Supporting Information Part B

Preparation of Chiral Allenes through Pd-Catalyzed Intermolecular Hydroamination of Conjugated Enynes: Enantioselective Synthesis Enabled by Catalyst Design

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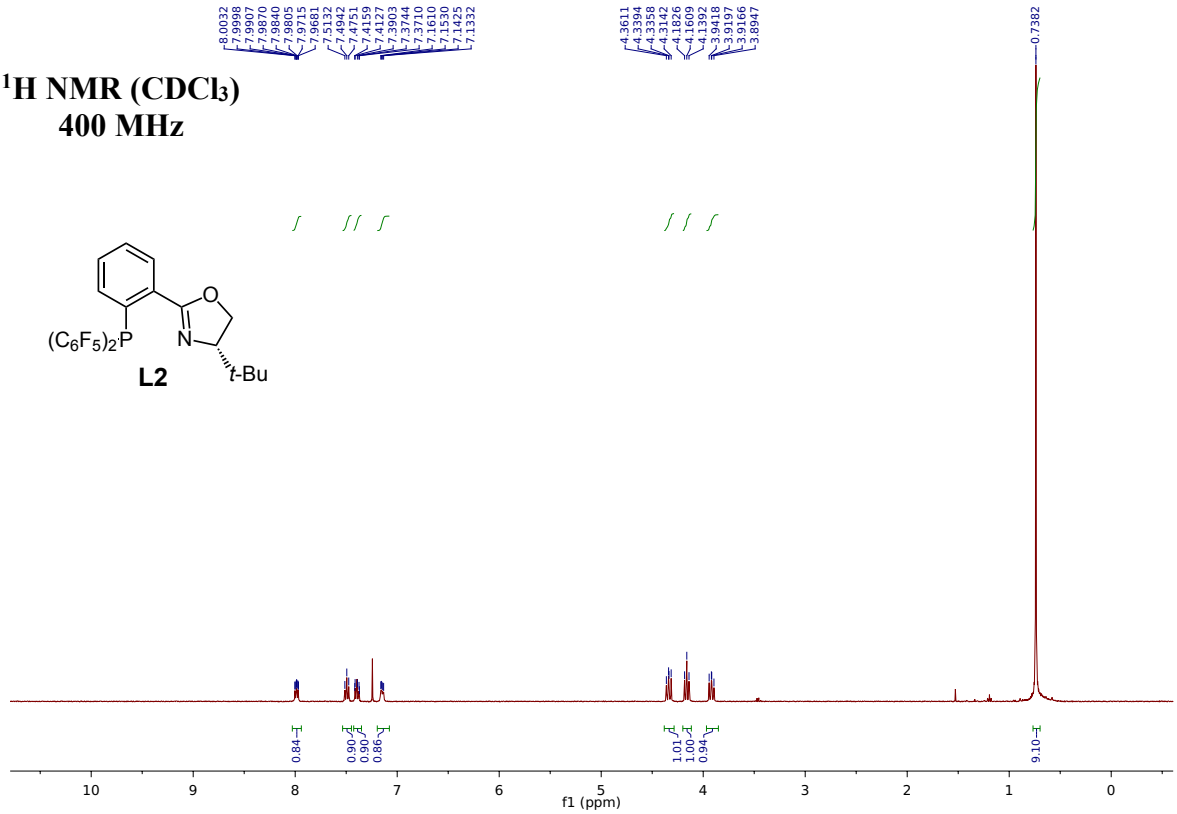
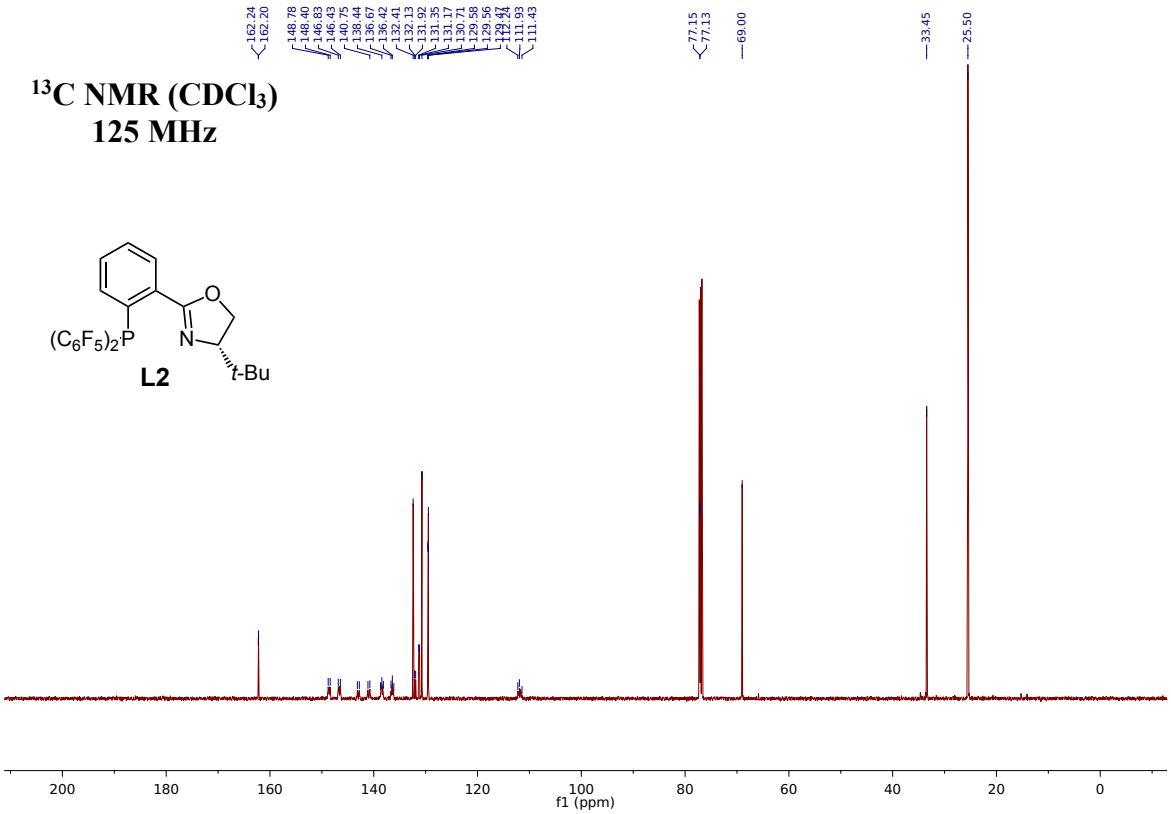
^{1}H NMR ($CDCl_3$)
400 MHz

L2



^{13}C NMR ($CDCl_3$)
125 MHz

L2



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

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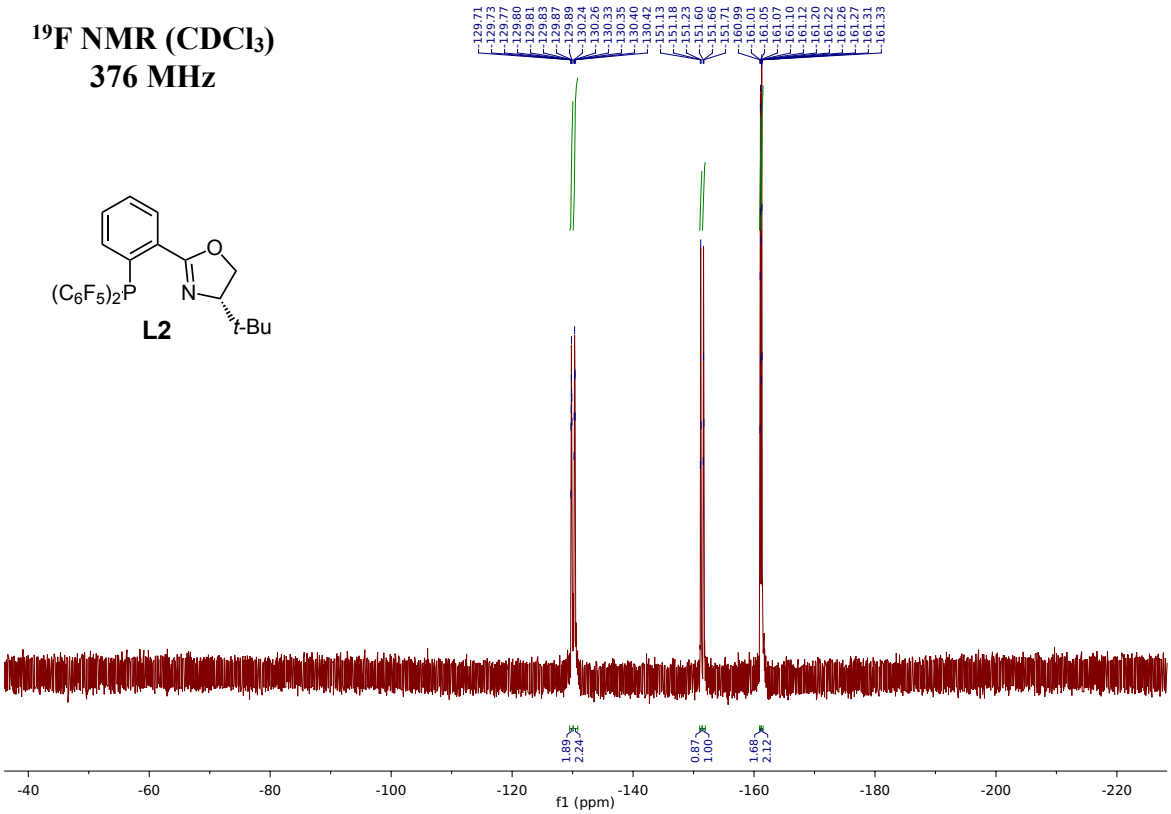
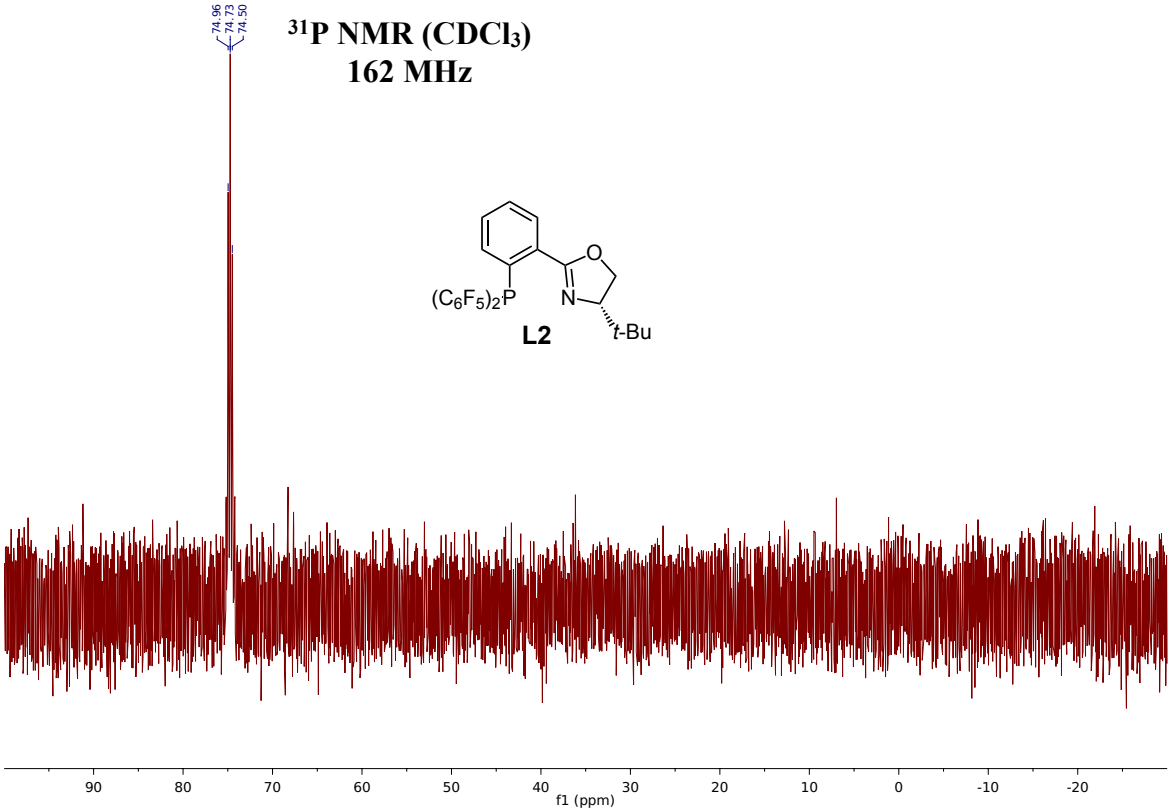


^{31}P NMR ($CDCl_3$)
162 MHz

L2



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

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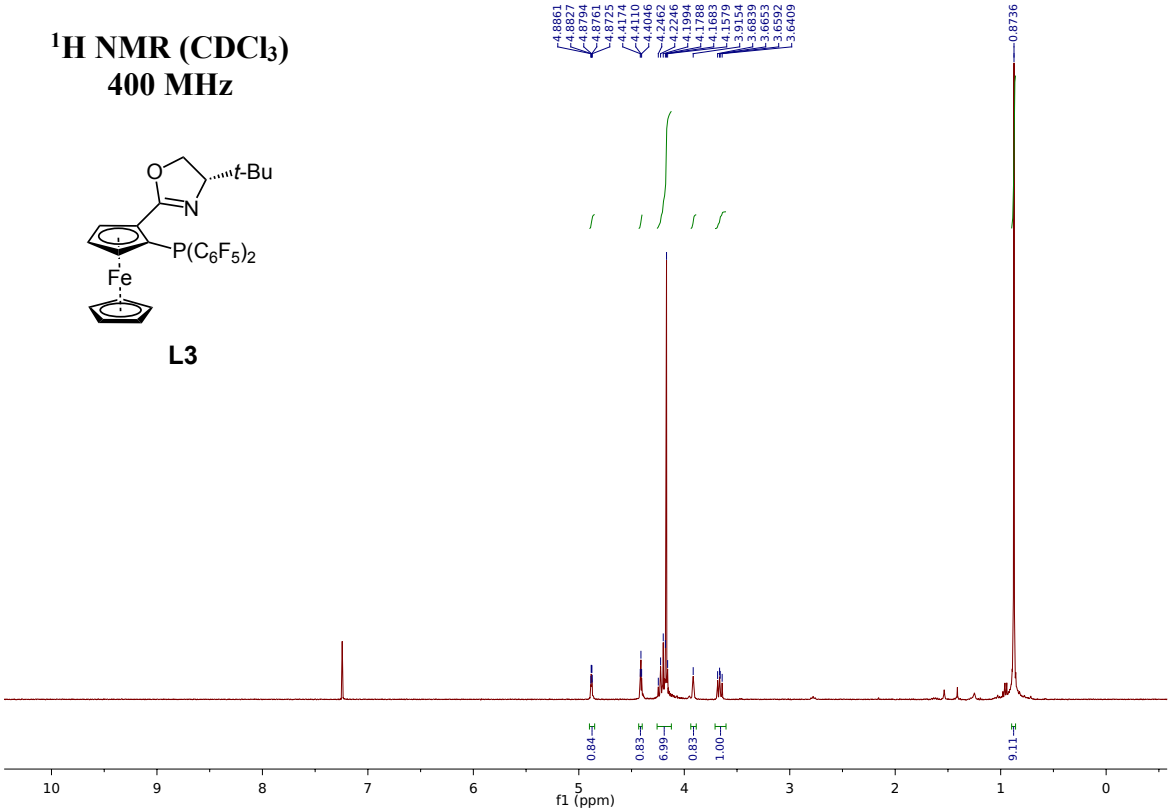

^{13}C NMR ($CDCl_3$)
125 MHz

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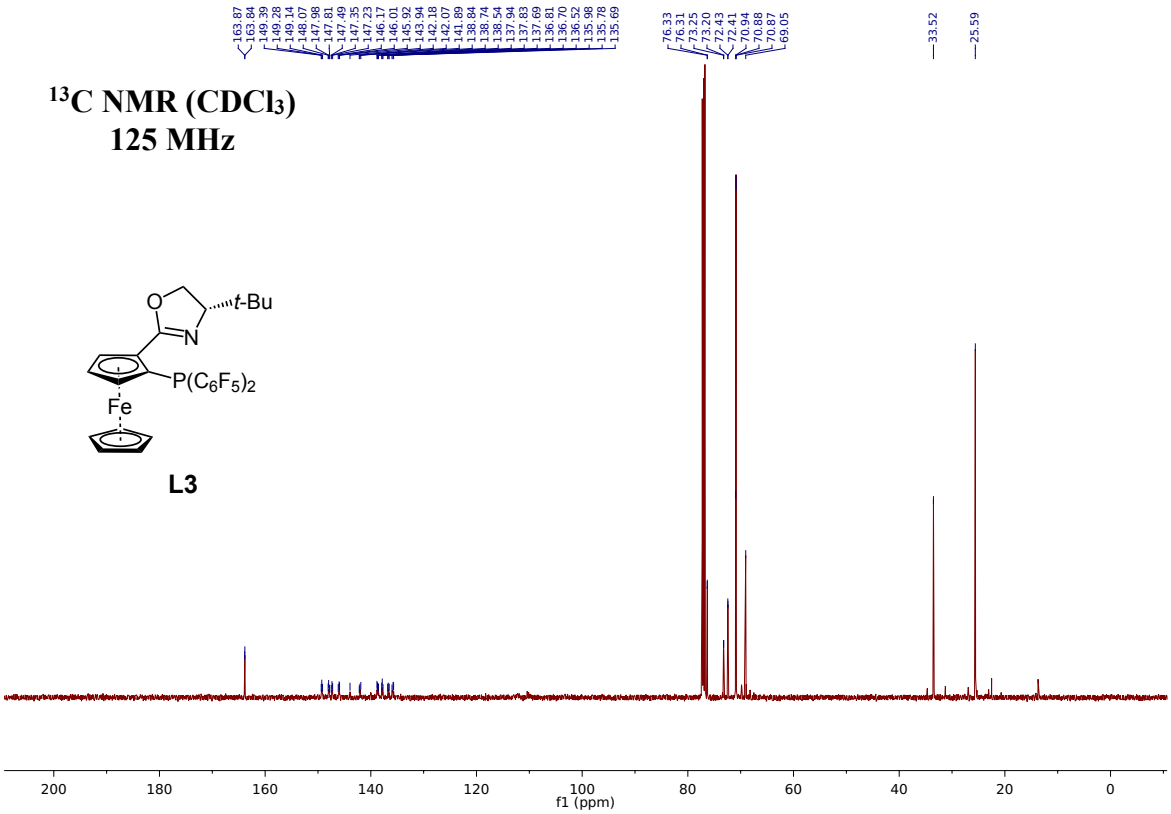
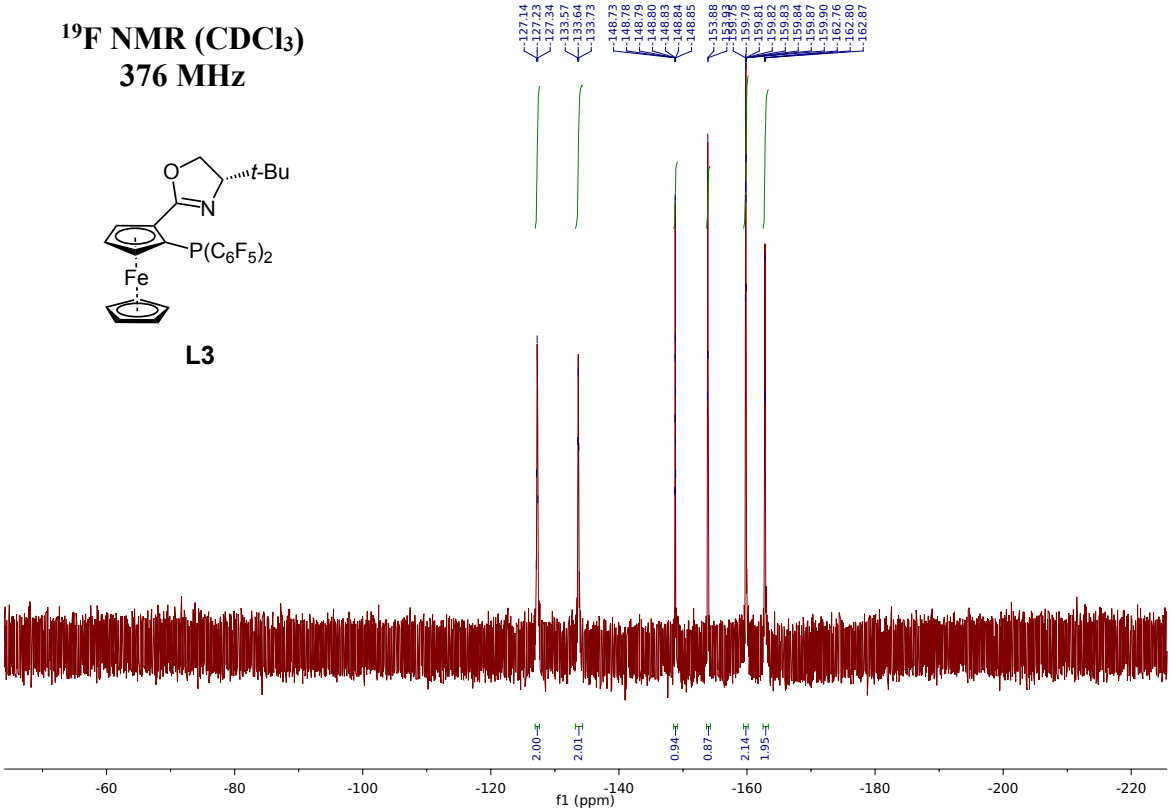
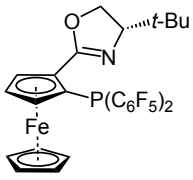


^{19}F NMR ($CDCl_3$)
376 MHz

L3



^{31}P NMR ($CDCl_3$)
162 MHz



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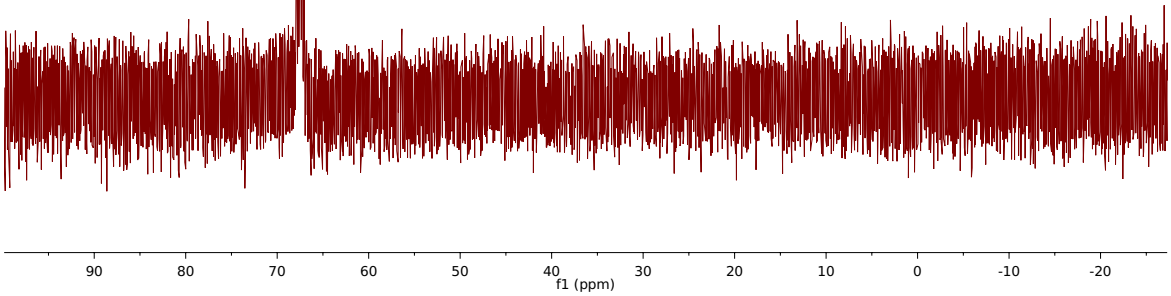
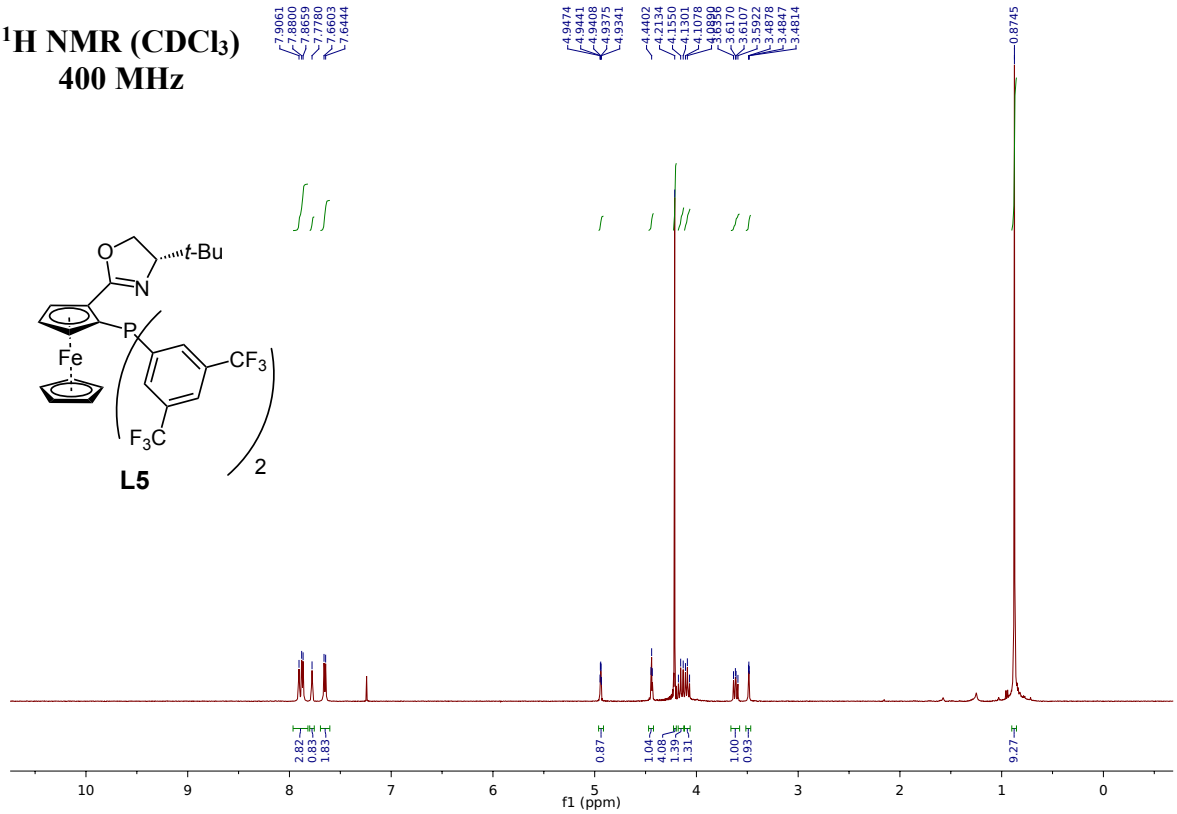


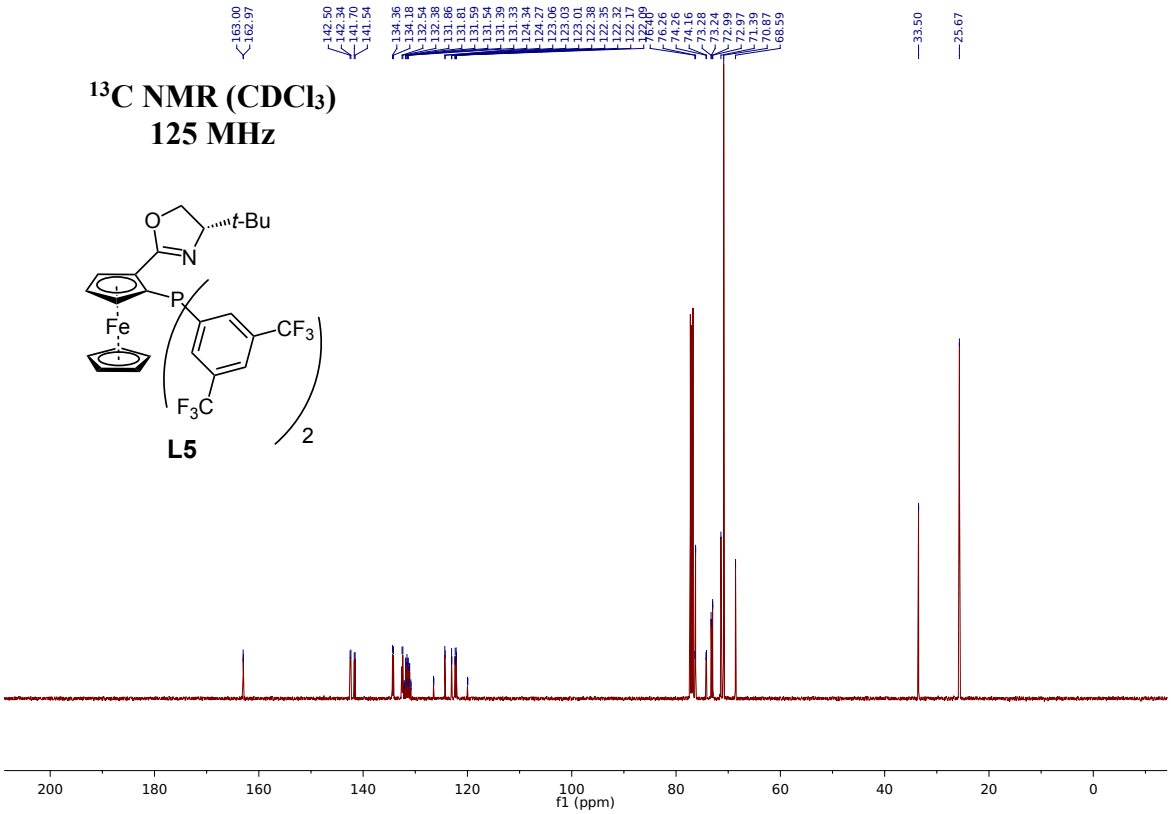
^{1}H NMR ($CDCl_3$)
400 MHz

L5

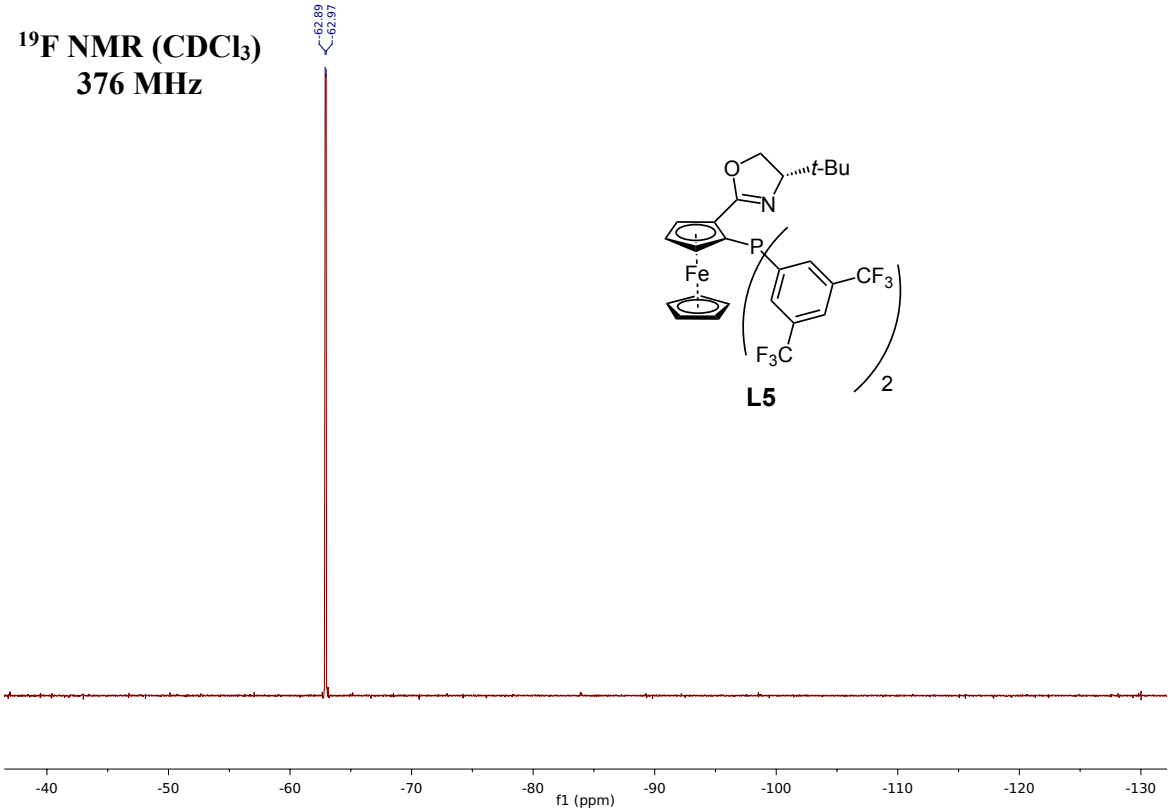


^{13}C NMR ($CDCl_3$)
125 MHz

L5

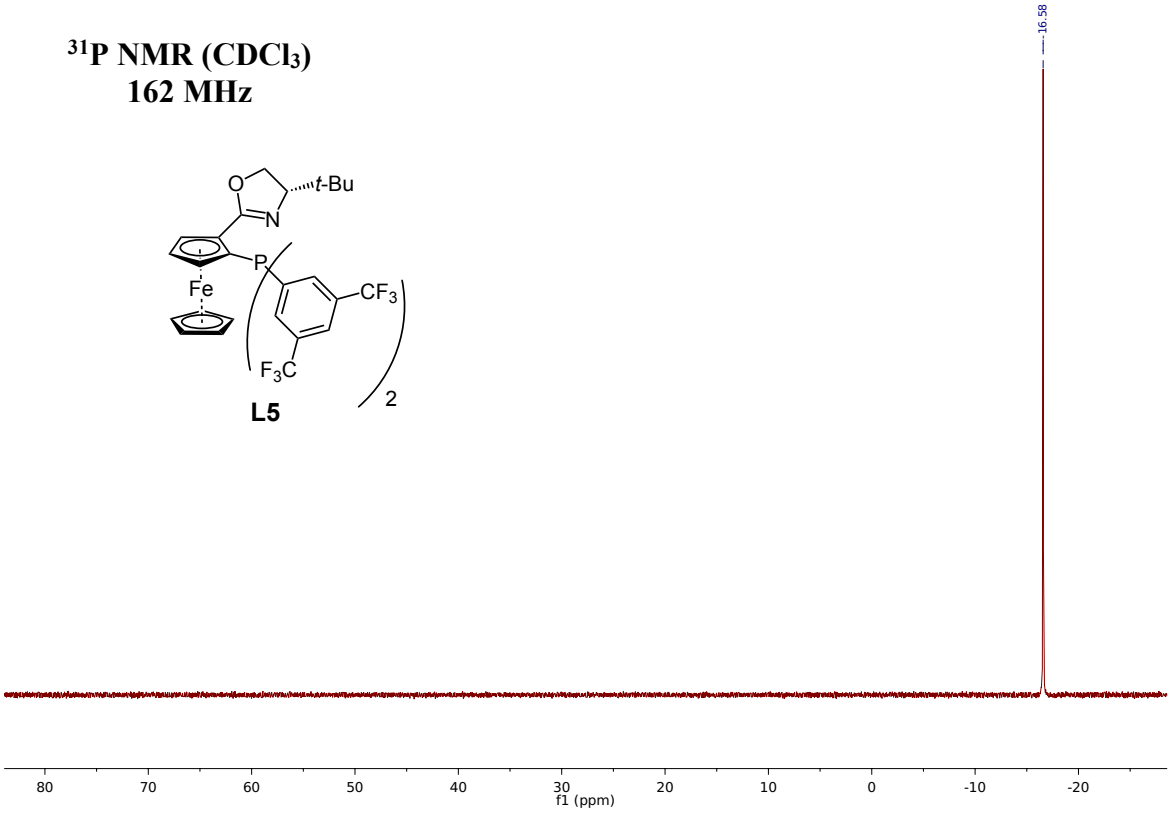


^{19}F NMR ($CDCl_3$)
376 MHz



L5

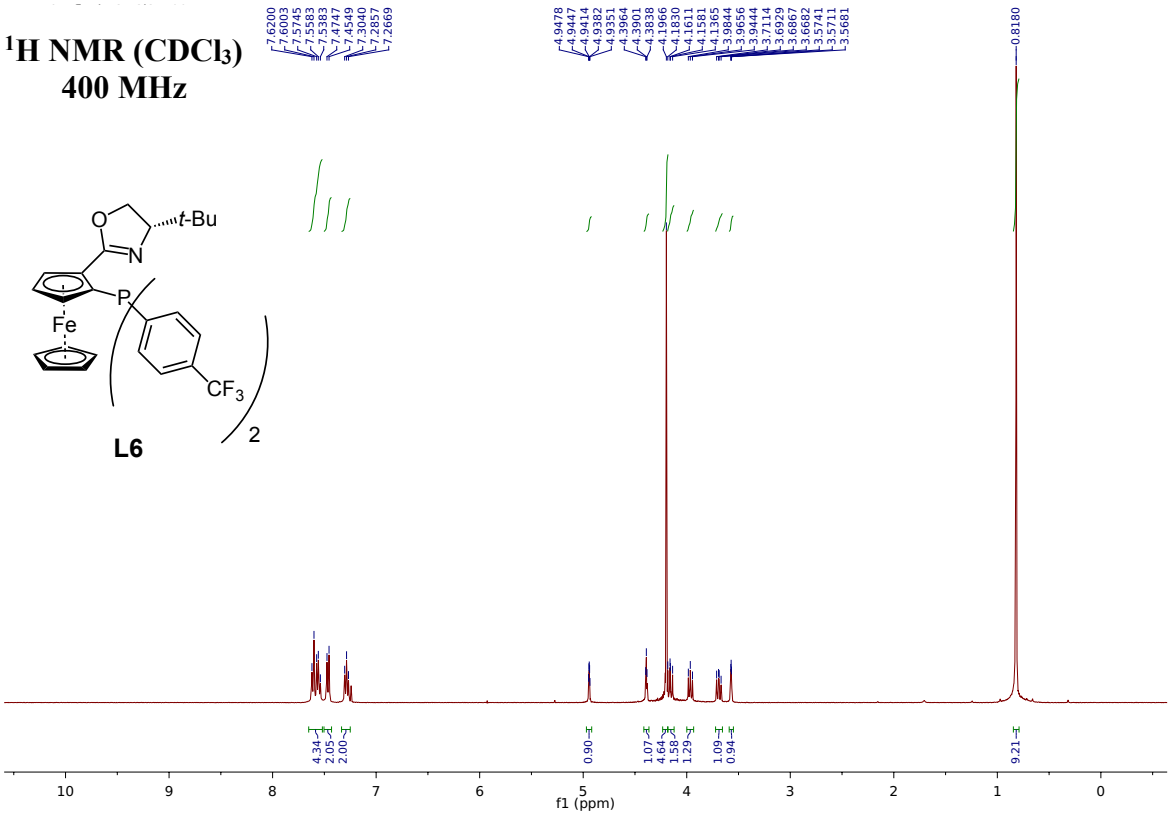
^{31}P NMR ($CDCl_3$)
162 MHz



L5

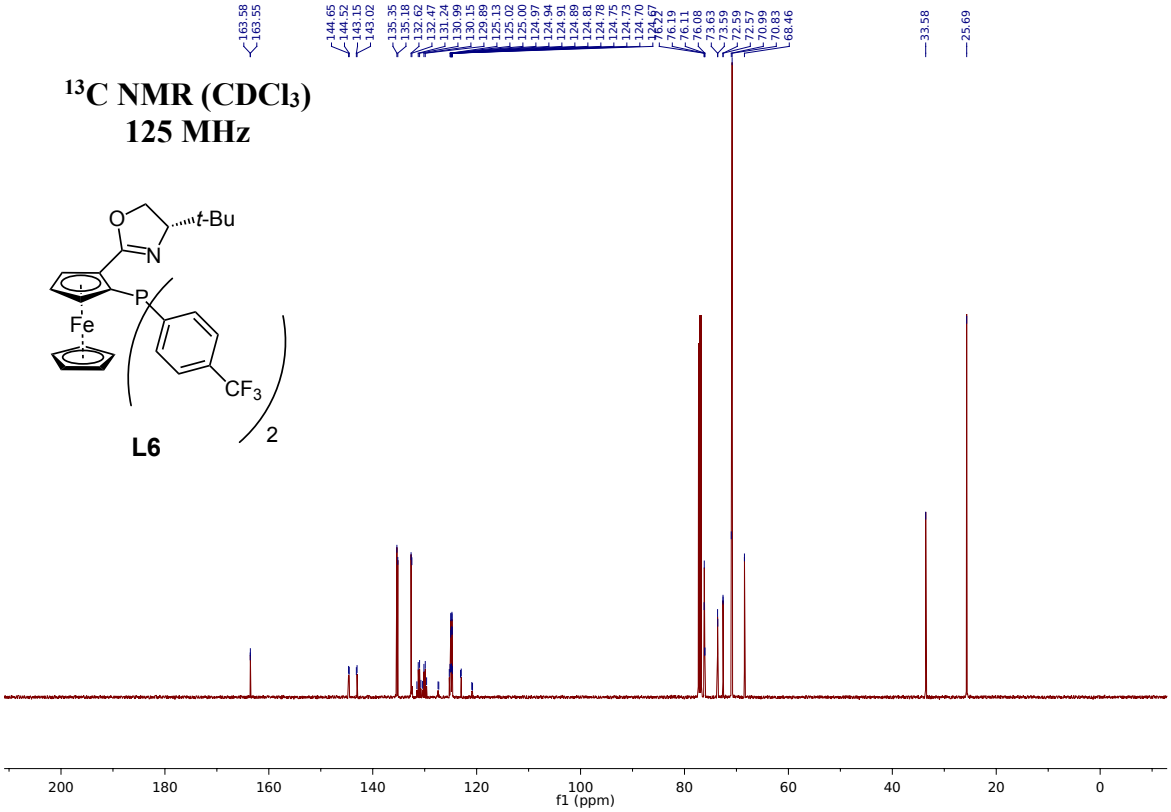
^{1}H NMR ($CDCl_3$)
400 MHz

L6



^{13}C NMR ($CDCl_3$)
125 MHz

L6



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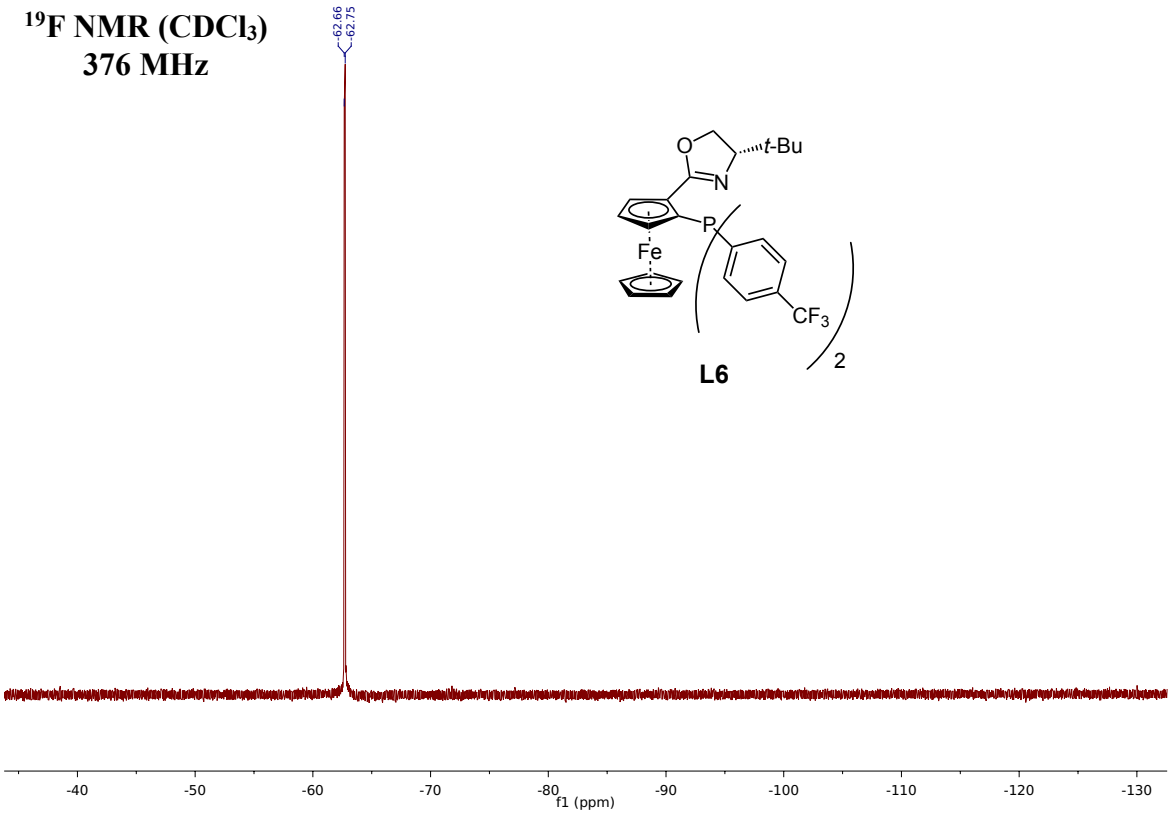
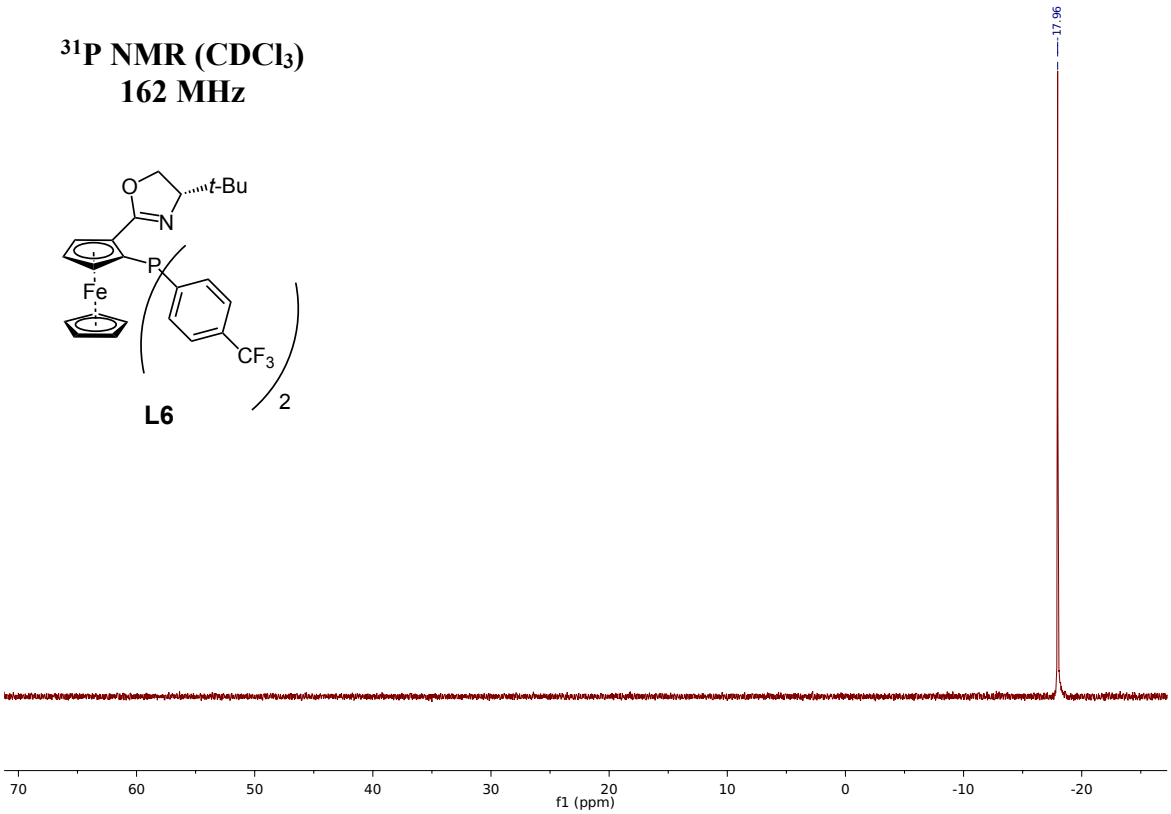
376 MHz



L6

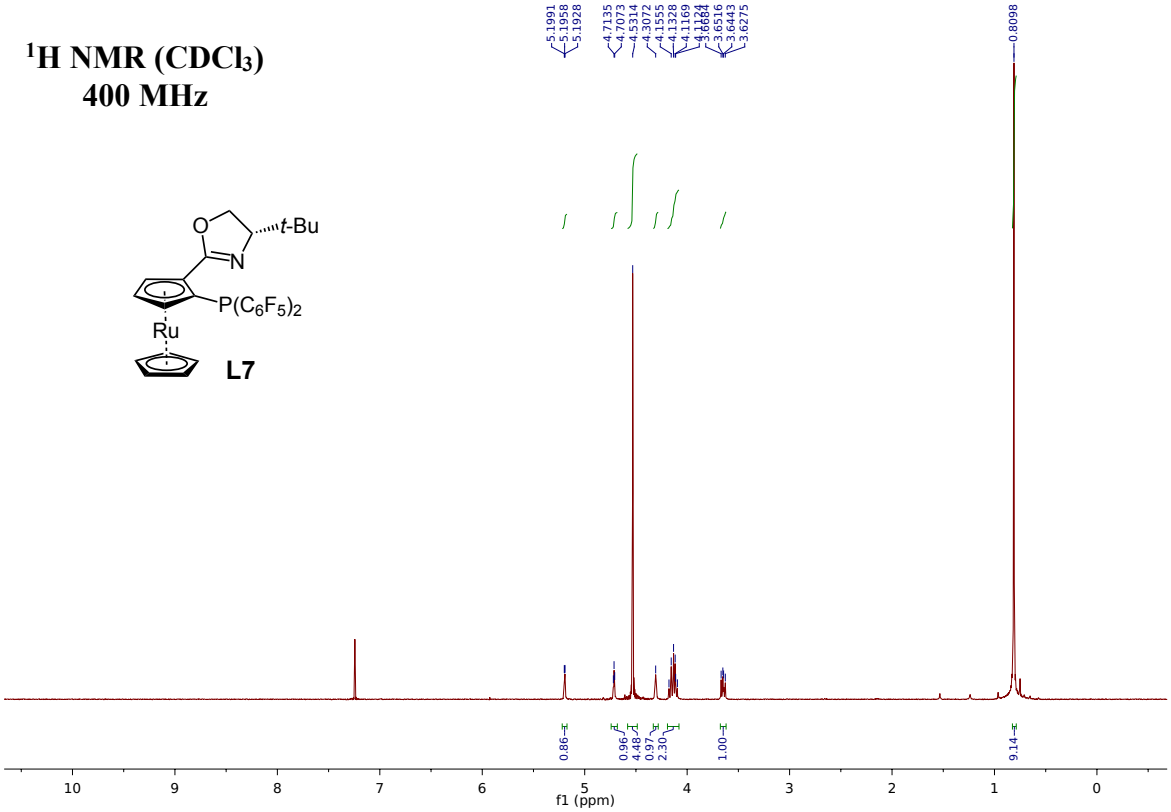
^{31}P NMR ($CDCl_3$)
162 MHz



L6

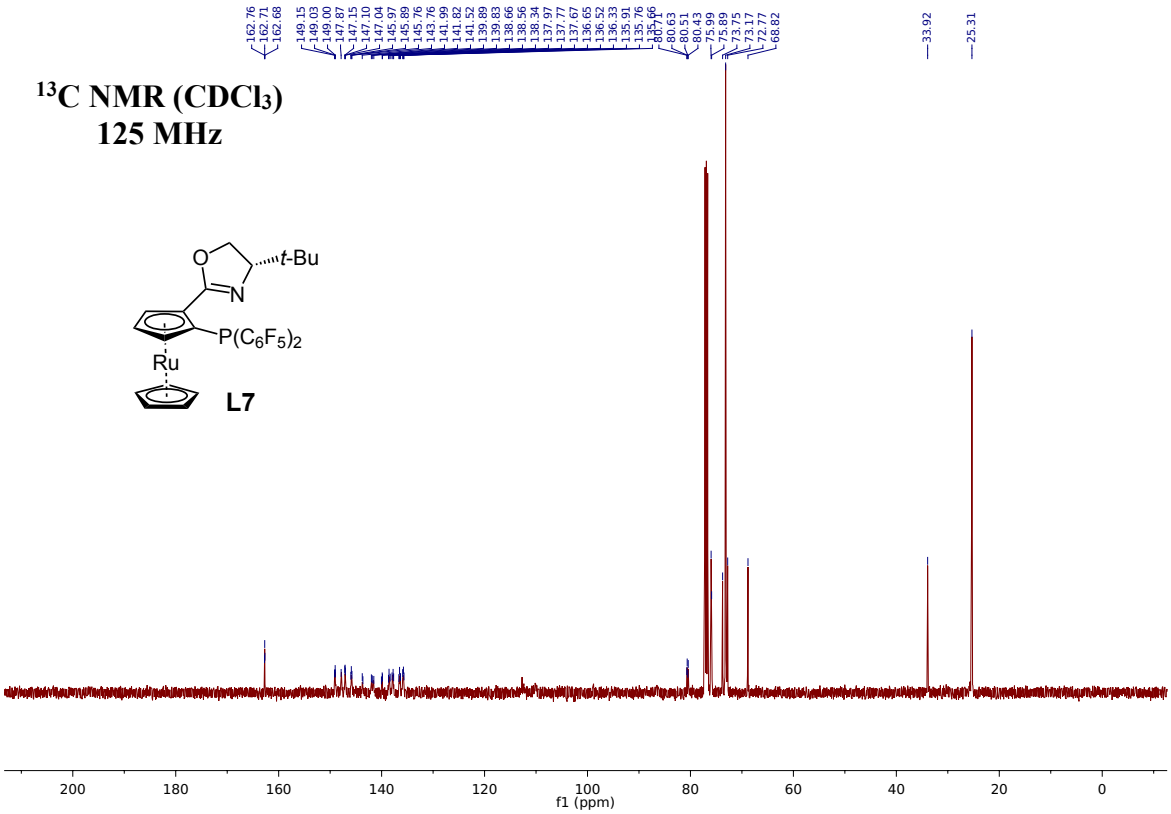
^{1}H NMR ($CDCl_3$)
400 MHz

L7



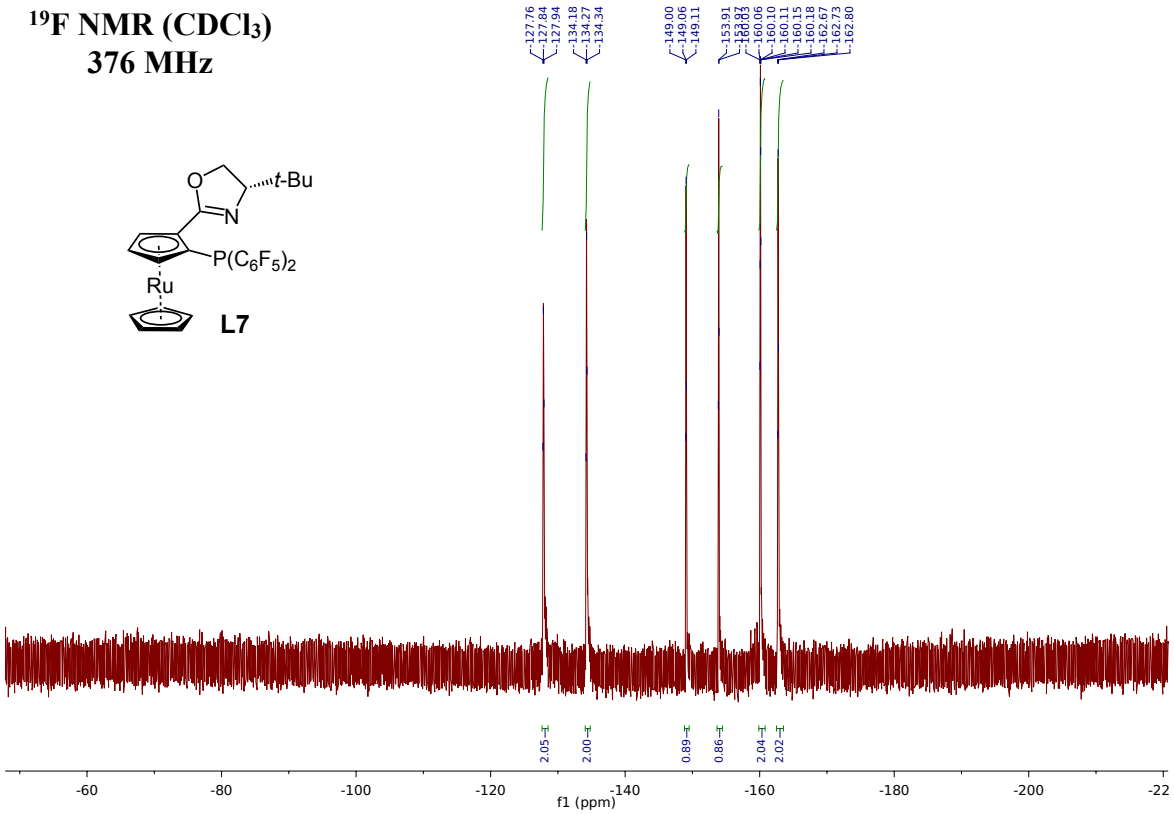
^{13}C NMR ($CDCl_3$)
125 MHz

L7



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

L7



^{31}P NMR ($CDCl_3$)
162 MHz

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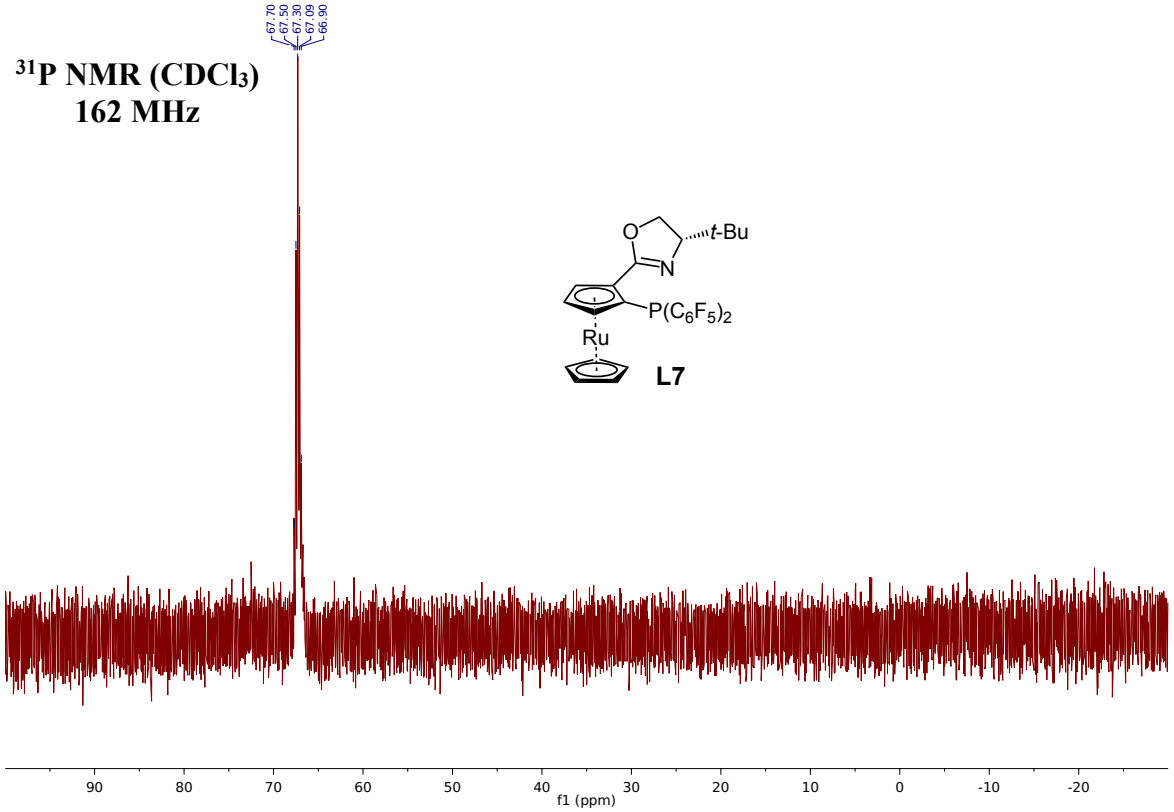
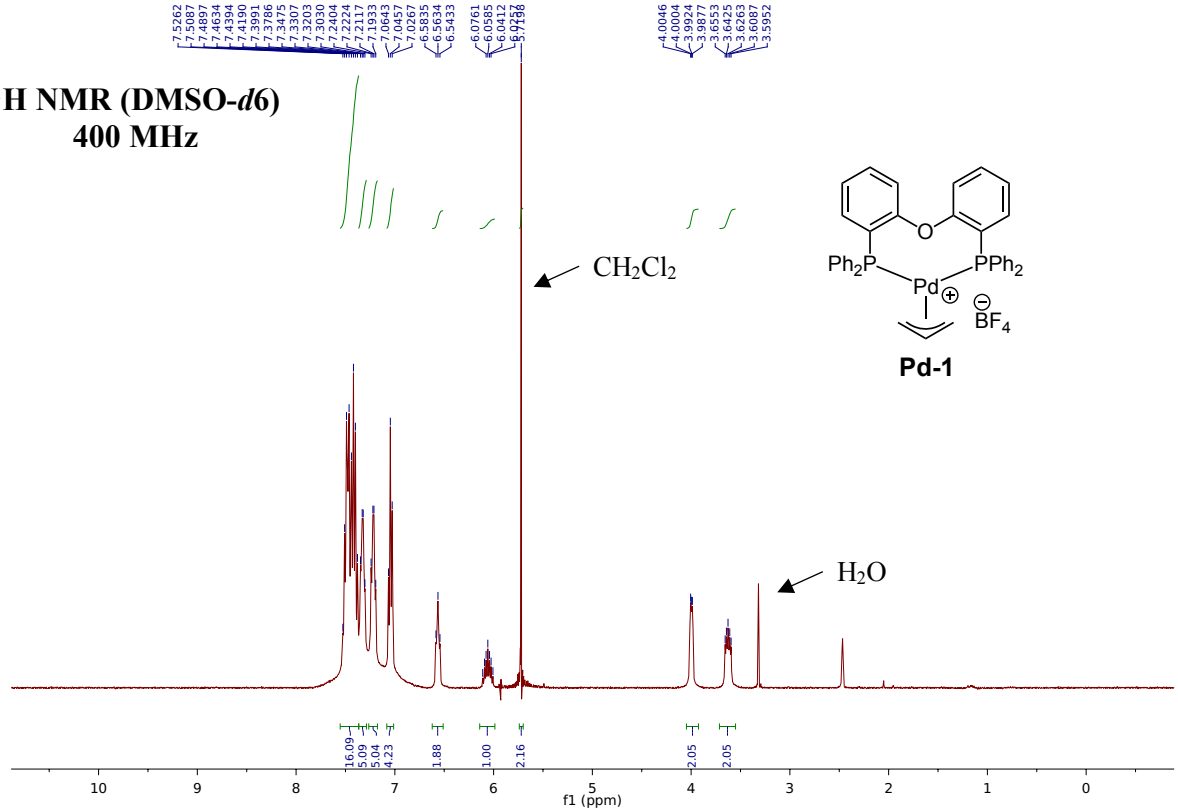
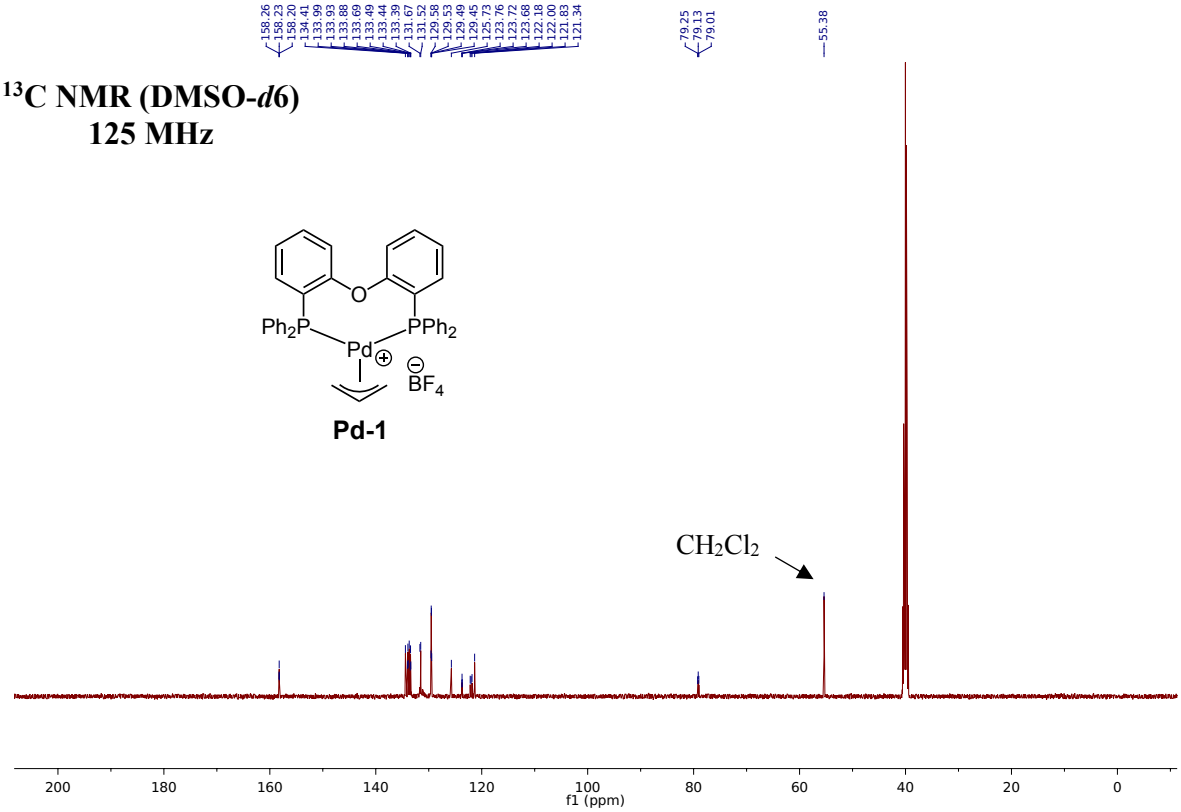


^{1}H NMR (DMSO-*d*6)
400 MHz



Pd-1

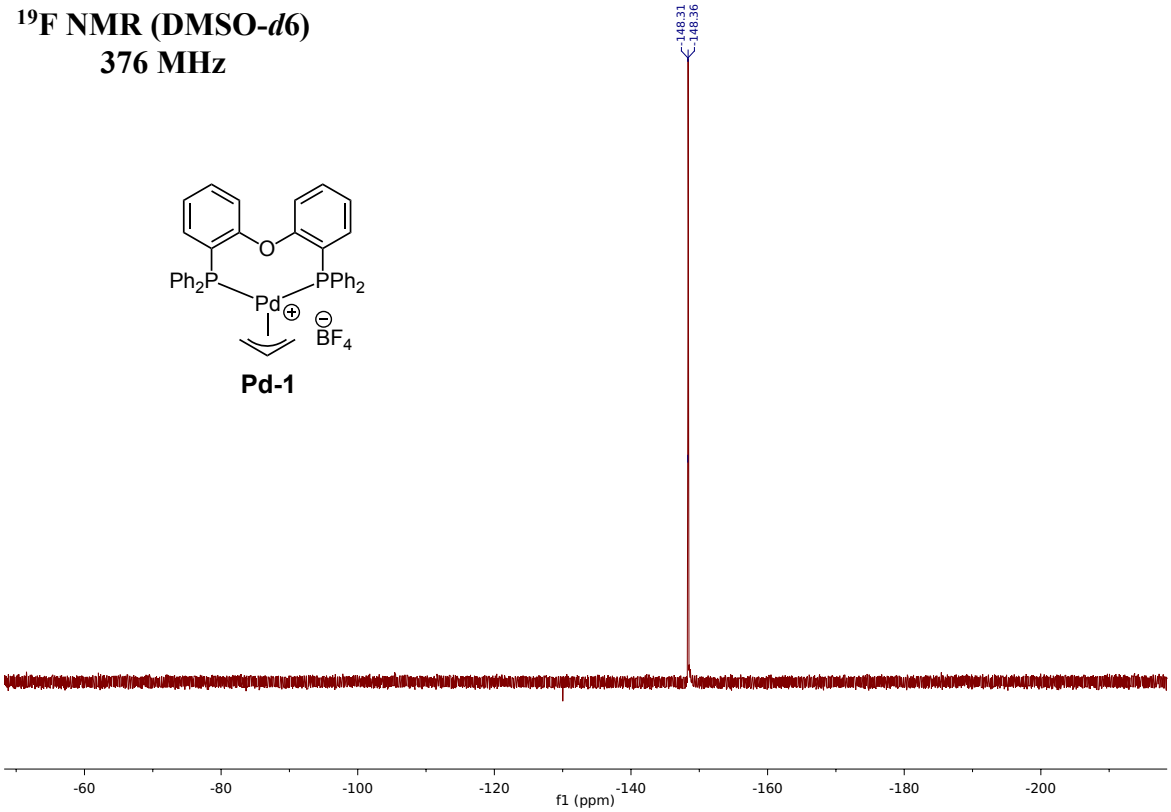
^{13}C NMR (DMSO-*d*6)
125 MHz



Pd-1

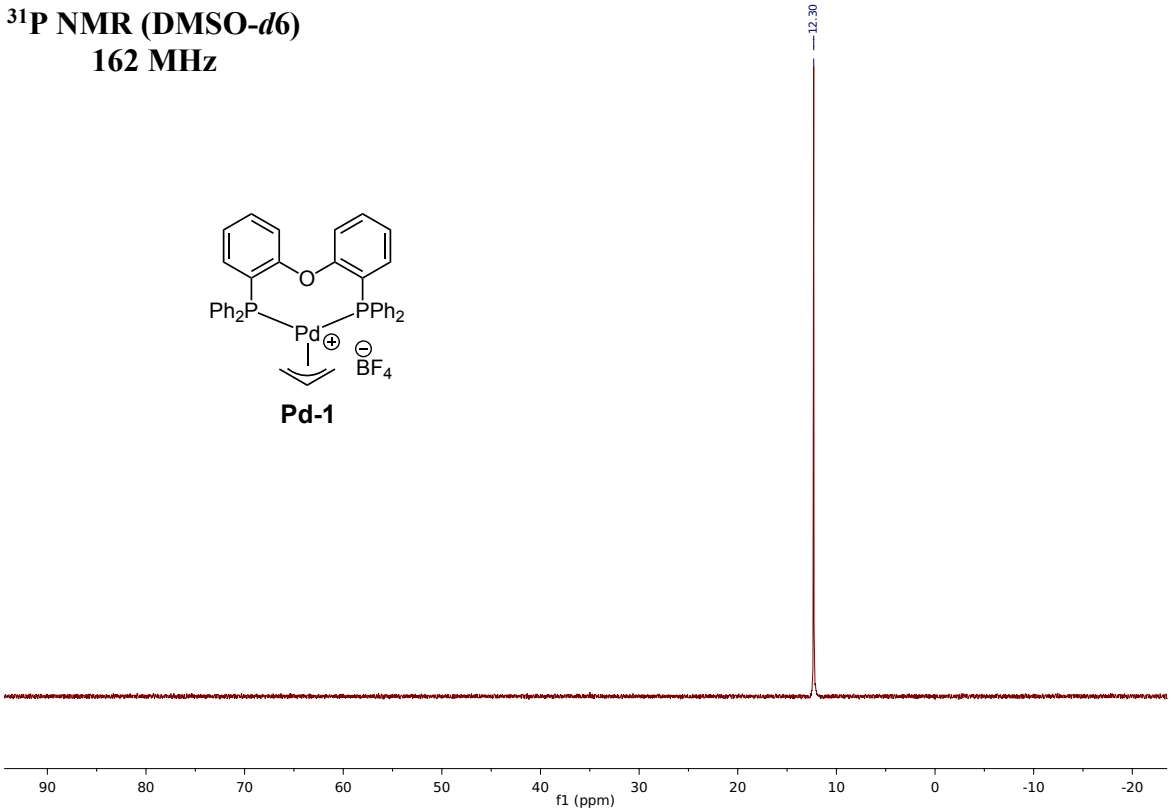
^{19}F NMR (DMSO-*d*6)
376 MHz

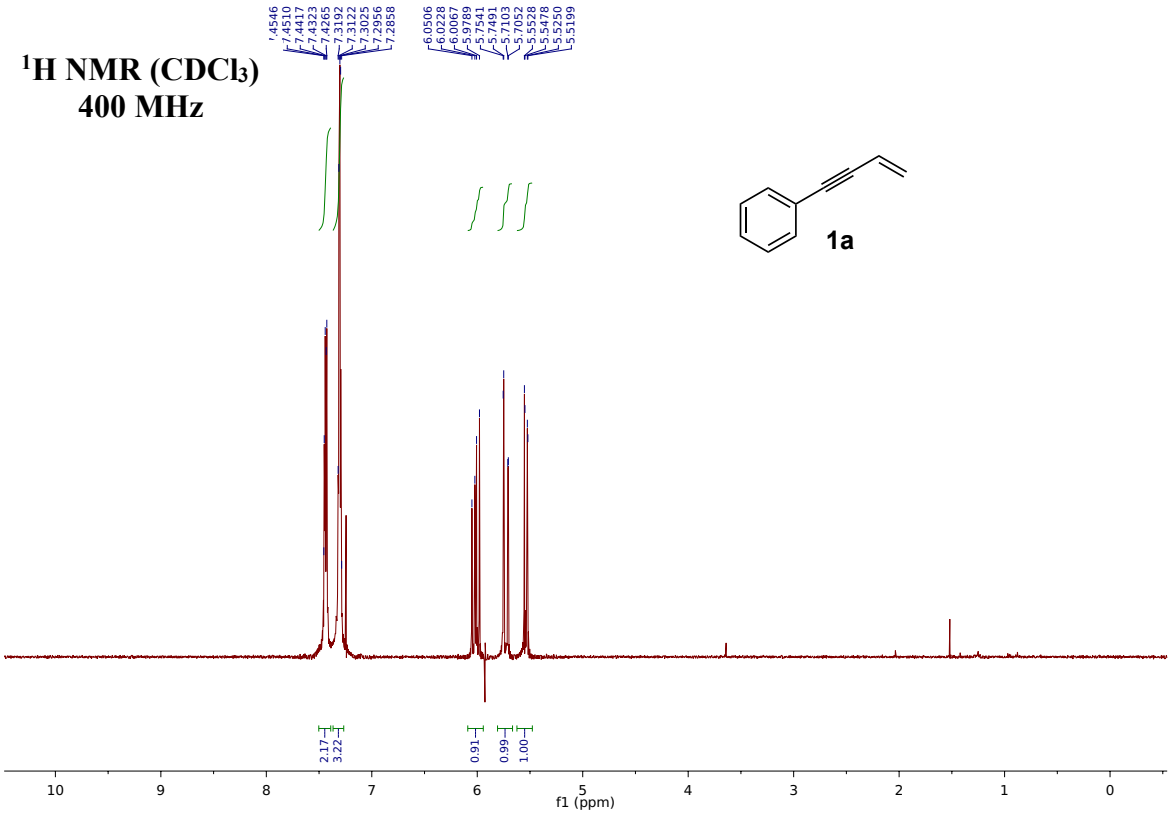
Pd-1



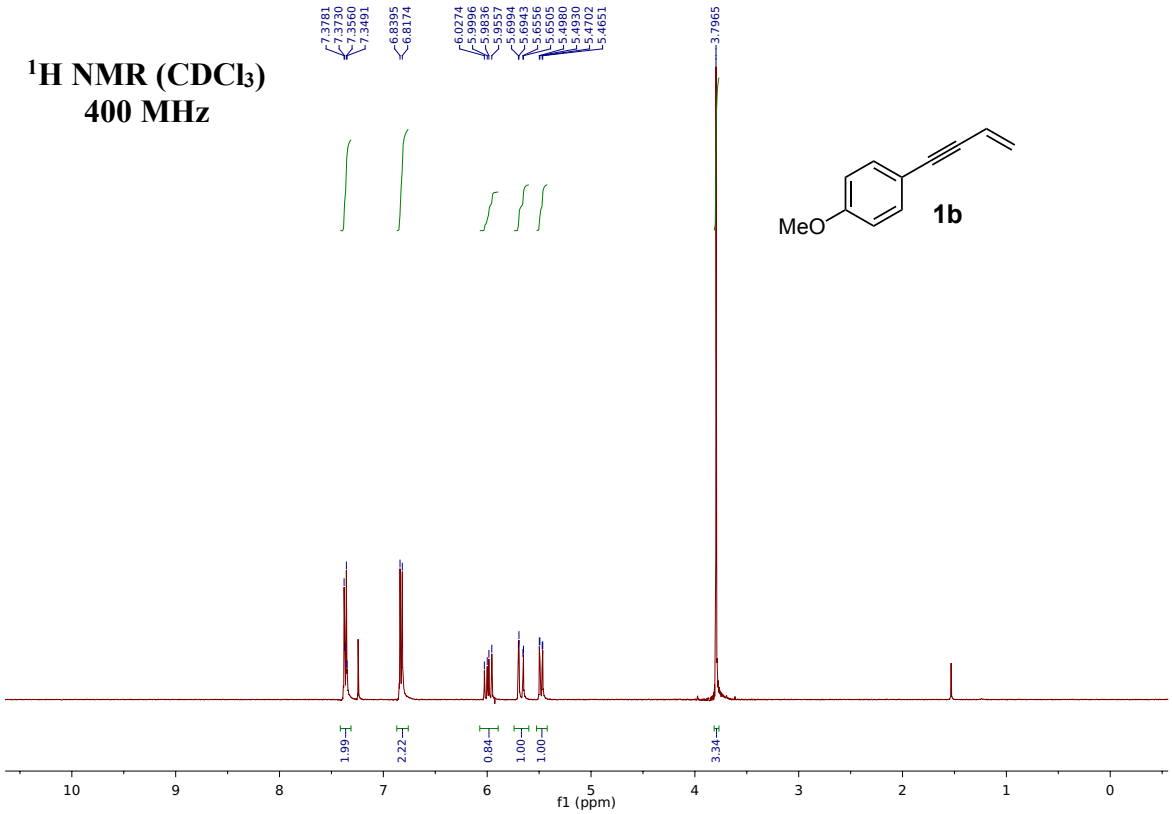
^{31}P NMR (DMSO-*d*6)
162 MHz

Pd-1



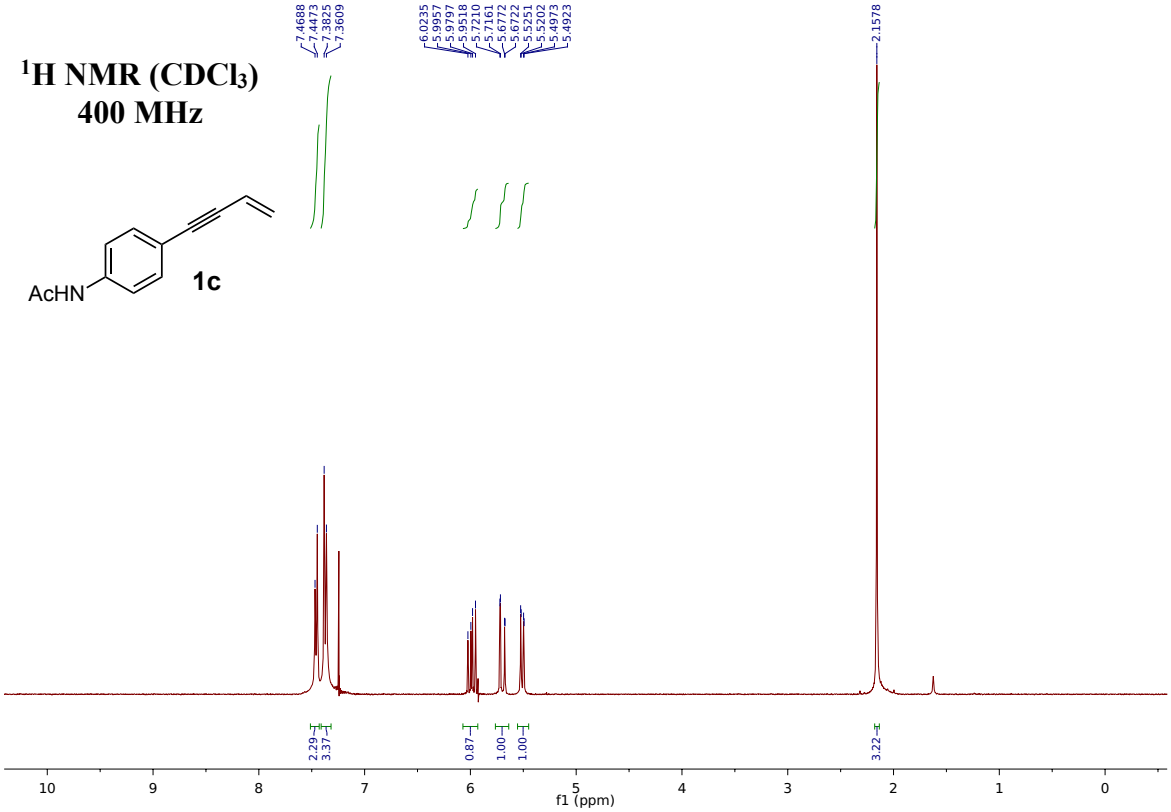

^{1}H NMR (CDCl$_3$)
400 MHz
7.4546
7.4510
7.4417
7.4323
7.4265
7.3192
7.3122
7.3025
7.2956
7.2858
6.0506
6.0228
6.0067
5.9789
5.7541
5.7491
5.7103
5.7052
5.5528
5.5478
5.5250
5.5199
1a
2.17
3.22
0.91
0.99
1.00
10
9
8
7
6
5
4
3
2
1
0
f1 (ppm)

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



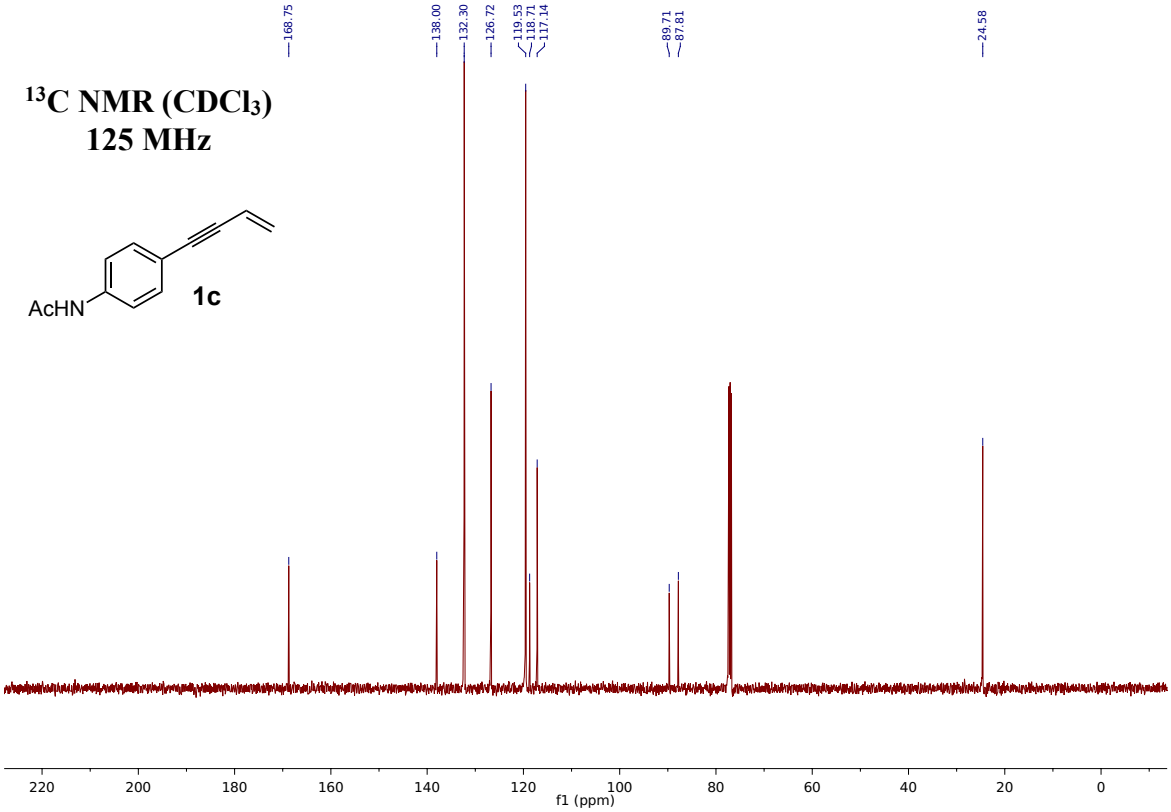
^{1}H NMR ($CDCl_3$)
400 MHz

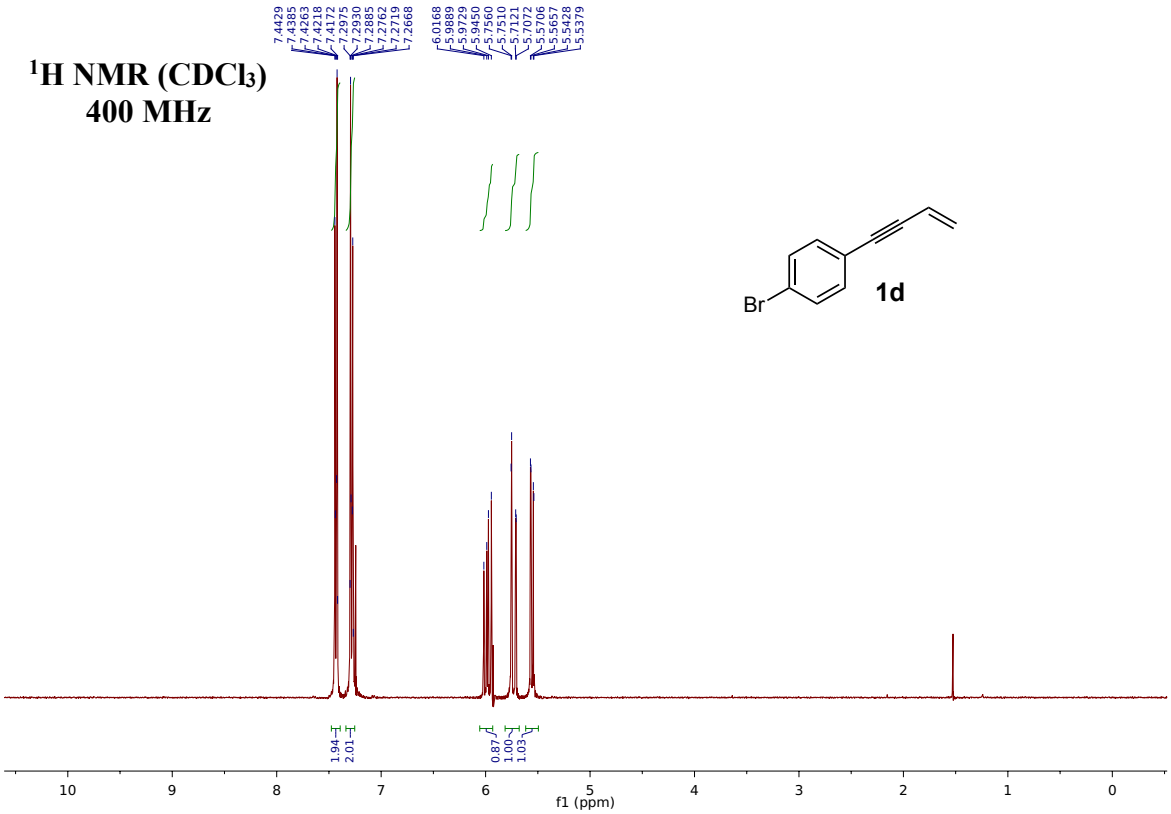
1c



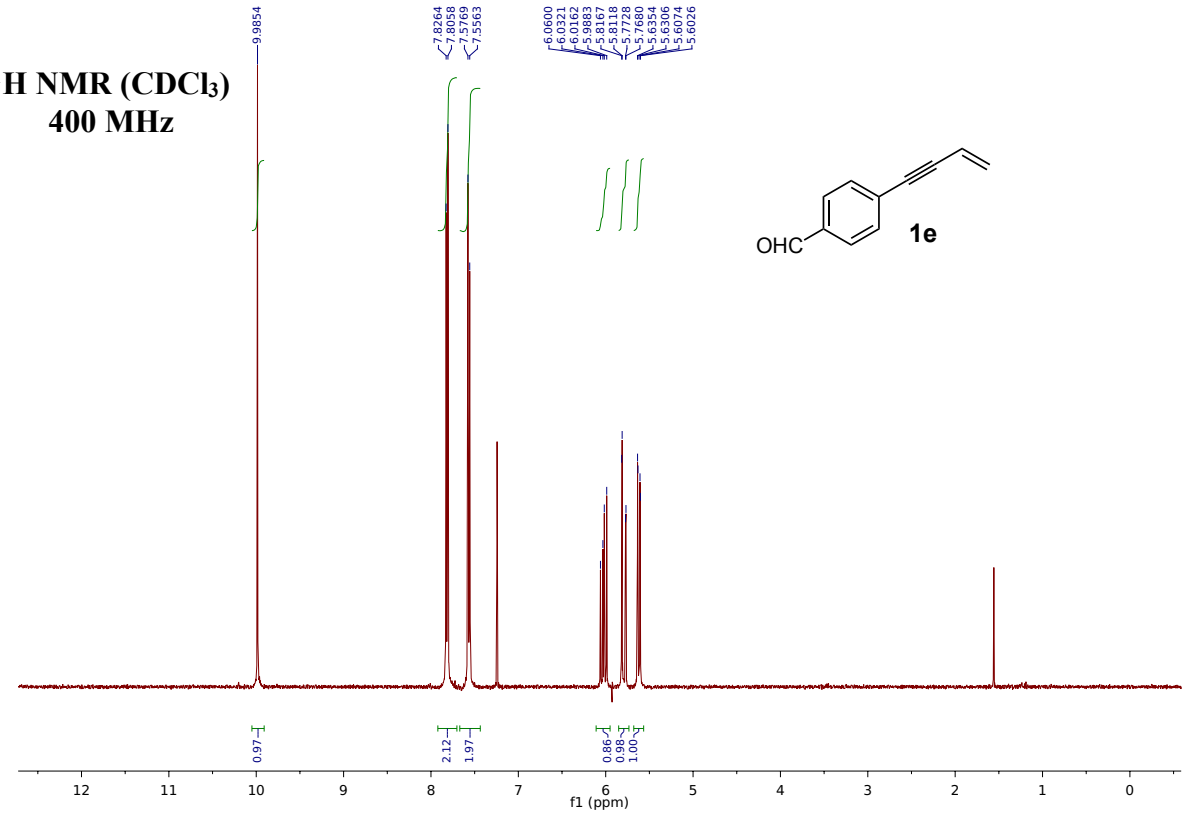
^{13}C NMR ($CDCl_3$)
125 MHz

1c

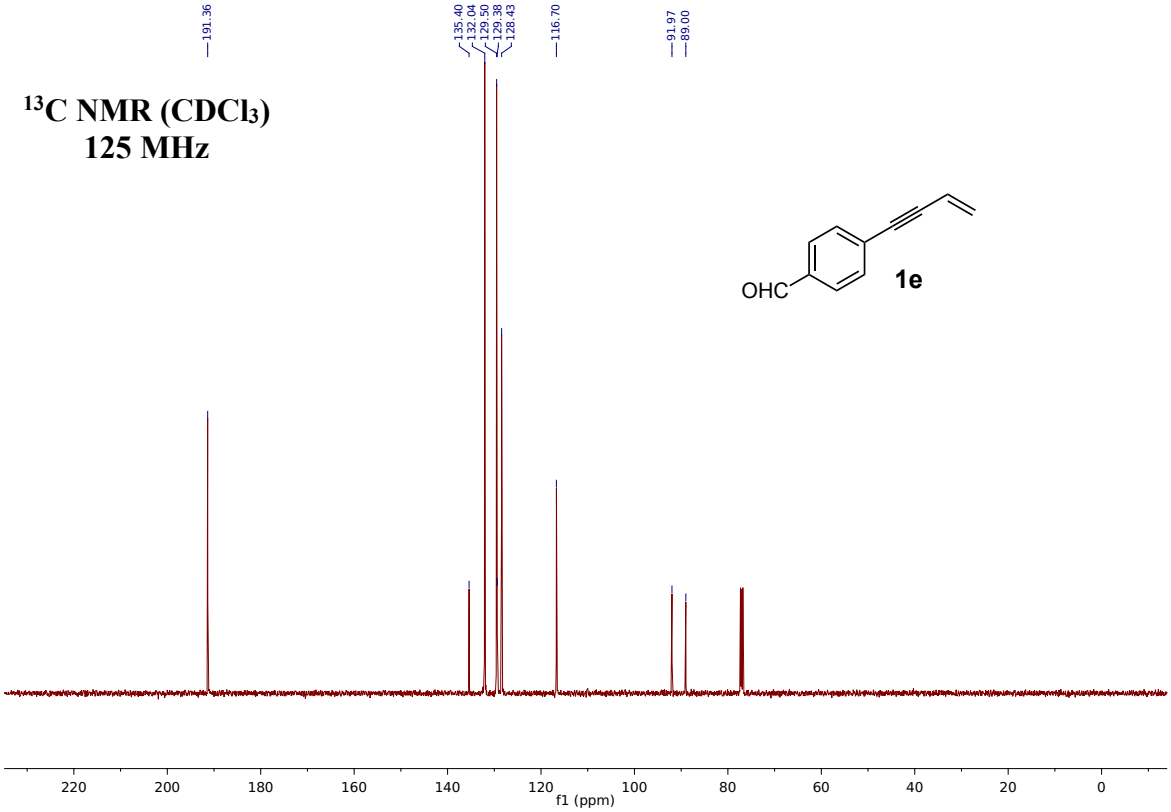



^{1}H NMR (CDCl$_3$)
400 MHz
7.4429
7.4385
7.4263
7.4218
7.4172
7.2975
7.2930
7.2885
7.2762
7.2719
7.2668
6.0168
5.9989
5.9729
5.9450
5.7560
5.7510
5.7121
5.7072
5.5706
5.5657
5.5428
5.5379
1.94
2.01
0.87
1.00
1.03
10
9
8
7
6
5
4
3
2
1
0
f1 (ppm)
Br
1d

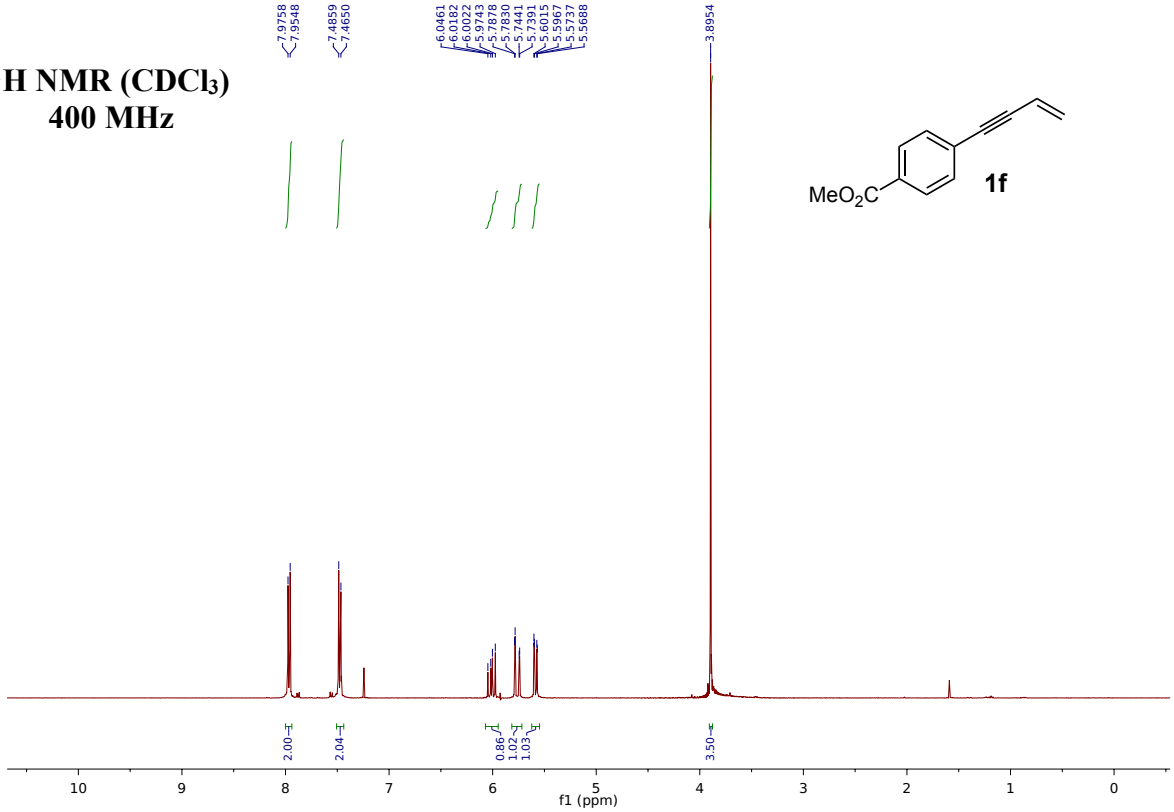
^{1}H NMR ($CDCl_3$)
400 MHz



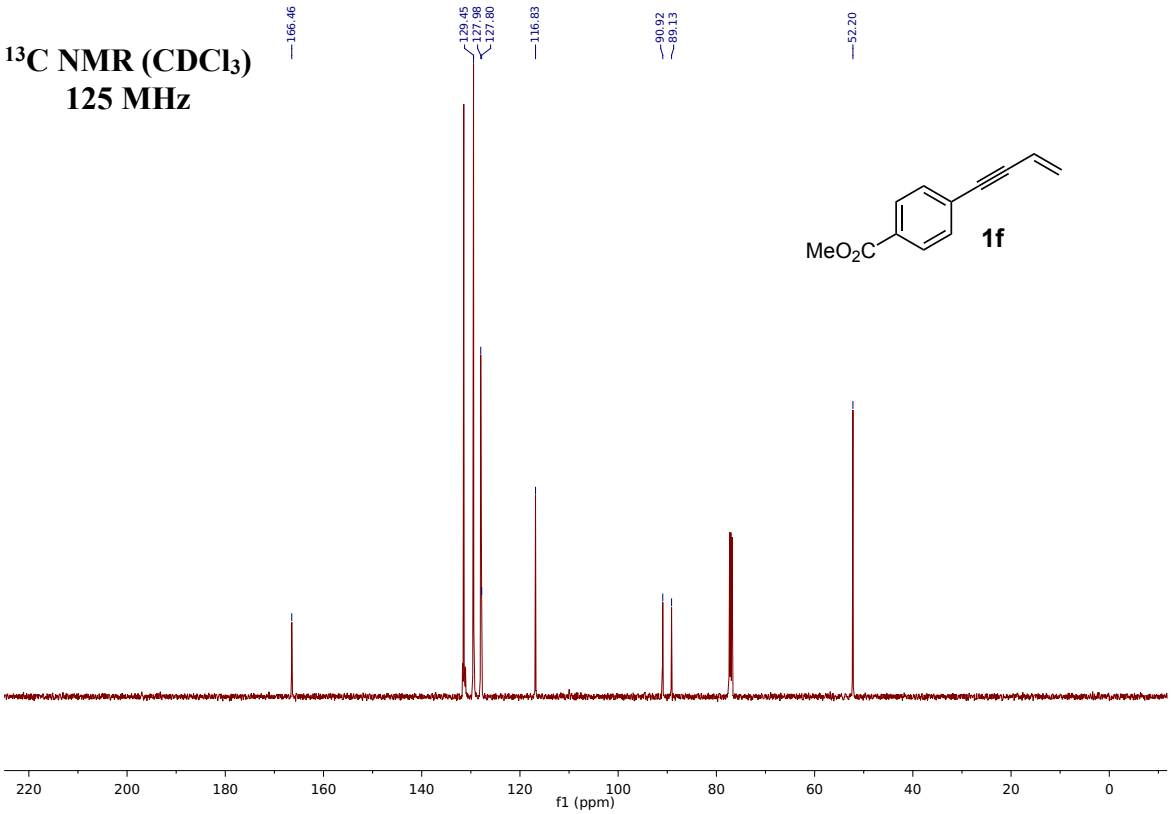
^{13}C NMR ($CDCl_3$)
125 MHz



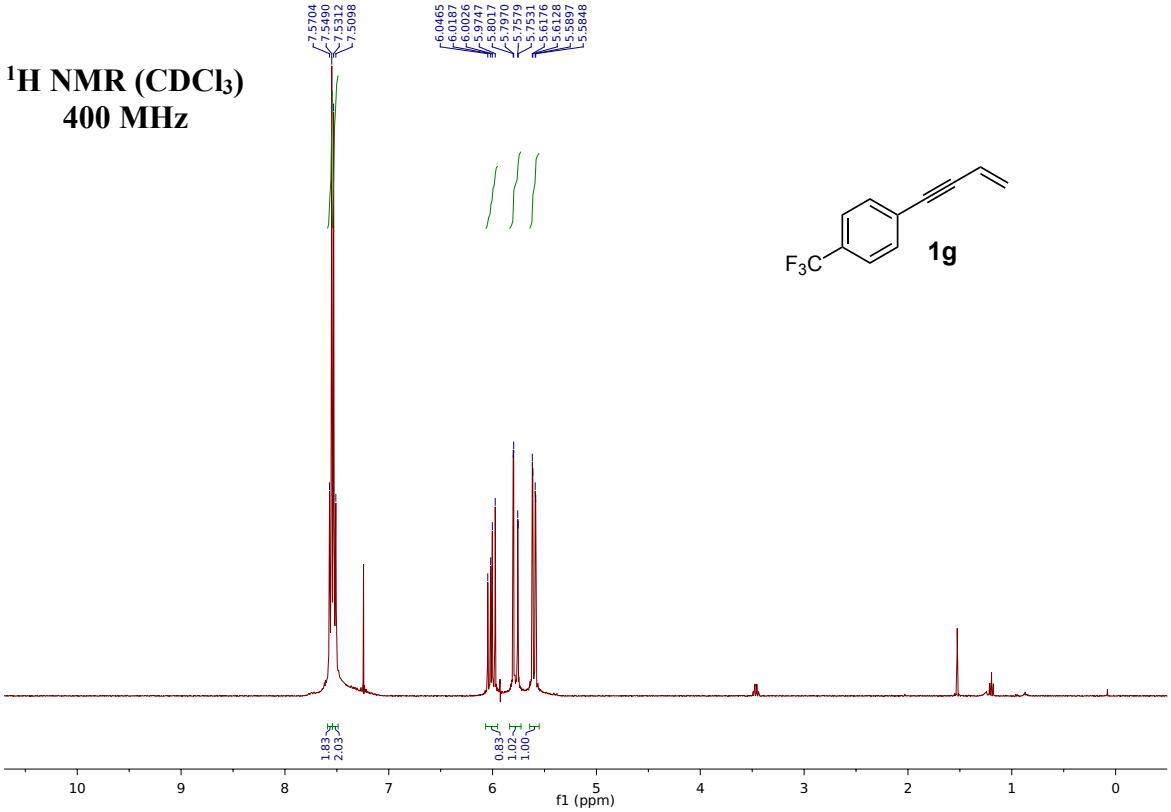
^{1}H NMR ($CDCl_3$)
400 MHz



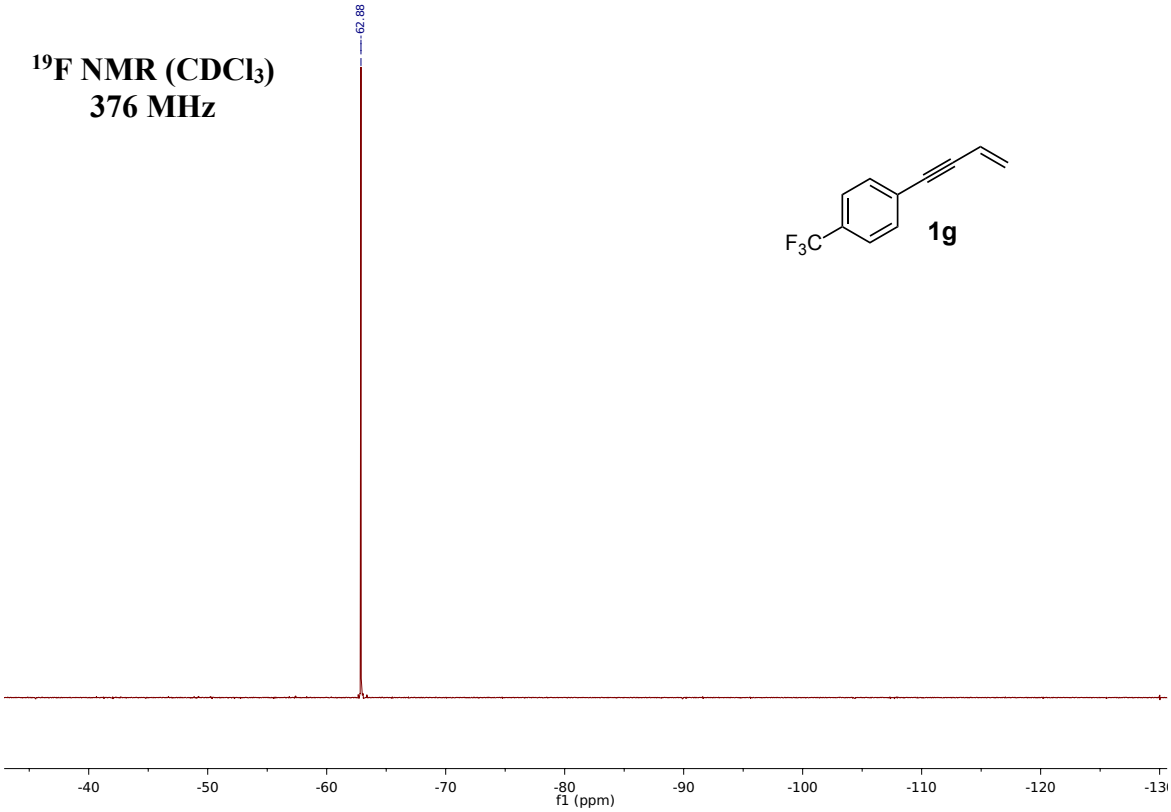
^{13}C NMR ($CDCl_3$)
125 MHz



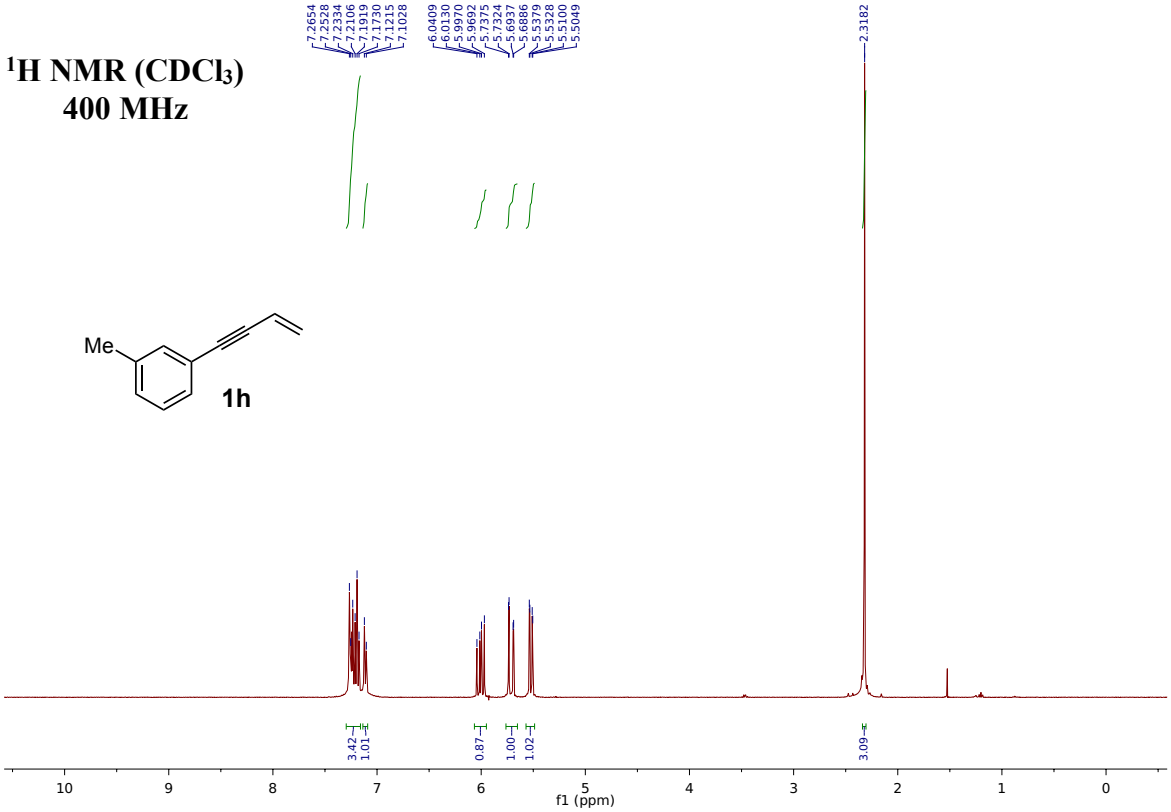
^{1}H NMR ($CDCl_3$)
400 MHz



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



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



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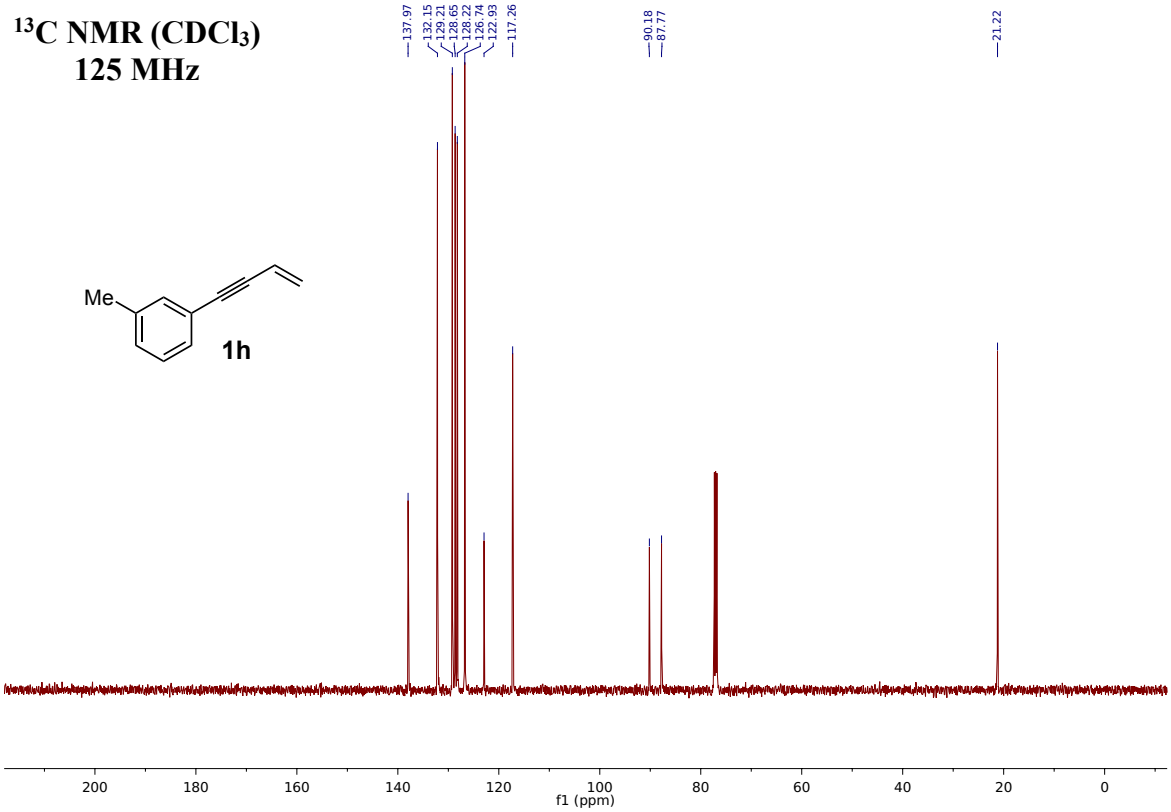
^{13}C NMR ($CDCl_3$)
125 MHz



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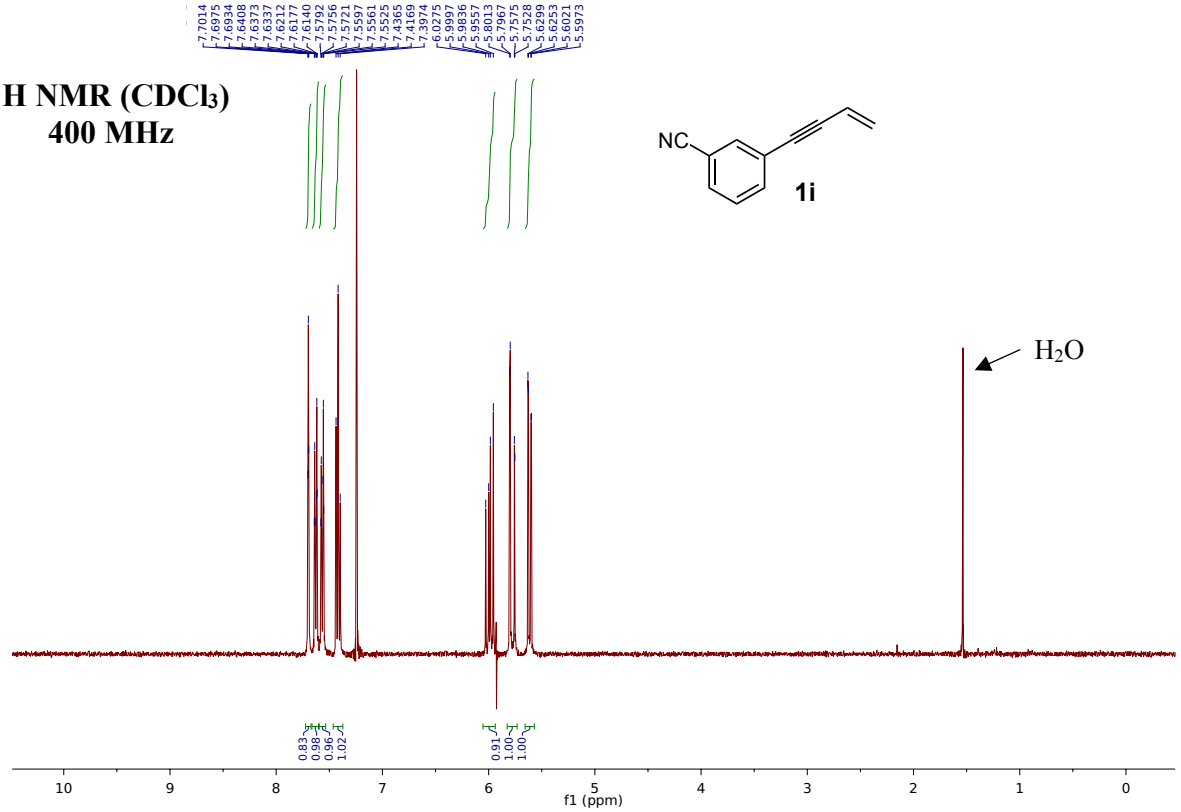
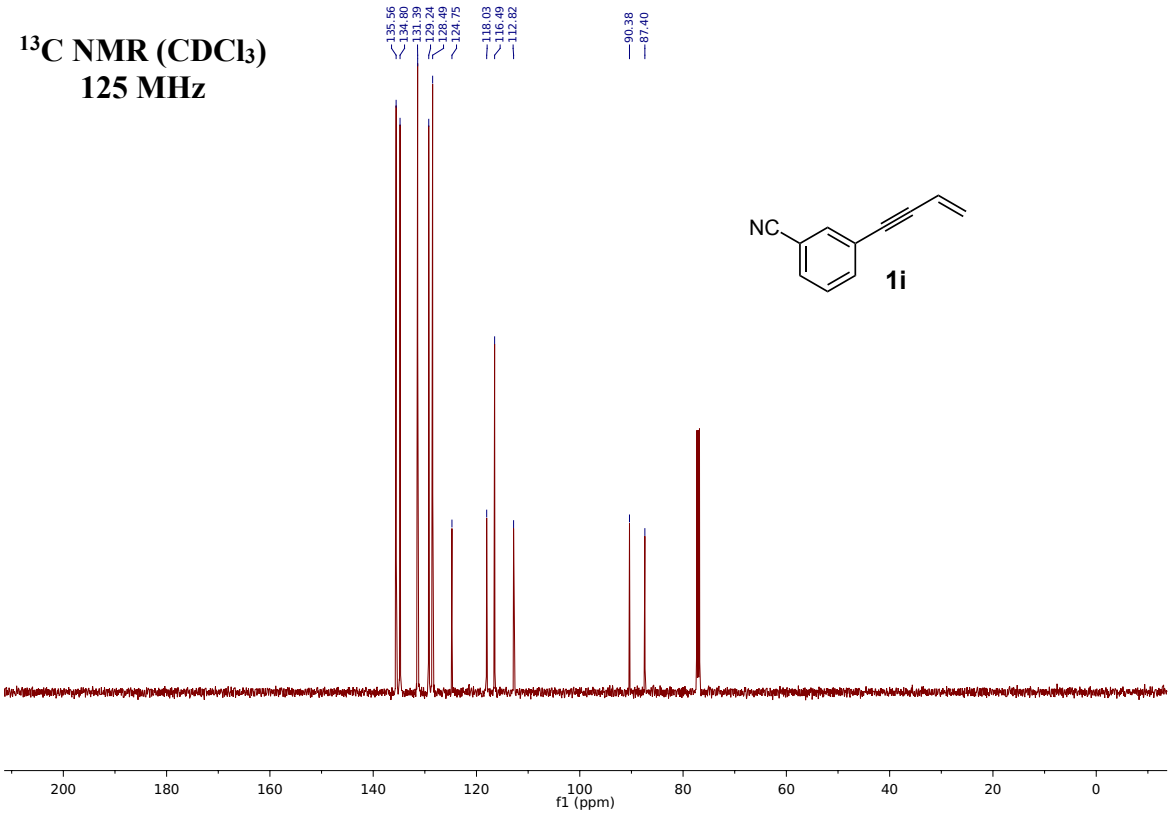
^{1}H NMR ($CDCl_3$)
400 MHz

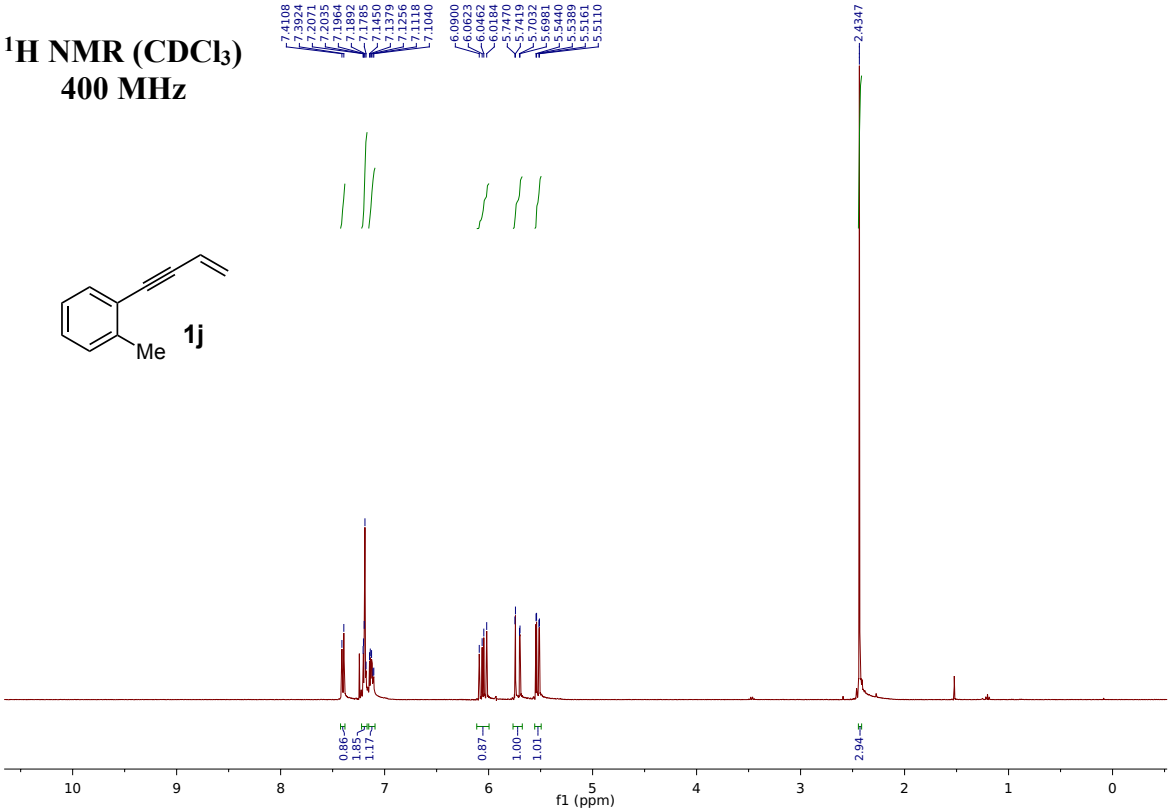


^{13}C NMR ($CDCl_3$)
125 MHz



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

1j



^{13}C NMR ($CDCl_3$)
125 MHz

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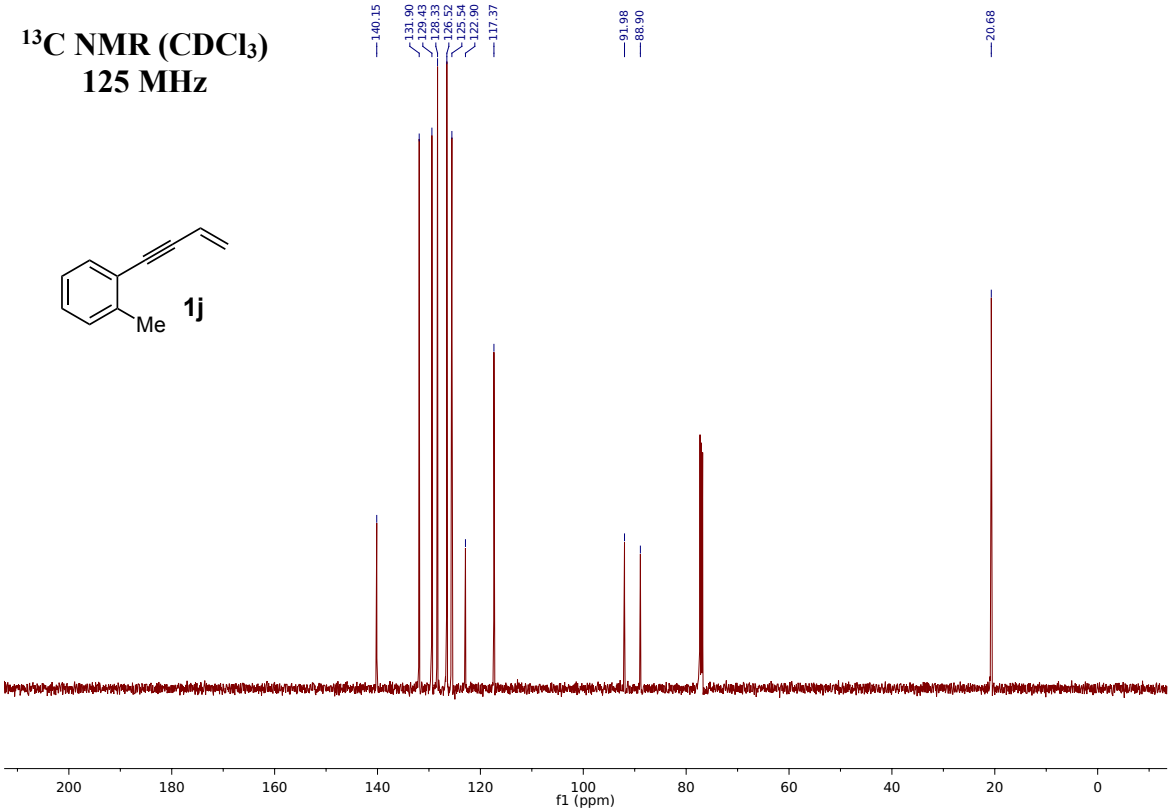
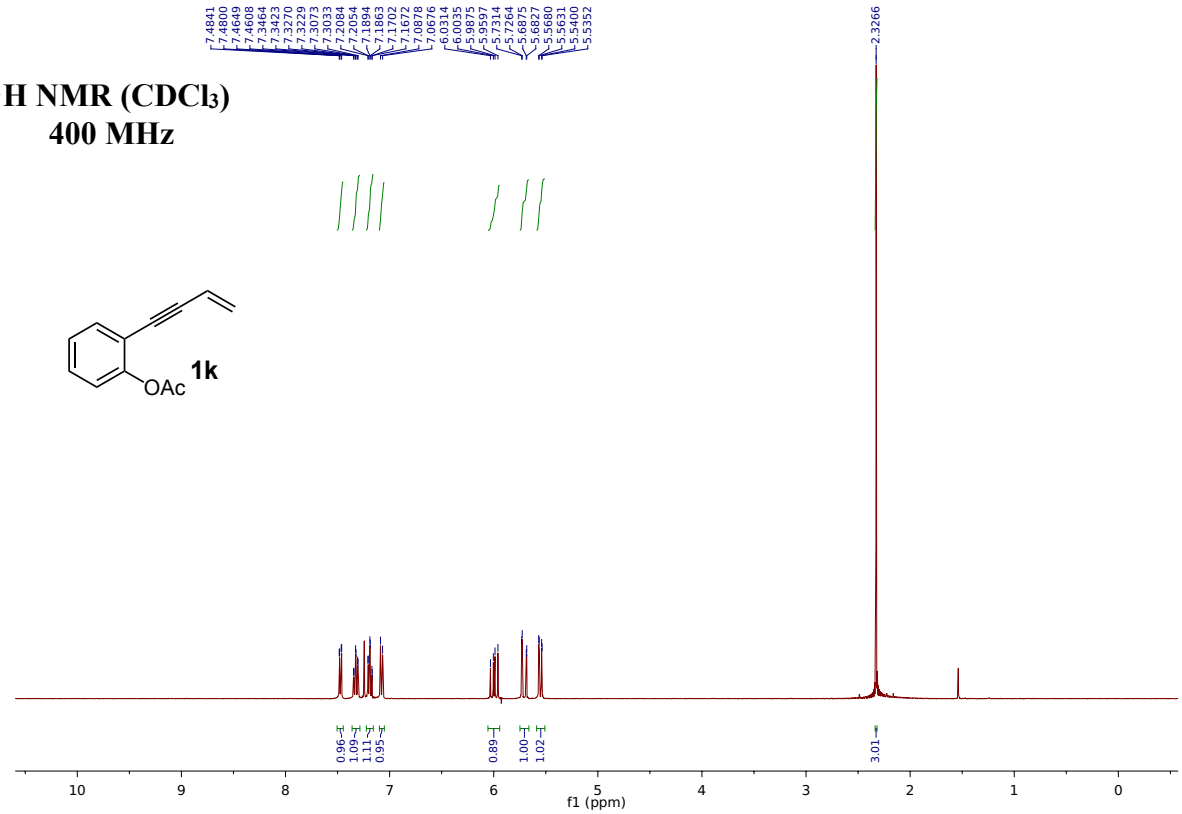


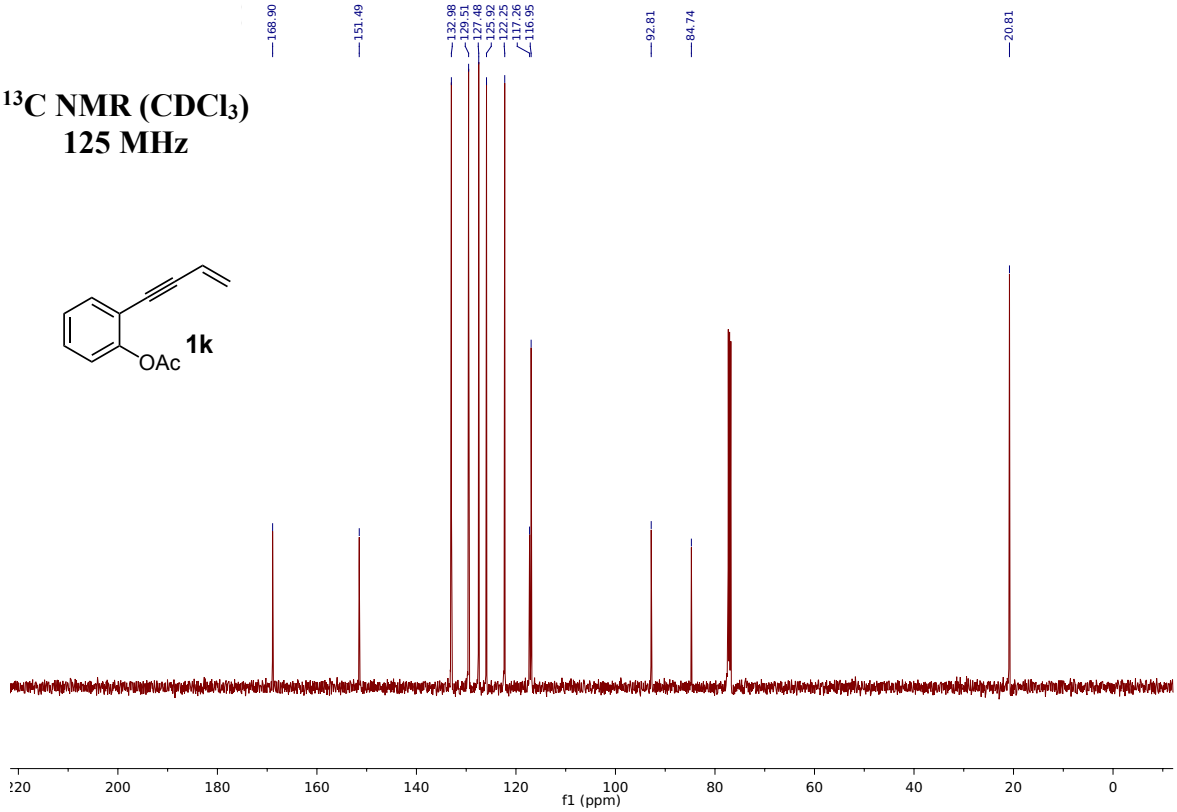
^{1}H NMR ($CDCl_3$)
400 MHz

1k

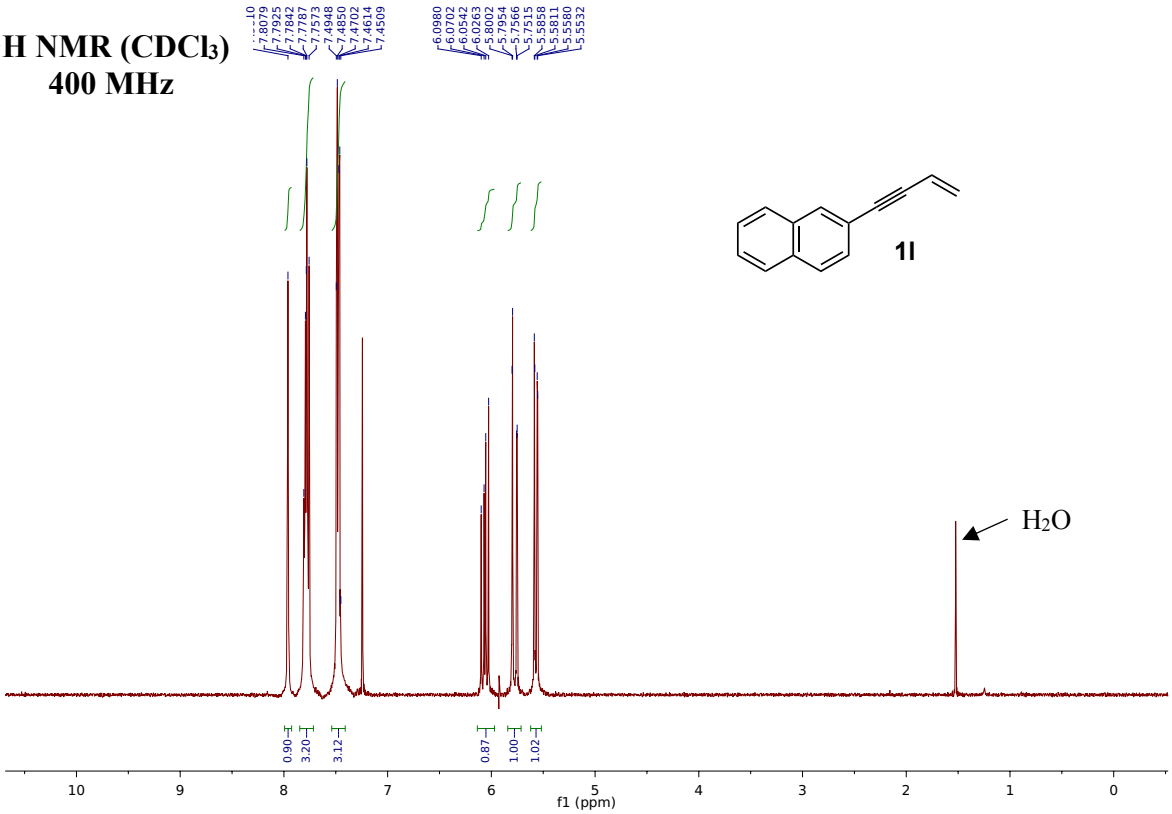


^{13}C NMR ($CDCl_3$)
125 MHz

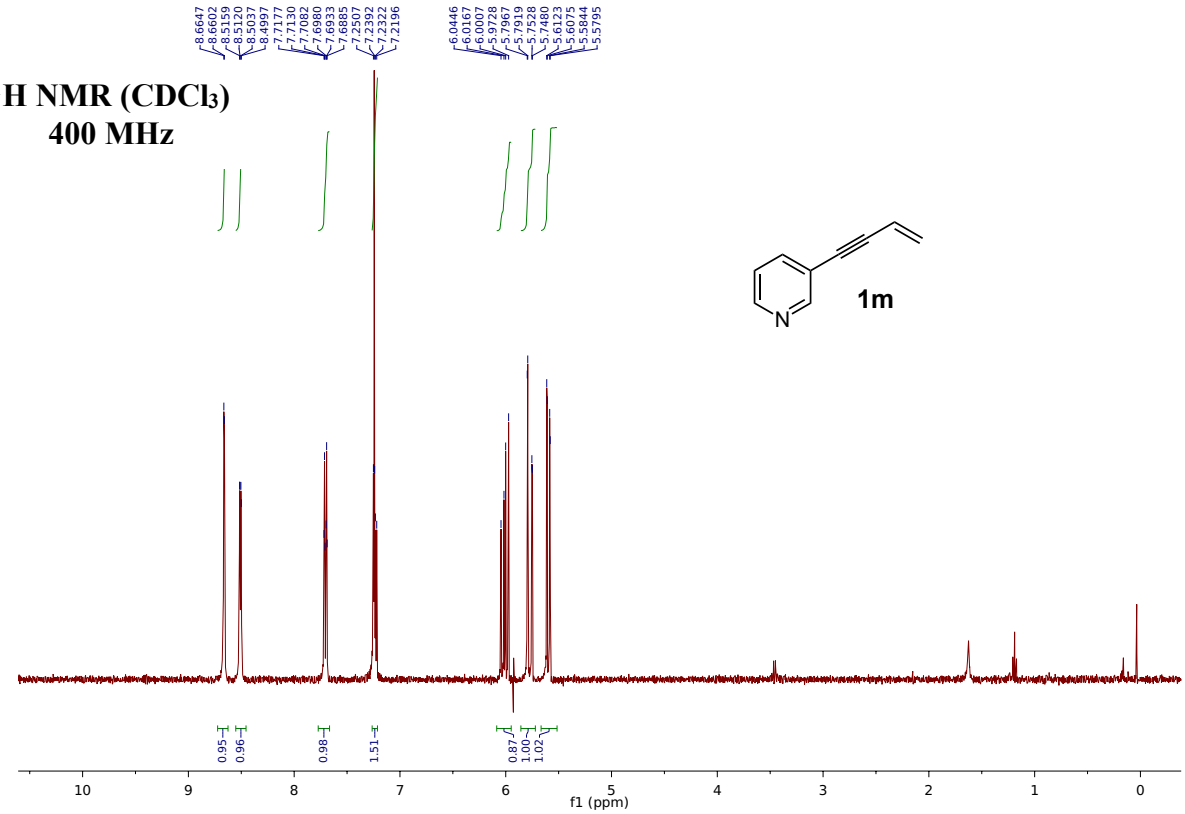
1k



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



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



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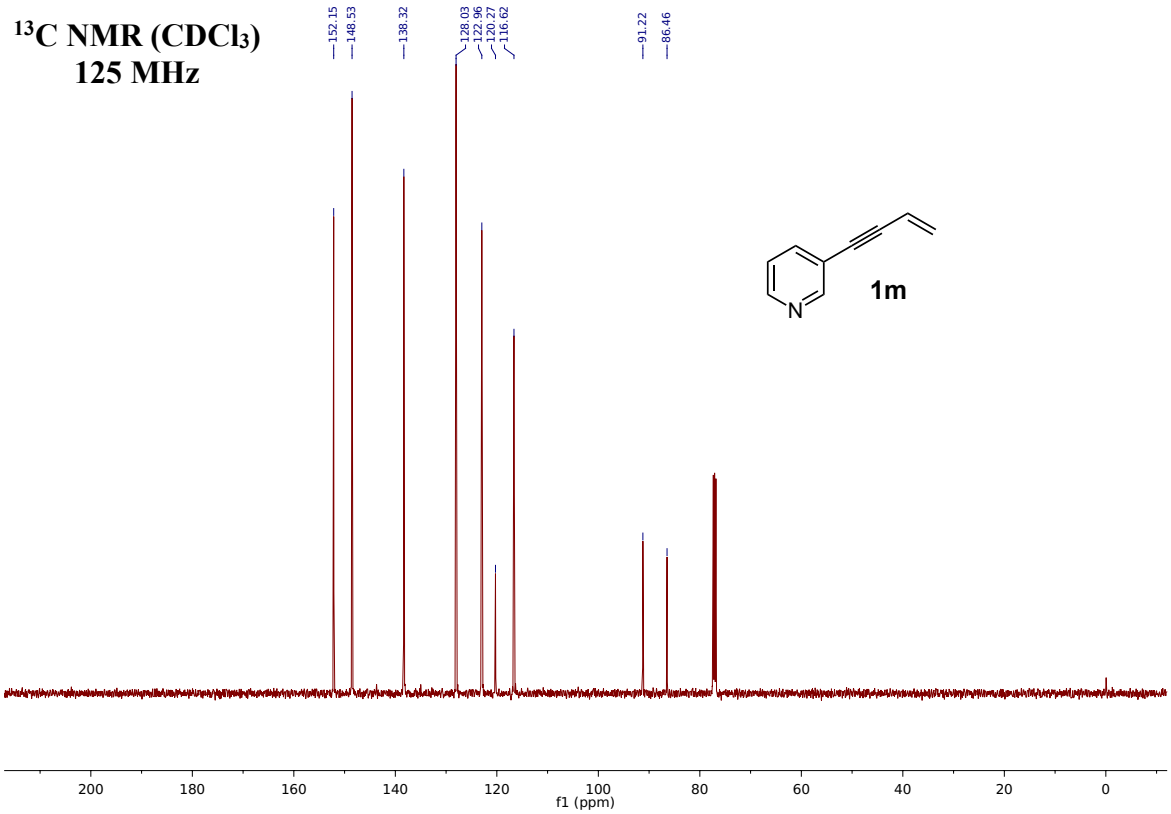
^{13}C NMR ($CDCl_3$)
125 MHz



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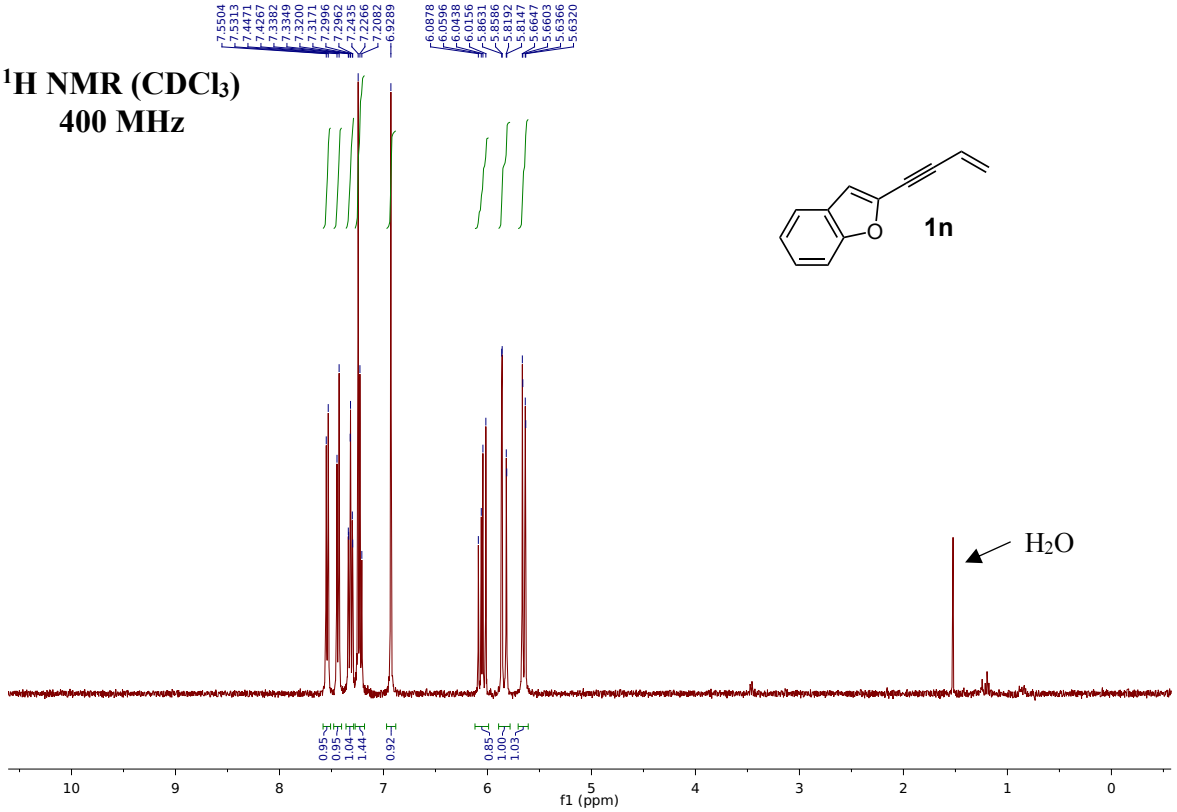
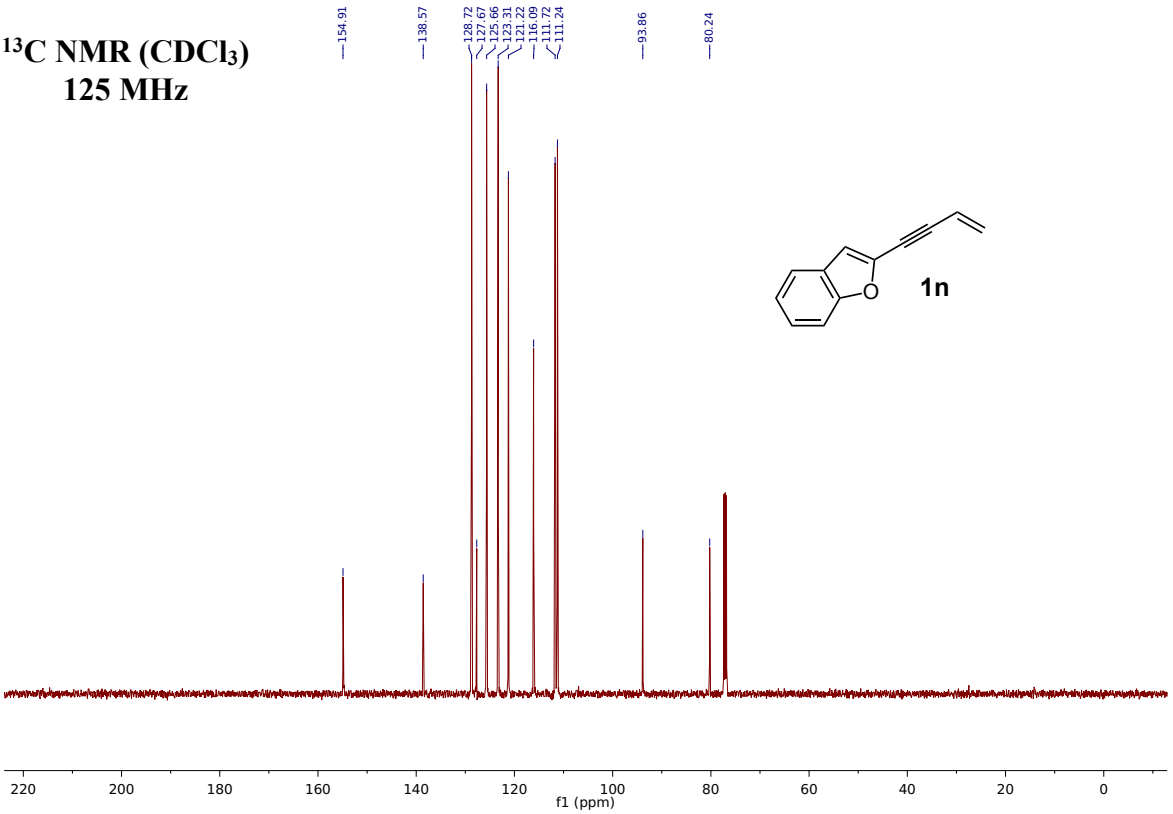
^{1}H NMR ($CDCl_3$)
400 MHz



^{13}C NMR ($CDCl_3$)
125 MHz



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

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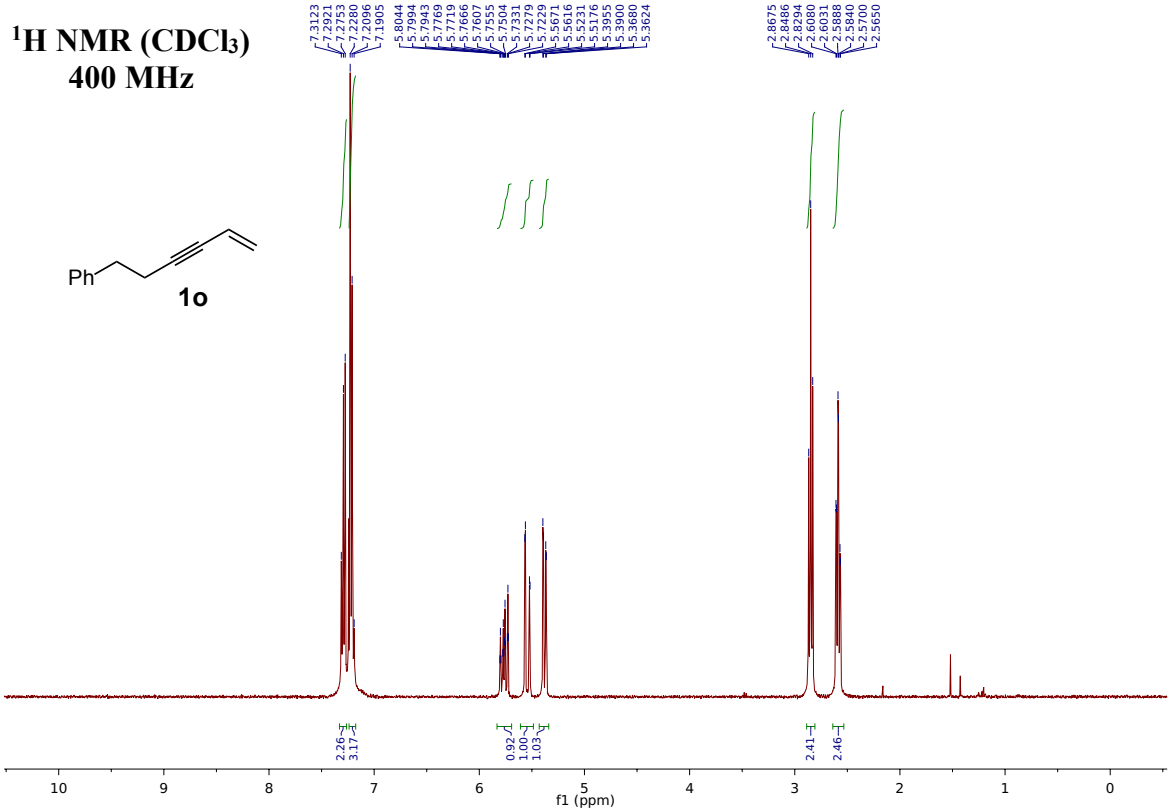
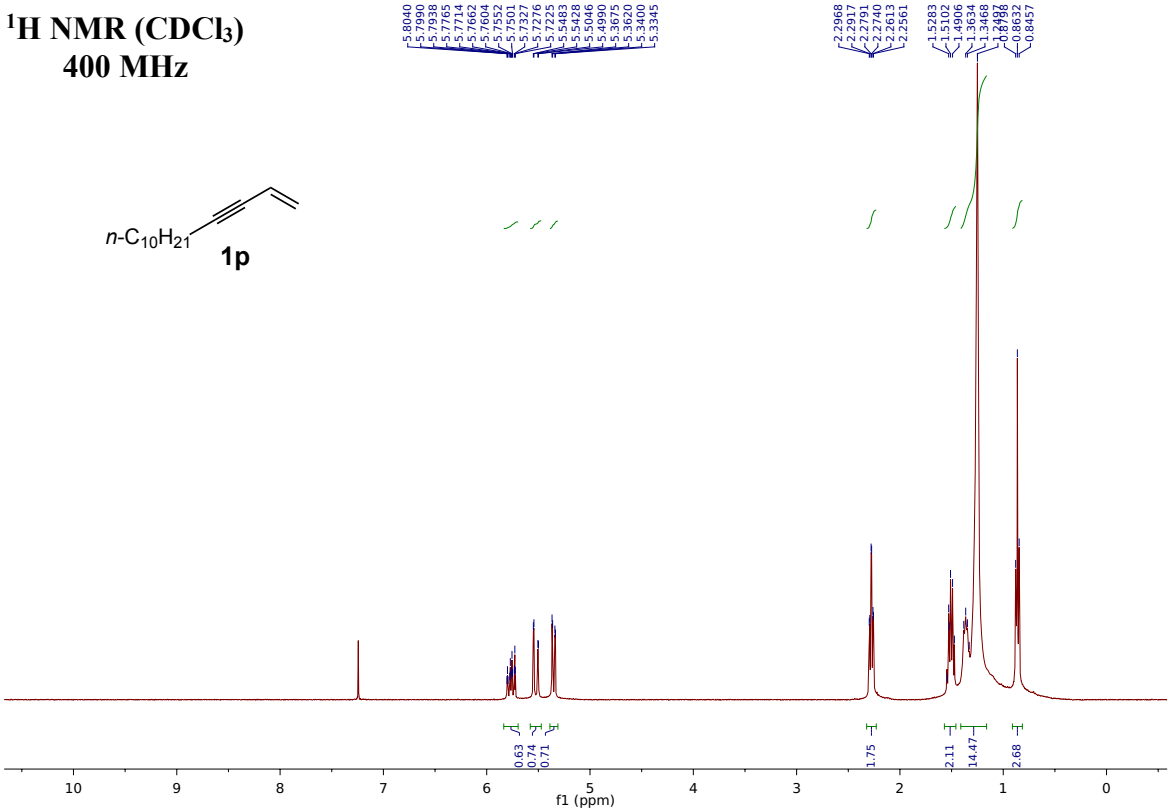


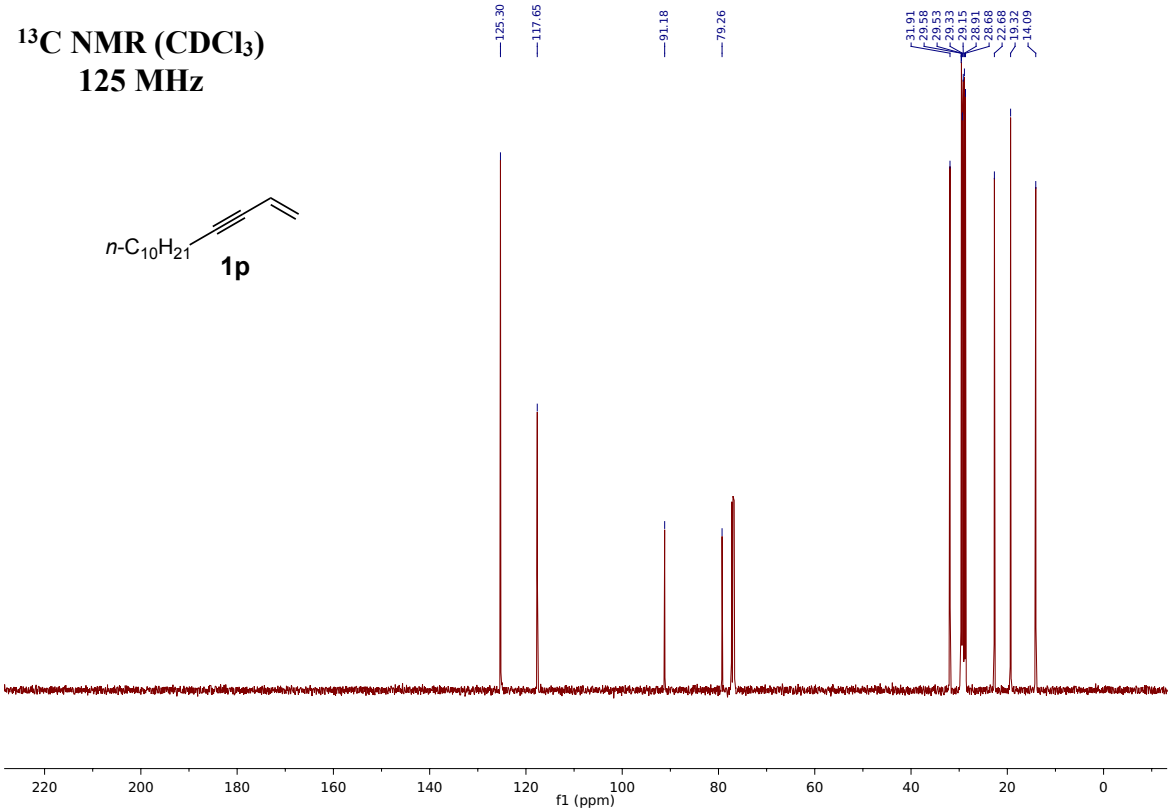
^{1}H NMR ($CDCl_3$)
400 MHz

1p

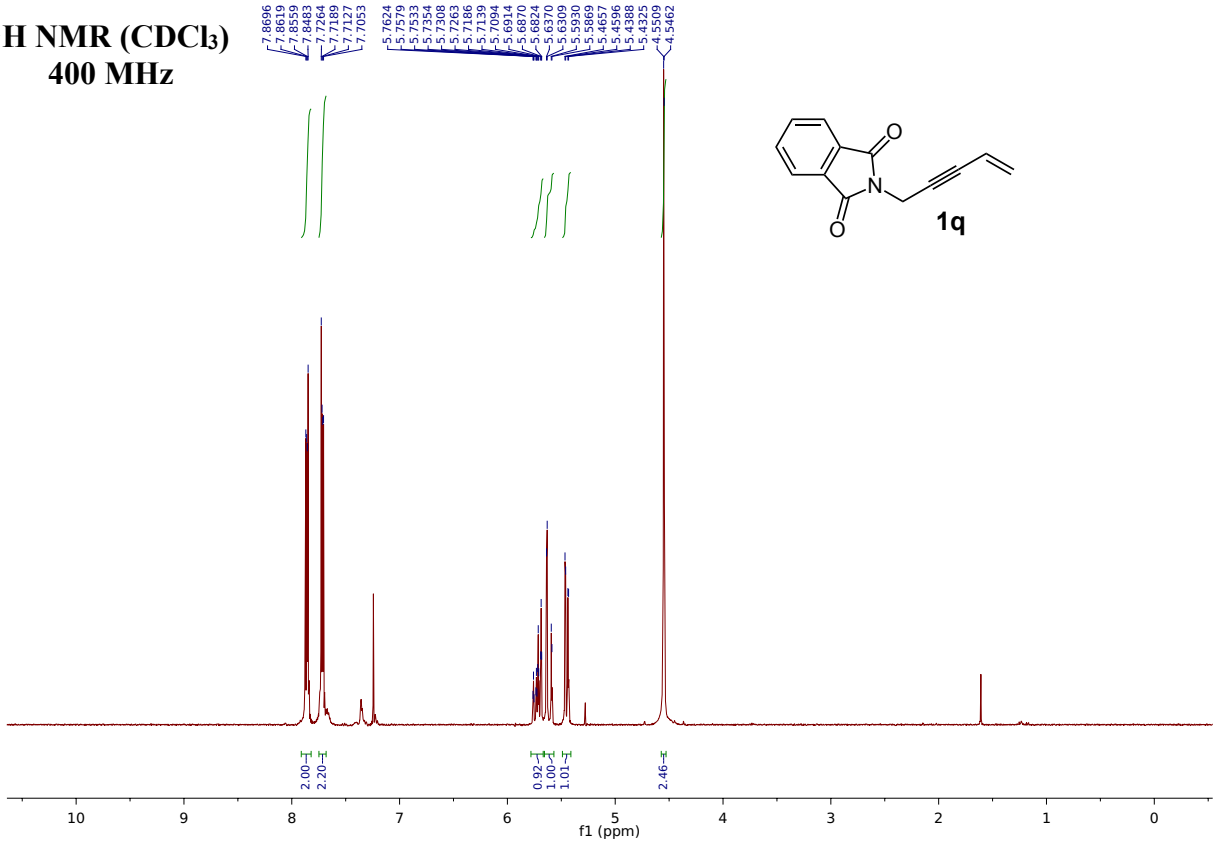


^{13}C NMR ($CDCl_3$)
125 MHz

1p

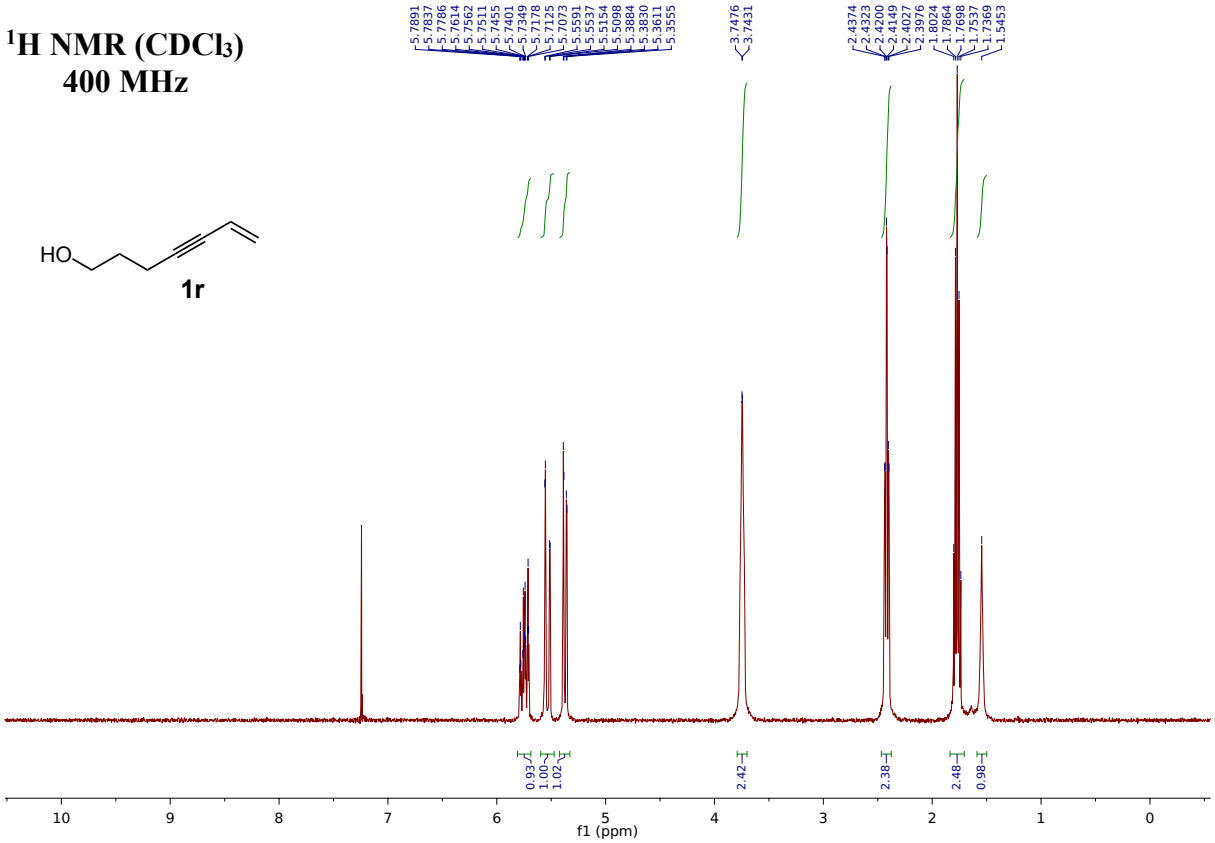


^{1}H NMR ($CDCl_3$)
400 MHz

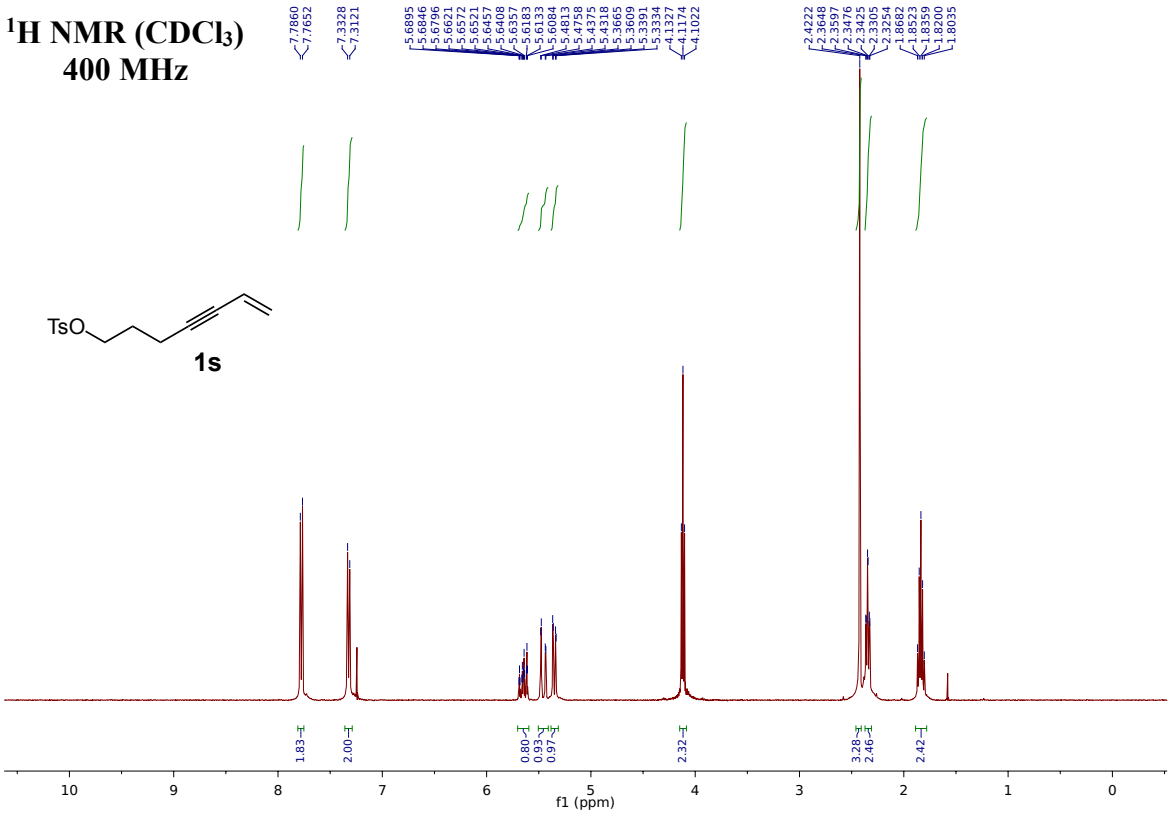


^{1}H NMR ($CDCl_3$)
400 MHz

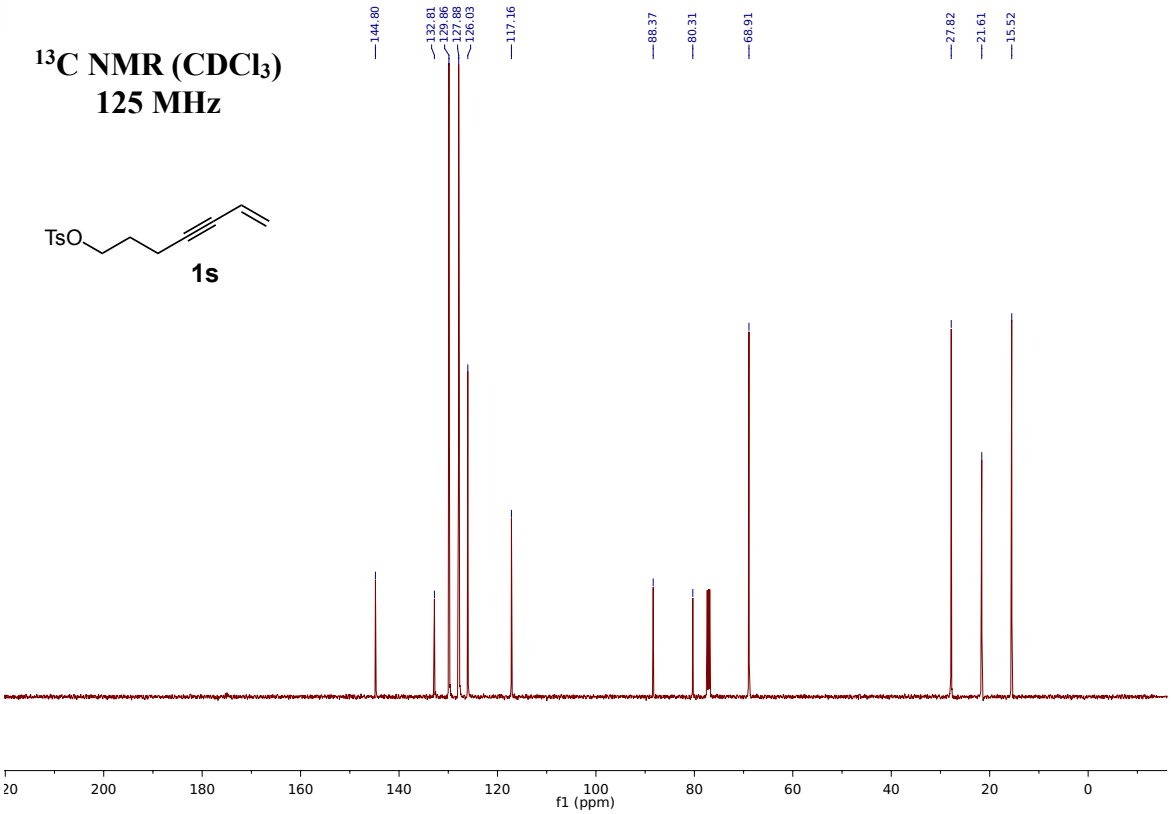
1r



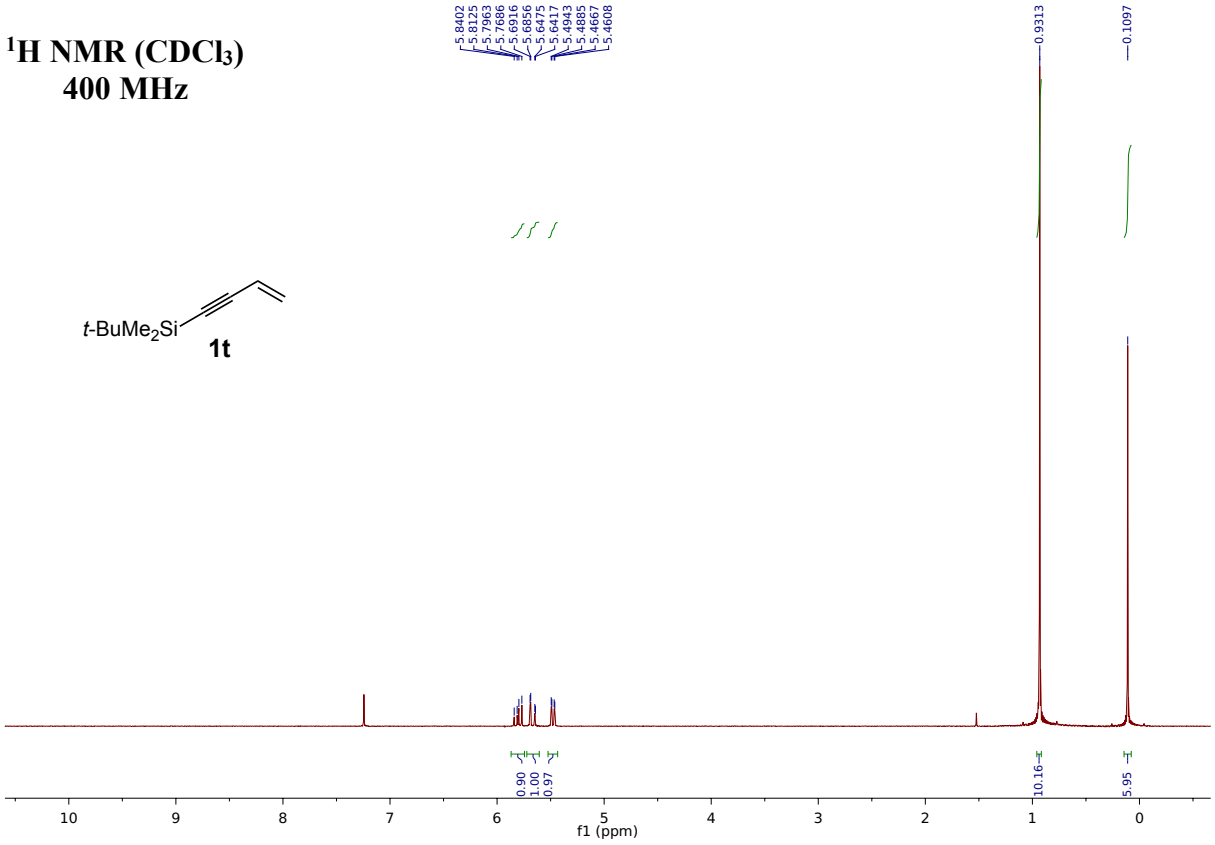
^{1}H NMR ($CDCl_3$)
400 MHz



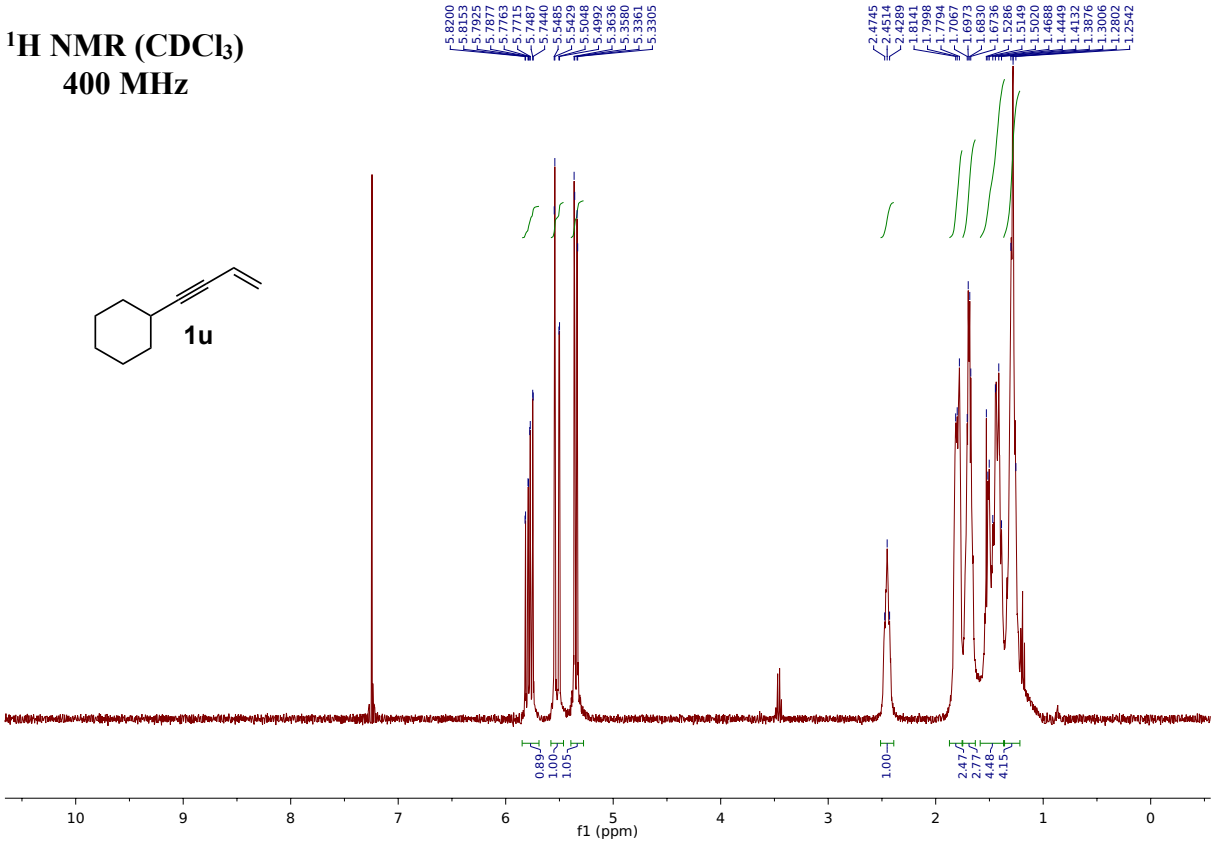
^{13}C NMR ($CDCl_3$)
125 MHz



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

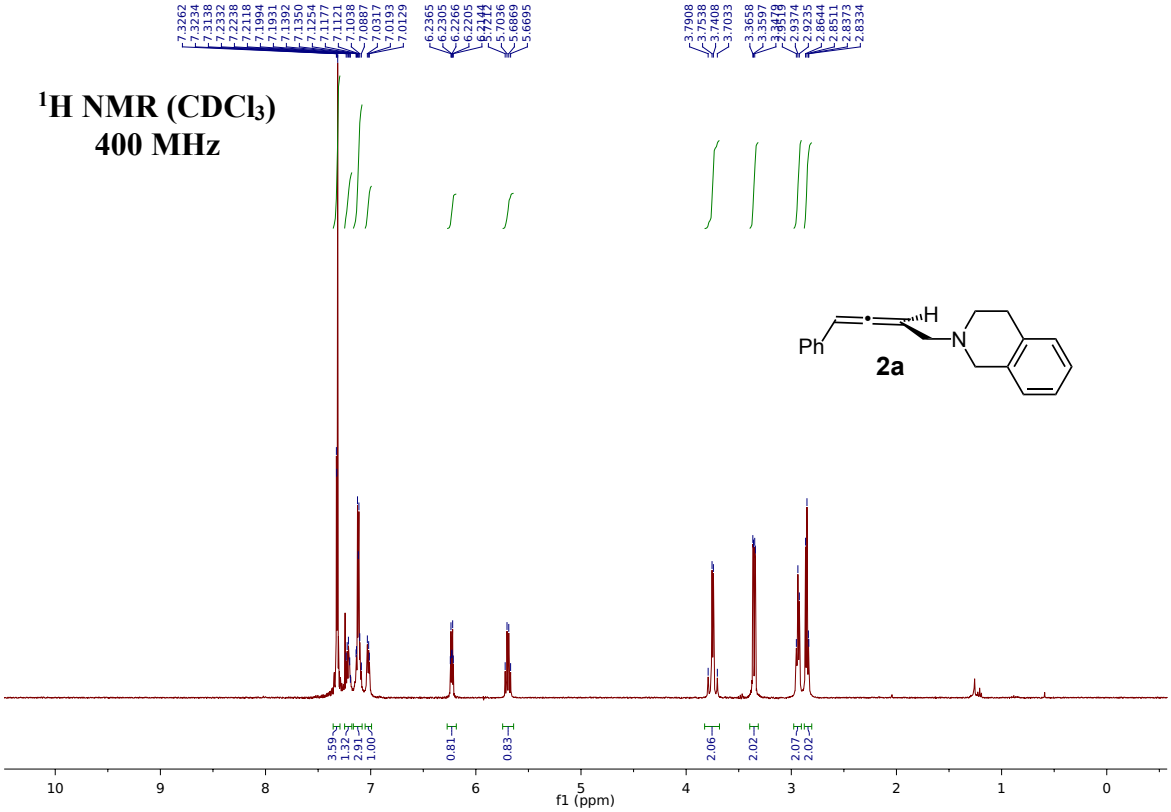


^{1}H NMR ($CDCl_3$)
400 MHz



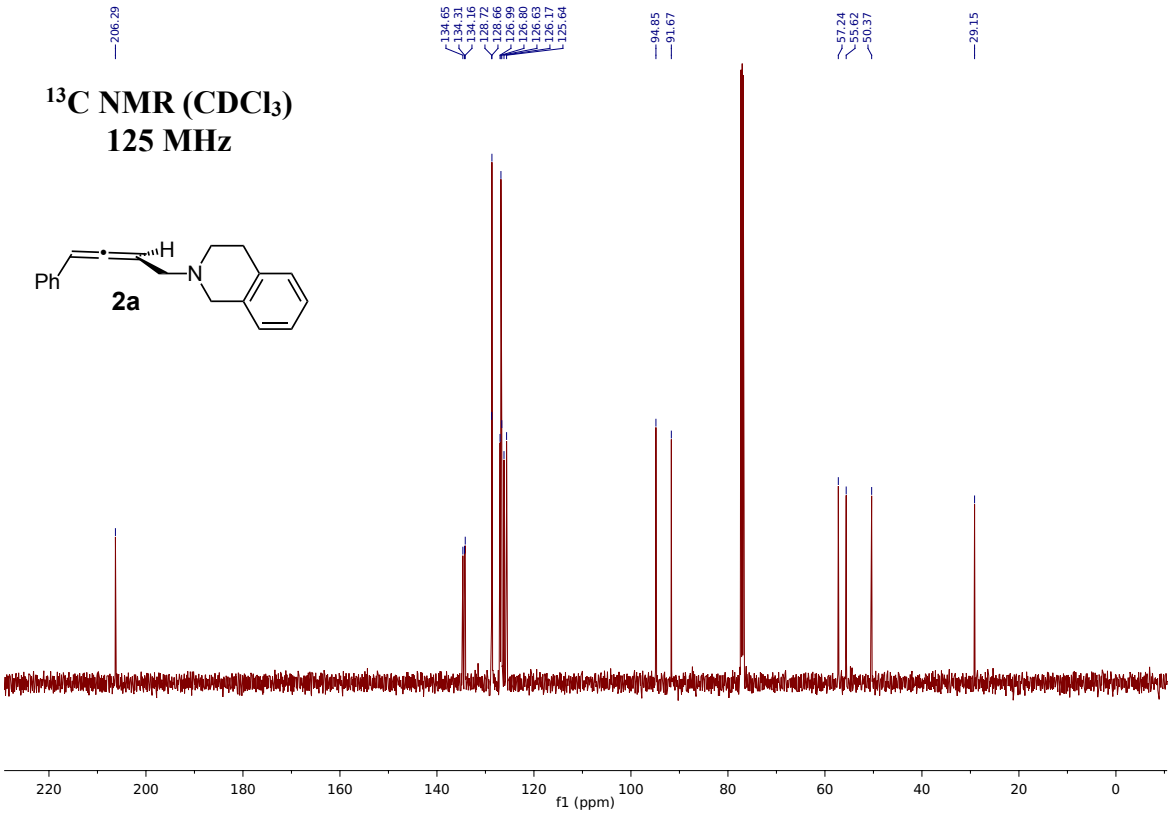
1u

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

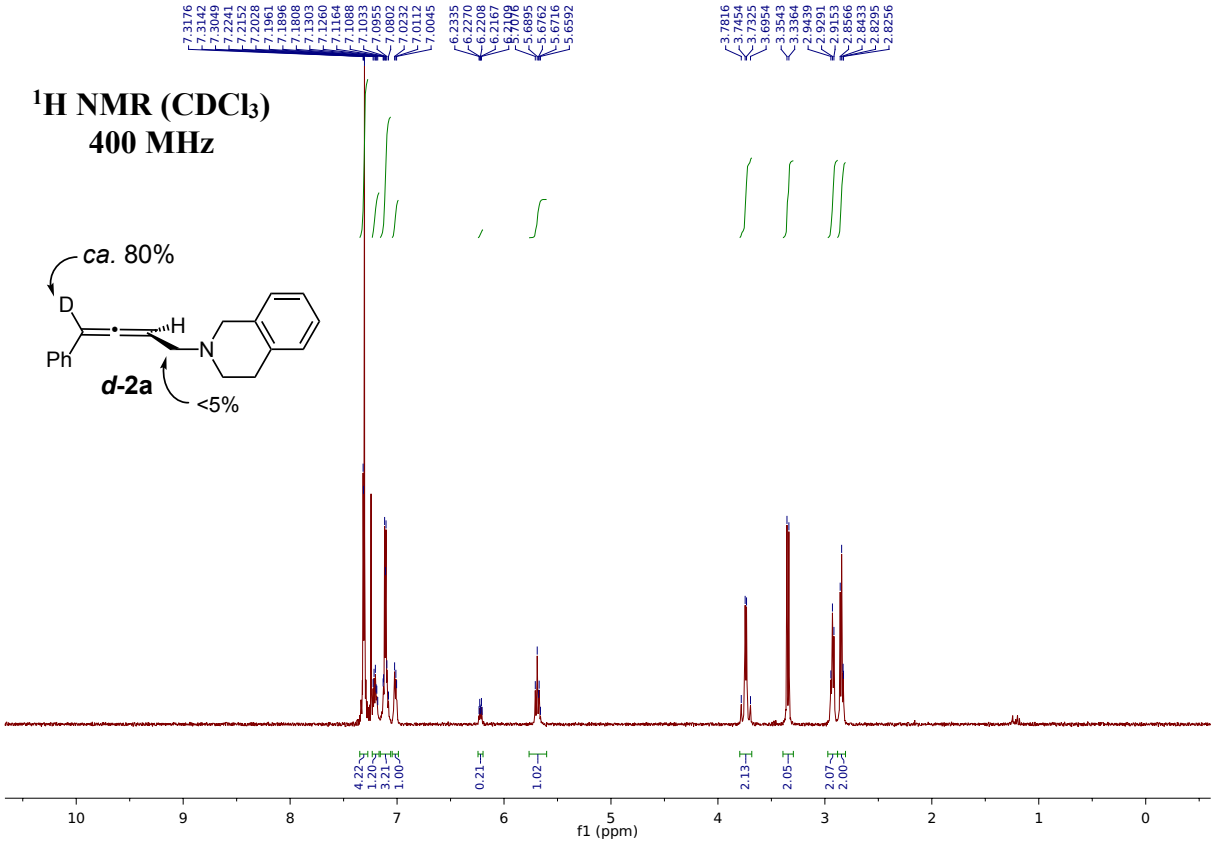


2a

^{13}C NMR ($CDCl_3$)
125 MHz



2a


7.3176
7.3142
7.3049
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7.2152
7.2028
7.1961
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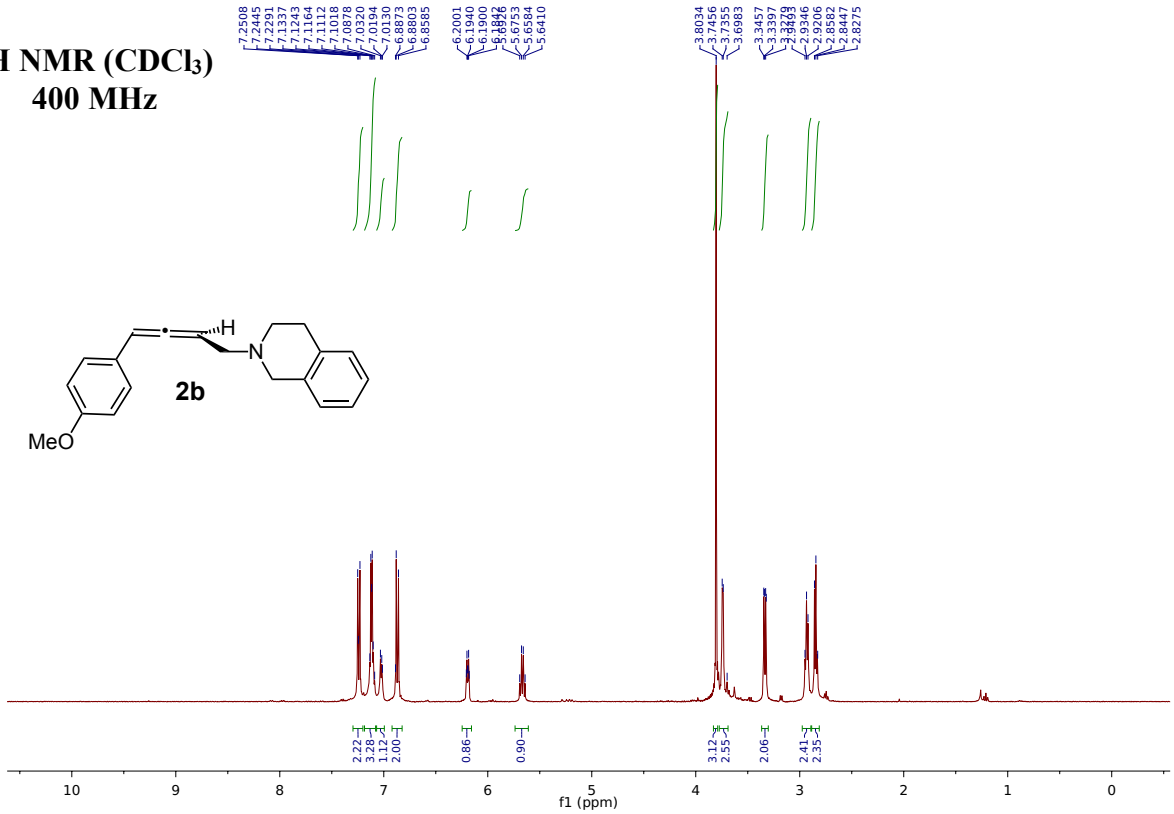
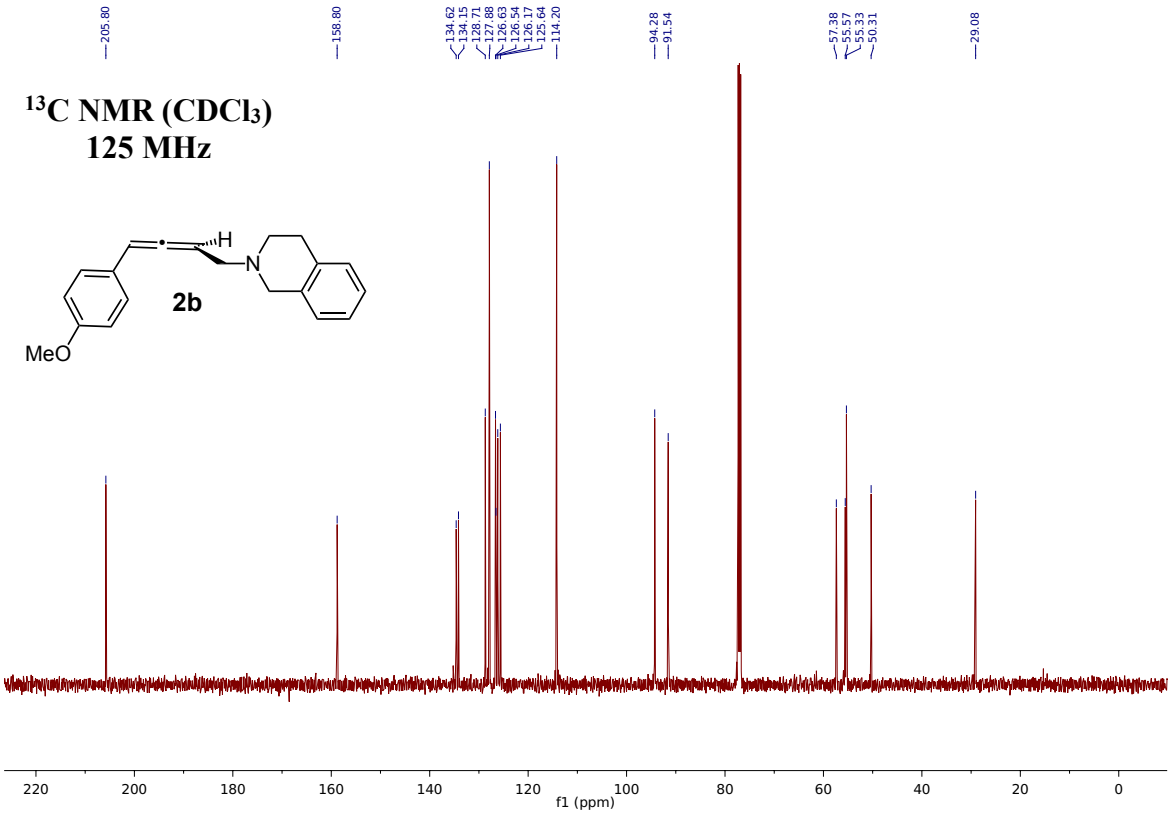
7.1808
7.1303
7.1260
7.1164
7.1088
7.1033
7.0955
7.0802
7.0232
7.0112
7.0045
6.2335
6.2270
6.2208
6.2167
6.2078
5.7008
5.6895
5.6762
5.6716
5.6592
3.7816
3.7454
3.7325
3.6954
3.3543
3.3364
2.9439
2.9291
2.9153
2.8566
2.8433
2.8295
2.8256
1H NMR (CDCl3)
400 MHz
ca. 80%
D
H
Ph
N
d-2a
<5%
4.22
1.20
3.21
1.00
0.21
1.02
2.13
2.05
2.07
2.00
10
9
8
7
6
5
4
3
2
1
0
f1 (ppm)

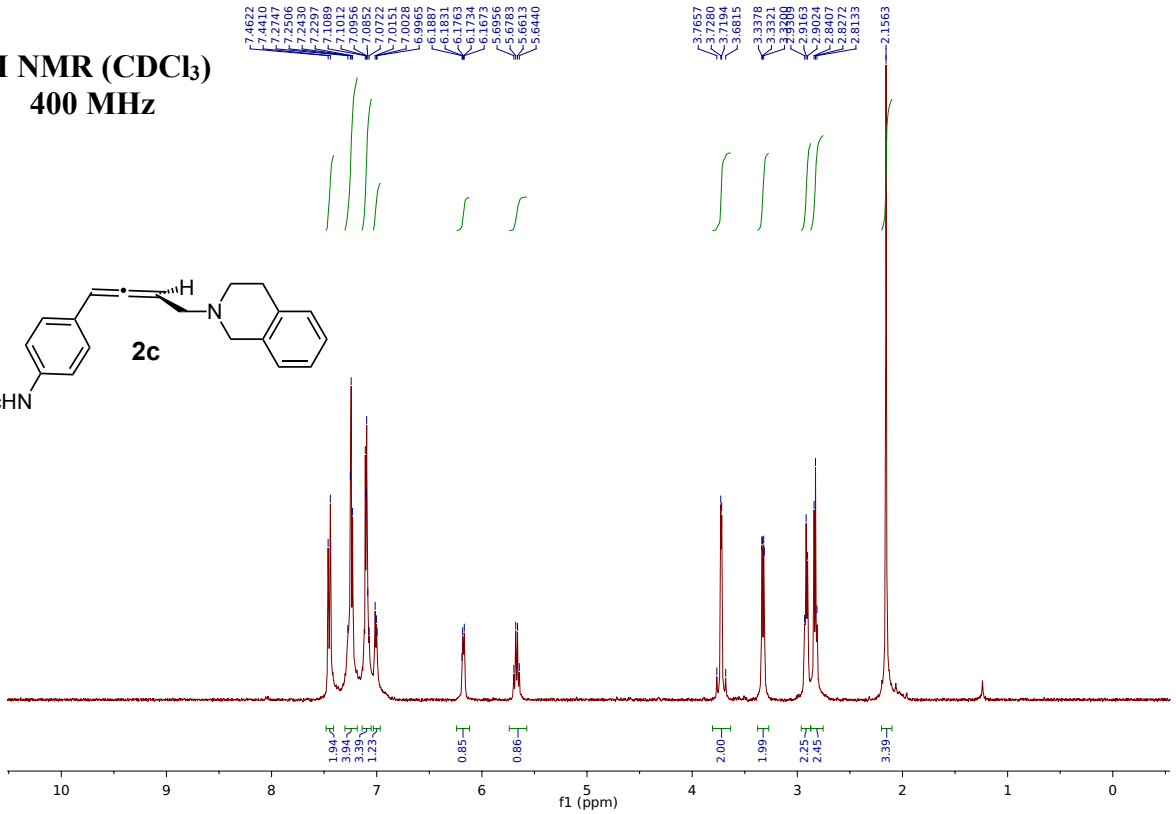
^{1}H NMR ($CDCl_3$)
400 MHz



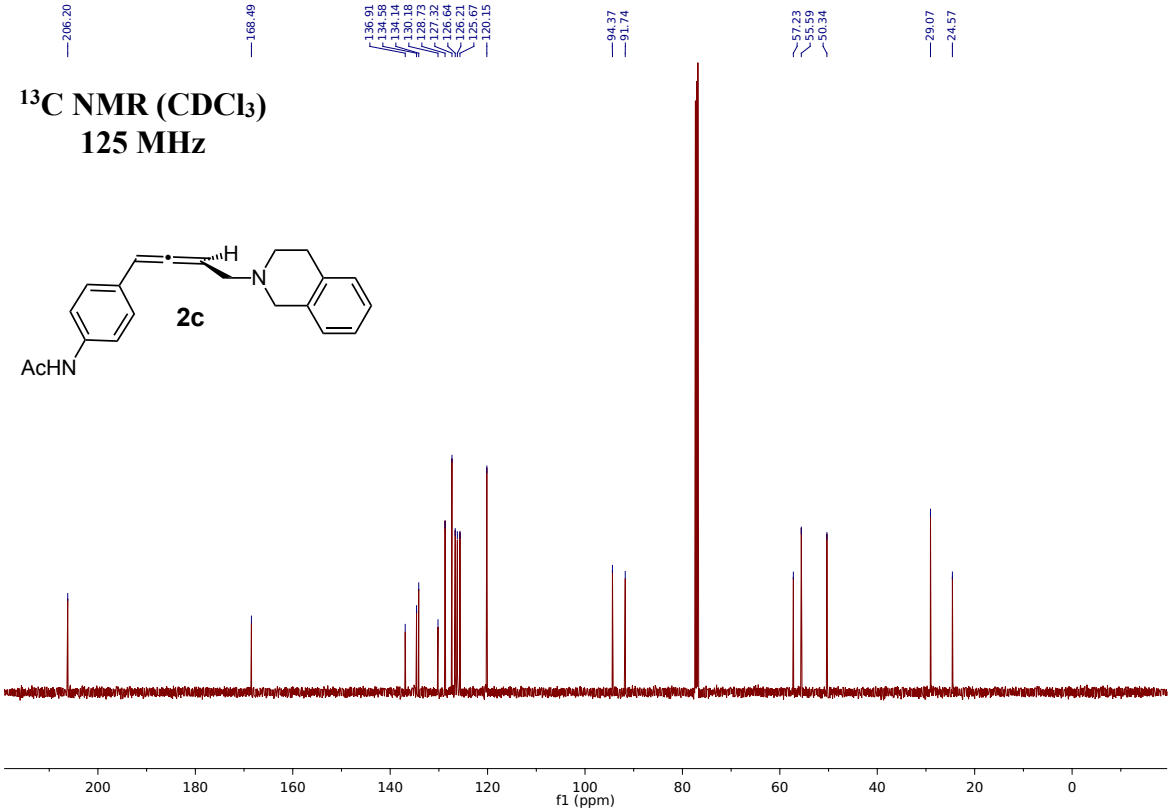
^{13}C NMR ($CDCl_3$)
125 MHz

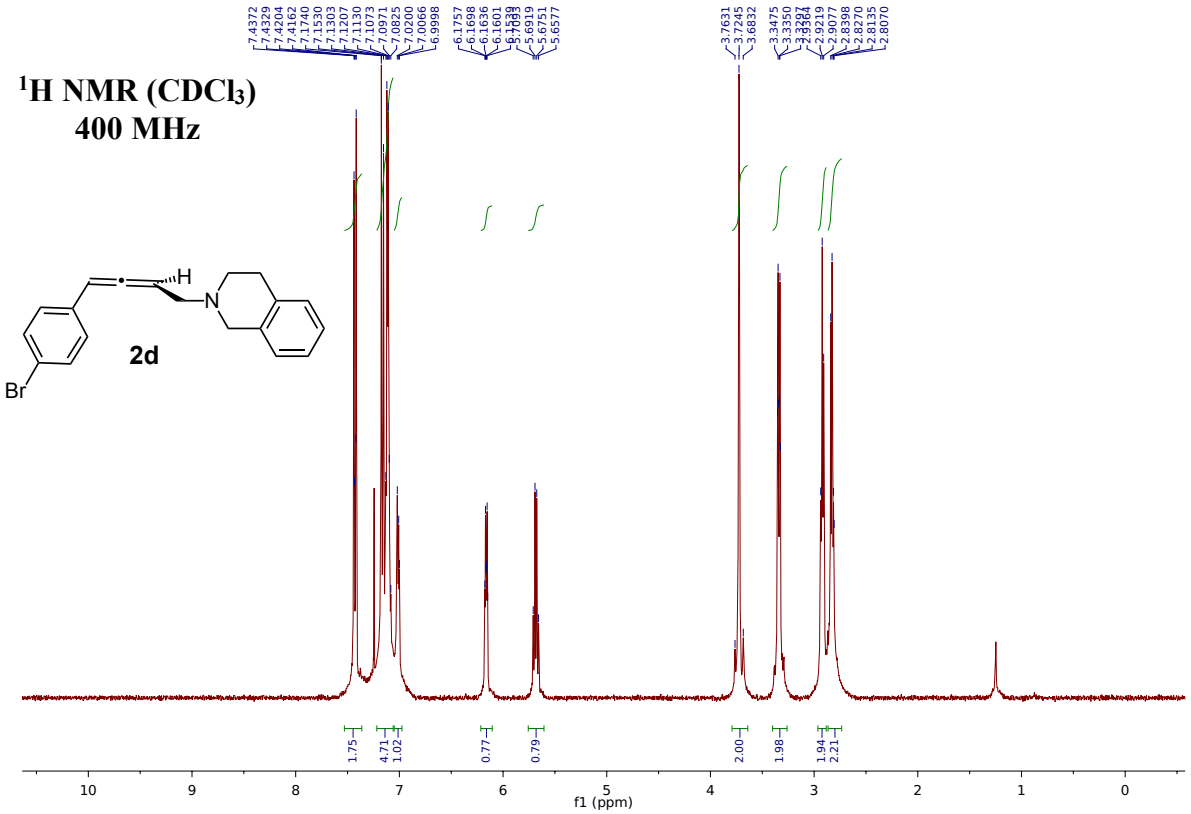


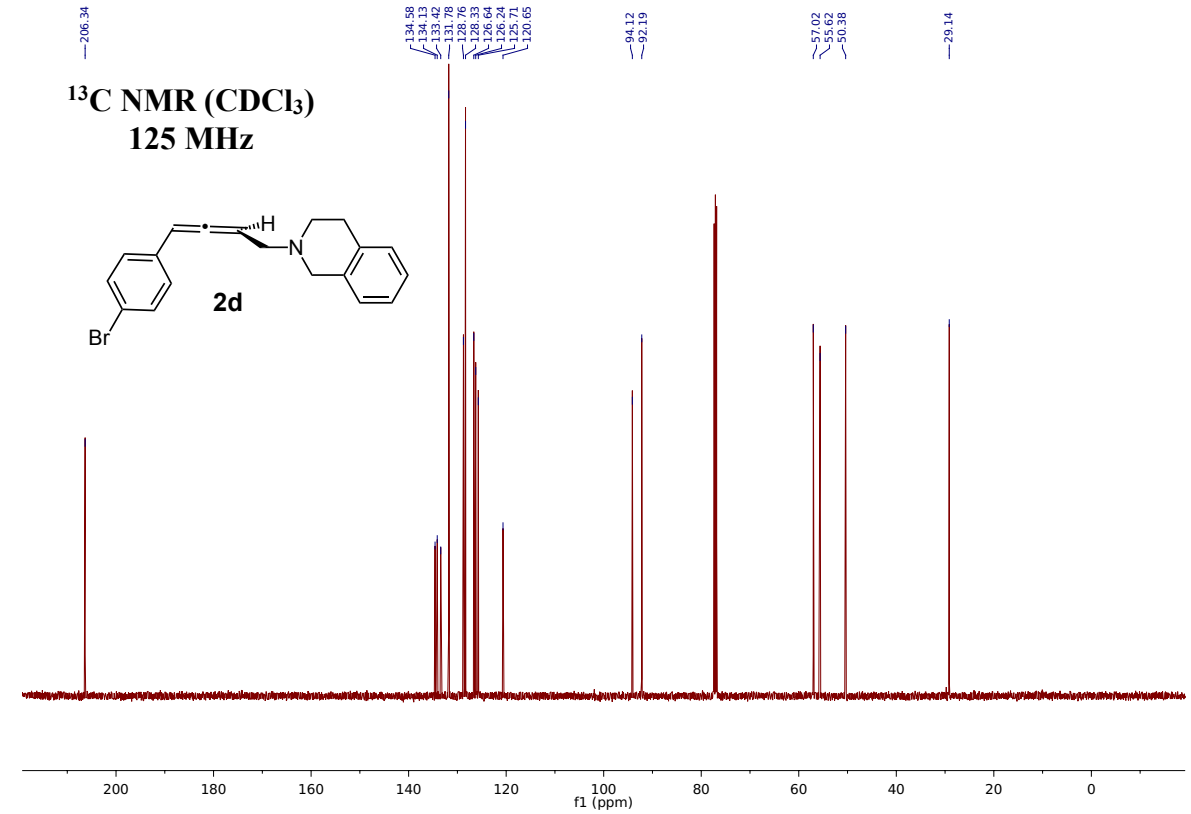
^{1}H NMR ($CDCl_3$)
400 MHz

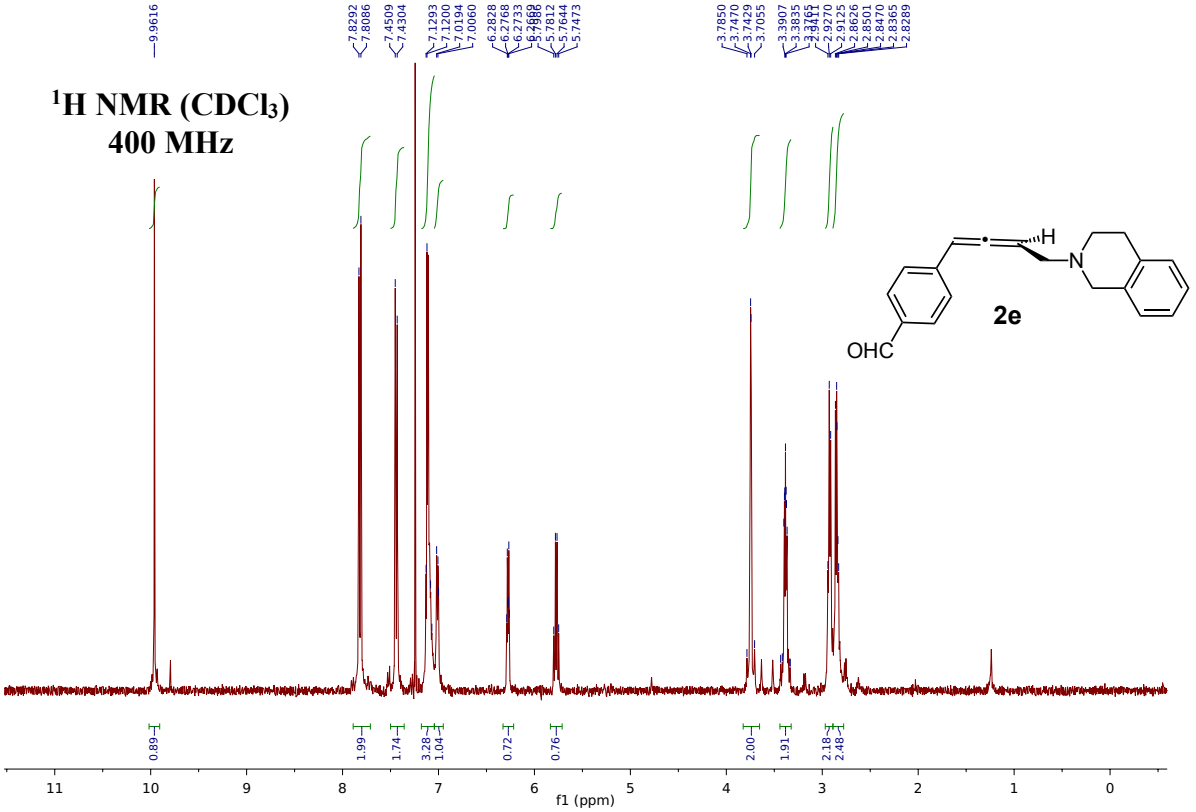


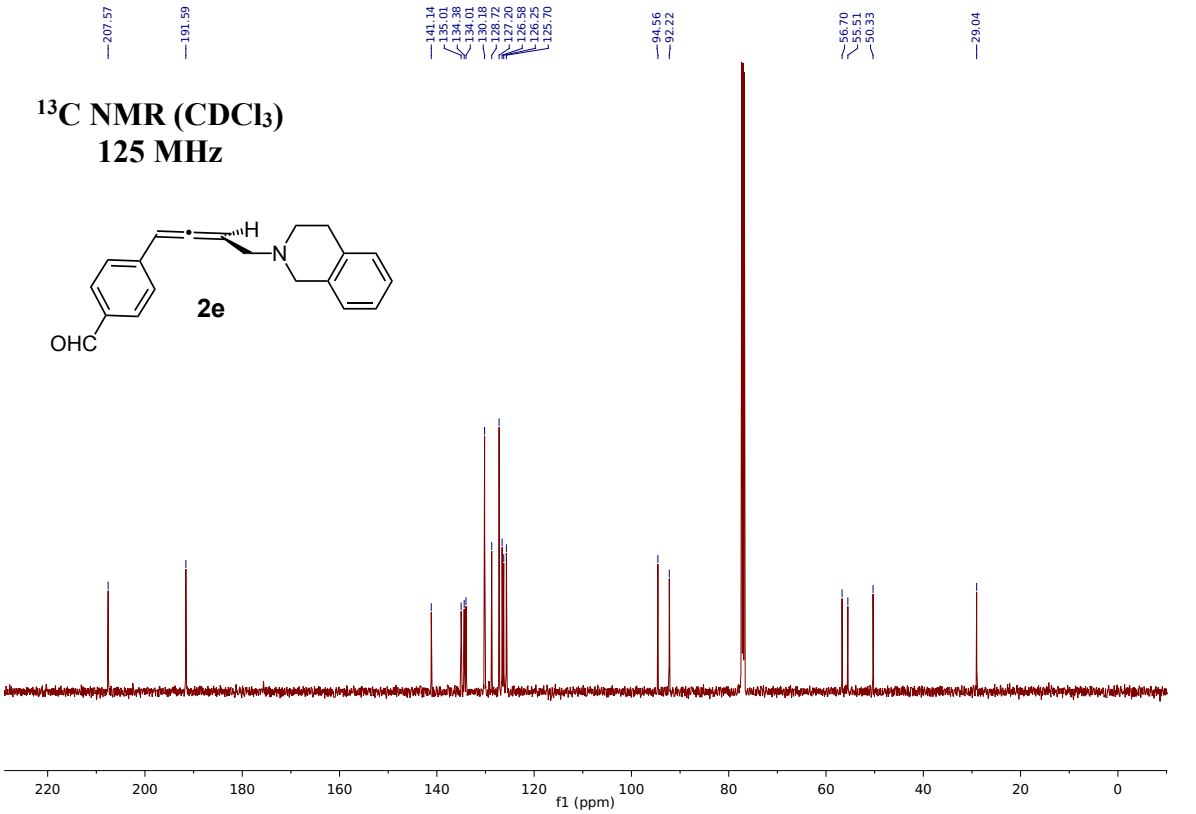
^{13}C NMR ($CDCl_3$)
125 MHz



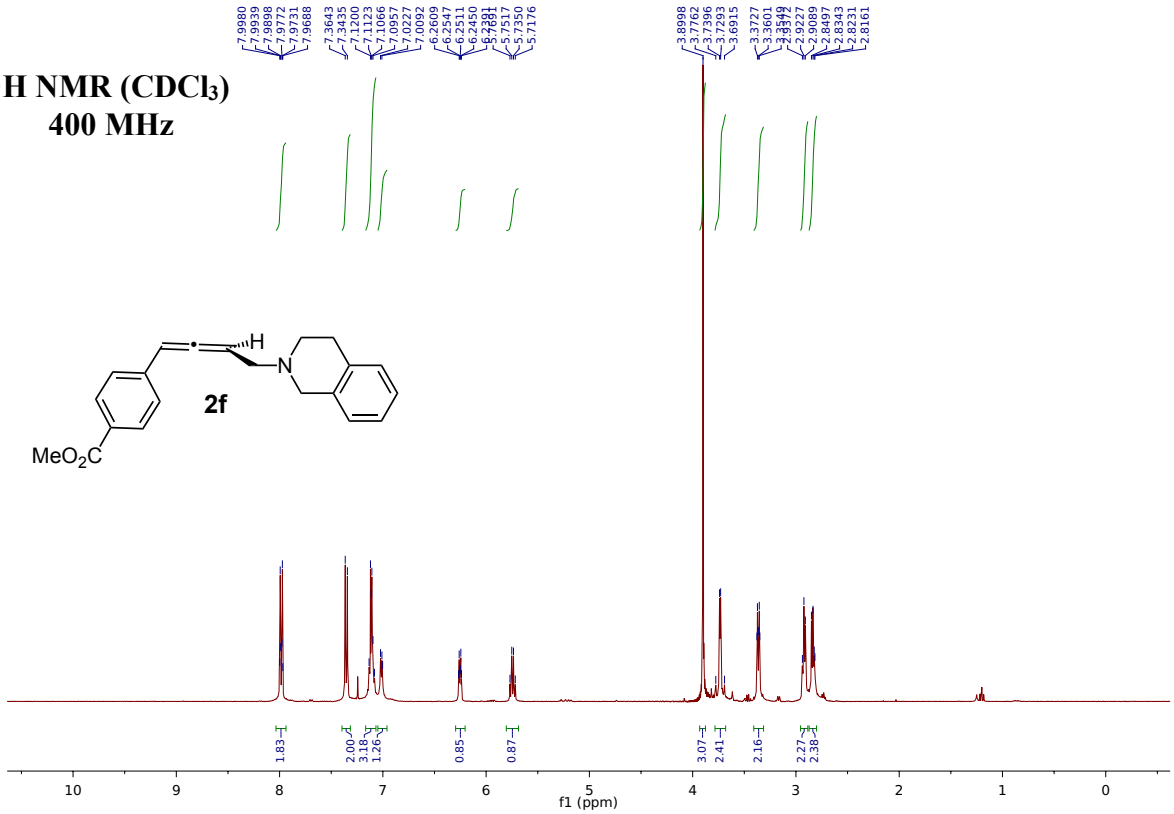

^{1}H NMR (CDCl$_3$)
400 MHz
2d
Br
H
N
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
2d
Br
H
N
f1 (ppm)

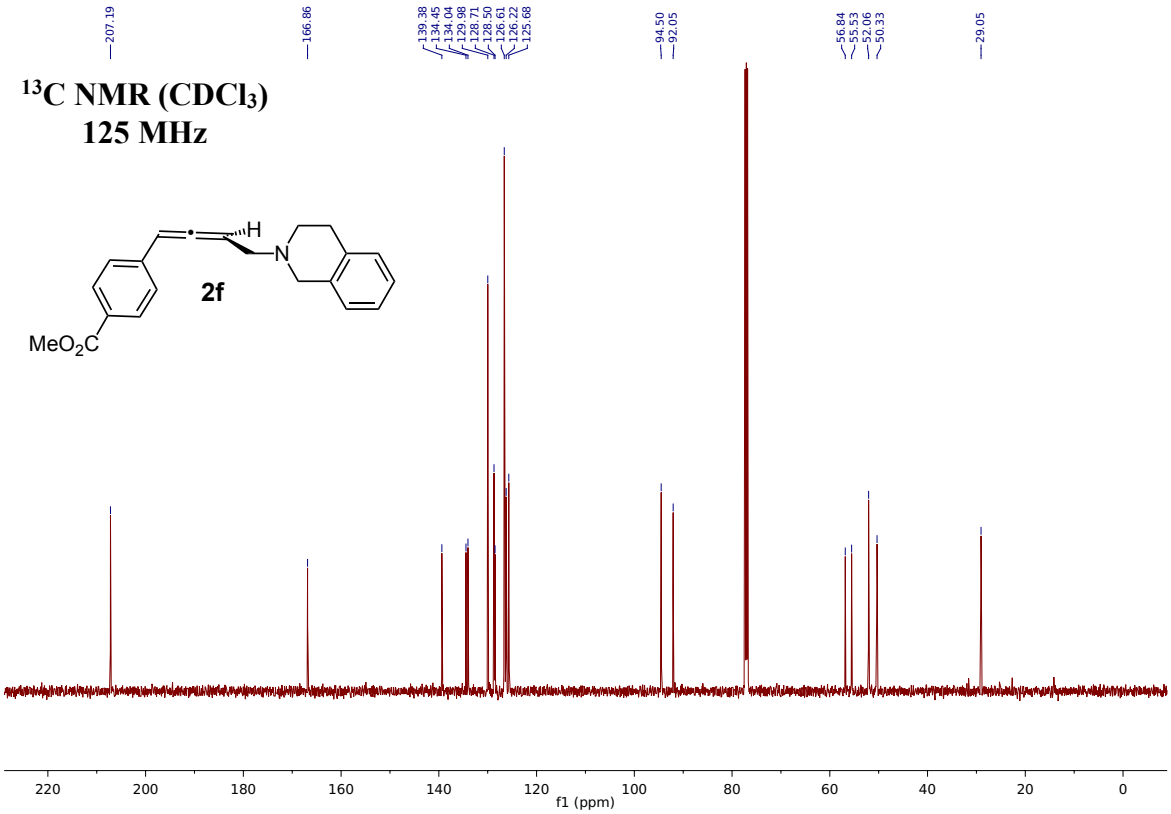

^{1}H NMR (CDCl$_3$)
400 MHz
2e
OHC
f1 (ppm)

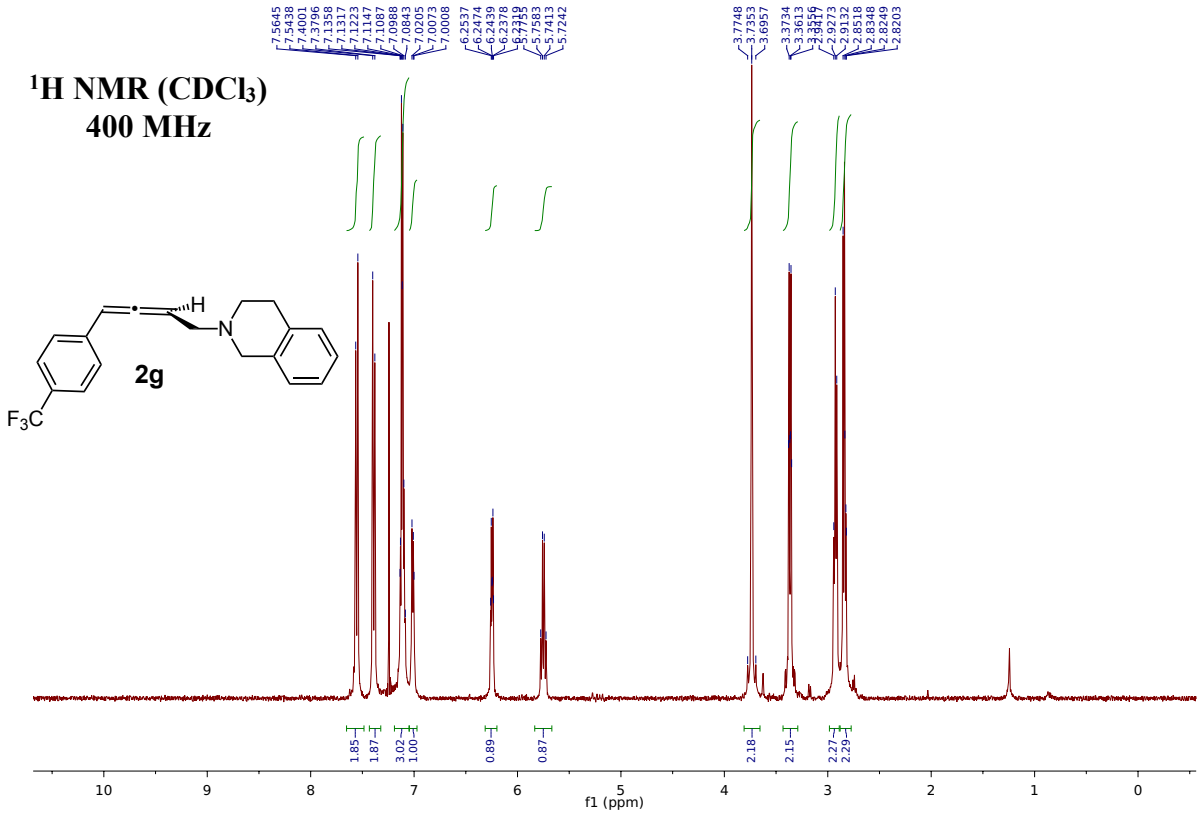

^{13}C NMR (CDCl$_3$)
125 MHz
2e
OHC
f1 (ppm)

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

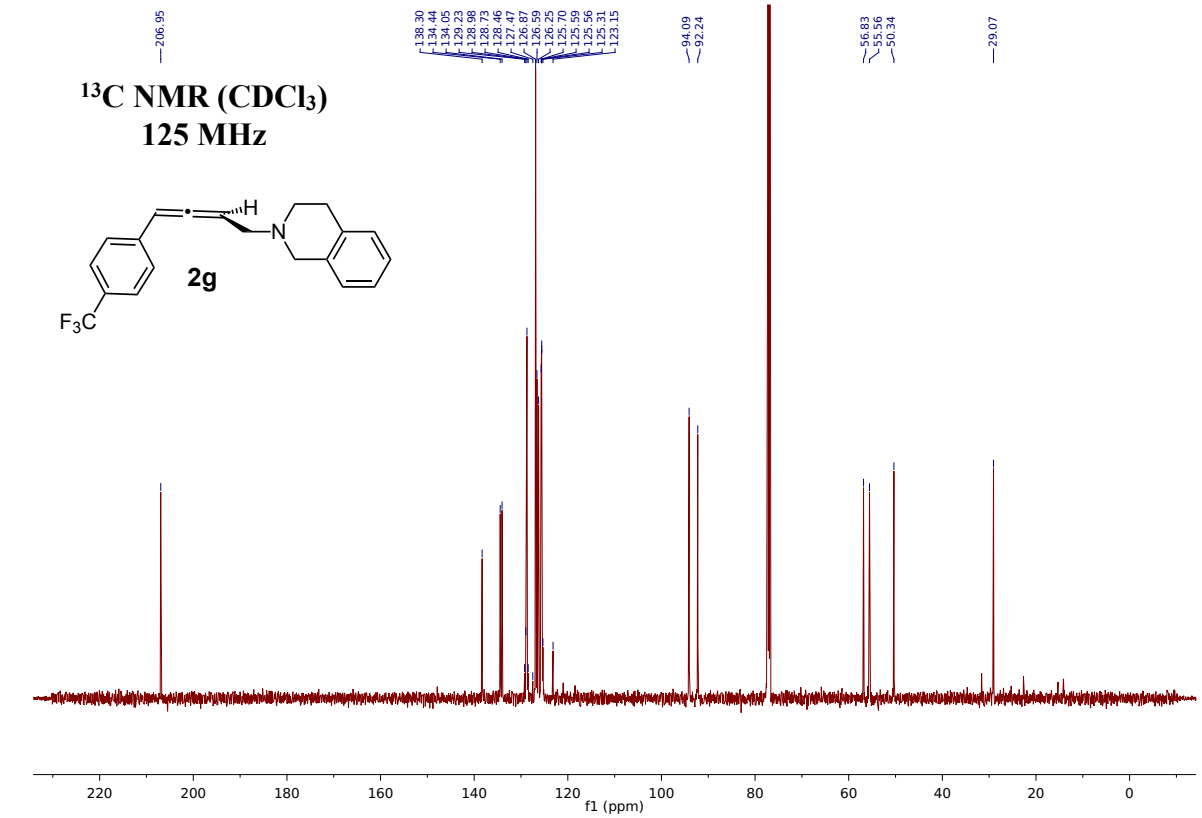


^{13}C NMR ($CDCl_3$)
125 MHz



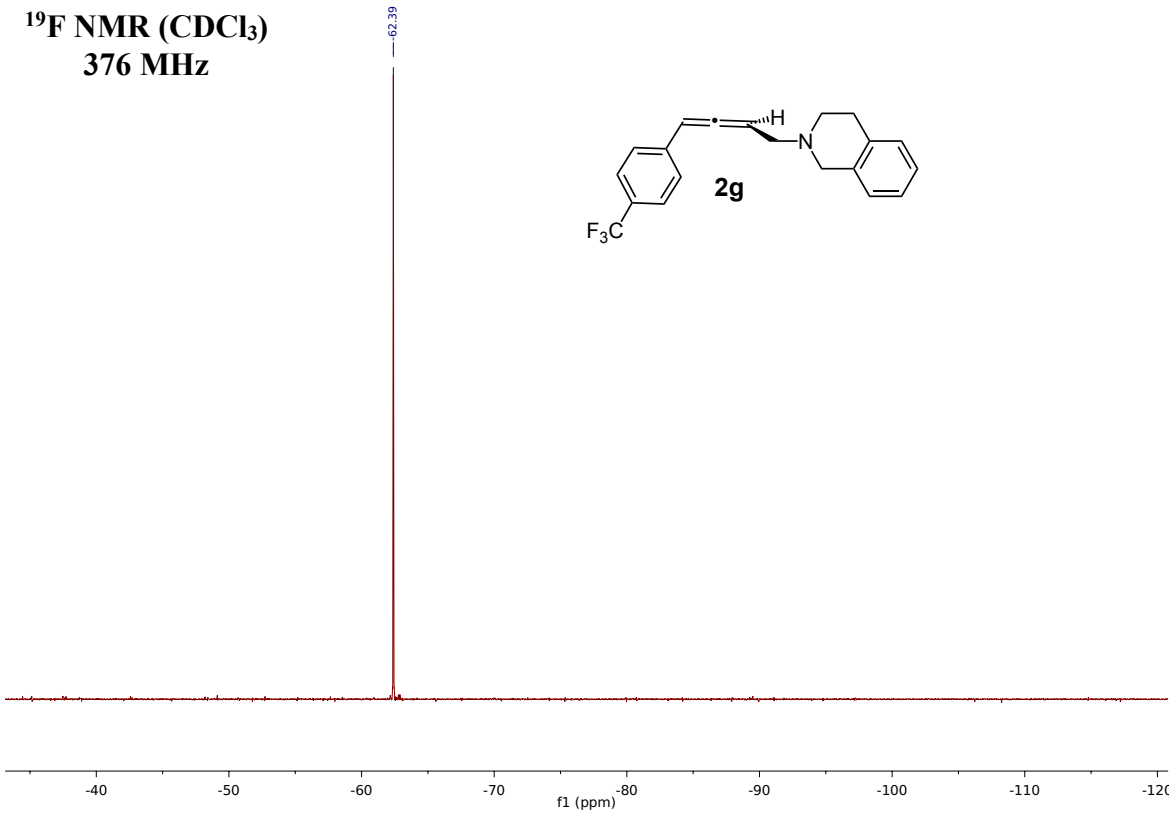


^{1}H NMR ($CDCl_3$)
400 MHz



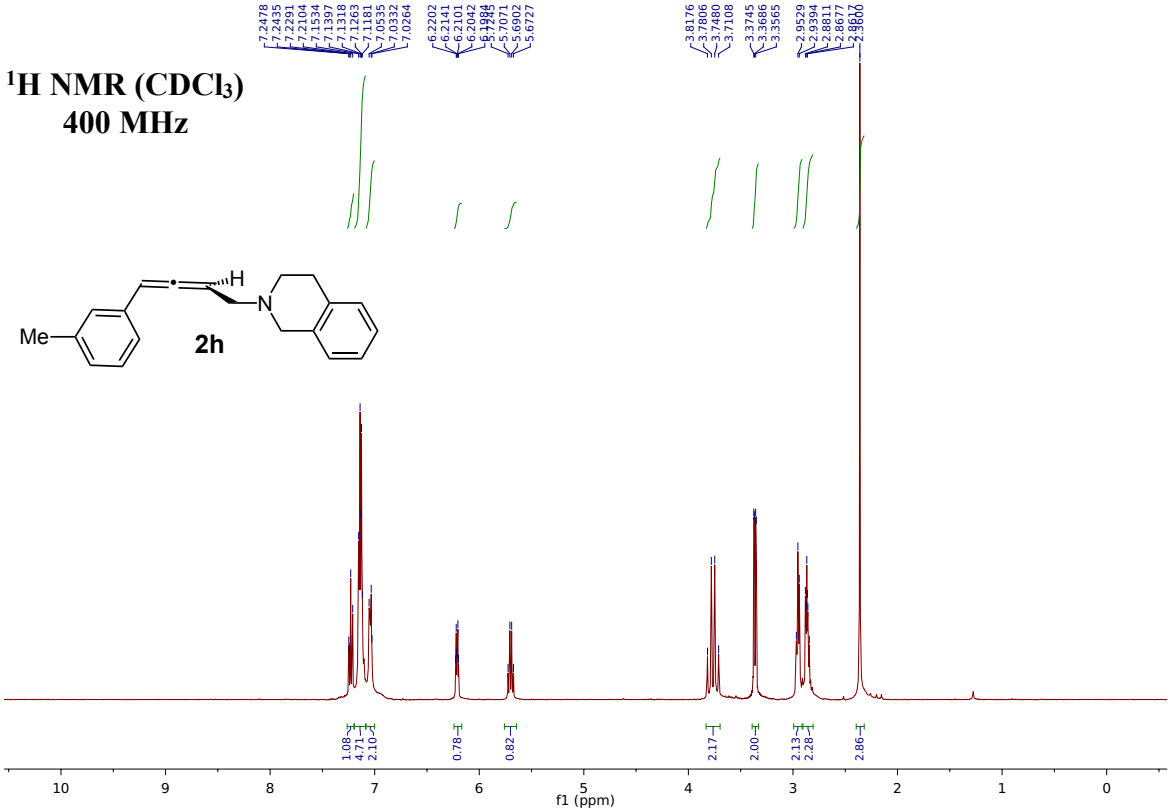
^{13}C NMR ($CDCl_3$)
125 MHz

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



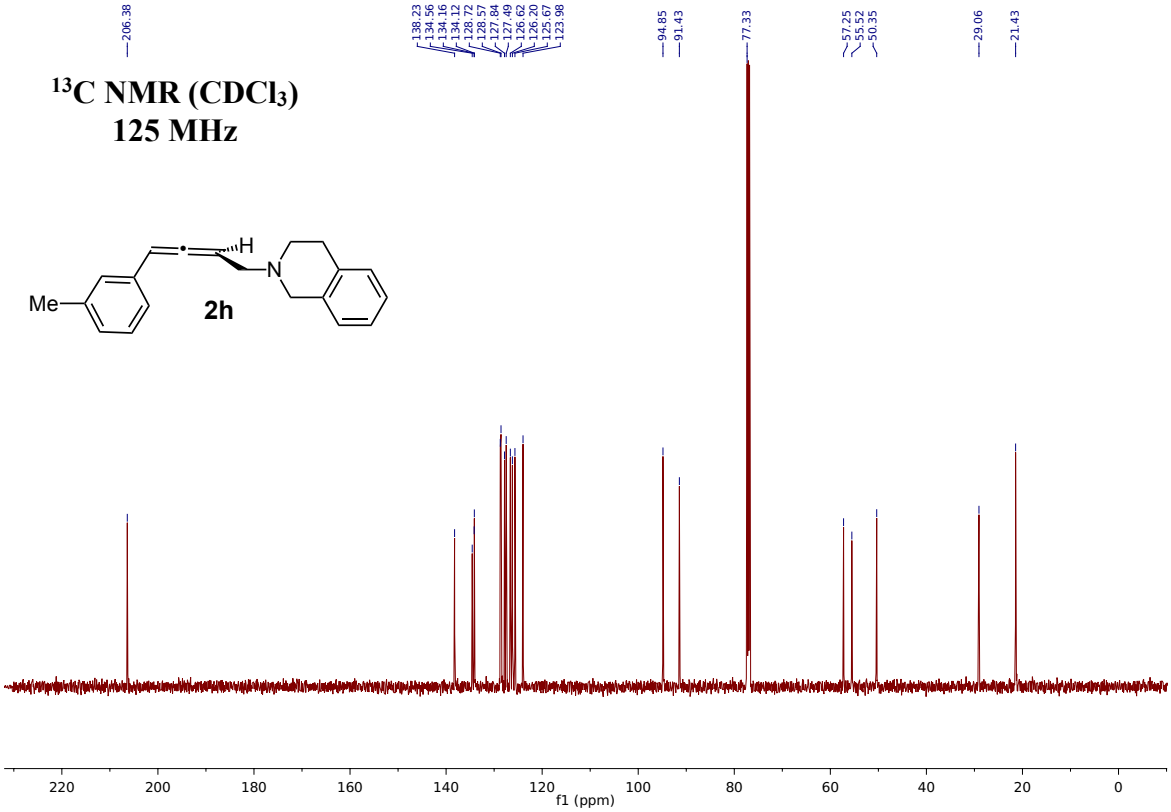
2g

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

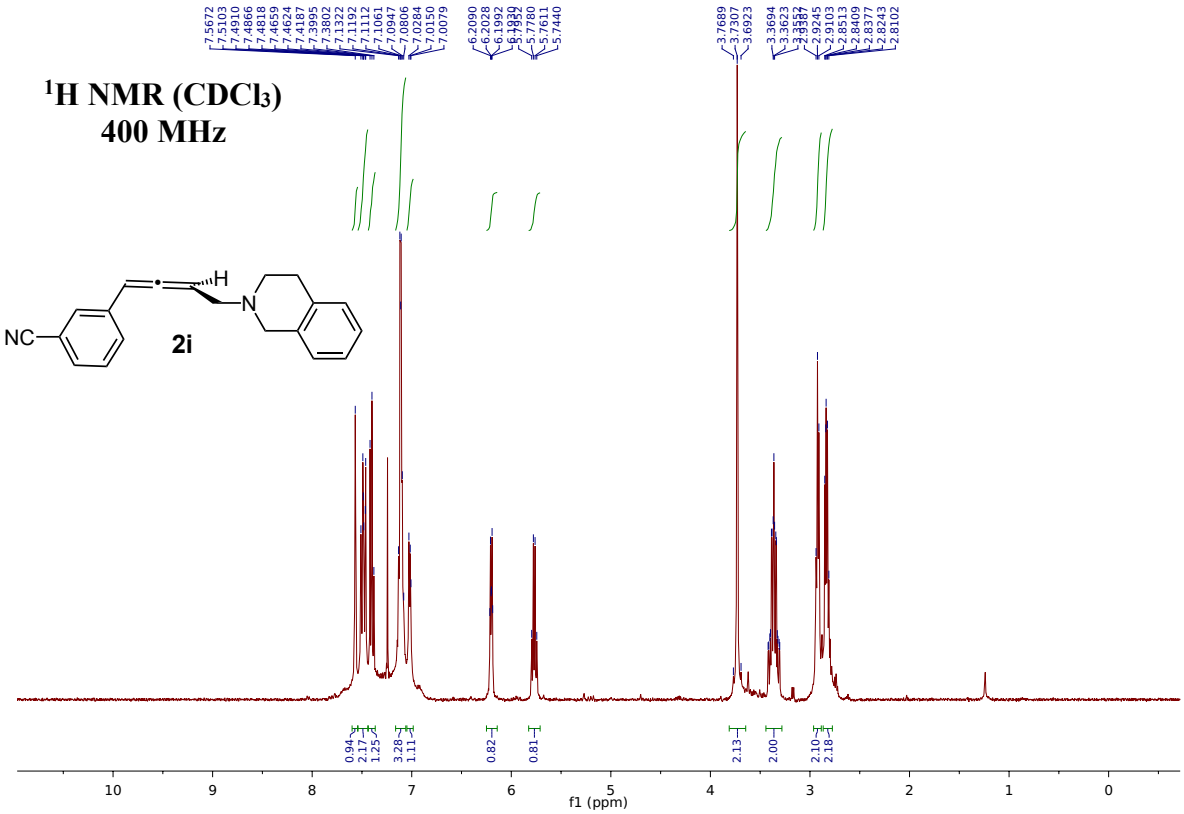


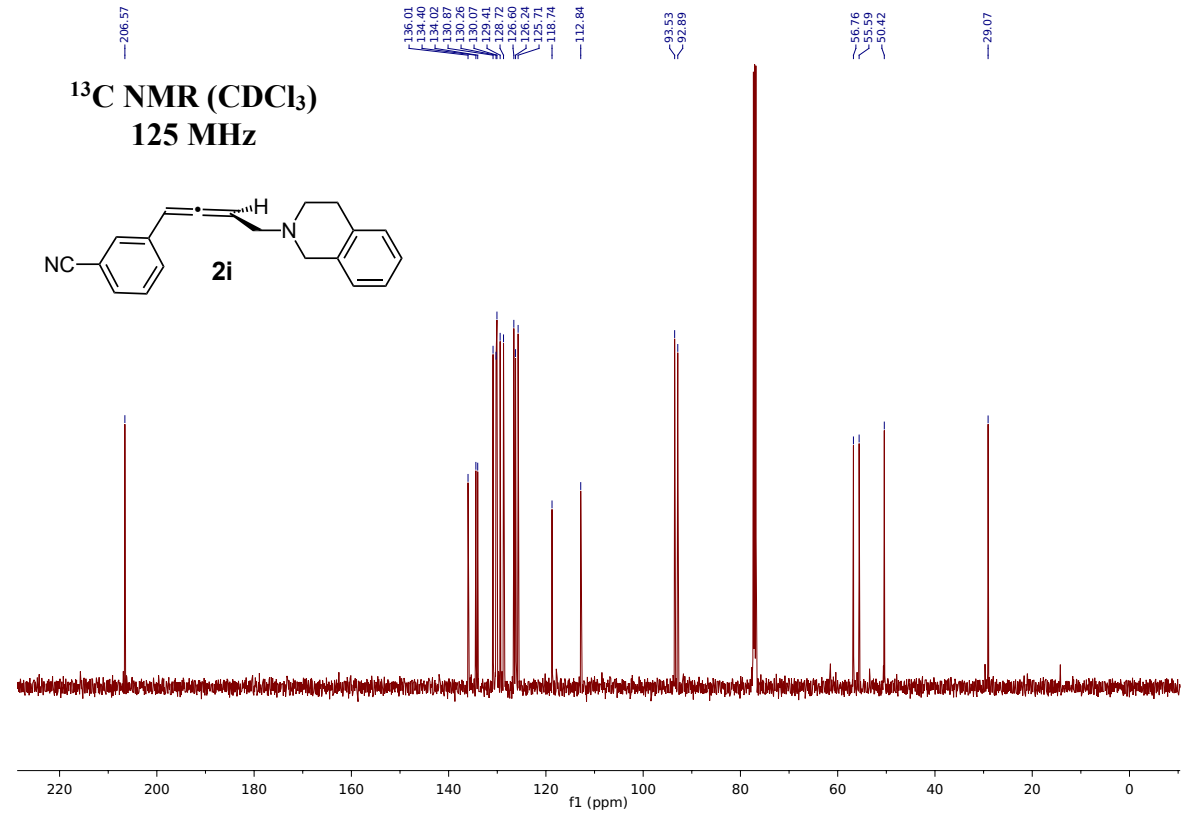
2h

^{13}C NMR ($CDCl_3$)
125 MHz



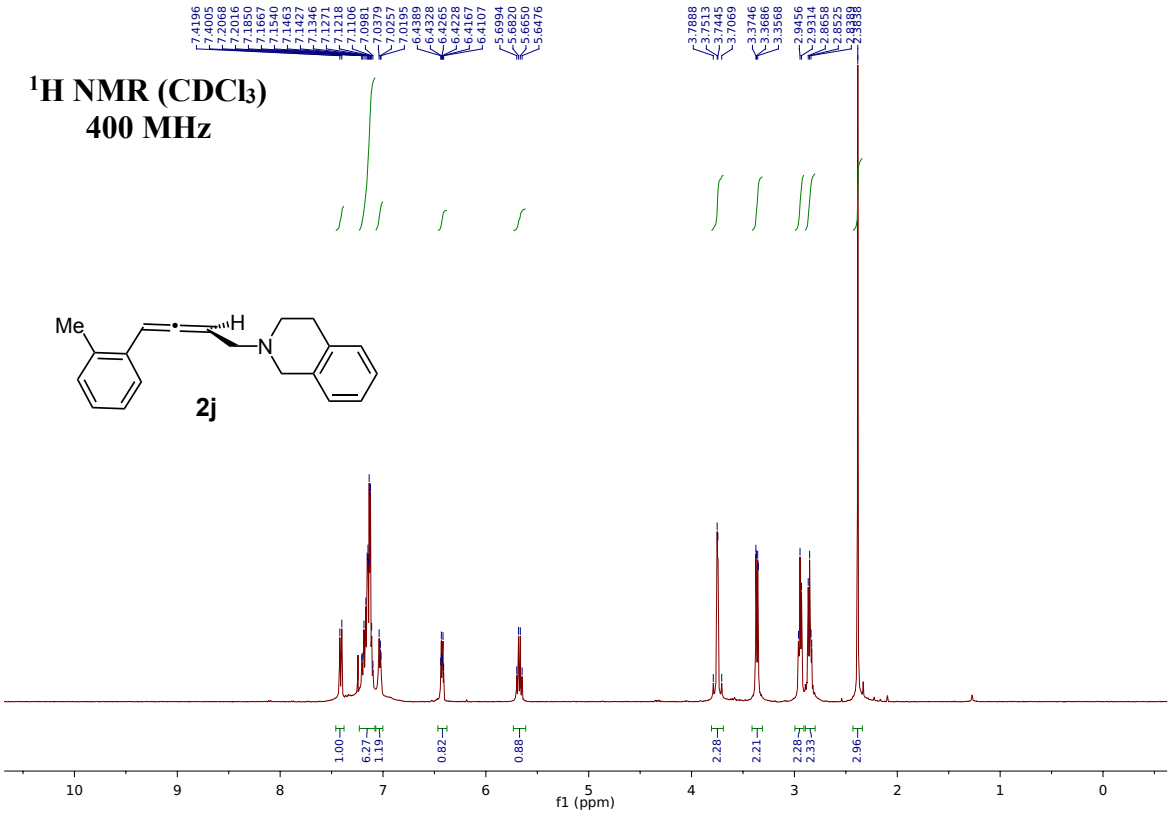
2h


^{1}H NMR (CDCl$_3$)
400 MHz
NC
H
N
2i
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
NC
H
N
2i
f1 (ppm)

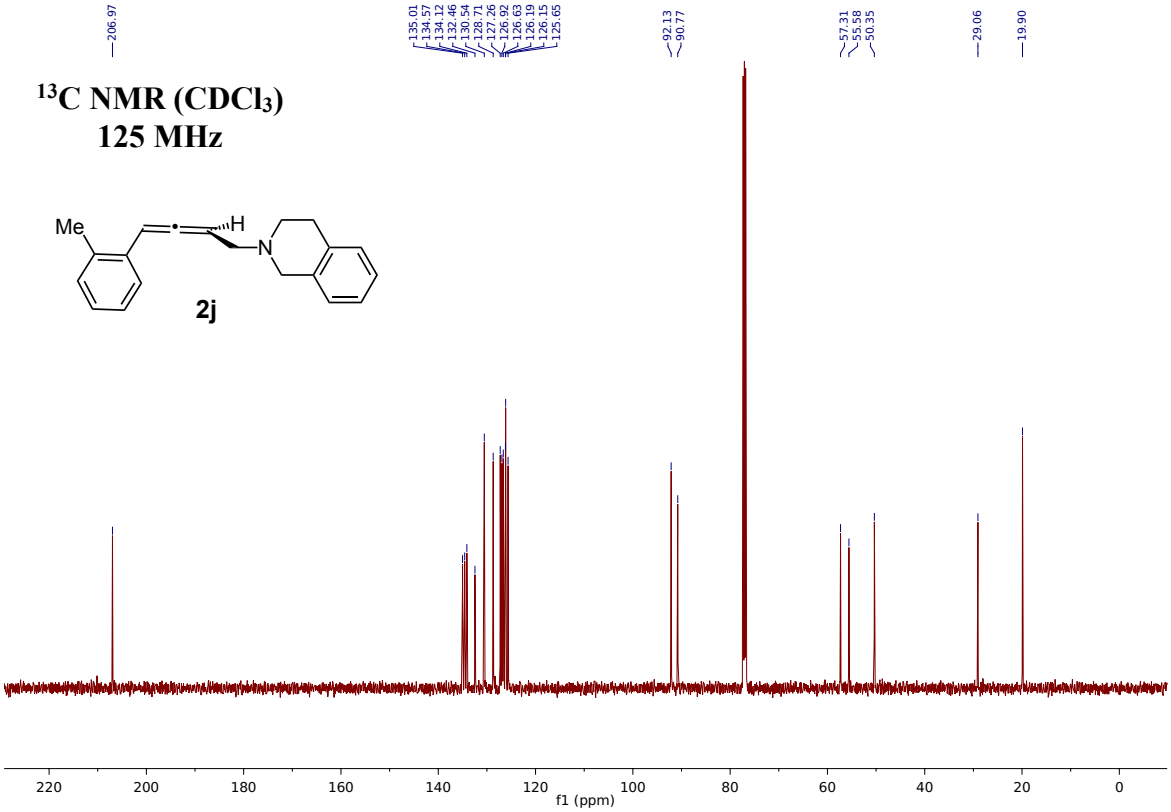
^{1}H NMR ($CDCl_3$)
400 MHz

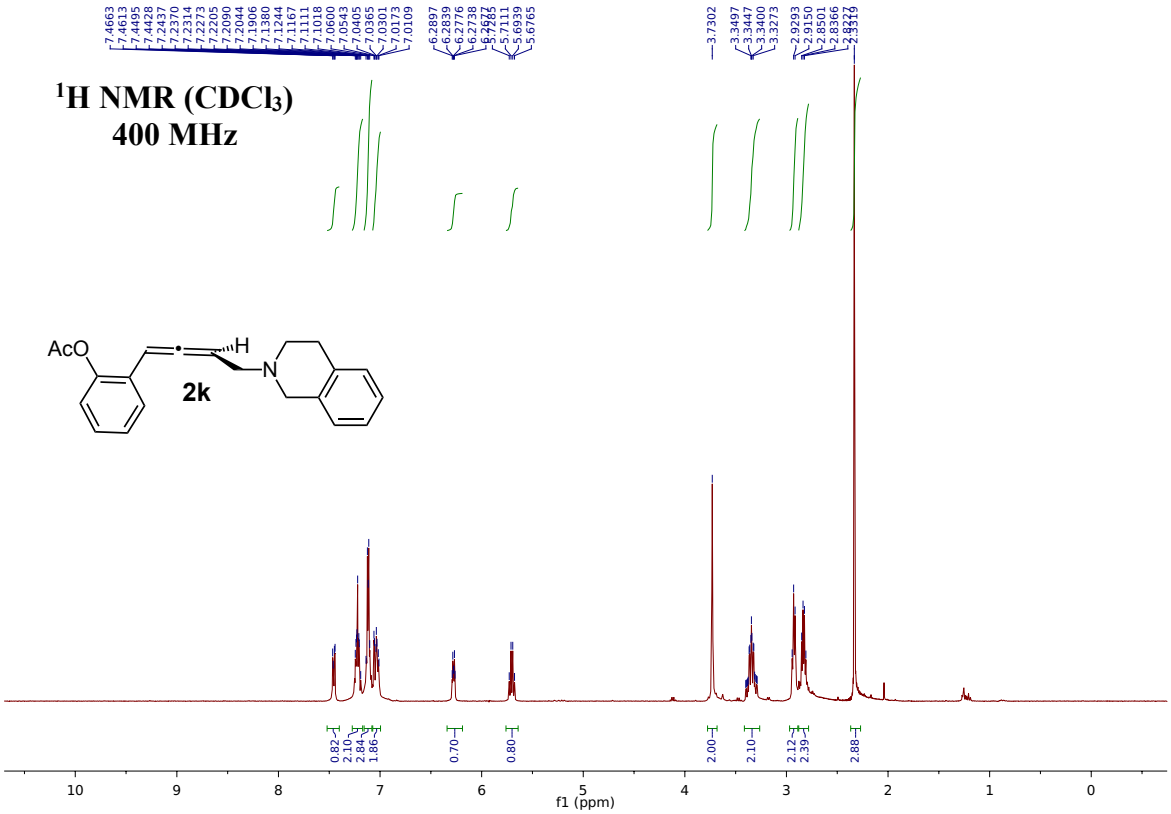
2j



^{13}C NMR ($CDCl_3$)
125 MHz

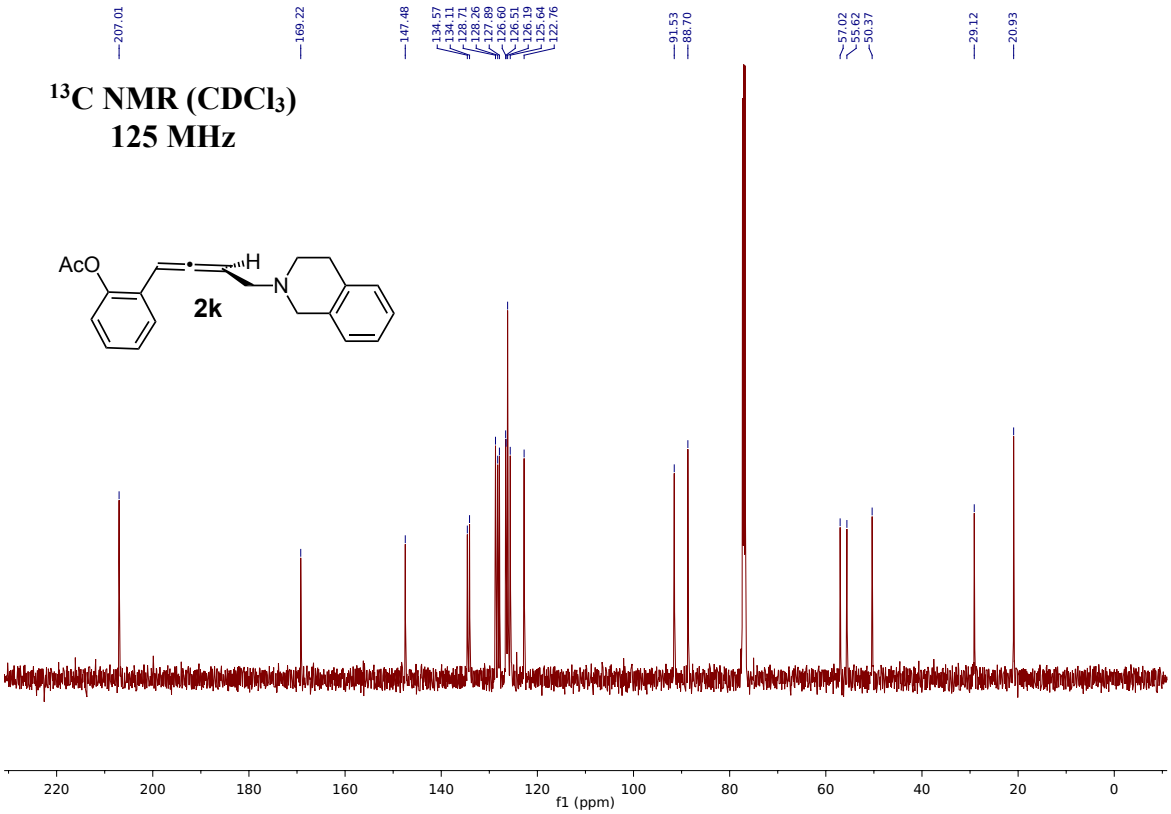
2j





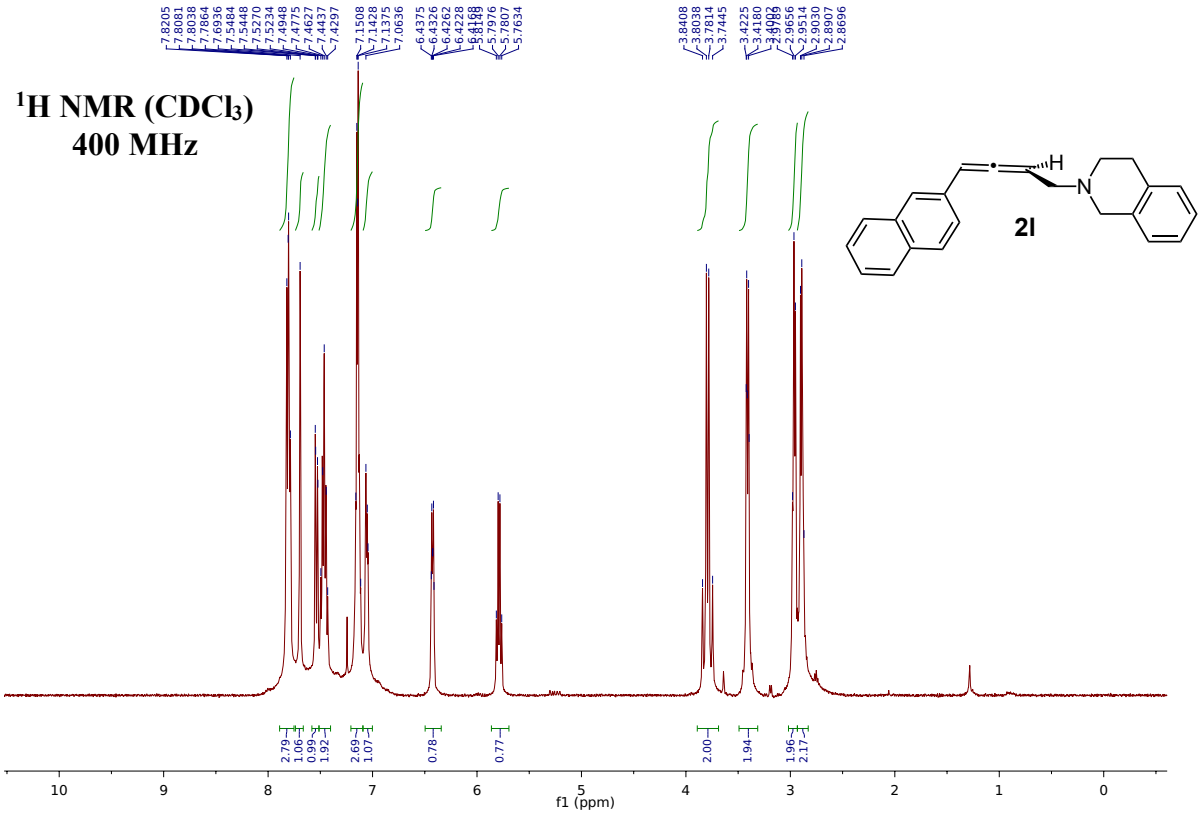
^{1}H NMR ($CDCl_3$)
400 MHz

2k



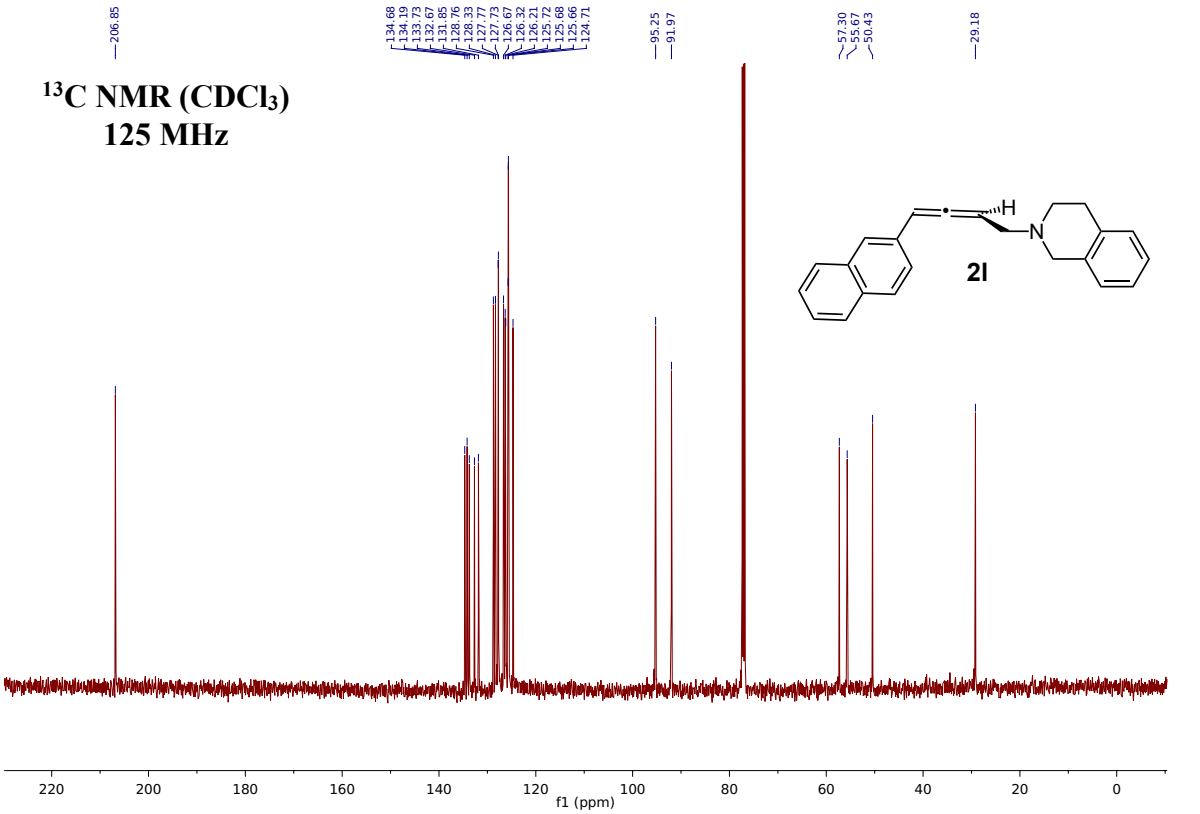
^{13}C NMR ($CDCl_3$)
125 MHz

2k



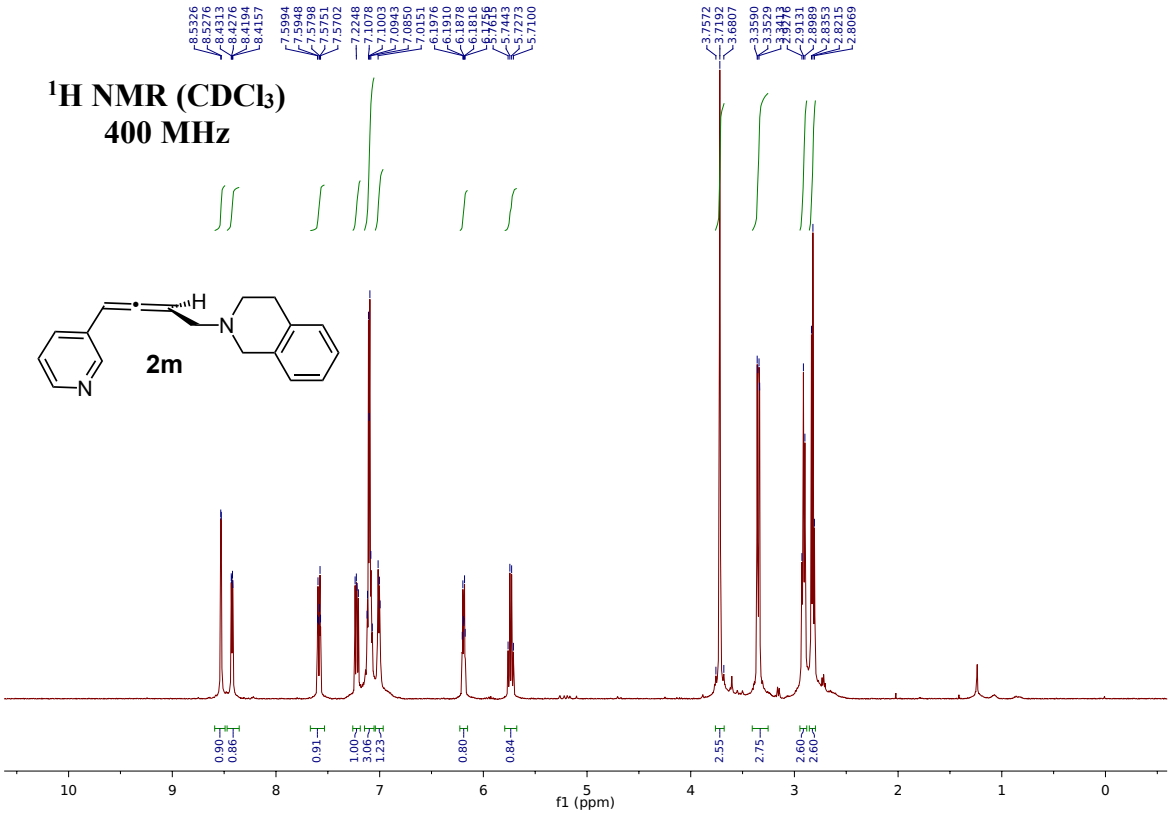
^{1}H NMR ($CDCl_3$)
400 MHz

2l



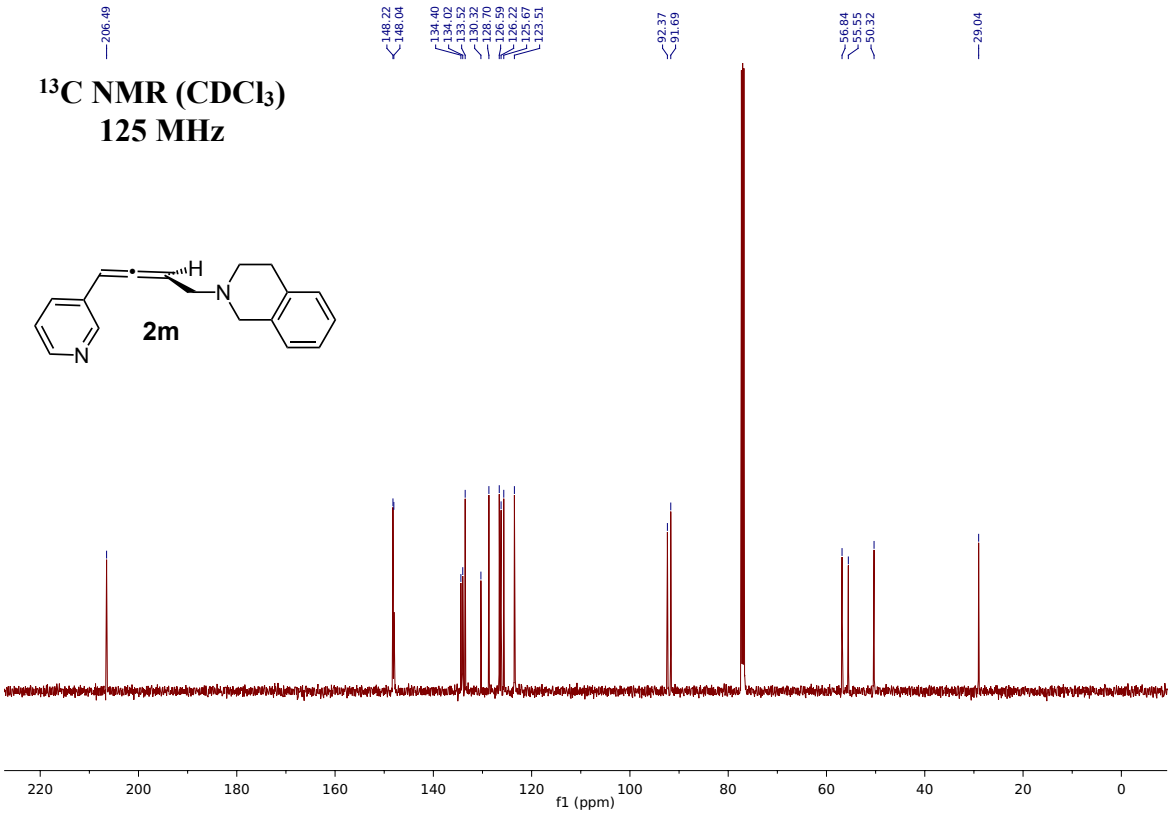
^{13}C NMR ($CDCl_3$)
125 MHz

2l



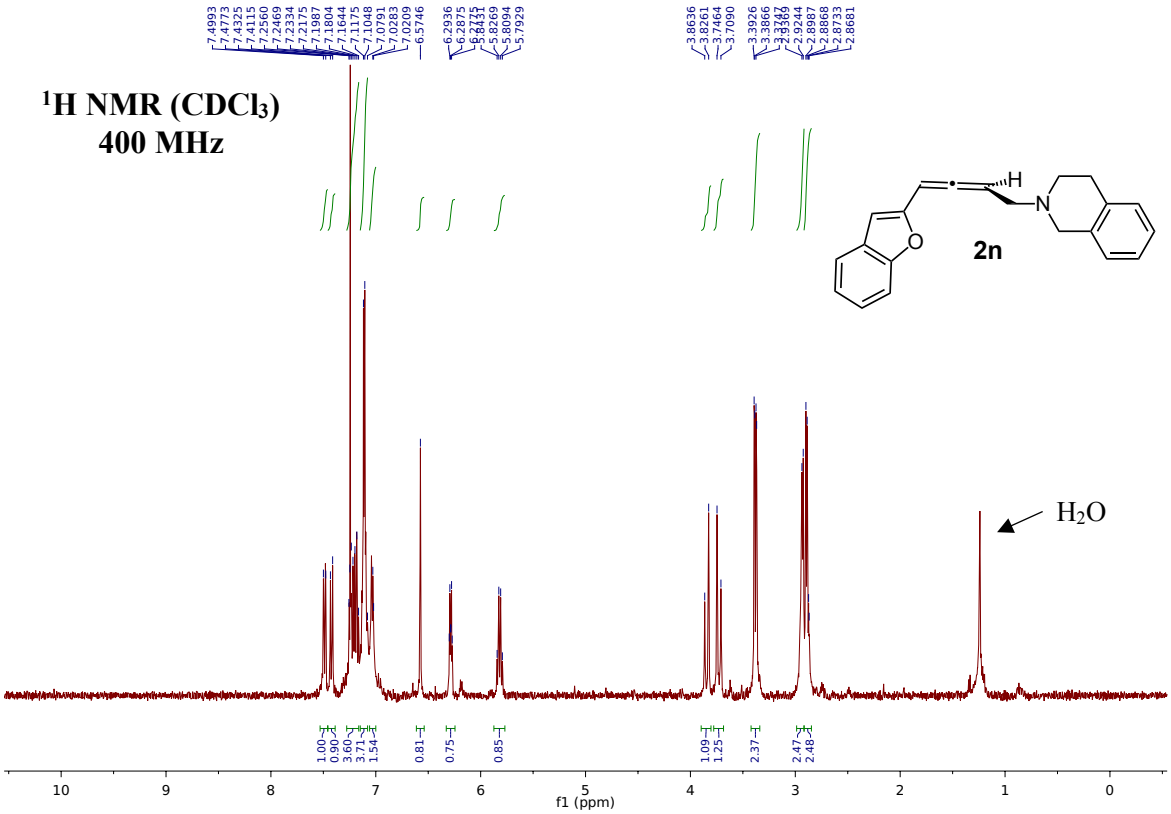
^{1}H NMR ($CDCl_3$)
400 MHz

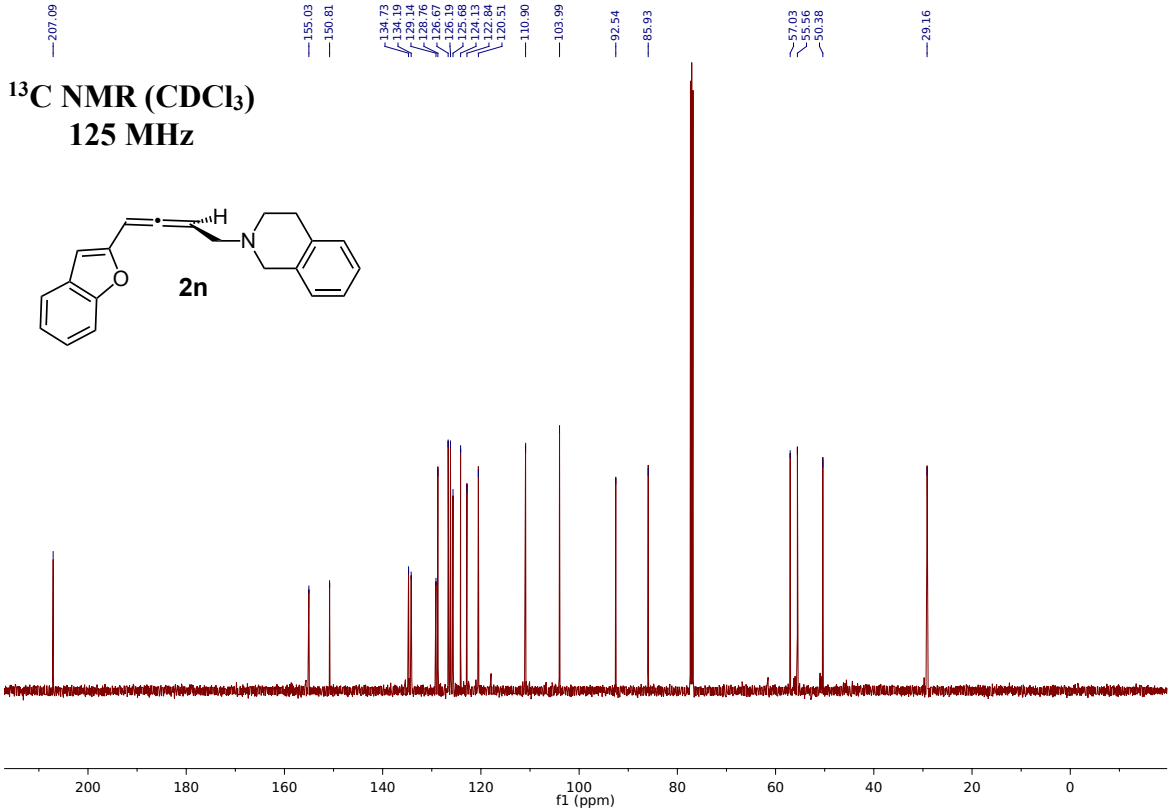
2m



^{13}C NMR ($CDCl_3$)
125 MHz

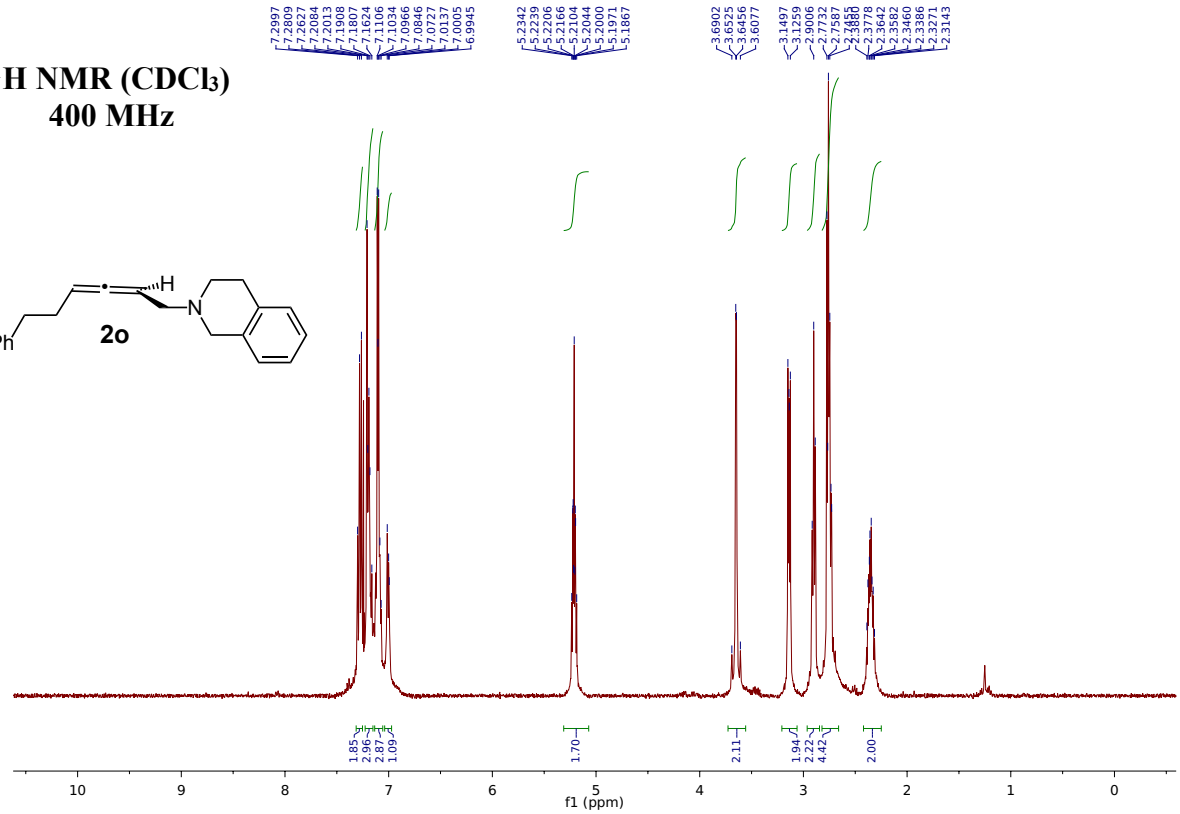
2m


^{1}H NMR (CDCl$_3$)
400 MHz
2n
H$_2$O
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
2n
f1 (ppm)

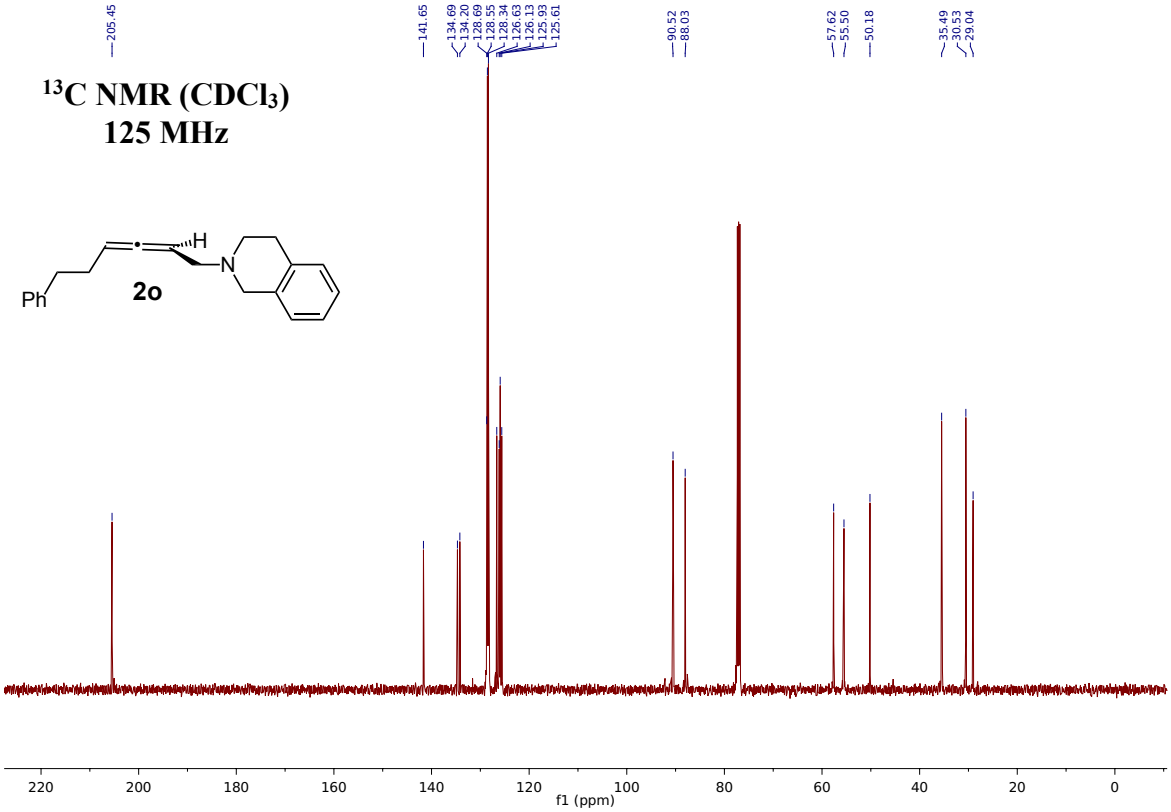
^{1}H NMR ($CDCl_3$)
400 MHz

2o



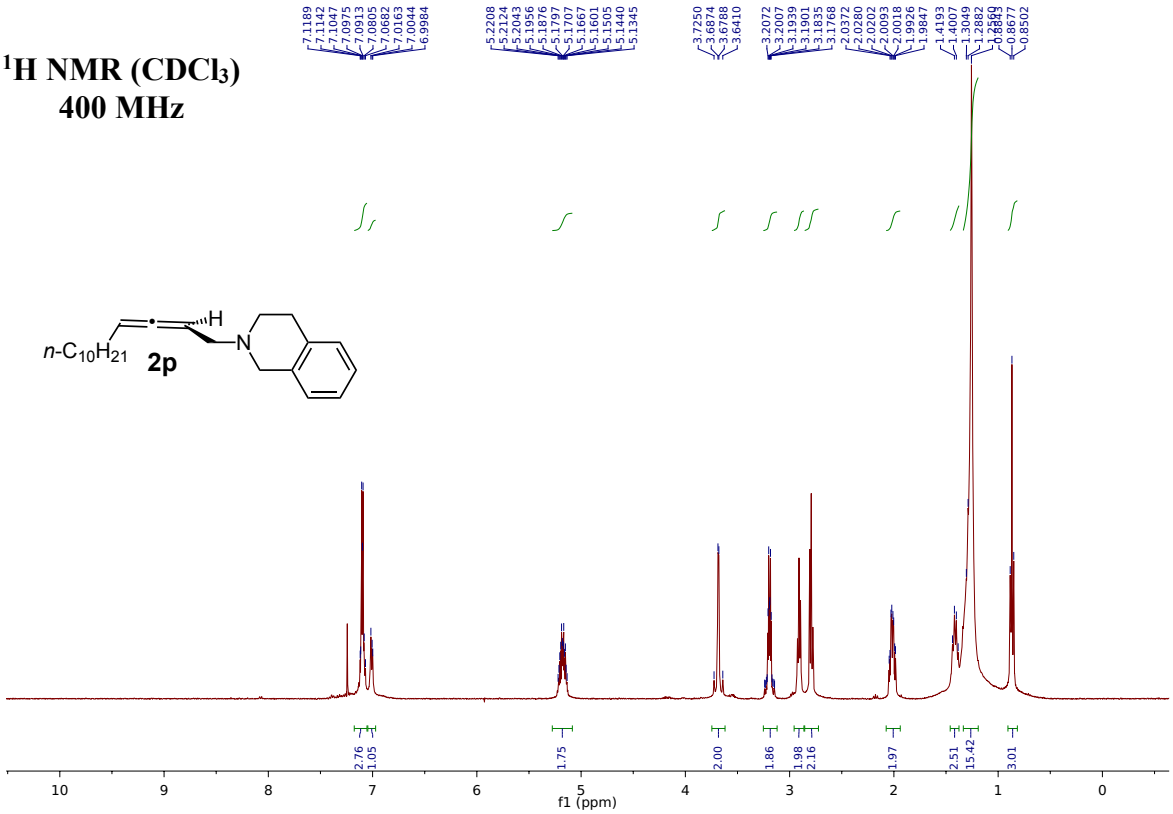
^{13}C NMR ($CDCl_3$)
125 MHz

2o



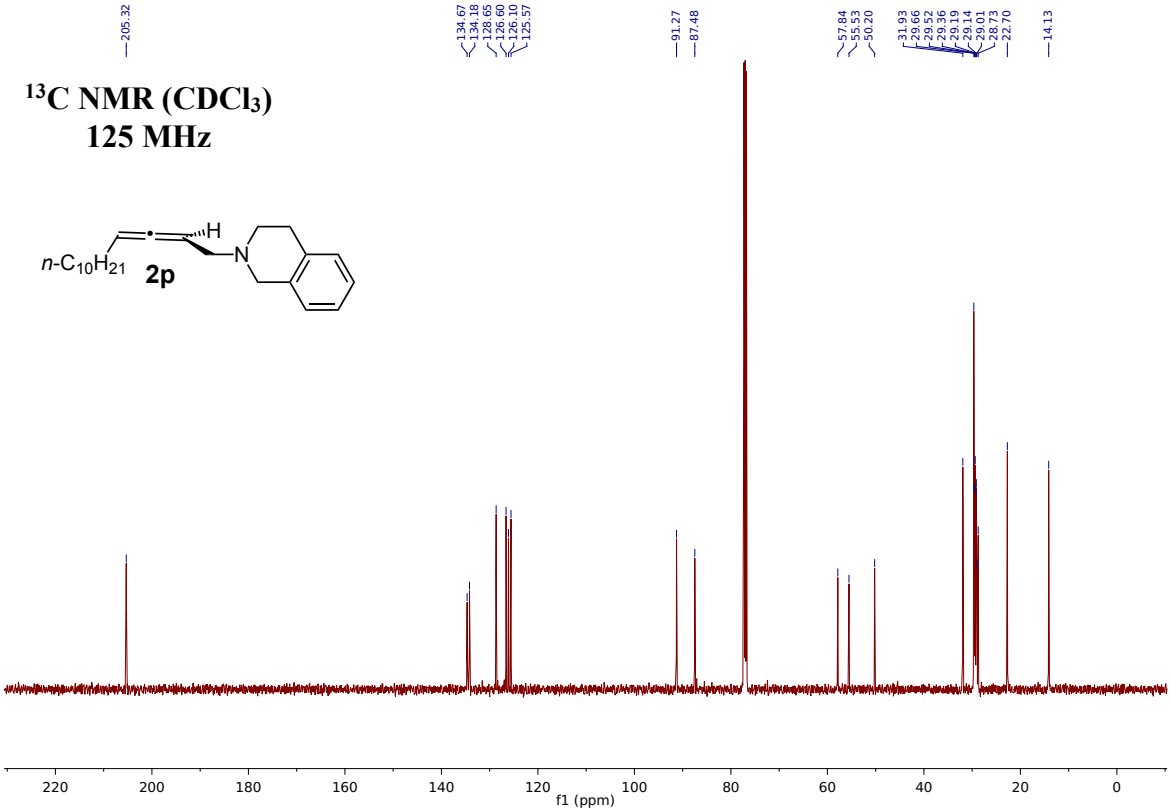
^{1}H NMR ($CDCl_3$)
400 MHz

2p

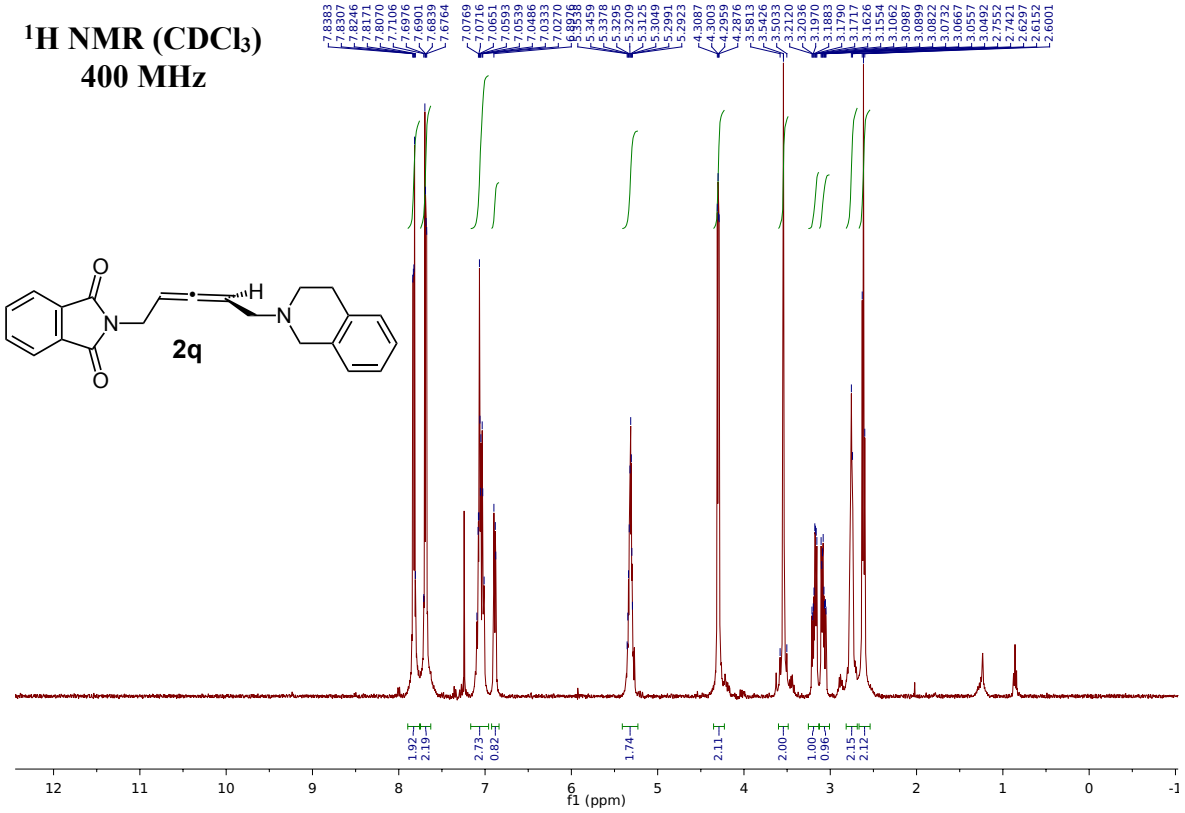


^{13}C NMR ($CDCl_3$)
125 MHz

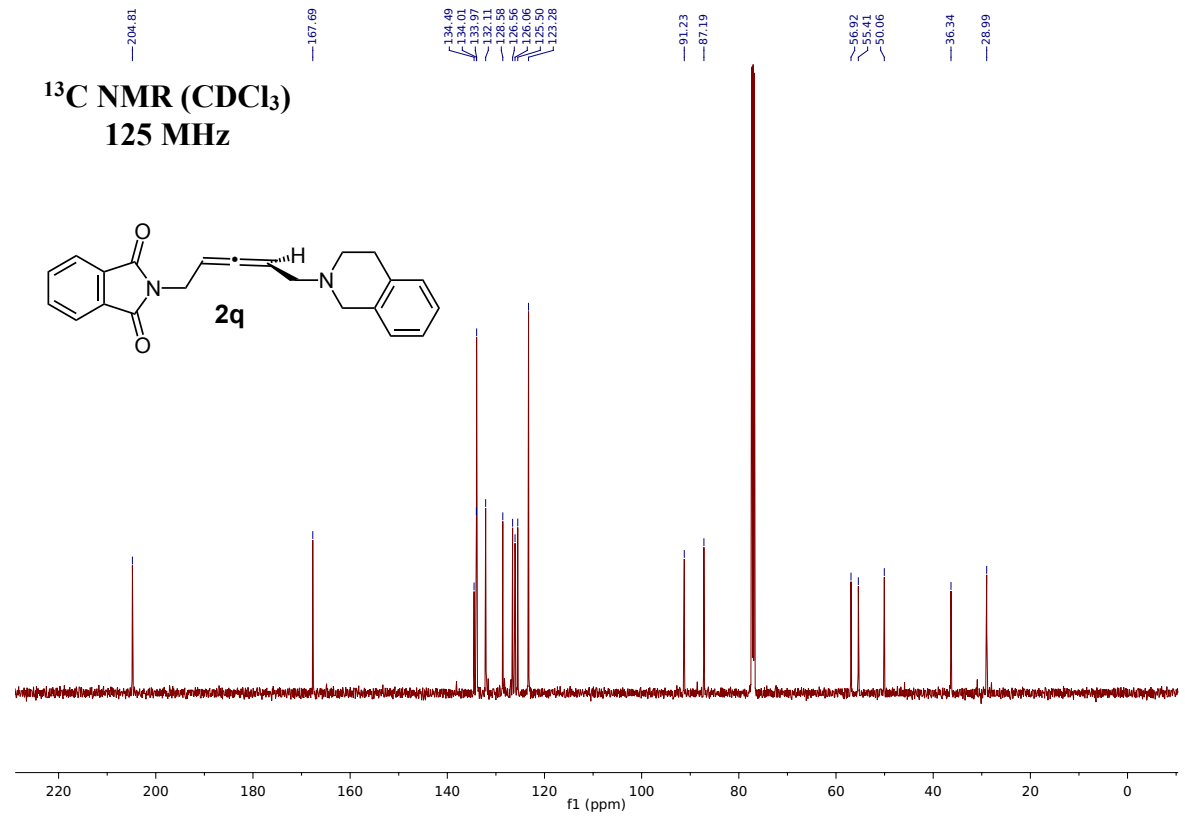
2p



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

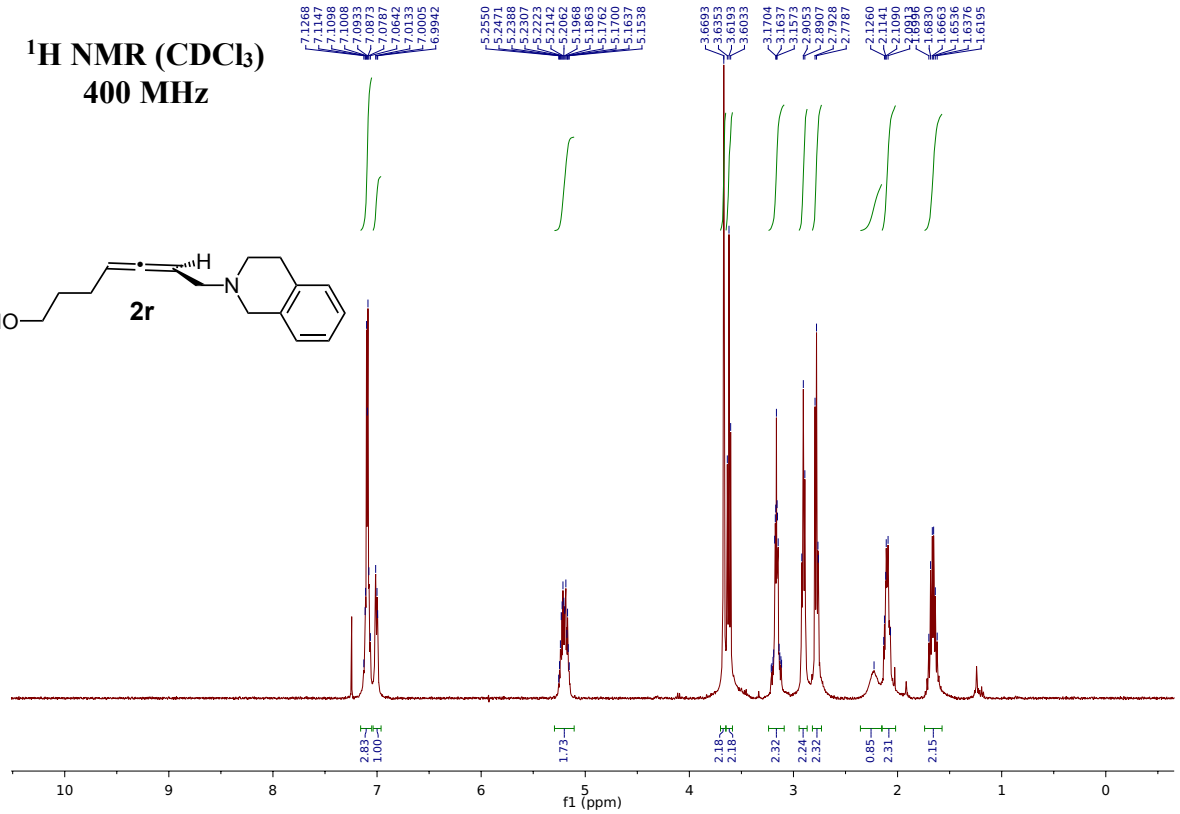


^{13}C NMR ($CDCl_3$)
125 MHz



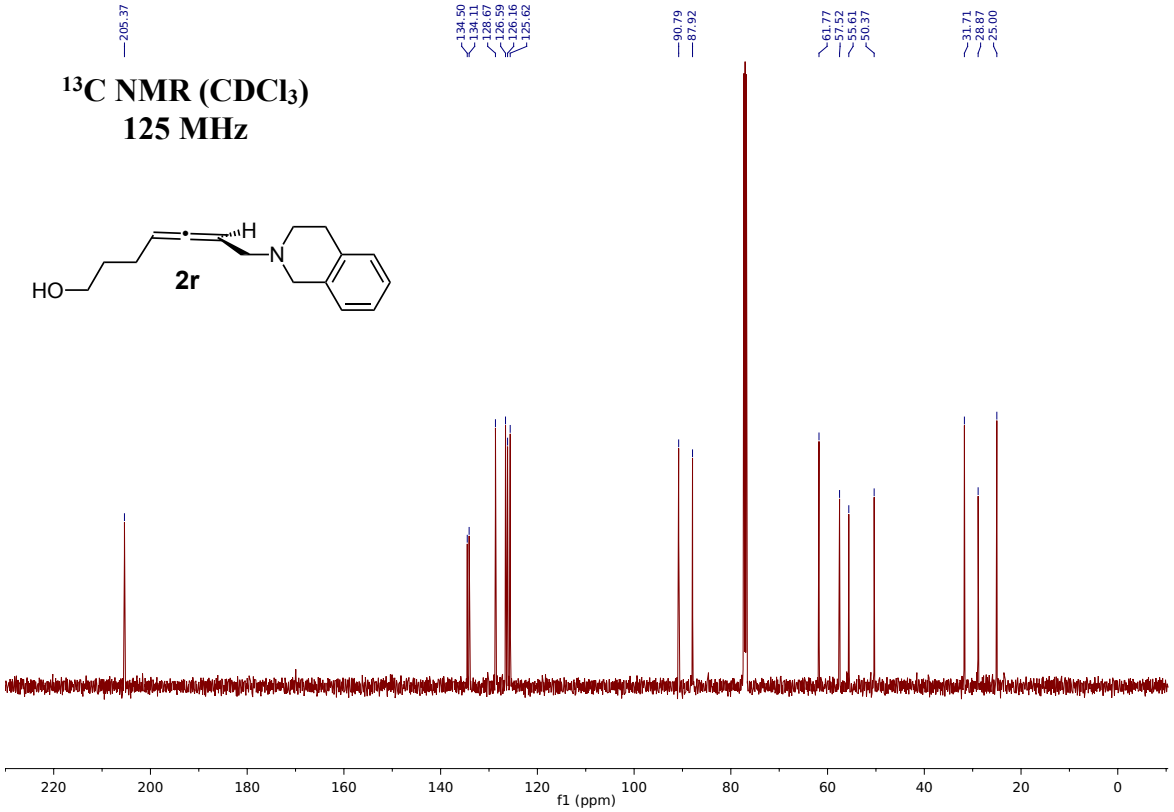
^{1}H NMR ($CDCl_3$)
400 MHz

2r

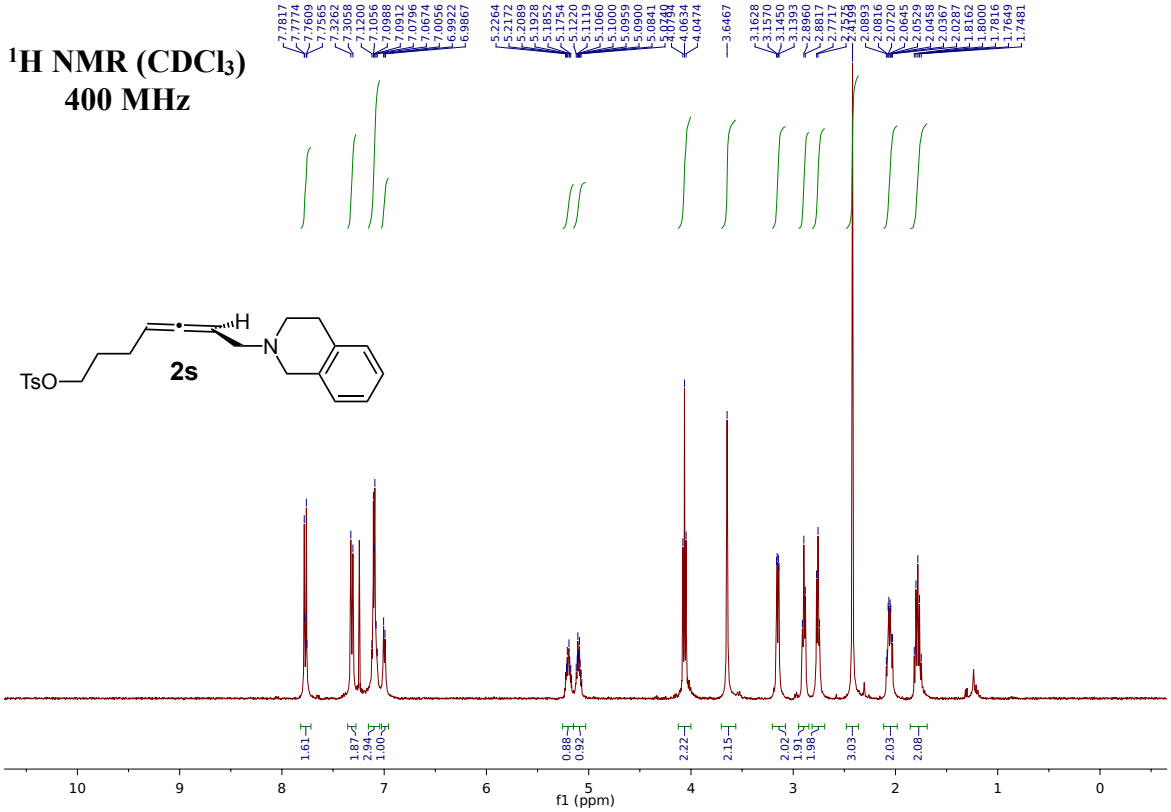


^{13}C NMR ($CDCl_3$)
125 MHz

2r

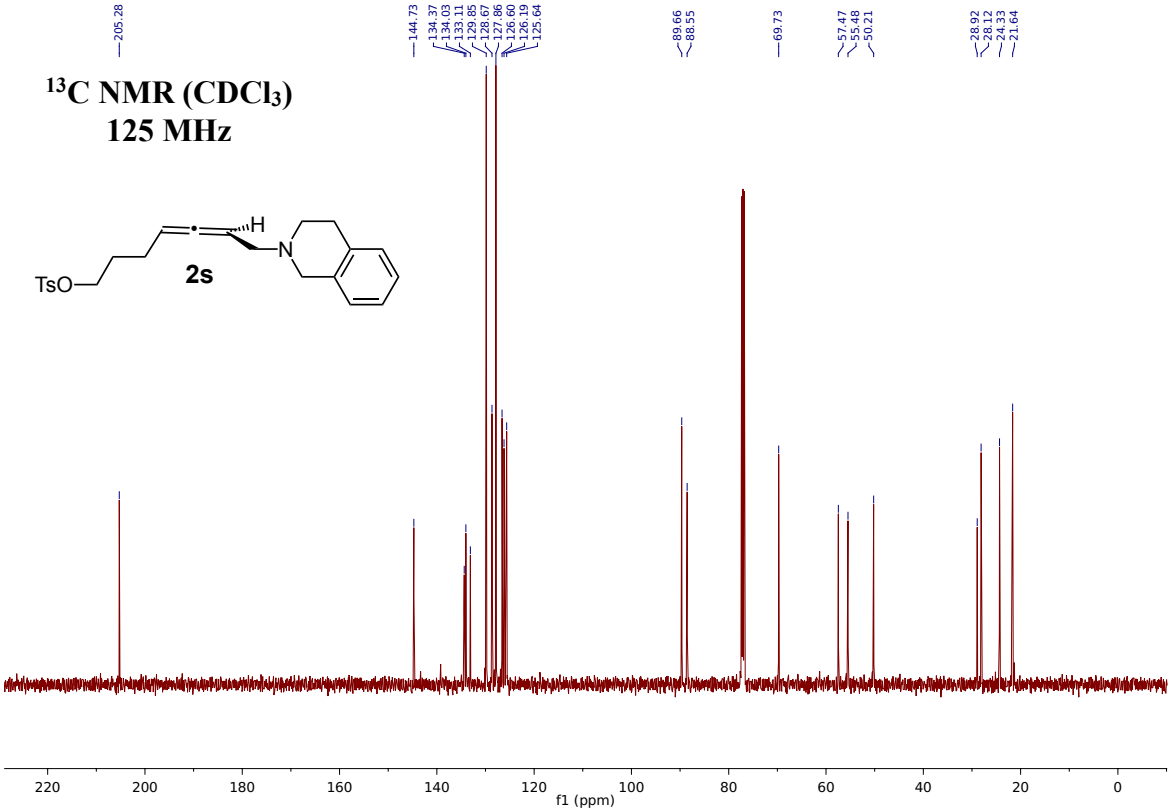


^{1}H NMR ($CDCl_3$)
400 MHz



2s

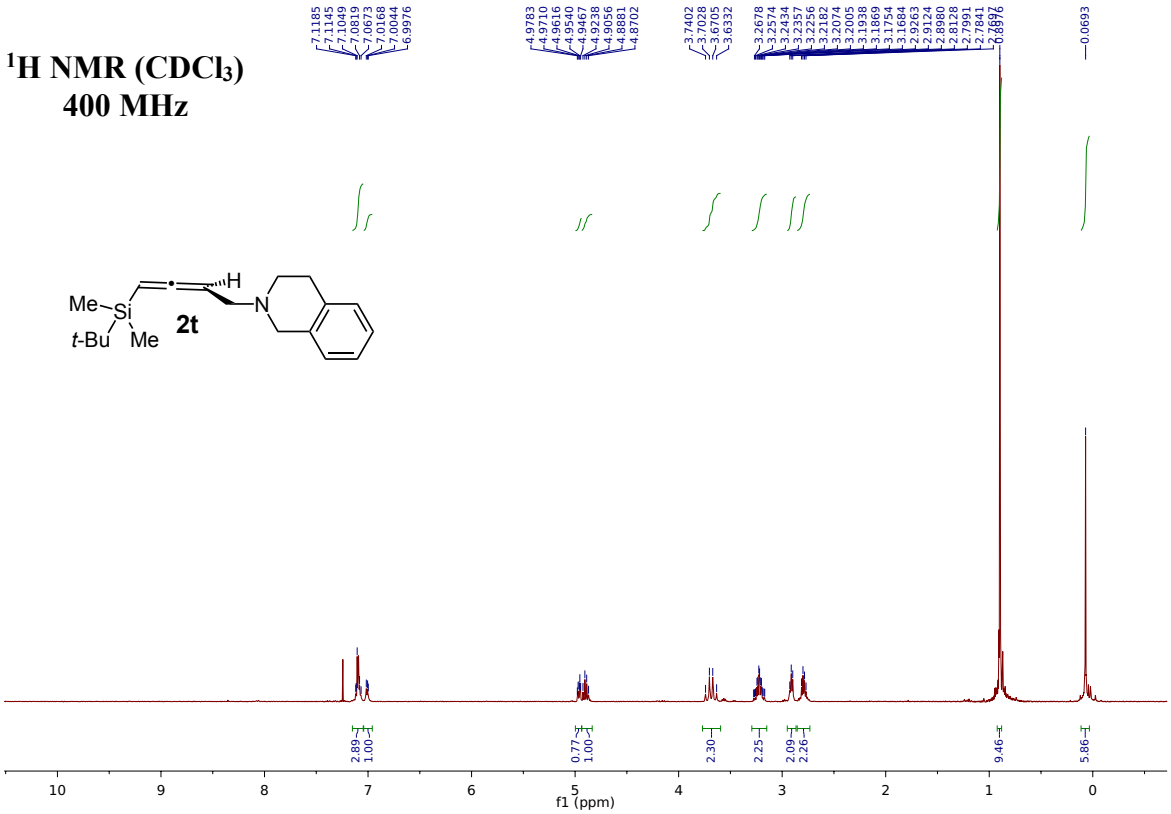
^{13}C NMR ($CDCl_3$)
125 MHz



2s

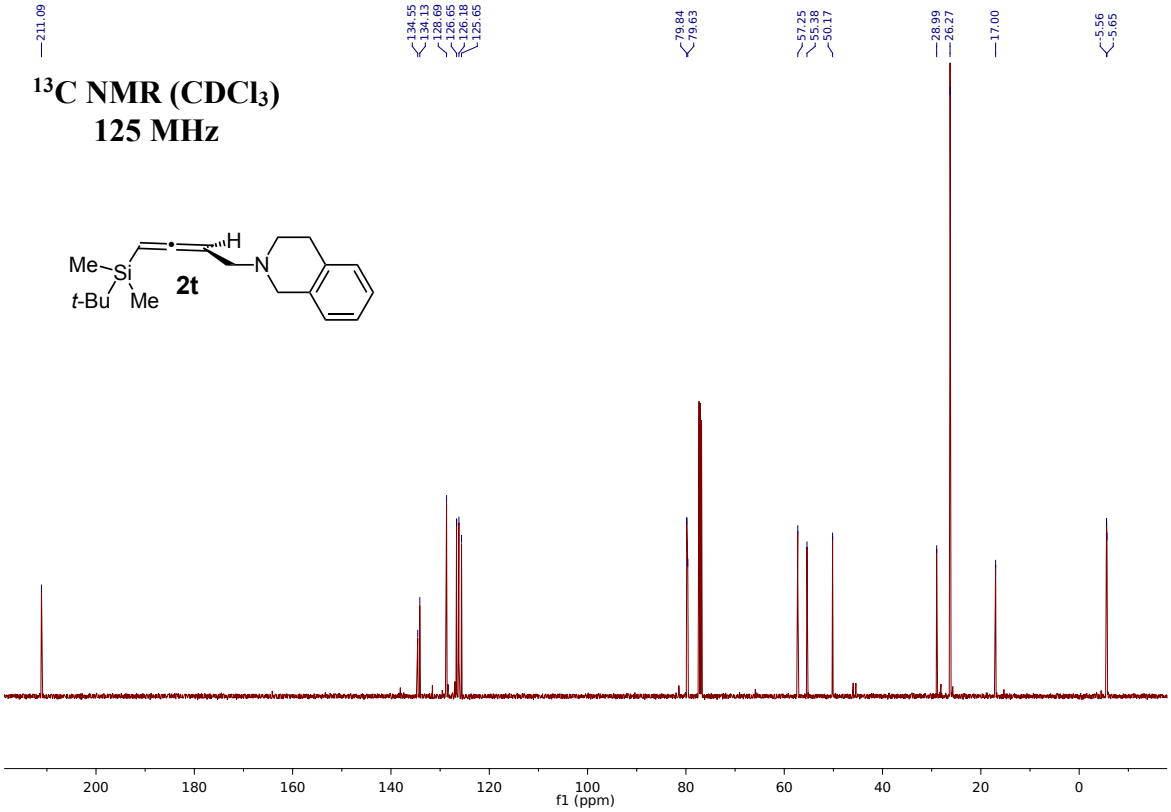
^{1}H NMR ($CDCl_3$)
400 MHz

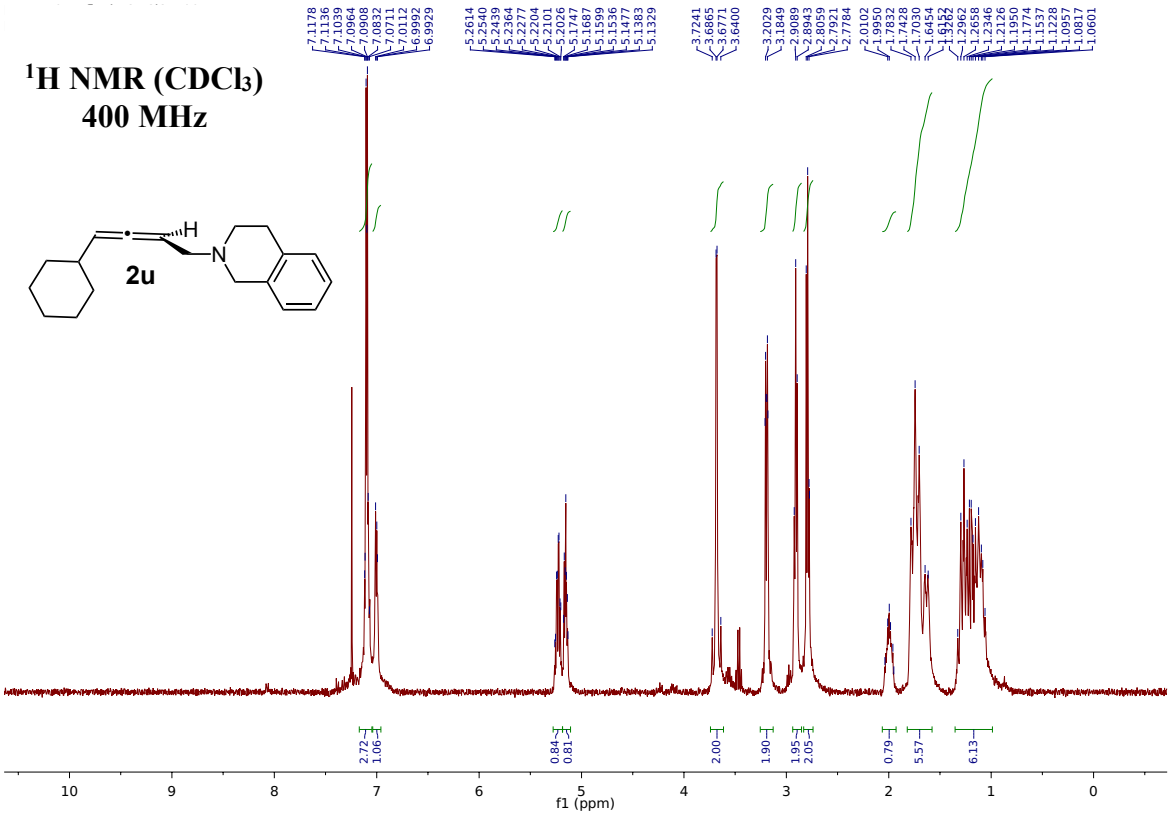
2t

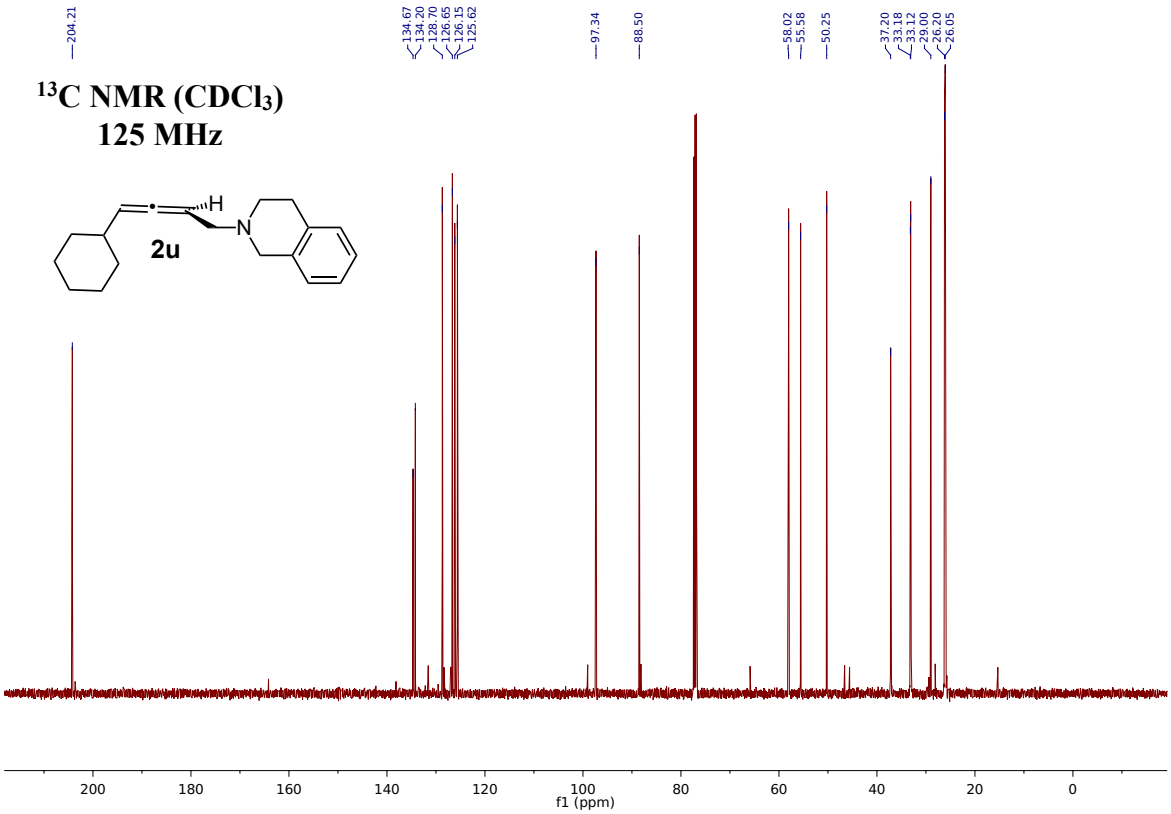


^{13}C NMR ($CDCl_3$)
125 MHz

2t

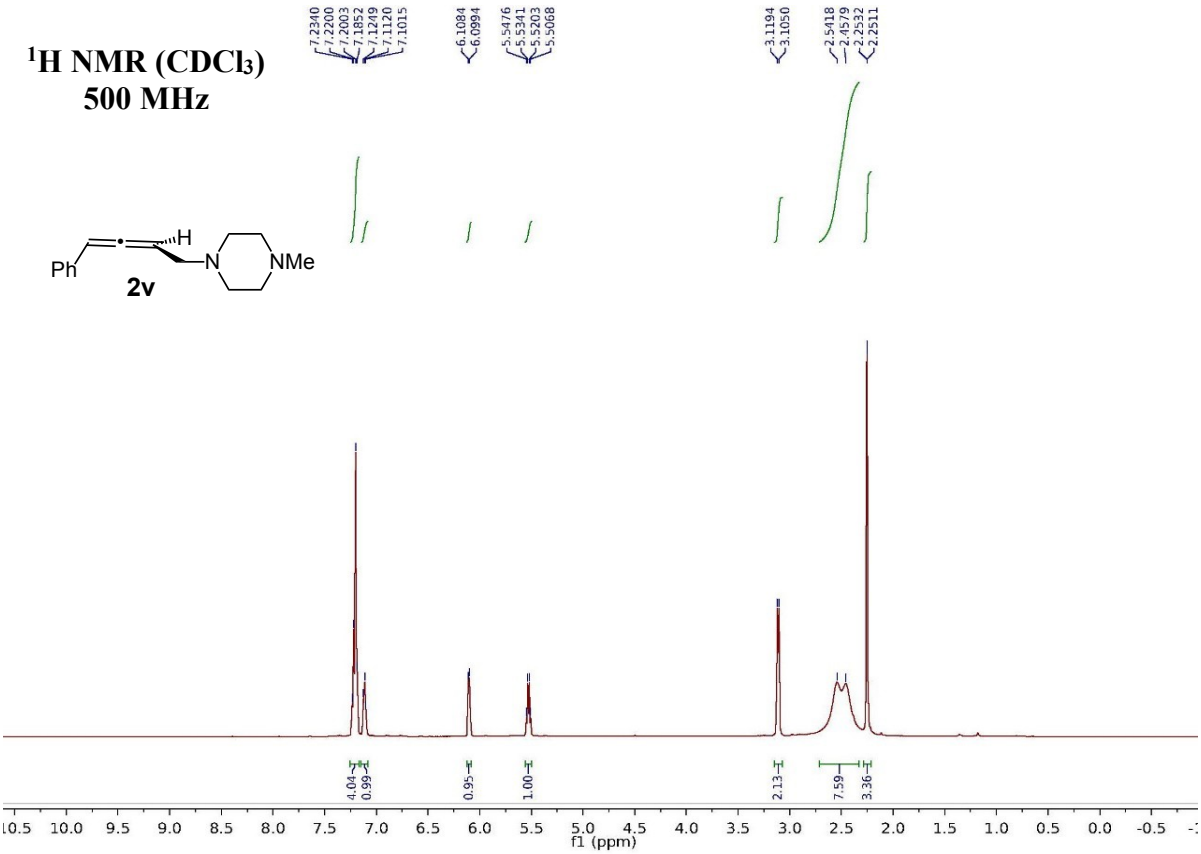



^{1}H NMR (CDCl$_3$)
400 MHz
2u
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
2u
f1 (ppm)

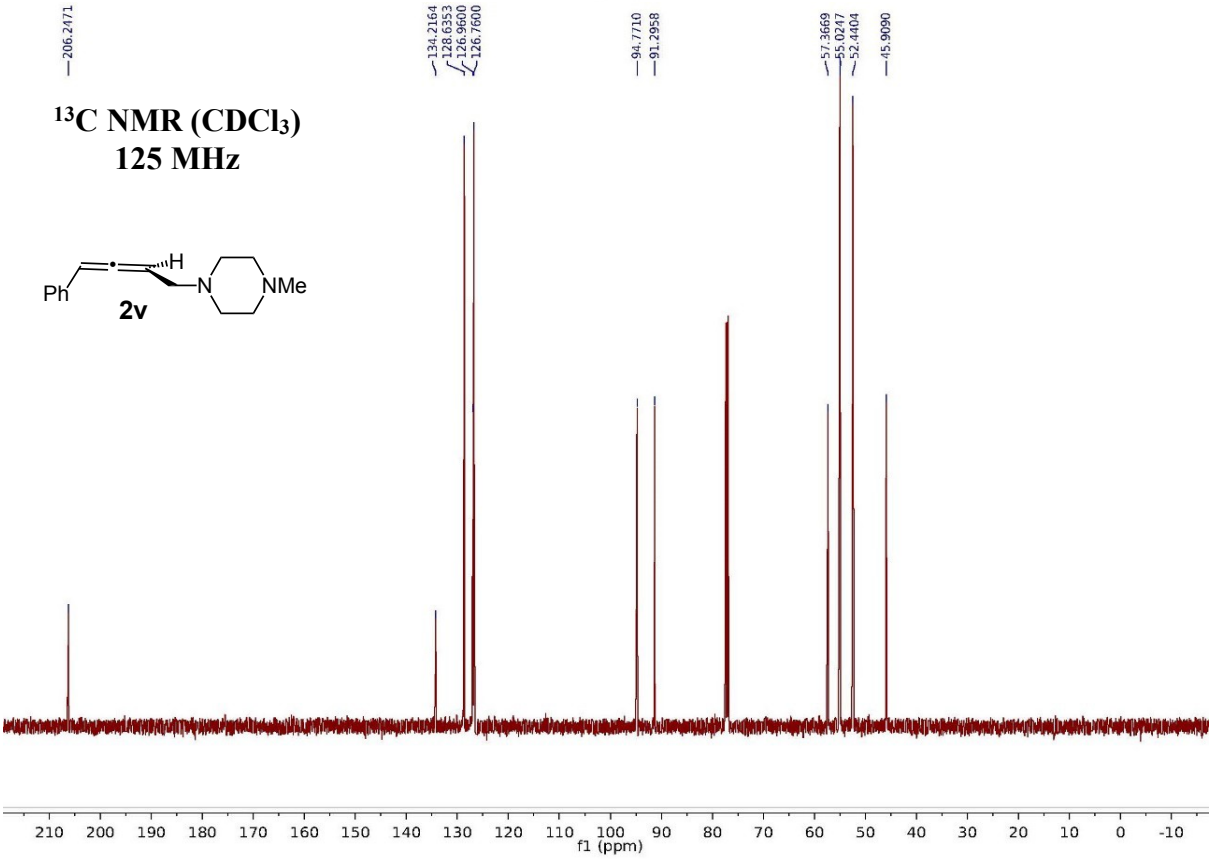
^{1}H NMR ($CDCl_3$)
500 MHz

2v



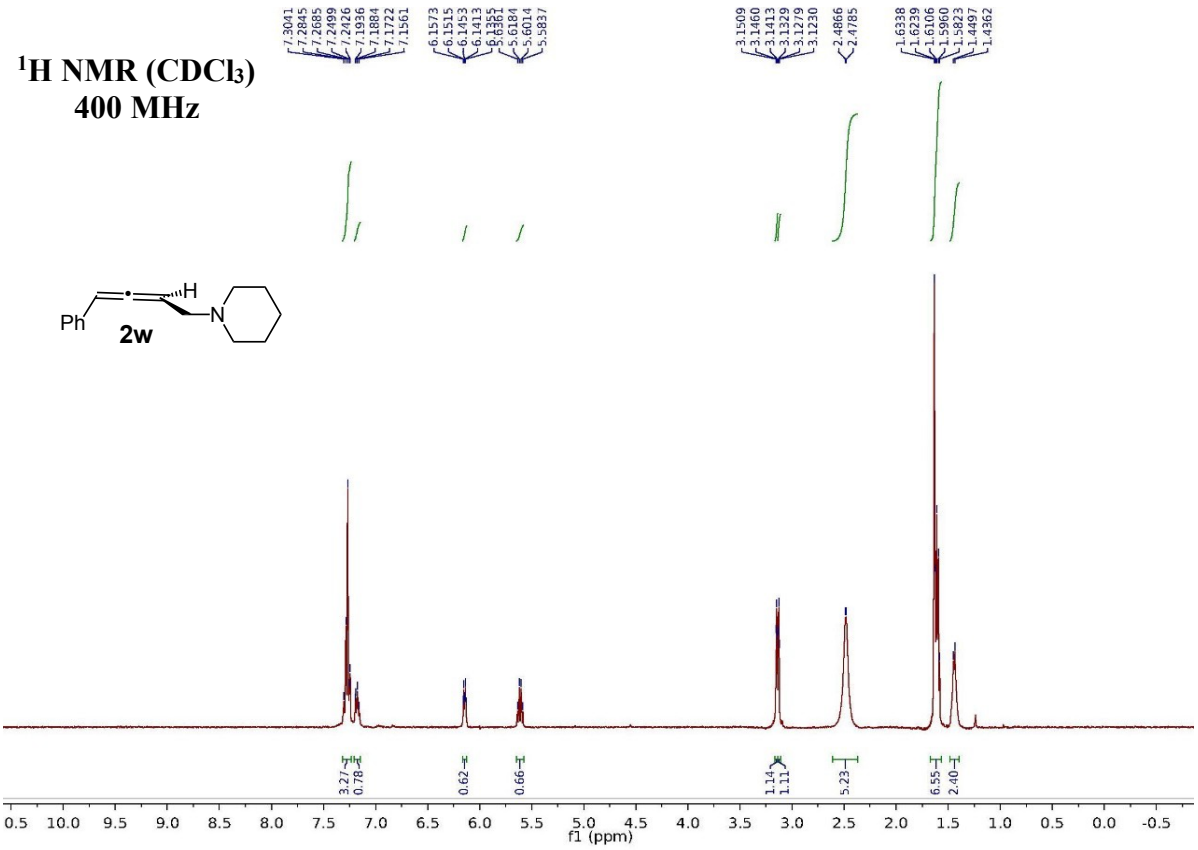
^{13}C NMR ($CDCl_3$)
125 MHz

2v



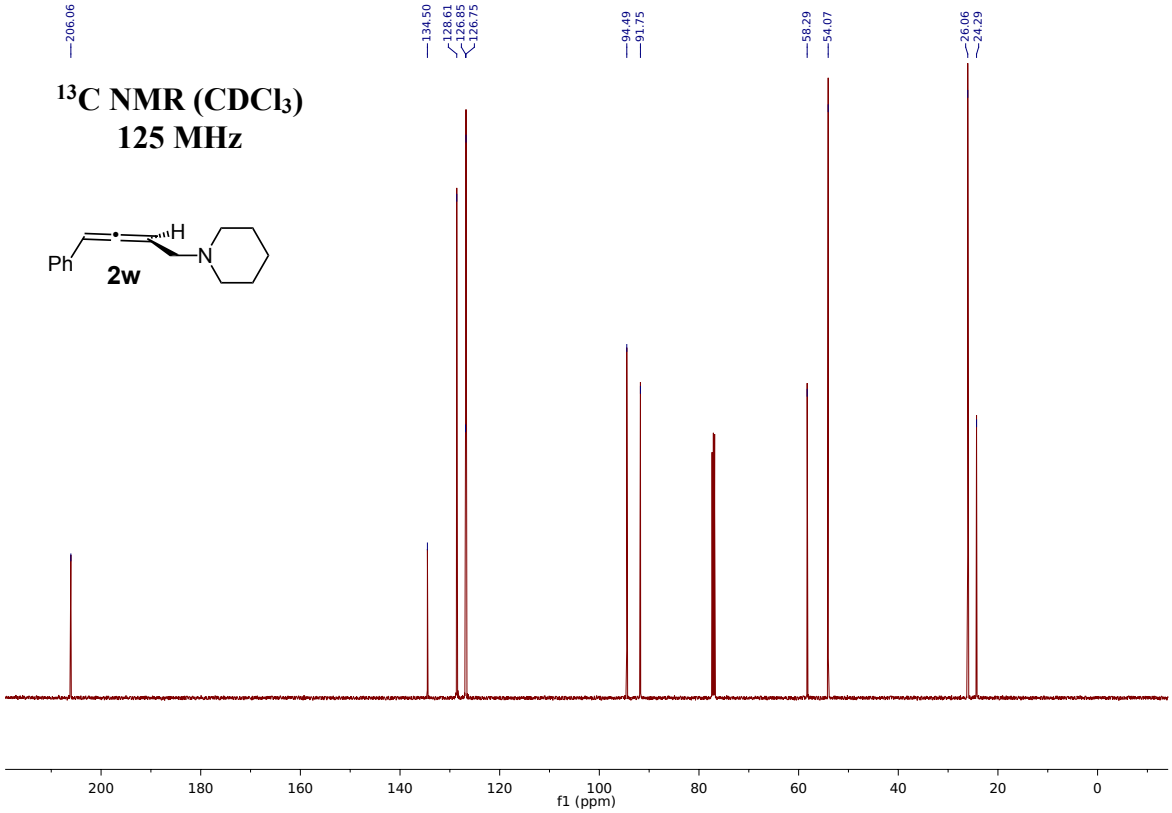
^{1}H NMR ($CDCl_3$)
400 MHz

2w



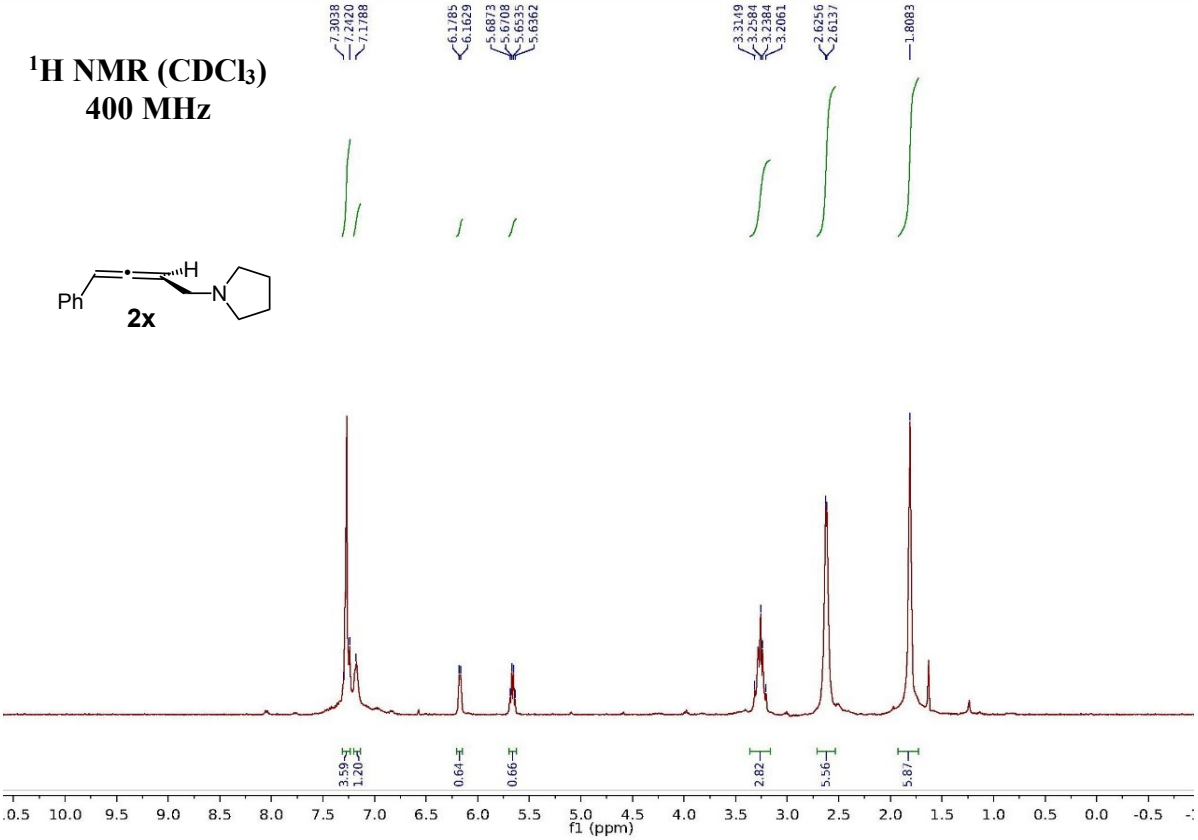
^{13}C NMR ($CDCl_3$)
125 MHz

2w



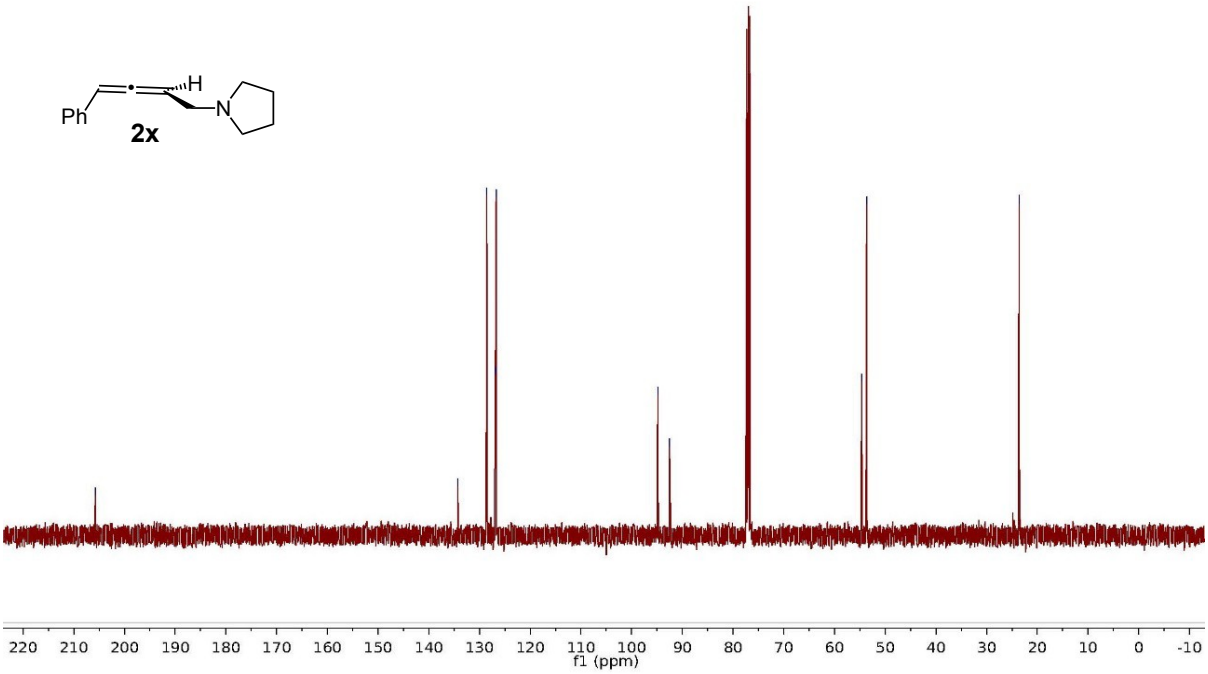
^{1}H NMR ($CDCl_3$)
400 MHz

2x



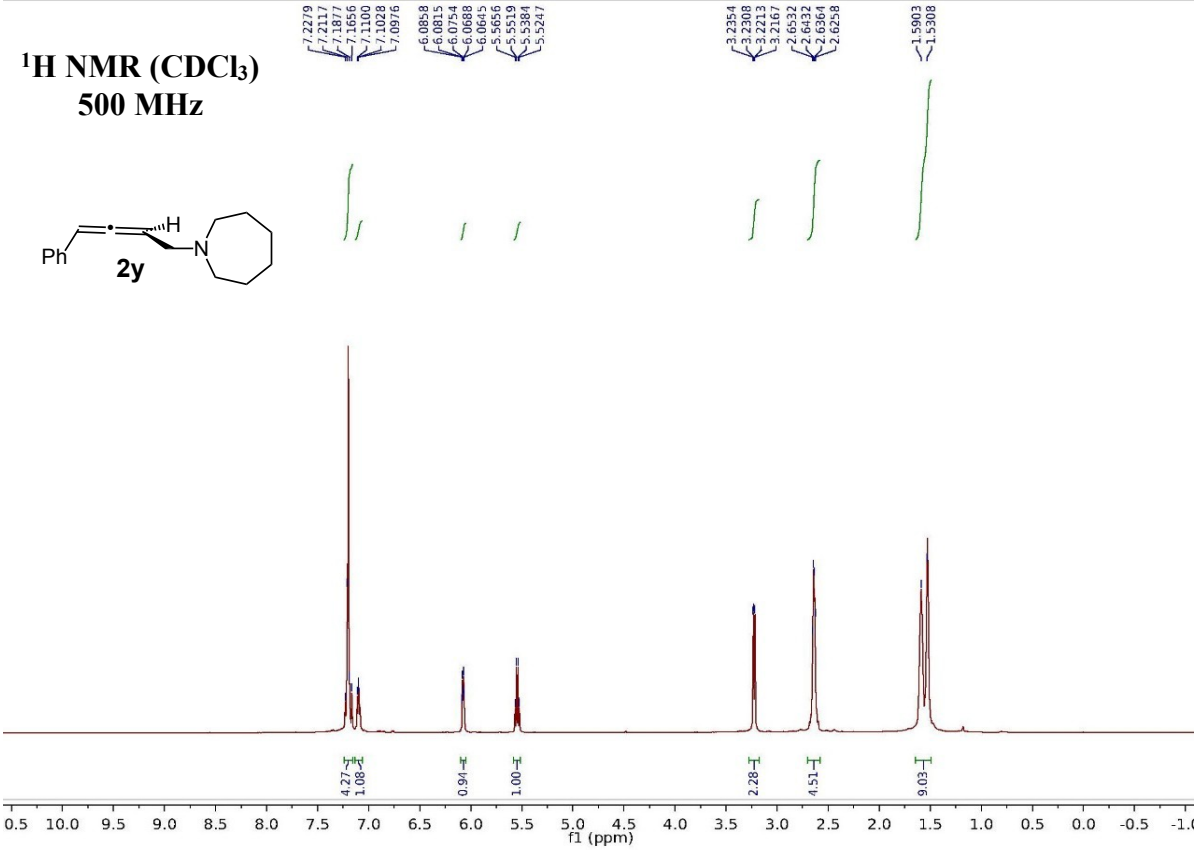
^{13}C NMR ($CDCl_3$)
125 MHz

2x



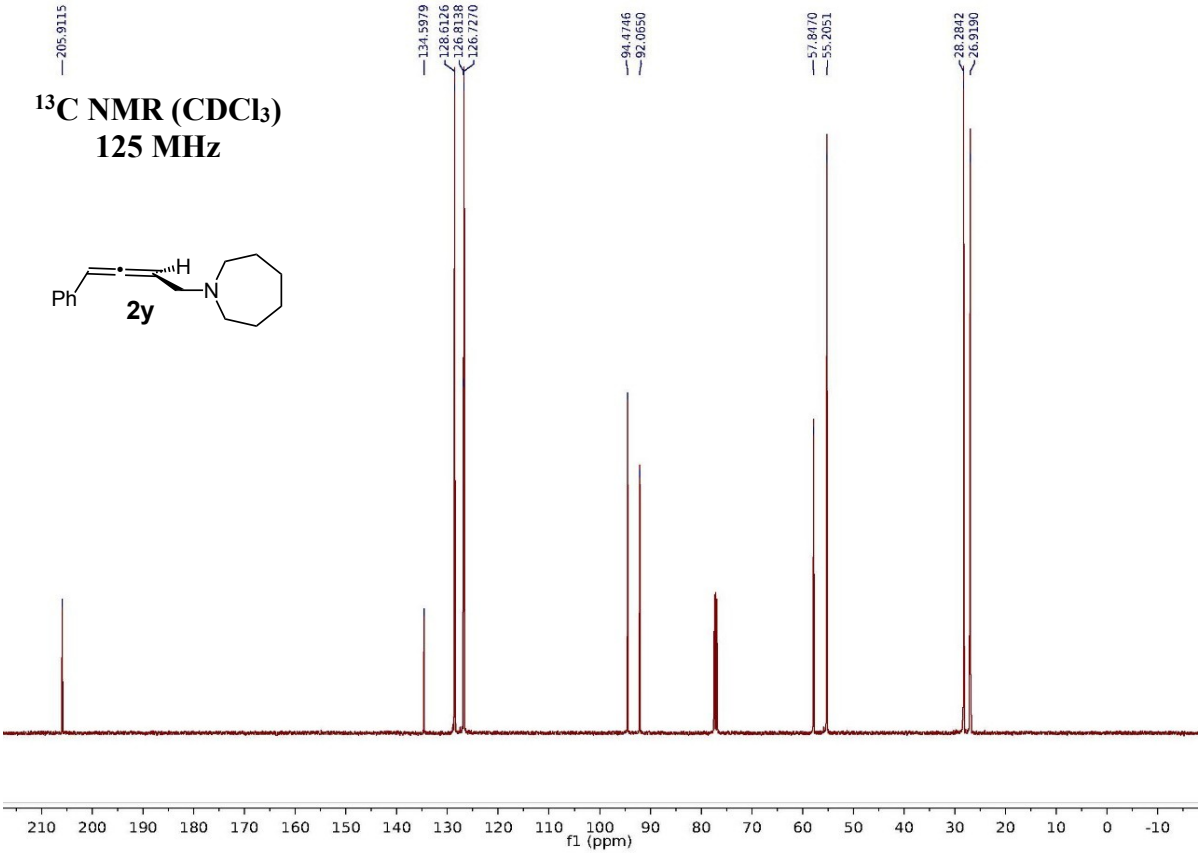
^{1}H NMR ($CDCl_3$)
500 MHz

2y



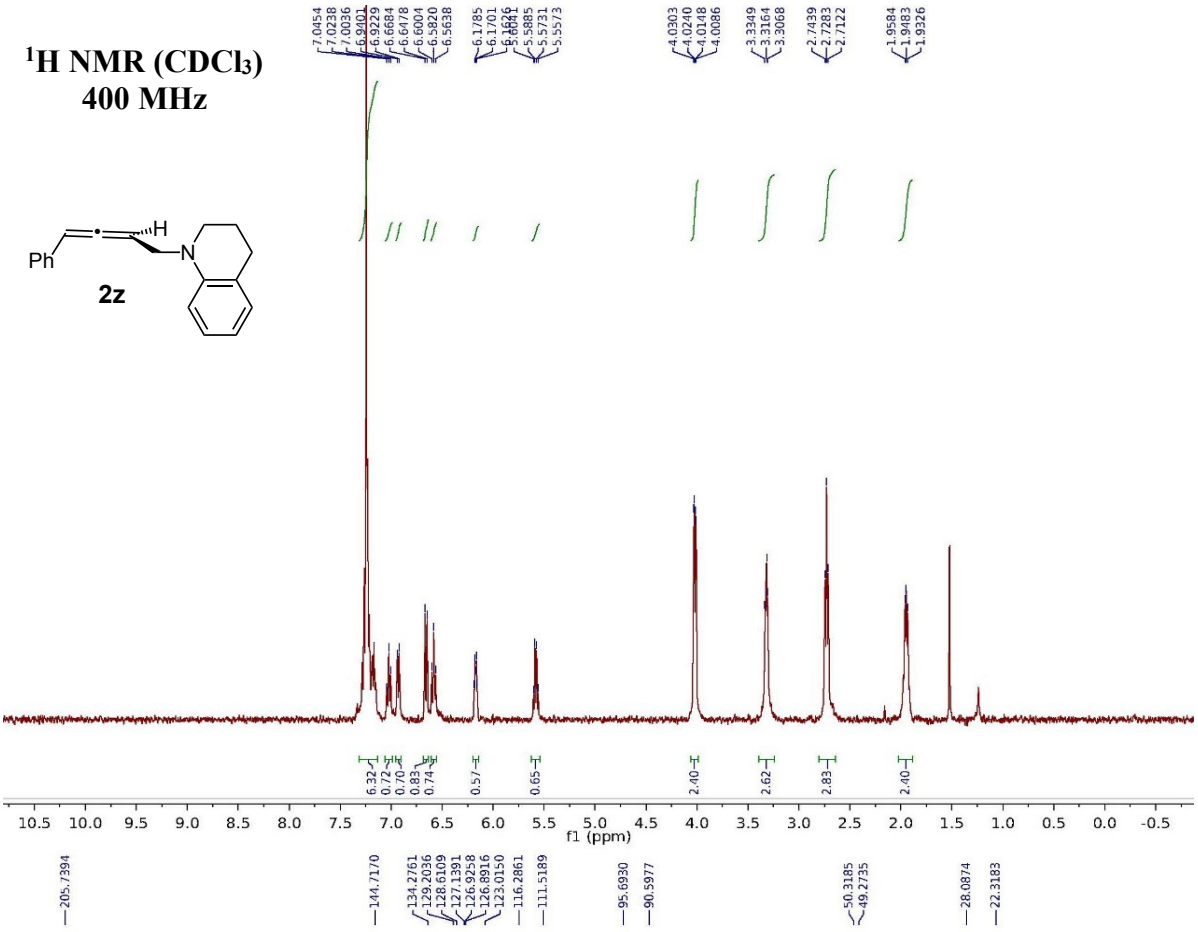
^{13}C NMR ($CDCl_3$)
125 MHz

2y



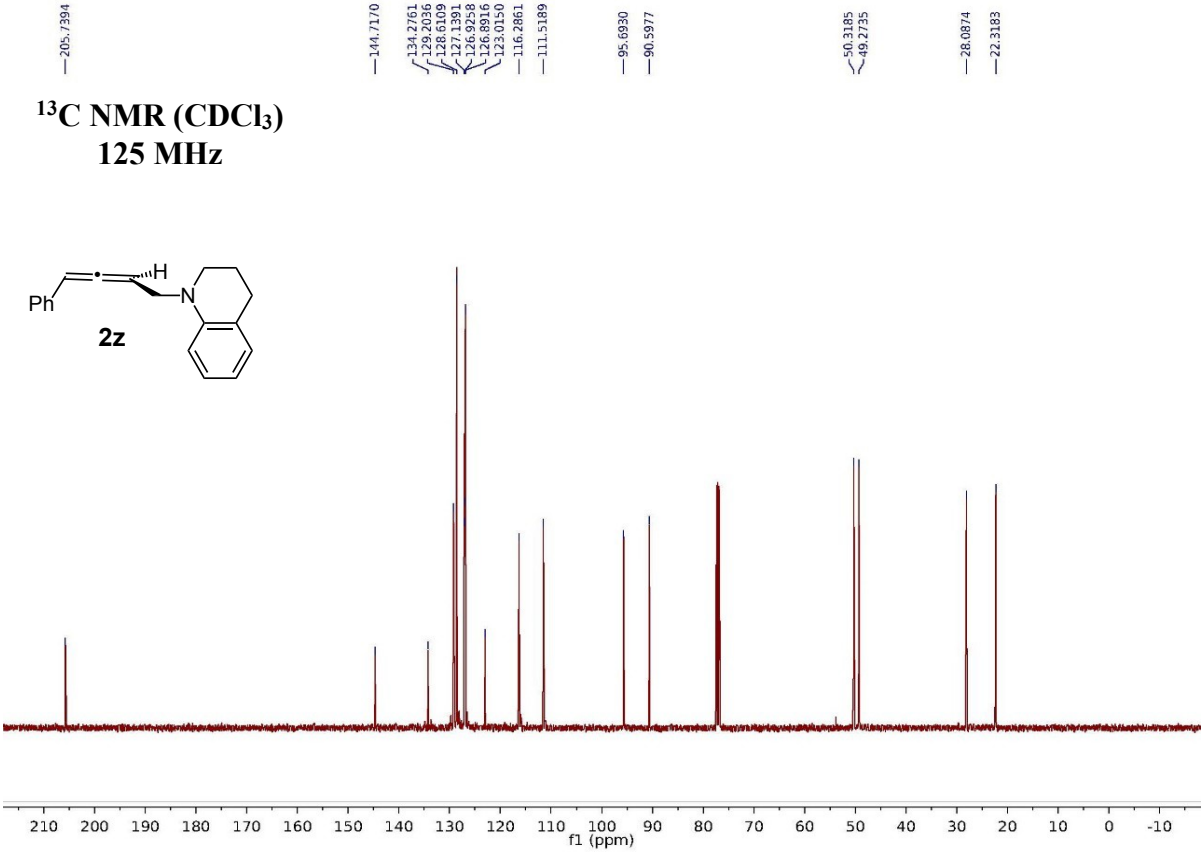
^{1}H NMR ($CDCl_3$)
400 MHz

2z



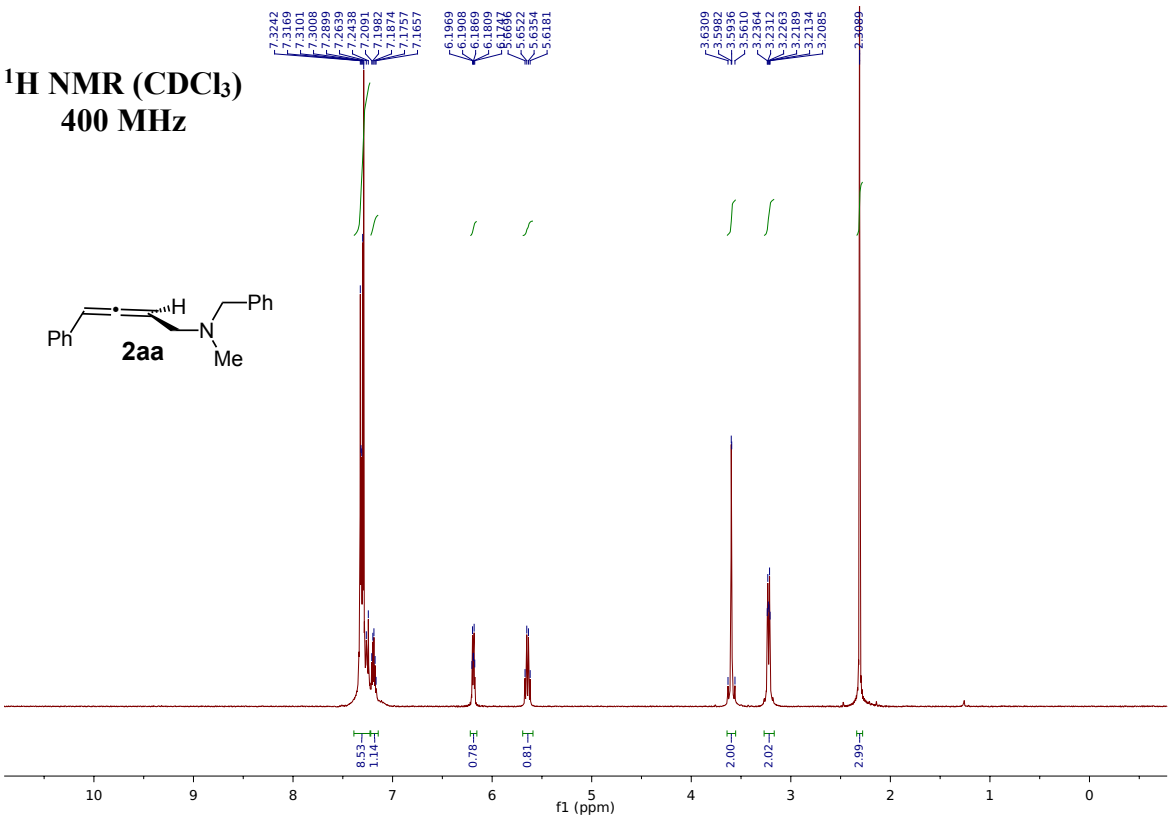
^{13}C NMR ($CDCl_3$)
125 MHz

2z



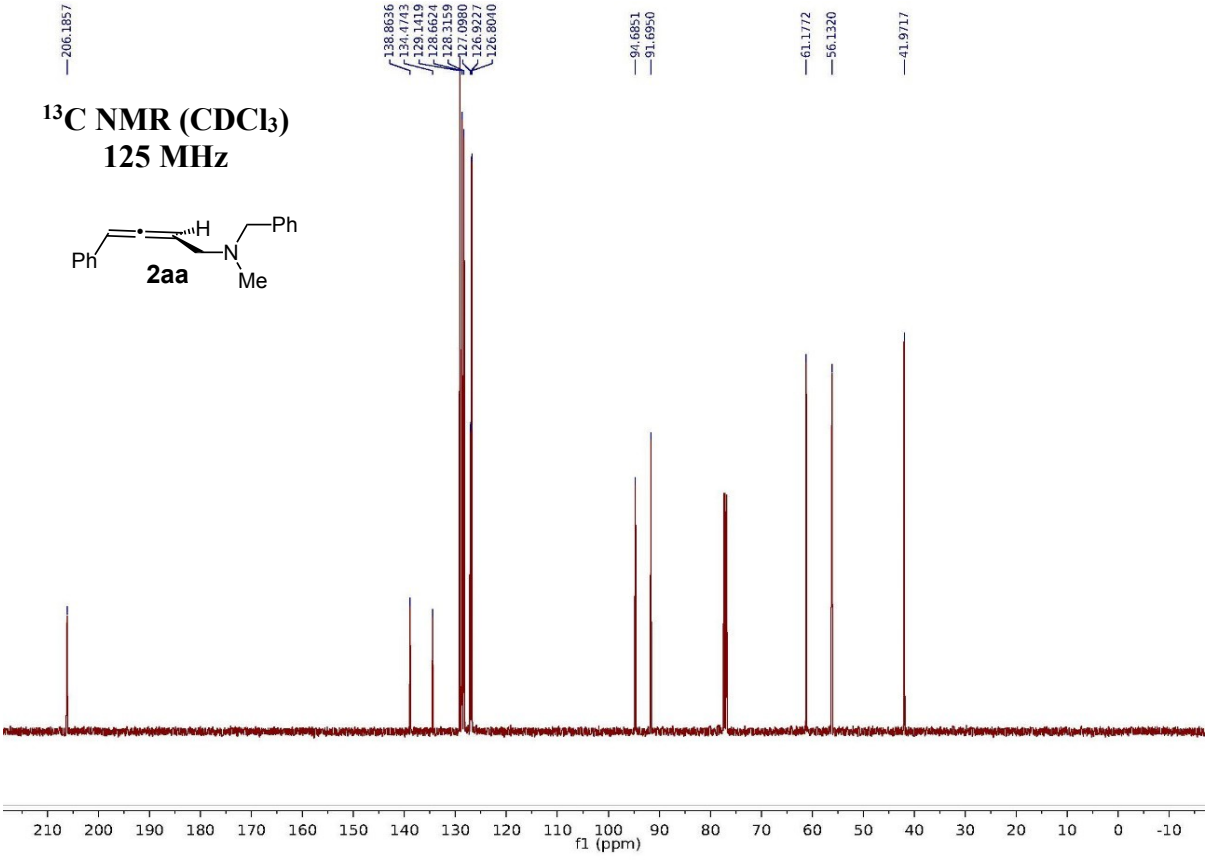
^{1}H NMR ($CDCl_3$)
400 MHz

2aa



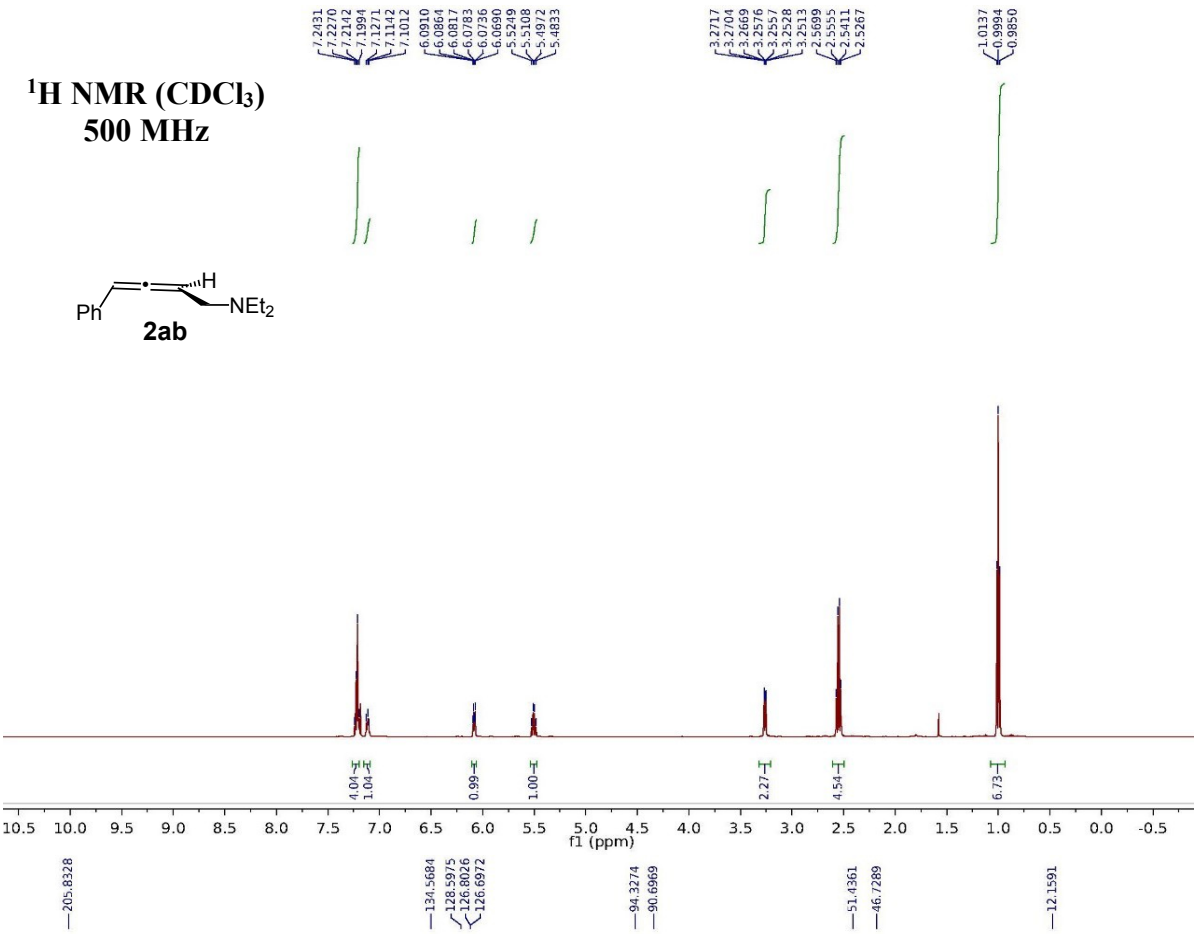
^{13}C NMR ($CDCl_3$)
125 MHz

2aa



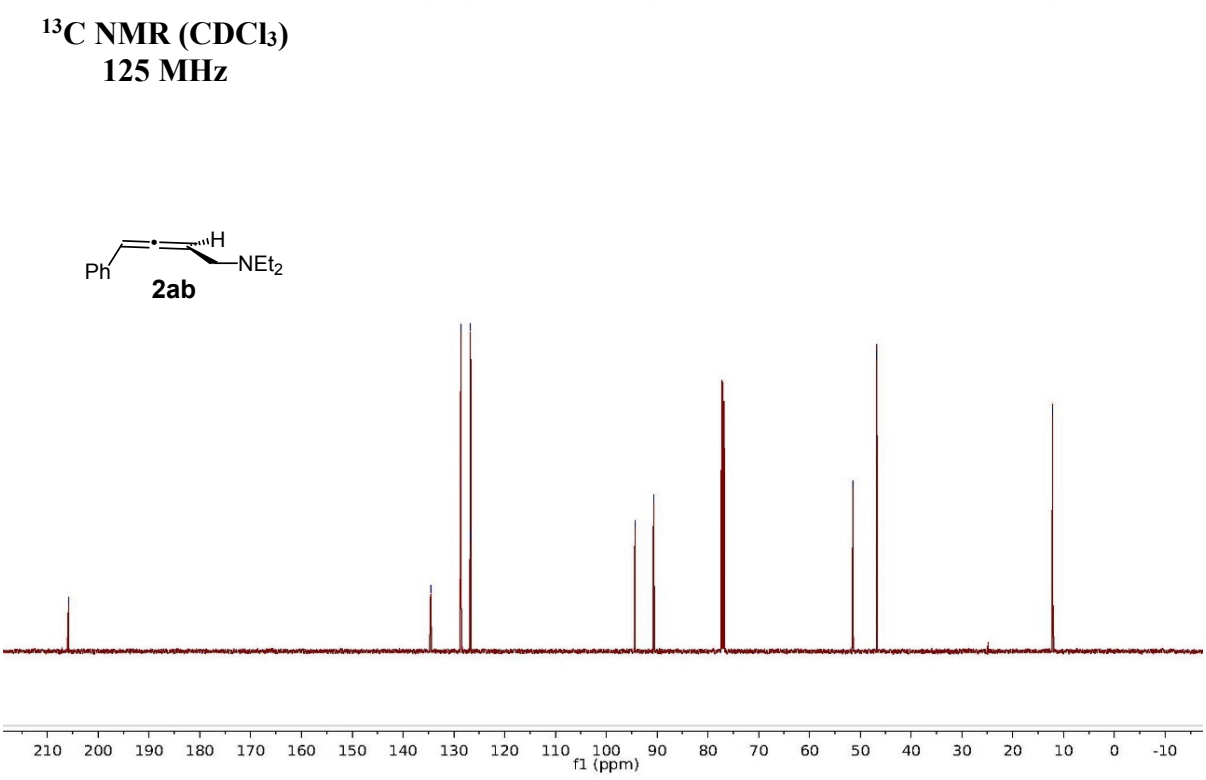
^{1}H NMR ($CDCl_3$)
500 MHz

2ab



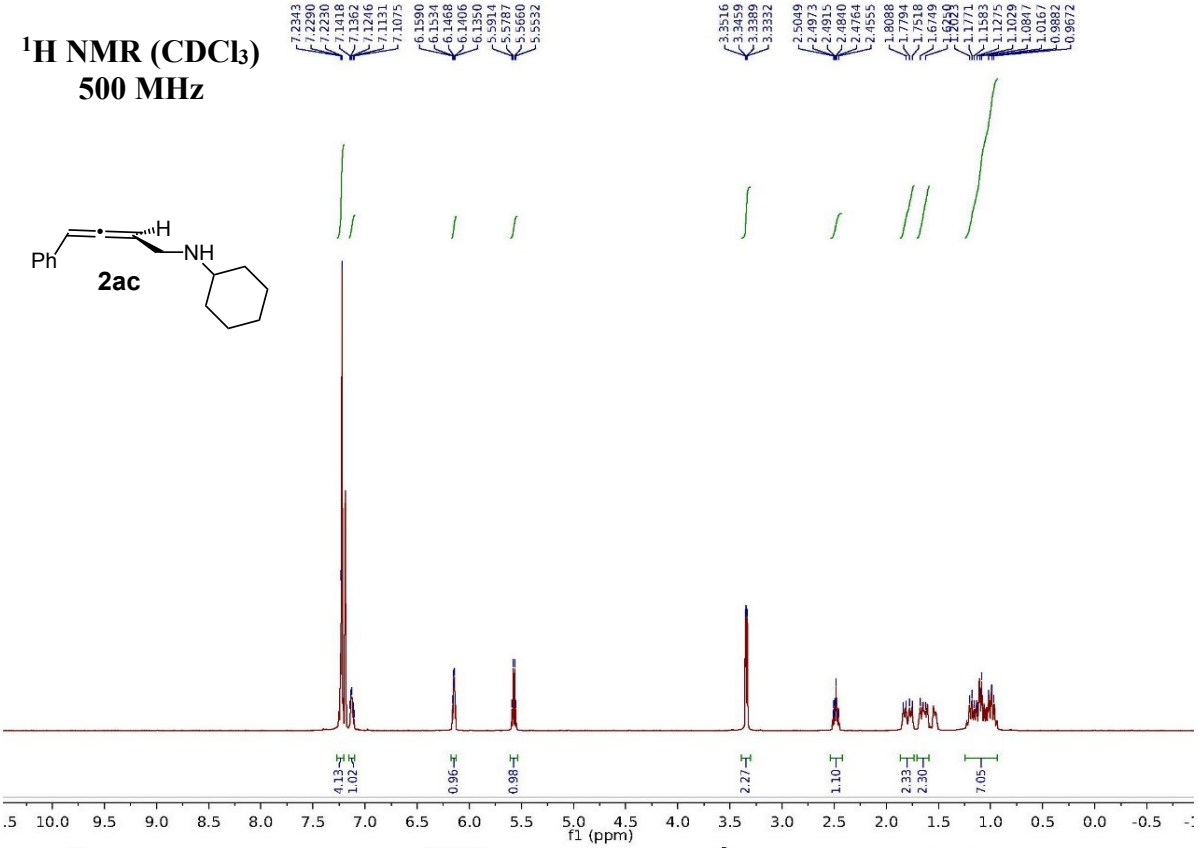
^{13}C NMR ($CDCl_3$)
125 MHz

2ab



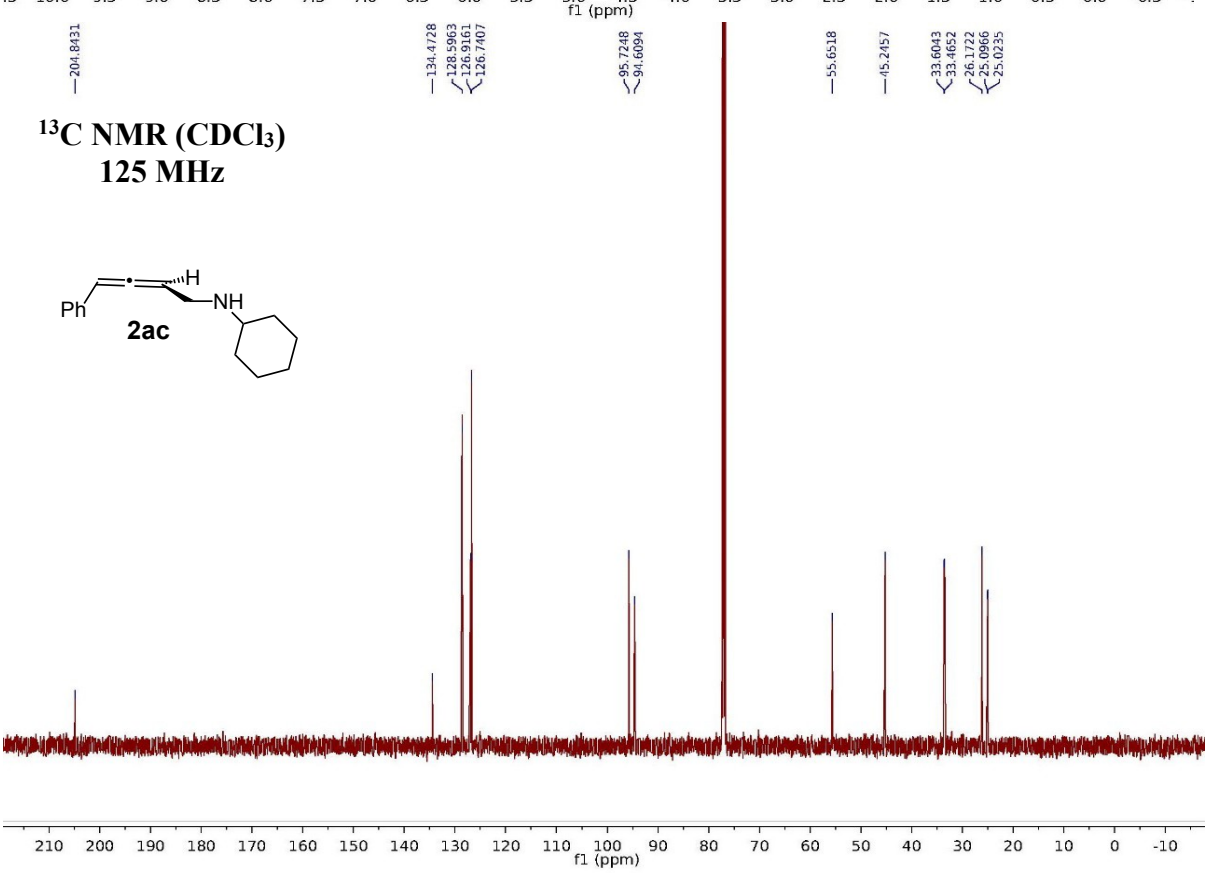
^{1}H NMR ($CDCl_3$)
500 MHz

2ac



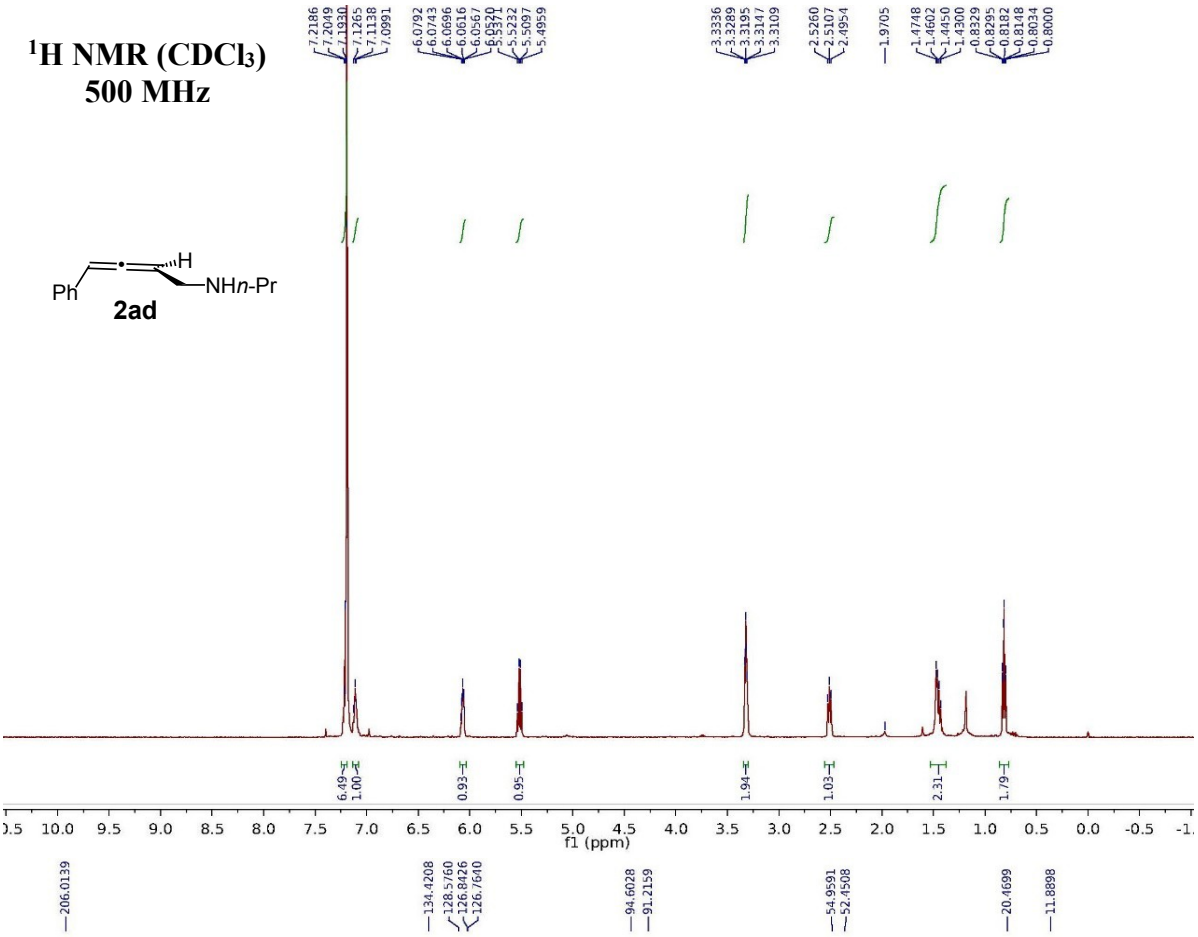
^{13}C NMR ($CDCl_3$)
125 MHz

2ac



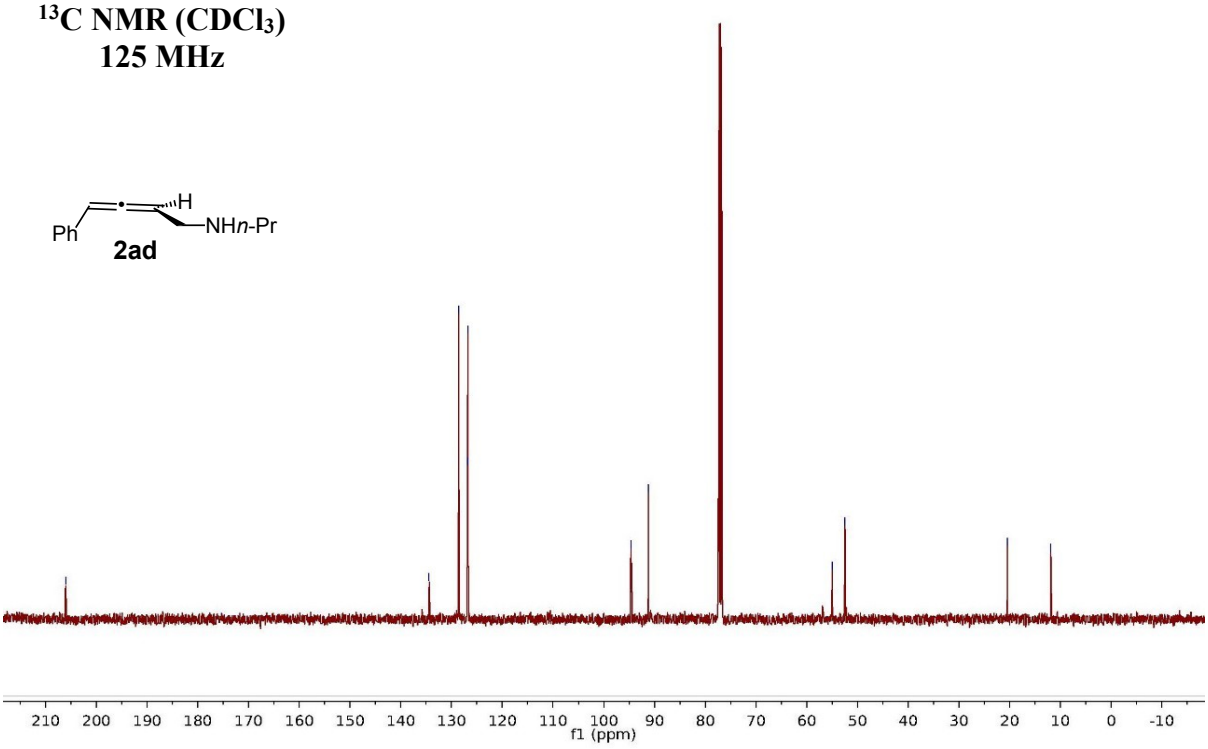
^{1}H NMR ($CDCl_3$)
500 MHz

2ad



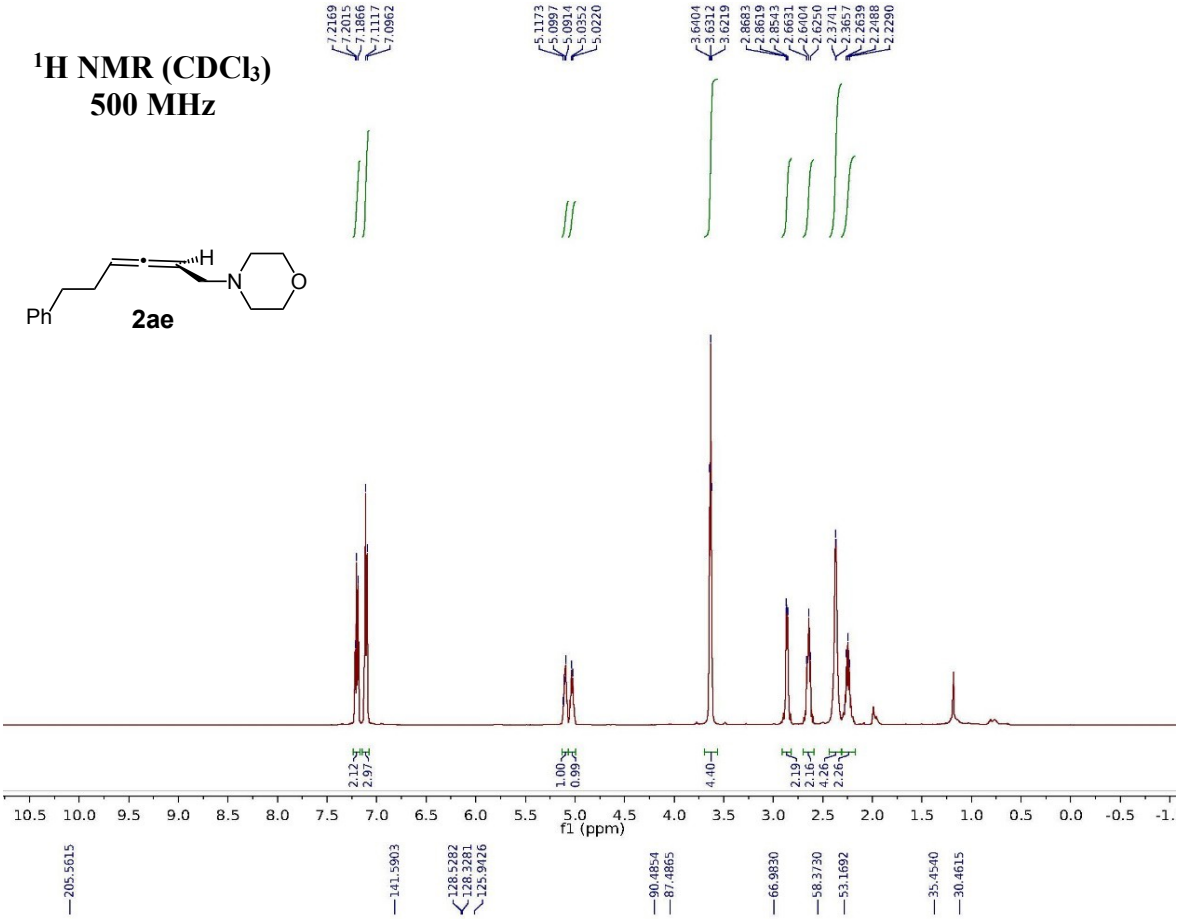
^{13}C NMR ($CDCl_3$)
125 MHz

2ad



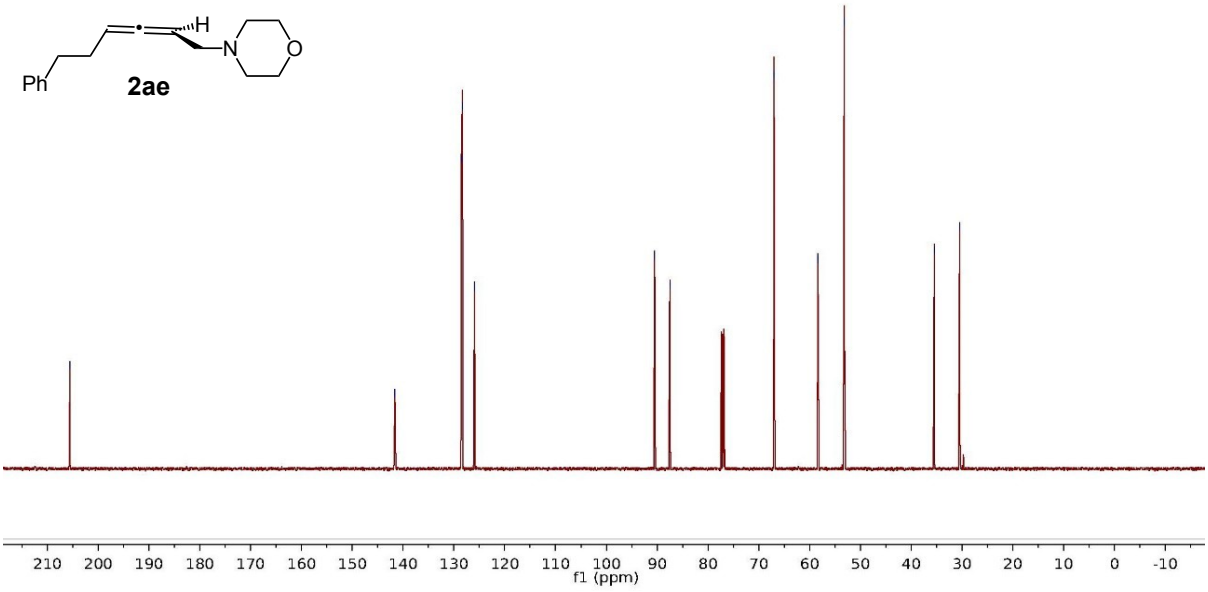
^{1}H NMR ($CDCl_3$)
500 MHz

2ae



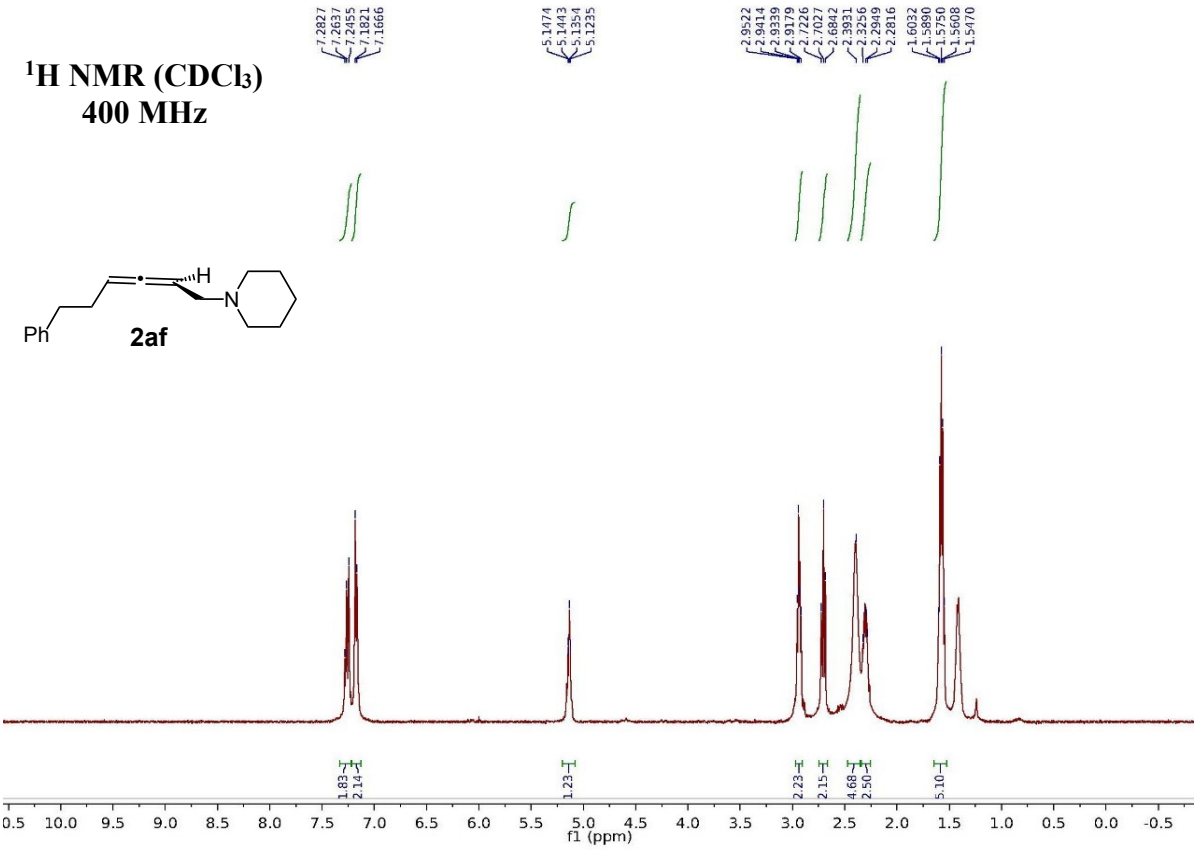
^{13}C NMR ($CDCl_3$)
125 MHz

2ae



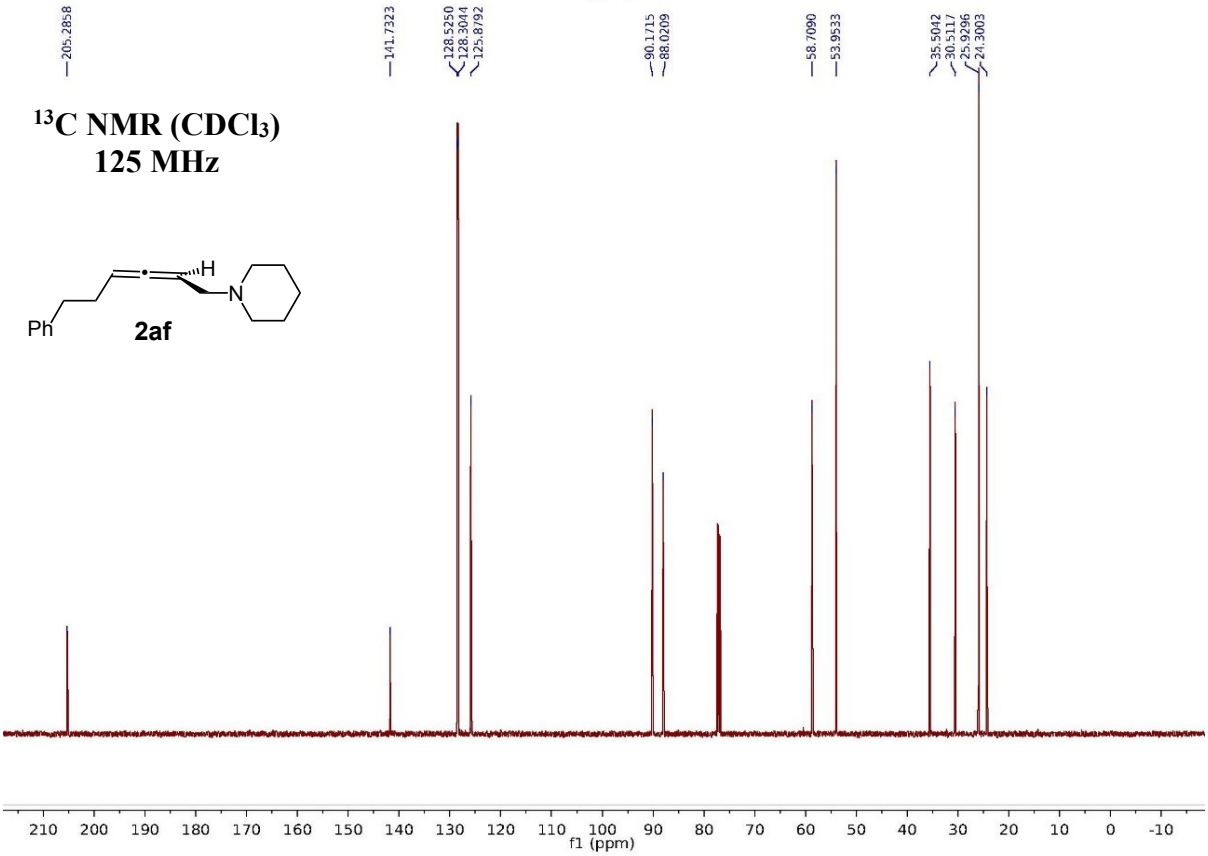
^{1}H NMR ($CDCl_3$)
400 MHz

2af

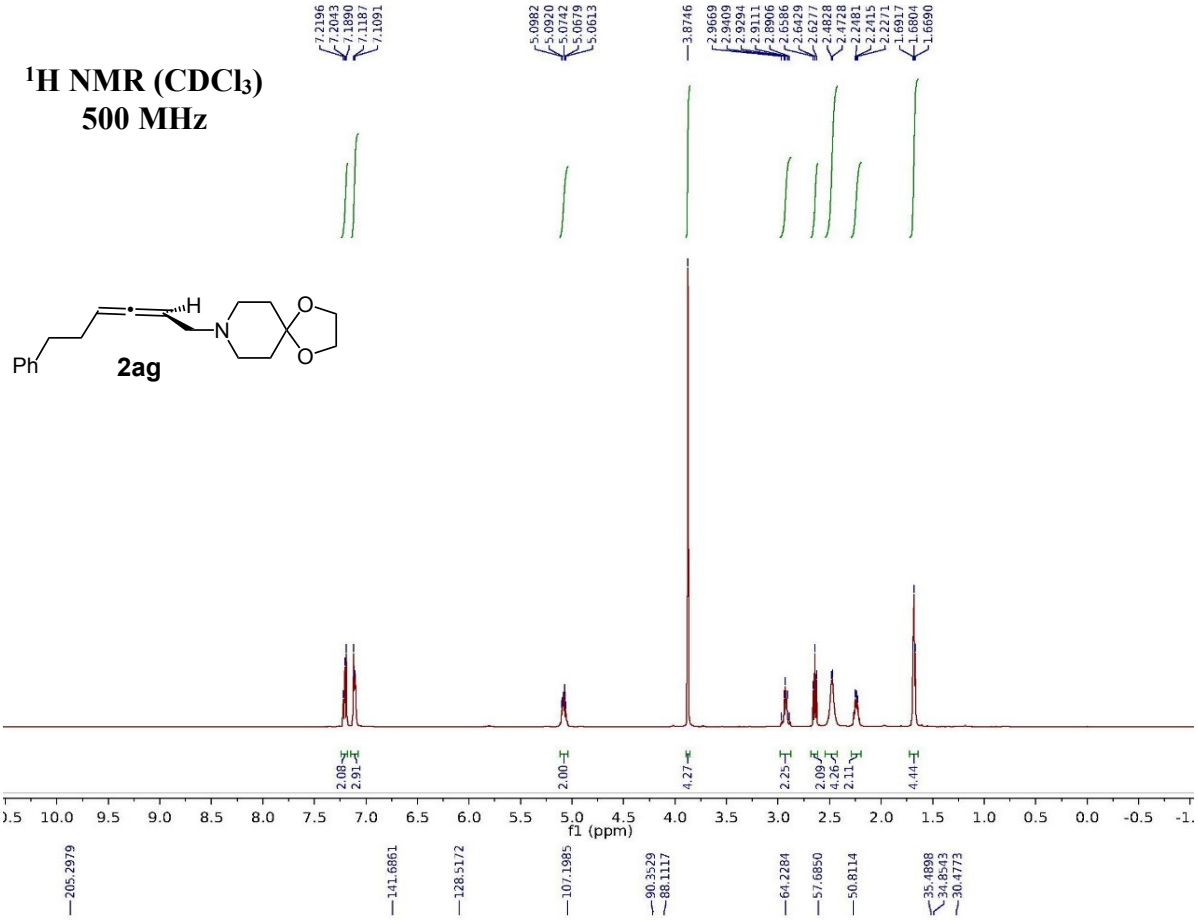


^{13}C NMR ($CDCl_3$)
125 MHz

2af

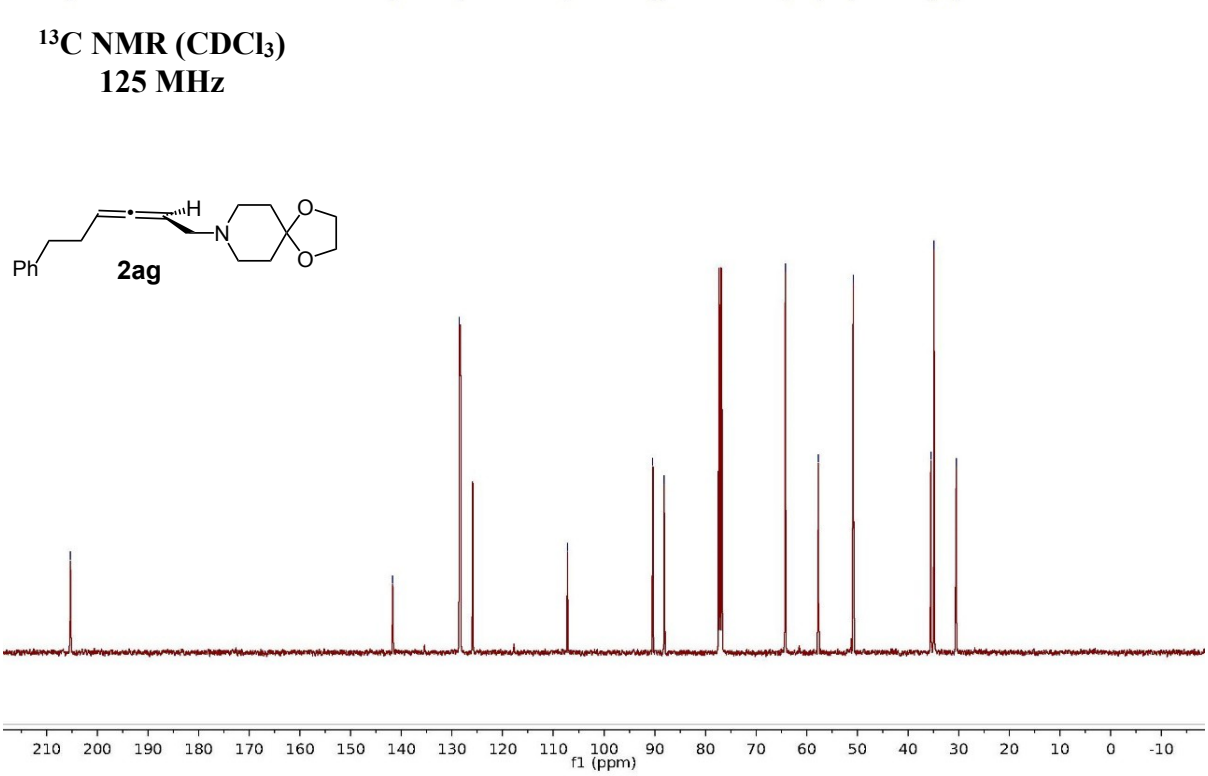


^{1}H NMR ($CDCl_3$)
500 MHz



2ag

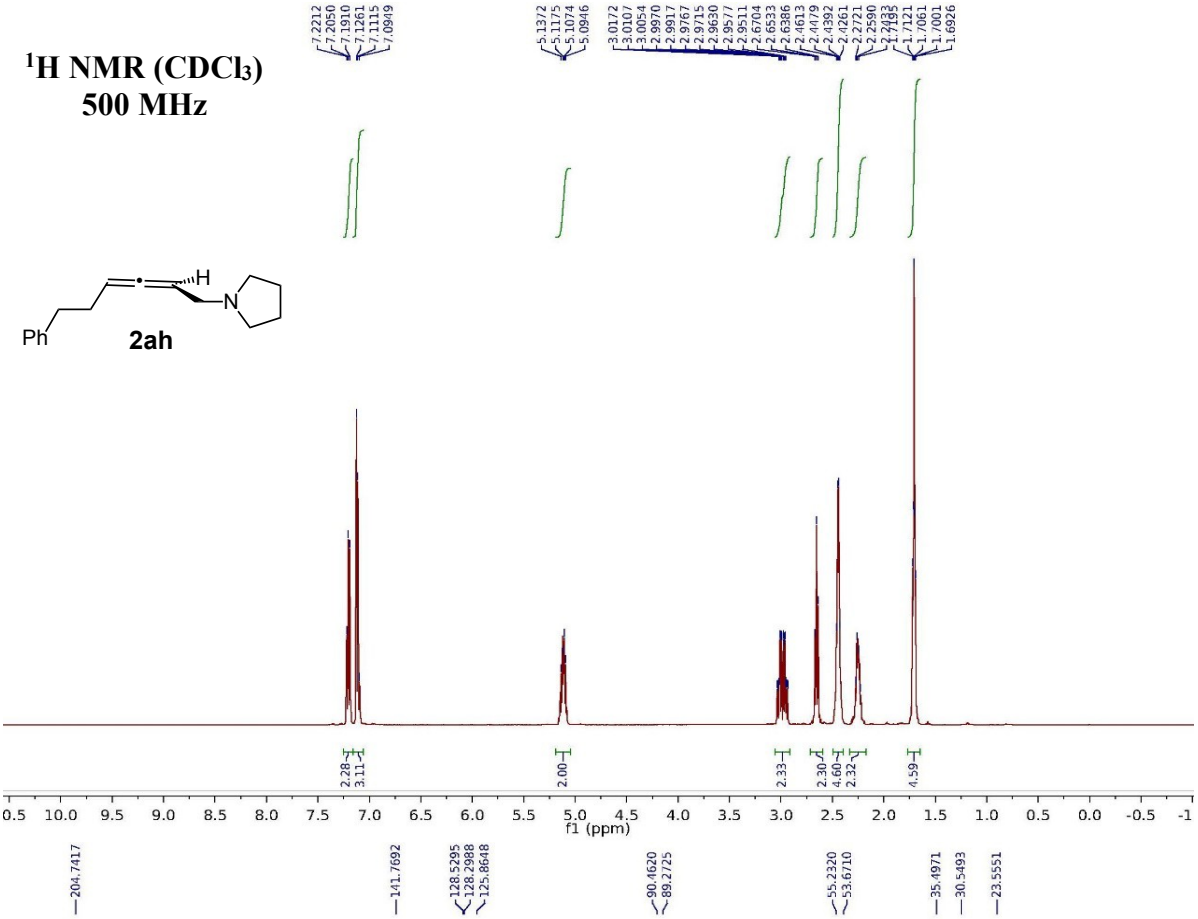
^{13}C NMR ($CDCl_3$)
125 MHz



2ag

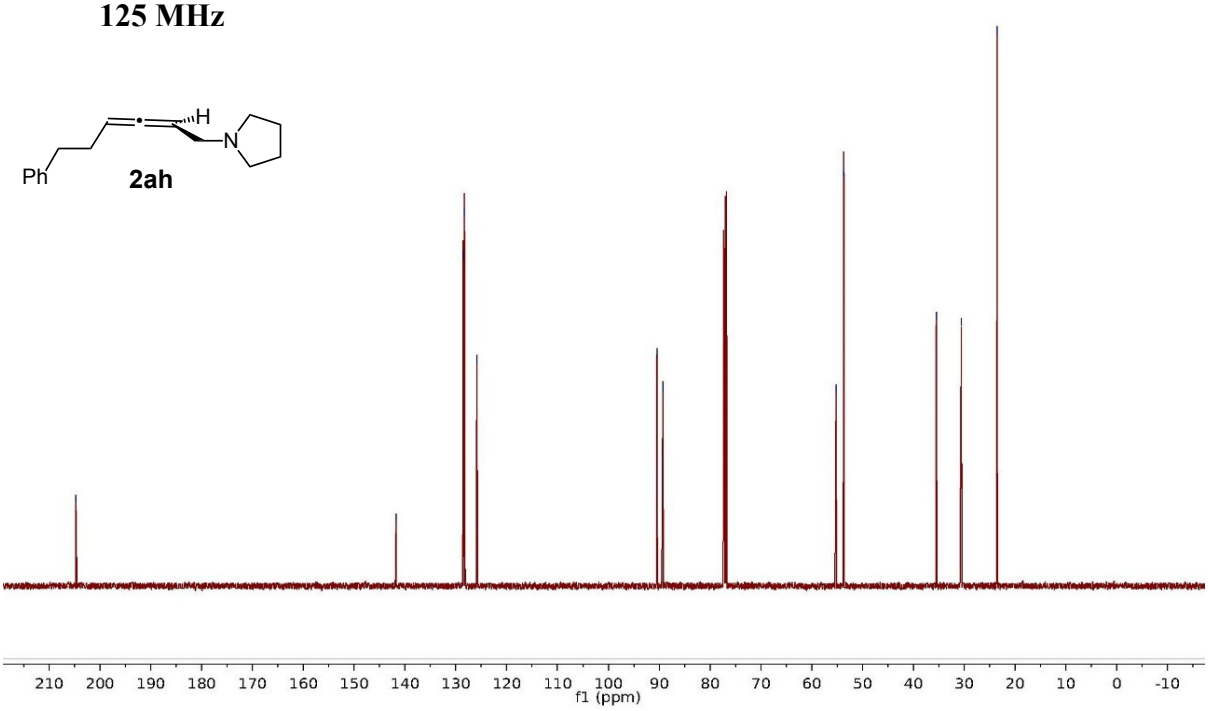
^{1}H NMR ($CDCl_3$)
500 MHz

2ah



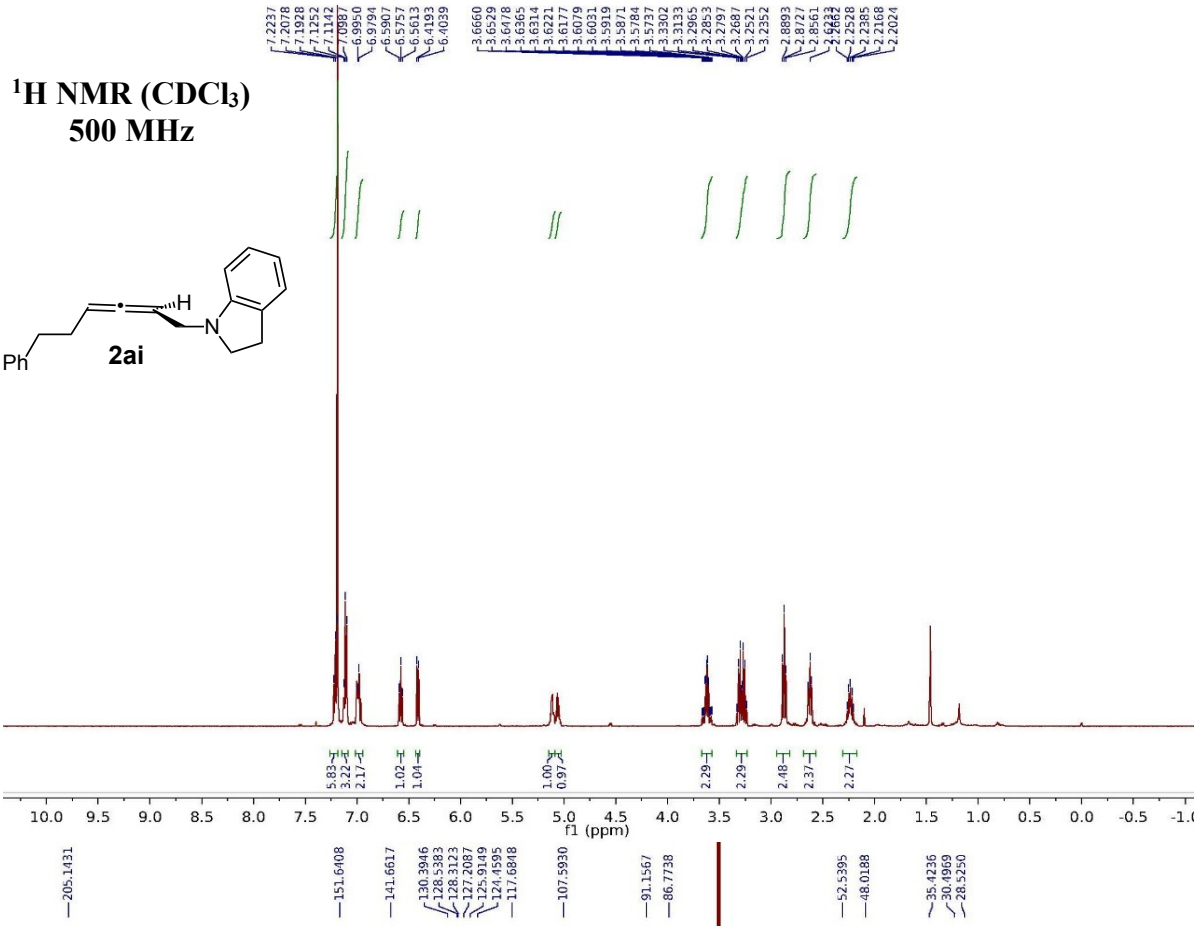
^{13}C NMR ($CDCl_3$)
125 MHz

2ah



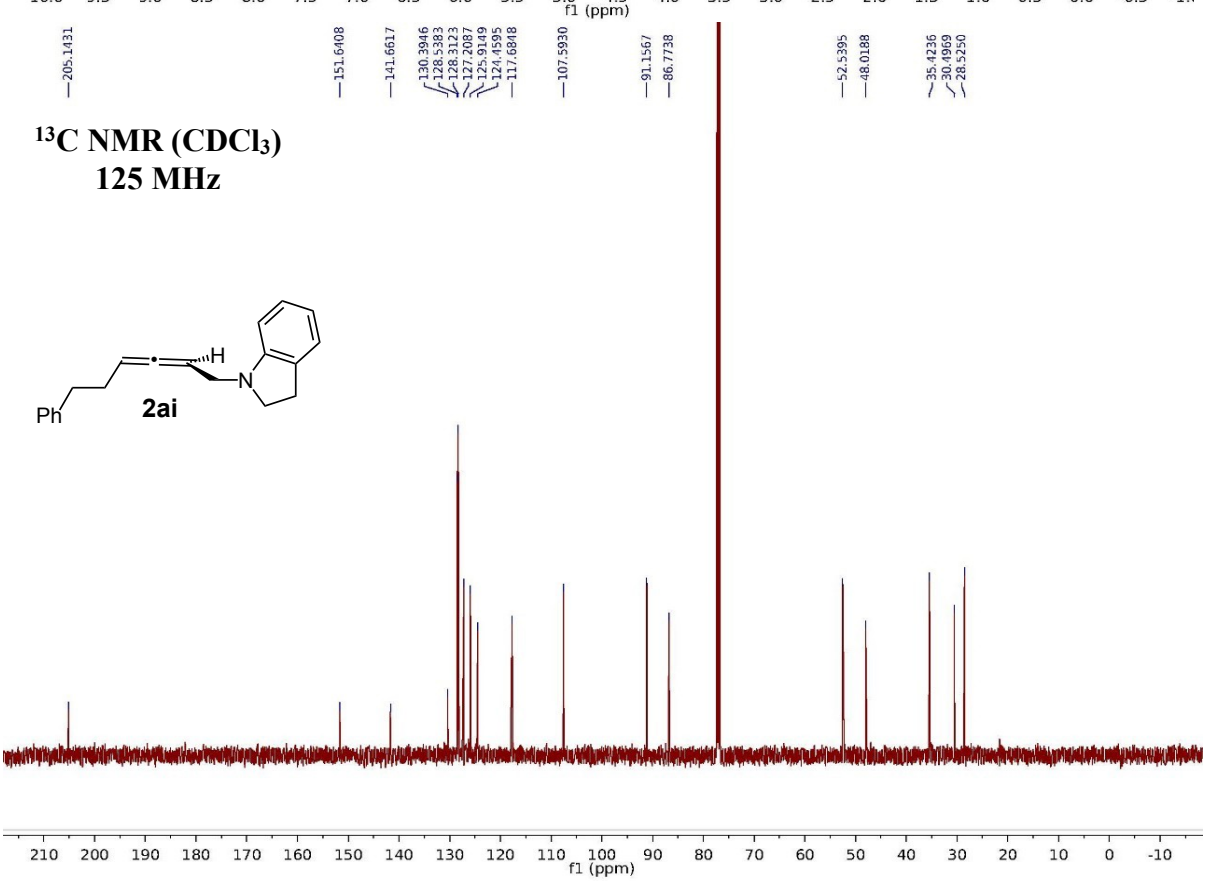
^{1}H NMR ($CDCl_3$)
500 MHz

2ai



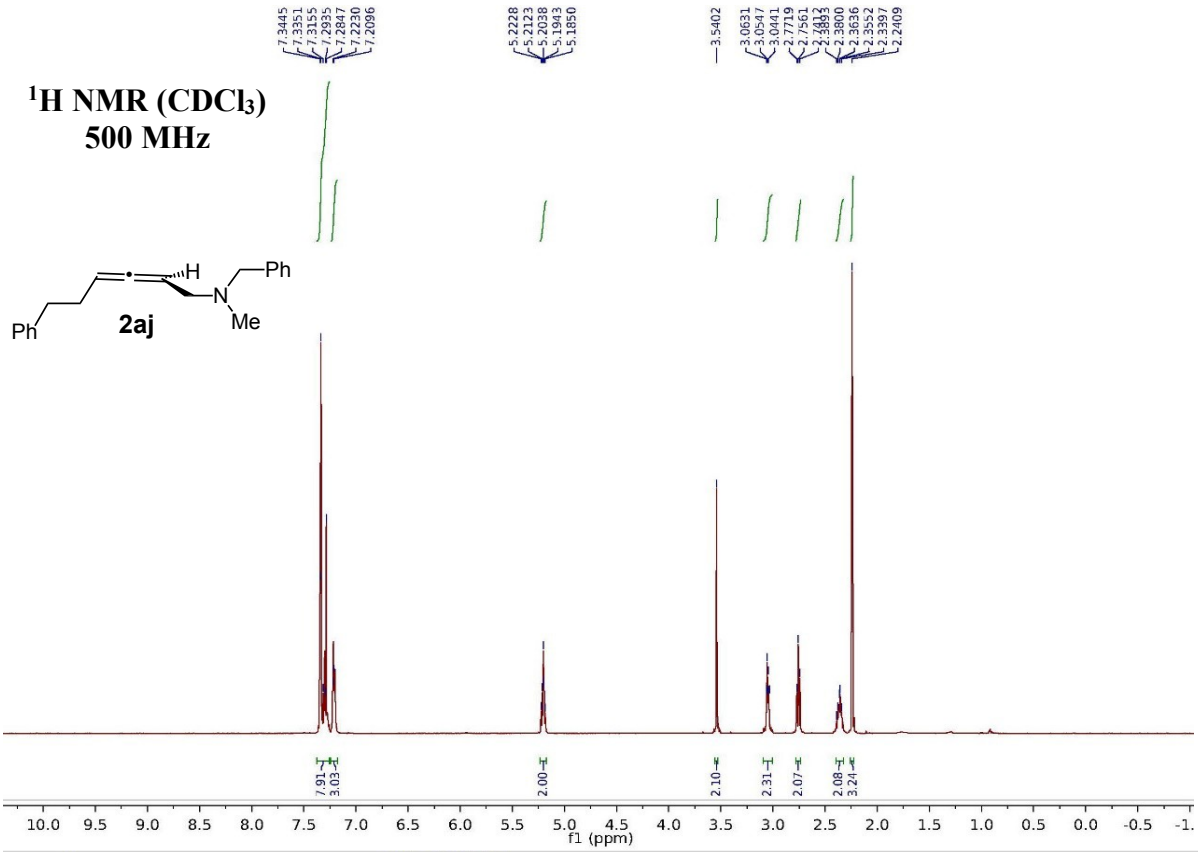
^{13}C NMR ($CDCl_3$)
125 MHz

2ai



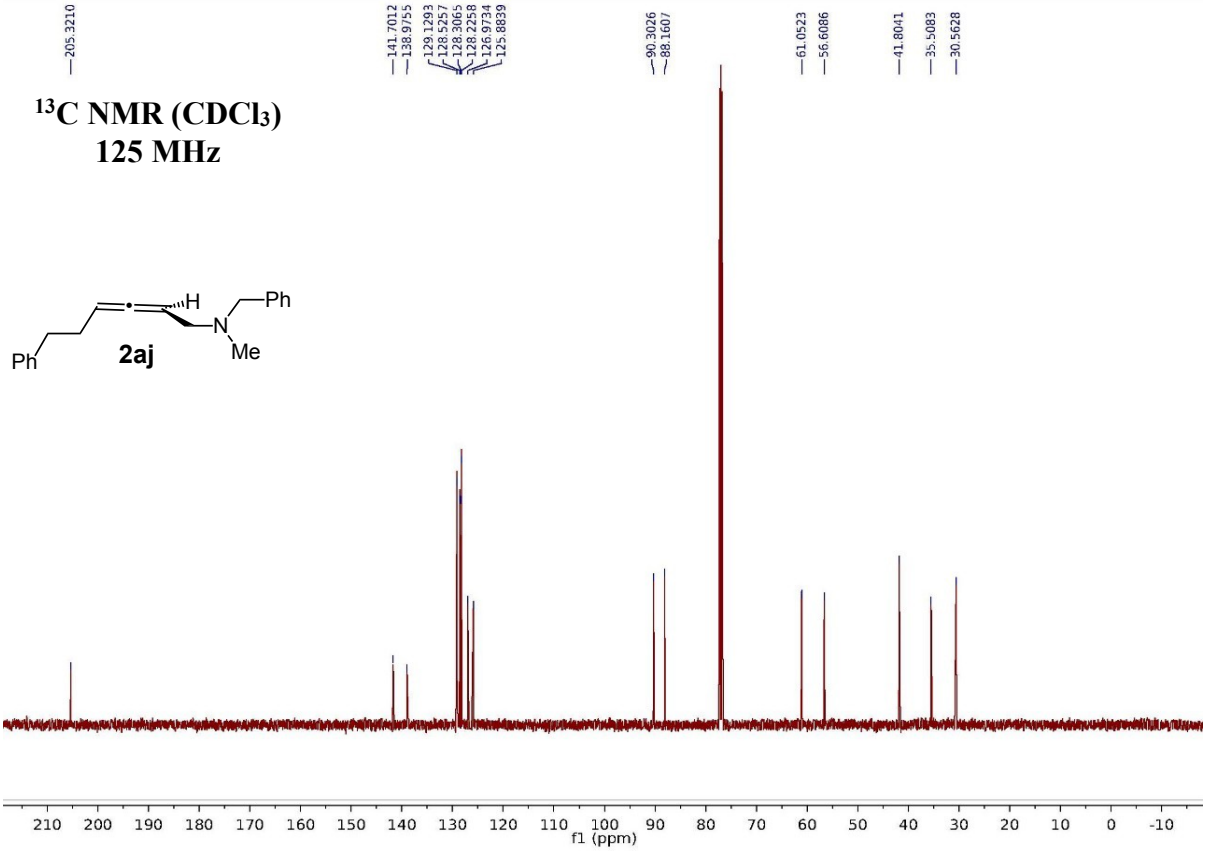
^{1}H NMR ($CDCl_3$)
500 MHz

2aj



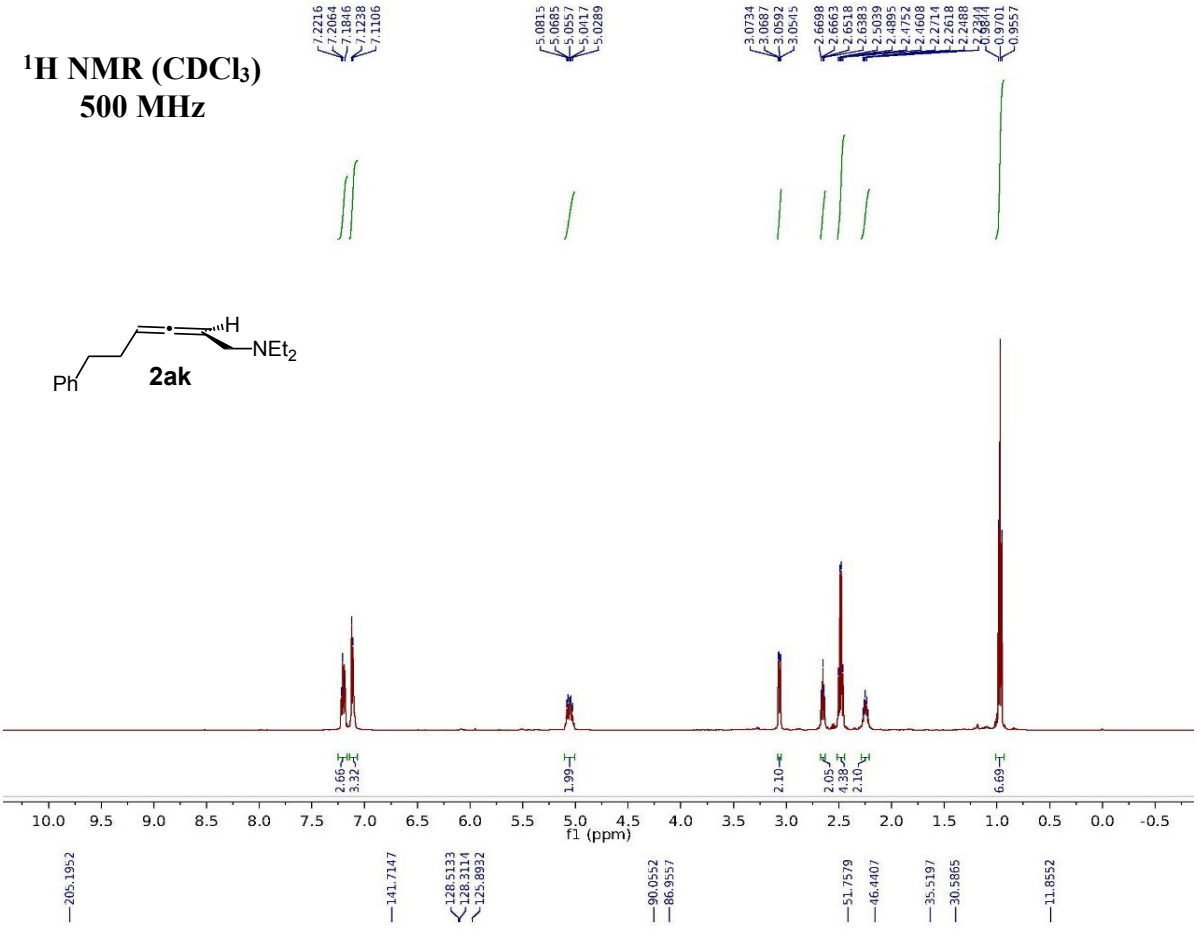
^{13}C NMR ($CDCl_3$)
125 MHz

2aj



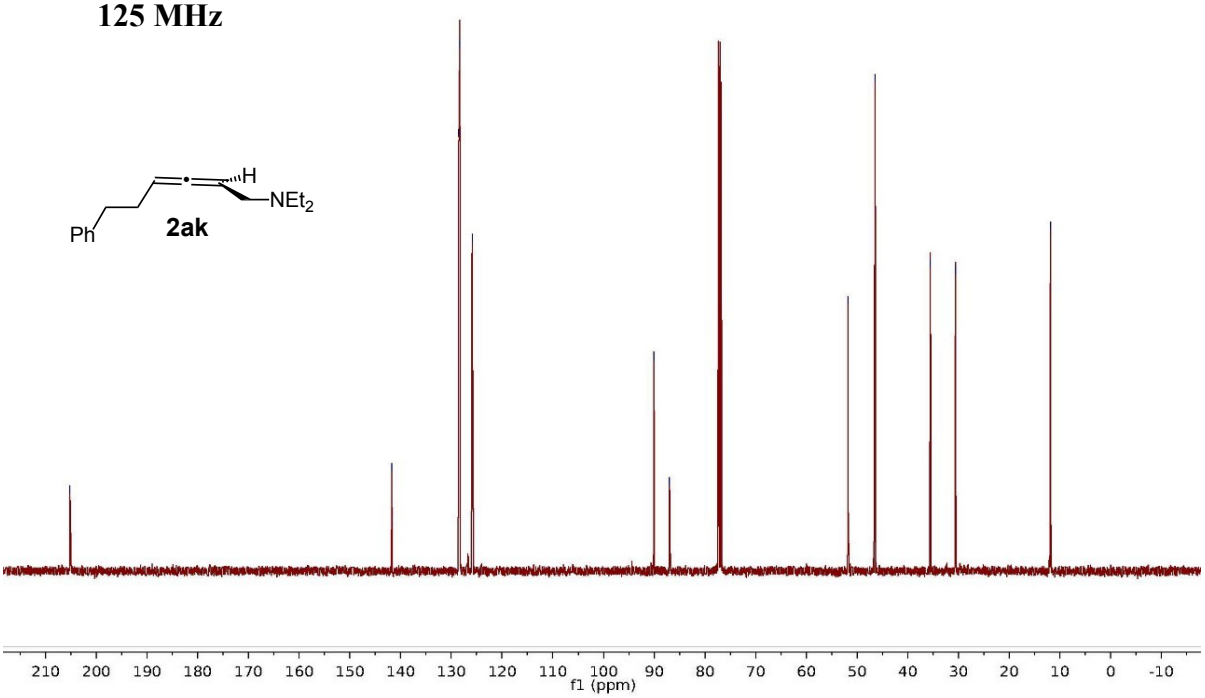
^{1}H NMR ($CDCl_3$)
500 MHz

2ak



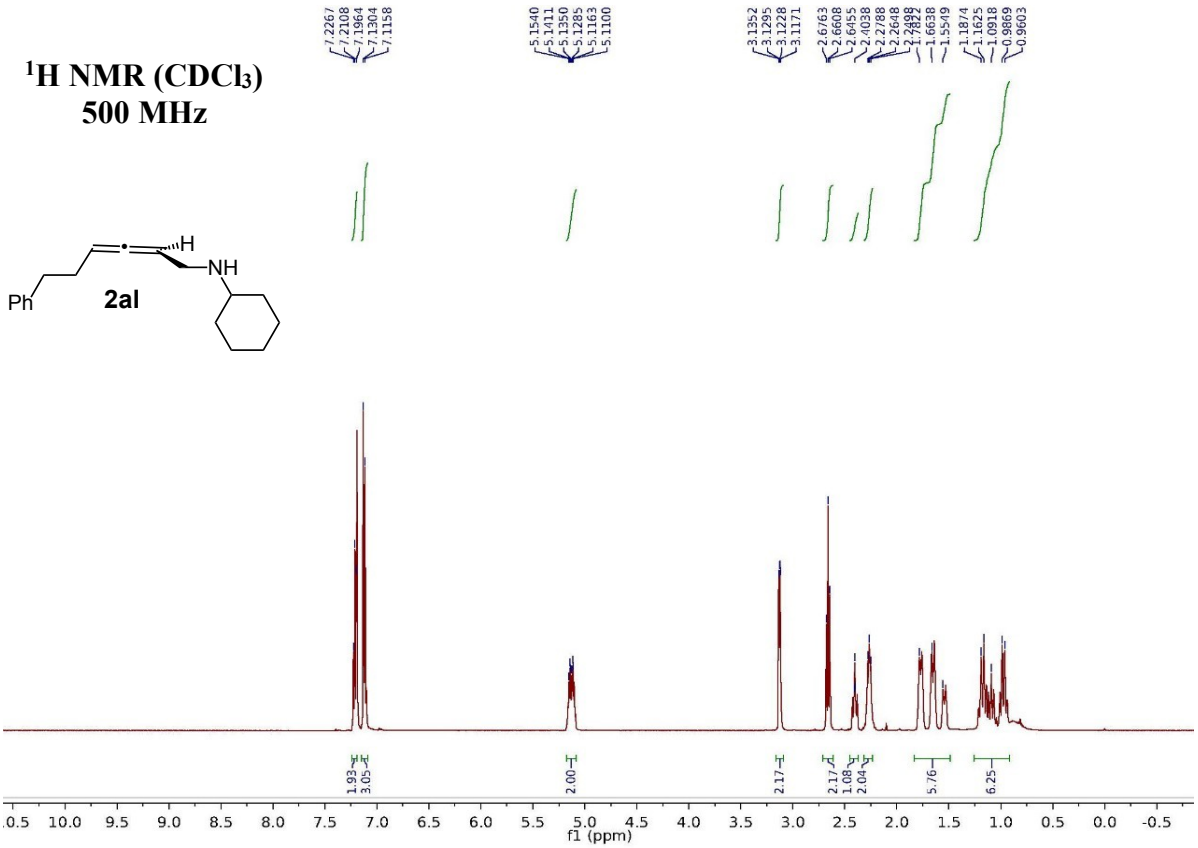
^{13}C NMR ($CDCl_3$)
125 MHz

2ak



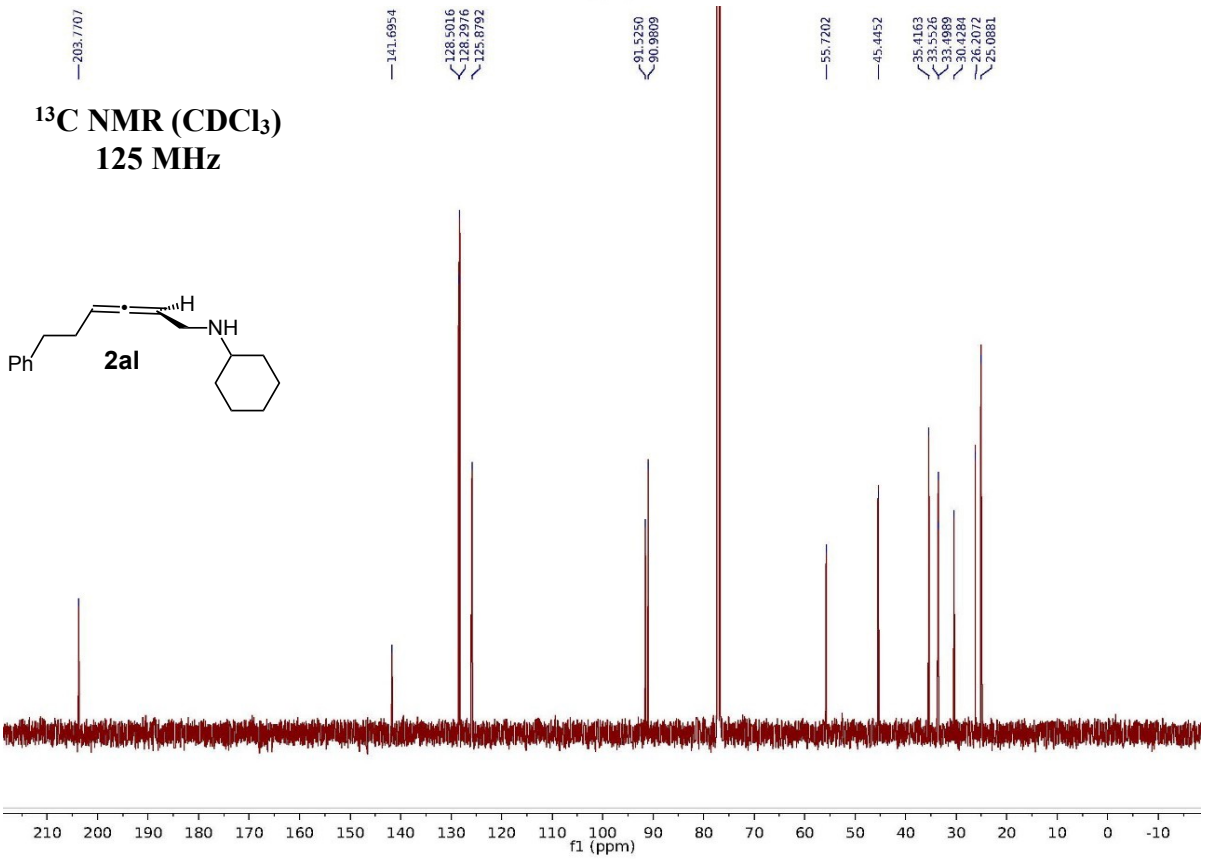
^{1}H NMR ($CDCl_3$)
500 MHz

2al

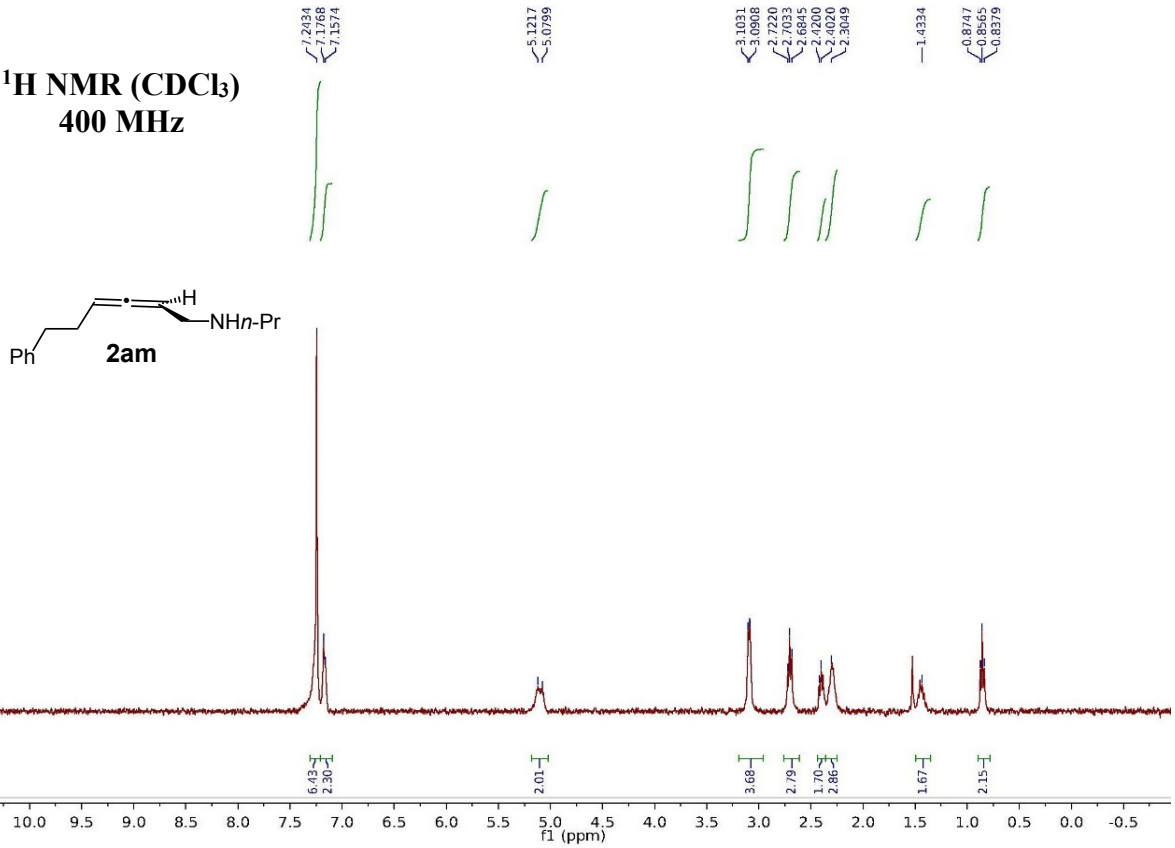


^{13}C NMR ($CDCl_3$)
125 MHz

2al

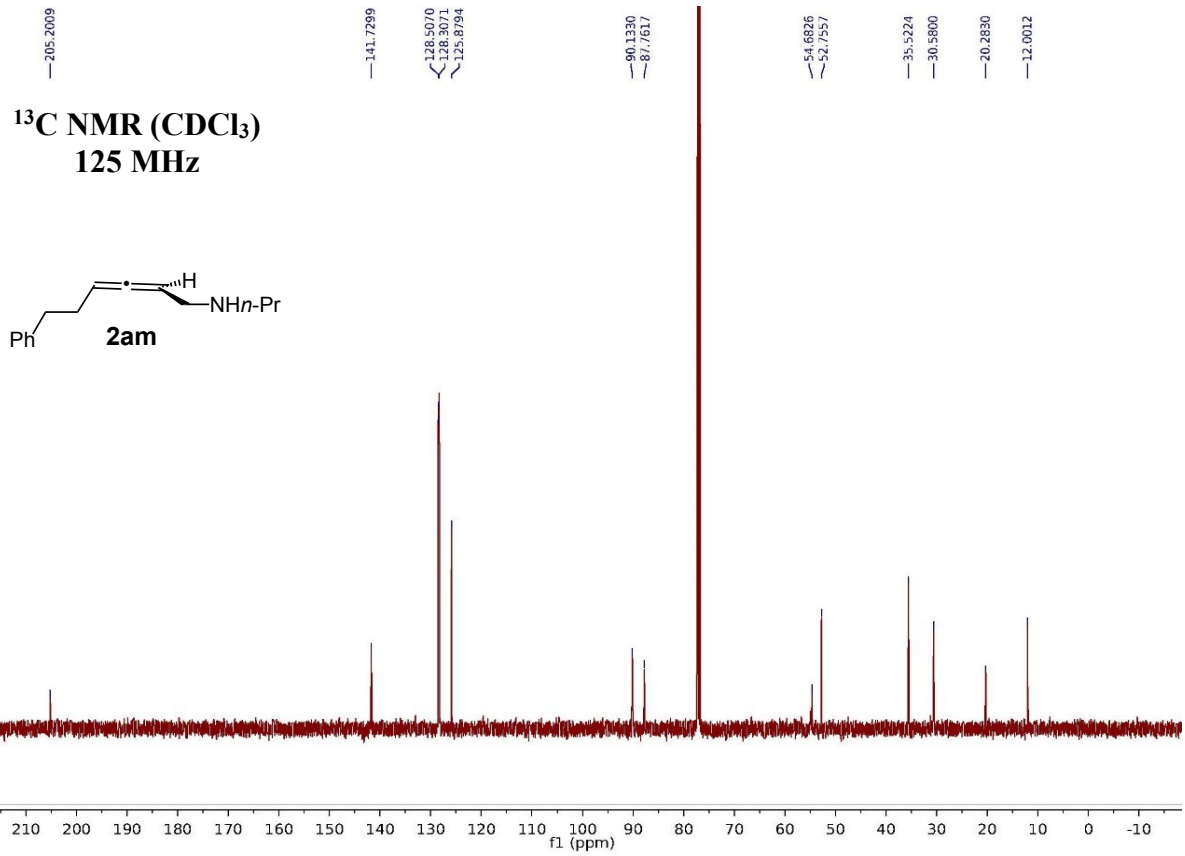


^{1}H NMR ($CDCl_3$)
400 MHz



2am

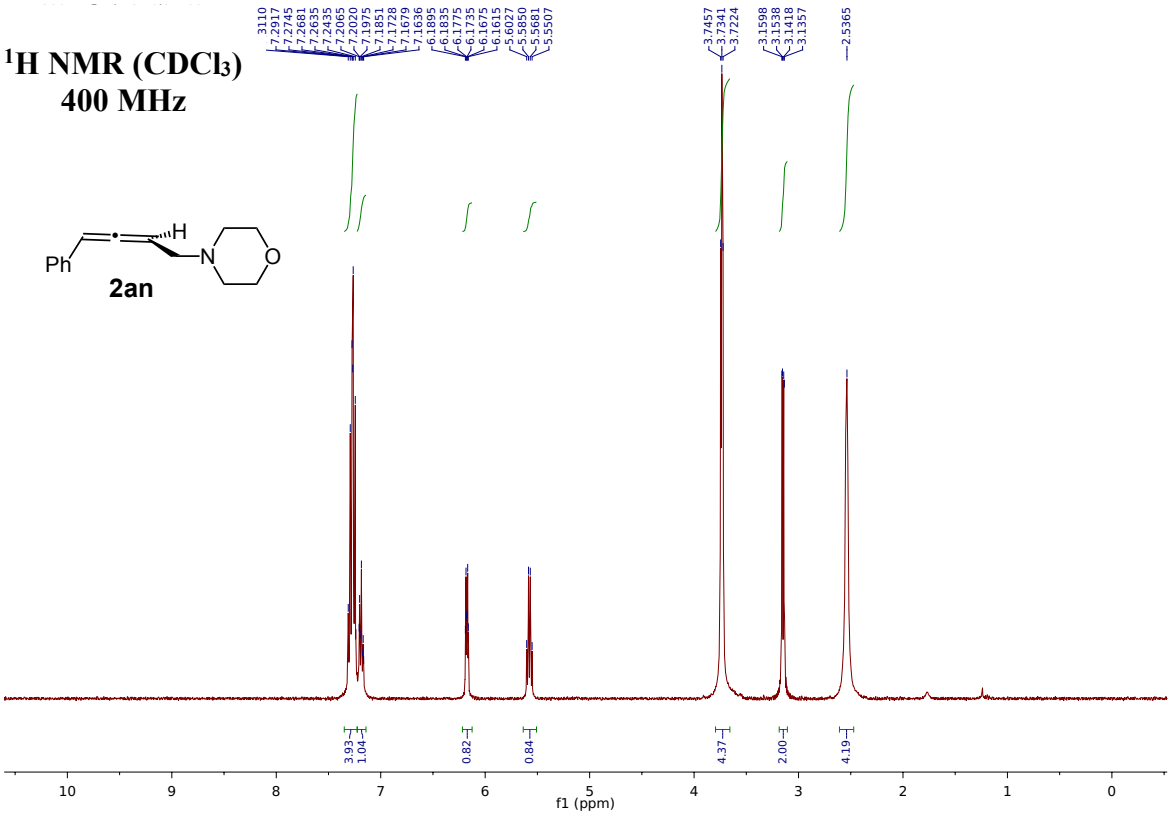
^{13}C NMR ($CDCl_3$)
125 MHz



2am

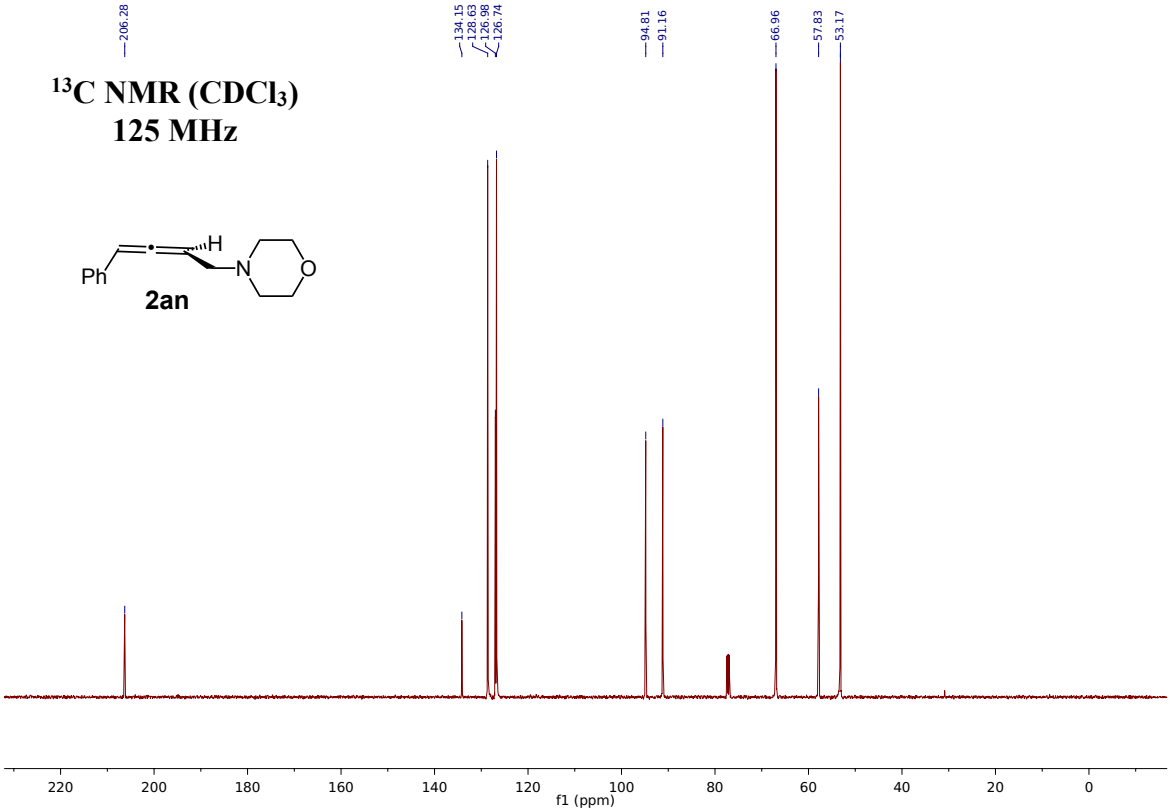
^{1}H NMR ($CDCl_3$)
400 MHz

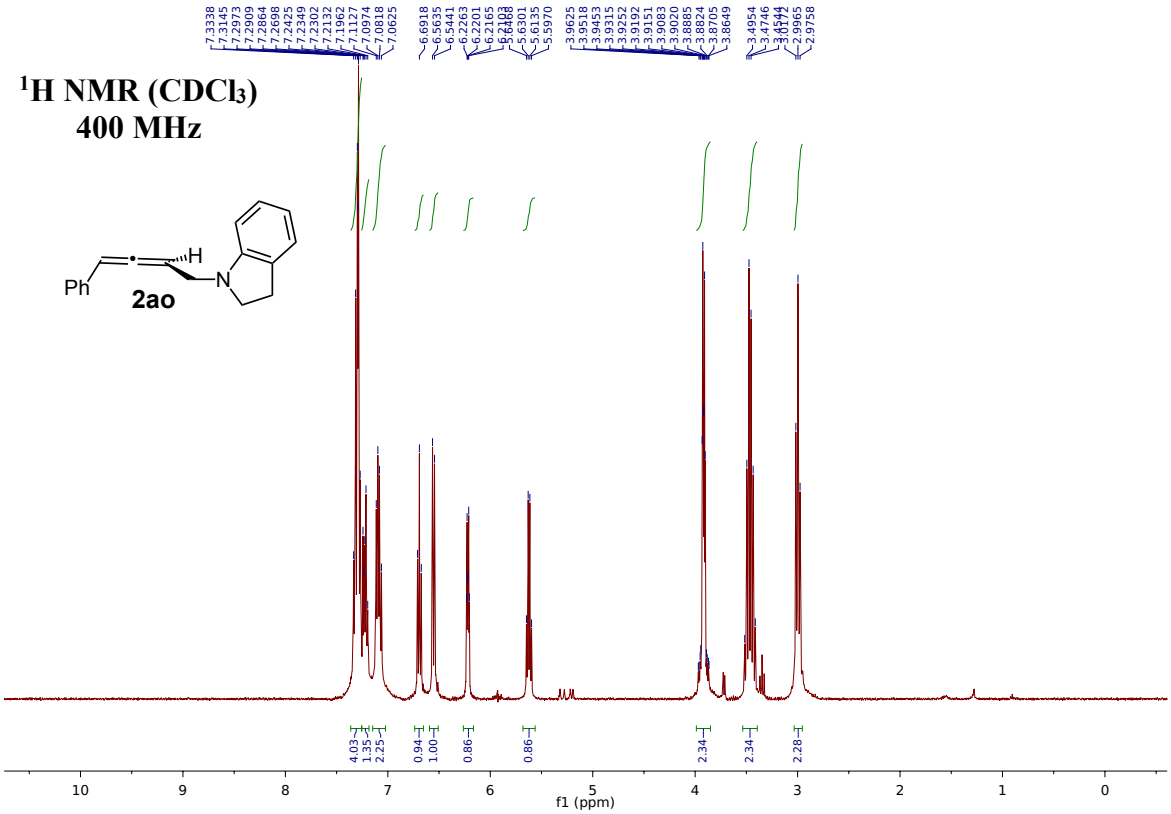
2an

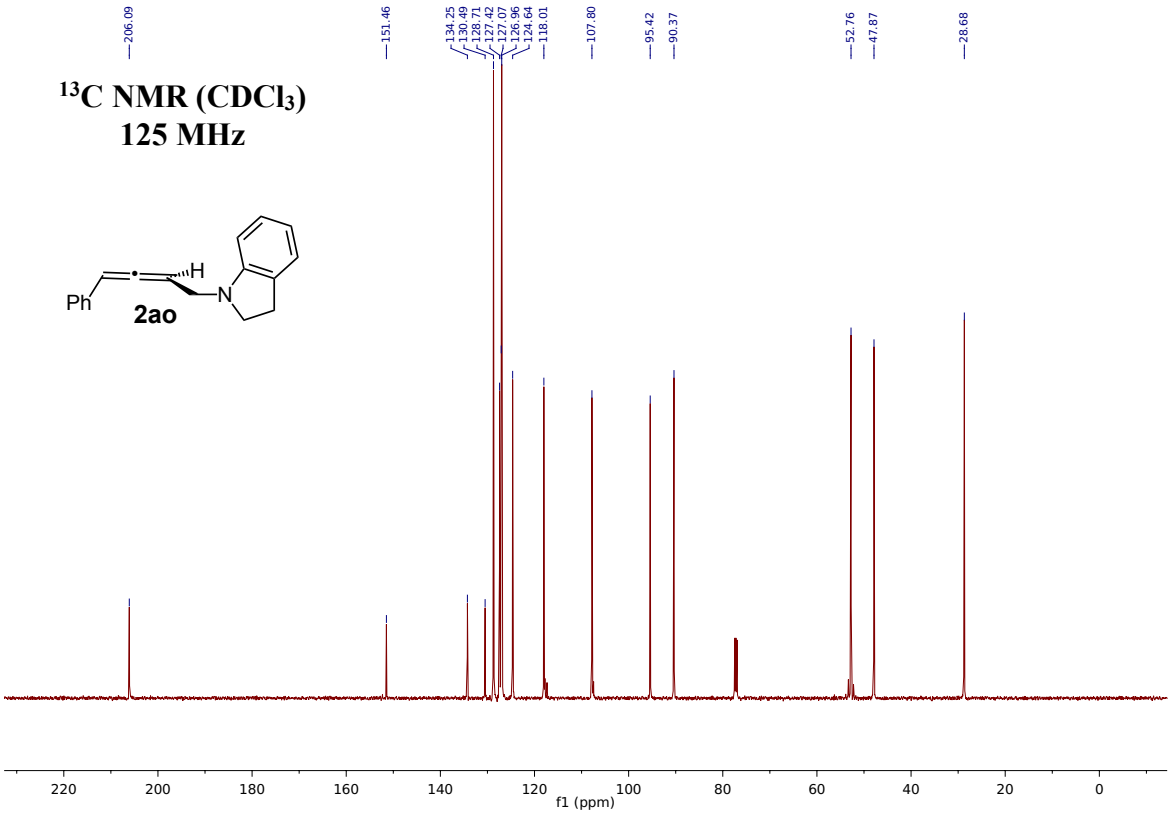


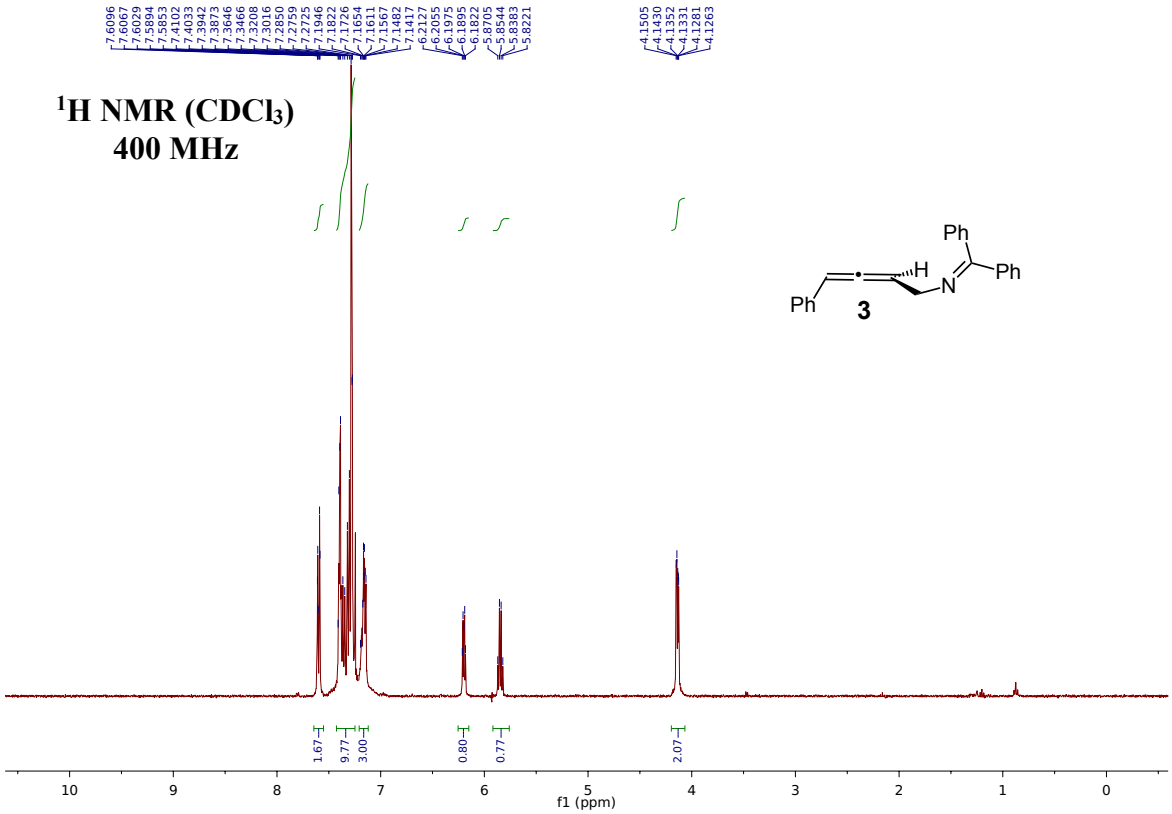
^{13}C NMR ($CDCl_3$)
125 MHz

2an



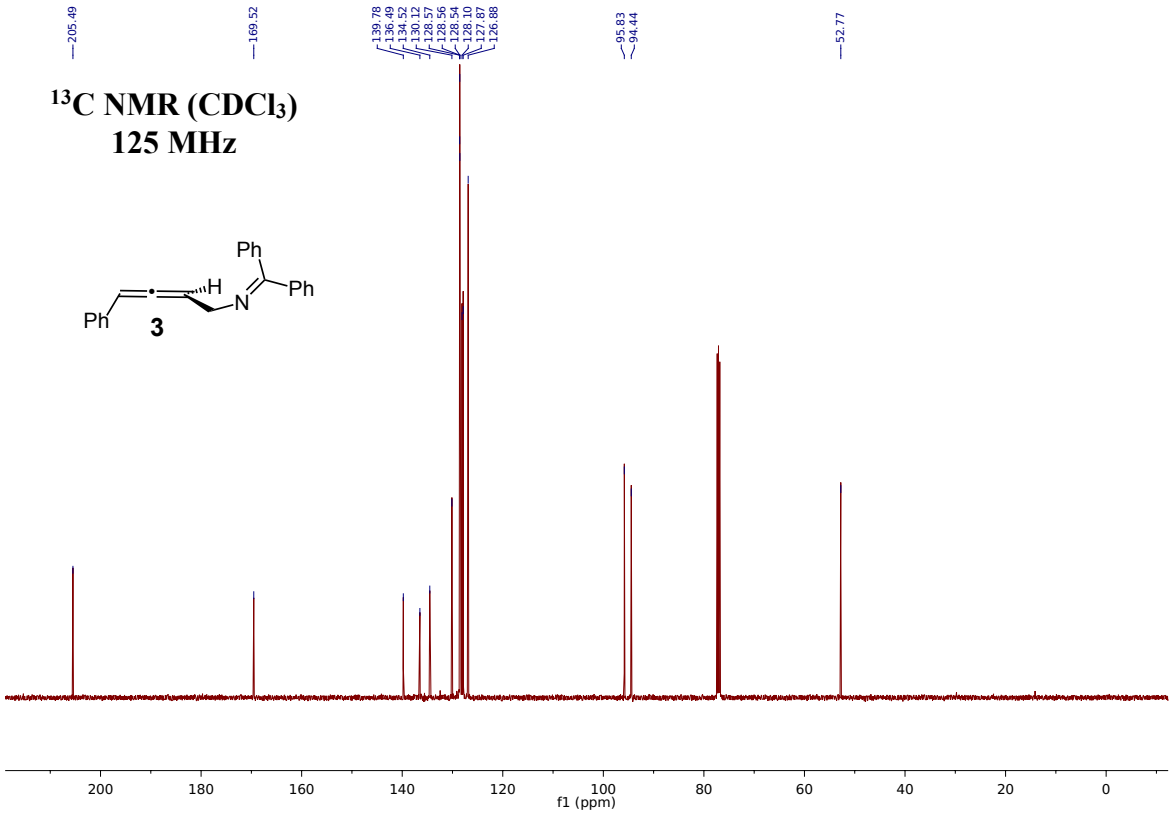

^{1}H NMR (CDCl$_3$)
400 MHz
Ph
H
N
2ao
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
Ph
H
N
2ao
f1 (ppm)



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

3

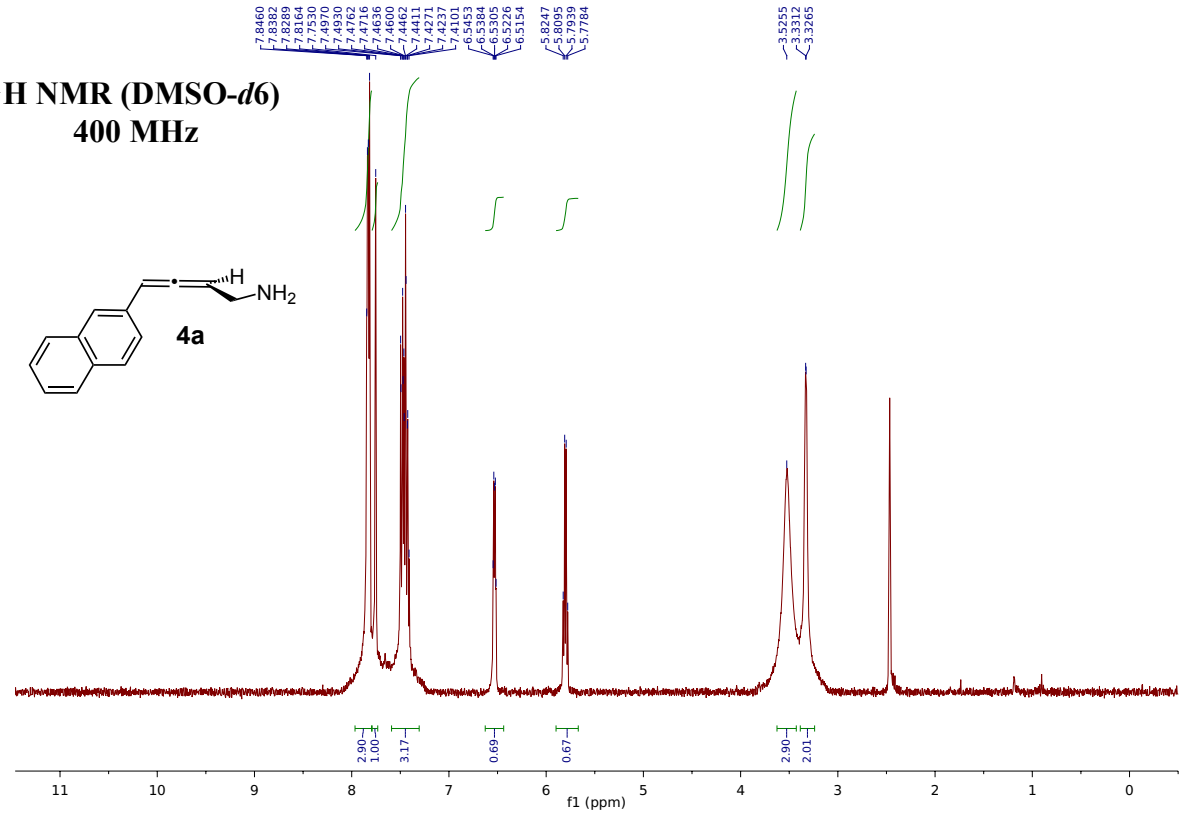


^{13}C NMR ($CDCl_3$)
125 MHz

3

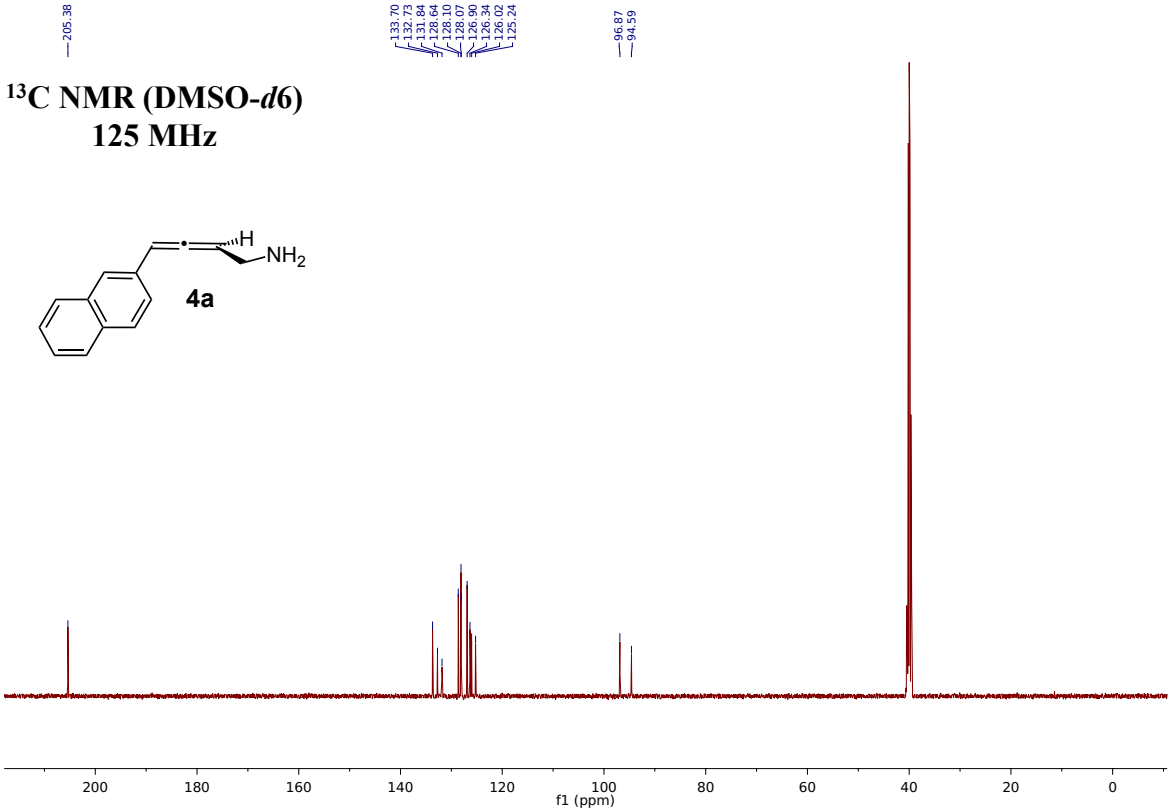
^{1}H NMR (DMSO-*d*6)
400 MHz

4a



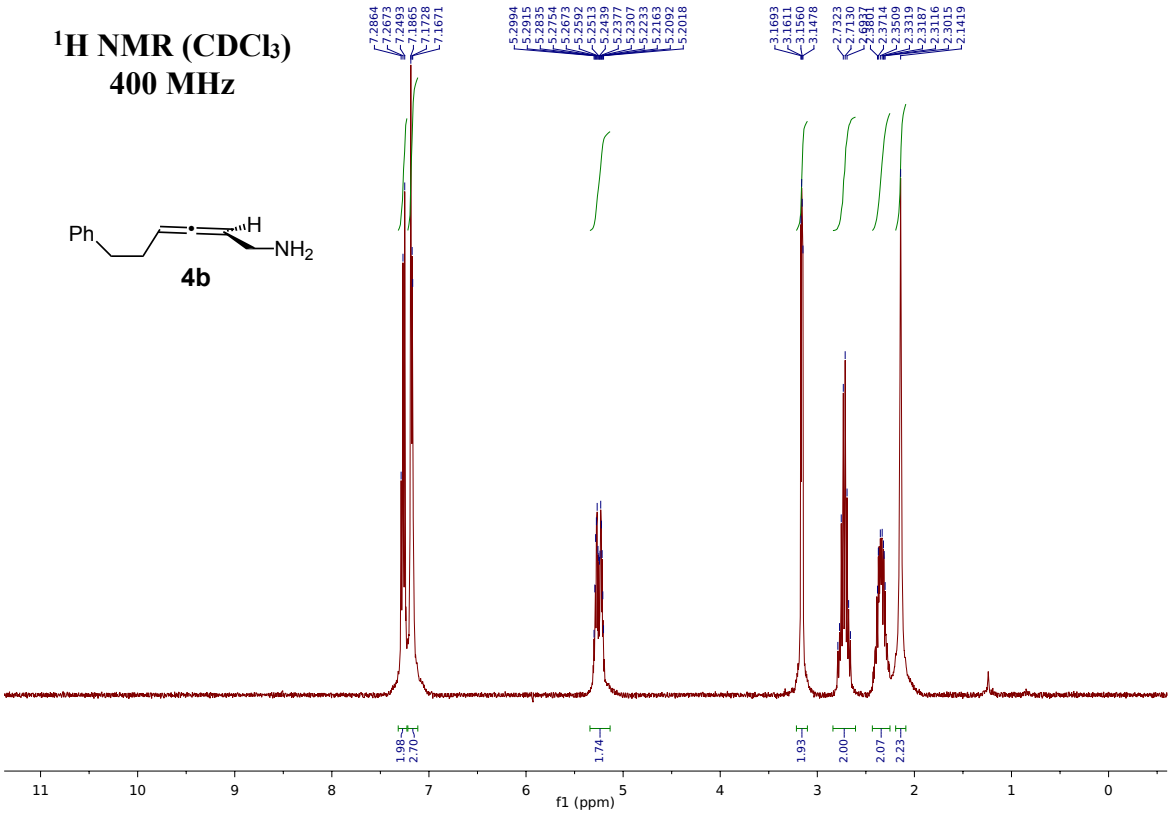
^{13}C NMR (DMSO-*d*6)
125 MHz

4a



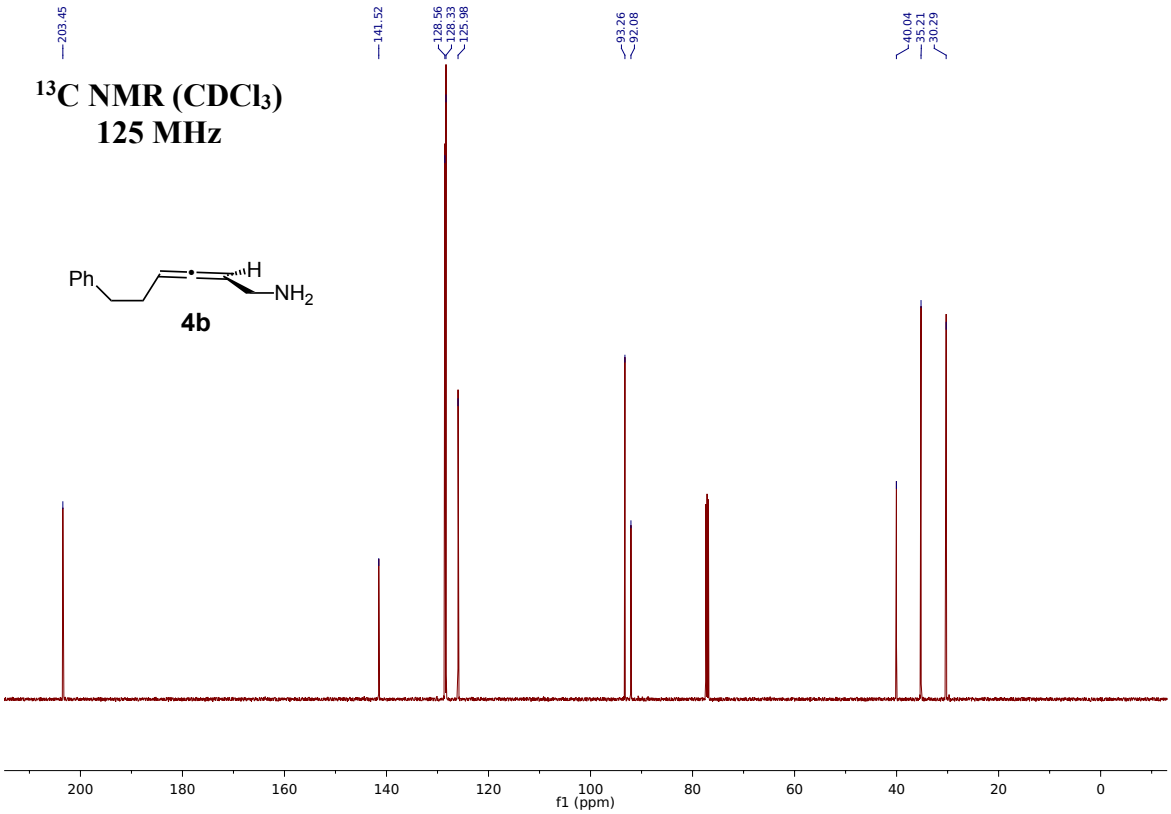
^{1}H NMR ($CDCl_3$)
400 MHz

4b



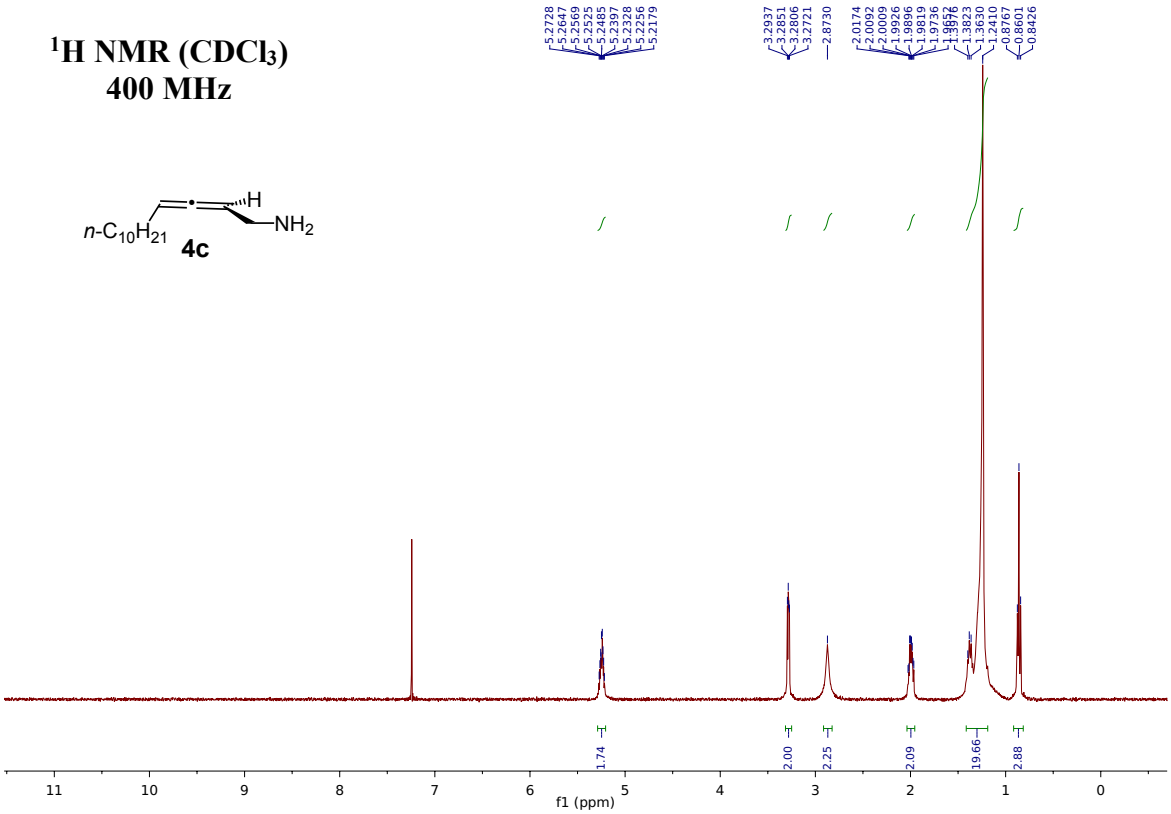
^{13}C NMR ($CDCl_3$)
125 MHz

4b



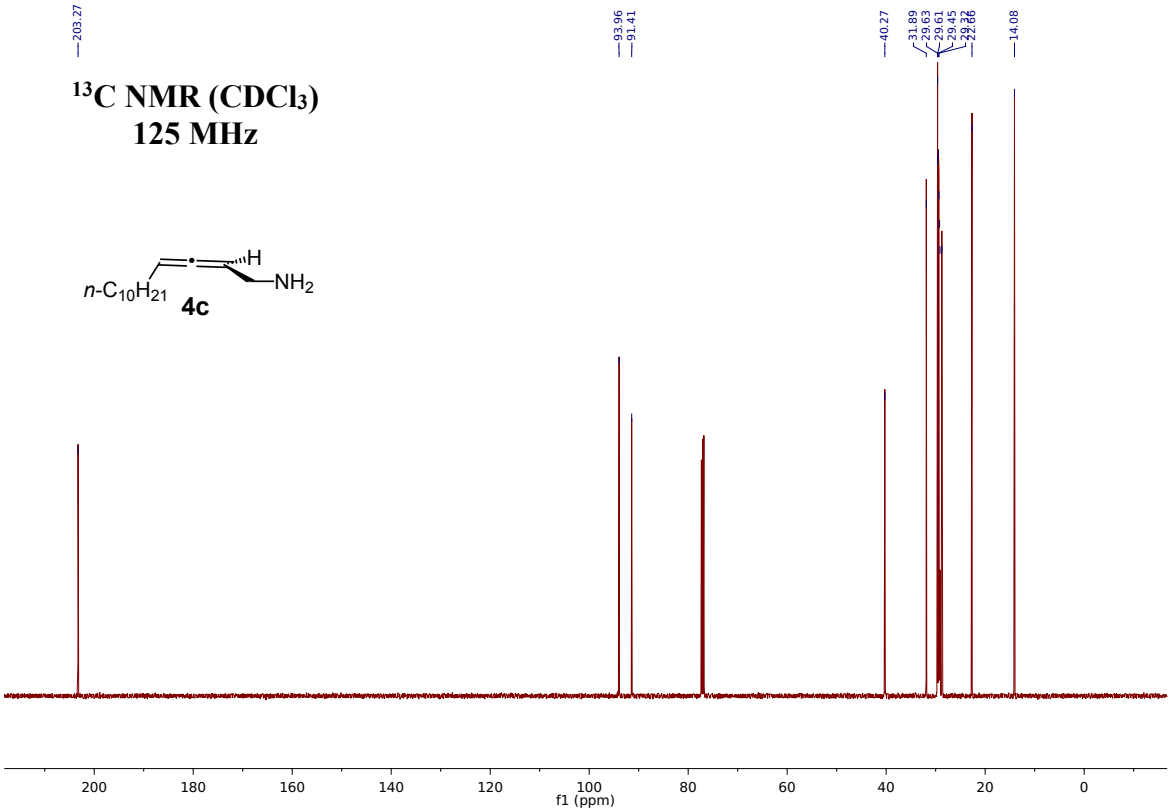
^{1}H NMR ($CDCl_3$)
400 MHz

4c



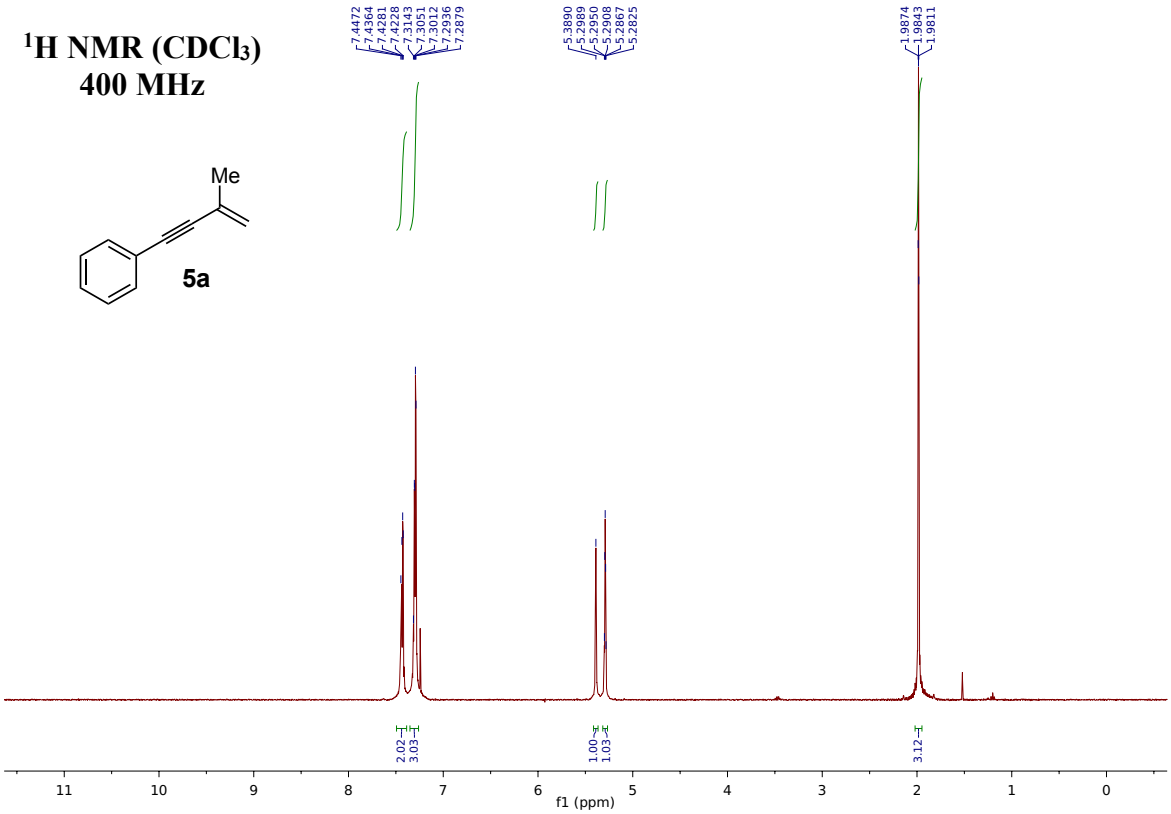
^{13}C NMR ($CDCl_3$)
125 MHz

4c

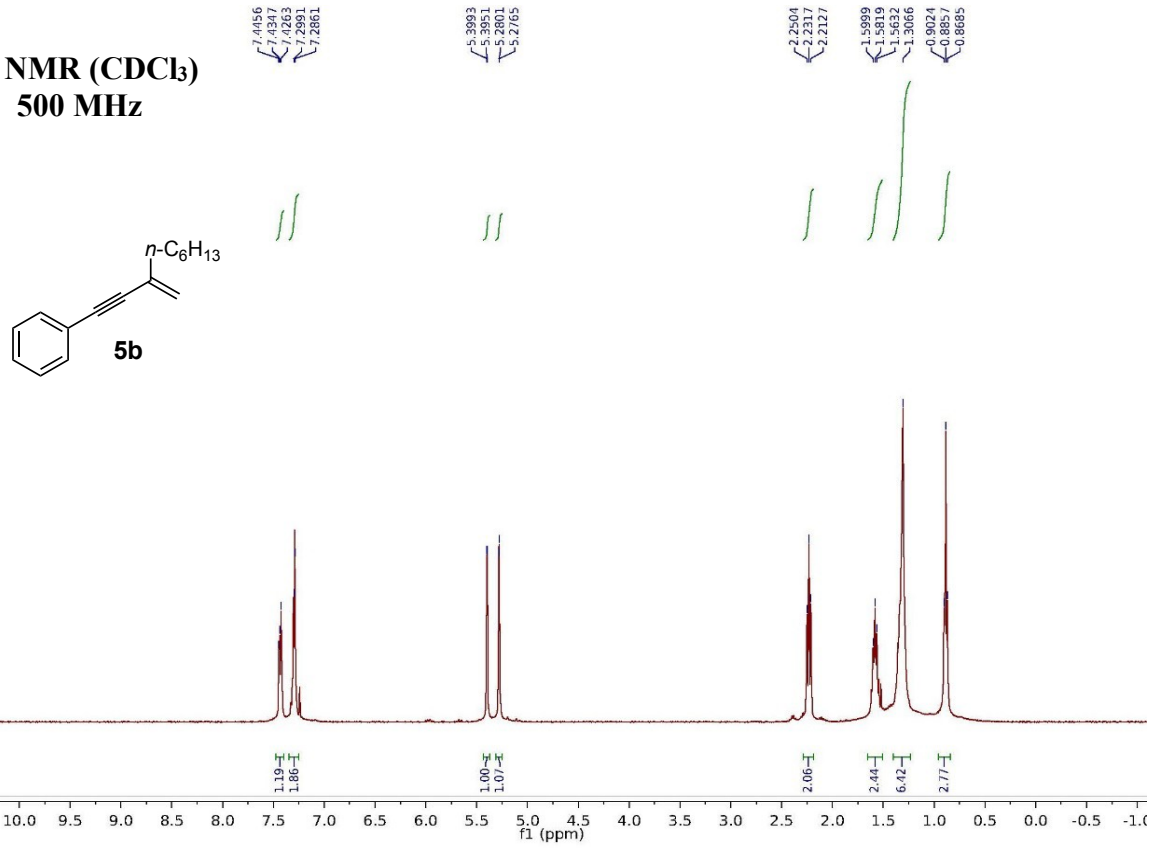


^{1}H NMR ($CDCl_3$)
400 MHz

5a

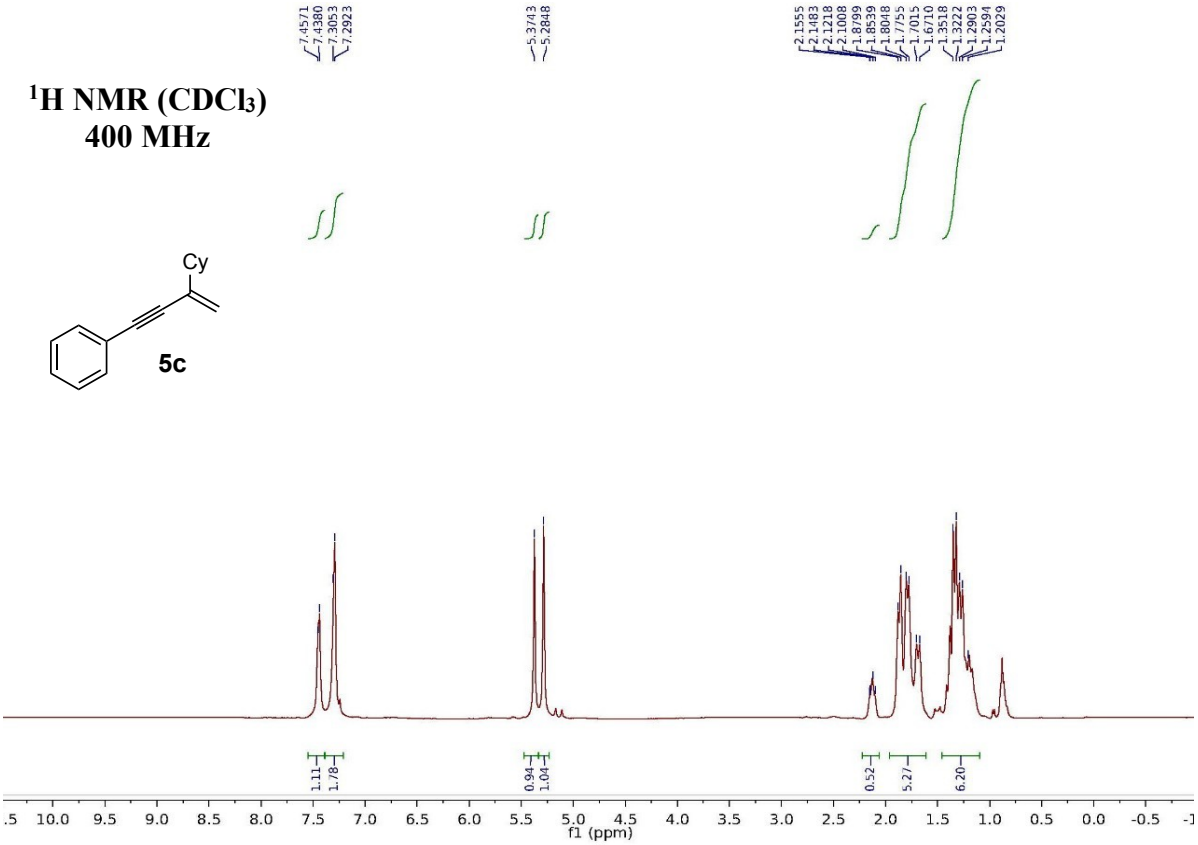


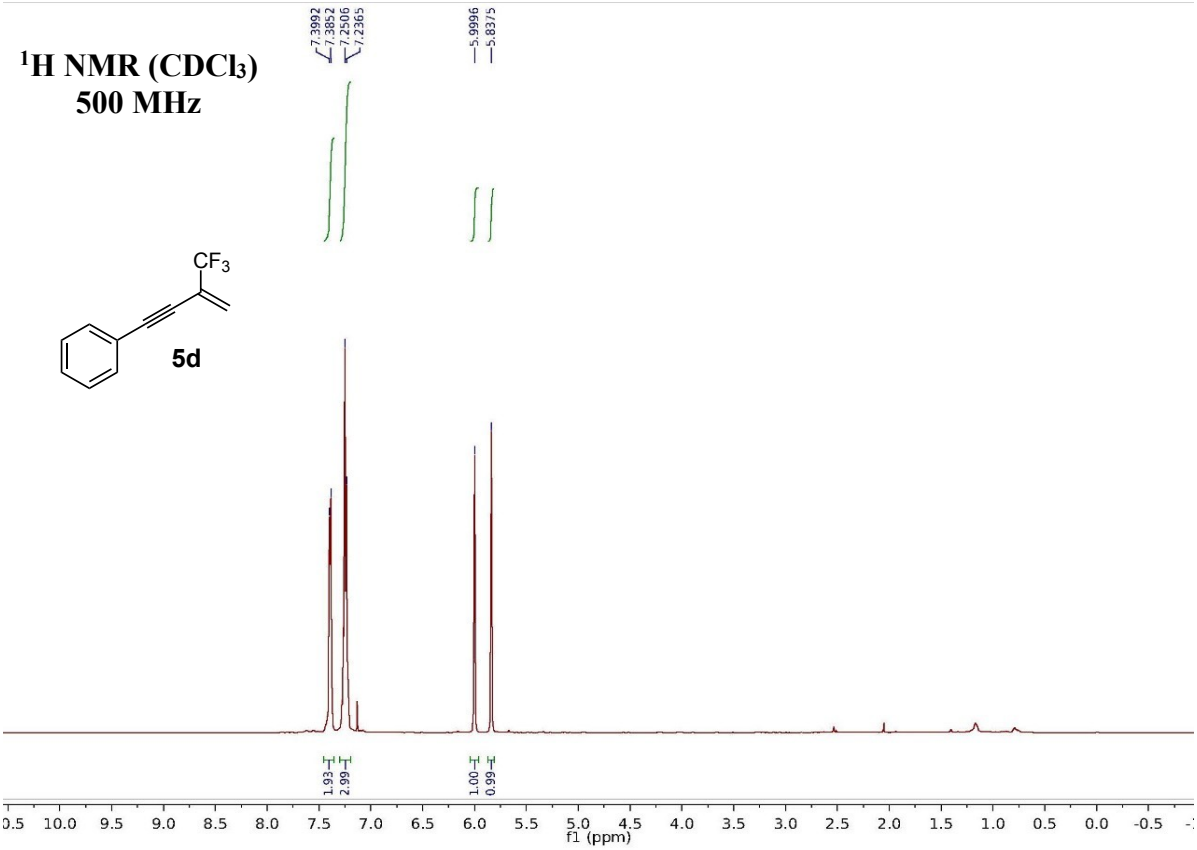
^{1}H NMR ($CDCl_3$)
500 MHz



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

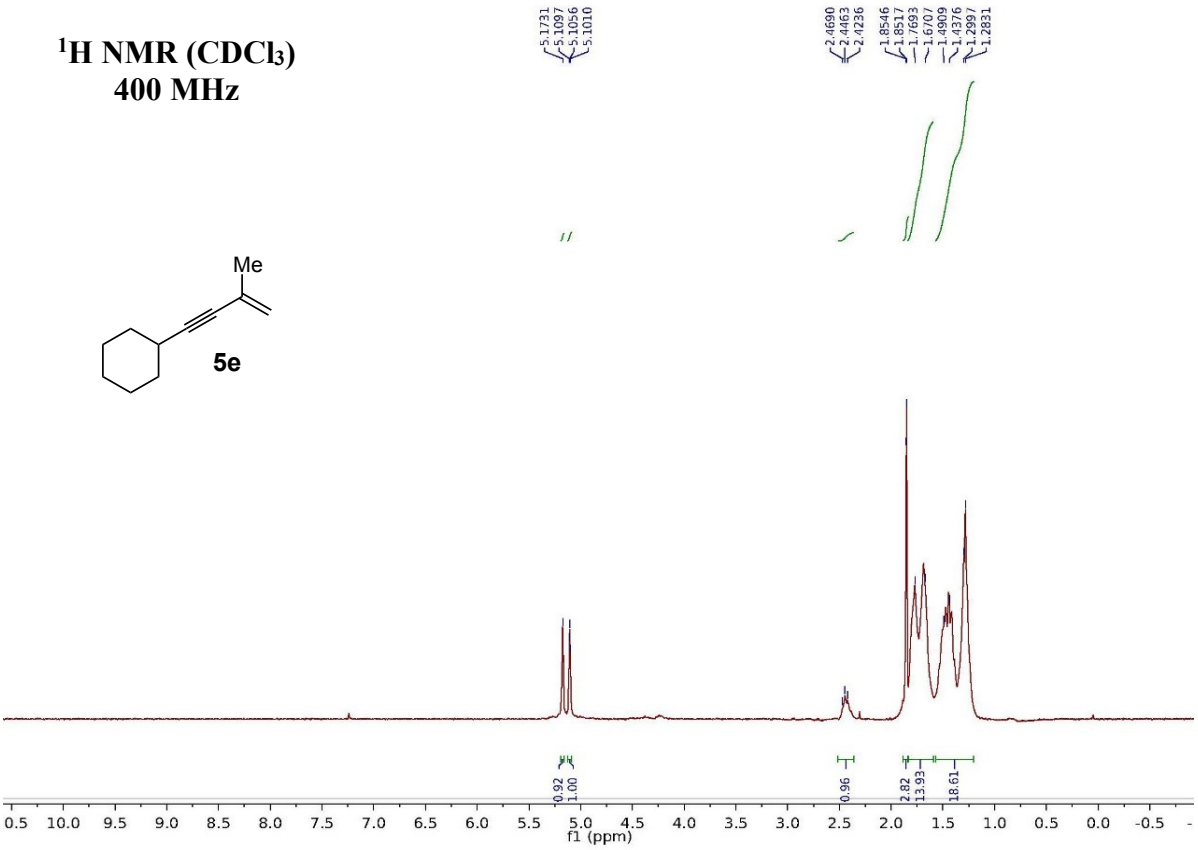
5c




^{1}H NMR (CDCl$_3$)
500 MHz
CF$_3$
5d
7.3992
7.3852
7.2506
7.2365
5.9996
5.8375
1.93
2.99
1.00
0.99
f1 (ppm)

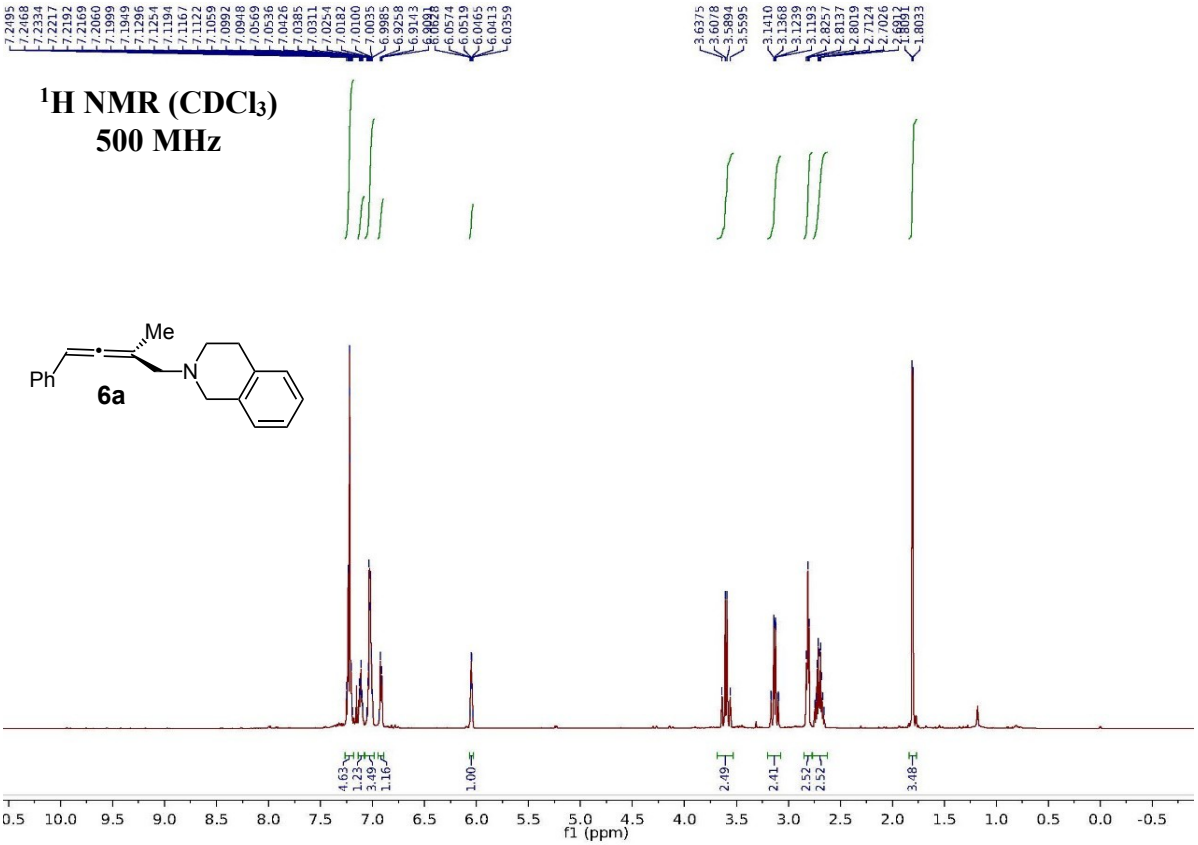
^{1}H NMR ($CDCl_3$)
400 MHz

5e



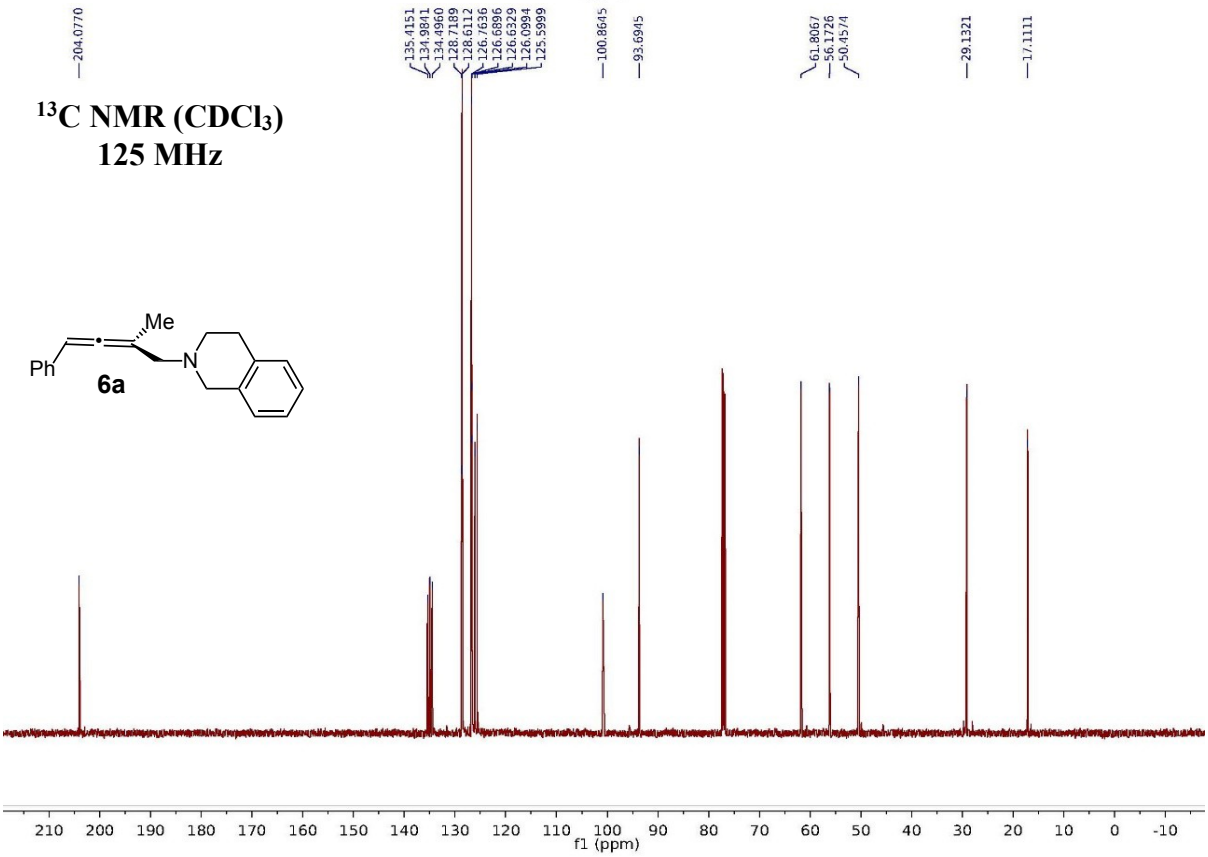
^{1}H NMR ($CDCl_3$)
500 MHz

6a



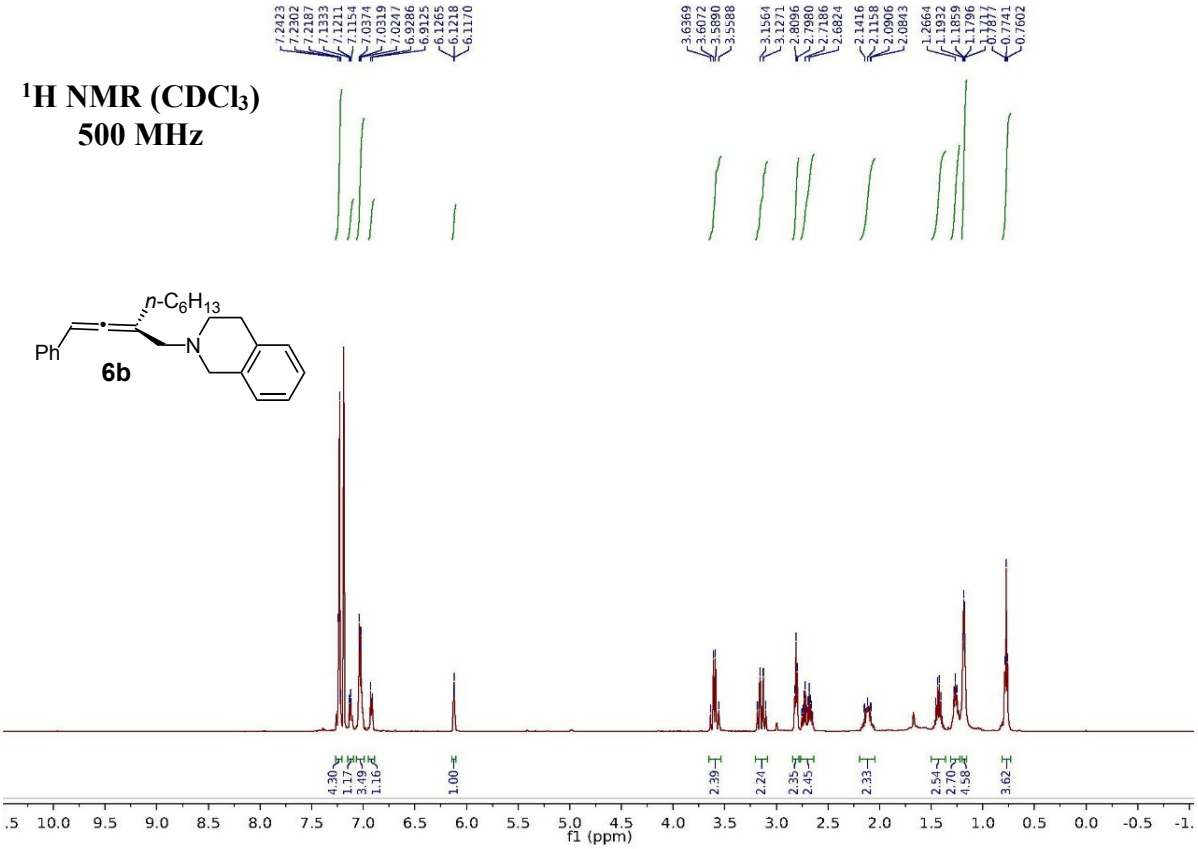
^{13}C NMR ($CDCl_3$)
125 MHz

6a



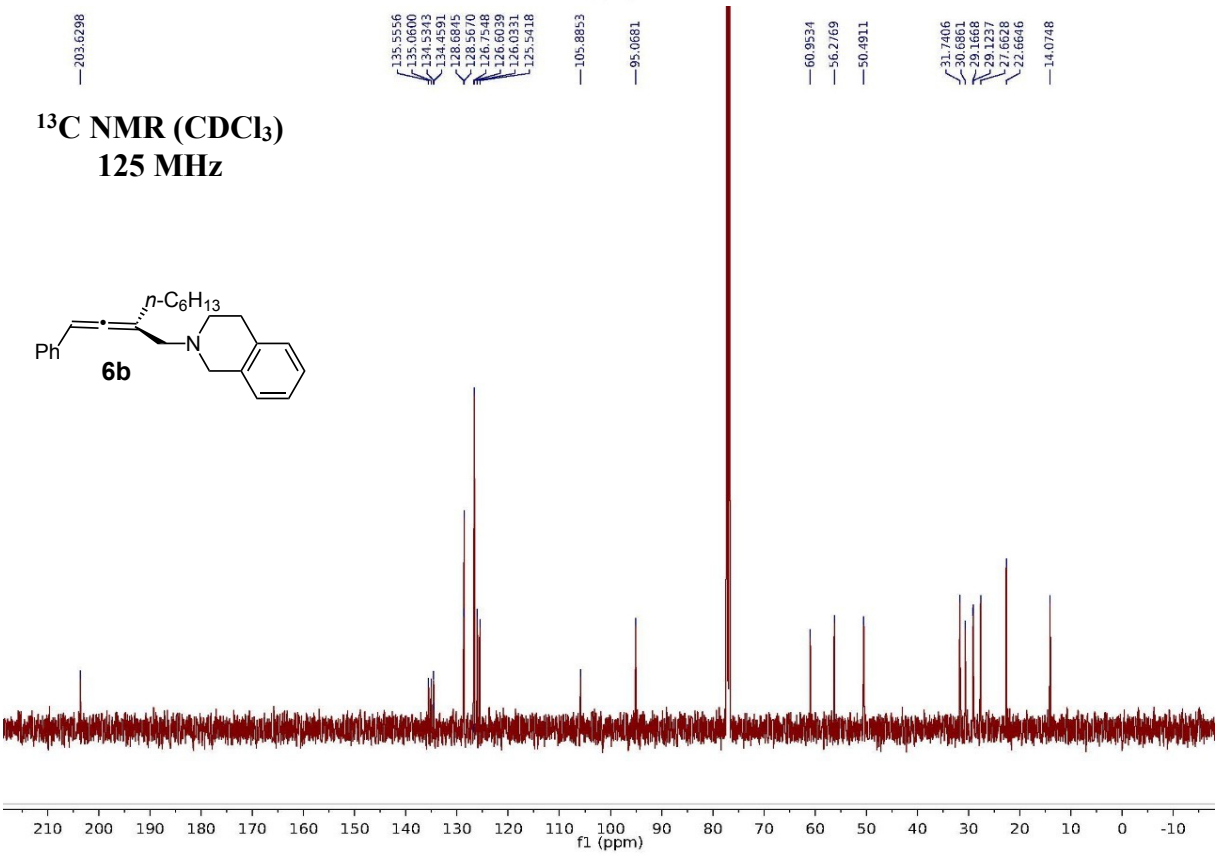
^{1}H NMR ($CDCl_3$)
500 MHz

6b



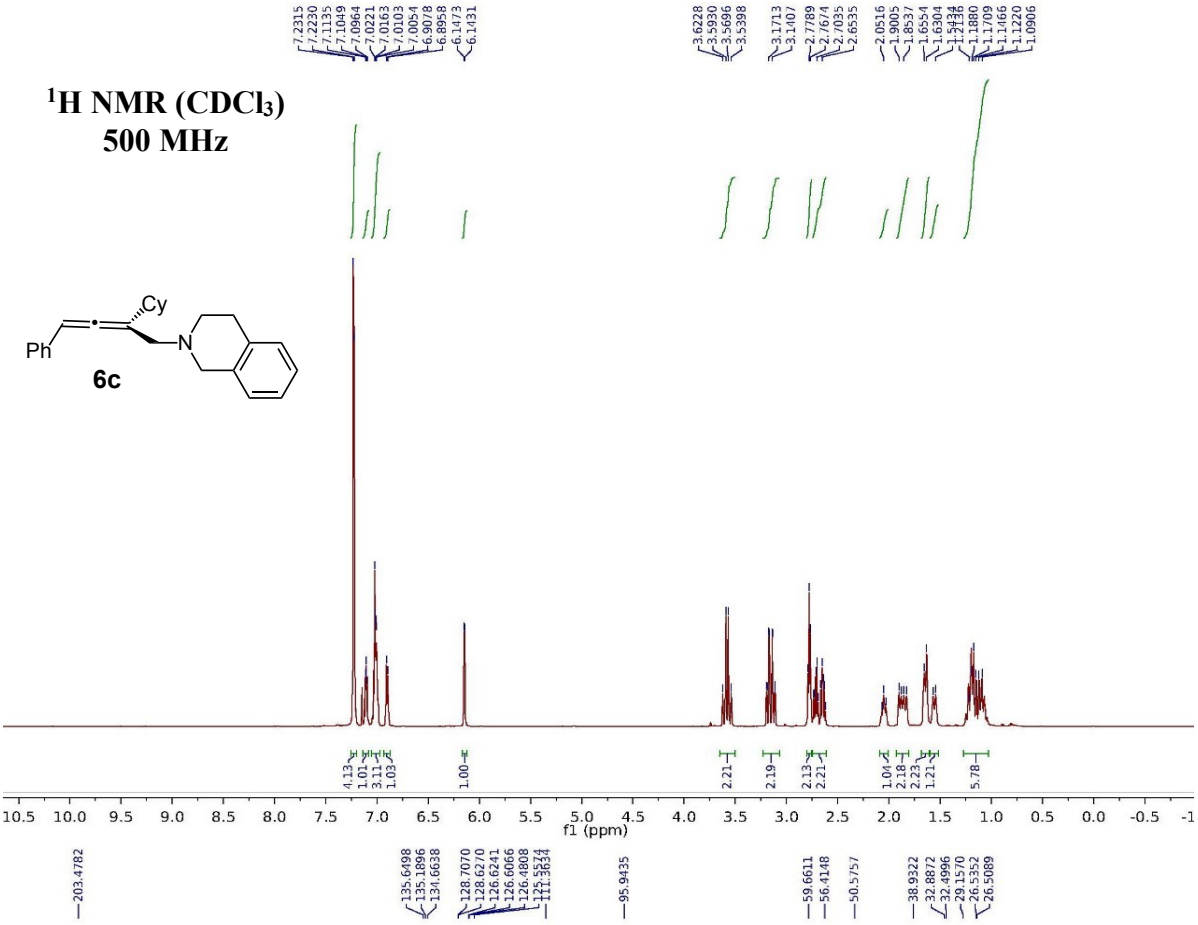
^{13}C NMR ($CDCl_3$)
125 MHz

6b



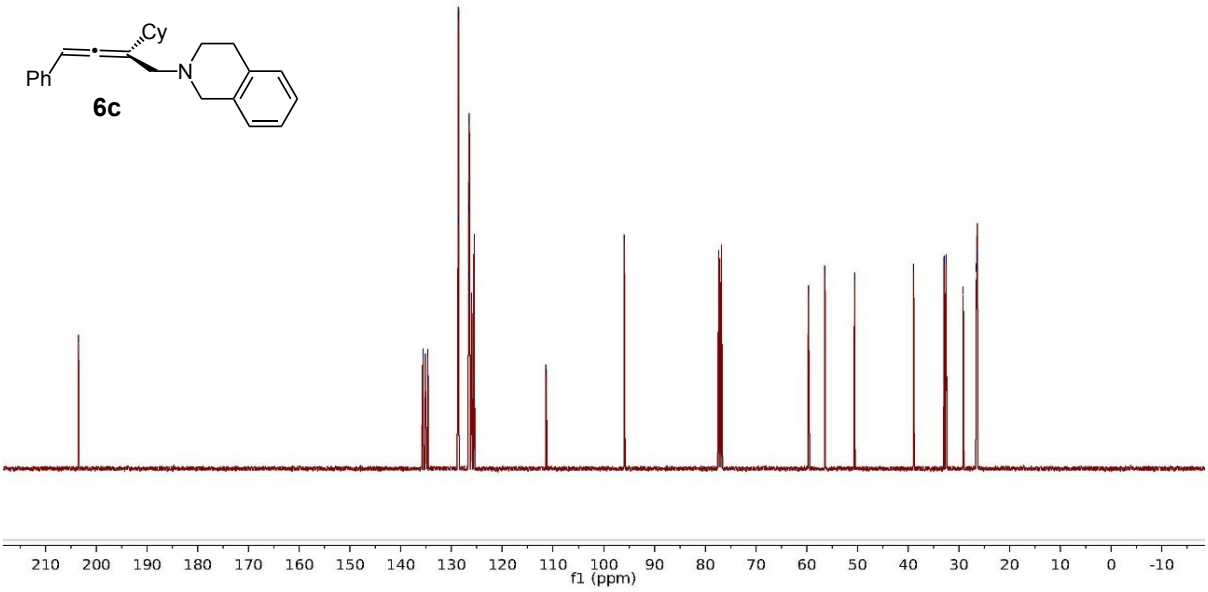
^{1}H NMR ($CDCl_3$)
500 MHz

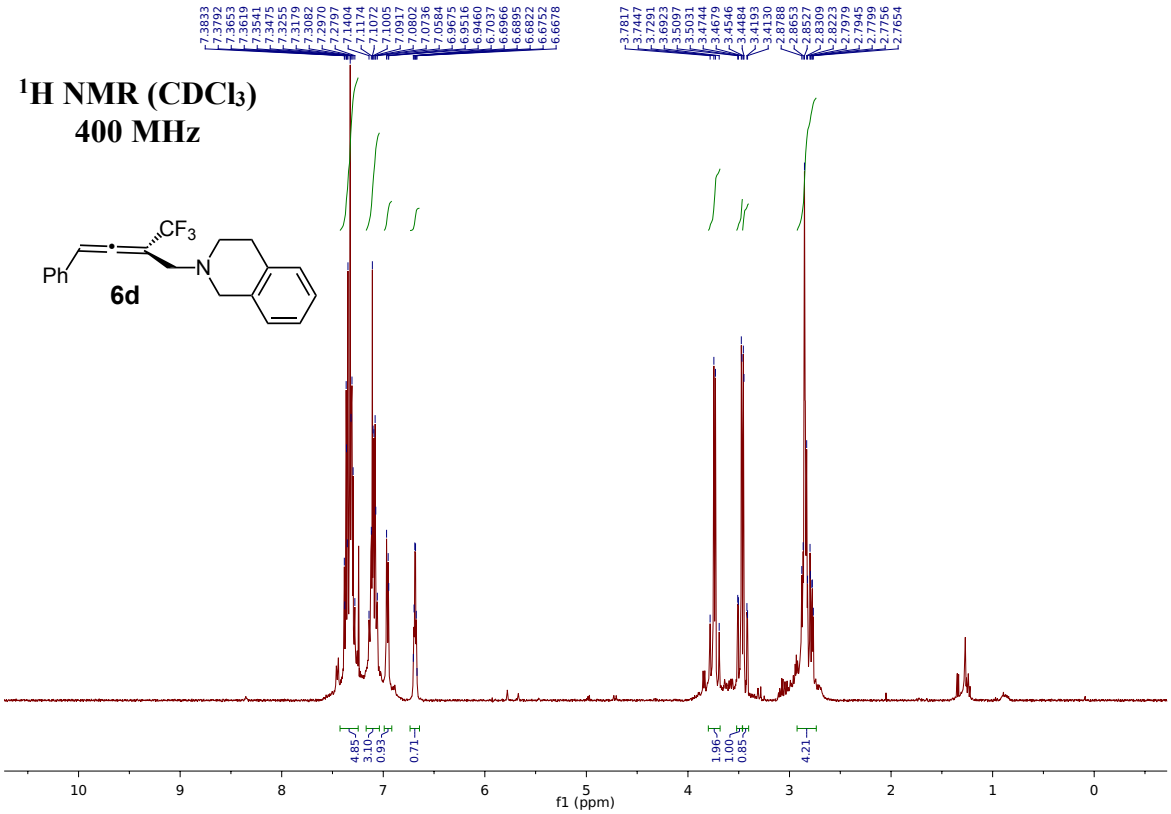
6c

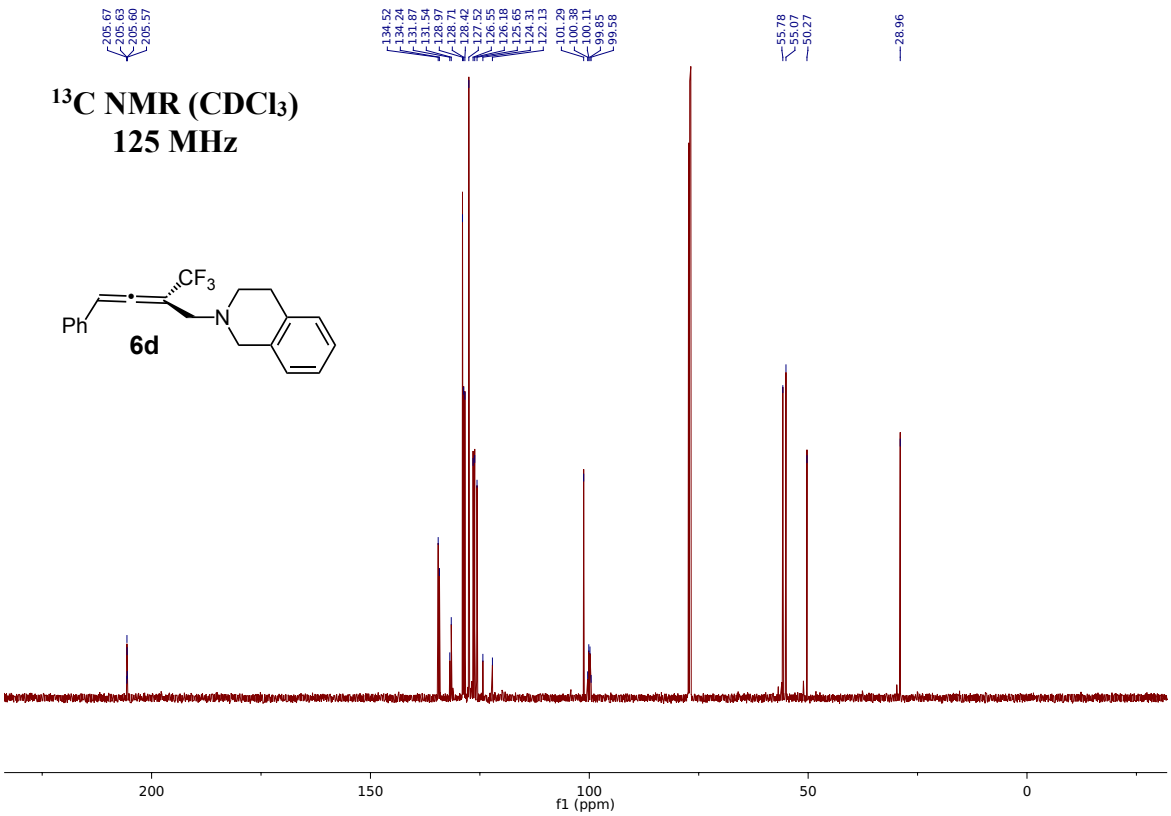


^{13}C NMR ($CDCl_3$)
125 MHz

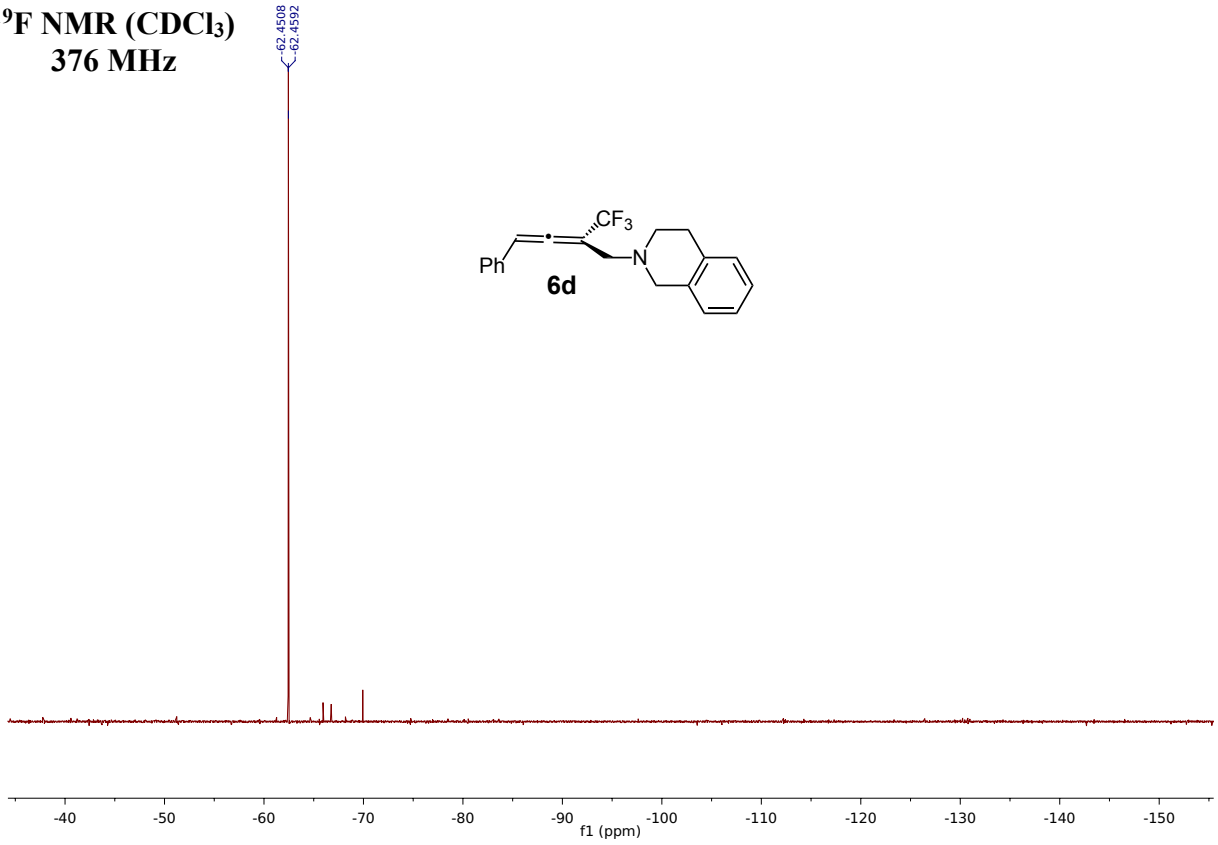
6c




^{1}H NMR (CDCl$_3$)
400 MHz
CF3
Ph
N
6d
f1 (ppm)

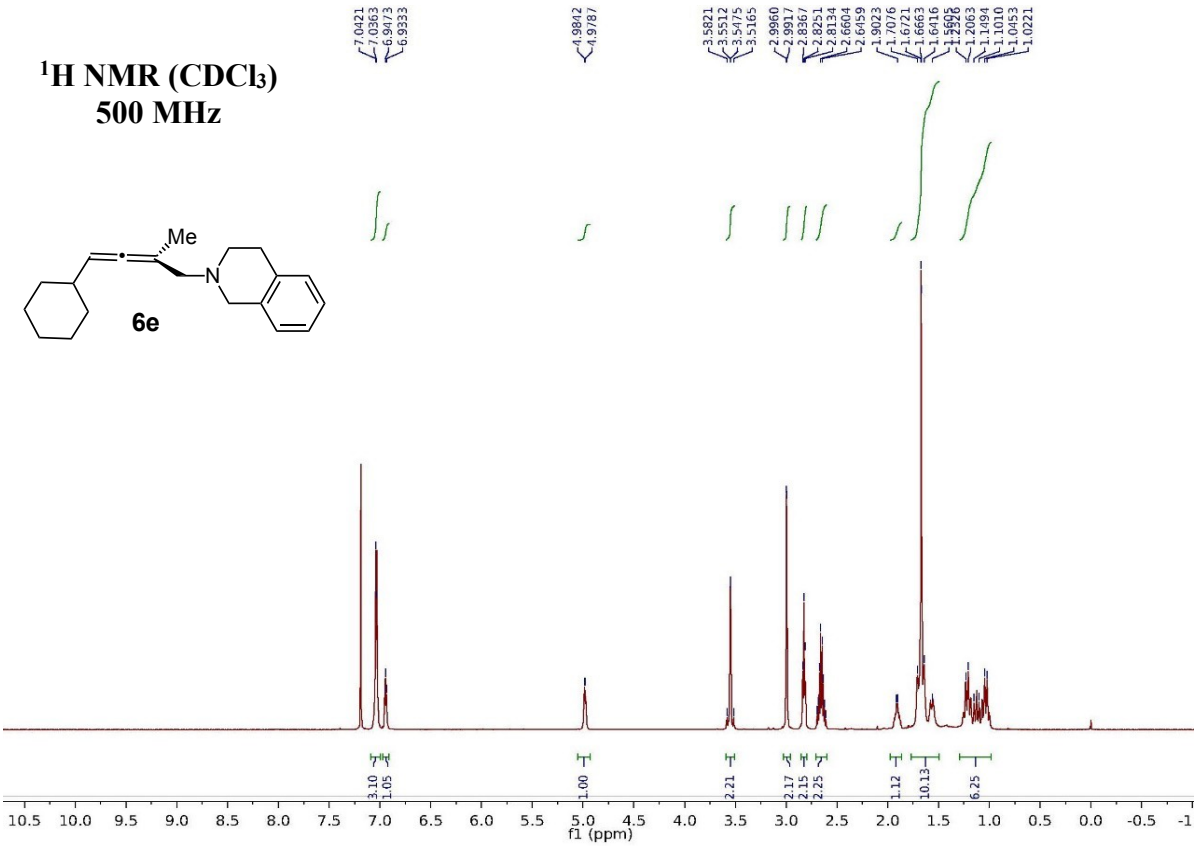

^{13}C NMR (CDCl$_3$)
125 MHz
CF3
Ph
N
6d
f1 (ppm)

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



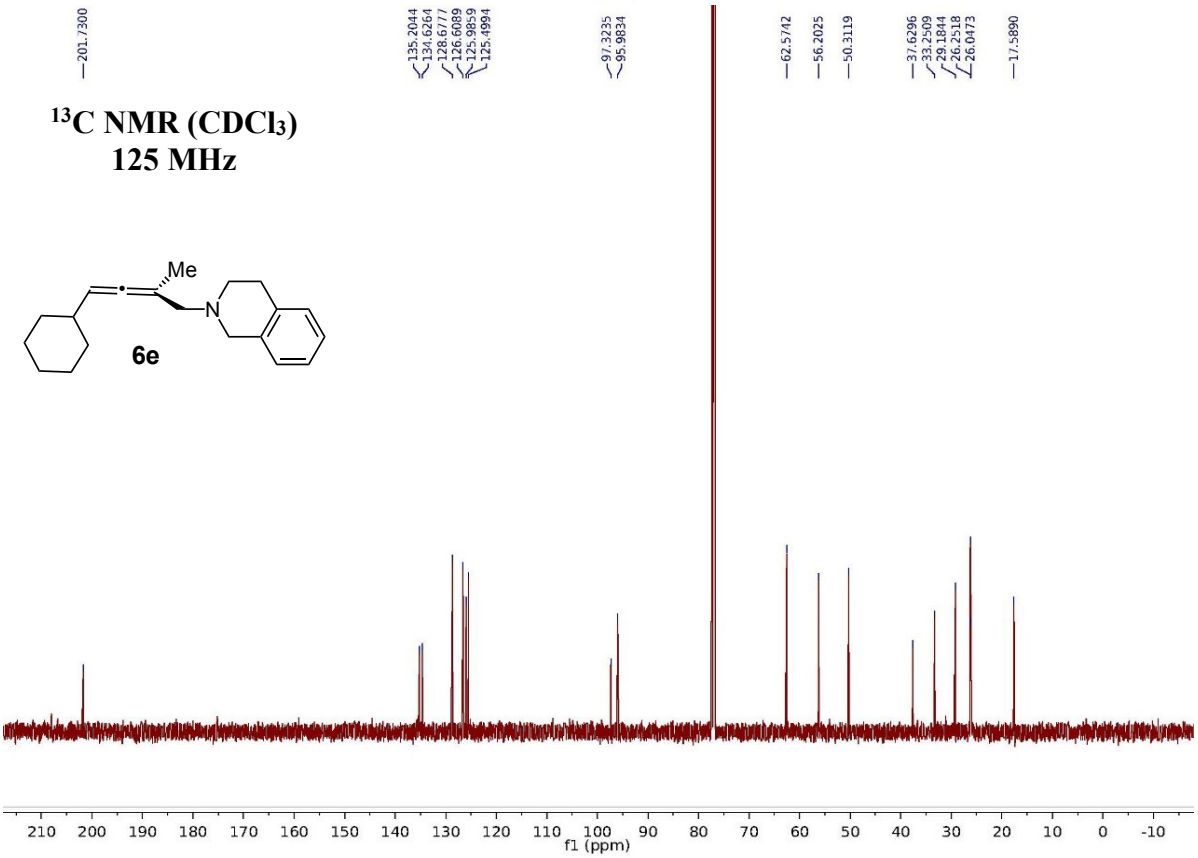
^{1}H NMR ($CDCl_3$)
500 MHz

6e



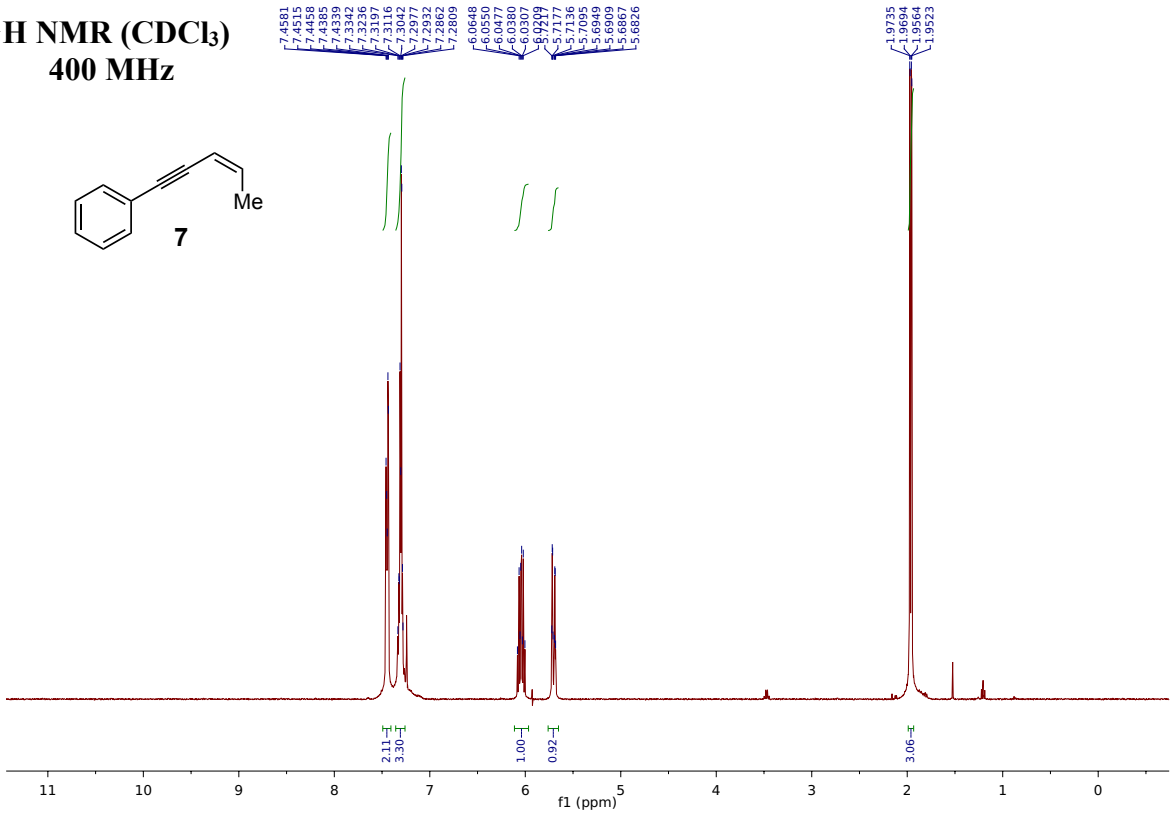
^{13}C NMR ($CDCl_3$)
125 MHz

6e



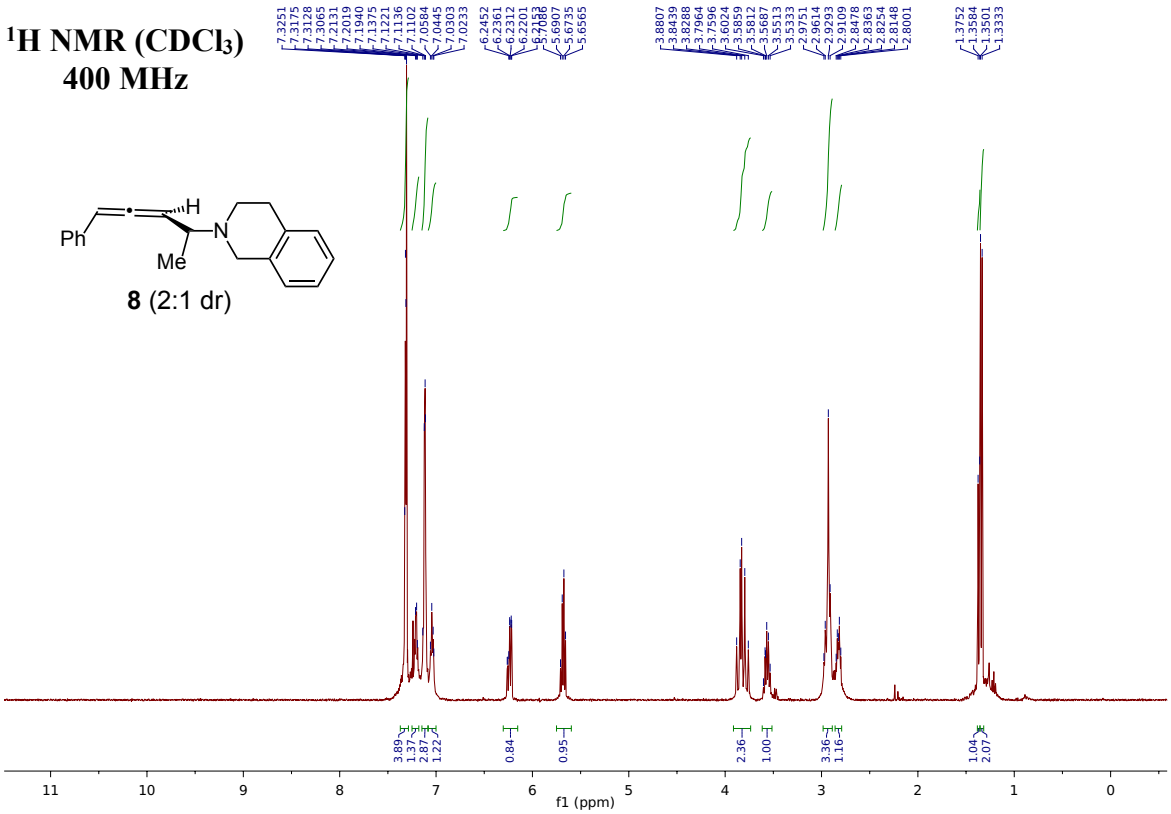
^{1}H NMR ($CDCl_3$)
400 MHz

7



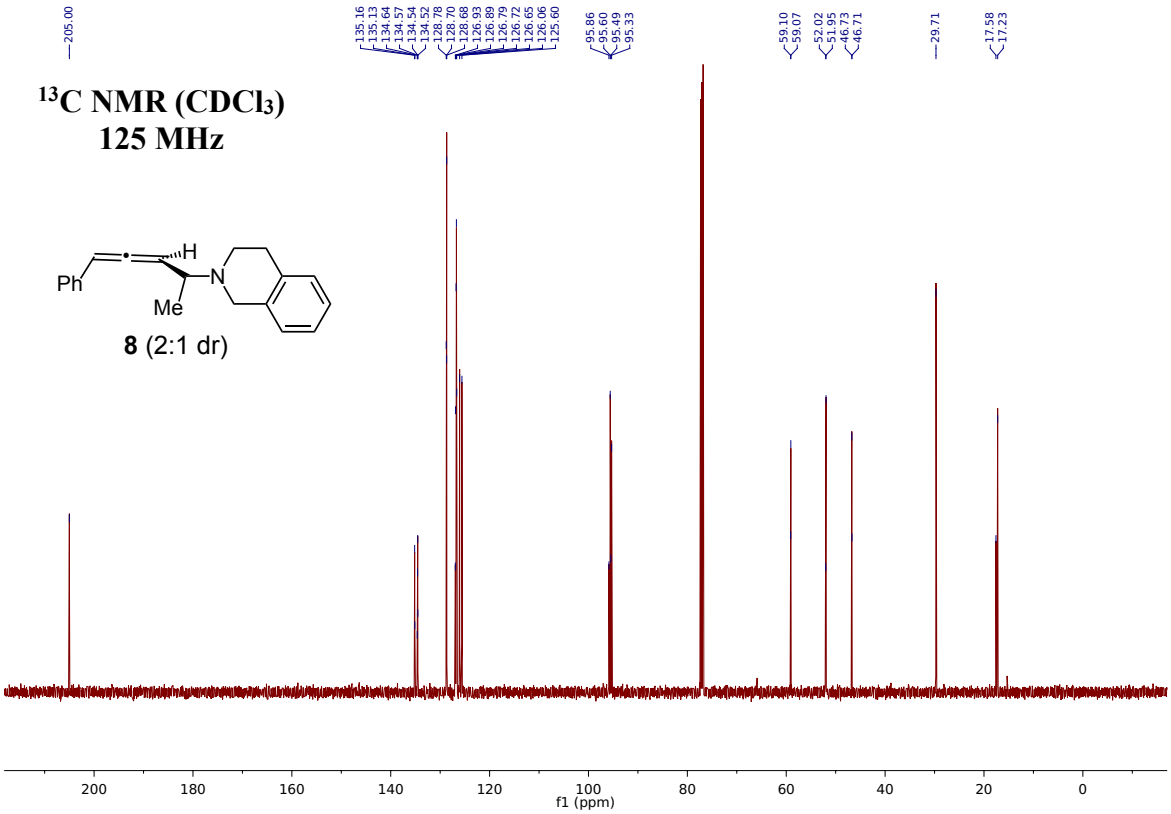
^{1}H NMR ($CDCl_3$)
400 MHz

8 (2:1 dr)

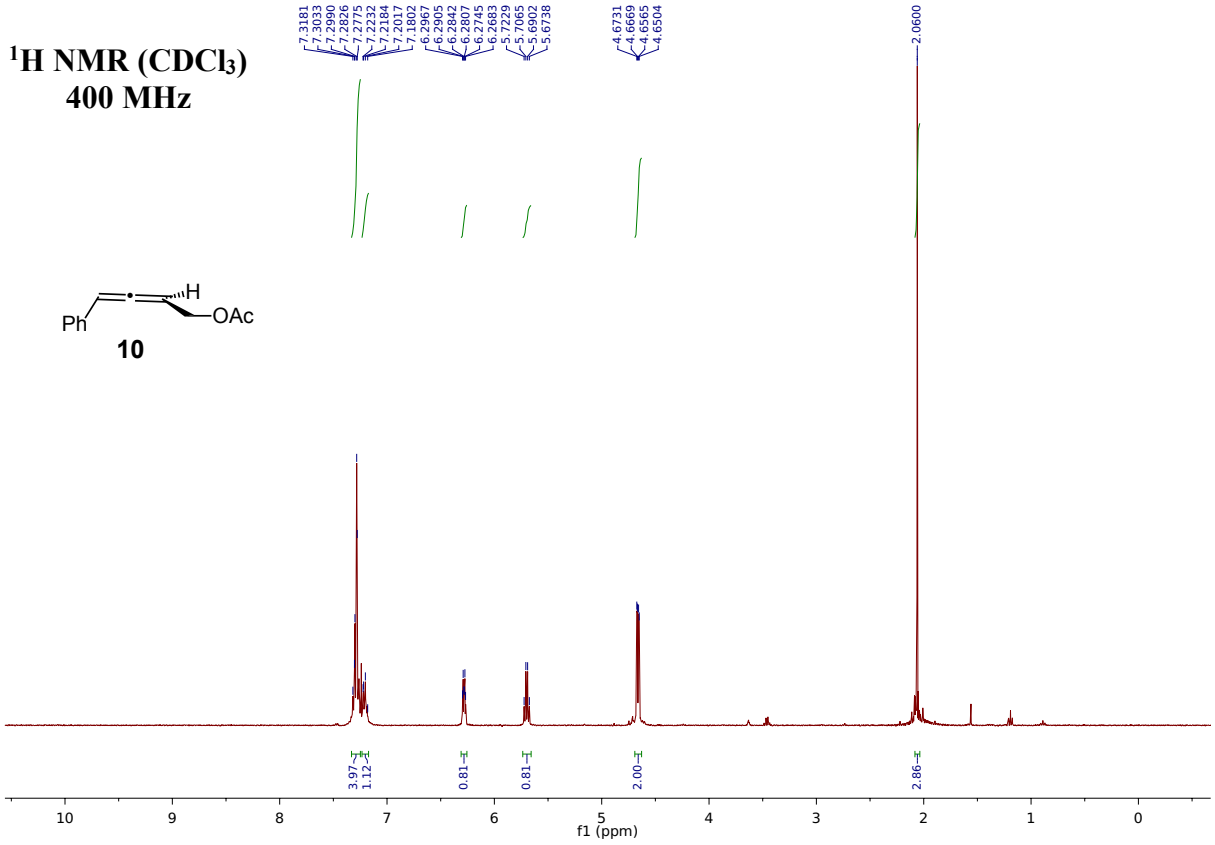


^{13}C NMR ($CDCl_3$)
125 MHz

8 (2:1 dr)

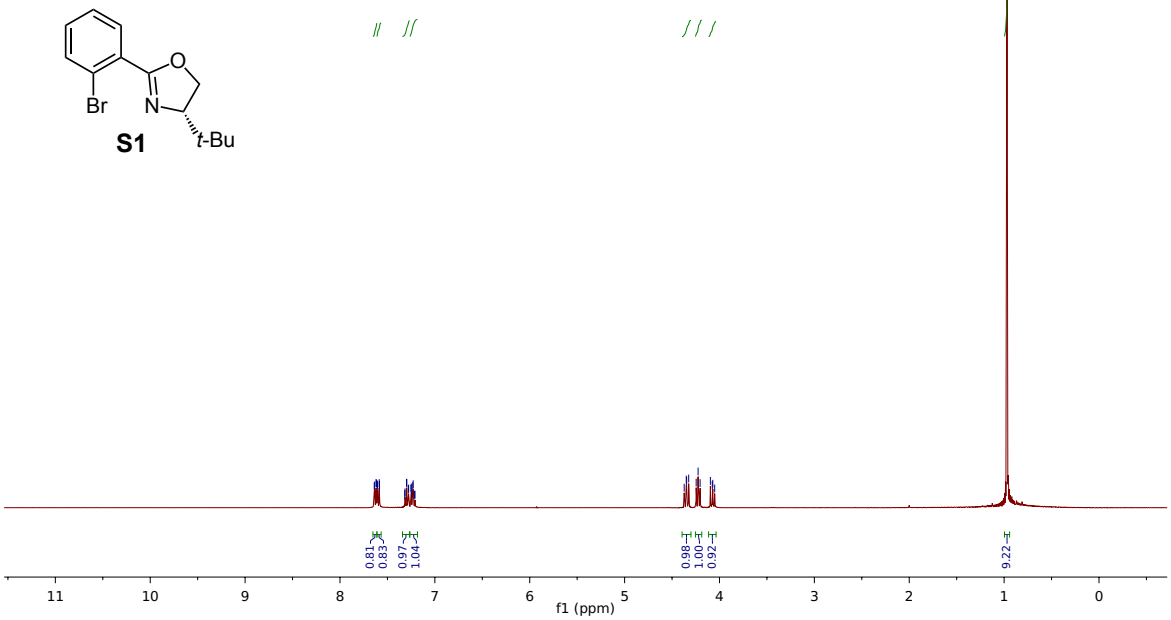


^{1}H NMR ($CDCl_3$)
400 MHz



10

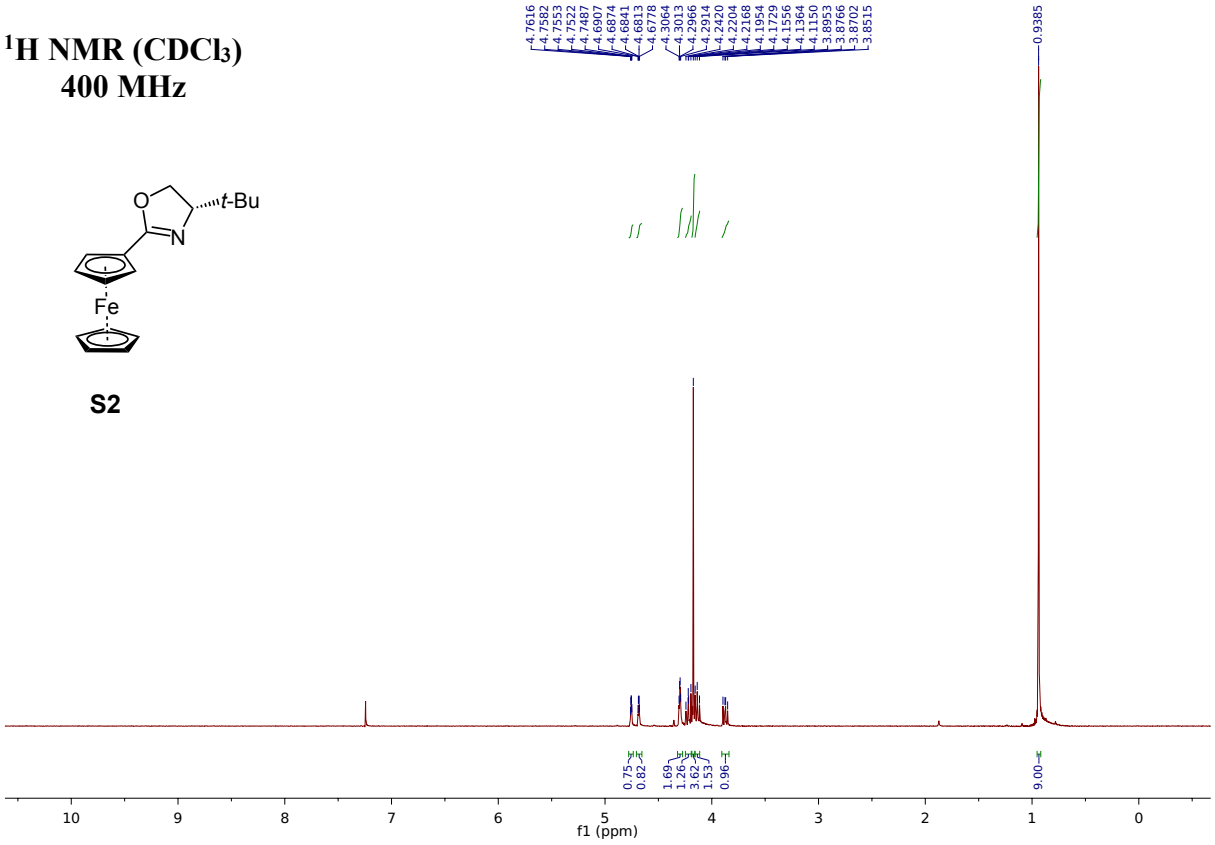
^{1}H NMR ($CDCl_3$)
400 MHz



S1

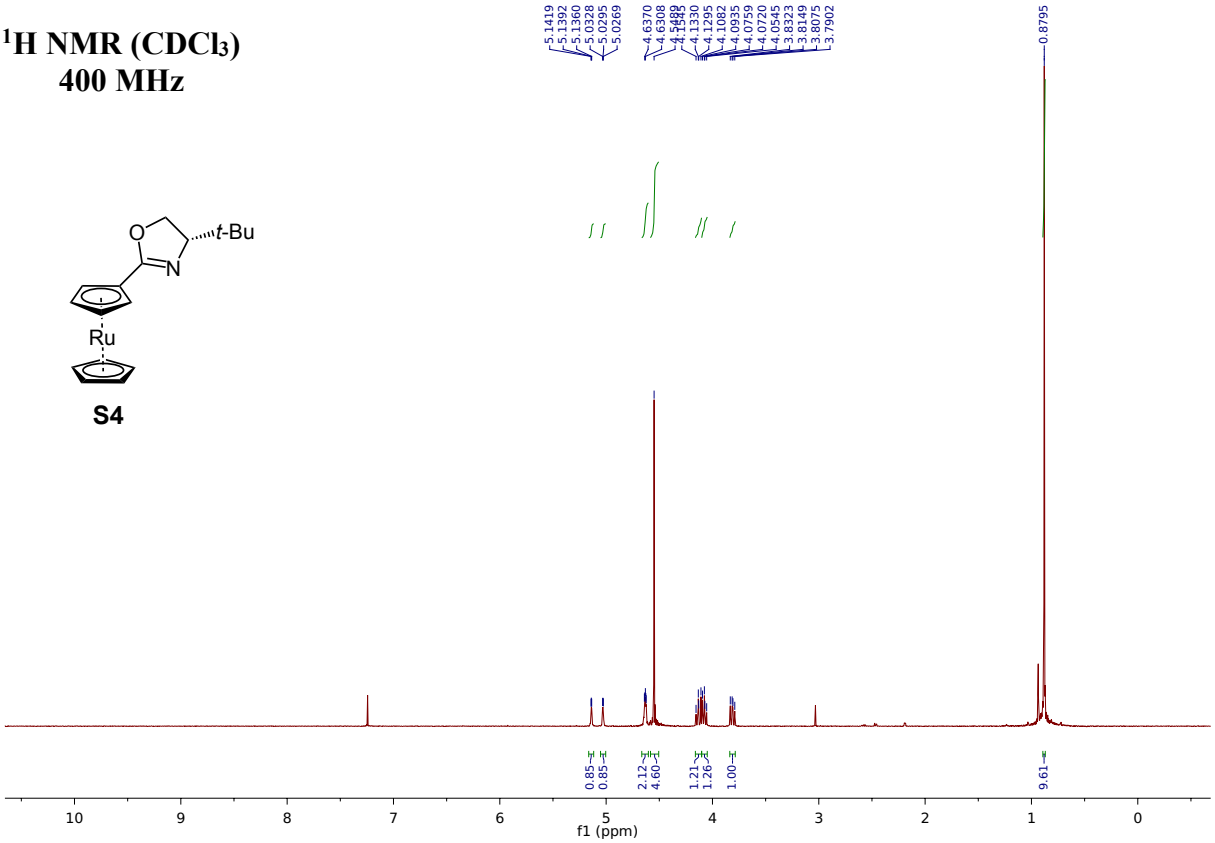
^{1}H NMR ($CDCl_3$)
400 MHz

S2



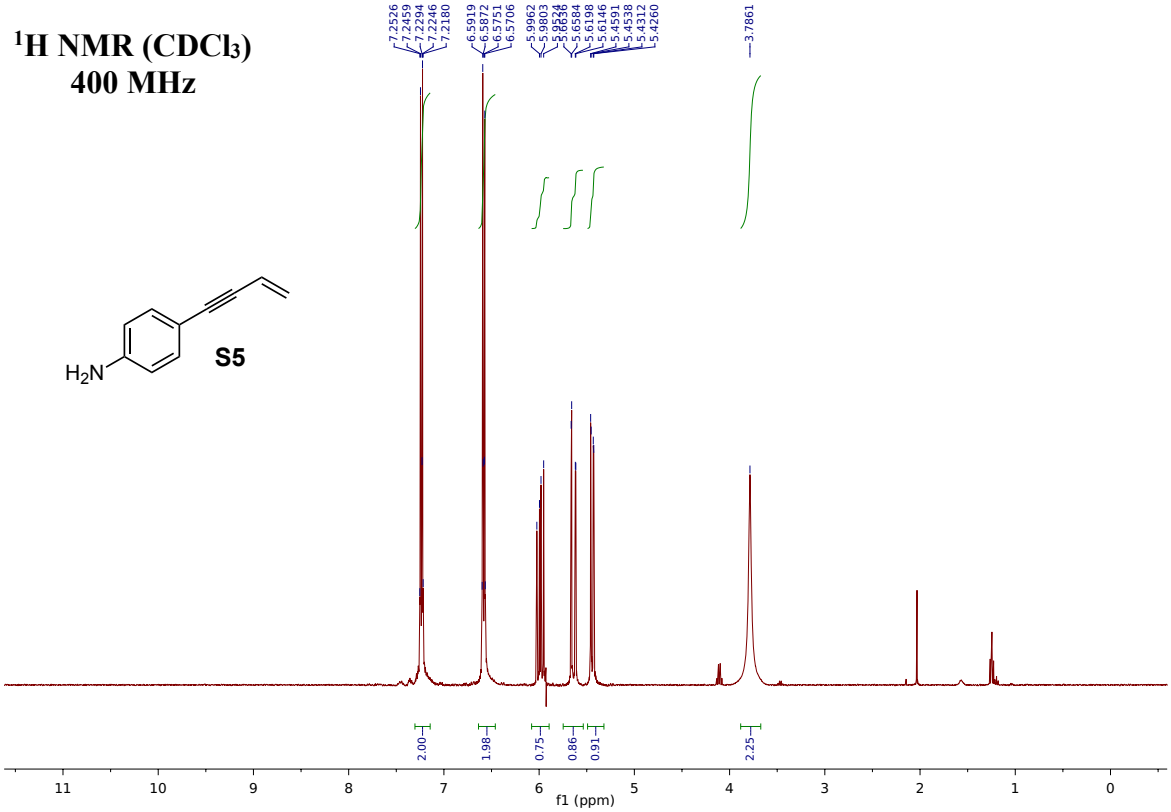
^{1}H NMR ($CDCl_3$)
400 MHz

S4



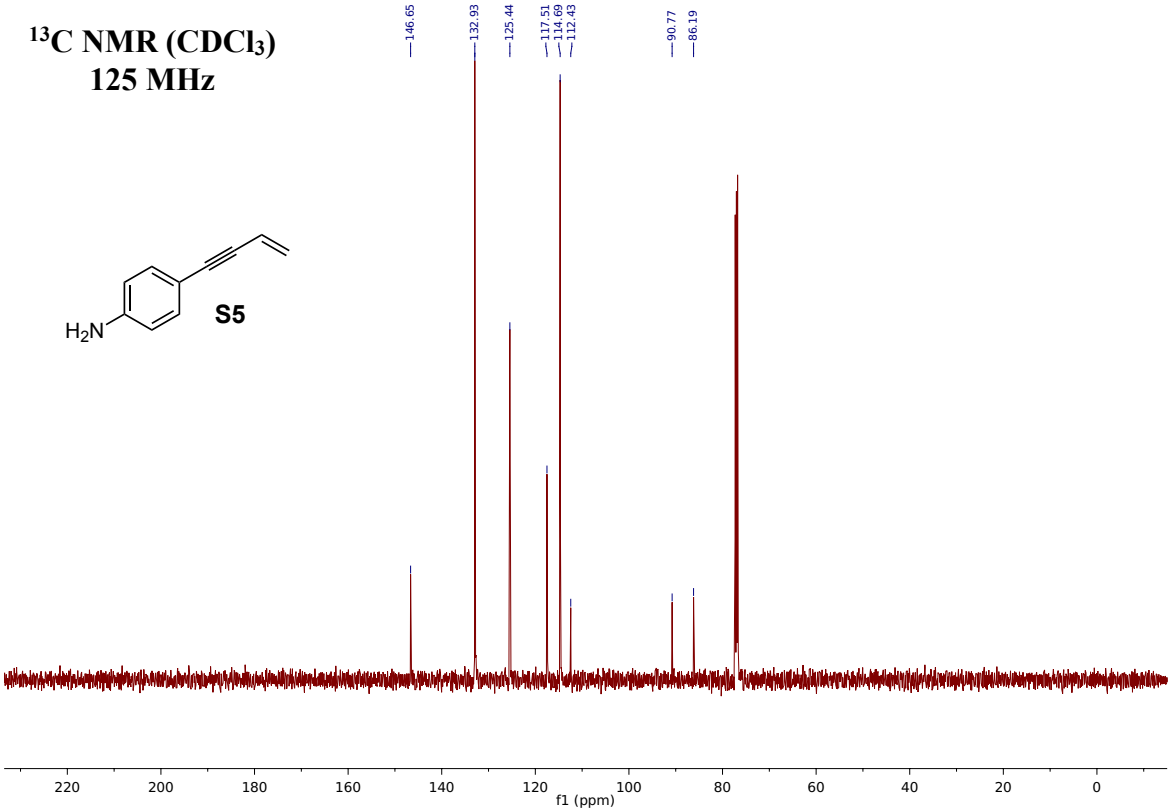
^{1}H NMR ($CDCl_3$)
400 MHz

S5



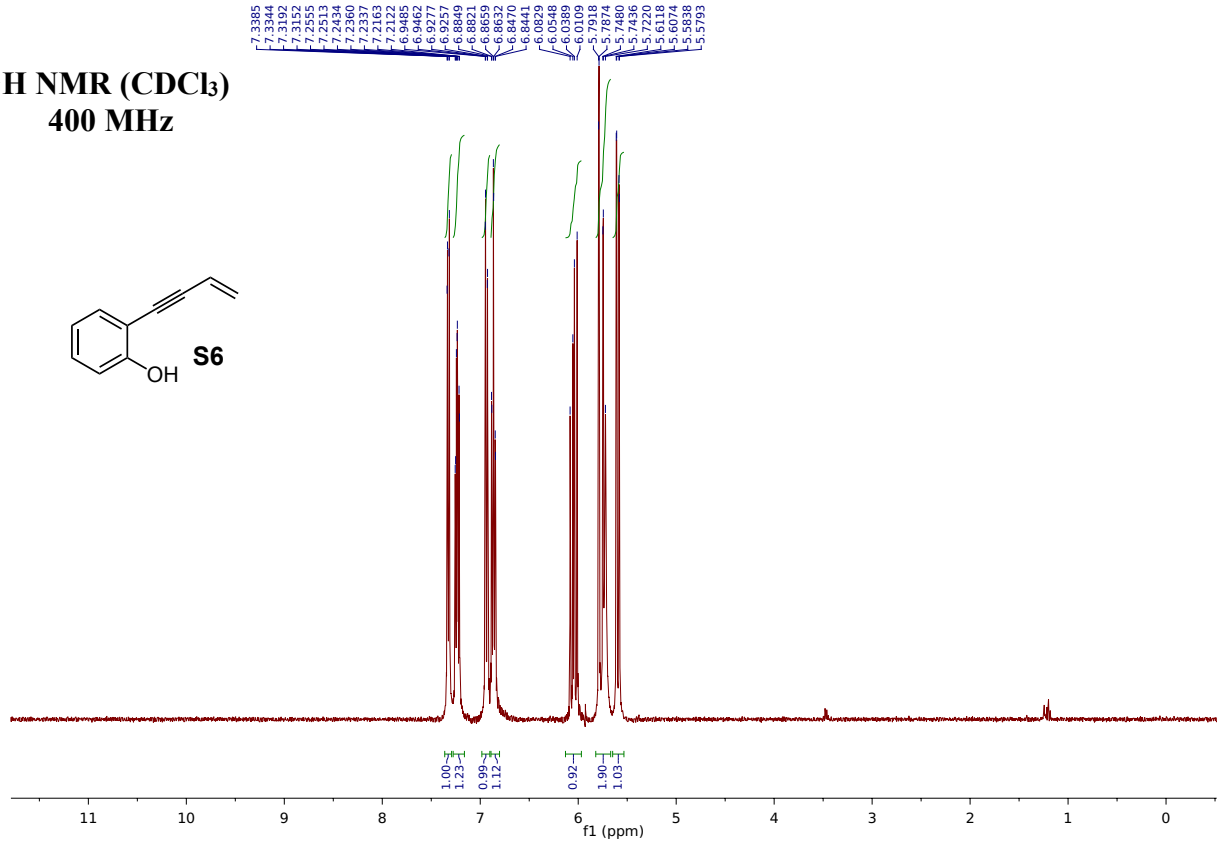
^{13}C NMR ($CDCl_3$)
125 MHz

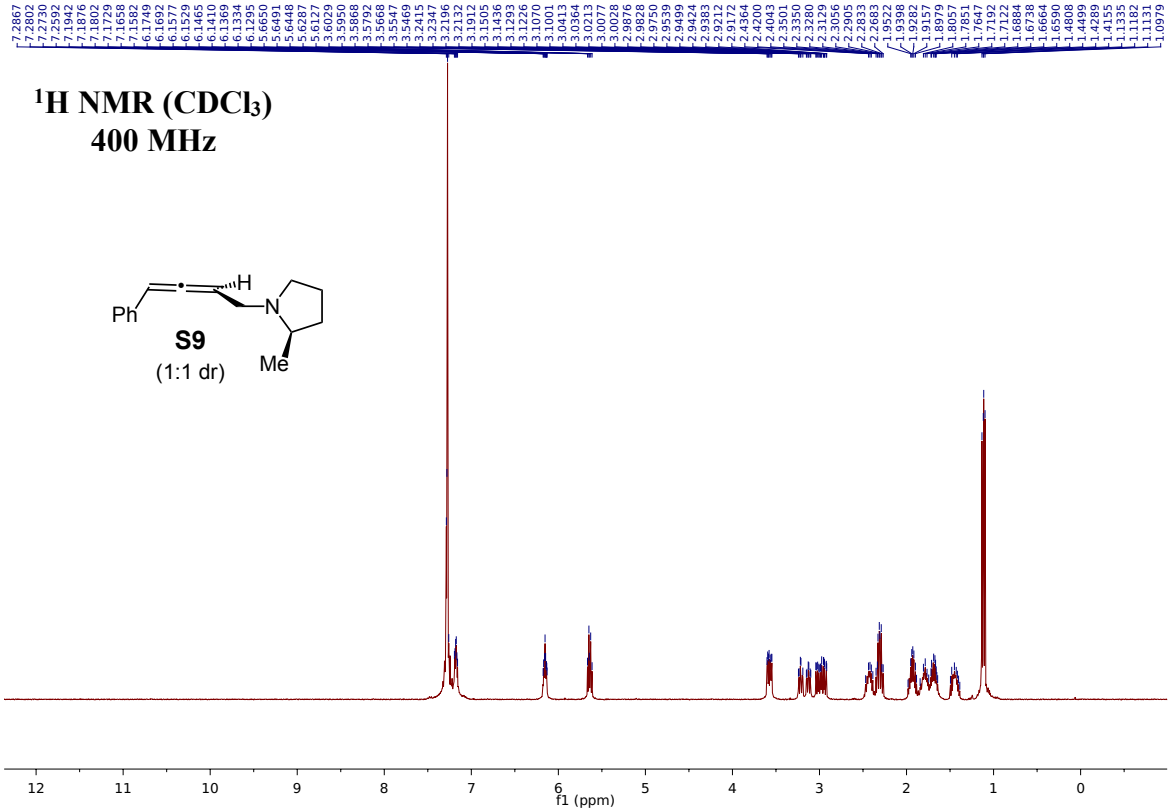
S5

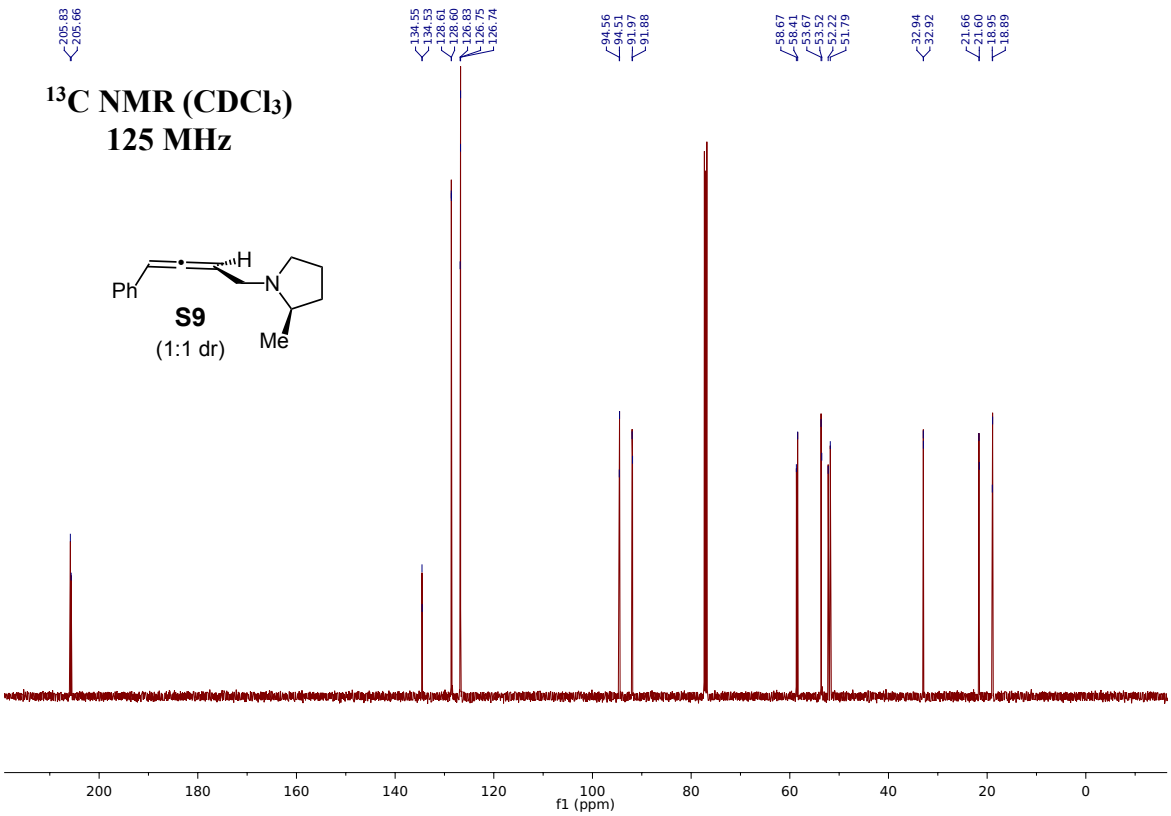


^{1}H NMR ($CDCl_3$)
400 MHz

S6

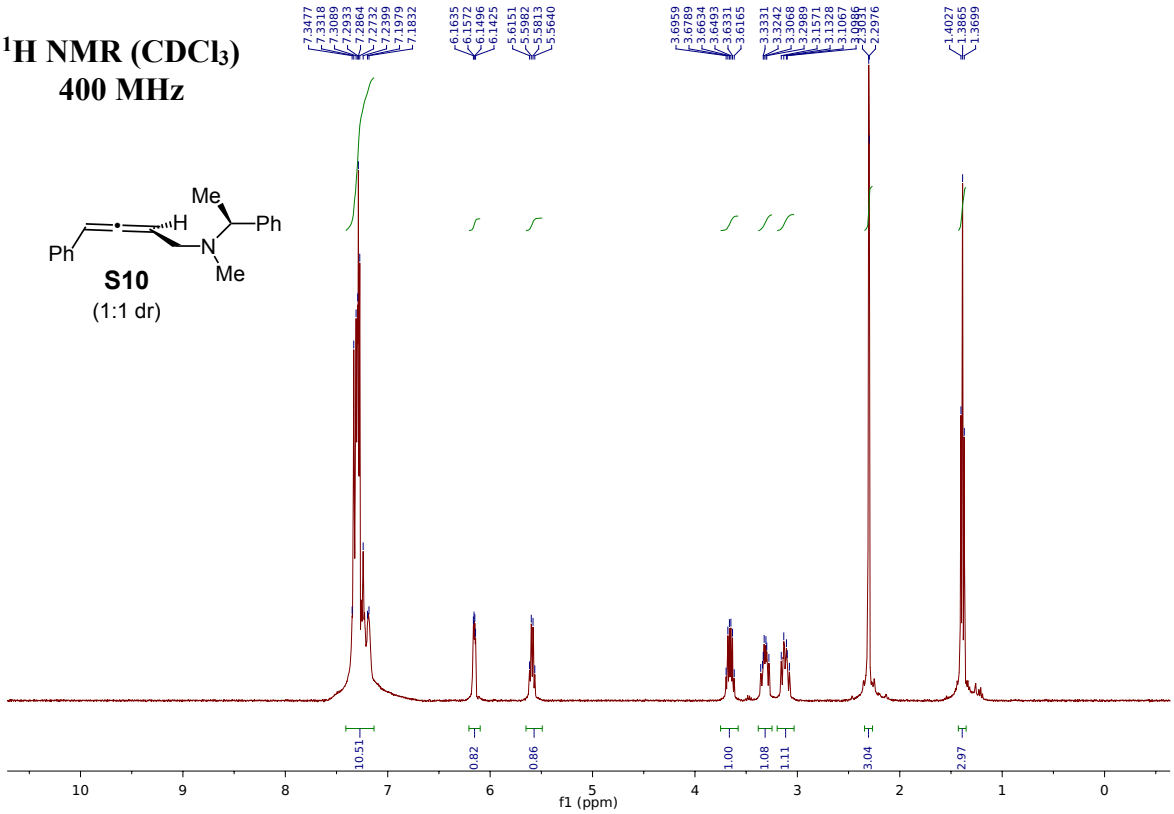



^{1}H NMR (CDCl$_3$)
400 MHz
Ph
H
N
Me
S9
(1:1 dr)
f1 (ppm)


^{13}C NMR (CDCl$_3$)
125 MHz
Ph
H
N
Me
S9
(1:1 dr)
f1 (ppm)

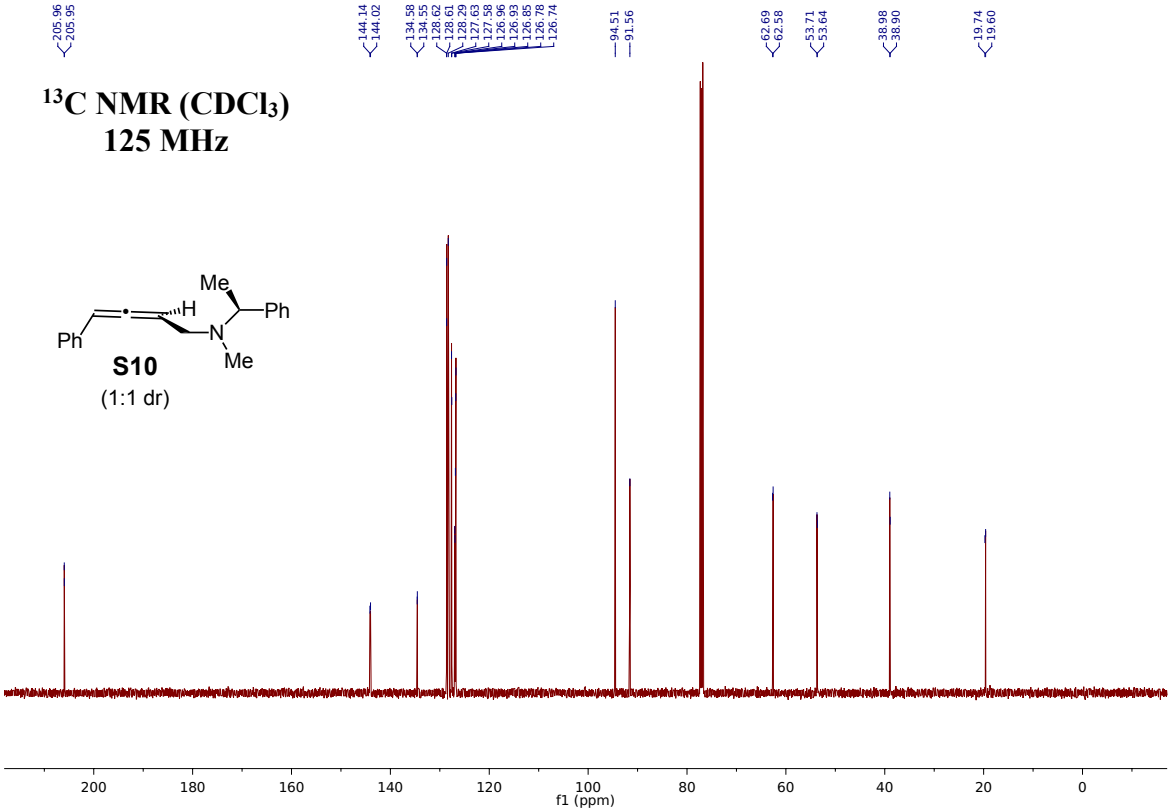
^{1}H NMR ($CDCl_3$)
400 MHz

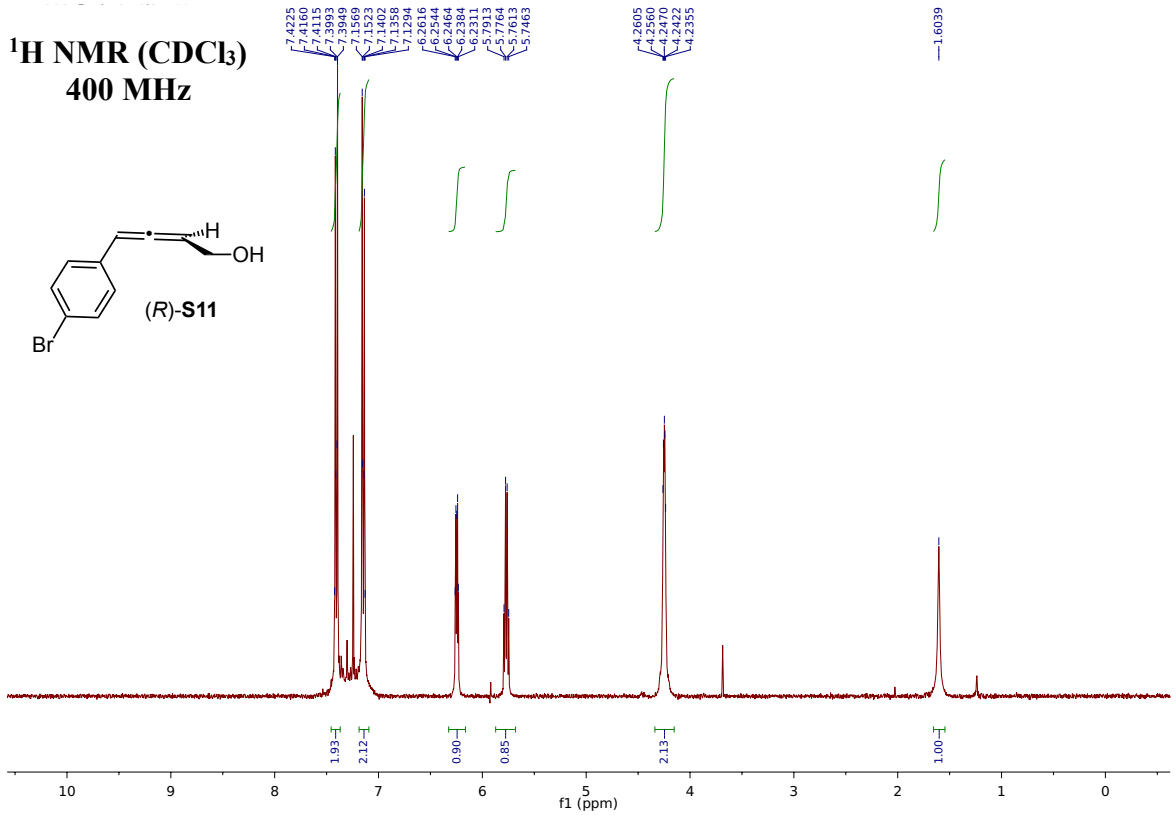
S10
(1:1 dr)



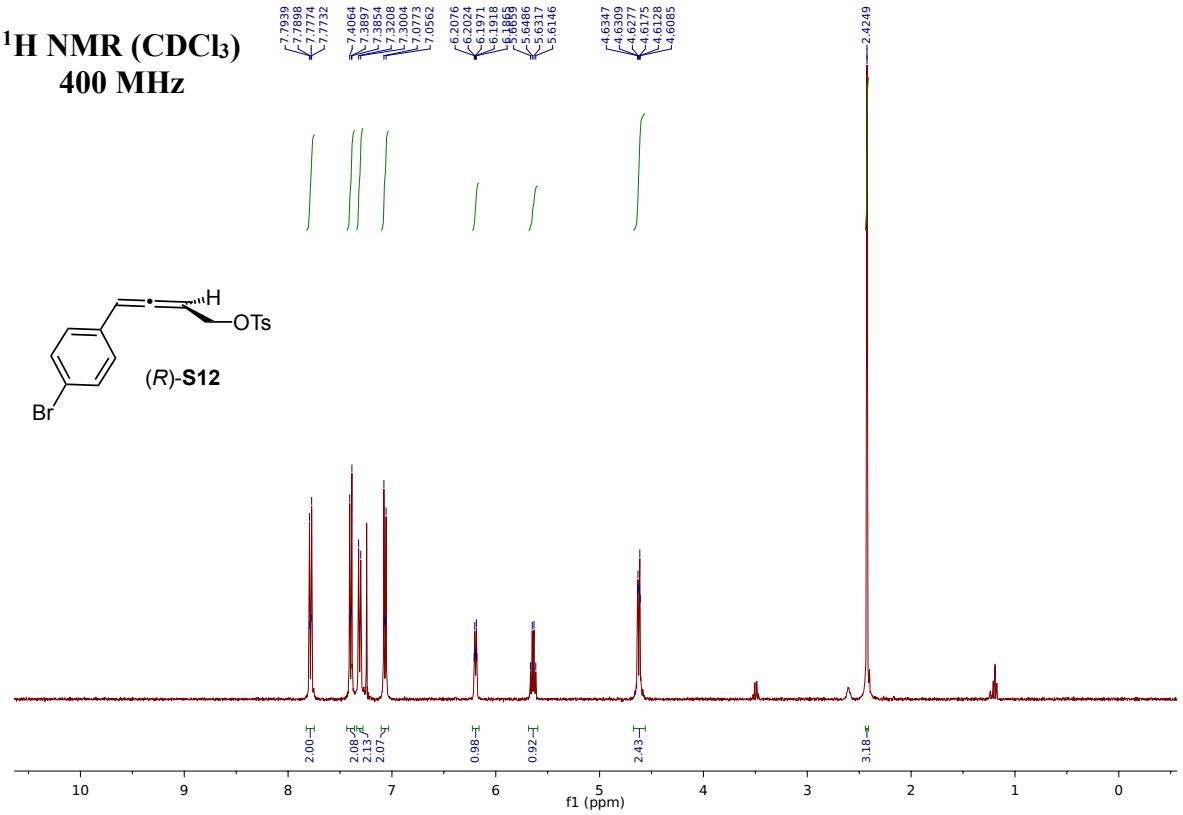
^{13}C NMR ($CDCl_3$)
125 MHz

S10
(1:1 dr)



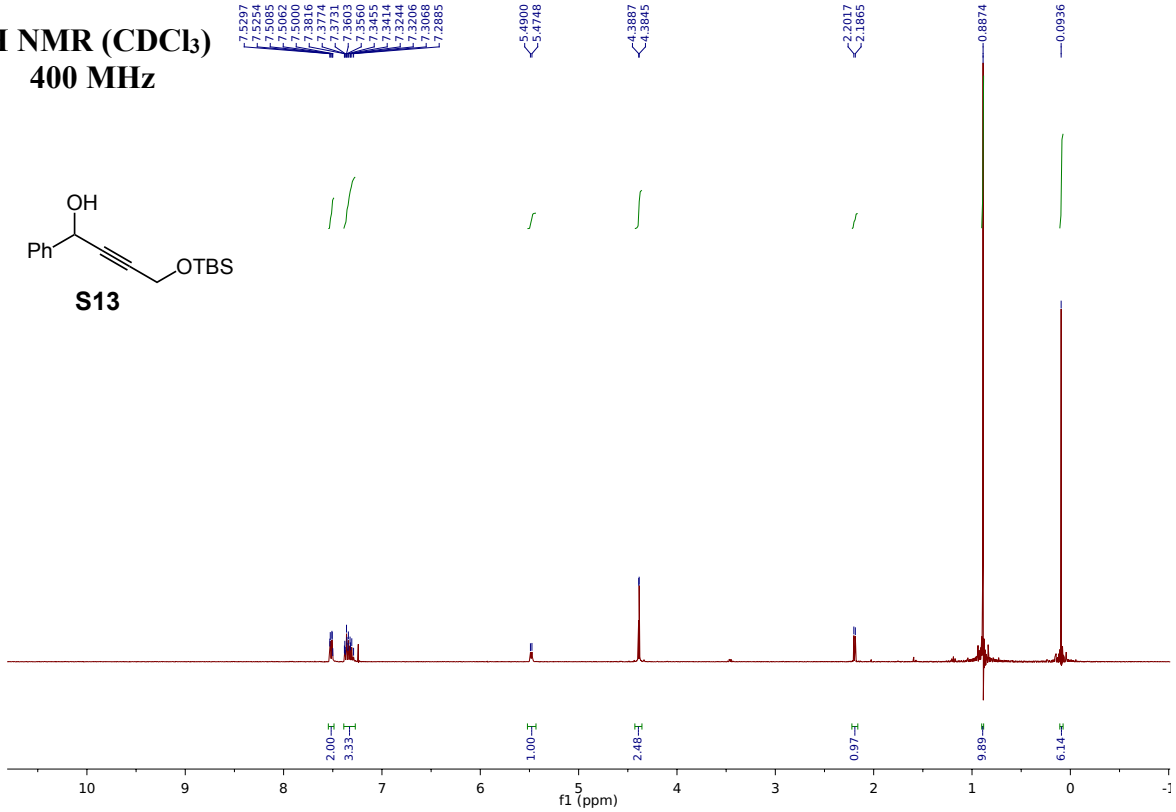

^{1}H NMR (CDCl$_3$)
400 MHz
(R)-S11
Br
OH
H
7.4225
7.4160
7.4115
7.3993
7.3949
7.1569
7.1523
7.1402
7.1358
7.1294
6.2616
6.2544
6.2464
6.2384
6.2311
5.7913
5.7764
5.7613
5.7463
4.2605
4.2560
4.2470
4.2422
4.2355
1.6039
1.93
2.12
0.90
0.85
2.13
1.00
f1 (ppm)

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



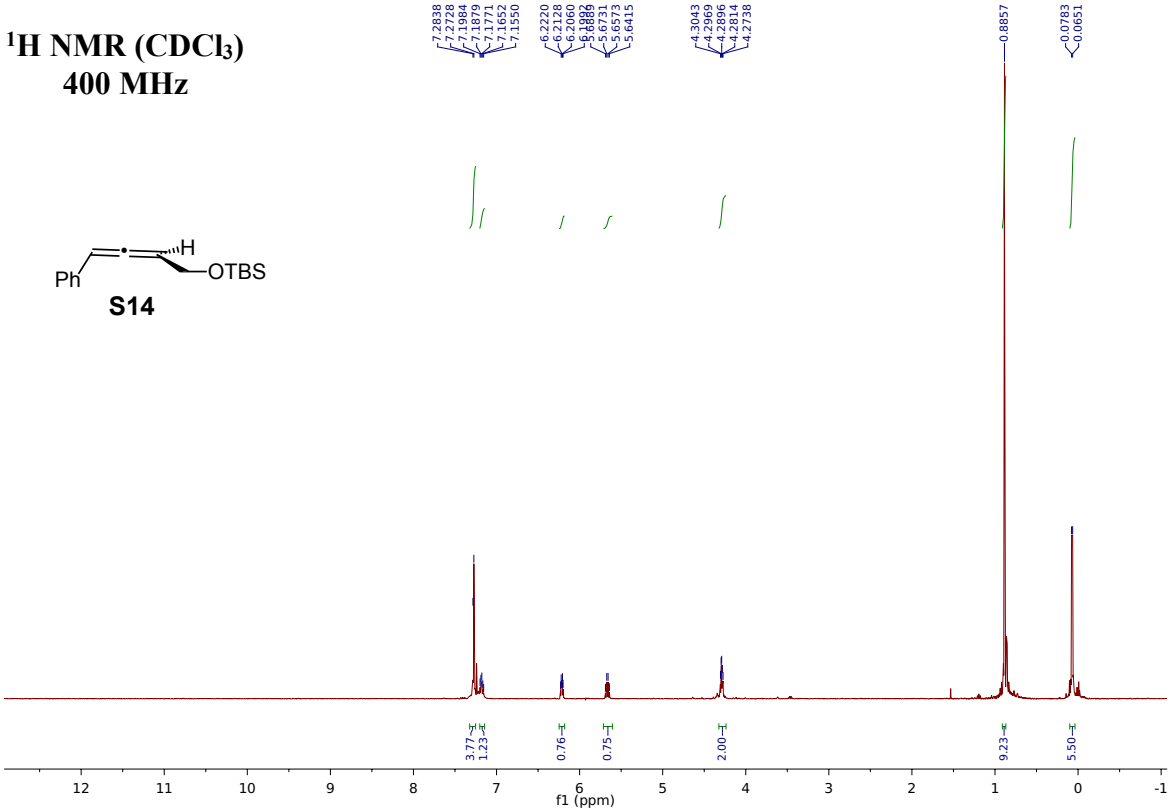
^{1}H NMR ($CDCl_3$)
400 MHz

S13



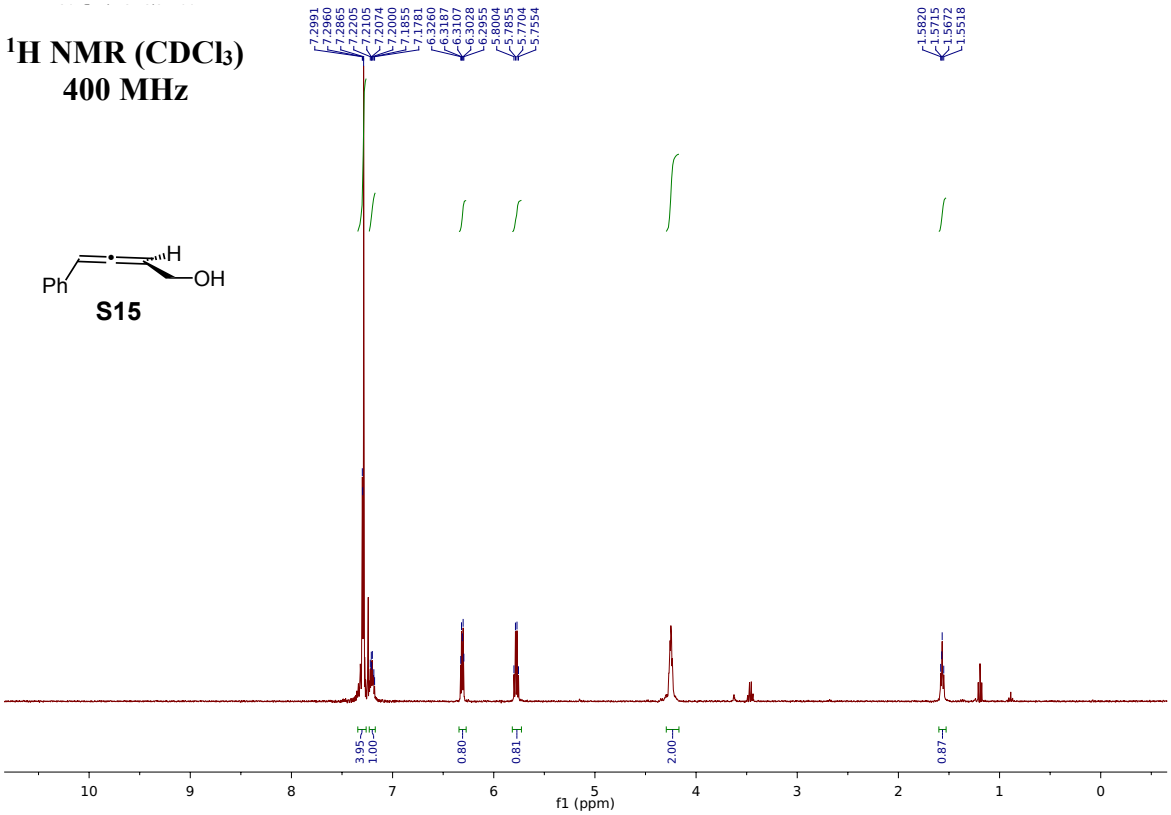
^{1}H NMR ($CDCl_3$)
400 MHz

S14



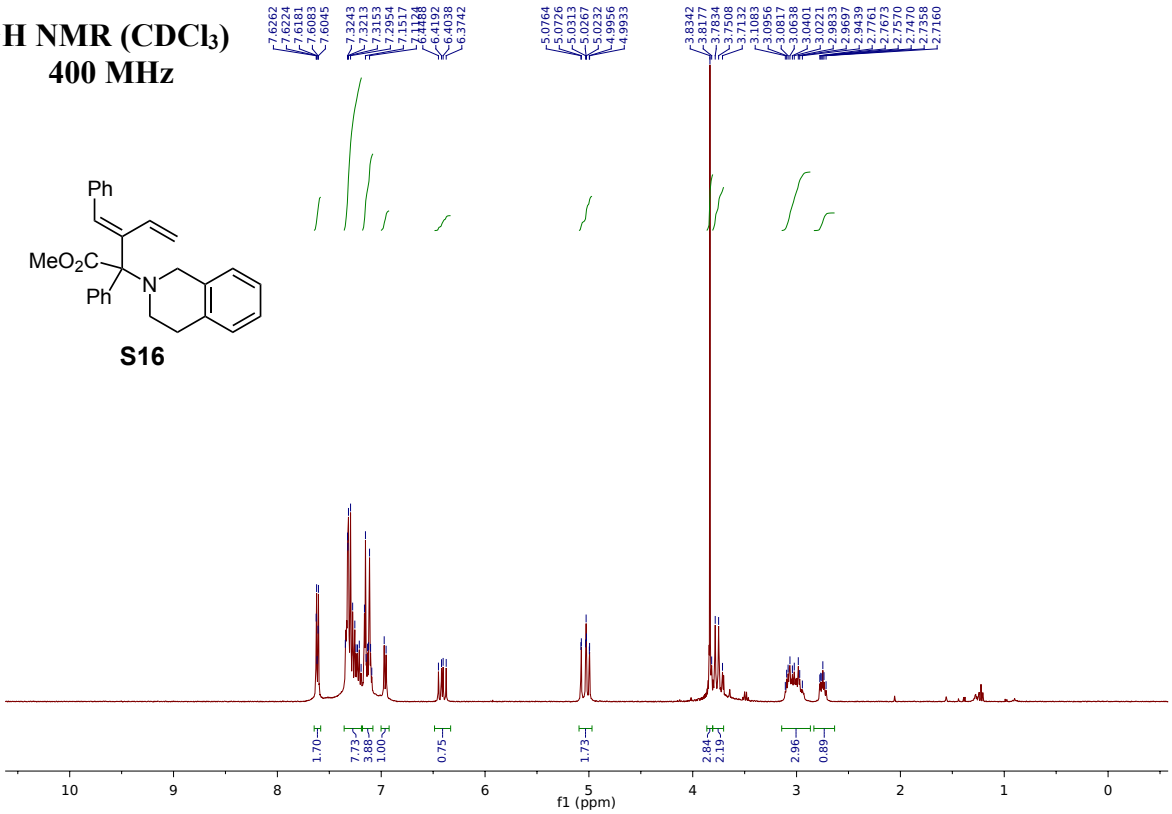
^{1}H NMR ($CDCl_3$)
400 MHz

S15



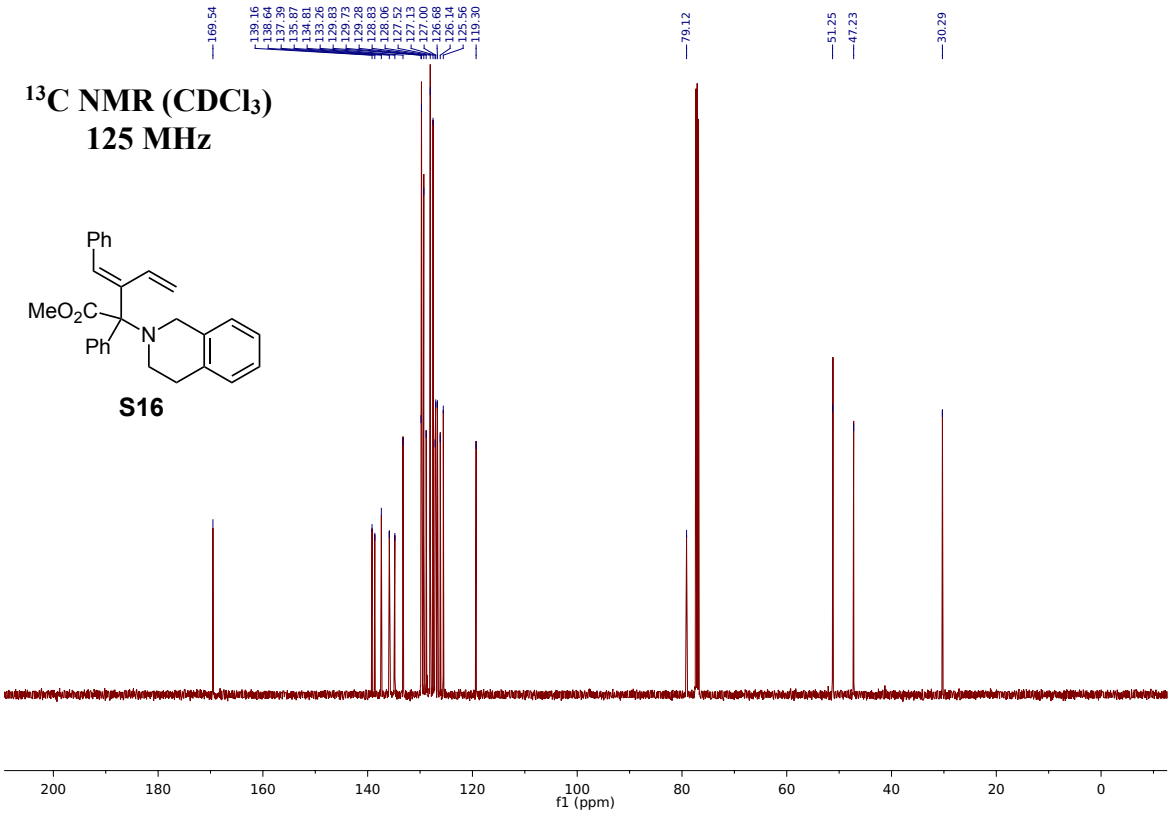
^{1}H NMR ($CDCl_3$)
400 MHz

S16



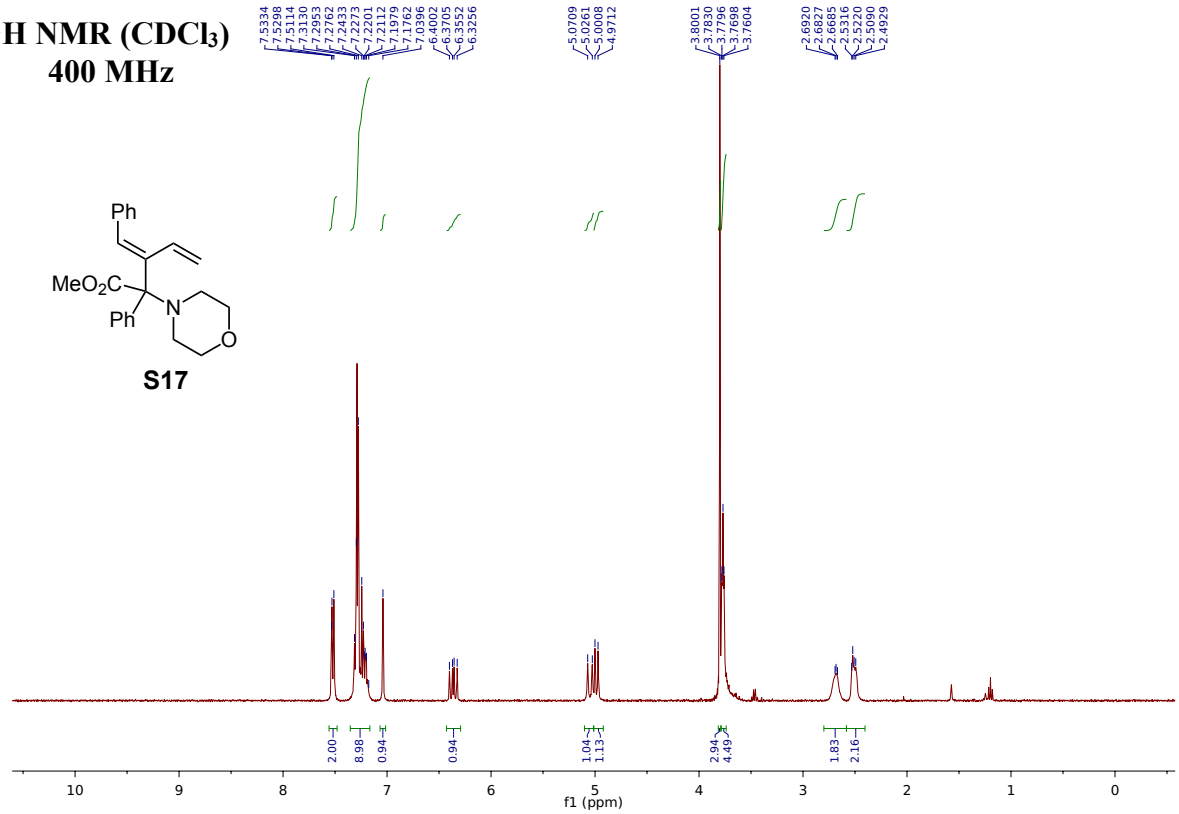
^{13}C NMR ($CDCl_3$)
125 MHz

S16



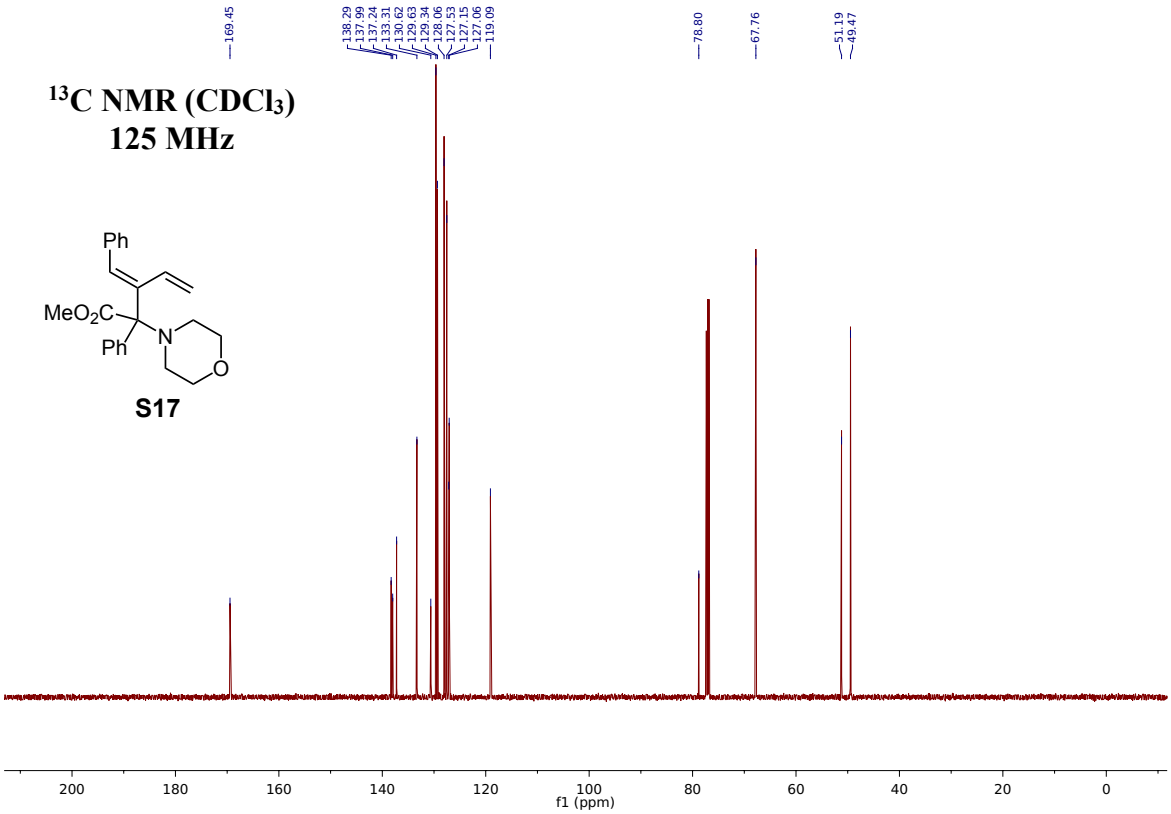
^{1}H NMR ($CDCl_3$)
400 MHz

S17



^{13}C NMR ($CDCl_3$)
125 MHz

S17



NOESY ($CDCl_3$)
500 MHz