

**Enantioselective Rh-Catalyzed Hydrogenation of
3-Aryl-2-phosphonomethylpropenoates by a New Class of Chiral
Ferrocenyl Diphosphine Ligands**

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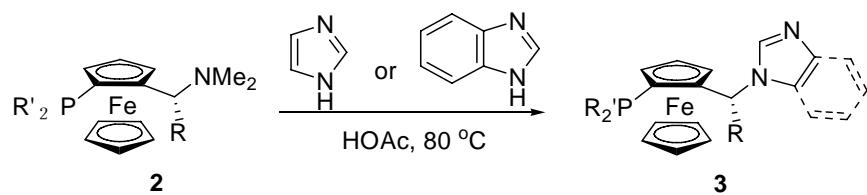
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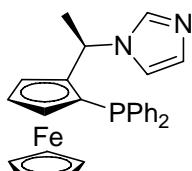
General Information: All reactions were conducted under a nitrogen or argon atmosphere unless otherwise noted. Anhydrous procedures were conducted using oven dried or flame dried glassware and standard syringe and cannula transfer techniques. Hydrogenation was performed in a stainless steel autoclave. Solvents were of reagent grade, dried and distilled before use following standard procedures. Unsaturated ester **4a-n** was prepared according to literature procedure.¹ All other chemicals were obtained commercially. ¹H NMR spectra were recorded on a 400 MHz spectrometer. Chemical shifts were reported in ppm from tetramethylsilane with the solvent resonance as the internal standard (CDCl_3 , $\delta = 7.26$). Data are reported as follows: chemical shift (δ ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), integration, and assignment. ¹³C NMR data were collected on a 100 MHz spectrometer with complete proton decoupling. Chemical shifts are reported in ppm from the tetramethylsilane with the solvent resonance as internal standard (CDCl_3 , $\delta = 77.0$). ³¹P NMR spectra were recorded on 162 MHz spectrometer. The enantiomeric excesses were determined by HPLC analysis on chiral chiralpak AD-H, chiralcel OD-H or chiralcel OJ-H column. Optical rotations were reported as follows: $[\alpha]^{25}_D$ (c g/100mL, in solvent). HRMS data were obtained with Micromass HPLC-Q-Tof mass spectrometer.

General Procedure for Preparation of **3a-f**



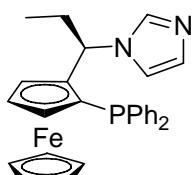
*General procedure for the preparation of **3**:* A mixture of (R_c, S_p)-**2** and imidazole or benzimidazole (8 equiv.) in degassed glacial AcOH was stirred at 80 °C for 8 h. The reaction mixture was quenched with an excess saturated NaHCO_3 solution and extracted with CH_2Cl_2 . The organic extracts were washed with brine and dried over anhydrous Na_2SO_4 , filtered and evaporated under reduced pressure. The crude product was purified by flash column chromatography (SiO_2 , hexane: ethyl acetate: Et_3N , 10:10:1) to afford the corresponding **3**.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]ethyl}-imidazole (3a). **2a** (1.32 g, 3



mmol) and imidazole (1.63 g, 24 mmol) in AcOH (15 mL) were used with reference to the general procedure. Yield: 89%, orange crystal. $[\alpha]^{20}_D$ -284.9 (c 1.0, CHCl₃); m.p. = 195-196 °C; ¹H NMR (400 MHz, CDCl₃): δ 1.86 (3H, d, *J* = 6.8 Hz), 3.88 (1H, s), 4.06 (5H, s), 4.41 (1H, s), 4.66 (1H, s), 5.61 (1H, q, *J* = 3.6 Hz), 6.55 (1H, s), 6.59 (1H, s), 6.72 (2H, t, *J* = 7.6 Hz), 7.02 (2H, t, *J* = 7.2 Hz), 7.11 (1H, t, *J* = 7.2 Hz), 7.18 (1H, s), 7.37 (3H, m), 7.52 (2H, m); ¹³C NMR (100 MHz CDCl₃): δ 22.7, 51.4 (d, *J* = 10 Hz), 68.7 (d, *J* = 3 Hz), 69.8, 70.0, 72.3 (d, *J* = 4 Hz), 76.2 (d, *J* = 9 Hz), 93.4 (d, *J* = 25 Hz), 116.5, 127.9, 128.2 (d, *J* = 8 Hz), 128.6, 129.4, 131.5 (d, *J* = 19 Hz), 135.1 (d, *J* = 21 Hz), 136.8 (d, *J* = 8 Hz), 138.1 (d, *J* = 6 Hz); ³¹P NMR (162 MHz, CDCl₃): δ -24.77; HRMS (ESI): calcd for C₂₇H₂₅FeN₂P [M+H]⁺: 465.1183, found: 465.1194.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]propyl}-imidazole (3b). **2b** (0.45 g,



1 mmol) and imidazole (0.54 g, 8 mmol) in AcOH (5 mL) were used with reference to the general procedure. Yield: 80%, orange crystal. $[\alpha]^{20}_D$ -277.4 (c 1.0, CHCl₃); m.p. = 213-214 °C; ¹H NMR (400 MHz, CDCl₃): δ 0.84 (3H, t, *J* = 7.3 Hz), 2.02 (1H, m), 2.51 (1H, m), 3.85 (1H, s), 4.04 (5H, s), 4.39 (1H, s), 4.64 (1H, s), 5.22 (1H, d, *J* = 11.8 Hz), 6.56 (1H, s), 6.58 (1H, s), 6.67 (2H, t, *J* = 7.6 Hz), 7.01 (2H, t, *J* = 7.2 Hz), 7.10 (1H, t, *J* = 7.3 Hz), 7.18 (1H, s), 7.36 (3H, m), 7.51 (2H, m); ¹³C NMR (100 MHz CDCl₃): δ 11.2, 28.8, 57.8 (d, *J* = 9 Hz), 68.9 (d, *J* = 3 Hz), 69.8, 70.0, 72.1 (d, *J* = 4 Hz), 76.0 (d, *J* = 9 Hz), 93.6 (d, *J* = 25 Hz), 116.4, 127.9 (d, *J* = 7 Hz), 128.2 (d, *J* = 8 Hz), 128.6, 129.4, 131.3 (d, *J* = 18 Hz), 135.2 (d, *J* = 21 Hz), 135.8, 136.8 (d, *J* = 7 Hz), 138.2 (d, *J* = 6 Hz); ³¹P NMR (162 MHz, CDCl₃): δ -24.63; HRMS (ESI): calcd for C₂₈H₂₇FeN₂P [M+H]⁺: 479.1340, found: 479.1344.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]-s-butyl}-imidazole (3c). **2c** (2.5 g,

5.3 mmol) and imidazole (2.9 g, 42.4 mmol) in AcOH (20 mL) were used with reference to the general procedure. Yield: 61%, orange solid. $[\alpha]^{20}_D$ -339.2 (c 1.0, CHCl₃); ¹H NMR (400 MHz, CDCl₃): δ 0.78 (t, *J* = 6.6 Hz, 3H), 1.13 (t, *J* = 6.9 Hz,

3H), 2.68 (m, 1H), 3.95 (s, 1H), 3.99 (s, 5H), 4.43 (s, 1H), 4.66 (s, 1H), 5.23 (s, 1H), 6.47 (s, 1H), 6.62 (s, 1H), 6.85 (t, $J = 7.7$ Hz, 2H), 7.07 (t, $J = 7.4$ Hz, 2H), 7.14 (t, $J = 7.3$ Hz, 1H), 7.25 (s, 1H), 7.36 (m, 3H), 7.52 (m, 2H); ^{13}C NMR (100 MHz CDCl_3): δ 19.1, 22.6, 32.7, 62.1 (d, $J = 8$ Hz), 69.6, 70.1, 70.4, 72.3 (d, $J = 4$ Hz), 76.2 (d, $J = 11$ Hz), 93.2 (d, $J = 25$ Hz), 118.8, 127.8 (d, $J = 7$ Hz), 128.1 (t, $J = 8$ Hz), 128.6, 129.2, 131.5 (d, $J = 19$ Hz), 135.1 (d, $J = 21$ Hz), 136.7, 137.1 (d, $J = 7$ Hz), 137.6 (d, $J = 7$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ -25.53; HRMS (ESI): calcd for $\text{C}_{29}\text{H}_{29}\text{FeN}_2\text{P}$ [M+H] $^+$: 493.1496, found: 493.1514.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]benzyl}-imidazole (3d). 2d (0.50 g,

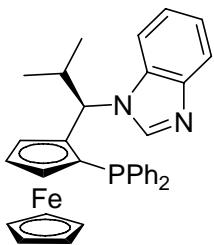
1 mmol) and imidazole (0.54 g, 8 mmol) in AcOH (5 mL) were used with reference to the general procedure. Yield: 80%, orange solid. $[\alpha]^{20}_D$ -181.6 (c 0.25, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 3.80 (s, 5H), 4.09 (s, 1H), 4.42 (s, 1H), 4.45 (s, 1H), 6.53 (d, $J = 4.8$ Hz, 1H), 6.59 (s, 1H), 6.94-7.00 (m, 3H), 7.08-7.20 (m, 4H), 7.34-7.42 (m, 8H), 7.59 (m, 2H); ^{13}C NMR (100 MHz CDCl_3): δ 60.2 (d, $J = 13$ Hz), 69.9, 70.1 (d, $J = 12$ Hz), 70.7 (t, $J = 19$ Hz), 72.6, 76.5 (d, $J = 9$ Hz), 91.8 (d, $J = 25$ Hz), 118.2, 127.6 (d, $J = 36$ Hz), 128.0 (t, $J = 8$ Hz), 128.2 (d, $J = 10$ Hz), 128.6, 129.4, 132.1 (d, $J = 10$ Hz), 135.0 (d, $J = 21$ Hz), 136.0, 136.8 (d, $J = 7$ Hz), 137.8, 140.4; ^{31}P NMR (162 MHz, CDCl_3): δ -25.23; HRMS (ESI): calcd for $\text{C}_{32}\text{H}_{27}\text{FeN}_2\text{P}$ [M+H] $^+$: 527.1340, found: 527.1317.

1-{(R)-1-[(S)-2-(bis(3,5-dimethylphenyl)phosphino)ferrocenyl]-s-butyl}-imidazole

(3e). 2e (0.67 g, 1.28 mmol) and imidazole (0.44 g, 6.40 mmol) in AcOH (5 mL) were used with reference to the general procedure. Yield: 51%, orange solid. $[\alpha]^{20}_D$ -210.1 (c 1.1, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 0.77 (d, $J = 6.8$ Hz, 3H), 1.06 (d, $J = 8.4$ Hz, 3H), 2.10 (d, $J = 8.4$ Hz, 6H), 2.29 (d, $J = 8.4$ Hz, 6H), 2.67 (m, 1H), 3.96 (m, 6H), 4.39 (m, 1H), 4.63 (m, 1H), 5.13 (m, 1H), 6.38 (m, 2H), 6.60 (m, 1H), 6.74 (m, 2H), 7.00 (m, 1H),

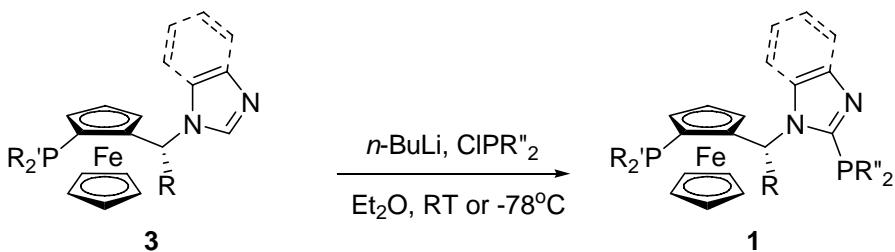
7.15 (m, 2H), 7.25 (m, 1H); ^{13}C NMR (100 MHz CDCl_3): δ 19.1, 21.3 (d, $J = 12$ Hz), 22.6, 33.1, 62.1 (d, $J = 8$ Hz), 69.5, 70.1, 70.3, 72.4, 76.6, 93.4 (d, $J = 24$ Hz), 118.8, 127.5, 129.5, 129.7 (d, $J = 8$ Hz), 131.0, 132.8 (d, $J = 21$ Hz), 136.9 (t, $J = 8$ Hz), 137.4 (d, $J = 8$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ -24.60; HRMS (ESI): calcd for $\text{C}_{33}\text{H}_{37}\text{FeN}_2\text{P} [\text{M}+\text{H}]^+$: 549.2122, found: 549.2106.

1- $\{(R)\text{-1-}[(S)\text{-2-(diphenylphosphino)ferrocenyl}\text{-s-butyl}\text{-}]\text{-benzimidazole (3f).}$ (0.75



g, 1.6 mmol) and benzimidazole (1.51 g, 12.8 mmol) in AcOH (5 mL) were used with reference to the general procedure. Yield: 73%, orange solid. $[\alpha]^{20}_{\text{D}} -298.2$ (c 1.1, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 0.76 (d, $J = 6.6$ Hz, 3H), 1.27 (d, $J = 6.7$ Hz, 3H), 2.87 (m, 1H), 3.89 (s, 1H), 4.06 (s, 5H), 4.46 (s, 1H), 4.81 (s, 1H), 5.63 (m, 1H), 6.46 (t, $J = 7.7$ Hz, 2H), 6.67 (t, $J = 7.3$ Hz, 2H), 6.84 (m, 1H), 6.98 (t, $J = 7.5$ Hz, 1H), 7.06 (m, 1H), 7.29 (m, 5H), 7.43 (m, 2H), 7.63 (m, 1H); ^{13}C NMR (100 MHz CDCl_3): δ 19.7, 23.3, 32.8, 60.4, 69.5, 70.3 (d, $J = 4$ Hz), 72.4 (d, $J = 4$ Hz), 76.7, 111.2, 120.0, 121.1, 121.9, 127.2 (d, $J = 7$ Hz), 127.7, 128.1 (d, $J = 8$ Hz), 129.1, 131.4 (d, $J = 20$ Hz), 133.5, 134.9 (d, $J = 21$ Hz), 135.6 (d, $J = 7$ Hz), 136.7 (d, $J = 8$ Hz), 142.9 (d, $J = 42$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ -25.97; HRMS (ESI): calcd for $\text{C}_{33}\text{H}_{31}\text{FeN}_2\text{P} [\text{M}+\text{H}]^+$: 543.1653, found: 543.1631.

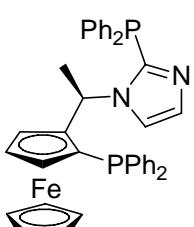
General Procedure for Preparation of Ligands 1a-i



To a solution of **3** in dry Et_2O was added dropwise $n\text{-BuLi}$ (1.5 equiv., 1.6 M solution in hexane) at room temperature (-78 °C for **1d**), and the mixture was stirred for an hour under argon atmosphere before chlorodiphenylphosphine (1.5 equiv.) was added. The reaction mixture was stirred for further 2 h, saturated NaHCO_3 solution was added. The organic layer was washed with brine and dried over anhydrous Na_2SO_4 , filtered

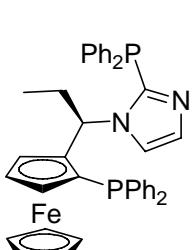
and evaporated under reduced pressure. The residue was purified by flash column chromatography (SiO_2 , hexane: ethyl acetate, 5:1) to afford the corresponding **1**.

1-*{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]ethyl}-2-(diphenylphosphino)imidazole (1a).* Yield: 75%. Orange crystal, $[\alpha]^{20}_{\text{D}} -147.2$ (c 1.0, CHCl_3); ^1H NMR (400



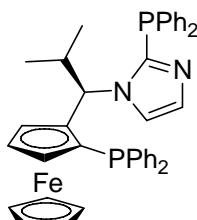
MHz, CDCl_3): δ 1.62 (d, $J = 6.8$ Hz, 3H), 3.91 (s, 1H), 4.06 (s, 5H), 4.43 (s, 1H), 4.69 (s, 1H), 6.43 (m, 1H), 6.57 (m, 2H), 6.78 (d, $J = 2.0$ Hz, 1H), 6.92 (m, 3H), 7.07 (m, 3H), 7.15 (m, 3H), 7.25 (s, 1H), 7.33-7.38 (m, 5H), 7.53 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 23.0, 51.2 (dd, $J = 17, 10$ Hz), 69.3, 70.0, 70.1, 72.1 (d, $J = 4$ Hz), 76.5 (d, $J = 12$ Hz), 93.8 (d, $J = 27$ Hz), 118.9, 127.4, 127.7 (d, $J = 5$ Hz), 127.9, 128.0 (d, $J = 7$ Hz), 128.2 (d, $J = 6$ Hz), 128.5 (d, $J = 8$ Hz), 129.2 (d, $J = 21$ Hz), 130.7, 131.4 (d, $J = 18$ Hz), 133.4 (d, $J = 19$ Hz), 134.4 (d, $J = 21$ Hz), 135.5 (d, $J = 22$ Hz), 136.2, 137.6 (d, $J = 9$ Hz), 139.0 (d, $J = 8$ Hz), 143.7; ^{31}P NMR (162 MHz, CDCl_3): δ -24.1, -35.1; HRMS (ESI): calcd for $\text{C}_{39}\text{H}_{34}\text{FeN}_2\text{P}_2$ [$\text{M}+\text{H}]^+$: 649.1625, found: 649.1636.

1-*{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]propyl}-2-(diphenylphosphino)imidazole (1b).* Yield: 50%. Orange crystal. $[\alpha]^{20}_{\text{D}} -246.9$ (c 1.0, CHCl_3); ^1H NMR (400



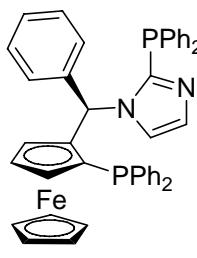
MHz, CDCl_3): δ 0.62 (m, 3H), 2.04 (br, 1H), 2.52 (m, 1H), 3.91 (s, 1H), 3.98 (s, 5H), 4.38 (s, 1H), 4.66 (br, 1H), 6.21 (br, 1H), 6.37 (t, $J = 7.0$ Hz, 2H), 6.86-6.92 (m, 3H), 7.00 (t, $J = 6.8$ Hz, 2H), 7.08-7.14 (m, 3H), 7.20-7.27 (m, 5H), 7.6 (m, 3H), 7.57 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 11.6, 29.6, 57.1, 70.0, 72.2 (d, $J = 4$ Hz), 76.3 (d, $J = 14$ Hz), 94.9 (d, $J = 25$ Hz), 119.0, 127.1, 127.6 (d, $J = 5$ Hz), 127.9, 128.0, 128.1, 128.2, 128.3, 128.7, 129.4, 131.2, 131.3, 133.6, 133.8, 134.3, 134.5, 135.5, 135.8, 136.6, 137.0, 138.0 (d, $J = 9$ Hz), 139.6 (d, $J = 8$ Hz), 144.8; ^{31}P NMR (162 MHz, CDCl_3): δ -23.9, -37.9; HRMS (ESI): calcd for $\text{C}_{40}\text{H}_{36}\text{FeN}_2\text{P}_2$ [$\text{M}+\text{H}]^+$: 663.1781, found: 663.1763.

1-*{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]-2-methylpropyl}-2-(diphenylphosphino)imidazole (1c).* Yield: 64%. Orange crystal. $[\alpha]^{20}_{\text{D}} -584.5$ (c 0.5, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 0.57 (d, $J = 6.5$ Hz, 3H), 0.79 (d, $J = 5.1$ Hz, 3H), 2.52



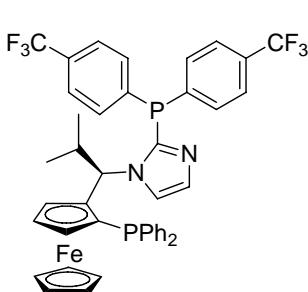
 (m, 1H), 3.64 (s, 5H), 4.02 (s, 1H), 4.41 (s, 1H), 4.62 (m, 1H), 5.99 (m, 1H), 6.79 (m, 2H), 7.06 (m, 2H), 7.12 (m, 2H), 7.32 (m, 6H), 7.36 (m, 3H), 7.54 (m, 4H), 7.65 (m, 1H), 7.75 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 20.2, 22.0, 34.1, 62.1 (d, $J = 18$ Hz), 69.4, 70.0, 72.7 (d, $J = 11$ Hz), 74.4 (d, $J = 15$ Hz), 95.7 (d, $J = 27$ Hz), 121.8 (d, $J = 16$ Hz), 127.7 (d, $J = 6$ Hz), 127.8, 128.0 (d, $J = 8$ Hz), 128.2, 128.3, 128.4, 128.6, 129.0, 129.2, 130.4, 132.4 (d, $J = 18$ Hz), 133.6 (d, $J = 20$ Hz), 134.8 (d, $J = 21$ Hz), 135.2 (d, $J = 22$ Hz), 135.8, 136.8, 137.9 (d, $J = 8$ Hz), 138.4 (d, $J = 8$ Hz), 145.1; ^{31}P NMR (162 MHz, CDCl_3): δ -25.6, -36.5; HRMS (ESI): calcd for $\text{C}_{41}\text{H}_{38}\text{FeN}_2\text{P}_2$ $[\text{M}+\text{H}]^+$: 677.1938, found: 677.1921.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]benzyl}-2-(diphenylphosphino)imidazole (1d**).** Yield: 70%. Orange crystal. $[\alpha]^{20}_D$ -59.9 (c 1.0, CHCl_3); ^1H NMR (400



 MHz, CDCl_3): δ 3.85 (s, 5H), 4.05 (s, 1H), 4.39 (s, 1H), 4.42 (s, 1H), 6.82 (m, 3H), 6.89 (m, 3H), 6.97 (m, 4H), 7.04 (m, 2H), 7.15 (m, 8H), 7.36 (m, 5H), 7.45 (m, 1H), 7.60 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 59.6, 59.8 (d, $J = 13$ Hz), 70.2, 70.4, 71.1, 72.6 (d, $J = 4$ Hz), 92.8 (d, $J = 27$ Hz), 120.2, 127.6, 127.7, 127.8, 127.9, 128.0, 128.1, 128.2, 129.3, 130.2, 132.0 (d, $J = 18$ Hz), 133.4, 133.6 (d, $J = 4$ Hz), 135.3 (d, $J = 21$ Hz), 135.6, 137.4 (d, $J = 9$ Hz), 138.3 (d, $J = 8$ Hz), 139.9, 144.7; ^{31}P NMR (162 MHz, CDCl_3): δ -25.3, -33.5; HRMS (ESI): calcd for $\text{C}_{44}\text{H}_{36}\text{FeN}_2\text{P}_2$ $[\text{M}+\text{H}]^+$: 711.1781, found: 711.1796.

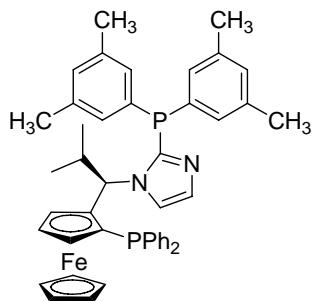
1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]-2-methylpropyl}-2-[bis(4-trifluoromethylphenyl)phosphino]imidazole (1e**).** Yield: 47%. Orange crystal. $[\alpha]^{20}_D$



 -280.0 (c 1.2, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 0.63 (d, $J = 6.6$ Hz, 3H), 0.98 (d, $J = 5.2$ Hz, 3H), 2.61 (m, 1H), 3.79 (s, 5H), 4.04 (s, 1H), 4.34 (s, 1H), 4.67 (s, 1H), 6.15 (m, 1H), 6.41 (t, $J = 7.4$ Hz, 2H), 6.93 (m, 3H), 7.01 (m, 1H), 7.22 (m, 1H), 7.33 (m, 4H), 7.41 (m, 1H), 7.51 (m, 4H), 7.75 (m, 2H), 7.80 (m, 1H), 8.17 (m, 1H); ^{13}C NMR

(100 MHz CDCl₃): δ 20.1, 22.5, 33.4, 61.7, 69.8, 70.1, 71.1, 72.6 (d, *J* = 4 Hz), 75.3 (d, *J* = 14 Hz), 94.6 (d, *J* = 27 Hz), 121.8, 122.7 (d, *J* = 7 Hz), 125.5, 126.0, 127.4 (d, *J* = 6 Hz), 128.1 (d, *J* = 8 Hz), 128.8 (dd, *J* = 6, 11 Hz), 129.3, 130.3 (d, *J* = 12 Hz), 130.8 (d, *J* = 9 Hz), 131.0, 131.7 (d, *J* = 18 Hz), 135.3 (d, *J* = 23 Hz), 136.7 (d, *J* = 16 Hz), 137.2, 137.7 (d, *J* = 8 Hz), 138.5 (d, *J* = 8 Hz), 142.8; ³¹P NMR (162 MHz, CDCl₃): δ -25.49 (d, *J* = 35.0 Hz), -39.31 (d, *J* = 33.5 Hz); HRMS (ESI): calcd for C₄₃H₃₆F₆FeN₂P₂ [M+H]⁺: 813.1686, found: 813.1656.

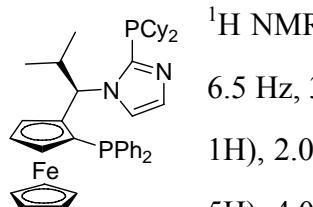
1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]-2-methylpropyl}-2-[bis(3,5-dimethylphenyl)phosphino]imidazole (1f). Yield: 49%. Orange solid. [α]²⁰_D -227.9 (c 1.0,



CHCl₃); ¹H NMR (400 MHz, CDCl₃): δ 0.53 (d, *J* = 6.4 Hz, 3H), 0.67 (d, *J* = 5.2 Hz, 3H), 2.23 (s, 12H), 2.41 (m, 1H), 3.54 (s, 5H), 4.00 (s, 1H), 4.35 (s, 1H), 4.57 (s, 1H), 5.80 (m, 1H), 6.91 (d, *J* = 12.4 Hz, 4H), 7.11 (m, 6H), 7.35 (s, 3H), 7.43 (d, *J* = 8.4 Hz, 2H), 7.56 (s, 2H), 7.92 (m, 1H); ¹³C NMR (100 MHz CDCl₃): δ 20.3, 21.4, 21.7, 34.4, 62.3

(d, *J* = 11 Hz), 69.1, 70.0, 72.6, 73.5, 73.8, 95.44, 121.6 (d, *J* = 20 Hz), 127.6 (d, *J* = 7 Hz), 127.8, 128.0 (d, *J* = 8 Hz), 129.1, 130.3, 131 (d, *J* = 20 Hz), 132.7 (t, *J* = 17 Hz), 135.2 (d, *J* = 22 Hz), 137.5, 138.0 (d, *J* = 9 Hz), 138.4; ³¹P NMR (162 MHz, CDCl₃): δ -25.34, -36.03; HRMS (ESI): calcd for C₄₅H₄₆FeN₂P₂ [M+H]⁺: 733.2564, found: 733.2585.

1-{(R)-1-[(S)-2-(diphenylphosphino)ferrocenyl]-2-methylpropyl}-2-(dicyclohexylphosphino)imidazole (1g). Yield: 38%. Orange solid. [α]²⁰_D -267.9 (c 1.12, CHCl₃);

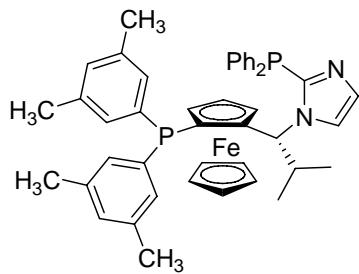


¹H NMR (400 MHz, CDCl₃): δ 0.48 (d, *J* = 5.5 Hz, 3H), 0.55 (d, *J* = 6.5 Hz, 3H), 1.24~1.44 (m, 11H), 1.66 (m, 3H), 1.83 (m, 4H), 1.96 (m, 1H), 2.06 (m, 1H), 2.20 (m, 1H), 2.37 (m, 1H), 2.59 (m, 1H), 3.51 (s, 5H), 4.05 (s, 1H), 4.37 (s, 1H), 4.39 (s, 1H), 5.33 (t, *J* = 9.7 Hz, 1H),

7.26 (m, 5H), 7.40 (m, 4H), 7.63 (m, 2H), 8.63 (m, 1H); ¹³C NMR (100 MHz CDCl₃): δ 20.5, 21.3, 26.3, 26.5, 26.8 (d, *J* = 9 Hz), 27.5 (d, *J* = 10 Hz), 27.7 (d, *J* = 9 Hz), 29.3 (d, *J* = 8 Hz), 30.1 (d, *J* = 16 Hz), 30.3 (d, *J* = 10 Hz), 30.7, 33.3, 34.7 (d, *J* = 9

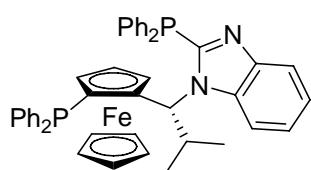
Hz), 35.9 (d, J = 10 Hz), 62.2 (d, J = 14 Hz), 69.0, 70.2, 72.4 (d, J = 16 Hz), 72.9, 75.2, 97.6 (d, J = 26 Hz), 122.5 (d, J = 29 Hz), 128.1 (dd, J = 8, 16 Hz), 129.3, 129.9, 132.9 (d, J = 18 Hz), 135.2 (d, J = 22 Hz), 137.8 (d, J = 9 Hz), 138.3, 145.6 (d, J = 13 Hz); ^{31}P NMR (162 MHz, CDCl_3): δ -25.65, -36.46; HRMS (ESI): calcd for $\text{C}_{41}\text{H}_{50}\text{FeN}_2\text{P}_2$ [$\text{M}+\text{H}]^+$: 689.2877, found: 689.2864.

1- $\{(R)\text{-1-}[(S)\text{-2-(bis(3,5-dimethylphenyl)phosphino)ferrocenyl]-2-methylpropyl}\}-2$ - $(\text{diphenylphosphino})\text{imidazole (1h)}$. Yield: 40%. Orange crystal. $[\alpha]^{20}_{\text{D}}$ -221.3 (c



1.20, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 0.55 (d, J = 6.4 Hz, 3H), 0.78 (d, J = 6.4 Hz, 3H), 2.10 (s, 6H), 2.31 (s, 6H), 2.48 (m, 1H), 3.60 (s, 5H), 3.99 (s, 1H), 4.36 (s, 1H), 4.58 (s, 1H), 5.91 (t, J = 8.2 Hz, 1H), 6.40 (d, J = 7.6 Hz, 2H), 6.73 (s, 1H), 6.99 (s, 1H), 7.15 (s, 1H), 7.20 (m, 5H), 7.28 (m, 3H), 7.53 (m, 2H), 7.60 (m, 2H), 7.76 (s, 1H); ^{13}C NMR (100 MHz CDCl_3): δ 20.2, 21.4 (d, J = 10 Hz), 22.1, 34.1, 62.0 (d, J = 17 Hz), 69.2, 69.9, 72.5, 72.7, 75.0 (d, J = 16 Hz), 95.9 (d, J = 26 Hz), 121.8 (d, J = 17 Hz), 128.2 (dd, J = 8, 16 Hz), 128.5, 128.7, 129.4, 129.9 (d, J = 18 Hz), 130.8 (d, J = 25 Hz), 133.1 (d, J = 21 Hz), 133.7 (d, J = 20 Hz), 134.6 (d, J = 21 Hz), 136.3, 136.7 (d, J = 6 Hz), 137.3 (d, J = 9 Hz), 137.8 (d, J = 8 Hz), 138.4, 145.1; ^{31}P NMR (162 MHz, CDCl_3): δ -24.33, -36.88; HRMS (ESI): calcd for $\text{C}_{45}\text{H}_{46}\text{FeN}_2\text{P}_2$ [$\text{M}+\text{H}]^+$: 733.2564, found: 733.2560.

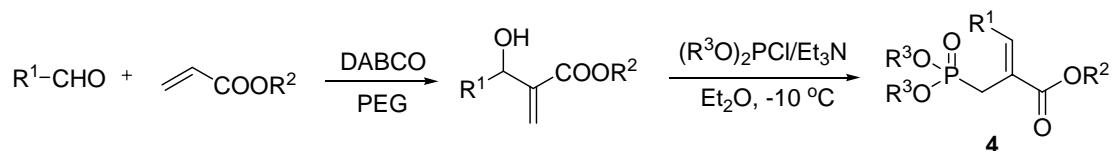
1- $\{(R)\text{-1-}[(S)\text{-2-(diphenylphosphino)ferrocenyl]-2-methylpropyl}\}-2$ - $(\text{diphenylphosphino})\text{benzimidazole (1i)}$. Yield: 50%. Orange crystal. $[\alpha]^{20}_{\text{D}}$ -391.1 (c 1.14, CHCl_3);



^1H NMR (400 MHz, CD_2Cl_2): δ -0.01 (d, J = 6.4 Hz, 3H), 1.12 (d, J = 6.4 Hz, 3H), 2.50 (m, 1H), 3.66 (m, 6H), 4.19 (s, 1H), 4.58 (s, 1H), 5.46 (m, 2H), 6.06 (m, 2H), 6.36 (m, 2H), 6.61 (m, 2H), 6.83 (m, 1H), 6.95 (m, 10H), 7.08 (m, 2H), 7.38 (m, 2H), 7.64 (m, 2H); ^{13}C NMR (100 MHz CD_2Cl_2): δ 19.3, 21.9, 30.7, 60.2 (d, J = 20 Hz), 68.6, 69.2, 69.8, 71.3 (d, J = 4 Hz), 74.3 (d, J = 15 Hz), 91.7 (d, J = 27 Hz), 111.9, 118.9, 120.1, 120.7, 125.1, 125.3 (d, J = 6 Hz), 126.4 (d, J = 8 Hz),

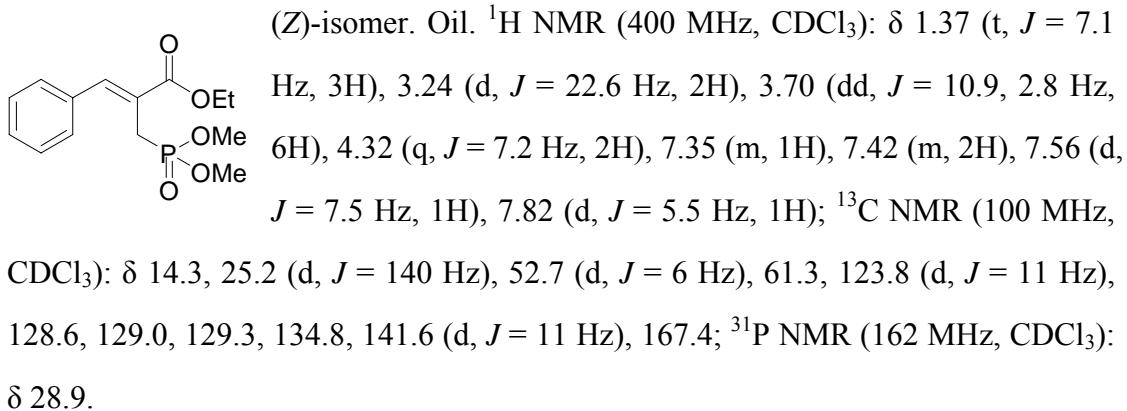
126.6 (d, $J = 8$ Hz), 127.0 (d, $J = 8$ Hz), 127.5 (d, $J = 13$ Hz), 127.9, 129.7 (d, $J = 11$ Hz), 133.0 (d, $J = 21$ Hz), 134.3 (dd, $J = 15, 21$ Hz), 135.5, 135.9, 136.3 (d, $J = 9$ Hz), 137.5 (d, $J = 10$ Hz); ^{31}P NMR (162 MHz, CD_2Cl_2): δ -27.94 (d, $J = 62.4$ Hz), -36.89 (d, $J = 62.0$ Hz); HRMS (ESI): calcd for $\text{C}_{45}\text{H}_{40}\text{FeN}_2\text{P}_2$ [$\text{M}+\text{H}$] $^+$: 727.2094, found: 727.2080.

General Procedure for Preparation of Unsaturated Ester (4a-4n).¹

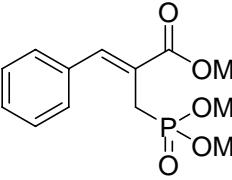


To a stirred solution of aldehyde (50 mmol) and acrylate ester (75 mmol) in 30 mL of PEG (400), was added DABCO (50 mmol). The solution was stirred for 2-25 days, then it was diluted with Et_2O , washed with 1N HCl and water, dried over Na_2SO_4 , filtered and evaporated in vacuo to give the crude adduct. The crude mixture was purified by column chromatography (SiO_2 , hexane: ethyl acetate, 5:1) to give the pure product. To a stirred solution of the Baylis Hillman adduct (20 mmol) and Et_3N (2.02 g, 20 mmol) in Et_2O (50 mL), dimethyl phosphorochloridite (2.57 g, 20 mmol) was added dropwise at -10 °C under argon, and stirring was continued for 20 min at -10 °C. The precipitate was filtered off and washed with Et_2O (2 x 10 mL). The filtrate was evaporated and the residue was heated at 70-100 °C under argon for 2-3 hours. The resultant product was purified by column chromatography (SiO_2 , hexane: ethyl acetate, 2:1). Overall yield 32-71%.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-phenyl-2-propenoate (4a). Yield: 54%,

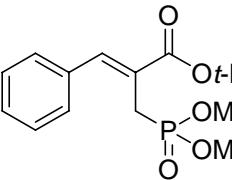


Methyl 2-[(dimethoxyphosphoryl)methyl]-3-phenyl-2-propenoate (4b). Yield:



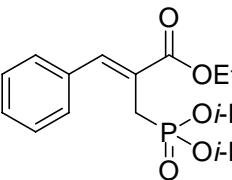
49%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 3.23 (d, J = 22.5 Hz, 2H), 3.70 (d, J = 10.8 Hz, 6H), 3.85 (s, 3H), 7.35 (d, J = 7.2 Hz, 1H), 7.41 (t, J = 7.2 Hz, 2H), 7.56 (d, J = 7.2 Hz, 2H), 7.82 (d, J = 5.1 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 25.2 (d, J = 140 Hz), 52.3, 52.6 (d, J = 6 Hz), 123.4 (d, J = 12 Hz), 128.6, 129.0, 129.2, 134.6, 141.7 (d, J = 10 Hz), 167.7; ^{31}P NMR (162 MHz, CDCl_3): δ 28.8.

t-Butyl 2-[(dimethoxyphosphoryl)methyl]-3-phenyl-2-propenoate (4c). Yield:



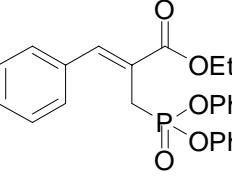
71%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.56 (s, 9H), 3.20 (d, J = 22.6 Hz, 2H), 3.70 (d, J = 10.8 Hz, 6H), 7.34 (t, J = 7.4 Hz, 1H), 7.41 (t, J = 7.3 Hz, 2H), 7.55 (d, J = 7.5 Hz, 2H), 7.72 (d, J = 5.5 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 25.3 (d, J = 139 Hz), 28.0, 52.7 (d, J = 7 Hz), 81.3, 125.2 (d, J = 12 Hz), 128.6, 128.7, 129.2, 135.1, 140.6 (d, J = 11 Hz), 166.5; ^{31}P NMR (162 MHz, CDCl_3): δ 29.3.

Ethyl 2-[(diisopropoxypyrophosphoryl)methyl]-3-phenyl-2-propenoate (4d). Yield:



32%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.26 (d, J = 6.2 Hz, 6H), 1.30 (d, J = 6.2 Hz, 2H), 1.37 (t, J = 7.1 Hz, 3H), 3.21 (d, J = 22.6 Hz, 2H), 4.30 (q, J = 7.1 Hz, 2H), 4.71 (m, 2H), 7.34 (t, J = 7.2 Hz, 1H), 7.40 (t, J = 7.4 Hz, 2H), 7.64 (d, J = 7.6 Hz, 2H), 7.77 (d, J = 5.5 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 23.8 (d, J = 5 Hz), 24.0 (d, J = 2 Hz), 27.5 (d, J = 141 Hz), 61.1, 70.6 (d, J = 6 Hz), 124.6 (d, J = 11 Hz), 128.4, 128.8, 129.5, 135.0, 140.7 (d, J = 11 Hz), 167.6; ^{31}P NMR (162 MHz, CDCl_3): δ 24.4.

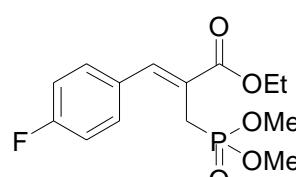
Ethyl 2-[(diphenoxypyrophosphoryl)methyl]-3-phenyl-2-propenoate (4e). Yield: 57%,



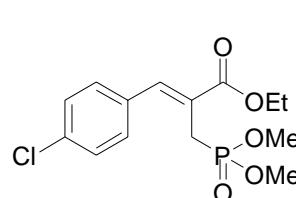
(*Z*)-isomer. Viscous oil. ^1H NMR (400 MHz, CDCl_3): δ 1.29 (t, J = 7.1 Hz, 3H), 3.59 (d, J = 22.6 Hz, 2H), 4.26 (q, J = 7.1 Hz, 2H), 7.10-7.15 (m, 6H), 7.28 (m, 4H), 7.35-7.40 (m, 3H), 7.59 (d, J = 7.3 Hz, 2H), 7.94 (d, J = 5.6 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 26.9 (d, J = 142 Hz), 61.5, 120.5 (d, J = 4 Hz), 123.2 (d, J = 12 Hz),

125.2 (d, $J = 14$ Hz), 128.8, 129.1, 129.4, 129.7, 134.7, 142.5 (d, $J = 12$ Hz), 150.5 (d, $J = 9$ Hz), 167.2; ^{31}P NMR (162 MHz, CDCl_3): δ 19.3.

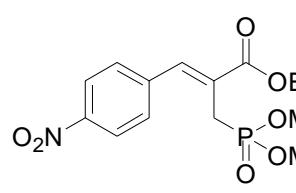
Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-fluorophenyl)-2-propenoate (4f).

 Yield: 59%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.37 (t, $J = 7.1$ Hz, 3H), 3.20 (dd, $J = 22.6, 4.6$ Hz, 2H), 3.74 (dd, $J = 10.9, 4.8$ Hz, 6H), 4.31 (q, $J = 7.2$ Hz, 2H), 7.10 (m, 2H), 7.60 (m, 2H), 7.77 (d, $J = 5.3$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 25.2 (d, $J = 140$ Hz), 52.7 (d, $J = 6$ Hz), 61.3, 115.6 (d, $J = 22$ Hz), 123.4 (d, $J = 12$ Hz), 130.8, 131.3 (d, $J = 8$ Hz), 140.4 (d, $J = 11$ Hz), 161.6, 164.1, 167.1; ^{31}P NMR (162 MHz, CDCl_3): δ 28.7.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-chlorophenyl)-2-propenoate (4g).

 Yield: 59%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.37 (t, $J = 7.1$ Hz, 3H), 3.20 (d, $J = 22.6$ Hz, 2H), 3.74 (dd, $J = 10.9, 4.8$ Hz, 6H), 4.31 (q, $J = 7.1$ Hz, 2H), 7.38 (d, $J = 8.5$ Hz, 2H), 7.55 (d, $J = 8.4$ Hz, 2H), 7.76 (d, $J = 5.5$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 25.2 (d, $J = 139$ Hz), 52.7 (d, $J = 6$ Hz), 61.3, 124.2 (d, $J = 12$ Hz), 128.8, 130.6, 133.1 (d, $J = 3$ Hz), 134.8, 140.1 (d, $J = 11$ Hz), 167.0; ^{31}P NMR (162 MHz, CDCl_3): δ 28.5.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-nitrophenyl)-2-propenoate (4h).

 Yield: 51%, (*Z*)-isomer. White crystal, m.p.: 78-80 °C. ^1H NMR (400 MHz, CDCl_3): δ 1.38 (t, $J = 7.2$ Hz, 3H), 3.17 (d, $J = 23.2$ Hz, 2H), 3.75 (d, $J = 10.8$ Hz, 6H), 4.34 (q, $J = 7.2$ Hz, 2H), 7.77 (d, $J = 8.4$ Hz, 2H), 7.82 (d, $J = 5.6$ Hz, 1H), 8.28 (d, $J = 8.4$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 25.5 (d, $J = 139$ Hz), 52.9 (d, $J = 6$ Hz), 61.8, 123.8, 127.1 (d, $J = 12$ Hz), 138.9 (d, $J = 11$ Hz), 141.3, 147.6, 166.6; ^{31}P NMR (162 MHz, CDCl_3): δ 27.9.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-methoxyphenyl)-2-propenoate (4i).

Yield: 56%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.36 (t, $J = 7.1$ Hz, 3H),

3.26 (d, $J = 22.3$ Hz, 2H), 3.73 (d, $J = 10.8$ Hz, 6H), 3.82 (s, 3H), 4.30 (q, $J = 7.0$ Hz, 2H), 6.95 (d, $J = 8.6$ Hz, 2H), 7.58 (d, $J = 8.4$ Hz, 2H), 7.78 (d, $J = 5.1$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.3, 25.4 (d, $J = 140$ Hz), 52.8 (d, $J = 5$ Hz), 55.3, 61.2, 114.1, 121.2 (d, $J = 11$ Hz), 127.2, 131.4, 141.4 (d, $J = 11$ Hz), 160.3, 167.7; ^{31}P NMR (162 MHz, CDCl_3): δ 29.2.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(3-methoxyphenyl)-2-propenoate (4j).

Yield: 62%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.37 (t, $J = 7.1$ Hz, 3H), 3.24 (d, $J = 22.6$ Hz, 2H), 3.73 (d, $J = 10.8$ Hz, 6H), 3.84 (s, 3H), 4.31 (q, $J = 7.1$ Hz, 2H), 6.91 (dd, $J = 8.1$, 1.6 Hz, 1H), 7.10 (d, $J = 7.5$ Hz, 1H), 7.20 (s, 1H), 7.32 (t, $J = 7.9$ Hz, 1H), 7.80 (d, $J = 5.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 25.4 (d, $J = 140$ Hz), 52.7 (d, $J = 7$ Hz), 55.4, 61.3, 114.0, 115.2, 121.7, 123.9 (d, $J = 11$ Hz), 129.6, 136.1, 141.6 (d, $J = 11$ Hz), 159.7, 167.3; ^{31}P NMR (162 MHz, CDCl_3): δ 29.0.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-methoxyphenyl)-2-propenoate (4k).

Yield: 49%, (*Z*)-isomer. White crystal, m.p.: 95-96 °C. ^1H NMR (400 MHz, CDCl_3): δ 1.37 (t, $J = 7.2$ Hz, 3H), 3.18 (d, $J = 22.4$ Hz, 2H), 3.69 (dd, $J = 10.8$, 2.0 Hz, 6H), 3.85 (s, 3H), 4.31 (q, $J = 7.2$ Hz, 2H), 6.91 (d, $J = 8.4$ Hz, 1H), 7.01 (t, $J = 7.6$ Hz, 1H), 7.34 (t, $J = 7.6$ Hz, 1H), 7.66 (d, $J = 7.6$ Hz, 1H), 7.94 (d, $J = 5.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.3, 25.4 (d, $J = 140$ Hz), 52.7 (d, $J = 7$ Hz), 55.5, 61.2, 110.5, 120.6, 123.8 (d, $J = 11$ Hz), 129.9, 130.5, 137.9 (d, $J = 12$ Hz), 157.4, 167.4; ^{31}P NMR (162 MHz, CDCl_3): δ 29.4.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-furyl)-2-propenoate (4l). Yield: 63%,

Yield: 63%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.35 (t, $J = 7.2$ Hz, 3H), 3.54 (d, $J = 23.6$ Hz, 2H), 3.69 (d, $J = 10.9$ Hz, 6H), 4.28 (q, $J = 7.2$ Hz, 2H), 6.51 (dd, $J = 3.6$, 2.0 Hz, 1H), 6.75 (d, $J = 1.6$ Hz, 1H), 7.51 (d, $J = 6.0$ Hz, 1H), 7.58 (d, $J = 1.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 25.4 (d, $J = 138$ Hz), 52.6 (d, $J = 7$ Hz), 61.2,

112.1, 116.7, 119.0 (d, J = 13 Hz), 127.2 (d, J = 11 Hz), 144.8, 150.8 (d, J = 4 Hz), 167.0; ^{31}P NMR (162 MHz, CDCl_3): δ 28.9.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-thienyl)-2-propenoate (4m). Yield:

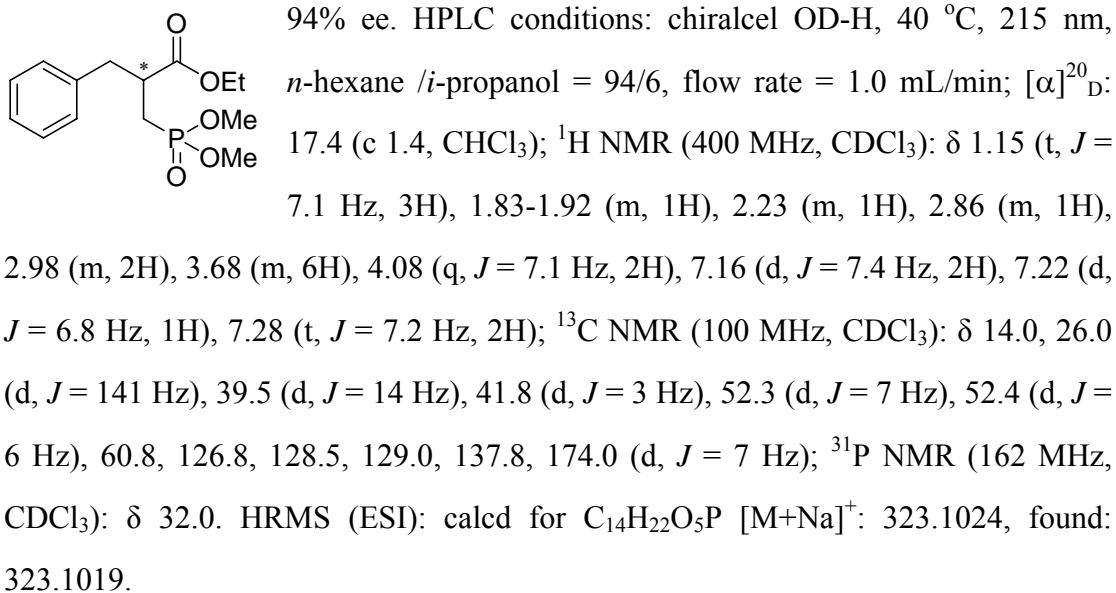
48%, (*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.36 (t, J = 7.1 Hz, 3H), 3.39 (d, J = 22.5 Hz, 2H), 3.72 (d, J = 11.0 Hz, 6H), 4.29 (q, J = 7.1 Hz, 2H), 7.11 (t, J = 4.4 Hz, 1H), 7.45 (s, 1H), 7.52 (d, J = 4.9 Hz, 1H), 7.92 (d, J = 5.4 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.3, 26.2 (d, J = 140 Hz), 52.8 (d, J = 6 Hz), 61.3, 119.7 (d, J = 13 Hz), 127.6, 129.6, 132.6, 133.6 (d, J = 11 Hz), 137.7 (d, J = 4 Hz), 167.1; ^{31}P NMR (162 MHz, CDCl_3): δ 28.2.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-4-methyl-2-pentenoate (4n). Yield: 63%,

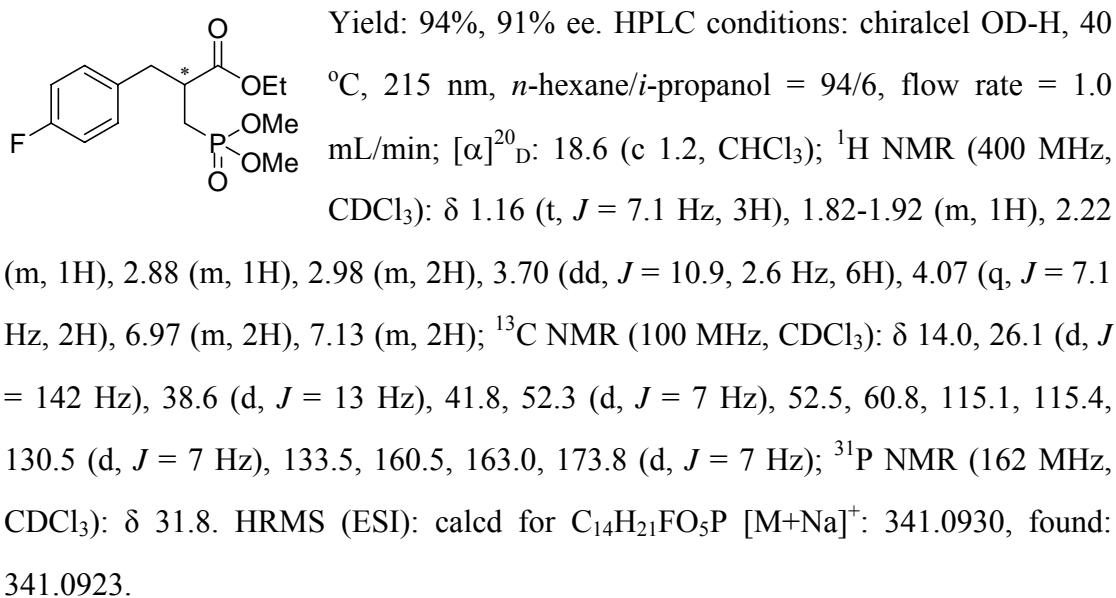
(*Z*)-isomer. Oil. ^1H NMR (400 MHz, CDCl_3): δ 1.06 (d, J = 6.6 Hz, 6H), 1.32 (t, J = 7.1 Hz, 3H), 2.71 (m, 1H), 3.00 (d, J = 22.1 Hz, 2H), 3.73 (d, J = 10.9 Hz, 6H), 4.23 (q, J = 7.1 Hz, 2H), 6.72 (dd, J = 10.5 Hz, 5.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.2, 21.6, 23.8 (d, J = 139 Hz), 28.6, 52.6 (d, J = 6 Hz), 60.9, 120.3 (d, J = 9 Hz), 152.1 (d, J = 10 Hz), 166.9; ^{31}P NMR (162 MHz, CDCl_3): δ 29.17.

General hydrogenation procedure: To a solution of $[\text{Rh}(\text{COD})_2]\text{SbF}_6$ (1.4 mg, 0.005 mmol) in anhydrous and degassed CH_2Cl_2 (1 mL), which was placed in a nitrogen-filled glovebox, was added ligand **1c** (0.0055 mmol). The reaction mixture was stirred at room temperature for 30 min, and then a solution of the unsaturated ester (0.5 mmol) in 1 mL of CH_2Cl_2 was added. The mixture was transferred to a Par stainless autoclave. The autoclave was purged three times with hydrogen, and maintains a hydrogen pressure of 10 bar. The hydrogenation was performed at room temperature for 24 hours. After carefully releasing the hydrogen gas, the solvent was removed. Conversion was directly determined by ^1H NMR spectroscopy. The enantiomeric excess was determined by HPLC after purification on silica gel.

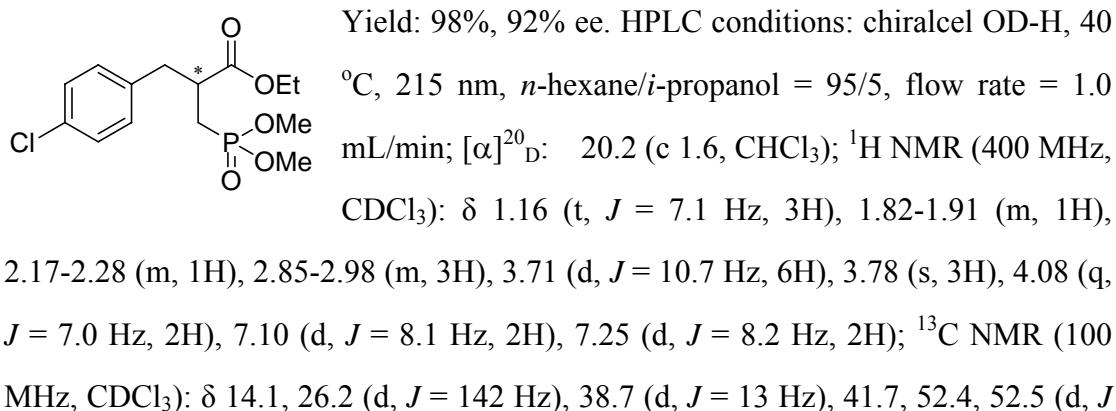
Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-phenyl-2-propionate (5a). Yield: 98%,



Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-fluorophenyl)-2-propionate (5f).

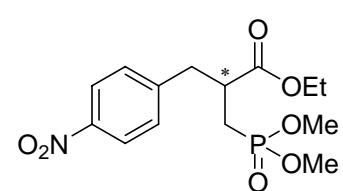


Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-chlorophenyl)-2-propionate (5g).



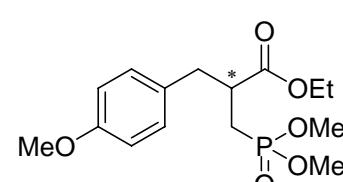
$= 7$ Hz), 60.9, 128.6, 130.4, 132.6, 136.3, 173.7 (d, $J = 7$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ 31.8. HRMS (ESI): calcd for $\text{C}_{14}\text{H}_{21}\text{ClO}_5\text{P} [\text{M}+\text{Na}]^+$: 357.0635, found: 357.0621.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-nitrophenyl)-2-propionate (5h).



Yield: 91%, 89% ee. HPLC conditions: chiralcel OJ-H, 40 °C, 215 nm, *n*-hexane/*i*-propanol = 90/10, flow rate = 1.0 mL/min; $[\alpha]^{20}_{\text{D}}$: 22.8 (c 1.4, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 1.16 (t, $J = 7.2$ Hz, 3H), 1.87-1.96 (m, 1H), 2.21-2.32 (m, 1H), 3.07 (m, 3H), 3.74 (d, $J = 10.9$ Hz, 6H), 3.78 (s, 3H), 4.08 (dq, $J = 7.1, 3.7$ Hz, 2H), 7.38 (d, $J = 8.5$ Hz, 2H), 8.16 (d, $J = 8.5$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.0, 26.5 (d, $J = 142$ Hz), 38.7 (d, $J = 11$ Hz), 41.4 (d, $J = 2$ Hz), 52.5, 52.6 (d, $J = 7$ Hz), 61.1, 123.7, 130.3, 145.8, 146.9, 173.2 (d, $J = 9$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ 31.1. HRMS (ESI): calcd for $\text{C}_{14}\text{H}_{21}\text{NO}_7\text{P} [\text{M}+\text{Na}]^+$: 368.0875, found: 368.0871.

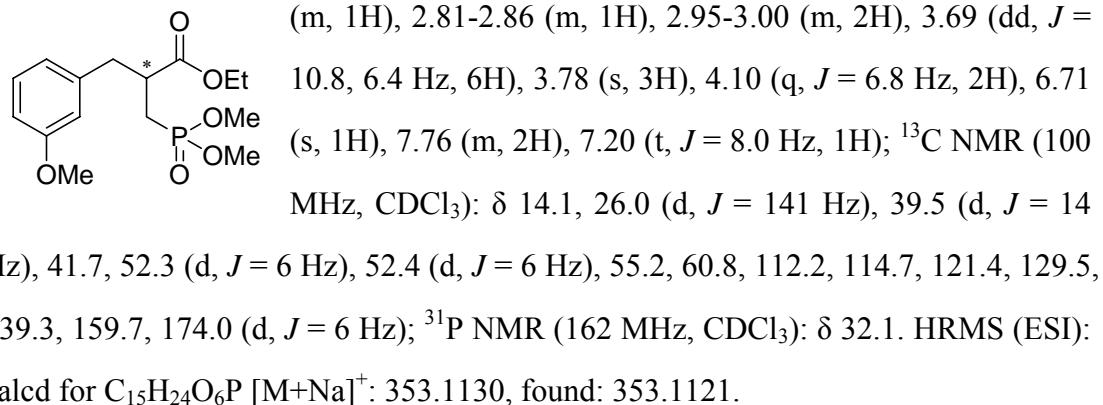
Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(4-methoxyphenyl)-2-propionate (5i).



Yield: 98%, 95% ee. HPLC conditions: chiralcel OJ-H, 40 °C, 215 nm, *n*-hexane/*i*-propanol = 95/5, flow rate = 1.0 mL/min; $[\alpha]^{20}_{\text{D}}$: 20.8 (c 1.4, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 1.17 (t, $J = 7.1$ Hz, 3H), 1.82-1.91 (m, 1H), 2.19 (m, 1H), 2.80 (m, 1H), 2.92 (m, 2H), 3.70 (dd, $J = 10.9, 2.6$ Hz, 6H), 3.77 (s, 3H), 4.09 (q, $J = 7.1$ Hz, 2H), 6.82 (d, $J = 8.2$ Hz, 2H), 7.07 ($J = 8.2$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.0, 25.9 (d, $J = 141$ Hz), 38.6 (d, $J = 14$ Hz), 41.9 (d, $J = 3$ Hz), 52.3 (d, $J = 7$ Hz), 52.4 (d, $J = 7$ Hz), 55.2, 60.7, 113.8, 129.7, 130.0, 158.4, 174.0 (d, $J = 6$ Hz); ^{31}P NMR (162 MHz, CDCl_3): δ 32.2. HRMS (ESI): calcd for $\text{C}_{15}\text{H}_{24}\text{O}_6\text{P} [\text{M}+\text{Na}]^+$: 353.1130, found: 353.1115.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(3-methoxyphenyl)-2-propionate (5j).

Yield: 98%, 92% ee. HPLC conditions: chiralpak AD-H, 40 °C, 215 nm, *n*-hexane/*i*-propanol = 90/10, flow rate = 1.0 mL/min; $[\alpha]^{20}_{\text{D}}$: 16.1 (c 1.4, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 1.18 (t, $J = 7.2$ Hz, 3H), 1.84-1.93 (m, 1H), 2.18-2.24



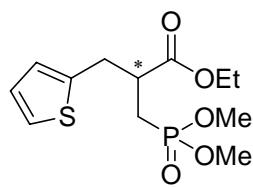
Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-methoxyphenyl)-2-propionate (5k).

Yield: 99%, 93% ee. HPLC conditions: chiralcel OJ-H, 40 °C, 215 nm, *n*-hexane/*i*-propanol = 95/5, flow rate = 1.0 mL/min; $[\alpha]^{20}_D$: 28.8 (c 1.4, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 1.14 (t, J = 7.2 Hz, 3H), 1.87 (m, 1H), 2.24 (m, 1H), 2.91 (m, 2H), 3.11 (m, 1H), 3.66 (dd, J = 10.6, 9.0 Hz, 6H), 3.82 (s, 3H), 4.06 (dq, J = 7.1, 2.4 Hz, 2H), 6.85 (m, 2H), 7.06 (d, J = 7.1 Hz, 1H), 7.20 (t, J = 7.6 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.1, 26.3 (d, J = 140 Hz), 34.9 (d, J = 15 Hz), 40.0, 52.2 (d, J = 6 Hz), 52.4 (d, J = 6 Hz), 55.2, 60.6, 110.3, 120.3, 126.1, 128.2, 130.9, 157.6, 174.4 (d, J = 4 Hz); ^{31}P NMR (162 MHz, CDCl_3): δ 32.5. HRMS (ESI): calcd for $\text{C}_{15}\text{H}_{24}\text{O}_6\text{P}$ [$\text{M}+\text{Na}]^+$: 353.1130, found: 353.1122.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-furyl)-2-propionate (5l). Yield: 97%,

90% ee. HPLC conditions: chiralpak AD-H, 40 °C, 215 nm, *n*-hexane/*i*-propanol = 95/5, flow rate = 1.0 mL/min; $[\alpha]^{20}_D$: 11.9 (c 1.4, CHCl_3); ^1H NMR (400 MHz, CDCl_3): δ 1.23 (t, J = 7.1 Hz, 3H), 1.87-1.97 (m, 1H), 2.21-2.31 (m, 1H), 2.95-3.11 (m, 3H), 3.71 (d, J = 10.9 Hz, 6H), 3.82 (s, 3H), 4.14 (q, J = 7.0 Hz, 2H), 6.07 (s, 1H), 6.27 (s, 1H), 7.31 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 14.1, 25.8 (d, J = 142 Hz), 31.5 (d, J = 13 Hz), 39.3, 52.3 (d, J = 7 Hz), 52.4 (d, J = 7 Hz), 61.0, 107.4, 110.2, 141.8, 151.7, 173.6 (d, J = 8 Hz); ^{31}P NMR (162 MHz, CDCl_3): δ 31.9. HRMS (ESI): calcd for $\text{C}_{12}\text{H}_{20}\text{O}_6\text{P}$ [$\text{M}+\text{Na}]^+$: 313.0841, found: 313.0827.

Ethyl 2-[(dimethoxyphosphoryl)methyl]-3-(2-thienyl)-2-propionate (5m). Yield:

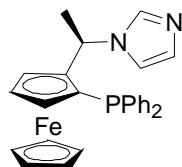
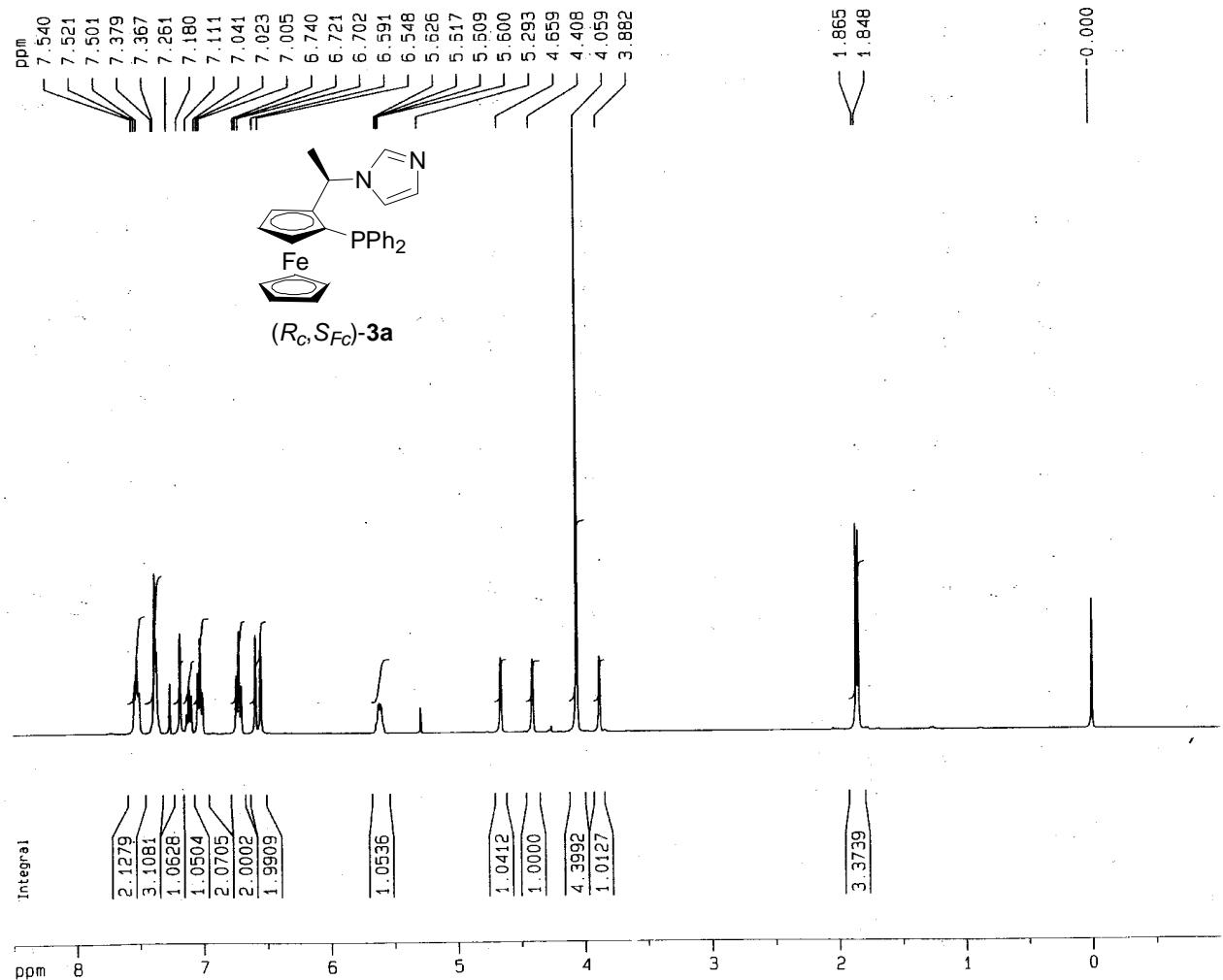


98%, 98% ee HPLC conditions: chiralcel OD-H, 40 °C, 215 nm,
n-hexane/*i*-propanol = 94/6, flow rate = 1.0 mL/min; $[\alpha]^{20}_D$:
12.4 (c 1.5, CHCl₃); ¹H NMR (400 MHz, CDCl₃): δ 1.23 (t, *J* =
7.1 Hz, 3H), 1.94 (m, 1H), 2.19-2.26 (m, 1H), 3.03 (m, 1H),
3.12-3.26 (m, 2H), 3.71 (dd, *J* = 10.7, 1.9 Hz, 6H), 4.14 (q, *J* = 7.2 Hz, 2H), 6.83 (d, *J*
= 3.2 Hz, 1H), 6.91 (dd, *J* = 5.0, 3.5 Hz, 1H), 7.15 (d, *J* = 5.1 Hz, 1H); ¹³C NMR (100
MHz, CDCl₃): δ 14.1, 25.7 (d, *J* = 142 Hz), 33.1 (d, *J* = 12 Hz), 42.0, 52.5, 61.1,
124.4, 126.4, 126.9, 139.7, 173.5 (d, *J* = 7 Hz); ³¹P NMR (162 MHz, CDCl₃): δ 32.0.
HRMS (ESI): calcd for C₁₂H₂₀O₅PS [M+Na]⁺: 329.0589, found: 329.0584.

References:

1. Janecki, T.; Bodalski, R. *Synthesis* **1990**, 799.
2. Burk, M. J.; Stammers, T. A.; Straub, J. A. *Org. Lett.* **1999**, 1, 38.

1H NMR WDY-1 IN CDCl₃ 08/01/15



Current Data Parameters

NAME wdy
EXPNO 718
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080115
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PULPROG zg
TD 32768
SOLVENT CDCl₃
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DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 90.5
DW 62.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

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PL1 5.00 dB
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F2 - Processing parameters

SI 32768
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SSB 0
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PC 1.40

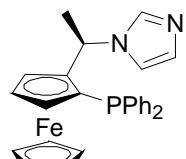
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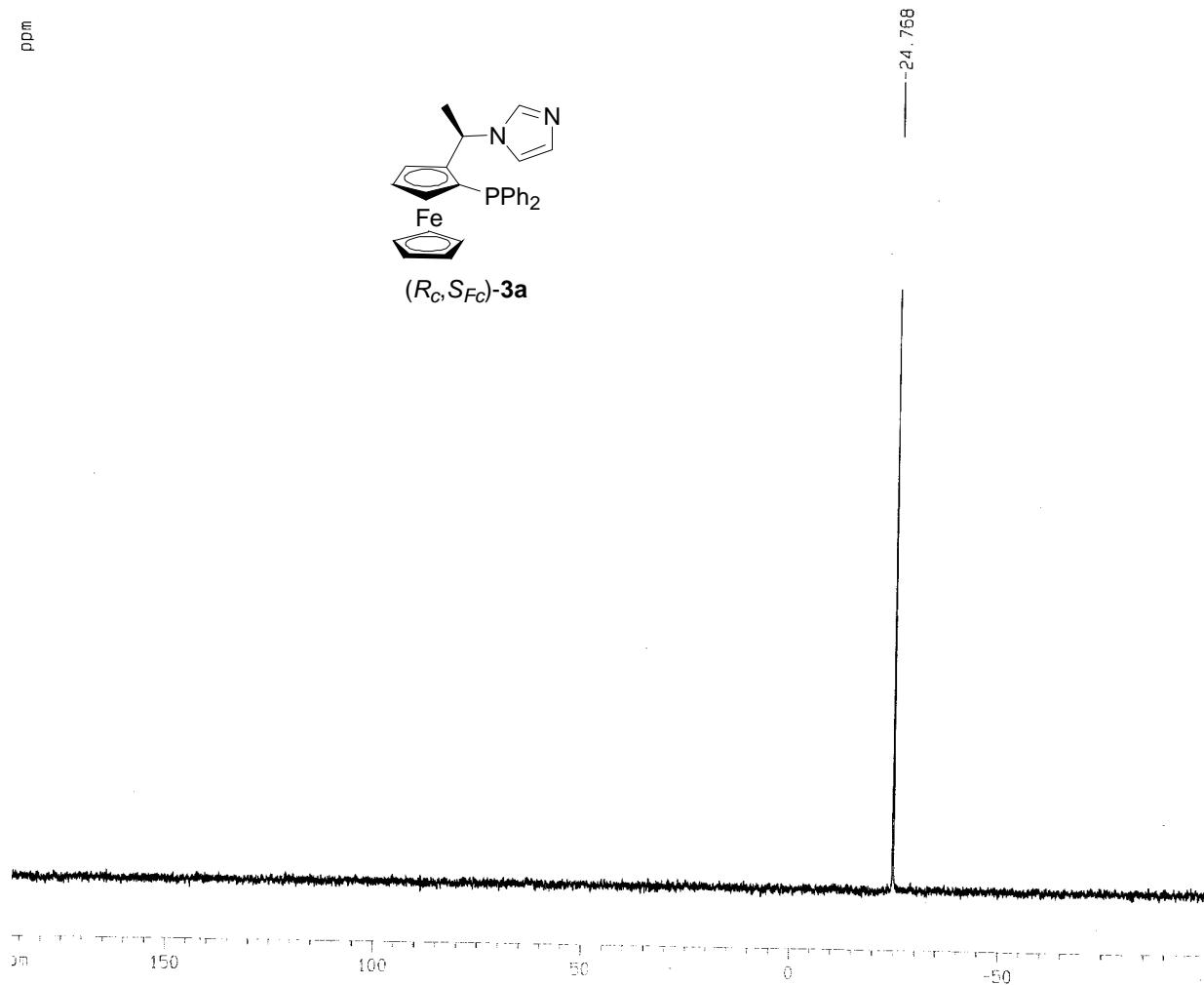


31P NMR WDY-1 IN CDCL3 08/01/15

ppm



(*R*c,*S*Fc)-3a



Current Data Parameters

NAME wdy
EXPNO 719
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080115
Time 11:00
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 23
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 293.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

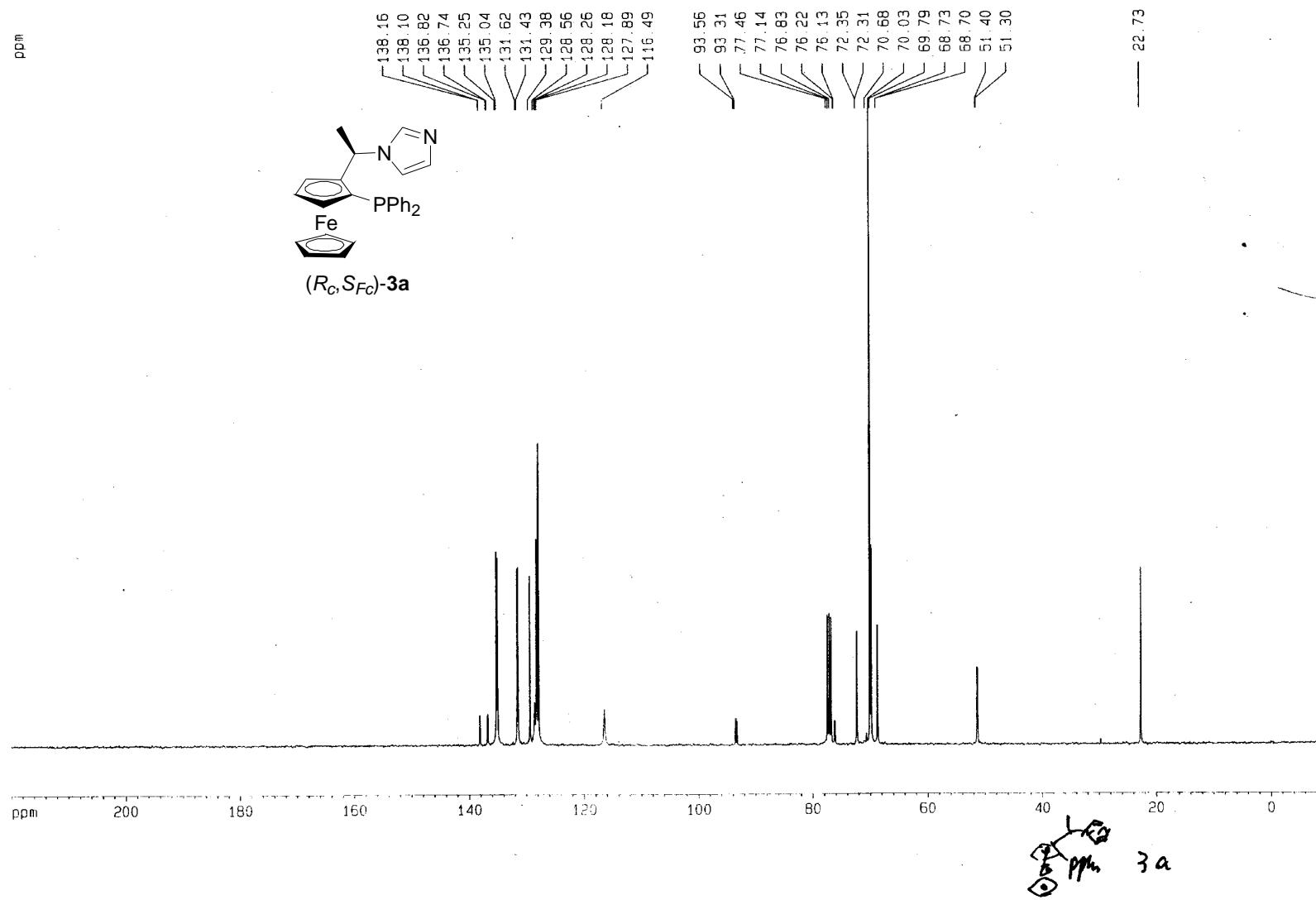
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F2P -100.000 ppm
F2 -16197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm

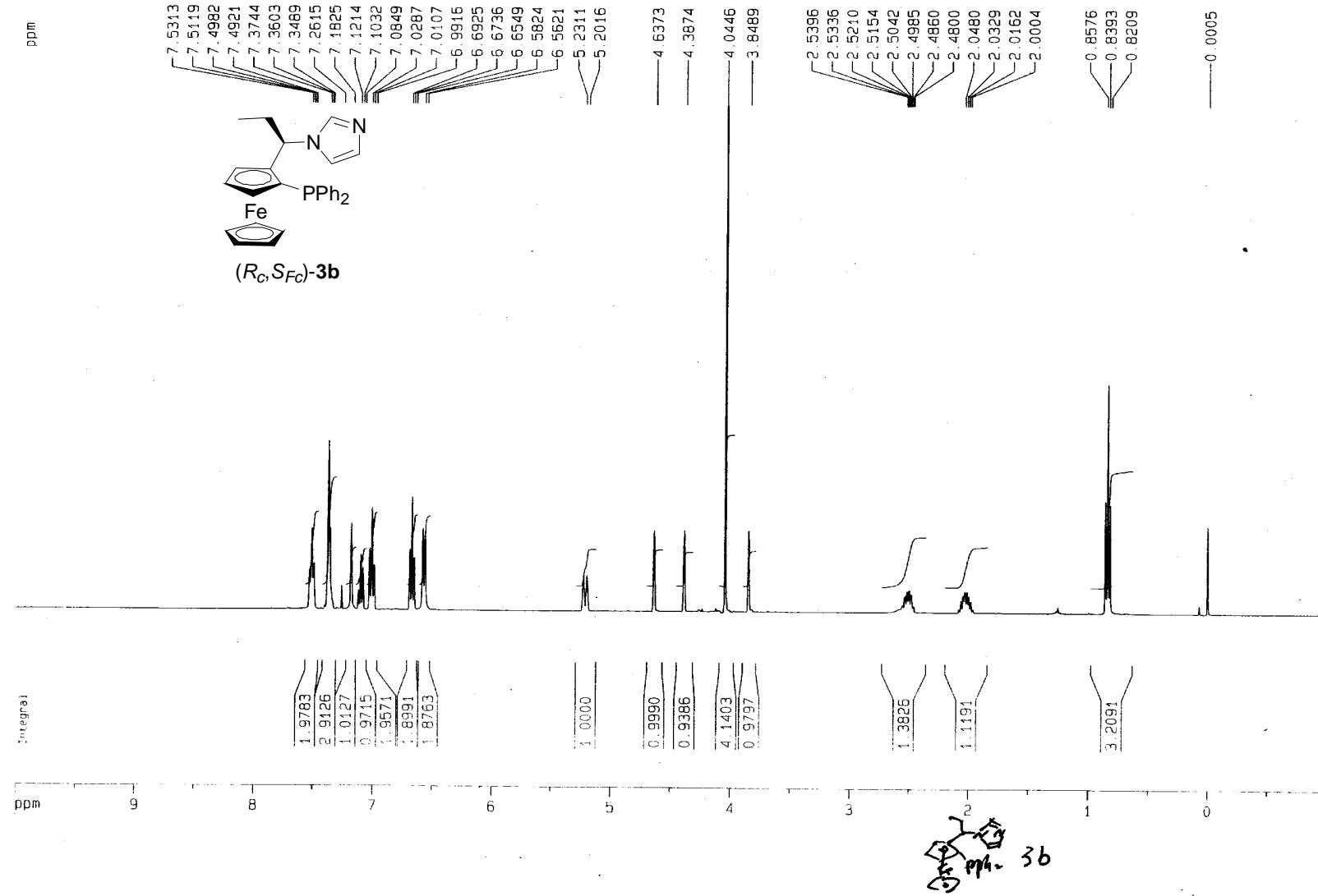


3a

¹³C NMR WDY-1 IN CDCl₃ 08/07/30

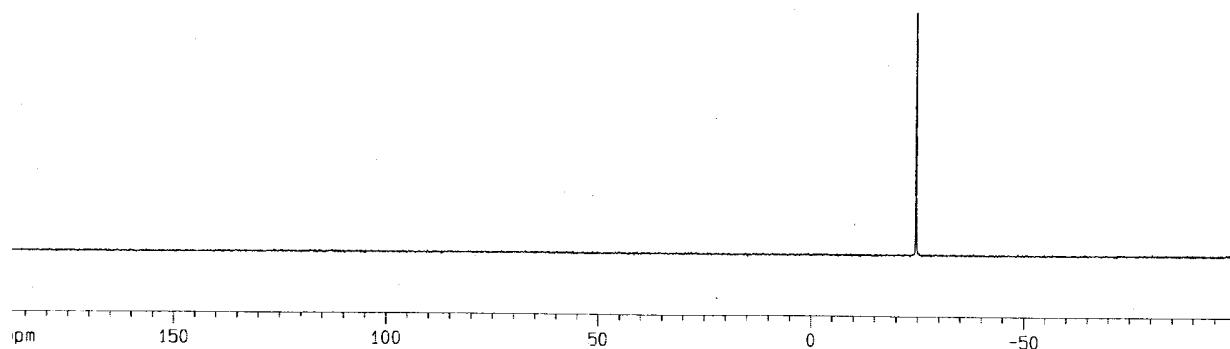
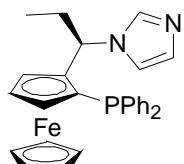


¹H NMR WDY-2 IN CDCl₃ 08/07/30



³¹P NMR WDY-2 IN CDCl₃ 08/07/30

ppm



Current Data Parameters

NAME	wdy
EXPNO	907
PROCNO	1

F2 - Acquisition Parameters

Date	20080730
Time	14.09
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PROBHD	5 mm PABBO BB-
PULPROG	zg
TD	32768
SOLVENT	CDCl ₃
NS	23
DS	0
SWH	48543.688 Hz
FIRES	1.481436 Hz
AQ	0.3375604 sec
RG	2298.8
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===== CHANNEL f1 =====

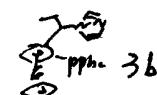
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F2 - Processing parameters

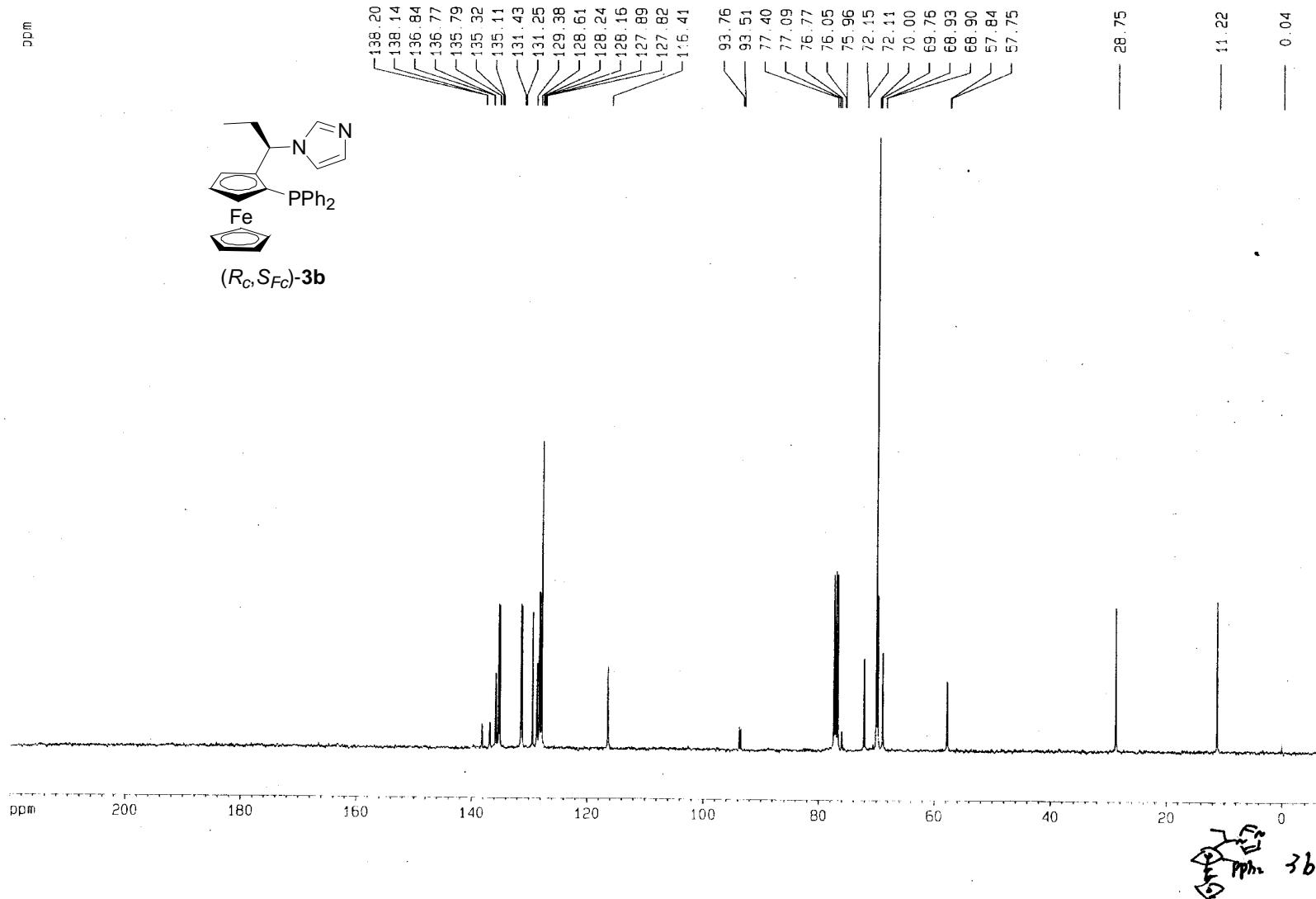
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LB	5.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

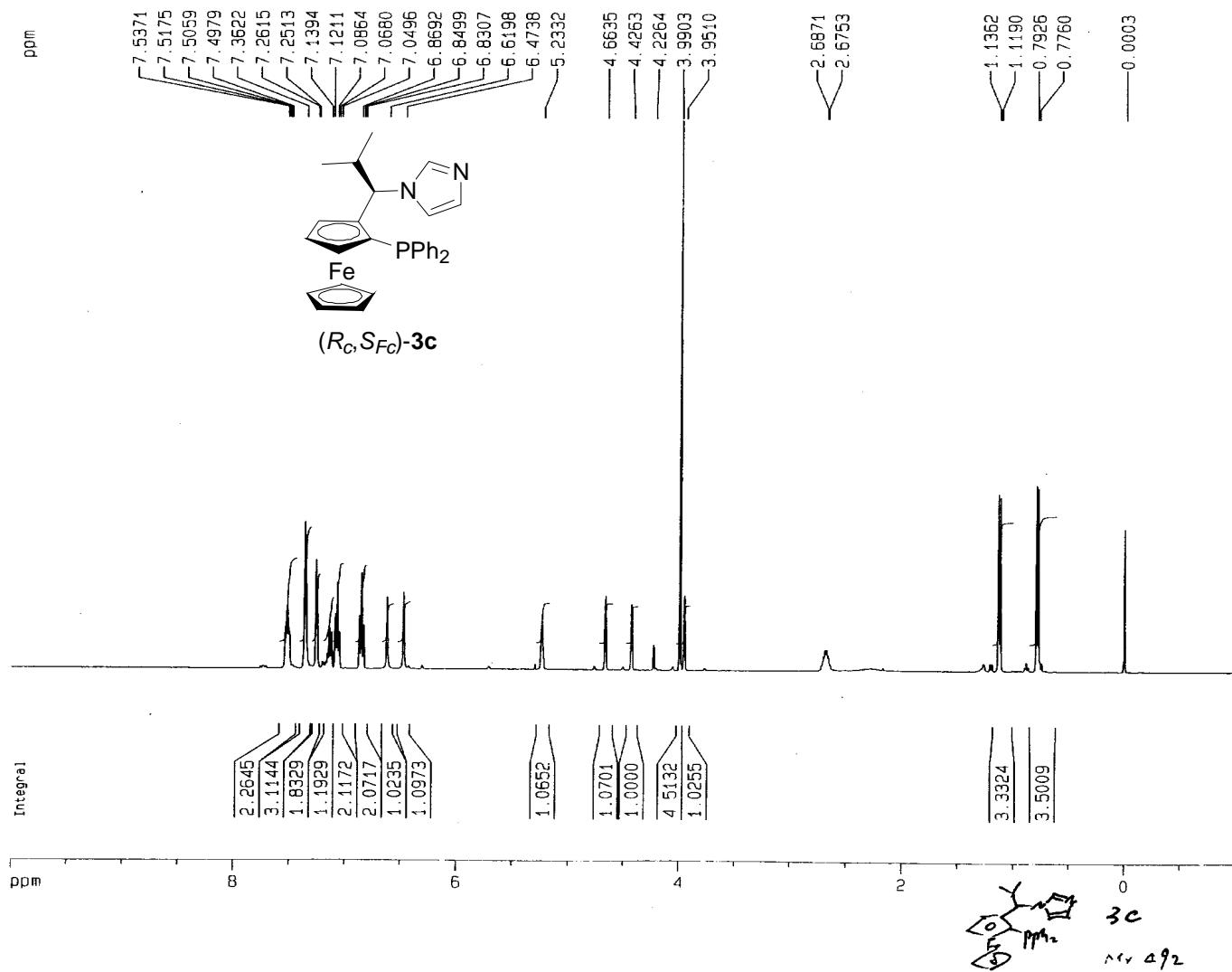
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F2	-16197.55 Hz
PPCM	14.50000 ppm/cm
HZCM	2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCl₃ 08/07/30



1H NMR WDY-1 IN CDCl₃ 08/05/26



Current Data Parameters
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 EXPNO 819
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080526
 Time 15.56
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
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 MCWRK 0.01500000 sec

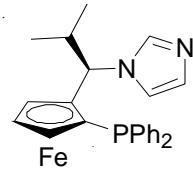
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F2 - Processing parameters
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 PC 1.40

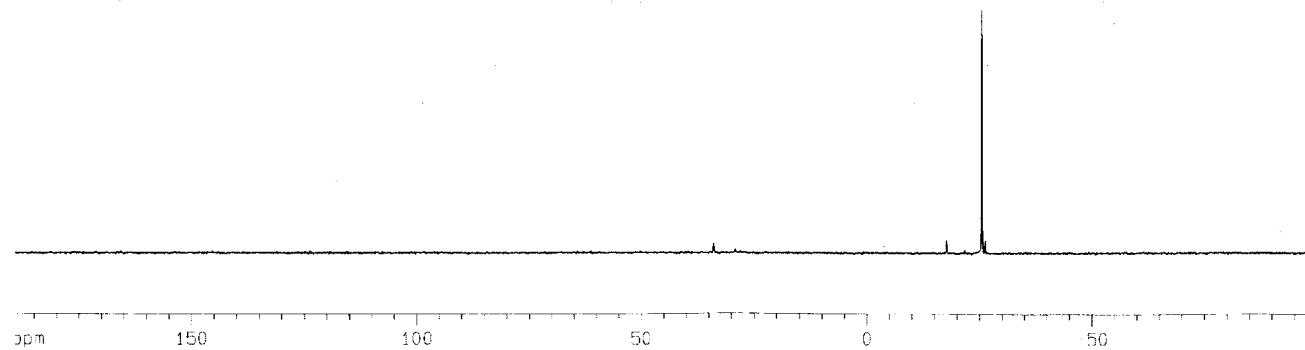
1D NMR plot parameters
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 F2 -400.13 Hz
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 HZCM 220.07150 Hz/cm

31P NMR WDY-1 IN CDCL3 09/04/30

ppm



(*R*_c,*S*_{Fc})-3c



Current Data Parameters

NAME wdy
EXPNO 1239
PROCNO 1

F2 - Acquisition Parameters

Date 20090430
Time 13.25
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PULPROG zg
TD 32768
SOLVENT D2O
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
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===== CHANNEL f1 =====

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PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

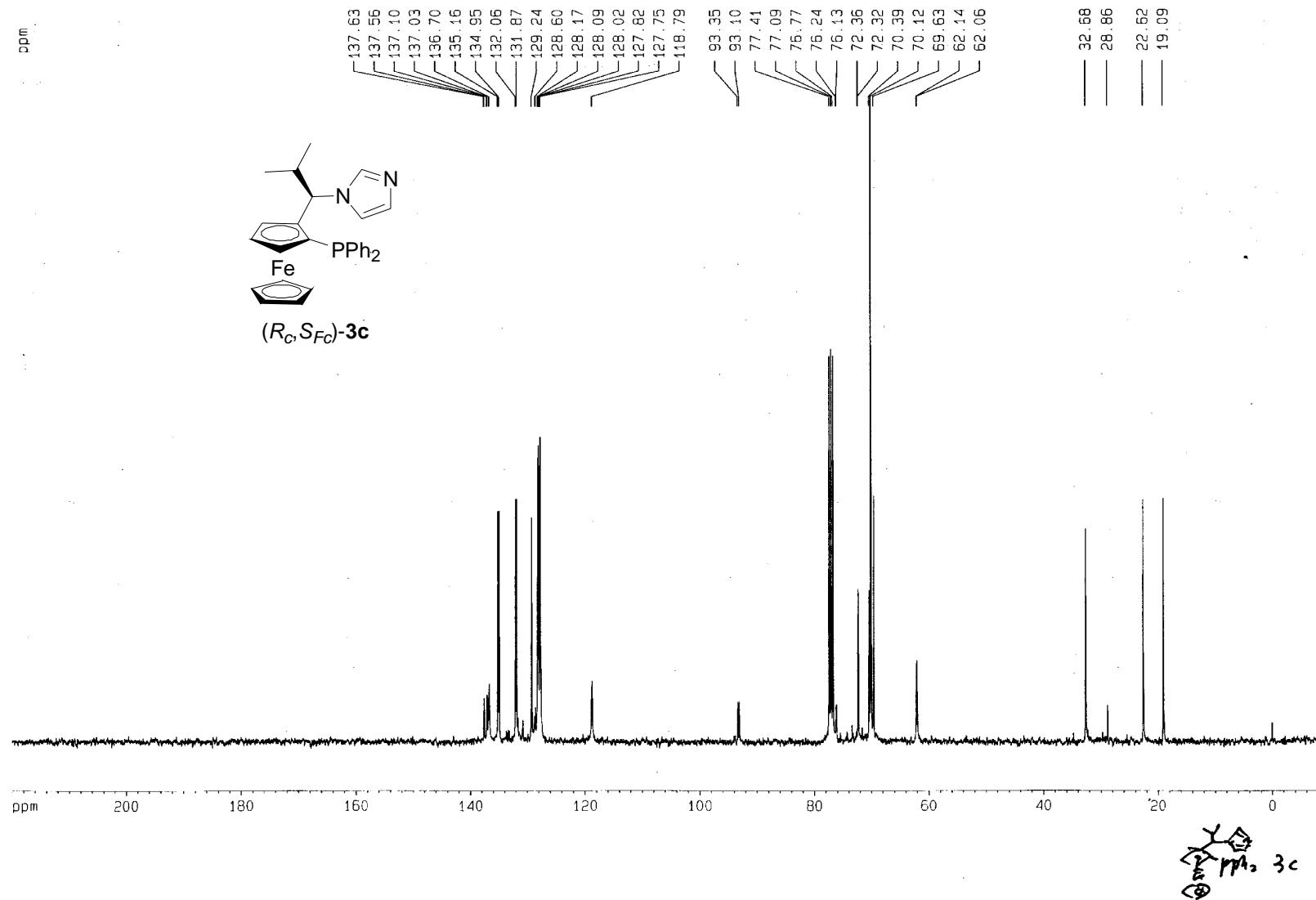
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1D NMR plot parameters

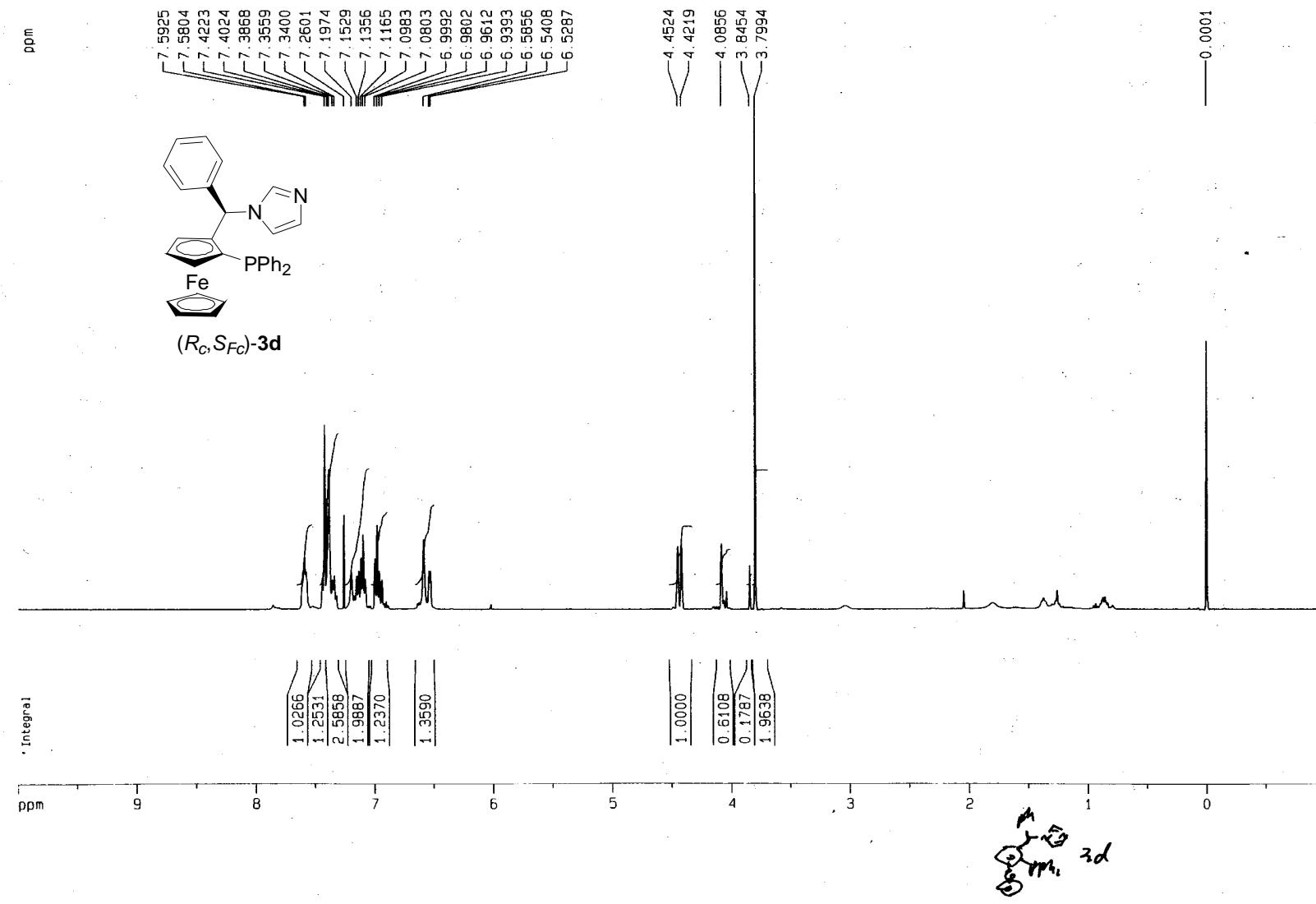
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F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
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H2CM 2348.64526 Hz/cm

(Rc,Sc)-3c

¹³C NMR WDY-1 IN CDCL₃ 09/04/30

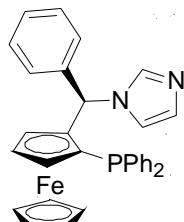


¹H NMR WDY-1 IN CDCl₃ 09/02/25

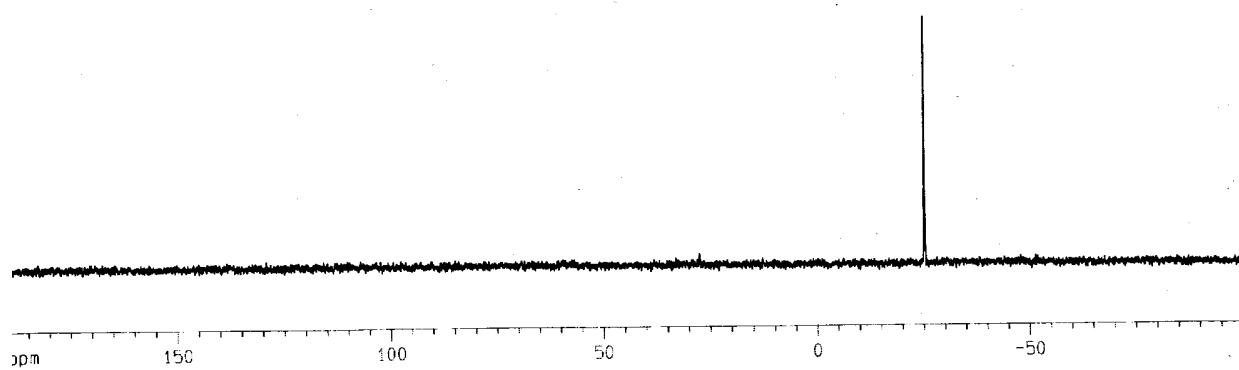


³¹P NMR WDY-1 IN CDCl₃ 09/02/25

μP



(R_c,S_{Fc})-3d



Current Data Parameters

NAME wdy
EXPNO 1199
PROCNO 1

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PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 36
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
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MCWRK 0.0150000 sec

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

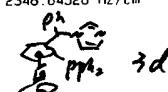
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PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

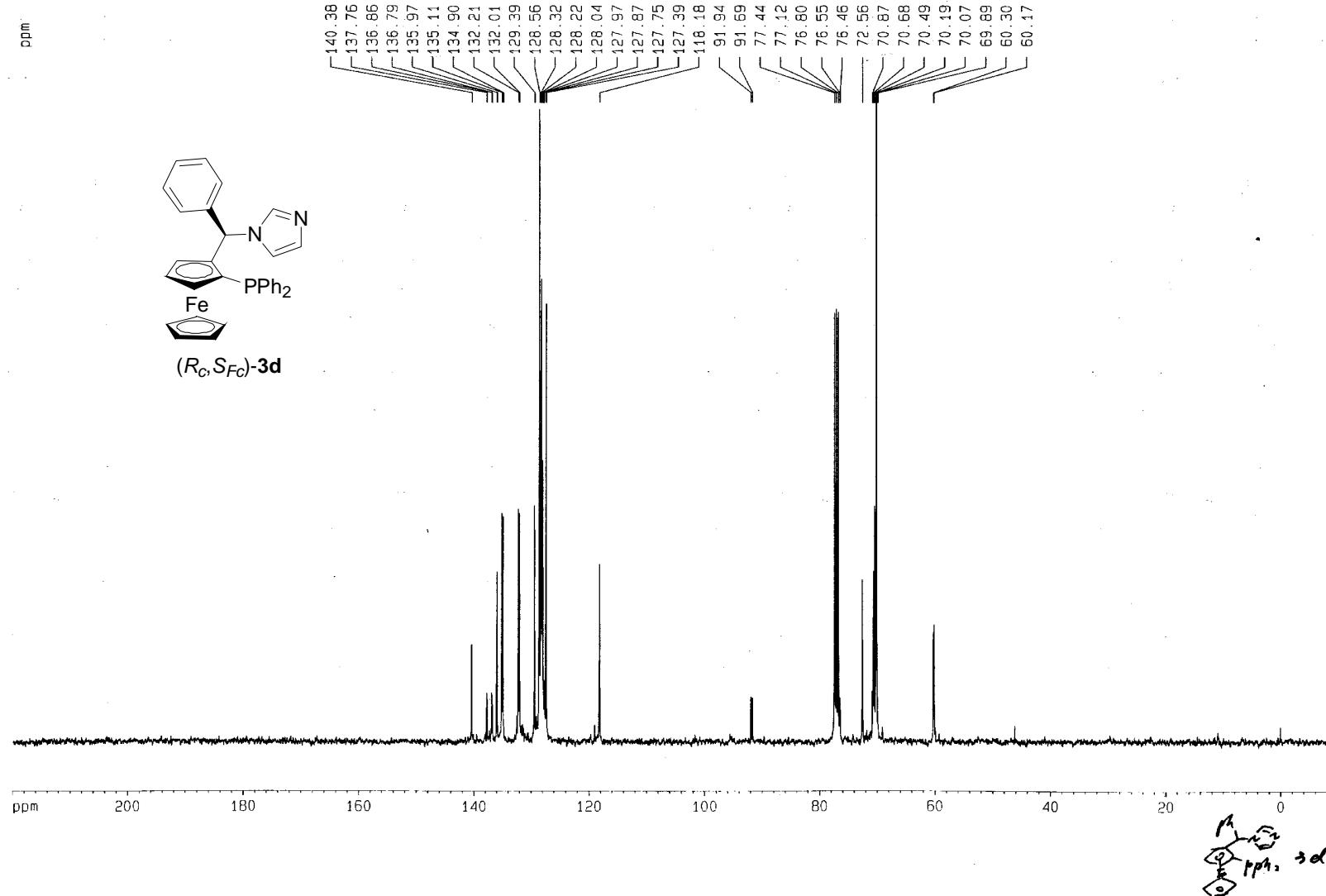
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LB 5.00 Hz
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PC 1.40

1D NMR plot parameters

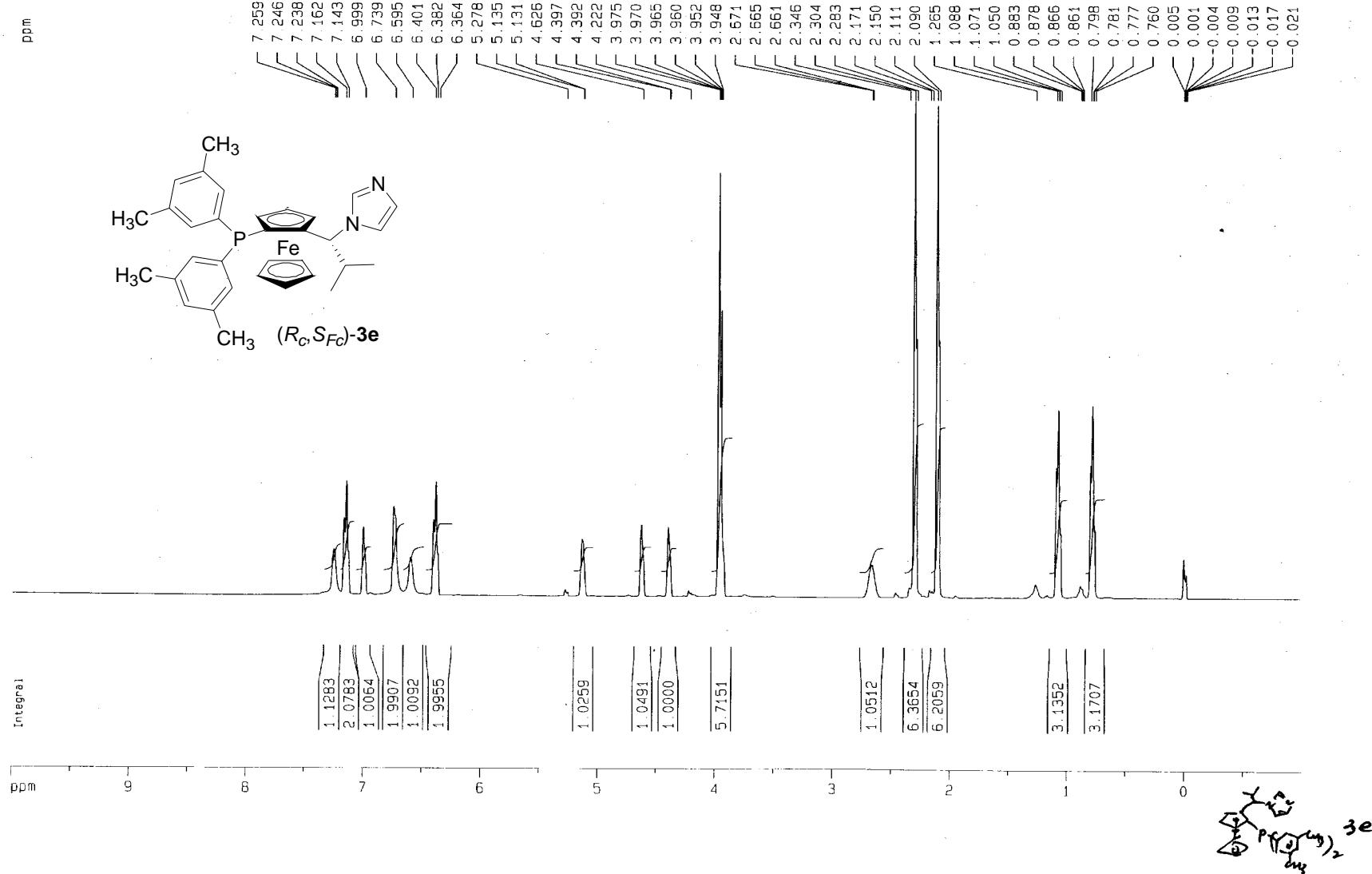
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F1 30775.35 Hz
F2P -100.000 ppm
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PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCl₃ 09/04/30

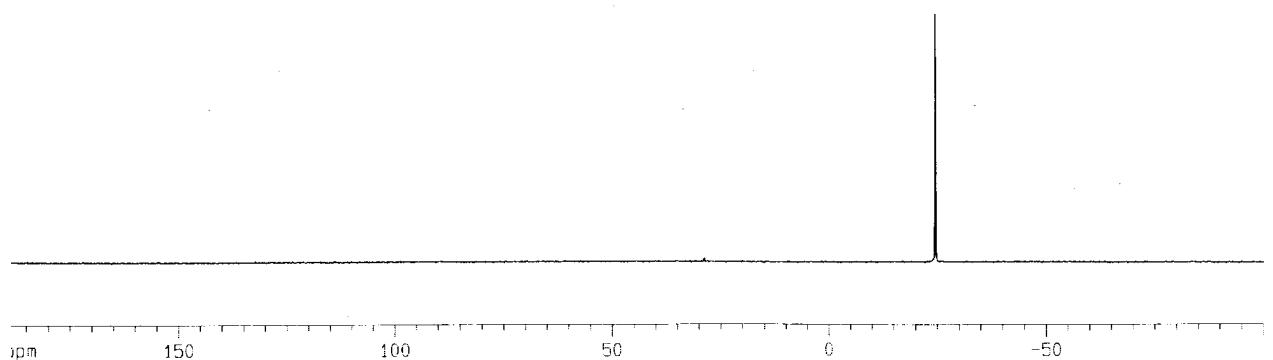
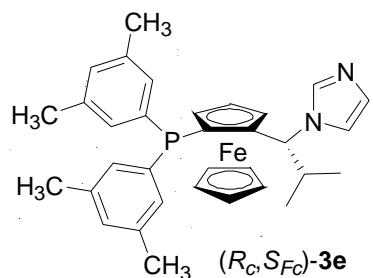


¹H NMR WDY-4 IN CDCL₃ 09/04/30



³¹P NMR WDV-4 IN CDCL₃ 09/04/30

ppm



Current Data Parameters

NAME wdy
EXPNO 1245
PROCNO 1

F2 - Acquisition Parameters

Date 20090430
Time 14.36
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PULPROG zg
TD 32768
SOLVENT D2O
NS 23
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

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

NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

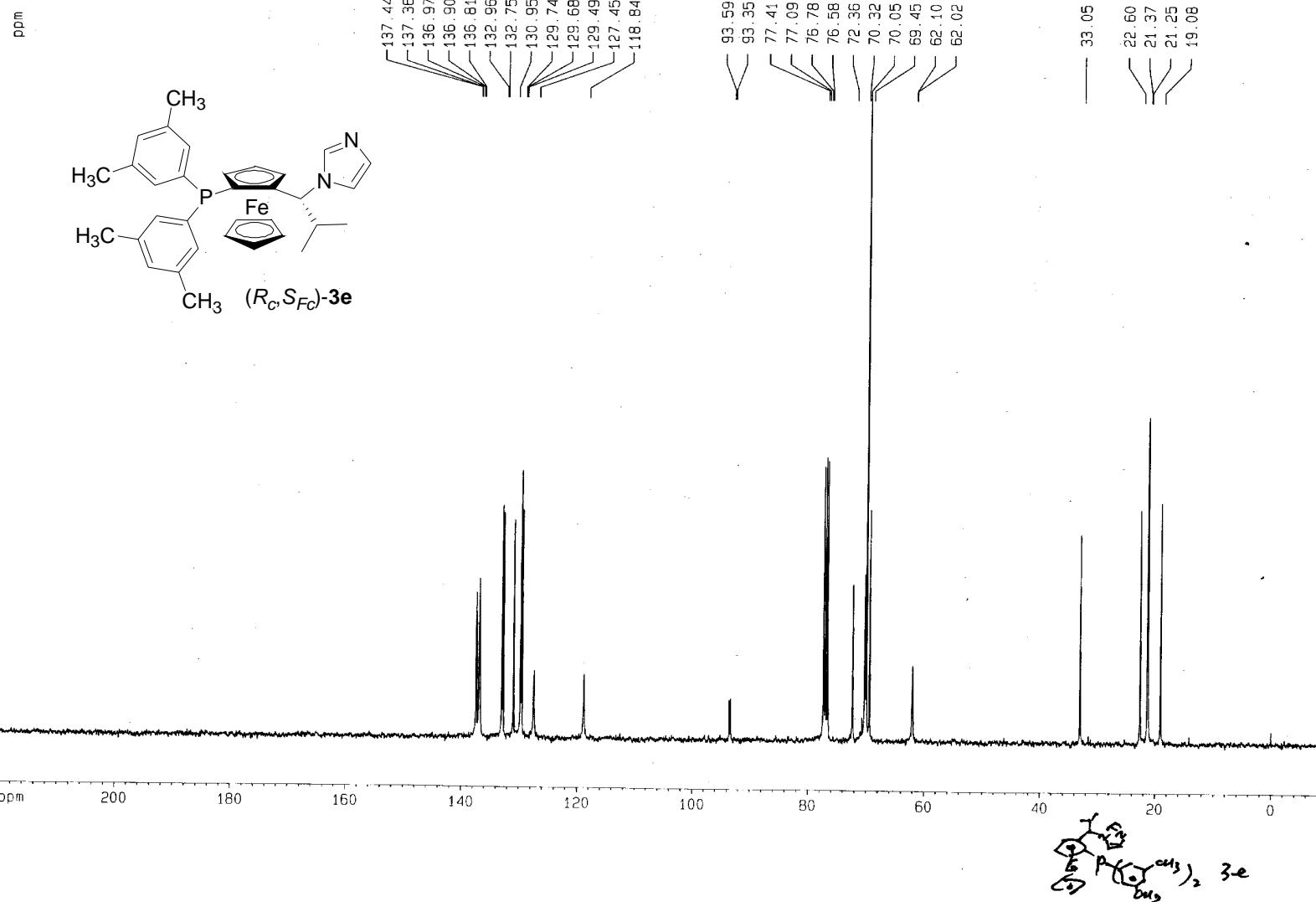
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

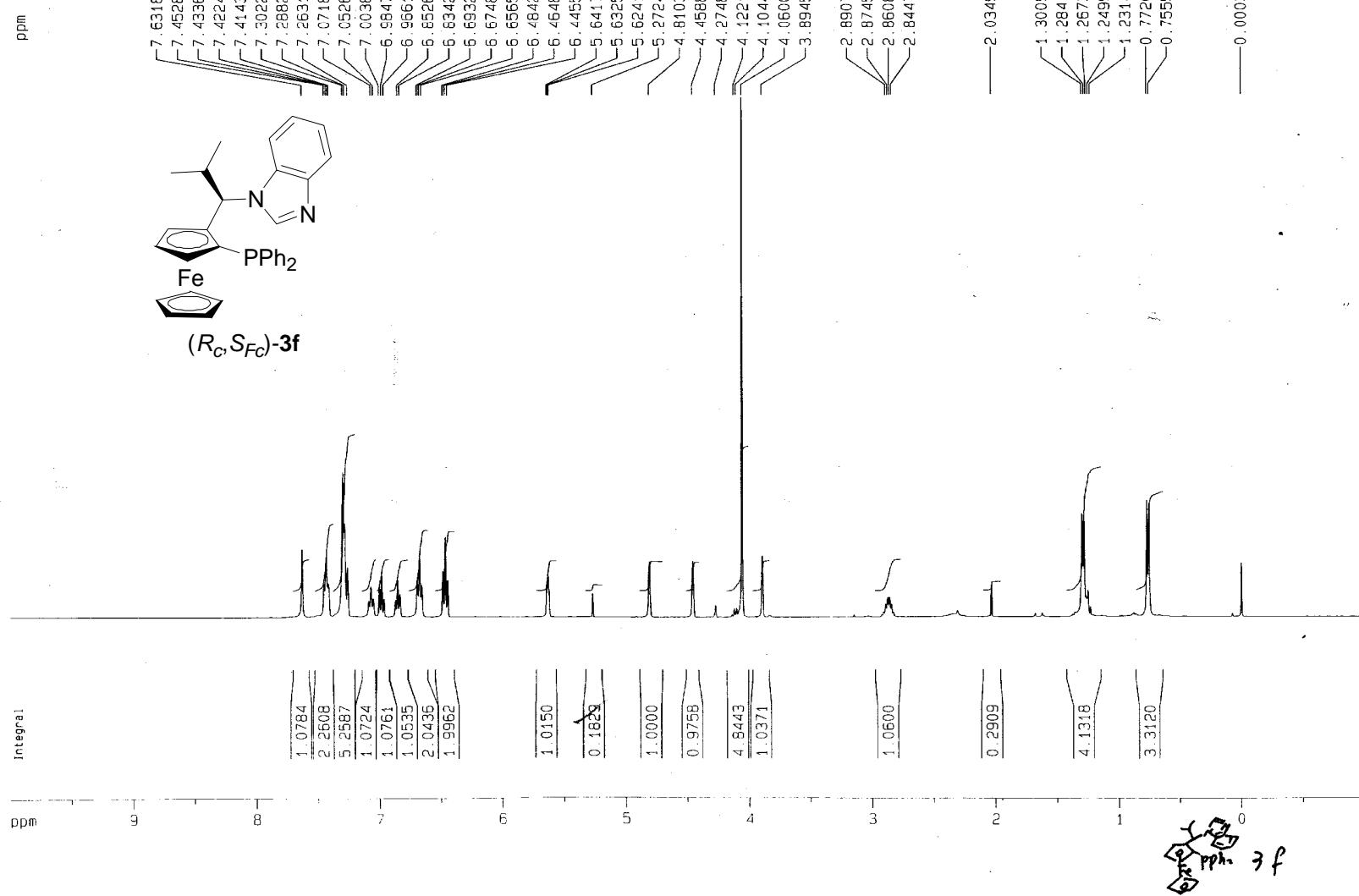
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



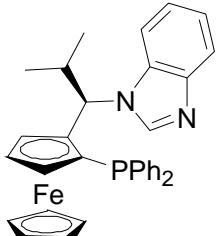
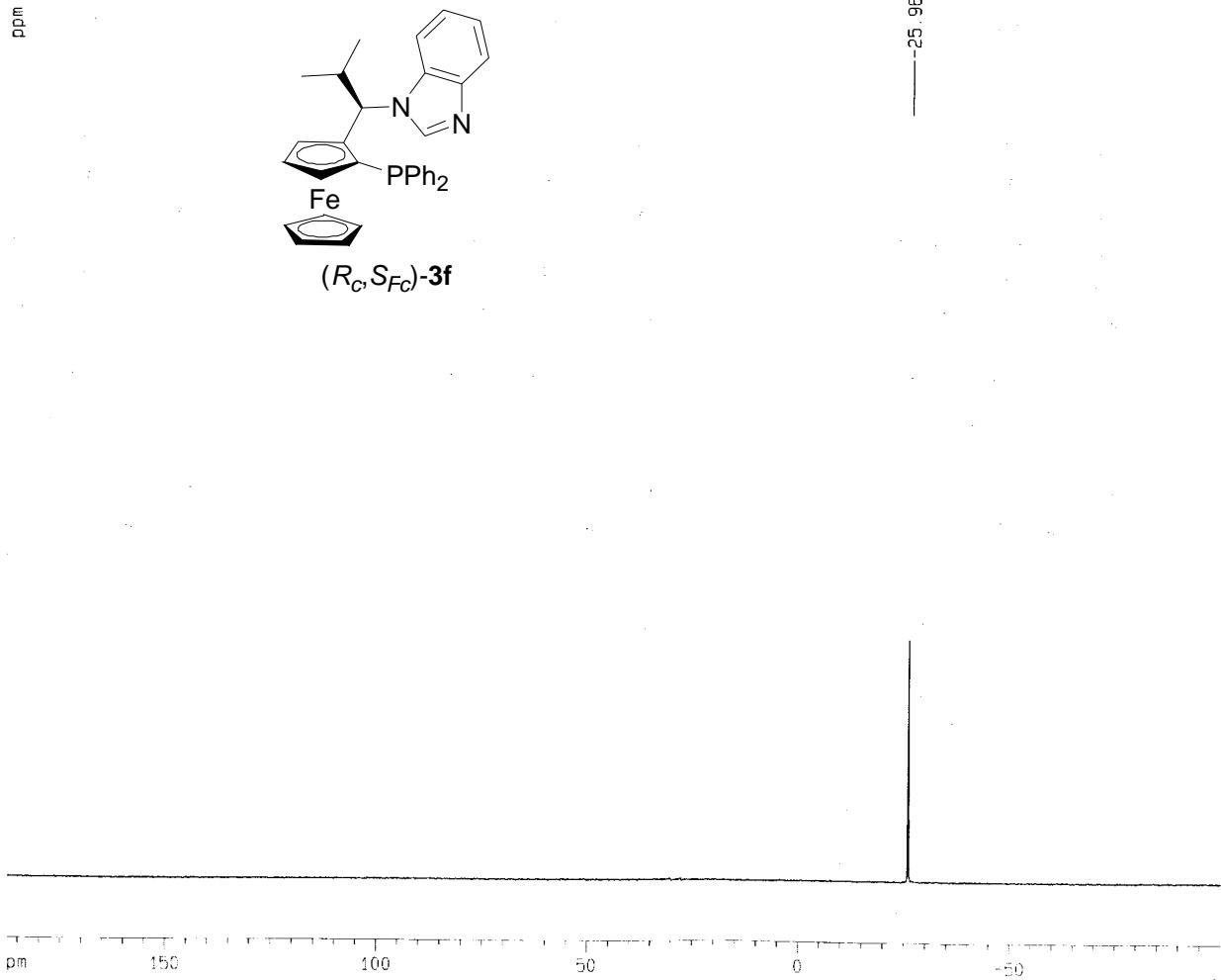
¹³C NMR WDY-4 IN CDCl₃ 09/04/30



1H NMR WDY-1 IN CDCL3 09/04/24



31P NMR WDV-1 IN CDCL3 09/04/24



(R_C, S_{FC})-3f

Current Data Parameters
NAME wdy
EXPNO 1227
PROCNO 1

F2 - Acquisition Parameters

Date_	20090424
Time	14.32
INSTRUM	dix400
PROBHD	5 mm PABBO BB-
PULPROG	zg
TD	32768
SOLVENT	D2O
NS	22
DS	0
SWH	48543.688 Hz
FIDRES	1.481436 Hz
AQ	0.3375604 sec
RG	9195.2
DW	10.300 usec
DE	6.00 usec
TE	296.2 K
D1	2.0000000 sec
MCREST	0.0000000 sec
MCWRK	0.0150000 sec

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

NUC1 31P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

F2 - Processing parameters

```

    E Processing parameters
SI           16384
SF          161.9755337 MHz
WDM          EM
SSB            0
LB            5.00 Hz
GB            0
PC           1.40

```

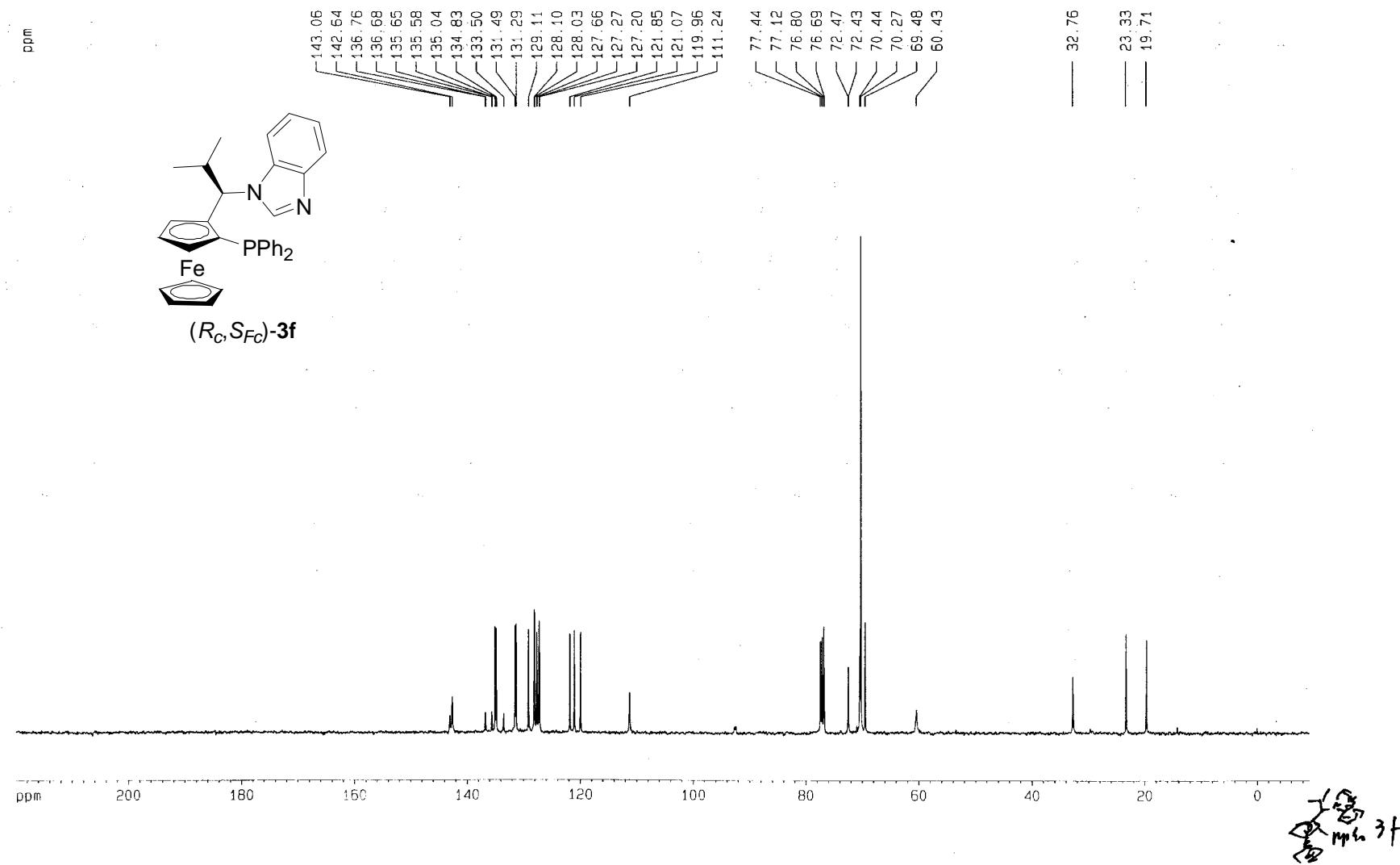
1D NMR plot parameters

10 NMR plot parameters

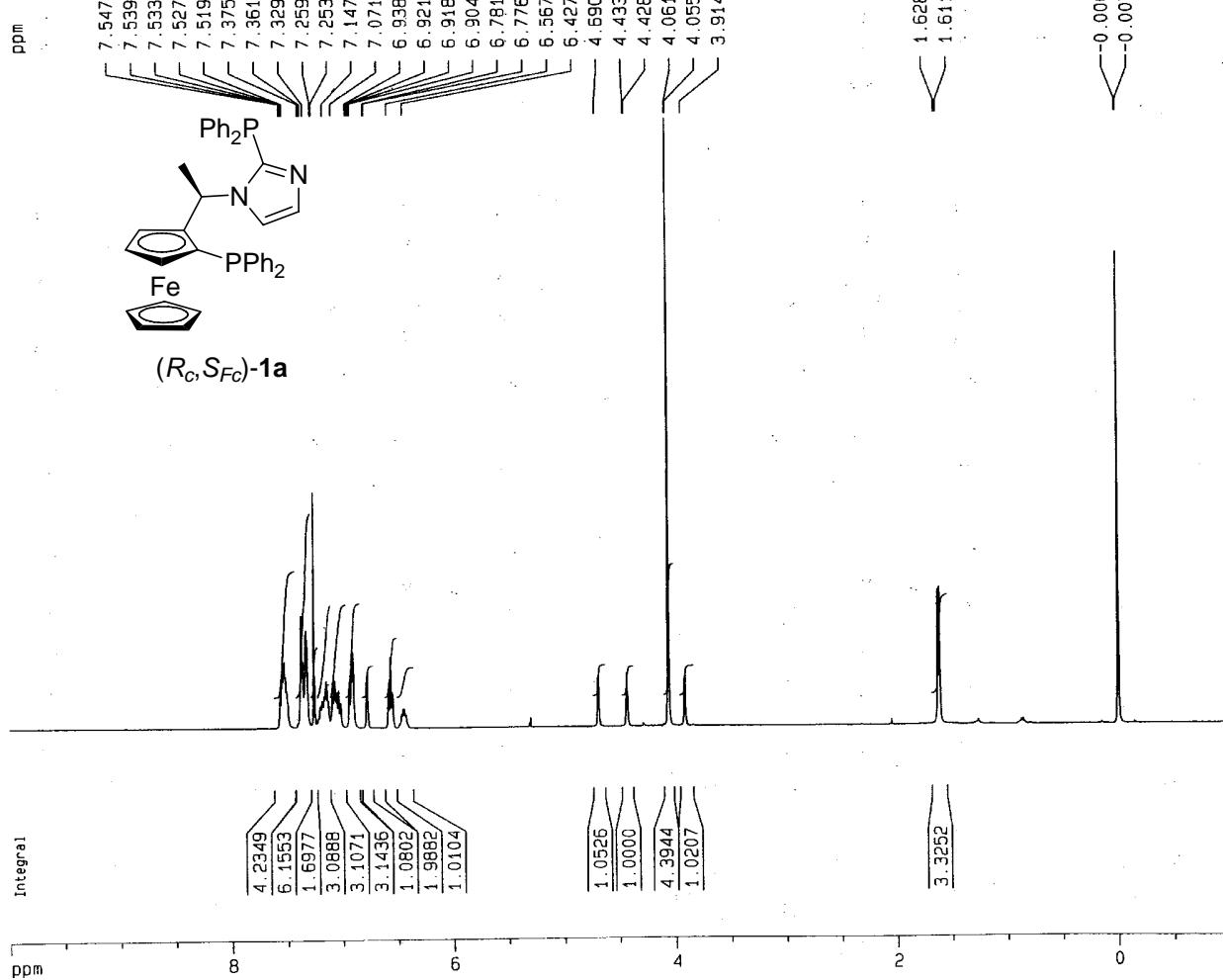
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CY	4.00	cm
F1P	190.000	ppm
F1	30775.35	Hz
F2P	-100.000	ppm
F2	-16197.55	Hz
PPCMC	14.50000	ppm/cm
HZCM	2348.64526	Hz/cm

ppha 3 f

¹³C NMR WDY-1 IN CDCL₃ 09/04/24



1H NMR WDY-1 IN CDCL3 08/01/17



Current Data Parameters
NAME wdy
EXPNO 728
PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080117
 Time 14.53
 INSTRUM drx400.
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl3
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 181
 DW 62.400, used
 DE 6.00 used
 TE 294.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 =====
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

```

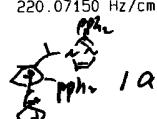
F2 - Processing parameters
SI          32768
SF          400.1300179 MHz
WDW         GM
SSB         0
LB          -0.50 Hz
GB          0.1
PC          1.40

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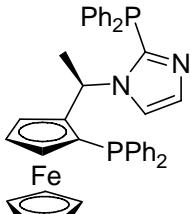
1D NMR plot parameters
CX           20.00 cm
CY           10.00 cm
F1P          10.000 ppm
F1           4001.30 Hz
F2P          -1.000 ppm
F2           -400.13 Hz
PPMCM        0.55000 ppm/cm
H7CM         220.07150 Hz/cm

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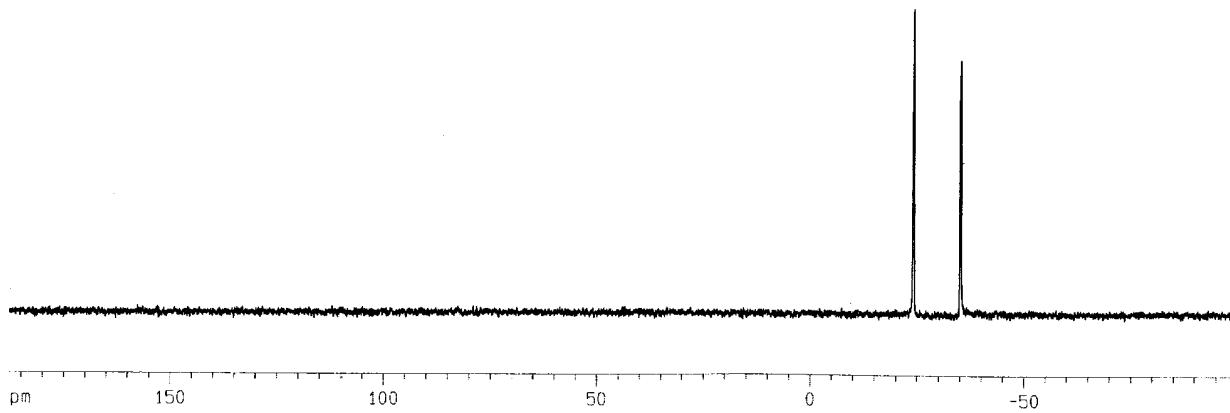


31P NMR WDY-2 IN CDCl3 08/01/18

ppm



(*R*_c, *S*_{Fc})-1a



Current Data Parameters

NAME wdy
EXPNO 734
PROCNO 1

F2 - Acquisition Parameters

Date 20080118
Time 12.55
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 295.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

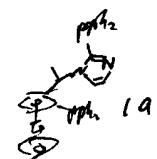
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

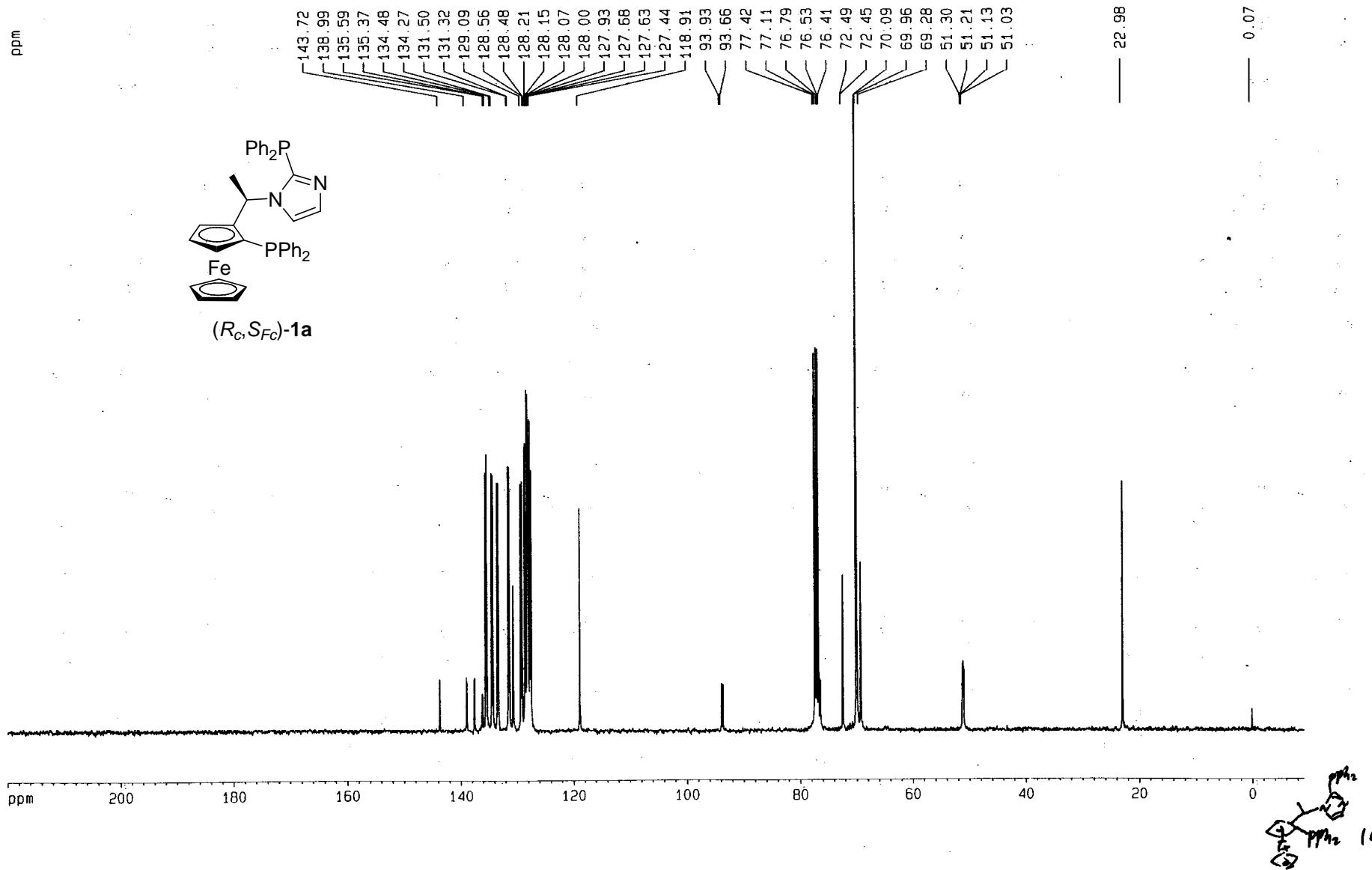
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

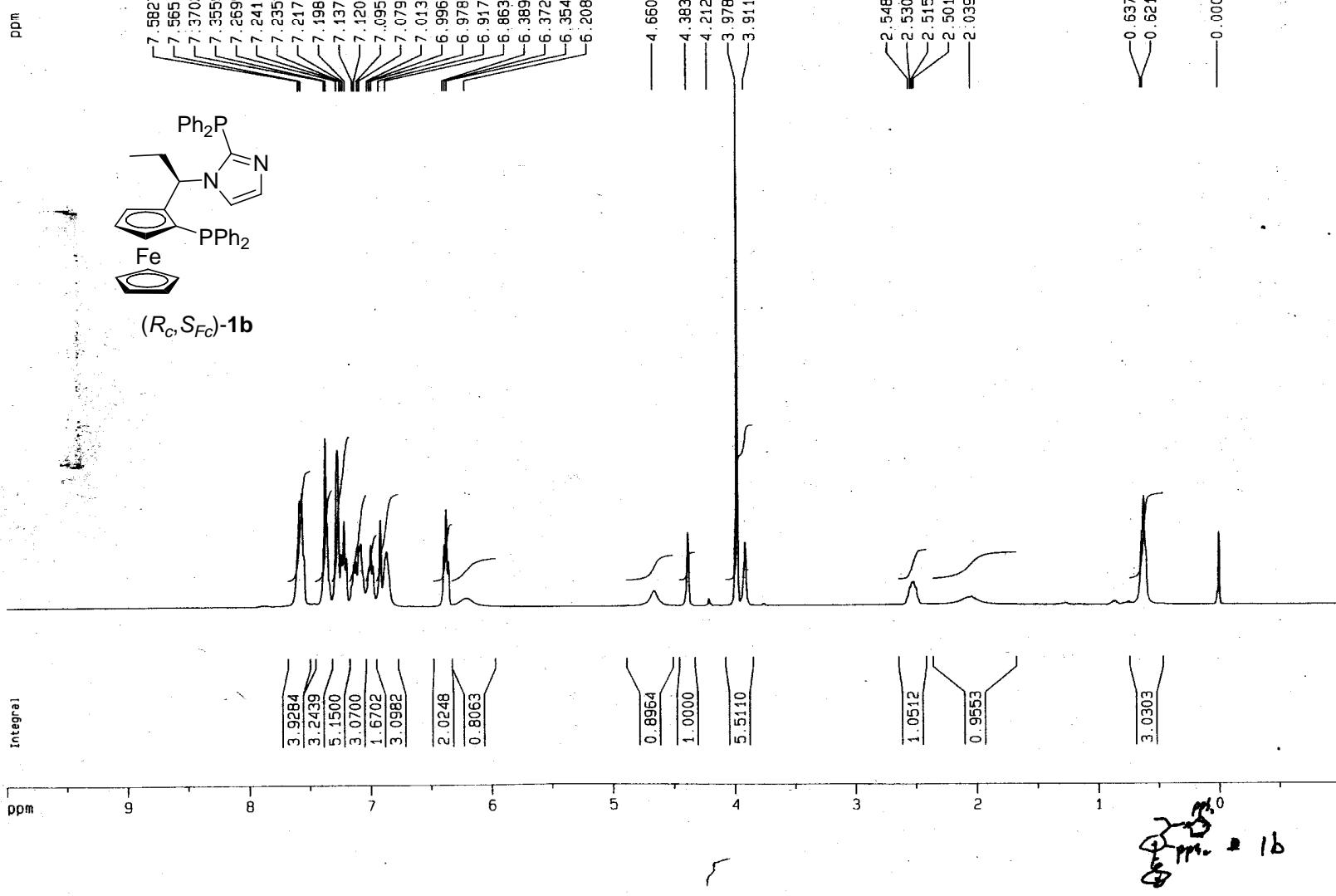
CX 20.00 cm
CY 5.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-1 IN CDCL₃ 08/07/23

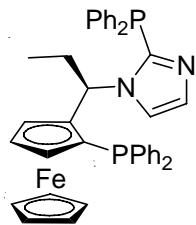


¹H NMR WDY-3 IN CDCl₃ 09/01/08

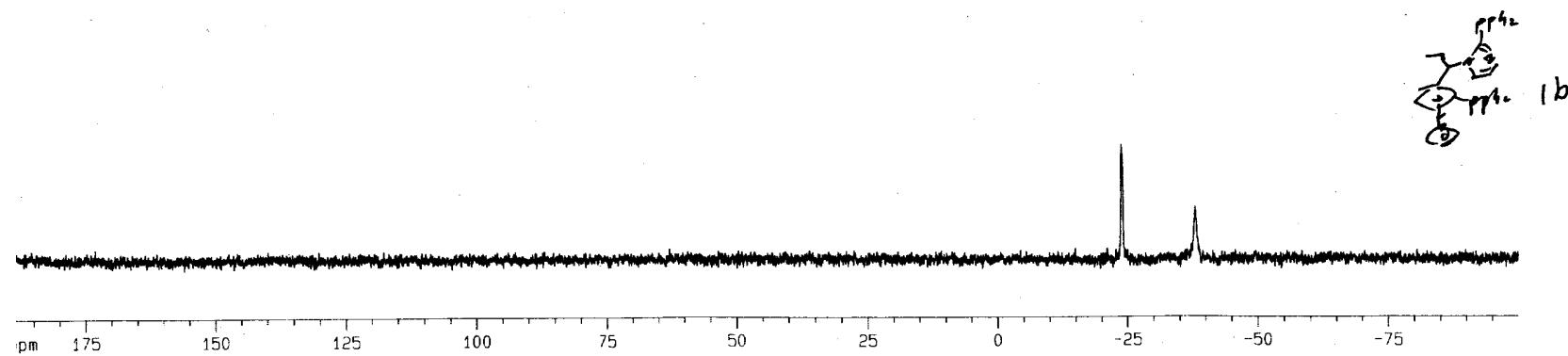


³¹P NMR WDY-1 IN CDCL₃ 08/02/25

μm



(*R*_c,*S*_{Fc})-1b

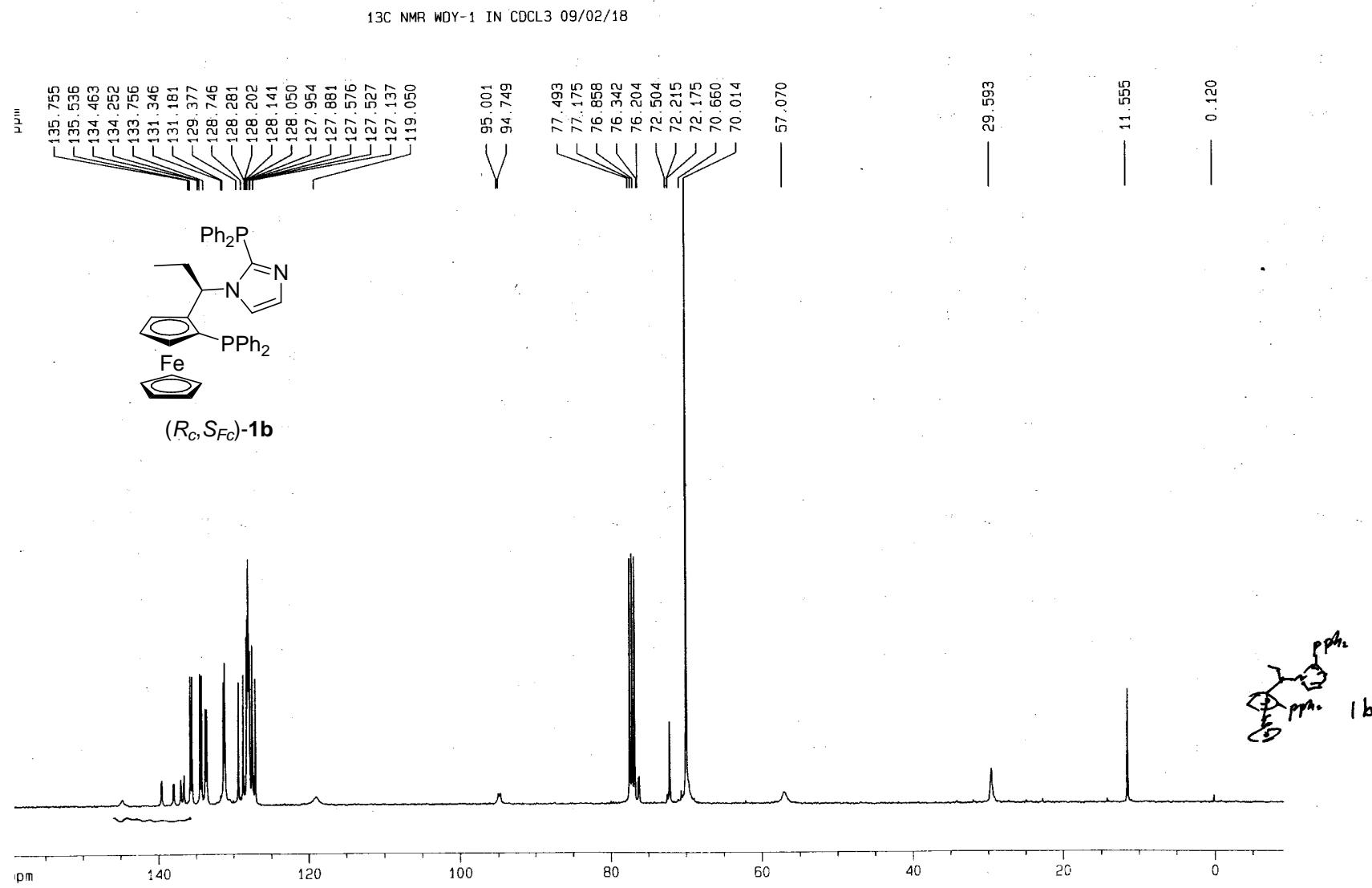


ppm

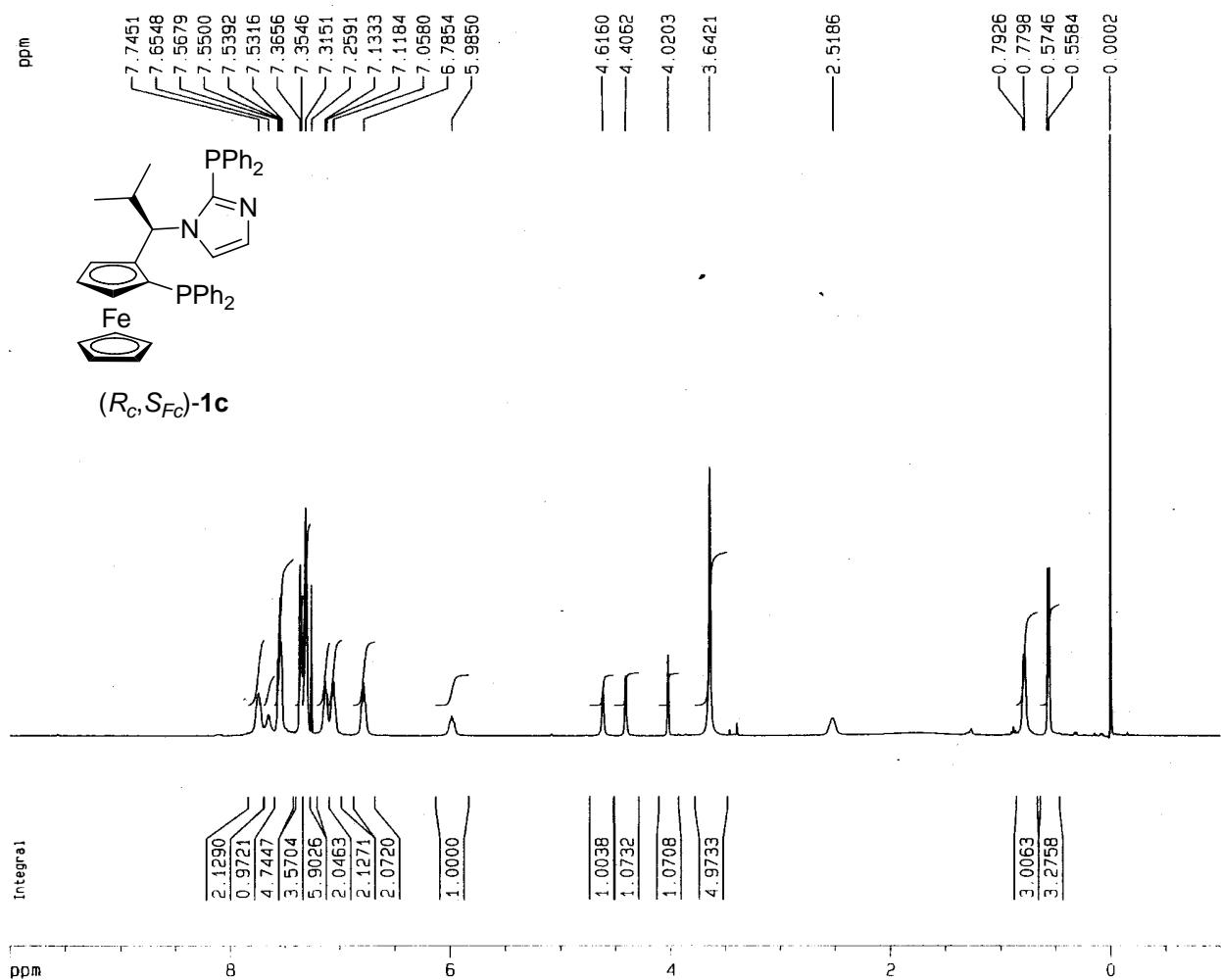
175 150 125 100 75 50 25 0

-25 -50

-75



1H NMR WDY-3 IN CDCl₃ 08/07/23



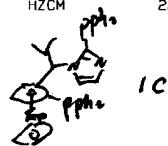
Current Data Parameters
 NAME wdy
 EXPNO 885
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080723
 Time 10.50
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 128
 DW 62.400 usec
 DE 6.00 usec
 TE 297.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 ======
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SFD1 400.1332521 MHz

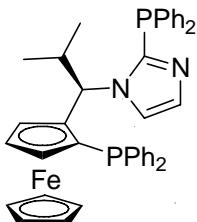
F2 - Processing parameters
 SI 32768
 SF 400.1300162 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm

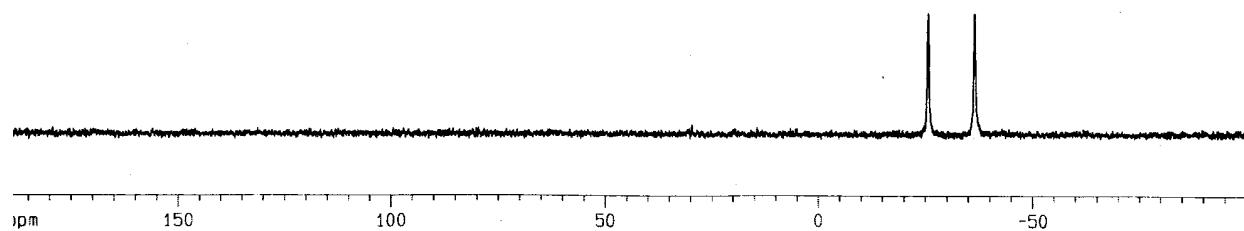


31P NMR WDY-3 IN CDCL3 08/07/23

ppm



(*R*_c,*S*_{Fc})-1c



Current Data Parameters

NAME wdy
EXPNO 886
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080723
Time 10.55
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 101
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

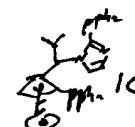
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

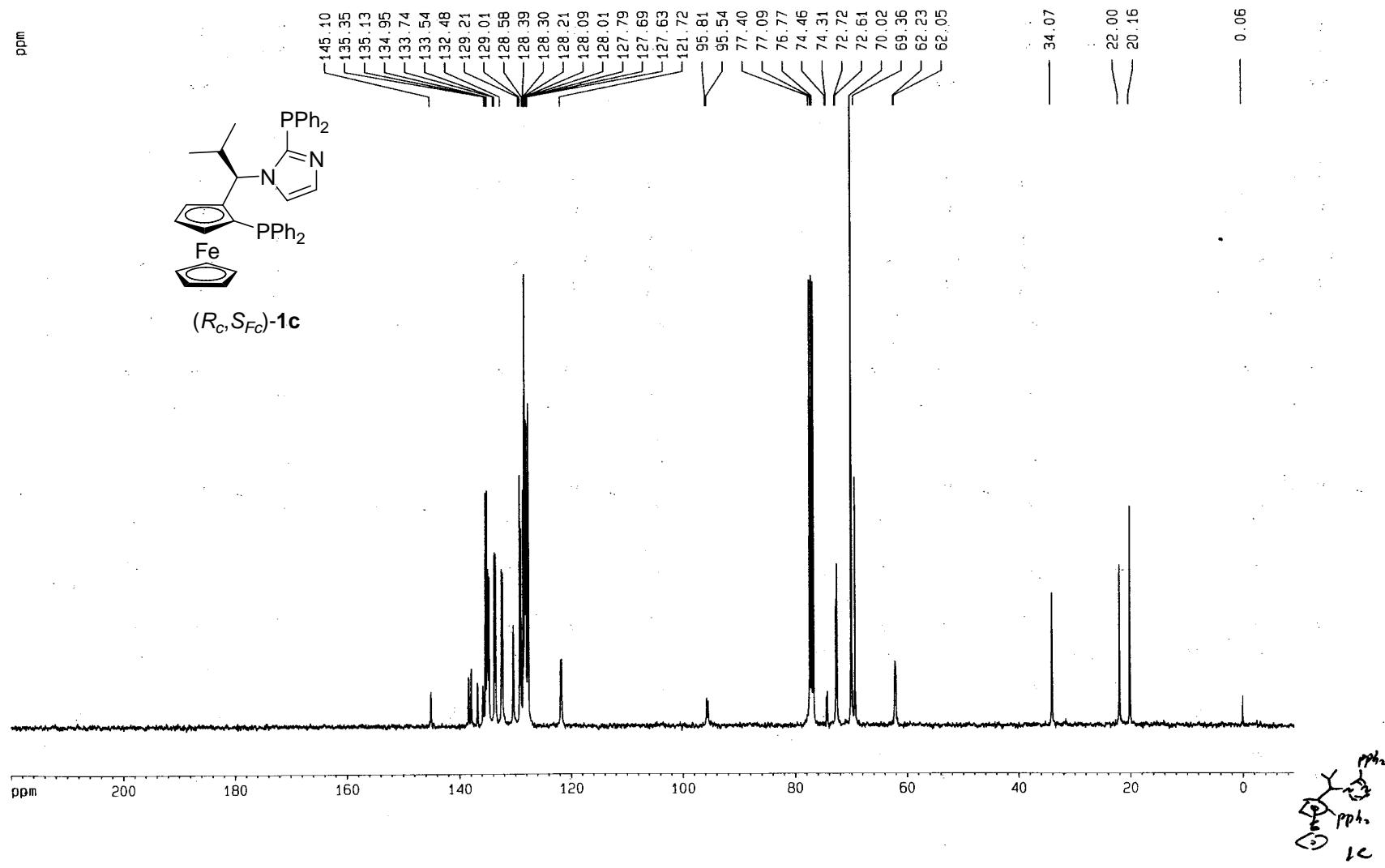
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

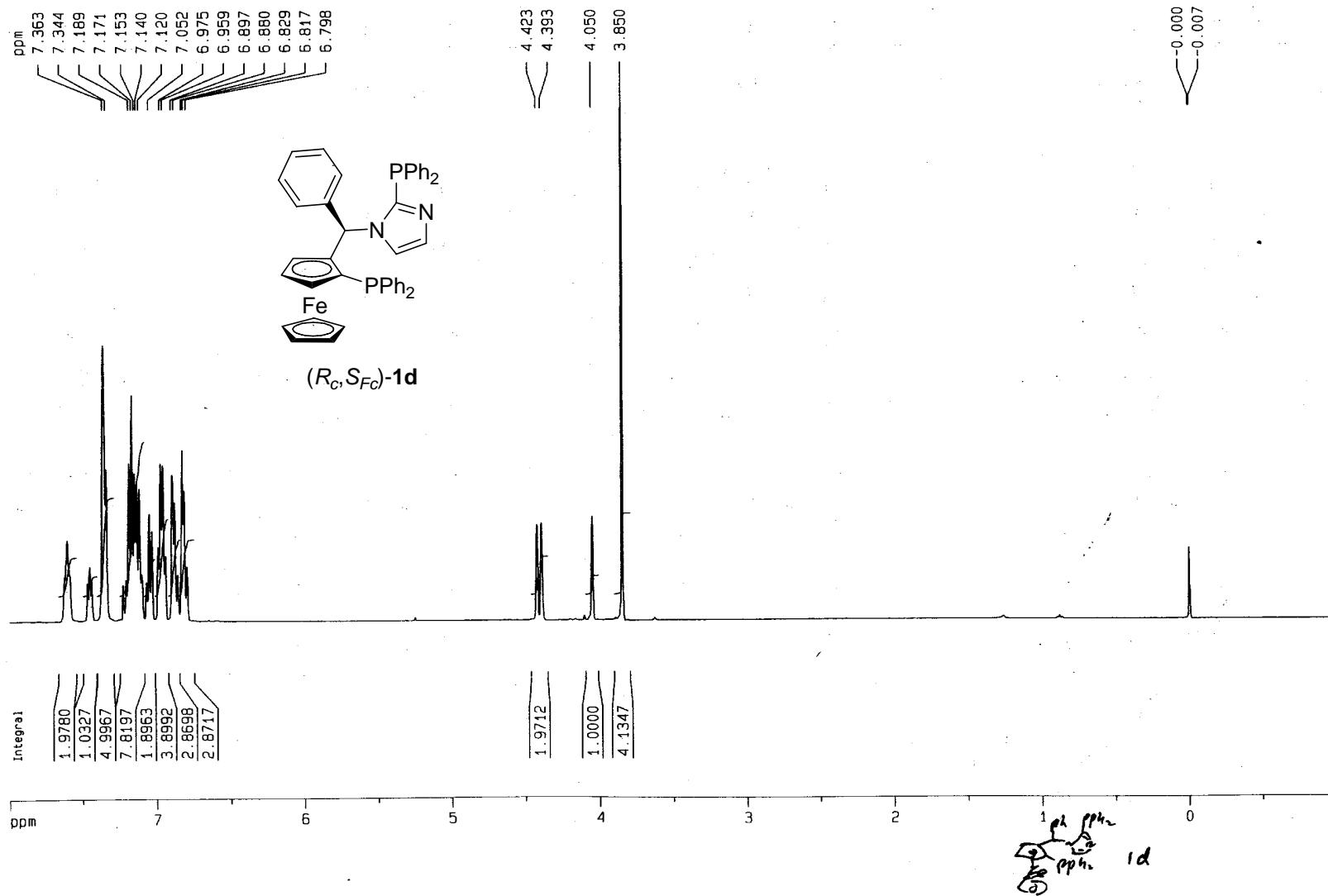
CX 20.00 cm
CY 2.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



13C NMR WDY-3 IN CDCL3 08/07/23.

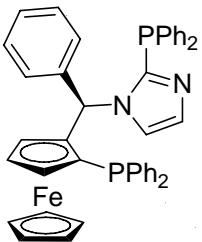


¹H NMR WDY-1 IN CDCL₃ 08/08/20

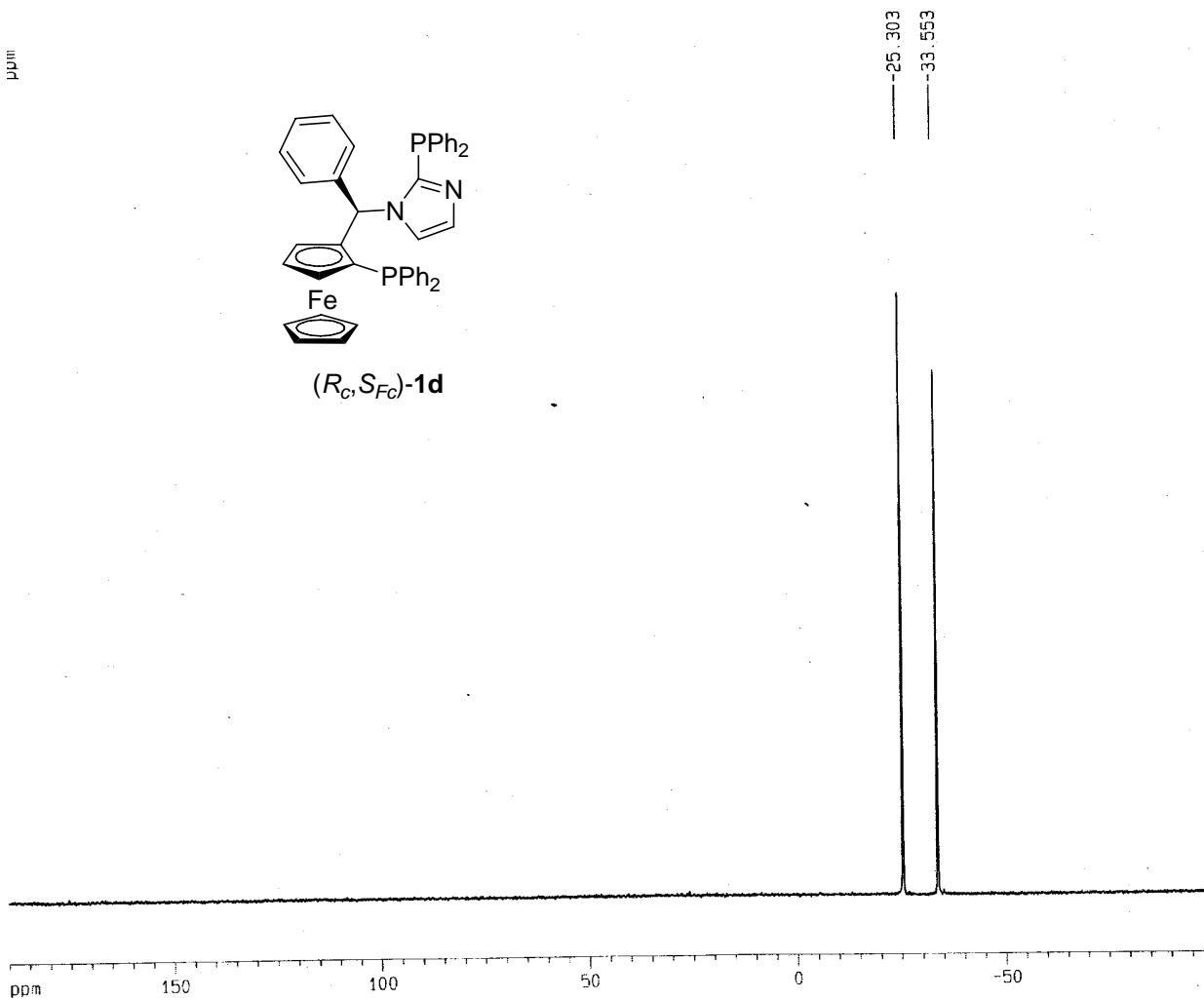


31P NMR WDY-1 IN CDCL3 08/08/20

ppm



(*R*_c,*S*_{Fc})-1d



Current Data Parameters

NAMF wdy
EXPNO 913
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080820
Time 15.28
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 69
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 0.0 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

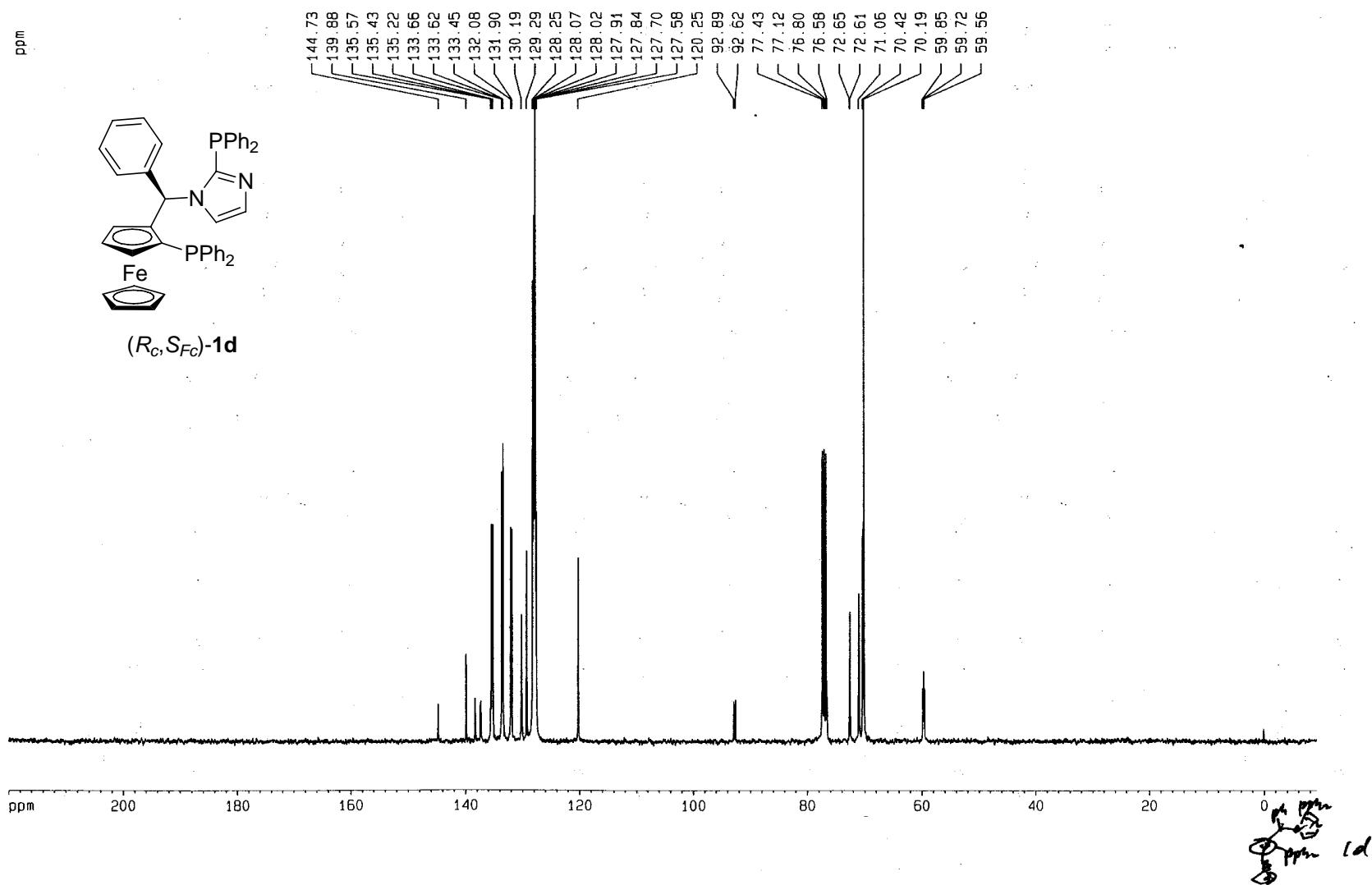
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

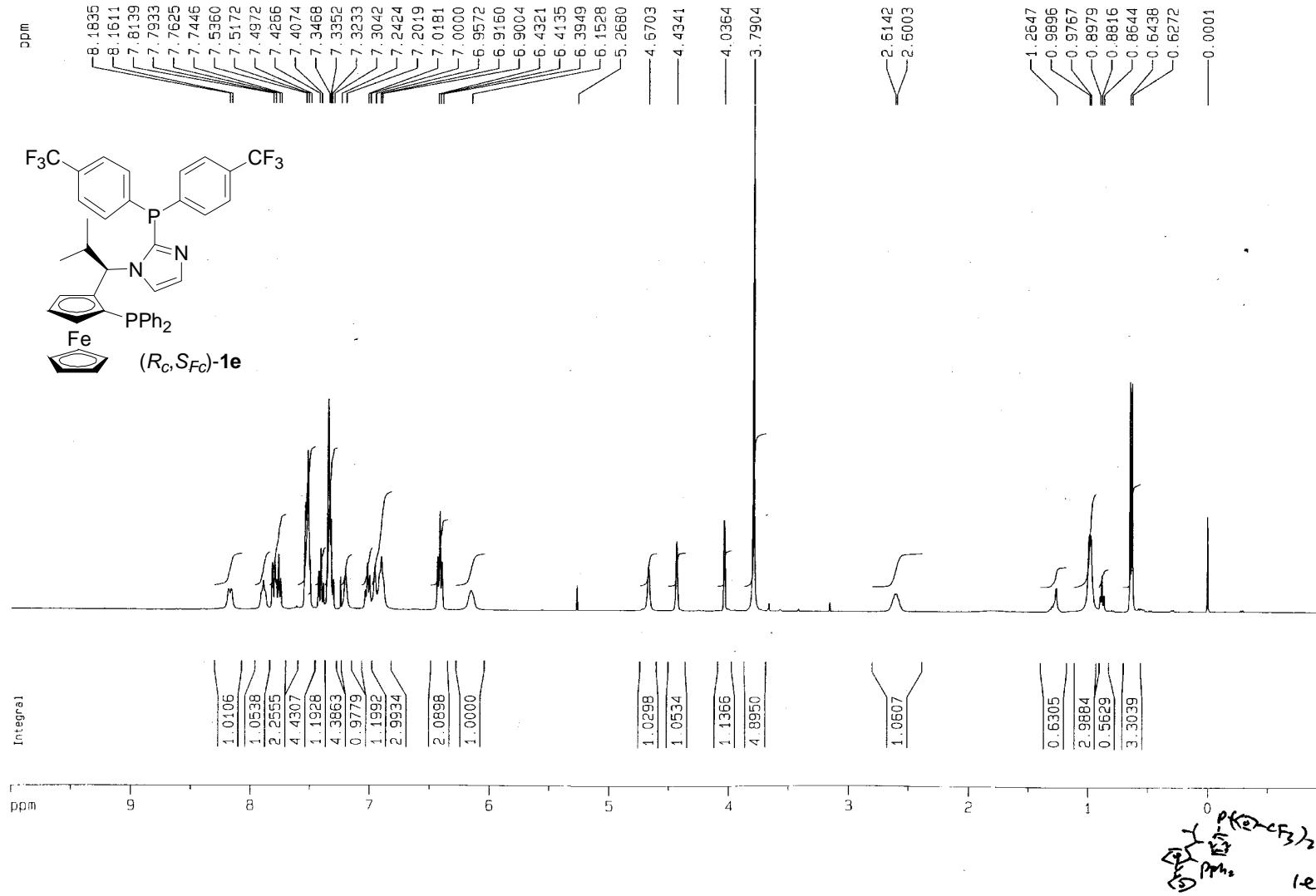
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-1 IN CDCL₃ 08/08/20

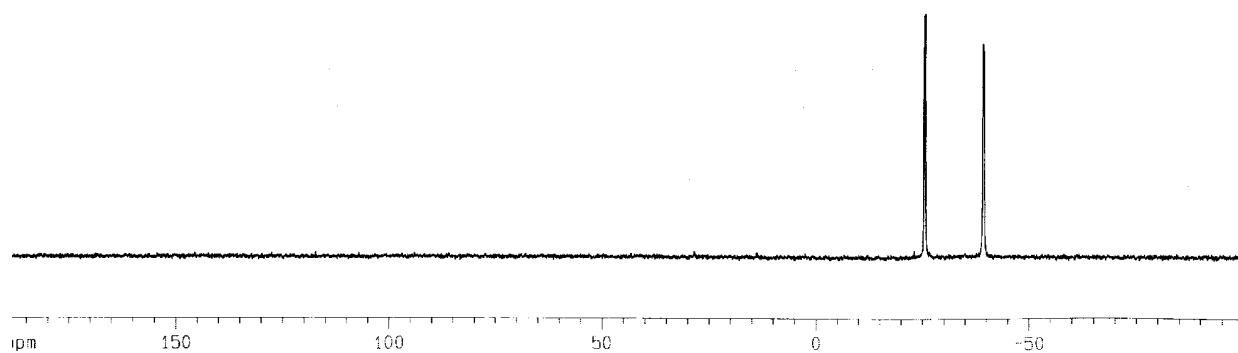
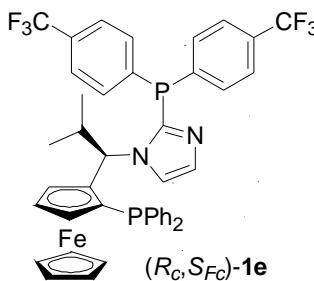


1H NMR WDY-2 IN CDCL₃ 09/05/05



³¹P NMR WDY-2 IN CDCL₃ 09/05/05

ppm



Current Data Parameters
NAME wdy
EXPNO 1256
PROCNO 1

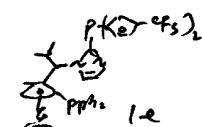
F2 - Acquisition Parameters
Date_ 20090505
Time 12.39
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT D2O
NS .19
DS 0
SWH 48543.668 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

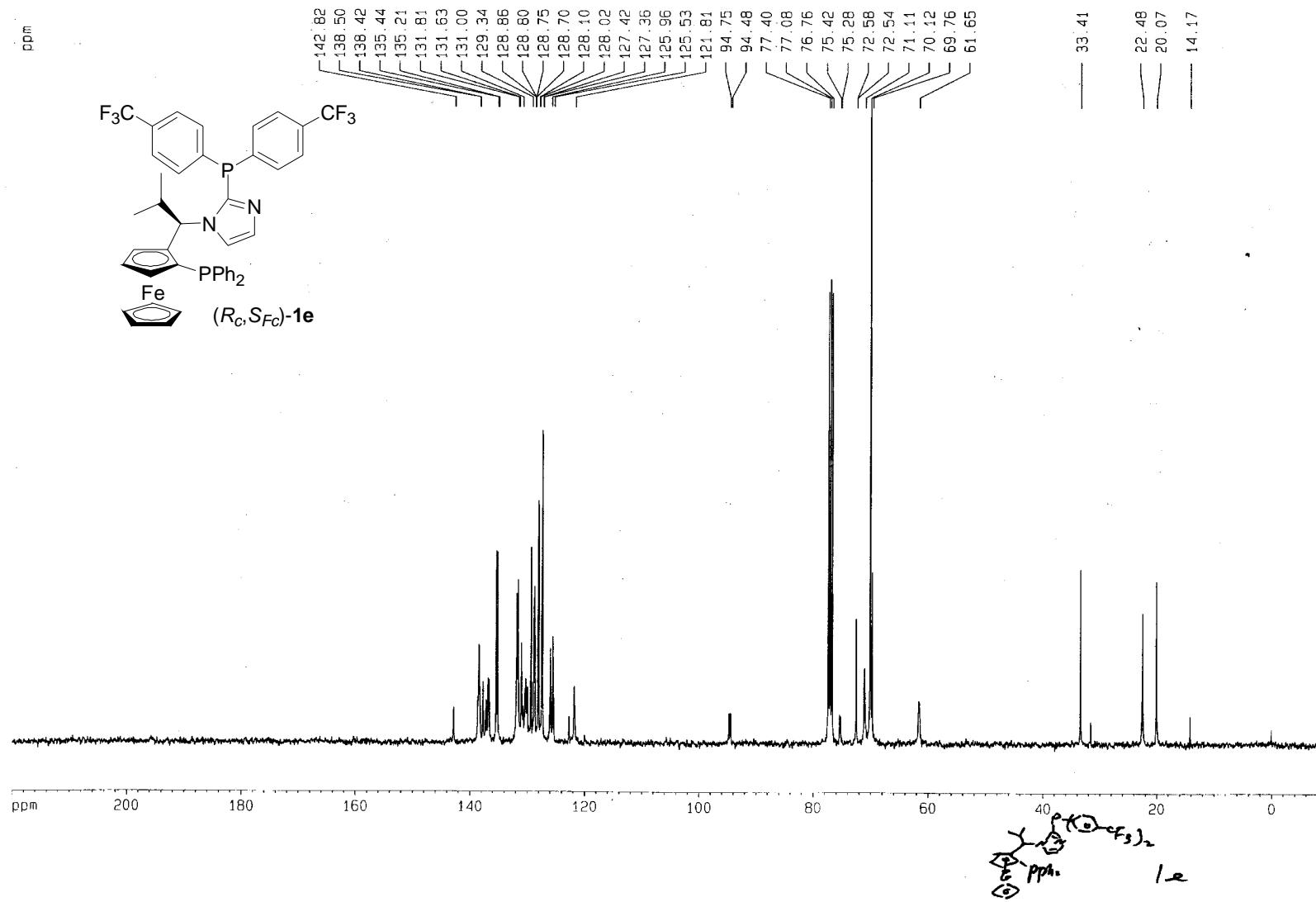
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

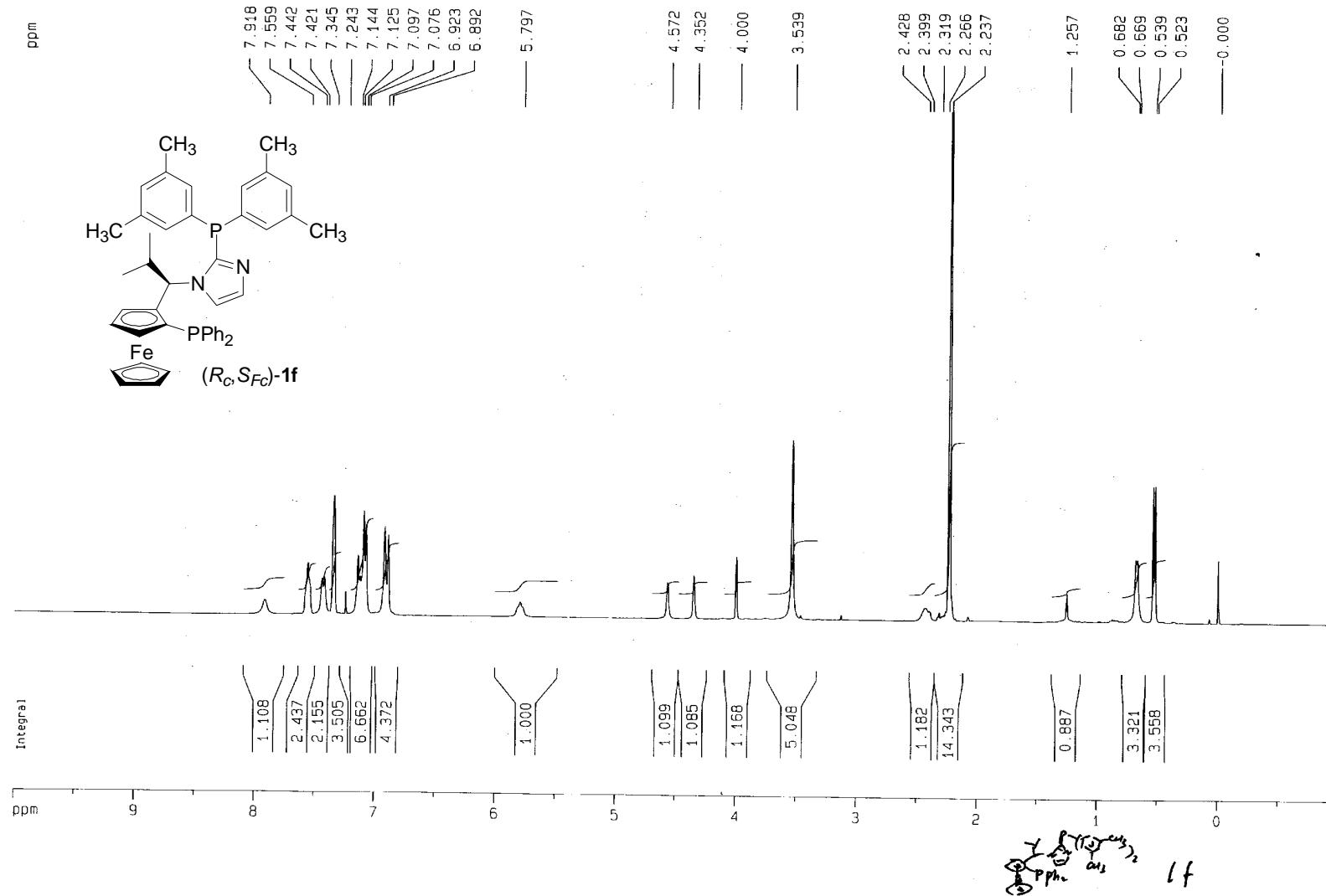
1D NMR plot parameters
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCl₃ 09/05/05

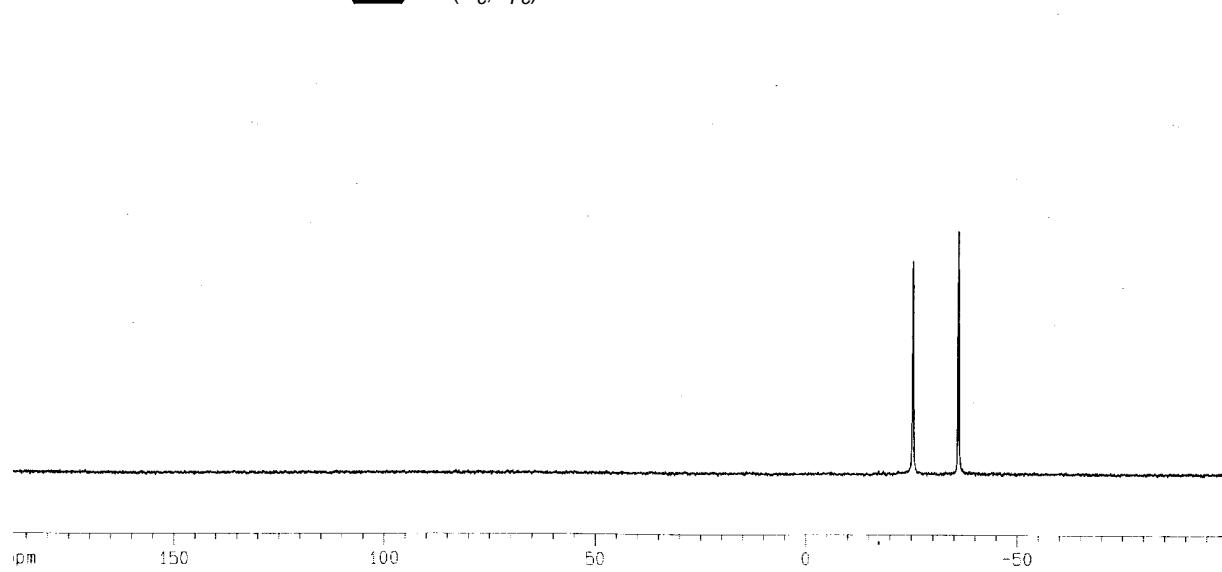
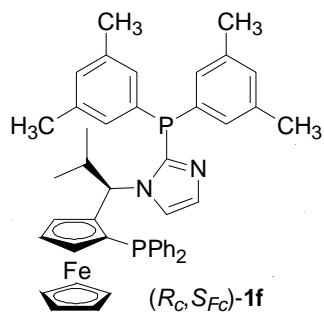


1H NMR WDY-2 IN CDCl₃ 09/05/07



31P NMR WDY-8 IN CDCl₃ 09/05/05

ppm



Current Data Parameters

NAME wdy
EXPNO 1263
PROCNO 1

F2 - Acquisition Parameters

Date_ 20090505
Time 13.58
INSTRUM dnx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 27
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

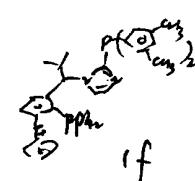
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

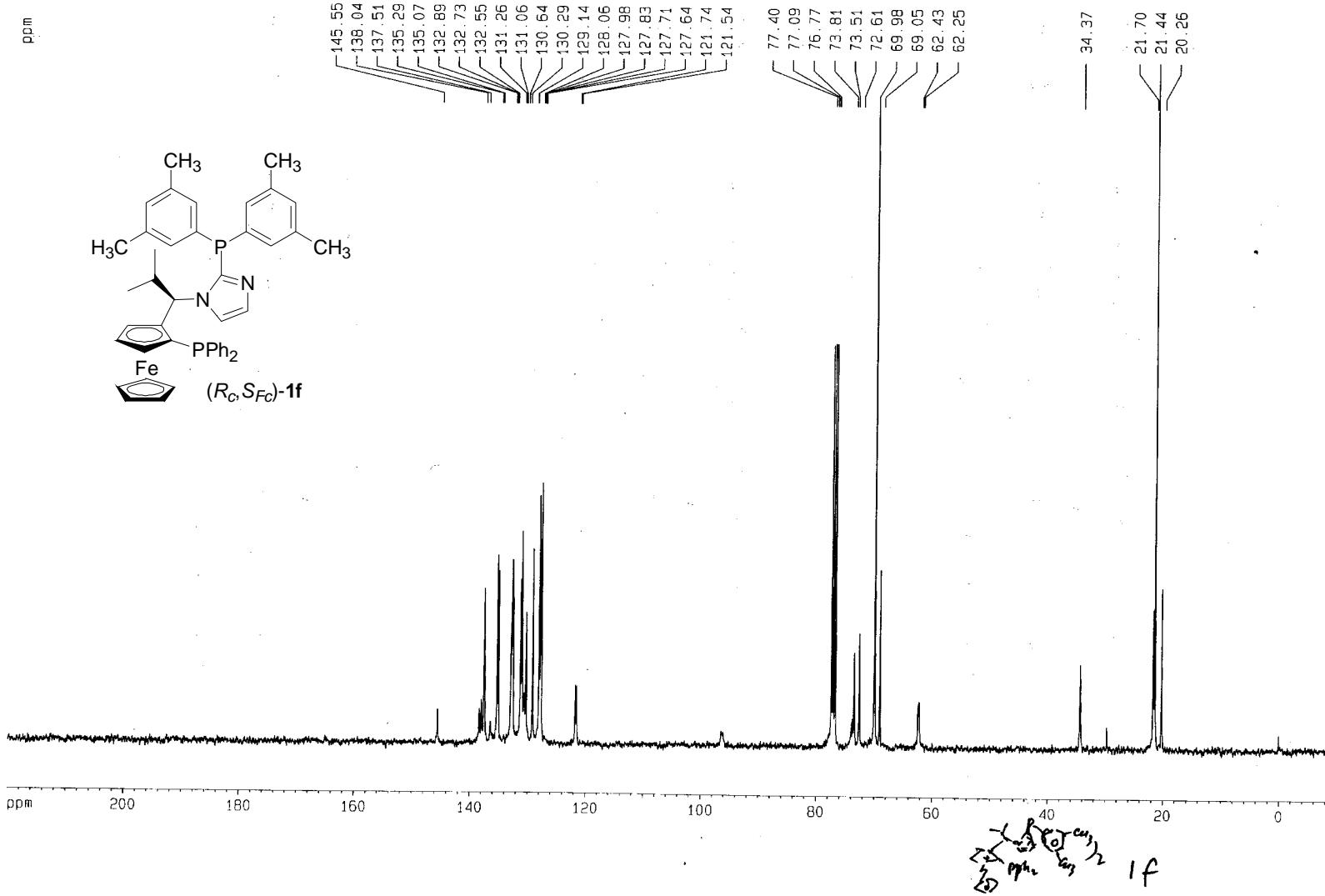
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

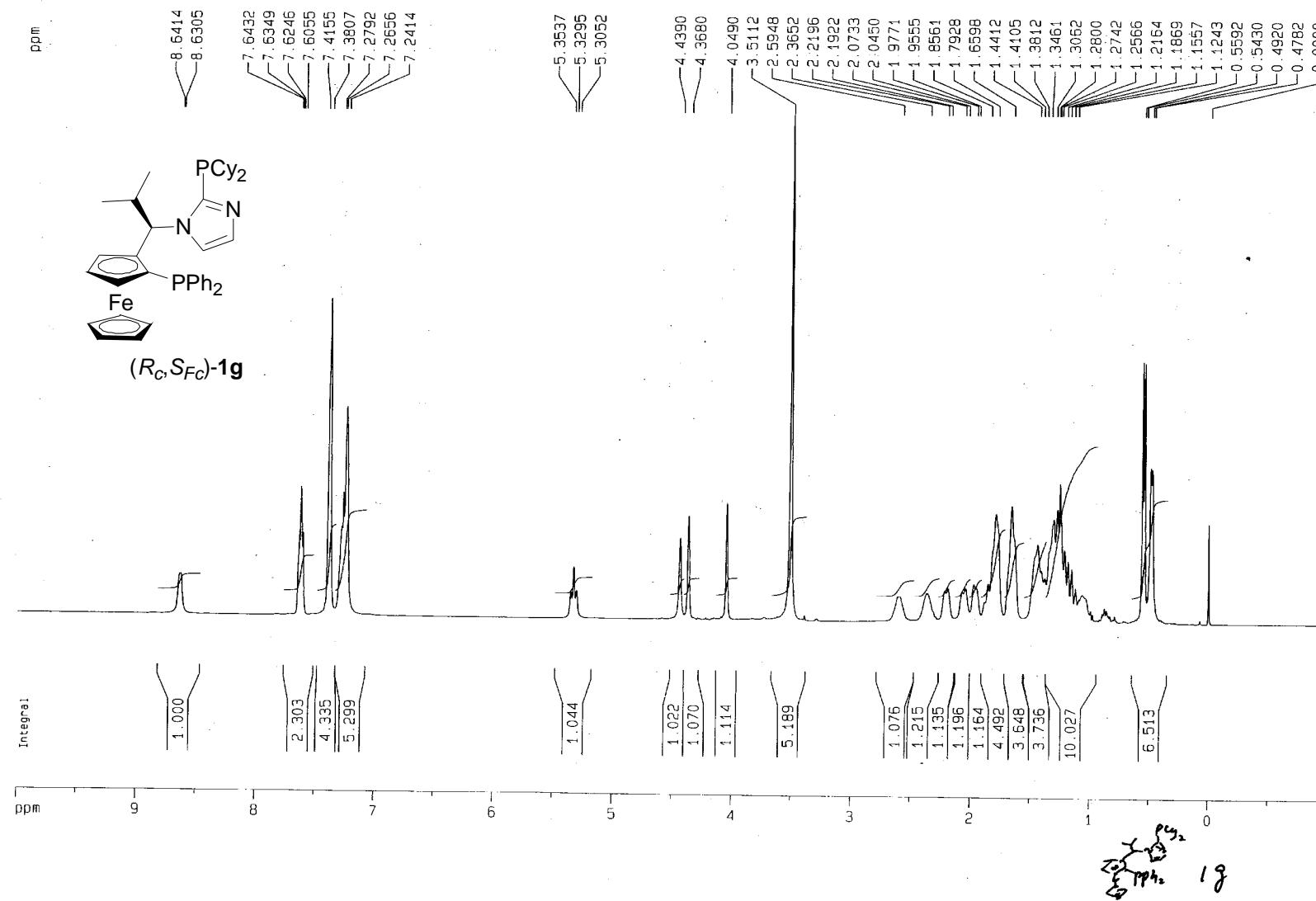
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCl₃ 09/05/09

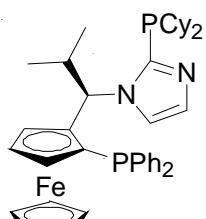


¹H NMR WDY-1 IN CDCl₃ 09/05/07

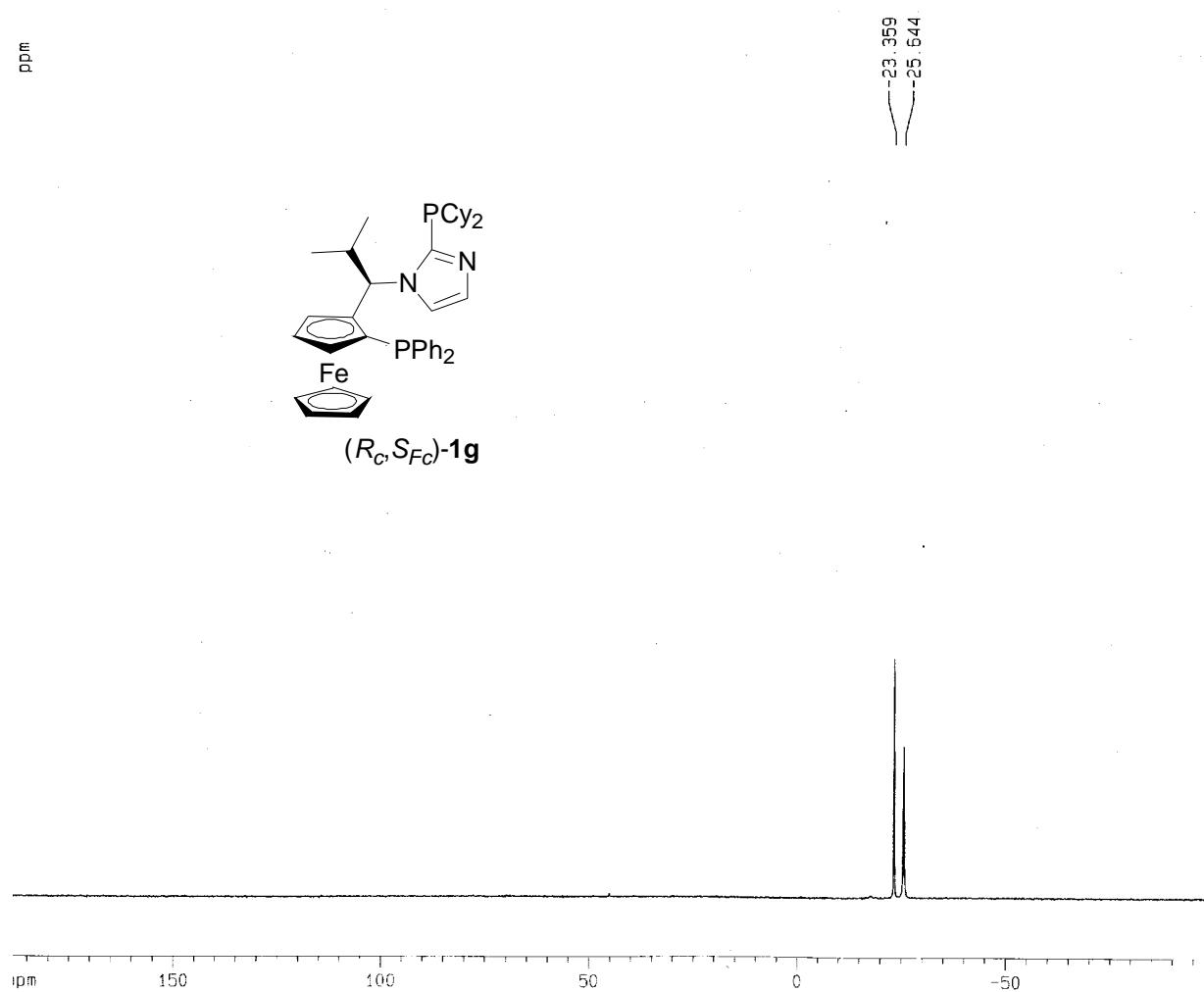


31P NMR WDY-7 IN CDCl₃ 09/05/05

ppm



(R_c,S_{Fc})-1g



Current Data Parameters

NAME wdy
EXPNO 1262
PROCNO 1

F2 - Acquisition Parameters

Date_ 20090505
Time 13.54
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 22
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

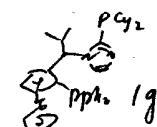
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

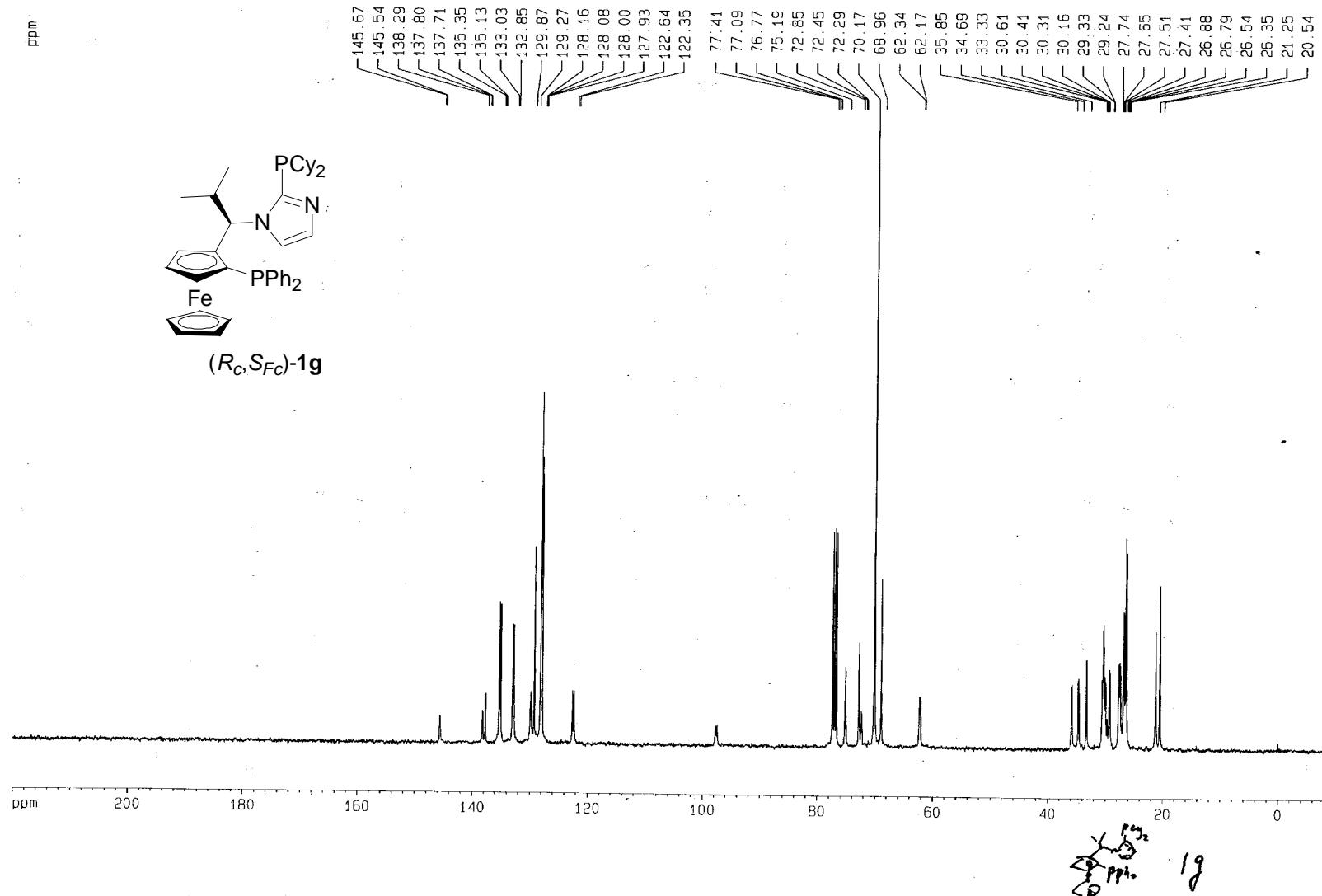
S1 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

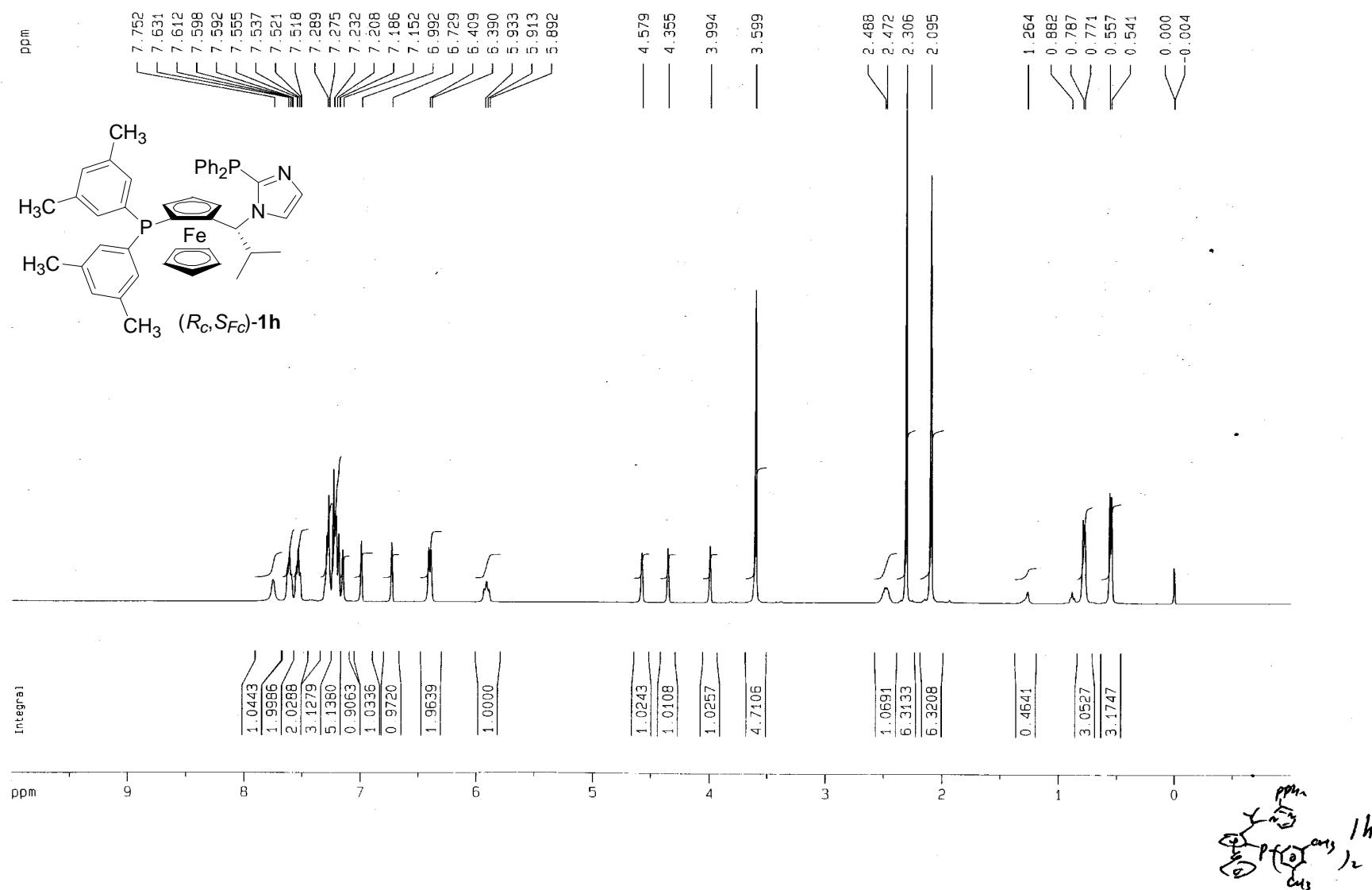
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-1 IN CDCL₃ 09/05/07

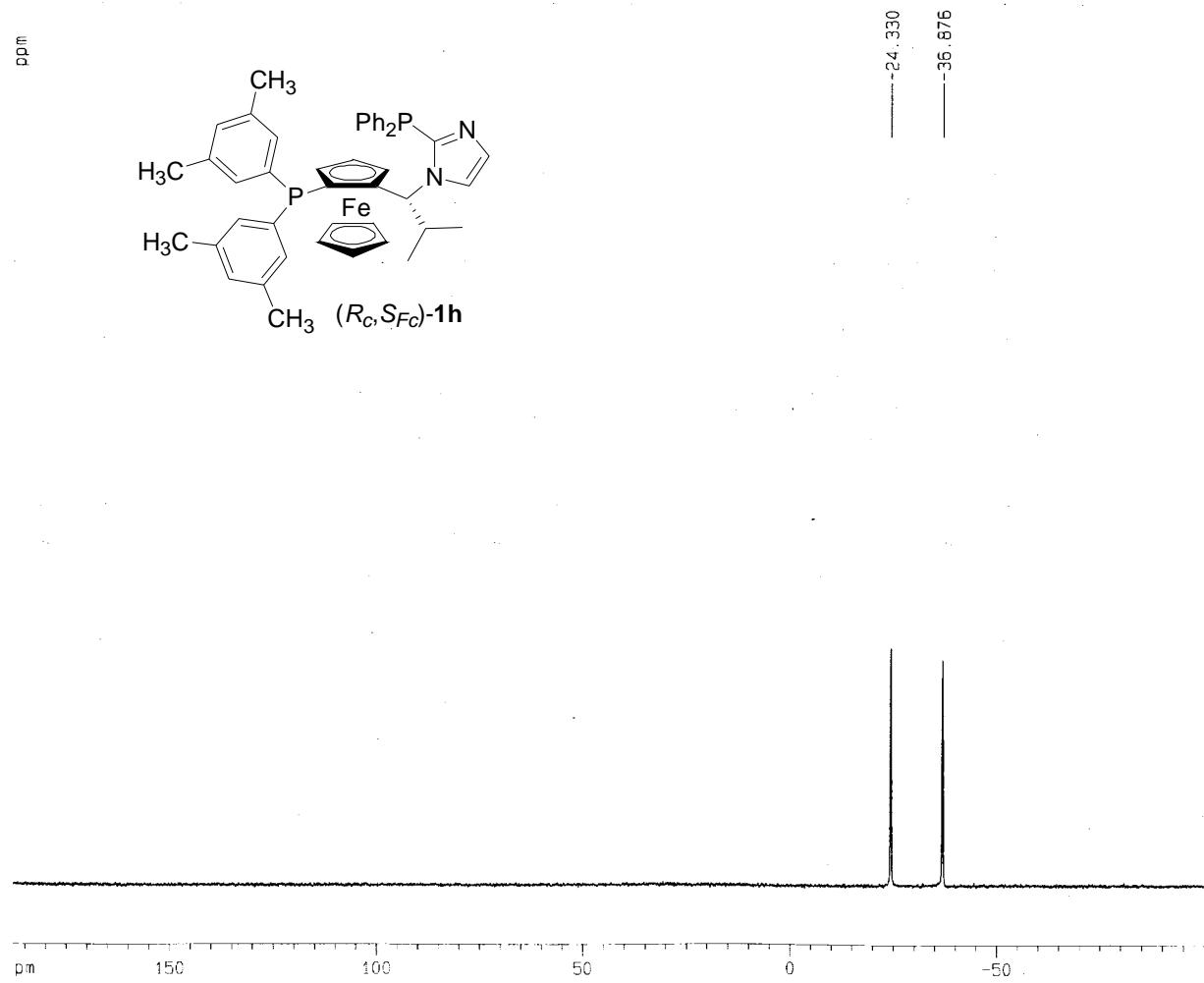
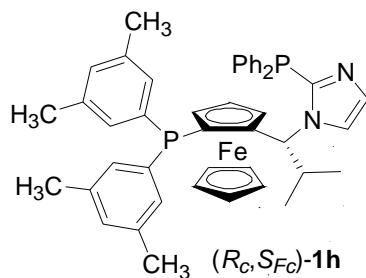


1H NMR WDY-4 IN CDCL₃ 09/05/05



31P NMR WDY-4 IN CDCL3 09/05/05

ppm



Current Data Parameters

NAME wdyl
EXPNO 1259
PROCNO 1

F2 - Acquisition Parameters

Date 20090505
Time 13.34
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT D2O
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

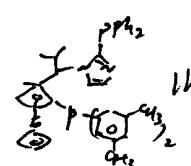
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

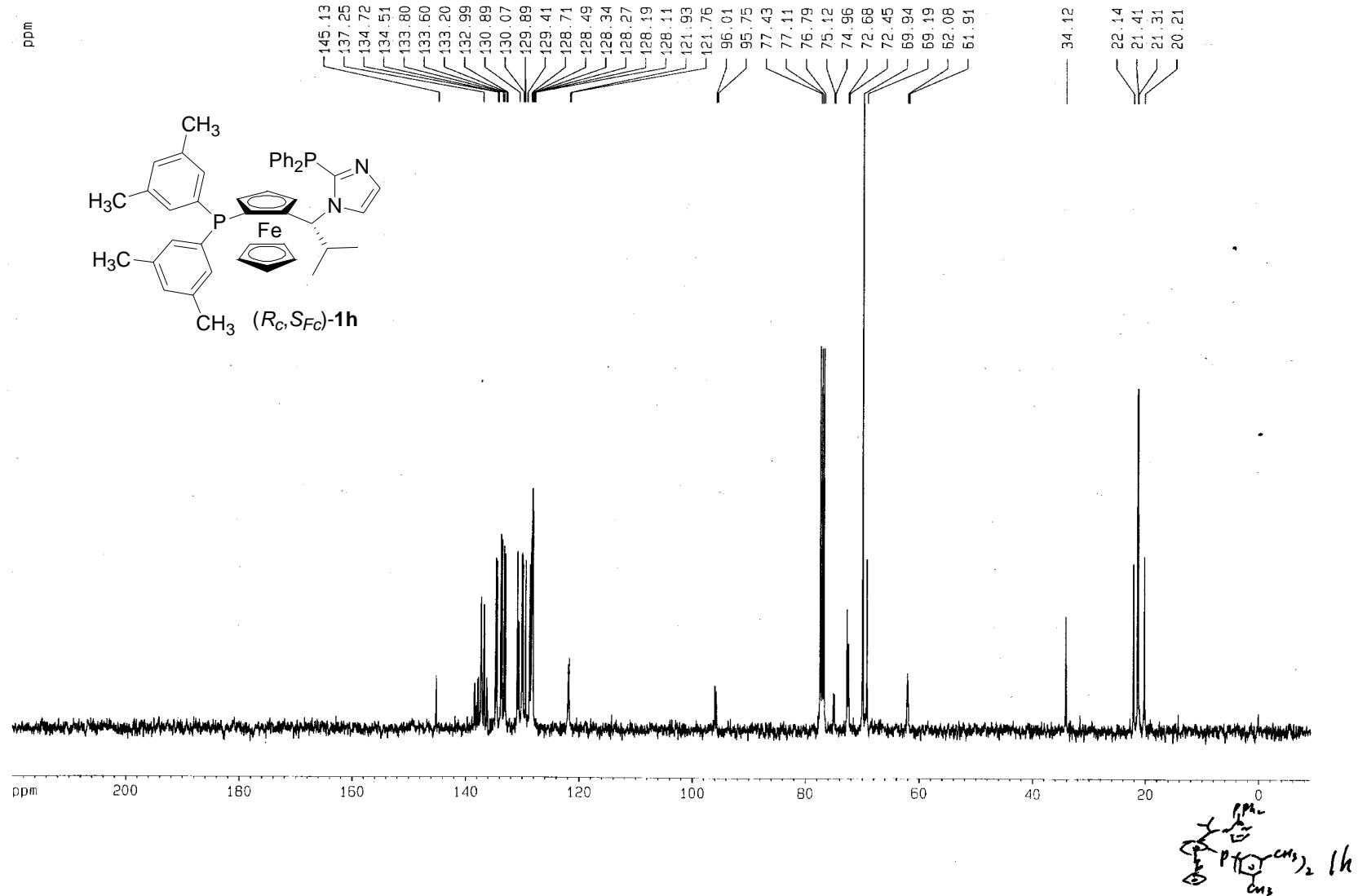
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

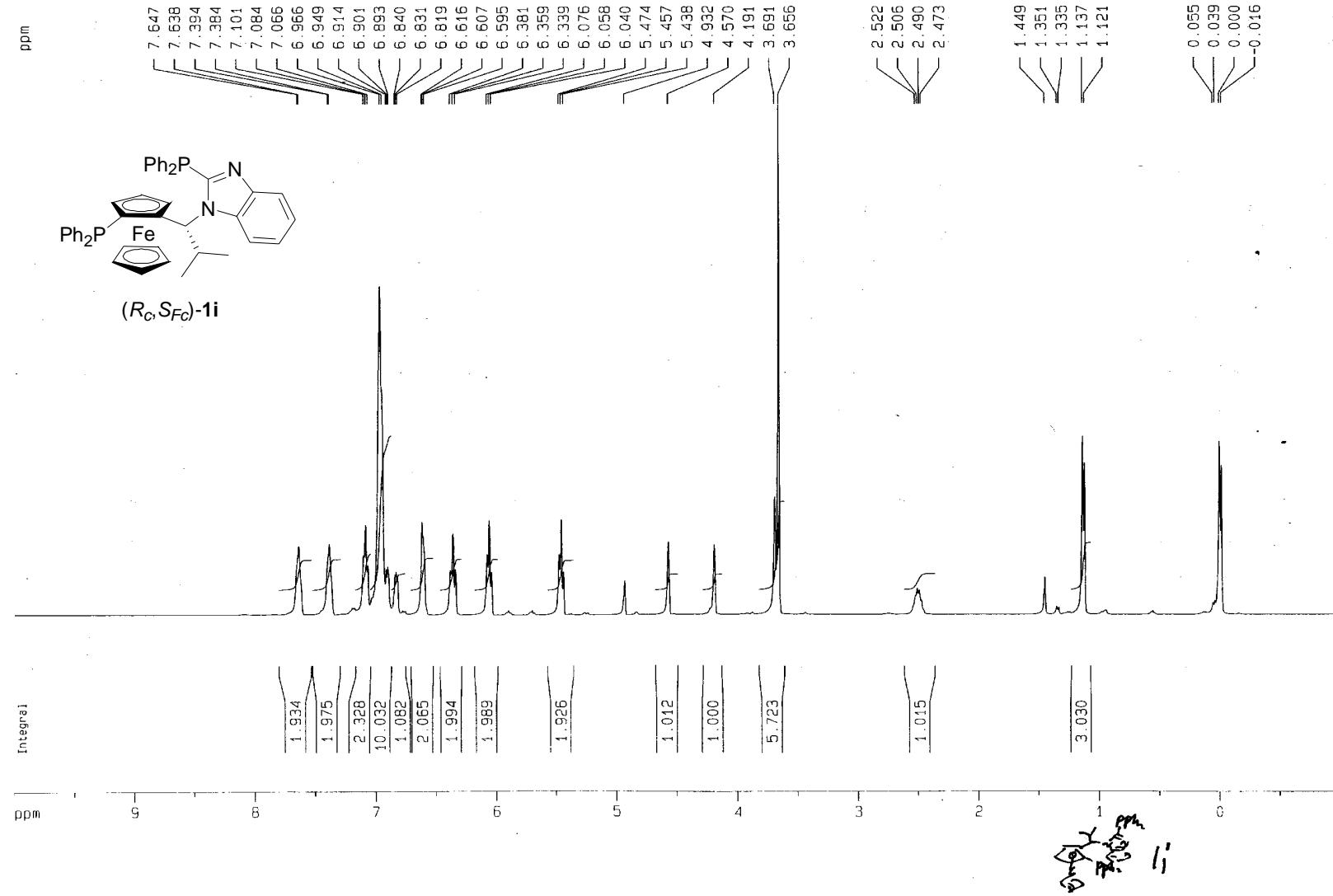
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -15197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-4 IN CDCl₃ 09/05/05

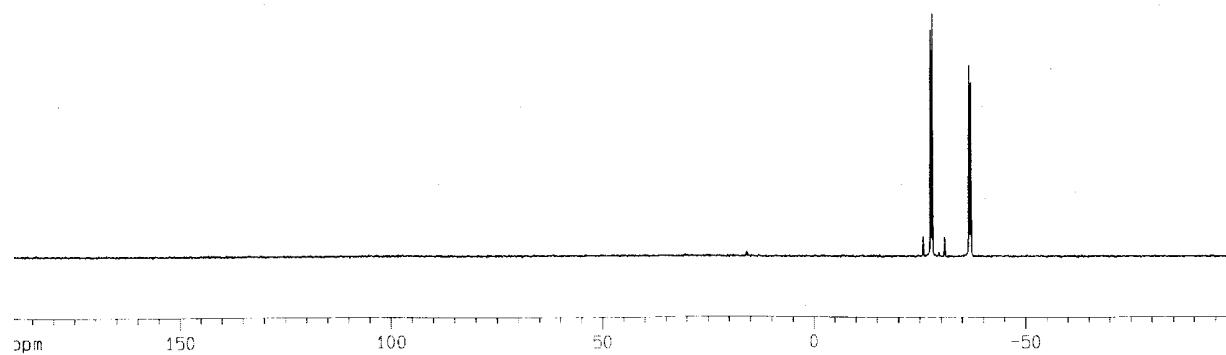
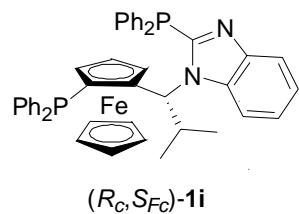


¹H NMR WDY-5 IN CD₂CL₂ 09/04/30



31P NMR WDY-5 IN CD2CL2 09/04/30

ppm



Current Data Parameters

NAME wdy
EXPNO 1242
PROCNO 1

F2 - Acquisition Parameters

Date 20090430
Time 14.03
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT O2O
NS 24
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 9195.2
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

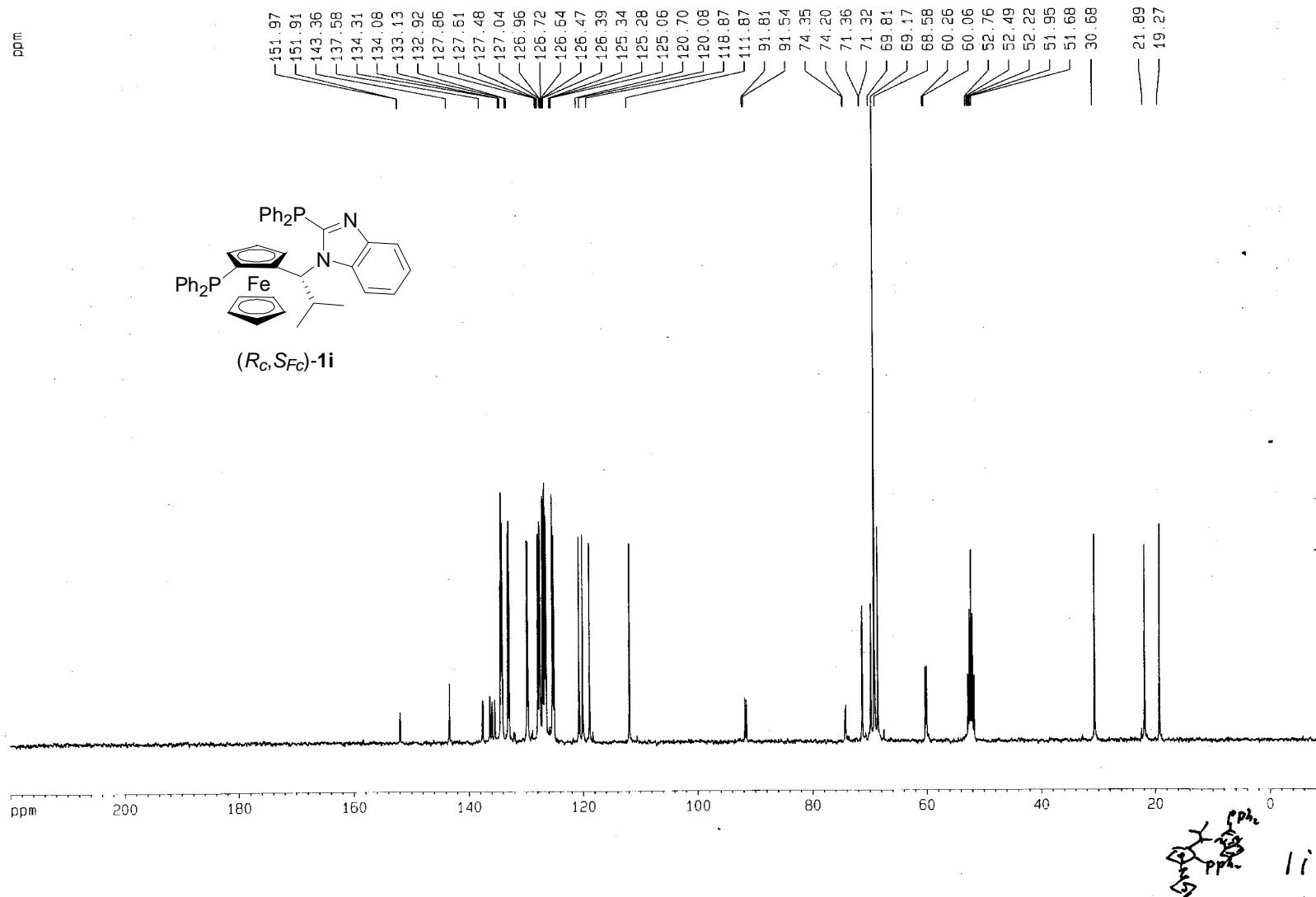
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

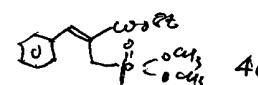
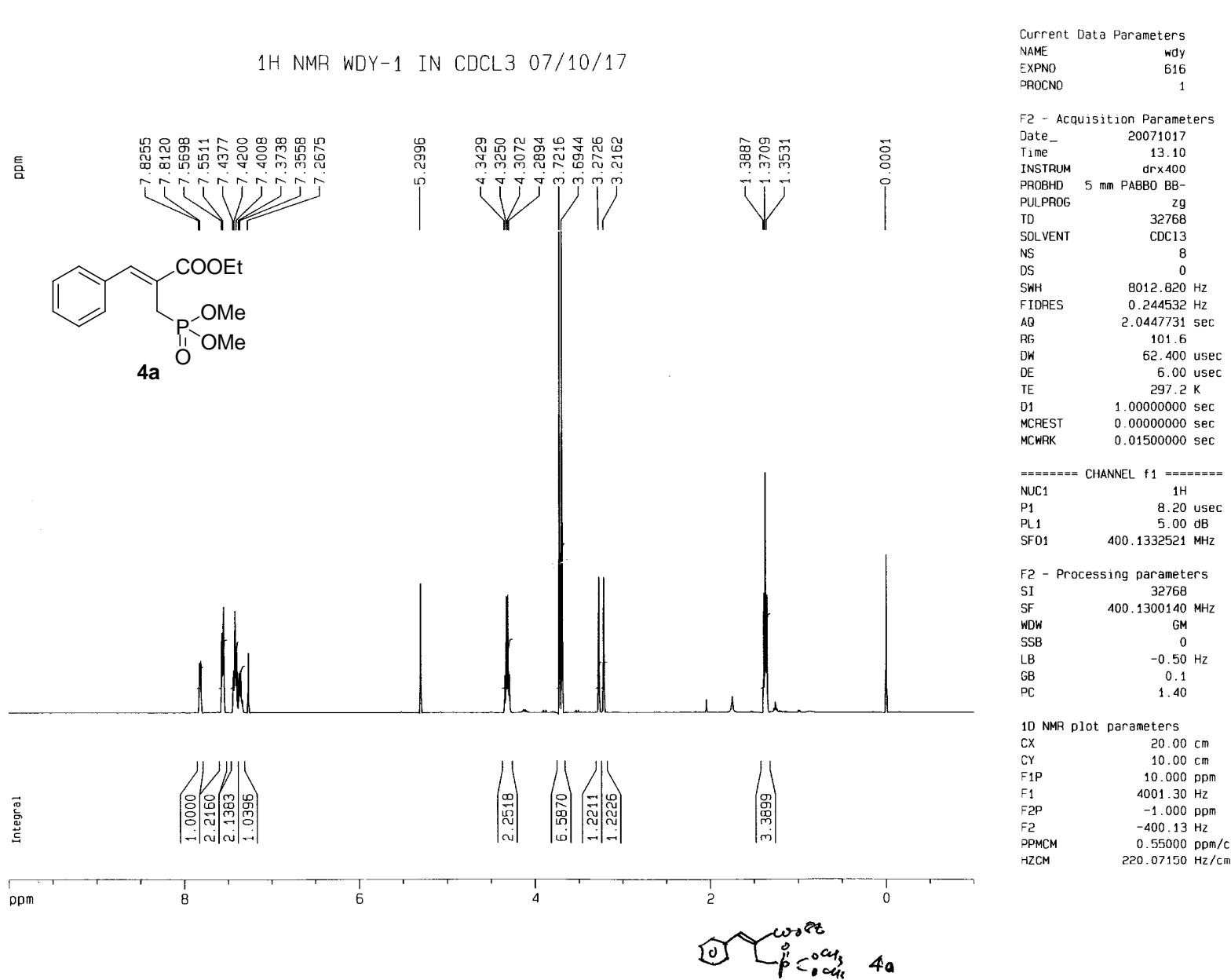
1D NMR plot parameters

CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



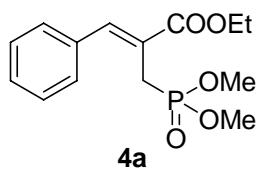
¹³C NMR WDY-5 IN CD₂CL₂ 09/04/30





31P NMR WDY-1 IN CDCl₃ 07/10/17

ppm



28.9869

150 100 50 0 -50

Current Data Parameters
NAME wdy
EXPNO 617
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071017
Time 13.13
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 23
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

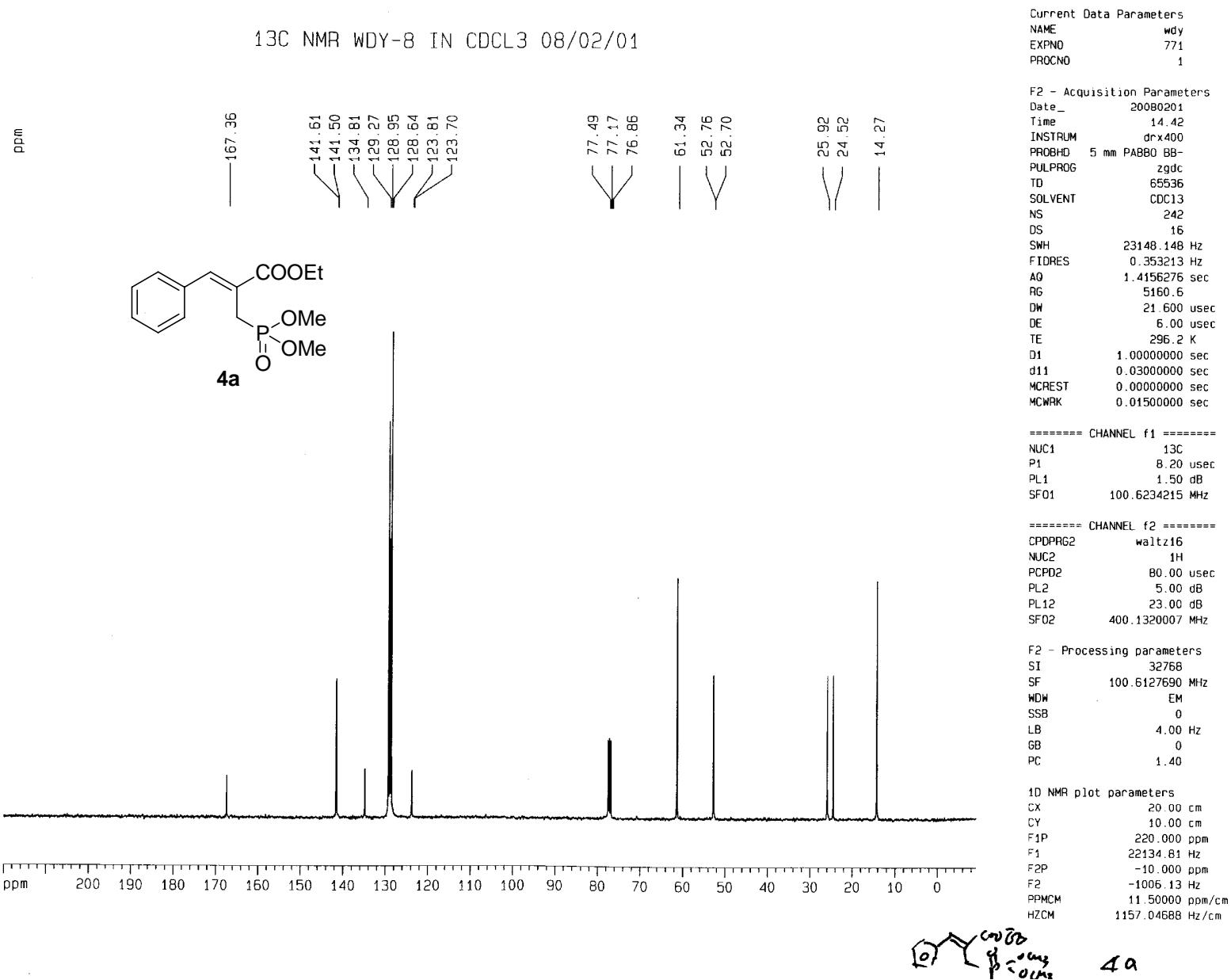
===== CHANNEL f1 =====
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

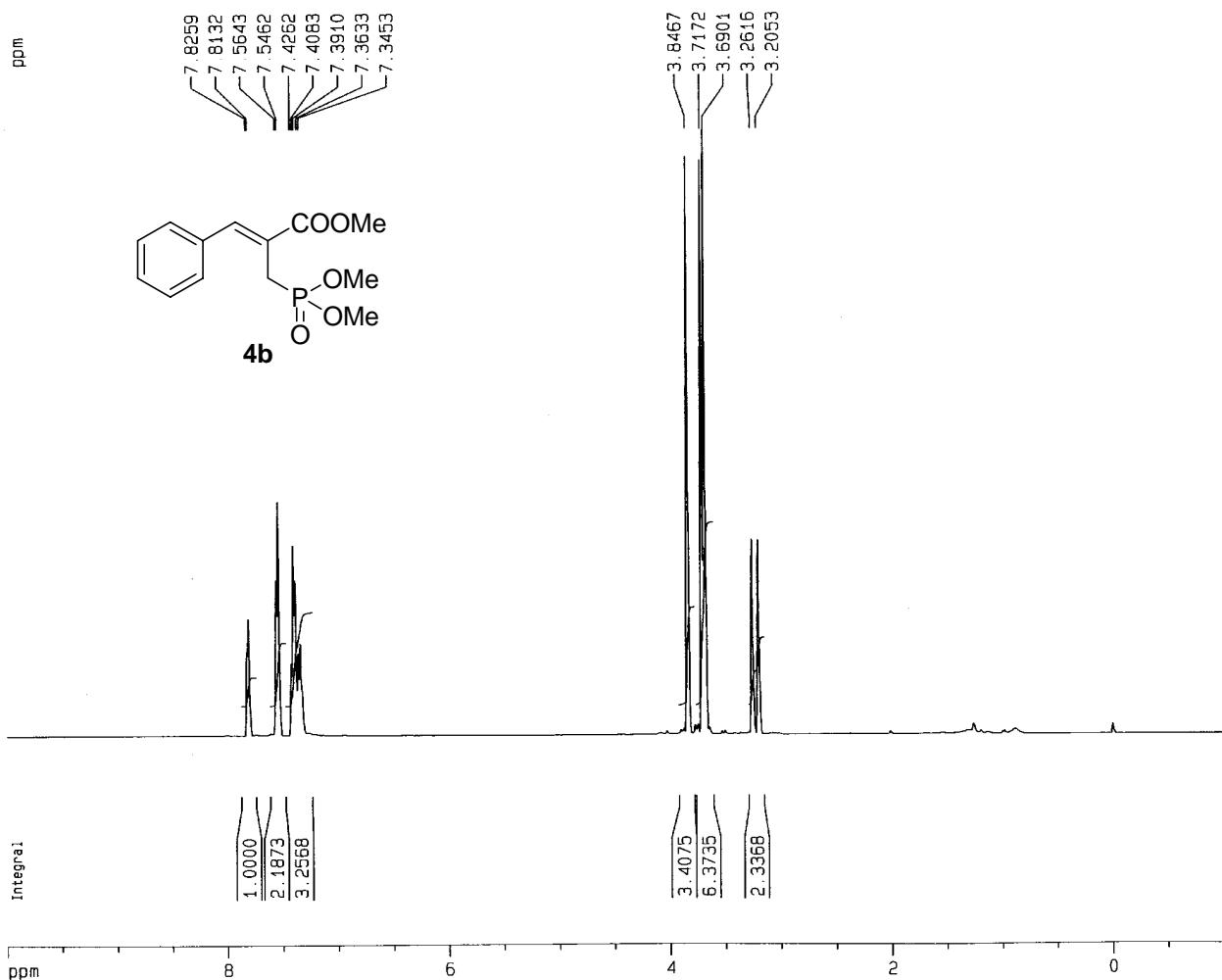
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



13C NMR WDY-8 IN CDCL3 08/02/01



1H NMR WDY-1 IN CDCl₃ 07/09/04



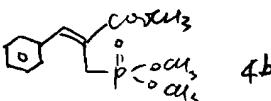
Current Data Parameters
 NAME wdy
 EXPNO 573
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20070904
 Time 11.52
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 16
 DW 62.400 usec
 DE 6.00 usec
 TE 298.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 ======
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

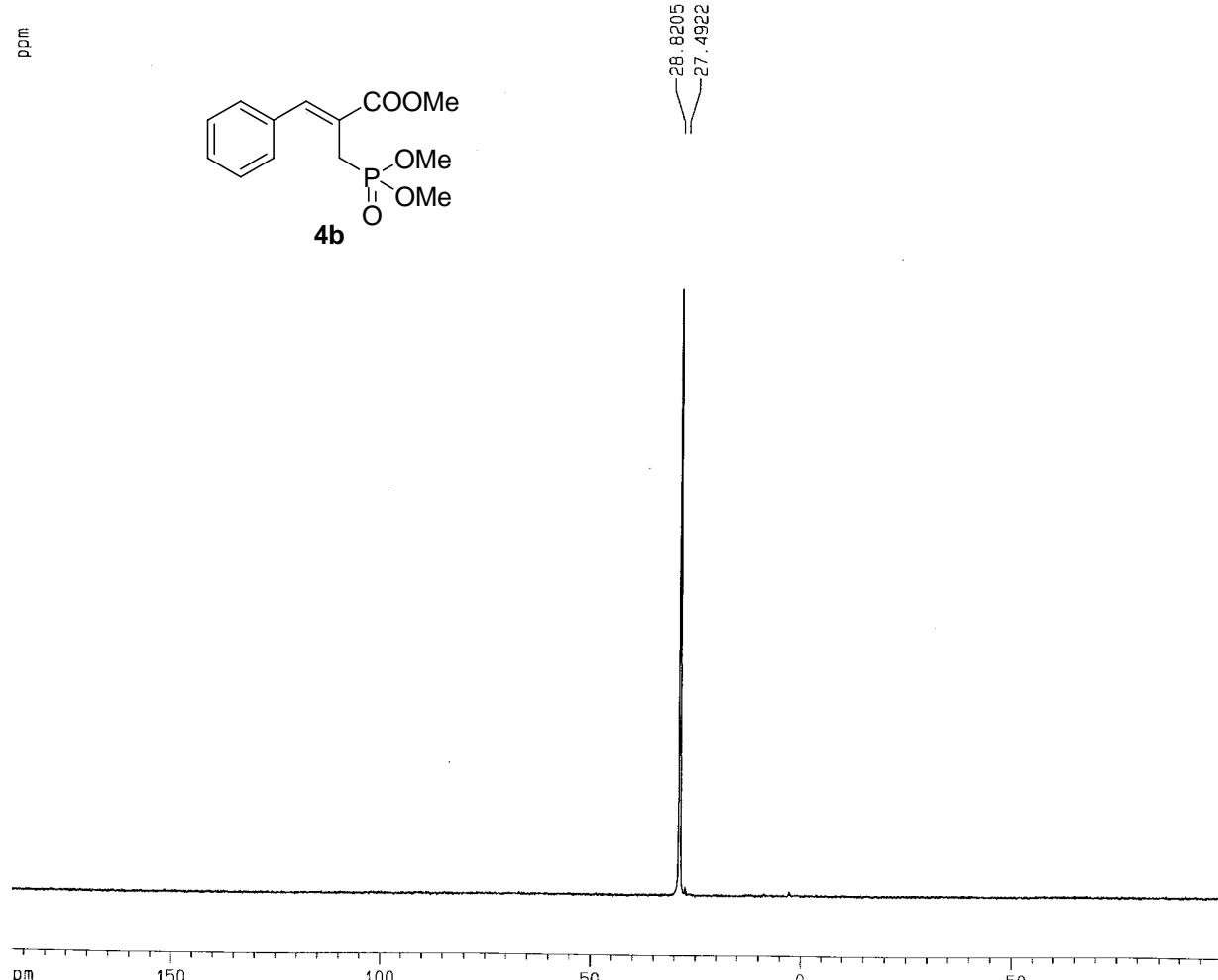
F2 - Processing parameters
 SI 32768
 SF 400.1299597 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07149 Hz/cm



31P NMR WDY-1 IN CDCl₃ 07/08/21

ppm



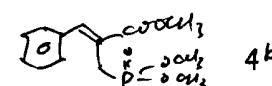
Current Data Parameters
 NAME wdy
 EXPNO 549
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20070821
 Time 14.09
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT DMSO
 NS 76
 DS 0
 SWH 48543.688 Hz
 FIDRES 1.481436 Hz
 AQ 0.3375604 sec
 RG 5792.6
 DW 10.300 usec
 DE 6.00 usec
 TE 299.2 K
 D1 2.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

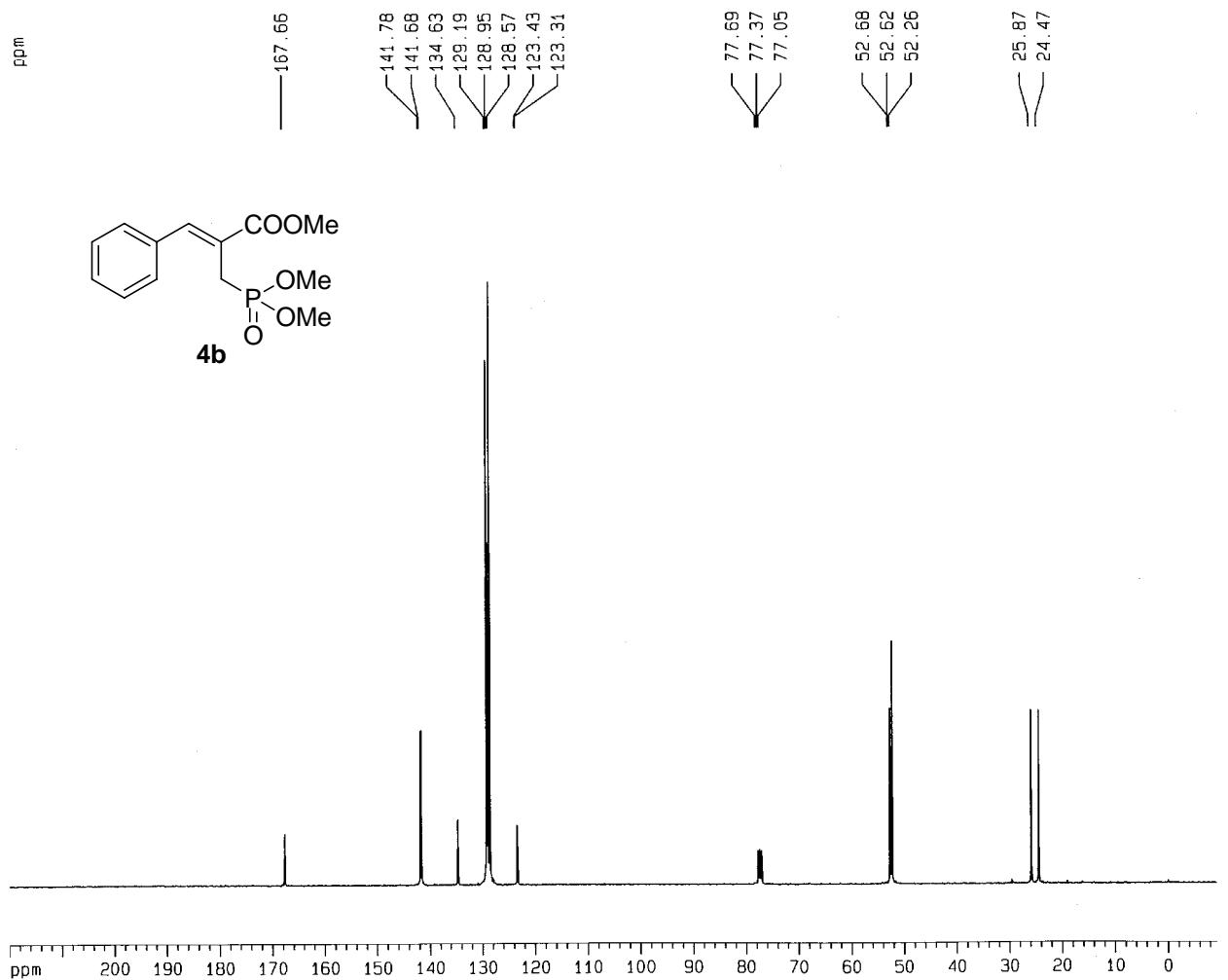
===== CHANNEL f1 =====
 NUC1 31P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

F2 - Processing parameters
 SI 16384
 SF 161.9755337 MHz
 WDW EM
 SSB 0
 LB 5.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 190.000 ppm
 F1 30775.35 Hz
 F2P -100.000 ppm
 F2 -16197.55 Hz
 PPMCM 14.50000 ppm/cm
 HZCM 2348.64526 Hz/cm



¹³C NMR WDY-1 IN CDCl₃ 07/09/04



Current Data Parameters

NAME wdy
EXPNO 574
PROCNO 1

F2 - Acquisition Parameters

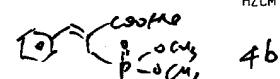
Date 20070904
Time 12.20
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zgdc
TD 65536
SOLVENT CDCl₃
NS 638
DS 16
SWH 23148.148 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 5160.6
DW 21.600 usec
DE 6.00 usec
TE 299.2 K
D1 1.0000000 sec
d11 0.0300000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

===== CHANNEL f1 =====
NUC1 ¹³C
P1 8.20 usec
PL1 1.50 dB
SF01 100.6234215 MHz

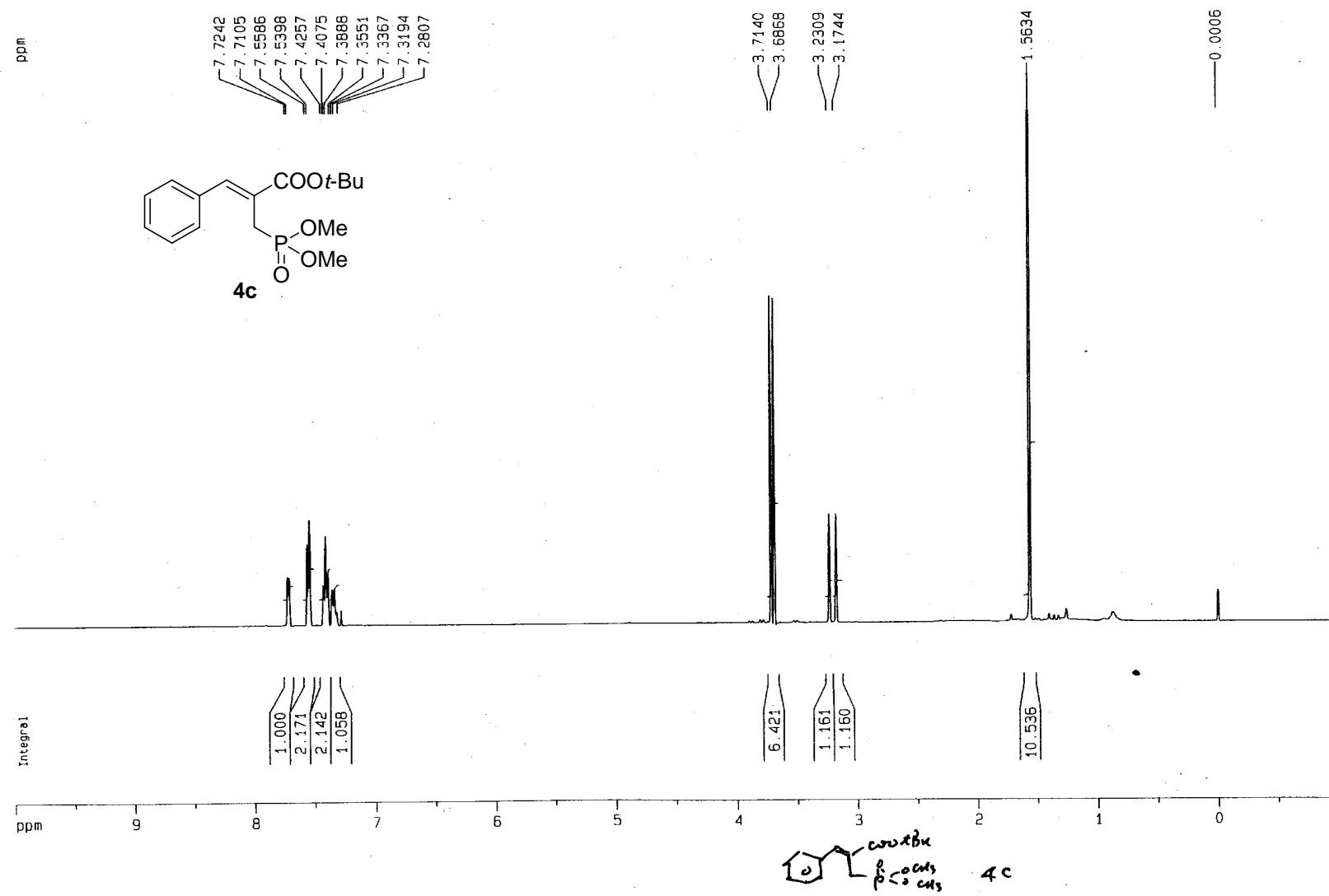
===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 ¹H
PCPD2 80.00 usec
PL2 5.00 dB
PL12 23.00 dB
SF02 400.1320007 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 220.000 ppm
F1 22134.81 Hz
F2P -10.000 ppm
F2 -1006.13 Hz
PPMCM 11.50000 ppm/cm
HZCM 1157.04688 Hz/cm

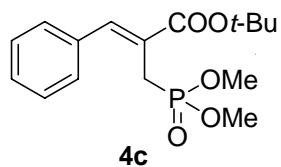


¹H NMR WDY-2 IN CDCL₃ 08/09/22

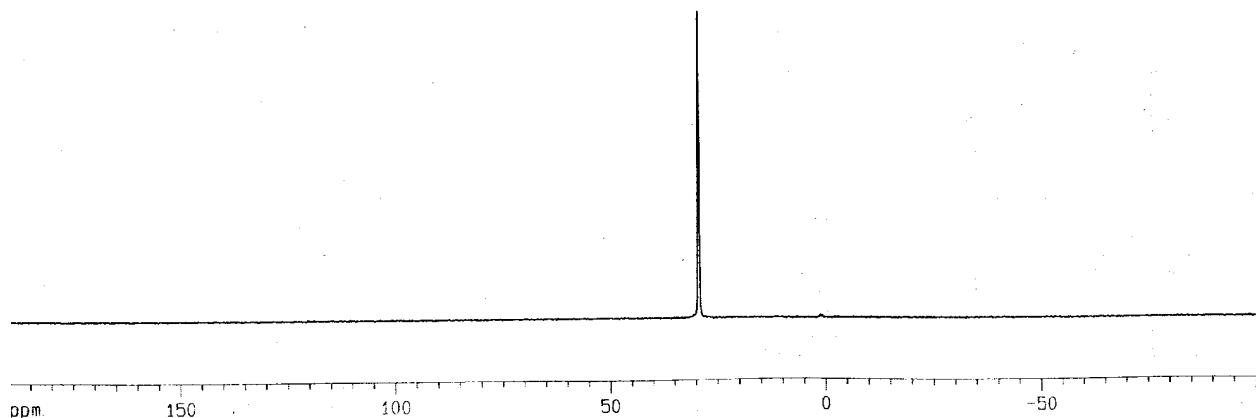


³¹P NMR WDY-2 IN CDCl₃ 08/09/22

ppm



29.2579



Current Data Parameters
NAME wdy
EXPNO 971
PROCNO 1

F2 - Acquisition Parameters
Date 20080922
Time 13.46
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 72
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 0.0 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

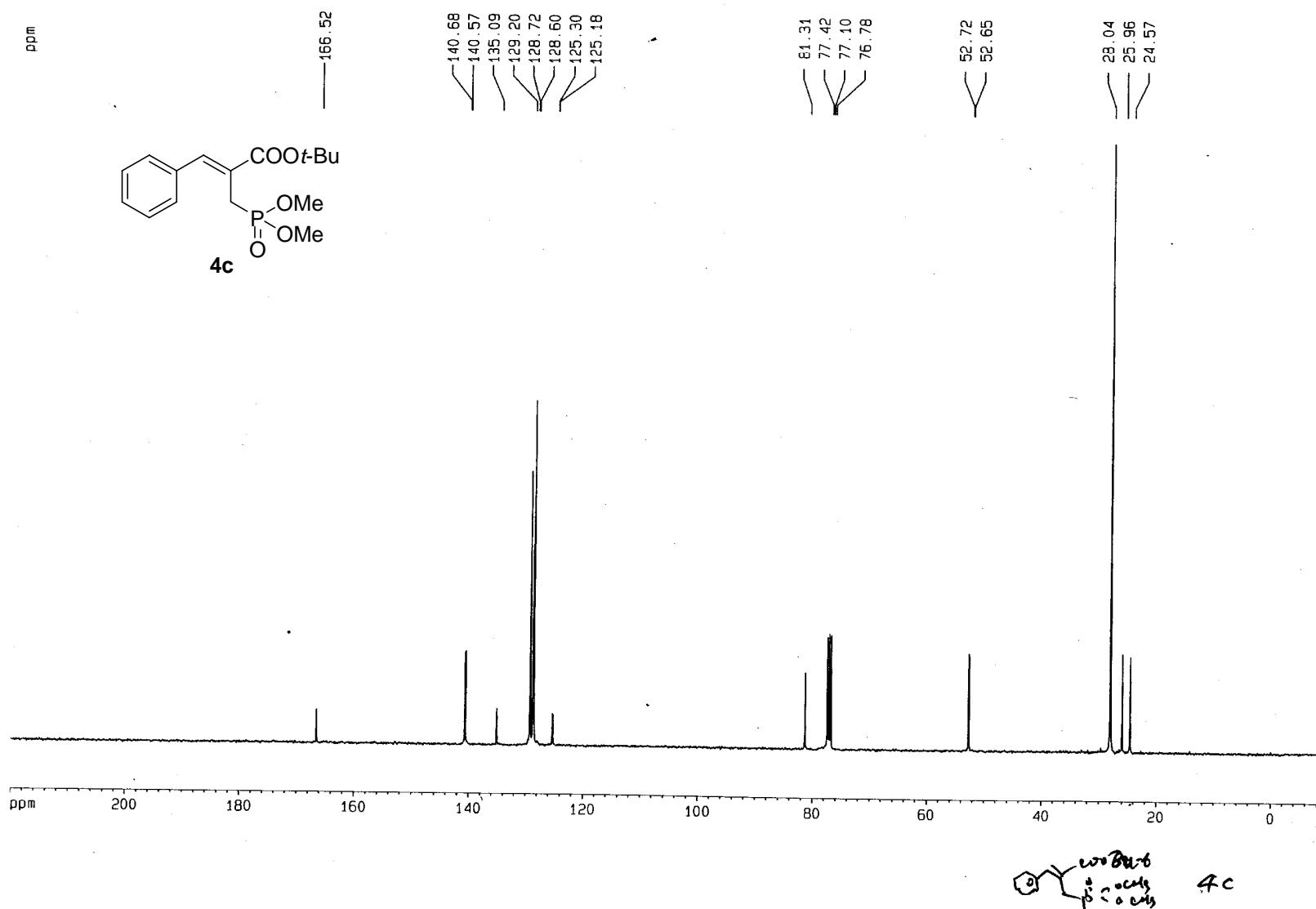
===== CHANNEL f1 =====
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

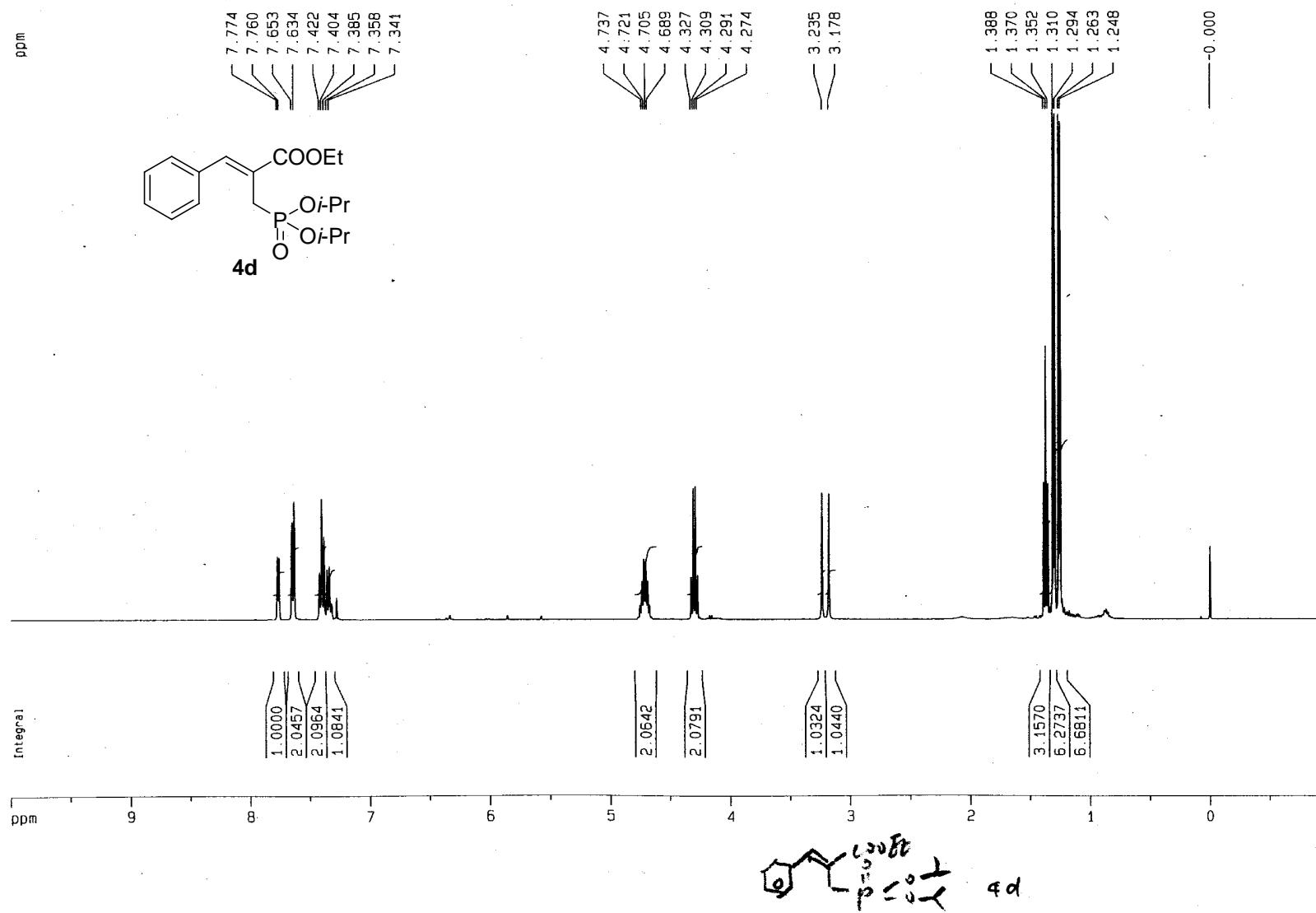
1D NMR plot parameters
CX 20.00 cm
CY 5.00 ppm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm

COOTBu
4c

¹³C NMR WDY-2 IN CDCl₃ 08/09/26

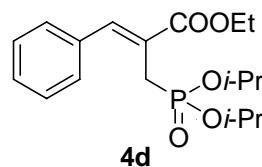


1H NMR WDY-2 IN CDCL₃ 08/09/02

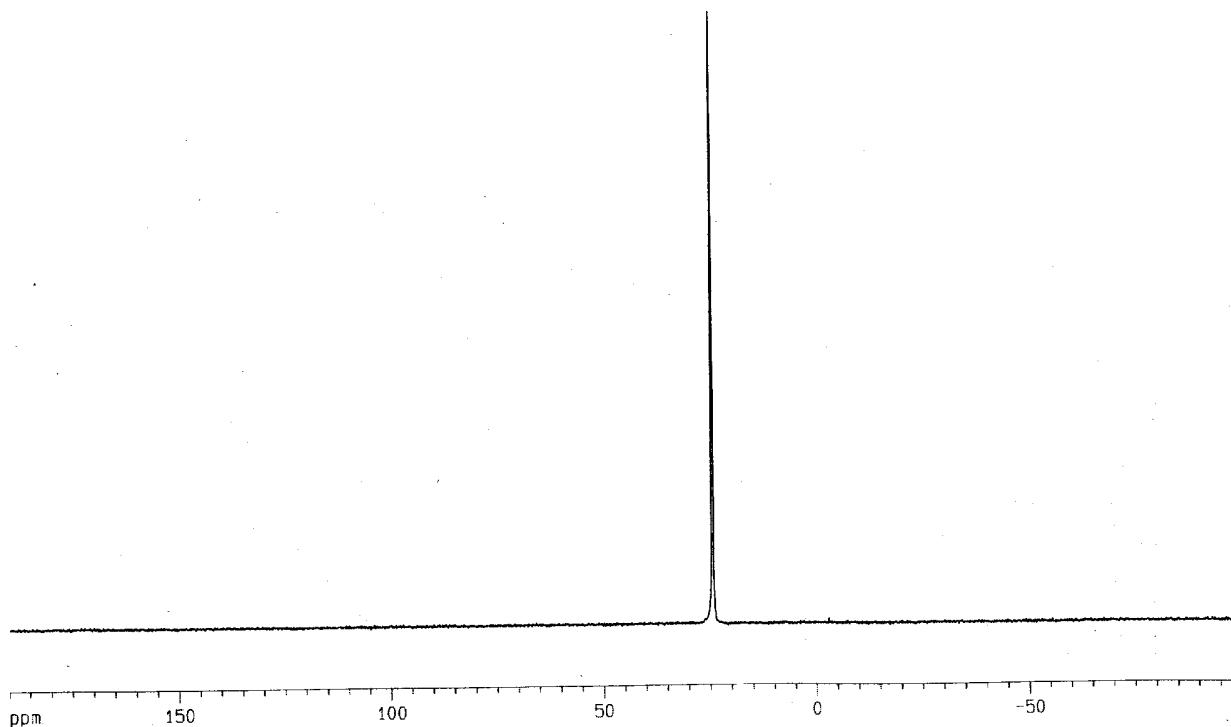


³¹P NMR WDY-2 IN CDCL₃ 08/09/02

ppm



24.3192



Current Data Parameters

NAME wdy
EXPNO 924
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080902
Time 10.56
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 45
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

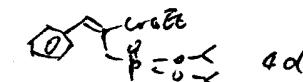
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

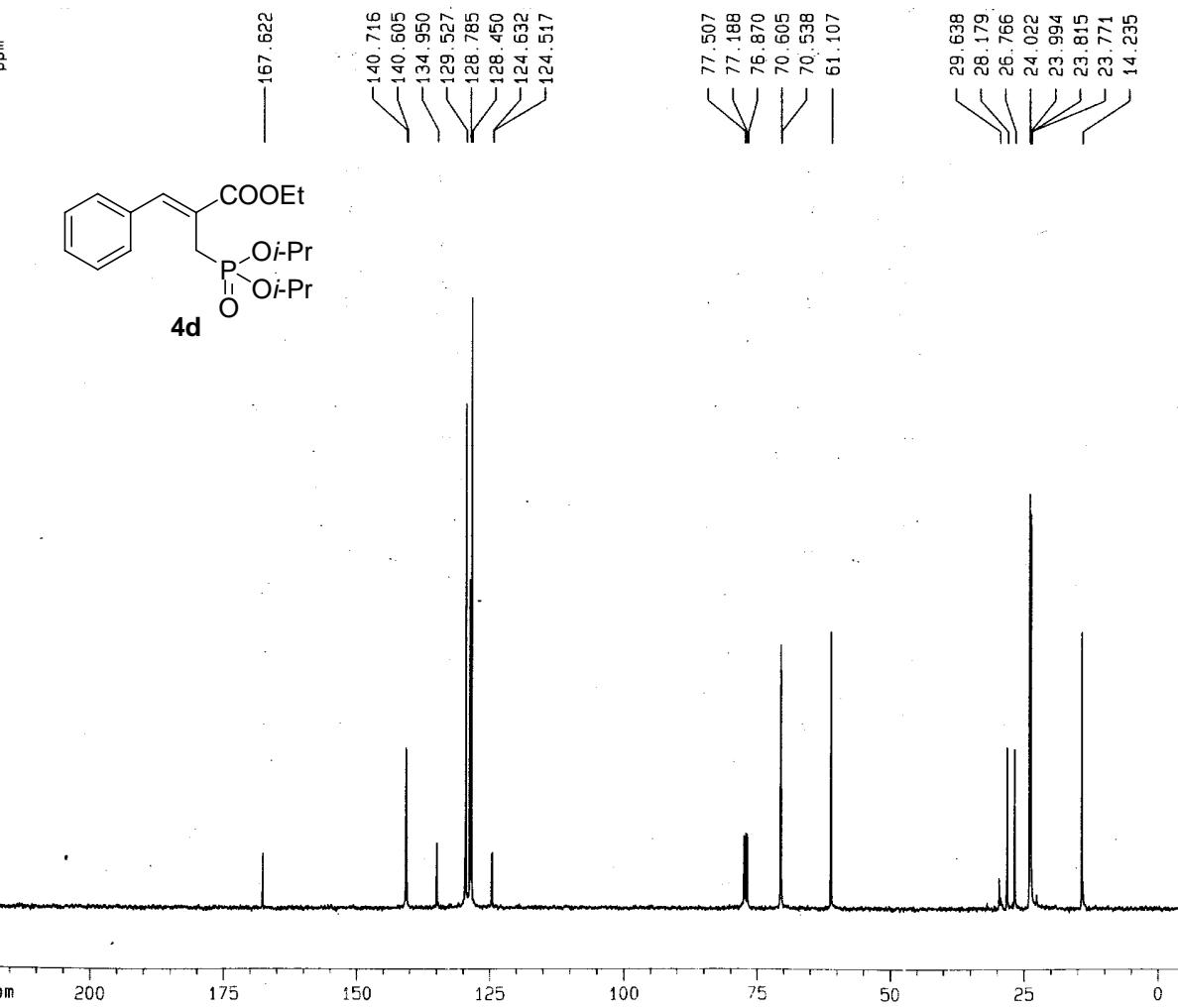
S1 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



ppm

13C NMR WDY-1 IN CDCl₃ 09/02/11

Current Data Parameters

NAME wdy
EXPNO 1171
PROCNO 1

F2 - Acquisition Parameters

Date 20090211
Time 12.08
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zgdc
TD 65536
SOLVENT CDCl₃
NS 151
DS 16
SWH 23148.148 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 16384
DW 21.600 usec
DE 6.00 usec
TE 0.0 K
D1 1.0000000 sec
d11 0.03000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

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

NUC1 13C
P1 8.20 usec
PL1 1.50 dB
SF01 100.6234215 MHz

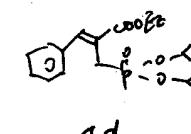
===== CHANNEL f2 =====

CPDPGR2 waltz16
NUC2 1H
PCP02 80.00 usec
PL2 5.00 dB
PL12 23.00 dB
SF02 400.1320007 MHz

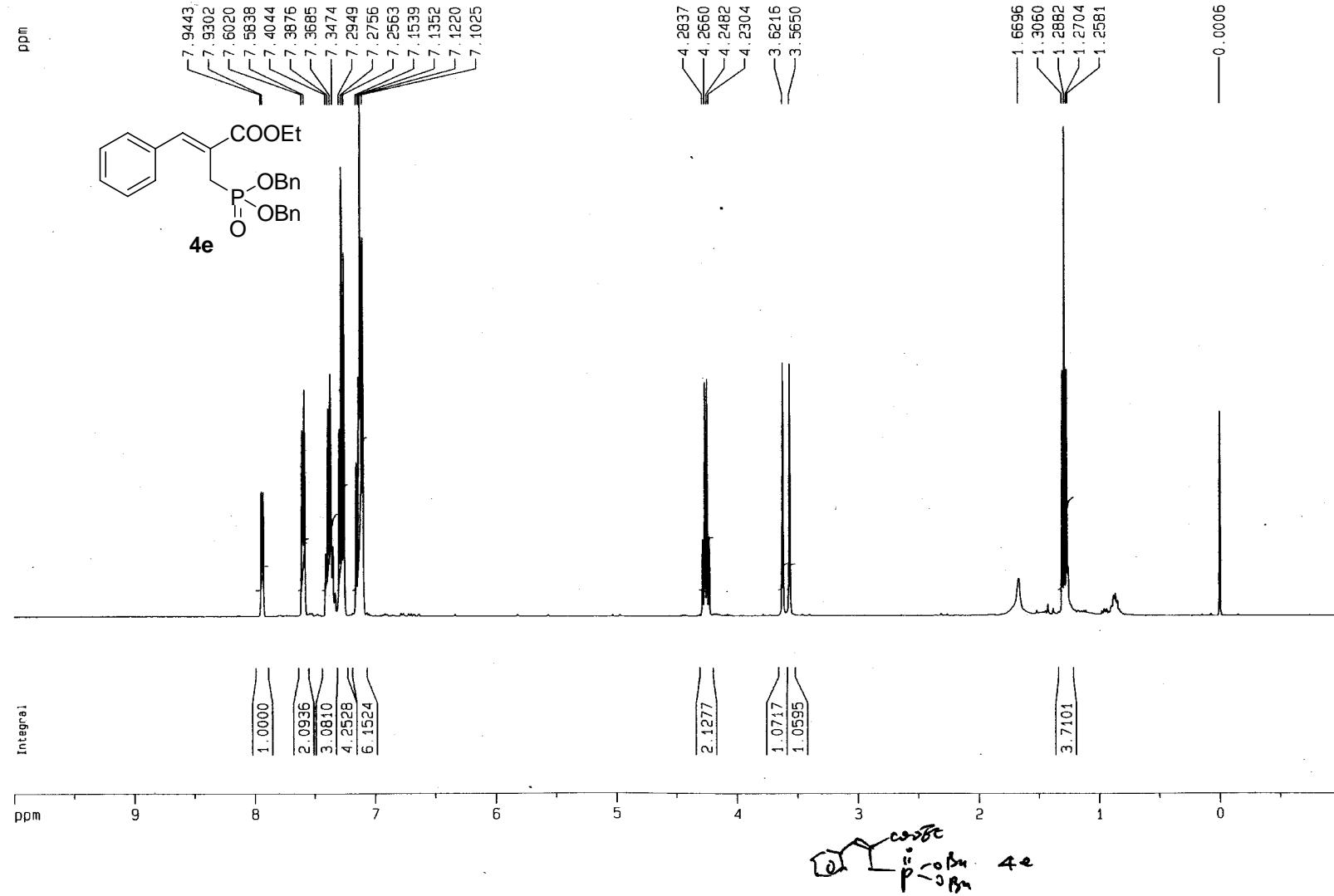
F2 - Processing parameters

SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 220.000 ppm
F1 22134.81 Hz
F2P -10.000 ppm
F2 -1006.13 Hz
PPCM 11.50000 ppm/cm
HZCM 1157.04688 Hz/cm

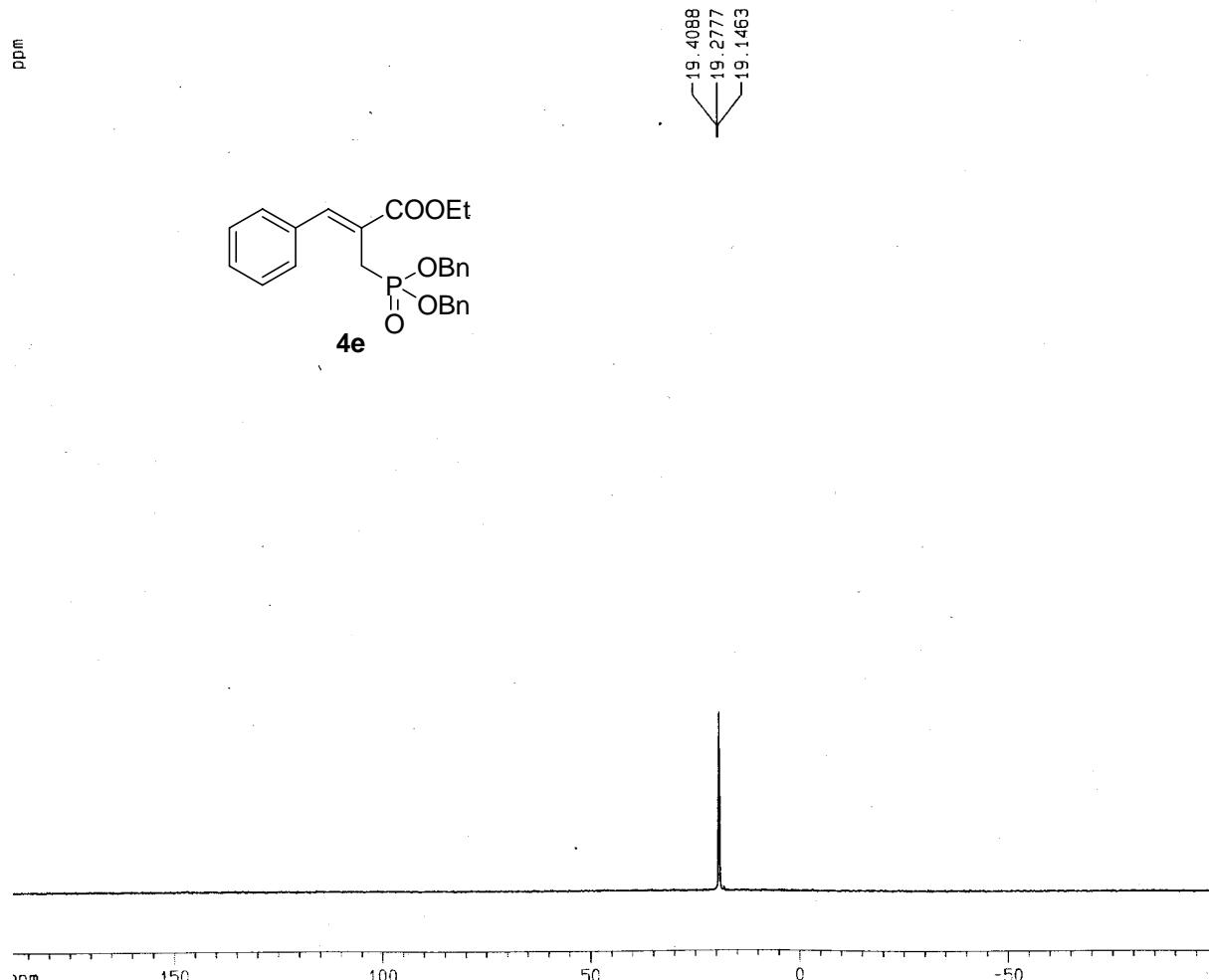
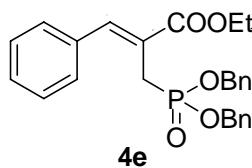


¹H NMR WDY-2 IN CDCl₃ 08/09/10



³¹P NMR WDV-2 IN CDCl₃ 08/09/10

ppm



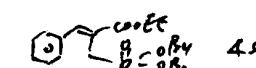
Current Data Parameters
 NAME wdy
 EXPNO 942
 PROCNO 1

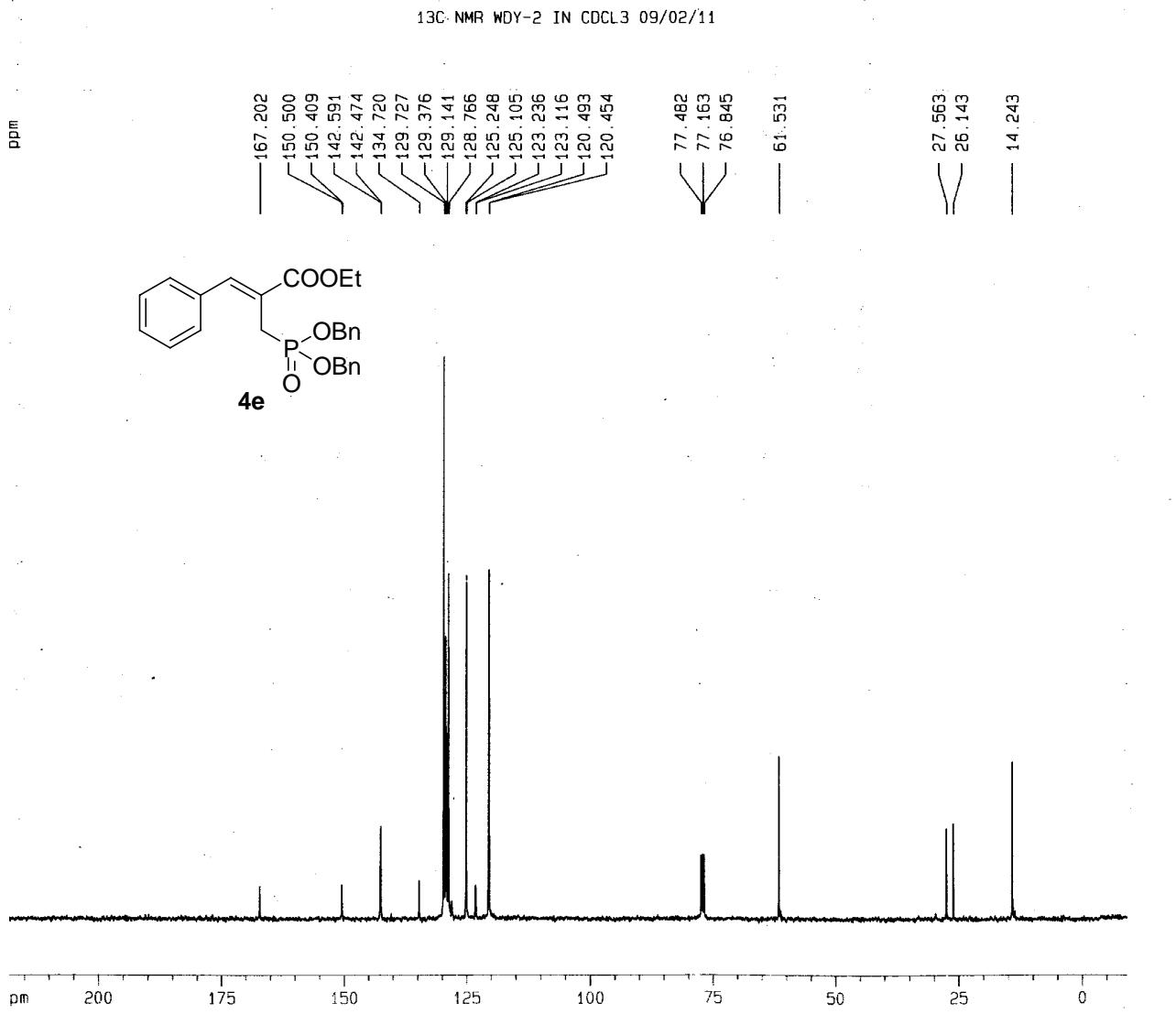
F2 - Acquisition Parameters
 Date 20080910
 Time 14.54
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 23
 DS 0
 SWH 48543.688 Hz
 FIDRES 1.481436 Hz
 AQ 0.3375604 sec
 RG 2298.8
 DW 10.300 usec
 DE 6.00 usec
 TE 296.2 K
 D1 2.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 ³¹P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

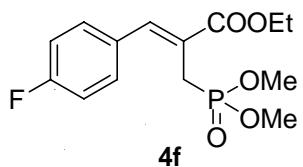
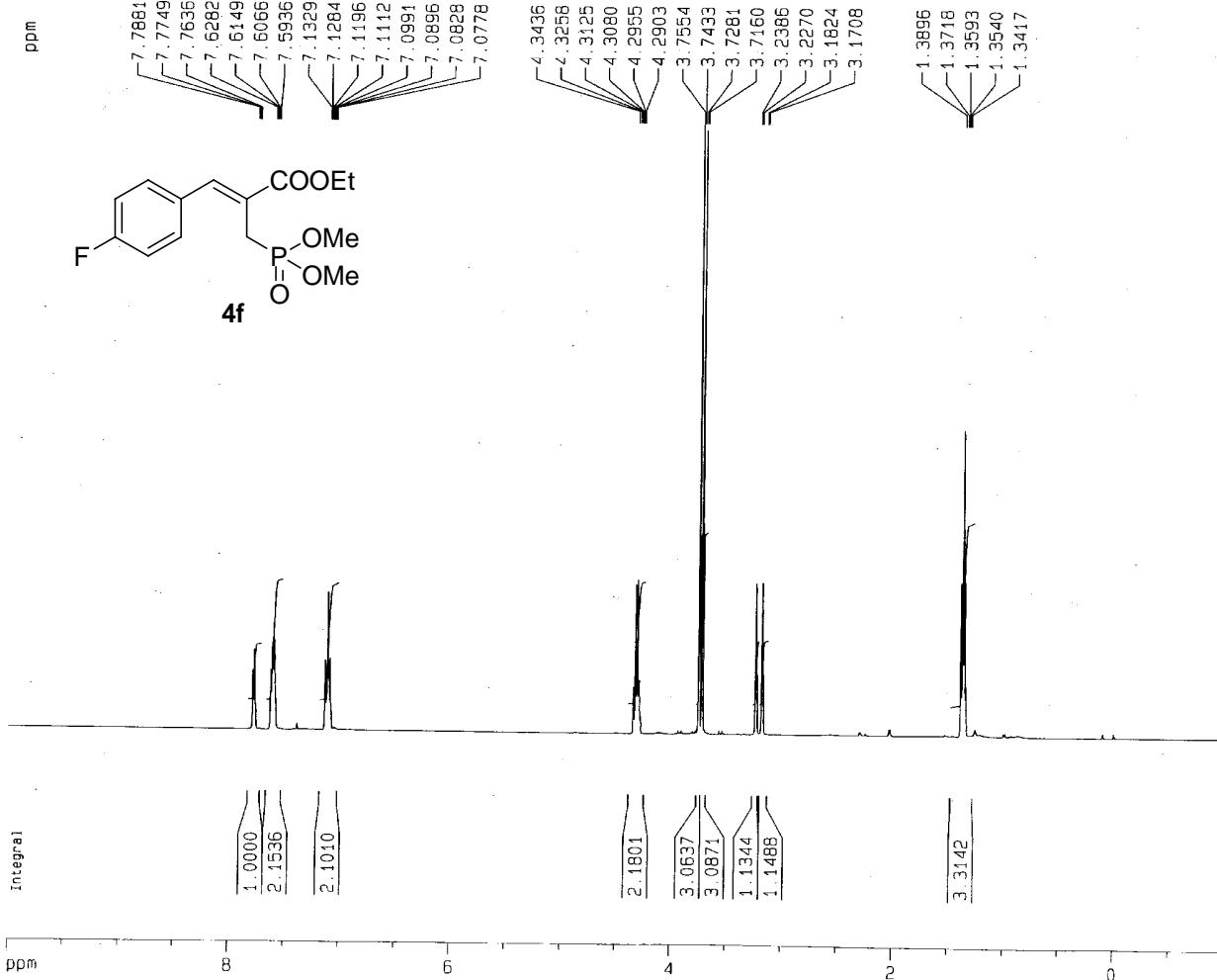
F2 - Processing parameters
 SI 16384
 SF 161.9755337 MHz
 WDW EM
 SSB 0
 LB 5.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 3.00 cm
 F1P 190.000 ppm
 F1 30775.35 Hz
 F2P -100.000 ppm
 F2 -16197.55 Hz
 PPMCM 14.50000 ppm/cm
 HZCM 2348.64526 Hz/cm





1H NMR WDY-1 IN CDCl₃ 08/01/04



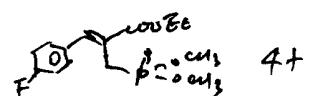
Current Data Parameters
 NAME wdy
 EXPNO 702
 PROCNO 1

F2 - Acquisition Parameters
 Date 20080104
 Time 15.39
 INSTRUM dnx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 14.3
 DW 62.400 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

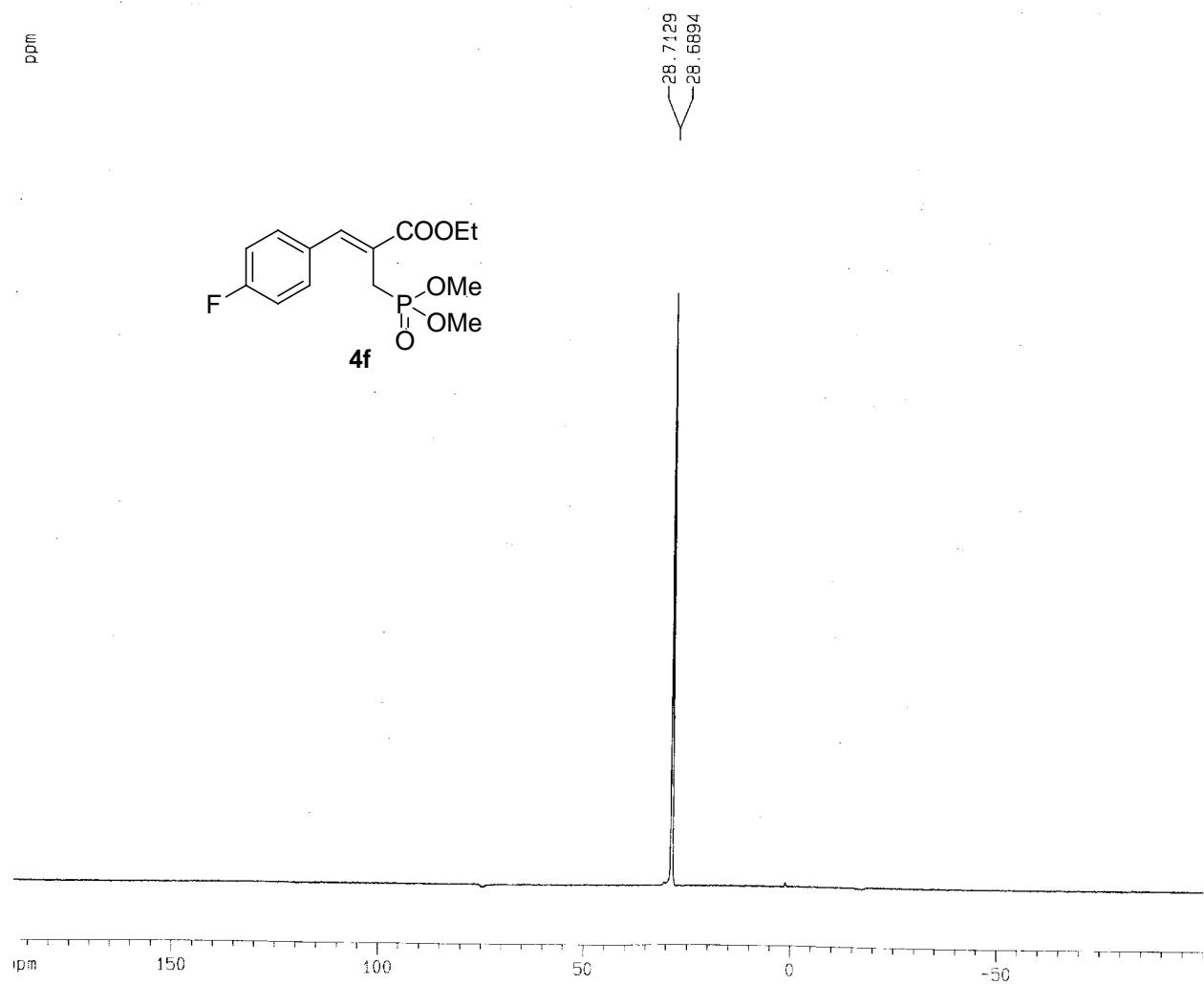
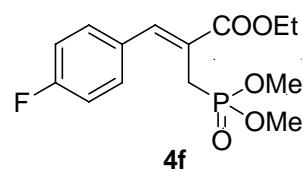
F2 - Processing parameters
 SI 32768
 SF 400.1299649 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07149 Hz/cm



31P NMR WDY-1 IN CDCl₃ 08/01/04

ppm



Current Data Parameters

NAME wdy
EXPNO 700
PROCNO 1

F2 - Acquisition Parameters

Date 20080104
Time 15.19
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 295.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

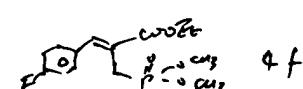
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

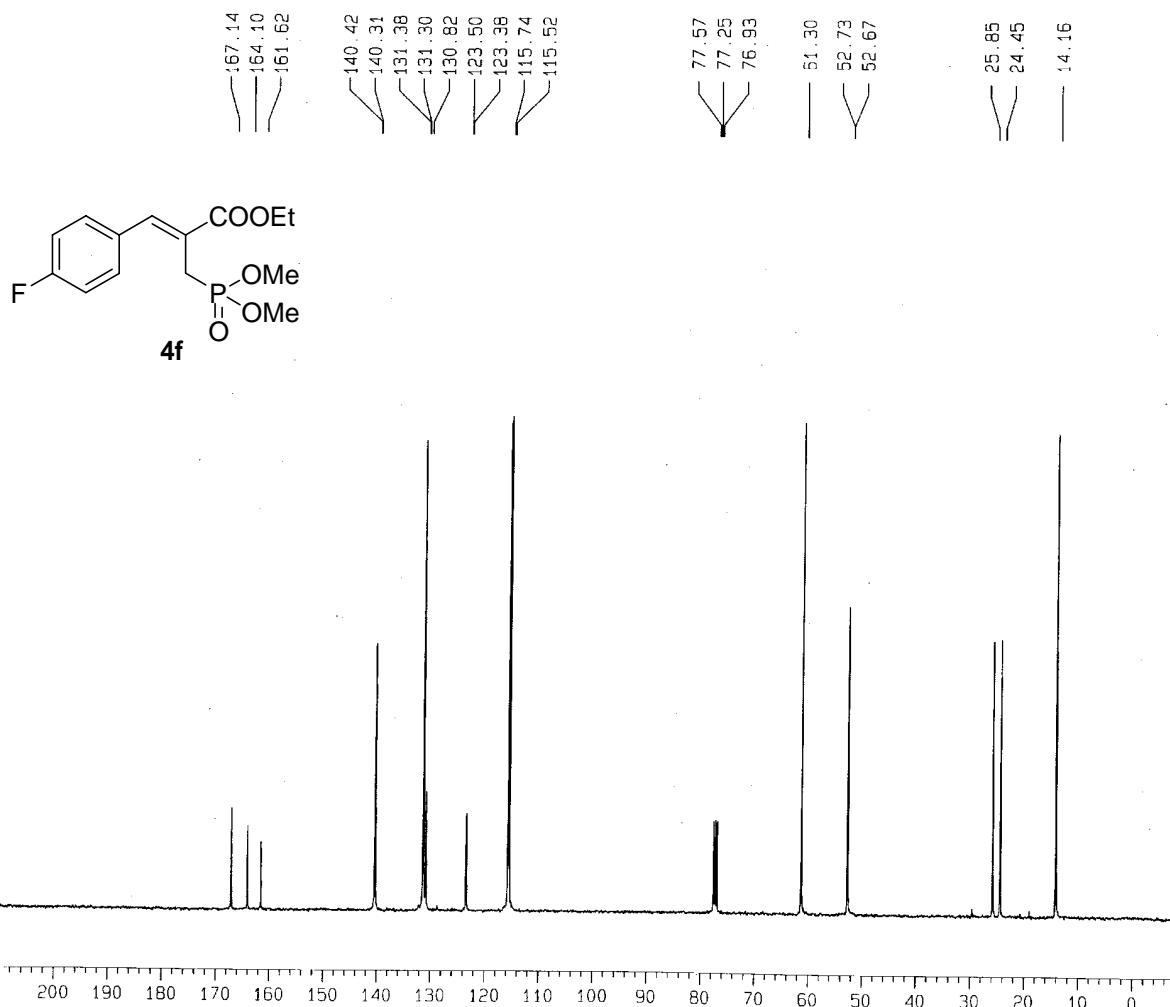
1D NMR plot parameters

CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



13C NMR WDY-1 IN CDCl₃ 08/01/04

ppm



Current Data Parameters
 NAME wdy
 EXPNO 701
 PROCNO 1

F2 - Acquisition Parameters

Date_ 20080104
 Time 15.35
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT CDCl₃
 NS 336
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 RG 3649.1
 DW 21.600 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWAK 0.01500000 sec

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

NUC1 13C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

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

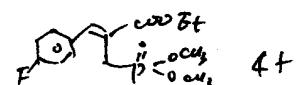
CPDPRG2 waltz16
 NUC2 1H
 PCPD2 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

F2 - Processing parameters

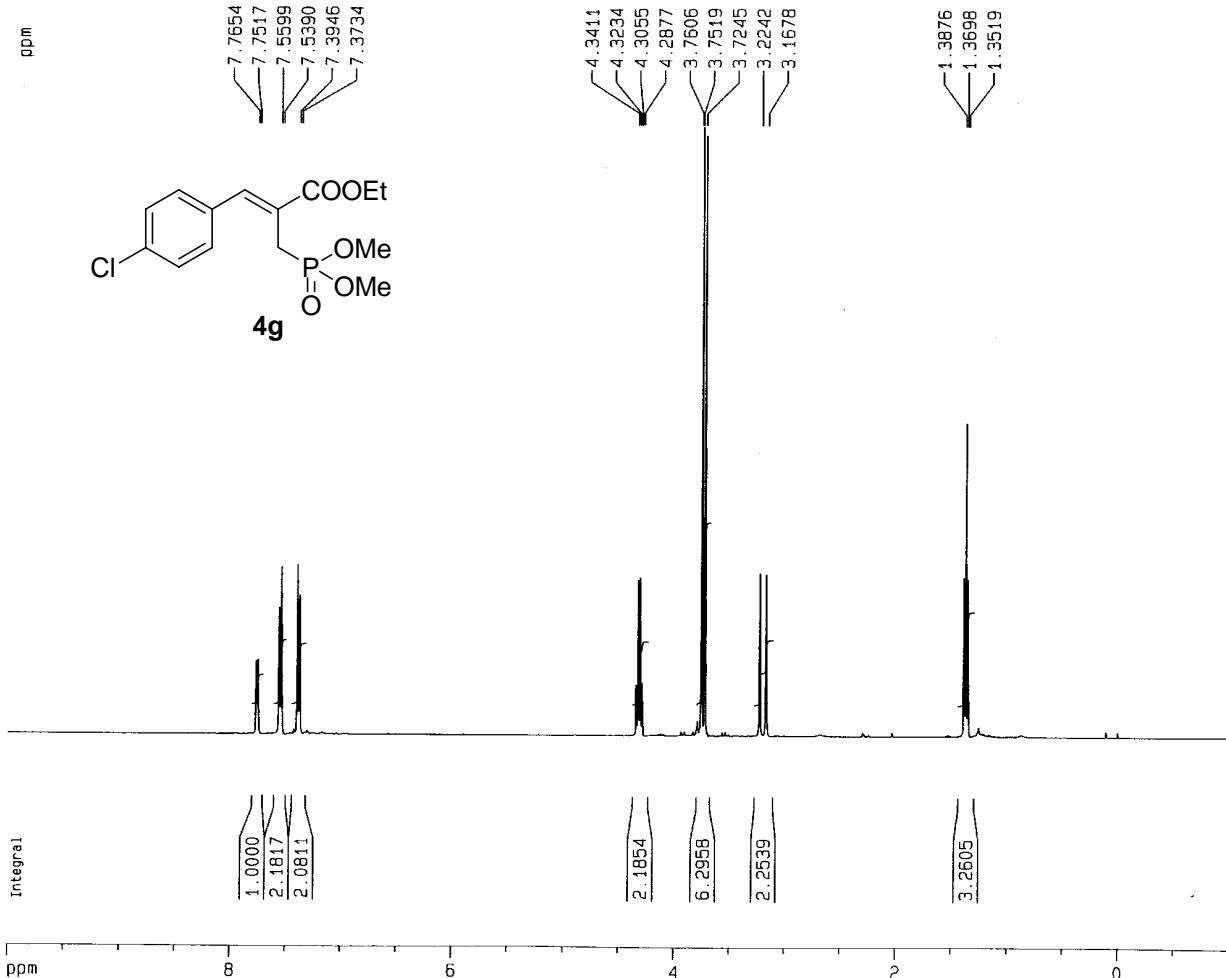
SI 32768
 SF 100.6127690 MHz
 WDW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters

CX 20.00 cm
 CY 8.00 cm
 F1P 220.000 ppm
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.50000 ppm/cm
 HZCM 1157.04588 Hz/cm



1H NMR WDY-3 IN CDCL₃ 07/12/11



Current Data Parameters
 NAME wdy
 EXPNO 671
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20071211
 Time 14.52
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.044731 sec
 RG 12.7
 DW 62.400 usec
 DE 6.00 usec
 TE 293.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

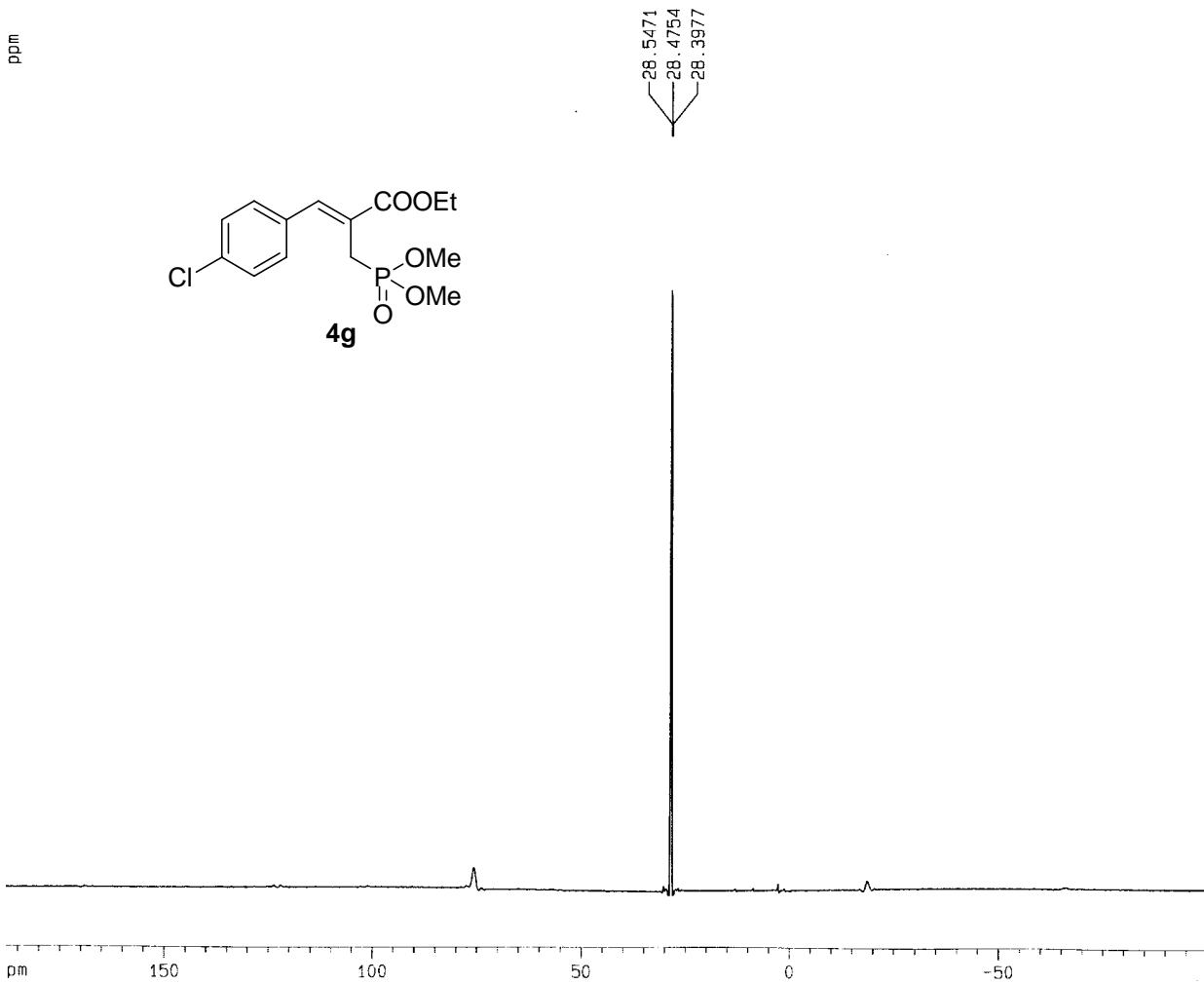
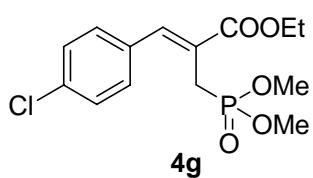
===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

F2 - Processing parameters
 SI 32768
 SF 400.1299499 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07146 Hz/cm

31P NMR WDY-3 IN CDCl₃ 07/12/11

ppm



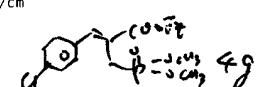
Current Data Parameters
NAME wdy
EXPNO 672
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071211
Time 14.54
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 24
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 293.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

===== CHANNEL f1 =====
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

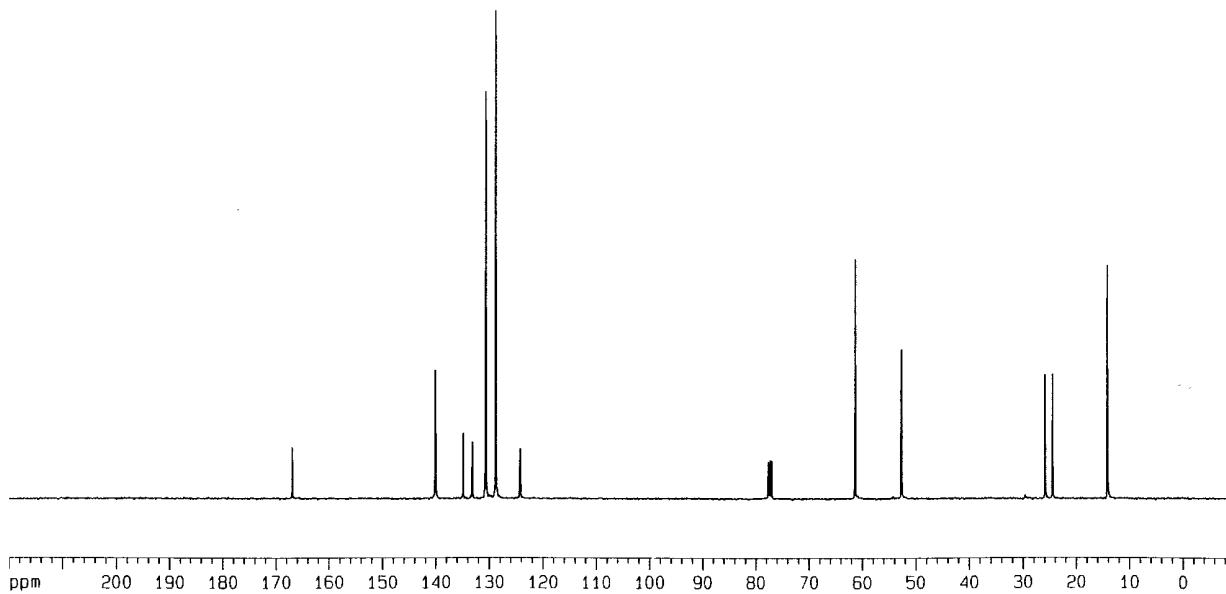
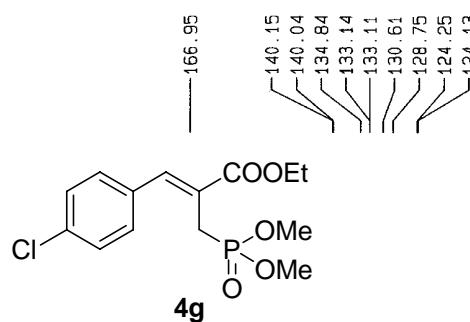
F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-3 IN CDCL₃ 07/12/11

ppm



Current Data Parameters
 NAME wdy
 EXPNO 673
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20071211
 Time 15.00
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT D2O
 NS 170
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 RG 3649.1
 DW 21.600 usec
 DE 6.00 usec
 TE 294.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 =====
 NUC1 ¹³C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

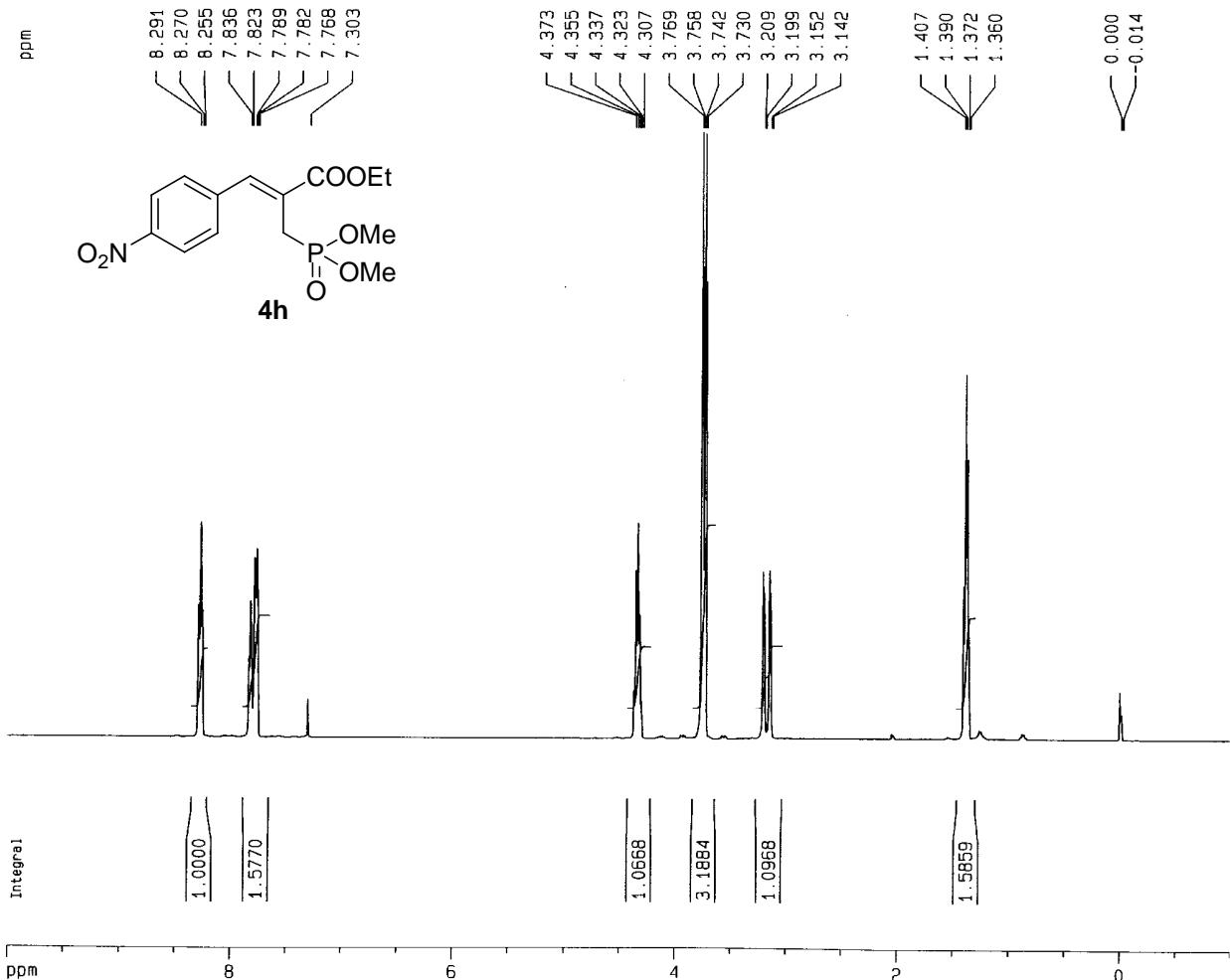
===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 ¹H
 PCPD2 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

F2 - Processing parameters
 SI 32768
 SF 100.6127690 MHz
 WDW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 22134.81 Hz
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.50000 ppm/cm
 HZCM 1157.04688 Hz/cm

4g

1H NMR WDY-1 IN CDCl₃ 07/12/20



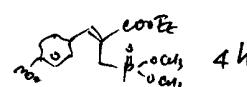
Current Data Parameters
 NAME wdy
 EXPNO 687
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20071220
 Time 12.19
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 35.9
 DW 62.400 usec
 DE 6.00 usec
 TE 294.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWAK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

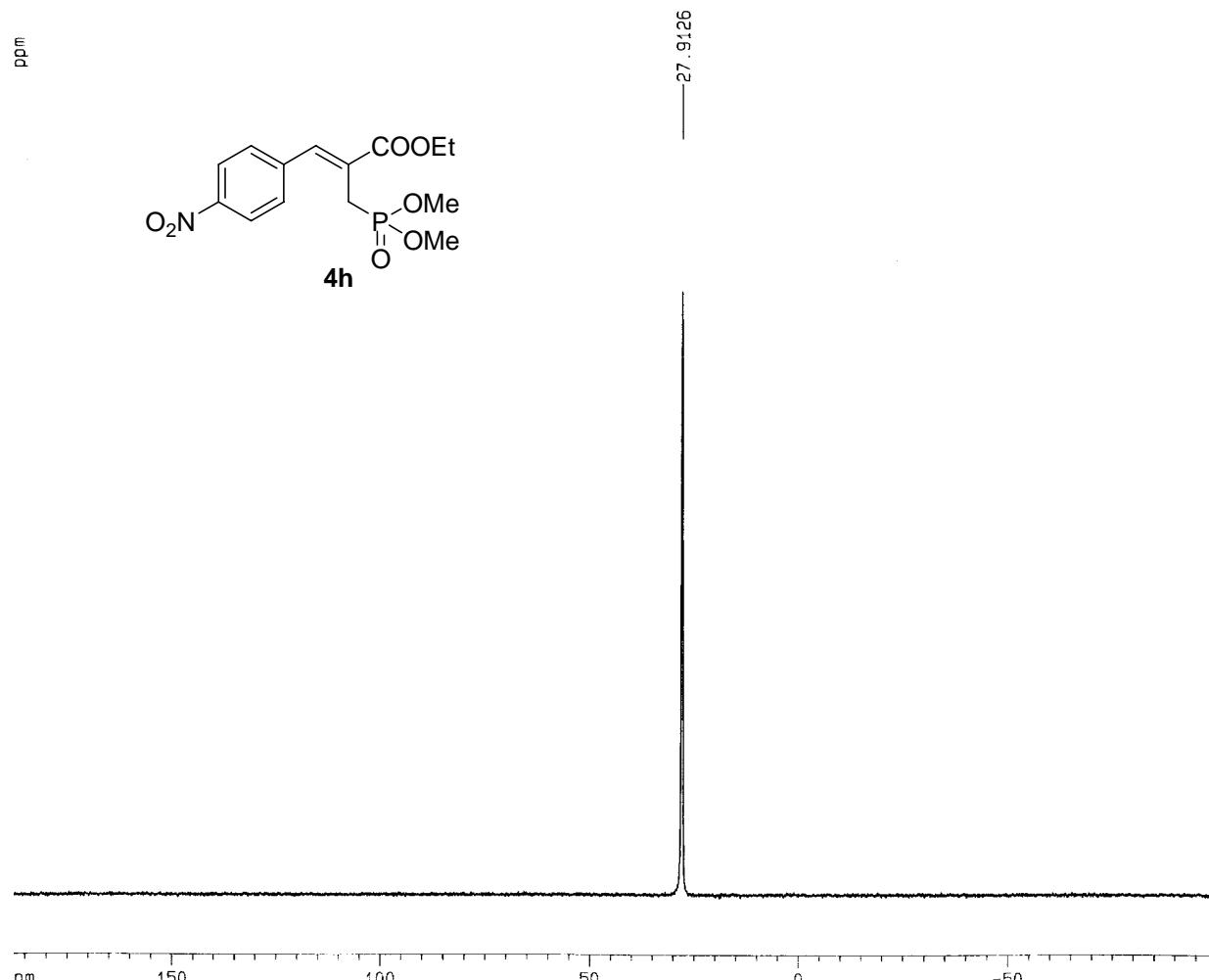
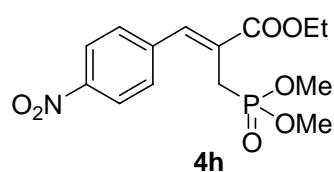
F2 - Processing parameters
 SI 32768
 SF 400.1299998 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm



31P NMR WDY-1 IN CDCL3 07/12/20

ppm



Current Data Parameters

NAME wdy
EXPNO 688
PROCNO 1

F2 - Acquisition Parameters

Date_ 20071220
Time 11.30
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 293.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

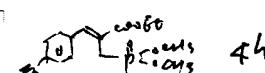
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

S1 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

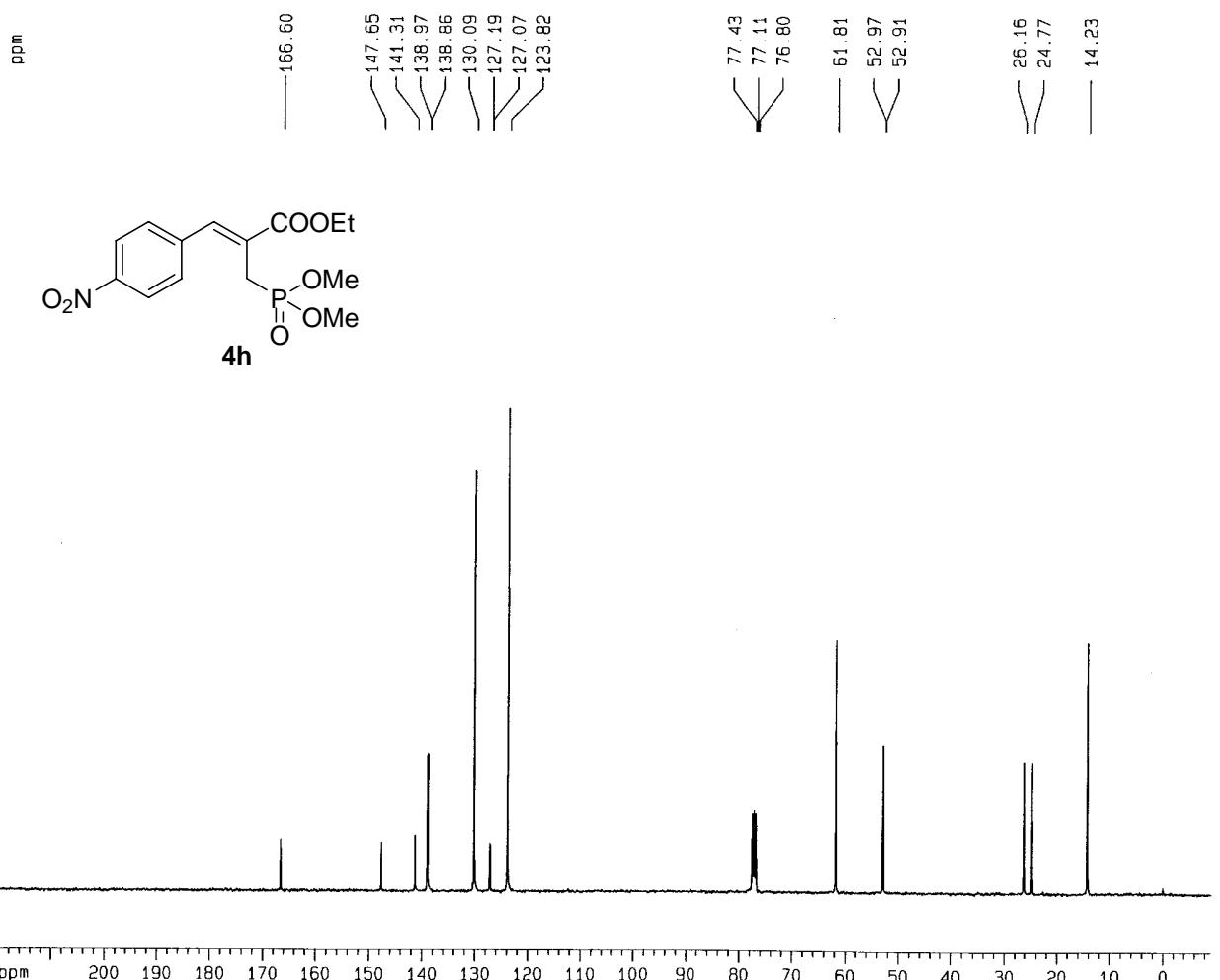
1D NMR plot parameters

CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



BBM

¹³C NMR WDY-1 IN CDCl₃ 07/12/20



Current Data Parameters
 NAME wdy
 EXPTD 689
 PROCNO 1

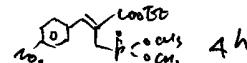
F2 - Acquisition Parameters
 Date_ 20071220
 Time 12.13
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT CDCl₃
 NS 972
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 RG 3649.1
 DW 21.600 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 =====
 NUC1 ¹³C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

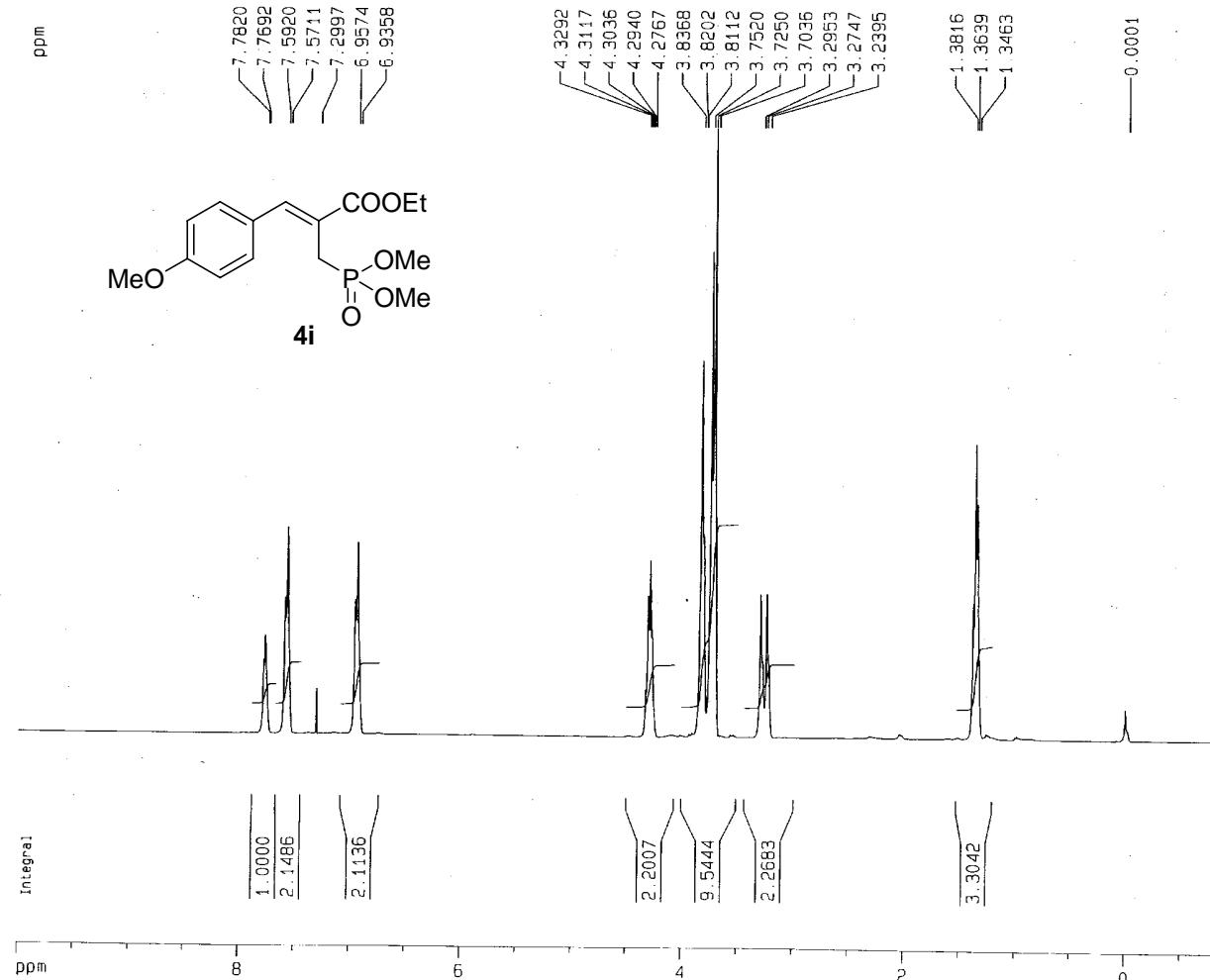
===== CHANNEL f2 =====
 CPDPG2 waltz16
 NUC2 ¹H
 PCP02 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

F2 - Processing parameters
 SI 32768
 SF 100.6127690 MHz
 WDW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 220.000 ppm
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.50000 ppm/cm
 HZCM 1157.04688 Hz/cm



¹H NMR WDY-3 IN CDCl₃ 08/01/15



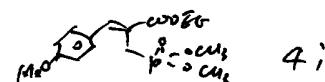
Current Data Parameters
 NAME wdy
 EXPO 722
 PROCNO 1

F2 - Acquisition Parameters
 Date 20080115
 Time 12.08
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 40.3
 DW 62.400 usec
 DE 6.00 usec
 TE 293.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

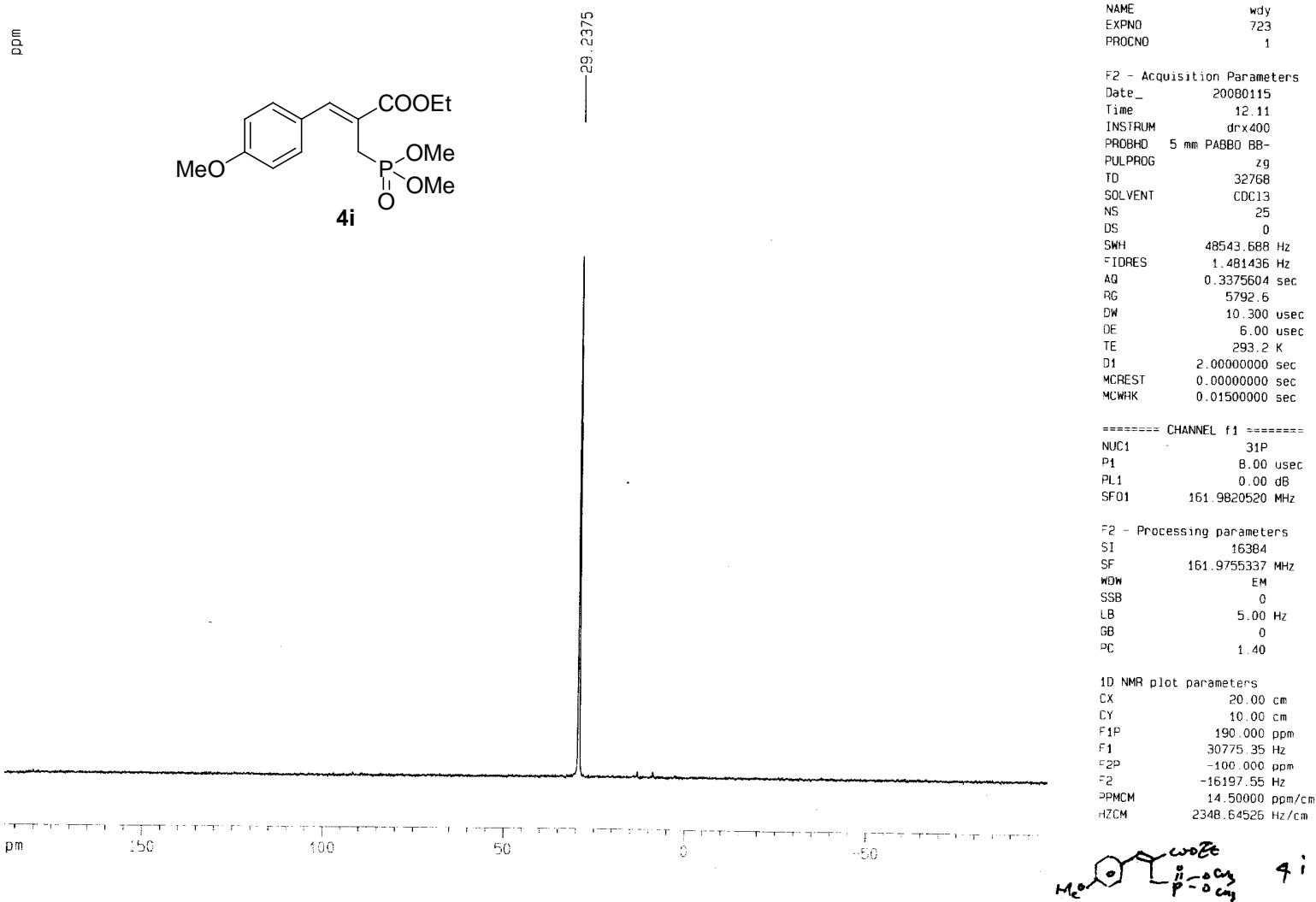
===== CHANNEL f1 ======
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

F2 - Processing parameters
 SI 32768
 SF 400.1300008 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

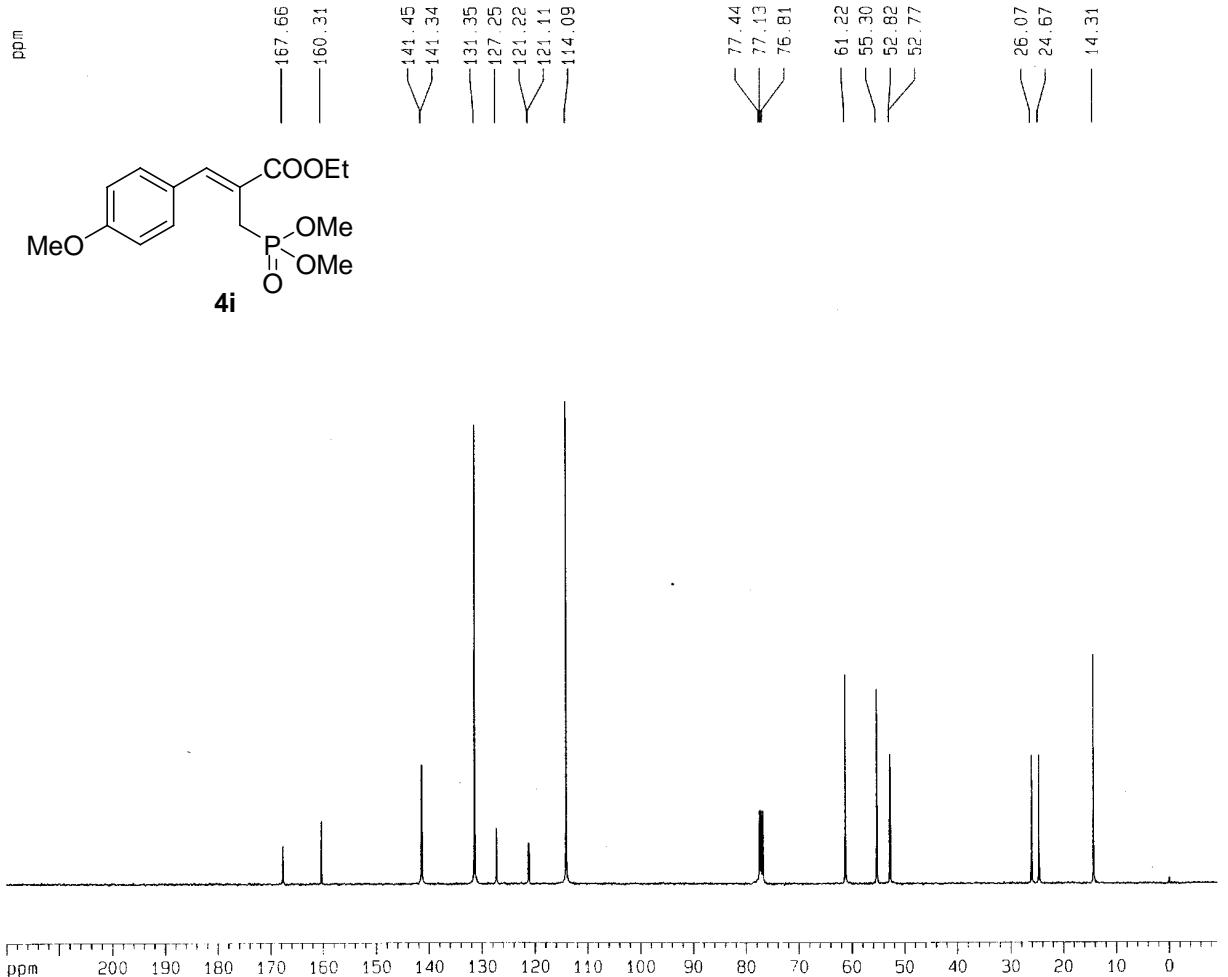
1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm



³¹P NMR WDY-3 IN CDCl₃ 08/01/15



¹³C NMR WDY-3 IN CDCl₃ 08/01/15



Current Data Parameters
 NAME wdy
 EXPNO 724
 PROCNO 1

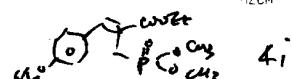
F2 - Acquisition Parameters
 Date_ 20080115
 Time 13.05
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT CDCl₃
 NS 1237
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 RG 3649.1
 DW 21.600 usec
 DE 6.00 usec
 TE 294.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 =====
 NUC1 ¹³C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 ¹H
 PCPD2 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

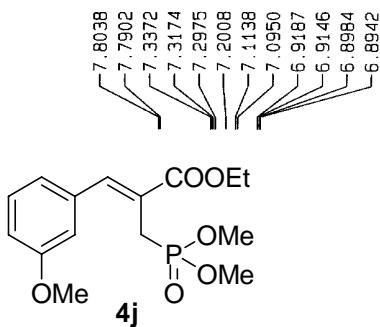
F2 - Processing parameters
 SI 32768
 SF 100.6127690 MHz
 WDW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 220.000 ppm
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.5000 ppm/cm
 HZCM 1157.04688 Hz/cm



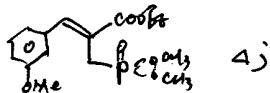
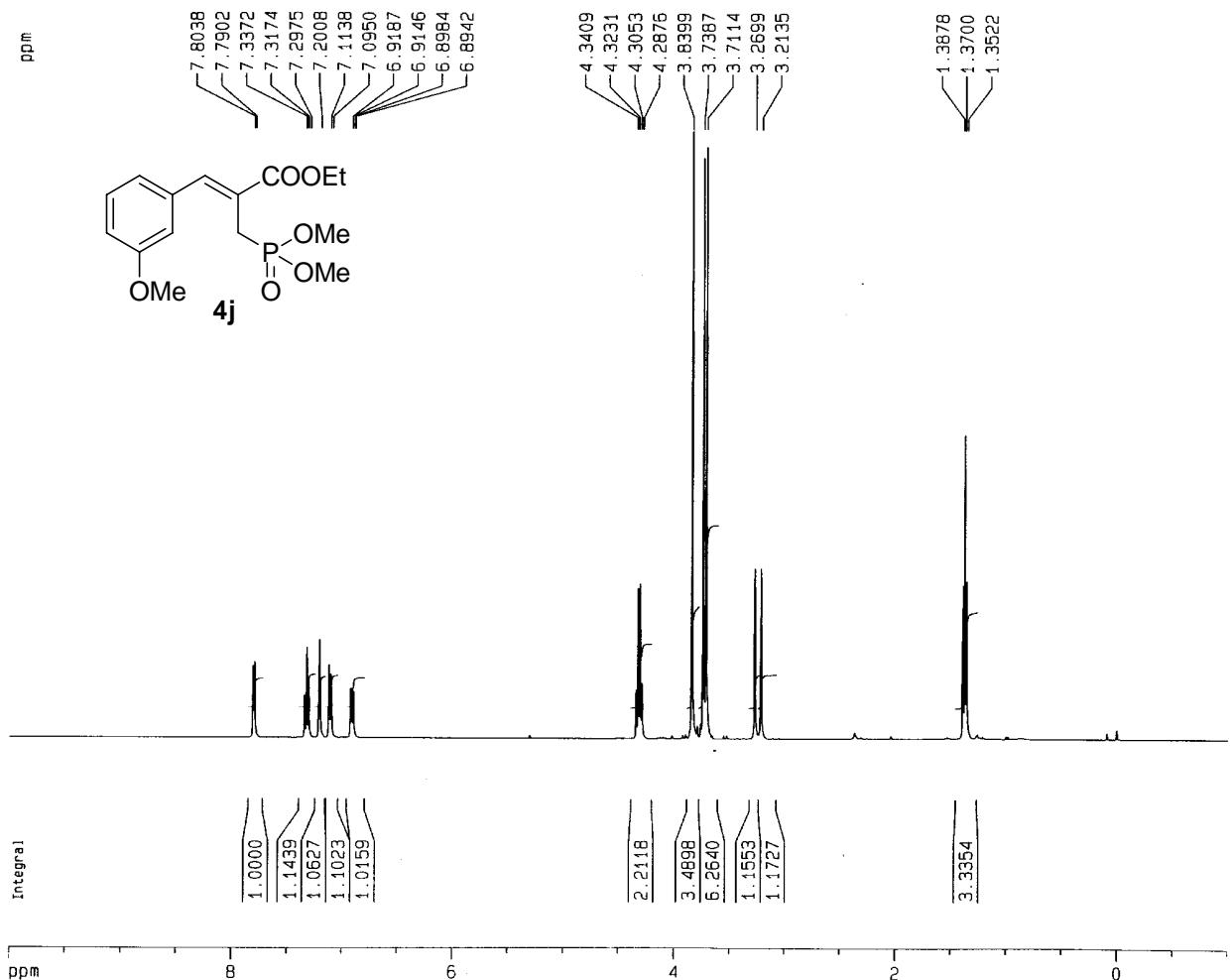
1H NMR WDY-2 IN CDCl₃ 07/12/20

ppm



Integral

ppm



Current Data Parameters
NAME wdy
EXPNO 690
PROCNO 1

F2 - Acquisition Parameters

Date 20071220
Time 15.55
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 20.2
DW 62.400 usec
DE 6.00 usec
TE 295.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCHWAK 0.0150000 sec

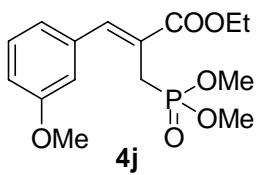
===== CHANNEL f1 =====
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

F2 - Processing parameters
SI 32768
SF 400.1299910 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

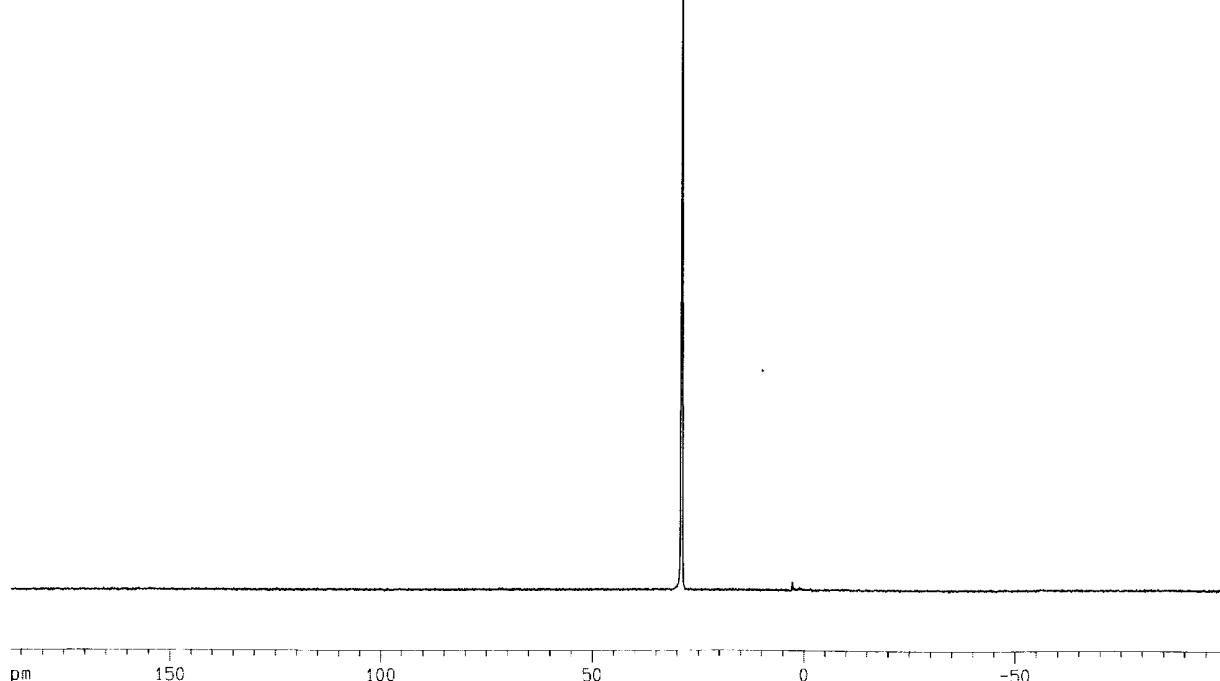
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 4001.30 Hz
F2P -1.000 ppm
F2 -400.13 Hz
PPMCM 0.55000 ppm/cm
HZCM 220.07150 Hz/cm

31P NMR WDY-2 IN CDCL3 07/12/20

ppm



29.0240
28.9894
28.9591
28.9242



Current Data Parameters

NAME wdy
EXPNO 691
PROCNO 1

F2 - Acquisition Parameters

Date 20071220
Time 15.57
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 295.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

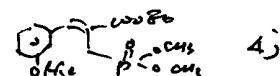
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

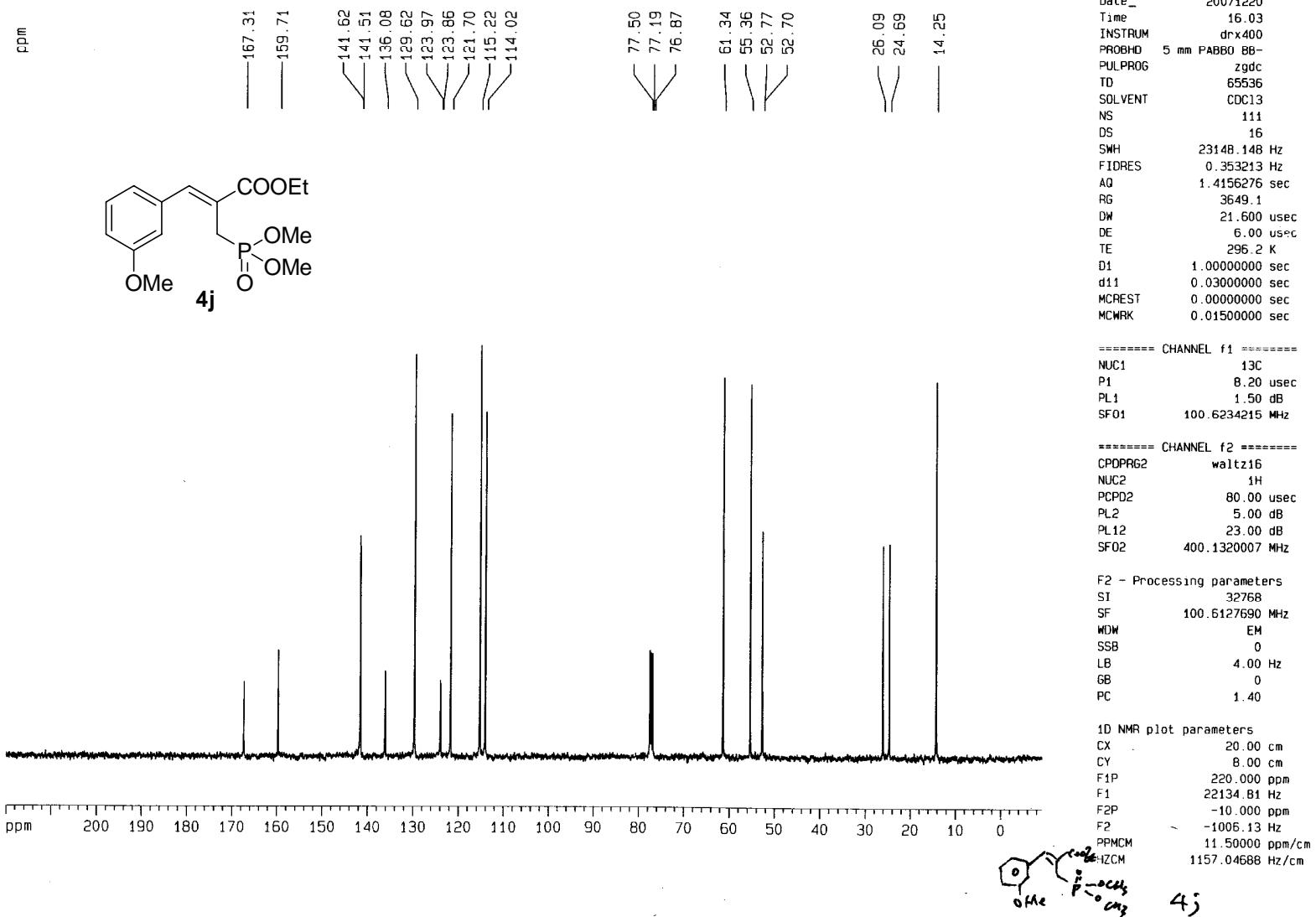
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

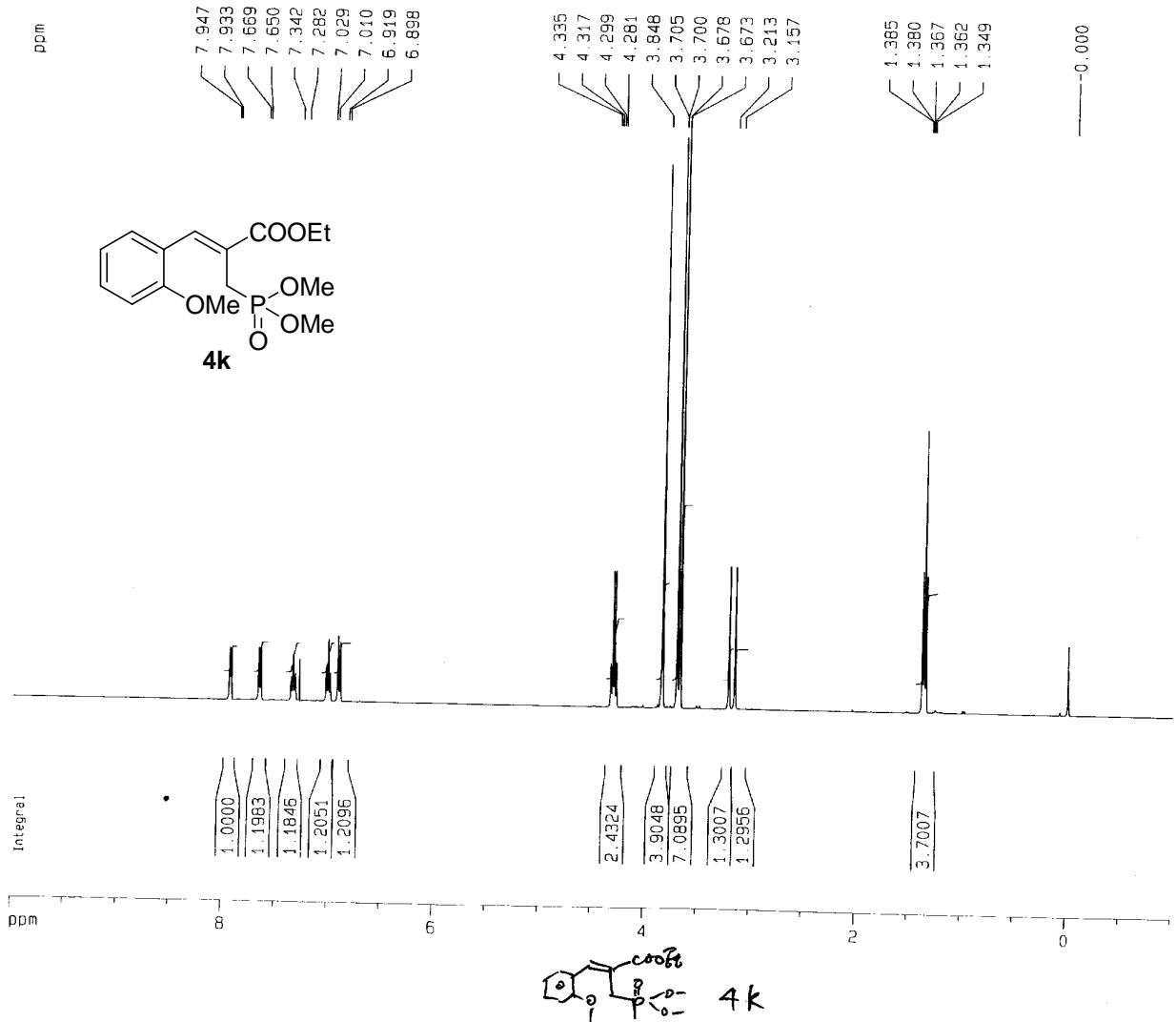
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCl₃ 07/12/20



1H NMR WDY-2 IN CDCl₃ 08/01/15



Current Data Parameters
NAME wdy
EXPNO 720
PROCNO 1

F2 - Acquisition Parameters
Date_ 20080115
Time 11.04
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 45.3
DW 62.400 usec
DE 6.00 usec
TE 293.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

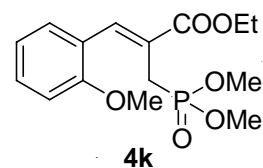
===== CHANNEL f1 =====
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

F2 - Processing parameters
SI 32768
SF 400.1300064 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 4001.30 Hz
F2P -1.000 ppm
F2 -400.13 Hz
PPCM 0.55000 ppm/cm
HZCM 220.07150 Hz/cm

31P NMR WDY-3 IN CDCl₃ 08/01/10

ppm



29.3842

150 100 50 0 -50

Current Data Parameters
NAME wdy
EXPNO 716
PROCNO 1

F2 - Acquisition Parameters
Date 20080110
Time 13.23
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TO 32768
SOLVENT CDCl₃
NS 23
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 0.0 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

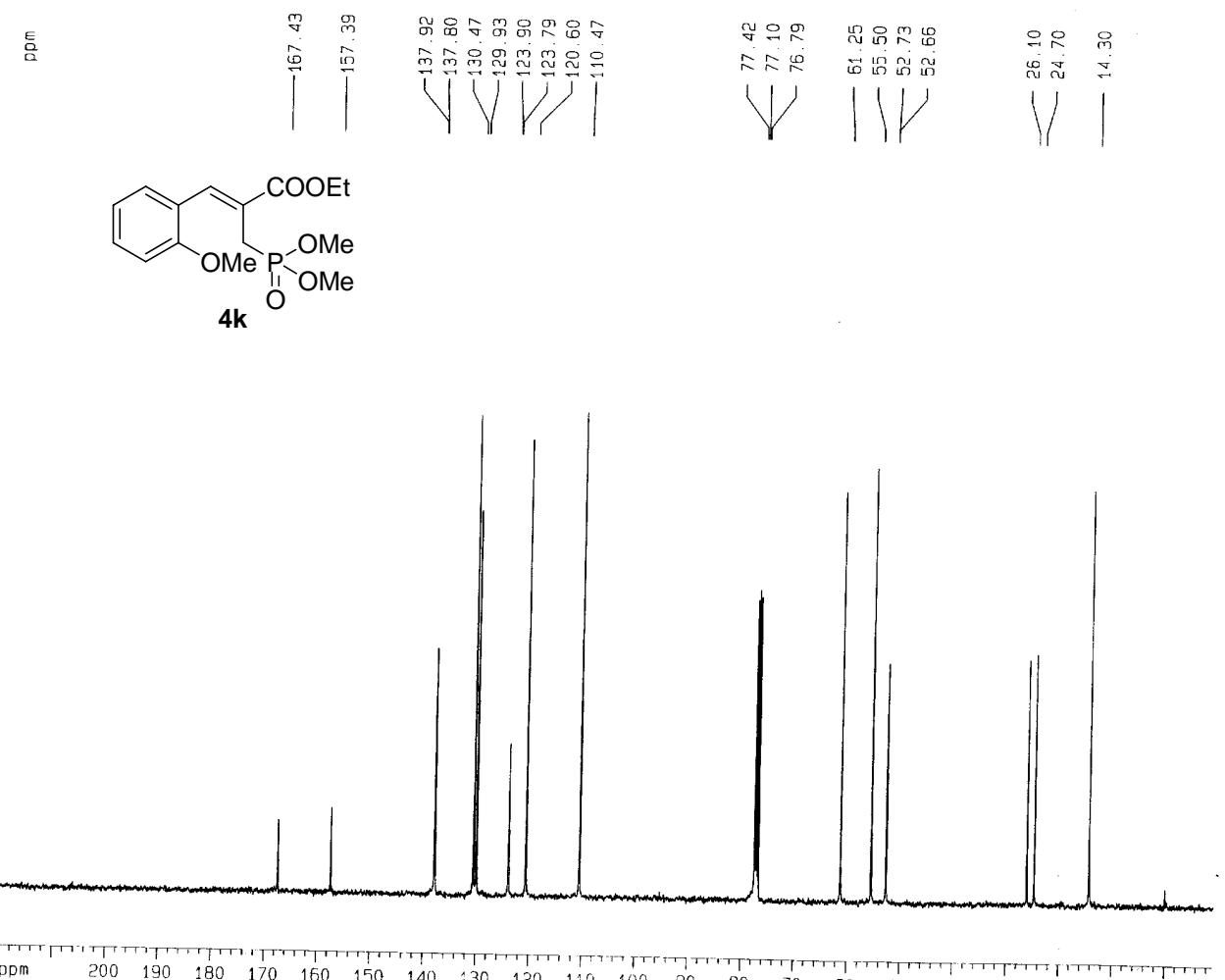
===== CHANNEL f1 =====
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPNCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm

*write
L₀OC₂H₅ P(=O)(OCH₃)₂ 4k*

¹³C NMR WDY-2 IN CDCl₃ 08/01/15



Current Data Parameters

NAME wdy
EXPNO 721
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080115
Time 11.09
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zgdc
TD 65536
SOLVENT CDCl₃
NS 1169
DS 16
SWH 23148.148 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 3649.1
DW 21.600 usec
DE 6.00 usec
TE 294.2 K
D1 1.0000000 sec
d11 0.0300000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

NUC1 ¹³C
P1 8.20 usec
PL1 1.50 dB
SF01 100.6234215 MHz

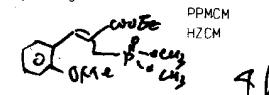
===== CHANNEL f2 =====

CPDPNG2 waltz16
NUC2 ¹H
PCPD2 80.00 usec
PL2 5.00 dB
PL12 23.00 dB
SF02 400.1320007 MHz

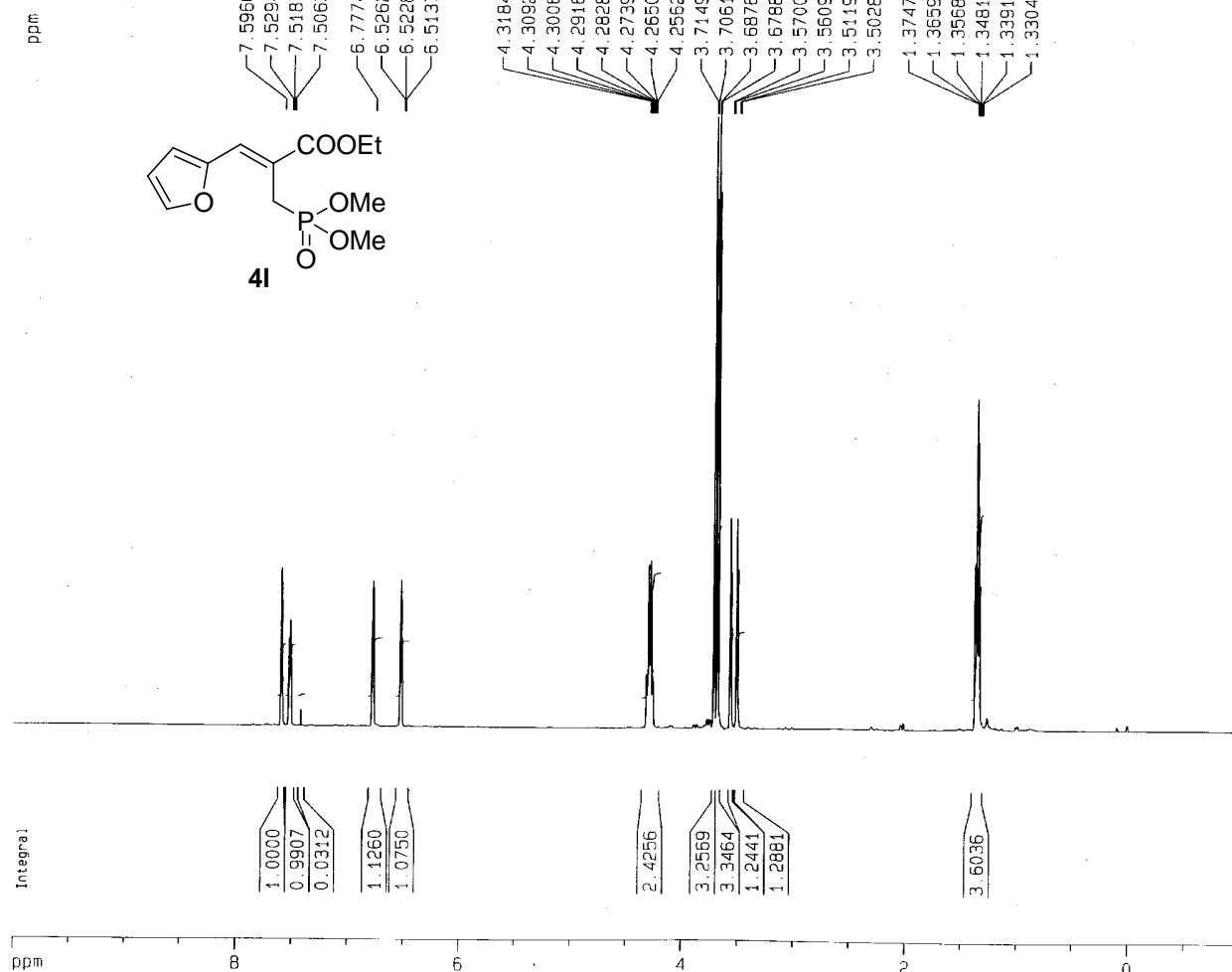
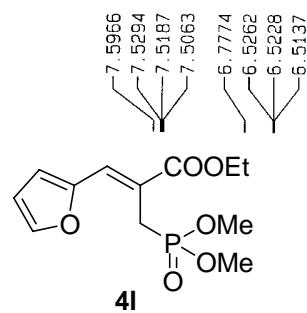
F2 - Processing parameters

S1 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 8.00 cm
F1P 220.000 ppm
F1 22134.81 Hz
F2P -10.000 ppm
F2 -1006.13 Hz
PPMCM 11.50000 ppm/cm
HZCM 1157.04686 Hz/cm



1H NMR WDY-2 IN CDCL3 08/01/04



Current Data Parameters
NAME wdy
EXPNO 703
PROCNO 1

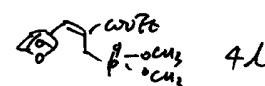
F2 - Acquisition Parameters
 Date_ 20080104
 Time 15.57
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl3
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 14.3
 DW 62.400 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHZ

F2 - Processing parameters
SI 32768
SF 400.1299514 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

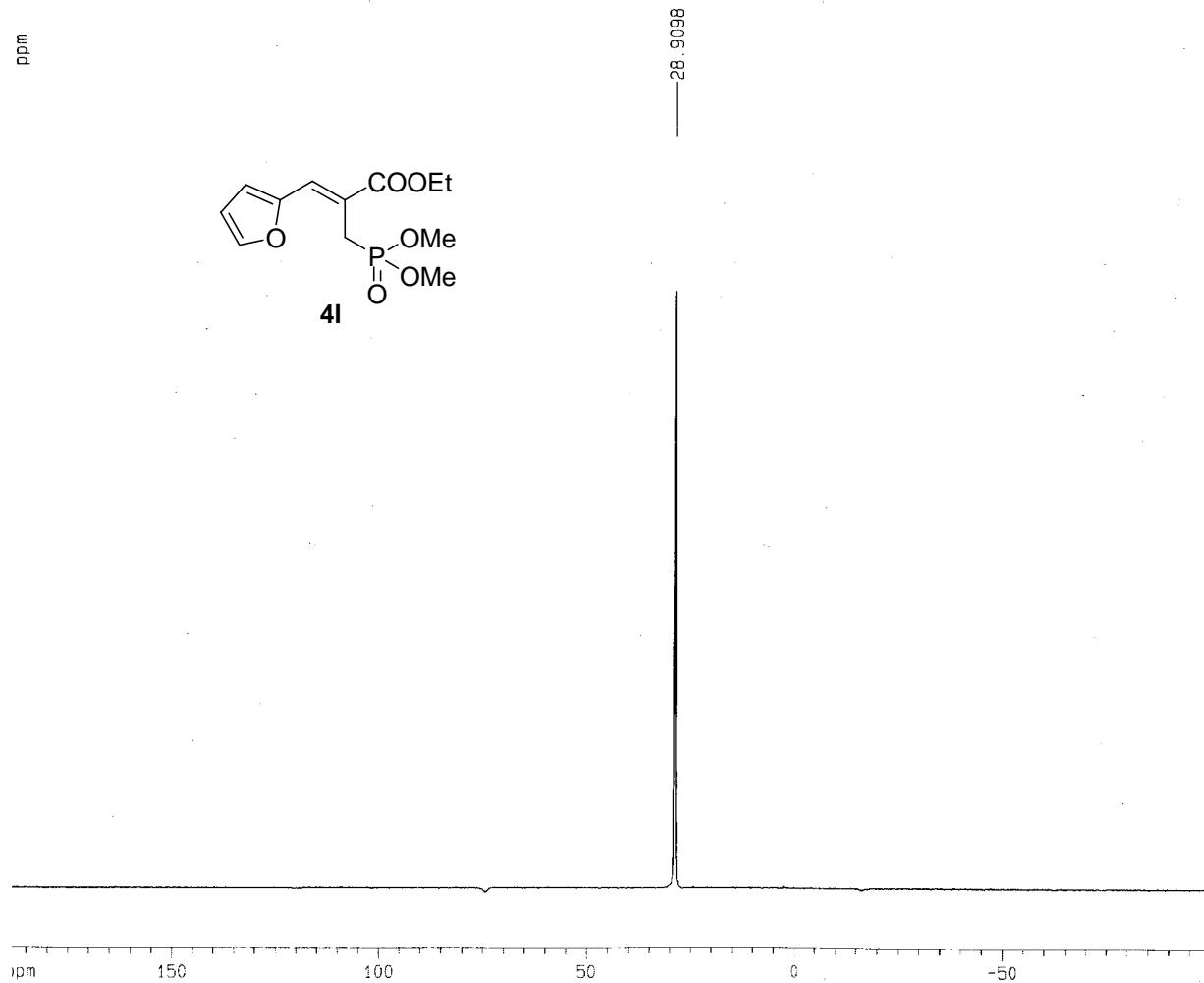
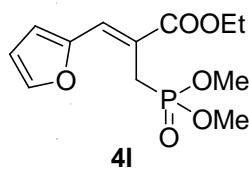
1D NMR plot parameters

CX	20.00	cm
CY	10.00	cm
F1P	10.000	ppm
F1	4001.30	Hz
F2P	-1.000	ppm
F2	-400.13	Hz
PPMCM	0.55000	ppm/cm
HZCM	220.0/146	Hz/cm



³¹P NMR WDY-2 IN CDCl₃ 08/01/04

ppm



Current Data Parameters
NAME wdy
EXPNO 704
PROCNO 1

F2 - Acquisition Parameters
Date 20080104
Time 16.00
INSTRUM dtx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 295.2 K
D1 2.0000000 sec
MCREFST 0.0000000 sec
MCWRFK 0.0150000 sec

===== CHANNEL f1 =====
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

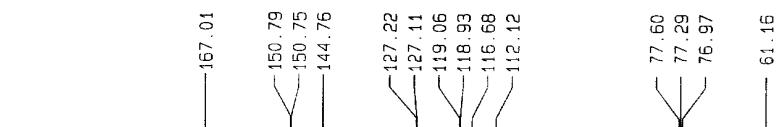
F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm

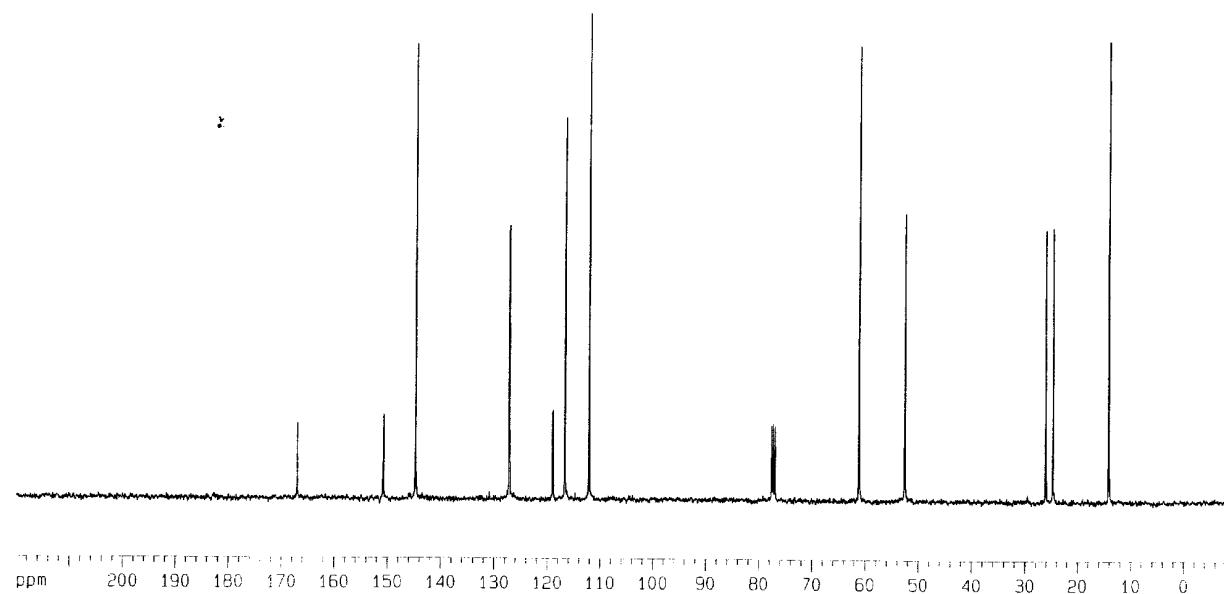


13C NMR WDY-2 IN CDCL3 08/01/04

ppm



4l



Current Data Parameters
NAME wdy
EXPNO 705
PROCNO 1

F2 - Acquisition Parameters
Date_ 20080104
Time 16.05
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zqdc
TD 65536
SOLVENT CDCl3
NS 85
DS 16
SWH 23148.148 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 3649.1
DW 21.600 usec
DE 6.00 usec
TE 295.2 K
D1 1.0000000 sec
d11 0.03000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

===== CHANNEL f1 =====
NUC1 13C
P1 8.20 usec
PL1 1.50 dB
SF01 100.6234215 MHz

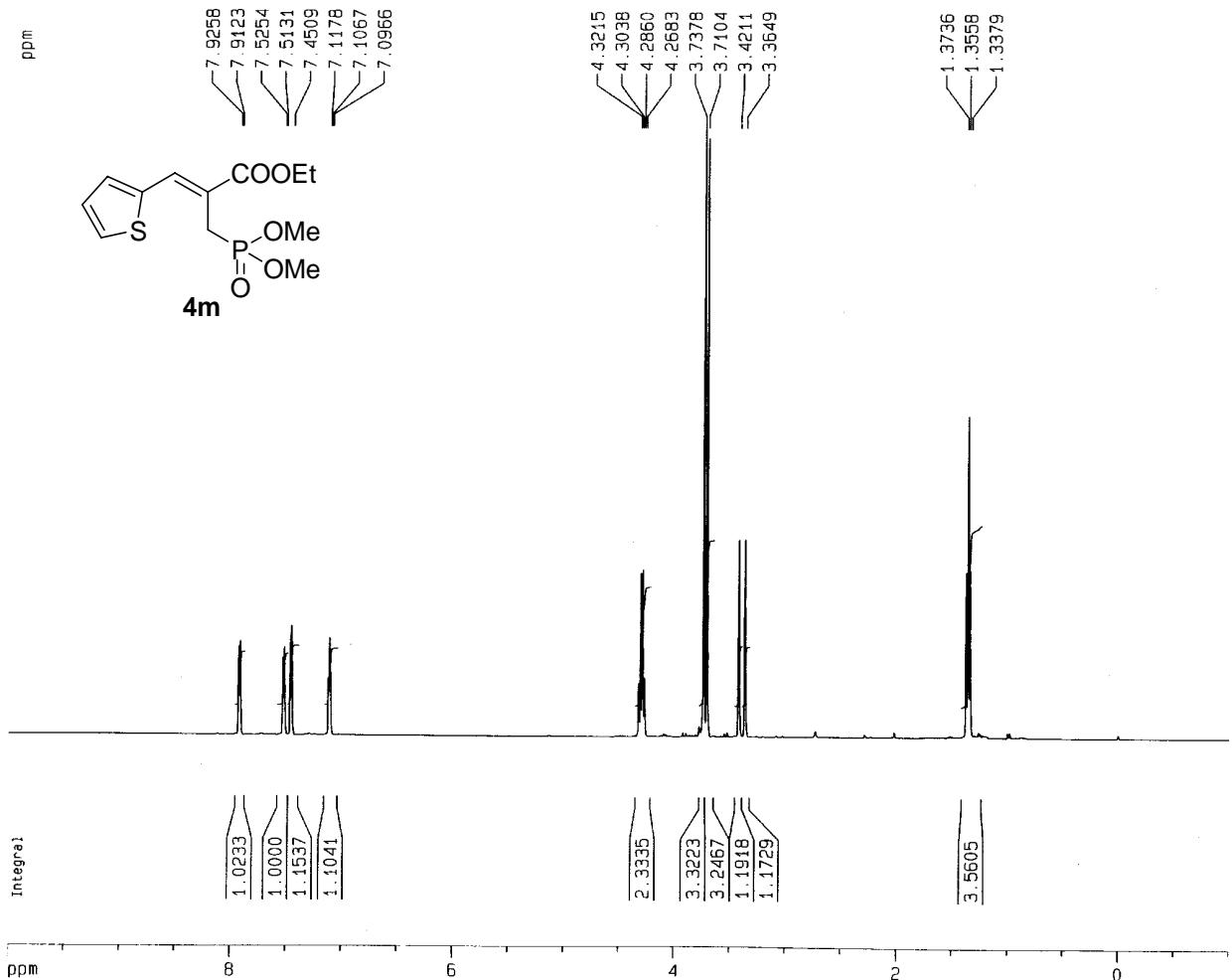
===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 5.00 dB
PL12 23.00 dB
SF02 400.1320007 MHz

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 8.00 cm
F1P 22134.81 Hz
F1 22134.81 Hz
F2P -10.000 ppm
F2 -1006.13 Hz
PPMCM 11.50000 ppm/cm
HZCM 1157.04688 Hz/cm



1H NMR WDY-1 IN CDCl₃ 07/12/24



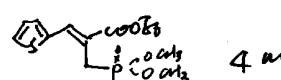
Current Data Parameters
NAME wdy
EXPNO 693
PROCNO 1

F2 - Acquisition Parameters
Date_ 20071224
Time 11.18
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 11.3
DW 62.400 usec
DE 6.00 usec
TE 295.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

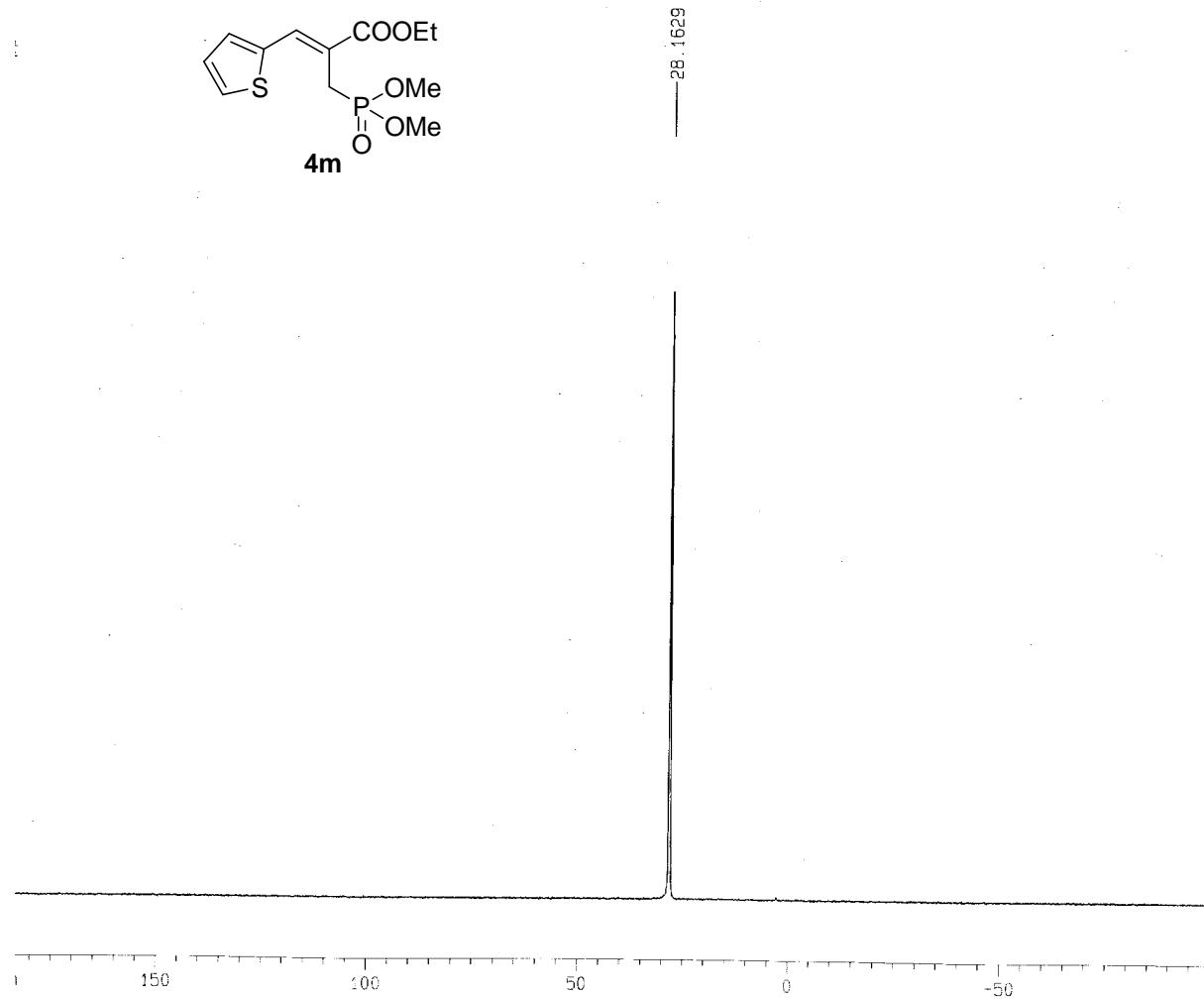
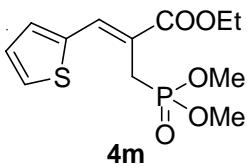
===== CHANNEL f1 =====
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

F2 - Processing parameters
SI 32768
SF 400.1299353 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 4001.30 Hz
F2P -1.000 ppm
F2 -400.13 Hz
PPMCM 0.55000 ppm/cm
HZCM 220.07146 Hz/cm



³¹P NMR WDV-1 IN CDCL₃ 08/01/03



Current Data Parameters

NAME wdy
EXPNO 698
PROCNO 1

F2 - Acquisition Parameters

Date 20080103
Time 11.13
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 21
DS 0
SWH 48543.688 Hz
FIRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 294.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

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

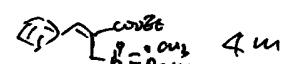
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

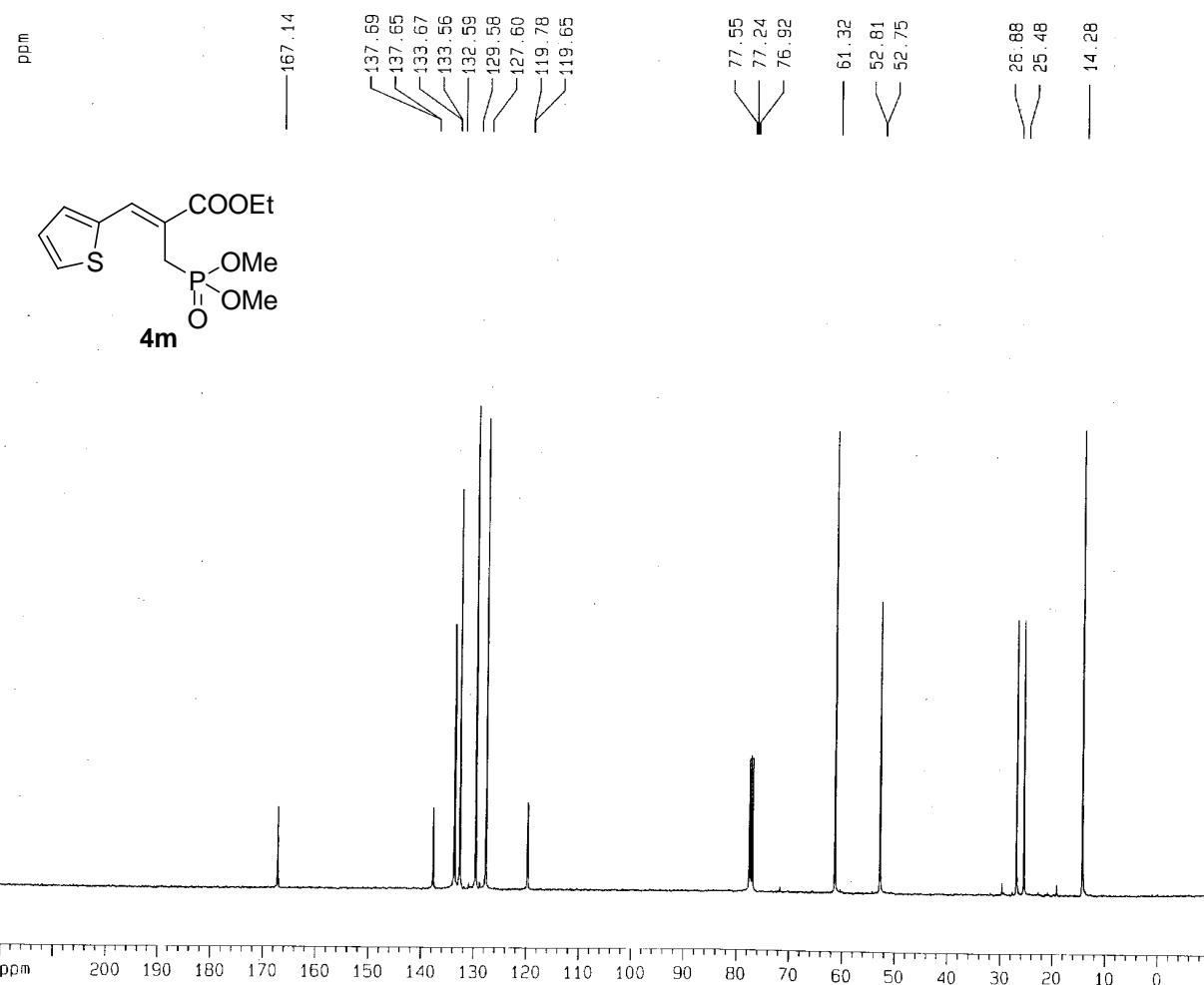
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-1 IN CDCl₃ 08/01/03



Current Data Parameters
 NAME wdy
 EXPNO 699
 PROCNO 1

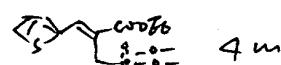
F2 - Acquisition Parameters
 Date 20080103
 Time 12.17
 INSTRUM drx400
 PROBID 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT CDCl₃
 NS 1476
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 R6 3649.1
 DW 21.500 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 ¹³C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

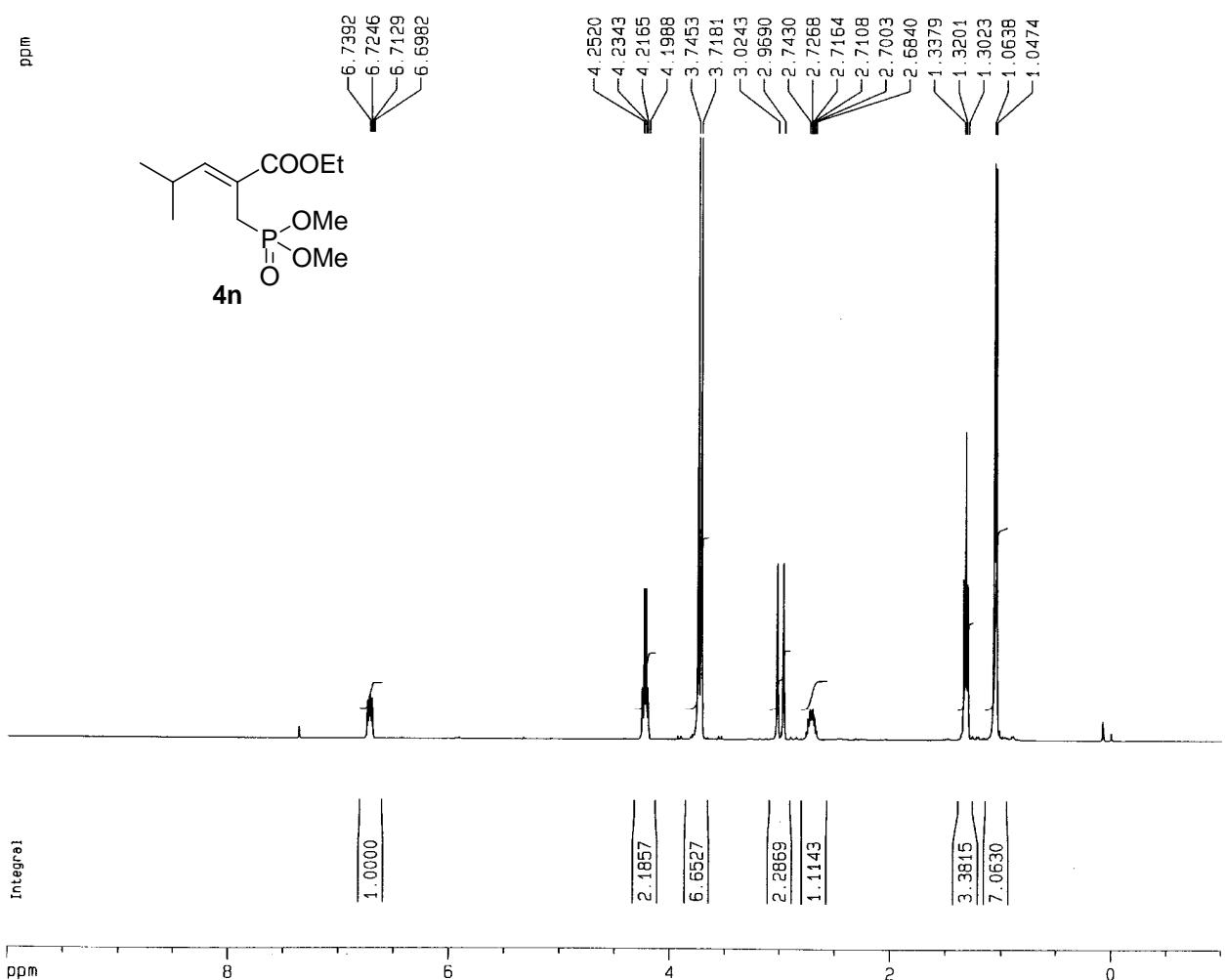
===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 ¹H
 PCPD2 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

F2 - Processing parameters
 SI 32768
 SF 100.6127690 MHz
 WMW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 220.000 ppm
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.50000 ppm/cm
 HZCM 1157.04688 Hz/cm



¹H NMR WDY-1 IN CDCl₃ 07/12/14



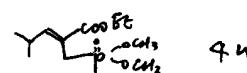
Current Data Parameters
 NAME wdy
 EXPNO 679
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20071214
 Time 13.27
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 12.7
 DW 62.400 usec
 DE 6.00 usec
 TE 294.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

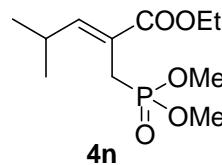
F2 - Processing parameters
 SI 32768
 SF 400.1299766 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07149 Hz/cm

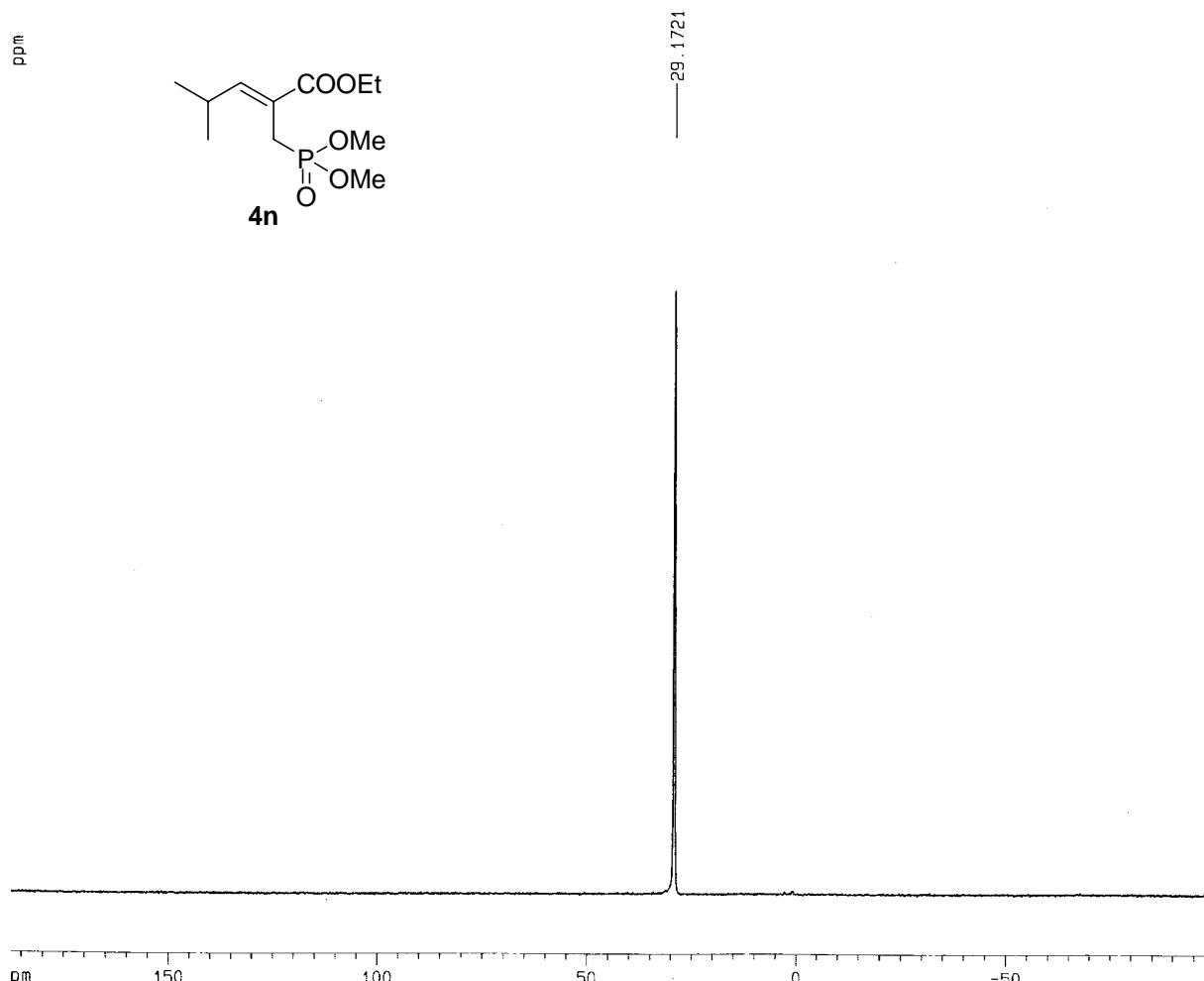


³¹P NMR WDY-1 IN CDCl₃ 07/12/14

ppm



29.1721



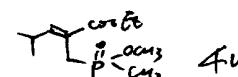
Current Data Parameters
NAME wdy
EXPNO 680
PROCNO 1

F2 - Acquisition Parameters
Date 20071214
Time 13.30
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 19
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 294.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

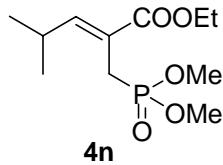
===== CHANNEL f1 ======
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

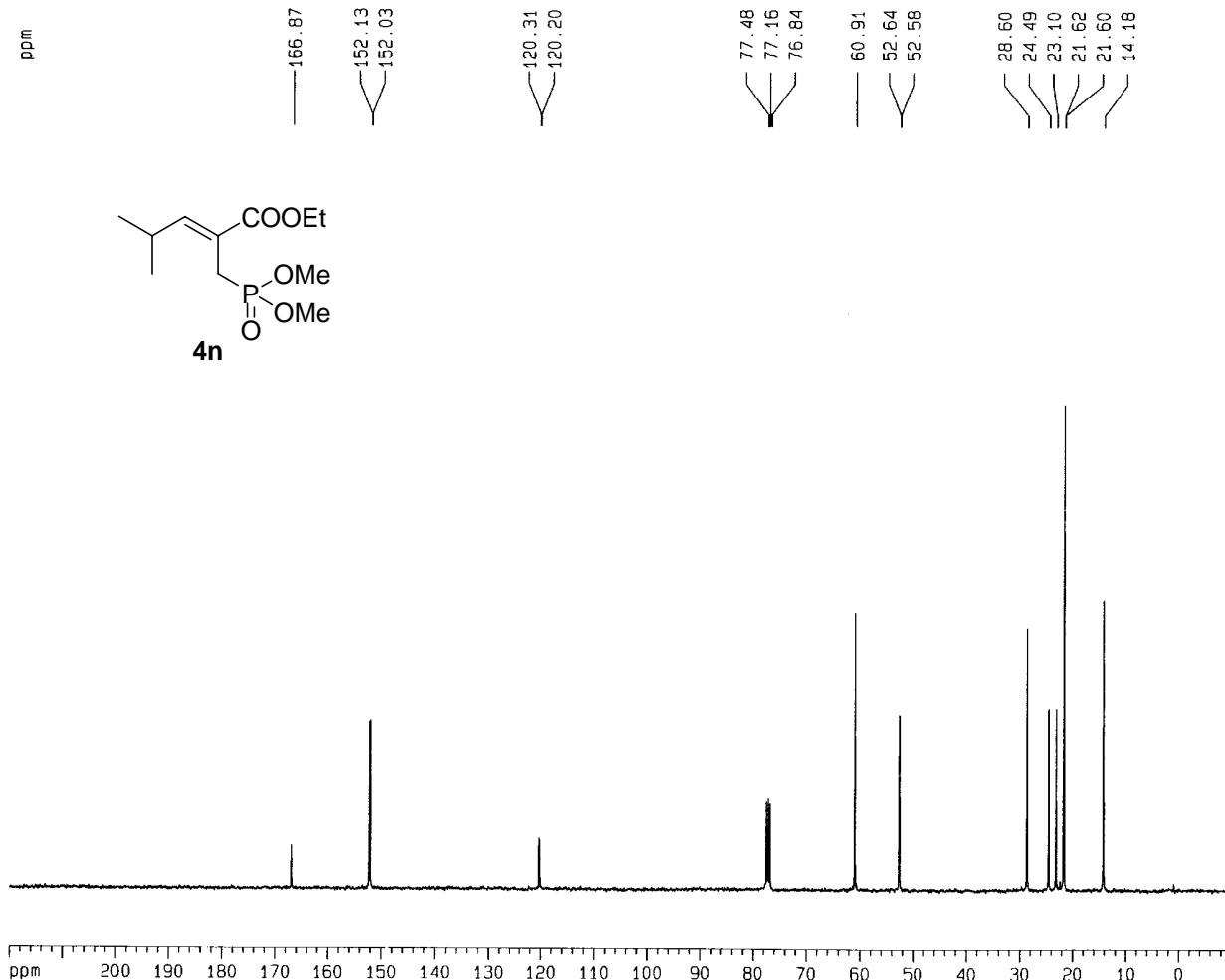
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



13C NMR WDY-1 IN CDCL3 07/12/14



4n



Current Data Parameter
NAME W
EXPNO 6
PROCNO

```

F2 - Acquisition Parameters
Date_      20071214
Time       13.42
INSTRUM   drx400
PROBHD   5 mm PABBO BB-
PULPROG  zgdc
TD        65536
SOLVENT    CDCl3
NS         225
DS          16
SWH      23148.148 Hz
FIDRES   0.353213 Hz
AQ        1.4156276 sec
RG        3649.1
DW        21.600 used
DE        6.00 used
TE        295.2 K
D1        1.0000000 sec
d11      0.03000000 sec
MCREST   0.00000000 sec
MCWRK    0.01500000 sec

```

===== CHANNEL f1 =====
NUC1 13C
P1 8.20 usec
PL1 1.50 dB
SF01 100.6234215 MHz

```
===== CHANNEL f2 =====
CPDPRG2          waltz16
NUC2              1H
PCPD2            80.00 usec
PL2               5.00 dB
PL12              23.00 dB
SF02             400.1320007 MHz
```

```

F2 - Processing parameters
SI           32768
SF          100.6127690 MHz
WDW          EM
SSB           0
LB            4.00 Hz
GB           0
PC           1.40

```

```

1D NMR plot parameters
CX           20.00 cm
CY           8.00 cm
F1P          220.000 ppm
F1           22134.81 Hz
F2P          -10.000 ppm
F2           -1006.13 Hz
PPMCM        11.50000 ppm/cm
HZCM        1157.04688 Hz/cm

```

curvif
o = ocos
p = 0cos

1H NMR WDY-548 IN CDCl₃ 08/06/20



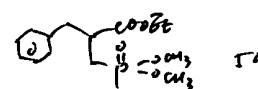
Current Data Parameters
 NAME wdy
 EXPNO 861
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080620
 Time 14.03
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 18
 DW 62.400 usec
 DE 6.00 usec
 TE 296.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

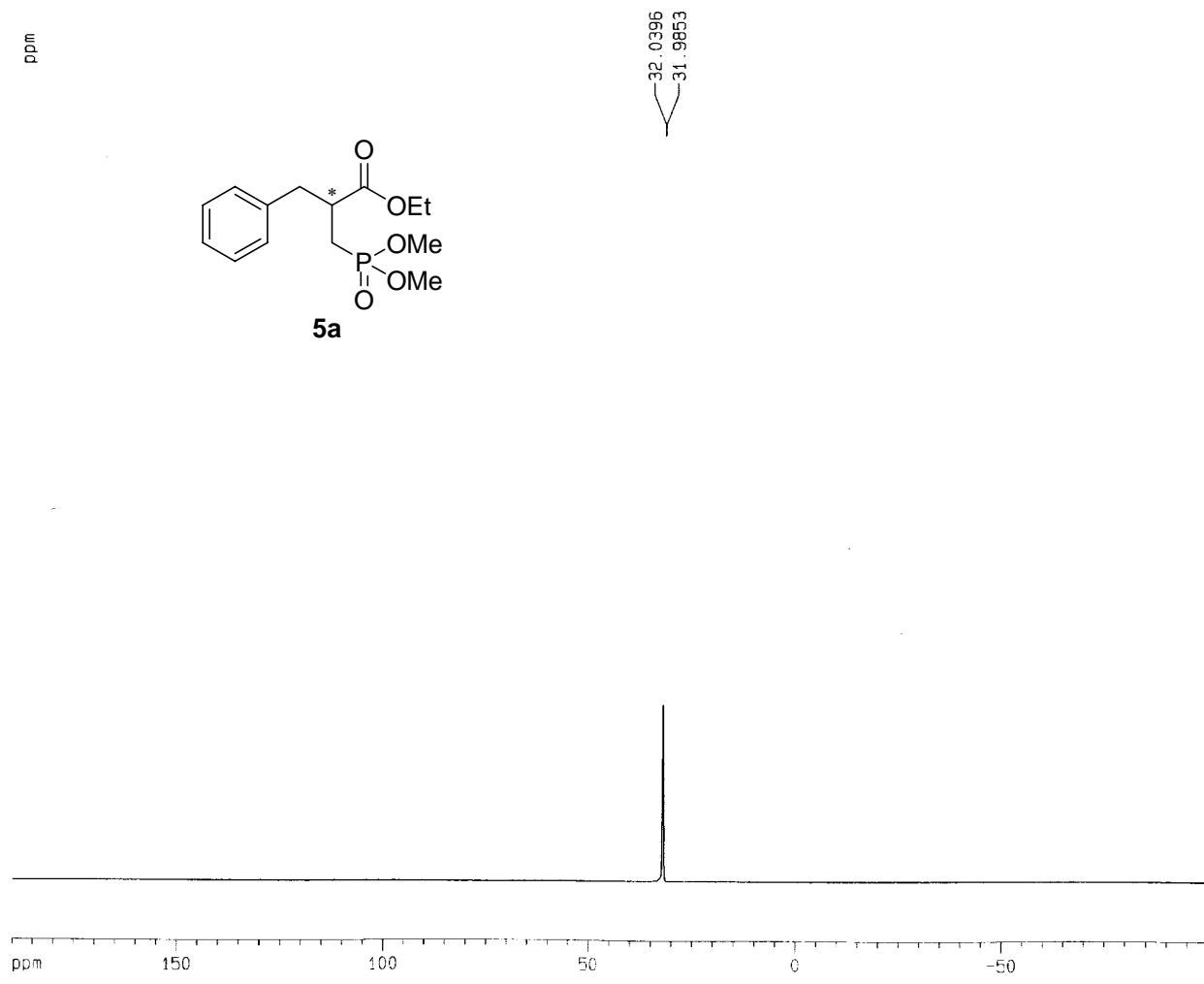
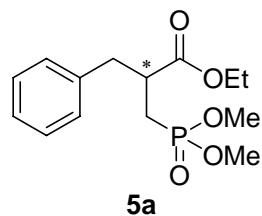
F2 - Processing parameters
 SI 32768
 SF 400.1299917 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm



31P NMR WDY-548 IN CDCl₃ 08/06/20

ppm



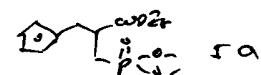
Current Data Parameters
NAME wdy
EXPNO 862
PROCNO 1

F2 - Acquisition Parameters
Date_ 20080620
Time 14.06
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 21
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 295.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

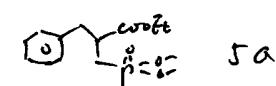
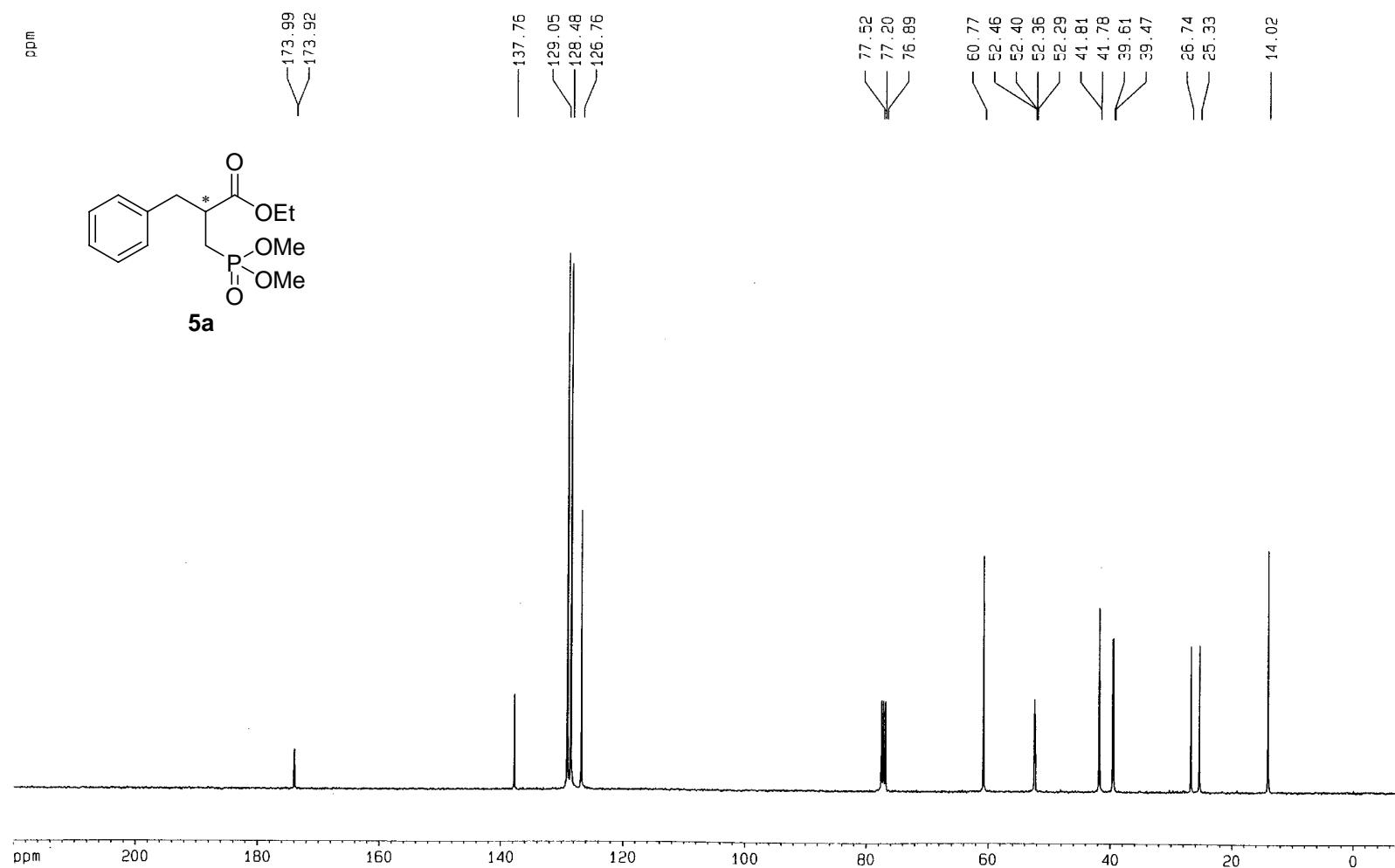
===== CHANNEL f1 =====
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

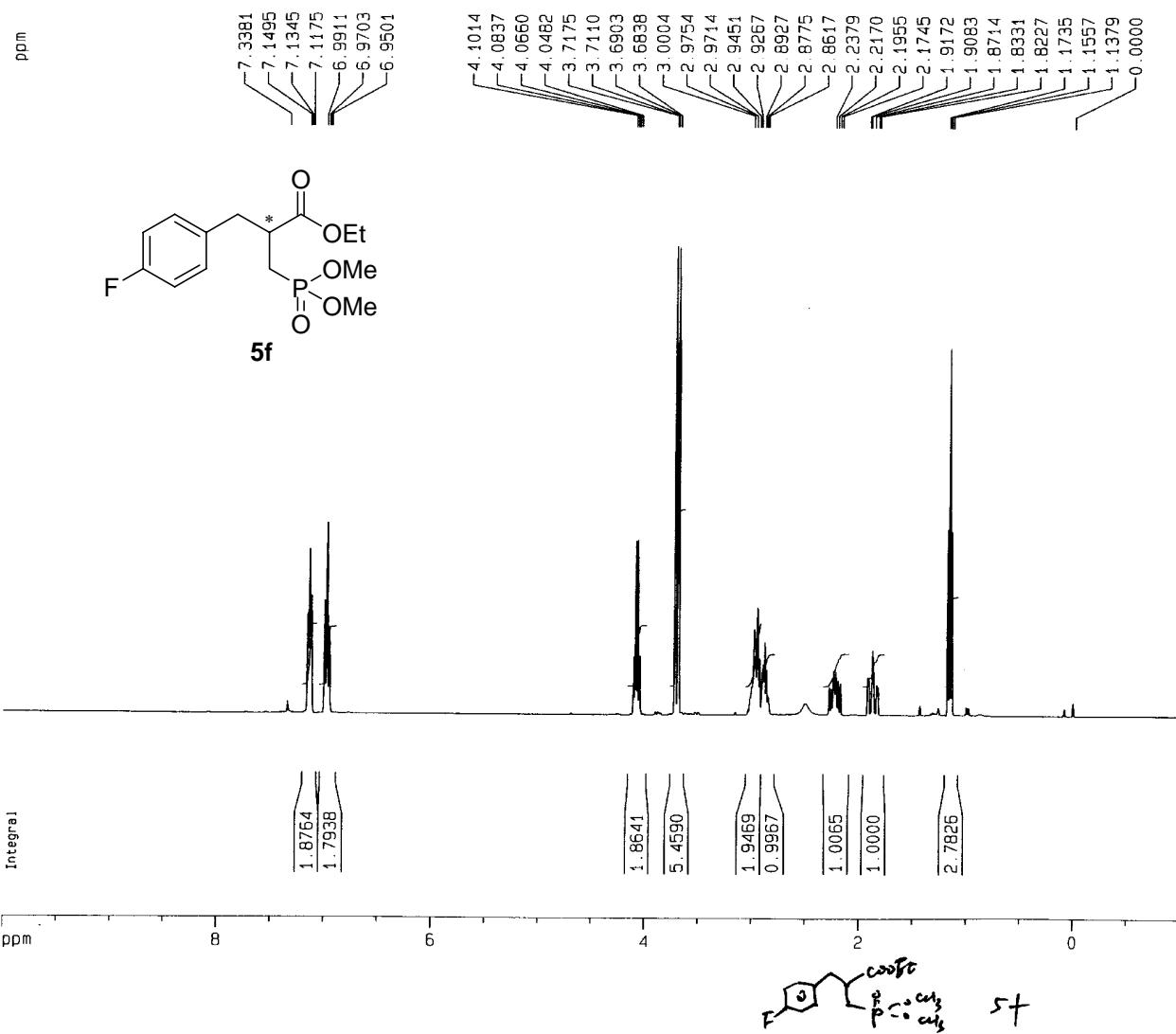
1D NMR plot parameters
CX 20.00 cm
CY 3.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



13C NMR WDY-548 IN CDCl₃ 08/06/20



1H NMR WDY-549 IN CDCl₃ 08/06/20



Current Data Parameters
 NAME wdy
 EXPNO 864
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080620
 Time 14.52
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 18
 DW 62.400 usec
 DE 6.00 usec
 TE 296.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

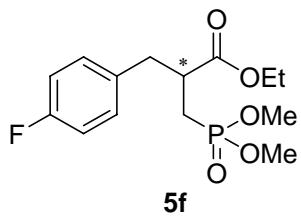
===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

F2 - Processing parameters
 SI 32768
 SF 400.1299829 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

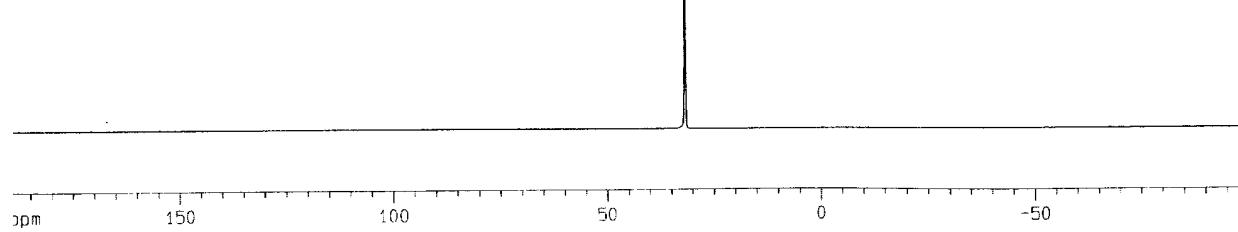
1D NMR plot parameters
 CX 20.00 cm
 CY 8.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07149 Hz/cm

31P NMR WDY-549 IN CDCl₃ 08/06/20

ppm



31.8096
31.7604



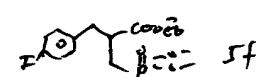
Current Data Parameters
NAME wdy
EXPNO 865
PROCNO 1

F2 - Acquisition Parameters
Date_ 20080620
Time 14.55
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 24
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 296.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

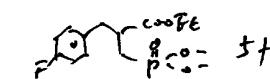
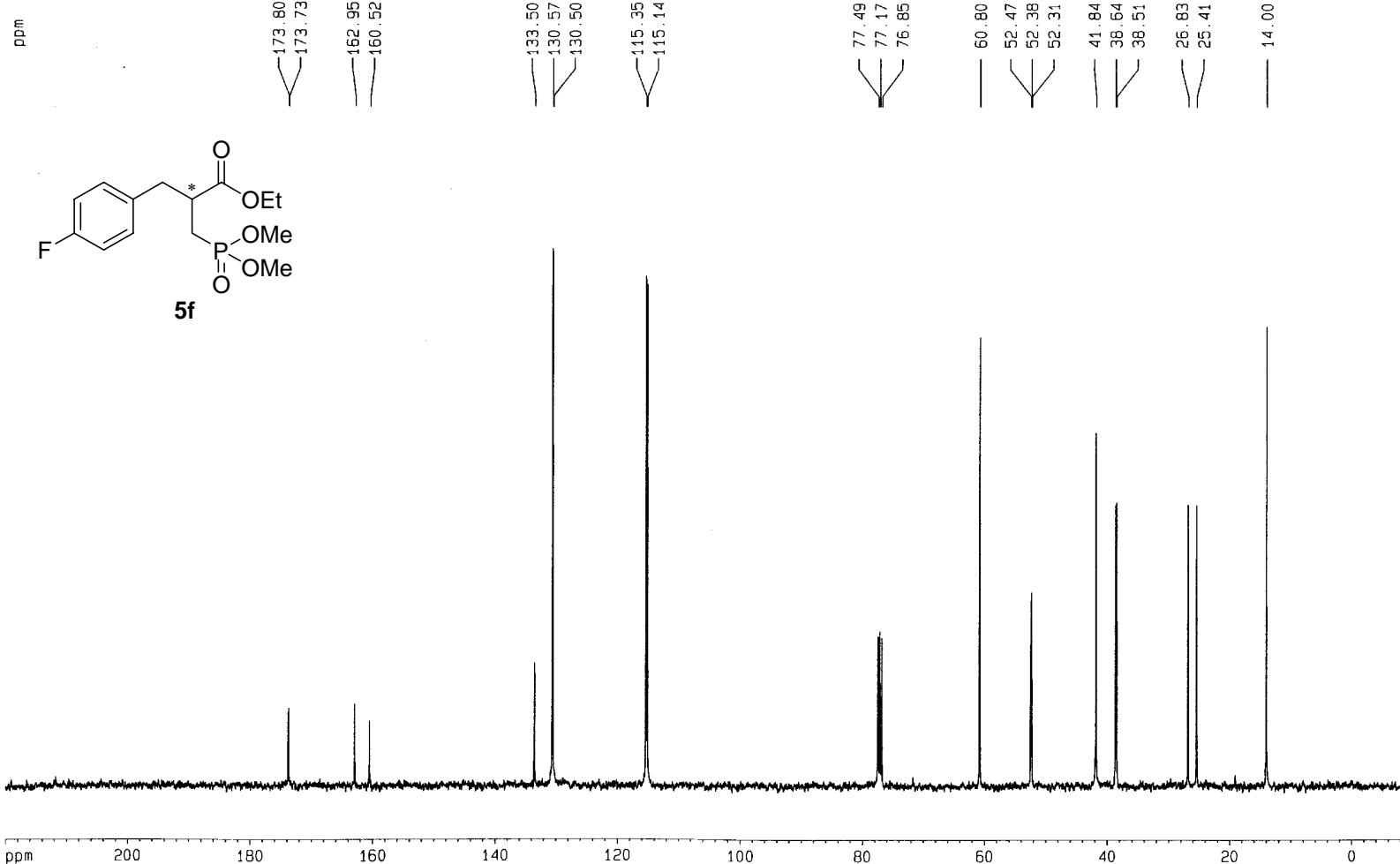
===== CHANNEL f1 ======
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 3.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm

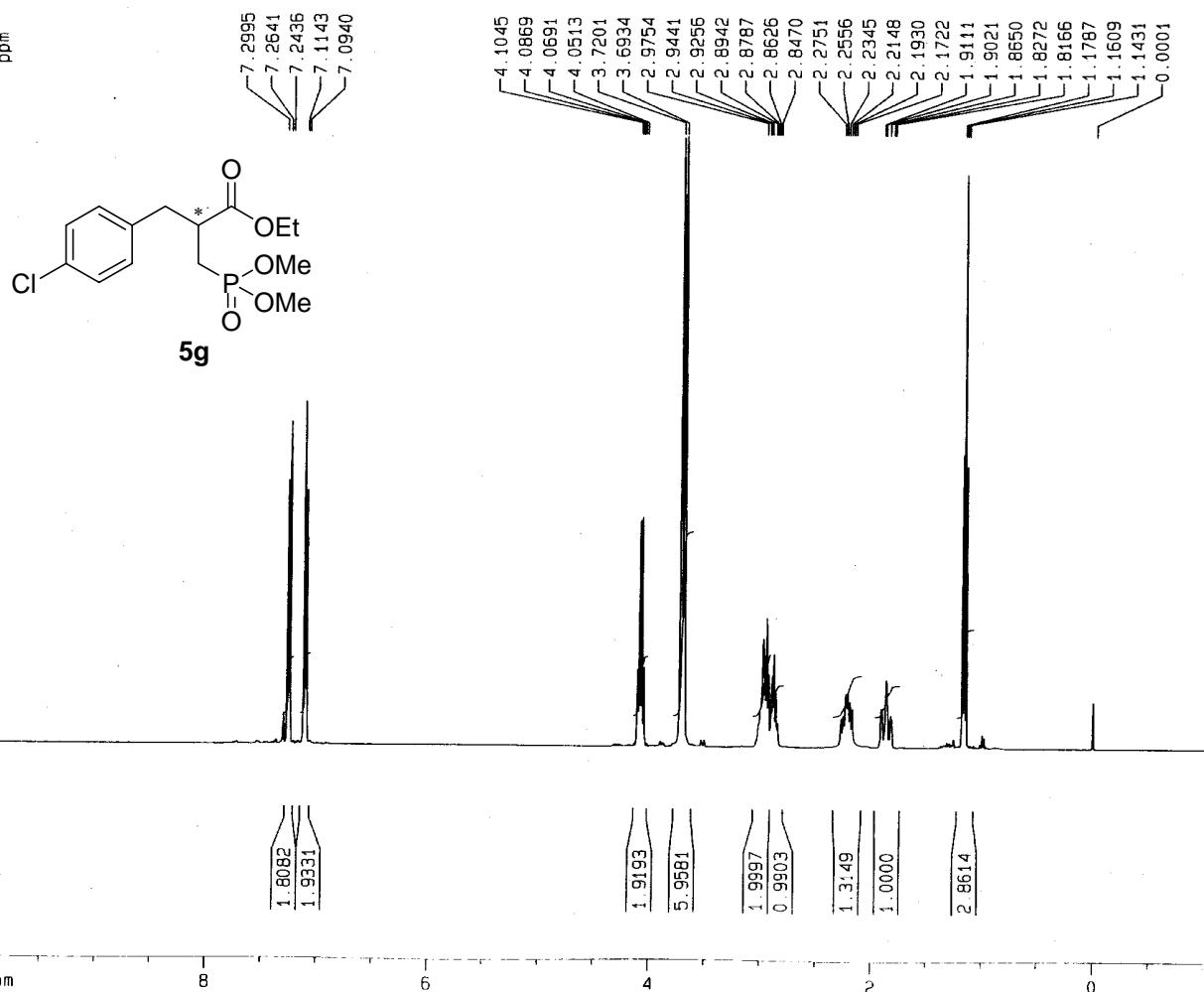


¹³C NMR WDY-549 IN CDCl₃ 08/06/20



1H NMR WDY-2 IN CDCl₃ 08/07/25

ppm



Current Data Parameters

NAME wdy
EXPNO 894
PROCNO 1

F2 - Acquisition Parameters

Date 20080725
Time 12.17
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 25.4
DW 62.400 usec
DE 6.00 usec
TE 297.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

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

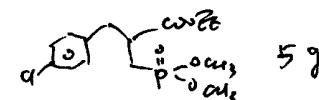
NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

F2 - Processing parameters

SI 32768
SF 400.1299984 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

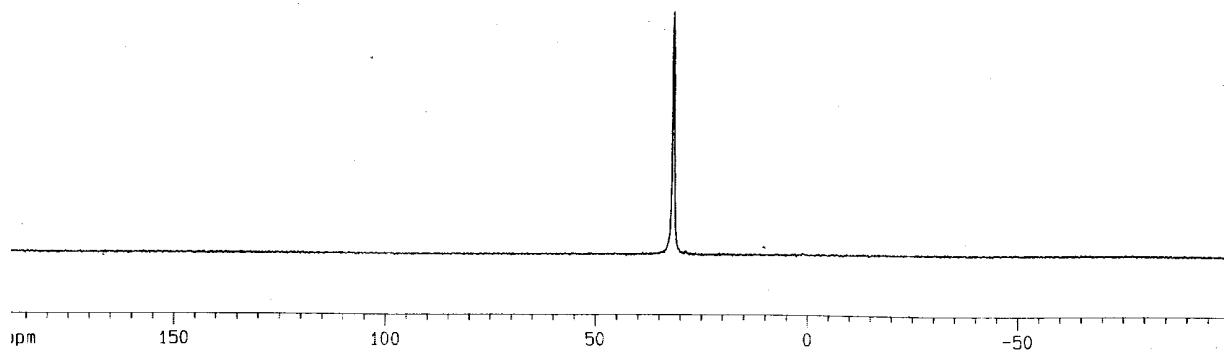
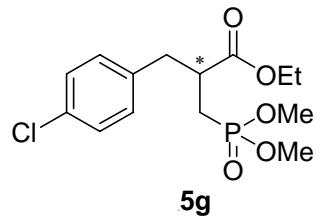
1D NMR plot parameters

CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 4001.30 Hz
F2P -1.000 ppm
F2 -400.13 Hz
DPMCM 0.55000 ppm/cm
HZCM 220.07150 Hz/cm



³¹P NMR WDV-2 IN CDCl₃ 08/07/25

ppm



Current Data Parameters

NAME wdy
EXPNO 895
PROCNO 1

F2 - Acquisition Parameters

Date 20080725
Time 12.20
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 23
DS 0
SWH 48543.688 Hz
FIORES 1.481436 Hz
AQ 0.3375604 sec
RG 229.8
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCHBK 0.0150000 sec

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

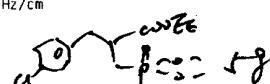
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters

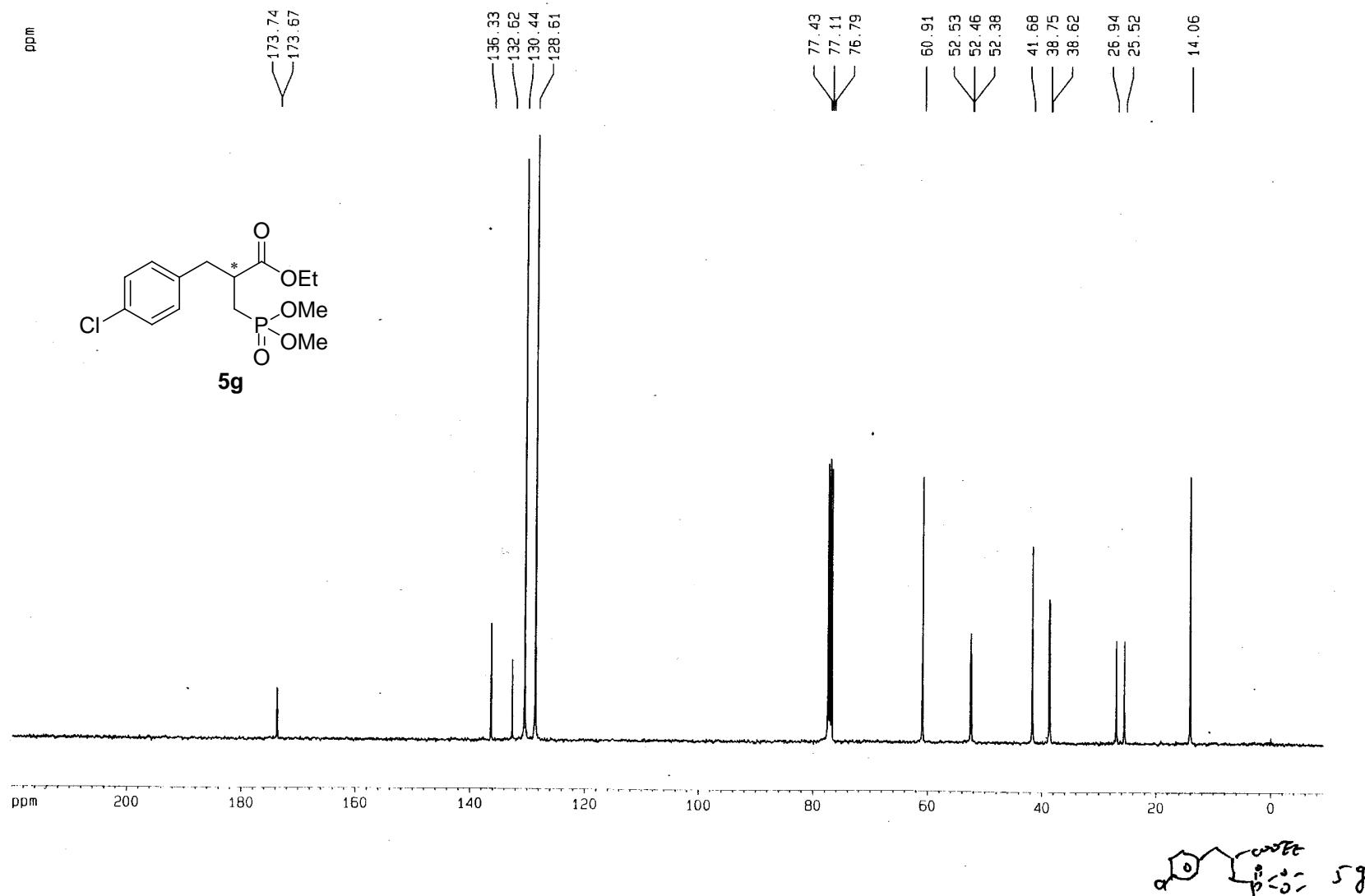
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters

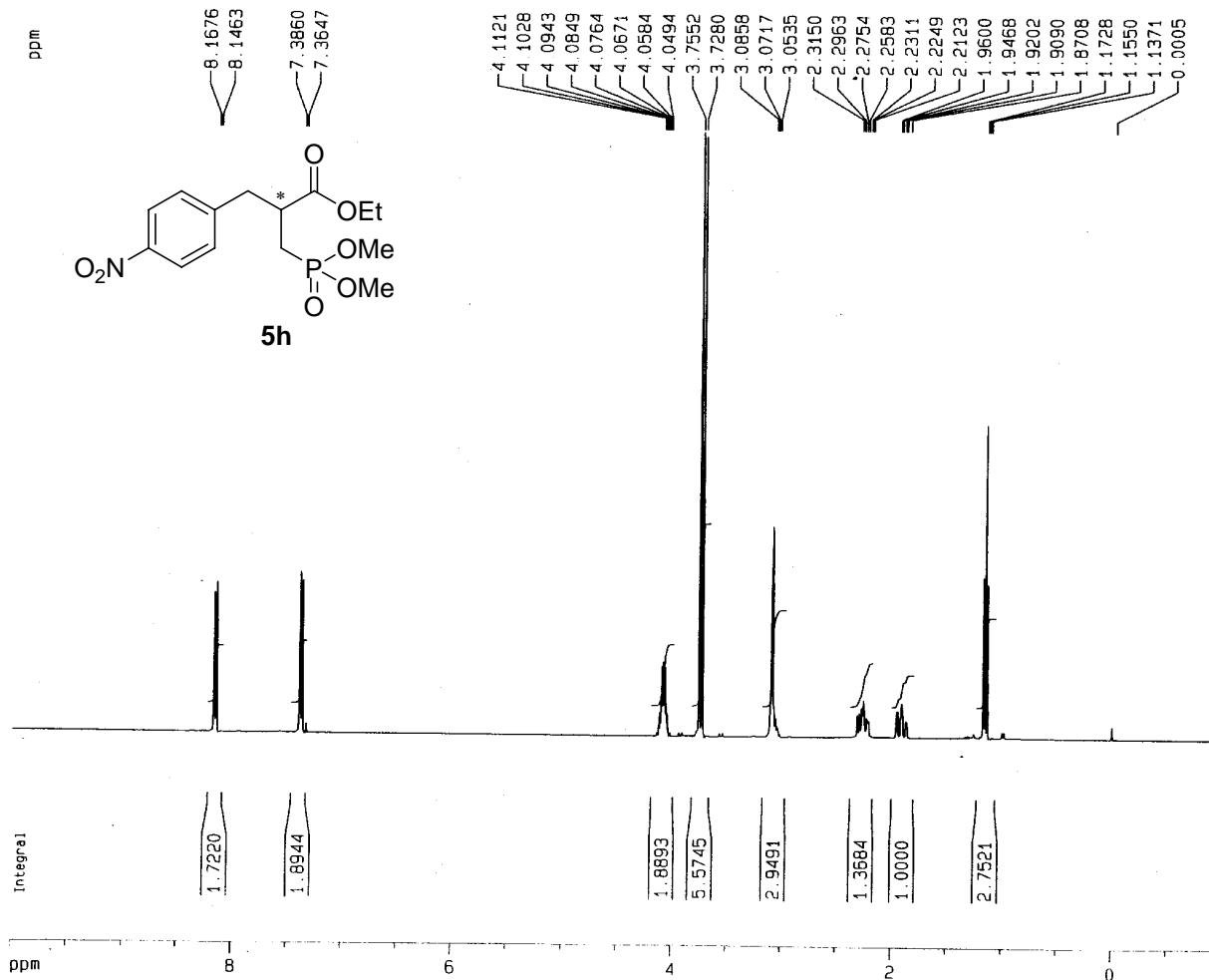
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-2 IN CDCL₃ 08/07/25



1H NMR WDY-3 IN CDCl₃ 08/07/25



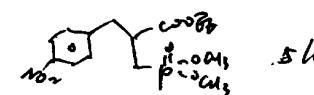
Current Data Parameters
 NAME wdy
 EXPNO 897
 PROCND 1

F2 - Acquisition Parameters
 Date_ 20080725
 Time 12.57
 INSTRUM grx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 25.4
 DW 62.400 usec
 DE 6.00 usec
 TE 297.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 ======
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

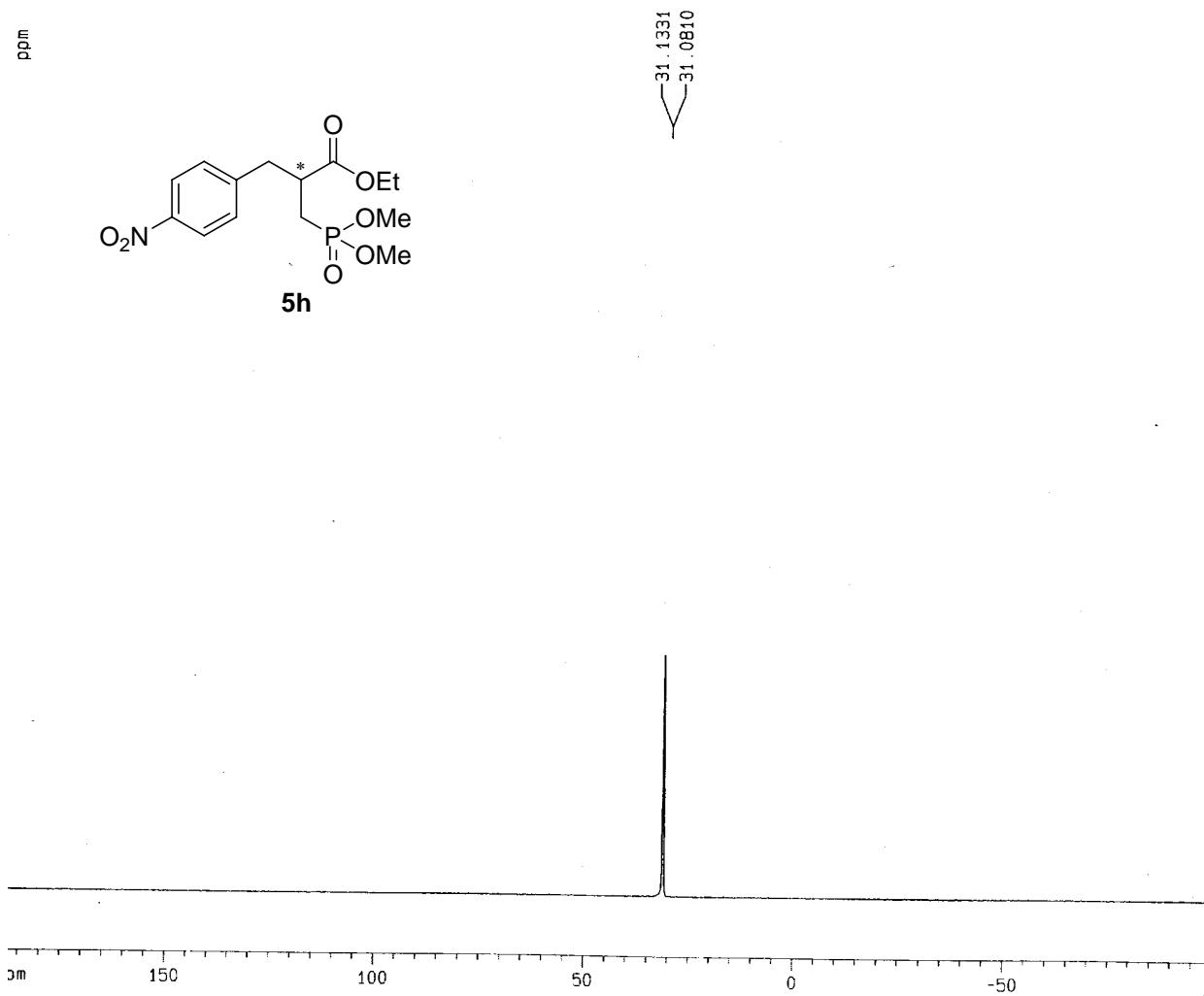
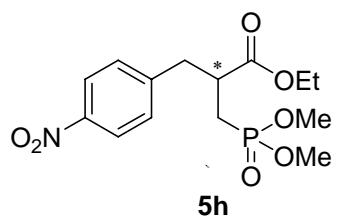
F2 - Processing parameters
 SI 32768
 SF 400.1299886 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07149 Hz/cm



31P NMR WDY-3 IN CDCl₃ 08/07/25

ppm



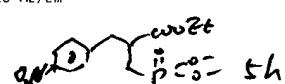
Current Data Parameters
 NAME wdy
 EXPNO 898
 PROCN 1

F2 - Acquisition Parameters
 Date 20080725
 Time 12.59
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 22
 DS 0
 SWH 48543.688 Hz
 FIDRES 1.481436 Hz
 AQ 0.3375604 sec
 RG 2298.8
 DW 10.300 usec
 DE 6.00 usec
 TE 297.2 K
 D1 2.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

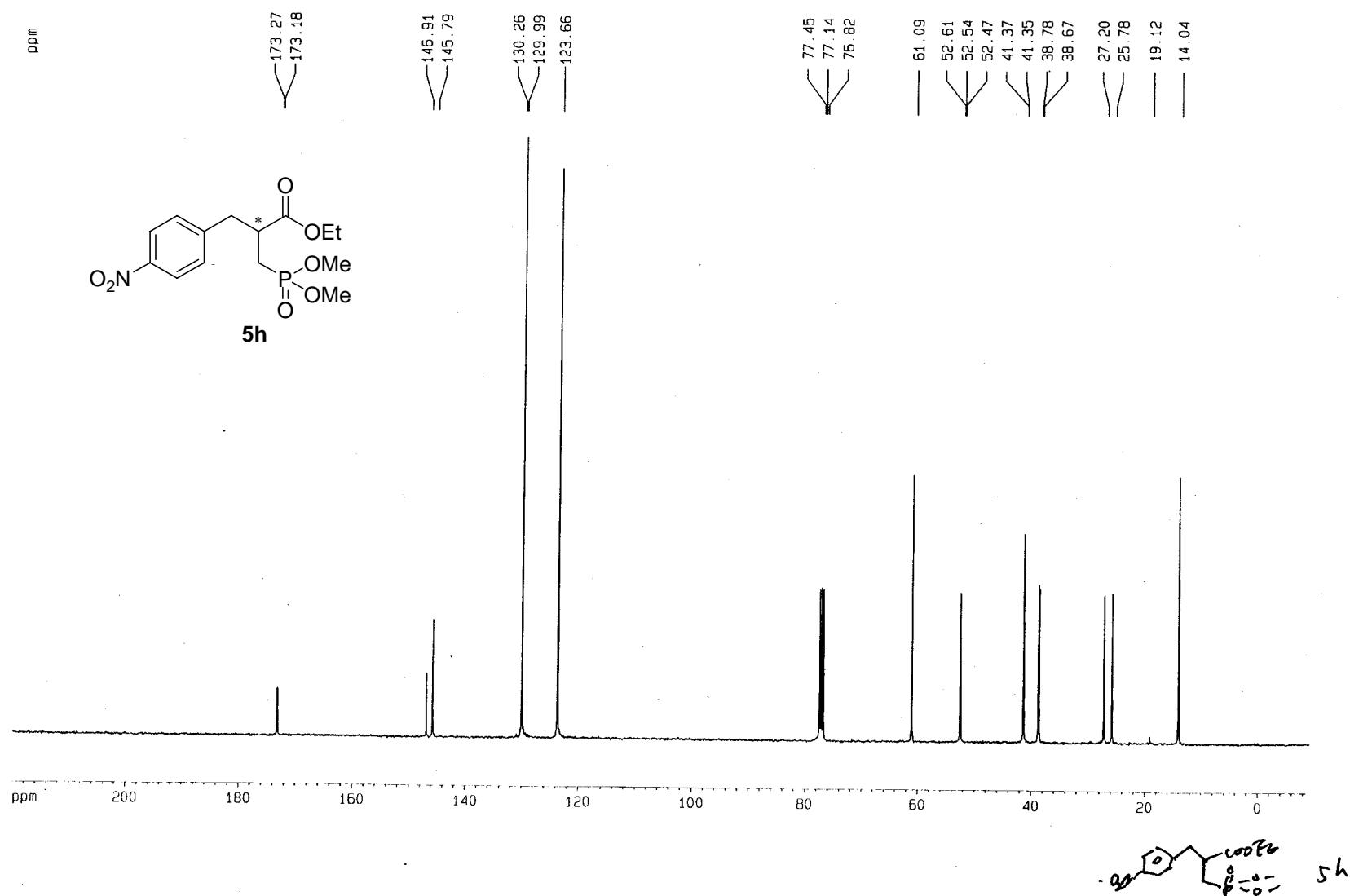
===== CHANNEL f1 ======
 NUC1 31P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

F2 - Processing parameters
 SI 16384
 SF 161.9755337 MHz
 WDM EM
 SSB 0
 LB 5.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 4.00 cm
 F1P 190.000 ppm
 F1 30775.35 Hz
 F2P -100.000 ppm
 F2 -16197.55 Hz
 PPMCM 14.50000 ppm/cm
 HZCM 2348.64526 Hz/cm

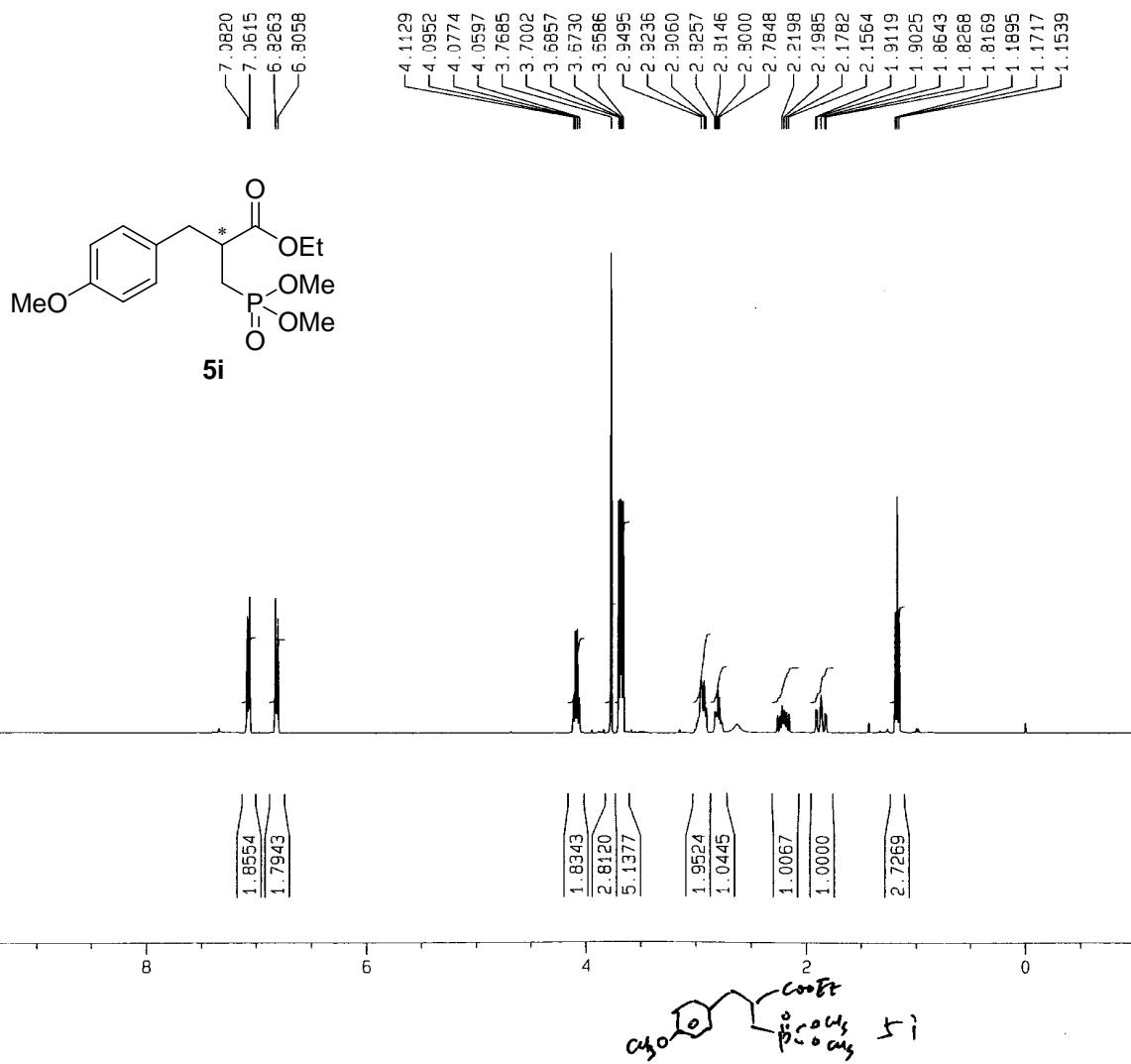


¹³C NMR WDY-3 IN CDCL₃ 08/07/25



1H NMR WDY-557 IN CDCl₃ 08/06/20

ppm



Current Data Parameters

NAME wdy
EXPNO 867
PROCNO 1

F2 - Acquisition Parameters

Date_ 20080620
Time 15.07
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 8
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 18
DW 62.400 usec
DE 6.00 usec
TE 296.2 K
D1 1.0000000 sec
MCREST 0.0000000 sec
MCWARK 0.0150000 sec

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

NUC1 1H
P1 8.20 usec
PL1 5.00 dB
SF01 400.1332521 MHz

F2 - Processing parameters

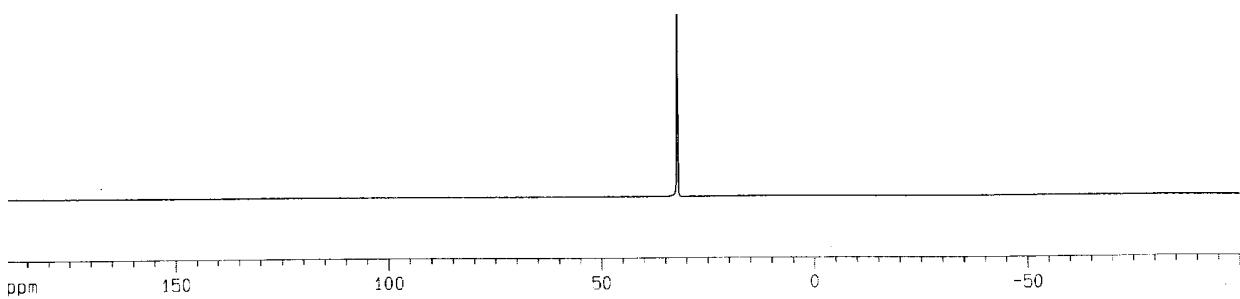
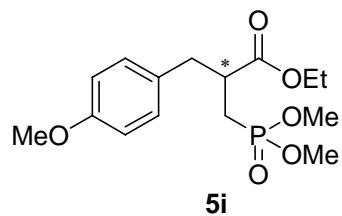
SI 32768
SF 400.1299812 MHz
WDW GM
SSB 0
LB -0.50 Hz
GB 0.1
PC 1.40

1D NMR plot parameters

CX 20.00 cm
CY 8.00 cm
F1P 10.000 ppm
F1 4001.30 Hz
F2P -1.000 ppm
F2 -400.13 Hz
PPMCM 0.55000 ppm/cm
HZCM 220.07149 Hz/cm

31P NMR WDY-557 IN CDCl₃ 08/06/20

ppm



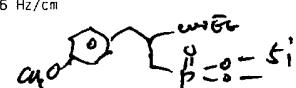
Current Data Parameters
 NAME wdy
 EXPNO 868
 PROCNO 1

F2 - Acquisition Parameters
 Date 20080620
 Time 15.10
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 21
 DS 0
 SWH 48543.688 Hz
 FIDRES 1.481436 Hz
 AQ 0.3375604 sec
 RG 2298.8
 DW 10.300 usec
 DE 6.00 usec
 TE 296.2 K
 D1 2.0000000 sec
 MCREST 0.0000000 sec
 MCWAK 0.0150000 sec

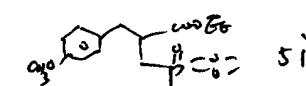
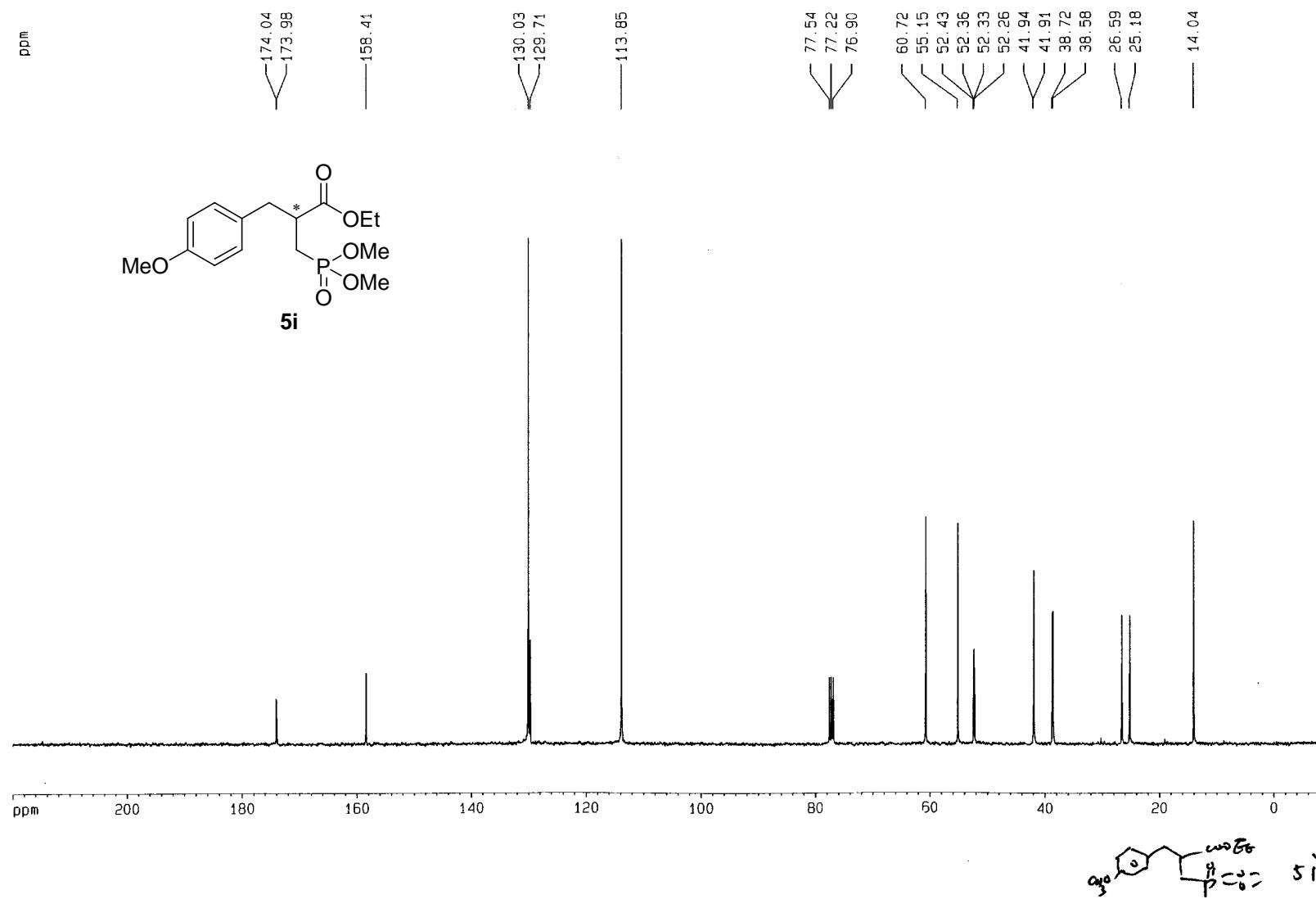
===== CHANNEL f1 =====
 NUC1 31P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

F2 - Processing parameters
 SI 16384
 SF 161.9755337 MHz
 WDW EM
 SSB 0
 LB 5.00 Hz
 GB 0
 PC 1.40

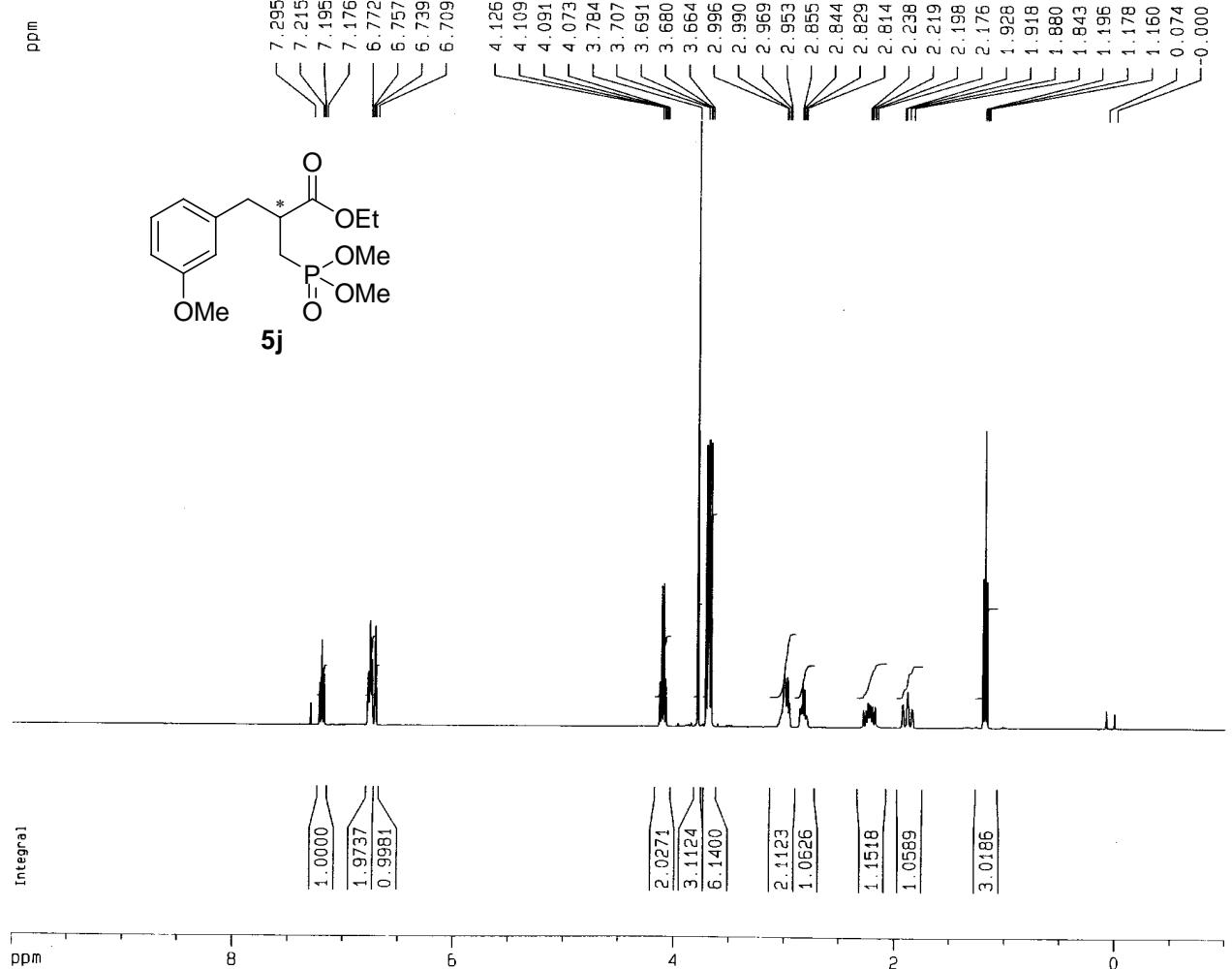
1D NMR plot parameters
 CX 20.00 cm
 CY 3.00 cm
 F1P 190.000 ppm
 F1 30775.35 Hz
 F2P -100.000 ppm
 F2 -16197.55 Hz
 PPMCM 14.50000 ppm/cm
 HZCM 2348.64526 Hz/cm



¹³C NMR WDY-557 IN CDCL₃ 08/06/20



1H NMR WDY-7 IN CDCl₃ 08/02/01



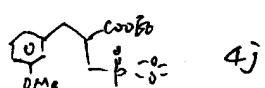
Current Data Parameters
 NAME wdy
 EXPNO 766
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080201
 Time 11.21
 INSTRUM drx400
 PHOBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 22.6
 DW 62.400 usec
 DE 6.00 usec
 TE 295.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 ======
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

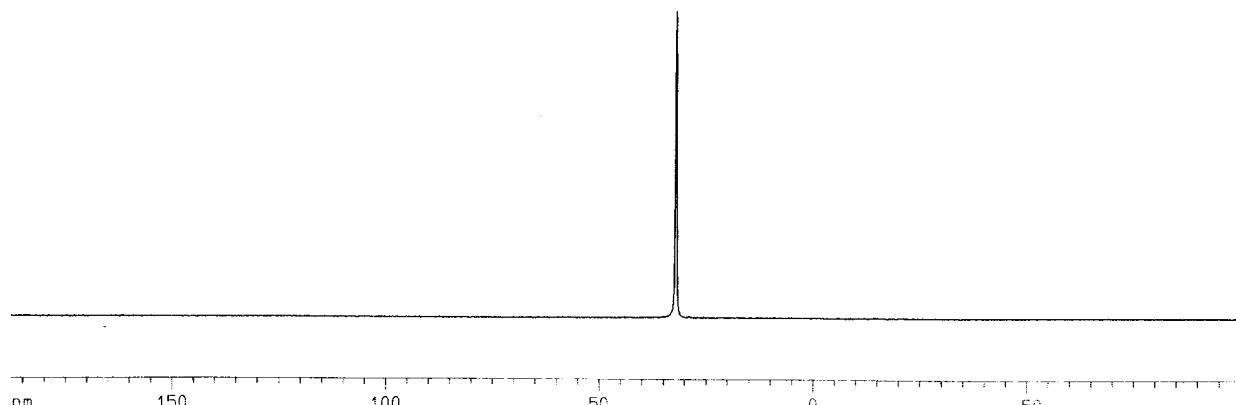
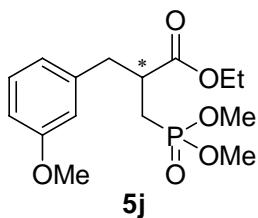
F2 - Processing parameters
 SI 32768
 SF 400.1300023 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm



31P NMR WDY-7 IN CDCL3 08/02/01

ppm



Current Data Parameters

NAME wdy
EXPNO 765
PROCNO 1

F2 - Acquisition Parameters

Date 20080201
Time 10.45
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 39
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 5792.6
DW 10.300 usec
DE 6.00 usec
TE 294.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

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

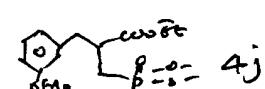
NUC1 31P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

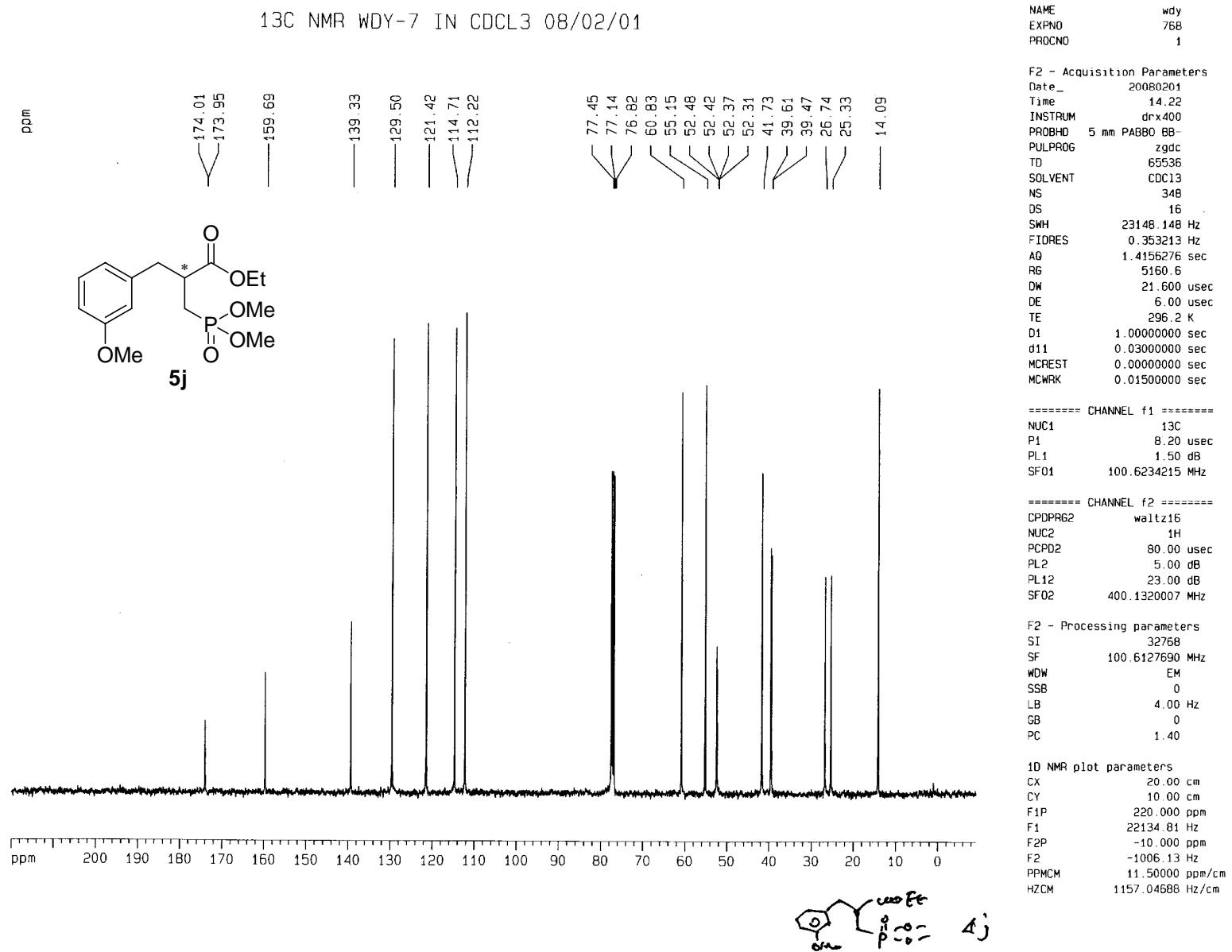
F2 - Processing parameters

SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

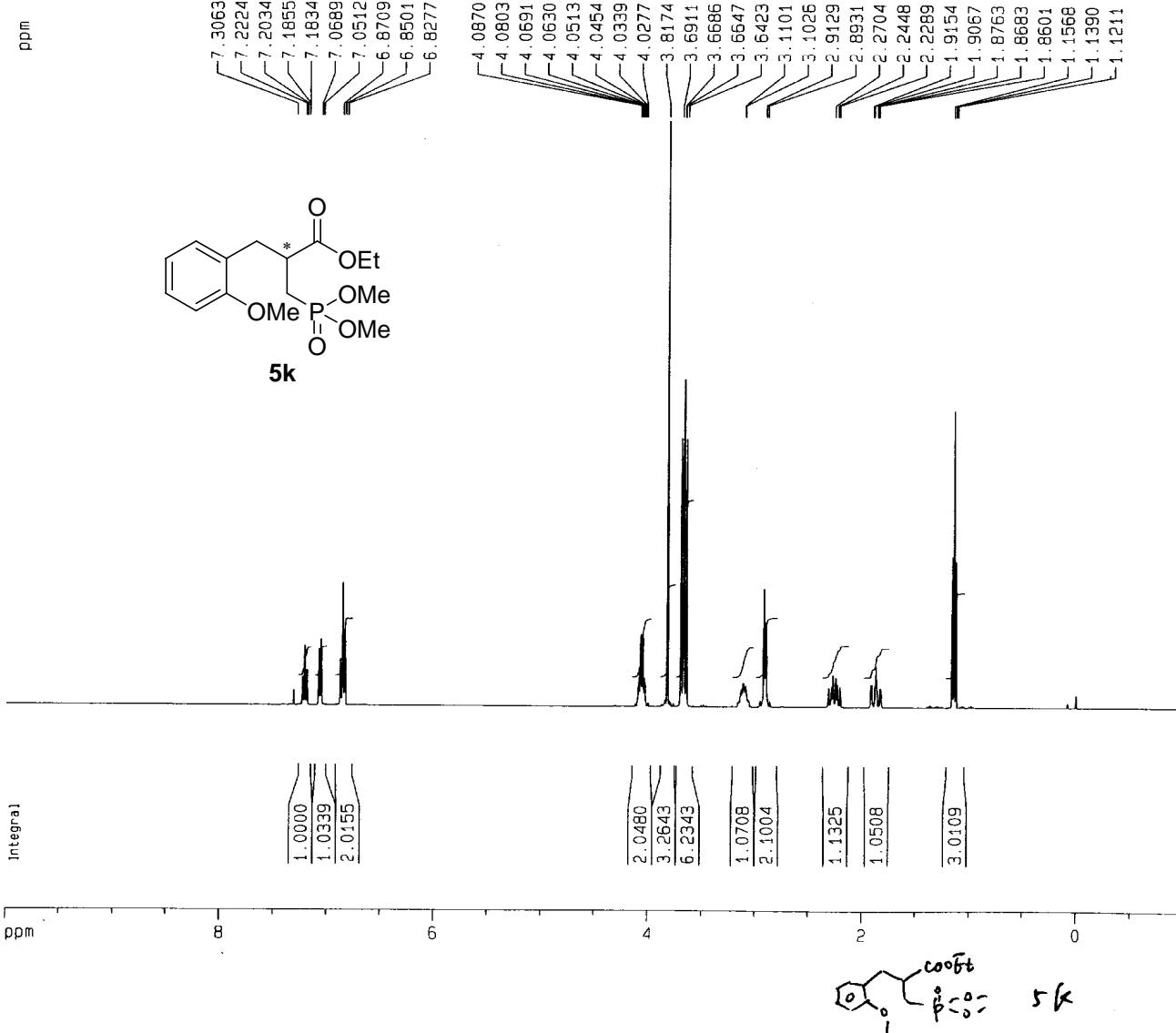
1D NMR plot parameters

CX 20.00 cm
CY 5.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm





1H NMR WDY-6 IN CDCl₃ 08/02/01



Current Data Parameters
 NAME wdy
 EXPNO 763
 PROCNO 1

F2 - Acquisition Parameters
 Date 20080201
 Time 10.37
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 22.6
 DW 62.400 usec
 DE 6.00 usec
 TE 294.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

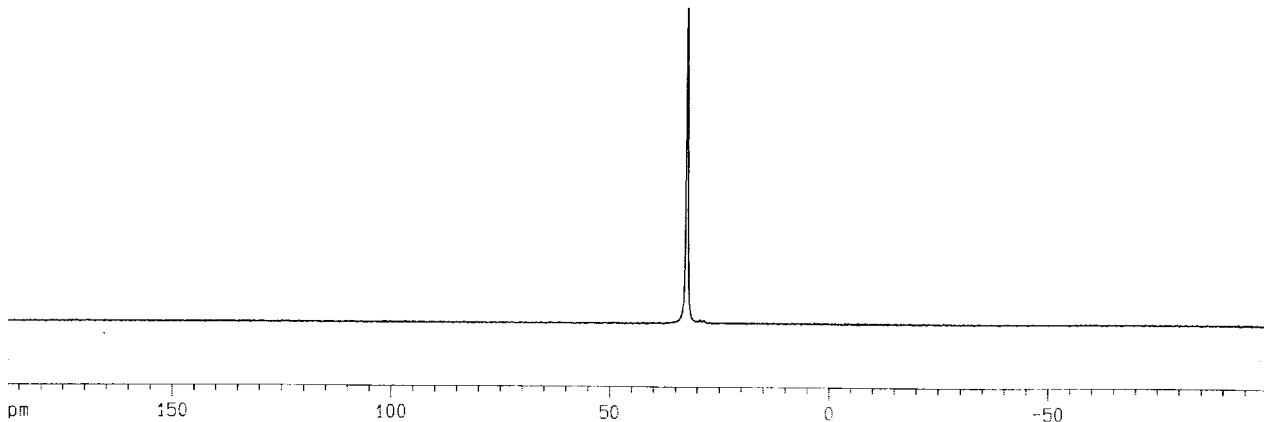
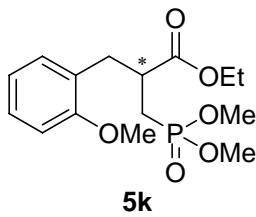
===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

F2 - Processing parameters
 SI 32768
 SF 400.1299976 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm

³¹P NMR WDY-6 IN CDCl₃ 08/02/01

ppm



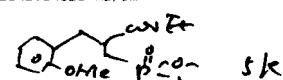
Current Data Parameters
 NAME wdy
 EXPNO 764
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080201
 Time 10.40
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 28
 DS 0
 SWH 48543.688 Hz
 FIDRES 1.481436 Hz
 AQ 0.3375604 sec
 RG 5792.6
 DW 10.300 usec
 DE 6.00 usec
 TE 294.2 K
 D1 2.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

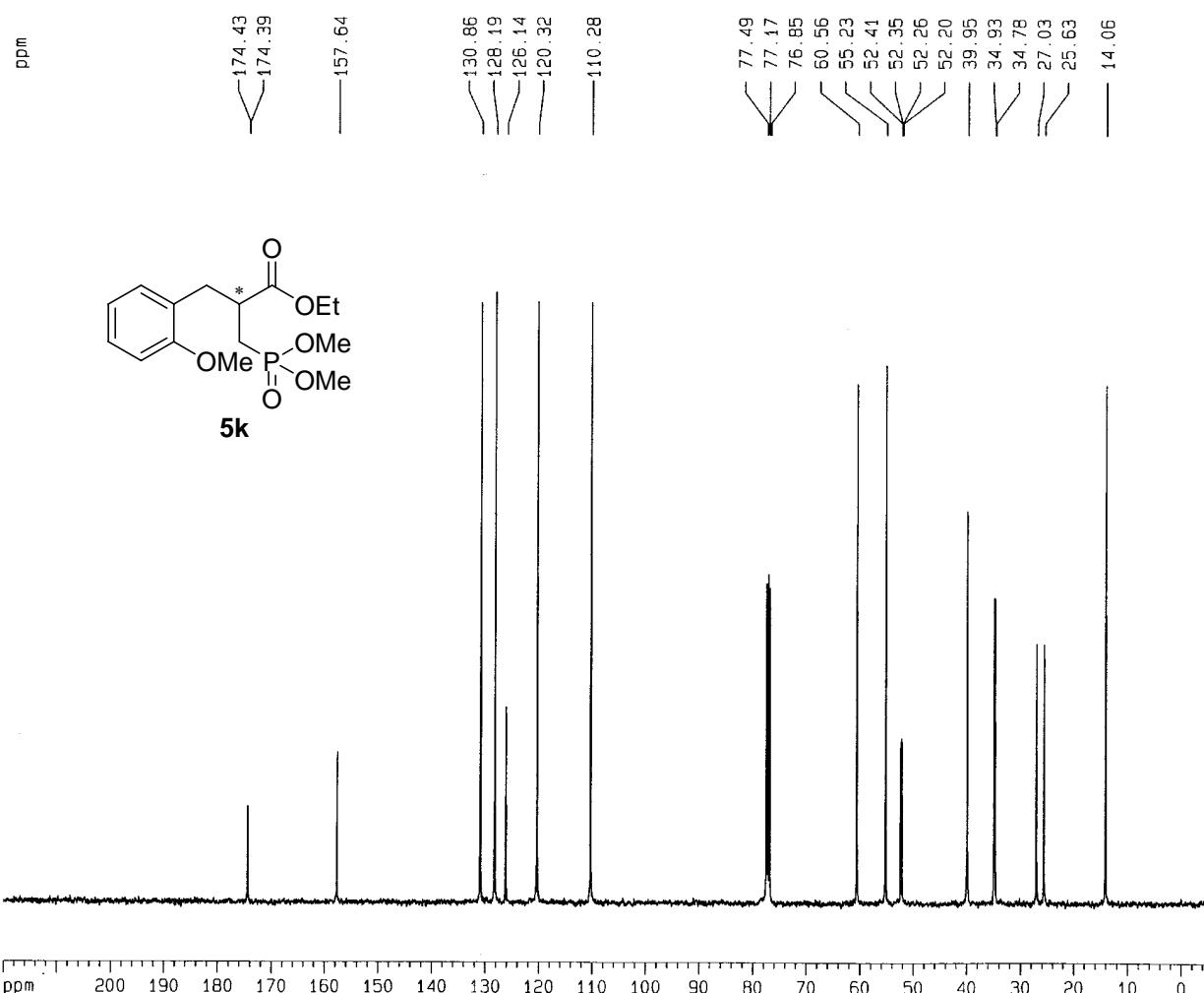
===== CHANNEL f1 ======
 NUC1 ³¹P
 P1 8.00 usec
 PL1 0.00 dB
 SF01 161.9820520 MHz

F2 - Processing parameters
 S1 16384
 SF 161.9755337 MHz
 WDW EM
 SSB 0
 LB 5.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 5.00 cm
 F1P 190.000 ppm
 F1 30775.35 Hz
 F2P -100.000 ppm
 F2 -16197.55 Hz
 PPMCM 14.50000 ppm/cm
 HZCM 2348.64526 Hz/cm



13C NMR WDY-6 IN CDCl₃ 08/02/01



Current Data Parameters
 NAME wdy
 EXPNO 767
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080201
 Time 14.01
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zgdc
 TD 65536
 SOLVENT CDCl₃
 NS 434
 DS 16
 SWH 23148.148 Hz
 FIDRES 0.353213 Hz
 AQ 1.4156276 sec
 RG 5160.6
 DW 21.600 usec
 DE 6.00 usec
 TE 296.2 K
 D1 1.0000000 sec
 d11 0.03000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.01500000 sec

===== CHANNEL f1 ======
 NUC1 13C
 P1 8.20 usec
 PL1 1.50 dB
 SF01 100.6234215 MHz

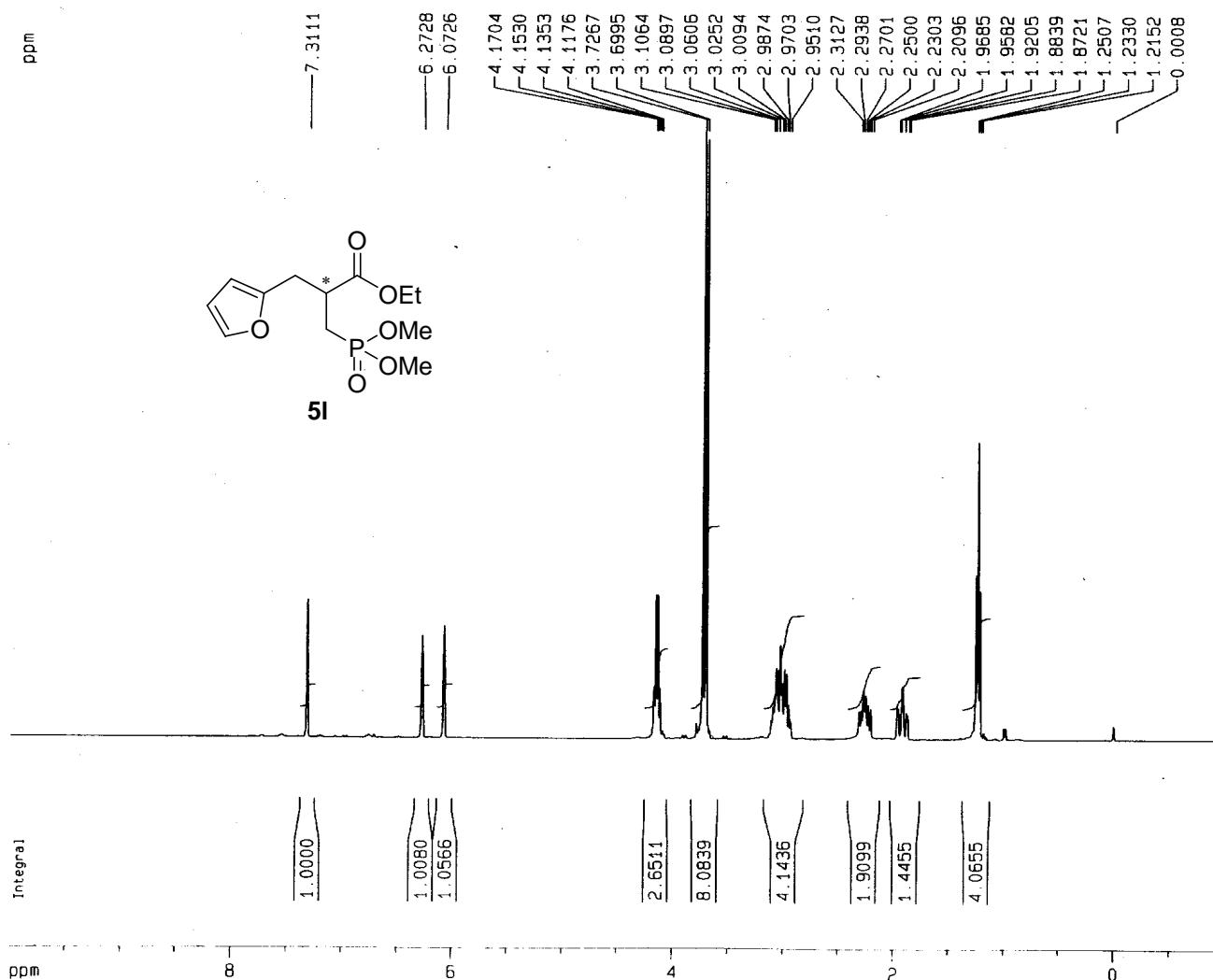
===== CHANNEL f2 ======
 CPDPRG2 waltz16
 NUC2 1H
 PCPD2 80.00 usec
 PL2 5.00 dB
 PL12 23.00 dB
 SF02 400.1320007 MHz

F2 - Processing parameters
 SI 32768
 SF 100.6127690 MHz
 WDW EM
 SSB 0
 LB 4.00 Hz
 GB 0
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 220.000 ppm
 F1 22134.81 Hz
 F2P -10.000 ppm
 F2 -1006.13 Hz
 PPMCM 11.50000 ppm/cm
 HZCM 1157.04688 Hz/cm

omega
 $\beta = 8^\circ$
5k

1H NMR WDV-4 IN CDCL₃ 08/07/25



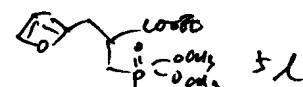
Current Data Parameters
 NAME wdy
 EXPNO 900
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080725
 Time 13.46
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 25.4
 DW 62.400 usec
 DE 6.00 usec
 TE 297.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

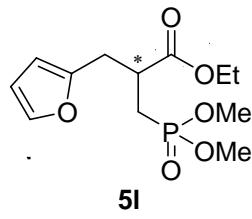
F2 - Processing parameters
 SI 32768
 SF 400.1299935 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30 Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm

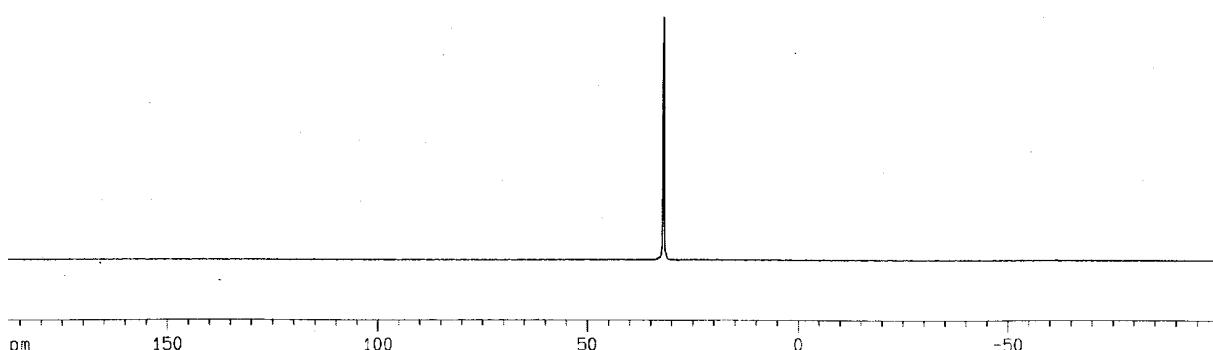


³¹P NMR WDY-4 IN CDCl₃ 08/07/25

ppm



5l



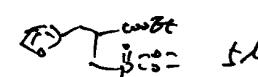
Current Data Parameters
NAME wdy
EXPNO 901
PROCNO 1

F2 - Acquisition Parameters
Date 20080725
Time 13.48
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 23
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.0150000 sec

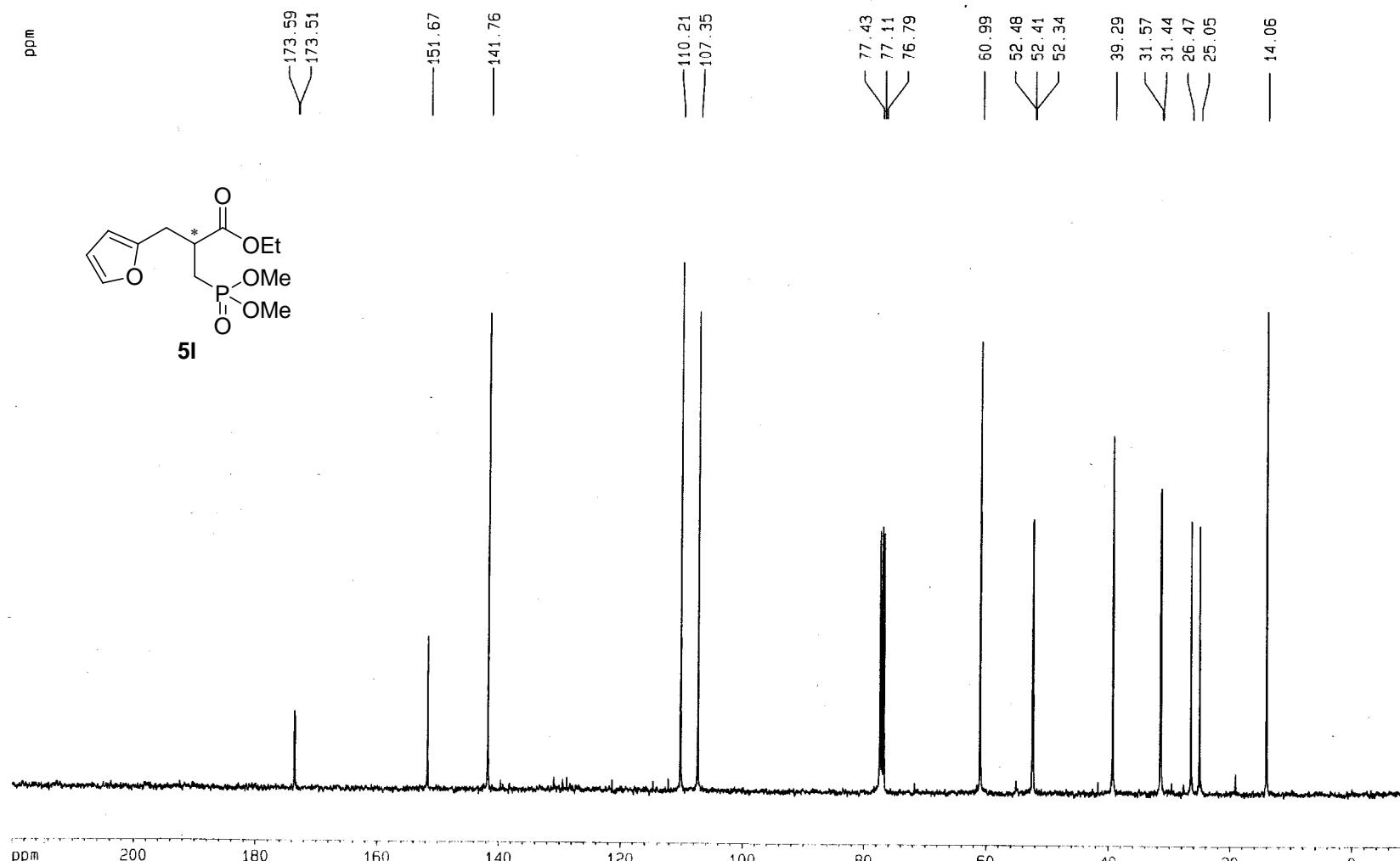
===== CHANNEL f1 =====
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

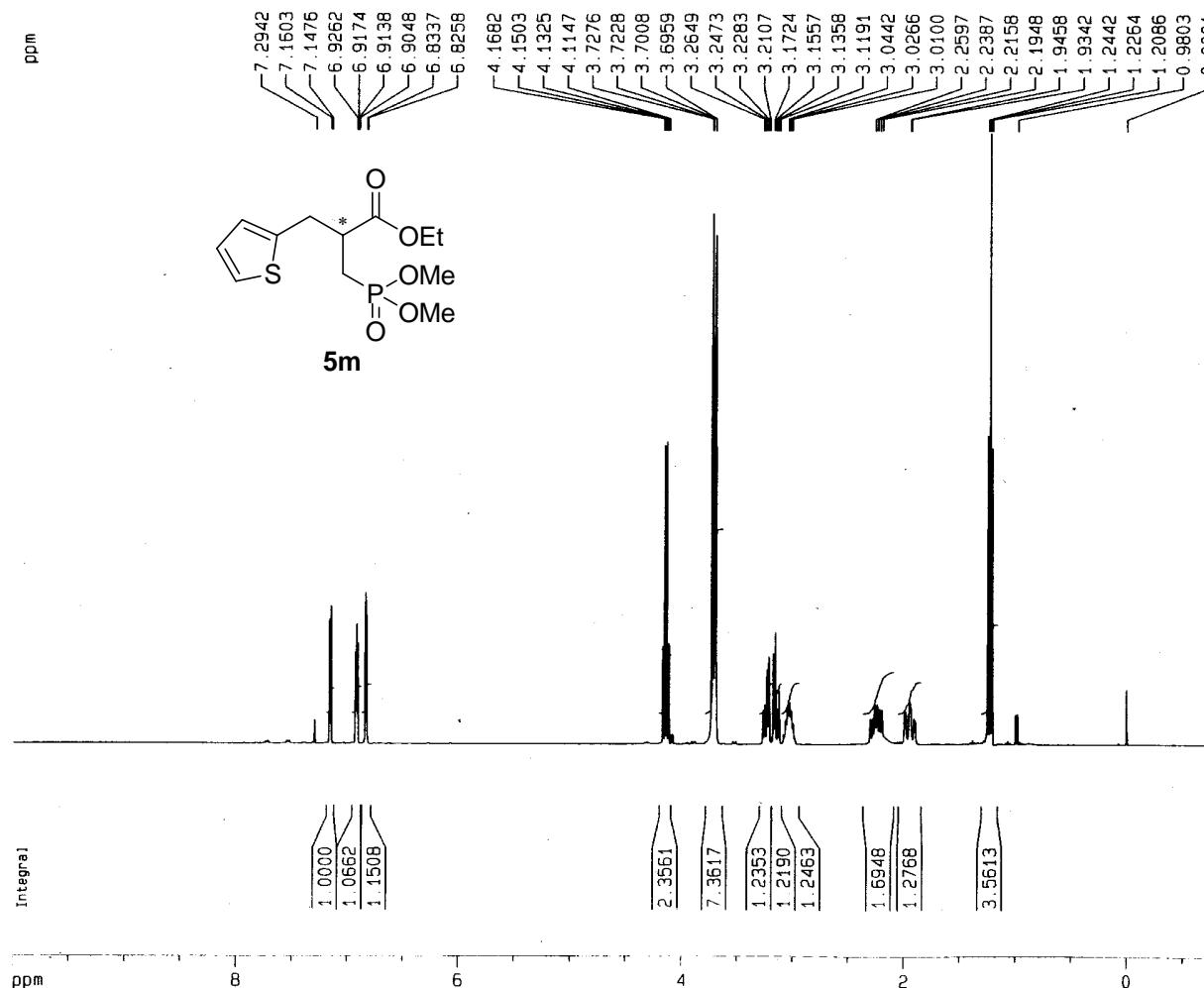
1D NMR plot parameters
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-4 IN CDCL₃ 08/07/25



1H NMR WDY-5 IN CDCl₃ 08/07/25



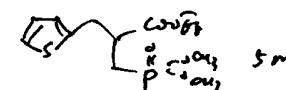
Current Data Parameters
 NAME wdy
 EXPNO 903
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080725
 Time 14.13
 INSTRUM drx400
 PROBHD 5 mm PABBO BB-
 PULPROG zg
 TD 32768
 SOLVENT CDCl₃
 NS 8
 DS 0
 SWH 8012.820 Hz
 FIDRES 0.244532 Hz
 AQ 2.0447731 sec
 RG 35.9
 DW 62.400 usec
 DE 6.00 usec
 TE 297.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 8.20 usec
 PL1 5.00 dB
 SF01 400.1332521 MHz

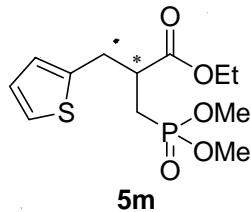
F2 - Processing parameters
 SI 32768
 SF 400.1300015 MHz
 WDW GM
 SSB 0
 LB -0.50 Hz
 GB 0.1
 PC 1.40

1D NMR plot parameters
 CX 20.00 cm
 CY 10.00 cm
 F1P 10.000 ppm
 F1 4001.30' Hz
 F2P -1.000 ppm
 F2 -400.13 Hz
 PPMCM 0.55000 ppm/cm
 HZCM 220.07150 Hz/cm

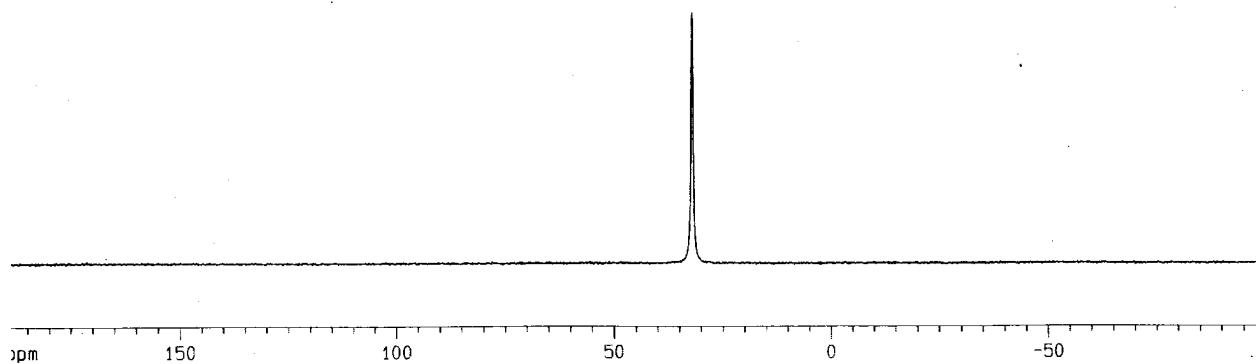


³¹P NMR WDY-5 IN CDCl₃ 08/07/25

ppm



32.0256



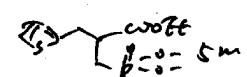
Current Data Parameters
NAME wdy
EXPNO 904
PROCNO 1

F2 - Acquisition Parameters
Date 20080725
Time 14.15
INSTRUM drx400
PROBHD 5 mm PABBO BB-
PULPROG zg
TD 32768
SOLVENT CDCl₃
NS 22
DS 0
SWH 48543.688 Hz
FIDRES 1.481436 Hz
AQ 0.3375604 sec
RG 2298.8
DW 10.300 usec
DE 6.00 usec
TE 297.2 K
D1 2.0000000 sec
MCREST 0.0000000 sec
MCWRK 0.01500000 sec

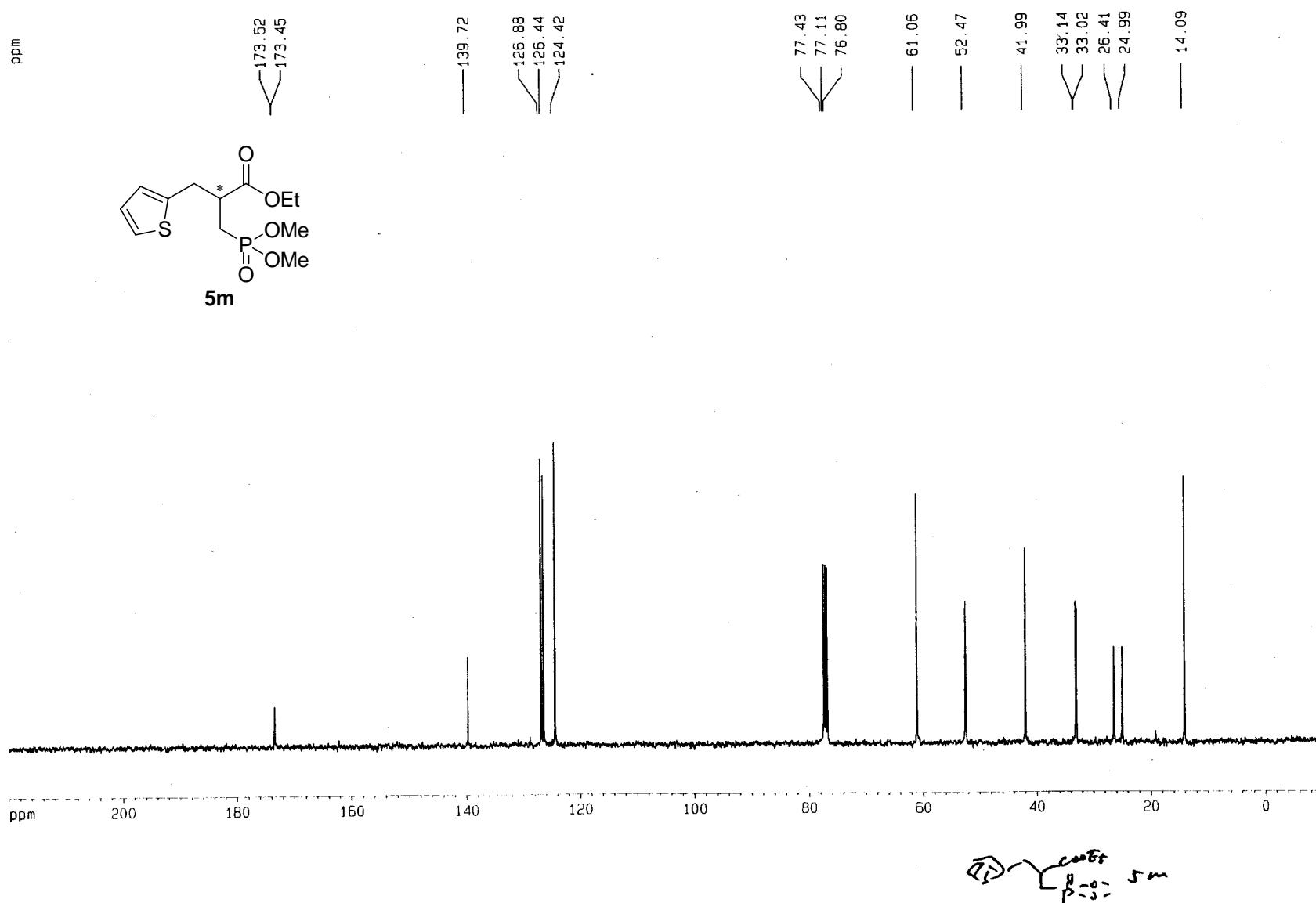
===== CHANNEL f1 =====
NUC1 ³¹P
P1 8.00 usec
PL1 0.00 dB
SF01 161.9820520 MHz

F2 - Processing parameters
SI 16384
SF 161.9755337 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
CY 4.00 cm
F1P 190.000 ppm
F1 30775.35 Hz
F2P -100.000 ppm
F2 -16197.55 Hz
PPMCM 14.50000 ppm/cm
HZCM 2348.64526 Hz/cm



¹³C NMR WDY-5 IN CDCl₃ 08/07/25



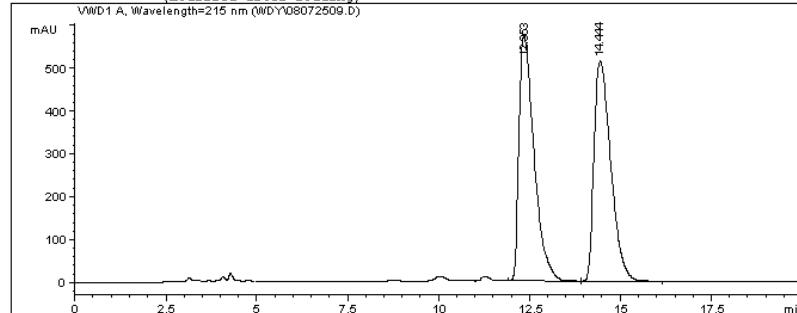
Data File C:\HPCHEM\2\DATA\WDY\08072509.D

Sample Name: 080720

Data File C:\HPCHEM\2\DATA\WDY\08072508.D

Sample Name: 080720

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 Sample Name : 080720
 Location : Vial 1
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 Last changed : 7/28/2008 4:32:53 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/1/2009 10:38:59 AM by wdy
 (modified after loading)



=====
 Area Percent Report
 =====

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

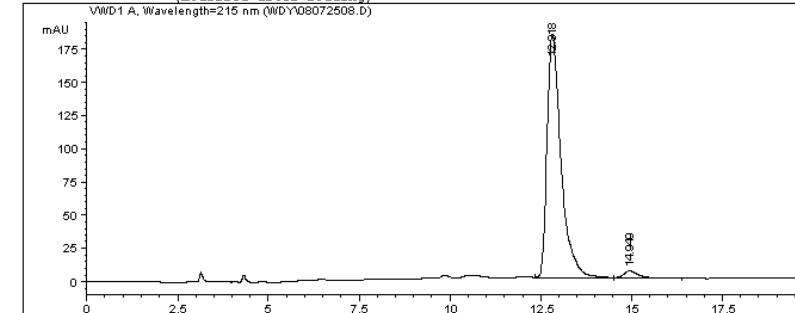
#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	12.353	VP	0.4457	1.66438e4	574.59308	50.2140
2	14.444	VV	0.4998	1.65019e4	513.90723	49.7860

Totals : 3.31458e4 1088.50031

Results obtained with enhanced integrator!

*** End of Report ***

=====
 Injection Date : 7/28/2008 8:41:29 PM
 Sample Name : 080720
 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/28/2008 4:32:53 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/1/2009 10:34:26 AM by wdy
 (modified after loading)



=====
 Area Percent Report
 =====

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

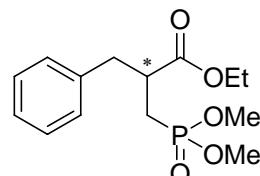
Signal 1: VWD1 A, Wavelength=215 nm

#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	12.818	VV	0.4068	4922.42529	183.11575	96.9042
2	14.949	VBA	0.4563	157.25885	5.21969	3.0958

Totals : 5079.68414 188.33544

Results obtained with enhanced integrator!

*** End of Report ***



5a

Instrument 2 2/1/2009 10:39:37 AM wdy

Page 1 of 1

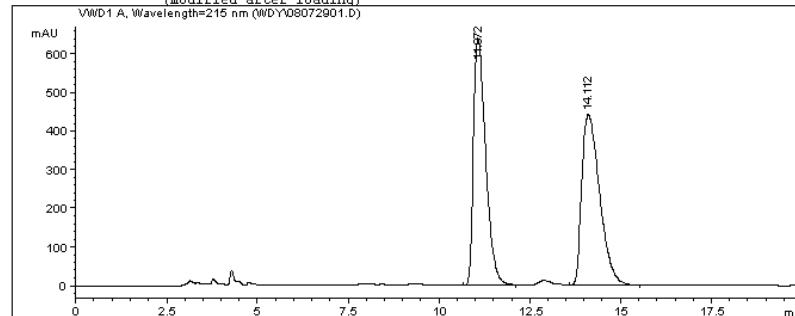
Instrument 2 2/1/2009 10:38:57 AM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\08072901.D

Sample Name: 080720

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 Injection Date : 7/29/2008 8:38:58 AM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/28/2008 10:00:03 PM by wdy
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/1/2009 10:43:02 AM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	11.072	BV	0.3604	1.48018e4	639.28314	49.5604
2	14.112	VBA	0.5383	1.50644e4	441.02121	50.4396

Totals : 2.98662e4 1080.30435

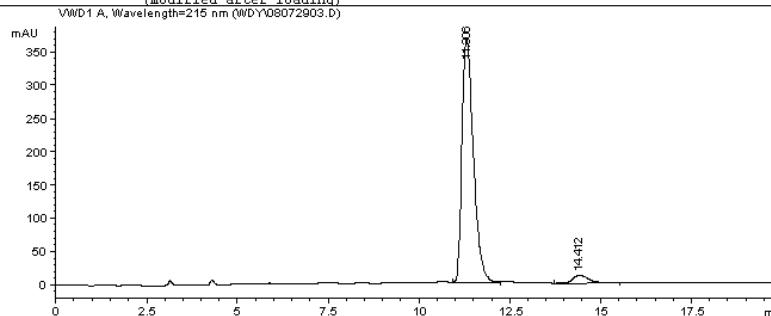
Results obtained with enhanced integrator!

*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\08072903.D

Sample Name: 080720

=====
 Injection Date : 7/29/2008 2:12:49 PM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/28/2008 10:00:03 PM by wdy
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/1/2009 10:42:02 AM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

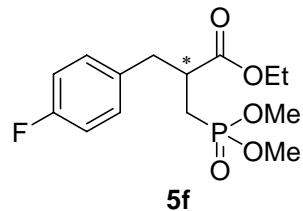
Signal 1: VWD1 A, Wavelength=215 nm

#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	11.306	BV	0.3369	8041.22998	367.32739	95.6253
2	14.412	VBA	0.4570	367.86963	12.49761	4.3747

Totals : 8409.09961 379.82500

Results obtained with enhanced integrator!

*** End of Report ***



Instrument 2 2/1/2009 10:43:44 AM wdy

Page 1 of 1

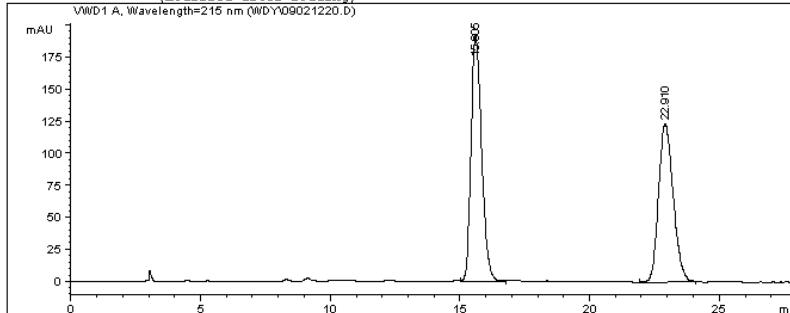
Instrument 2 2/1/2009 10:43:01 AM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\09021220.D

Sample Name: race

=====
 Injection Date : 2/12/2009 9:58:43 PM
 Sample Name : race Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/12/2009 7:00:01 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/18/2009 9:05:53 AM by dj
 (modified after loading)



Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	15.605	VV	0.4402	5487.58252	192.58850	53.0573	
2	22.910	PBA	0.6173	4855.16504	123.12354	46.9427	

Totals : 1.03427e4 315.71204

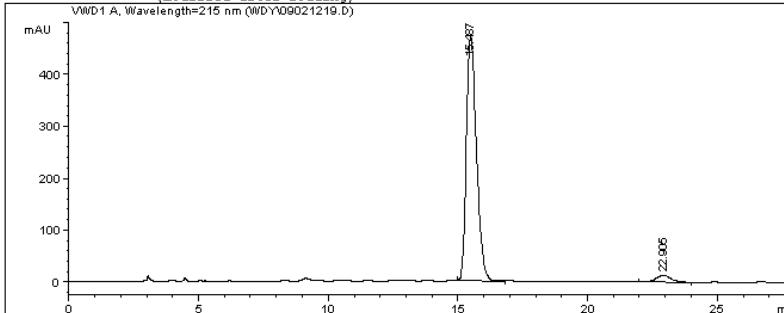
Results obtained with enhanced integrator!

*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\09021219.D

Sample Name: race

=====
 Injection Date : 2/12/2009 9:30:29 PM
 Sample Name : race Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/12/2009 7:00:01 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/18/2009 9:04:33 AM by dj
 (modified after loading)



Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

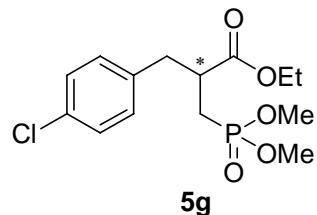
Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	15.487	VB	0.4168	1.27963e4	474.04904	96.1130	
2	22.905	VP	0.6069	517.51263	13.08744	3.8870	

Totals : 1.33138e4 487.13648

Results obtained with enhanced integrator!

*** End of Report ***



Instrument 2 2/18/2009 9:07:25 AM dj

Page 1 of 1

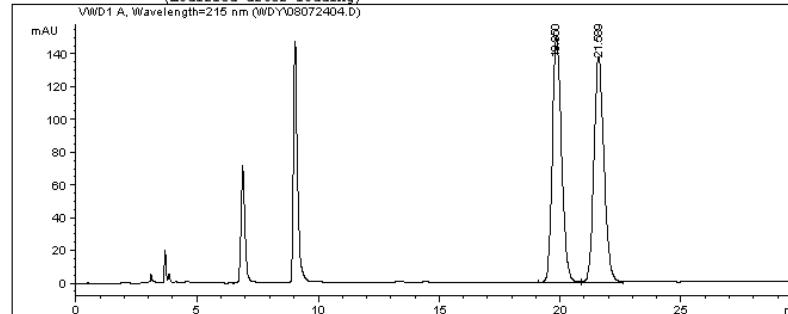
Instrument 2 2/18/2009 9:05:52 AM dj

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Data File C:\HPCHEM\2\DATA\WDY\08072404.D

Sample Name: 080720

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 Injection Date : 7/24/2008 10:50:51 AM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
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 Last changed : 7/24/2008 8:45:02 AM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 4:11:22 PM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	19.850	BV	0.4064	3992.28027	150.52663	49.9391	
2	21.589	VBA	0.4438	4002.01392	137.73019	50.0609	

Totals : 7994.29419 288.25682

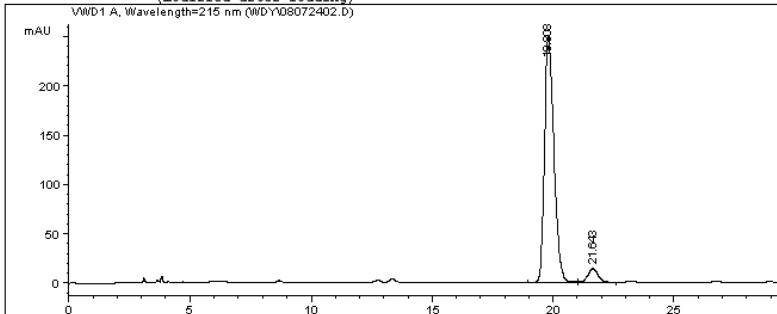
Results obtained with enhanced integrator!

=====
*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\08072402.D

Sample Name: 080720

=====
 Injection Date : 7/24/2008 9:52:42 AM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/24/2008 8:45:02 AM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 4:08:28 PM by wdy
 (modified after loading)



=====
 Area Percent Report

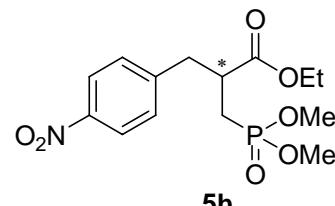
Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	19.808	BV	0.4215	6793.86914	250.29901	94.1225	
2	21.643	VBA	0.4659	424.24594	13.93430	5.8775	

Totals : 7218.11508 264.23331

Results obtained with enhanced integrator!

=====
*** End of Report ***

Instrument 2 2/4/2009 4:12:56 PM wdy

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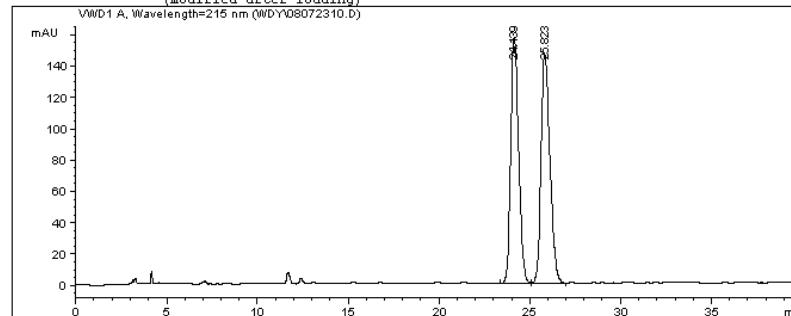
Instrument 2 2/4/2009 4:11:21 PM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\08072310.D

Sample Name: 080720

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 Injection Date : 7/23/2008 10:16:48 PM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/23/2008 10:54:57 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 3:50:09 PM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	24.139	BV	0.4789	4790.38770	156.70979	48.8634	
2	25.823	VV	0.5316	5013.24463	146.02036	51.1366	

Totals : 9803.63232 302.73015

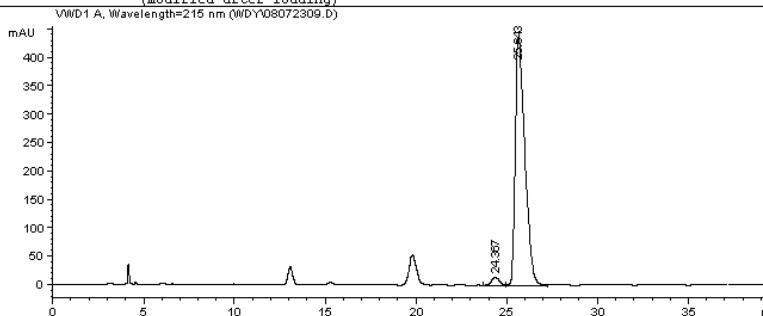
Results obtained with enhanced integrator!

=====
*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\08072309.D

Sample Name: 080720

=====
 Injection Date : 7/23/2008 9:33:57 PM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/23/2008 9:09:44 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 3:50:53 PM by wdy
 (modified after loading)



=====
 Area Percent Report

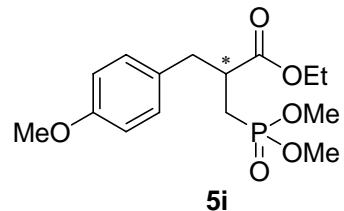
Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	24.367	VV	0.4695	435.18405	14.38407	2.6276	
2	25.643	VBA	0.5600	1.61266e4	435.67914	97.3724	

Totals : 1.65617e4 450.06321

Results obtained with enhanced integrator!

=====
*** End of Report ***

Instrument 2 2/4/2009 3:50:52 PM wdy

Page 1 of 1

Instrument 2 2/4/2009 3:51:36 PM wdy

Page 1 of 1

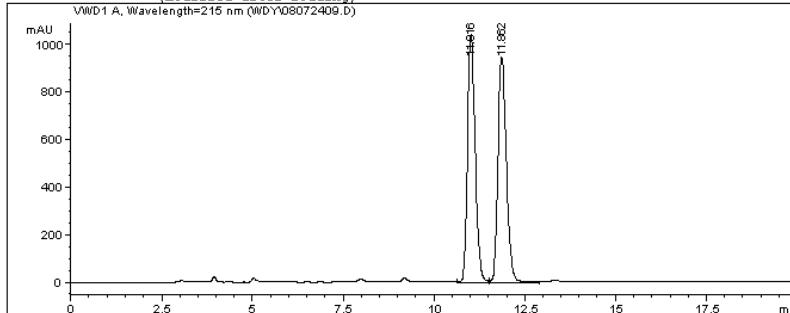
Data File C:\HPCHEM\2\DATA\WDY\08072409.D

Sample Name: 080720

Data File C:\HPCHEM\2\DATA\WDY\08072408.D

Sample Name: 080720

=====
 Injection Date : 7/24/2008 3:59:43 PM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/24/2008 2:24:02 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 3:54:17 PM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

Signal 1: VWD1 A, Wavelength=215 nm

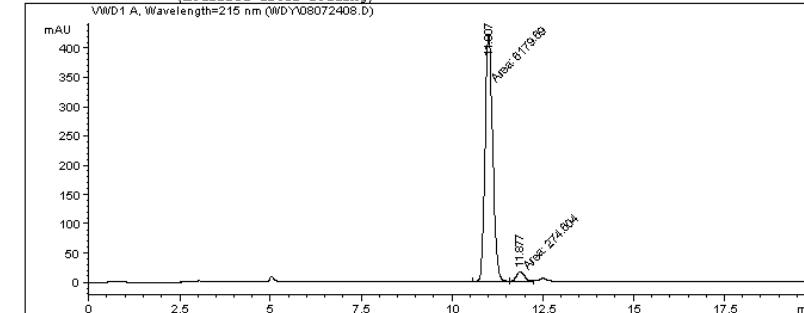
Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	11.016	VV	0.2261	1.51886e4	1037.74512	50.0299	
2	11.862	VV	0.2489	1.51704e4	942.50958	49.9701	

Totals : 3.03590e4 1980.25470

Results obtained with enhanced integrator!

*** End of Report ***

=====
 Injection Date : 7/24/2008 3:39:13 PM
 Sample Name : 080720 Location : Vial 1
 Acq. Operator : wdy
 Acq. Method : C:\HPCHEM\2\METHODS\DZC-P.M
 Last changed : 7/24/2008 2:24:02 PM by wdy
 (modified after loading)
 Analysis Method : C:\HPCHEM\2\METHODS\DZC-P1.M
 Last changed : 2/4/2009 3:57:20 PM by wdy
 (modified after loading)



=====
 Area Percent Report

Sorted By : Signal
 Multiplier : 1.0000
 Dilution : 1.0000

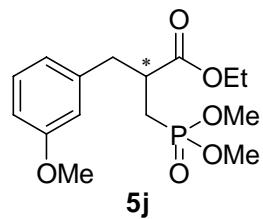
Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	Area %
1	11.007	MF	0.2443	6179.69238	421.54111	95.7454	
2	11.877	MF	0.2751	274.60391	16.63382	4.2546	

Totals : 6454.29630 438.17492

Results obtained with enhanced integrator!

*** End of Report ***



Instrument 2 2/4/2009 3:55:54 PM wdy

Page 1 of 1

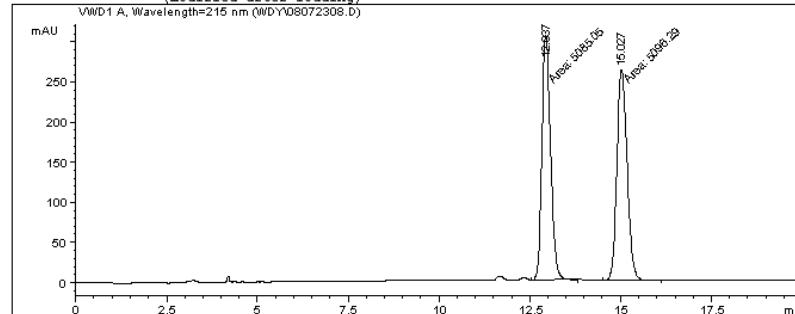
Instrument 2 2/4/2009 4:00:14 PM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\08072308.D

Sample Name: 080720

```
=====
Injection Date : 7/23/2008 6:35:47 PM
Sample Name   : 080720
Location      : Vial 1
Acq. Operator  : wdy
Acq. Method   : C:\HPCHEM\2\METHODS\DJC-P.M
Last changed   : 7/23/2008 11:56:17 AM by ysb
(modified after loading)
Analysis Method: C:\HPCHEM\2\METHODS\DJC-P1.M
Last changed   : 2/4/2009 4:03:44 PM by wdy
(modified after loading)
```



```
=====
Area Percent Report
```

```
Sorted By       : Signal
Multiplier     : 1.0000
Dilution      : 1.0000
```

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	%
1	12.937	MM	0.2781	5085.05127	304.77679	49.9448	
2	15.027	MM	0.3231	5096.28662	262.85007	50.0552	

Totals : 1.01813e4 567.62686

Results obtained with enhanced integrator!

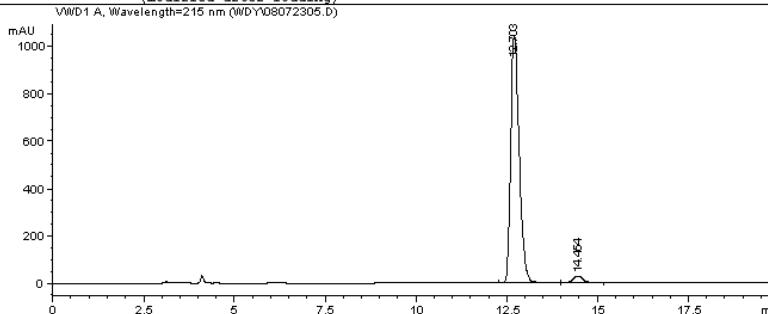
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*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\08072305.D

Sample Name: 080720

```
=====
Injection Date : 7/23/2008 4:20:57 PM
Sample Name   : 080720
Location      : Vial 1
Acq. Operator  : wdy
Acq. Method   : C:\HPCHEM\2\METHODS\DJC-P.M
Last changed   : 7/23/2008 11:56:17 AM by ysb
(modified after loading)
Analysis Method: C:\HPCHEM\2\METHODS\DJC-P1.M
Last changed   : 2/4/2009 4:02:46 PM by wdy
(modified after loading)
```



```
=====
Area Percent Report
```

```
Sorted By       : Signal
Multiplier     : 1.0000
Dilution      : 1.0000
```

Signal 1: VWD1 A, Wavelength=215 nm

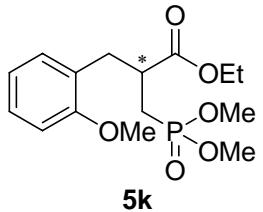
Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	%
1	12.703	BV	0.2503	1.69180e4	1043.55225	96.6343	
2	14.454	VBA	0.3128	589.23938	28.63968	3.3657	

Totals : 1.75072e4 1072.19192

Results obtained with enhanced integrator!

=====

*** End of Report ***



Instrument 2 2/4/2009 4:05:23 PM wdy

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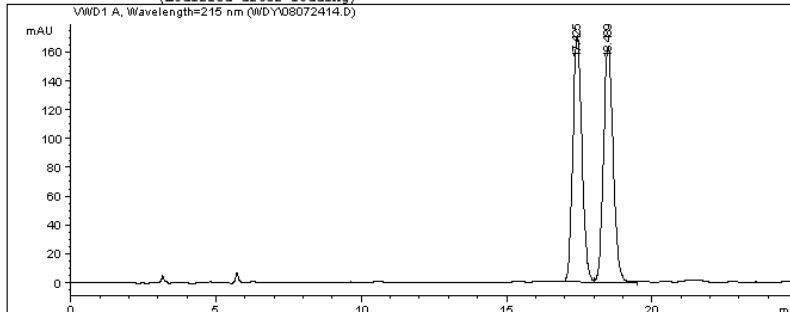
Instrument 2 2/4/2009 4:03:43 PM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\08072414.D

Sample Name: 080720

```
=====
Injection Date : 7/24/2008 6:02:50 PM
Sample Name   : 080720
Location      : Vial 1
Acq. Operator  : wdy
Acq. Method   : C:\HPCHEM\2\METHODS\DZC-P.M
Last changed   : 7/24/2008 5:17:28 PM by wdy
                           (modified after loading)
Analysis Method: C:\HPCHEM\2\METHODS\DZC-P1.M
Last changed   : 2/4/2009 3:40:29 PM by wdy
                           (modified after loading)
```



```
=====
Area Percent Report
=====
```

```
Sorted By      : Signal
Multiplier     : 1.0000
Dilution      : 1.0000
```

Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	%
1	17.425	BV	0.3401	3739.22241	170.66513	49.6359	
2	18.489	VV	0.3620	3794.07690	162.88693	50.3641	

Totals : 7533.29932 333.55206

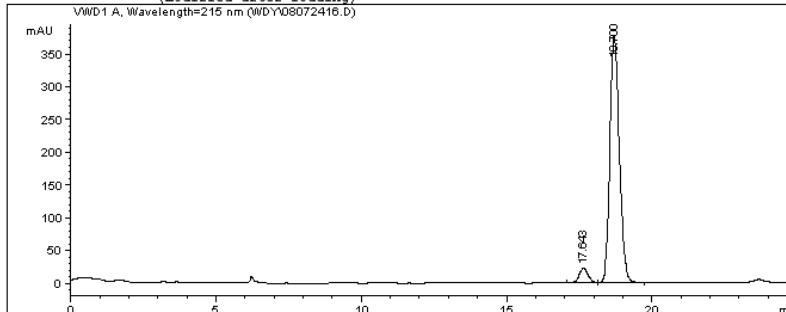
Results obtained with enhanced integrator!

*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\08072416.D

Sample Name: 080720

```
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Injection Date : 7/24/2008 6:56:57 PM
Sample Name   : 080720
Location      : Vial 1
Acq. Operator  : wdy
Acq. Method   : C:\HPCHEM\2\METHODS\DZC-P.M
Last changed   : 7/24/2008 5:17:28 PM by wdy
                           (modified after loading)
Analysis Method: C:\HPCHEM\2\METHODS\DZC-P1.M
Last changed   : 2/4/2009 3:35:33 PM by wdy
                           (modified after loading)
```



```
=====
Area Percent Report
=====
```

```
Sorted By      : Signal
Multiplier     : 1.0000
Dilution      : 1.0000
```

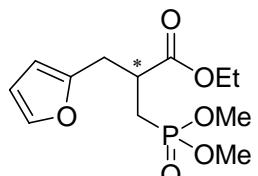
Signal 1: VWD1 A, Wavelength=215 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height *s	Area [mAU]	%
1	17.643	BP	0.3273	460.39487	21.85809	5.0874	
2	18.700	VV	0.3533	8589.32031	376.87573	94.9126	

Totals : 9049.71518 398.73382

Results obtained with enhanced integrator!

*** End of Report ***



Instrument 2 2/4/2009 3:40:55 PM wdy

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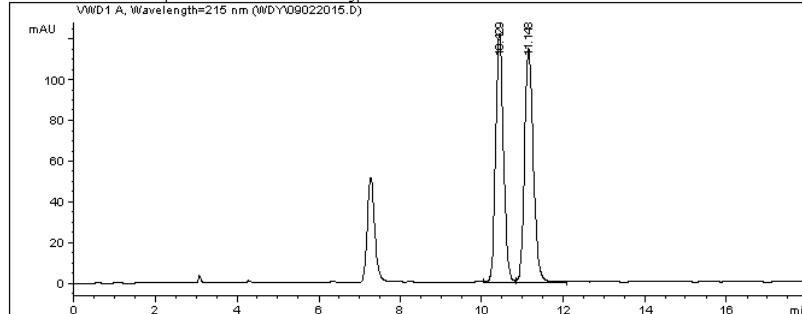
Instrument 2 2/4/2009 3:38:49 PM wdy

Page 1 of 1

Data File C:\HPCHEM\2\DATA\WDY\09022015.D

Sample Name: Cu(OTf)2

```
=====
Injection Date : 2/20/2009 7:57:11 PM
Sample Name : Cu(OTf)2
Location : Vial 1
Acq. Operator : wdy
Acq. Method : C:\HPCHEM\2\METHODS\DC2C-P1.M
Last changed : 2/20/2009 7:06:34 PM by wdy
(modified after loading)
Analysis Method: C:\HPCHEM\2\METHODS\DC2C-P1.M
Last changed : 2/20/2009 8:18:03 PM by wdy
(modified after loading)
```



=====
Area Percent Report

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
```

Signal 1: VWD1 A, Wavelength=215 nm

#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	10.429	VV	0.2092	1635.31396	121.67947	48.6502
2	11.138	VBA	0.2389	1726.05847	115.02900	51.3498

Totals : 3361.37244 236.70847

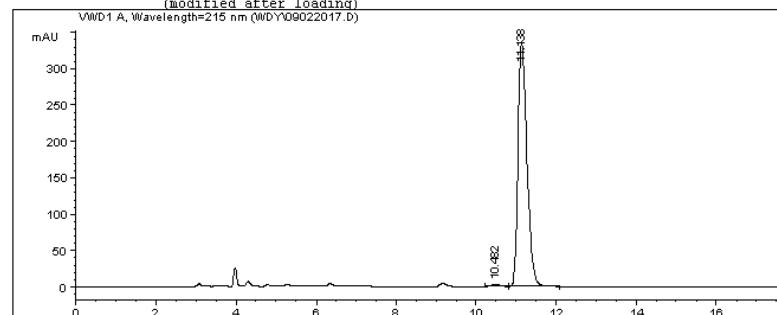
Results obtained with enhanced integrator!

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*** End of Report ***

Data File C:\HPCHEM\2\DATA\WDY\09022017.D

Sample Name: Cu(OTf)2

```
=====
Injection Date : 2/20/2009 8:35:30 PM
Sample Name : Cu(OTf)2
Location : Vial 1
Acq. Operator : wdy
Acq. Method : C:\HPCHEM\2\METHODS\DC2C-P1.M
Last changed : 2/20/2009 8:37:56 PM by wdy
(modified after loading)
```



=====
Area Percent Report

```
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
```

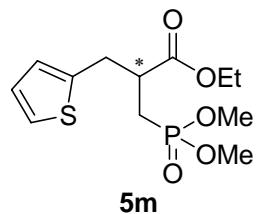
Signal 1: VWD1 A, Wavelength=215 nm

#	RetTime	Type	Width	Area	Height	Area
	[min]		[min]	[mAU]	*s	[mAU]
1	10.482	VV	0.2120	40.53185	2.96387	0.7719
2	11.138	VBA	0.2389	5210.34033	336.46518	99.2281

Totals : 5250.87218 339.42905

Results obtained with enhanced integrator!

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*** End of Report ***



Instrument 2 2/20/2009 8:37:56 PM wdy

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Instrument 2 2/20/2009 8:56:30 PM wdy

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