Supplementary Information (SI) for RSC Advances.
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Thiophenol-mediated metal-free regioselective conjugate reduction strategy for 3-alkylidene Oxindoles

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Supporting Information

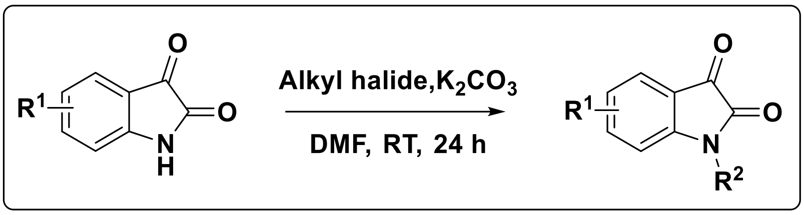
Contents.

1. General information

Unless otherwise noted, materials obtained from commercial suppliers were used without further purification. The one pot reactions were carried out with anhydrous solvents in reaction tube. All solvents were purchased anhydrous. The reactions were monitored by analytical thin layer chromatography (TLC) visualizing under UV light (254 nm) or I_2 staining. ^{1}H NMR spectra, ^{13}C NMR spectra and ^{19}F NMR spectra was acquired in appropriate deuterated solvents at room temperature on Bruker: Ultrashield AV 400 MHz, Ultrashield AV 500 MHz spectrometer. Chemical shifts (δ) are reported for ^{1}H NMR in ppm from TMS as internal standard solvent signals as secondary standards. ^{13}C NMR from the residual solvent peak. ^{1}H NMR spectra are reported as follows: chemical shift (δ ppm), multiplicity designated as *s* (singlet), *d* (doublet), *t* (triplet), *dd* (doublet of doublet), *q* (quartet), *m* (multiplet), etc., coupling constant (Hz). Data for ^{13}C NMR spectra are reported in terms of chemical shift (δ ppm). HRMS data was recorded on a Thermo scientific Q-Exactive, Accela 1250 pump.

2. General Procedure for the Synthesis of N-alkyl protected isatine derivatives

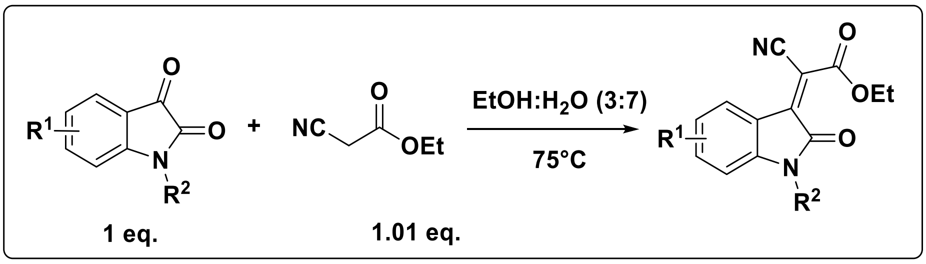
N-protected isatin derivatives were synthesized starting from commercially available isatin and alkyl halides in the presence of potassium carbonate (K_2CO_3) as a base in dimethylformamide (DMF) solvent. To a stirred solution of isatin (10 mmol, 1.0 eq.) and K_2CO_3 (12 mmol, 1.2 eq.) in DMF, alkyl halides (12 mmol, 1.2 eq.) were added dropwise. The reaction mixture was stirred at room temperature for 12 hours, with progress monitored by thin-layer chromatography (TLC). Upon completion, the reaction was quenched with water (20 mL) and the product was extracted with dichloromethane (3 × 20 mL). The combined organic layers were washed with brine, dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel using a gradient of ethyl acetate/petroleum ether (10/90 to 20/80) to afford the *N*-protected isatin derivative.[1]



3. General Procedure for the Synthesis starting materials

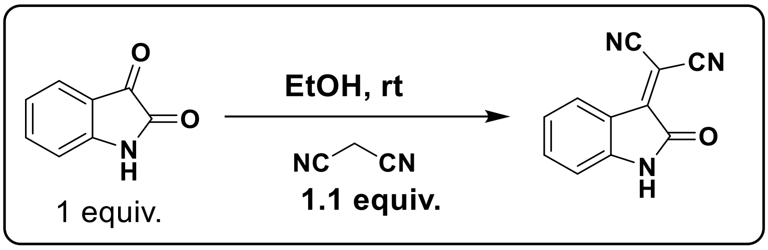
A. Synthesis of Starting Material 1A.

A mixture of isatin or substituted isatin (1 mmol, 1 equiv.) and ethyl cyanoacetate (1.1 mmol, 1.1 equiv.) in a 3:7 ethanol: water (4 mL) reaction mixture stirred at 75 °C until the starting material was fully converted to the product (6-8 h), as monitored by thin-layer chromatography (TLC). Upon completion of the reaction, the mixture was filtered using a Büchner funnel, and the resulting residue was dried under reduced pressure at 60 °C. The obtained product, was used directly in the next step without further purification.[2]



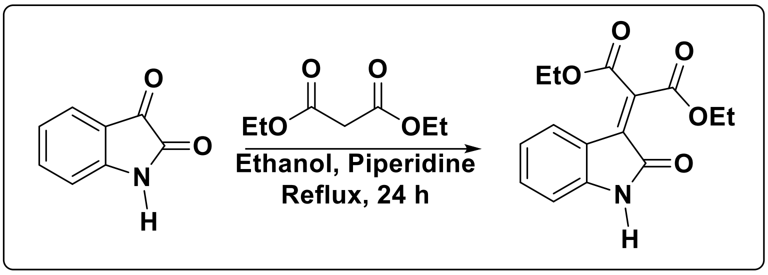
D. Synthesis of Starting Material 1B.

A mixture of isatin (0.5 mmol, 1 equiv.) and malononitrile (0.55 mmol, 1.1 equiv.) in EtOH (1 mL) was stirred at room temperature until isatin was totally converted to product (monitored by TLC). After completion of reaction solvent was removed under low pressure. Obtained residue was washed with cold methanol to get pure product.[3]



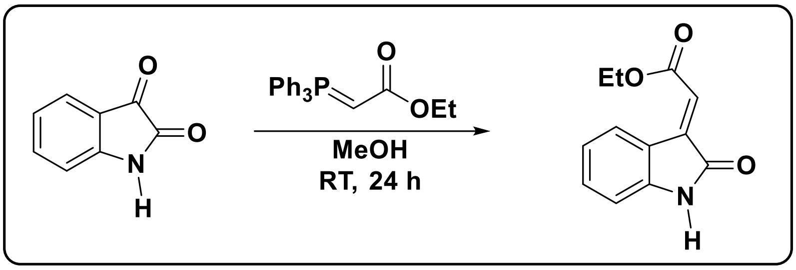
C. Synthesis of Starting Material 1C.

To a (25 ml) pair-shaped round bottom flask was sequentially added corresponding substituted isatin (0.5 mmol, 1equiv.), EtOH (5 mL), diethyl malonate (0.5 mmol) and piperidine (1.0 mmol). The mixture was stirred under reflux overnight. The resulting dark red mixture was evaporated to dryness under reduced pressure and the residue was directly purified by column chromatography on silica gel, (Pet ether/Ethyl acetate = 10/1) to afford the purified product.[4]



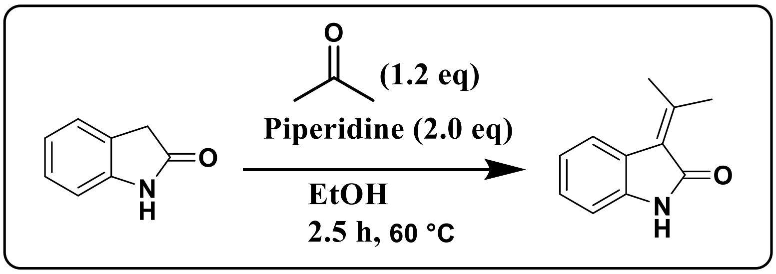
B. Synthesis of Starting Material 1D.

To a solution of the isatin (0.5 mmol, 1equiv.) in methanol (5 mL) was added phosphonium ylide (1.2 equiv.) and the mixture was stirred at room temperature. After the completion of the reaction, the solvent was removed under reduced pressure and the residue was purified by Column chromatography, (20% ethyl acetate/ petroleum ether) directly to afford the purified product.[5]



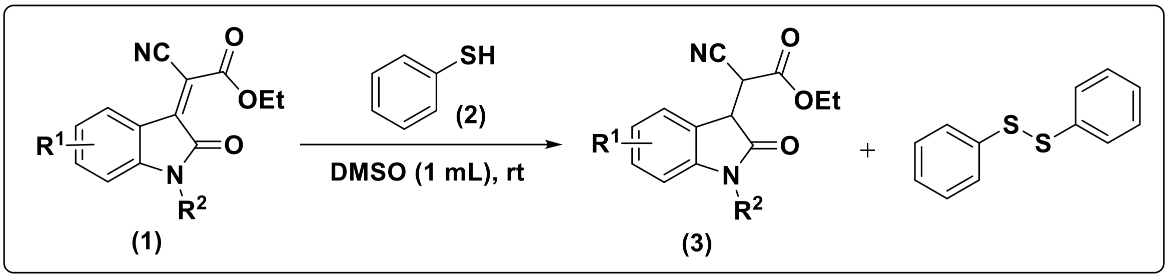
E. Synthesis of Starting Material 1E.

To a solution of oxindole (2.0 g, 15.0 mmol, 1.0 equiv.) in EtOH (15.0 mL, 0.10 M) were added acetone (1.34 mL, 18.0 mmol, 1.2 equiv.) and piperidine (2.97 mL, 30.0 mmol, 2.0 equiv.). The reaction was then heated at reflux in an oil bath for 2.5 h. After cooling to 0 °C, the orange-colored precipitate formed was filtered, washed with cold EtOH and dried under vacuum. 3-(Propan-2-ylidene) indolin-2-one is obtained as a yellow solid (1.3 g, 7.51 mmol, 50%) and used in next step without further purification.[6]



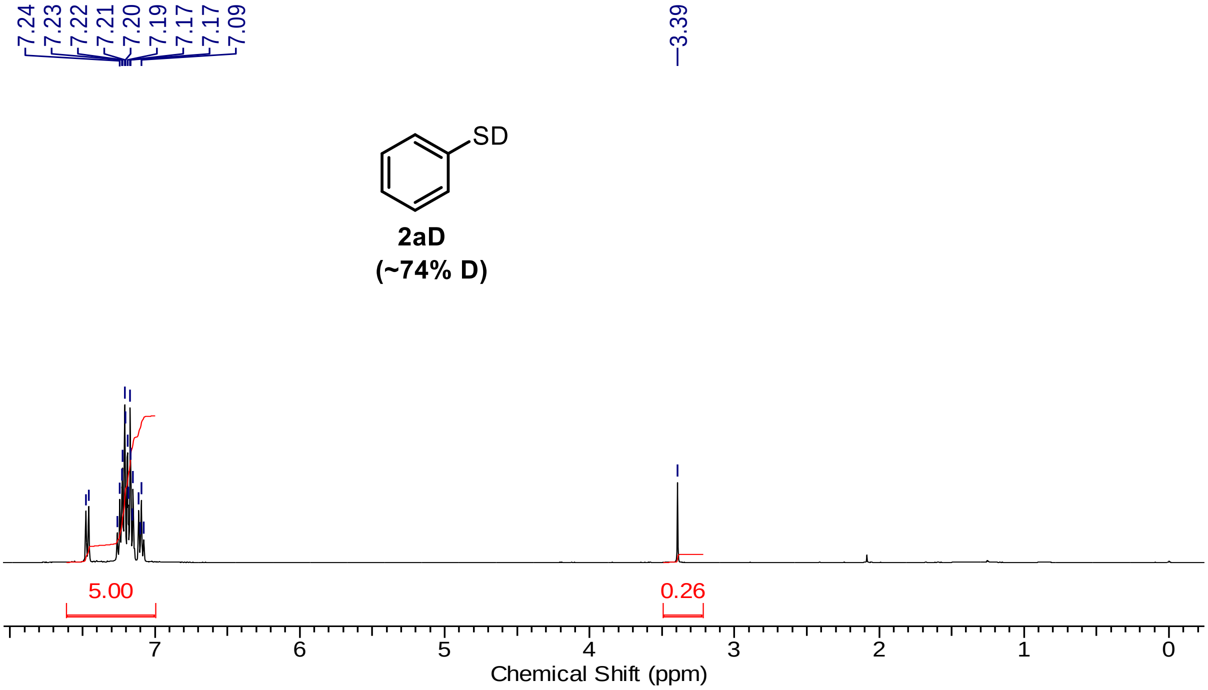
4. General Procedure for the Synthesis of product 3.

Procedure: All reactions were carried out in oven dried reaction tube with magnetic stir bar, a solution of indolylidenecyanoester **(1)** derivative (1) (0.3 mmol, 1 equiv.) in DMSO (1 mL) solvent. To this solution Thiophenol **(2)** (0.6 mmol, 2 equiv.) was added. The reaction mixture was stirred at room temperature for 1 hour (or till complete reaction). Upon complete consumption of the starting material, as monitored by TLC, the reaction mixture was transferred into ice cold water and extracted with DCM (5 ml × 3). The organic layer was collected and dried over anhydrous Na_2SO_4. After evaporation under vacuum the crude product obtained was purified by silica gel column chromatography to afford product **3** (Petroleum ether/Ethyl acetate 75:30).



5. Synthesis of 2aD

Benezenethiol 2a (1.62 g, 15 mmol) was dissolved in D2O (3.0 g, 150 mmol) and vigorously stirred for 2 hours at room temperature. The clear solution was concentrated *in vacuo* and resulted in **2aD** with 74% D incorporation which was determined by 1H NMR. Colourless oil, **^{1}H NMR** (400 MHz, *CHLOROFORM-d*) δ ppm 7.08 - 7.50 (m, 5H), 3.39 (s, 0.26H).[7]



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3. B. R. Patil, C. B. Nichinde, S. S. Chaudhari, R. K. Gamidi and A. K. Kinage, *RSC Adv.* 2024, **14**, 2873–2877;

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5. S. S. Chaudhari, C. B. Nichinde, B. R. Patil, A. S. Girase, A. K. Kinage, *ChemistrySelect,* 2025, **10**, e202405996.

6. M. Pastor, M. Vayer, H. Weinstabl, N. Maulide, *J. Org. Chem.* 2022, **87**, 606– 612.

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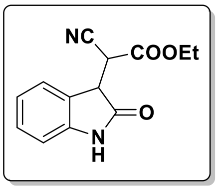
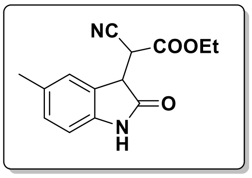
7.Characterization data of products

Ethyl 2-cyano-2-(2-oxoindolin-3-yl) acetate (3Aa):



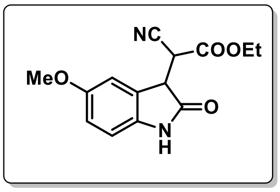
The titled compound was prepared by following the procedure A, obtained as a Solid, 67 mg, 92% yield, mp= 105−110°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1.20) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.25 (br. s., 1H), 9.21 (s, 1H), 7.42 (d, J=7.50 Hz, 1H), 7.20 (td, J=7.72, 4.44 Hz, 2H), 7.13 (d, J=7.50 Hz, 1H), 6.97 (td, J=7.19, 3.38 Hz, 2H), 6.86 (t, J=8.32 Hz, 2H), 4.36 (d, J=3.25 Hz, 1H), 4.32 (q, J=7.13 Hz, 2H), 4.28 (d, J=3.88 Hz, 1H), 4.08 (d, J=3.88 Hz, 1H), 3.98 - 4.05 (m, 2H), 3.91 (d, J=3.13 Hz, 1H), 1.30 (t, J=7.13 Hz, 3H), 1.00 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 175.7 [C=O amide]; 164.5, 163.3 [C=O ester]; 142.0, 141.9 [C]; 129.6, 129.4 [CH]; 124.6 [CH]; 124.2, 124.0 [C]; 123.9 [CH]; 123.0, 122.8 [CH]; 115.2, 113.4 [CN]; 110.7, 110.4 [CH]; 63.7, 63.2 [CH_2]; 45.2 [CH]; 38.7, 37.6 [CH]; 13.9, 13.5 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{13}O_3N_2$, $[M + H]^+$ 245.0921 found: 245.0919.

Ethyl 2-cyano-2-(5-methyl-2-oxoindolin-3-yl) acetate (3Ab):



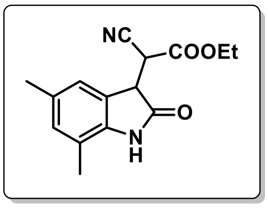
The titled compound was prepared by following the procedure A, obtained as a Solid, 70 mg, 90% yield, mp = 114−118°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1.20); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.22 (br. s., 2H), 7.30 (s, 1H), 7.03 - 7.12 (m, 2H), 7.01 (s, 1H), 6.83 (t, J=8.38 Hz, 2H), 4.42 - 4.45 (m, 1H), 4.37 - 4.42 (m, 2H), 4.34 (d, J=3.88 Hz, 1H), 4.12 - 4.14 (m, 1H), 4.06 - 4.11 (m, 2H), 3.94 (d, J=3.13 Hz, 1H), 2.32 (s, 3H), 2.30 (s, 3H), 1.39 (t, J=7.13 Hz, 3H), 1.09 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 175.7 [C=O amide]; 164.6, 163.3 [C=O ester]; 139.5, 139.3 [C];132.6, 132.5 [C]; 129.9, 129.7 [CH]; 125.3, 124.6 [CH]; 124.2, 124.1 [C]; 115.3, 113.5 [CN]; 110.3, 110.1 [CH]; 63.6, 63.2 [CH_2]; 45.3 [CH]; 38.8, 37.6 [CH]; 21.0, 20.9 [CH_3]; 13.9, 13.5 [CH_3]; **HRMS** (ESI) calcd for: $C_{14}H_{15}O_3N_2$, $[M + H]^+$ 259.1077, found: 259.1064.

Ethyl 2-cyano-2-(5-methoxy-2-oxoindolin-3-yl) acetate (3Ac):



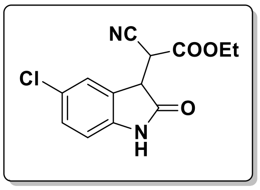
The titled compound was prepared by following the procedure A, obtained as a Solid, 73 mg, 89% yield, mp = 112−114°C; column chromatography on silica gel (petroleum ether/EtOAc 68:32); (Diastereomeric mixture, ratio 1:1); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.16 (br. s., 1H), 9.12 (br. s., 1H), 7.02 (s, 1H), 6.75 - 6.81 (m, 2H), 6.69 - 6.75 (m, 3H), 4.34 (dd, J=7.38, 2.38 Hz, 2H), 4.27 - 4.32 (m, 2H), 4.01 - 4.06 (m, 3H), 3.89 (s, 1H), 3.69 (s, 3H), 3.67 (s, 3H), 1.30 (t, J=7.13 Hz, 3H), 1.04 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm , 175.5 [C=O amide]; 164.5, 163.3 [C=O ester]; 155.9, 155.8 [C]; 135.3, 135.2 [C]; 125.4, 125.3 [C]; 114.1, 113.9 [CH]; 115.2, 113.4 [CN]; 111.9, 111.0 [CH]; 110.9, 110.8 [CH]; 63.7, 63.2 [CH_2]; 55.7, 55.6 [CH_3]; 45.6 [CH]; 38.8, 37.6 [CH]; 13.9, 13.5 [CH_3]; **HRMS** (ESI) calcd for: $C_{14}H_{15}O_4N_2$, $[M + H]^+$ 275.1026, found: 275.1014.

Ethyl 2-cyano-2-(5,7-dimethyl-2-oxoindolin-3-yl) acetate (3Ad):



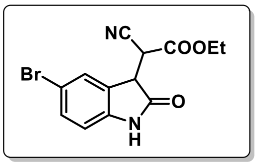
The titled compound was prepared by following the procedure A, obtained as a Solid, 67 mg, 82% yield, mp = 118−120°C; column chromatography on silica gel (petroleum ether/EtOAc 74:26); (Diastereomeric mixture, ratio 1:1); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 10.39 (br. s., 1H), 10.29 (br. s., 1H), 6.97 (d, J=5.00 Hz, 1H), 6.80 (t, J=6.32 Hz, 2H), 6.68 (d, J=5.00 Hz, 1H), 4.38 (d, J=3.38 Hz, 1H), 4.33 (d, J=3.63 Hz, 2H), 4.30 (d, J=3.13 Hz, 1H), 4.00 - 4.12 (m, 2H), 3.95 (d, J=7.35 Hz, 1H), 3.86 (s, 1H), 2.19 (s, 6H), 2.15 (s, 6H), 1.30 (t, J=7.16 Hz, 3H), 1.04 (t, J=7.16 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 175.1, 175.1 [C=O amide]; 164.5, 163.1 [C=O ester]; 138.7, 138.6 [C]; 131.4, 131.3 [C]; 131.0, 130.8 [CH]; 123.6, 123.4 [C]; 122.0, 121.4 [CH]; 119.4, 119.16 [C]; 115.1, 113.4 [CN]; 63.1, 62.5 [CH_2]; 45.3 [CH]; 38.6, 37.5 [CH]; 20.6, 20.5 [CH_3]; 16.2, 16.1 [CH_3]; 13.6, 13.2 [CH_3]; **HRMS** (ESI) calcd for: $C_{15}H_{17}O_3N_2$, $[M + H]^+$ 273.1234, found: 273.1232.

Ethyl 2-(5-chloro-2-oxoindolin-3-yl)-2-cyanoacetate (3Ae):



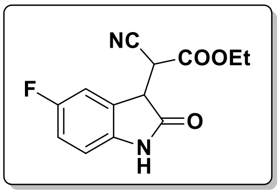
The titled compound was prepared by following the procedure A, obtained as a Solid, 73 mg, 88% yield, mp = 122−126°C; column chromatography on silica gel (petroleum ether/EtOAc 68:32); (Diastereomeric mixture, ratio 1:1.20); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.18 (br. s., 1H), 9.12 (br. s., 1H), 7.41 (s, 1H), 7.15 - 7.24 (m, 2H), 7.13 (s, 1H), 6.81 (t, J=8.32 Hz, 2H), 4.31 - 4.39 (m, 3H), 4.29 (d, J=3.50 Hz, 1H), 4.01 - 4.12 (m, 3H), 3.88 - 3.95 (m, 1H), 1.32 (t, J=7.13 Hz, 3H), 1.08 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 175.6, 175.6 [C=O amide]; 164.6, 163.4 [C=O ester]; 140.9, 140.7 [C]; 130.1, 129.8 [CH]; 128.8, 128.6 [C]; 126.2, 126.0 [C]; 125.6, 124.8 [CH]; 115.2, 113.5 [CN]; 112.0, 111.8 [CH]; 64.3, 63.9 [CH_2]; 45.6, 45.5 [CH]; 38.9, 37.7 [CH]; 14.2, 13.9 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2Cl$, [M + H]$^+$ 279.0531, found: 279.0529.

Ethyl 2-(5-bromo-2-oxoindolin-3-yl)-2-cyanoacetate (3Af):



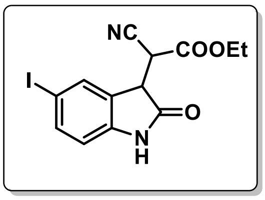
The titled compound was prepared by following the procedure A, obtained as a Solid, 82 mg, 85% yield, mp = 130−132°C; column chromatography on silica gel (petroleum ether/EtOAc 66:34); (Diastereomeric mixture, ratio 1:1); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.64 (br. s., 1H), 8.60 (br. s., 1H), 7.57 (s, 1H), 7.33 - 7.41 (m, 2H), 7.29 (s, 1H), 6.76 (t, J=8.75 Hz, 2H), 4.33 - 4.41 (m, 2H), 4.33 (d, J=3.25 Hz, 1H), 4.27 (d, J=3.63 Hz, 1H), 4.09 - 4.13 (m, 2H), 4.05 - 4.09 (m, 1H), 3.91 (d, J=3.25 Hz, 1H), 1.34 (t, J=7.13 Hz, 3H), 1.10 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.9, 174.8 [C=O amide]; 164.3, 163.0 [C=O ester]; 140.9, 140.8 [C]; 132.8, 132.6 [CH]; 128.3, 127.3 [CH]; 126.3, 126.1 [C]; 115.9, 115.6 [C]; 114.9, 113.1 [CN]; 112.0, 111.8 [CH]; 64.1, 63.7 [CH_2]; 45.2, 45.1 [CH]; 38.7, 37.4 [CH]; 14.0, 13.7 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2Br$, [M + H]$^+$ 323.0026, found: 323.0022.

Ethyl 2-cyano-2-(5-fluoro-2-oxoindolin-3-yl) acetate (3Ag):



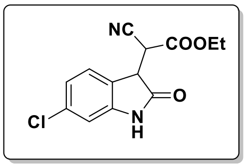
The titled compound was prepared by following the procedure A, obtained as a Solid, 70 mg, 88% yield, mp = 108−110°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.32 (s, 1H), 9.26 (s, 1H), 7.24 - 7.30 (m, 1H), 6.96-7.04 (m, 3H), 6.90 (td, J=8.63, 4.25 Hz, 2H), 4.40 - 4.48 (m, 3H), 4.38 (d, J=3.75 Hz, 1H), 4.10 - 4.19 (m, 3H), 4.00 (d, J=2.75 Hz, 1H), 1.39 (t, J=7.19 Hz, 3H), 1.15 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 175.8, 175.7 [C=O amide]; 164.4 163.3 [C=O ester]; 160.3, 157.8 (d, J = 241.9 Hz), [C-F] 138.1, 138.0 [C]; 125.8, 125.5 [C]; 116.4, 115.9 (d, J = 7.8 Hz) [CH]; 115.0, 113.3 [CN]; 113.1, 112.1 (d, J = 24.1 Hz) [CH]; 111.5, 111.2 (d, J = 20.7 Hz), [CH]; 64.0, 63.6 [CH_2]; 45.7, 45.6, [CH]; 38.7, 37.6 [CH]; 14.0, 13.7 [CH_3]; **^{19}F NMR** (377 MHz, CHLOROFORM-d) δ ppm -119.15 (s, 1F), -119.23 (s, 1F) ; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2F$, $[M + H]^+$ 263.0826, found: 263.0828.

Ethyl 2-cyano-2-(5-iodo-2-oxoindolin-3-yl) acetate (3Ah):



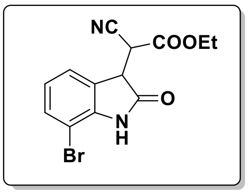
The titled compound was prepared by following the procedure A, obtained as a Solid, 86 mg, 78% yield, mp = 135−138°C; column chromatography on silica gel (petroleum ether/EtOAc 65:35); (Diastereomeric mixture, ratio 1:1); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.64 (br. s., 1H), 8.60 (br. s., 1H), 7.72 (s, 1H), 7.55 (d, J=7.25 Hz, 2H), 7.44 (s, 1H), 6.66 (t, J=8.76 Hz, 2H), 4.36 (qd, J=7.19, 3.94 Hz, 2H), 4.31 (d, J=3.38 Hz, 1H), 4.26 (d, J=3.63 Hz, 1H), 4.05 - 4.14 (m, 3H), 3.90 (d, J=2.88 Hz, 1H), 1.34 (t, J=7.13 Hz, 3H), 1.10 (t, J=7.19 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.6, 174.5 [C=O amide]; 164.3, 163.0 [C=O ester]; 141.6, 141.4 [C]; 138.6, 138.5 [CH]; 133.7, 132.8 [CH]; 126.6, 126.4 [C]; 114.9, 113.1 [CN]; 112.5, 112.3 [CH]; 85.6, 85.3 [C]; 64.1, 63.6 [CH_2]; 45.0, 44.8 [CH]; 38.7, 37.4 [CH]; 14.0, 13.7 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2I$, $[M + H]^+$ 370.9887, found: 370.9888.

Ethyl 2-(6-chloro-2-oxoindolin-3-yl)-2-cyanoacetate (3Ai):



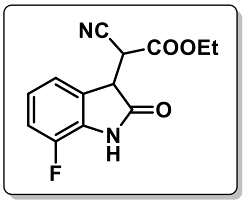
The titled compound was prepared by following the procedure A, obtained as a Solid, 73 mg, 87% yield, mp = 126−130°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1.20); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.75 (br. s., 2H), 7.45 (d, J=8.00 Hz, 1H), 7.16 (d, J=8.00 Hz, 1H), 7.06 (td, J=6.25, 1.75 Hz, 2H), 6.98 (d, J=1.75 Hz, 1H), 6.95 (d, J=1.75 Hz, 1H), 4.42 - 4.46 (m, 1H), 4.38 - 4.42 (m, 2H), 4.33 (d, J=3.75 Hz, 1H), 4.09 - 4.19 (m, 3H), 3.94 (d, J=3.00 Hz, 1H), 1.40 (t, J=7.19 Hz, 3H), 1.16 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.97 [C=O amide]; 164.1 (s), 162.8 [C=O ester]; 142.7, 142.5 [C]; 135.3, 135.1 [C]; 125.6, 124.8 [CH]; 122.9, 122.7 [CH]; 122.3, 122.1 [C]; 114.7, 112.9 [CN]; 111.0, 110.7 [CH]; 63.6, 63.2 [CH_2]; 44.5, 44.4 [CH]; 38.5, 37.1 [CH]; 13.7, 13.4 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2ClNa$, [M + Na]$^+$ 301.0350, found: 301.0353.

Ethyl 2-(7-bromo-2-oxoindolin-3-yl)-2-cyanoacetate (3Aj):



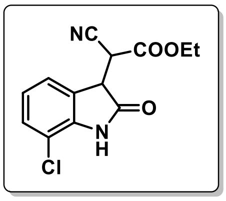
The titled compound was prepared by following the procedure A, obtained as a Solid, 85 mg, 89% yield, mp = 132−134°C; column chromatography on silica gel (petroleum ether/EtOAc 65:35); (Diastereomeric mixture, ratio 1:1.30) **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.87 (br. s., 1H), 8.79 (br. s., 1H), 7.40 (d, J=7.50 Hz, 1H), 7.35 (dd, J=8.19, 5.32 Hz, 2H), 7.11 (d, J=7.50 Hz, 1H), 6.90 (td, J=7.85, 2.94 Hz, 2H), 4.39 (d, J=3.13 Hz, 1H), 4.28 - 4.35 (m, 2H), 4.22 (d, J=3.63 Hz, 1H), 4.05 - 4.10 (m, 1H), 3.96 - 4.05 (m, 3H), 1.31 (t, J=7.13 Hz, 3H), 1.03 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.4, 174.3 [C=O amide]; 164.32, 162.94 [C=O ester]; 141.4, 141.3 [C]; 132.5, 132.2 [CH]; 125.5, 125.3 [C]; 124.3, 124.1 [CH]; 123.7, 122.9 [CH]; 115.0, 113.1 [CN]; 103.5, 103.2 [C]; 63.9, 63.4 [CH_2]; 46.3, 46.2 [CH]; 38.7, 37.5 [CH]; 13.9, 13.5 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2Br$, [M + H]$^+$ 323.0026, found: 323.0013.

ethyl 2-cyano-2-(7-fluoro-2-oxoindolin-3-yl) acetate (3Ak):



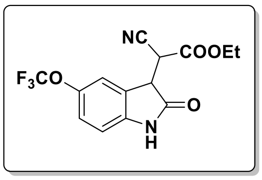
The titled compound was prepared by following the procedure A, obtained as a Solid, 68 mg, 86% yield, mp = 128−130°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1) **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 10.67 (br. s., 4 H), 10.52 (br. s., 5 H), 7.20 (d, J=7.25 Hz, 5 H), 6.87 - 7.04 (m, 23 H), 4.40 (d, J=3.25 Hz, 1H), 4.29 - 4.37 (m, 3H), 4.01 - 4.11 (m, 3H), 3.93 (d, J=3.25 Hz, 1H), 1.31 (t, J=7.13 Hz, 3H), 1.05 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.9 [C=O amide]; 164.5, 163.1 [C=O ester]; 148.3, 146.0 (d, J = 244.9 Hz), [C-F]; 129.5, 129.3 [C]; 127.0, 126.7 [C]; 123.9, 123.7 (d, J = 11.9 Hz), [CH]; 120.6, 119.8 (d, J = 22.3 Hz), [CH]; 117.0, 116.6 (d, J = 3.5 Hz), [CH]; 115.1, 113.2 [CN]; 63.9, 63.5 [CH_2]; 45.6, 45.4 [CH]; 38.8, 37.6 [CH]; 14.0, 13.6 [CH_3]; **^{19}F NMR** (377 MHz, CHLOROFORM-d) δ ppm -132.54 (s, 1F), -132.84 (s, 1F); **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2F$, [M + H]$^+$ 263.0826, found: 263.0827.

Ethyl 2-(7-chloro-2-oxoindolin-3-yl)-2-cyanoacetate (3Al):



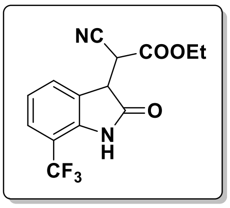
The titled compound was prepared by following the procedure A, obtained as a Solid, 72 mg, 87% yield, mp = 134−138°C; column chromatography on silica gel (petroleum ether/EtOAc 68:32); (Diastereomeric mixture, ratio 1:1.30) **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.09 (br. s., 1H), 9.01 (br. s., 1H), 7.44 (d, J=7.38 Hz, 1H), 7.25 - 7.33 (m, 2H), 7.15 (d, J=7.50 Hz, 1H), 7.03 (t, J=7.88 Hz, 2H), 4.47 (d, J=3.13 Hz, 1H), 4.39 - 4.46 (m, 2H), 4.38 (d, J=3.63 Hz, 1H), 4.27 (d, J=3.00 Hz, 1H), 4.12 (d, J=7.50 Hz, 1H), 4.03 - 4.10 (m, 2H), 1.39 (t, J=7.13 Hz, 3H), 1.11 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.8, 174.7 [C=O amide]; 164.4, 163.0 [C=O ester]; 139.9, 139.7 [C]; 129.8, 129.5 [CH]; 125.7, 125.5 [C]; 124.1, 123.9 [CH]; 123.2, 122.4 [CH]; 115.9, 115.6 [C]; 115.1, 113.2 [CN]; 64.0, 63.5 [CH_2]; 46.1, 46.0 [CH]; 38.7, 37.6 [CH]; 14.0, 13.6 [CH_3]; **HRMS** (ESI) calcd for: $C_{13}H_{12}O_3N_2ClNa$, [M + Na]$^+$ 301.0350, found: 301.0353.

Ethyl 2-cyano-2-(2-oxo-5-(trifluoromethoxy) indolin-3-yl) acetate (3Am):



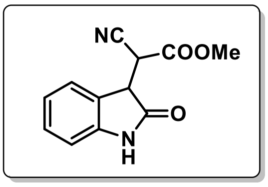
The titled compound was prepared by following the procedure A, obtained as a Solid, 89 mg, 91% yield, mp = 140−142°C; column chromatography on silica gel (petroleum ether/EtOAc 60:40); (Diastereomeric mixture, ratio 1:1) **^{1}H NMR** (400 MHz, *CHLOROFORM-d*) δ ppm 9.17 (br. s., 1H), 9.12 (br. s., 1H), 7.41 (s, 1H), 7.19 (d, *J*=8.50 Hz, 2H), 7.14 (s, 1H), 6.96 (t, *J*=8.63 Hz, 2H), 4.39 - 4.45 (m, 3H), 4.38 (d, *J*=3.75 Hz, 1H), 4.20 (d, *J*=3.75 Hz, 1H), 4.15 (qd, *J*=7.15, 2.31 Hz, 2H), 4.02 (d, *J*=3.38 Hz, 1H),, 1.39 (t, *J*=7.13 Hz, 3H), 1.15 (t, *J*=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, *CHLOROFORM-d*) δ ppm 175.5, 175.4 [C=O amide]; 164.3, 163.1[C=O ester]; 144.9, 144.7 [C-O] 140.7, 140.6 [C]; 125.7, 125.4 [C]; 123.0, 122.8 [CH]; 121.7, 119.1[-OCF$_3$] 118.9, 118.2[CH]; 114.8, 113.1[CN]; 111.3, 111.1 [CH]; 64.1, 63.6 [CH$_2$]; 45.5, 45.3 [CH]; 38.6, 37.4 [CH]; 13.9, 13.6 [CH$_3$]; **^{19}F NMR** (376 MHz, *CHLOROFORM-d*) δ ppm -58.42 (s, 1F), -58.46 (s, 1F).; **HRMS** (ESI) calcd for: $C_{14}H_{12}O_4N_2F_3$, $[\mathrm{M + H}]^+$ 329.0744, found: 329.0734.

Ethyl 2-cyano-2-(2-oxo-7-(trifluoromethyl) indolin-3-yl) acetate (3An):



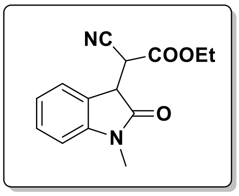
The titled compound was prepared by following the procedure A, obtained as a Solid, 84 mg, 90% yield, mp = 148−150°C; column chromatography on silica gel (petroleum ether/EtOAc 60:40); (Diastereomeric mixture, ratio 1:1.50) **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.87 (br. s., 1H), 8.82 (br. s., 1H), 7.66 (d, J=7.50 Hz, 1H), 7.42 - 7.49 (m, 2H), 7.38 (d, J=7.50 Hz, 1H), 7.12 (t, J=7.75 Hz, 2H), 4.42 (d, J=3.13 Hz, 1H), 4.35 (q, J=7.13 Hz, 2H), 4.30 (d, J=3.88 Hz, 1H), 4.15 (d, J=3.75 Hz, 1H), 3.99 - 4.07 (m, 2H), 3.92 (d, J=3.00 Hz, 1H), 1.33 (t, J=7.13 Hz, 3H), 1.01 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.9, 174.8 [C=O amide]; 164.3, 162.8 [C=O ester]; 139.4, 139.1 [C]; 128.4, 127.5 [CH]; 126.5, [CH]; 125.9, 125.7 [C]; 123.0, 122.8 [CH]; 124.9, 122.2 (q, *J*=3.8 Hz), [C-CF3] 115.0 [CN]; 113.0 [-CF$_3$], 64.0, 63.5 [CH$_2$]; 44.3, 44.2 [CH]; 38.5, 37.4 [CH]; 13.9, 13.5 [CH$_3$]; **^{19}F NMR** (377 MHz, CHLOROFORM-d) δ ppm -60.92 (s, 1F), -61.02 (s, 1F); **HRMS** (ESI) calcd for: $C_{14}H_{12}O_3N_2F_3$, $[\mathrm{M + H}]^+$ 313.0795, found: 313.0781.

Methyl 2-cyano-2-(2-oxoindolin-3-yl) acetate (3Ao):



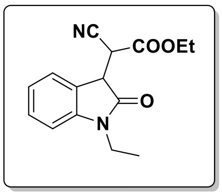
The titled compound was prepared by following the procedure, obtained as a Solid, 63 mg, 91% yield, mp = 98−102°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.32 (br. s., 1H), 9.25 (s, 1H), 7.38 (d, J=7.50 Hz, 1H), 7.15 - 7.23 (m, 2H), 7.10 (d, J=7.50 Hz, 1H), 6.96 (td, J=7.35, 5.07 Hz, 2H), 6.87 (t, J=8.00 Hz, 2H), 4.37 (d, J=3.50 Hz, 1H), 4.30 (d, J=4.00 Hz, 1H), 4.06 (d, J=3.75 Hz, 1H), 3.91 (d, J=3.38 Hz, 1H), 3.85 (s, 3H), 3.58 (s, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 174.9 [C=O amide]; 165.0, 163.8 [C=O ester]; 142.4, 142.4 [C]; 129.2, 129.0 [CH]; 124.1, 124.00 [C]; 123.7, 123.5 [CH]; 122.2, 122.1 [CH]; 114.9, 113.3 [CN]; 110.4, 110.2 [CH]; 53.7, 53.3 [CH]; 45.0, 44.9 [CH]; 38.3, 37.3 [CH_3]; **HRMS** (ESI) $C_{12}H_{10}O_3N_2Na$, [M + Na]$^+$ 253.0584, found: 253.0579.

Ethyl 2-cyano-2-(1-methyl-2-oxoindolin-3-yl) acetate (3Ap):



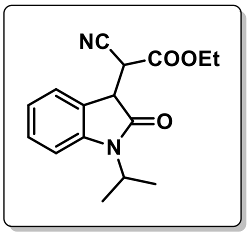
The titled compound was prepared by following the procedure A, obtained as a Solid, 72 mg, 93% yield, mp = 96−98°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.53 (d, J=7.38 Hz, 1H), 7.31 - 7.42 (m, 2H), 7.24 (d, J=7.38 Hz, 1H), 7.10 (t, J=7.38 Hz, 2H), 6.88 (d, J=7.88 Hz, 1H), 6.90 (d, J=7.88 Hz, 1H), 4.42 - 4.45 (m, 1H), 4.37 - 4.42 (m, 2H), 4.34 (d, J=3.88 Hz, 1H), 4.14 (d, J=3.63 Hz, 1H), 4.02 - 4.11 (m, 2H), 3.94 (d, J=3.13 Hz, 1H), 3.25 (s, 3H), 3.24 (s, 3H), 1.39 (t, J=7.13 Hz, 3H), 1.07 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 173.2, 173.1 [C=O amide]; 164.6, 163.1 [C=O ester]; 144.6, 144.5 [C]; 129.7, 129.5 [CH];124.5, 123.8 [CH]; 123.6, 123.4 [C]; 123.1, 122.9 [CH]; 115.3, 113.3 [CN]; 108.8, 108.5 [CH]; 63.6, 63.0 [CH_2]; 44.7, 44.6 [CH]; 39.0, 37.7 [CH]; 26.5, 26.4 [CH_3]; 13.9, 13.6 [CH_3]; **HRMS** (ESI) calcd for: $C_{14}H_{15}O_3N_2$, [M + H]$^+$ 259.1077, found: 259.1076.

Ethyl 2-cyano-2-(1-ethyl-2-oxoindolin-3-yl) acetate (3Aq):



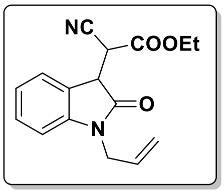
The titled compound was prepared by following the procedure A, obtained as a Solid, 74 mg, 92% yield, mp = 90−92°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.52 (d, J=7.38 Hz, 1H), 7.35 (q, J=7.34 Hz, 2H), 7.23 (d, J=7.38 Hz, 1H), 7.08 (t, J=7.50 Hz, 2H), 6.84 - 6.96 (m, 2H), 4.37 - 4.44 (m, 3H), 4.35 (d, J=3.75 Hz, 1H), 4.04 - 4.15 (m, 3H), 3.90 - 3.96 (m, 1H), 3.69 - 3.89 (m, 2H), 1.39 (t, J=7.13 Hz, 3H), 1.28 (t, J=7.25 Hz, 6H), 1.07 (t, J=7.82 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.4, 172.4 [C=O amide]; 164.3, 162.8 [C=O ester]; 143.4, 143.21 [C]; 129.2, 129.0 [CH]; 124.3, 123.6 [CH]; 123.5, 123.3 [C]; 122.5, 122.3 [CH]; 114.9, 112.8 [CN]; 108.5, 108.2 [CH]; 63.2, 62.6 [CH_2]; 44.30 [CH]; 38.8, 37.4 [CH]; 34.7, 34.6 [CH_2]; 13.5, 13.2 [CH_3]; 12.0, 11.9 [CH_3]; **HRMS** (ESI) calcd for: $C_{15}H_{17}O_3N_2$, [M + H]$^+$ 273.1234, found: 273.1225.

Ethyl 2-cyano-2-(1-isopropyl-2-oxoindolin-3-yl) acetate (3Ar):



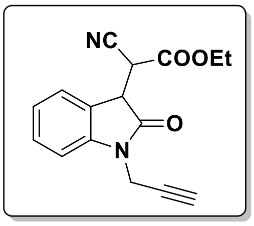
The titled compound was prepared by following the procedure A, obtained as a Solid, 72 mg, 85% yield, mp = 88−90°C; column chromatography on silica gel (petroleum ether/EtOAc 77:23); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.53 (d, J=7.50 Hz, 1H), 7.33 (q, J=7.67 Hz, 2H), 7.22 (d, J=7.75 Hz, 1H), 7.06 - 7.09 (m, 2H), 7.01 - 7.05 (m, 2H), 4.61 (quind, J=7.04, 7.04, 7.04, 7.04, 2.63 Hz, 2H), 4.37 - 4.44 (m, 3H), 4.33 (d, J=3.75 Hz, 1H), 4.04 - 4.16 (m, 3H), 3.89 (d, J=3.00 Hz, 1H), 1.49 - 1.54 (m, 12H), 1.39 (t, J=7.19 Hz, 3H), 1.08 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 173.3, 173.2 [C=O amide]; 165.1, 163.5 [C=O ester]; 143.9, 143.7 [C]; 129.8, 129.5 [CH]; 125.1, 124.3 [CH]; 124.4 124.2 [C]; 122.9, 122.7 [CH]; 115.7, 113.5 [CN]; 110.7, 110.4 [CH]; 63.9, 63.4 [CH_2]; 45.1 [CH]; 44.9, 44.8 [CH]; 39.8, 38.3 [CH]; 19.6, 19.5 [CH_3]; 19.4, 19.3 [CH_3]; 14.3, 13.9 [CH_3]; **HRMS** (ESI) calcd for: $C_{16}H_{19}O_3N_2$, [M + H]$^+$ 287.1390, found: 287.1390.

Ethyl 2-(1-allyl-2-oxoindolin-3-yl)-2-cyanoacetate (3As):



The titled compound was prepared by following the procedure A, obtained as a Solid, 73 mg, 86% yield, mp = 95−97°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1) **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.46 (d, J=7.50 Hz, 1H), 7.25 (q, J=7.46 Hz, 2H), 7.16 (d, J=7.38 Hz, 1H), 7.01 (t, J=7.25 Hz, 2H), 6.80 (t, J=8.00 Hz, 2H), 5.76 (ddt, J=15.29, 10.22, 5.19, 5.19 Hz, 2H), 5.11 - 5.29 (m, 4H), 4.32 - 4.41 (m, 4H), 4.20 - 4.32 (m, 4H), 4.11 (d, J=3.63 Hz, 1H), 3.97 - 4.08 (m, 2H), 3.90 (d, J=3.13 Hz, 1H), 1.32 (t, J=7.13 Hz, 3H), 1.02 (t, J=7.19 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 173.0, 172.8 [C=O amide]; 164.6, 163.1 [C=O ester]; 143.8, 143.7 [C]; 130.8, 130.4 [CH]; 129.6, 129.3 [CH]; 124.5, 123.8 [CH]; 123.6, 123.4 [C]; 123.1, 122.8 [CH]; 118.0, 117.8 [=CH$_2$]; 115.3, 113.3 [CN]; 109.7, 109.4 [CH]; 63.7, 63.1 [CH$_2$]; 44.8, 44.7 [CH]; 42.7, 42.5 [CH$_2$]; 39.1, 37.7 [CH]; 13.9, 13.6 [CH$_3$]; **HRMS** (ESI) calcd for: $C_{16}H_{17}O_3N_2$, [M + H]$^+$ 285.1234, found: 285.1234

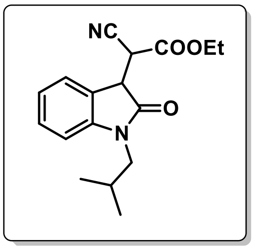
Ethyl 2-cyano-2-(2-oxo-1-(prop-2-yn-1-yl) indolin-3-yl) acetate (3At):



The titled compound was prepared by following the procedure A, obtained as a Solid, 67 mg, 80% yield, mp = 102−104°C; column chromatography on silica gel (petroleum ether/EtOAc 76:24); (Diastereomeric mixture, ratio 1:1.35); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.47 (d, J=7.38 Hz, 1H), 7.31 (q, J=7.25 Hz, 2H), 7.14 - 7.23 (m, 1H), 7.03 (q, J=8.17 Hz, 4H), 4.51 - 4.59 (m, 1H), 4.48 (d, J=2.38 Hz, 1H), 4.42 (d, J=2.50 Hz, 1H), 4.34 - 4.38 (m, 2H), 4.28 - 4.34 (m, 2H), 4.26 (d, J=3.88 Hz, 1H), 4.10 (d, J=3.75 Hz, 1H), 3.99 (dd, J=14.95, 7.19 Hz, 2H), 3.89 (d, J=3.00 Hz, 1H), 2.21 (s, 2H), 1.30 (t, J=7.13 Hz, 3H), 0.96 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.0, 171.8 [C=O amide]; 164.1, 162.6 [C=O ester]; 142.3, 142.2 [C];129.3, 129.1 [CH];124.2, 123.5 [CH]; 123.06 [C]; 123.1, 122.9 [CH]; 114.8,112.81 [CN]; 109.4, 109.1 [CH]; 75.9, 75.8 [CH]; 72.4, 72.2 [C]; 63.3, 62.8 [CH$_2$]; 44.2 [CH]; 38.5, 37.4

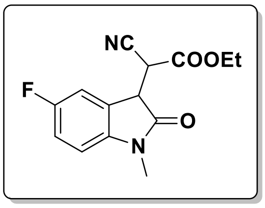
[CH]; 29.2, 29.1 [CH_2]; 13.5, 13.1 [CH_3]; **HRMS** (ESI) calcd for: $C_{16}H_{15}O_3N_2$, [M + H]$^+$ 283.1077, found: 283.1078.

Ethyl 2-cyano-2-(1-isobutyl-2-oxoindolin-3-yl) acetate (3Au):



The titled compound was prepared by following the procedure A, obtained as a Solid, 79 mg, 88% yield, mp = 86−88°C; column chromatography on silica gel (petroleum ether/EtOAc 80:20); (Diastereomeric mixture, ratio 1:1); ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.51 (d, J=7.50 Hz, 1H), 7.29 - 7.38 (m, 2H), 7.23 (d, J=7.50 Hz, 1H), 7.04 - 7.12 (m, 2H), 6.88 (d, J=7.88 Hz, 1H), 6.91 (d, J=7.88 Hz, 1H), 4.42 - 4.46 (m, 1H), 4.38 - 4.42 (m, 2H), 4.36 (d, J=3.63 Hz, 1H), 4.15 (d, J=3.63 Hz, 1H), 4.06 - 4.14 (m, 2H), 3.97 (d, J=3.13 Hz, 1H), 3.58 - 3.66 (m, 1H), 3.53 (dd, J=7.50, 3.50 Hz, 2H), 3.44 - 3.50 (m, 1H), 2.05 - 2.24 (m, 2H), 1.40 (t, J=7.13 Hz, 3H), 1.10 (t, J=7.13 Hz, 3H), 0.95 - 1.02 (m, 12H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 173.4, 173.2 [C=O amide]; 164.7, 163.2 [C=O ester]; 144.6, 144.3 [C]; 129.5, 129.3 [CH]; 124.6, 123.8 [CH]; 123.7, 123.5 [C]; 122.9, 122.6 [CH]; 115.3, 113.4 [CN]; 109.3, 109.0 [CH]; 63.6, 63.1 [CH_2]; 48.0, 47.9 [CH_2]; 44.8, 44.7 [CH]; 39.1, 37.7 [CH]; 27.1, 26.9 [CH]; 20.2 [CH_3]; 20.0 [CH_3]; 14.0, 13.6 [CH_3]; **HRMS** (ESI) calcd for: $C_{17}H_{21}O_3N_2$, [M + H]$^+$ 301.1551, found: 301.1541.

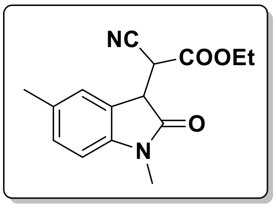
Ethyl 2-cyano-2-(5-fluoro-1-methyl-2-oxoindolin-3-yl) acetate (3Av):



The titled compound was prepared by following the procedure A, obtained as Solid, 73 mg, 90% yield, mp = 112−114°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1.60) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.22 (dd, J=7.25, 2.13 Hz, 1H), 6.91 - 7.04 (m, 3H), 6.68 - 6.80 (m, 2H), 4.32 - 4.38 (m, 3H), 4.30 (d, J=3.63 Hz, 1H), 3.98 - 4.07 (m, 3H), 3.87 (d, J=3.00 Hz, 1H), 3.16 (s, 3H), 3.15 (s, 3H), 1.31 (t, J=7.13 Hz, 3H), 1.04 (t, J=7.13 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.9, 172.8 [C=O amide]; 164.5, 163.1 [C=O ester]; 160.4, 157.9 (d, J = 241.7 Hz), [C-F]; 140.8, 140.6 [C]; 125.2, 125.0 [C]; 116.2, 115.7 (d, J = 12.7 Hz), [CH]; 115.1, 113.2 [CN]; 113.2, 112.1 (d, J = 21.9 Hz), [CH]; 109.5, 109.1 (d, J = 15.5 Hz) [CH]; 63.9, 63.3 [CH_2]; 44.9, 44.8 [CH]; 38.9, 37.6

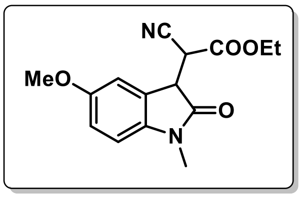
[CH]; 26.7 [N- CH_3]; 14.0, 13.7 [CH_3]; ^{19}**F NMR** (377 MHz, CHLOROFORM-d) δ ppm -119.37 (s, 1F), -119.53 (s, 1F); **HRMS** (ESI) calcd for: $C_{14}H_{14}O_3N_2F$, [M + H]$^+$ 277.0983, found: 277.0969.

Ethyl 2-cyano-2-(1,5-dimethyl-2-oxoindolin-3-yl) acetate (3Aw):



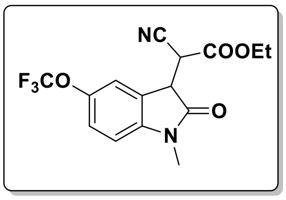
The titled compound was prepared by following the procedure A, obtained as a Solid, 75 mg, 92% yield, mp = 102−106°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.31 - 7.38 (m, 1H), 7.16 (t, J=6.75 Hz, 2H), 7.05 (s, 1H), 6.76 (d, J=7.88 Hz, 1H), 6.79 (d, J=8.00 Hz, 1H), 4.42 - 4.46 (m, 1H), 4.39 - 4.42 (m, 2H), 4.32 (d, J=3.75 Hz, 1H), 4.10 - 4.13 (m, 1H), 4.05 - 4.10 (m, 2H), 3.90 (d, J=3.00 Hz, 1H), 3.23 (s, 3H), 3.22 (s, 3H), 2.35 (s, 3H), 2.33 (s, 3H), 1.40 (t, J=7.13 Hz, 3H), 1.08 (t, J=7.19 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.8, 172.7 [C=O amide]; 164.4, 162.8 [C=O ester]; 142.0, 141.8 [C]; 132.5, 132.3 [C];129.6, 129.4 [CH]; 125.0, 124.3 [CH]; 123.3, 123.2 [C];115.1, 113.12 [CN];108.2, 107.9 [CH]; 63.3, 62.7 [CH_2]; 44.5, 44.4 [CH]; 38.7, 37.5 [CH]; 26.3, 26.2 [N-CH3]; 20.8, 20.7 [CH_3]; 13.7, 13.3 [CH_3]; ; **HRMS** (ESI) calcd for: $C_{15}H_{17}O_3N_2$, [M + H]$^+$ 273.1234, found: 273.1222.

Ethyl 2-cyano-2-(5-methoxy-1-methyl-2-oxoindolin-3-yl) acetate (3Ax):



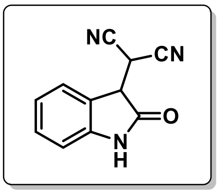
The titled compound was prepared by following the procedure A, obtained as a Solid, 74 mg, 86% yield, mp = 98−100°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1) ^{1}**H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.14 (s, 1H), 6.85 - 6.92 (m, 3H), 6.79 (t, J=9.35 Hz, 2H), 4.40 - 4.44 (m, 2H), 4.37 - 4.40 (m, 1H), 4.35 (d, J=3.79 Hz, 1H), 4.03 - 4.15 (m, 3H), 3.92 (d, J=3.06 Hz, 1H), 3.78 (d, J=6.36 Hz, 6H), 3.21 (d, J=4.65 Hz, 6H), 1.39 (t, J=7.15 Hz, 3H), 1.11 (t, J=7.15 Hz, 3H); ^{13}**C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.7, 172.6 [C=O amide]; 164.6, 163.1 [C=O ester]; 156.1, 156.0 [C]; 138., 137.9 [C]; 124.8, 124.6 [C]; 113.7, 113.6 [CH]; 115.17, 113.29 [CN]; 112.2, 111.1 [CH]; 109.0, 108.8 [CH]; 63.6, 63.0 [CH_2]; 55.7, 55.6 [CH_3]; 45.0, 44.9 [CH_3]; 38.9, 37.7 [CH]; 26.5, 26.4 [CH]; 13.9, 13.5 [CH_3]; **HRMS** (ESI) calcd for: $C_{15}H_{17}O_4N_2$, [M + H]$^+$ 289.1183, found: 289.1176.

Ethyl 2-cyano-2-(1-methyl-2-oxo-5-(trifluoromethoxy) indolin-3-yl) acetate (4Ay):



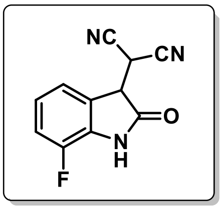
The titled compound was prepared by following the procedure A, obtained as a Solid, 95 mg, 92% yield, mp = 124–128°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); (Diastereomeric mixture, ratio 1:1); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 7.35 (s, 1H), 7.14 - 7.22 (m, 2H), 7.09 (s, 1H), 6.83 (d, J=8.63 Hz, 1H), 6.80 (d, J=8.50 Hz, 1H), 4.36 (d, J=3.13 Hz, 1H), 4.31 - 4.36 (m, 2H), 4.30 (d, J=3.75 Hz, 1H), 4.08 (d, J=3.63 Hz, 1H), 3.98 - 4.06 (m, 2H), 3.89 (d, J=3.25 Hz, 1H), 3.19 (s, 3H), 3.17 (s, 3H), 1.32 (t, J=7.13 Hz, 3H), 1.05 (t, J=7.19 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 172.9, 172.8 [C=O amide]; 164.4, 162.9 [C=O ester]; 144.8 144.6 [C-O], 143.5, 143.2 [C];, 125.1, 124.8 [C]; 122.8, 122.6 [CH]; 121.7, 119.1 [-OCF_3] 118.8, 118.0 [CH]; 114.9, 113.0 [CN]; 109.3, 109.0 [CH]; 63.9, 63.3 [CH_2]; 44.8, 44.6 [CH]; 38.8, 37.5[CH]; 26.7, 26.6 [N-CH_3]; 13.82, 13.5 [CH_3]; **^{19}F NMR** (376 MHz, CHLOROFORM-d) δ ppm -58.44 (s, 1F), -58.49 (s, 1F) ; **HRMS** (ESI) calcd for: $C_{15}H_{14}O_4N_2F_3$, [M + H]$^+$ 343.0900, found: 343.0891.

2-(2-oxoindolin-3-yl) malononitrile (3B):



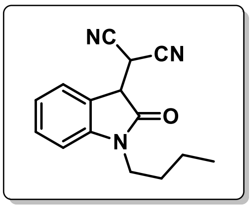
The titled compound was prepared by following the procedure A, obtained as a Solid, 55 mg, 92% yield, mp = 160–164°C; column chromatography on silica gel (petroleum ether/EtOAc 60:40); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 10.92 (s, 1H), 7.46 (d, J=7.38 Hz, 1H), 7.33 (t, J=7.75 Hz, 1H), 7.01 - 7.16 (m, 1H), 6.94 (d, J=7.75 Hz, 1H), 5.64 (d, J=4.50 Hz, 1H), 4.44 (d, J=4.38 Hz, 1H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 173.7, 143.1, 129.8, 124.5, 123.7, 122.2, 112.7, 112.4, 110.2, 44.0, 23.8; **HRMS** (ESI) calcd for: $C_{11}H_8ON_3$, [M + H]$^+$ 198.0662, found: 198.0663.

2-(7-fluoro-2-oxoindolin-3-yl) malononitrile (3Ba):



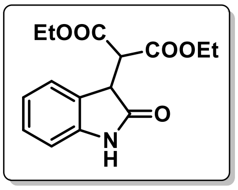
The titled compound was prepared by following the procedure A, obtained as a Solid, 58 mg, 90% yield, mp = 152−154°C; column chromatography on silica gel (petroleum ether/EtOAc 60:40); **^{1}H NMR** (400 MHz, *DMSO-d*^{6}) δ ppm 11.45 (s, 2H), 7.23 - 7.33 (m, 2H), 7.07 - 7.14 (m, 1H), 5.68 (d, *J*=4.50 Hz, 1H), 4.56 (d, *J*=4.50 Hz, 1H); **^{13}C NMR** (101 MHz, *DMSO-d*^{6}) δ ppm 173.5, 145.2 (d, J = 242.9 Hz); 130.2, 126.6, 123.2 (d, J = 10.9 Hz); 120.6 (d, J = 3.3 Hz); 117.0 (d, J = 17.0 Hz); 112.5, 112.2, 44.3, 23.8. **^{19}F NMR** (376 MHz, *DMSO-d*^{6}) δ ppm -127.17 (s, 1F) **HRMS** (ESI) calcd for: $C_{11}H_6ON_3FNa$, $[M + Na]^+$ 238.0390, found: 238.0384.

2-(1-butyl-2-oxoindolin-3-yl) malononitrile (3Bb):



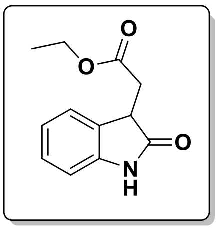
The titled compound was prepared by following the procedure A, obtained as a Solid, 65 mg, 86% yield, mp = 136−140°C; column chromatography on silica gel (petroleum ether/EtOAc 70:30); **^{1}H NMR** (400 MHz, *CHLOROFORM-d*) δ ppm 7.58 (d, *J*=7.38 Hz, 1H), 7.37 (t, *J*=7.75 Hz, 1H), 7.12 (t, *J*=7.94 Hz, 1H), 6.89 (d, *J*=7.88 Hz, 1H), 4.50 (d, *J*=4.40 Hz, 1H), 3.85 (d, *J*=4.40 Hz, 1H), 3.81 (dt, *J*=14.13, 7.19 Hz, 1H), 3.61 (dt, *J*=14.13, 7.19 Hz, 1H), 1.57 - 1.65 (m, 2H), 1.33 (dq, *J*=14.95, 7.44 Hz, 2H), 0.88 (t, *J*=7.38 Hz, 3H); **^{13}C NMR** (101 MHz, *CHLOROFORM-d*) δ ppm 170.8, 144.0, 130.7, 124.8, 123.6, 121.6, 111.6, 109.6, 109.5, 44.9, 40.5, 29.2, 24.6, 20.0, 13.6 **HRMS** (ESI) calcd for: $C_{15}H_{16}ON_3$, $[M + H]^+$ 254.1288, found: 254.1284.

Diethyl 2-(2-oxoindolin-3-yl) malonate (3C):



The titled compound was prepared by following the procedure, obtained as a Solid, 61 mg, 74% yield, mp = 88−90°C; column chromatography on silica gel (petroleum ether/EtOAc 75:25); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 8.85 (br. s., 1H), 7.30 (d, J=7.50 Hz, 1H), 7.15 (t, J=7.75 Hz, 1H), 6.92 (t, J=7.63 Hz, 1H), 6.82 (d, J=7.75 Hz, 1H), 4.22 (m, 2H), 4.15 (d, J=7.13 Hz, 1H), 4.00-3.95 (m, 3H), 1.22 (t, J=7.19 Hz, 3H), 0.94 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 177.7, 168.0, 166.9, 141.9, 128.6, 126.1, 125.1, 122.4, 109.8, 61.9, 61.7, 52.1, 45.1, 14.0, 13.; **HRMS** (ESI) calcd for: $C_{15}H_{18}O_5N$, [M + H]$^+$ 292.1179, found: 292.1176.

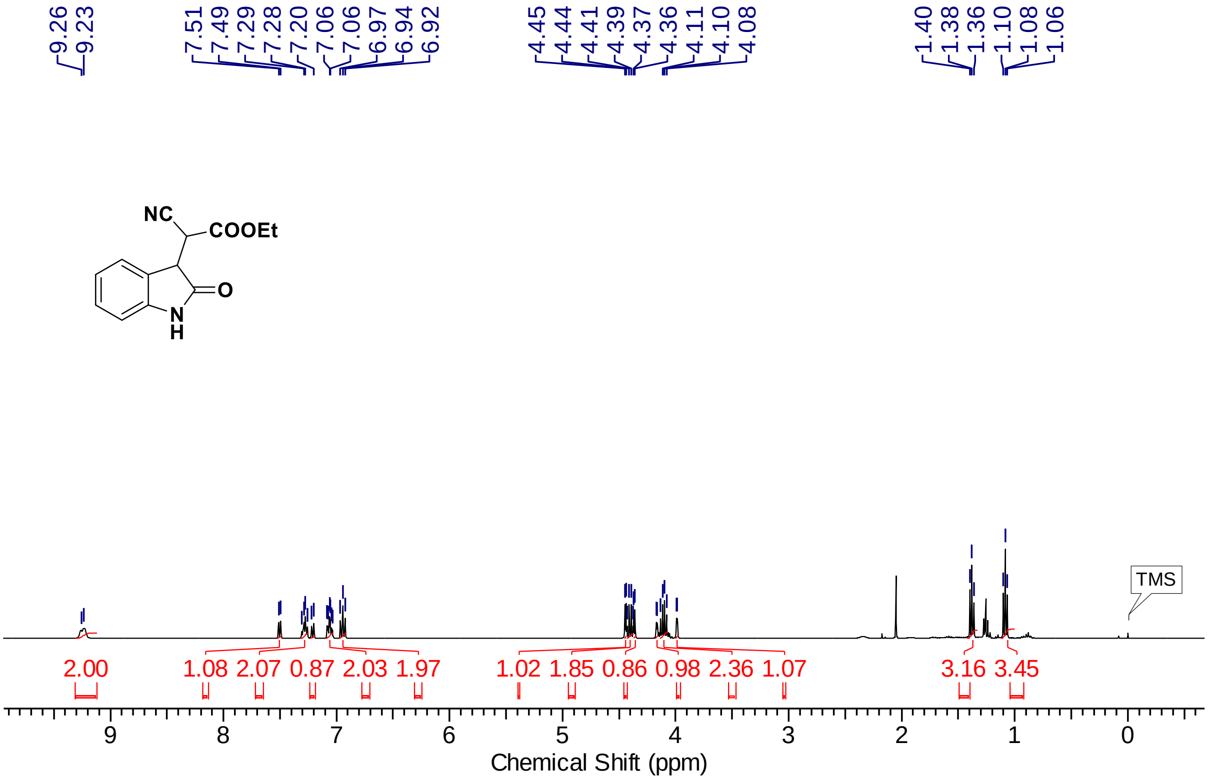
Ethyl 2-(2-oxoindolin-3-yl) acetate (3D):



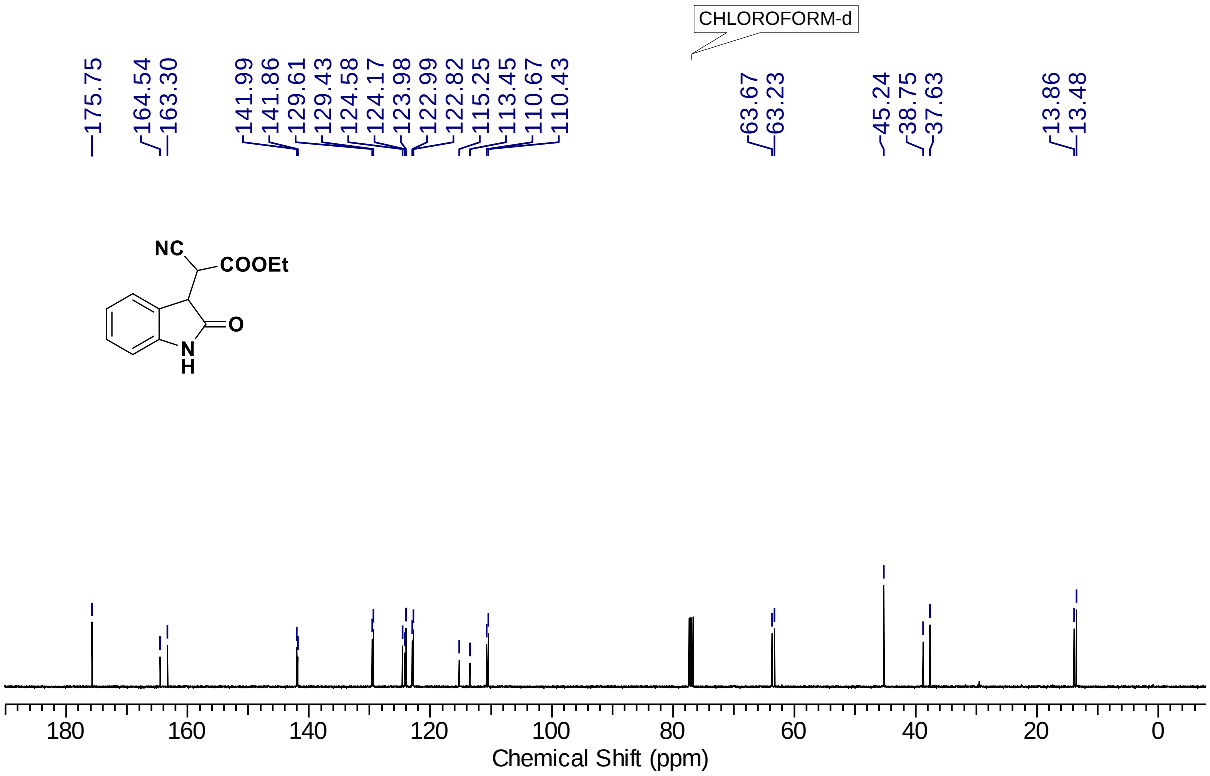
The titled compound was prepared by following the procedure A, obtained as a Solid, 37 mg, 56% yield, mp = 95−97°C; column chromatography on silica gel (petroleum ether/EtOAc 85:15); **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ ppm 9.17 (br. s., 1H), 7.08 - 7.18 (m, 2H), 6.88 - 6.96 (m, 1H), 6.84 (d, J=7.75 Hz, 1H), 4.06 (dtt, J=10.76, 7.16, 7.16, 3.66, 3.66 Hz, 2H), 3.74 (dd, J=7.82, 4.57 Hz, 1H), 3.00 (dd, J=16.82, 4.57 Hz, 1H), 2.76 (dd, J=16.88, 7.88 Hz, 1H), 1.12 (t, J=7.13 Hz, 3H); **^{13}C NMR** (101 MHz, CHLOROFORM-d) δ ppm 179.9, 171.3, 142.0, 129.0, 128.5, 124.3, 122.7, 110.2, 61.3, 42.7, 35.0, 14.3; HRMS (ESI) calcd for: $C_{12}H_{14}O_3NNa$, [M + Na]$^+$ 242.0993, found: 242.0988.

8. NMR Spectra of Compounds

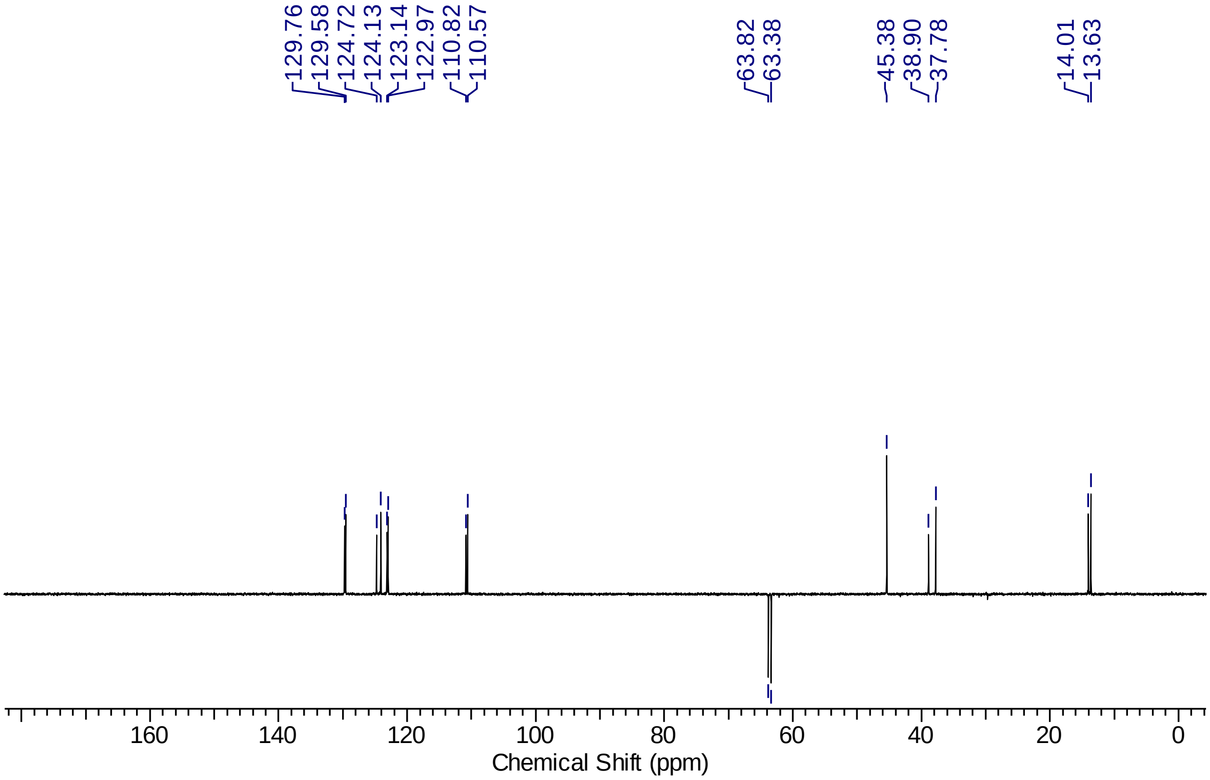
^{1}H NMR spectrum of compound 3Aa (400 MHz, $CDCl_3$)



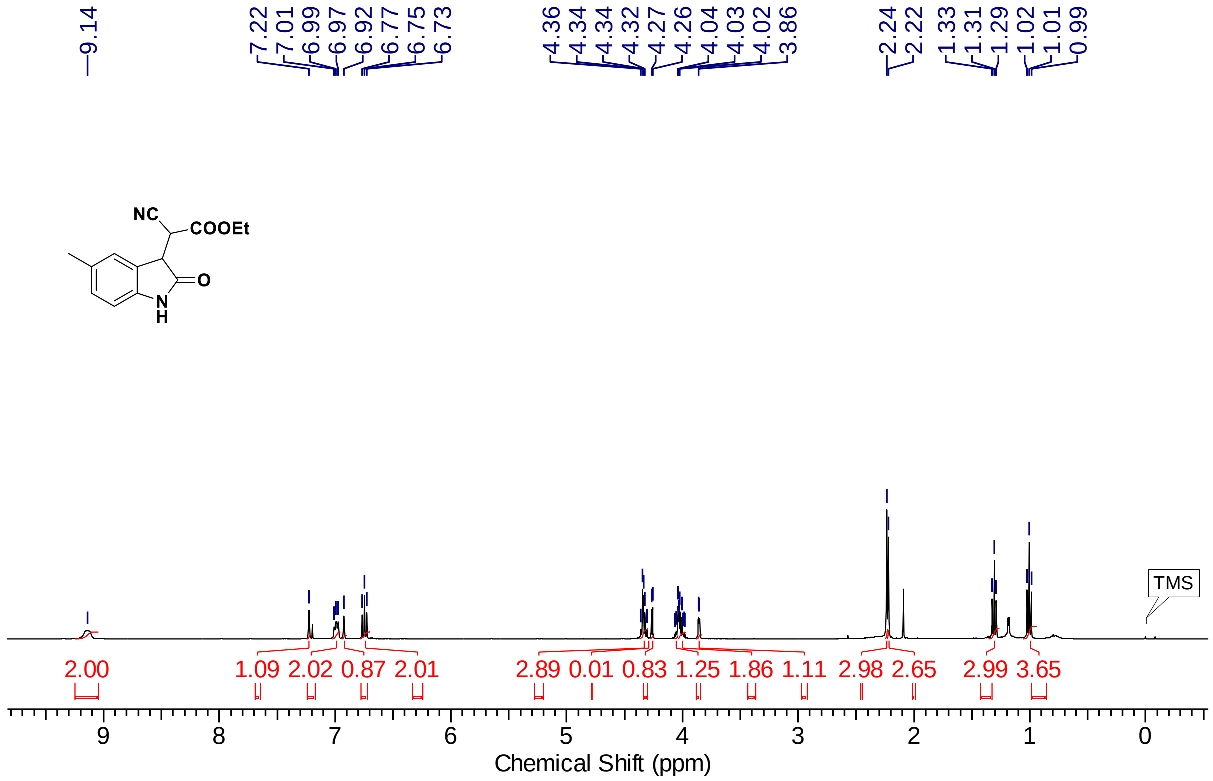
^{13}C NMR spectrum of compound 3Aa (101 MHz, $CDCl_3$)



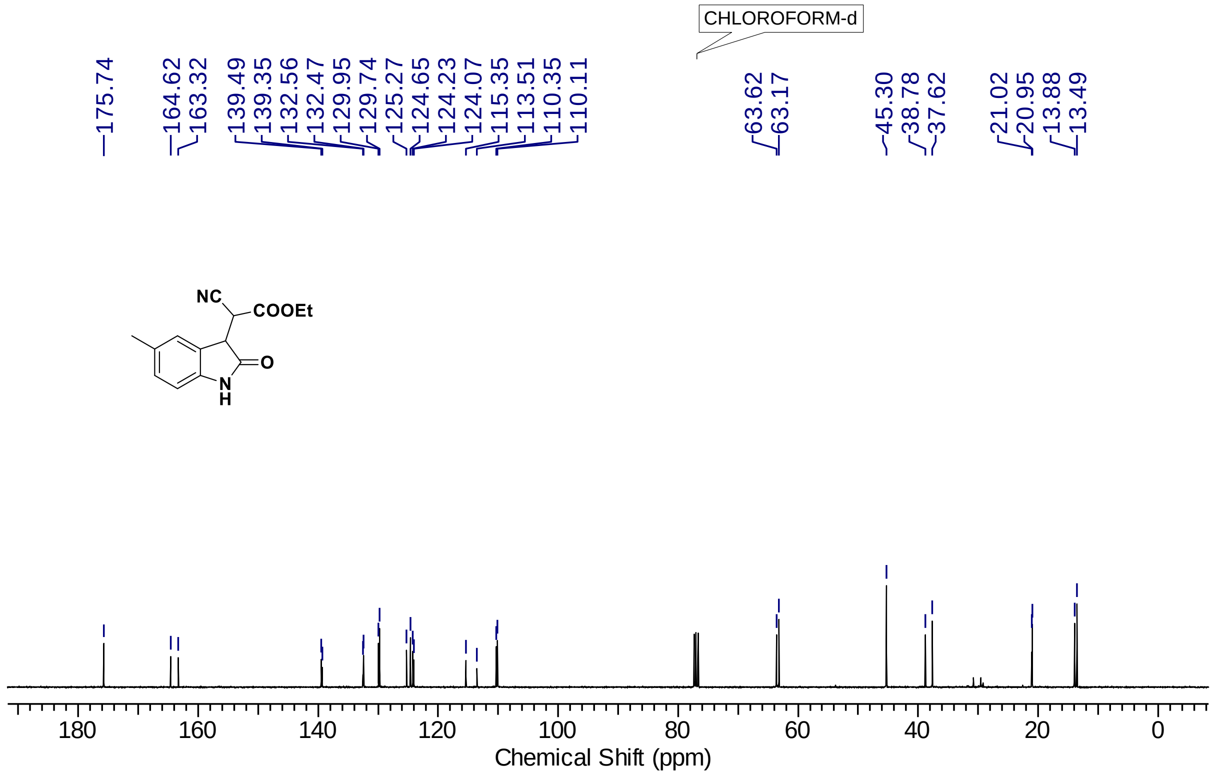
135 DEPT NMR spectrum of compound 3Aa



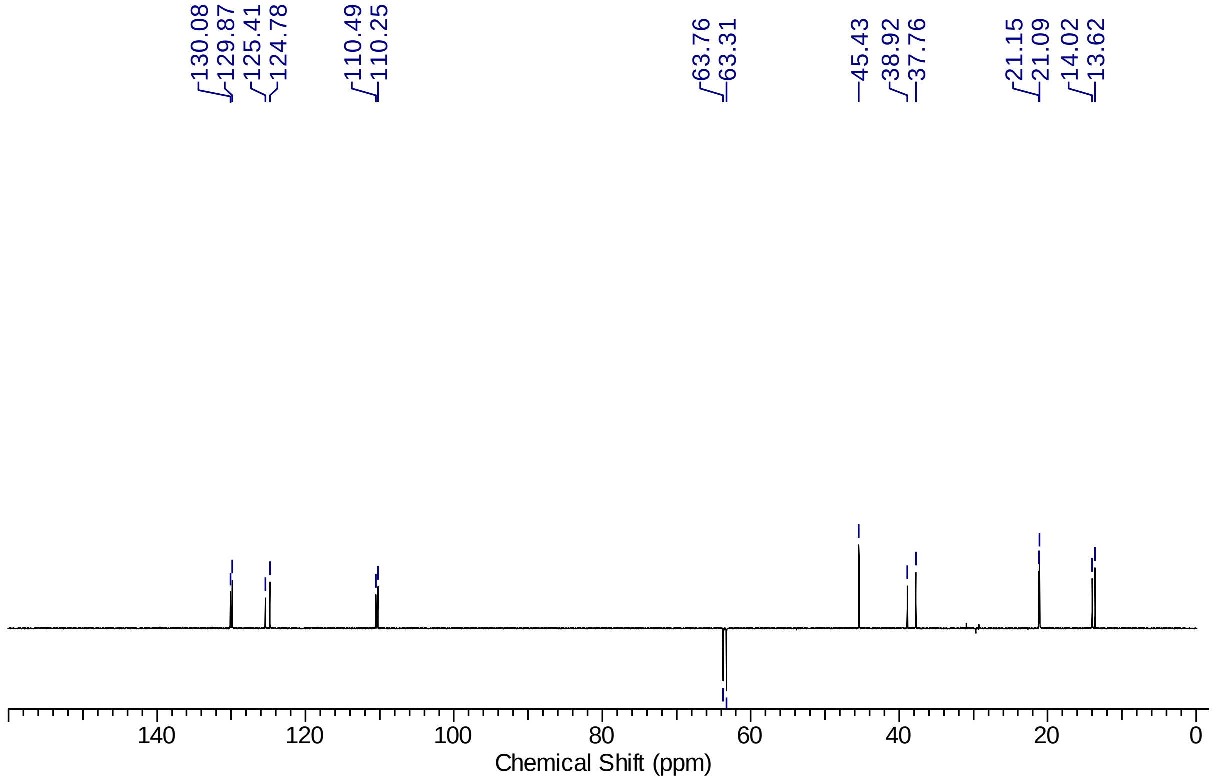
^{1}H NMR spectrum of compound 3Ab (400 MHz, $CDCl_3$)



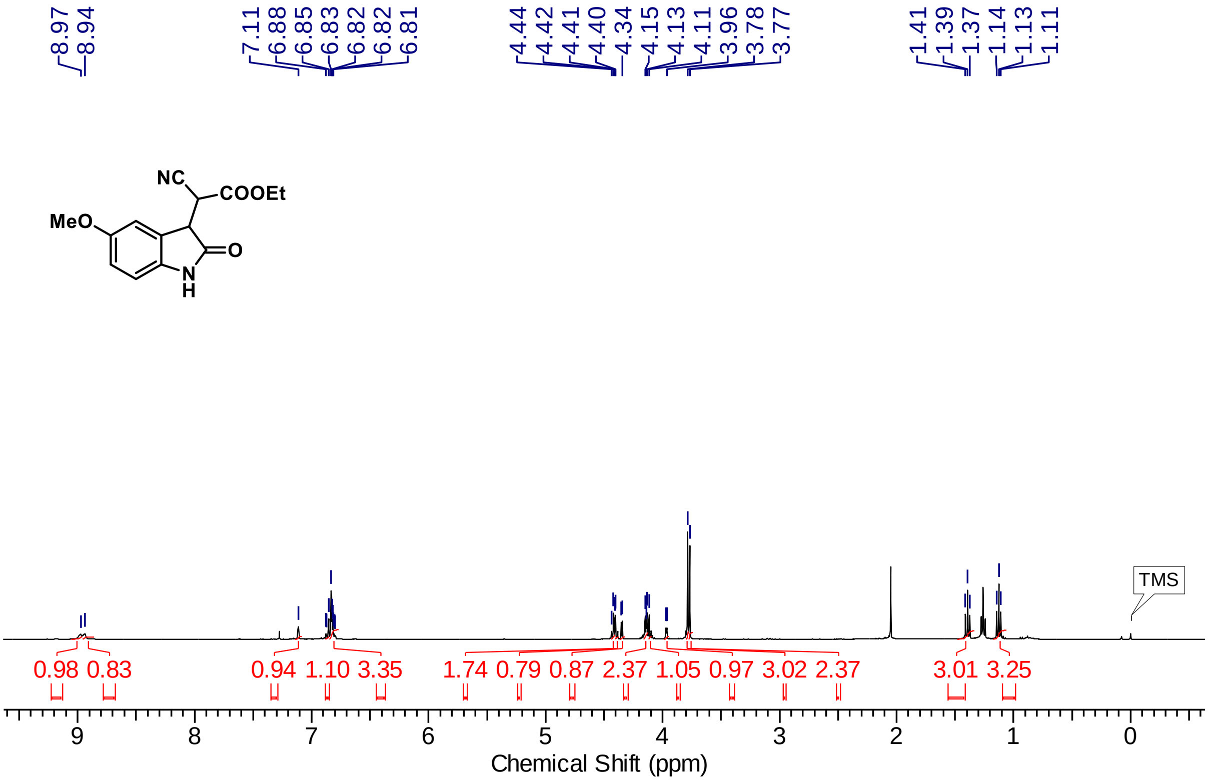
^{13}C NMR spectrum of compound 3Ab (101 MHz, $CDCl_3$)



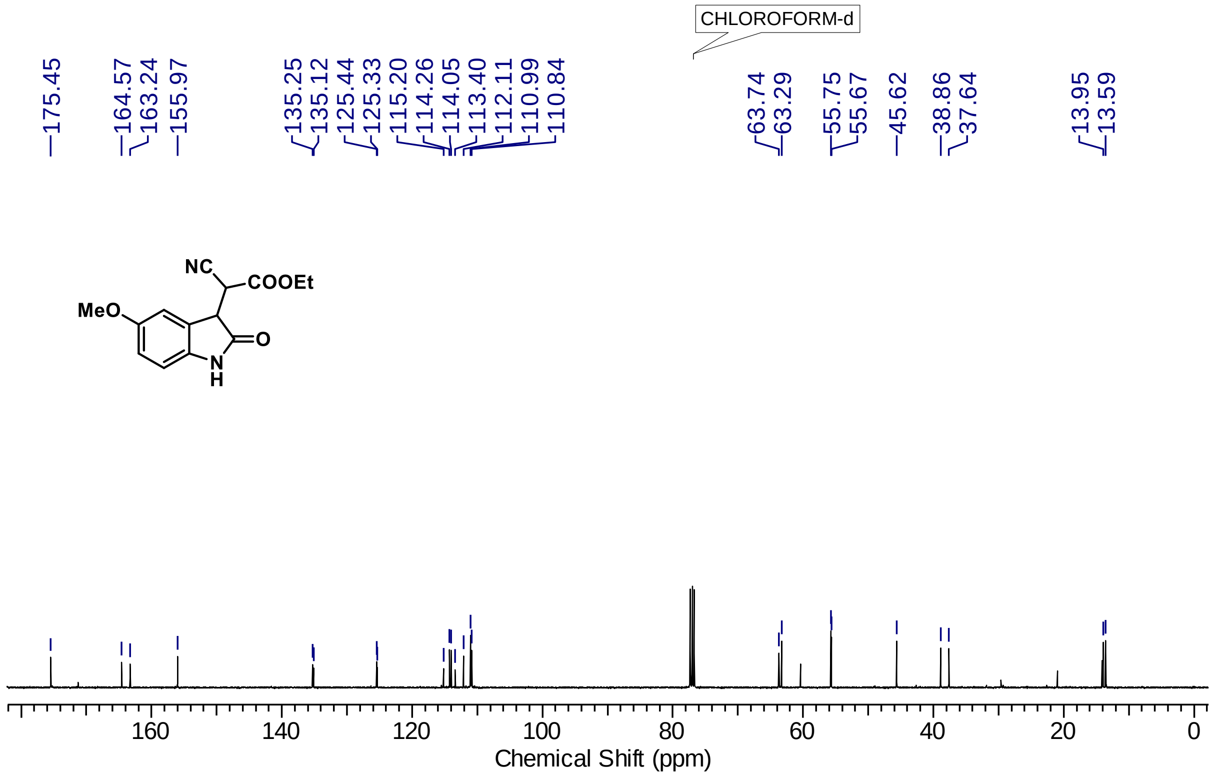
135 DEPT NMR spectrum of compound 3Ab



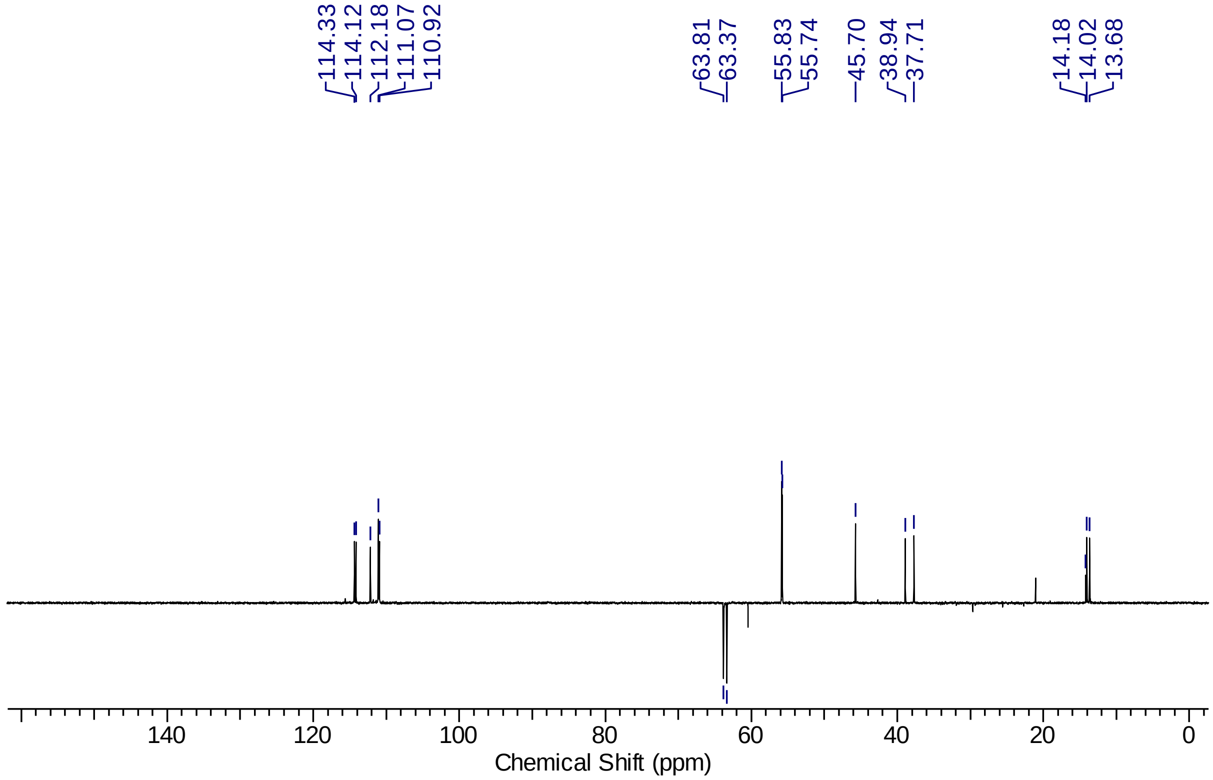
^{1}H NMR spectrum of compound 3Ac (400 MHz, $CDCl_3$)



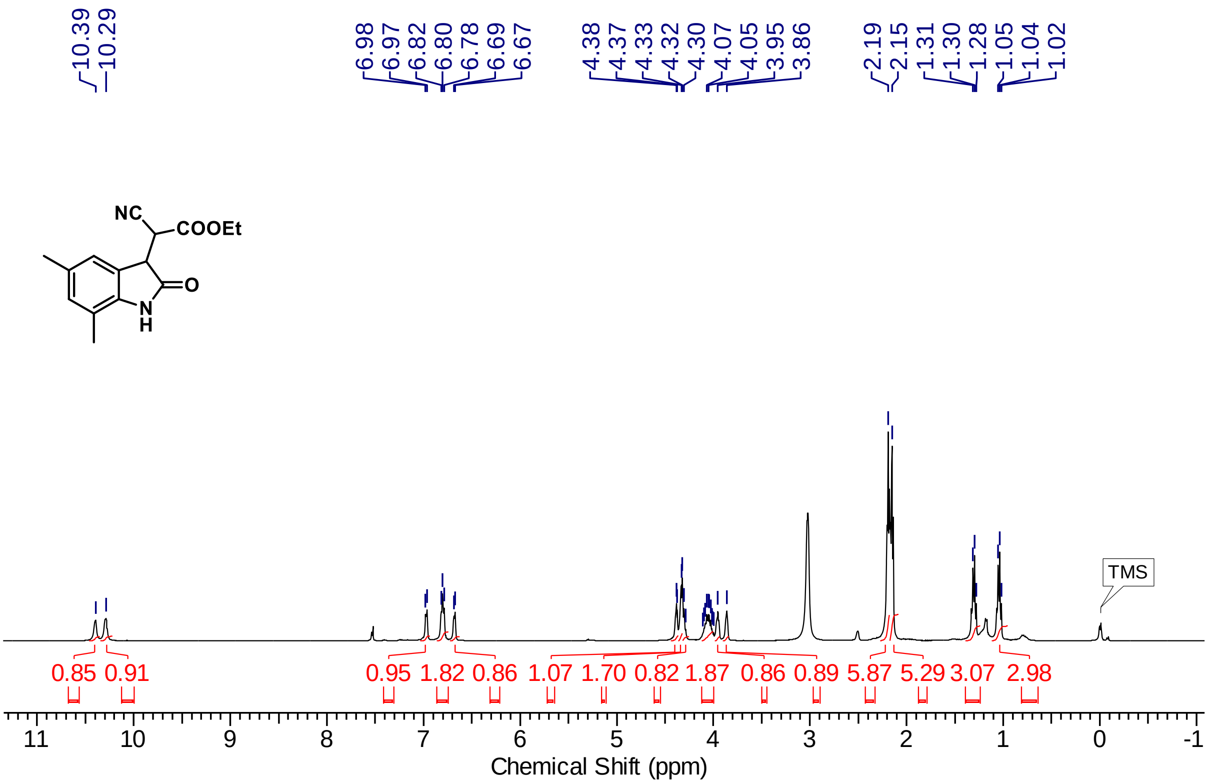
^{13}C NMR spectrum of compound 3Ac (101 MHz, $CDCl_3$)



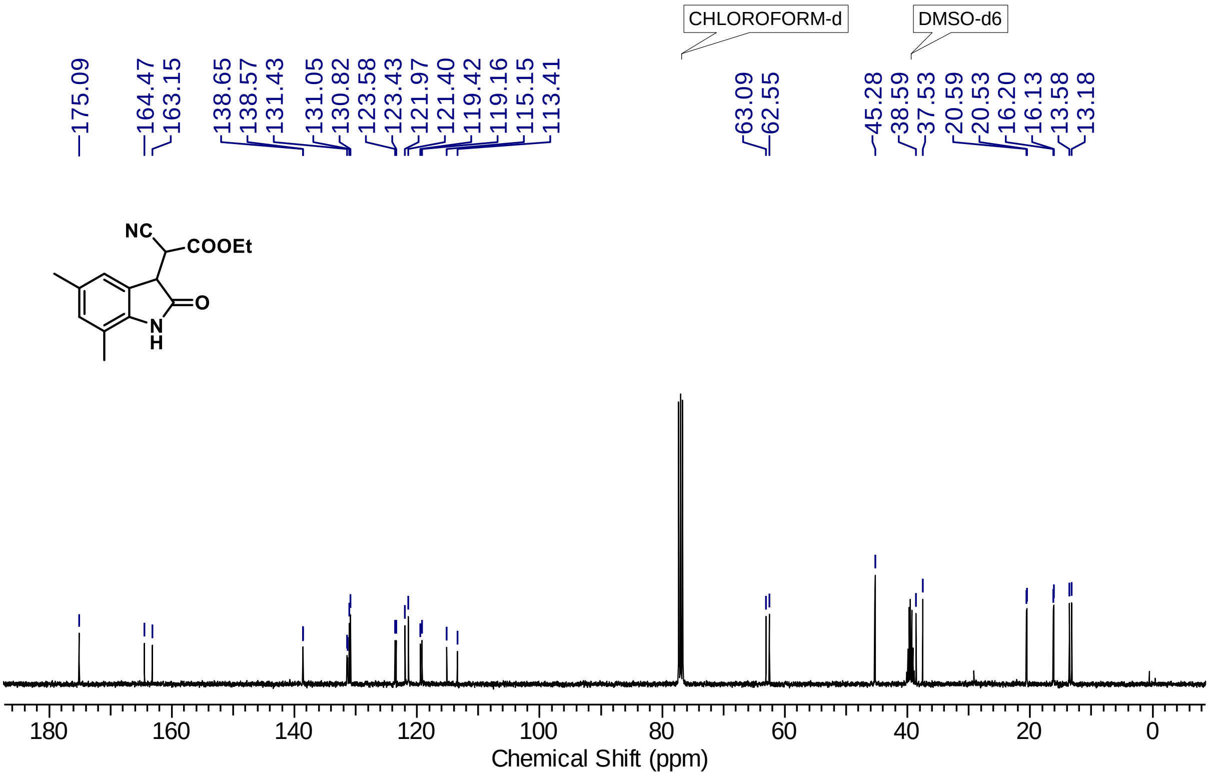
135 DEPT NMR spectrum of compound 3Ac



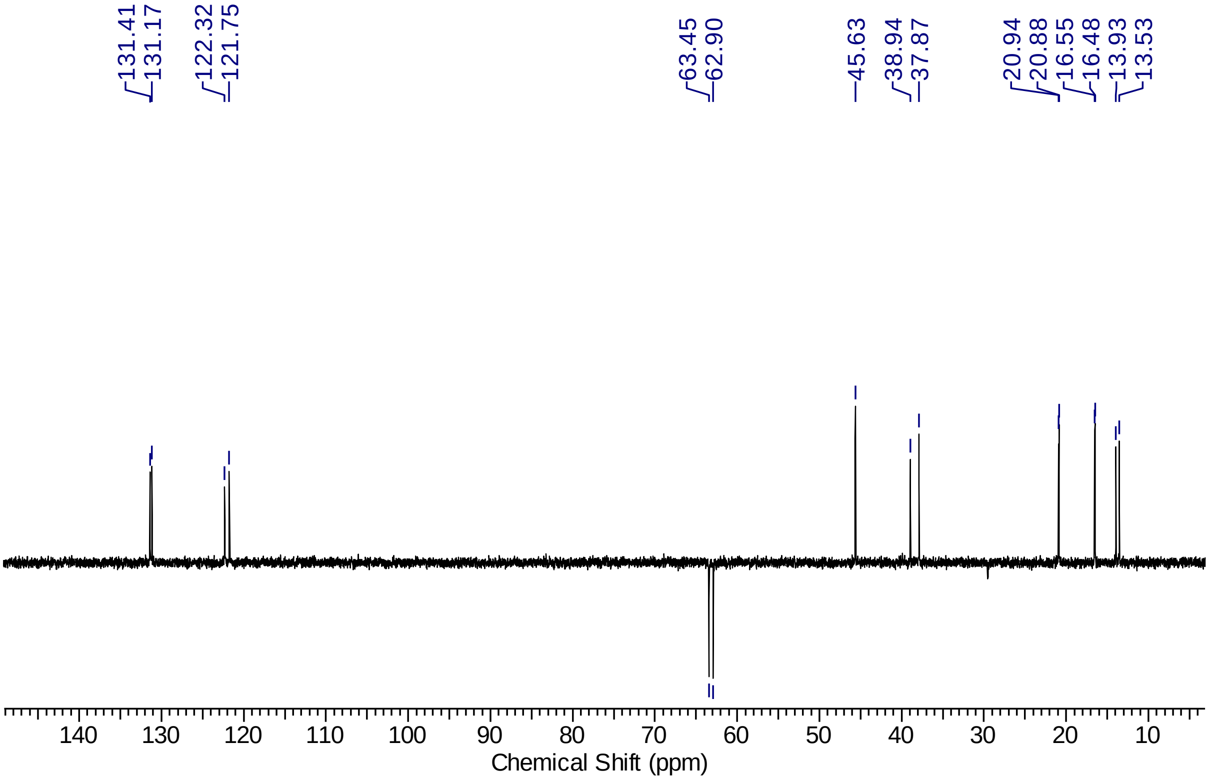
^{1}H NMR spectrum of compound 3Ad (400 MHz, $CDCl_3$)



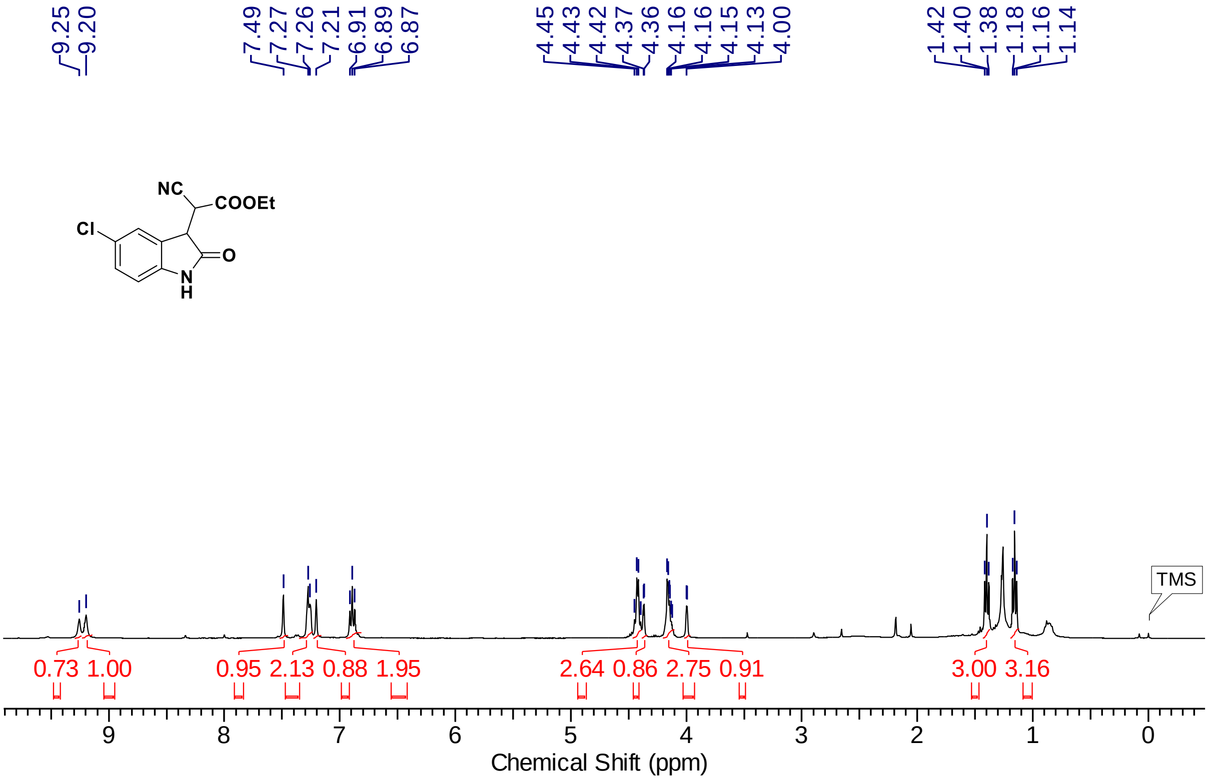
^{13}C NMR spectrum of compound 3Ad (101 MHz, $CDCl_3$)



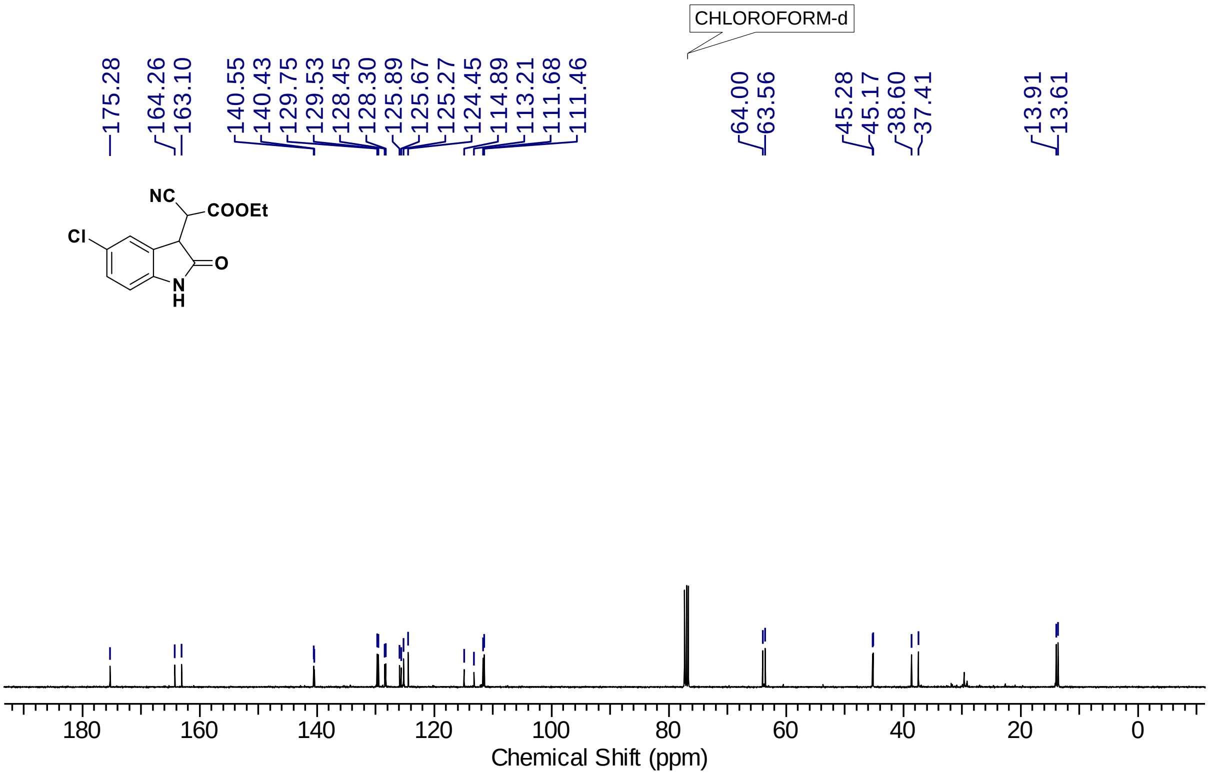
135 DEPT NMR spectrum of compound 3Ad



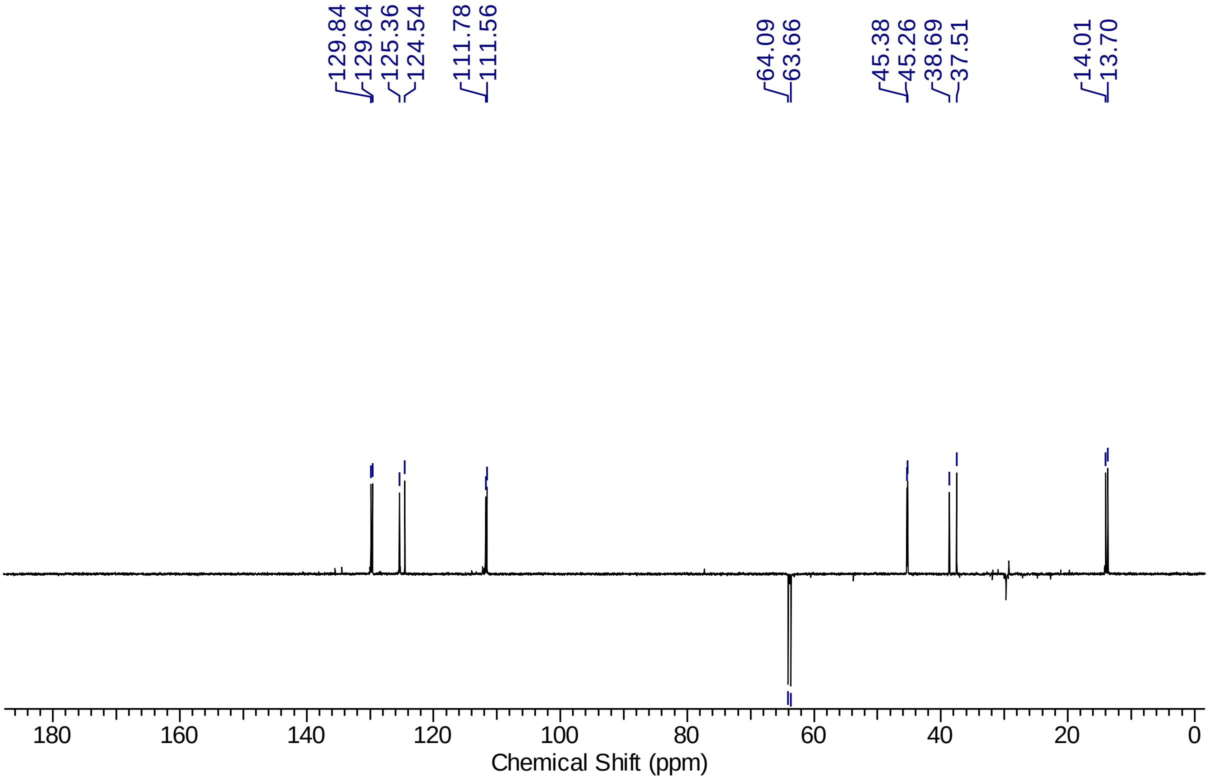
^{1}H NMR spectrum of compound 3Ae (400 MHz, CDCl$_3$)



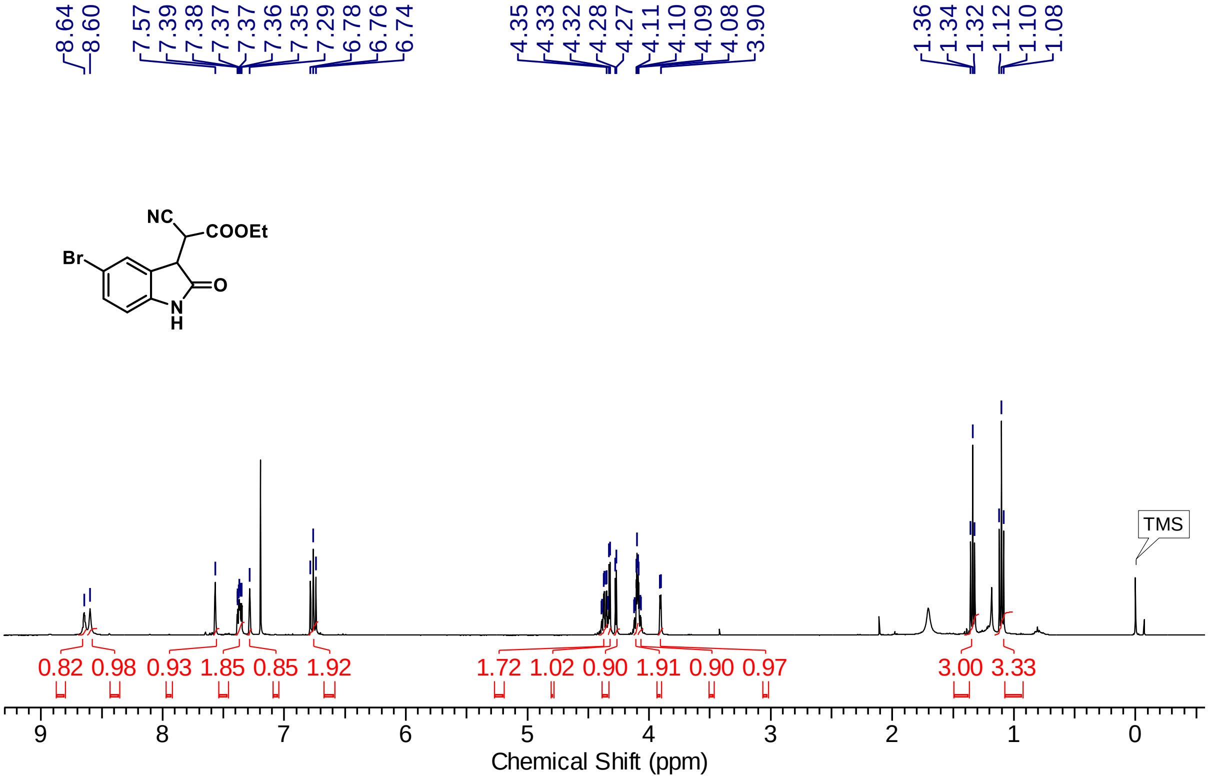
^{13}C NMR spectrum of compound 3Ae (101 MHz, CDCl$_3$)



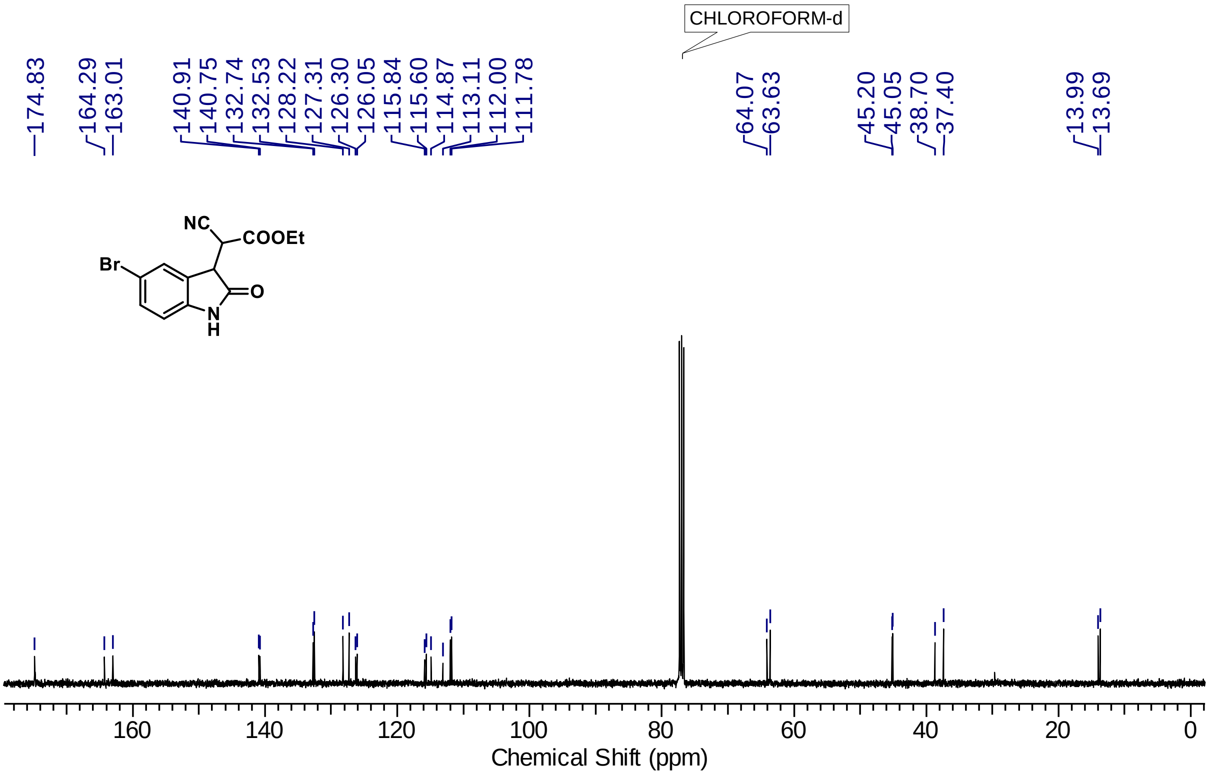
135 DEPT NMR spectrum of compound 3Ae



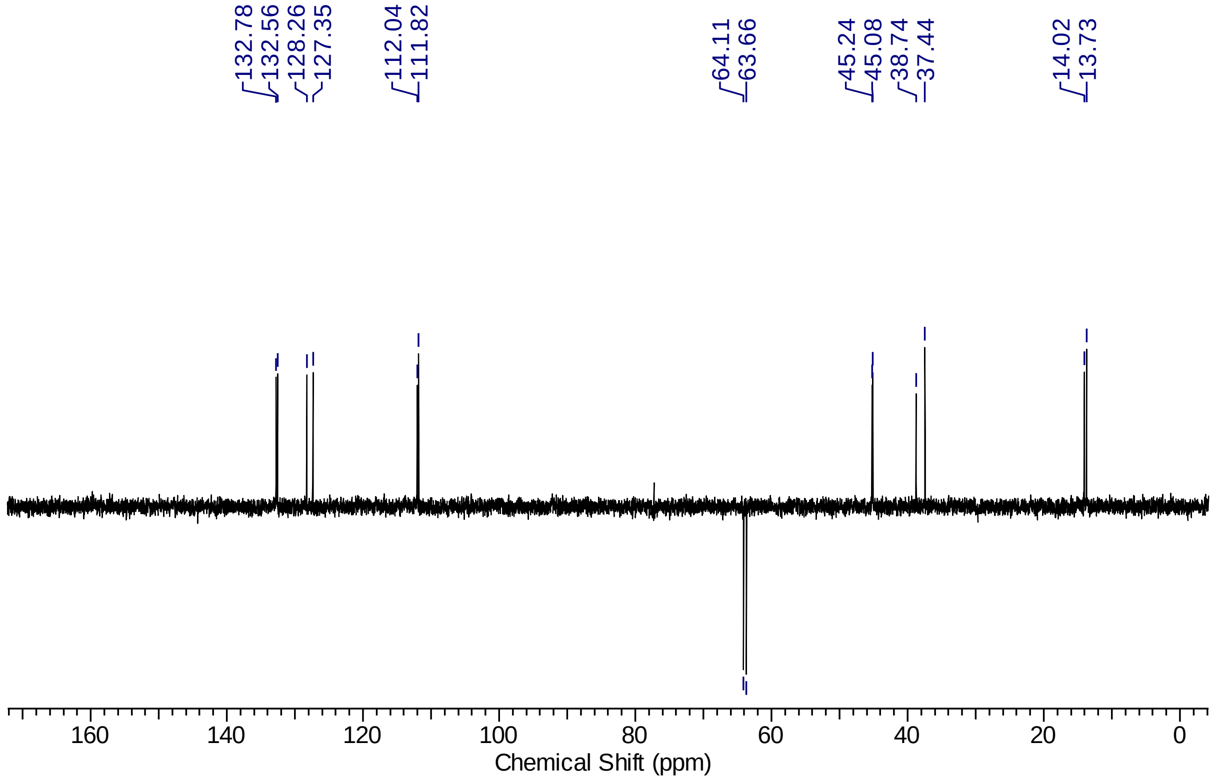
^{1}H NMR spectrum of compound 3Af (400 MHz, CDCl$_3$)



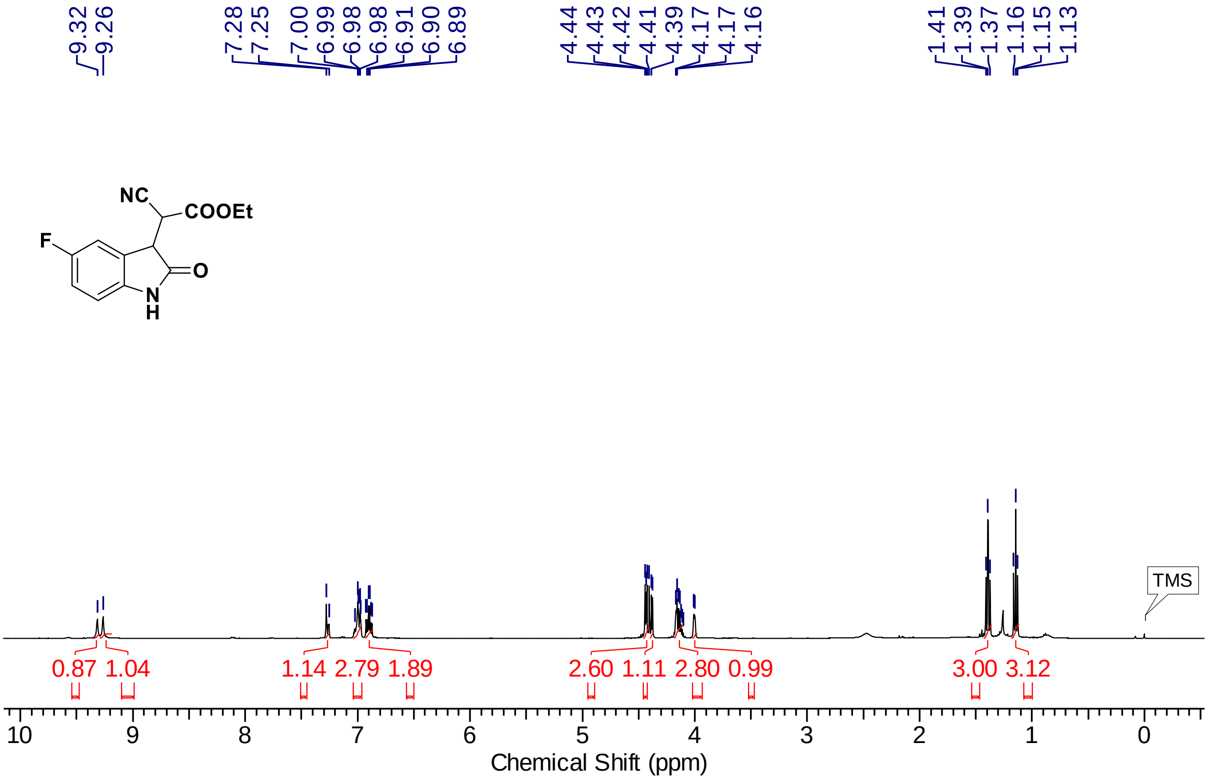
^{13}C NMR spectrum of compound 3Af (101 MHz, CDCl$_3$)



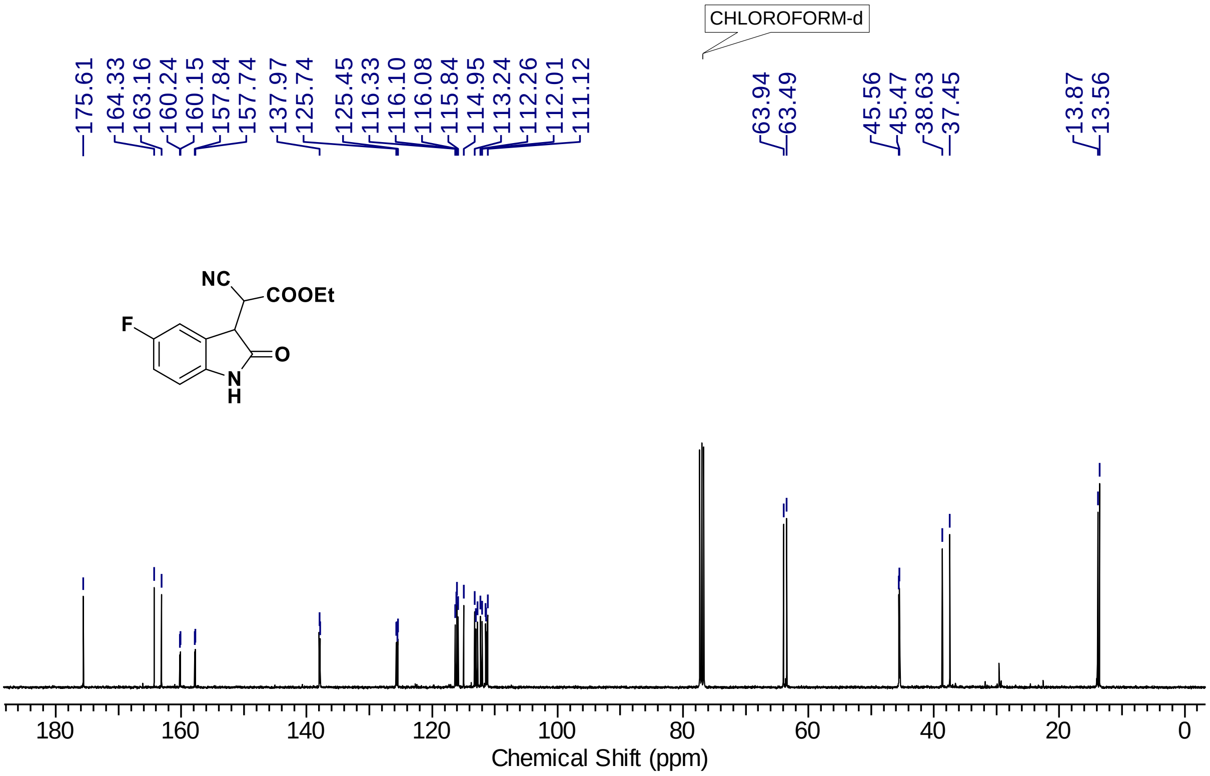
135 DEPT NMR spectrum of compound 3Af



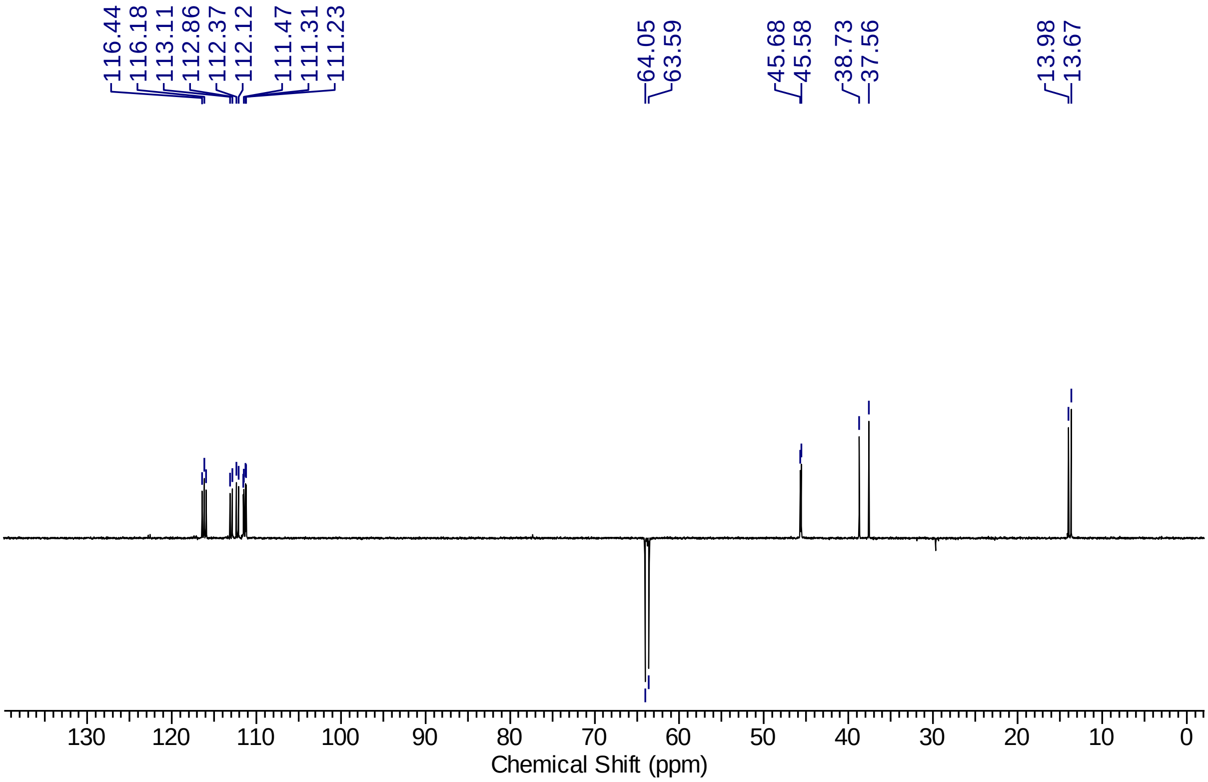
^{1}H NMR spectrum of compound 3Ag (400 MHz, CDCl$_3$)



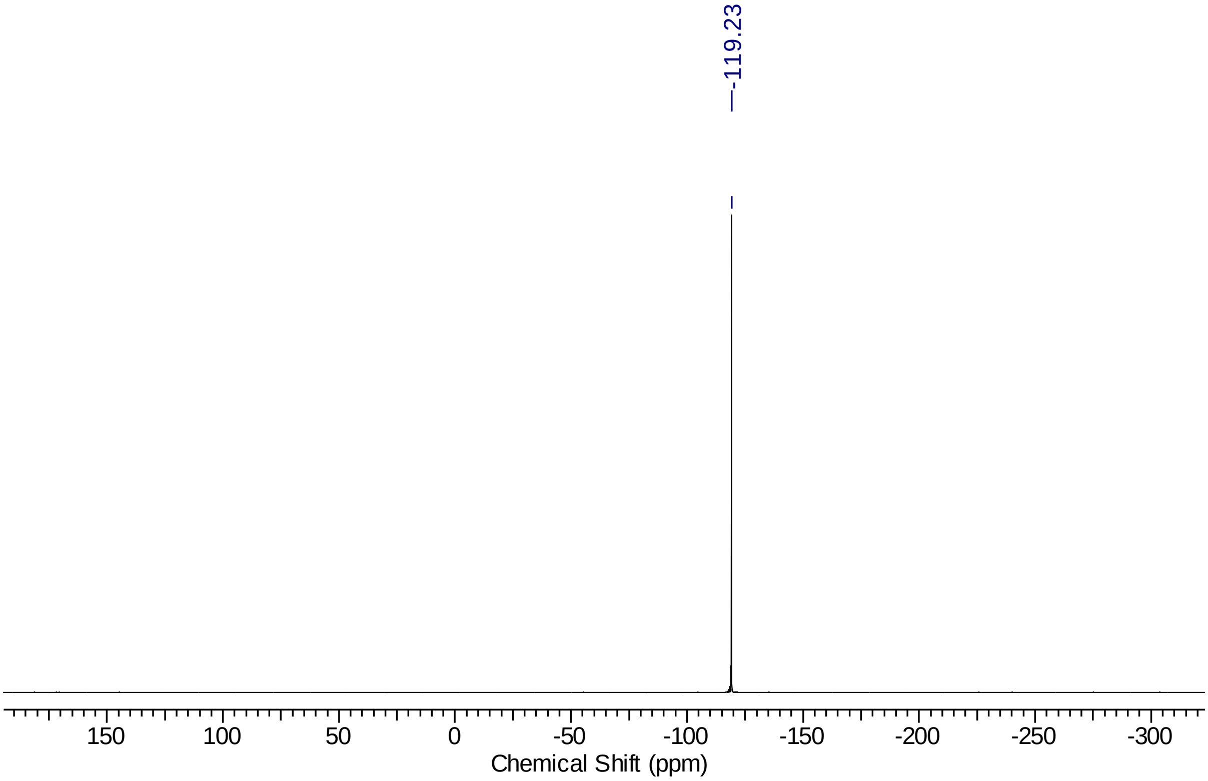
^{13}C NMR spectrum of compound 3Ag (101 MHz, CDCl$_3$)



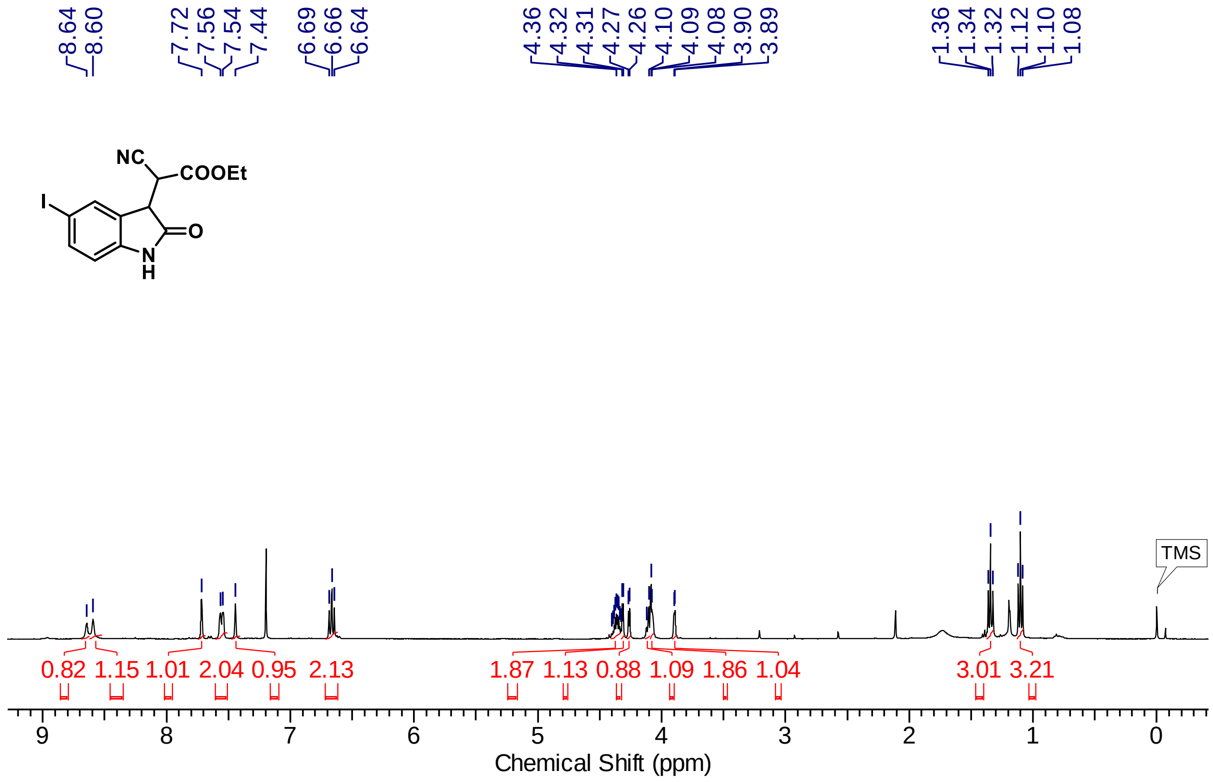
135 DEPT NMR spectrum of compound 3Ag



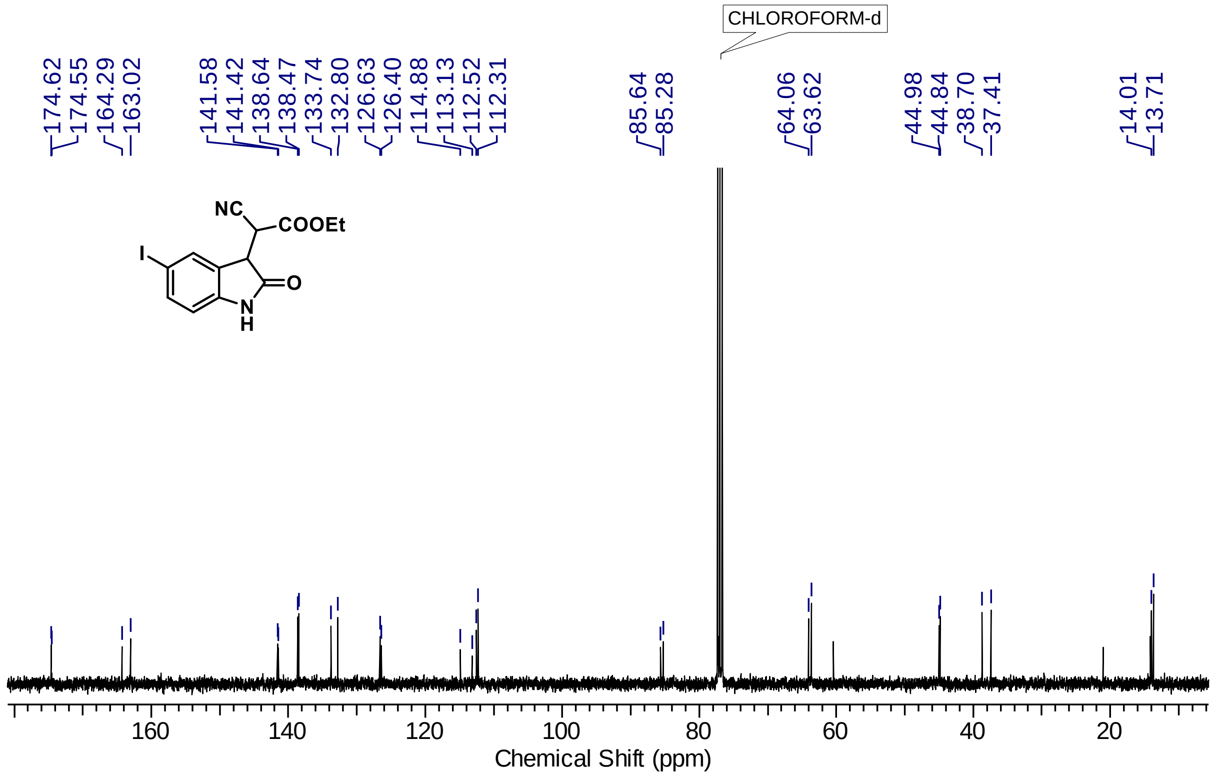
^{19}F spectrum of compound 3Ag



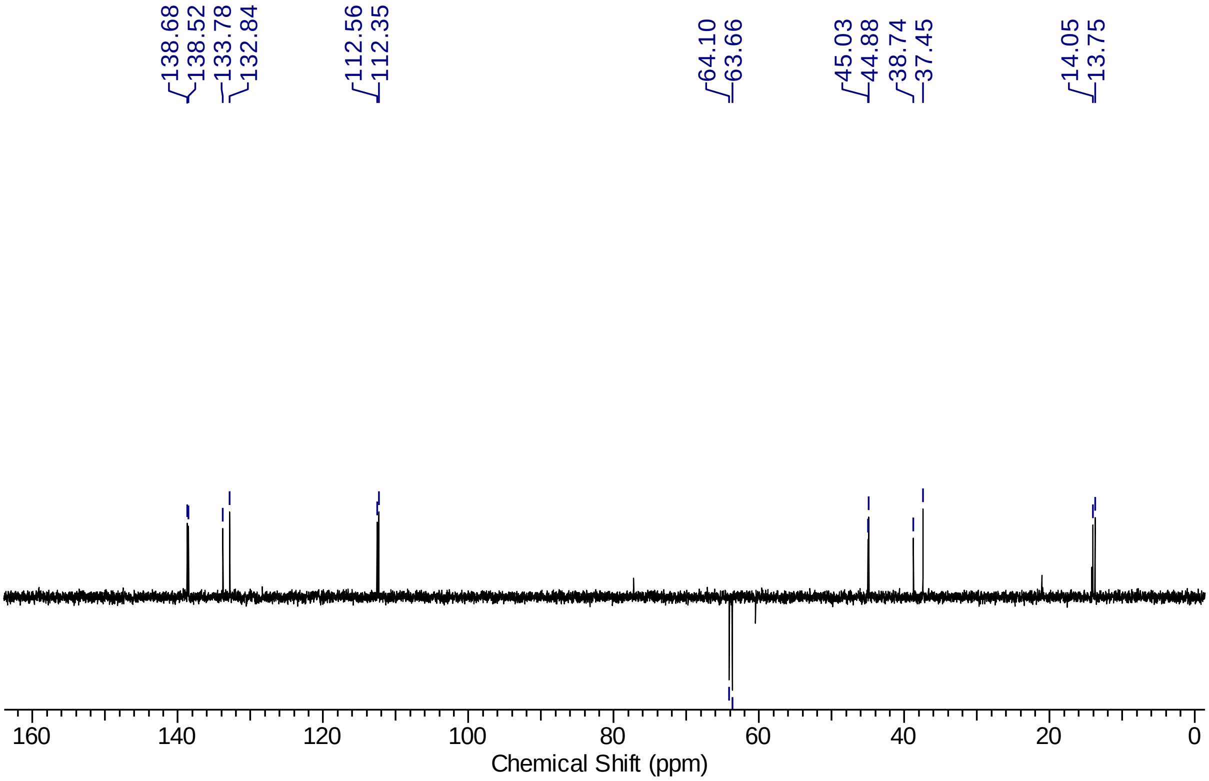
^{1}H NMR spectrum of compound 3Ah (400 MHz, CDCl$_3$)



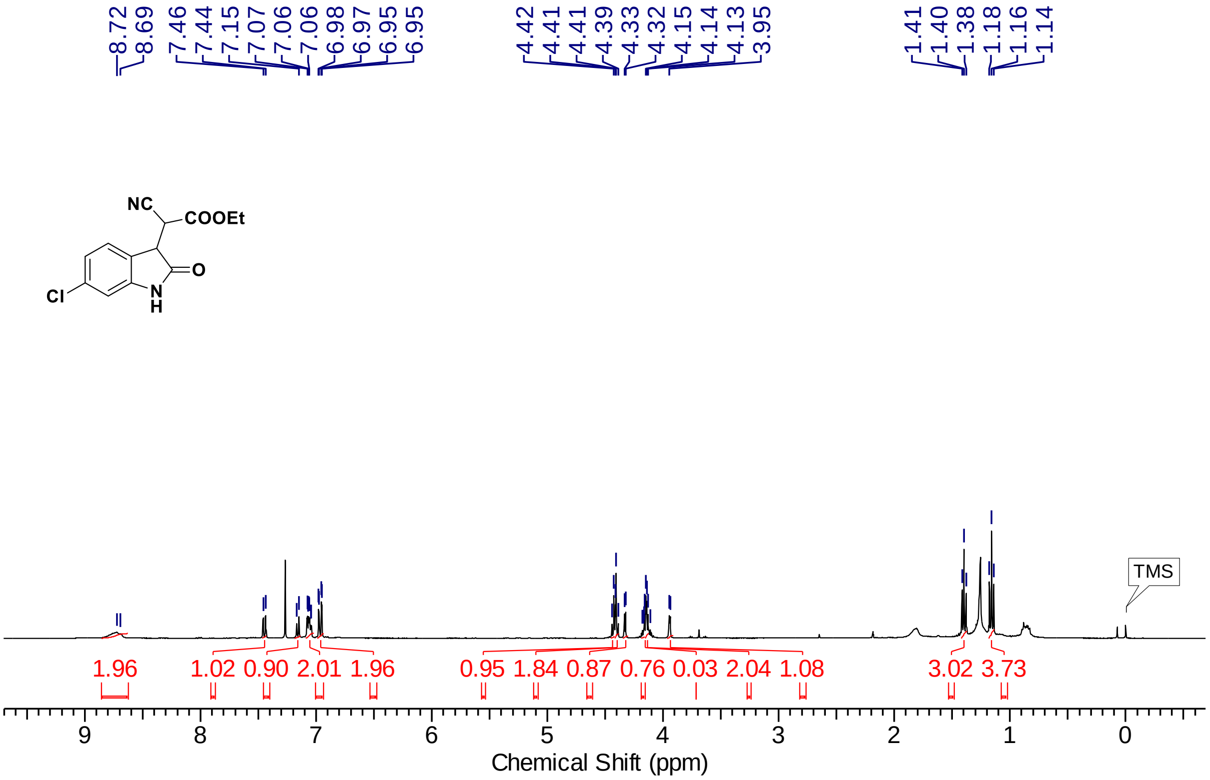
^{13}C NMR spectrum of compound 3Ah (101 MHz, CDCl$_3$)



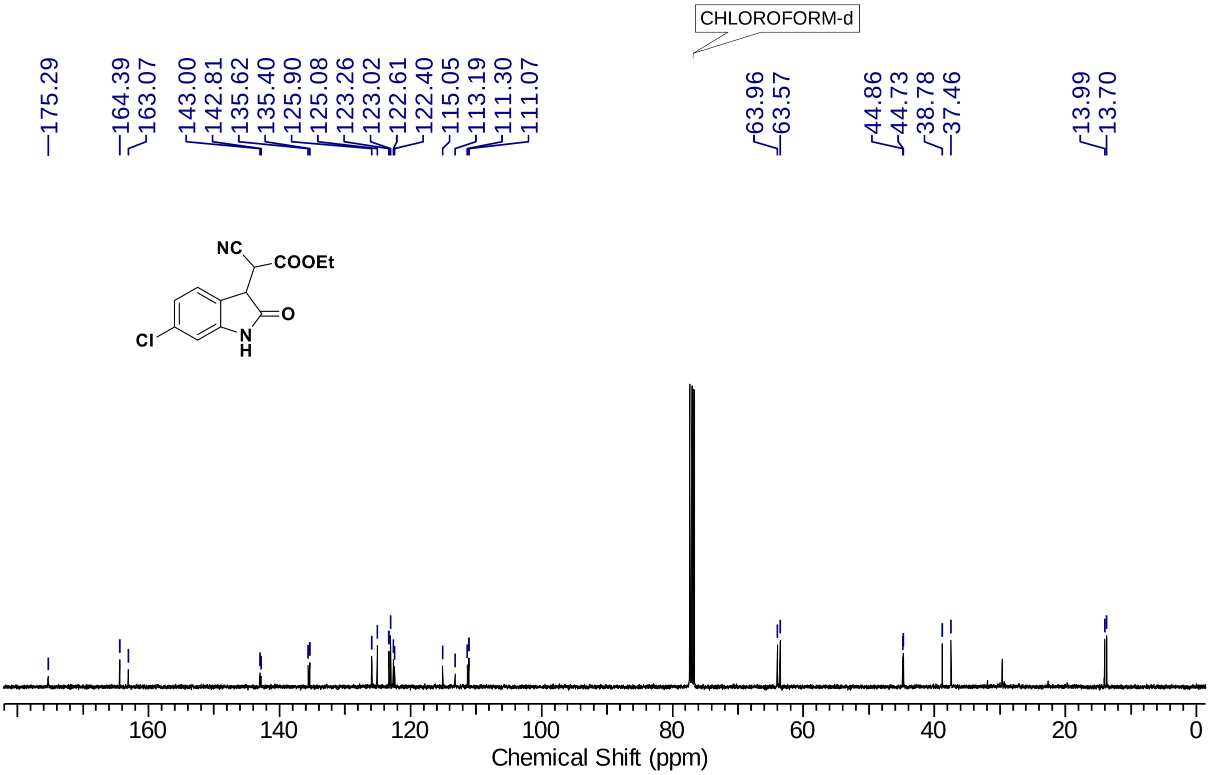
135 DEPT NMR spectrum of compound 3Ah



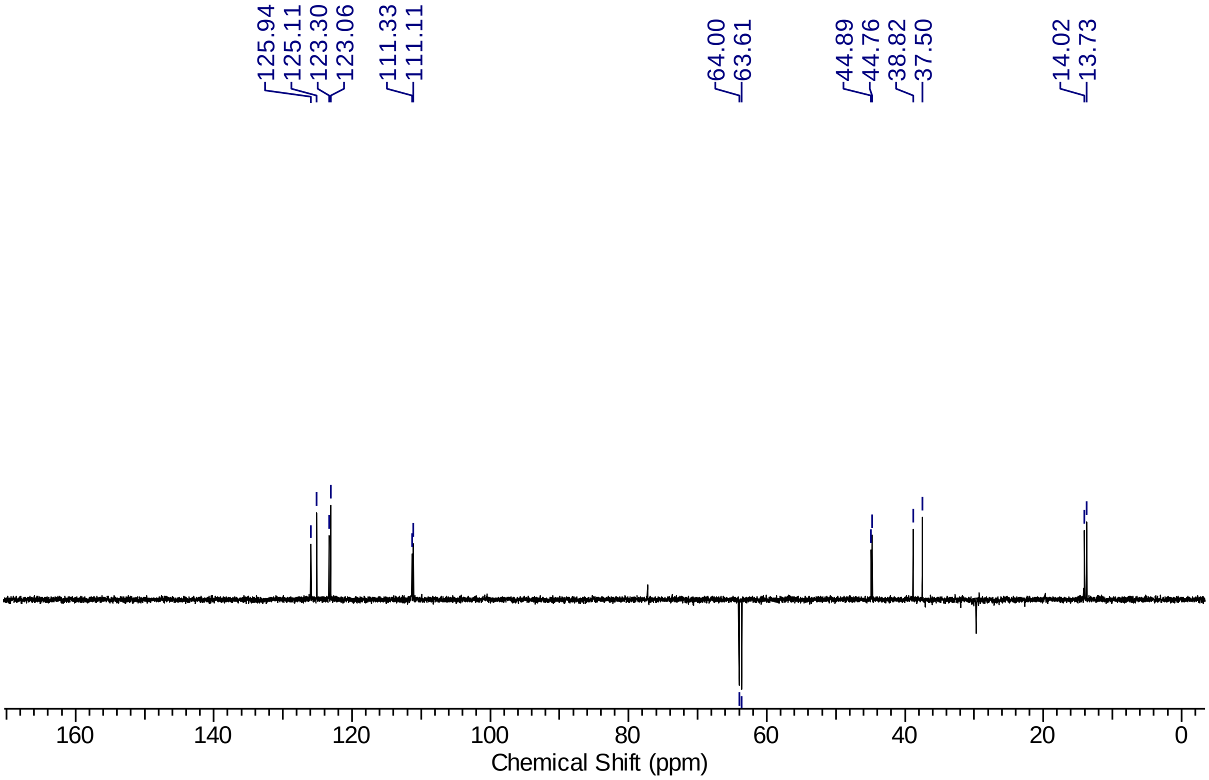
^{1}H NMR spectrum of compound 3Ai (400 MHz, CDCl$_3$)



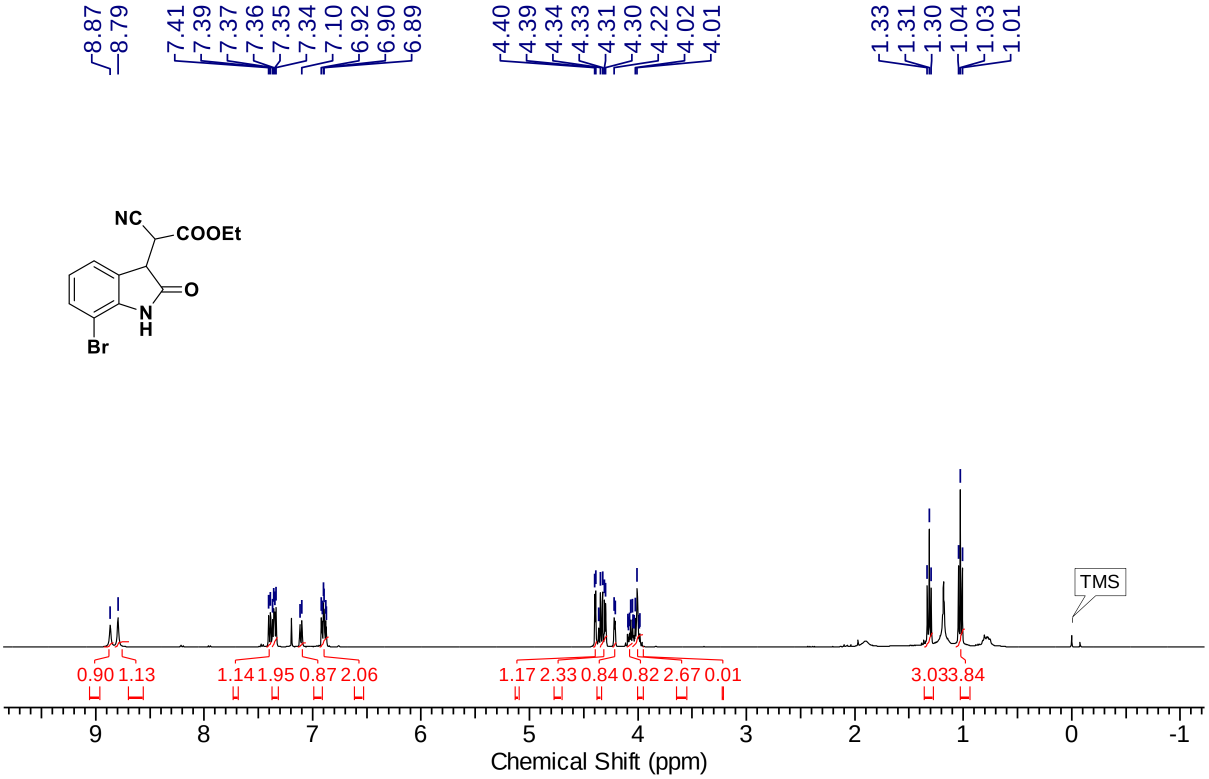
^{13}C NMR spectrum of compound 3Ai (101 MHz, CDCl$_3$)



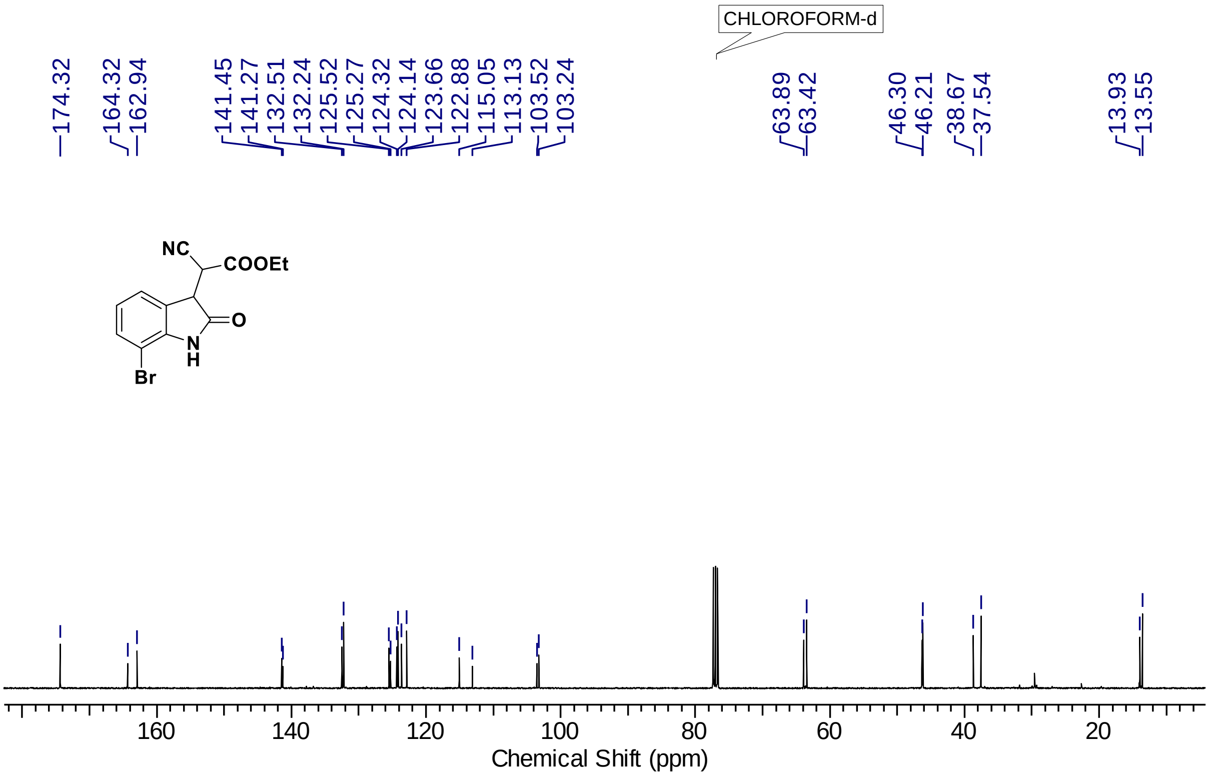
135 DEPT NMR spectrum of compound 3Ai



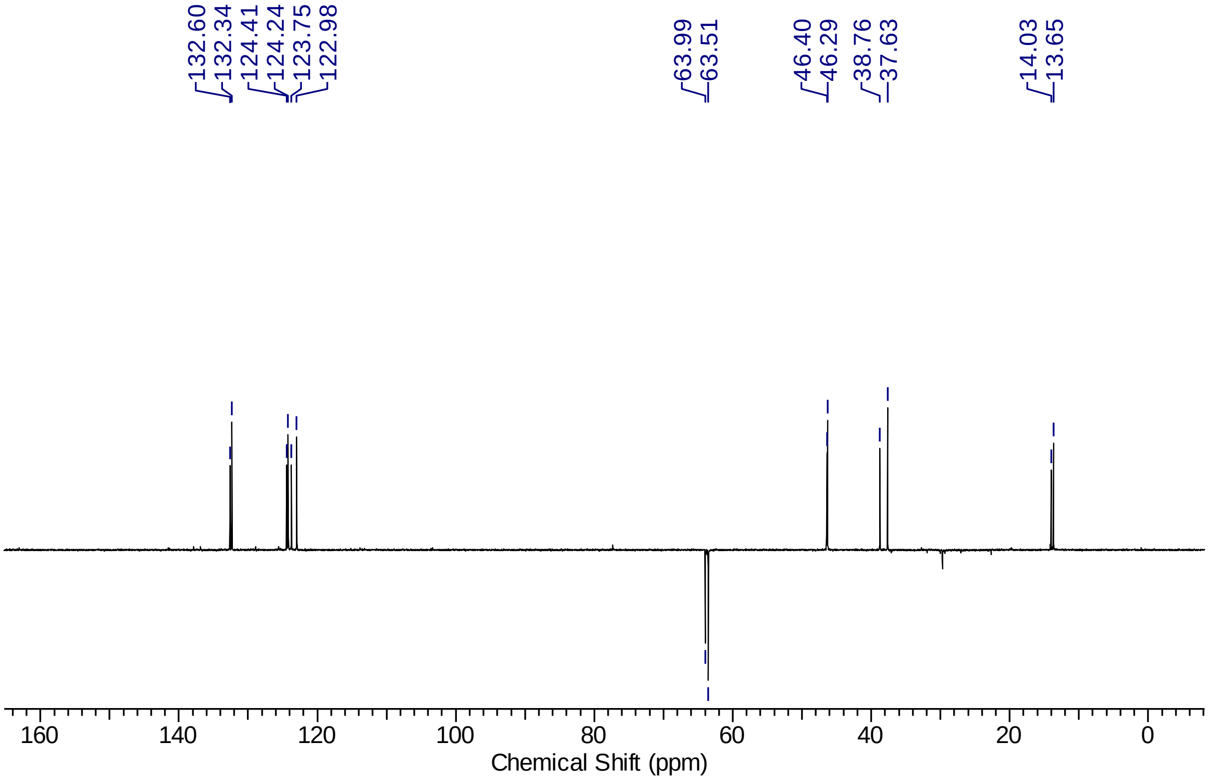
^{1}H NMR spectrum of compound 3Aj (400 MHz, CDCl$_3$)



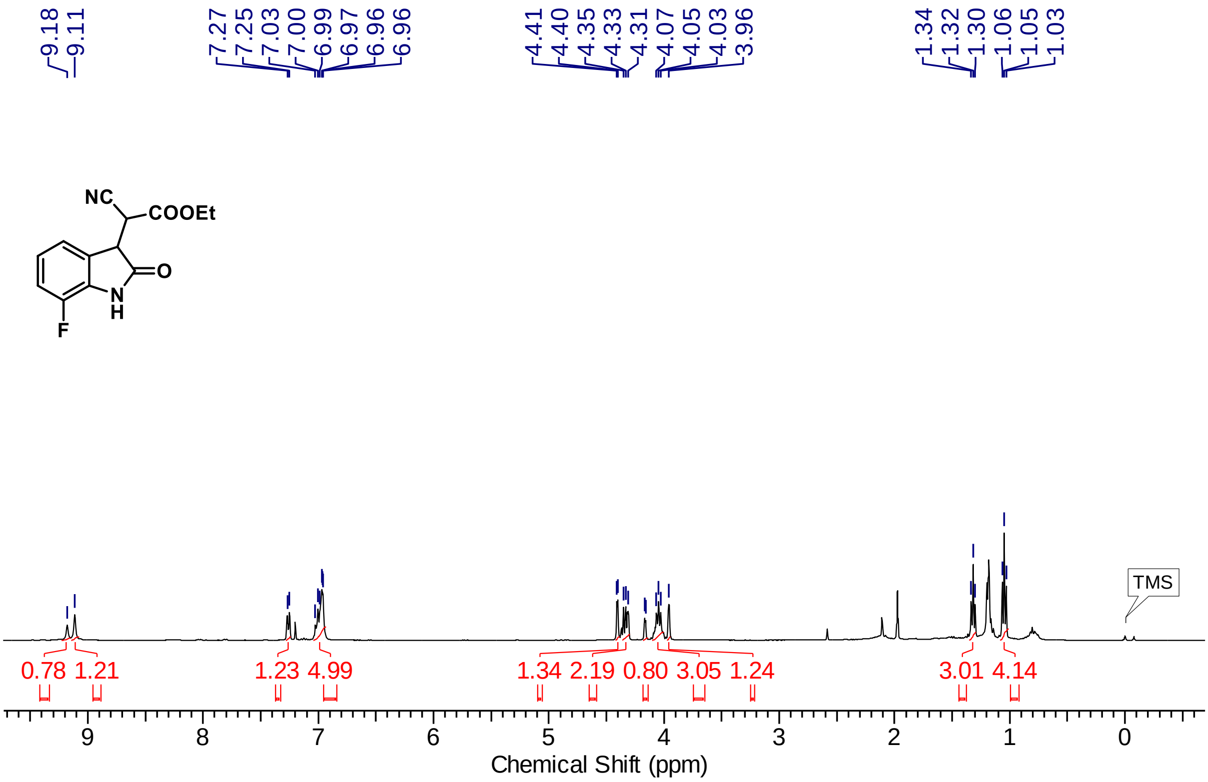
^{13}C NMR spectrum of compound 3Aj (101 MHz, CDCl$_3$)



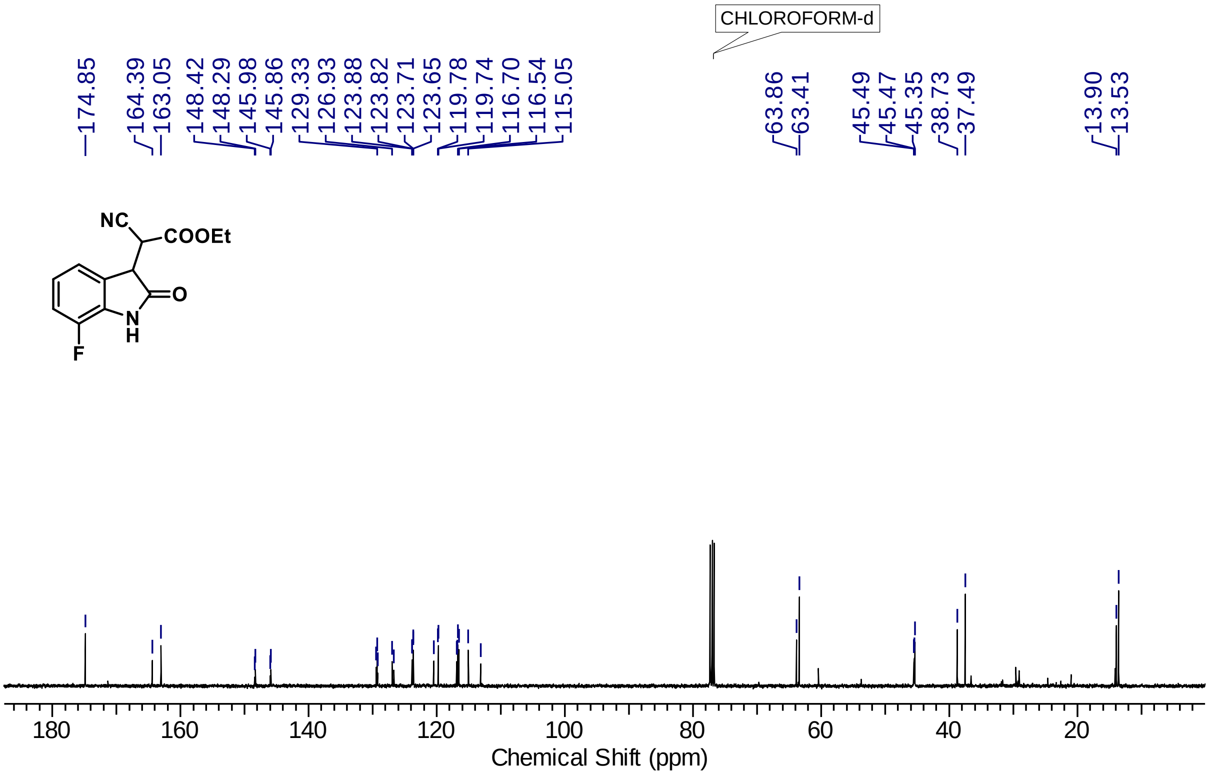
135 DEPT NMR spectrum of compound 3Aj



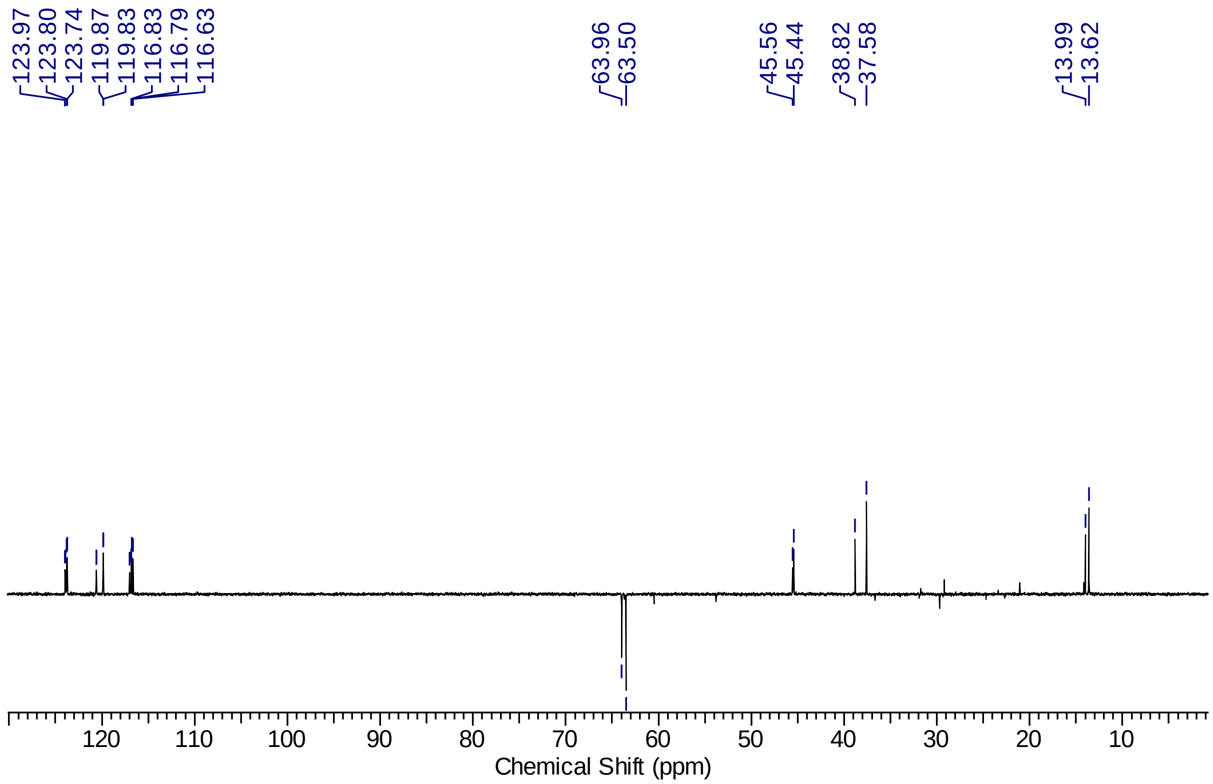
^{1}H NMR spectrum of compound 3Ak (400 MHz, CDCl$_3$)



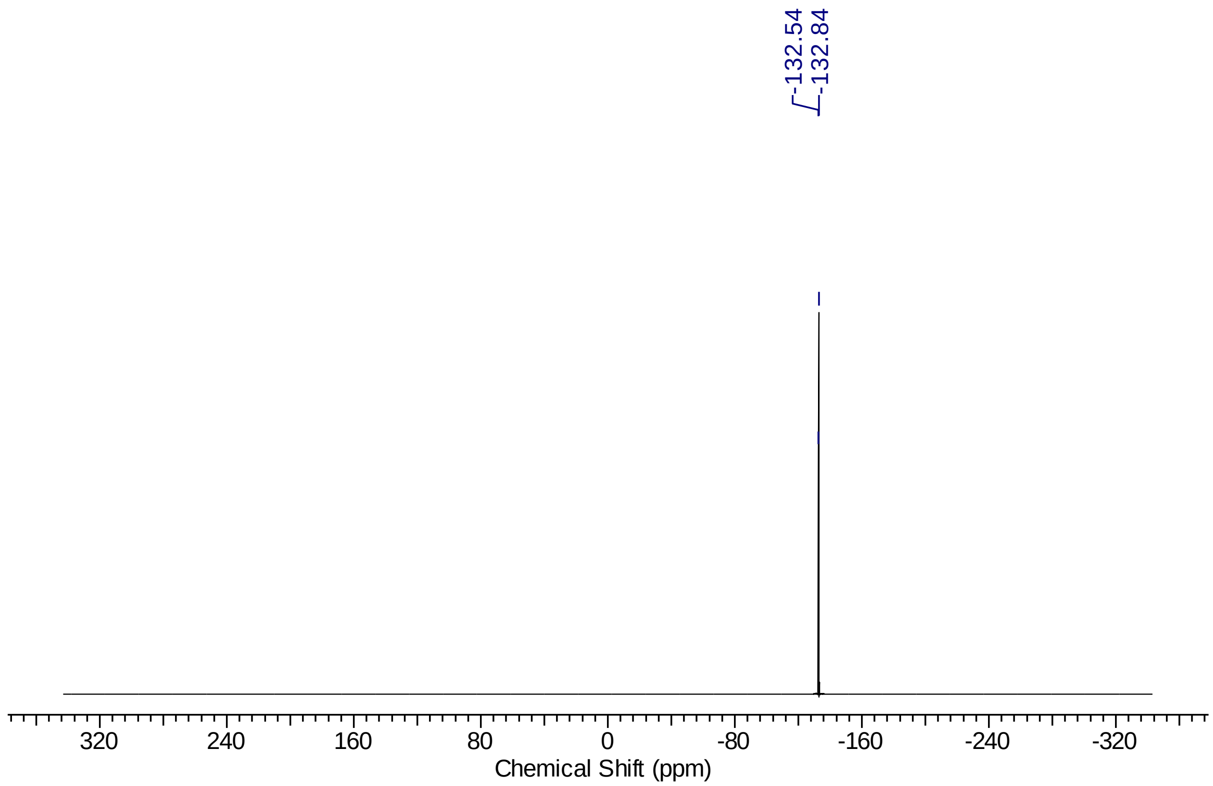
^{13}C NMR spectrum of compound 3Ak (101 MHz, CDCl$_3$)



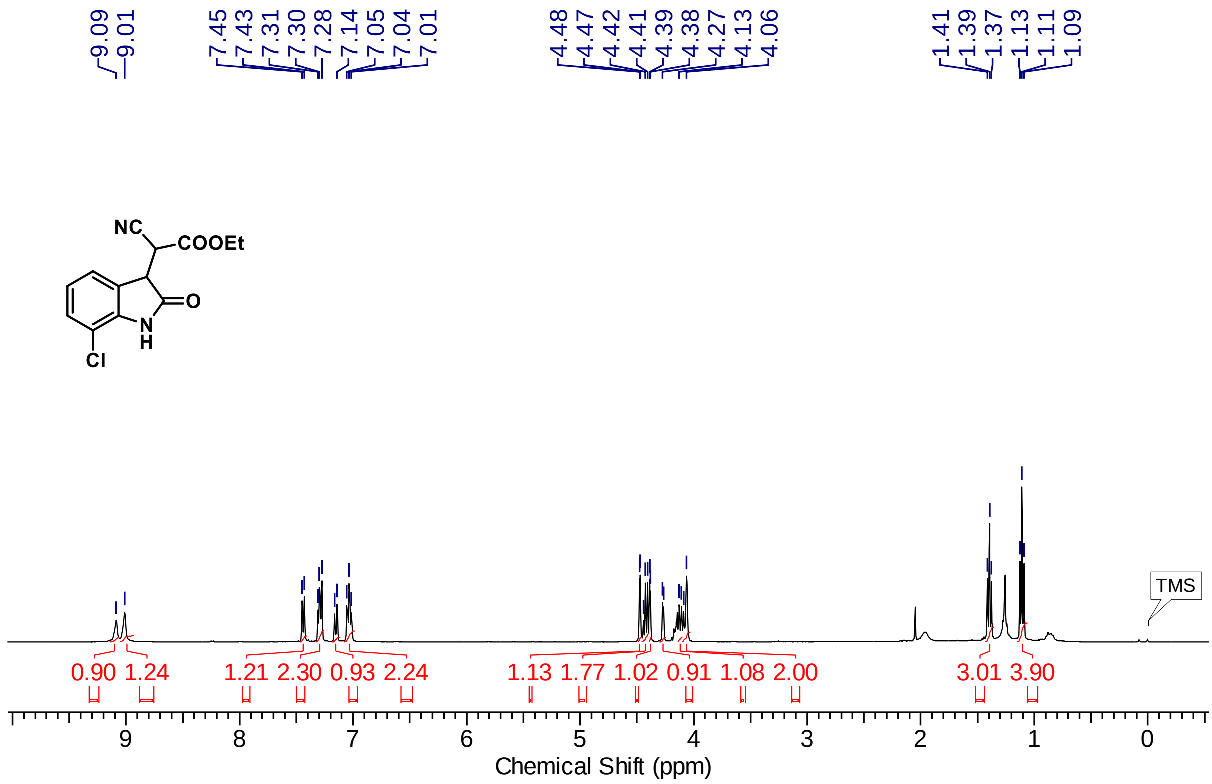
135 DEPT NMR spectrum of compound 3Ak



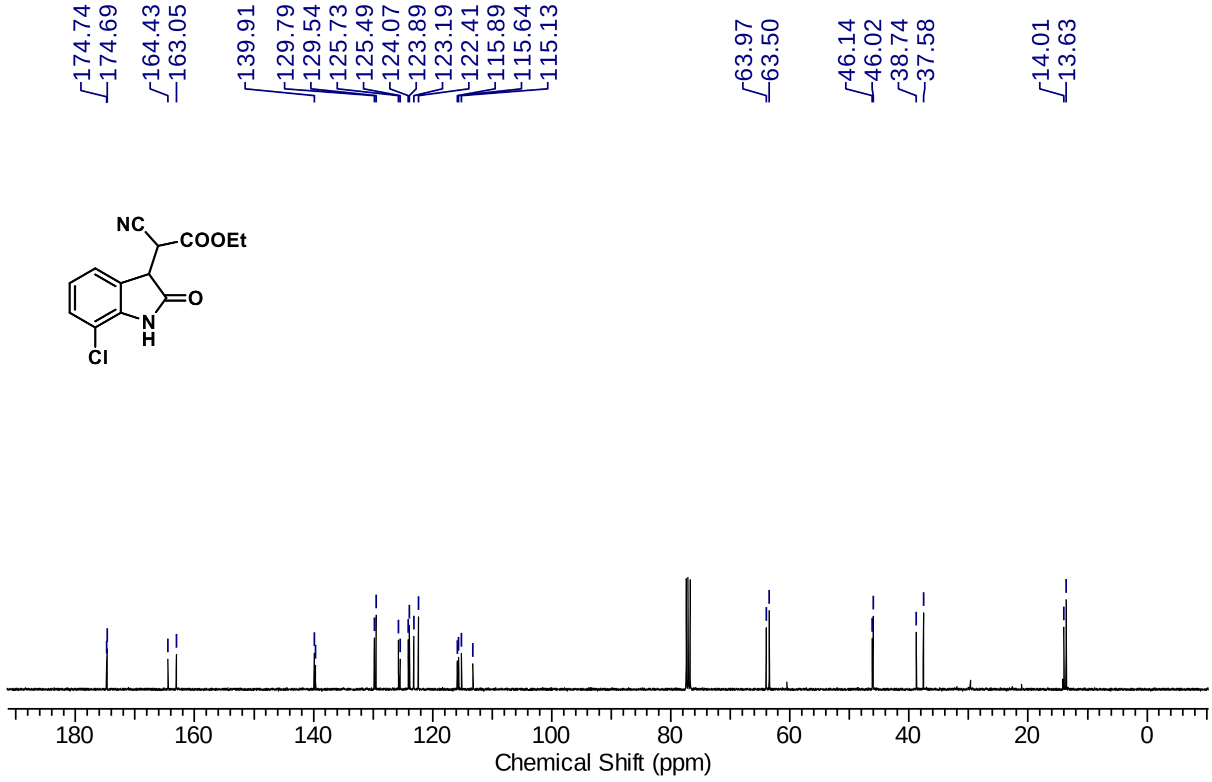
^{19}F spectrum of compound 3Ak



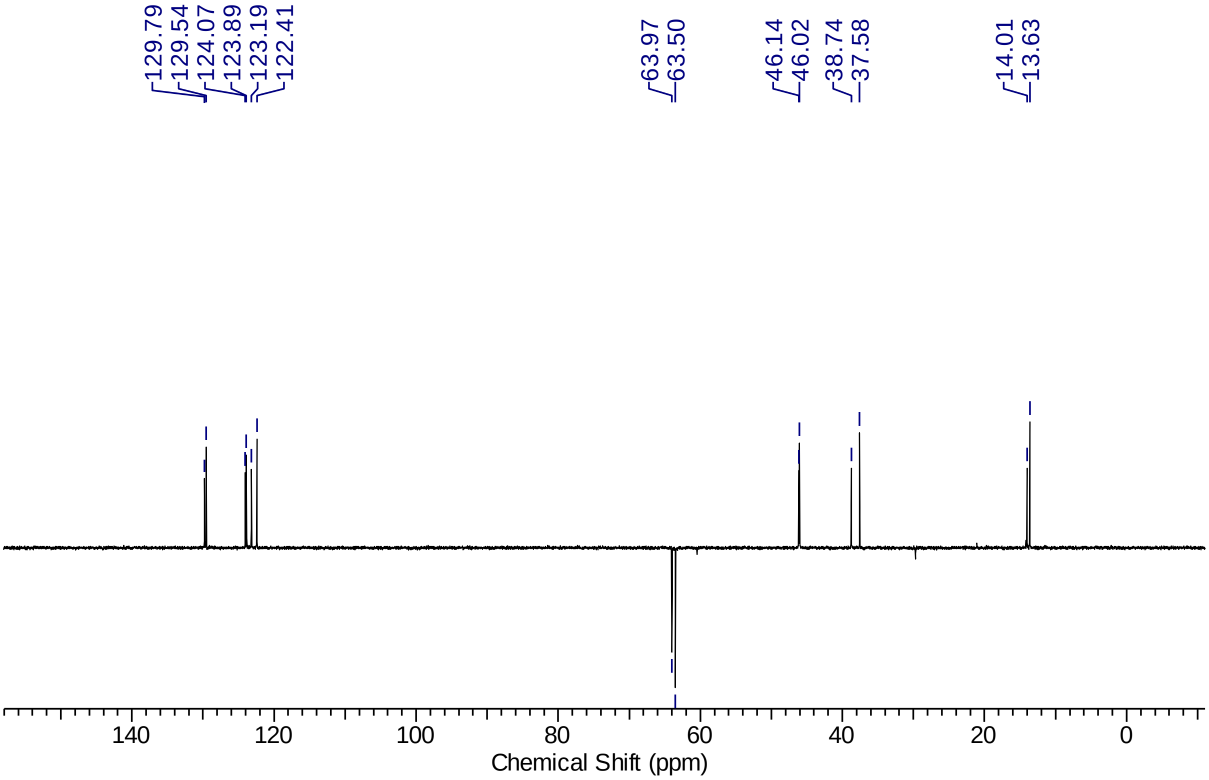
^{1}H NMR spectrum of compound 3Al (400 MHz, $CDCl_3$)



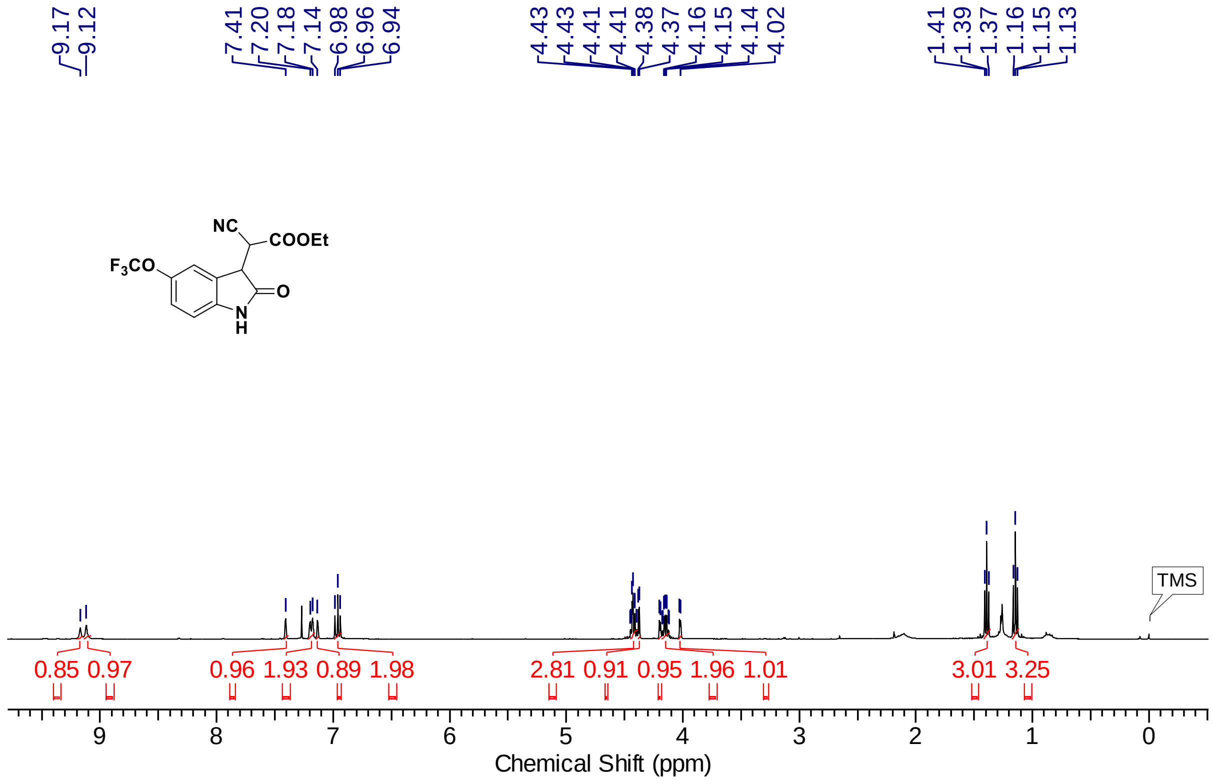
^{13}C NMR spectrum of compound 3Al (101 MHz, $CDCl_3$)



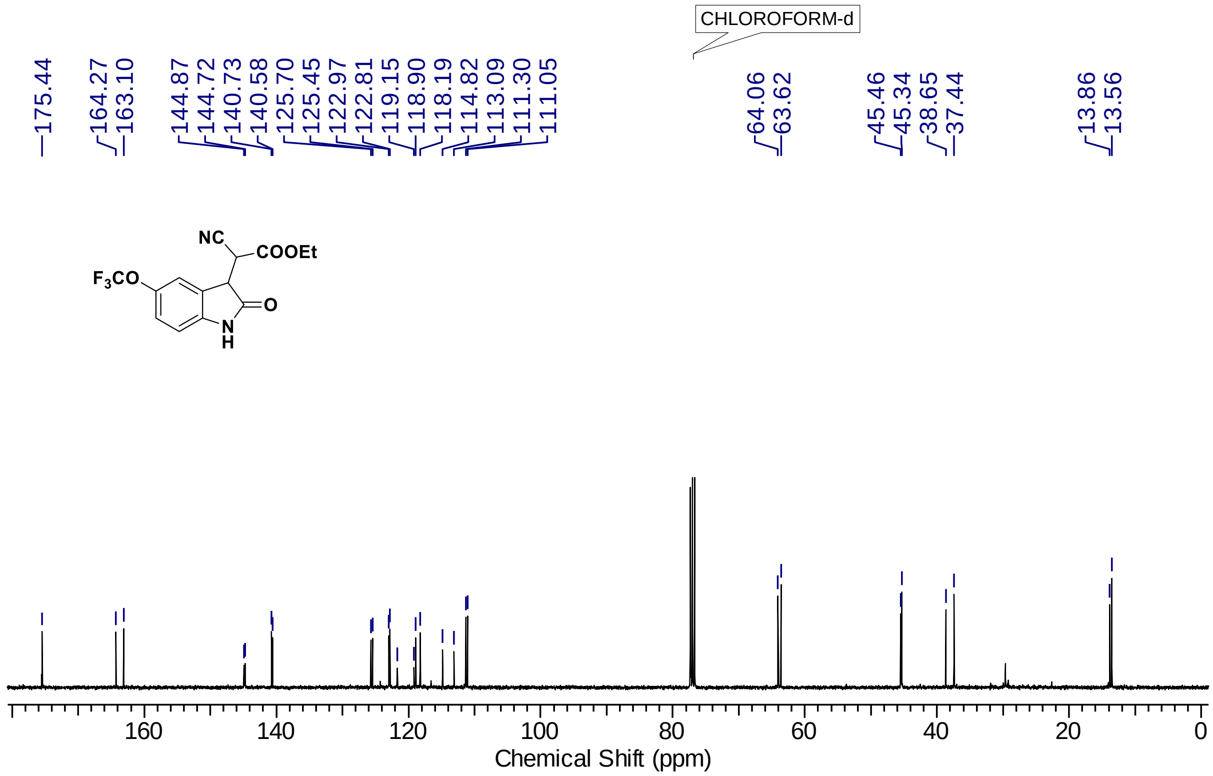
135 DEPT NMR spectrum of compound 3Al



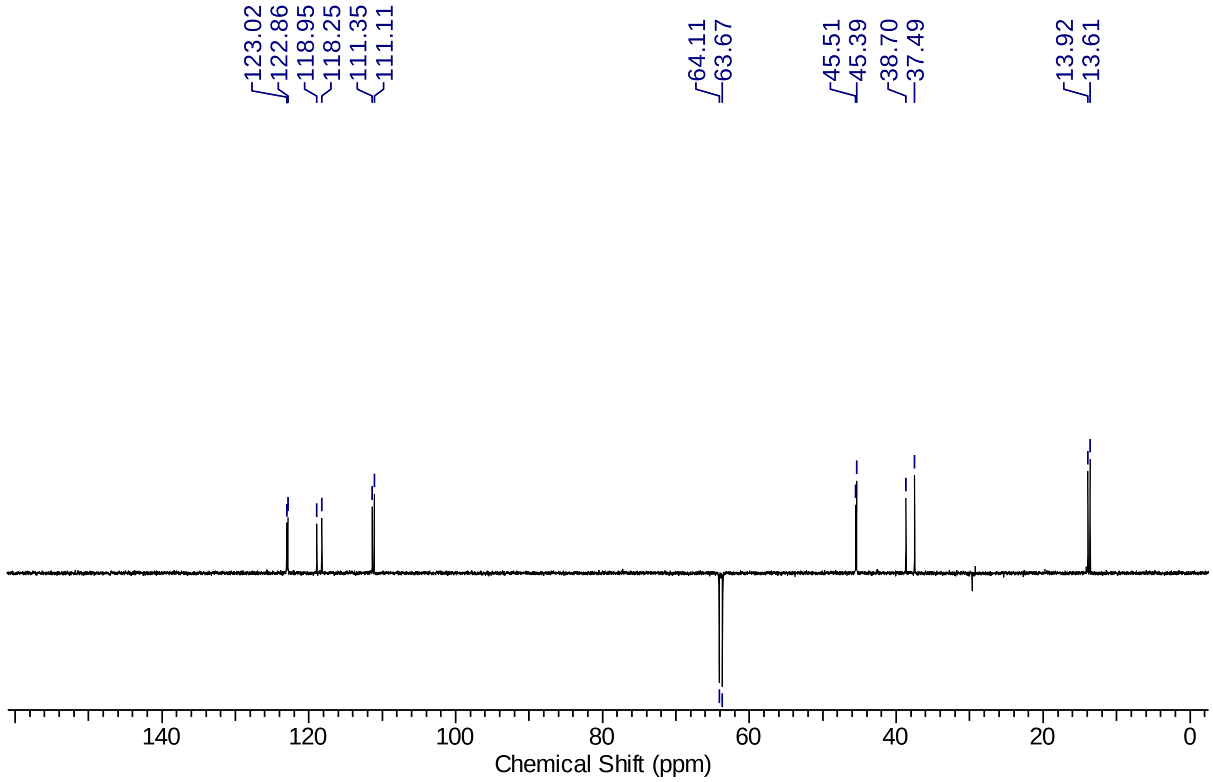
^1H NMR spectrum of compound 3Am (400 MHz, $CDCl_3$)



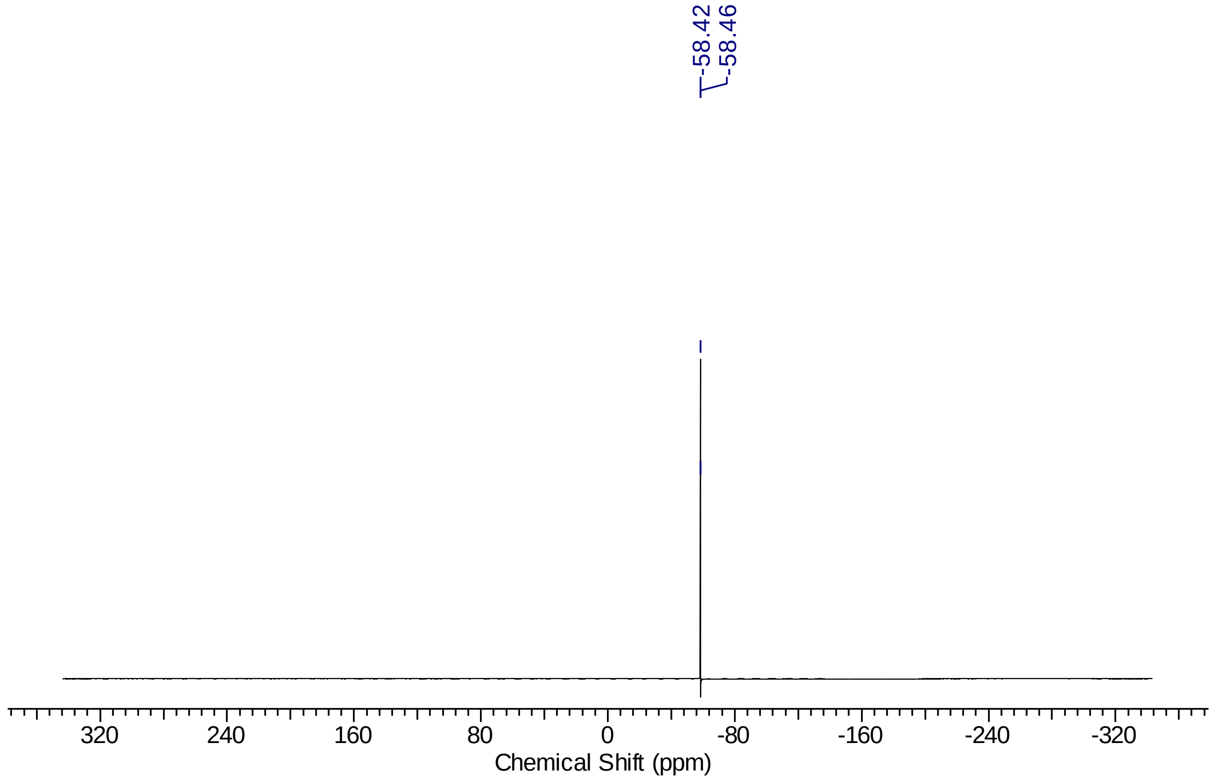
^{13}C NMR spectrum of compound 3Am (101 MHz, $CDCl_3$)



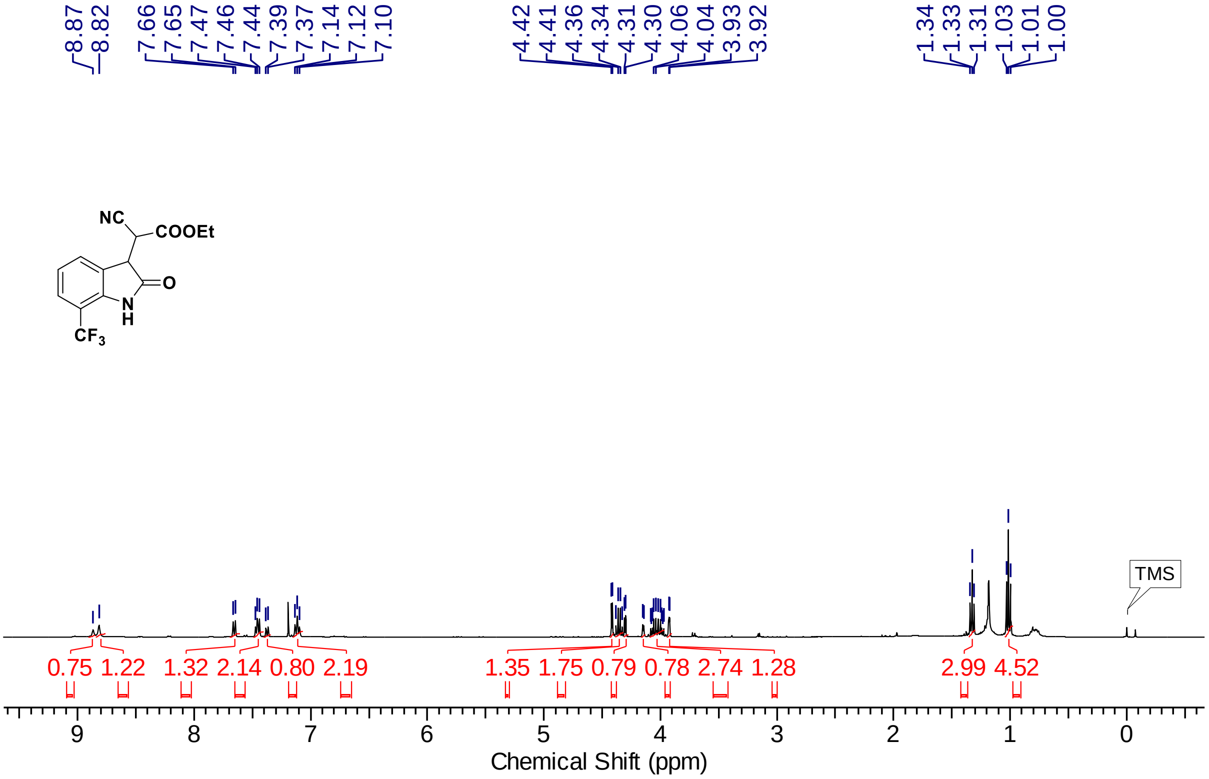
135 DEPT NMR spectrum of compound 3Am



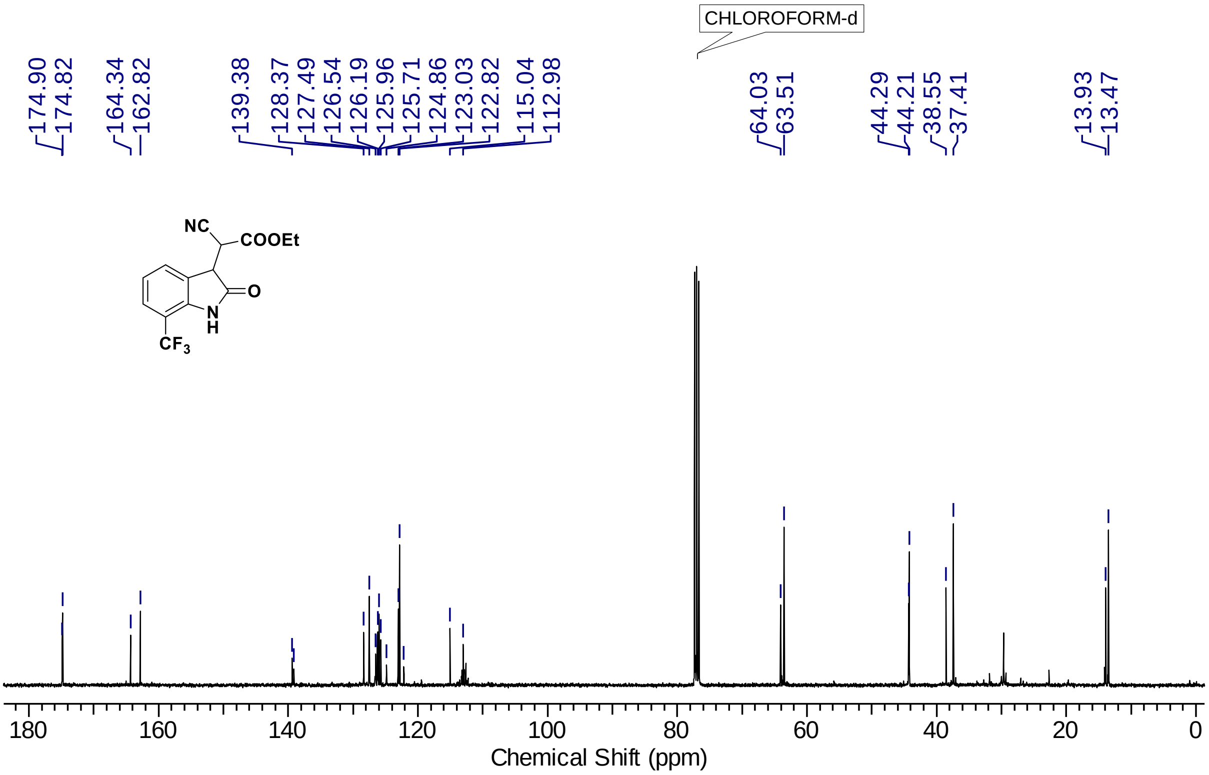
^{19}F spectrum of compound 3Am



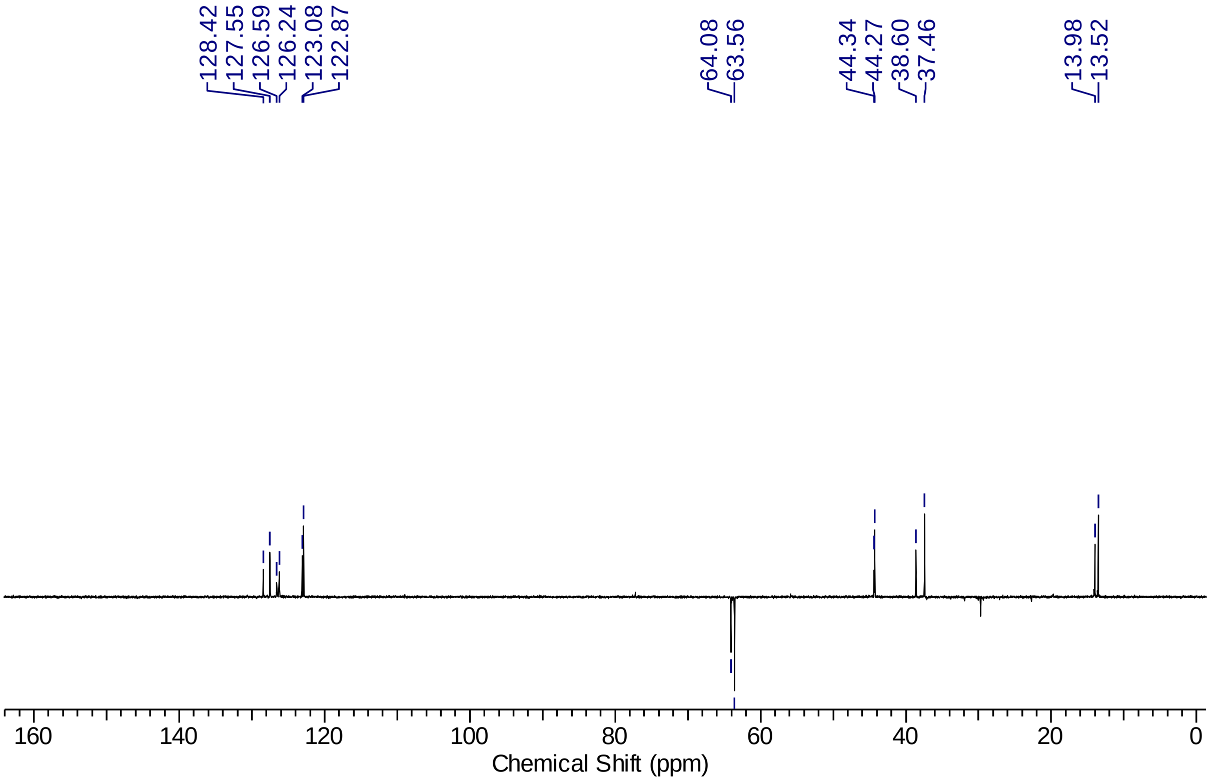
^{1}H NMR spectrum of compound 3An (400 MHz, $CDCl_3$)



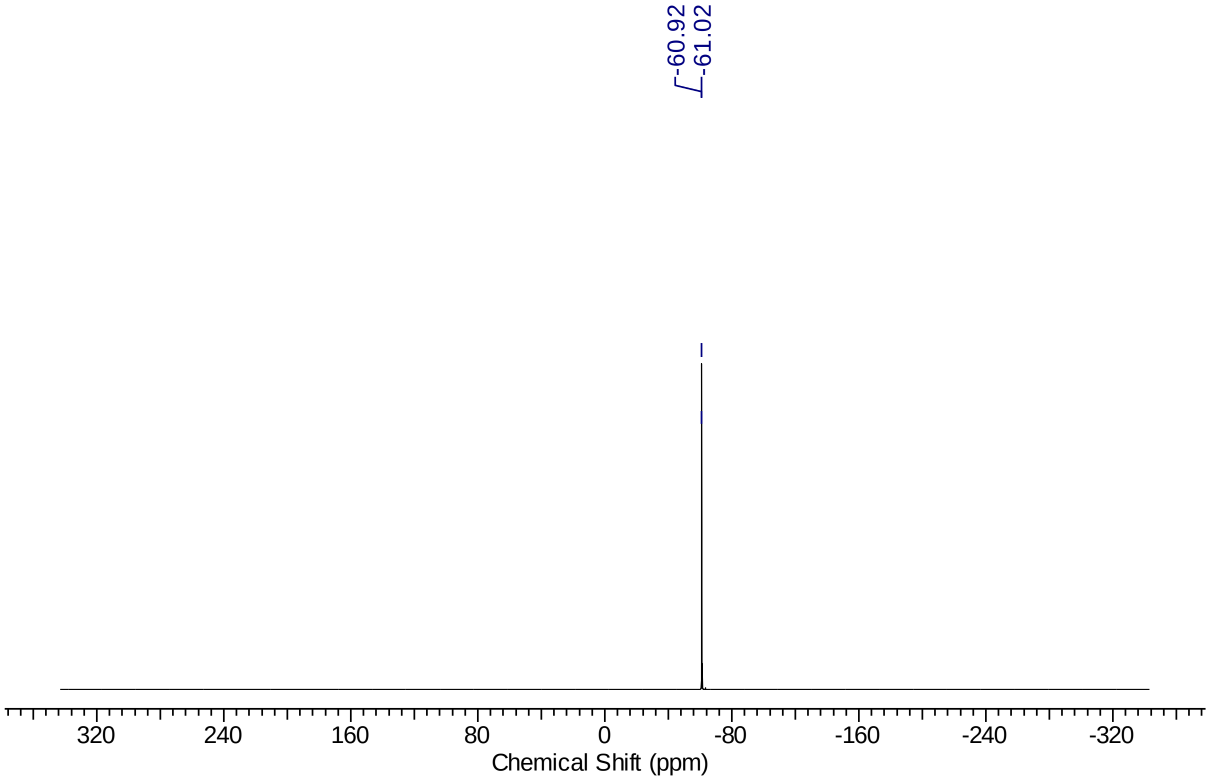
^{13}C NMR spectrum of compound 3An (101 MHz, $CDCl_3$)



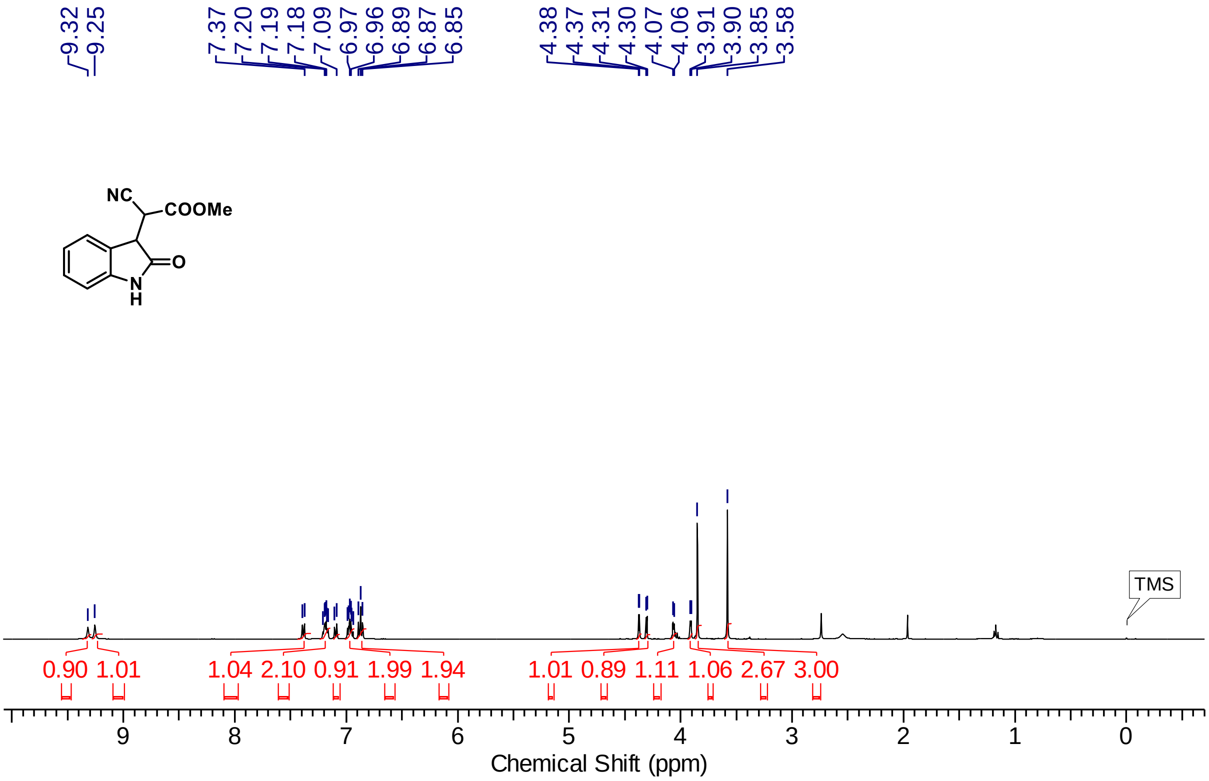
135 DEPT NMR spectrum of compound 3An



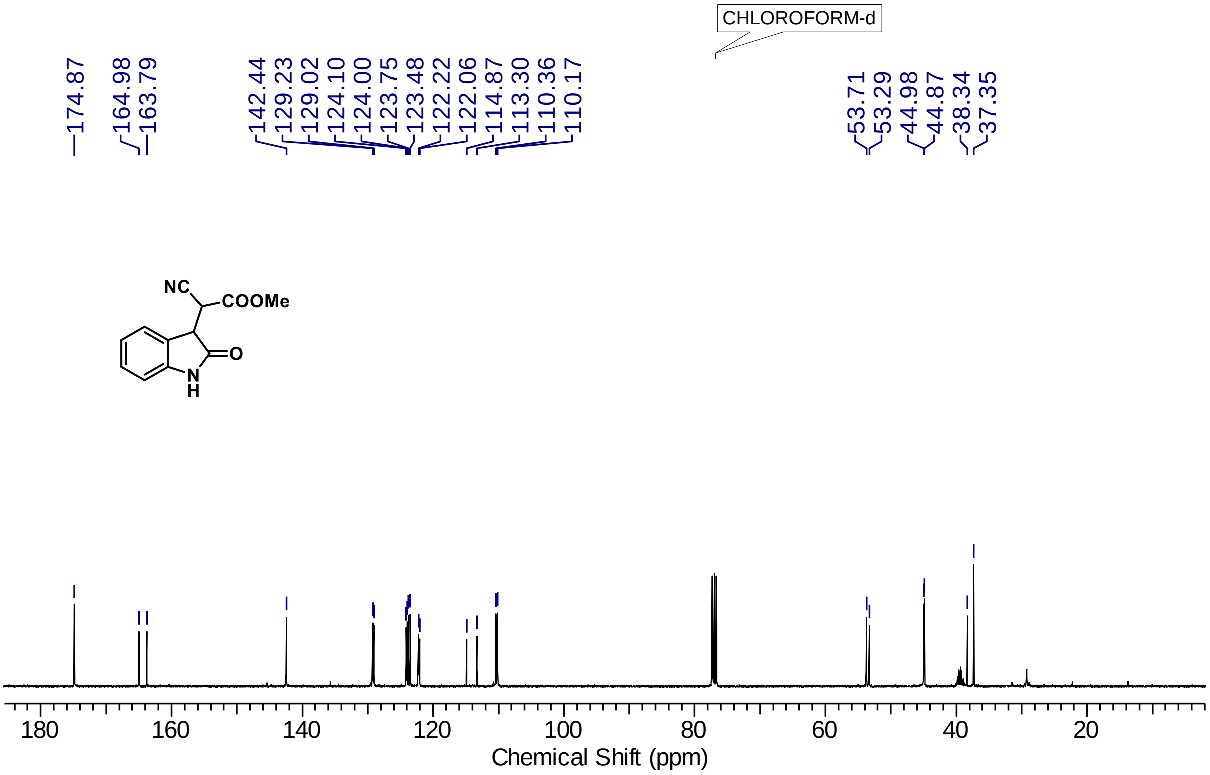
^{19}F spectrum of compound 3An



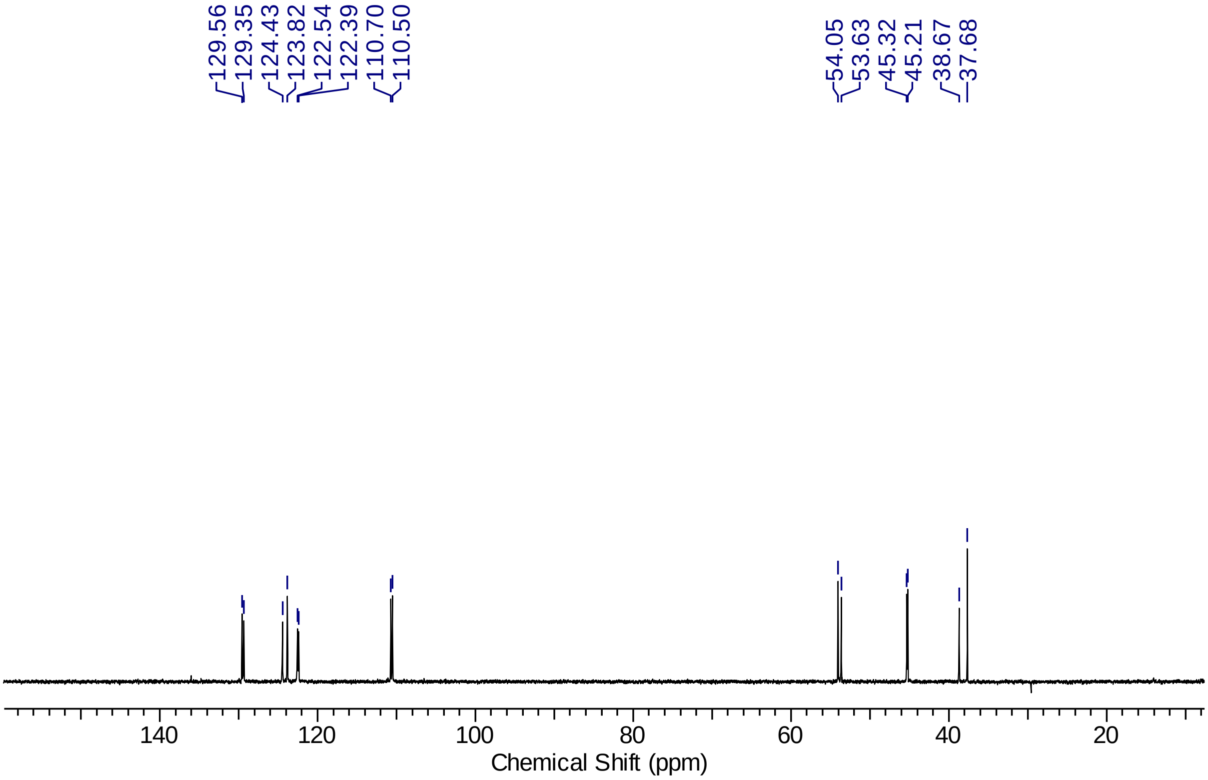
^{1}H NMR spectrum of compound 3Ao (400 MHz, $CDCl_3$)



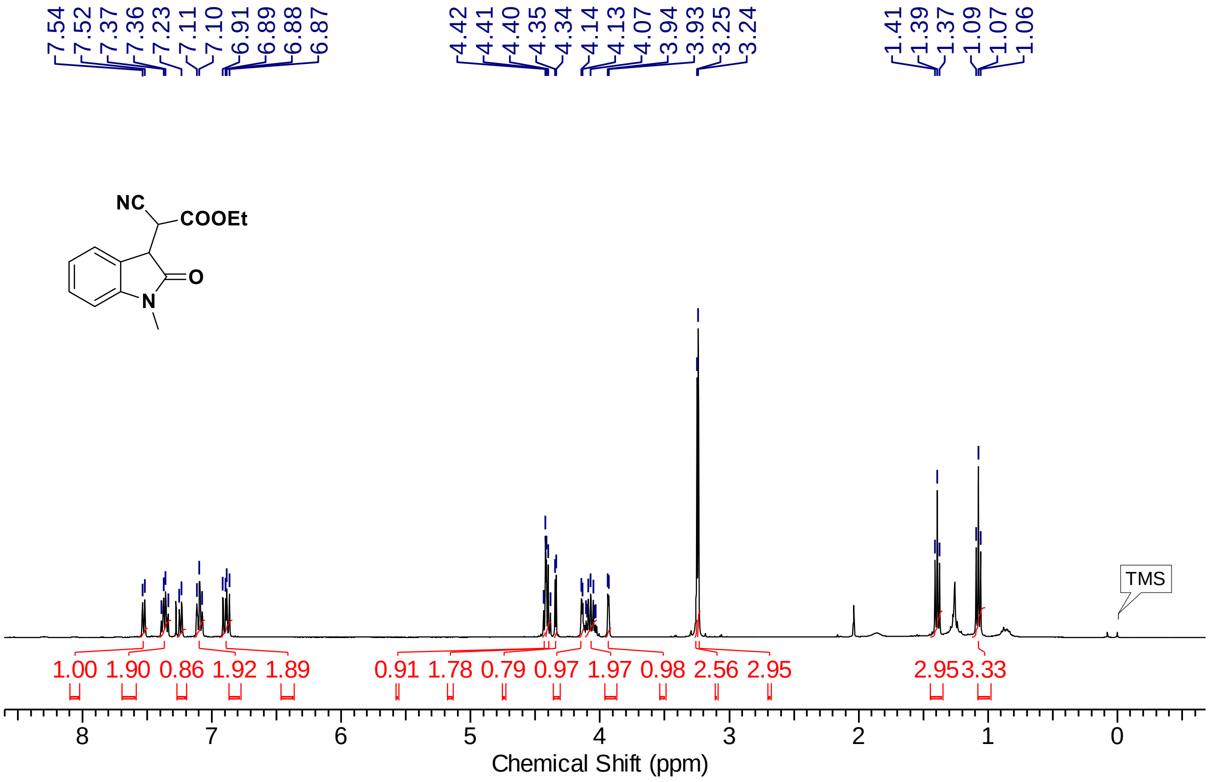
^{13}C NMR spectrum of compound 3Ao (101 MHz, $CDCl_3$)



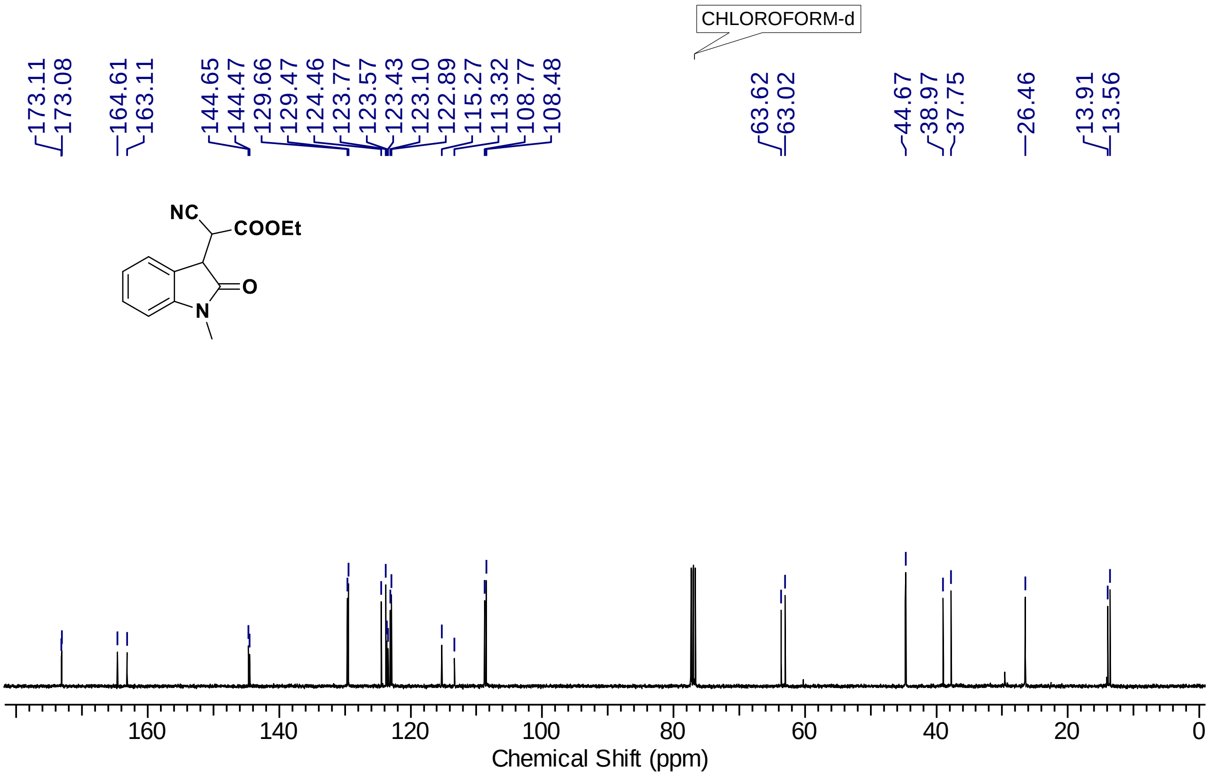
135 DEPT NMR spectrum of compound 3Ao



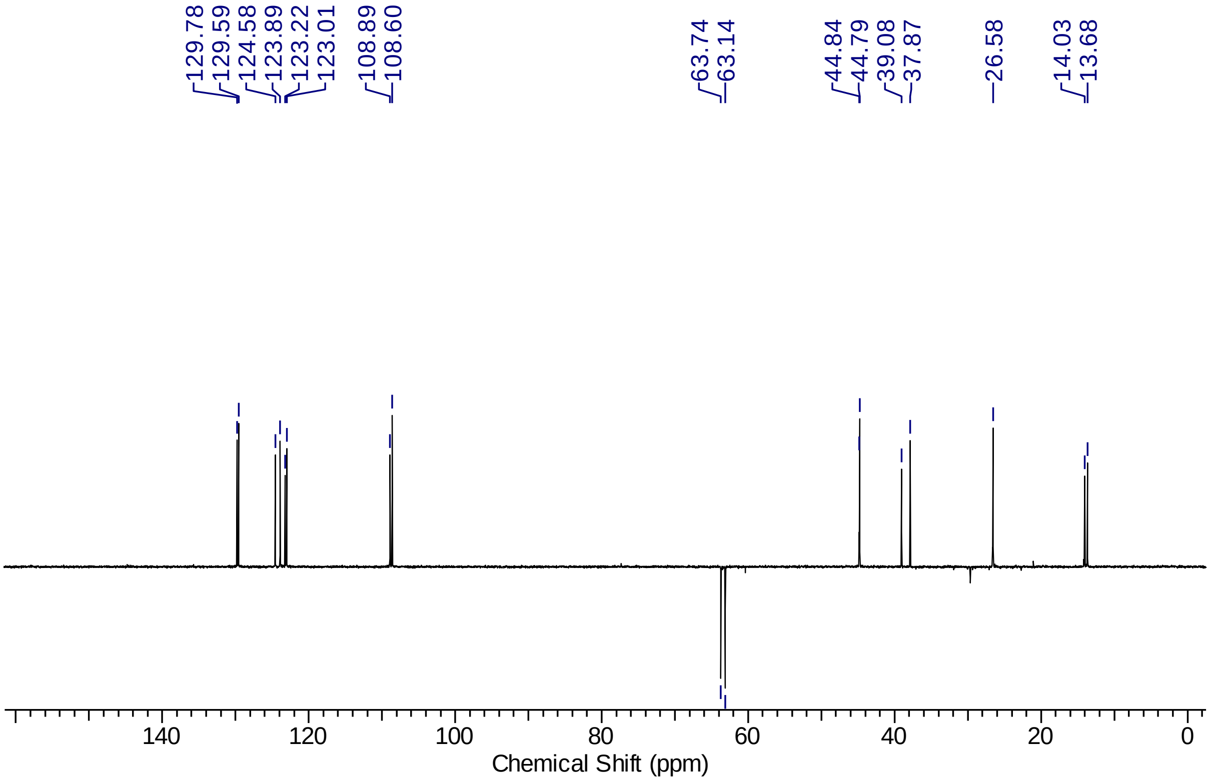
^{1}H NMR spectrum of compound 3Ap (400 MHz, CDCl$_3$)



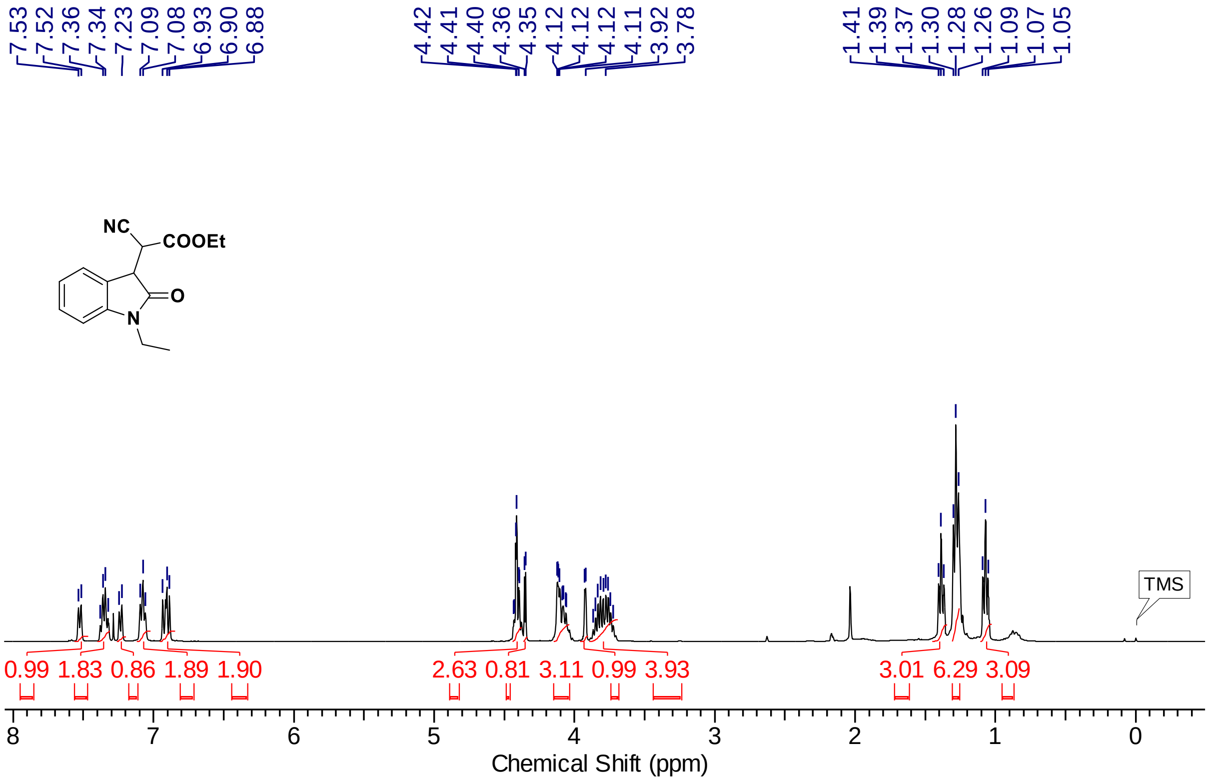
^{13}C NMR spectrum of compound 3Ap (101 MHz, CDCl$_3$)



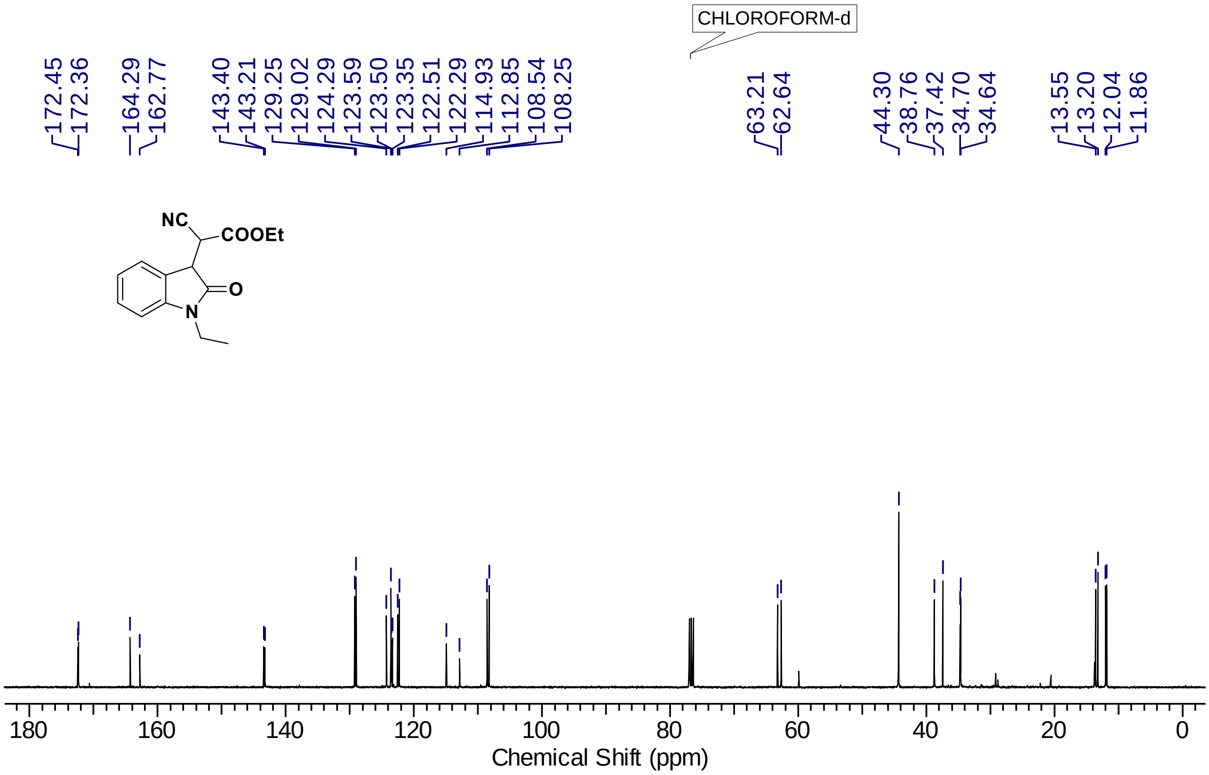
135 DEPT NMR spectrum of compound 3Ap



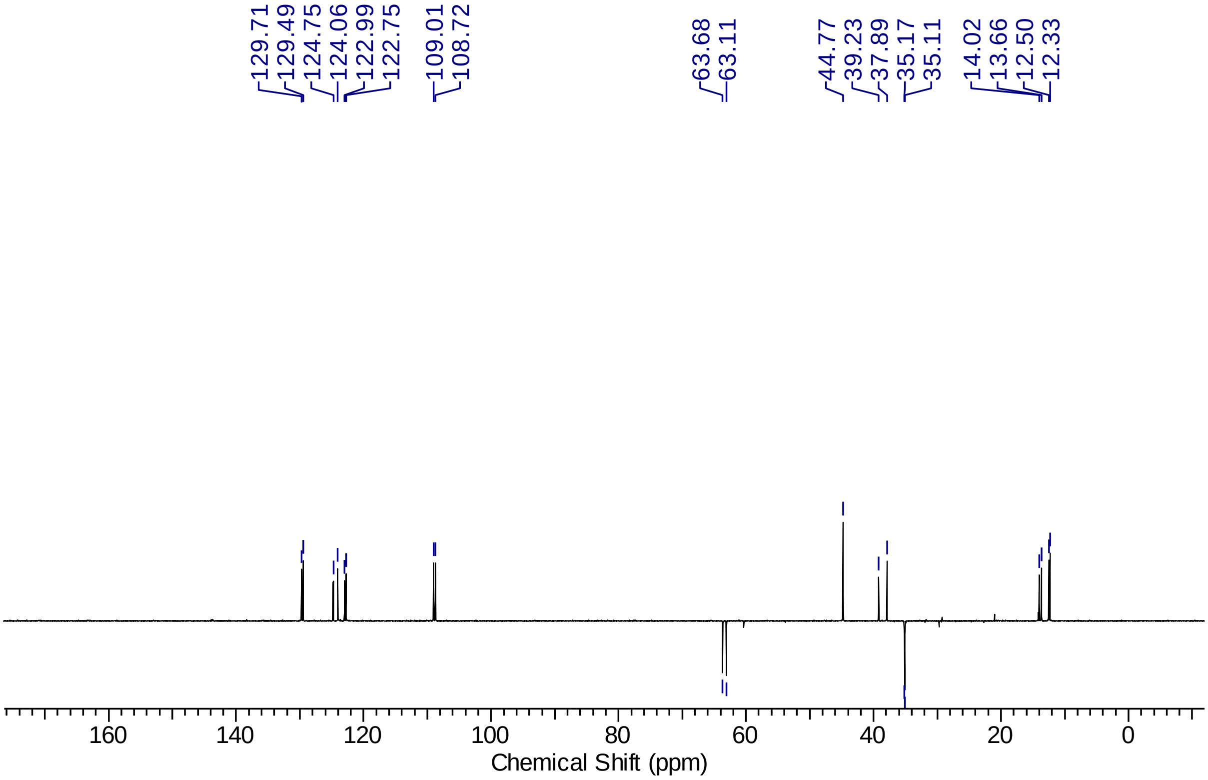
^{1}H NMR spectrum of compound 3Aq (400 MHz, $CDCl_3$)



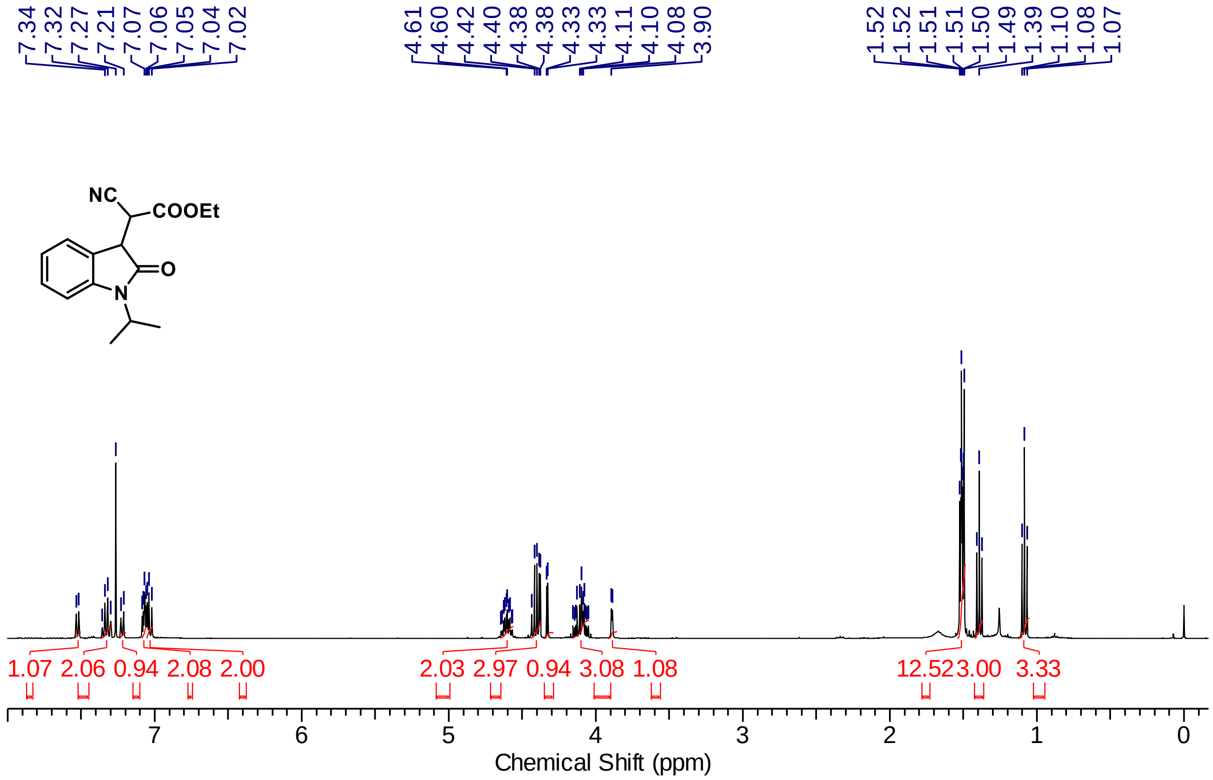
^{13}C NMR spectrum of compound 3Aq (101 MHz, $CDCl_3$)



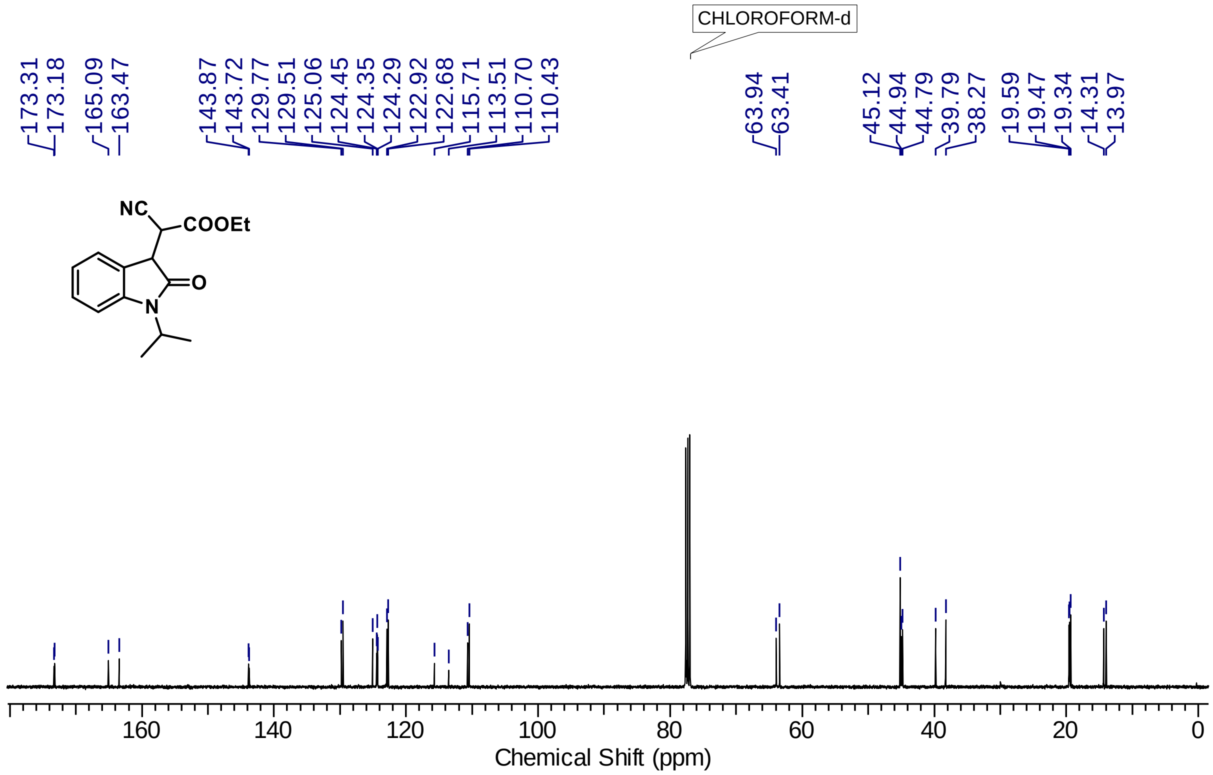
135 DEPT NMR spectrum of compound 3Aq



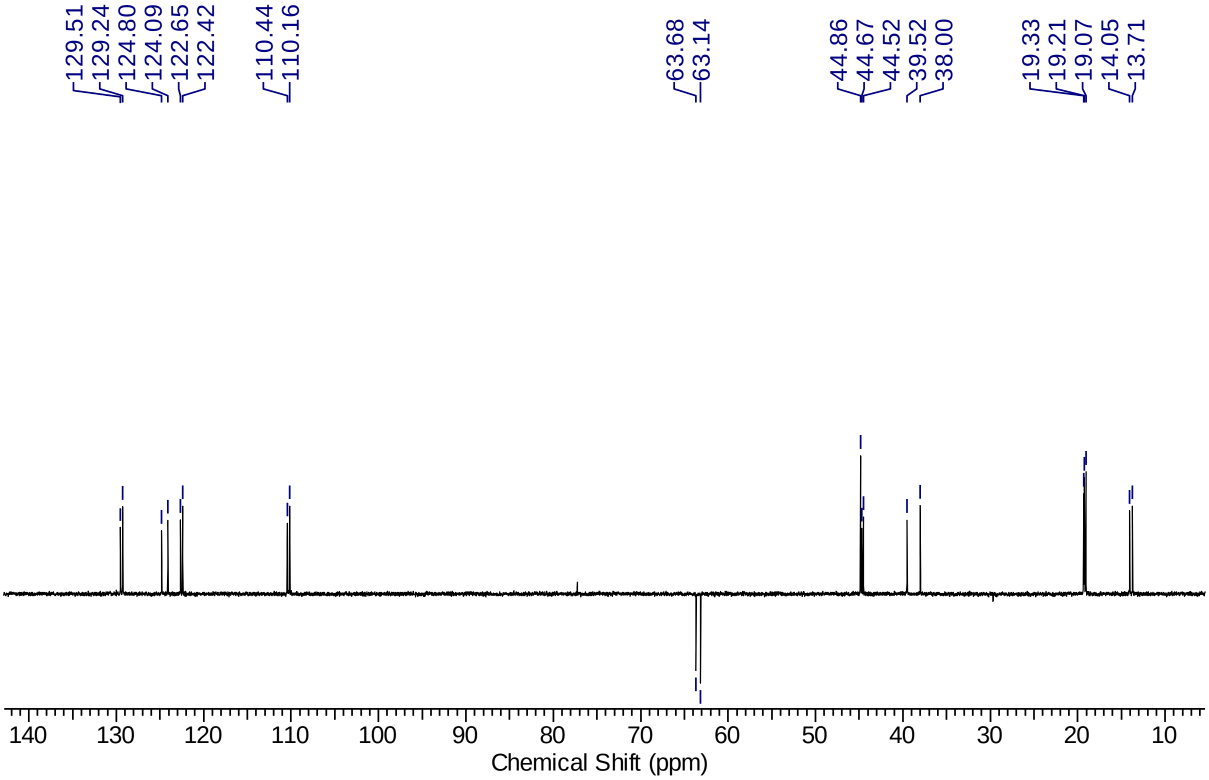
^{1}H NMR spectrum of compound 3Ar (400 MHz, CDCl$_3$)



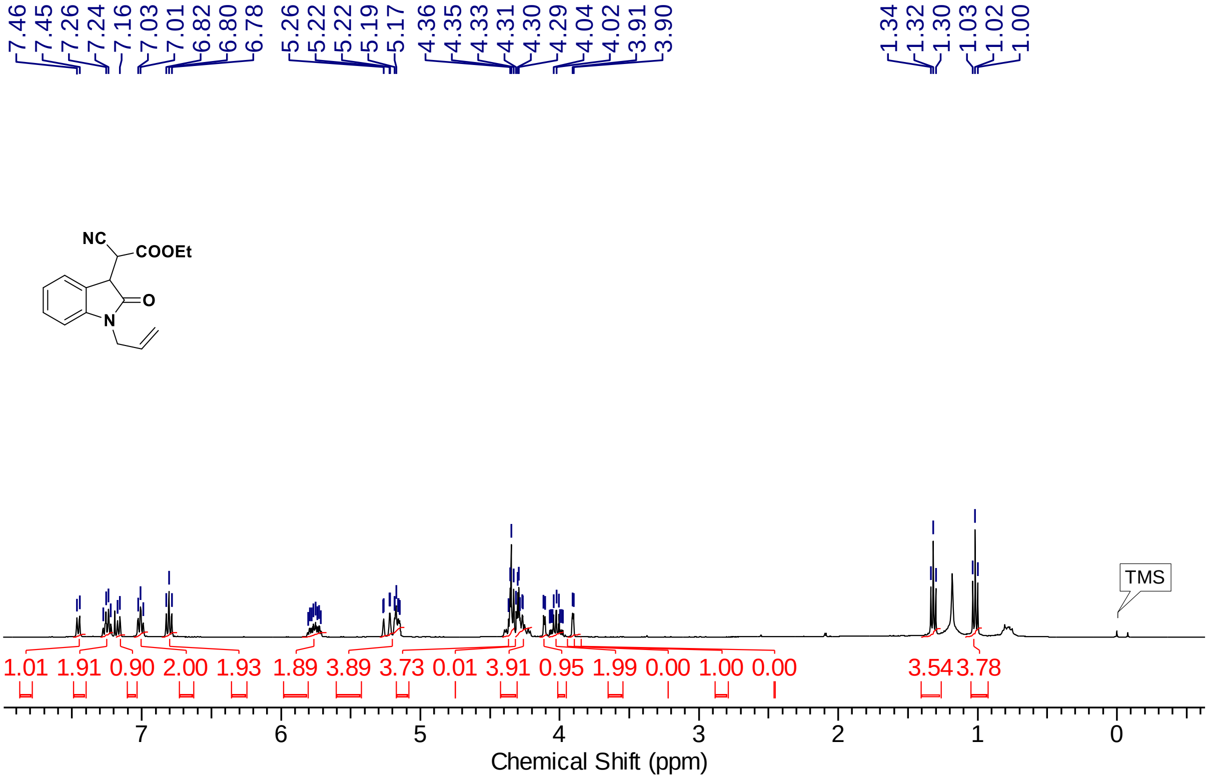
^{13}C NMR spectrum of compound 3Ar (101 MHz, CDCl$_3$)



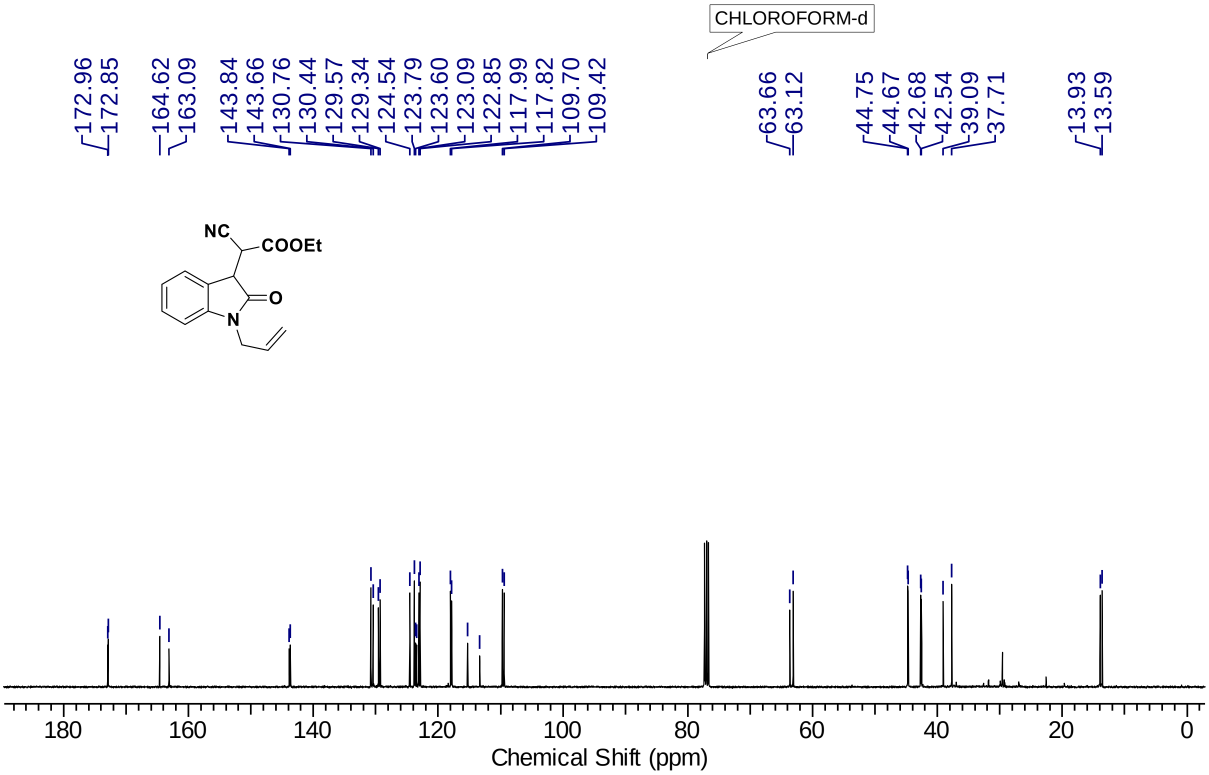
135 DEPT NMR spectrum of compound 3Ar



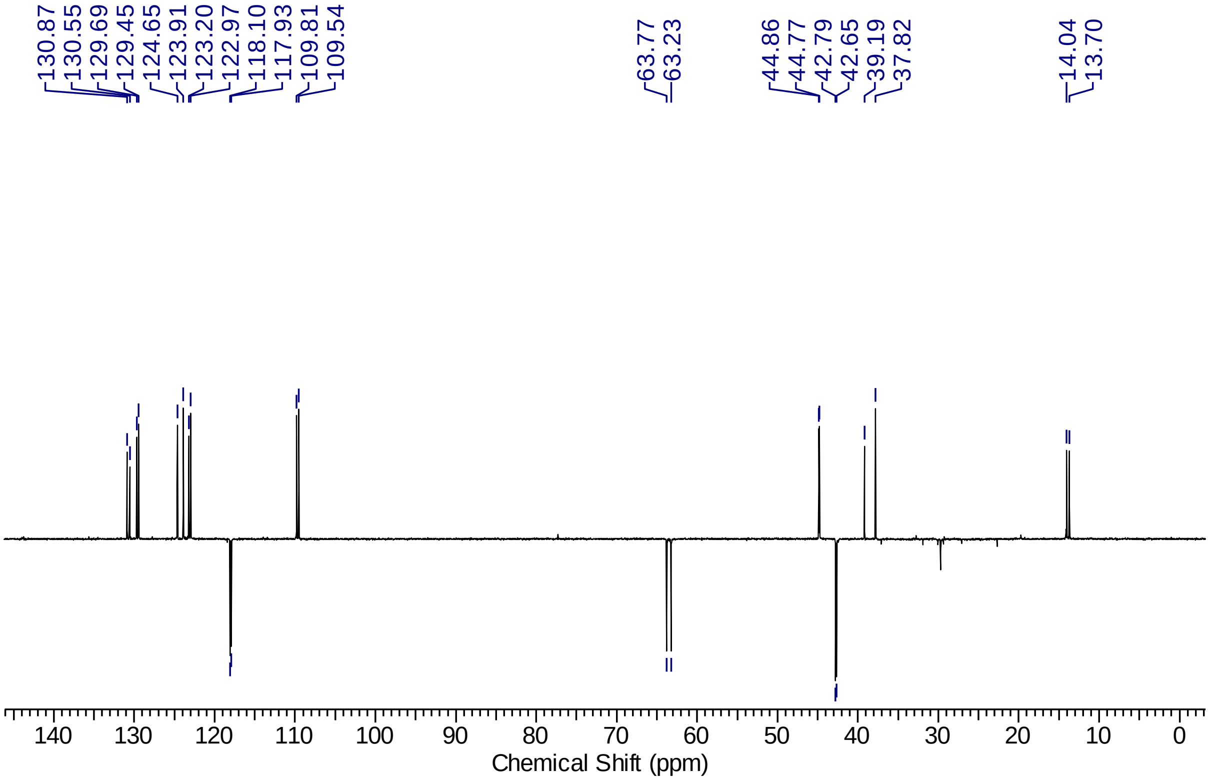
^{1}H NMR spectrum of compound 3As (400 MHz, CDCl$_3$)



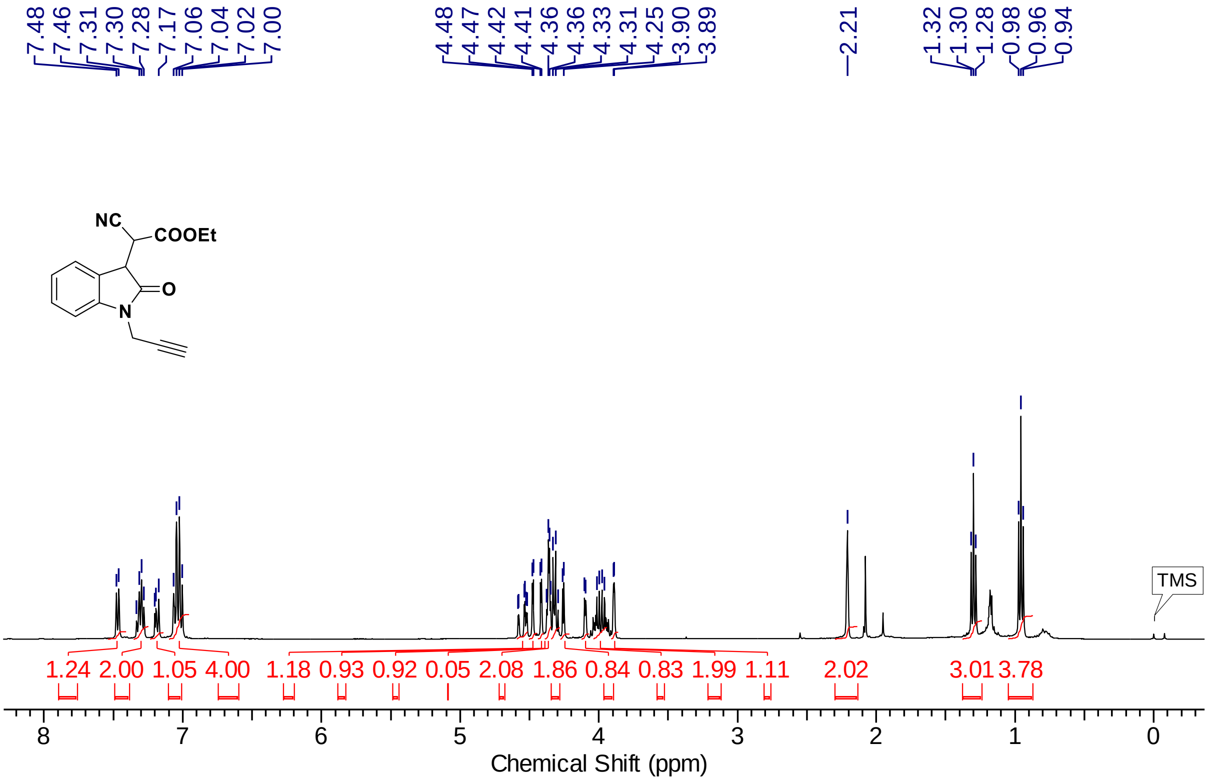
^{13}C NMR spectrum of compound 3As (101 MHz, CDCl$_3$)



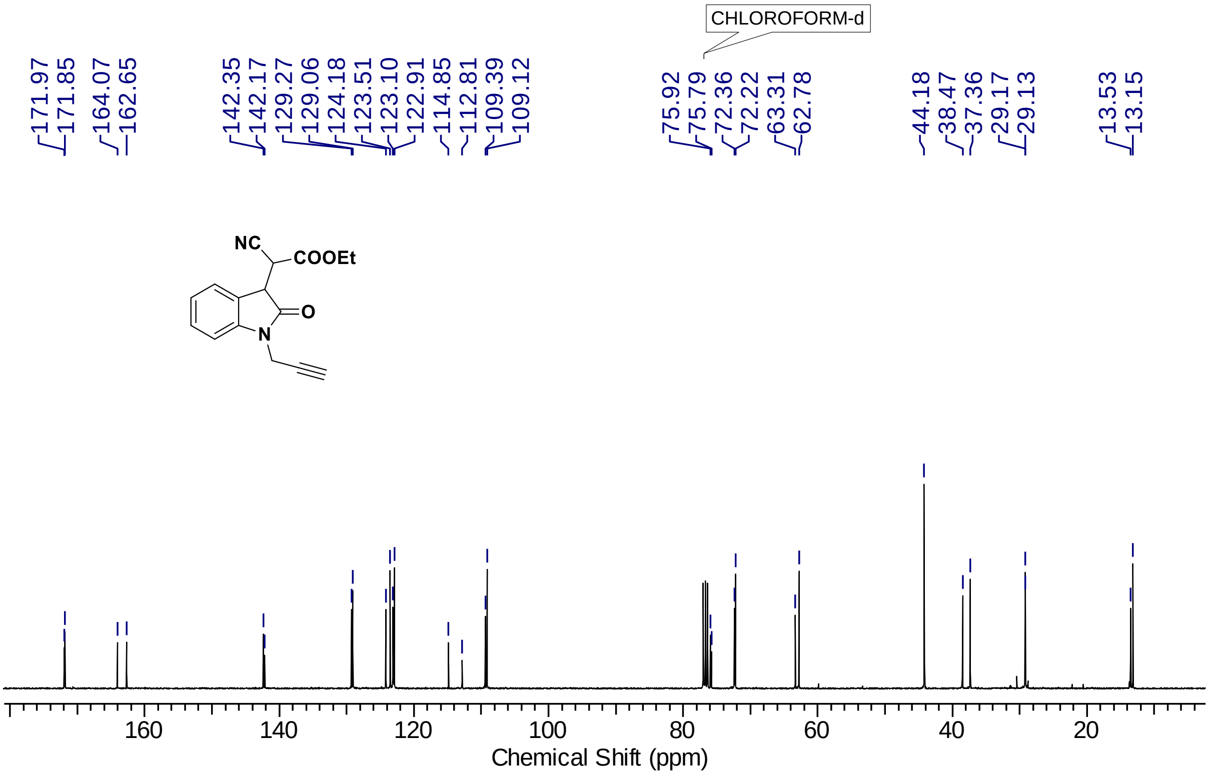
135 DEPT NMR spectrum of compound 3As



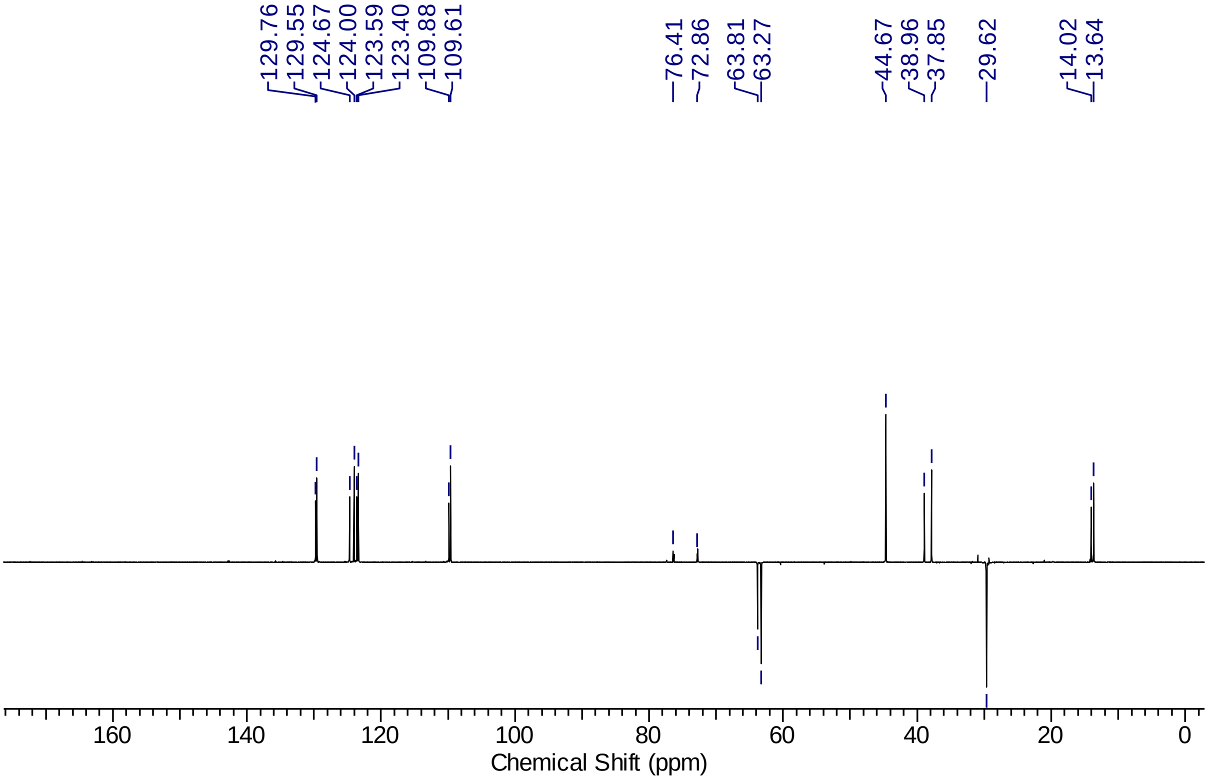
^{1}H NMR spectrum of compound 3At (400 MHz, CDCl$_3$)



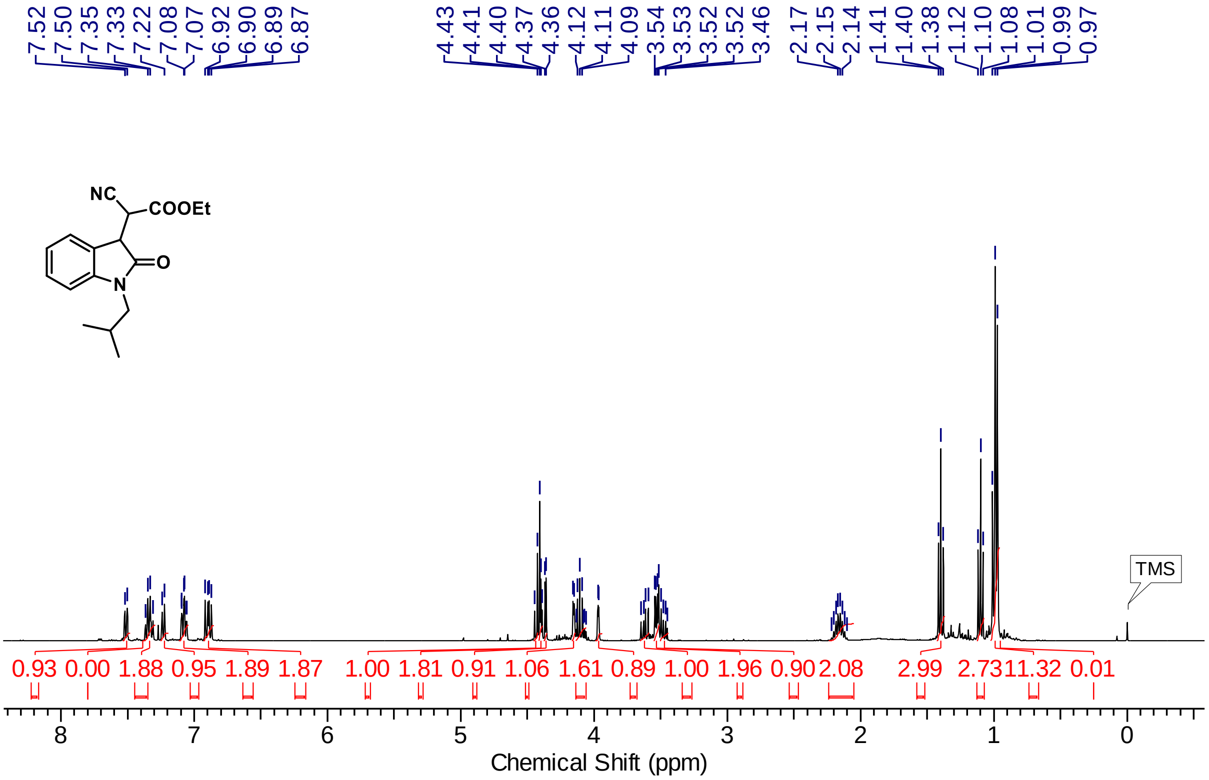
^{13}C NMR spectrum of compound 3At (101 MHz, CDCl$_3$)



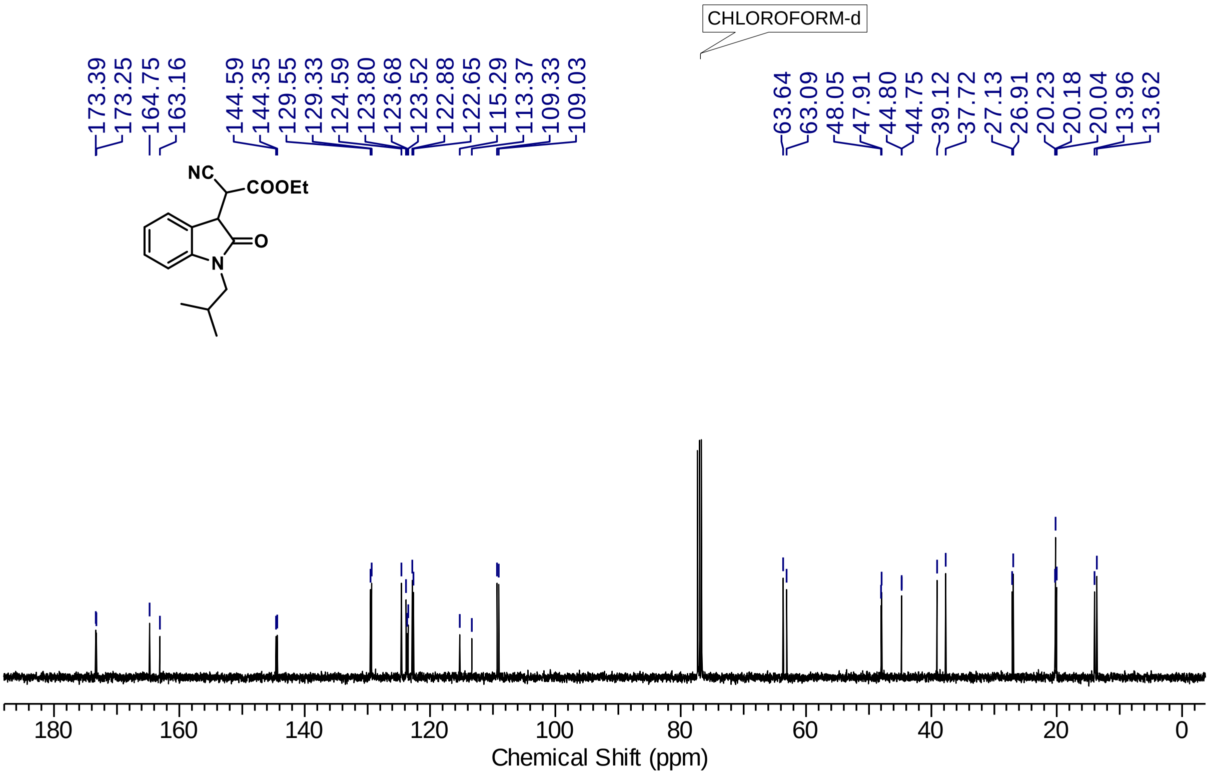
135 DEPT NMR spectrum of compound 3At



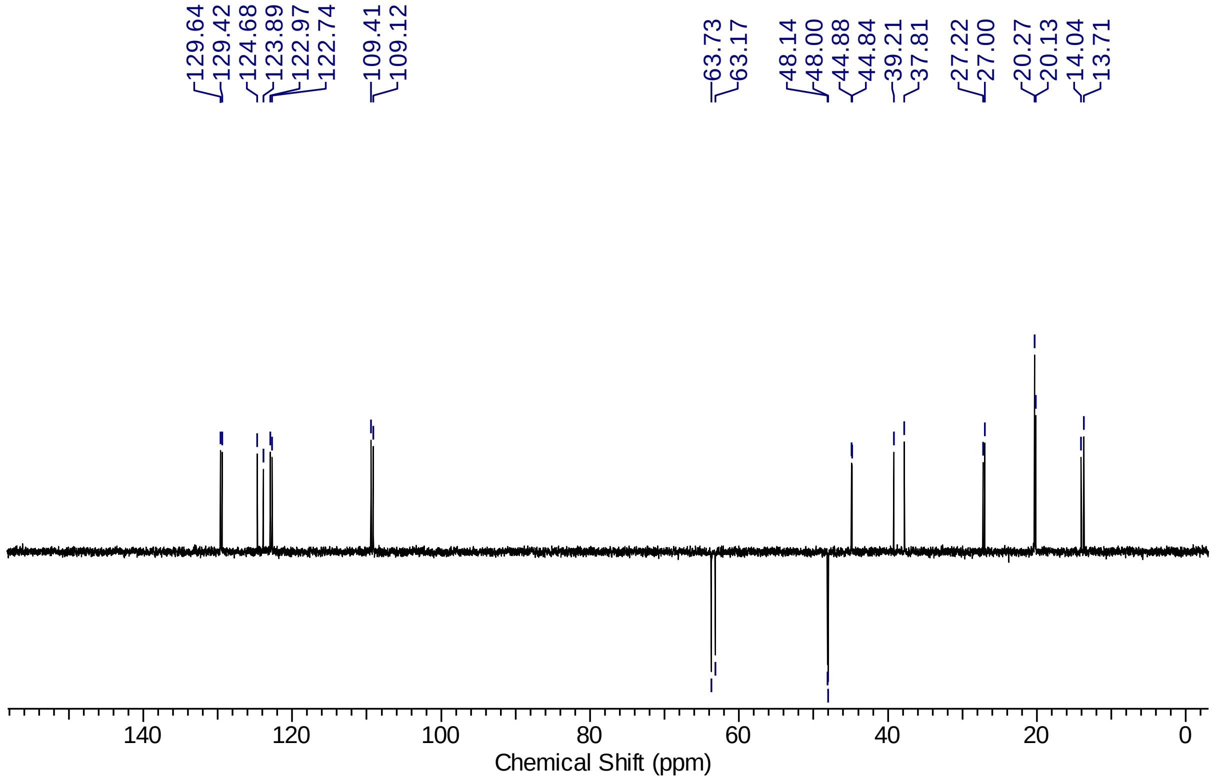
^{1}H NMR spectrum of compound 3Au (400 MHz, $CDCl_3$)



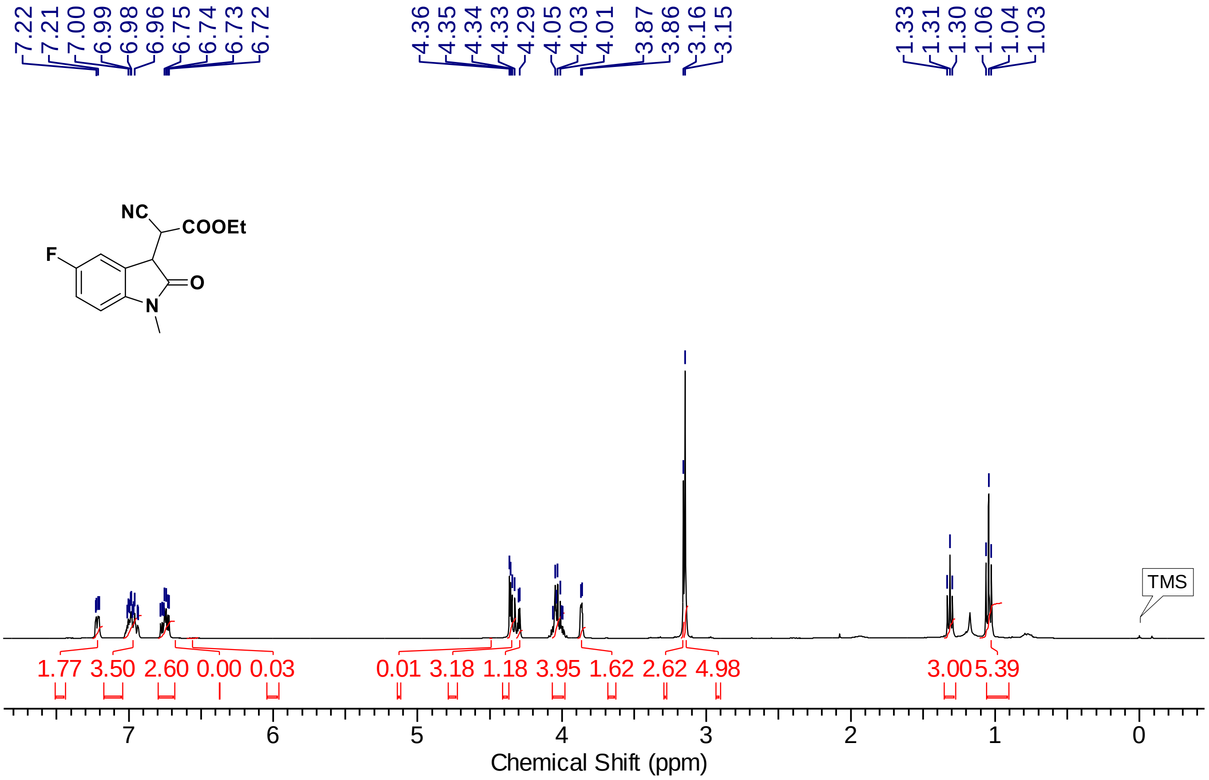
^{13}C NMR spectrum of compound 3Au (101 MHz, $CDCl_3$)



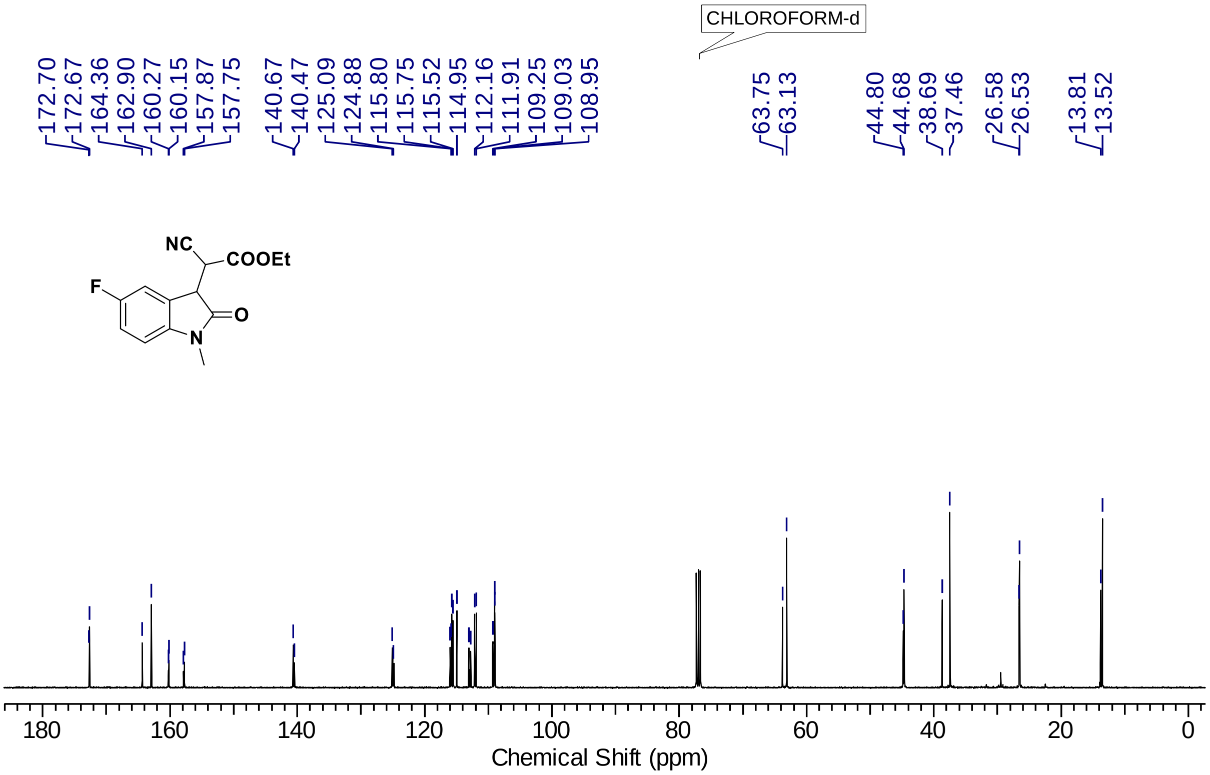
135 DEPT NMR spectrum of compound 3Au



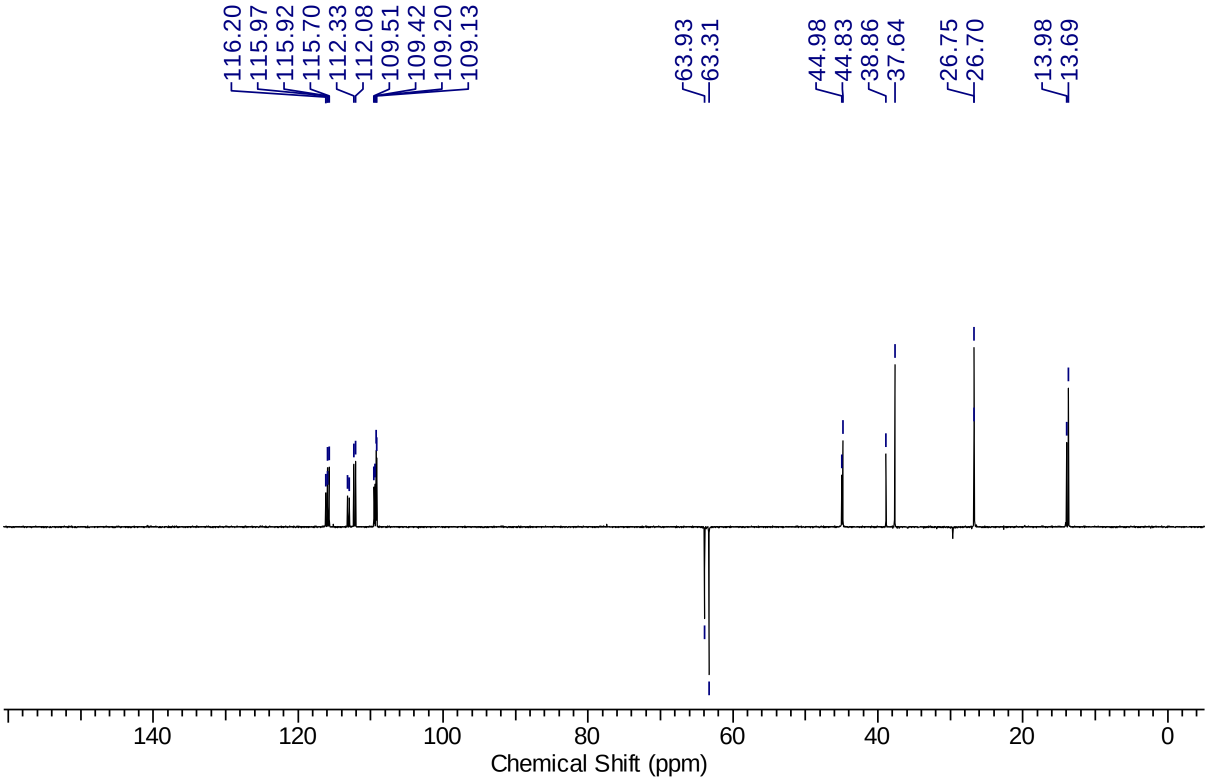
^{1}H NMR spectrum of compound 3Av (400 MHz, $CDCl_3$)



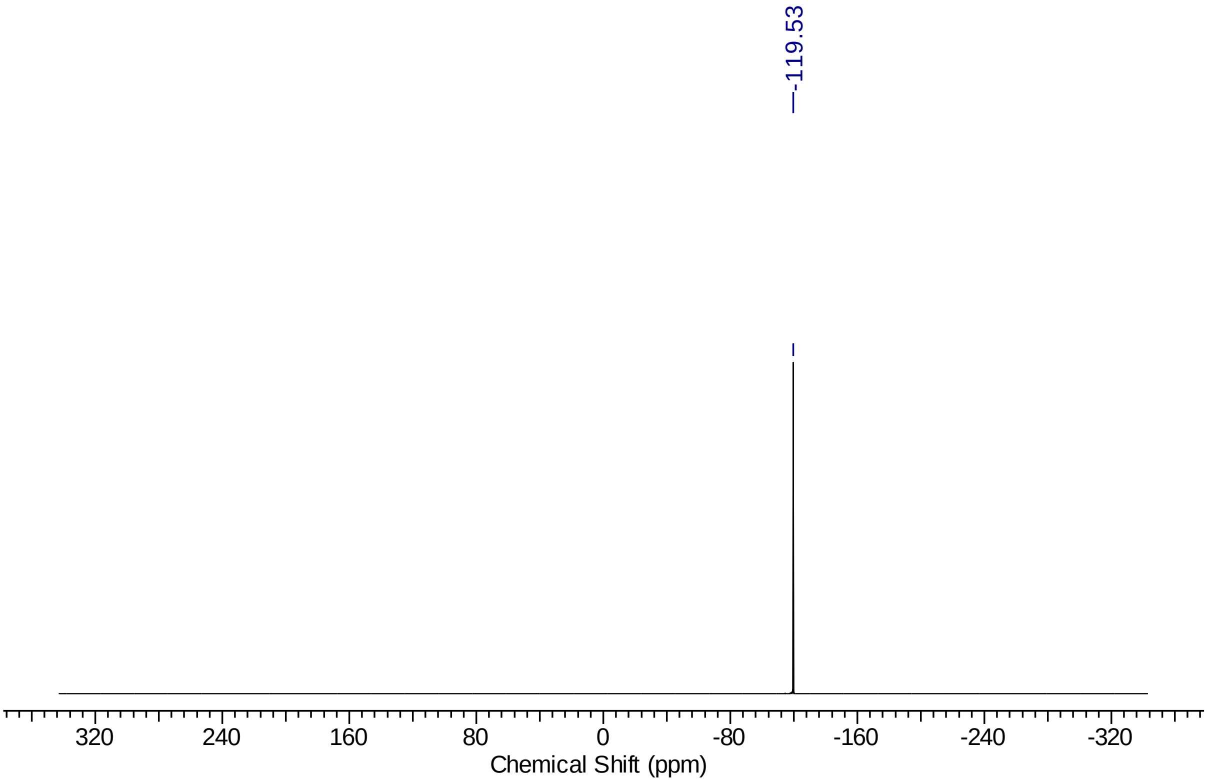
^{13}C NMR spectrum of compound 3Av (101 MHz, $CDCl_3$)



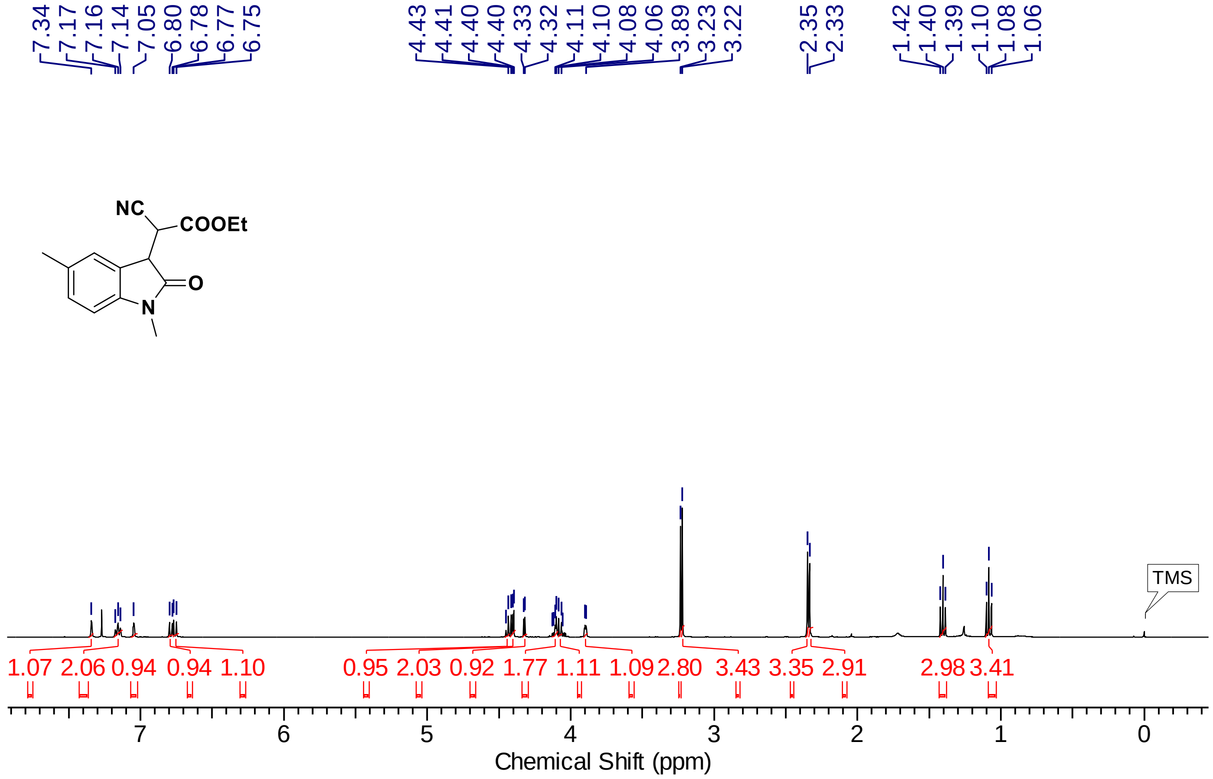
135 DEPT NMR spectrum of compound 3Av



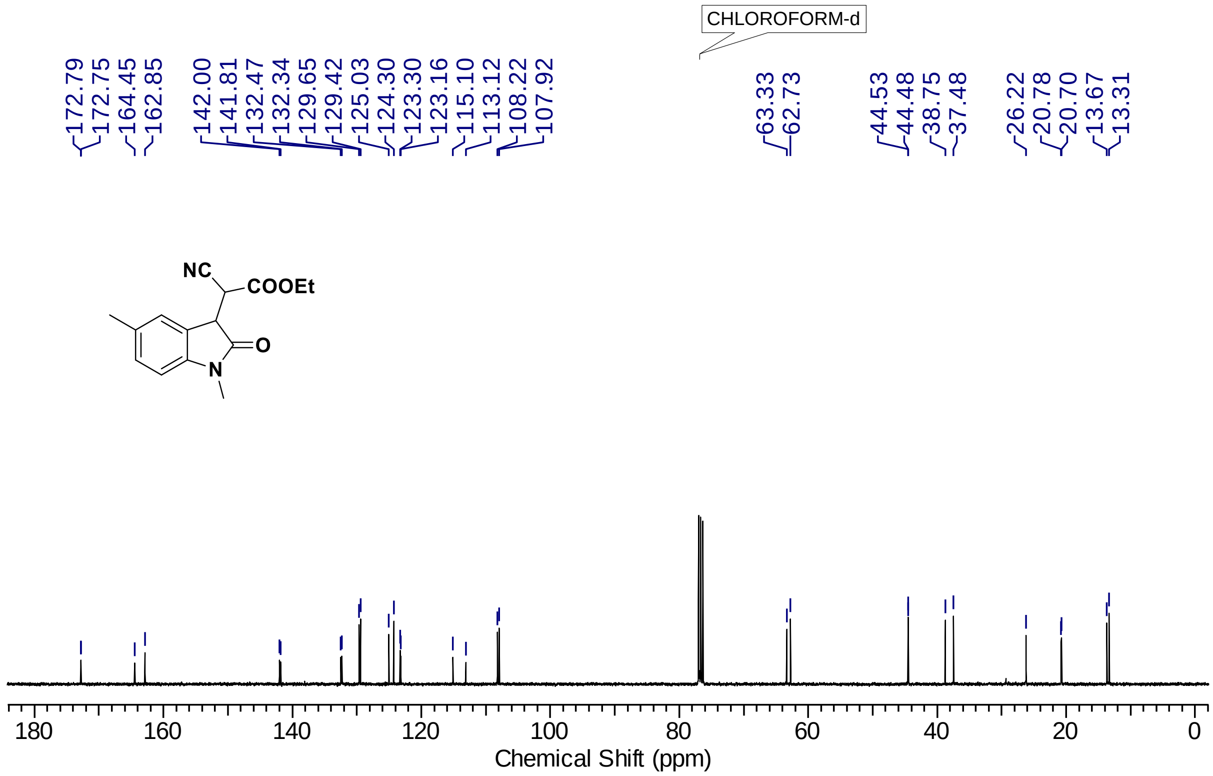
^{19}F spectrum of compound 3Av



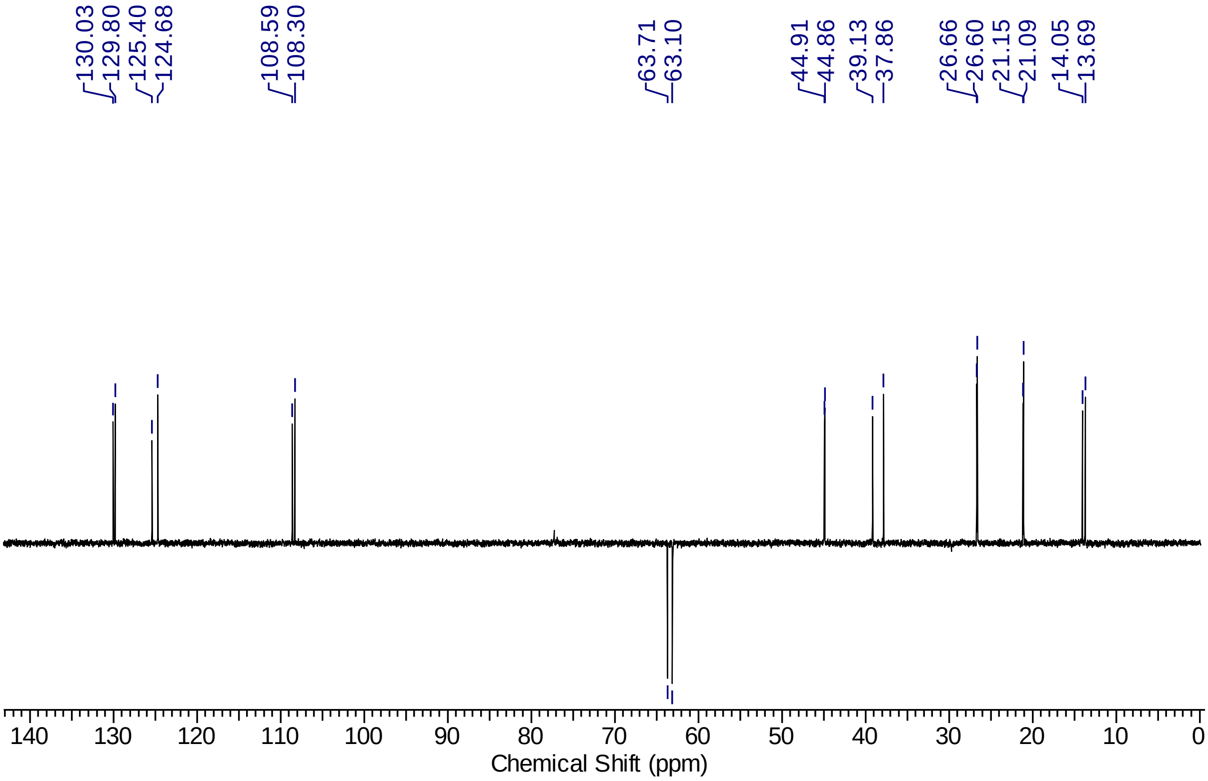
^{1}H NMR spectrum of compound 3Aw (400 MHz, $CDCl_3$)



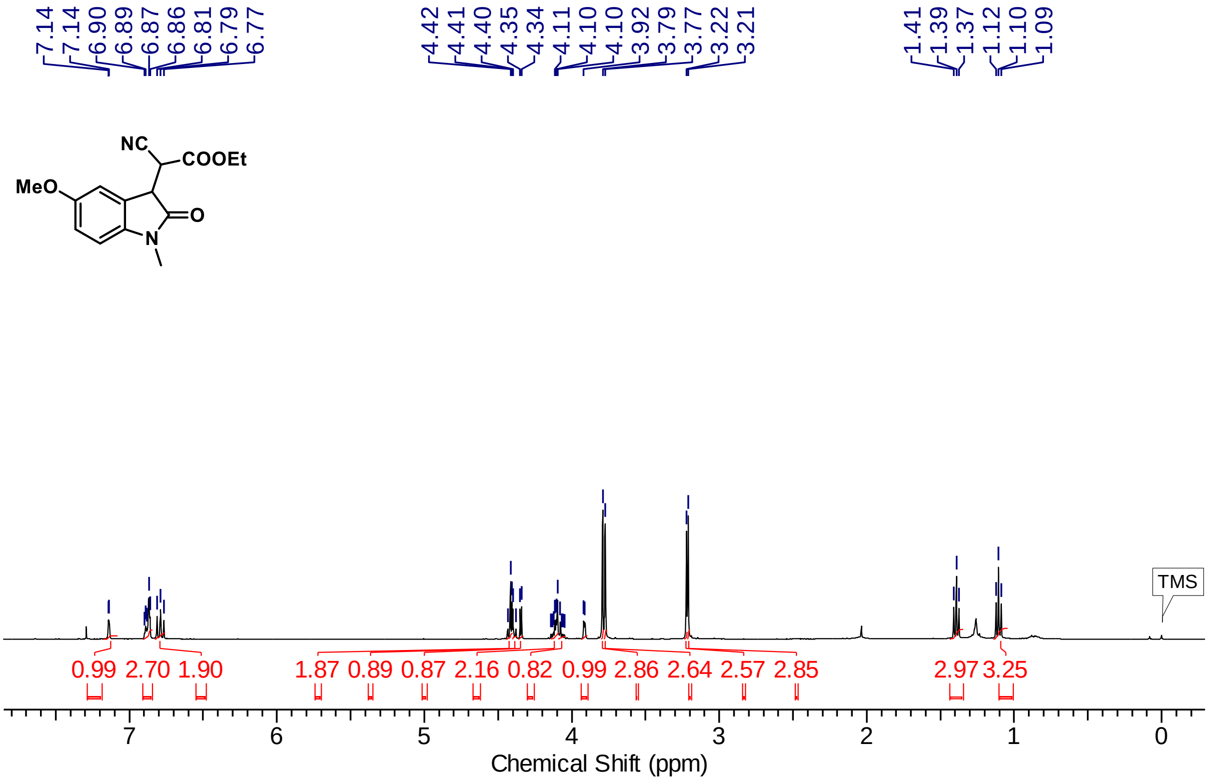
^{13}C NMR spectrum of compound 3Aw (101 MHz, $CDCl_3$)



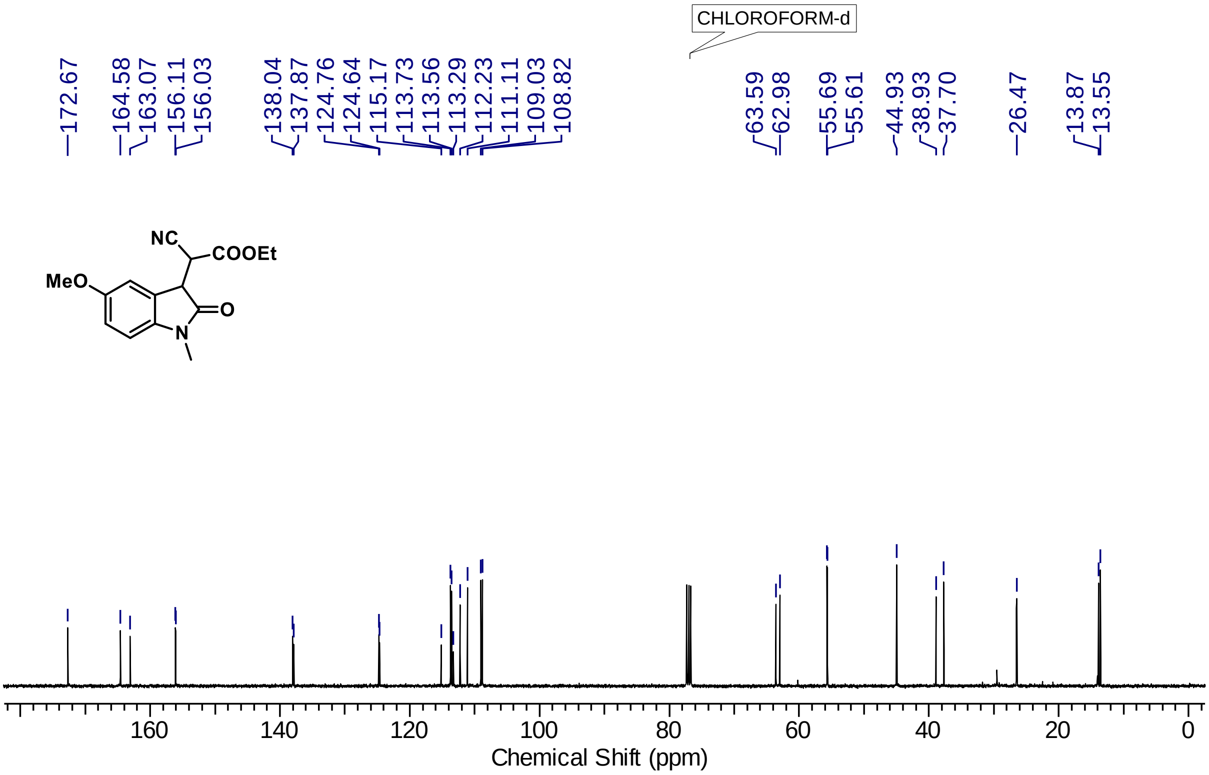
135 DEPT NMR spectrum of compound 3Aw



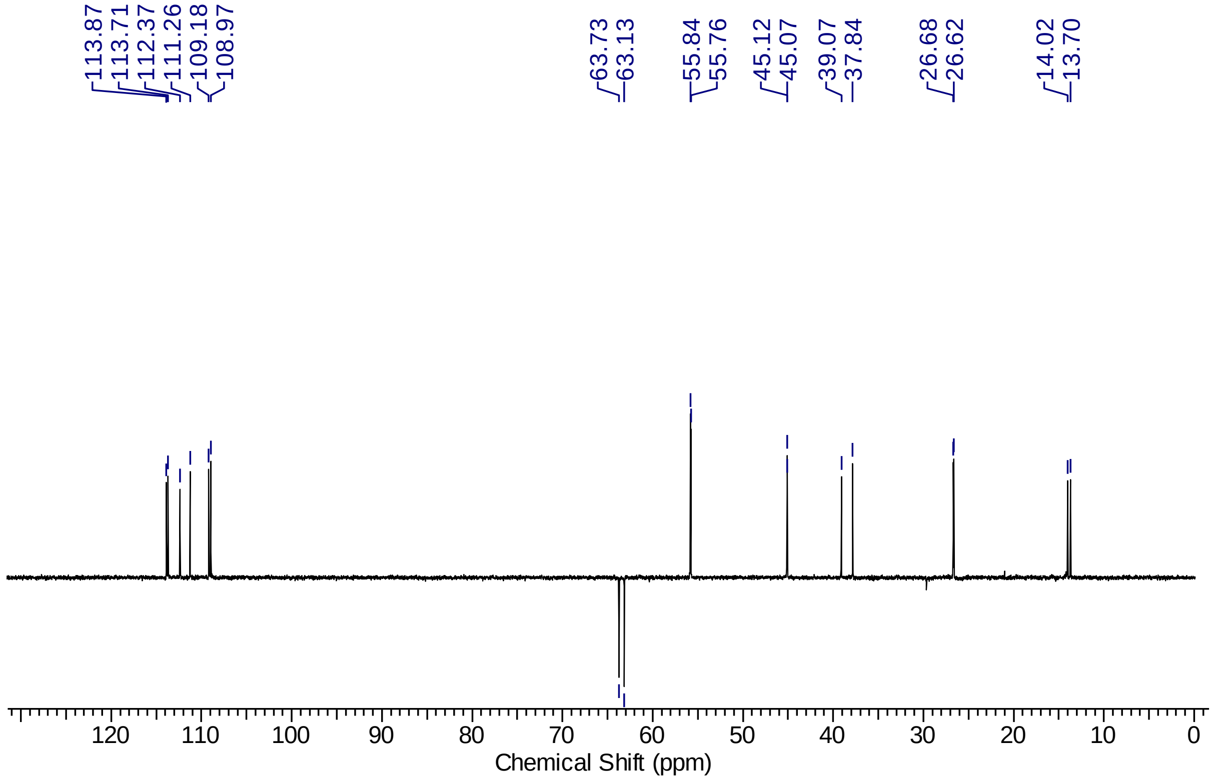
^{1}H NMR spectrum of compound 3Ax (400 MHz, $CDCl_3$)



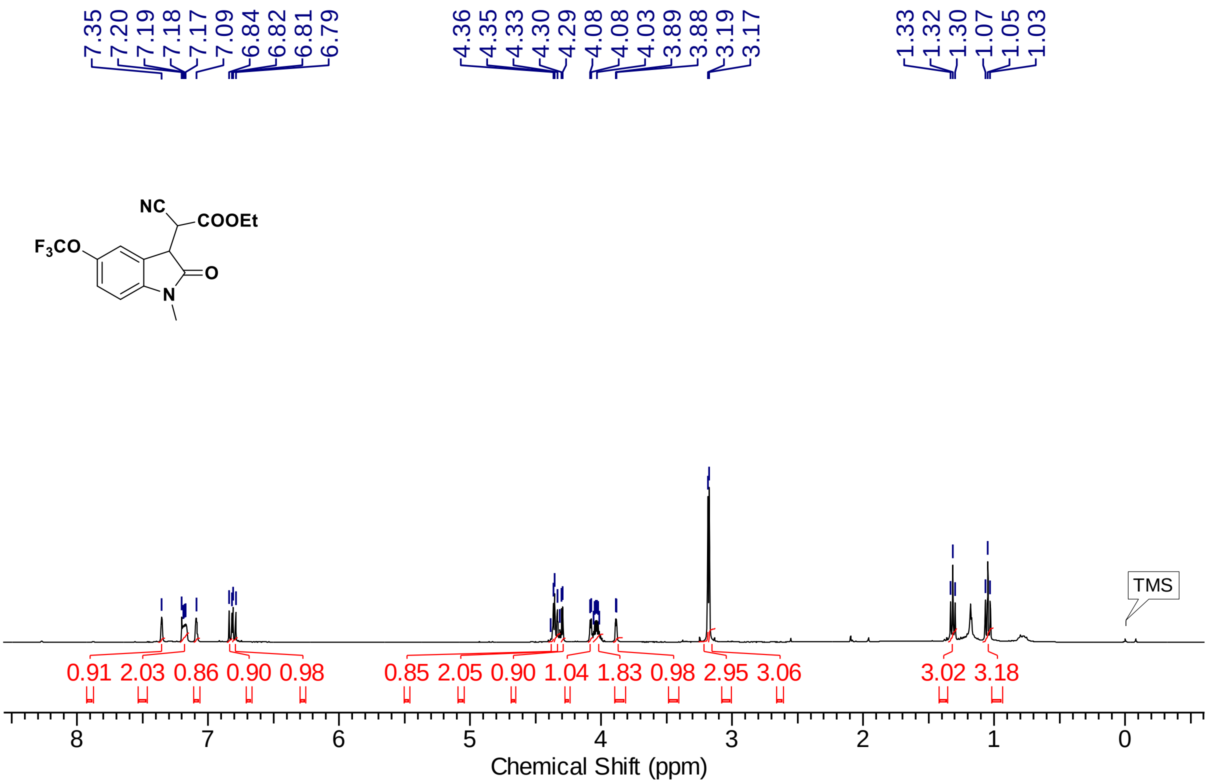
^{13}C NMR spectrum of compound 3Ax (101 MHz, $CDCl_3$)



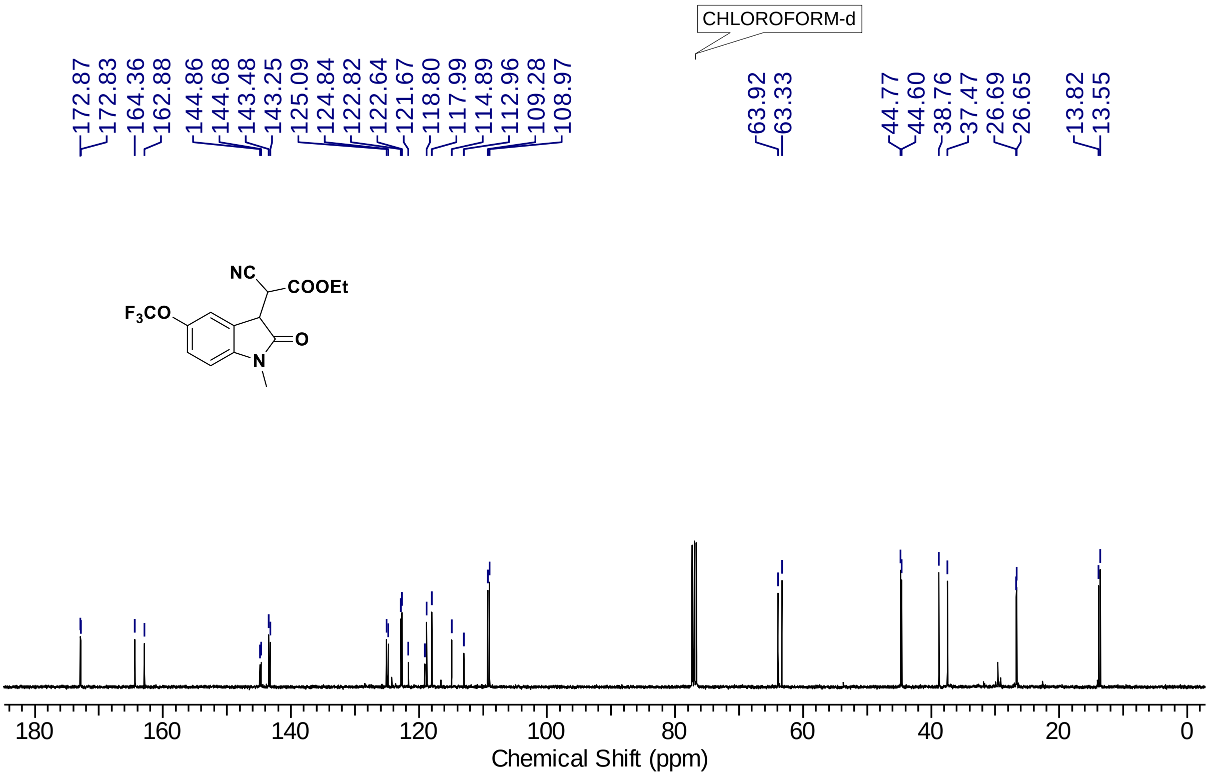
135 DEPT NMR spectrum of compound 3Ax



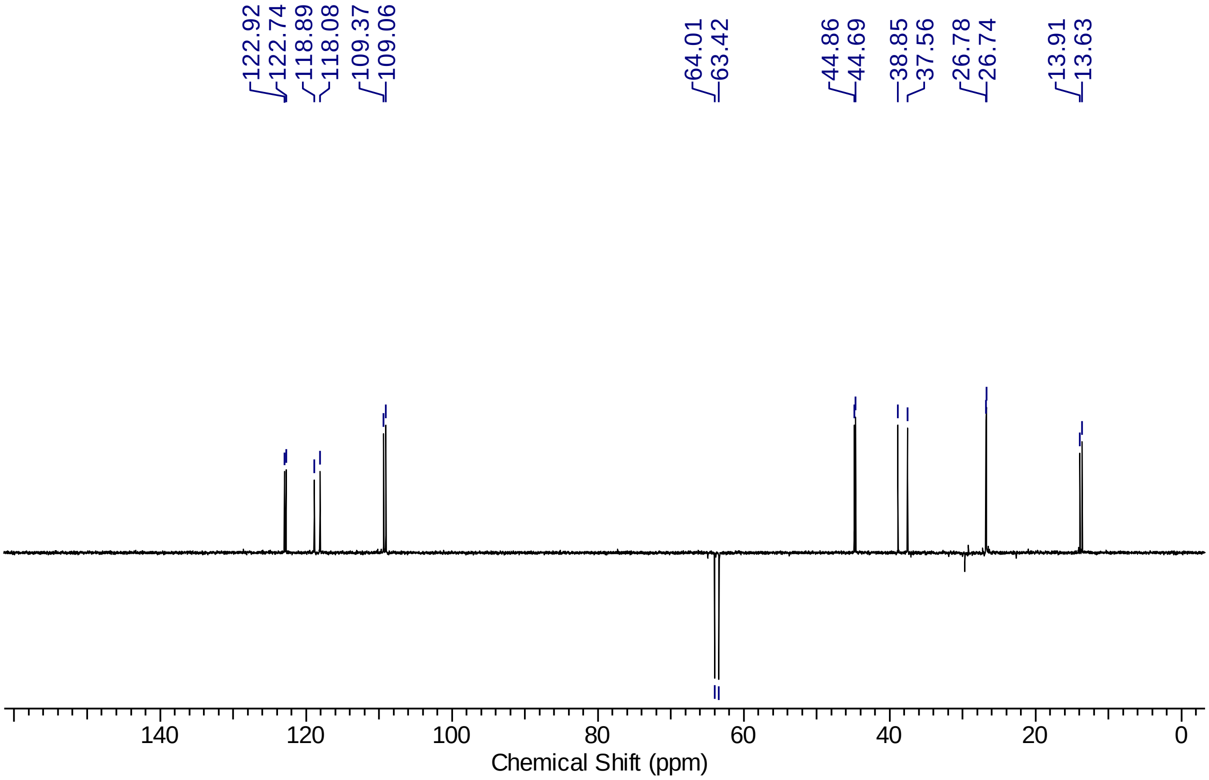
^{1}H NMR spectrum of compound 3Ay (400 MHz, $CDCl_3$)



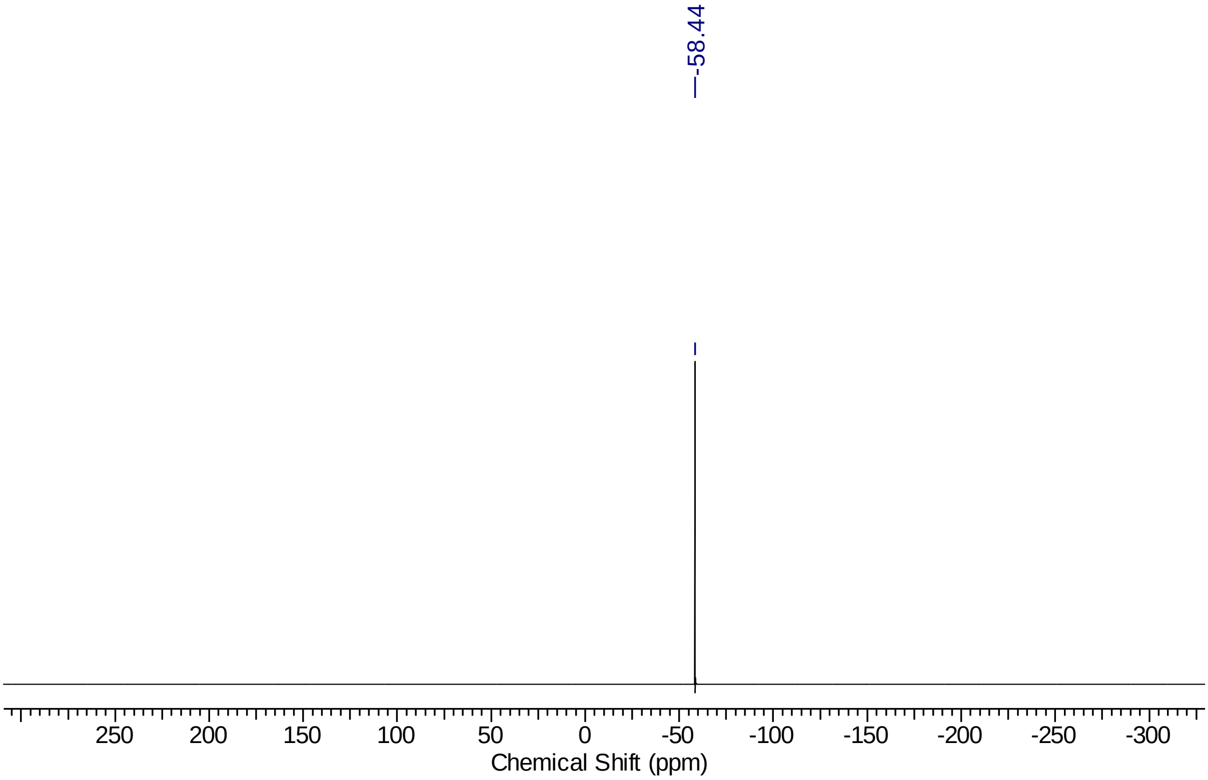
^{13}C NMR spectrum of compound 3Ay (101 MHz, $CDCl_3$)



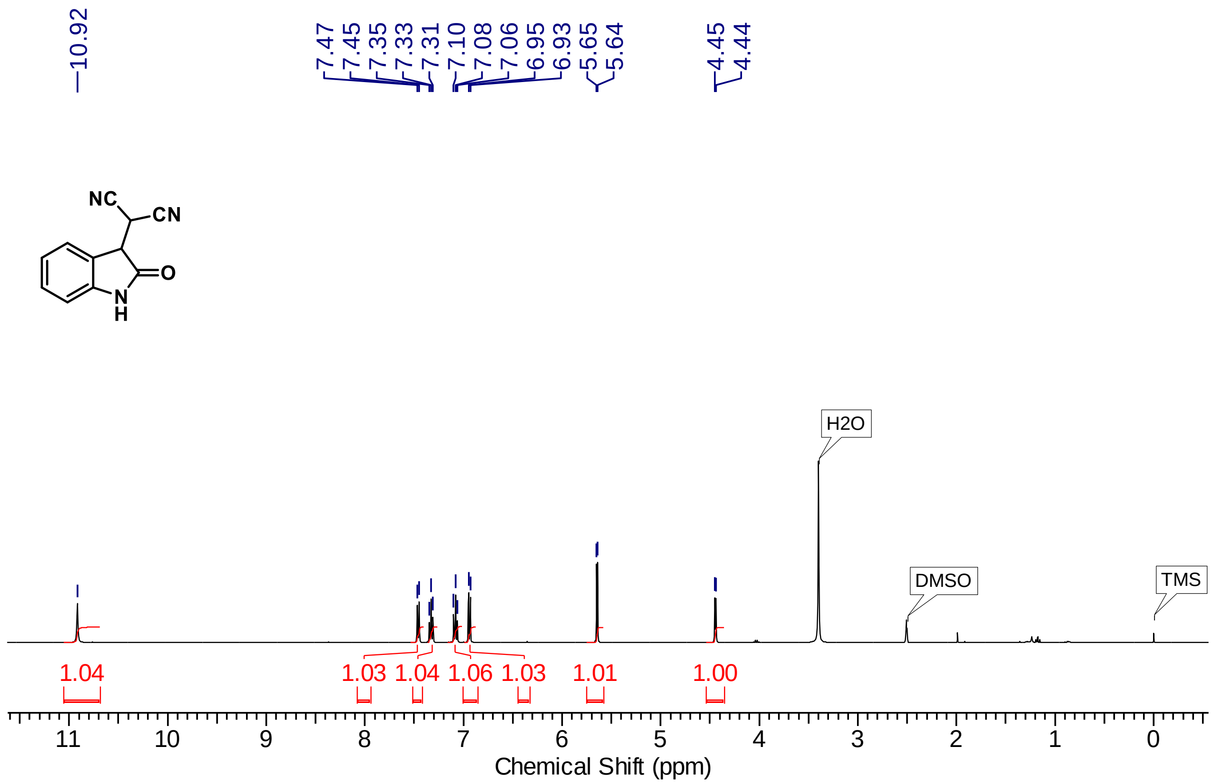
135 DEPT NMR spectrum of compound 3Ay



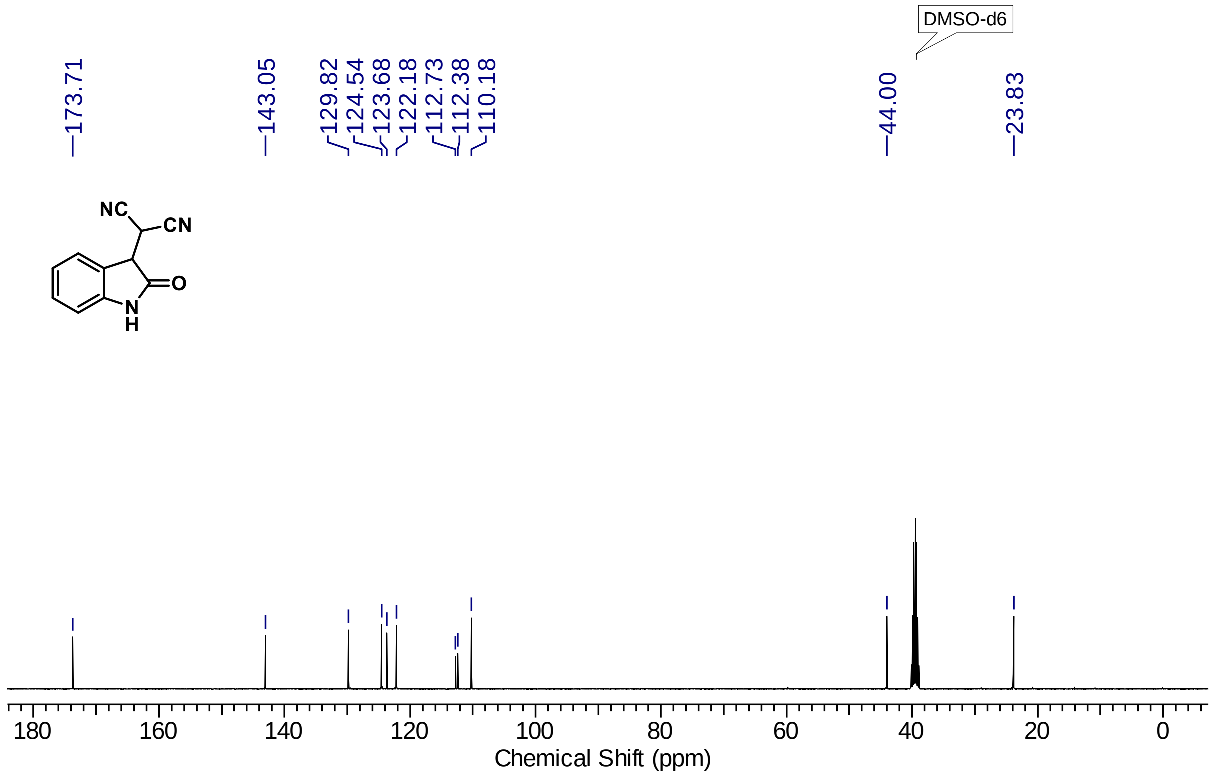
^{19}F spectrum of compound 3Ay



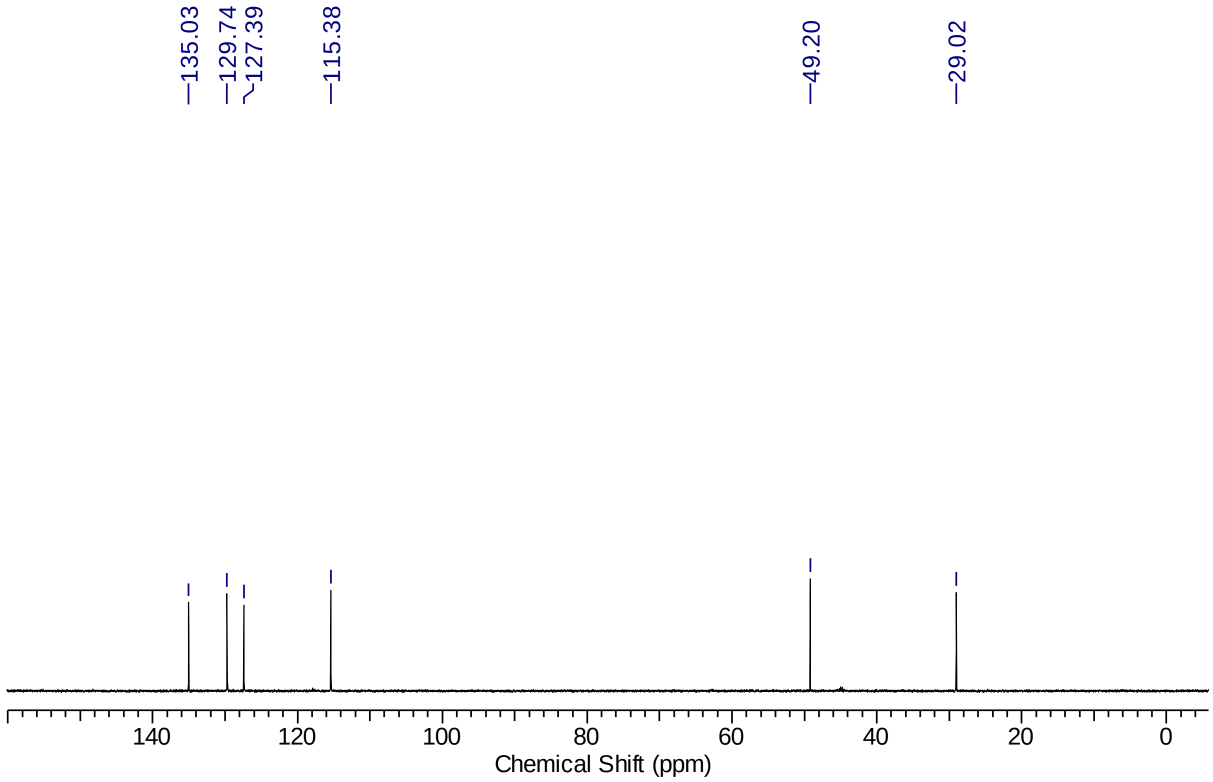
^{1}H NMR spectrum of compound 3B (400 MHz, DMSO-d^{6})



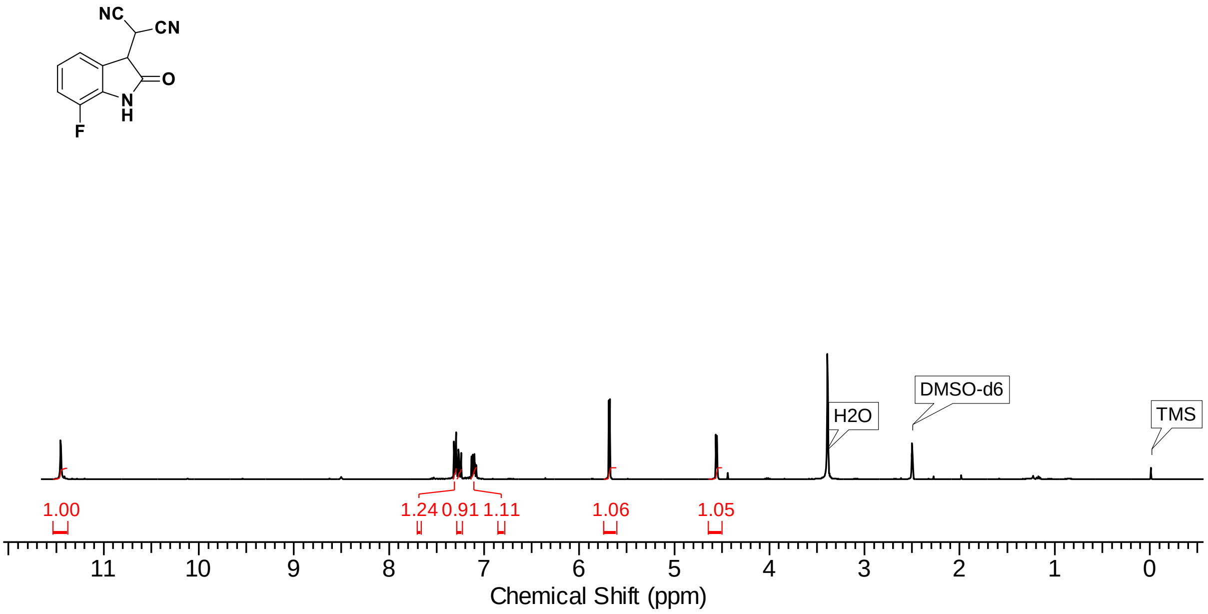
^{13}C NMR spectrum of compound 3B (101 MHz, DMSO-d^{6})



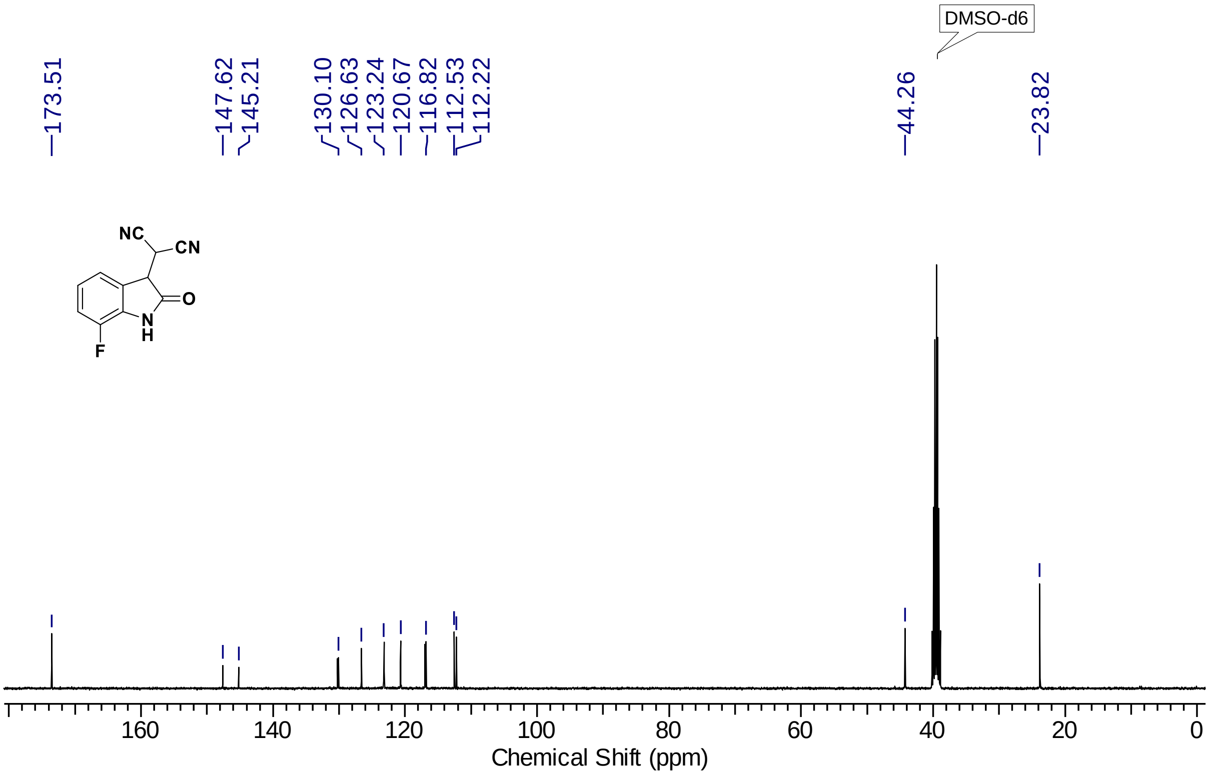
135 DEPT NMR spectrum of compound 3B



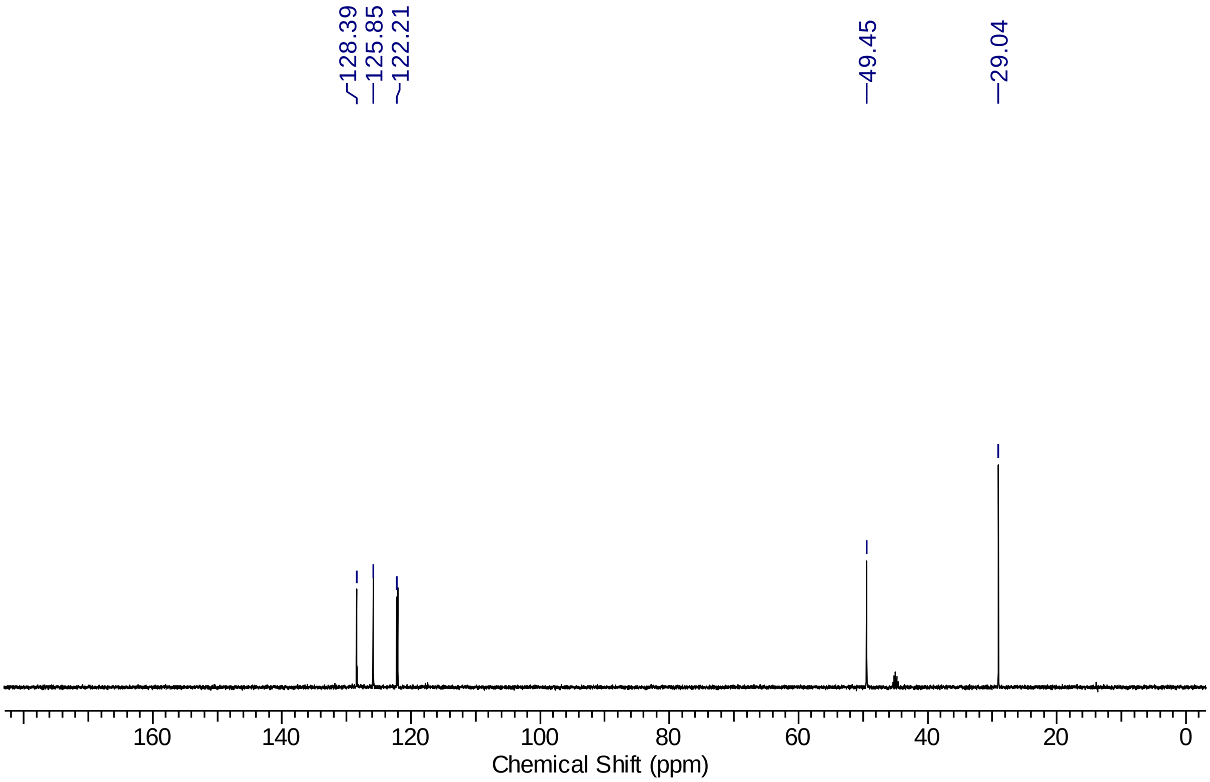
^{1}H NMR spectrum of compound 3Ba (400 MHz, DMSO-d^6)



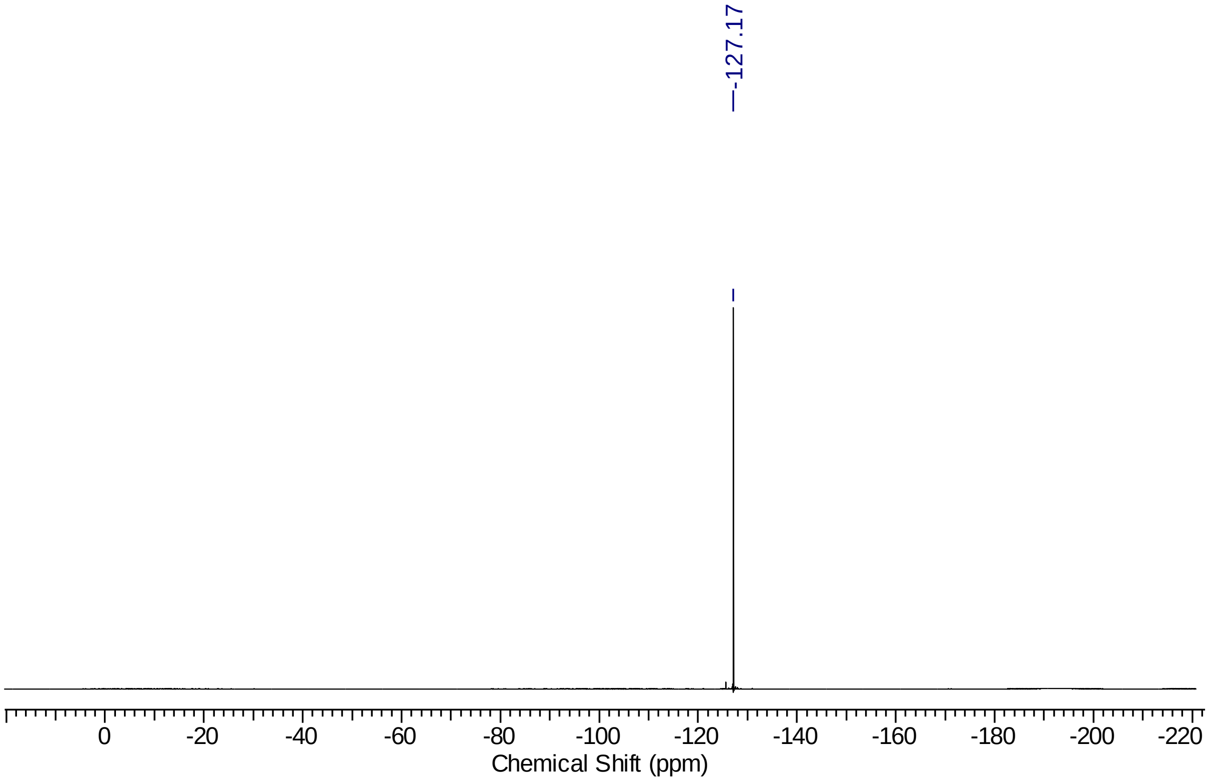
^{13}C NMR spectrum of compound 3Ba (101 MHz, DMSO-d^6)



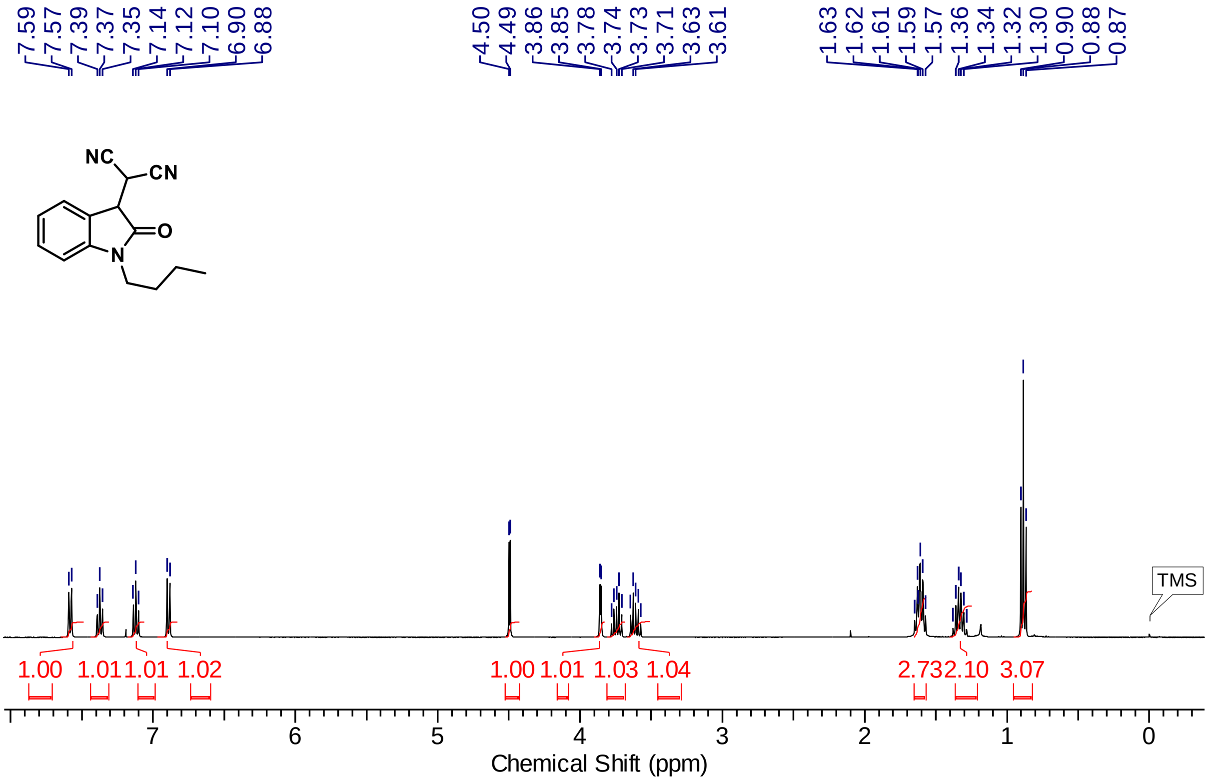
135 DEPT NMR spectrum of compound 3Ba



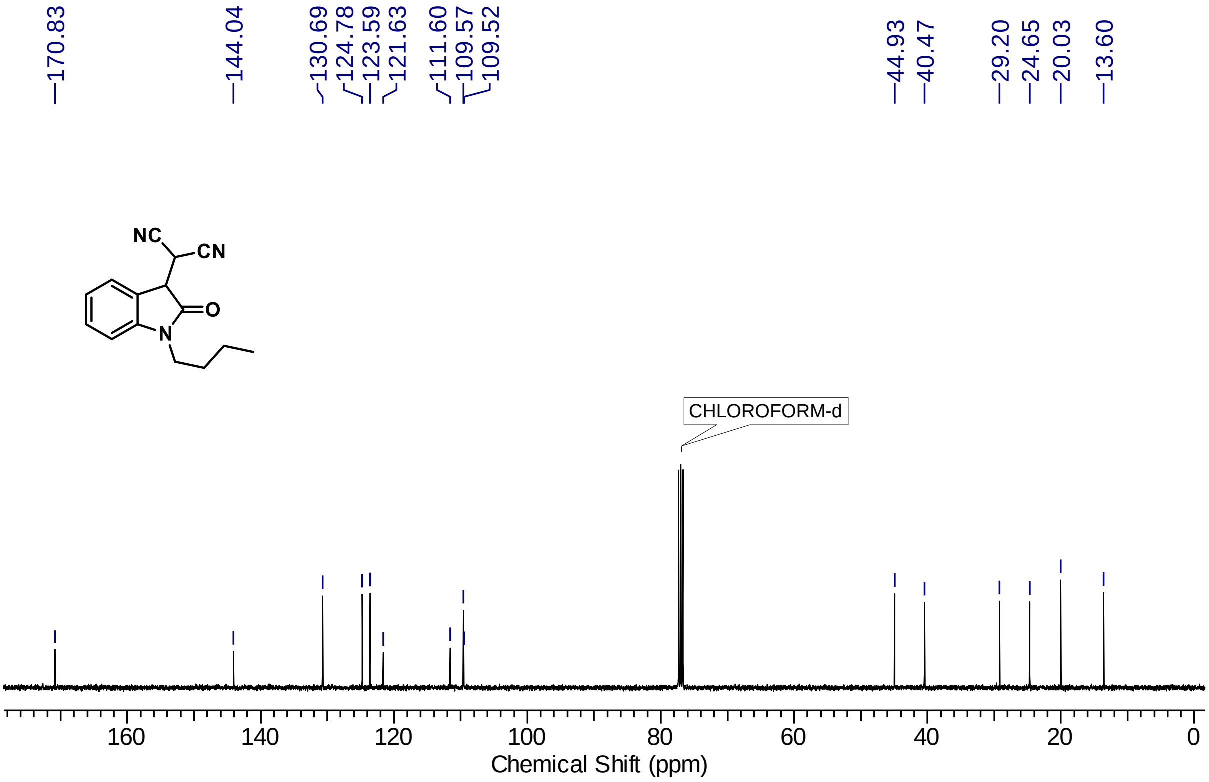
^{19}F spectrum of compound 3Ba



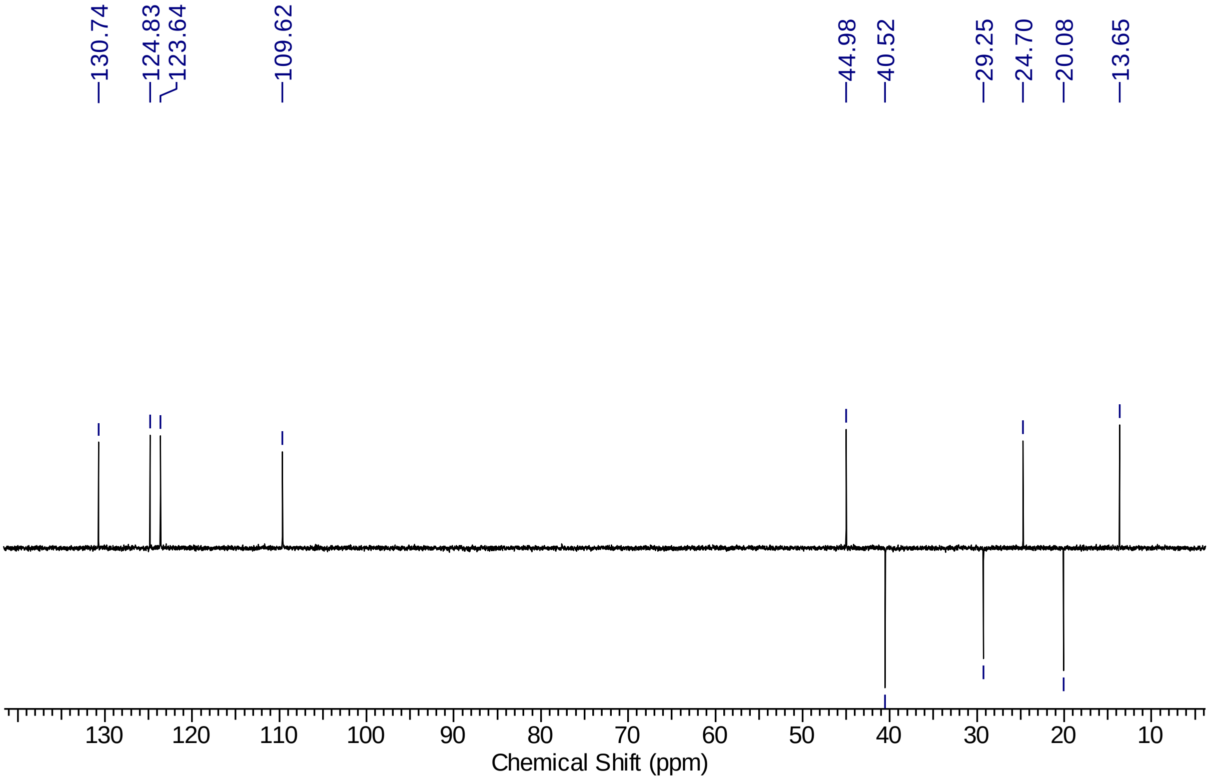
^{1}H NMR spectrum of compound 3Bb (400 MHz, $CDCl_3$)



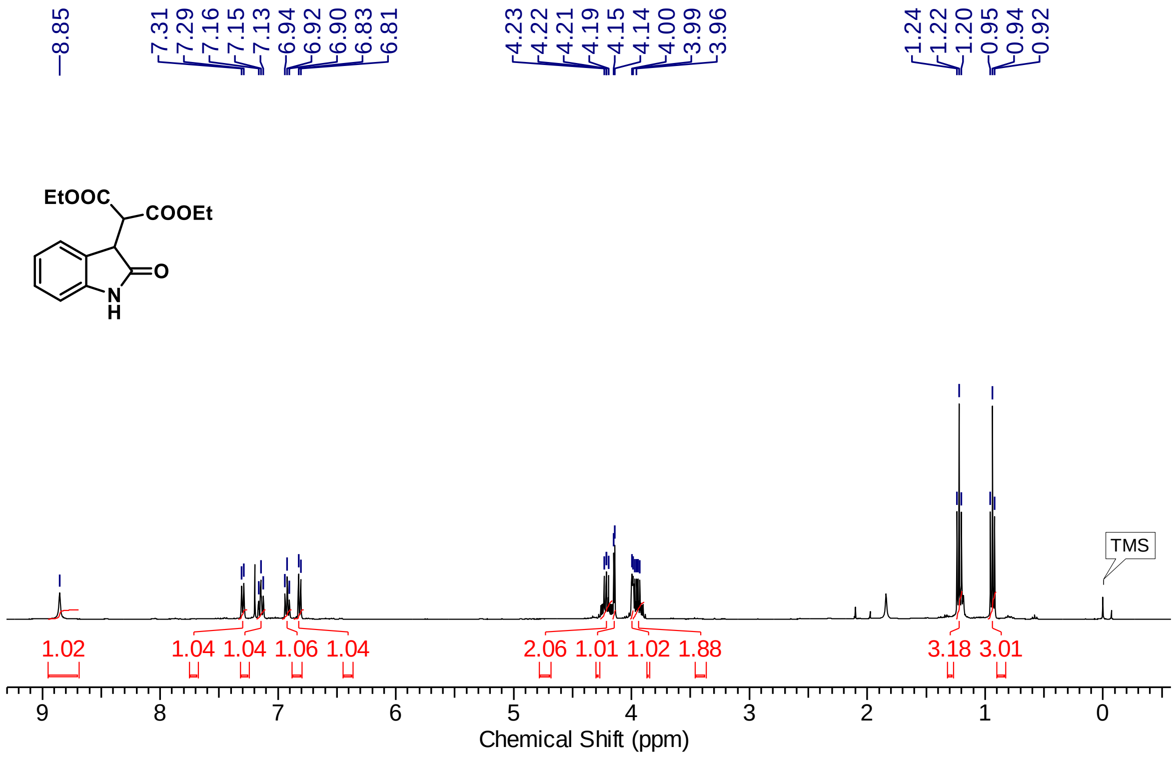
^{13}C NMR spectrum of compound 3Bb (101 MHz, $CDCl_3$)



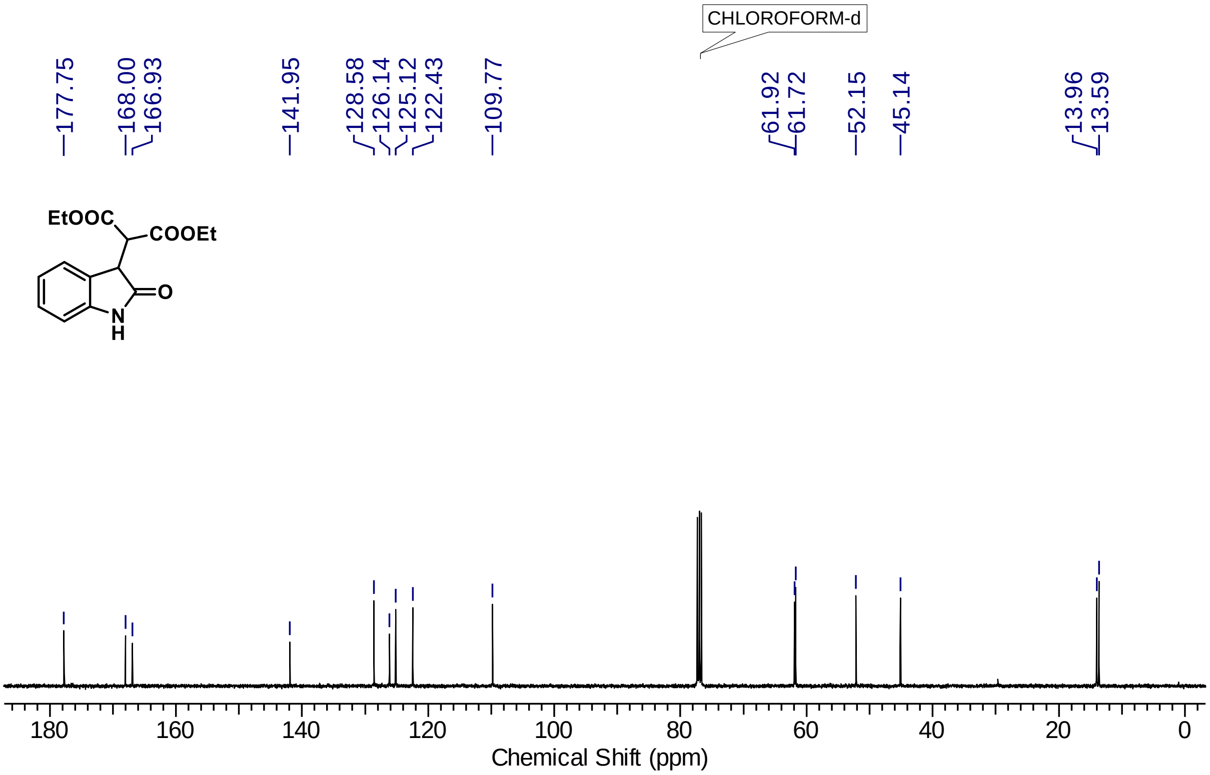
135 DEPT NMR spectrum of compound 3Bb



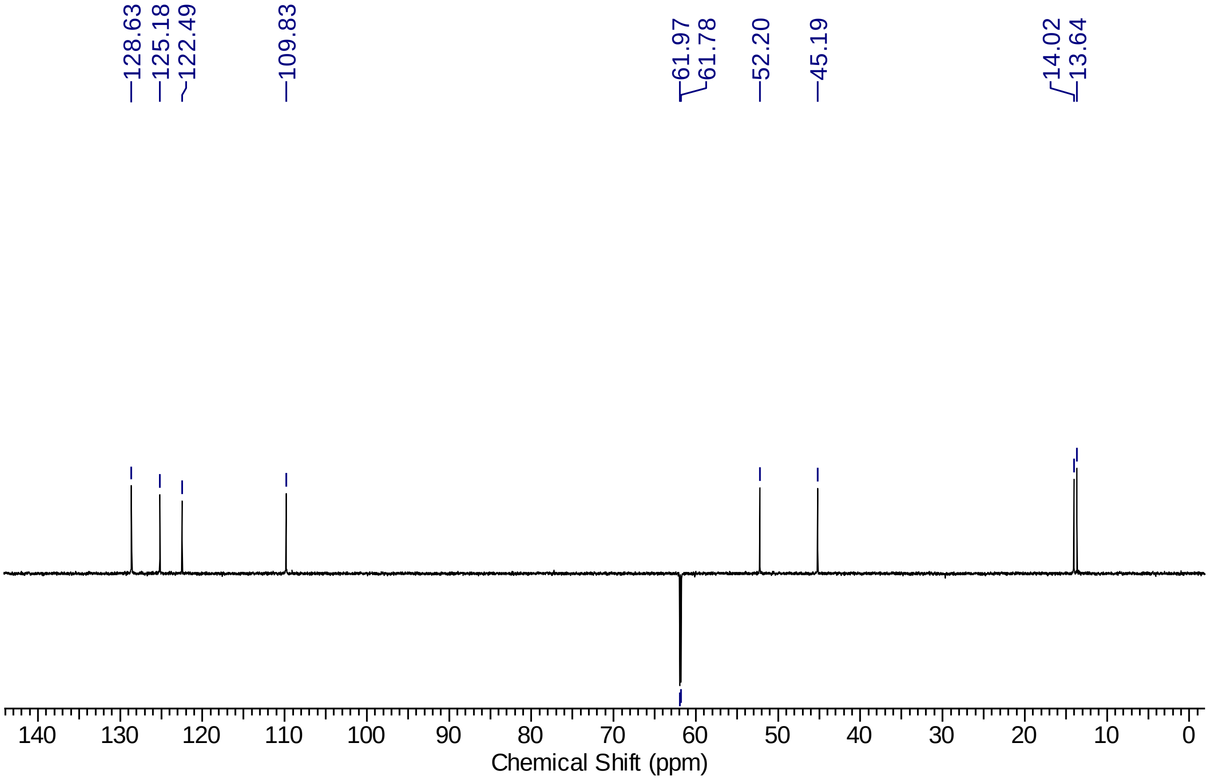
^1H NMR spectrum of compound 3C (400 MHz, $CDCl_3$)



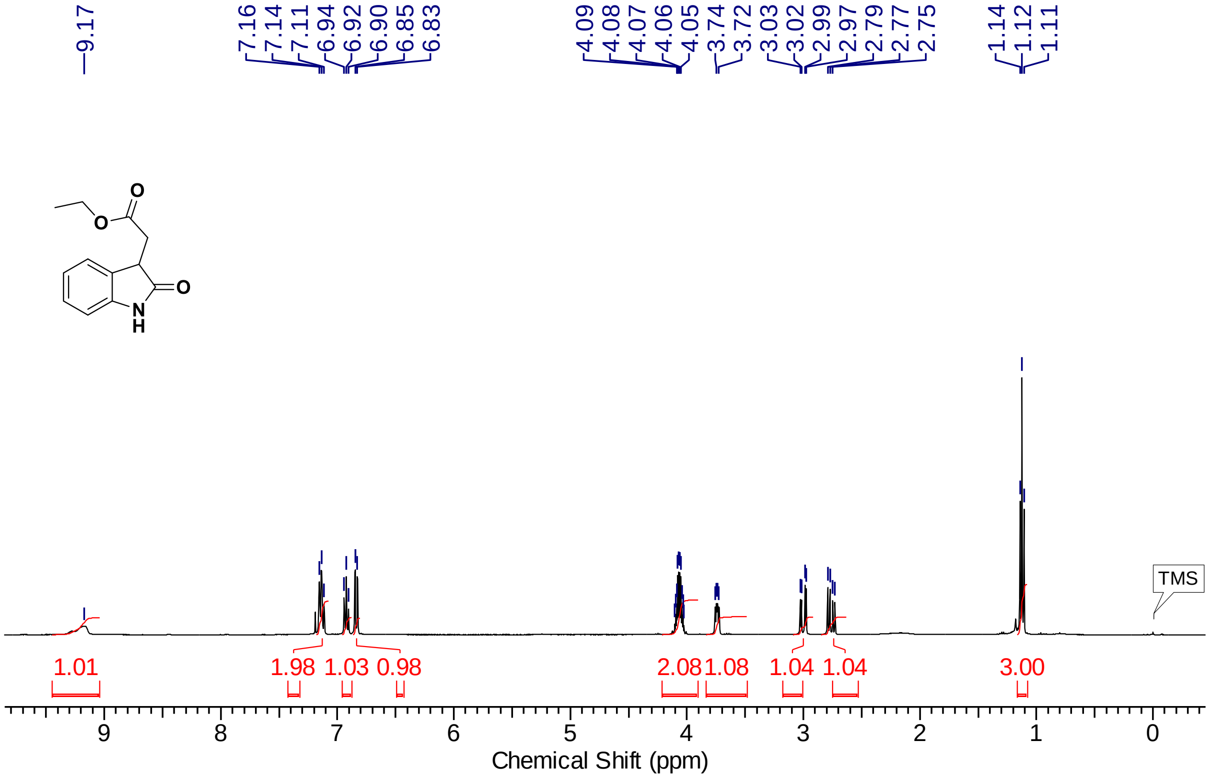
^{13}C NMR spectrum of compound 3C (101 MHz, $CDCl_3$)



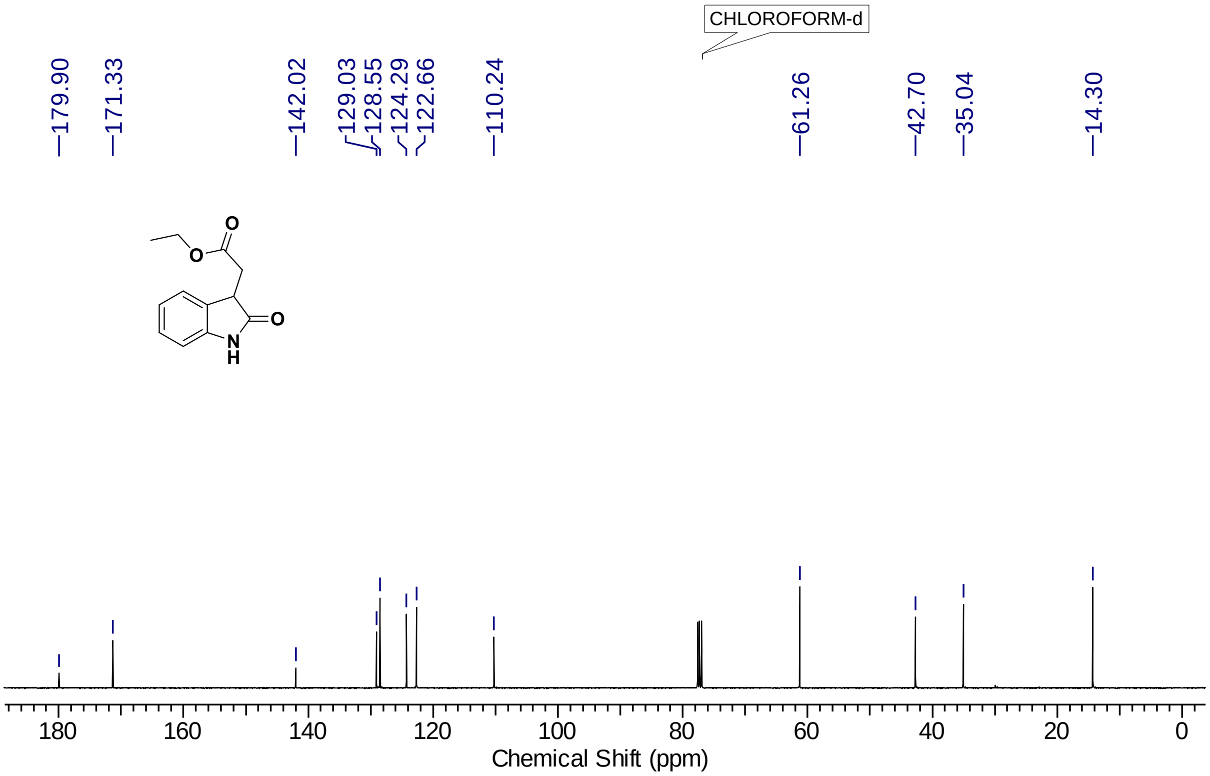
135 DEPT NMR spectrum of compound 3C



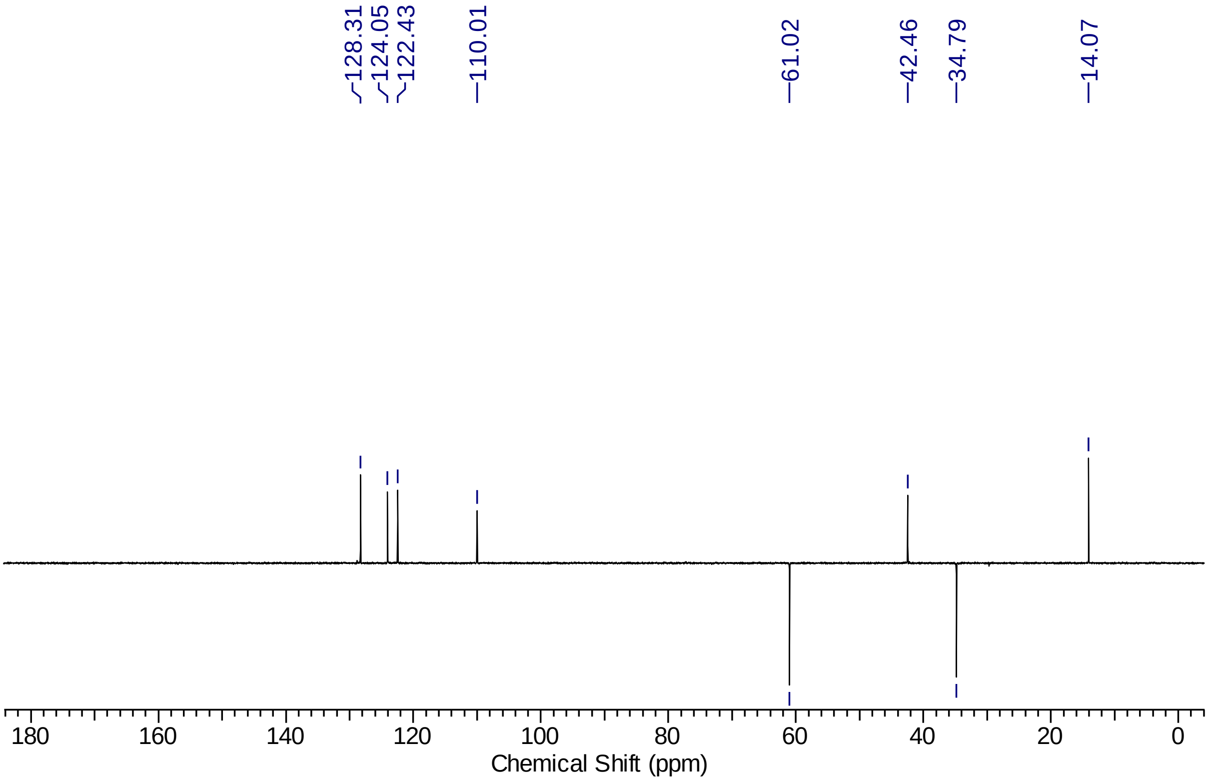
^1H NMR spectrum of compound 3D (400 MHz, $CDCl_3$)



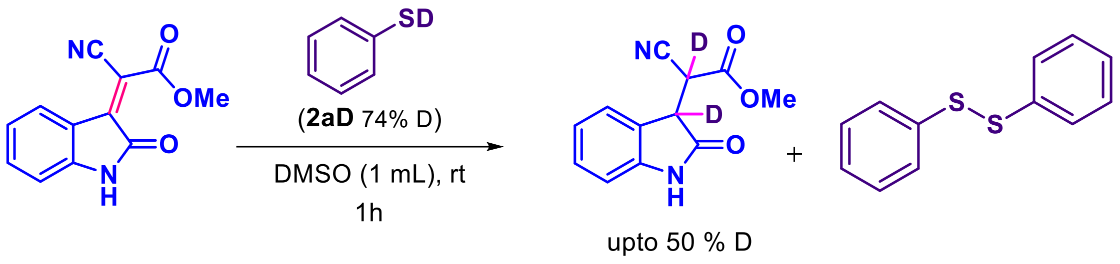
^{13}C NMR spectrum of compound 3D (101 MHz, $CDCl_3$)



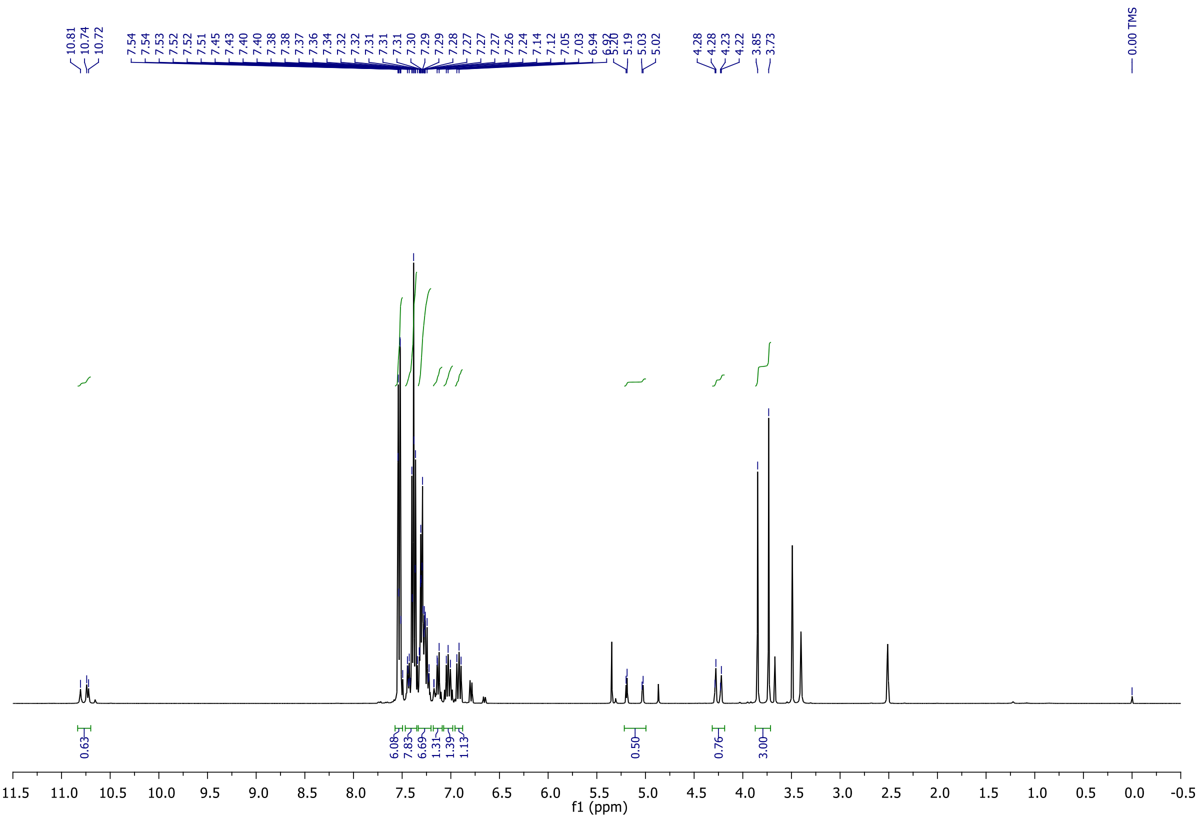
135 DEPT NMR spectrum of compound 3D



Deuterium Scrambling Experiment:

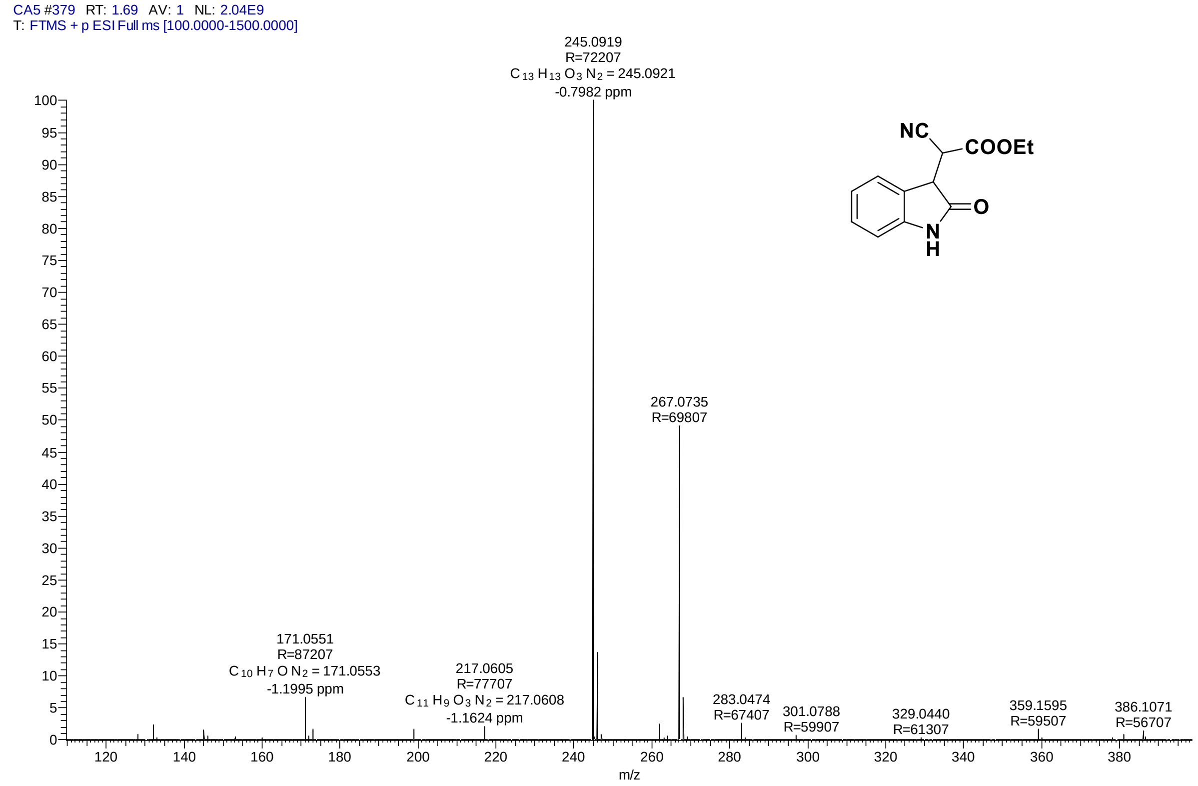


NMR of crude product

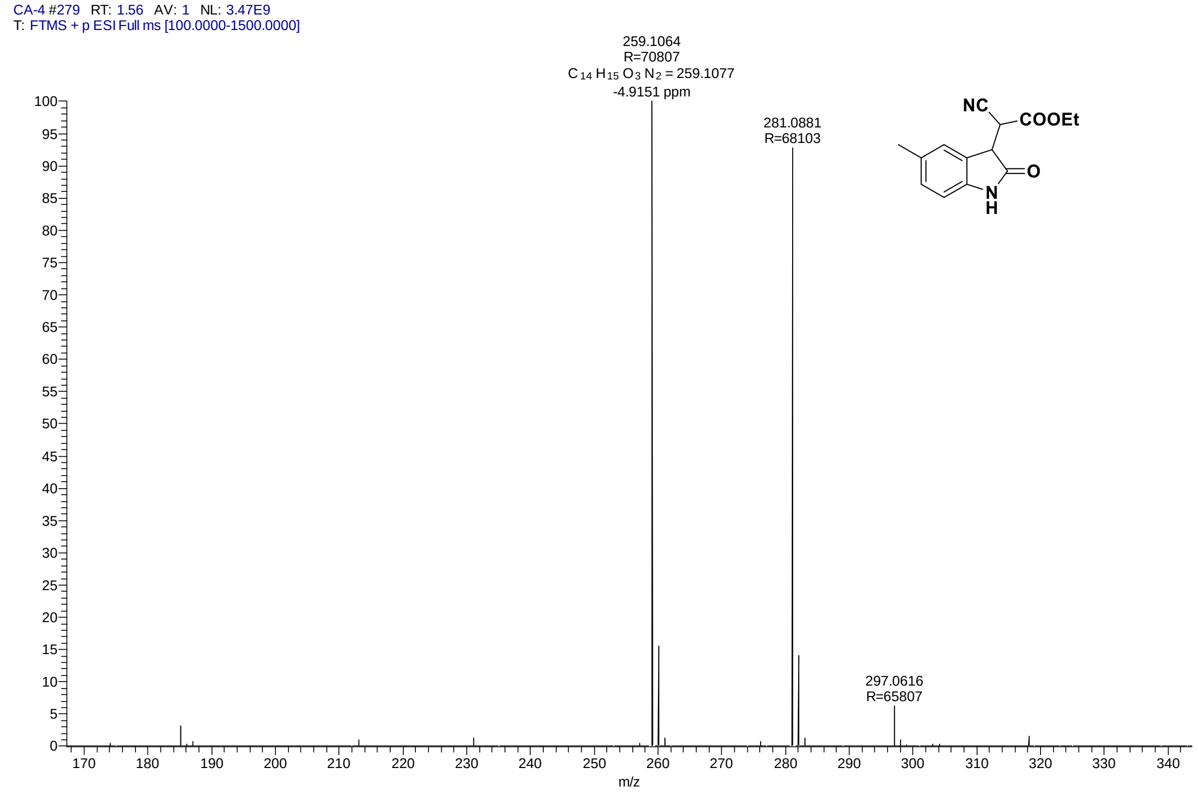


9. HRMS Spectral data.

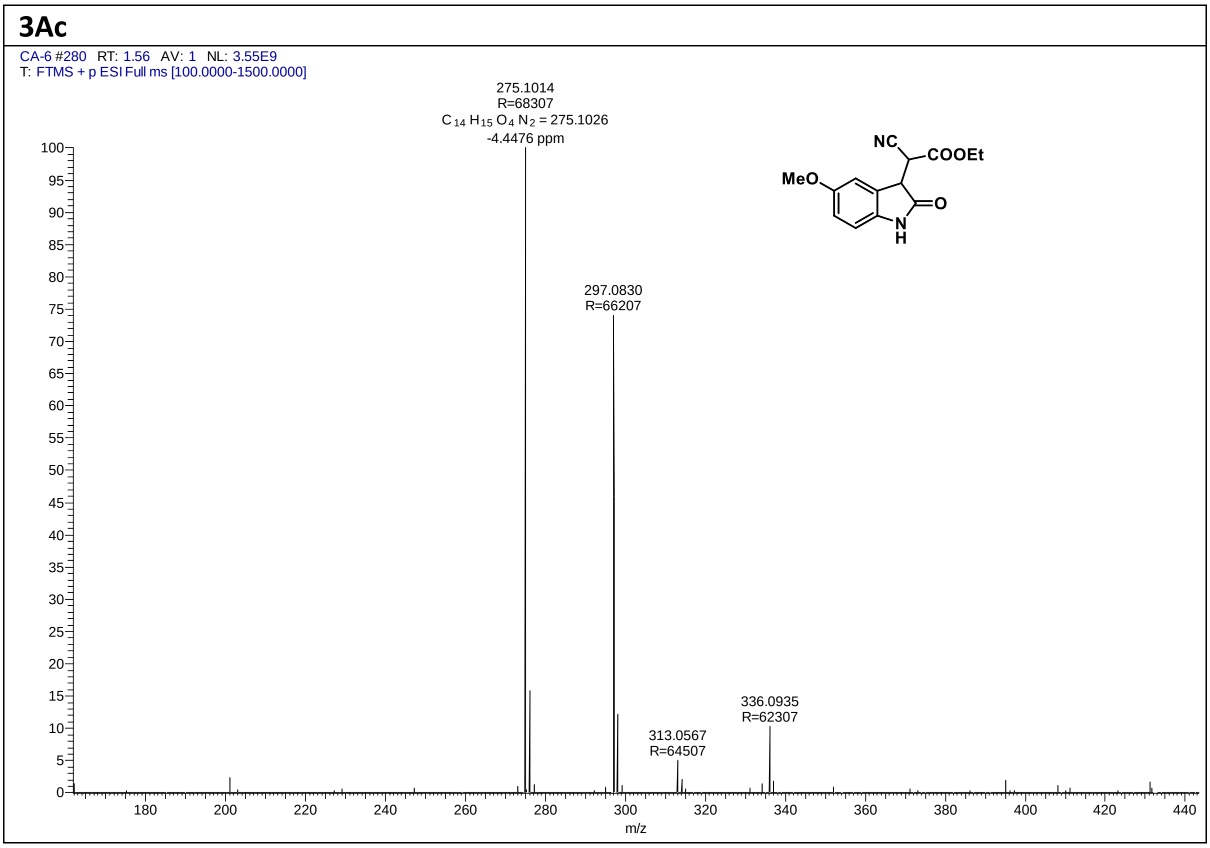
3Aa



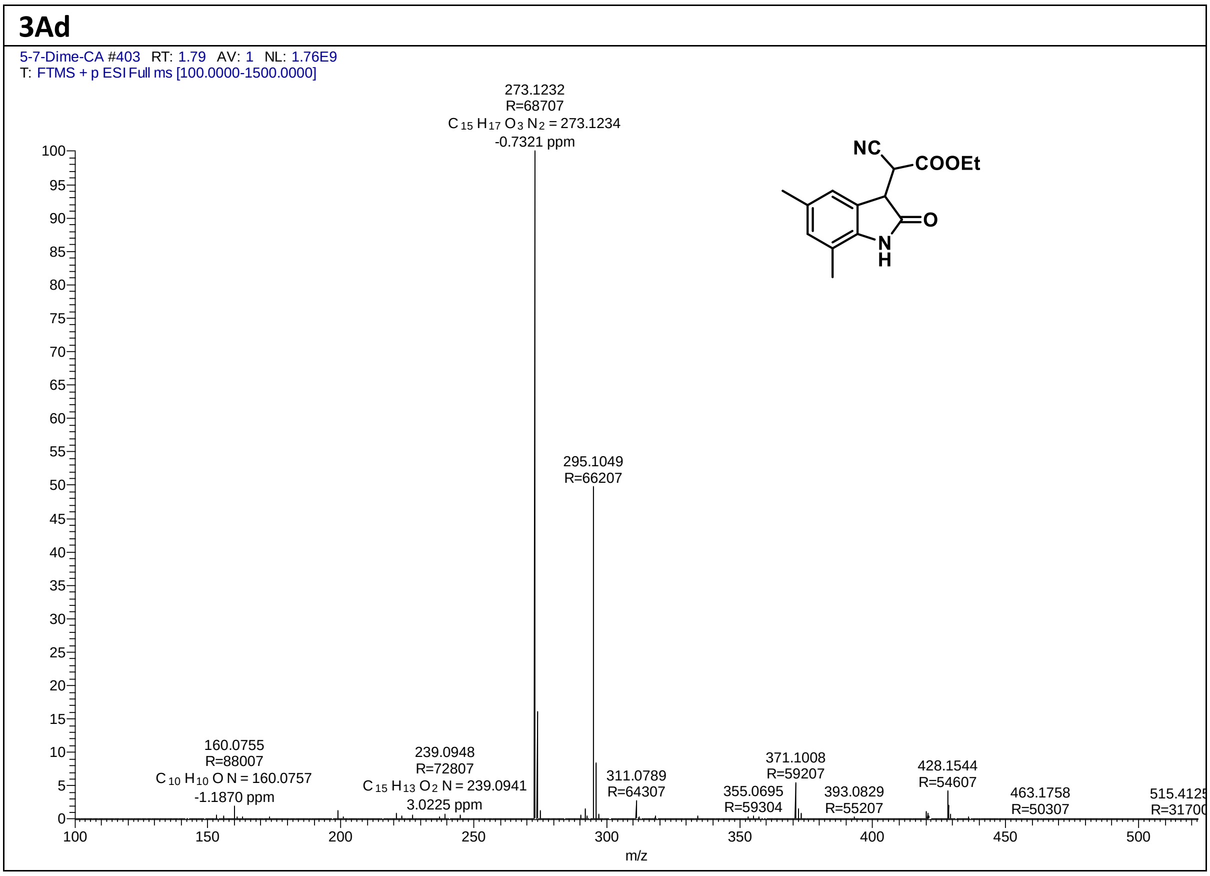
3Ab



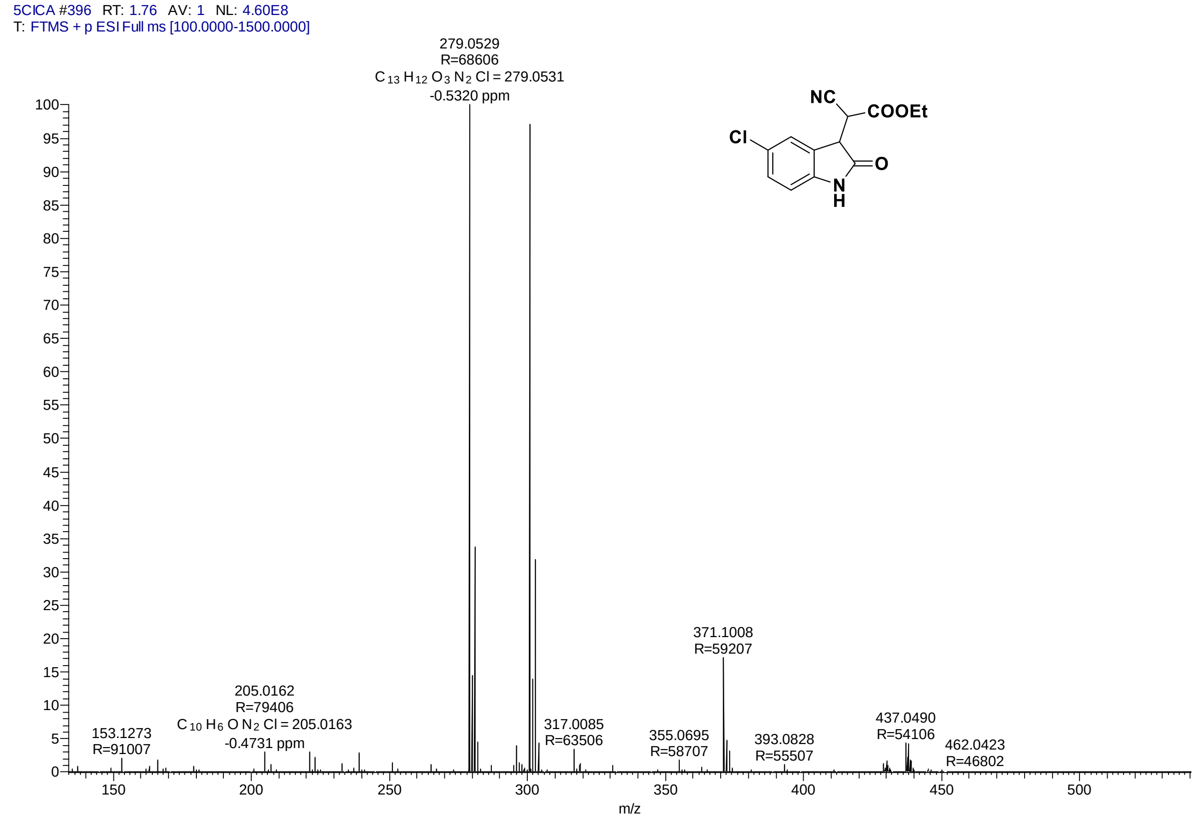
3Ac


CA-6 #280 RT: 1.56 AV: 1 NL: 3.55E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
275.1014
R=68307
$C_{14}H_{15}O_4N_2$ = 275.1026
-4.4476 ppm
297.0830
R=66207
313.0567
R=64507
336.0935
R=62307
NC
COOEt
MeO
O
N
H
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
180
200
220
240
260
280
300
320
340
360
380
400
420
440
m/z

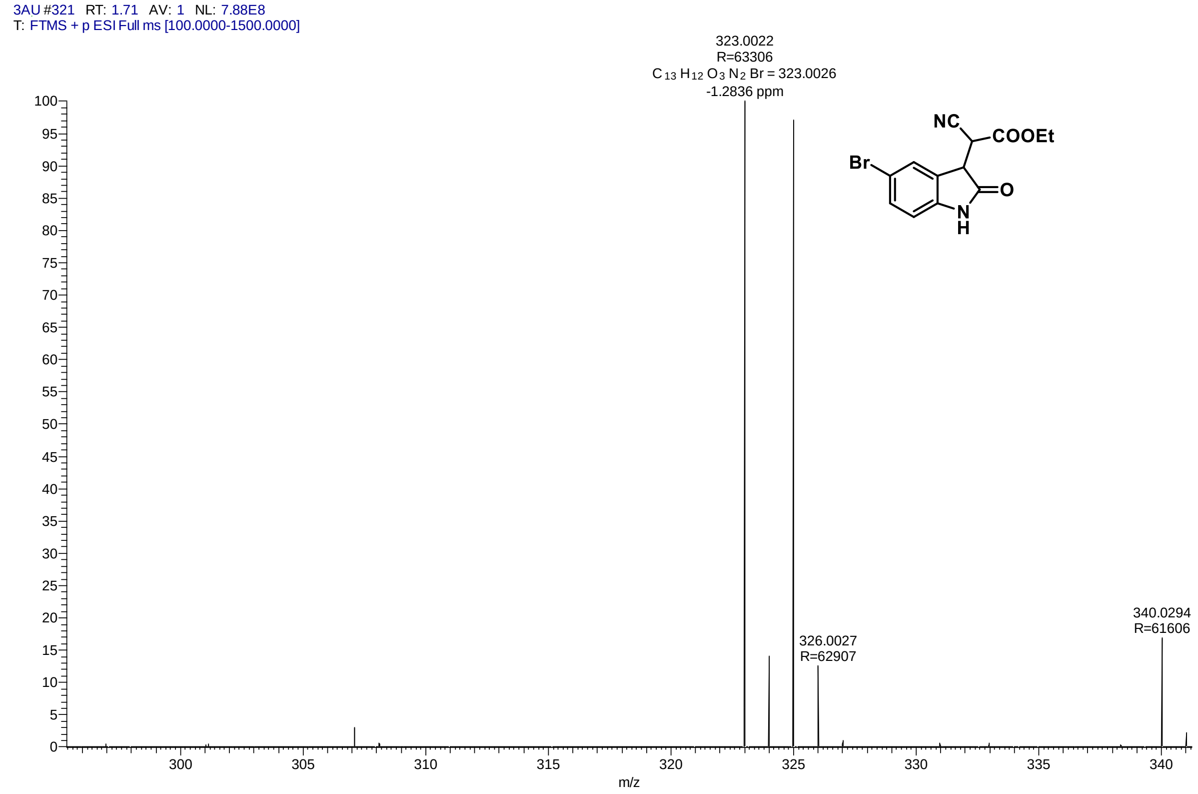
3Ad


5-7-Dime-CA #403 RT: 1.79 AV: 1 NL: 1.76E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
273.1232
R=68707
$C_{15}H_{17}O_3N_2$ = 273.1234
-0.7321 ppm
295.1049
R=66207
160.0755
R=88007
$C_{10}H_{10}ON$ = 160.0757
-1.1870 ppm
239.0948
R=72807
$C_{15}H_{13}O_2N$ = 239.0941
3.0225 ppm
311.0789
R=64307
355.0695
R=59304
371.1008
R=59207
393.0829
R=55207
428.1544
R=54607
463.1758
R=50307
515.4125
R=3170
NC
COOEt
O
N
H
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
100
150
200
250
300
350
400
450
500
m/z

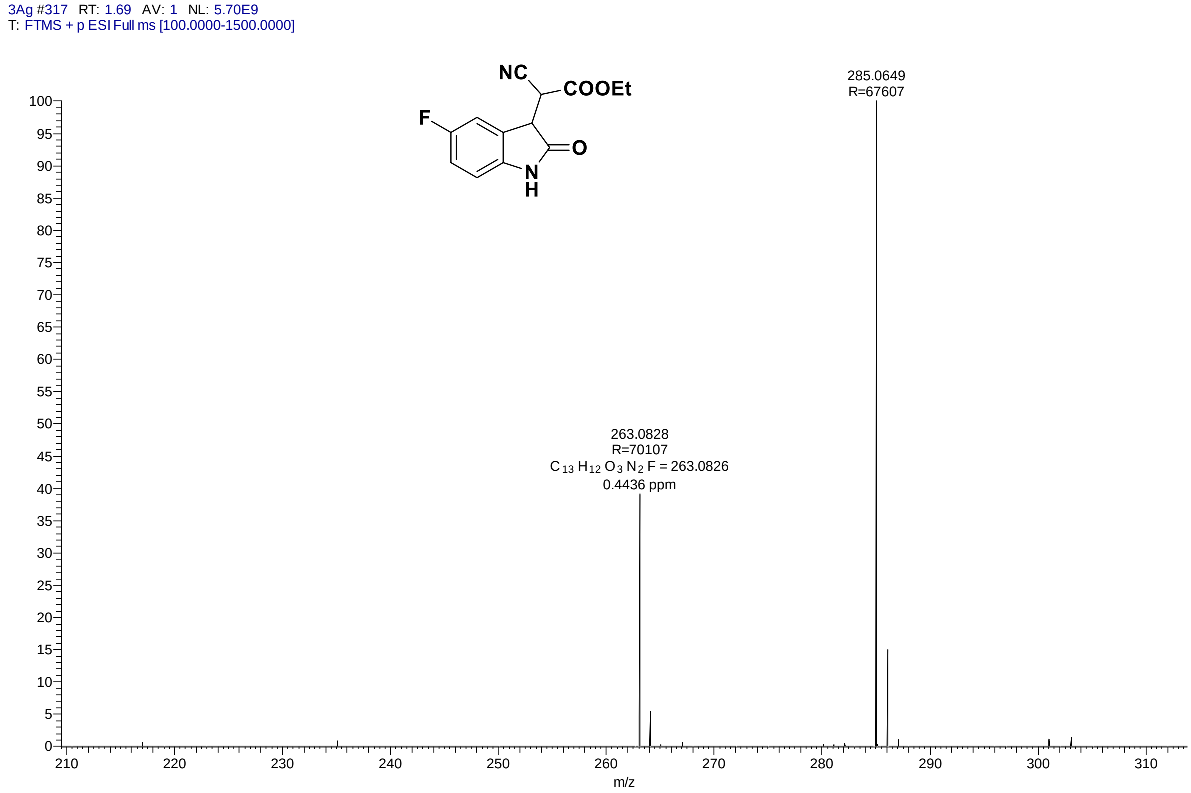
3Ae


5ClCA #396 RT: 1.76 AV: 1 NL: 4.60E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
279.0529
R=68606
$C_{13}H_{12}O_3N_2Cl$ = 279.0531
-0.5320 ppm
NC
COOEt
Cl
O
N
H
371.1008
R=59207
205.0162
R=79406
$C_{10}H_6ON_2Cl$ = 205.0163
-0.4731 ppm
153.1273
R=91007
317.0085
R=63506
355.0695
R=58707
393.0828
R=55507
437.0490
R=54106
462.0423
R=46802
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
150
200
250
300
350
400
450
500
m/z

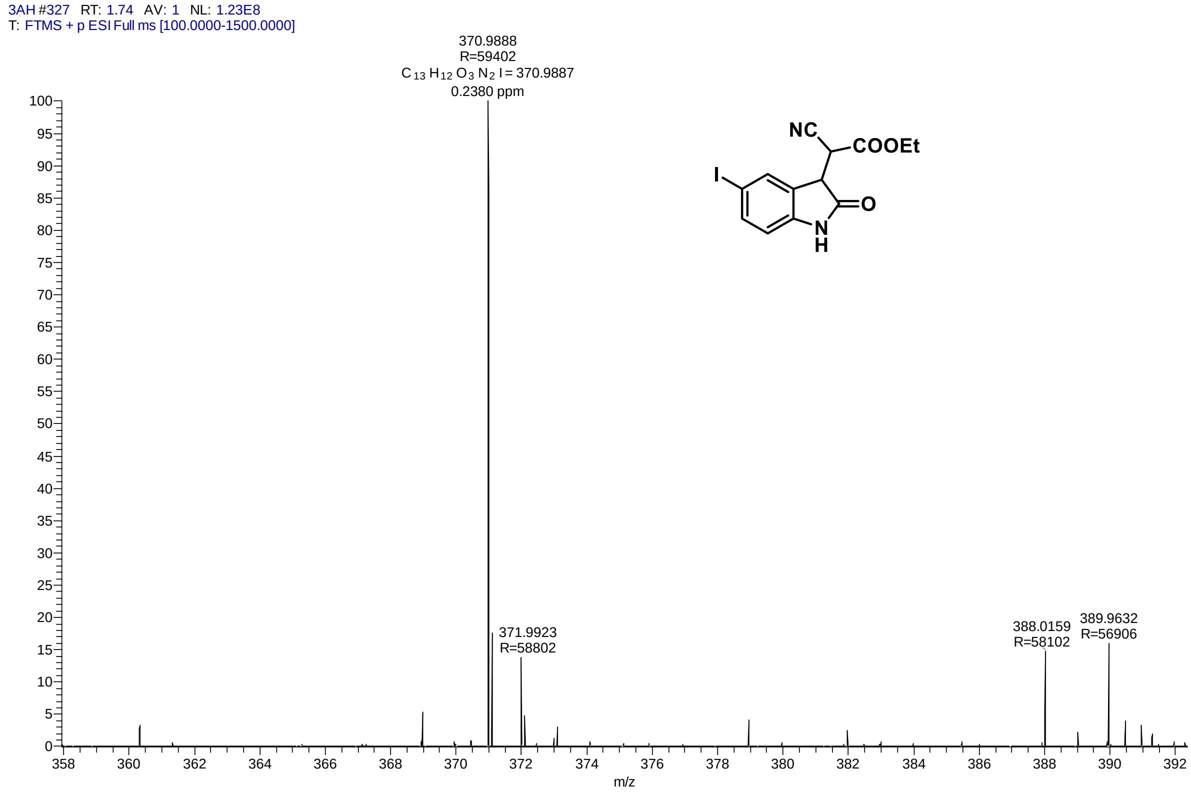
3Af


3AU #321 RT: 1.71 AV: 1 NL: 7.88E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
323.0022
R=63306
$C_{13}H_{12}O_3N_2Br$ = 323.0026
-1.2836 ppm
NC
COOEt
Br
O
N
H
326.0027
R=62907
340.0294
R=61606
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
300
305
310
315
320
325
330
335
340
m/z

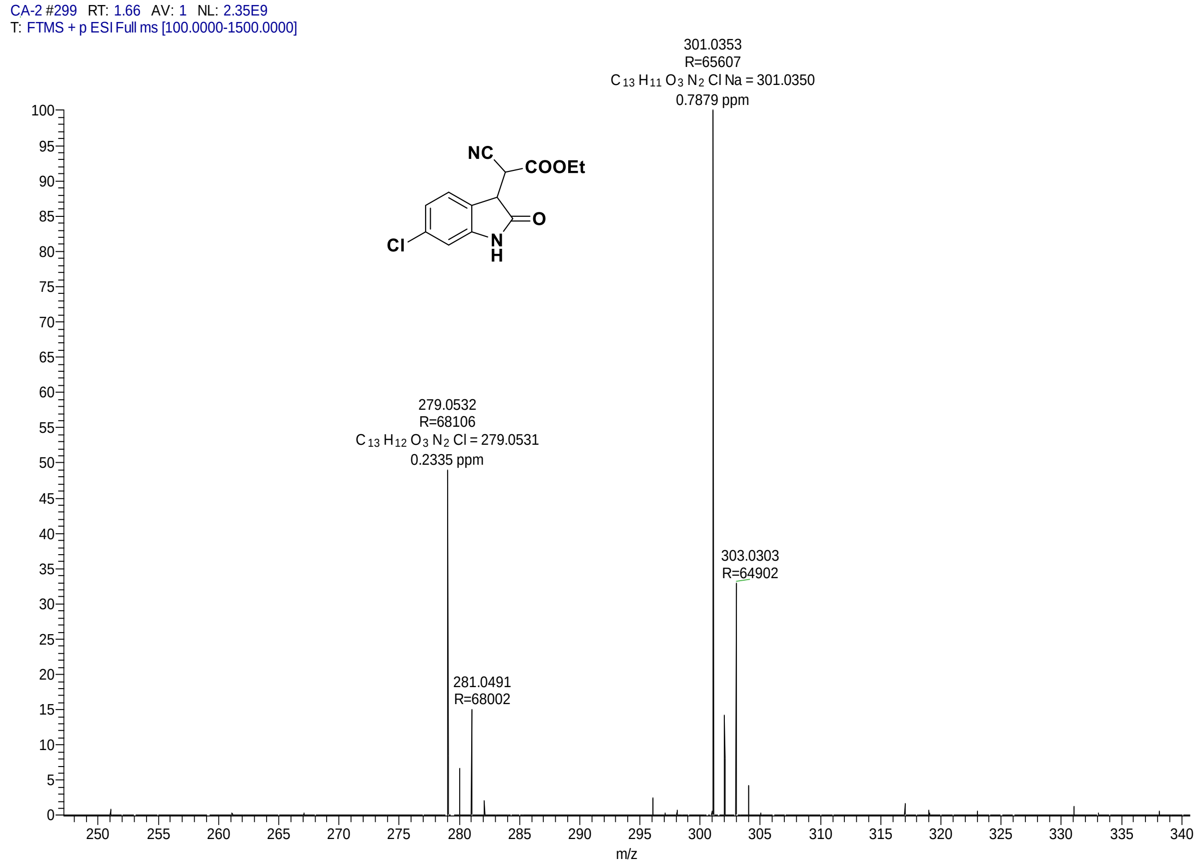
3Ag


3Ag #317 RT: 1.69 AV: 1 NL: 5.70E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
NC
COOEt
F
O
N
H
285.0649
R=67607
263.0828
R=70107
C 13 H 12 O 3 N 2 F = 263.0826
0.4436 ppm
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
210
220
230
240
250
260
270
280
290
300
310
m/z

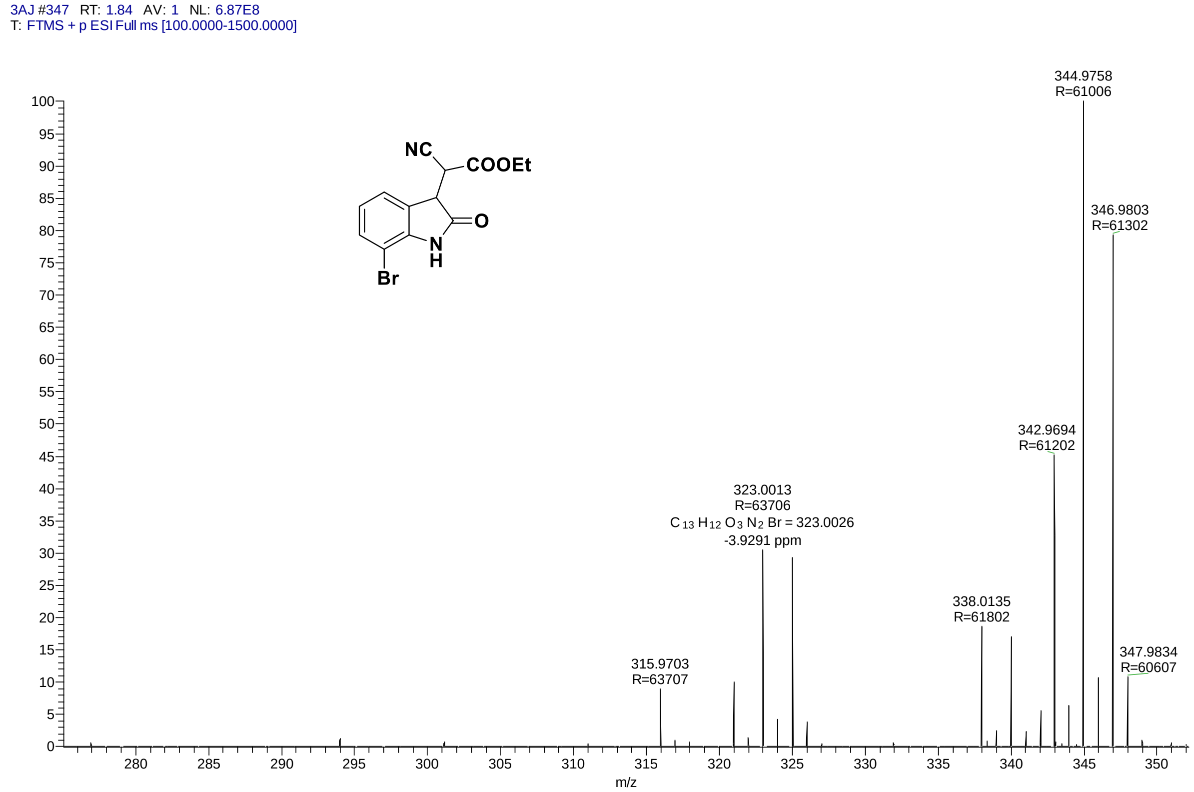
3Ah


3AH #327 RT: 1.74 AV: 1 NL: 1.23E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
370.9888
R=59402
C 13 H 12 O 3 N 2 I = 370.9887
0.2380 ppm
NC
COOEt
I
O
N
H
371.9923
R=58802
388.0159
R=58102
389.9632
R=56906
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
358
360
362
364
366
368
370
372
374
376
378
380
382
384
386
388
390
392
m/z

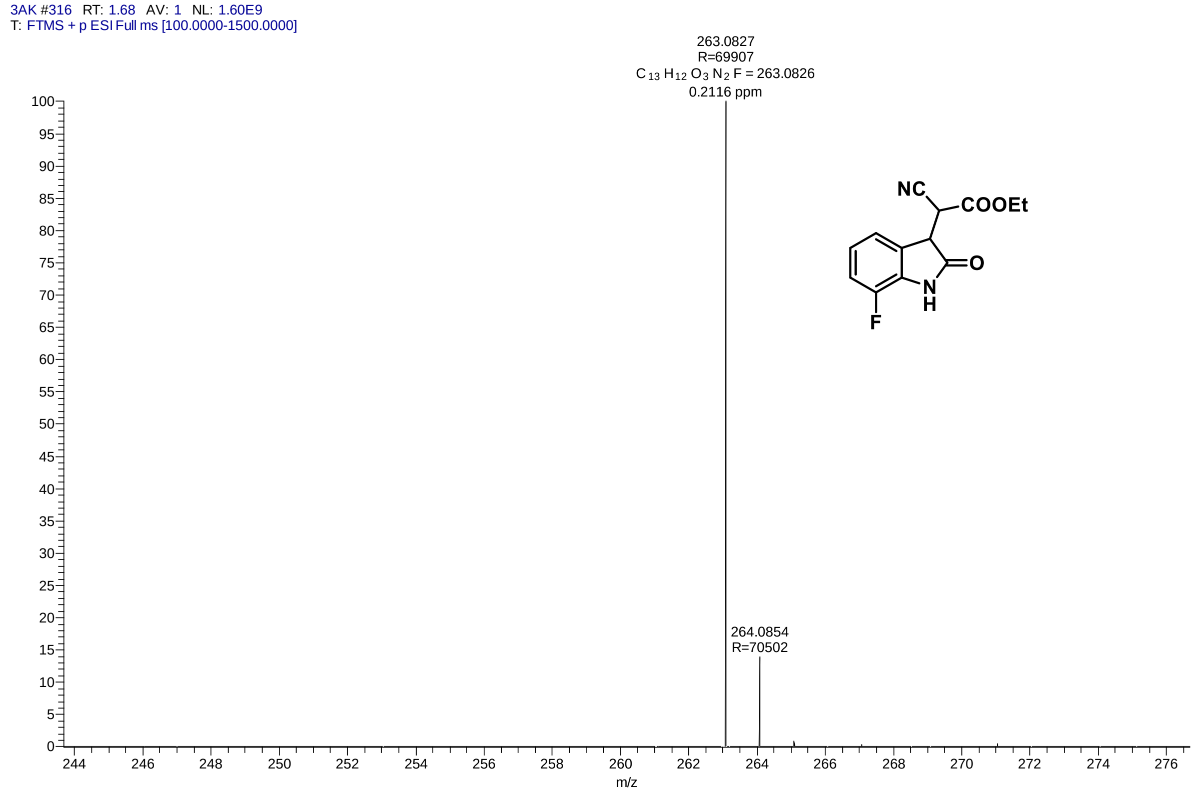
3Ai


CA-2 #299 RT: 1.66 AV: 1 NL: 2.35E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
301.0353
R=65607
C 13 H 11 O 3 N 2 Cl Na = 301.0350
0.7879 ppm
279.0532
R=68106
C 13 H 12 O 3 N 2 Cl = 279.0531
0.2335 ppm
303.0303
R=64902
281.0491
R=68002
NC
COOEt
O
Cl
N
H
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
m/z

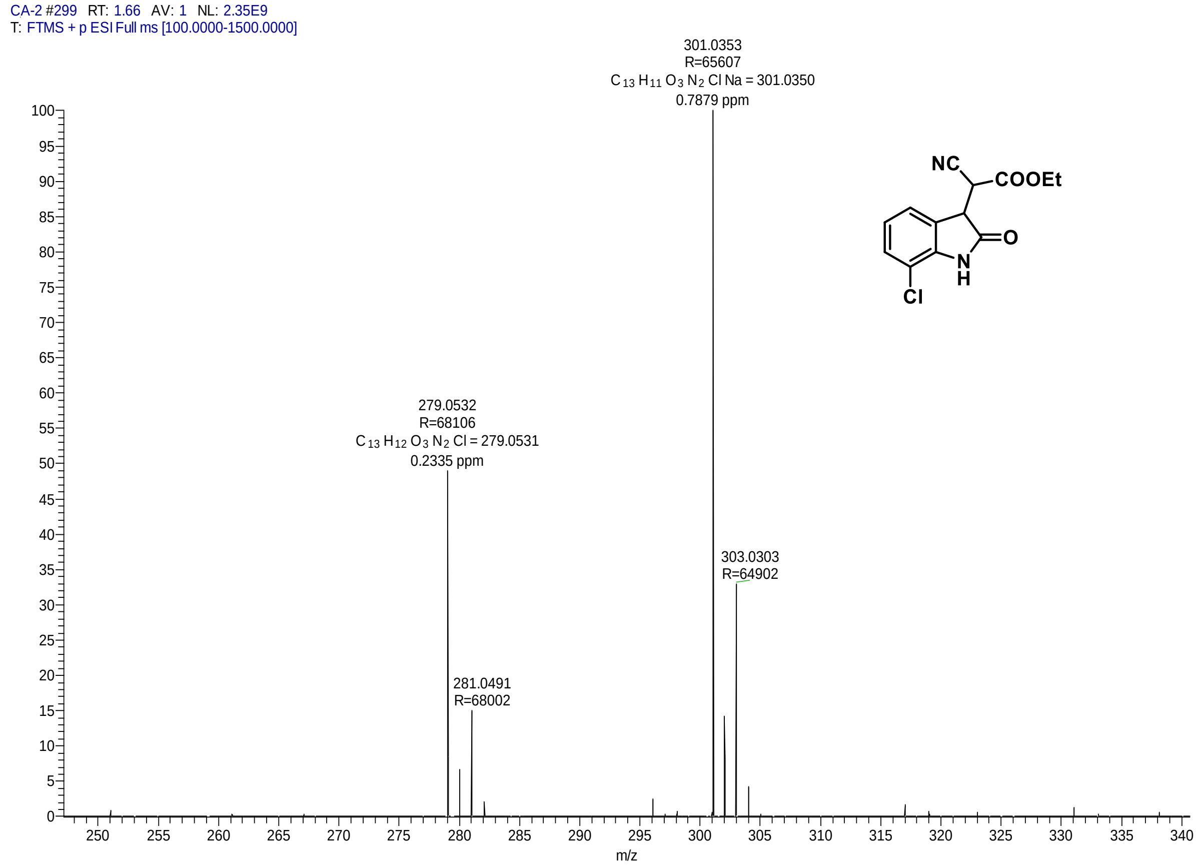
3Aj


3AJ #347 RT: 1.84 AV: 1 NL: 6.87E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
344.9758
R=61006
346.9803
R=61302
342.9694
R=61202
323.0013
R=63706
C 13 H 12 O 3 N 2 Br = 323.0026
-3.9291 ppm
338.0135
R=61802
315.9703
R=63707
347.9834
R=60607
NC
COOEt
O
N
H
Br
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
m/z

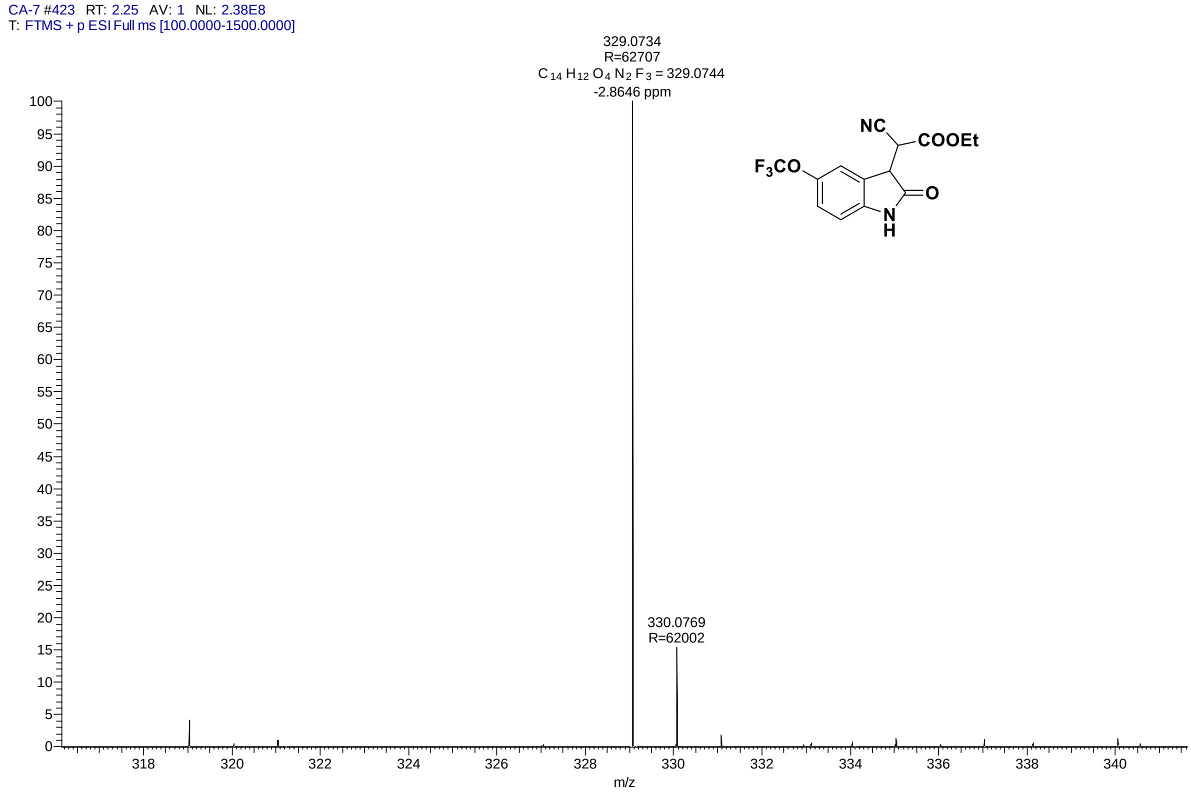
3Ak


3AK #316 RT: 1.68 AV: 1 NL: 1.60E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
263.0827
R=69907
C 13 H12 O3 N2 F = 263.0826
0.2116 ppm
264.0854
R=70502
NC
COOEt
O
N
H
F
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
244
246
248
250
252
254
256
258
260
262
264
266
268
270
272
274
276
m/z

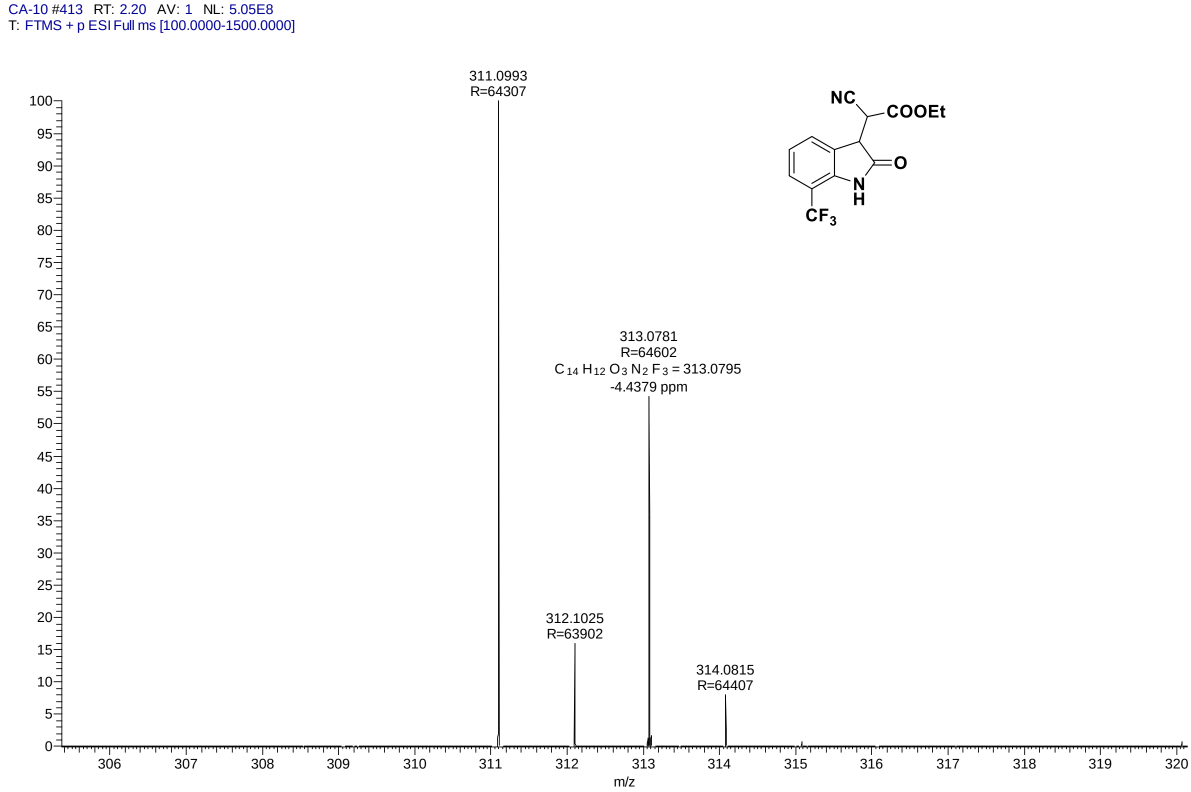
3Al


CA-2 #299 RT: 1.66 AV: 1 NL: 2.35E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
301.0353
R=65607
C 13 H11 O3 N2 Cl Na = 301.0350
0.7879 ppm
279.0532
R=68106
C 13 H12 O3 N2 Cl = 279.0531
0.2335 ppm
281.0491
R=68002
303.0303
R=64902
NC
COOEt
O
N
H
Cl
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
m/z

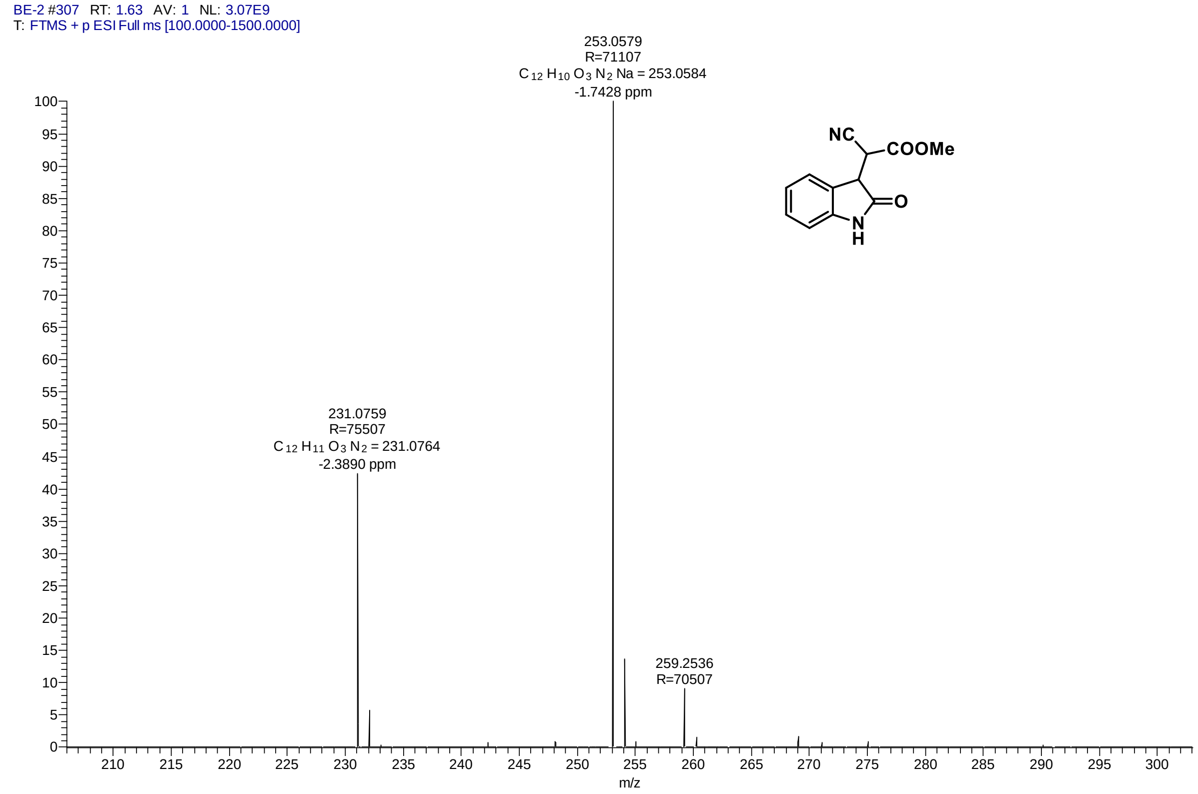
3Am


CA-7 #423 RT: 2.25 AV: 1 NL: 2.38E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
329.0734
R=62707
$C_{14}H_{12}O_4N_2F_3$ = 329.0744
-2.8646 ppm
330.0769
R=62002
NC
COOEt
F_3CO
O
N
H
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
318
320
322
324
326
328
330
332
334
336
338
340
m/z

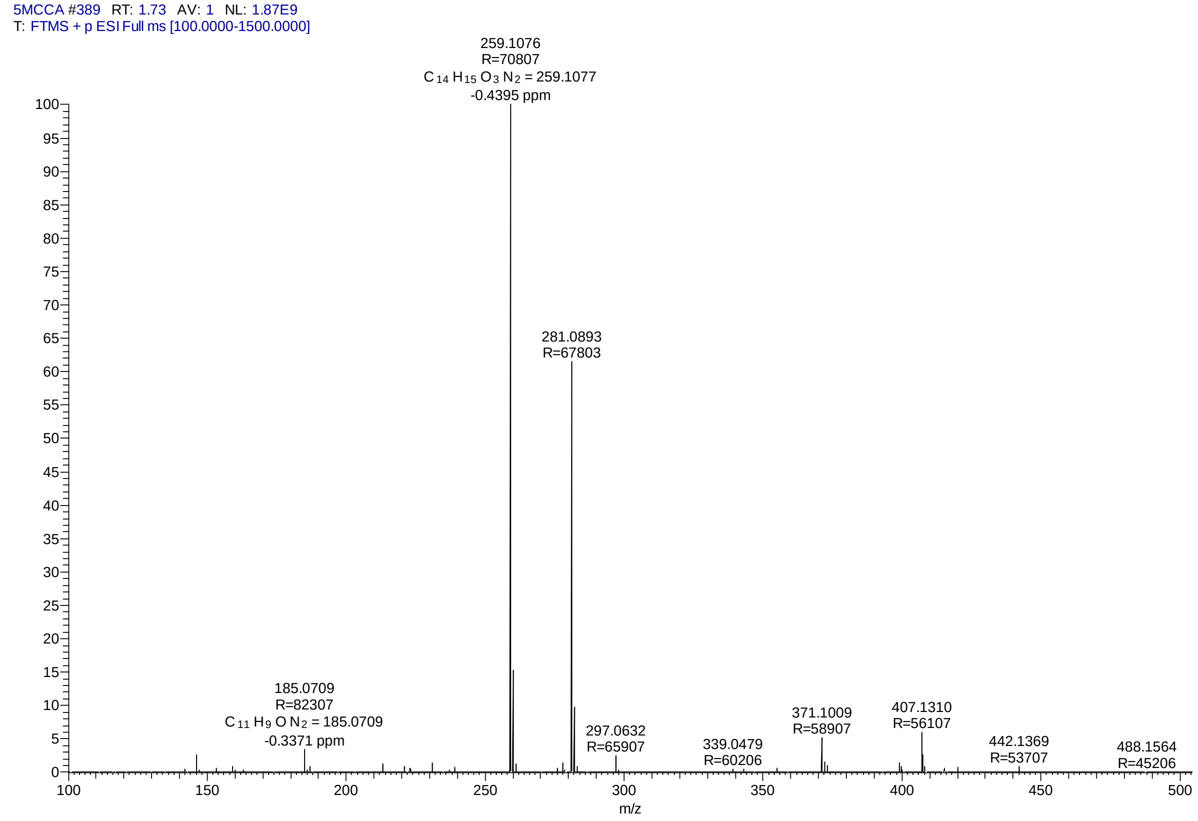
3An


CA-10 #413 RT: 2.20 AV: 1 NL: 5.05E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
311.0993
R=64307
313.0781
R=64602
$C_{14}H_{12}O_3N_2F_3$ = 313.0795
-4.4379 ppm
312.1025
R=63902
314.0815
R=64407
NC
COOEt
O
N
H
CF_3
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
m/z

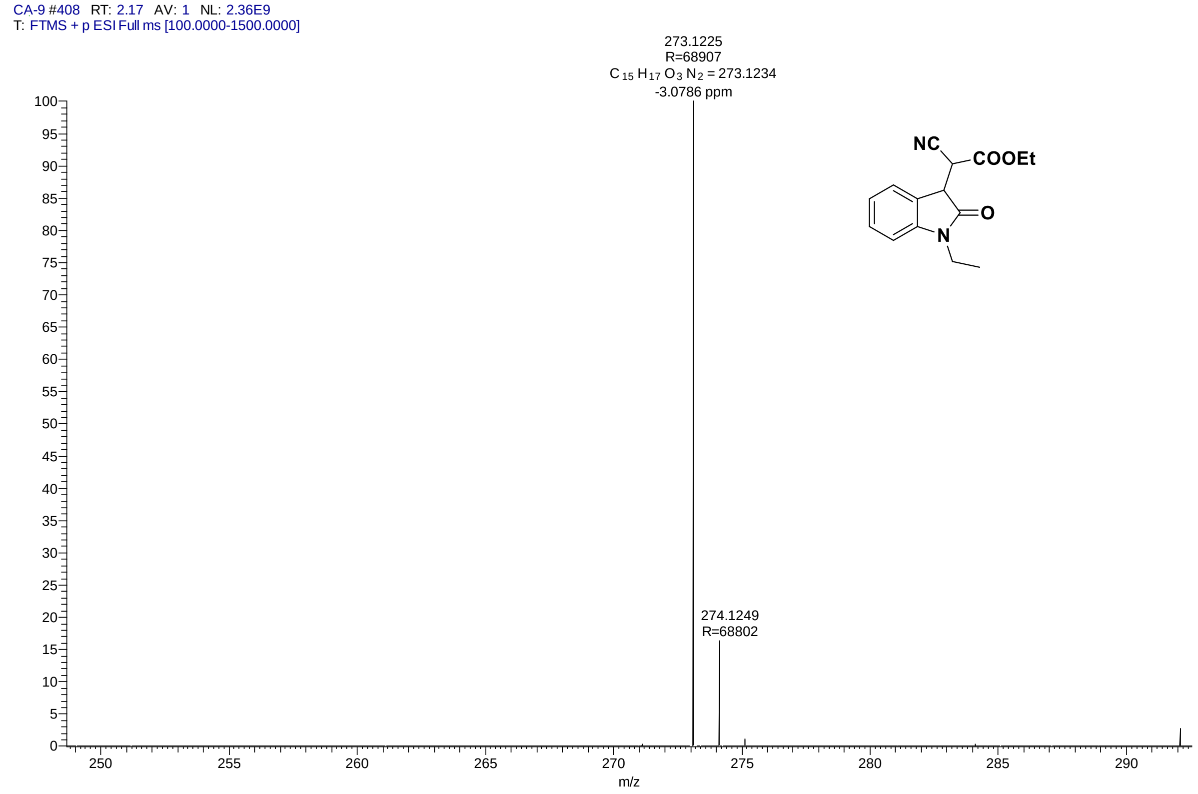
3Ao


BE-2 #307 RT: 1.63 AV: 1 NL: 3.07E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
253.0579
R=71107
C 12 H10 O3 N2 Na = 253.0584
-1.7428 ppm
231.0759
R=75507
C 12 H11 O3 N2 = 231.0764
-2.3890 ppm
259.2536
R=70507
NC
COOMe
O
N
H
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
m/z

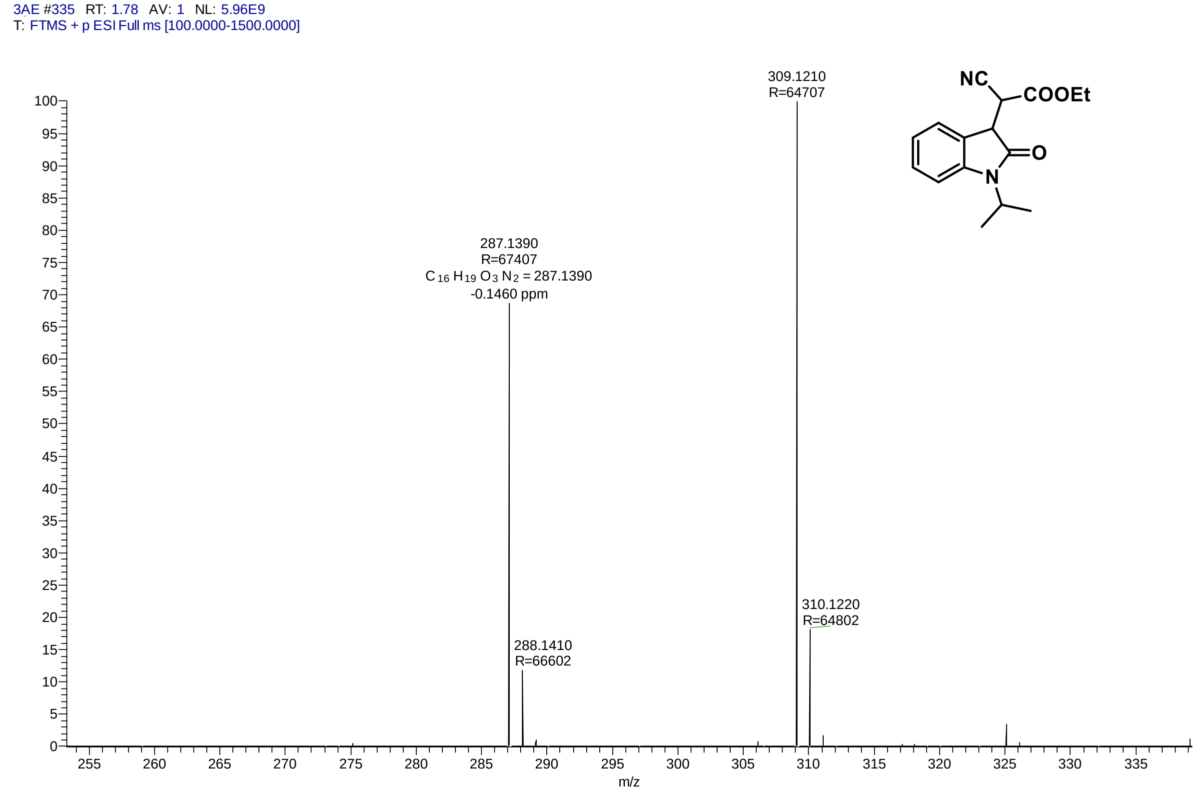
3Ap


5MCCA #389 RT: 1.73 AV: 1 NL: 1.87E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
259.1076
R=70807
C 14 H15 O3 N2 = 259.1077
-0.4395 ppm
281.0893
R=67803
185.0709
R=82307
C 11 H9 O N2 = 185.0709
-0.3371 ppm
297.0632
R=65907
339.0479
R=60206
371.1009
R=58907
407.1310
R=56107
442.1369
R=53707
488.1564
R=45206
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
100
150
200
250
300
350
400
450
500
m/z

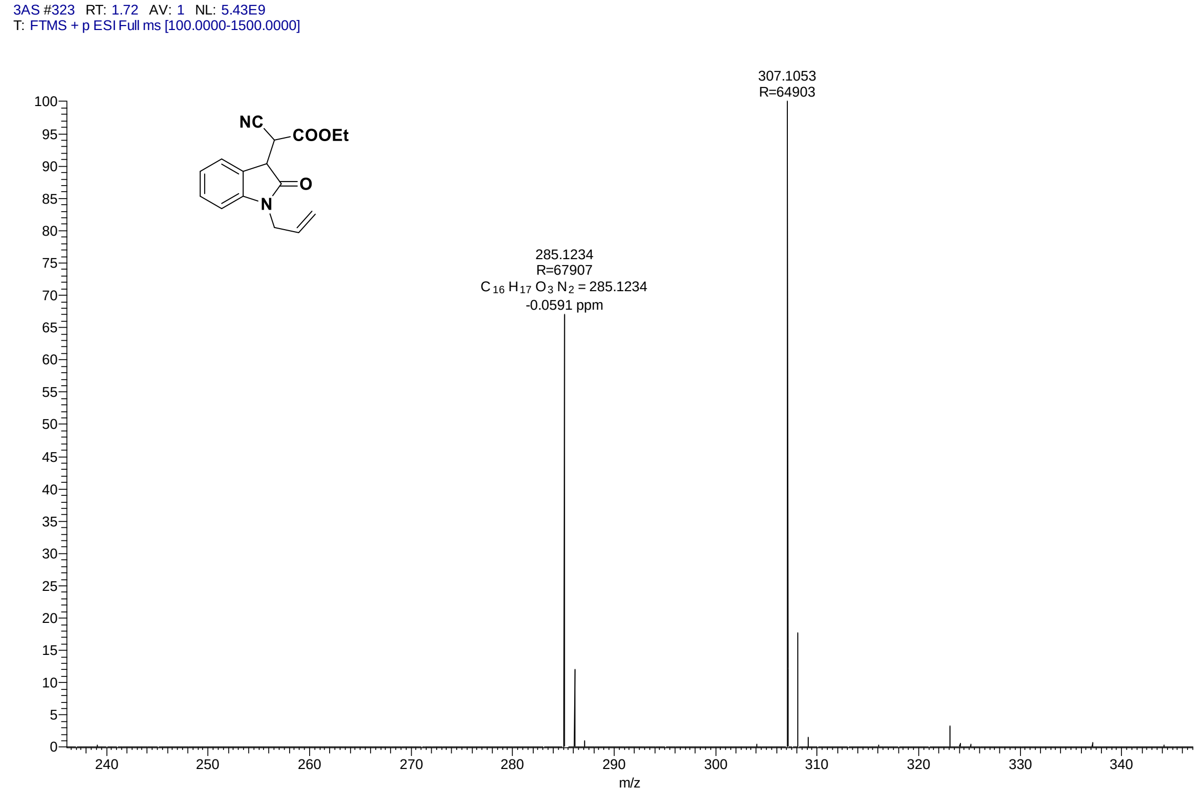
3Aq


CA-9 #408 RT: 2.17 AV: 1 NL: 2.36E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
273.1225
R=68907
C 15 H17 O3 N2 = 273.1234
-3.0786 ppm
274.1249
R=68802
NC
COOEt
O
N
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
250
255
260
265
270
275
280
285
290
m/z

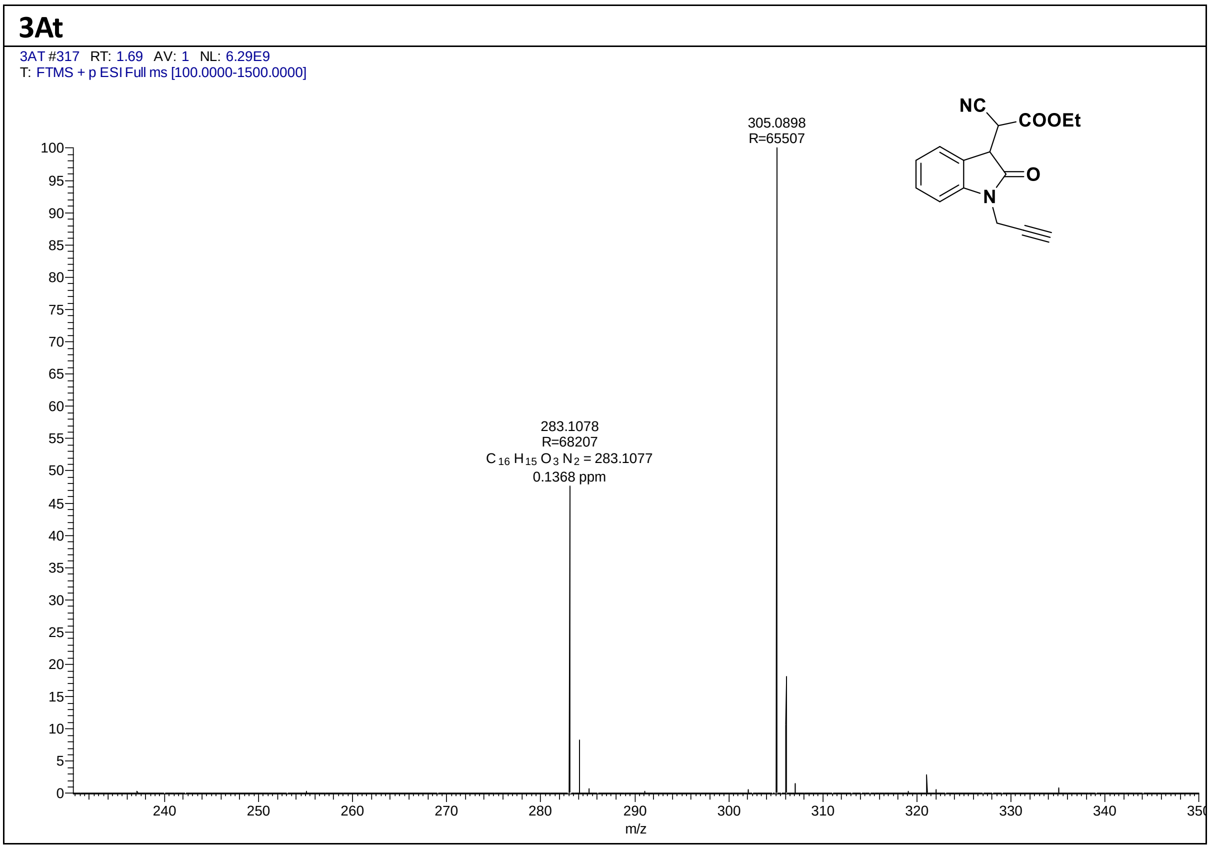
3Ar


3AE #335 RT: 1.78 AV: 1 NL: 5.96E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
309.1210
R=64707
287.1390
R=67407
C 16 H19 O3 N2 = 287.1390
-0.1460 ppm
288.1410
R=66602
310.1220
R=64802
NC
COOEt
O
N
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
m/z

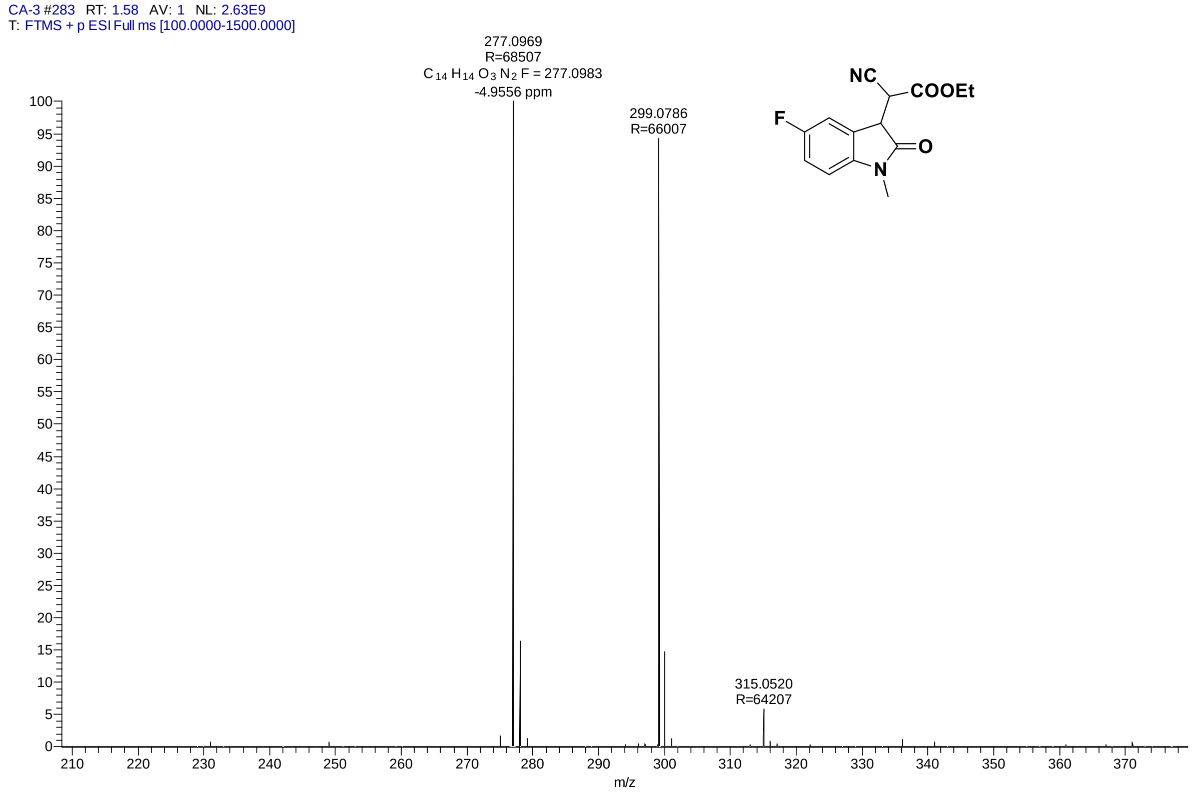
3As


3AS #323 RT: 1.72 AV: 1 NL: 5.43E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
307.1053
R=64903
285.1234
R=67907
C 16 H 17 O 3 N 2 = 285.1234
-0.0591 ppm
NC
COOEt
O
N
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
240
250
260
270
280
290
300
310
320
330
340
m/z

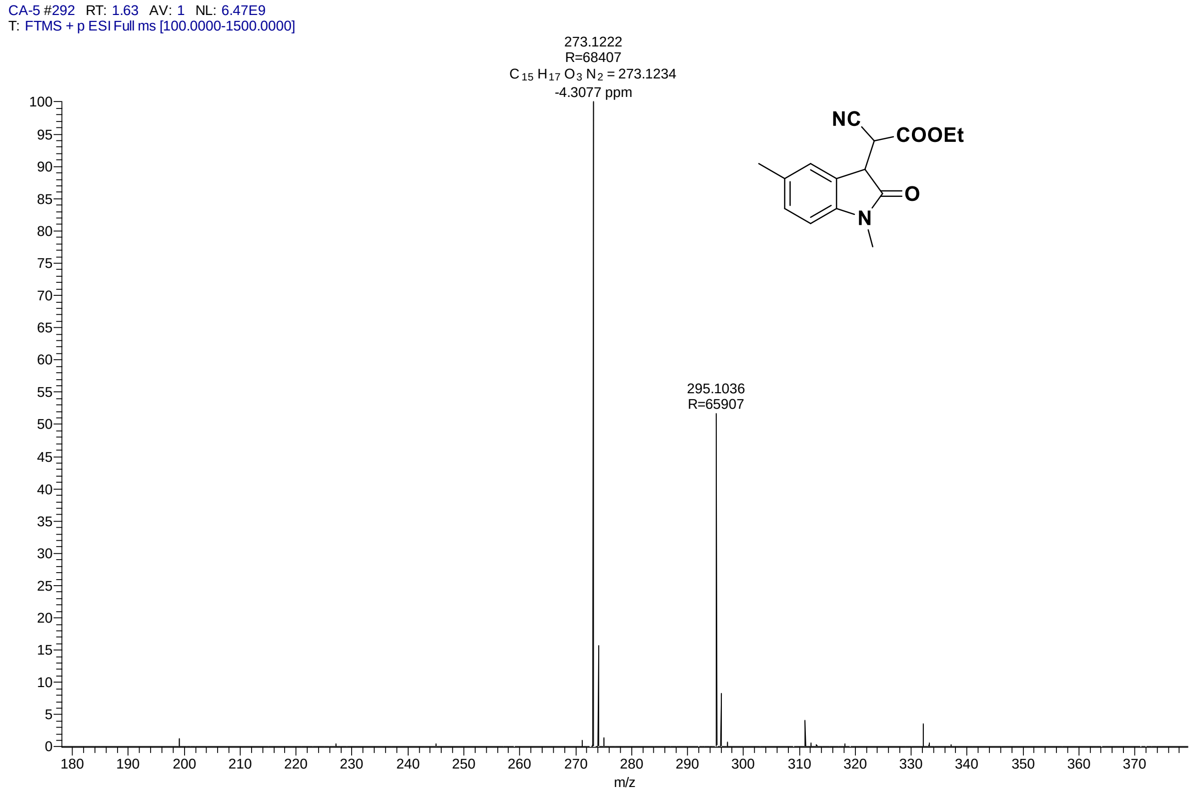
3At


3AT #317 RT: 1.69 AV: 1 NL: 6.29E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
305.0898
R=65507
283.1078
R=68207
C 16 H 15 O 3 N 2 = 283.1077
0.1368 ppm
NC
COOEt
O
N
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
240
250
260
270
280
290
300
310
320
330
340
350
m/z

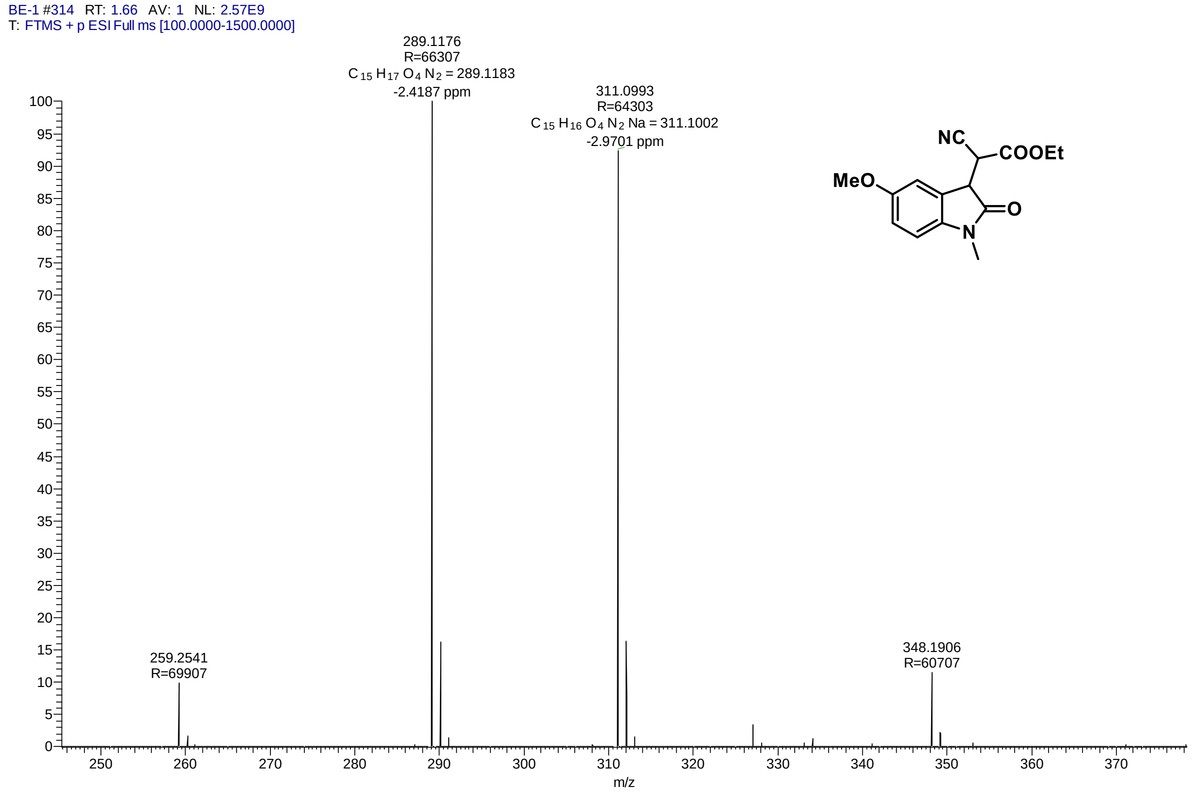
3Av


CA-3 #283 RT: 1.58 AV: 1 NL: 2.63E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
277.0969
R=68507
C 14 H 14 O 3 N 2 F = 277.0983
-4.9556 ppm
299.0786
R=66007
315.0520
R=64207
NC
COOEt
F
O
N
m/z
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
370

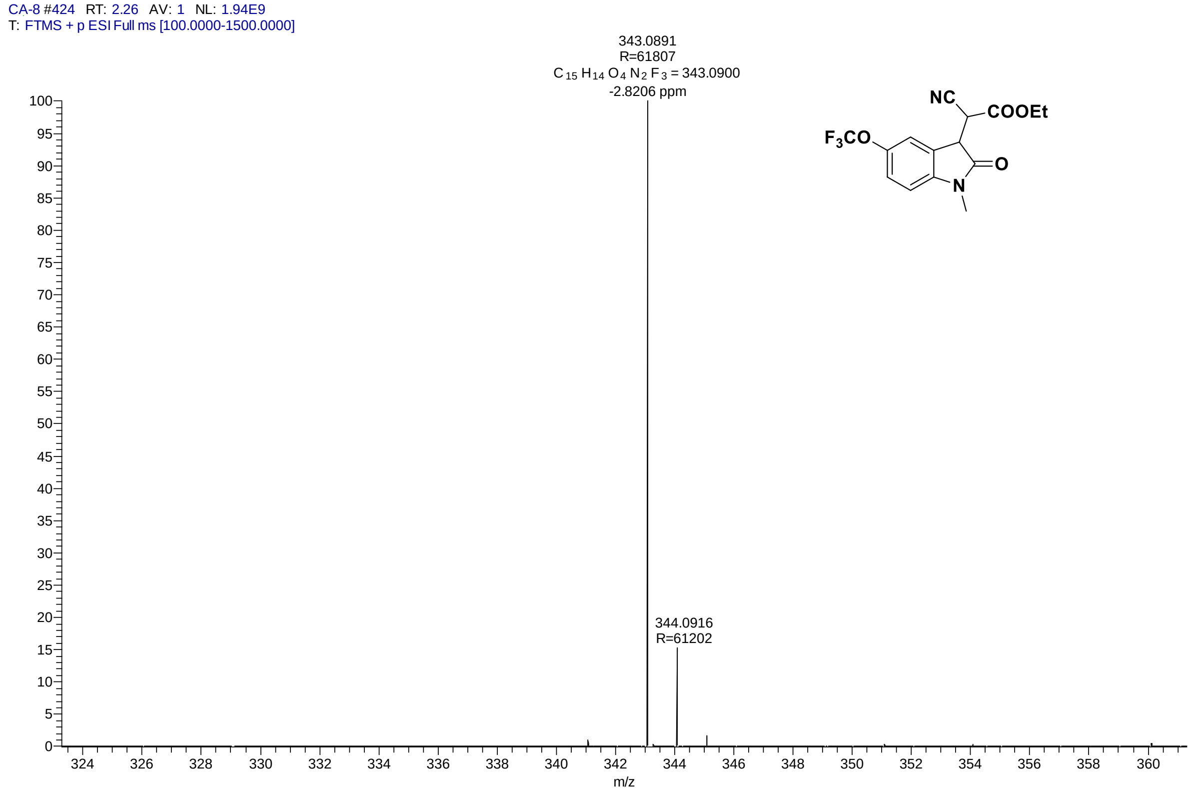
3Aw


CA-5 #292 RT: 1.63 AV: 1 NL: 6.47E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
273.1222
R=68407
C 15 H 17 O 3 N 2 = 273.1234
-4.3077 ppm
295.1036
R=65907
NC
COOEt
O
N
m/z
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
370

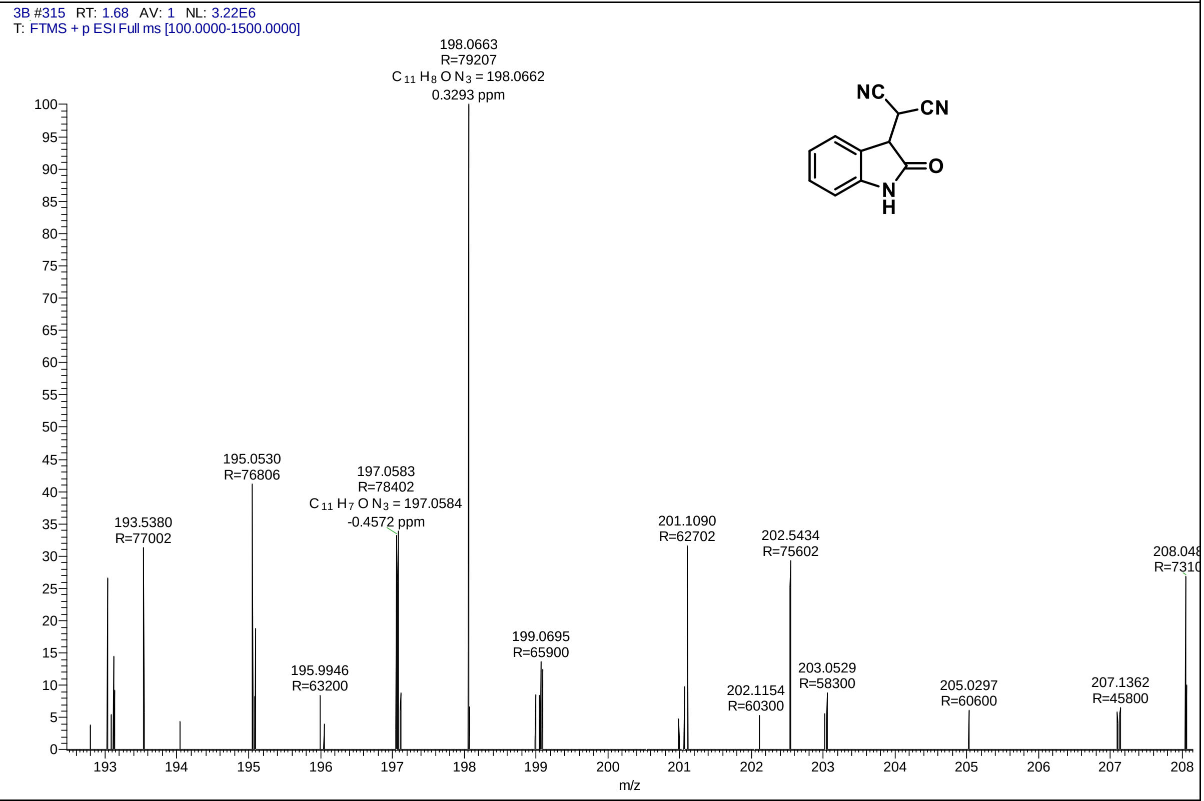
3Ax


BE-1 #314 RT: 1.66 AV: 1 NL: 2.57E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
289.1176
R=66307
C 15 H 17 O 4 N 2 = 289.1183
-2.4187 ppm
311.0993
R=64303
C 15 H 16 O 4 N 2 Na = 311.1002
-2.9701 ppm
259.2541
R=69907
348.1906
R=60707
NC
COOEt
MeO
O
N
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
250
260
270
280
290
300
310
320
330
340
350
360
370
m/z

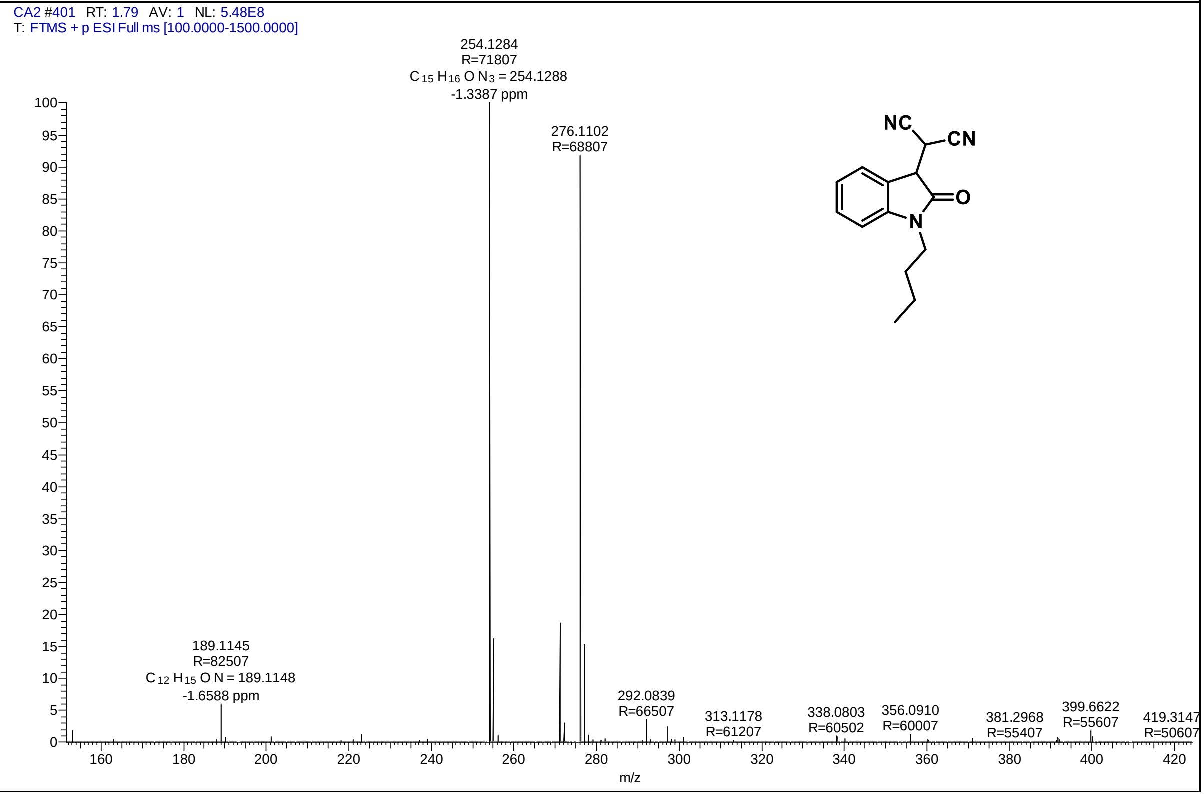
3Ay


CA-8 #424 RT: 2.26 AV: 1 NL: 1.94E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
343.0891
R=61807
C 15 H 14 O 4 N 2 F 3 = 343.0900
-2.8206 ppm
344.0916
R=61202
NC
COOEt
F3CO
O
N
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
324
326
328
330
332
334
336
338
340
342
344
346
348
350
352
354
356
358
360
m/z

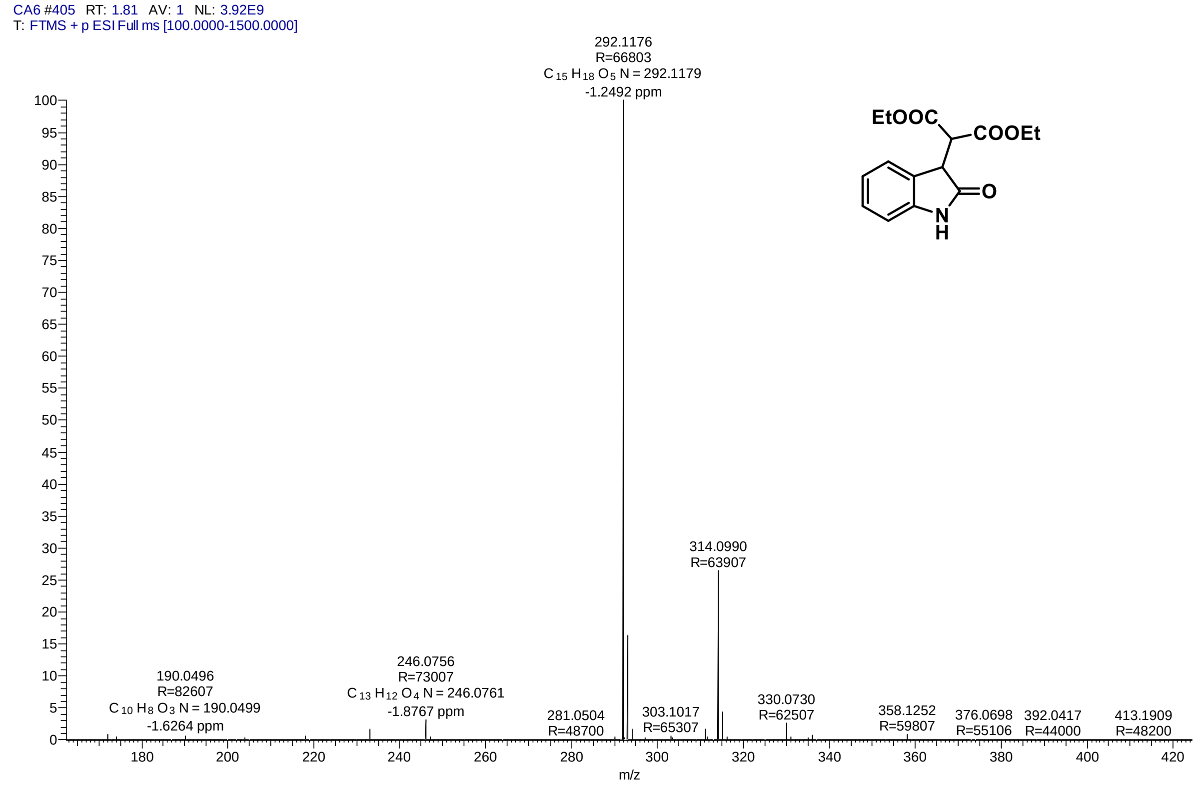
3B


3B #315 RT: 1.68 AV: 1 NL: 3.22E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]
198.0663
R=79207
$C_{11}H_8ON_3$ = 198.0662
0.3293 ppm
195.0530
R=76806
197.0583
R=78402
$C_{11}H_7ON_3$ = 197.0584
-0.4572 ppm
193.5380
R=77002
201.1090
R=62702
202.5434
R=75602
208.048
R=7310
199.0695
R=65900
195.9946
R=63200
203.0529
R=58300
202.1154
R=60300
205.0297
R=60600
207.1362
R=45800
m/z
NC
CN
O
N
H

3Bb


CA2 #401 RT: 1.79 AV: 1 NL: 5.48E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]
254.1284
R=71807
$C_{15}H_{16}ON_3$ = 254.1288
-1.3387 ppm
276.1102
R=68807
189.1145
R=82507
$C_{12}H_{15}ON$ = 189.1148
-1.6588 ppm
292.0839
R=66507
313.1178
R=61207
338.0803
R=60502
356.0910
R=60007
381.2968
R=55407
399.6622
R=55607
419.3147
R=50607
m/z
NC
CN
O
N

3C


CA6 #405 RT: 1.81 AV: 1 NL: 3.92E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]
292.1176
R=66803
C 15 H 18 O 5 N = 292.1179
-1.2492 ppm
EtOOC
COOEt
O
N
H
314.0990
R=63907
190.0496
R=82607
C 10 H 8 O 3 N = 190.0499
-1.6264 ppm
246.0756
R=73007
C 13 H 12 O 4 N = 246.0761
-1.8767 ppm
281.0504
R=48700
303.1017
R=65307
330.0730
R=62507
358.1252
R=59807
376.0698
R=55106
392.0417
R=44000
413.1909
R=48200
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
180
200
220
240
260
280
300
320
340
360
380
400
420
m/z