Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supporting Information

Regioselective Ruthenium catalysed H-D exchange using D_2O as the deuterium source

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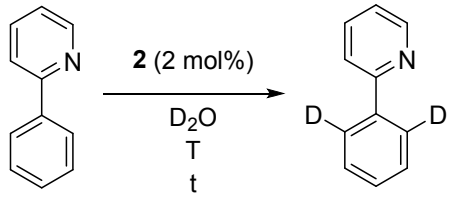
Contents

Optimization table of H-D exchange.

Table 1. H/D exchange of phenylpyridine in D_2O.[a]

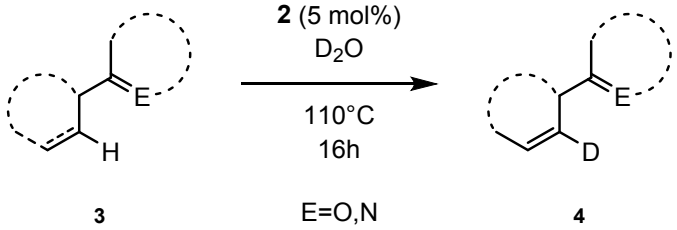


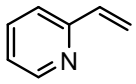
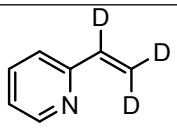
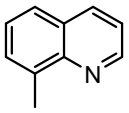
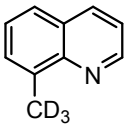
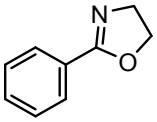
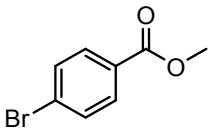
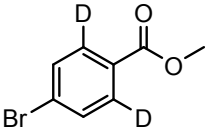
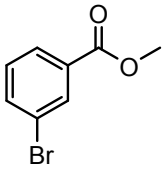
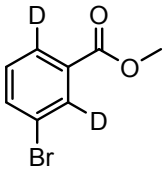
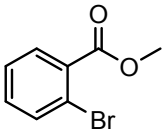
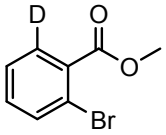
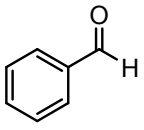
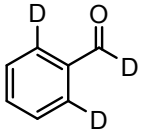
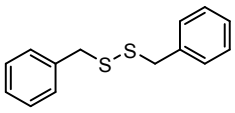
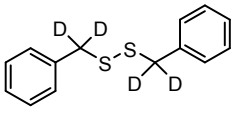
3a **4a**

Entry	[Ru] (%)	Temperature (ºC)	*t* (h)	Conversion (%)[b]
1	2	110	16	95
2	2	90	16	69.5
3	2	70	16	0
4	2	110	8	95
5	2	110	6	82
6	2	110	4	80
7	1	110	16	81.5
8	0.5	110	16	0
9	0.25	110	16	0

[a] Reactions conditions: **2** (2 mol%), 2-phenylpyridine (0.25 mmol), and D_2O (0.5 mL). [b] Conversion determined by ^1H NMR.

Table 2. Scope and limitations of the deuteration[a].

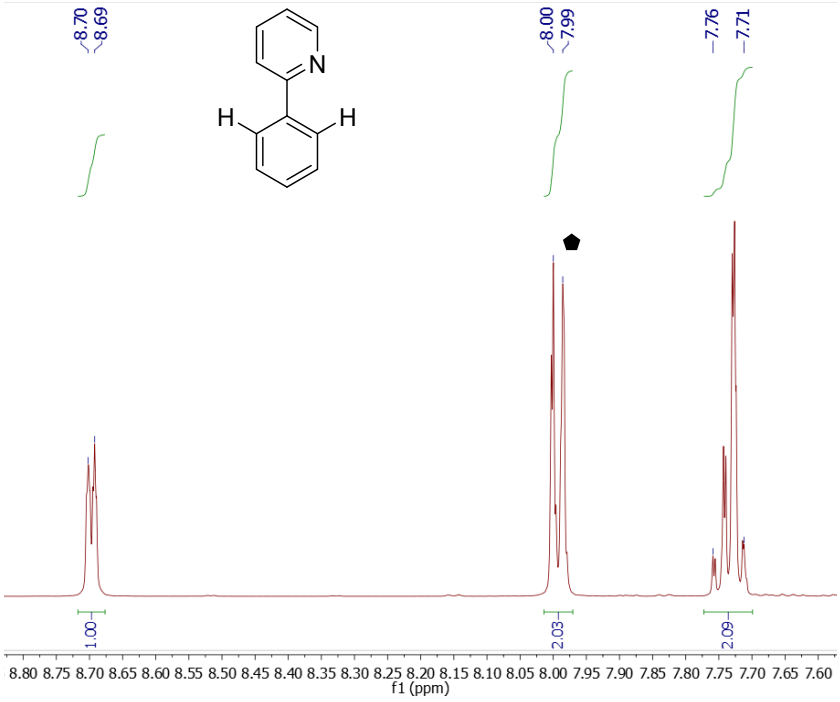


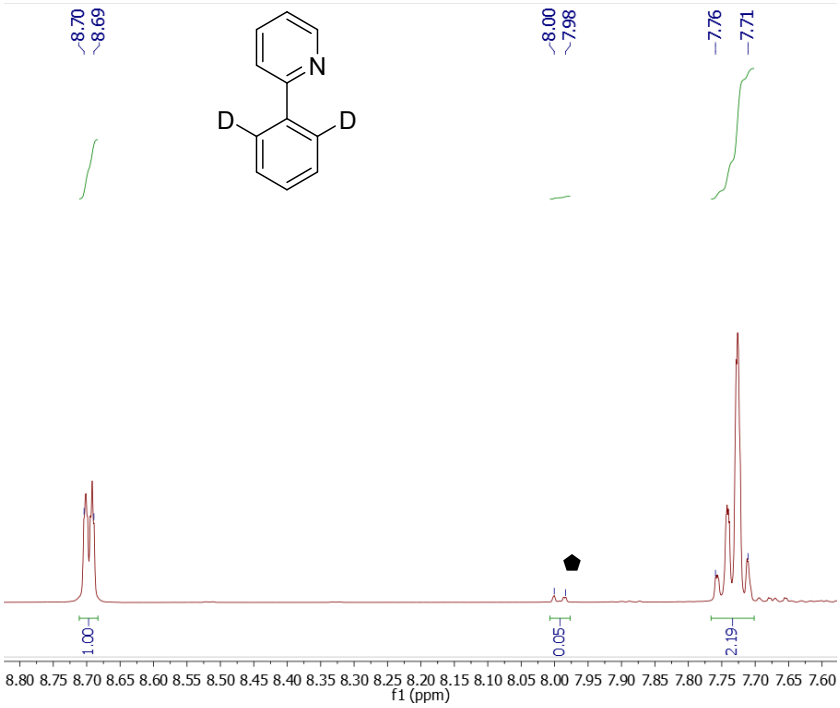
	Substrate		Product		Conversion (%)[b]
1		3s		4s	<5[c]
2		3t		4t	<5[c]
3		3u	-	4u	-[d]
4		3v		4v	10[c]
5		3w		4w	<5[c]
6		3x		4x	<5[c]
7		3y		4y	<5
8		3z		4z	25

Reaction conditions: **2** (5 mol%), substrate (0.25 mmol) and D_2O (0.5 mL). [b] Conversion determined by ^{1}H-NMR. [c] Solvent is a mixture of toluene and D_2O (1:1) (0.5 mL). [d] Complex mixture.

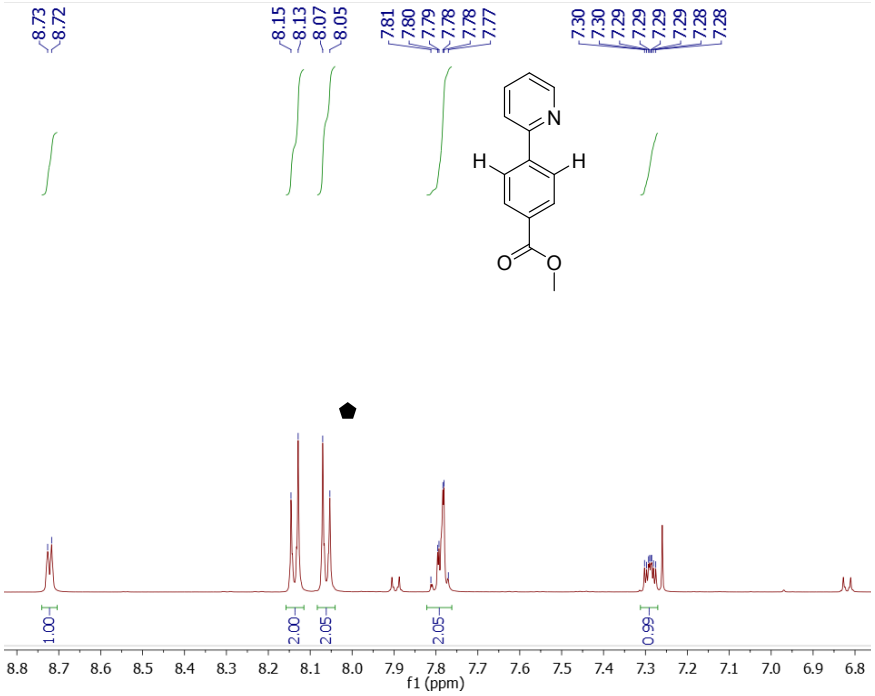
NMR SPECTRA

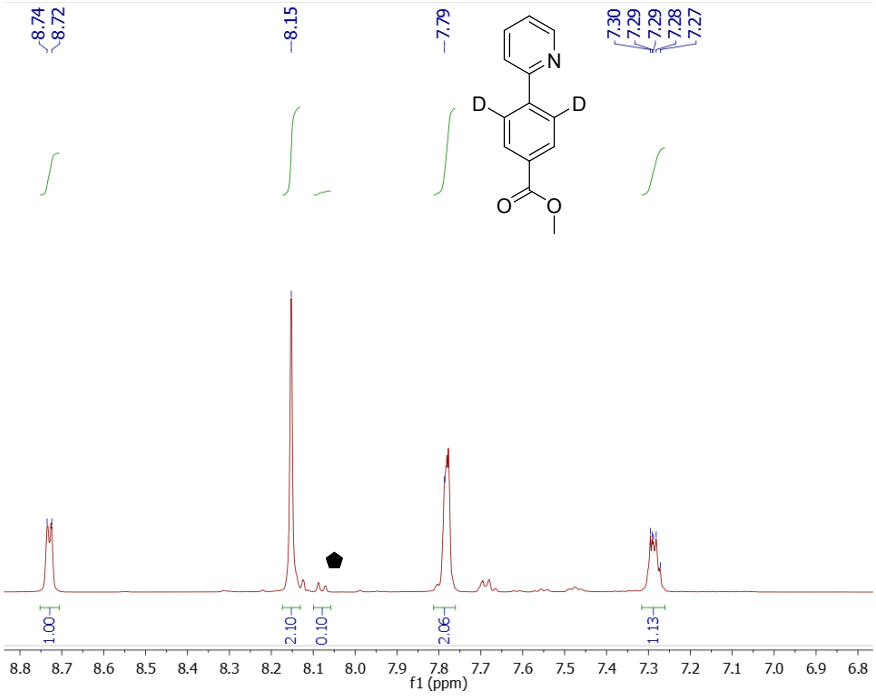
2-(2,6-Dideuterophenyl)pyridine (4a).



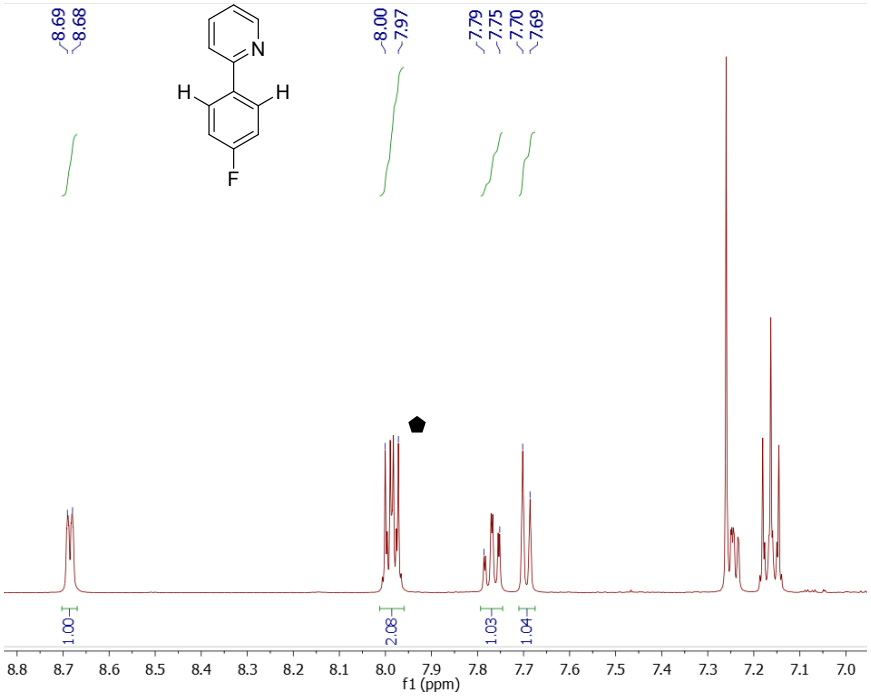


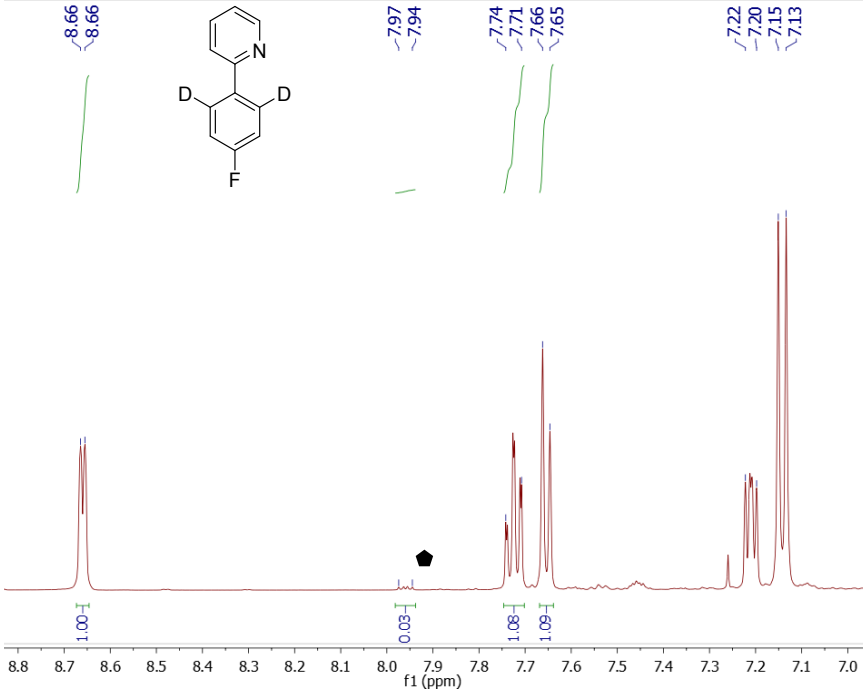
2-(4-Carboxy-2,6-dideuterophenyl)pyridine (4b).



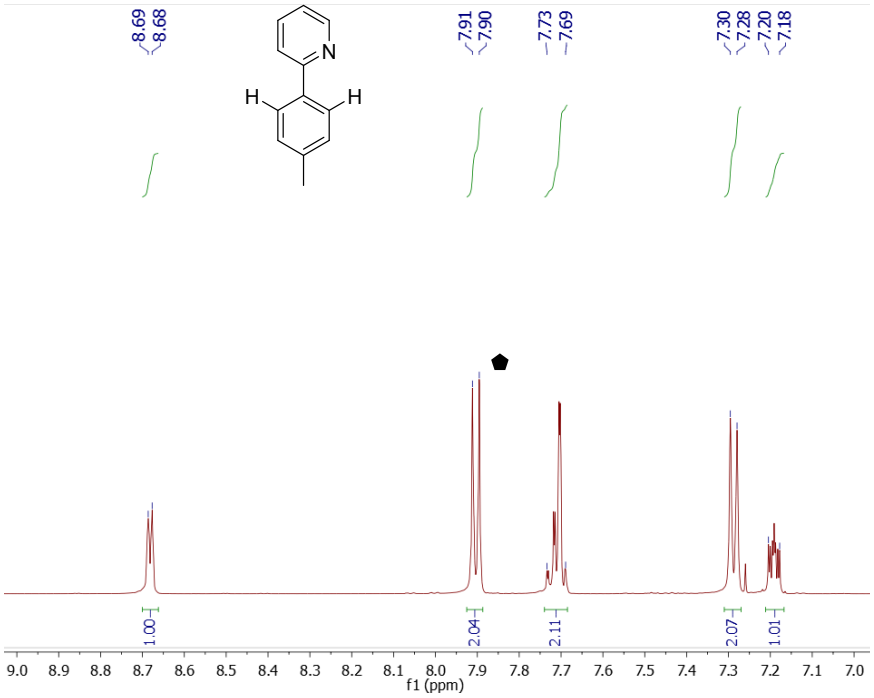


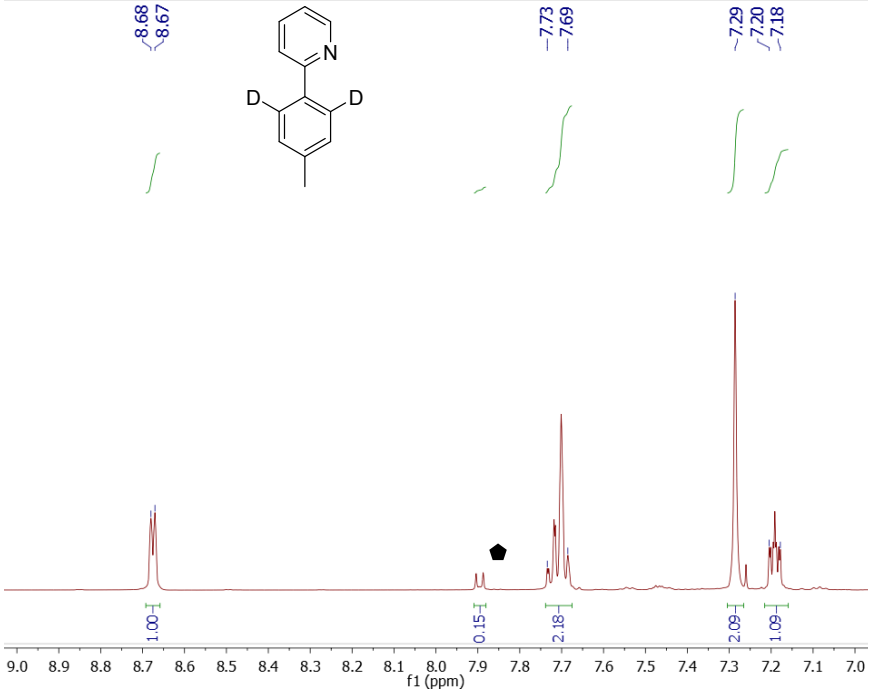
2-(2,6-Dideutero-4-fluoro-phenyl)pyridine (4c).



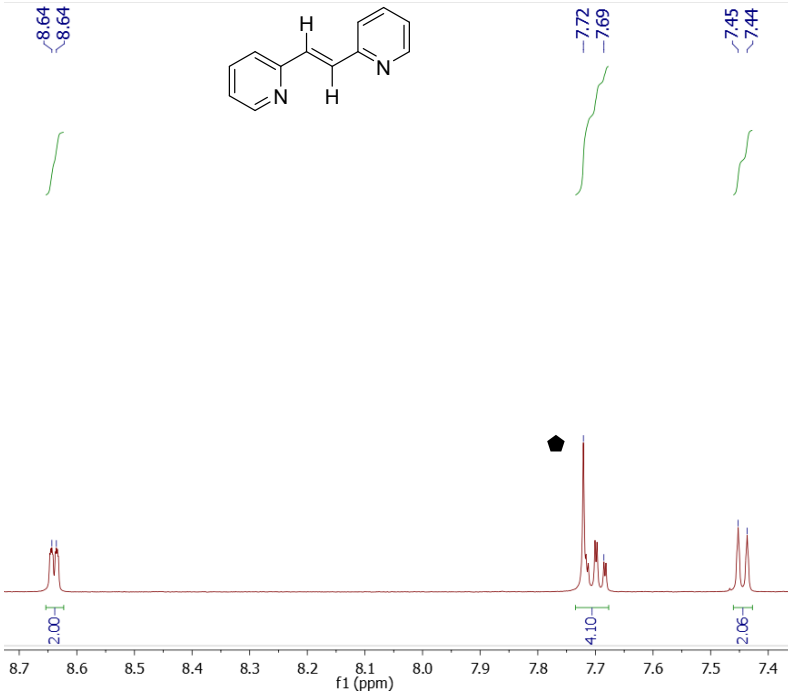


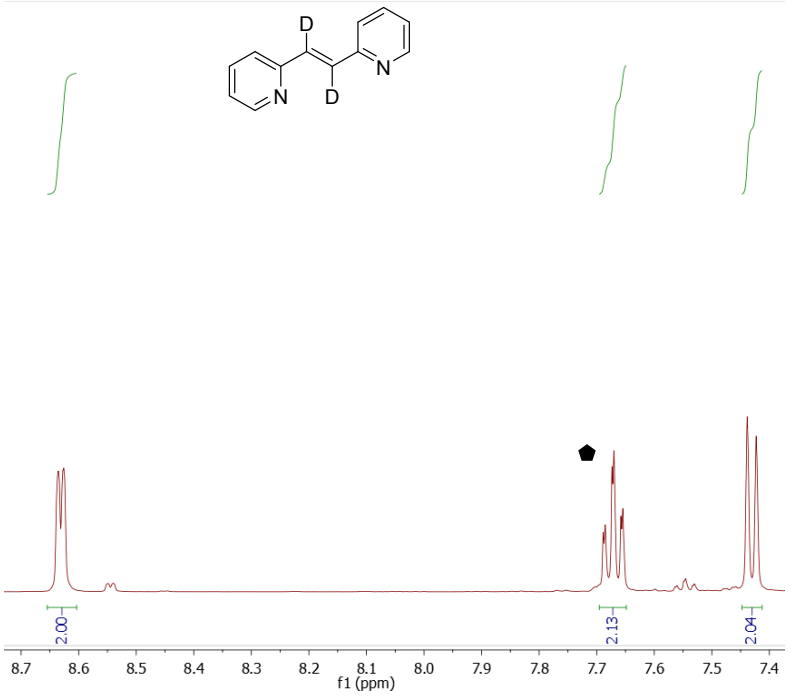
2-(4-Methyl-2,6-dideuterophenyl)pyridine (4d).



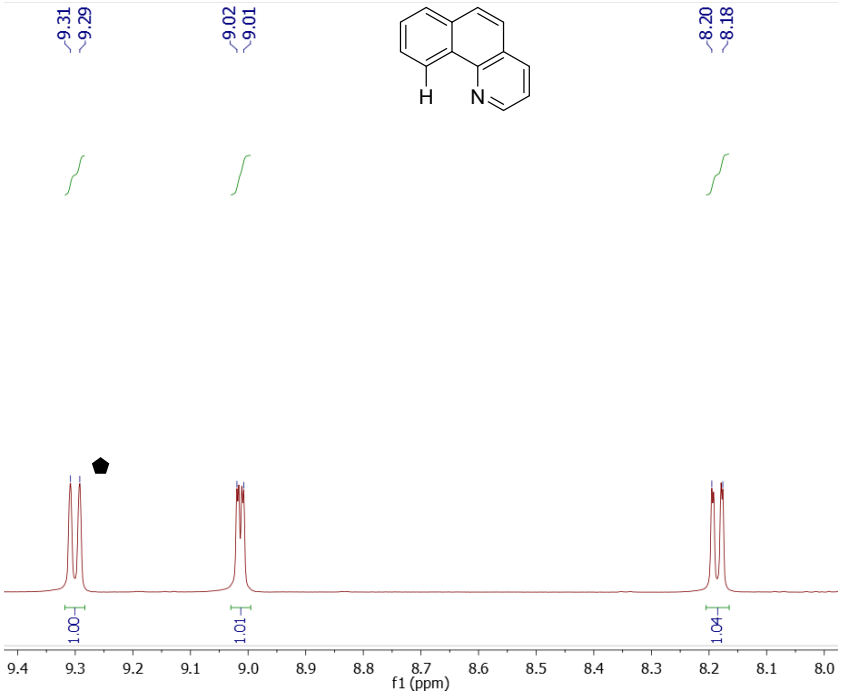


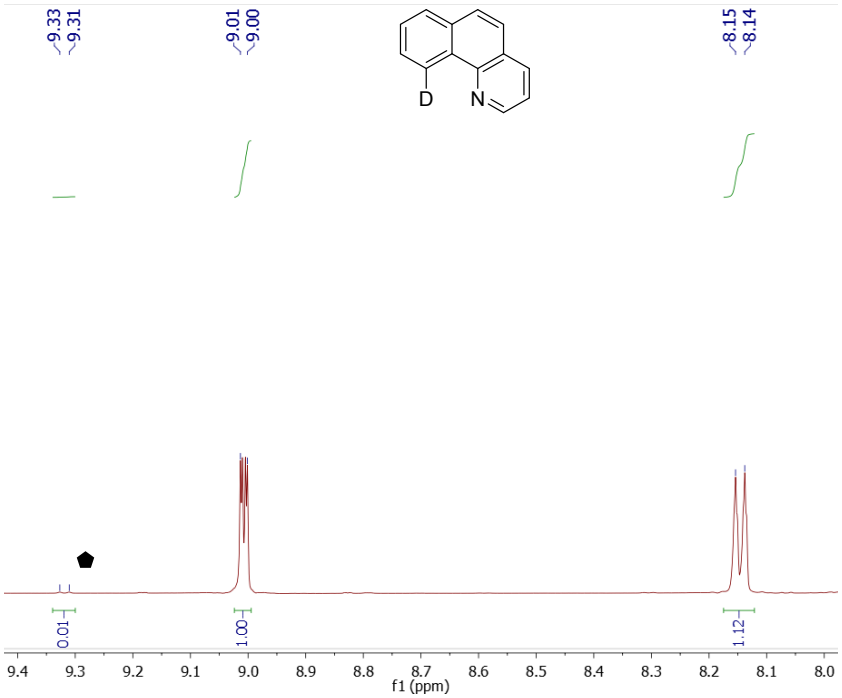
1,2-Dideutero-1,2-bis(2-pyridyl)ethylene (4e).



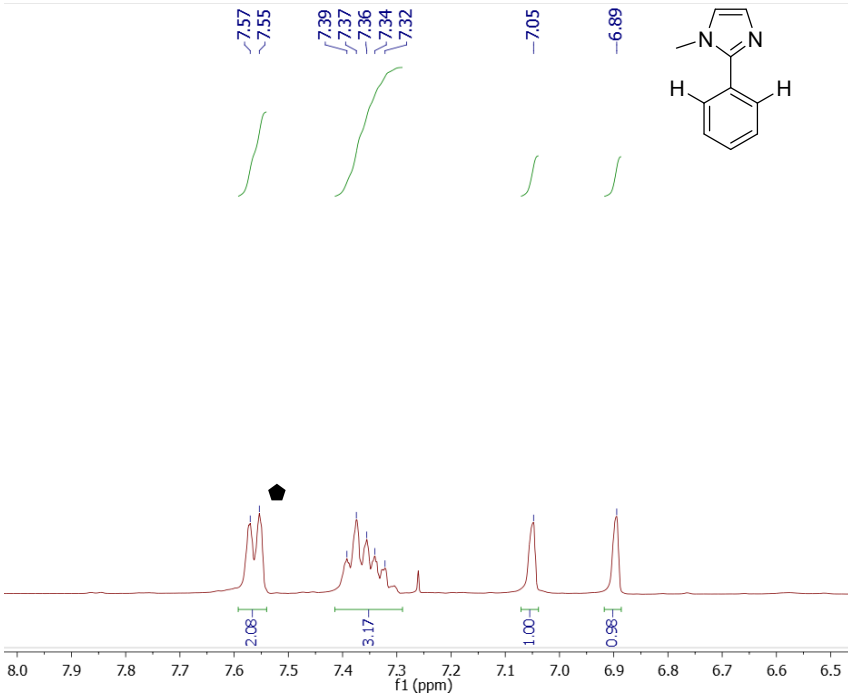


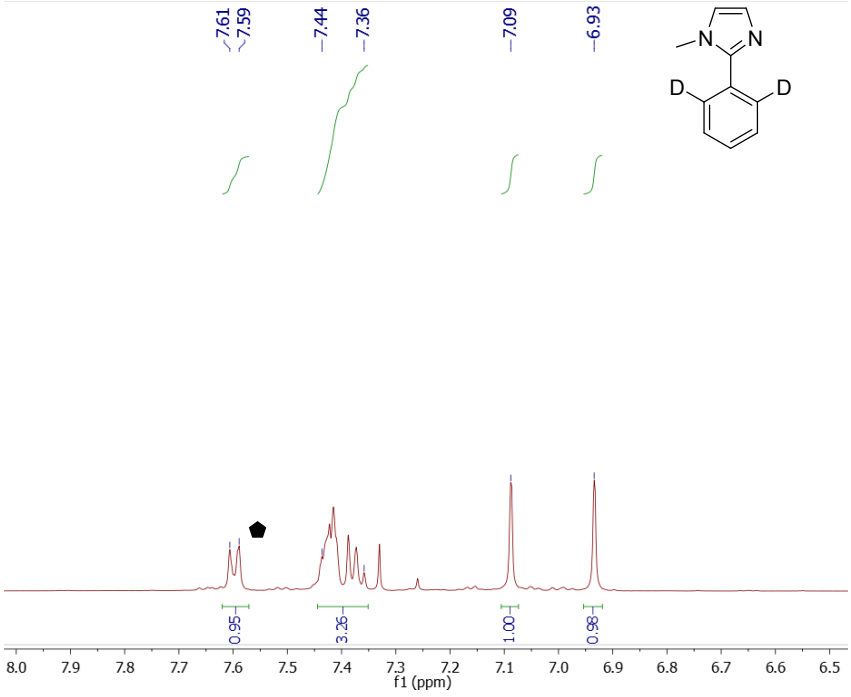
7,8-(4-Deutero)-benzoquinoline (4f).



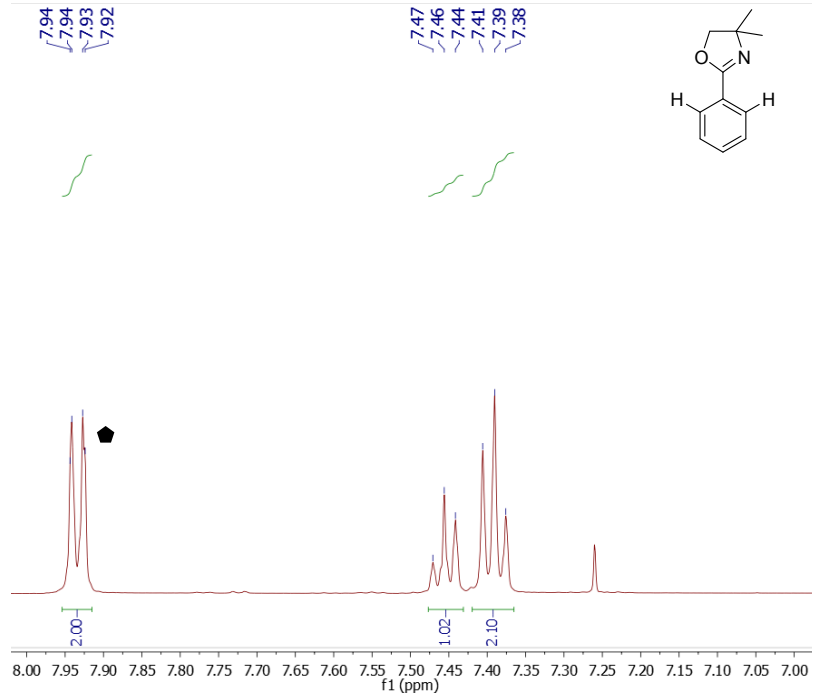


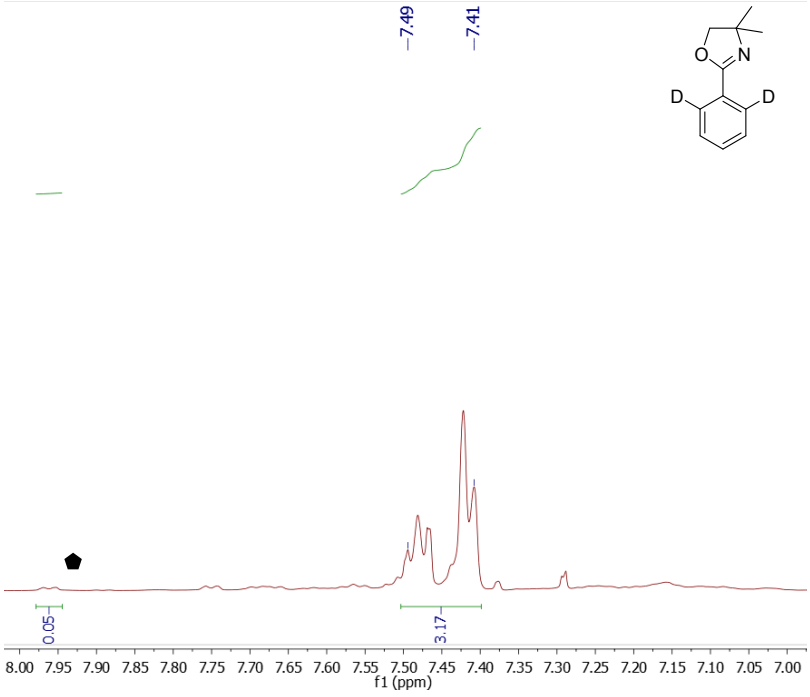
(5)-Methyl-2-(2,6-dideuterophenyl)-imidazole (4g).



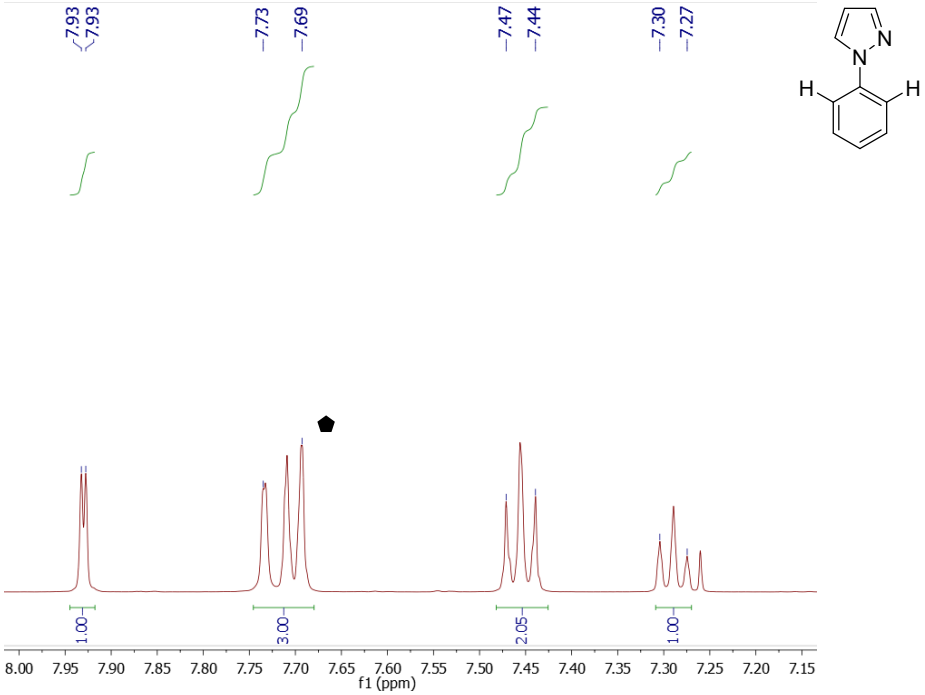


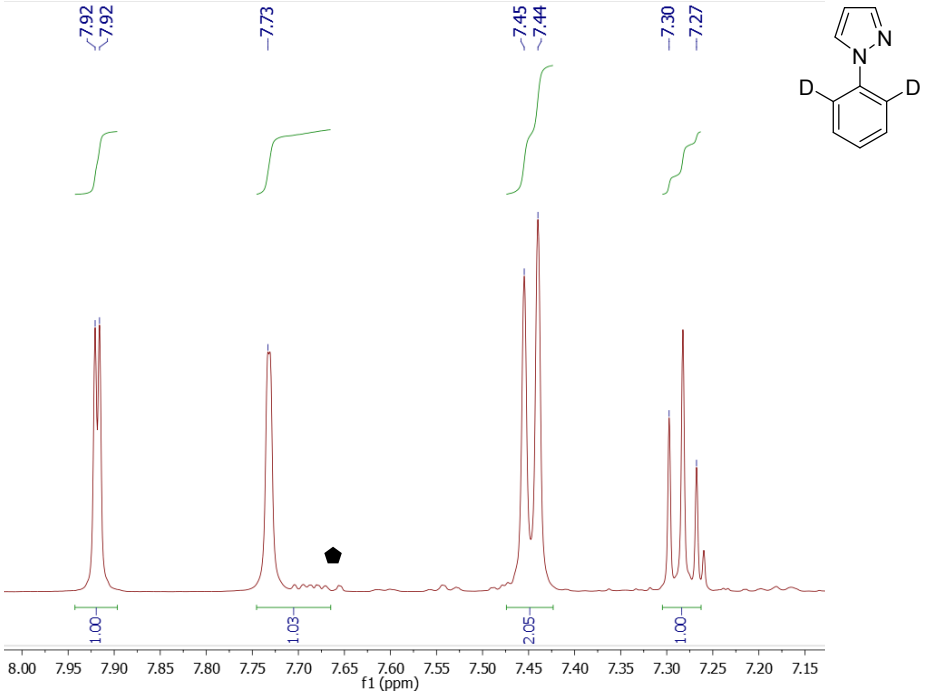
4,4-Dimethyl-4,5-dihydro-2-(2,6-dideuterophenyl) oxazole (4h).



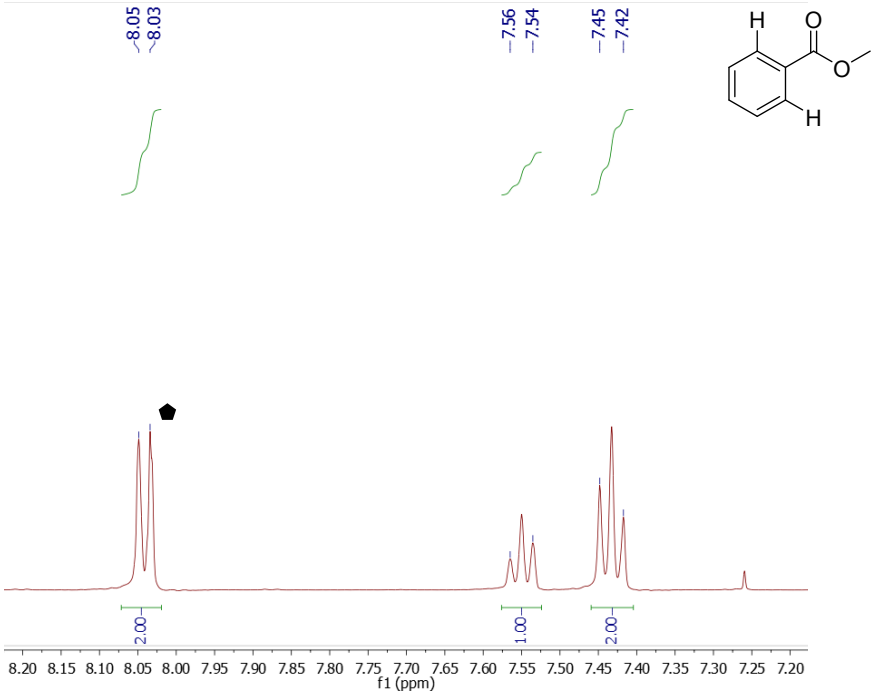


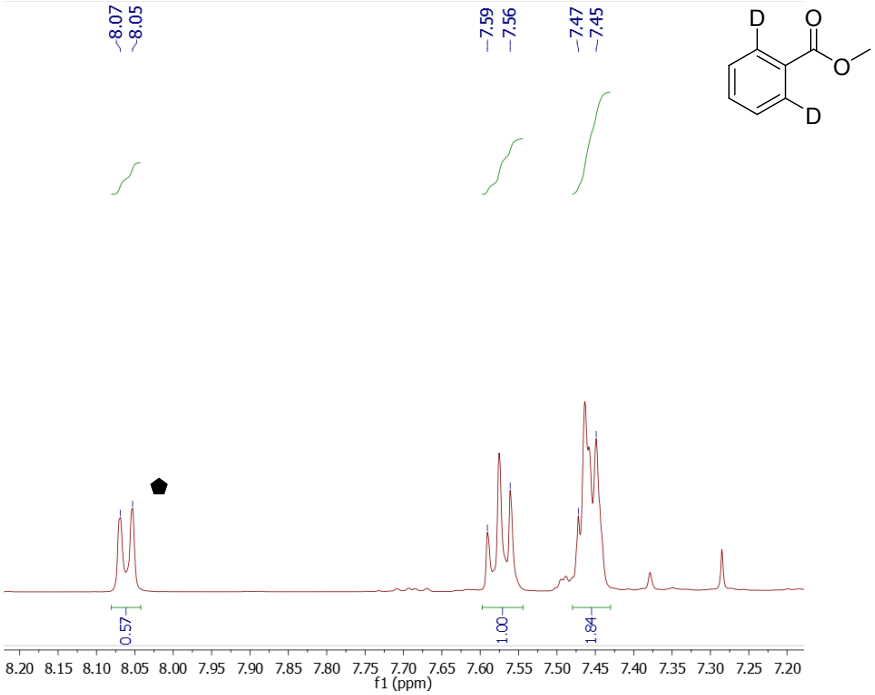
1-(2,6-Dideuterophenyl)-1H-pyrazole (4i).



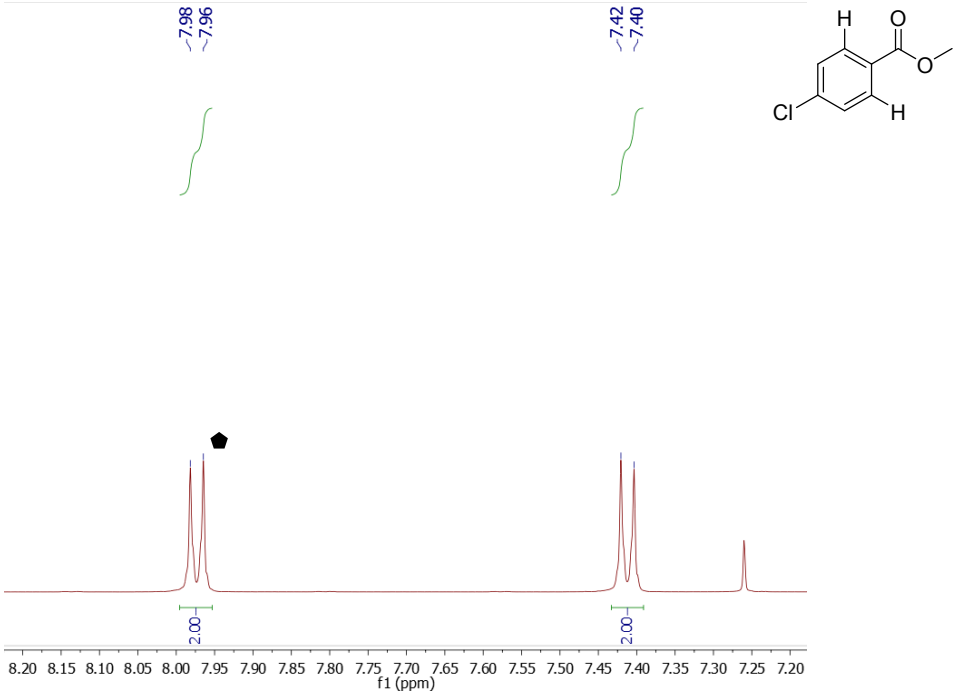


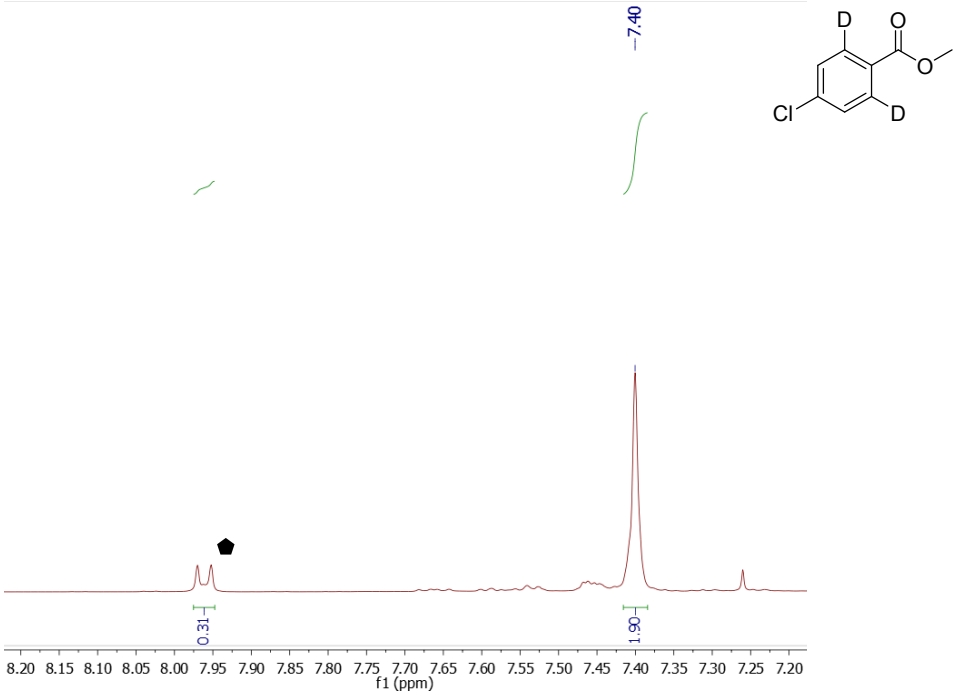
Methyl 2,6-dideuterobenzoate (4j).



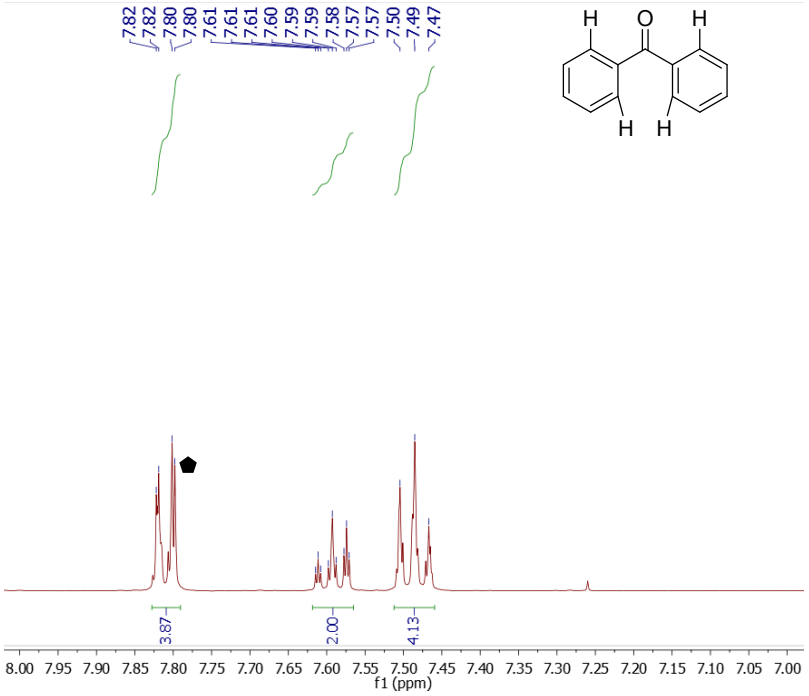


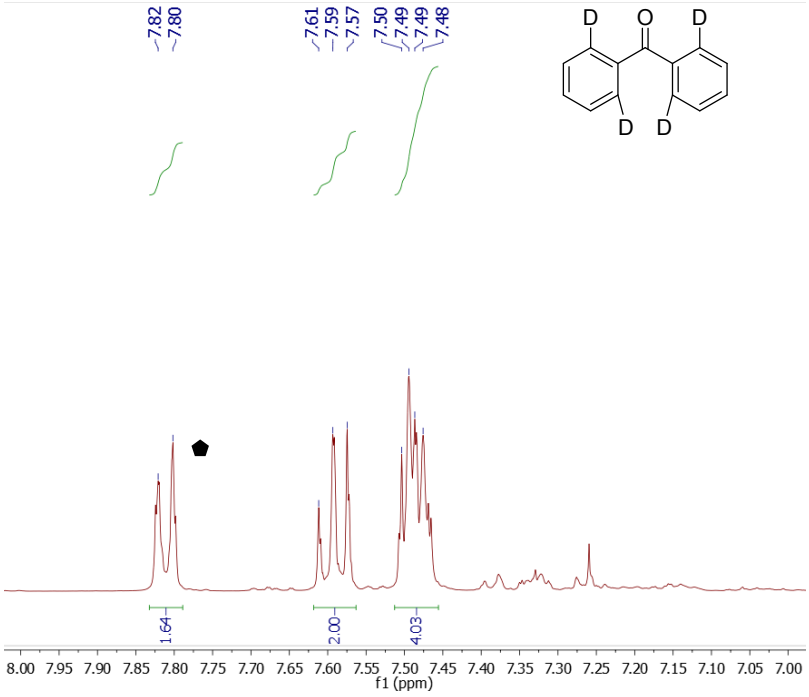
Methyl 4-chloro-2,6-dideuterobenzoate (4k).



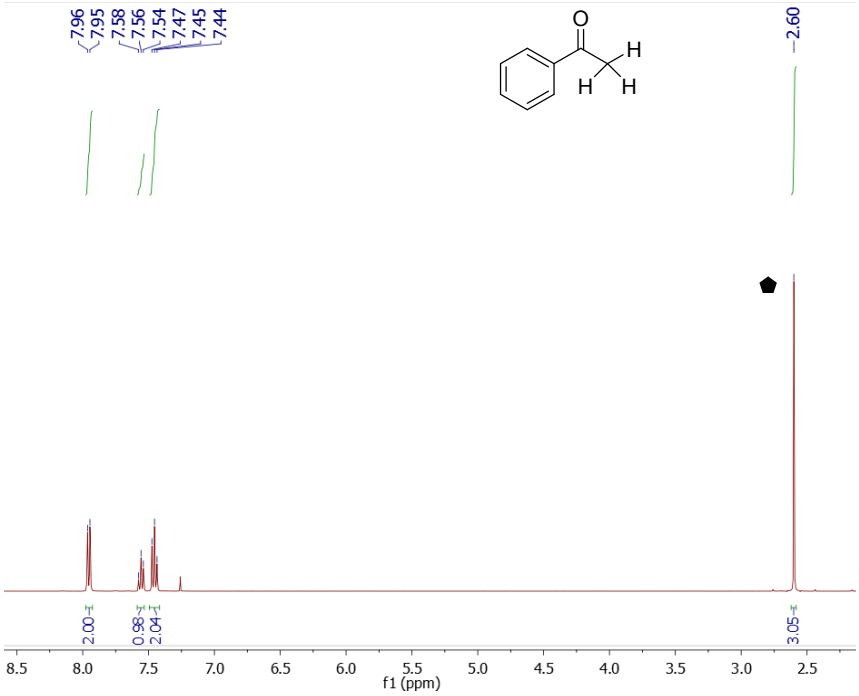


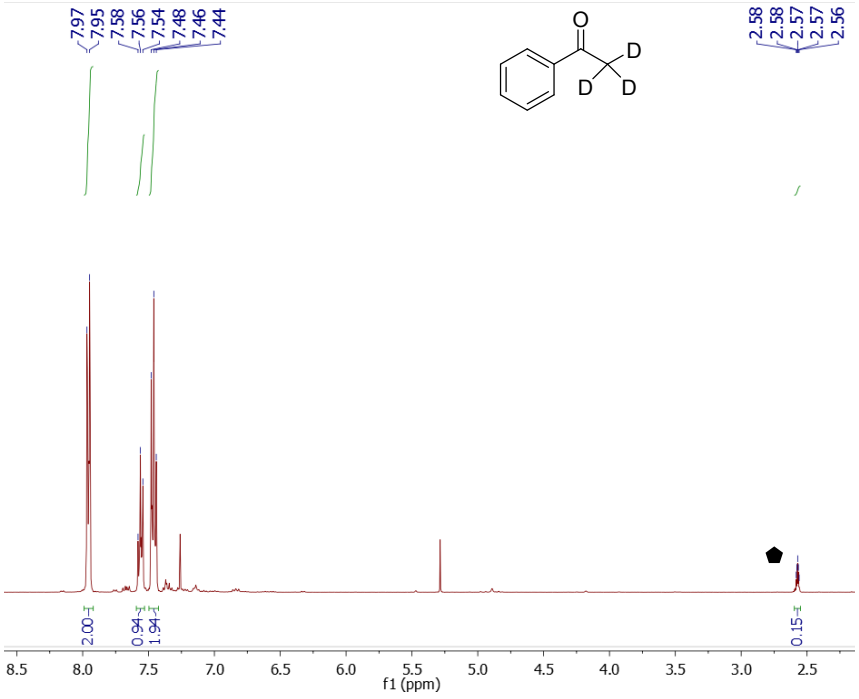
2,2',6,6'-Tetradeuteriobenzophenone (4l).



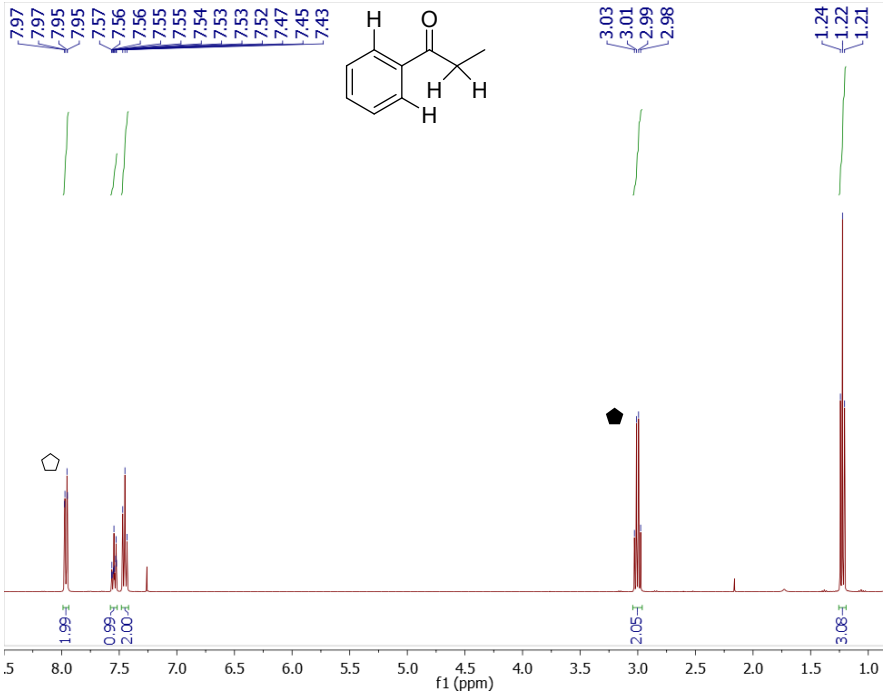


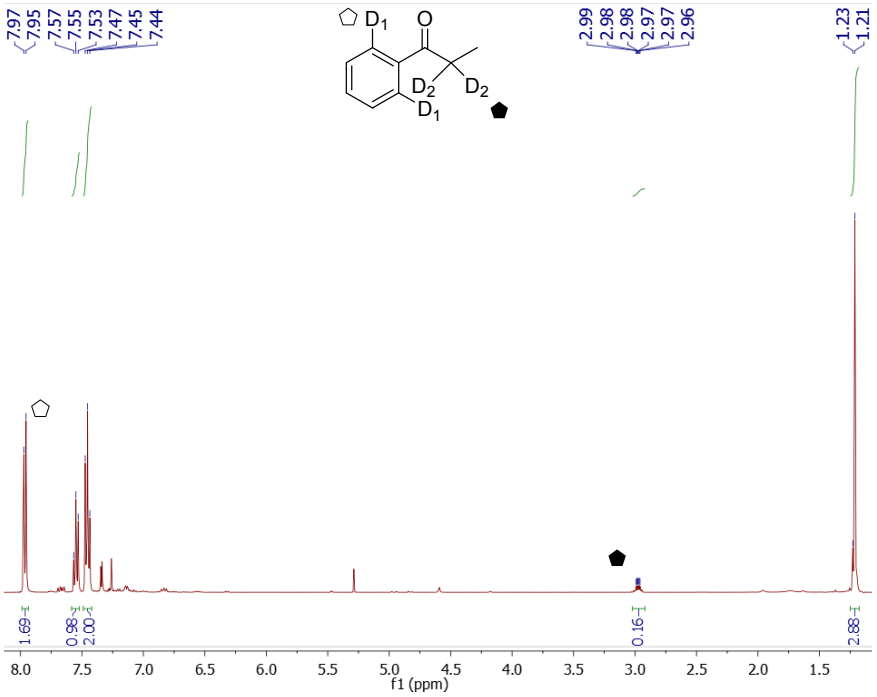
α,α,α-Trideuteromethyl phenyl ketone (4m).



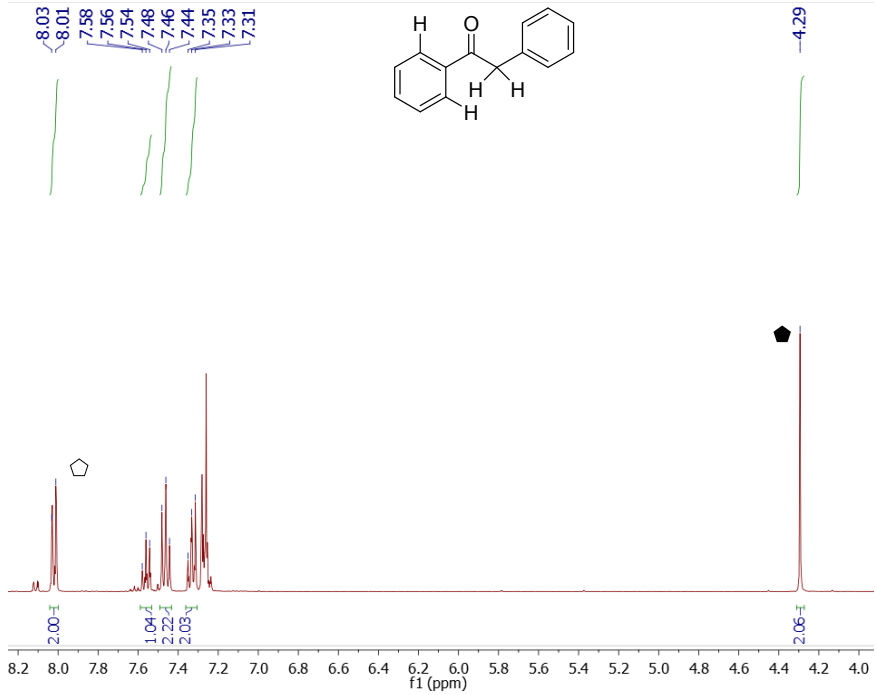


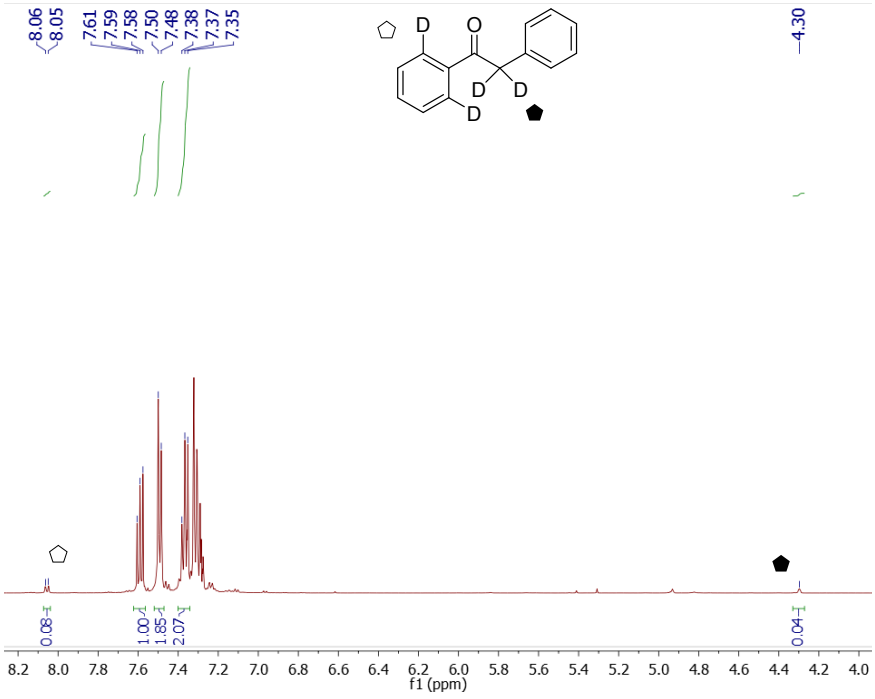
α,α-Dideuteroethyl phenyl ketone (4n).



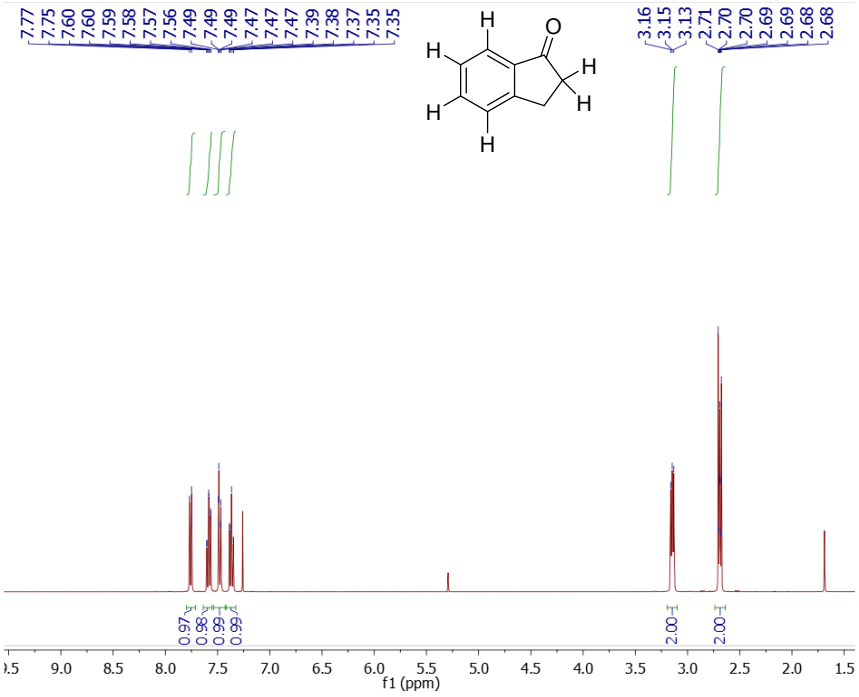


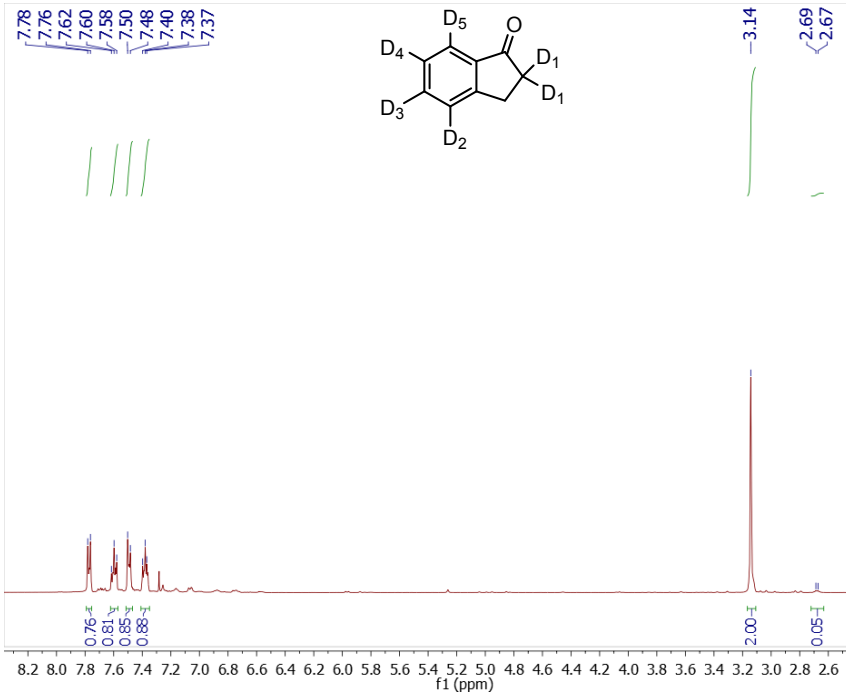
2,2-Dideuterio-1,2-diphenyl-ethanone (4o).



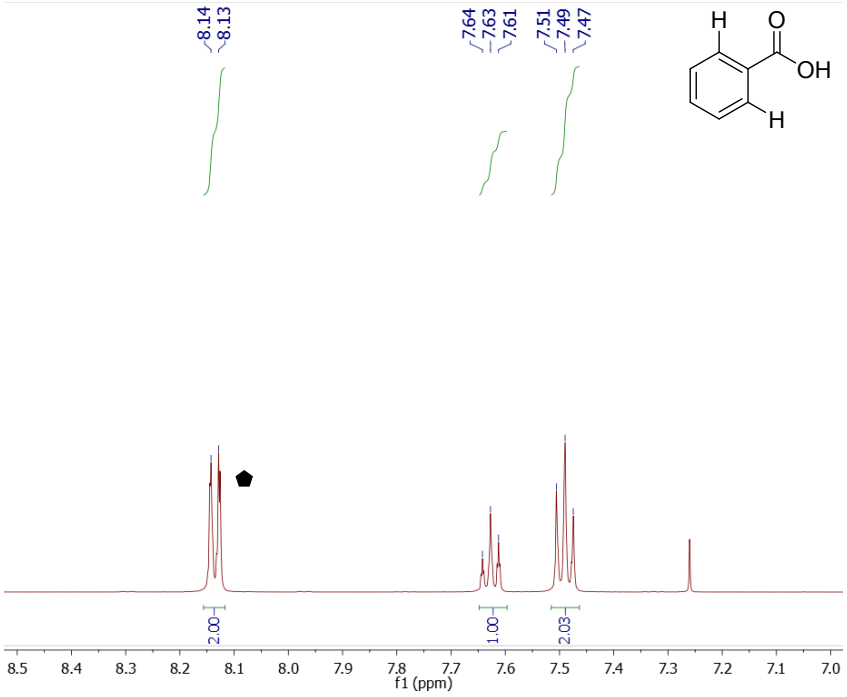


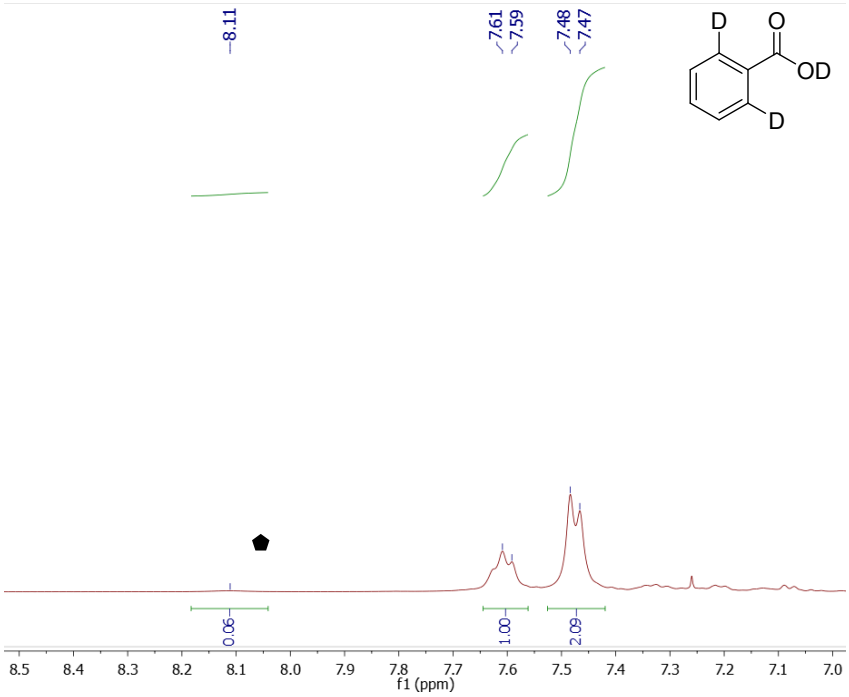
2,2-Dideuterio-1-indanone (4p).



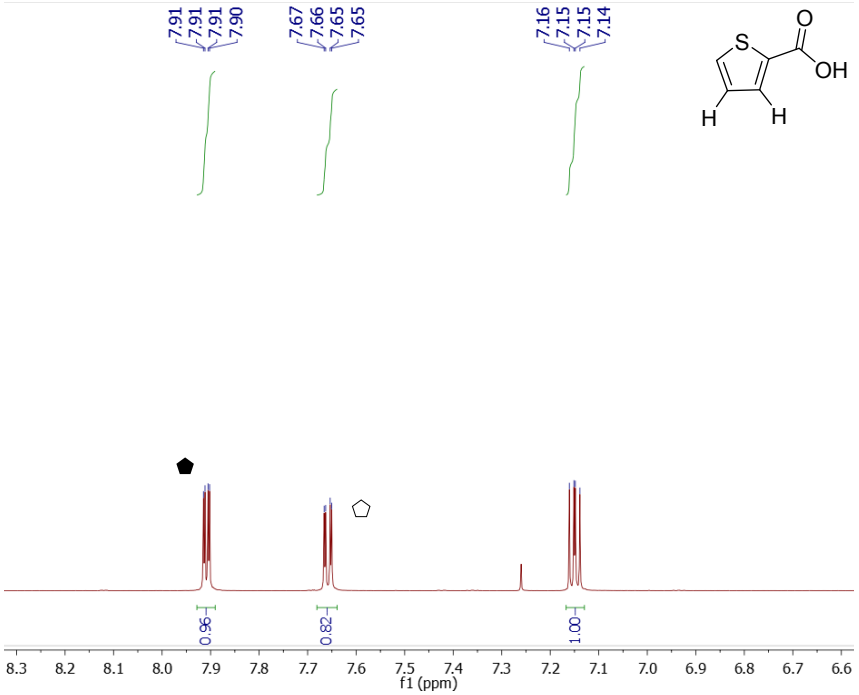


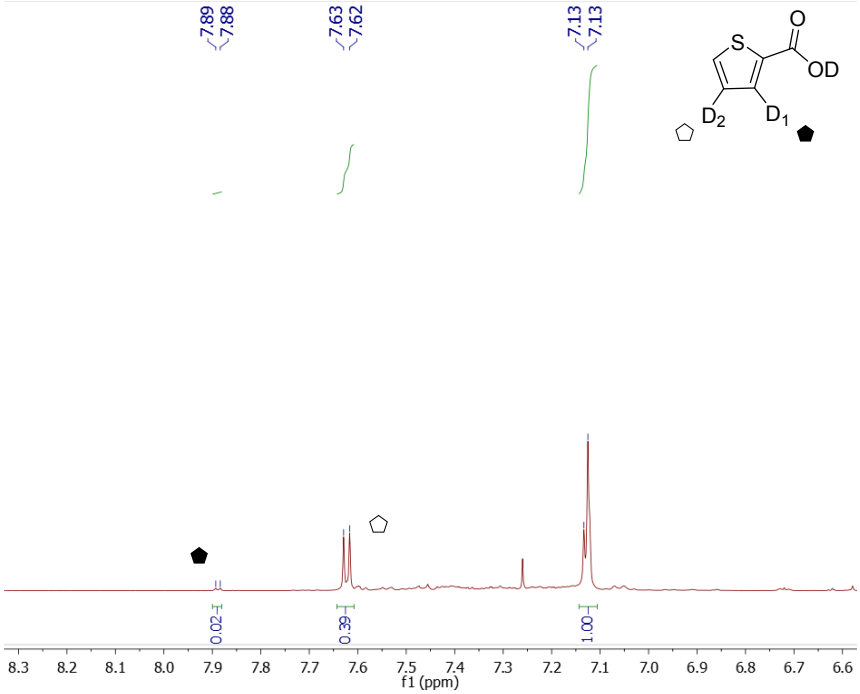
2,6-Dideuteriobenzoic acid (4q).



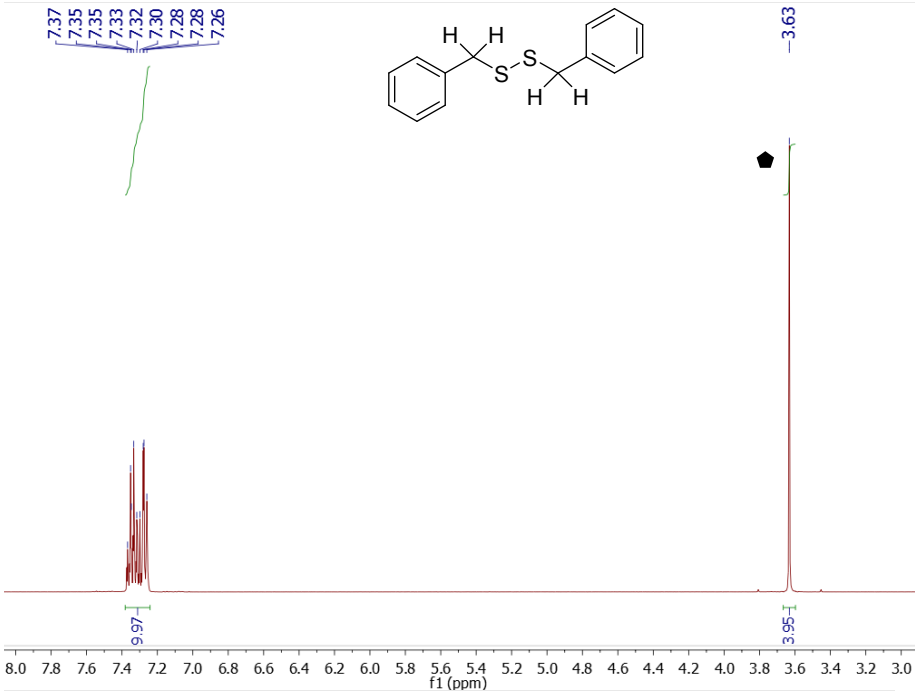


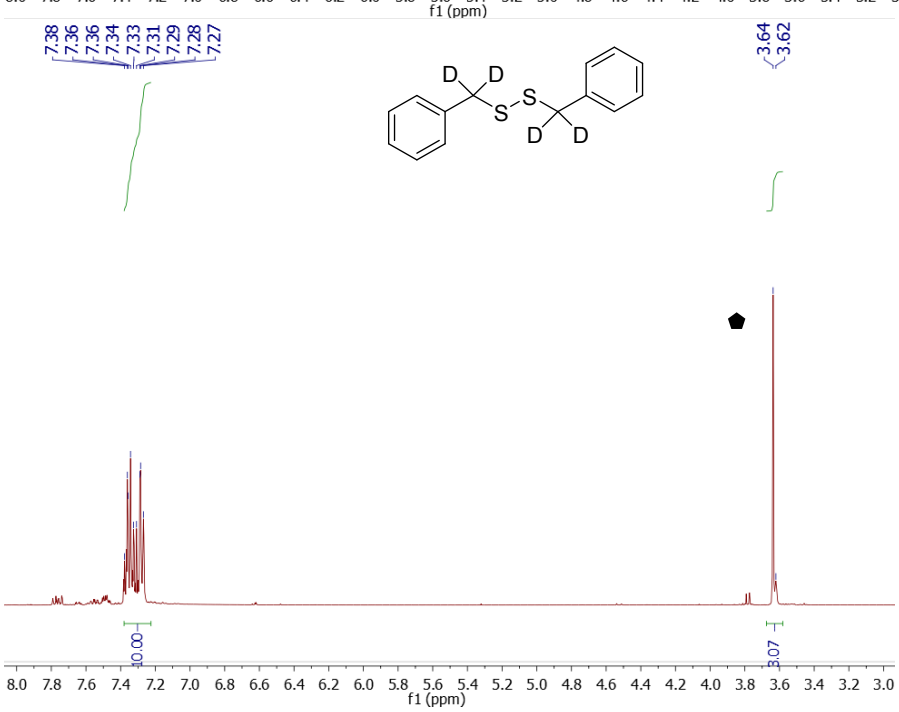
3-Deuteriothiophene-2-carboxylic acid (4r).



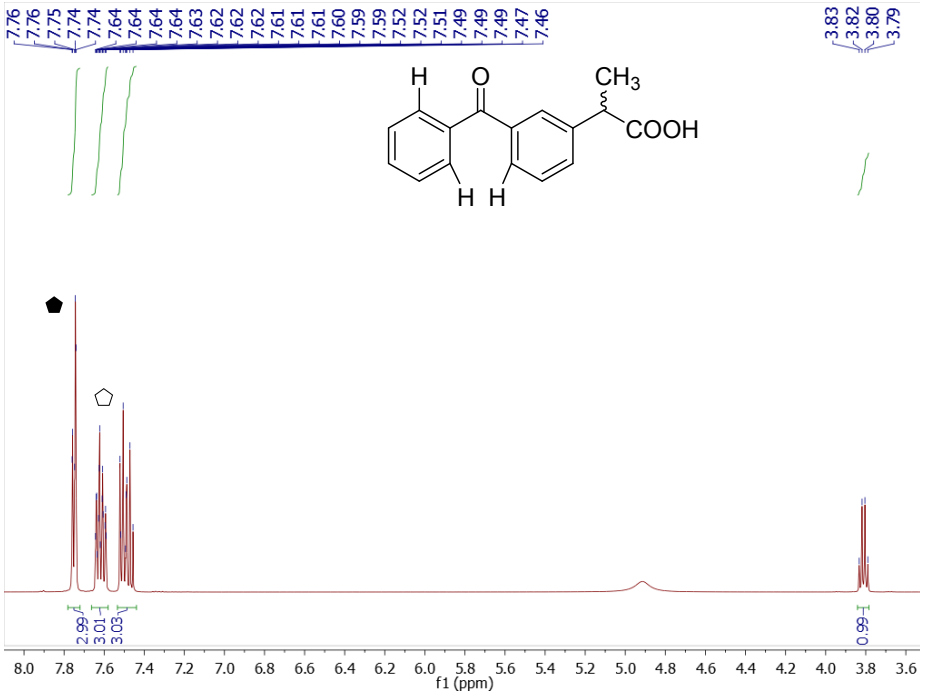


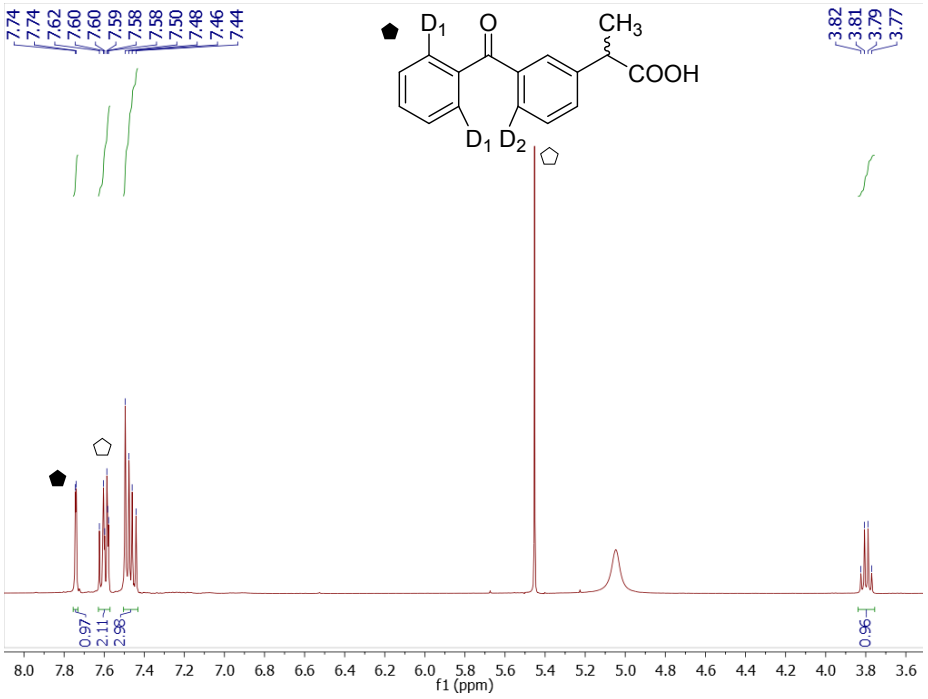
Bis(1-deuteriobenzyl) disulphide (4z).



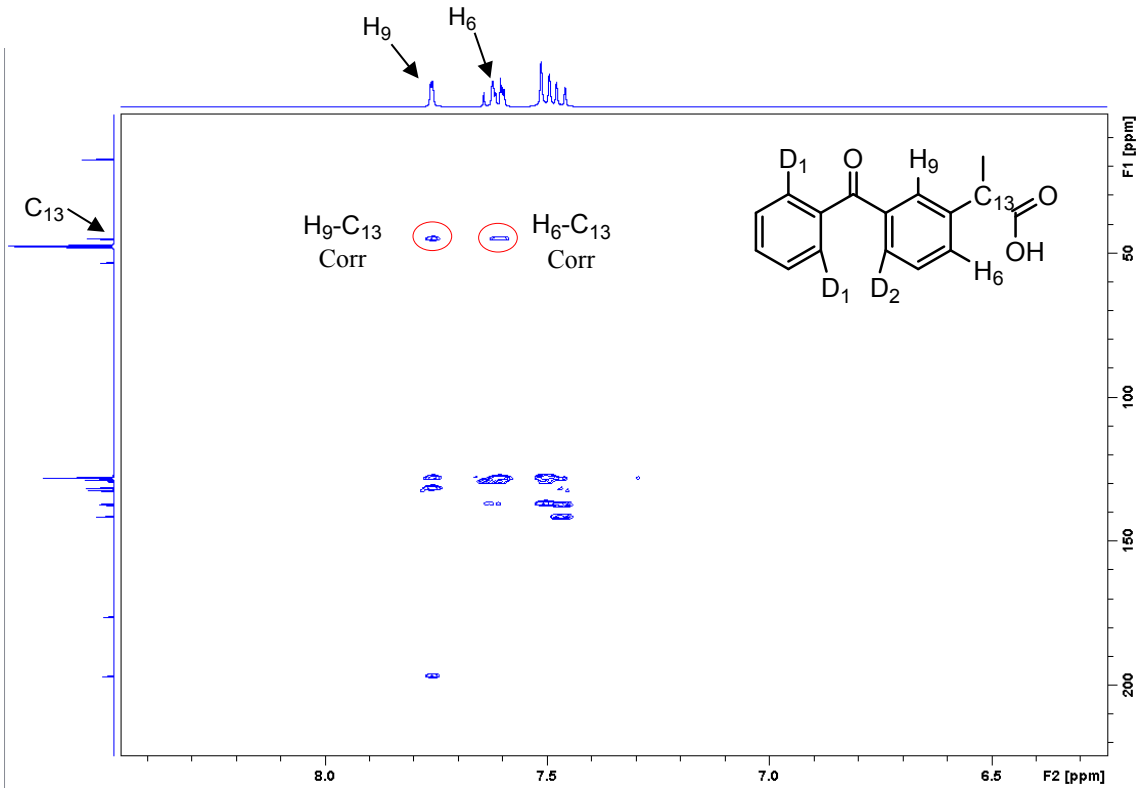


2-(4-Deutero-3-benzoyl-2,6-dideuterophenyl)propionic acid (d_3-Ketoprofen)) (4aa).

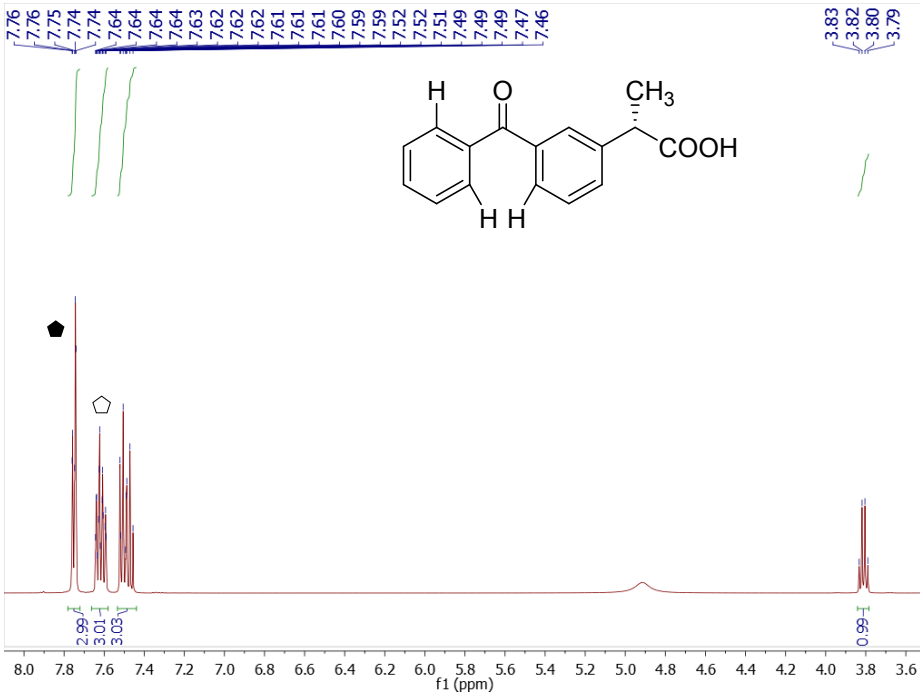


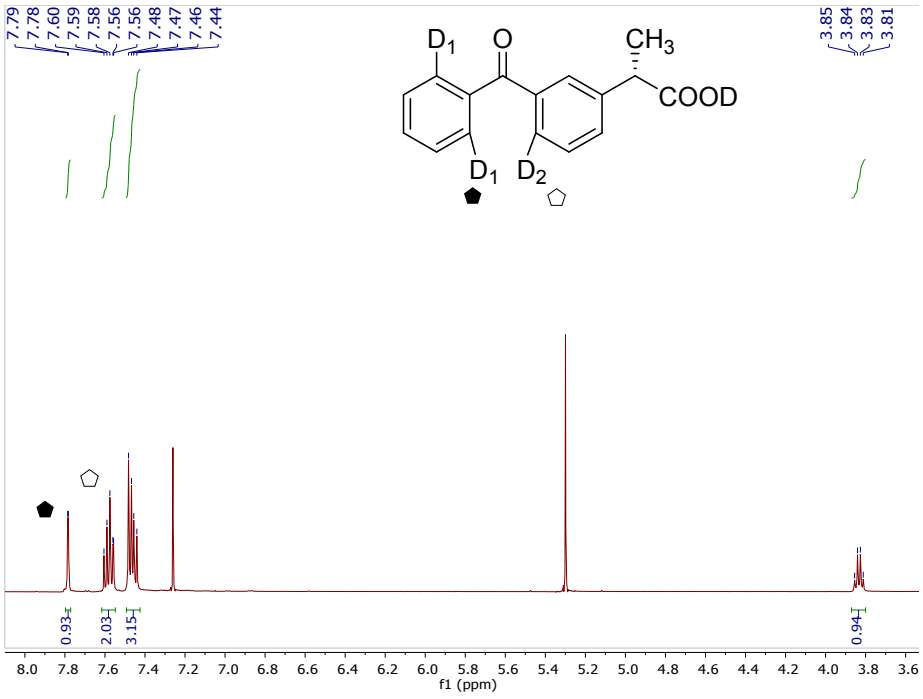


HMBC spectrum shows the correlation between C_{13} with H_6 and H_9, which taking into account the integrals in the ^{1}H-NMR, demonstrates no deuterium incorporation in positions 9 and 6.



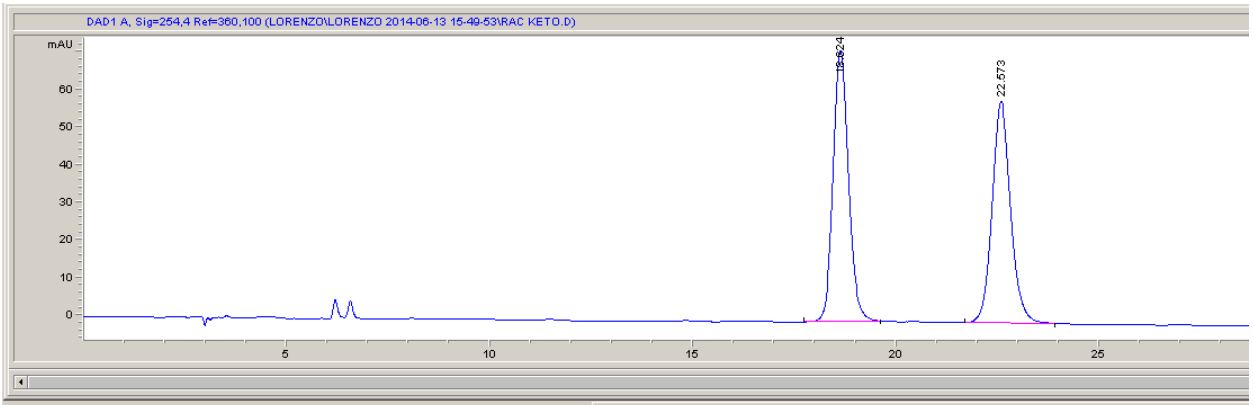
(S)-2-(4-Deutero-3-benzoyl-2,6-dideuterophenyl)propionic acid ((S)-d_3-Ketoprofen)) (4ab).





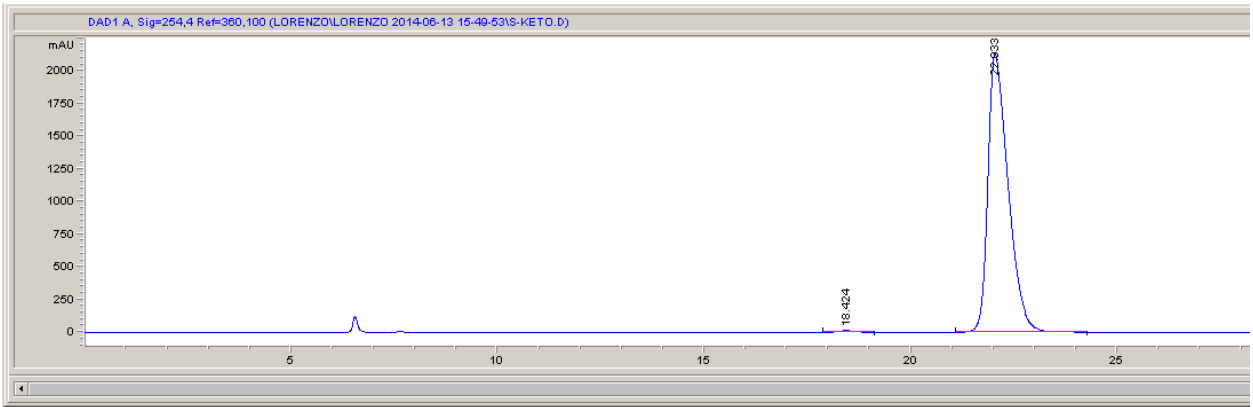
HPLC of *rac*-**3aa**:

Condition: Chiralpak AD-H column; hexane/i-PrOH/TFA 95:5:0.1; flow rate 0.5 mL/min.



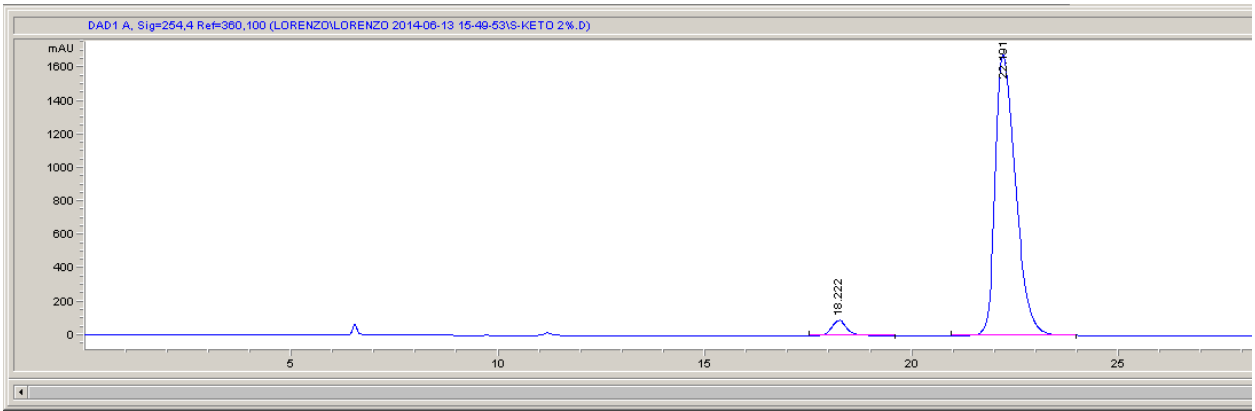
#	Time	Area	Height	Width	Area%	Symmetry
1	18.624	1876.2	71.9	0.3984	49.892	0.876
2	22.573	1884.4	58.9	0.489	50.108	0.871

HPLC of (*S*)-**3ab**:



#	Time	Area	Height	Width	Area%	Symmetry
1	18.424	316.8	12.7	0.3796	0.429	0.903
2	22.033	73486.9	2144.6	0.5278	99.571	0.531

HPLC of **(S)-4ab.**

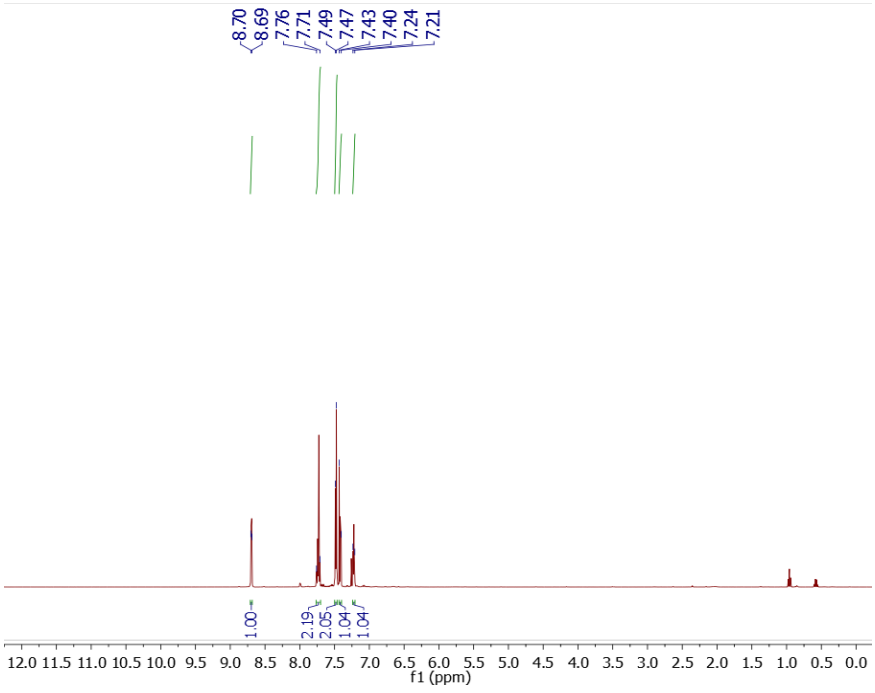


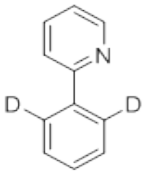
#	Time	Area	Height	Width	Area%	Symmetry
1	18.222	2362.1	91	0.3967	3.972	0.856
2	22.191	57103.2	1675.4	0.5196	96.028	0.595

NMR SPECTRA:

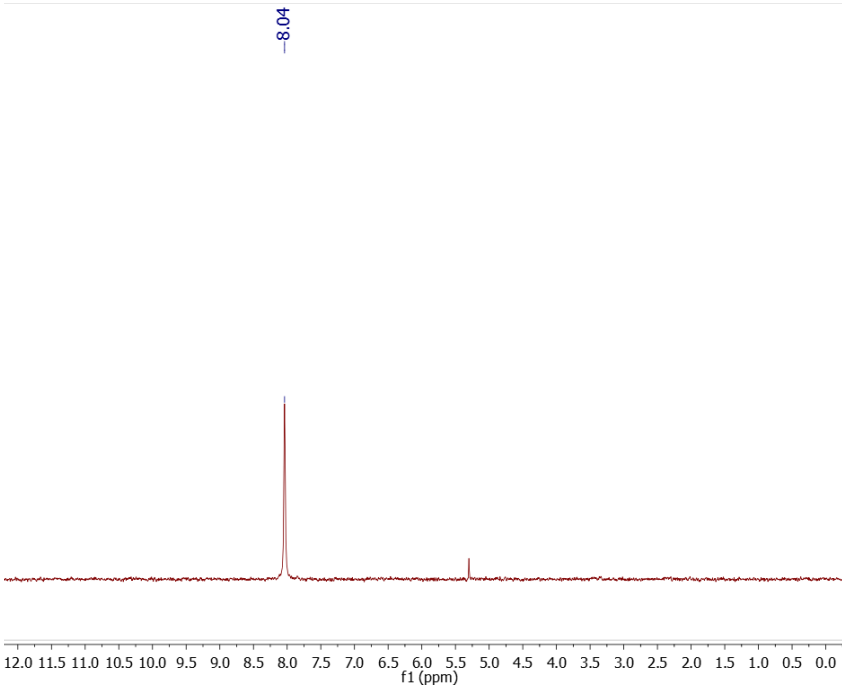
2-(2,6-Dideuterophenyl)pyridine (4a).

^{1}H NMR:



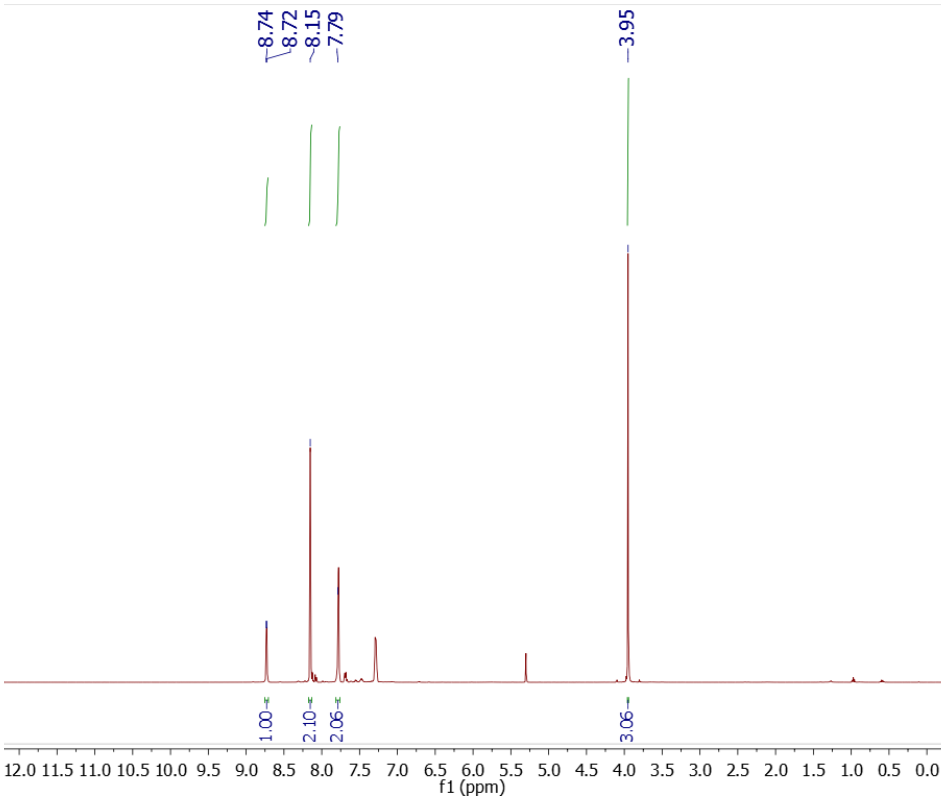


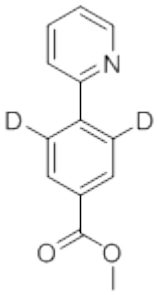
^{2}H NMR:



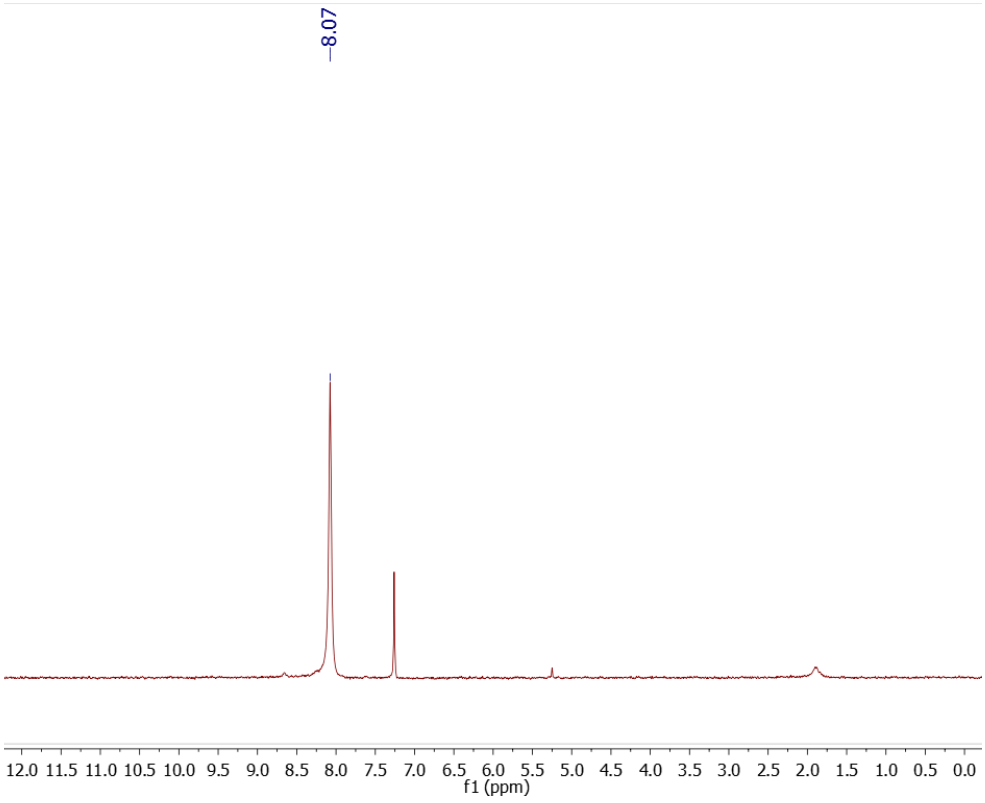
2-(4-Carboxy-2,6-dideuterophenyl)pyridine (4b).

^{1}H NMR:



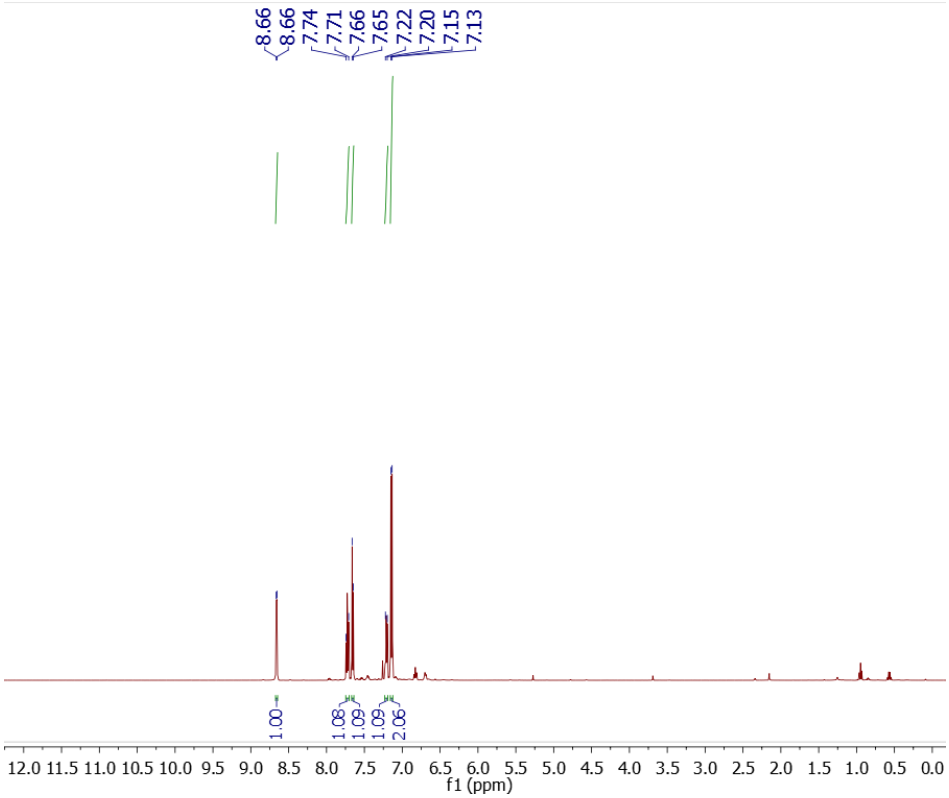


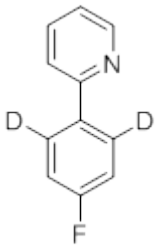
^{2}H NMR:



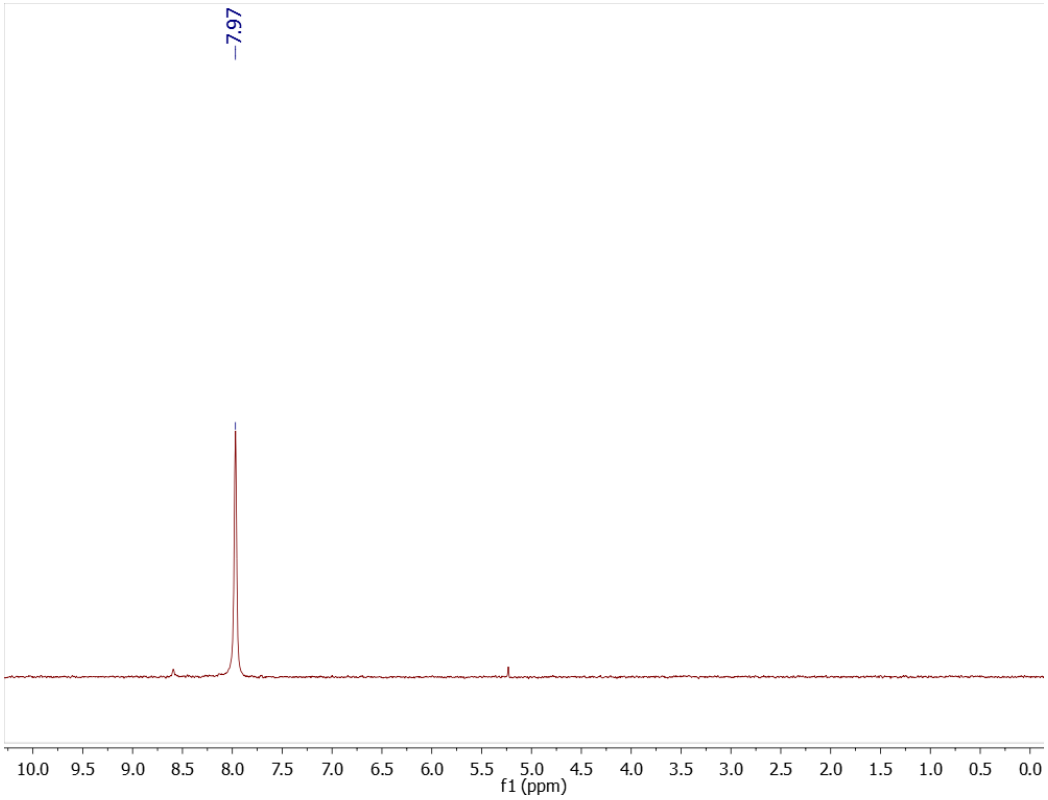
2-(2,6-Dideutero-4-fluoro-phenyl)pyridine (4c).

^{1}H NMR:



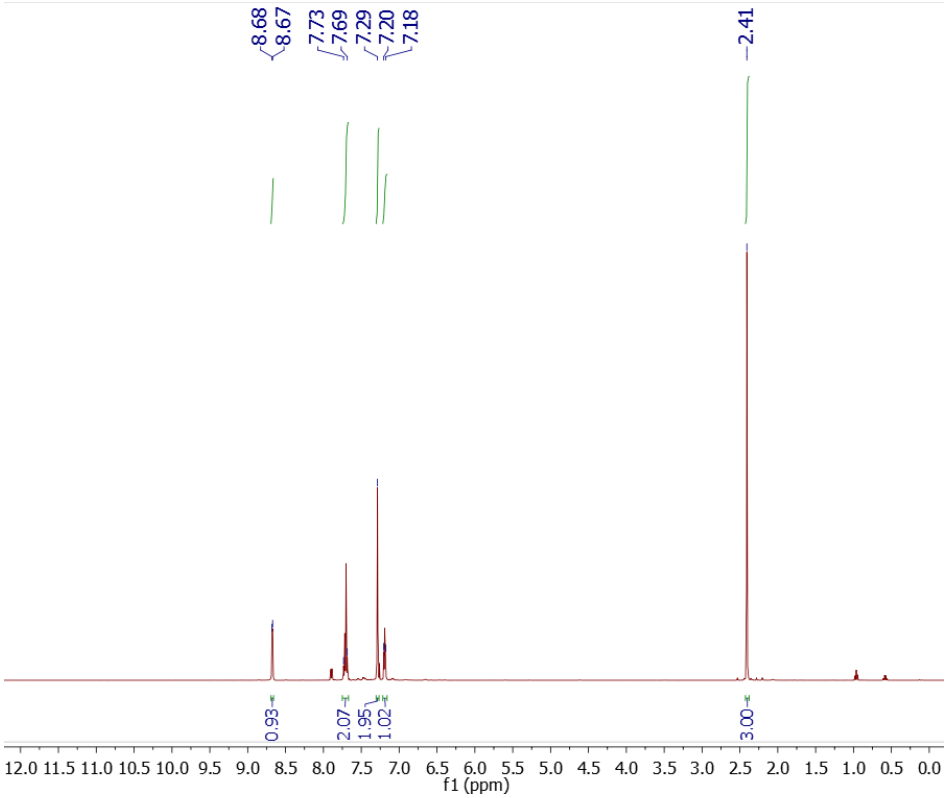


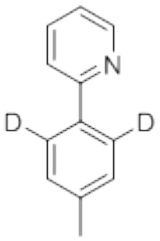
^{2}H NMR:



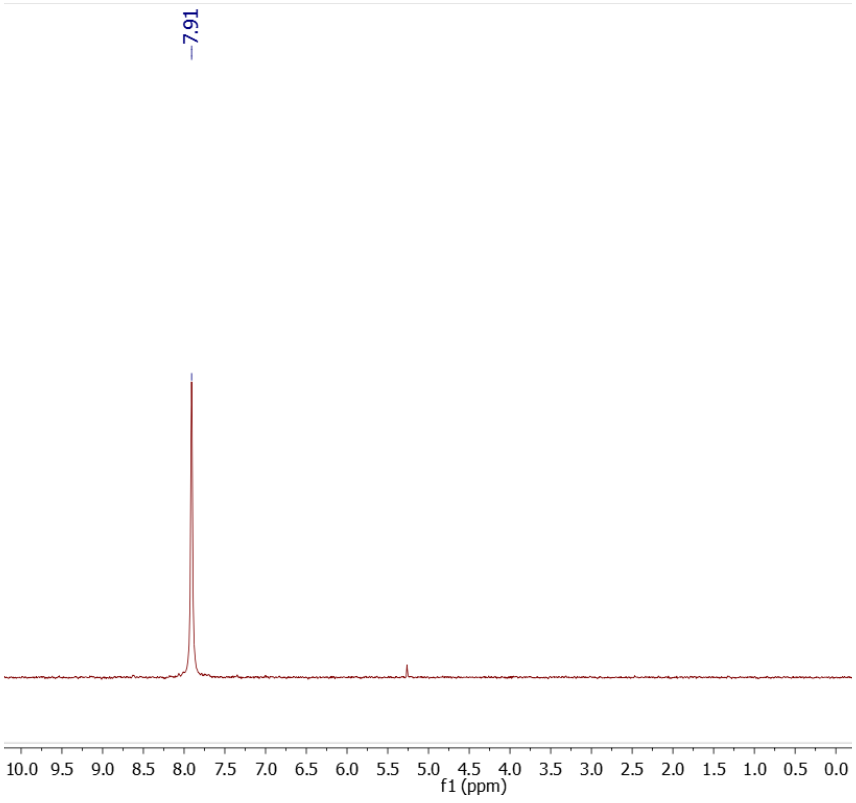
2-(4-Methyl-2,6-dideuterophenyl)pyridine (4d).

^{1}H NMR:



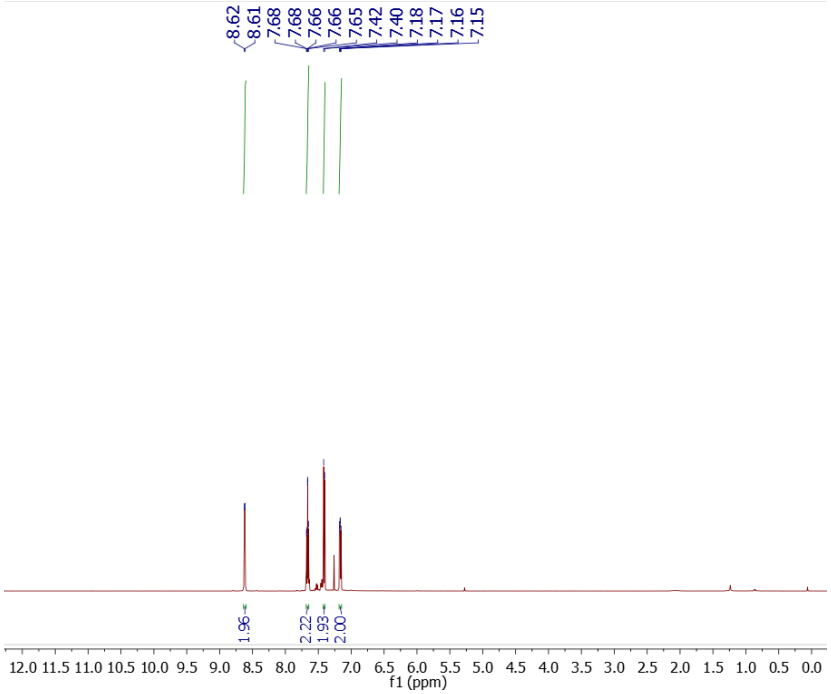


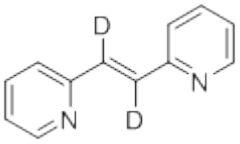
^{2}H NMR:



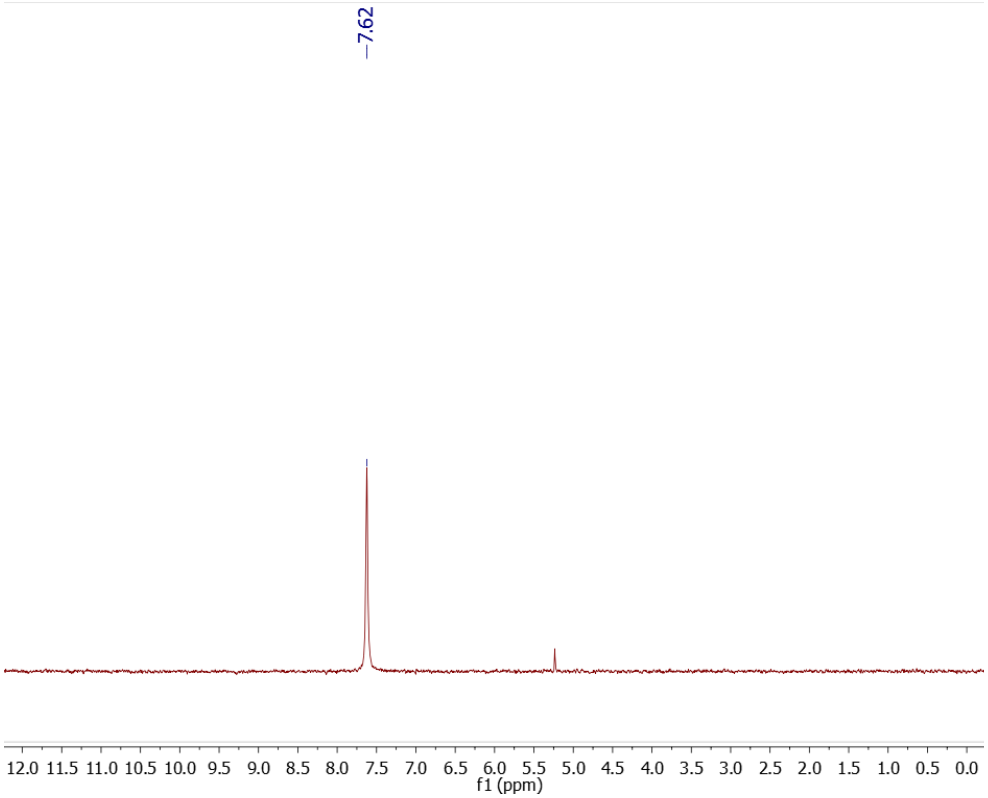
1,2-Dideutero-1,2-bis(2-pyridyl)ethylene (4e).

^{1}H NMR:



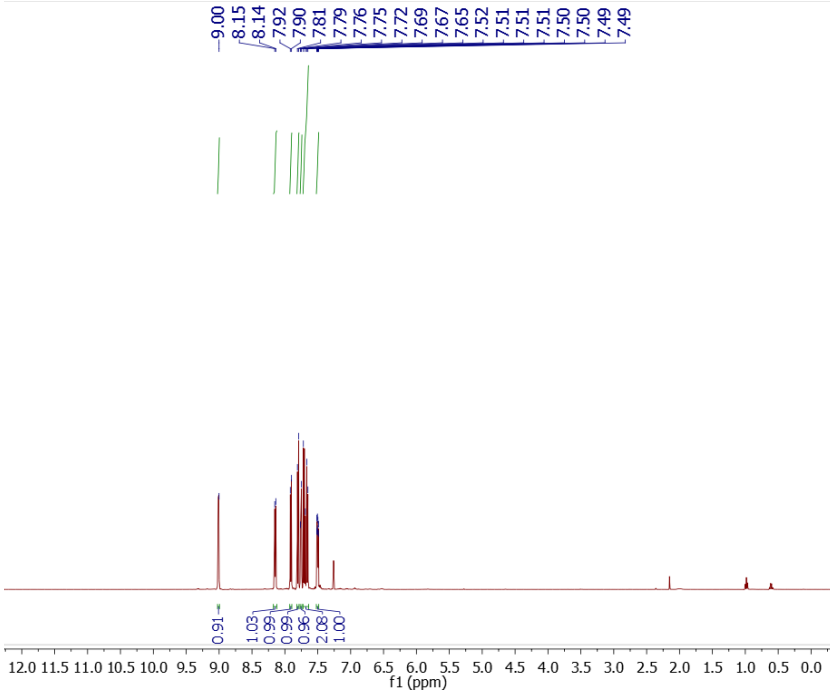


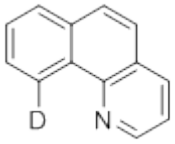
^{2}H NMR:



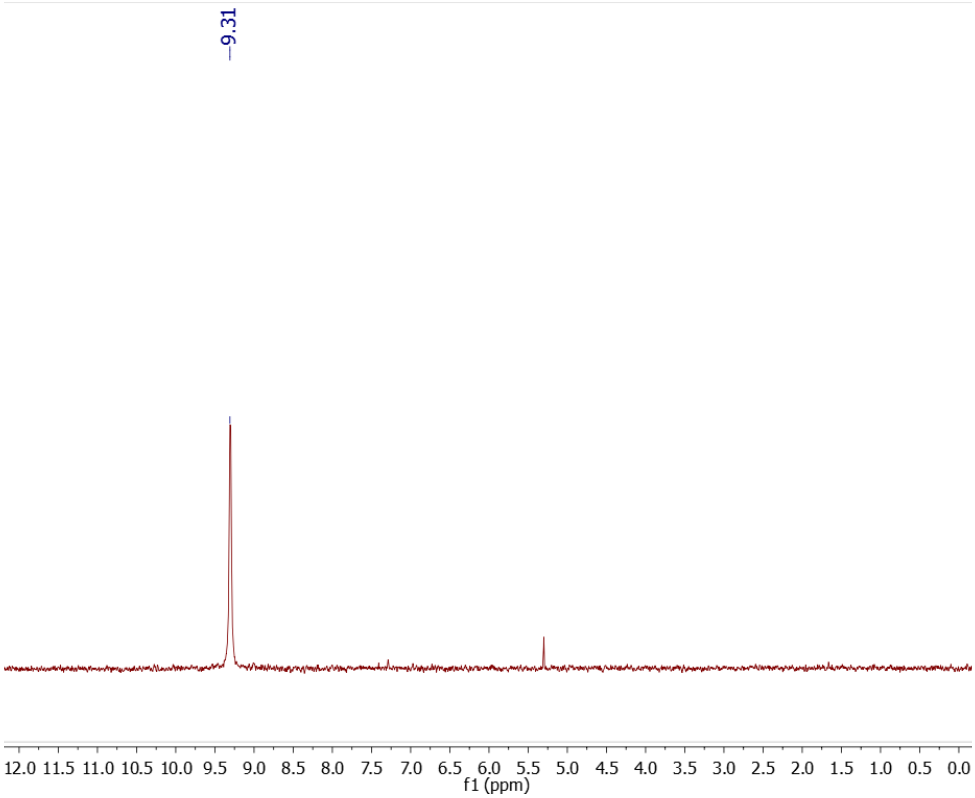
7,8-(4-Deutero)-benzoquinoline (4f).

^{1}H NMR:



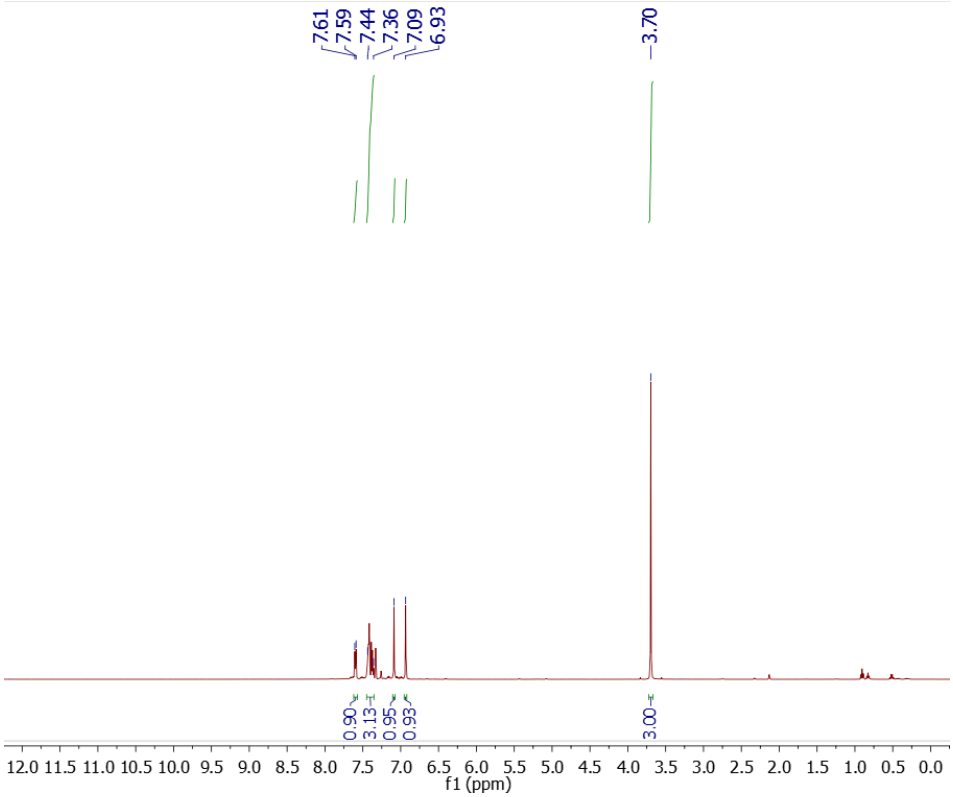


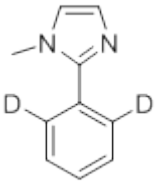
^{2}H NMR:



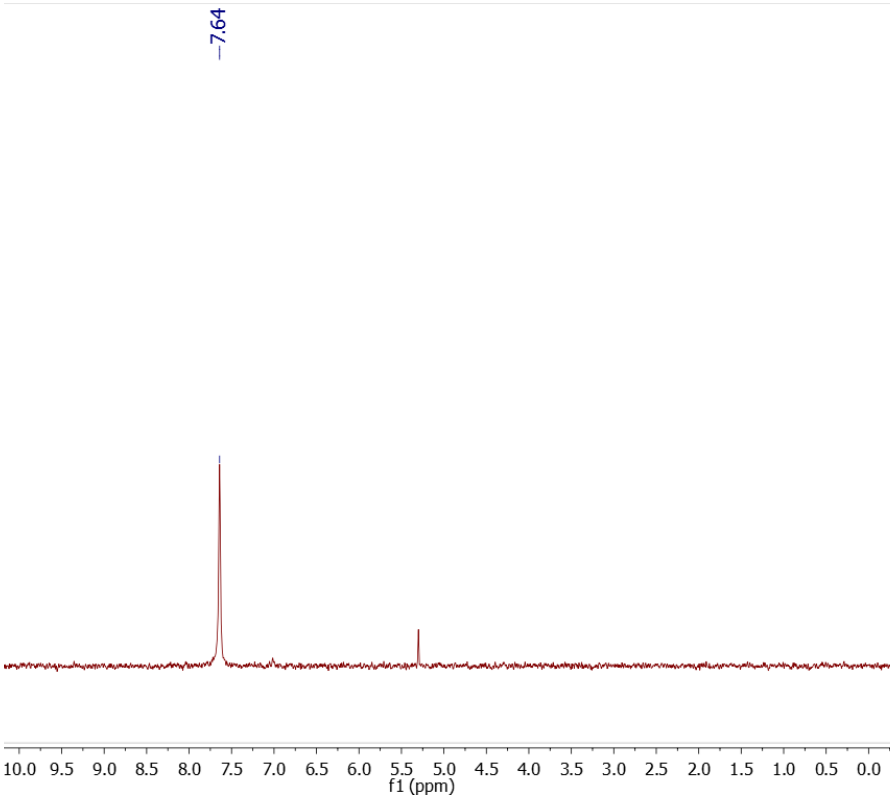
(5)-Methyl-2-(2,6-dideuterophenyl)-imidazole (4g).

^{1}H NMR:



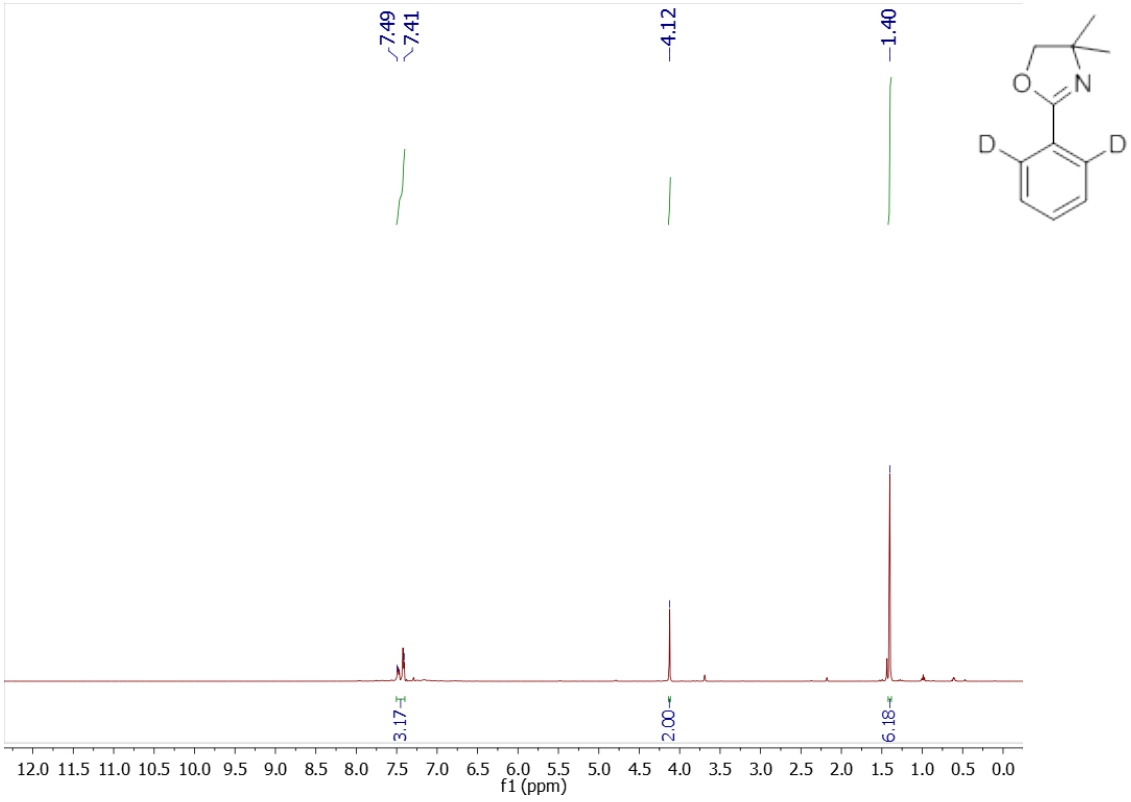


^{2}H NMR:

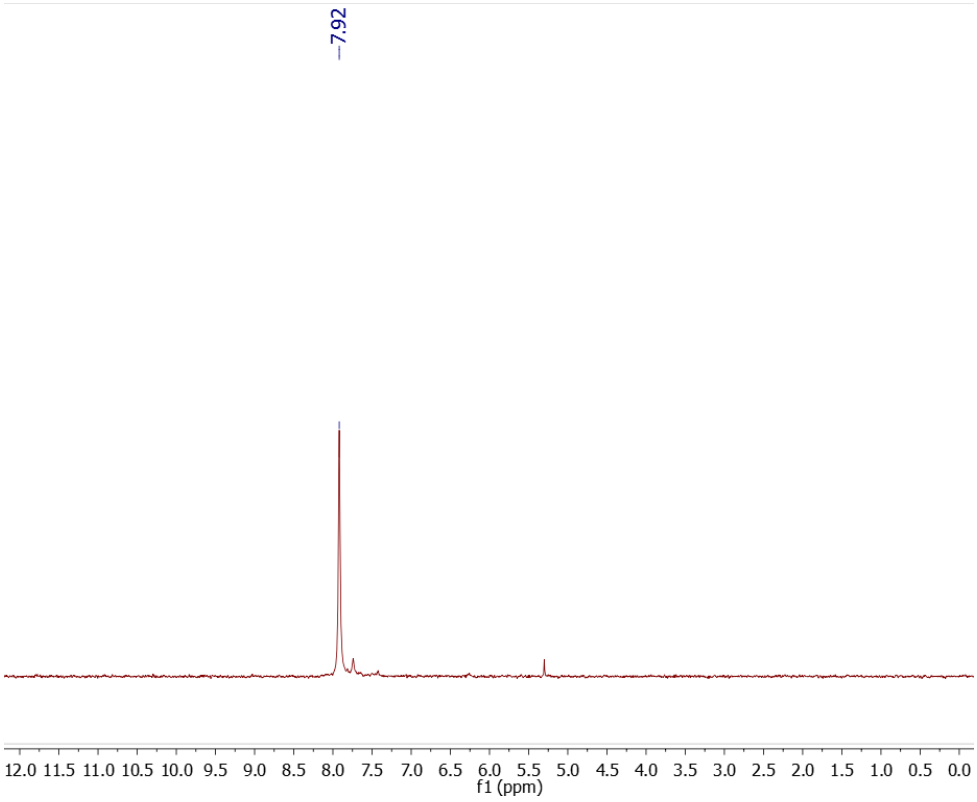


4,4-Dimethyl-4,5-dihydro-2-(2,6-dideuterophenyl) oxazole (4h).

^{1}H NMR:

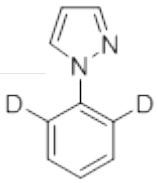


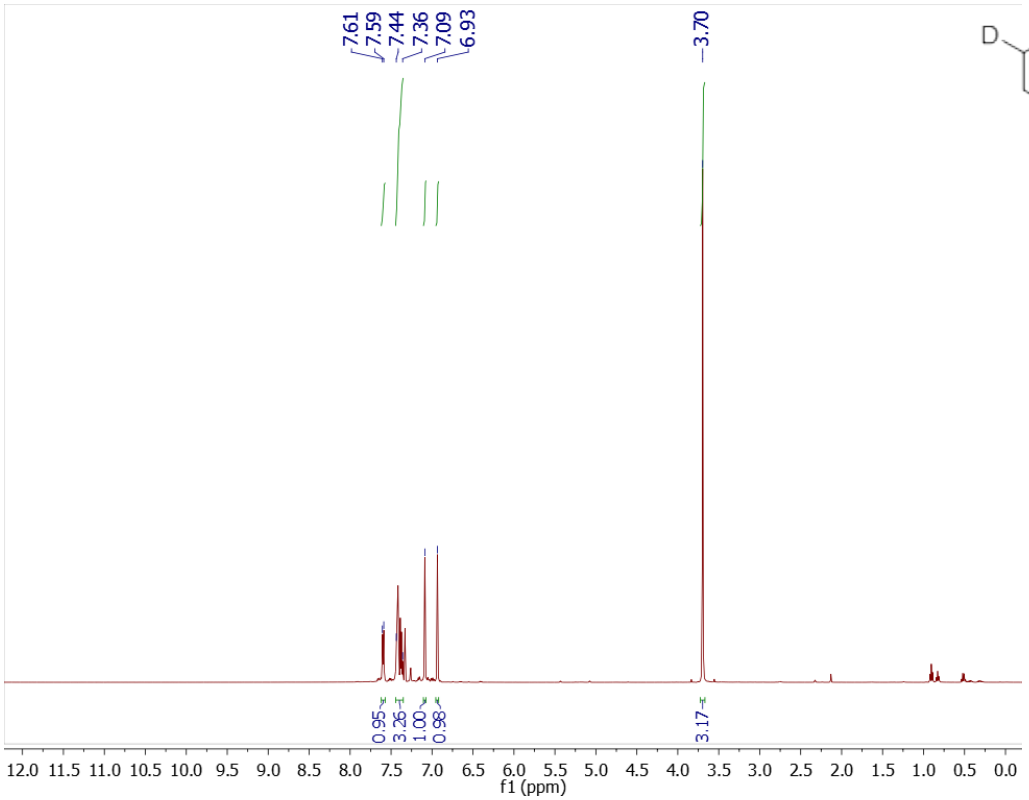
^{2}H NMR:



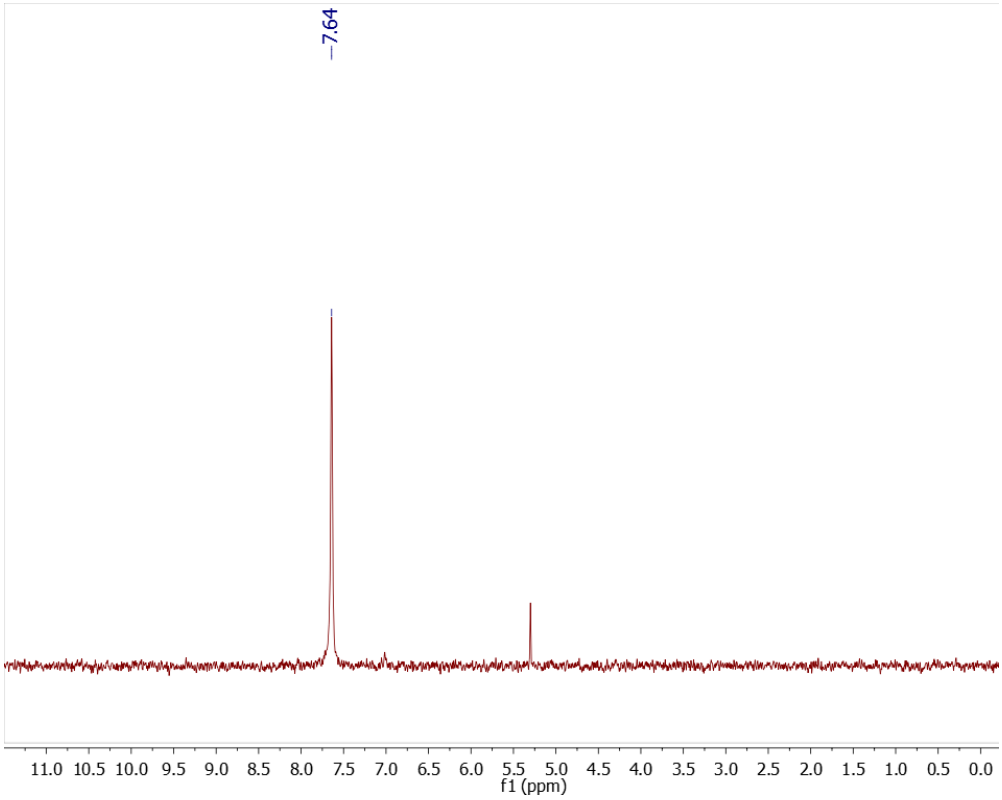
1-(2,6-Dideuterophenyl)-1H-pyrazole (4i).

^{1}H NMR:



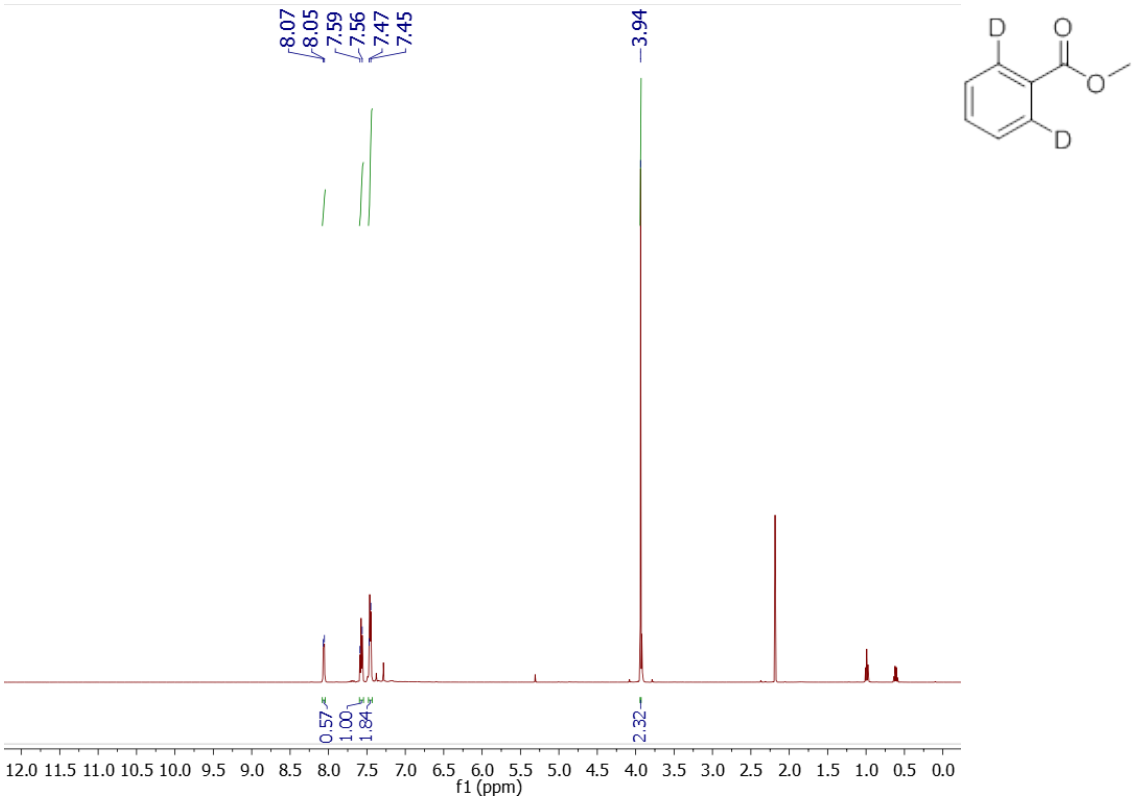


^{2}H NMR:

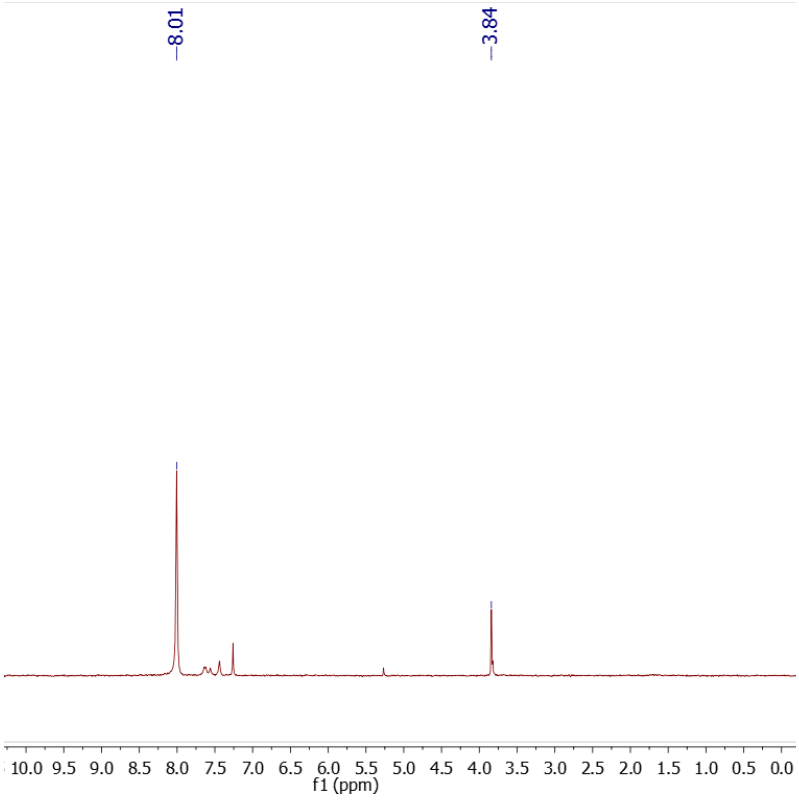


Methyl 2,5-dideuterobenzoate (4j).

^{1}H NMR:

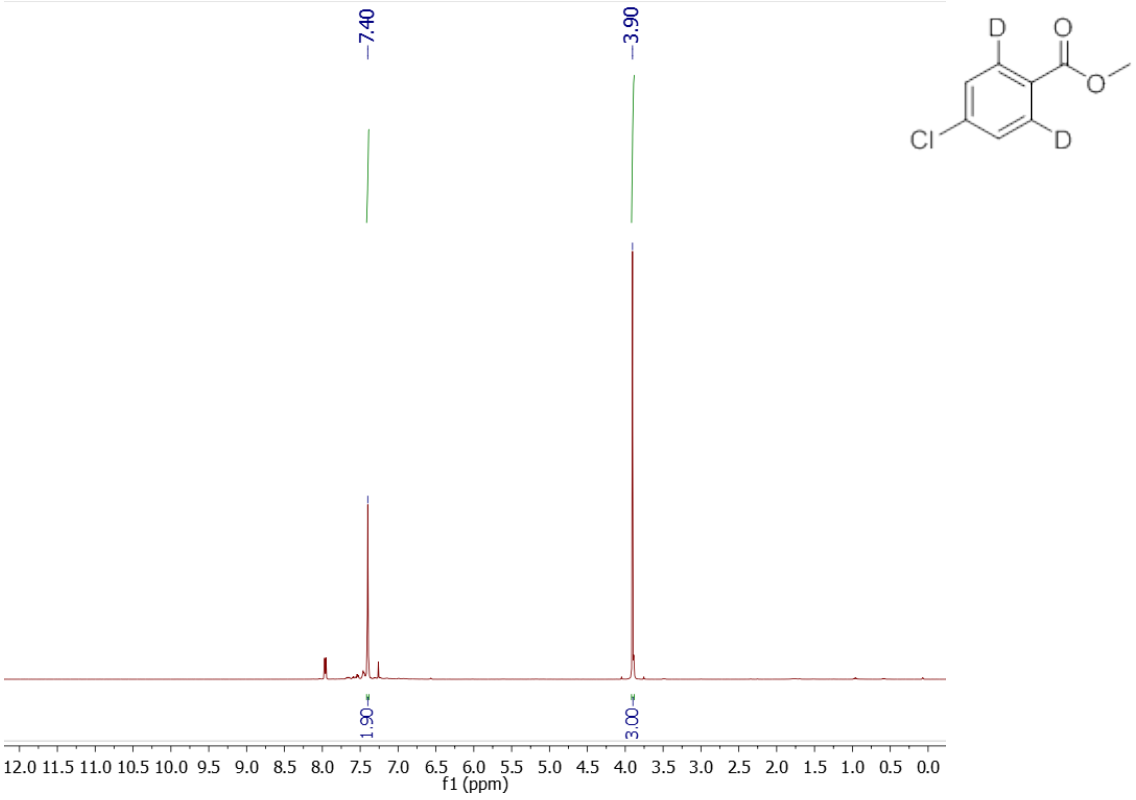


^{2}H NMR:

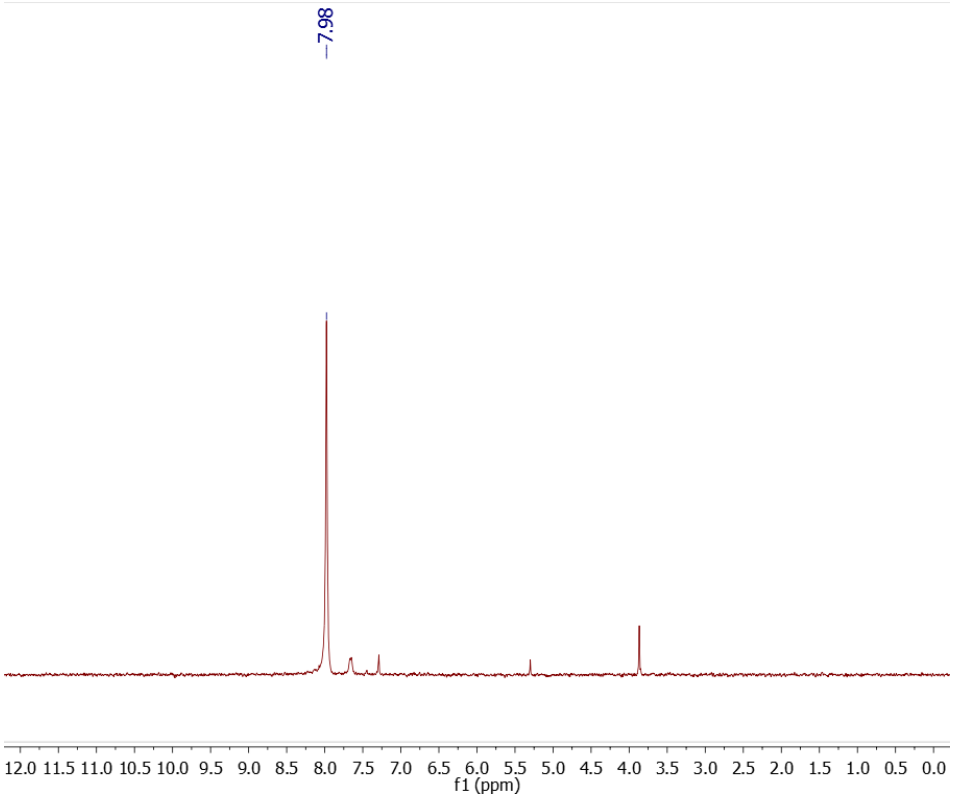


Methyl 4-chloro-2,5-dideuterobenzoate (4k).

^{1}H NMR:

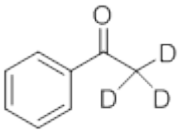


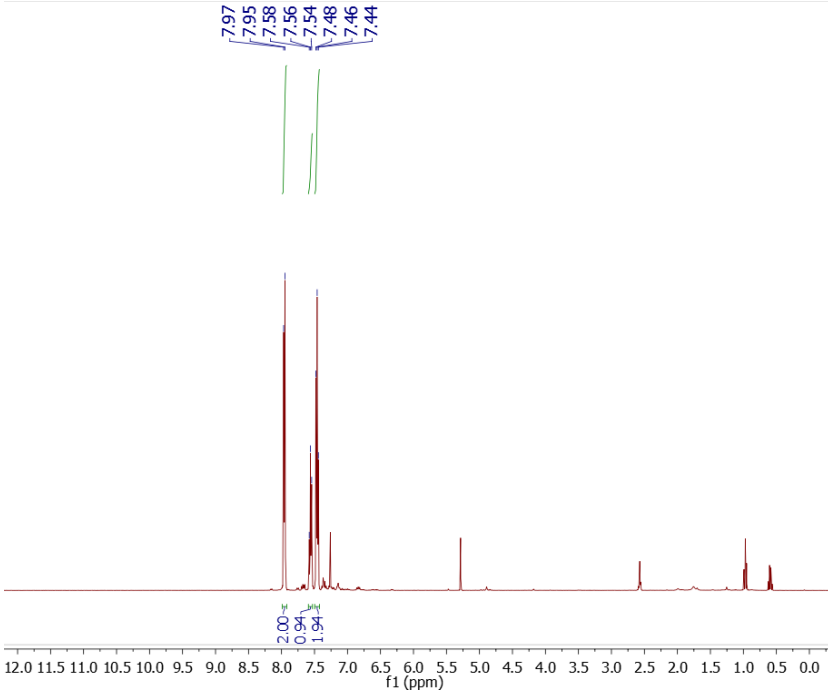
^{2}H NMR:



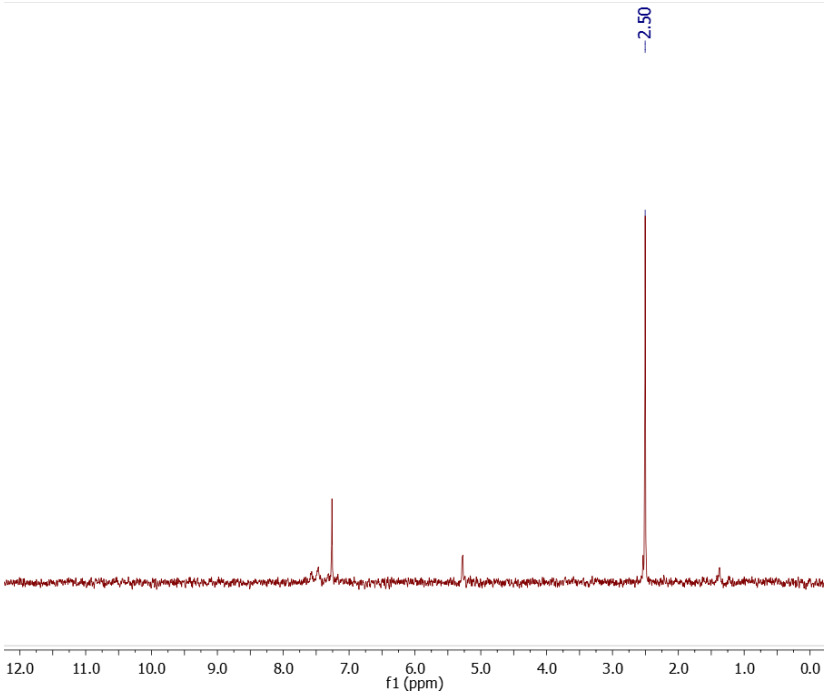
α,α,α-trideuteromethyl phenyl ketone (4l).

^{1}H NMR:



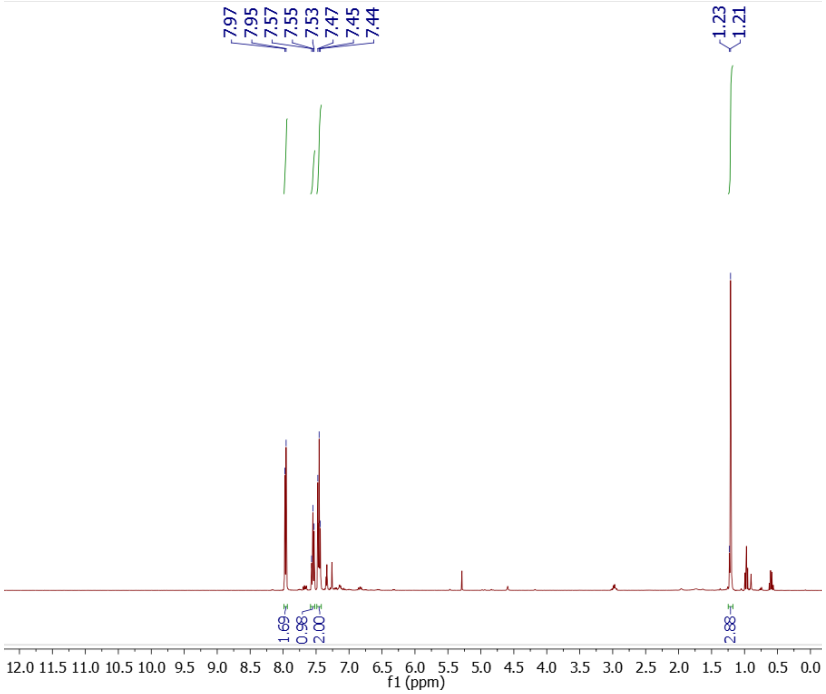


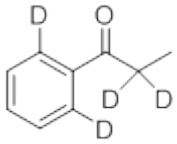
^{2}H NMR:



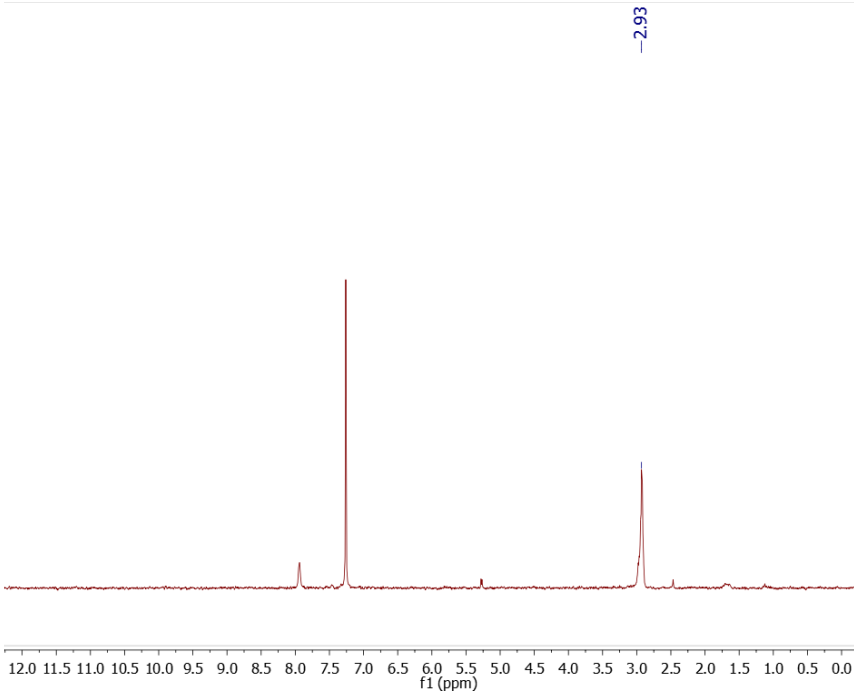
α,α-dideuteroethyl phenyl ketone (4m).

^{1}H NMR:



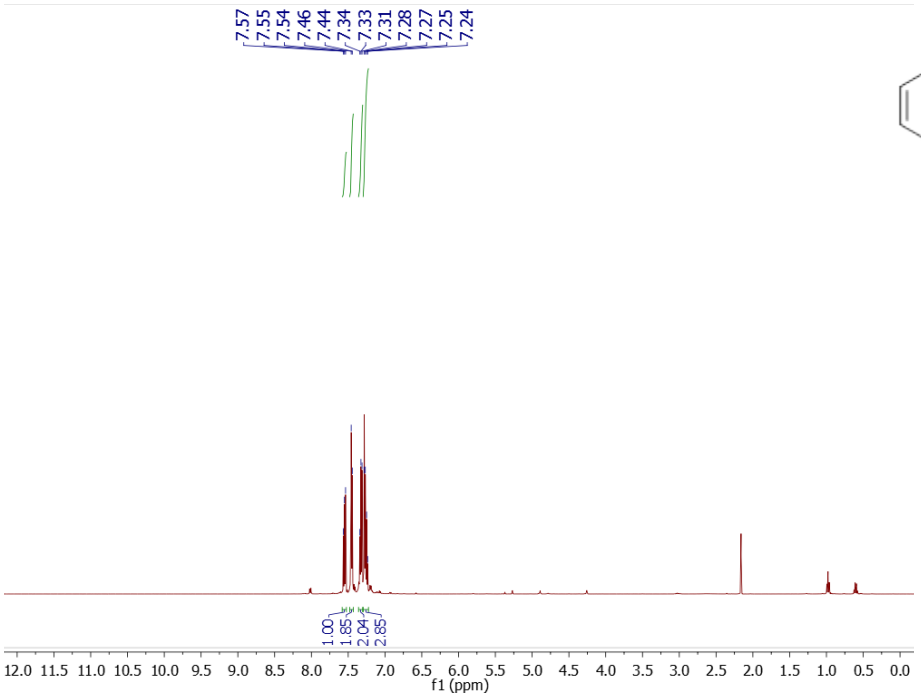


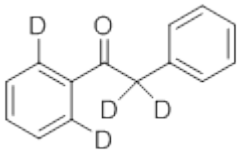
^{2}H NMR:



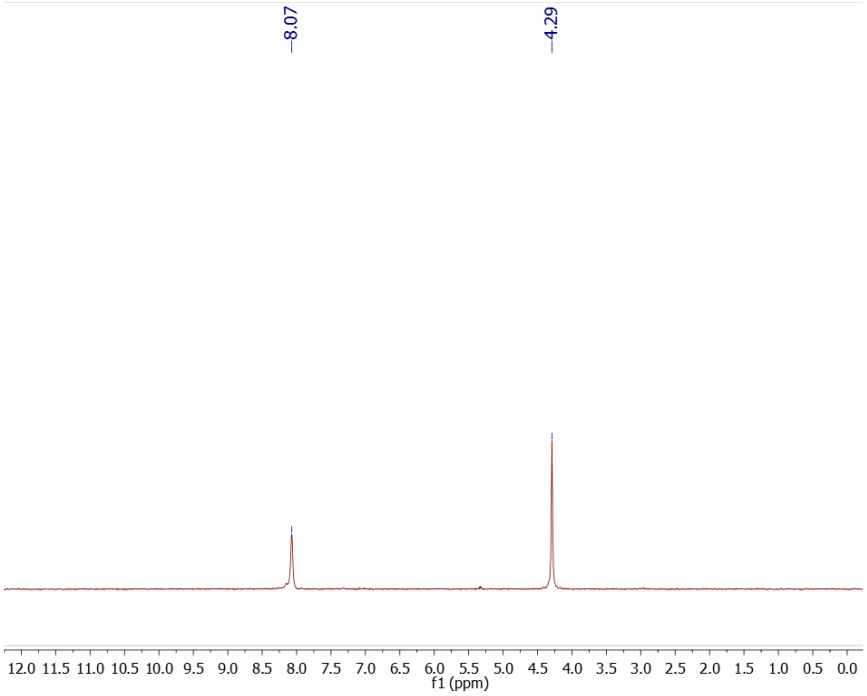
2,2-dideuterio-1,2-diphenyl-ethanone (4n).

^{1}H NMR:



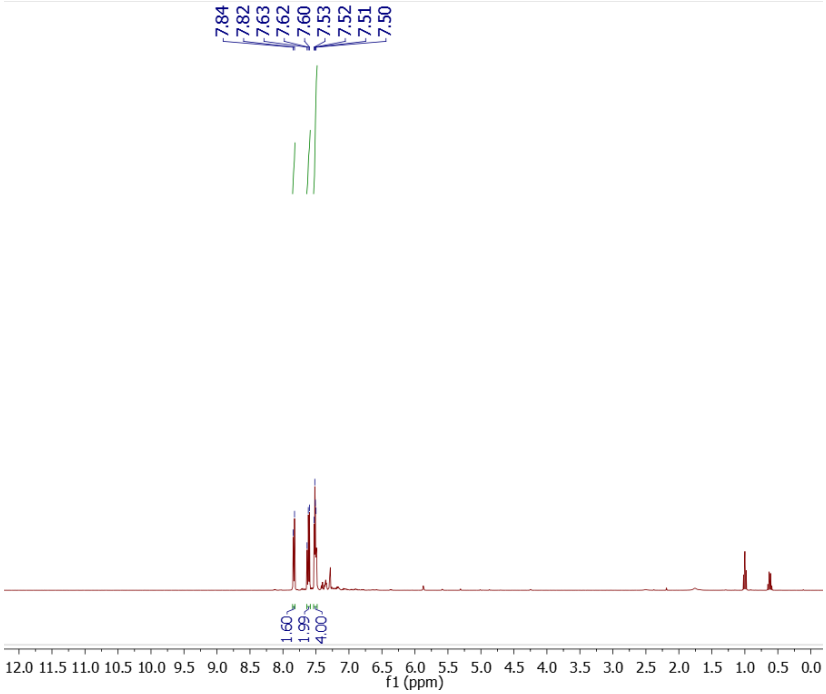


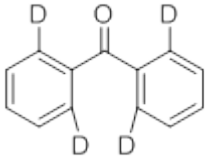
^{2}H NMR:



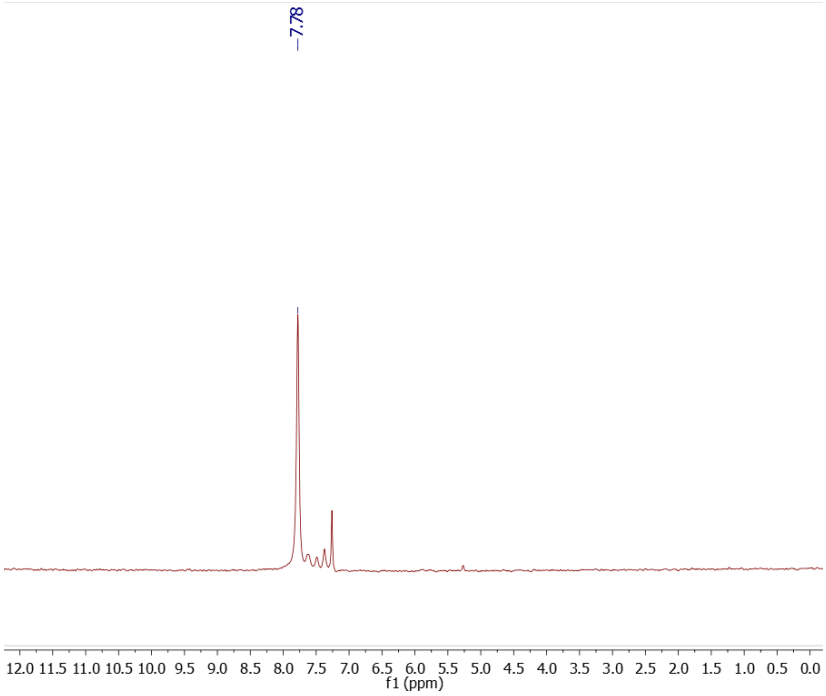
2,2',6,6'-tetradeuteriobenzophenone (4o).

^{1}H NMR:



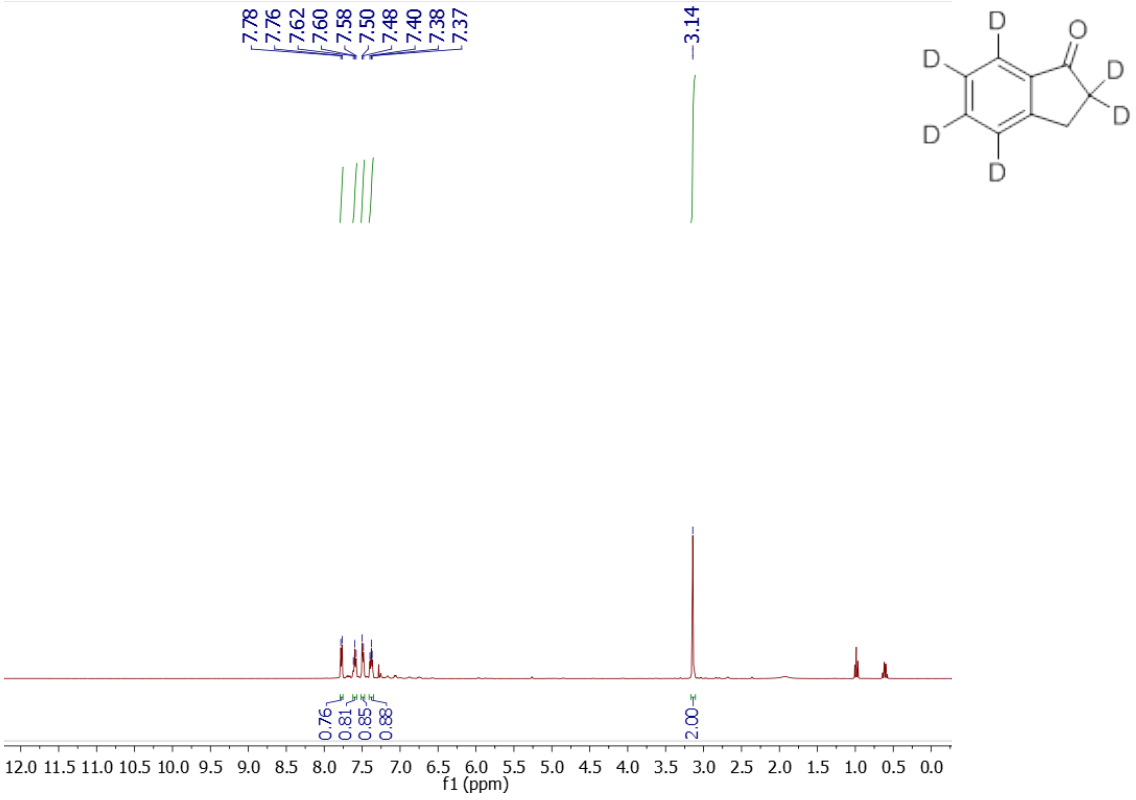


^{2}H NMR:

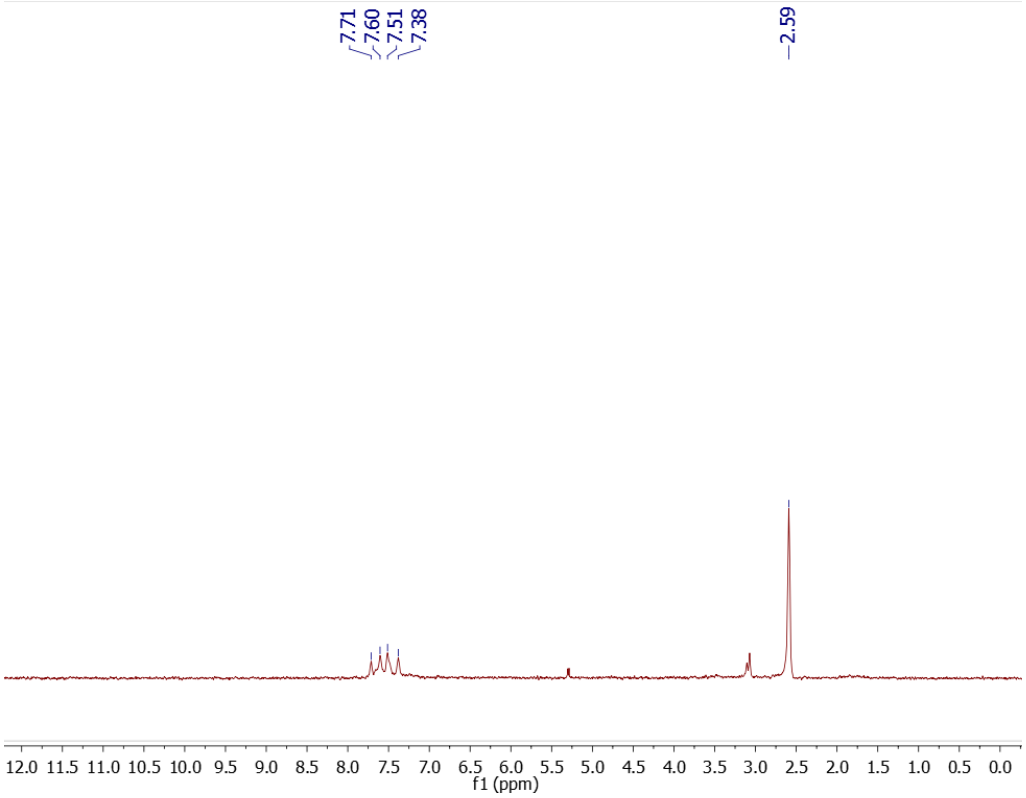


2,2-Dideuterio-1-indanone (4p).

^{1}H NMR:

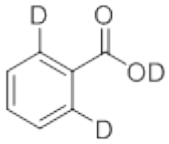


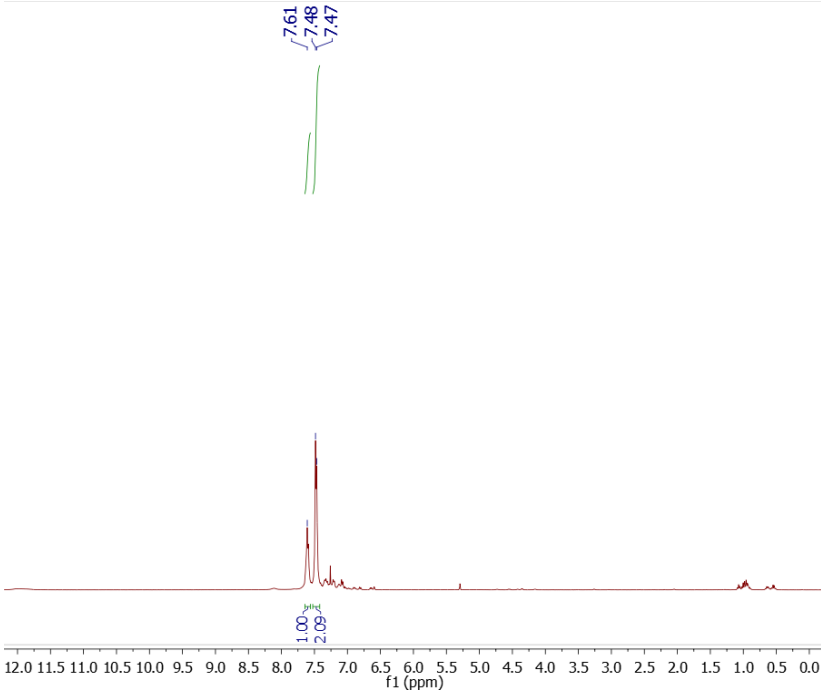
^{2}H NMR:



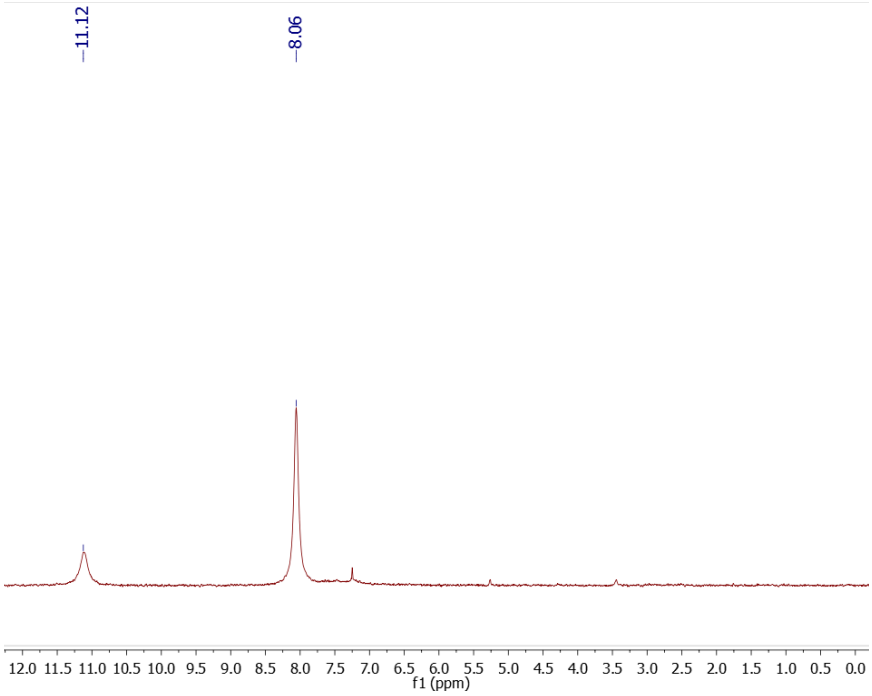
2,6-Dideuteriobenzoic acid (4q).

^{1}H NMR:



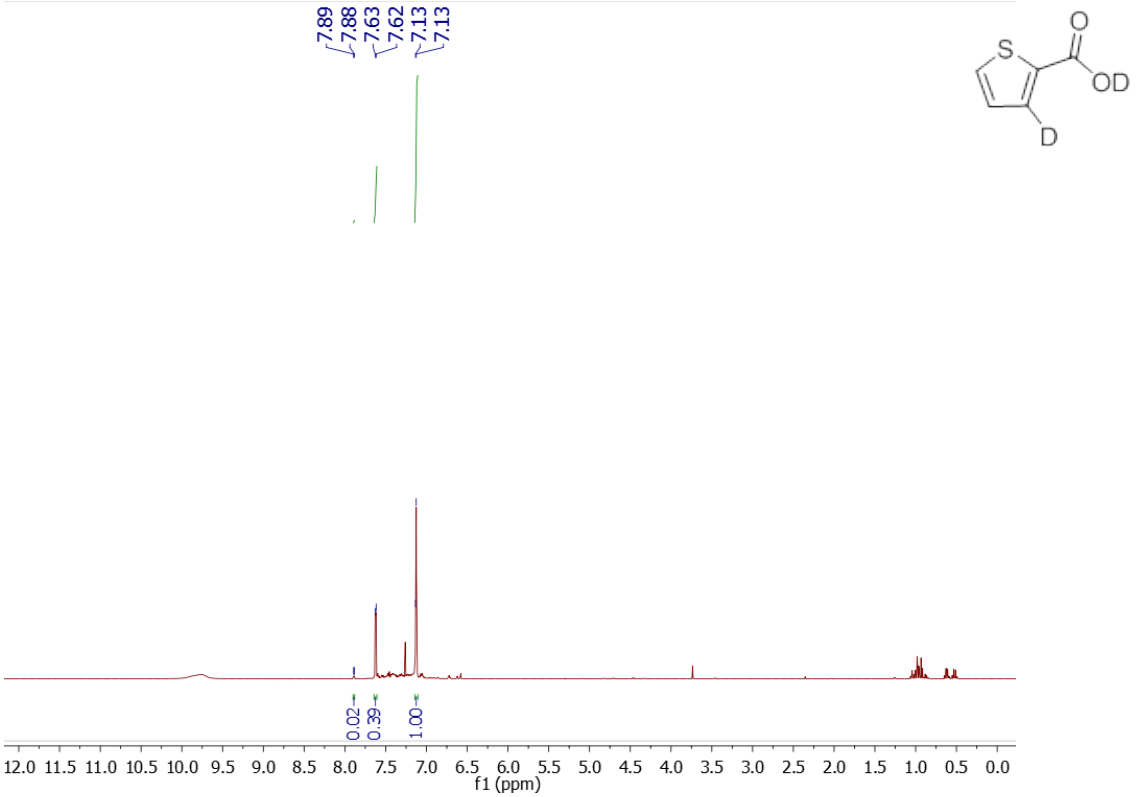


^{2}H NMR:

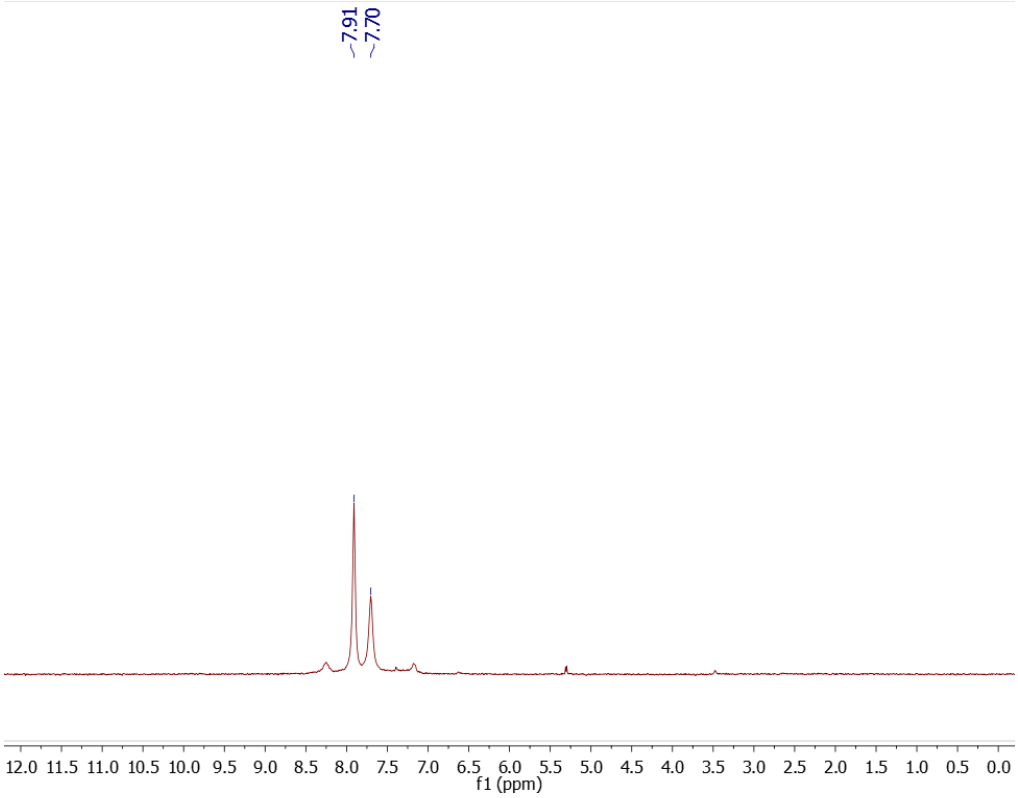


3-deuteriothiophene-2-carboxylic acid (4r).

^{1}H NMR:

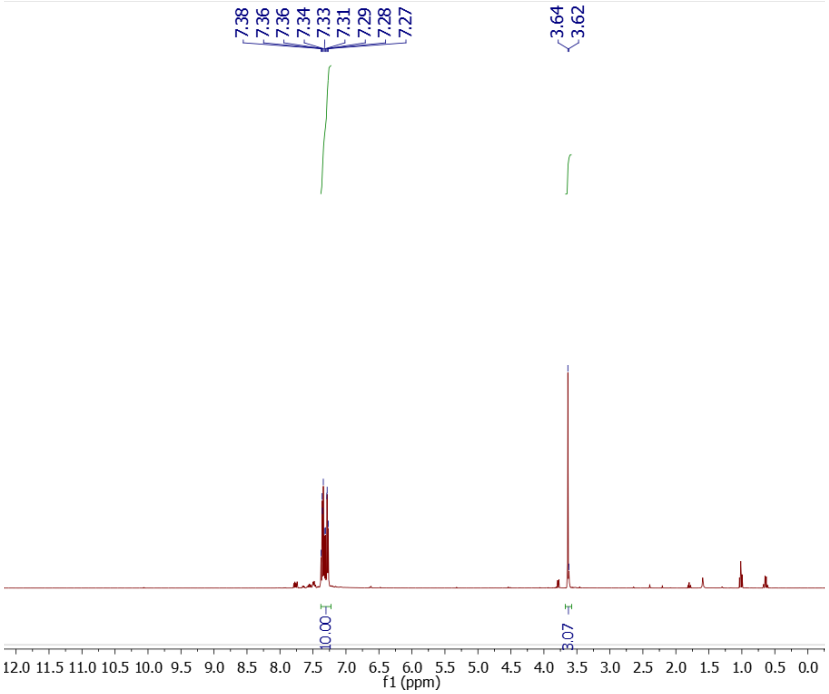


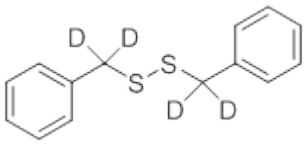
^{2}H NMR:



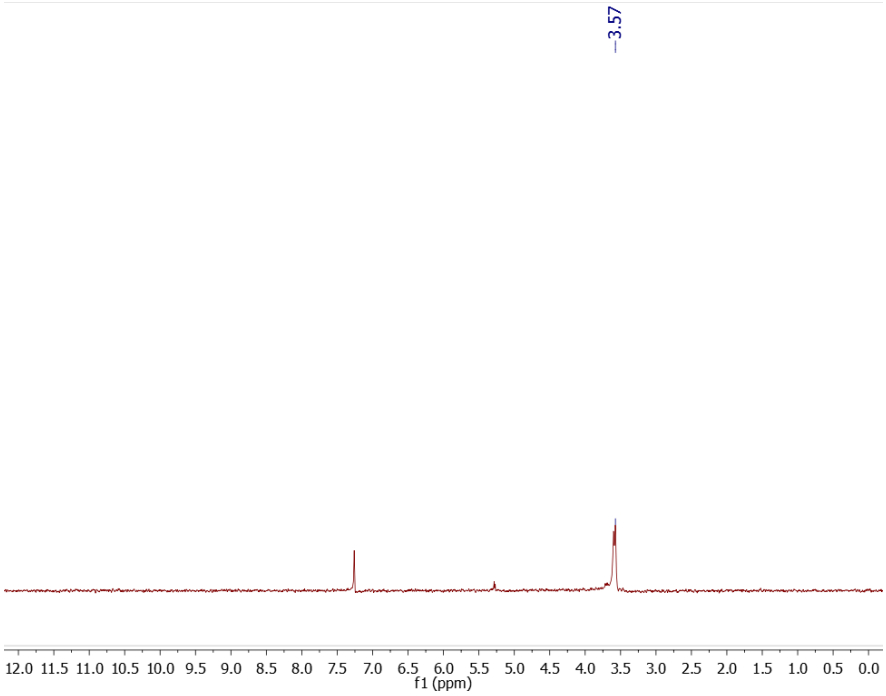
Bis(1-deuteriobenzyl) disulphide (4z).

^{1}H NMR:



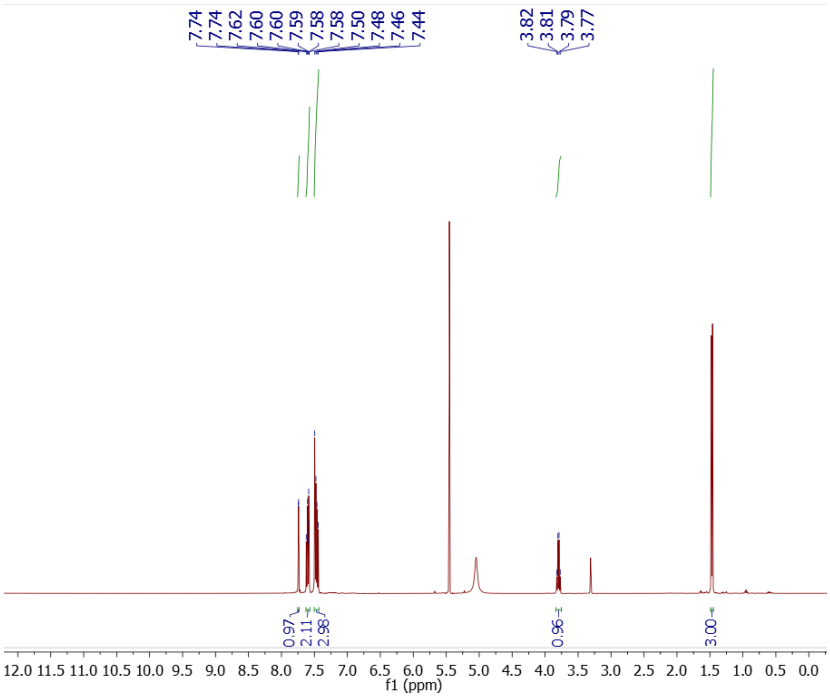


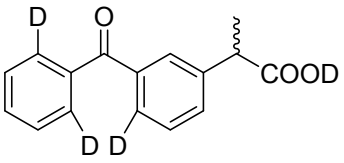
^{2}H NMR:



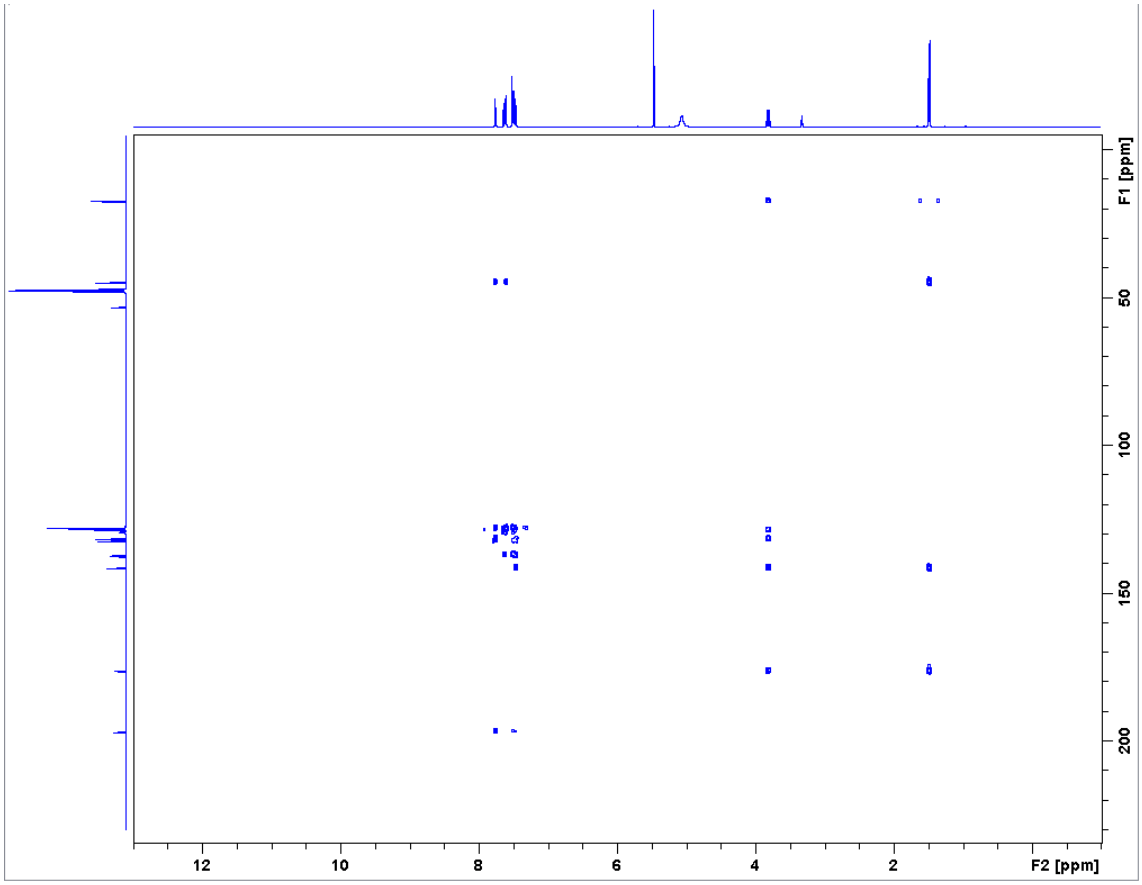
2-(4-deutero-3-benzoyl-2,6-dideuterophenyl)propionic acid (d_3-Ketoprofen) (4aa).

^{1}H NMR:





HMBC NMR:



(S)-2-(4-deutero-3-benzoyl-2,6-dideuterophenyl)propionic acid ((S)-d_3-Ketoprofen)) (4aa).