Supporting Information

Palladium-Catalyzed Intramolecular Asymmetric Hydrocyclopropanylation of Alkynes: Synthesis of Cyclopropane-Fused *γ*-Lactams

Han-Ze Lin,[†,#] Zhuang Qi,[†,#] Qi-Min Wu,[†] Yong-Yu Jiang[†] and Jin-Bao Peng*[,†]

[†]School of Biotechnology and Health Sciences, Wuyi University, Jiangmen, Guangdong 529020, P. R. China; orcid.org/0000-0002-0568-7740; E-mail: pengjb_05@126.com

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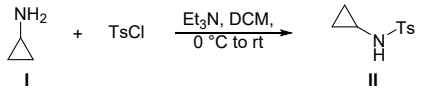
1. General Information

Reagents, solvents and analytical methods:

Unless otherwise noted, all reactions were carried out under a nitrogen atmosphere. All reagents were from commercial sources and used as received without further purification. All solvents were dried by standard techniques and distilled prior to use. Column chromatography was performed on silica gel (200-300 meshes) using petroleum ether (bp. 60~90 °C) and ethyl acetate as eluent. ^{1}NMR spectra were recorded on a Bruker Avance operating at for ^{1}H NMR at 500 MHz, ^{13}C NMR at 126 MHz and ^{19}F NMR at 471 MHz and spectral data were reported in ppm relative to tetramethylsilane (TMS) as internal standard and $CDCl_3$ (^{1}H NMR δ 7.27, ^{13}C NMR δ 77.0) as solvent. High-resolution mass spectra (HRMS) is produced by Thermo Fisher Scientific. Its main body is composed of two parts: Thermo Scientific's UltiMate 3000 Series liquid system and Thermo Scientific Q-Exactive combined quadrupole Orbitrap mass spectrometer. All coupling constants (*J*) are reported in Hz. The following abbreviations were used to describe peak splitting patterns when appropriate: s = singlet, d = doublet, dd = double doublet, ddd = double doublet of doublets, t = triplet, dt = double triplet, q = quatriplet, m = multiplet, br = broad. Compounds **1a-1r** were prepared according to the previous literatures.[1, 2, 3, 4]

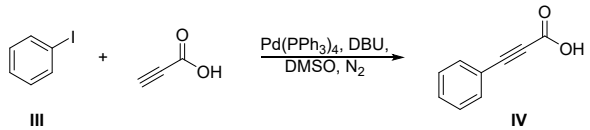
2 Preparation of the Compounds 1a-1r

Compounds **1a-1r** were prepared according to the previous literature.



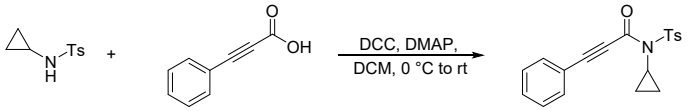
I **II**

Following a modified version of a reported procedure,[1] to a solution of acyl chloride (12 mmol, 1.2 equiv.) in dichloromethane (10 mL). Then, triethylamine (1.40 mL, 10.0 mmol, 1.1 equiv.) was added slowly. Then a solution of cyclopropylamine (0.70 mL, 10 mmol, 1.0 equiv.) in dichloromethane (10 mL) was added slowly at 0 °C. The reaction mixture was stirred at room temperature usually for 16 hours. Upon completion, the aqueous layer was then extracted with dichloromethane. The organic extract was dried over Na_2SO_4, filtered and concentrated in vacuo. the residue was purified by a flash column chromatograph on silica gel using petroleum ether / ethyl acetate as the eluent to yield the products **II**.



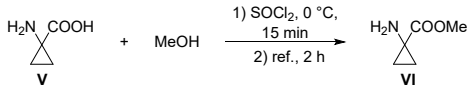
III **IV**

Following a modified version of a reported procedure,[2] A small round bottomed flask was charged with aryl iodide (5.0 mmol), DBU (1.67 g, 2.2 equiv., 12 mmol), $Pd(PPh_3)_4$ (173 mg, 3 mol%) and DMSO (6 mL). The solution of propiolic acid (420 mg, 1.2 equiv., 6.0 mmol) in DMSO (6 mL) was poured to the flask. The mixture was stirred at ambient temperature for 12 h. Upon completion of the reaction, the reaction mixture was diluted with ethyl acetate (20 mL), then extracted with $NaHCO_3$ (sat. aq). The aqueous layer was separated, acidified to pH 1.0 by adding HCl (1 N), and extracted with ethyl acetate. The combined organic layers were dried with Na_2SO_4, and the solvent was removed under reduced pressure. The resulting crude product was purified by flash chromatography (on silica, ethyl acetate: petroleum ether = 4:1) gave the corresponding aryl alkynyl carboxylic acids **IV**.



II **IV** **1a**

Following a modified version of a reported procedure,[3] dichloromethane (20 mL) and phenylpropynoic acid (11 mmol) were added into a 50 mL round bottom glass flask, and then *N*-alkylaniline (10 mmol) was added at 0 °C. Thereafter, a solution of DCC (15 mmol), DMAP (0.5 mmol) and dichloromethane (20 mL) was slowly added dropwise with stirring. The mixture was washed with 5 mL saturated Na_2CO_3 solution, 5 mL saturated NaCl solution, and 5 mL water. The organic phase was dried over Na_2SO_4, filtered and concentrated. The residue was purified by column chromatography on silica gel (petroleum ether/ethyl acetate as the eluent) affording the corresponding *N*-cyclopropyl-3-phenyl-*N*-tosylpropiolamide **1a**.



Following a modified version of a reported procedure,[4] Add ethanol (2 mL) to a round-bottom flask. Cool the reaction mixture to 0 °C. Add thionyl chloride (706 mg, 430 μL) dropwise to the reaction mixture. Stir the reaction mixture for 15 minutes. Add 1-aminocyclopropanecarboxylic acid (300 mg) to the reaction mixture. Reflux the reaction mixture for 2 hours. Remove the solvent and affording the corresponding product **VI**.

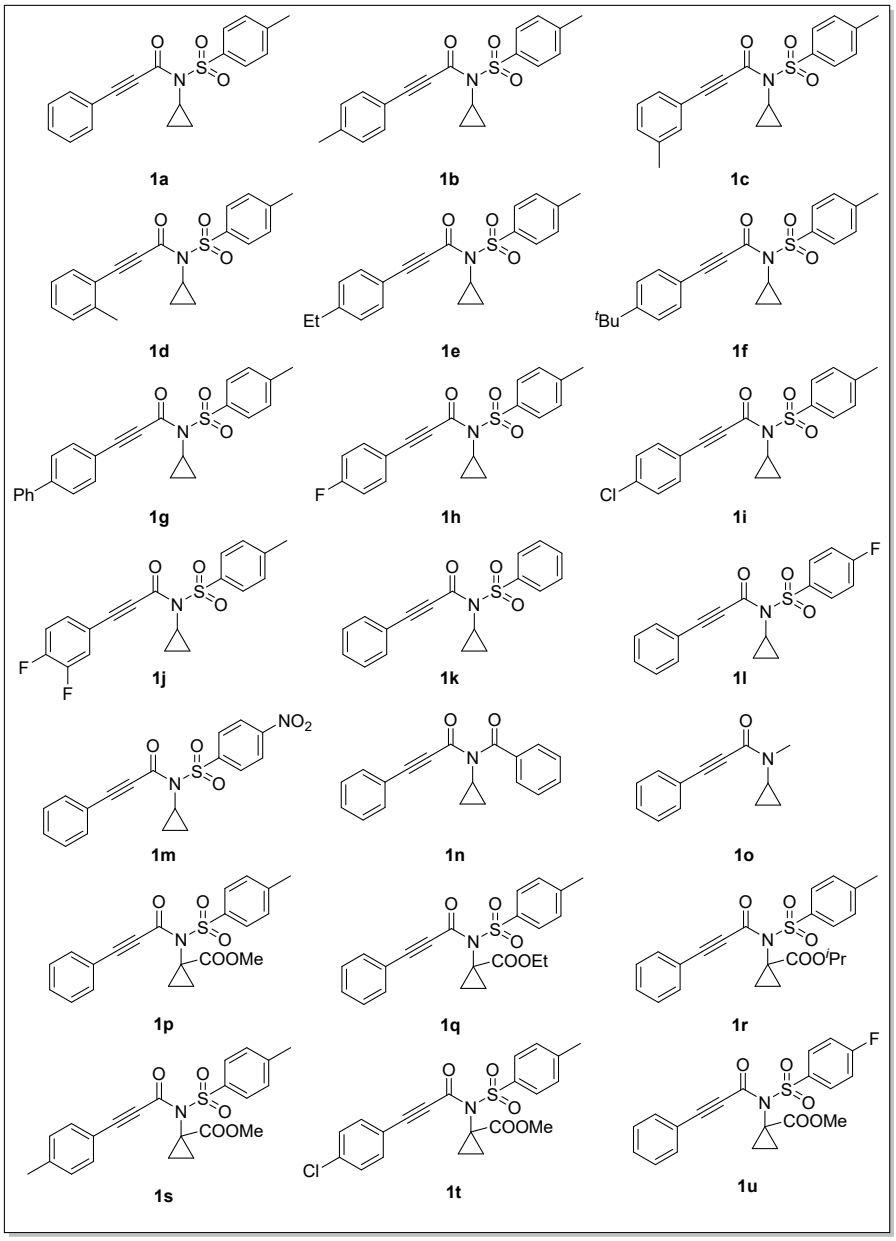


Figure S1 Substrates of *N*-cyclopropyl-3-phenyl-*N*-tosylpropiolamide derivatives

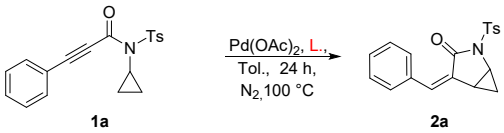
3 Optimization of Reaction Conditions

Table S1. Optimization of the Catalyst.

Entry	Catalyst	Yield (%)[b]
1	$PdCl_2$	NR
2	$Pd(acac)_2$	17
3	$Pd(OAc)_2$	52
4	$Pd_2(dba)_3$	23
5	$Pd(PPh_3)_4$	trace
6	Pd/C	NR

[a] Reaction conditions: **1a** (0.2 mmol), Catalyst (5 mol%), DPPF (5 mol%), toluene (2 mL), N_2 atmosphere. [b] Isolated yield.

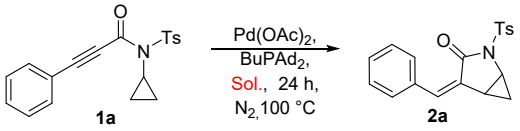
Table S2. Optimization of the Ligand.[a]



Entry	Ligand	Yield (%)[b]
1	PPh_3	35
2	PCy_3	90
3	$BuPAd_2$	96
4	dppp	95
5	DPEphos	27
6	Xantphos	trace

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol% for monodentate ligand, 5 mol% for bidentate ligand), toluene (2 mL), N_2 atmosphere. [b] Isolated yield.

Table S3. Optimization of the Solvent.[a]

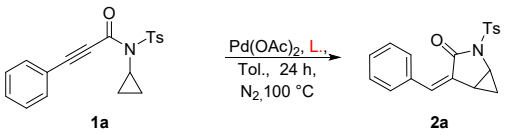


Entry	Solvent	Yield (%)[b]
1	toluene	96
2	THF	85
3	Dioxane	88
4	DCM	27

5	MeCN	trace
6	DMSO	36
7	DMF	44

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), solvent (2 mL), N_2 atmosphere. [b] Isolated yield.

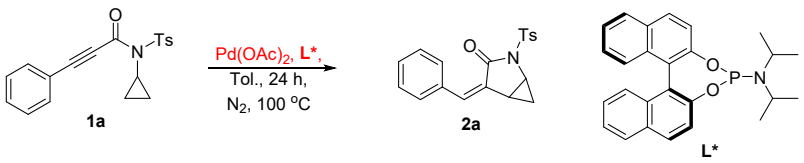
Table S4. Optimization of the Ligand.[a]



Entry	Ligand	Yield (%)[b]
1	PPh_3	35
2	PCy_3	90
3	$BuPAd_2$	96
4	dppp	95
5	DPEphos	27
6	Xantphos	trace

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol% for monodentate ligand, 5 mol% for bidentate ligand), toluene (2 mL), N_2 atmosphere. [b] Isolated yield.

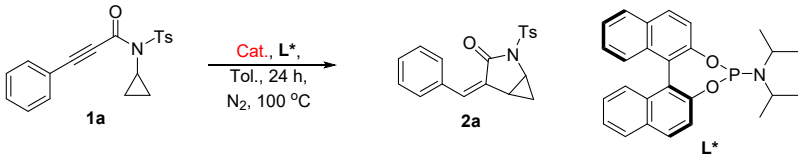
Table S5. Optimization of the ratio of chiral Ligand and Catalyst.[a]



Entry	Cat. and L.	Yield (%)[b]	*ee* (%)[c]
1	2%+4%	56	67
2	2%+5%	NR	-
3	3%+6%	43	69
4	5%+10%	59	67
5	5%+12%	60	65

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), toluene (2 mL), N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

Table S6. Optimization of the Catalyst.[a]

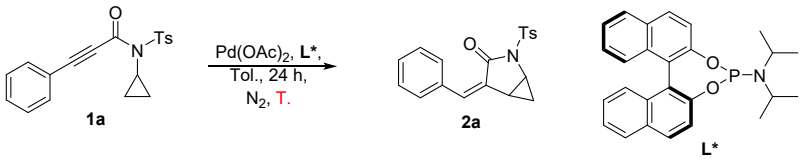


Entry	Catalyst	Yield (%)[b]	*ee* (%)[c]
1	$Pd(OAc)_2$	35	67

2	$PdCl_2$	NR	-
3	$Pd(acac)_2$	50	67
4	$Pd_2(dba)_3$	23	57
5	$Pd(PPh_3)_4$	NR	-
6	Pd/C	NR	-
7	$PdBr_2$	NR	-
8	$Pd(TFA)_2$	NR	-
9	$Pd(MeCN)_2Cl_2$	NR	-

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), toluene (2 mL), N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

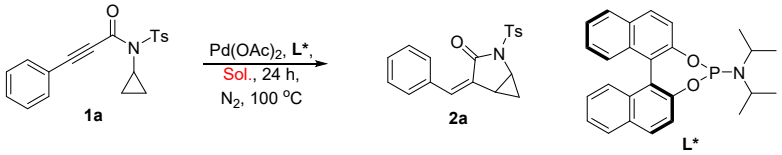
Table S7. Optimization of Temperature.[a]



Entry	Temp.	Yield (%)[b]	*ee* (%)[c]
1	30	NR	-
2	60	17	60
3	80	35	59
4	100	47	63
5	120	49	68

[a] Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), toluene (2 mL), N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

Table S8. Optimization of the Solvent.[a]

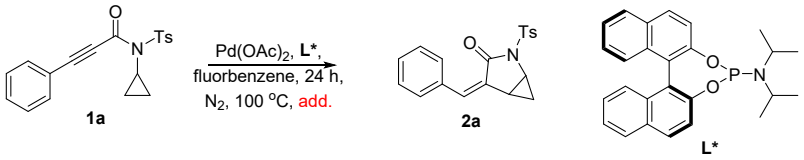


Entry	Solvent	Yield (%)[b]	*ee* (%)[c]
1	toluene	45	63
2	THF	NR	-
3	MeCN	NR	-
4	dioxane	NR	-
5	DCM	NR	-
6	DMF	NR	-
7	DMSO	NR	-
8	o-xylene	NR	-
9	m-Xylene	55	63
10	p-Xylene	33	63

11	Chlorobenzene	35	70
12	Bromobenzene	trace	-
13	fluorobenzene	73	70
14	(trifluoromethyl)benzene	67	66

[a] Reaction conditions: 1a (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), Solvent (2 mL), N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

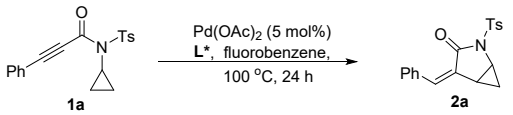
Table S9. Optimization of additive.

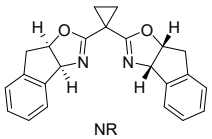
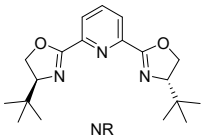
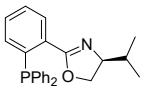
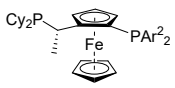
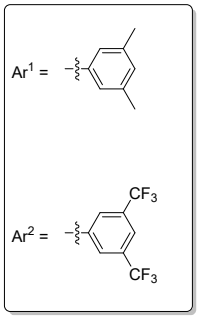
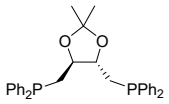
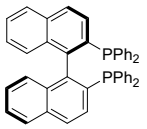
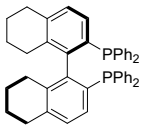
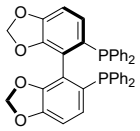
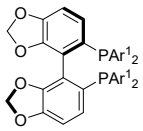
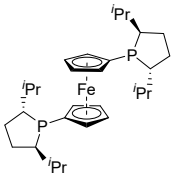
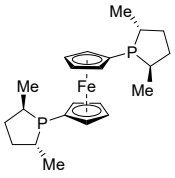
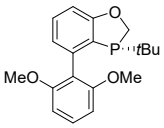
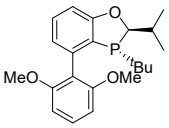
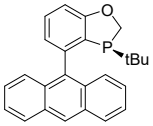
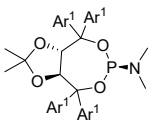
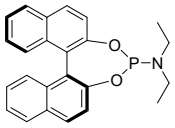
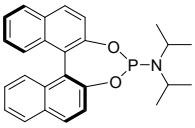
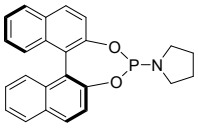
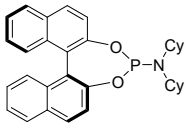
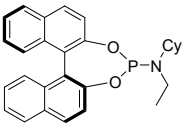
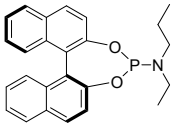
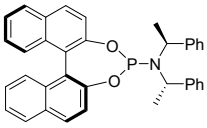
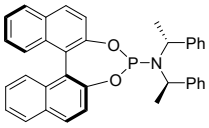
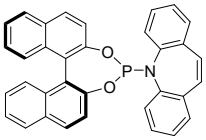
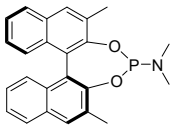
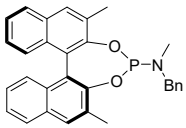
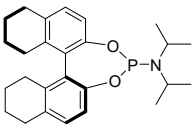


Entry	Additive	Yield (%)[b]	*ee* (%)[c]
1	(R)-(+)-alpha	45	63
2	L(-)-Proline	55	70
3	N-Boc-L-Tert-Leucine	35	57
4	N-Boc-L-valine	37	60
5	N-Ac-Phe-OH	35	63
6	L-Phenylalanine	NR	-
7	Ag_2O	51	67
8	AgOTf	trace	-
9	4Å MS	59	67
10	K_2CO_3	NR	63
11	^{t}BuOK	53	69
12	4-Chlorobenzenesulfonic acid	NR	-
14	PTSA	NR	-

[a] Reaction conditions: 1a (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol%), Solvent (2 mL), additive (20 mol%) N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

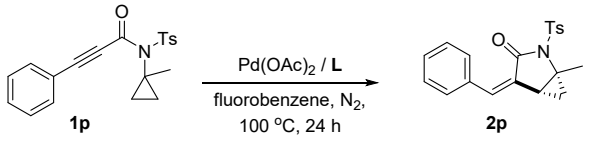
Table S10. Optimization of the chiral Ligand.[a]

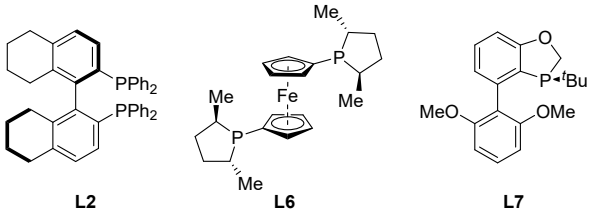


 NR	 NR	 NR	 trace	
 65% yield, 27.3% ee	 NR	 NR	 trace	
 40% yield, 0 ee	 71% yield, 0% ee	 76% yield, 21.2% ee	 59% yield, 51.3% ee	 20% yield, 17% ee
 21% yield, 50% ee	 29% yield, 45% ee	 46% yield, 60.2% ee	 62% yield, 67% ee	 51% yield, 47% ee
 76 yield, 85% ee	 32 yield, 60% ee	 60 yield, 62% ee	 NR	 NR
 NR	 65% yield, 31% ee	 55% yield, 59% ee	 53% yield, 50% ee	

Reaction conditions: **1a** (0.2 mmol), $Pd(OAc)_2$ (5 mol%), Ligand (10 mol% for monodentate ligand, 5 mol% for bidentate ligand), fluorobenzene (2 mL), N_2 atmosphere.

Table S11. Optimization of the chiral Ligand.[a]

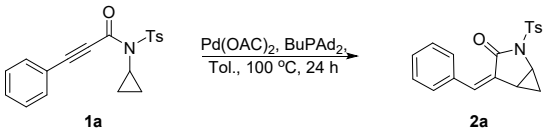




Entry	L.	Yield (%)[b]	*ee* (%)[c]
1	**L2**	NR	-
2	**L6**	trace	-
3	**L7**	61	91

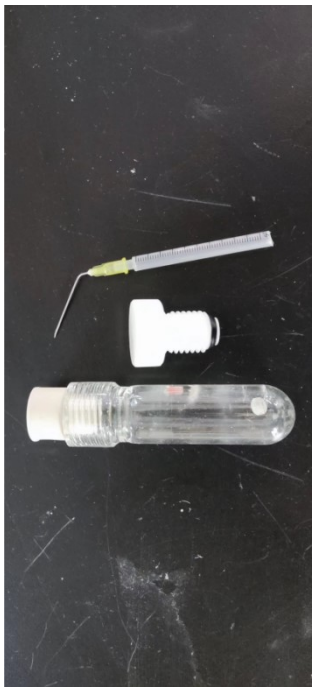
[a] Reaction conditions: 1a (0.2 mmol), Pd(OAc)2 (5 mol%), Ligand (20 mol% for monodentate ligand, 10 mol% for bidentate ligand), Solvent (2 mL), N_2 atmosphere. [b] Isolated yield. [c] Determined by HPLC analysis on a chiral stationary phase.

4 General Procedure

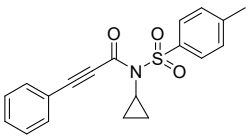


1a (67.8 mg, 0.2 mmol, 1 eq.), $Pd(OAc)_2$ (2.2 mg, 5 mol%), $BuPAd_2$ (71.8 mg, 10 mol%), were transferred into a 15 mL tube. A 2.0 mL vial was placed in the tube and the tube was sealed with a septum. The tube was connected to an nitrogen-vacuum line, evacuated and backfilled with N_2 (x3). Then, a solution of toluene (2 mL) was added to the reaction tube. Then, the reaction tube was sealed with a screw-top septum cap quickly and placed in a heating block that was preheated to 100 °C. After a time period of 24 h, the reaction tube was allowed cooled to room temperature. The mixture was concentrated under reduced pressure and the residue was purified by flash chromatography on silica gel eluting with petroleum ether / EtOAc to afford the products **2a.**

[a]For preparation of the asymmetric products, chiral ligand **L12** (or **L7**) was used with fluorobenzene as solvent.



5 Experimental Characterization Data for the Starting Materials

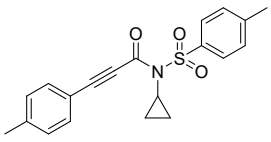


***N*-cyclopropyl-3-phenyl-*N*-tosylpropiolamide (1a)**. The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.4 Hz, 2H), 7.53 (dd, *J* = 5.1, 3.3 Hz, 2H), 7.48 – 7.43 (m, 1H), 7.37 (dd, *J* = 10.5, 4.6 Hz, 2H), 7.32 (d, *J* = 8.2 Hz, 2H), 2.96 – 2.88 (m, 1H), 2.42 (s, 3H), 1.23 – 1.19 (m, 2H), 1.15 – 1.11 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.7, 145.0, 136.0, 132.7, 130.9, 129.4, 128.6, 119.6, 93.6, 82.3, 28.6, 21.6, 10.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{18}NO_3S^+$ 340.1002; Found 340.0997.

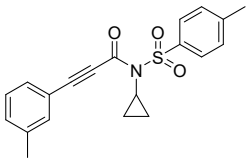


***N*-cyclopropyl-3-(p-tolyl)-*N*-tosylpropiolamide (1b)**. The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.3 Hz, 2H), 7.43 (d, *J* = 8.1 Hz, 2H), 7.32 (d, *J* = 8.1 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 2.96 – 2.90 (m, 1H), 2.43 (s, 3H), 2.38 (s, 3H), 1.24 – 1.19 (m, 2H), 1.16 – 1.10 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.9, 145.1, 141.8, 136.2, 132.9, 129.6, 128.6, 116.6, 94.4, 82.2, 28.7, 21.8, 10.4.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1154.

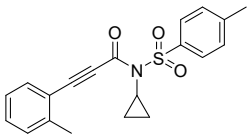


***N*-cyclopropyl-3-(m-tolyl)-*N*-tosylpropiolamide (1c)**. The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.3 Hz, 2H), 7.35 – 7.33 (m, 4H), 7.32 – 7.27 (m, 2H), 2.95 – 2.91 (m, 1H), 2.44 (s, 3H), 2.35 (s, 3H), 1.25 – 1.21 (m, 2H), 1.16 – 1.12 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.9, 145.1, 138.7, 136.2, 133.3, 132.0, 130.0, 129.6, 128.7, 119.5, 94.1, 82.2, 28.7, 21.8, 21.3, 10.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1154.

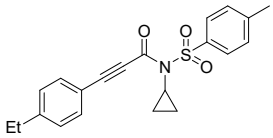


***N*-cyclopropyl-3-(o-tolyl)-*N*-tosylpropiolamide (1d)**. The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.4 Hz, 2H), 7.50 (d, *J* = 7.7 Hz, 1H), 7.38 – 7.31 (m, 3H), 7.25 (d, *J* = 7.7 Hz, 1H), 7.20 (t, *J* = 7.6 Hz, 1H), 2.98 – 2.92 (m, 1H), 2.47 (s, 3H), 2.44 (s, 3H), 1.25 – 1.19 (m, 2H), 1.16 – 1.10 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 156.0, 145.0, 140.7, 137.3, 136.2, 133.8, 130.5, 130.1, 129.5, 128.6, 116.8, 94.7, 82.1, 28.7, 21.7, 20.1, 19.6, 10.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1153.

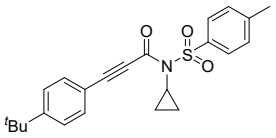


***N*-cyclopropyl-3-(4-ethylphenyl)-*N*-tosylpropiolamide (1e)**. The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.3 Hz, 2H), 7.46 (d, *J* = 8.1 Hz, 2H), 7.32 (d, *J* = 8.2 Hz, 2H), 7.21 (d, *J* = 8.1 Hz, 2H), 2.98 – 2.89 (m, 1H), 2.67 (q, *J* = 7.6 Hz, 2H), 2.42 (s, 3H), 1.27 – 1.19 (m, 5H), 1.16 – 1.08 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.8, 147.9, 144.9, 136.1, 132.9, 129.4, 128.6, 128.2, 116.7, 94.3, 82.1, 29.0, 28.6, 21.6, 15., 10.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{22}NO_3S^+$ 368.1315; Found 368.1310.

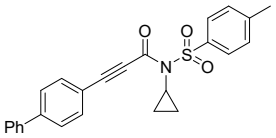


3-(4-(tert-butyl)phenyl)-*N*-cyclopropyl-*N*-tosylpropiolamide (1h). The compound was prepared according to the general procedure to give a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.3 Hz, 2H), 7.73 (d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.5 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 6.95 (s, 1H), 4.00 (ddd, *J* = 7.3, 5.1, 2.4 Hz, 1H), 2.42 (s, 3H), 2.35 (td, *J* = 7.6, 4.7 Hz, 1H), 1.30 (s, 9H), 1.13 – 1.08 (m, 1H), 0.53 – 0.48 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.9, 152.9, 145.0, 140.2, 135.2, 130.6, 129.6, 128.8, 128.3, 125.0, 34.8, 33.5, 31.1, 21.6, 17.5, 16.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{26}NO_3S^+$ 396.1628; Found 396.1623.

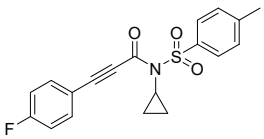


3-([1,1'-biphenyl]-4-yl)-*N*-cyclopropyl-*N*-tosylpropiolamide (1i). The compound was prepared according to the general procedure to give a white solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.3 Hz, 2H), 7.65 – 7.58 (m, 6H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.40 (t, *J* = 7.3 Hz, 1H), 7.34 (d, *J* = 8.2 Hz, 2H), 2.95 (ddd, *J* = 10.5, 7.0, 3.7 Hz, 1H), 2.45 (s, 3H), 1.24 (dd, *J* = 10.8, 4.1 Hz, 2H), 1.16 (dd, *J* = 10.1, 7.4 Hz, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.7, 145.0, 143.9, 139.8, 136.2, 133.4, 129.6, 129.1, 128.7, 128.4, 127.5, 127.2, 118.4, 93.7, 83.3, 28.6, 21.6, 10.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{25}H_{22}NO_3S^+$ 416.1315; Found 416.1311.



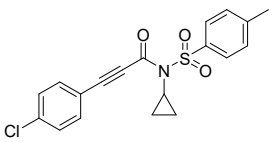
***N*-cyclopropyl-3-(4-fluorophenyl)-*N*-tosylpropiolamide (1f)**. The compound was prepared according to the general procedure to give a white solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.12 – 8.04 (m, 2H), 7.59 – 7.51 (m, 2H), 7.47 (dd, *J* = 10.7, 4.3 Hz, 1H), 7.38 (t, *J* = 7.6 Hz, 2H), 7.20 (t, *J* = 8.6 Hz, 2H), 3.00 – 2.88 (m, 1H), 1.29 – 1.21 (m, 5H), 1.18 – 1.12 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 165.1, 163.1, 154.7, 145.2, 136.0, 135.2, 129.6, 128.6, 116.4, 116.3, 92.7, 82.3, 28.7, 21.7, 10.7.

^{19}F NMR (471 MHz, $CDCl_3$) δ -105.60 (s).

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{17}FNO_2S^+$ 358.0908; Found 358.0902.

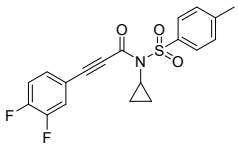


3-(4-chlorophenyl)-*N*-cyclopropyl-*N*-tosylpropiolamide (1g). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (d, *J* = 8.3 Hz, 2H), 7.47 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.2 Hz, 2H), 2.94 – 2.86 (m, 1H), 2.44 (s, 3H), 1.24 – 1.18 (m, 2H), 1.15 – 1.10 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154.6, 145.3, 137.5, 136.1, 134.1, 129.7, 129.3, 128.7, 118.6, 92.4, 83.2, 28.7, 21.8, 10.4.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{17}ClNO_3S^+$ 374.0612; Found 374.0606.



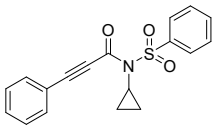
***N*-cyclopropyl-3-(3,4-difluorophenyl)-*N*-tosylpropiolamide (1j)**. The compound was prepared according to the general procedure to give a brown solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.3 Hz, 2H), 7.65 – 7.58 (m, 6H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.40 (t, *J* = 7.3 Hz, 1H), 7.34 (d, *J* = 8.2 Hz, 2H), 2.95 (ddd, *J* = 10.5, 7.0, 3.7 Hz, 1H), 2.45 (s, 3H), 1.24 (dd, *J* = 10.8, 4.1 Hz, 2H), 1.16 (dd, *J* = 10.1, 7.4 Hz, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 154., 153.2, 151.1, 149.1, 145.3, 135.9, 129.9, 129.6, 128.5, 121.7, 118.2, 116.5, 91.0, 82.5, 28.6, 21.7, 10.3.

^{19}F NMR (471 MHz, CDCl3) δ -130.69 (s), -135.47 (s).

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{16}NO_3S^+$ 376.0813; Found 376.0811.

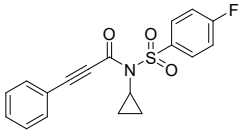


***N*-cyclopropyl-3-phenyl-*N*-(phenylsulfonyl)propiolamide (1l)**. The compound was prepared according to the general procedure to give a white solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.05 (d, *J* = 7.7 Hz, 2H), 7.63 (t, *J* = 7.2 Hz, 1H), 7.53 (s, 4H), 7.46 (t, *J* = 7.3 Hz, 1H), 7.37 (t, *J* = 7.3 Hz, 2H), 2.95 (s, 1H), 1.23 (d, *J* = 6.0 Hz, 2H), 1.14 (s, 2H).

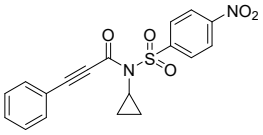
^{13}C NMR (126 MHz, $CDCl_3$) δ 154.8, 139.1, 134.0, 132.9, 131.1, 129.0, 128.8, 128.6, 119.7, 94.0, 82.4, 28.8, 10.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{16}NO_3S^+$ 326.0845; Found 326.0842.

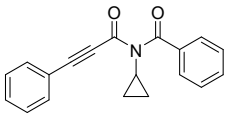


***N*-cyclopropyl-*N*-((4-fluorophenyl)sulfonyl)-3-phenylpropiolamide (1m)**. The compound was prepared according to the general procedure to give a white solid.

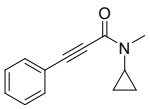
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.12 – 8.06 (m, 2H), 7.57 – 7.52 (m, 2H), 7.48 (dd, *J* = 10.7, 4.3 Hz, 1H), 7.39 (t, *J* = 7.6 Hz, 2H), 7.24 – 7.18 (m, 2H), 2.99 – 2.93 (m, 1H), 1.24 (d, *J* = 6.3 Hz, 2H), 1.19 – 1.13 (m, 2H), 0.86 (ddd, *J* = 18.7, 11.5, 6.7 Hz, 2H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 167.0, 164.9, 154.8, 135.0, 132.9, 131.8, 131.2, 128.9, 119.6, 116.4, 116.2, 94.2, 82.3, 28.8, 10.6.
^{19}F NMR (471 MHz, CDCl3) δ -102.75 (s).
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{15}FNO_2S^+$ 344.0751; Found 344.0746.



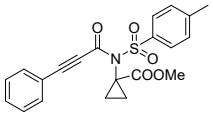
***N*-cyclopropyl-*N*-((4-nitrophenyl)sulfonyl)-3-phenylpropiolamide (1n)**. The compound was prepared according to the general procedure to give a white solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.43 – 8.35 (m, 2H), 8.28 – 8.22 (m, 2H), 7.58 – 7.53 (m, 2H), 7.52 – 7.47 (m, 1H), 7.41 (t, *J* = 7.6 Hz, 2H), 3.05 – 2.98 (m, 1H), 1.32 – 1.28 (m, 2H), 1.22 – 1.16 (m, 2H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 154.7, 150.6, 144.4, 132.9, 131.3, 130.1, 128.8, 124.0, 119.1, 95.0, 81.8, 28.8, 10.6.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H1_5N_2O_5S^+$ 371.0696; Found 371.0691.



***N*-cyclopropyl-*N*-(3-phenylpropioloyl)benzamide (1o)**. The compound was prepared according to the general procedure to give a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 – 7.65 (m, 2H), 7.56 (t, *J* = 7.4 Hz, 1H), 7.45 (t, *J* = 7.7 Hz, 2H), 7.42 – 7.37 (m, 1H), 7.36 – 7.27 (m, 4H), 3.16 – 2.90 (m, 1H), 1.08 (q, *J* = 6.8 Hz, 2H), 0.83 – 0.72 (m, 2H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 155.5, 135.3, 133.1, 132.7, 130.6, 129.20, 128.5, 119.7, 93.8, 82.6, 28.6, 9.4.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{16}NO_2^+$ 290.1176; Found 290.1171.



***N*-cyclopropyl-*N*-methyl-3-phenylpropiolamide (1k)**. The compound was prepared according to the general procedure to give a white solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 – 7.50 (m, 2H), 7.39 – 7.32 (m, 3H), 2.96 (s, 3H), 2.84 (ddd, *J* = 10.7, 7.0, 4.0 Hz, 1H), 0.96 – 0.90 (m, 2H), 0.90 – 0.86 (m, 2H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 132.2, 132.2, 129.8, 128.4, 120.8, 90.5, 82.9, 33.7, 31.7, 8.7.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{13}H_{14}NO^+$ 200.1070; Found 200.1068.

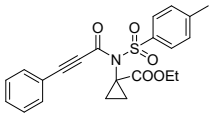


methyl 1-(3-phenyl-*N*-tosylpropiolamido)cyclopropane-1-carboxylate (1p). The compound was prepared according to the general procedure to give a white solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.1 Hz, 2H), 7.47 – 7.39 (m, 3H), 7.38 – 7.28 (m, 4H), 3.81 – 3.71 (m, 3H), 2.46 – 2.33 (m, 3H), 2.12 (ddd, *J* = 7.1, 4.1, 2.4 Hz, 1H), 2.05 – 1.91 (m, 2H), 1.65 – 1.54 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 154.0, 145.3, 135.2, 132.8, 131.1, 129.9, 129.2, 128.7, 119.2, 93.5, 81.7, 53.0, 39.6, 22.9, 21.7, 21.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{25}N_2O_2^+$ 361.1911; Found 361.1907.

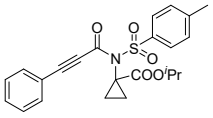


ethyl 1-(3-phenyl-*N*-tosylpropiolamido)cyclopropane-1-carboxylate (1q). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.4 Hz, 2H), 7.42 – 7.33 (m, 3H), 7.27 (dd, *J* = 19.5, 7.9 Hz, 4H), 4.26 – 4.10 (m, 2H), 2.35 (s, 3H), 2.11 – 2.03 (m, 1H), 2.00 – 1.85 (m, 2H), 1.58 – 1.45 (m, 1H), 1.16 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.0, 154.0, 145.2 (s), 135.3 (s), 132.6, 131.1, 129.7, 129.0, 128.7, 119.0, 93.2, 81.7, 62.0, 39.6, 22.8, 21.5, 20.9, 14.1.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{20}NO_5S^+$ 398.1057; Found 398.1055.

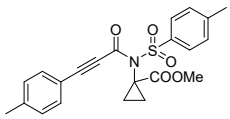


isopropyl 1-(3-phenyl-*N*-tosylpropiolamido)cyclopropane-1-carboxylate (1r). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.05 (d, *J* = 8.4 Hz, 2H), 7.48 – 7.42 (m, 3H), 7.39 – 7.29 (m, 4H), 5.10 (hept, *J* = 6.3 Hz, 1H), 2.43 (s, 3H), 2.15 – 2.08 (m, 1H), 2.01 – 1.92 (m, 2H), 1.60 – 1.54 (m, 1H), 1.29 (d, *J* = 6.3 Hz, 3H), 1.19 (d, *J* = 6.3 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.0, 164.7, 145.2, 141.6, 135.6, 133.1, 131.0, 130.1, 129.5, 129.2, 128.2, 127.7, 70.3, 44.4, 28.4, 24.1, 21.9, 21.8, 21.8, 1.1.

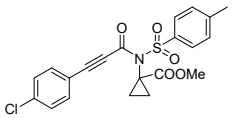
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{24}NO_5S^+$ 426.1370; Found 426.1364.



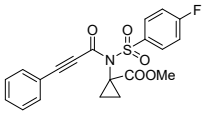
methyl 1-(3-(p-tolyl)-N-tosylpropiolamido)cyclopropane-1-carboxylate (1s). The compound was prepared according to the general procedure to give a foam yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.4 Hz, 2H), 7.33 (dd, *J* = 8.0, 5.1 Hz, 4H), 7.16 (d, *J* = 7.9 Hz, 2H), 3.76 (s, 3H), 2.43 (s, 3H), 2.37 (s, 3H), 2.16 – 2.09 (m, 1H), 1.98 (ddt, *J* = 13.3, 8.6, 4.5 Hz, 2H), 1.64 – 1.57 (m, 1H).

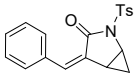
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.8, 154.2, 145.3, 142.0, 135.3, 132.8, 129.9, 129.5, 129.0, 116.1, 94.2, 81.6, 53.0, 39.6, 22.9, 21.7, 21.7, 21.3.



methyl 1-(3-(4-chlorophenyl)-N-tosylpropiolamido)cyclopropane-1-carboxylate (1t). The compound was prepared according to the general procedure to give a foam yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.4 Hz, 2H), 7.39 – 7.30 (m, 6H), 3.76 (s, 3H), 2.43 (s, 3H), 2.16 – 2.09 (m, 1H), 2.02 – 1.93 (m, 2H), 1.59 (dt, *J* = 8.2, 6.1 Hz, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.6, 153.8, 145.3, 137.5, 135.1, 133.9, 129.9, 129.2, 129.0, 117.6, 92.1, 82.4, 52.9, 39.5, 22.7, 21.6, 21.2.

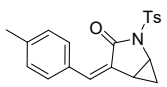


Methyl 1-(N-((4-fluorophenyl)sulfonyl)-3-phenylpropiolamido)cyclopropane-1-carboxylate (1u). The compound was prepared according to the general procedure to give a foam yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.25 – 8.14 (m, 2H), 7.49 – 7.43 (m, 3H), 7.37 (dd, *J* = 10.5, 4.8 Hz, 2H), 7.21 (t, *J* = 8.6 Hz, 2H), 3.77 (s, 3H), 2.15 (ddd, *J* = 9.4, 5.4, 2.2 Hz, 1H), 2.01 (tdd, *J* = 13.8, 8.6, 5.0 Hz, 2H), 1.68 – 1.61 (m, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.6, 154.0, 133.16, 133.1, 132.8, 131.2, 128.7, 119.0, 115.7, 115.5, 93.9, 81.5, 53.0, 39.6, 22.7, 21.3.
^{19}F NMR (471 MHz, $CDCl_3$) δ -102.48.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{16F}NO_5S^+$ 402.0806; Found 402.0816.



(*Z*)-4-benzylidene-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2a). The compound was prepared according to the general procedure to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.3 Hz, 2H), 7.76 (dd, *J* = 7.6, 1.6 Hz, 2H), 7.32 (dd, *J* = 7.5, 5.2 Hz, 5H), 6.96 (s, 1H), 4.00 (ddd, *J* = 7.2, 5.1, 2.4 Hz, 1H), 2.41 (s, 3H), 2.35 (td, *J* = 7.8, 4.8 Hz, 1H), 1.15 – 1.08 (m, 1H), 0.55 – 0.49 (m, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 163.9, 145.3, 140.3, 135.3, 133.4, 130.8, 129.8, 128.4, 128.2, 33.7, 21.8, 17.7, 16.4.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{18}NO_2S^+$ 340.1002; Found 340.0997.

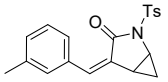
$[\alpha]_D^{20}$ -20 (*c* 1.0, $CHCl_3$, 85% ee sample).



(*Z*)-4-(4-methylbenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2b). The compound was prepared according to the general procedure to give a yellow solid.

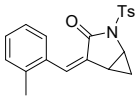
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.3 Hz, 2H), 7.68 (d, *J* = 8.1 Hz, 2H), 7.30 (d, *J* = 8.1 Hz, 2H), 7.13 (d, *J* = 8.0 Hz, 2H), 6.92 (s, 1H), 3.98 (ddd, *J* = 7.3, 5.0, 2.5 Hz, 1H), 2.41 (s, 3H), 2.37 – 2.26 (m, 4H), 1.09 (ddd, *J* = 8.5, 6.1, 5.3 Hz, 1H), 0.54 – 0.43 (m, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.1, 145.2, 140.5, 140.1, 135.4, 130.9, 129.7, 128.9, 128.4, 33.6, 21.8, 21.6, 17.5, 16.5.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1156.

$[\alpha]_D^{20}$ -270 (*c* 1.0, $CHCl_3$, 80% ee sample).

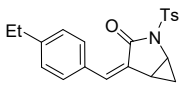


(*Z*)-4-(3-methylbenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2c). The compound was prepared according to the general procedure to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.3 Hz, 2H), 7.63 (d, *J* = 7.7 Hz, 1H), 7.51 (s, 1H), 7.32 (d, *J* = 8.1 Hz, 2H), 7.23 (t, *J* = 7.7 Hz, 1H), 7.13 (d, *J* = 7.6 Hz, 1H), 6.94 (s, 1H), 4.00 (ddd, *J* = 7.2, 5.0, 2.5 Hz, 1H), 2.42 (s, 3H), 2.38 – 2.32 (m, 4H), 1.11 (ddd, *J* = 8.5, 6.1, 5.3 Hz, 1H), 0.54 – 0.49 (m, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8, 145.2, 140.5, 137.8, 135.4, 133.4, 131.4, 130.5, 129.7, 128.4, 128.1, 127.9, 33.7, 21.8, 21.5, 17.7, 16.5.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1154.

$[\alpha]_D^{20}$ -150 (*c* 1.0, $CHCl_3$, 79% ee sample).



(*Z*)-4-(2-methylbenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2d). The compound was prepared according to the general procedure to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.3 Hz, 1H), 7.55 (d, *J* = 7.6 Hz, 1H), 7.30 (d, *J* = 8.1 Hz, 1H), 7.21 (t, *J* = 7.3 Hz, 1H), 7.14 (d, *J* = 7.4 Hz, 2H), 2.42 (s, 1H), 2.38 (td, *J* = 7.8, 4.9 Hz, 1H), 2.26 (s, 2H), 1.18 – 1.11 (m, 1H), 0.93 – 0.86 (m, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8, 145.3, 140.5, 137.8, 135.4, 133.4, 131.4, 130.5, 129.7, 128.4, 128.1, 127.9, 33.7, 21.8, 21.5, 17.7, 16.5.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{20}NO_3S^+$ 354.1158; Found 354.1155.

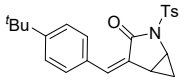


(*Z*)-4-(4-ethylbenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2e). The compound was prepared according to the general procedure to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.2 Hz, 2H), 7.71 (d, *J* = 8.1 Hz, 2H), 7.31 (d, *J* = 8.1 Hz, 2H), 7.16 (d, *J* = 8.1 Hz, 2H), 6.94 (s, 1H), 4.04 – 3.96 (m, 1H), 2.64 (q, *J* = 7.6 Hz, 2H), 2.42 (s, 3H), 2.38 – 2.29 (m, 1H), 1.22 (t, *J* = 7.6 Hz, 3H), 1.10 (dt, *J* = 8.5, 5.7 Hz, 1H), 0.56 – 0.48 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.9, 146.2, 145.0, 140.4, 135.3, 130.9, 129.6, 128.7, 128.3, 127.6 , 33.5, 28.8, 21.7, 17.5, 16.4, 15.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{22}NO_3S^+$ 368.1315; Found 368.1311.

$[\alpha]_D^{20}$ -10 (*c* 1.0, $CHCl_3$, 71% ee sample).

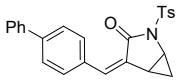


(*Z*)-4-(4-(tert-butyl)benzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2h). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.38 (d, *J* = 7.4 Hz, 2H), 7.34 (m, 1H), 7.28 (dd, *J* = 10.5, 4.8 Hz, 2H), 7.24 – 7.17 (m, 2H), 6.99 (m, 1H), 1.60 (dd, *J* = 8.9, 6.8 Hz, 2H), 1.10 (dd, *J* = 8.9, 6.8 Hz, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 164.1, 153.1, 145.2, 140.3, 135.4, 130.8, 129.8, 129.0, 128.4, 125.2, 34.9, 33.6, 31.2, 21.8, 17.6, 16.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{26}NO_3S^+$ 396.1628; Found 396.1625.

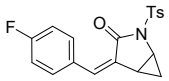


(*Z*)-4-([1,1'-biphenyl]-4-ylmethylene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2i). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.3 Hz, 2H), 7.87 (d, *J* = 8.3 Hz, 2H), 7.64 – 7.53 (m, 4H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.37 (d, *J* = 7.3 Hz, 1H), 7.34 (t, *J* = 7.1 Hz, 2H), 7.00 (s, 1H), 4.03 (ddd, *J* = 7.2, 5.1, 2.4 Hz, 1H), 2.43 (s, 3H), 2.38 (td, *J* = 7.7, 4.9 Hz, 1H), 1.17 – 1.10 (m, 1H), 0.60 – 0.50 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 164.0, 145.3, 142.3, 140.5, 139.9, 135.3, 132.5, 131.4, 129.8, 128.9, 128.4, 127.8, 127.2, 126.8, 33.8, 21.8, 17.8, 16.6.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{25}H_{22}NO_3S^+$ 416.1315; Found 416.1310.



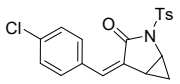
(*Z*)-4-(4-fluorobenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2f). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 7.6 Hz, 2H), 7.83 – 7.74 (m, 2H), 7.32 (d, *J* = 7.8 Hz, 2H), 6.99 (t, *J* = 8.1 Hz, 2H), 6.91 (s, 1H), 4.00 (s, 1H), 2.42 (s, 3H), 2.38 – 2.31 (m, 1H), 1.12 (dd, *J* = 12.5, 6.4 Hz, 1H), 0.52 (s, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8, 145.2, 138.8, 135.0, 132.9, 132.9, 129.6, 129.4, 128.2, 115.1, 114.9, 33.6, 21.6, 17.5, 16.2.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{17}FNO_2S^+$ 358.0908; Found 358.0901.

$[\alpha]_D^{20}$ -340 (*c* 1.0, $CHCl_3$, 84% ee sample).



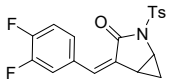
(*Z*)-4-(4-chlorobenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2g). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.3 Hz, 2H), 7.72 (d, *J* = 8.5 Hz, 2H), 7.34 (d, *J* = 8.2 Hz, 2H), 7.30 (d, *J* = 8.6 Hz, 2H), 6.91 (s, 1H), 4.03 (ddd, *J* = 7.2, 5.0, 2.4 Hz, 1H), 2.44 (s, 3H), 2.36 (td, *J* = 7.7, 4.9 Hz, 1H), 1.19 – 1.12 (m, 1H), 0.56 (ddd, *J* = 6.7, 4.6, 2.5 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.9, 145.4, 138.7, 135.4, 135.2, 132.2, 131.9, 130.6, 129.8, 128.4, 33.9, 21.8, 17.9, 16.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{17}ClNO_3S^+$ 374.0612; Found 374.0606.

$[\alpha]_D^{20}$ -70 (*c* 1.0, $CHCl_3$, 85% ee sample).



(*Z*)-4-(3,4-difluorobenzylidene)-2-tosyl-2-azabicyclo[3.1.0]hexan-3-one (2j). The compound was prepared according to the general procedure to give a yellow solid.

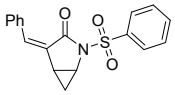
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.3 Hz, 2H), 7.65 – 7.58 (m, 6H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.40 (t, *J* = 7.3 Hz, 1H), 7.34 (d, *J* = 8.2 Hz, 2H), 2.95 (ddd, *J* = 10.5, 7.0, 3.7 Hz, 1H), 2.45 (s, 3H), 1.24 (dd, *J* = 10.8, 4.1 Hz, 2H), 1.16 (dd, *J* = 10.1, 7.4 Hz, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8 (s), 151.9, 150.7, 149.9, 148.8, 145.5, 137.7, 135.1, 131.1, 130.5, 129.9, 128.4, 127.8, 119.7, 116.9, 34.0, 21.8, 18.0, 16.5.

^{19}F NMR (471 MHz, $CDCl_3$) δ -255.60 (s), -258.05 (s).

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{16}NO_3S^+$ 376.0813; Found 376.0810.

$[\alpha]_D^{20}$ -340 (*c* 1.0, $CHCl_3$, 85% ee sample).



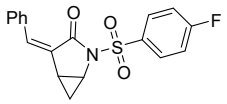
(*Z*)-4-benzylidene-2-(phenylsulfonyl)-2-azabicyclo[3.1.0]hexan-3-one (2l). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.10 – 8.06 (m, 2H), 7.75 (dd, *J* = 7.5, 1.6 Hz, 2H), 7.62 (d, *J* = 7.5 Hz, 1H), 7.52 (t, *J* = 7.8 Hz, 2H), 7.32 (d, *J* = 7.1 Hz, 3H), 6.97 (s, 1H), 4.01 (ddd, *J* = 7.3, 5.0, 2.5 Hz, 1H), 2.36 (td, *J* = 7.7, 4.9 Hz, 1H), 1.12 (ddd, *J* = 8.5, 6.1, 5.2 Hz, 1H), 0.55 – 0.46 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8, 140.6, 133.2, 131.2, 131.2, 130.6, 129.6, 129.4, 128.1, 116.4, 116.3, 33.5, 17.6, 16.3.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{16}NO_3S^+$ 326.0845; Found 326.0841.

$[\alpha]_D^{20}$ -230 (*c* 1.0, $CHCl_3$, 83% ee sample).



(*Z*)-4-benzylidene-2-((4-fluorophenyl)sulfonyl)-2-azabicyclo[3.1.0]hexan-3-one (2m). The compound was prepared according to the general procedure to give a yellow solid.

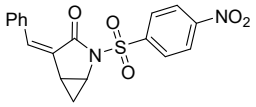
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.14 – 8.09 (m, 2H), 7.75 (dd, *J* = 7.5, 2.0 Hz, 2H), 7.36 – 7.32 (m, 3H), 7.20 (t, *J* = 8.5 Hz, 2H), 7.00 (s, 1H), 4.01 (ddd, *J* = 7.2, 5.0, 2.4 Hz, 1H), 2.39 (td, *J* = 7.7, 4.7 Hz, 1H), 1.17 – 1.11 (m, 1H), 0.57 – 0.49 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.7, 140.3, 138.7, 134.0, 133.2, 130.6, 129.6, 129.5, 129.0, 128.2, 128.0, 33.6, 17.6, 16.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ -102.66 (s).

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{15}FNO_2S^+$ 344.0751; Found 344.0748.

$[\alpha]_D^{20}$ -30 (*c* 1.0, $CHCl_3$, 80% ee sample).



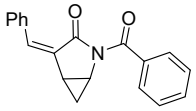
(*Z*)-4-benzylidene-2-((4-nitrophenyl)sulfonyl)-2-azabicyclo[3.1.0]hexan-3-one (2n). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.35 (dd, *J* = 8.8, 1.5 Hz, 2H), 8.30 – 8.25 (m, 2H), 7.75 – 7.67 (m, 2H), 7.34 (dd, *J* = 4.3, 1.5 Hz, 3H), 7.04 (s, 1H), 4.05 (ddd, *J* = 7.3, 5.1, 2.5 Hz, 1H), 2.46 – 2.40 (m, 1H), 1.20 (ddd, *J* = 8.6, 6.4, 5.1 Hz, 1H), 0.60 – 0.56 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 163.8, 150.8, 143.4, 141.5, 133.0, 130.6, 129.8, 129.8, 129.7, 129.6, 128.9, 128.7, 128.1, 124.2, 124.2, 33.6, 17.6, 16.5, 1.0.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H1_5N_2O_5S^+$ 371.0696; Found 371.0692.

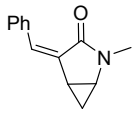
$[\alpha]_D^{20}$ -50 (*c* 1.0, $CHCl_3$, 76% ee sample).



(*Z*)-2-benzoyl-4-benzylidene-2-azabicyclo[3.1.0]hexan-3-one (2o). The compound was prepared according to the general procedure to give a yellow oil.

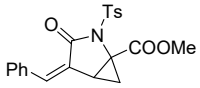
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 – 8.06 (m, 1H), 7.76 (dd, *J* = 7.5, 1.6 Hz, 1H), 7.63 (t, *J* = 7.5 Hz, 1H), 7.53 (t, *J* = 7.8 Hz, 1H), 7.33 (d, *J* = 7.1 Hz, 1H), 6.98 (s, 1H), 4.02 (ddd, *J* = 7.3, 5.0, 2.5 Hz, 1H), 2.37 (td, *J* = 7.7, 4.9 Hz, 1H), 1.13 (ddd, *J* = 8.5, 6.1, 5.2 Hz, 1H), 0.55 – 0.48 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 166.9, 165.3, 143.6, 135.5, 132.0, 129.4, 128.9, 128.8, 128.8, 128.6, 128.0, 126.9, 24.7, 8.4, 1.0.



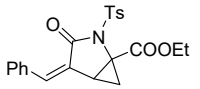
(*Z*)-4-benzylidene-2-methyl-2-azabicyclo[3.1.0]hexan-3-one (2k). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.6 Hz, 2H), 7.35 (t, *J* = 7.5 Hz, 2H), 7.29 (d, *J* = 7.1 Hz, 1H), 6.91 (s, 1H), 3.26 (ddd, *J* = 6.8, 4.8, 2.3 Hz, 1H), 2.97 (s, 3H), 2.27 (td, *J* = 7.4, 4.7 Hz, 1H), 1.03 (dt, *J* = 8.4, 5.1 Hz, 1H), 0.69 (td, *J* = 5.5, 2.3 Hz, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 166.1, 135.0, 134.6, 133.0, 130.5, 128.3, 127.9, 36.1, 30.0, 19.4, 16.7.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{13}H_{14}NO^+$ 200.1070; Found 200.1068.

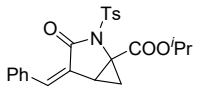


methyl (*Z*)-4-benzylidene-3-oxo-2-tosyl-2-azabicyclo[3.1.0]hexane-1-carboxylate (2p). The compound was prepared according to the general procedure to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.09 (d, *J* = 8.4 Hz, 2H), 7.77 (dd, *J* = 6.8, 2.8 Hz, 2H), 7.35 – 7.30 (m, 5H), 7.01 (s, 1H), 3.85 (s, 3H), 2.73 – 2.66 (m, 1H), 2.41 (s, 3H), 2.26 (dd, *J* = 8.9, 6.0 Hz, 1H), 1.48 (t, *J* = 5.8 Hz, 1H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 168.8, 164.4, 145.2, 141.7, 135.3, 132.8, 130.8), 129.9, 129.3, 129.0, 128.0, 127.2, 52.8, 43.9, 28.3, 24.1, 21.6.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{20}NO_5S^+$ 398.1053; Found 398.1057.

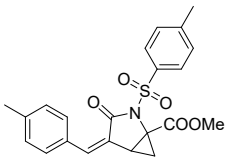
$[\alpha]_D^{20}$ 110 (*c* 1.0, $CHCl_3$, 91% ee sample).



ethyl (*Z*)-4-benzylidene-3-oxo-2-tosyl-2-azabicyclo[3.1.0]hexane-1-carboxylate (2q). The compound was prepared according to the general procedure at 120 °C to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.10 (d, *J* = 8.3 Hz, 2H), 7.77 (dd, *J* = 6.5, 2.9 Hz, 2H), 7.37 – 7.30 (m, 5H), 7.02 (s, 1H), 4.39 – 4.26 (m, 2H), 2.69 (dd, *J* = 8.8, 5.6 Hz, 1H), 2.43 (s, 3H), 2.27 (dd, *J* = 8.9, 6.0 Hz, 1H), 1.48 (t, *J* = 5.8 Hz, 1H), 1.35 (t, *J* = 7.1 Hz, 3H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 168.4, 164.5, 145.1, 141.6, 135.4, 132.9, 130.87, 130.0 (s), 129.4, 129.1, 128.1, 127.4, 62.2, 44.1, 28.4, 24.1, 21.7, 14.1, 1.0.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{22}NO_5S^+$ 412.1213; Found 412.1209.



isopropyl (*Z*)-4-benzylidene-3-oxo-2-tosyl-2-azabicyclo[3.1.0]hexane-1-carboxylate (2r). The compound was prepared according to the general procedure at 120 °C to give a yellow solid.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 (d, *J* = 8.2 Hz, 2H), 7.78 (dd, *J* = 6.4, 2.7 Hz, 2H), 7.37 – 7.30 (m, 5H), 7.01 (s, 1H), 5.17 (dt, *J* = 12.5, 6.2 Hz, 1H), 2.67 (dd, *J* = 8.8, 5.6 Hz, 1H), 2.43 (s, 3H), 2.26 (s, 1H), 1.46 (t, *J* = 5.7 Hz, 1H), 1.34 (t, *J* = 6.4 Hz, 6H).
^{13}C NMR (126 MHz, $CDCl_3$) δ 168.0, 164.7, 145.2, 141.6, 135.6, 133.1), 131.0, 130.0, 129.5, 129.2, 128.2, 127.7, 70.2, 44.4, 28.4, 24.2, 21.9, 21.8, 21.8, 1.1.
HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{24}NO_5S^+$ 426.1370; Found 426.1366.



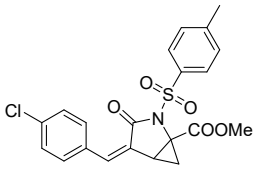
methyl (Z)-4-(4-methylbenzylidene)-3-oxo-2-tosyl-2-azabicyclo[3.1.0]hexane-1-carboxylate (2s). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.3 Hz, 2H), 7.69 (d, *J* = 8.1 Hz, 2H), 7.32 (t, *J* = 12.6 Hz, 2H), 7.14 (d, *J* = 8.0 Hz, 2H), 6.97 (s, 1H), 3.84 (s, 3H), 2.68 (dd, *J* = 8.7, 5.7 Hz, 1H), 2.43 (s, 3H), 2.36 (d, *J* = 22.4 Hz, 3H), 2.24 (dt, *J* = 14.3, 7.2 Hz, 1H), 1.45 (dd, *J* = 15.2, 9.4 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.9, 164.5, 145.1, 141.8, 140.5, 135.4, 131.0, 130.2, 129.3, 129.0, 128.8, 126.1, 52.8, 43.8, 28.5, 24.0, 21.6, 21.5

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{20}NO_5S^+$ 398.1053; Found 98.1057.

$[\alpha]_D^{20}$ -30 (*c* 1.0, $CHCl_3$, 91% ee sample).



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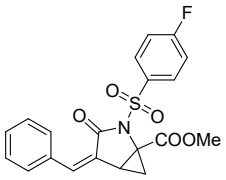
methyl (Z)-4-(4-chlorobenzylidene)-3-oxo-2-tosyl-2-azabicyclo[3.1.0]hexane-1-carboxylate (2t). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.07 (d, *J* = 8.3 Hz, 2H), 7.71 (d, *J* = 8.5 Hz, 2H), 7.32 (dd, *J* = 26.7, 8.3 Hz, 4H), 6.94 (s, 1H), 3.84 (s, 3H), 2.69 (dd, *J* = 8.5, 5.8 Hz, 1H), 2.43 (s, 3H), 2.27 (dd, *J* = 8.9, 6.1 Hz, 1H), 1.50 (t, *J* = 5.8 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.7, 164.4, 145.3, 140.1, 135.8, 135.2, 132.2, 131.3, 129.4, 129.0, 128.3, 127.9, 52.9, 44.1, 28.3, 24.3, 21.7.

$[\alpha]_D^{20}$ -280 (*c* 1.0, $CHCl_3$, 91% ee sample).



Methyl(Z)-4-benzylidene-2-((4-fluorophenyl)sulfonyl)-3-oxo-2-azabicyclo[3.1.0]hexane-1-carboxylate (2u). The compound was prepared according to the general procedure to give a yellow solid.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.29 – 8.22 (m, 2H), 7.79 – 7.72 (m, 2H), 7.38 – 7.32 (m, 3H), 7.22 (t, *J* = 8.6 Hz, 2H), 7.05 (s, 1H), 3.84 (s, 3H), 2.73 (dd, *J* = 8.8, 5.7 Hz, 1H), 2.29 (dd, *J* = 8.9, 6.1 Hz, 1H), 1.54 (t, *J* = 5.9 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.8, 164.5, 142.2, 132.8, 132.2, 132.1, 130.9, 130.1, 128.1, 127.0, 116.2, 116.0, 52.9, 44.0, 28.5, 24.5.

^{19}F NMR (471 MHz, $CDCl_3$) δ -102.71 (s).

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{16F}NO_5S^+$ 402.0806; Found 402.0813.

$[\alpha]_D^{20}$ -10 (*c* 1.0, $CHCl_3$, 90% ee sample).

7 X-ray Crystal Structure Determination of the Products

To grow the crystals used to collect the X-ray data for **2f**, the following method was used: the sample was dissolved with 3 mL petroleum ether and 1 mL CH_2Cl_2 in a small vial, which was kept aside at room temperature to obtain crystals.

A suitable crystal was selectedon a ROD, Synergy Custom system, HyPix diffractometer. The crystal was kept at 296.6 K during data collection. Using Olex2, the structure was solved with the ShelXT structure solution program using Intrinsic Phasing and refined with the ShelXL refinement package using Least Squares minimisation. The data have been deposited at the Cambridge Crystallographic Data Center (CCDC 2257065).

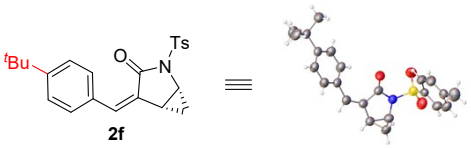


Figure S2. The X-ray Diffraction Configuration of **2f**.

Table S8. Crystallographic data for compounds **2f**

Identification code	**2f**
Empirical formula	$C_{23}H_{25}NO_3S$
Formula weight	395.50
Temperature/K	298
Crystal system	Orthorhombic
Space group	$Pna2_1$
a/Å	15.4097(9)
b/Å	10.4118(4)
c/Å	12.7879(7)
α/°	90°
β/°	90°
γ/°	90°
Volume/Å^3	2051.73(18)
Z	4
ρcalcg/cm^3	1.280
μ/mm^{-1}	1.587
F(000)	840.0

Crystal size/mm^3	? × ? × ?
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/°	10.254 to 154.352
Index ranges	-18 ≤ h ≤ 18, -12 ≤ k ≤ 12, -15 ≤ I≤ 6
Reflections collected	7909
Independent reflections	2859 [R_{int} = 0.0459, R_{sigma} = 0.0493]
Data/restraints/parameters	2859/1/258
Goodness-of-fit on F^2	1.031
Final R indexes [I>=2σ (I)]	R_1 = 0.0492, wR_2 = 0.1326
Final R indexes [all data]	R_1 = 0.0536, wR_2 = 0.1383
Largest diff. peak/hole / e Å^{-3}	0.34/-0.33

To grow the crystals used to collect the X-ray data for **2i**, the following method was used: the sample was dissolved with 3 mL petroleum ether and 1 mL CH_2Cl_2 in a small vial, which was kept aside at room temperature to obtain crystals.

A suitable crystal was selectedon a ROD, Synergy Custom system, HyPix diffractometer. The crystal was kept at 296.6 K during data collection. Using Olex2, the structure was solved with the ShelXT structure solution program using Intrinsic Phasing and refined with the ShelXL refinement package using Least Squares minimisation. The data have been deposited at the Cambridge Crystallographic Data Center (CCDC 2257688).

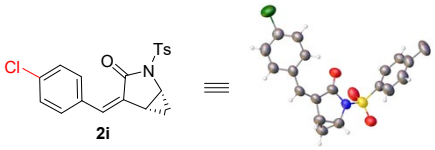


Figure S3. The X-ray Diffraction Configuration of (*R,R*)-**2i**.

Table S8. Crystallographic data for compounds **2i**

Identification code	**2i**
Empirical formula	$C_{19}H_{16}ClNO_3S$
Formula weight	373.85
Temperature/K	296.6
Crystal system	triclinic
Space group	P1
a/Å	6.7397(2)
b/Å	8.1678(2)
c/Å	16.0806(3)
α/°	93.714(2)
β/°	95.548(2)
γ/°	96.111(2)
Volume/Å^3	873.54(4)
Z	1

ρcalcg/cm^3	1.416
μ/mm^{-1}	3.208
F(000)	385.0
Crystal size/mm^3	? × ? × ?
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/°	10.926 to 155.292
Index ranges	-8 ≤ h ≤ 8, -10 ≤ k ≤ 10, -20 ≤ I≤ 19
Reflections collected	23126
Independent reflections	6332 [R_{int} = 0.0338, R_{sigma} = 0.0341]
Data/restraints/parameters	6332/3/453
Goodness-of-fit on F^2	1.028
Final R indexes [I>=2σ (I)]	R_1 = 0.0592, wR_2 = 0.1586
Final R indexes [all data]	R_1 = 0.0731, wR_2 = 0.1723
Largest diff. peak/hole / e Å^{-3}	0.32/-0.32

8 References

[1] Chen, L.; Li, Y.; Han, M.; Peng, Y.; Chen, X.; Xiang, S.; Gao, H.; Lu, T.; Luo, S.-P.; Zhou, B.; Wu, H.; Yang, Y.-F.; Liu, Y. *P/N*-Heteroleptic Cu(I)-Photosensitizer-Catalyzed [3 + 2] Regiospecific Annulation of Aminocyclopropanes and Functionalized Alkynes. *J. Org. Chem*. **2022**, *87*, 15571–15581.

[2] Gu, J.; Hong, B.; Xue, X.; Xi, J.; Gu, Z. Synthesis of Atropisomers with Biaryl and Vinylaryl Chirality via Pd-Catalyzed Point-to-Axial Chirality Transfer Ring-Opening Reaction. *Org. Lett*. **2022**, *24*, 9097–9101.

[3] Nogami, M.; Hirano, K.; Morimoto, K.; Tanioka, M.; Miyamoto, K.; Muranaka, A.; Uchiyama M. Alkynylboration Reaction Leading to Boron-containing π-Extended *cis*-Stilbenes as a Highly Tunable Fluorophore. *Org. Lett*. **2019**, *21*, 3392–3395.

[4] Wang, S.-Y.; Mao, W.-W.; She. Z.-G.; Li, C.-R.; Yang, D.-Q.; Lin, Y.-C. Fu, L.-W. Synthesis and biological evaluation of 12 allenic aromatic ethers. *Bioorganic & Medicinal Chemistry Letters*, **2007**, *17*, 2785-2788.

9 Copies of NMR Spectra for Compounds

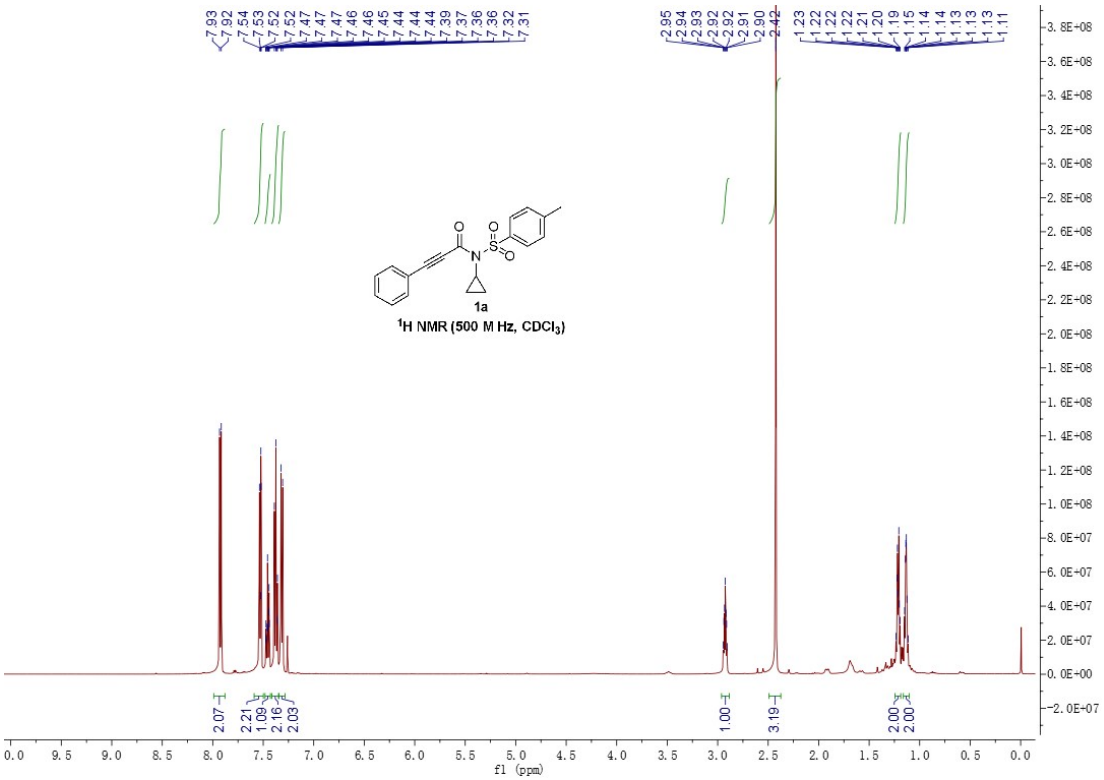


Figure S4. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1a

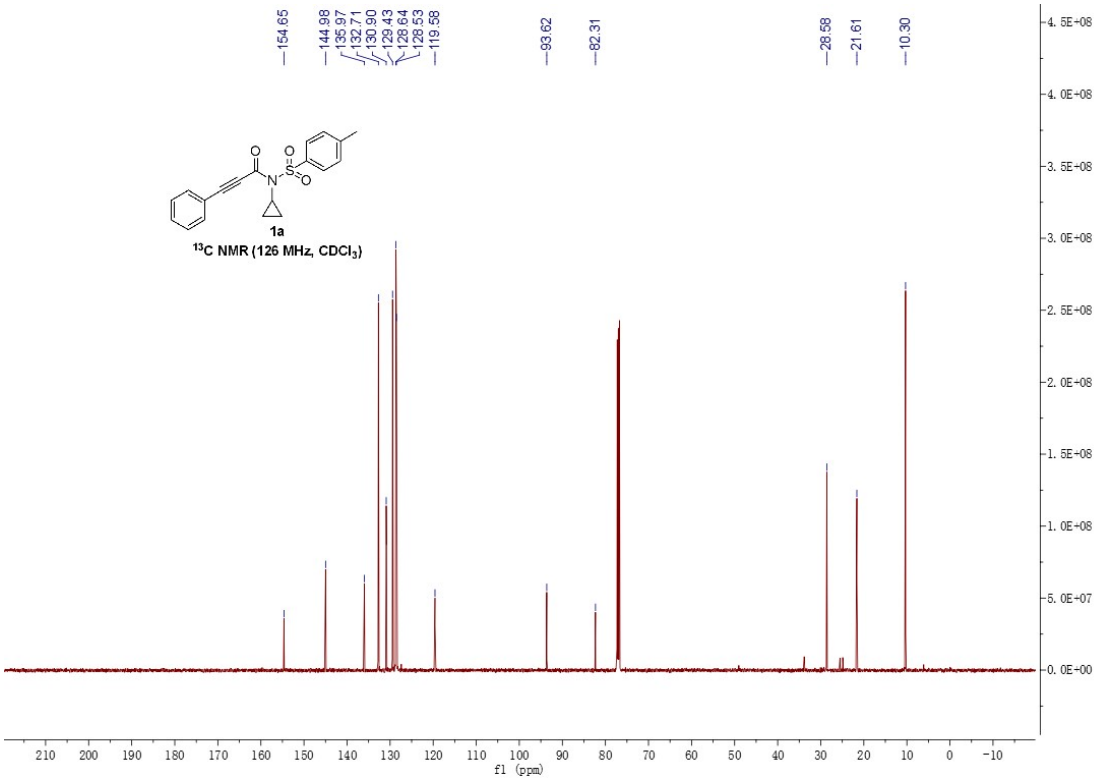


Figure S5. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1a

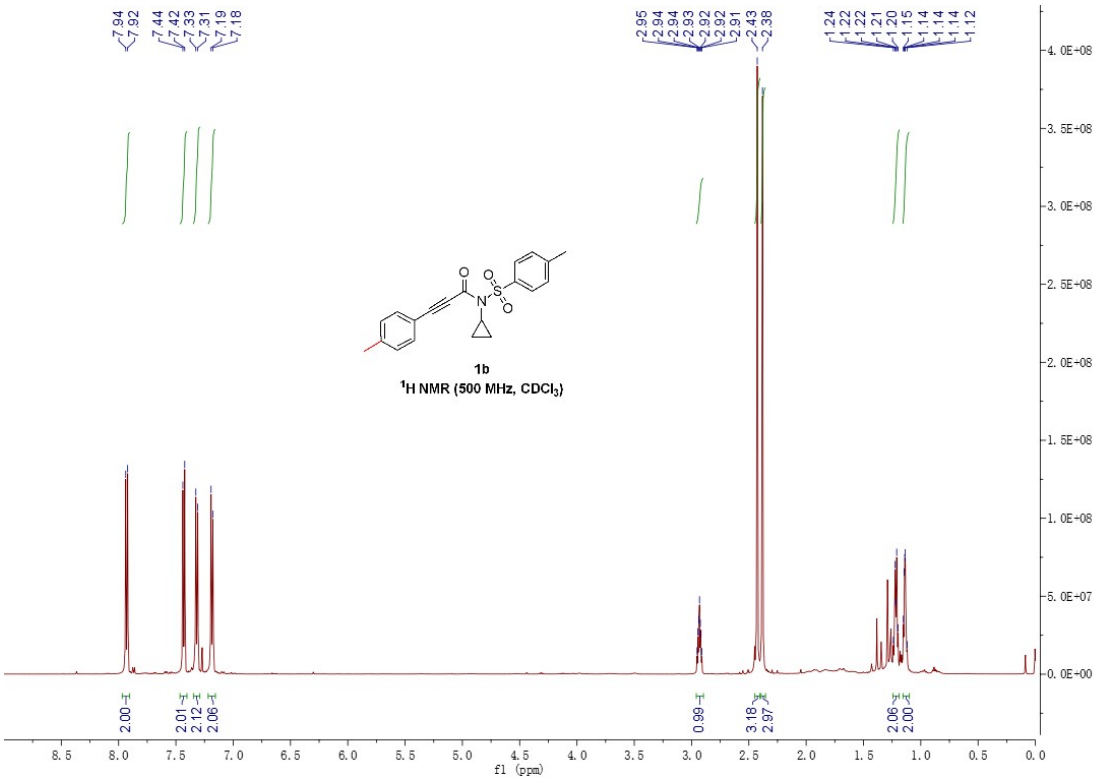


Figure S6. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1b

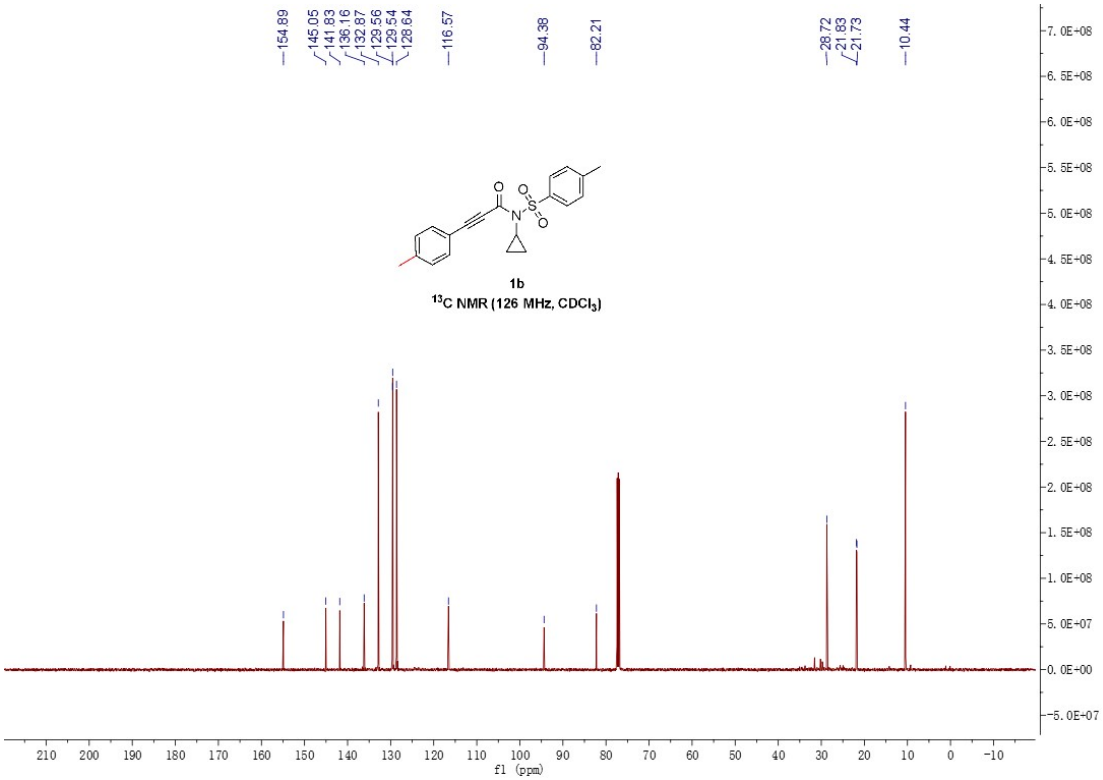


Figure S7. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1b

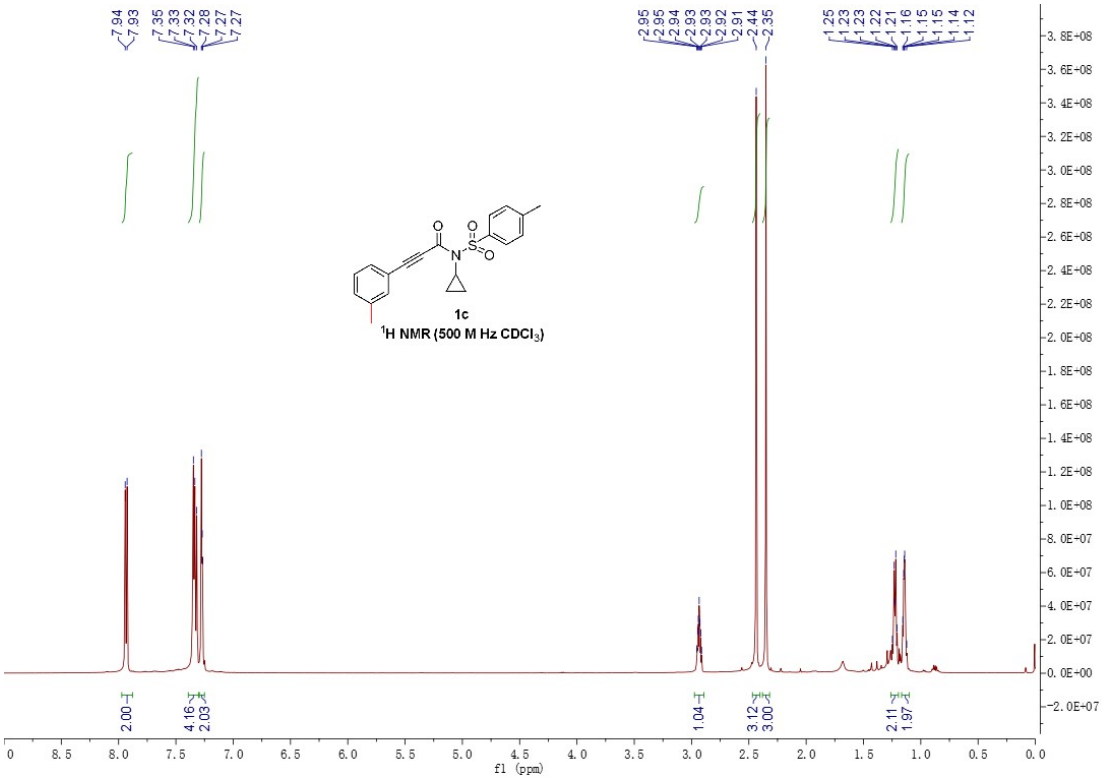


Figure S8. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1c

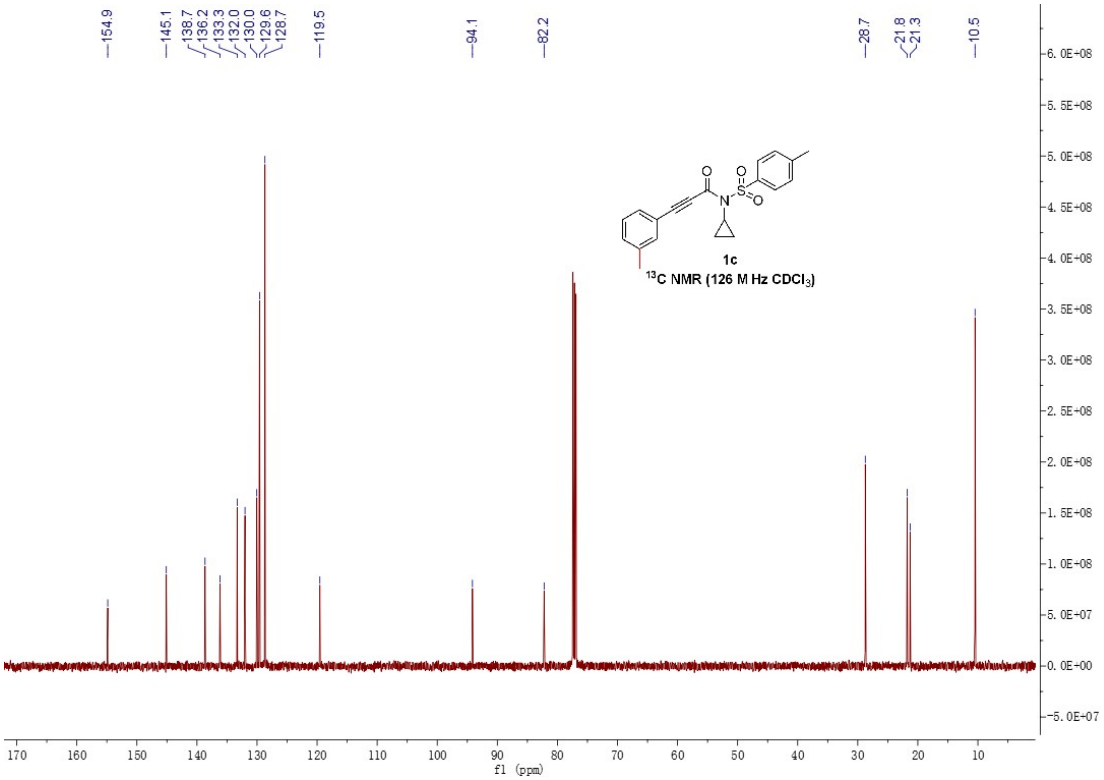


Figure S9. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1c

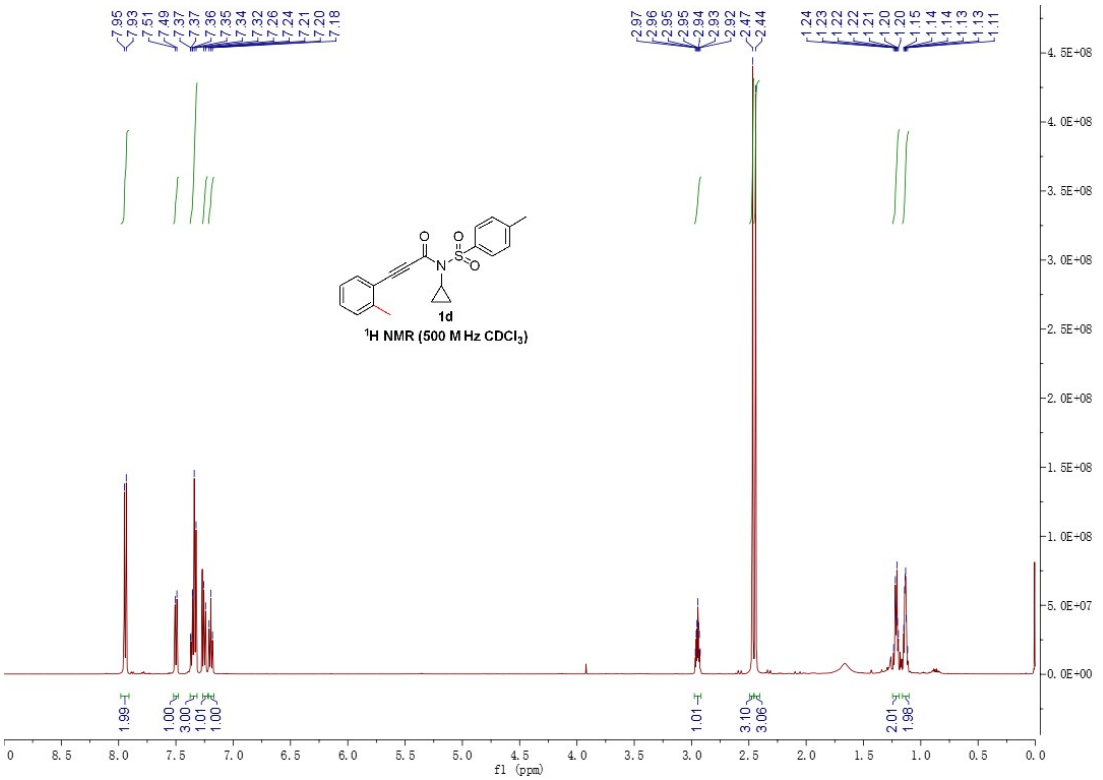


Figure S10. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1d

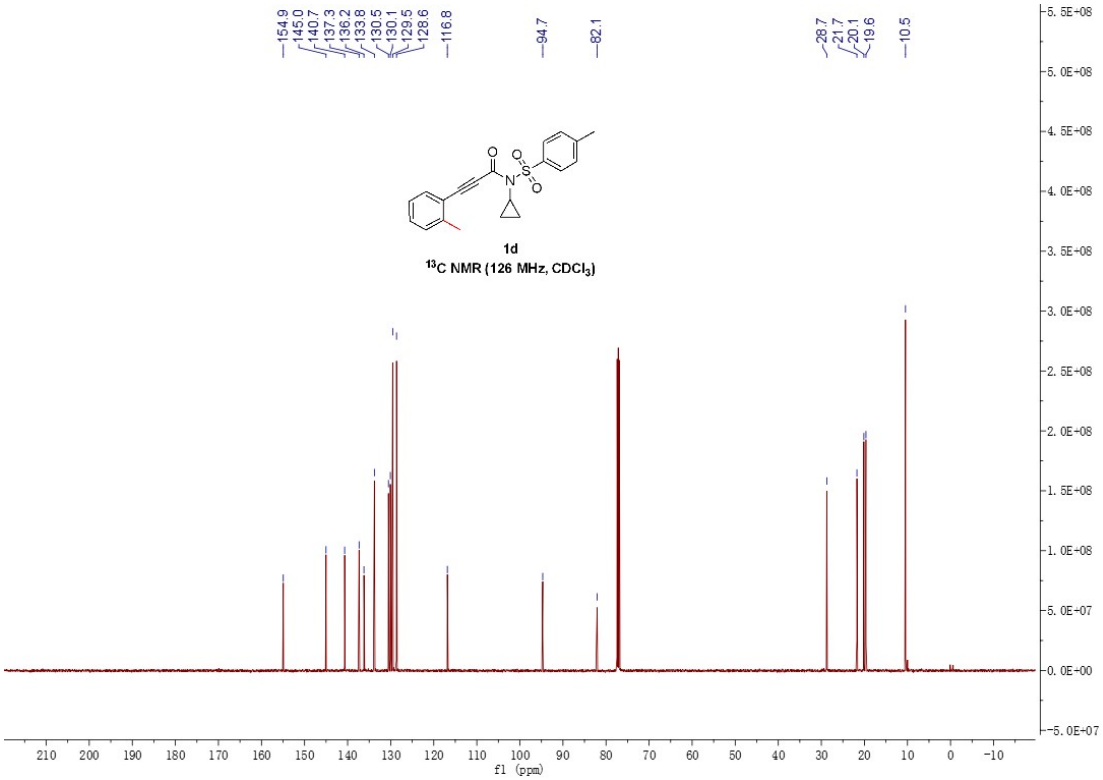


Figure S11. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1d

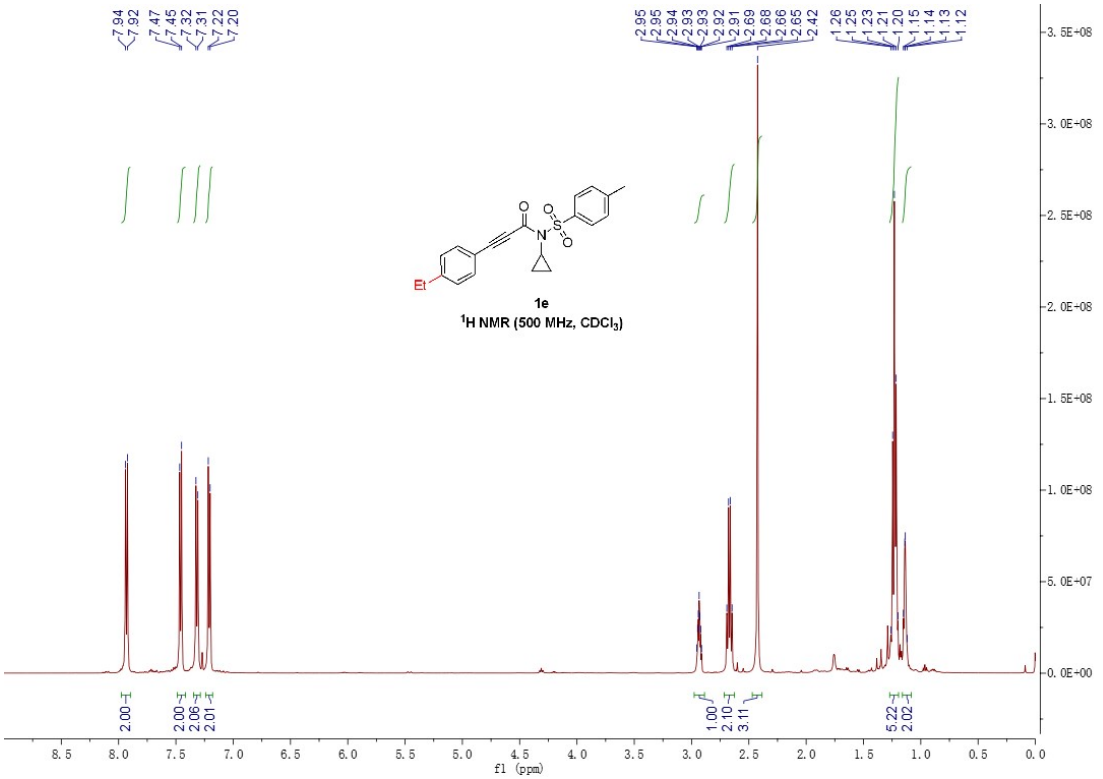


Figure S12. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1e

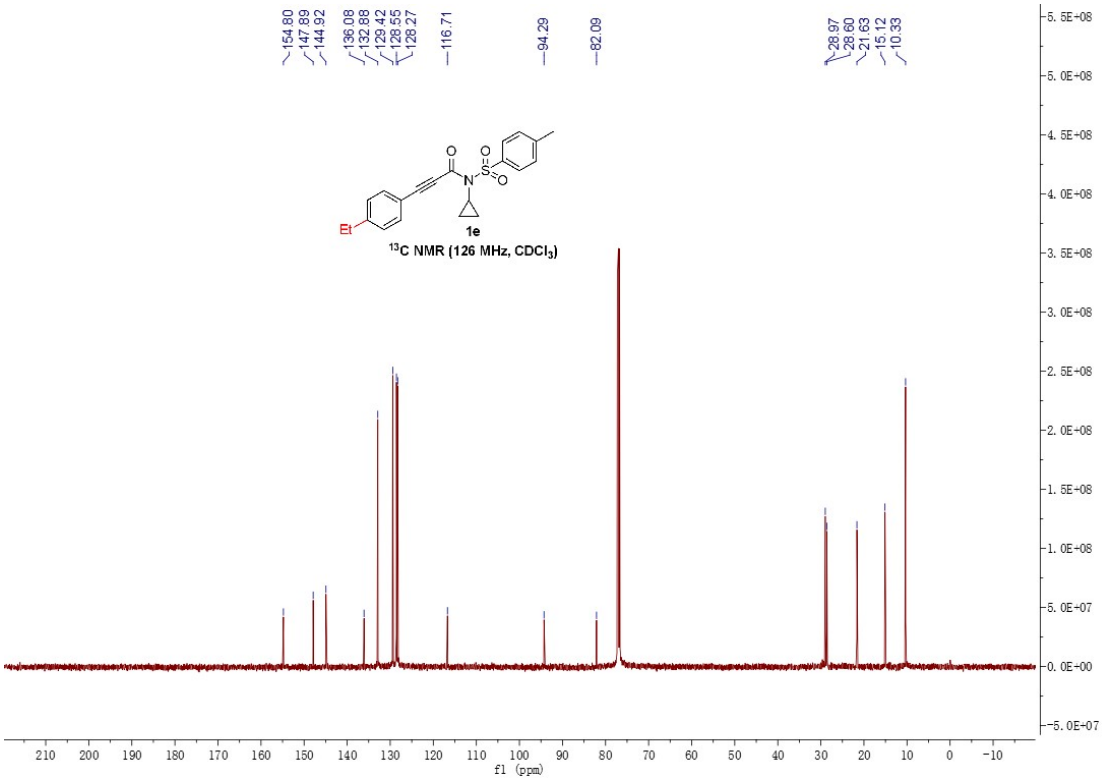


Figure S13. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1e

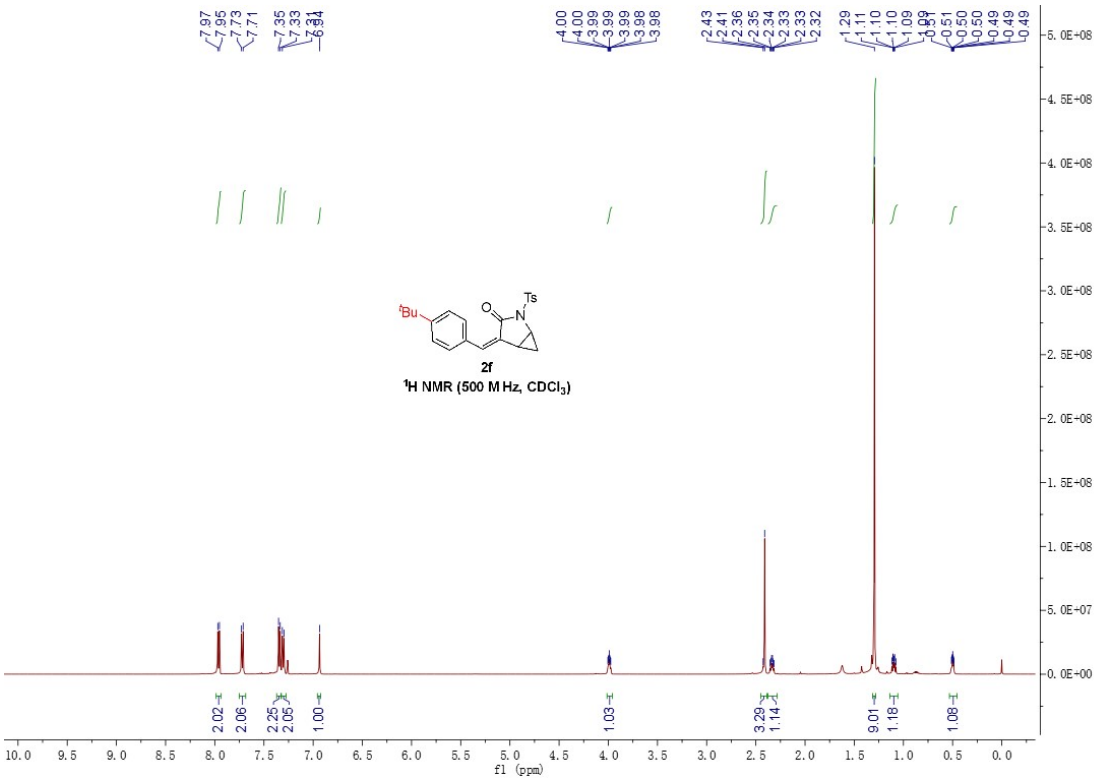


Figure S14. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1f

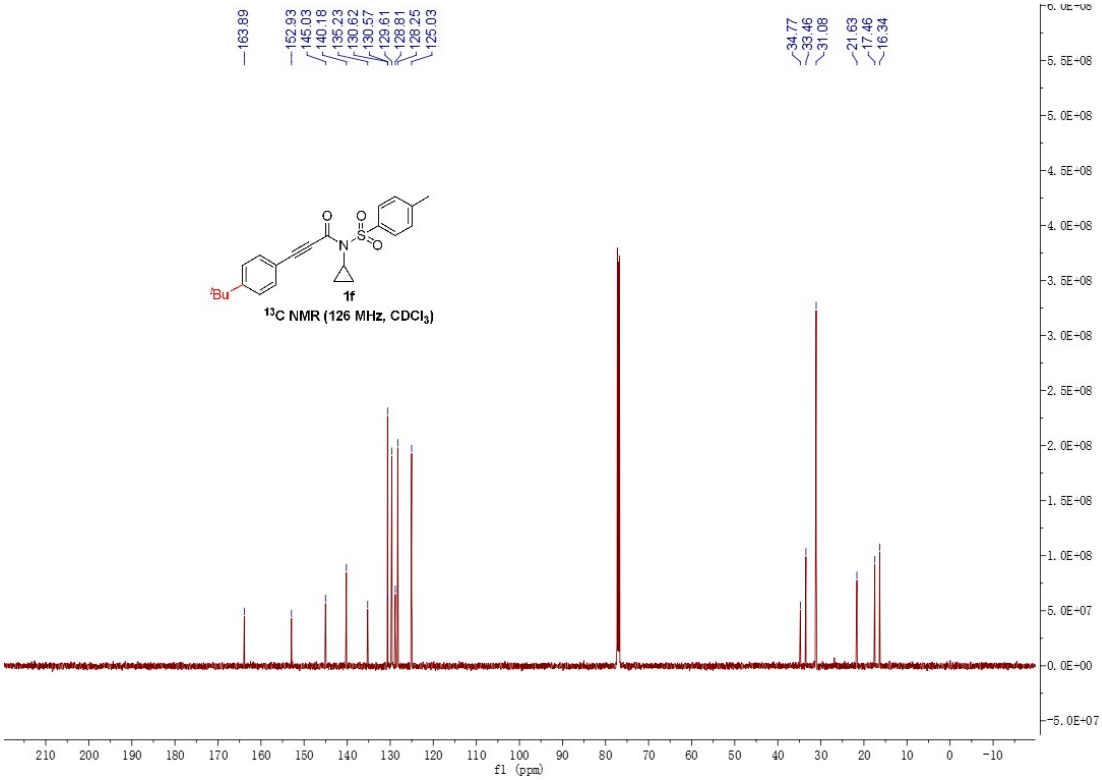


Figure S15. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1f

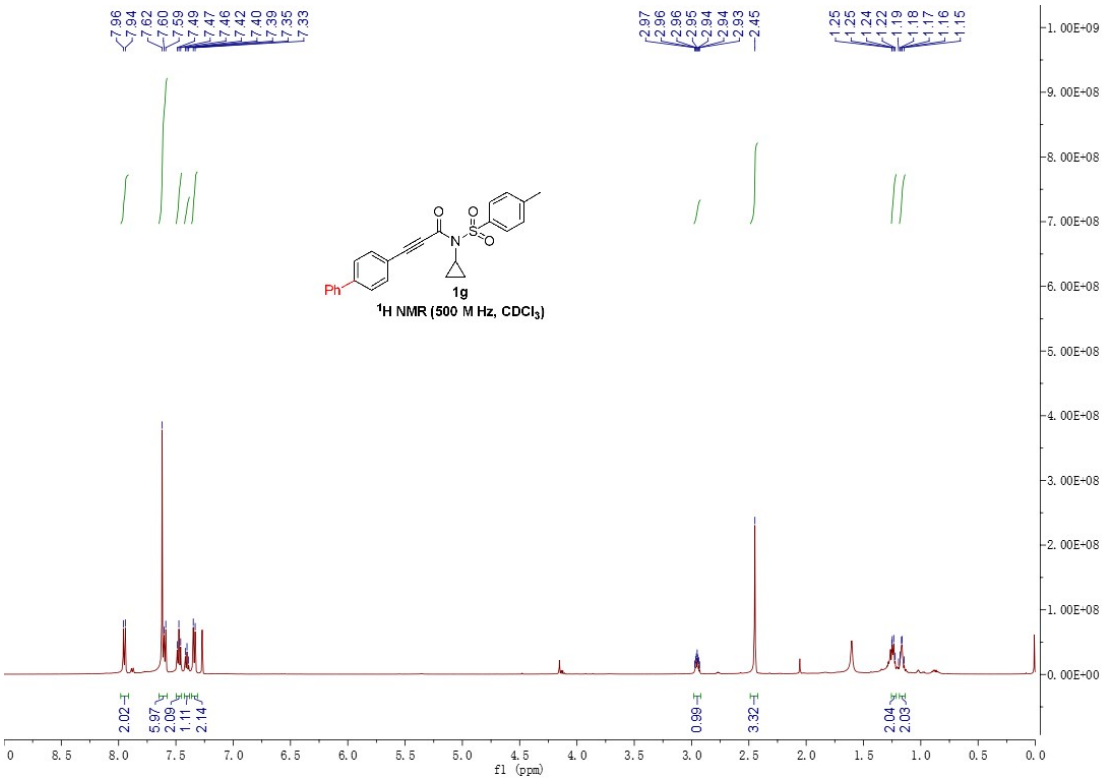


Figure S16. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1g

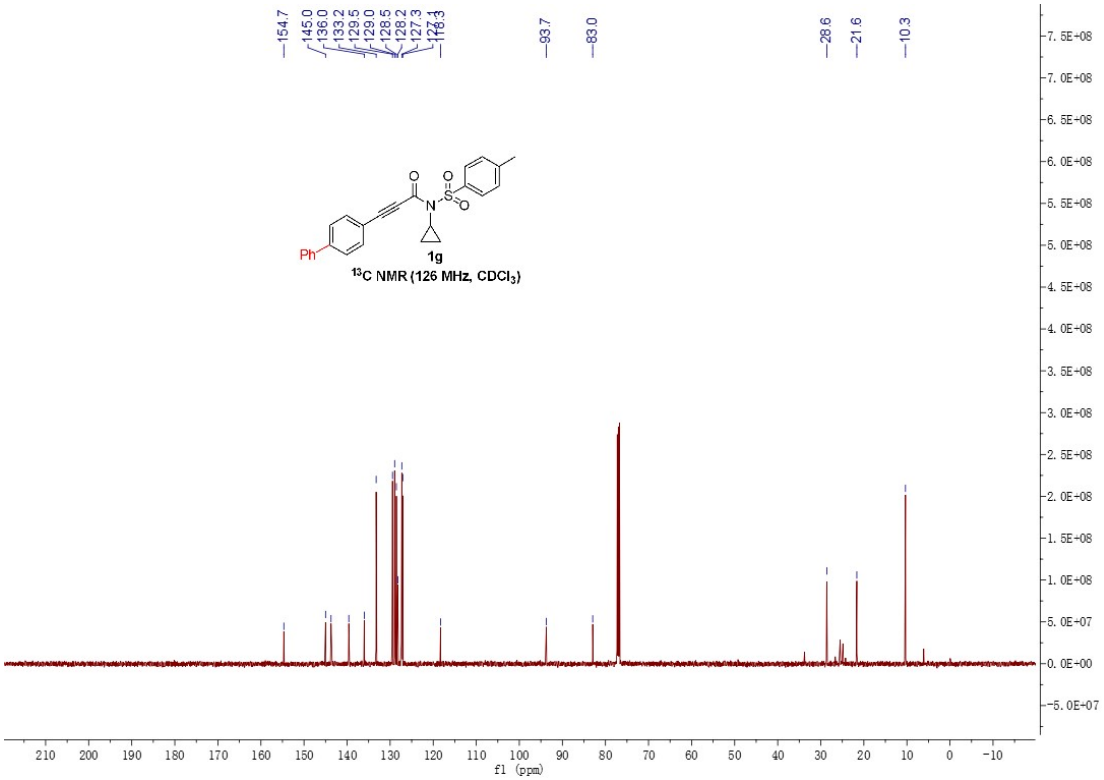


Figure S17. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1g

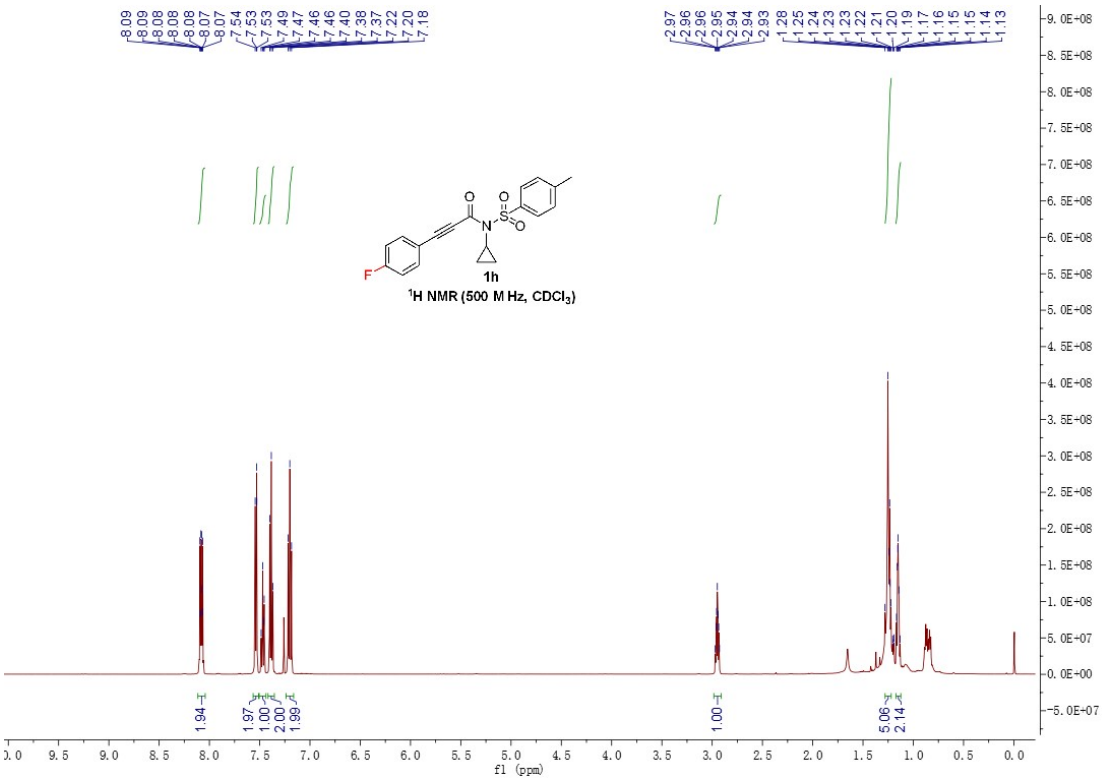


Figure S18. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1h

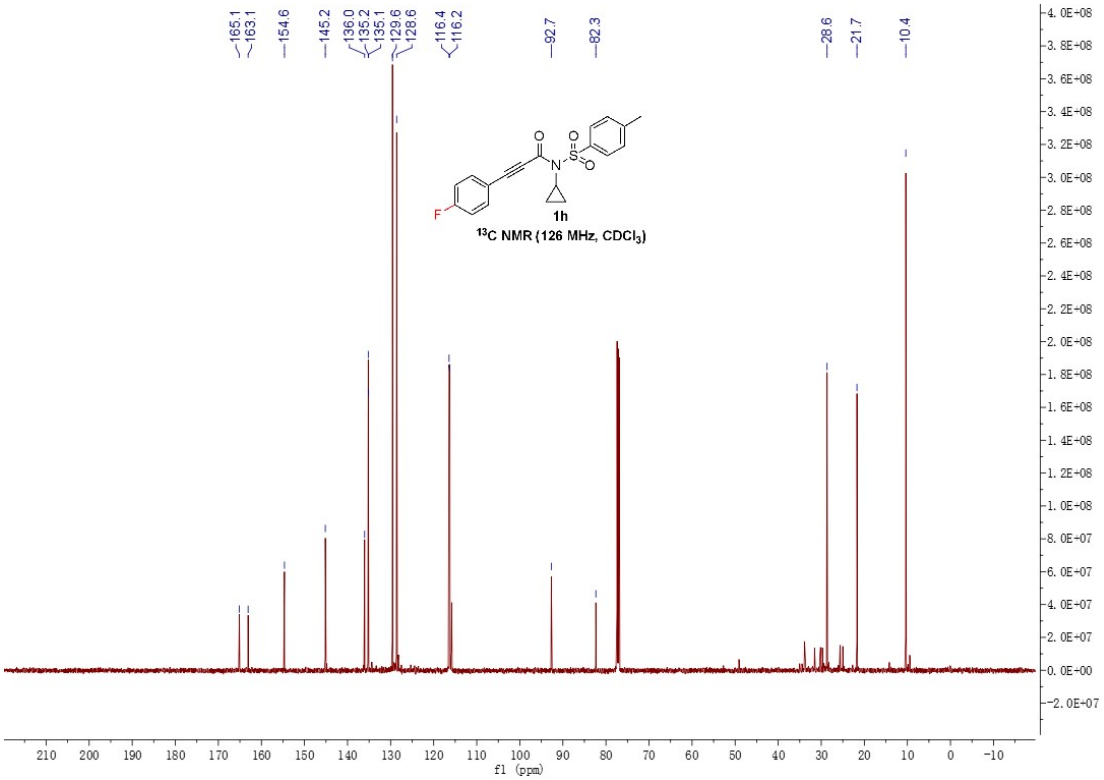


Figure S19. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1h

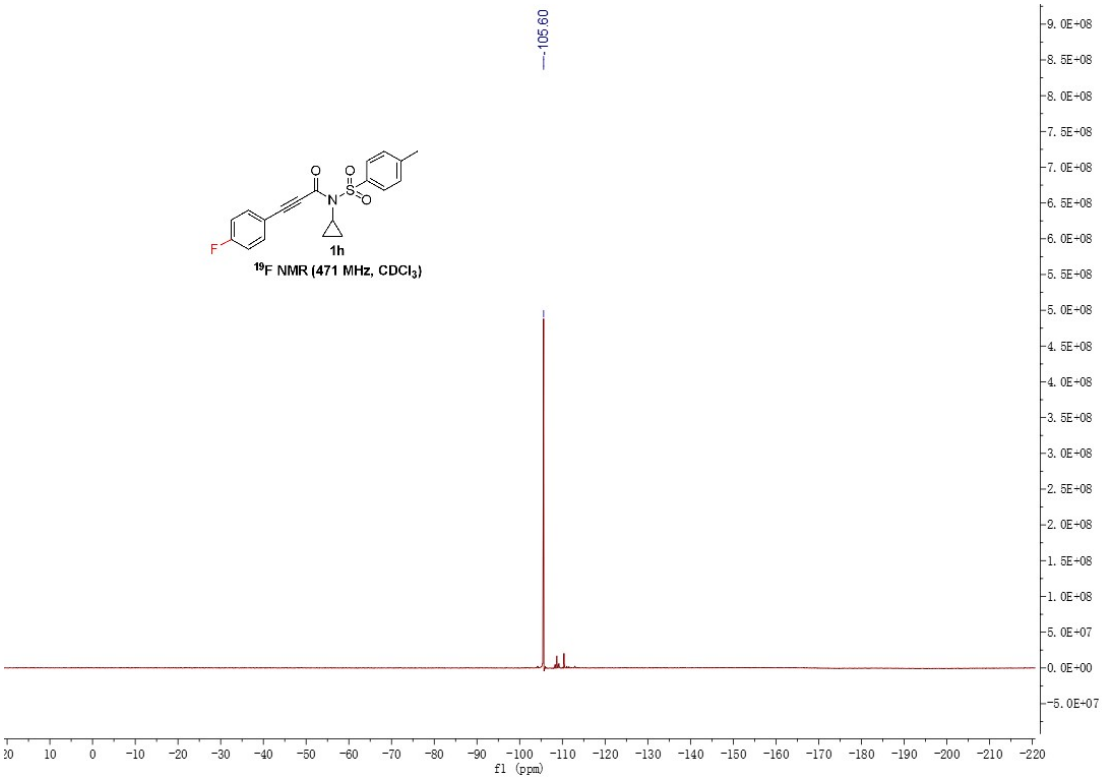


Figure S20. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 1h

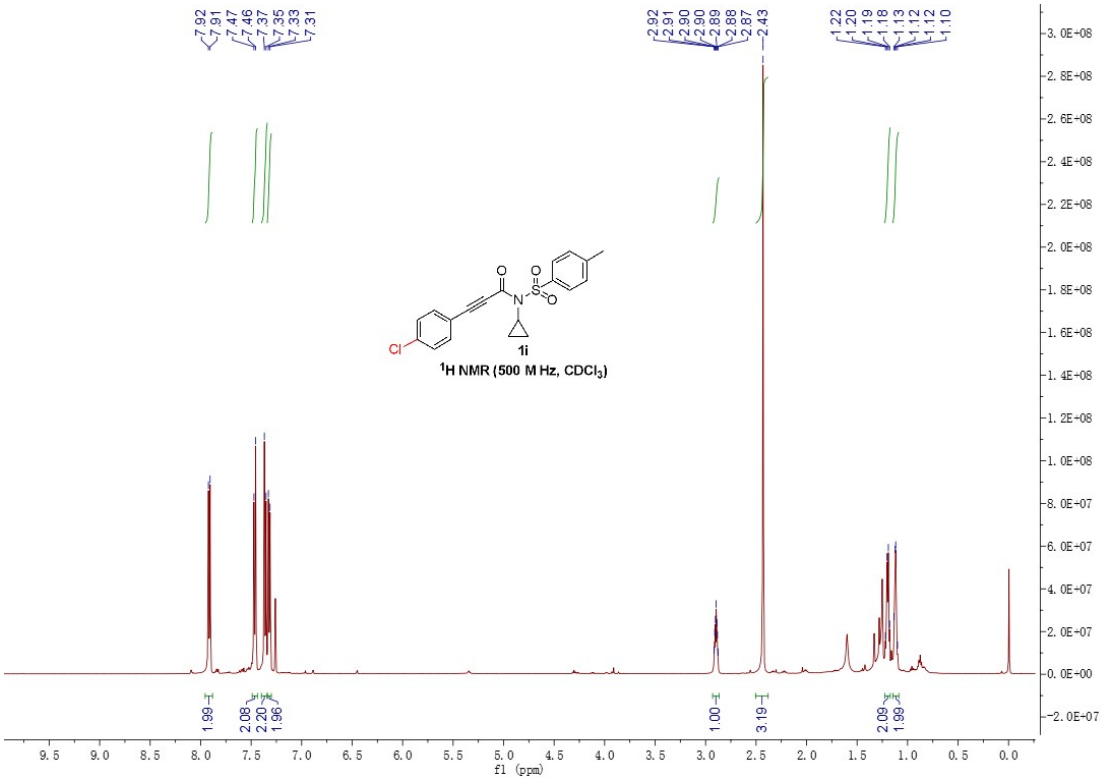


Figure S21. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1i

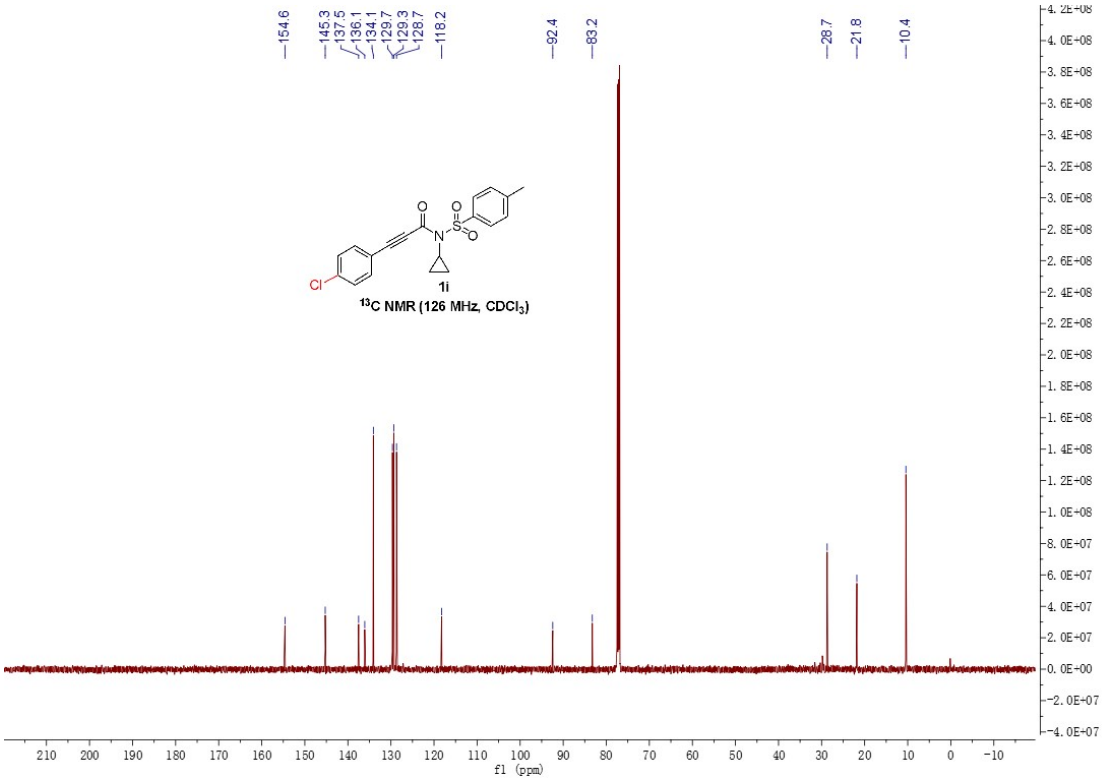


Figure S22. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1i

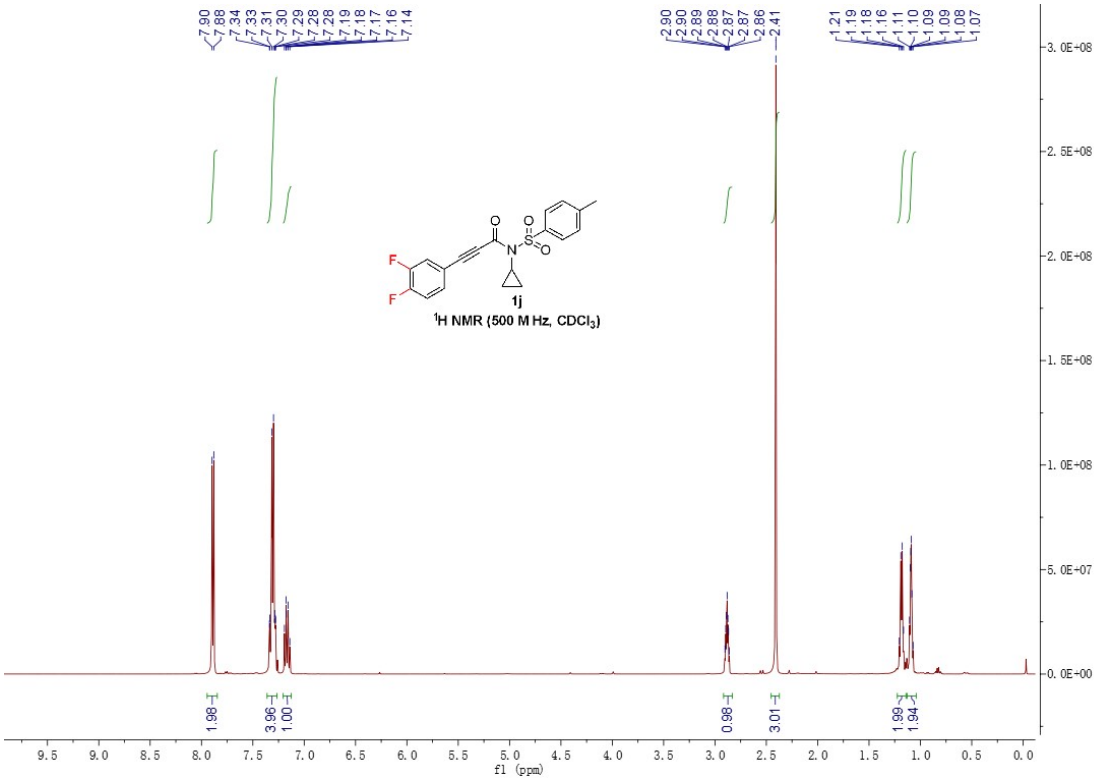


Figure S23. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1j

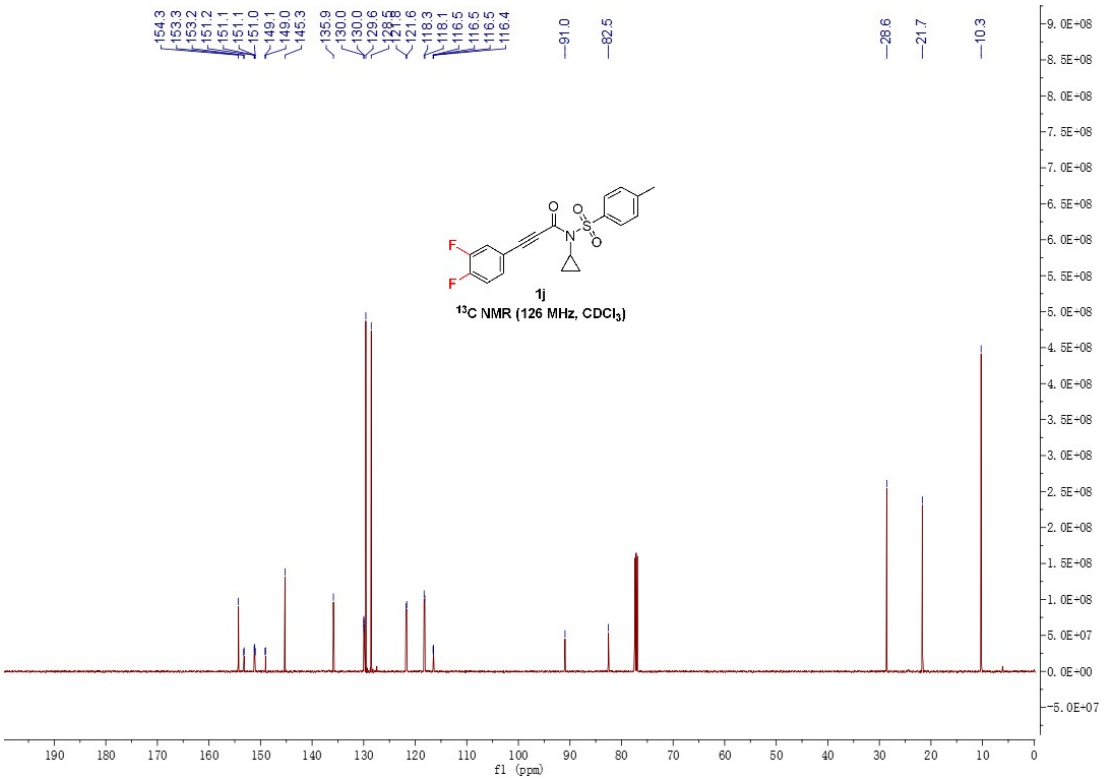


Figure S24. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1j

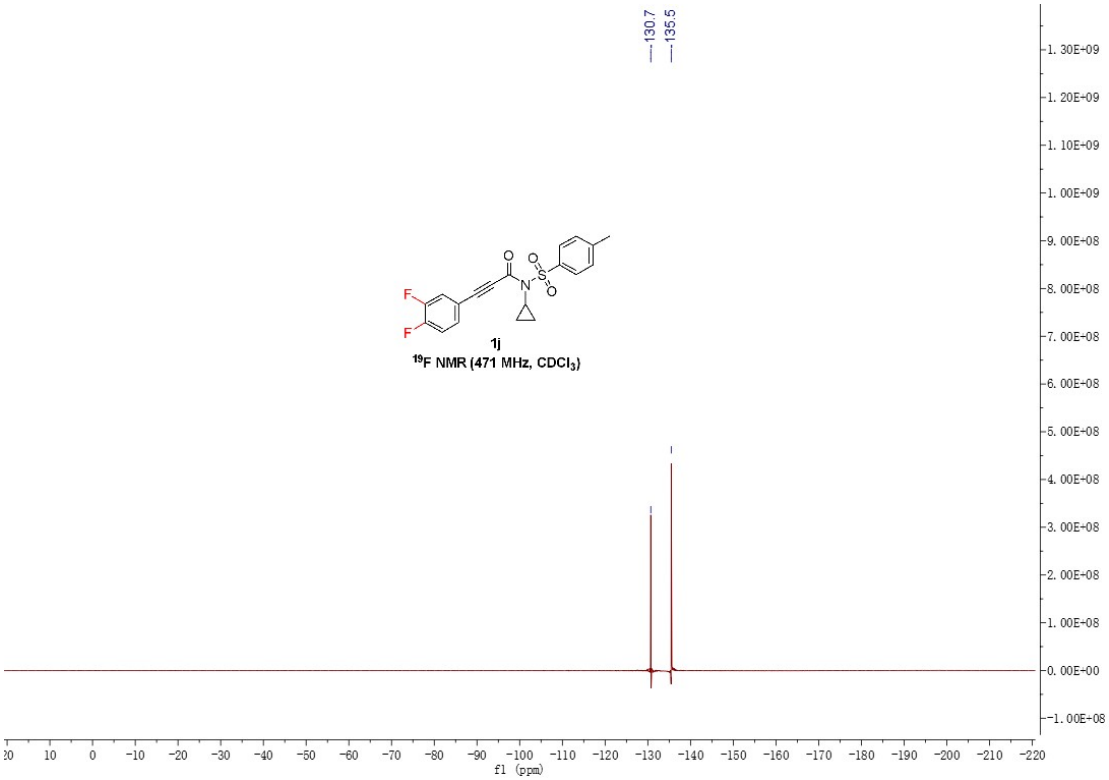


Figure S25. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 1j

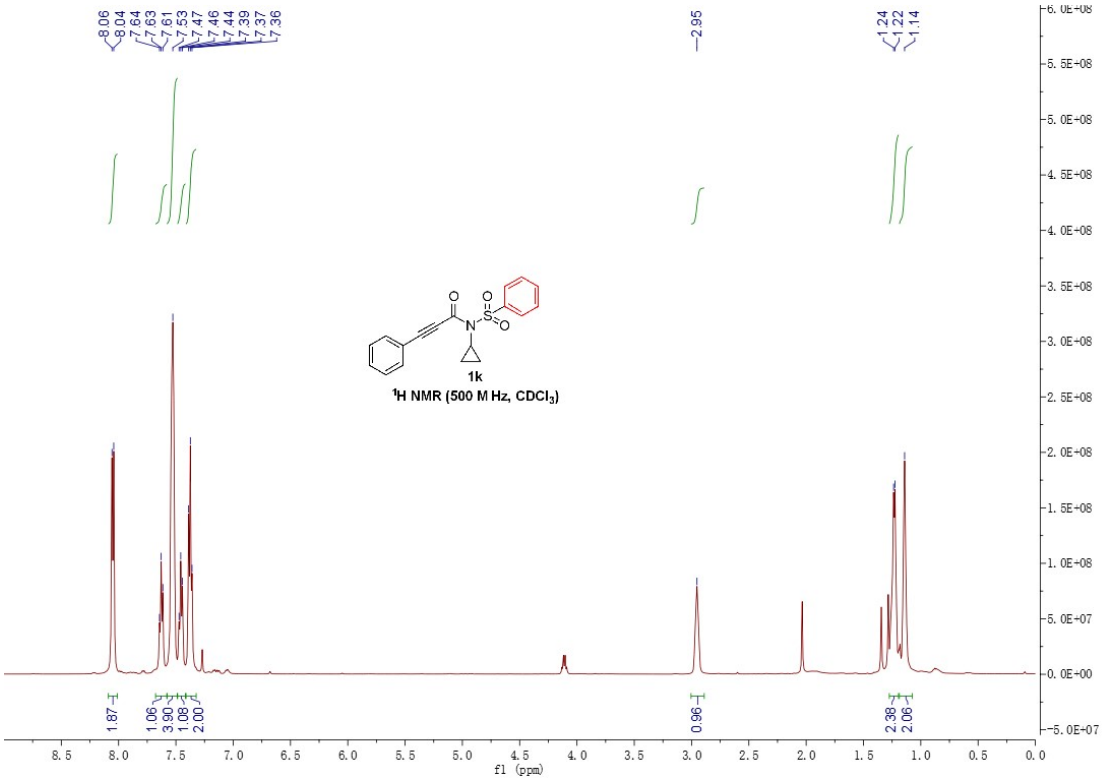


Figure S26. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1k

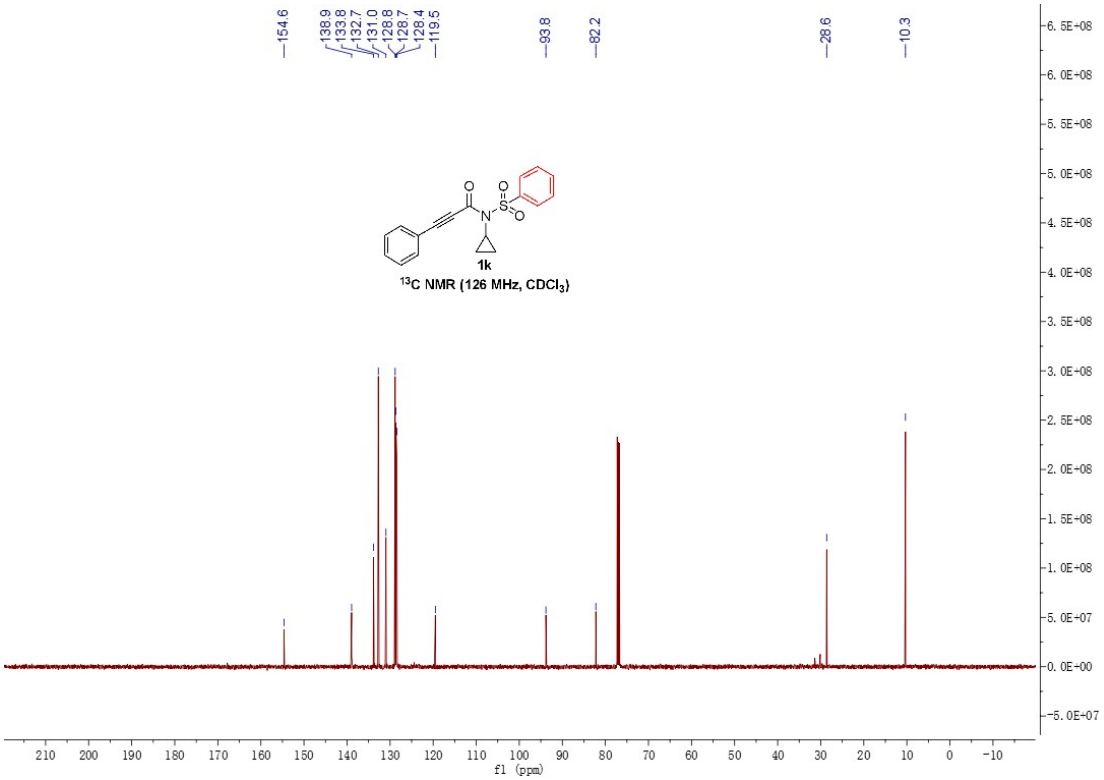


Figure S27. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1l

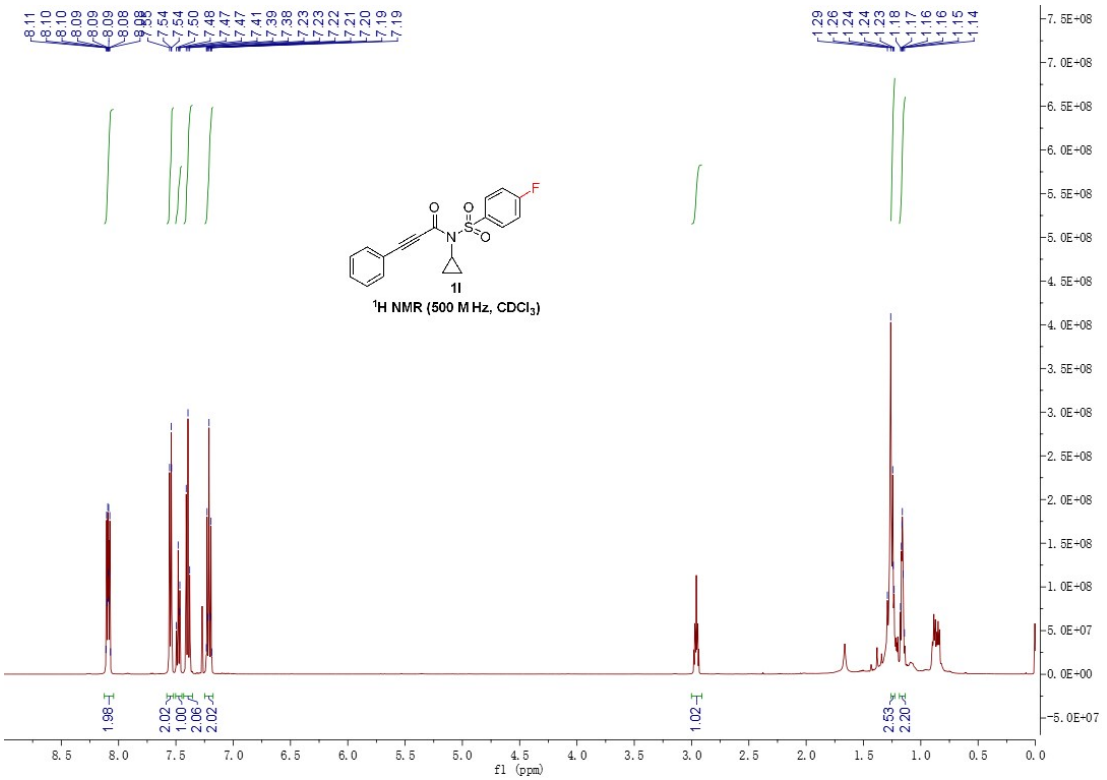


Figure S28. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1l

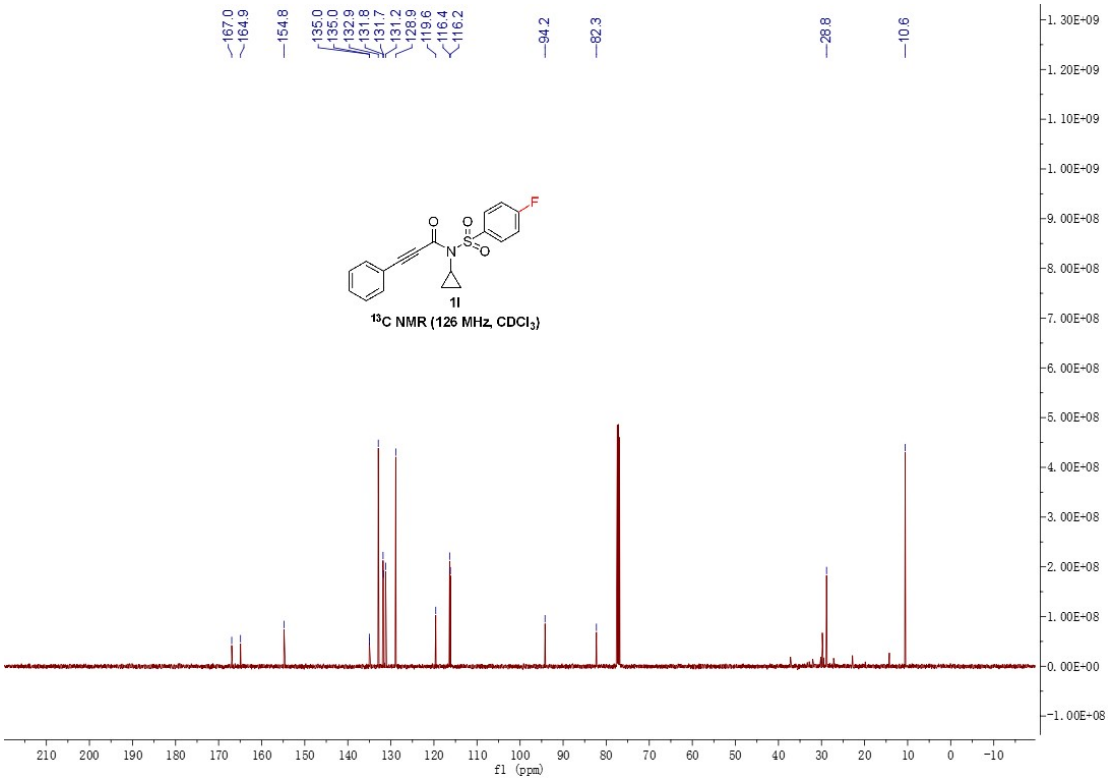


Figure S29. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1l

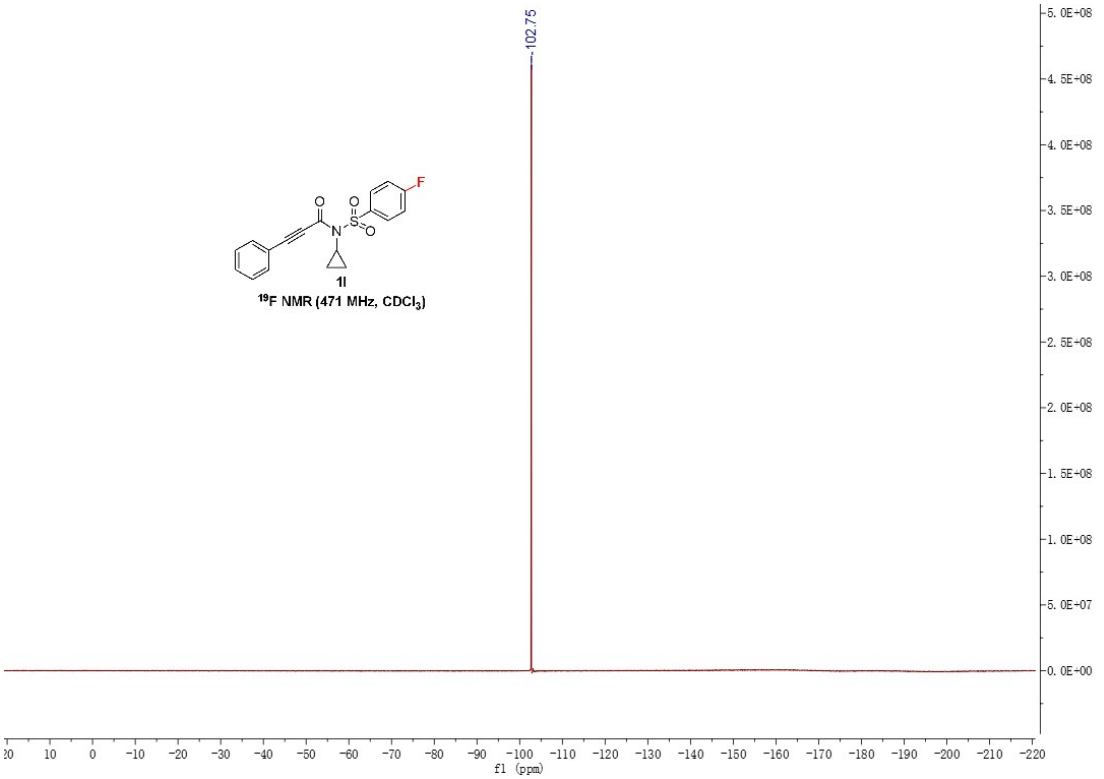


Figure S30. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 2j

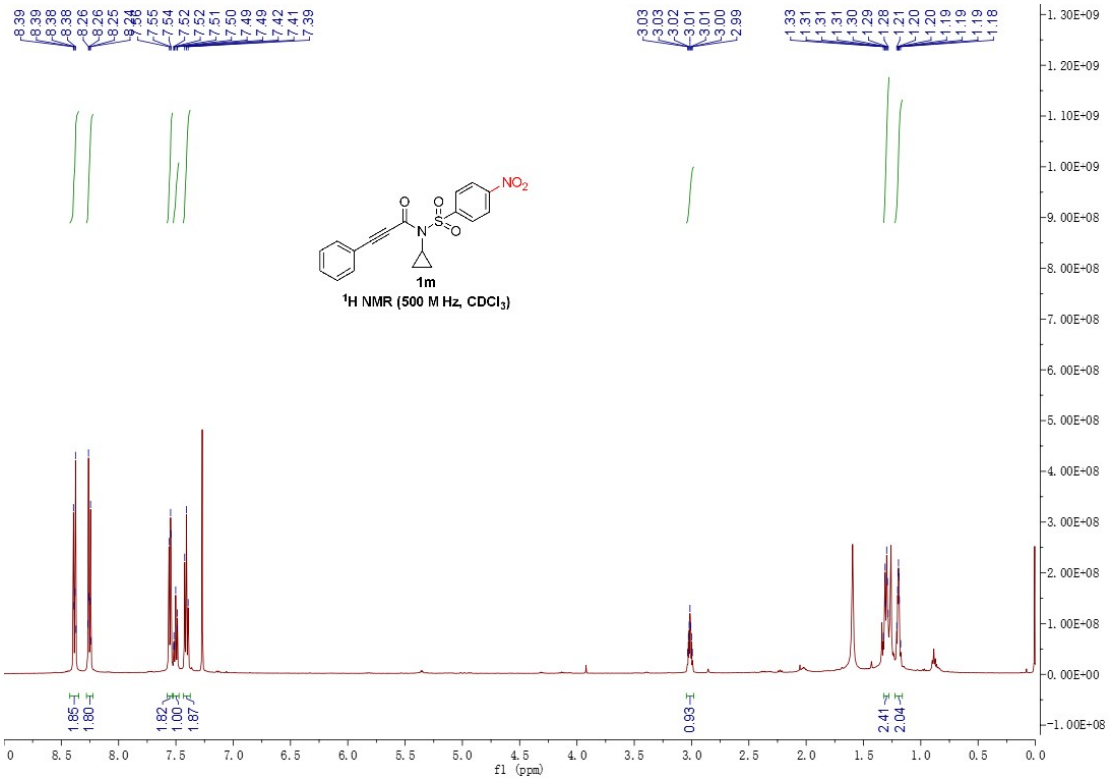


Figure S31. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1m

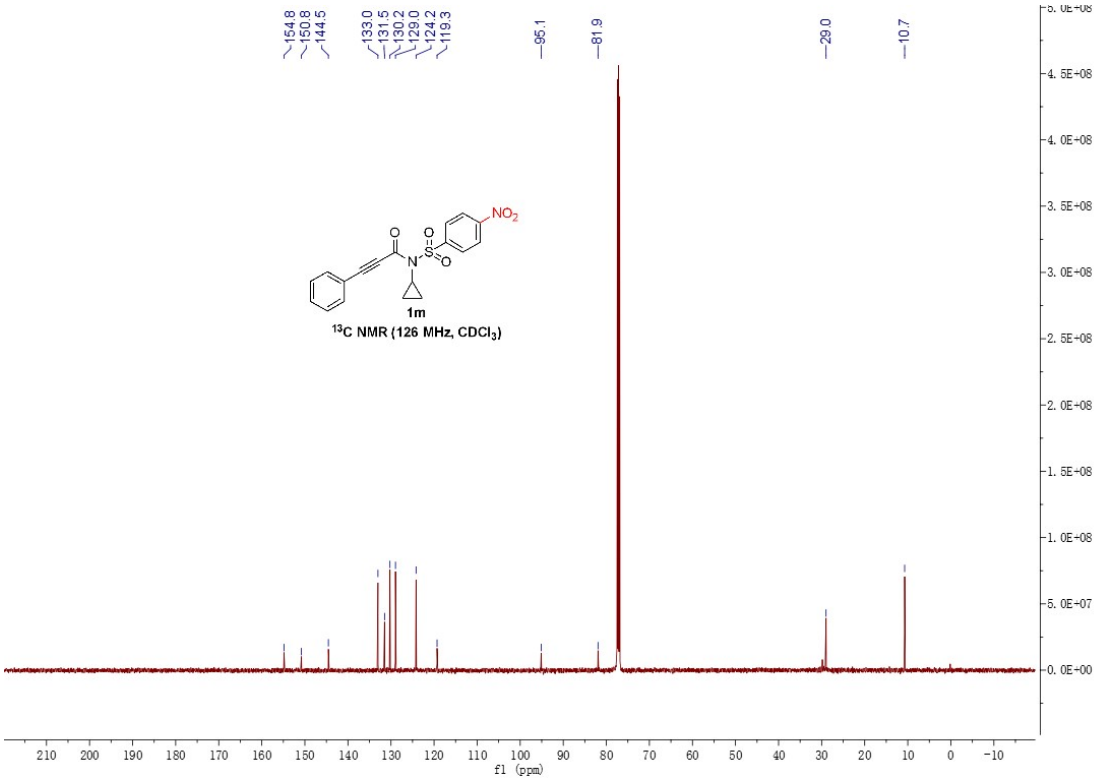


Figure S32. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1m

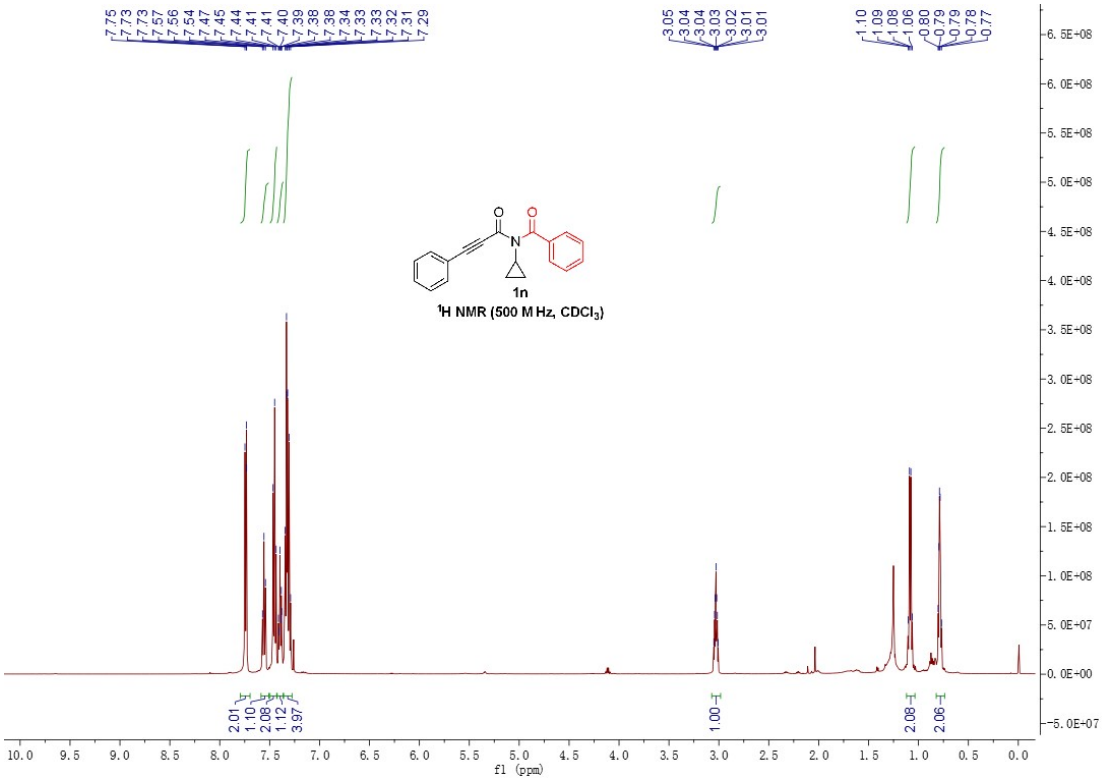


Figure S33. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1n

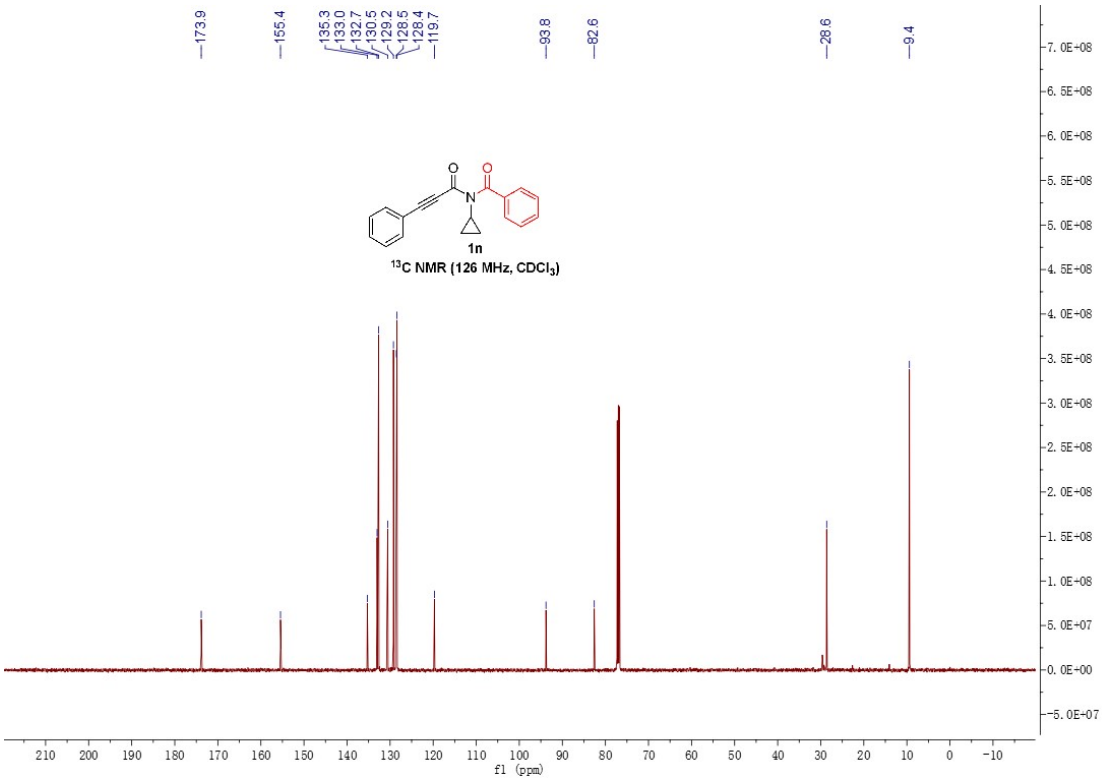


Figure S34. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1n

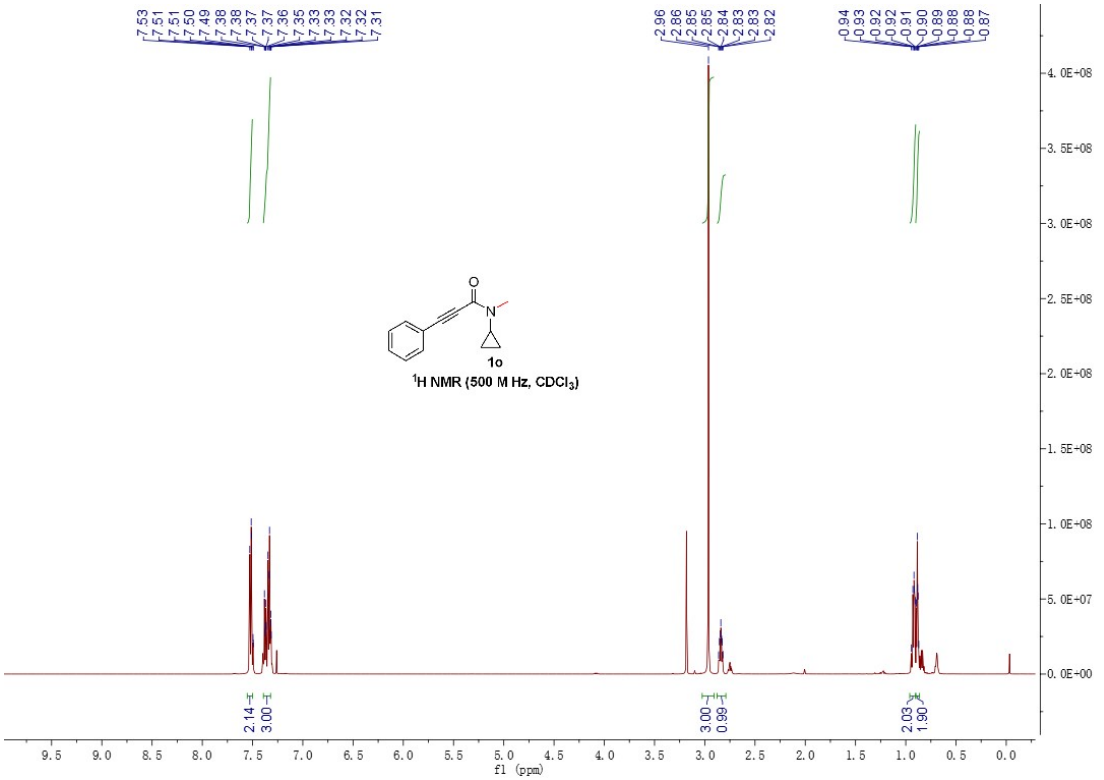


Figure S35. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1o

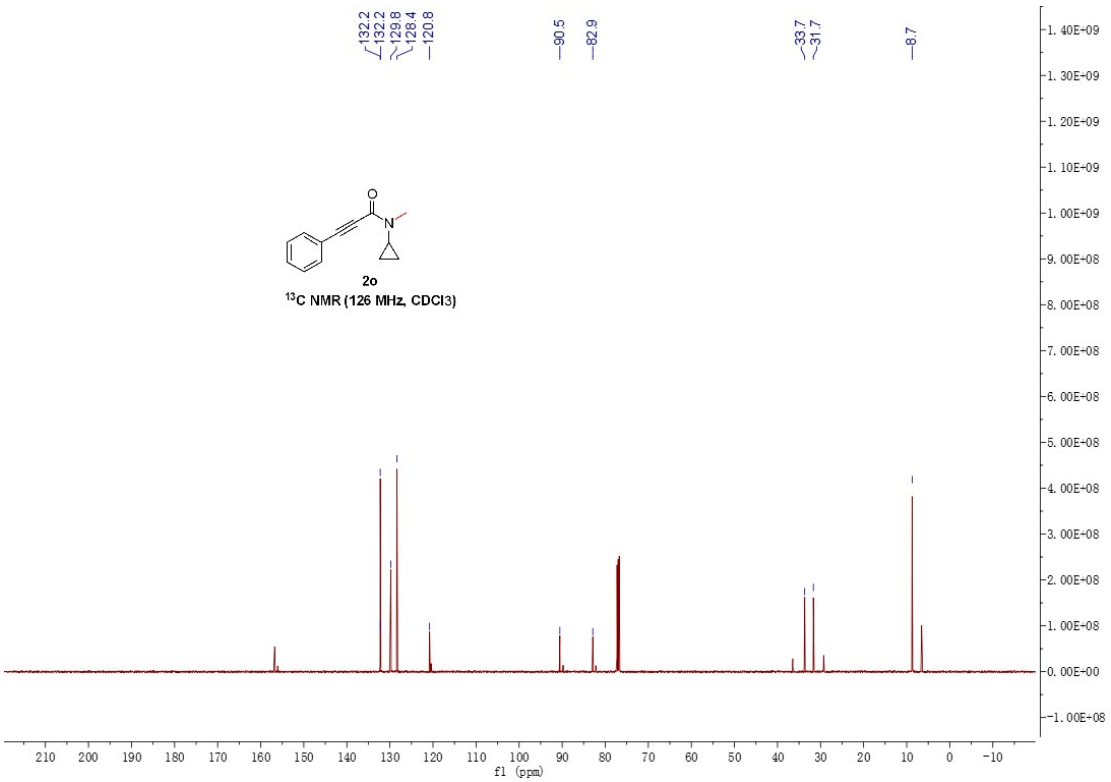


Figure S36. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1o

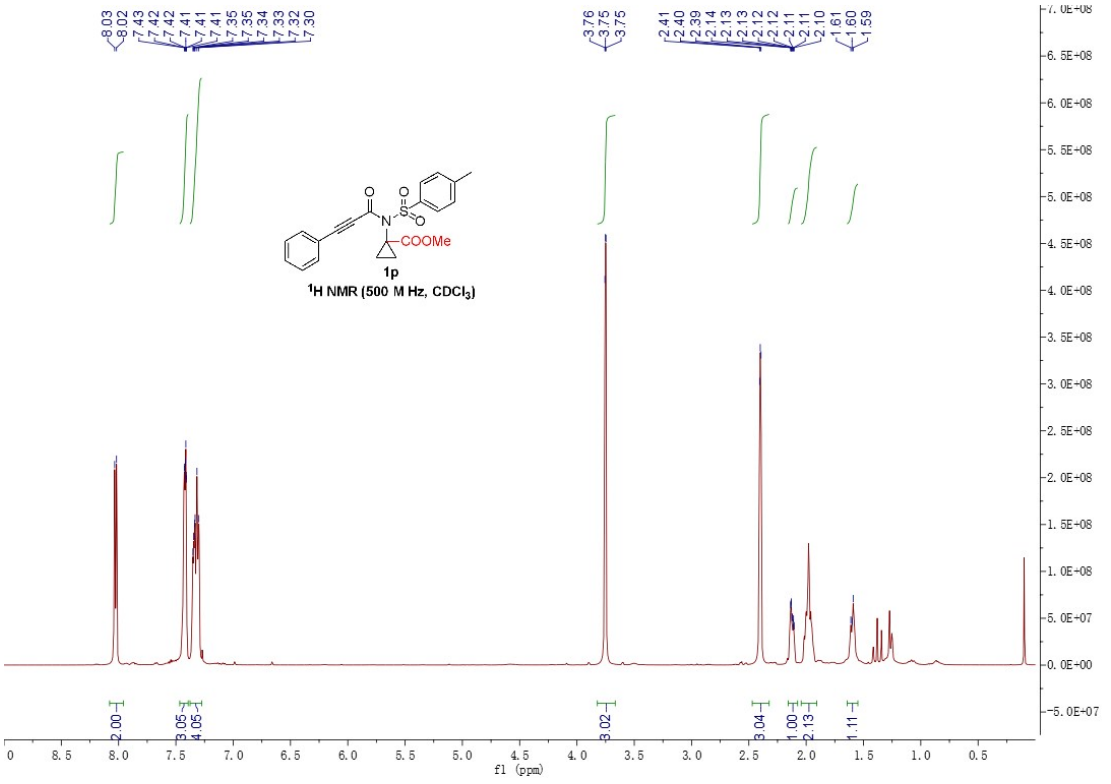


Figure S37. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1p

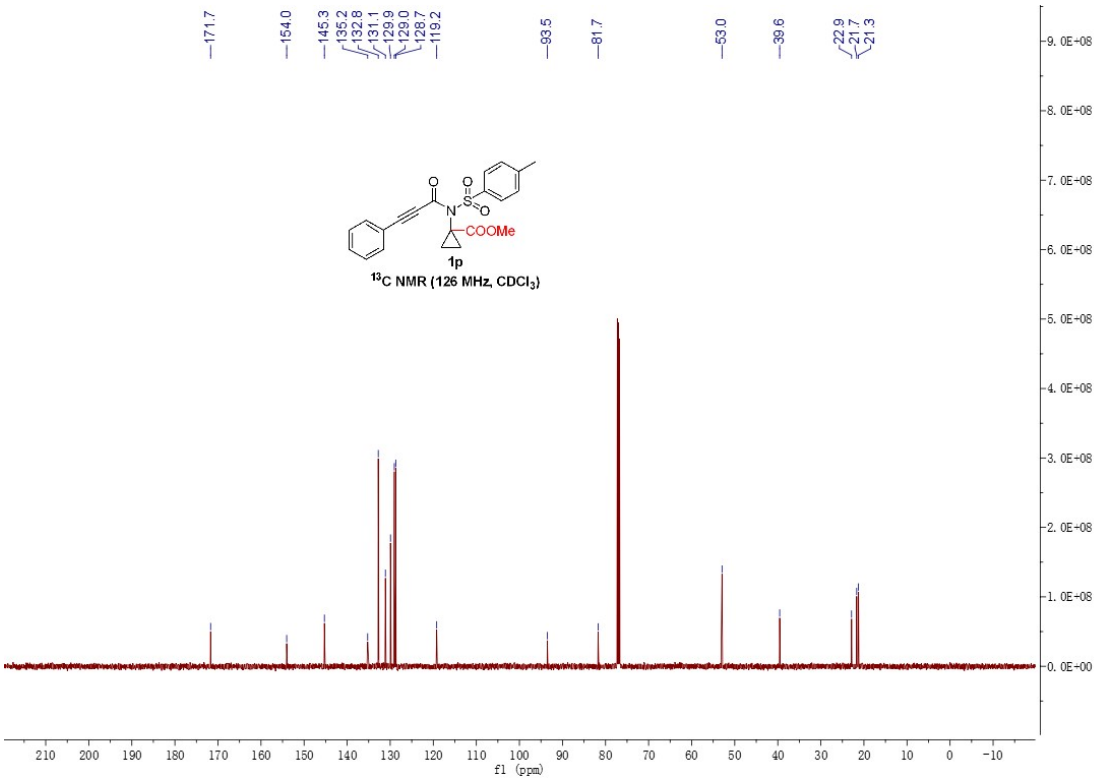


Figure S38. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1p

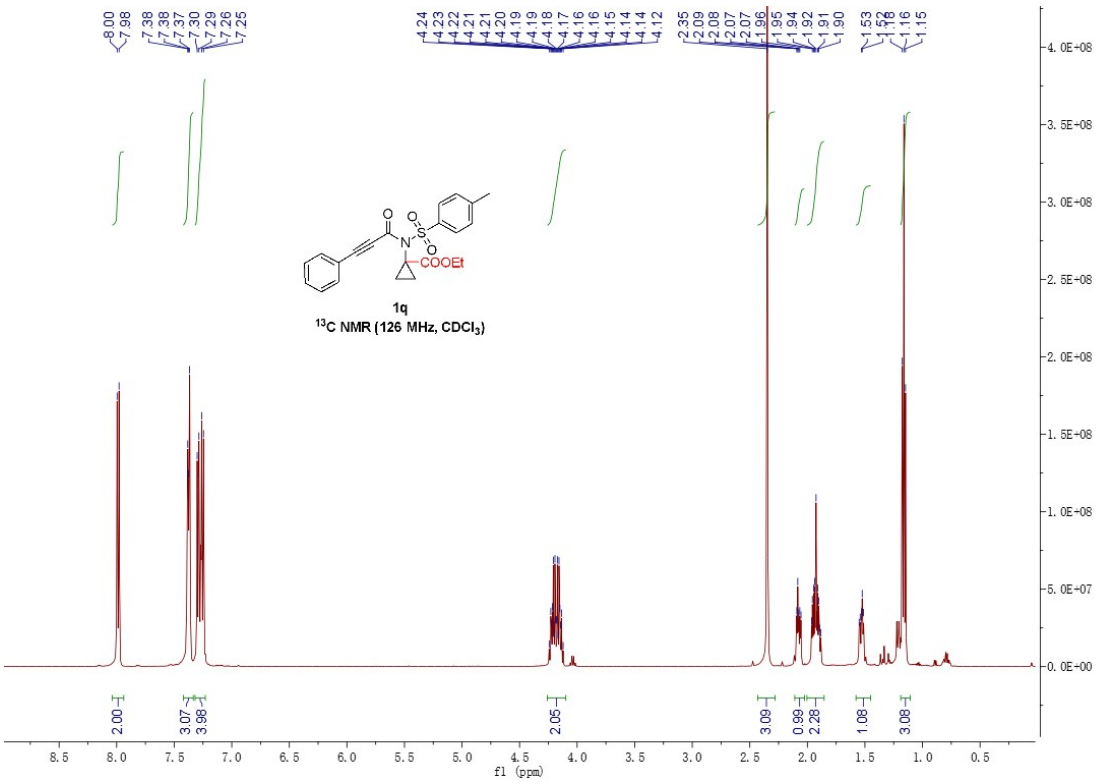


Figure S39. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1q

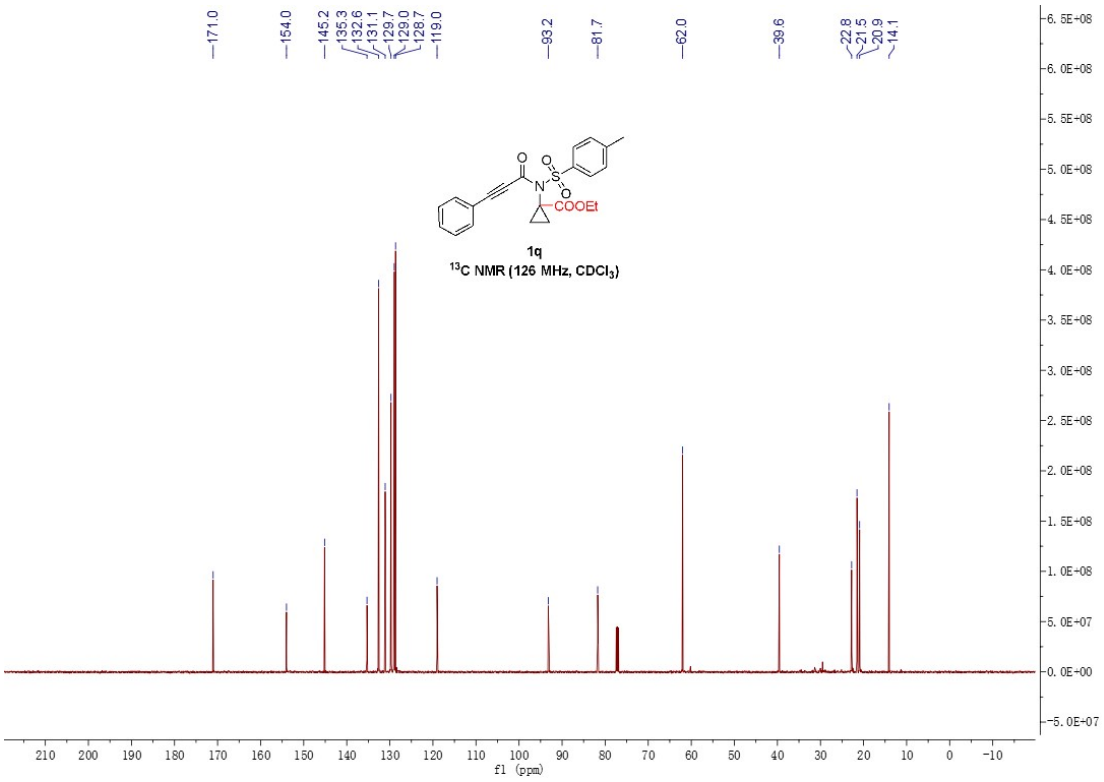


Figure S40. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1q

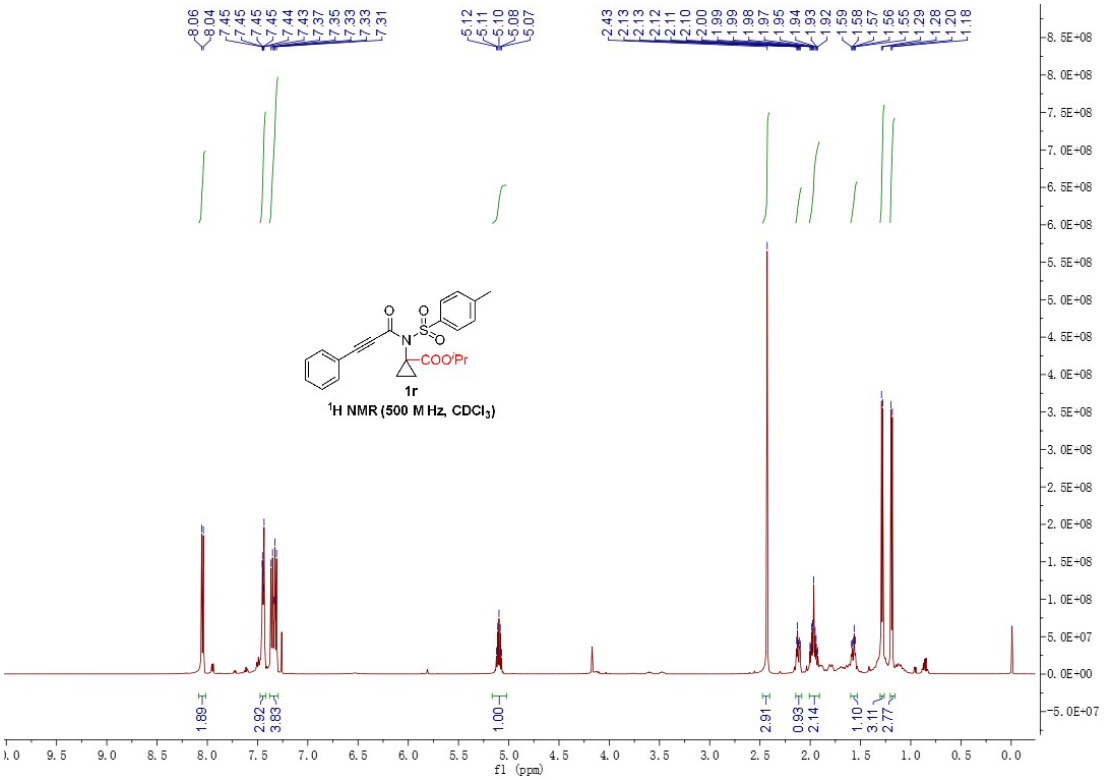


Figure S41. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1r

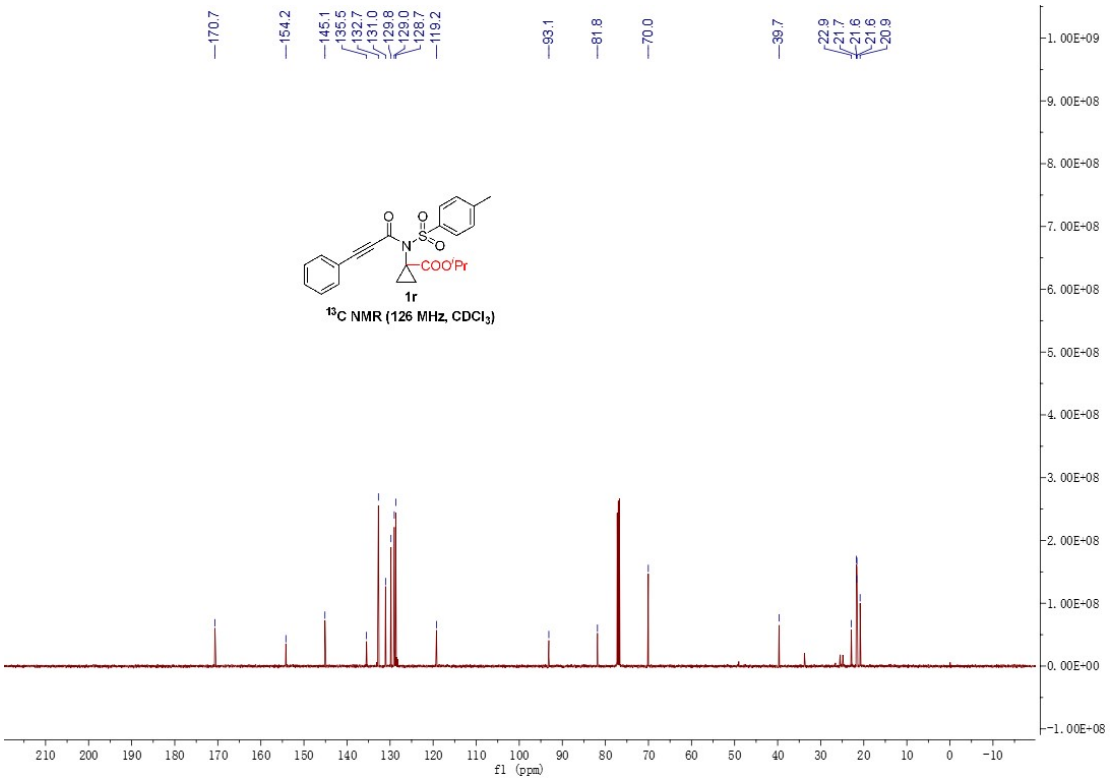


Figure S42. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1r

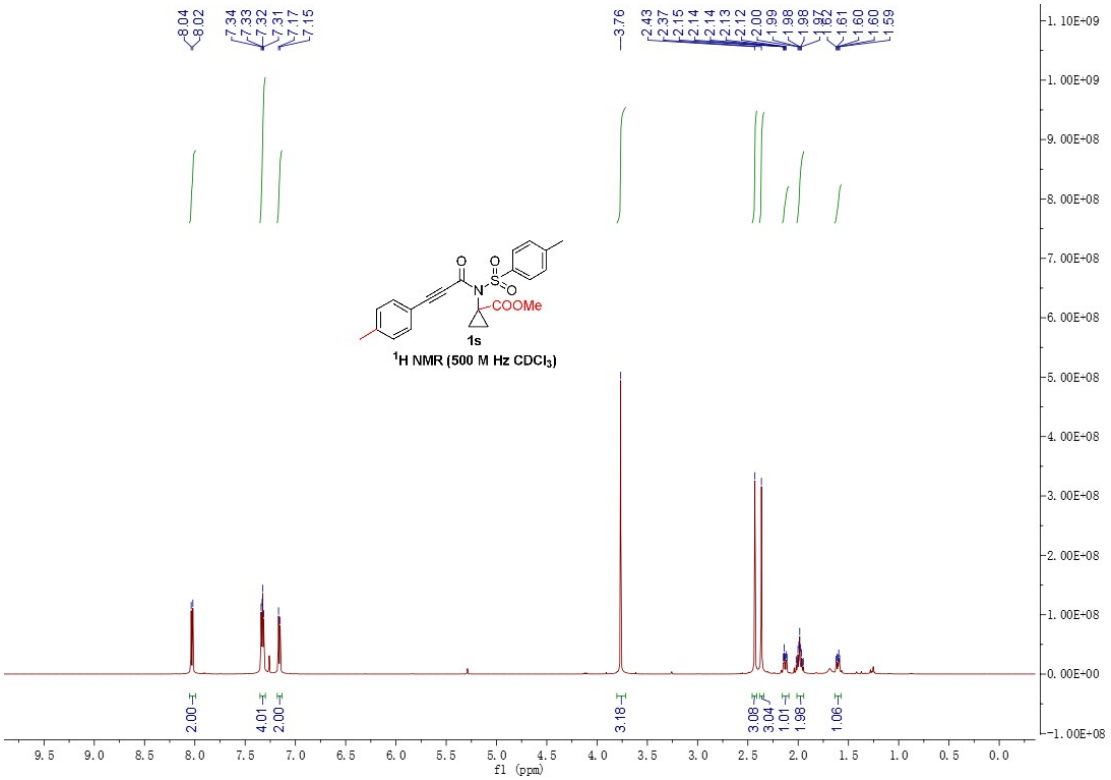


Figure S43. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1s

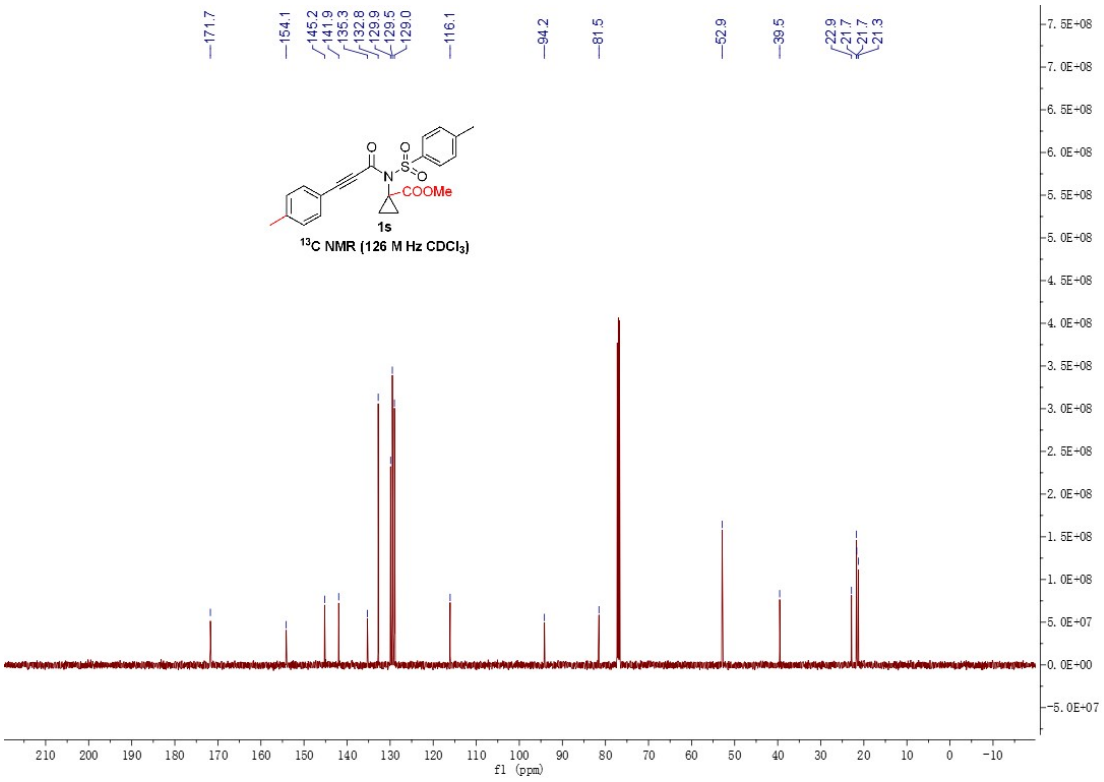


Figure S44. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 1s

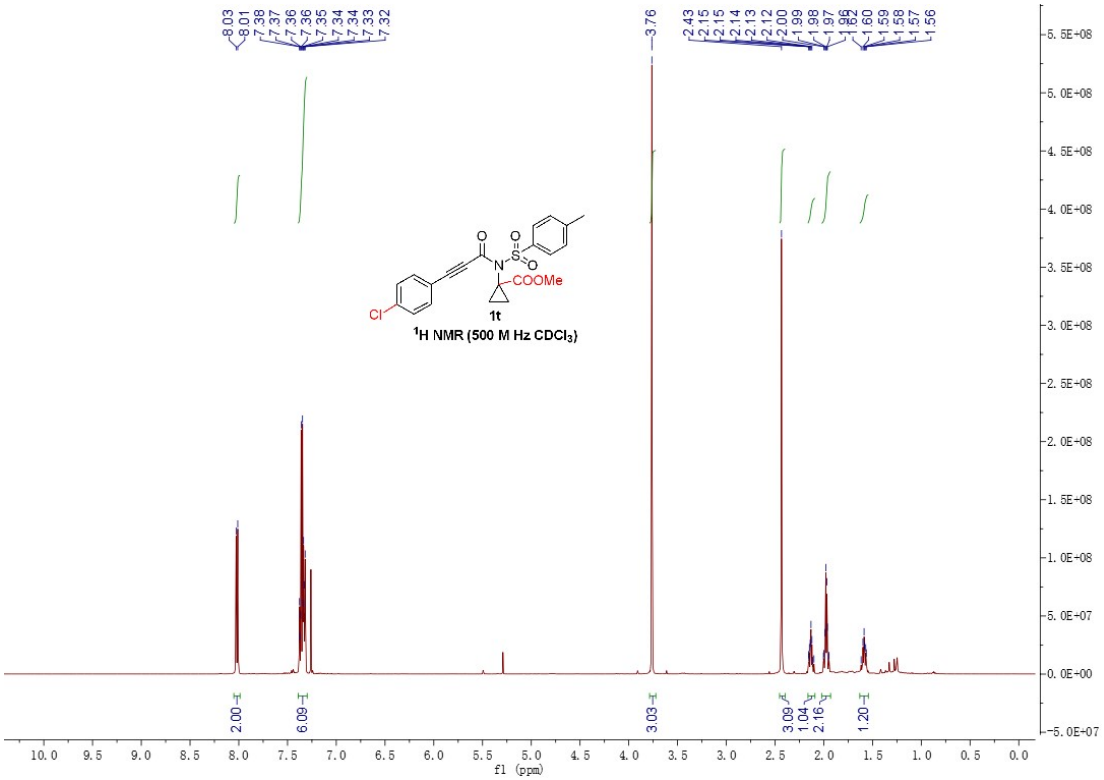


Figure S45. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1t

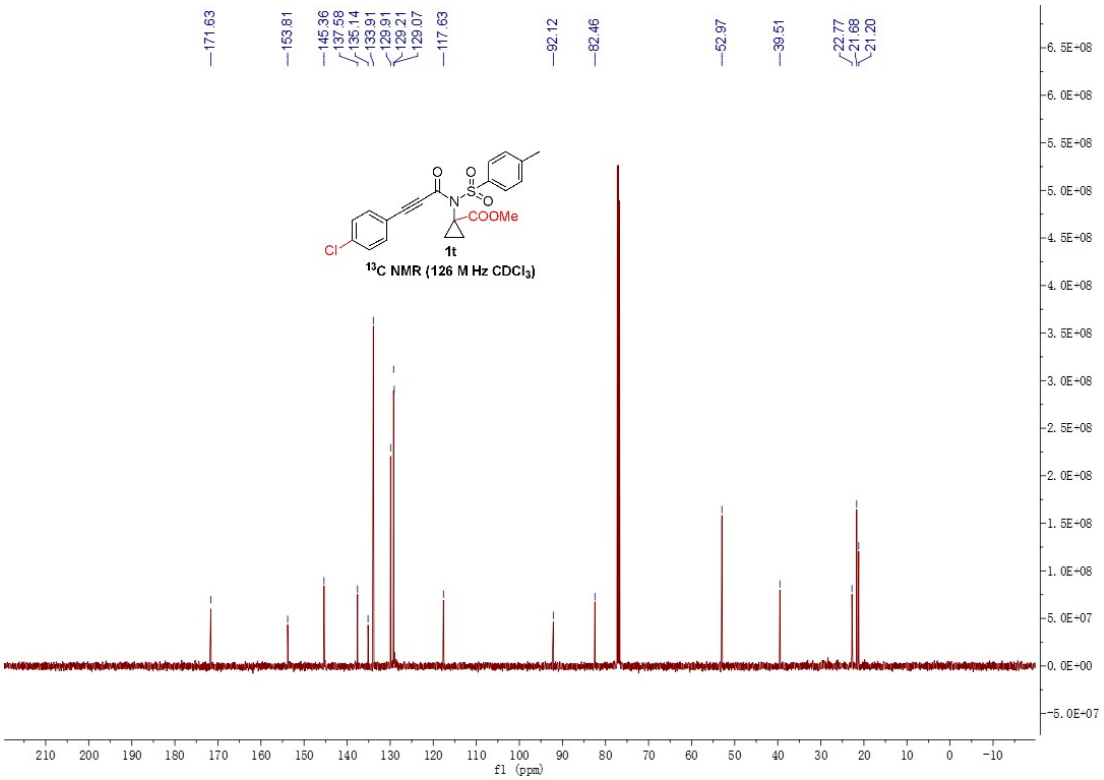


Figure S46. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2a

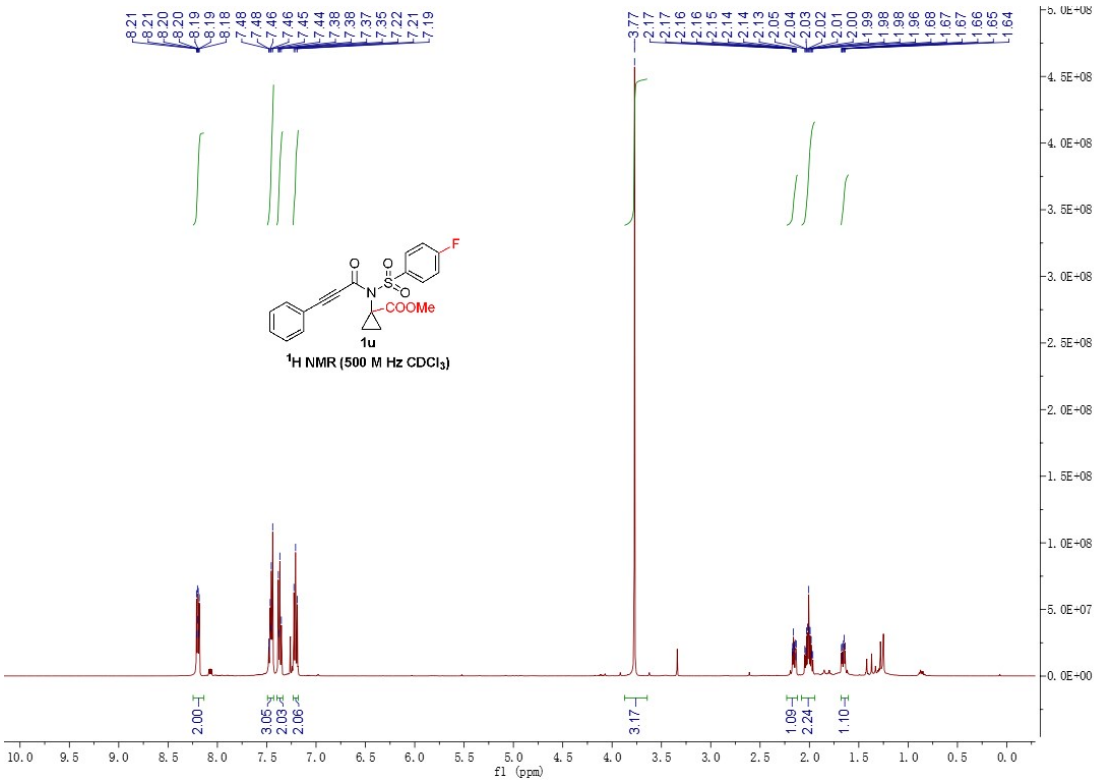


Figure S47. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 1u

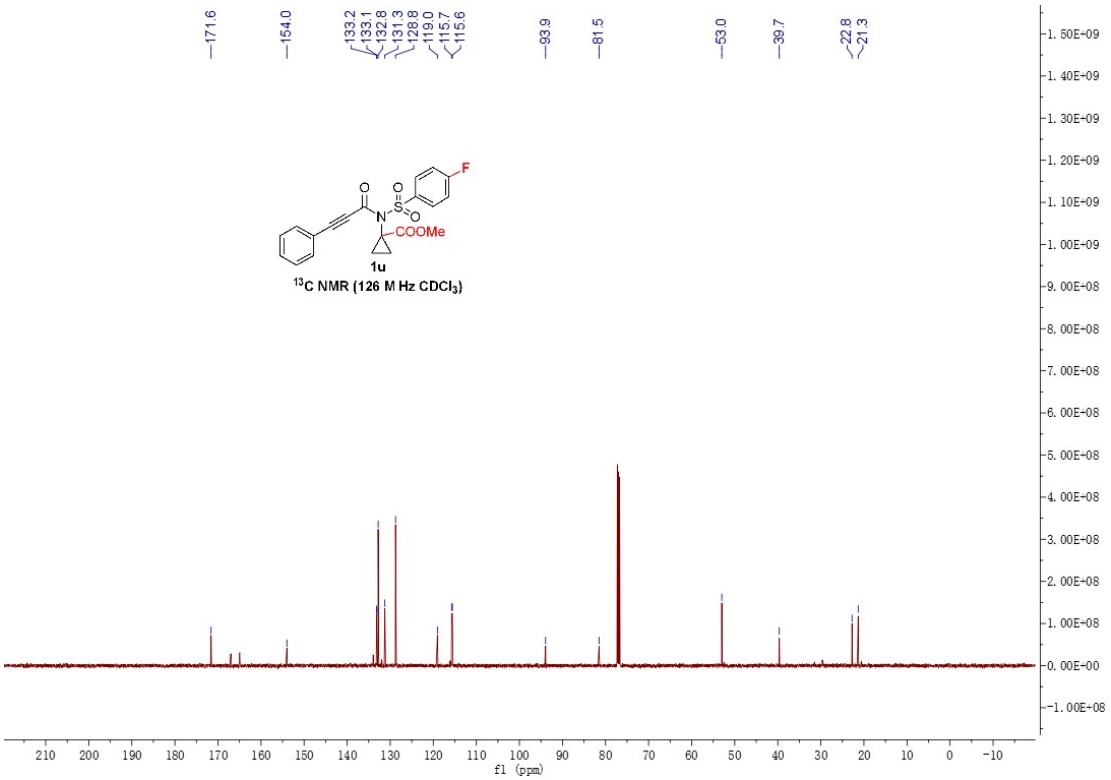


Figure S48. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2a

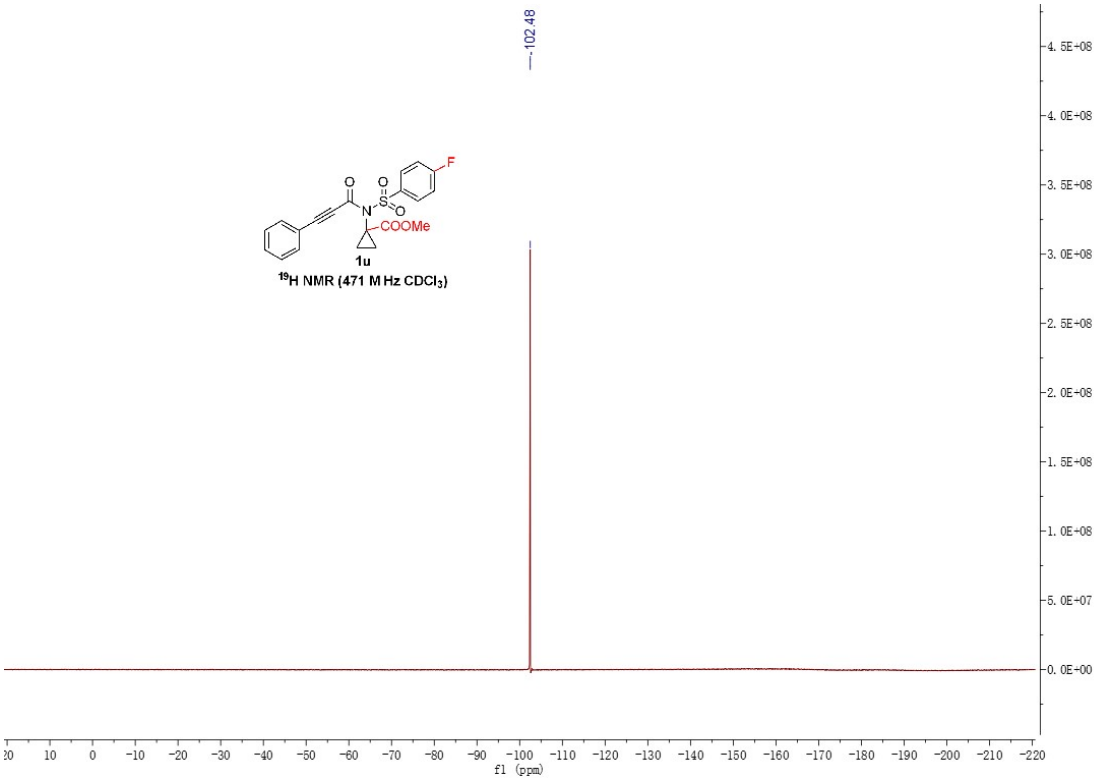


Figure S49. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 1u5

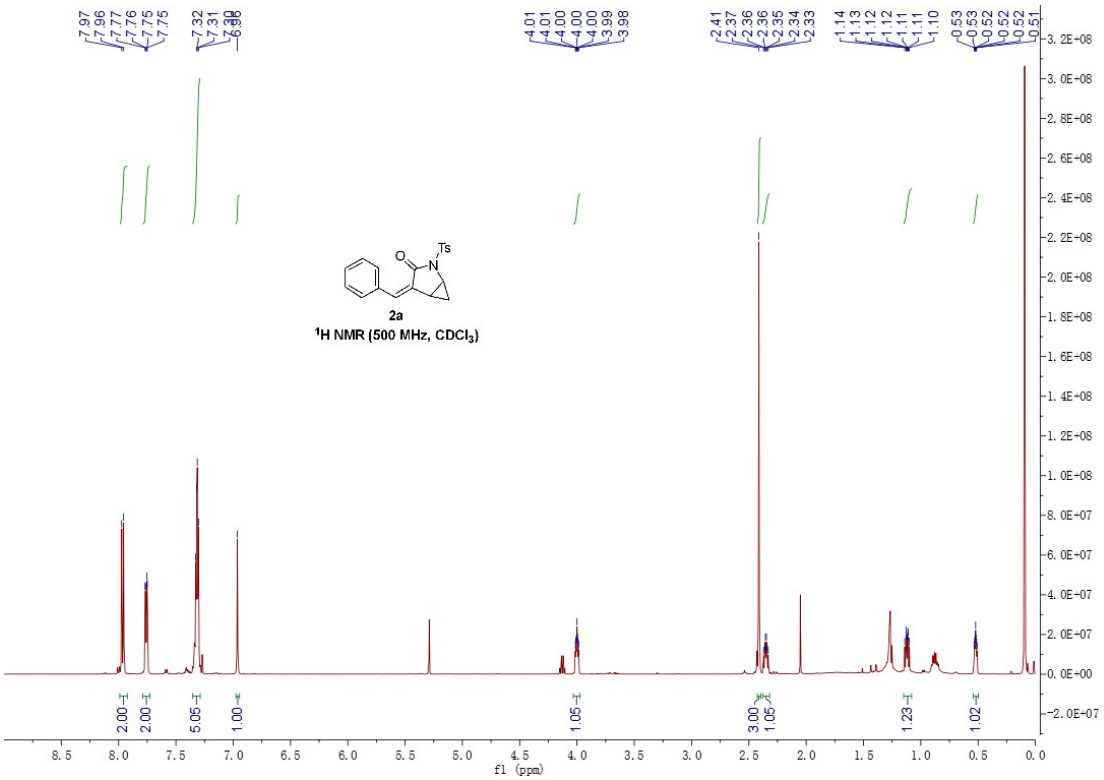


Figure S50. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2a

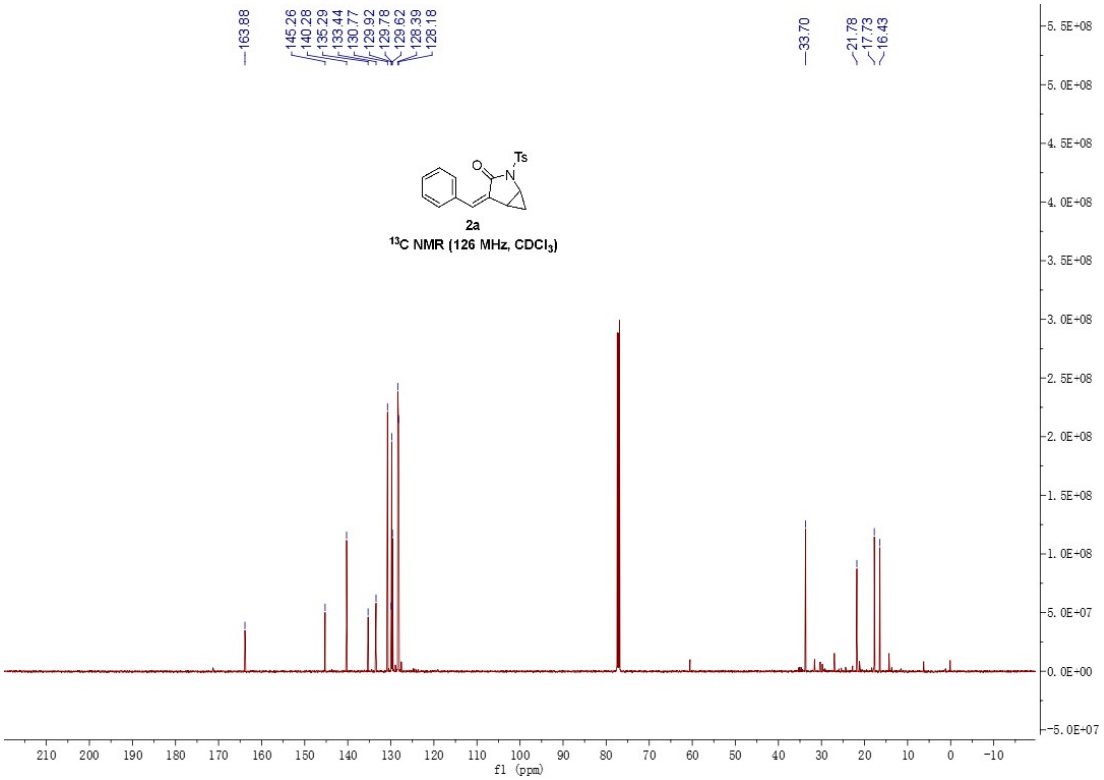


Figure S51. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2a

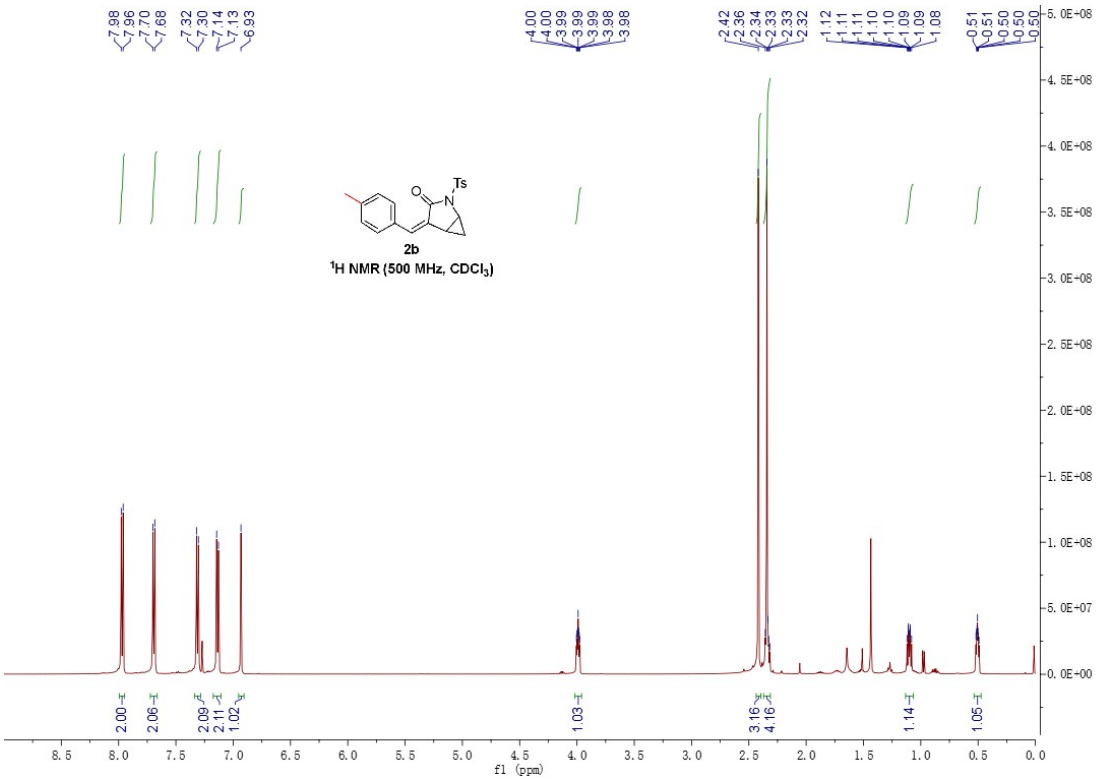


Figure S52. ^{1}H NMR (500 MHz, CDCl$_3$) spectrum of 2b

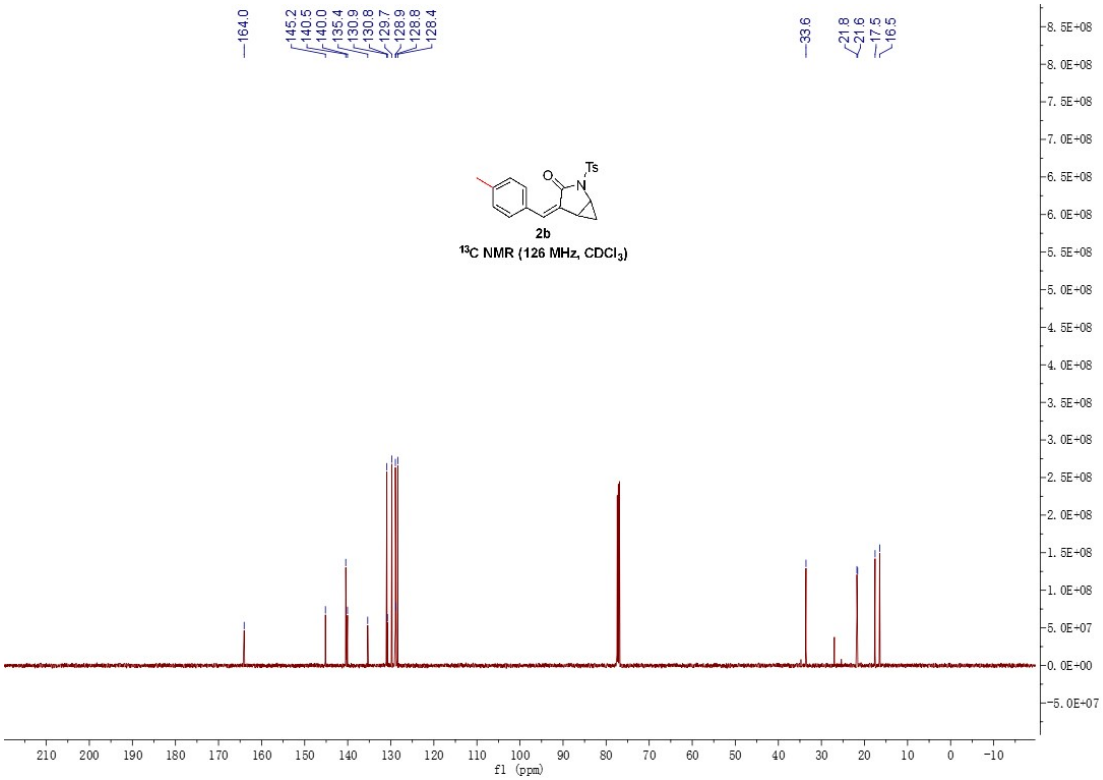


Figure S53. ^{13}C NMR (126 MHz, CDCl$_3$) spectrum of 2b

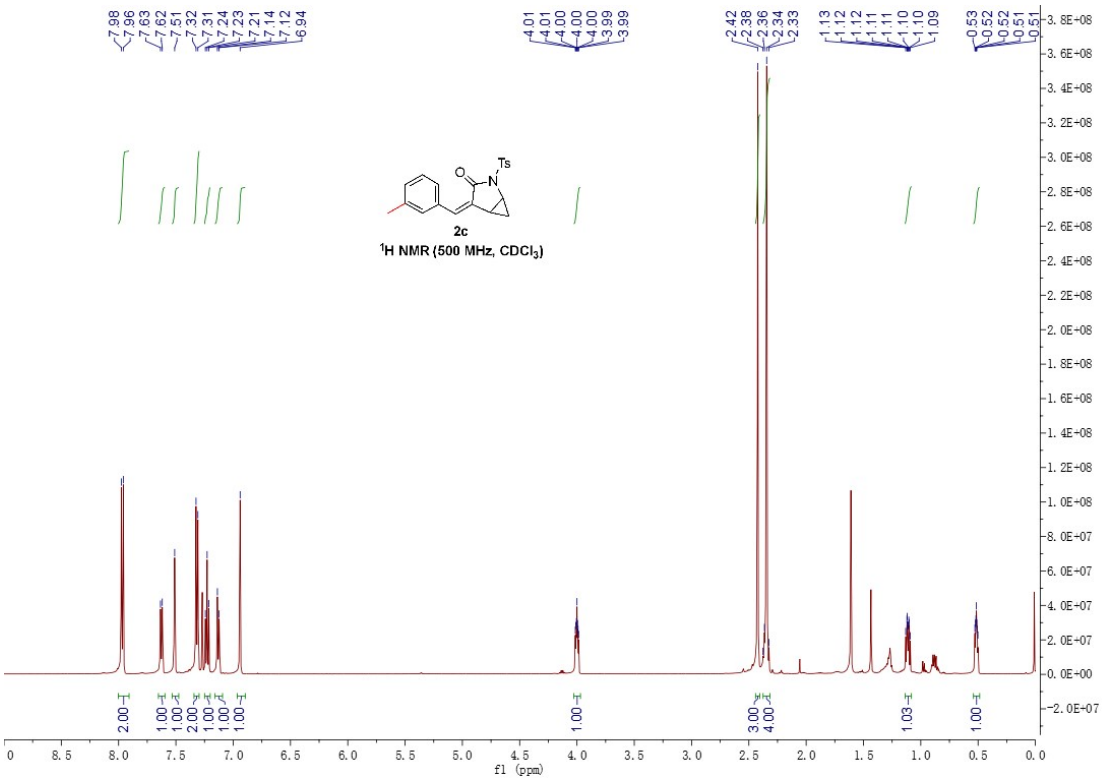


Figure S54. ^{1}H NMR (500 MHz, CDCl$_3$) spectrum of 2c

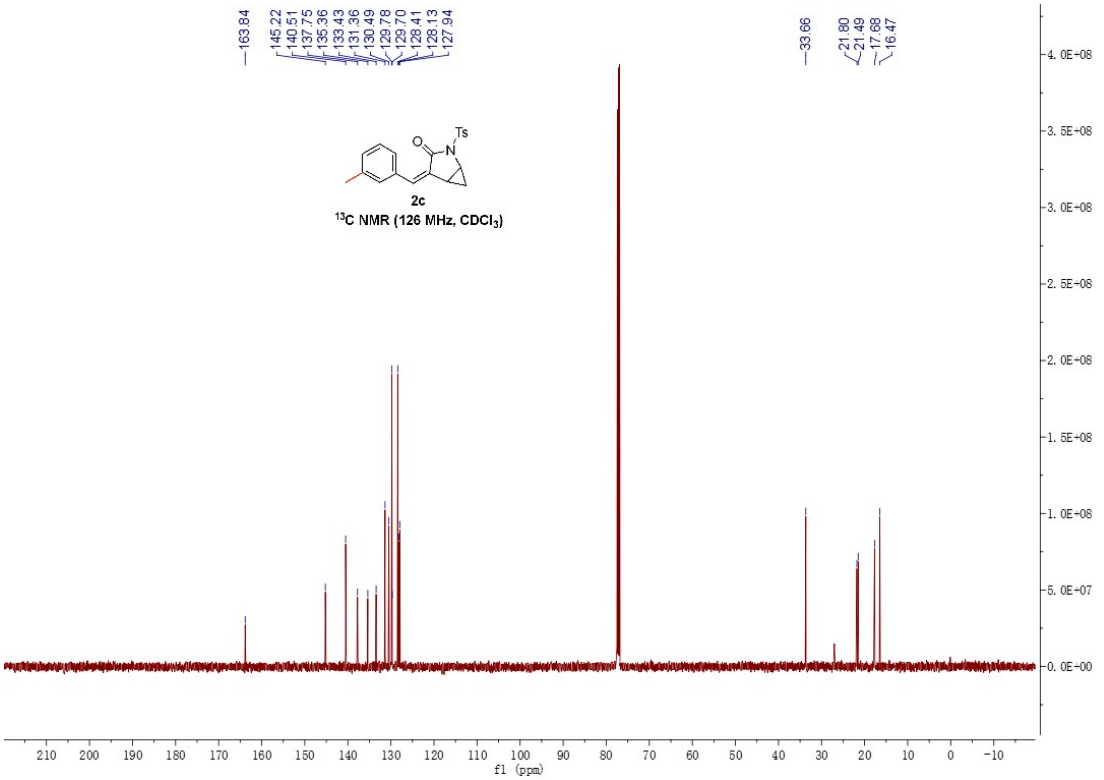


Figure S55. ^{13}C NMR (126 MHz, CDCl$_3$) spectrum of 2c

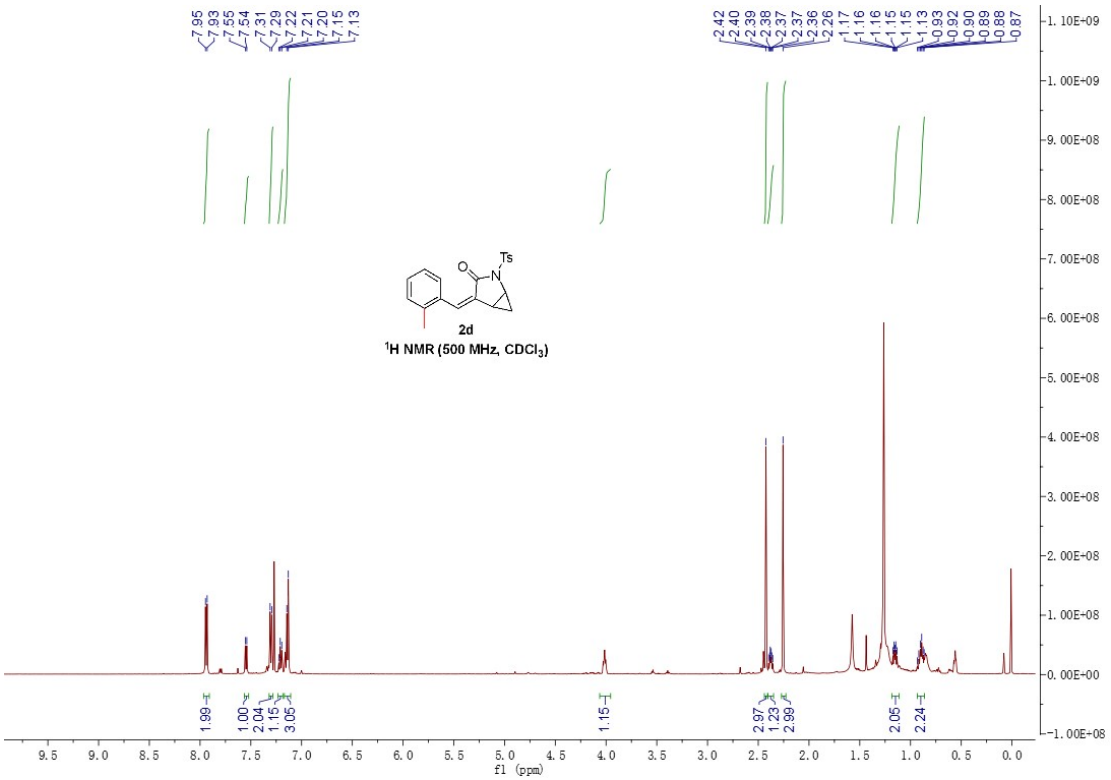


Figure S56. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2d

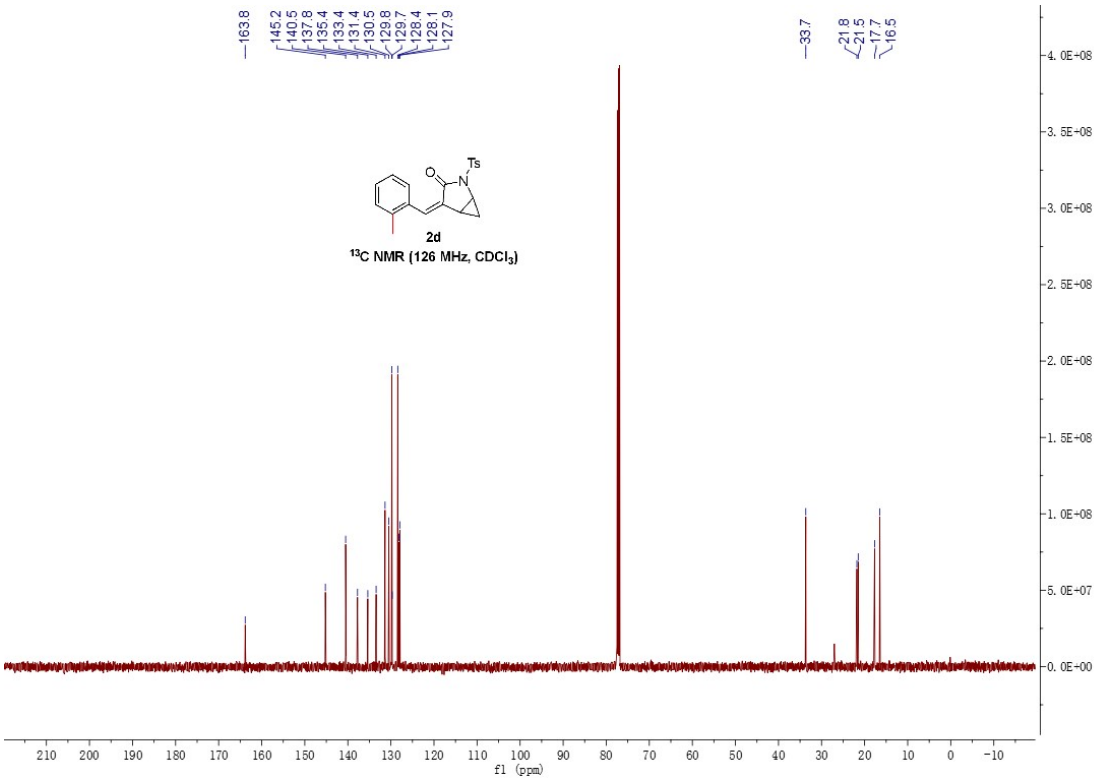


Figure S57. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2d

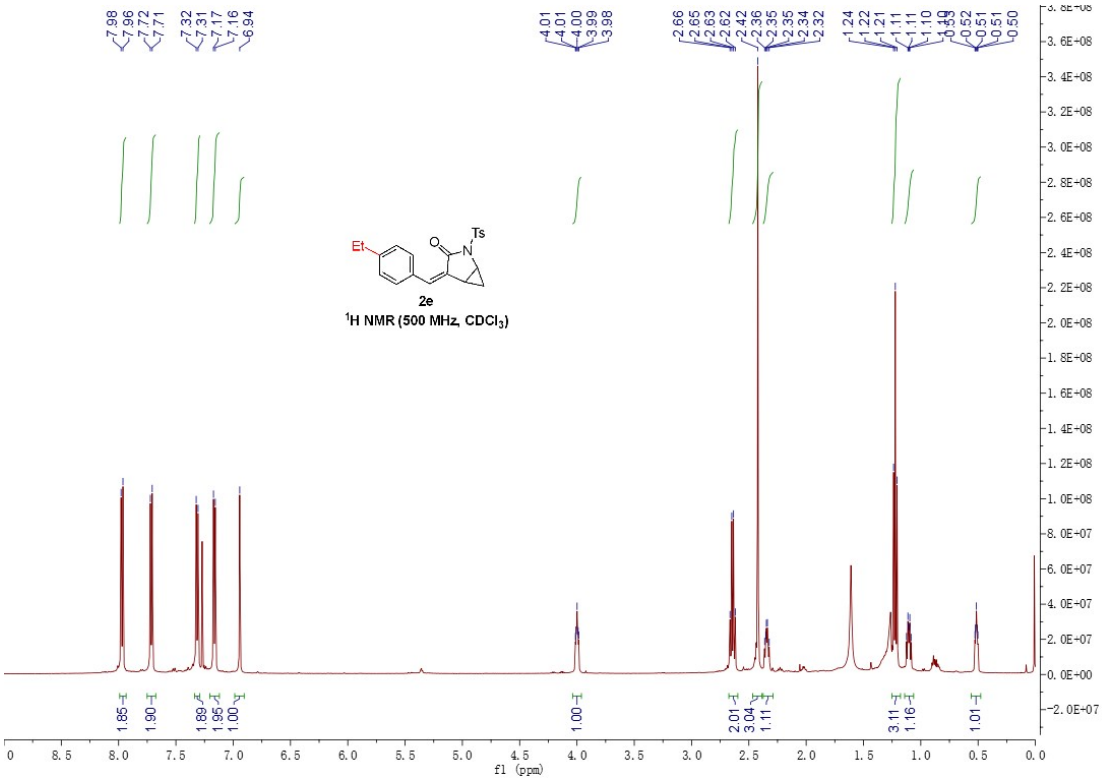


Figure S58. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2e

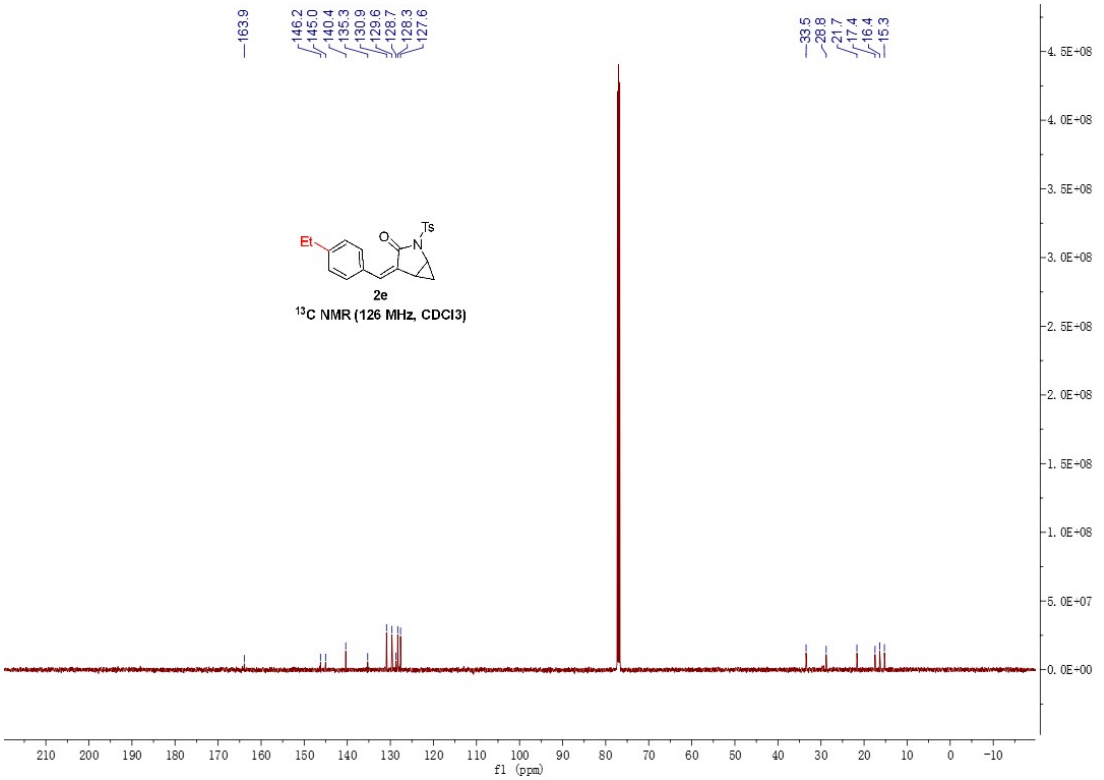


Figure S59. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2e

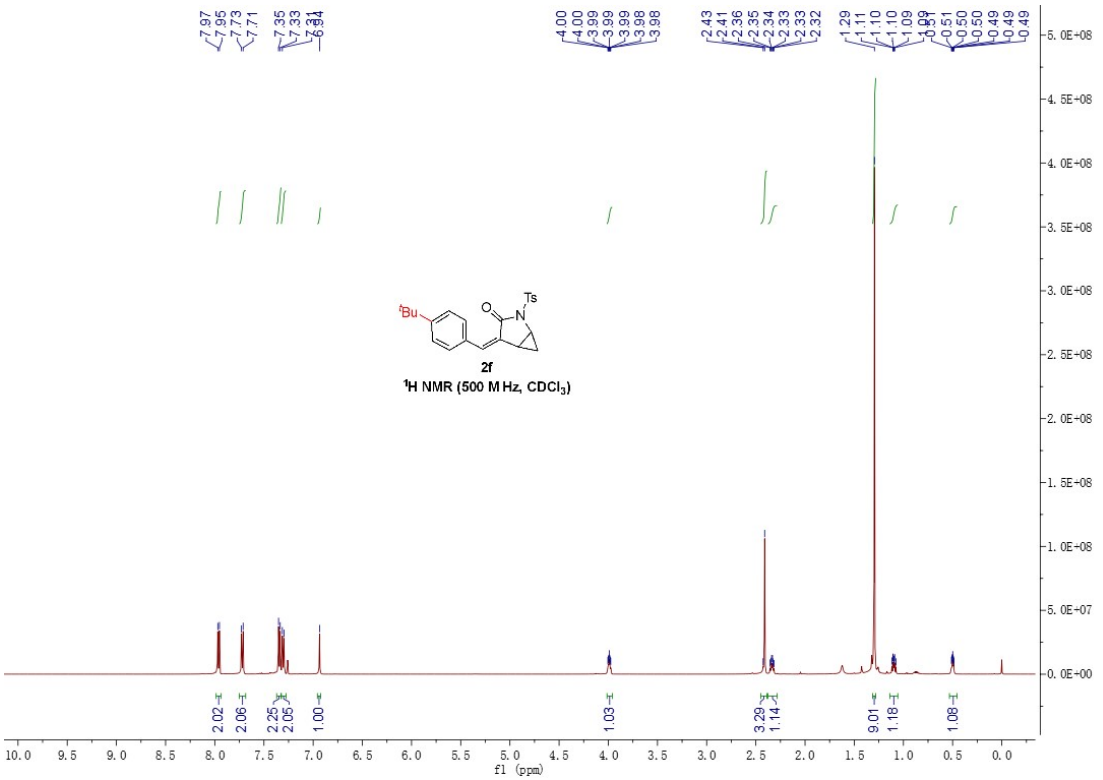


Figure S60. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2f

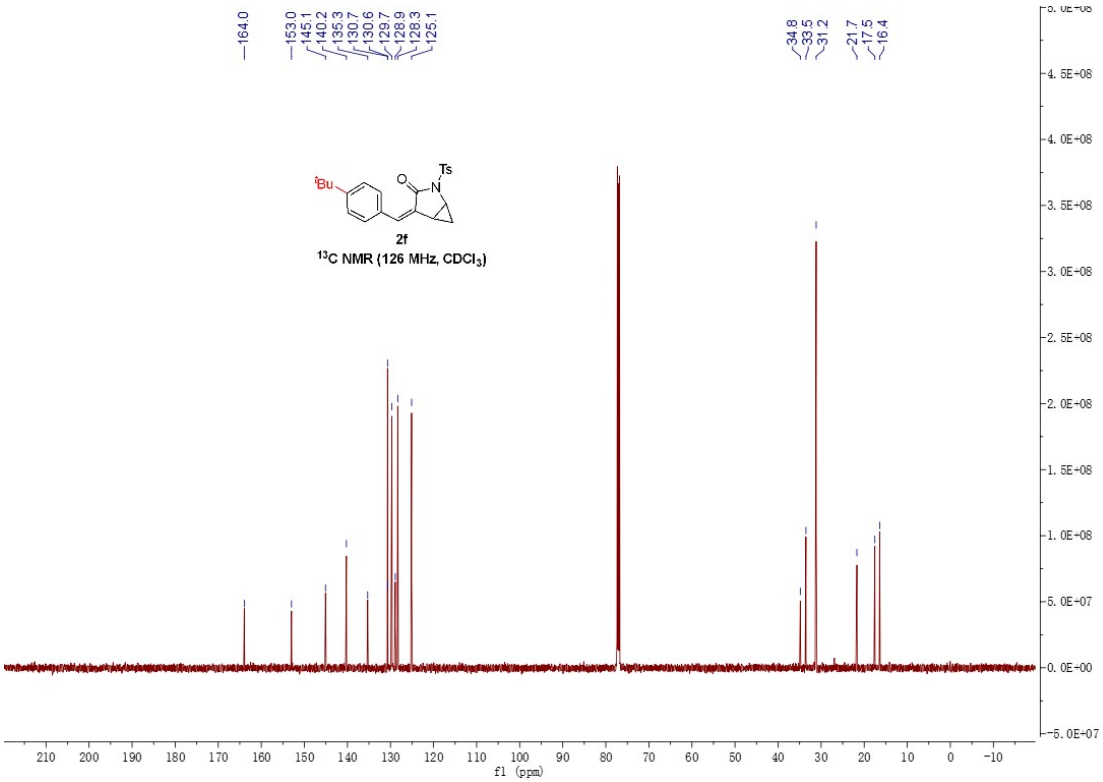


Figure S61. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2f

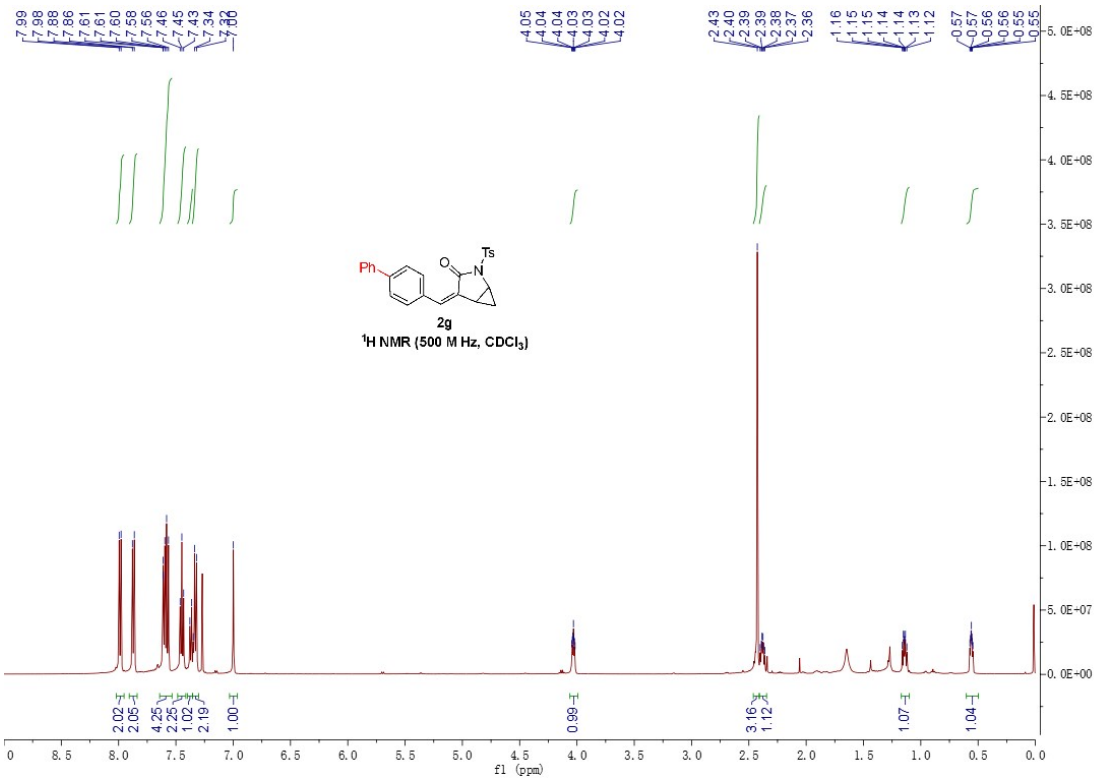


Figure S62. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2g

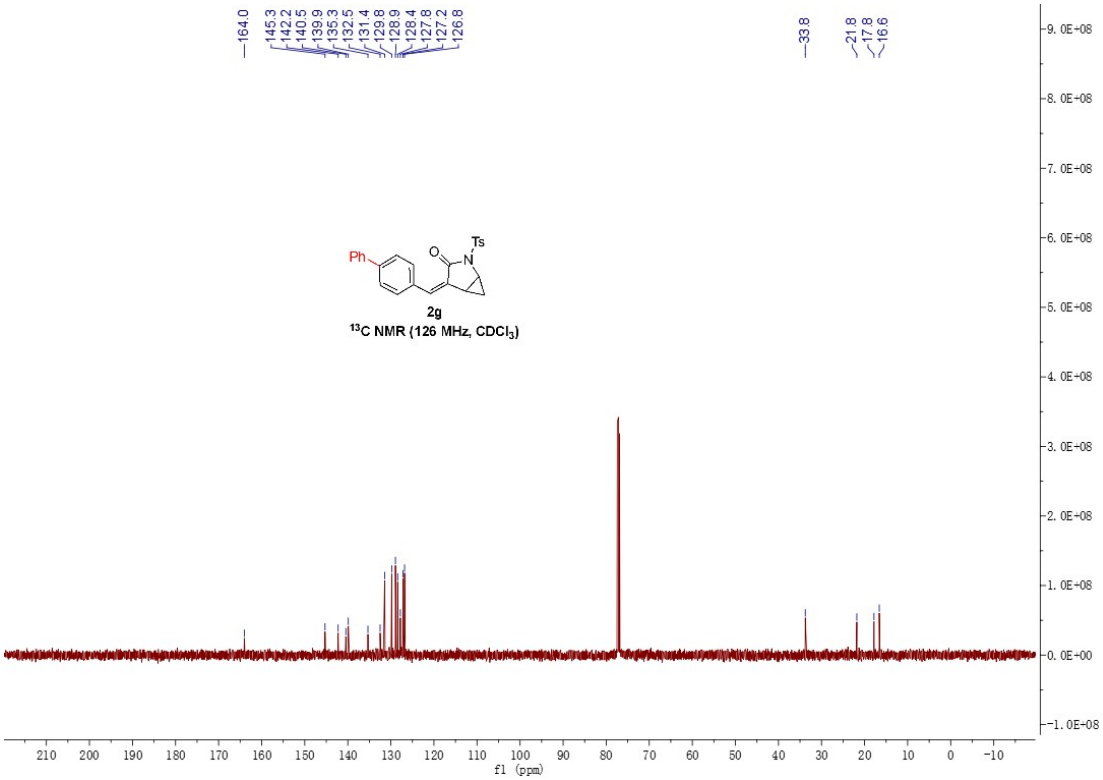


Figure S63. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2g

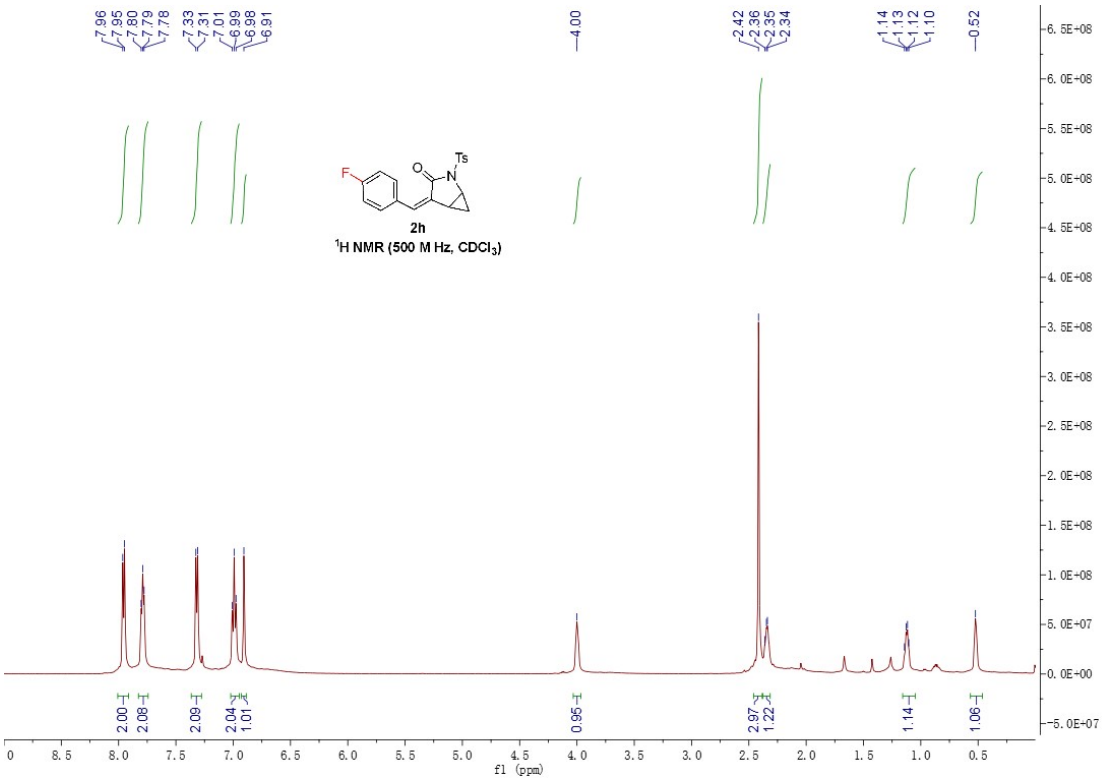


Figure S64. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2h

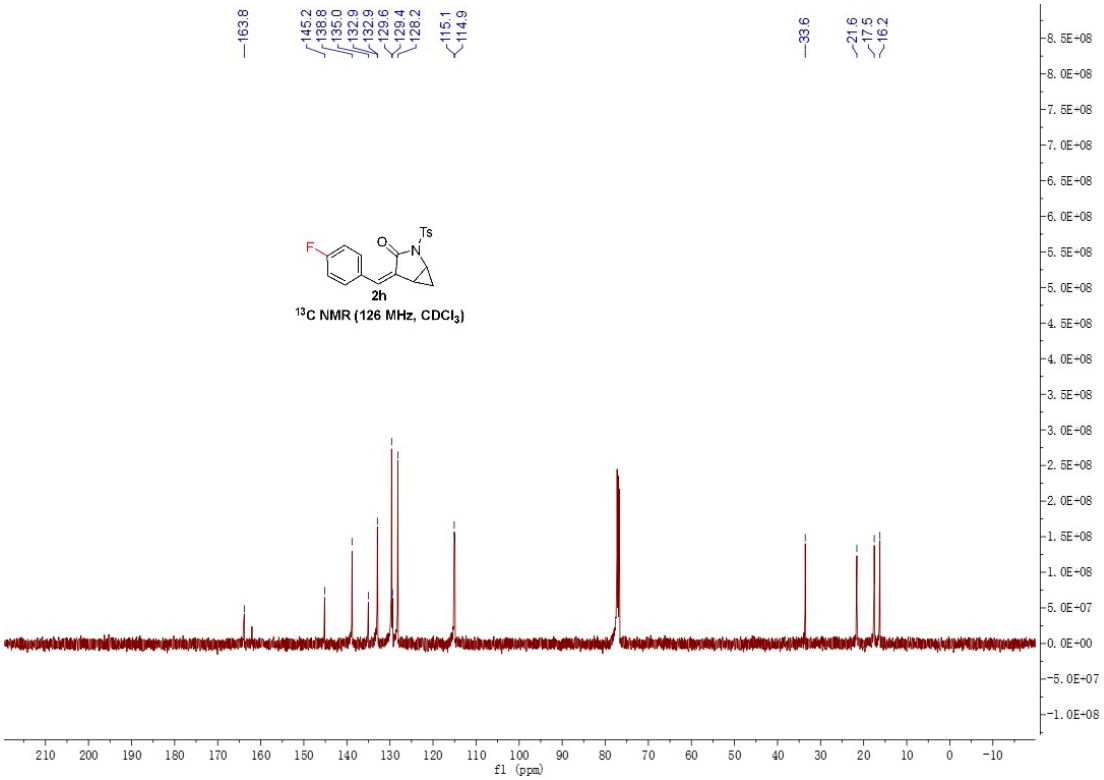


Figure S65. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2i

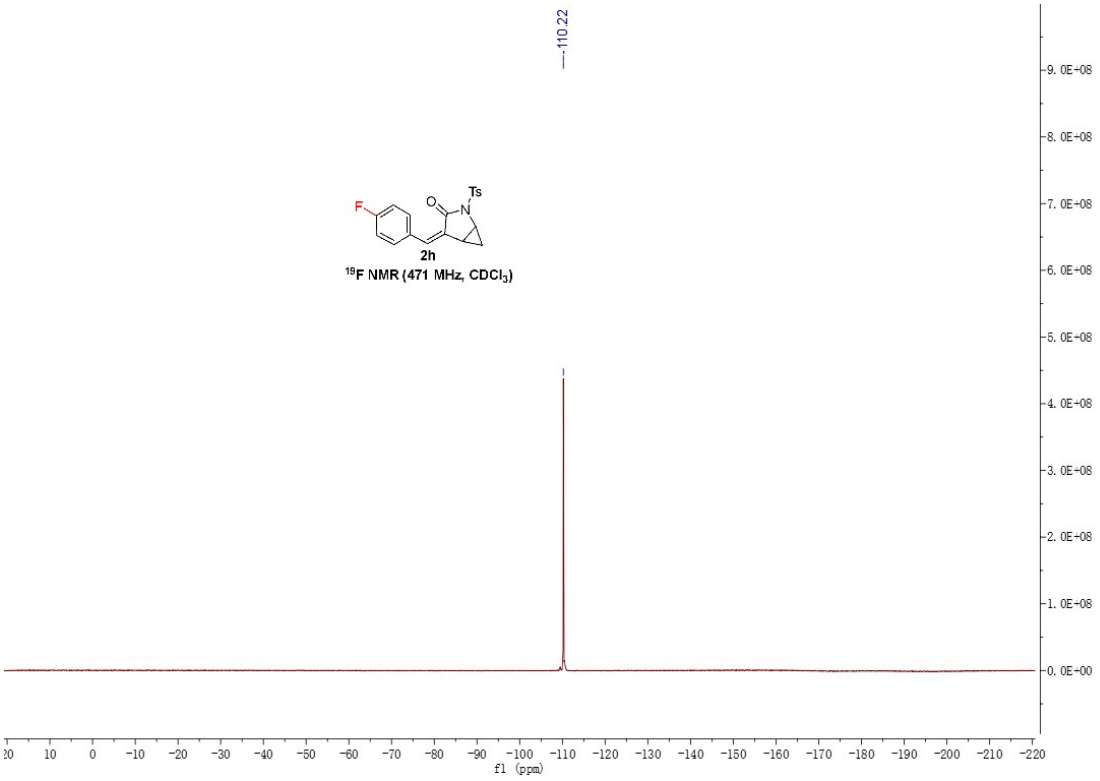


Figure S66. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 2h

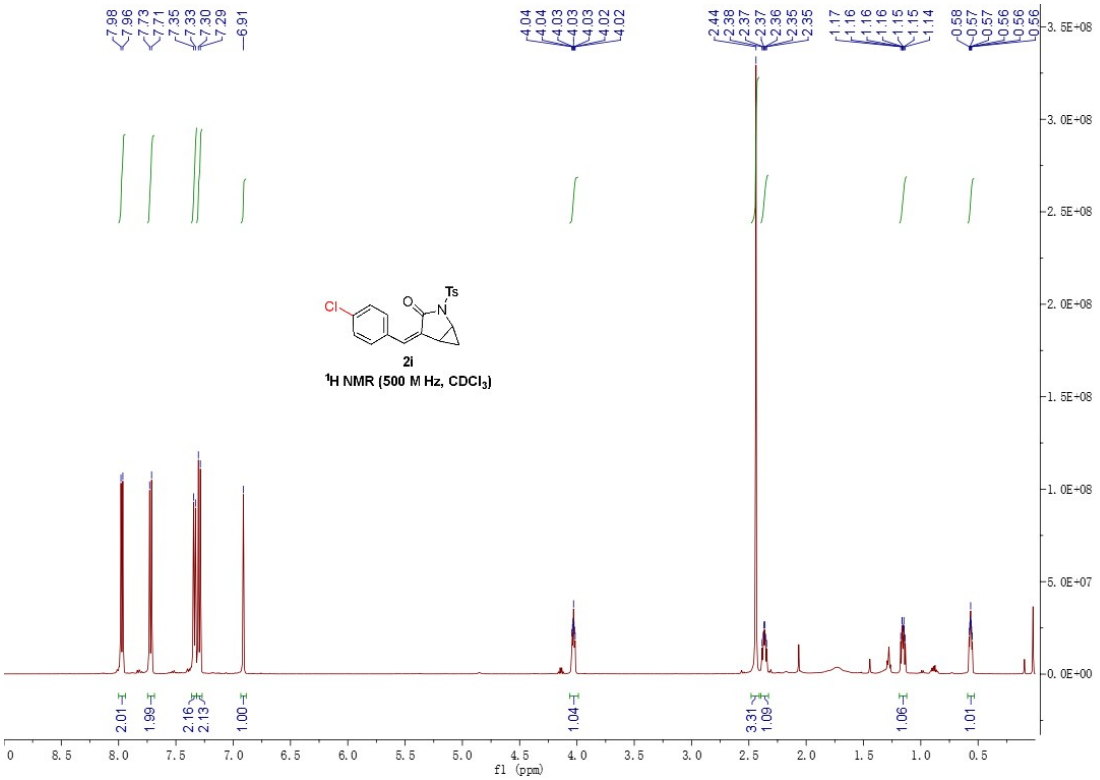


Figure S67. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2i

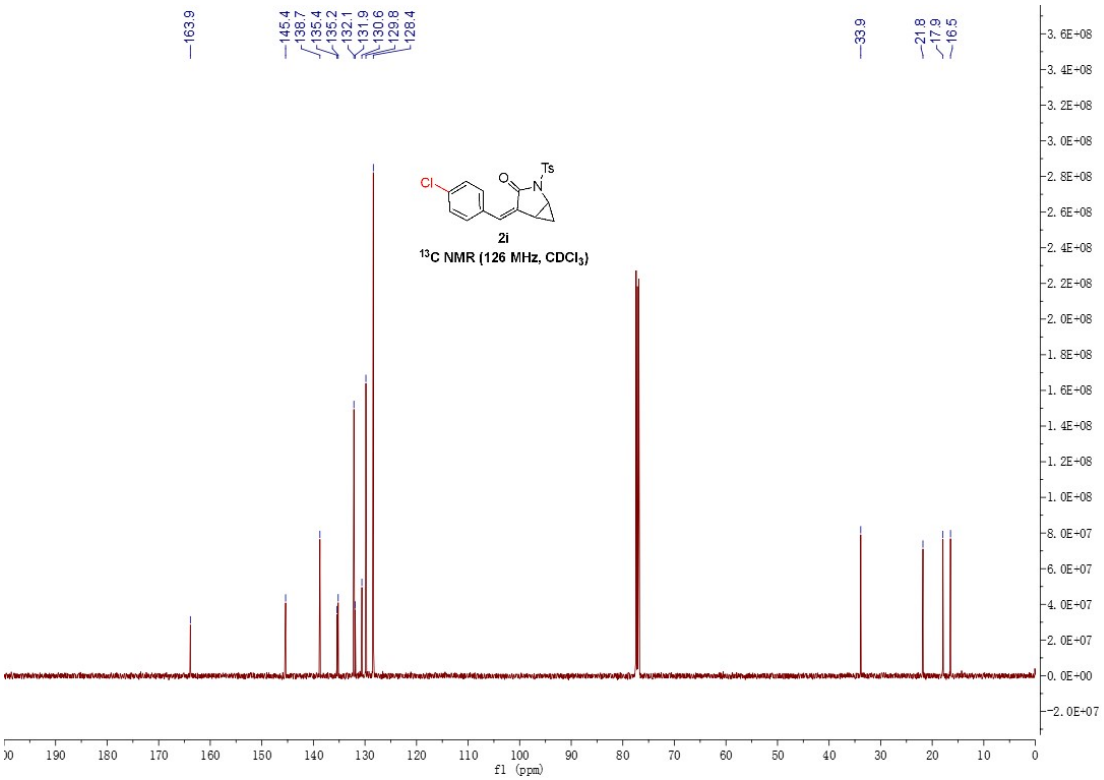


Figure S68. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2i

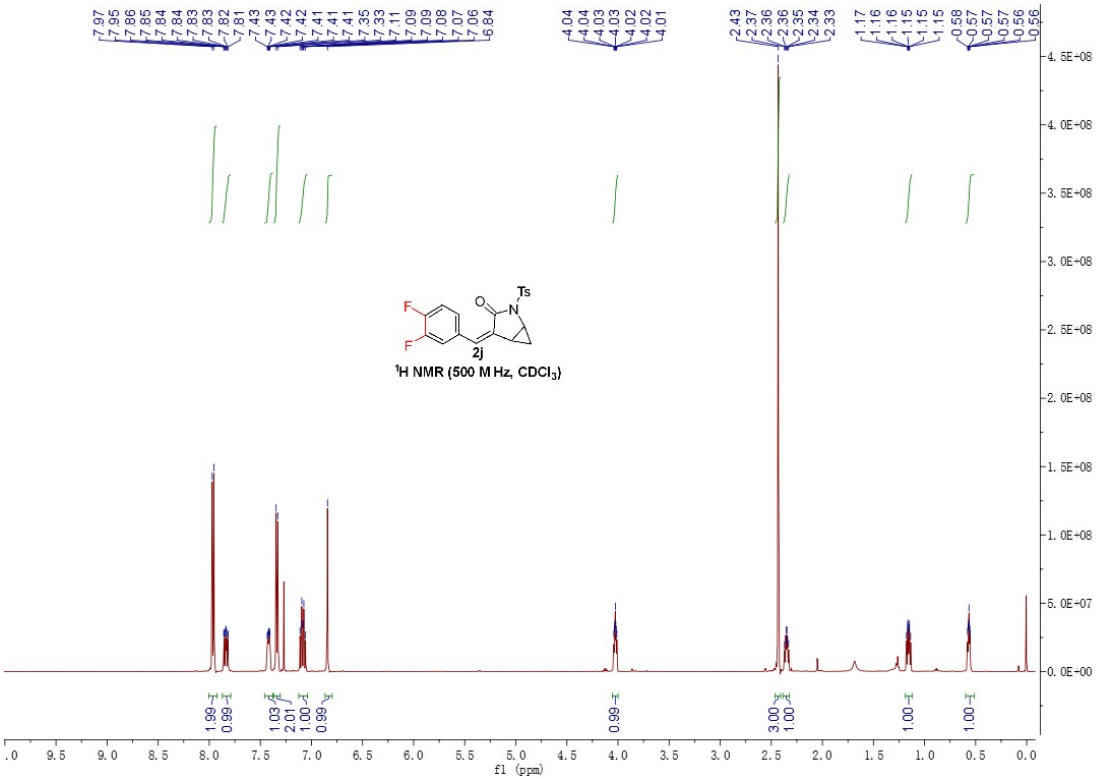


Figure S69. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2j

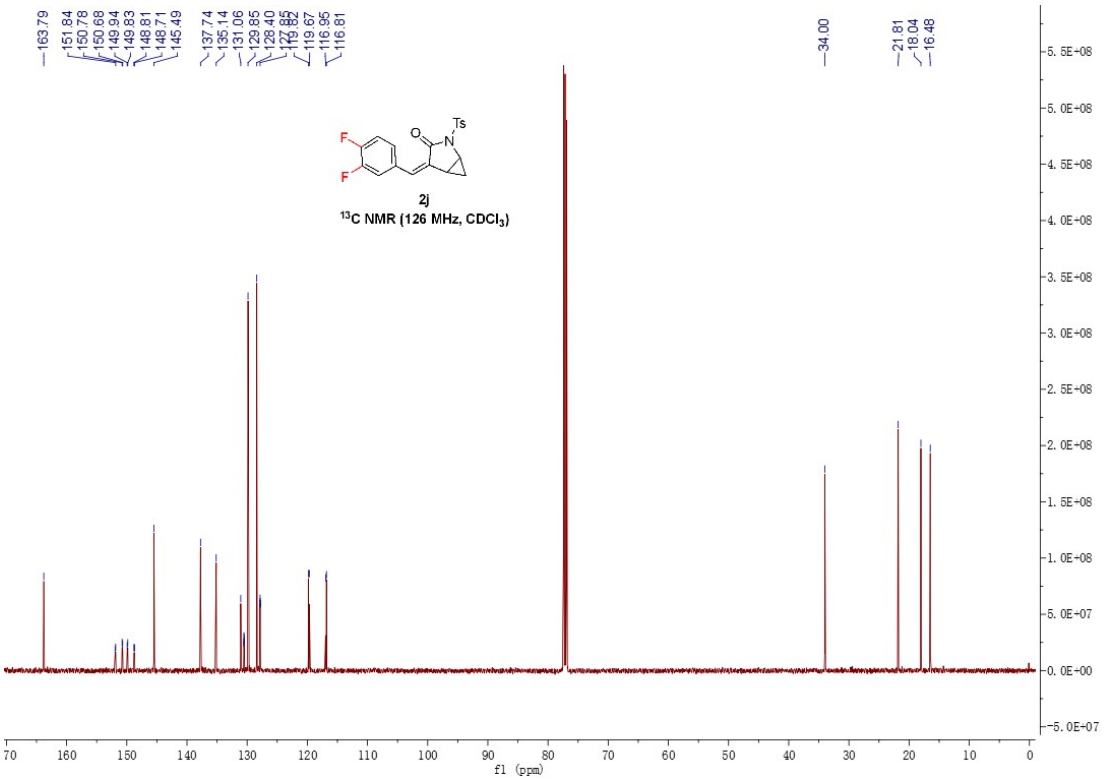


Figure S70. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2j

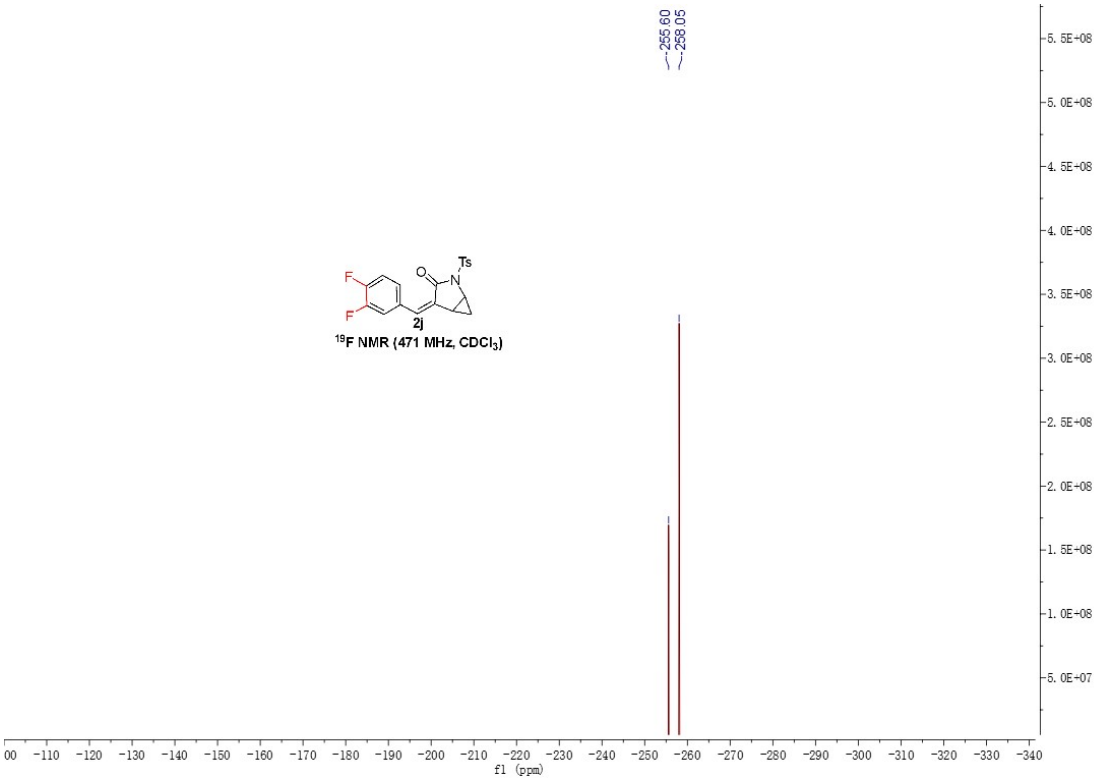


Figure S71. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 2j

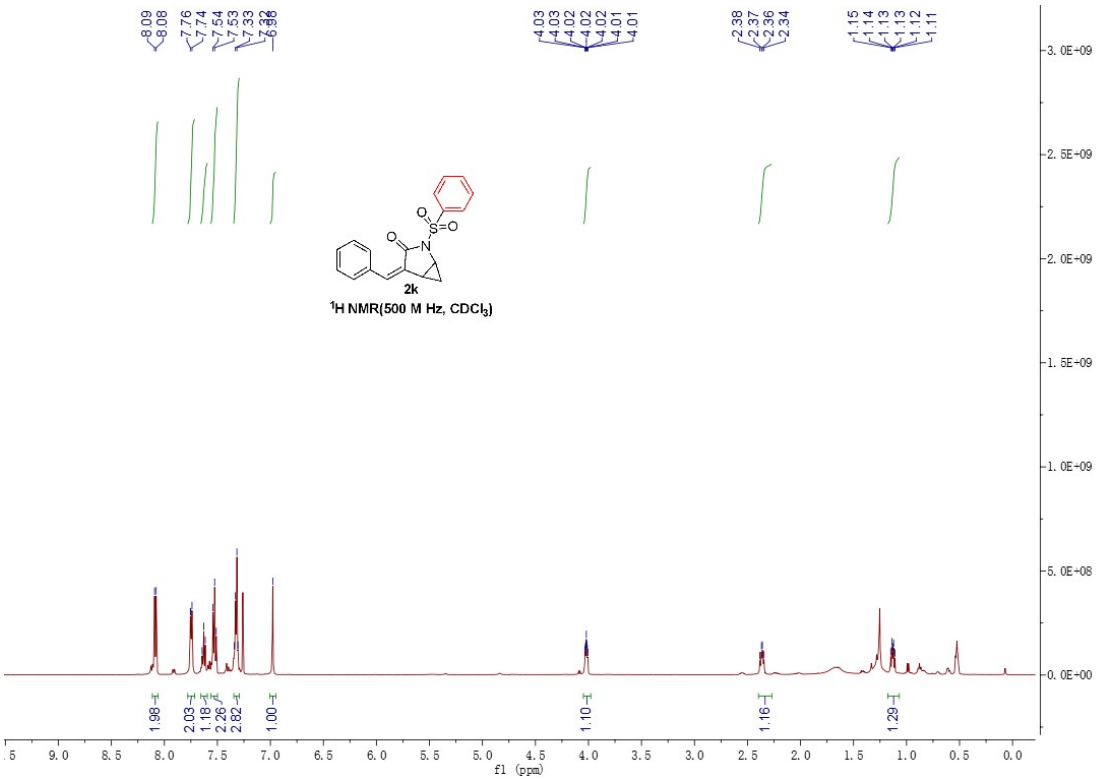


Figure S70. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2k

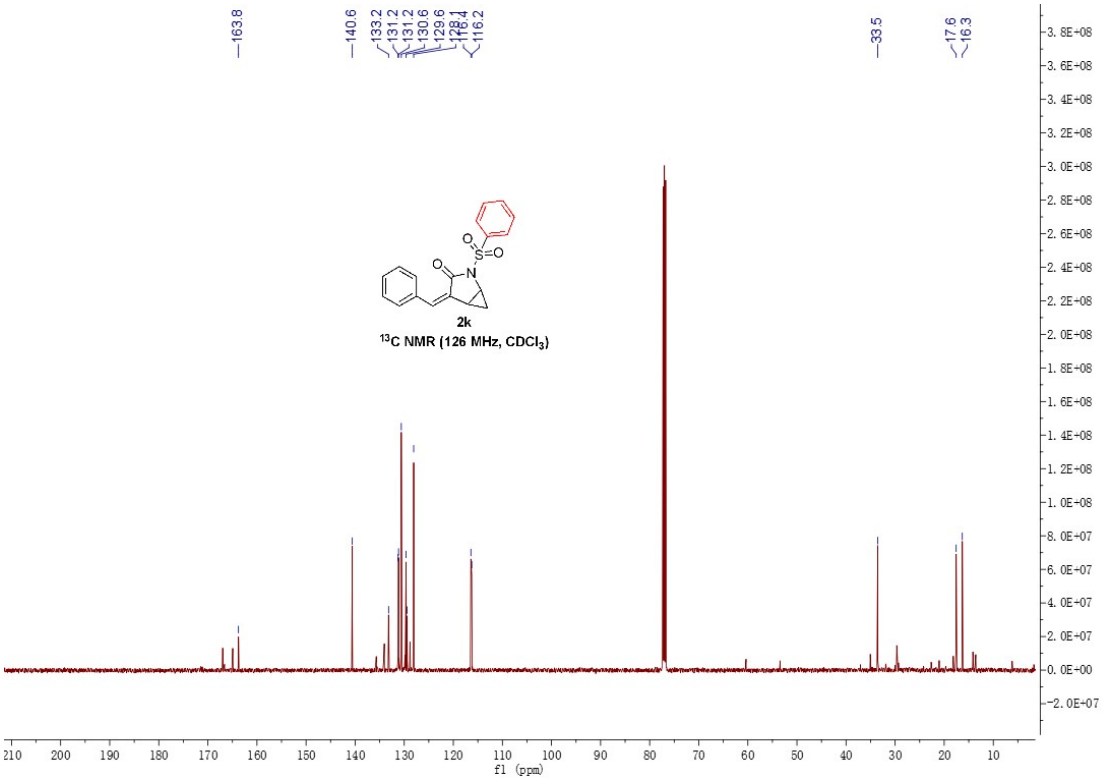


Figure S73.^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2k

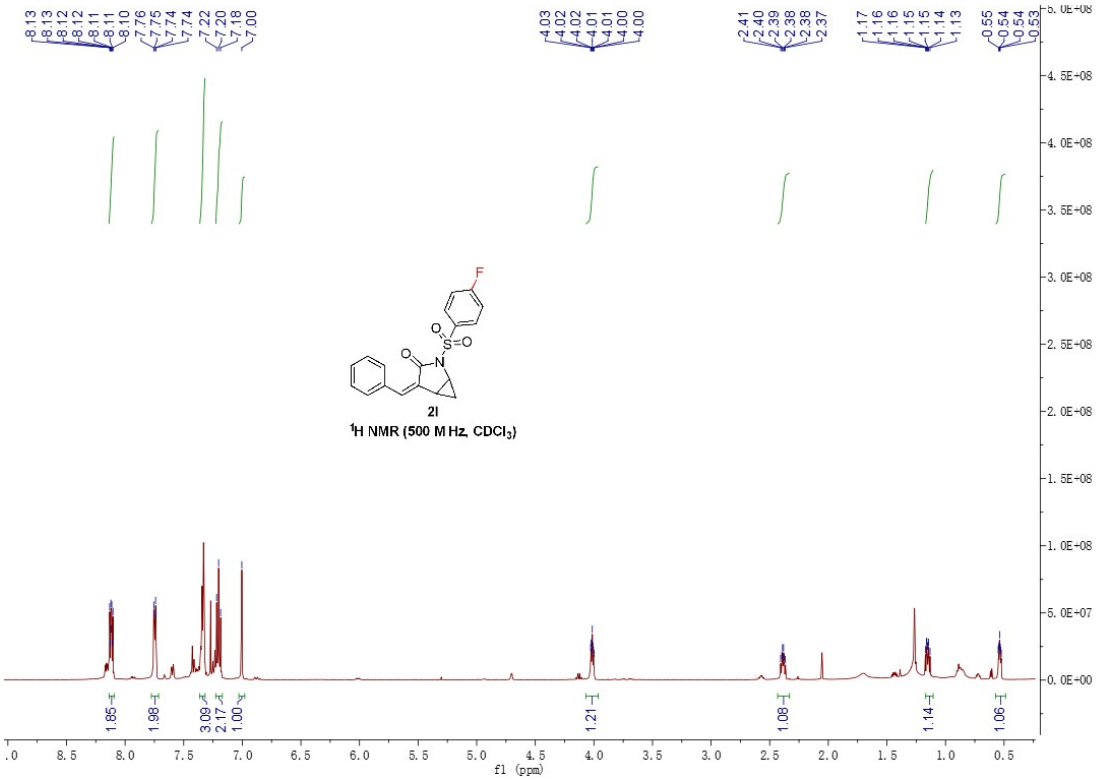


Figure S74. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2l

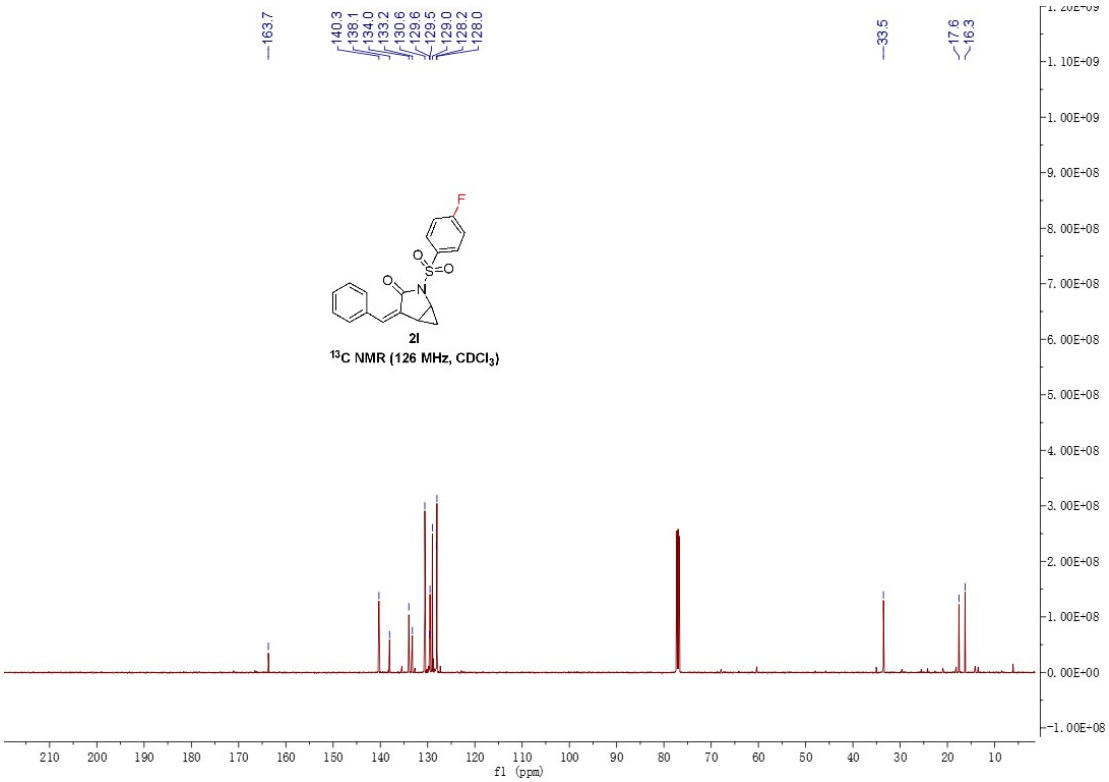


Figure S75. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2l

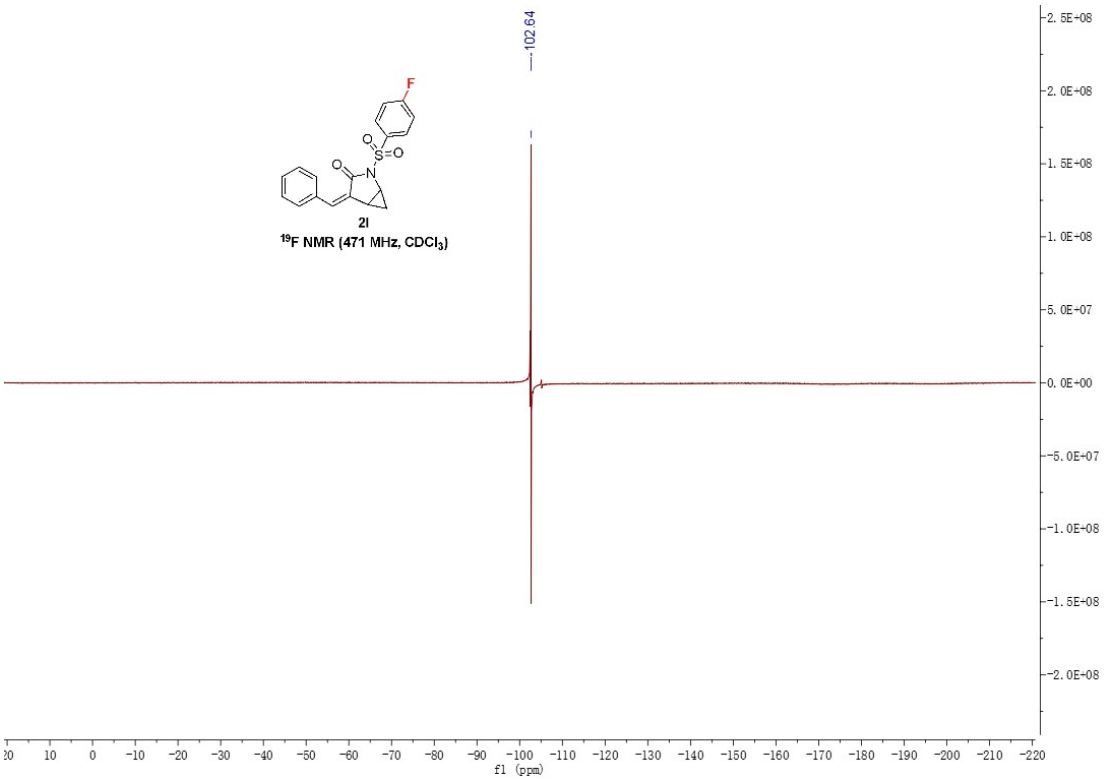


Figure S76. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 2l

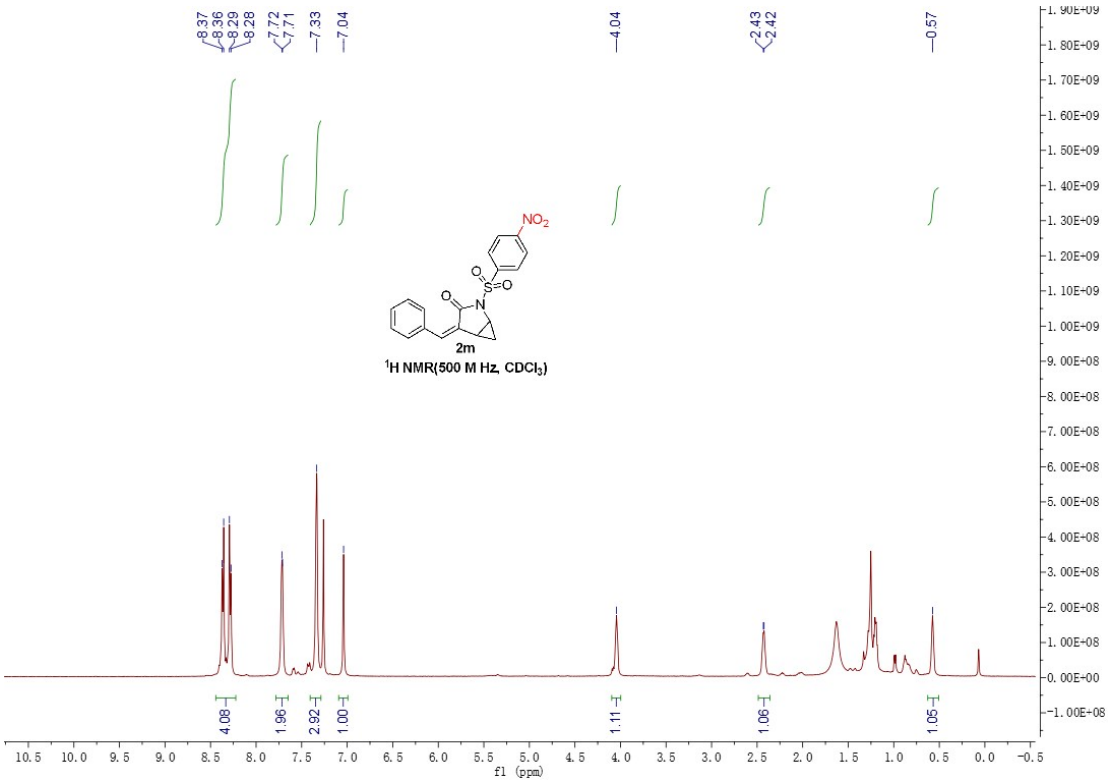


Figure S77. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2m

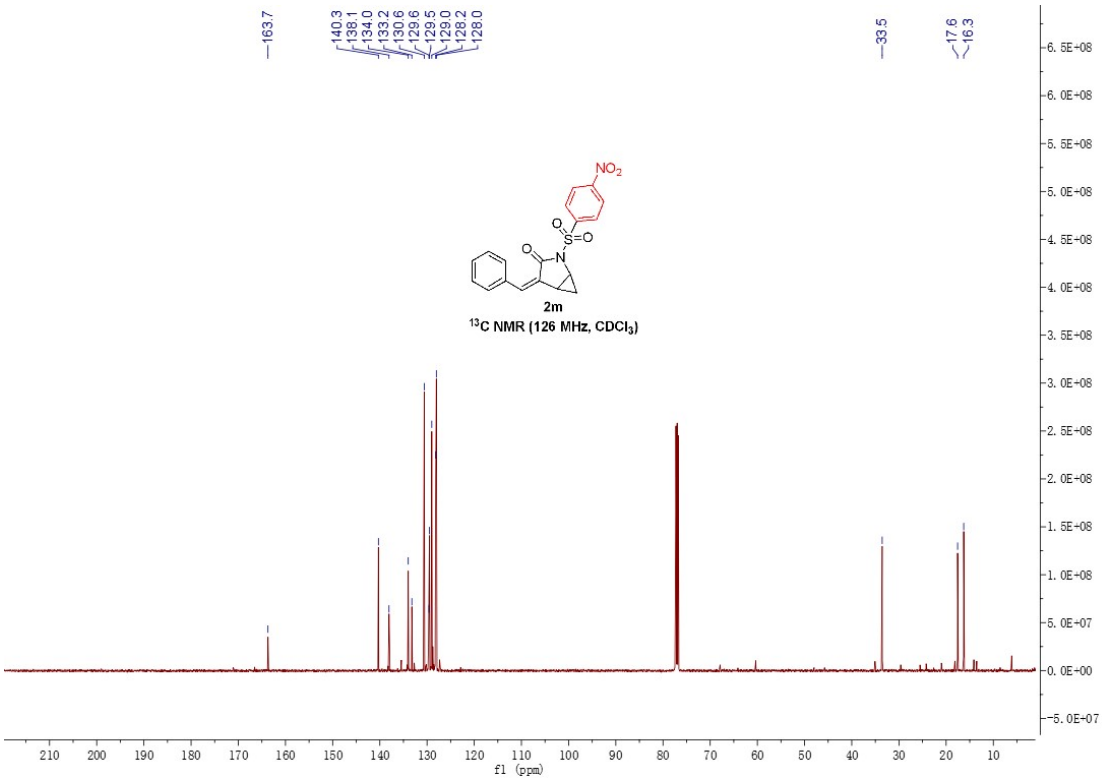


Figure S78. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2m

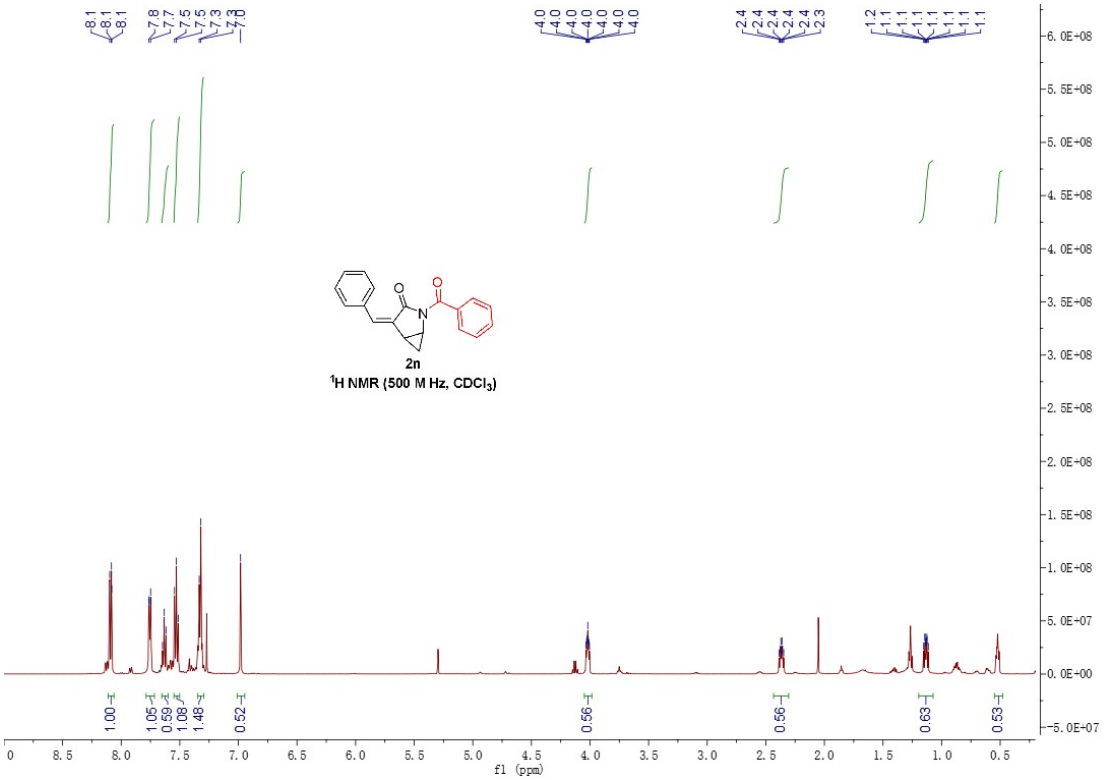


Figure S79. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2n

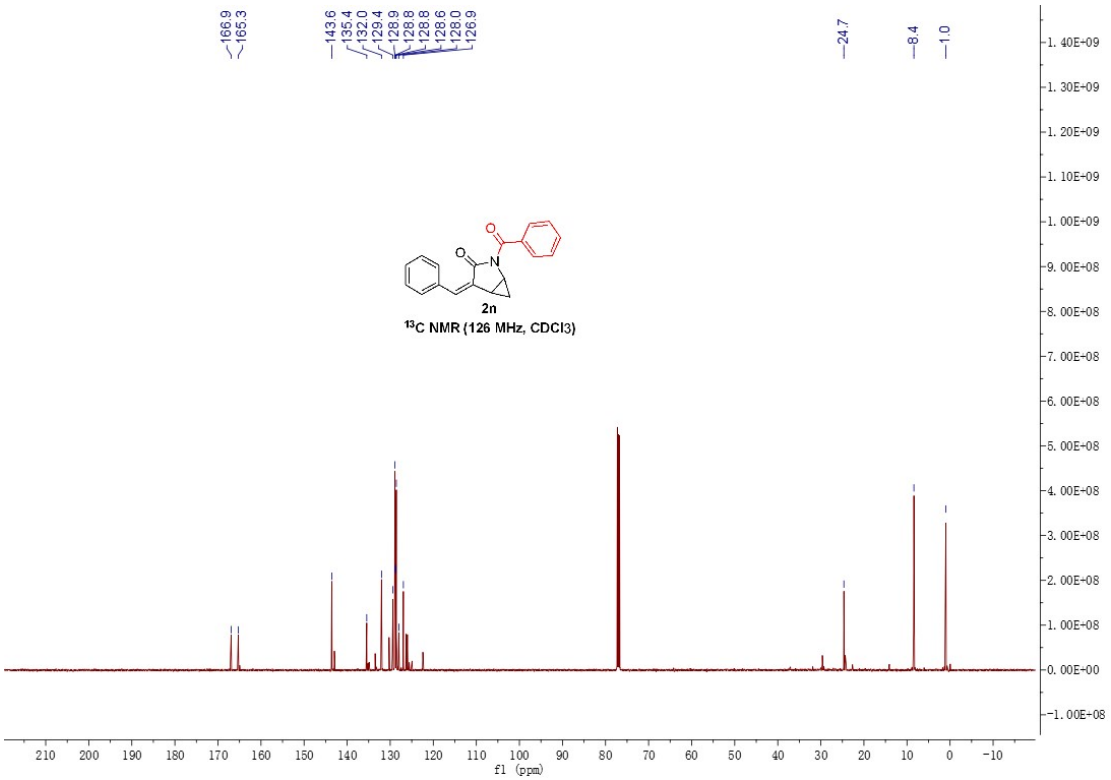


Figure S80. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2n

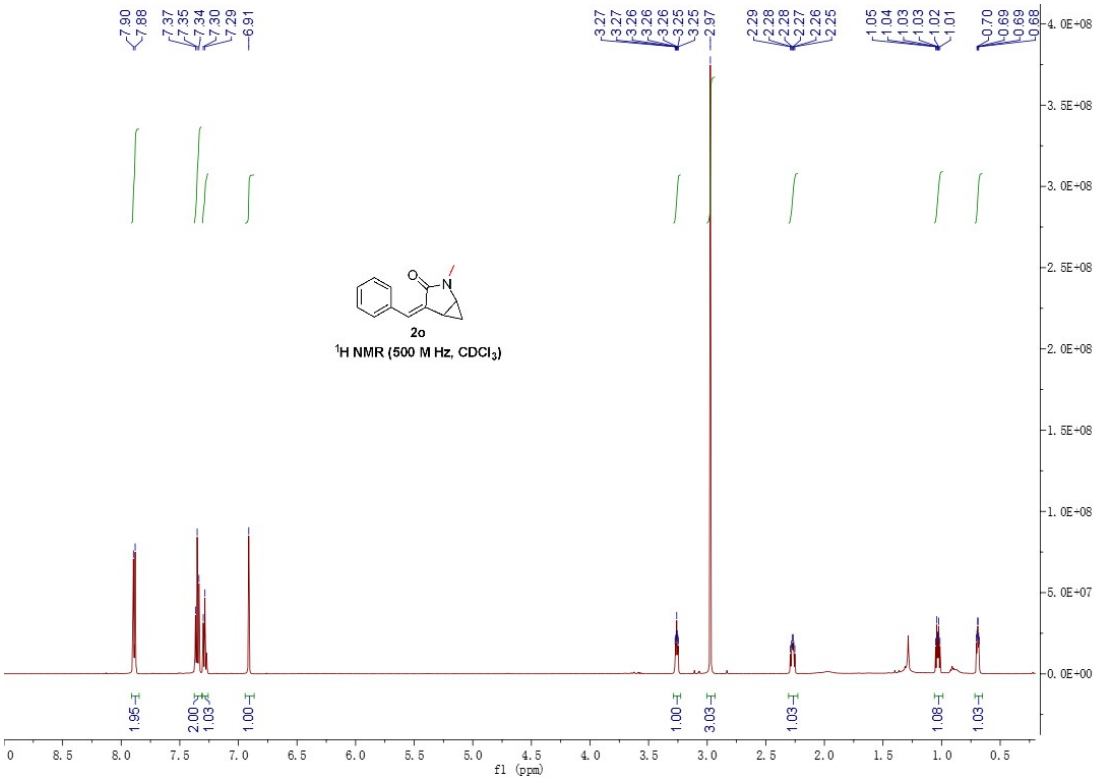


Figure S81. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2o

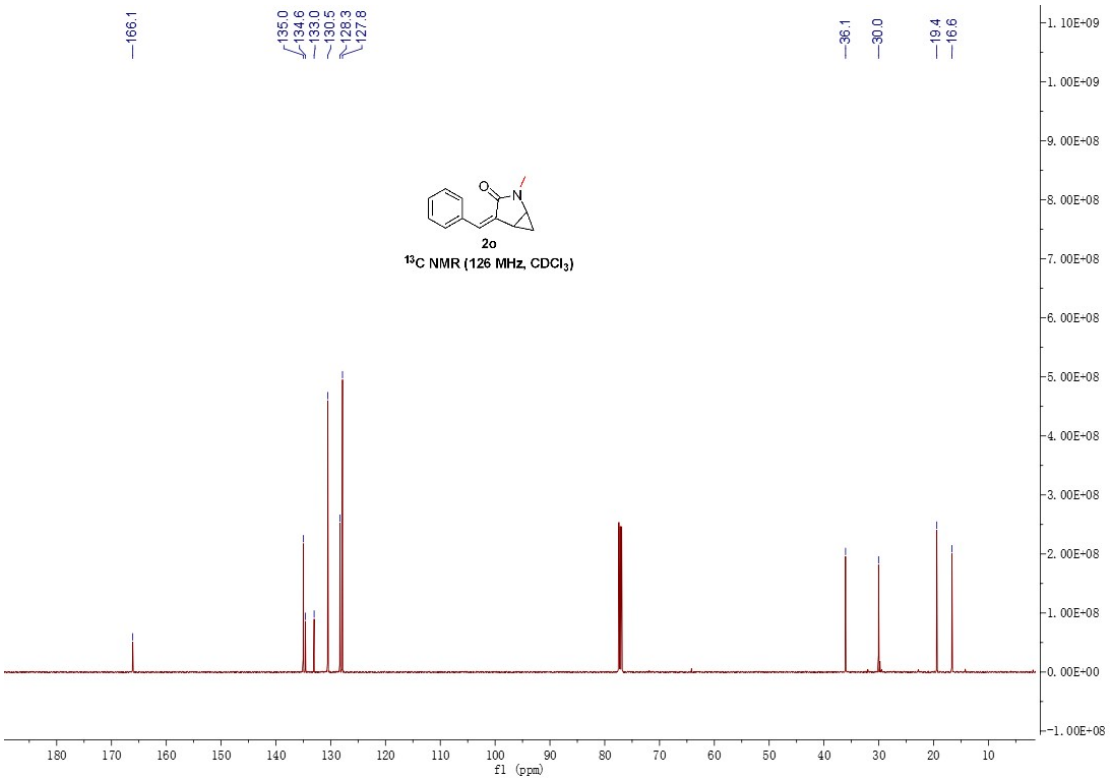


Figure S82. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2o

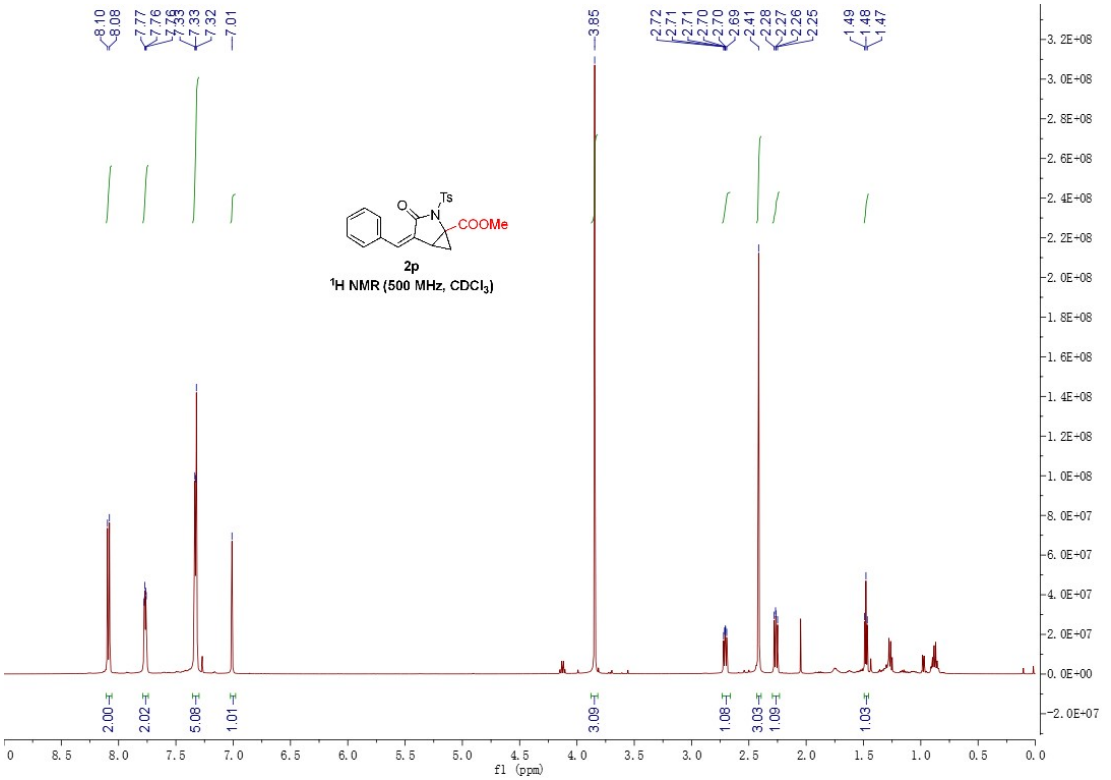


Figure S83. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2r

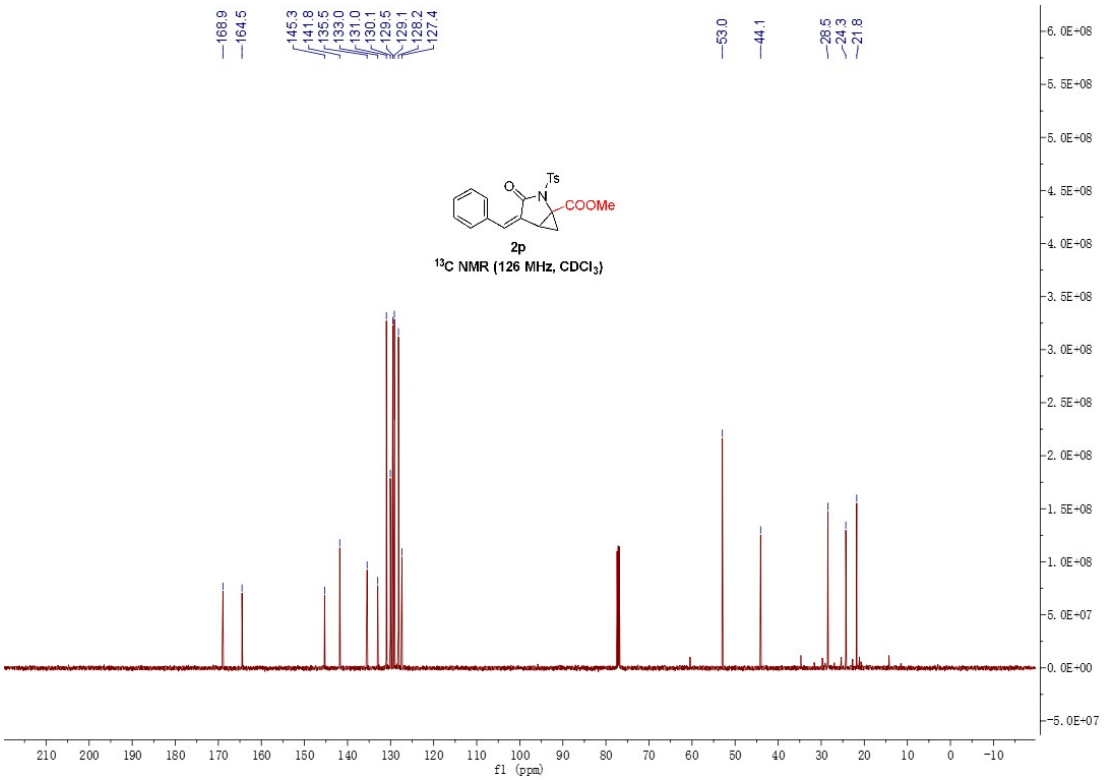


Figure S84. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2p

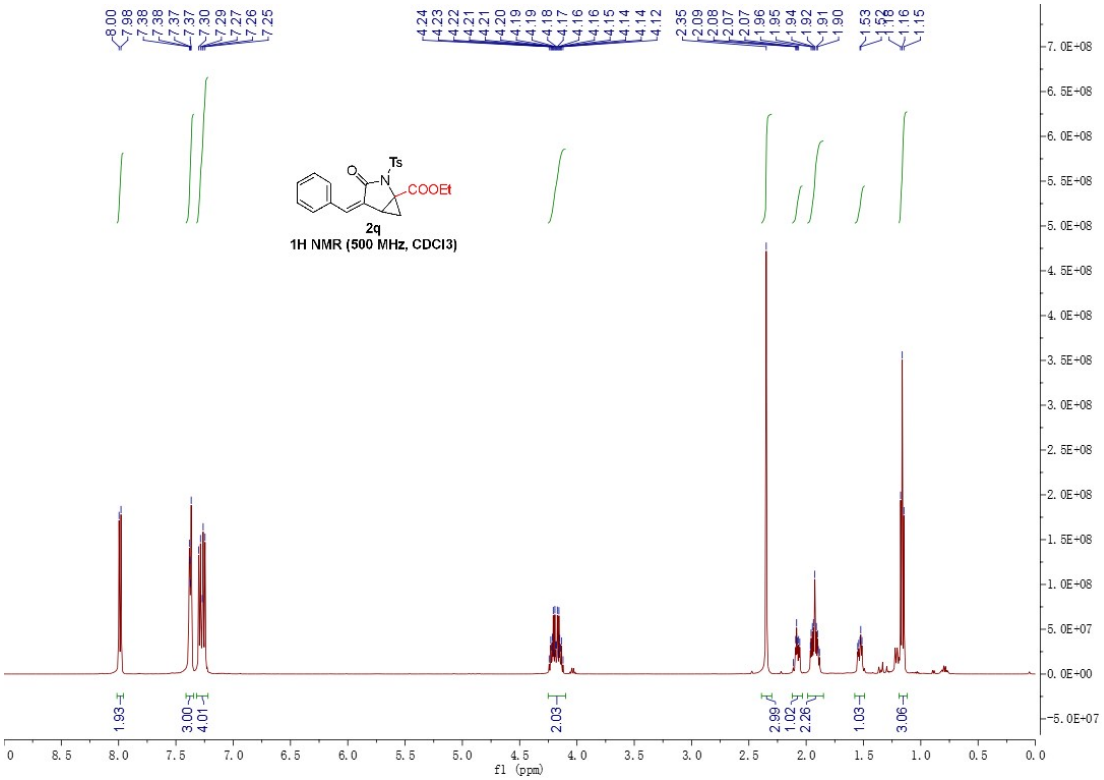


Figure S85. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2q

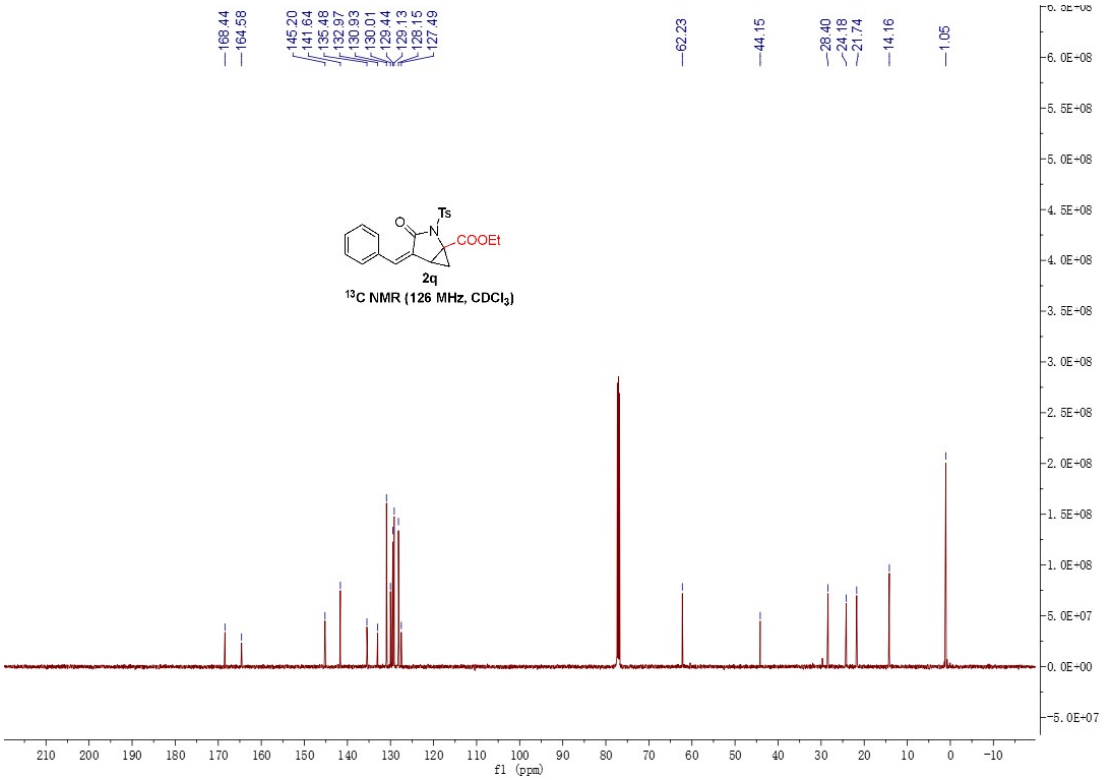


Figure S86. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2q

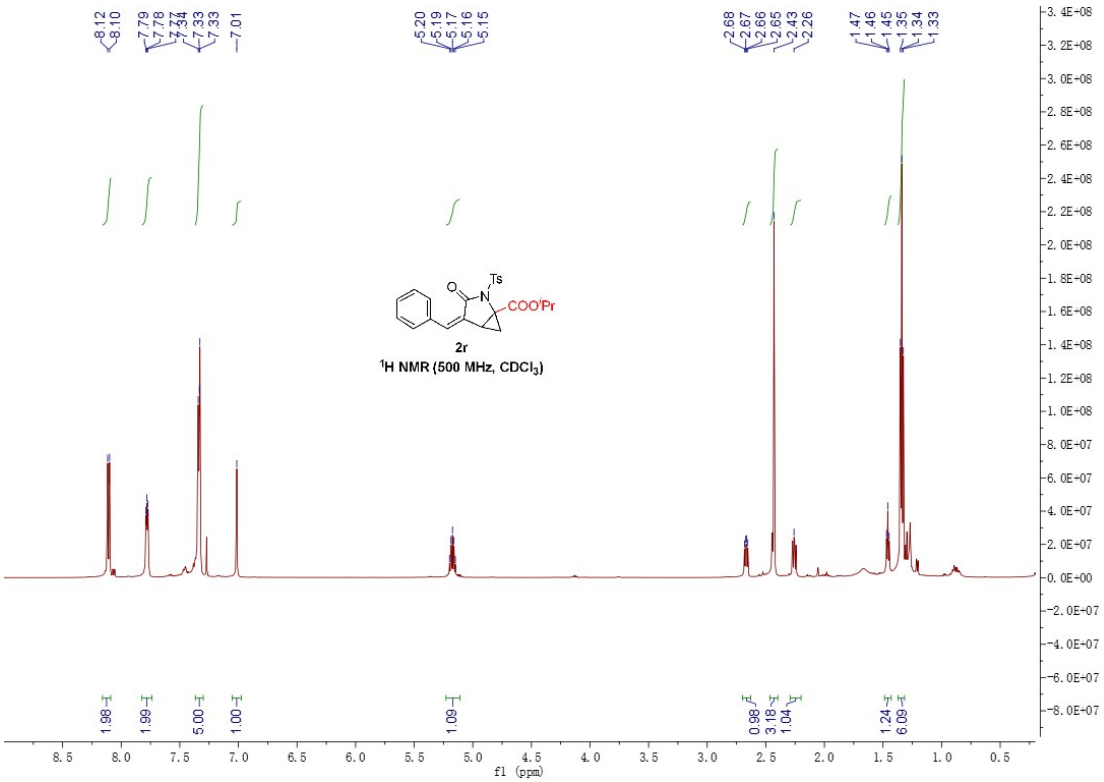


Figure S87. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2r

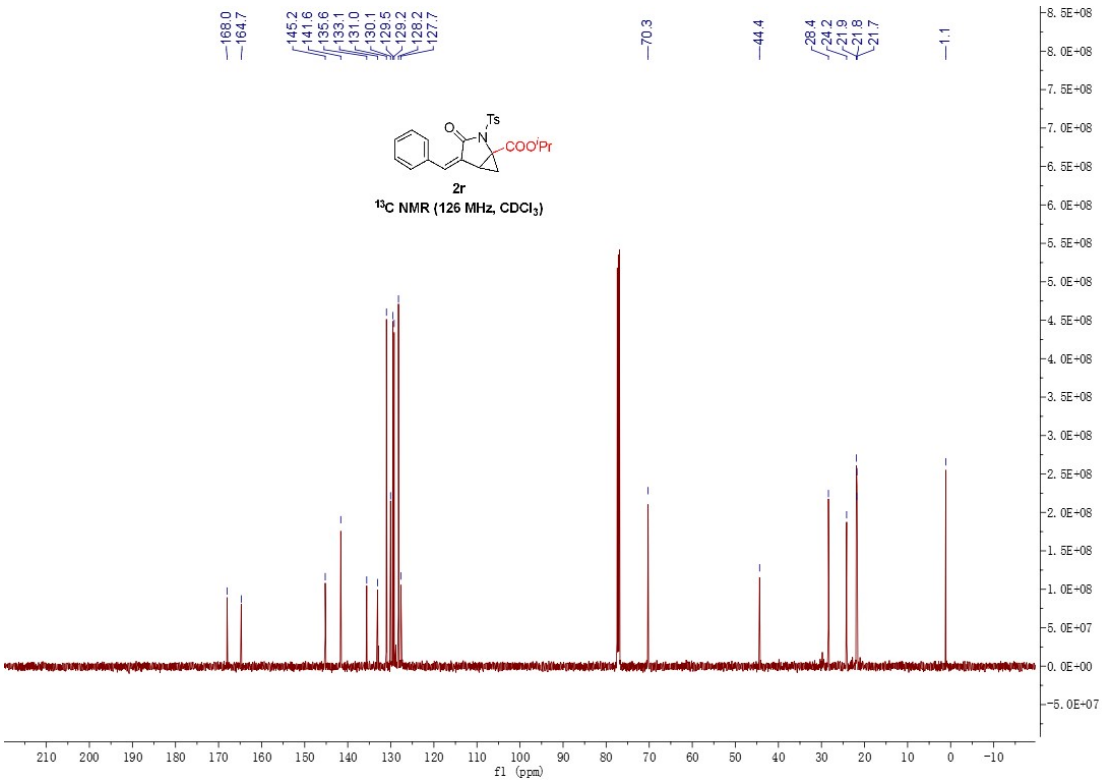


Figure S88. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2r

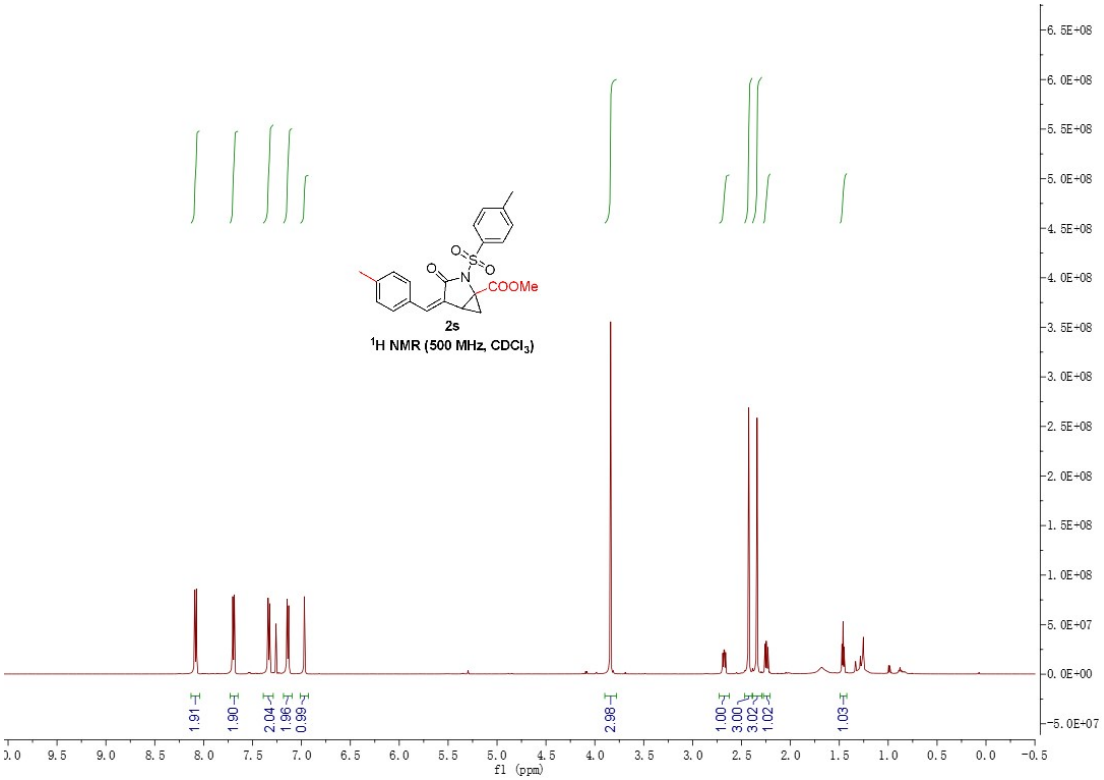


Figure S89. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2s

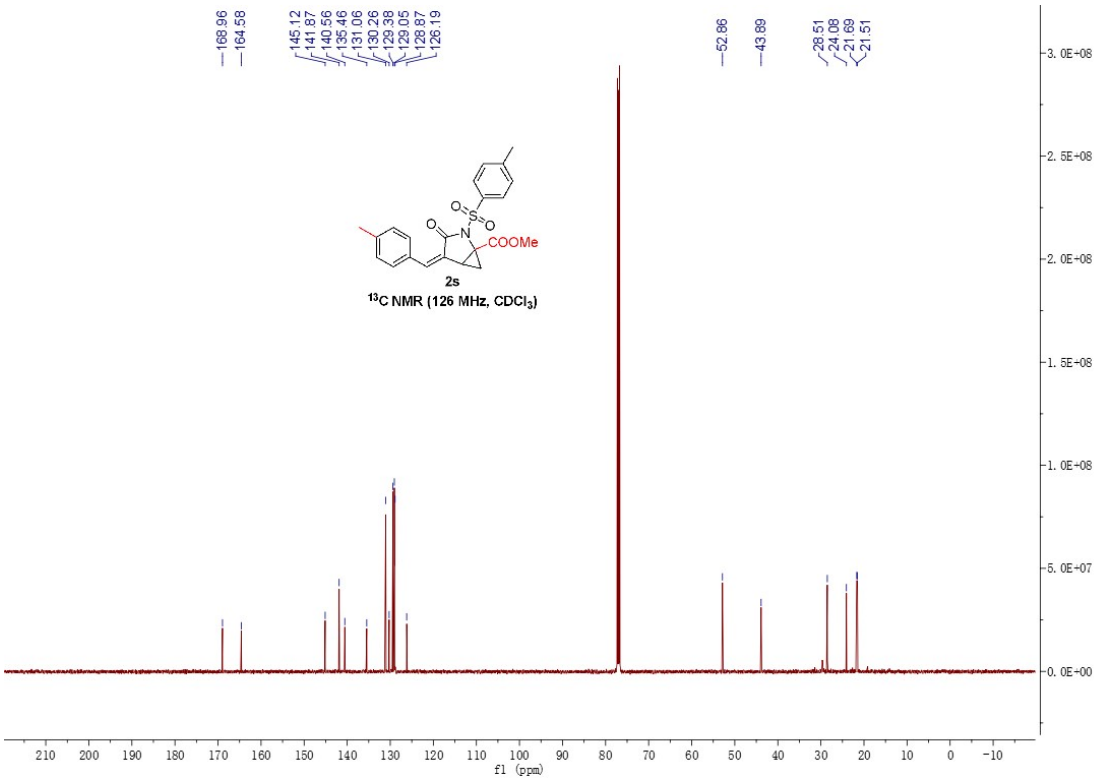


Figure S90. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2s

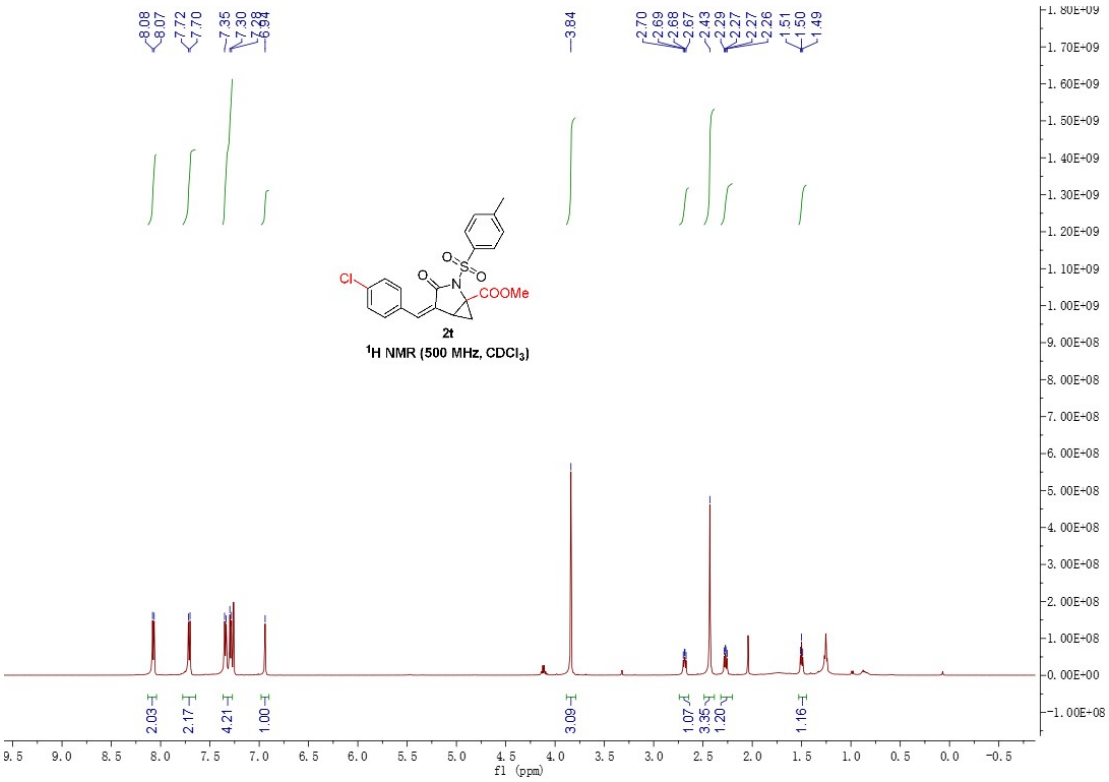


Figure S91. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2s

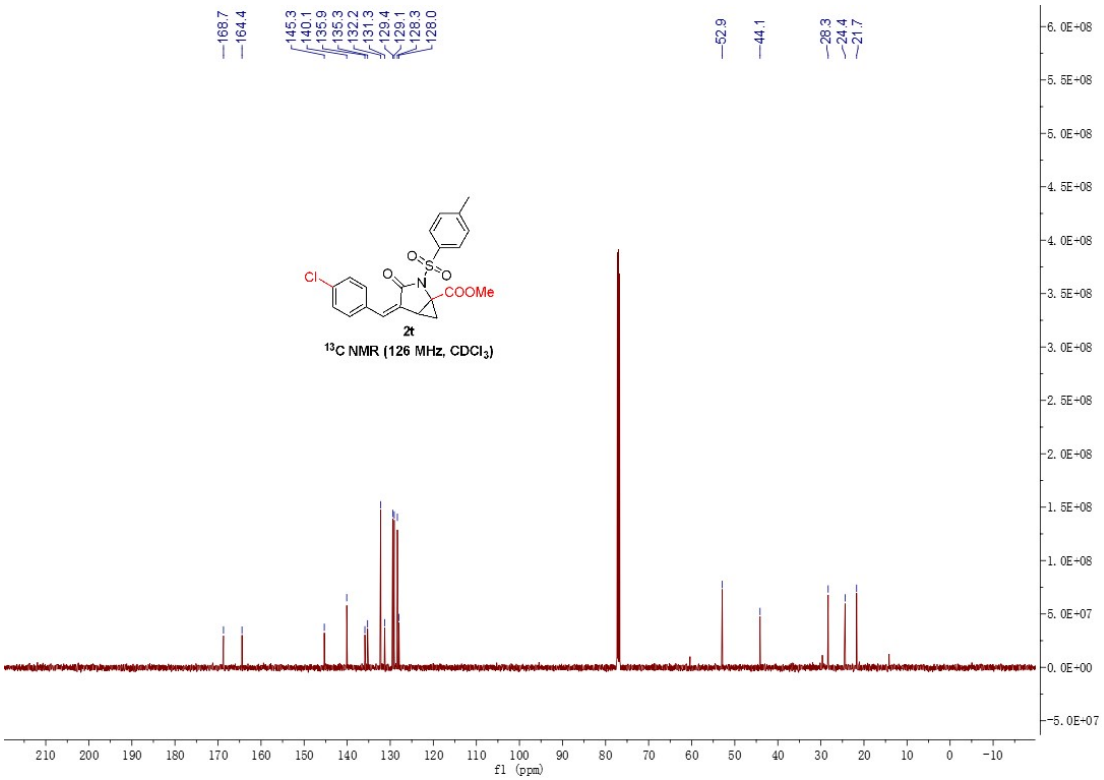


Figure S92. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2s

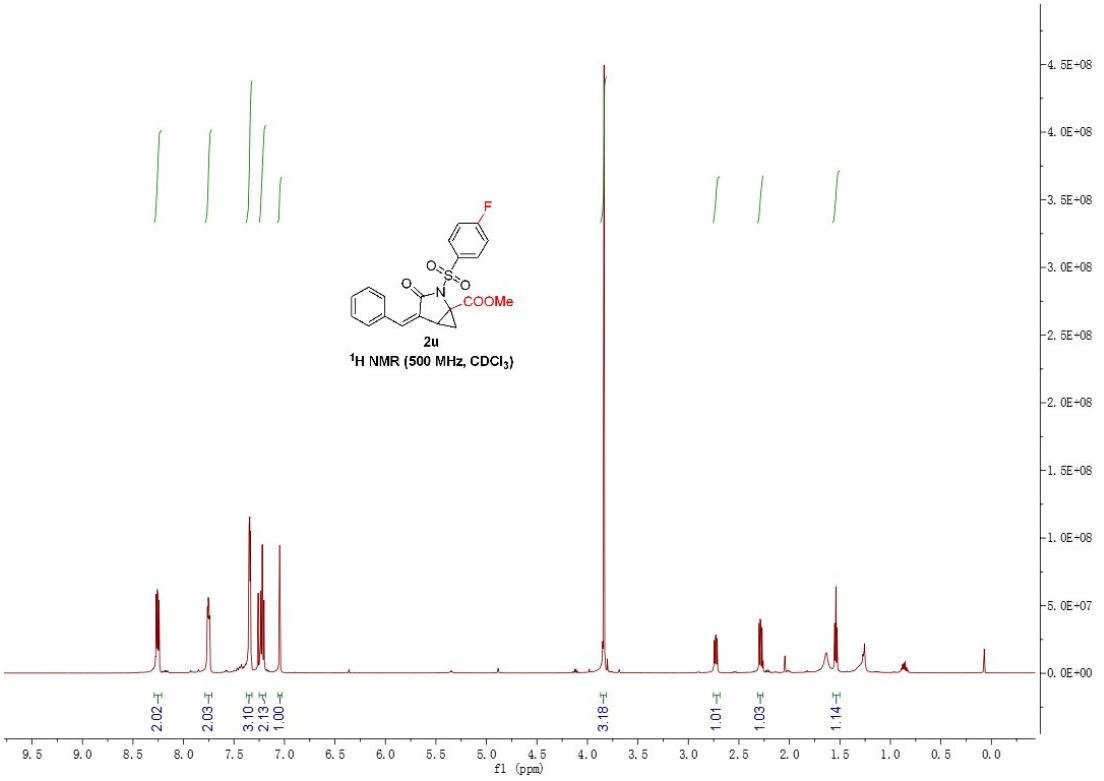


Figure S93. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of 2u

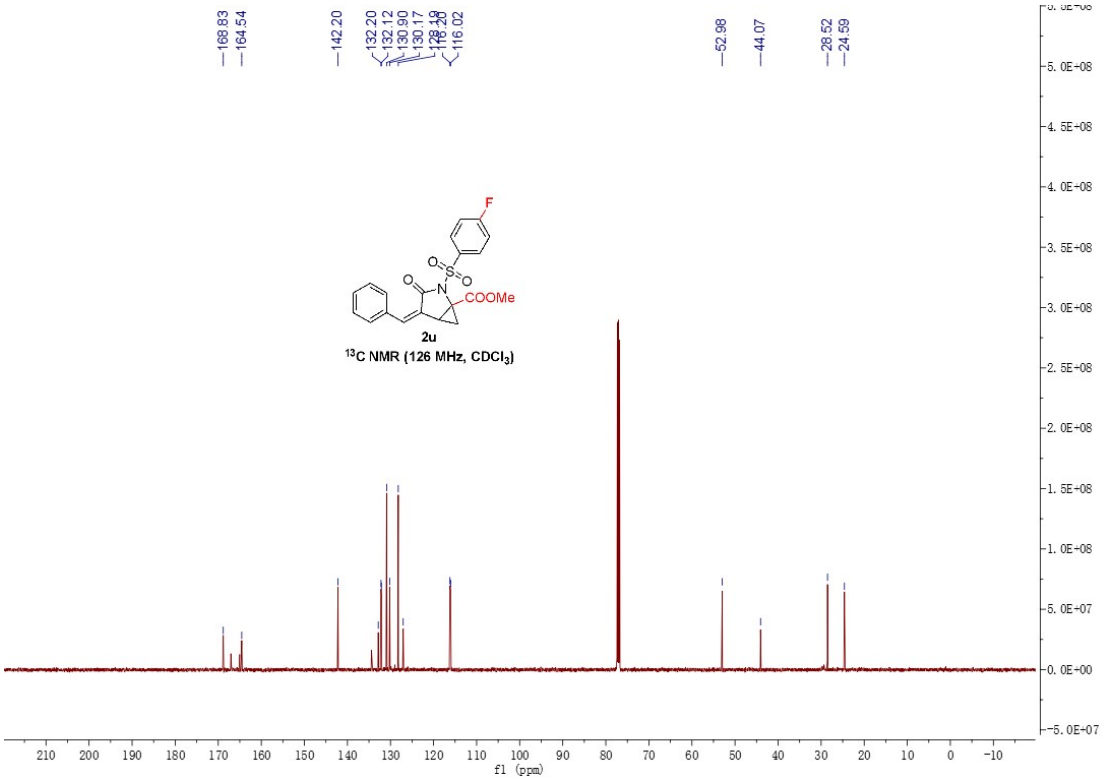


Figure S94. ^{13}C NMR (126 MHz, $CDCl_3$) spectrum of 2u

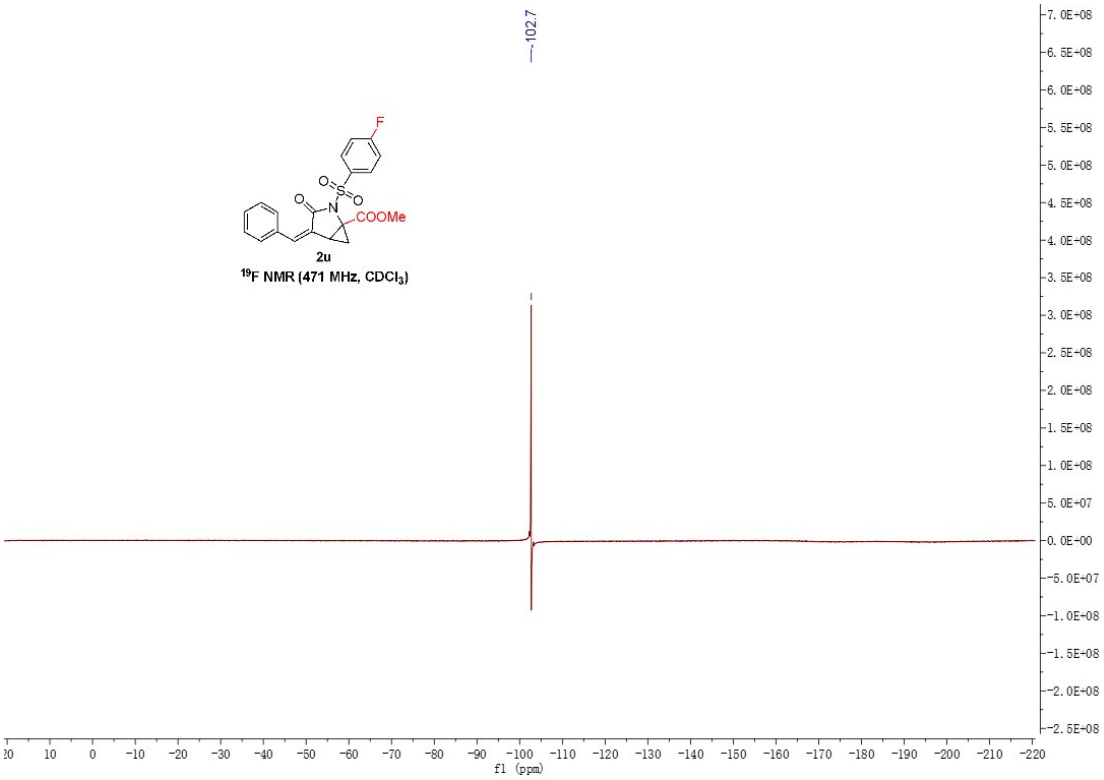
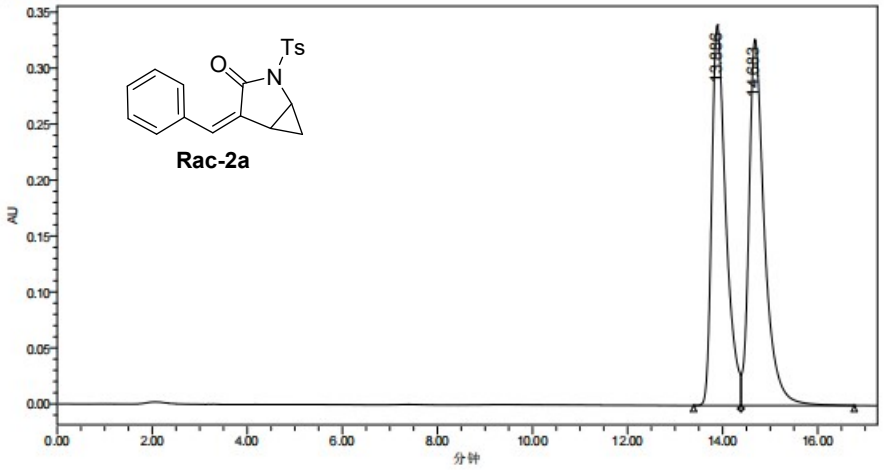


Figure S95. ^{19}F NMR (471 MHz, $CDCl_3$) spectrum of 2u

SAMPLE INFORMATION

Sample Name:	LHZ-MO-W IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/24 10:05:10 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/24 11:02:43 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	ASDF



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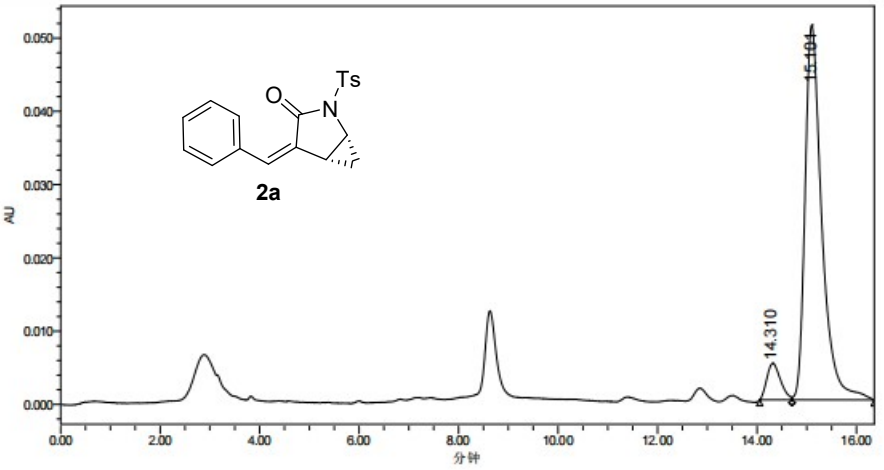
2	14.683	7432494	51.52	327213	49.05

SAMPLE INFORMATION

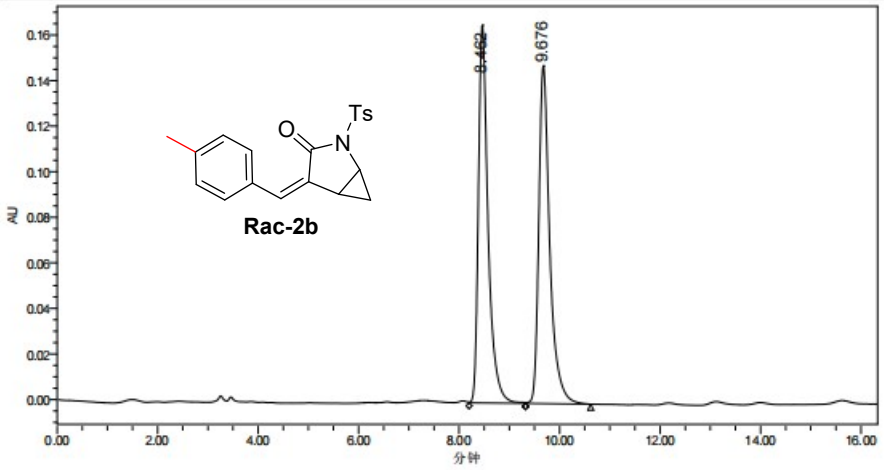
Sample Name:	LHZ-MO-S IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/24 9:46:21 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/24 10:22:06 CST
Injection Volume:	5.00 ul	Channel Name:	292.5 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	156



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	14.310	95078	7.35	4982	8.87
2	15.101	1197937	92.65	51178	91.13

SAMPLE INFORMATION

Sample Name:	LHZ-4-Me-W IA 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/19 16:20:56 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/24 11:31:04 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	4511

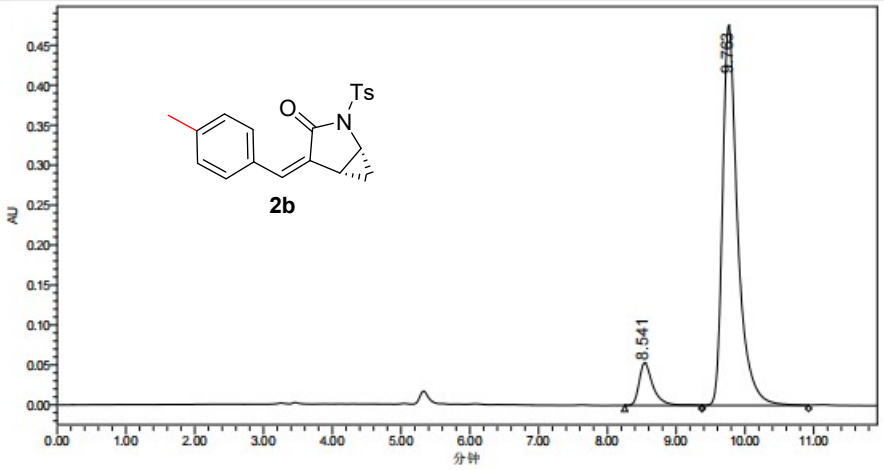


Rac-2b

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	8.462	2225348	49.79	165772	52.79
2	9.676	2244410	50.21	148260	47.21

SAMPLE INFORMATION

Sample Name:	LHZ-4-Me-S IA 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/19 15:53:53 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/24 11:30:40 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	ASDF

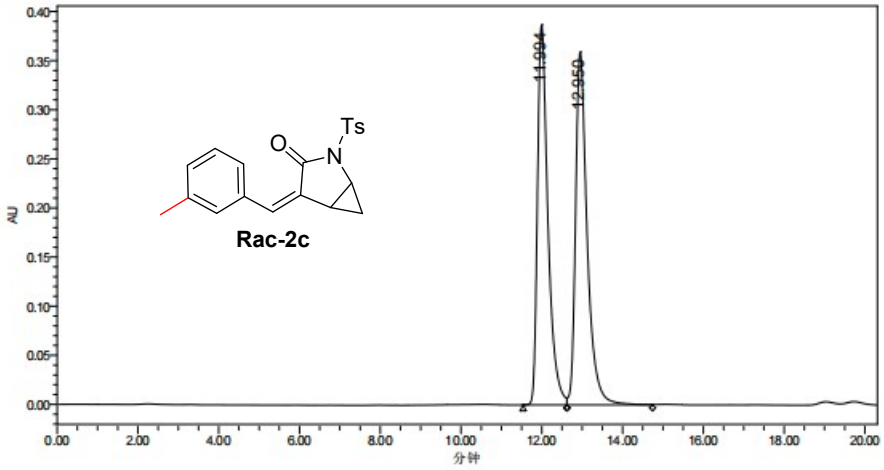


2b

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	8.541	747748	9.30	53226	10.07
2	9.763	7288335	90.70	475290	89.93

SAMPLE INFORMATION

Sample Name:	LHZ-3-ME-W IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/24 10:23:24 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/24 11:03:17 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	ASDF

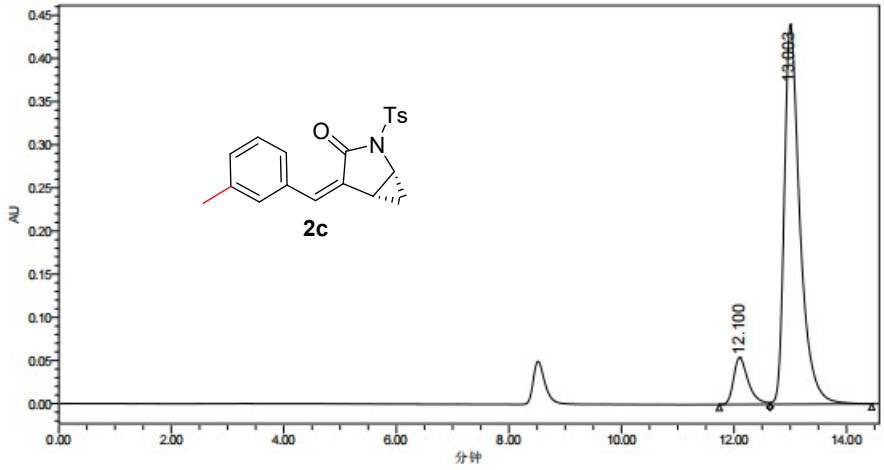


Rac-2c

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	11.994	6955634	49.23	386880	51.86
2	12.950	7174121	50.77	359128	48.14

SAMPLE INFORMATION

Sample Name:	LHZ-3-ME-S IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/4/24 10:44:25 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/24 11:03:38 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	15341

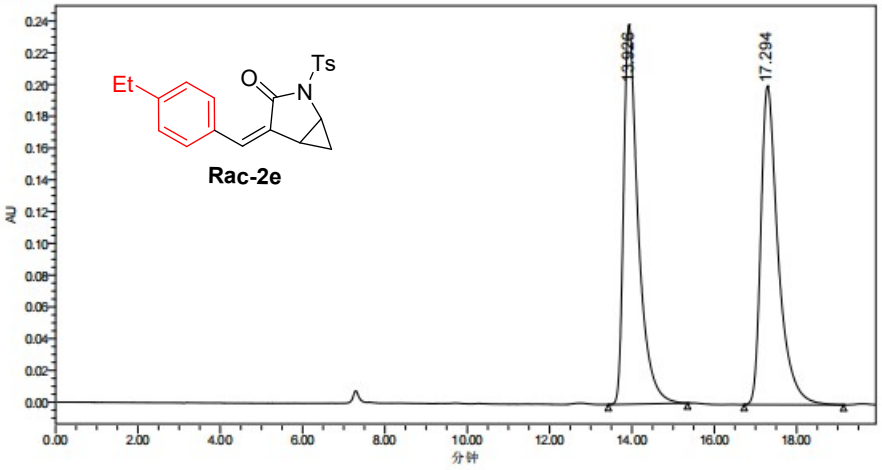


2c

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	12.100	988840	10.42	54486	11.02
2	13.003	8504302	89.58	440059	88.98

SAMPLE INFORMATION

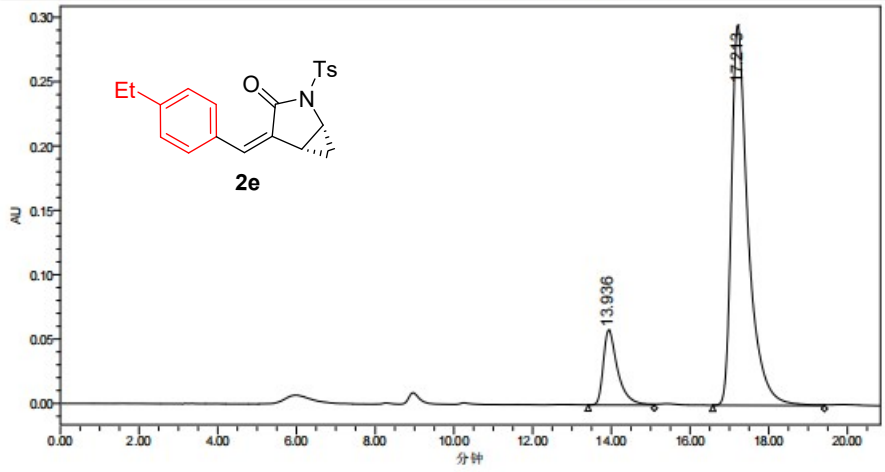
Sample Name:	LHZ-ET-W10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 9:03:50 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 19:56:13 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	30.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	419156



	RT (min)	Area (礦*sec)	% Area	Height (礦)	% Height
1	13.926	5875828	49.99	238984	54.36
2	17.294	5877067	50.01	200662	45.64

SAMPLE INFORMATION

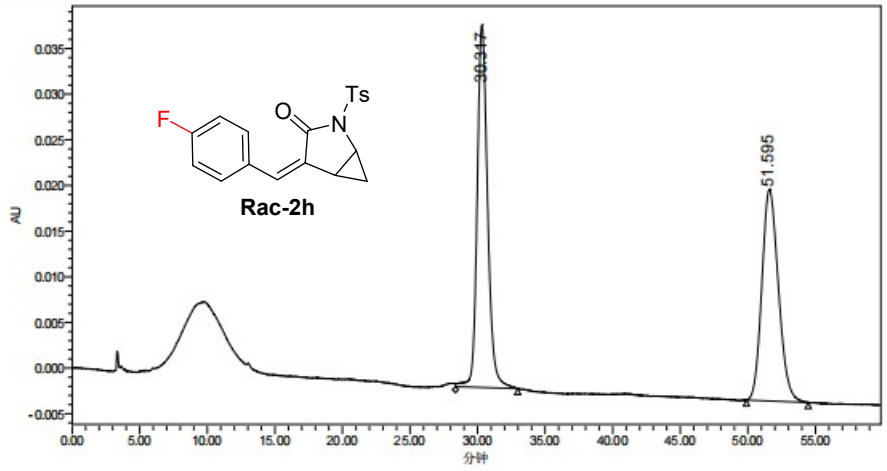
Sample Name:	LHZ-ET IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 9:26:06 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 19:55:42 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	30.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	4516345



	RT (min)	Area (礦*sec)	% Area	Height (礦)	% Height
1	13.936	1479954	14.47	58165	16.46
2	17.213	8747299	85.53	295254	83.54

SAMPLE INFORMATION

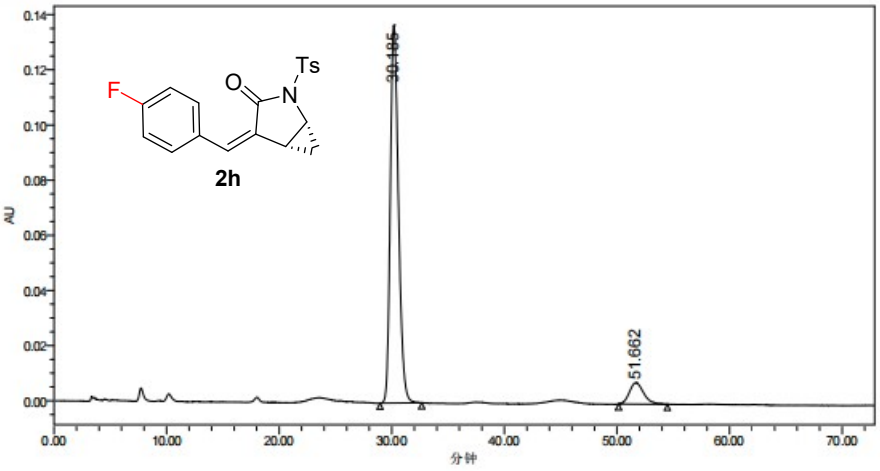
Sample Name:	LHZ-4-F-WIC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/17 15:44:37 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:50:06 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	64



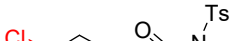
	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.317	2121044	51.83	39684	63.12
2	51.595	1971592	48.17	23191	36.88

SAMPLE INFORMATION

Sample Name:	LHZ-4-F-S IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/17 16:47:46 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:49:12 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	415341

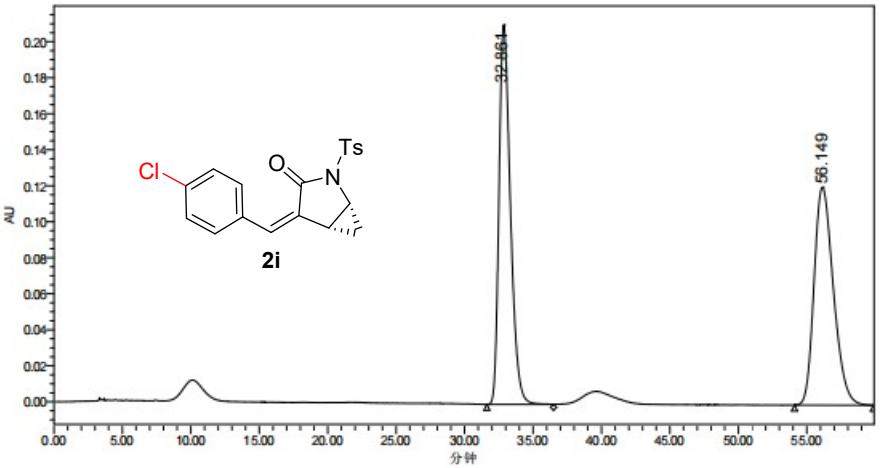


	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.185	6908550	90.98	137045	94.65
2	51.662	684696	9.02	7748	5.35



SAMPLE INFORMATION

Sample Name:	LHZ-CL-WIC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 14:29:07 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:53:50 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	4534

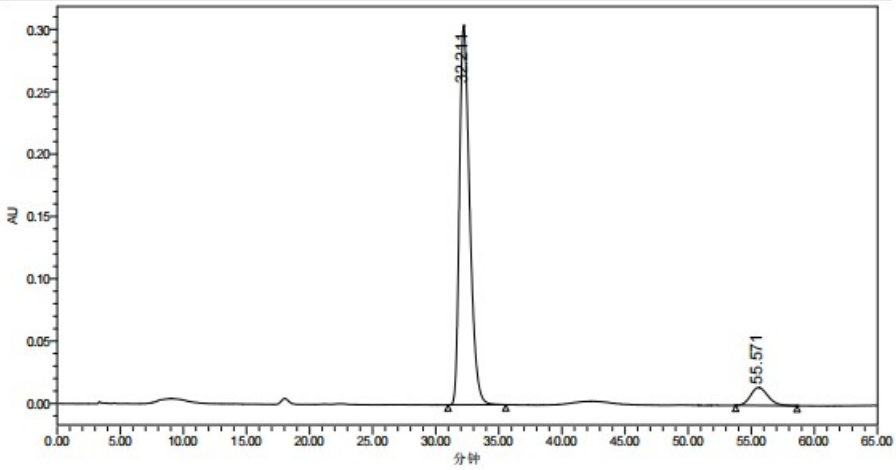


2i

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	32.861	12166962	50.54	210725	63.52
2	56.149	11905673	49.46	121014	36.48

SAMPLE INFORMATION

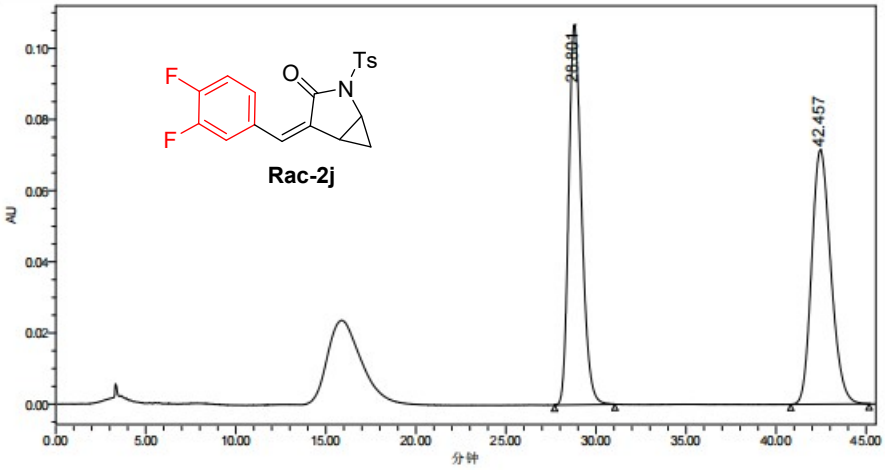
Sample Name:	LHZ-CL-S IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 15:45:14 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:54:47 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	65.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	1561



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	32.211	17177227	92.57	304197	95.47
2	55.571	1377977	7.43	14423	4.53

SAMPLE INFORMATION

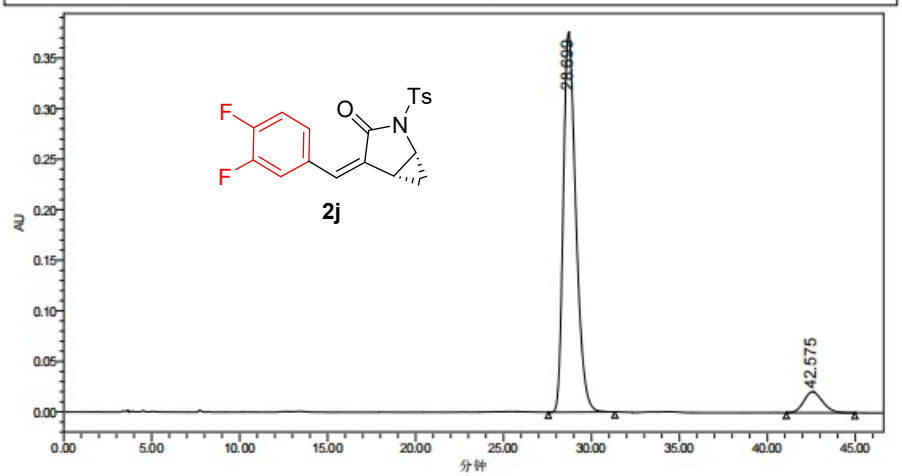
Sample Name:	LHZ-2F-w IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 20:43:59 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:50:52 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	453453



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	28.801	5290705	50.02	106790	59.91
2	42.457	5286732	49.98	71457	40.09

SAMPLE INFORMATION

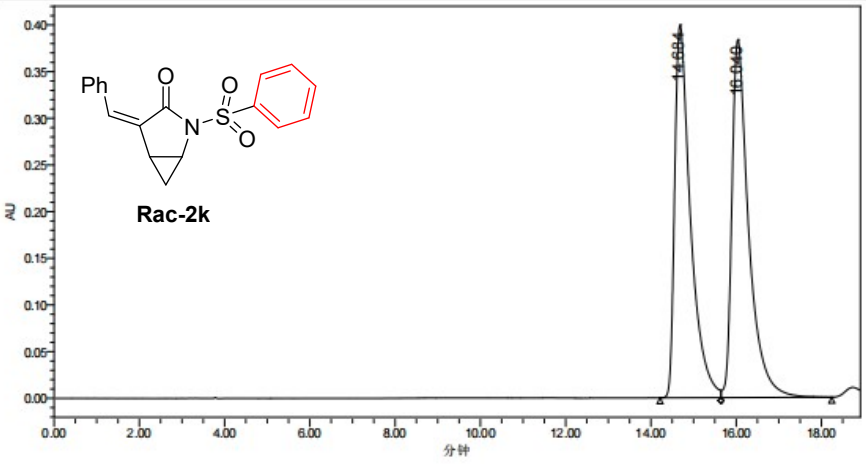
Sample Name:	LHZ-2F-S IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/15 19:54:50 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:51:35 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	25616



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	28.699	18619308	92.37	375482	94.75
2	42.575	1537188	7.63	20791	5.25

SAMPLE INFORMATION

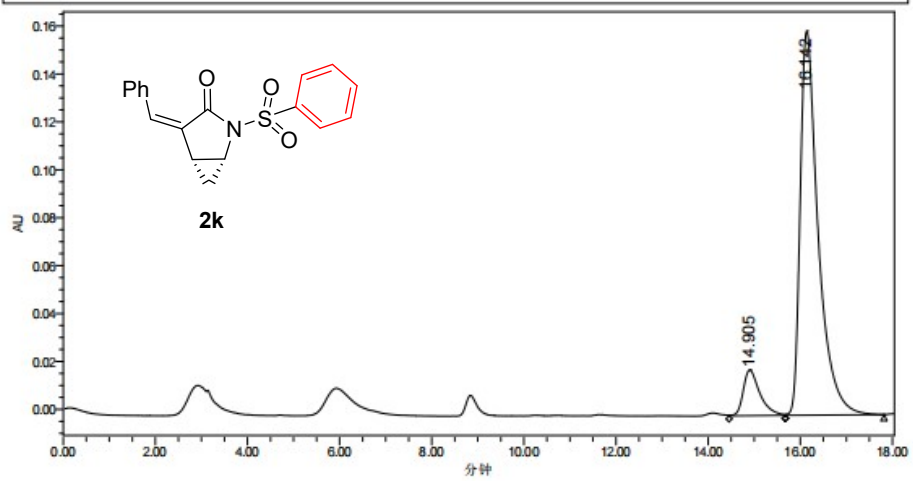
Sample Name:	LHZ-TS-PH-W IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/19 17:34:36 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 19:41:45 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	1561



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	14.684	10281563	49.44	399530	51.01
2	16.040	10516056	50.56	383650	48.99

SAMPLE INFORMATION

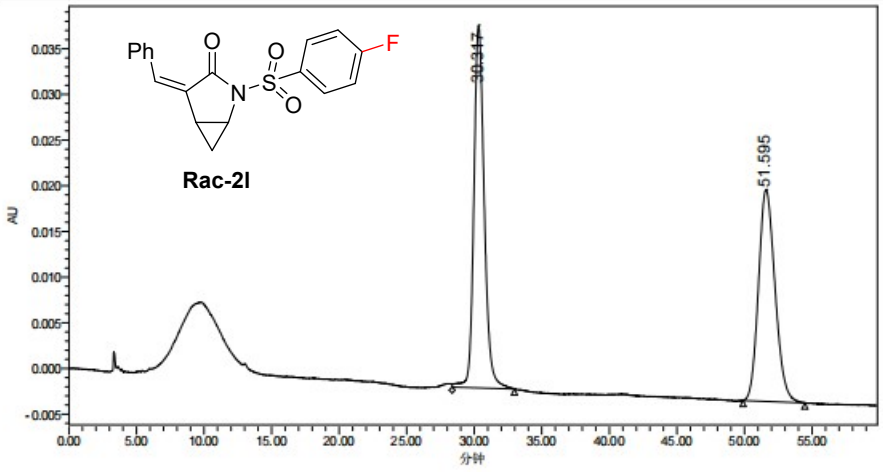
Sample Name:	LHZ-TS-PH-S IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/19 17:54:42 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 19:41:08 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	60.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	15313



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	14.905	476356	9.88	19119	10.65
2	16.142	4345035	90.12	160342	89.35

SAMPLE INFORMATION

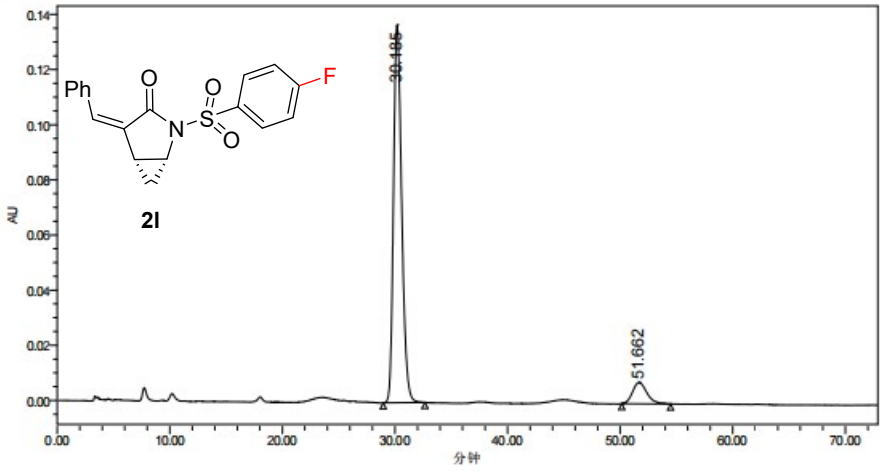
Sample Name:	LHZ-4-F-WIC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/17 15:44:37 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:50:06 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	64



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.317	2121044	51.83	39684	63.12
2	51.595	1971592	48.17	23191	36.88

SAMPLE INFORMATION

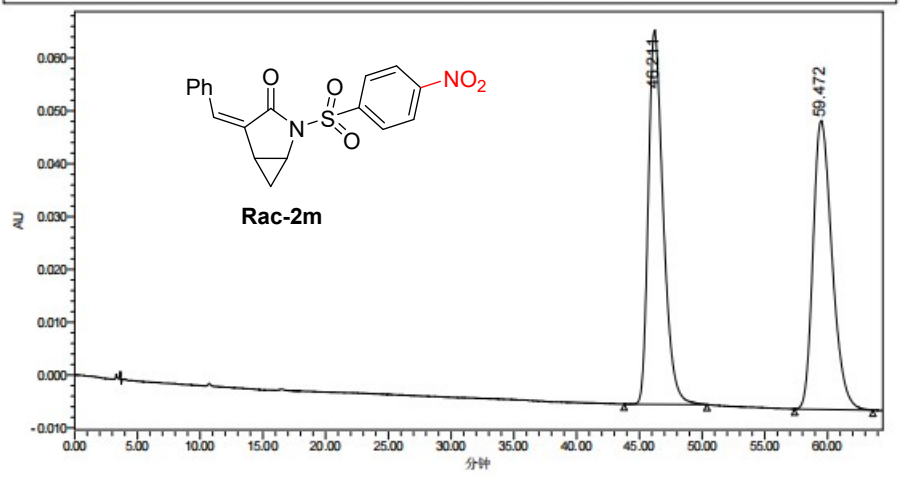
Sample Name:	LHZ-4-F-S IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/17 16:47:46 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:49:12 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	415341



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.185	6908550	90.98	137045	94.65
2	51.662	684696	9.02	7748	5.35

SAMPLE INFORMATION

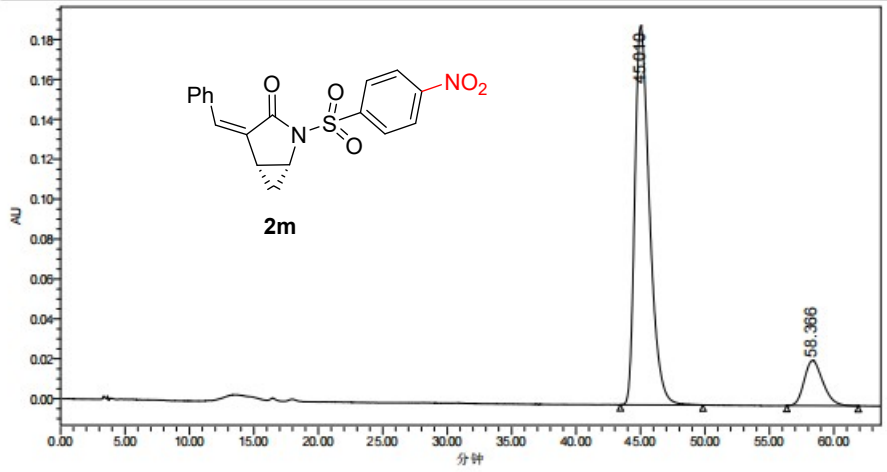
Sample Name:	LHZ-NO2-WIC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/18 10:05:06 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:48:15 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	1531



	RT (min)	Area (碳*sec)	% Area	Height (碳)	% Height
1	46.211	5840088	50.43	70727	56.43
2	59.472	5740590	49.57	54599	43.57

SAMPLE INFORMATION

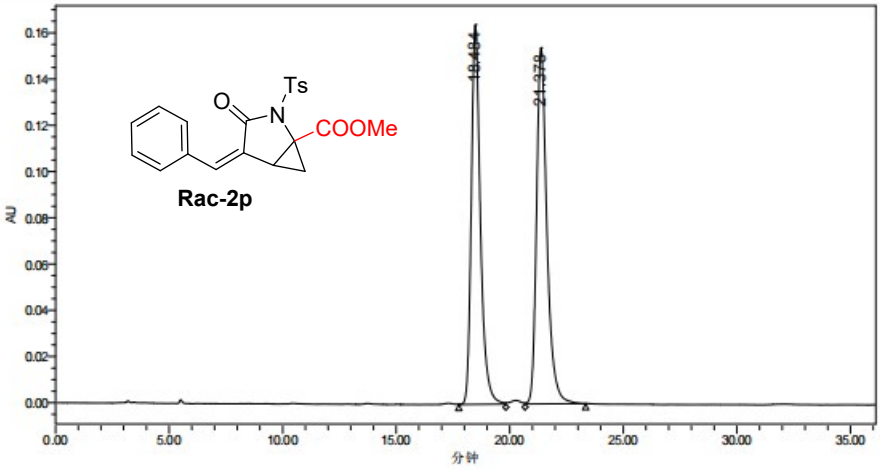
Sample Name:	LHZ-NO2-S IC 20VS80	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/3/18 11:11:44 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 20vs80
Injection #:	1	Date Processed:	2023/4/12 19:47:29 CST
Injection Volume:	5.00 ul	Channel Name:	290.8 纳米
Run Time:	120.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	SDFsd



	RT (min)	Area (碳*sec)	% Area	Height (碳)	% Height
1	45.010	15038486	86.85	189907	89.33
2	58.366	2277658	13.15	22677	10.67

SAMPLE INFORMATION

Sample Name:	LHZ-2022-0923-1 IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2022/9/23 20:14:19 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 20:37:11 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	40.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	4861

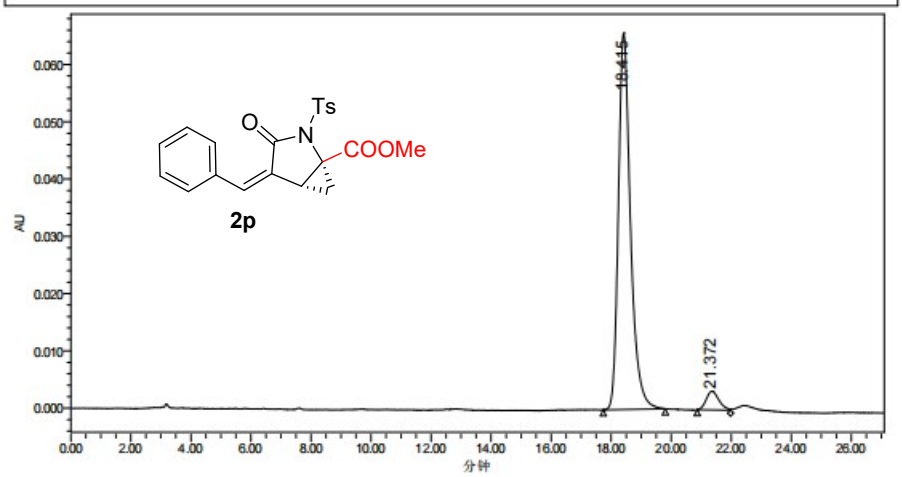


Rac-2p

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	18.484	4563033	48.34	164210	51.59
2	21.378	4877220	51.66	154067	48.41

SAMPLE INFORMATION

Sample Name:	LHZ-2022-0923-3 IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2022/9/23 10:35:28 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/4/12 20:35:42 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	40.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	SDF

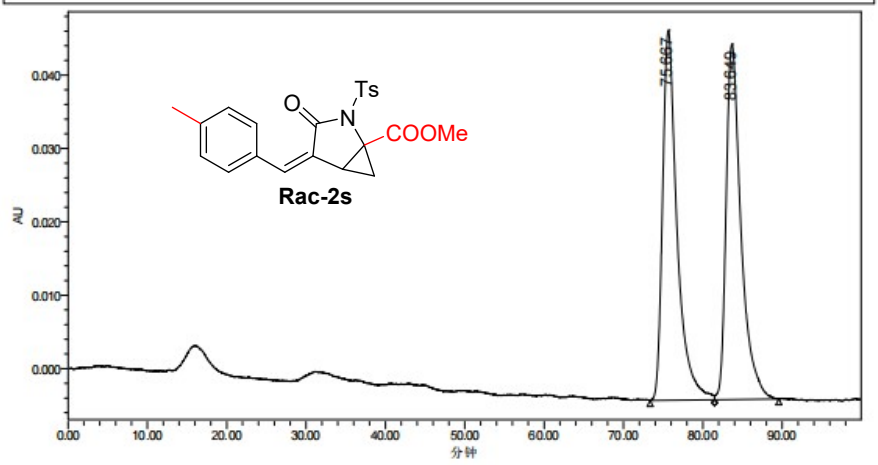


2p

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	18.415	1840327	95.08	65720	95.28
2	21.372	95128	4.92	3256	4.72

SAMPLE INFORMATION

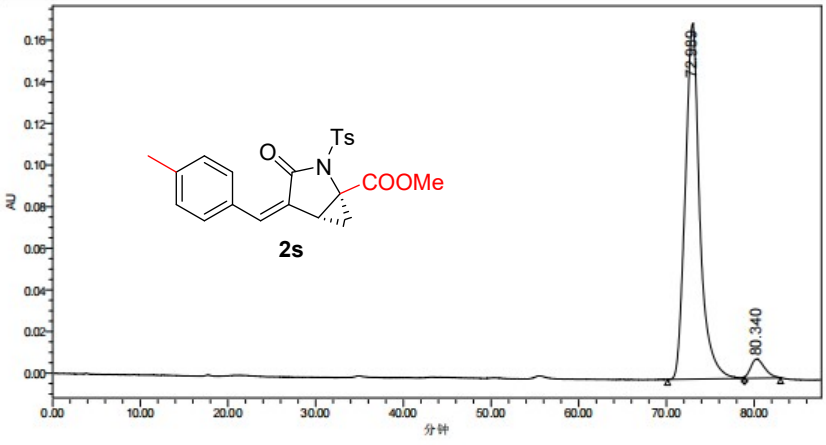
Sample Name:	LHZ-4-Me-COOMe-WIA 2VS98	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/25 14:50:49 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 2vs98
Injection #:	1	Date Processed:	2023/5/30 10:39:07 CST
Injection Volume:	5.00 ul	Channel Name:	303.1 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	262



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	75.667	6402062	50.29	50426	51.01
2	83.649	6327508	49.71	48425	48.99

SAMPLE INFORMATION

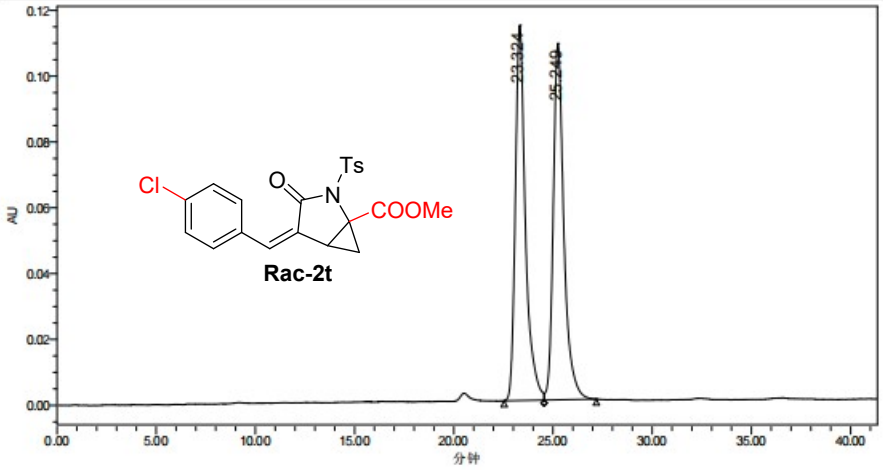
Sample Name:	LHZ-ME-S IA 2VS98	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/26 10:31:19 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 2vs98
Injection #:	1	Date Processed:	2023/5/30 10:42:55 CST
Injection Volume:	5.00 ul	Channel Name:	303.1 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	156



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	72.989	19721603	95.07	170784	94.88
2	80.340	1022050	4.93	9210	5.12

SAMPLE INFORMATION

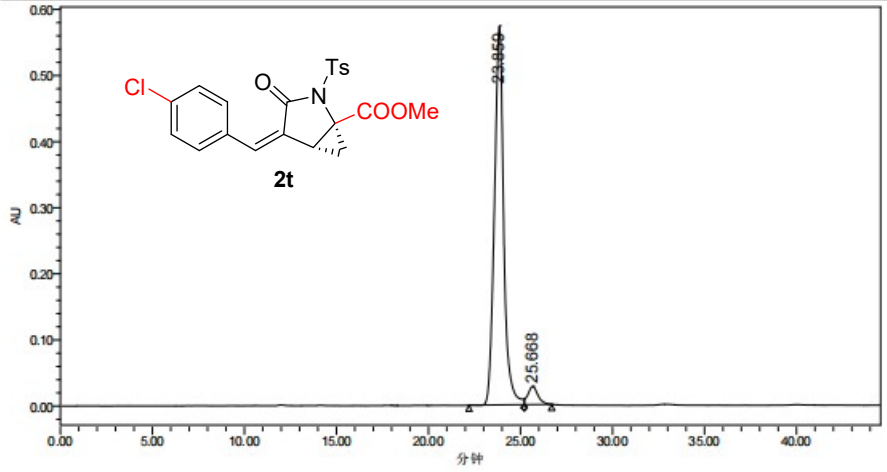
Sample Name:	LHZ-	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/26 18:31:24 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/5/30 10:43:46 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	2



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	23.324	4037310	50.09	113978	51.28
2	25.249	4023314	49.91	108276	48.72

SAMPLE INFORMATION

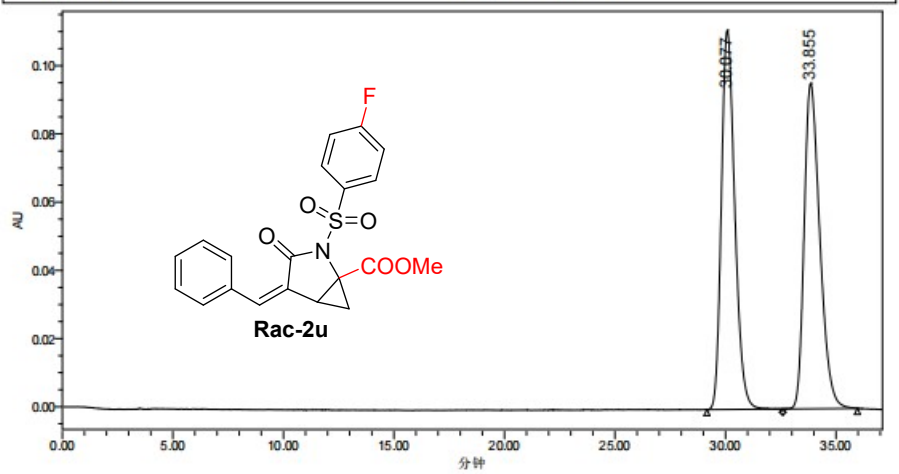
Sample Name:	LHZ-CL-S IA 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/26 19:13:42 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/5/30 10:44:58 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	ASDF



	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	23.859	20059008	95.05	573190	95.42
2	25.668	1044286	4.95	27500	4.58

SAMPLE INFORMATION

Sample Name:	LHZ-F-W ID 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/28 17:23:22 CST
Vial:	1:A,1	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/5/30 10:45:18 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	15

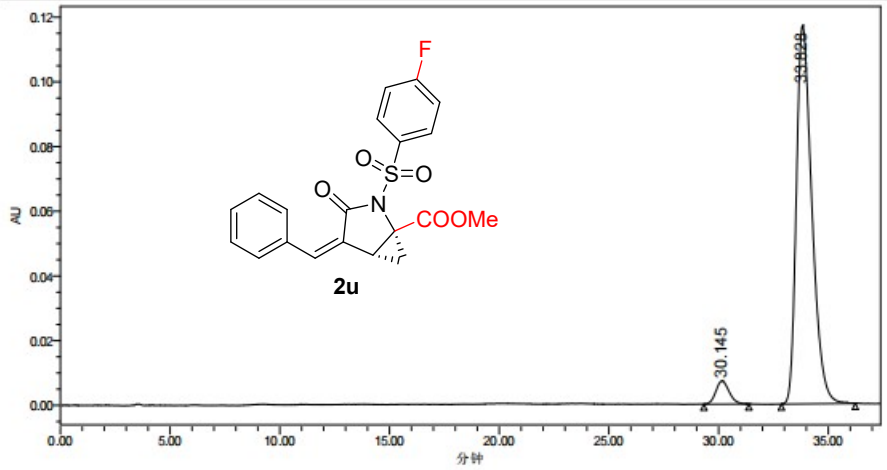


Rac-2u

	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.077	4694086	49.96	111163	53.82
2	33.855	4701362	50.04	95397	46.18

SAMPLE INFORMATION

Sample Name:	LHZ-F-S ID 10VS90	Acquired By:	Breeze
Sample Type:	未知	Date Acquired:	2023/5/28 18:01:26 CST
Vial:	1:A,2	Acq. Method:	iPr vs Hex 10vs90
Injection #:	1	Date Processed:	2023/5/30 10:46:15 CST
Injection Volume:	5.00 ul	Channel Name:	318.9 纳米
Run Time:	100.00 Minutes	Channel Desc.:	2998 (210-400)纳米
Column Type:		Sample Set Name	ZXCVB



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	RT (min)	Area (碘*sec)	% Area	Height (碘)	% Height
1	30.145	301493	4.99	7164	5.77
2	33.828	5743212	95.01	116973	94.23