Electronic Supporting Information for

Palladium(0)/Benzoic Acid Catalysis Merges Sequences with D_2O-promoted Labelling of C−H bonds

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Table of Contents

General Remarks

All chemicals those syntheses are not reported hereafter were purchased from commercial sources and used as received. Solvents were dried and stored over molecular sieves previously activated in an oven (450 °C overnight). Catalytic reactions required the use of dry solvents. Chromatographic purifications were performed under gradient using a Combiflash® system and prepacked disposable silica cartridges. ^{1}H and ^{13}C-NMR spectra were recorded at 300 K on a Bruker 400 MHz or Bruker 300 MHz spectrometer using solvent residual signals as internal standards (7.26 ppm for ^{1}H NMR and 77.00 ppm for ^{13}C NMR using $CDCl_3$, 2.05 ppm for ^{1} H-NMR and 29.84 ppm for ^{13}C-NMR using acetone-d_6). ^{2}H-NMR spectra were recorded at 300 K on a Bruker 400 MHz spectrometer using the corresponding protic solvents. ^{19}F NMR spectra were recorded in $CDCl_3$ at 298 K on a Bruker 400 spectrometer fitted with a BBFO probe head at 263 MHz. The terms m, s, d, t, q and quint represent multiplet, singlet, doublet, triplet, quadruplet and quintuplet respectively, and the term br means a broad signal. MS analyses were collected on an Infusion Water Acquity Ultra Performance LC HO6UPS-823M instrument equipped with SQ detector (ESI source).

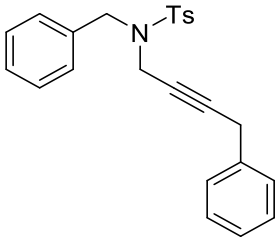
The percentage of deuterium incorporation was determined by integrating a CH_2 [(multiplicity, 2H)$_{ref}$] assumed to have a value of 2.0 or a CH peak [(multiplicity, 1H)$_{ref}$] assumed to have a value of 1.0, with respect to the residual proton signals of the partly deuterated carbons. The reference peak (underline) is given for each spectrum. The percentage of deuterium incorporation was further validated by integrating ^{2}H NMR signals to the calibrated deuterium signals, whose value has been previously determined by ^{1}H NMR. This approach has been extensively used in literature.[1]

Materials

Targeted Sulfonamides were synthesized in variable yields (70-88%) from commercial benzylamines following typical protocols. Benzylamine/TsCl/TEA (1.0/1.2/2 equiv), CH_2Cl_2 (0.2 M), r.t., 4 hours.[2] Propargylic alcohols were purchased from commercial available sources or synthesized according to known procedures.[3] Propargylamides **1** and propargyltryptamines **3** that are not described hereafter were synthesized according to the method recently reported by our group.[4,5] Crystalline $Pd(PPh_3)_4$ has been synthesized from polymeric $PdCl_2$ following the conventional route.[6]

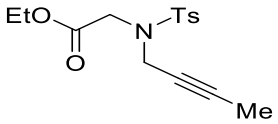
Synthesis of Novel Reagents

***N*-Benzyl-4-methyl-*N*-(4-phenylbut-2-yn-1-yl)benzenesulfonamide (1g)**



In an oven-dried two-necked round-bottomed flask, 4-phenylbut-2-yn-1-ol (262 mg, 1.8 mmol) was added to a 1.0 M solution in THF of *N*-benzyl-4-methylbenzenesulfonamide (390 mg, 1.5 mmol) and PPh_3 (520 mg, 2.0 mmol) under N_2 atmosphere. Subsequently, the mixture was placed at 0 °C and DIAD (400 µl, 2.0 mmol) was carefully added dropwise over 10 min. The mixture was stirred until complete consumption of the starting material (16 hs). Subsequently, a solution of HCl (0.1 M, 10 ml) was added and the resulting mixture was extracted with EtOAc (3 x 15 ml). The organic layers were separated and dried over Na_2SO_4. The combined fractions were concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes/EtOAc 80:20) yielding **1g** (430 mg, 74%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.82 (d, *J* = 8.3 Hz, 2H), 7.39 – 7.26 (m, 8H), 7.24 (d, *J* = 8.1 Hz, 2H), 7.16 – 7.10 (m, 2H), 4.37 (s, 2H), 4.03 (t, *J* = 2.3 Hz, 2H), 3.37 (d, *J* = 2.4 Hz, 2H), 2.38 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 143.4 (C_q), 136.2 (C_q), 136.1 (C_q), 135.2 (C_q), 129.4 (CH), 128.8 (CH), 128.7 (CH), 128.5 (CH), 128.0 (CH), 127.9 (CH), 127.7 (CH), 126.7 (CH), 84.0 (C_q), 74.6 (C_q), 49.9 (CH_2), 36.2 (CH_2), 24.9 (CH_2), 21.5 (CH_3).
(ESI)-MS calcd for $C_{24}H_{23}KNO_2S$ $[M+K]^+$ 428.11 found 428.19.

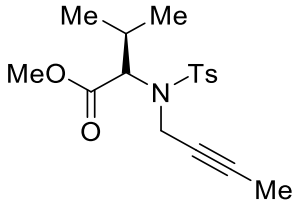
Ethyl *N*-(but-2-yn-1-yl)-*N*-tosylglycinate (1l)



In a Schlenk-type flask, 1-bromo-2-butyne (317 mg, 2.4 mmol) was added dropwise to a solution of ethyl tosylglycinate (450 mg, 2.0 mmol) and K_2CO_3 (331 mg, 2.4 mmol) in acetone (10 ml). Subsequently, the mixture was placed in a oil bath pre-heated at 60 °C and stirred overnight. After completion, the reaction mixture was cooled down to room temperature and sat. NH_4Cl (15 ml) was added. The mixture was extracted with EtOAc (3 x 15 ml), the organic layers were separated and dried over Na_2SO_4. The combined fractions were concentrated under reduced pressure and the crude was purified by chromatography on silica gel (*n*-hexanes/EtOAc 80:20) yielding **1l** (525 mg, 68%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.73 (d, *J* = 8.1 Hz, 2H), 7.30 (d, *J* = 8.1 Hz, 2H), 4.21 – 4.11 (m, 4H), 4.09 (s, 2H), 2.43 (s, 3H), 1.64 (t, *J* = 2.4 Hz,

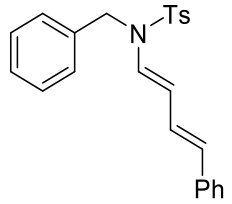
3H), 1.24 (t, J = 7.2 Hz, 3H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 168.6 (C_q), 143.6 (C_q), 136.2 (C_q), 129.4 (CH), 127.6 (CH), 82.3 (C_q), 71.5 (C_q), 61.3 (CH_2), 46.9 (CH_2), 37.9 (CH_2), 21.5 (CH_3), 14.0 (CH_3), 3.3 (CH_3). **(ESI)-MS** calcd for $C_{15}H_{19}KNO_4S$ $[M+K]^+$ 348.07 found 348.09.

Methyl *N*-(but-2-yn-1-yl)-*N*-tosyl-L-valinate (1m)



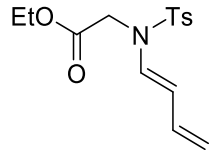
In a Schlenk-type flask, 1-bromo-2-butyne (414 mg, 3.0 mmol) was added dropwise to a solution of methyl tosyl-L-valinate (570 mg, 2.0 mmol) and K_2CO_3 (396 mg, 3.0 mmol) in acetone (10 ml). Subsequently, the mixture was placed in a oil bath pre-heated at 60 °C and stirred overnight. After completion, the reaction mixture was cooled down to room temperature and sat. NH_4Cl (15 ml) was added. The mixture was extracted with EtOAc (3 x 15 ml), the organic layers were separated and dried over Na_2SO_4. The combined fractions were concentrated under reduced pressure and the crude was purified by chromatography on silica gel (*n*-hexanes/EtOAc 80:20) yielding **1m** (581 mg, 87%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.78 (d, J = 8.0 Hz, 2H), 7.28 (d, J = 8.0 Hz, 2H), 4.31 (dq, J = 18.5, 2.4 Hz, 1H), 4.17 – 3.98 (m, 2H), 3.48 (s, 3H), 2.43 (s, 3H), 2.22 (dp, J = 10.5, 6.7 Hz, 1H), 1.67 (t, J = 2.4 Hz, 3H), 1.04 (d, J = 6.6 Hz, 3H), 0.94 (d, J = 6.6 Hz, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 170.8 (C_q), 143.2 (C_q), 137.2 (C_q), 129.0 (CH), 127.9 (CH), 80.0 (C_q), 74.4 (C_q), 65.0 (CH), 51.5 (CH_3), 34.0 (CH_2), 28.3 (CH), 21.5 (CH_3), 19.6 (CH_3), 19.3 (CH_3), 3.4 (CH_3). **(ESI)-MS** calcd for $C_{17}H_{23}KNO_4S$ $[M+K]^+$ 376.10 found 376.15.

***N*-Benzyl-4-methyl-*N*-[(1*E*,3*E*)-4-phenylbuta-1,3-dien-1-yl]benzenesulfonamide (2g)**



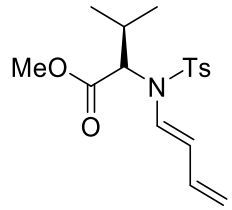
In an oven dried tube, **1g** (233 mg, 0.6 mmol), $Pd(PPh_3)_4$ (34.6 mg, 0.03 mmol), PCy_3 (16.8 mg, 0.06 mmol) and BzOH (22.0 mg, 0.18 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (6 ml, 0.1 M) was added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 100 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded **2g** (169 mg, 72%) as a pale yellow solid. 3*E*:3*Z* > 10:1. **M. p.** = 142.4 °C. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.74 (d, *J* = 8.3 Hz, 2H), 7.40 – 7.27 (m, 11H), 7.23 – 7.08 (m, 2H), 6.69 (dd, *J* = 15.6, 10.5 Hz, 1H), 6.26 (d, *J* = 15.6 Hz, 1H), 5.55 (dd, *J* = 13.9, 10.5 Hz, 1H), 4.62 (s, 2H), 2.46 (s, 3H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 144.2 (C_q), 137.5 (C_q), 135.9 (C_q), 135.3 (CH), 130.0 (CH), 129.8 (CH), 129.2 (CH), 128.7 (CH), 128.6 (CH), 128.5 (C_q), 127.6 (CH), 127.0 (CH), 126.9 (CH), 126.8 (CH), 125.8 (CH), 112.9 (CH), 49.6 (CH_2), 21.6 (CH_3).
(ESI)-MS calcd for $C_{24}H_{23}KNO_2S$ $[M+K]^+$ 428.11 found 428.19

Ethyl (*E*)-*N*-(buta-1,3-dien-1-yl)-*N*-tosylglycinate (2l)



In an oven dried tube, **1l** (61.8 mg, 0.2 mmol), $Pd(PPh_3)_4$ (11.5 mg, 0.01 mmol), PCy_3 (5.6 mg, 0.02 mmol) and BzOH (7.3 mg, 0.06 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2 ml, 0.1 M) was added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 100 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded **2l** (38.2 mg, 62%) as a yellow oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.73 (d, *J* = 8.3 Hz, 2H), 7.33 (d, *J* = 8.1 Hz, 2H), 6.95 (d, *J* = 14.0 Hz, 1H), 6.26 (dt, *J* = 16.8, 10.2 Hz, 1H), 5.33 (dd, *J* = 14.0, 10.2 Hz, 1H), 5.04 (d, *J* = 16.8 Hz, 1H), 4.95 (d, *J* = 10.4 Hz, 1H), 4.25 (s, 2H), 4.13 (q, *J* = 7.1 Hz, 2H), 2.44 (s, 3H), 1.19 (t, *J* = 7.1 Hz, 3H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 167.4 (C_q), 144.3 (C_q), 135.9 (C_q), 134.3 (CH), 129.8 (CH), 129.4 (CH), 127.3 (CH), 114.4 (CH), 111.8 (CH_2), 61.6 (CH_2), 47.1 (CH_2), 21.6 (CH_3), 14.0 (CH_3).
(ESI)-MS calcd for $C_{15}H_{19}KNO_4S$ $[M+K]^+$ 348.07 found 348.09.

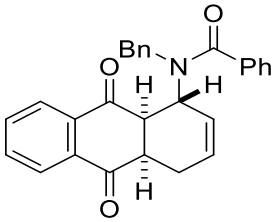
Methyl (*E*)-*N*-(buta-1,3-dien-1-yl)-*N*-tosyl-L-valinate (2m)



In an oven dried tube, **1m** (67.4 mg, 0.2 mmol), $Pd(PPh_3)_4$ (11.5 mg, 0.01 mmol), PCy_3 (5.6 mg, 0.02 mmol) and BzOH (7.3 mg, 0.06 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2 ml, 0.1 M) was added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 100 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded **2m** (29.9 mg, 62%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.79 – 7.65 (m, 2H), 7.36 – 7.24 (m, 2H), 6.47 (d, *J* = 13.2 Hz, 1H), 6.33 – 6.11 (m, 2H), 5.22 – 5.14 (m, 1H), 5.09 – 5.00 (m, 1H), 4.39 (d, *J* = 10.6 Hz, 1H), 3.42 (s, 3H), 2.44 (s, 3H), 2.30 (dt, *J* = 10.4, 6.6 Hz, 1H), 1.01 (dd, *J* = 9.5, 6.6 Hz, 6H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 170.4 (C_q), 143.8 (C_q), 136.4 (C_q), 134.6 (CH), 129.4 (CH), 127.6 (CH), 126.7 (CH), 121.8 (CH), 116.1 (CH_2), 65.1 (CH), 51.7 (CH_3), 28.1 (CH), 21.6 (CH_3), 20.0 (CH_3), 19.0 (CH_3).

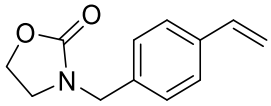
(ESI)-MS calcd for $C_{17}H_{23}KNO_4S$ $[M+K]^+$ 376.10 found 376.02.

***N*-Benzyl-*N*-[(4a,9a)-9,10-dioxo-1,4,4a,9,9a,10-hexahydroanthracen-1-yl]benzamide (8c)**



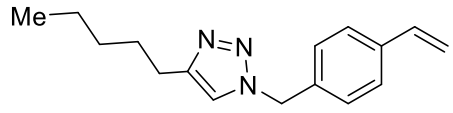
A solution of **2i** (86.0 mg, 0.33 mmol) and naphtoquinone (47.4 mg, 0.30 mmol) in toluene (4 ml) was stirred at 90 °C for 24 hs. After completion the mixture was concentrated in vacuo yielding a solid that was further recrystallized using Et_2O. **8c** (68.6 mg, 54%) was isolated as a yellow solid. **M. p.** = 128.8 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 8.14 (d, *J* = 7.2 Hz, 1H), 8.06 (d, *J* = 7.1 Hz, 1H), 7.88 – 7.77 (m, 3H), 7.33 – 7.23 (m, 2H), 7.20 (d, *J* = 7.2 Hz, 2H), 7.11 (s, 1H), 7.02 (d, *J* = 7.6 Hz, 2H), 6.84 (d, *J* = 7.5 Hz, 2H), 5.83 (d, *J* = 11.4 Hz, 1H), 5.72 (d, *J* = 12.4 Hz, 1H), 5.62 – 5.50 (m, 1H), 4.89 (d, *J* = 18.1 Hz, 1H), 4.71 (d, *J* = 18.3 Hz, 1H), 4.34 (t, *J* = 5.2 Hz, 1H), 3.59 (q, *J* = 6.5 Hz, 1H), 2.65 – 2.51 (m, 1H), 2.48 – 2.32 (m, 1H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 197.3 (C_q), 197.0 (C_q), 173.3 (C_q), 139.9 (C_q), 136.5 (C_q), 135.7 (C_q), 134.5 (CH), 134.2 (CH), 133.8 (C_q), 133.5 (CH), 129.0 (CH), 128.8 (CH), 128.6 (CH), 127.9 (CH), 126.9 (CH), 126.8 (CH), 126.1 (CH), 125.6 (CH), 124.6 (CH), 52.3 (CH), 51.9 (CH_2), 49.9 (CH), 46.8 (CH), 25.0 (CH_2).
(ESI)-MS calcd for $C_{28}H_{23}NNaO_3$ $[M+Na]^+$ 444.16 found 444.20.

3-(4-Vinylbenzyl)oxazolidin-2-one (10c)



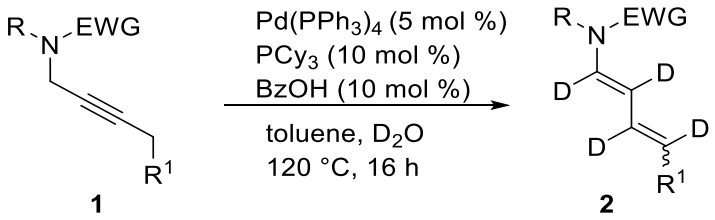
In a Schlenk flask, under nitrogen atmosphere at 0 °C, NaH (60% in mineral oil) (150 mg, 3.6 mmol) was carefully added to a solution of oxazolidin-2-one (261 mg, 3.0 mmol) in dry DMF (15 ml). After 30 min of sturring, 1-(Chloromethyl)-4-vinylbenzene (500 µl, 3.6 mmol) was added dropwise. The mixture was subsequently placed in a pre-heated oil bath at 60 °C and stirred overnight. After completion, the reaction mixture was cooled down to room temperature and acq. HCl (1.0 M) (20 ml) was added. The mixture was extracted with EtOAc (3 x 20 ml) and the organic layers washed with a sat. LiCl. The combined organic fraction were dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by chromatography on silica gel (n-hexanes/EtOAc 80:20→55:45) yielding **10c** (493 mg, 79%) as a viscous oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ= 7.40 (dd, *J* = 8.1, 2.1 Hz, 2H), 7.25 (dd, *J* = 8.1, 2.1 Hz, 2H), 6.71 (ddd, *J* = 17.7, 11.0, 2.1 Hz, 1H), 5.76 (dd, *J* = 17.6, 2.1 Hz, 1H), 5.27 (dd, *J* = 10.9, 2.1 Hz, 1H), 4.42 (d, *J* = 2.2 Hz, 2H), 4.34 – 4.25 (m, 2H), 3.52 – 3.35 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 158.6 (C_q), 137.4 (CH), 136.2 (C_q), 135.3 (C_q), 128.4 (CH), 126.7 (CH), 114.3 (CH_2), 61.8 (CH_2), 48.1 (CH_2), 43.9 (CH_2). **(ESI)-MS** calcd for $C_{12}H_{13}NNaO_2$ $[M+Na]^+$ 226.08 found 226.12.

4-Pentyl-1-(4-vinylbenzyl)-1*H*-1,2,3-triazole (10d)



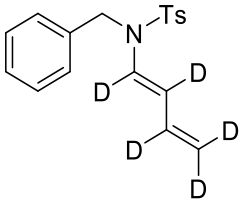
In a round bottomed flask, 1-heptyne (750 µl, 5.5 mmol) was added to a solution of 1-(azidomethyl)-4-vinylbenzene (795 mg, 5.0 mmol) in *t*-BuOH:H_2O (20:1, 20 ml:1 ml). Subsequently, sodium ascorbate (198 mg, 1.0 mmol) and $CuSO_4$*$5H_2O$ (124 mg, 0.5 mmol) were added and the mixture stirred overnight. After completion, sat NH_4Cl (30 ml) was added and the mixture was extracted with EtOAc (3 x 20 ml). The combined organic fraction were dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by chromatography on silica gel (n-hexanes/EtOAc 95:5→60:40) yielding **10d** (725 mg, 57%) as a white solid. M. p. = 75.6 °C. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.41 (d, *J* = 8.3 Hz, 2H), 7.30 – 7.16 (m, 3H), 6.71 (dd, *J* = 17.6, 10.9 Hz, 1H), 5.77 (d, *J* = 17.4 Hz, 1H), 5.49 (s, 2H), 5.29 (d, *J* = 11.0 Hz, 1H), 2.79 – 2.59 (m, 2H), 1.78 – 1.58 (m, 2H), 1.46 – 1.24 (m, 4H), 1.01 – 0.78 (m, 3H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 149.0 (C_q), 138.0 (C_q), 136.0 (CH), 134.4 (C_q), 128.2 (CH), 126.8 (CH), 120.5 (CH), 114.8 (CH_2), 53.7 (CH_2), 31.5 (CH_2), 29.1 (CH_2), 25.7 (CH_2), 22.4 (CH_2), 14.0 (CH_3).
(ESI)-MS calcd for $C_{16}H_{22}N_3$ $[M+H]^+$ 256.18 found 256.16.

General Procedure for the Synthesis of Deuterated Dienes (A)



In an oven dried tube, **1** (0.20 mmol), $Pd(PPh_3)_4$ (0.01 mmol), PCy_3 (0.02 mmol) and BzOH (0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (10 mmol) were added under N_2 atmosphere and the tube placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel.

(*E*)-*N*-Benzyl-*N*-(buta-1,3-dien-1-yl-d_5)-4-methylbenzenesulfonamide (*d*-**2a**)



Representative procedure **A** was followed using **1a** (62.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2a** (43.4 mg, 68%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.71 (d, *J* = 8.1 Hz, 2H), 7.39 – 7.23 (m, 7H), 7.05 – 6.99 (m, 0.88H), 6.25 – 6.16 (m, 0.11H), 5.44 – 5.34 (m, 0.12H), 4.92 – 4.81 (m, 0.14H), 4.57 (s, 2H)$_{ref}$, 2.47 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.97 (s, 0.13D), 6.25 (s, 0.88D)$_{ref}$, 5.41 (s, 0.83D), 5.03 – 4.68 (m, 1.69D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 144.1 (C_q), 136.0 (C_q), 135.3 (C_q), 134.4 (CD, weak), 130.0 (CH), 129.8 (CD), 128.7 (CH), 127.5 (CH), 127.0 (CH), 126.8 (CH), 113.2 (CD, weak), 112.4 (CD_2, weak), 49.5 (CH_2), 21.6 (CH_3).

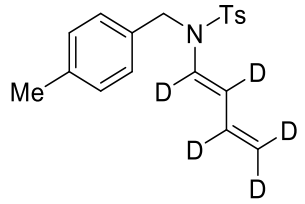
(ESI)-MS calcd for $C_{18}H_{15}D_4KNO_2S$ $[M+K]^+$ 356.10 found 356.17; intensity 100%

(ESI)-MS calcd for $C_{18}H_{16}D_3KNO_2S$ $[M+K]^+$ 355.09 found 355.12; intensity 50%

(ESI)-MS calcd for $C_{18}H_{14}D_5KNO_2S$ $[M+K]^+$ 357.10 found 357.20; intensity 10%

Average *d*- content for *d*-**2a** calculated from the isotopic abundance of MS analyses: 3.75

(*E*)-*N*-(Buta-1,3-dien-1-yl-d_5)-4-methyl-*N*-(4-methylbenzyl)benzenesulfonamide (*d*-**2b**)



Representative procedure **A** was followed using **1b** (65.4 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2b** (41.4 mg, 62%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.79 – 7.64 (m, 2H), 7.36 – 7.28 (m, 2H), 7.19 (d, *J* = 8.0 Hz, 2H), 7.13 (d, *J* = 7.9 Hz, 2H), 7.03 – 6.98 (m, 0.92H), 6.24 – 6.19 (m, 0.09H), 5.45 – 5.28 (m, 0.19H), 4.92 – 4.82 (m, 0.27H), 4.53 (s, 2H)*$_{ref}$*, 2.45 (s, 3H), 2.34 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.94 (s, 0.12D), 6.19 (s, 0.91D)*$_{ref}$*, 5.38 (s, 0.79D), 5.03 – 4.57 (m, 1.70D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 144.0 (C_q), 137.2 (C_q), 136.0 (C_q), 134.4 (CD, weak), 132.2 (C_q), 129.9 (CH), 129.8 (CD), 129.3 (CH), 127.0 (CH), 126.8 (CH), 113.9 (CD, weak), 113.0 (CD_2, weak), 49.3 (CH_2), 21.6 (CH_3), 21.1 (CH_3).

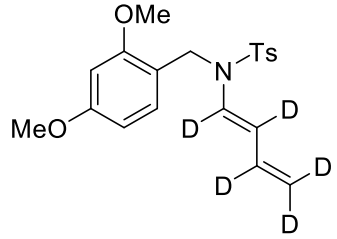
(ESI)-MS calcd for $C_{19}H_{17}D_4KNO_2S$ $[M+K]^+$ 370.11 found 370.15; intensity 100%

(ESI)-MS calcd for $C_{19}H_{16}D_5KNO_2S$ $[M+K]^+$ 371.12 found 371.18; intensity 42%

(ESI)-MS calcd for $C_{19}H_{18}D_3KNO_2S$ $[M+K]^+$ 369.11 found 369.20; intensity 19%

Average *d*- content for *d*-**2b** calculated from the isotopic abundance of MS analyses: 4.14

(*E*)-*N*-(Buta-1,3-dien-1-yl-d_5)-*N*-(2,4-dimethoxybenzyl)-4-methylbenzenesulfonamide (*d*-**2c**)



Representative procedure **A** was followed using **1c** (74.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2c** (48.1 mg, 64%) as a yellow oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.70 (d, *J* = 8.0 Hz, 2H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.22 (d, *J* = 8.2 Hz, 1H), 7.05 – 6.97 (m, 0.89H), 6.49 – 6.42 (m, 2H), 6.27 – 6.21 (m, 0.10H), 5.46 – 5.37 (m, 0.12H), 4.90 – 4.82 (m, 0.24H), 4.49 (s, 2H)*$_{ref}$*, 3.82 (s, 3H), 3.80 (s, 3H), 2.44 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.90 (s, 0.12D), 6.19 (s, 0.90D)*$_{ref}$*, 5.36 (s, 0.85D), 5.01 – 4.60 (m, 1.72D). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 160.2 (C_q), 157.3 (C_q), 143.9 (C_q), 136.1 (C_q), 134.3 (CD, weak), 129.9 (CH), 129.8 (CD), 128.6 (CH), 127.0 (CH), 115.4 (C_q), 113.3 (CD, weak), 111.8 (CD_2, weak), 104.4 (CH), 98.2 (CH), 55.4 (CH_3), 55.2 (CH_3), 43.7 (CH_2), 21.6 (CH_3).

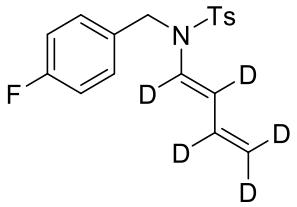
(ESI)-MS calcd for $C_{20}H_{19}D_4NNaO_4S$ $[M+Na]^+$ 400.15 found 400.07; intensity 100%

(ESI)-MS calcd for $C_{20}H_{18}D_5NNaO_4S$ $[M+Na]^+$ 401.15 found 401.20; intensity 48%

(ESI)-MS calcd for $C_{20}H_{20}D_3NNaO_4S$ $[M+Na]^+$ 399.14 found 399.22; intensity 23%

Average *d*- content for *d*-**2c** calculated from the isotopic abundance of MS analyses: 4.15

(*E*)-*N*-(Buta-1,3-dien-1-yl-d_5)-*N*-(4-fluorobenzyl)-4-methylbenzenesulfonamide (*d*-**2d**)



Representative procedure **A** was followed using **1d** (66.2 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2d** (29.7 mg, 44%) as an orange wax. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.86 – 7.57 (m, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.31 – 7.23 (m, 2H), 7.05 – 7.02 (m, 0.93H), 7.02 – 6.98 (m, 2H), 6.25 – 6.20 (m, 0.10H), 5.38 – 5.29 (m, 0.18H), 4.95 – 4.84 (m, 0.82), 4.52 (s, 2H)$_{ref}$, 2.52 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 7.01 (s, 0.08D), 6.28 (s, 0.90D)$_{ref}$, 5.44 (s, 0.78D), 5.22 – 4.80 (m, 1.20D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 162.1 (d, $^1J_{C\text{-}F}$ = 246 Hz, C_q), 144.2 (C_q), 135.8 (C_q), 134.2 (CD, weak), 131.0 (d, $^4J_{C\text{-}F}$ = 4 Hz, C_q), 130.0 (CH), 129.5 (CD), 128.5 (d, $^3J_{C\text{-}F}$ = 8Hz, CH), 127.0 (CH), 115.6 (d, $^2J_{C\text{-}F}$ = 22Hz, CH), 114.0 (CD, weak), 112.6 (CD_2), 48.8 (CH_2), 21.6 (CH_3). **^{19}F NMR** (376 MHz, Acetone-d_6) δ = -116.7 in analogy with its protio analogue.[3]

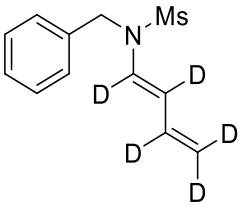
(ESI)-MS calcd for $C_{18}H_{14}D_4FKNO_2S$ $[M+K]^+$ 374.09 found 374.18; intensity 100%

(ESI)-MS calcd for $C_{18}H_{15}D_3FKNO_2S$ $[M+K]^+$ 373.08 found 373.12; intensity 75%

(ESI)-MS calcd for $C_{18}H_{13}D_5FKNO_2S$ $[M+K]^+$ 375.09 found 375.18; intensity 19%

Average *d*- content for *d*-**2d** calculated from the isotopic abundance of MS analyses: 3.73

(*E*)-*N*-benzyl-*N*-(buta-1,3-dien-1-yl-d_5)methanesulfonamide (*d*-**2e**)



Representative procedure **A** was followed using **1e** (47.4 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2e** (34.5 mg, 72%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.47 – 7.23 (m, 5H), 6.90 – 6.85 (m, 0.85H), 6.25 – 6.22 (m, 0.10H), 5.61 –5.55 (0.08H), 4.99 – 4.89 (m, 0.13H), 4.76 (s, 2H)$_{ref}$, 2.92 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.88 (s, 0.15D), 6.24 (s, 0.90D)$_{ref}$, 5.55 (s, 0.94D), 5.10 – 4.73 (m, 1.94D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 135.3 (C_q), 134.1 (CD), 129.4 (CD), 128.9 (CH), 127.8 (CH), 127.0 (CH), 114.8 (CD, weak), 112.7 (CD_2, weak), 49.4 (CH_2), 39.8 (CH_3).

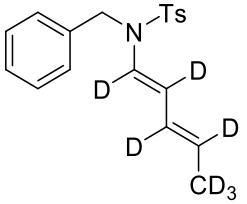
(ESI)-MS calcd for $C_{12}H_{12}D_3KNO_2S$ $[M+K]^+$ 279.06 found 279.12; intensity 100%

(ESI)-MS calcd for $C_{12}H_{13}D_2KNO_2S$ $[M+K]^+$ 278.06 found 278.20; intensity 43%

(ESI)-MS calcd for $C_{12}H_{11}D_4KNO_2S$ $[M+K]^+$ 280.07 found 280.16; intensity 21%

Average *d*- content for *d*-**2e** calculated from the isotopic abundance of MS analyses: 2.46

***N*-Benzyl-4-methyl-*N*-[(1*E*,3*E*)-penta-1,3-dien-1-yl-d_7]benzenesulfonamide** (*d*-**2f**)



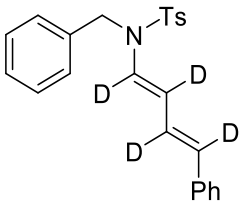
Representative procedure **A** was followed using **1f** (65.4 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2f** (45.4 mg, 68%) as a yellow oil. 3*E*:3*Z* = 3.4:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.71 (d, *J* = 8.2 Hz, 2H), 7.45 – 7.21 (m, 7H), 6.98 –6.86 (m, 0.90H), 5.95 – 5.88 (s, 0.09H), 5.44 – 5.26 (m, 0.61H), 4.63 – 4.57 (m, 2H)$_{ref}$, 2.50 – 2.45 (m, 3H), 1.69 – 1.46 (m, 1.81H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.89 (s, 0.11D), 5.87 (s, 0.91D)$_{ref}$, 5.62 – 5.09 (m, 1.51D), 1.73 – 1.43 (s, 1.34D). **^{13}C NMR** (101 MHz, $CDCl_3$, major isomer) δ = 144.0 (C_q), 135.9 (C_q), 135.5 (C_q), 134.6 (CD, weak), 129.9 (CH), 128.6 (CD), 127.5 (CH), 127.0 (CH), 126.9 (CH) 126.8 (CH), 126.3 (CD), 113.3 (CD, weak), 49.5 (CH_2), 21.6 (CH_3), 18.1 (CH_3).

(ESI)-MS calcd for $C_{19}H_{14}D_7NNaO_2S$ $[M+Na]^+$ 357.16 found 357.09; intensity 100%

(ESI)-MS calcd for $C_{19}H_{15}D_6NNaO_2S$ $[M+Na]^+$ 356.16 found 356.02; intensity 31%

Average *d*- content for *d*-**2f** calculated from the isotopic abundance of MS analyses: 6.74

***N*-Benzyl-4-methyl-*N*-[(1*E*,3*E*)-4-phenylbuta-1,3-dien-1-yl-1,2,3,4-d_4]benzenesulfonamide** (*d*-**2g**)



Representative procedure **A** was followed using **1g** (77.8 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2g** (57.6 mg, 73%) as a whitish solid. 3*E*:3*Z* >10:1. **M. p.** = 148.4 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.75 (d, *J* = 8.1 Hz, 2H), 7.41 – 7.25 (m, 11H), 7.23 – 7.12 (m, 1.95H), 6.73 – 6.64 (m, 0.05H), 6.29 –6.21 (m, 0.76H), 5.59 – 5.41 (m, 0.10H), 4.66 – 4.52 (m, 2H)$_{ref}$, 2.46 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 7.21 (s. 0.13D), 6.66 (s, 0.95D)$_{ref}$, 6.22 (s, 0.34D), 5.52 (s, 0.89D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 144.2 (C_q), 137.5 (C_q), 135.9 (C_q), 135.3 (CD, weak), 130.0 (CH), 129.7 (CH), 129.1 (CD), 128.8 (CH), 128.6 (CH), 128.5 (C_q), 127.6 (CH), 127.0 (CH), 126.8 (CH), 126.6 (CD, weak), 125.8 (CH), 112.8 (CD, weak), 49.6 (CH_2), 21.6 (CH_3).

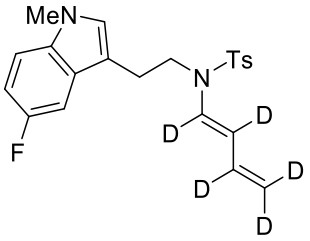
(ESI)-MS calcd for $C_{24}H_{21}D_2NNaO_2S$ $[M+Na]^+$ 414.15 found 413.99; intensity 100%

(ESI)-MS calcd for $C_{24}H_{20}D_3NNaO_2S$ $[M+Na]^+$ 415.15 found 415.00; intensity 74%

(ESI)-MS calcd for $C_{24}H_{19}D_4NNaO_2S$ $[M+Na]^+$ 416.16 found 416.09; intensity 12%

Average *d*- content for *d*-**2g** calculated from the isotopic abundance of MS analyses: 2.53

(*E*)-*N*-(buta-1,3-dien-1-yl-d_5)-*N*-[2-(5-fluoro-1-methyl-1*H*-indol-3-yl)ethyl]-4-methylbenzenesulfonamide (*d*-**2h**)



Representative procedure **A** was followed using **1g** (79.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2g** (51.5 mg, 64%) as a yellow wax. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.69 (d, *J* = 8.4 Hz, 2H), 7.32 – 7.28 (m, 2H), 7.27 – 7.17 (m, 2H), 7.04 – 7.01 (m, 0.70H), 7.00 – 6.97 (m, 1H), 6.96 (s, 1H), 6.37 – 6.32 (m, 0.11H), 5.65 – 5.57 (s, 0.16H), 5.10 – 4.94 (m, 0.47H), 3.75 (s, 3H), 3.65 – 3.49 (m, 2H), 3.11 – 2.92 (m, 2H)*ref*, 2.42 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.91 (s, 0.24D), 6.33 (s, 0.89D)*ref*, 5.60 – 4.95 (m, 2.88D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 157.7 (d, $^1J_{C\text{-}F}$ = 233 Hz, C_q), 144.0 (C_q), 136.1 (C_q), 134.5 (CD), 133.7 (C_q), 129.9 (CH), 129.6 (CD), 128.5 (CH), 127.9 (d, $^5J_{C\text{-}F}$ = 9Hz, C_q), 126.9 (CH), 113.5 (CD), 111.8 (CD_2), 110.7 (d, $^6J_{C\text{-}F}$ = 5 Hz, C_q), 110.1 (d, $^3J_{C\text{-}F}$ = 18 Hz, CH), 109.1 (d, $^4J_{C\text{-}F}$ = 10 Hz, CH), 103.5 (d, $^2J_{C\text{-}F}$ = 24 Hz, CH), 46.2 (CH_2), 32.9 (CH_3), 23.5 (CH_2), 21.5 (CH_3). **^{19}F NMR** (376 MHz, CD_2Cl_2) δ = -126.1 in analogy with its protio analogue.[3]

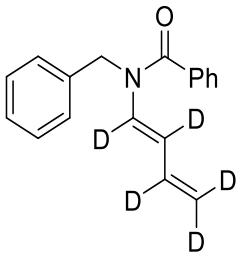
(ESI)-MS calcd for $C_{22}H_{19}D_4FKN_2O_2S$ $[M+K]^+$ 441.13 found 441.18; intensity 100%

(ESI)-MS calcd for $C_{22}H_{20}D_3FKN_2O_2S$ $[M+K]^+$ 440.12 found 440.17; intensity 45%

(ESI)-MS calcd for $C_{22}H_{18}D_5FKN_2O_2S$ $[M+K]^+$ 442.14 found 442.22; intensity 22%

Average *d*- content for *d*-**2h** calculated from the isotopic abundance of MS analyses: 3.86

(*E*)-*N*-Benzyl-*N*-(buta-1,3-dien-1-yl-d_5)benzamide (*d*-**2i**)



Representative procedure **A** was followed using **1h** (52.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2h** (39.1 mg, 74%) as a white solid. **M p.** = 84.2 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.61 – 7.43 (m, 5H)*ref*, 7.43 – 7.35 (m, 2H), 7.35 – 7.22 (m, 3H), 6.94 – 6.72 (m, 0.71H), 6.10 – 6.04 (m, 0.08H), 5.76 – 5.67 (m, 0.10H), 5.16 – 5.02 (m, 2H), 5.01 – 4.80 (m, 0.34H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.95 (s, 0.31D), 6.16 (s, 0.82D), 5.74 (s, 0.90D)*ref*, 5.19 – 4.29 (m, 1.74D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 170.7 (C_q), 136.7 (C_q), 135.0 (C_q), 134.5 (CD, weak), 132.5 (CH),

130.6 (CH), 128.8 (CH), 128.6 (CH), 127.9 (CH), 127.3 (CH), 126.6 (CD), 114.0 (CD, weak), 113.0 (CD_2, weak), 47.3 (CH_2).

(ESI)-MS calcd for $C_{18}H_{13}D_4KNO$ $[M+K]^+$ 306.12 found 306.18; intensity 100%

(ESI)-MS calcd for $C_{18}H_{14}D_3KNO$ $[M+K]^+$ 305.11 found 305.19; intensity 53%

(ESI)-MS calcd for $C_{18}H_{12}D_5KNO$ $[M+K]^+$ 307.13 found 307.23; intensity 40%

Average *d*- content for *d*-**2i** calculated from the isotopic abundance of MS analyses: 3.93

3 mmol scale: Representative procedure **A** was followed using **1h** (790 mg, 3.0 mmol). Purification by column chromatography on silica gel (n-hexanes/EtOAc 95:5) yielded *d*-**2h** (535 mg, 67%) as a white solid.

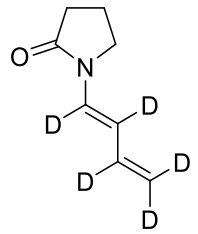
(ESI)-MS calcd for $C_{18}H_{13}D_4KNO$ $[M+K]^+$ 306.12 found 306.14; intensity 100%

(ESI)-MS calcd for $C_{18}H_{14}D_3KNO$ $[M+K]^+$ 305.11 found 305.17; intensity 48%

(ESI)-MS calcd for $C_{18}H_{12}D_5KNO$ $[M+K]^+$ 307.13 found 307.19; intensity 35%

Average *d*- content for *d*-**2i** (3 mmol scale) calculated from the isotopic abundance of MS analyses: 3.93

(*E*)-1-(Buta-1,3-dien-1-yl-*d*$_5$)pyrrolidin-2-one (*d*-**2j**)



Representative procedure **A** was followed using **1j** (68.5 mg, 0.50 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2j** (43.4 mg, 61%) as a yellow oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.16 – 7.08 (m, 0.92H), 6.37 – 6.32 (m, 0.09H), 5.68 – 5.60 (m, 0.08H), 5.15 – 4.96 (m, 0.08H), 3.71 – 3.48 (m, 2H)$_{ref}$, 2.53 (dd, *J* = 8.6, 7.6 Hz, 2H), 2.14 (qd, *J* = 8.2, 6.9 Hz, 2H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 7.19 (s, 0.09D), 6.36 (s, 0.91D)$_{ref}$, 5.60 (s, 0.98D), 5.18 – 4.75 (m, 1.83D). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 173.3 (C_q), 134.6 (CD), 126.6 (CD), 114.8 (CD), 112.3 (CD_2), 45.1 (CH_2), 31.2 (CH_2), 17.5 (CH_2).

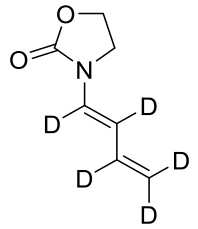
(ESI)-MS calcd for $C_{16}H_{13}D_9KN_2O_2$ $[2M+K]^+$ 322.188 found 322.337; intensity 100%

(ESI)-MS calcd for $C_{16}H_{12}D_{10}KN_2O_2$ $[2M+K]^+$ 323.523 found 323.331; intensity 84%

(ESI)-MS calcd for $C_{16}H_{14}D_8KN_2O_2$ $[2M+K]^+$ 321.182 found 321.381; intensity 69%

Average *d*- content for *d*-**2j** calculated from the isotopic abundance of MS analyses: 4.53

(*E*)-3-(Buta-1,3-dien-1-yl-d_5)oxazolidin-2-one (*d*-**2k**)



Representative procedure **A** was followed using **1k** (69.5 mg, 0.50 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2k** (39.9 mg, 55%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 6.93 – 6.85 (m, 0.80H), 6.35 – 6.29 (m, 0.10H), 5.57 – 5.48 (s, 0.09H), 5.13–4.95 (m, 0.14H), 4.57 – 4.36 (m, 2H)*ref*, 3.84 – 3.67 (m, 2H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.82 (s, 0.17D), 6.34 (s, 0.90D)*ref*, 5.53 (s, 0.92D), 5.14 – 4.63 (m, 1.87D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 155.2 (C_q), 133.9 (CD), 126.8 (CD), 114.2 (CD), 111.9 (CD_2), 62.2 (CH_2), 42.4 (CH_2).

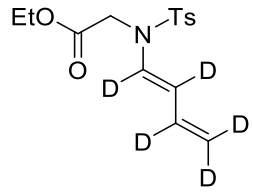
(ESI)-MS calcd for $C_7H_5D_4KNO_2$ $[M+K]^+$ 182.05 found 182.12; intensity 100%

(ESI)-MS calcd for $C_7H_4D_5KNO_2$ $[M+K]^+$ 183.06 found 183.00; intensity 13%

(ESI)-MS calcd for $C_7H_6D_3KNO_2$ $[M+K]^+$ 181.05 found 181.13; intensity 10%

Average *d*- content for *d*-**2k** calculated from the isotopic abundance of MS analyses: 4.04

Ethyl (*E*)-*N*-(buta-1,3-dien-1-yl-d_5)-*N*-tosylglycinate (*d*-**2l**)



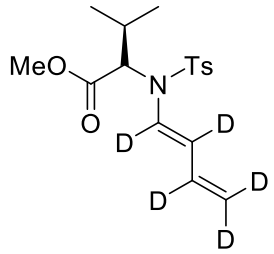
Representative procedure **A** was followed using **1l** (61.8 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2l** (37.4 mg, 60%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.73 (d, *J* = 8.4 Hz, 2H)*ref*, 7.38 – 7.29 (d, *J* = 8.4 Hz, 2H), 6.97 – 6.91 (m, 0.80H), 6.29 – 6.21 (m, 0.08H), 5.04 – 4.99 (m, 0.46H), 4.97 – 4.91 (m, 0.45H), 4.25 (s, 2H), 4.13 (q, *J* = 7.1 Hz, 2H), 2.44 (s, 3H), 1.19 (t, *J* = 7.2 Hz, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 7.02 (s, 0.20D), 6.31 (s, 0.80D), 5.36 (s, 0.87D)*ref*, 5.14 – 4.87 (m, 0.91D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 167.5 (C_q), 144.3 (C_q), 135.9 (C_q), 134.2 (CD, weak), 129.8 (CH), 129.3 (CD, weak), 127.3 (CH), 114.2 (CD, weak), 111.9 (CD_2, weak), 61.6 (CH_2), 47.1 (CH_2), 21.6 (CH_3), 14.0 (CH_3).

(ESI)-MS calcd for $C_{15}H_{16}D_3NNaO_4S$ $[M+Na]^+$ 335.11 found 335.17; intensity 100%

(ESI)-MS calcd for $C_{15}H_{15}D_4NNaO_4S$ $[M+Na]^+$ 336.12 found 335.21; intensity 71%

Average *d*- content for *d*-**2l** calculated from the isotopic abundance of MS analyses: 3.41

Methyl (*E*)-*N*-(buta-1,3-dien-1-yl-d_5)-*N*-tosyl-L-valinate (*d*-**2m**)



Representative procedure **A** was followed using **1m** (67.4 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2**m (26.7 mg, 39%) as a yellow oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.69 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.5 Hz, 2H), 6.50 – 6.38 (m, 0.85H), 6.21 – 6.19 (m, 0.14H), 5.19 – 5.13 (m, 0.54H), 5.09 – 4.96 (m, 0.60H), 4.39 (d, *J* = 10.5 Hz, 1H)$_{ref}$, 3.42 (s, 3H), 2.44 (s, 3H), 2.36 – 2.20 (m, 1H), 1.01 (dd, *J* = 9.3, 6.6 Hz, 6H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.99 (s, 0.13D), 6.31 (s, 0.86D)$_{ref}$, 5.87 – 5.03 (m, 1.76D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 170.4 (C_q), 143.7 (C_q), 136.5 (C_q), 134.2 (CD, weak), 129.3 (CH), 127.6 (CH), 126.6 (CD, weak), 115.9 (CD, weak), 112.2 (CD_2, weak), 65.2 (CH), 51.6 (CH_3), 28.1 (CH), 21.5 (CH_3), 19.9 (CH_3), 18.9 (CH_3).

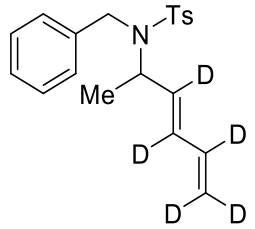
(ESI)-MS calcd for $C_{17}H_{19}D_4KNO_4S$ $[M+K]^+$ 380.12 found 380.03; intensity 100%

(ESI)-MS calcd for $C_{17}H_{20}D_3KNO_4S$ $[M+K]^+$ 379.12 found 379.18; intensity 40%

(ESI)-MS calcd for $C_{17}H_{21}D_2KNO_4S$ $[M+K]^+$ 378.11 found 377.99; intensity 27%

Average *d*- content for *d*-**2m** calculated from the isotopic abundance of MS analyses: 3.44

(*E*)-*N*-Benzyl-*N*-(hexa-3,5-dien-2-yl-3,4,5,6,6-d_5)-4-methylbenzenesulfonamide (*d*-**2n**)



Representative procedure **A** was followed using **1n** (68.2 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded *d*-**2n** (52.6 mg, 76%) as a yellow oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.72 (d, *J* = 8.3 Hz, 2H), 7.45 – 7.22 (m, 7H), 6.19 – 6.07 (m, 0.24H), 5.97 – 5.84 (m, 0.11H), 5.41 – 5.34 (m, 0.09H), 5.18 – 4.99 (m, 1.08H), 4.61 (q, *J* = 6.9 Hz, 1H), 4.50 (d, *J* = 15.9 Hz, 1H), 4.23 (d, *J* = 15.9 Hz, 1H)$_{ref}$, 2.45 (s, 3H), 1.13 (d, *J* = 6.9 Hz, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.13 (s, 0.60D), 5.94 (s, 0.88D), 5.36 (s, 0.91D)$_{ref}$, 5.13 (s, 0.94D). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 143.1 (C_q), 138.5 (C_q), 138.1 (C_q), 132.6 (CD, weak), 132.0 (CD, weak), 129.6 (CH), 128.3 (CH), 128.0 (CH), 127.7 (CD, weak), 127.3 (CH), 127.2 (CH), 117.7 (CD_2, weak), 54.8 (CH_2), 47.8 (CH), 21.5 (CH_3), 18.8 (CH_3).

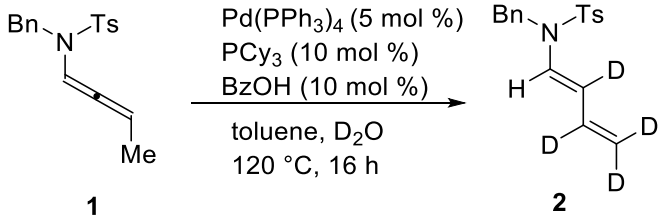
(ESI)-MS calcd for $C_{20}H_{19}D_4NNaO_4S$ $[M+Na]^+$ 368.16 found 368.07; intensity 100%

(ESI)-MS calcd for $C_{20}H_{20}D_3NNaO_4S$ $[M+Na]^+$ 367.15 found 366.99; intensity 65%

(ESI)-MS calcd for $C_{20}H_{18}D_5NNaO_4S$ $[M+Na]^+$ 369.17 found 369.24; intensity 37%

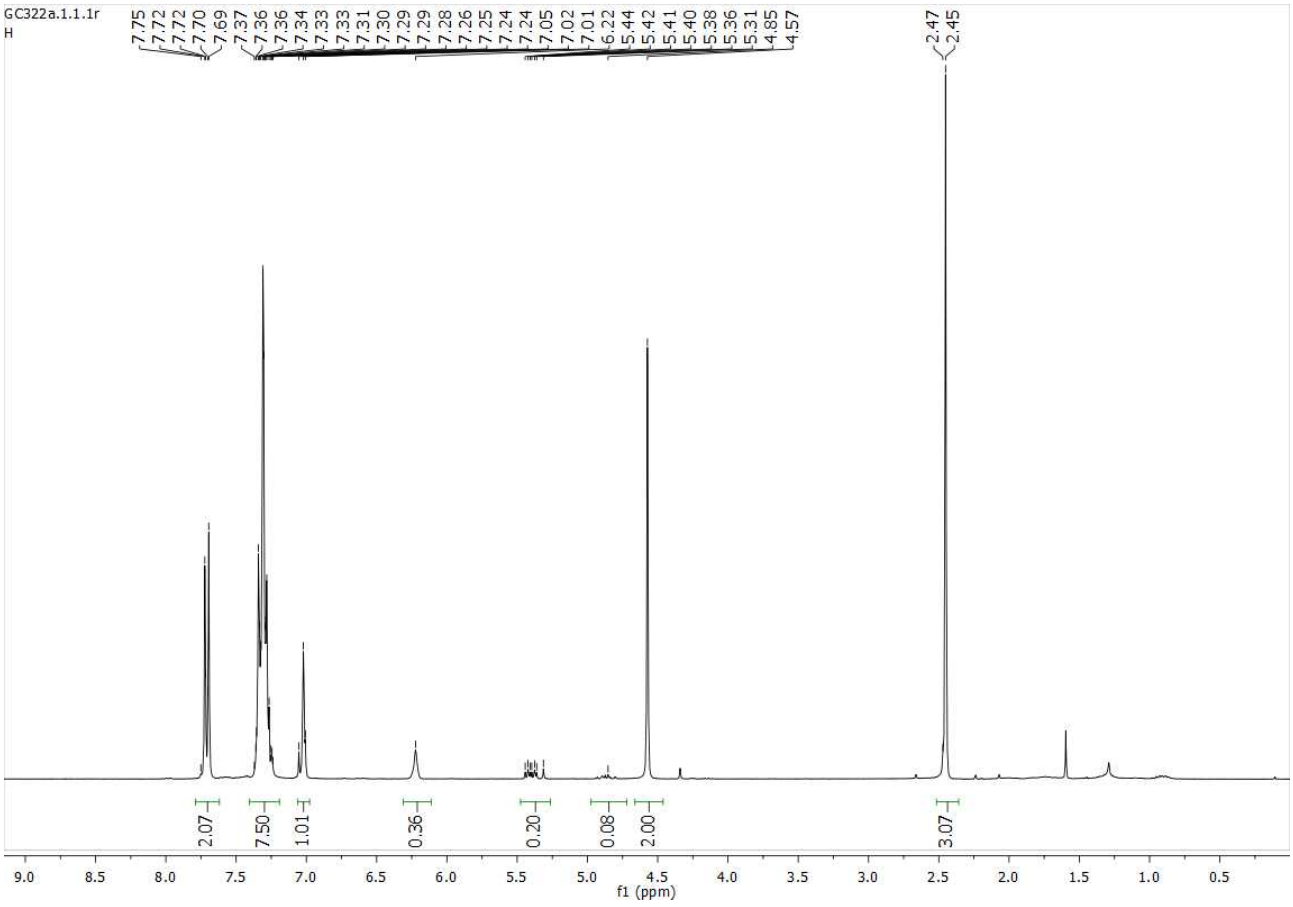
Average *d*- content for *d*-**2n** calculated from the isotopic abundance of MS analyses: 3.86

(*E*)-*N*-Benzyl-*N*-(buta-1,3-dien-1-yl-d_5)-4-methylbenzenesulfonamide (*d*-**2a**)



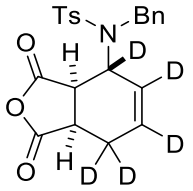
1 **2**

In an oven dried tube, **7a** (56.3 mg, 0.18 mmol), $Pd(PPh_3)_4$ (0.009 mmol), PCy_3 (0.018 mmol) and BzOH (0.018 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (9 mmol, 50 equiv) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5) yielded **2a** (49.2 mg, 86%) as a yellow oil.



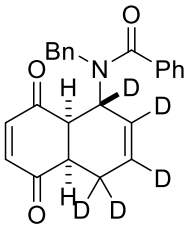
Synthesis of Deuterated Polycycles

***N*-Benzyl-*N*-[(3a,4,7a)-1,3-dioxo-1,3,3a,4,7,7a-hexahydroisobenzofuran-4-yl-4,5,6,7,7-d_5]-4-methylbenzenesulfonamide** (*d*-**8a**)



A solution of *d*-**2a** (71.0 mg, 0.22 mmol) and maleic anydride (25.0 mg, 0.22 mmol) in toluene (2 ml) was stirred at 70 °C for 24 hs. After completion, the reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes/EtOAc 8:2) yielding *d*-**8a** (55.8 mg, 61%) as a white solid. **M. p**. = 76.2 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.73 – 7.62 (m, 2H), 7.33 – 7.24 (m, 5H), 7.21 – 7.17 (m, 2H), 6.06 – 6.00 (m, 0.08H), 5.92 – 5.88 (m, 0.08H), 4.90 (d, *J* = 17.3 Hz, 1H), 4.72 (d, *J* = 7.8 Hz, 0.93H), 4.37 (d, *J* = 17.3 Hz, 1H)*ref*, 3.74 (ddd, *J* = 10.2, 7.8, 1.8 Hz, 1H), 3.45 (d, *J* = 10.3 Hz, 1H), 2.86 – 2.77 (m, 0.20H), 2.42 (s, 3H), 2.34 – 2.25 (m, 0.20H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.43 – 5.74 (m, 1.89D), 4.78 (s, 0.06D), 2.78 (s, 0.80D)*ref*, 2.29 (s, 0.78D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 173.5 (C_q), 170.7 (C_q), 143.9 (C_q), 137.4 (C_q), 137.2 (C_q), 130.2 (CD, weak), 129.7 (CH), 128.5 (CH), 127.6 (CH), 127.5 (CH), 127.3 (CH), 126.8 (CD, weak), 53.5 (CD, weak), 51.5 (CH_2), 43.8 (CH), 39.2 (CH), 24.7 (CD_2, weak), 21.6 (CH_3).
(ESI)-MS calcd for $C_{22}H_{17}D_4NNaO_5S$ $[M+Na]^+$ 438.13 found 438.07; intensity 100%
(ESI)-MS calcd for $C_{22}H_{18}D_3NNaO_5S$ $[M+Na]^+$ 437.12 found 436.99; intensity 44%
(ESI)-MS calcd for $C_{22}H_{19}D_5NNaO_5S$ $[M+Na]^+$ 439.13 found 439.09; intensity 31%
Average *d*- content for *d*-**8a** calculated from the isotopic abundance of MS analyses: 3.93

***N*-Benzyl-*N*-[(4aR,8aR)-5,8-dioxo-1,4,4a,5,8,8a-hexahydronaphthalen-1-yl-1,2,3,4,4-d_5]benzamide** (*d*-**8b**)



A solution of *d*-**2i** (88.1 mg, 0.33 mmol) and benzoquinone (32.4 mg, 0.30 mmol) in CH_2Cl_2 (4 ml) was stirred at 55 °C for 2 hs. After completion the mixture was concentrated in vacuo yielding a solid that was further recrystallized using *n*-hexanes/EtOAc 8:2. *d*-**8b** (91.8 mg, 82%) was isolated as a white solid. **M. p.** = 121.8 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.37 – 7.16 (m, 8H), 7.05 (d, *J* = 7.5 Hz, 2H), 6.75 (d, *J* = 10.2 Hz, 1H), 6.69 (d, *J* = 10.2 Hz, 1H), 5.79 – 5.74 (m, 0.07H), 5.67 – 5.63 (m, 0.07H), 5.35 – 5.29 (m, 0.77H), 4.79 (s,

2H), 4.22 – 4.12 (m, 1H)*ref*, 3.41 – 3.35 (m, 1H), 2.55 – 2.47 (m, 0.18H), 2.33 – 2.26 (m, 0.19H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.18 – 5.15 (m, 2.47D), 2.63 – 2.12 (m, 1.63D)*ref*. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 198.9 (C_q), 198.5 (C_q), 173.3 (C_q), 140.7 (CH), 139.6 (C_q), 138.3 (C_q), 136.6 (CH), 133.1 (CD, weak), 129.3 (CH), 128.7 (CH), 128.2 (CH), 126.9 (CH), 126.2 (CH), 125.7 (CH), 124.5 (CD, weak), 52.4 (CD, weak), 52.2 (CH_2), 49.2 (CH), 46.3 (CH), 25.0 (CD_2, weak).

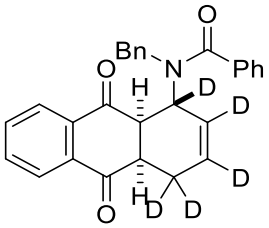
(ESI)-MS calcd for $C_{24}H_{17}D_4NNaO_3$ $[M+Na]^+$ 398.16 found 397.98; intensity 100%

(ESI)-MS calcd for $C_{24}H_{18}D_3NNaO_3$ $[M+Na]^+$ 397.16 found 396.97; intensity 31%

(ESI)-MS calcd for $C_{24}H_{16}D_5NNaO_3$ $[M+Na]^+$ 399.17 found 398.99; intensity 20%

Average *d*- content for *d*-**8b** calculated from the isotopic abundance of MS analyses: 3.93

***N*-Benzyl-*N*-[(4aR,9aR)-9,10-dioxo-1,4,4a,9,9a,10-hexahydroanthracen-1-yl-1,2,3,4,4-*d*$_5$]benzamide** (*d*-**8c**)



A solution of *d*-**2i** (88.1 mg, 0.33 mmol) and naphtoquinone (47.4 mg, 0.30 mmol) in toluene (4 ml) was stirred at 90 °C for 24 hs. After completion the mixture was concentrated in vacuo yielding a solid that was further recrystallized using Et_2O. *d*-**8c** (89.7 mg, 70%) was isolated as a white solid. **M. p.** = 126.4 °C. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 8.20 – 8.11 (m, 1H), 8.11 – 8.01 (m, 1H), 7.84 – 7.73 (m, 2H), 7.30 – 7.23 (m, 2H), 7.18 (dd, *J* = 8.7, 5.3 Hz, 2H), 7.11 (d, *J* = 7.4 Hz, 2H), 7.02 (d, *J* = 7.4 Hz, 2H), 6.84 (d, *J* = 7.4 Hz, 2H), 5.84 – 5.79 (m, 0.08H) 5.75 – 5.69 (m, 0.08H), 5.59 – 5.52 (m, 0.78H), 4.89 (d, *J* = 18.3 Hz, 1H)*ref*, 4.70 (d, *J* = 18.3 Hz, 1H), 4.33 (t, *J* = 5.9 Hz, 1H), 3.57 (d, *J* = 5.4 Hz, 1H), 2.62 – 2.52 (m, 0.18H), 2.42 – 2.30 (m, 0.18H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.31 – 5.33 (m, 2.42D), 2.89 – 2.11 (m, 1.63D)*ref*. **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 197.2 (C_q), 197.0 (C_q), 173.3 (C_q), 139.9 (C_q), 136.6 (C_q), 135.7 (C_q), 134.5 (CH), 134.2 (CH), 133.9 (C_q), 133.3 (CD, weak), 129.0 (CH), 128.8 (CD),128.6 (CH), 127.9 (CH), 126.9 (CH), 126.8 (CH), 126.1 (CH), 125.6 (CH), 125.2 (CD, weak), 52.2 (CD), 51.9 (CH_2), 49.9 (CH), 46.6 (CH), 25.1 (CD_2, weak).

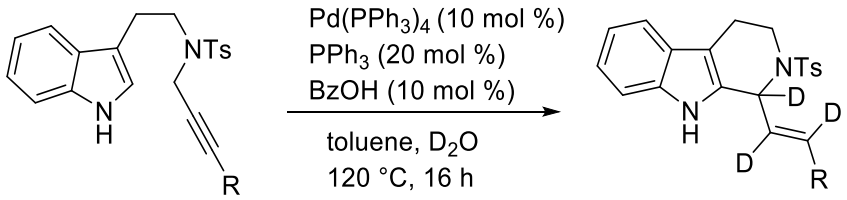
(ESI)-MS calcd for $C_{28}H_{19}D_4NNaO_3$ $[M+Na]^+$ 448.18 found 448.01; intensity 100%

(ESI)-MS calcd for $C_{28}H_{20}D_3NNaO_3$ $[M+Na]^+$ 447.18 found 447.20; intensity 58%

(ESI)-MS calcd for $C_{28}H_{21}D_2NNaO_3$ $[M+Na]^+$ 446.17 found 446.29; intensity 43%

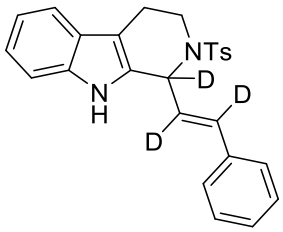
Average *d*- content for *d*-**8c** calculated from the isotopic abundance of MS analyses: 3.28

General Procedure for the Synthesis of Deuterated Carbolines (B)



In an oven dried tube, **3** (0.20 mmol), $Pd(PPh_3)_4$ (0.02 mmol), PPh_3 (0.04 mmol) and BzOH (0.02 mmol) were sequentially added and the tube was purged three times with nitrogen. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (10 mmol) were added under N_2 and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down to room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel.

(*E*)-1-(2-Phenylvinyl-1,2-*d*$_2$)-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4a**)



Representative procedure **B** was followed using **3a** (85.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4a** (67.4 mg, 78%) as a yellowish solid. **M. p.** = 180.5 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.96 (s, 1H), 7.72 – 7.68 (m, 2H), 7.49 – 7.39 (m, 2H), 7.35 – 7.23 (m, 5H), 7.20 (ddd, *J* = 8.2, 7.1, 1.3 Hz, 1H), 7.16 – 7.09 (m, 3H), 6.53 – 6.48 (m, 0.06H), 6.27 – 6.22 (m, 0.19H), 5.85 – 5.75 (s, 0.81H), 4.15 (dt, *J* = 13.7, 3.8 Hz, 1H), 3.48 – 3.30 (m, 1H)$_{ref}$, 2.75 – 2.66 (m, 2H), 2.31 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.41 (s, 0.94D)$_{ref}$, 6.23 (s, 0.66D), 5.77 (s, 0.24D). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 143.3 (C_q), 137.9 (C_q), 136.2 (C_q), 135.8 (C_q), 130.4 (C_q), 130.2 (CD, weak) 129.6 (CH), 128.6 (CH), 128.2 (CH), 127.9 (CH), 127.1 (CH), 126.8 (C_q), 126.2 (CD, weak), 122.3 (CH), 119.6 (CH), 118.3 (CH), 111.1 (CH), 109.1 (C_q), 54.7 (CD), 40.1 (CH_2), 21.4 (CH_3), 21.0 (CH_2).

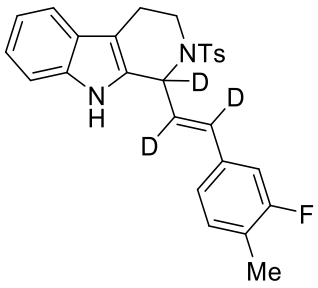
(ESI)-MS calcd for $C_{26}H_{22}D_2KN_2O_2S$ $[M+K]^+$ 469.132 found 469.199; intensity 100%

(ESI)-MS calcd for $C_{26}H_{21}D_3KN_2O_2S$ $[M+K]^+$ 470.138 found 470.207; intensity 39%

(ESI)-MS calcd for $C_{26}H_{23}DKN_2O_2S$ $[M+K]^+$ 468.126 found 468.100; intensity 32%

Average *d*- content for *d*-**4a** calculated from the isotopic abundance of MS analyses: 2.04

(*E*)-1-[2-(3-Fluoro-4-methylphenyl)vinyl-1,2-d_2]-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (***d*-4b**)



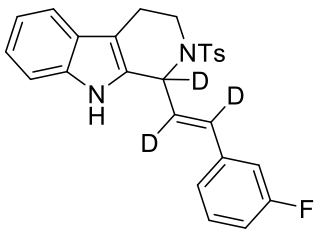
Representative procedure **B** was followed using **3b** (92.0 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded ***d*-4b** (62.1 mg, 67%) as a yellowish solid. **M. p.** = 179.8 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.96 (s, 1H), 7.74 – 7.66 (m, 2H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.33 (d, *J* = 8.1 Hz, 1H), 7.20 (d, *J* = 1.2 Hz, 1H), 7.17 – 7.07 (m, 4H), 6.91 (dd, *J* = 7.8, 1.7 Hz, 1H), 6.86 (dd, *J* = 10.8, 1.7 Hz, 1H), 6.42 – 6.40 (m, 0.05H), 6.20 – 6.14 (m, 0.13H), 5.82 – 5.79 (m, 0.61H), 4.15 (ddd, *J* = 13.7, 4.1, 2.6 Hz, 1H), 3.36 (ddd, *J* = 14.0, 9.0, 7.8 Hz, 1H)*ref*, 2.75 – 2.65 (m, 2H), 2.33 (s, 3H), 2.27 (s, 3H). **^{2}H NMR** (61 MHz, Acetone) δ = 6.60 – 6.15 (m, 1.76D), 5.73 (s, 0.39D)*ref*. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 162.5 (d, $^1J_{C\text{-}F}$ = 248 Hz, C_q), 143.4 (C_q), 137.9 (C_q), 136.2 (C_q), 135.5 (d, $^4J_{C\text{-}F}$ = 8 Hz, C_q), 132.1 (CD, weak),131.5 (d, $^5J_{C\text{-}F}$ = 5 Hz, CH), 130.2 (C_q), 129.6 (CH), 127.1 (CH), 126.7 (C_q), 126.5 (CD, weak), 124.8 (d, $^3J_{C\text{-}F}$ = 18 Hz, C_q), 122.5 (d, $^6J_{C\text{-}F}$ = 3 Hz, CH), 122.4 (CH), 119.7 (CH), 118.4 (CH), 112.7 (d, $^2J_{C\text{-}F}$ = 23 Hz, CH), 111.1 (CH), 109.2 (C_q), 54.5 (CD), 40.0 (CH_2), 21.4 (CH_3), 21.0 (CH_2), 14.4 (d, $J_{C\text{-}F}$ = 4 Hz, CH_3). **^{19}F-NMR** (376 MHz, $CDCl_3$) δ = -117.5 Hz in analogy with its protio analogue.[4]

(ESI)-MS calcd for $C_{27}H_{24}D_2FN_2O_2S$ $[M+H]^+$ 463.182 found 463.178; intensity 100%

(ESI)-MS calcd for $C_{27}H_{25}DFN_2O_2S$ $[M+H]^+$ 462.176 found 462.202; intensity 42%

Average *d*- content for ***d*-4b** calculated from the isotopic abundance of MS analyses: 1.70

(*E*)-1-[2-(3-fluorophenyl)vinyl-1,2-d_2]-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (***d*-4c**)



Representative procedure **B** was followed using 1x (89.2 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded 2x (51.4 mg, 57%) as a yellowish solid. **M. p.** = 194.3 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 8.00 (s, 1H), 7.70 (d, *J* = 8.1 Hz, 2H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.33 (d, *J* = 8.0 Hz, 1H), 7.30 – 7.24 (m, 3H), 7.24 – 7.17 (m, 1H), 7.14 (d, *J* = 8.2 Hz, 2H), 7.03 – 6.99 (m, 1H), 6.98 – 6.93 (m, 1H), 6.90 (dt, *J* = 10.1, 2.1 Hz, 1H), 6.46 – 6.44 (m, 0.05H), 6.29 – 6.20 (m, 0.21H), 5.84 – 5.80 (m, 0.39H), 4.16 (dt, *J* = 13.6, 3.6 Hz, 1H)*ref*, 3.36 (dt, *J* = 13.4, 7.8 Hz, 1H), 2.73 – 2.67 (m, 2H),

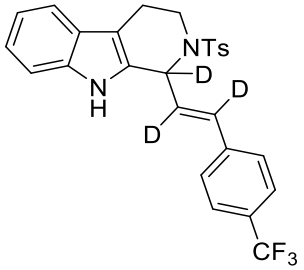
2.32 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.44 (s, 0.98D), 6.28 (s, 0.72D), 5.74 (s, 0.39D)*ref*. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 162.9 (d, $^{1}J_{C\text{-}F}$ = 245 Hz, C_q), 143.5 (C_q), 138.1 (d, $^{4}J_{C\text{-}F}$ = 8 Hz, C_q), 137.8 (C_q), 134.7 (C_q), 132.1 (CD, weak), 130.1 (d, $^{5}J_{C\text{-}F}$ = 7 Hz, CH), 129.6 (CH), 127.6 (CD), 127.5 (C_q), 127.1 (CH), 126.7 (C_q), 122.7 (d, $^{6}J_{C\text{-}F}$ = 3 Hz, CH), 122.4 (CH), 119.7 (CH), 118.4 (CH), 115.0 (d, $^{3}J_{C\text{-}F}$ = 22 Hz, CH), 113.1 (d, $^{2}J_{C\text{-}F}$ = 24 Hz, CH), 111.1 (CH), 109.2 (C_q), 54.5 (CD), 40.1 (CH_2), 21.4 (CH_3), 21.0 (CH_2). **^{19}F-NMR** (376 MHz, $CDCl_3$) δ = -112.9 Hz in analogy with its protio analogue.[4]

(ESI)-MS calcd for $C_{26}H_{21}D_2FN_2NaO_2S$ $[M+Na]^+$ 471.149 found 471.198; intensity 100%

(ESI)-MS calcd for $C_{26}H_{20}D_3FN_2NaO_2S$ $[M+Na]^+$ 472.155 found 472.183; intensity 36%

Average *d*- content for *d*-**4c** calculated from the isotopic abundance of MS analyses: 2.26

(*E*)-2-Tosyl-1-{2-[4-(trifluoromethyl)phenyl]vinyl-1,2-*d*$_2$}-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4d**)



Representative procedure **B** was followed using **3d** (99.2 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4d** (51.2 mg, 51%) as a yellowish solid. **M. p.** = 232.8 °C **^{1}H NMR** (400 MHz, Acetone-d_6) δ = 10.07 (s, 1H), 7.75 (d, *J* = 8.3 Hz, 2H), 7.66 (d, *J* = 8.3 Hz, 2H), 7.58 (d, *J* = 8.3 Hz, 2H), 7.41 (d, *J* = 7.8 Hz, 2H), 7.34 (d, *J* = 8.1 Hz, 1H), 7.23 (d, *J* = 8.1 Hz, 1H), 7.15 – 7.06 (m, 1H), 7.06 – 6.97 (m, 1H), 6.71 – 6.68 (m, 0.07H), 6.56 – 6.50 (m, 0.13H), 5.90 – 5.85 (m, 0.45H), 4.26 – 4.19 (m, 1H)*ref*, 3.49 (ddd, *J* = 13.8, 10.7, 5.3 Hz, 1H), 2.79 – 2.59 (m, 2H), 2.27 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.52 (s, 0.89D), 6.33 (s, 0.89D), 5.77 (s, 0.55D)*ref*. **^{13}C NMR** (101 MHz, Acetone-d_6) δ = 143.2 (C_q), 140.4 (C_q), 138.5 (C_q), 136.8 (C_q), 130.9 (CH), 130.8 (CD, weak), 129.5 (CH), 128.9 (d, $^{2}J_{C\text{-}F}$ = 32 Hz, C_q), 127.6 (CD, weak), 127.2 (CH), 127.1 (CH), 126.8 (C_q), 125.8 (d, $^{3}J_{C\text{-}F}$ = 4 Hz, CH), 124.4 (d, $^{1}J_{C\text{-}F}$ = 273 Hz, C_q), 121.7 (CH), 119.0 (CH), 118.0 (CH), 111.1 (CH), 107.9 (C_q), 54.8 (CD), 40.2 (CH_2), 20.8 (CH_3), 20.3 (CH_2). **^{19}F-NMR** (376 MHz, d_6-DMSO) δ = -61.0 Hz in analogy with its protio analogue.[4]

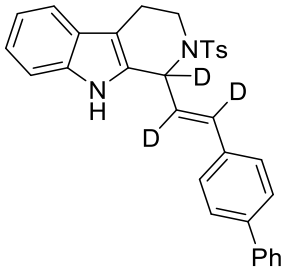
(ESI)-MS calcd for $C_{27}H_{21}D_2F_3N_2NaO_2S$ $[M+Na]^+$ 521.146 found 521.146; intensity 100%

(ESI)-MS calcd for $C_{27}H_{20}D_3F_3N_2NaO_2S$ $[M+Na]^+$ 522.125 found 521.984; intensity 24%

(ESI)-MS calcd for $C_{27}H_{22}DF_3N_2NaO_2S$ $[M+Na]^+$ 520.139 found 520.355; intensity 17%

Average *d*- content for *d*-**4d** calculated from the isotopic abundance of MS analyses: 2.05

(*E*)-1-{2-[(1,1'-Biphenyl)-4-yl]vinyl-1,2-d_2}-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4e**)



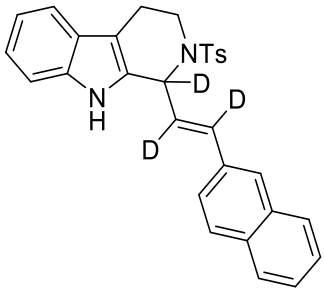
Representative procedure **B** was followed using **3e** (100.8 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4e** (53.8 mg, 53%) as a yellowish solid. **M. p.** = 151.9 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.99 (s, 1H), 7.74 – 7.70 (m, 2H), 7.64 – 7.59 (m, 2H), 7.57 – 7.53 (m, 2H), 7.50 – 7.44 (m, 2H), 7.44 – 7.37 (m, 3H), 7.36 – 7.30 (m, 2H), 7.23 – 7.19 (m, 1H) 7.17 – 7.10 (m, 3H), 6.54 –6.51 (m, 0.06H), 6.32 – 6.23 (m, 0.19H), 5.87 – 5.83 (m, 0.83H), 4.27 – 4.07 (m, 1H), 3.52 – 3.29 (m, 1H)$_{ref}$, 2.72 (dd, *J* = 8.1, 3.6 Hz, 2H), 2.31 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.66 – 6.28 (m, 1.88D), 5.74 (s, 0.17D)$_{ref}$. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 143.3 (C_q), 140.9 (C_q), 140.5 (C_q), 137.9 (C_q), 136.2 (C_q), 134.8 (C_q), 132.9 (CD, weak), 130.4 (C_q), 129.6 (CH), 128.9 (CH), 127.5 (CH), 127.2 (CH), 127.2 (CH), 127.1 (CH), 127.0 (CH), 126.7 (C_q), 126.3 (CD, weak), 122.3 (CH), 119.6 (CH), 118.4 (CH), 111.1 (CH), 109.2 (C_q), 54.7 (CD), 40.1 (CH_2), 21.4 (CH_3), 21.0 (CH_3).

(ESI)-MS calcd for $C_{32}H_{26}D_2N_2NaO_2S$ $[M+Na]^+$ 529.189 found 529.177; intensity 100%

(ESI)-MS calcd for $C_{32}H_{27}DN_2NaO_2S$ $[M+Na]^+$ 528.183 found 528.083; intensity 46%

Average *d*- content for *d*-**4e** calculated from the isotopic abundance of MS analyses: 1.73

(*E*)-1-[2-(Naphthalen-2-yl)vinyl-1,2-d_2]-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4f**)



Representative procedure **B** was followed using **3f** (95.6 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4f** (66.8 mg, 69%) as a yellowish solid. **M. p.** = 193.9 °C. **^{1}H NMR** (400 MHz,$CDCl_3$) δ = 8.06 (s, 1H), 7.85 – 7.80 (m, 1H), 7.74 (m, 4H), 7.64 – 7.58 (m, 1H), 7.53 – 7.47 (m, 2H), 7.47 – 7.37 (m, 2H), 7.32 (d, *J* = 8.4 Hz, 1H), 7.20 (ddd, *J* = 8.2, 7.0, 1.3 Hz, 1H), 7.17 – 7.10 (m, 1H), 7.08 (d, *J* = 8.0 Hz, 2H), 6.64 – 6.61 (m, 0.06H), 6.40 – 6.24 (m, 0.21H), 5.90 – 5.86 (m, 0.83H), 4.27 – 4.03 (m, 1H), 3.51 – 3.31 (m, 1H)$_{ref}$, 2.75 – 2.63 (m, 2H), 2.26 (s, 3H). **^{2}H NMR** (61 MHz, THF) δ = 6.68 – 6.34 (m, 1.75D), 5.85 (s, 0.17D)$_{ref}$. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 143.3 (C_q), 137.9 (C_q), 136.2 (C_q), 133.5 (C_q), 133.3 (CH), 133.2 (C_q), 132.7 (CD, weak), 130.3 (C_q), 129.6 (CH), 128.2 (C_q),

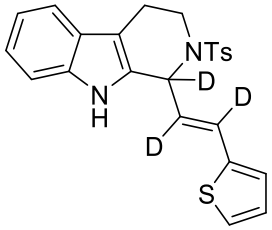
128.1 (CH), 127.7 (CH), 127.1 (CH), 127.0 (CH), 126.7 (C_q), 126.5 (CH), 126.4 (CD, weak), 126.3 (CH), 123.5 (CH), 122.3 (CH), 119.6 (CH), 118.3 (CH), 111.2 (CH), 109.0 (C_q), 54.7 (CD), 40.1 (CH_2), 21.4 (CH_3), 20.9 (CH_2).

(ESI)-MS calcd for $C_{30}H_{25}D_2N_2O_2S$ $[M+H]^+$ 481.192 found 482.373; intensity 100%

(ESI)-MS calcd for $C_{30}H_{24}D_3N_2O_2S$ $[M+H]^+$ 482.198 found 482.060; intensity 78%

Average *d*- content for *d*-**4f** calculated from the isotopic abundance of MS analyses: 2.44

(*E*)-1-[2-(Thiophen-2-yl)vinyl-1,2-*d*$_2$]-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4g**)



Representative procedure **B** was followed using **3g** (86.8 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4g** (53.9 mg, 62%) as a yellowish solid. **M. p.** = 102.8 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.92 (s, 1H), 7.76 – 7.65 (m, 2H), 7.44 (d, *J* = 7.8 Hz, 1H), 7.37 – 7.32 (m, 1H), 7.24 – 7.17 (m, 2H), 7.17 – 7.10 (m, 3H), 6.96 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.91 (dd, *J* = 3.6, 1.2 Hz, 1H), 6.66 – 6.58 (m, 0.07H), 6.10 – 6.04 (m, 0.11H), 5.81 – 5.77 (m, 0.66H), 4.14 (dt, *J* = 13.6, 3.4 Hz, 1H), 3.45 – 3.23 (m, 1H)$_{ref}$, 2.79 – 2.59 (m, 2H), 2.33 (s, 3H). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.59 (s, 0.93D), 6.06 (s, 0.91D), 5.86 (s, 0.34D)$_{ref}$. **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 143.3 (C_q), 140.8 (C_q), 137.9 (C_q), 136.2 (C_q), 130.2 (CD, weak), 130.1 (C_q), 129.6 (CH), 127.5 (CH), 127.0 (CH), 126.9 (CH), 126.7 (C_q), 125.6 (CD, weak), 125.2 (CH), 122.4 (CH), 119.7 (CH), 118.4 (CH), 111.1 (CH), 109.3 (C_q), 54.4 (CD), 40.0 (CH_2), 21.4 (CH_3), 20.9 (CH_2).

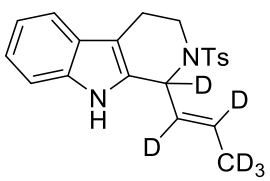
(ESI)-MS calcd for $C_{24}H_{21}D_2N_2O_2S_2$ $[M+H]^+$ 437.133 found 437.195; intensity 100%

(ESI)-MS calcd for $C_{24}H_{22}DN_2O_2S_2$ $[M+H]^+$ 436.126 found 436.202; intensity 32%

(ESI)-MS calcd for $C_{24}H_{20}D_3N_2O_2S_2$ $[M+H]^+$ 438.139 found 438.199; intensity 15%

Average *d*- content for *d*-**4g** calculated from the isotopic abundance of MS analyses: 1.88

(*E*)-1-(Prop-1-en-1-yl-*d*$_5$)-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4h**)



Representative procedure **B** was followed using **3h** (73.2 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4h** (38.2 mg, 51%) as a white solid.

M. p. = 99.6 °C. **^{1}H NMR** (400 MHz, acetone-d_6) δ = 9.91 (s, 1H), 7.76 – 7.65 (m, 2H), 7.42 – 7.32 (m, 2H), 7.27 (d, *J* = 8.1 Hz, 2H), 7.08 (ddd, *J* = 8.1, 7.0, 1.3 Hz, 1H), 6.98 (td, *J* = 7.5, 7.0, 1.1 Hz, 1H)*ref*, 5.65 – 5.60 (m, 0.27H), 5.60 – 5.54 (m, 0.11H), 4.13 (ddd, *J* = 13.8, 5.0, 2.1 Hz, 1H), 3.34 (ddd, *J* = 13.8, 10.5, 5.6 Hz, 1H), 2.70 – 2.57 (m, 2H), 2.32 (s, 3H), 1.64 – 1.58 (m, 1.71H). **^{2}H NMR** (61 MHz, Acetone) δ = 5.89 – 5.25 (m, 2.63D)*ref*, 1.54 (s, 1.67D). **^{13}C NMR** (101 MHz, acetone-d_6) δ = 143.0 (C_q), 138.8 (C_q), 136.6 (C_q), 131.7 (C_q), 129.3 (CH), 128.5 (CD, weak), 128.1 (CD, weak), 127.0 (CH), 126.8 (C_q), 121.4 (CH), 118.8 (CH), 117.8 (CH), 111.0 (CH), 107.42 (C_q), 54.5 (CD), 39.7 (CH_2), 20.6 (CH_3), 20.4 (CH_2), 16.6 (CD_3).

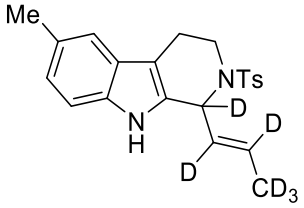
(ESI)-MS calcd for $C_{21}H_{20}D_3N_2O_2S$ $[M+H]^+$ 370.17 found 370.19; intensity 100%

(ESI)-MS calcd for $C_{21}H_{19}D_4N_2O_2S$ $[M+H]^+$ 371.17 found 371.19; intensity 41%

(ESI)-MS calcd for $C_{21}H_{21}D_2N_2O_2S$ $[M+H]^+$ 369.16 found 369.07; intensity 22%

Average *d*- content for *d*-**4h** calculated from the isotopic abundance of MS analyses: 3.12

(*E*)-6-Methyl-1-(prop-1-en-1-yl-d$_5$)-2-tosyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-b]indole-1-*d* (*d*-**4i**)



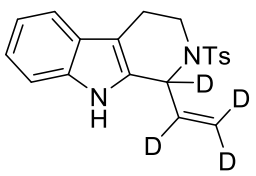
Representative procedure **B** was followed using **3i** (76.0 mg, 0.20 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**4i** (42.6 mg, 55%) as a white solid**.** **M. p.** = 91.2 °C. **^{1}H NMR** (300 MHz, acetone-d_6) δ = 9.78 (s, 1H), 7.71 (d, *J* = 8.3 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.2 Hz, 1H), 7.14 (s, 1H), 6.91 (dd, *J* = 8.2 Hz, 1H)*ref*, 5.64 – 5.62 (m, 0.15H), 5.61 – 5.58 (m, 0.23), 5.57 – 5.53 (m, 0.09H), 4.11 (ddd, *J* = 13.7, 4.5, 2.4 Hz, 1H), 3.32 (ddd, *J* = 13.8, 10.0, 6.2 Hz, 1H), 2.64 – 2.60 (m, 2H), 2.37 (s, 3H), 2.32 (s, 3H), 1.63 – 1.58 (2.58H). **^{2}H NMR** (61 MHz, Acetone) δ = 5.87 – 5.23 (m, 2.53D)*ref*, 1.52 (s, 1.1D). **^{13}C NMR** (75 MHz, acetone-d_6) δ = 143.0 (C_q), 138.8 (C_q), 134.9 (C_q), 131.8 (C_q), 131.7 (C_q), 129.3 (CH), 128.4 (CD, weak), 128.0 (CD, weak), 128.3 (C_q), 127.6 (CH), 127.0 (CH), 122.9 (CH), 117.6 (CH), 110.7 (CH), 106.9 (C_q), 54.6 (CD), 39.7 (CH_2), 20.7 (CH_3), 20.6 (CH_2), 20.4 (CH_2), 16.6 (CD_3).

(ESI)-MS calcd for $C_{22}H_{19}D_5KN_2O_2S$ $[M+K]^+$ 424.15 found 424.18; intensity 100%

(ESI)-MS calcd for $C_{22}H_{20}D_4KN_2O_2S$ $[M+K]^+$ 423.15 found 423.17; intensity 28%

Average *d*- content for *d*-**4i** calculated from the isotopic abundance of MS analyses: 4.78

2-Tosyl-1-(vinyl-*d*$_3$)-2,3,4,9-tetrahydro-1H-pyrido[3,4-b]indole-1-*d* (*d*-**9a**)



Representive procedure **B** was followed using *N*-[2-(1*H*-indol-3-yl)ethyl)-4-methyl-*N*-(propa-1,2-dien-1-yl]benzenesulfonamide **5a** (105.6 mg, 0.30 mmol). Purification by column chromatography on silica gel (*n*-hexanes/EtOAc 95:5→80:20) yielded *d*-**9a** (56.3 mg, 53%) as a white solid. **M. p.** = 172.1 °C. **^{1}H NMR** (300 MHz, acetone-d_6) δ = 9.97 (s, 1H), 7.83 – 7.69 (m, 2H), 7.44 – 7.31 (m, 2H), 7.26 (d, *J* = 7.9 Hz, 2H), 7.09 (ddd, *J* = 8.3, 7.0, 1.2 Hz, 1H), 6.99 (ddd, *J* = 8.0, 7.1, 1.1 Hz, 1H), 6.11 – 5.98 (m, 0.18H), 5.73 – 5.69 (m, 0.84H), 5.26 – 5.17 (m, 1.75H), 4.23 – 4.01 (m, 1H)$_{ref}$, 3.37 (ddd, *J* = 14.1, 10.6, 5.7 Hz, 1H), 2.68 – 2.50 (m, 2H), 2.31 (s, 3H). **^{2}H NMR** (61 MHz, Acetone) δ = 6.02 (s, 0.81D), 5.66 (s, 0.11D), 5.17 (s, 0.25D)$_{ref}$. **^{13}C NMR** (75 MHz, acetone-d_6) δ = 143.1 (C_q), 138.7 (C_q), 136.6 (C_q), 135.5 (CD, weak), 130.8 (C_q), 129.4 (CH), 126.9 (CH), 126.8 (C_q), 121.5 (CH), 118.9 (CH), 117.9 (CH), 116.8 (CD_2), 111.1 (CH), 107.7 (C_q), 54.8 (CD), 39.7 (CH_2), 20.4 (CH_3), 20.4 (CH_2).

(ESI)-MS calcd for $C_{20}H_{19}DN_2NaO_2S$ $[M+Na]^+$ 376.12 found 376.01; intensity 100%

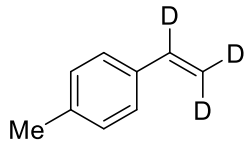
(ESI)-MS calcd for $C_{20}H_{18}D_2N_2NaO_2S$ $[M+Na]^+$ 377.13 found 376.95; intensity 81%

(ESI)-MS calcd for $C_{20}H_{17}D_3N_2NaO_2S$ $[M+Na]^+$ 378.13 found 377.97; intensity 18%

Average *d*- content for *d*-**9a** calculated from the isotopic abundance of MS analyses: 1.58

Synthesis of Deuterated Styrenes

1-Methyl-4-(vinyl-d_3)benzene (*d*-10a)



In an oven dried tube, **10a** (118 mg, 1.0 mmol), $Pd(PPh_3)_4$ (0.05 mmol, 5 mol %), PCy_3 (0.1 mmol, 10 mol %) and (+)-mandelic acid (0.3 mmol, 30 mol%) were added sequentially and purged with nitrogen three times. Subsequently, toluene (500 µl, 0.1 M) and D_2O (50 mmol, 50 equiv.) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes) yielding *d*-**10a** (76.6 mg, 63%) as a pale oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.35 (d, *J* = 8.2 Hz, 2H)$_{ref}$, 7.17 (d, *J* = 7.9 Hz, 2H), 6.78 – 6.67 (m, 0.32H), 5.71 – 5.68 (m, 0.03H), 5.24 – 5.18 (m, 0.03H), 2.38 (s, 3H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 137.6 (C_q), 136.5 (C_q), 134.83 (CD, weak), 129.2 (CH), 126.1 (CH), 112.6 (CD_2, weak), 21.2 (CH_3). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.74 (s, 0.66D), 5.72 (s, 0.97D)$_{ref}$, 5.22 (s, 1D).

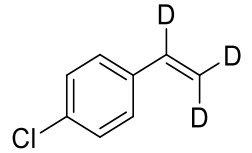
(ESI)-MS calcd for $C_9H_8D_3$ $[M+H]^+$ 122.10 found 122.02, intensity 100%

(ESI)-MS calcd for $C_{21}H_9D_2$ $[M+H]^+$ 121.10 found 121.18, intensity 63%

(ESI)-MS calcd for $C_{21}H_{10}D$ $[M+H]^+$ 120.10 found 120.02, intensity 13%

Average *d*- content for *d*-**10a** calculated from the isotopic abundance of MS analyses: 2.49

1-Chloro-4-(vinyl-d_3)benzene (*d*-10b)



In an oven dried tube, **10b** (138 mg, 1.0 mmol), $Pd(PPh_3)_4$ (0.05 mmol, 5 mol%), PCy_3 (0.1 mmol, 10 mol%) and (+)-mandelic acid (0.3 mmol, 30 mol%) were added sequentially and purged with nitrogen three times. Subsequently, toluene (500 µl, 0.1 M) and D_2O (50 mmol, 50 equiv.) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes) yielding *d*-**10b** (90.9 mg, 65%) as a pale oil. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.45 – 7.27 (m, 4H)$_{ref}$, 6.73 – 6.66 (m, 0.74H), 5.78 – 5.69 (m, 0.03H), 5.34 – 5.26 (m, 0.03H). **^{13}C NMR** (75 MHz, $CDCl_3$) δ = 136.0 (CD, weak), 135.5 (C_q), 133.4 (C_q), 128.70 (CH), 127.46 (CH), 114.4 (CD_2, weak). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.66 (s, 0.20D)$_{ref}$, 5.71 (s, 1D), 5.25 (s, 1D).

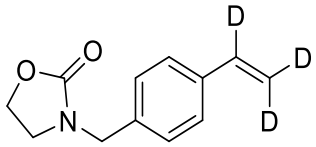
(ESI)-MS calcd for $C_8H_6D_2Cl$ $[M+H]^+$ 141.04 found 141.12, intensity 100%

(ESI)-MS calcd for $C_8H_5D_3Cl$ $[M+H]^+$ 142.05 found 142.13, intensity 41%

(ESI)-MS calcd for C_8H_7DCl $[M+H]^+$ 140.04 found 140.08, intensity 26%

Average *d*- content for *d*-**10b** calculated from the isotopic abundance of MS analyses: 2.08.

3-[4-(Vinyl-*d*$_3$)benzyl]oxazolidin-2-one (*d*-10c)



In an oven dried tube, **10c** (83.2 mg, 0.40 mmol) $Pd(PPh_3)_4$ (0.02 mmol, 5 mol%), PCy_3 (0.04 mmol, 10 mol%) and (+)-mandelic acid (0.12 mmol, 30 mol%) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.2 M) and D_2O (20 mmol, 50 equiv.) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes/EtOAc 80:20→55:45) yielded *d*-**10c** (66.9 mg, 80%) as a viscous oil. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.41 (dd, *J* = 8.0, 2.1 Hz, 2H), 7.26 (d, *J* = 7.8 Hz, 2H), 6.73 – 6.67 (m, 0.77H), 5.79 – 5.71 (m, 0.03H), 5.36 – 5.23 (m, 0.04H), 4.43 (d, *J* = 2.0 Hz, 2H)$_{ref}$, 4.35 – 4.28 (m, 2H), 3.54 – 3.32 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 158.6 (C_q), 137.4 (CD), 136.1 (C_q), 135.3 (C_q), 128.5 (CH), 126.7 (CH), 114.2 (CD_2, weak), 61.8 (CH_2), 48.2 (CH_2), 43.9 (CH_2). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.73 (0.23D)$_{ref}$, 5.75 (1D), 5.26 (1D).

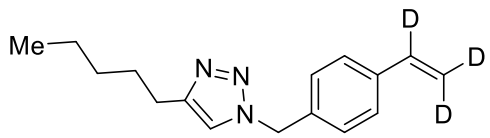
(ESI)-MS calcd for $C_{12}H_{11}D_2NNaO_2$ $[M+Na]^+$ 228.10 found 228.18, intensity 100%

(ESI)-MS calcd for $C_{12}H_{10}D_3NNaO_2$ $[M+Na]^+$ 229.10 found 229.02, intensity 35%

(ESI)-MS calcd for $C_{12}H_{12}DNNaO_2$ $[M+Na]^+$ 227.09 found 227.00 intensity 27%

Average *d*- content for *d*-**10c** calculated from the isotopic abundance of MS analyses: 2.05.

4-Pentyl-1-[4-(vinyl-*d*$_3$)benzyl]-1*H*-1,2,3-triazole (*d*-10d)



In an oven dried tube, **10d** (76.5 mg, 0.3 mmol), $Pd(PPh_3)_4$ (0.015 mmol, 5 mol%), PCy_3 (0.03 mmol, 10 mol%) and (+)-mandelic acid (0.09 mmol, 30 mol%) were added sequentially and purged with nitrogen three times. Subsequently, toluene (3.0 ml, 0.1 M) and D_2O (15 mmol, 50 equiv.) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel (*n*-hexanes/EtOAc 80:20) yielded *d*-**10d** (63.9

mg, 82%) as a white solid. M. p. = 72.7 °C. **^{1}H NMR** (300 MHz, $CDCl_3$) δ = 7.45 – 7.35 (m, 2H), 7.25 – 7.14 (m, 3H), 6.72 – 6.66 (m, 0.36H), 5.79 – 5.64 (m, 0.13H), 5.48 (s, 2H)*ref*, 5.30 – 5.22 (m, 0.13H), 2.81 – 2.56 (m, 2H), 1.74 – 1.52 (m, 2H), 1.32 (h, *J* = 3.5 Hz, 4H), 0.93 – 0.78 (m, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ = 149.0 (C_q), 138.0 (C_q), 135.8 (CD), 134.4 (C_q), 128.2 (CH), 126.8 (CH), 120.5 (CH), 114.0 (CD_2, weak), 53.7 (CH_2), 31.4 (CH_2), 29.1 (CH_2), 25.7 (CH_2), 22.4 (CH_2), 14.0 (CH_3). **^{2}H NMR** (61 MHz, $CHCl_3$) δ = 6.71 (s, 0.64D)*ref*, 5.76 (s, 1D), 5.30 (s, 1D).

(ESI)-MS calcd for $C_{16}H_{20}D_2N_3$ $[M+H]^+$ 259.20 found 259.28, intensity 100%

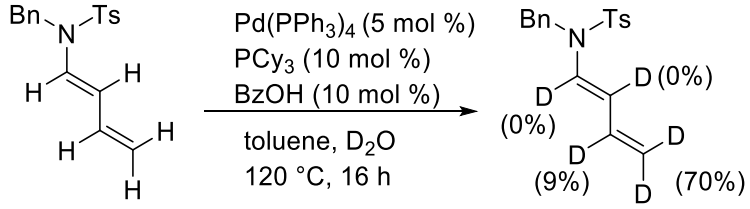
(ESI)-MS calcd for $C_{16}H_{19}D_3N_3$ $[M+H]^+$ 258.20 found 258.29, intensity 69%

(ESI)-MS calcd for $C_{16}H_{21}DN_3$ $[M+H]^+$ 257.19 found 257.28, intensity 13%

Average *d*- content for *d*-**10c** calculated from the isotopic abundance of MS analyses: 2.30.

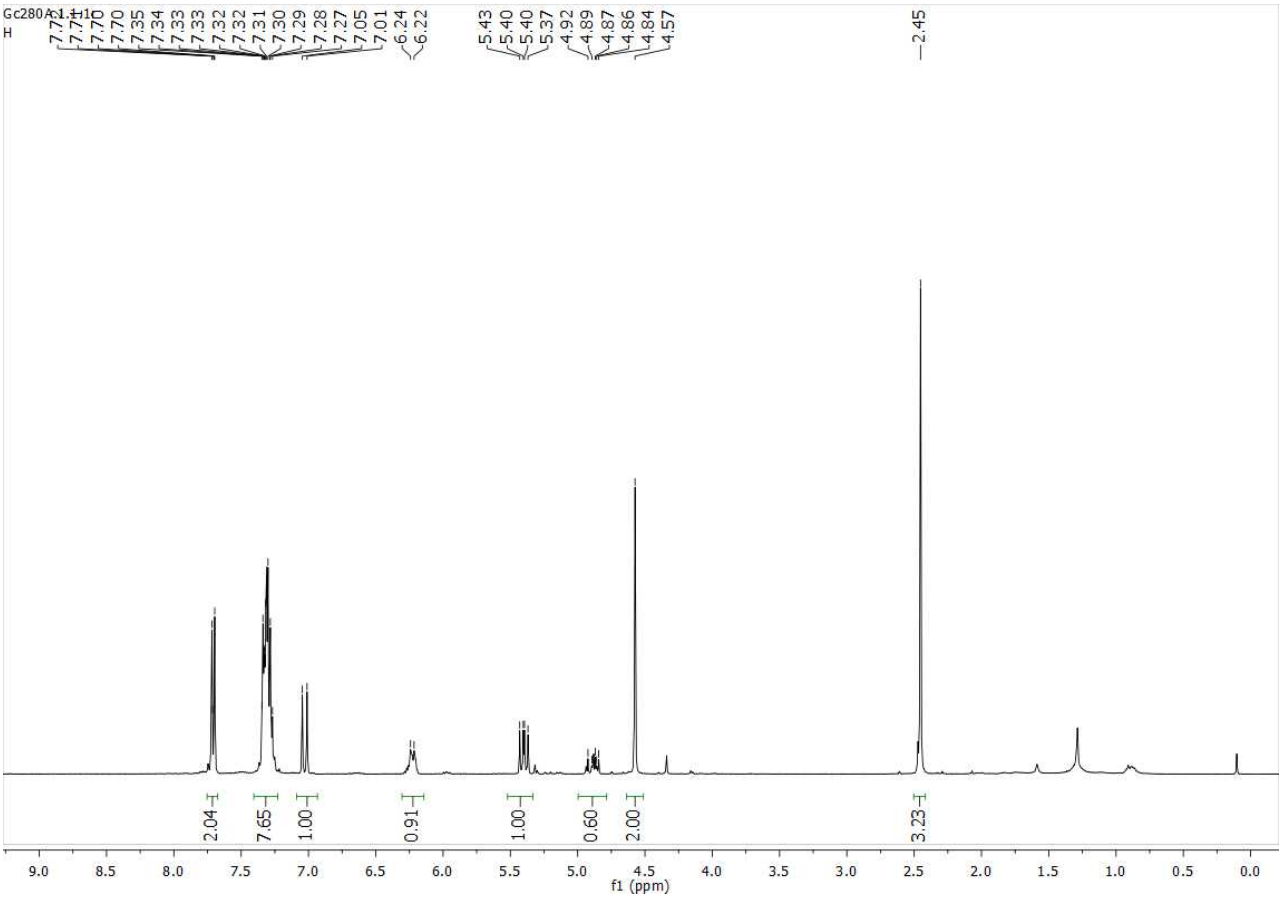
Mechanistic Studies

Deuteration of diene 2a

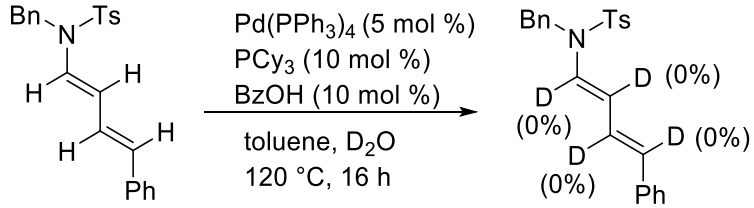


2a *d*-**2a**

In an oven dried tube, **2a** (62.6 mg, 0.20 mmol), $Pd(PPh_3)_4$ (0.01 mmol), PCy_3 (0.02 mmol) and BzOH (0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (10 mmol, 50 equiv) were added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel to yield *d*-**2a** (49.7 mg, 79%) as a yellow oil.

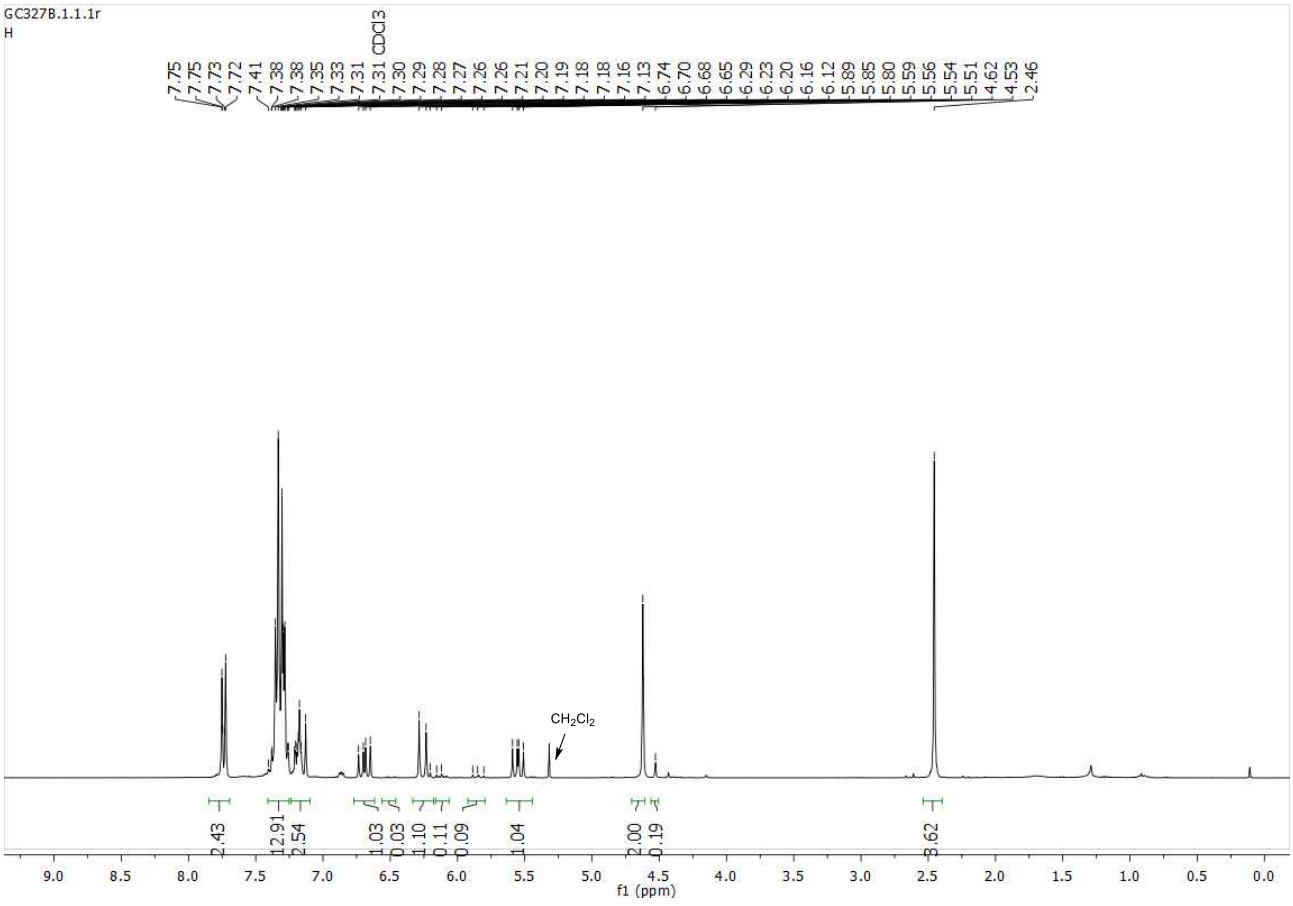


Attempted deuteration of diene 2g

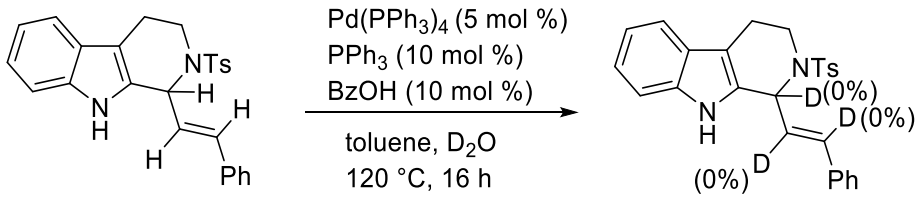


2g **2g**

In an oven dried tube, **2g** (77.8 mg, 0.20 mmol), $Pd(PPh_3)_4$ (0.01 mmol), PCy_3 (0.02 mmol) and BzOH (0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (10 mmol, 50 equiv) were added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel to yield **2g** (54.9 mg, 71%) as a white solid (*E*:*Z* = 10:1).

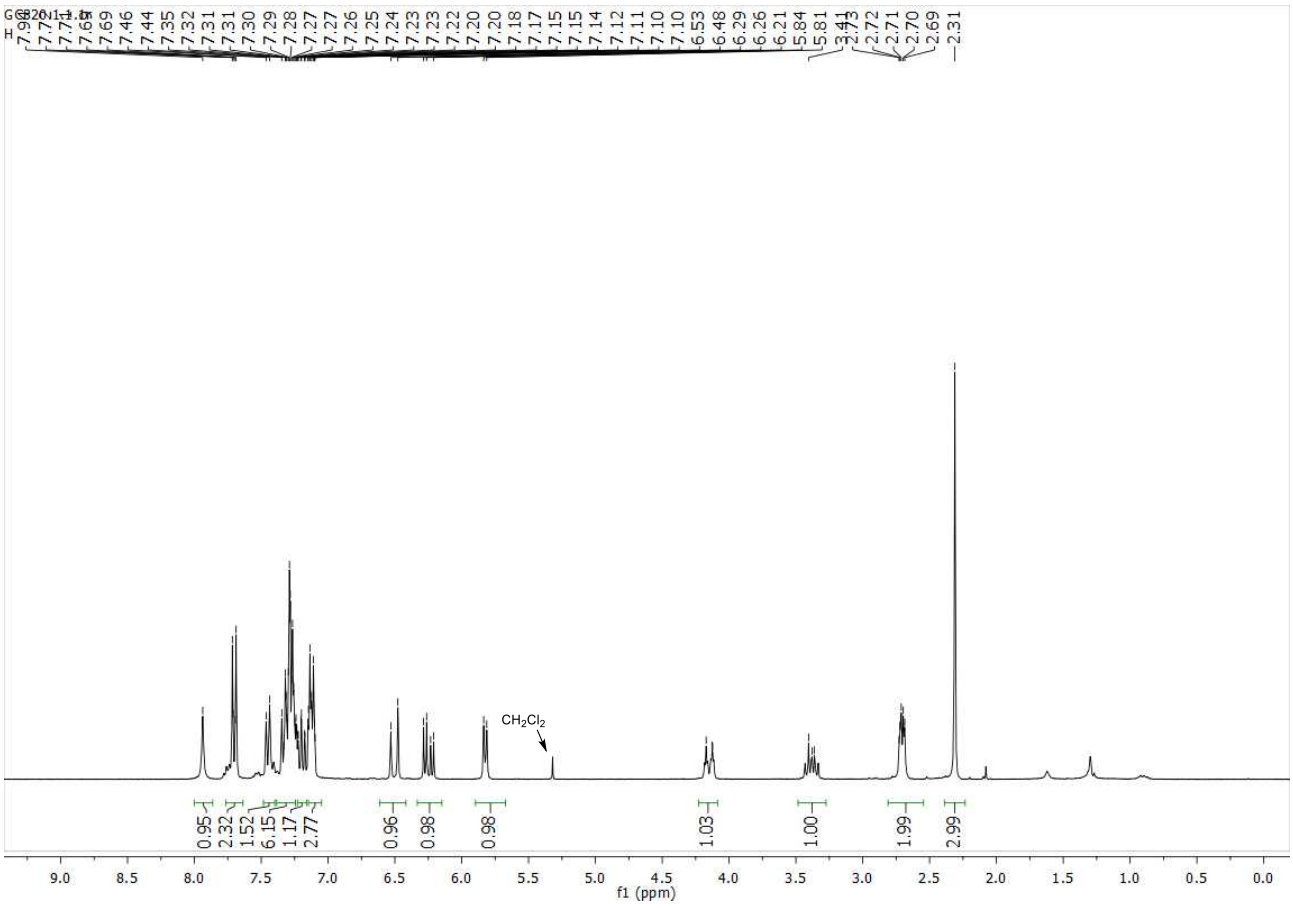


Attempted deuteration of carboline 4a

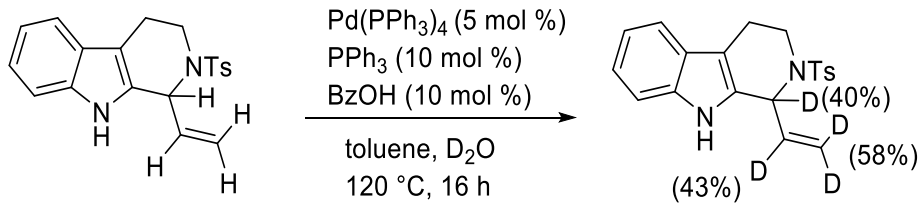


4a **4a**

In an oven dried tube, **4a** (42.8 mg, 0.10 mmol), $Pd(PPh_3)_4$ (0.005 mmol), PPh_3 (0.01 mmol) and BzOH (0.01 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (5 mmol, 50 equiv) were added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel to yield **4a** (33.0 mg, 77%) as a white solid.

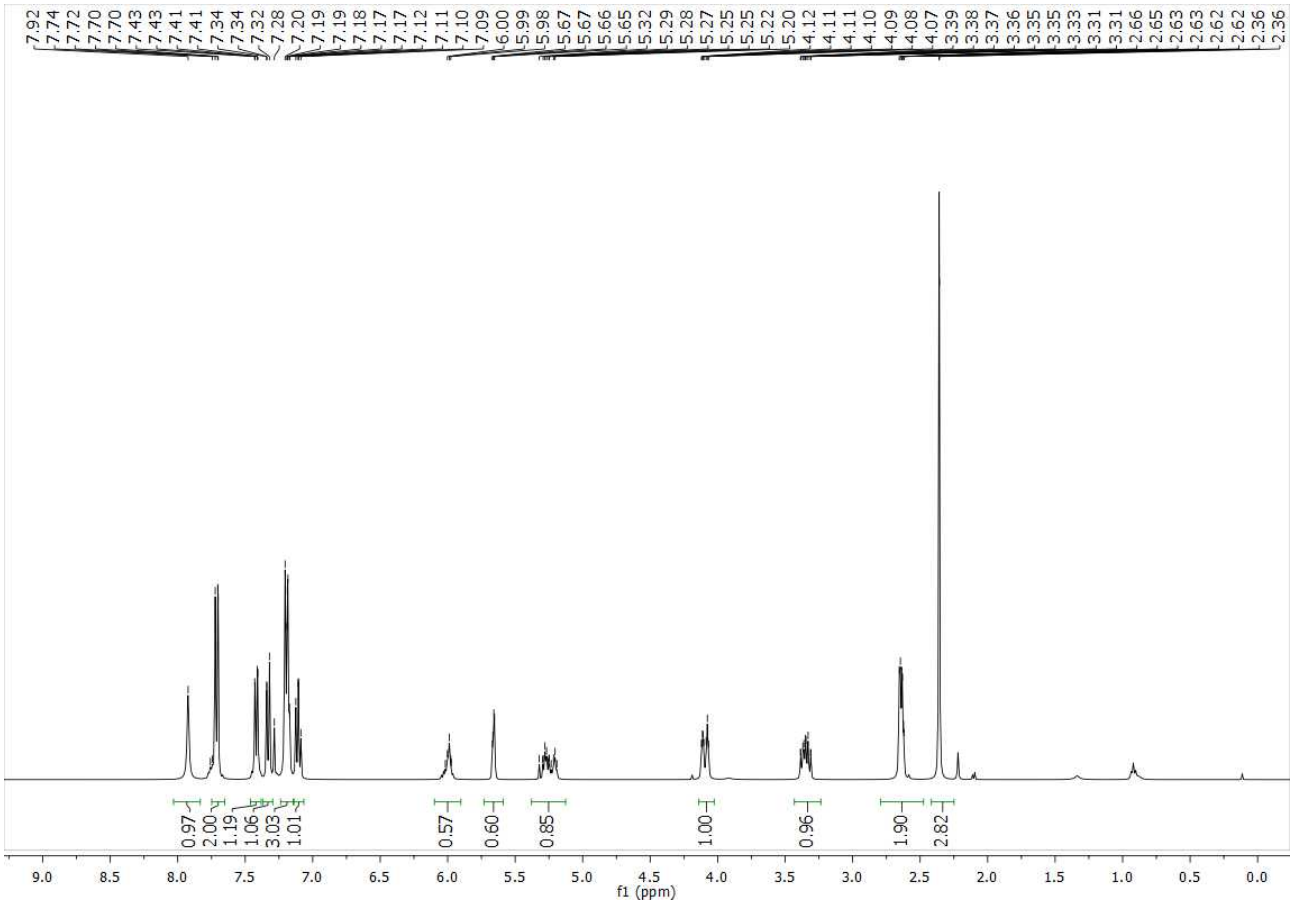


Deuteration of carboline 9a

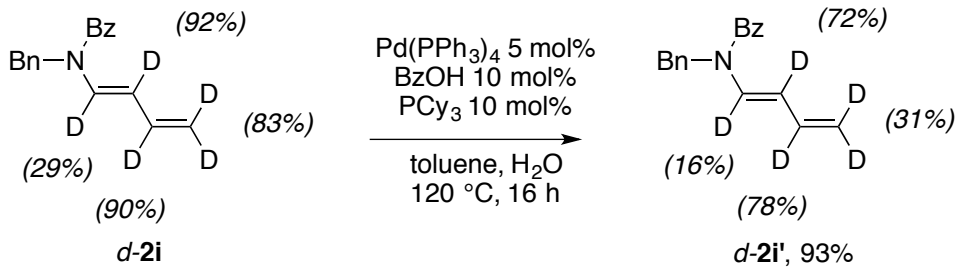


9a *d*-**9a**

In an oven dried tube, **9a** (49.3 mg, 0.14 mmol), $Pd(PPh_3)_4$ (0.0075 mmol), PPh_3 (0.014 mmol) and BzOH (0.014 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (7 mmol, 50 equiv) were added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel to yield *d*-**9a** (34.7 mg, 70%) as a white solid.

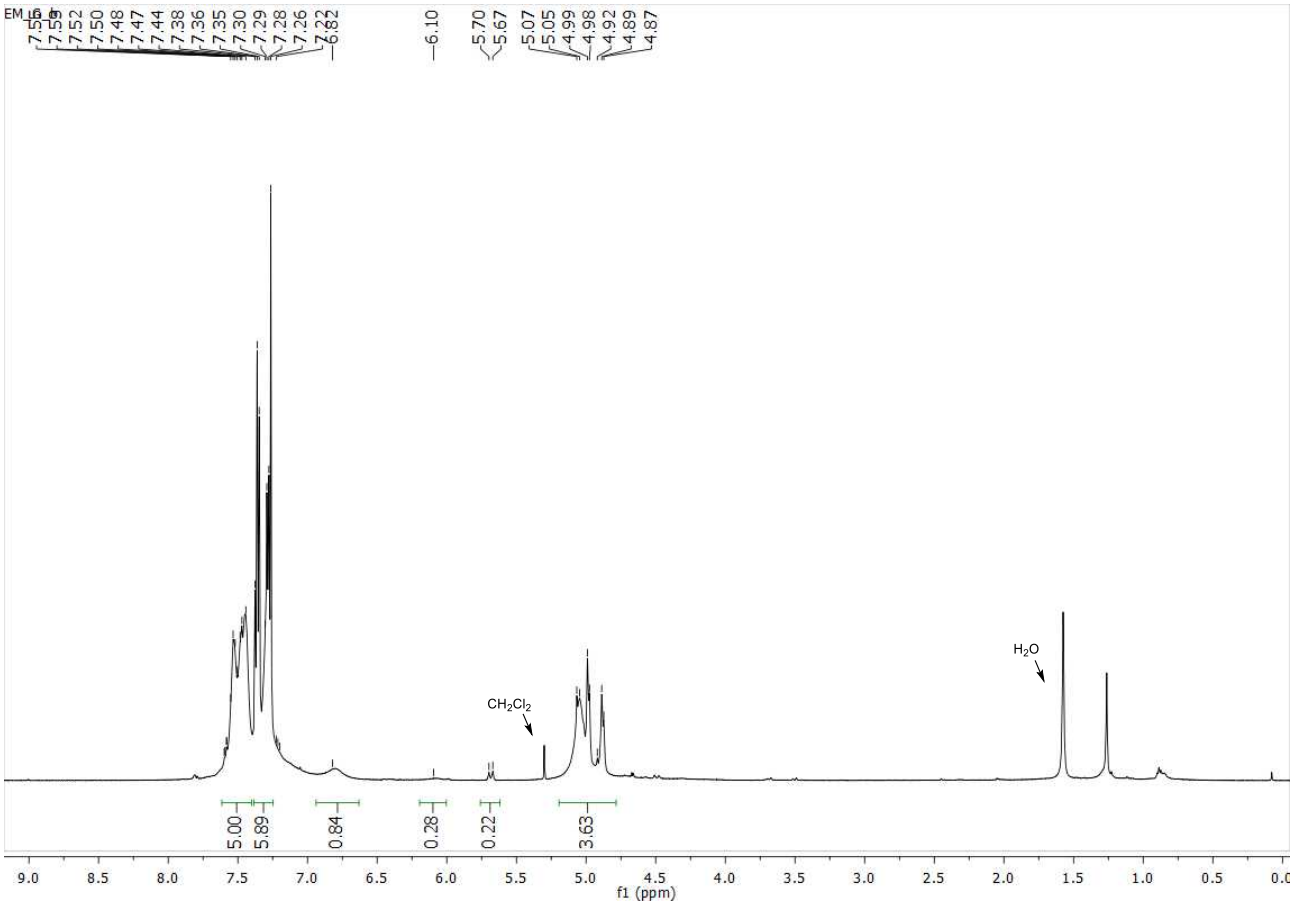


"Washing-out" Experiment on *d*-2i

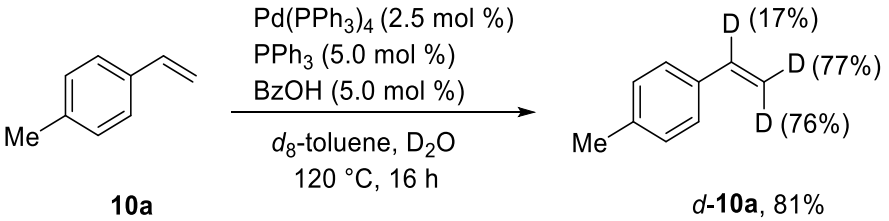


d-**2i** *d*-**2i'**, 93%

In an oven dried tube, *d*-**2i** (53.4 mg, 0.20 mmol), $Pd(PPh_3)_4$ (0.01 mmol), PCy_3 (0.02 mmol) and BzOH (0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and H_2O (10 mmol, 50 equiv) were added under N_2 atmosphere and the tube placed in a pre-heated oil bath at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and CH_2Cl_2 (10 ml) was added. The mixture was concentrated under reduced pressure and the crude purified by chromatography on silica gel to yield *d*-**2i'** (49.4 mg, 93%) as a white oil.

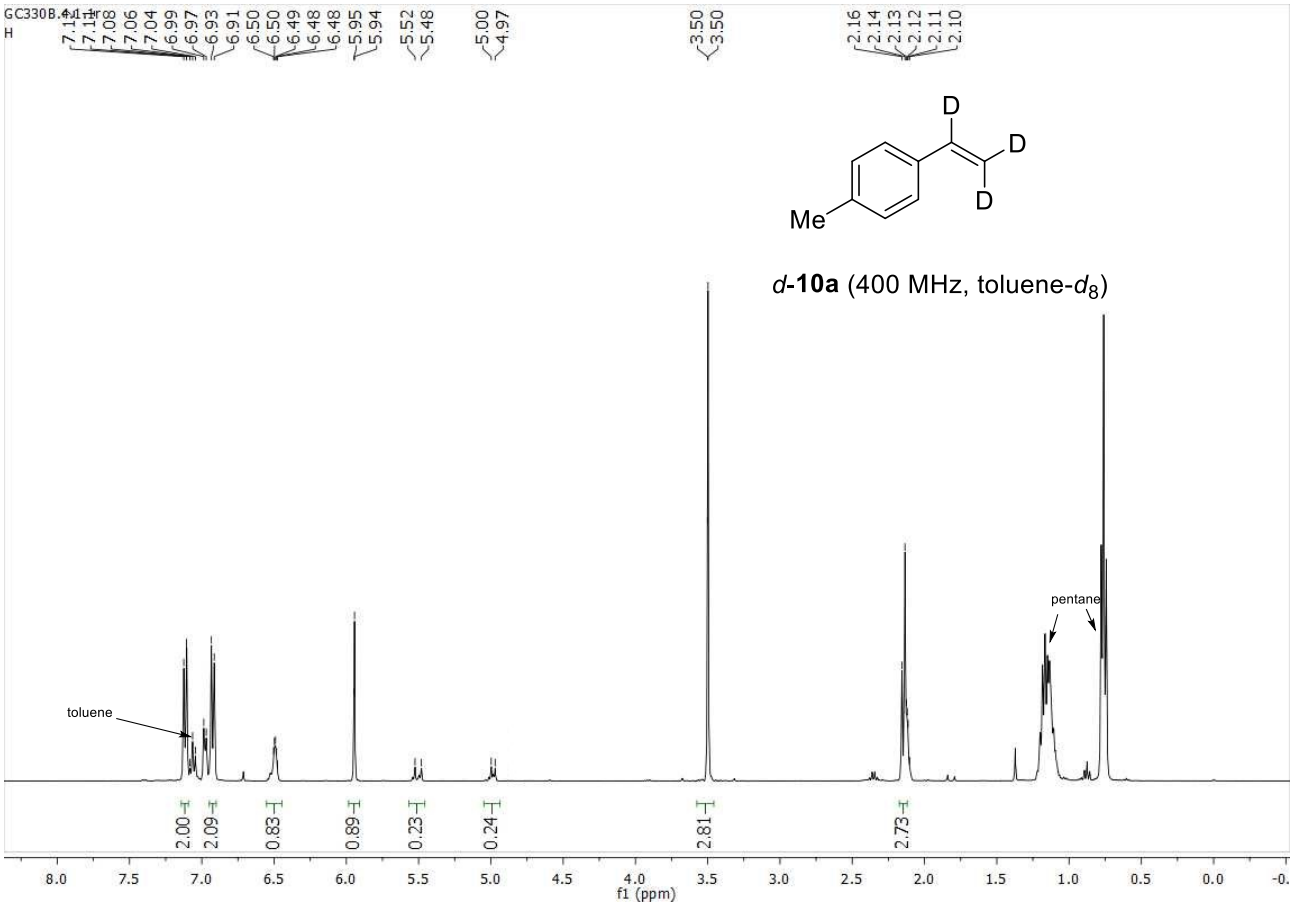


Deuteration of styrene 10a under model conditions

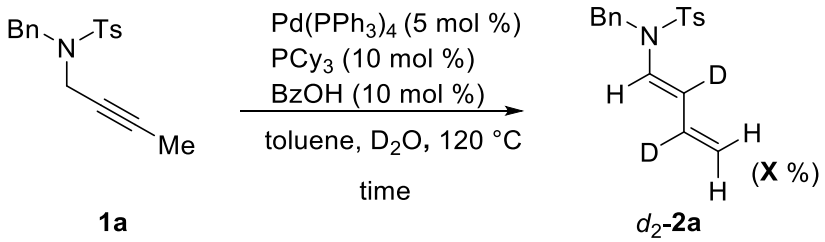


10a *d*-**10a**, 81%

In an oven dried tube, **10a** (47.2 mg, 0.40 mmol), $Pd(PPh_3)_4$ (11.5 mg, 0.01 mmol), PPh_3 (5.6 mg, 0.02 mmol) and BzOH (2.5 mg, 0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, d_8-toluene (1.0 ml, 0.4 M) and D_2O (20 mmol, 50 equiv) were added under N_2 atmosphere and the tube was placed in a oil bath pre-heated at 120 °C overnight (16 hs). The reaction mixture was then cooled down at room temperature and pentane (10 ml) was added. The mixture was passed through a pad of silica and then carefully concentrated under reduced pressure. The resulting *crude* has been analyzed by ^{1}H-NMR using 1,3,5-trimethoxybenzene (16.3 mg) as the internal standard.



Reaction profile through time



1a d_2-**2a**

Experiments were performed running four parallel independent reactions. In four oven dried tubes, **1a** (62.4 mg, 0.20 mmol), $Pd(PPh_3)_4$ (0.01 mmol), PCy_3 (0.02 mmol) and BzOH (0.02 mmol) were added sequentially and purged with nitrogen three times. Subsequently, toluene (2.0 ml, 0.1 M) and D_2O (10 mmol) were added under N_2 atmosphere and the tubes were placed in a oil bath pre-heated at 120 °C. After 15, 30, 45 and 60 minutes, respectively, each reaction mixtures was cooled down at room temperature and diluted with CH_2Cl_2 (10 ml). Sequentially, each mixtures was then passed over a pad of silica, concentrated under reduced pressure and the resulting crude was eventually analyzed by ^{1}H-NMR spectroscopy using 1,3,5-trimethoxybenzene as the internal standard.

Table S1. Analysis of the reaction profile *via* NMR

Entry	[min]	I.S. (mg)	A[**2**]/A[I.S.]	Yield d_2-**2a** [%]	D_X [%]	H_X [%]
1	15	8.6	1/5.7	5	11	89
2	30	13.2	1/2.4	16	23	77
3	45	14.0	1/1.9	22	33	67
4	60	10.1	1/1.0	32	40	60

The yield of **2a** was measured by comparing the intensity of its benzylic methylene signal with the internal standard in experiments taken from fifteen minutes up to one hour. The product increases through time up to 32% after 60 min. Resonances of $C(sp_2)$−H signals corresponding to the β− and γ− carbons of diene **2a** were not observed among these four experiments. On the contrary, signals due to $C(sp_2)$−H groups in the α− and the δ− positions were clearly observed. In particular, the *protio* content on the terminal methylene of **2a** is 89%, 77%, 67% and 60%, respectively, throughout this series of experiments. This shows that d_2-**2a** is the most abundant isotopomer at the initial stage of the reaction. Beyond this point, a progressive deuteration of the terminal methylene group of **2a** was observed, up to 93% *d*- after 16 hs (68% isolated yield).

Figure S1. Plot of the yield of diene d_2-**2a** through time

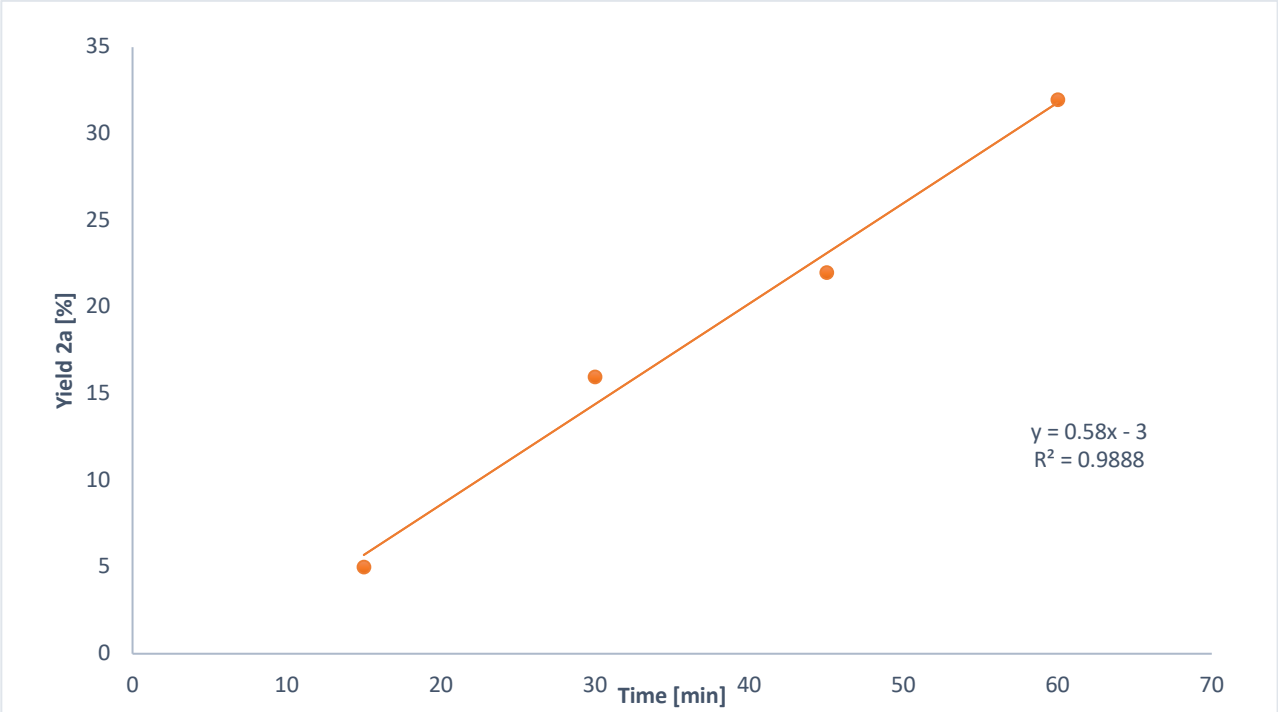


Figure S2. Plot of the deuteration of methylene unit of diene d_2-**2a** through time

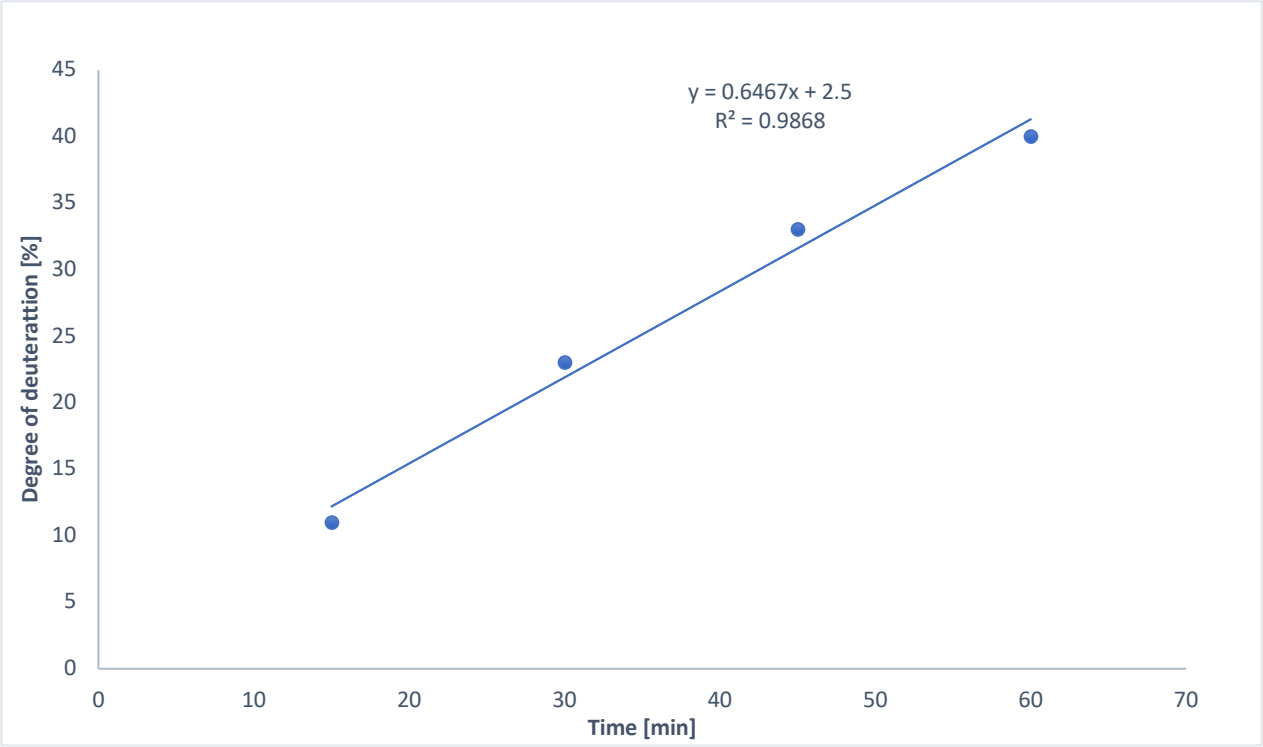
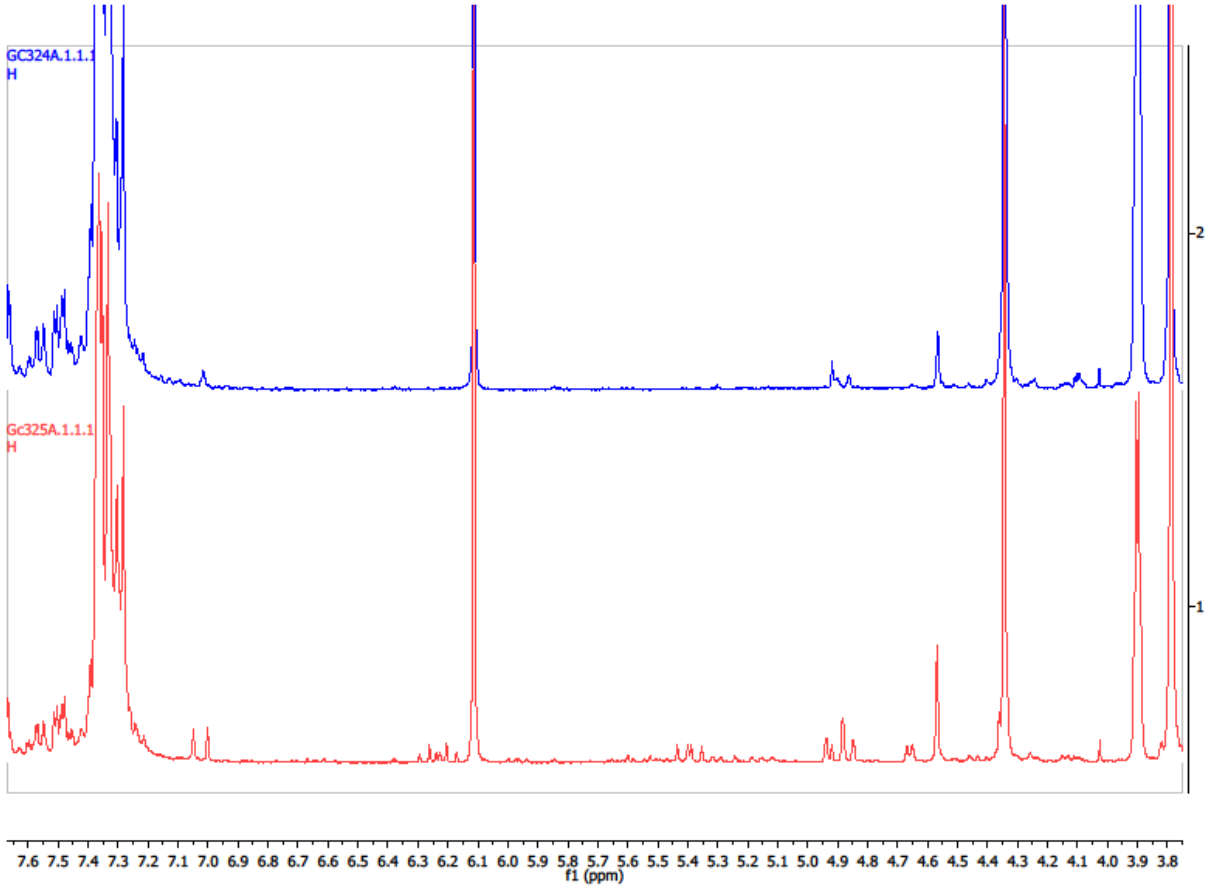
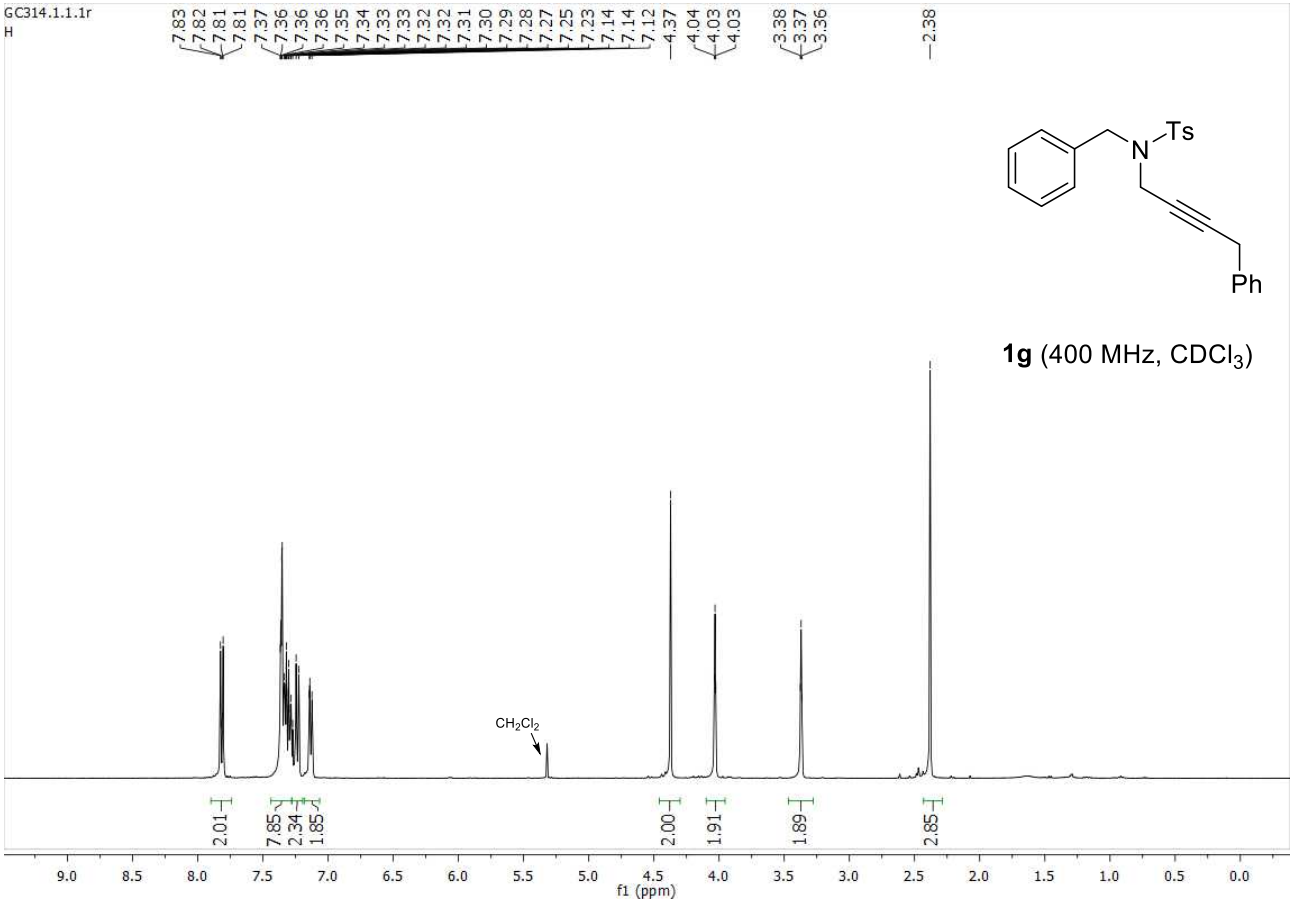


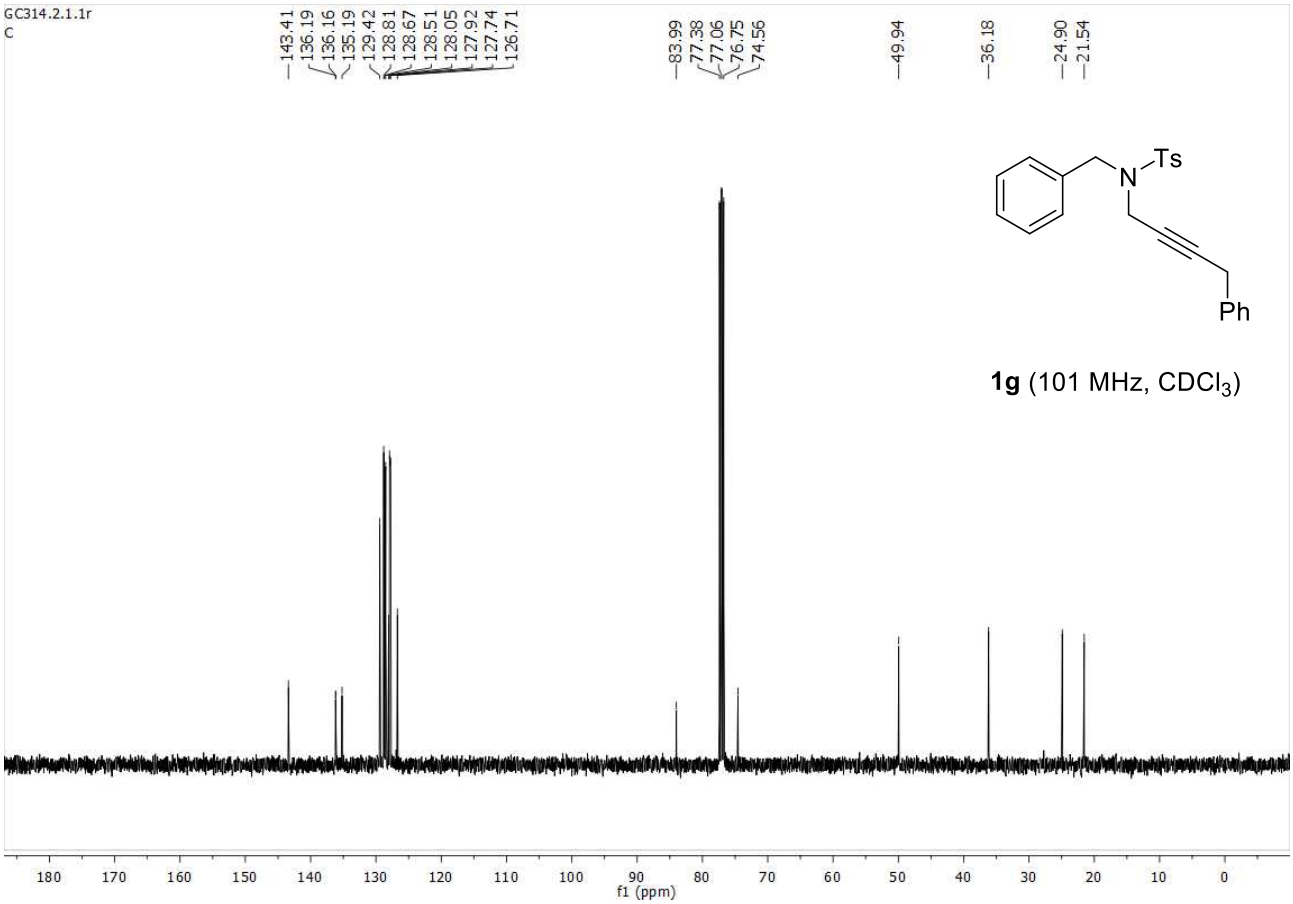
Figure S3. Comparison of the ^{1}H-NMR spectra recorded at 15 minutes for the isomerization of propargylamide **1a** performed in D_2O and H_2O (blue and red curves, respectively).



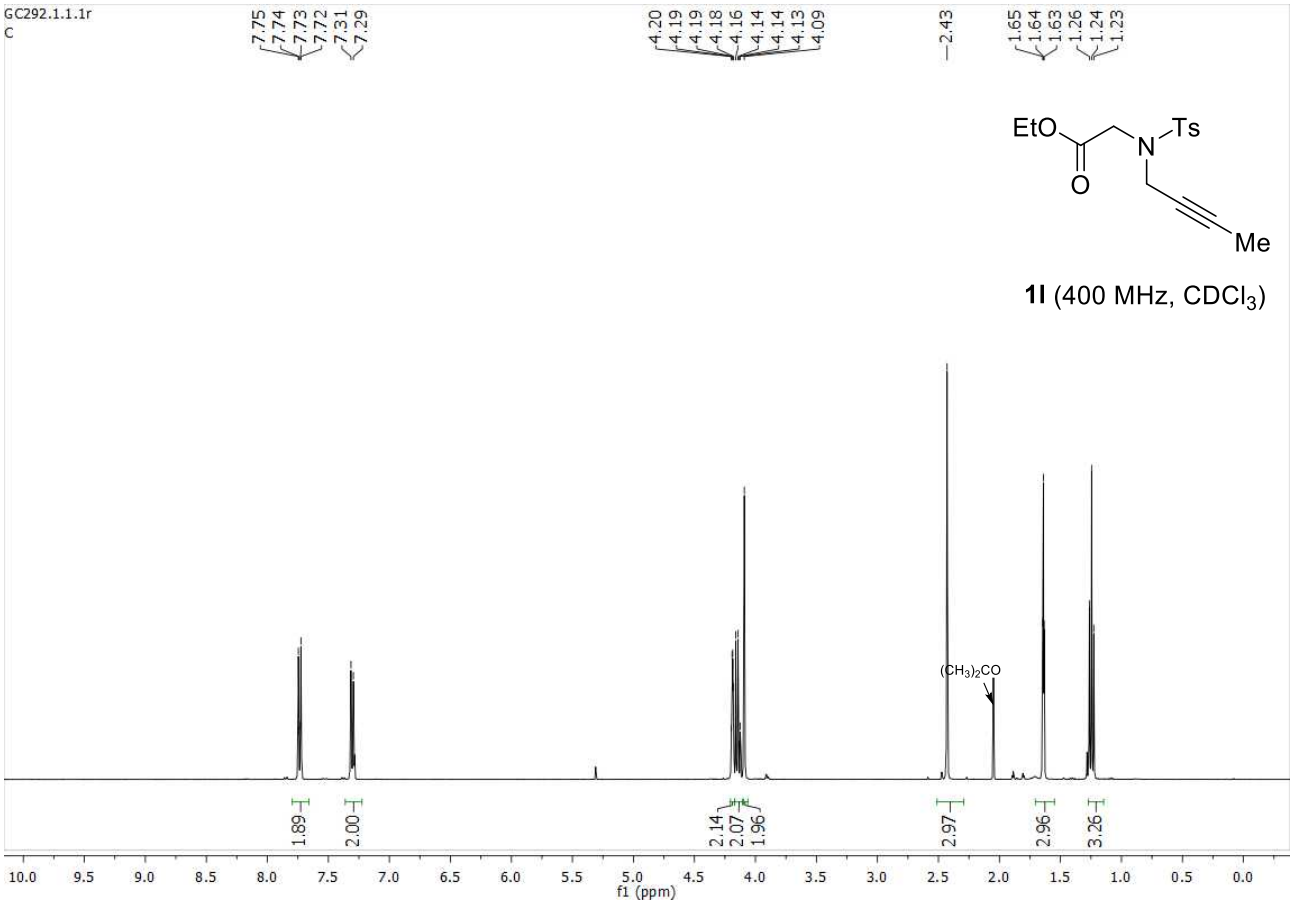
Copies of NMR Spectra



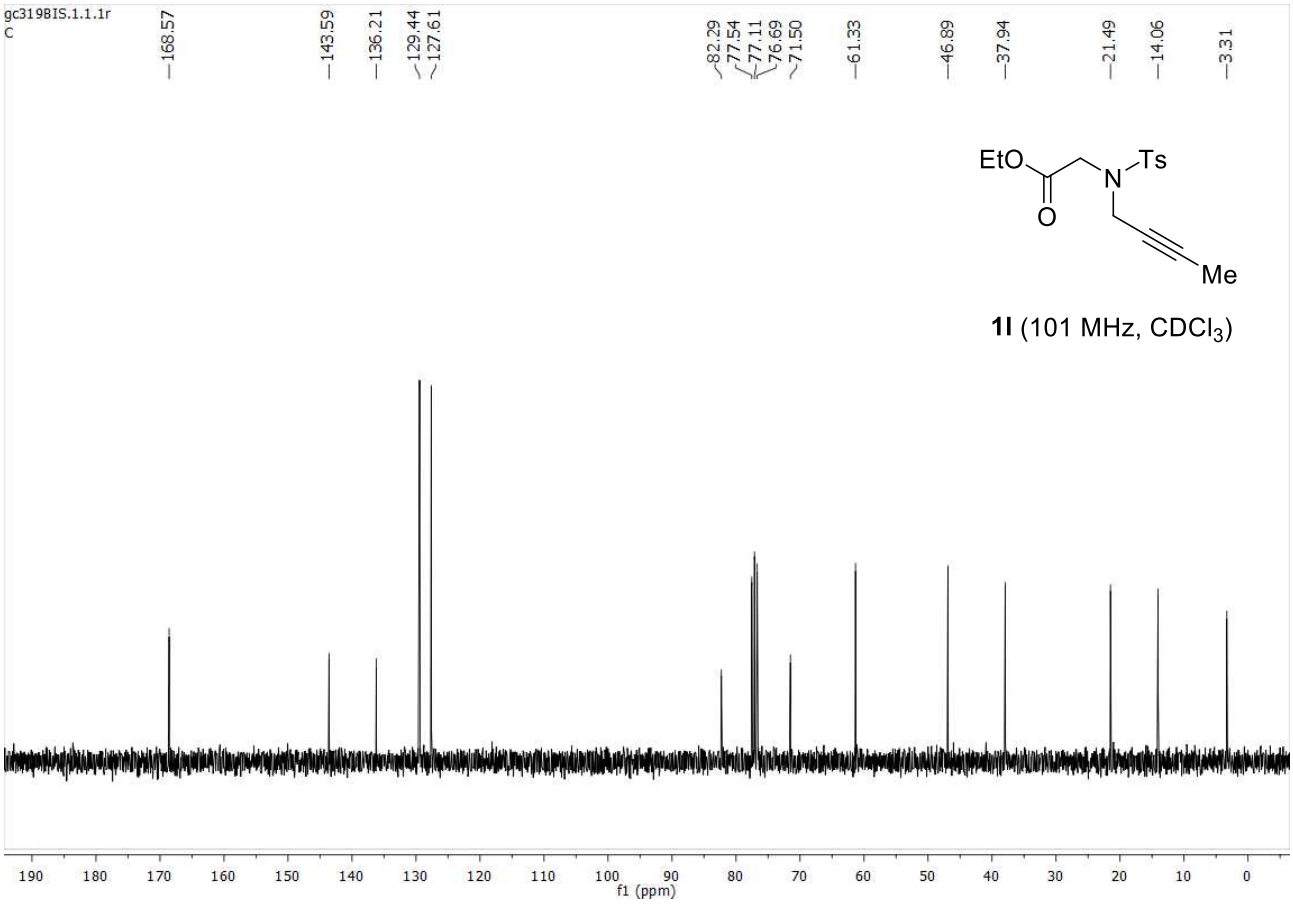
1g (400 MHz, $CDCl_3$)



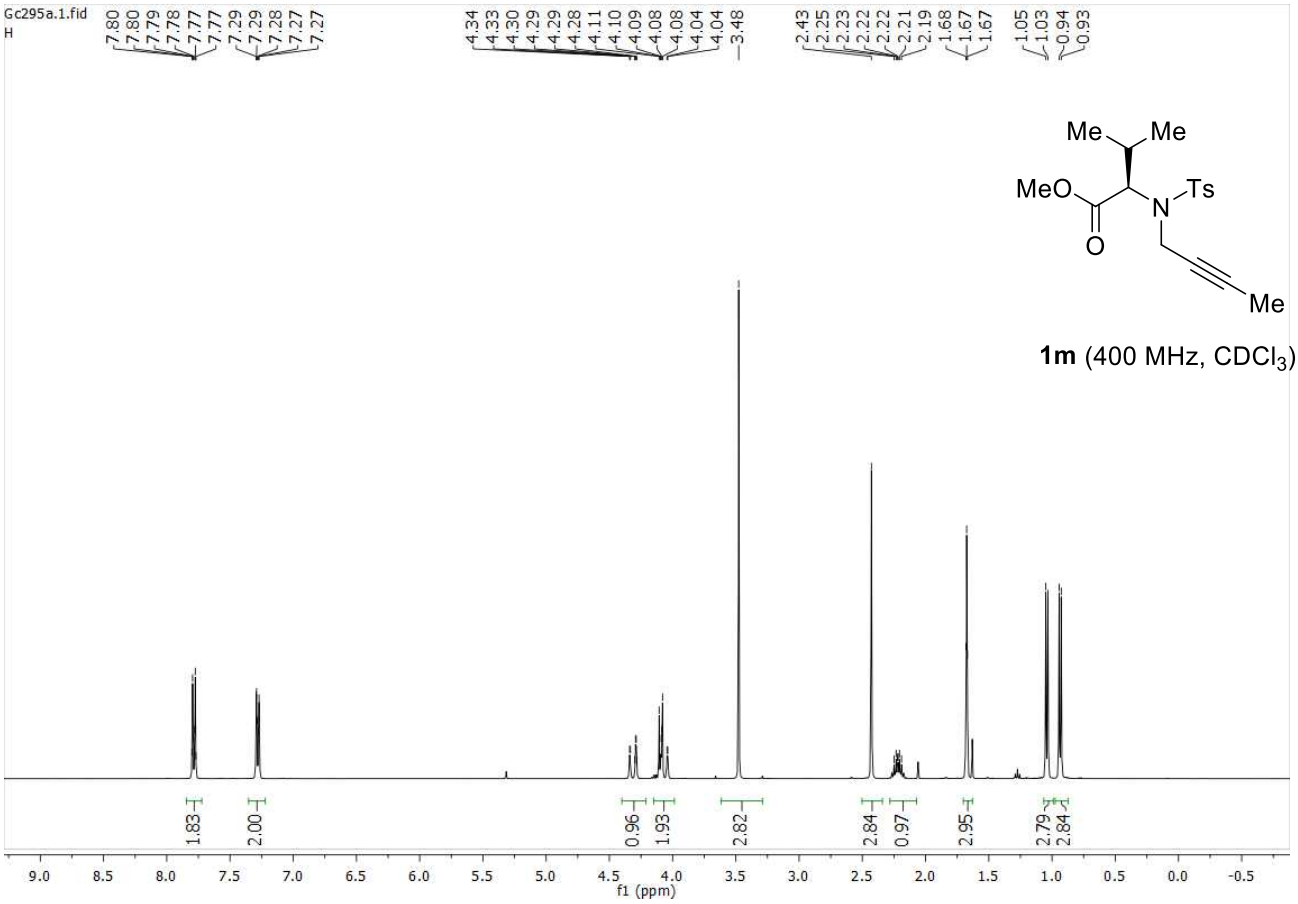
1g (101 MHz, $CDCl_3$)



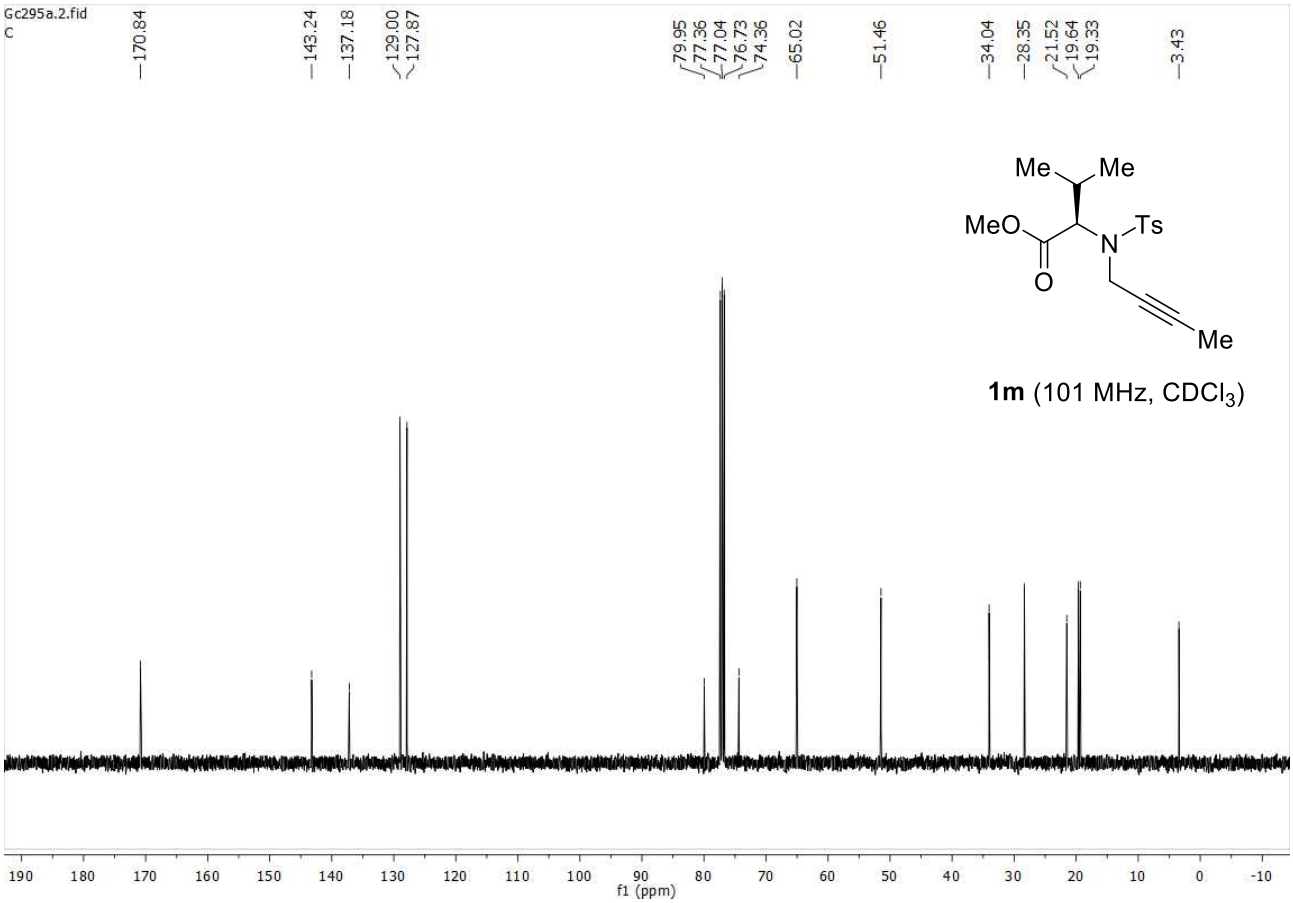
1l (400 MHz, $CDCl_3$)



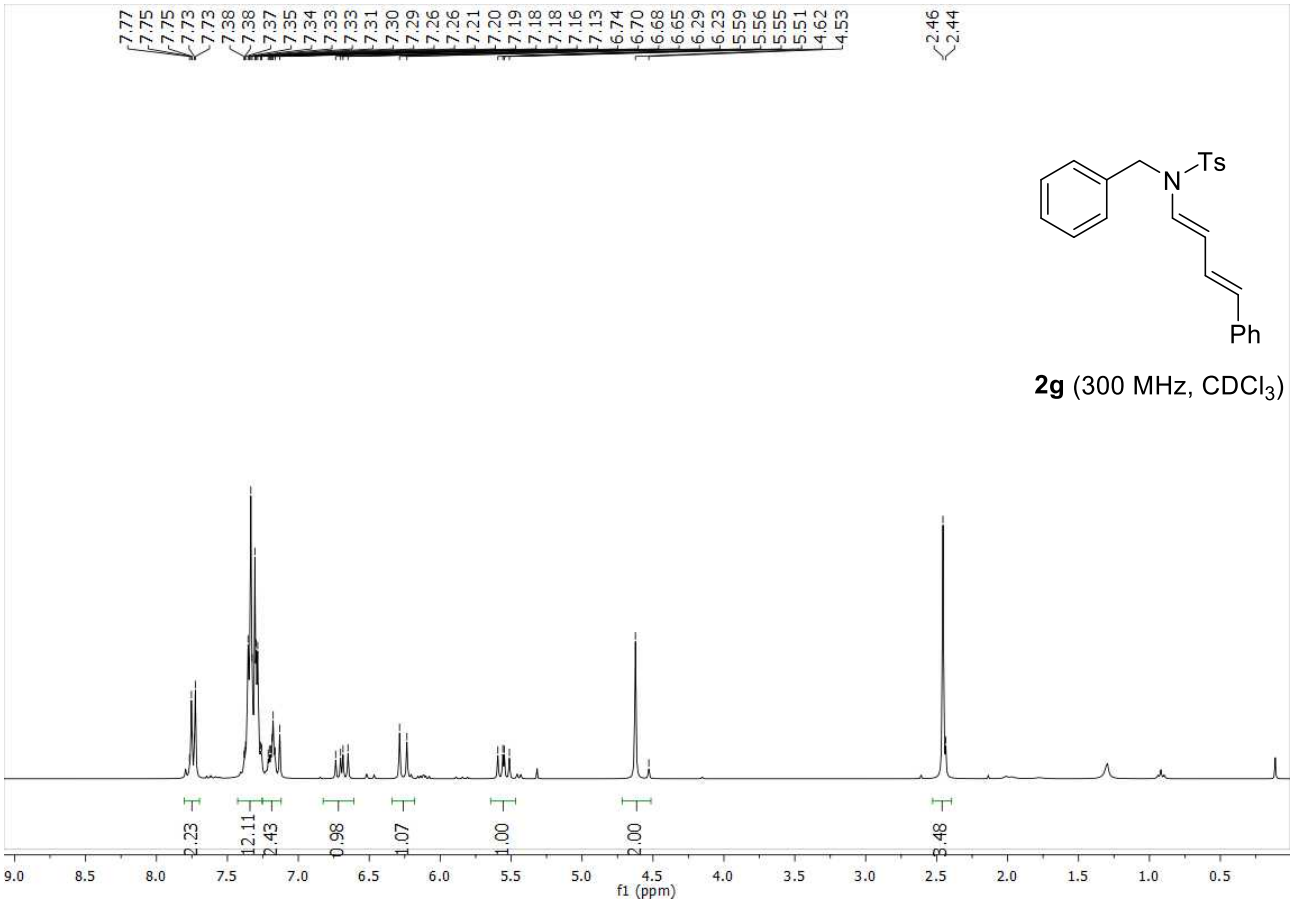
1l (101 MHz, $CDCl_3$)



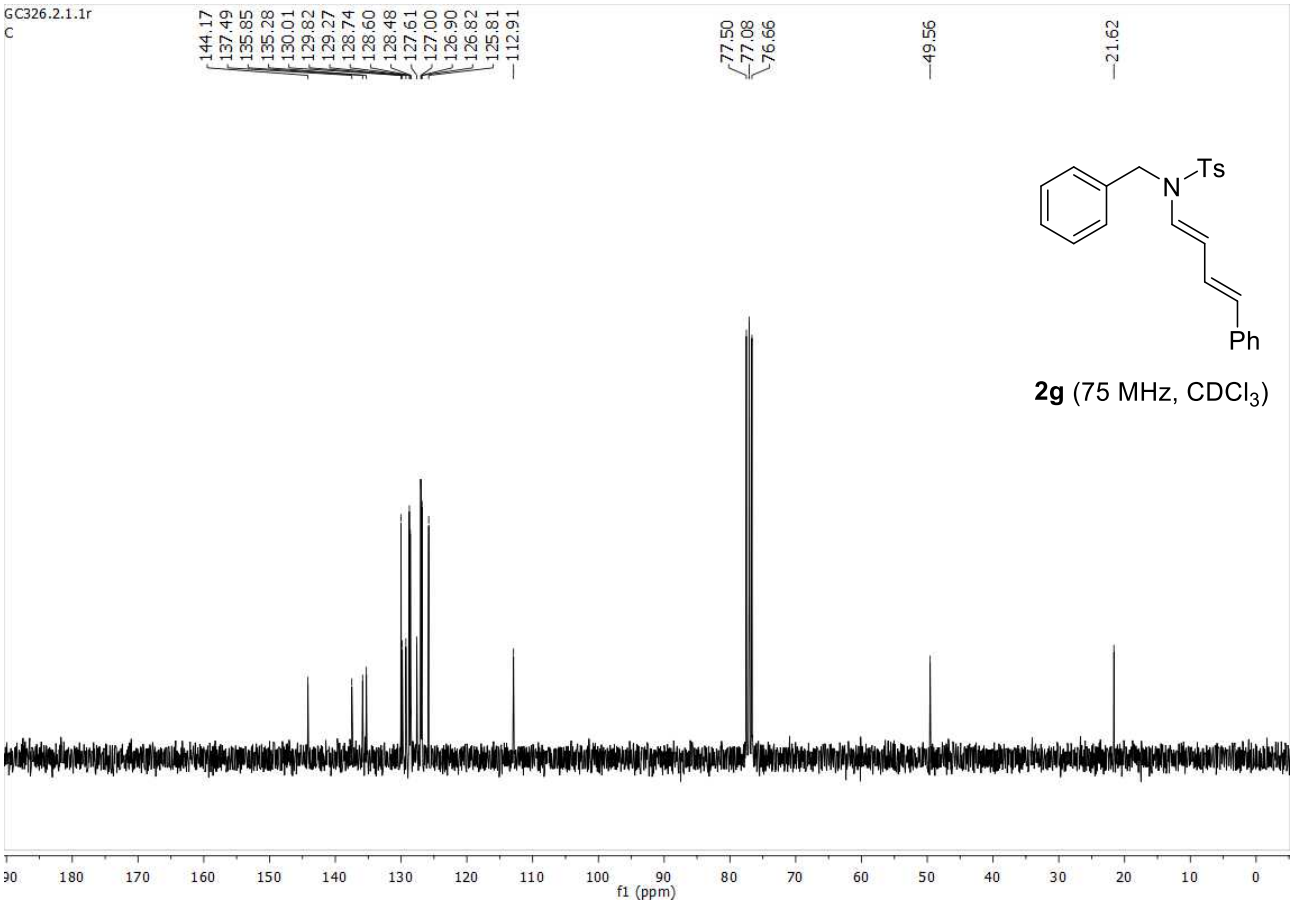
1m (400 MHz, $CDCl_3$)



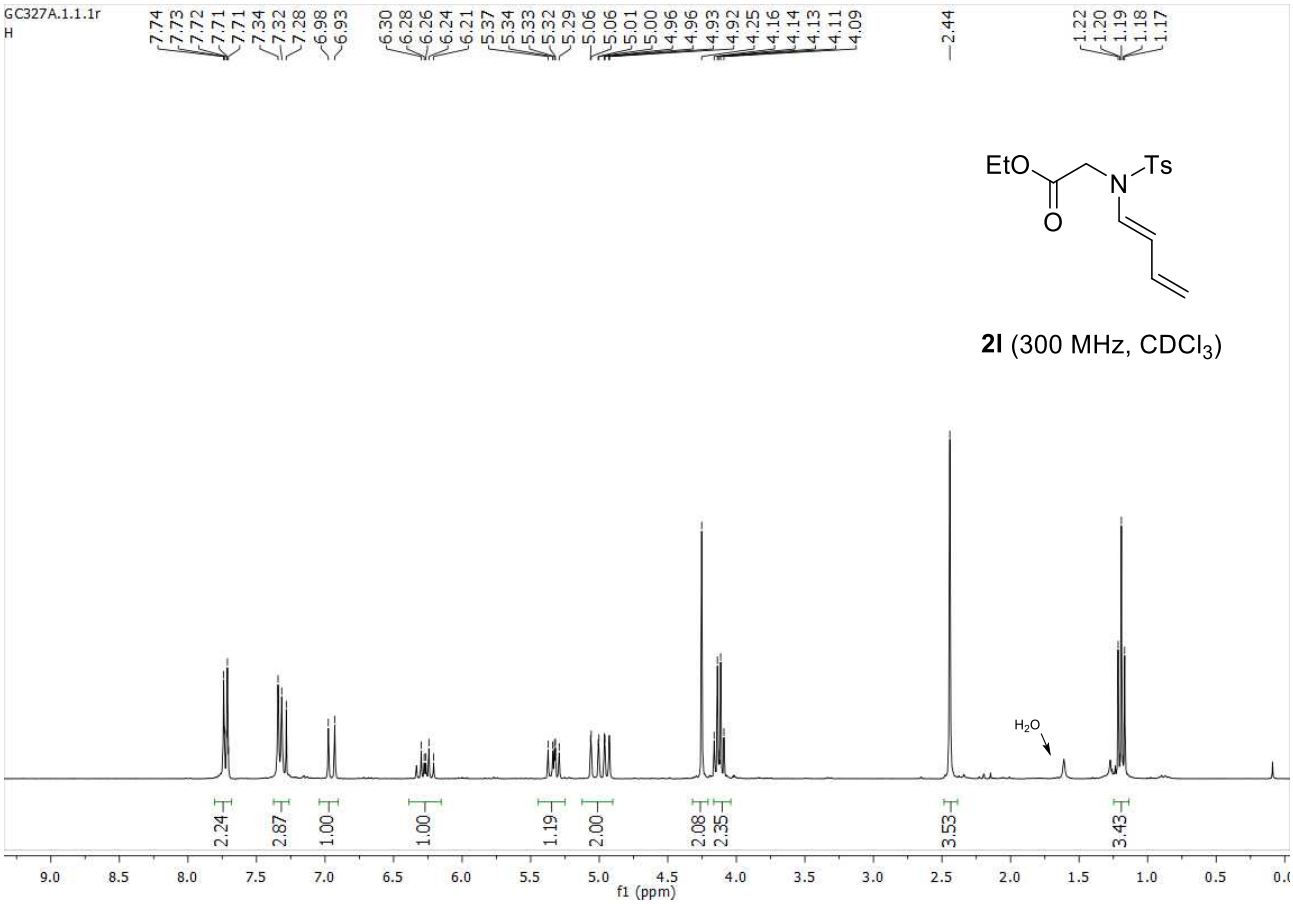
1m (101 MHz, $CDCl_3$)



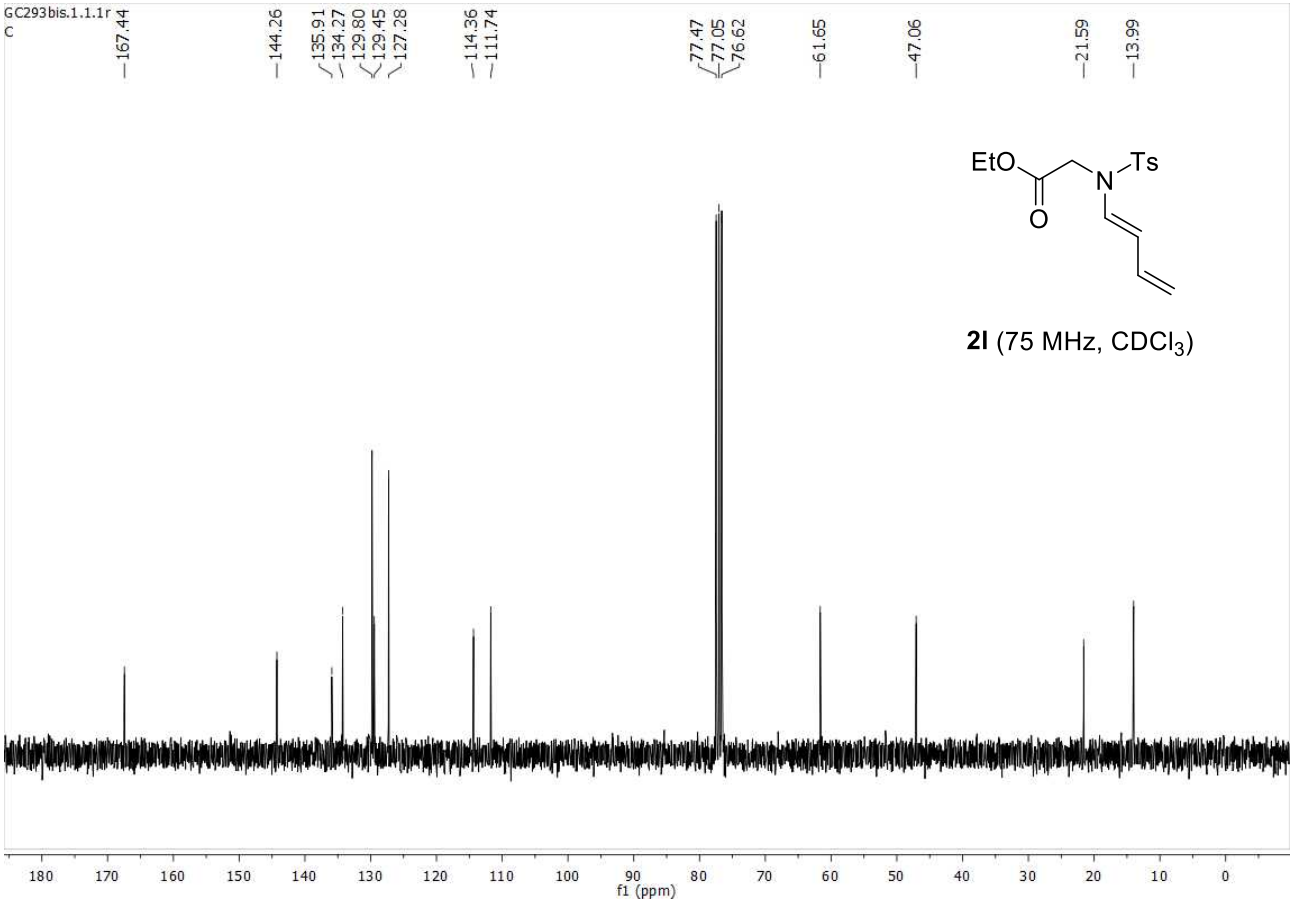
2g (300 MHz, $CDCl_3$)



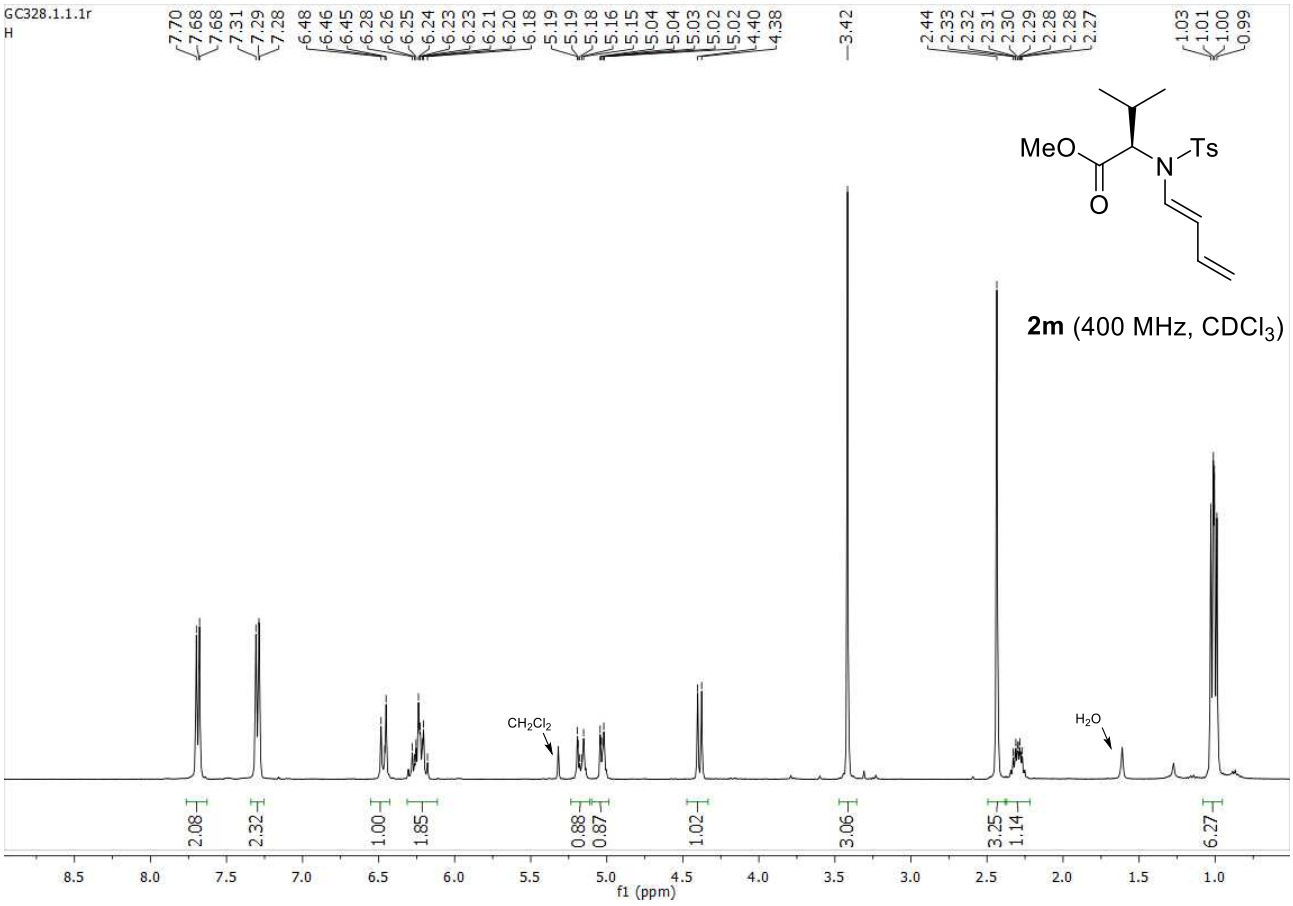
2g (75 MHz, $CDCl_3$)

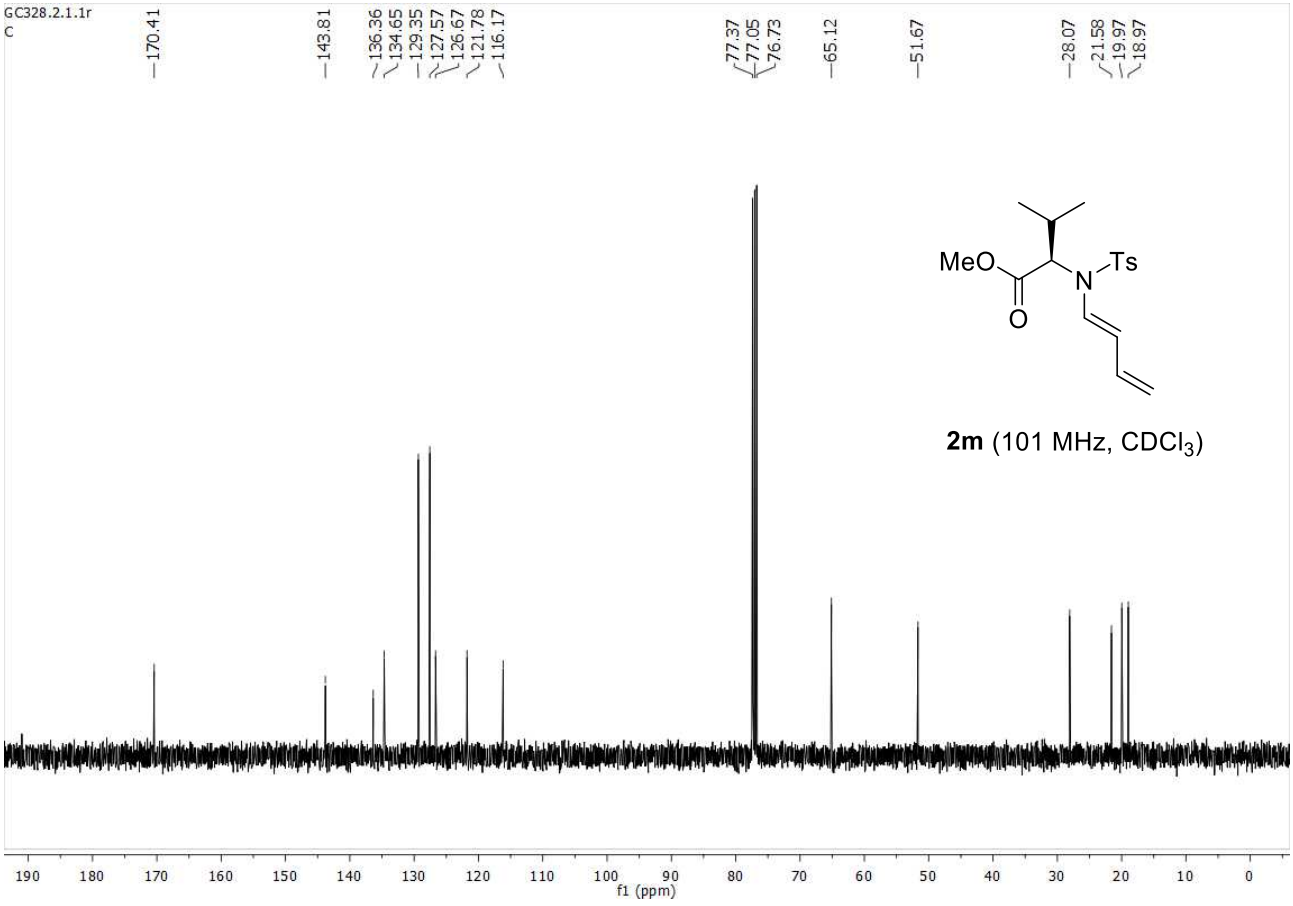


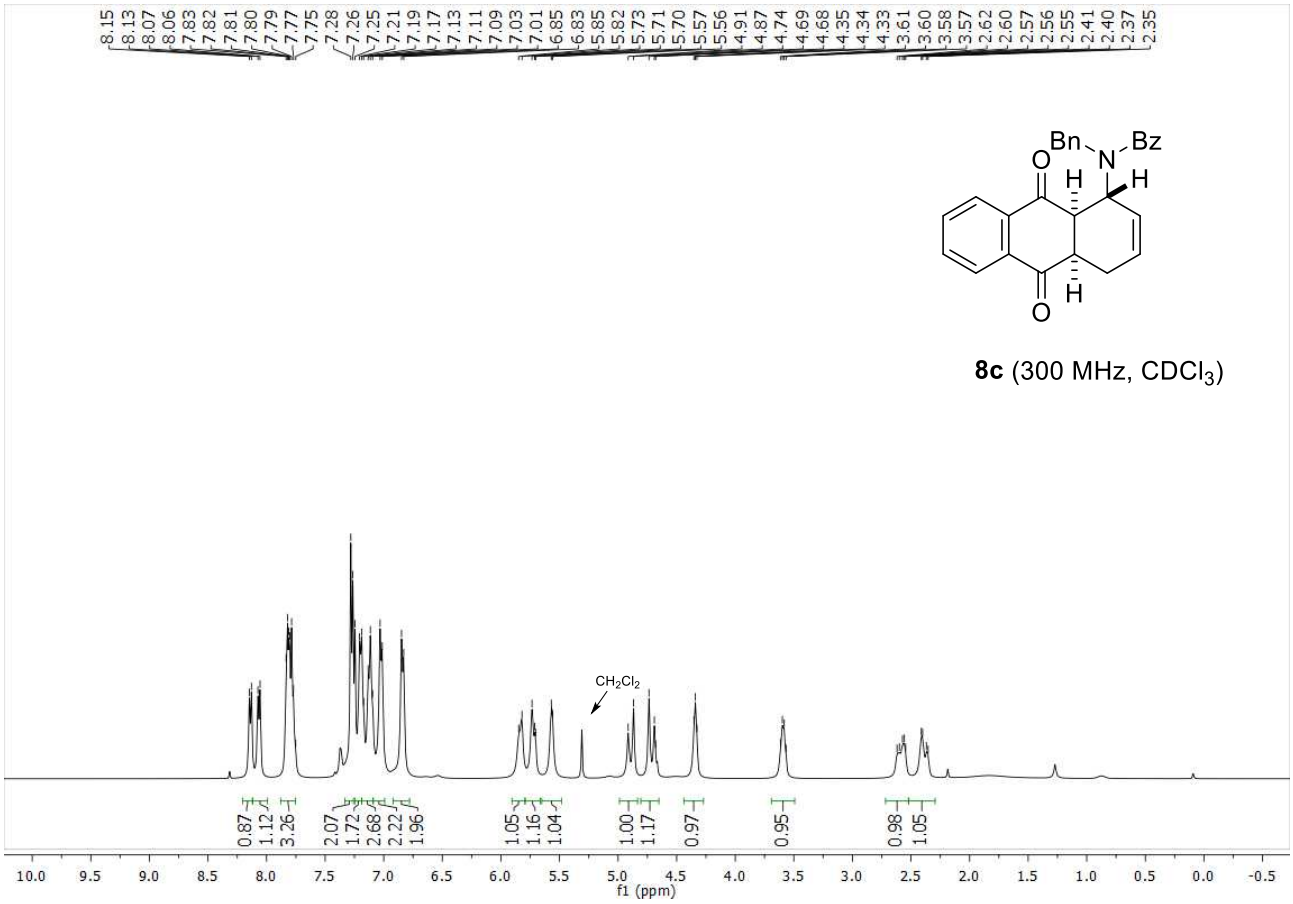
2l (300 MHz, $CDCl_3$)



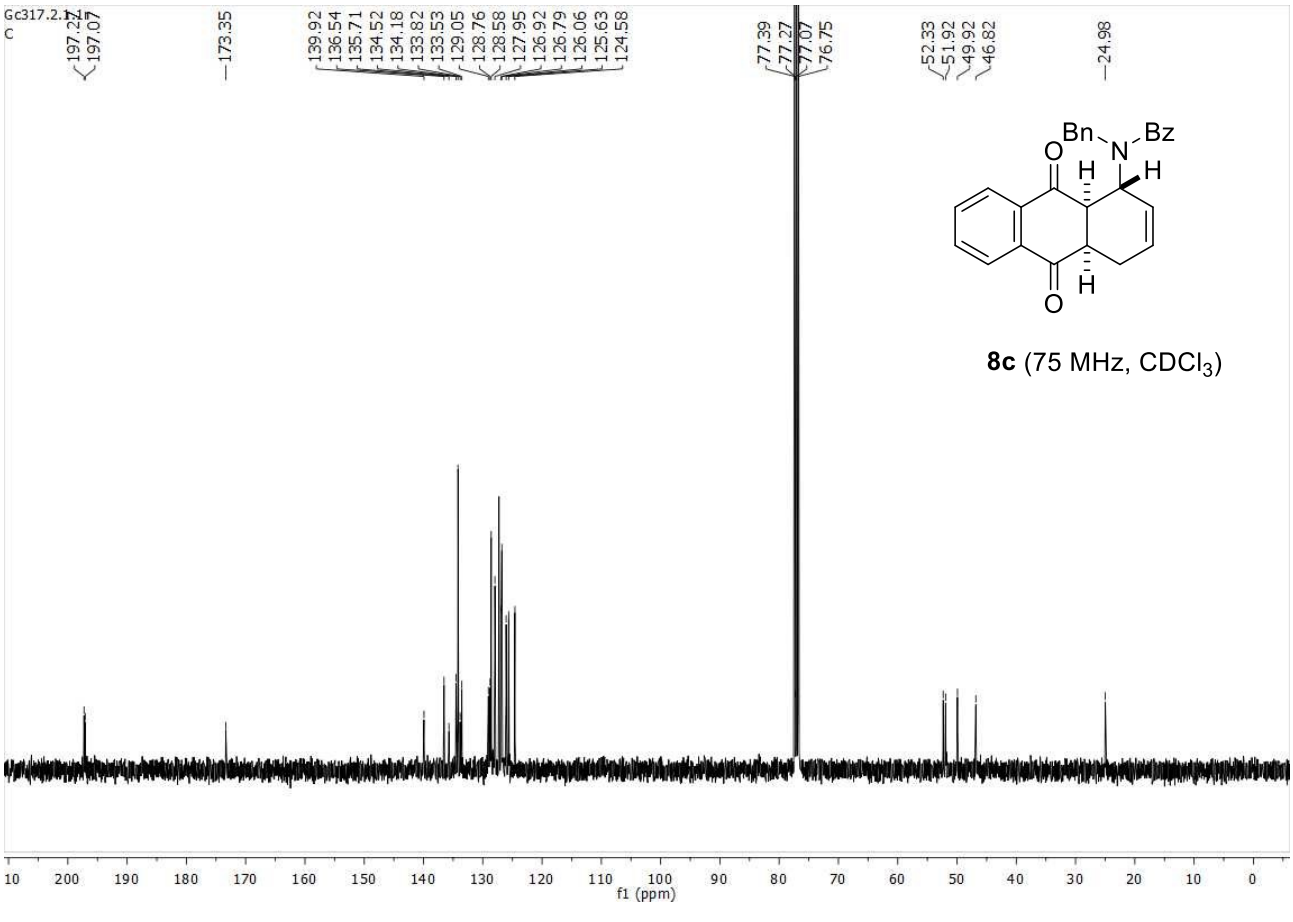
2l (75 MHz, $CDCl_3$)


GC328.1.1.1r
H
MeO
Ts
N
O
2m (400 MHz, CDCl3)
CH2Cl2
H2O
f1 (ppm)

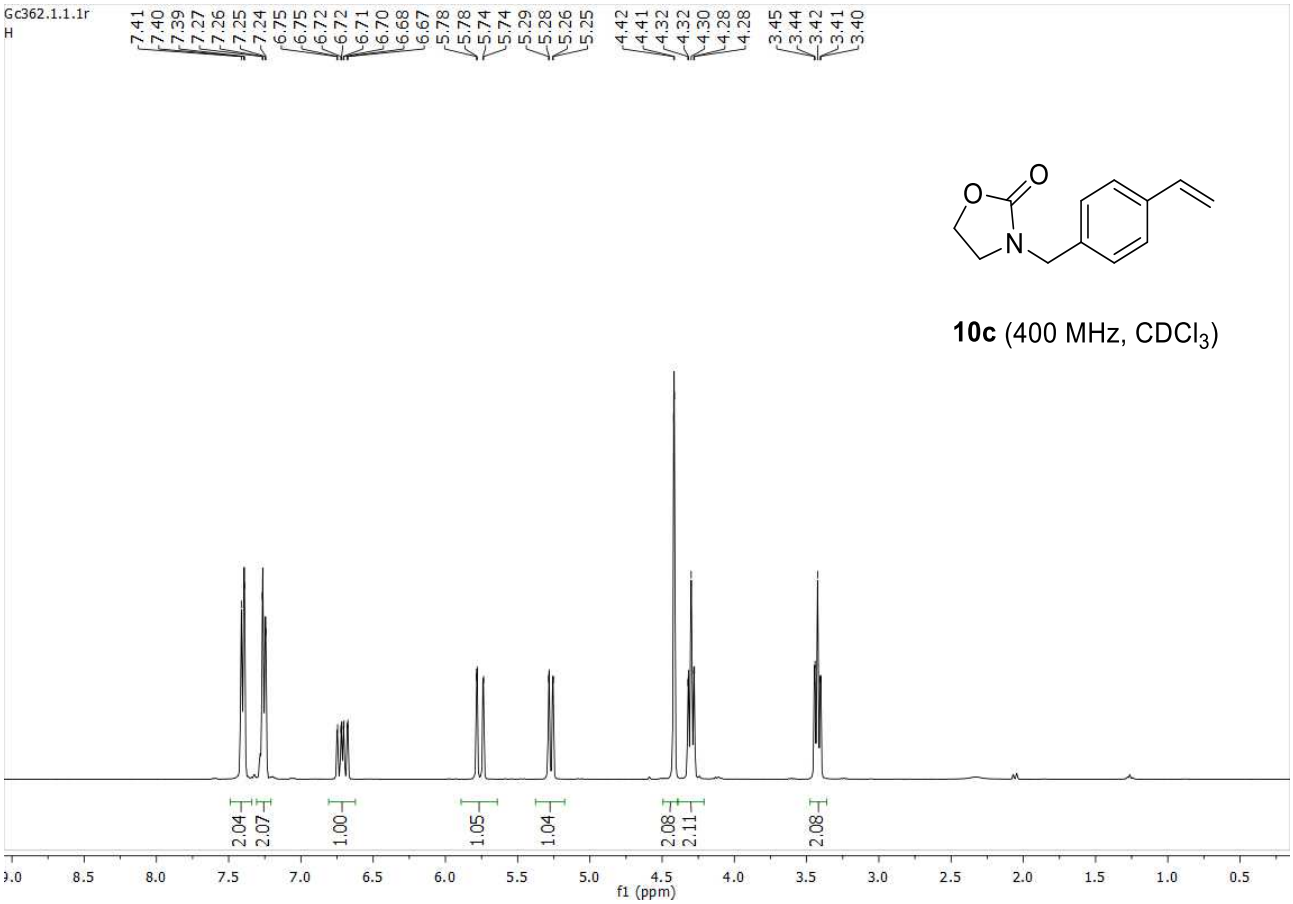

GC328.2.1.1r
C
MeO
Ts
N
O
2m (101 MHz, CDCl3)
f1 (ppm)



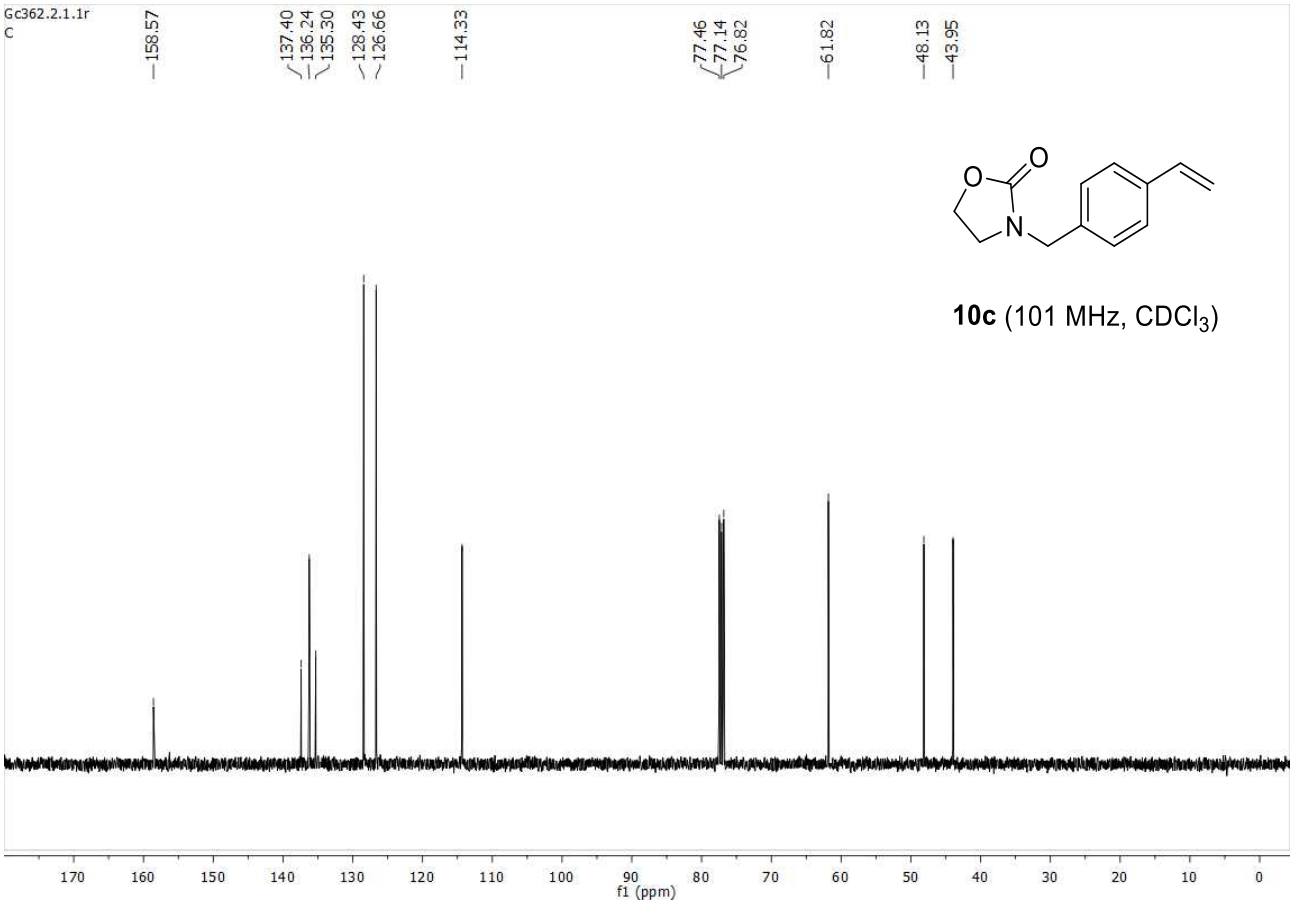
8c (300 MHz, $CDCl_3$)



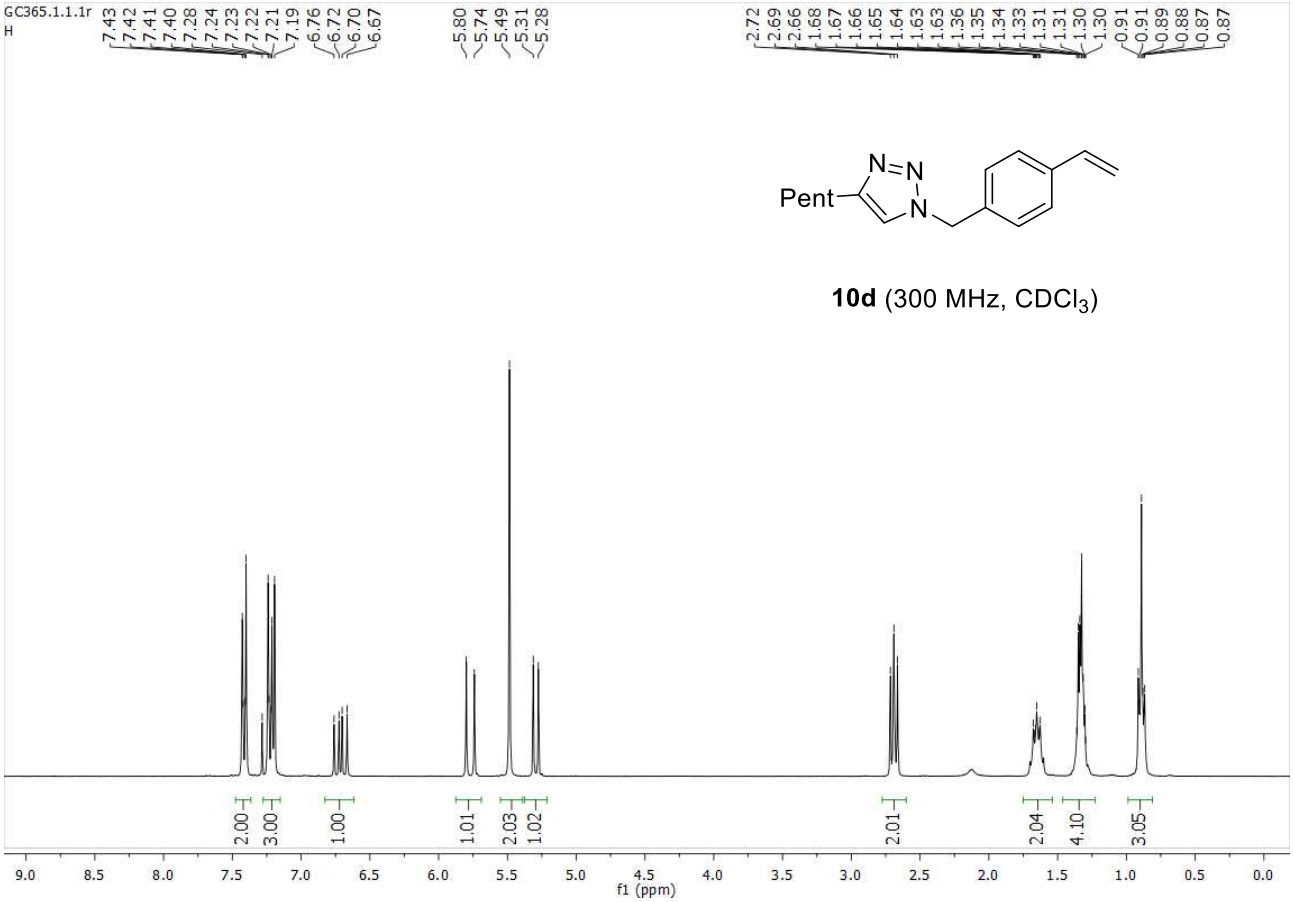
8c (75 MHz, $CDCl_3$)



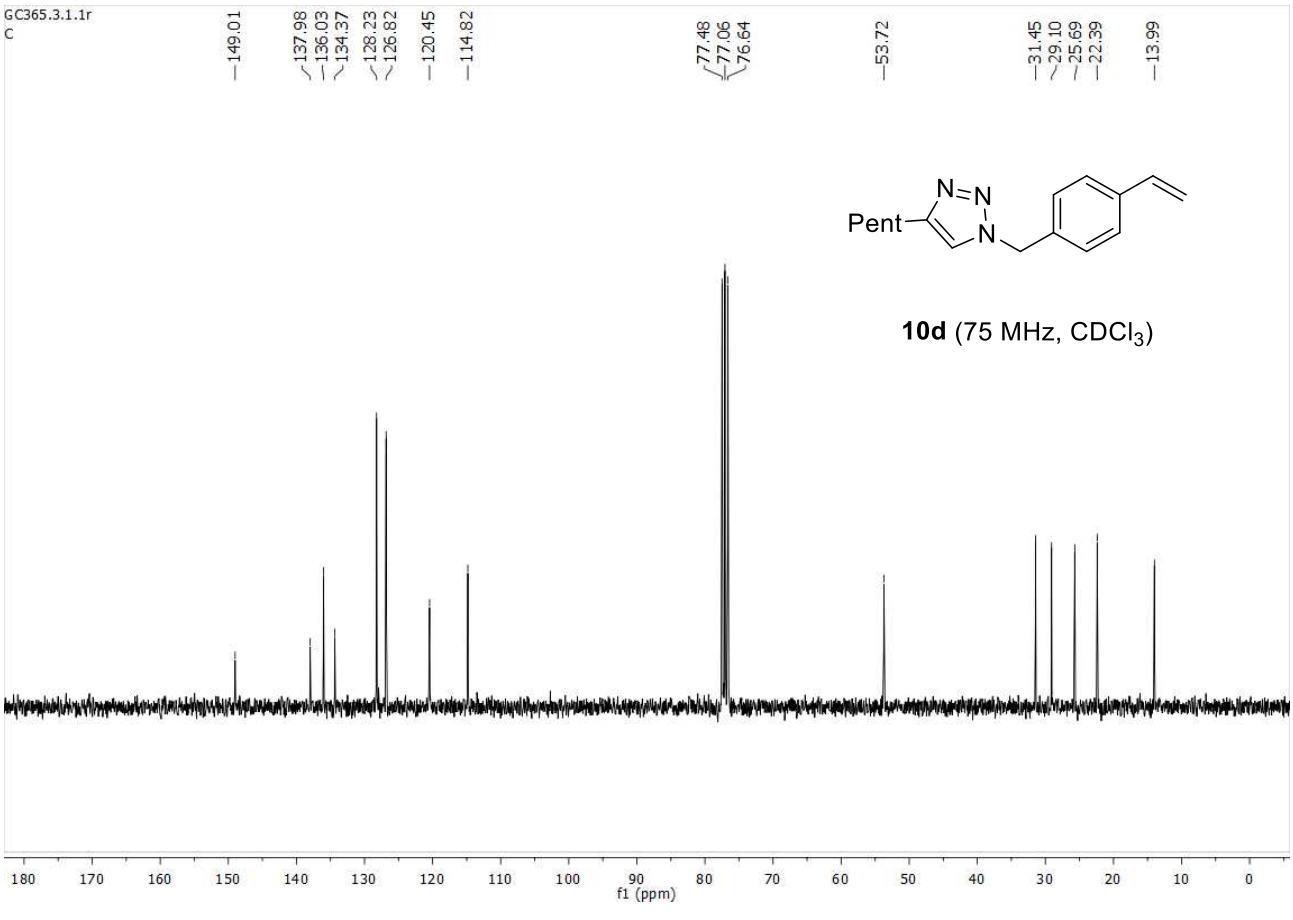
10c (400 MHz, $CDCl_3$)



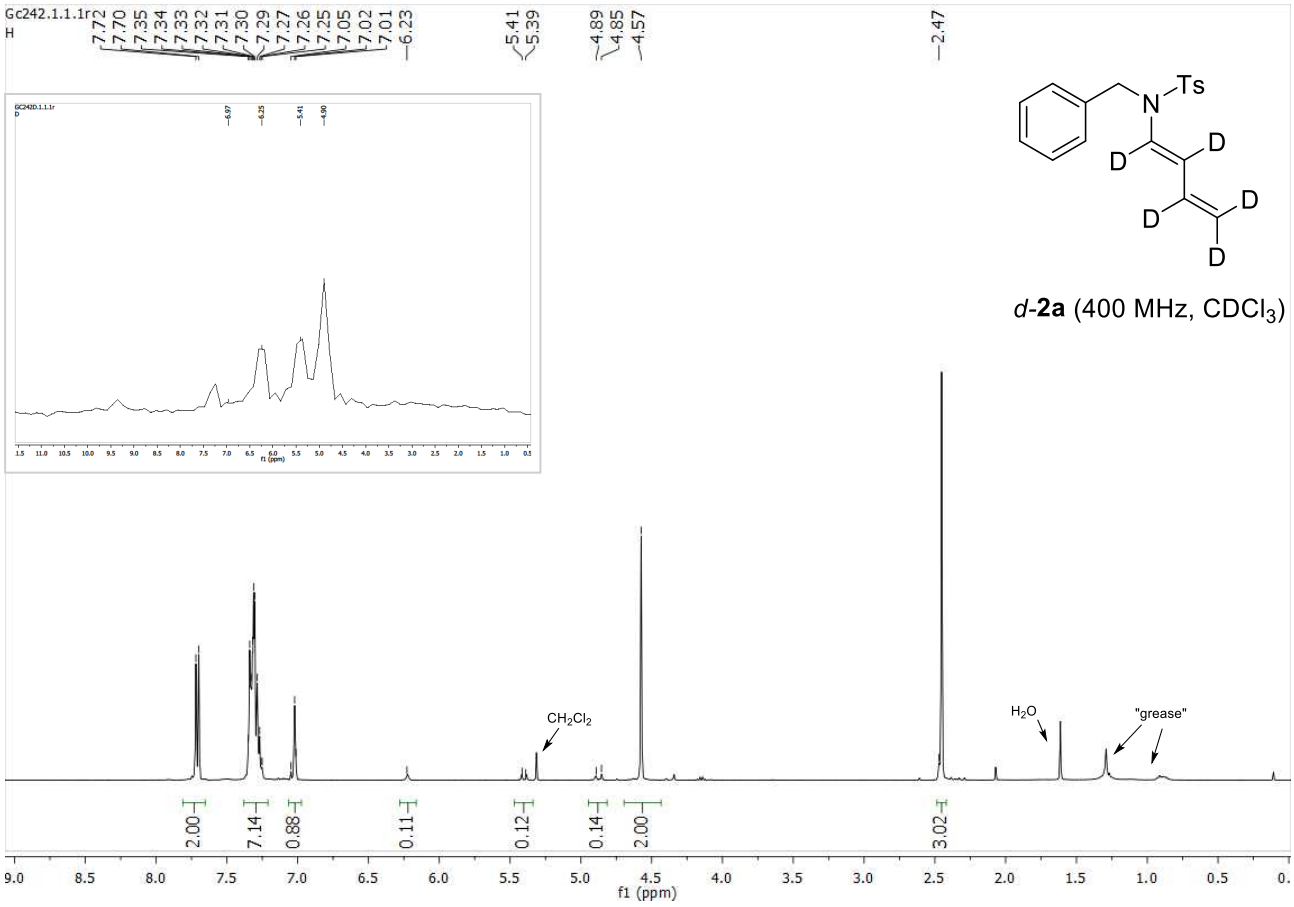
10c (101 MHz, $CDCl_3$)



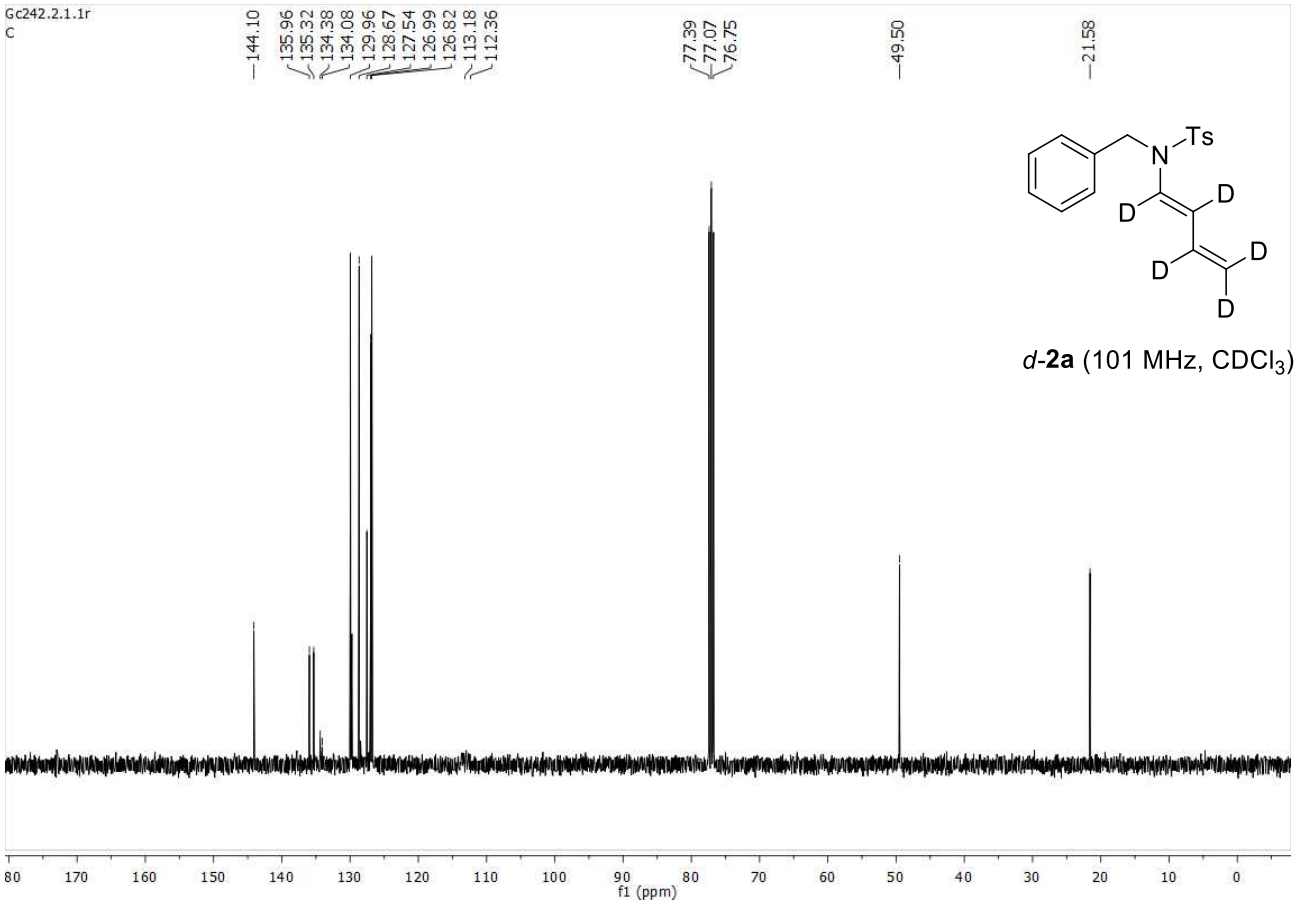
10d (300 MHz, $CDCl_3$)



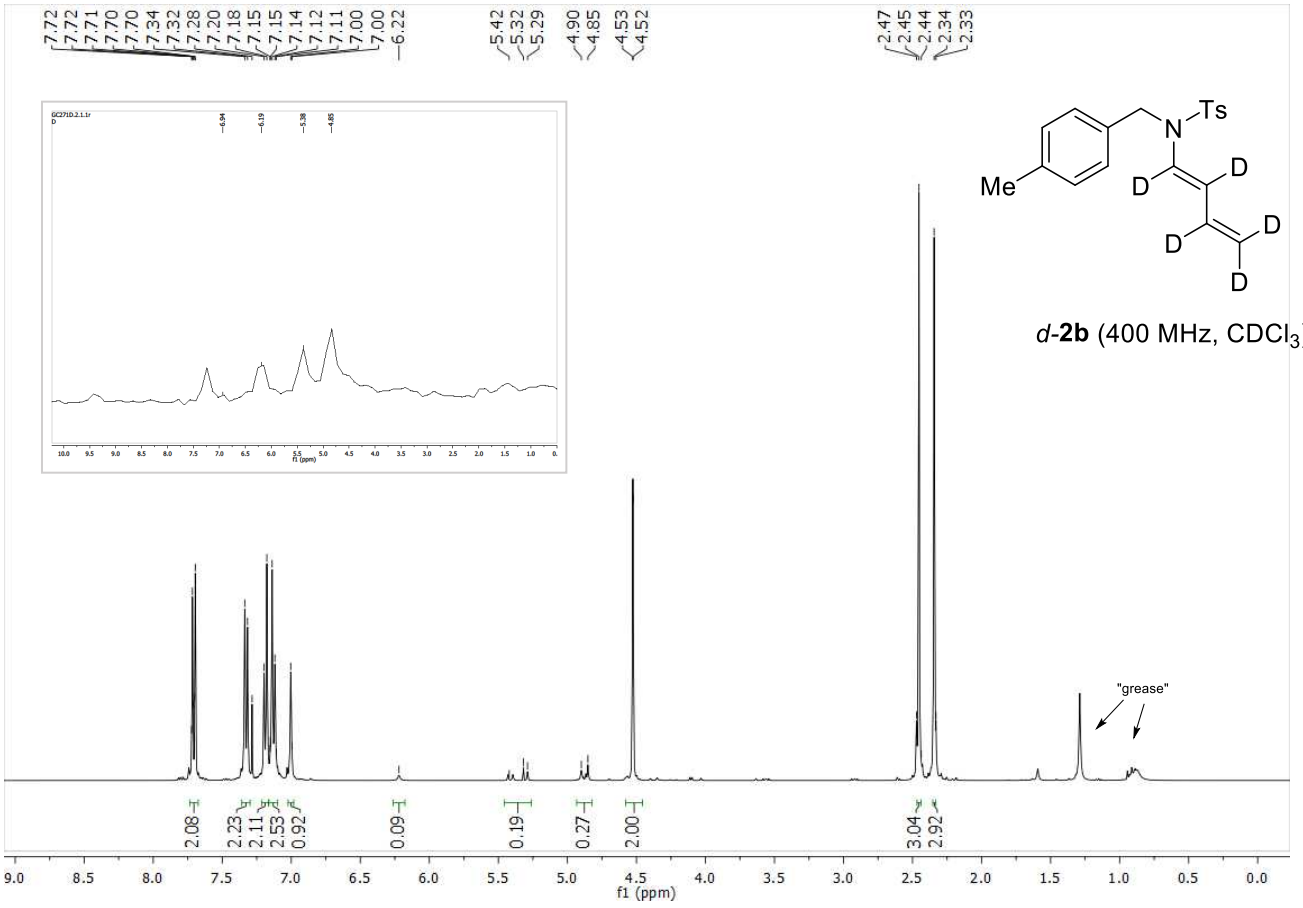
10d (75 MHz, $CDCl_3$)



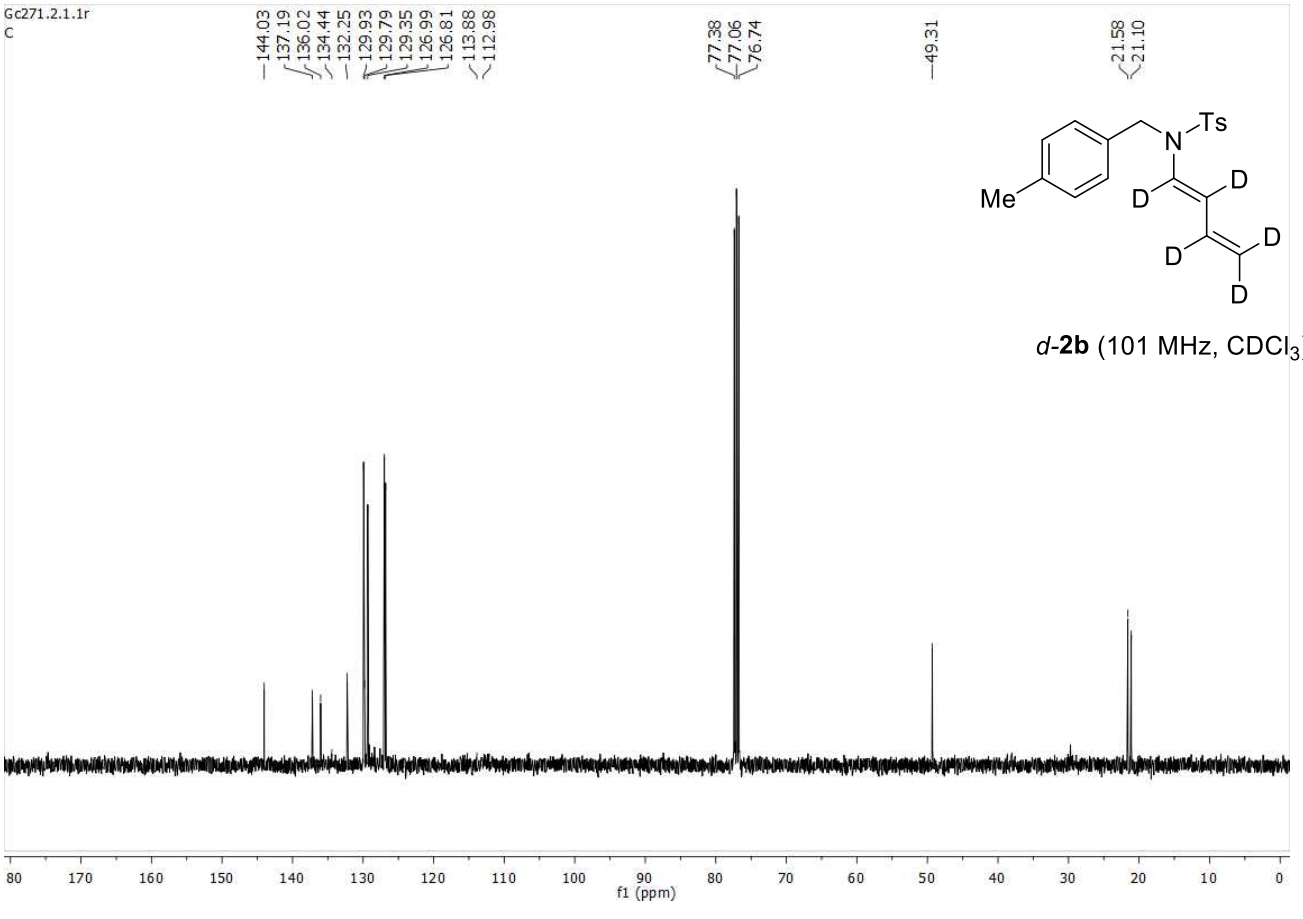
d-**2a** (400 MHz, $CDCl_3$)



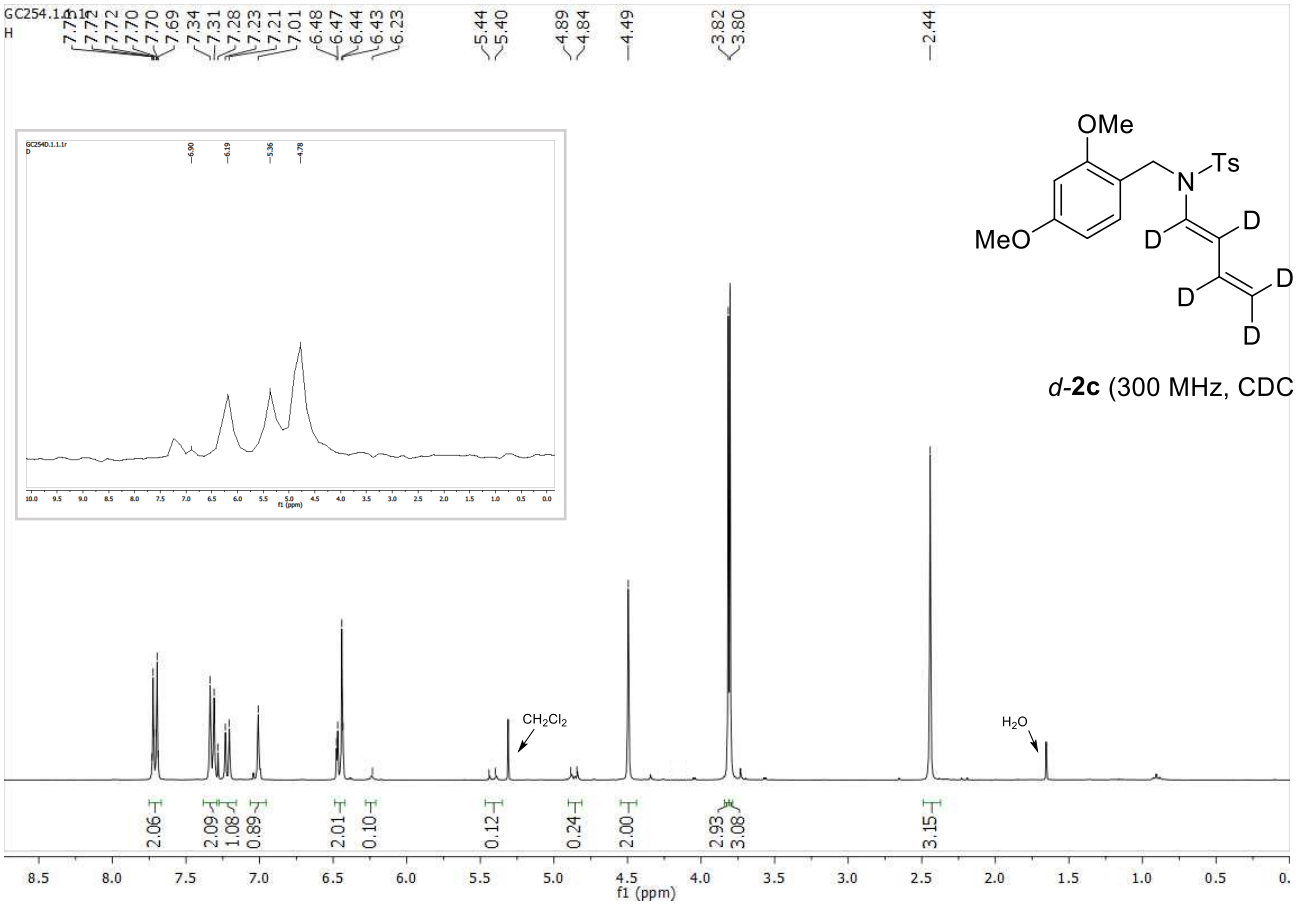
d-**2a** (101 MHz, $CDCl_3$)



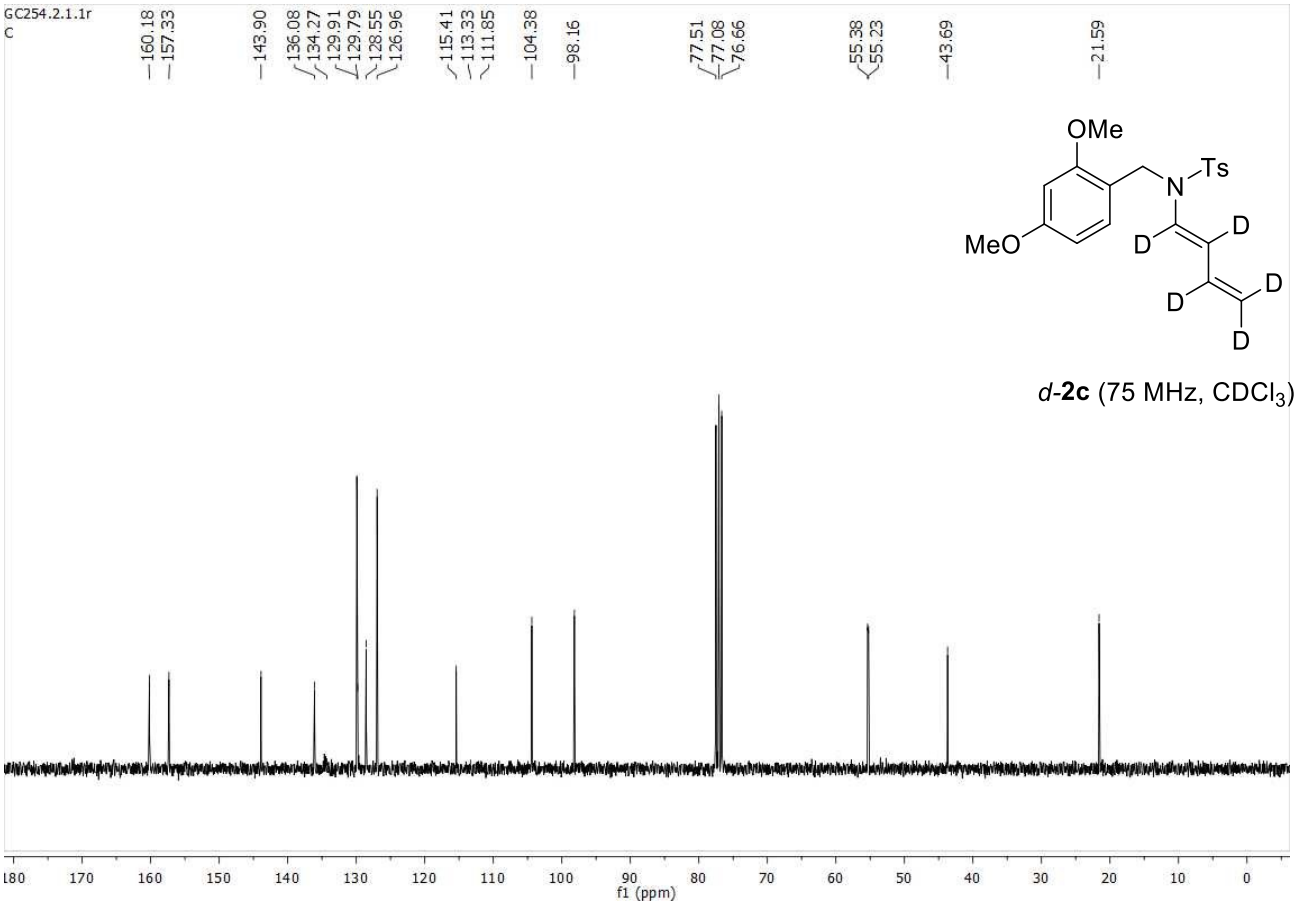
d-**2b** (400 MHz, $CDCl_3$)



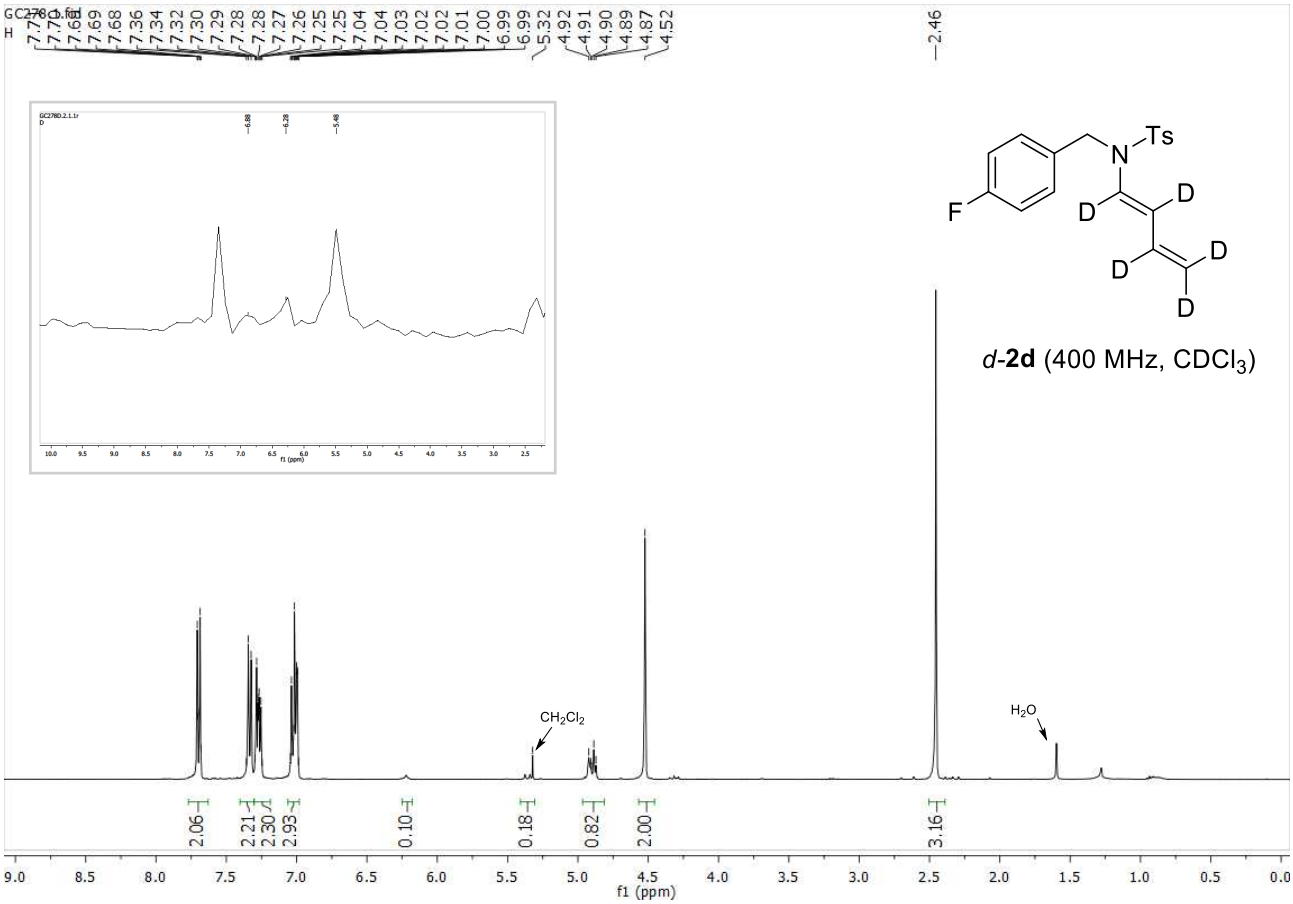
d-**2b** (101 MHz, $CDCl_3$)



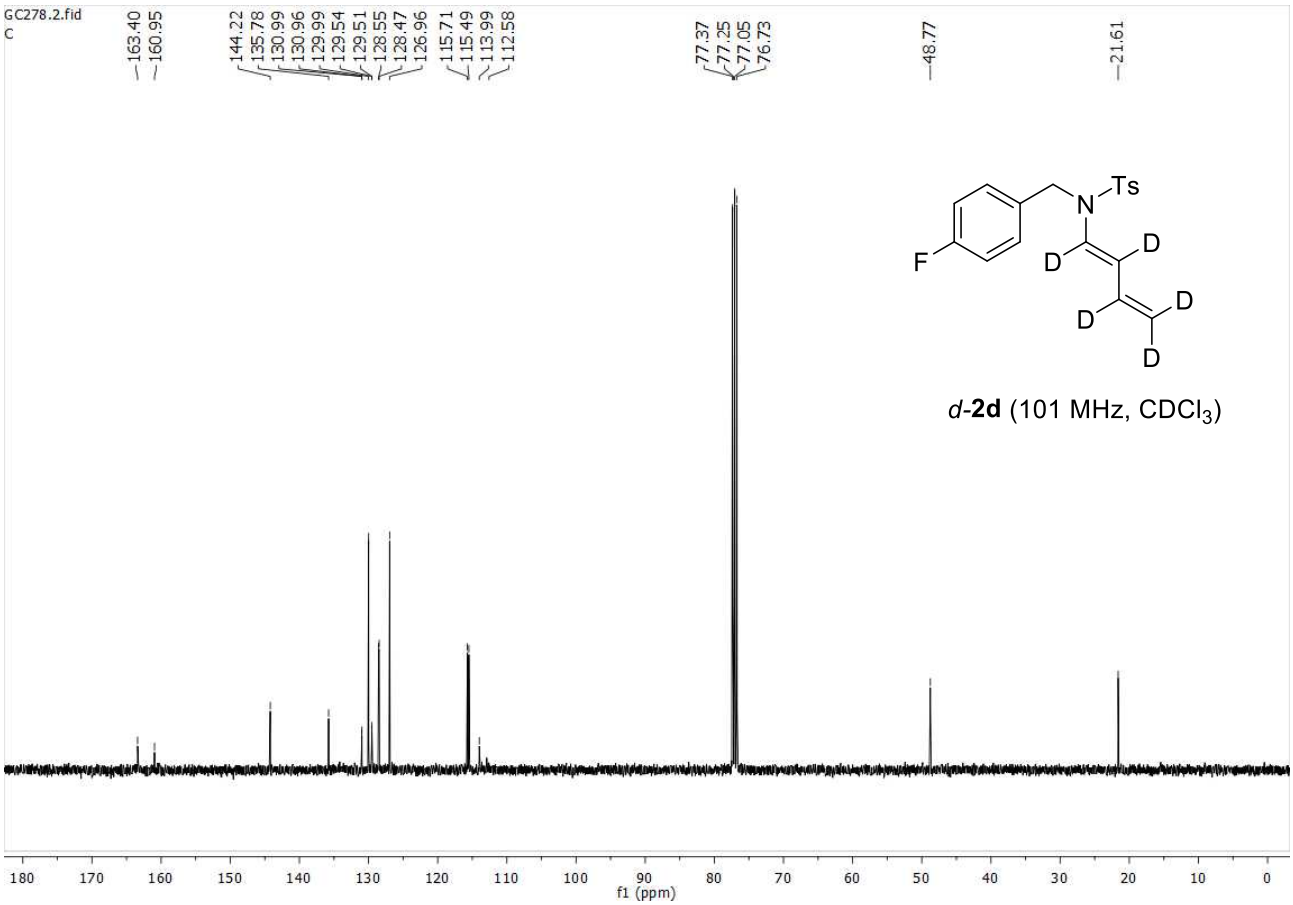
d-**2c** (300 MHz, $CDCl_3$)



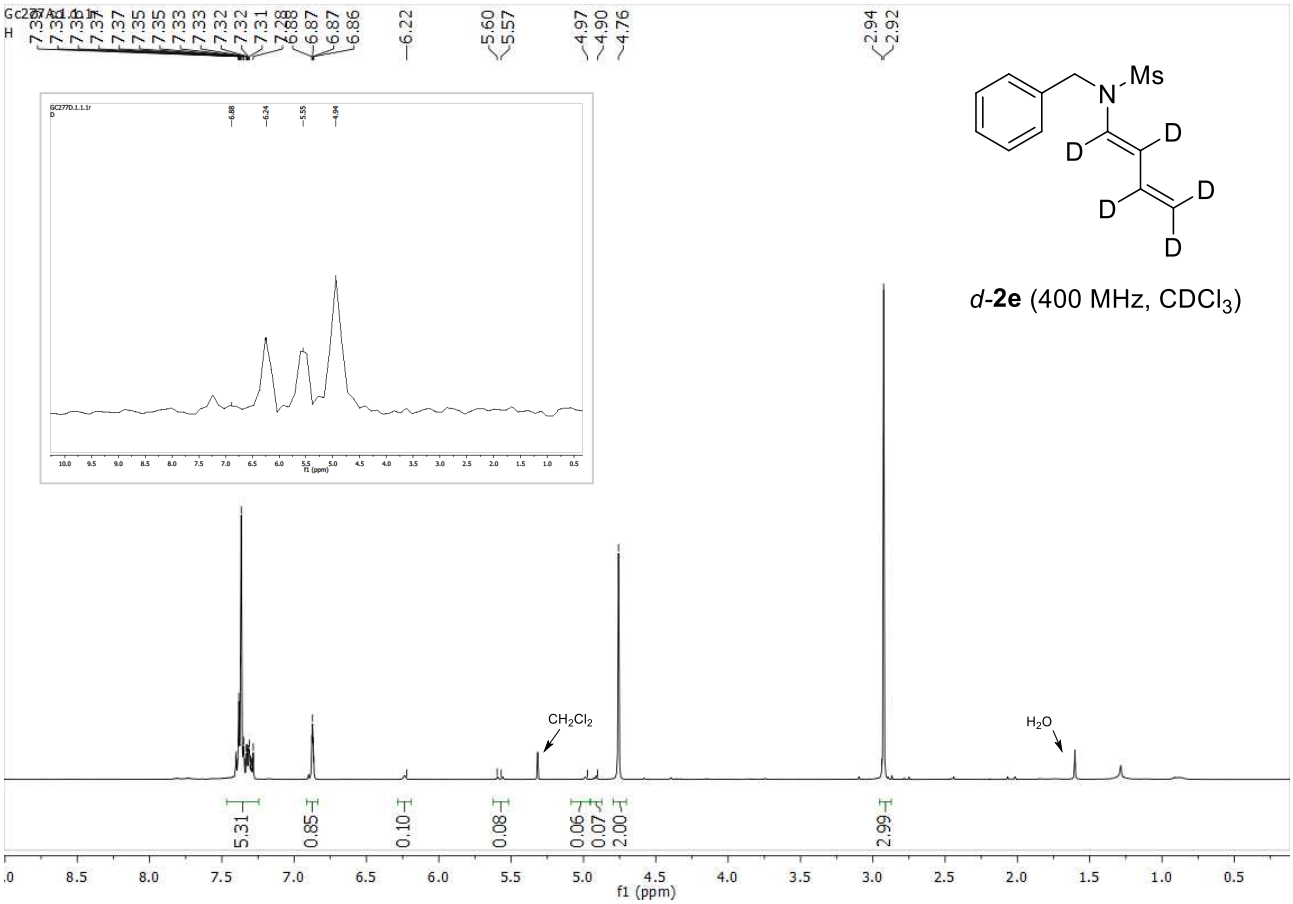
d-**2c** (75 MHz, $CDCl_3$)



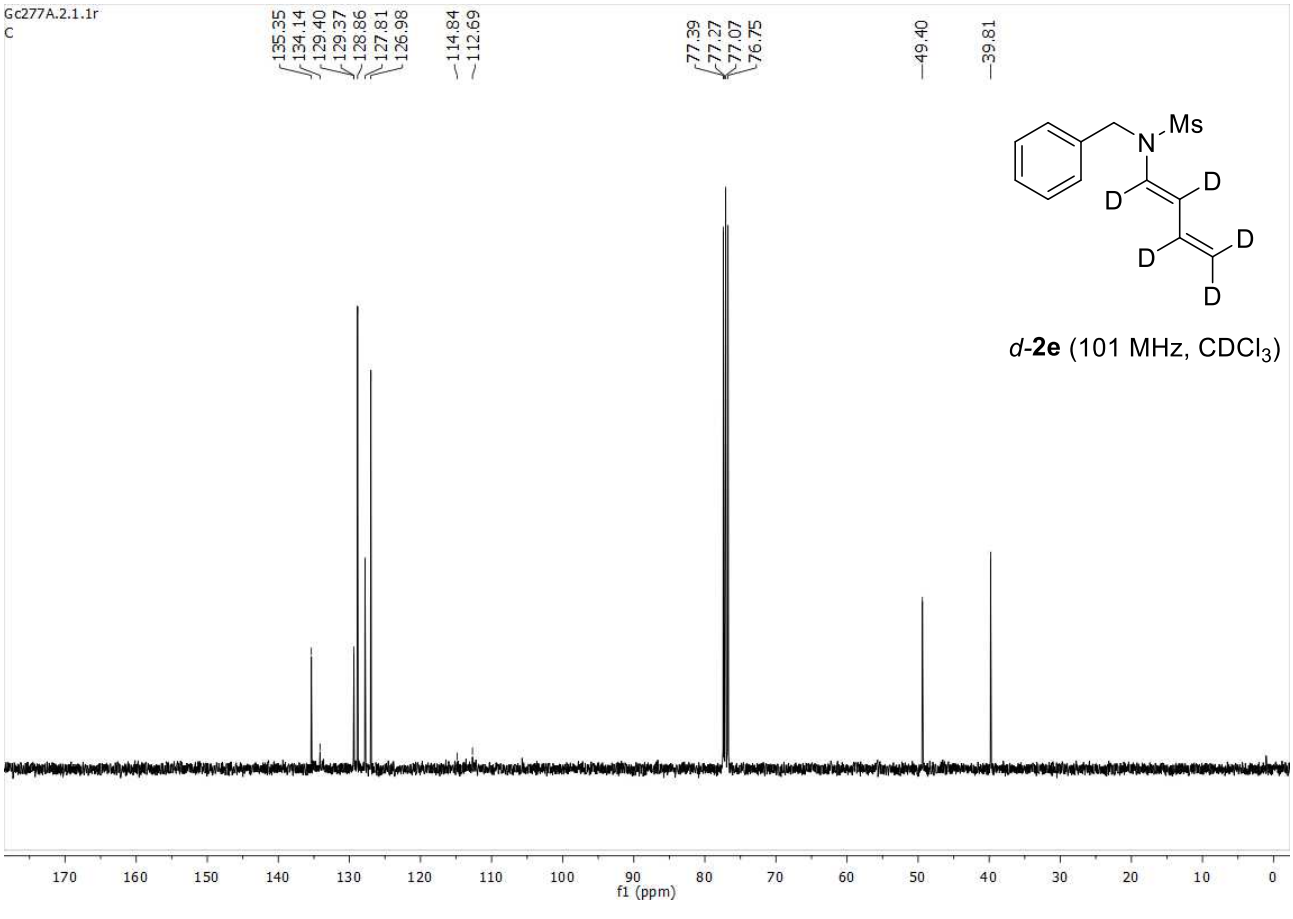
d-**2d** (400 MHz, $CDCl_3$)



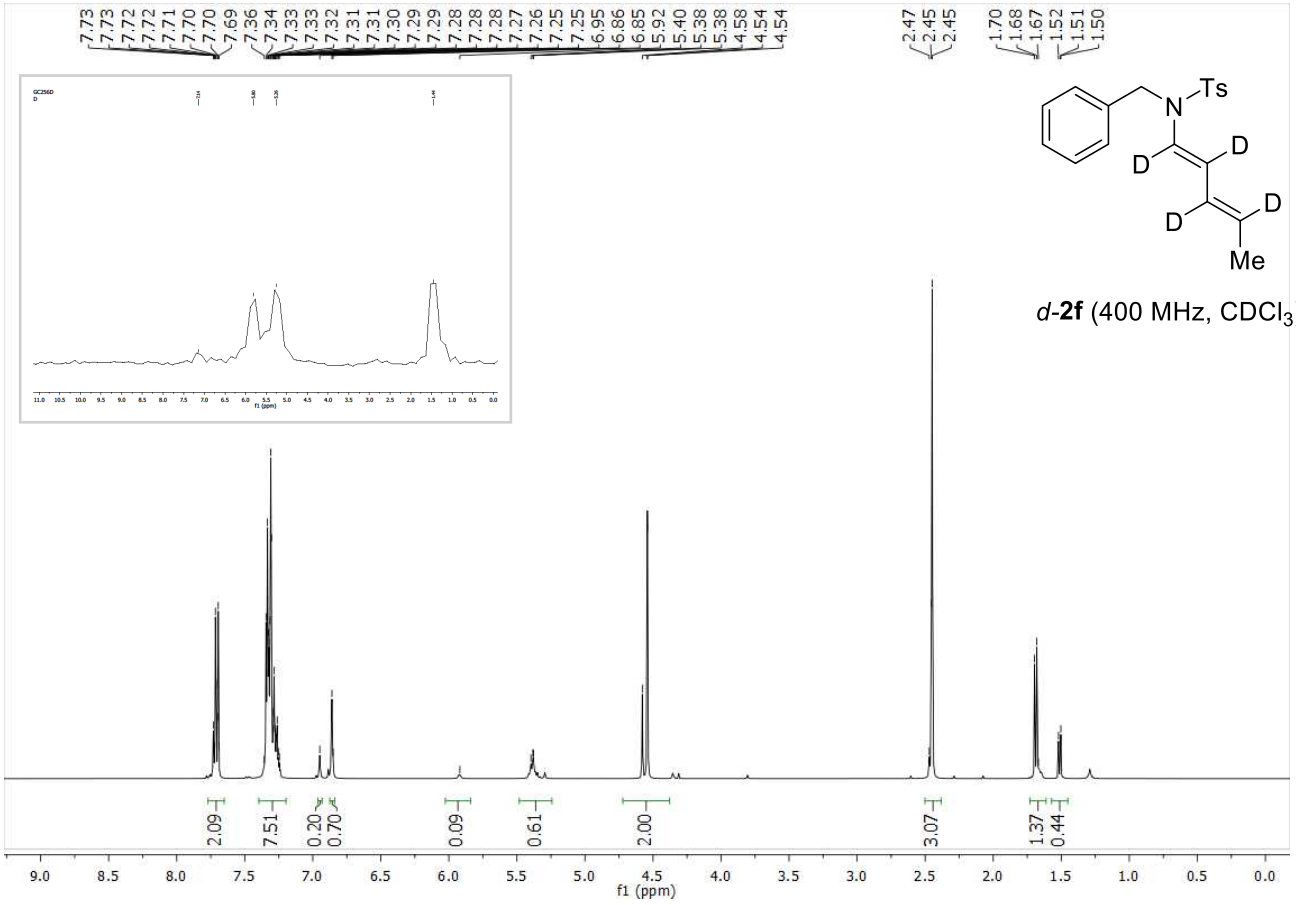
d-**2d** (101 MHz, $CDCl_3$)



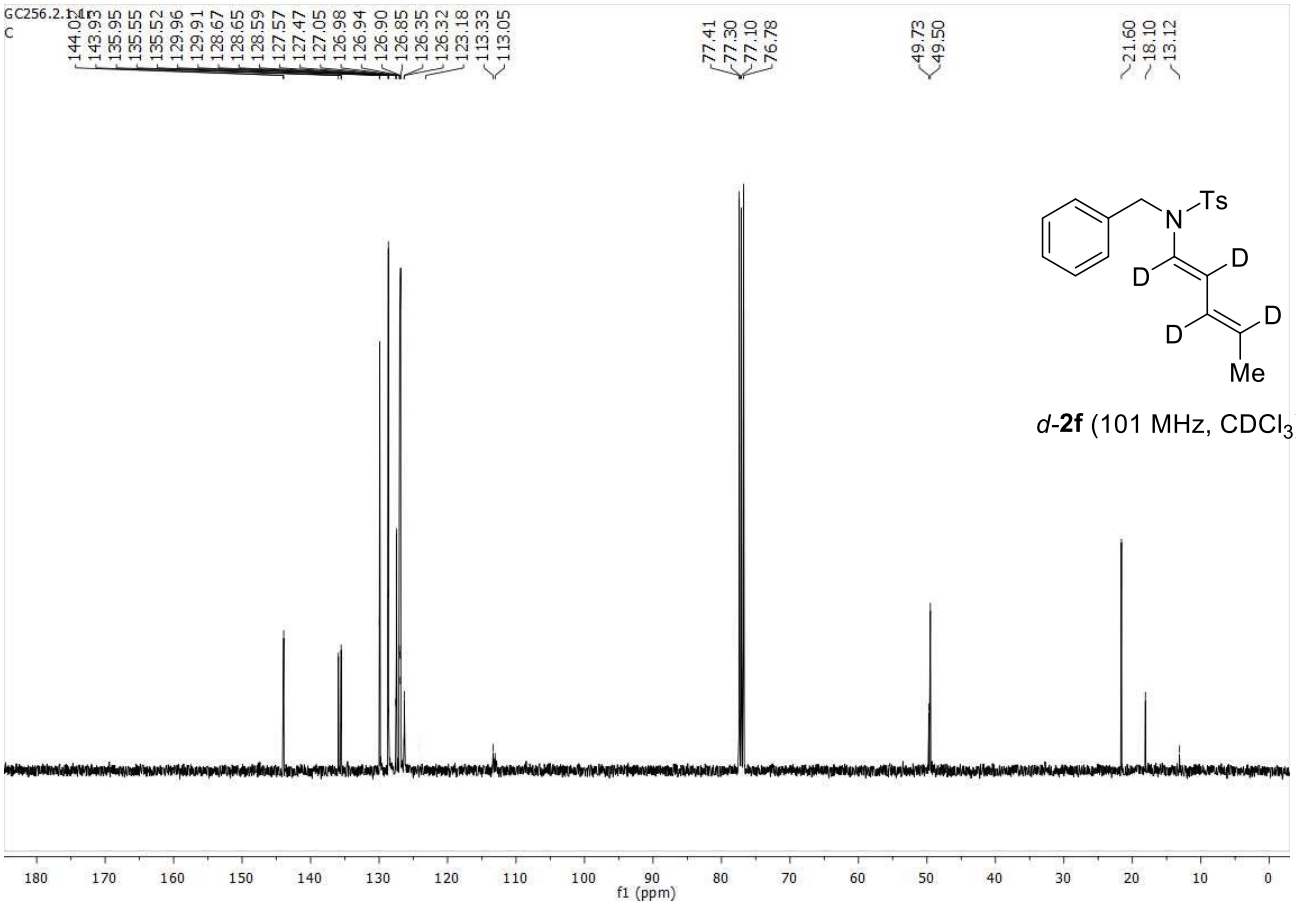
d-**2e** (400 MHz, $CDCl_3$)



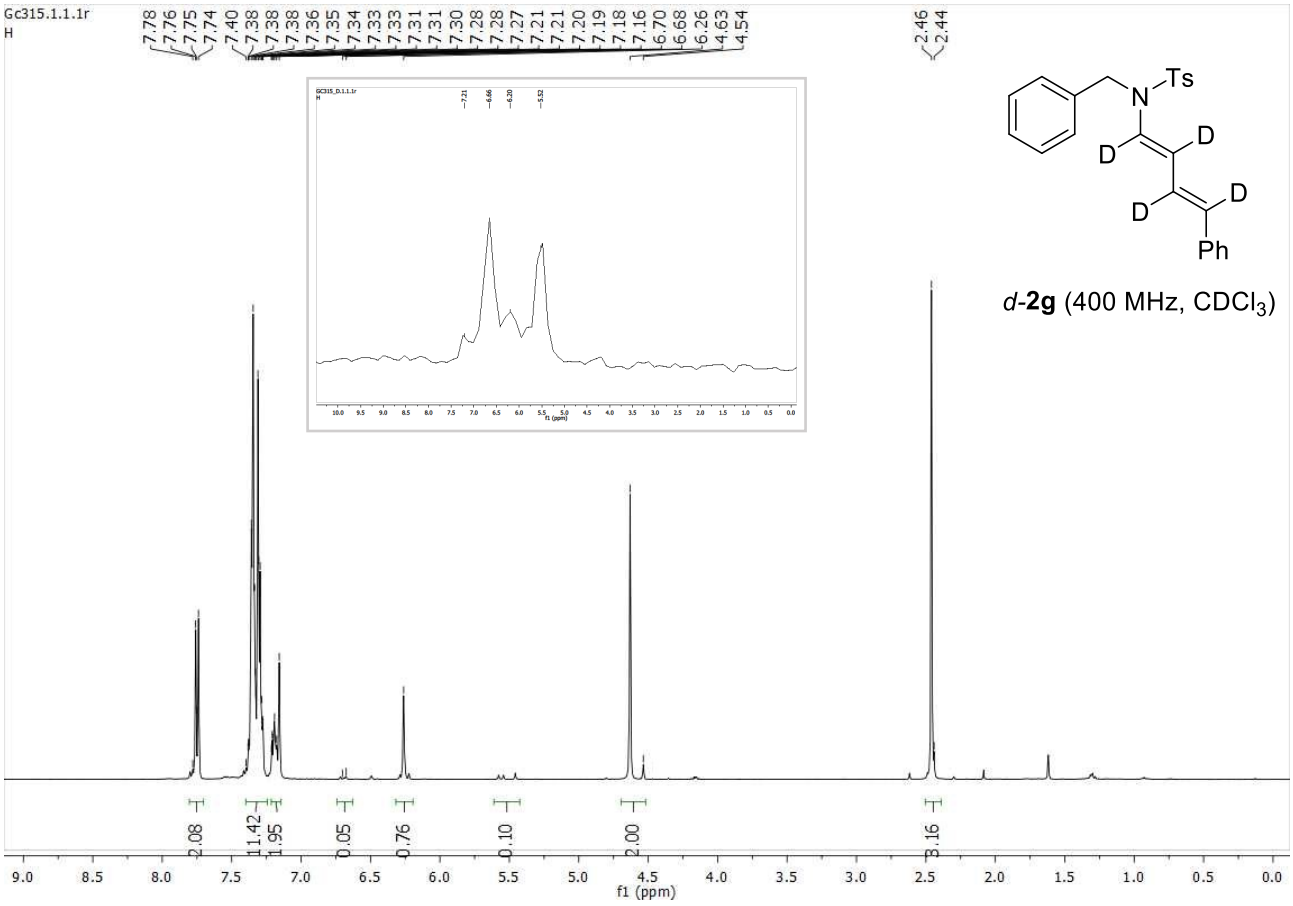
d-**2e** (101 MHz, $CDCl_3$)



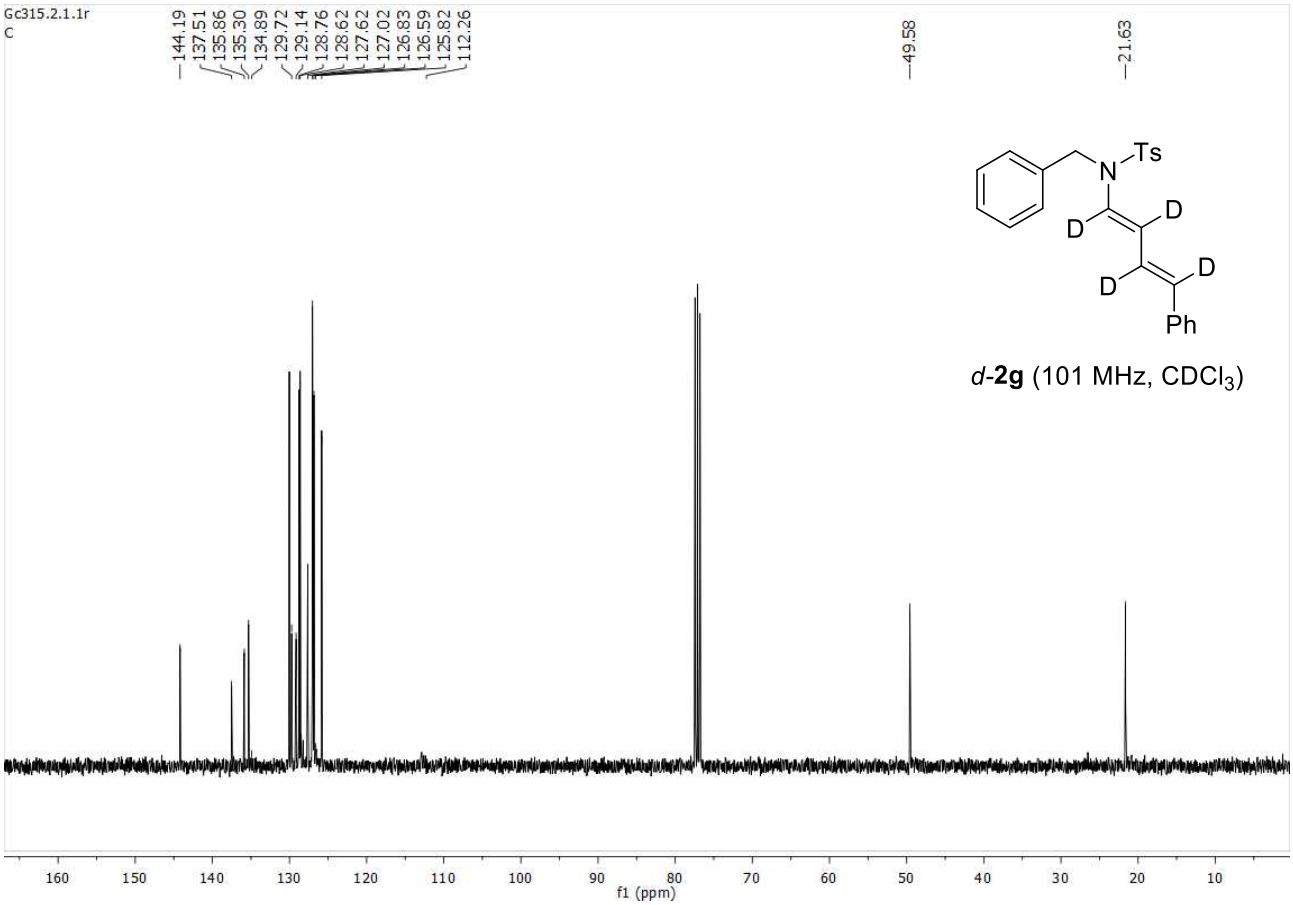
d-**2f** (400 MHz, $CDCl_3$)



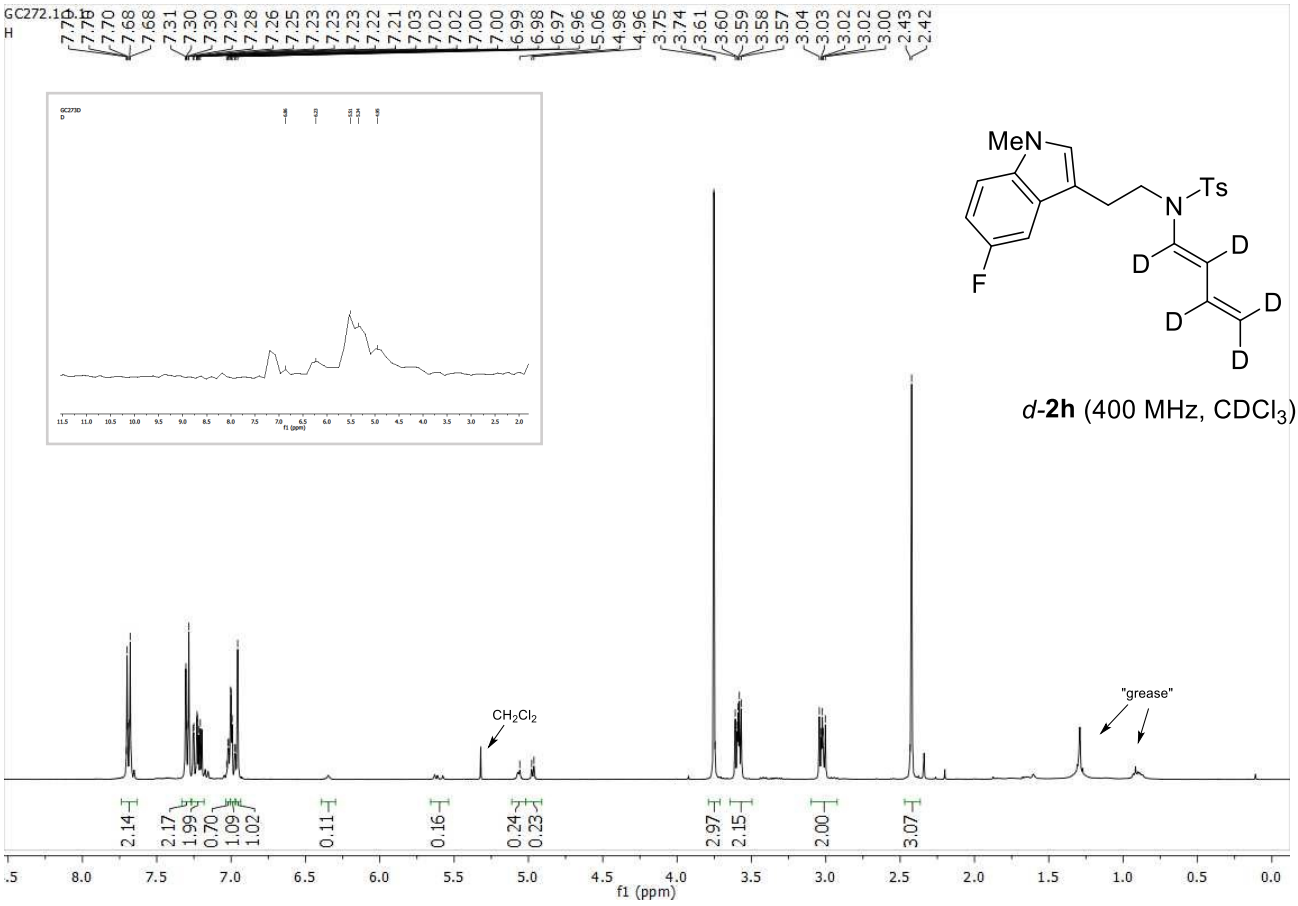
d-**2f** (101 MHz, $CDCl_3$)



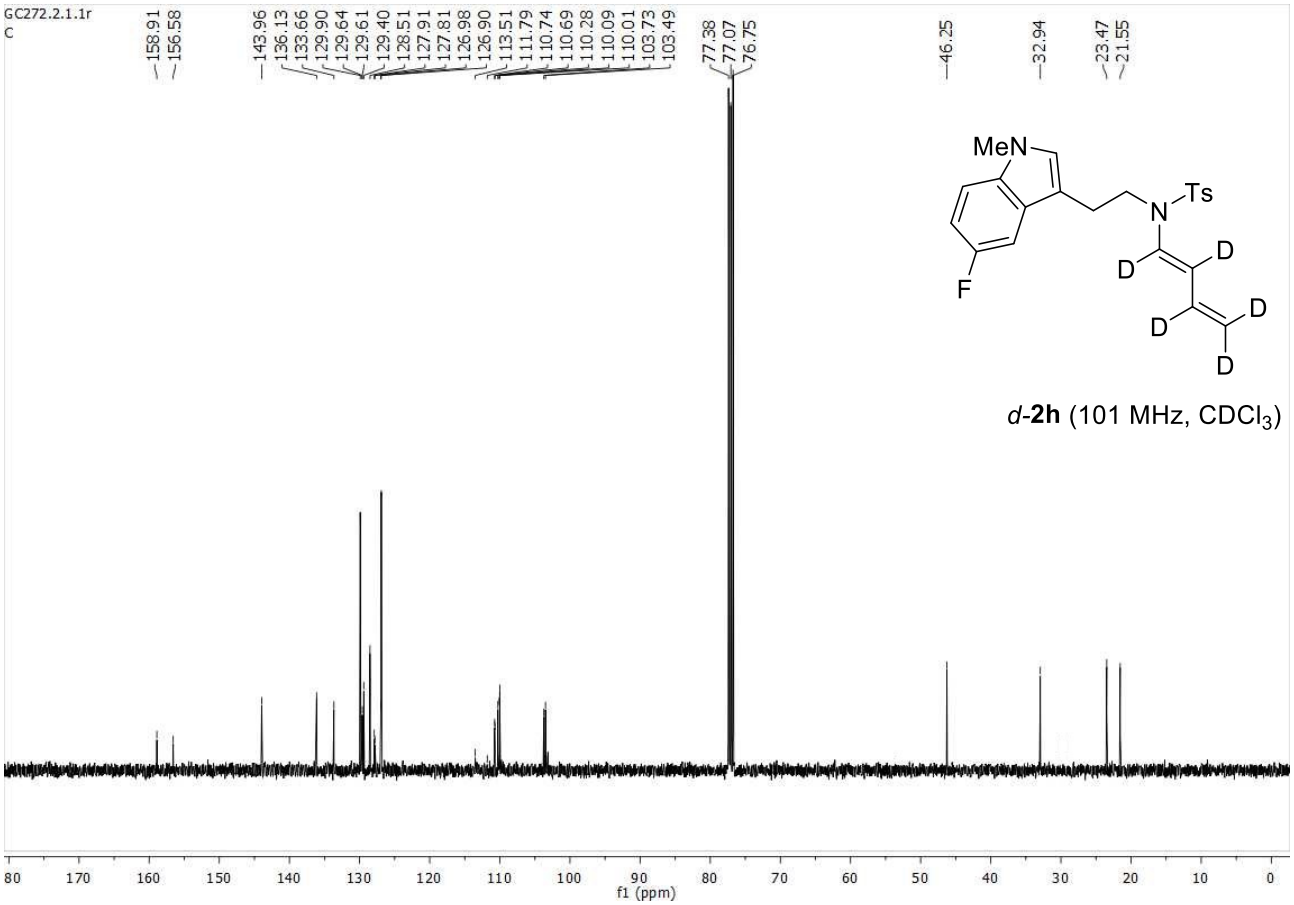
d-**2g** (400 MHz, $CDCl_3$)



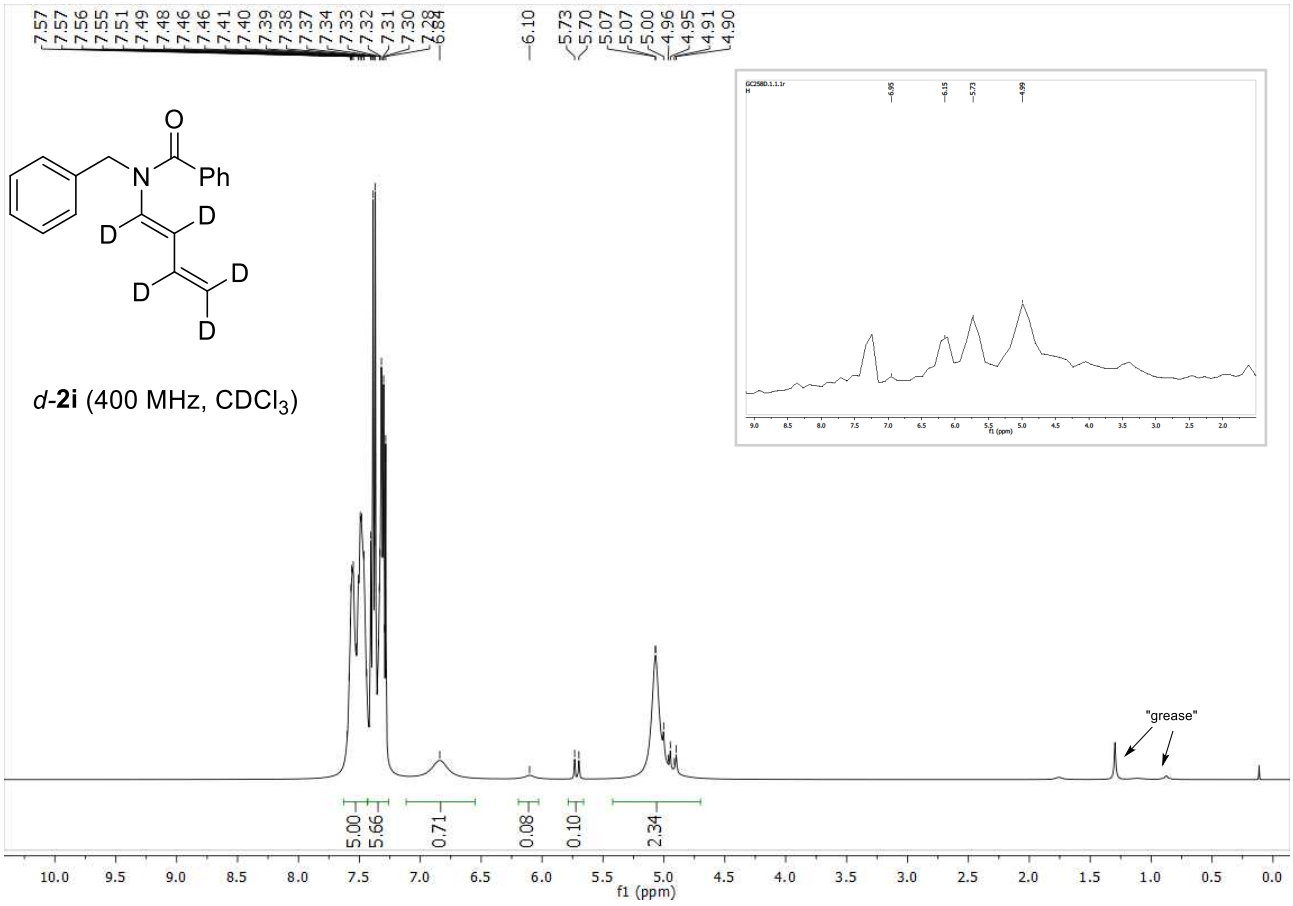
d-**2g** (101 MHz, $CDCl_3$)



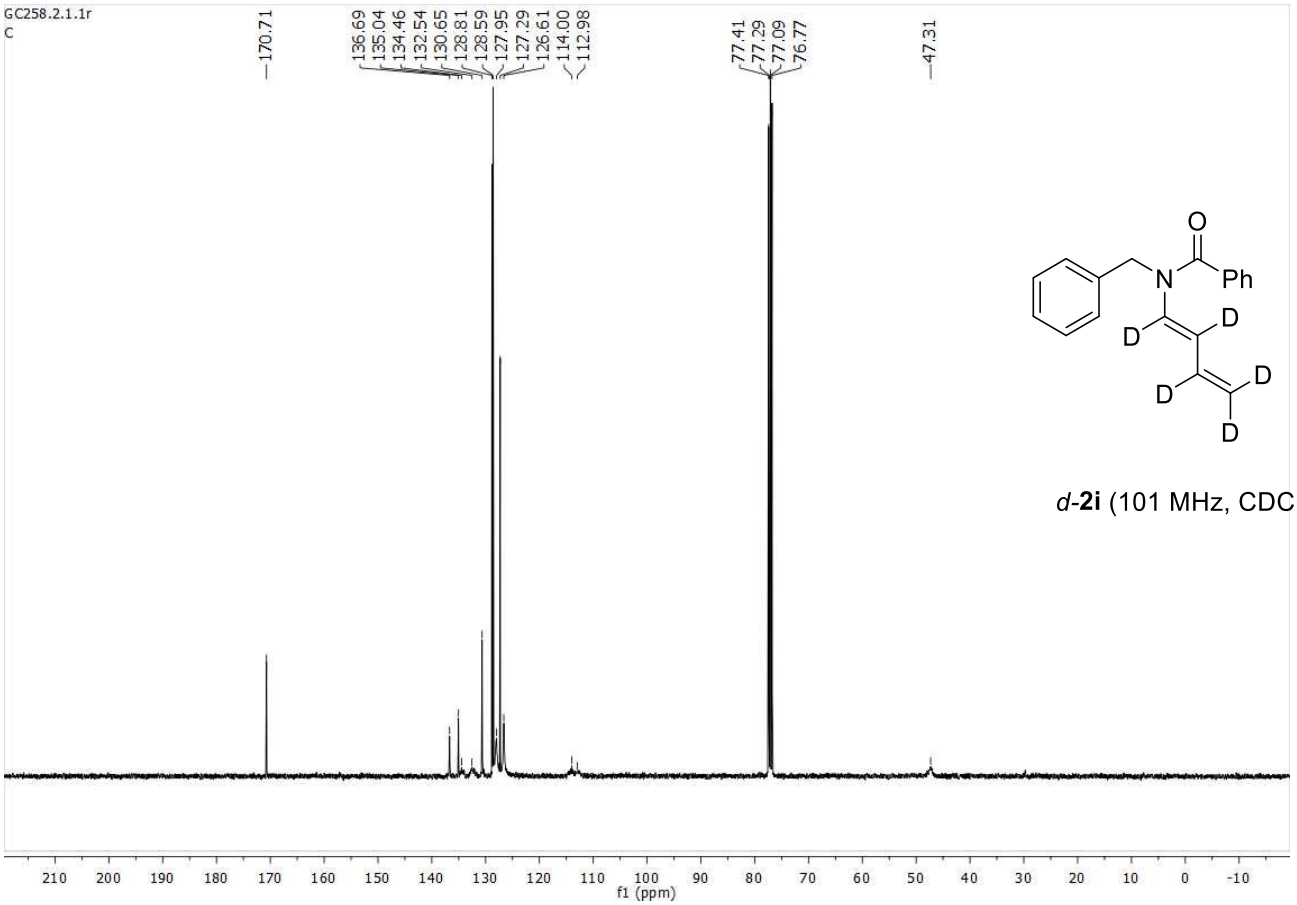
d-**2h** (400 MHz, $CDCl_3$)



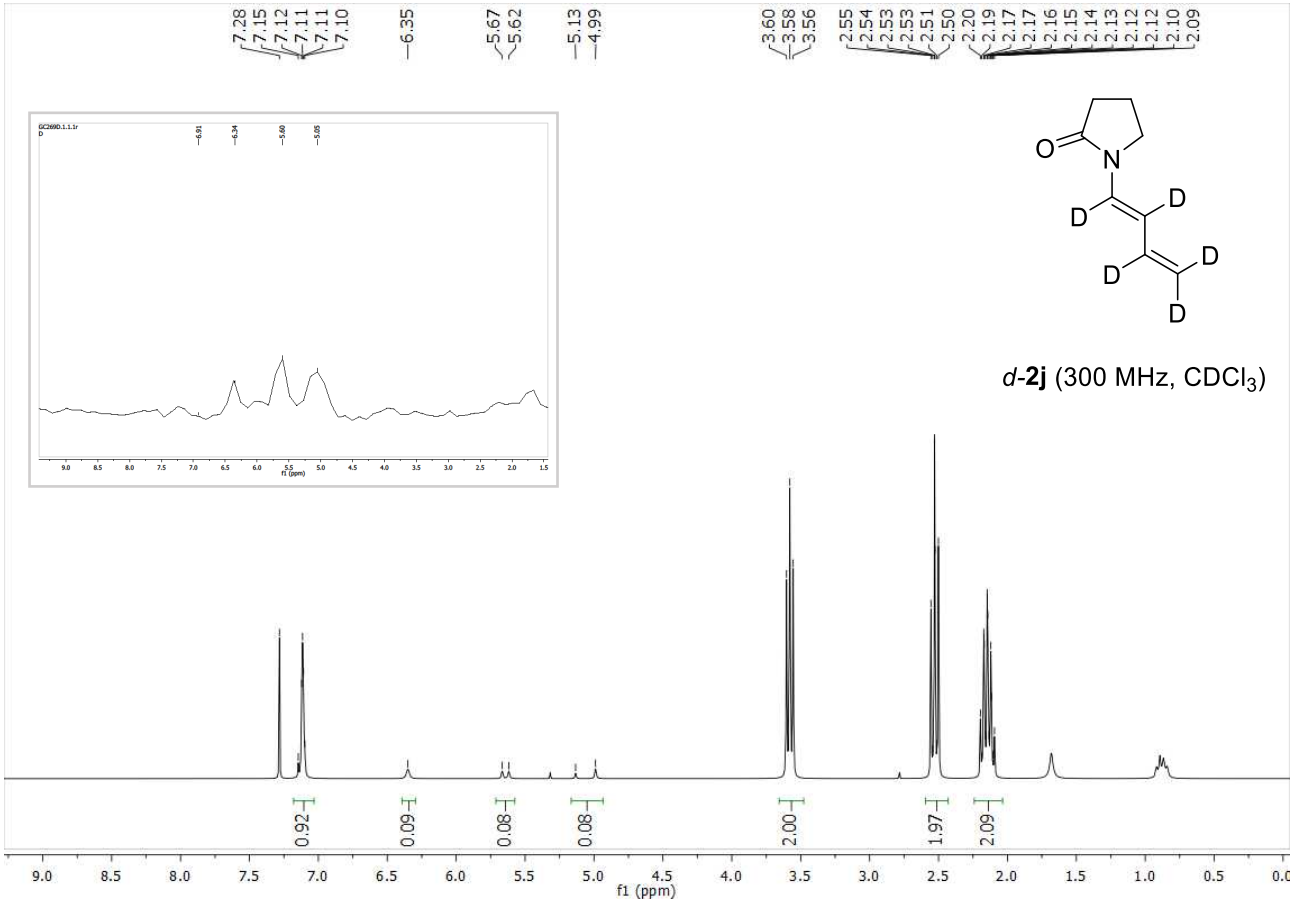
d-**2h** (101 MHz, $CDCl_3$)



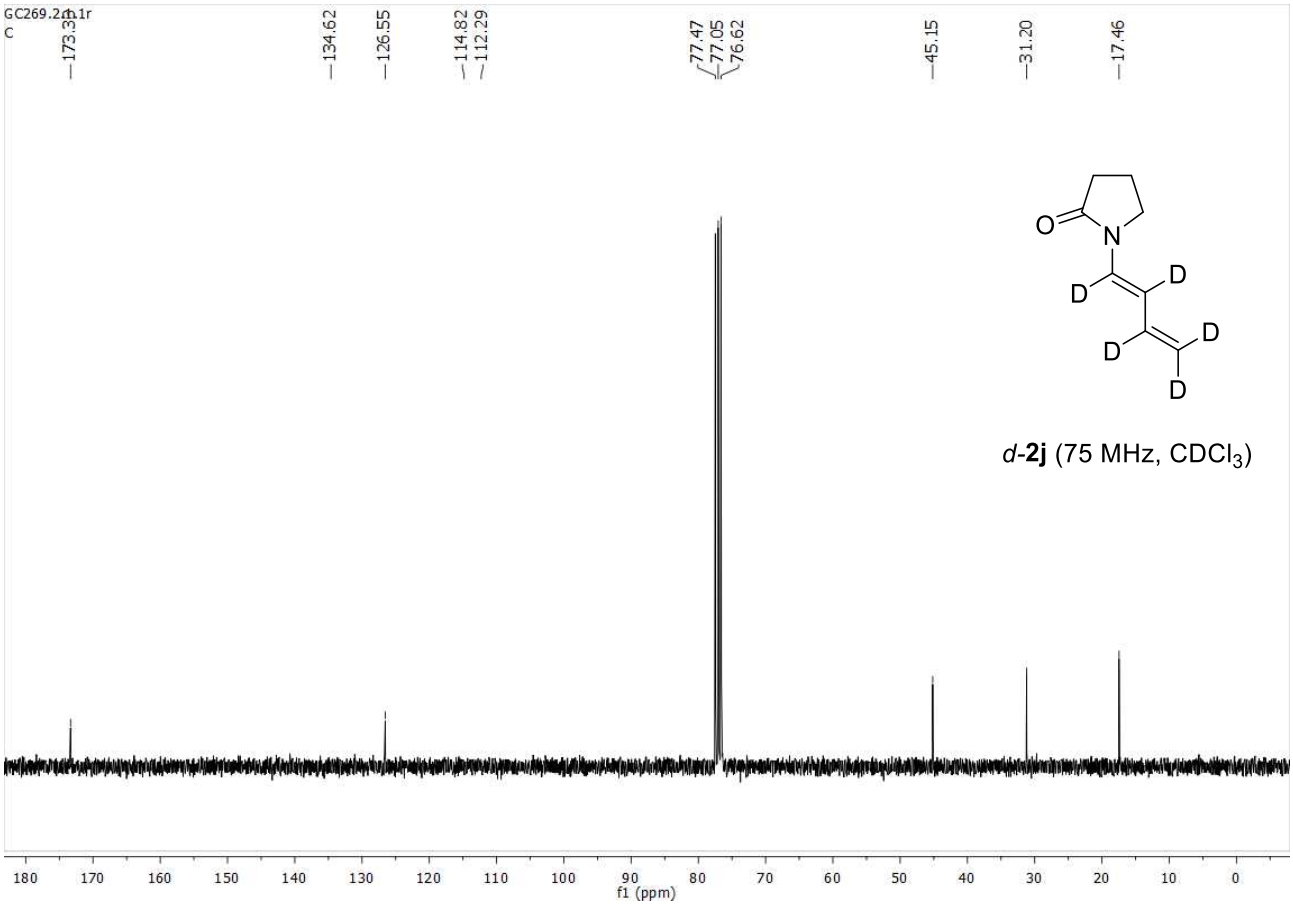
d-**2i** (400 MHz, $CDCl_3$)



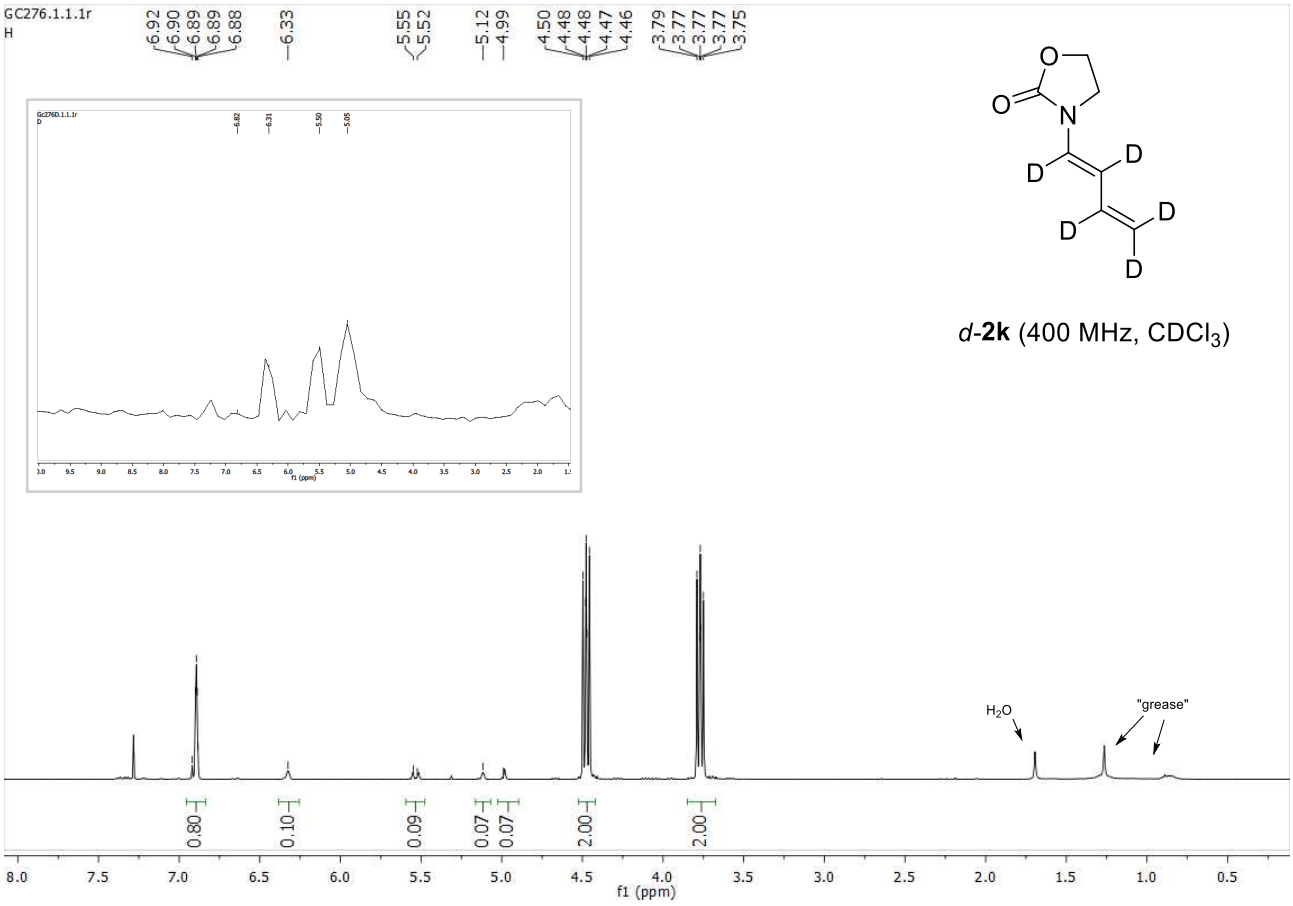
d-**2i** (101 MHz, $CDCl_3$)



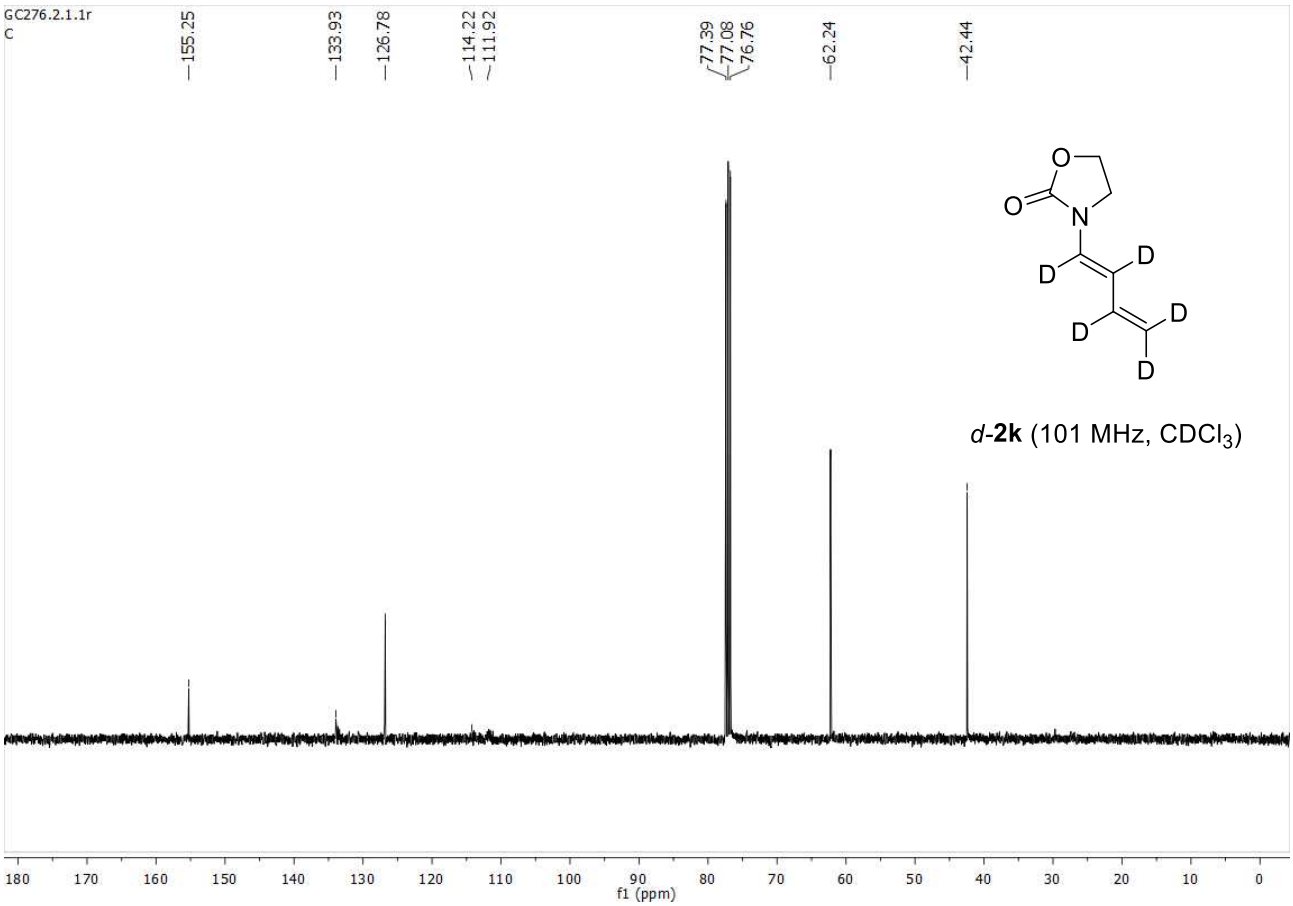
d-**2j** (300 MHz, $CDCl_3$)



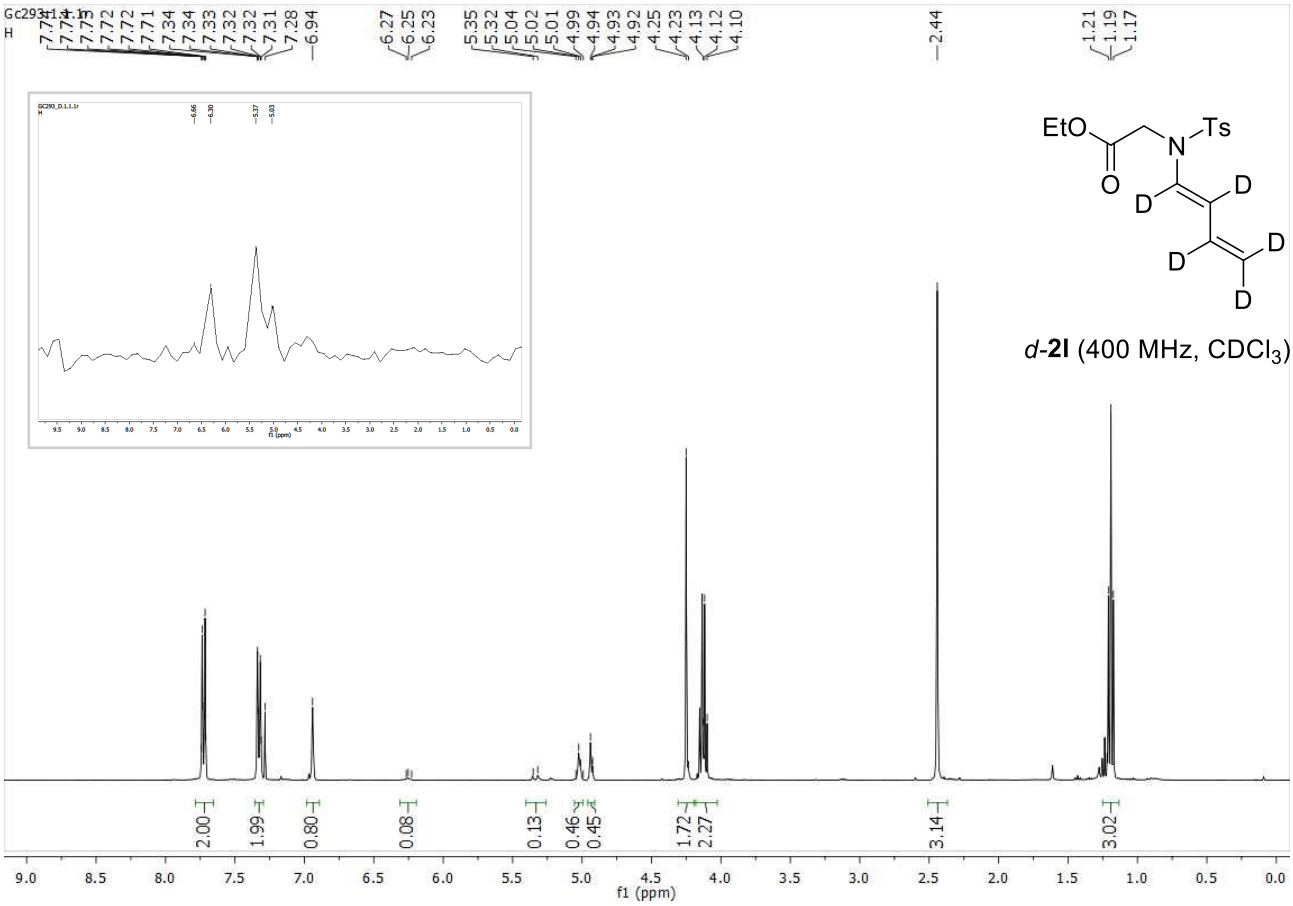
d-**2j** (75 MHz, $CDCl_3$)



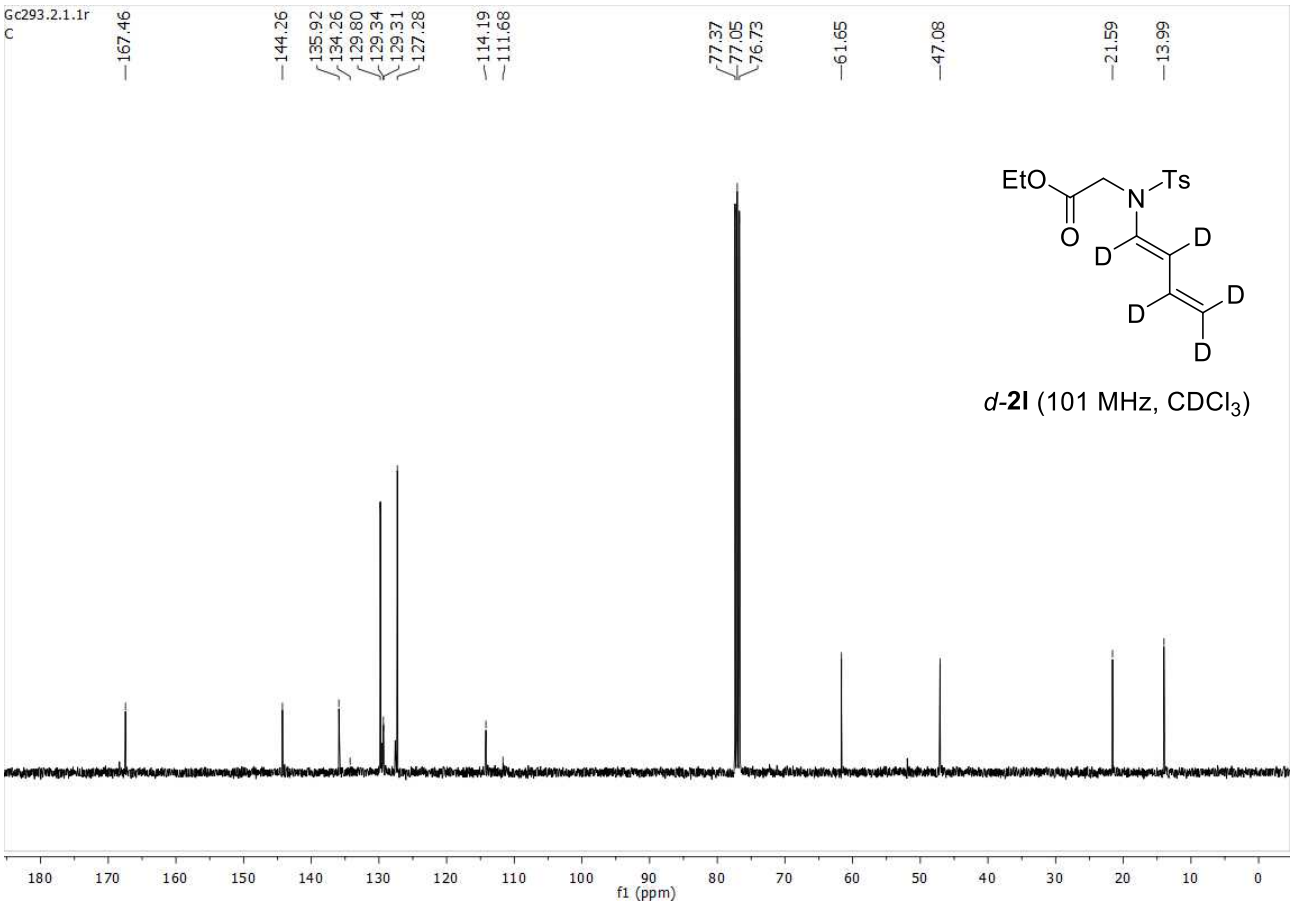
d-**2k** (400 MHz, $CDCl_3$)



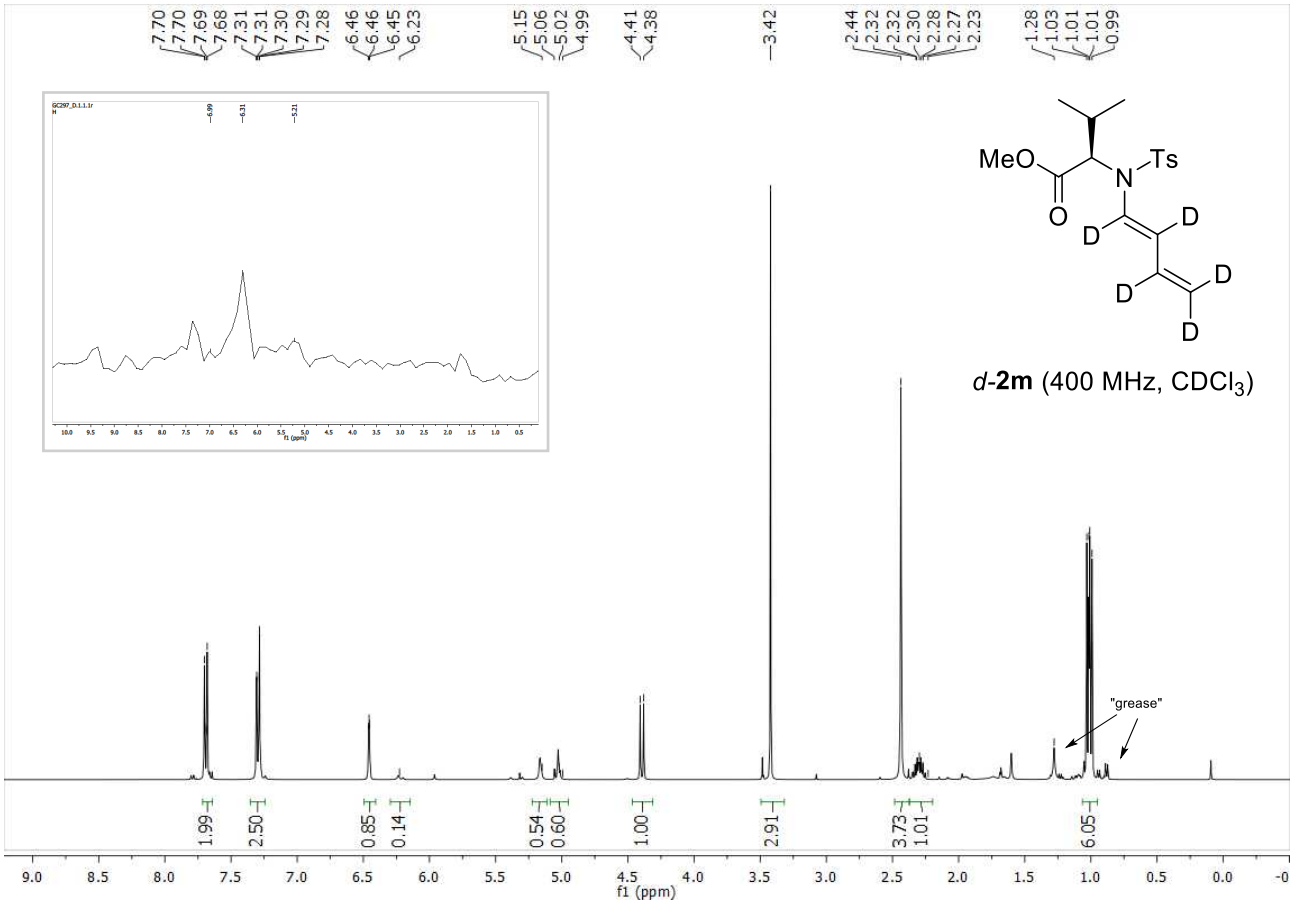
d-**2k** (101 MHz, $CDCl_3$)



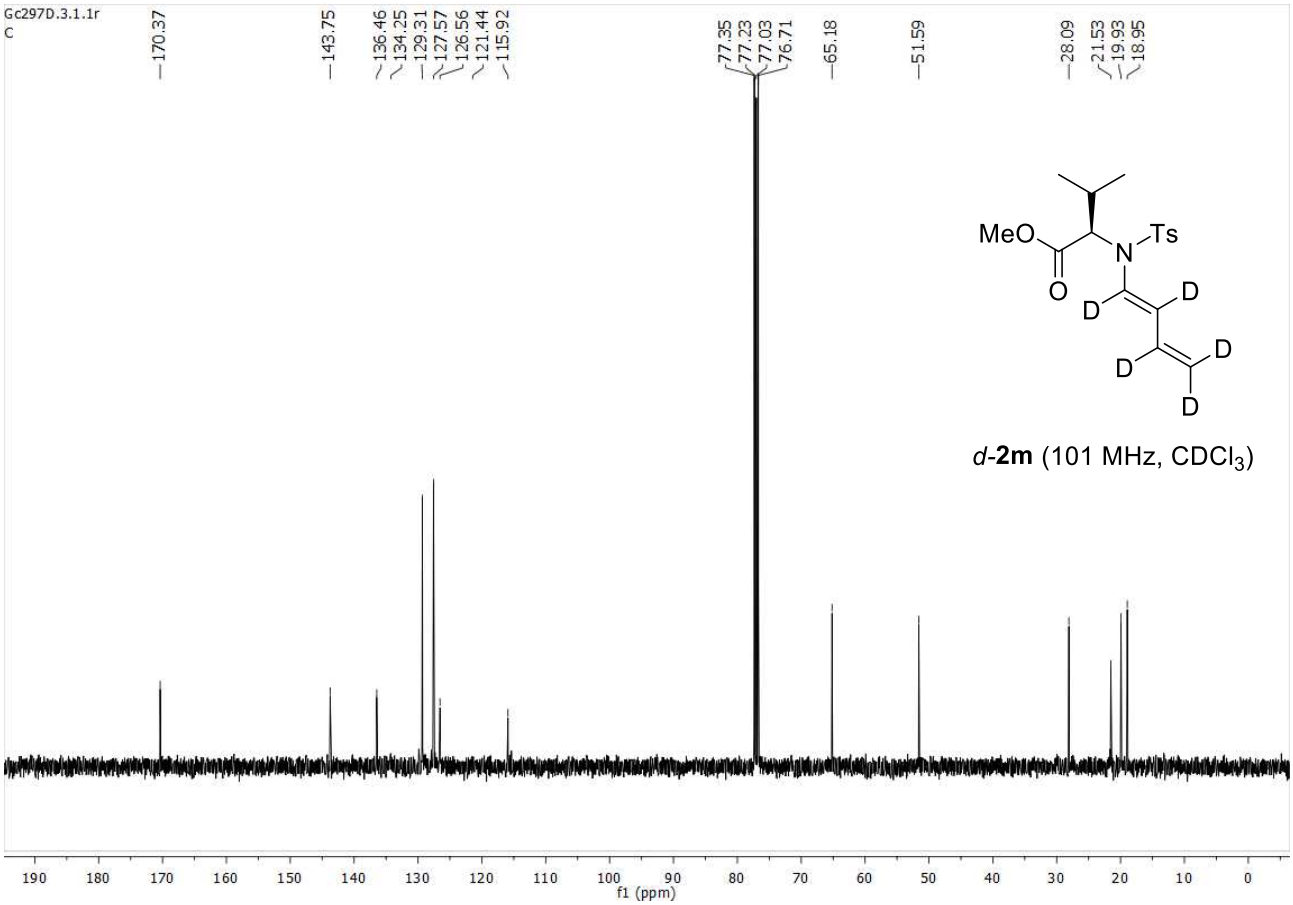
d-**2l** (400 MHz, $CDCl_3$)



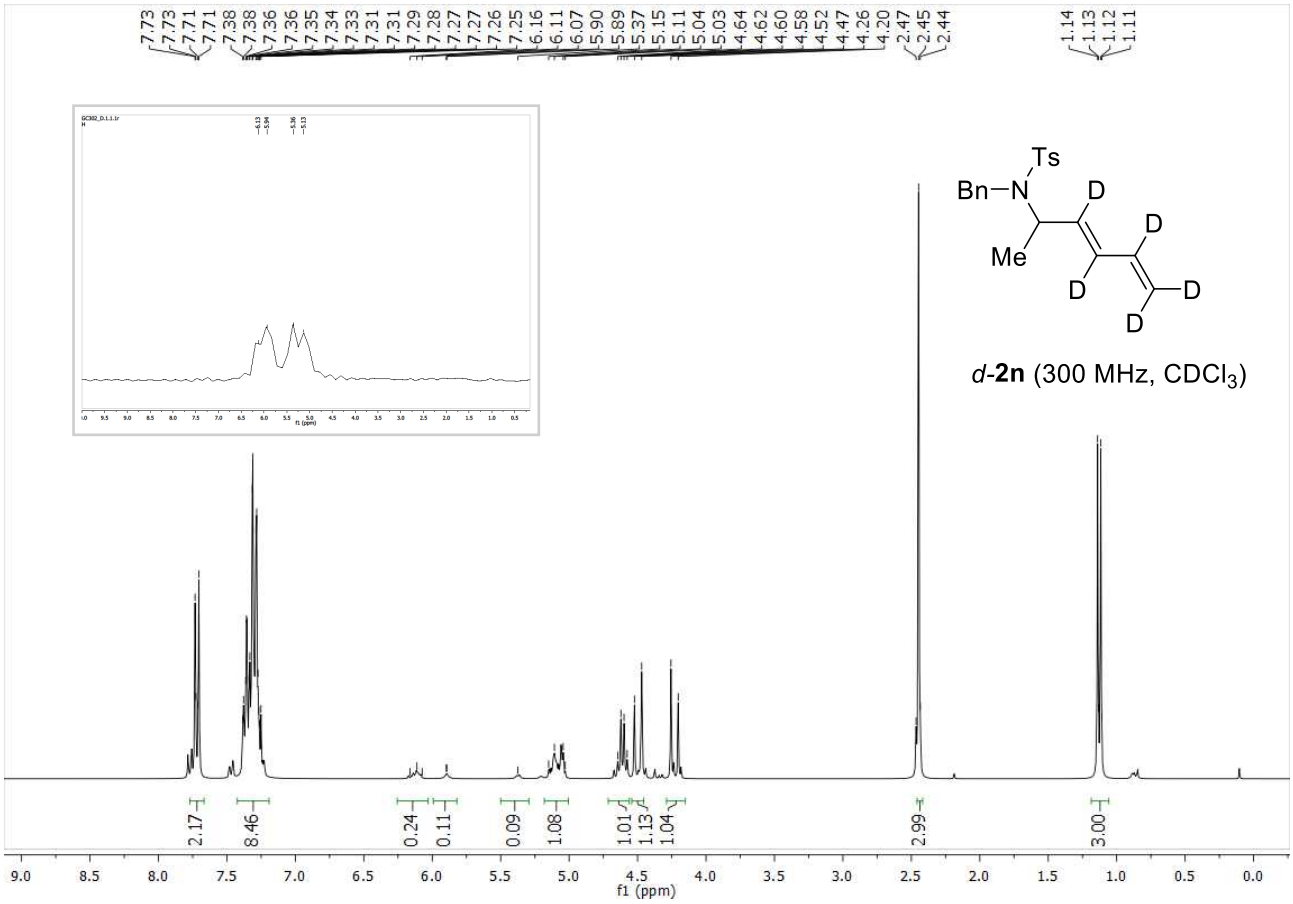
d-**2l** (101 MHz, $CDCl_3$)



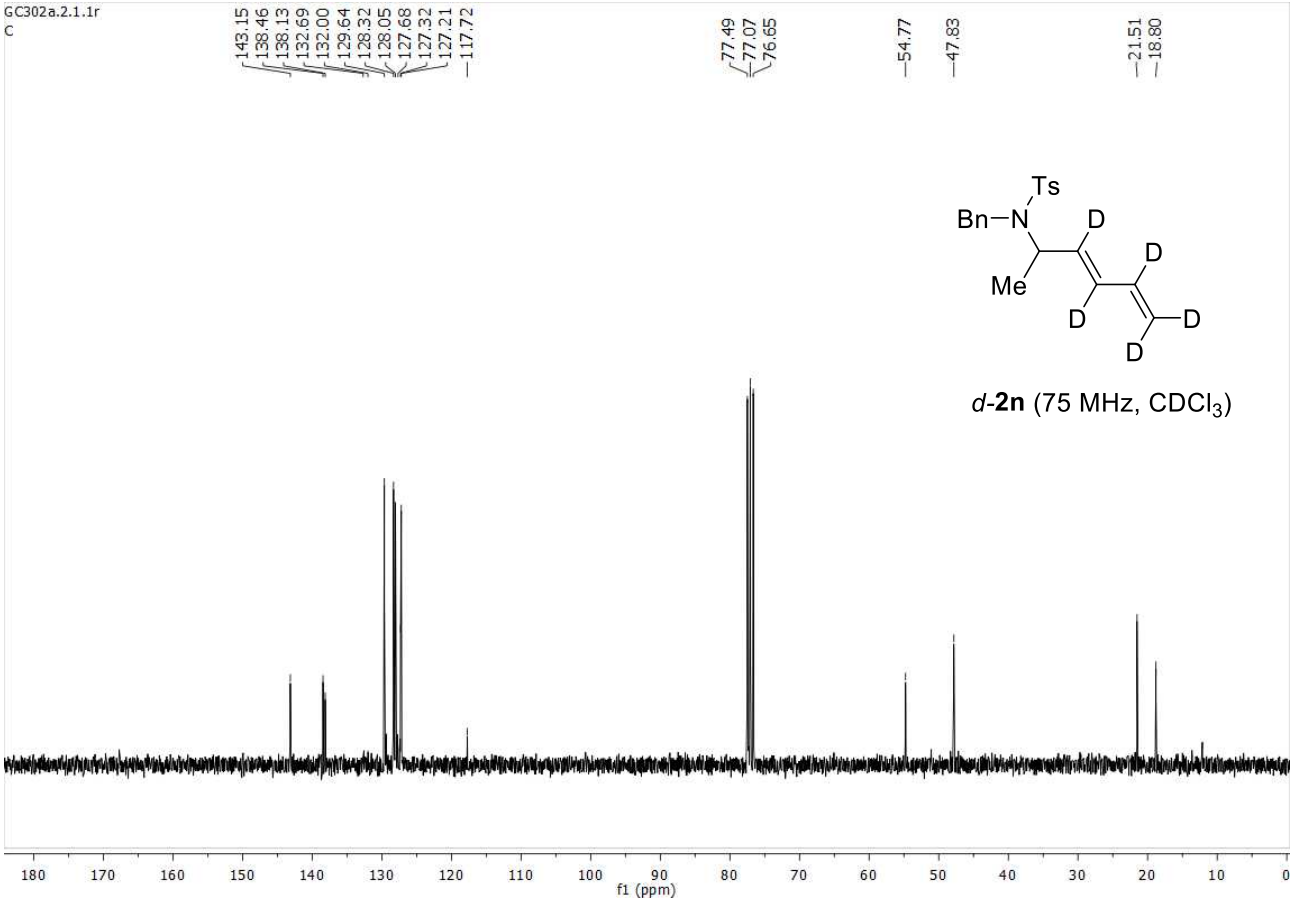
d-**2m** (400 MHz, $CDCl_3$)



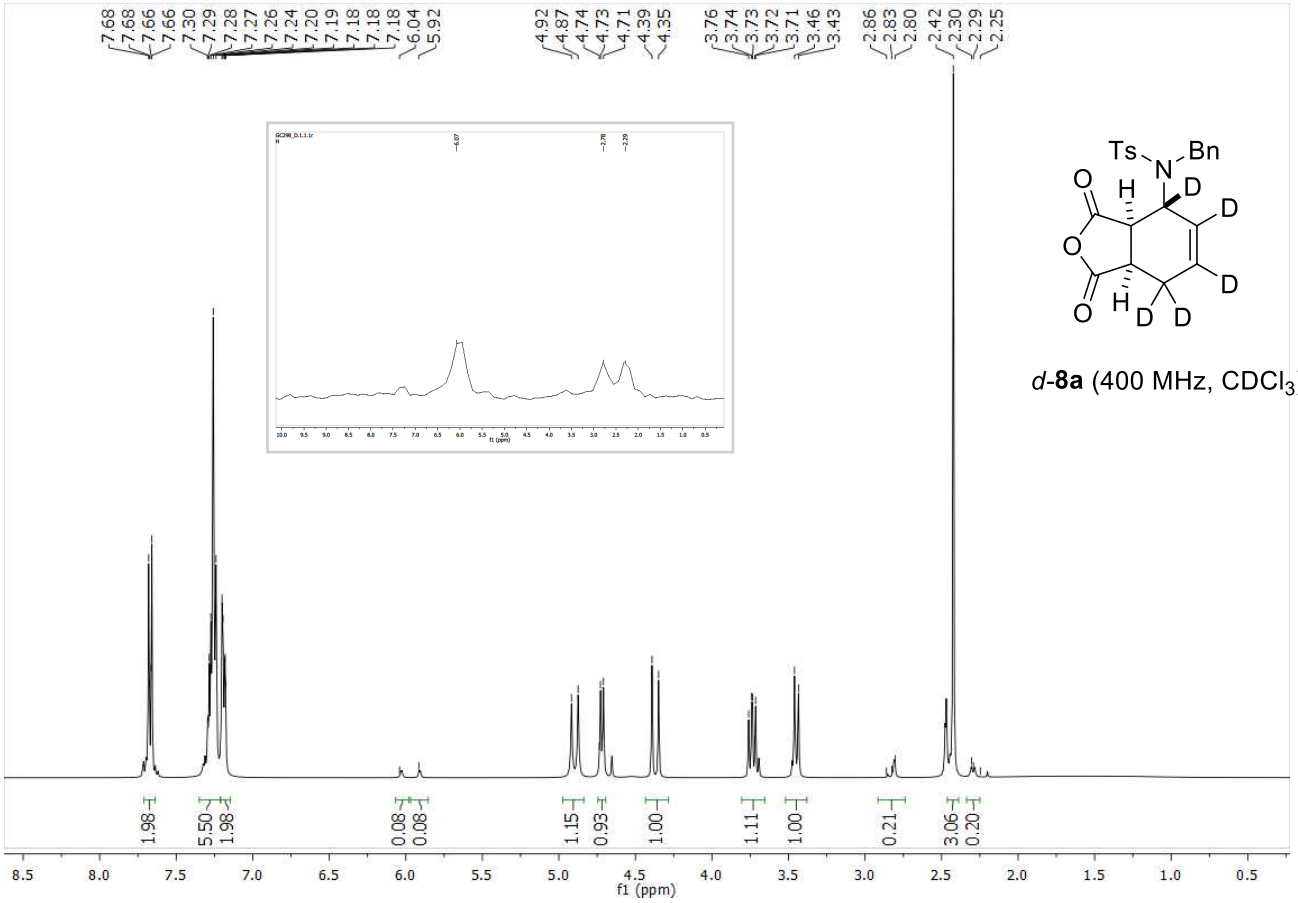
d-**2m** (101 MHz, $CDCl_3$)



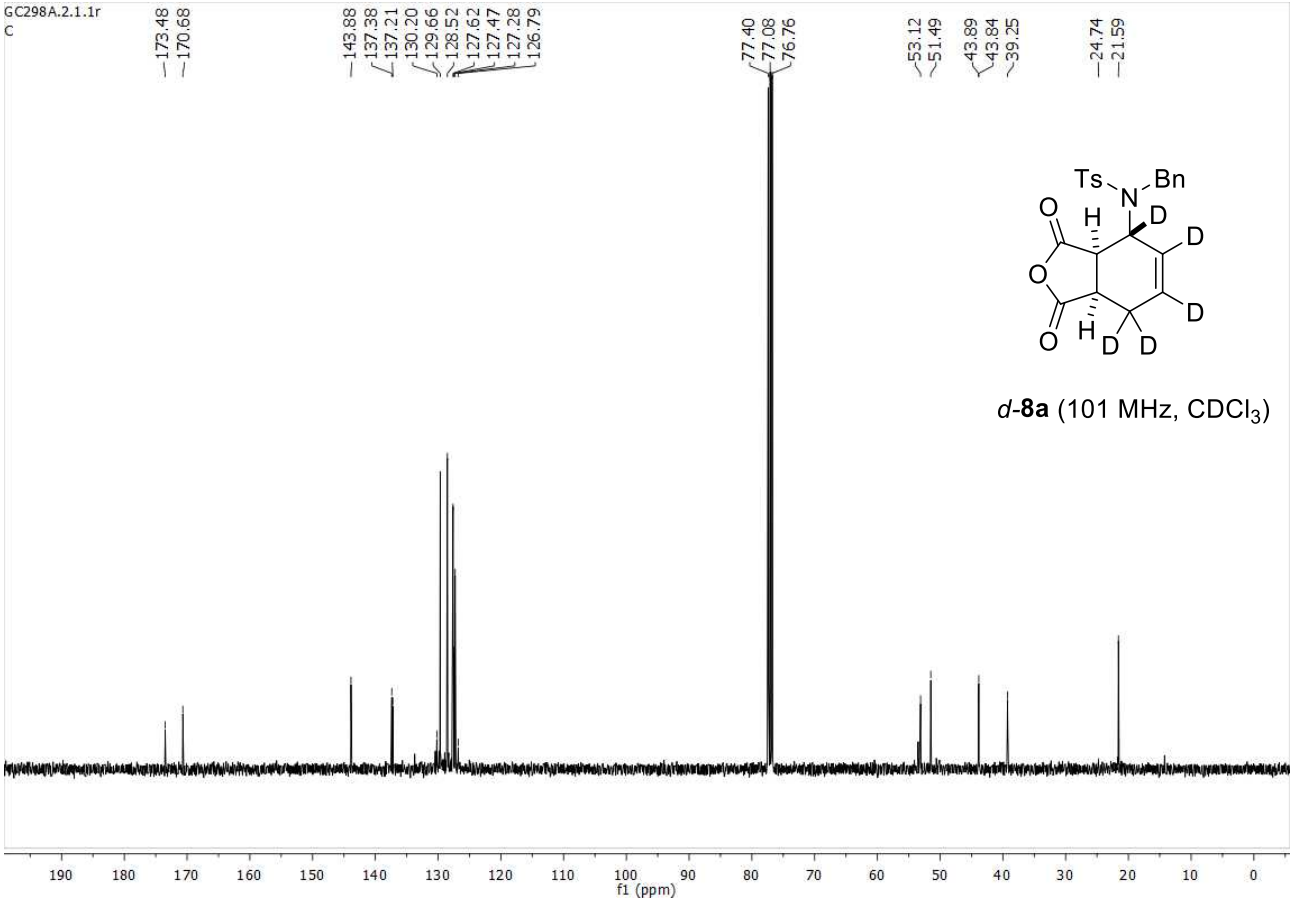
d-**2n** (300 MHz, $CDCl_3$)



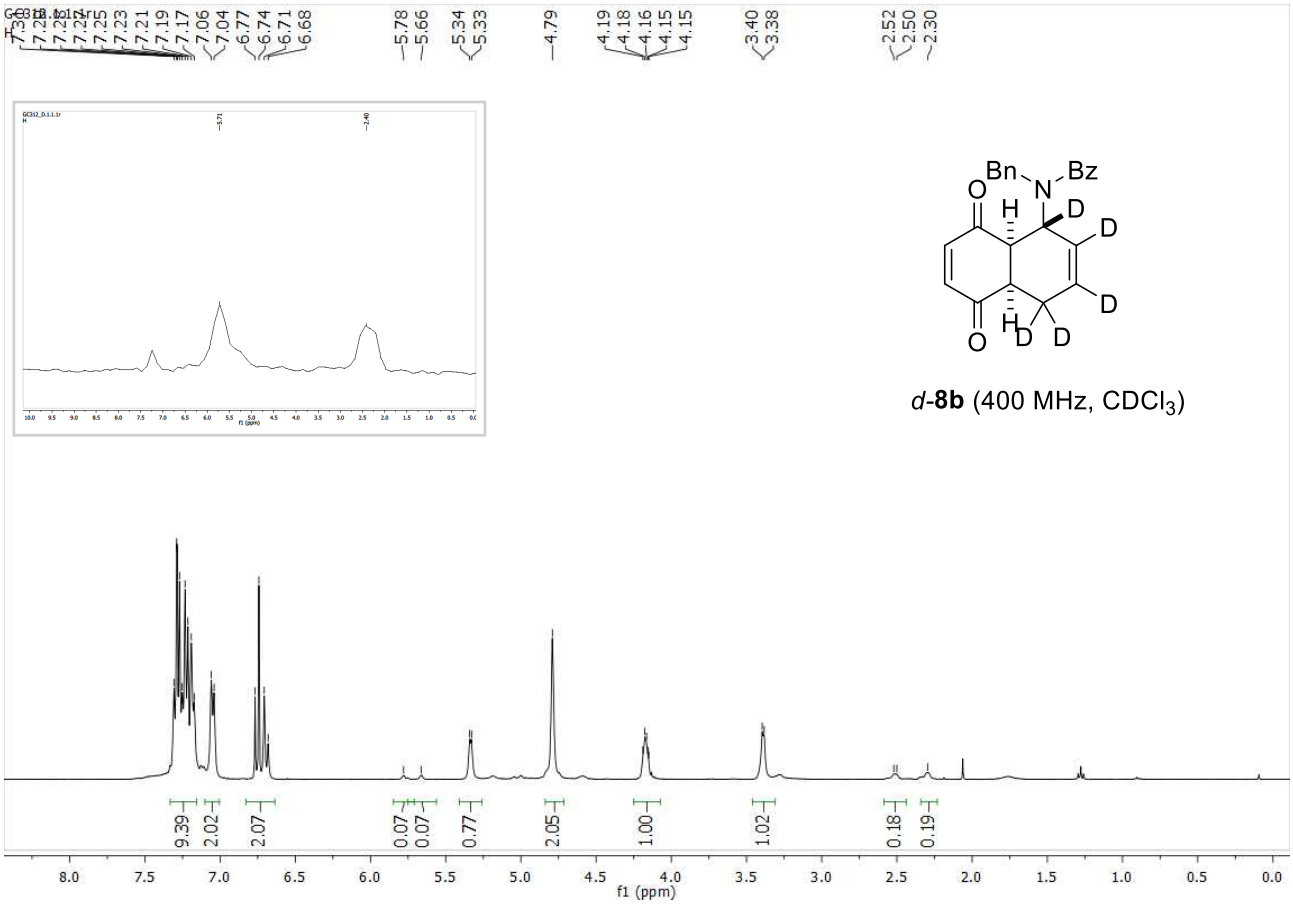
d-**2n** (75 MHz, $CDCl_3$)



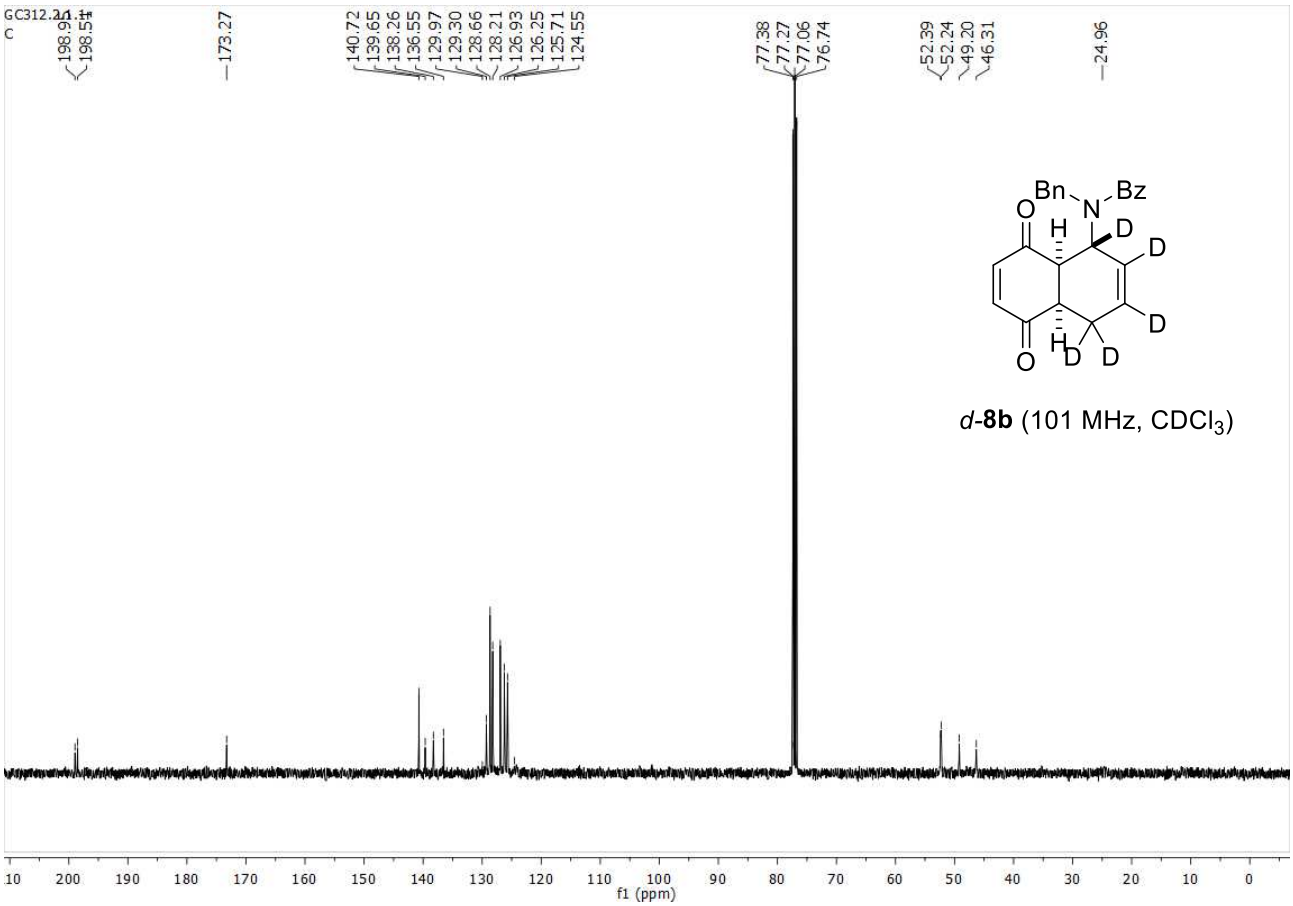
d-**8a** (400 MHz, $CDCl_3$)



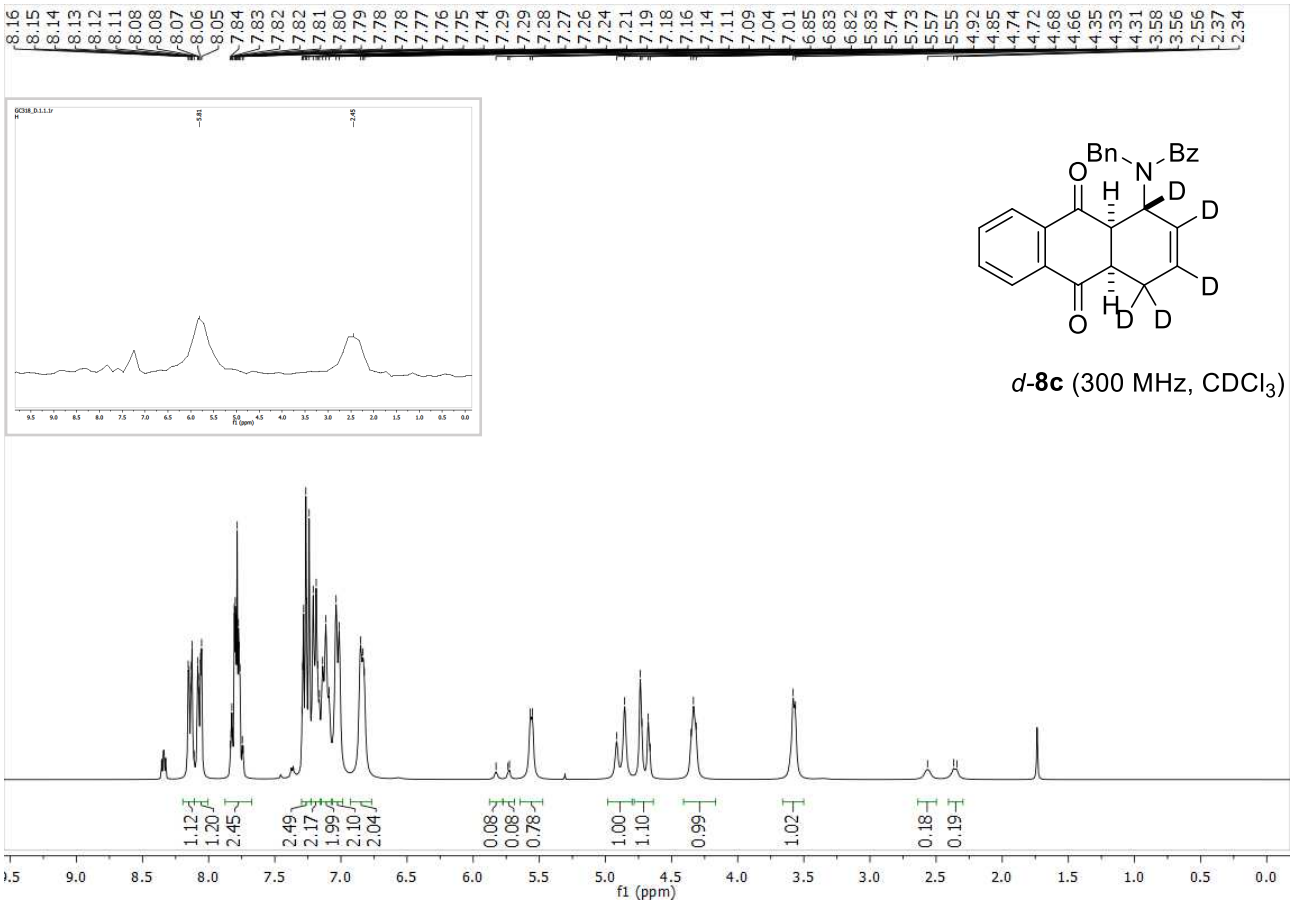
d-**8a** (101 MHz, $CDCl_3$)



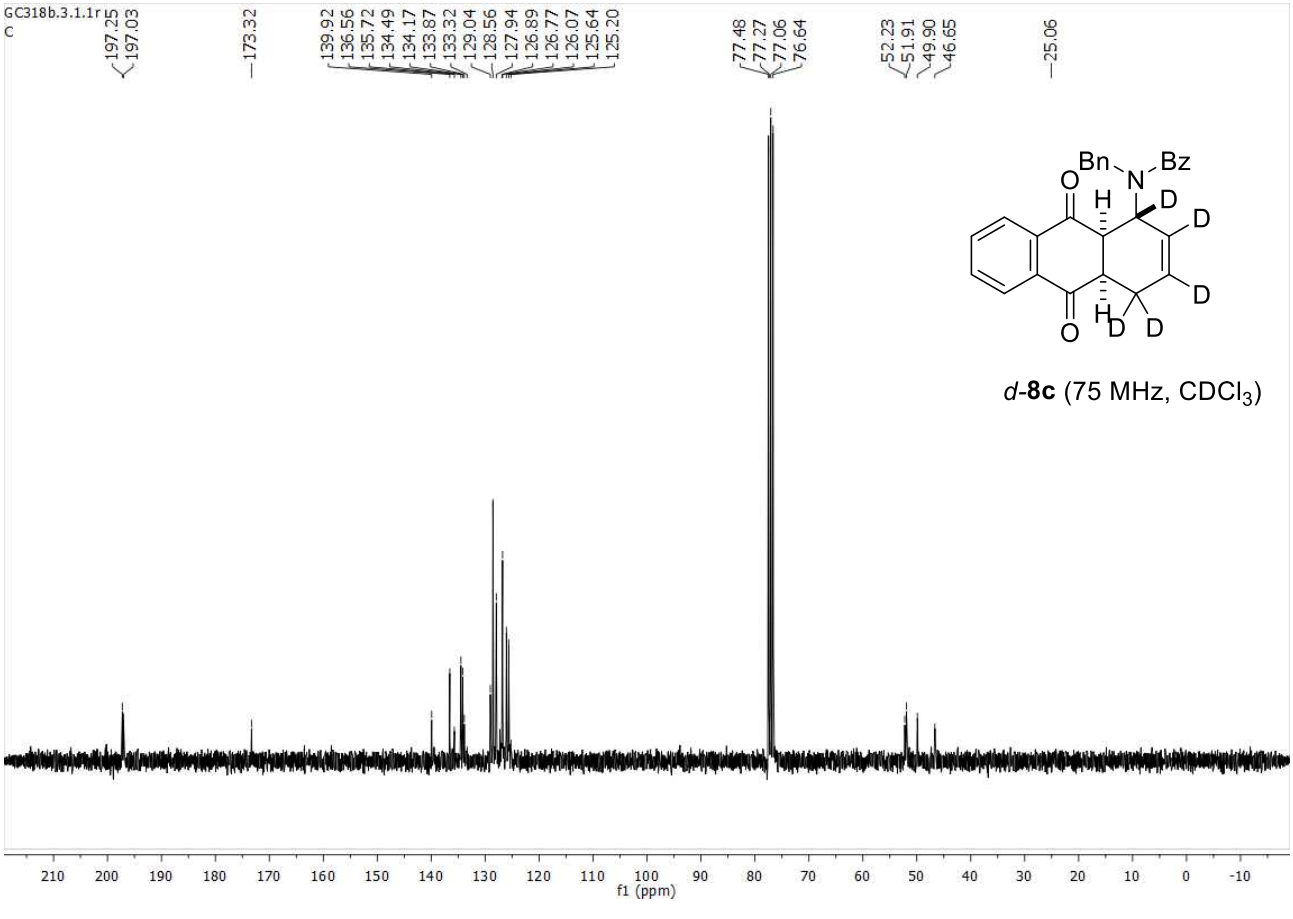
d-**8b** (400 MHz, $CDCl_3$)



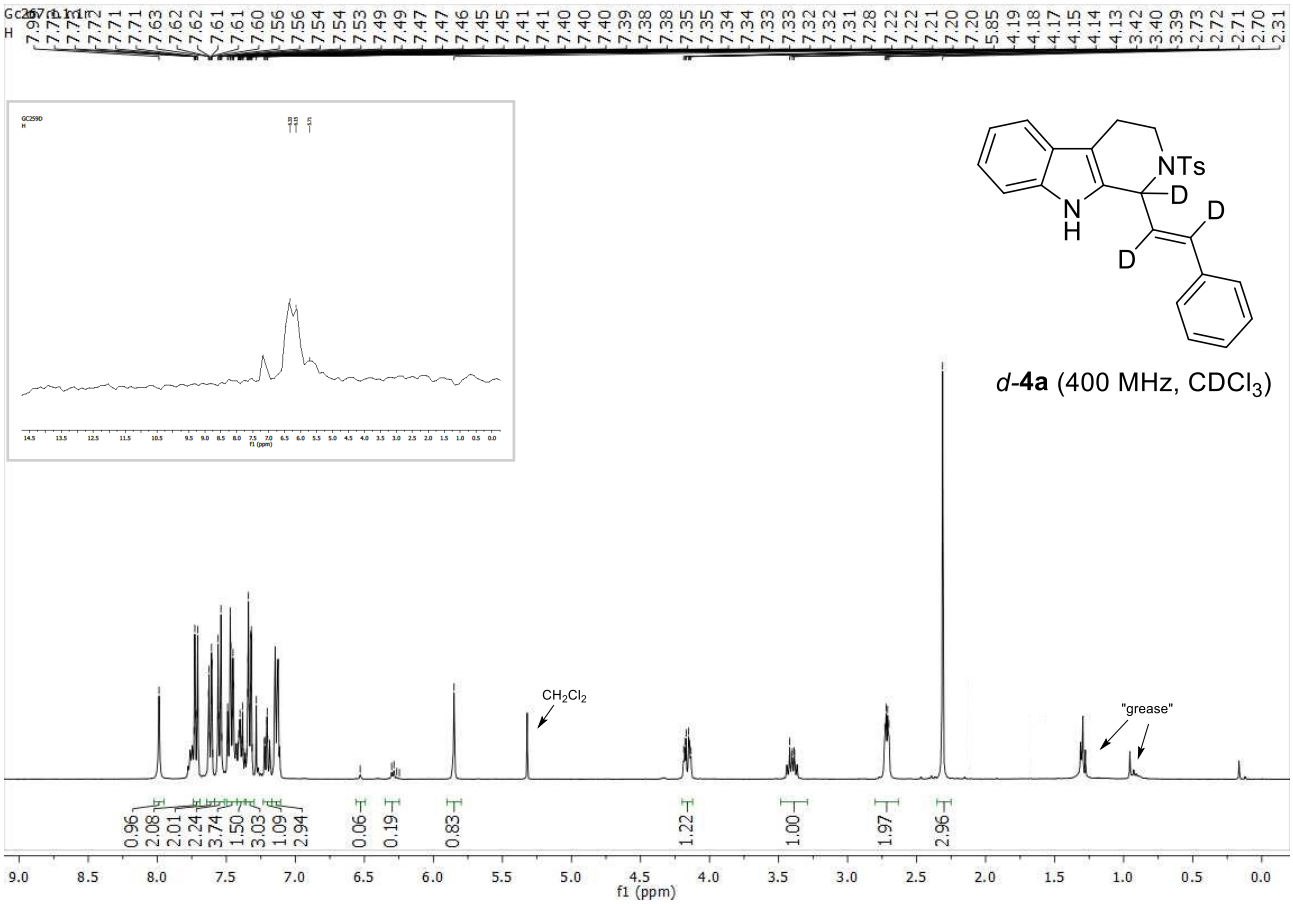
d-**8b** (101 MHz, $CDCl_3$)



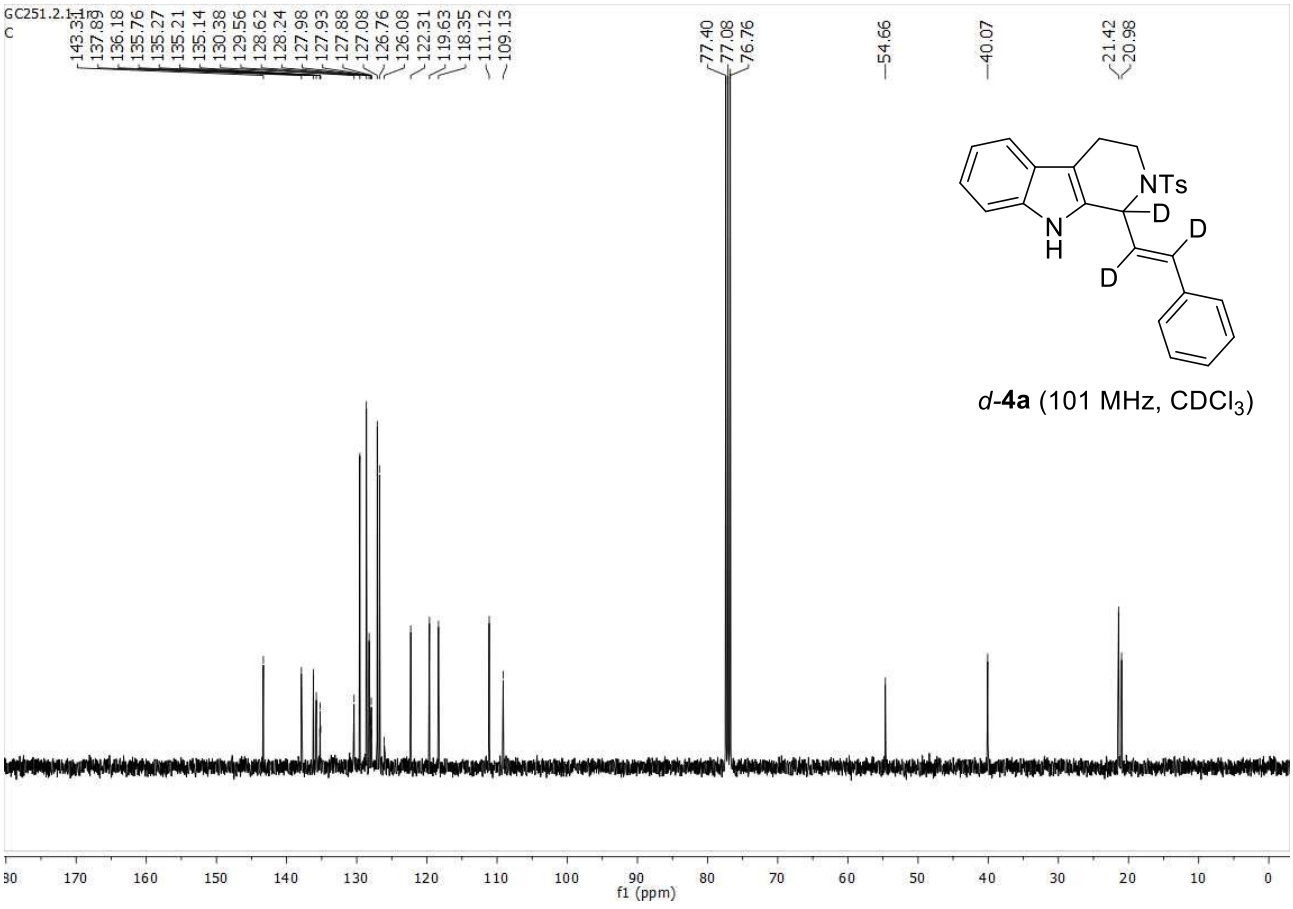
d-**8c** (300 MHz, $CDCl_3$)



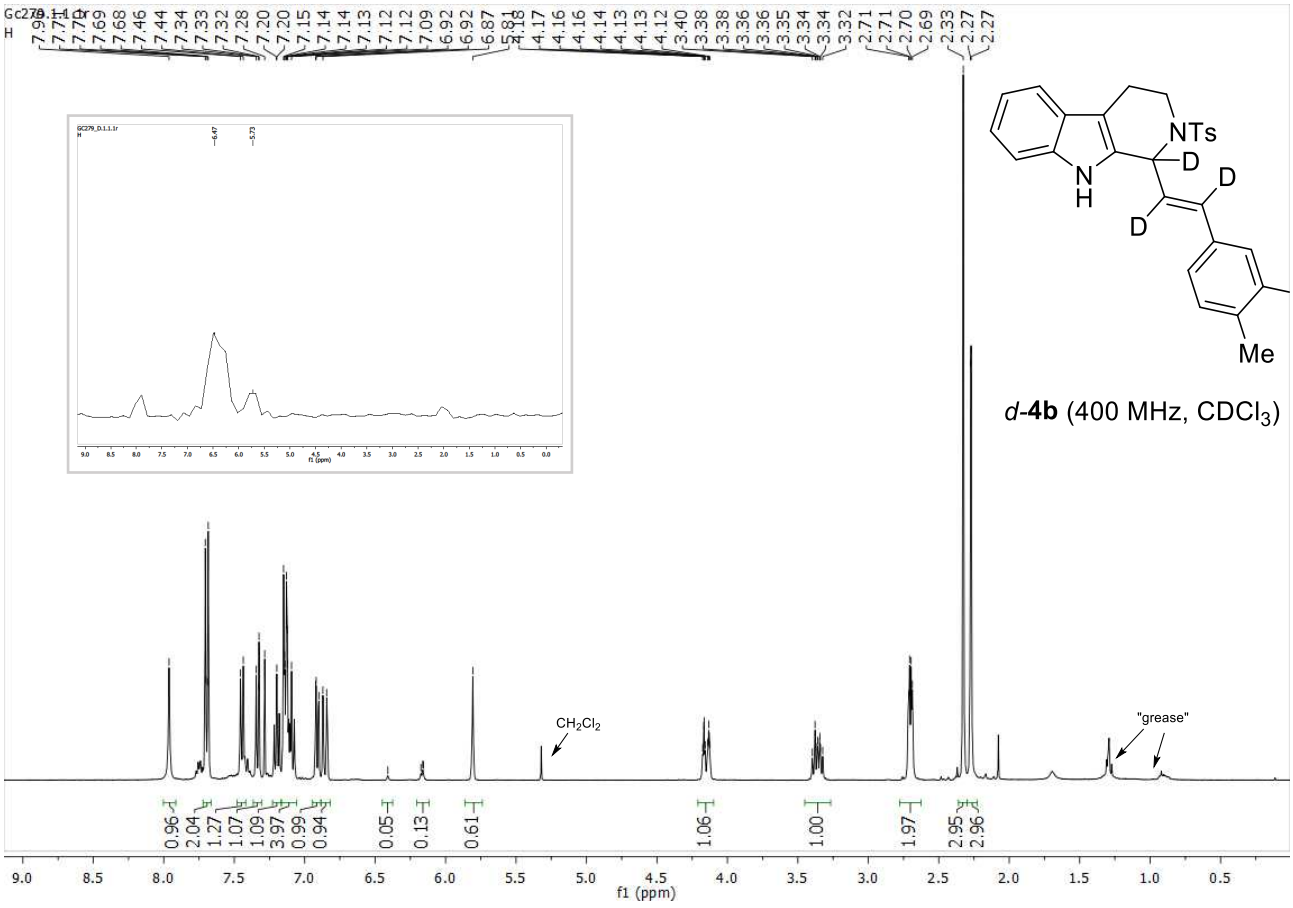
d-**8c** (75 MHz, $CDCl_3$)



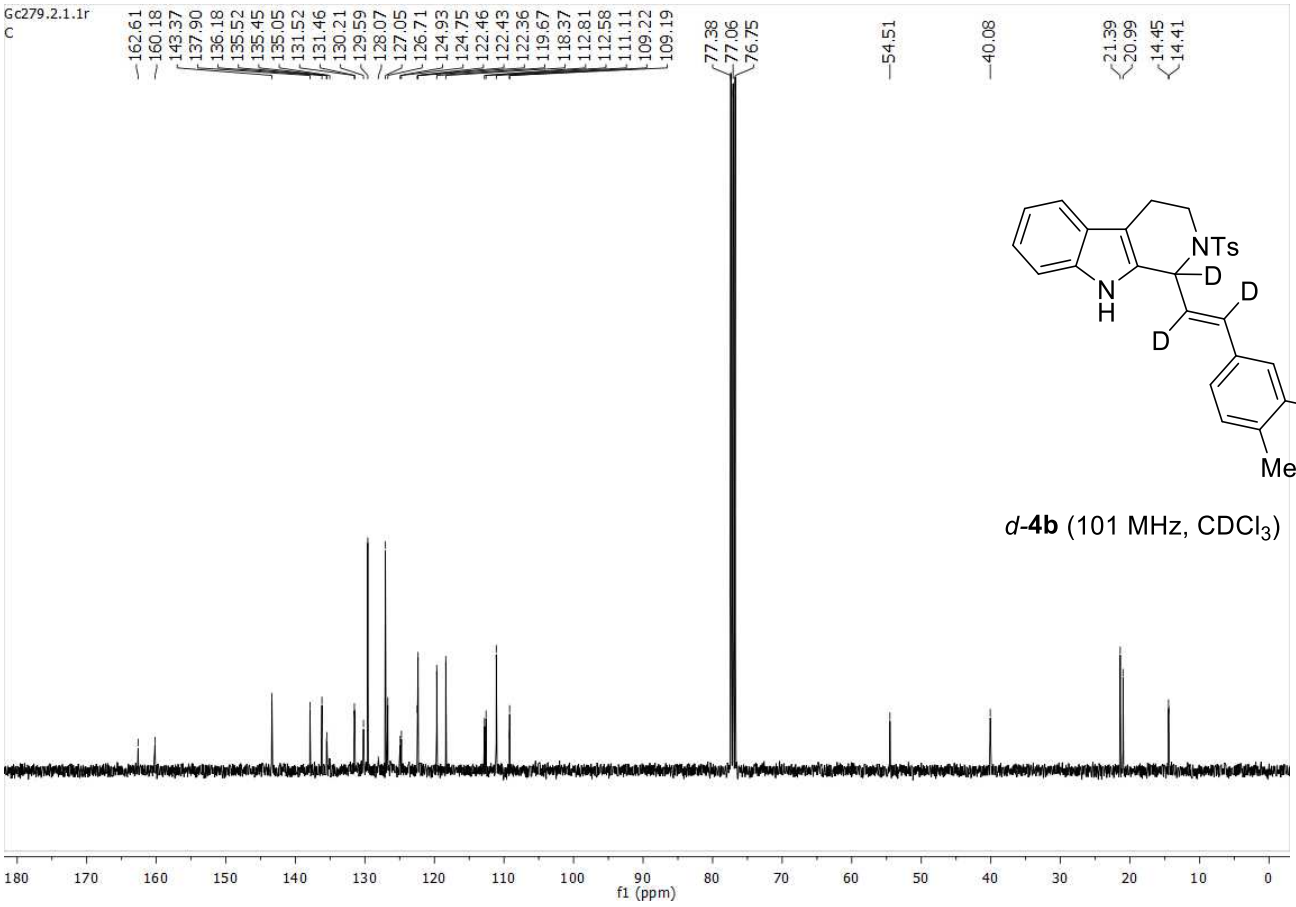
d-**4a** (400 MHz, $CDCl_3$)



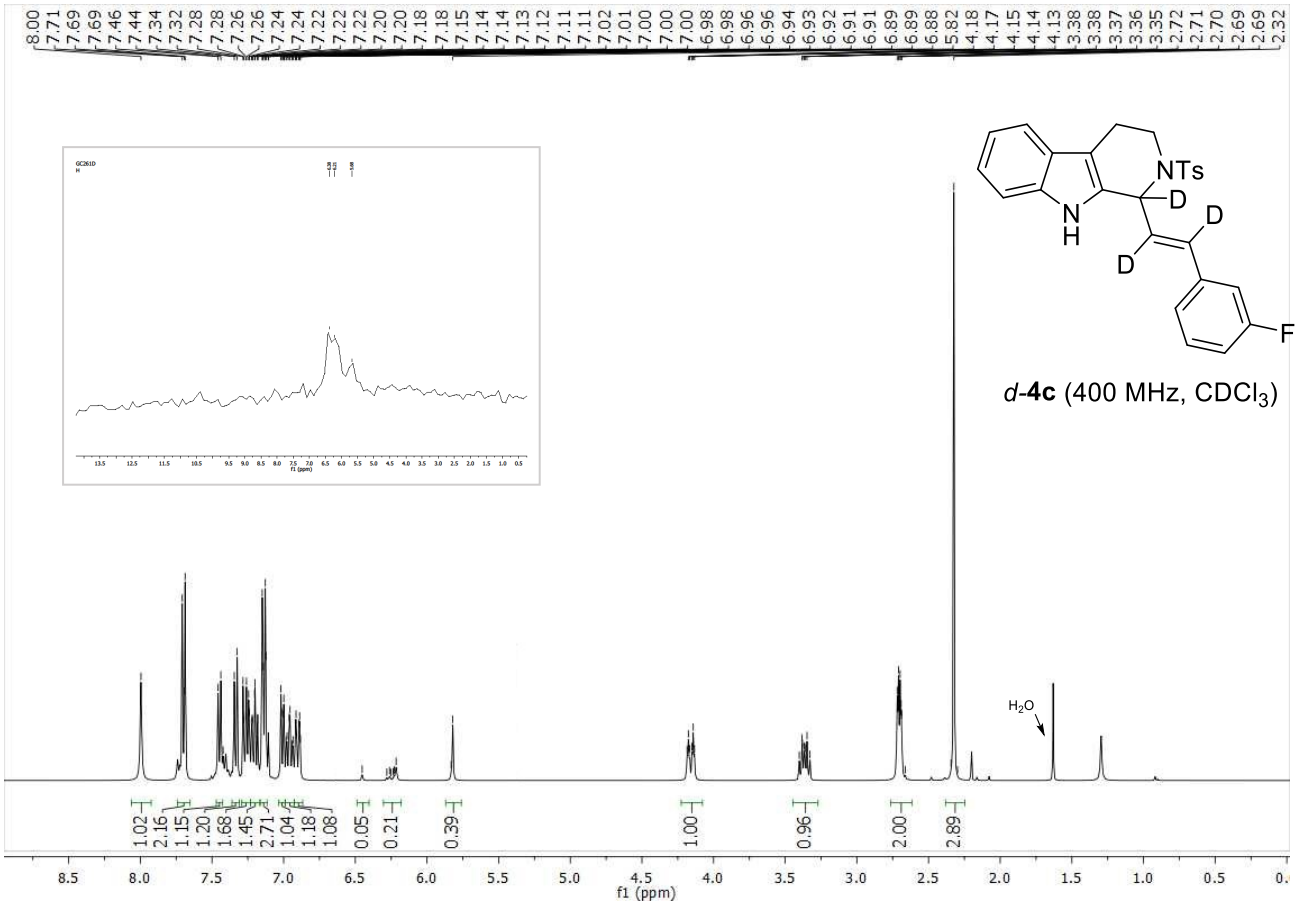
d-**4a** (101 MHz, $CDCl_3$)



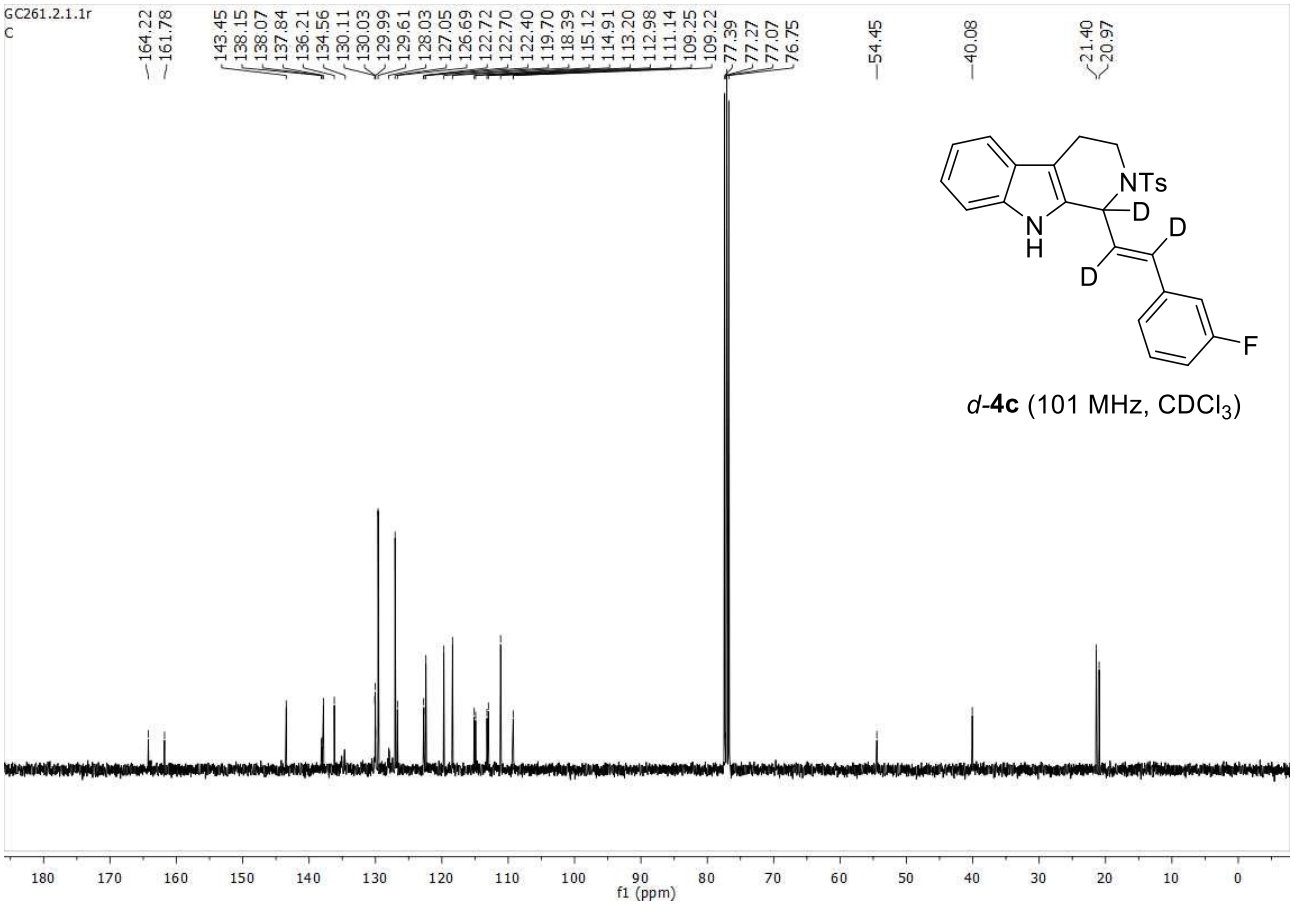
d-**4b** (400 MHz, $CDCl_3$)



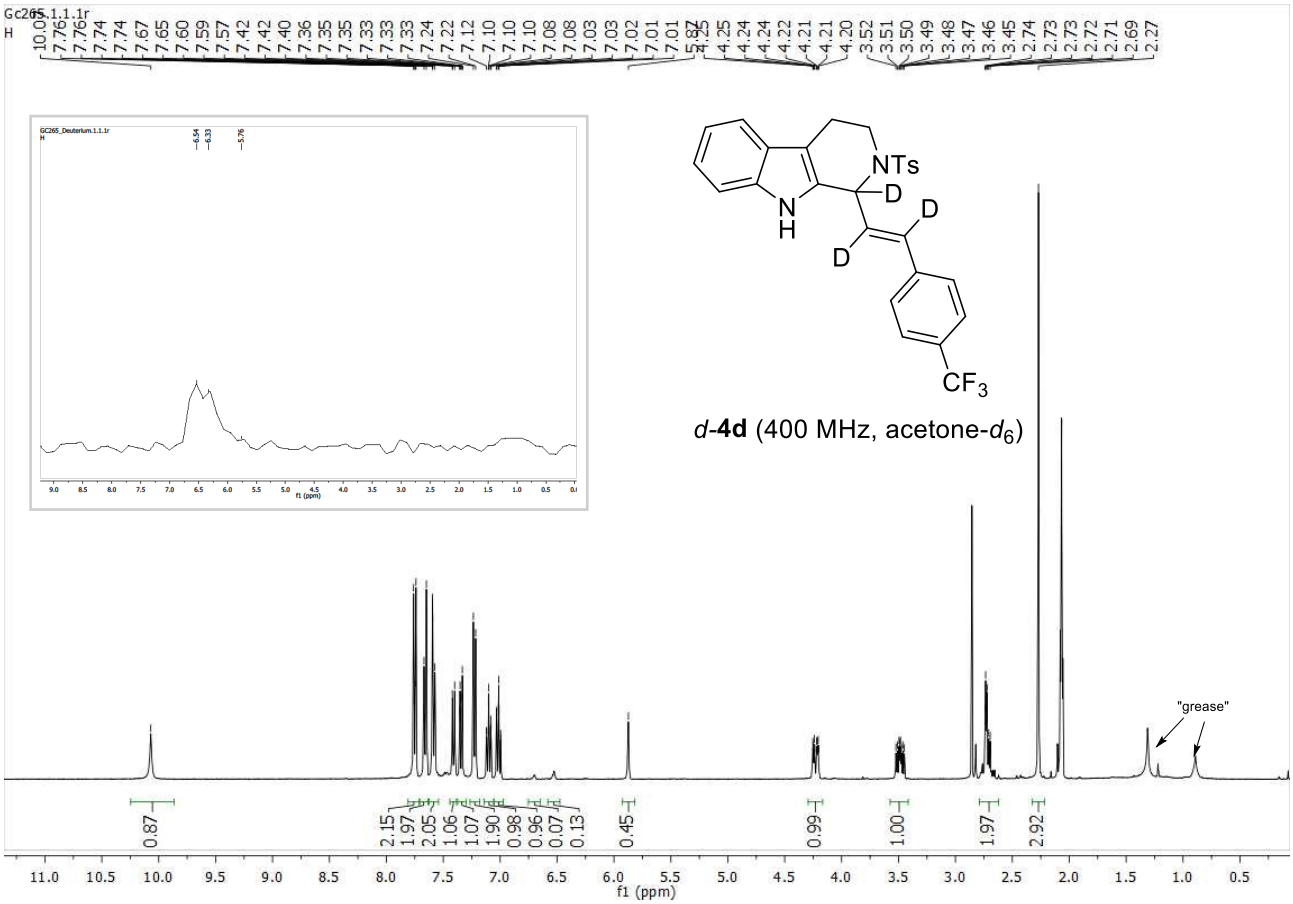
d-**4b** (101 MHz, $CDCl_3$)



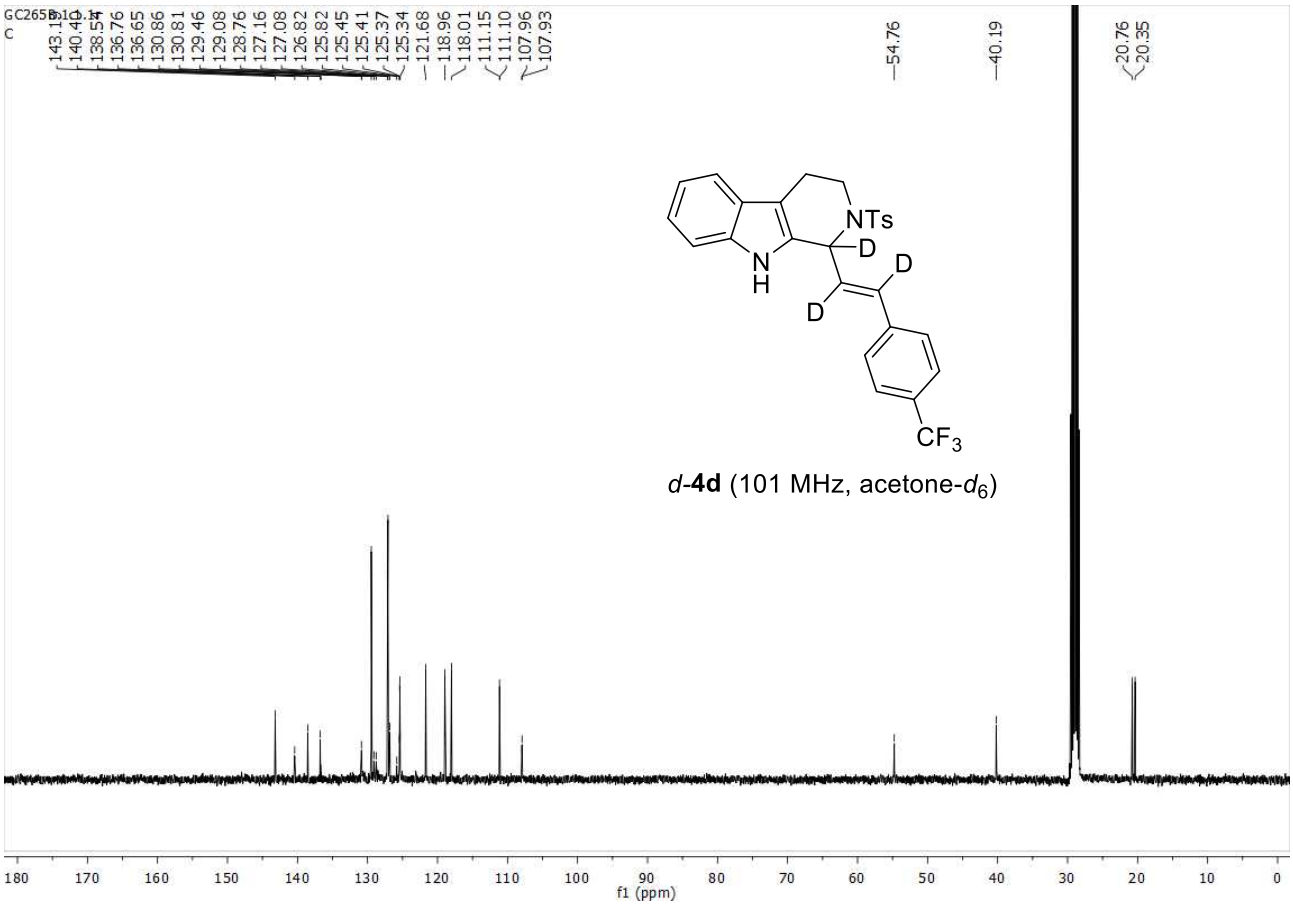
d-**4c** (400 MHz, $CDCl_3$)



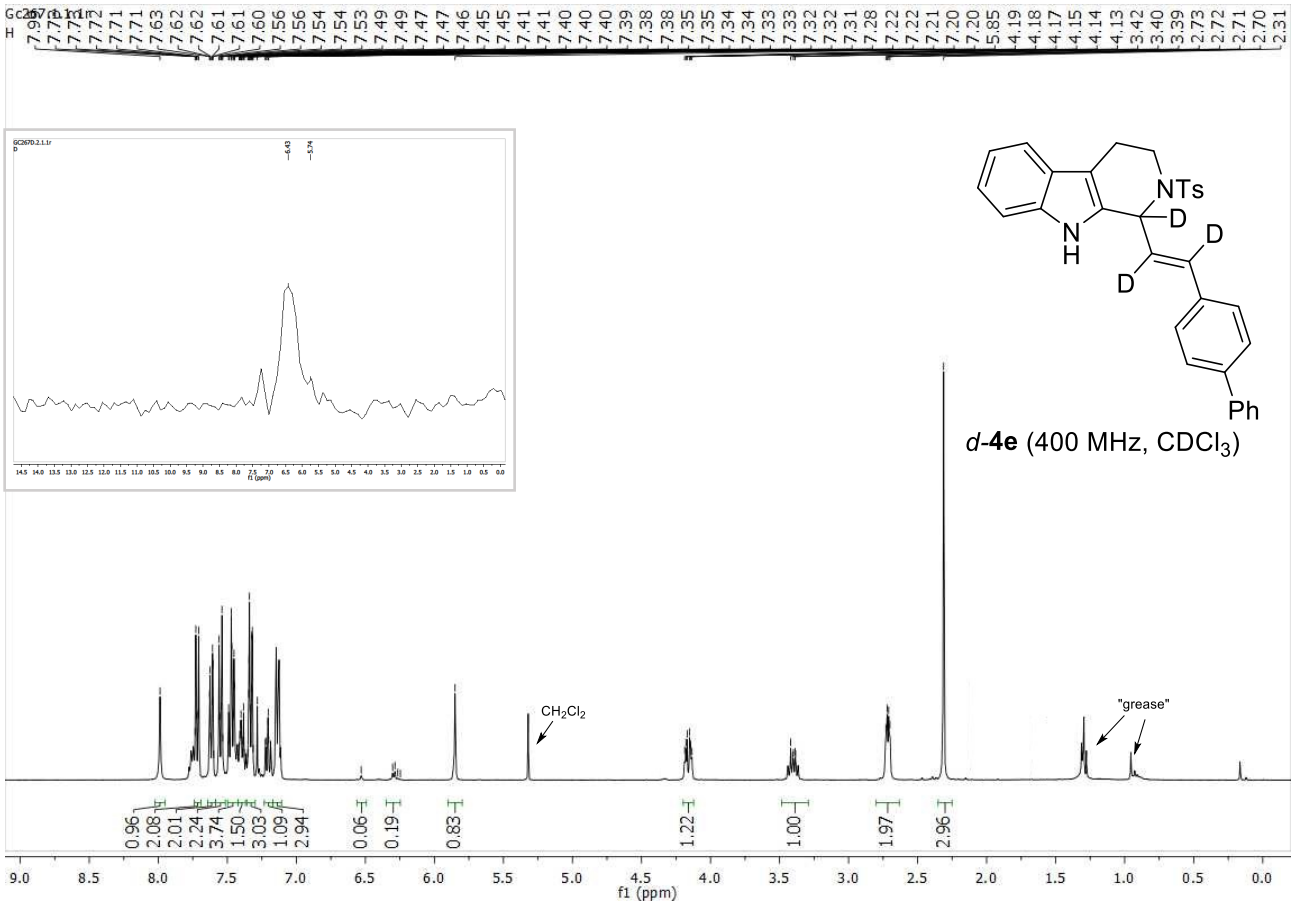
d-**4c** (101 MHz, $CDCl_3$)



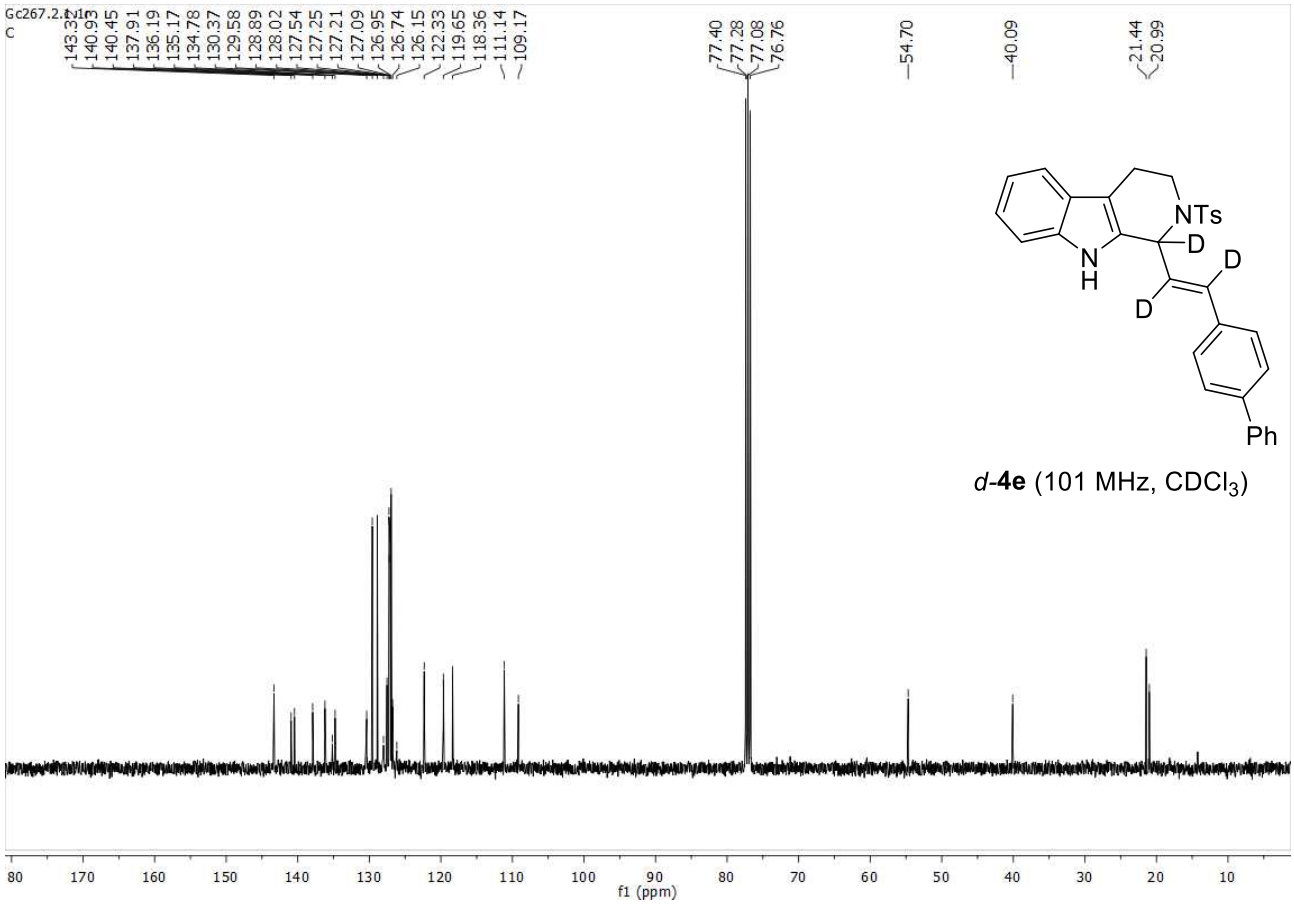
d-**4d** (400 MHz, acetone-d_6)



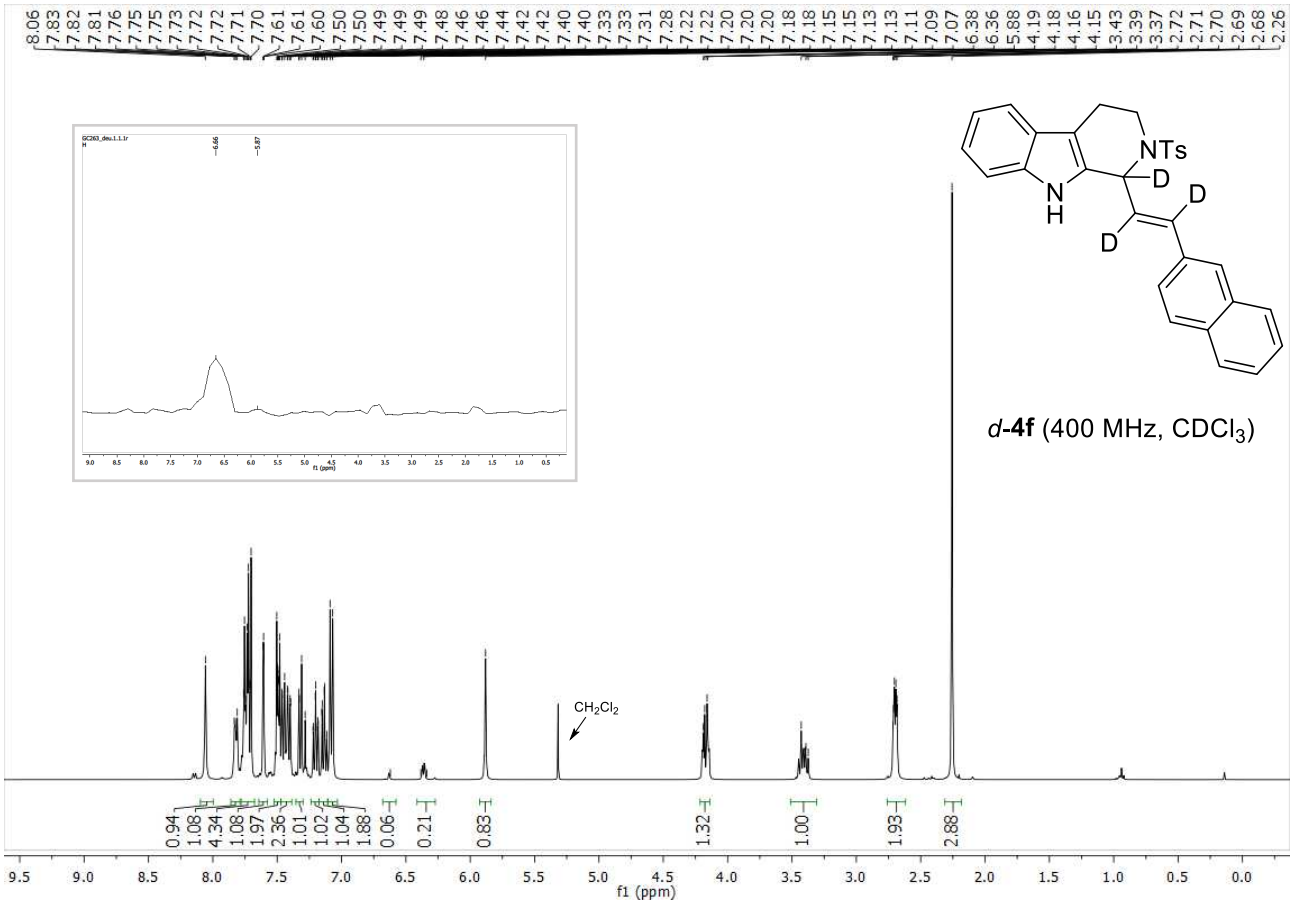
d-**4d** (101 MHz, acetone-d_6)



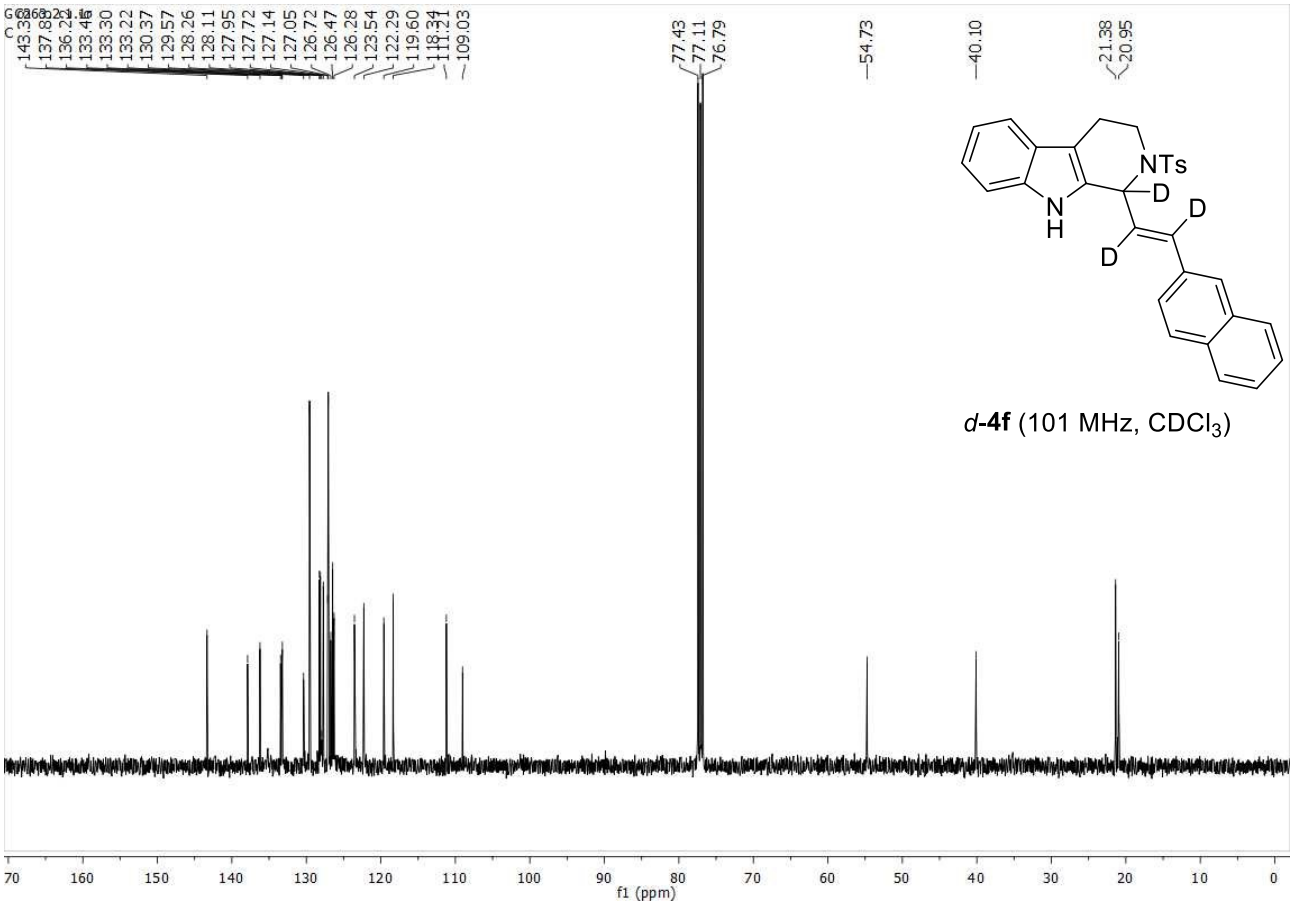
d-**4e** (400 MHz, $CDCl_3$)



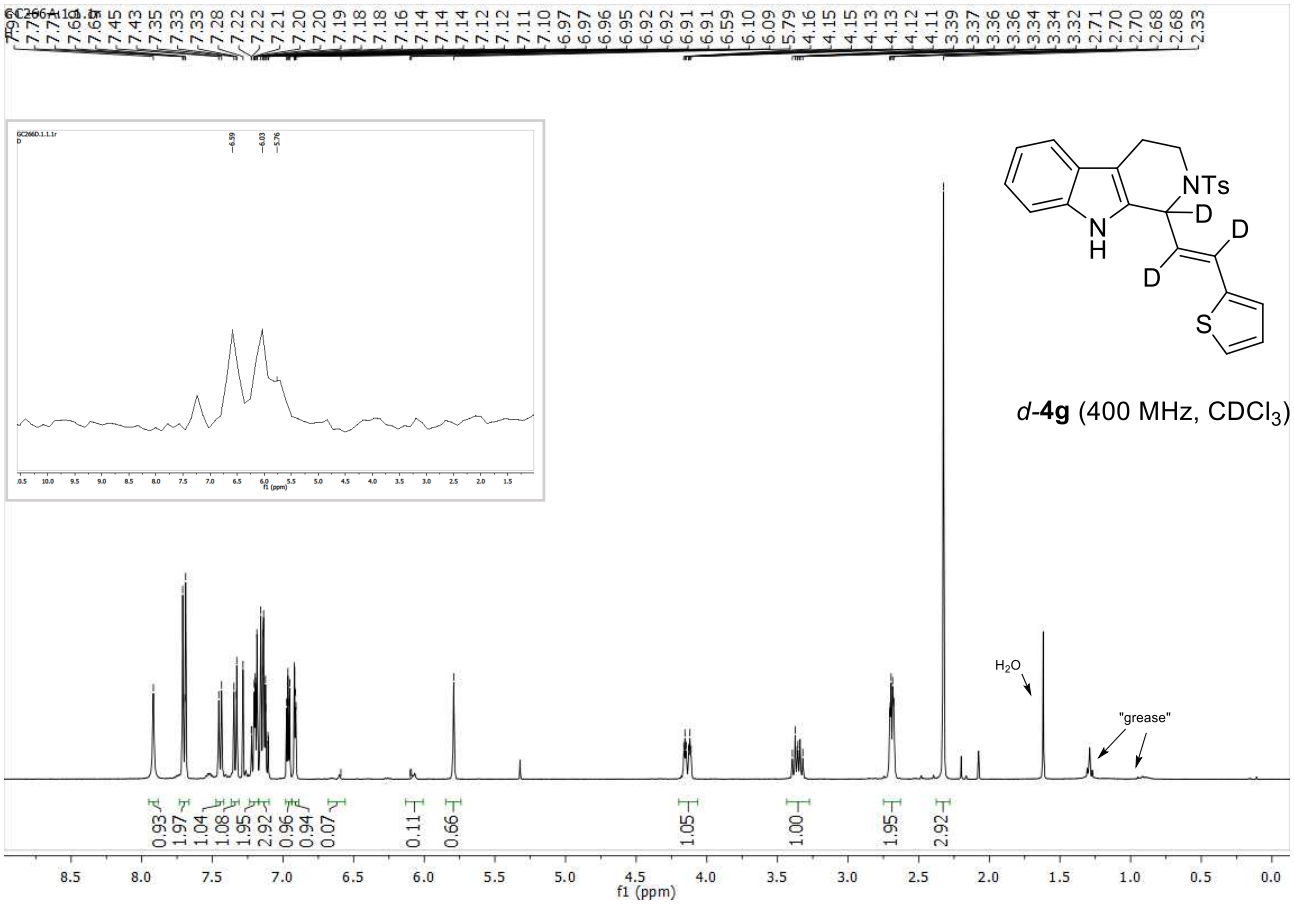
d-**4e** (101 MHz, $CDCl_3$)



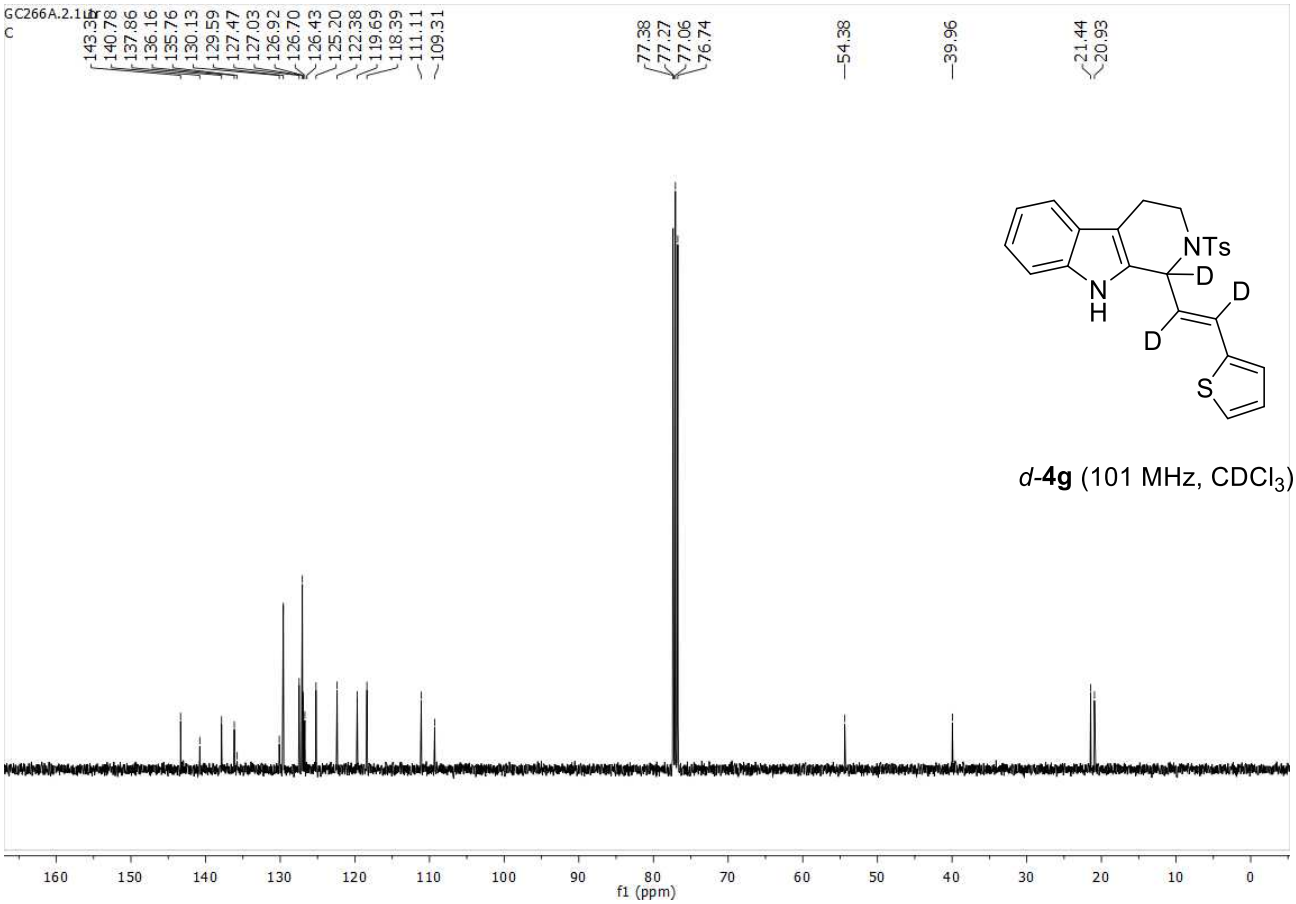
d-**4f** (400 MHz, $CDCl_3$)



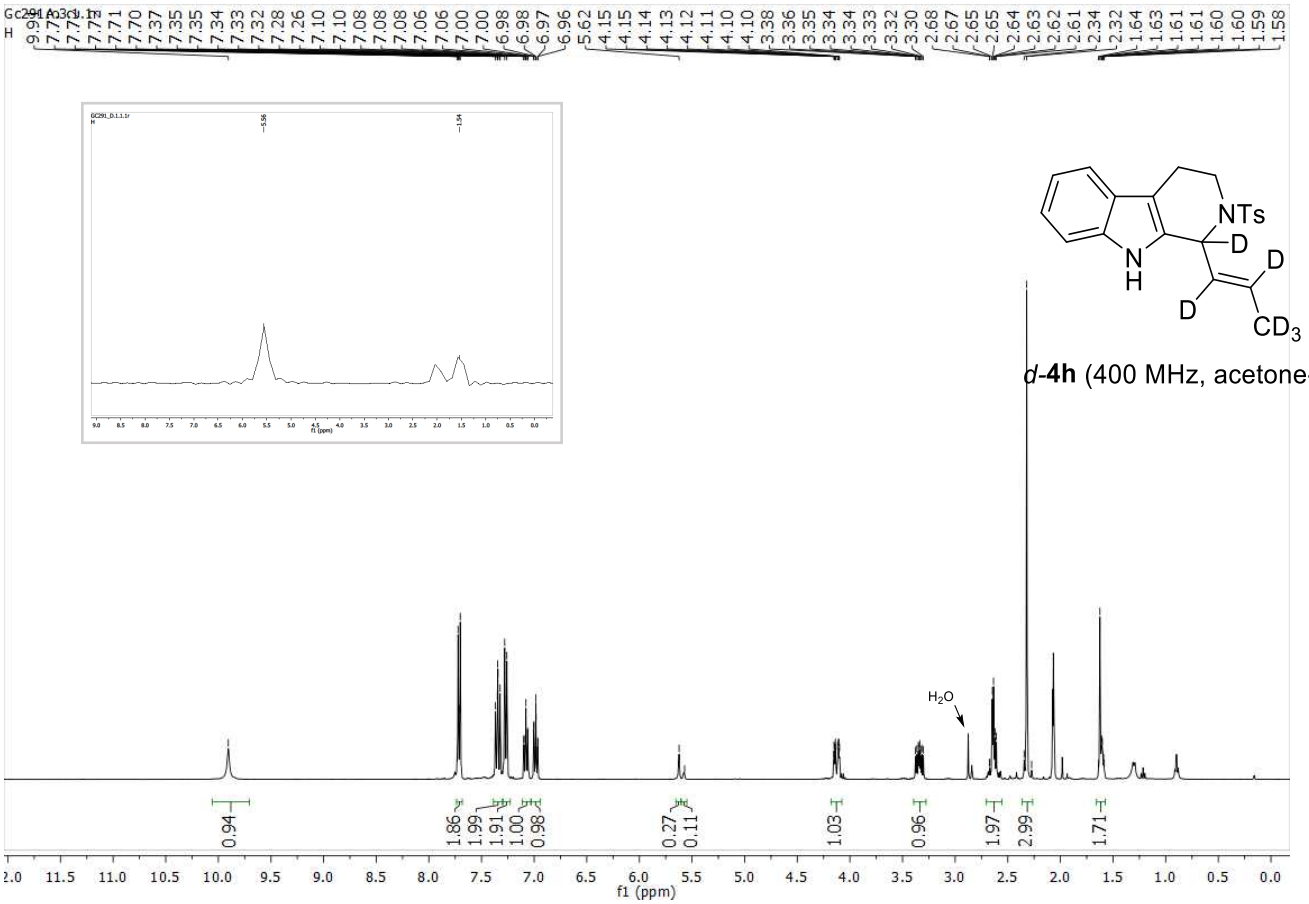
d-**4f** (101 MHz, $CDCl_3$)



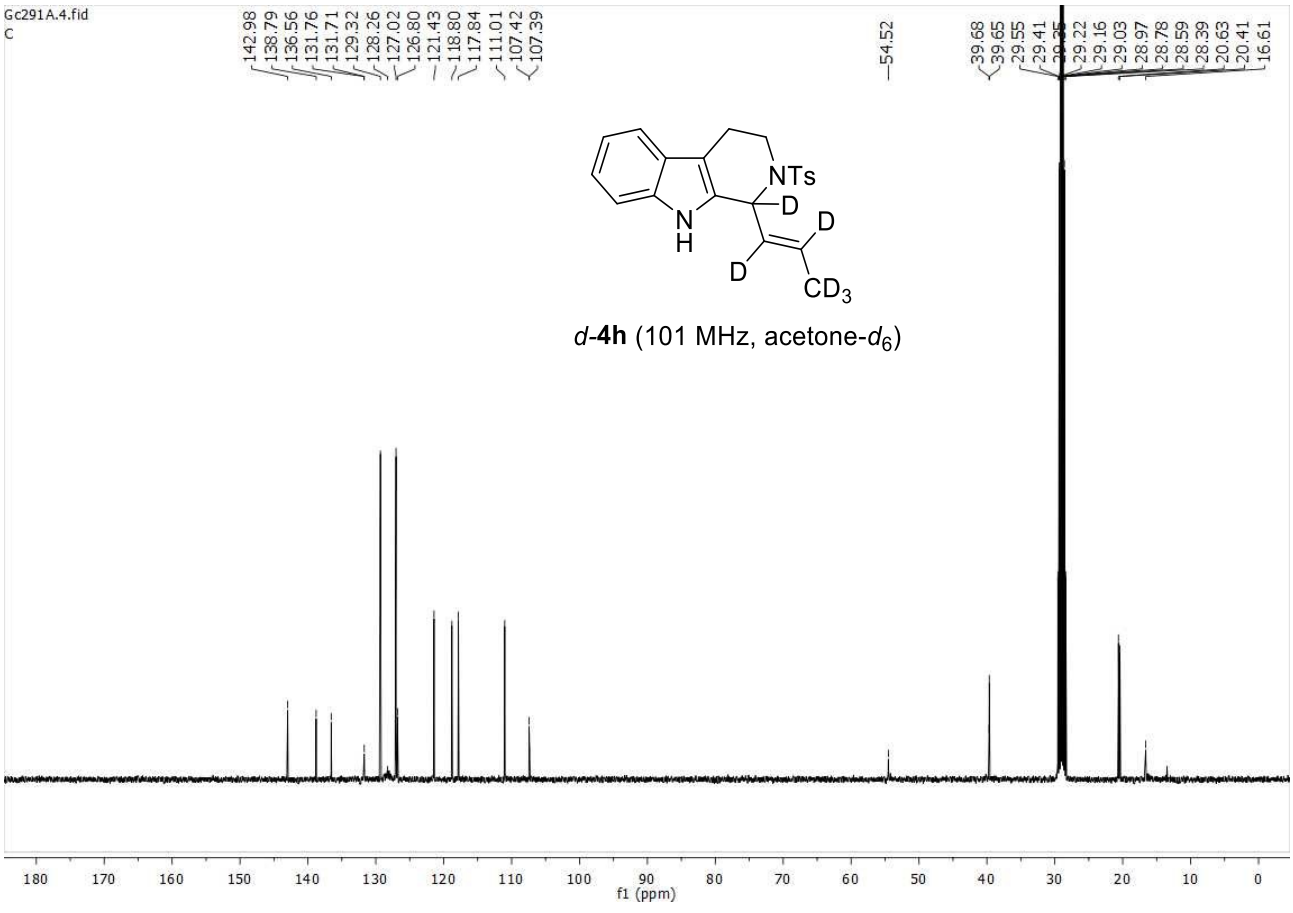
d-**4g** (400 MHz, $CDCl_3$)



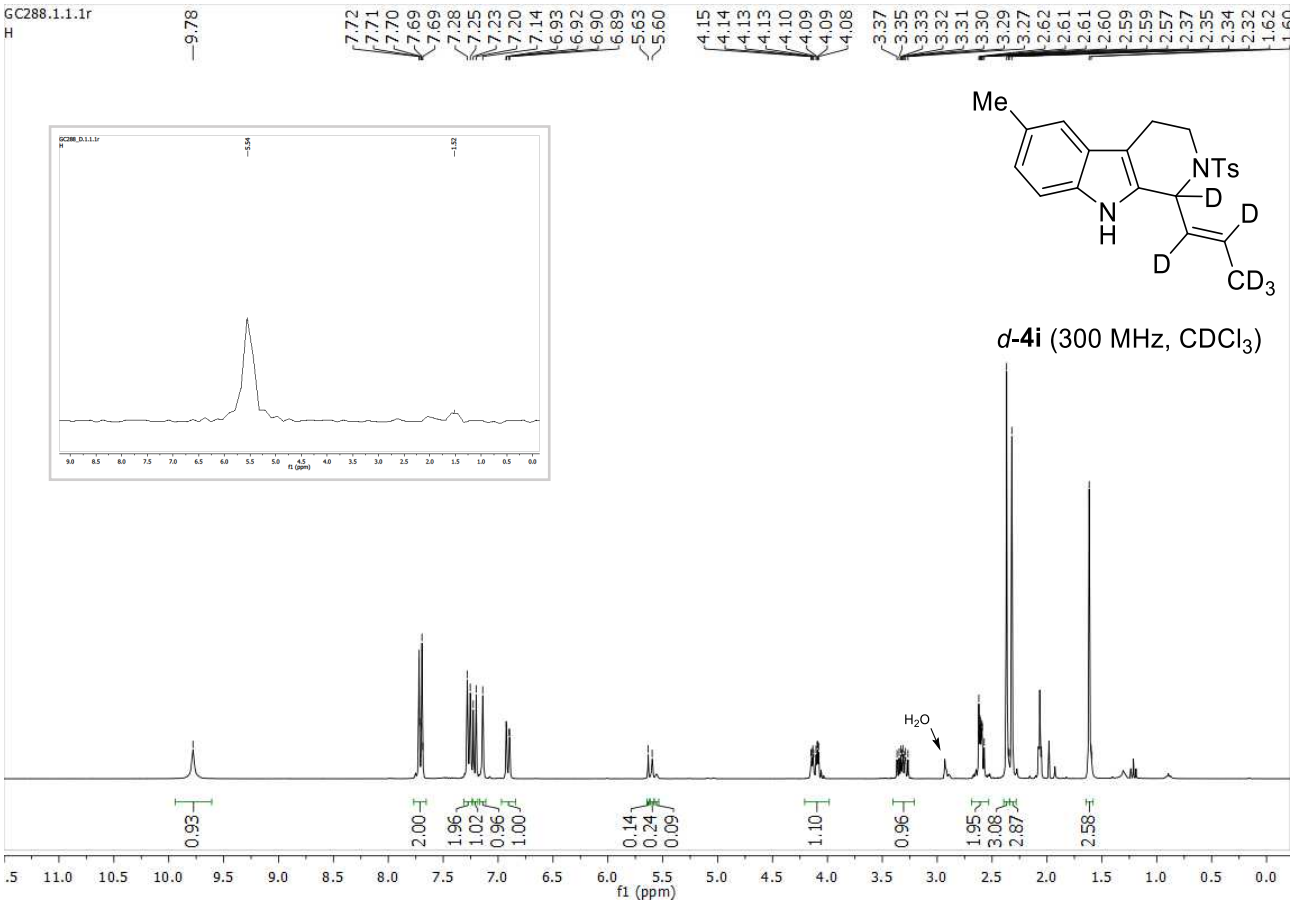
d-**4g** (101 MHz, $CDCl_3$)



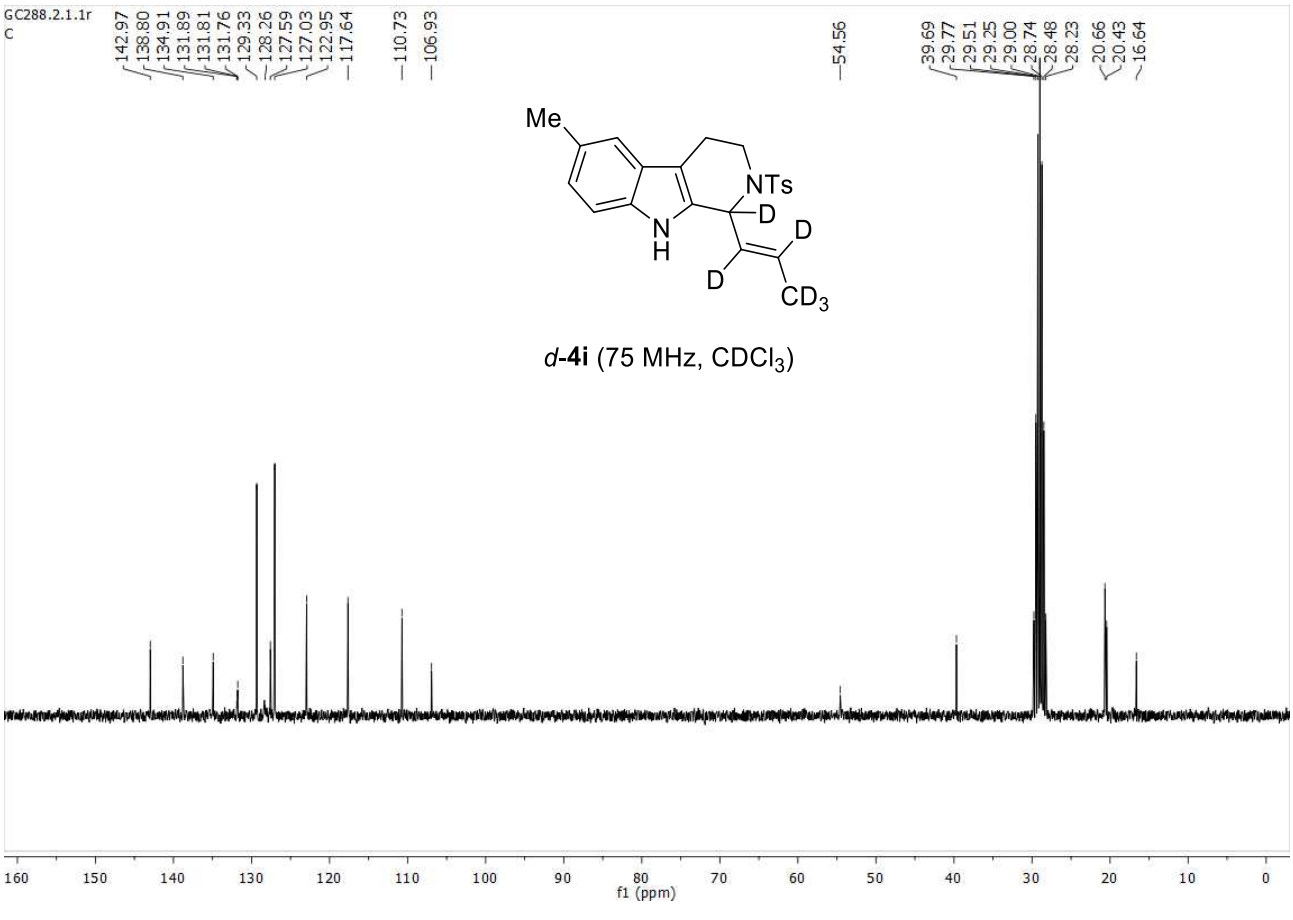
d-**4h** (400 MHz, acetone-d_6)



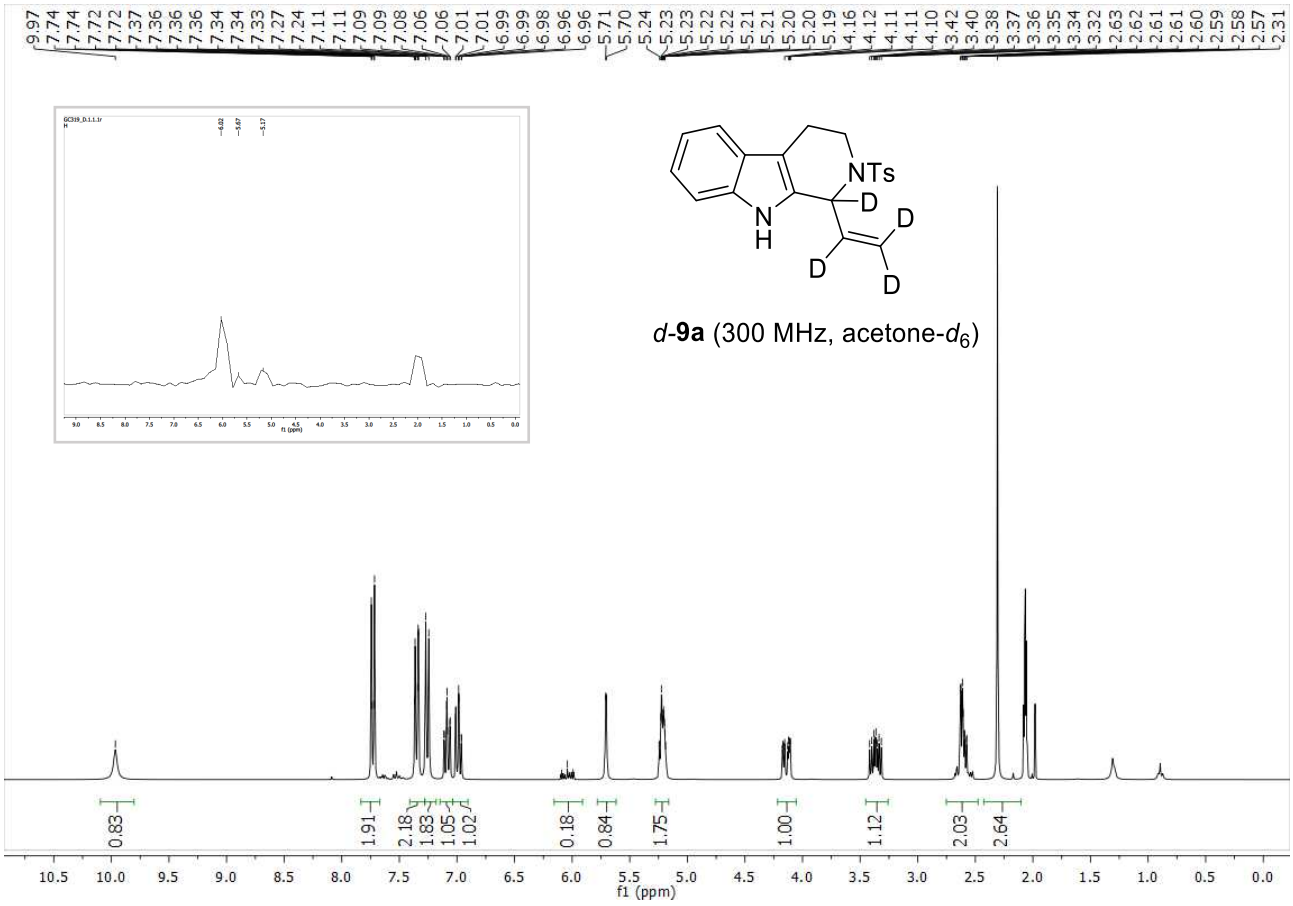
d-**4h** (101 MHz, acetone-d_6)



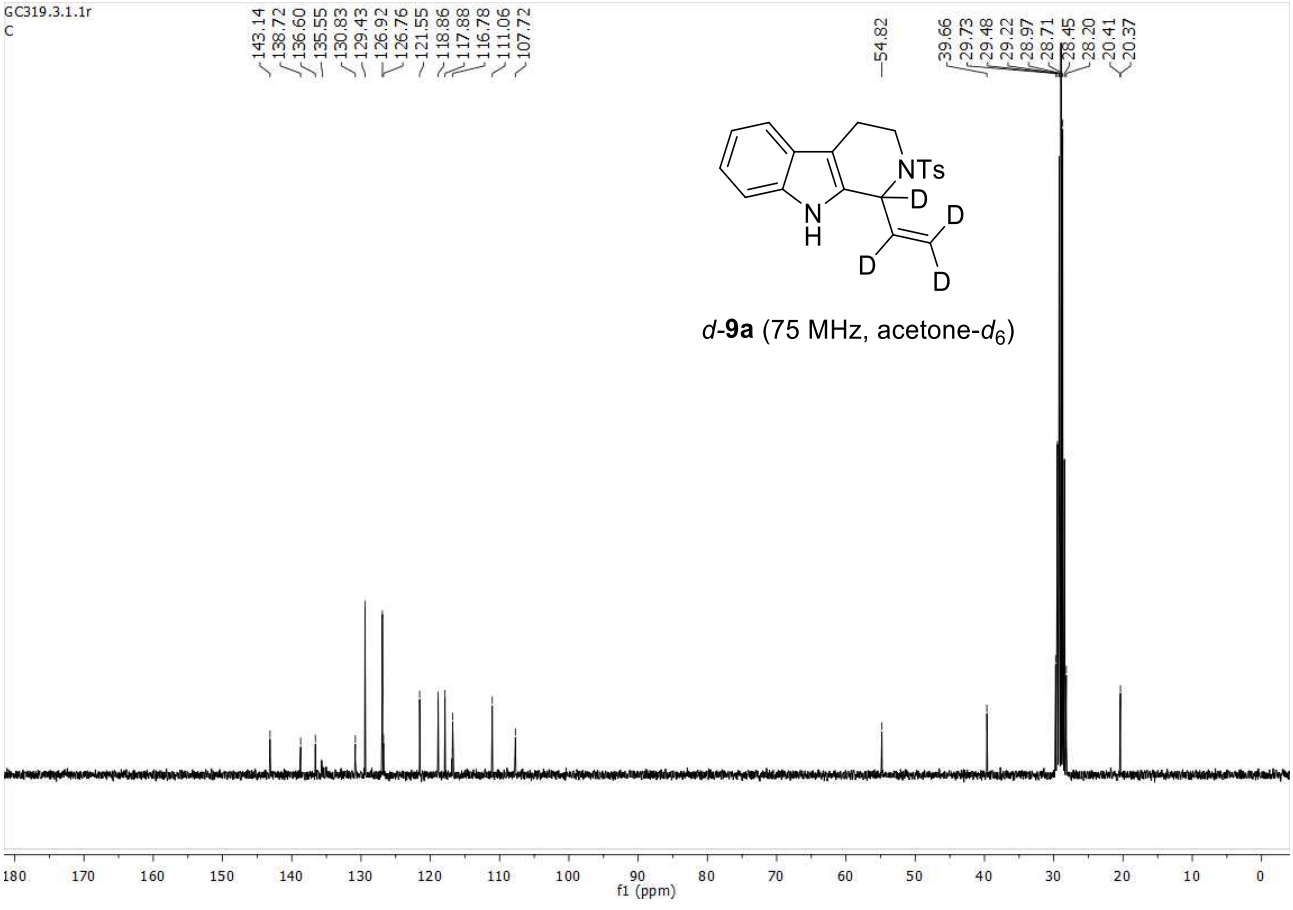
d-**4i** (300 MHz, $CDCl_3$)



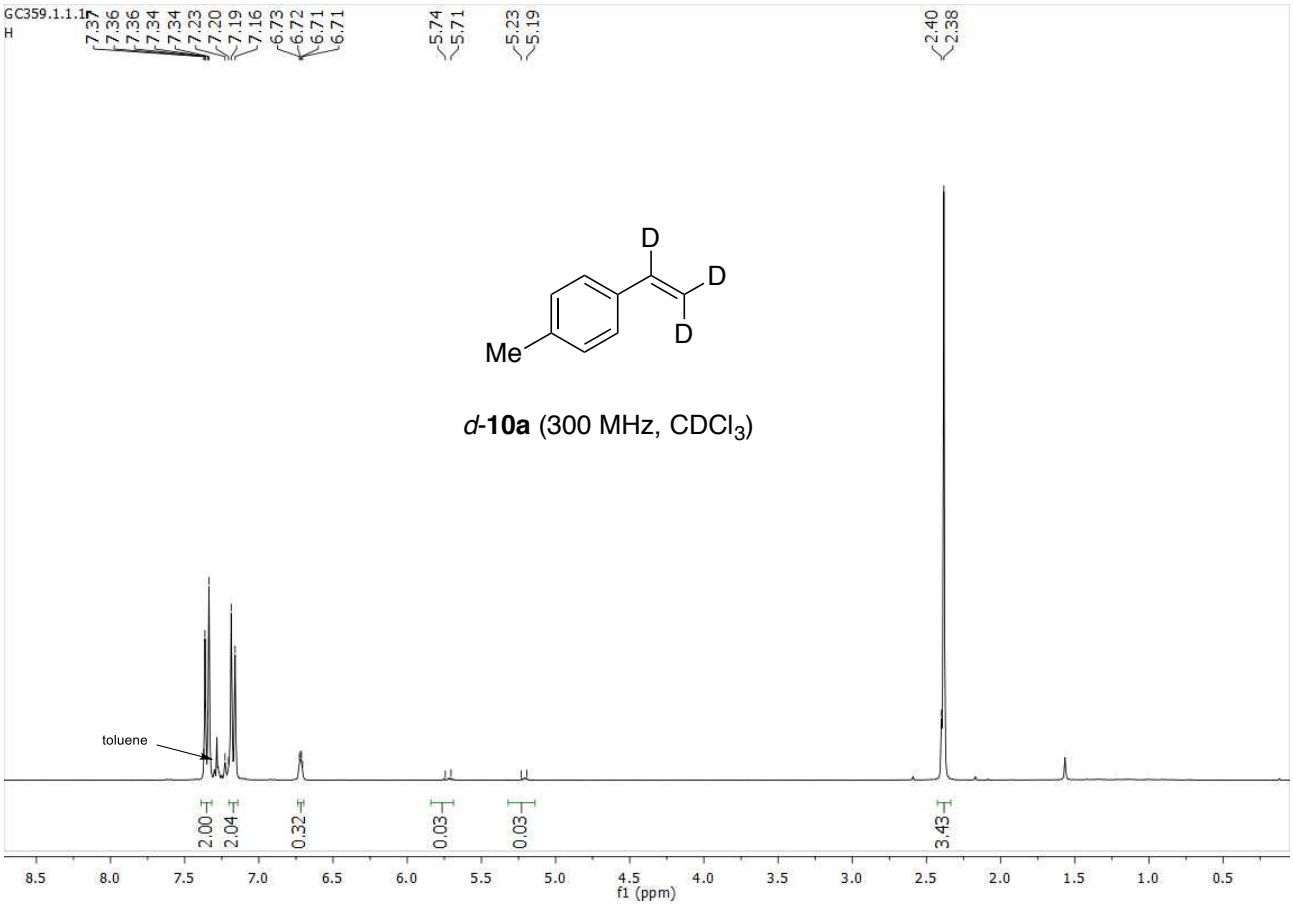
d-**4i** (75 MHz, $CDCl_3$)



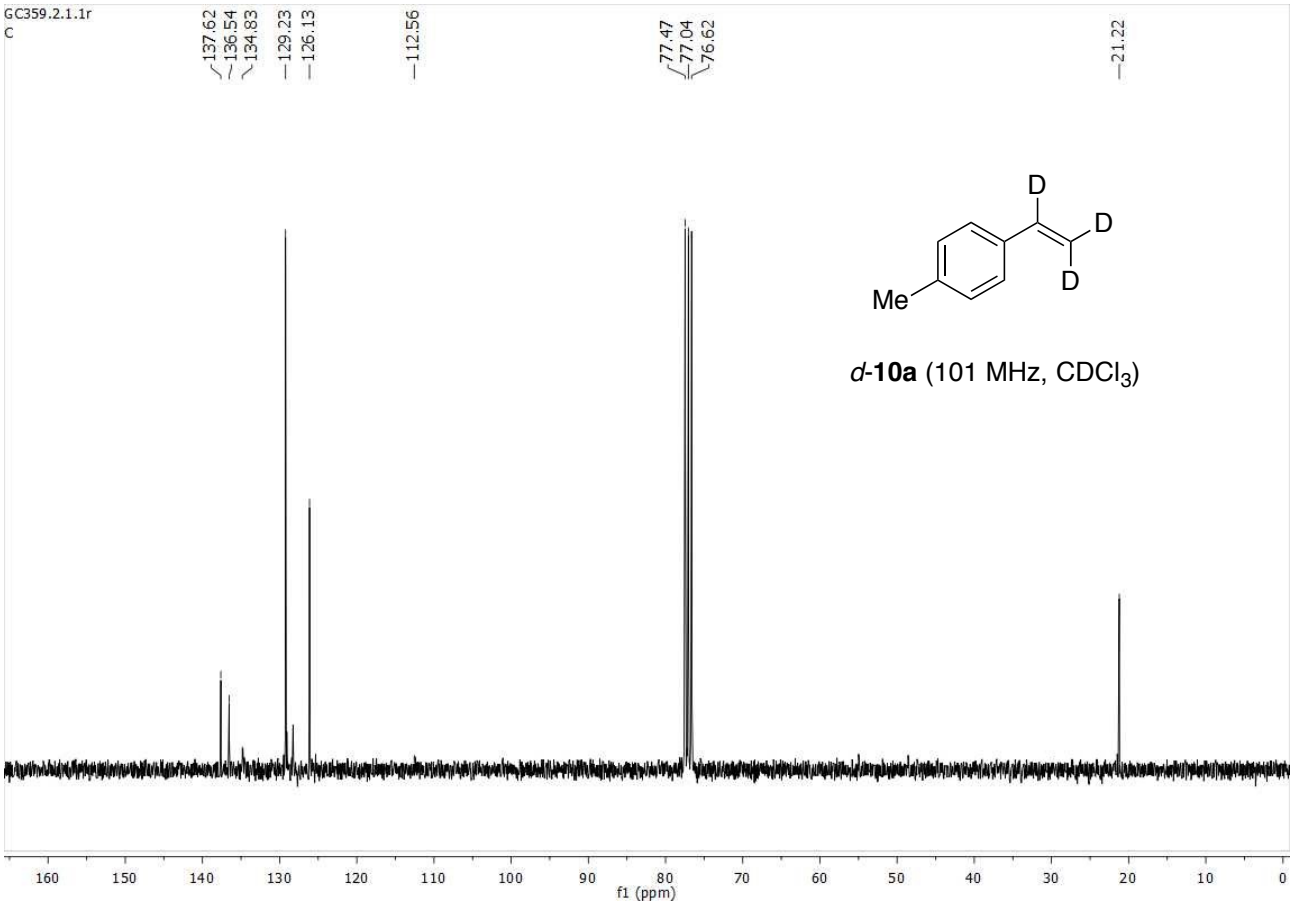
d-**9a** (300 MHz, acetone-d_6)



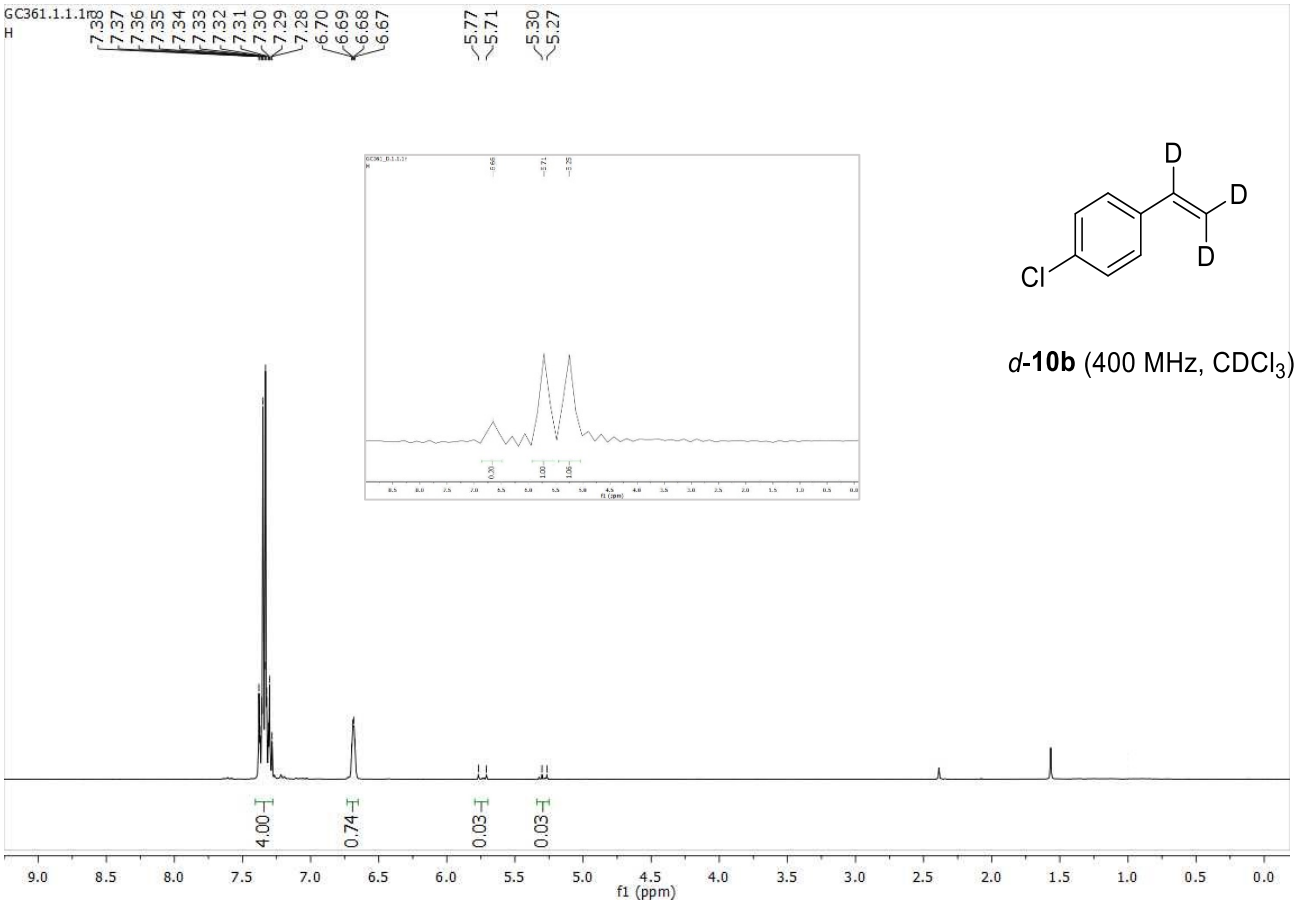
d-**9a** (75 MHz, acetone-d_6)



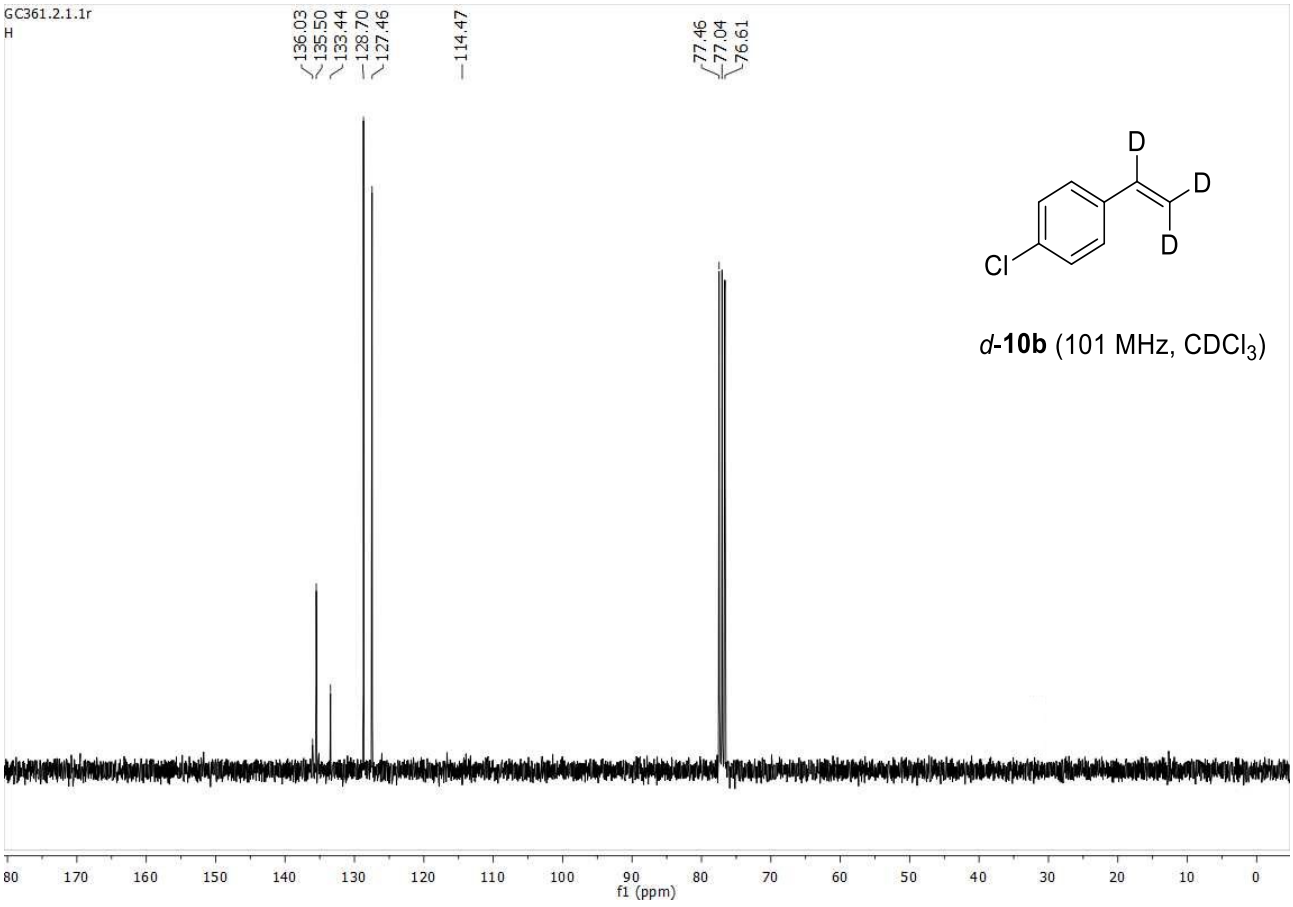
d-**10a** (300 MHz, $CDCl_3$)



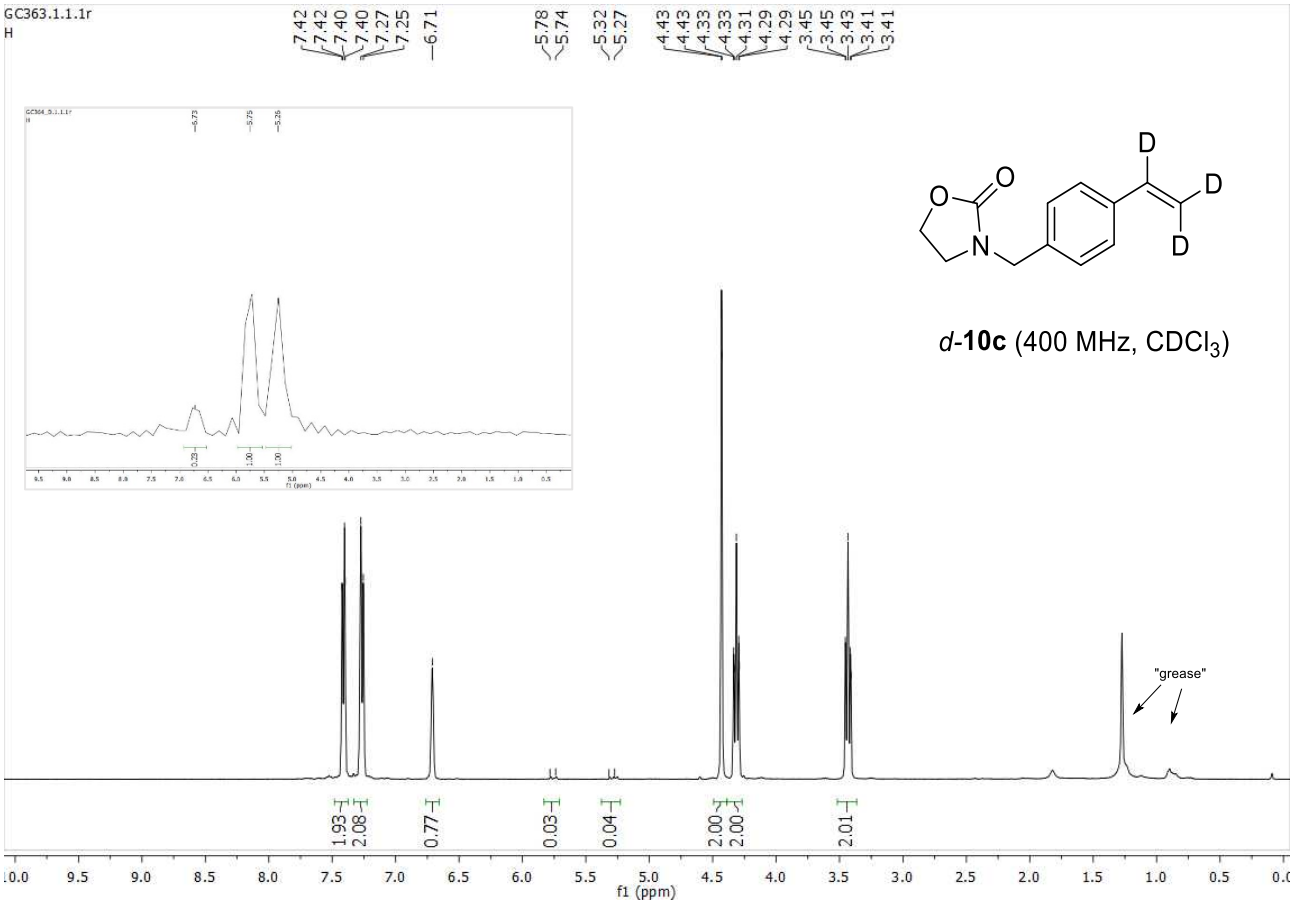
d-**10a** (101 MHz, $CDCl_3$)



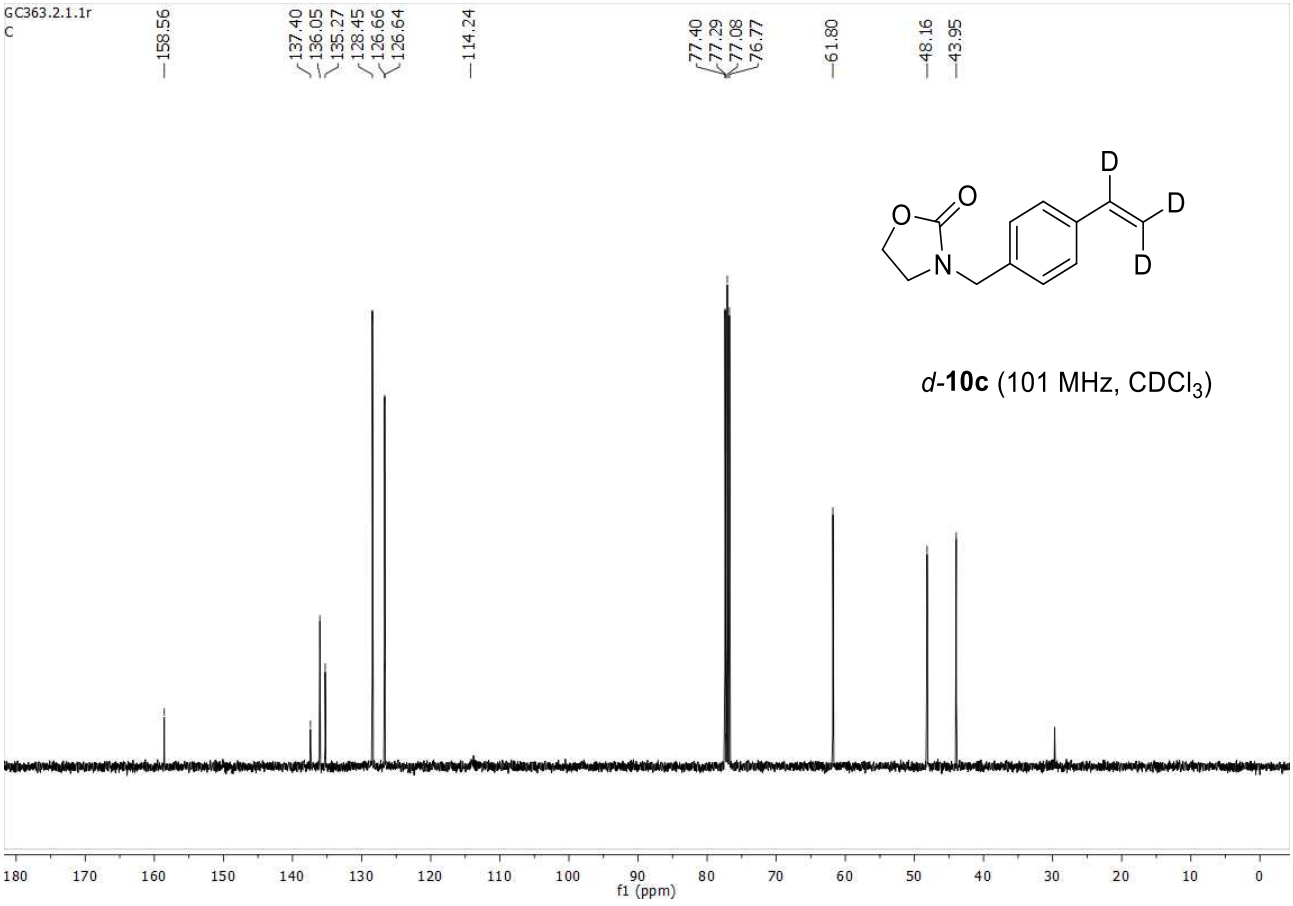
d-**10b** (400 MHz, $CDCl_3$)



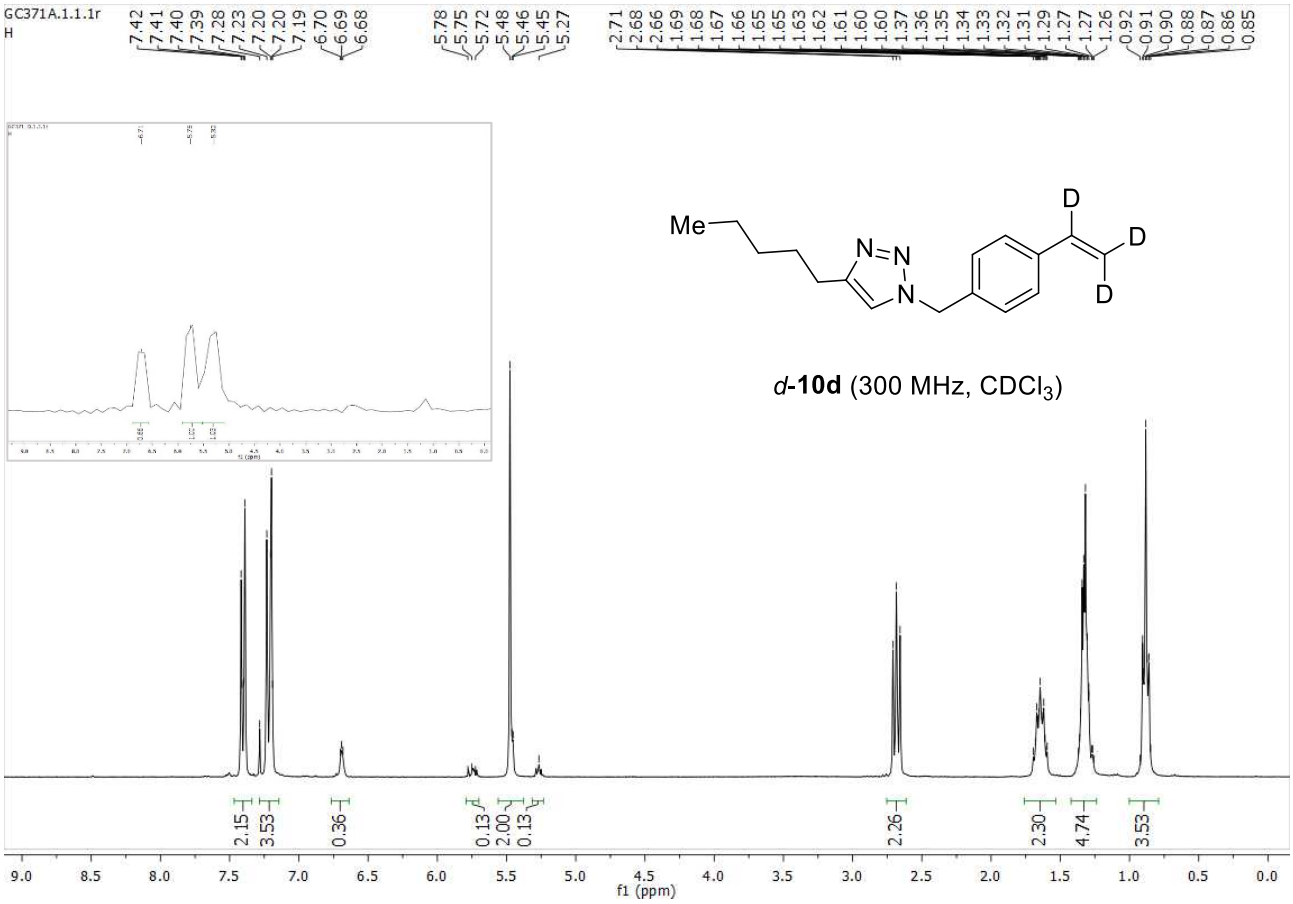
d-**10b** (101 MHz, $CDCl_3$)



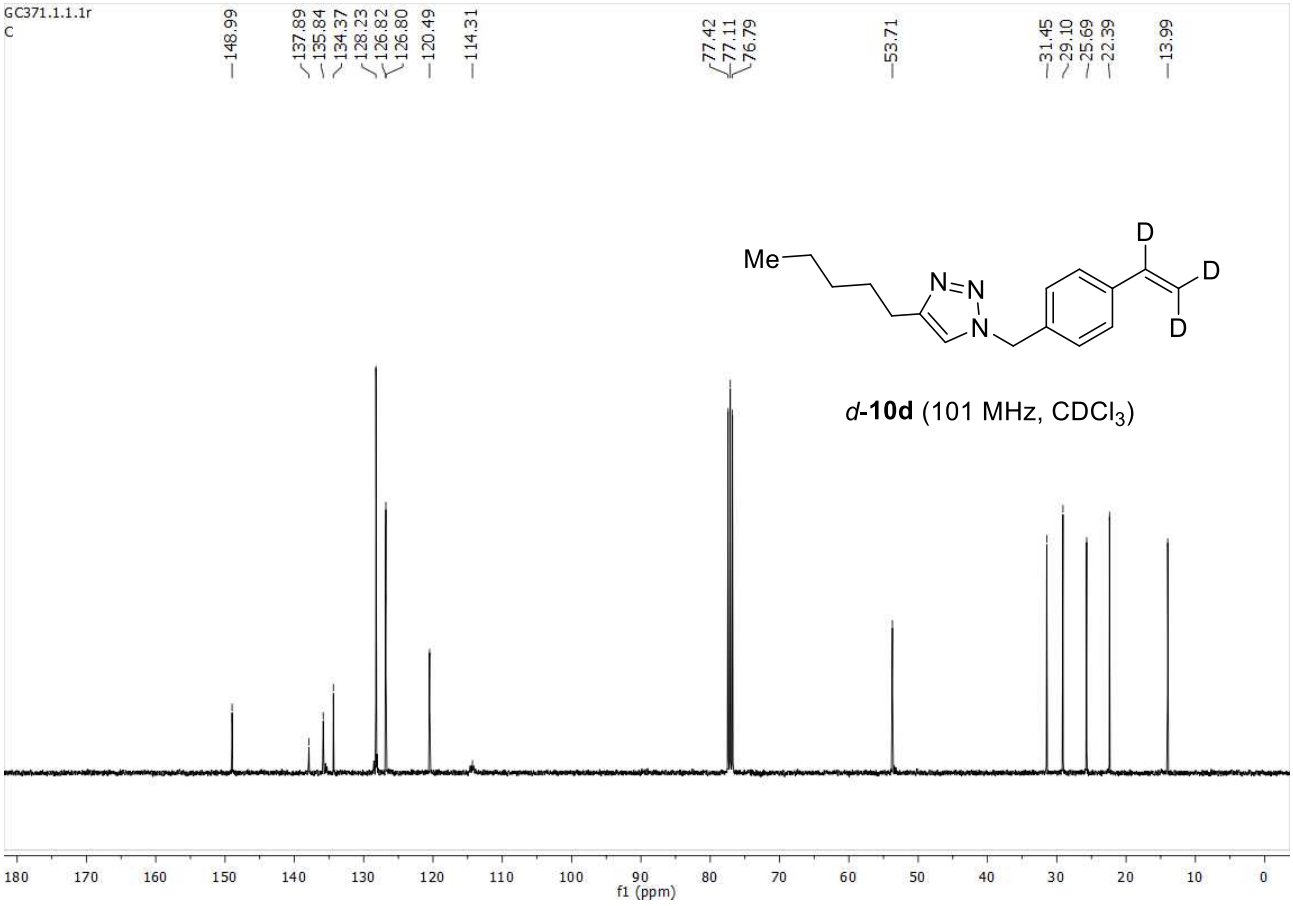
d-**10c** (400 MHz, $CDCl_3$)



d-**10c** (101 MHz, $CDCl_3$)



d-**10d** (300 MHz, $CDCl_3$)



d-**10d** (101 MHz, $CDCl_3$)

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