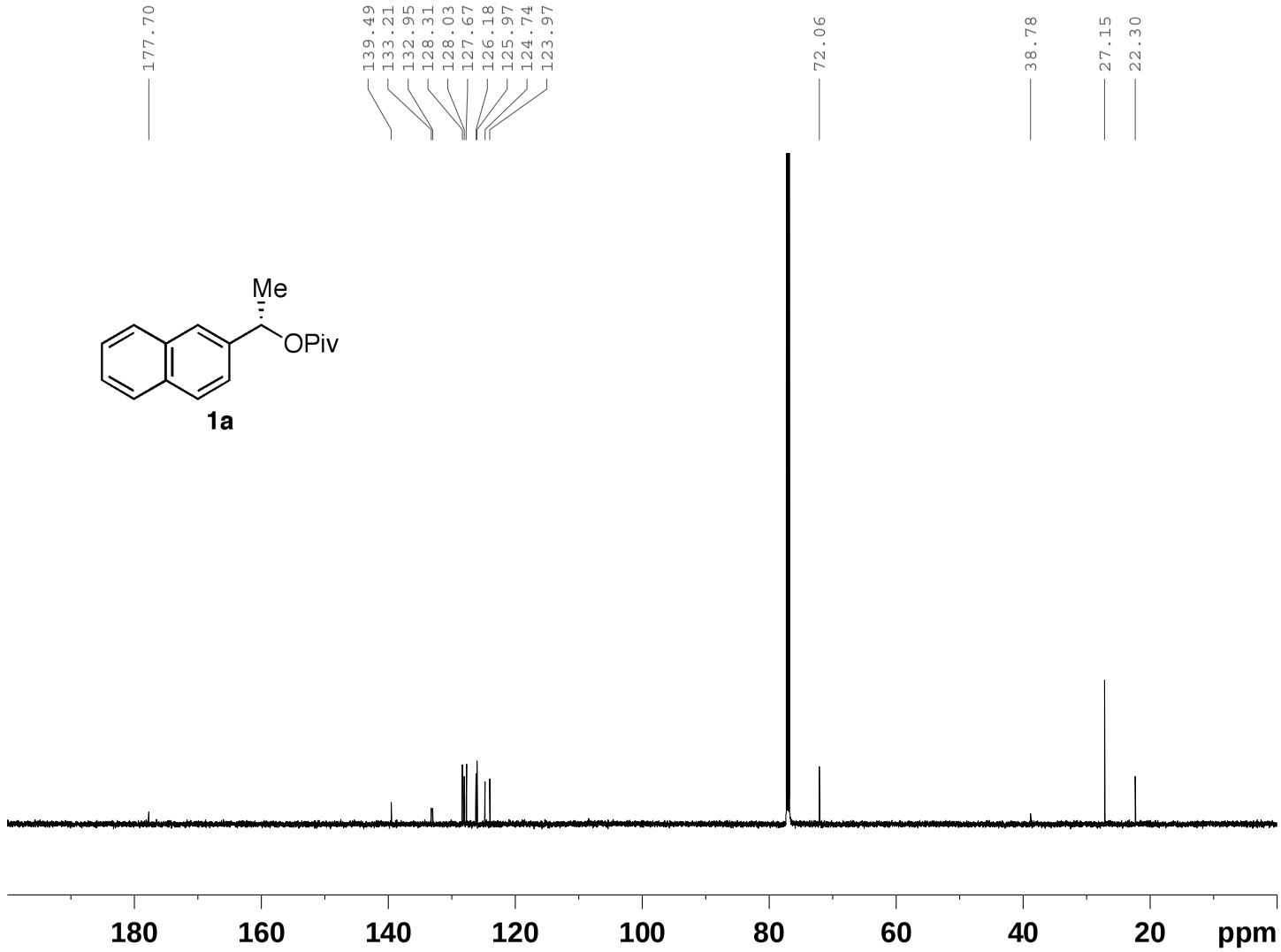
Current Data Parameters
NAME methyl sub
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121125
Time 18.30
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 406
DW 59.500 usec
DE 9.10 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 14.80 usec

F2 - Processing parameters
SI 65536
SF 600.3200156 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

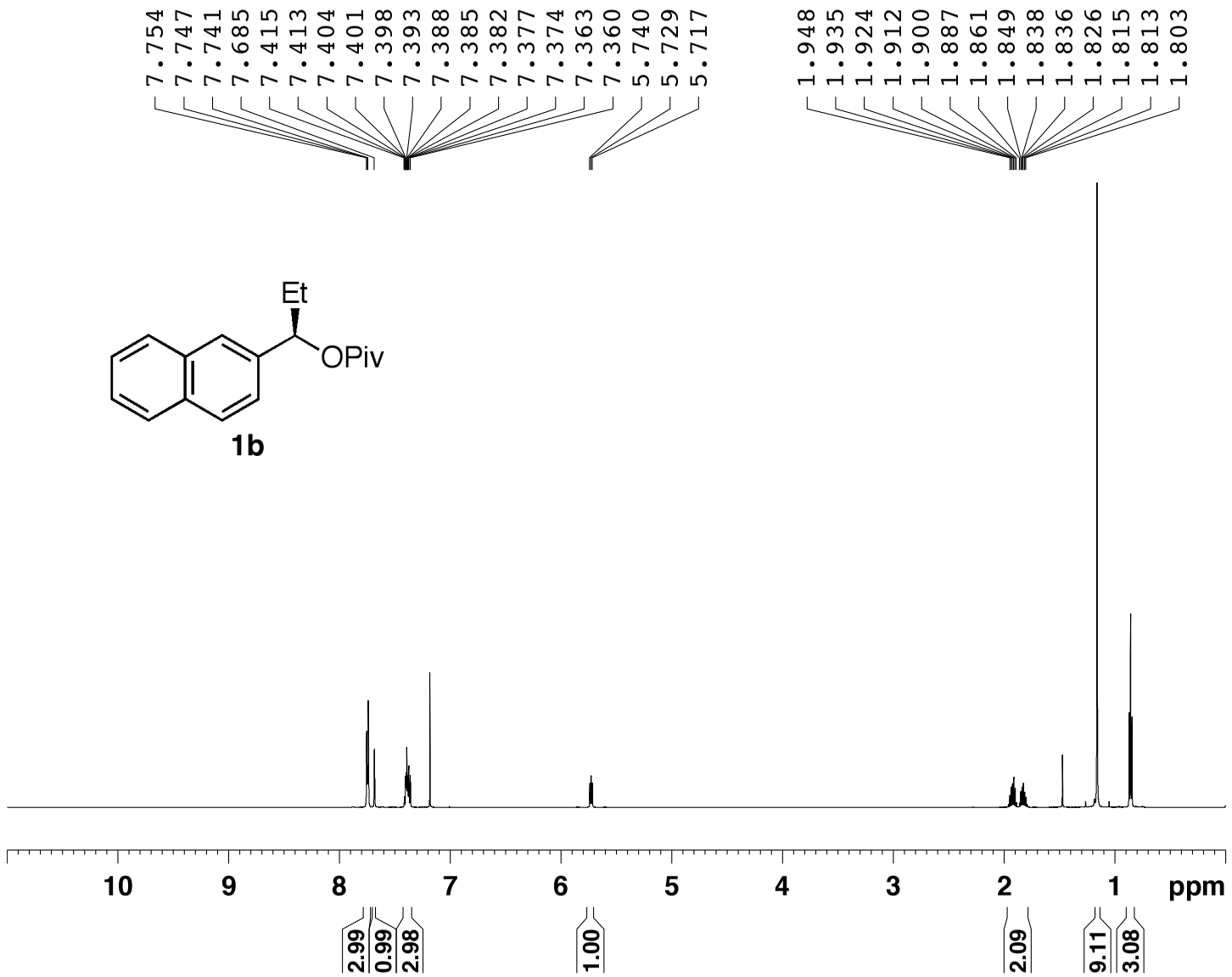
Compound 1a 13CNMR



BRUKER

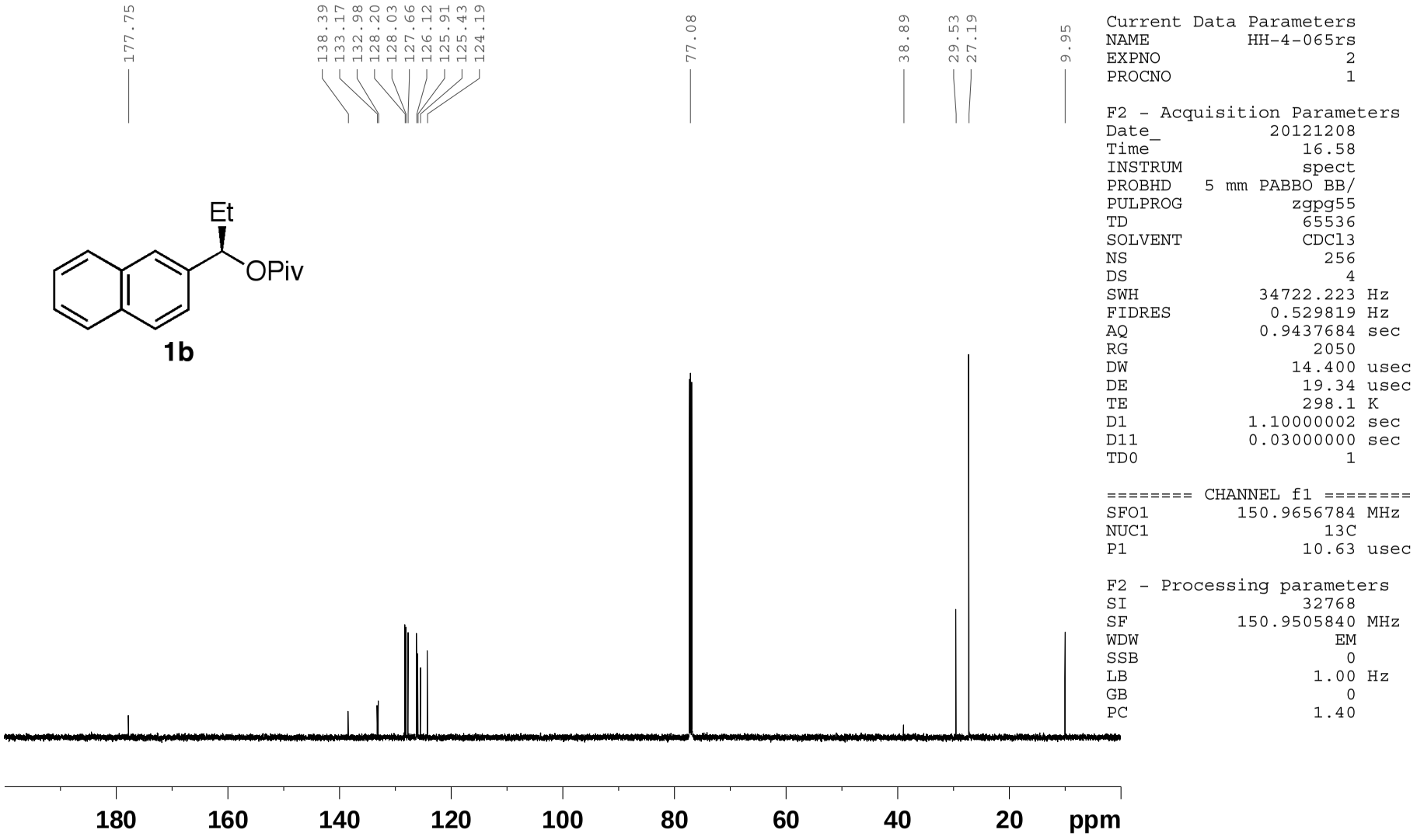
```
Current Data Parameters
NAME          methyl sub
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121125
Time               22.39
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg55
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE                8.88 usec
TE                298.1 K
D1           1.10000002 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1                13C
P1                9.00 usec

F2 - Processing parameters
SI                32768
SF          150.9505840 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 1b 1HNMR



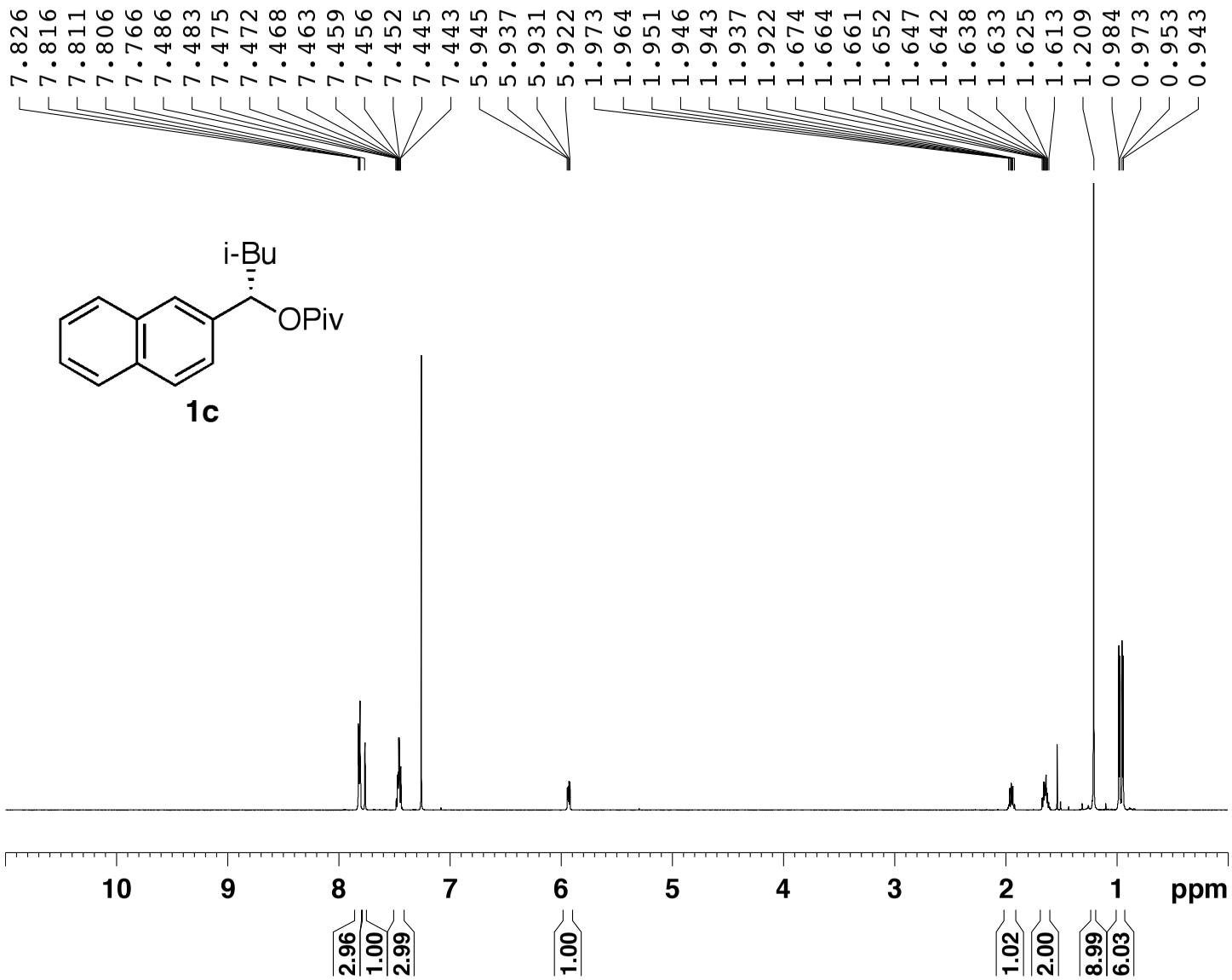

```
Current Data Parameters
NAME        HH-4-065rs_2
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121208
Time               16.48
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   144
DW                59.500 usec
DE                17.39 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                 10.77 usec

F2 - Processing parameters
SI                 65536
SF          600.3200619 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
```

Compound 1b 1HNMR



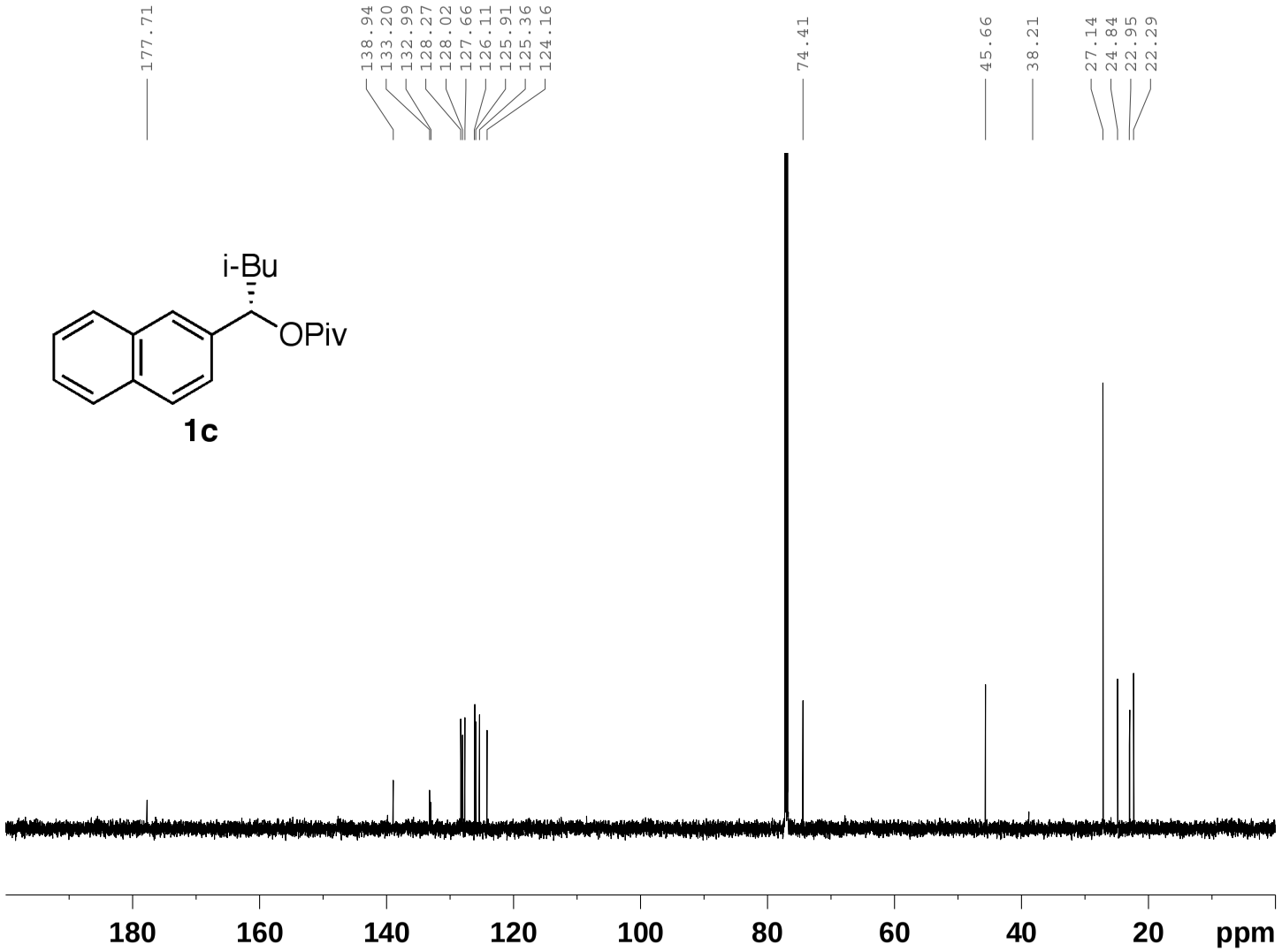

```
Current Data Parameters
NAME          HH-4-065rs
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121208
Time              16.58
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg55
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE               19.34 usec
TE               298.1 K
D1            1.10000002 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1               13C
P1               10.63 usec

F2 - Processing parameters
SI                32768
SF          150.9505840 MHz
WDW                EM
SSB                 0
LB               1.00 Hz
GB                  0
PC               1.40
```

Compound 1c 1HNMR




```
Current Data Parameters
NAME                  QZ-3-134
EXPNO                        1
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20121126
Time                     12.44
INSTRUM                  spect
PROBHD    5 mm PABBO BB-
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                           8
DS                           2
SWH                  8403.361 Hz
FIDRES               0.128225 Hz
AQ                   3.8994420 sec
RG                         322
DW                    59.500 usec
DE                     9.10 usec
TE                     298.1 K
D1                 1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1           600.3233018 MHz
NUC1                     1H
P1                    14.80 usec

F2 - Processing parameters
SI                       65536
SF             600.3200160 MHz
WDW                         EM
SSB                          0
LB                    0.30 Hz
GB                           0
PC                        1.00
```

Compound 1c 13CNMR



Current Data Parameters

NAME	QZ-3-134
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121126
Time	12.54
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg55
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	34722.223 Hz
FIDRES	0.529819 Hz
AQ	0.9437684 sec
RG	2050
DW	14.400 usec
DE	8.88 usec
TE	298.1 K
D1	1.10000002 sec
D11	0.03000000 sec
TD0	1

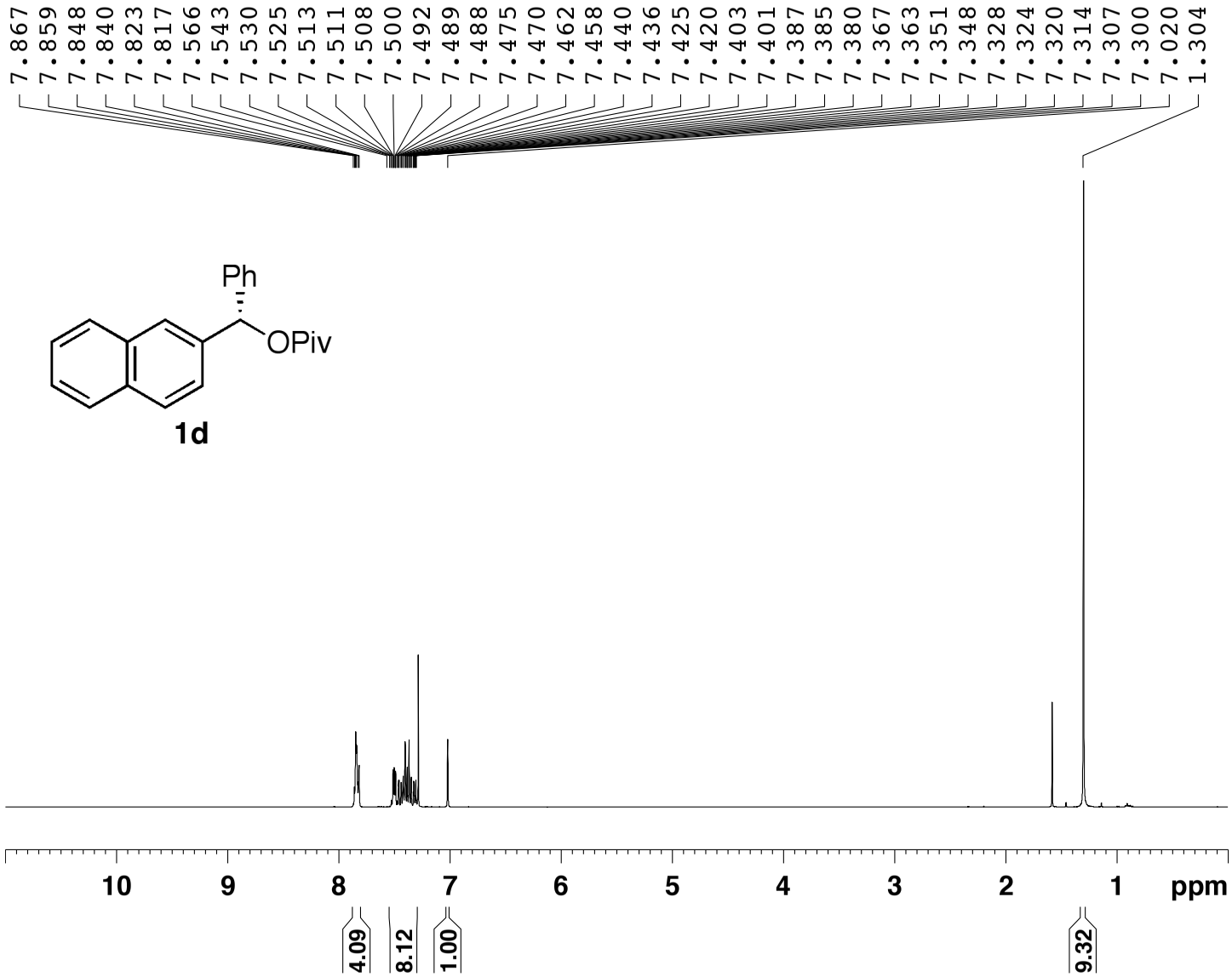
======== CHANNEL f1 ========

SFO1	150.9656784 MHz
NUC1	13C
P1	9.00 usec

F2 - Processing parameters

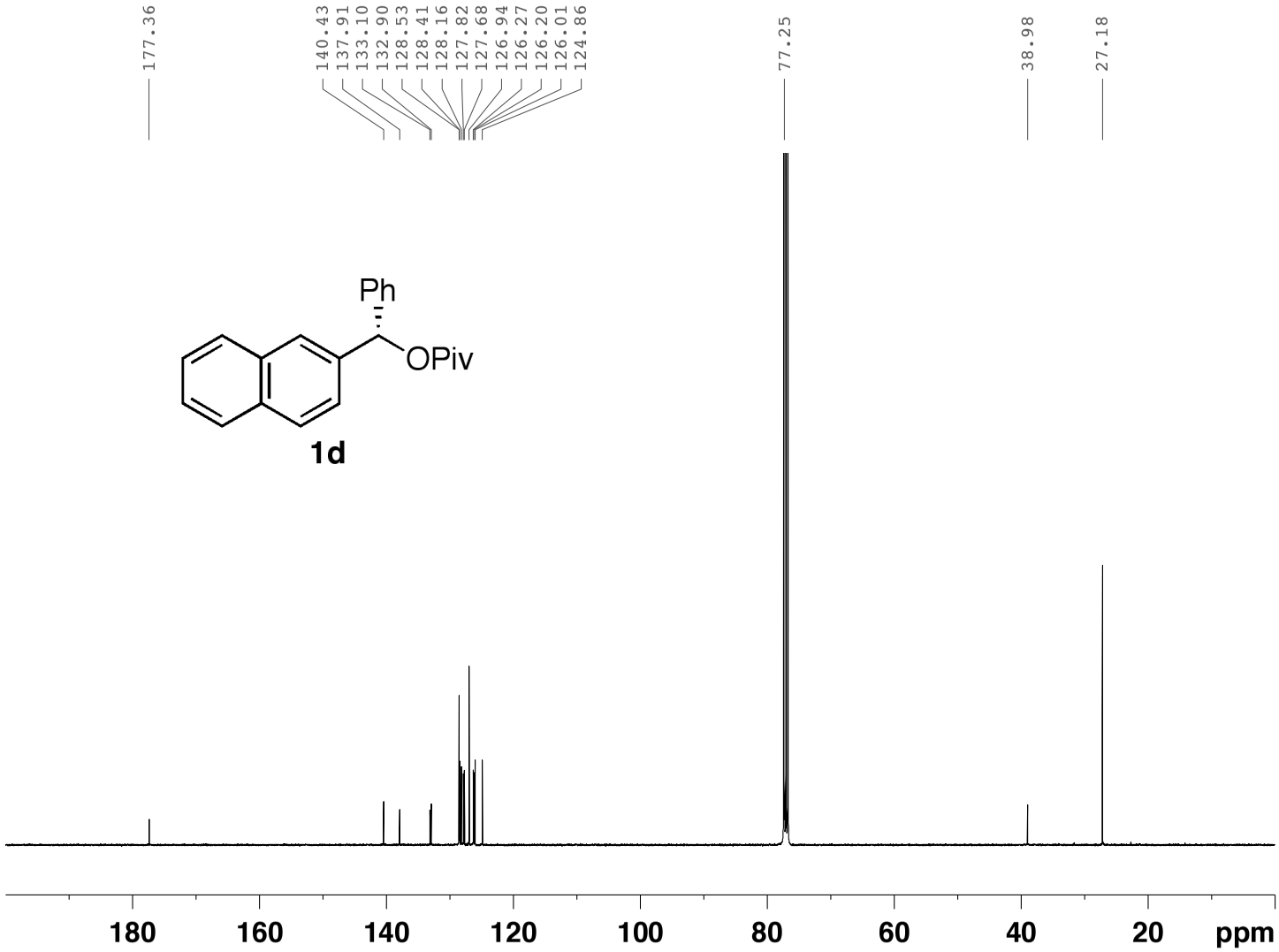
SI	32768
SF	150.9505840 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 1d, 1HNMR



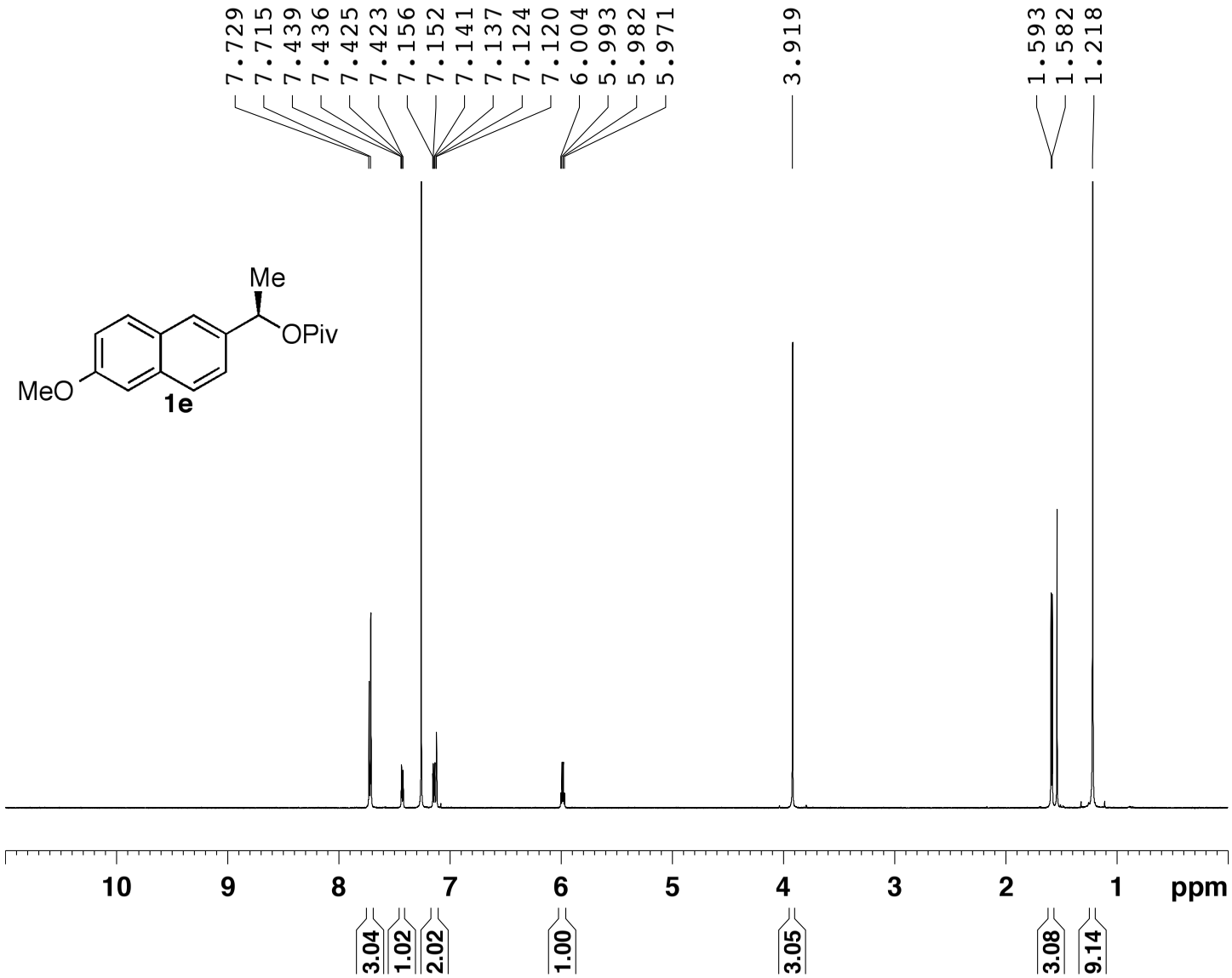

```
Current Data Parameters
NAME                  HH-3-266
EXPNO                        1
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20120914
Time                      9.42
INSTRUM                  spect
PROBHD    5 mm CPQNP 1H/
PULPROG                   zg30
TD                       65536
SOLVENT                  CDCl3
NS                          16
DS                           2
SWH                   8278.146 Hz
FIDRES                0.126314 Hz
AQ                    3.9584243 sec
RG                         11.3
DW                       60.400 usec
DE                        6.00 usec
TE                       298.2 K
D1                  1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                        1H
P1                       15.00 usec
PL1                       4.90 dB
PL1W                3.30822015 W
SFO1              400.1324710 MHz

F2 - Processing parameters
SI                       32768
SF                400.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

Compound 1d 13CNMR



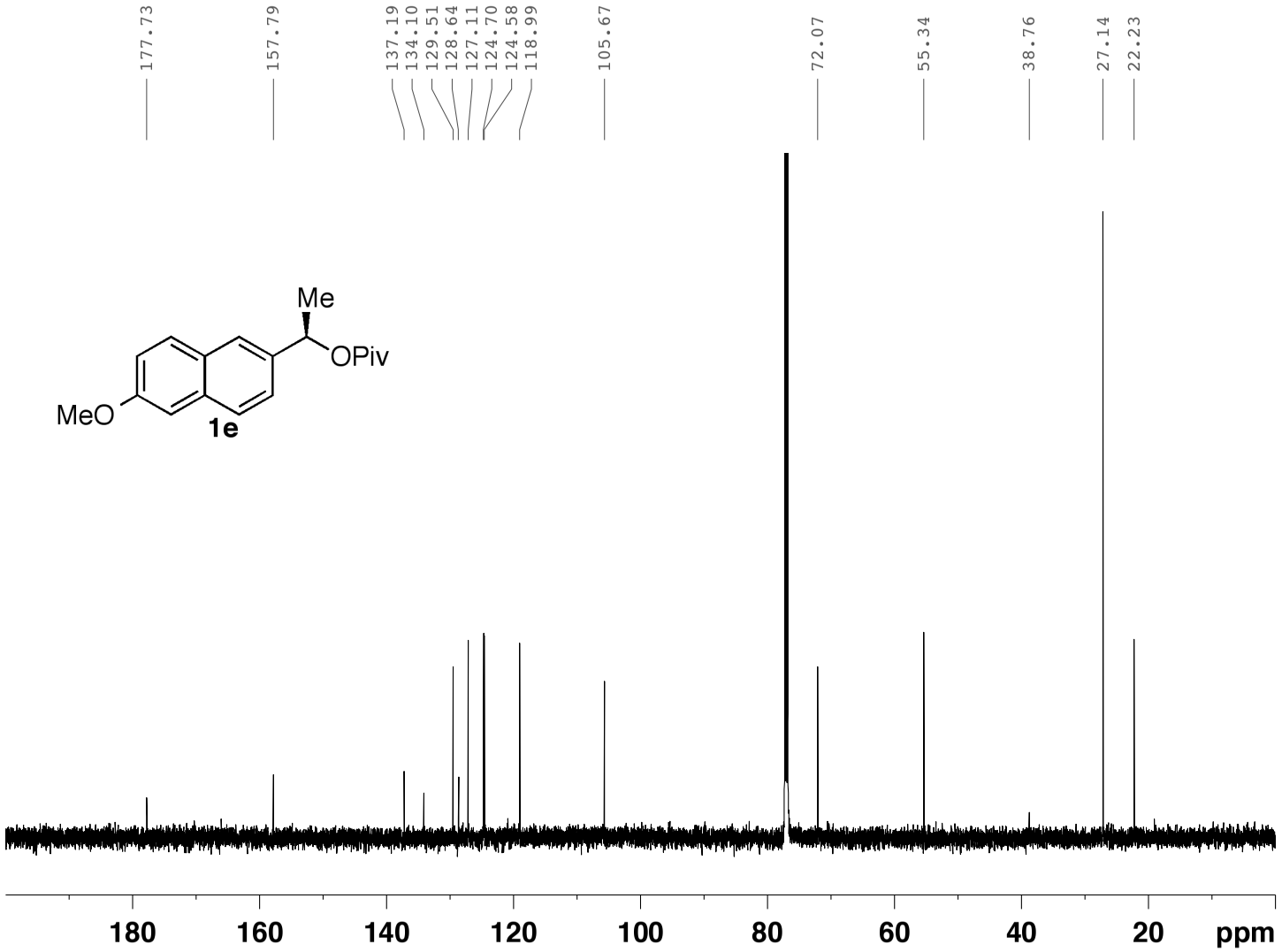

```
Current Data Parameters
NAME            HH-3-266
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120916
Time               14.48
INSTRUM            spect
PROBHD   5 mm CPQNP 1H/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           23980.814 Hz
FIDRES         0.365918 Hz
AQ             1.3664756 sec
RG                   512
DW                20.850 usec
DE                18.00 usec
TE                298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                 13C
P1                  9.25 usec
PL1                 0.55 dB
PL1W        35.18820572 W
SFO1        100.6228298 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2              90.00 usec
PL2                 4.90 dB
PL12               20.46 dB
PL13               21.00 dB
PL2W         3.30822015 W
PL12W        0.09195905 W
PL13W        0.08120718 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127690 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```

Compound 1e 1HNMR




```
Current Data Parameters
NAME        6methoxy piv
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121125
Time              18.34
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                    8
DS                    2
SWH            8403.361 Hz
FIDRES         0.128225 Hz
AQ             3.8994420 sec
RG                  406
DW                59.500 usec
DE                 9.10 usec
TE                298.1 K
D1           1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        600.3233018 MHz
NUC1                   1H
P1                14.80 usec

F2 - Processing parameters
SI                65536
SF          600.3200157 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

Compound 1e 13CNMR



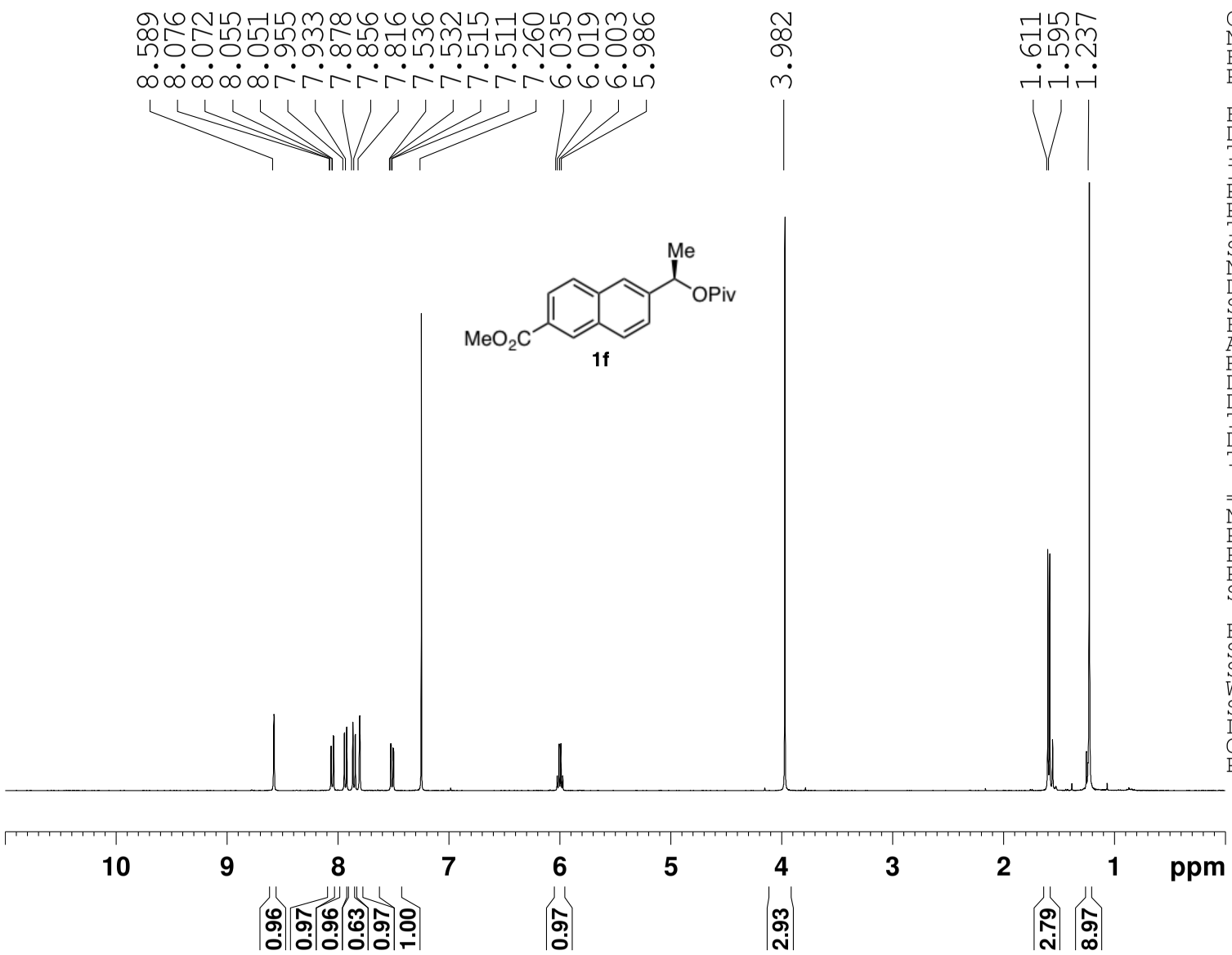
Current Data Parameters
NAME 6methoxy piv
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121125
Time 23.58
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 2048
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 8.88 usec
TE 298.1 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 9.00 usec

F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

compound 1f 1HNMR



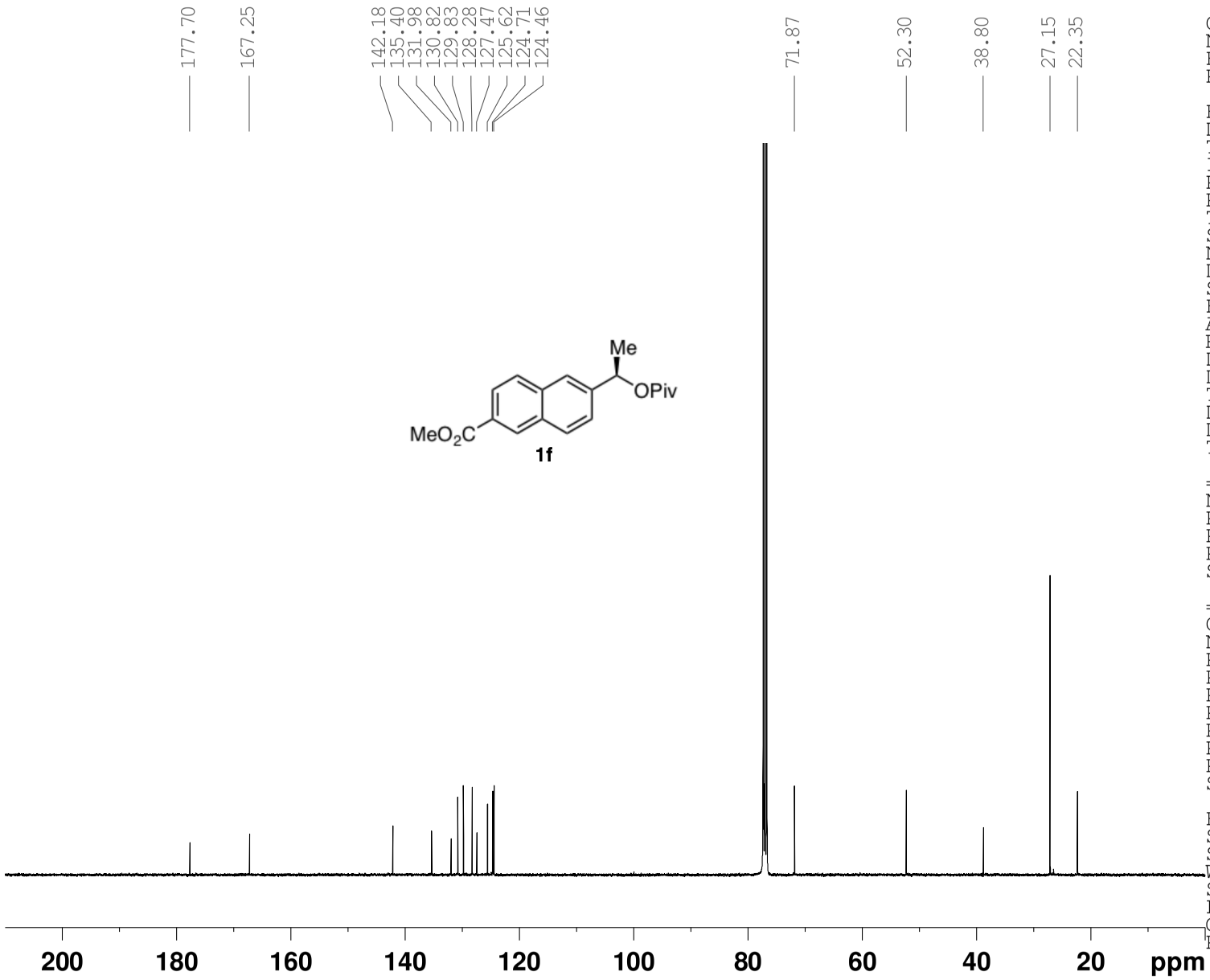
Current Data Parameters
NAME HH-4-140
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130122
Time 15.23
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 9
DW 60.400 usec
DE 6.00 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 4.90 dB
PL1W 3.30822015 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 32768
SF 400.1300140 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

compound 1f 13CNMR



Current Data Parameters

NAME	HH-4-140
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20130123
Time	1.17
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.2 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

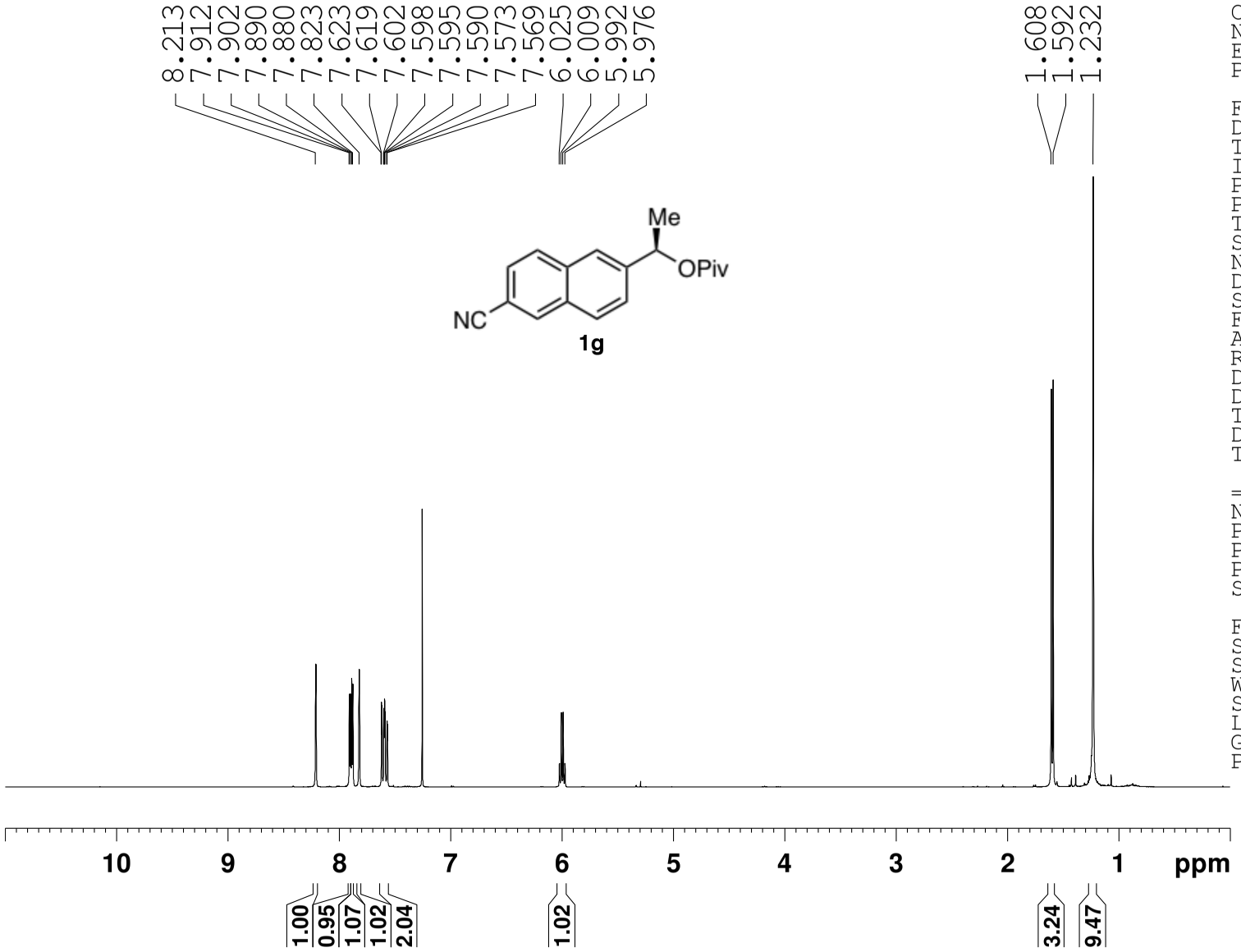
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

compound 1g 1HNMR



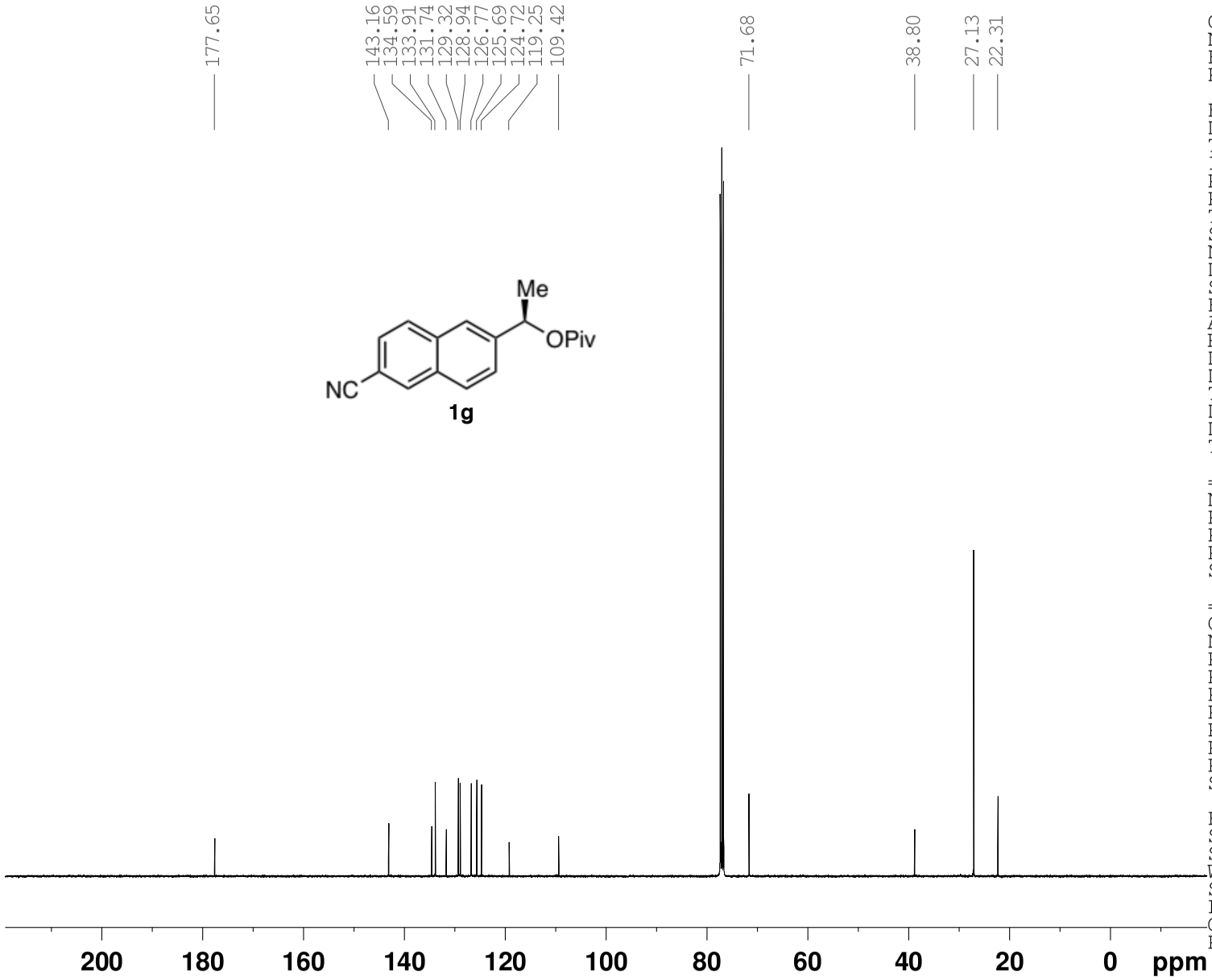
Current Data Parameters
NAME HH-4-142
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130124
Time 0.23
INSTRUM spect
PROBHD 5 mm CPQNP 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8278.146 Hz
FIDRES 0.126314 Hz
AQ 3.9584243 sec
RG 12.7
DW 60.400 usec
DE 6.00 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 15.00 usec
PL1 4.90 dB
PL1W 3.30822015 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 32768
SF 400.1300111 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

compound 1g 13CNMR



Current Data Parameters

NAME	HH-4-142
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20130124
Time	0.39
INSTRUM	spect
PROBHD	5 mm CPQNP 1H/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	23980.814 Hz
FIDRES	0.365918 Hz
AQ	1.3664756 sec
RG	512
DW	20.850 usec
DE	18.00 usec
TE	298.2 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1

======== CHANNEL f1 ========

NUC1	13C
P1	9.25 usec
PL1	0.55 dB
PL1W	35.18820572 W
SFO1	100.6228298 MHz

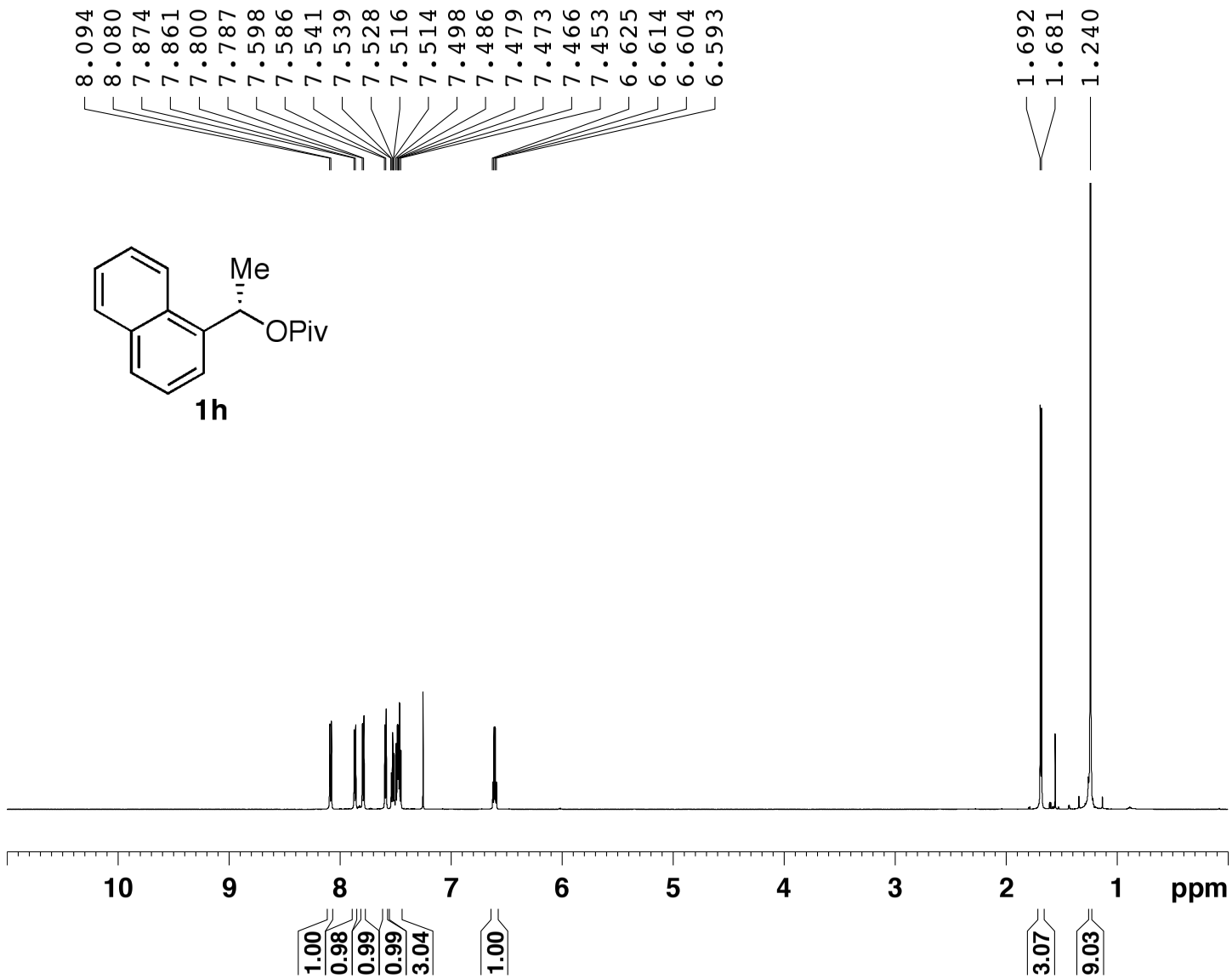
======== CHANNEL f2 ========

CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	4.90 dB
PL12	20.46 dB
PL13	21.00 dB
PL2W	3.30822015 W
PL12W	0.09195905 W
PL13W	0.08120718 W
SFO2	400.1316005 MHz

F2 - Processing parameters

SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Compound 1h 1HNMR



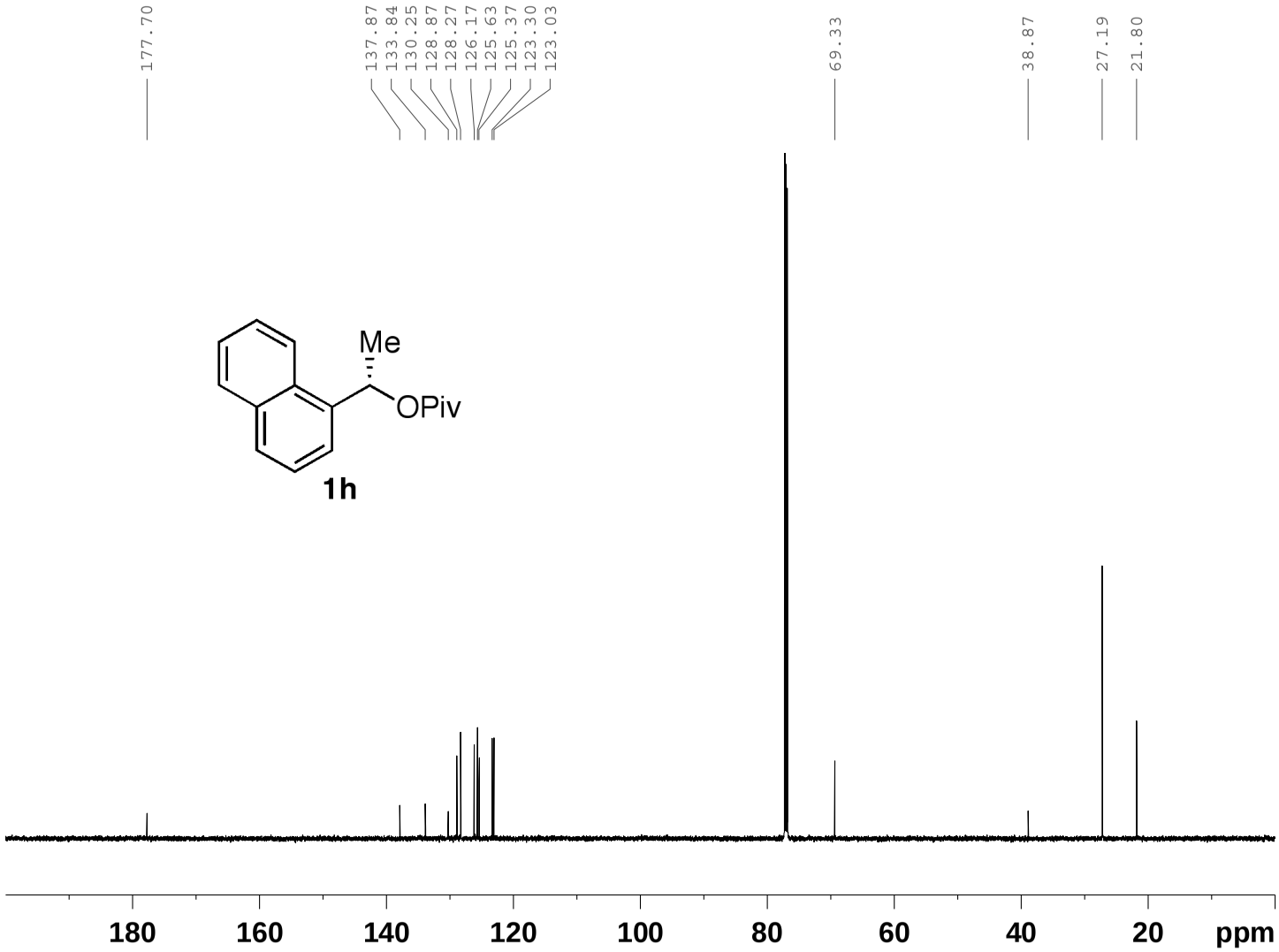
Current Data Parameters
NAME QZ-Compound 1f 1HNMR
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121210
Time 9.04
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 90.5
DW 59.500 usec
DE 17.39 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 10.77 usec

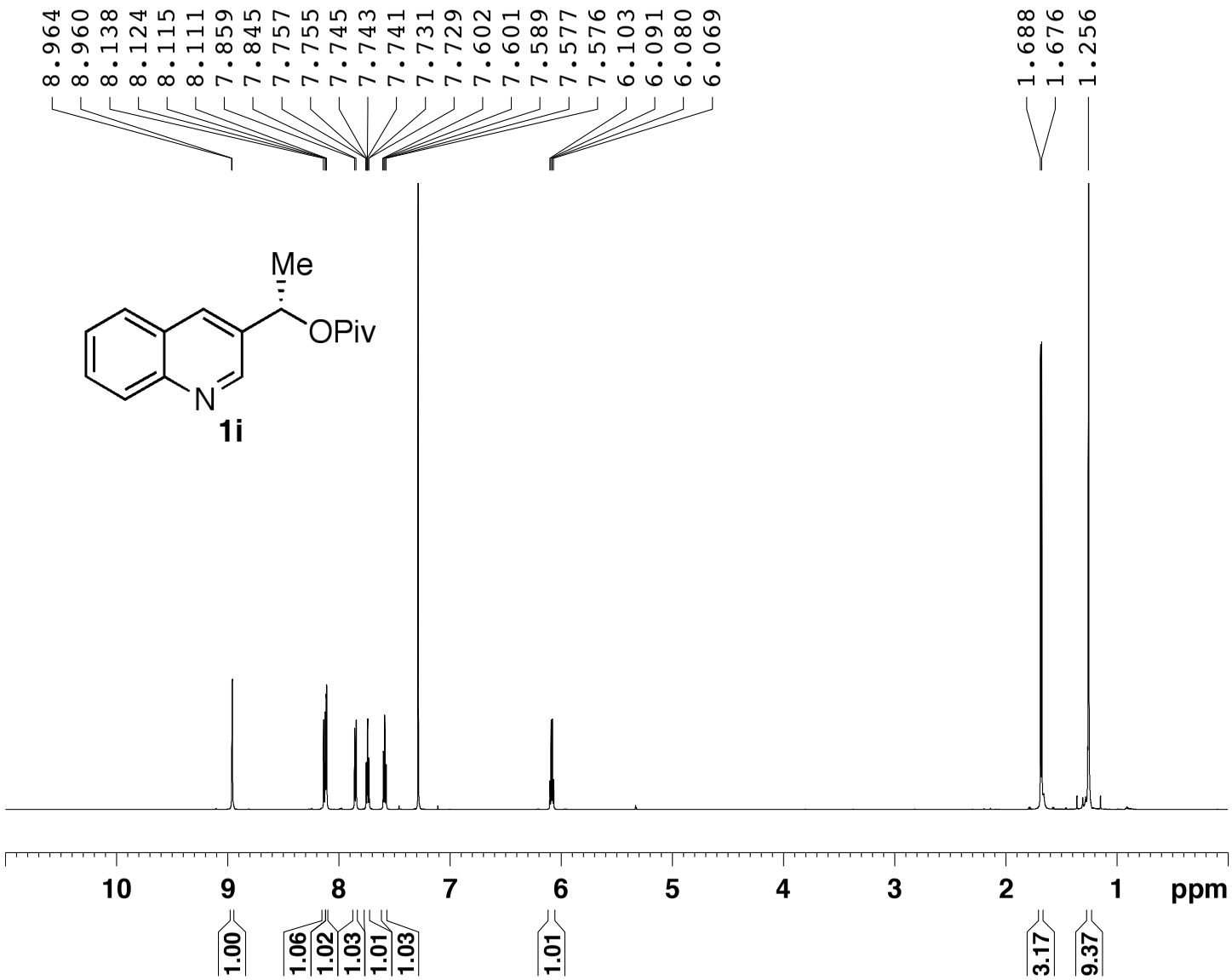
F2 - Processing parameters
SI 65536
SF 600.3200200 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

Compound 1h 13CNMR



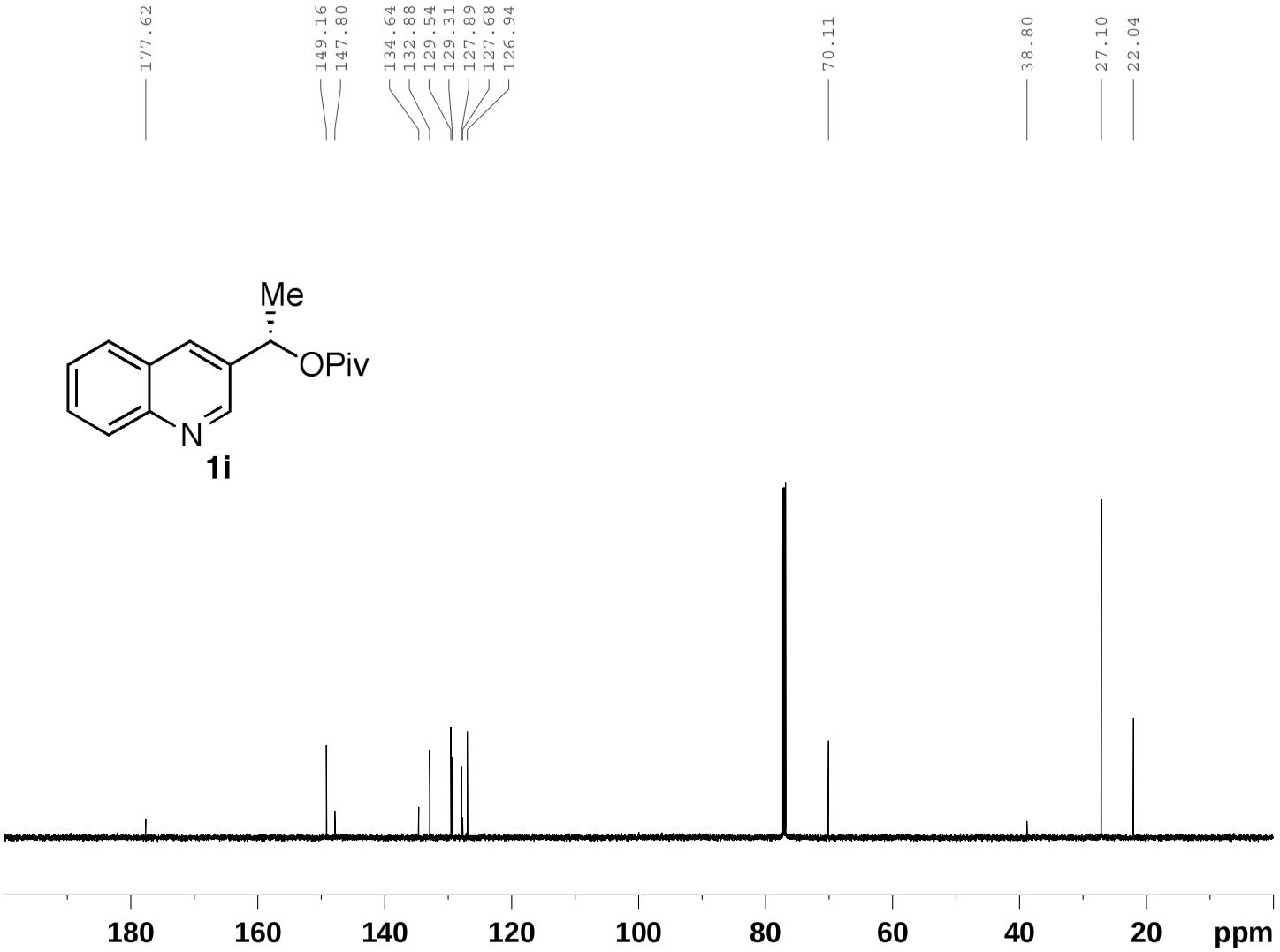

```
Current Data Parameters
NAME                  HH-4-077
EXPNO                        3
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20121129
Time                     20.50
INSTRUM                  spect
PROBHD    5 mm PABBO BB-
PULPROG                 zgpg55
TD                       65536
SOLVENT                  CDCl3
NS                        2048
DS                           4
SWH                 34722.223 Hz
FIDRES               0.529819 Hz
AQ                   0.9437684 sec
RG                        1030
DW                      14.400 usec
DE                       8.88 usec
TE                      298.1 K
D1                  1.10000002 sec
D11                 0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1               150.9656784 MHz
NUC1                       13C
P1                        9.00 usec

F2 - Processing parameters
SI                       32768
SF                 150.9505840 MHz
WDW                         EM
SSB                          0
LB                        1.00 Hz
GB                           0
PC                        1.40
```

Compound 1i 1HNMR




```
Current Data Parameters
NAME          QZ-2-290-2
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121203
Time               22.51
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   161
DW                59.500 usec
DE                17.39 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                 10.77 usec

F2 - Processing parameters
SI                 65536
SF          600.3200000 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
```

Compound **1i** 13CNMR



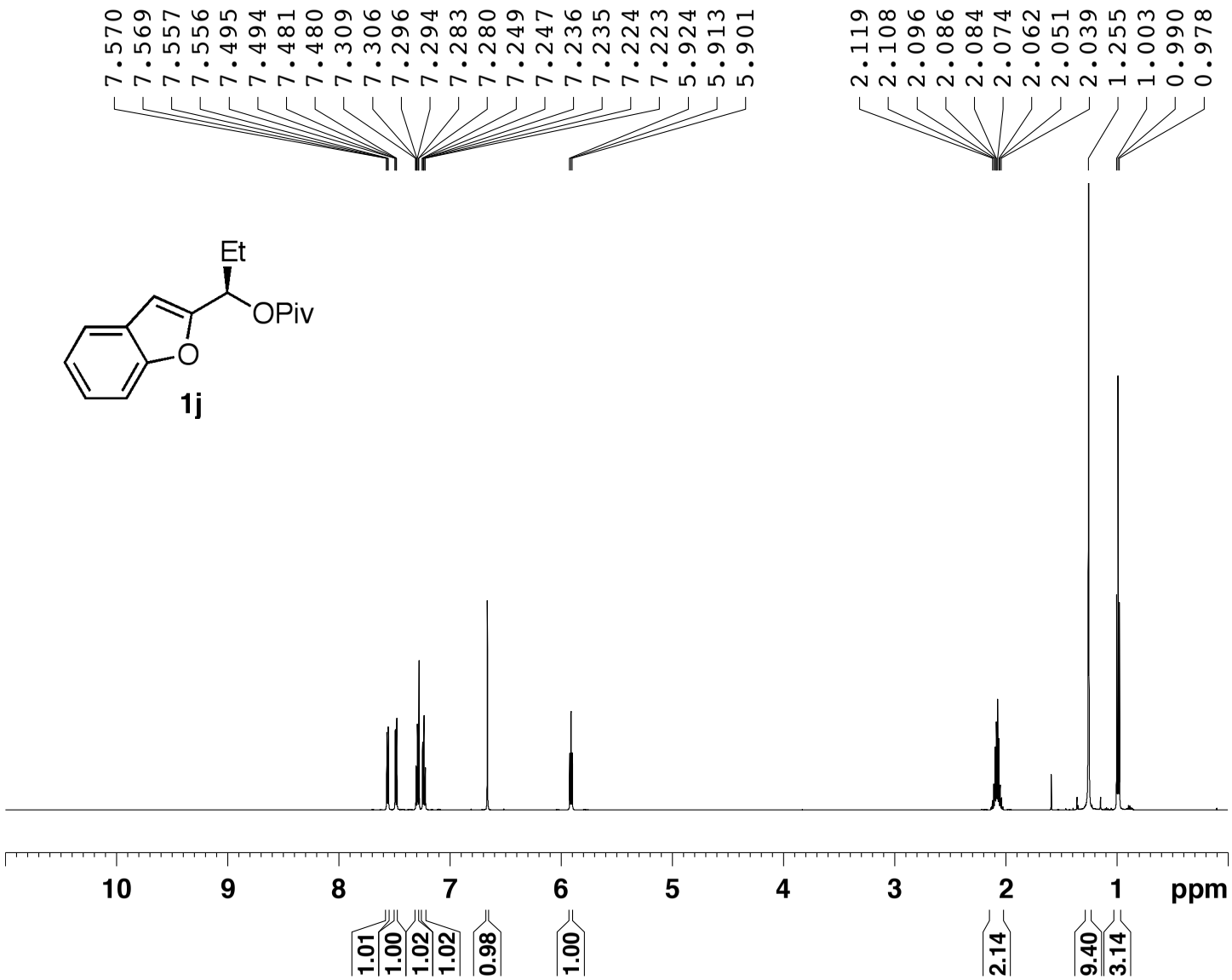
Current Data Parameters
NAME QZ-2-290-2
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121203
Time 23.01
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 19.34 usec
TE 298.1 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 10.63 usec

F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Compound 1j 1HNMR



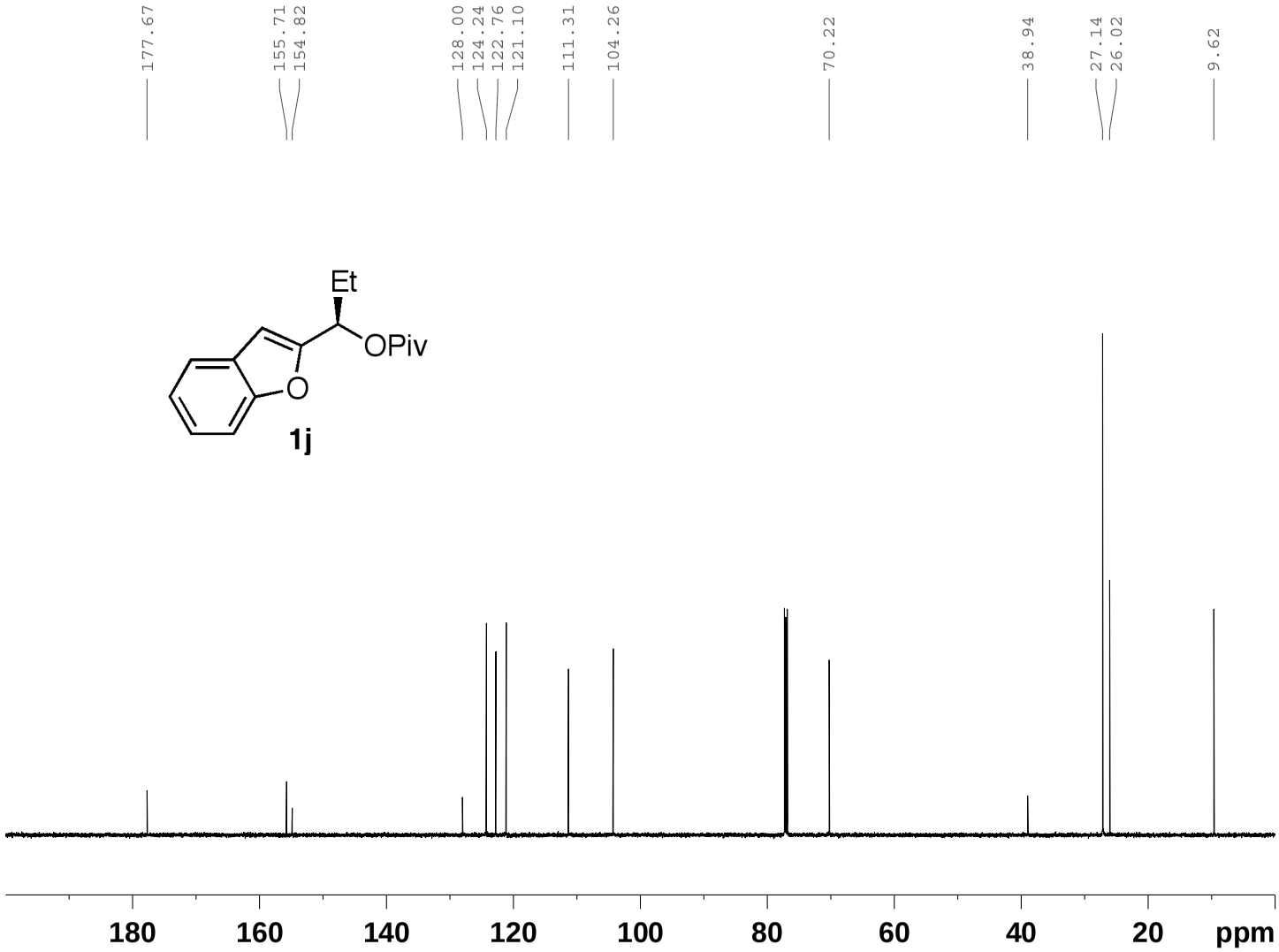
Current Data Parameters
NAME QZ-Compound-1h
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20121209
Time 12.06
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 57
DW 59.500 usec
DE 17.39 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 10.77 usec

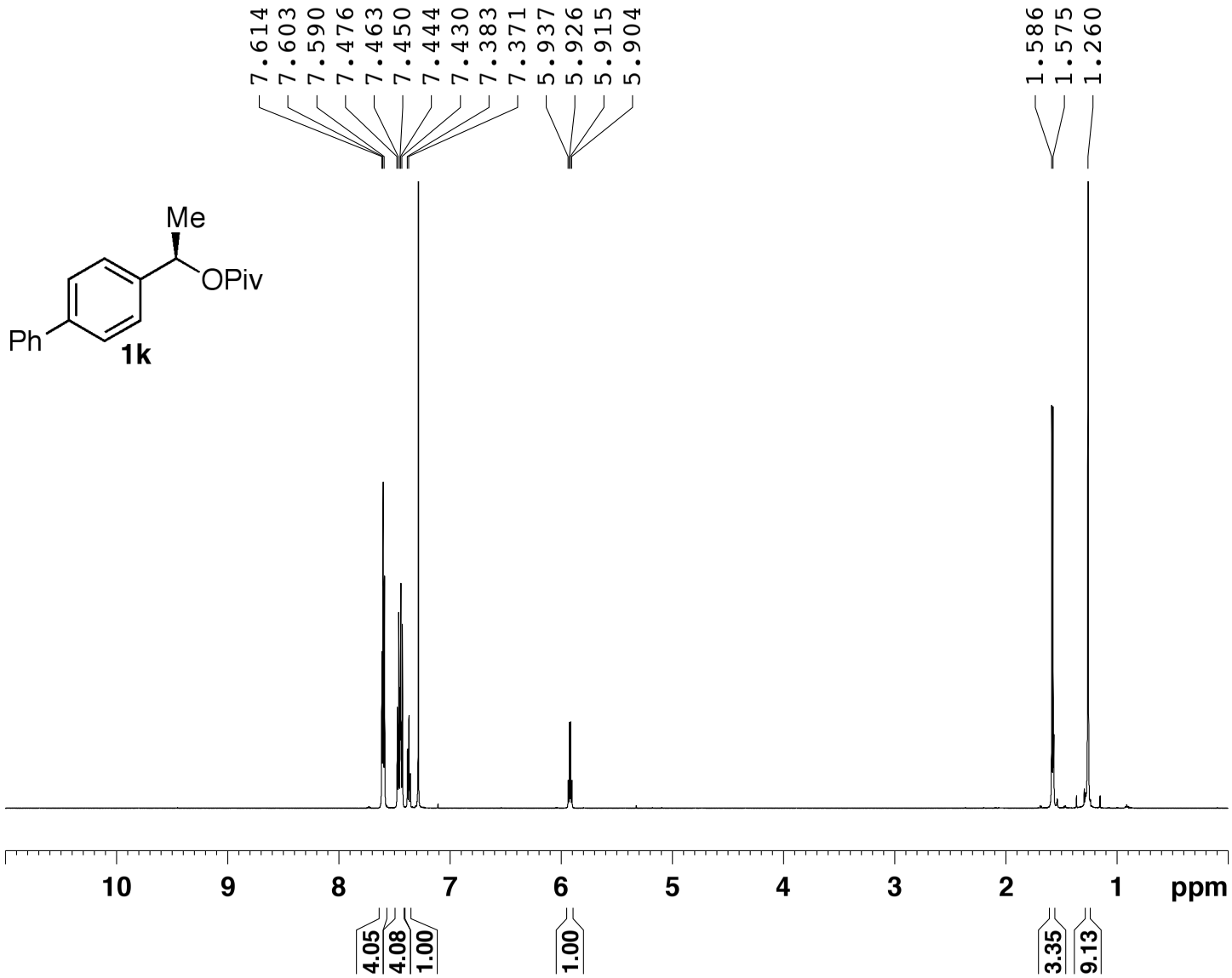
F2 - Processing parameters
SI 65536
SF 600.3200046 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

Compound 1j 13CNMR



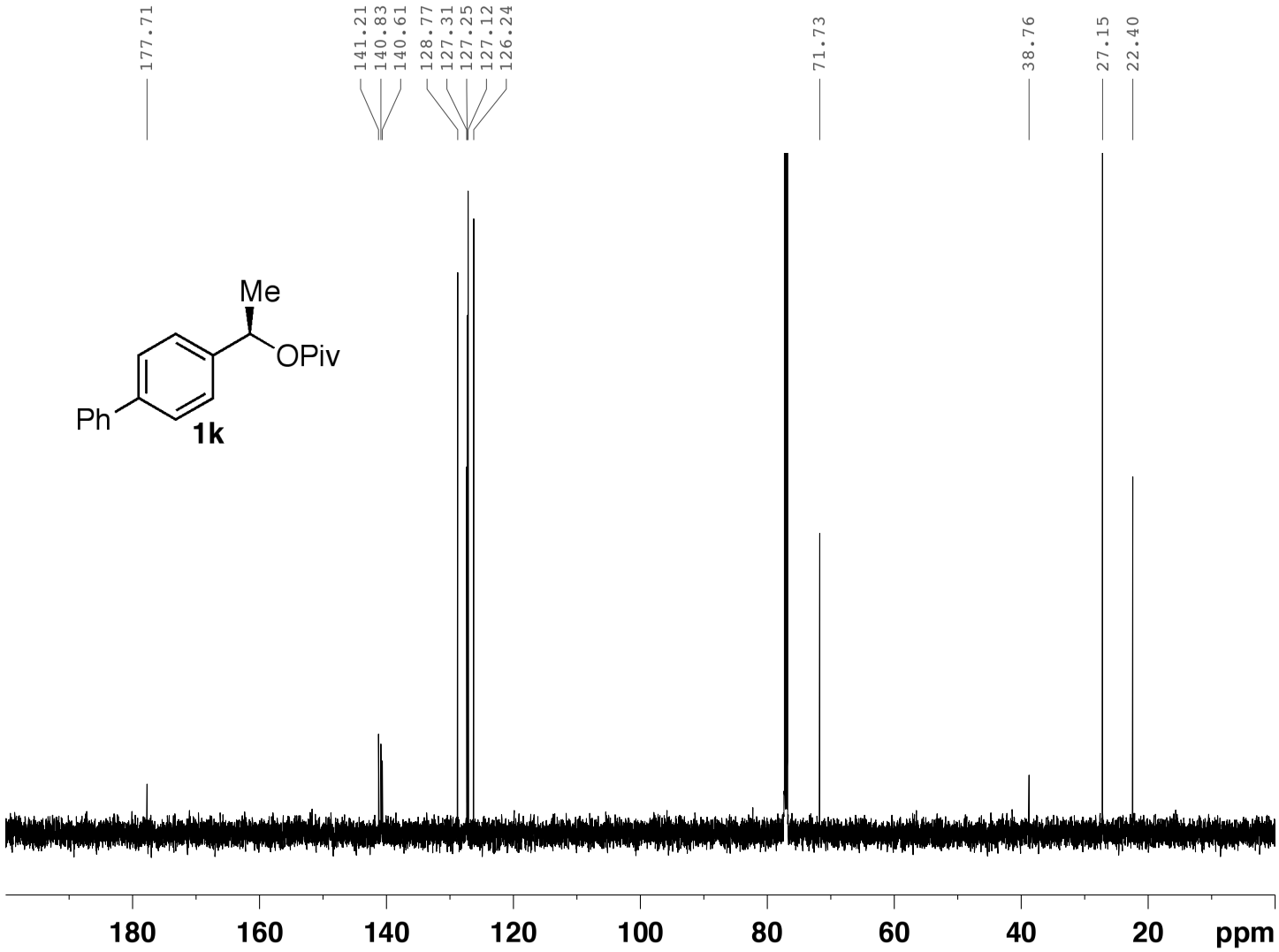

```
Current Data Parameters
NAME      QZ-Compound-1h
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121209
Time               12.16
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg55
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE               19.34 usec
TE               298.1 K
D1            1.10000002 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1                13C
P1                10.63 usec

F2 - Processing parameters
SI                32768
SF          150.9505840 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

Compound 1k 1HNMR




```
Current Data Parameters
NAME          QZ-3-145-1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121201
Time              17.19
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                    8
DS                    2
SWH            8403.361 Hz
FIDRES         0.128225 Hz
AQ             3.8994420 sec
RG                  287
DW                59.500 usec
DE                 9.10 usec
TE                298.1 K
D1           1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        600.3233018 MHz
NUC1                  1H
P1                14.80 usec

F2 - Processing parameters
SI                65536
SF          600.3200000 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

Compound 1k 13CNMR



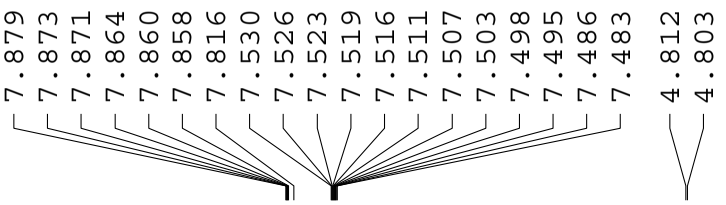
Current Data Parameters
NAME QZ-3-145-1
EXPNO 2
PROCNO 1

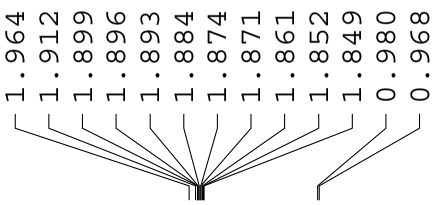
F2 - Acquisition Parameters
Date_ 20121201
Time 17.29
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 8.88 usec
TE 298.1 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

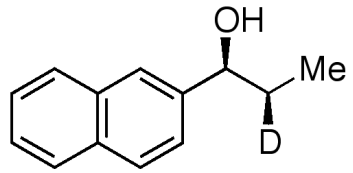
======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 9.00 usec

F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

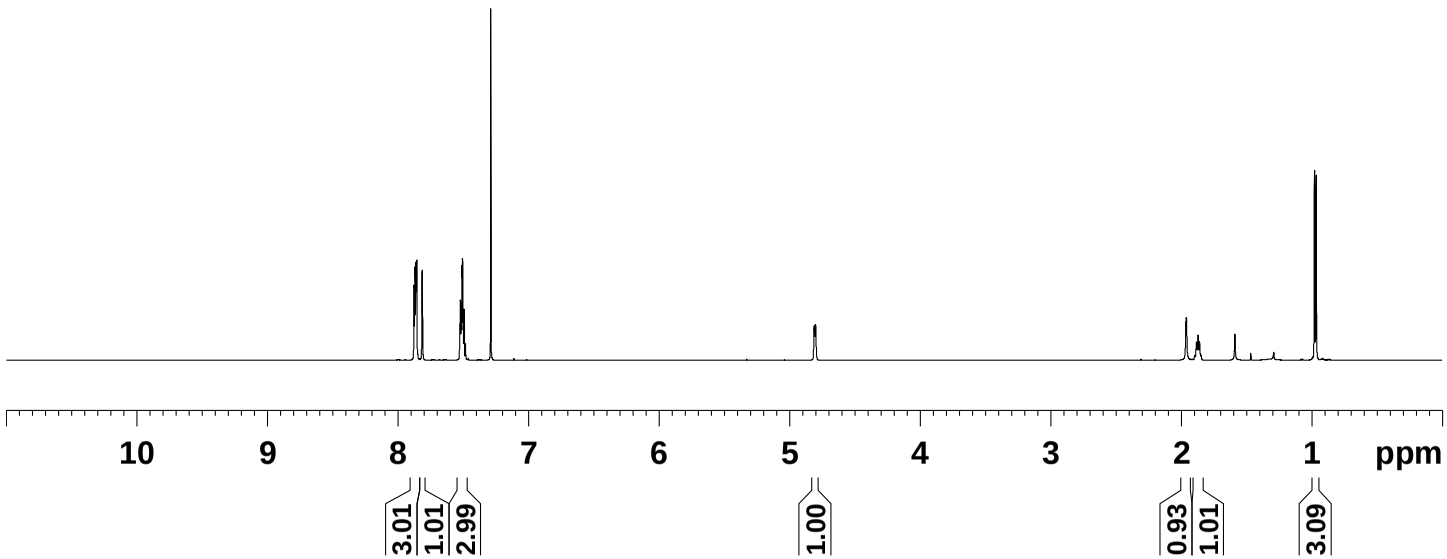
Compoung **S-6** 1H NMR





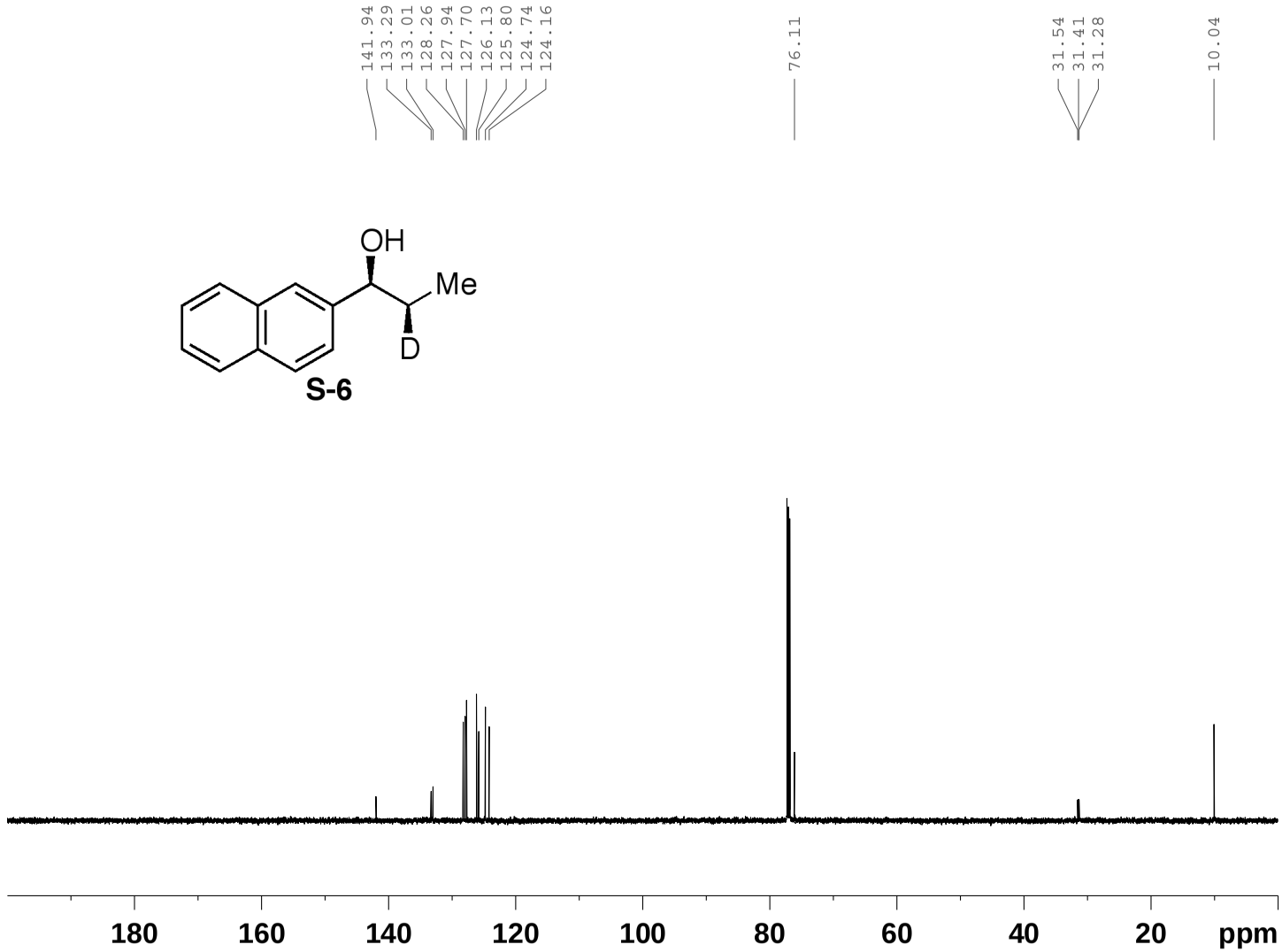


S-6



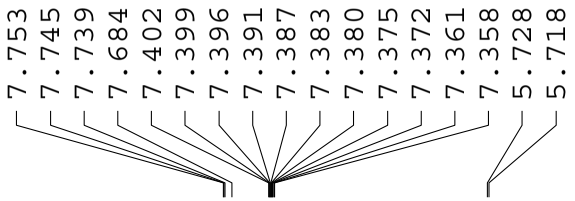

```
Current Data Parameters
NAME          QZ-3-132-1
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121203
Time               22.38
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   144
DW                59.500 usec
DE                17.39 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                 10.77 usec

F2 - Processing parameters
SI                 65536
SF           600.3199982 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
```

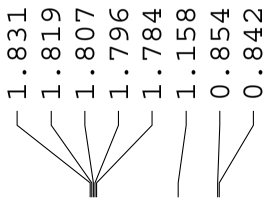
Compound **S-6** 13C NMR

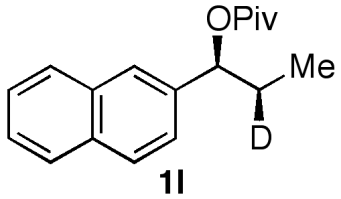



```
Current Data Parameters
NAME          QZ-3-132-1
EXPNO                  4
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121203
Time              22.48
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg55
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           34722.223 Hz
FIDRES         0.529819 Hz
AQ            0.9437684 sec
RG                 2050
DW               14.400 usec
DE               19.34 usec
TE               298.1 K
D1            1.10000002 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        150.9656784 MHz
NUC1                13C
P1                10.63 usec

F2 - Processing parameters
SI                 32768
SF          150.9505840 MHz
WDW                   EM
SSB                    0
LB                1.00 Hz
GB                     0
PC                1.40
```

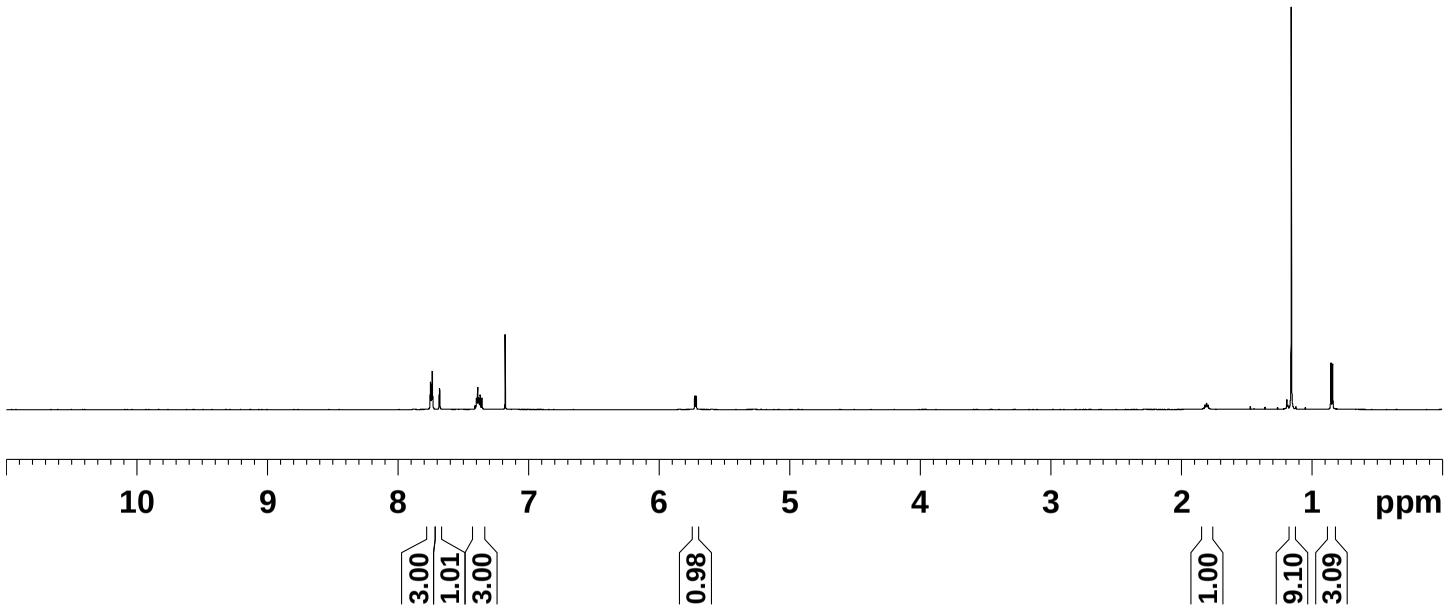
Compound 1l 1HNMR





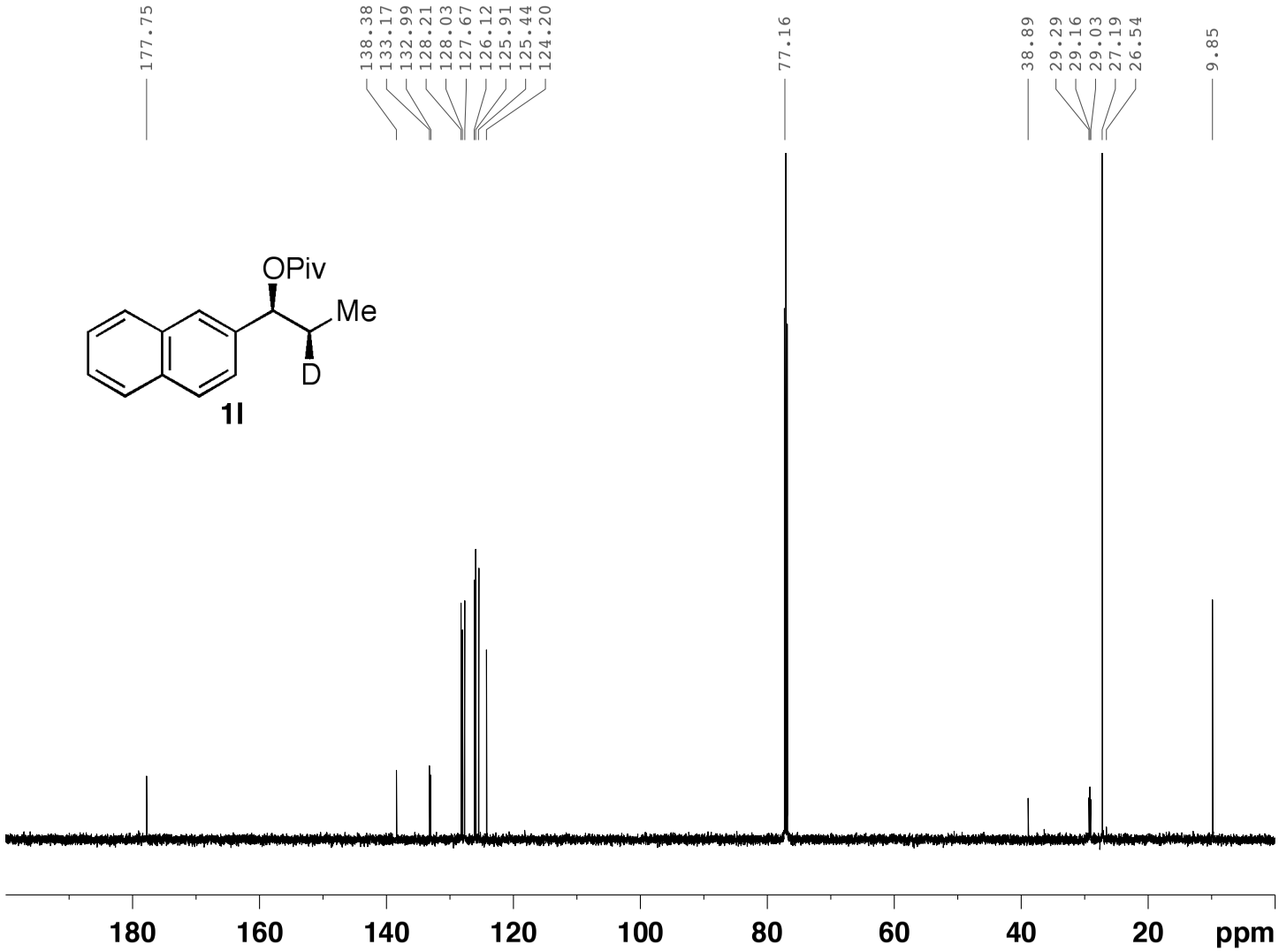


1l




```
Current Data Parameters
NAME          QZ-3-156-1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121205
Time               15.54
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     2
SWH             8403.361 Hz
FIDRES          0.128225 Hz
AQ              3.8994420 sec
RG                   114
DW                59.500 usec
DE                17.39 usec
TE                298.1 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.3233018 MHz
NUC1                   1H
P1                10.77 usec

F2 - Processing parameters
SI                 65536
SF           600.3200641 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                1.00
```

Compound 1l 13CNMR



Current Data Parameters

NAME	QZ-3-156-1
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20121205
Time	16.04
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zgpg55
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	34722.223 Hz
FIDRES	0.529819 Hz
AQ	0.9437684 sec
RG	2050
DW	14.400 usec
DE	19.34 usec
TE	298.1 K
D1	1.10000002 sec
D11	0.03000000 sec
TD0	1

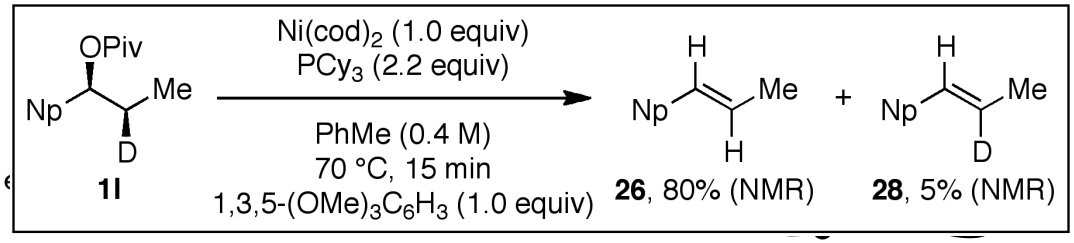
======== CHANNEL f1 ========

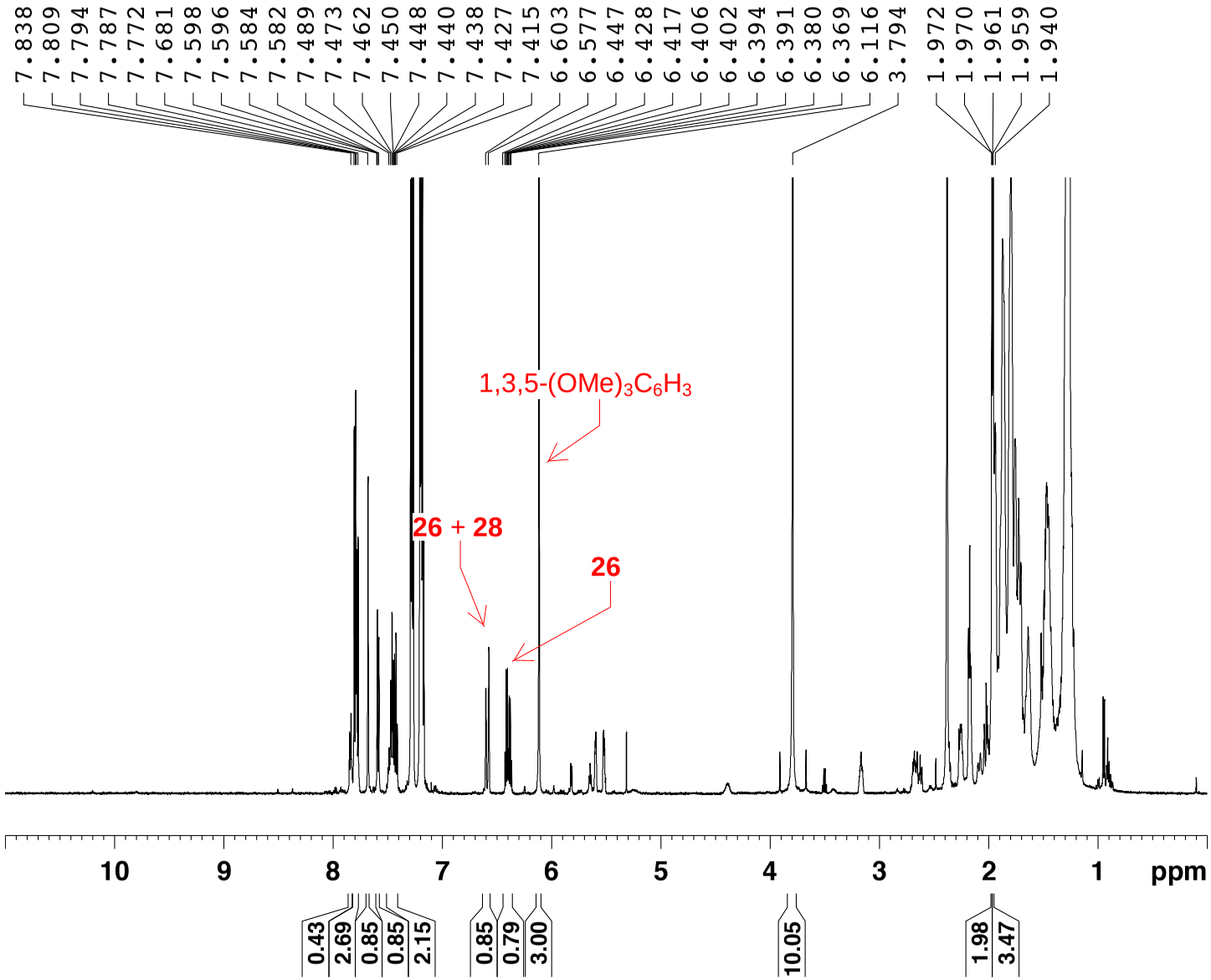
SFO1	150.9656784 MHz
NUC1	13C
P1	10.63 usec

F2 - Processing parameters

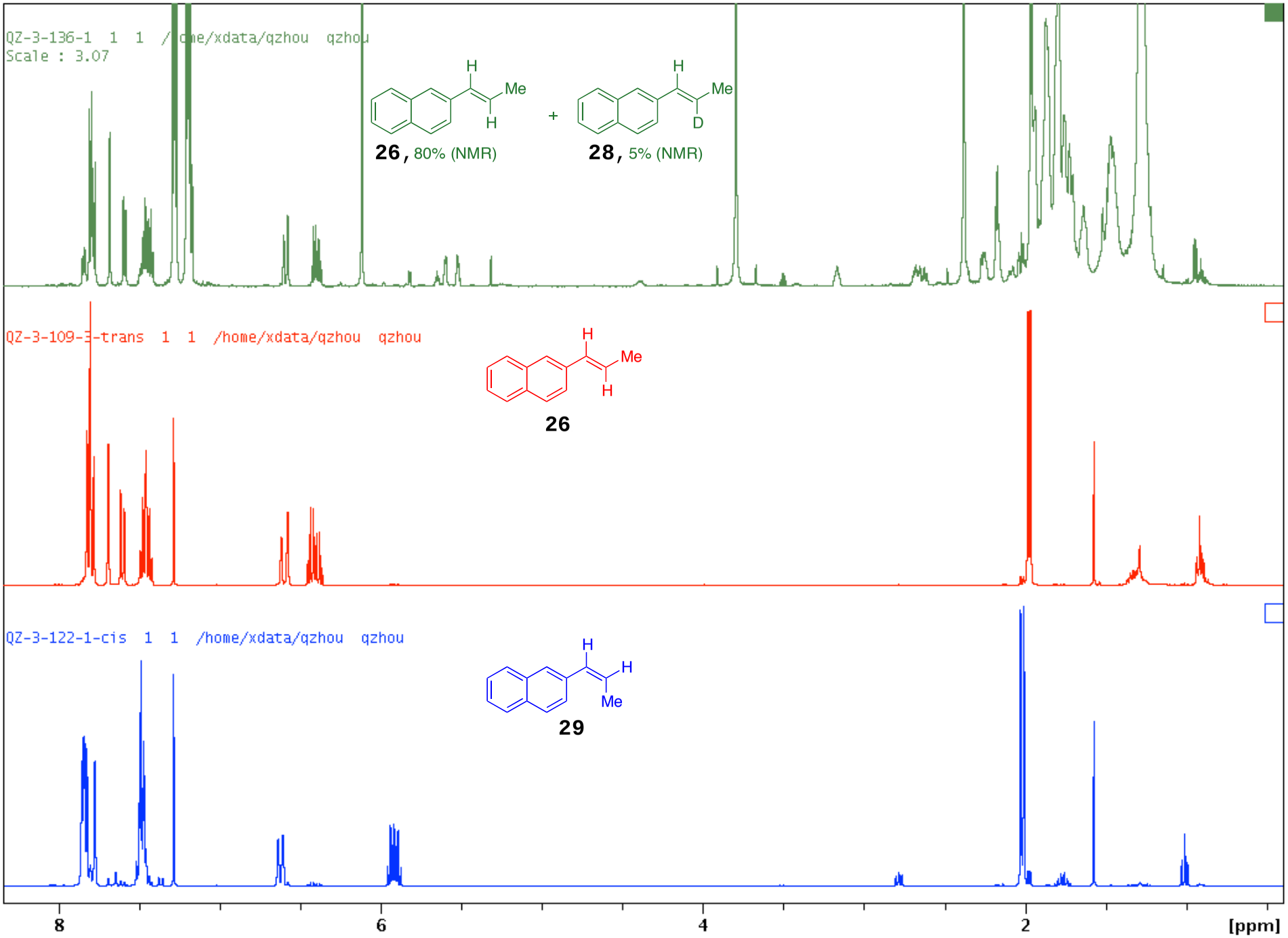
SI	32768
SF	150.9505840 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

Crude 1HNMR for beta-hydride elimination e

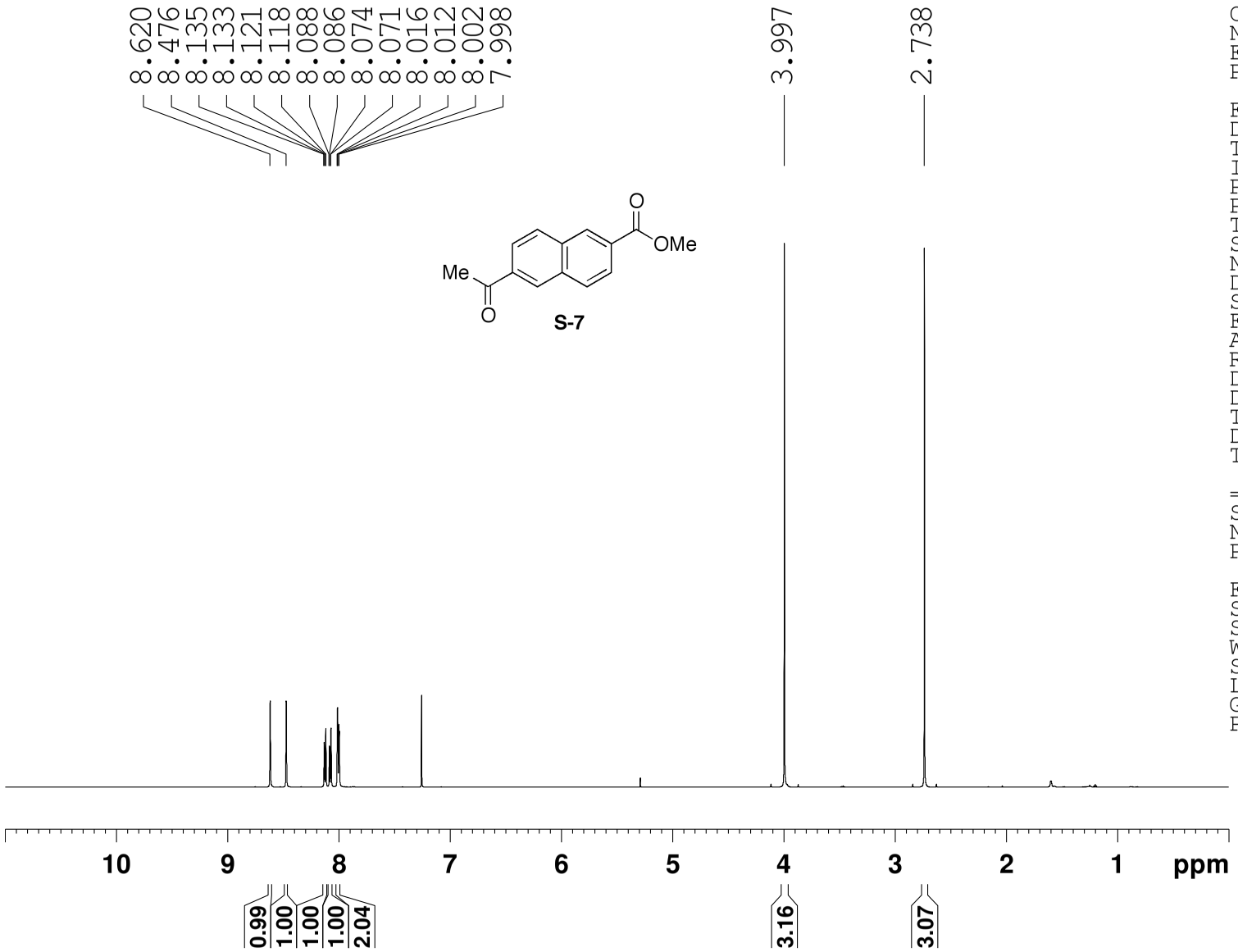





```
Current Data Parameters
NAME          QZ-3-136-1
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121125
Time              22.43
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                    8
DS                    2
SWH            8403.361 Hz
FIDRES         0.128225 Hz
AQ             3.8994420 sec
RG                  144
DW               59.500 usec
DE                9.10 usec
TE                298.1 K
D1            1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        600.3233018 MHz
NUC1                1H
P1                14.80 usec

F2 - Processing parameters
SI                65536
SF          600.3200037 MHz
WDW                 EM
SSB                 0
LB               0.30 Hz
GB                  0
PC               1.00
```


QZ-3-136-1 1 1 / me/xdata/qzhou qzhou
Scale : 3.07
H
Me
H
+
H
Me
D
26, 80% (NMR)
28, 5% (NMR)
QZ-3-109-3-trans 1 1 /home/xdata/qzhou qzhou
H
Me
H
26
QZ-3-122-1-cis 1 1 /home/xdata/qzhou qzhou
H
H
Me
29
8
6
4
2
[ppm]

compound S-7 1HNMR



Current Data Parameters

NAME	HH-4-136
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	20130120
Time	10.12
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	2
SWH	8403.361 Hz
FIDRES	0.128225 Hz
AQ	3.8994420 sec
RG	128
DW	59.500 usec
DE	17.39 usec
TE	300.0 K
D1	1.00000000 sec
TD0	1

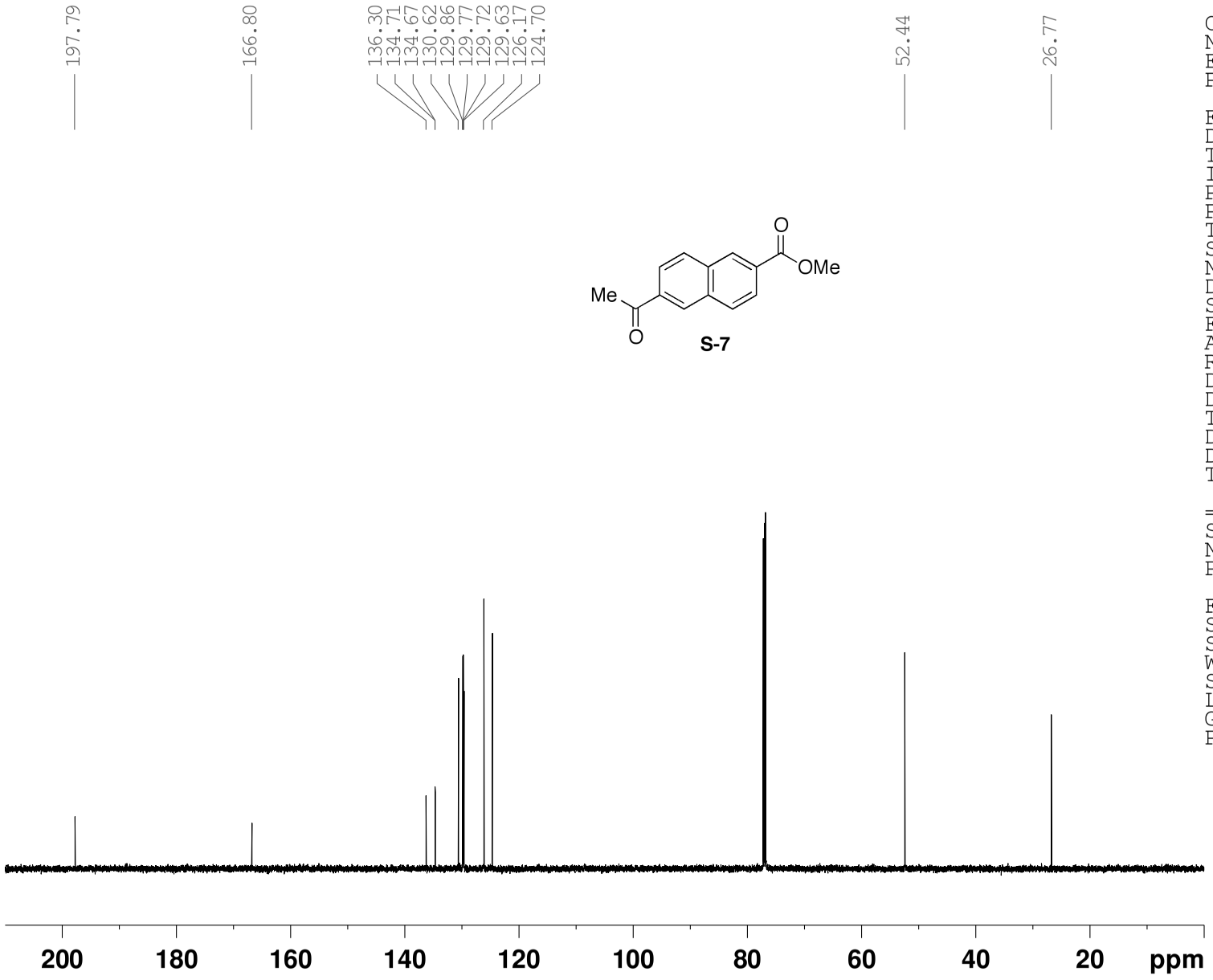
CHANNEL f1

SFO1	600.3233018 MHz
NUC1	1H
P1	10.77 usec

F2 - Processing parameters

SI	65536
SF	600.3200164 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

compound S-7 13CNMR



Current Data Parameters

NAME	HH-4-136
EXPNO	2
PROCNO	1

F2 - Acquisition Parameters

Date_	20130120
Time	10.49
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zgpg55
TD	65536
SOLVENT	CDCl3
NS	256
DS	4
SWH	34722.223 Hz
FIDRES	0.529819 Hz
AQ	0.9437684 sec
RG	2050
DW	14.400 usec
DE	19.34 usec
TE	300.0 K
D1	1.10000002 sec
D11	0.03000000 sec
TD0	1

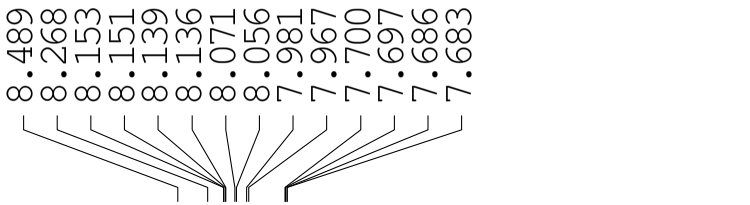
CHANNEL f1

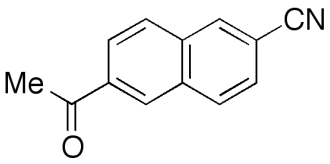
SFO1	150.9656784 MHz
NUC1	13C
P1	10.63 usec

F2 - Processing parameters

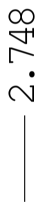
SI	32768
SF	150.9505840 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

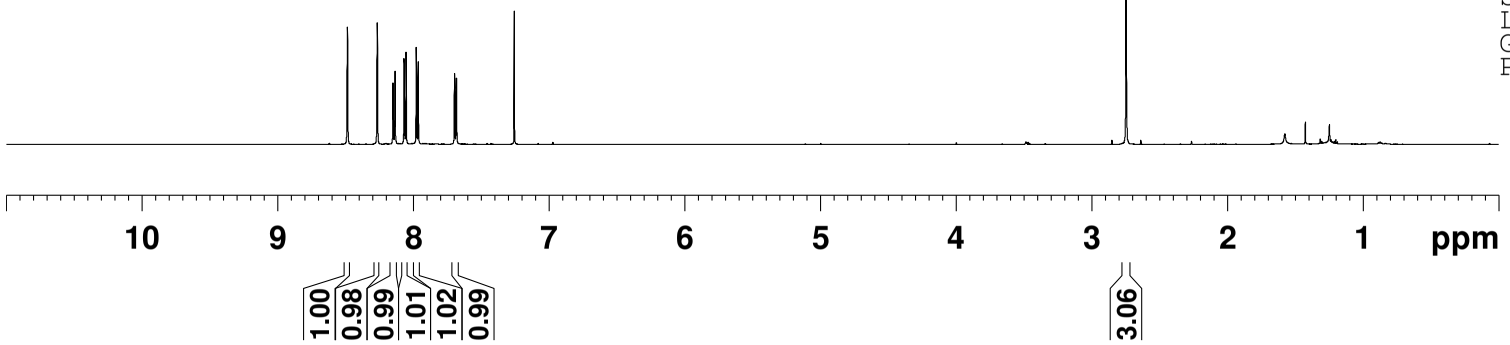
compound S-11 1HNMR





S-11





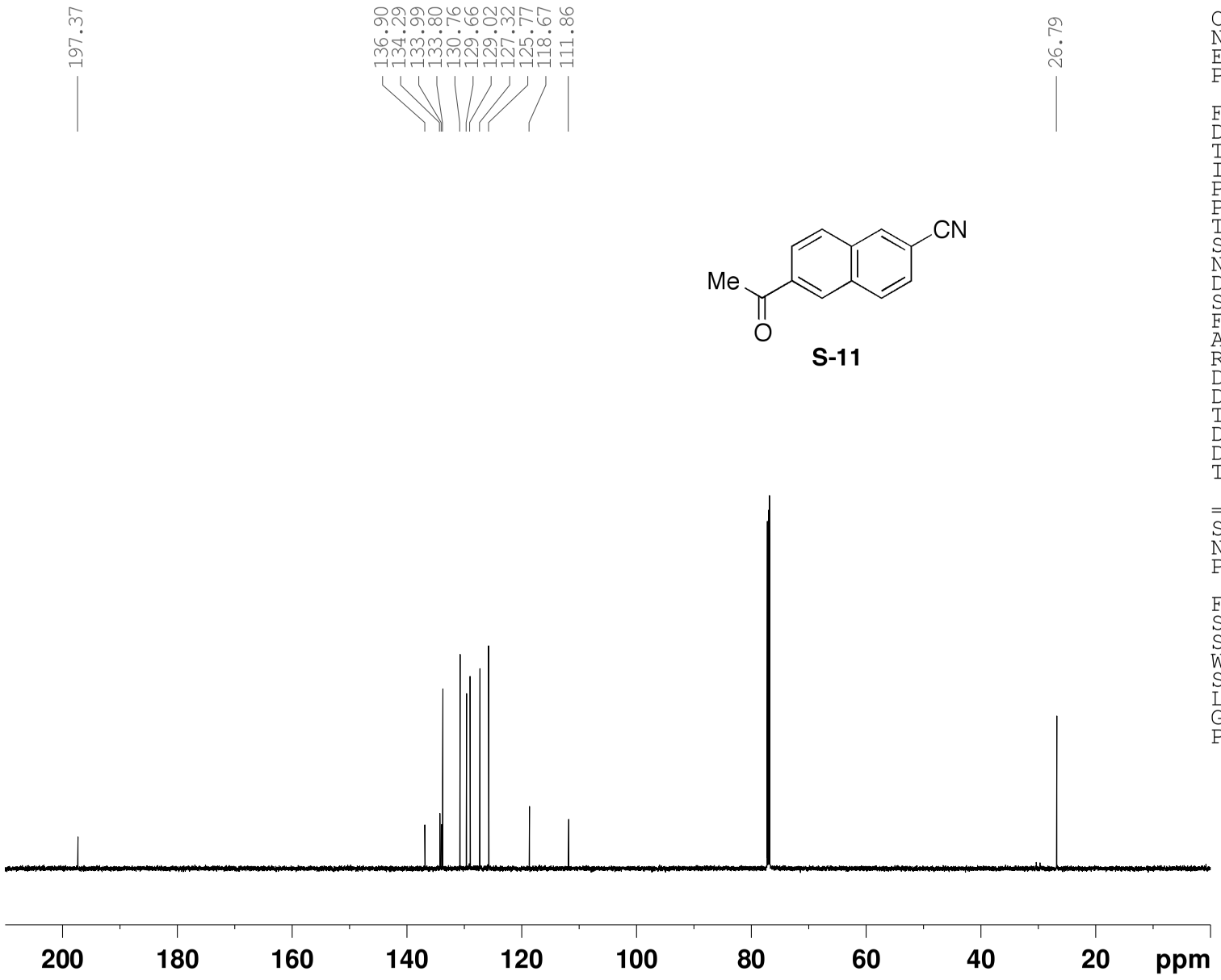
Current Data Parameters
NAME QZ-3-207-1
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130120
Time 1.03
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 2
SWH 8403.361 Hz
FIDRES 0.128225 Hz
AQ 3.8994420 sec
RG 161
DW 59.500 usec
DE 17.39 usec
TE 300.0 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 600.3233018 MHz
NUC1 1H
P1 10.77 usec

F2 - Processing parameters
SI 65536
SF 600.3200165 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

compound S-11 13CNMR



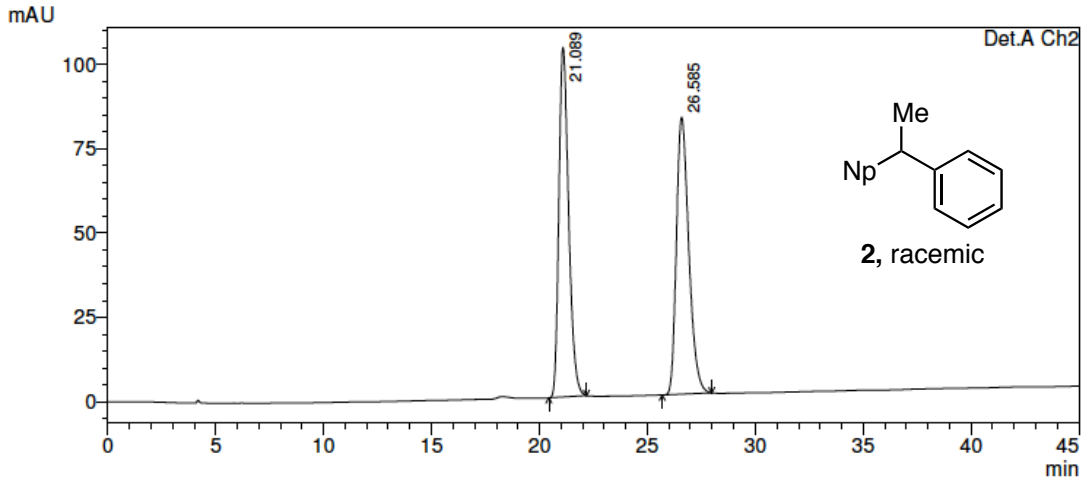
Current Data Parameters
NAME QZ-3-207-1
EXPNO 2
PROCNO 1

F2 - Acquisition Parameters
Date_ 20130120
Time 1.22
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg55
TD 65536
SOLVENT CDCl3
NS 512
DS 4
SWH 34722.223 Hz
FIDRES 0.529819 Hz
AQ 0.9437684 sec
RG 2050
DW 14.400 usec
DE 19.34 usec
TE 300.0 K
D1 1.10000002 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9656784 MHz
NUC1 13C
P1 10.63 usec

F2 - Processing parameters
SI 32768
SF 150.9505840 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

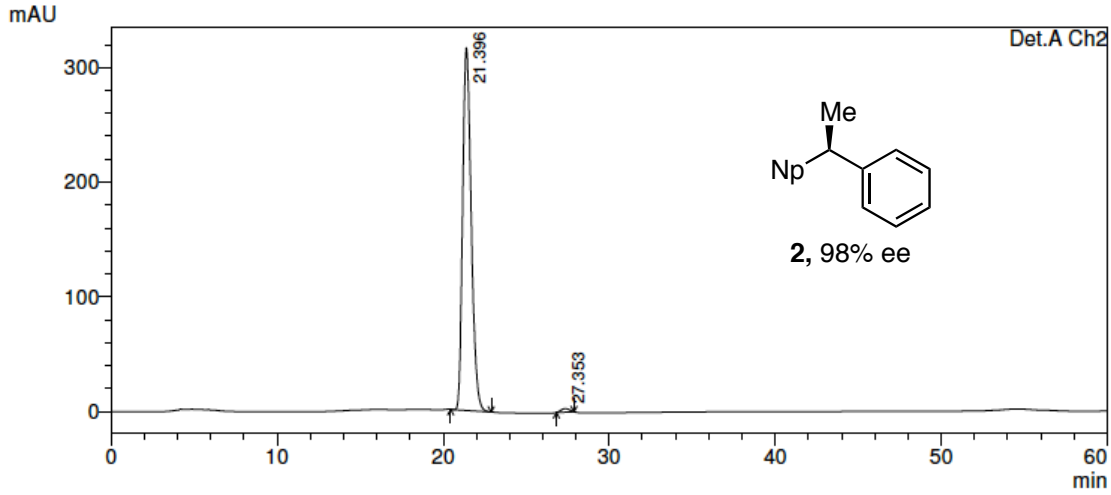
Compound 2, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	21.089	3262561	103718	49.915	55.809
2	26.585	3273635	82125	50.085	44.191
Total		6536196	185843	100.000	100.000

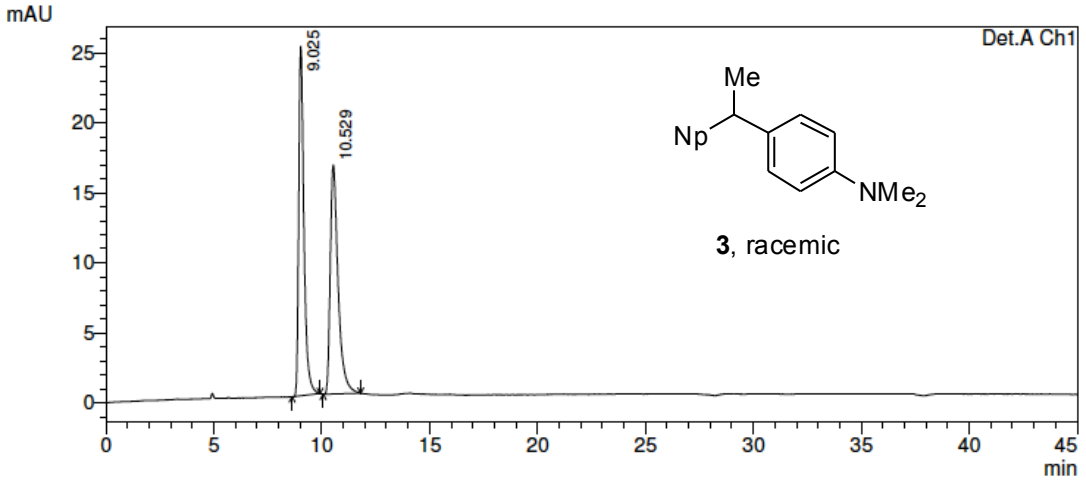
Compound 2, 98% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	21.396	11355848	316283	99.047	99.024
2	27.353	109219	3118	0.953	0.976
Total		11465067	319400	100.000	100.000

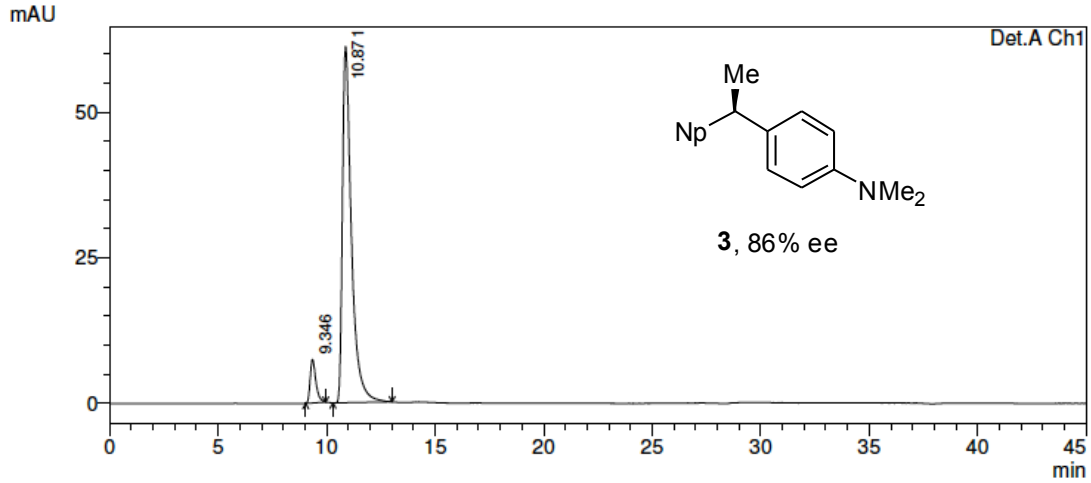
Compound 3, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.025	420349	24972	50.369	60.385
2	10.529	414192	16383	49.631	39.615
Total		834541	41355	100.000	100.000

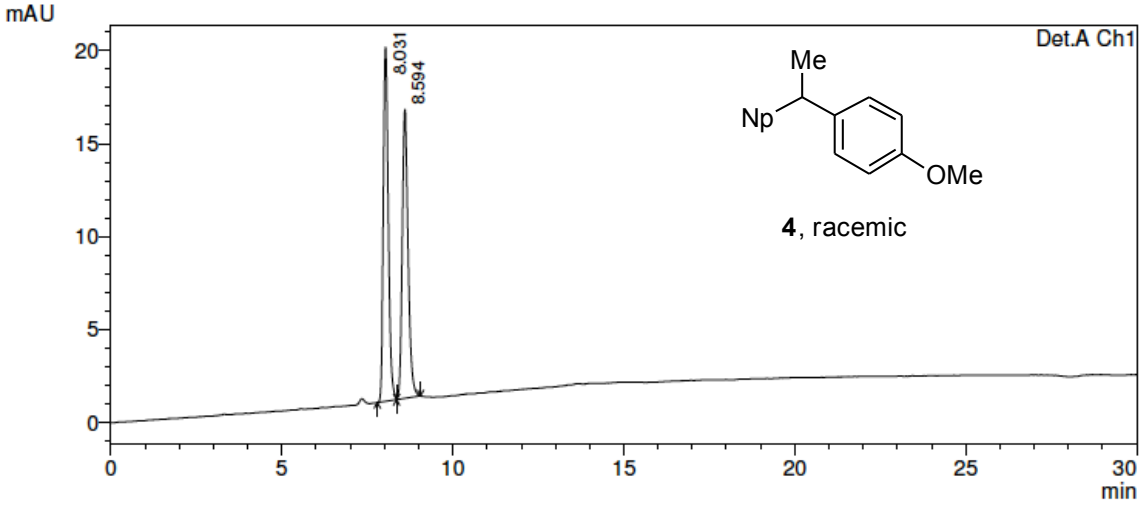
Compound 3, 86% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.346	136637	7475	7.169	10.895
2	10.871	1769349	61137	92.831	89.105
Total		1905986	68612	100.000	100.000

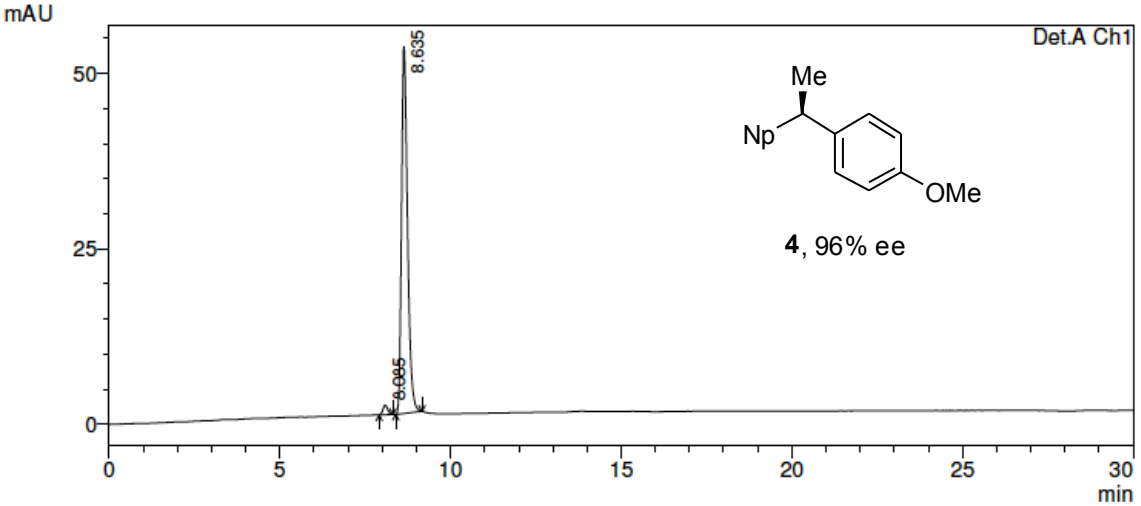
Compound 4, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.031	191673	19028	50.578	55.069
2	8.594	187296	15524	49.422	44.931
Total		378969	34552	100.000	100.000

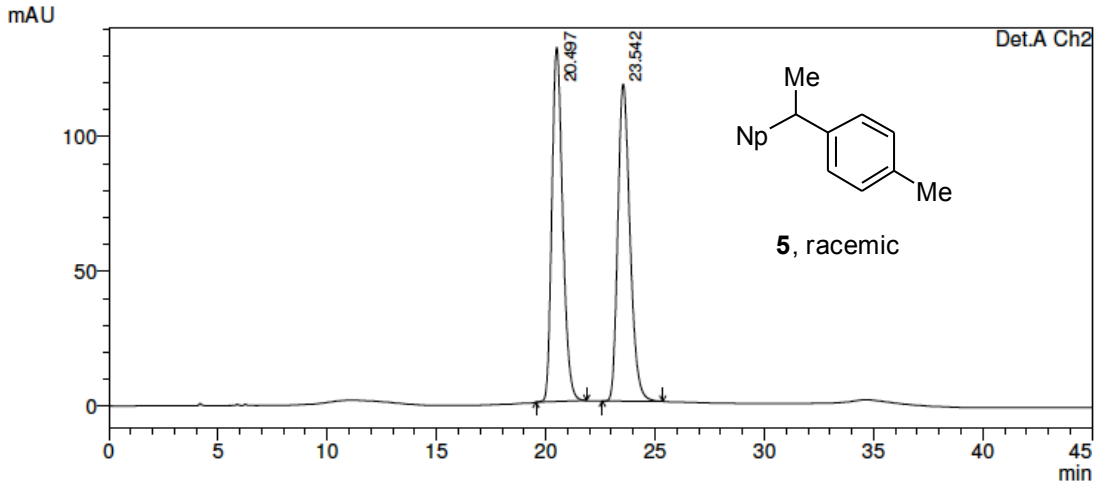
Compound 4, 96% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.085	13175	1356	1.992	2.529
2	8.635	648308	52277	98.008	97.471
Total		661483	53633	100.000	100.000

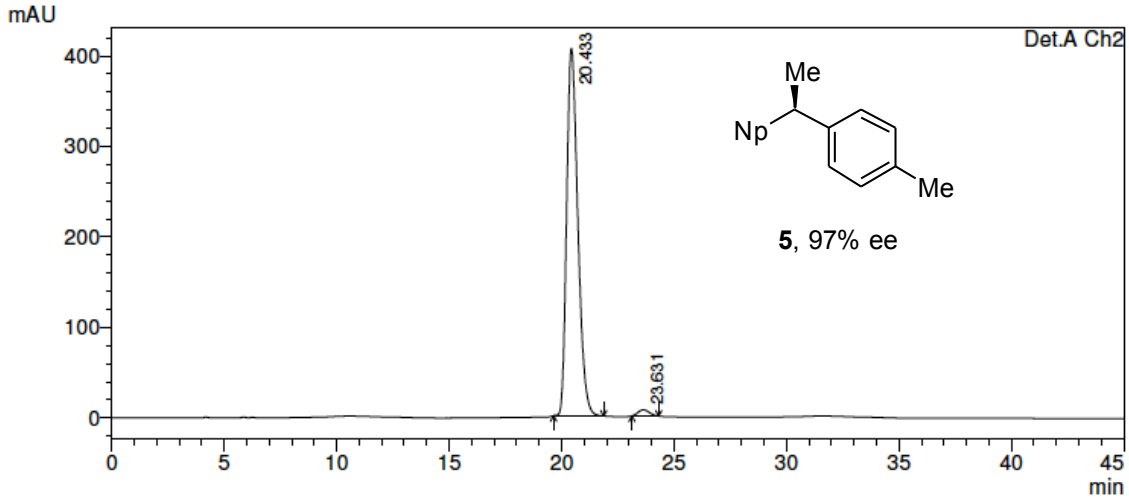
Compound 5, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	20.497	4523871	131568	49.803	52.771
2	23.542	4559688	117752	50.197	47.229
Total		9083559	249320	100.000	100.000

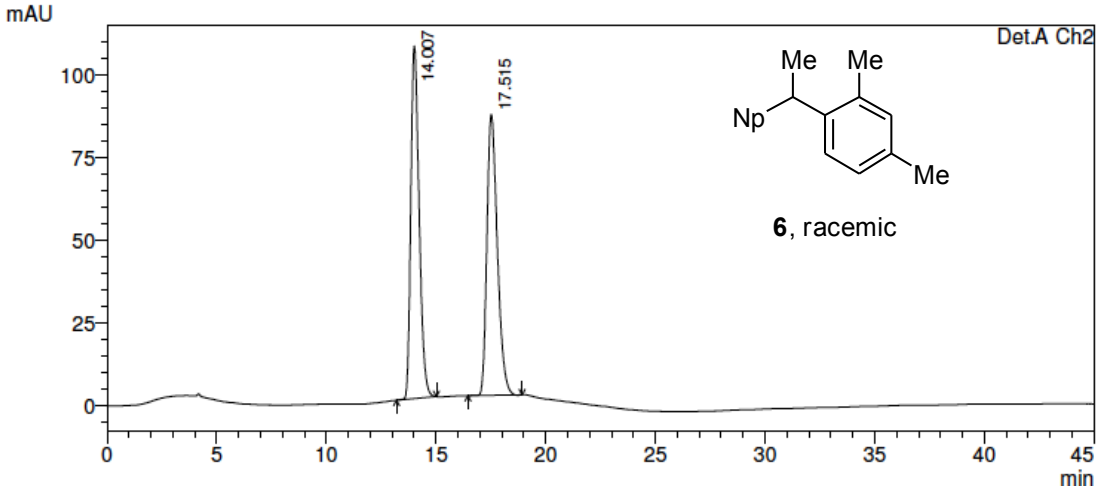
Compound 5, 97% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	20.433	14024628	406137	98.341	98.352
2	23.631	236613	6803	1.659	1.648
Total		14261242	412940	100.000	100.000

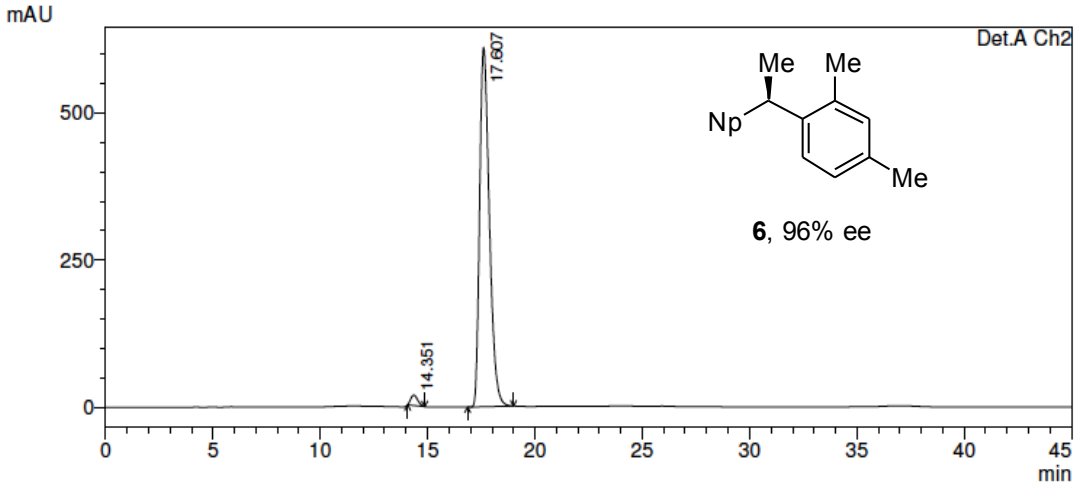
Compound 6, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.007	2808009	106586	50.097	55.666
2	17.515	2797140	84887	49.903	44.334
Total		5605149	191474	100.000	100.000

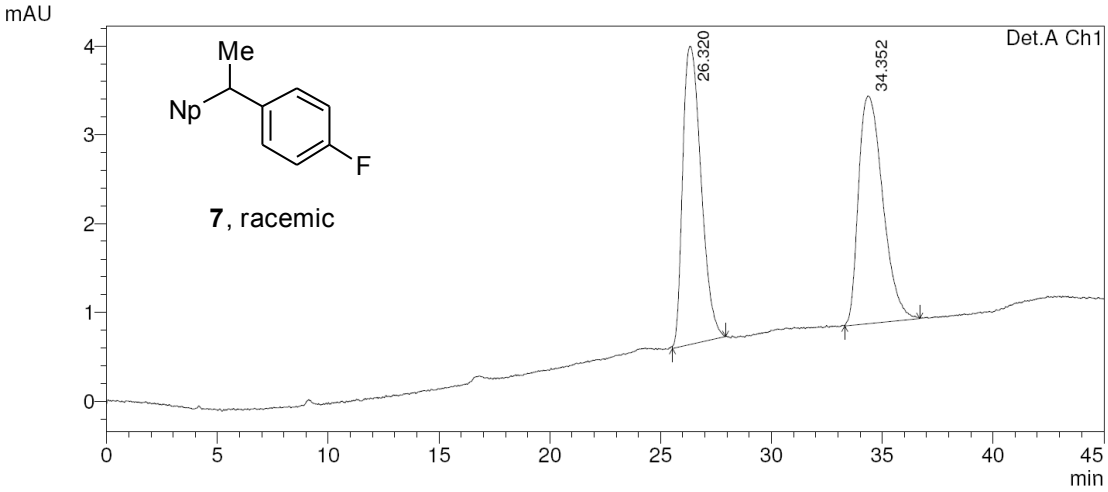
Compound 6, 96% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.351	393869	17724	2.008	2.823
2	17.607	19217322	610132	97.992	97.177
Total		19611191	627856	100.000	100.000

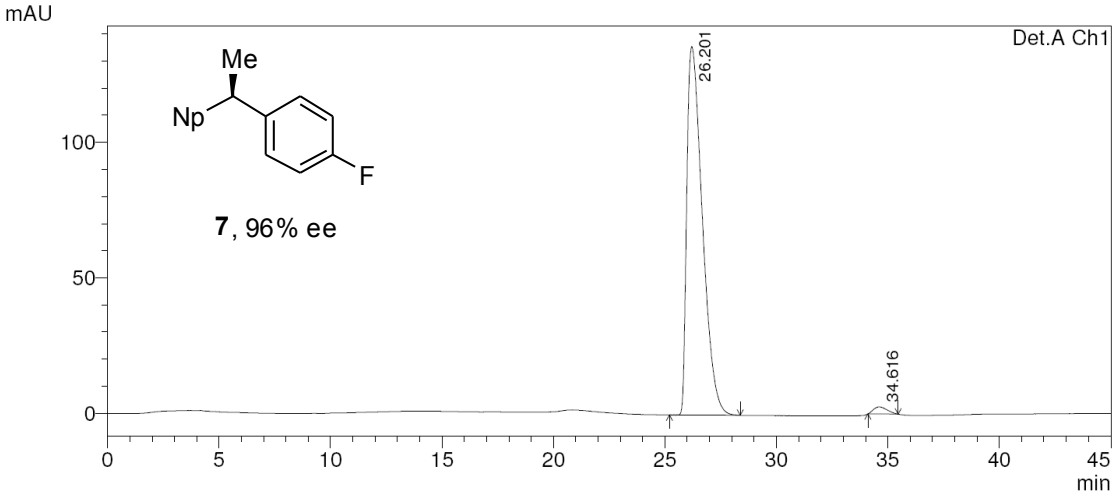
Compound 7, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	26.320	193738	3360	49.747	56.717
2	34.352	195710	2564	50.253	43.283
Total		389449	5925	100.000	100.000

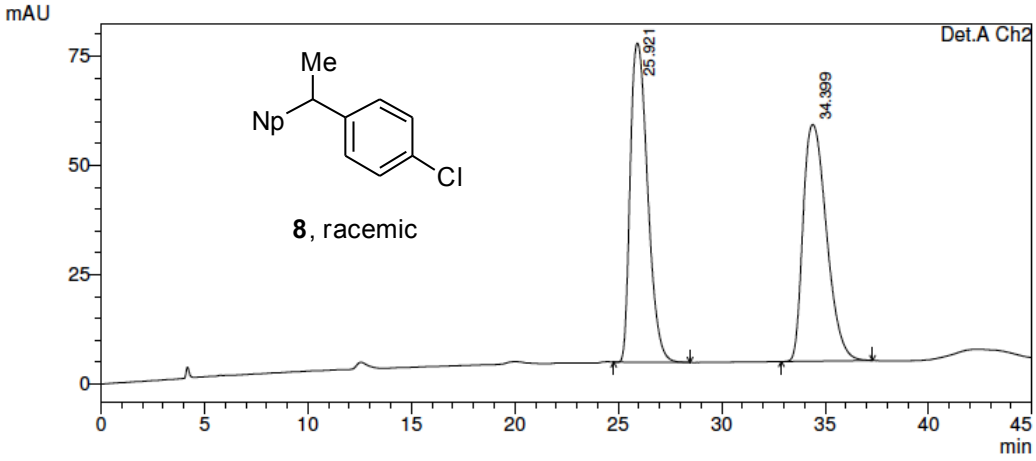
Compound 7, 96% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	26.201	6602080	135918	98.328	98.110
2	34.616	112284	2618	1.672	1.890
Total		6714364	138536	100.000	100.000

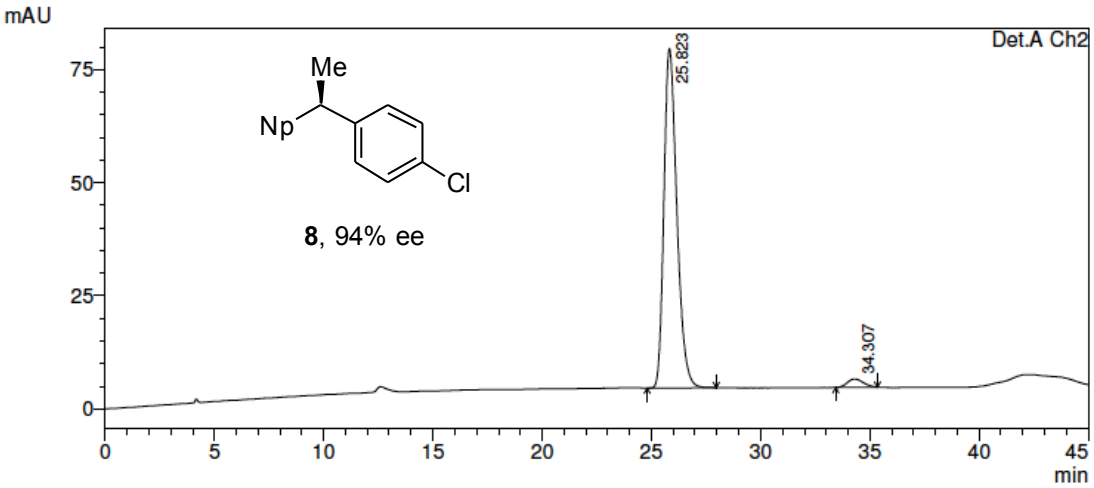
Compound 8, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	25.921	4270293	73019	49.968	57.422
2	34.399	4275844	54144	50.032	42.578
Total		8546138	127164	100.000	100.000

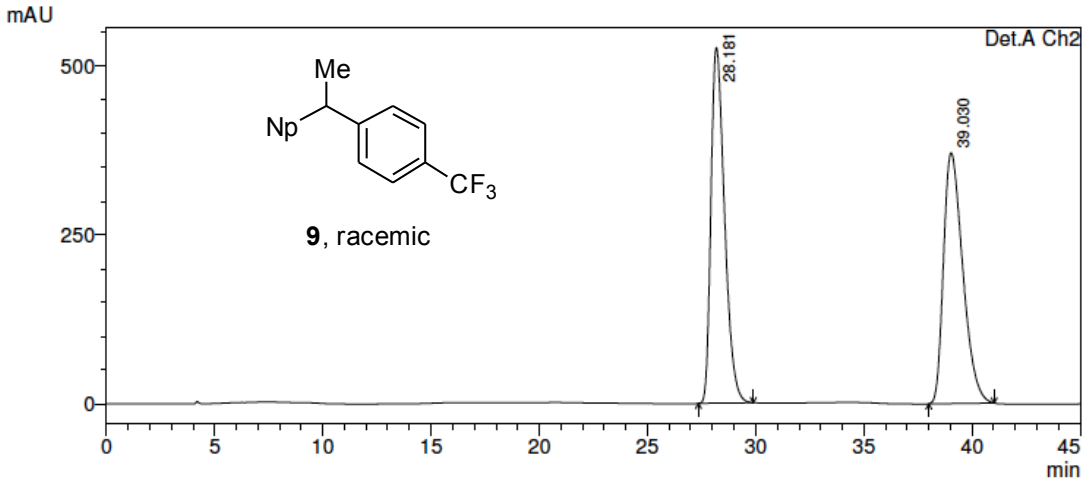
Compound 8, 94% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	25.823	3087241	75048	97.037	97.589
2	34.307	94277	1854	2.963	2.411
Total		3181518	76902	100.000	100.000

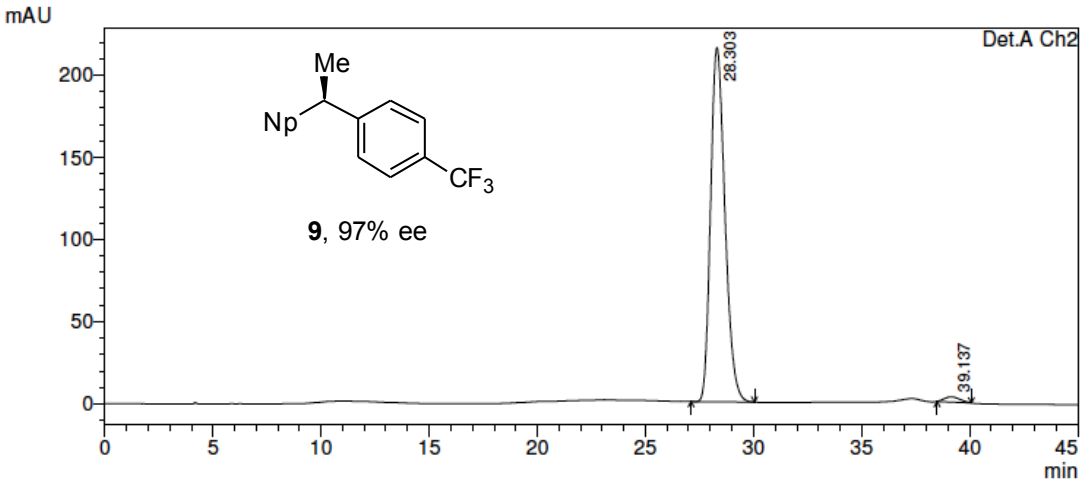
Compound 9, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	28.181	23034505	527033	50.014	58.657
2	39.030	23021610	371471	49.986	41.343
Total		46056115	898503	100.000	100.000

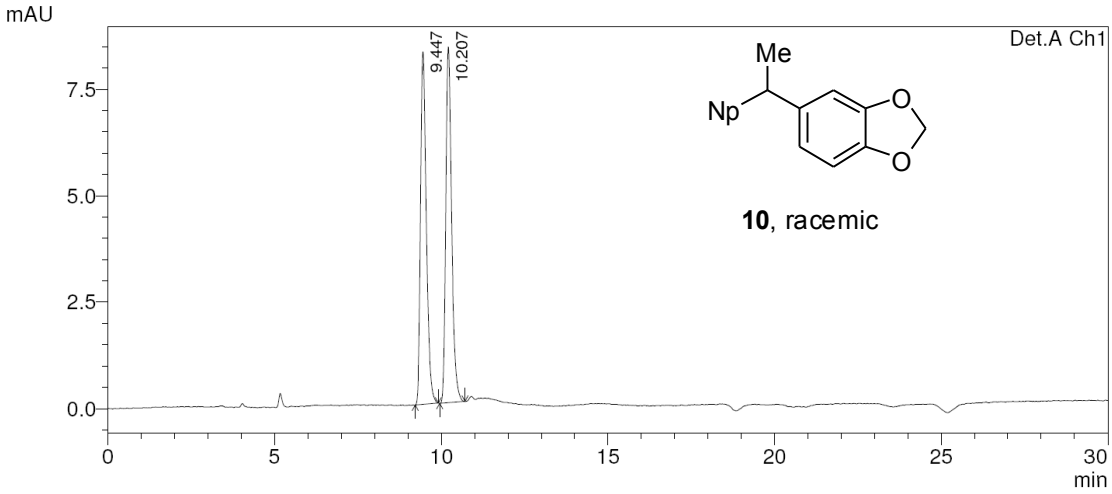
Compound 9, 97% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	28.303	9967337	215692	98.419	98.556
2	39.137	160085	3159	1.581	1.444
Total		10127422	218851	100.000	100.000

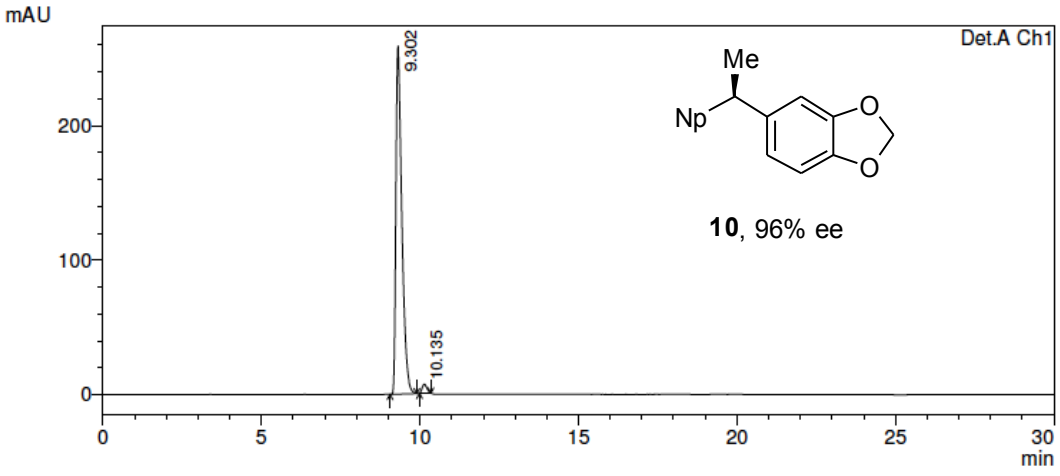
Compound 10, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.447	99369	8286	49.582	49.778
2	10.207	101046	8360	50.418	50.222
Total		200415	16646	100.000	100.000

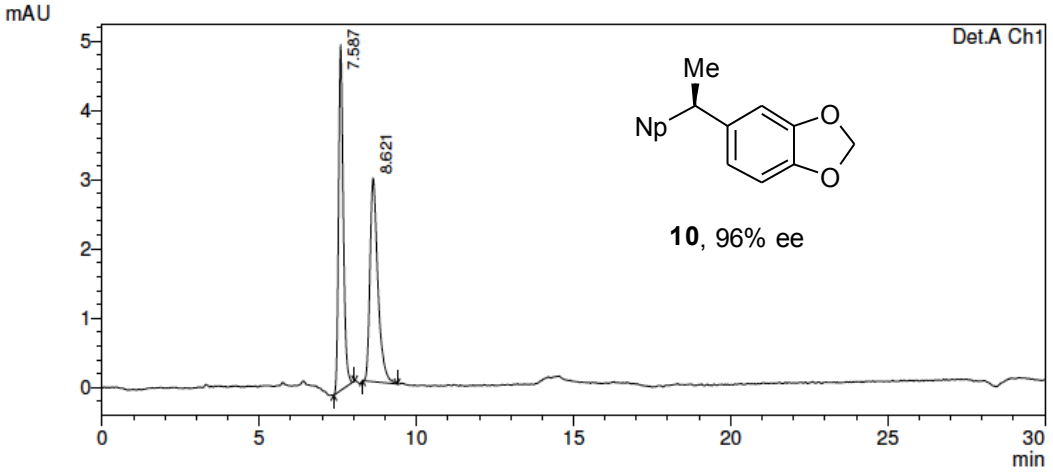
Compound 10, 96% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.302	3412628	258849	98.030	97.482
2	10.135	68590	6685	1.970	2.518
Total		3481218	265533	100.000	100.000

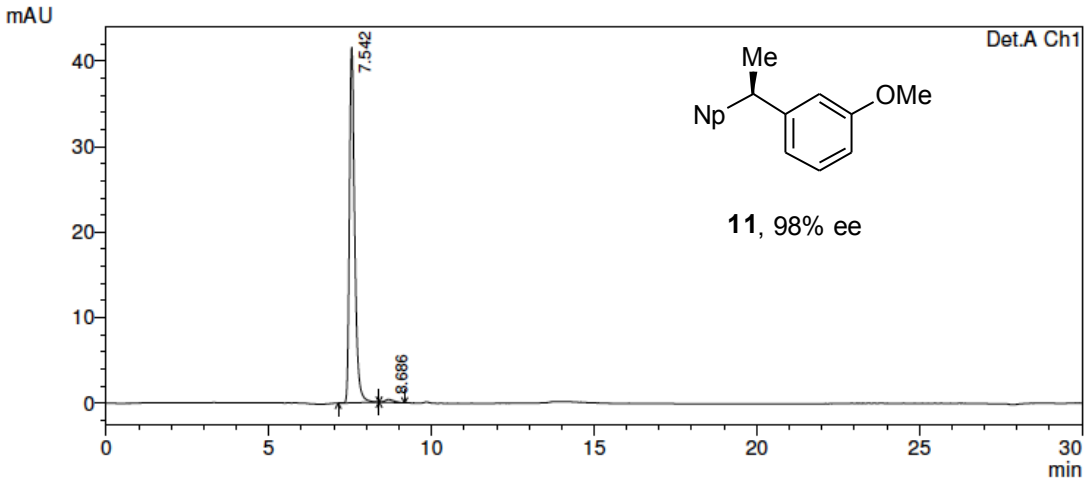
Compound 11, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.587	53165	4992	50.782	62.930
2	8.621	51528	2941	49.218	37.070
Total		104693	7933	100.000	100.000

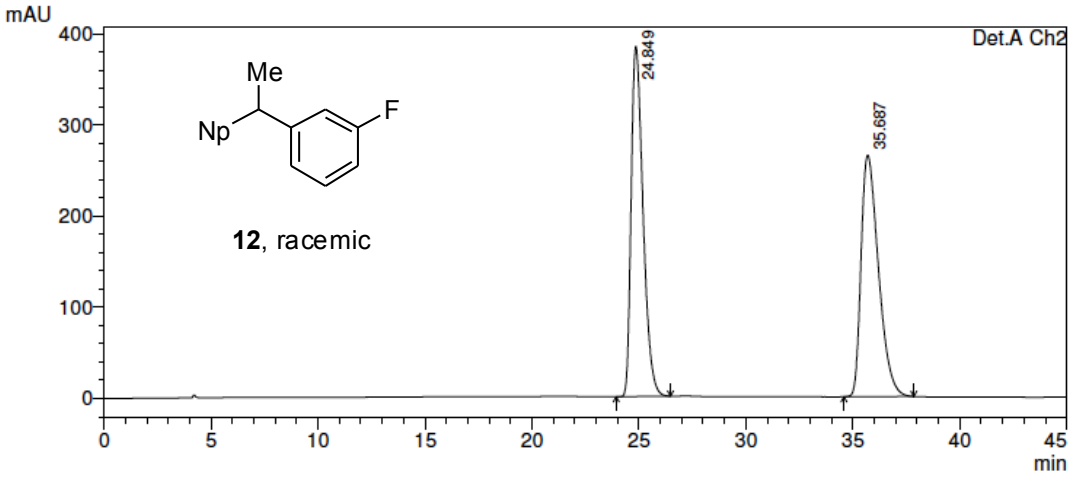
Compound 11, 98% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.542	475460	41545	98.690	99.195
2	8.686	6310	337	1.310	0.805
Total		481770	41882	100.000	100.000

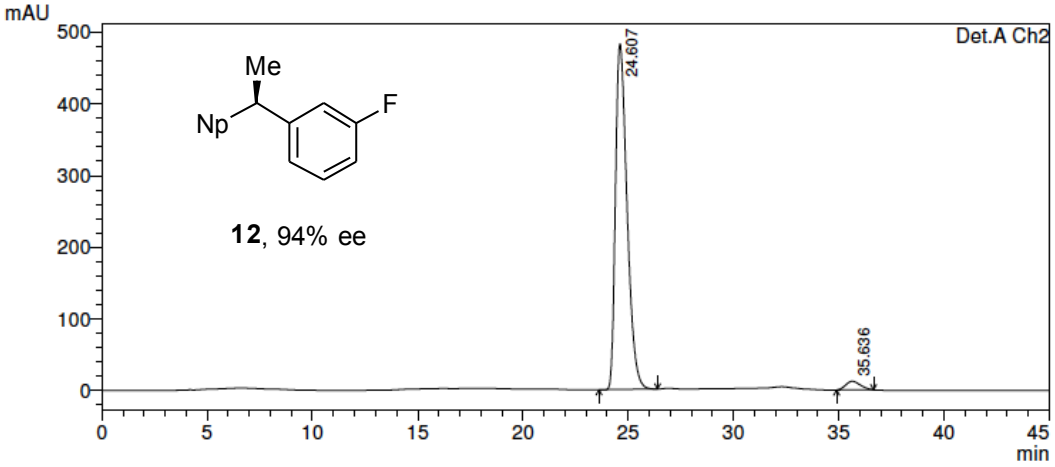
Compound 12, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	24.849	14888201	384482	49.841	59.188
2	35.687	14983179	265111	50.159	40.812
Total		29871380	649593	100.000	100.000

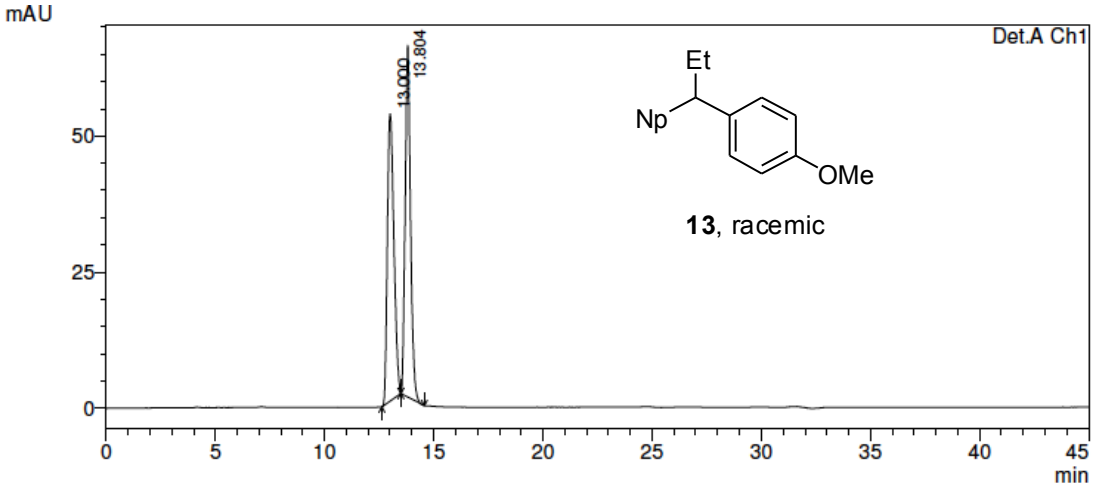
Compound 12, 94% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	24.607	18437656	482435	96.983	97.593
2	35.636	573579	11899	3.017	2.407
Total		19011234	494333	100.000	100.000

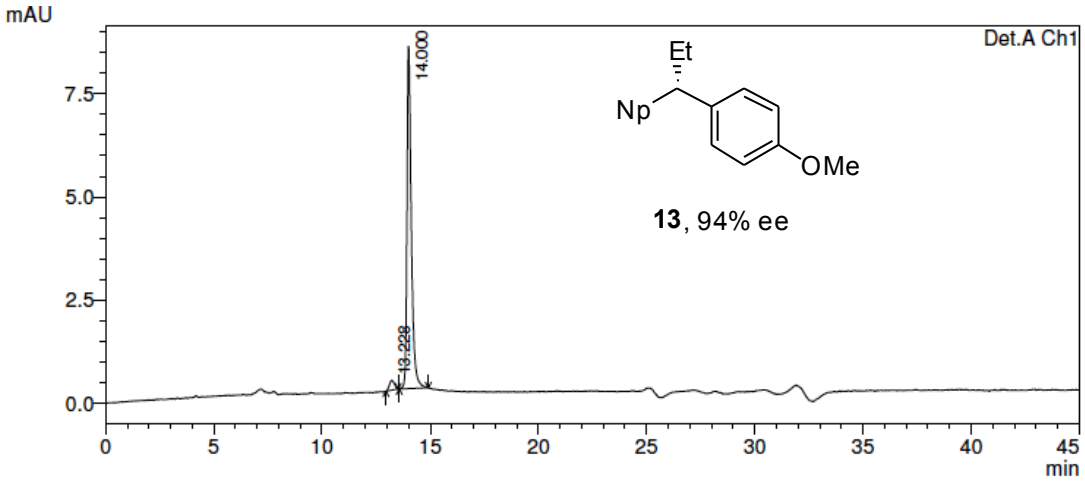
Compound 13, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.000	1095755	52759	49.972	44.969
2	13.804	1096990	64565	50.028	55.031
Total		2192745	117324	100.000	100.000

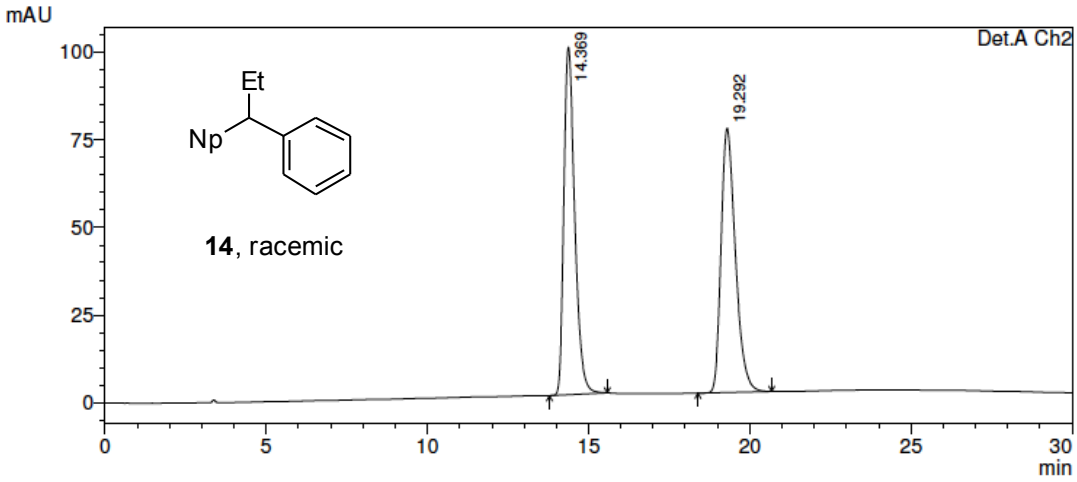
Compound 13, 94% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.228	3845	237	3.216	2.779
2	14.000	115716	8281	96.784	97.221
Total		119561	8518	100.000	100.000

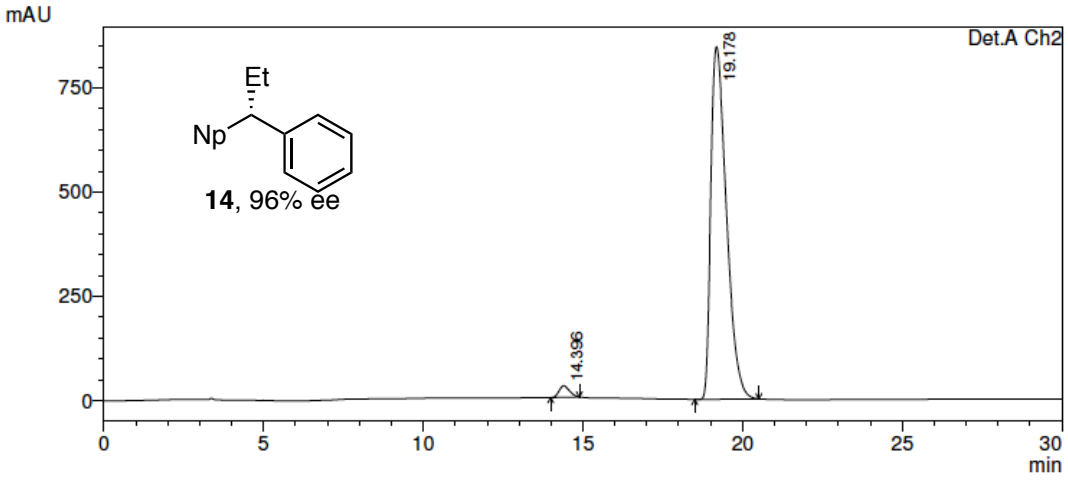
Compound 14, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.369	2317727	98945	49.927	56.791
2	19.292	2324539	75281	50.073	43.209
Total		4642266	174226	100.000	100.000

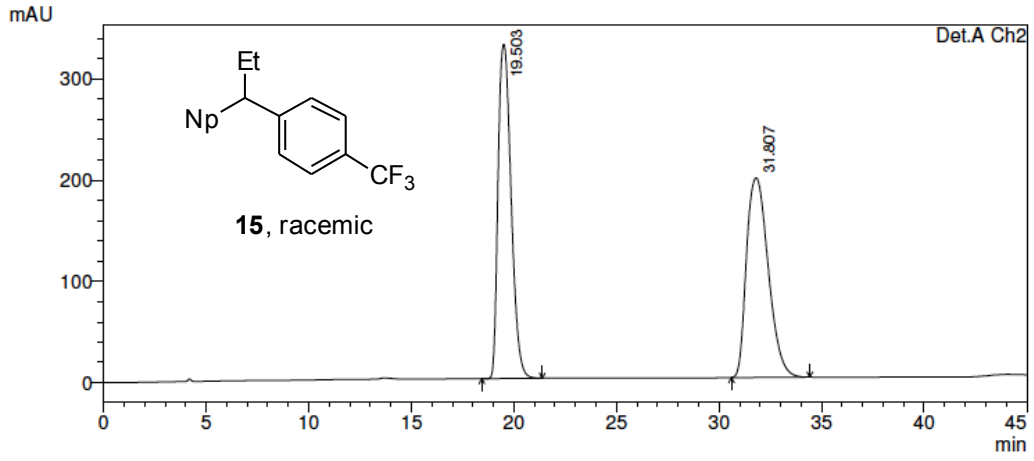
Compound 14, 96% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.396	619653	27486	2.118	3.152
2	19.178	28642737	844555	97.882	96.848
Total		29262391	872041	100.000	100.000

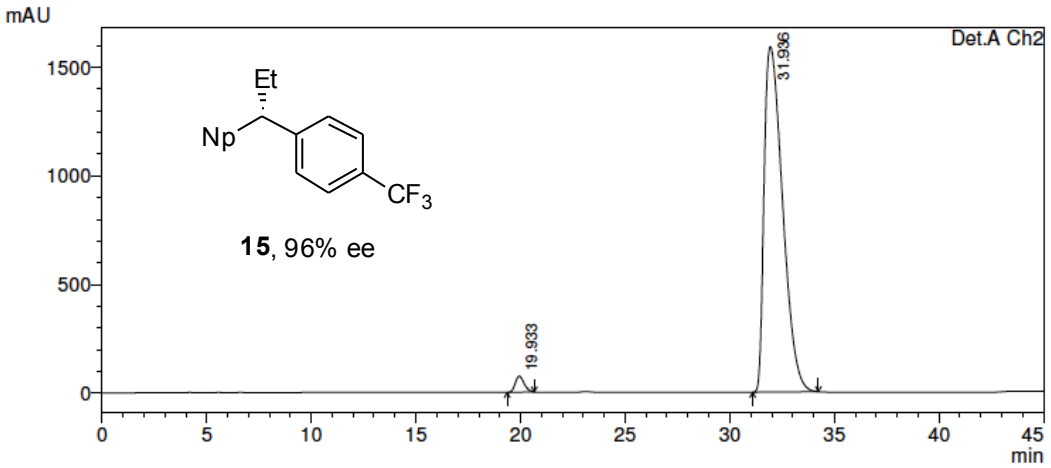
Compound 15, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.503	14527364	330016	49.946	62.606
2	31.807	14558791	197114	50.054	37.394
Total		29086155	527130	100.000	100.000

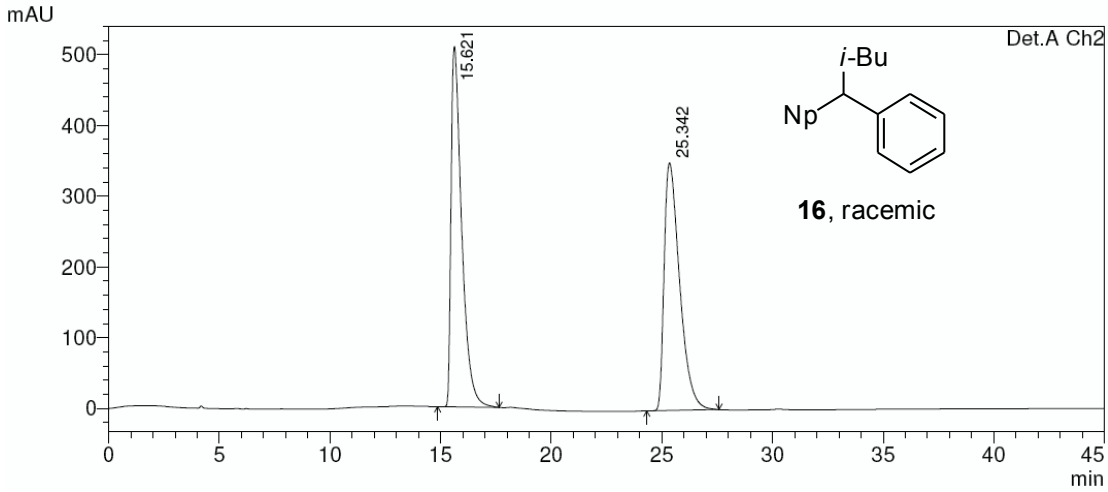
Compound 15, 96% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.933	2186019	73861	2.187	4.435
2	31.936	97776569	1591639	97.813	95.565
Total		99962589	1665500	100.000	100.000

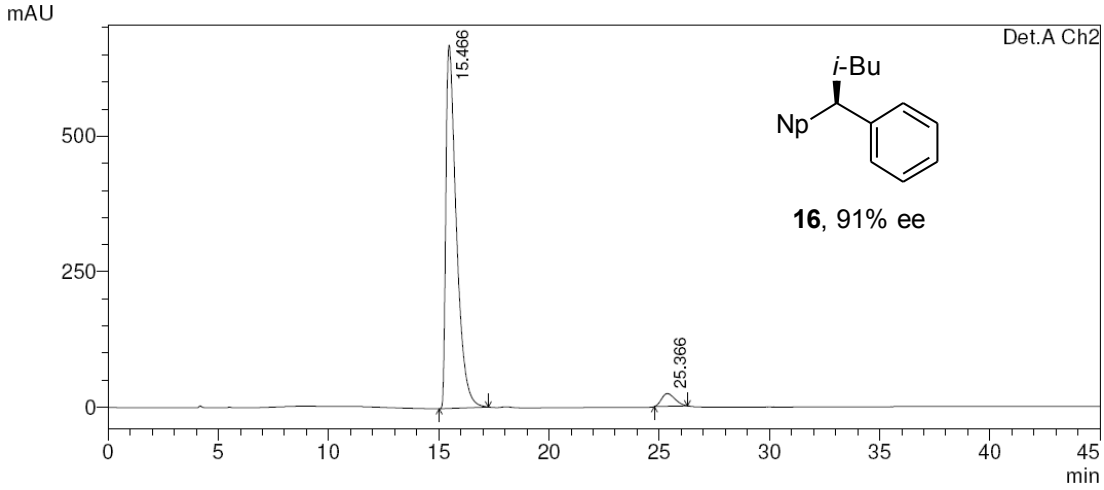
Compound 16, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.621	16984566	509077	50.009	59.278
2	25.342	16978126	349718	49.991	40.722
Total		33962693	858795	100.000	100.000

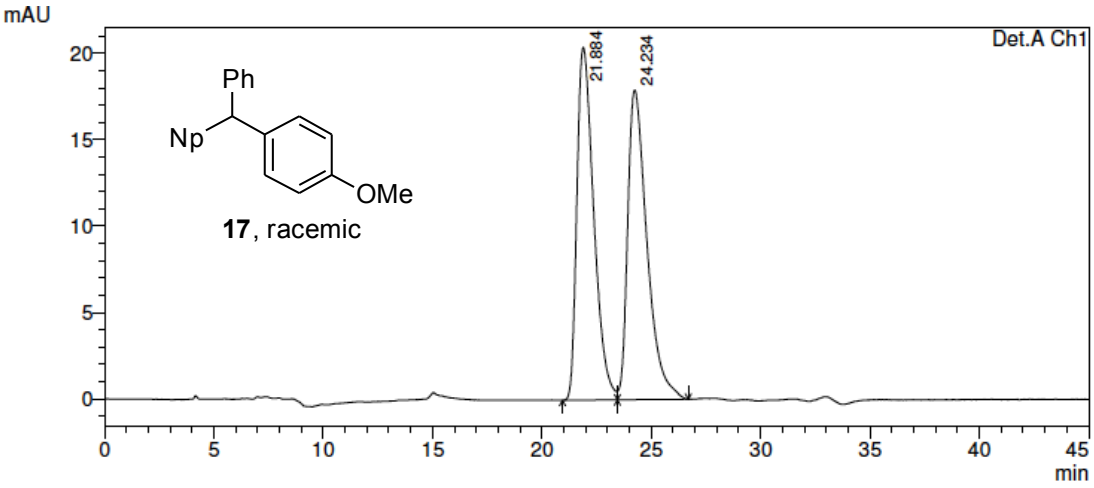
Compound 16, 91% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.466	22211081	670111	95.721	96.614
2	25.366	992790	23482	4.279	3.386
Total		23203871	693593	100.000	100.000

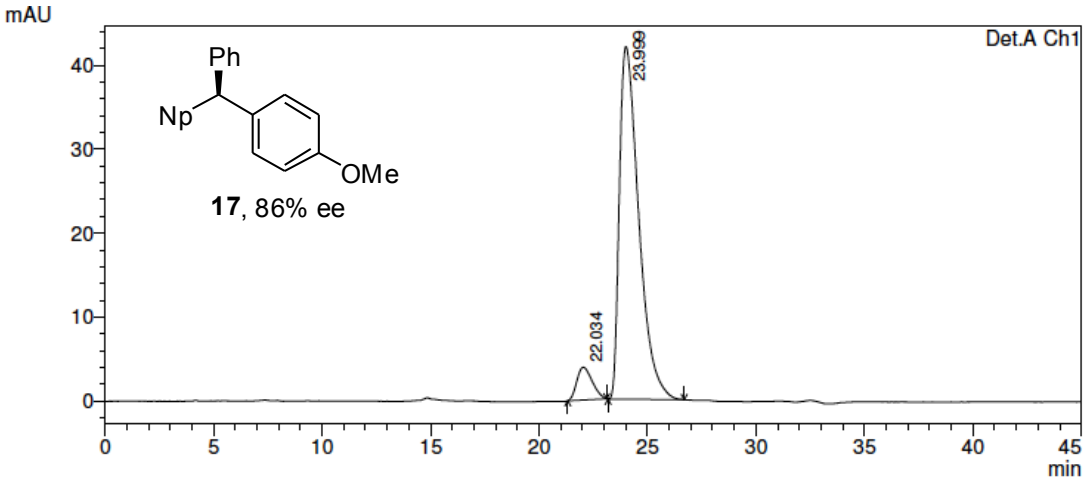
Compound 17, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	21.884	1094878	20418	49.887	53.263
2	24.234	1099828	17916	50.113	46.737
Total		2194707	38334	100.000	100.000

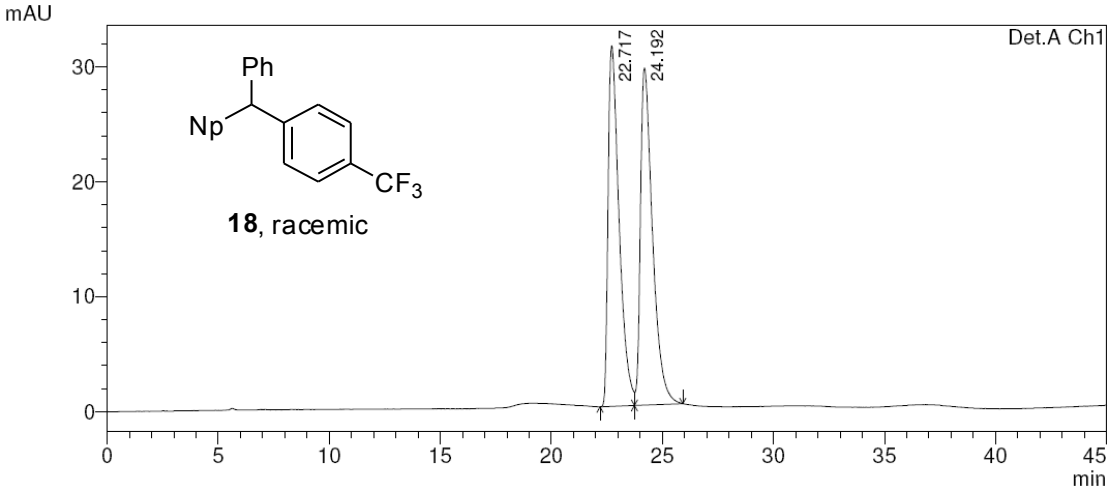
Compound 17, 86% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.034	191831	3896	6.858	8.490
2	23.999	2605492	41994	93.142	91.510
Total		2797324	45890	100.000	100.000

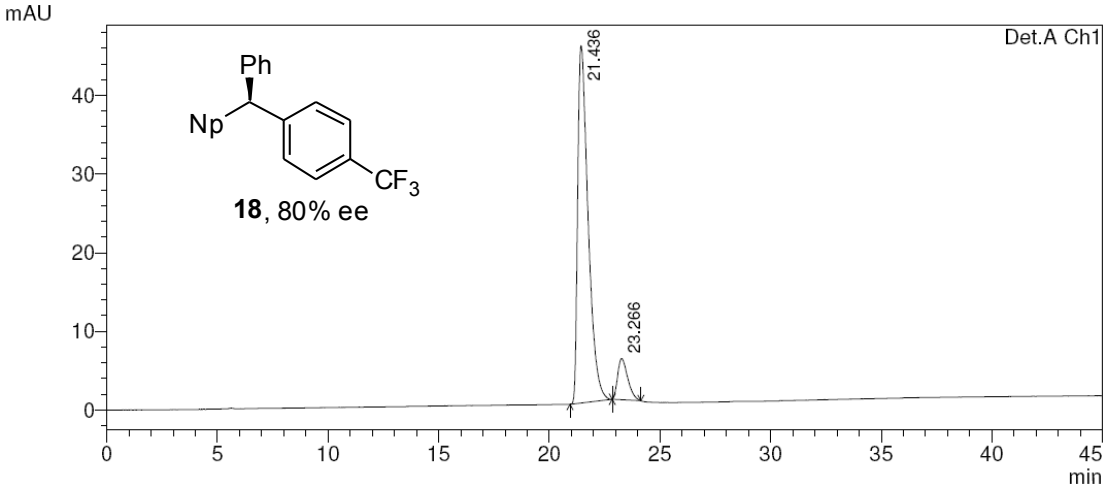
Compound 18, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.717	1082361	31364	49.305	51.676
2	24.192	1112865	29329	50.695	48.324
Total		2195226	60693	100.000	100.000

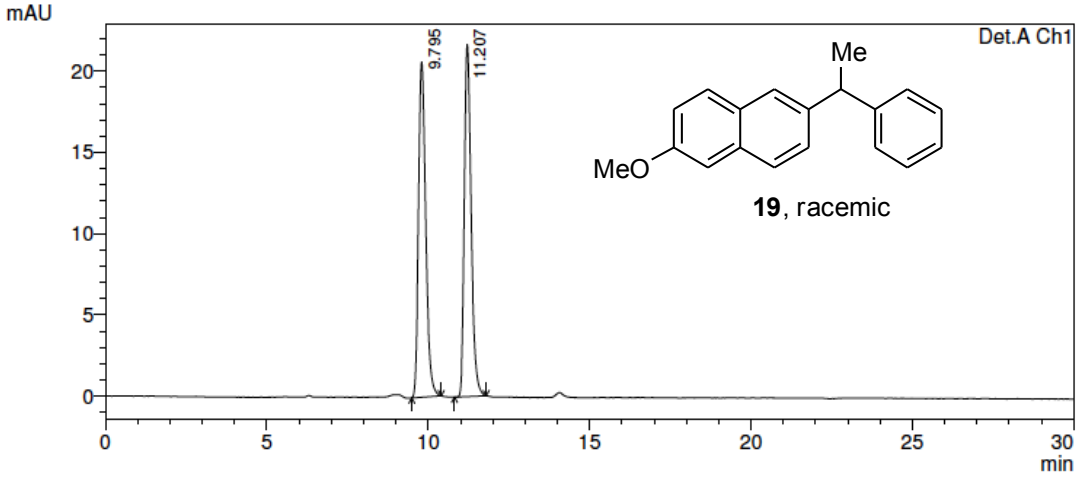
Compound 18, 80% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	21.436	1487789	45441	89.984	89.669
2	23.266	165603	5235	10.016	10.331
Total		1653392	50676	100.000	100.000

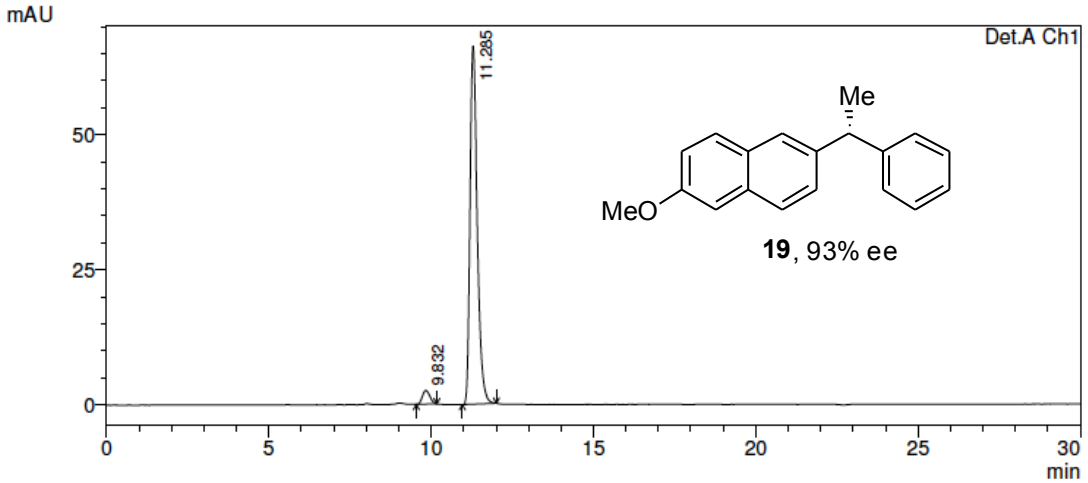
Compound 19, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.795	319664	20638	50.251	48.794
2	11.207	316471	21658	49.749	51.206
Total		636135	42296	100.000	100.000

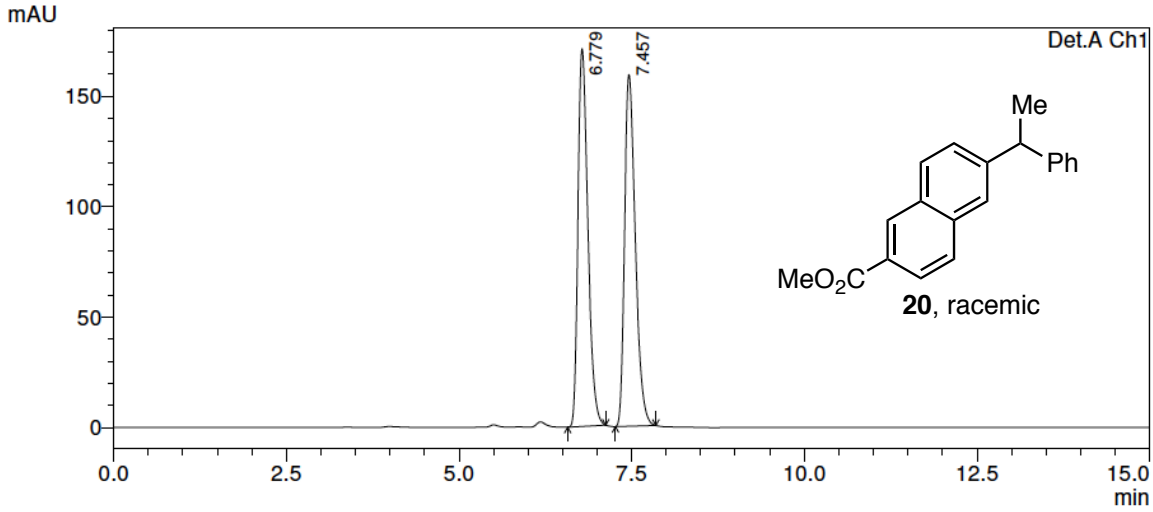
Compound 19, 93% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.832	40139	2543	3.773	3.694
2	11.285	1023789	66290	96.227	96.306
Total		1063928	68833	100.000	100.000

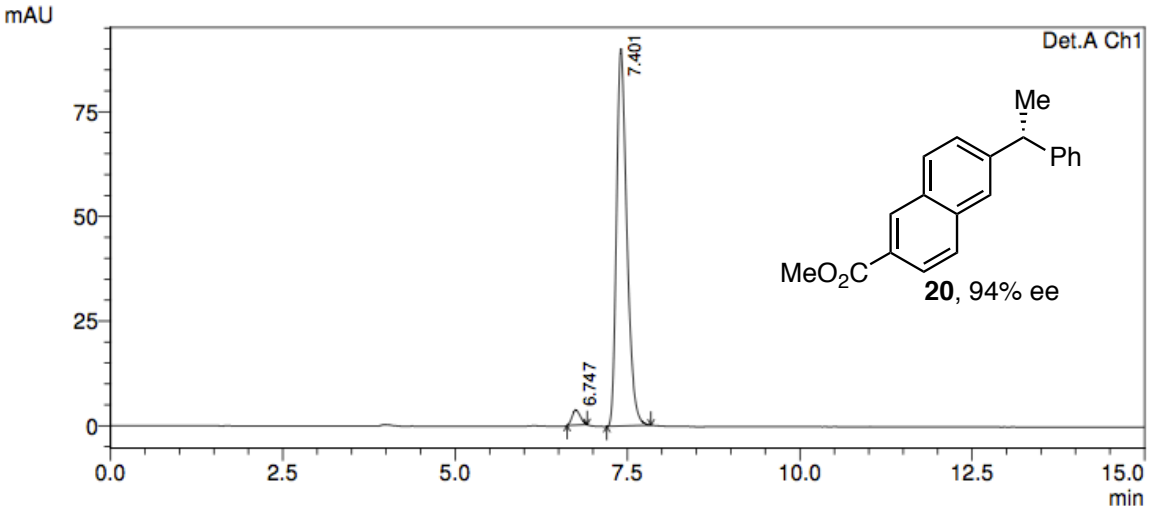
Compound 20, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.779	1705134	171182	49.744	51.809
2	7.457	1722698	159230	50.256	48.191
Total		3427831	330412	100.000	100.000

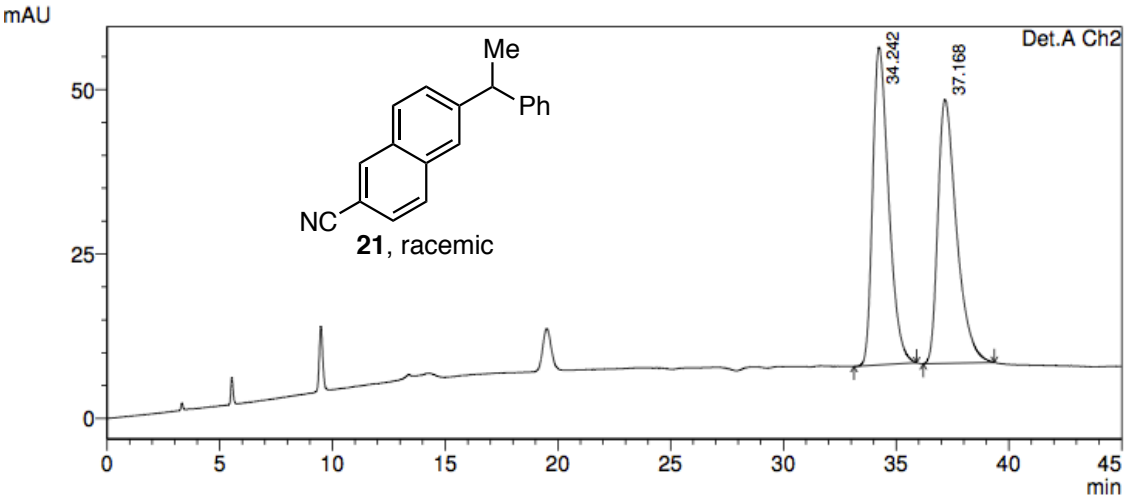
Compound 20, 94% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.747	30236	3609	3.099	3.847
2	7.401	945469	90198	96.901	96.153
Total		975705	93807	100.000	100.000

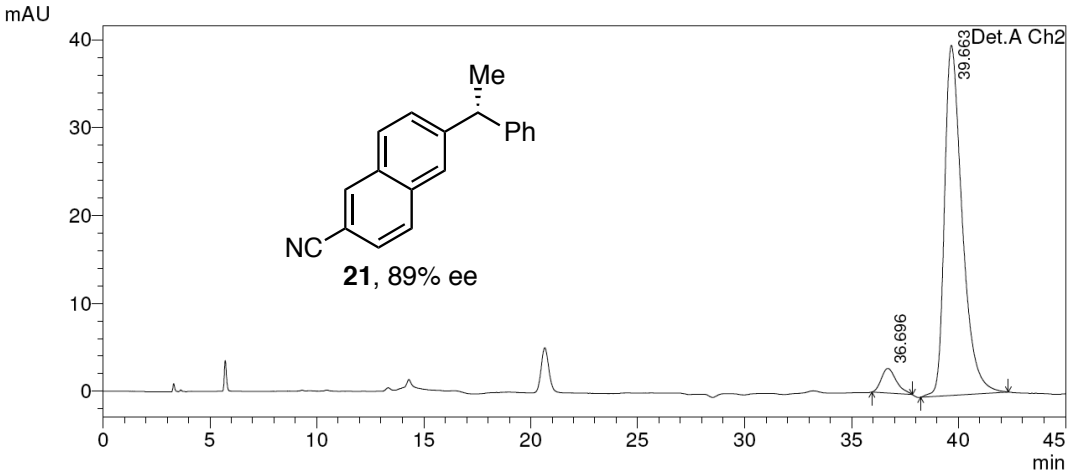
Compound 21, racemic



Detector A Ch2 230nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	34.242	2385648	48276	50.718	54.631
2	37.168	2318059	40092	49.282	45.369
Total		4703707	88368	100.000	100.000

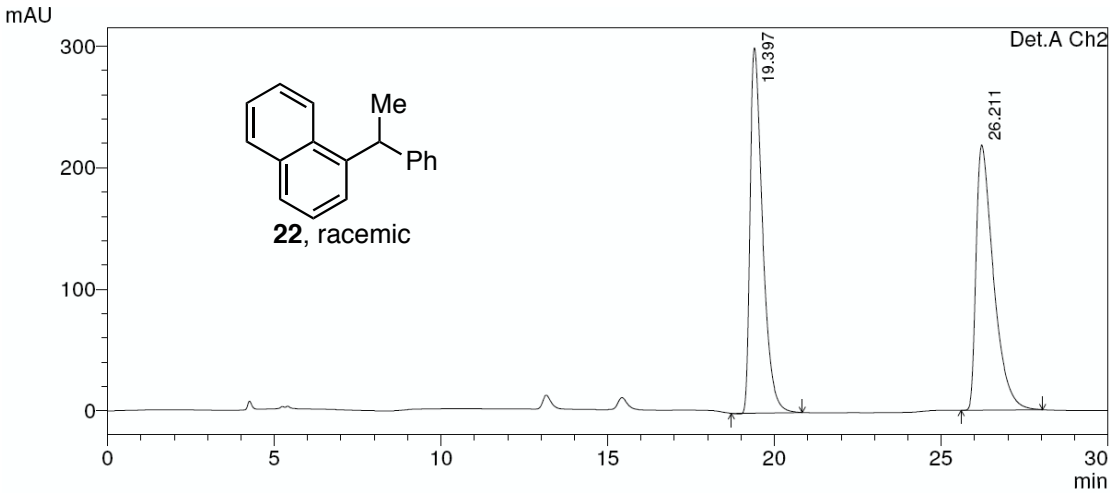
Compound 21, 89% ee



Detector A Ch2 230nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	32.051	57812	1412	5.285	6.564
2	34.791	1036032	20095	94.715	93.436
Total		1093843	21507	100.000	100.000

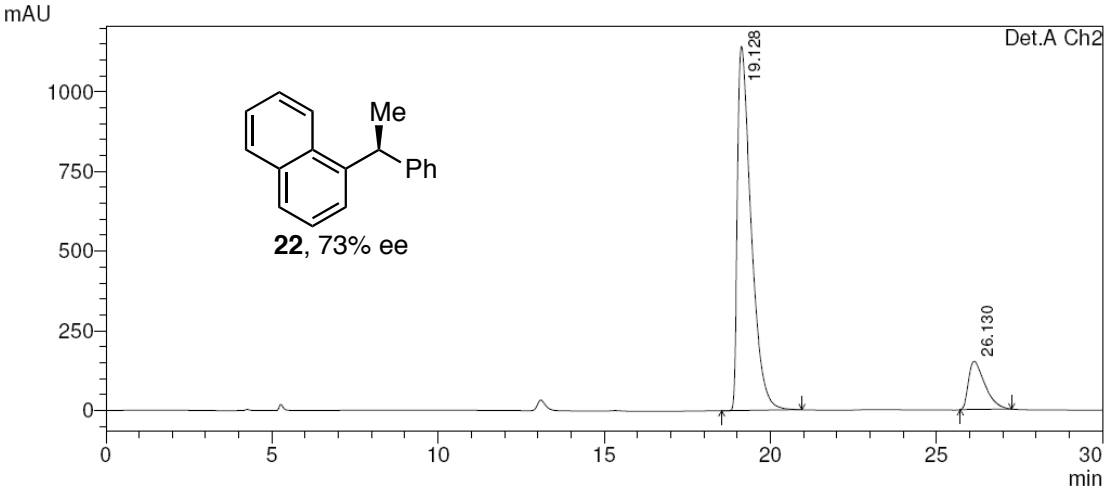
Compound 22, racemic



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.397	7810522	300253	49.720	57.922
2	26.211	7898490	218125	50.280	42.078
Total		15709011	518378	100.000	100.000

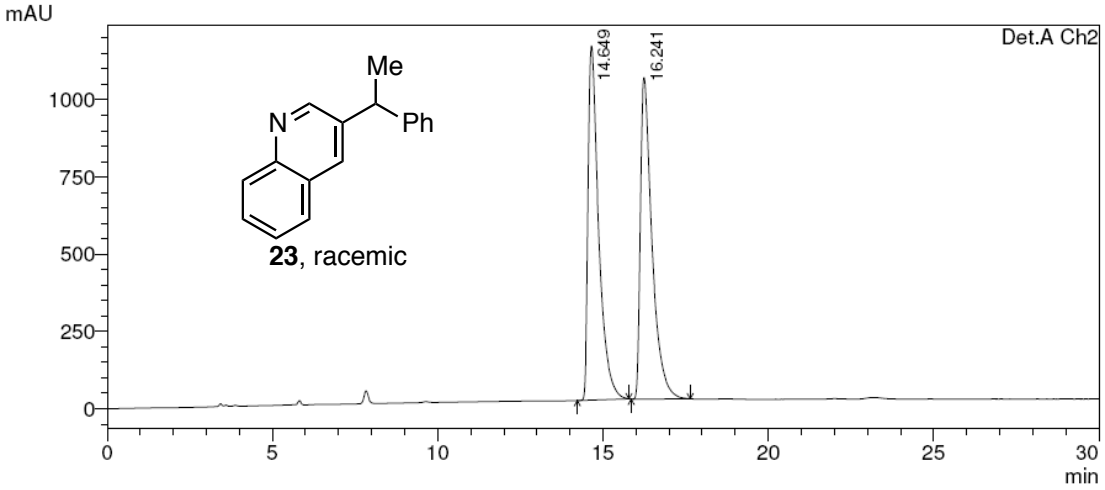
Compound 22, 73% ee



Detector A Ch2 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.128	32816995	1143059	86.387	88.309
2	26.130	5171503	151332	13.613	11.691
Total		37988498	1294391	100.000	100.000

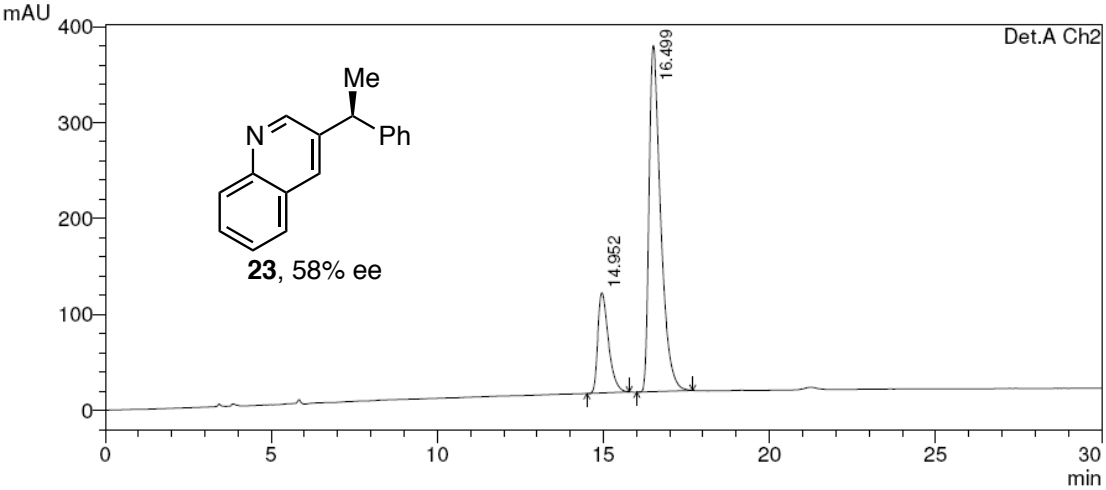
Compound 23, racemic



Detector A Ch2 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.649	25499869	1145829	50.011	52.413
2	16.241	25488158	1040344	49.989	47.587
Total		50988027	2186173	100.000	100.000

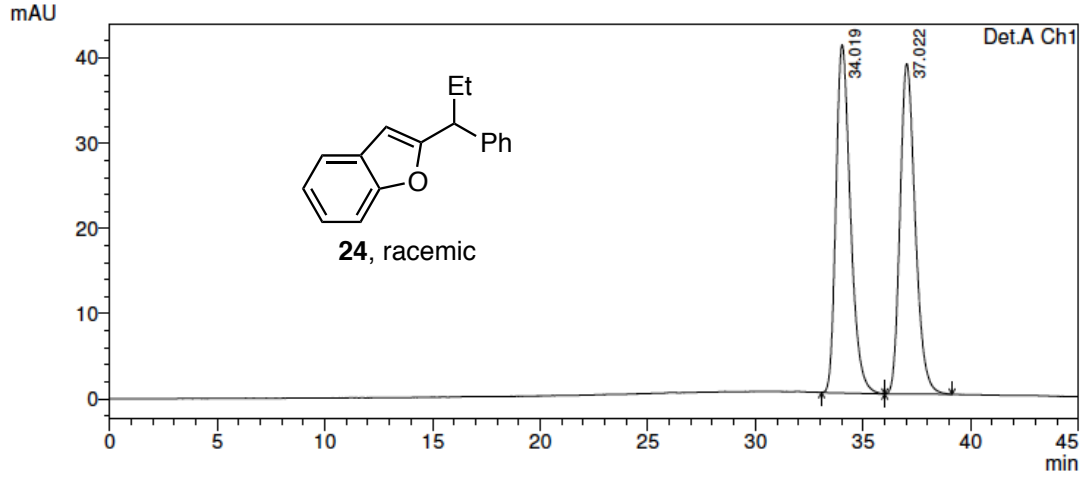
Compound 23, 58% ee



Detector A Ch2 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.952	2329178	104604	20.956	22.464
2	16.499	8785565	361045	79.044	77.536
Total		11114743	465649	100.000	100.000

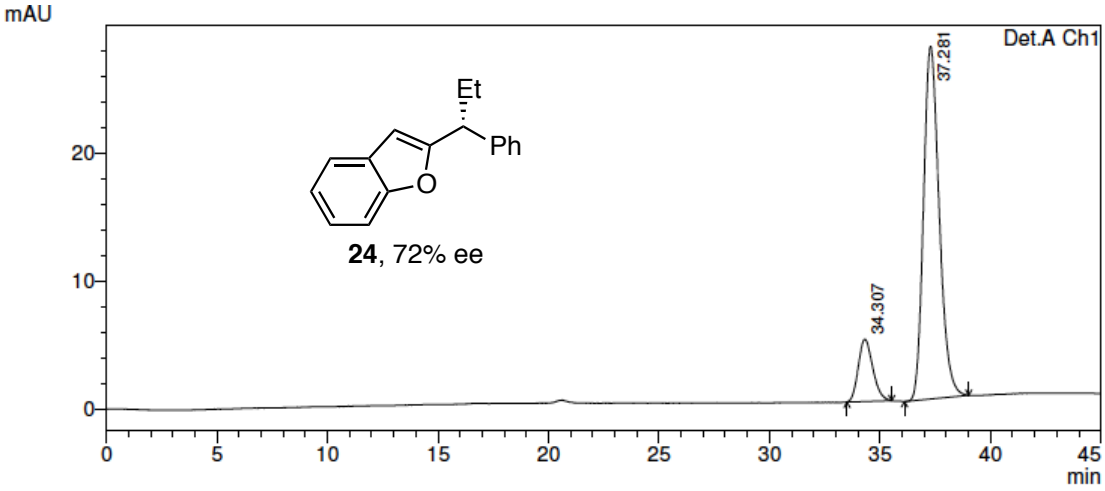
Compound 24, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	34.019	1909990	40855	50.048	51.323
2	37.022	1906321	38748	49.952	48.677
Total		3816311	79603	100.000	100.000

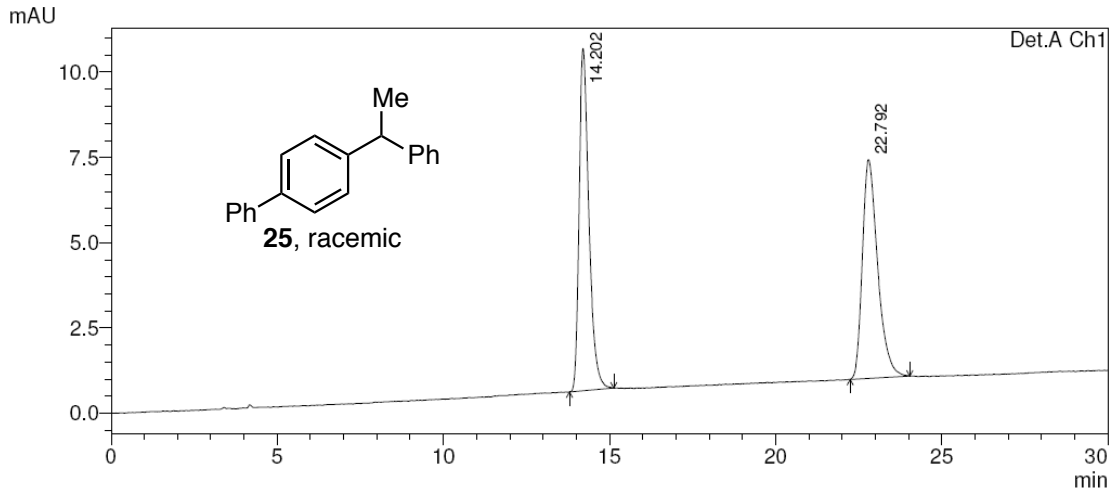
Compound 24, 72% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	34.307	221554	4844	14.011	14.963
2	37.281	1359765	27528	85.989	85.037
Total		1581318	32372	100.000	100.000

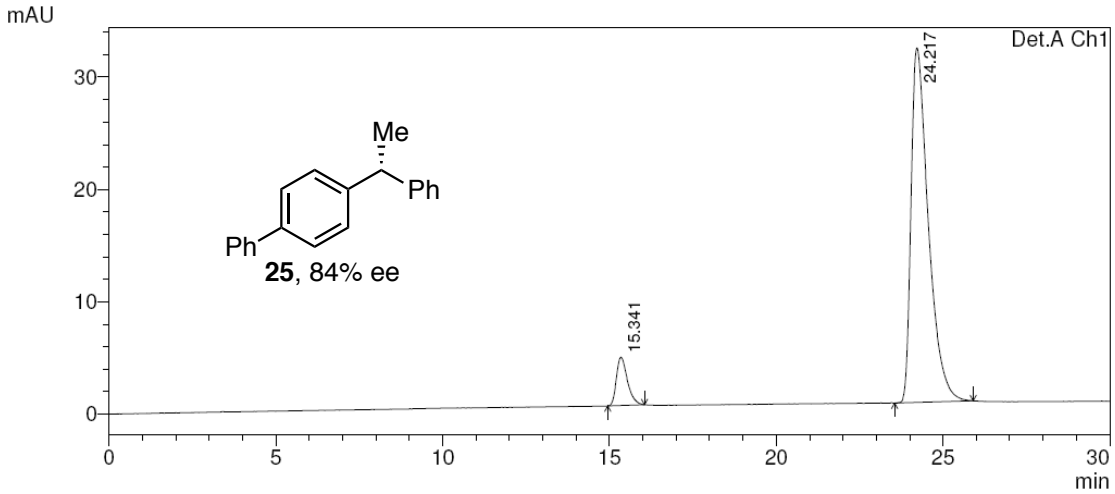
Compound 25, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.202	205998	10036	50.049	60.984
2	22.792	205596	6420	49.951	39.016
Total		411595	16456	100.000	100.000

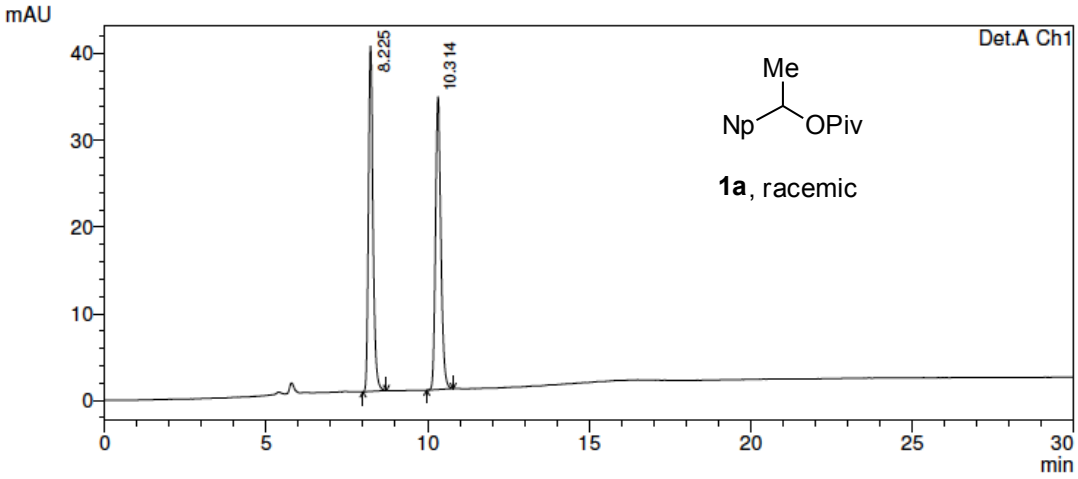
Compound 25, 84% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.341	98693	4298	7.974	11.991
2	24.217	1138964	31549	92.026	88.009
Total		1237657	35848	100.000	100.000

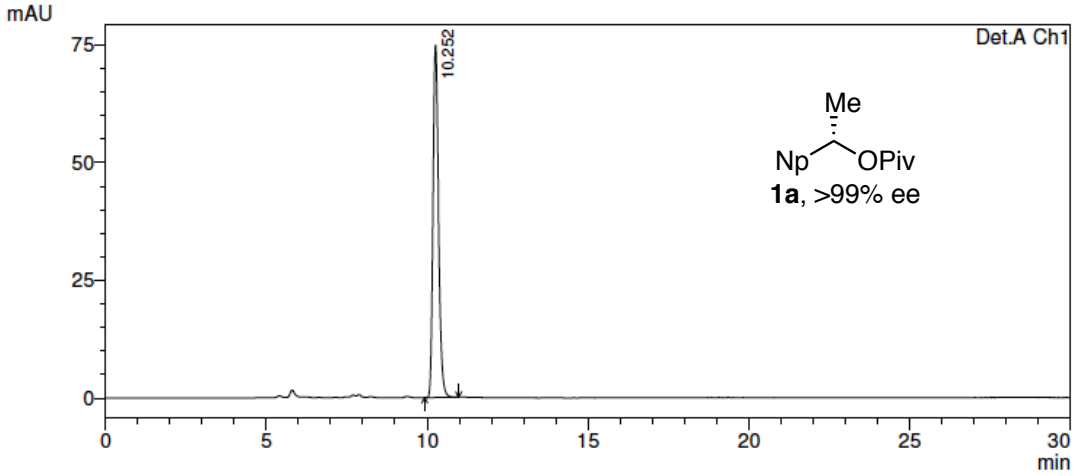
Compound 1a, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.225	396397	39831	49.995	54.121
2	10.314	396480	33765	50.005	45.879
Total		792877	73597	100.000	100.000

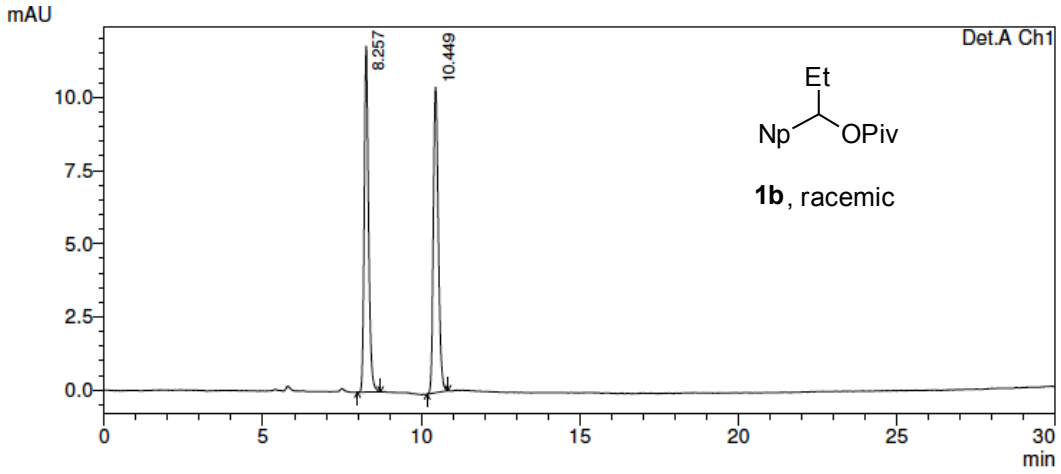
Compound 1a, >99% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.252	897607	74803	100.000	100.000
Total		897607	74803	100.000	100.000

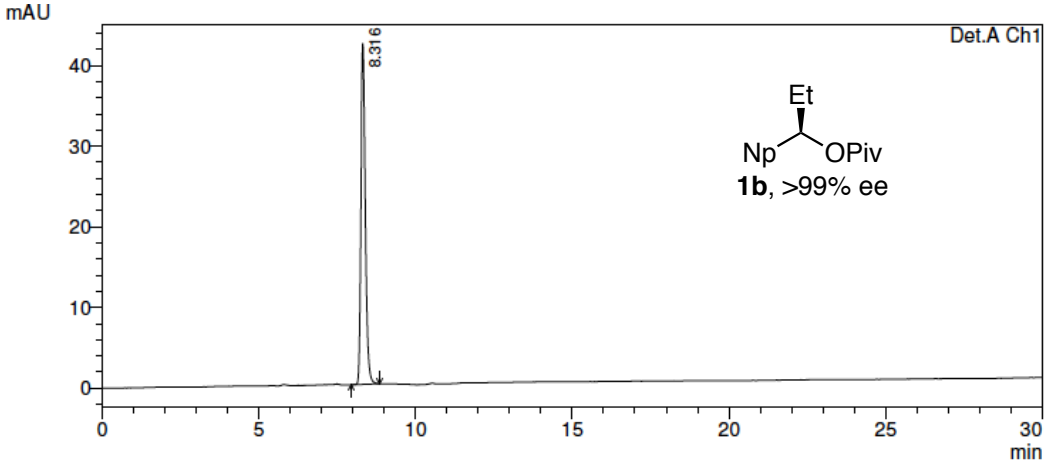
Compound 1b, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.257	114388	11828	50.272	53.100
2	10.449	113152	10447	49.728	46.900
Total		227540	22276	100.000	100.000

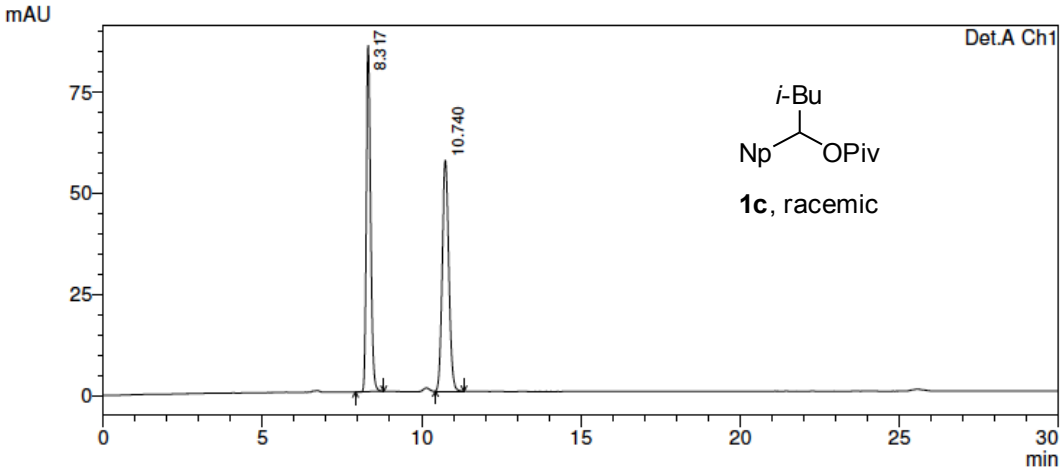
Compound 1b, >99% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.316	415101	42242	100.000	100.000
Total		415101	42242	100.000	100.000

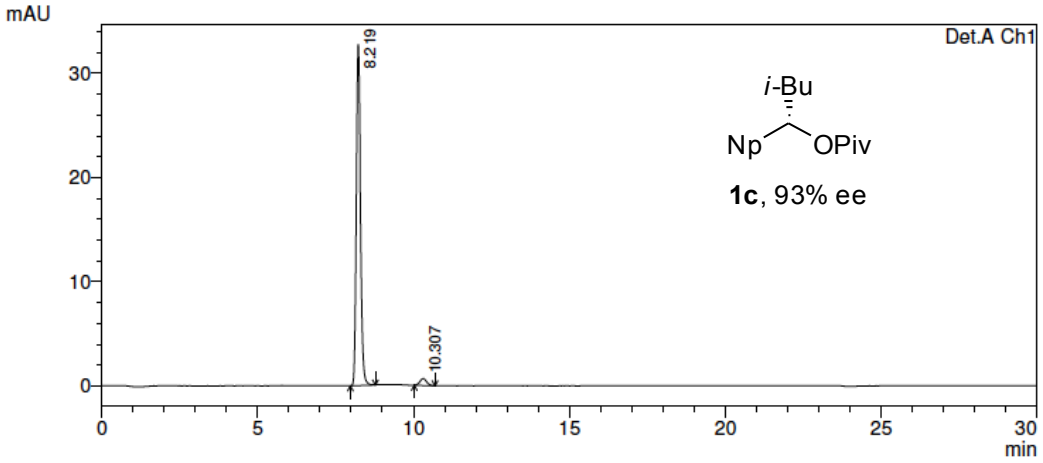
Compound 1c, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.317	820067	85600	49.944	59.987
2	10.740	821921	57098	50.056	40.013
Total		1641989	142698	100.000	100.000

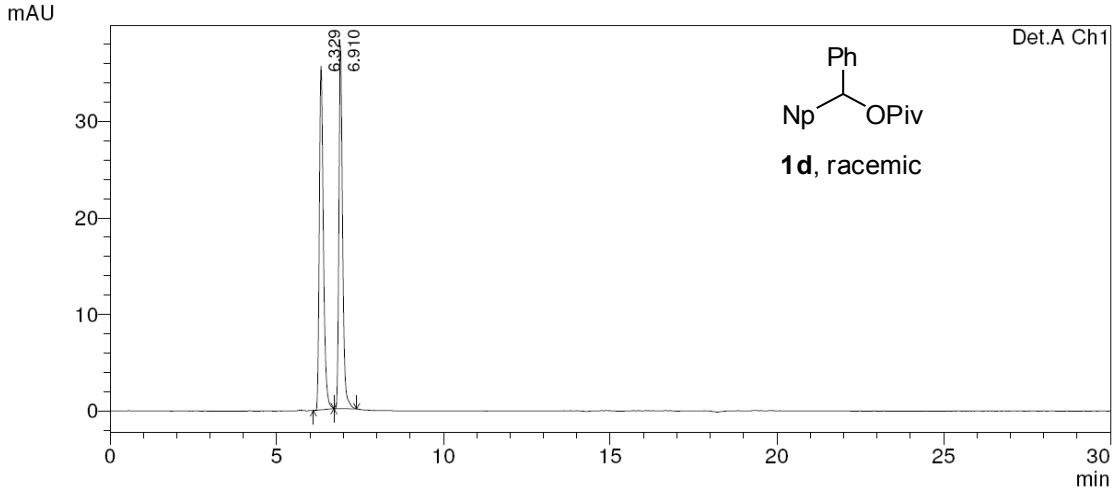
Compound 1c, 93% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.219	308202	32752	96.654	97.974
2	10.307	10668	677	3.346	2.026
Total		318870	33429	100.000	100.000

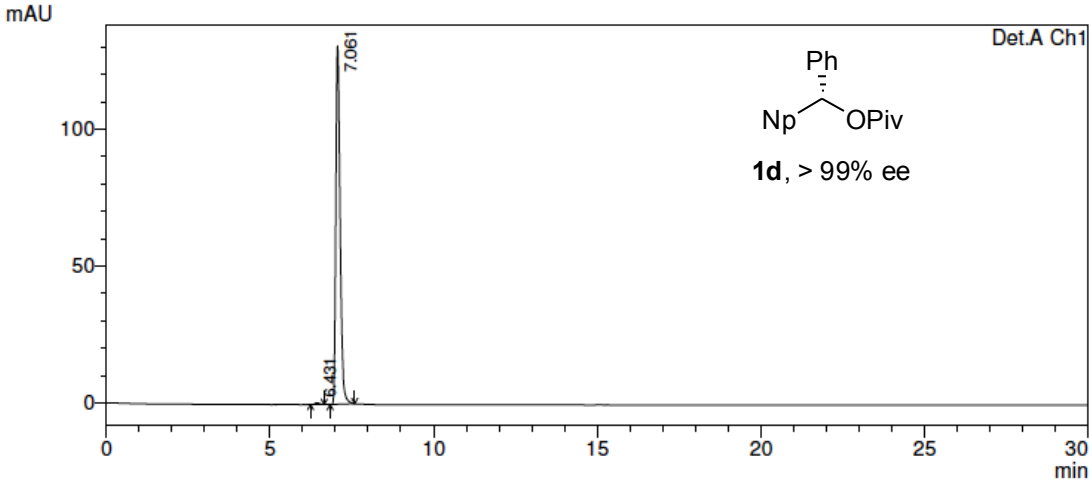
Compound 1d, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.329	297105	35629	49.891	48.644
2	6.910	298408	37615	50.109	51.356
Total		595513	73244	100.000	100.000

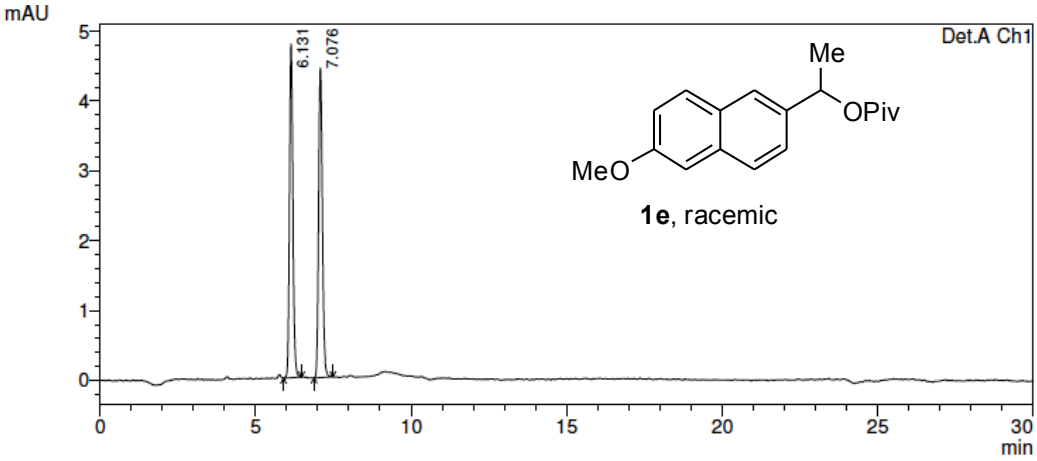
Compound 1d, >99% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.431	5458	661	0.464	0.503
2	7.061	1171050	130897	99.536	99.497
Total		1176509	131558	100.000	100.000

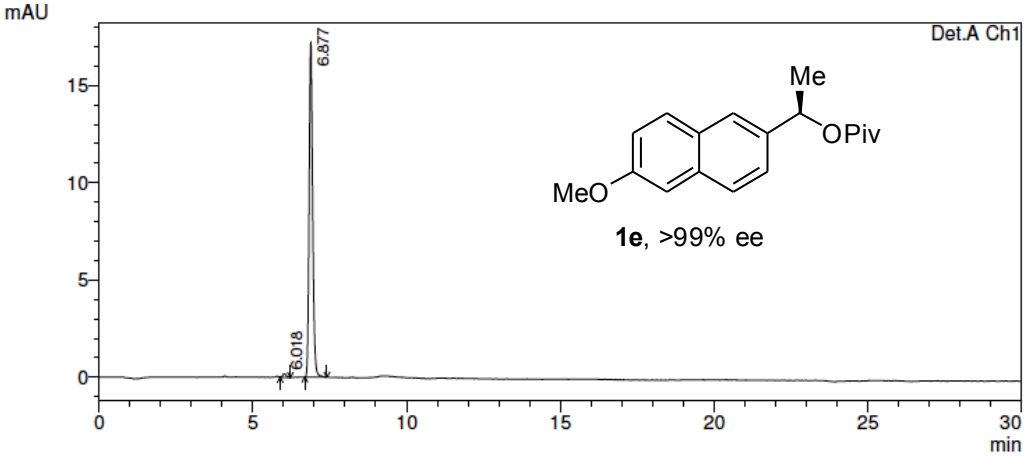
Compound 1e, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.131	37054	4787	50.237	51.891
2	7.076	36705	4438	49.763	48.109
Total		73759	9224	100.000	100.000

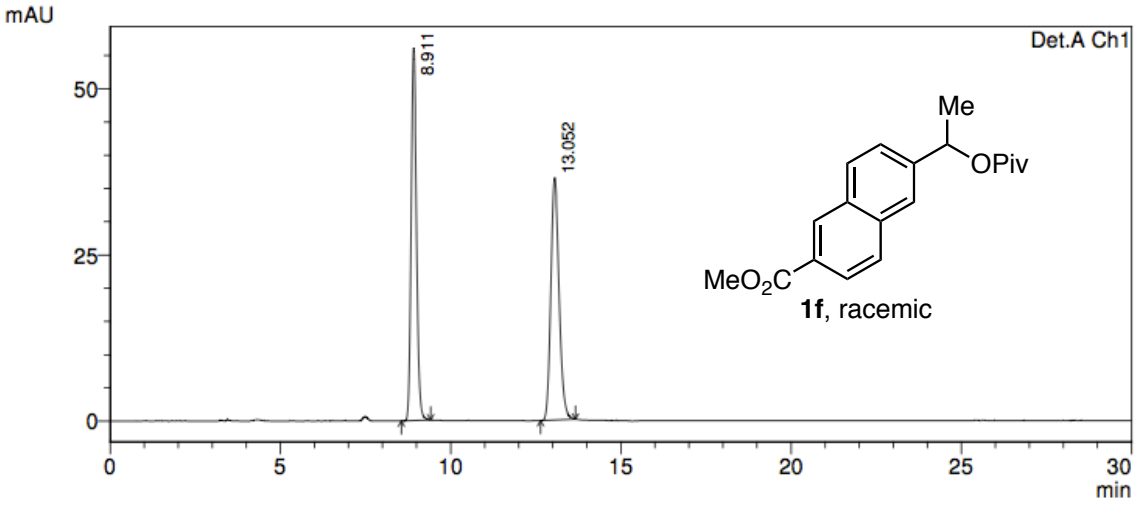
Compound 1e, >99% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.018	1376	185	0.962	1.060
2	6.877	141653	17224	99.038	98.940
Total		143029	17409	100.000	100.000

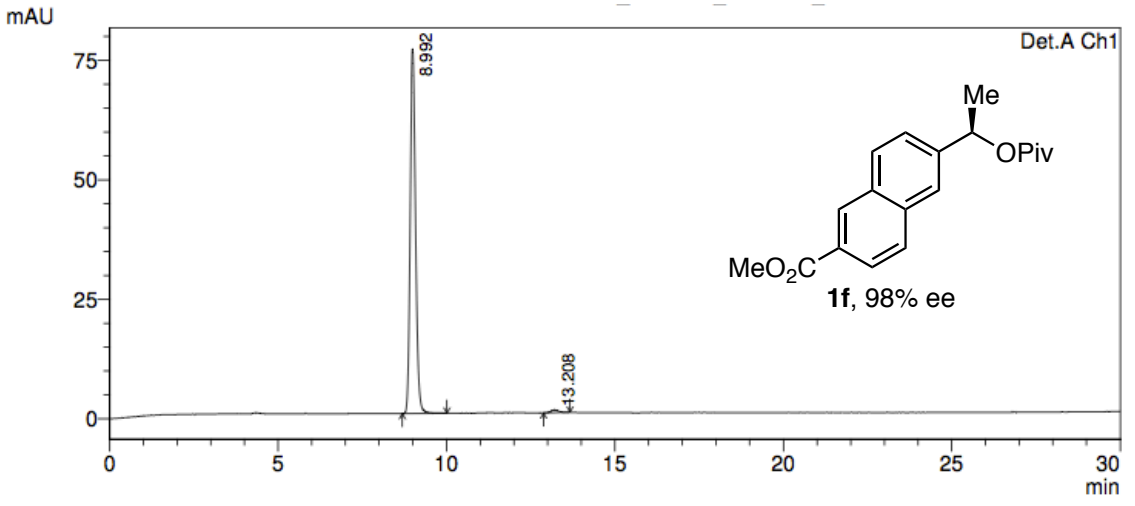
Compound 1f, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.911	613049	56085	50.015	60.609
2	13.052	612685	36451	49.985	39.391
Total		1225734	92536	100.000	100.000

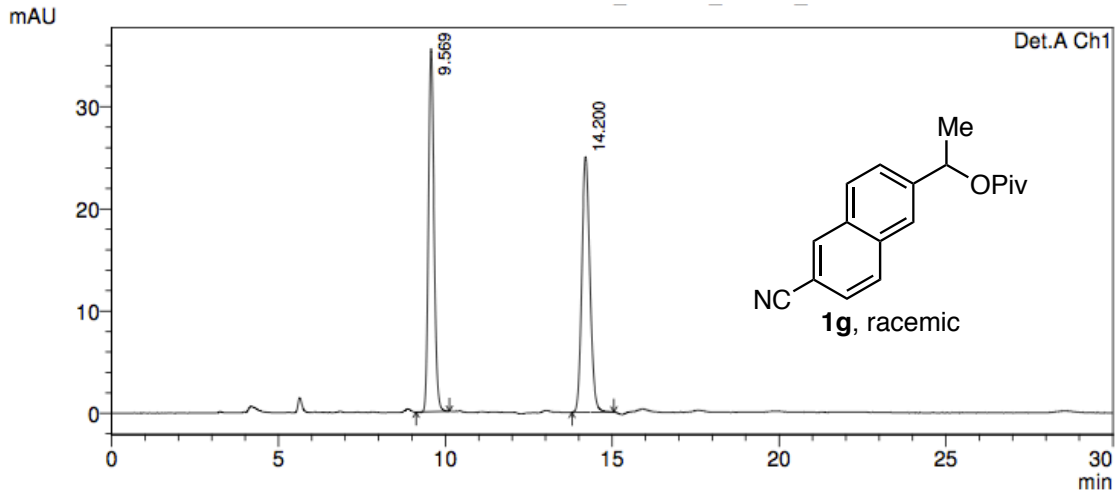
Compound 1f, 98% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.992	851729	76272	99.004	99.274
2	13.208	8567	557	0.996	0.726
Total		860296	76830	100.000	100.000

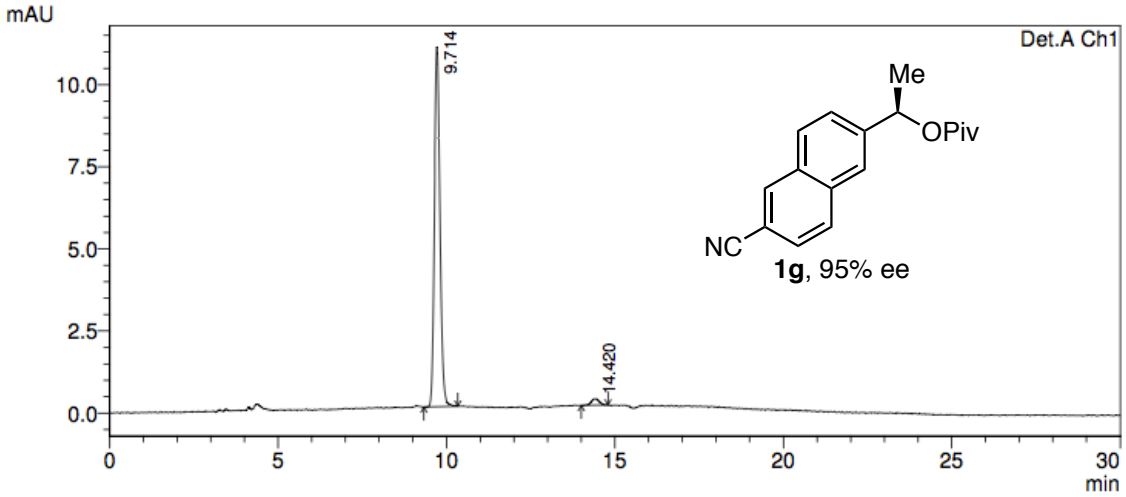
Compound 1g, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.569	415129	35588	49.625	58.719
2	14.200	421402	25019	50.375	41.281
Total		836531	60608	100.000	100.000

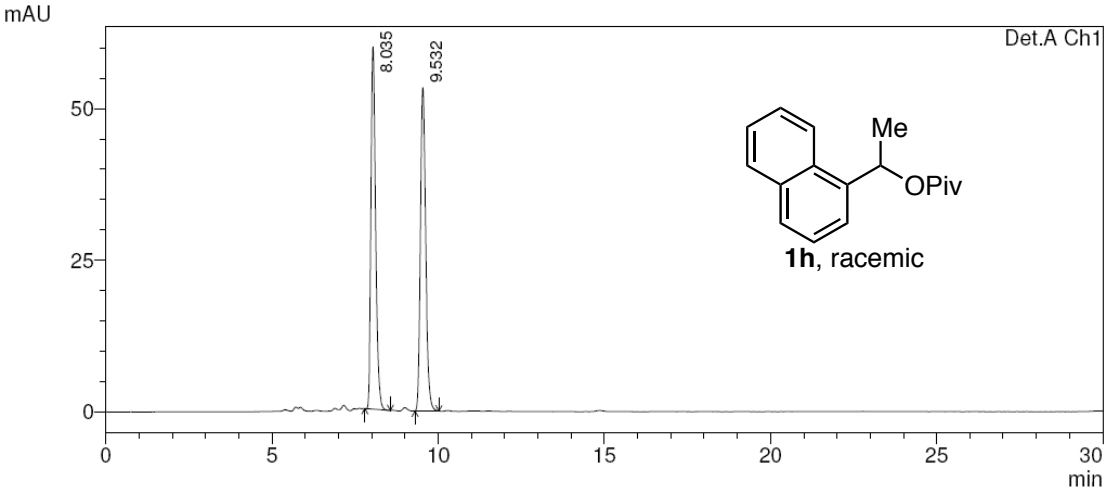
Compound 1g, 95% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.714	126744	10973	97.412	98.176
2	14.420	3367	204	2.588	1.824
Total		130111	11177	100.000	100.000

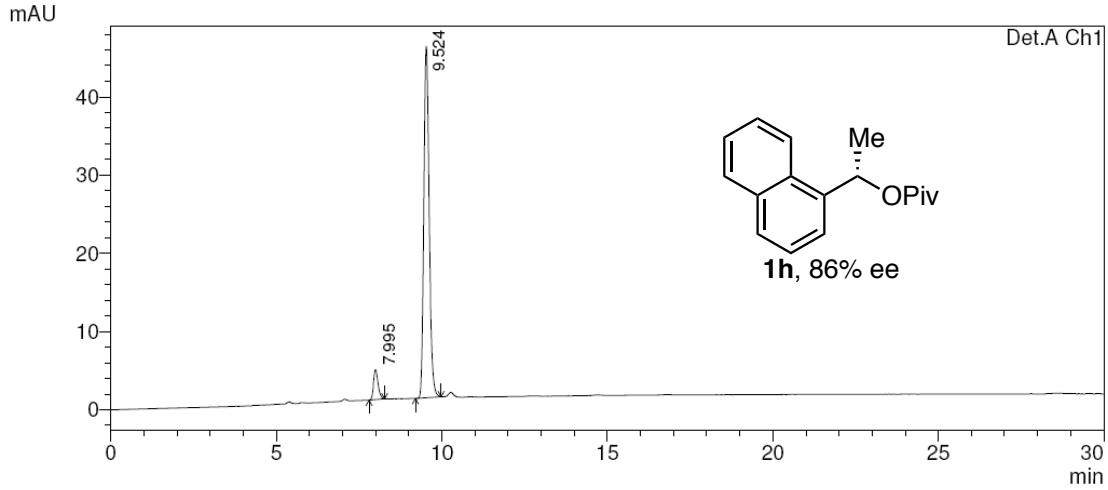
Compound 1h, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.035	579672	59706	49.676	52.828
2	9.532	587238	53313	50.324	47.172
Total		1166910	113019	100.000	100.000

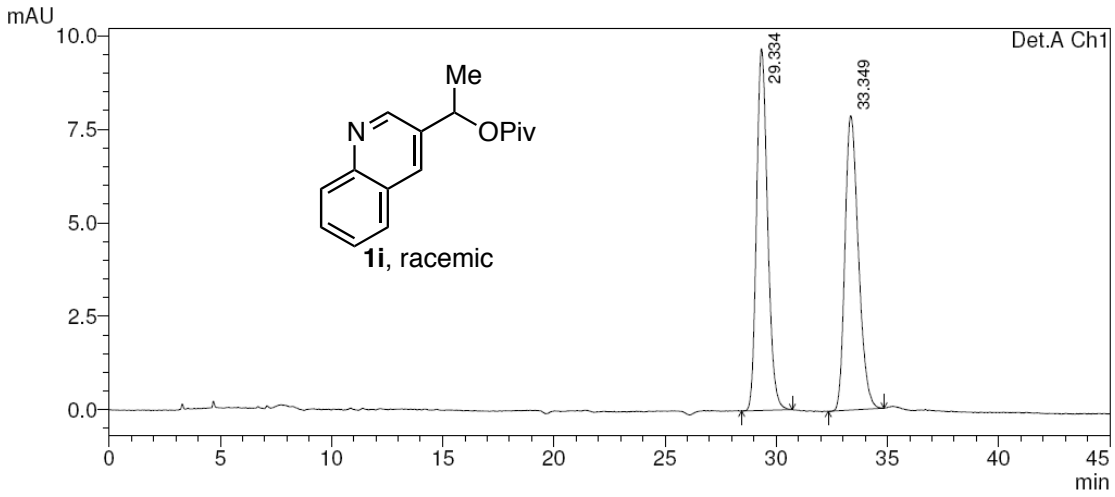
Compound 1h, 86% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.995	36367	3814	6.791	7.825
2	9.524	499160	44924	93.209	92.175
Total		535527	48738	100.000	100.000

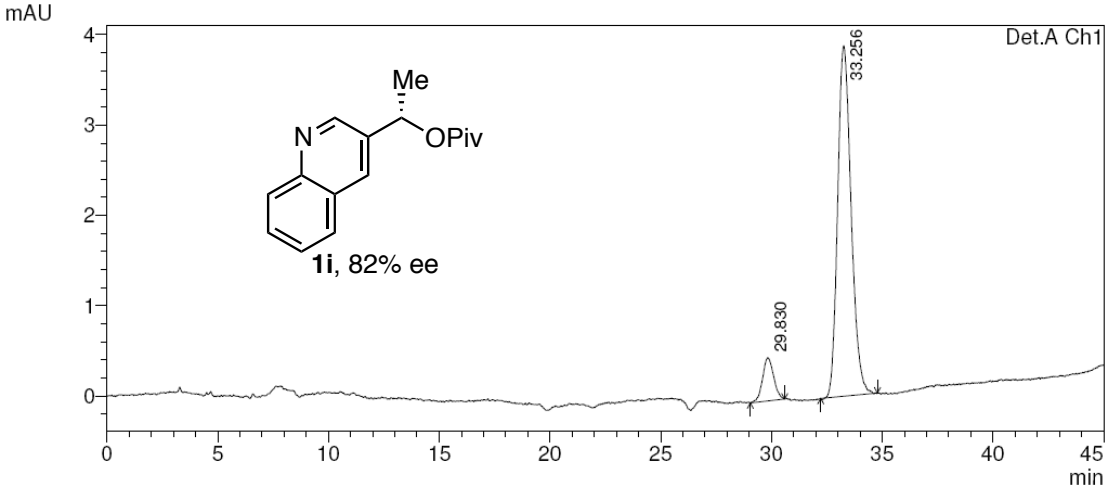
Compound 1i, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	29.334	333054	9664	50.134	55.117
2	33.349	331269	7870	49.866	44.883
Total		664323	17534	100.000	100.000

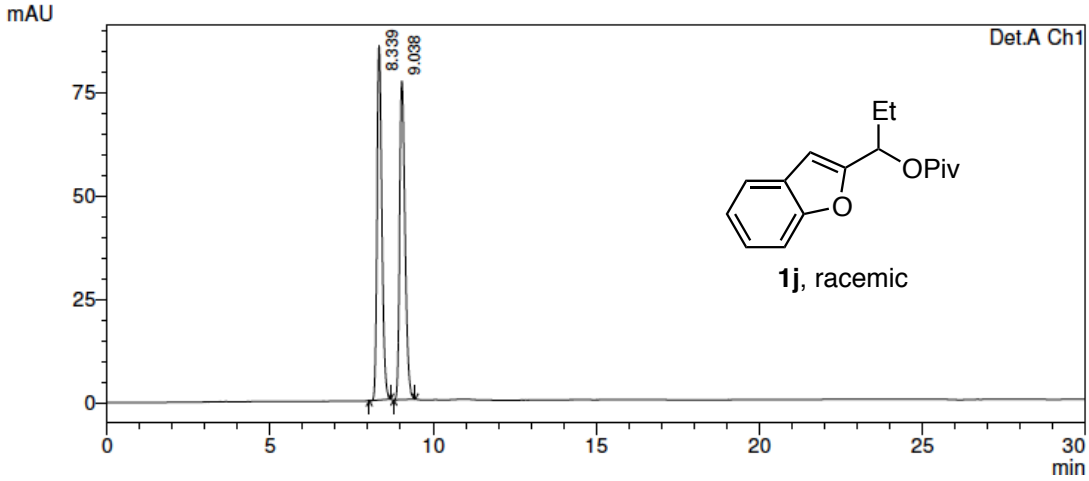
Compound 1i, 82% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	29.830	16673	481	9.218	11.024
2	33.256	164207	3881	90.782	88.976
Total		180880	4362	100.000	100.000

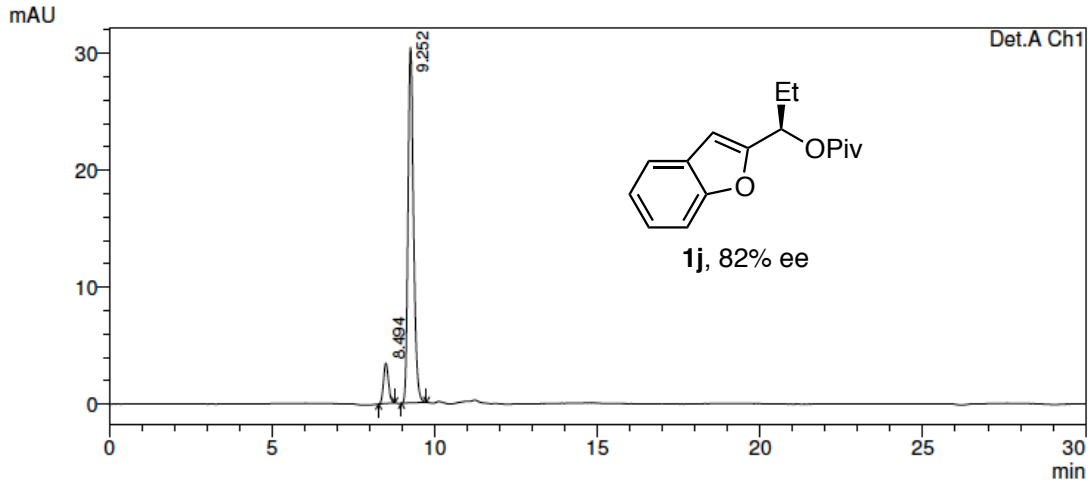
Compound 1j, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.339	888842	85736	50.018	52.657
2	9.038	888188	77084	49.982	47.343
Total		1777030	162821	100.000	100.000

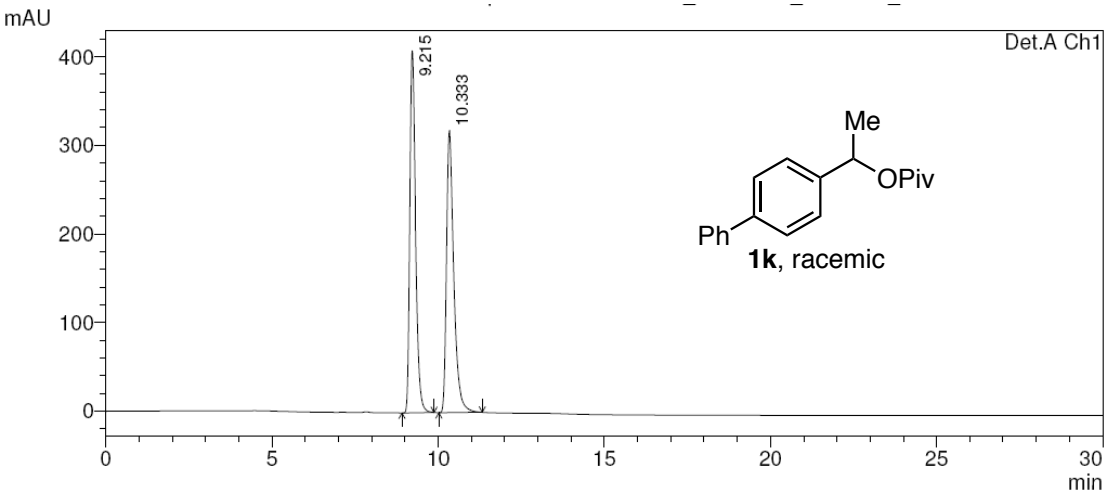
Compound 1j, 82% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.494	36076	3440	9.012	10.169
2	9.252	364222	30391	90.988	89.831
Total		400298	33832	100.000	100.000

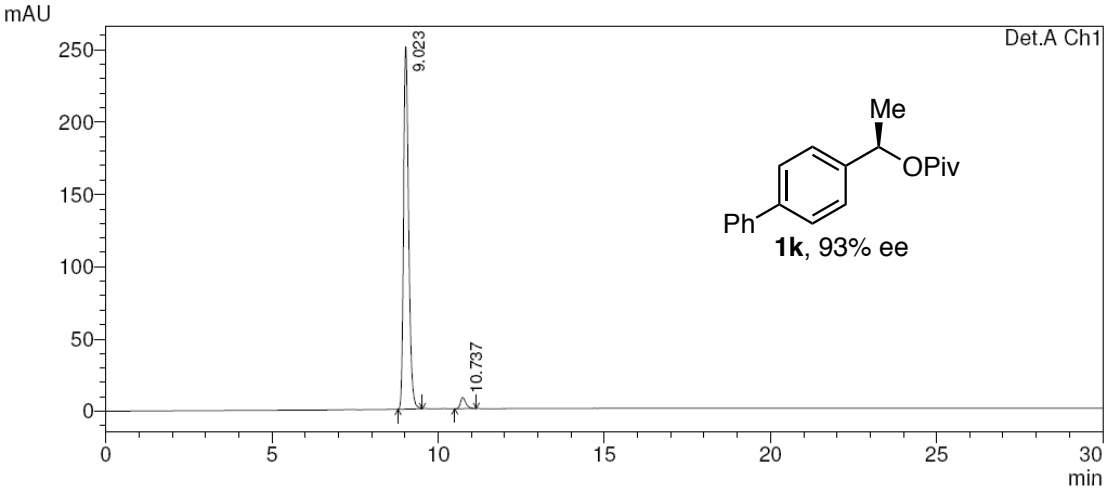
Compound 1k, racemic



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.215	4946210	408528	50.233	56.198
2	10.333	4900271	318419	49.767	43.802
Total		9846481	726947	100.000	100.000

Compound 1k, 93% ee



Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.023	2670459	250803	96.736	96.996
2	10.737	90112	7769	3.264	3.004
Total		2760571	258572	100.000	100.000