Electrochemical C(sp^3)-H Functionalization of Ethers via Hydrogen-Atom Transfer by means of cathodic reduction

Leonardo Rapisarda,[a] Andrea Fermi,[a,b] Paola Ceroni,[a,b] Riccardo Giovanelli,[a,b] Giulio Bertuzzi[a,b] and Marco Bandini[a,b]

[a] Dipartimento di Chimica "Giacomo Ciamician", Alma Mater Studiorum – Università di Bologna. Via Selmi 2, 40126, Bologna, Italy

[b] Center for Chemical Catalysis – C3, Alma Mater Studiorum – Università di Bologna. Via Selmi 2, 40126, Bologna, Italy.

Table of contents

1. General Methods

^{1}H-NMR spectra were recorded on Varian 400 (400 MHz) . Chemical shifts are reported in ppm from TMS with the solvent resonance as the internal standard ($CHCl_3$: 7.26 ppm). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, dd= double doublet, t = triplet, td = triple doublet, dt = double triplet, q = quartet, b = broad, m = multiplet), coupling constants (Hz).

^{13}C-NMR spectra were recorded on a Varian 400 (400 MHz) with complete proton decoupling. Chemical shifts are reported in ppm from TMS with the solvent as the internal standard ($CHCl_3$: 77.0 ppm).

HRMS spectra were obtained with a G2XS QTof mass spectrometer using either ESI or APCI ionization techniques, as specified case by case.

Chromatographic purification was done with 240-400 mesh silica gel.

Anhydrous solvents, including DMF and ACN for the electrochemical processes, were supplied by Merck in Sureseal® bottles and used without any further purification.

THF (**2a**), THP (**2d**), Dioxane (**2f**), Et_2O (**2i**) and 1,2-dimethoxyethane (**2j**) were distilled over Na-benzophenone (and stored under N_2) prior to use, to remove the stabilizers. The remaining ethers **2** were purchased as stabilizer-free batches and used as received. All other commercially available starting materials and (non-anhydrous) solvents were purchased from Merck, TCI chemicals, Fluorochem or Alfa Aesar and were used as such without further purification.

MBH acetates **1a-1v** are known compounds and were synthesized according to literature procedures.[1]

Products **3a**,[2] **3b**,[3] **3c**,[4] **3g**[5] and **3h**[6] are known compounds and were synthesized according to literature procedures. Compound **3d** is commercially available. Compound **3f** was prepared following the reported procedure for the preparation of **3d** (*vide infra*).

Cyclic voltammetry experiments were carried out at room temperature in argon-purged dried CH_3CN by using an EcoChemie Autolab 30 potentiostat in a three-electrode setup. The working electrode consisted of a glassy carbon electrode (3 mm diameter), the counter electrode was a Pt spiral and a Ag wire was used as quasi-reference electrode (AgQRE). Working electrode and quasi-reference electrodes were polished on a felt pad with 0.05 or 0.3 μm alumina suspension and sonicated in deionized water for 1 minute before each experiment; the Pt wire was flame-cleaned. Tetrabutylammonium hexafluorophosphate

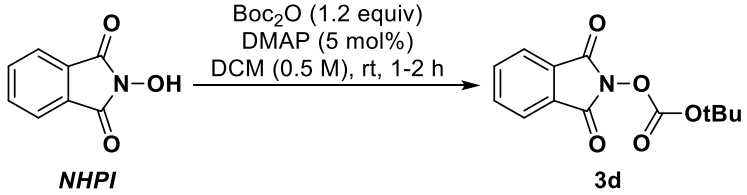
($TBAPF_6$, 0.1 M) is added to the solution as a supporting electrode. Ferrocene (purified by sublimation at reduced pressure) is used as an internal reference ($E_{Fc+/0}$ = 0.40 V vs. SCE).[7]

2. Synthesis of starting materials

2.1 Synthesis *N*-(tert-butoxycarbonyloxy)phthalimide **3d**

RAC **3d** is commercially available, however, it is more conveniently and inexpensively prepared, when large quantities are needed.

We report a simple and inexpensive synthesis, from *NHPI* (*N*-hydroxyphthalimide) and Boc_2O, as follows.



In a 250-mL Schlenk tube under N_2 atmosphere, were added NHPI (10 mmol, 1.63 g), DCM (20 mL), 4-dimethylaminopyridine (DMAP, 0.5 mmol, 61.0 mg) and Boc_2O (12 mmol, 2.60 g). The orange suspension was vigorously stirred until the color disappeared and gas evolution ceased, to obtain a clear colorless solution (CAUTION! The reaction is quite fast, although not exothermic, and rapid gas evolution is observed, always keep the reaction vessel vented). The reaction was quenched with H_2O (10 mL) and std. NH_4Cl_{aq} (10 mL), transferred to a separatory funnel, the aqueous phase extracted with DCM, and the organic phases washed with std. $NH_4Cl_{(aq)}$ (3 x 10 mL), dried over anhydrous Na_2SO_4 and evaporated under reduced pressure to obtain spectroscopically pure **3d** in 89% yield (8.9 mmol, 2.34 g) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.89 – 7.83 (m, 2H), 7.79 – 7.73 (m, 2H), 1.55 (s, 9H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 161.8 (2C), 150.1, 134.8 (2C), 128.8 (2C), 123.9 (2C), 87.8, 27.4 (3C).

Additional notes:

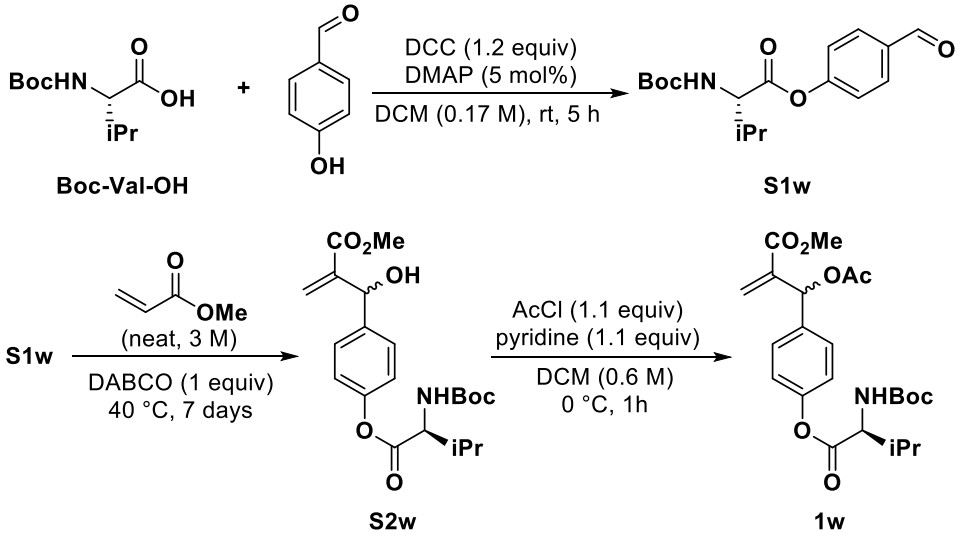
1. Product **3d** is a bench-stable compound; nevertheless, upon prolonged standing at room temperature (or directly after the preparation, in some rare cases) some batches might become faintly pink. Although still spectroscopically pure by ^{1}H NMR analysis, performance of this material in the electrochemical process was noticed to be slightly inferior compared

to other batches. In this case, purification by trituration in a cold (0 °C) Et_2O/*n*-hexane mixture (1:1, ca. 12 mL per gram **3d**) can be carried out (75% recovery).

2. Product **3d** is quite unstable upon contact with silica gel (rapid yellowing and decomposition). A fast Flash Chromatography (FC) purification can be carried out (*c*Hex/EtOAc 3:1) if needed but leads to poor product recovery (40-50%).

2.2 Synthesis or MBH acetates **1w** and **1x**

MBH acetate **1w** was prepared from **S1w** following modified literature procedures. [1] **S1w** was prepared from Boc-Val-OH and 4-hydroxybenzaldehyde.

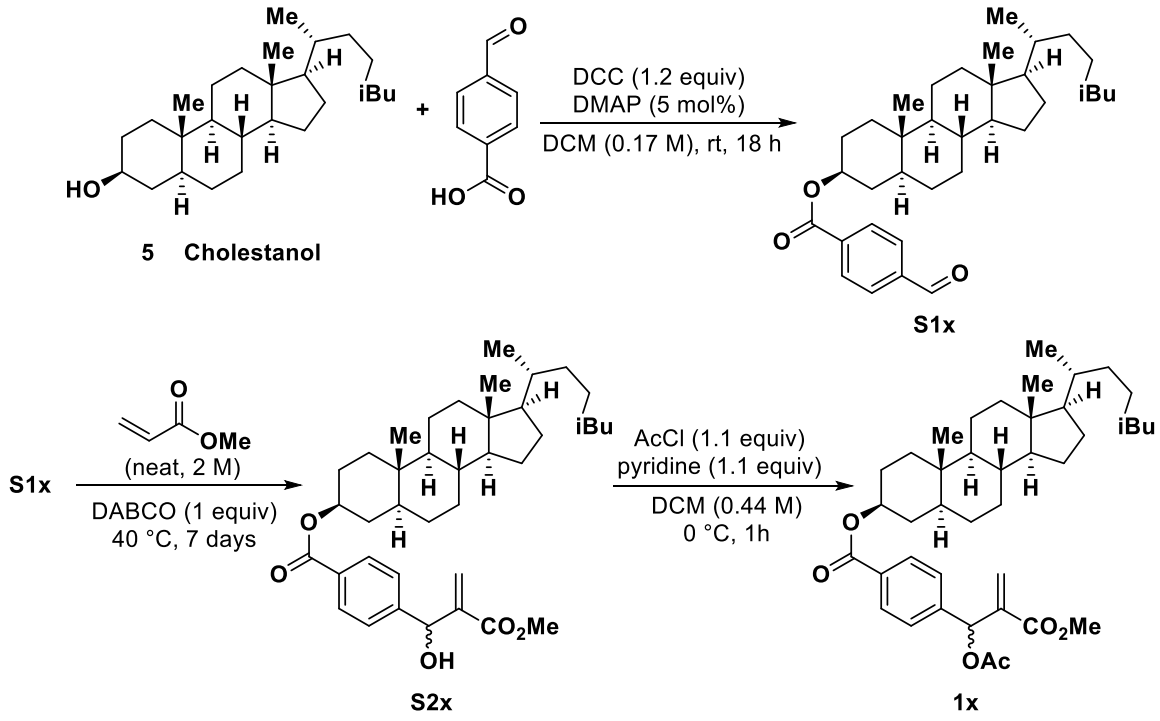


In a Schlenk tube under N_2 atmosphere, were added 4-hydroxybenzaldehyde (5.0 mmol, 560 mg), DCM (20 mL), Boc-Val-OH (5.0 mmol, 1.09 g) and DMAP (0.25 mmol, 31 mg). The suspension was cooled to 0 °C and a solution of *N,N'*-dicyclohexylcarbodiimide (DCC, 5.5 mmol, 1.13 g) in DCM (10 mL) was added dropwise. The mixture was then stirred at room temperature until TLC indicated full consumption of the starting materials (ca. 5 h). The mixture was then concentrated under reduced pressure to about 10 mL and the thick white suspension was filtered over Celite, washing with two small aliquots (2 mL ca.) of DCM. The filtrate was then diluted with DCM (20 mL) and transferred to a separatory funnel. The organic phase was washed with std. $NH_4Cl_{(aq)}$ (3 x 10 mL), dried over anhydrous Na_2SO_4 and evaporated under reduced pressure to afford crude **S1w** that was used in the next step without further purification.

In a screw-capped 20-mL vial, crude **S1w** (3.0 mmol, 963 mg) and 1,4-diazabicyclo[2.2.2]octane (DABCO, 3.0 mmol, 522 mg) were stirred in methyl acrylate (10 mmol, 861 mg, 910 µL) for 7 days at 40 °C. The mixture was then evaporated under reduced pressure, dissolved in EtOAc and transferred to a separatory funnel. The organic phase was washed with 2M HCl (3 x 10 mL), dried over anhydrous Na_2SO_4 and evaporated under reduced pressure to afford crude **S2w** that was used in the next step without further purification.

In a heat gun-dried Schlenk tube under N_2 atmosphere, were added **S2w** (3.0 mmol, from previous step), dry DCM (5 mL) and pyridine (3.3 mmol, 261 mg, 267 µL). The solution was cooled to 0 °C and acetyl chloride (3.3 mmol, 259 mg, 236 µL) was added dropwise. The resulting white suspension was stirred at 0 °C until TLC indicated full consumption of the starting materials (ca. 1 h). The reaction was quenched with H_2O (5 mL) and std. NH_4Cl_{aq} (5 mL), transferred to a separatory funnel, the aqueous phase extracted with DCM (2 x 10 mL), and the organic phase dried over anhydrous Na_2SO_4 and evaporated under reduced pressure. The crude product was purified by FC on silica gel (*c*Hex/EtOAc: 2:1) to afford **1w** (*d.r.* = 1.0:1) as a very thick, sticky colorless oil (738 mg, 1.56 mmol, 52% yield over 2 steps). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.41 – 7.33 (m, 2H), 7.08 – 7.01 (m, 2H), 6.65 (s, 1H), 6.37 (s, 1H), 5.86 (s, 1H), 5.05 (d, *J* = 9.0 Hz, 1H), 4.41 (dd, *J* = 9.2, 4.8 Hz, 1H), 3.68 (s, 3H), 2.33 – 2.22 (m, 1H), 2.07 (s, 3H), 1.44 (s, 9H), 1.05 (d, *J* = 6.8 Hz, 3H), 0.98 (d, *J* = 6.9 Hz, 3H), the signals of the two diastereoisomers overlap completely, appearing as a single compound; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 170.9, 169.3, 165.2, 155.7, 150.3, 139.4, 135.6, 128.9 (2C), 125.7, 121.4 (2C), 80.0, 72.4, 58.7, 52.0, 31.3, 28.3 (3C), 21.0, 19.0, 17.7, the signals of the two diastereoisomers overlap completely, appearing as a single compound. **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{23}H_{32}NO_8$ 450.2122; found 450.2114.

MBH acetate **1x** was prepared from **S1x** following modified literature procedures.[1] **S1x** was prepared from 5α-Cholestanol and 4-formylbenzoic acid.



In a Schlenk tube under N_2 atmosphere, were added 4-formylbenzoic acid (4.0 mmol, 600 mg), DCM (15 mL), 5α-Cholestanol (4.0 mmol, 1.55 g) and DMAP (0.20 mmol, 25 mg). The suspension was cooled to 0 °C and a solution of DCC (4.4 mmol, 906 mg) in DCM (8 mL) was added dropwise. The mixture was then stirred at room temperature until TLC indicated full consumption of the starting materials (ca. 18 h). The mixture was then concentrated under reduced pressure to about 8 mL and the thick white suspension was filtered over Celite, washing with two small aliquots (2 mL ca.) of DCM. The filtrate was then diluted with DCM (20 mL) and transferred to a separatory funnel. The organic phase was washed with std. $NH_4Cl_{(aq)}$ (3 x 10 mL), dried over anhydrous Na_2SO_4 and evaporated under reduced pressure to afford crude **S1x** that was used in the next step without further purification.

In a screw-capped 20-mL vial, crude **S1x** (2.0 mmol, 1.04 mg) and DABCO (2.0 mmol, 348 mg) were stirred in methyl acrylate (10 mmol, 861 mg, 910 µL) for 7 days at 40 °C, until a clear solution was obtained. The mixture was then evaporated under reduced pressure, dissolved in EtOAc and transferred to a separatory funnel. The organic phase was washed with 2M HCl (3 x 10 mL), dried over anhydrous Na_2SO_4 and evaporated under reduced pressure to afford crude **S2x** that was used in the next step without further purification.

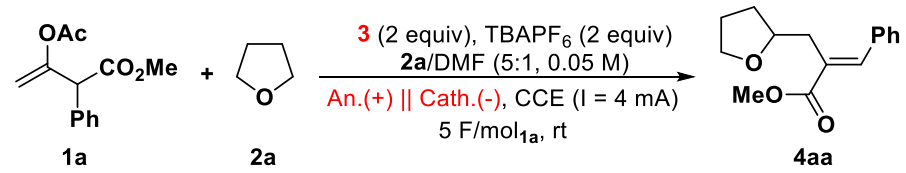
In a heat gun-dried Schlenk tube under N_2 atmosphere, were added **S2x** (2.0 mmol, from previous step), dry DCM (5 mL) and pyridine (2.2 mmol, 174 mg, 178 µL). The solution was cooled to 0 °C and acetyl chloride (2.2 mmol, 173 mg, 157 µL) was added dropwise. The resulting white suspension was stirred at 0 °C until TLC indicated full consumption of the starting materials (ca. 1 h). The reaction was quenched with H_2O (5 mL) and std. NH_4Cl_{aq} (5 mL), transferred to a separatory funnel, the aqueous phase extracted with DCM (2 x 10 mL), and the organic phase dried over anhydrous Na_2SO_4 and evaporated under reduced pressure. The crude product was purified by FC on silica gel (100% DCM) to afford **1x** (*d.r.* = 1.0:1) as a white solid (1.02 g, 1.54 mmol, 77% yield over 2 steps).

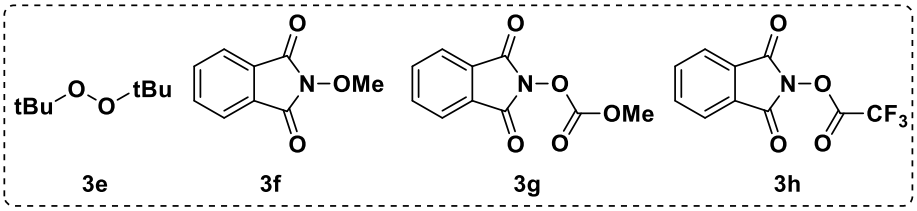
^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.02 – 7.95 (m, 2H), 7.45 – 7.38 (m, 2H), 6.68 (s, 1H), 6.39 (s, 1H), 5.86 (s, 1H), 4.91 (tt, *J* = 11.3, 4.9 Hz, 1H), 3.68 (s, 3H), 2.09 (s, 3H), 1.99 – 1.86 (m, 2H), 1.84 – 1.72 (m, 2H), 1.72 – 1.60 (m, 3H), 1.60 – 1.41 (m, 4H), 1.40 – 1.16 (m, 10H), 1.15 – 0.92 (m, 9H), 0.88 (d, *J* = 6.5 Hz, 3H), 0.85 (d, *J* = 6.6 Hz, 3H) overlapped with 0.84 (s, 3H) overlapped with 0.83 (d, *J* = 6.5 Hz, 3H), 0.71 – 0.63 (m, 1H) overlapped with 0.64 (s, 3H), the signals of the two diastereoisomers overlap completely, appearing as a single compound; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.2, 165.6, 165.1, 142.5, 139.2, 130.9, 129.7 (2C), 127.4 (2C), 126.3, 74.4, 72.6, 56.4, 56.3, 54.2, 52.0, 44.7, 42.6, 40.0, 39.5, 36.8, 36.1, 35.8, 35.5, 34.1, 32.0, 31.6, 28.6, 28.2, 28.0, 27.5, 24.2, 23.8, 22.8, 22.5, 21.2, 21.0, 18.6,

12.3, 12.1, the signals of the two diastereoisomers overlap completely, appearing as a single compound; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{41}H_{61}O_6$ 649.4463; found 649.4471.

3. Additional Optimization Tables

3.1. **Table S1**: Additional Electrodes and HAT reagents **3** screening





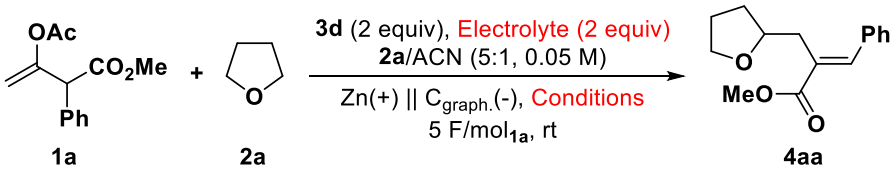
Entry[a]	HAT reagent **3**	Anode	Cathode	Yield [%][b]
1	**3d**	Mg	$C_{(graphite)}$	0
2	**3d**	Ni	$C_{(graphite)}$	12
3	**3d**	Zn	$Ni_{(foam)}$	18
4	**3d**	Zn	Glassy Carbon	44
5	**3e**	Zn	$C_{(graphite)}$	0[c]
6	**3f**	Zn	$C_{(graphite)}$	0
7	**3g**	Zn	$C_{(graphite)}$	37
8	**3h**	Zn	$C_{(graphite)}$	0

[a] Reaction conditions: **1a** (35.1 mg, 0.15 mmol), **3** (0.3 mmol), $TBAPF_6$ (115 mg, 0.3 mmol), THF (**2a**, 2.5 mL), DMF (0.5 mL), Anode(+) || Cathode(-), CCE (I = 4 mA), 5 F/mol_{1a}, rt. [b] Determined by ^1H NMR spectroscopy on the crude mixture using mesitylene as internal standard. [c] Byproduct **5** was isolated in 38% yield as the sole reaction product.

Anodes different from Zn (entries 1 and 2) behaved poorly, as well as a metal cathode (entry 3), while a carbonaceous cathode (entry 4) behaved similarly to graphite (compare with Table 1, entry 7 in main text).

Alkoxy radical precursors such as di-tert-butyl peroxide **3e** (entry 5) and *N*-methoxyphthalimide **3f** (entry 6) did not show the desired reactivity: cathodic reduction followed by fragmentation to yield the alkoxy radical most likely did not occur. On the other hand, *RAC* **3g** promoted the desired HAT process, although not as efficiently as *RAC* **3d** (compare entry 7 with Table 1, entry 6 in main text). Finally, *N*-trifluoroacetoxyphthalimide **3h** has been reported to yield the phthalimido radical upon reduction and fragmentation;[6] this is an electrophilic radical, potentially able to promote a HAT process from **2a**. Nevertheless, although cathodic reduction of **3h** occurred, no desired product **4aa** could be isolated (entry 8).

3.2. **Table S2**: Comparison on the behavior of three electrolytes.



Entry[a]	Electrolyte (equiv)	Conditions	Current or Voltage[b]	Yield[c] [%]
1	$TBAClO_4$ (2)	CVE (V = 5 V)	26.7 mA – 20.7 mA	7
2	$TBAClO_4$ (2)	CVE (V = 3 V)	16.3 mA – 9.3 mA	4
3	$TBAClO_4$ (2)	CCE (I = 2 mA)	0.87 V – 1.63 V	27
4	$TBAPF_6$ (2)	CVE (V = 5 V)	28.0 mA – 16.2 mA	0
5	$TBAPF_6$ (2)	CVE (V = 3 V)	16.0 mA – 2.9 mA	0
6	$TBAPF_6$ (2)	CCE (I = 2 mA)	0.45 V – 2.80 V	27
7	$LiBF_4$ (2)	CVE (V = 5 V)	4.8 mA – 1.0 mA	75
8	$LiBF_4$ (2)	CVE (V = 3 V)	2.5 mA – 0 mA[d]	30
9	$LiBF_4$ (2)	CCE (I = 2 mA)	1.50 V – 5.88 V	60
10	$LiBF_4$ (4)	CVE (V = 5 V)	12.6 mA – 1.4 mA	61
11	$LiBF_4$ (1)	CVE (V = 5 V)	3.3 mA – 0 mA[d]	n.d.

[a] Reaction conditions: **1a** (35.1 mg, 0.15 mmol), **3d** (79.0 mg, 0.3 mmol), Electrolyte (0.3 mmol), THF (**2a**, 2.5 mL), ACN (0.5 mL), Zn(+) || $C_{graphite}$(-), electrolytic conditions as specified case by case, 5 F/mol_{1a}, rt. [b] Initial and terminal value, as determined by the ElectraSyn apparatus, of the parameter that was *NOT* set as constant. [c] Determined by ^{1}H NMR spectroscopy on the crude mixture using mesitylene as internal standard. [d] The electrolysis could not be conducted until 5 F/mol_{1a} were reached and had to be terminated in advance, as, during its course, the resistivity of the medium raised too high.

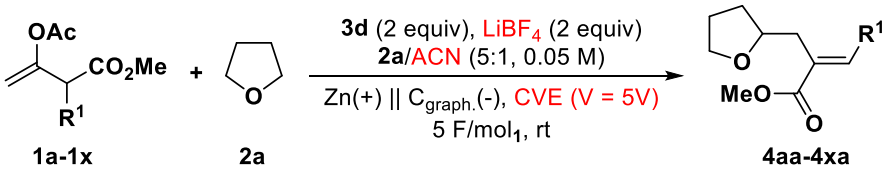
With the data reported in **Table S2** we aim to show that, at least for the present process, the choice of the electrolyte and the electrolytic conditions are not independent. Indeed, when $TBAClO_4$ or $TBAPF_6$ were chosen (entries 1-2 and 4-5), under a constant voltage electrolysis of 5 or 3 V (optimal conditions when $LiBF_4$ is chosen, entry 7), almost no product was formed. We believe that, in the presence of $TBAClO_4$ or $TBAPF_6$ the conductivity of the reaction medium is higher than in the presence of $LiBF_4$. This generates (at V = 5 or 3 V) a current that is too high for the desired process to occur, probably due to a very rapid reduction of **3d**, leading mainly to over-reduced products or decomposition. Entries 3 and 6,

on the other hand, show that in the presence of both $TBAClO_4$ and $TBAPF_6$ the process can occur in higher yields, excluding the intrinsic unsuitability of these electrolytes for the disclosed process (*vide* also *Conditions* ***B***). Therefore, a judicious choice of the electrolytic conditions is pivotal to gain the best results from a given electrolyte, and *vice versa*. Moreover, entries 10 and 11 show that the quantity of electrolyte also plays a fundamental role. If it is quite intuitive that in entry 11 $LiBF_4$ was added in a concentration that was too low for the desired process, the result in entry 10, compared to entry 7, is more difficult to rationalize. Again, the current generated by a more conductive medium, at least at the beginning of the reaction, was probably too high, and reduction of **3d** was too fast and partially unproductive.

4. Electroreductive HAT

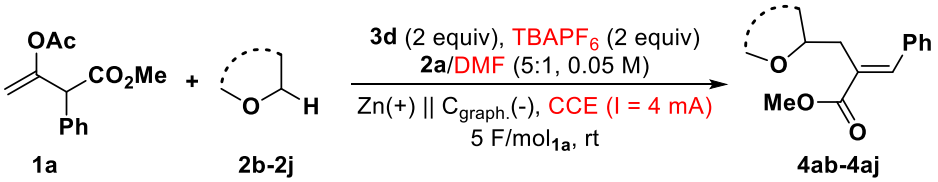
4.1 General procedures for the electroreductive functionalization of ethers *via* HAT.

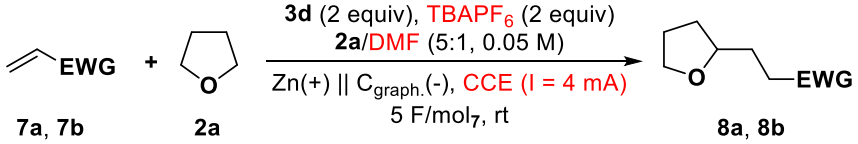
General Procedure ***A***.



General Procedure ***A*** is the protocol to follow when *Conditions* ***A*** (main text) are applied. The ElectraSyn vial (5 mL), equipped with a stir bar, was charged with MBH acetate **1** (0.15 mmol), *RAC* **3d** (0.30 mmol, 79.0 mg) and $LiBF_4$ (0.30 mmol, 28.0 mg). The ElectraSyn vial cap, equipped with anode (Zn) and cathode (graphite), was inserted into the mixture and closed with a rubber septum. The vessel was evacuated and backfilled with N_2 three times, then dry ACN (0.5 mL) was added and the mixture stirred until complete dissolution of the solids occurred. Then, THF **2a** (2.5 mL) was added and the solution bubbled with N_2 (balloon) under stirring for 1 min. The reaction mixture was electrolyzed (under N_2, balloon) at a constant voltage of 5 V, until a total charge of 0.75 F (5 F/mol$_1$) was reached. The ElectraSyn vial cap was removed, and the electrodes and vial were rinsed with EtOAc (10 mL) and $HCl_{(aq)}$ (1M, 10 mL), which were combined with the crude mixture in a separatory funnel. Then, the organic layer was separated, and the aqueous layer was extracted with EtOAc (2 x 10 mL). The combined organic layers were dried over Na_2SO_4 and concentrated under reduced pressure. The crude product was finally purified by FC to afford pure products **4**.

General Procedure ***B***.



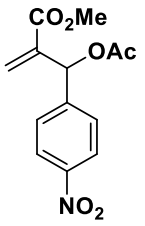


*General Procedure **B*** is the protocol to follow when *Conditions **B*** (main text) are applied. The ElectraSyn vial (5 mL), equipped with a stir bar, was charged with MBH acetate **1a** (0.15 mmol, 35.0 mg for products **4**) or Michael acceptor **7** (0.15 mmol, for products **8**), *RAC* **3d** (0.30 mmol, 79.0 mg) and $TBAPF_6$ (0.30 mmol, 116 mg). The ElectraSyn vial cap, equipped with anode (Zn) and cathode (graphite), was inserted into the mixture and closed with a rubber septum. The vessel was evacuated and backfilled with N_2 three times, then dry DMF (0.5 mL) was added and the mixture stirred until complete dissolution of the solids occurred. Then, ether **2** (2.5 mL) was added and the solution bubbled with N_2 (balloon) under stirring for 1 min. The reaction mixture was electrolyzed (under N_2, balloon) at a constant current of 4 mA, until a total charge of 0.75 F (5 F/mol$_{\mathbf{1a}\text{ or }\mathbf{7}}$) was reached. The ElectraSyn vial cap was removed, and the electrodes and vial were rinsed with Et_2O (10 mL) and $HCl_{(aq)}$ (1M, 10 mL), which were combined with the crude mixture in a separatory funnel. Then, the organic layer was separated, the aqueous layer was extracted with Et_2O (2 x 10 mL) and the combined organic layers were washed with $HCl_{(aq)}$ (0.1 M, 3 x 10 mL), dried over Na_2SO_4 and concentrated *in vacuo*. The crude product was finally purified by FC to afford pure products **4** or **8**.

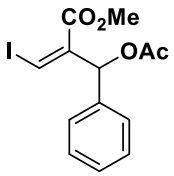
Additional notes:

1. In running *General Procedure **A*** it was found beneficial to begin the electrolysis at a constant voltage of 3V instead of 5 V, in order to avoid the production of a very high current (in some occasions > 20 mA) in the first minutes of the process. Typically, when started at 3V, the initial current was registered to be between 7 and 5 mA. This usually dropped rapidly below 1 mA (15 – 30 min, 0.2 – 0.4 F/mol$_{\mathbf{1}}$). At this point, the voltage was raised at 5 V, with the current value being stabilized to 4 – 6 mA. The current value dropped significantly when ca. 4.5 - 4.8 F/mol$_{\mathbf{1}}$ were reached. At this point, the reaction could be either stopped or left stirring overnight until completion without significant difference in the outcome.
2. For products **4da**, **4ga**, **4ha**, **4va**, **4ag**, and **8a** chromatographic separation from phthalimide coproduct was troublesome. Therefore, after FC a basic wash (aqueous 1N NaOH / Et_2O) was carried out to obtain the pure compounds.
3. For product **4wa** the aqueous work-up was carried out with 0.05 M HCl.
4. Product **4xa** is scarcely soluble in EtOAc, therefore DCM was used for the extraction.

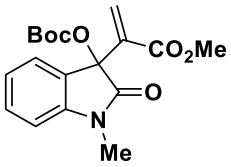
4.2. Unsuccessful substrates



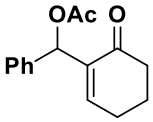
1y



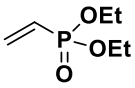
1z



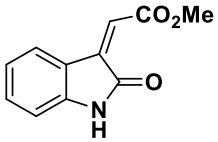
1aa



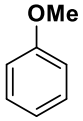
1ab



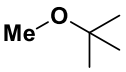
7c



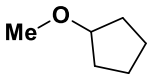
7d



2k



2l

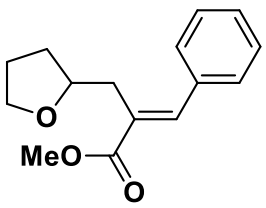


2m

Either under *Conditions **A*** or ***B**,* MBH acetates **1y**, **1z** and **1ab**, as well as vinyl phosphonate **7c** failed to give appreciable amounts of the desired products. MBH carbonate **1aa** alkylidene oxindole **7d** showed the desired reactivity but rendered the respective products as complex diastereomeric mixtures with low diastereoselectivity; therefore, they were not included in the reaction scope.

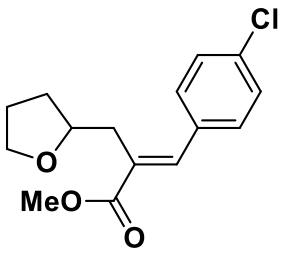
Ethers **2k**, **2l** and **2m** did not show any reactivity under *Conditions **B**.*

4.3 Characterization data of compounds **4** and **8**.

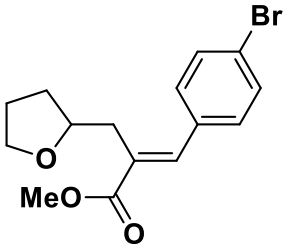


4aa. Obtained following *General Procedure **A*** from MBH acetate **1a** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 7:1. Yield = 75%, (0.113 mmol, 27.7 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.76 (s, 1H), 7.52 – 7.45 (m, 2H), 7.39 – 7.33 (m, 2H), 7.33 – 7.27 (m, 1H), 4.17 – 4.05 (m, 1H), 3.86 – 3.81 (m, 1H) partially overlapped with 3.80 (s, 3H), 3.72 – 3.66 (m, 1H), 2.81 (dd, *J* = 13.5, 7.8 Hz, 1H), 2.70 (dd, *J* = 13.5, 5.4 Hz, 1H), 2.01 – 1.91 (m, 1H), 1.88 – 1.79 (m, 2H), 1.54 – 1.43 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 164.1, 136.0, 130.9, 125.5, 124.6 (2C), 123.6 (2C and C overlapped), 73.2, 63.0, 47.2, 28.5, 26.7, 20.9; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{19}O_3$ 247.1329; found 247.1327.

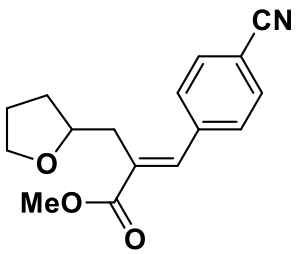
4aa was prepared on a 1.0 mmol scale following a slight modification of *General Procedure **A***, as follows: The ElectraSyn vial (10 mL), equipped with a stir bar, was charged with MBH acetate **1a** (234 mg, 1.0 mmol), *RAC* **3d** (527 mg, 2.0 mmol) and $LiBF_4$ (187 mg, 2.0 mmol). The ElectraSyn vial cap, equipped with anode (Zn) and cathode (graphite), was inserted into the mixture and closed with a rubber septum. The vessel was evacuated and backfilled with N_2 three times, then dry ACN (1.5 mL) was added, and the mixture stirred until complete dissolution of the solids occurred. Then, THF **2a** (7.5 mL) was added and the solution bubbled with N_2 (balloon) under stirring for 2 min. The reaction mixture was electrolyzed (under N_2, balloon) at a constant voltage of 5 V, until a total charge of 2.5 F (2.5 F/mol$_{\mathbf{1a}}$) was reached. At this point a significant drop in the operating current was noticed, along with a substantial deposition of sticky material at the graphite cathode. Therefore, the cathode was replaced with a new one and additional $LiBF_4$ (187 mg, 2.0 mmol) was added and the electrolysis carried out until an additional charge of 2.5 F (5 total F/mol$_{\mathbf{1a}}$) was reached. The ElectraSyn vial cap was removed, and the electrodes and vial were rinsed with EtOAc (25 mL) and $HCl_{(aq)}$ (1M, 25 mL), which were combined with the crude mixture in a separatory funnel Then, the organic layer was separated, and the aqueous layer was extracted with EtOAc (2 x 25 mL). The combined organic layers were dried over Na_2SO_4 and concentrated under reduced pressure. The crude product was finally purified by FC (*n*Hex/Et_2O: 7:1) to afford pure product **4aa** in 61% yield (0.61 mmol, 187 mg).



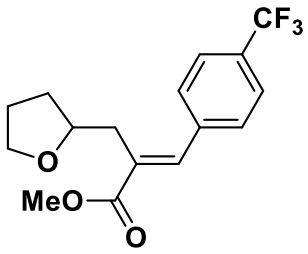
4ba. Obtained following *General Procedure **A*** from MBH acetate **1b** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 40:1.. Yield = 72%, (0.108 mmol, 30.2 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.69 (s, 1H), 7.48 – 7.41 (m, 2H), 7.35 – 7.27 (m, 2H), 4.15 – 4.04 (m, 1H), 3.87 – 3.80 (m, 1H) partially overlapped with 3.79 (s, 3H), 3.74 – 3.64 (m, 1H), 2.76 – 2.64 (m, 2H), 2.04 – 1.94 (m, 1H), 1.89 – 1.78 (m, 2H), 1.52 – 1.42 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.5, 139.5, 134.3, 134.0, 130.8, 130.7 (2C), 128.6 (2C), 77.9, 67.8, 52.0, 33.4, 31.6, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{18}{}^{35}ClO_3$ 281.0939; found 281.0939; calcd. for $C_{15}H_{18}{}^{37}ClO_3$ 283.0910; found 283.0912.



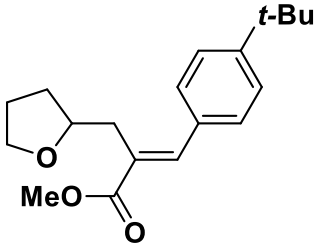
4ca. Obtained following *General Procedure **A*** from MBH acetate **1c** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 40:1.. Yield = 72%, (0.099 mmol, 32.2 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.67 (s, 1H), 7.52 – 7.45 (m, 2H), 7.40 – 7.35 (m, 2H), 4.09 (tdd, *J* = 7.6, 6.3, 5.2 Hz, 1H), 3.85 – 3.80 (m, 1H) partially overlapped with 3.79 (s, 3H), 3.72 – 3.65 (m, 1H), 2.75 – 2.63 (m, 2H), 2.03 – 1.93 (m, 1H), 1.89 – 1.78 (m, 2H), 1.52 – 1.42 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.5, 139.5, 134.5, 131.5 (2C), 131.0 (2C), 130.9, 122.6, 77.9, 67.8, 52.0, 33.4, 31.6, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{18}{}^{79}BrO_3$ 325.0434; found 325.0434; calcd. for $C_{15}H_{18}{}^{81}BrO_3$ 327.0414; found 327.0410.



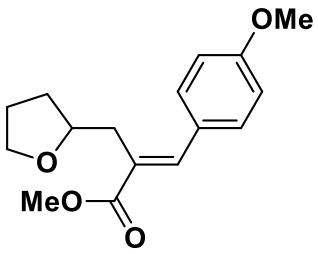
4da. Obtained following *General Procedure **A*** from MBH acetate **1d** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: from 10:1 to 2:1. Yield = 52%, (0.078 mmol, 21.1 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.72 (s, 1H), 7.68 – 7.58 (m, 4H), 4.14 – 4.03 (m, 1H), 3.83 – 3.78 (m, 1H) overlapped with 3.81 (s, 3H), 3.74 – 3.62 (m, 1H), 2.72 – 2.59 (m, 2H), 2.08 – 1.95 (m, 1H), 1.91 – 1.78 (m, 2H), 1.53 – 1.42 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.0, 140.3, 138.6, 133.1, 132.0 (2C), 129.9 (2C), 118.6, 111.8, 77.7, 67.8, 52.2, 33.6, 31.7, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{18}NO_3$ 272.1282; found 272.1276.



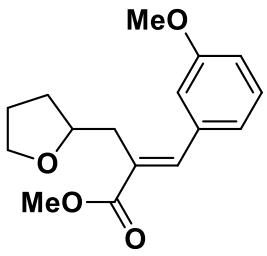
4ea. Obtained following *General Procedure **A*** from MBH acetate **1e** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 60:1. Yield = 74%, (0.111 mmol, 35.0 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.75 (s, 1H), 7.61 (*pseudo*-s, 4H), 4.16 – 4.05 (m, 1H), 3.84 – 3.79 (m, 1H) overlapped with 3.81 (s, 3H), 3.70 (dt, *J* = 7.9, 6.8 Hz, 1H), 2.74 – 2.65 (m, 2H), 2.07 – 1.95 (m, 1H), 1.91 – 1.80 (m, 2H), 1.53 – 1.38 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.3, 139.2 (q, *J* = 1.4 Hz), 139.1, 132.3, 130.1 (q, *J* = 32.5 Hz), 129.5 (2C), 125.2 (q, *J* = 3.8 Hz, 2C), 124.0 (q, *J* = 272.0 Hz), 77.8, 67.8, 52.1, 33.5, 31.7, 25.6; **^{19}F NMR** (376 MHz, $CDCl_3$) δ = -62.7 (s, 3H); **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{18}F_3O_3$ 315.1203; found 315.1210.



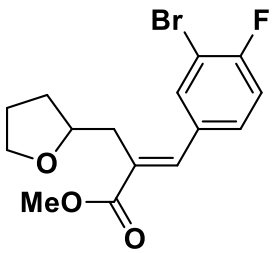
4fa. Obtained following *General Procedure **A*** from MBH acetate **1f** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 7:1. Yield = 68%, (0.102 mmol, 30.8 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.72 (s, 1H), 7.49 – 7.42 (m, 2H), 7.42 – 7.35 (m, 2H), 4.16 – 4.08 (m, 1H), 3.90 – 3.83 (m, 1H), 3.79 (ss, *J* = 1.1 Hz, 3H), 3.75 – 3.67 (m, 1H), 2.85 (dd, *J* = 13.6, 7.6 Hz, 1H), 2.73 (dd, *J* = 13.6, 5.5 Hz, 1H), 2.03 – 1.92 (m, 1H), 1.92 – 1.77 (m, 2H), 1.60 – 1.46 (m, 1H), 1.31 (s, 9H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.0, 151.7, 140.7, 132.6, 129.4 (2C), 129.3, 125.4 (2C), 78.1, 67.8, 51.9, 34.7, 33.3, 31.4, 31.2 (3C), 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{19}H_{27}O_3$ 303.1955; found 303.1951.



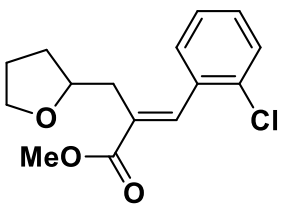
4ga. Obtained following *General Procedure **A*** from MBH acetate **1g** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 5:1. Yield = 49%, (0.074 mmol, 20.3 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.71 (s, 1H), 7.53 – 7.45 (m, 2H), 6.93 – 6.85 (m, 2H), 4.11 (tt, *J* = 7.4, 5.9 Hz, 1H), 3.90 – 3.83 (m, 1H), 3.81 (s, 3H), 3.78 (s, 3H), 3.74 – 3.67 (m, 1H), 2.84 (dd, *J* = 13.6, 7.5 Hz, 1H), 2.75 (dd, *J* = 13.6, 5.7 Hz, 1H), 2.02 – 1.92 (m, 1H), 1.92 – 1.78 (m, 2H), 1.58 – 1.48 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.1, 159.8, 140.5, 131.3 (2C), 128.1, 128.0, 113.9 (2C), 78.1, 67.8, 55.2, 51.9, 33.2, 31.4, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_4$ 277.1434; found 277.1428.



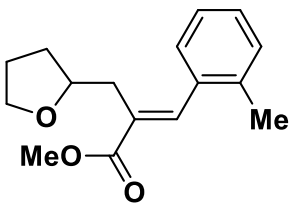
4ha. Obtained following *General Procedure* ***A*** from MBH acetate **1h** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 20:1. Yield = 49%, (0.092 mmol, 25.3 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.73 (s, 1H), 7.27 (t, *J* = 7.9 Hz, 1H), 7.12 (t, *J* = 2.1 Hz, 1H), 7.04 (d, *J* = 7.6 Hz, 1H), 6.85 (dd, *J* = 8.4, 2.6 Hz, 1H), 4.14 – 4.06 (m, 1H), 3.87 – 3.81 (m, 1H) partially overlapped with 3.80 (s, 3H and 3H overlapped), 3.73 – 3.65 (m, 1H), 2.81 (dd, *J* = 13.6, 8.0 Hz, 1H), 2.71 (dd, *J* = 13.6, 5.0 Hz, 1H), 2.03 – 1.93 (m, 1H), 1.89 – 1.79 (m, 2H), 1.54 – 1.43 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.8, 159.5, 140.7, 136.9, 130.4, 129.3, 121.8, 114.5, 114.3, 78.0, 67.8, 55.2, 52.0, 33.4, 31.5, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_4$ 277.1434; found 277.1432.



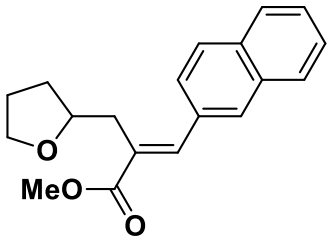
4ia. Obtained following *General Procedure* ***A*** from MBH acetate **1i** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 7:1. Yield = 60%, (0.090 mmol, 30.9 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.89 (dd, *J* = 6.7, 2.1 Hz, 1H), 7.66 (s, 1H), 7.40 (ddd, *J* = 7.1, 4.7, 2.1 Hz, 1H), 7.09 (t, *J* = 8.4 Hz, 1H), 4.14 (p, *J* = 6.8 Hz, 1H), 3.95 – 3.87 (m, 1H), 3.79 (s, 3H), 3.77 – 3.68 (m, 1H), 2.68 – 2.59 (m, 2H), 2.07 – 2.00 (m, 1H), 1.95 – 1.79 (m, 2H), 1.54 – 1.46 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.2, 158.8 (d, *J* = 250.0 Hz), 138.4, 134.6, 133.1 (d, *J* = 3.9 Hz), 131.3, 130.1 (d, *J* = 7.3 Hz), 116.3 (d, *J* = 22.5 Hz), 108.9 (d, *J* = 21.0 Hz), 77.7, 67.9, 52.1, 33.7, 31.9, 25.8; **^{19}F NMR** (376 MHz, $CDCl_3$) δ =-107.38 – -107.64 (m, 1F) ; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{17}{}^{79}BrFO_3$ 343.0340; found 343.0335; calcd. for $C_{15}H_{17}{}^{81}BrFO_3$ 345.0320; found 345.0311.



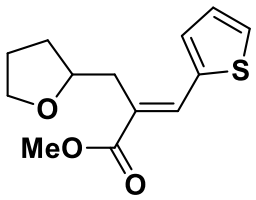
4ja. Obtained following *General Procedure* ***A*** from MBH acetate **1j** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 40:1. Yield = 71%, (0.107 mmol, 29.8 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.79 (s, 1H), 7.61 – 7.53 (m, 1H), 7.41 – 7.35 (m, 1H), 7.27 – 7.21 (m, 2H), 4.08 (p, *J* = 6.7 Hz, 1H), 3.81 (s, 3H), 3.78 – 3.70 (m, 1H), 3.70 – 3.63 (m, 1H), 2.67 – 2.53 (m, 2H), 1.99 – 1.90 (m, 1H), 1.85 – 1.71 (m, 2H), 1.43 – 1.34 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.2, 138.0, 134.3, 133.9, 131.9, 130.6, 129.4, 129.4, 126.5, 77.6, 67.7, 52.1, 33.5, 31.3, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{18}{}^{35}ClO_3$ 281.0939; found 281.0938; calcd. for $C_{15}H_{18}{}^{37}ClO_3$ 283.0910; found 283.0903.



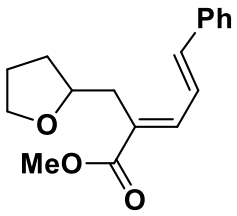
4ka. Obtained following *General Procedure **A*** from MBH acetate **1k** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 84%, (0.126 mmol, 32.8 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.78 (s, 1H), 7.38 – 7.32 (m, 1H), 7.22 – 7.13 (m, 3H), 4.11 – 4.03 (m, 1H), 3.80 (s, 3H), 3.74 – 3.59 (m, 2H), 2.63 (dd, *J* = 13.3, 7.9 Hz, 1H), 2.52 (dd, *J* = 13.4, 5.5 Hz, 1H), 2.25 (s, 3H), 1.95 – 1.83 (m, 1H), 1.82 – 1.67 (m, 2H), 1.40 – 1.29 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.6, 140.5, 136.5, 135.1, 130.8, 129.8, 128.7, 128.1, 125.5, 77.7, 67.5, 51.9, 33.3, 31.2, 25.5, 19.9; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_3$ 261.1486; found 261.1494.



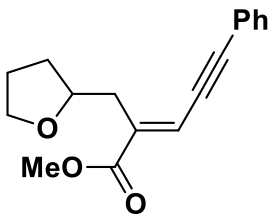
4la. Obtained following *General Procedure **A*** from MBH acetate **1l** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 61%, (0.092 mmol, 27.1 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 8.03 (s, 1H), 7.92 (s, 1H), 7.85 – 7.78 (m, 3H), 7.59 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.51 – 7.44 (m, 2H), 4.24 – 4.14 (m, 1H), 3.92 – 3.85 (m, 1H), 3.83 (s, 3H), 3.78 – 3.71 (m, 1H), 2.89 (dd, *J* = 13.6, 8.1 Hz, 1H), 2.78 (dd, *J* = 13.6, 5.1 Hz, 1H), 2.06 – 1.95 (m, 1H), 1.92 – 1.80 (m, 2H), 1.54 – 1.47 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.8, 140.9, 133.1, 133.1, 133.0, 130.4, 129.1, 128.4, 127.9, 127.6, 126.8, 126.6, 126.3, 78.0, 67.8, 52.0, 33.5, 31.6, 25.7; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{19}H_{21}O_3$ 297.1485; found 297.1479.



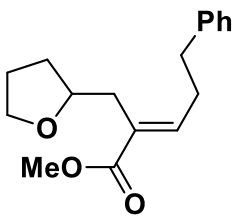
4ma. Obtained following *General Procedure **A*** from MBH acetate **1m** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 62%, (0.093 mmol, 23.4 mg). *E*/*Z* = 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.88 (s, 1H), 7.43 (dt, *J* = 5.2, 1.0 Hz, 1H), 7.31 (dd, *J* = 3.4, 1.1 Hz, 1H), 7.06 (dd, *J* = 5.1, 3.7 Hz, 1H), 4.18 – 4.09 (m, 1H), 3.92 – 3.86 (m, 1H), 3.79 (s, 3H), 3.74 – 3.67 (m, 1H), 2.99 (dd, *J* = 13.7, 7.2 Hz, 1H), 2.87 (dd, *J* = 13.7, 6.2 Hz, 1H), 2.02 – 1.91 (m, 2H), 1.89 – 1.78 (m, 1H), 1.70 – 1.62 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.7, 138.4, 133.1, 132.7, 129.0, 127.2, 126.2, 77.8, 67.9, 52.0, 34.1, 31.2, 25.7; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{13}H_{17}O_3S$ 253.0893; found 253.0890.



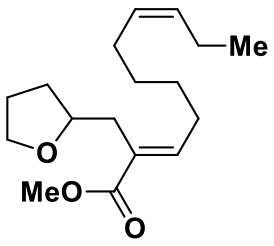
4na. Obtained following *General Procedure **A*** from MBH acetate **1n** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 52%, (0.078 mmol, 21.2 mg). *E*/*Z* = 20:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.49 – 7.42 (m, 3H), 7.37 – 7.30 (m, 2H), 7.30 – 7.25 (m, 1H), 7.11 (dd, *J* = 15.5, 11.4 Hz, 1H), 6.87 (d, *J* = 15.4 Hz, 1H), 4.07 – 3.99 (m, 1H), 3.91 – 3.84 (m, 1H), 3.77 (s, 3H), 3.75 – 3.67 (m, 1H), 2.79 (dd, *J* = 13.5, 6.8 Hz, 1H), 2.70 (dd, *J* = 13.5, 6.3 Hz, 1H), 1.98 – 1.78 (m, 3H), 1.61 – 1.51 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.5, 140.5, 139.9, 136.5, 128.8, 128.7 (2C), 128.3, 127.1 (2C), 124.1, 78.6, 67.8, 51.8, 32.9, 30.9, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{21}O_3$ 273.1485; found 273.1481.



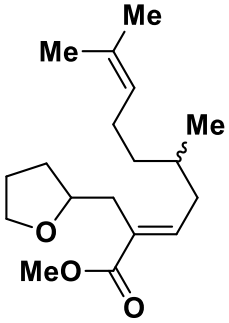
4oa. Obtained following *General Procedure **A*** from MBH acetate **1o** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 38%, (0.057 mmol, 15.4 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.49 – 7.40 (m, 2H), 7.39 – 7.28 (m, 3H), 6.91 (s, 1H), 4.19 (p, *J* = 6.5 Hz, 1H), 3.95 – 3.86 (m, 1H), 3.78 (s, 3H), 3.77 – 3.69 (m, 1H), 2.89 (dd, *J* = 12.8, 7.0 Hz, 1H), 2.74 (dd, *J* = 12.8, 6.8 Hz, 1H), 2.02 – 1.91 (m, 2H), 1.89 – 1.80 (m, 1H), 1.75 – 1.61 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 162.4, 134.9, 127.0 (2C), 124.3, 123.7 (2C), 117.9, 116.6, 96.5, 81.4, 73.0, 63.0, 47.3, 30.8, 26.1, 20.7; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{19}O_3$ 271.1329; found 271.1326.



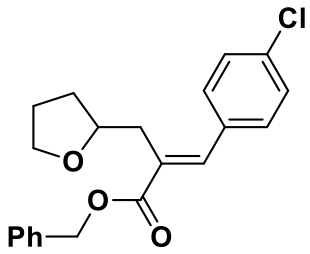
4pa. Obtained following *General Procedure **A*** from MBH acetate **1p** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 56%, (0.084 mmol, 23.0 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.31 – 7.25 (m, 2H), 7.21 – 7.14 (m, 3H), 6.90 (t, *J* = 7.4 Hz, 1H), 3.89 (p, *J* = 6.7 Hz, 1H), 3.84 – 3.78 (m, 1H), 3.71 (s, 3H) partially overlapped with 3.70 – 3.63 (m, 1H), 2.79 – 2.69 (m, 2H), 2.60 – 2.43 (m, 4H), 1.94 – 1.76 (m, 3H), 1.50 – 1.40 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.3, 143.6, 141.2, 129.5, 128.4 (2C), 128.3 (2C), 126.1, 78.2, 67.6, 51.7, 34.9, 32.6, 31.0, 30.9, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{23}O_3$ 275.1642; found 275.1634.



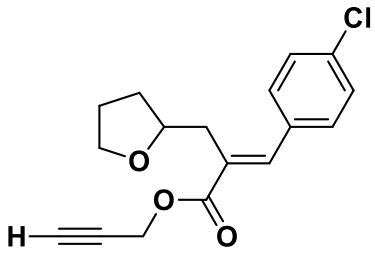
4qa. Obtained following *General Procedure* ***A*** from MBH acetate **1q** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 54%, (0.081 mmol, 22.7 mg). *E*/*Z* = 13:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 6.83 (t, *J* = 7.5 Hz, 1H), 5.42 – 5.22 (m, 2H), 3.98 – 3.90 (m, 1H), 3.86 – 3.79 (m, 1H), 3.71 (s, 3H) partially overlapped with 3.70 – 3.65 (m, 1H), 2.56 (dd, *J* = 13.4, 7.1 Hz, 1H), 2.48 (dd, *J* = 13.4, 6.1 Hz, 1H), 2.27 – 2.15 (m, 2H), 2.06 – 1.96 (m, 4H), 1.95 – 1.75 (m, 3H), 1.54 – 1.32 (m, 5H), 0.93 (t, *J* = 7.6 Hz, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.4, 144.9, 131.9, 128.8, 128.7, 78.3, 67.6, 51.6, 32.6, 31.0, 29.4, 28.8, 28.3, 26.8, 25.6, 20.5, 14.3; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{29}O_3$ 281.2111; found 281.2112.



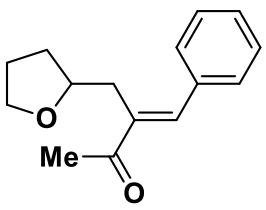
4ra. Obtained following *General Procedure* ***A*** from MBH acetate **1r** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 10:1. Yield = 38%, (0.057 mmol, 16.8 mg). *d.r.* = 1:1. *EZ* = 17:1 (for both diastereoisomers). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 6.87 (t, *J* = 7.5 Hz, 1H), 5.06 (t, *J* = 7.2 Hz, 1H), 3.96 – 6.92 (m, 1H), 3.83 (q, *J* = 7.1 Hz, 1H), 3.71 (s, 3H), 3.72 – 3.63 (m, 1H), 2.57 (two almost overlapping dd, *J* = 13.6, 7.0, 1H, diastereomeric signals), 2.48 (two almost overlapping dd, *J* = 13.4, 6.4, 1H, diastereomeric signals), 2.29 – 2.16 (m, 1H), 2.10 – 1.68 (m, 6H), 1.66 (s, 3H), 1.63 – 1.56 (m, 1H) partially overlapping with 1.58 (s, 3H), 1.54 – 1.43 (m, 1H), 1.41 – 1.28 (m, 1H), 1.26 – 1.12 (m, 1H), 0.90 and 0.89 (two overlapping d, *J* = 6.7 Hz, 3H, diastereomeric signals), the signals of the two diastereoisomers overlap in some cases, appearing as a single compound, in other cases (as specified in the list) they split; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.4, 143.9 (two diastereomeric signals), 131.4 (two diastereomeric signals), 129.5, 124.5, 78.3, 67.6, 51.6, 36.9, 36.8, 36.1 (two diastereomeric signals), 32.7, 32.6, 31.0 (two diastereomeric signals), 25.7, 25.6 (two diastereomeric signals), 19.6 (two diastereomeric signals), 17.6, the signals of the two diastereoisomers overlap in some cases, appearing as a single compound, in other cases (as specified in the list) they split; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{18}H_{31}O_3$ 295.2268; found 295.2271.



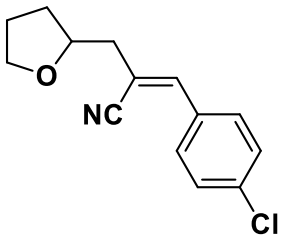
4sa. Obtained following *General Procedure **A*** from MBH acetate **1s** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 7:1. Yield = 81%, (0.122 mmol, 43.4 mg). *E*/*Z* = 13:1 (*Z* isomer was separated by FC). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.74 (s, 1H), 7.49 – 7.43 (m, 2H), 7.42 – 7.36 (m, 4H), 7.36 – 7.30 (m, 3H), 5.26 (d, *J* = 12.4 Hz, 1H), 5.22 (d, *J* = 12.4 Hz, 1H), 4.17 – 4.05 (m, 1H), 3.86 – 3.76 (m, 1H), 3.74 – 3.63 (m, 1H), 2.75 (dd, *J* = 12.9, 6.9 Hz, 1H), 2.70 (dd, *J* = 12.9, 5.3 Hz, 1H), 2.01 – 1.92 (m, 1H), 1.90 – 1.78 (m, 2H), 1.53 – 1.42 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 167.9, 139.7, 136.1, 134.4, 134.0, 130.8, 130.8 (2C), 128.6 (2C), 128.5 (2C), 128.2 (2C and C overlapped), 77.9, 67.8, 66.7, 33.4, 31.6, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{21}H_{22}{}^{35}ClO_3$ 357.1252; found 357.1257; calcd. for $C_{21}H_{22}{}^{37}ClO_3$ 359.1223; found 359.1229.



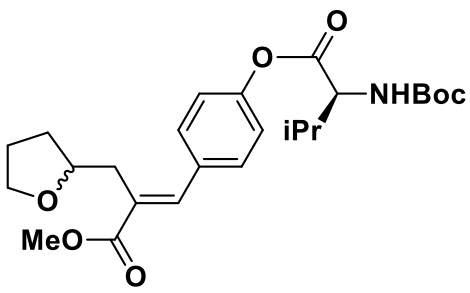
4ta. Obtained following *General Procedure **A*** from MBH acetate **1t** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 8:1. Yield = 61%, (0.092 mmol, 27.9 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.75 (s, 1H), 7.51 – 7.43 (m, 2H), 7.36 – 7.30 (m, 2H), 4.85 – 4.73 (m, 2H), 4.17 – 4.06 (m, 1H), 3.88 – 3.78 (m, 1H), 3.75 – 3.65 (m, 1H), 2.81 – 2.64 (m, 2H), 2.48 (t, *J* = 2.5 Hz, 1H), 2.04 – 1.94 (m, 1H), 1.91 – 1.79 (m, 2H), 1.55 – 1.44 (m, 1H); **^{13}C NMR** δ = 167.2, 140.4, 134.6, 133.8, 130.8 (2C), 130.2, 128.6 (2C), 77.8, 77.7, 74.9, 67.8, 52.4, 33.3, 31.6, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{18}{}^{35}ClO_3$ 305.0939; found 305.0927; calcd. for $C_{17}H_{18}{}^{37}ClO_3$ 307.0910; found 307.0894.



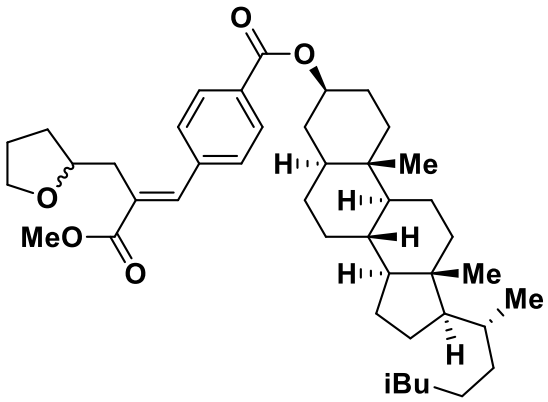
4ua. Obtained following *General Procedure **A*** from MBH acetate **1u** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 9:1. Yield = 77%, (0.116 mmol, 26.6 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.58 (s, 1H), 7.55 – 7.50 (m, 2H), 7.41 – 7.35 (m, 2H), 7.34 – 7.28 (m, 1H), 4.09 – 3.97 (m, 1H), 3.85 – 3.75 (m, 1H), 3.73 – 3.62 (m, 1H), 2.76 (dd, *J* = 13.4, 4.9 Hz, 1H), 2.69 (dd, *J* = 13.4, 8.2 Hz, 1H), 2.45 (s, 3H), 2.02 – 1.76 (m, 3H), 1.53 – 1.42 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 200.5, 141.4, 139.8, 135.6, 129.4 (2C), 128.5, 128.4 (2C), 78.0, 67.7, 32.2, 31.7, 26.2, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{19}O_2$ 231.1380; found 231.1372.



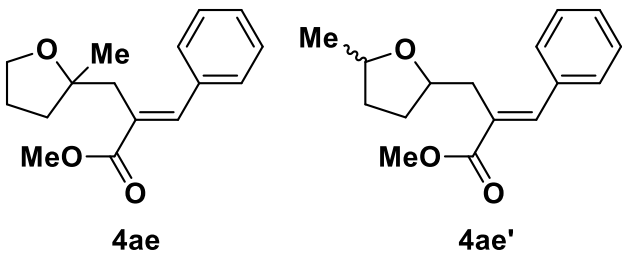
4va. Obtained following *General Procedure* ***A*** from MBH acetate **1v** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: from 7:1 to 5:1. Yield = 36%, (0.054 mmol, 13.4 mg). *E*/*Z* = 1:5 (the minor *E* isomer was separated by FC, only the characterization of the major *Z* isomer is provided). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.70 – 7.62 (m, 2H), 7.40 – 7.28 (m, 2H), 6.95 (s, 1H), 4.17 – 4.09 (m, 1H), 3.95 – 3.85 (m, 1H), 3.81 – 3.71 (m, 1H), 2.63 – 2.51 (m, 2H), 2.13 – 2.05 (m, 1H), 1.98 – 1.86 (m, 2H), 1.65 – 1.56 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 143.9, 135.9, 132.1, 129.9 (2C), 129.0 (2C), 118.6, 108.8, 77.1, 68.1, 41.9, 31.0, 25.6; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{14}H_{15}{}^{35}ClNO$ 248.0837; found 248.0831; calcd. for $C_{14}H_{15}{}^{37}ClNO$ 250.0808; found 250.0800.



4wa. Obtained following *General Procedure* ***A*** from MBH acetate **1w** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 60:1 to 10:1. Yield = 62%, (0.093 mmol, 42.9 mg). *d.r.* = 1:1. *E*/*Z* > 25:1 (for both diastereoisomers). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.72 (s, 1H), 7.57 – 7.50 (m, 2H), 7.13 – 7.05 (m, 2H), 5.06 (d, *J* = 9.1 Hz, 1H), 4.44 (dd, *J* = 9.2, 4.8 Hz, 1H), 4.15 – 4.04 (m, 1H), 3.86 – 3.79 (m, 1H) partially overlapped with 3.79 (s, 3H), 3.73 – 3.64 (m, 1H), 2.75 (dd, *J* = 13.6, 8.0 Hz, 1H), 2.68 (dd, *J* = 13.6, 5.0 Hz, 1H), 2.35 – 2.23 (m, 1H), 2.04 – 1.92 (m, 1H), 1.92 – 1.78 (m, 2H), 1.53 – 1.43 (m, 1H) partially overlapped with 1.44 (s, 9H), 1.06 (d, *J* = 6.8 Hz, 3H), 1.00 (d, *J* = 6.9 Hz, 3H), the signals of the two diastereoisomers overlap completely, appearing as a single compound; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 171.0, 168.6, 155.7, 150.3, 139.7, 133.5, 130.7 (2C), 130.5, 121.3 (2C), 80.0, 77.9, 67.8, 58.7, 52.0, 33.3, 31.6, 31.3, 28.3, 25.6, 19.1, 17.7, the signals of the two diastereoisomers overlap completely, appearing as a single compound; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{25}H_{36}NO_7$ 462.2486; found 462.2490.



4xa. Obtained following *General Procedure* ***A*** from MBH acetate **1x** and THF **2a**. Viscous colorless oil. FC eluent: DCM/Et_2O: from 100:0 to 30:1. Yield = 58%, (0.087 mmol, 57.4 mg). *d.r.* = 1:1. *E*/*Z* = 25:1 (for both diastereoisomers). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 8.04 – 7.99 (m, 2H), 7.76 (s, 1H), 7.57 – 7.50 (m, 2H), 4.97 – 4.88 (m, 1H), 4.15 – 4.07 (m, 1H), 3.83 – 3.78 (m, 1H) overlapped with 3.80 (s, 3H), 3.72 – 3.66 (m, 1H), 2.73 (dd, *J* = 13.6, 8.2 Hz, 1H), 2.67 (dd, *J* = 13.7, 5.1 Hz, 1H), 2.03 – 1.89 (m, 3H), 1.88 – 1.60 (m, 7H), 1.58 – 1.41 (m, 5H), 1.38 – 1.16 (m, 10 H), 1.16 – 0.95 (m, 9H), 0.88 (d, *J* = 6.5 Hz, 3H), 0.85 (s, 3H) overlapped with 0.84 (d, *J* = 6.6 Hz, 3H) overlapped with 0.83 (d, *J* = 6.5 Hz, 3H) 0.71 – 0.63 (m, 1H) overlapped with 0.64 (s, 3H), the signals of the two diastereoisomers overlap completely, appearing as a single compound; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.4, 165.7, 140.0, 139.7, 131.9, 130.5, 129.5 (2C), 129.1 (2C), 77.8, 74.5, 67.8, 56.4, 56.2, 54.2, 52.1, 44.7, 42.6, 40.0, 39.5, 36.8, 36.1, 35.8, 35.5, 35.5, 34.1, 33.5, 32.0, 31.6, 28.6, 28.2, 28.0, 27.6, 25.6, 24.2, 23.8, 22.8, 22.5, 21.2, 18.6, 12.3, 12.1, the signals of the two diastereoisomers overlap completely, appearing as a single compound; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{43}H_{64}O_5$ 661.4827; found 661.2831.

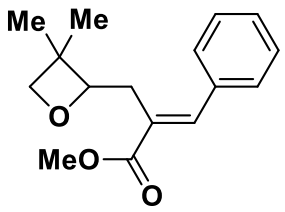


4ae **4ae'**

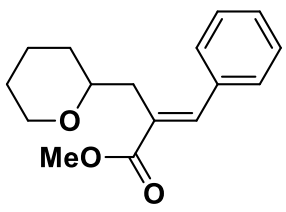
4ab and **4ab'**. Obtained following *General Procedure* ***B*** from MBH acetate **1a** and 2-methyltetrahydrofuran **2b**. FC eluent: *n*Hex/Et_2O: 20:1. Yield = 55% (combined). **4ab**:**4ab'** = 2.5:1. Separation of the isomers is possible by FC.

4ab (second eluting fraction). Viscous colorless oil. Yield = 39% (individual), (0.059 mmol, 15.2 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.62 (s, 1H), 7.49 – 7.40 (m, 2H), 7.37 – 7.31 (m, 2H), 7.30 – 7.25 (m, 1H), 3.79 (s, 3H), 3.75 – 3.67 (m, 1H), 3.67 – 3.59 (m, 1H), 2.89 (d, = 13.6 Hz, 1H), 2.86 (d, = 13.6 Hz, 1H), 1.86 – 1.78 (m, 2H), 1.76 – 1.68 (m, 1H), 1.59 – 1.47 (m, 1H), 1.08 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 170.2, 139.8, 136.1, 131.4, 129.1 (2C), 128.4 (2C), 128.0, 83.3, 67.3, 52.0, 37.0, 36.8, 26.7, 25.9; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_3$ 261.1485; found 261.1489.

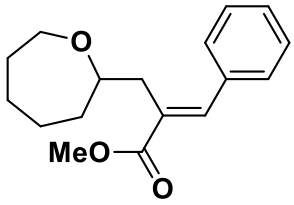
4ab' (first eluting fraction). Viscous colorless oil. Yield = 16% (individual), (0.024 mmol, 6.2 mg). *d.r.* = 1.8:1. *E*/*Z* > 25:1 for both diastereoisomers. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.75 (s, 1H major + 1H minor), 7.59 – 7.53 (m, 2H minor), 7.49 – 7.43 (m, 2H major), 7.38 – 7.32 (m, 2H major + 2H minor), 7.32 – 7.26 (m, 1H major + 1H minor), 4.32 – 4.23 (m, 1H major), 4.13 – 4.06 (m, 1H minor), 4.04 – 3.90 (m, 1H major + 1H minor), 3.79 (s, 3H major + 3H minor), 2.86 – 2.70 (m, 1H major + 2H minor), 2.64 (dd, *J* = 13.5, 5.4 Hz, 1H major), 2.07 – 1.90 (m, 3H major + 3H minor), 1.46 – 1.35 (m, 1H major + 1H minor), 1.20 (d, *J* = 6.1 Hz, 3H minor), 1.15 (d, *J* = 6.1 Hz, 3H major); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.3 (minor), 168.9 (major), 143.5 (minor), 140.8 (major), 130.3 (minor), 129.5 (major), 129.2 (major), 129.2 (minor), 128.8 (2C minor), 128.5 (2C minor), 128.3 (2C major), 128.2 (2C major), 109.9 (minor), 108.5 (major), 75.5 (minor), 74.5 (major), 52.2 (minor), 51.9 (major), 33.9 (minor), 33.7 (major), 33.6 (major), 33.3 (minor), 32.8 (minor), 32.0 (major), 31.3 (minor), 29.7 (major), 21.4 (minor), 21.1 (major); **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_3$ 261.1485; found 261.1480.



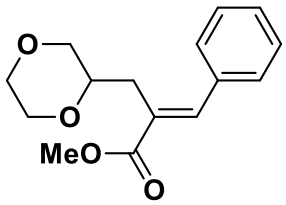
4ac. Obtained following *General Procedure **B*** from MBH acetate **1a** and 3,3-dimethyloxetane **2c**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 9:1. Yield = 41%, (0.062 mmol, 16.0 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.80 (s, 1H), 7.63 – 7.55 (m, 2H), 7.41 – 7.35 (m, 2H), 7.35 – 7.29 (m, 1H), 4.70 (dd, *J* = 9.6, 3.4 Hz, 1H), 4.31 (d, *J* = 5.4 Hz, 1H), 4.14 (d, *J* = 5.4 Hz, 1H), 3.79 (s, 3H), 3.02 (dd, *J* = 13.9, 9.6 Hz, 1H), 2.63 (dd, *J* = 13.9, 3.5, 1H), 1.24 (s, 3H), 1.15 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.4, 141.7, 135.4, 129.4 (2C), 128.5, 128.5, 128.3 (2C), 89.2, 80.9, 51.9, 38.8, 30.3, 26.3, 21.1; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_3$ 261.1485; found 261.1480.



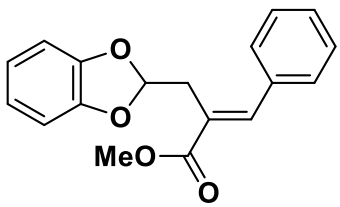
4ad. Obtained following *General Procedure **B*** from MBH acetate **1a** and tetrahydropyran **2d**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 12:1. Yield = 40%, (0.060 mmol, 15.6 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.74 (s, 1H), 7.55 – 7.48 (m, 2H), 7.40 – 7.33 (m, 2H), 7.32 – 7.26 (m, 1H), 3.94 (ddd, *J* = 11.7, 4.3, 2.1 Hz, 1H), 3.80 (s, 3H), 3.60 – 3.50 (m, 1H), 3.36 (td, *J* = 11.6, 2.3 Hz, 1H), 2.78 (dd, *J* = 13.7, 7.8 Hz, 1H), 2.63 (dd, *J* = 13.7, 5.5 Hz, 1H), 1.83 – 1.73 (m, 1H), 1.65 – 1.37 (m, 3H), 1.33 – 1.17 (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.0, 140.8, 135.5, 129.9, 129.6 (2C), 128.4, 128.3 (2C), 76.7, 68.6, 51.9, 34.3, 32.0, 26.0, 23.5; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_3$ 261.1485; found 261.1479.



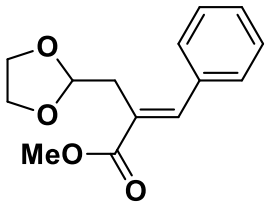
4ae. Obtained following *General Procedure **B*** from MBH acetate **1a** and oxepane **2e**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 15:1. Yield = 25%, (0.038 mmol, 10.2 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.71 (s, 1H), 7.53 – 7.45 (m, 2H), 7.40 – 7.33 (m, 2H), 7.33 – 7.26 (m, 1H), 3.80 (s, 3H) partially overlapped with 3.78 – 3.68 (m, 2H), 3.43 – 3.33 (m, 1H), 2.80 (dd, *J* = 13.8, 8.5 Hz, 1H), 2.58 (dd, *J* = 13.7, 4.9, Hz, 1H), 1.83 – 1.39 (m, 8H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.1, 140.3, 135.7, 130.7, 129.4 (2C), 128.3 (2C and C overlapped), 128.2, 78.3, 67.9, 51.9, 35.6, 34.2, 31.2, 26.9; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{17}H_{23}O_3$ 275.1642; found 275.1644.



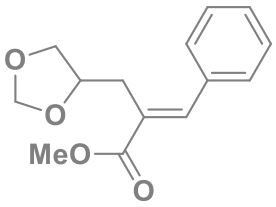
4af. Obtained following *General Procedure **B*** from MBH acetate **1a** and 1,4-dioxane **2f**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 12:1. Yield = 50%, (0.075 mmol, 19.7 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.79 (s, 1H), 7.53 – 7.46 (m, 2H), 7.41 – 7.35 (m, 2H), 7.35 – 7.29 (m, 1H), 3.87 – 3.79 (m, 1H) overlapping 3.81 (s, 3H), 3.78 – 3.64 (m, 4H), 3.58 (td, *J* = 11.6, 2.7 Hz, 1H), 3.26 (dd, *J* = 11.5, 9.9 Hz, 1H), 2.71 (dd, *J* = 13.8, 7.8 Hz, 1H), 2.55 (dd, *J* = 13.9, 5.4 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.5, 141.6, 135.2, 129.4 (2C), 128.6, 128.5, 128.4 (2C), 74.5, 71.2, 67.0, 66.4, 52.1, 29.7; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{19}O_4$ 263.1278; found 263.1287.



4ag. Obtained following *General Procedure **B*** from MBH acetate **1a** and 1,3-benzodioxole **2g** but employing 20 equiv of **2g** (0.2 mL) in DMF (2.8 mL) as solvent. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 5:1. Yield = 61%, (0.092 mmol, 27.1 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.93 (s, 1H), 7.48 – 7.41 (m, 2H), 7.35 – 7.26 (m, 3H), 6.84 – 6.72 (m, 4H), 6.44 (t, *J* = 5.3 Hz, 1H), 3.85 (s, 1H), 3.17 (d, *J* = 5.4 Hz, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.1, 147.2 (2C), 143.5, 134.9, 129.2 (2C), 128.8, 128.5 (2C), 125.5, 121.5 (2C), 109.9, 108.6 (2C), 52.2, 33.3; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{18}H_{17}O_4$ 297.1121; found 297.1116.

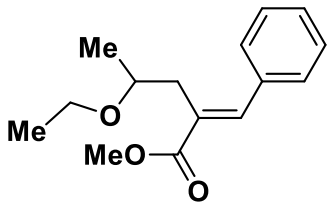


4ah

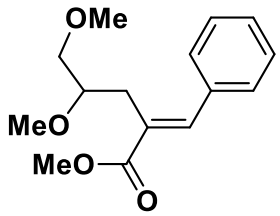


4ah'

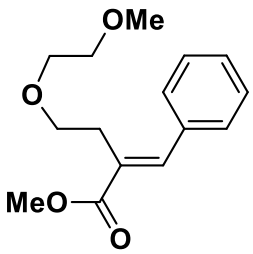
4ah. Obtained following *General Procedure* ***B*** from MBH acetate **1a** and 1,3-dioxolane **2h** but employing 20 equiv of **2h** (0.2 mL) in DMF (2.8 mL) as solvent. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 5:1. Yield = 51%, (0.077 mmol, 19.0 mg). *E*/*Z* > 25:1. Traces of isomer **4ah'** were detected, **4ah**:**4ah'** = 17:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.80 (s, 1H), 7.57 – 7.50 (m, 2H), 7.39 – 7.34 (m, 2H), 7.34 – 7.28 (m, 1H), 5.17 (t, *J* = 5.0 Hz, 1H), 4.00 – 3.92 (m, 2H), 3.89 – 3.82 (m, 2H), 3.81 (s, 3H), 2.93 (d, *J* = 5.0 Hz, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.7, 141.9, 135.3, 129.4 (2C), 128.6, 128.4 (2C), 127.5, 103.1, 64.8 (2C), 52.1, 32.4; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{14}H_{17}O_4$ 249.1121; found 249.1115.



4ai. Obtained following *General Procedure* ***B*** from MBH acetate **1a** and Et_2O **2i**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 20:1. Yield = 44%, (0.066 mmol, 16.4 mg). *E*/*Z* > 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.72 (s, 1H), 7.54 – 7.47 (m, 2H), 7.39 – 7.32 (m, 2H), 7.32 – 7.26 (m, 1H), 3.80 (s, 3H), 3.71 – 3.62 (m, 1H), 3.50 (dq, *J* = 9.3, 7.0 Hz, 1H), 3.38 (dq, *J* = 9.3, 7.0 Hz, 1H), 2.82 (dd, *J* = 13.6, 7.6 Hz, 1H), 2.60 (dd, *J* = 13.6, 5.5 Hz, 1H), 1.11 (d, *J* = 6.3 Hz, 4H) partially overlapped with 1.00 (t, *J* = 7.0 Hz, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 169.1, 140.7, 135.6, 130.6, 129.4 (2C), 128.3 (2C), 128.3, 74.5, 64.3, 51.9, 34.8, 20.3, 15.5; **HRMS (APCI)** m/z: $[M\text{-MeO}]^+$ calcd. for $C_{14}H_{17}O_2$ 217.1223; found 217.1218; $[M\text{-EtO}]^+$ calcd. for $C_{13}H_{15}O_2$ 203.1067; found 203.1064 (the semi-molecular ion peak generated by capture of a proton, or an alkaline metal cation could not be found).



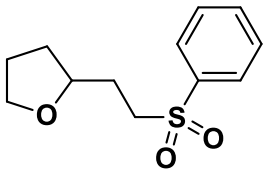
4aj



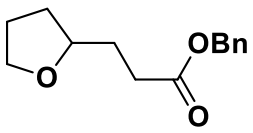
4aj'

4aj and **4aj'** (inseparable mixture). Obtained following *General Procedure* ***B*** from MBH acetate **1a** and 1,2-dimethoxyethane **2j**. Viscous colorless oil. FC eluent: *n*Hex/Et_2O: 8:1. Yield = 39%, (0.056 mmol, 15.4 mg). **4aj**:**4aj'** = 1.1:1. *E*/*Z* > 25:1 for both isomers. **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.76 (s, 1H_{4aj}) partially overlapped with 7.75 (s, 1$H_{4aj'}$), 7.53 – 7.49 (m, 2H_{4aj}), 7.48 – 7.42 (m, 2$H_{4aj'}$), 7.40 – 7.34 (m, 3H_{4aj} + 3$H_{4aj'}$), 7.34 – 7.27 (m, 1H_{4aj} + 1$H_{4aj'}$), 3.82 (s, 3H_{4aj}), 3.80 (s, 3$H_{4aj'}$), 3.66 (t, *J* = 7.2 Hz, 2$H_{4aj'}$) partially overlapped with 3.65 – 3.58 (m, 1H_{4aj}) 3.60 – 3.56 (m, 2$H_{4aj'}$), 3.53 – 3.49 (m, 2$H_{4aj'}$), 3.40 (dd, *J* = 10.3,

3.8 Hz, 1H$_{4aj}$) partially overlapped with 3.37 (s, 3H$_{4aj}$), 3.36 (s, 3H$_{4aj'}$), 3.31 (dd, *J* = 10.2, 5.5 Hz, 1H$_{4aj}$), 3.27 (s, 3H$_{4aj}$), 2.89 – 2.82 (m, 1H$_{4aj}$ + 2H$_{4aj'}$), 2.72 (dd, *J* = 13.9, 5.9 Hz, 1H$_{4aj}$); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.8, 168.6, 141.3, 141.2, 135.4, 135.3, 129.6, 129.4 (2C), 129.3 (2C), 129.2, 128.6, 128.5, 128.5 (2C), 128.4 (2C), 79.2, 74.4, 71.9, 70.1, 69.9, 59.1, 59.0, 58.1, 52.0, 52.0, 29.6, 28.1, all peaks are given, without assignment; **HRMS (APCI)** m/z: $[M\text{-}MeO]^+$ calcd. for $C_{14}H_{17}O_3$ 233.1172; found 233.1164 (the semi-molecular ion peak generated by capture of a proton, or an alkaline metal cation could not be found).



8a. Obtained following *General Procedure **B*** from phenyl vinyl sulfone **7a** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/EtOAc: from 4:1 to 1:1. Yield = 55%, (0.083 mmol, 19.8 mg). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.96 – 7.85 (m, 2H), 7.70 – 7.59 (m, 1H), 7.57 – 7.49 (m, 2H), 3.87 – 3.80 (m, 1H), 3.79 – 3.72 (m, 1H), 3.70 – 3.60 (m, 1H), 3.28 (ddd, *J* = 14.1, 11.4, 4.9 Hz, 1H), 3.11 (ddd, *J* = 14.0, 11.2, 4.9 Hz, 1H), 2.02 – 1.89 (m, 2H), 1.88 – 1.76 (m, 3H), 1.50 – 1.38 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 139.2, 133.6, 129.2, 128.0, 77.0, 67.8, 53.6, 31.2, 28.5, 25.6; **8a** is a known compound and spectral data are in accordance with the literature.

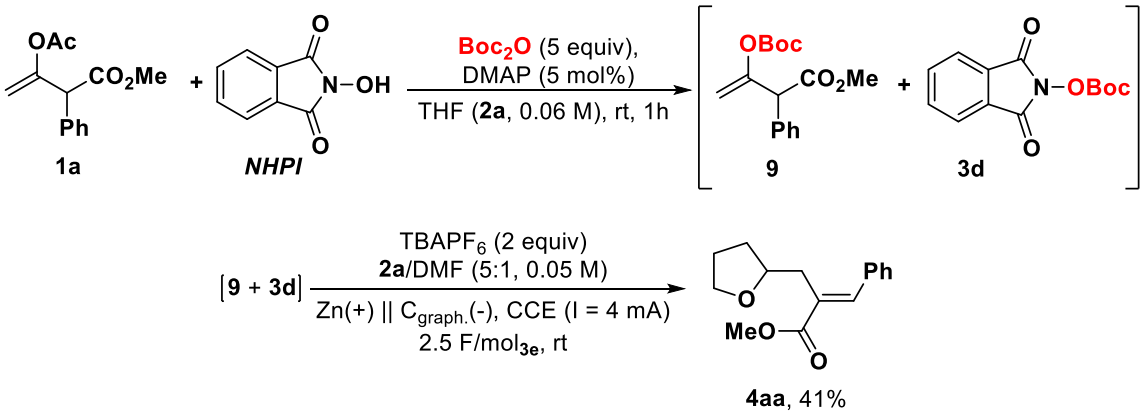


8b. Obtained following *General Procedure **B*** from benzyl acrylate **7b** and THF **2a**. Viscous colorless oil. FC eluent: *n*Hex/EtOAc: 7:1. Yield = 43%, (0.065 mmol, 15.1 mg). **^{1}H NMR** (400 MHz, $CDCl_3$) δ = 7.39 – 7.27 (m, 5H), 5.10 (s, 2H), 3.85 – 3.76 (m, 2H), 3.71 – 3.64 (m, 1H), 2.55 – 2.36 (m, 2H), 2.00 – 1.76 (m, 5H), 1.54 – 1.38 (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 173.4, 134.7, 128.5 (2C), 128.1 (2C), 124.0, 78.1, 67.7, 66.1, 31.1, 30.6, 27.4, 25.7; **8b** is a known compound and spectral data are in accordance with the literature.

5. Further experiments

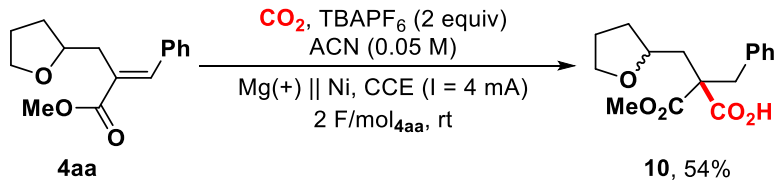
5.1 Preparation of **4aa** from MBH alcohol **9** and *NHPI*.

4aa can be prepared from MBH alcohol **9** and *NHPI* by a double activation-electrochemical functionalization, as follows.

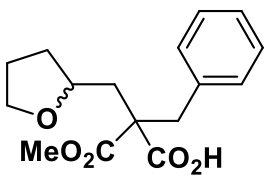


The ElectraSyn vial (5 mL), equipped with a stir bar, was charged with MBH alcohol **9** (26.6 mg, 0.15 mmol), *NHPI* (48.9 mg, 0.3 mmol) and DMAP (1.0 mg, 0.0075 mmol). The ElectraSyn vial cap, equipped with anode (Zn) and cathode (graphite), was inserted into the mixture and closed with a rubber septum. The vessel was evacuated and backfilled with N_2 three times, then dry THF **3a** (2.5 mL) was added, followed by Boc_2O (164.0 mg, 0.75 mmol) and the mixture stirred until TLC showed disappearance of **9** and *NHPI*, and, at the same time, appearance of **1a'** and **3d** (as judged by comparison with authentic samples), ca 1 h. Then, a solution of $TBAPF_6$ (115 mg, 0.3 mmol) in DMF (0.5 mL) was added and the solution bubbled with N_2 (balloon) under stirring for 2 min. The reaction mixture was electrolyzed (under N_2, balloon) at a constant current of 4 mA, until a total charge of 0.75 F (5 $F/mol_{\mathbf{1a'}}$) was reached. The ElectraSyn vial cap was removed, and the electrodes and vial were rinsed with Et_2O (10 mL) and $HCl_{(aq)}$ (1M, 10 mL), which were combined with the crude mixture in a separatory funnel. Then, the organic layer was separated, the aqueous layer was extracted with Et_2O (2 x 10 mL) and the combined organic layers were washed with $HCl_{(aq)}$ (0.1 M, 3 x 10 mL), dried over Na_2SO_4 and concentrated *in vacuo*. The crude product was finally purified by FC (*n*Hex/Et_2O 10:1) to afford pure product **4aa** in 41% yield (15.1 mg, 0.062 mmol).

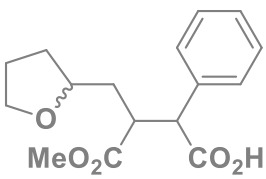
5.2 Electroreductive carboxylation of **4aa**: synthesis and characterization of **10**



The following is an adaptation of literature procedures for the electroreductive carboxylation of methyl cinnamate.[8] The ElectraSyn vial (5 mL), equipped with a stir bar, was charged with product **4aa** (37.0 mg, 0.15 mmol), and $TEABF_4$ (33.0 mg, 0.3 mmol). The ElectraSyn vial cap, equipped with anode (Mg) and cathode (Ni), was inserted into the mixture, and closed with a rubber septum. The vessel was evacuated and backfilled with CO_2 three times, then dry ACN (3.0 mL) was added, and the solution bubbled with CO_2 (balloon) under stirring for 2 min. The reaction mixture was electrolyzed (under CO_2, balloon) at a constant current of 4 mA, until a total charge of 0.3 F (2 F/mol$_{\mathbf{4aa}}$) was reached. The ElectraSyn vial cap was removed, and the electrodes and vial were rinsed with EtOAc (10 mL) and $HCl_{(aq)}$ (1M, 10 mL), which were combined with the crude mixture in a separatory funnel. Then, the organic layer was separated, the aqueous layer was extracted with EtOAc (2 x 10 mL) and the combined organic layers were washed with $HCl_{(aq)}$ (0.1 M, 3 x 10 mL), dried over Na_2SO_4 and concentrated *in vacuo*. The crude product was finally purified by FC (*n*Hex/EtOAc 7:3 + 1% HCOOH) to afford pure product **10** (colorless sticky oil) in 54% yield (*d.r.* = 1.8:1, 23.7 mg, 0.081 mmol). The identification of the reaction product with structure **10** was unambiguously assigned by HSQC NMR experiments, showing the presence of 5 methylene units (in contrast with the 4 ones expected from **10'**).



10

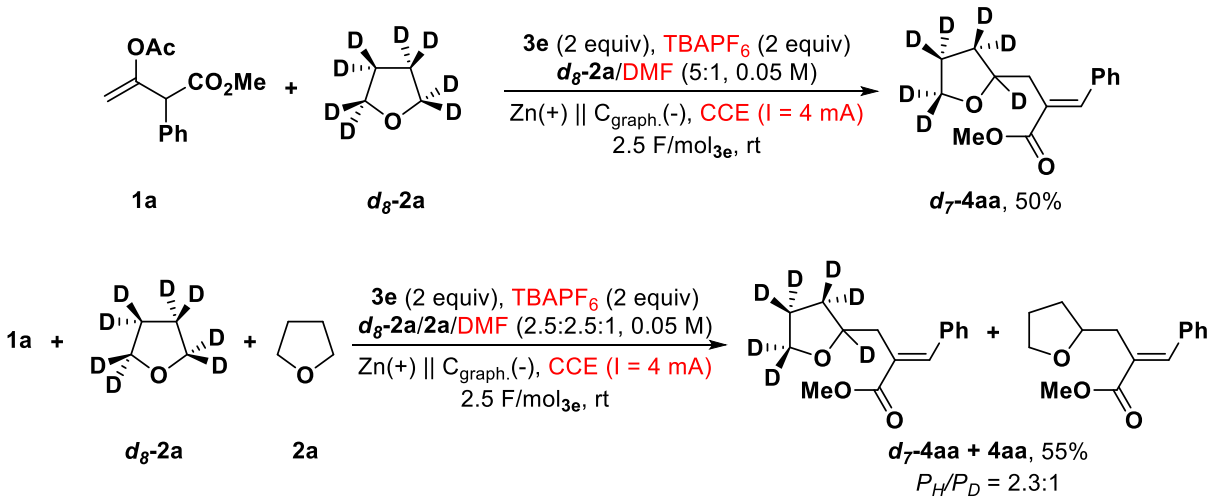


10' not observed

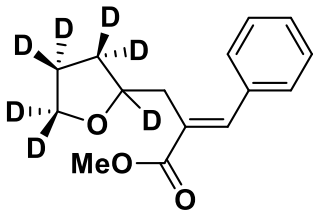
^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.28 – 7.20 (m, 3H major + 3H minor), 7.11 – 7.02 (m, 2H major + 2H minor), 4.02 – 3.90 (m, 1H major + 1H minor), 3.78 (s, 3H minor), 3.79 – 3.74 (m, 1H major + 1H minor) 3.78 (s, 3H major), 3.71 – 3.60 (m, 1H major + 1H minor), 3.39 (d, *J* = 13.3 Hz, 1H major), 3.32 (d, *J* = 13.5 Hz, 1H minor), 3.23 (d, *J* = 13.5 Hz, 1H minor), 3.09 (d, *J* = 13.3 Hz, 1H major), 2.34 – 2.24 (m, 2H minor + 1H major), 2.19 (dd, *J* = 13.9, 10.3 Hz, 1H major), 2.08 – 1.95 (m, 1H major + 1H minor), 1.92 – 1.74 (m, 2H major + 2H minor), 1.53 – 1.41 (m, 1H major + 1H minor) the -

COOH proton was not detected; **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 177.1 (major), 175.0 (minor), 173.4 (minor), 173.2 (major), 135.4 (minor), 135.2 (major), 129.6 (2C minor), 129.2 (2C major), 128.6 (2C major), 128.5 (2C minor), 127.5 (major), 127.3 (minor), 75.6 (major), 75.4 (minor), 67.9 (major), 67.8 (minor), 57.7 (major), 57.5 (minor), 52.9 (major), 52.8 (minor), 43.9 (major), 43.5 (major), 42.8 (minor), 41.3 (minor), 32.0 (minor), 31.8 (major), 25.5 (major), 25.4 (minor); **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{16}H_{21}O_5$ 293.1384; found 293.1380.

5.3 Kinetic Isotope Effect

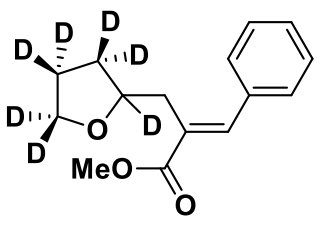


Product d_7-**4aa** was prepared following *General Procedure* ***B*** but using d_8-THF (d_8-**2a**) instead of regular THF **2a**. The product (colorless sticky oil) was obtained after FC (*n*Hex/Et_2O 10:1) in 50% yield (19.0 mg, 0.075 mmol).

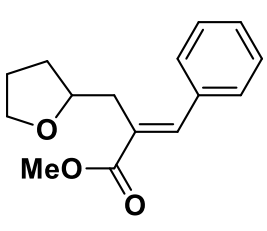


^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.76 (s, 1H), 7.54 – 7.44 (m, 2H), 7.40 – 7.32 (m, 2H), 7.32 – 7.27 (m, 1H), 3.80 (s, 3H), 2.80 (d, *J* = 13.5 Hz, 1H), 2.69 (d, *J* = 13.5 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ = 168.8, 140.8, 135.6, 130.2, 129.3, 128.3, 128.3, 51.9, 33.1, the CD and CD_2 carbons were not detected in the spectrum; **HRMS (APCI)** m/z: $[M+H]^+$ calcd. for $C_{15}H_{12}D_7O_4$ 254.1768; found 254.1763.

Following *General Procedure* ***B*** but using a 1:1 mixture of d_8-THF (d_8-**2a**, 1.25 mL) and THF **2a** (1.25 mL) a 2.3:1 mixture of products **4aa** and d_7-**4aa** (colorless sticky oil) was obtained after FC (*n*Hex/Et_2O 10:1) in 55% yield (20.9 mg, 0.083 mmol).



d_7-**4aa**



4aa

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.52 (s, 1H **4aa** + 1H d_7-**4aa**), 7.28 – 7.21 (m, 2H **4aa** + 2H d_7-**4aa**), 7.16 – 7.09 (m, 2H **4aa** + 2H d_7-**4aa**), 7.08 – 7.03 (m, 1H **4aa** + 1H d_7-**4aa**), 3.92 – 3.82 (m, 1H **4aa**), 3.62 – 3.58 (m, 1H

4aa) partially overlapped with 3.57 (s, 3H **4aa** + 3H d_7-**4aa**), 3.47 – 3.43 (m, 1H **4aa**), 2.61 – 2.51 (m, 1H **4aa** + 1H d_7-**4aa**), 2.51 – 2.41 (m, 1H **4aa** + 1H d_7-**4aa**), 1.77 – 1.67 (m, 1H **4aa**), 1.65 – 1.54 (m, 2H **4aa**), 1.31 – 1.20 (m, 1H **4aa**).

5.4 On-Off Experiment.

The ElectraSyn vial (5 mL), equipped with a stir bar, was charged with MBH acetate **1a** (0.15 mmol), *RAC* **3d** (0.30 mmol, 79.0 mg) and $LiBF_4$ (0.30 mmol, 28.0 mg). The ElectraSyn vial cap, equipped with anode (Zn) and cathode (graphite), was inserted into the mixture and closed with a rubber septum. The vessel was evacuated and backfilled with N_2 three times, then dry ACN (0.5 mL) was added, and the mixture stirred until complete dissolution of the solids occurred. Then, THF **2a** (2.5 mL) was added and the solution bubbled with N_2 (balloon) under stirring for 1 min. The reaction mixture was electrolyzed (under N_2, balloon) at a constant current of 4 mA, exposing the reaction alternatively to electrolysis (45 min, 0.75 F/mol$_{\mathbf{1a}}$) and to stirring without electrolysis (30 min). The reaction (**Figure S1**) was monitored by taking aliquots (100 µL) that were quenched by dilution with EtOAc (1 mL) and $HCl_{(aq)}$ (1M, 1 mL) in a glass vial. Then, the organic layer was separated and the aqueous layer was extracted with EtOAc (2 x 1 mL). The combined organic layers were dried over Na_2SO_4 and concentrated under reduced pressure. Conversion into product **4aa** with respect to **1a** were measured by ^{1}H NMR spectroscopy on each aliquot.

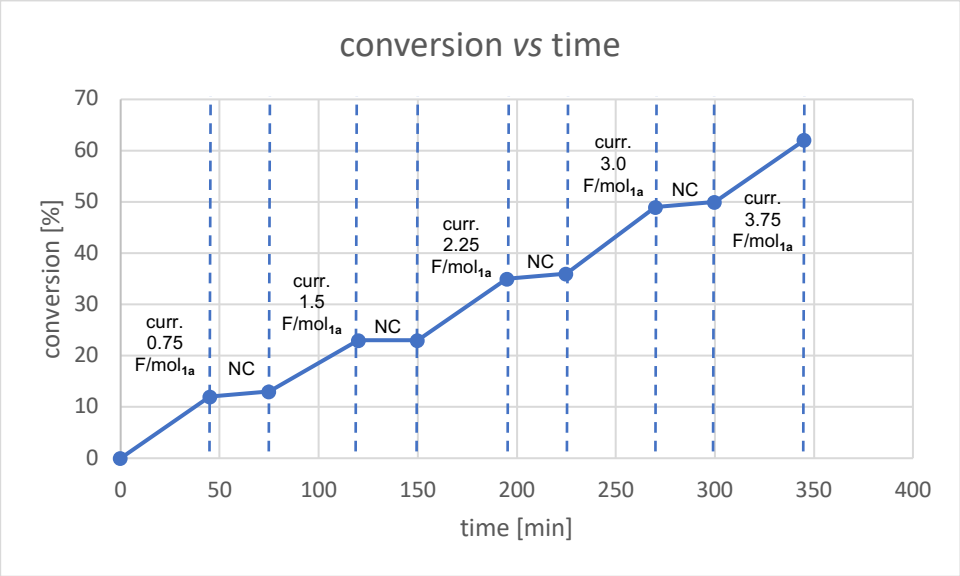
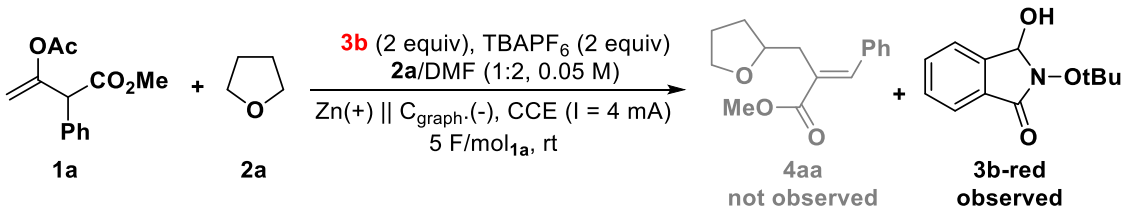
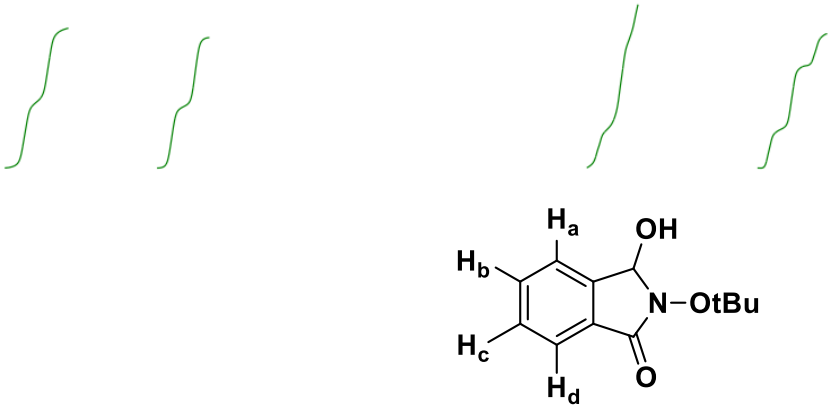


Figure S1. Monitoring of the conversion *vs* time and F/mol$_{\mathbf{1a}}$ in the on-off experiment. NC = no current.

5.4 Observation of reduced **3b** in the crude mixture.

The ^{1}H NMR of the reaction mixture where **3b** was tentatively employed as HAT reagent shows signals of the reduced species (**3b-red**). Isolation of this compound was not possible, probably due to high instability.





3b-red

6. Cyclovoltammetry Experiments

Full cyclovoltammetric characterization and discussion. To gain further insights on the electrochemical behaviour of the redox-active N-hydroxyphthalimide derivatives **3** and the substrates involved in the further reactive steps, cyclic voltammetry experiments were carried out in ACN with TBAPF6 as the supporting electrolyte (Figure S2). Both *RAC* **3d** and redox-active ester **3a** showed very similar redox behaviour, with a first chemically irreversible reduction process with cathodic peaks (E_{pc}) at -1.26 and -1.24 V vs. SCE at a scan rate of 1 V/s, respectively. A second reduction process is also observed with $E_{1/2}$ = -2.15 and -2.13 V vs. SCE for **3d** and **3a**, respectively. This process attains chemical reversibility at scan rates higher than 0.5 V/s for both **3d** and **3a**. In agreement with literature reports,[9] the first reduction process is likely localized on the phthalimide fragment, and it is followed by the N-O bond cleavage with formation of phthalimide anion and neutral radical $tBuOCO_2^{\bullet}$ (**3d**) and $Me^{\bullet}$ (**3a**). The second electron transfer process corresponds to the reduction of the phthalimide anion to dianion, as expected from similar compounds. On the other hand, ether **3b** displays two reduction processes which attain chemical reversibility at scan rates higher than 1 V/s. Compared to **3d** and **3a**, **3b** is characterized by a first reduction process at more negative potentials ($E_{1/2}$ = -1.43 V *v*s SCE) that is not followed by a chemical reaction. Therefore, **3b** is not suitable for its application in the described reaction protocol, not delivering the desired alkoxy radical, useful for the HAT process. Furthermore, MBH acetate **1a** shows a more negative and chemically irreversible reduction process with E_{pc} = -2.08 V *vs* SCE at a scan rate of 3 V/s, and it is therefore out of the available range of applied potentials to perform a redox-driven chemical initiation, in competition with *N*-hydroxyphthalimide derivatives **3**. No significant oxidation processes were identified for any compound in the available potential window.

To find additional insights on the reasons why di-*tert*butyl peroxide **3e** did not promote the desired reaction machinery, we conducted a CV experiment, analogous to the ones reported in the main text. This species is characterised by more negative and chemically irreversible reduction processes with E_{pc}= -2.61 V *vs* SCE[10] at scan rate of 0.2 V/s and is therefore out of the available range of applied potentials to perform the described redox-driven chemical initiation. Importantly, cathodic reduction of MBH acetate **1a** is supposed to occur more easily than the reductive cleavage of the O-O bond of **3e**. This is in line with the observation of substantial amounts of byproduct **5** in the reaction run in its presence (see **Table S1**, entry 5). **Figure S2** shows the CV profiles of **3e**, together with the ones shown in the main text, for comparison.

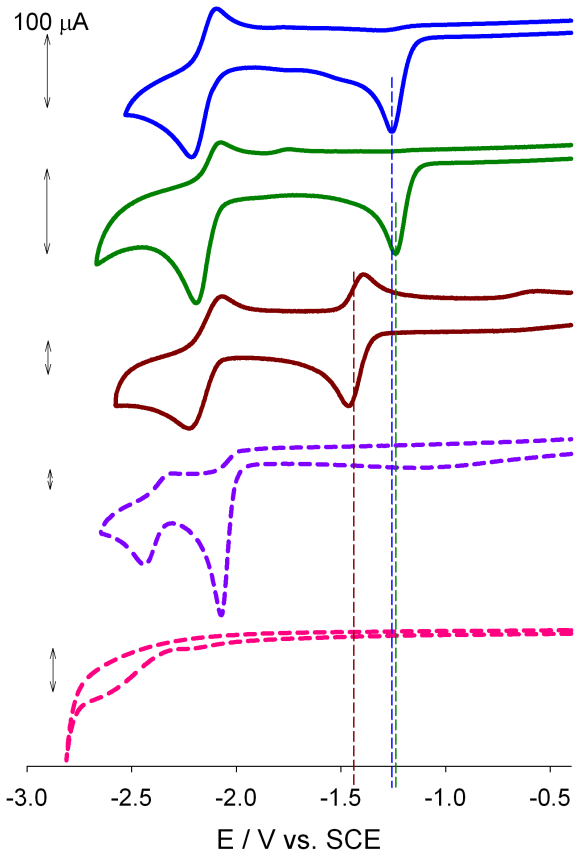


Figure S2. Comparison between reduction waves in CH_3CN for **3d** (blue line; 1.0 mM, scan rate 1 V/s), **3a** (green line; 1.1 mM, scan rate 1 V/s), **3b** (brown line; 1.1 mM, scan rate 5 V/s), **1a** (dashed purple line; 1.0 mM, scan rate 3 V/s) and **3e** (dashed pink line; 2.2 mM, 0.2 V/s). Vertical arrows indicate a 100 μA current.

By analyzing the evolution of voltammograms upon consecutive additions of 1,3-benzodioxole **2g** to a solution of **3d** in CH_3CN we had no clear indication of any interaction between the two upon the reduction of the latter, with its peak positions not significantly affected even at high concentration of **2g** (ca. 50 mM, **Figure S3**). Since the reduction peaks do not shift anodically, we can conclude that the presence of **2g** is not significantly affecting the rate of the N-O cleavage that follows the electrochemical reduction. The so-performed analysis is therefore not conclusive for a full description of the HAT process involved.

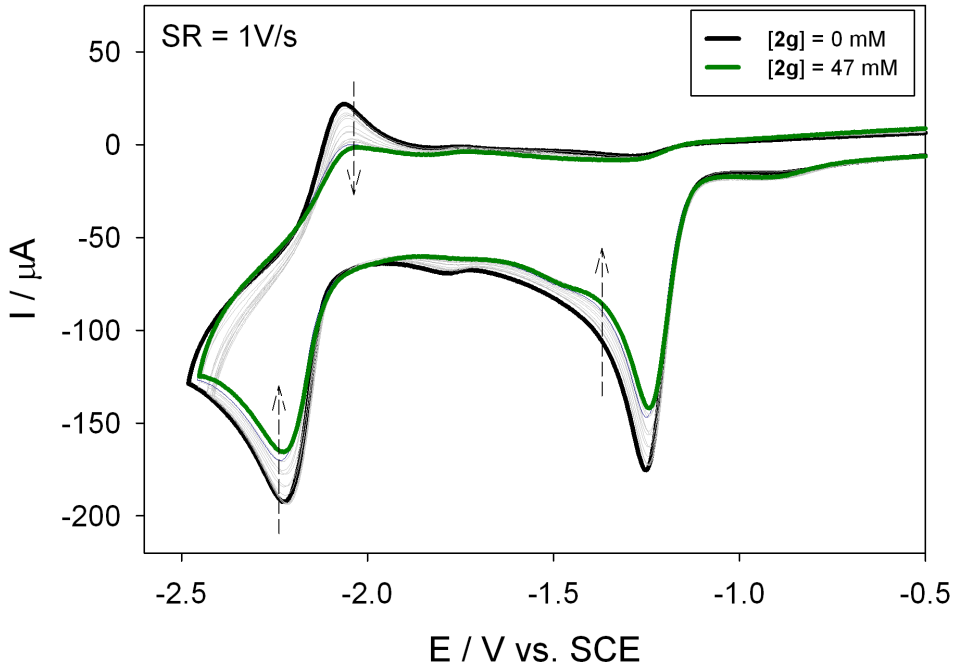
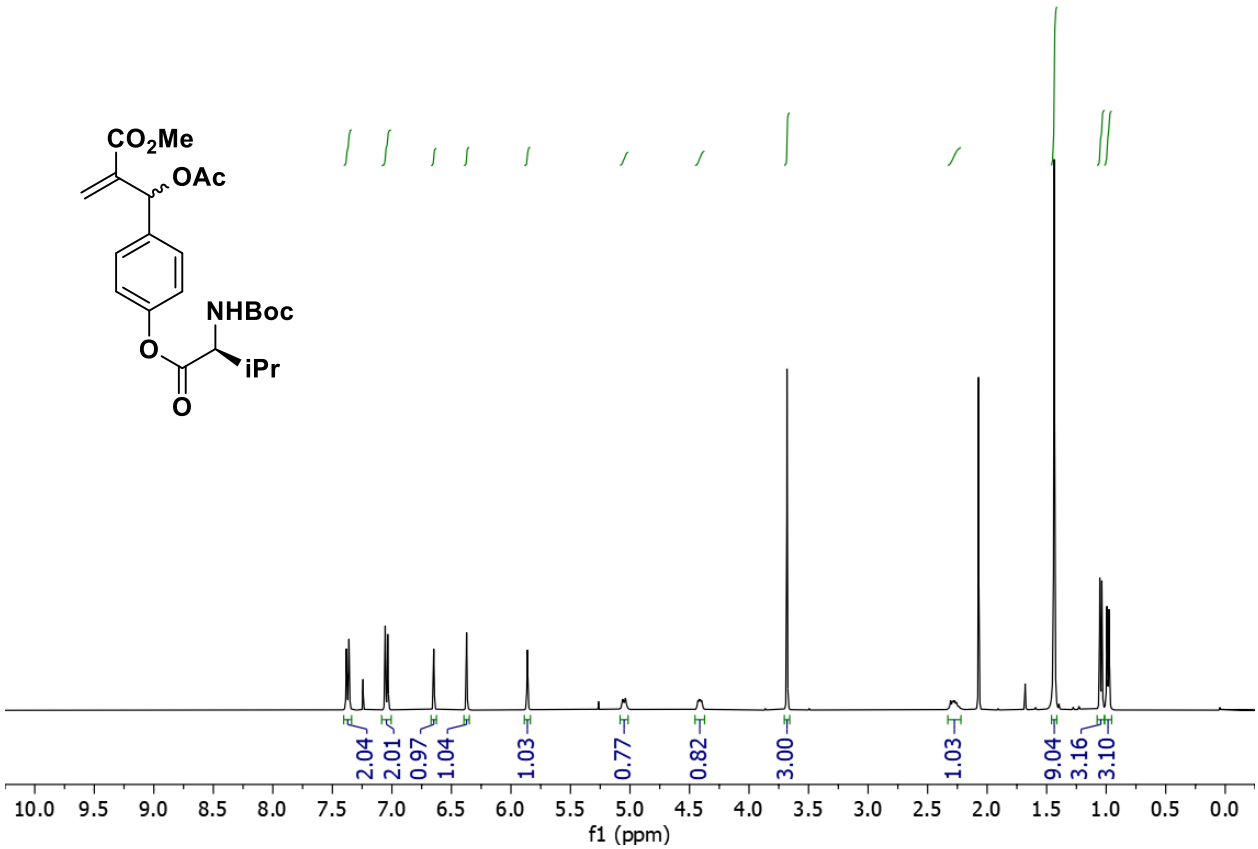


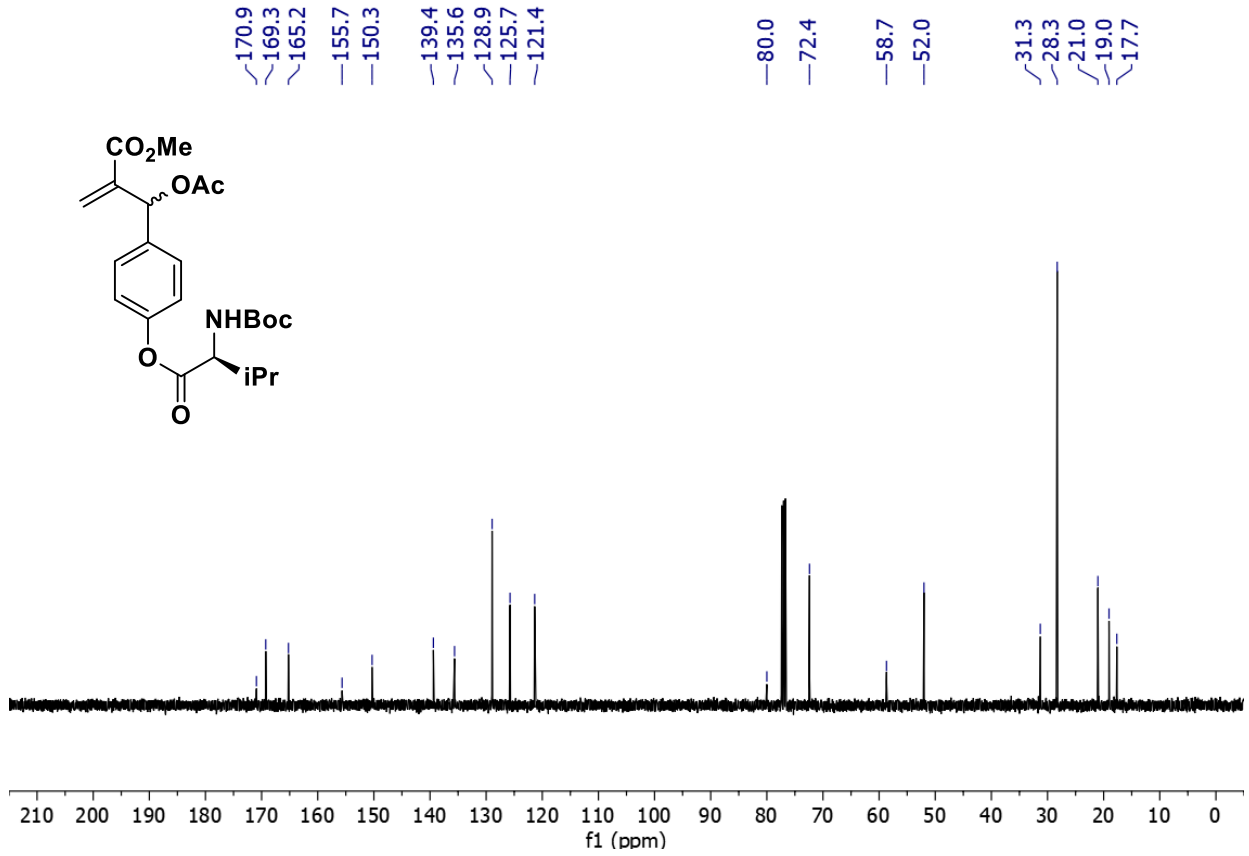
Figure S3. Evolution of voltammograms for a solution of **3d** (black line; 1.0 mM, scan rate 1 V/s) upon addition of increasing amounts of **2g** (up to 47 mM).

7. ^{1}H-, ^{19}F-, ^{13}C-NMR Spectra of New Compounds

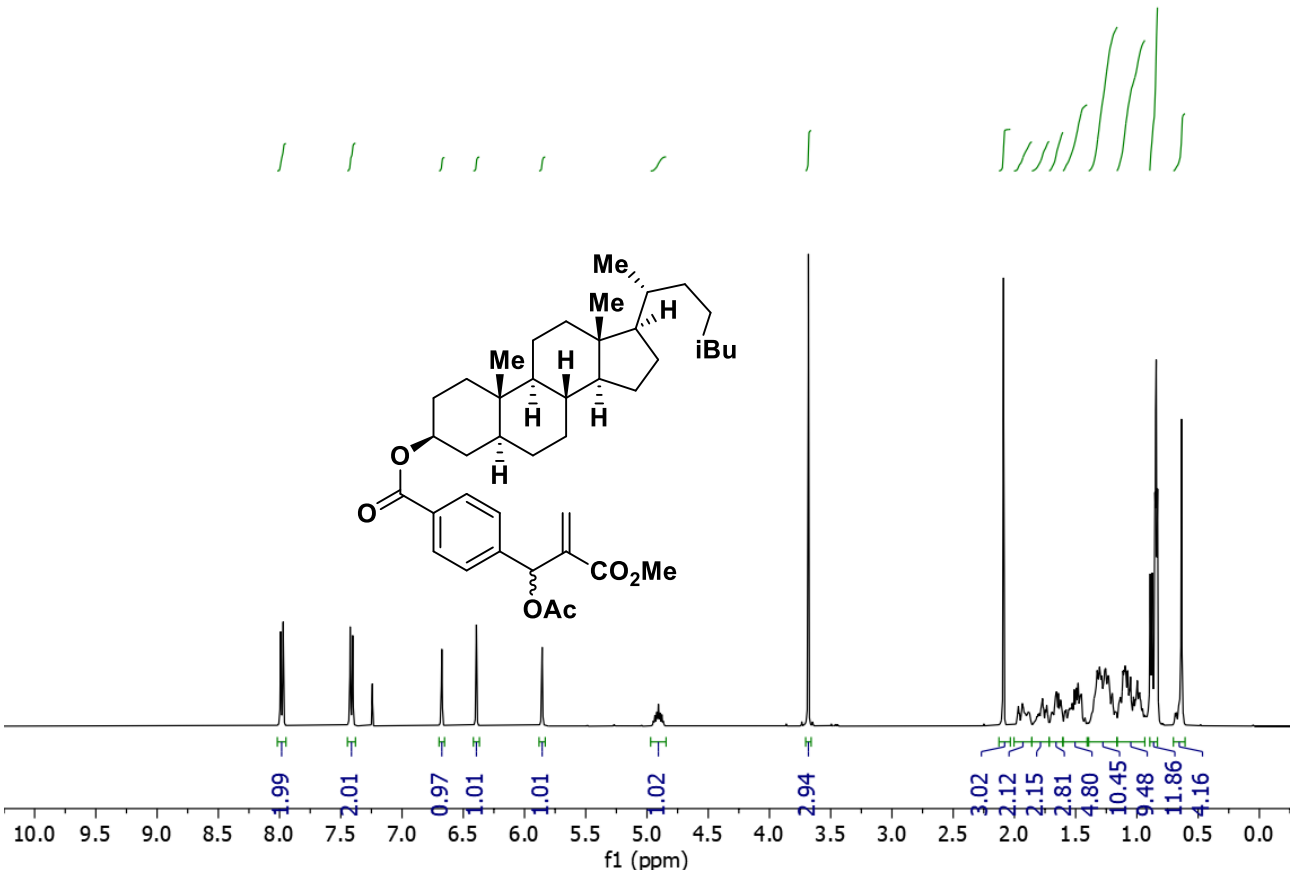
1w ^{1}H NMR (400 MHz, $CDCl_3$)



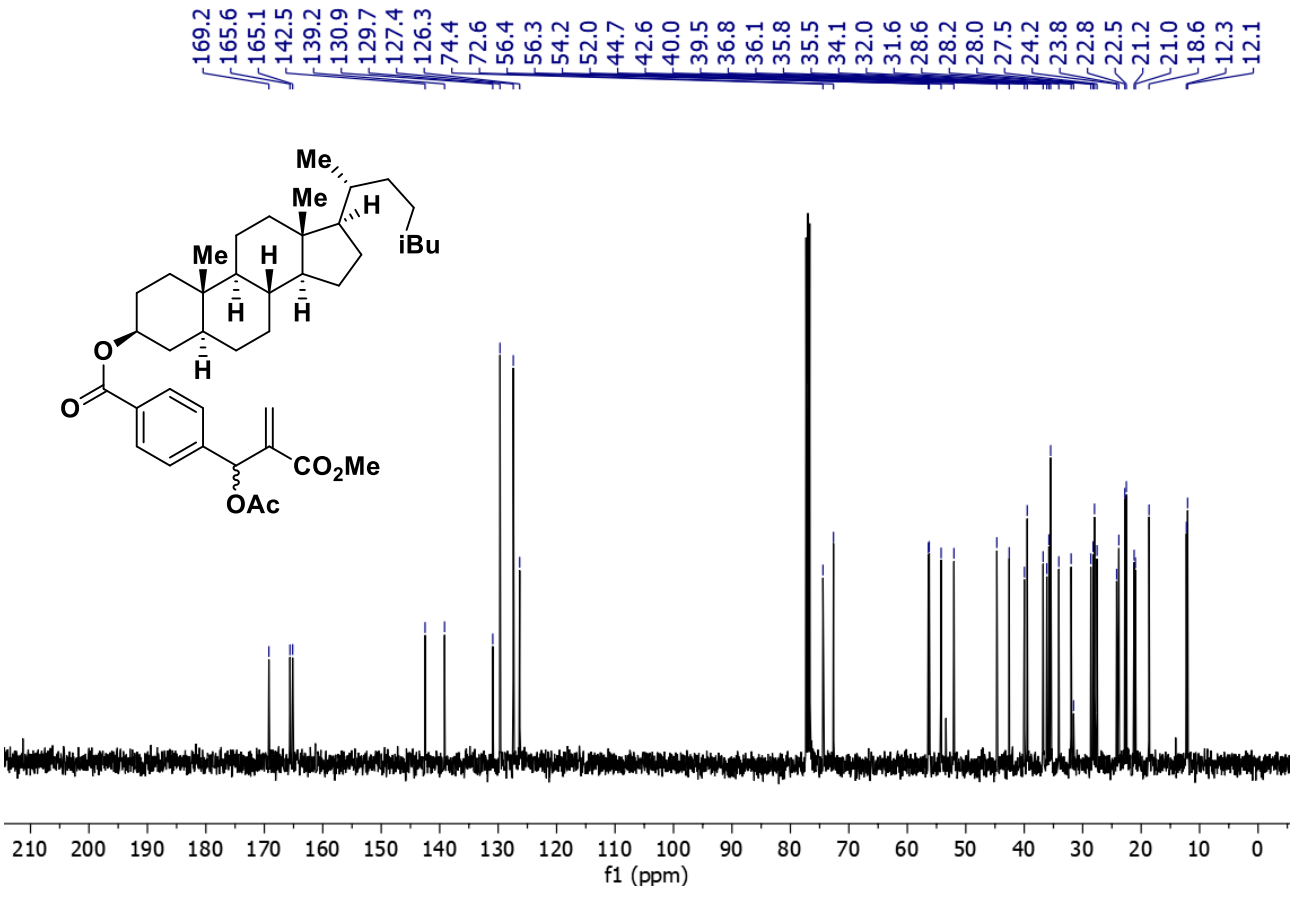
1w ^{13}C NMR (100 MHz, $CDCl_3$)



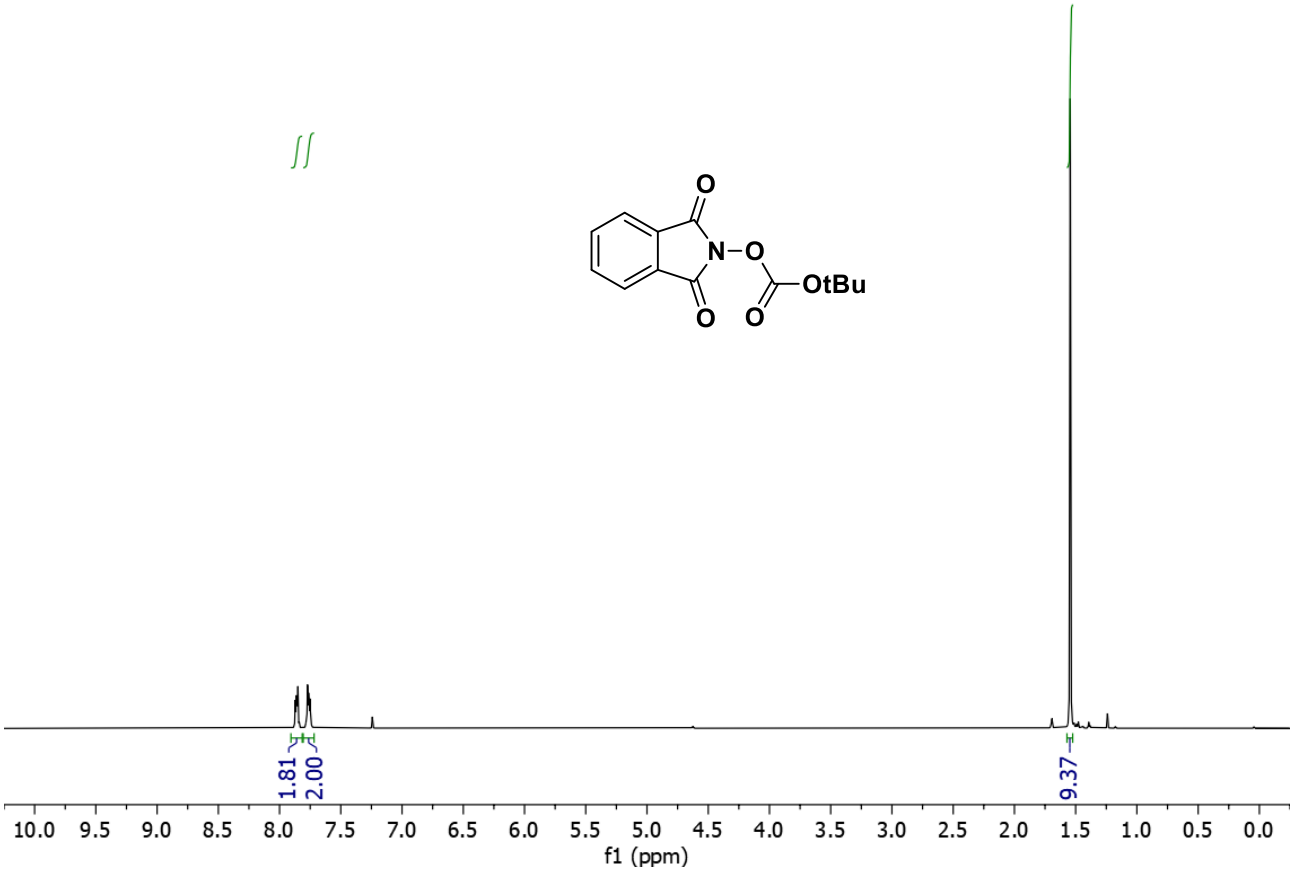
1x ^{1}H NMR (400 MHz, $CDCl_3$)



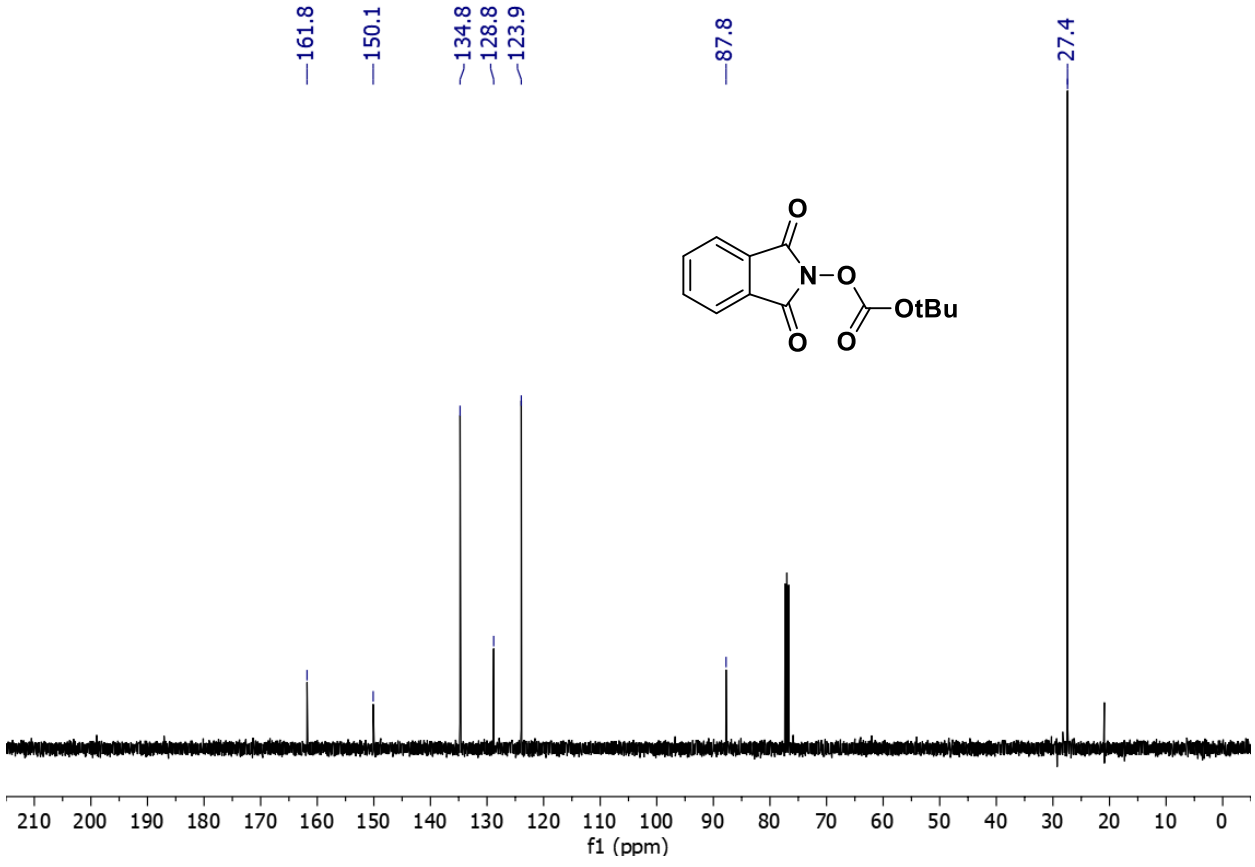
1w ^{13}C NMR (100 MHz, $CDCl_3$)



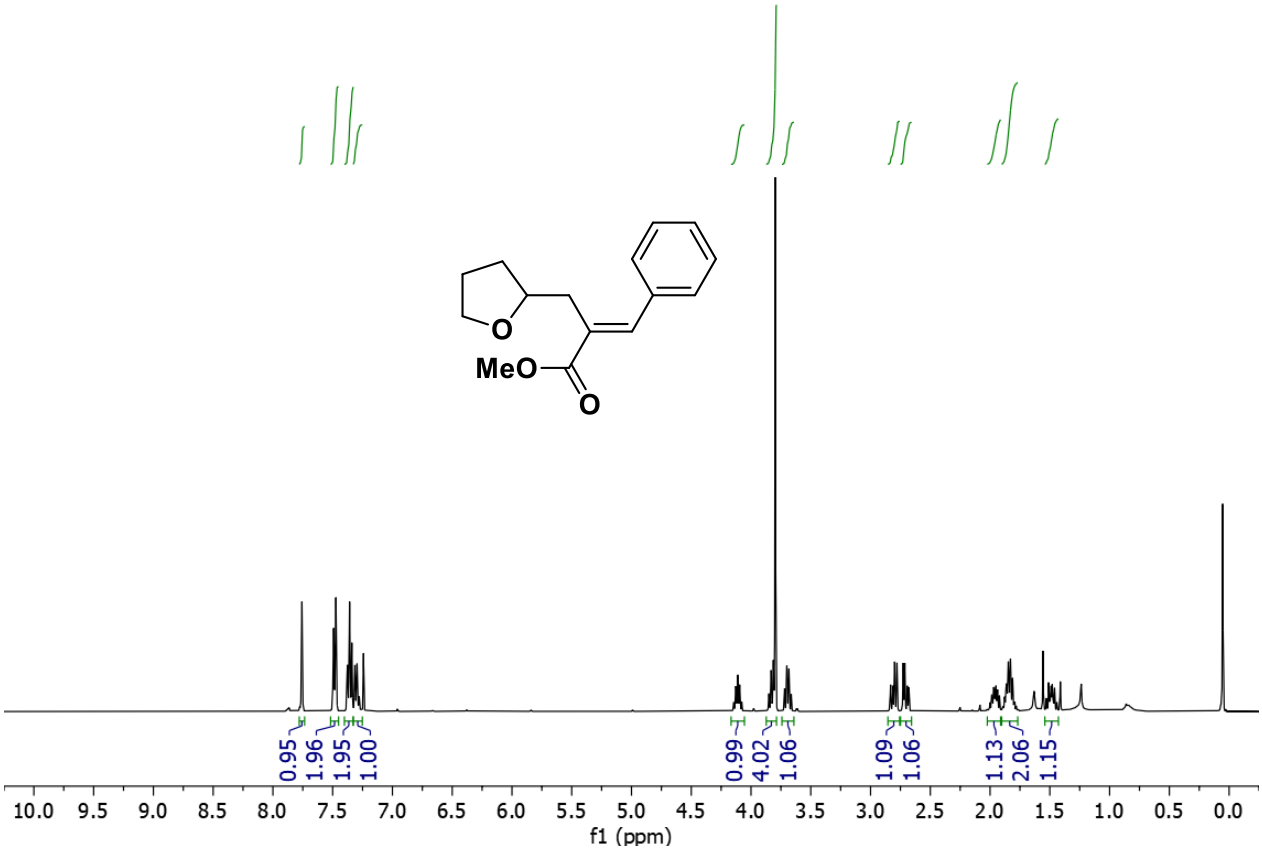
3d ^{1}H NMR (400 MHz, $CDCl_3$)



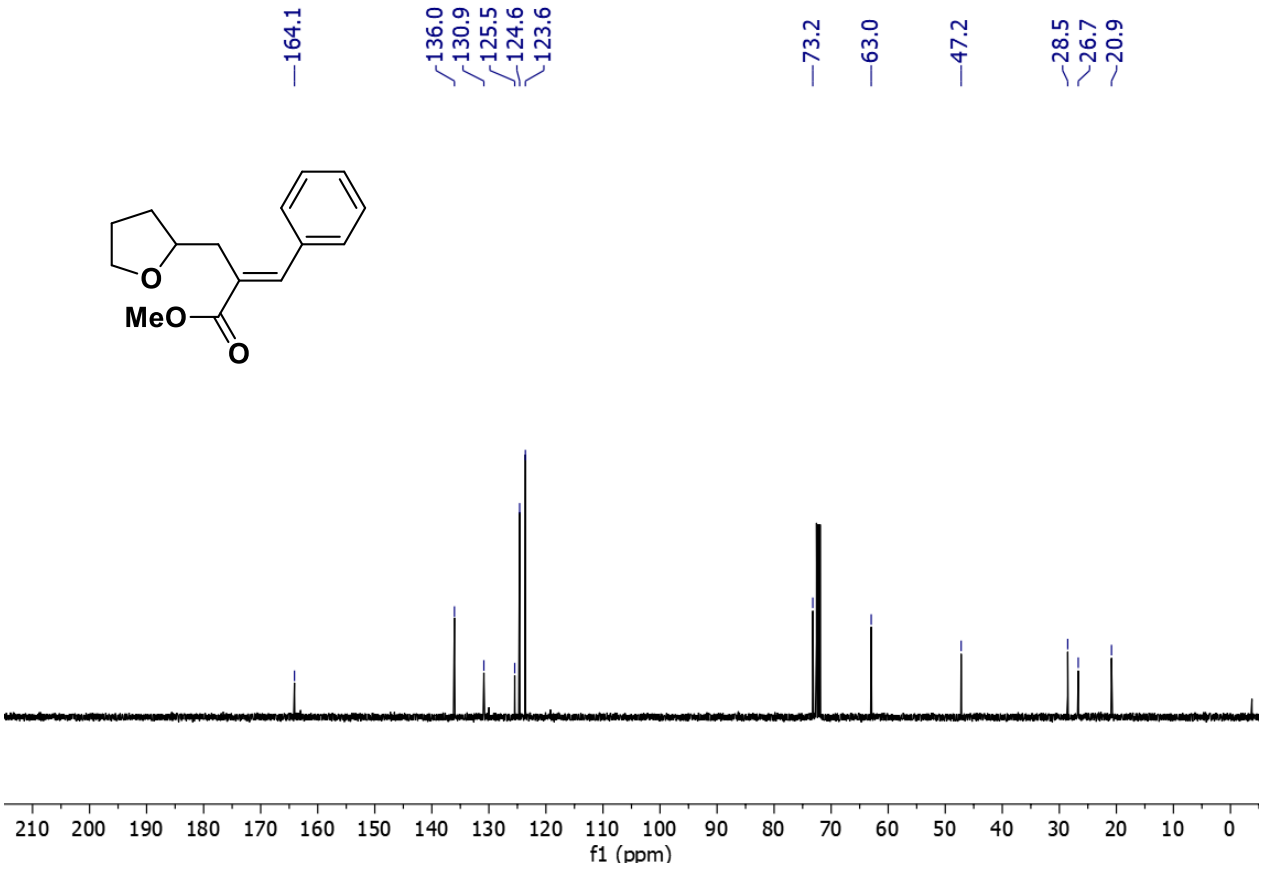
3d ^{13}C NMR (100 MHz, $CDCl_3$)



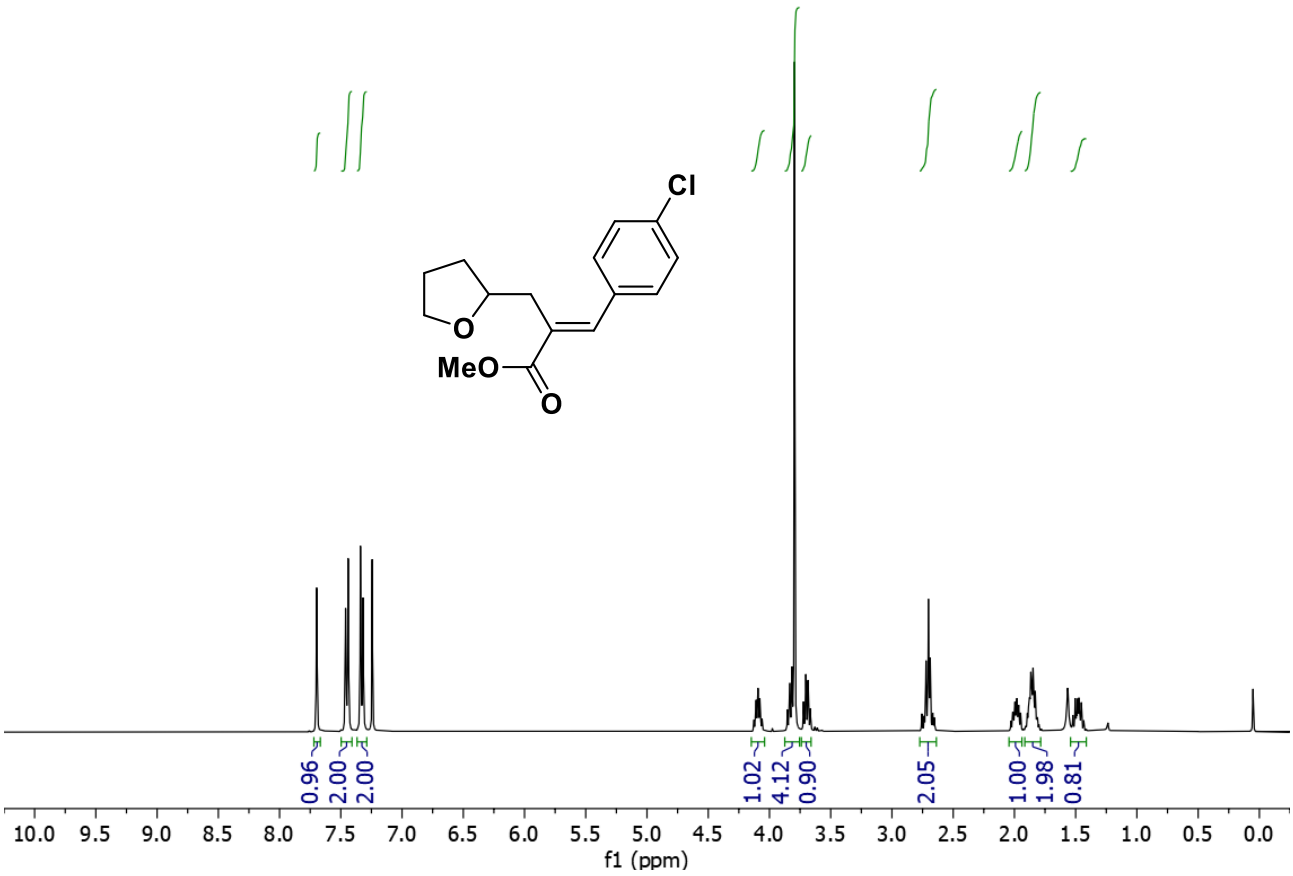
4aa ^{1}H NMR (400 MHz, $CDCl_3$)



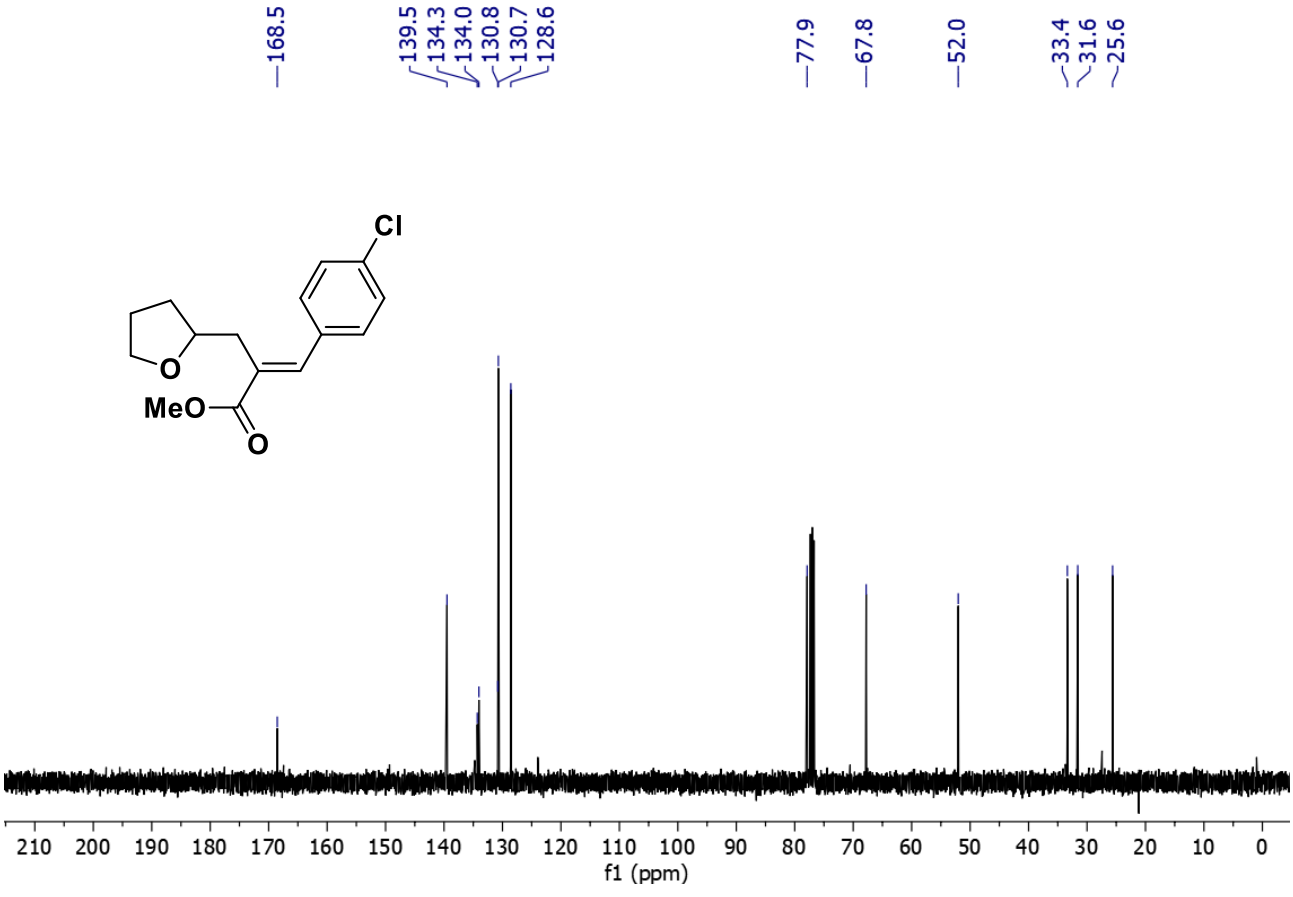
4aa ^{13}C NMR (100 MHz, $CDCl_3$)



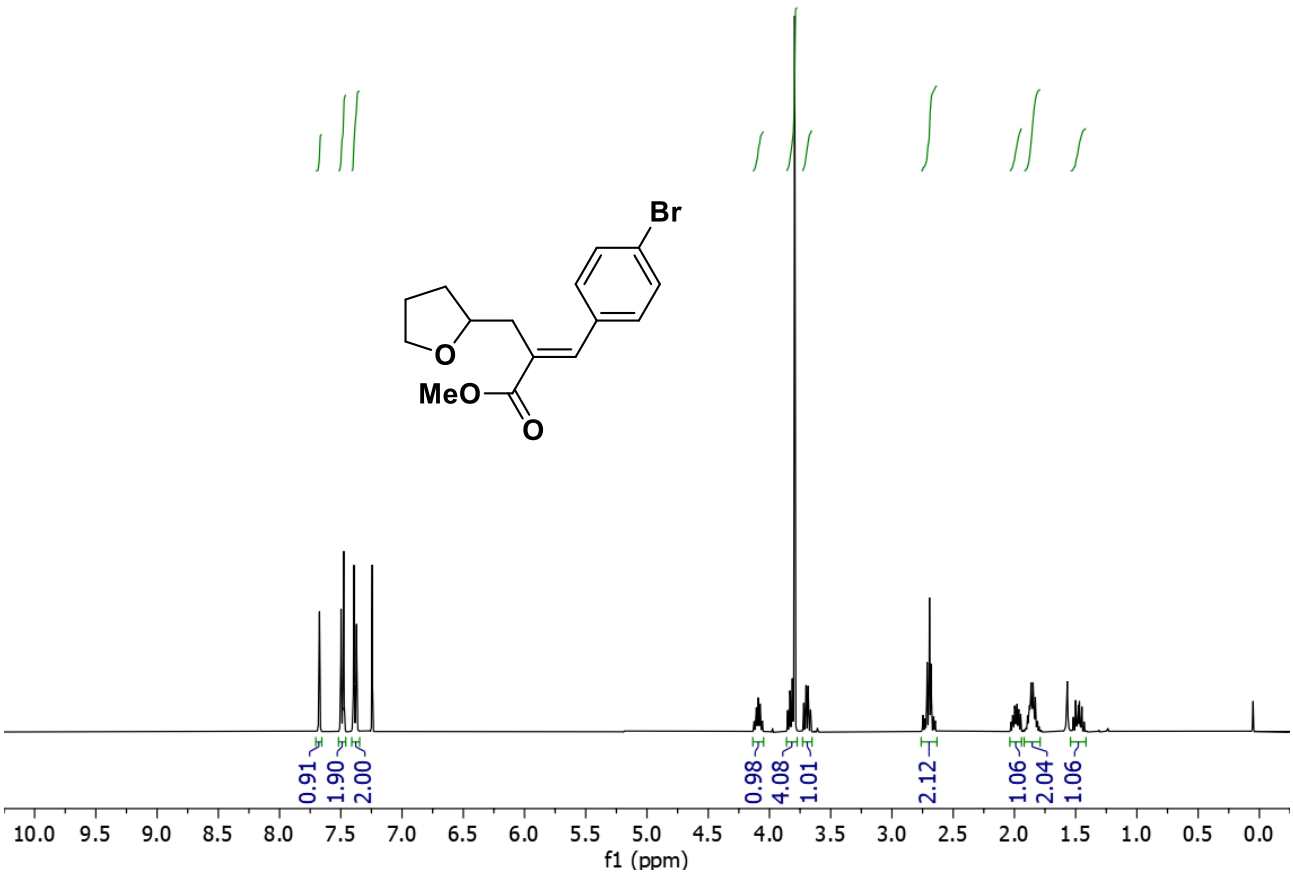
4ba ^{1}H NMR (400 MHz, $CDCl_3$)



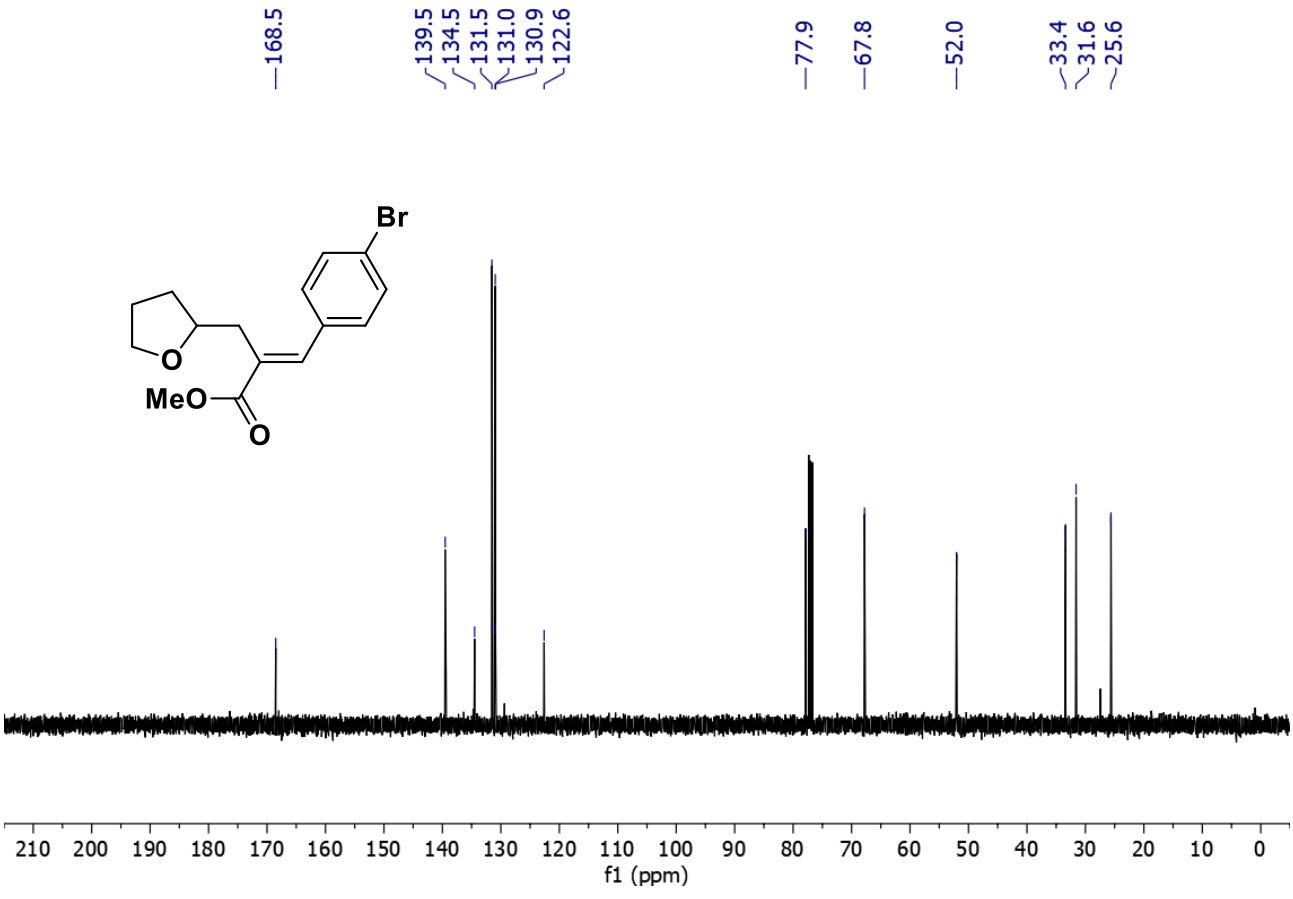
4ba ^{13}C NMR (100 MHz, $CDCl_3$)



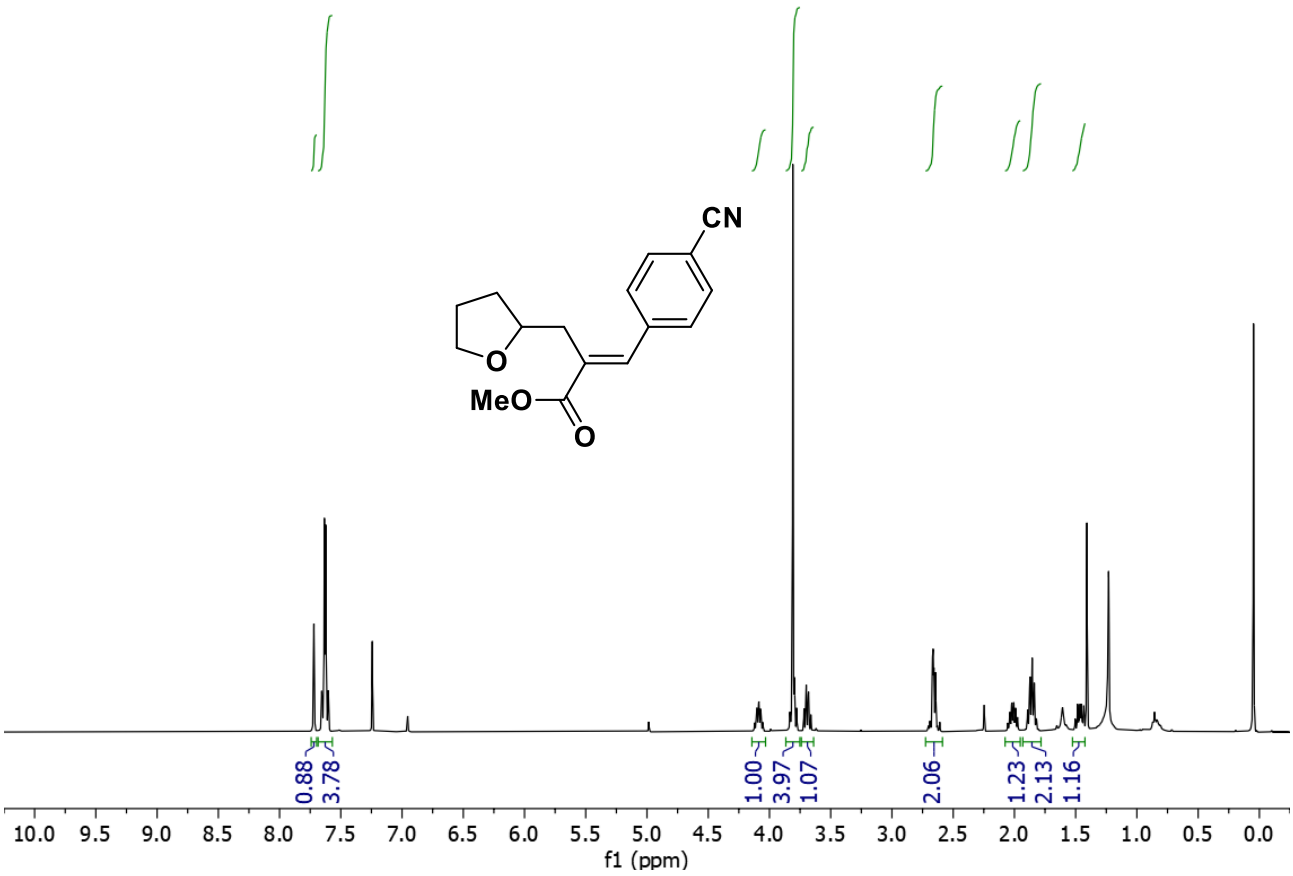
4ca ^{1}H NMR (400 MHz, $CDCl_3$)



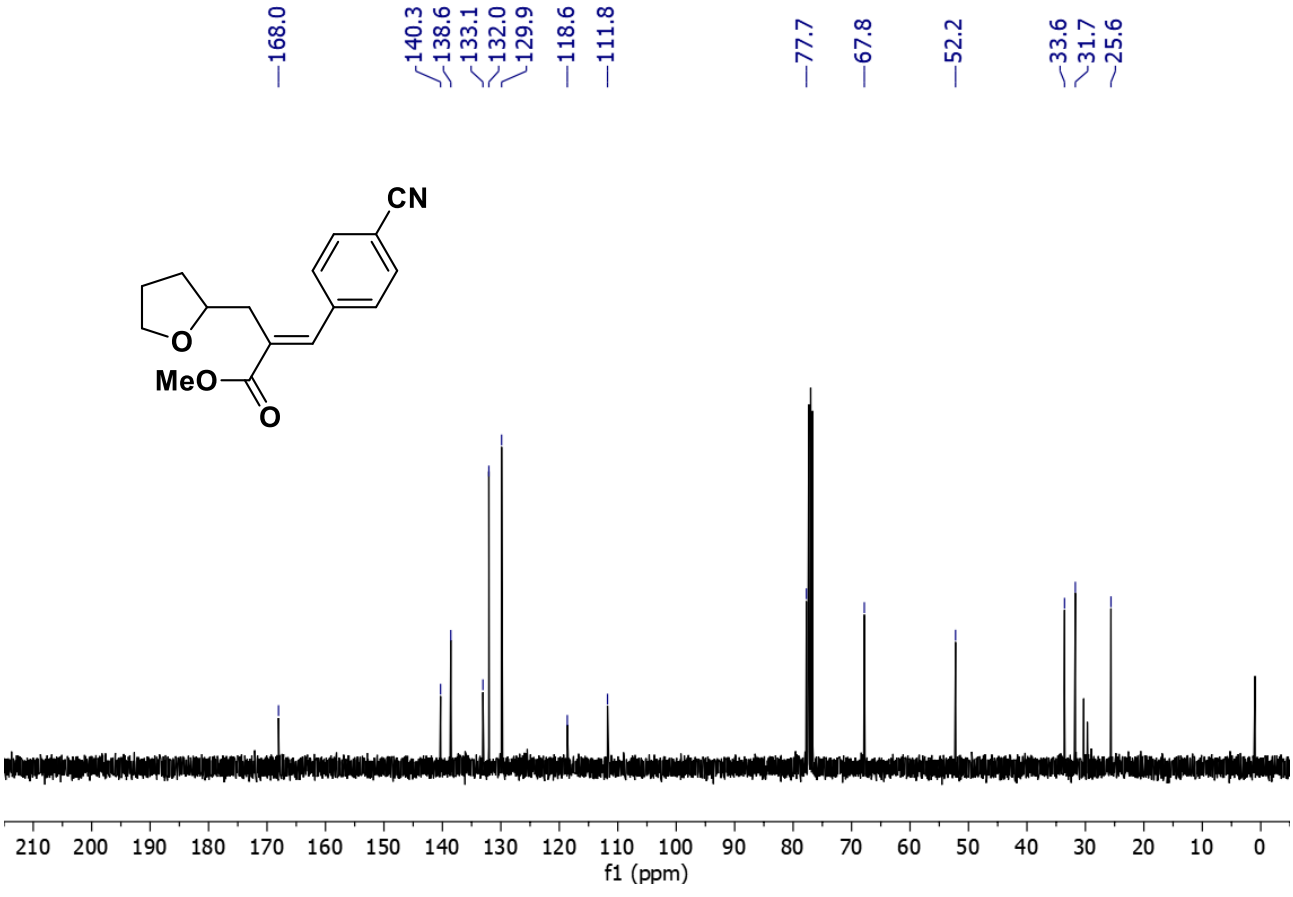
4ca ^{13}C NMR (100 MHz, $CDCl_3$)



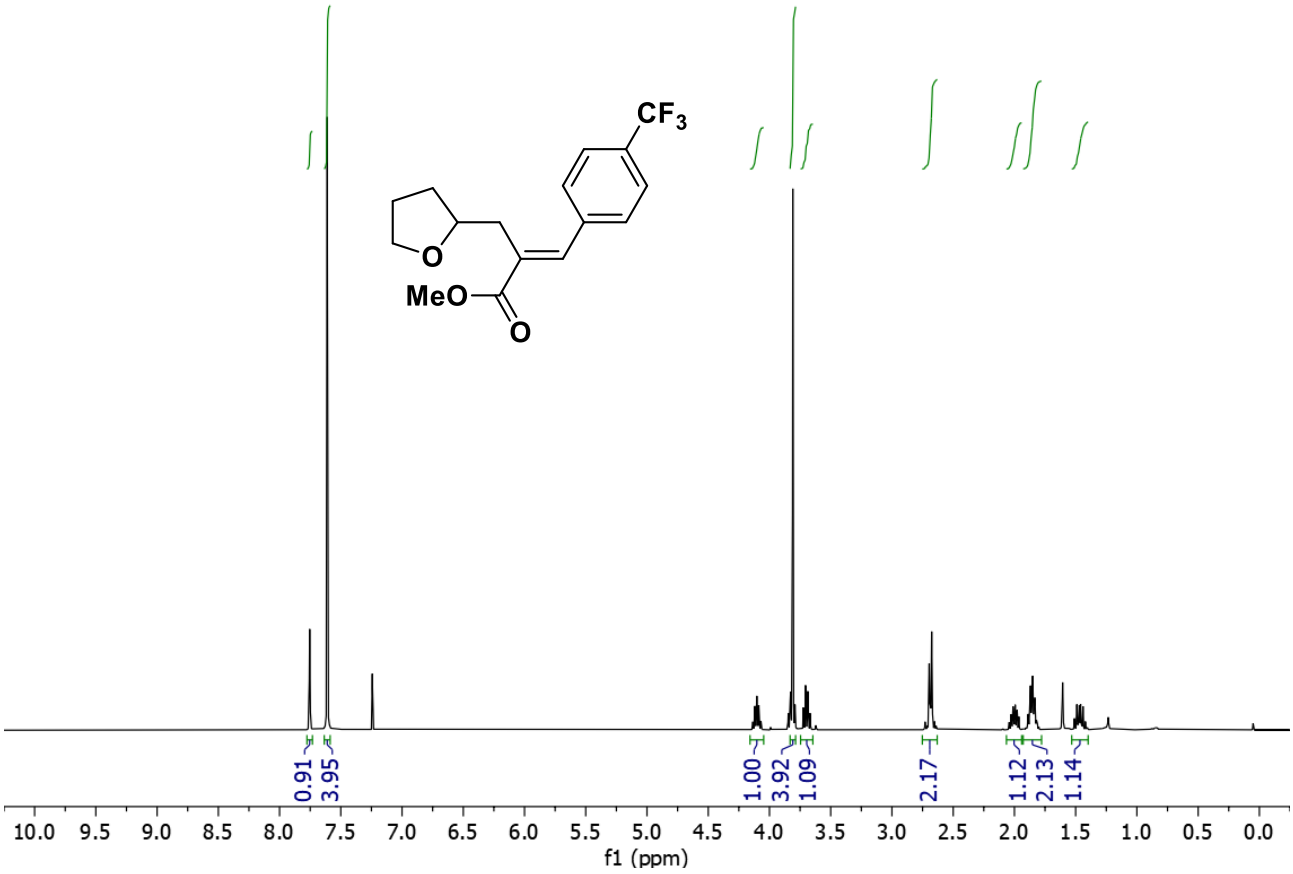
4da ^{1}H NMR (400 MHz, $CDCl_3$)



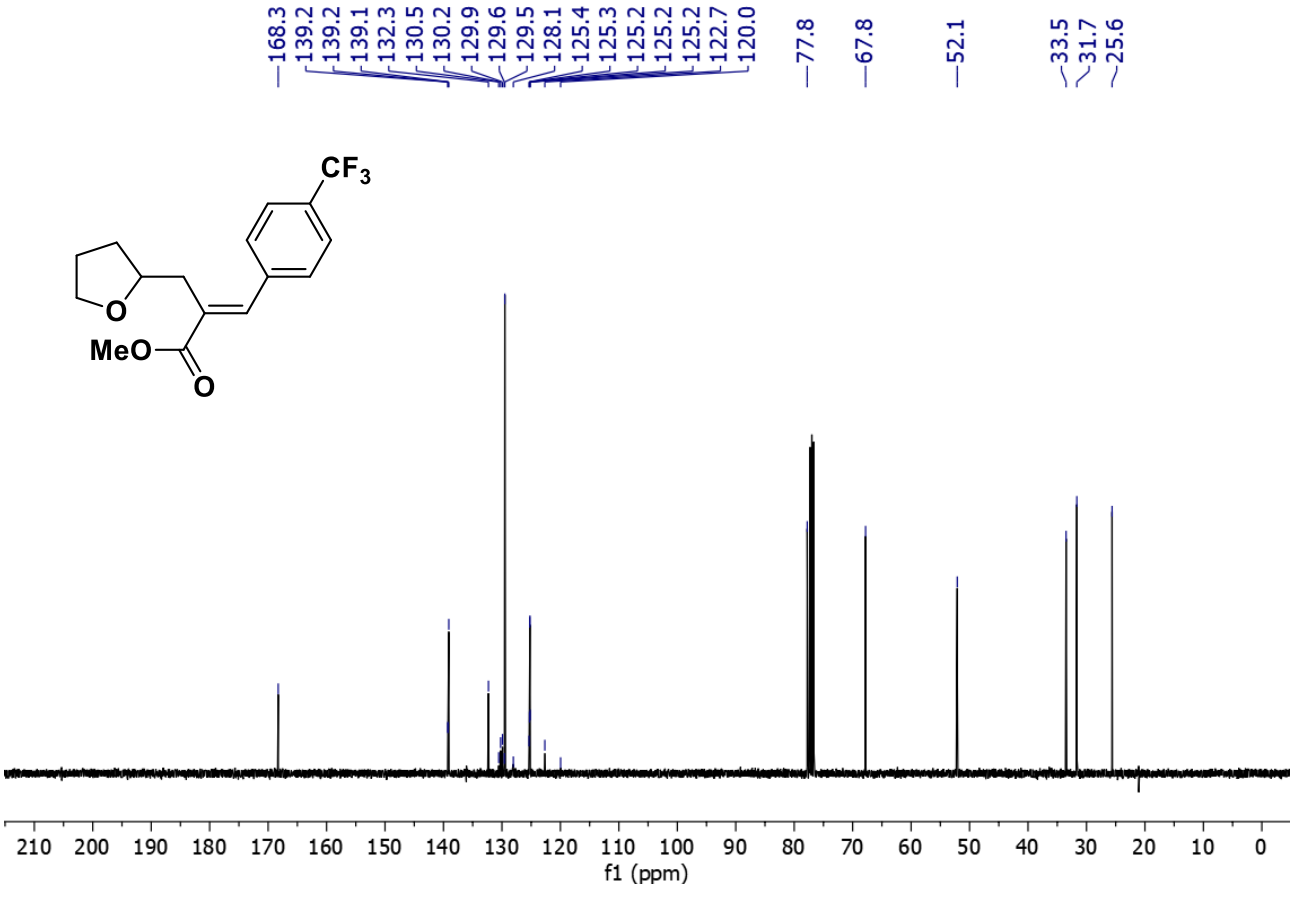
4da ^{13}C NMR (100 MHz, $CDCl_3$)



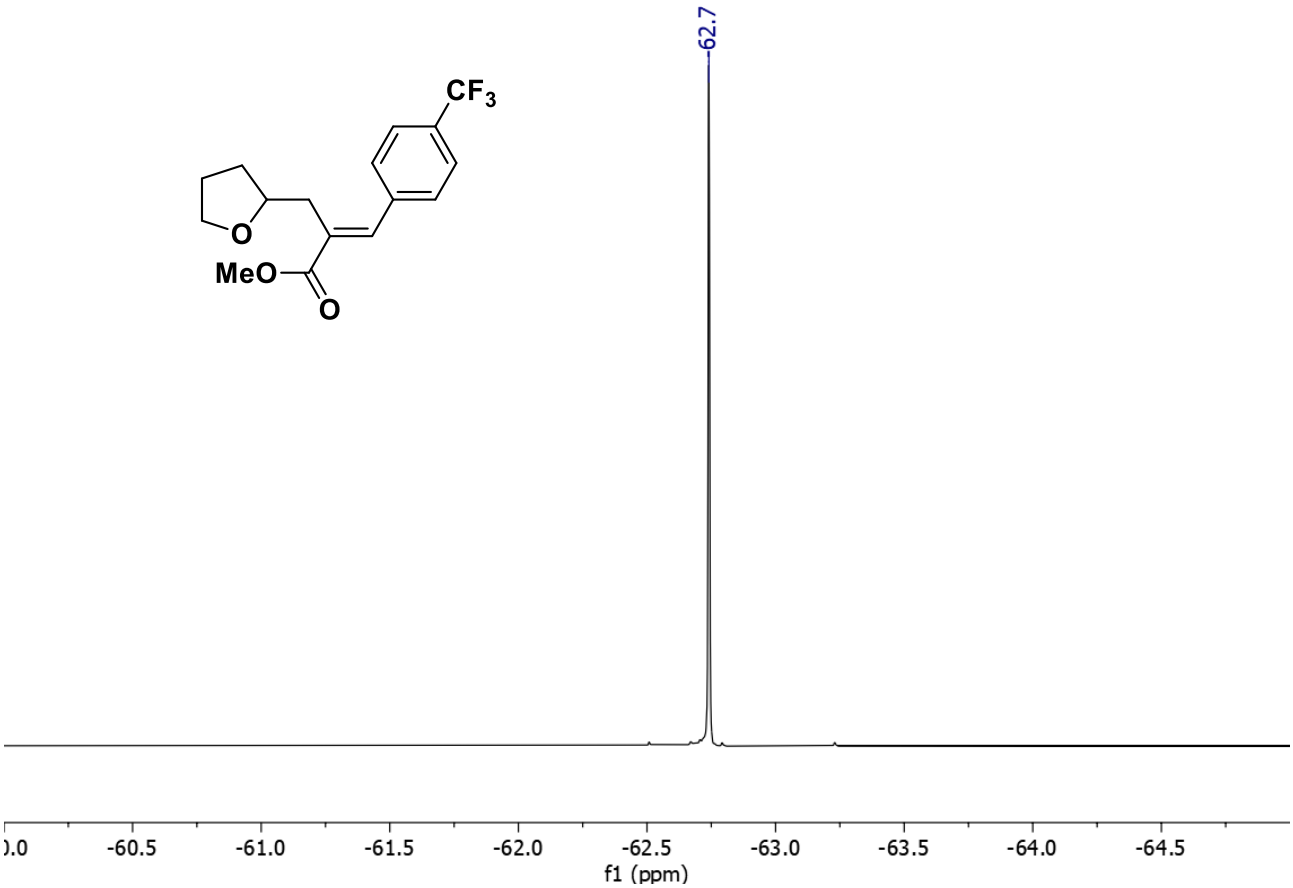
4ea ^{1}H NMR (400 MHz, $CDCl_3$)



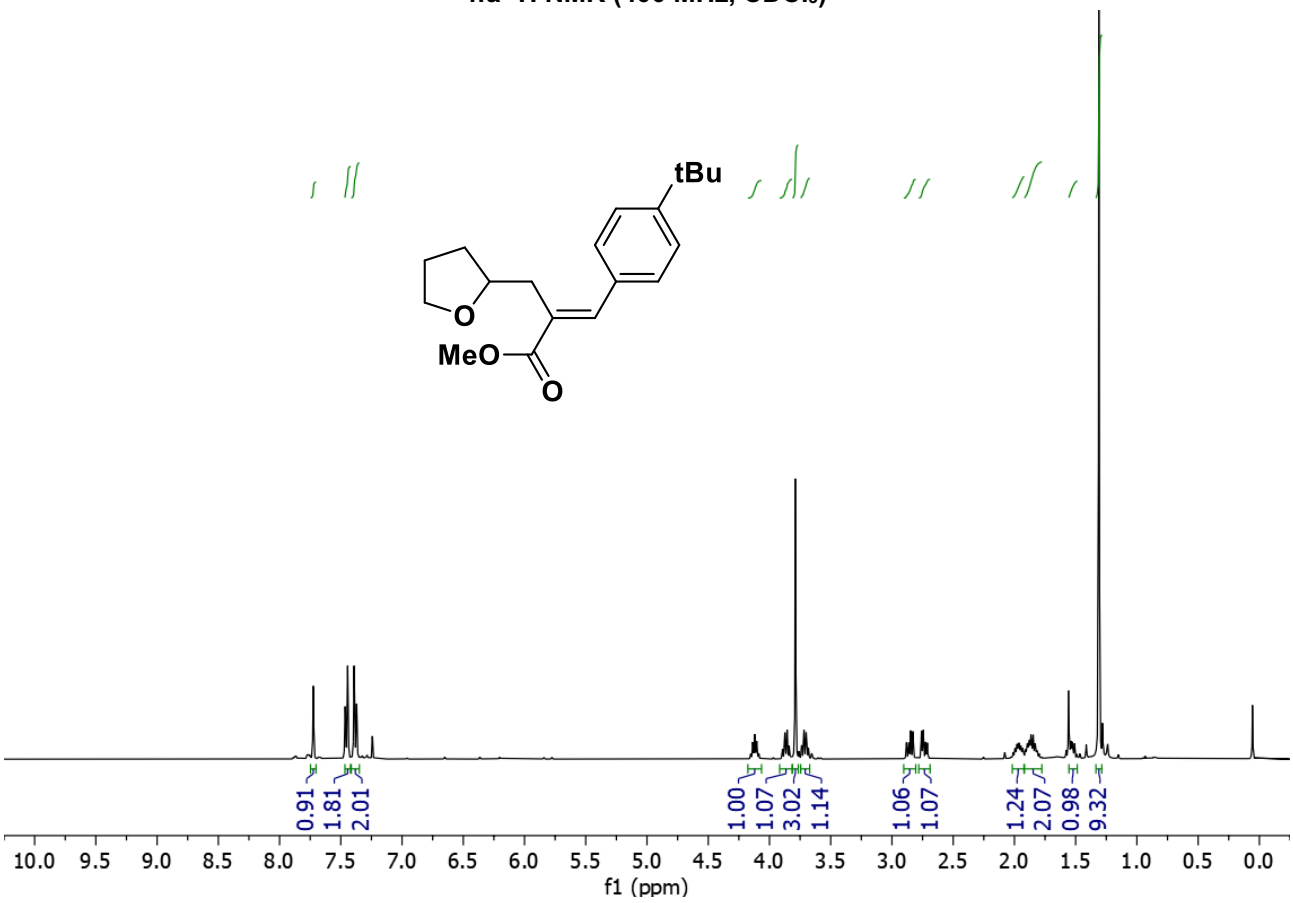
4ea ^{13}C NMR (100 MHz, $CDCl_3$)



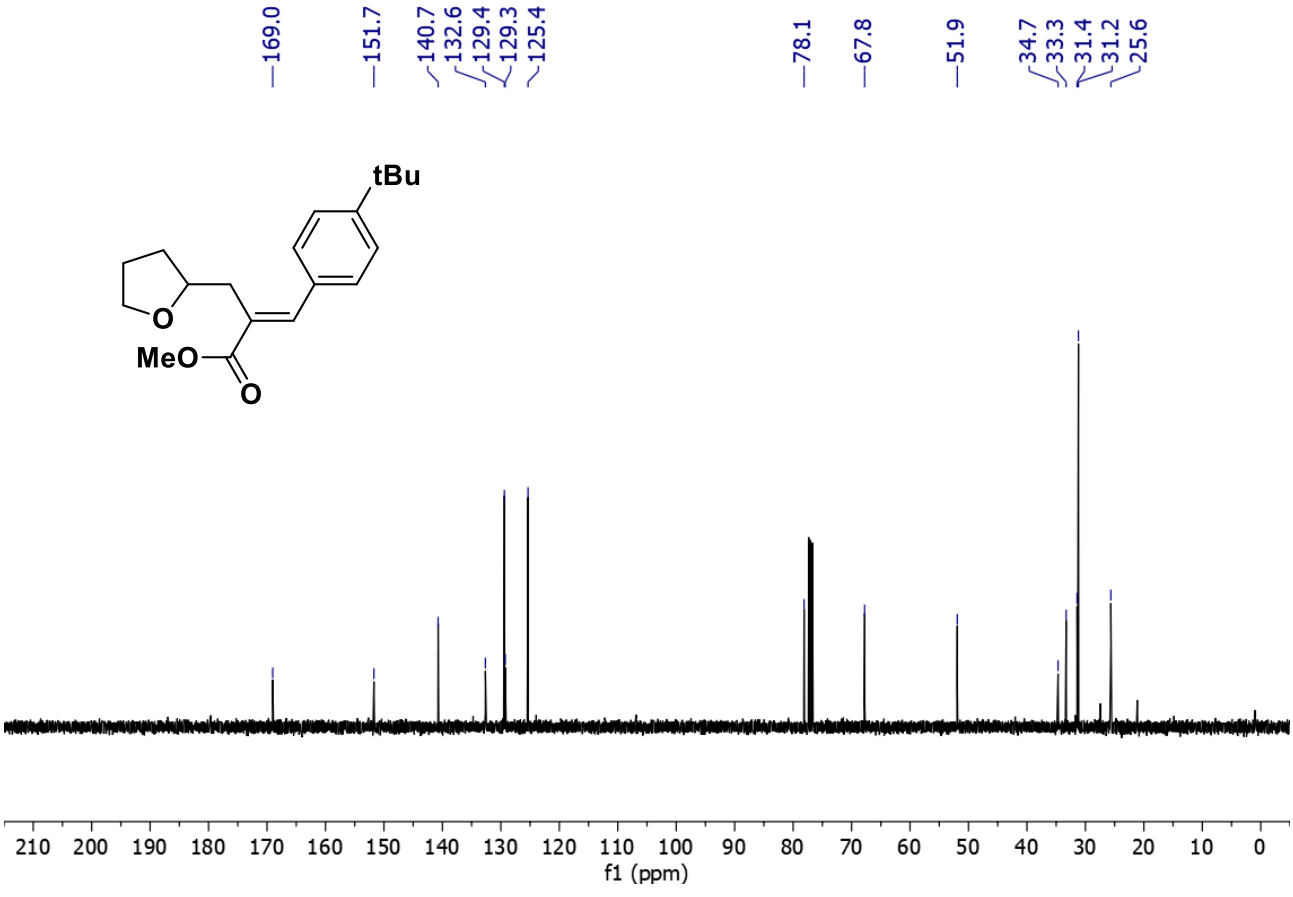
4ea ^{19}F NMR (376 MHz, $CDCl_3$)



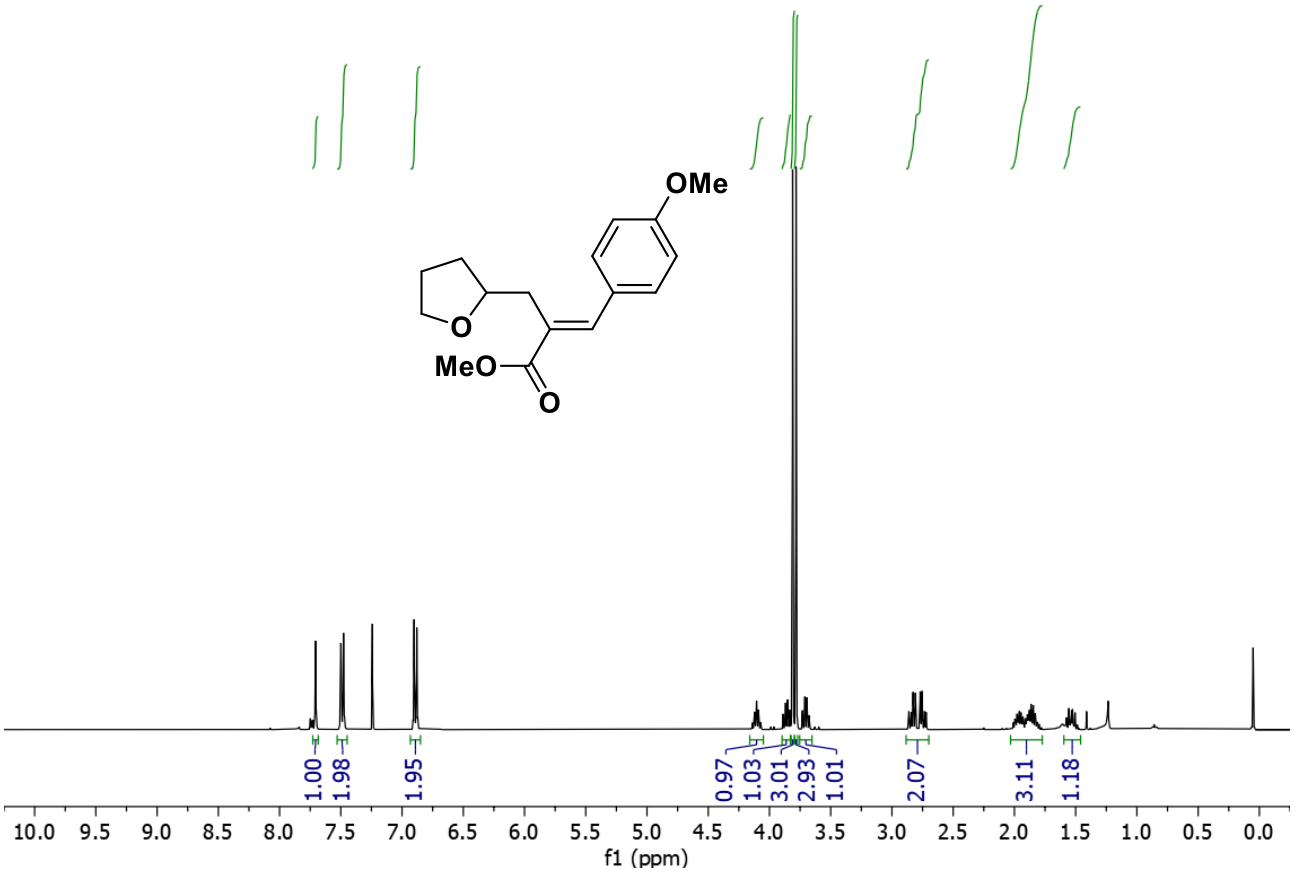
4fa ^{1}H NMR (400 MHz, $CDCl_3$)



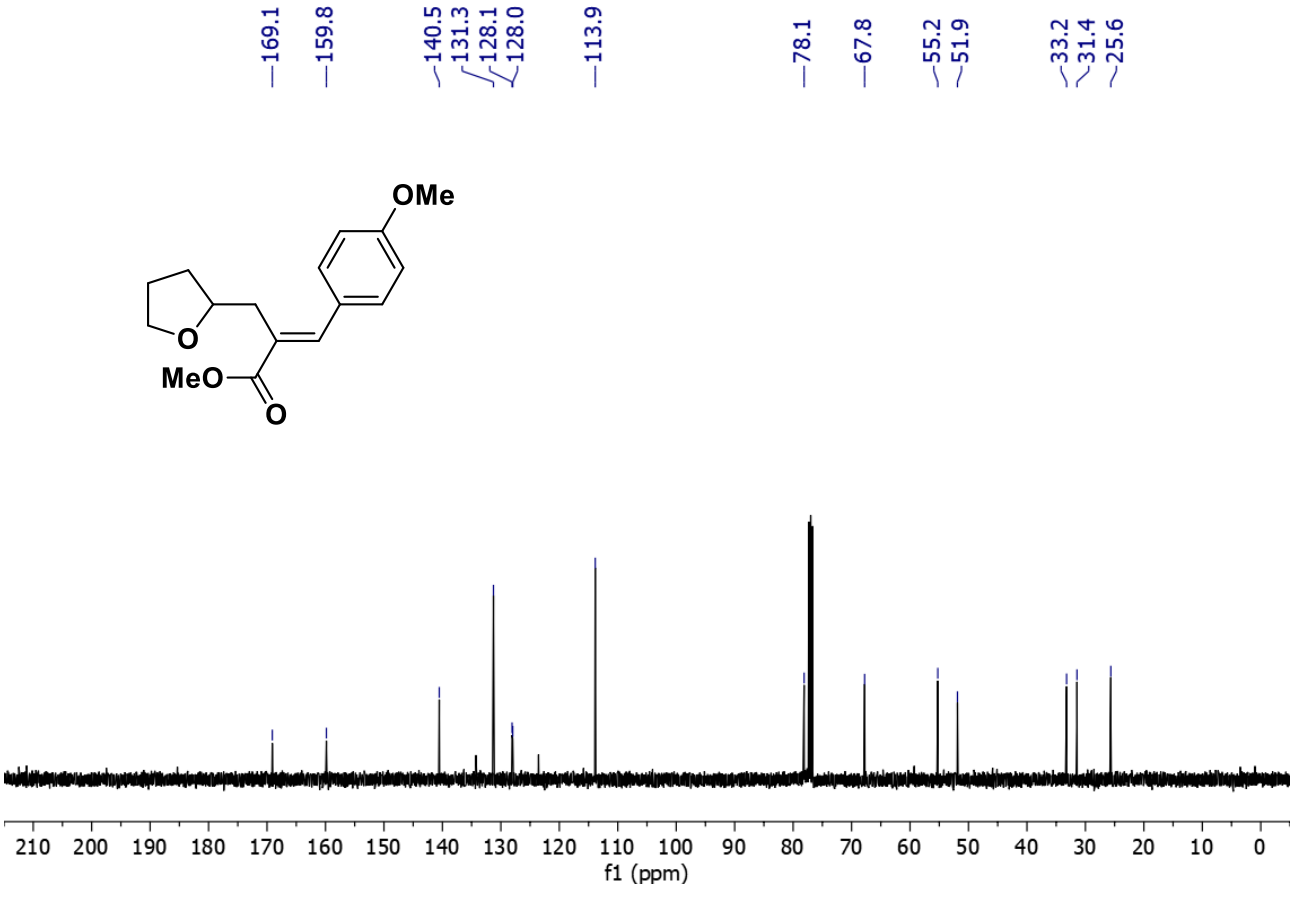
4fa ^{13}C NMR (100 MHz, $CDCl_3$)



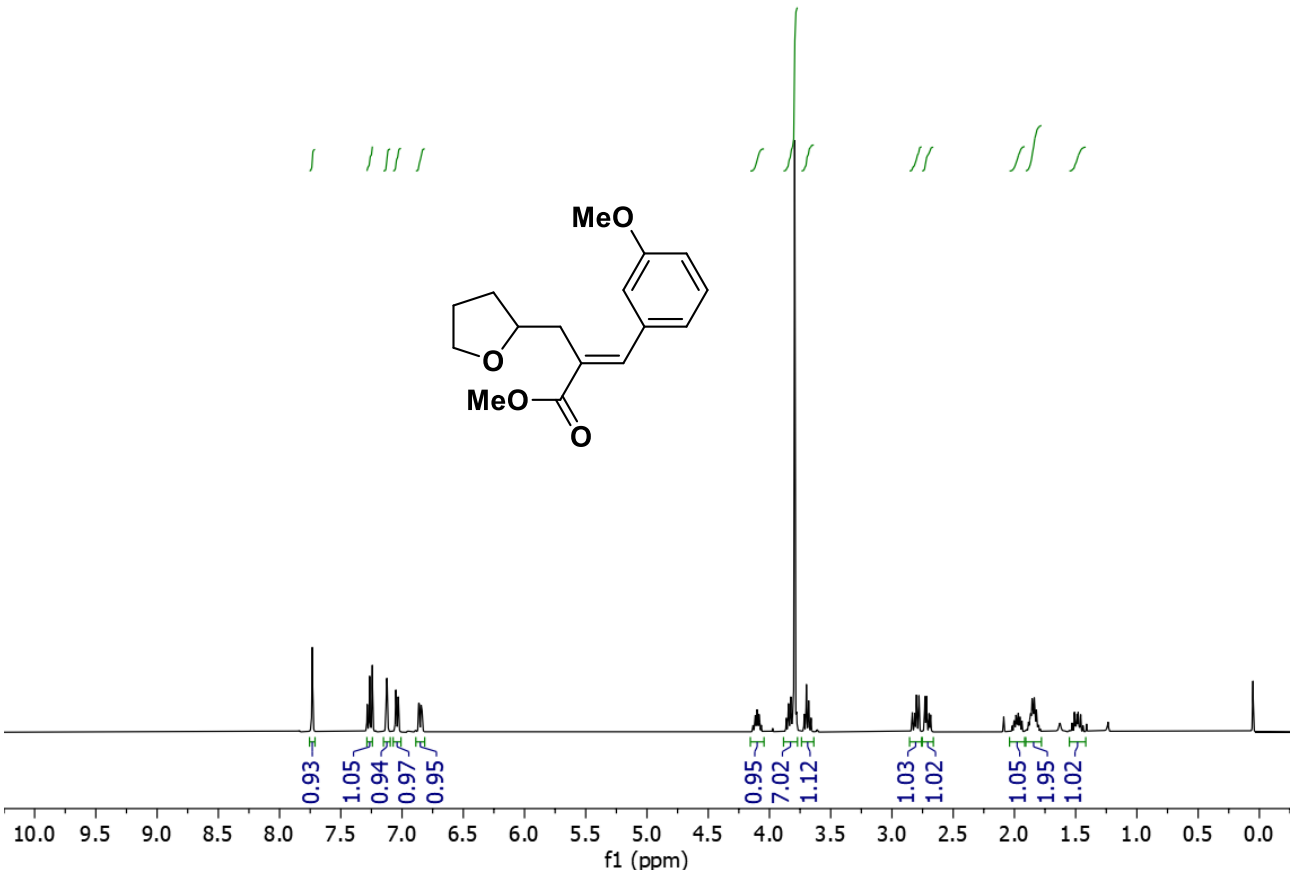
4ga ^{1}H NMR (400 MHz, $CDCl_3$)



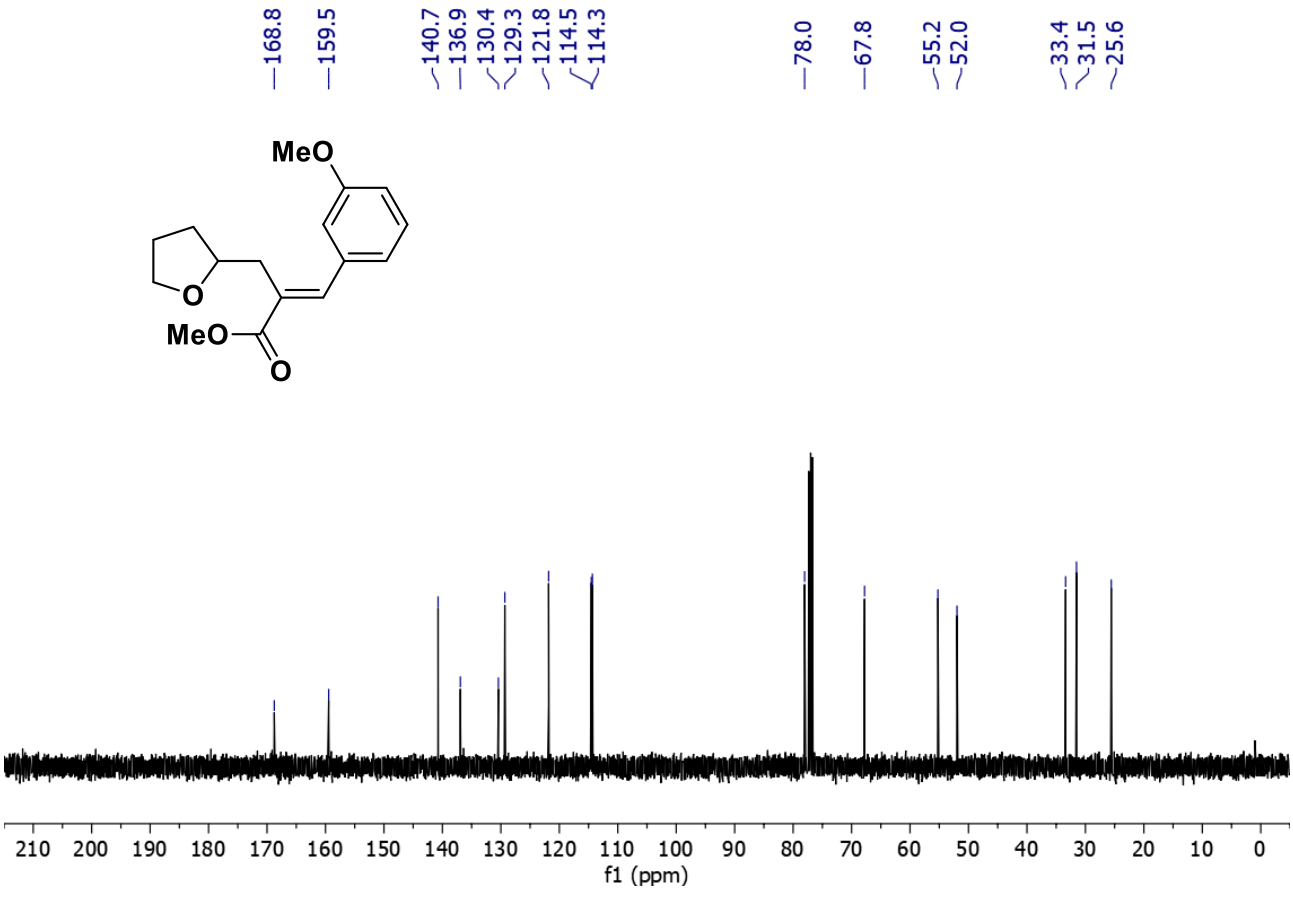
4ga ^{13}C NMR (100 MHz, $CDCl_3$)



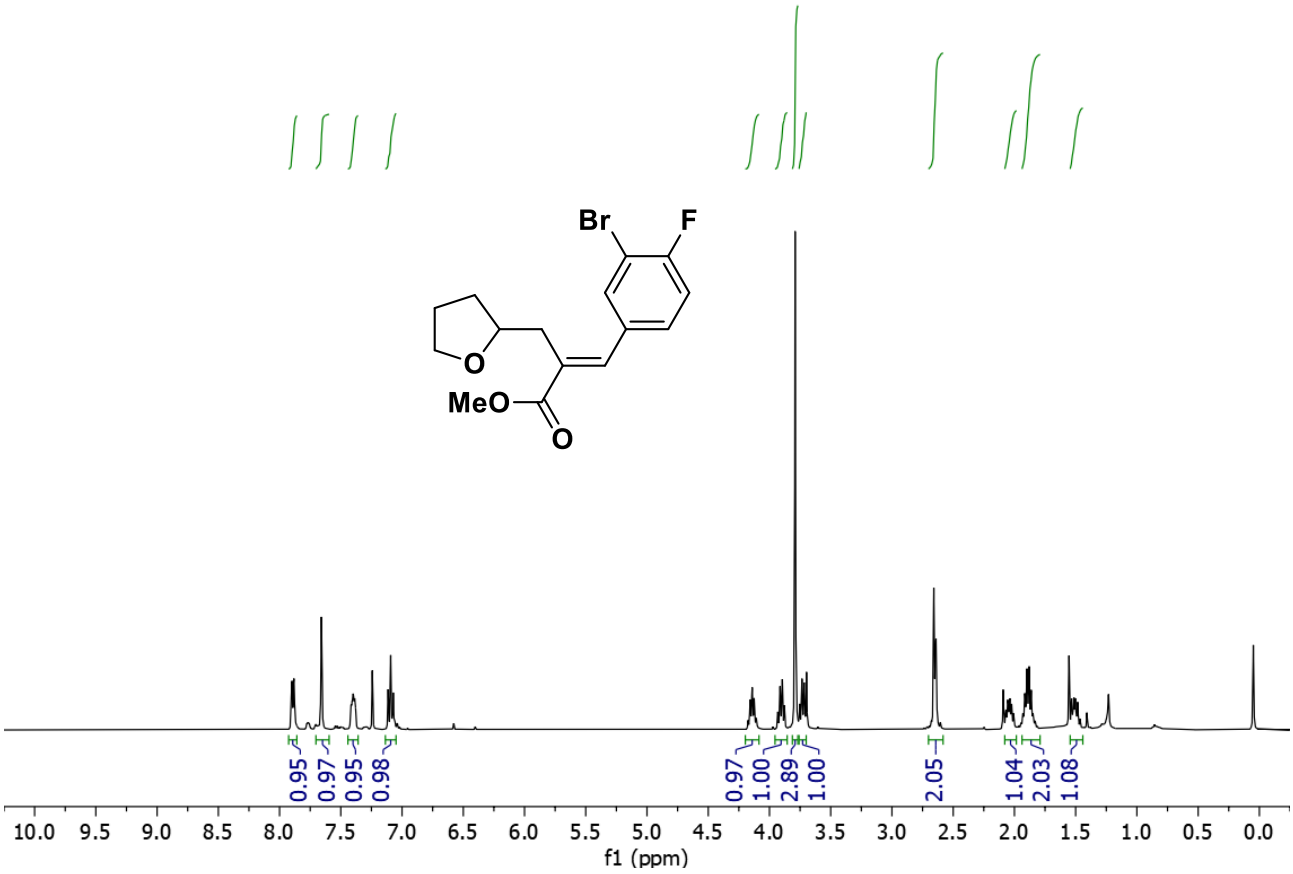
4ha ^{1}H NMR (400 MHz, $CDCl_3$)



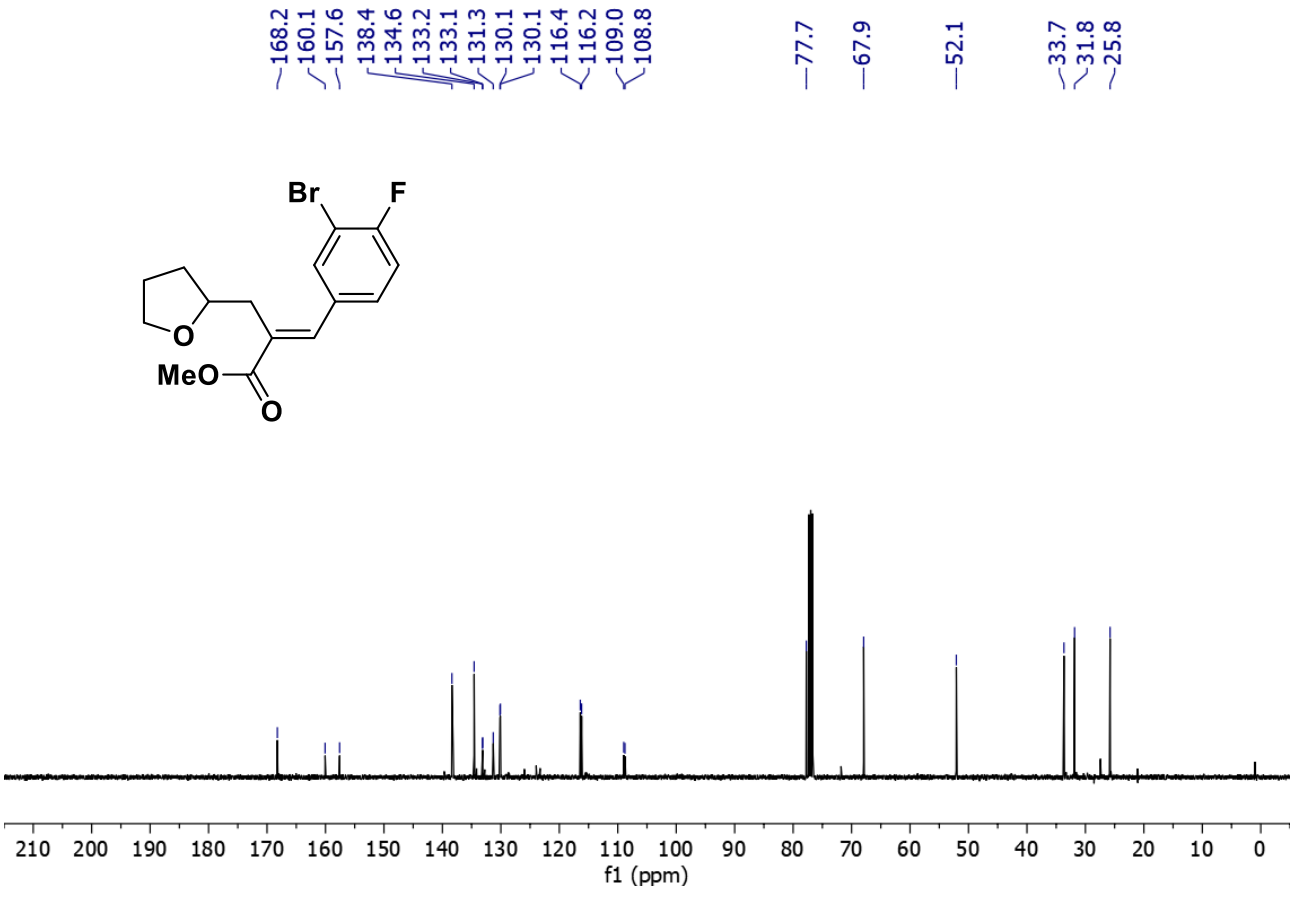
4ha ^{13}C NMR (100 MHz, $CDCl_3$)



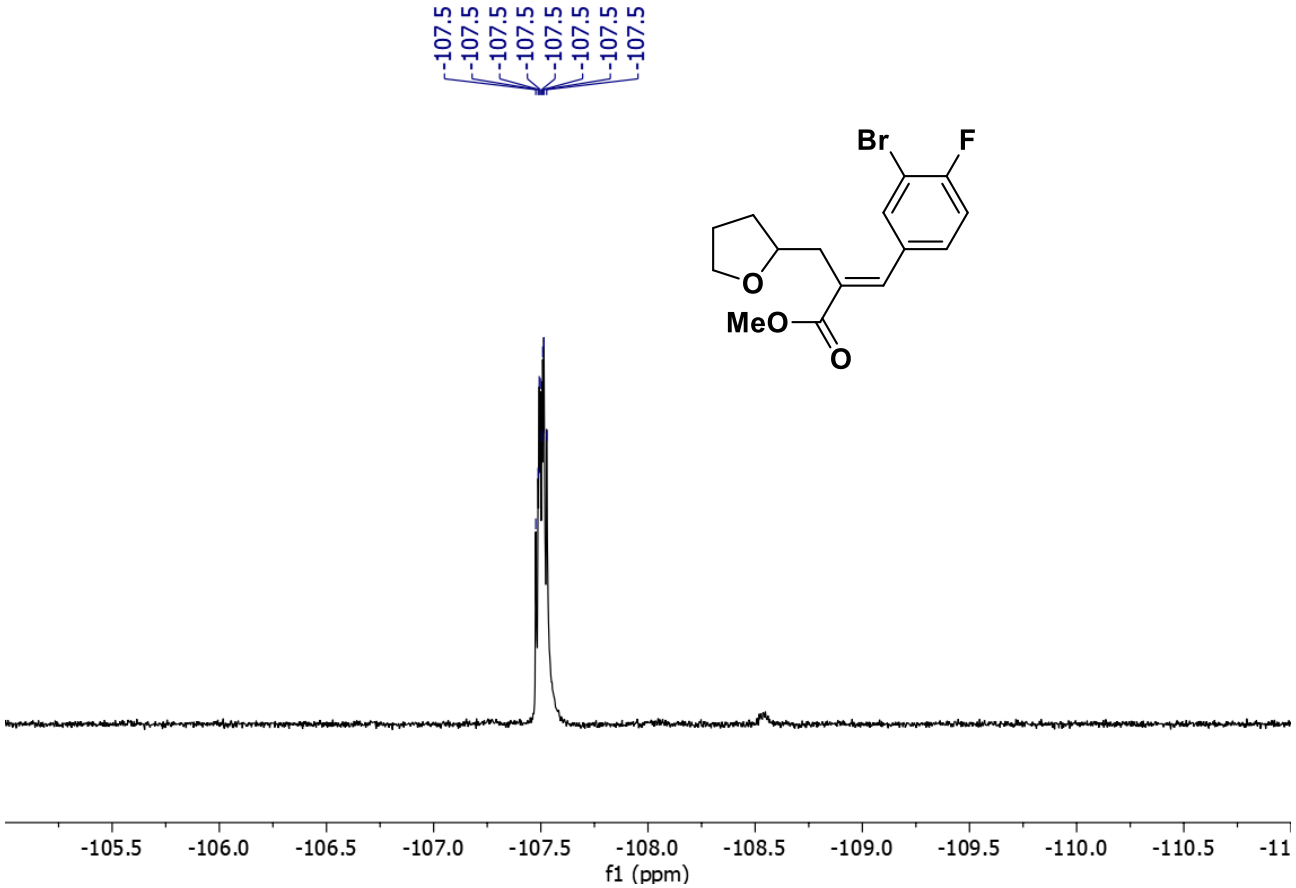
4ia ^{1}H NMR (400 MHz, $CDCl_3$)



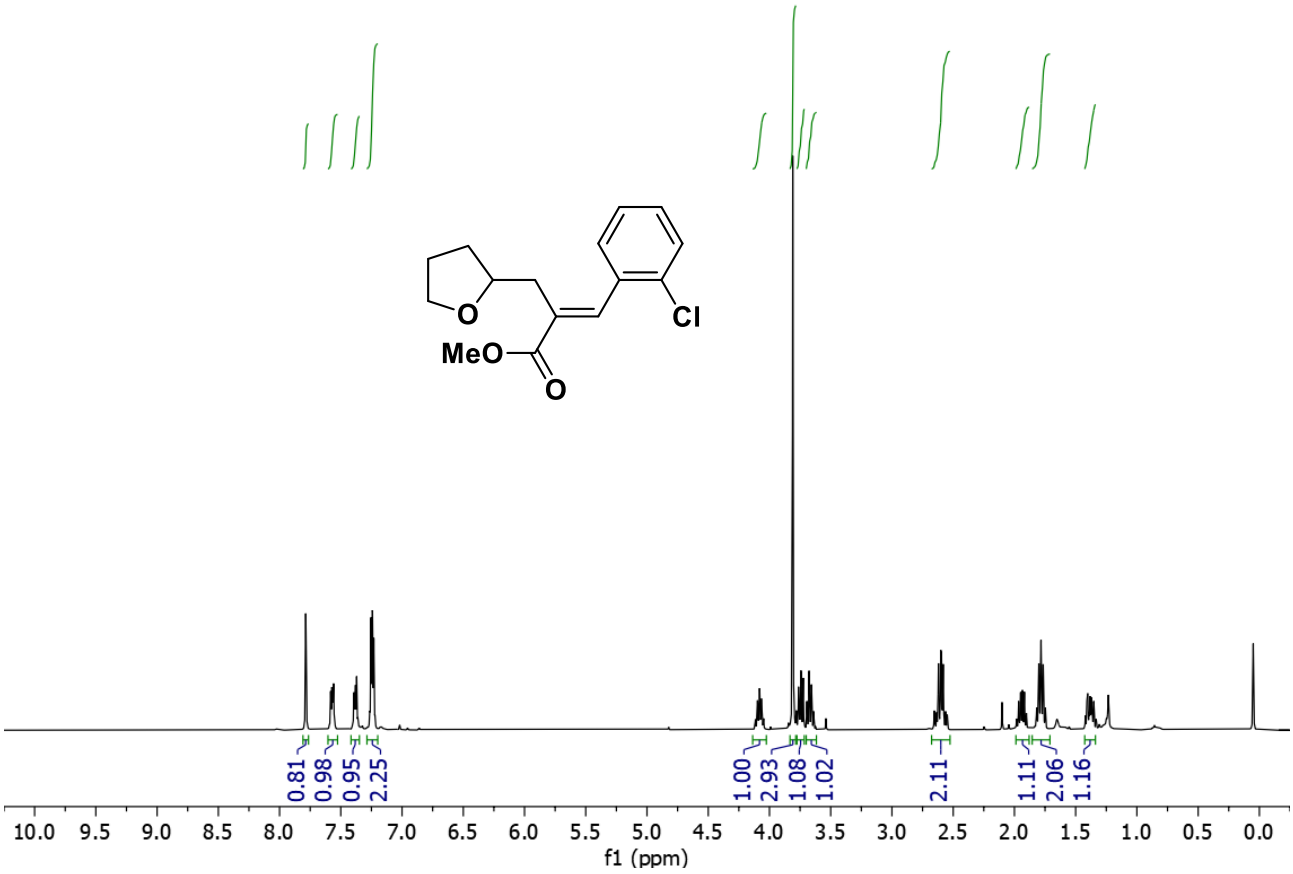
4ia ^{13}C NMR (100 MHz, $CDCl_3$)



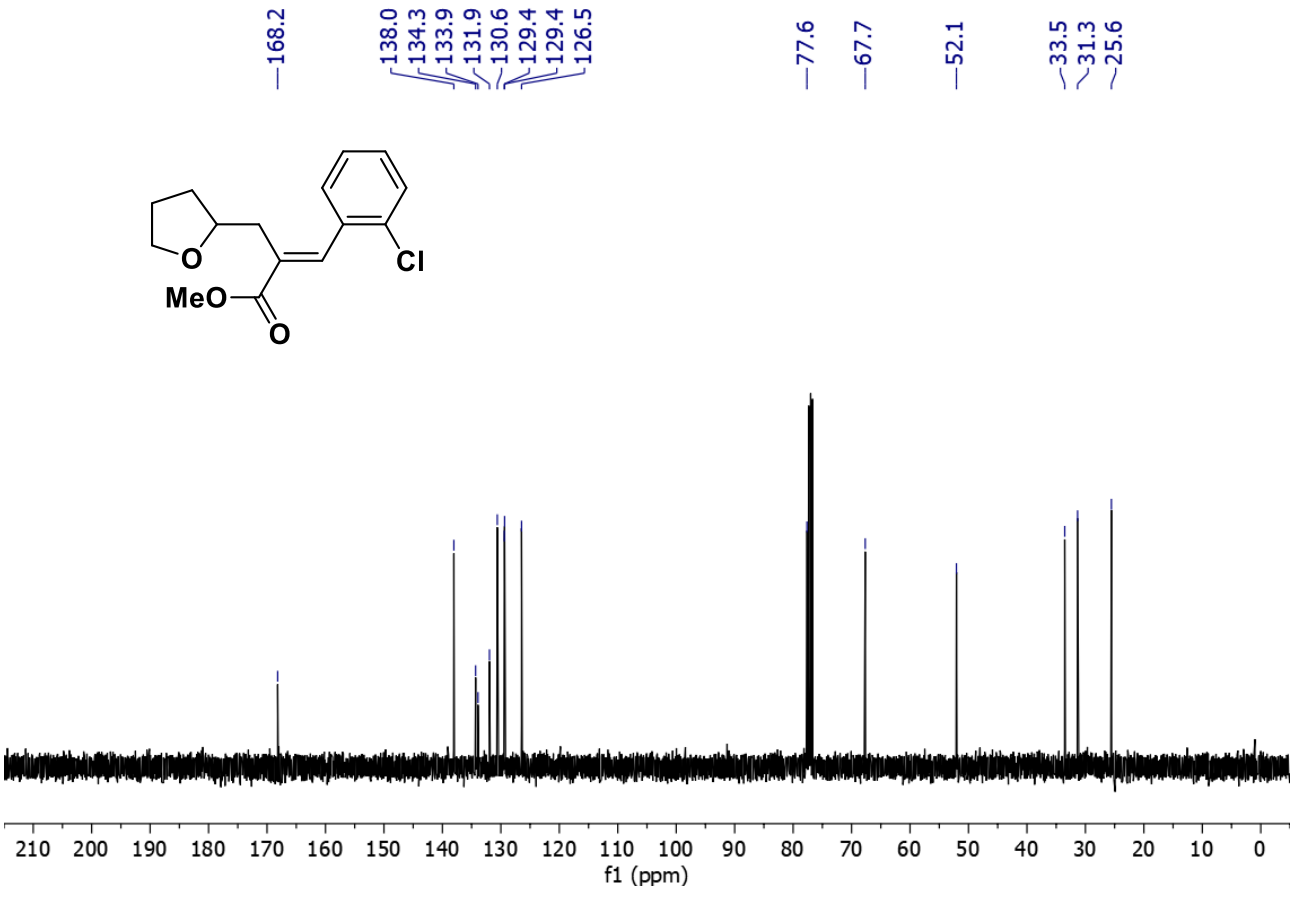
4ia ^{19}F NMR (376 MHz, $CDCl_3$)



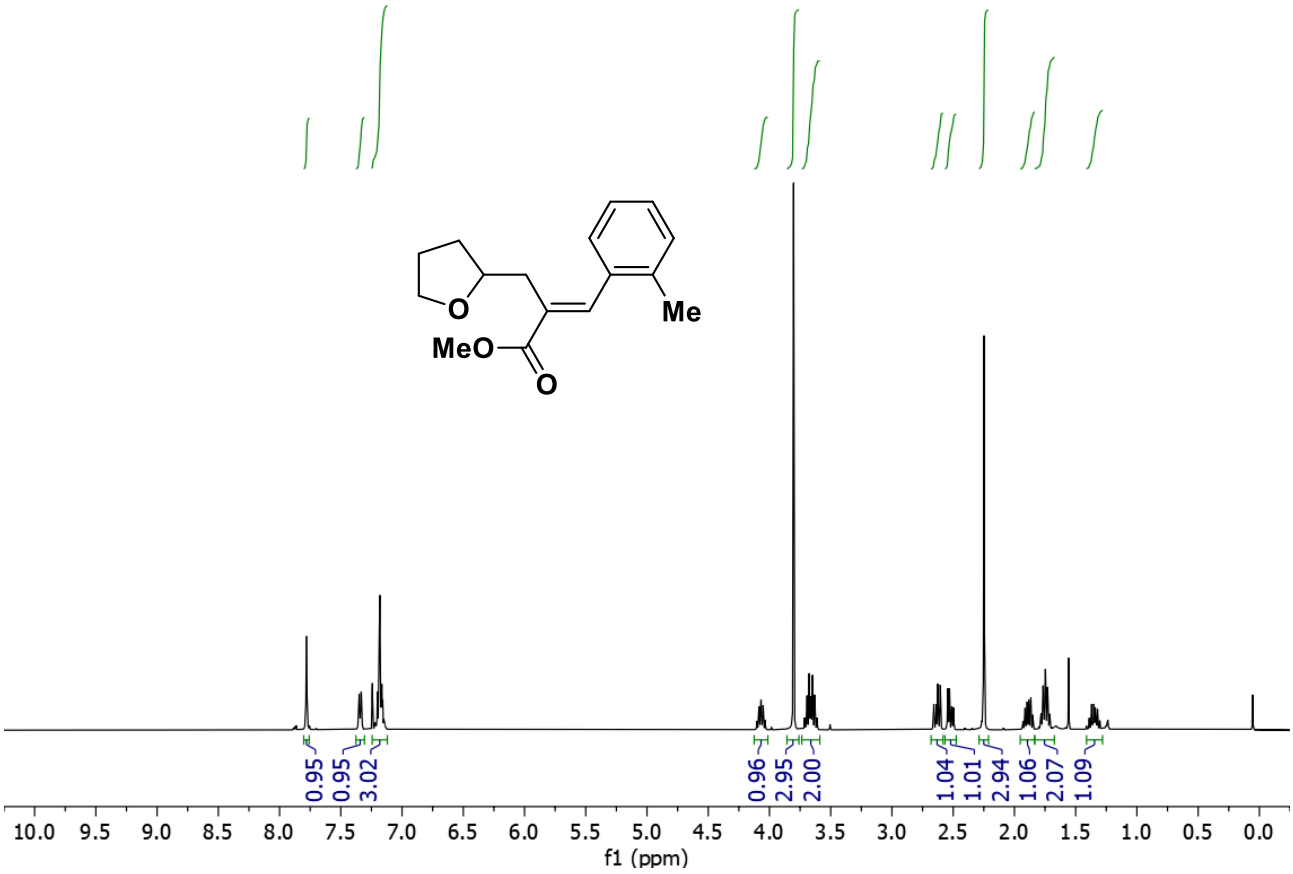
4ja ^{1}H NMR (400 MHz, $CDCl_3$)



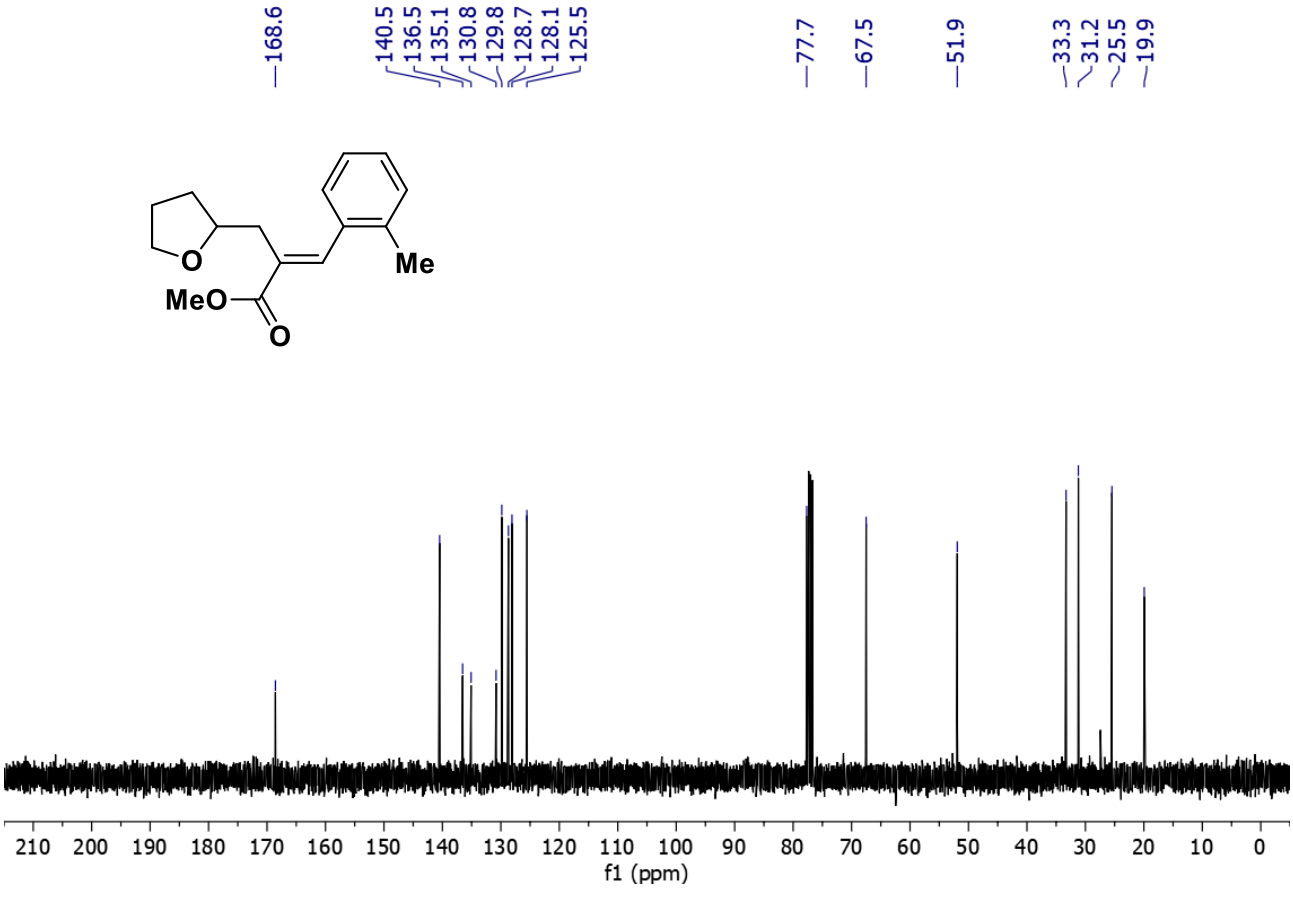
4ja ^{13}C NMR (100 MHz, $CDCl_3$)



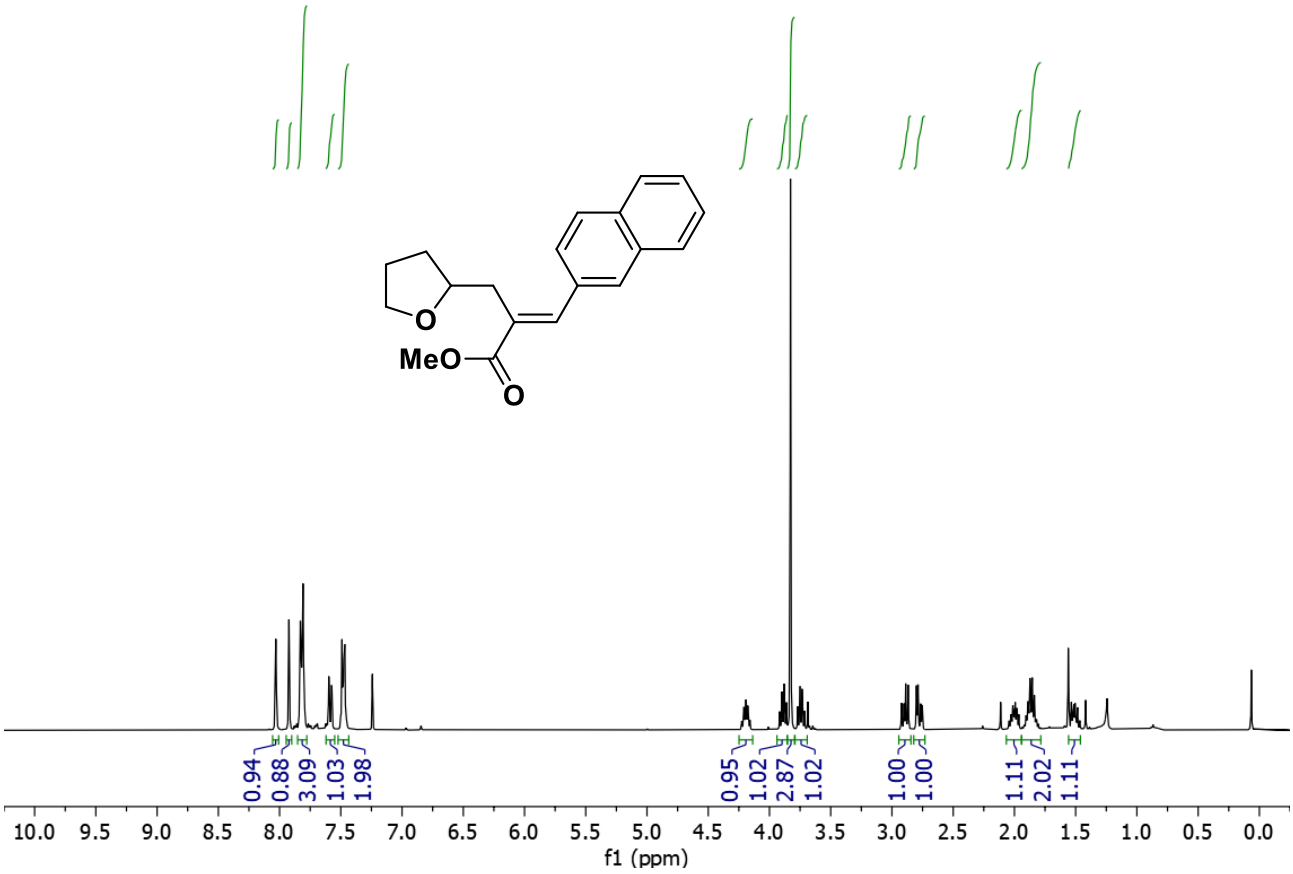
4ka ^{1}H NMR (400 MHz, $CDCl_3$)



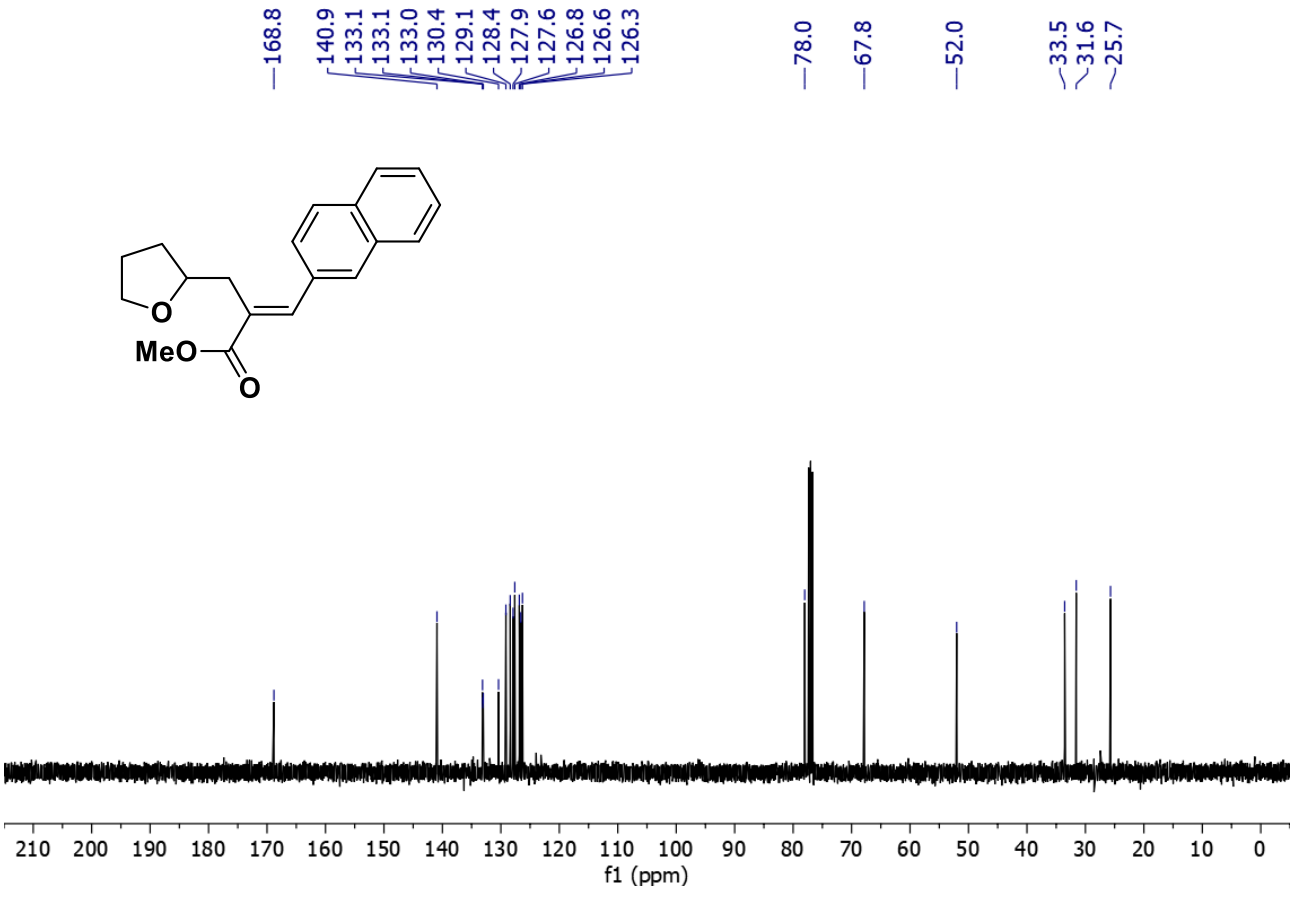
4ka ^{13}C NMR (100 MHz, $CDCl_3$)



4la ^{1}H NMR (400 MHz, $CDCl_3$)



4la ^{13}C NMR (100 MHz, $CDCl_3$)



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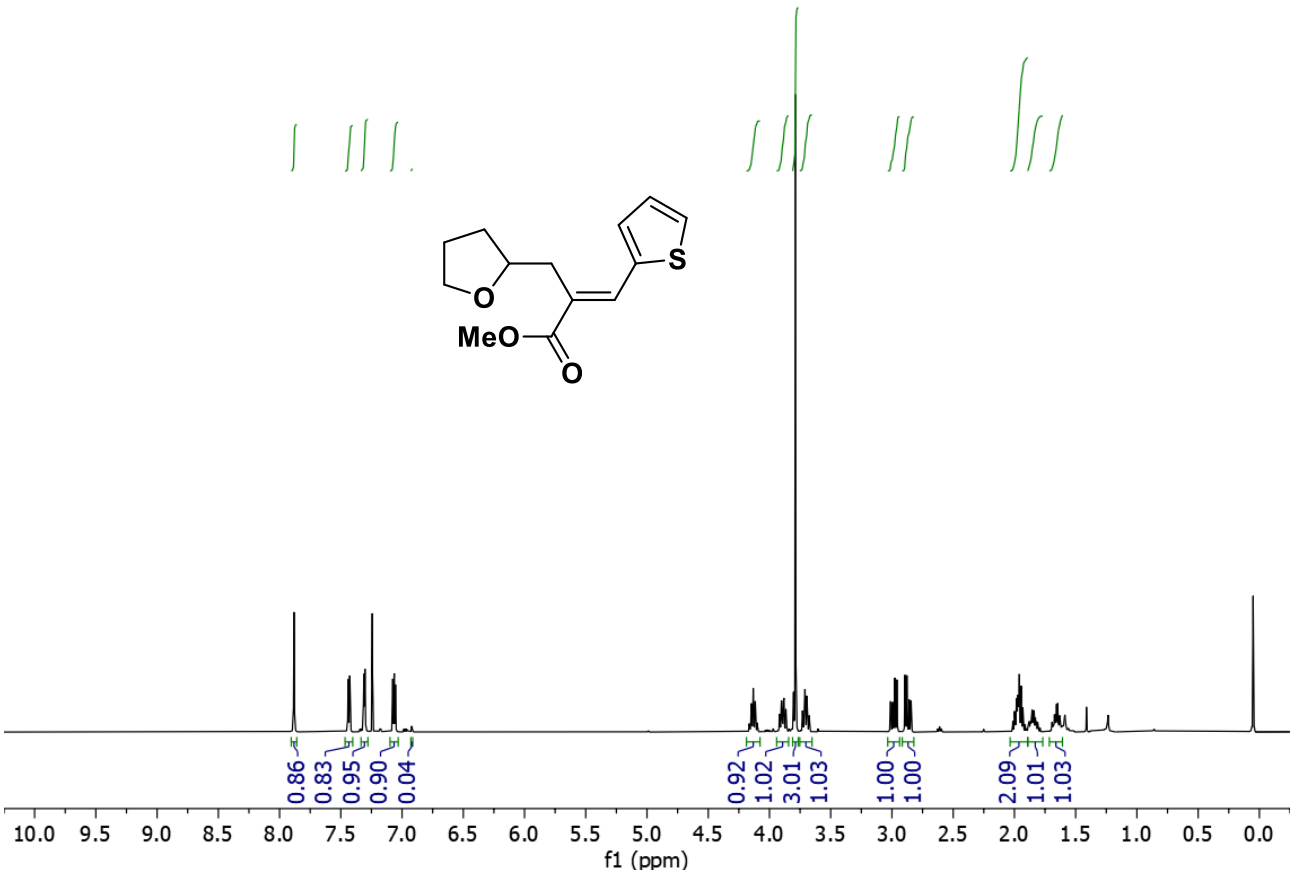
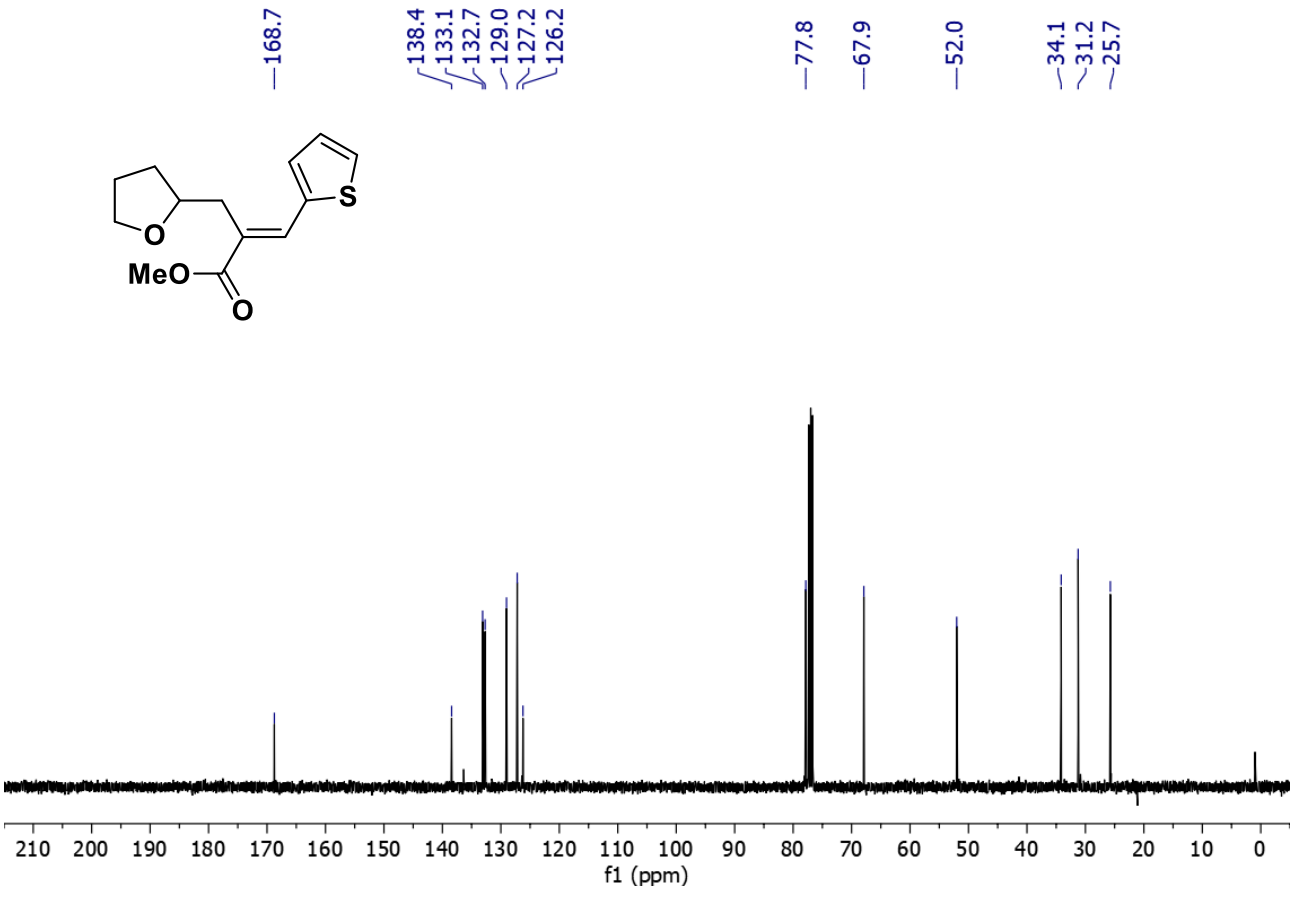
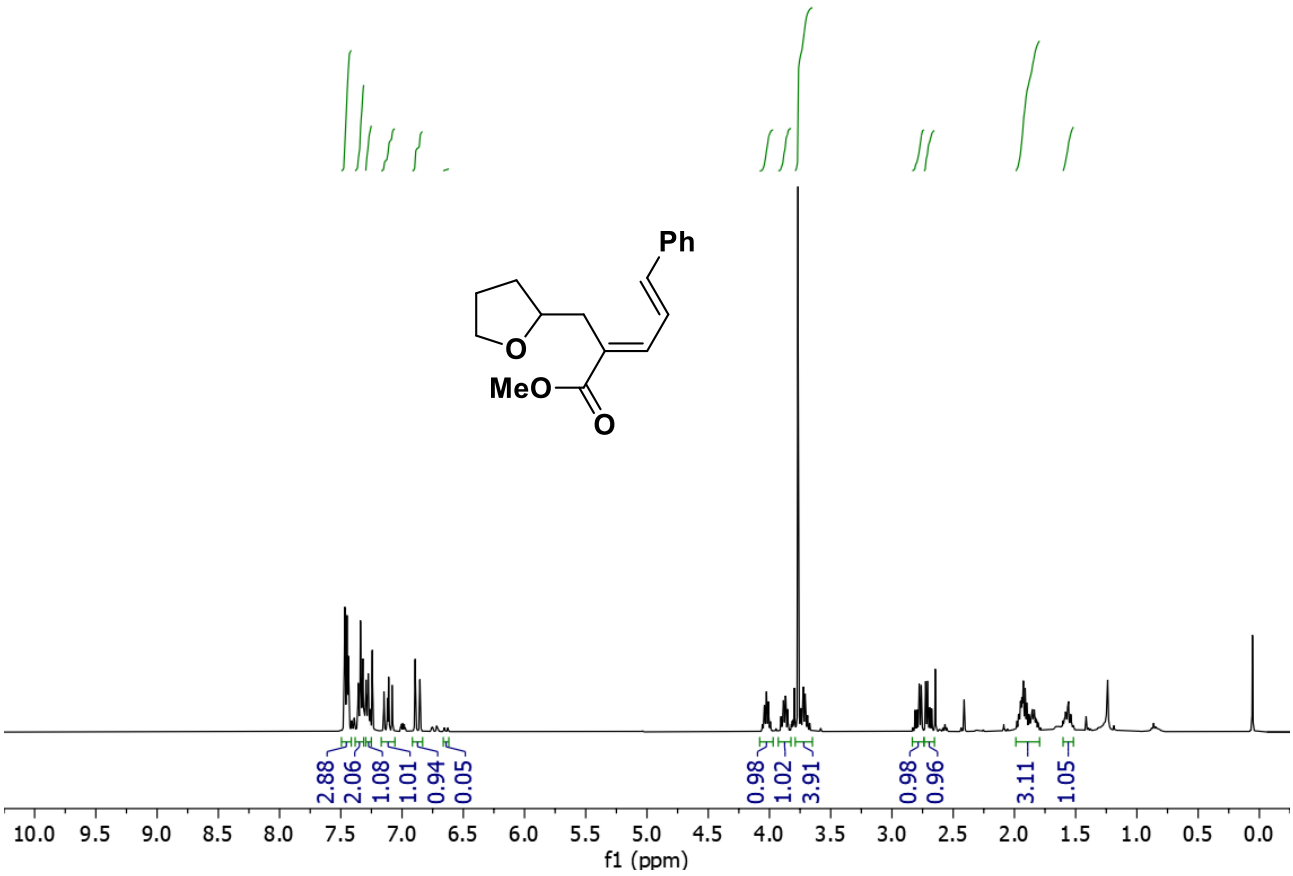


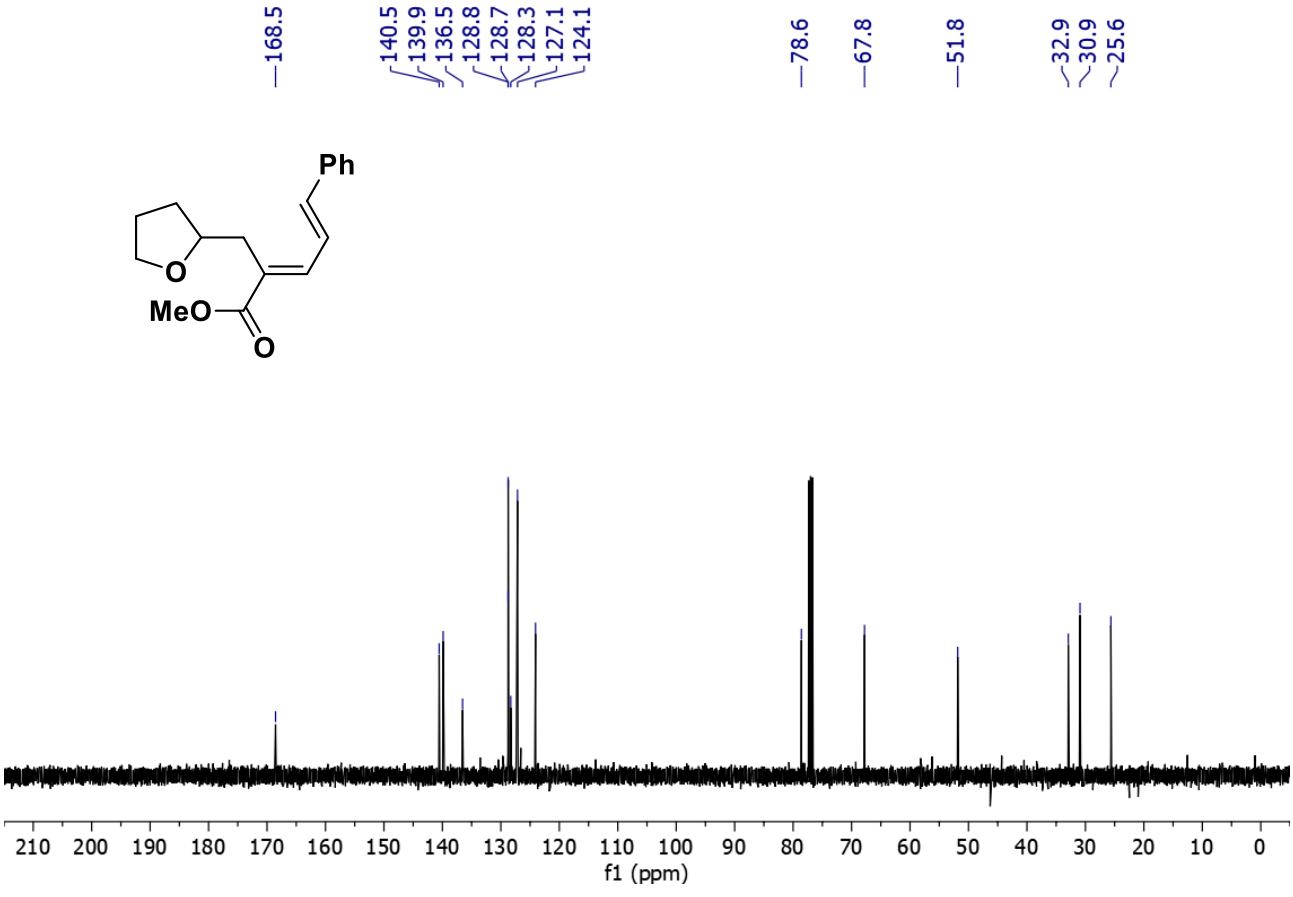
4ma ^{13}C NMR (100 MHz, $CDCl_3$)



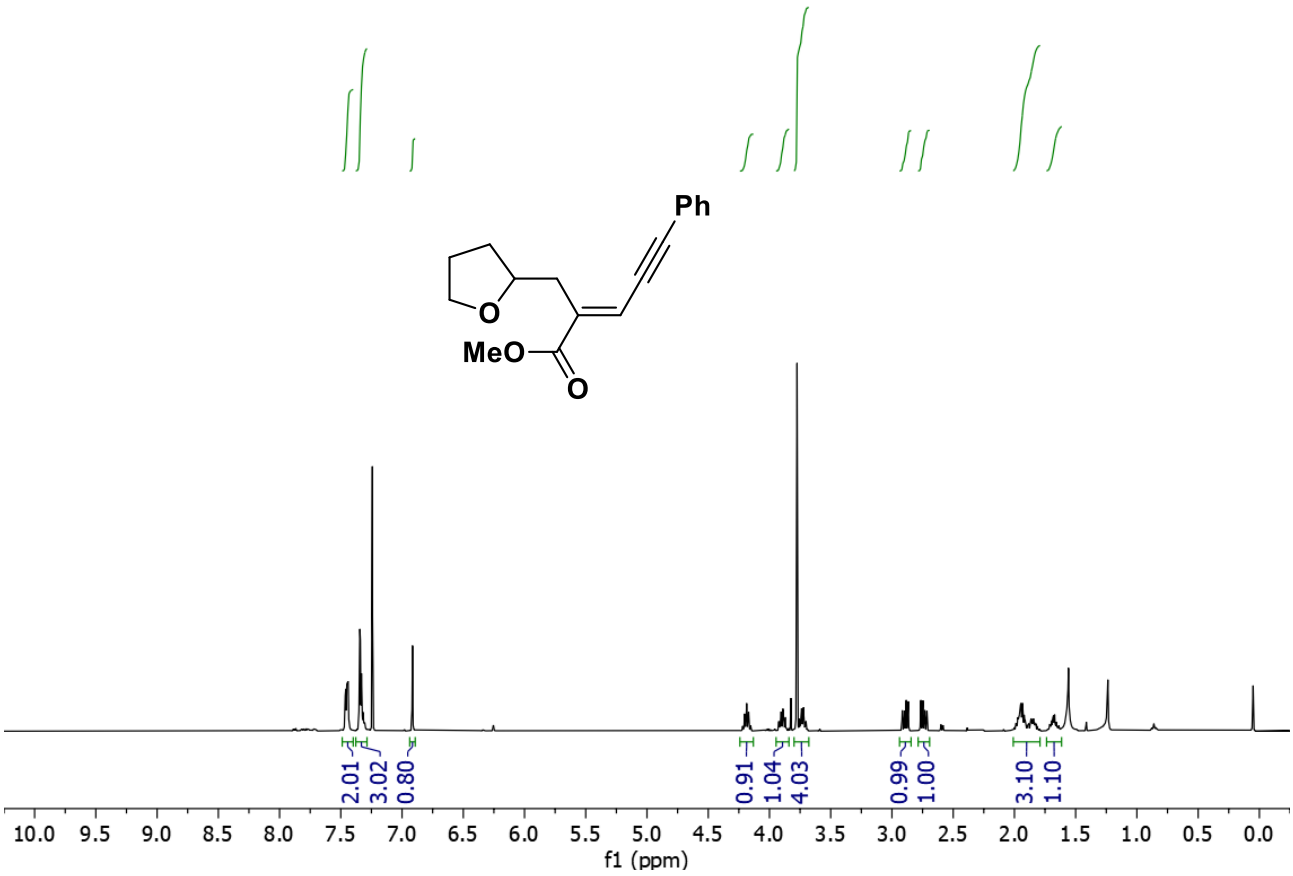
4na ^{1}H NMR (400 MHz, $CDCl_3$)



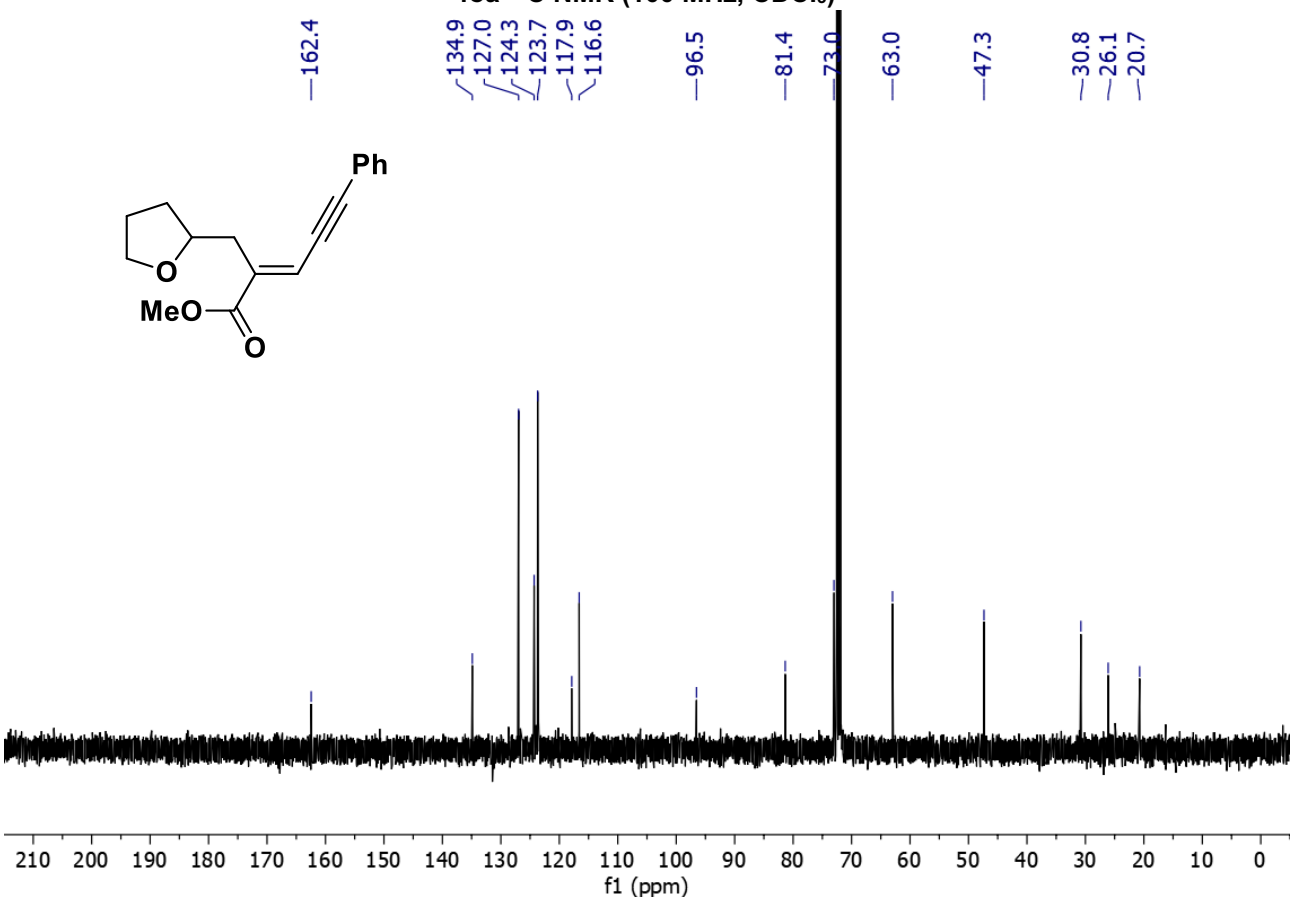
4na ^{13}C NMR (100 MHz, $CDCl_3$)



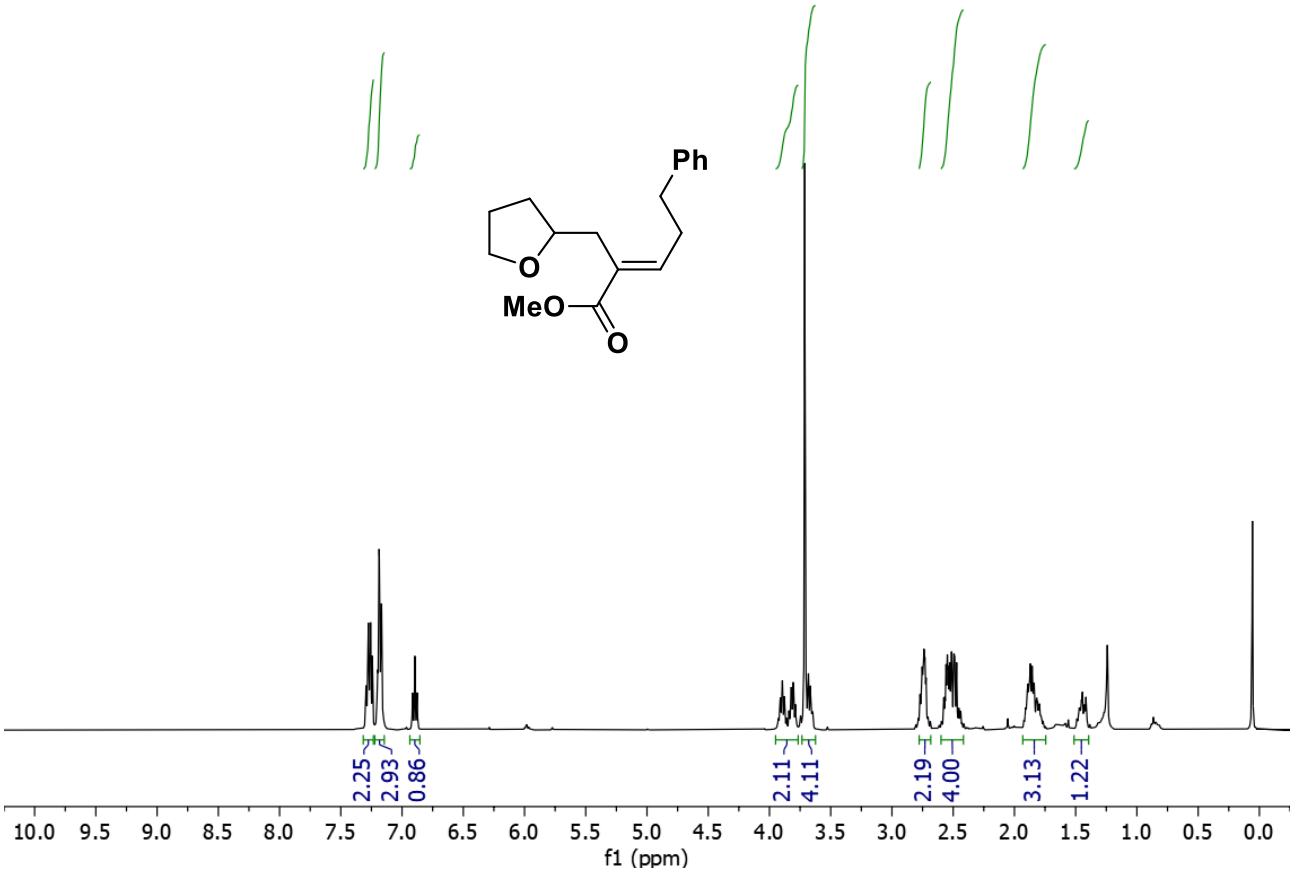
4oa ^{1}H NMR (400 MHz, $CDCl_3$)



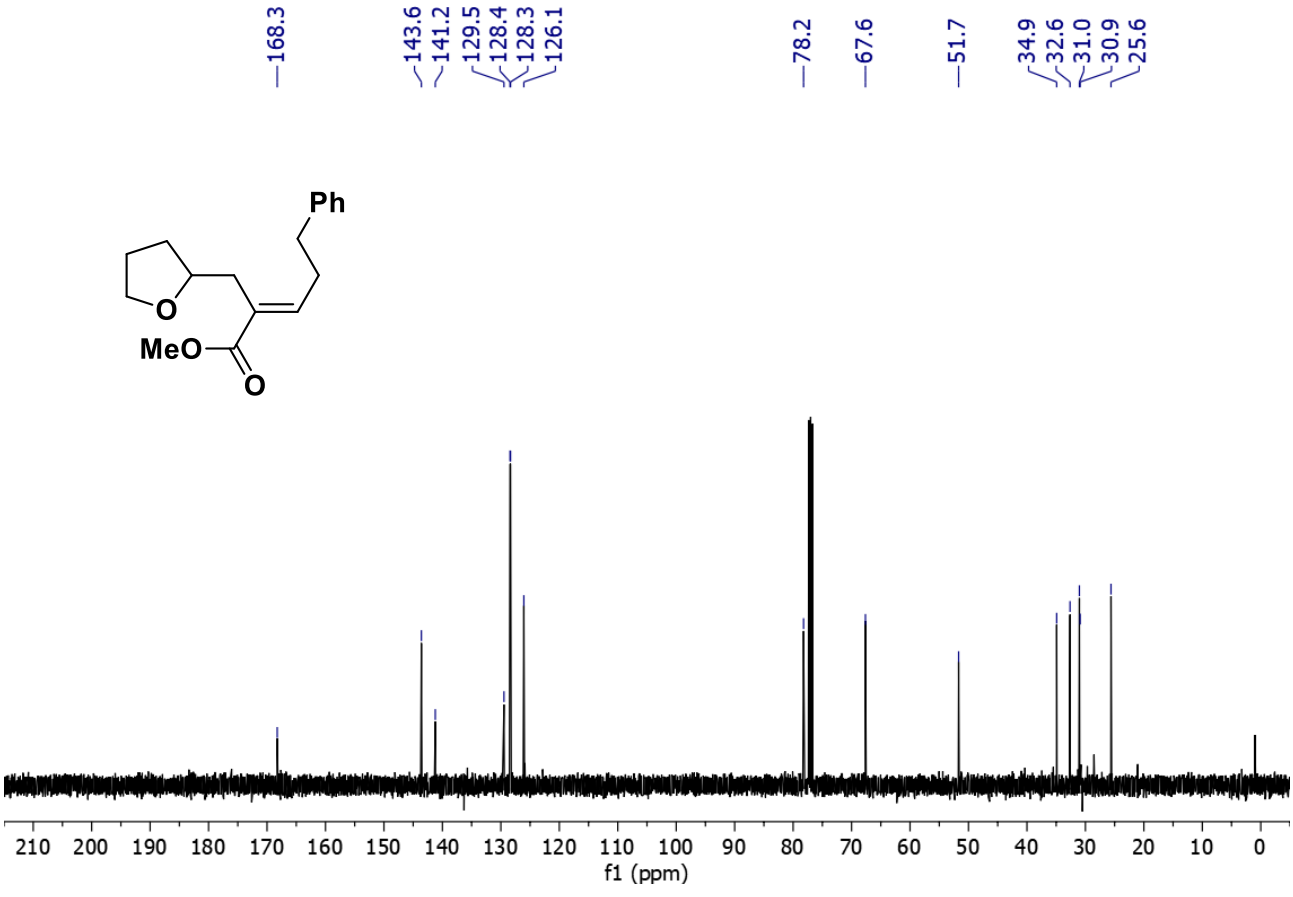
4oa ^{13}C NMR (100 MHz, $CDCl_3$)



4pa ^{1}H NMR (400 MHz, $CDCl_3$)



4pa ^{13}C NMR (100 MHz, $CDCl_3$)



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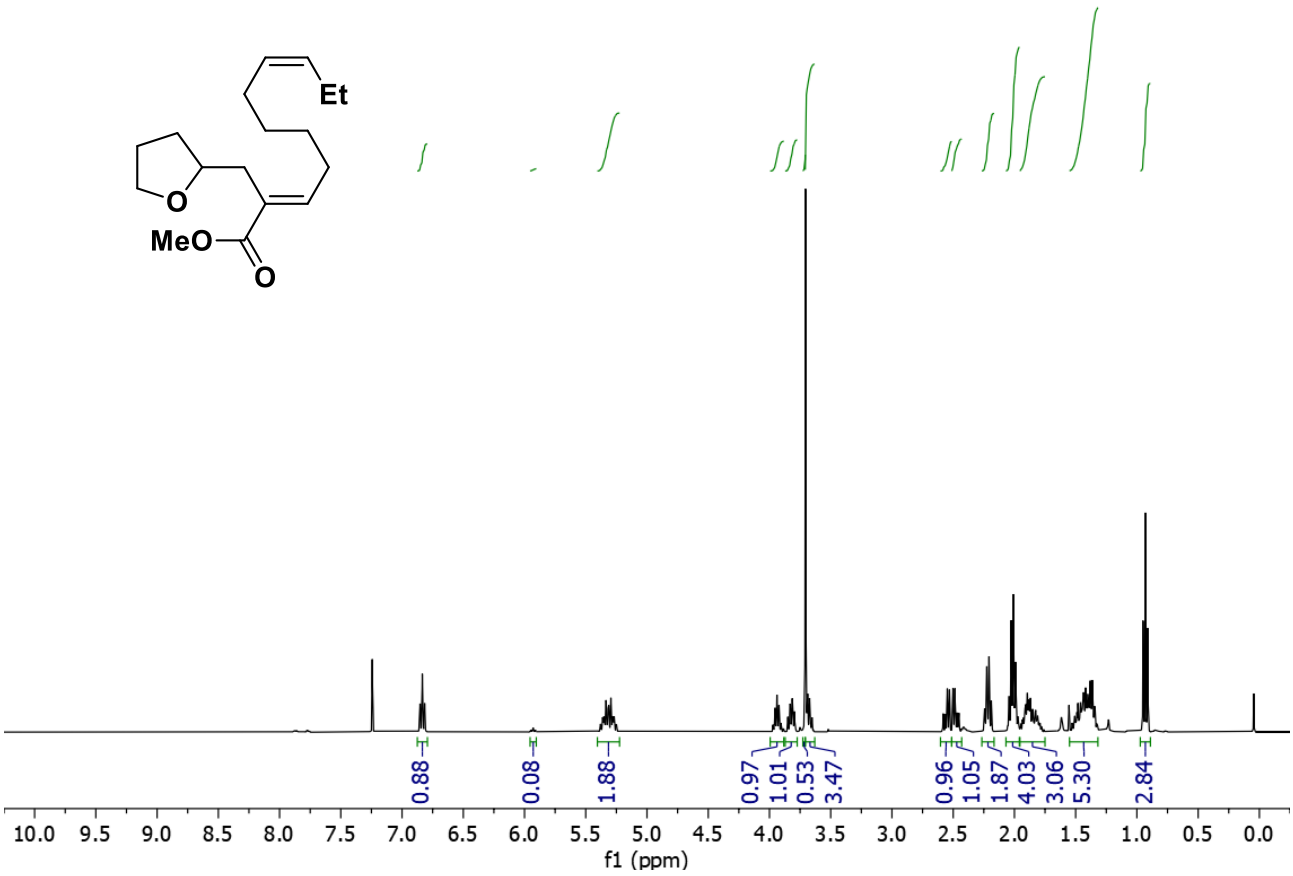
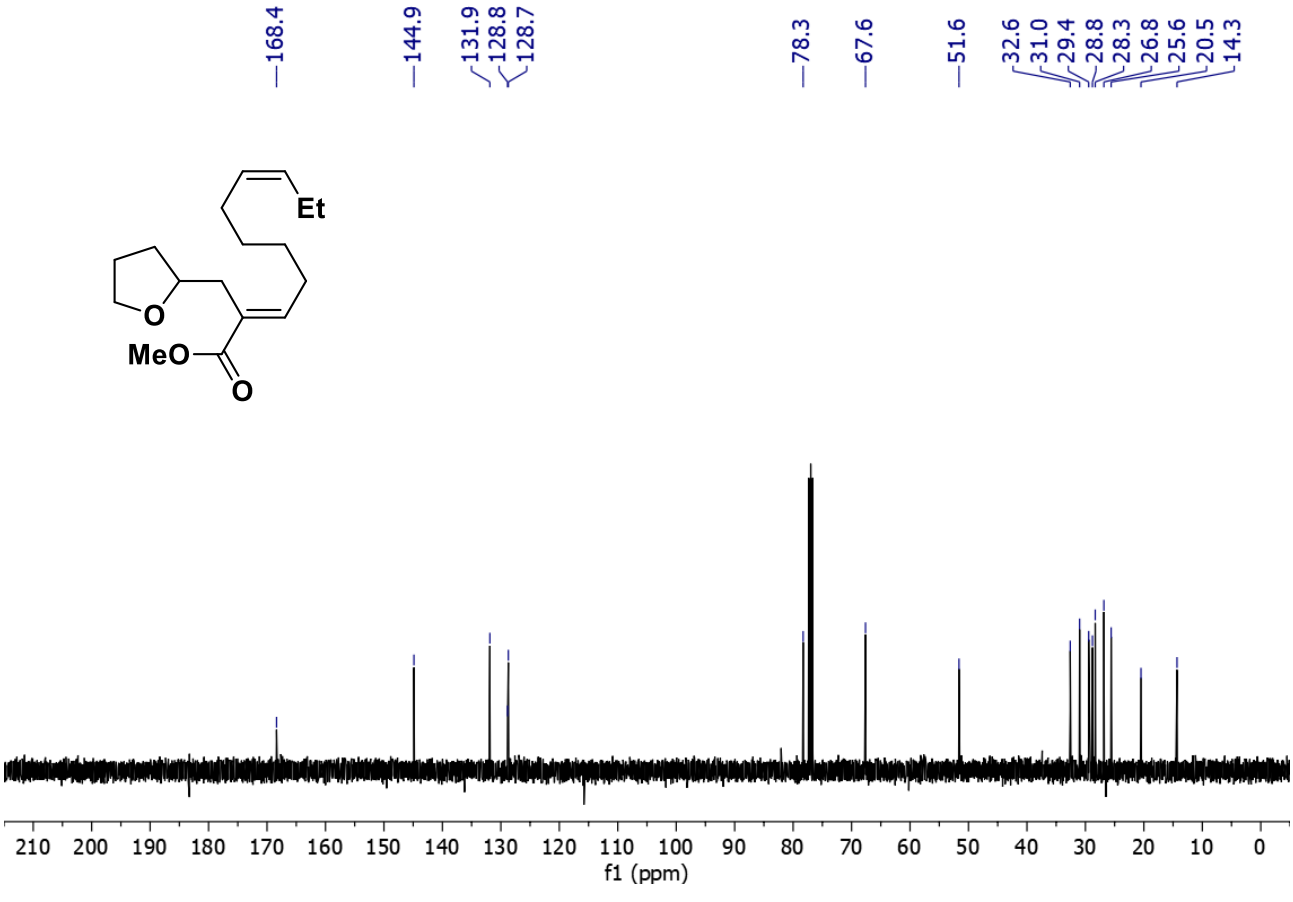


4qa ^{13}C NMR (100 MHz, $CDCl_3$)



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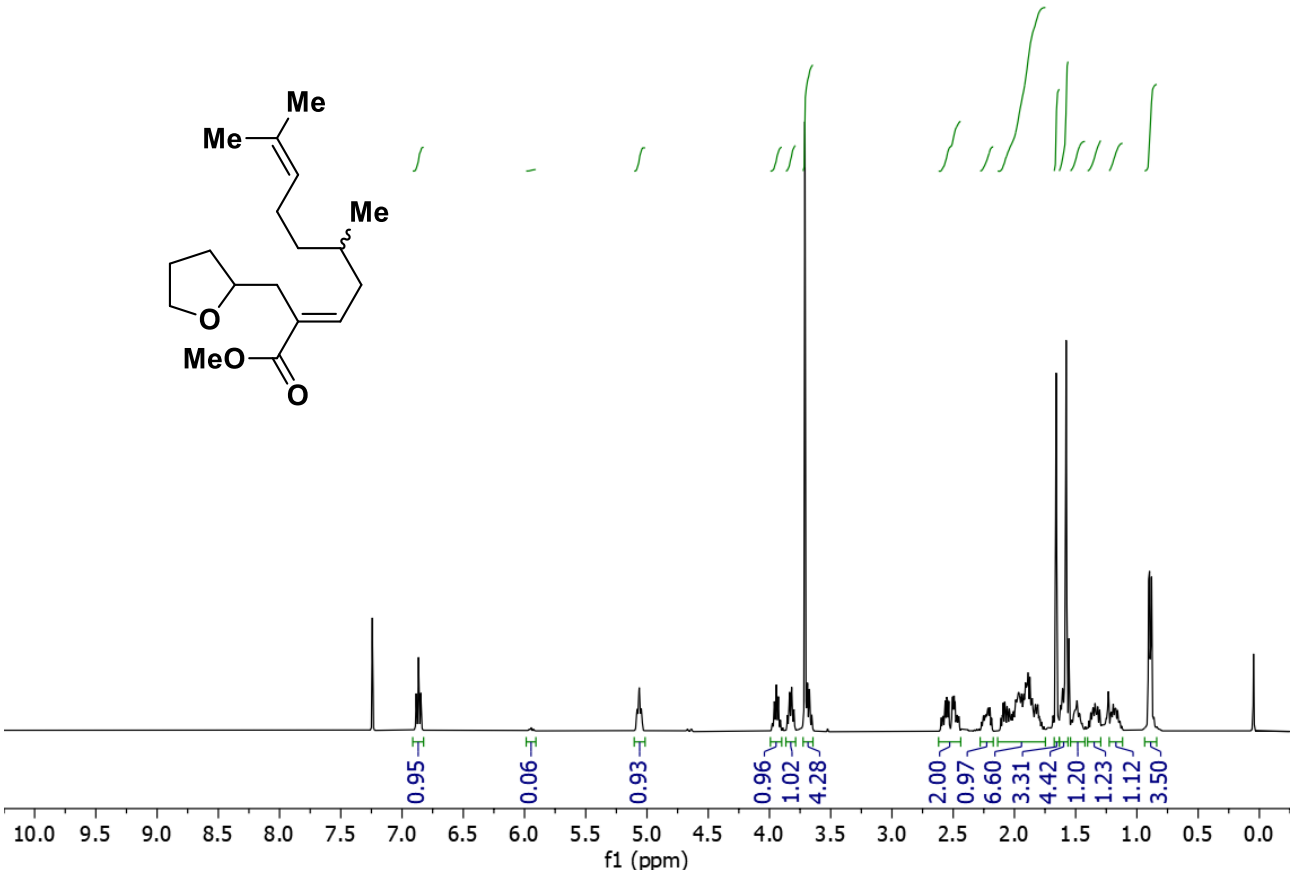
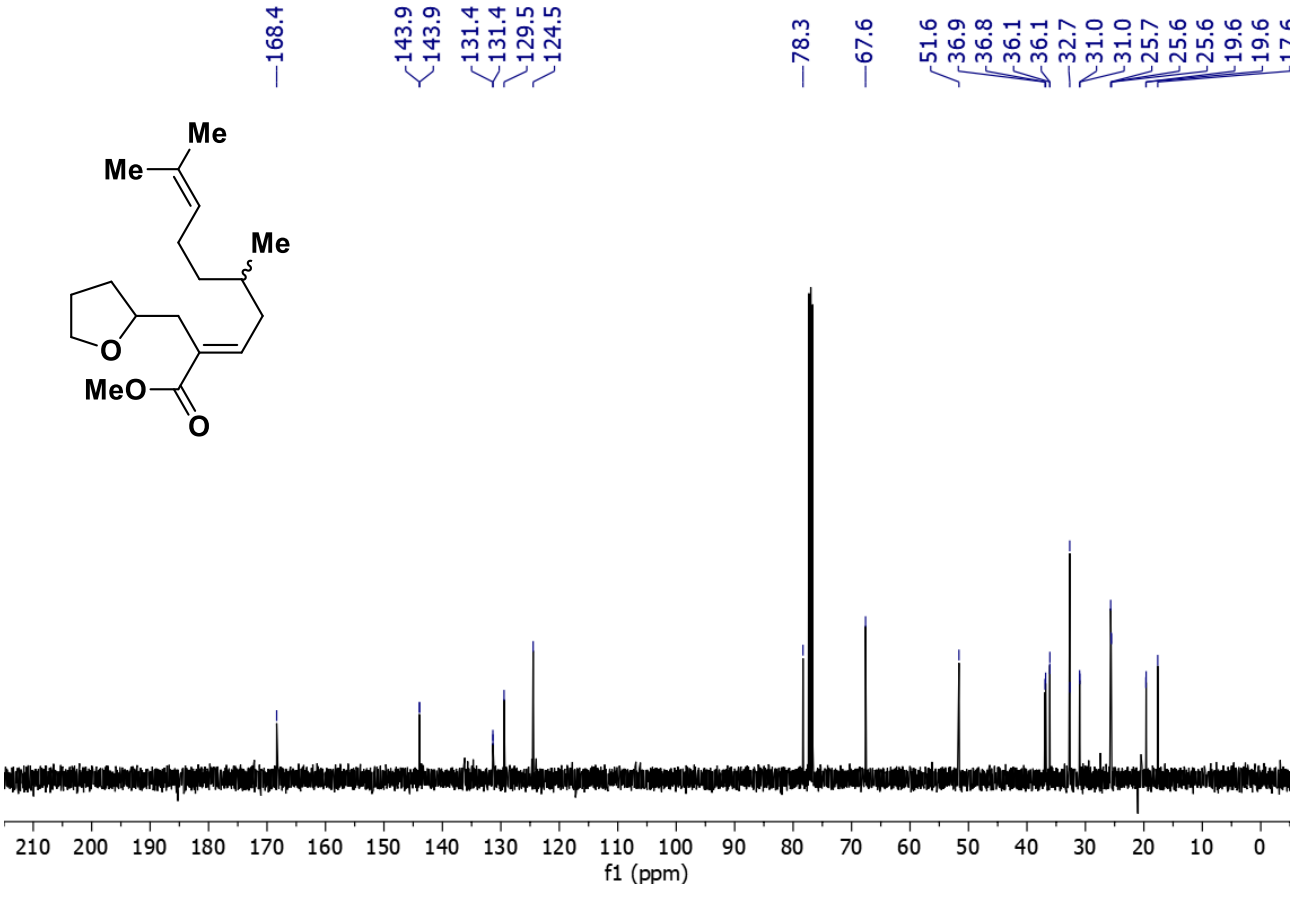
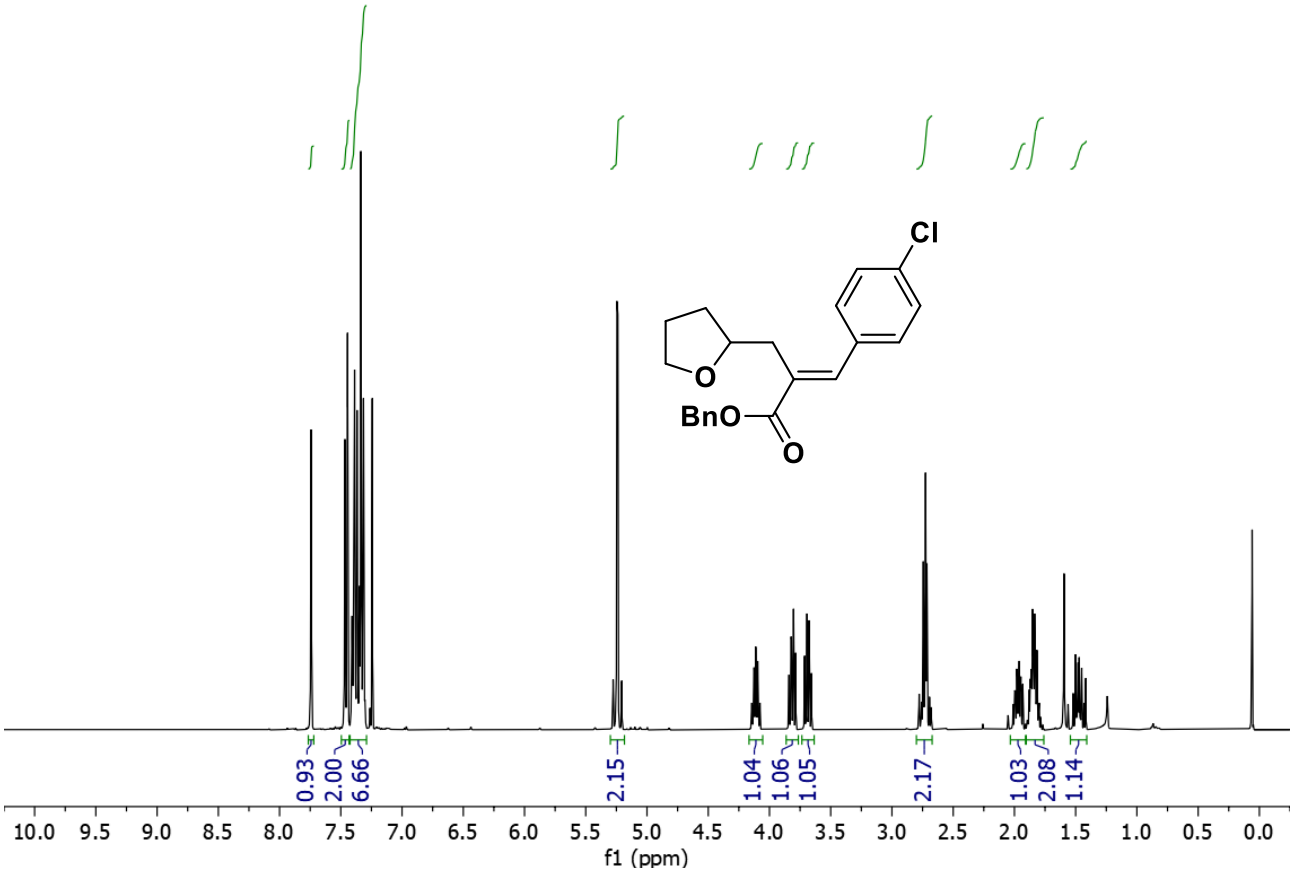


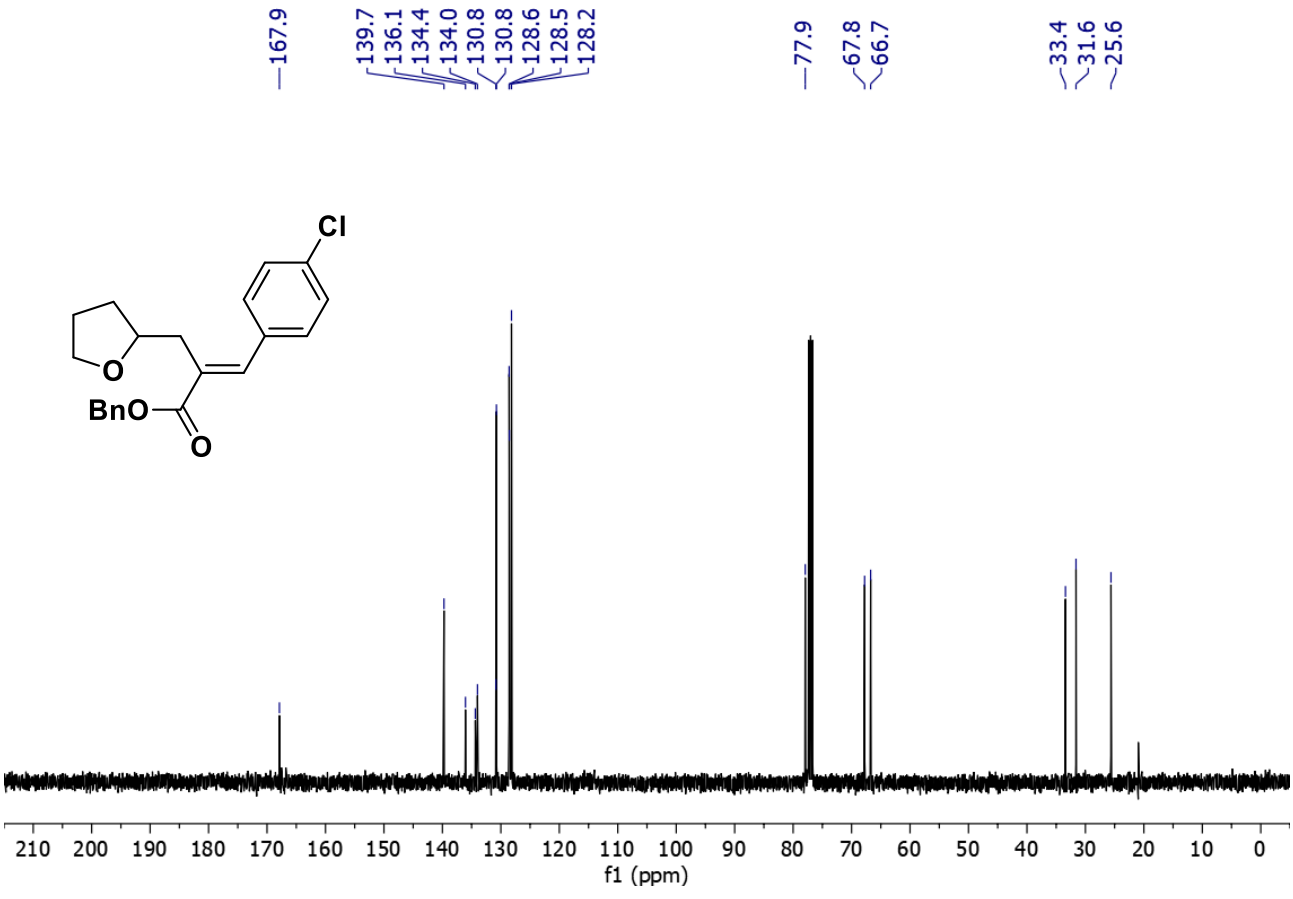
4ra ^{13}C NMR (100 MHz, $CDCl_3$)



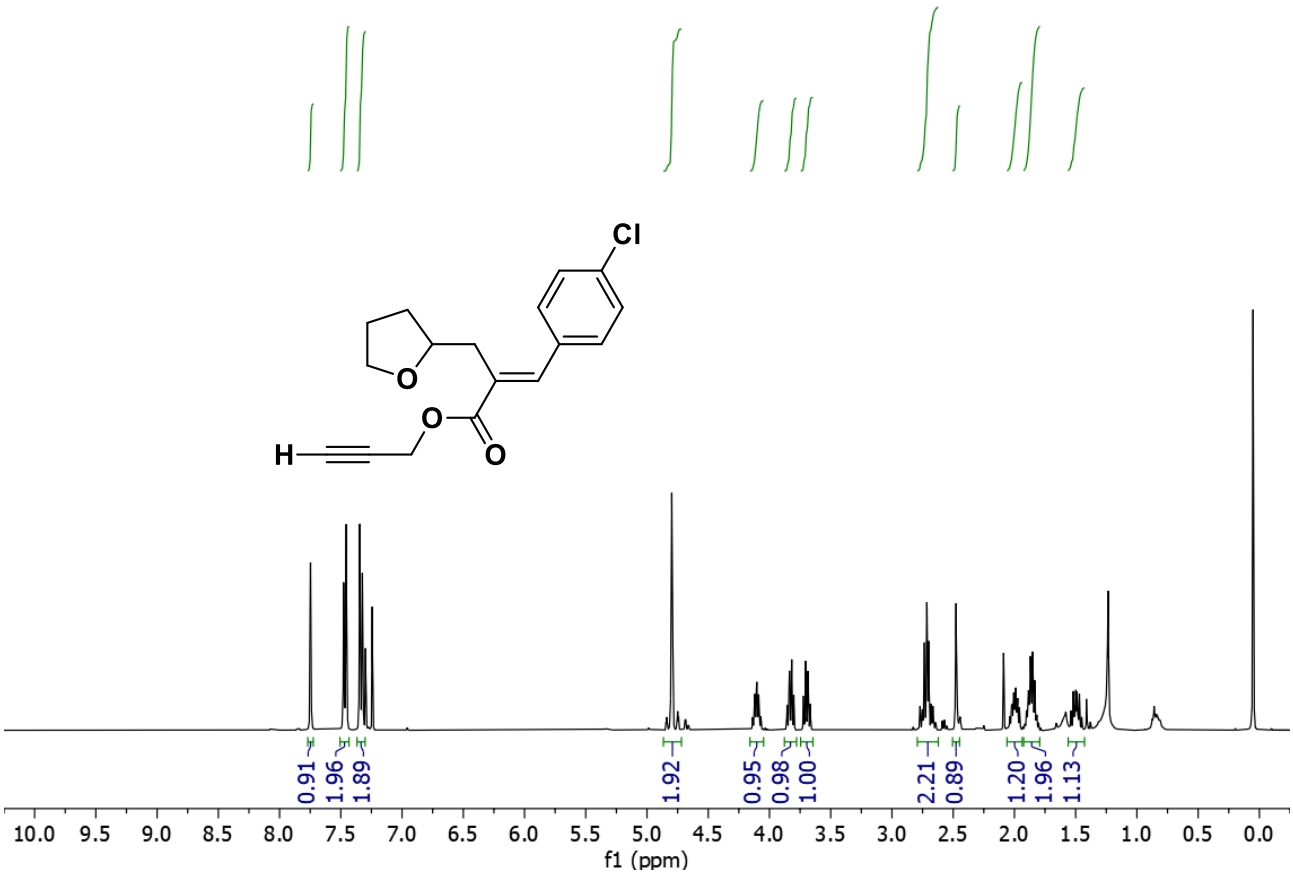
4sa ^{1}H NMR (400 MHz, $CDCl_3$)



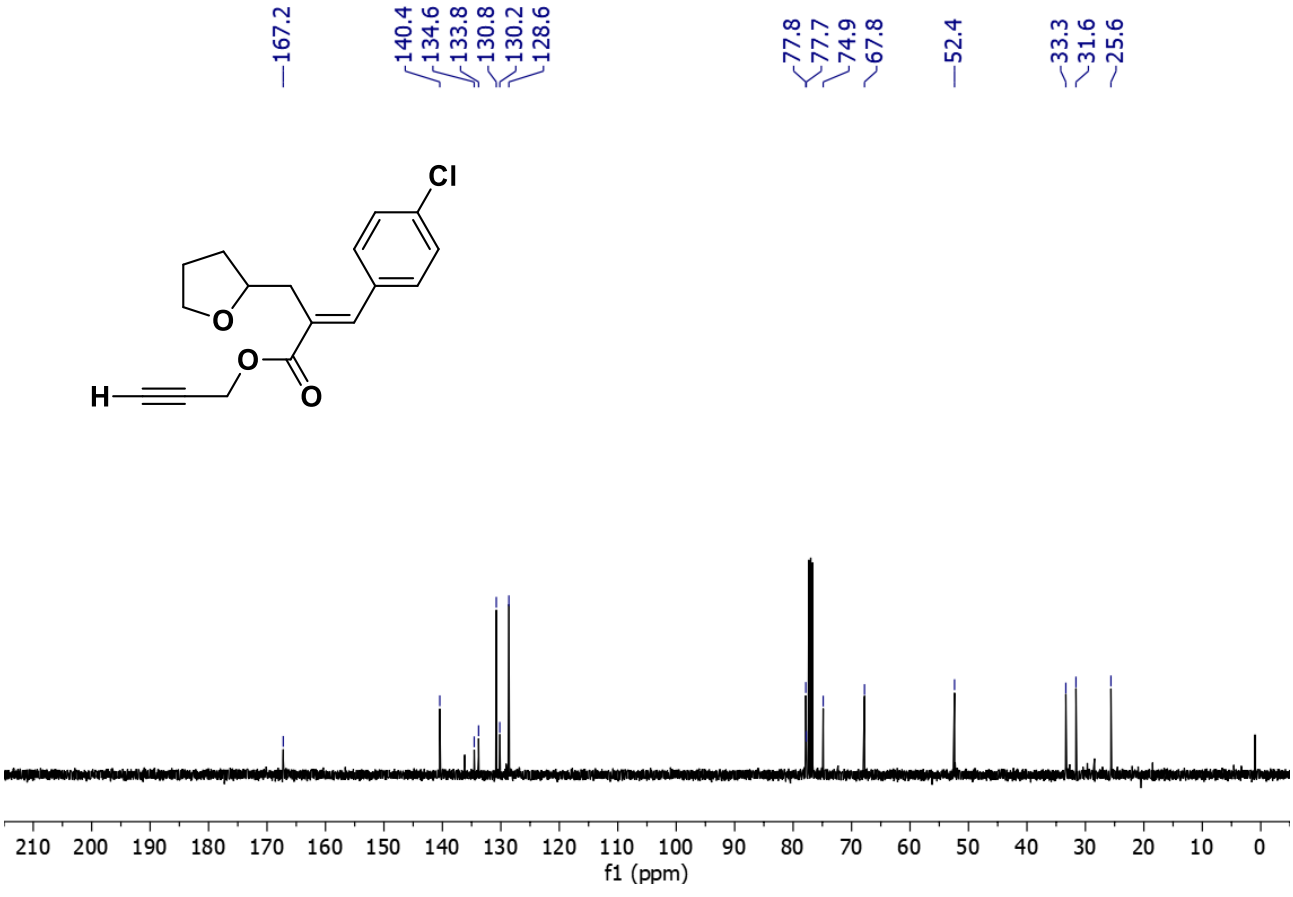
4sa ^{13}C NMR (100 MHz, $CDCl_3$)



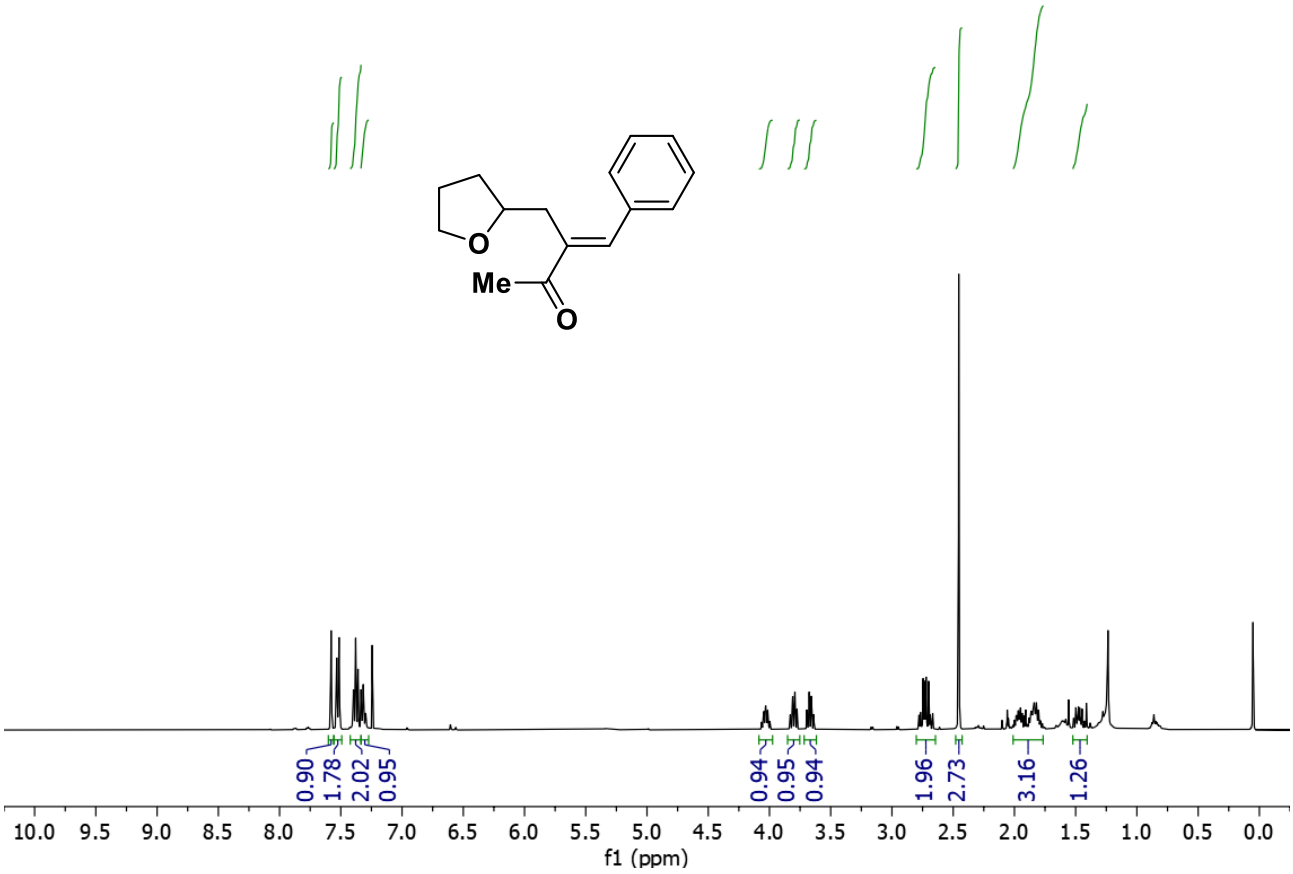
4ta ^{1}H NMR (400 MHz, $CDCl_3$)



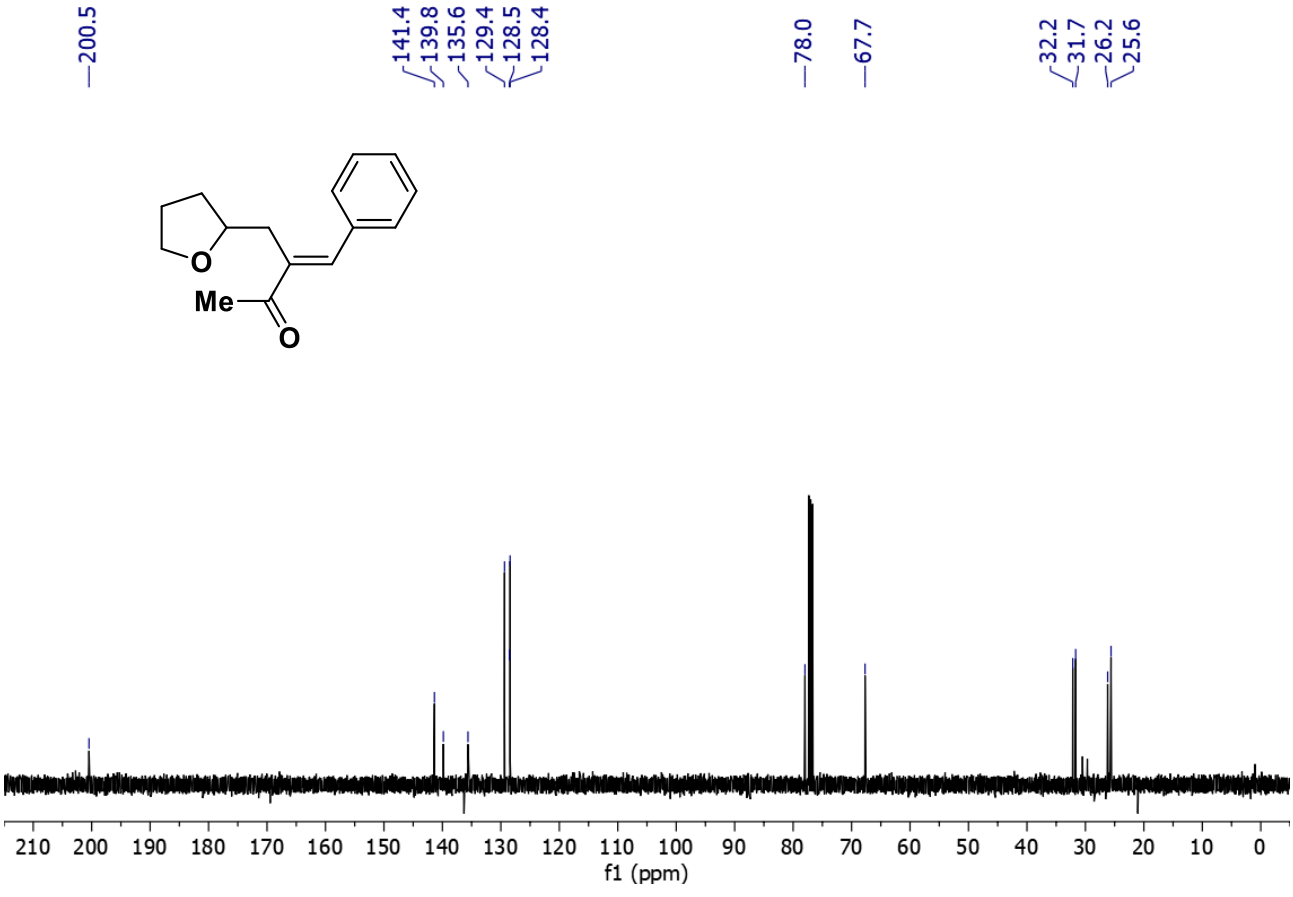
4ta ^{13}C NMR (100 MHz, $CDCl_3$)



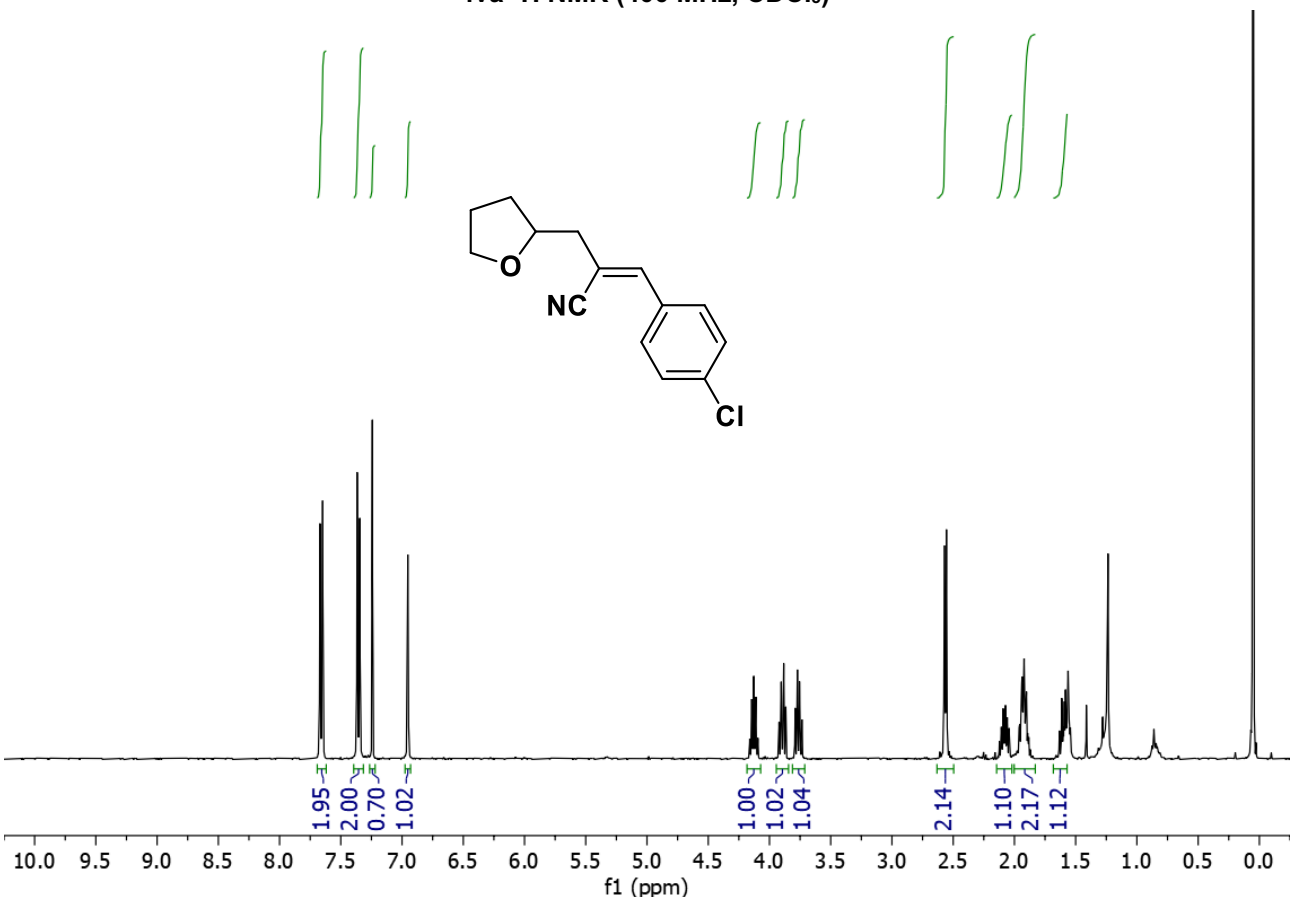
4ua ^{1}H NMR (400 MHz, $CDCl_3$)



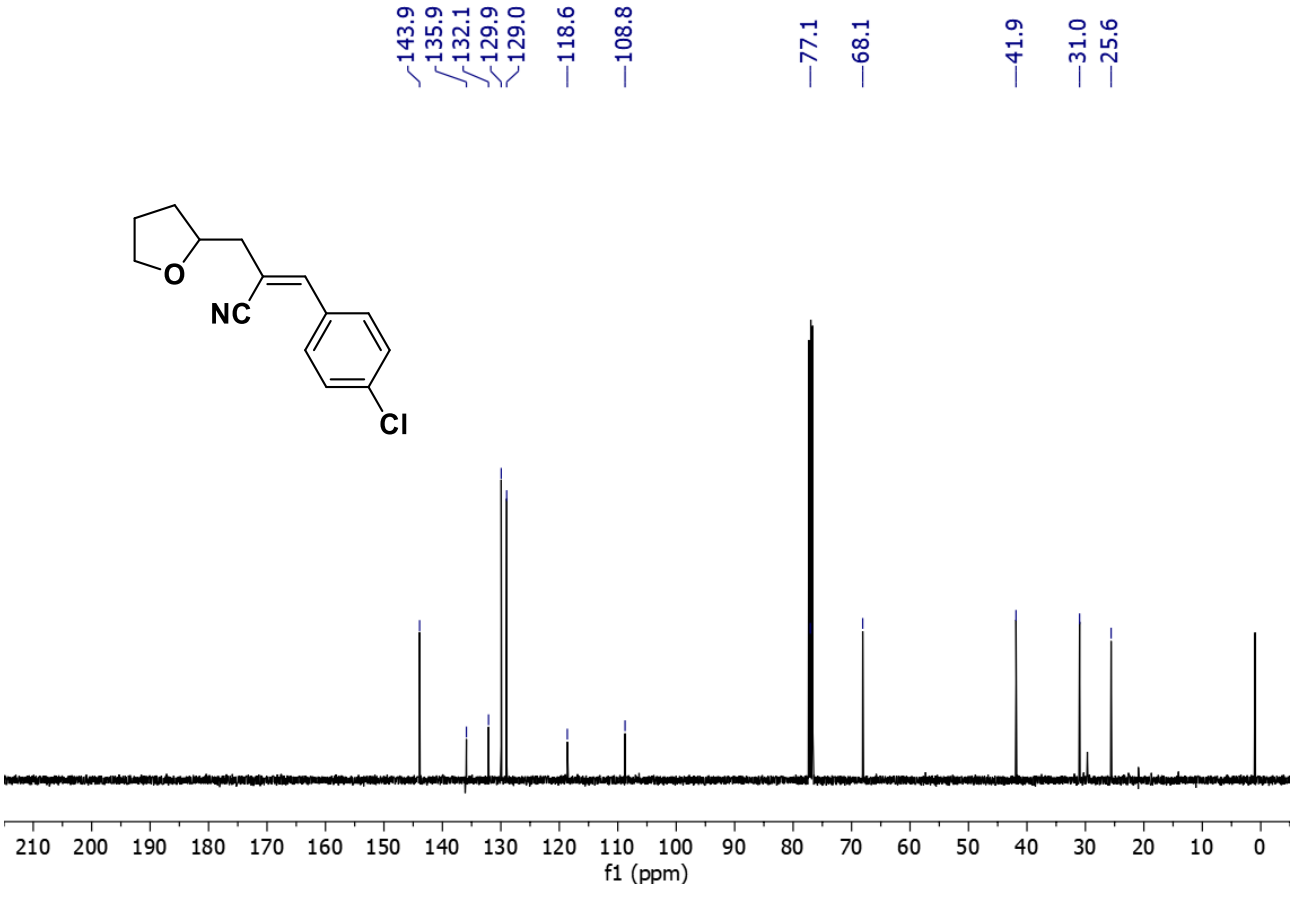
4ua ^{13}C NMR (100 MHz, $CDCl_3$)



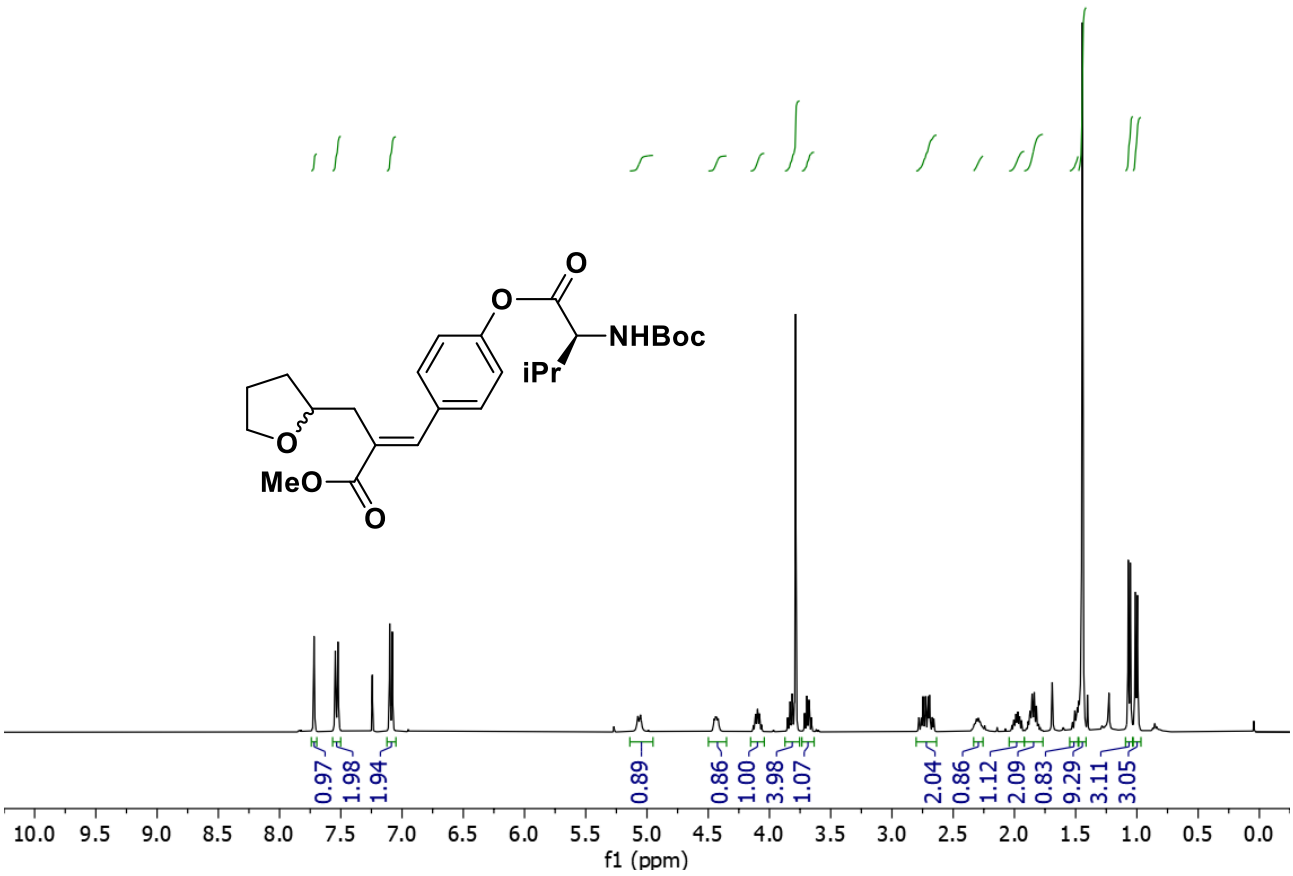
4va ^{1}H NMR (400 MHz, $CDCl_3$)



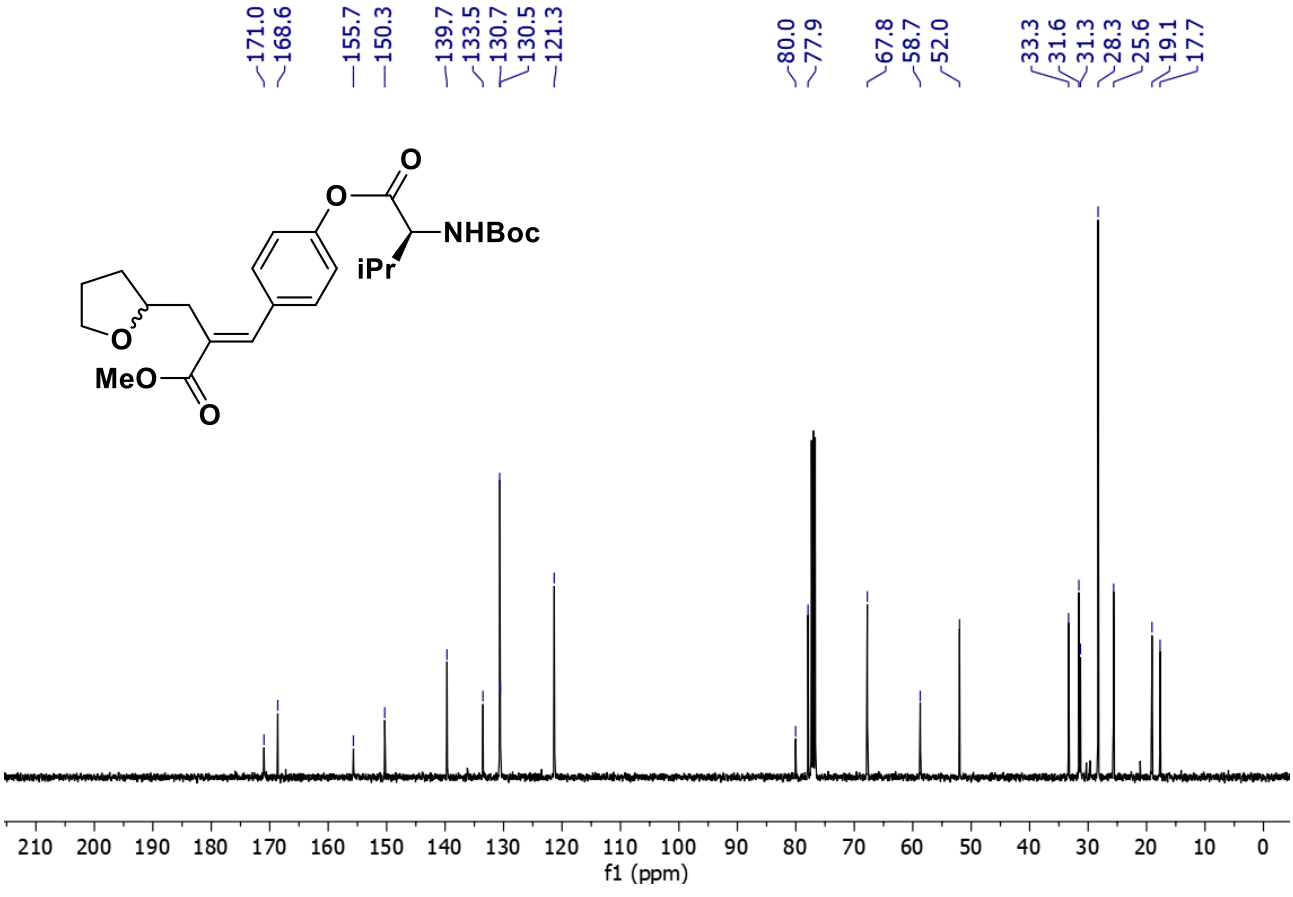
4va ^{13}C NMR (100 MHz, $CDCl_3$)



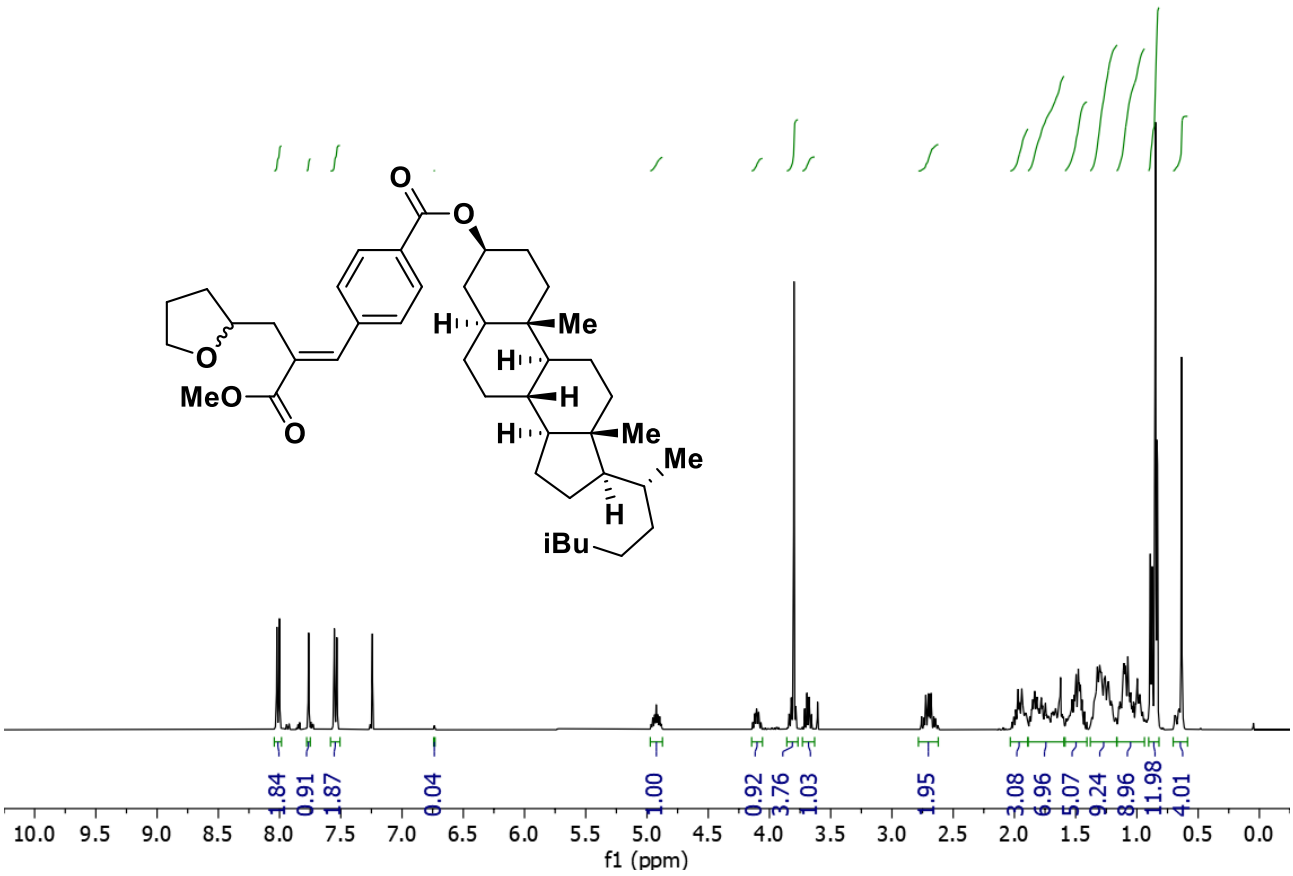
4wa ^{1}H NMR (400 MHz, $CDCl_3$)



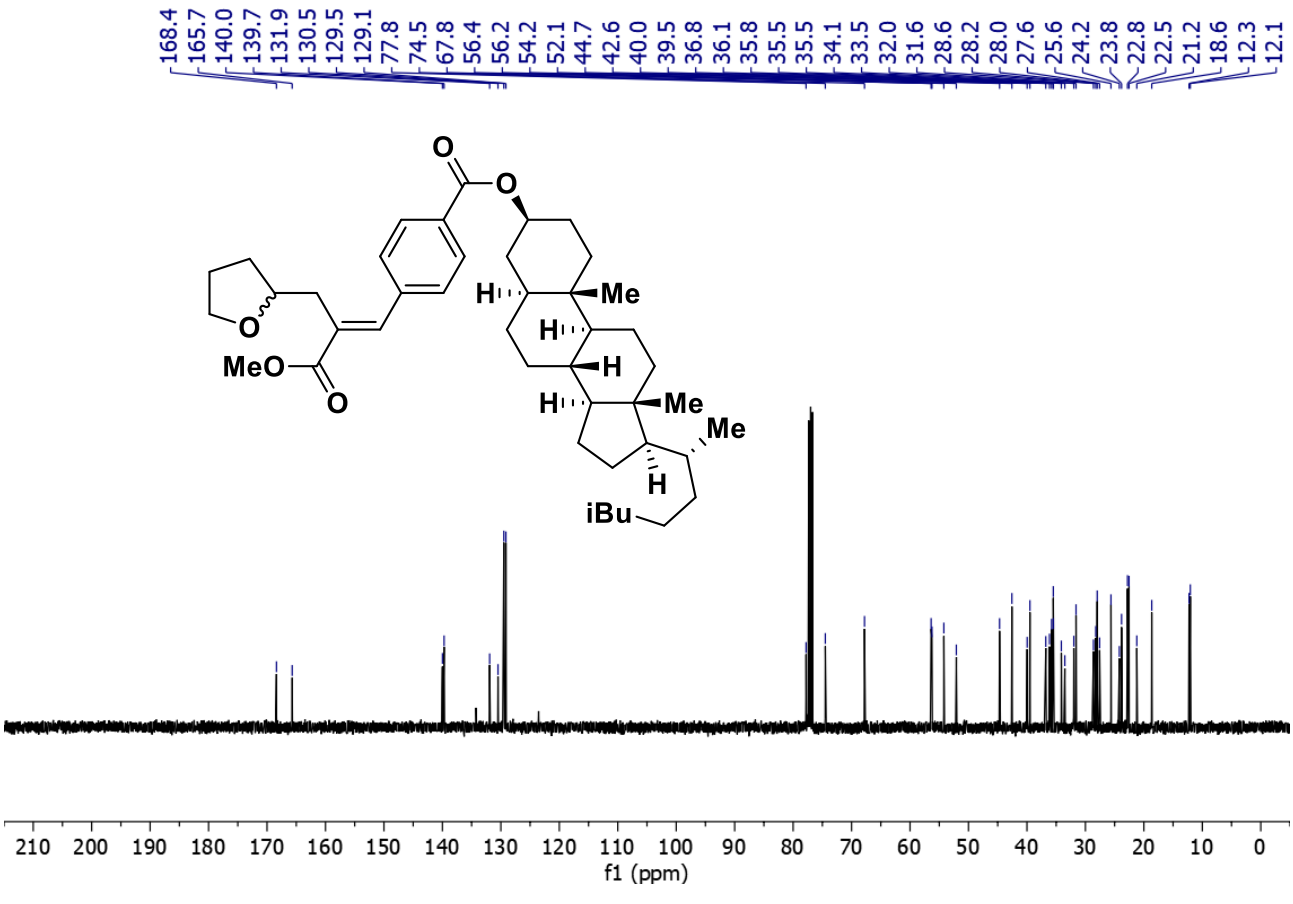
4wa ^{13}C NMR (100 MHz, $CDCl_3$)



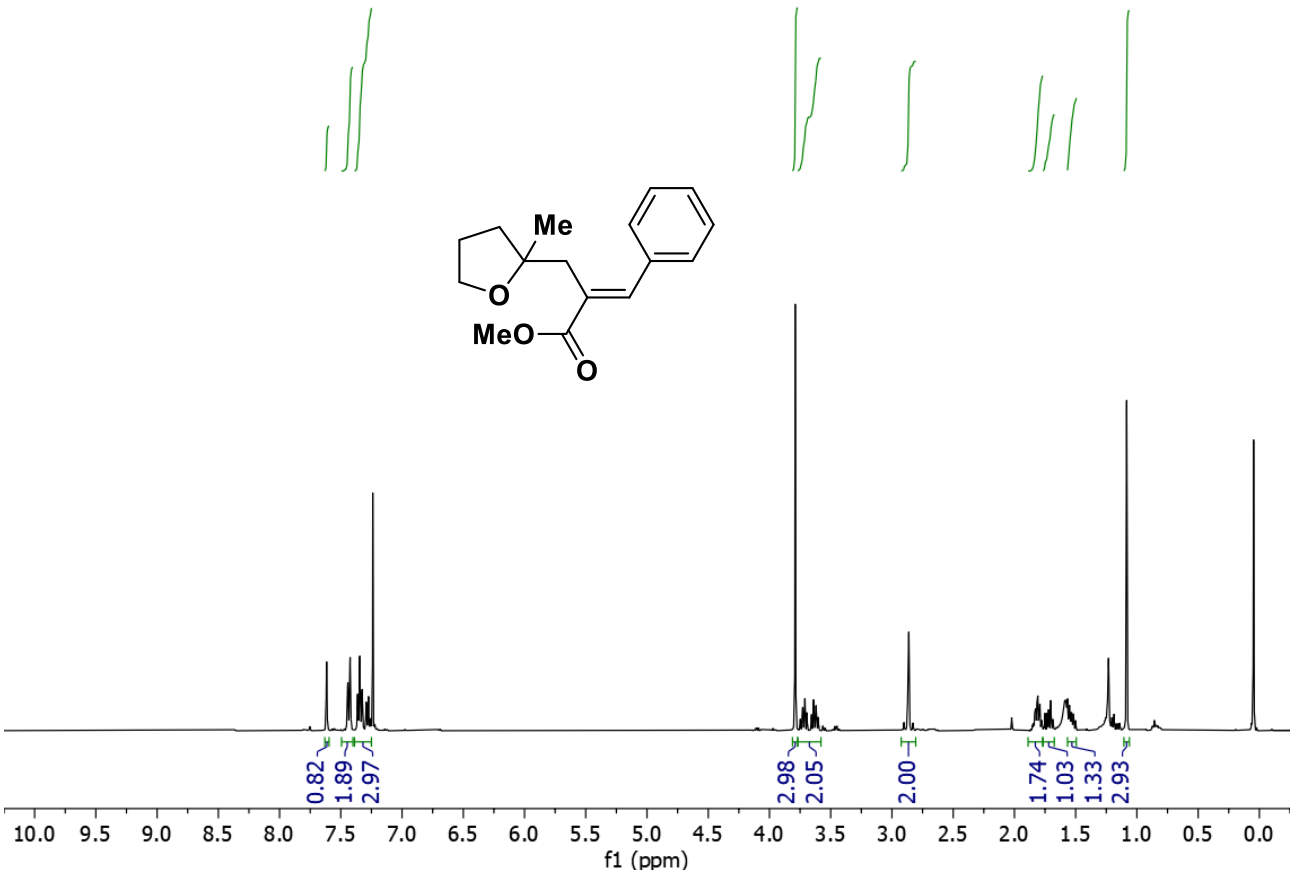
4xa ^{1}H NMR (400 MHz, $CDCl_3$)



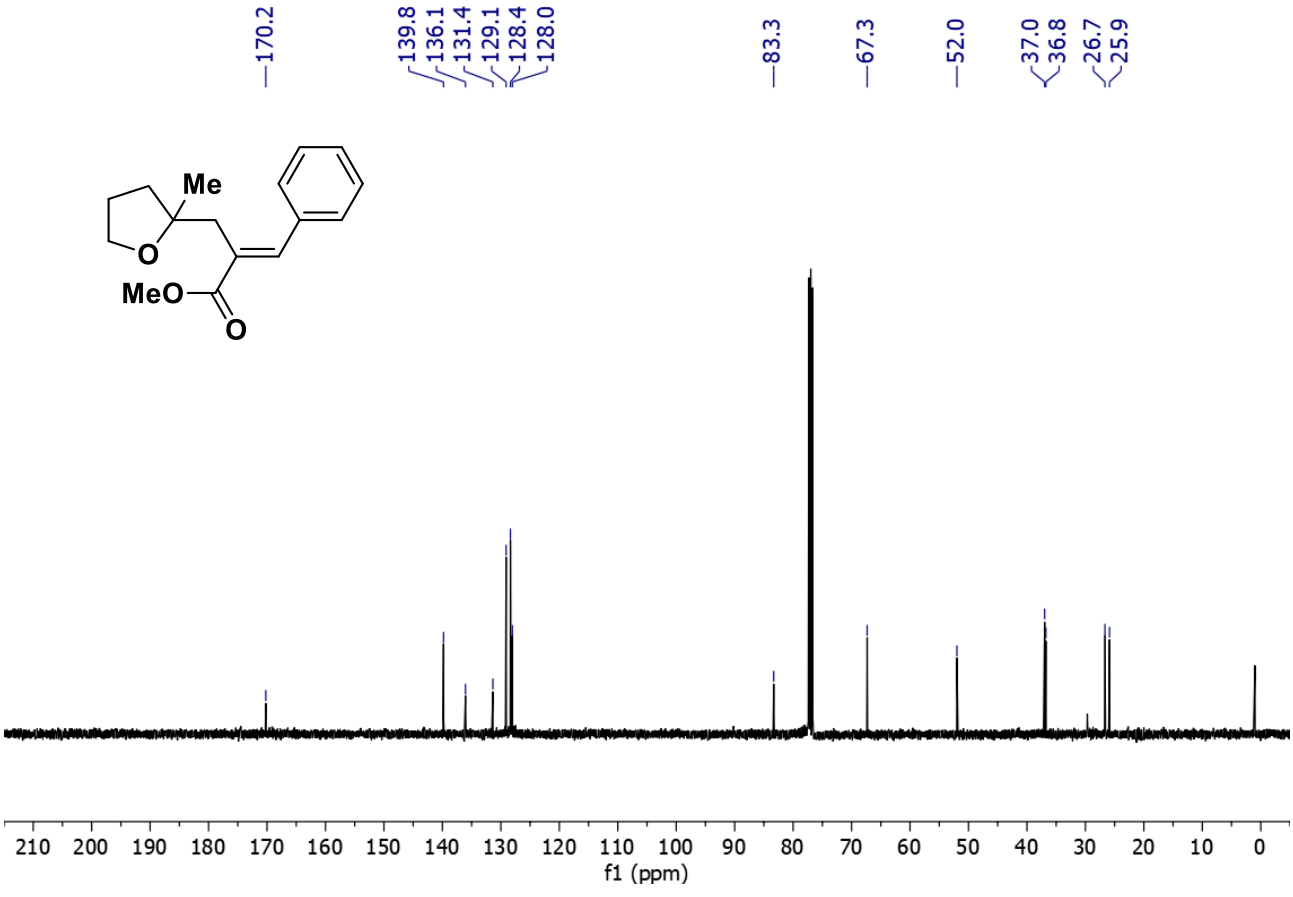
4xa ^{13}C NMR (100 MHz, $CDCl_3$)



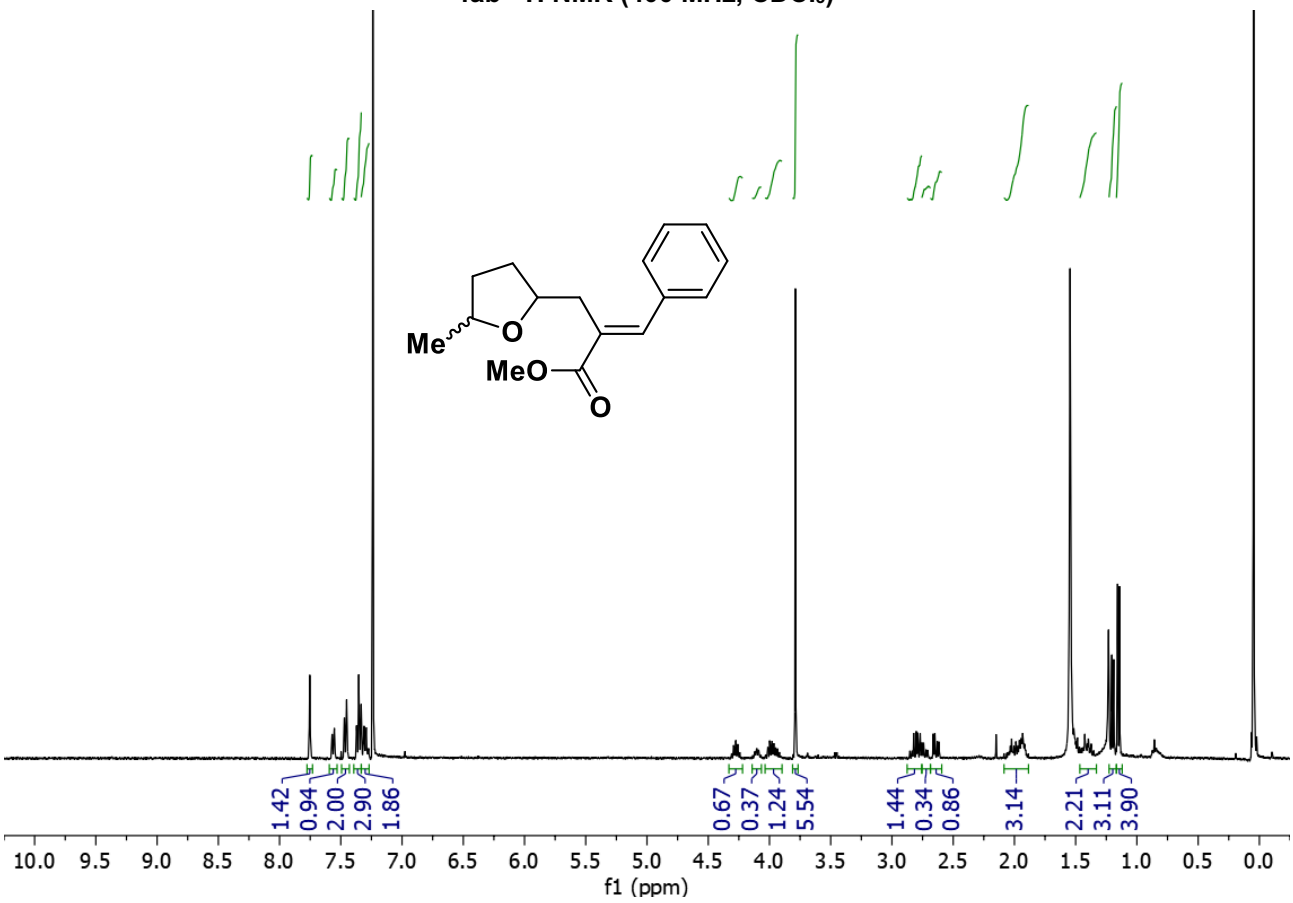
4ab ^{1}H NMR (400 MHz, $CDCl_3$)



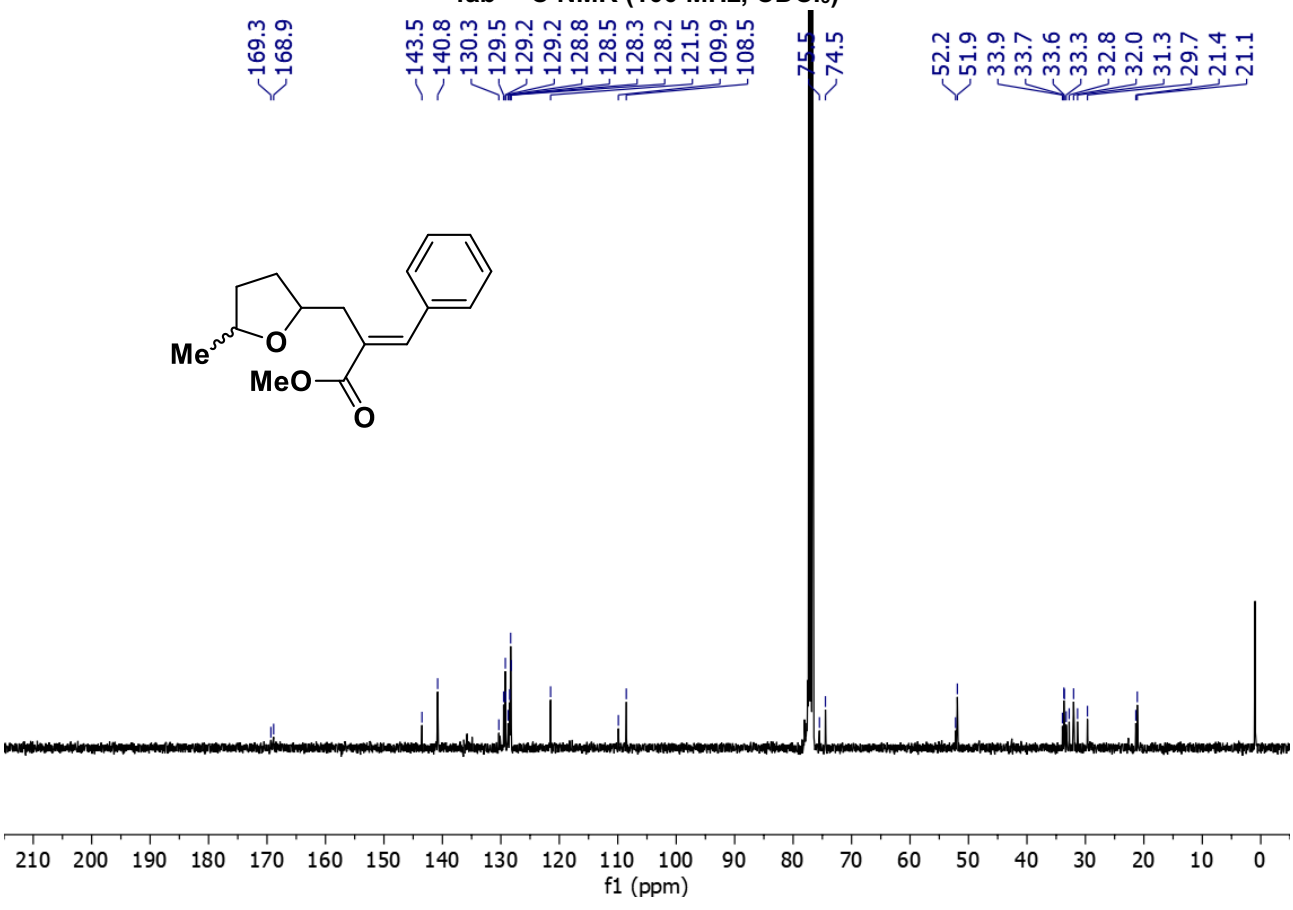
4ab ^{13}C NMR (100 MHz, $CDCl_3$)



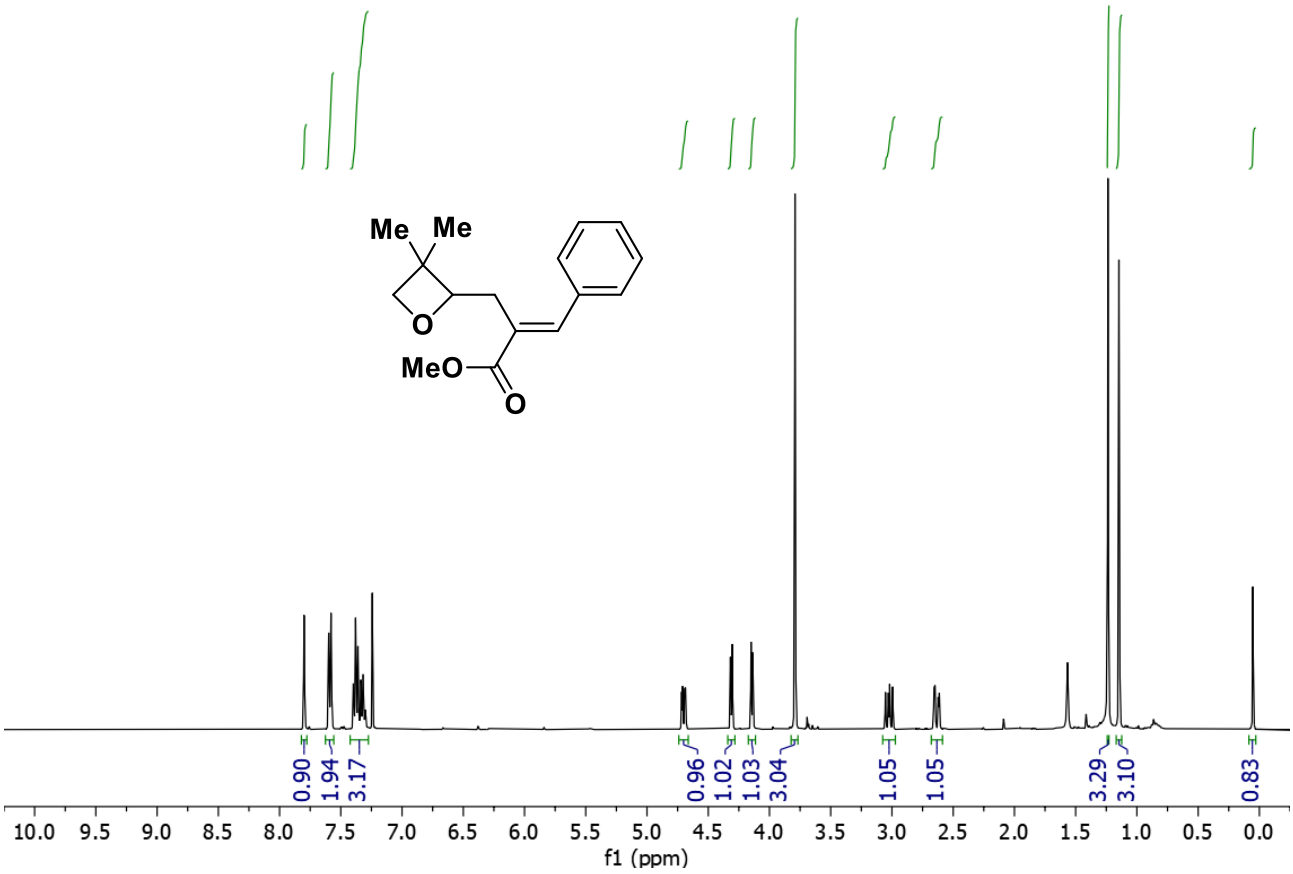
4ab' ^{1}H NMR (400 MHz, $CDCl_3$)



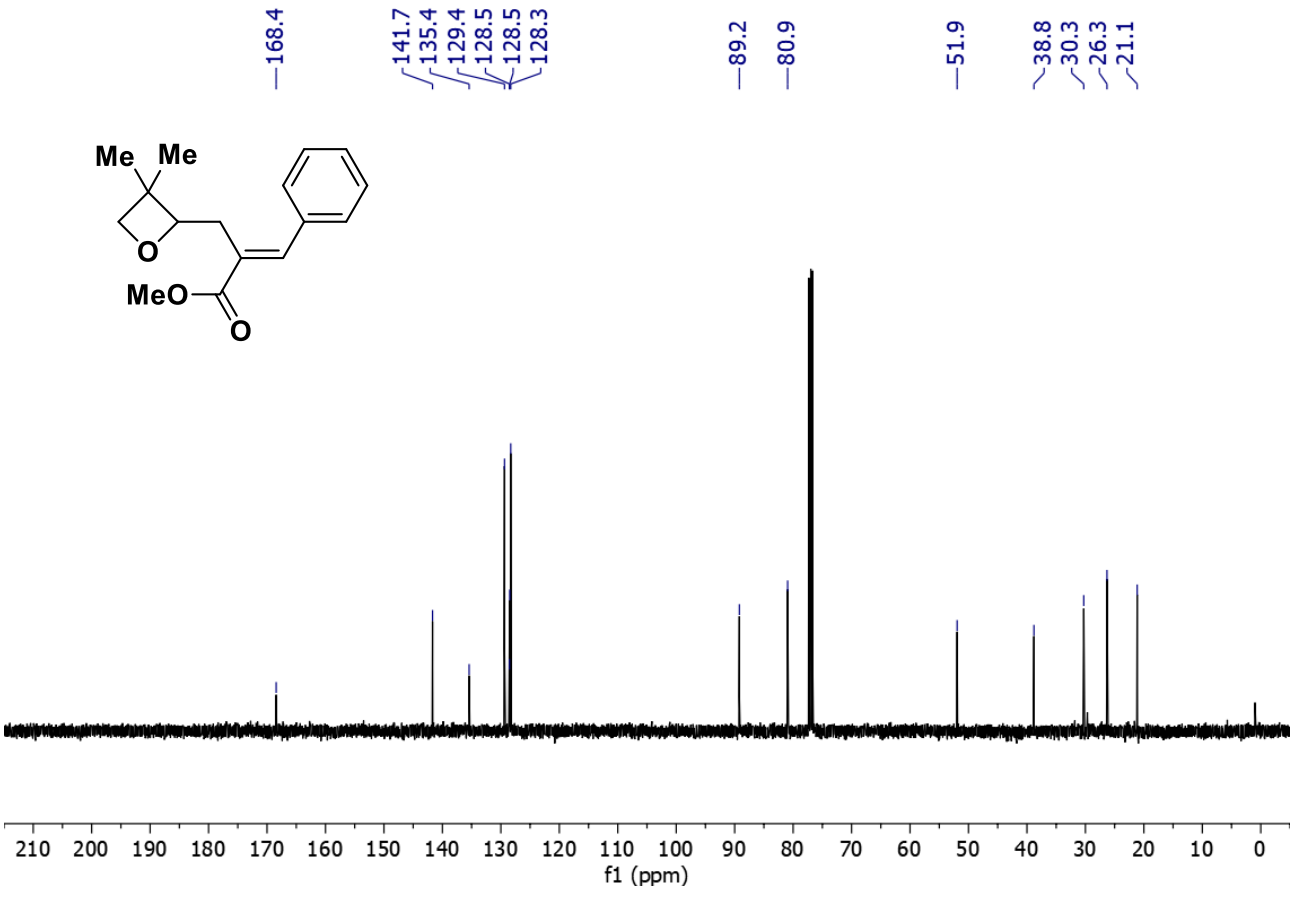
4ab' ^{13}C NMR (100 MHz, $CDCl_3$)



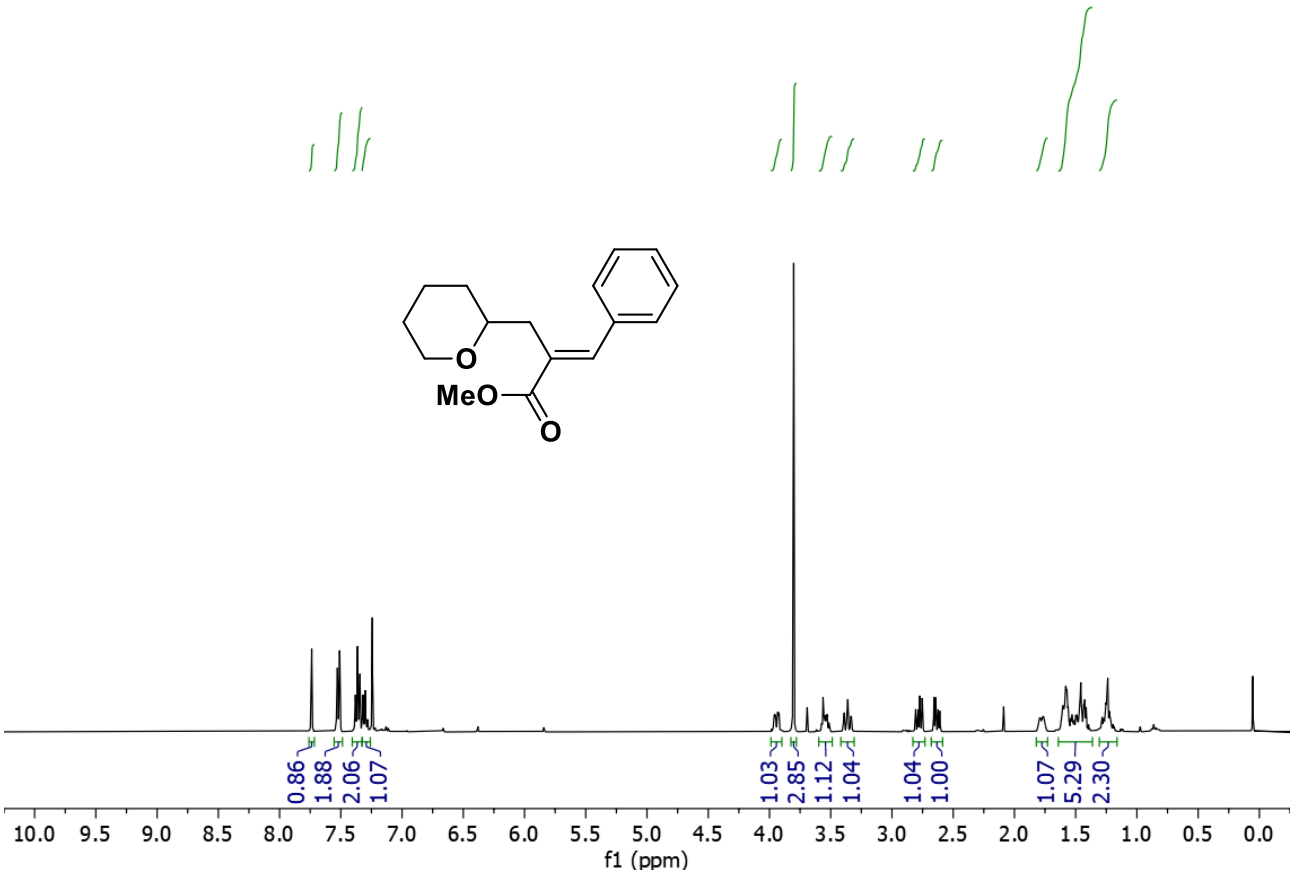
4ac ^{1}H NMR (400 MHz, $CDCl_3$)



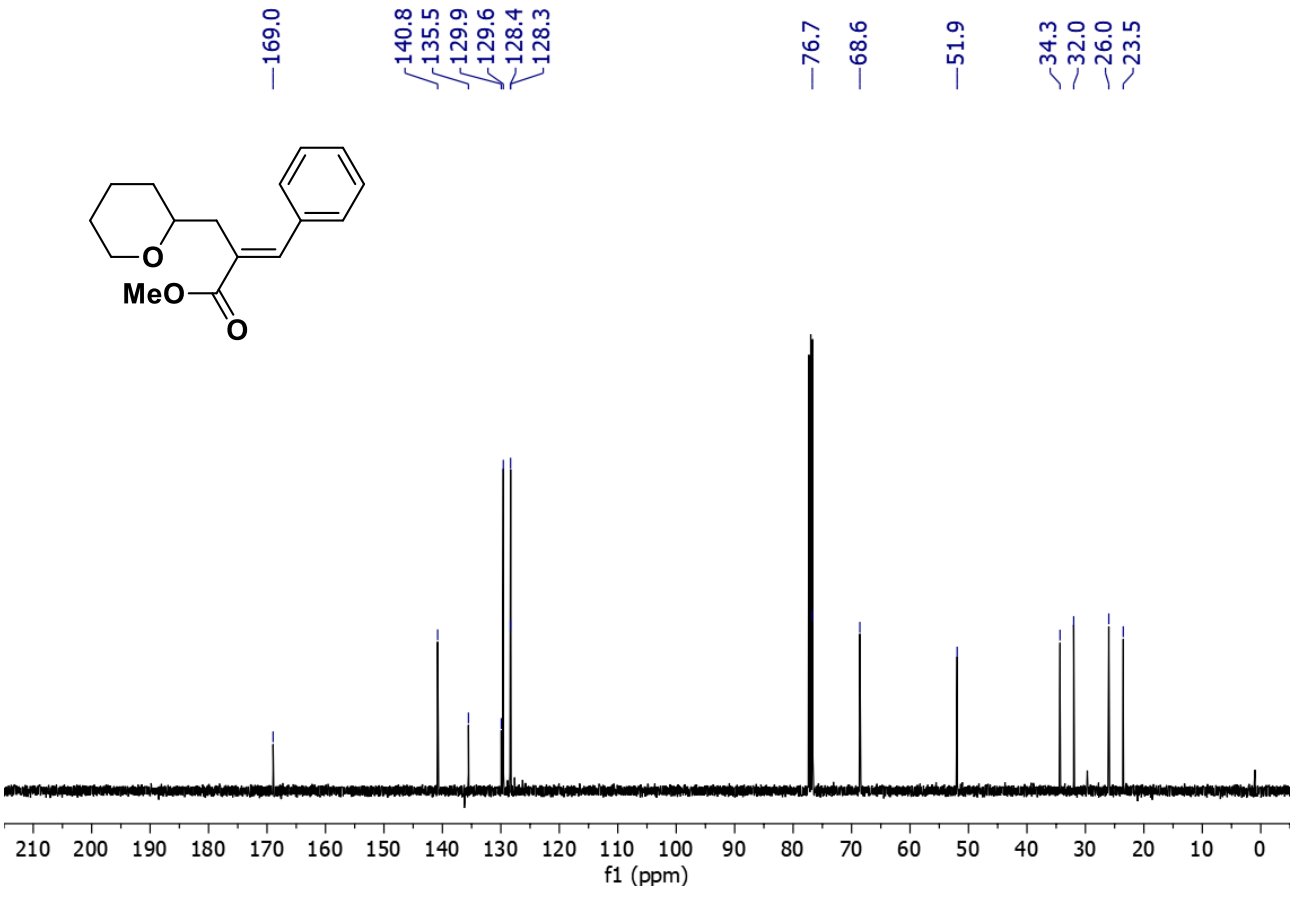
4ac ^{13}C NMR (100 MHz, $CDCl_3$)



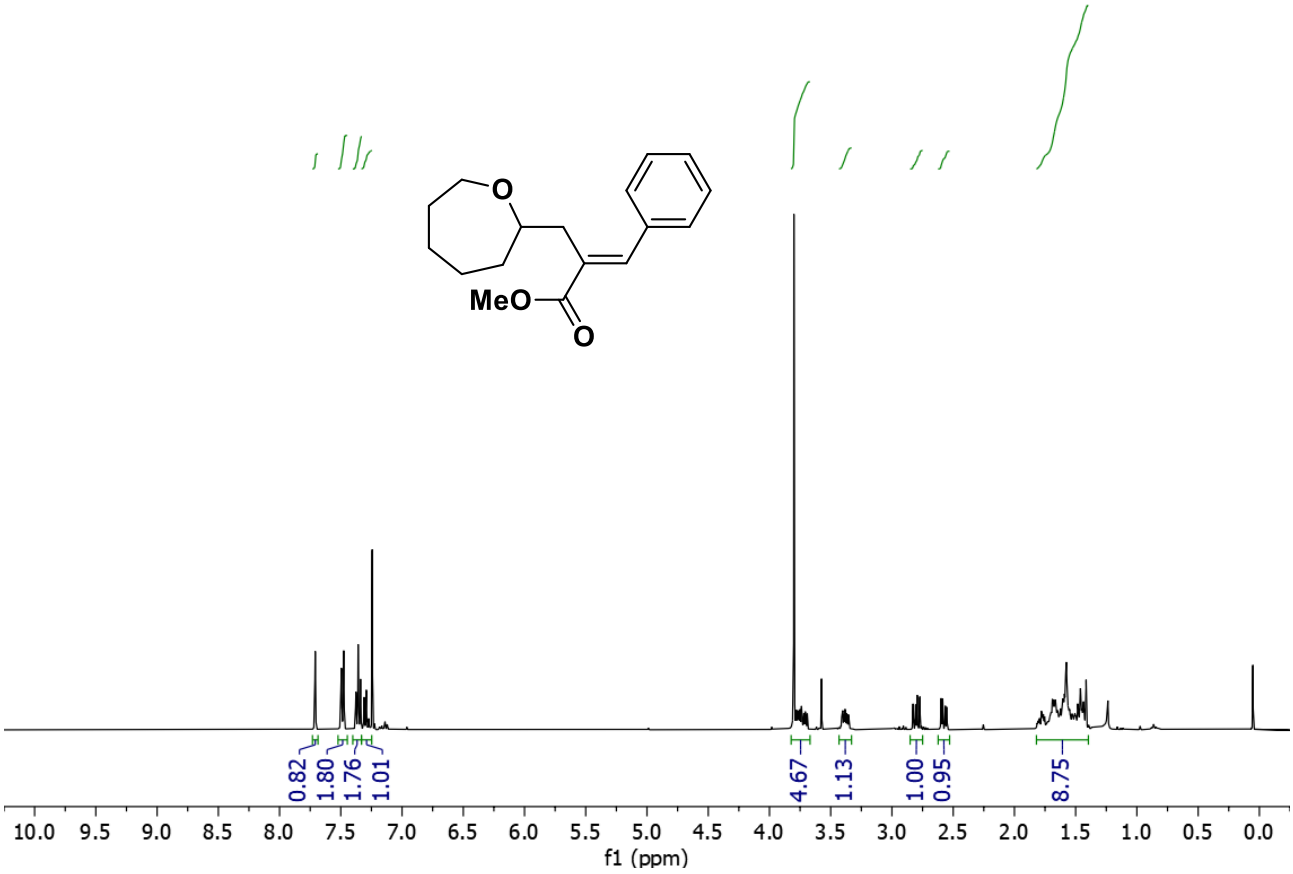
4ad ^{1}H NMR (400 MHz, $CDCl_3$)



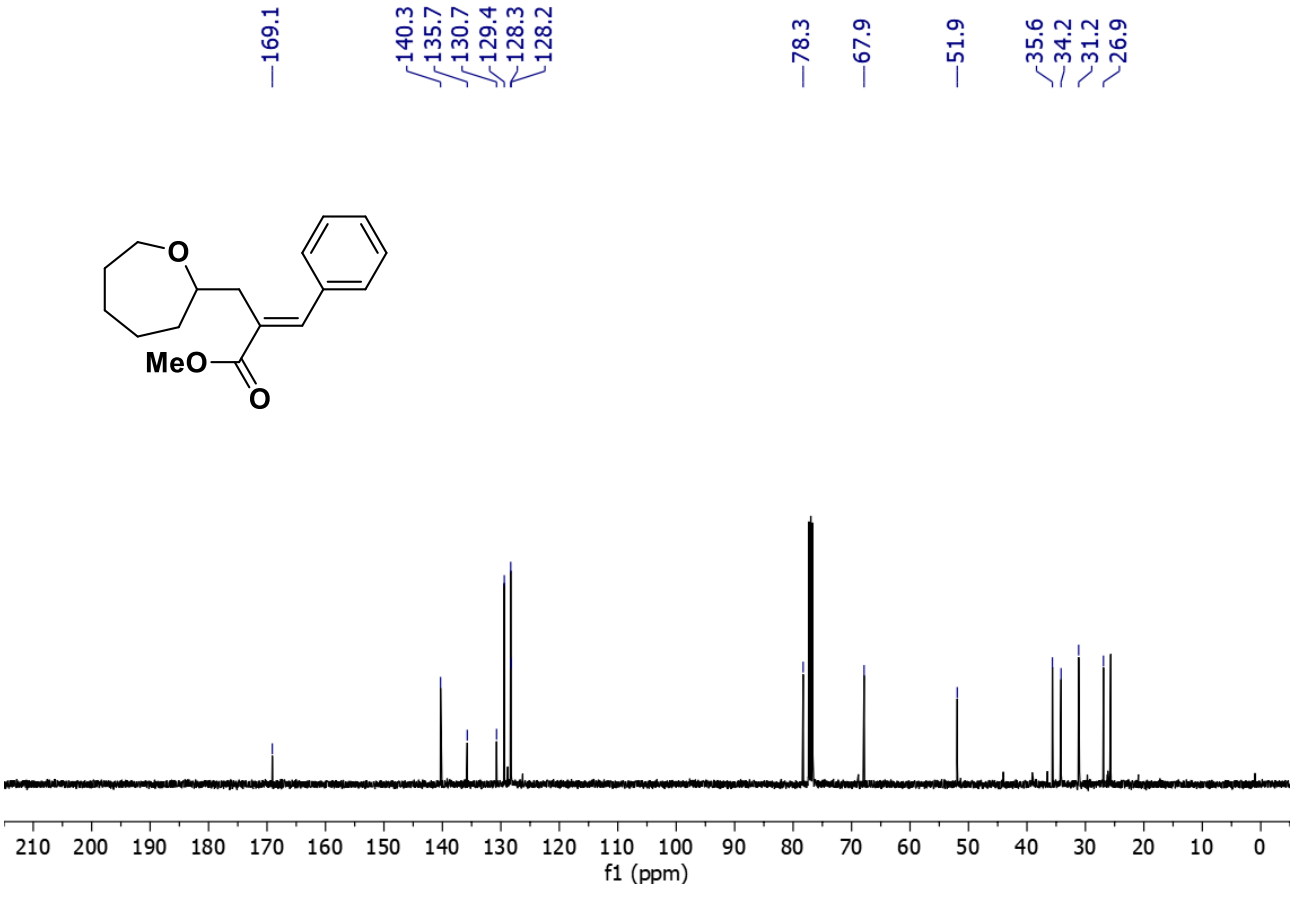
4ad ^{13}C NMR (100 MHz, $CDCl_3$)



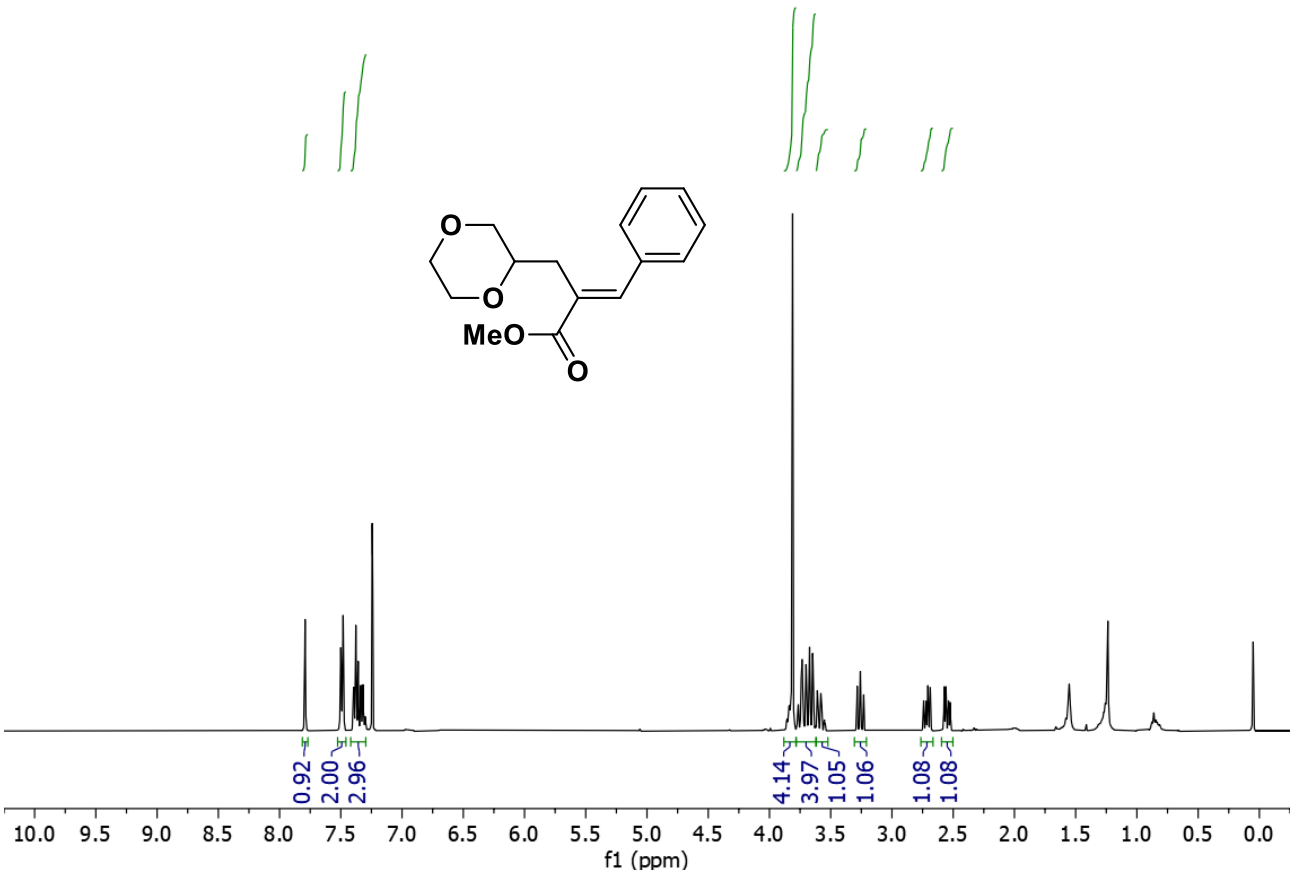
4ae ^{1}H NMR (400 MHz, $CDCl_3$)



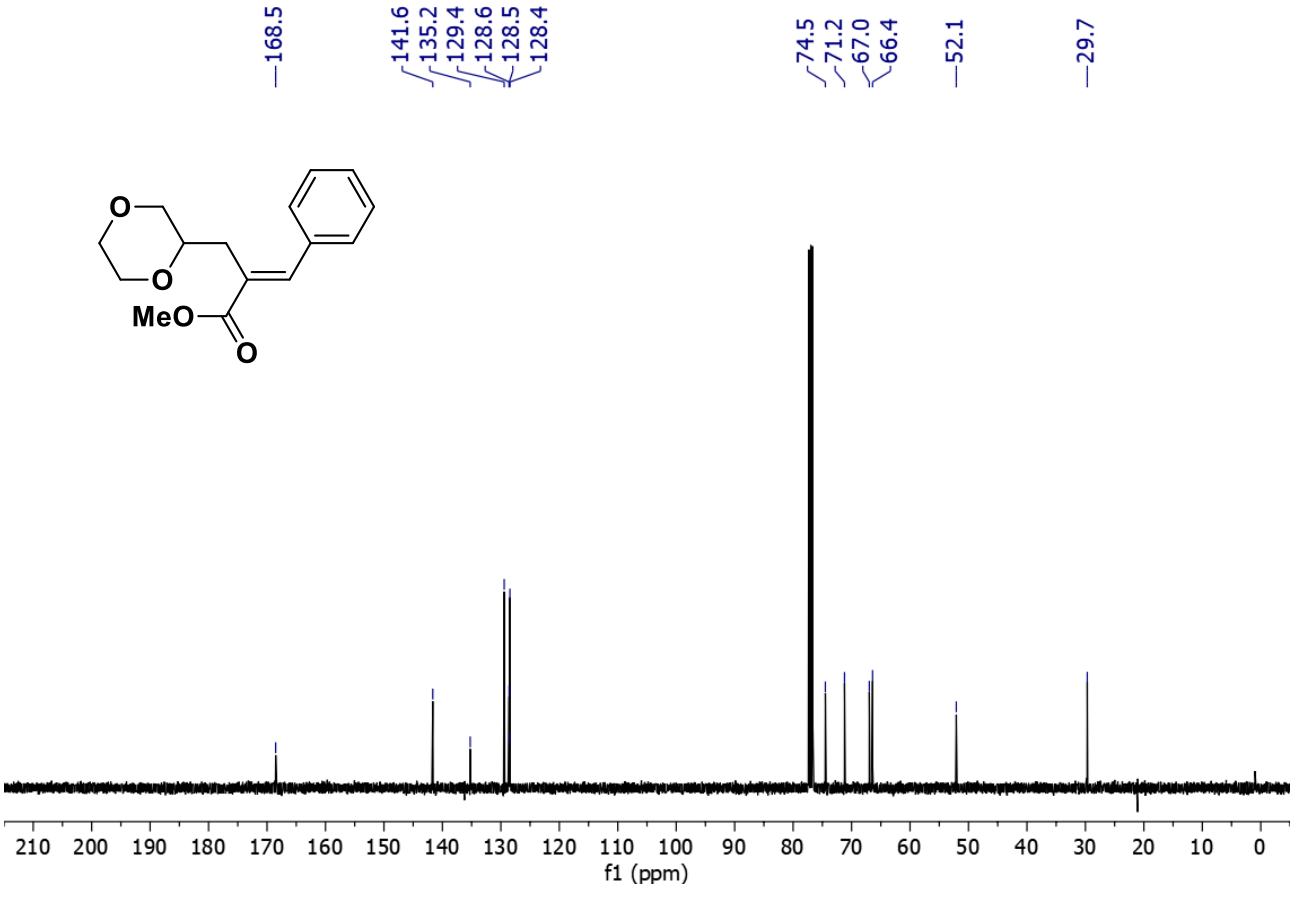
4ae ^{13}C NMR (100 MHz, $CDCl_3$)



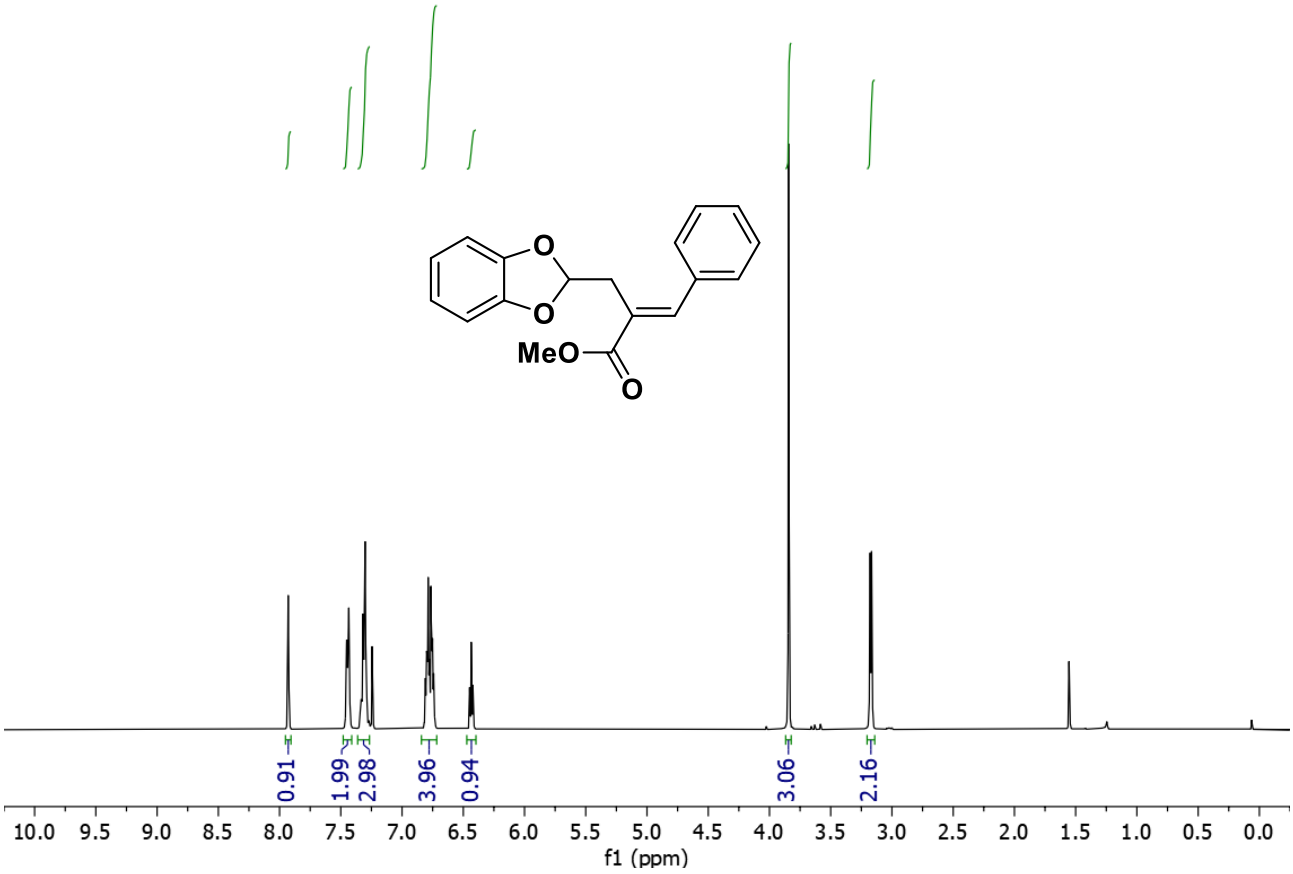
4af ^{1}H NMR (400 MHz, $CDCl_3$)



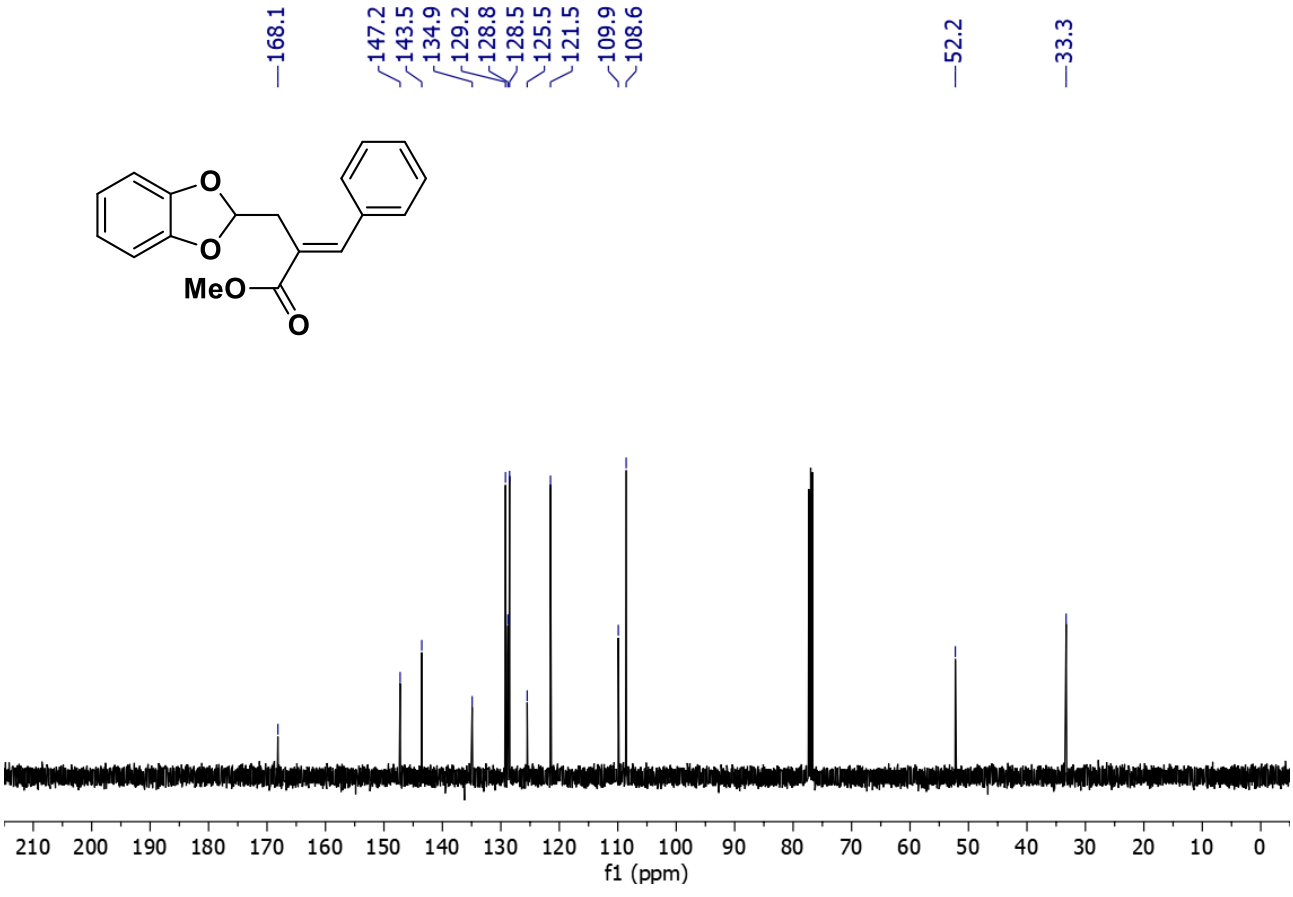
4af ^{13}C NMR (100 MHz, $CDCl_3$)



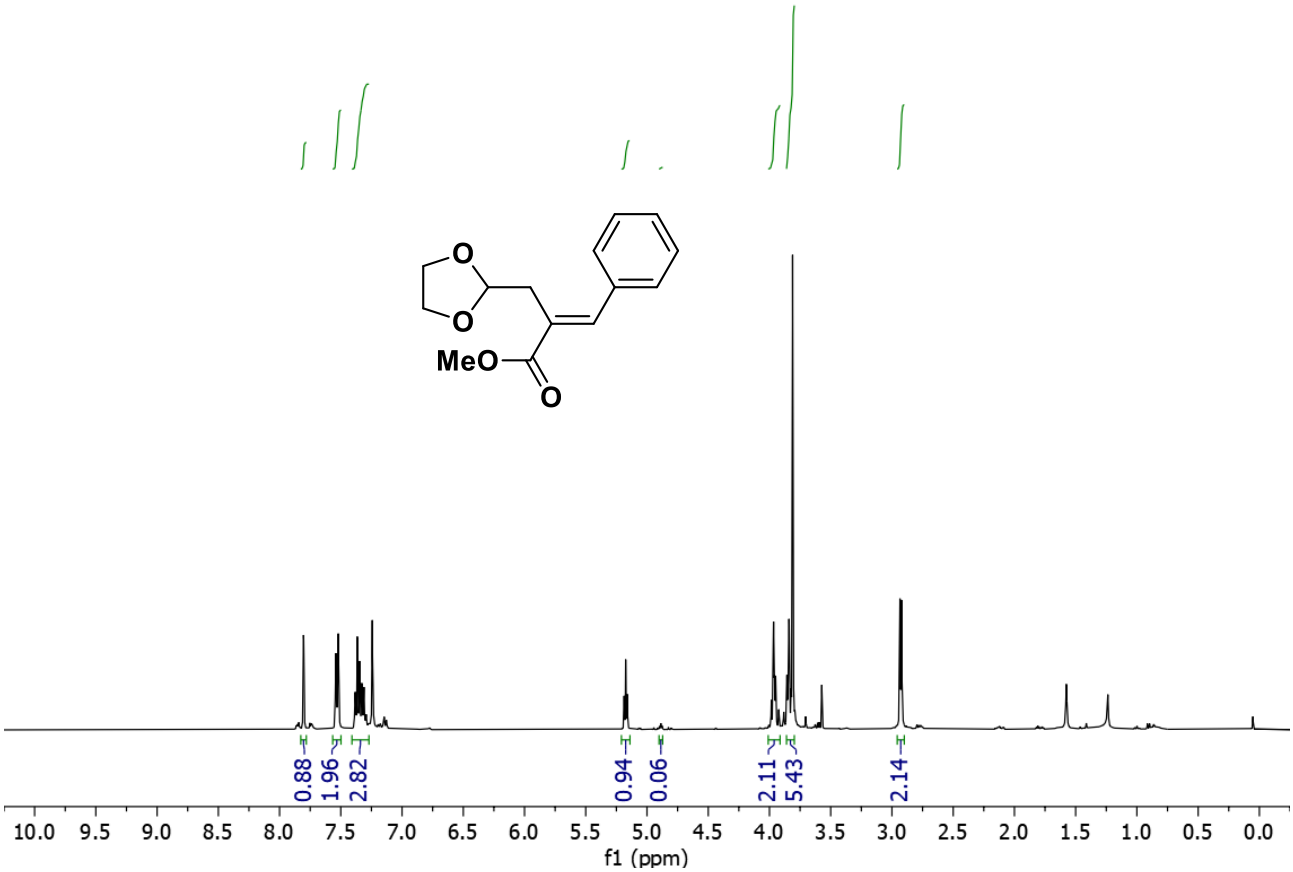
4ag ^{1}H NMR (400 MHz, $CDCl_3$)



4ag ^{13}C NMR (100 MHz, $CDCl_3$)



4ah ^{1}H NMR (400 MHz, $CDCl_3$)



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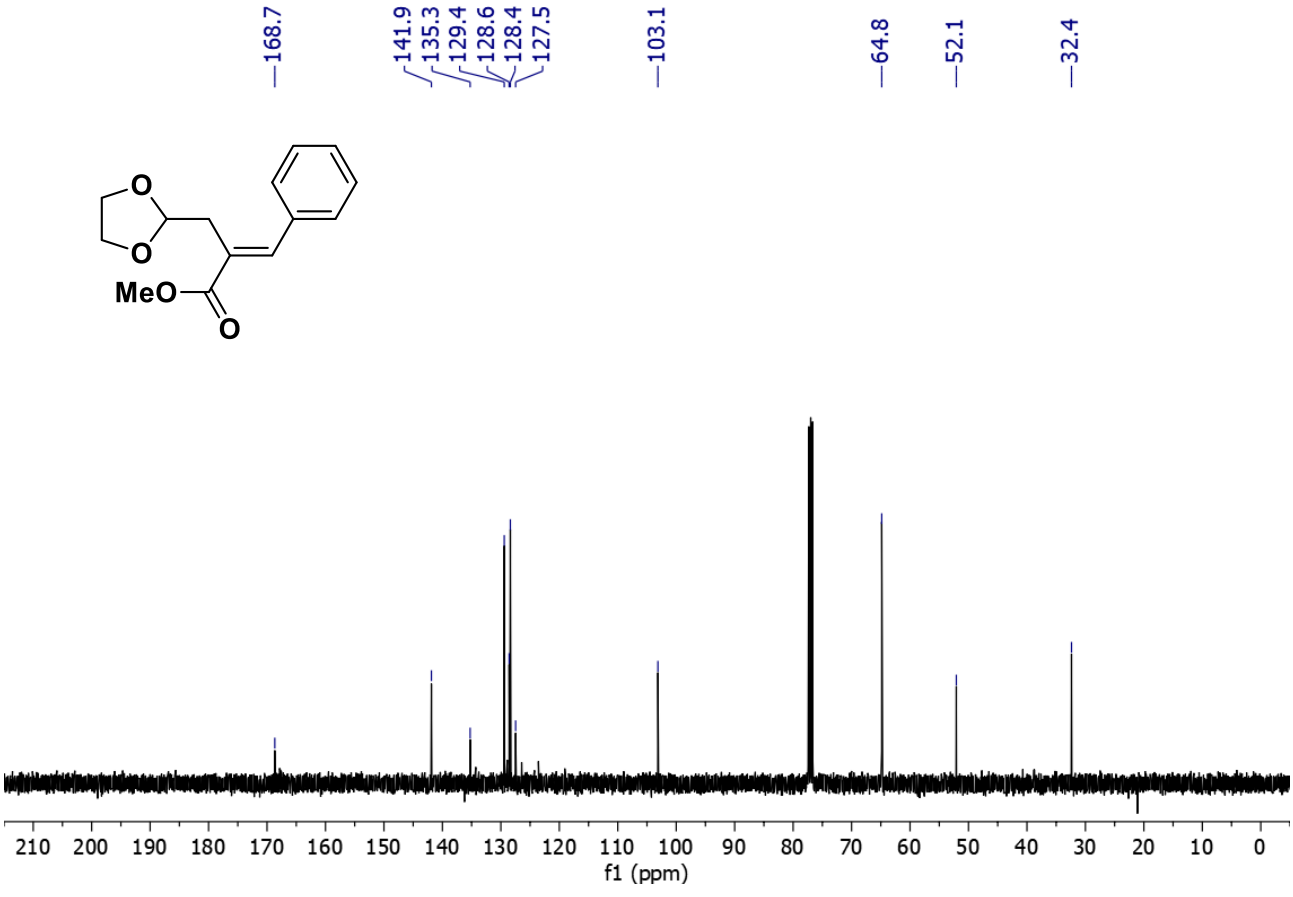
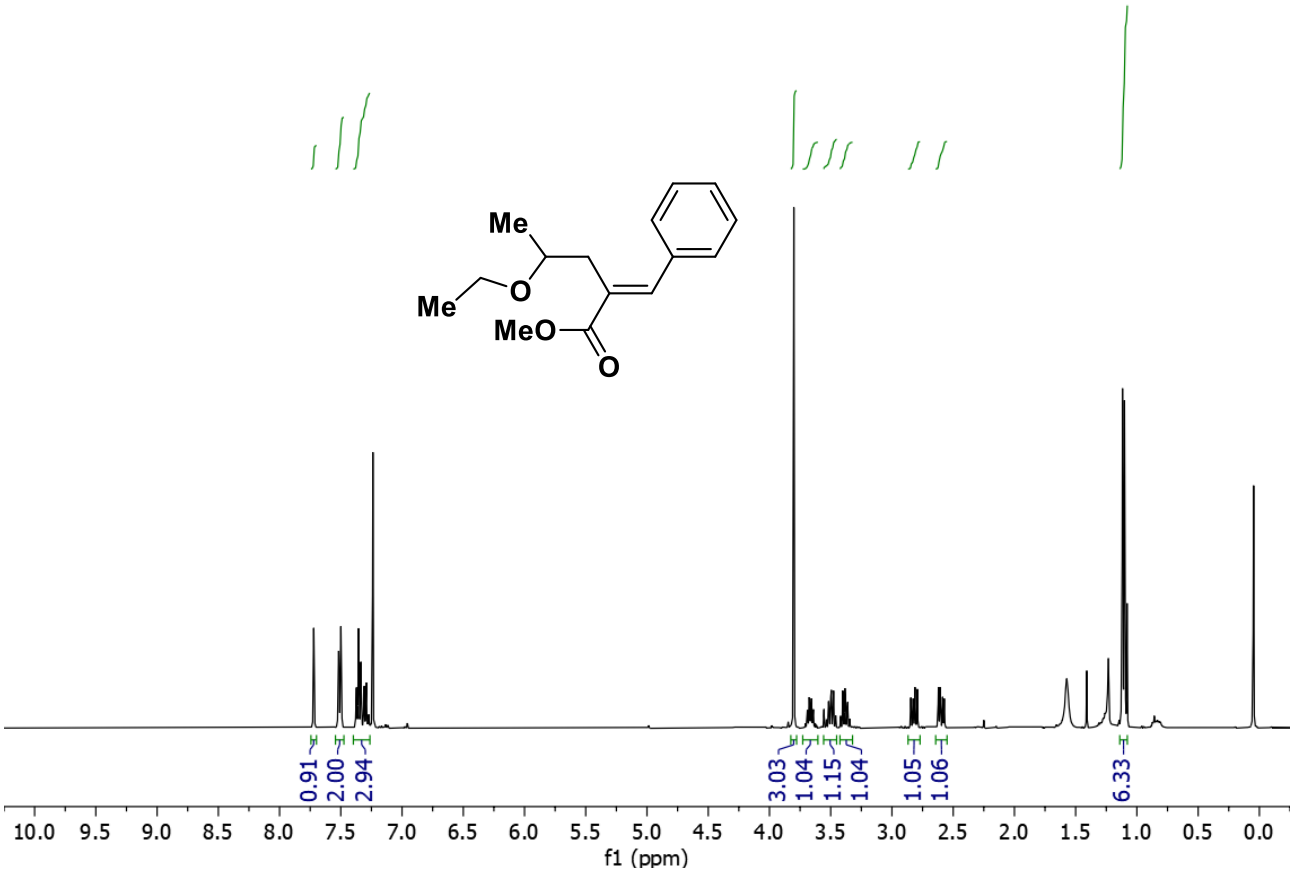


4ai ^{1}H NMR (400 MHz, $CDCl_3$)



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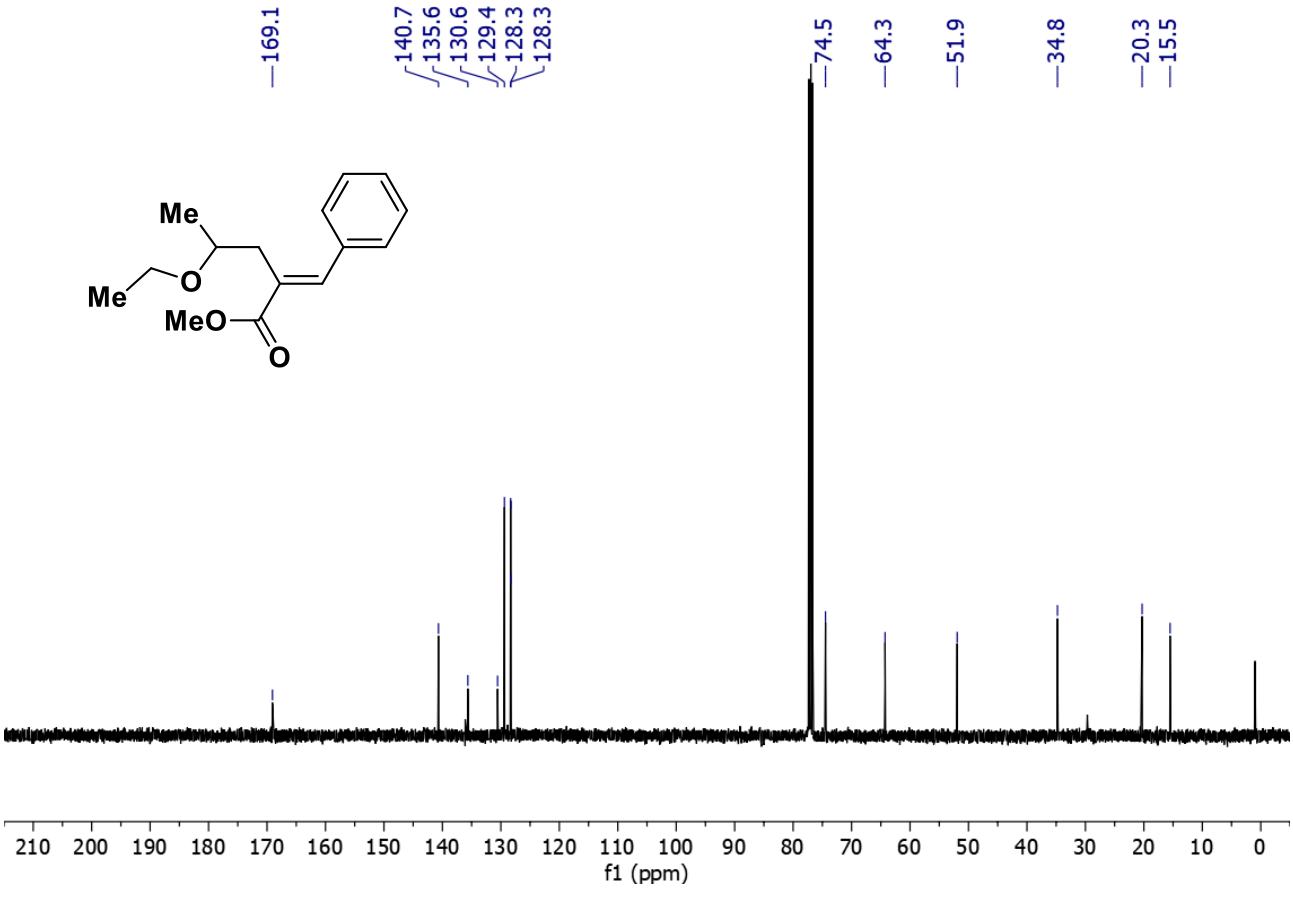
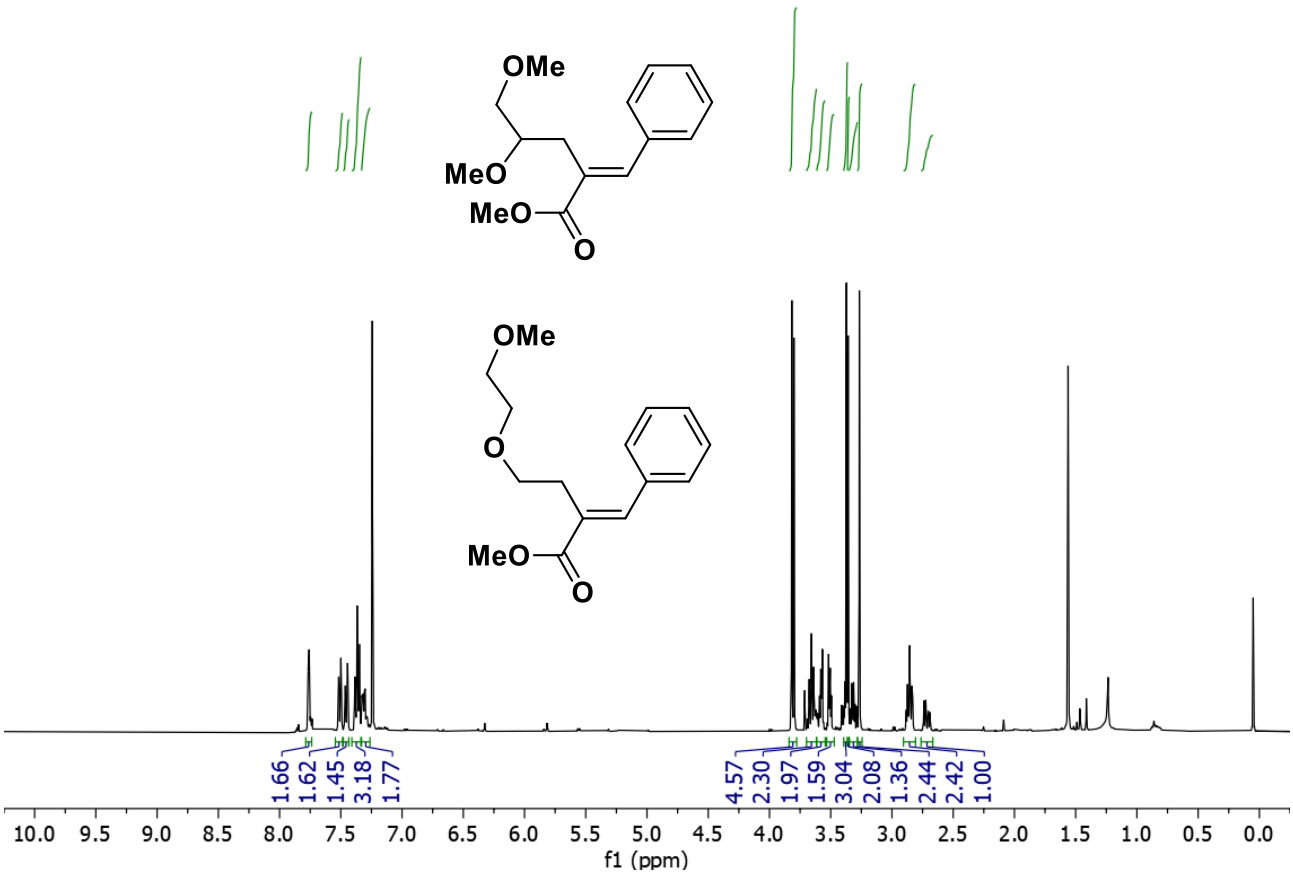
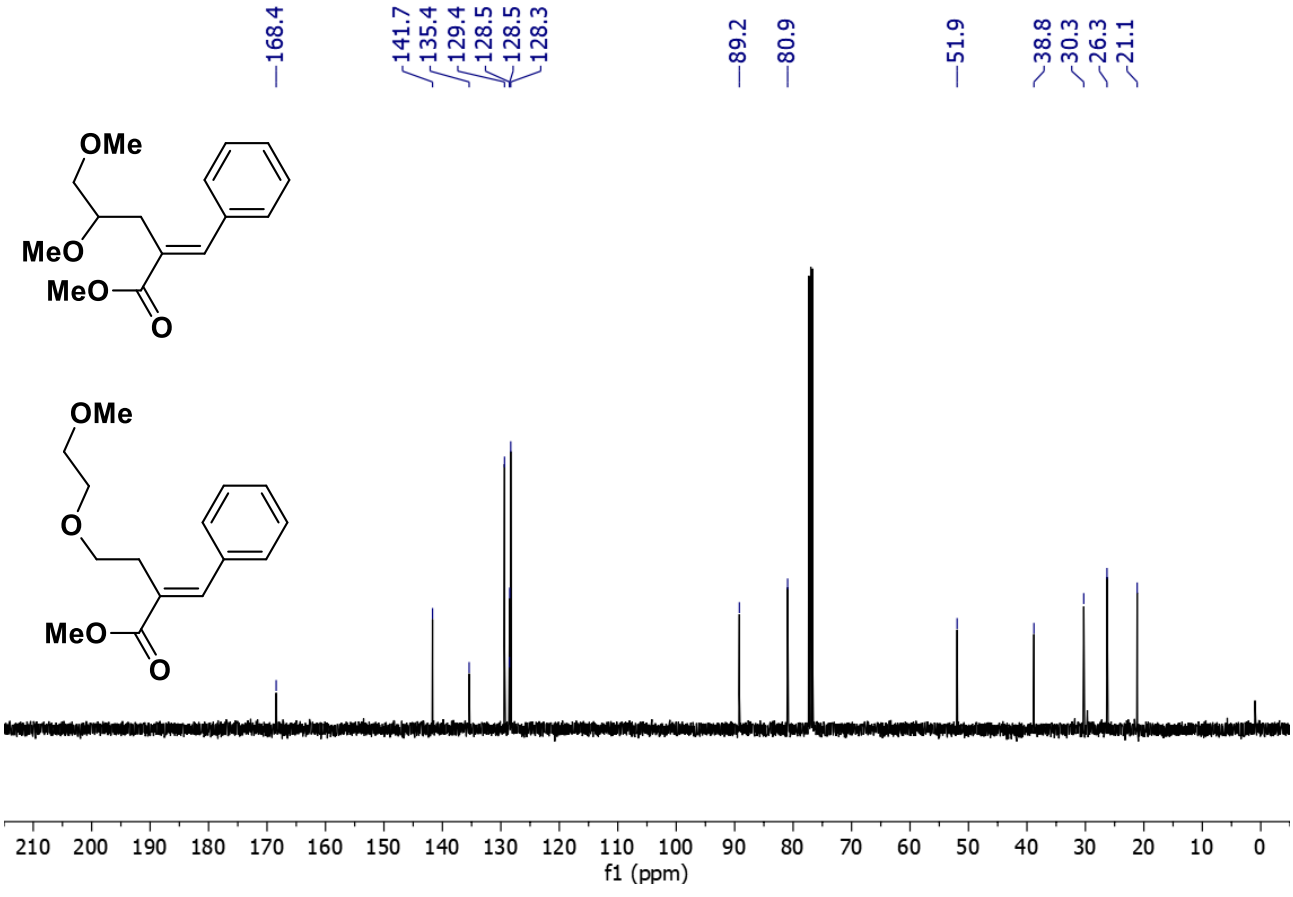


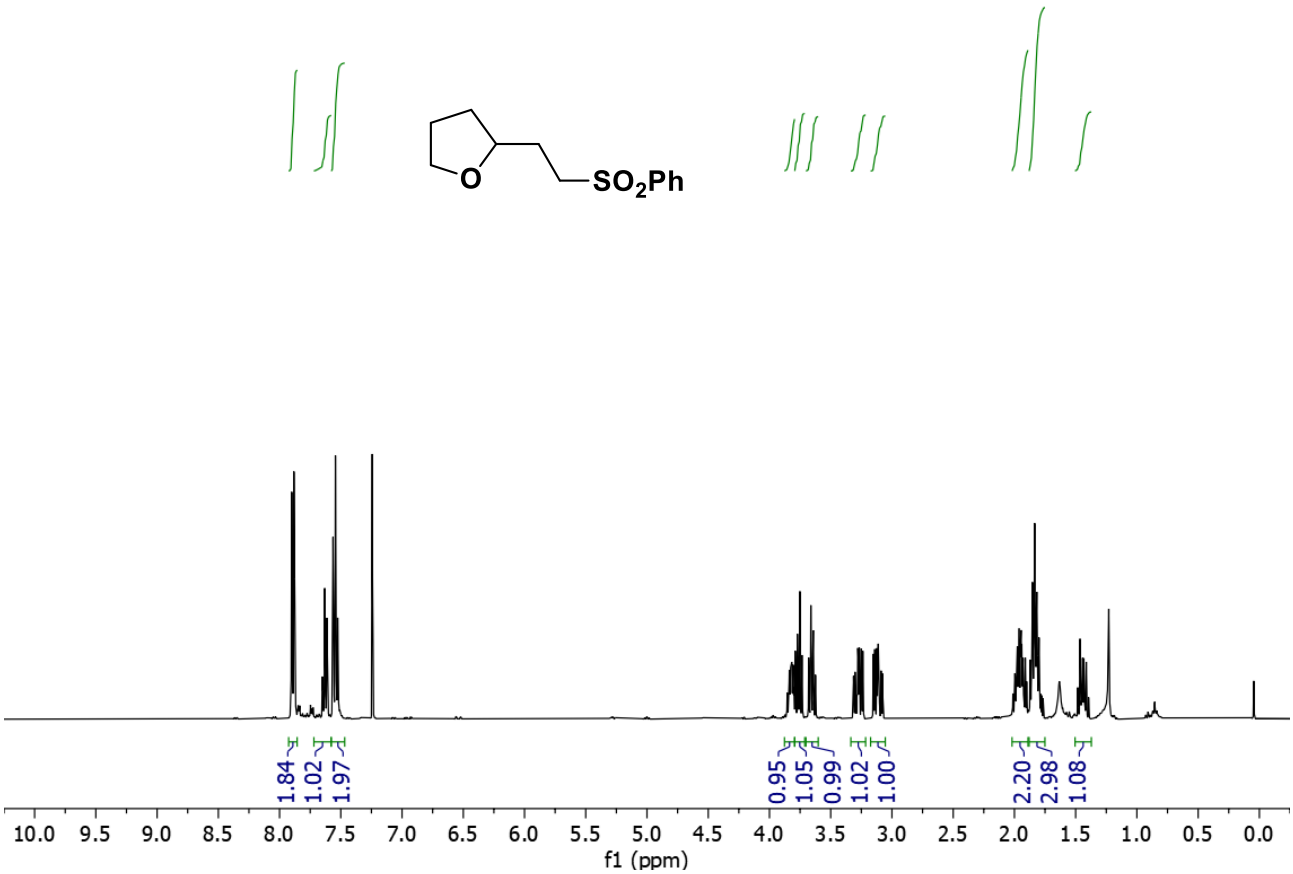
4aj and 4aj' ^{1}H NMR (400 MHz, $CDCl_3$)



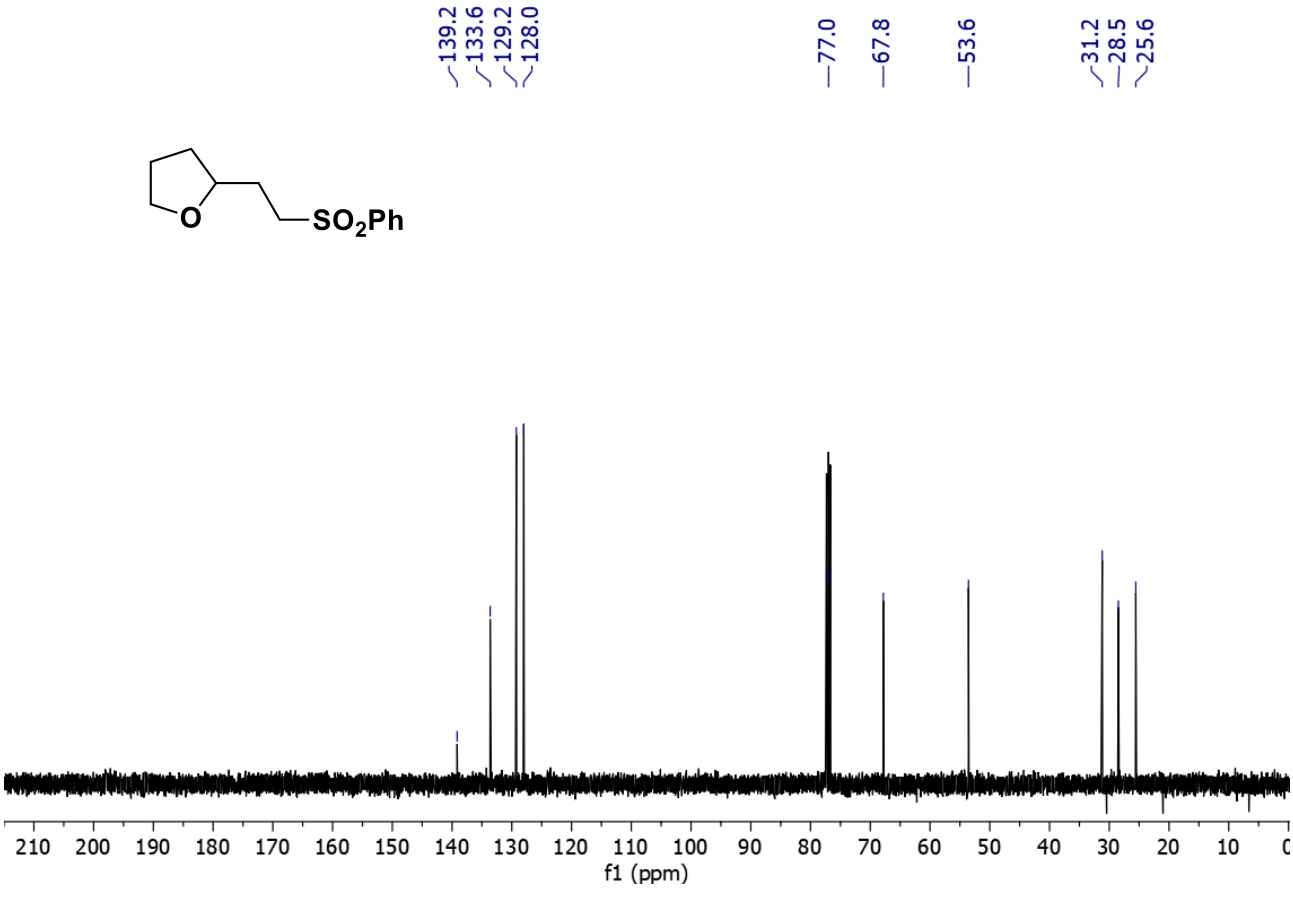
4aj and 4aj' ^{13}C NMR (100 MHz, $CDCl_3$)



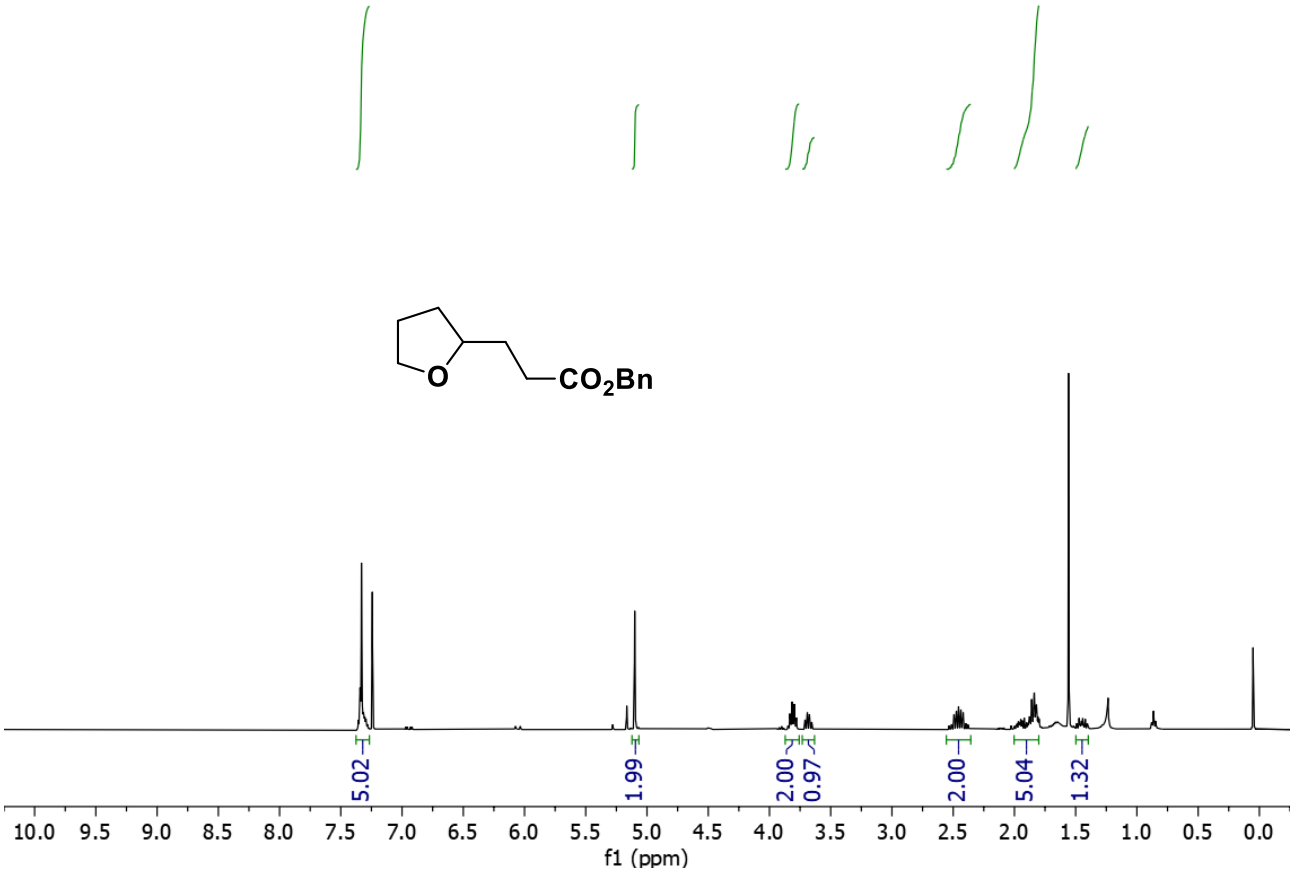
8a ^{1}H NMR (400 MHz, $CDCl_3$)



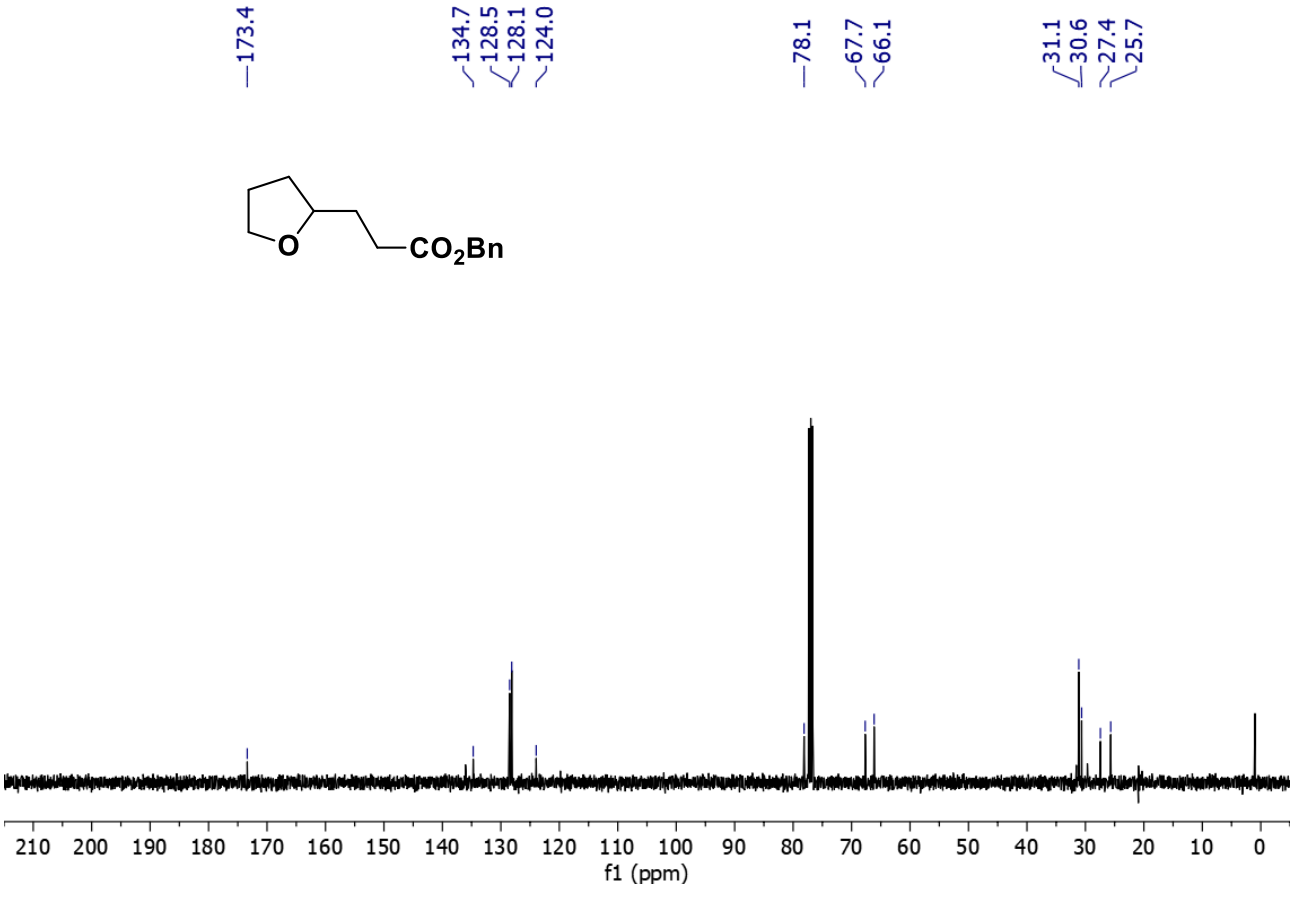
8a ^{13}C NMR (100 MHz, $CDCl_3$)



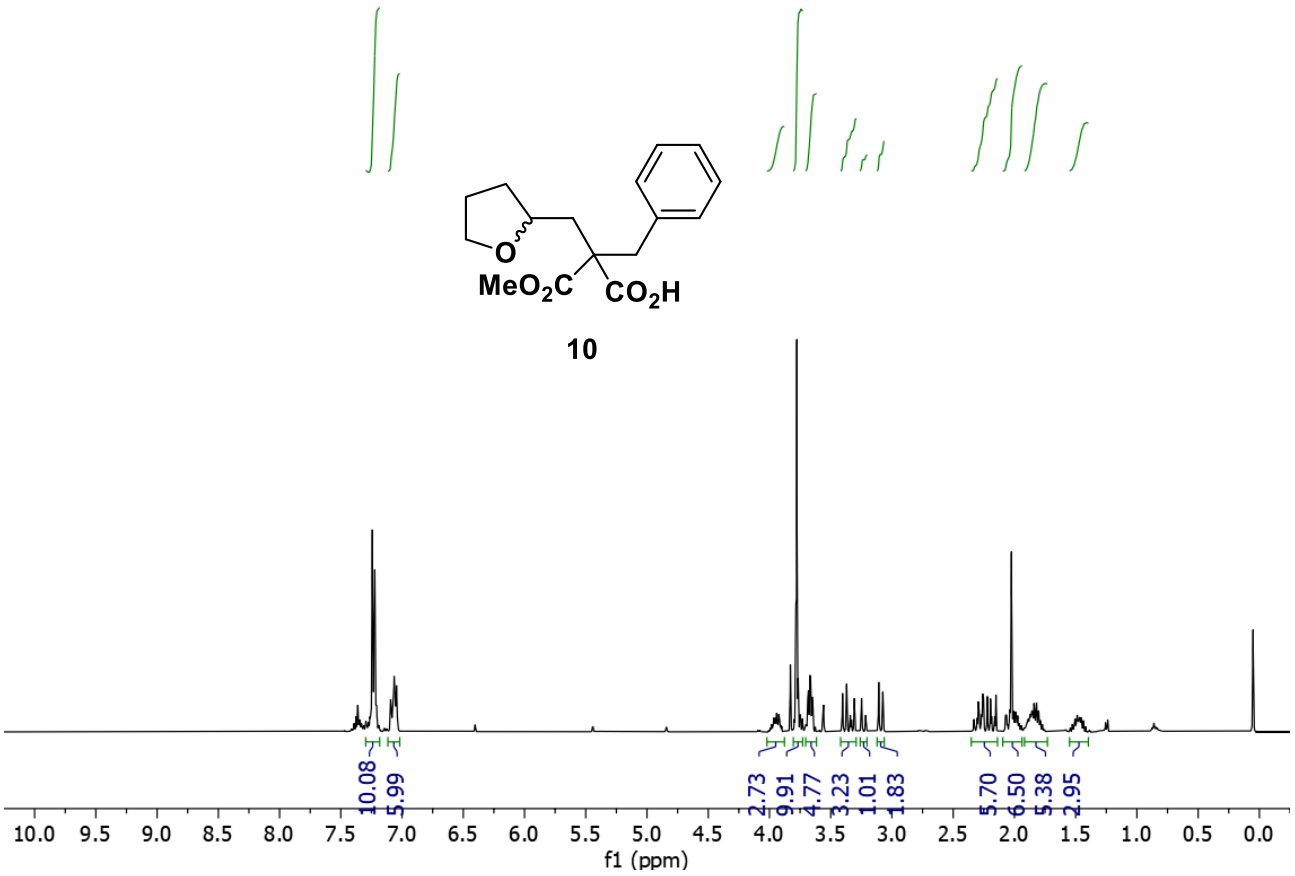
8b ^{1}H NMR (400 MHz, $CDCl_3$)



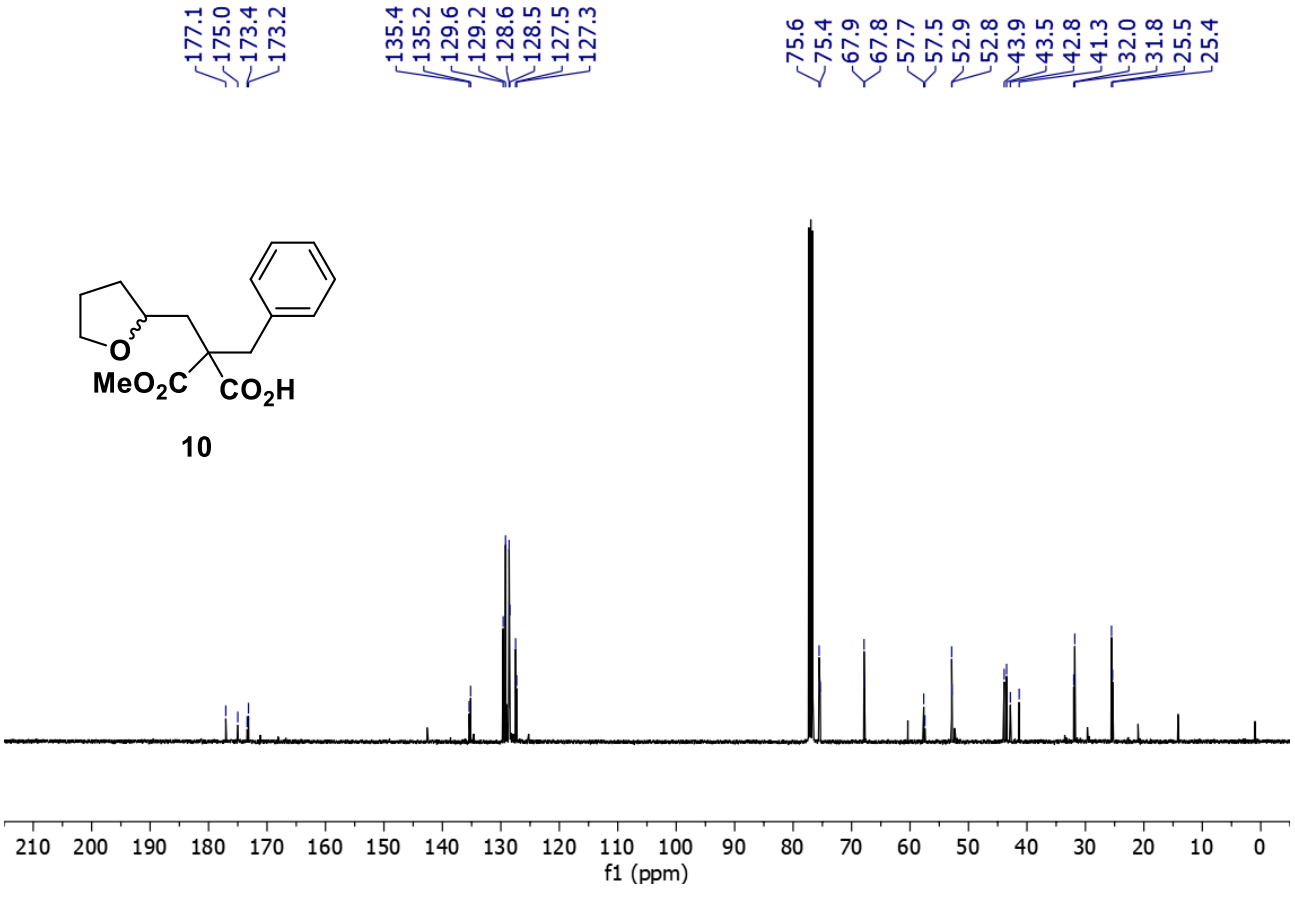
8b ^{13}C NMR (100 MHz, $CDCl_3$)



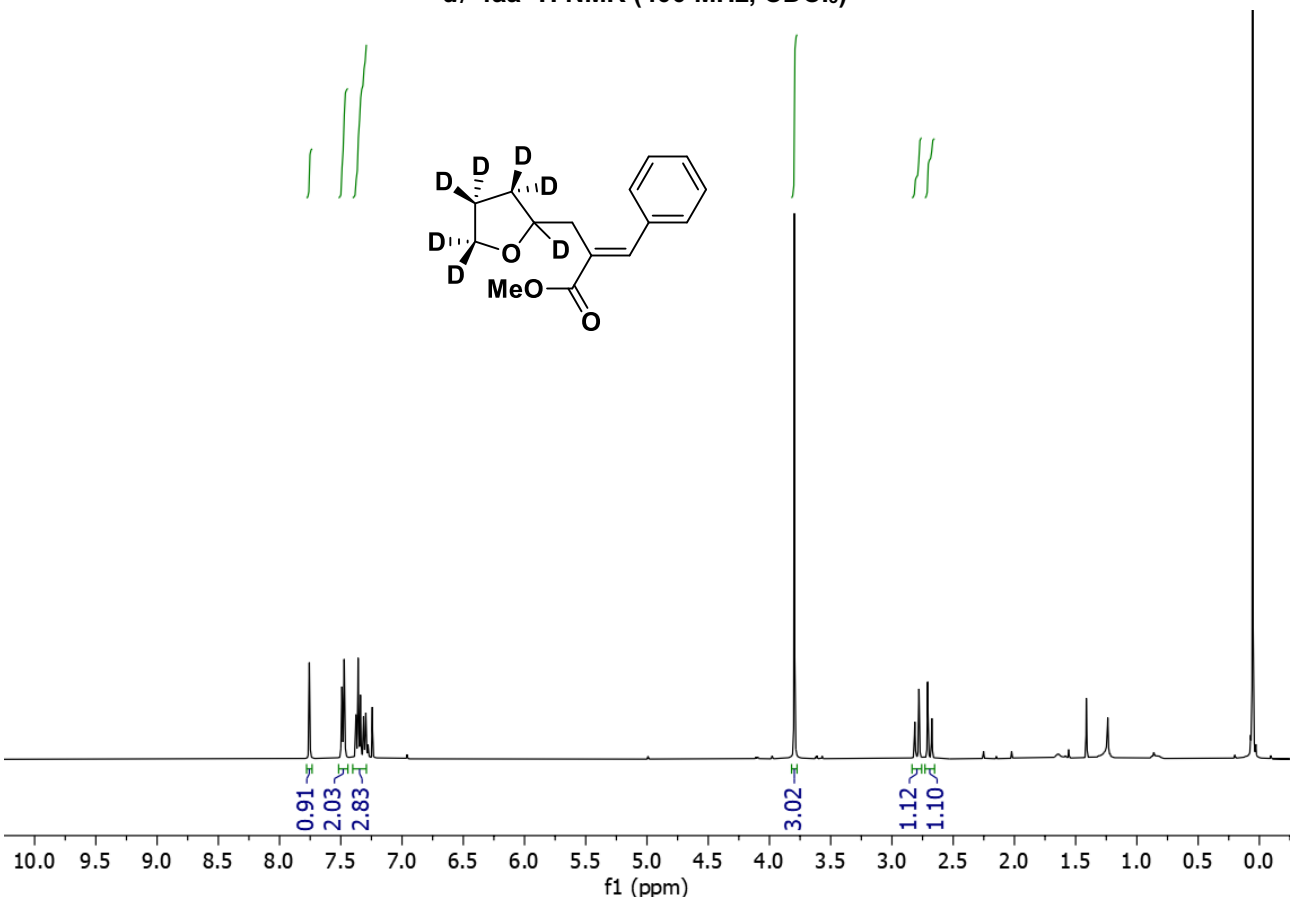
10 ^{1}H NMR (400 MHz, $CDCl_3$)



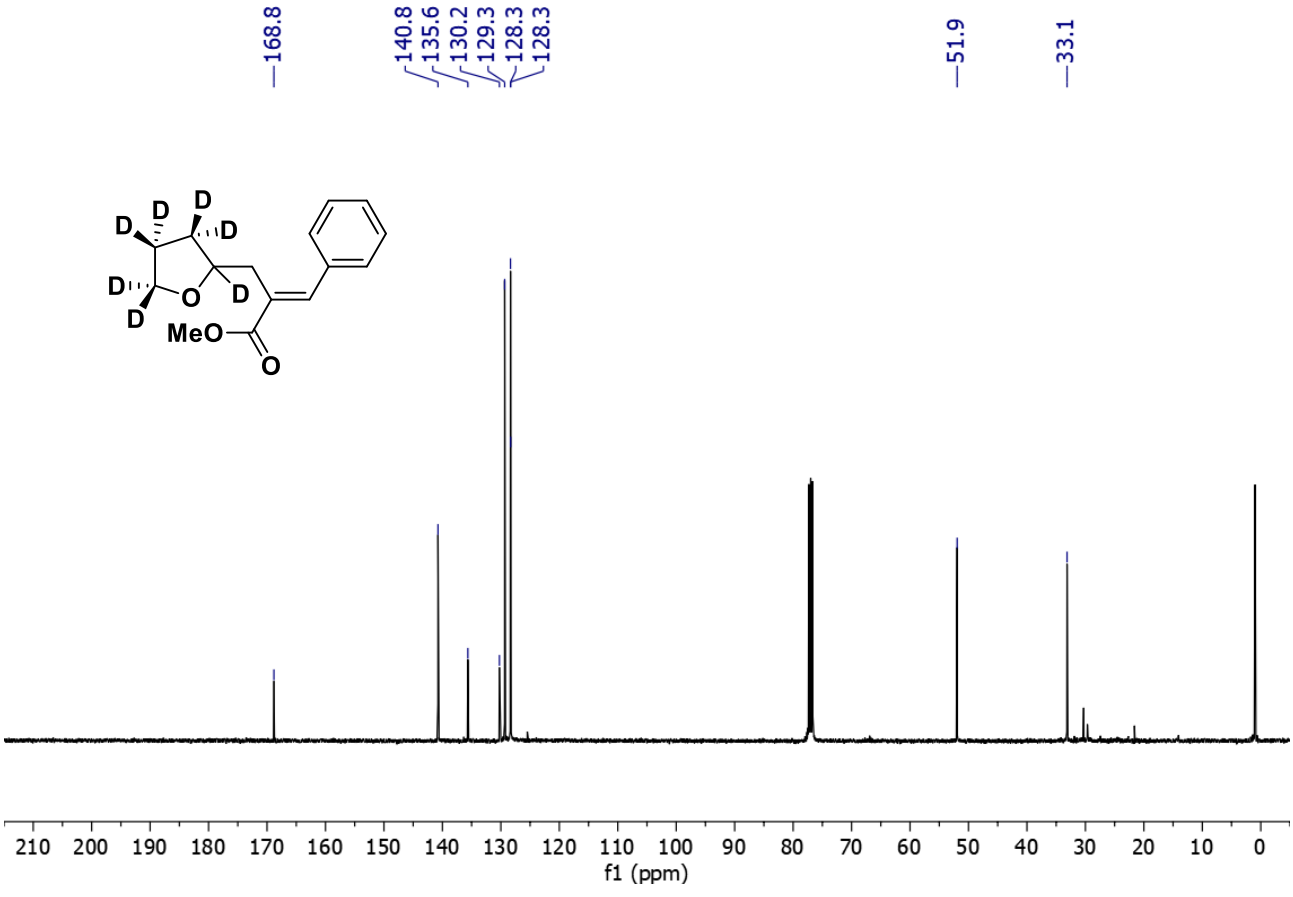
10 ^{13}C NMR (100 MHz, $CDCl_3$)



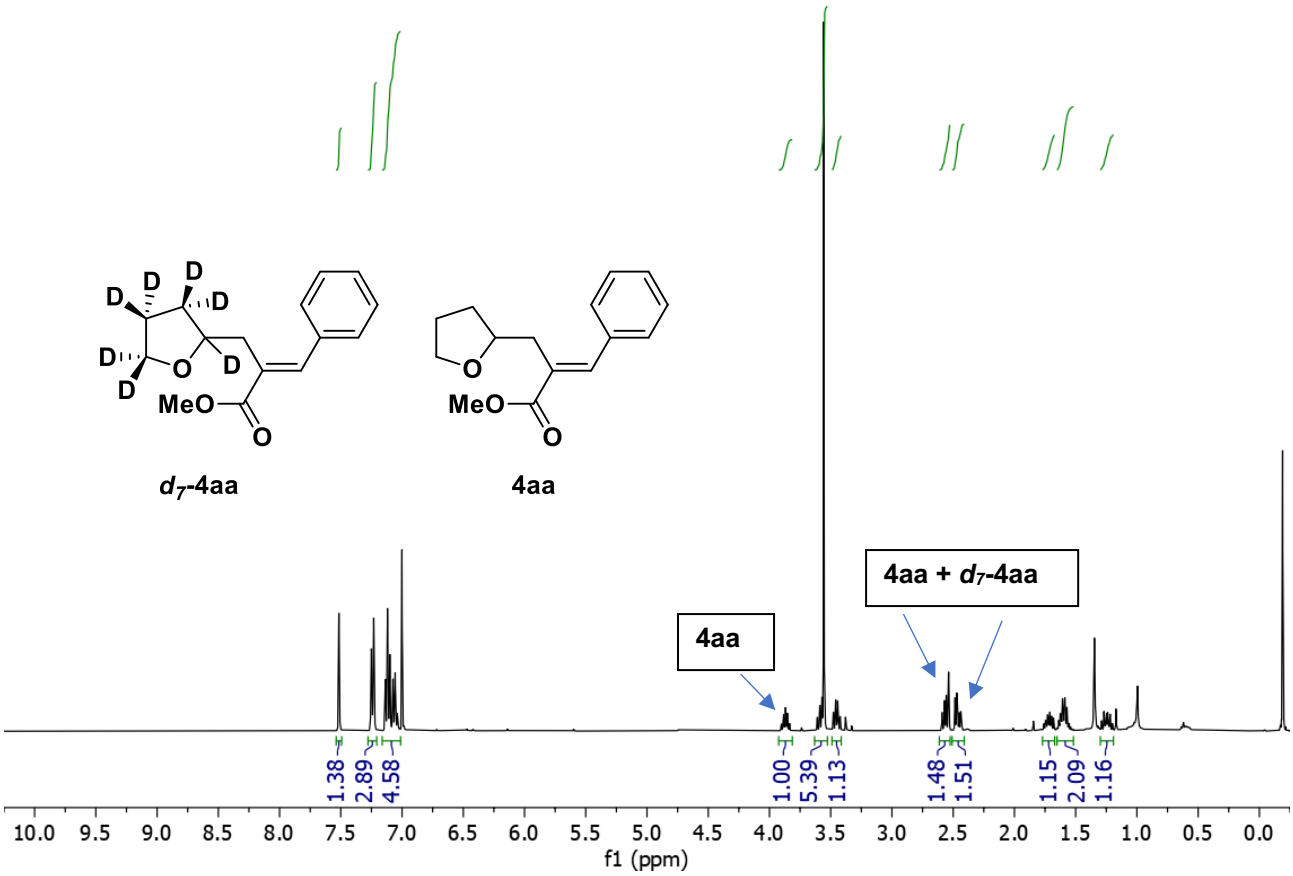
***d*$_7$-4aa ^{1}H NMR (400 MHz, CDCl$_3$)**



***d*$_7$-4aa ^{13}C NMR (100 MHz, CDCl$_3$)**



4aa + d_7-4aa ^{1}H NMR (400 MHz, $CDCl_3$)



8. References

[1] a) For the MBH reaction of aldehydes and acrylates see the supporting information of: H. Batchu, S. Bhattacharyya and S. Batra, *Org. Lett.*, 2012, **14**, 6330 and references therein; b) The acetylation of the MBH adducts was carried out following the methodology reported in: R. Annunziata, M. Benaglia, M. Cinquini, F. Cozzi and L. Raimondi, *J. Org. Chem.*, 1995, **60**, 4697.
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