Supporting Information

Chiral (phosphine)-(imidazoline) PCN pincer palladium(II) complexes: synthesis and application in asymmetric hydrophosphination of 2-alkenoylpyridines with diphenylphosphine

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X-ray diffraction studies of complexes 3c, 3e, 3i, and 3k.

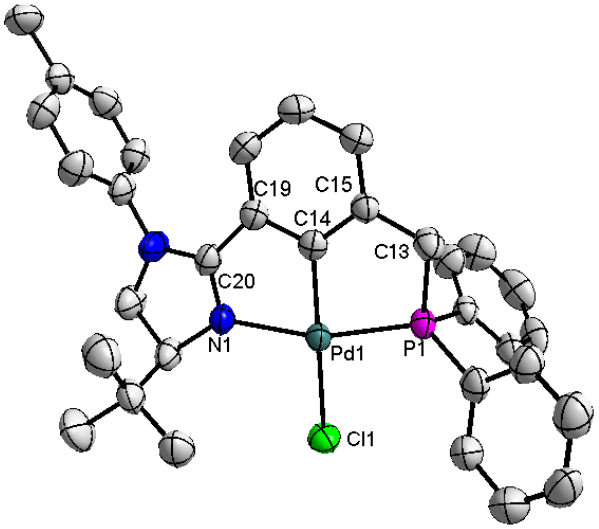


Figure S1. Molecular structure of complex **3c** with ellipsoids drawn at the 50% probability level (hydrogen atoms are omitted for clarity). Selected bond lengths (Å) and angles (deg): Pd(1)−C(14) 1.980(5), Pd(1)−P(1) 2.2308(12), Pd(1)−N(1) 2.112(4), Pd(1)−Cl(1) 2.3964(14); C(14)−Pd(1)−P(1) 82.30(15), C(14)−Pd(1)−N(1) 79.73(18), C(14)−Pd(1)−Cl(1) 172.70(15), N(1)−Pd(1)−P(1) 162.01(12), P(1)−Pd(1)−Cl(1) 99.26(5), N(1)−Pd(1)−Cl(1) 98.47(12).

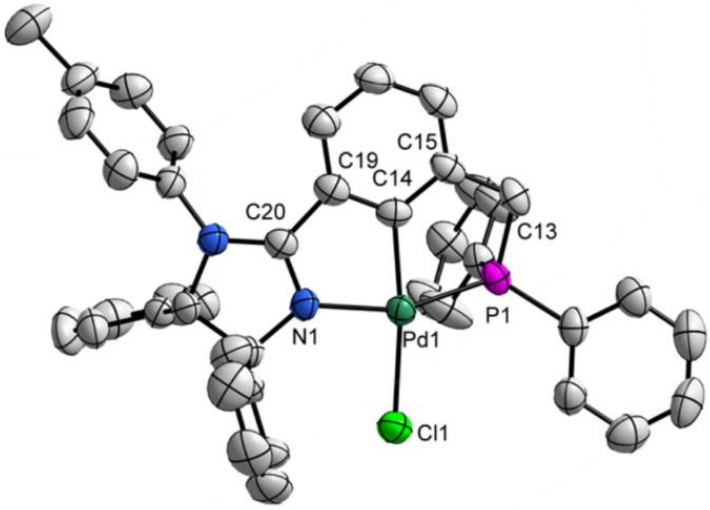


Figure S2. Molecular structure of complex **3e** with ellipsoids drawn at the 50% probability level (hydrogen atoms are omitted for clarity; one of the two independent molecules shown). Selected bond lengths (Å) and angles (deg): Pd(1)−C(14) 1.985(8), Pd(1)−P(1) 2.217(2), Pd(1)−N(1) 2.065(6), Pd(1)−Cl(1) 2.391(2); C(14)−Pd(1)−P(1) 81.1(3), C(14)−Pd(1)−N(1) 79.5(3), C(14)−Pd(1)−Cl(1) 173.0(3), N(1)−Pd(1)−P(1) 159.06(19), P(1)−Pd(1)−Cl(1) 104.10(8), N(1)−Pd(1)−Cl(1) 94.7(2).

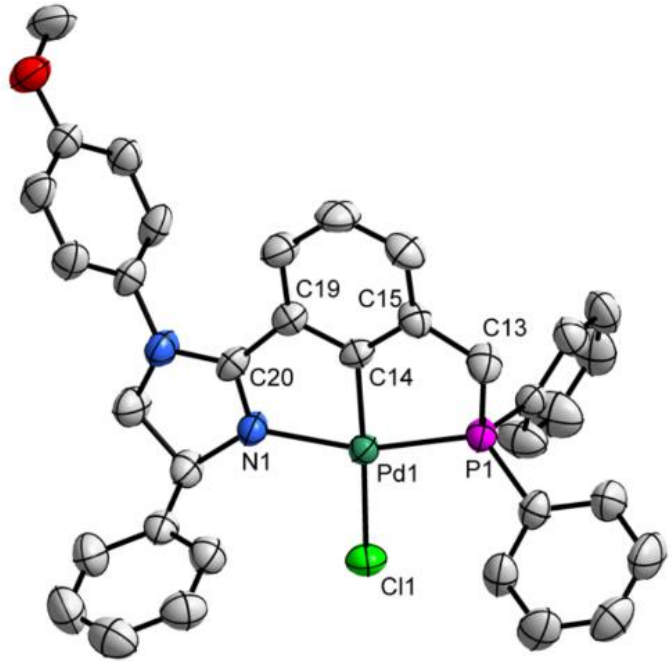


Figure S3. Molecular structure of complex **3i** with ellipsoids drawn at the 50% probability level (hydrogen atoms are omitted for clarity). Pd(1)−C(14) 1.9859(19), Pd(1)−P(1) 2.2175(13), Pd(1)−N(1) 2.082(4), Pd(1)−Cl(1) 2.3942(12); C(14)−Pd(1)−P(1) 82.12(9), C(14)−Pd(1)−N(1) 79.59(15), C(14)−Pd(1)−Cl(1) 174.37(9), N(1)−Pd(1)−P(1) 161.59(12), P(1)−Pd(1)−Cl(1) 101.02(5), N(1)−Pd(1)−Cl(1) 97.04(12).

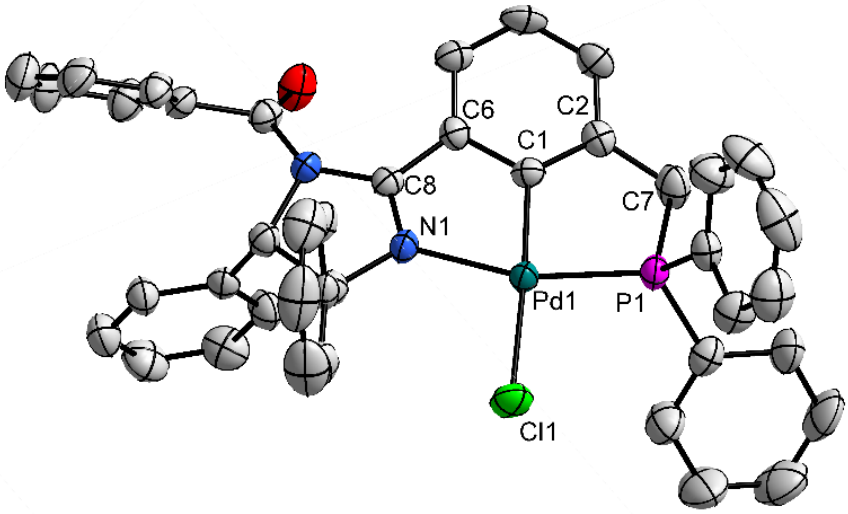
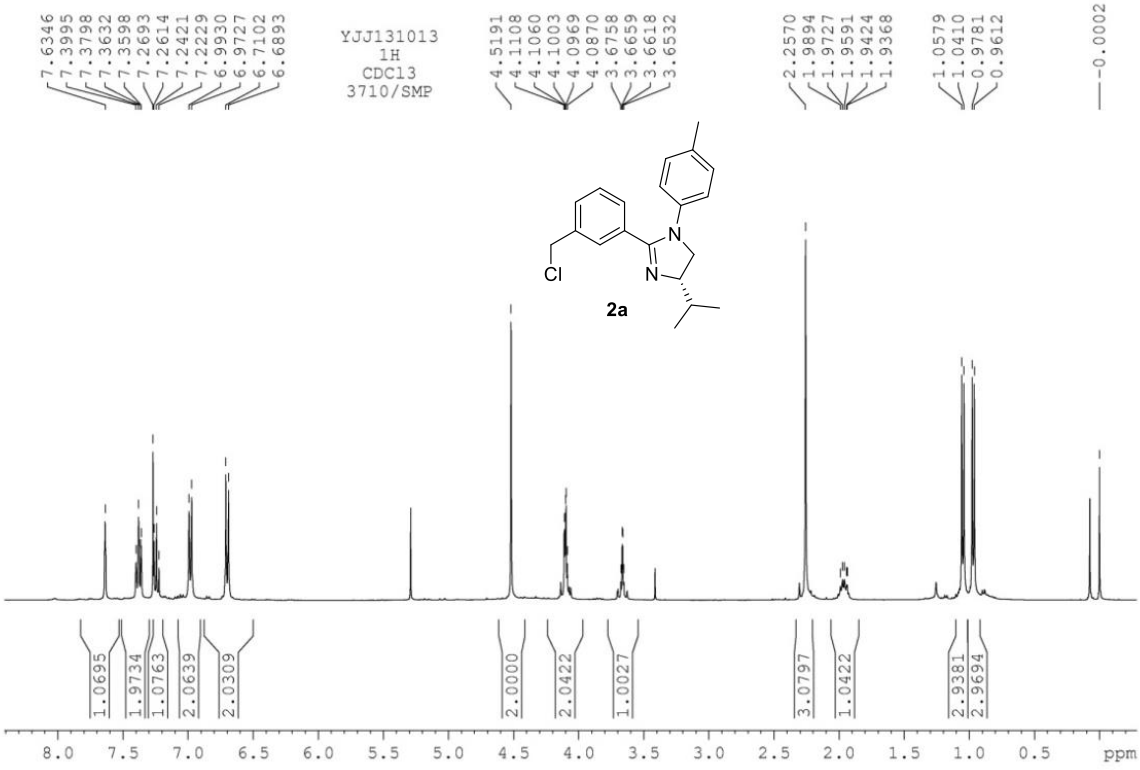


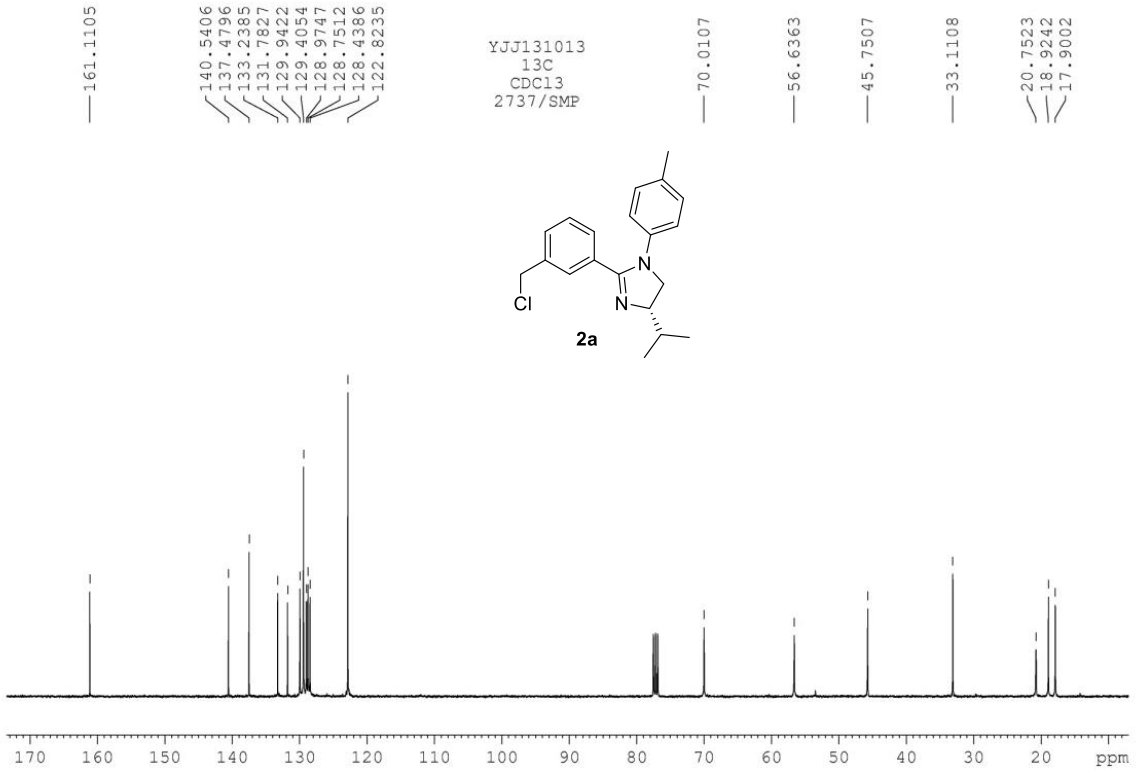
Figure S4. Molecular structure of complex **3k** with ellipsoids drawn at the 50% probability level. (hydrogen atoms are omitted for clarity) Selected bond lengths (Å) and angles (deg): Pd(1)−C(1) 1.987(5), Pd(1)−P(1) 2.2159(14), Pd(1)−N(1) 2.082(4), Pd(1)−Cl(1) 2.3701(15); C(1)−Pd(1)−P(1) 83.25(16), C(1)−Pd(1)−N(1) 79.8(2), C(1)−Pd(1)−Cl(1) 176.90(16), N(1)−Pd(1)−P(1) 162.82(13), P(1)−Pd(1)−Cl(1) 99.84(5), N(1)−Pd(1)−Cl(1) 97.09(13).

Table S1. Summary of crystal structure determination for 3c, 3e,3i and 3k.

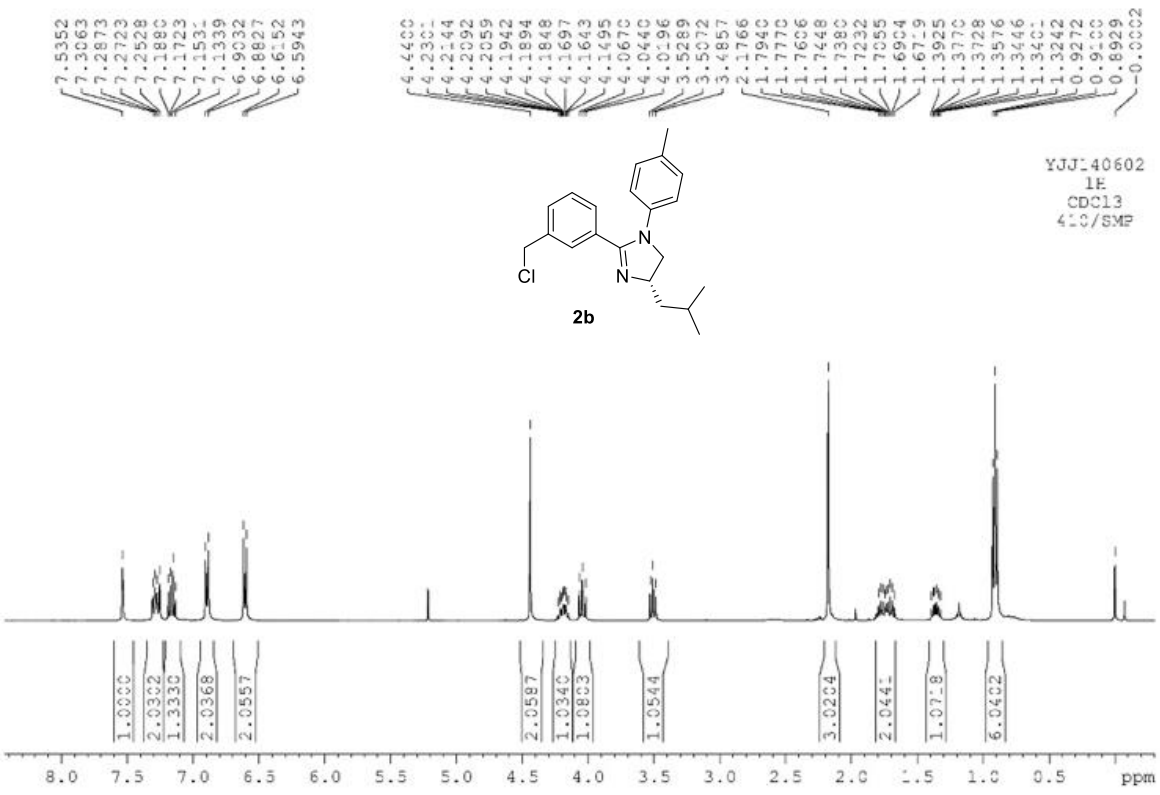
	3c	**3e**	**3i**	**3k**
formula	$C_{33}H_{34}ClN_2PPd$	$C_{41}H_{34}ClN_2PPd$	$C_{35}H_{30}ClN_2OPPd$	$C_{41}H_{32}ClN_2OPPd$
Mr	631.44	727.52	667.43	741.50
Temp[K]	291.15	293(2)	293(2)	293(2)
wavelength [Å]	0.71073	1.54184	1.54184	1.54184
Cryst system	monoclinic	monoclinic	orthorhombic	orthorhombic
Space group	$P2_1$	$P2_1$	$P2_12_12_1$	$P2_12_12_1$
a/Å	10.2862(5)	12.41683(19)	9.20754(8)	9.34262(12)
b/Å	12.1285(4)	23.3274(3)	14.47998(12)	14.76131(19)
c/Å	12.6954(5)	12.73072(19)	22.6523(2)	24.6818(3)
α/°	90	90	90	90
β/°	111.540(5)	113.1047(17)	90	90
γ/°	90	90	90	90
V [$Å^3$]	1473.22(11)	3391.70(9)	3020.12(5)	3403.85(8)
Z	2	4	4	4
$\rho_{calc}g/cm^3$	1.423	1.425	1.468	1.447
μ/mm^{-1}	0.799	5.823	6.508	5.838
F(000)	648.0	1488.0	1360.0	1512.0
Crystal size/mm^3	0.22 × 0.2 × 0.18	0.13 × 0.1 × 0.08	0.13 × 0.1 × 0.09	0.23 × 0.171 × 0.119
θ range [deg]	6.39 to 52.728	7.55 to 141.9	7.246 to 134.144	7.164 to 134.15
Index ranges	$-12 \le h \le 12$	$-15 \le h \le 14$	$11 \le h \le 9$	$-10 \le h \le 11$
	$-15 \le k \le 13$	$-27 \le k \le 28$	$-17 \le k \le 17$	$-11 \le k \le 17$
	$-15 \le l \le 12$	$-15 \le l \le 15$	$27 \le l \le 26$	$-29 \le l \le 25$
no. of data collected	6698	32816	22452	13142
no. of unique data	5022	12231	5374	6055
Final R indexes	$R_1 = 0.0324$	$R_1 = 0.0452$	$R_1 = 0.0279$	$R_1 = 0.0320$
[I>=2σ (I)]	$wR_2 = 0.0575$	$wR_2 = 0.1138$	$wR_2 = 0.0694$	$wR_2 = 0.0684$
Final R indexes [all	$R_1 = 0.0380$	$R_1 = 0.0491$	$R_1 = 0.0302$	$R_1 = 0.0382$
data]	$wR_2 = 0.0615$	$wR_2 = 0.1183$	$wR_2 = 0.0712$	$wR_2 = 0.0723$
peak/hole [e $Å^{-3}$]	0.55/-0.29	0.86/-0.58	0.33/-0.35	0.30/-0.41
Flack parameter	-0.03(2)	-0.034(7)	-0.030(5)	-0.024(6)
CCDC number	2154126	2154135	2154138	2154139



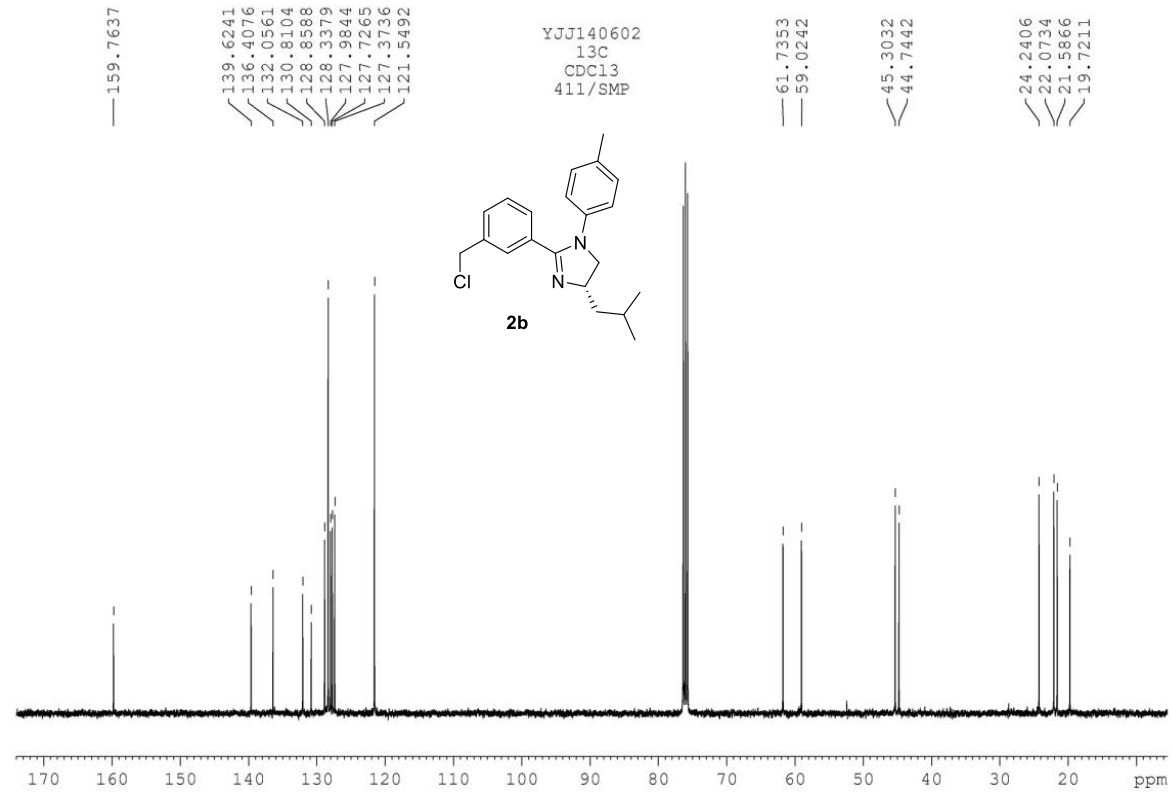
^{1}H NMR spectrum of **2a** (400 MHz, $CDCl_3$)



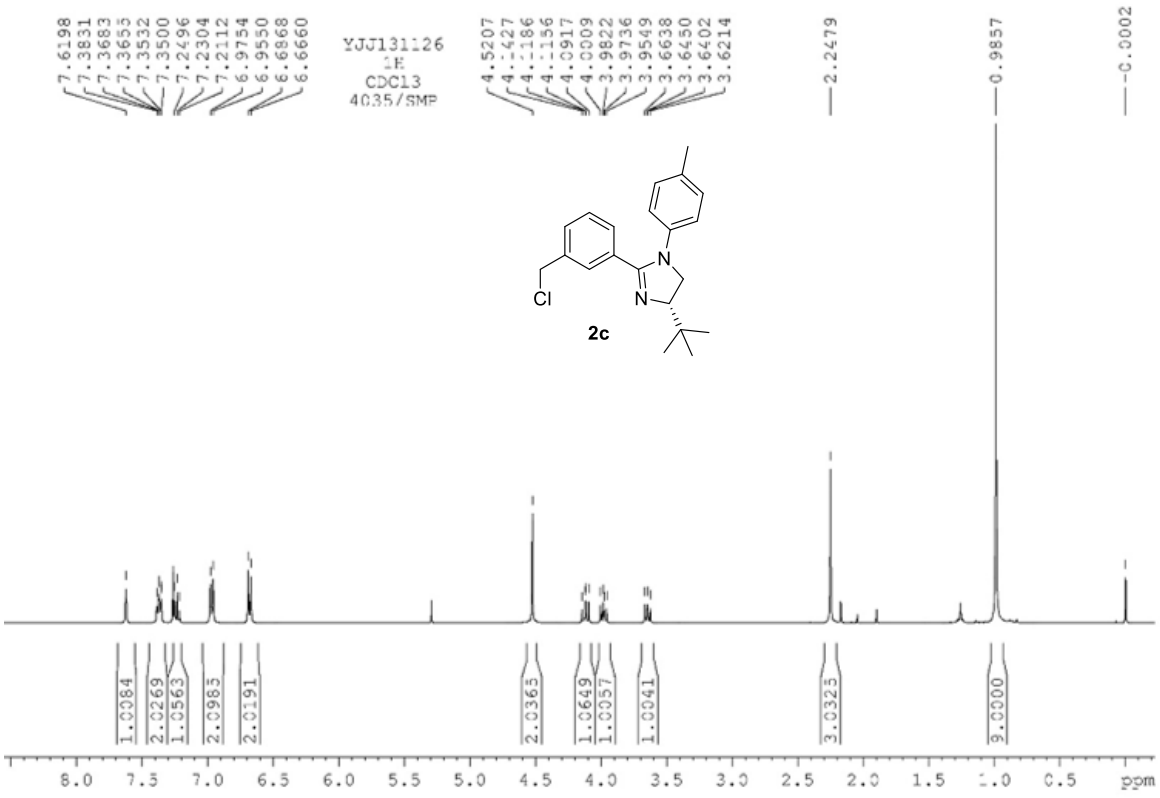
^{13}C{^{1}H} NMR spectrum of **2a** (100 MHz, $CDCl_3$)



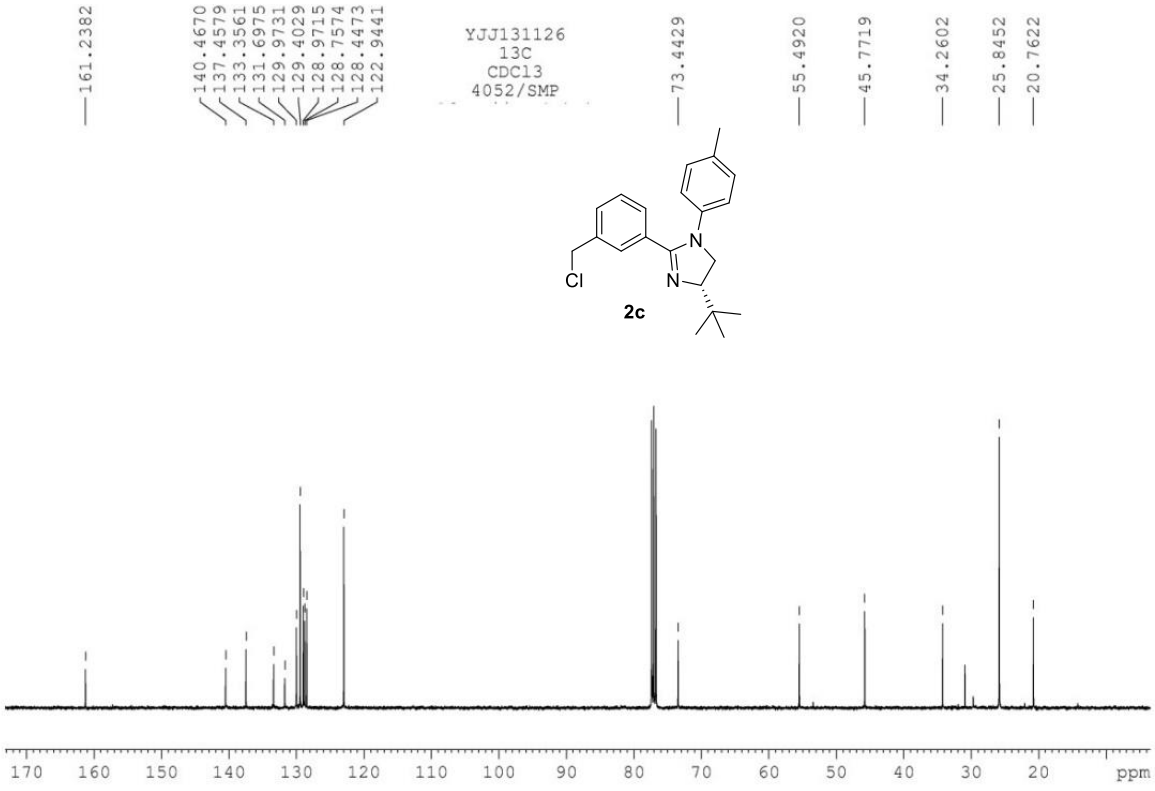
^{1}H NMR spectrum of **2b** (400 MHz, $CDCl_3$)



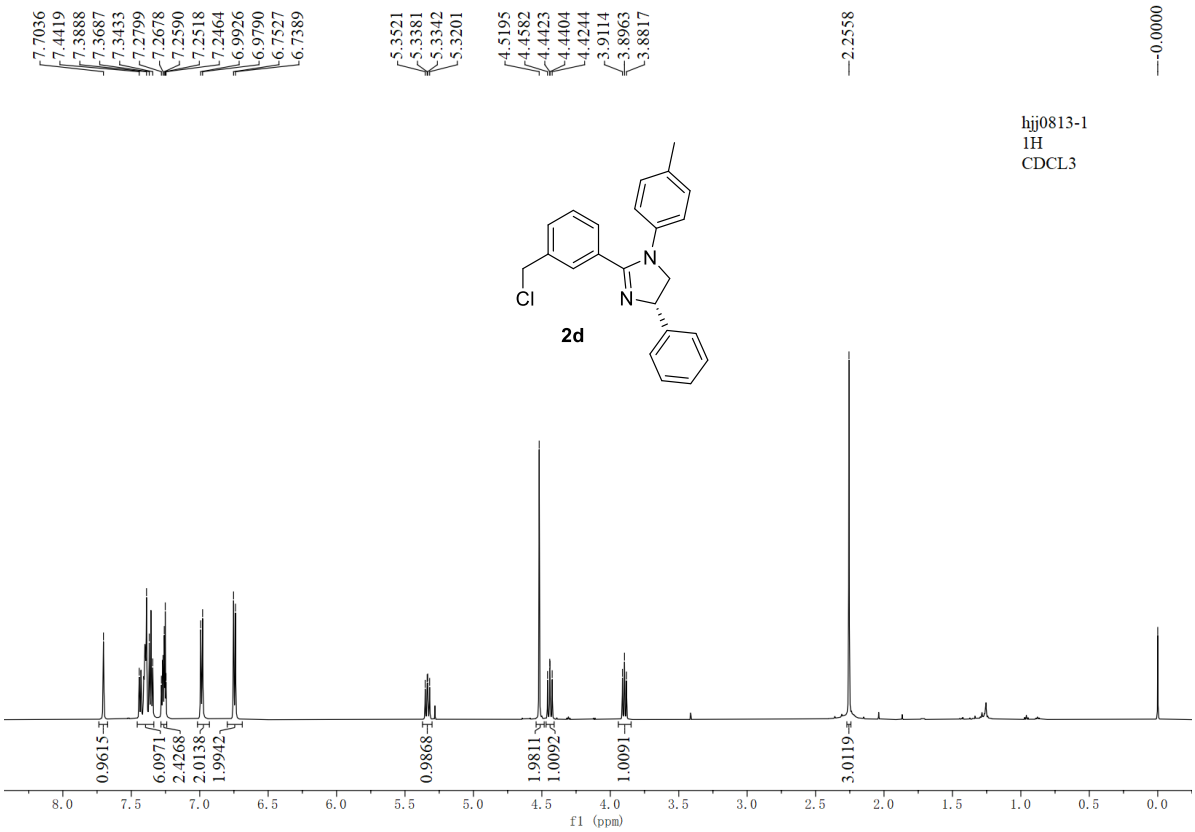
^{13}C{^{1}H} NMR spectrum of **2b** (100 MHz, $CDCl_3$)



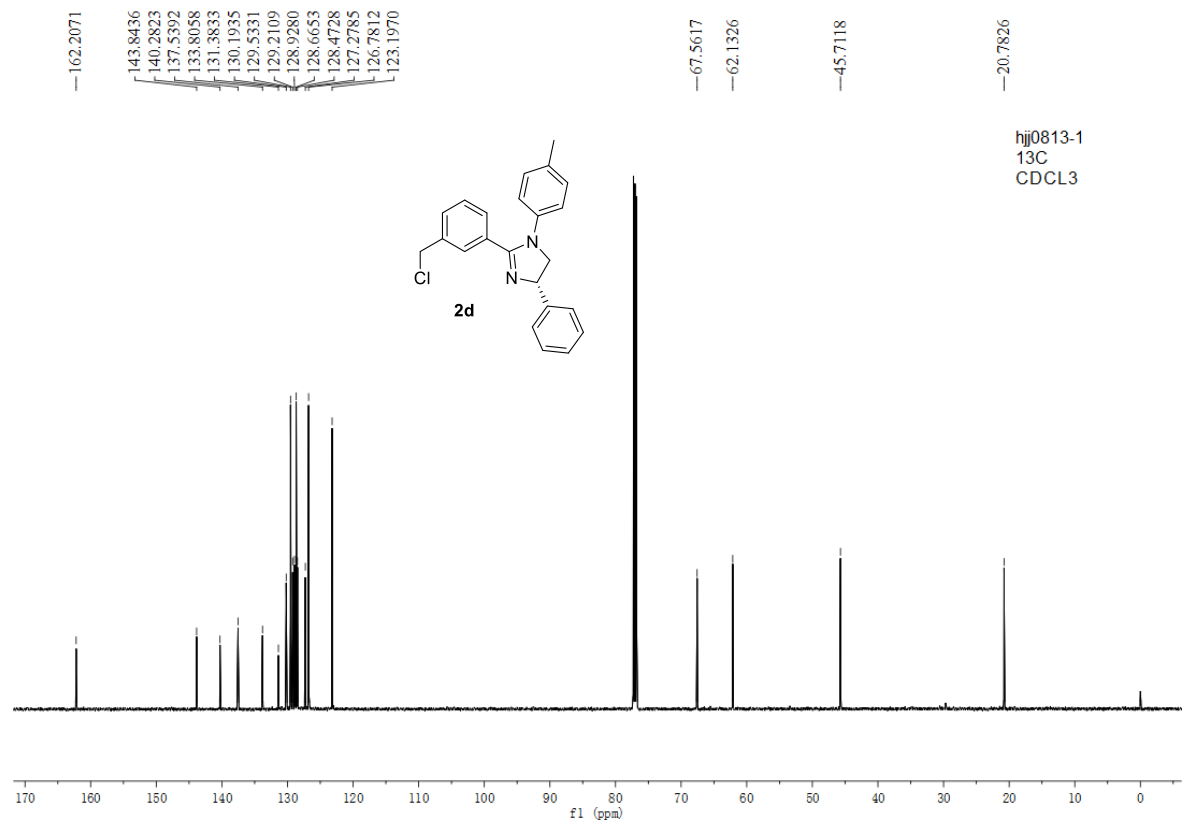
^{1}H NMR spectrum of **2c** (400 MHz, $CDCl_3$)



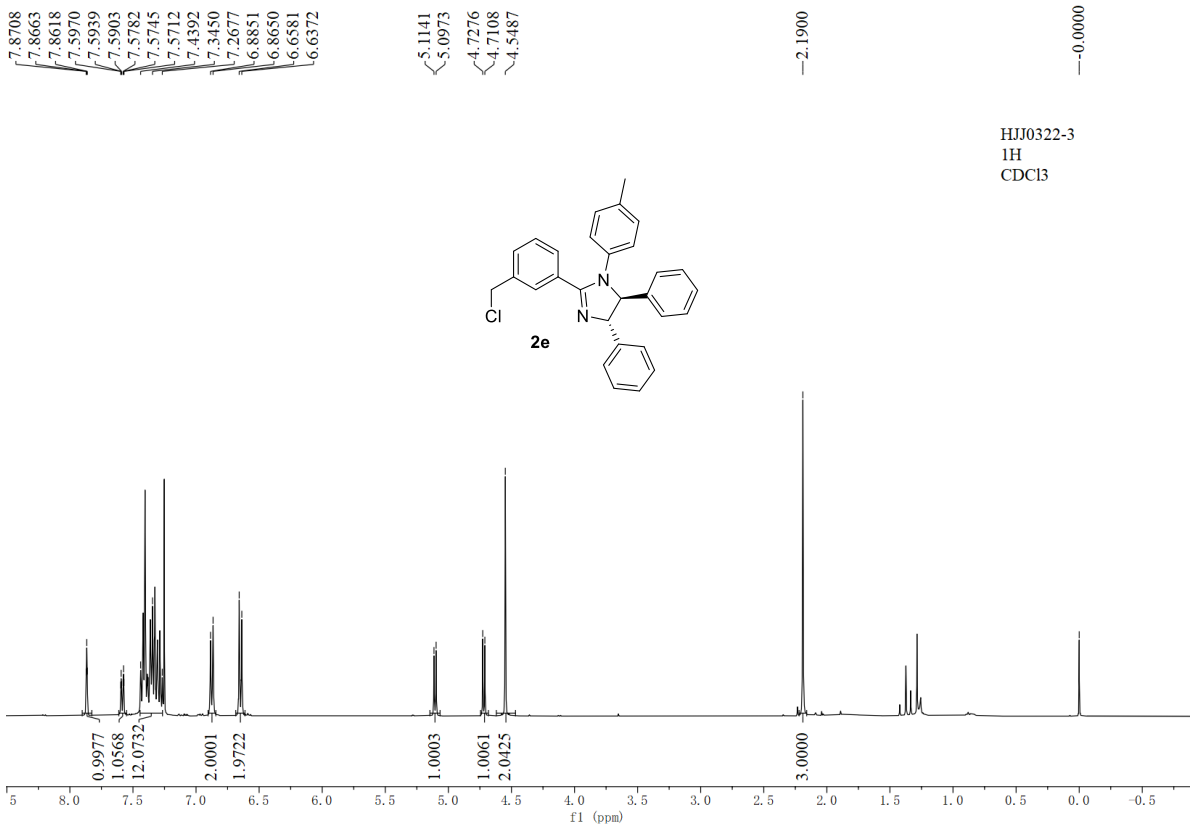
$^{13}C\{^{1}H\}$ NMR spectrum of **2c** (100 MHz, $CDCl_3$)



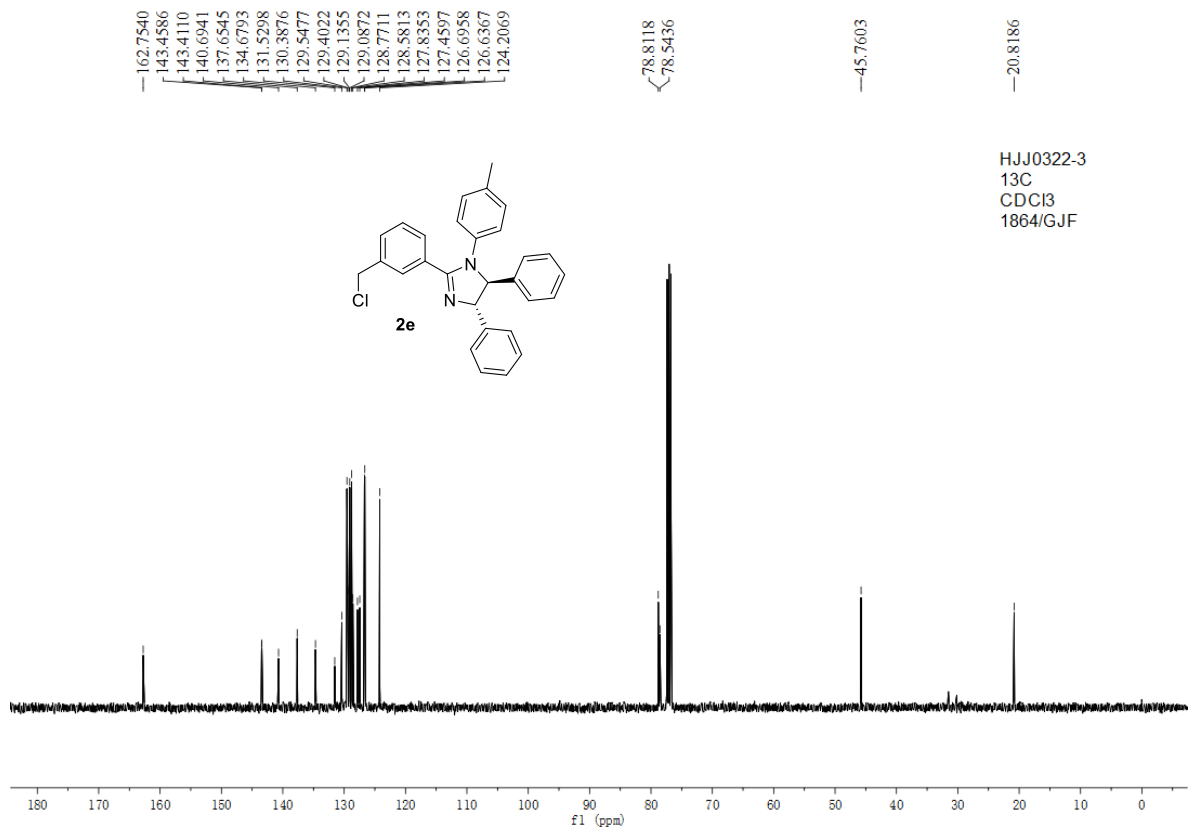
^{1}H NMR spectrum of **2d** (600 MHz, $CDCl_3$)



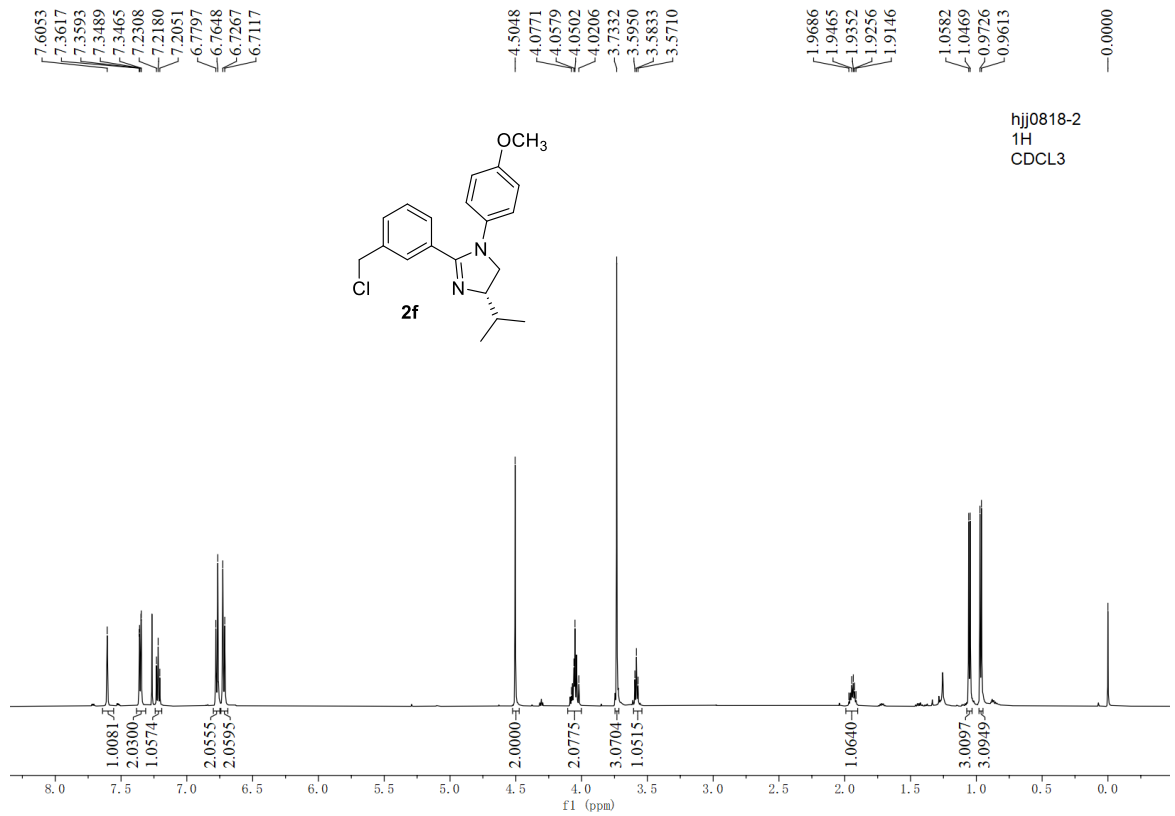
^{13}C{^{1}H} NMR spectrum of **2d** (150 MHz, $CDCl_3$)



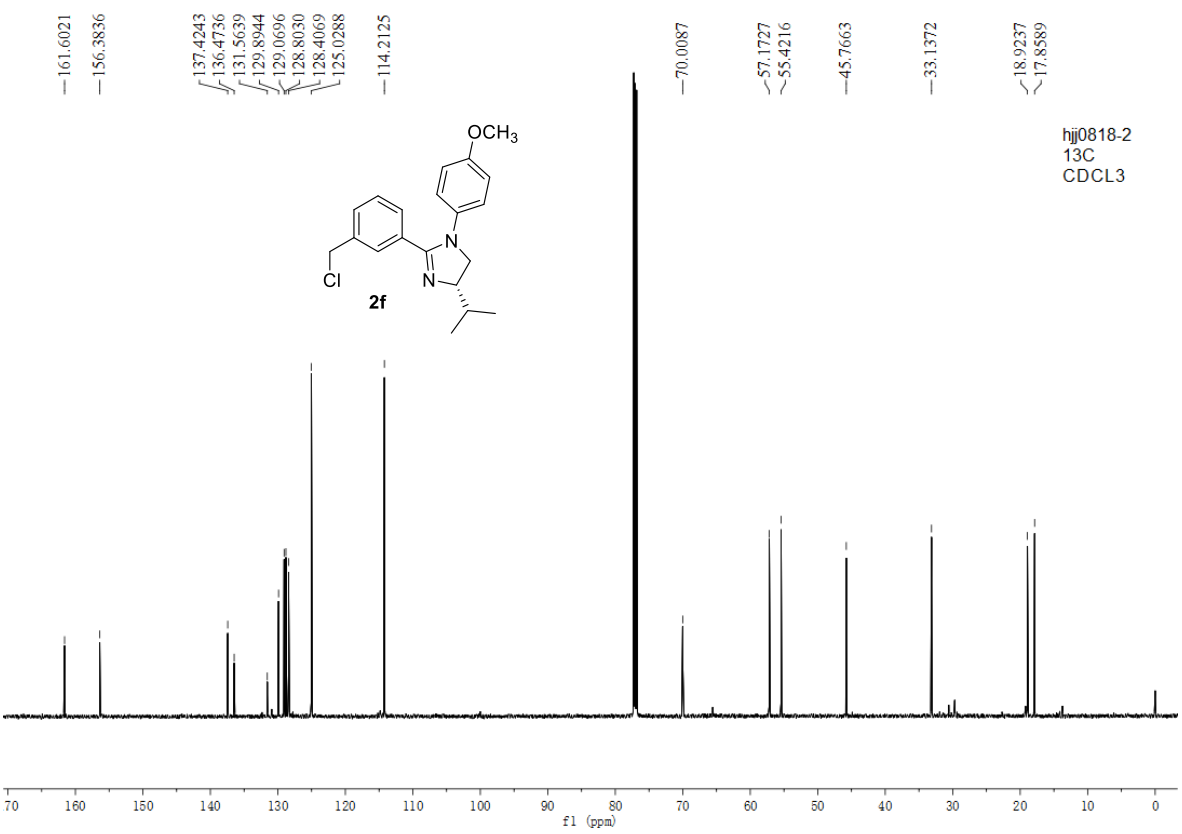
^{1}H NMR spectrum of **2e** (400 MHz, $CDCl_3$)



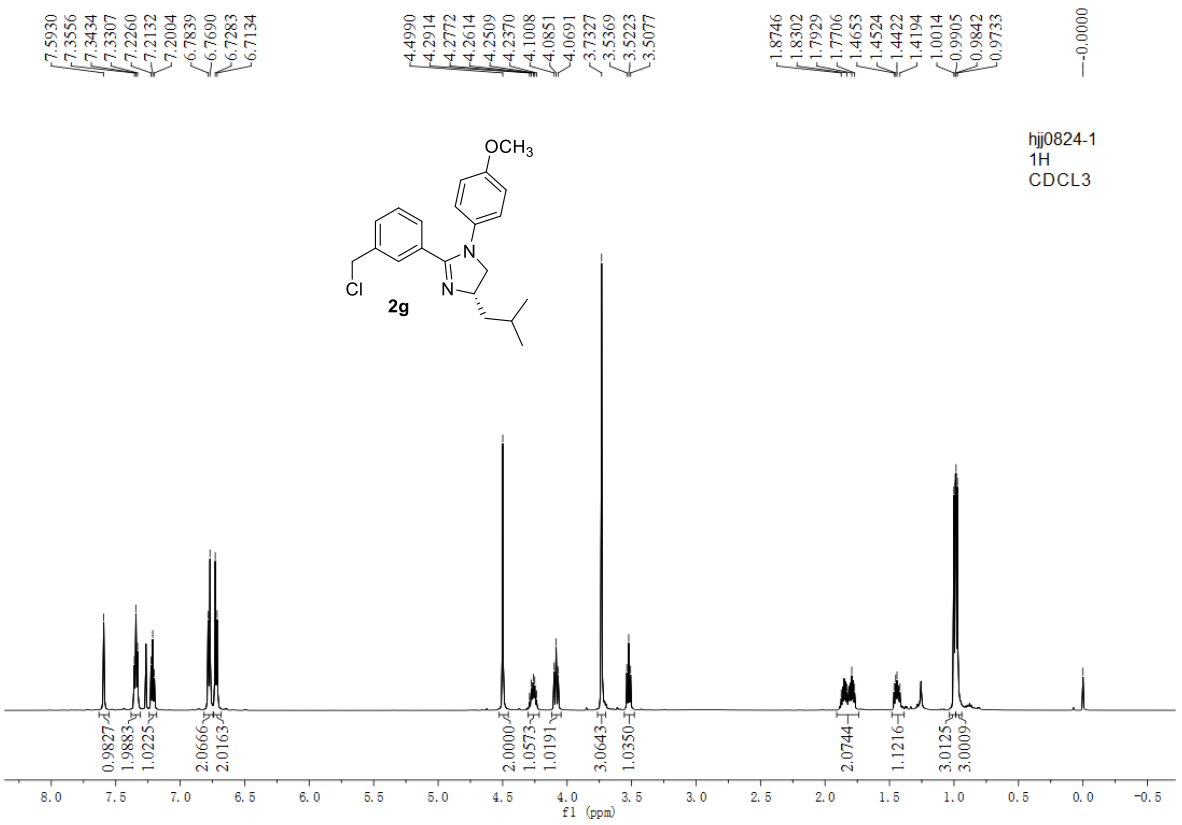
^{13}C{^{1}H} NMR spectrum of **2e** (100 MHz, $CDCl_3$)



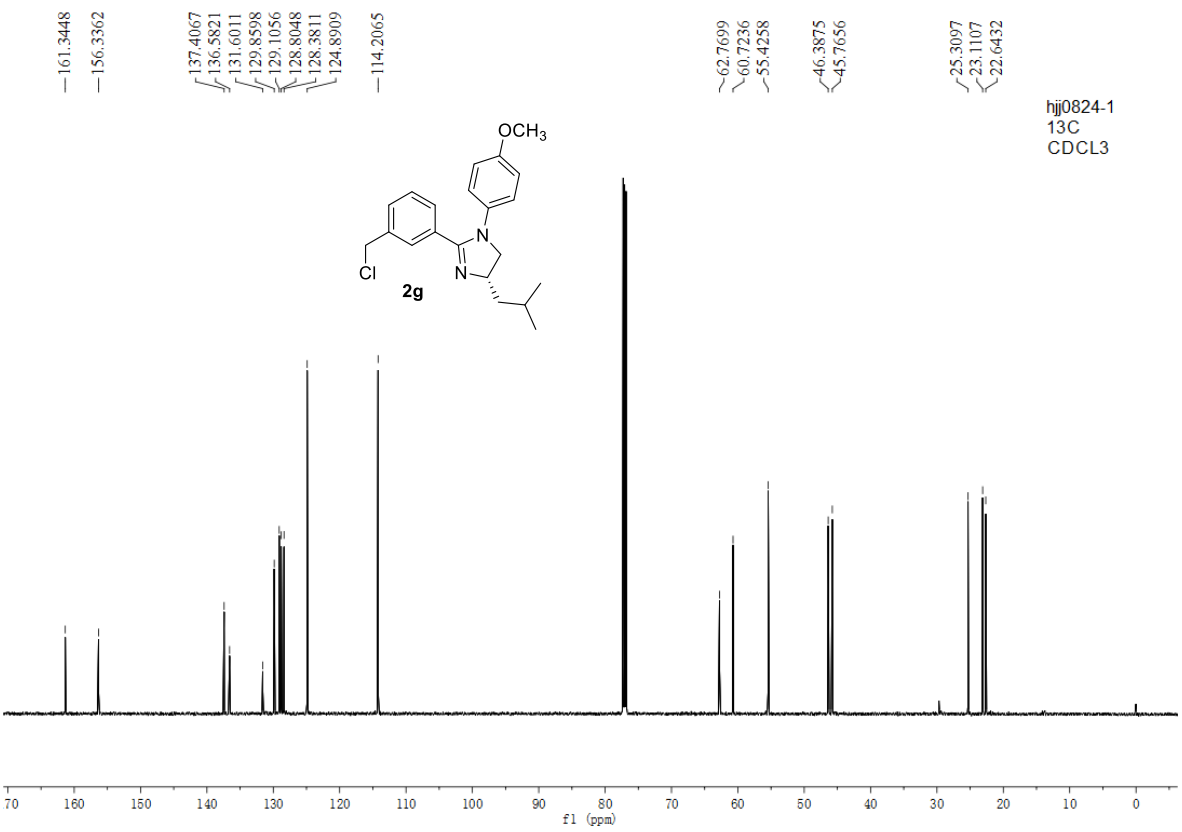
^{1}H NMR spectrum of **2f** (600 MHz, $CDCl_3$)



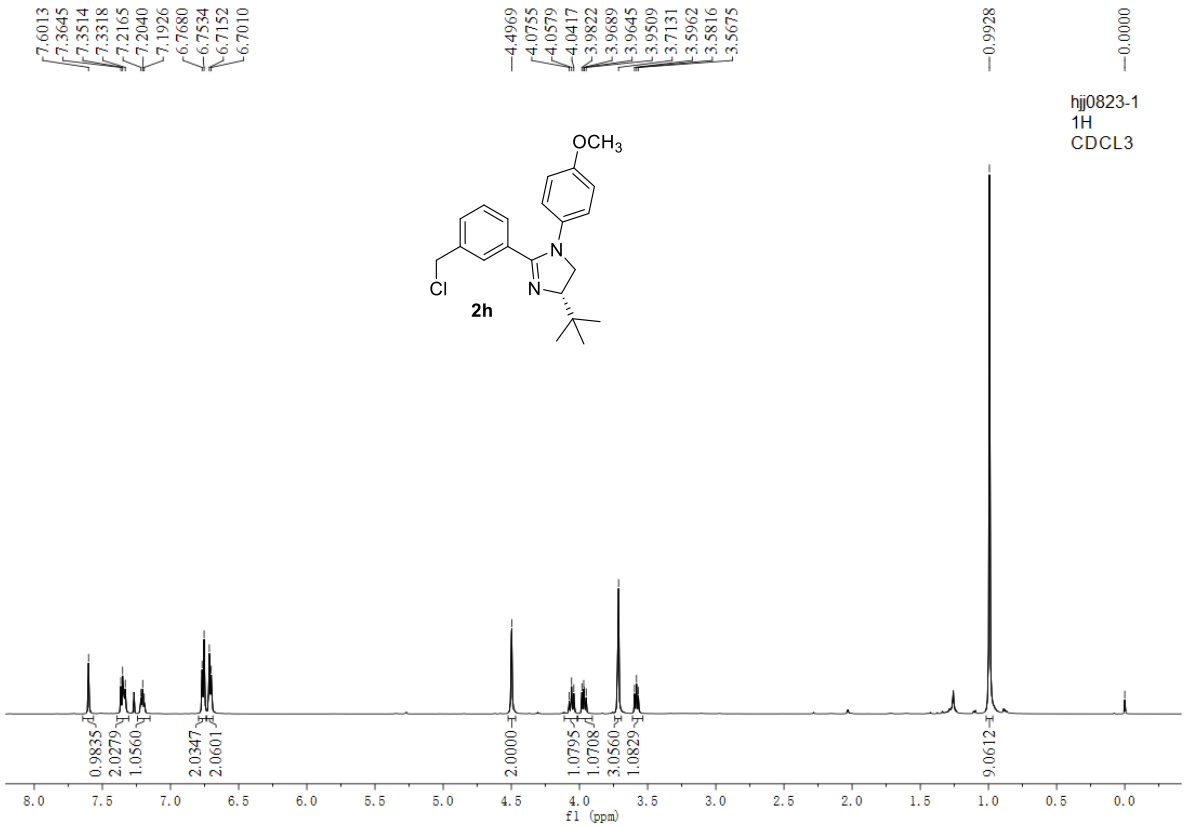
^{13}C{^{1}H} NMR spectrum of **2f** (150 MHz, $CDCl_3$)



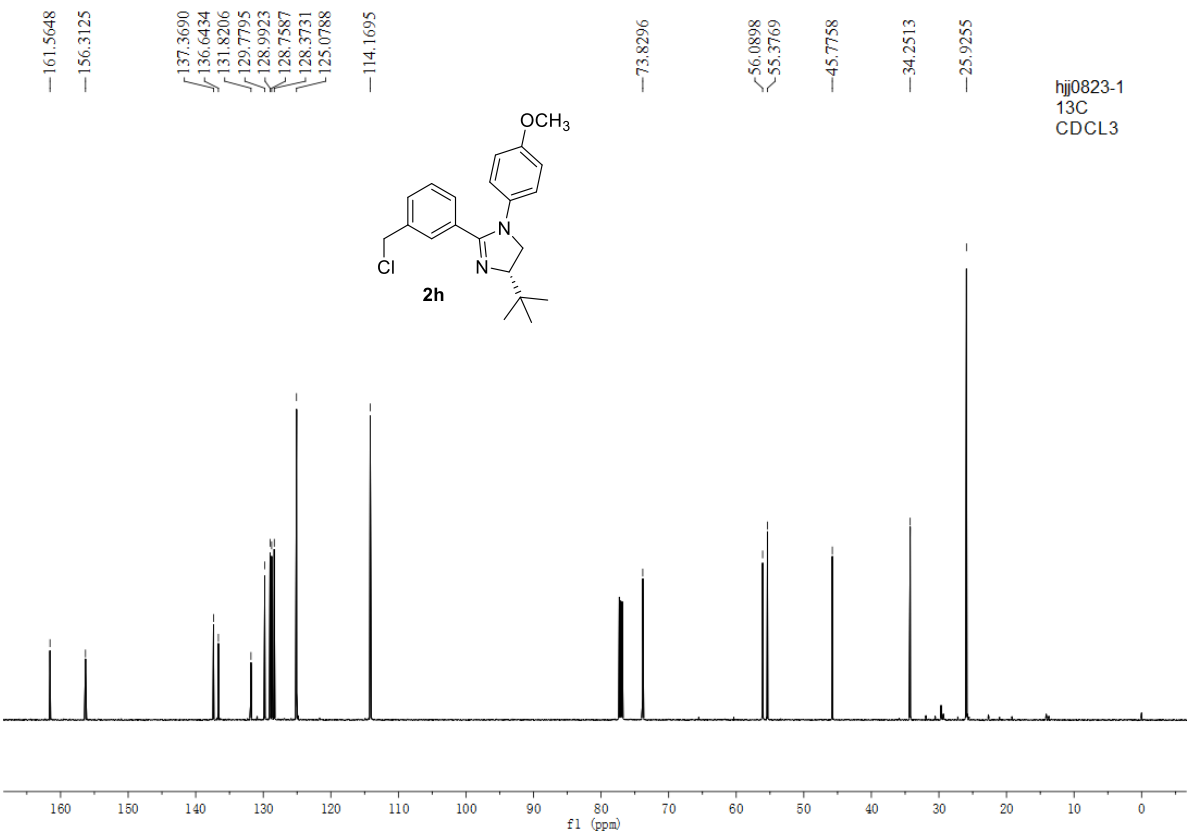
^{1}H NMR spectrum of **2g** (600 MHz, $CDCl_3$)



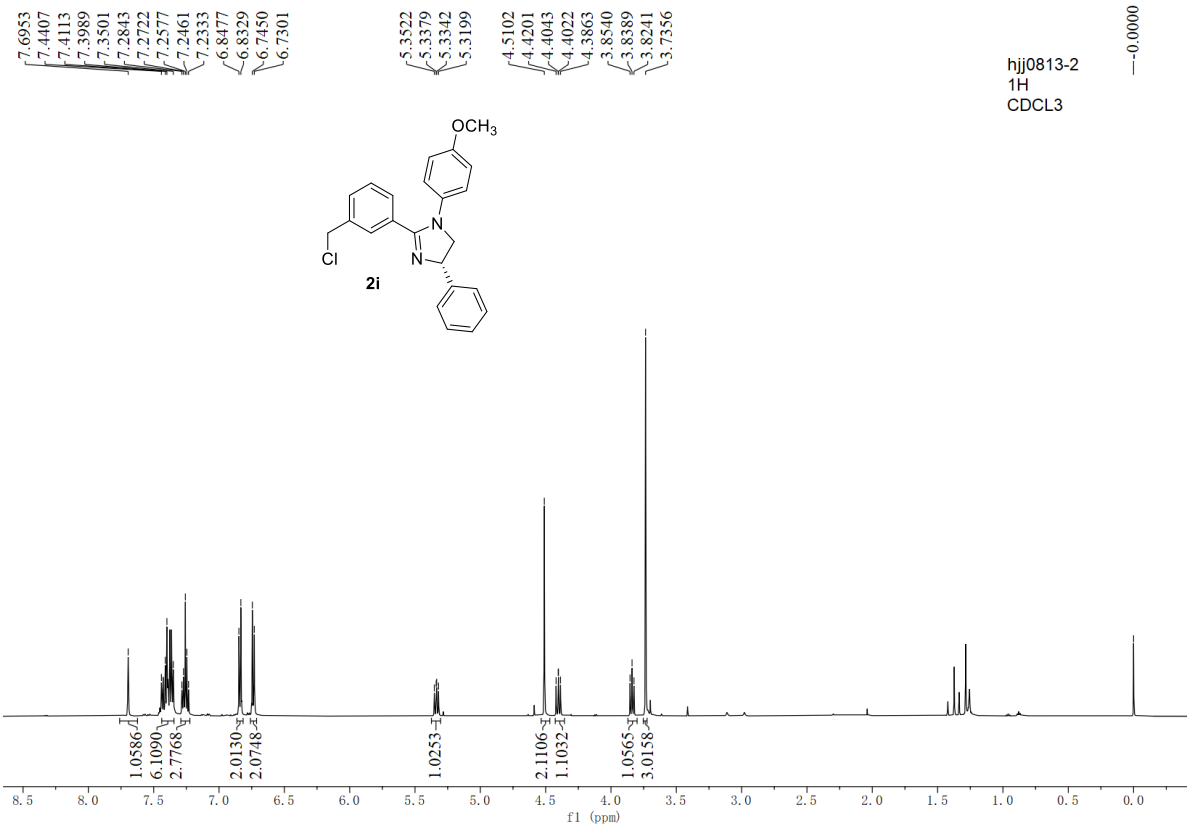
^{13}C{^{1}H} NMR spectrum of **2g** (150 MHz, $CDCl_3$)



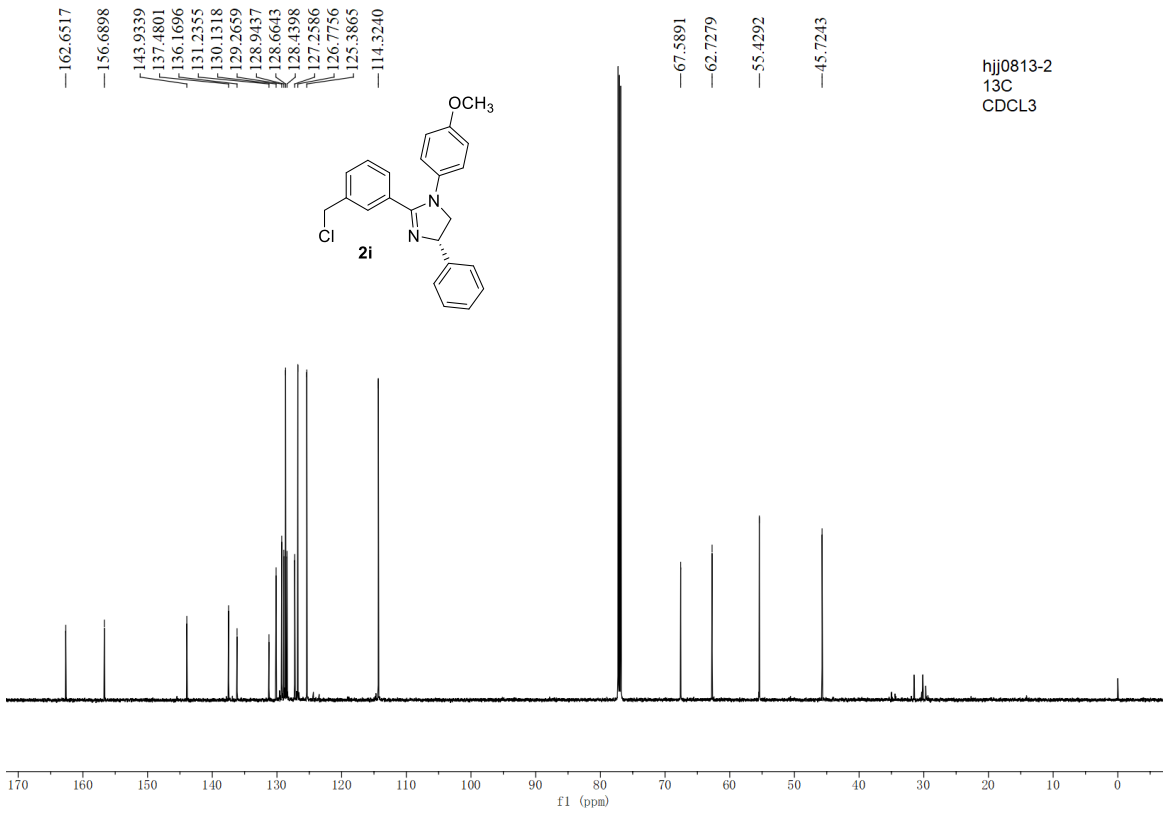
^{1}H NMR spectrum of **2h** (600 MHz, $CDCl_3$)



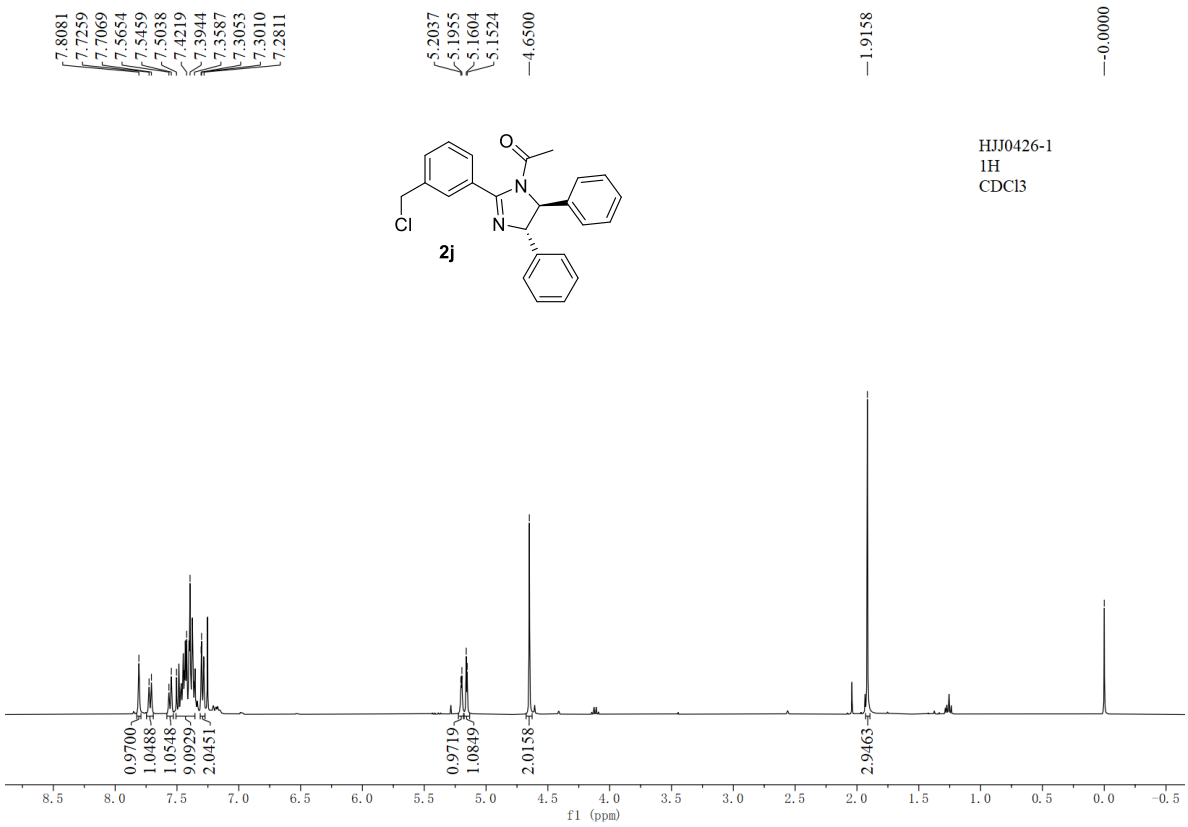
^{13}C{^{1}H} NMR spectrum of **2h** (150 MHz, $CDCl_3$)



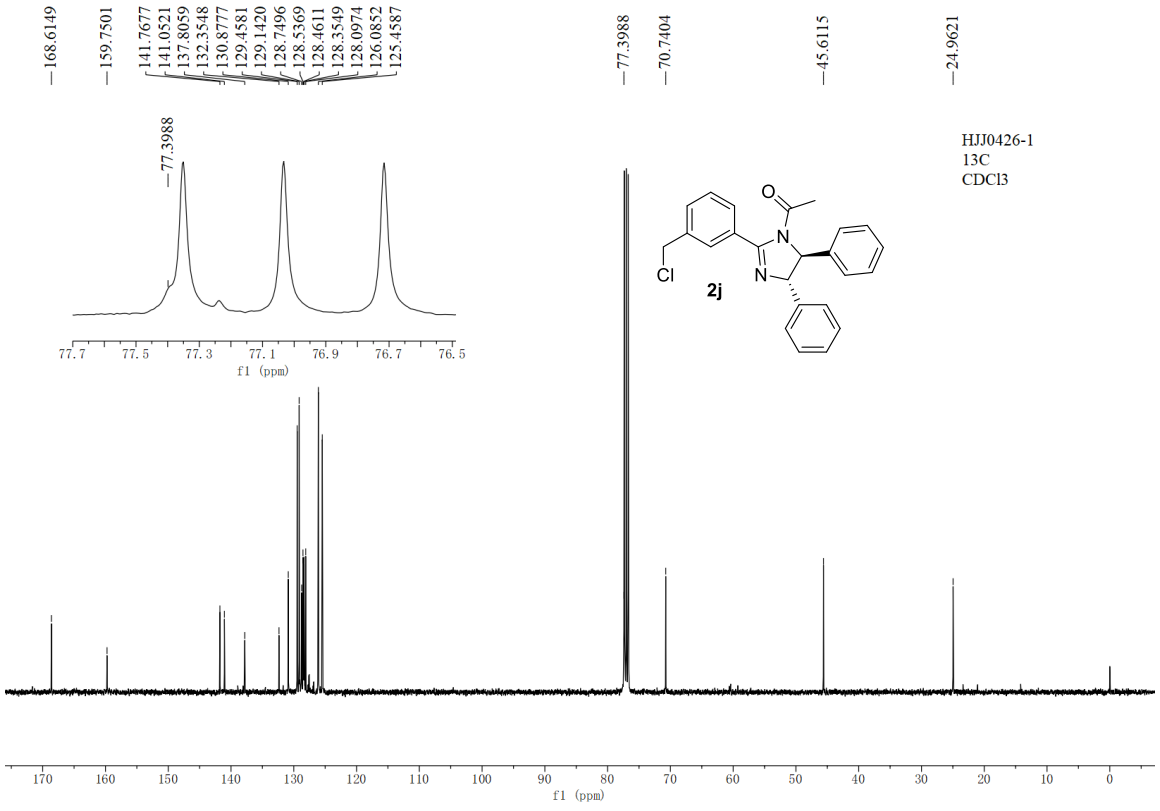
^{1}H NMR spectrum of **2i** (600 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR spectrum of **2i** (150 MHz, $CDCl_3$)



^{1}H NMR spectrum of **2j** (400 MHz, $CDCl_3$)



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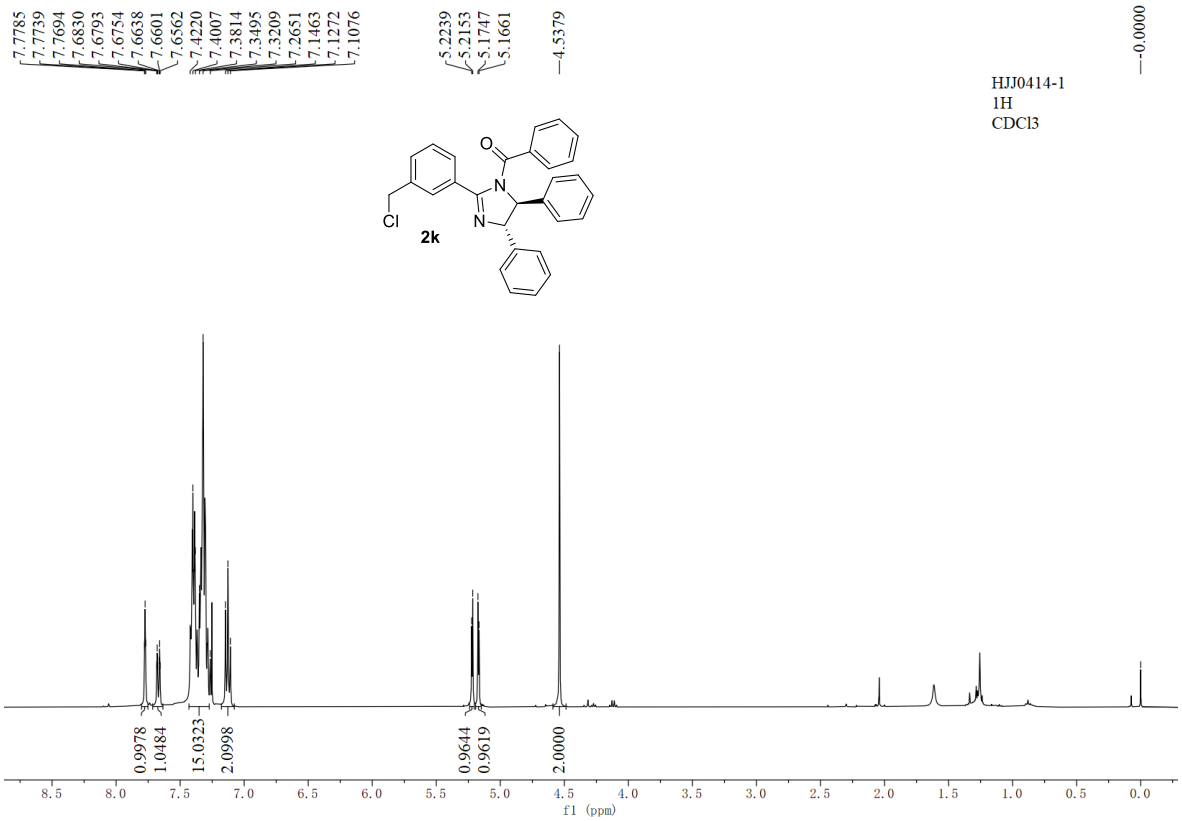
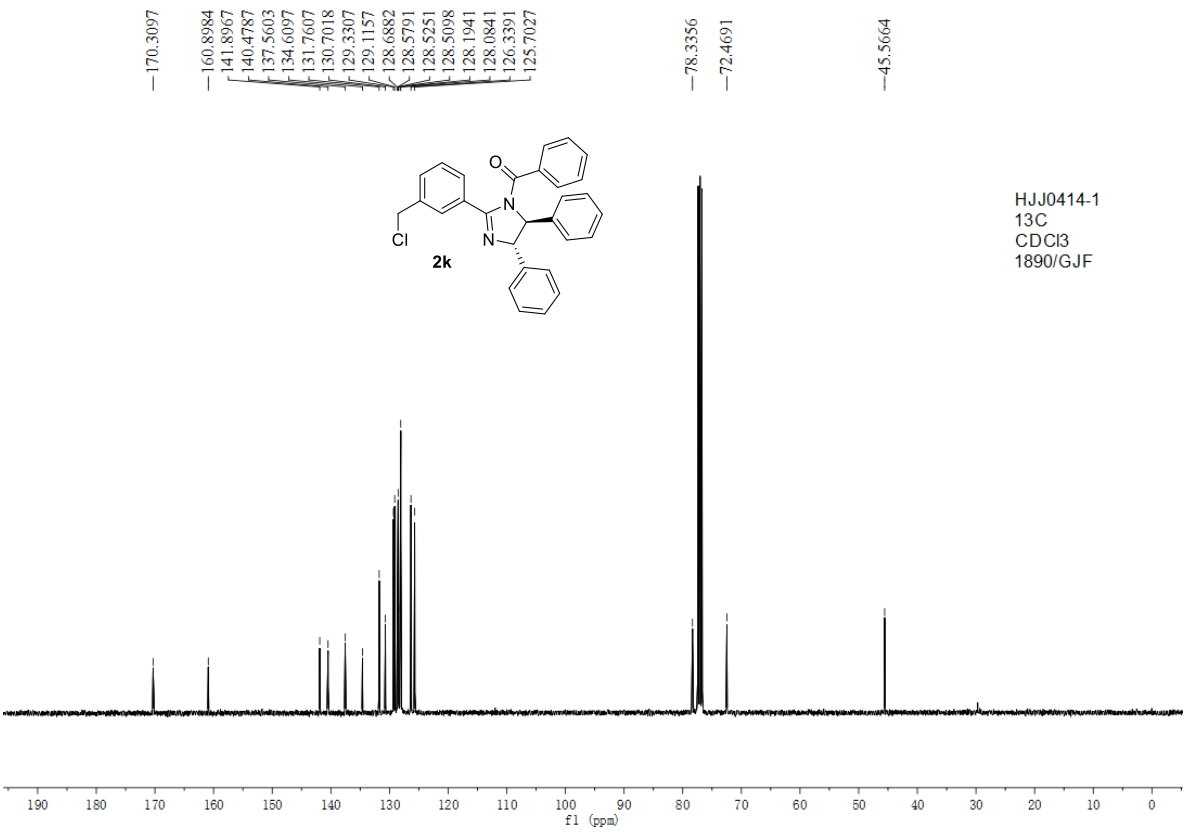
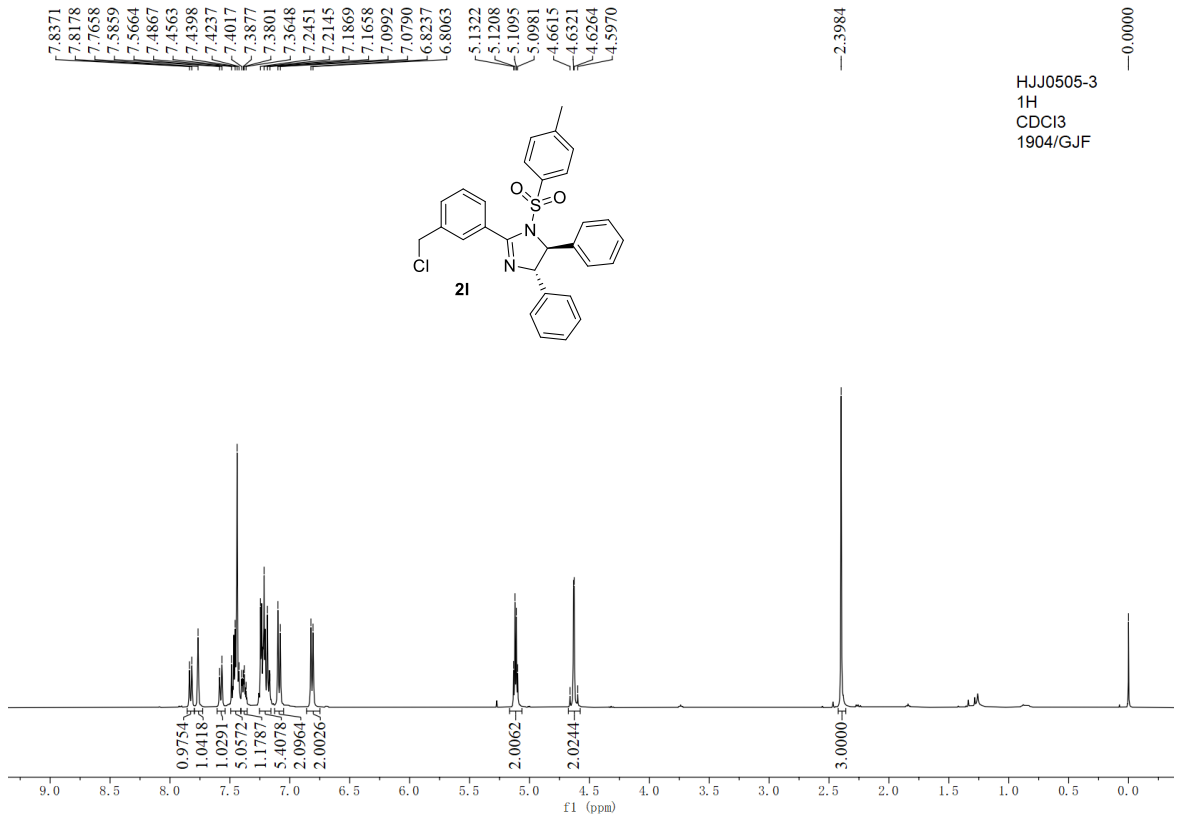


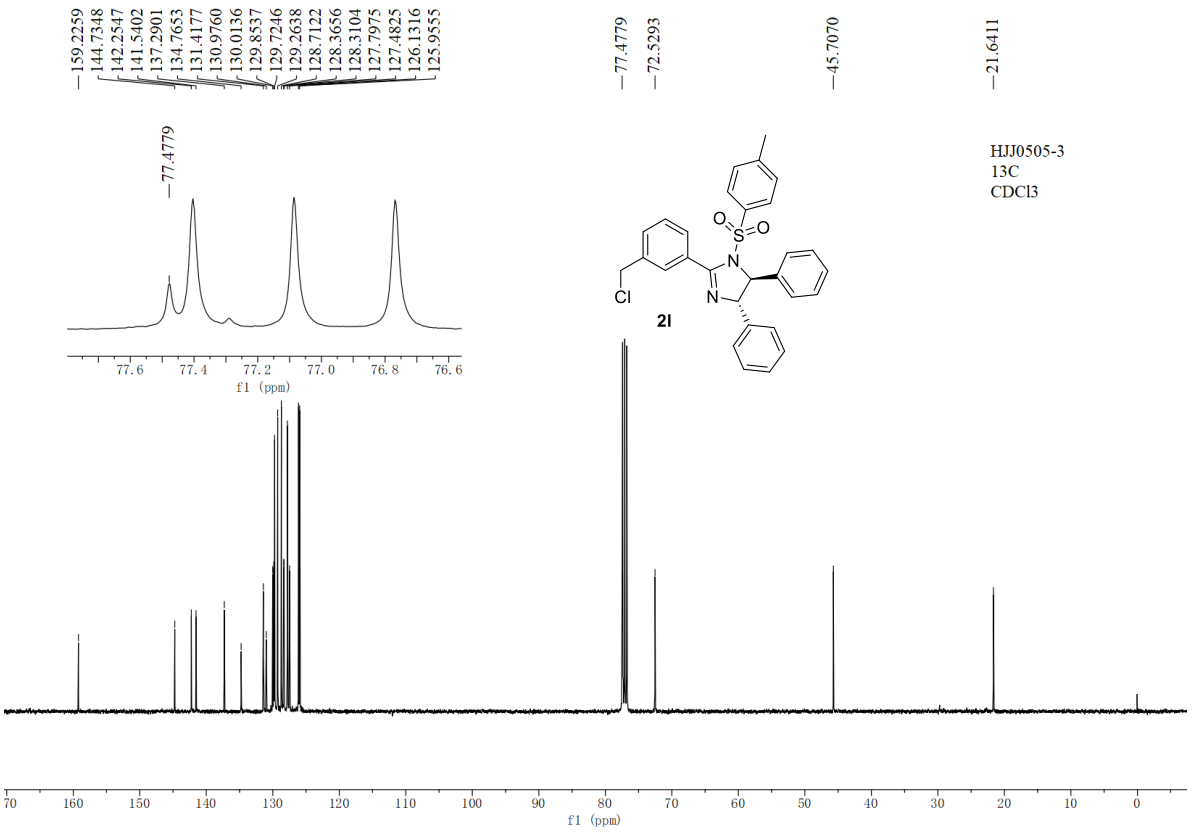
^{1}H NMR spectrum of **2k** (400 MHz, $CDCl_3$)



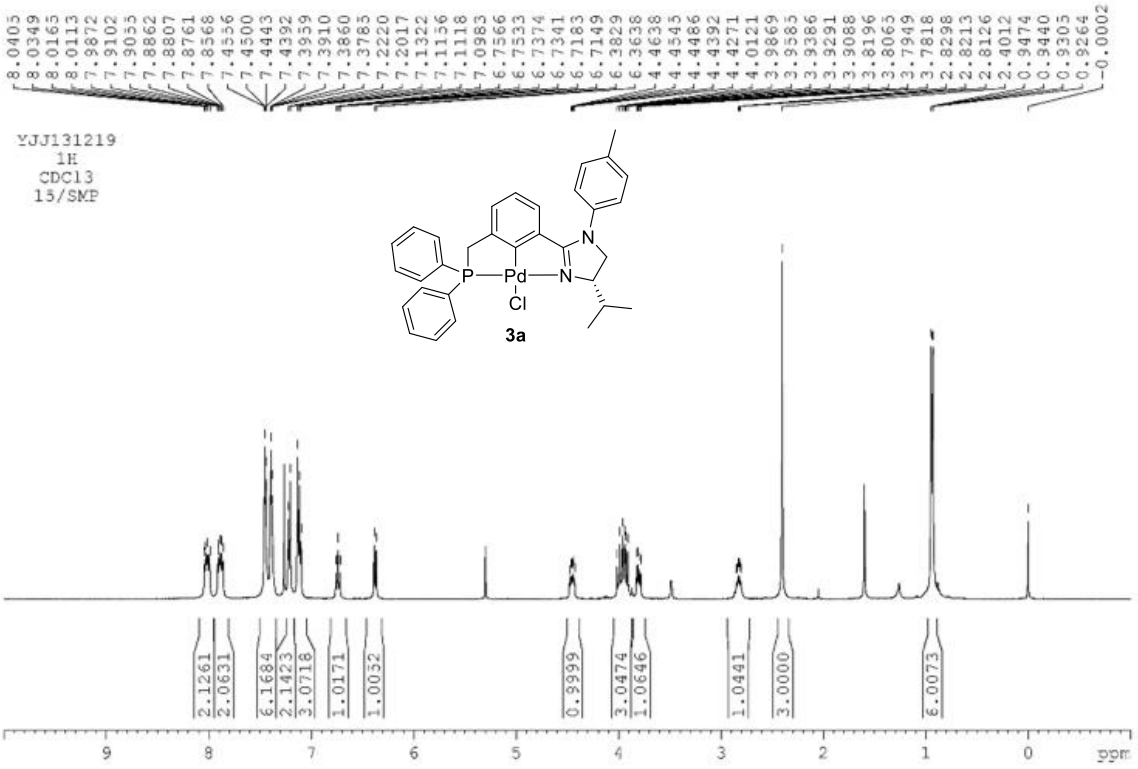
^{13}C{^{1}H} NMR spectrum of **2k** (100 MHz, $CDCl_3$)



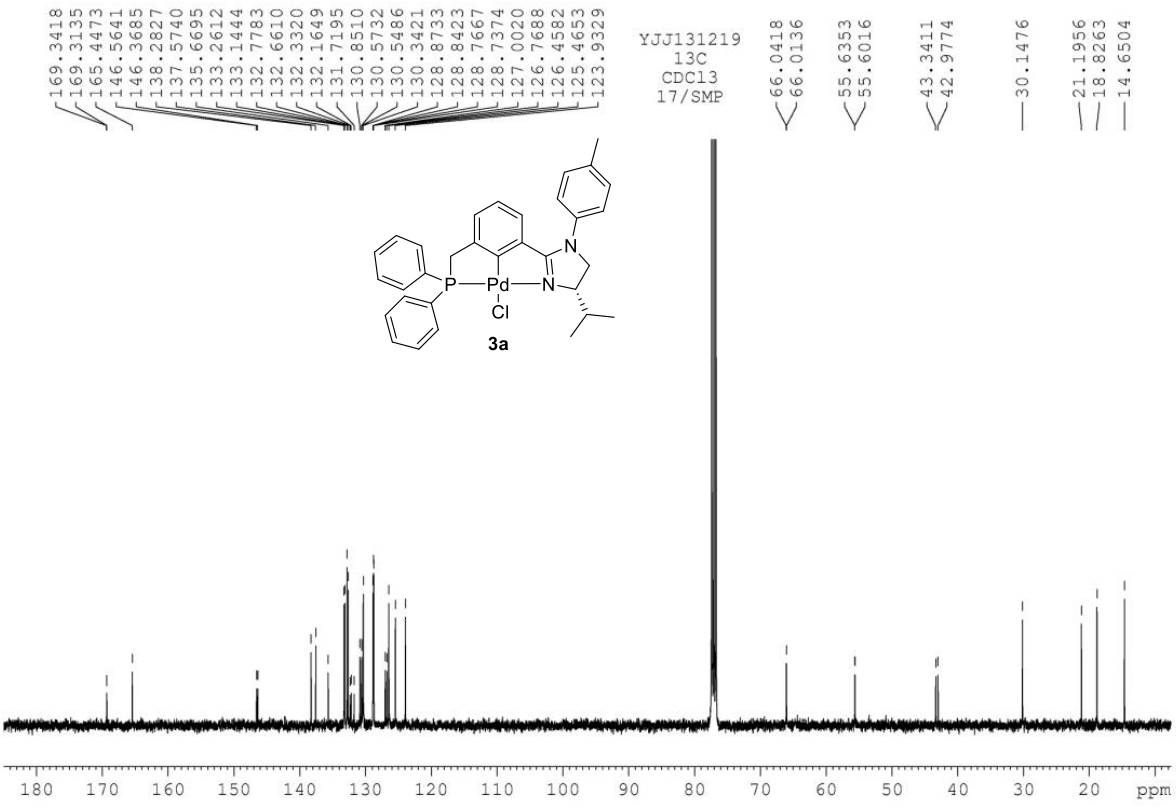
^{1}H NMR spectrum of **2l** (400 MHz, $CDCl_3$)



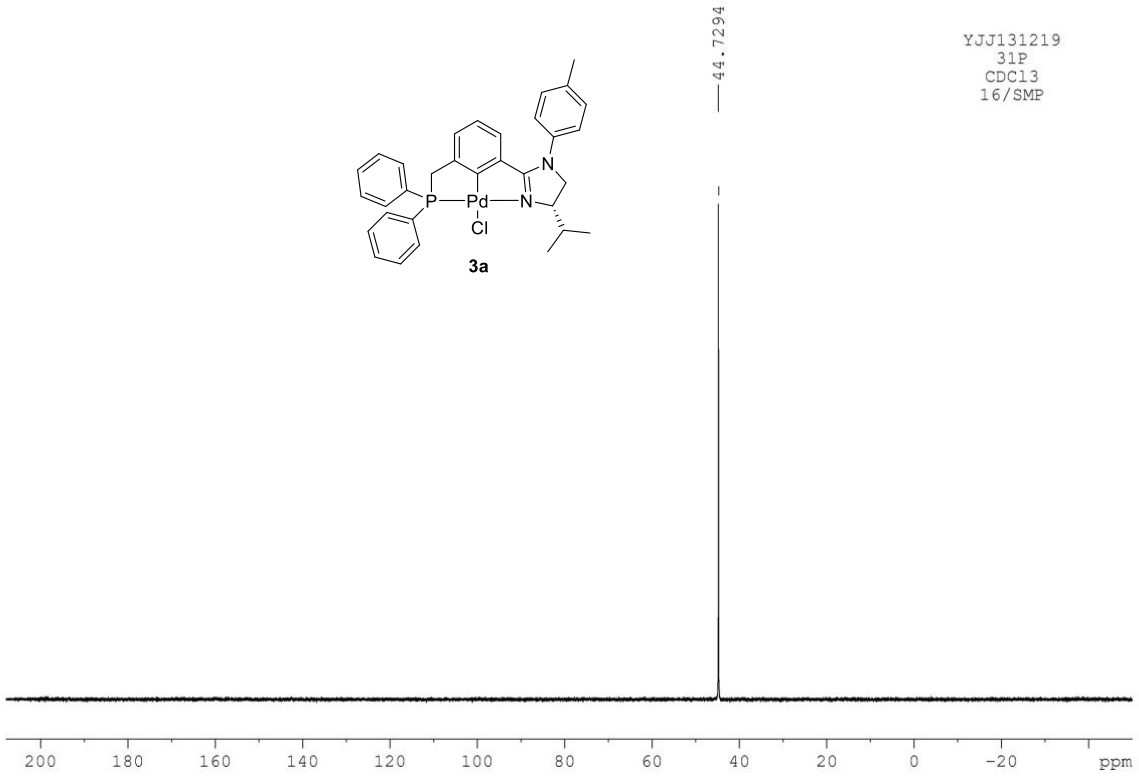
^{13}C{^{1}H} NMR spectrum of **2l** (100 MHz, $CDCl_3$)



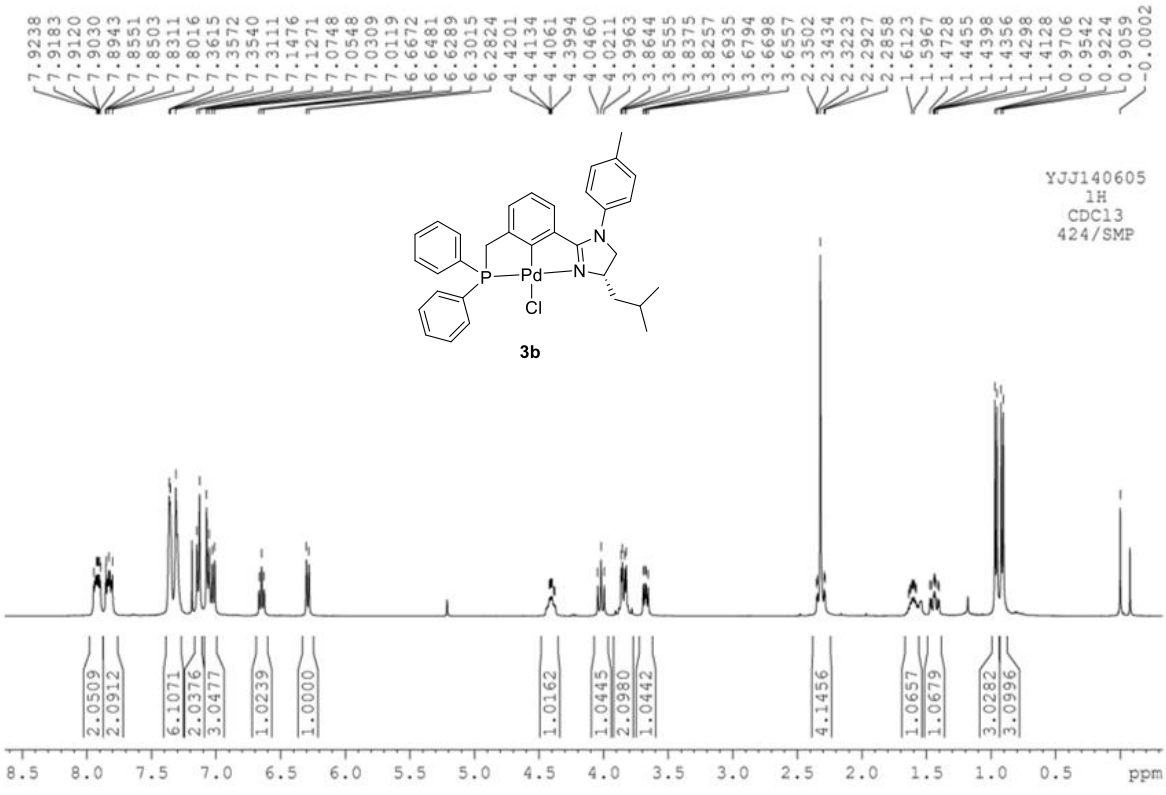
^{1}H NMR spectrum of **3a** (400 MHz, $CDCl_3$)



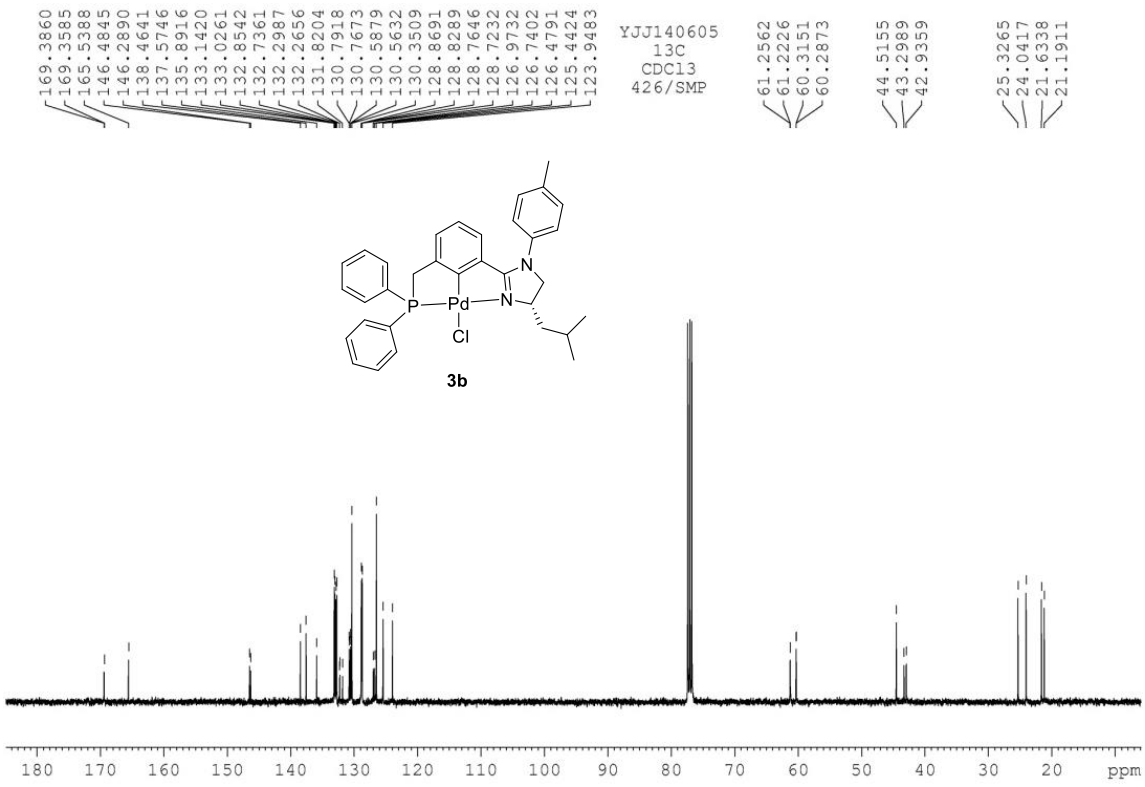
^{13}C{^{1}H} NMR spectrum of **3a** (100 MHz, $CDCl_3$)



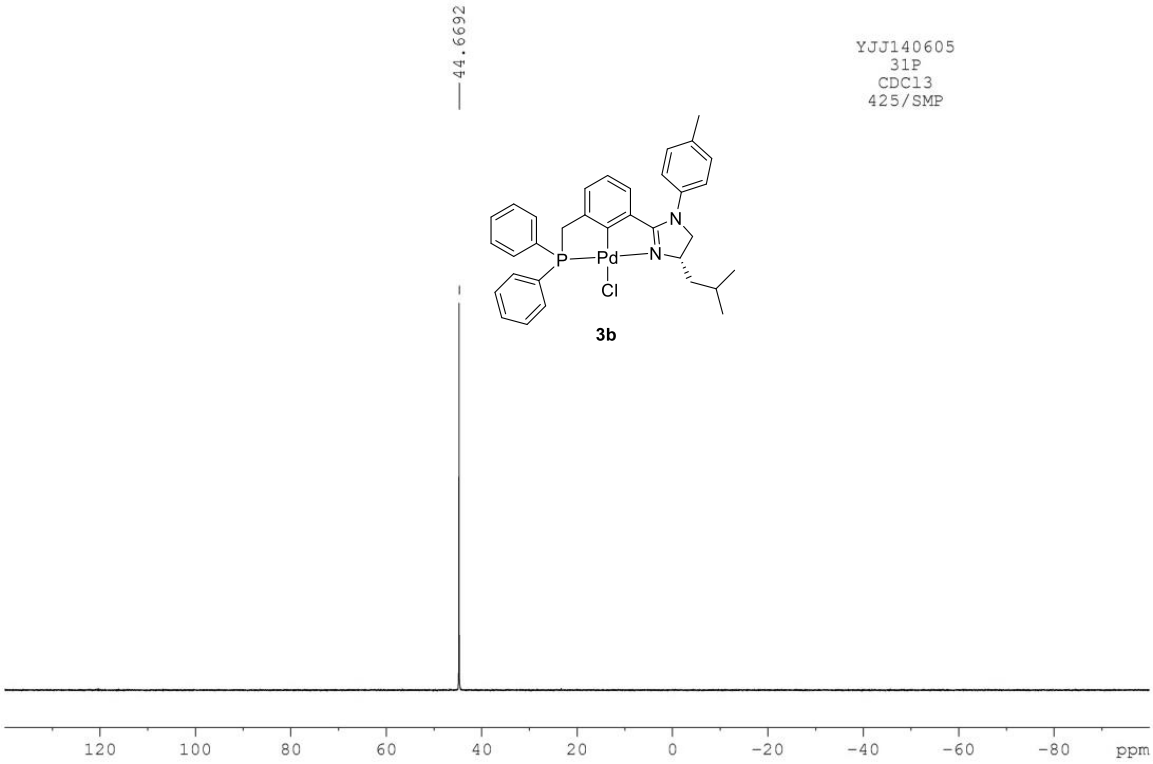
$^{31}P\{^{1}H\}$ NMR spectrum of **3a** (162 MHz, $CDCl_3$)



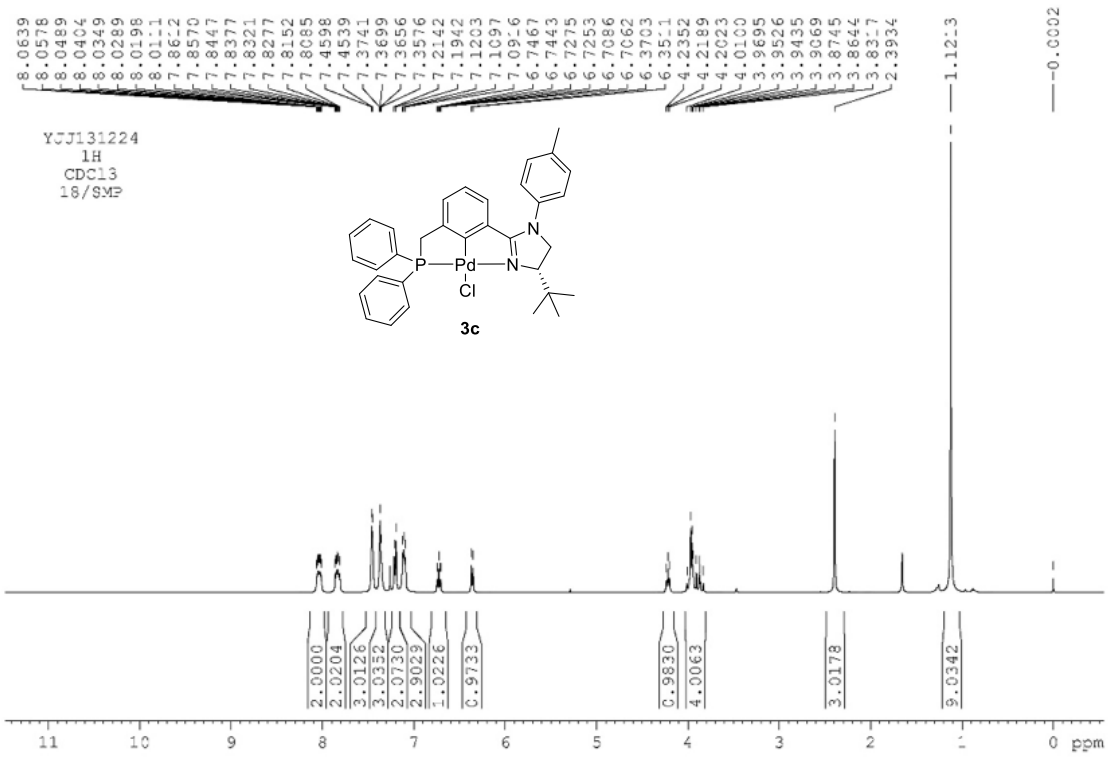
^{1}H NMR spectrum of **3b** (400 MHz, $CDCl_3$)



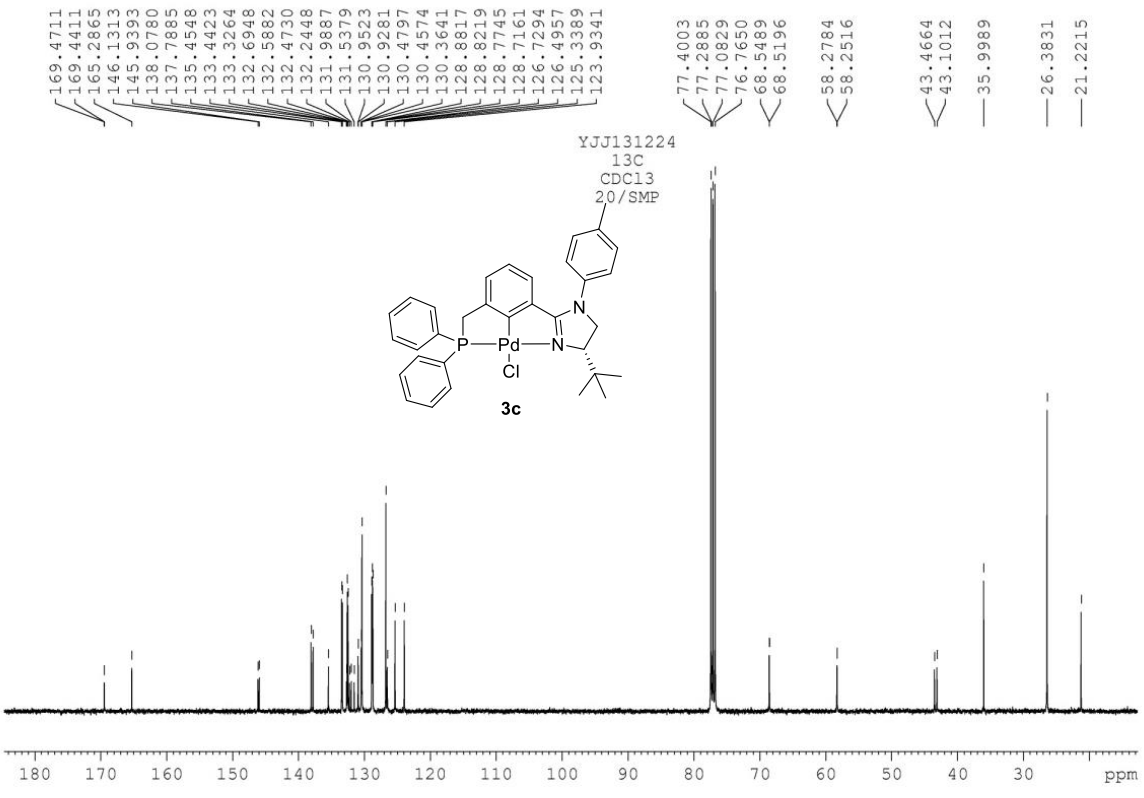
$^{13}C\{^{1}H\}$ NMR spectrum of **3b** (100 MHz, $CDCl_3$)



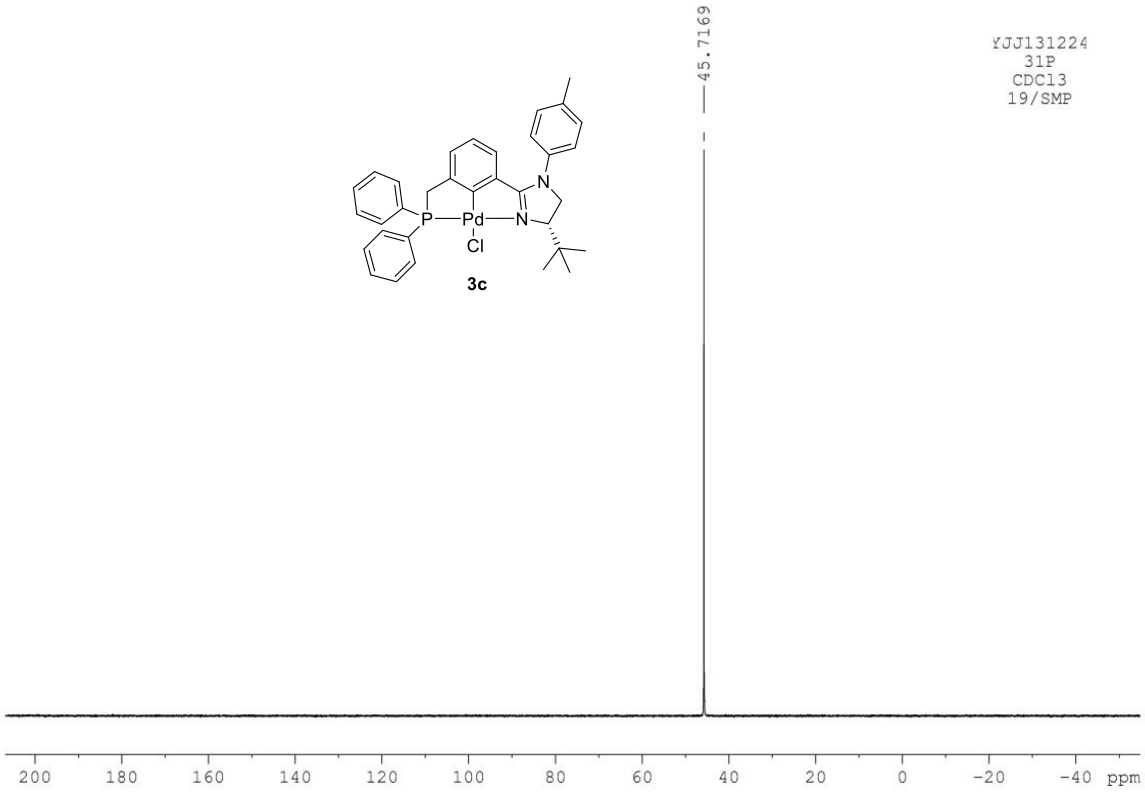
$^{31}P\{^{1}H\}$ NMR spectrum of **3b** (162 MHz, $CDCl_3$)



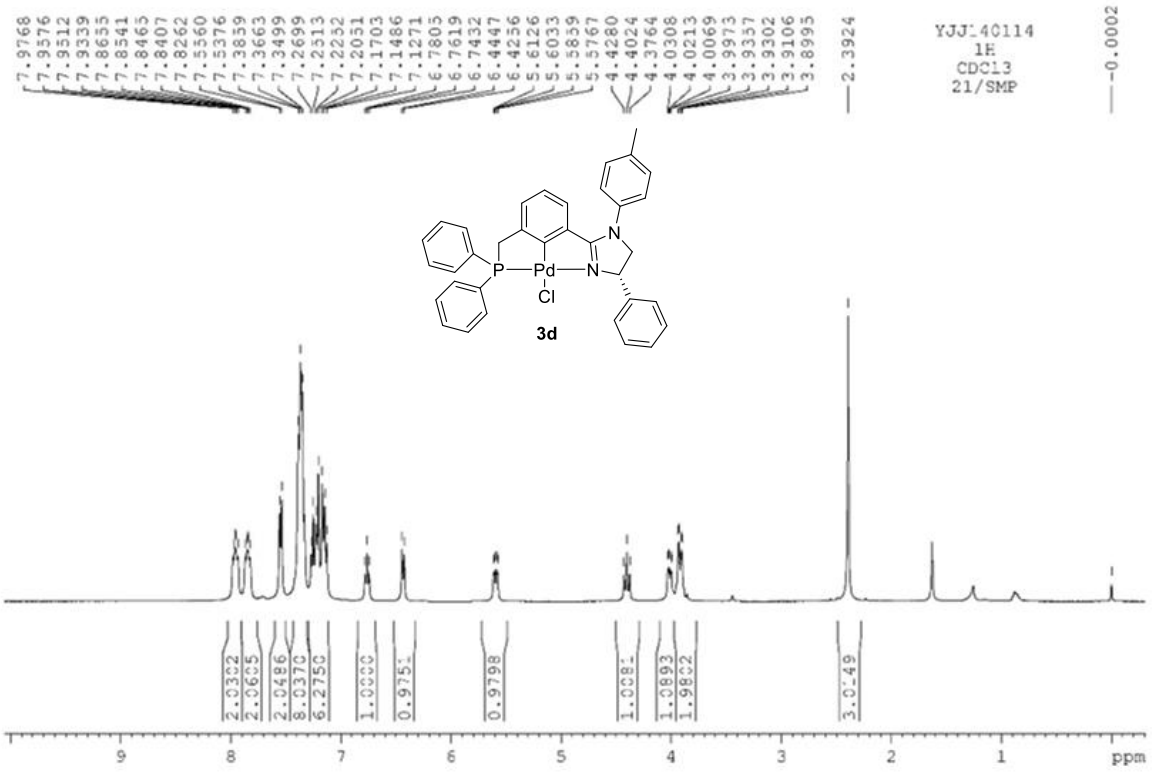
^{1}H NMR spectrum of **3c** (400 MHz, $CDCl_3$)



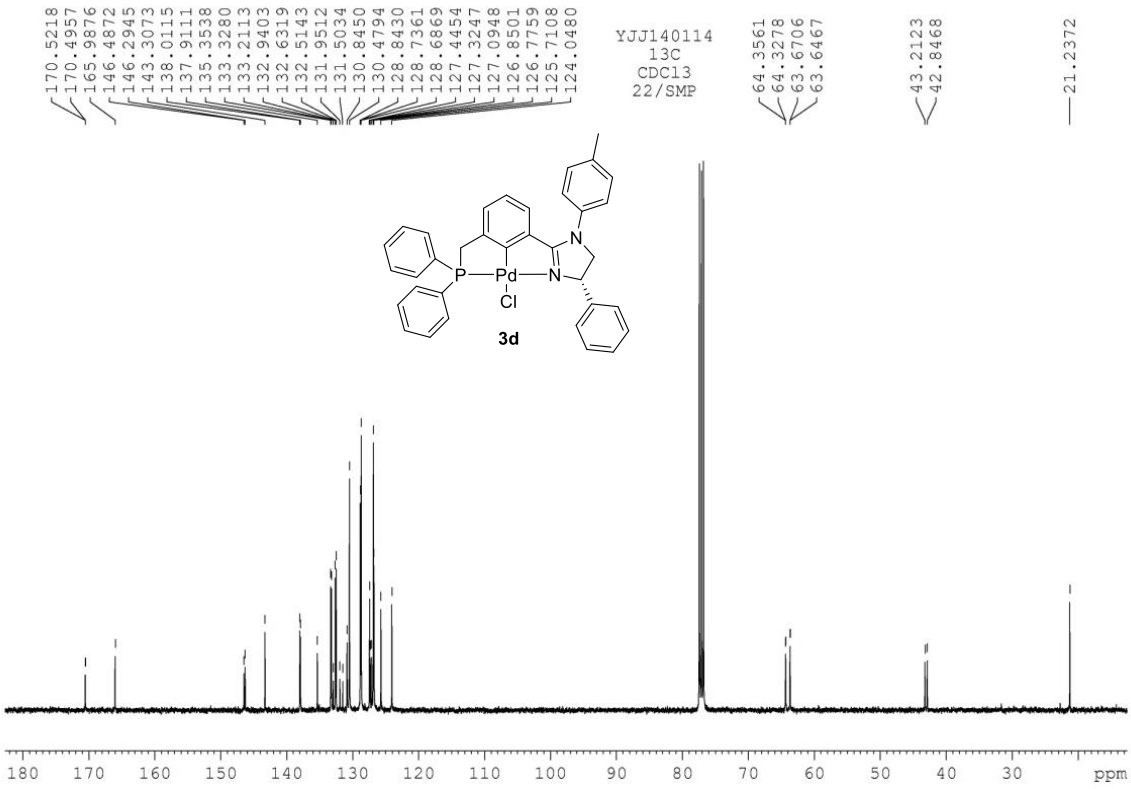
^{13}C{^{1}H} NMR spectrum of **3c** (100 MHz, $CDCl_3$)



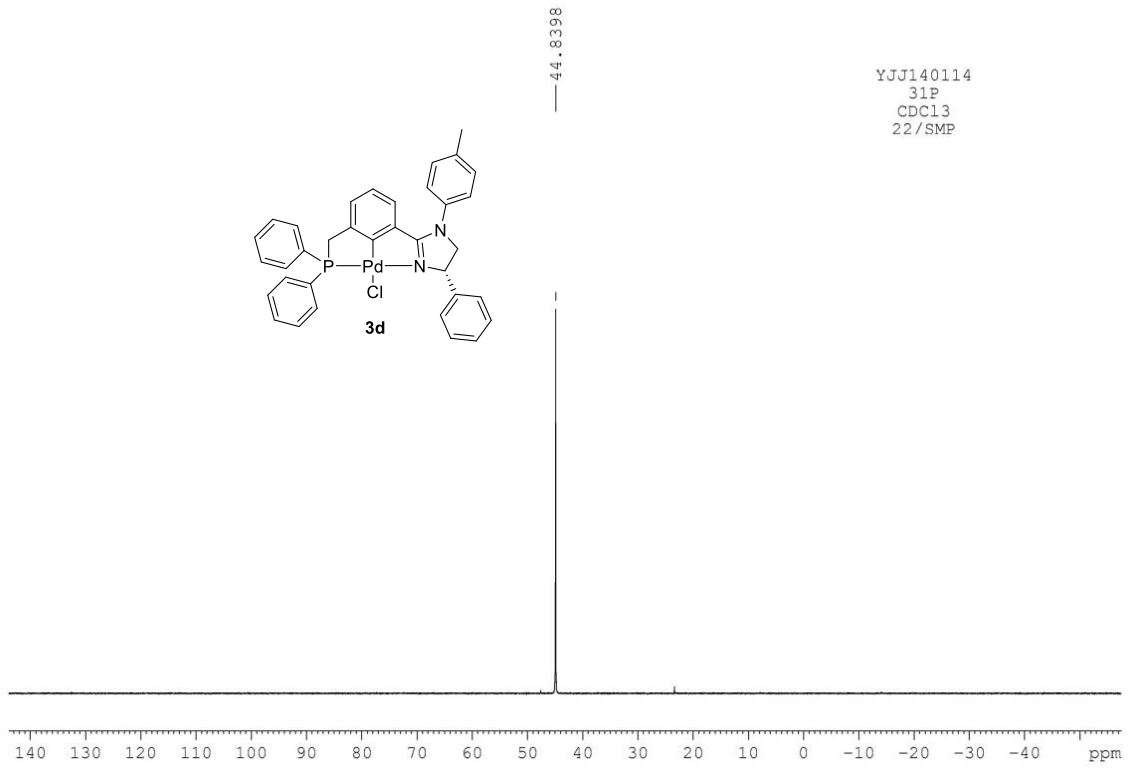
$^{31}P\{^{1}H\}$ NMR spectrum of **3c** (162 MHz, $CDCl_3$)



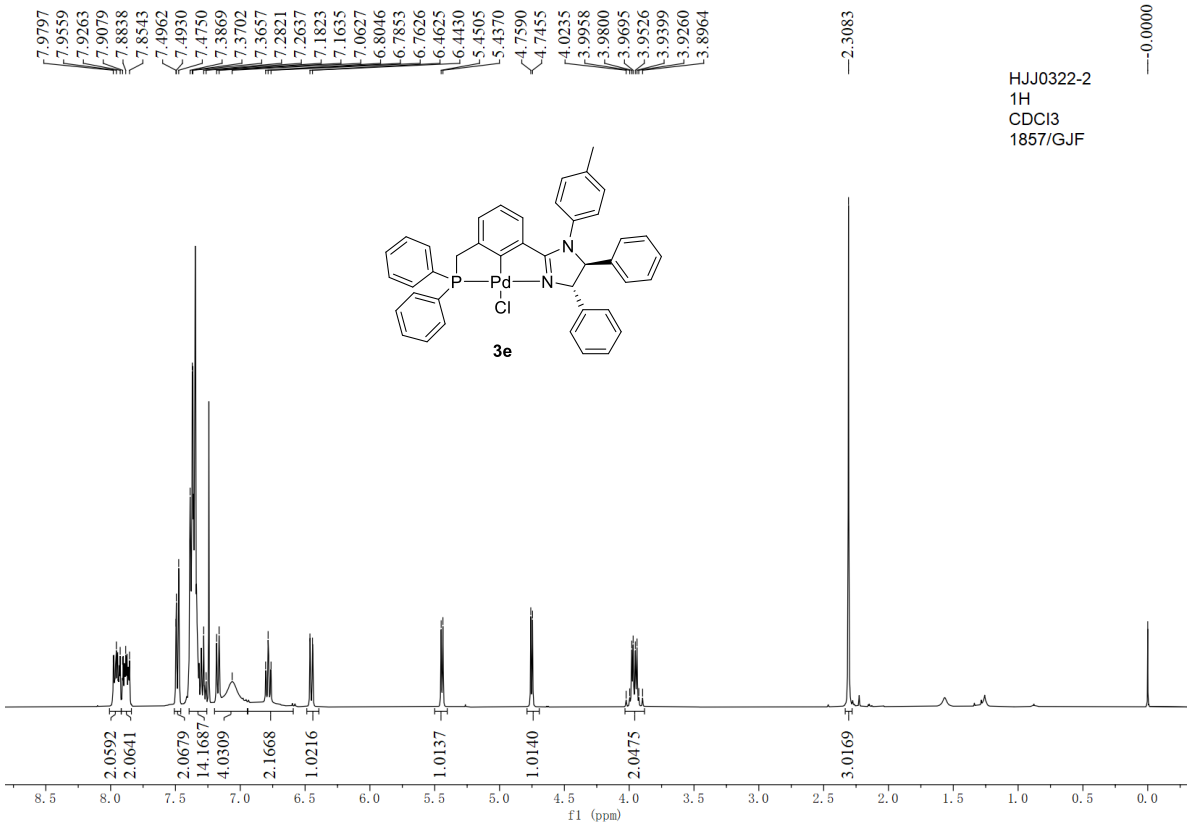
^{1}H NMR spectrum of **3d** (400 MHz, $CDCl_3$)



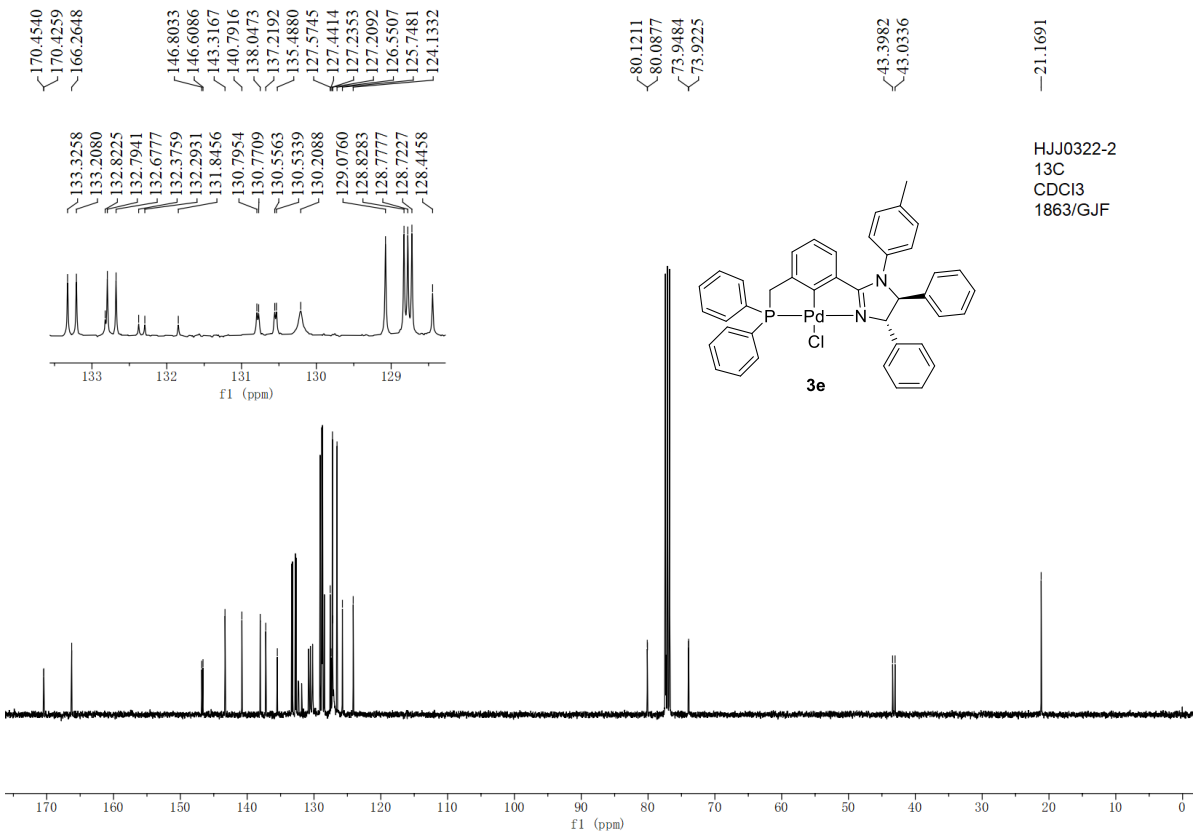
$^{13}C\{^{1}H\}$ NMR spectrum of **3d** (100 MHz, $CDCl_3$)



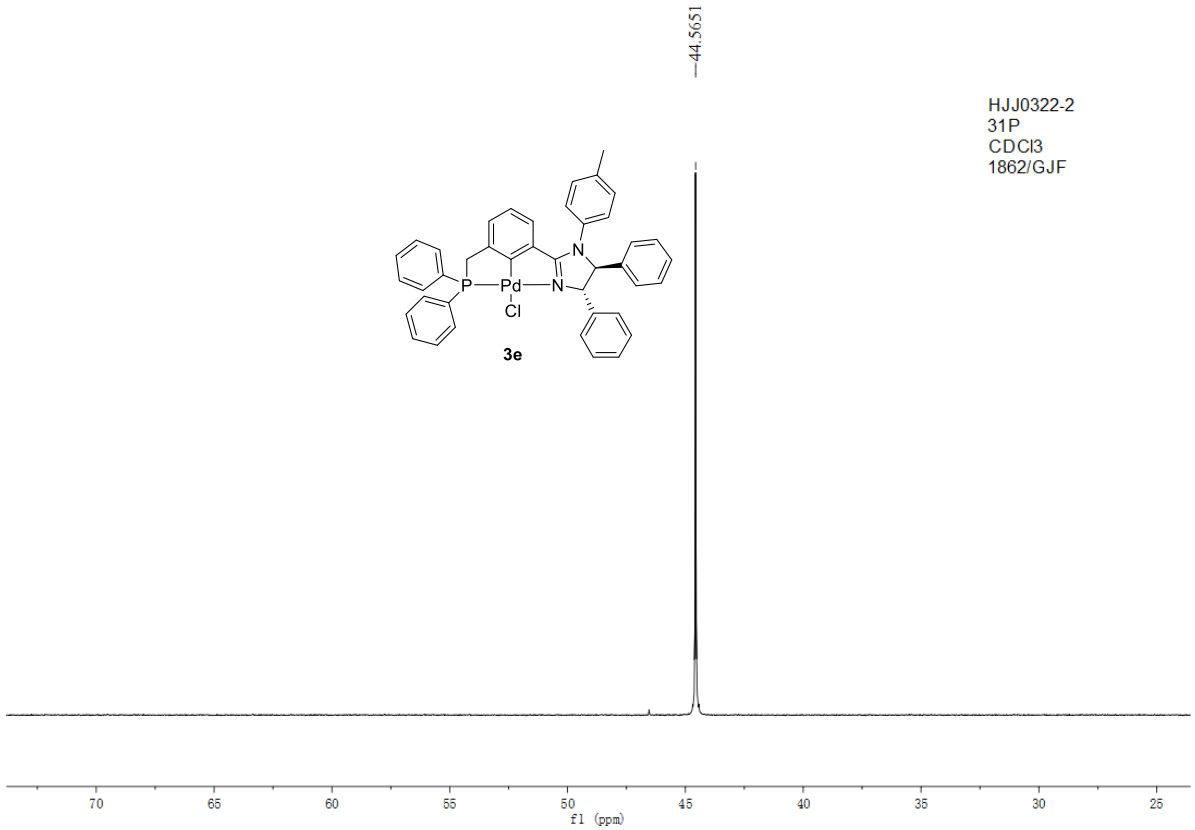
$^{31}P\{^{1}H\}$ NMR spectrum of **3d** (162 MHz, $CDCl_3$)



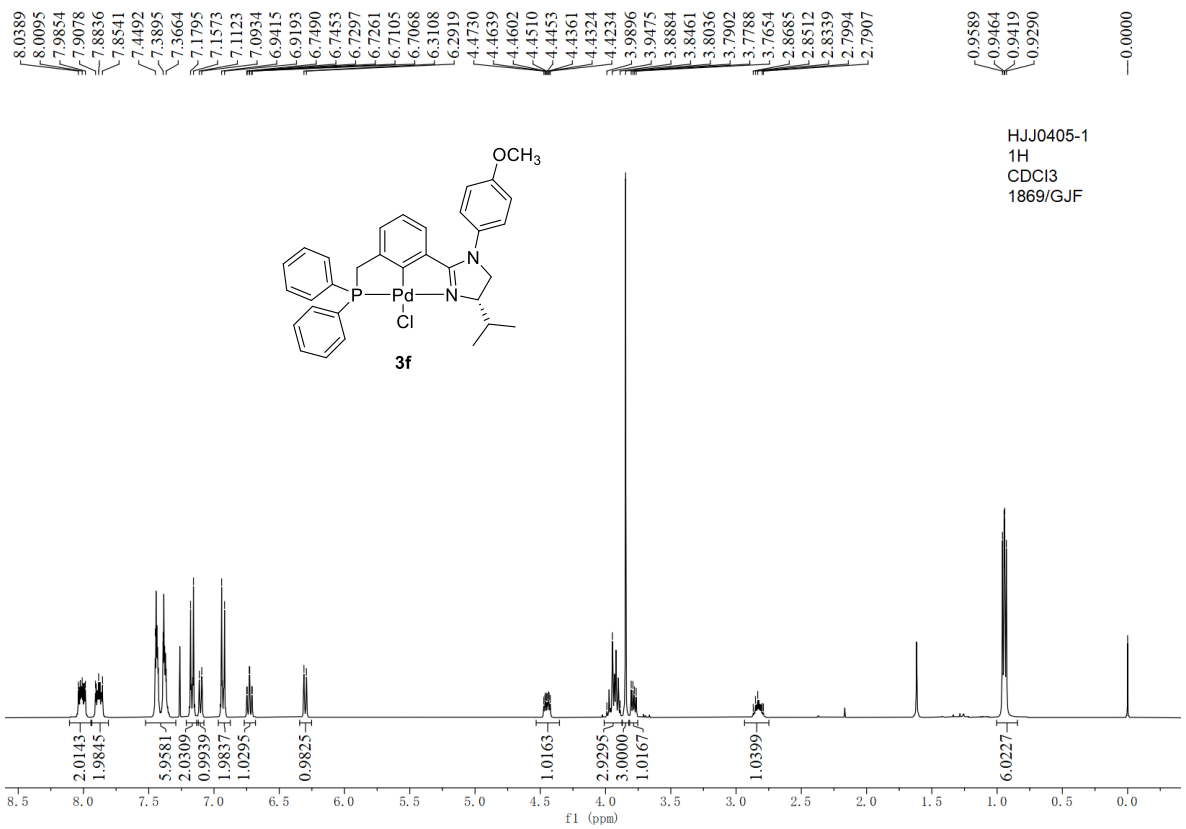
^{1}H NMR spectrum of **3e** (400 MHz, $CDCl_3$)



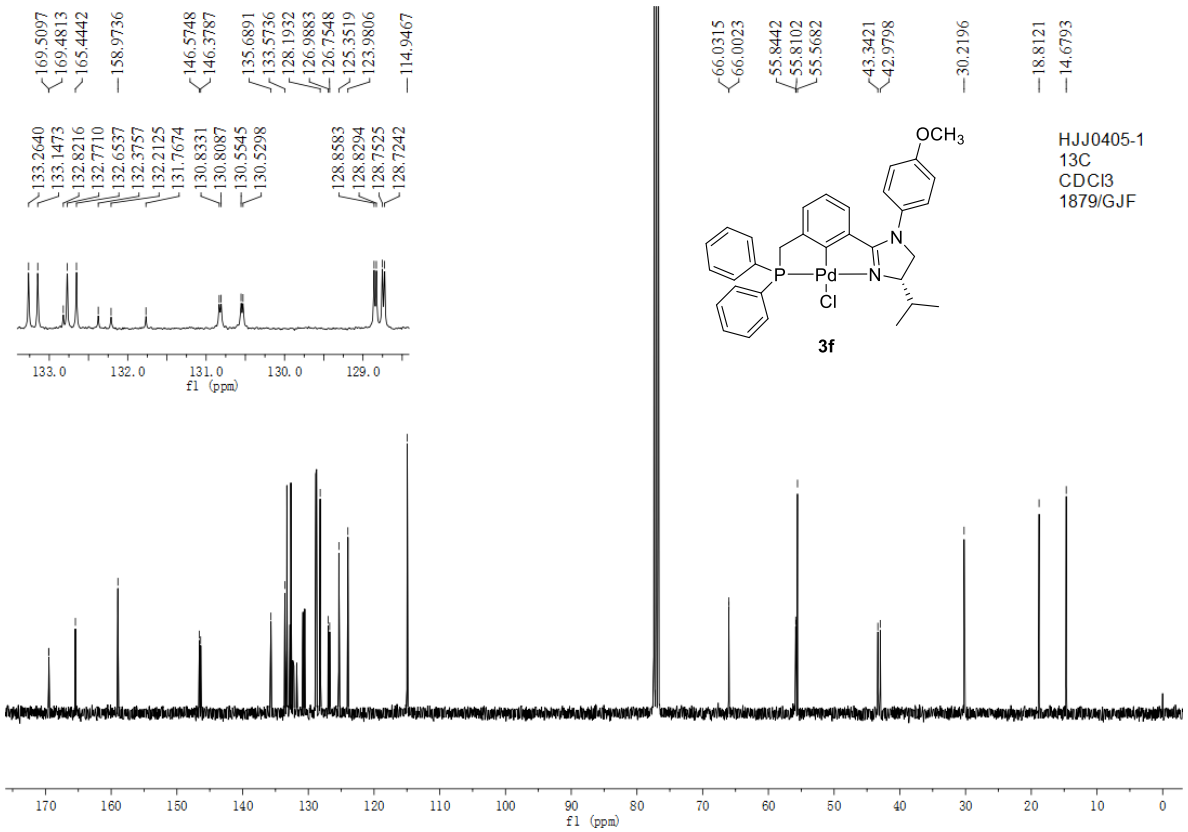
$^{13}C\{^{1}H\}$ NMR spectrum of **3e** (100 MHz, $CDCl_3$)



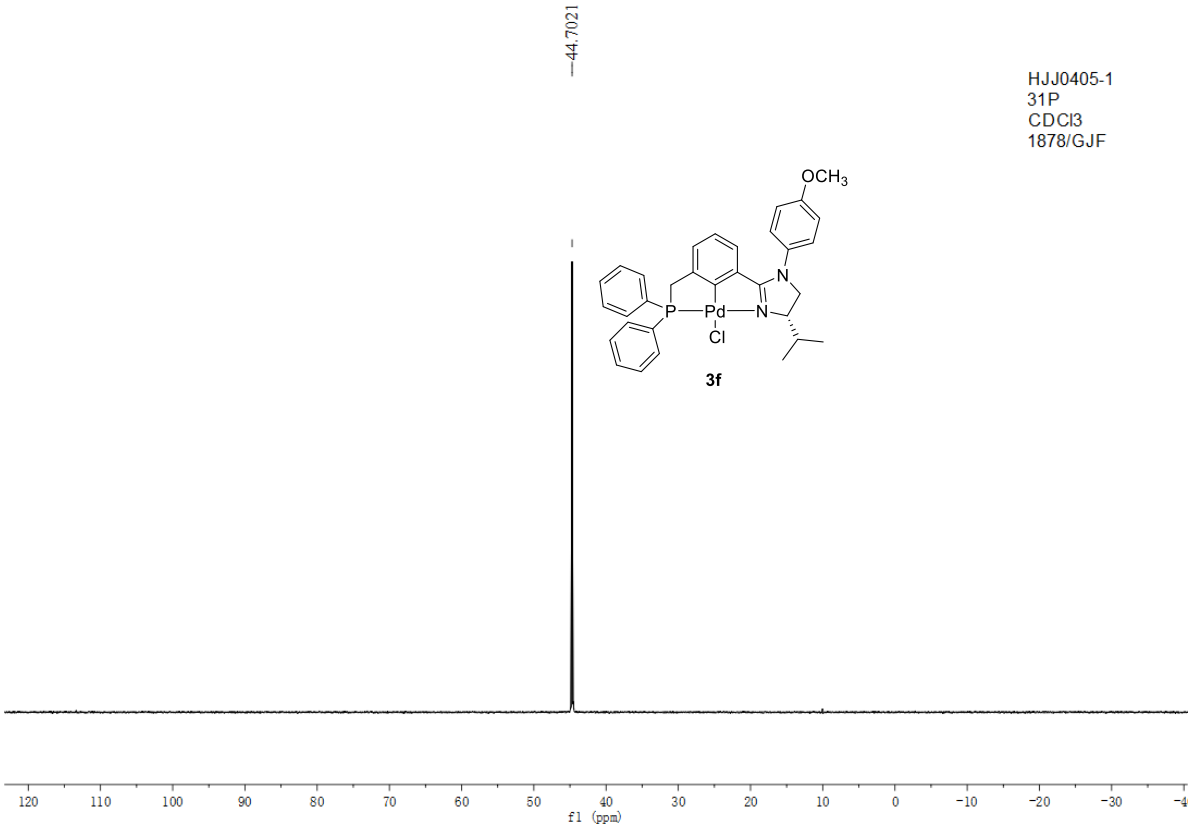
$^{31}P\{^{1}H\}$ NMR spectrum of **3e** (162 MHz, $CDCl_3$)



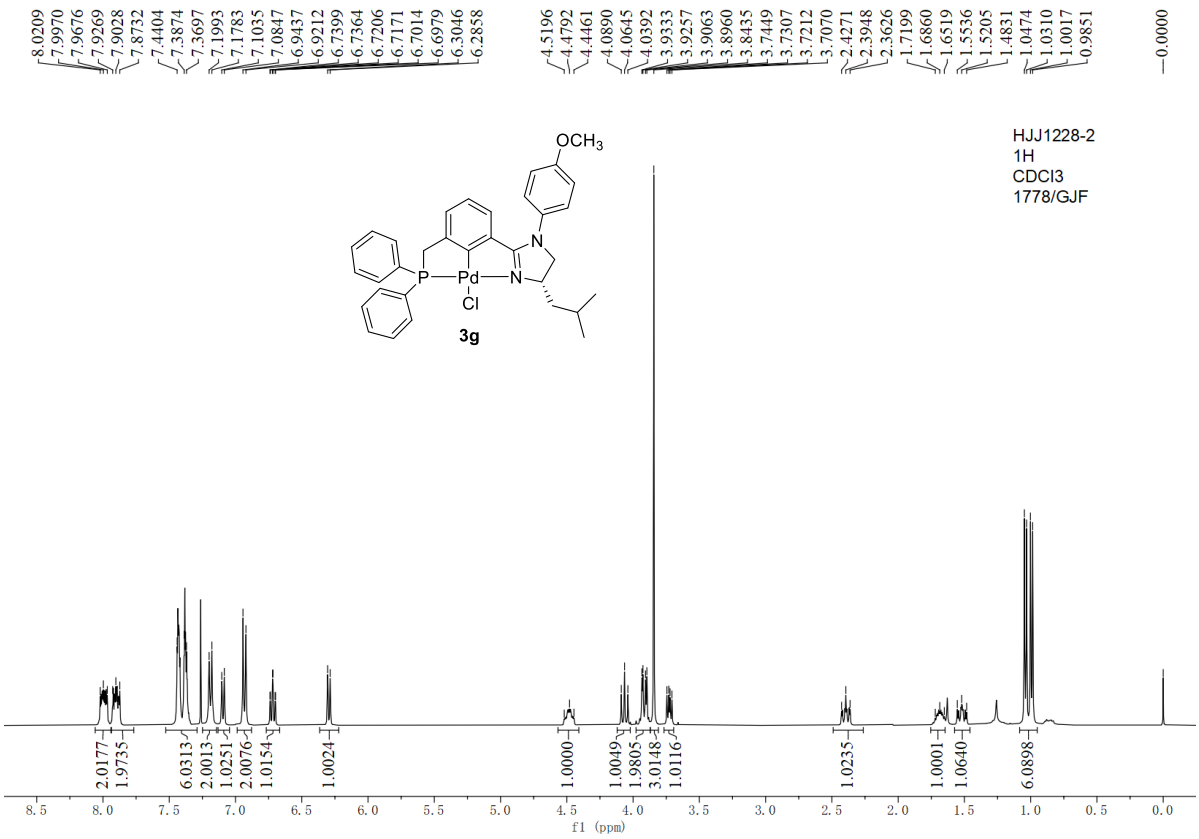
^{1}H NMR spectrum of **3f** (400 MHz, $CDCl_3$)



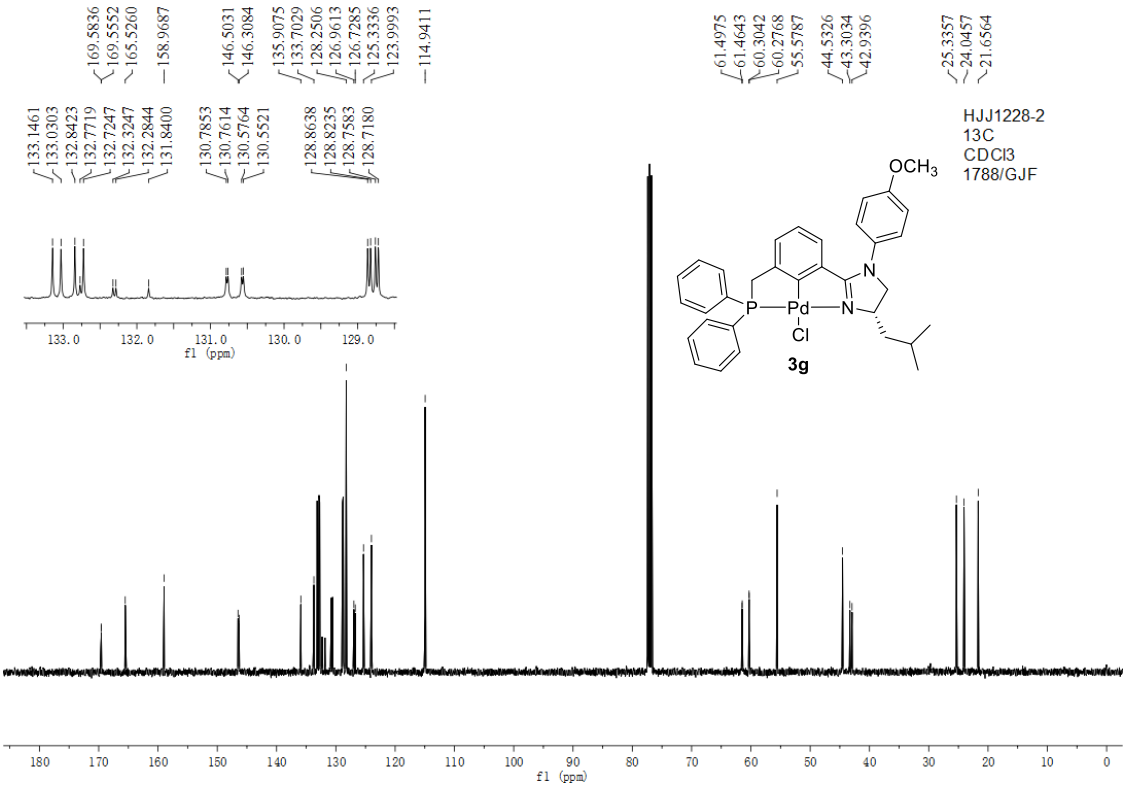
$^{13}C\{^{1}H\}$ NMR spectrum of **3f** (100 MHz, $CDCl_3$)



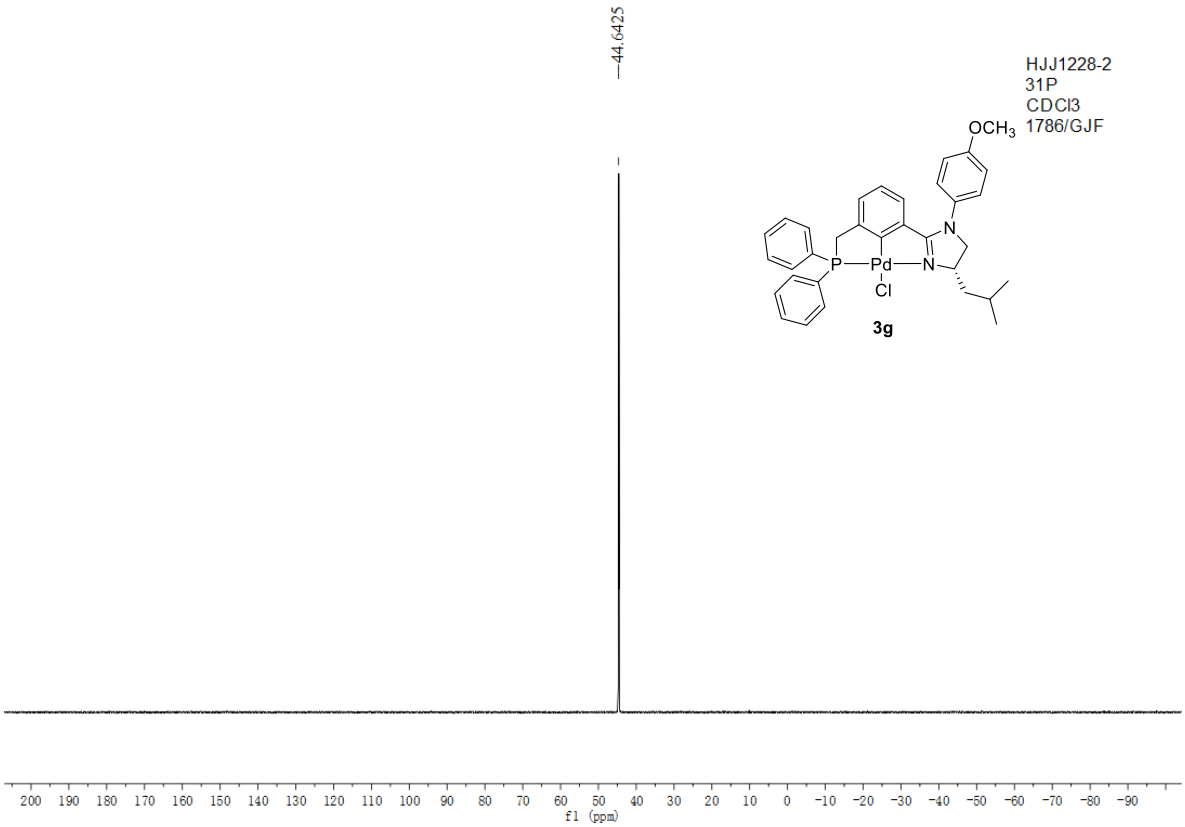
$^{31}P\{^{1}H\}$ NMR spectrum of **3f** (162 MHz, $CDCl_3$)



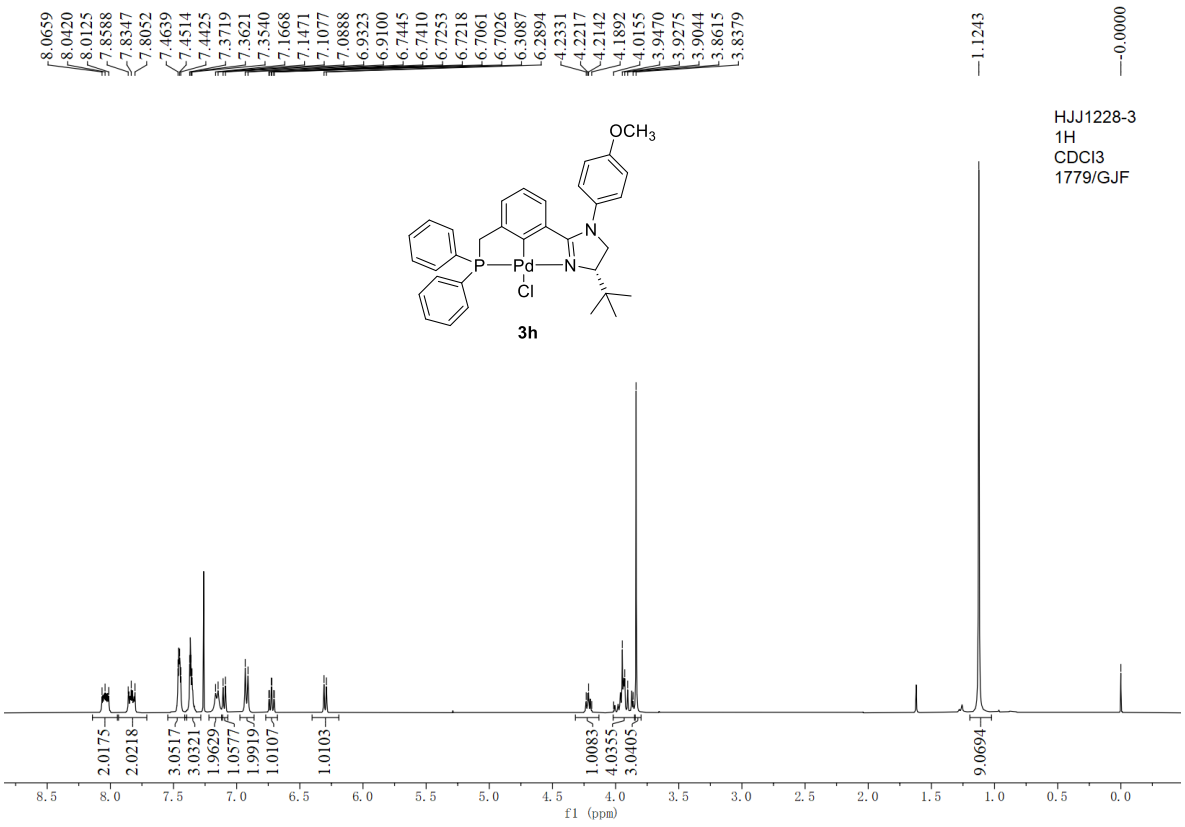
^{1}H NMR spectrum of **3g** (400 MHz, $CDCl_3$)



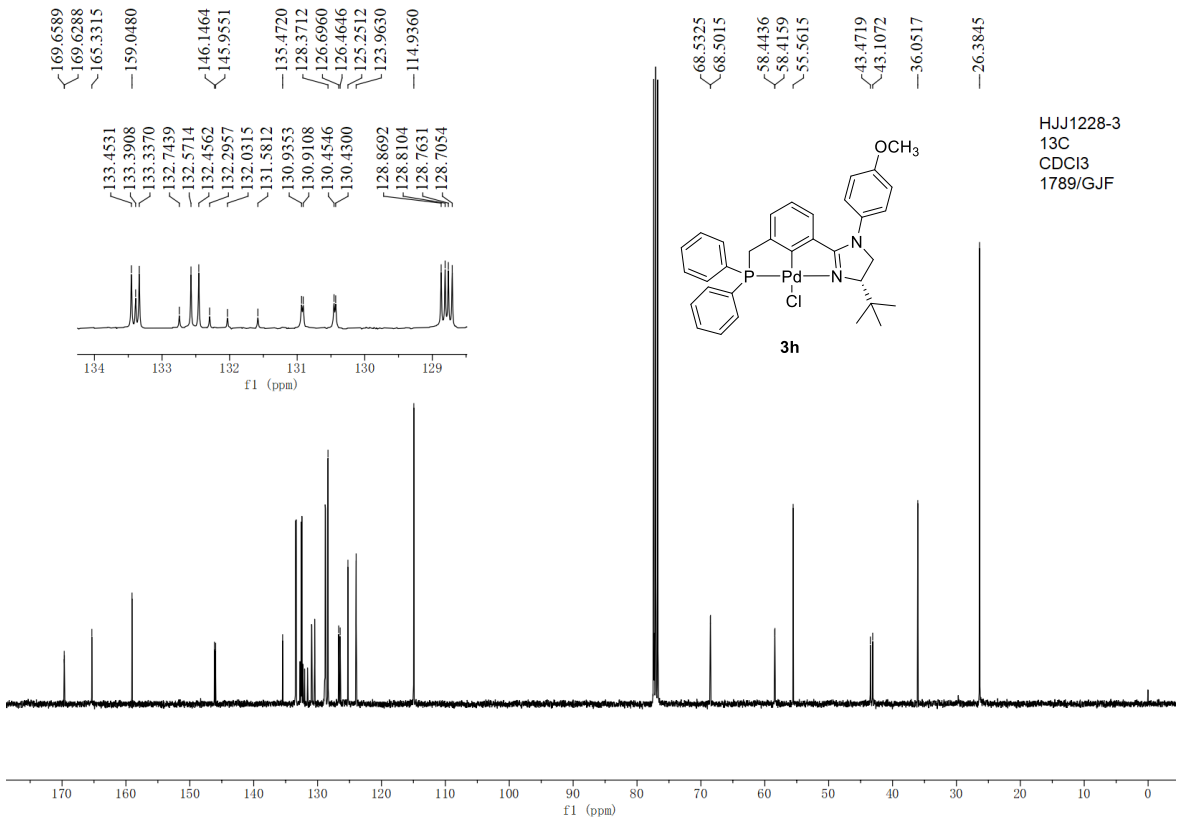
^{13}C{^{1}H} NMR spectrum of **3g** (100 MHz, $CDCl_3$)



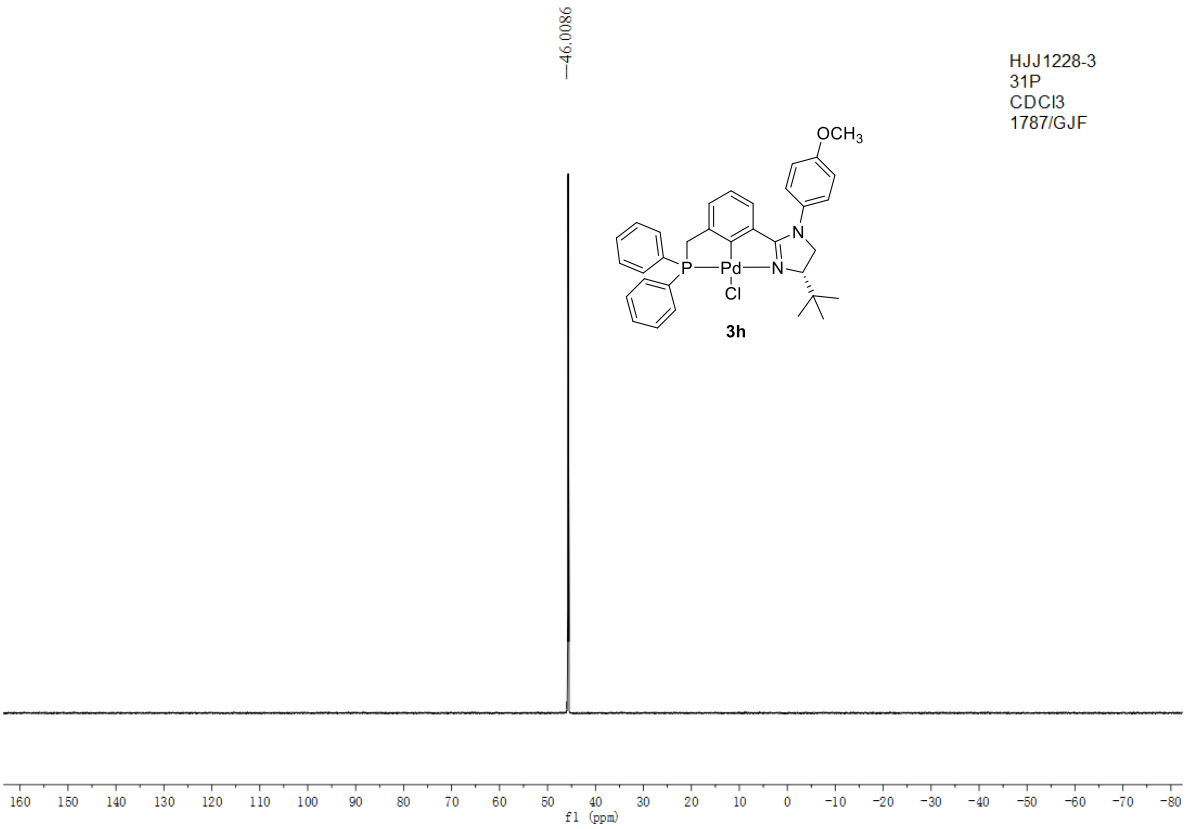
$^{31}P\{^{1}H\}$ NMR spectrum of **3g** (162 MHz, $CDCl_3$)



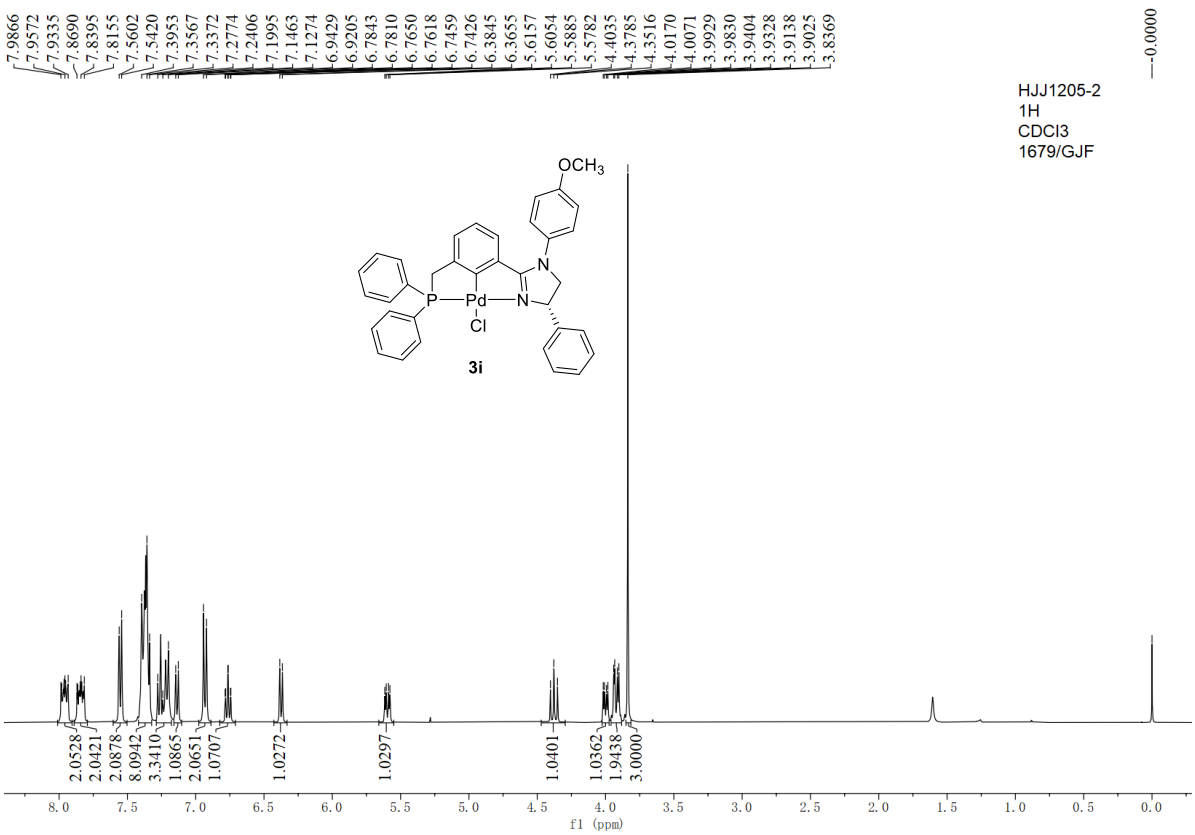
^{1}H NMR spectrum of **3h** (400 MHz, $CDCl_3$)



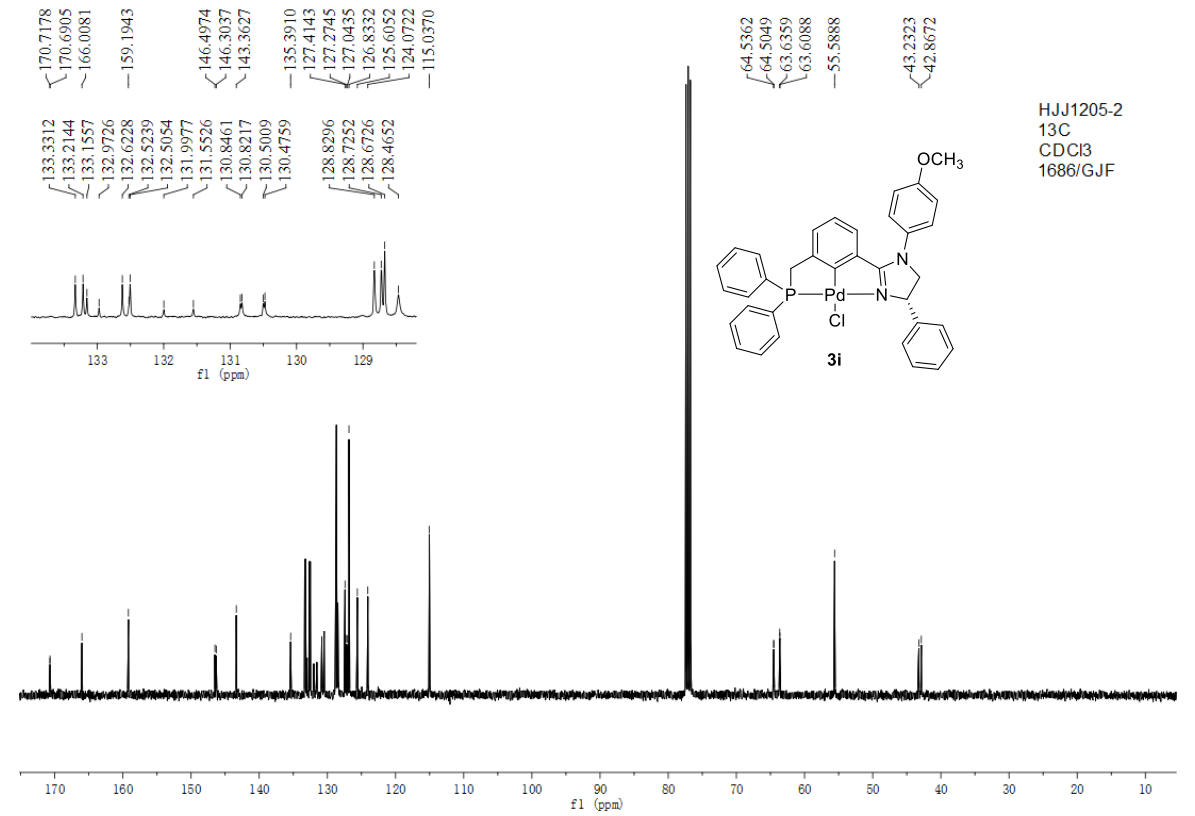
$^{13}C\{^{1}H\}$ NMR spectrum of **3h** (100 MHz, $CDCl_3$)



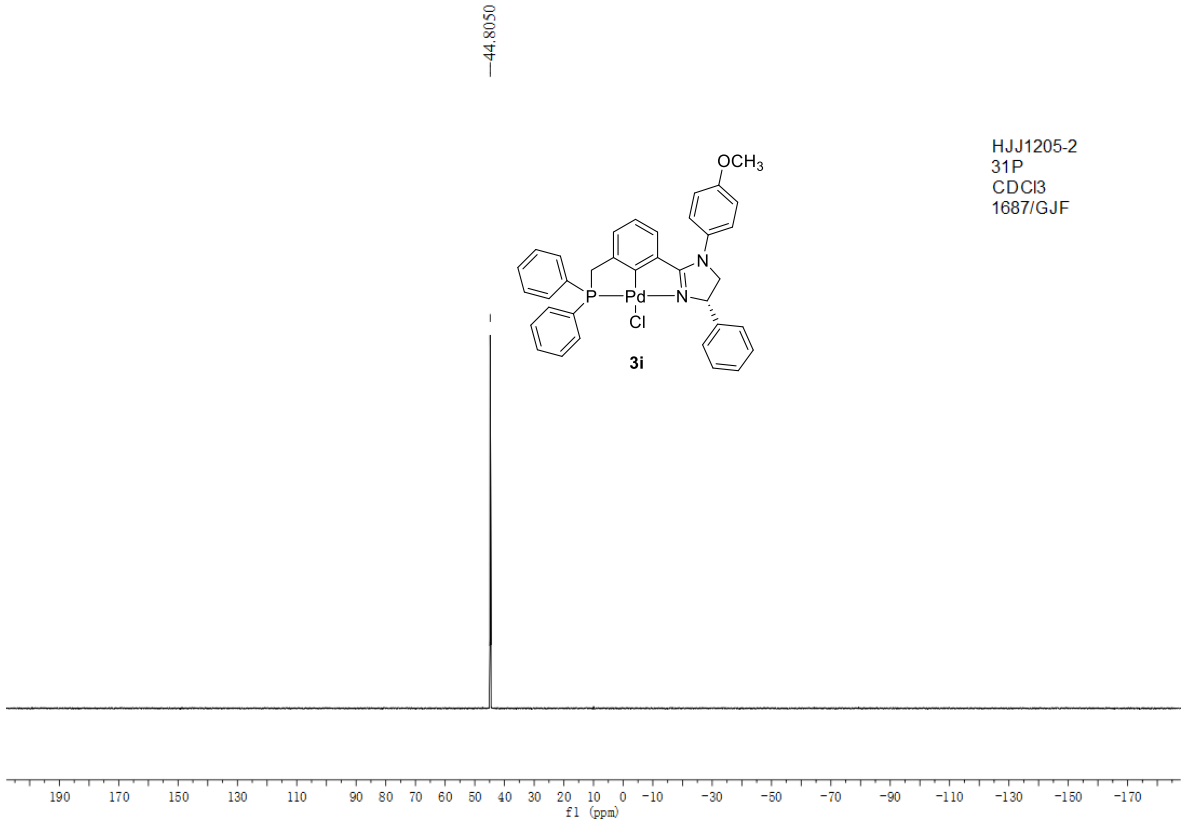
$^{31}P\{^{1}H\}$ NMR spectrum of **3h** (162 MHz, $CDCl_3$)



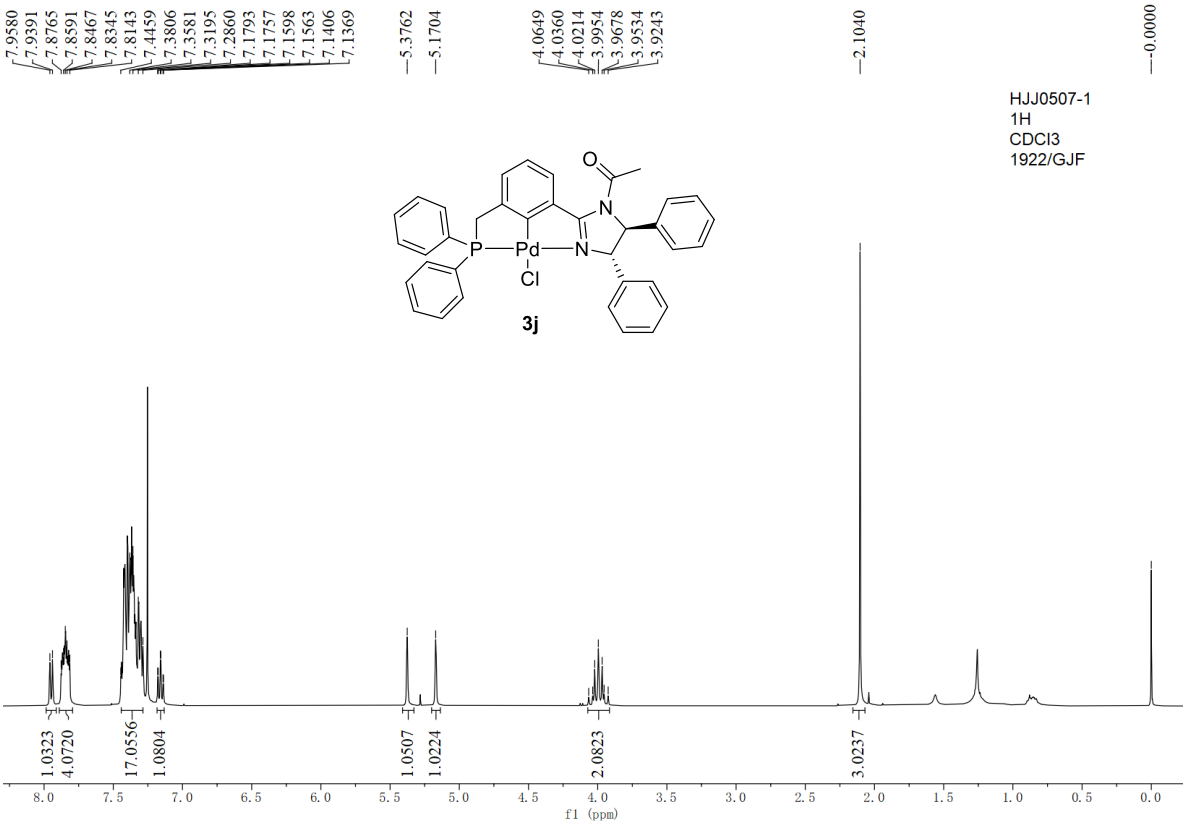
^{1}H NMR spectrum of **3i** (400 MHz, $CDCl_3$)



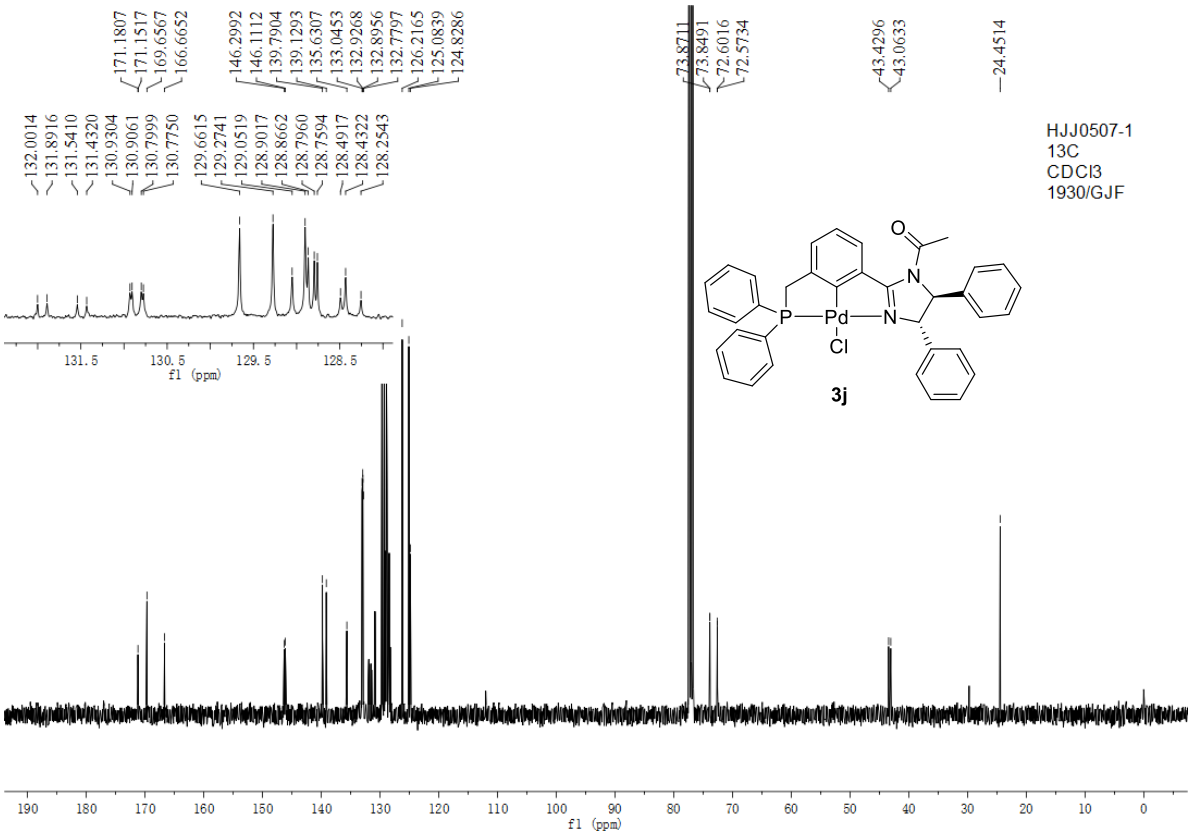
^{13}C{^{1}H} NMR spectrum of **3i** (100 MHz, $CDCl_3$)



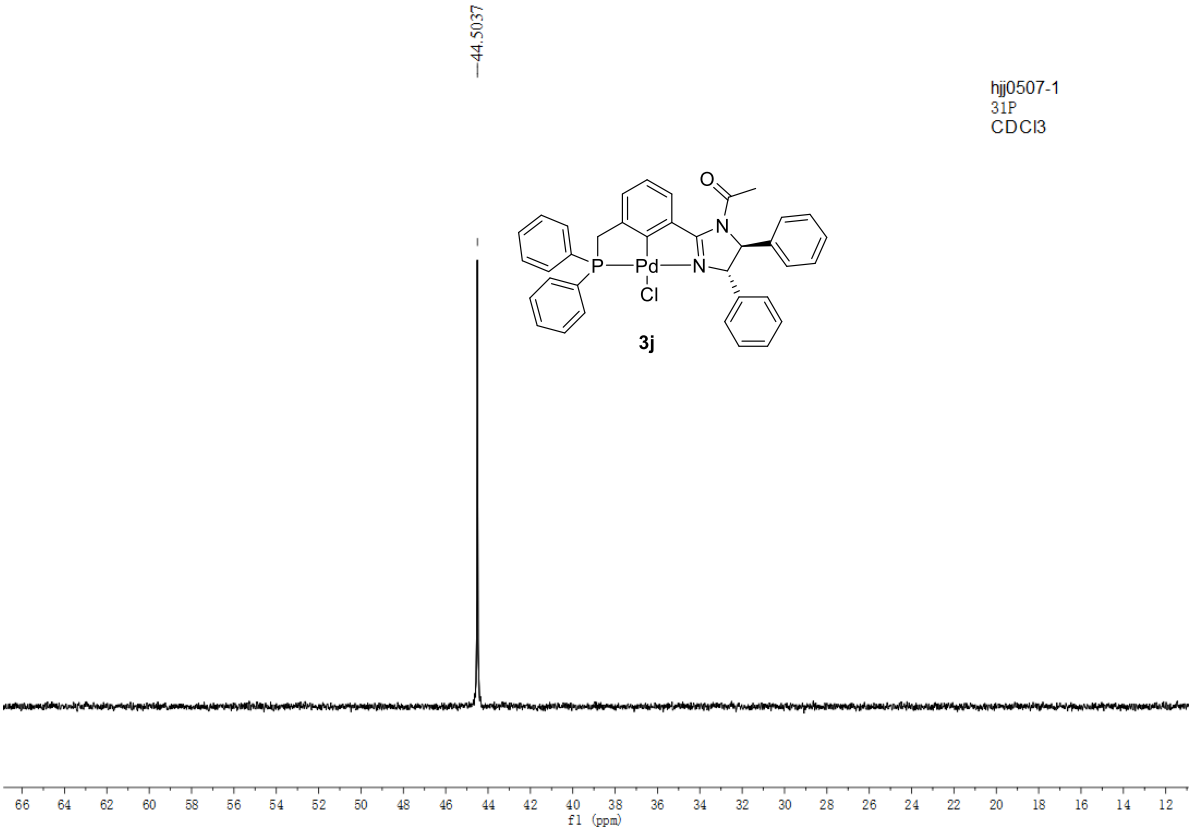
$^{31}P\{^{1}H\}$ NMR spectrum of **3i** (162 MHz, $CDCl_3$)



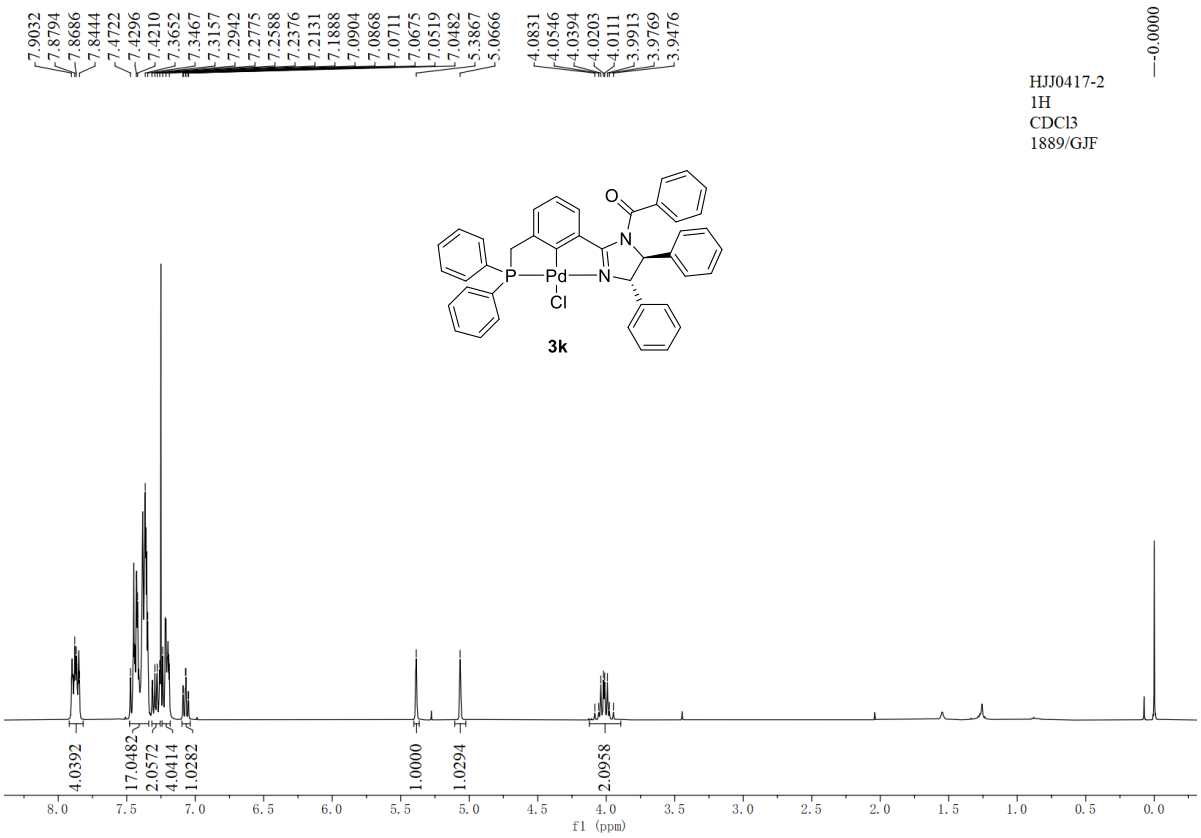
^{1}H NMR spectrum of **3j** (400 MHz, $CDCl_3$)



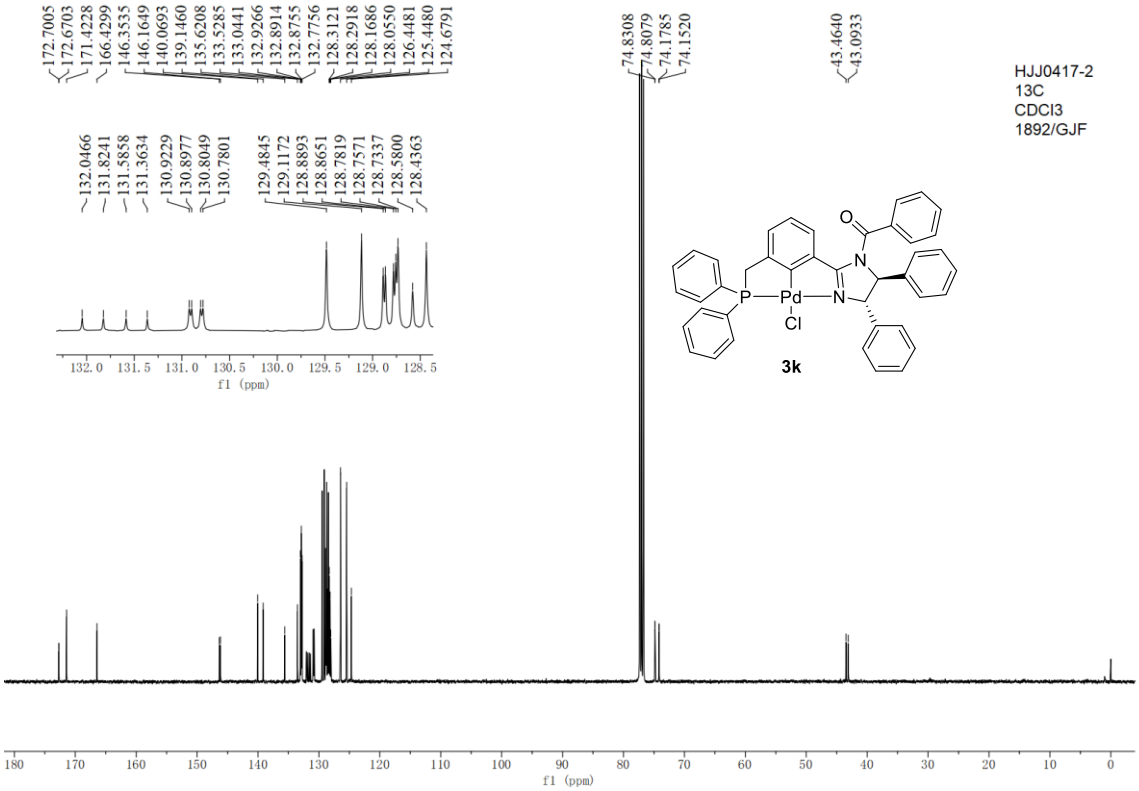
$^{13}C\{^{1}H\}$ NMR spectrum of **3j** (100 MHz, $CDCl_3$)



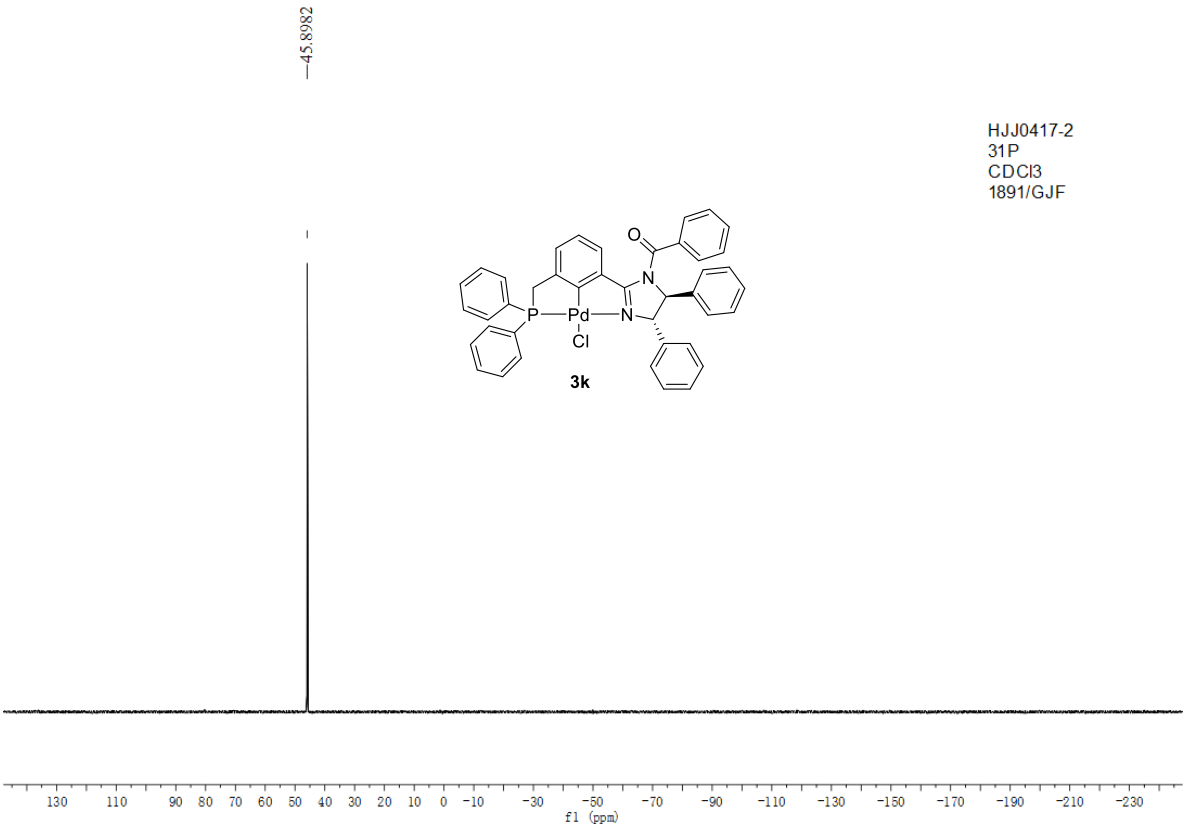
$^{31}P\{^{1}H\}$ NMR spectrum of **3j** (162 MHz, $CDCl_3$)



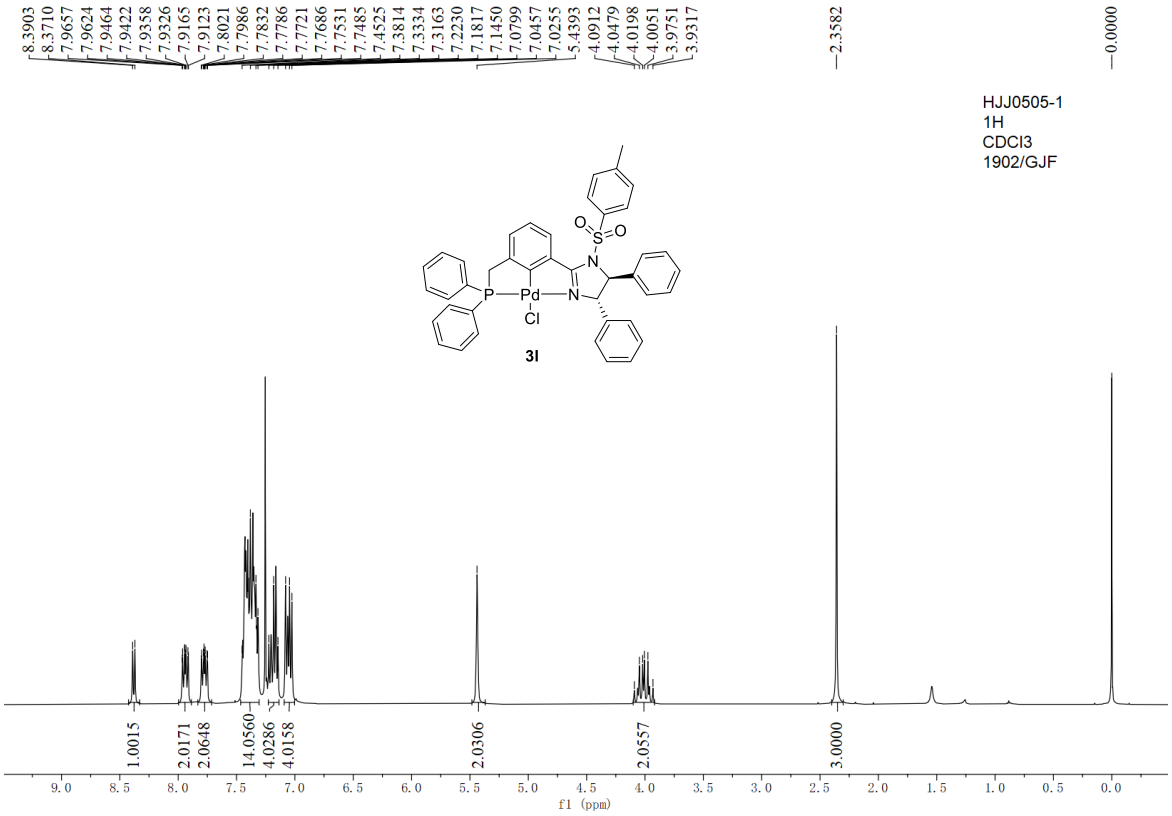
^{1}H NMR spectrum of **3k** (400 MHz, $CDCl_3$)



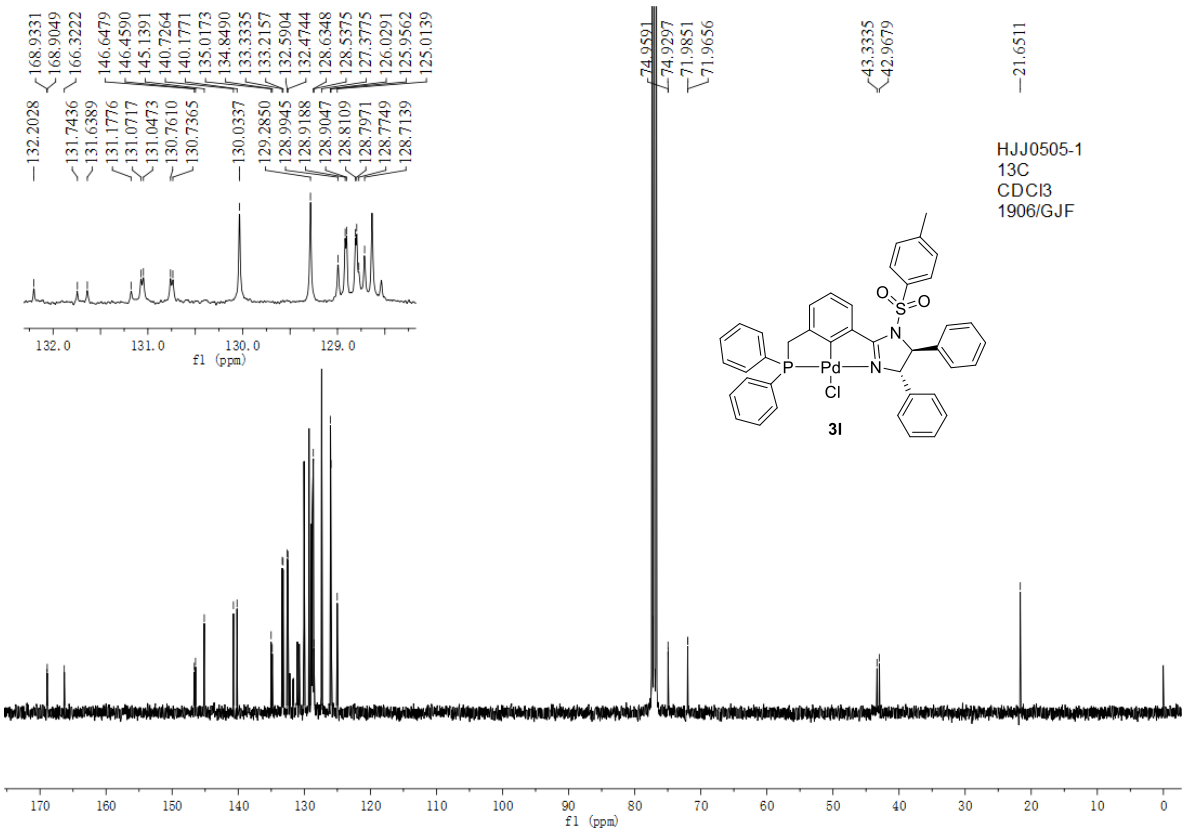
^{13}C{^{1}H} NMR spectrum of **3k** (100 MHz, $CDCl_3$)



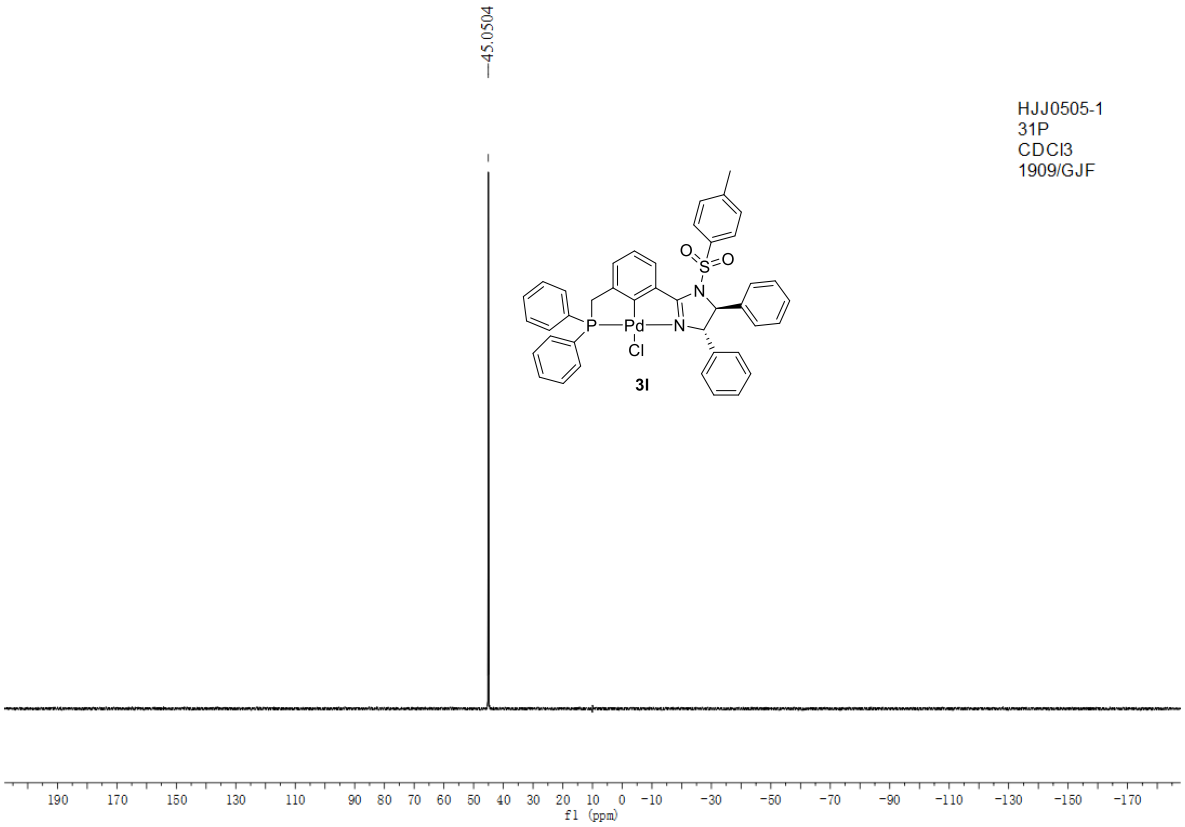
$^{31}P\{^{1}H\}$ NMR spectrum of **3k** (162 MHz, $CDCl_3$)



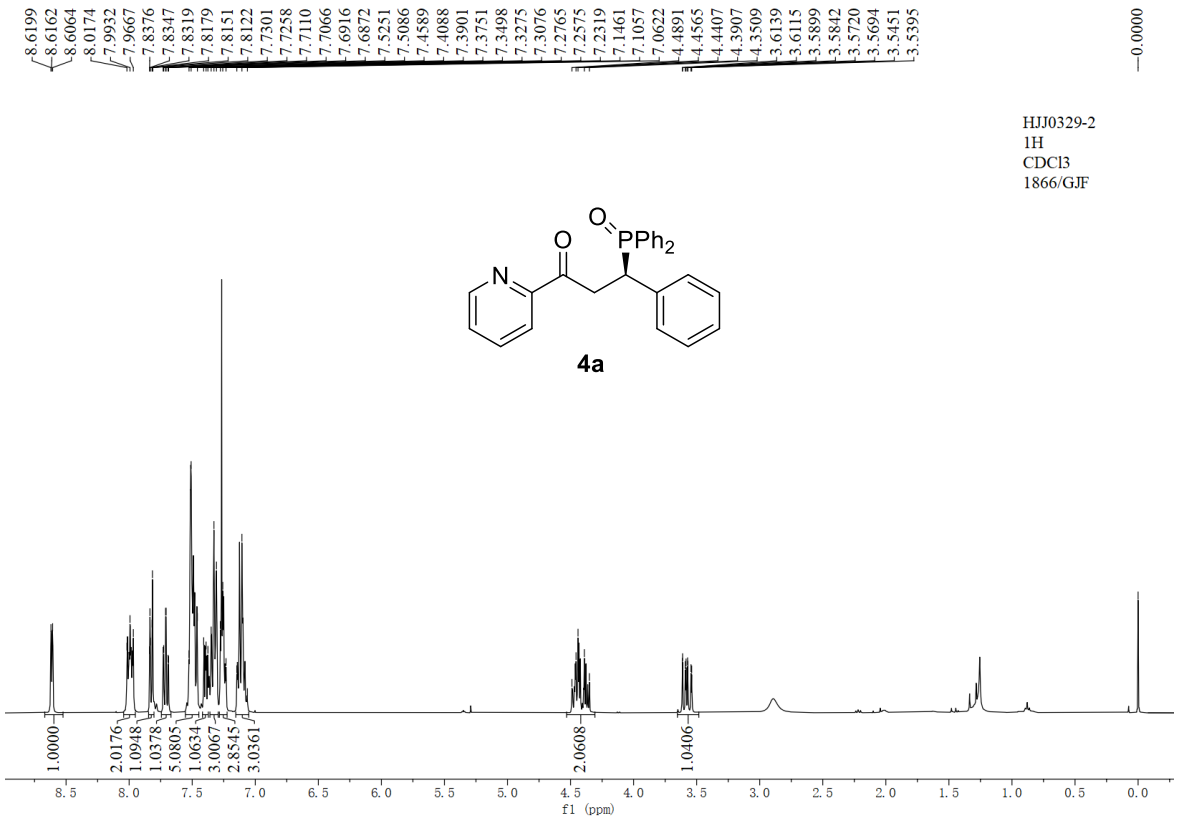
^{1}H NMR spectrum of **3l** (400 MHz, $CDCl_3$)



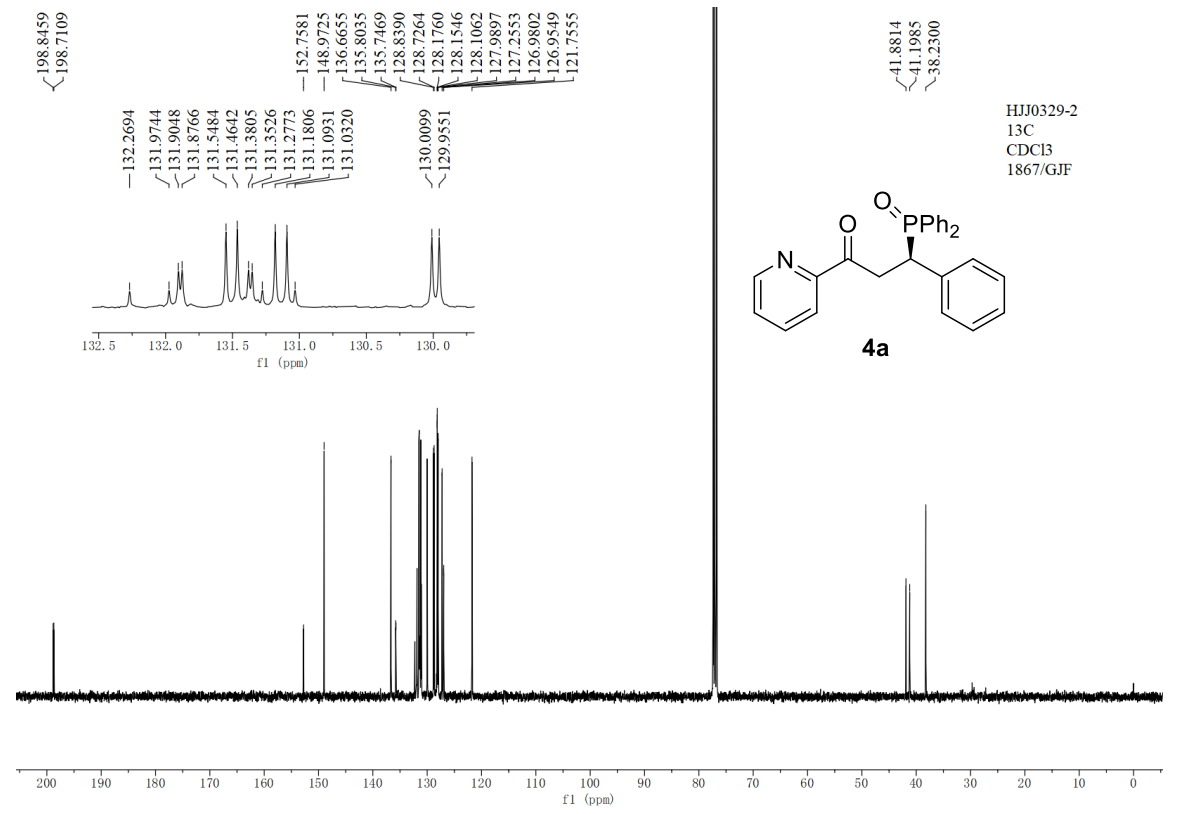
$^{13}C\{^{1}H\}$ NMR spectrum of **3l** (100 MHz, $CDCl_3$)



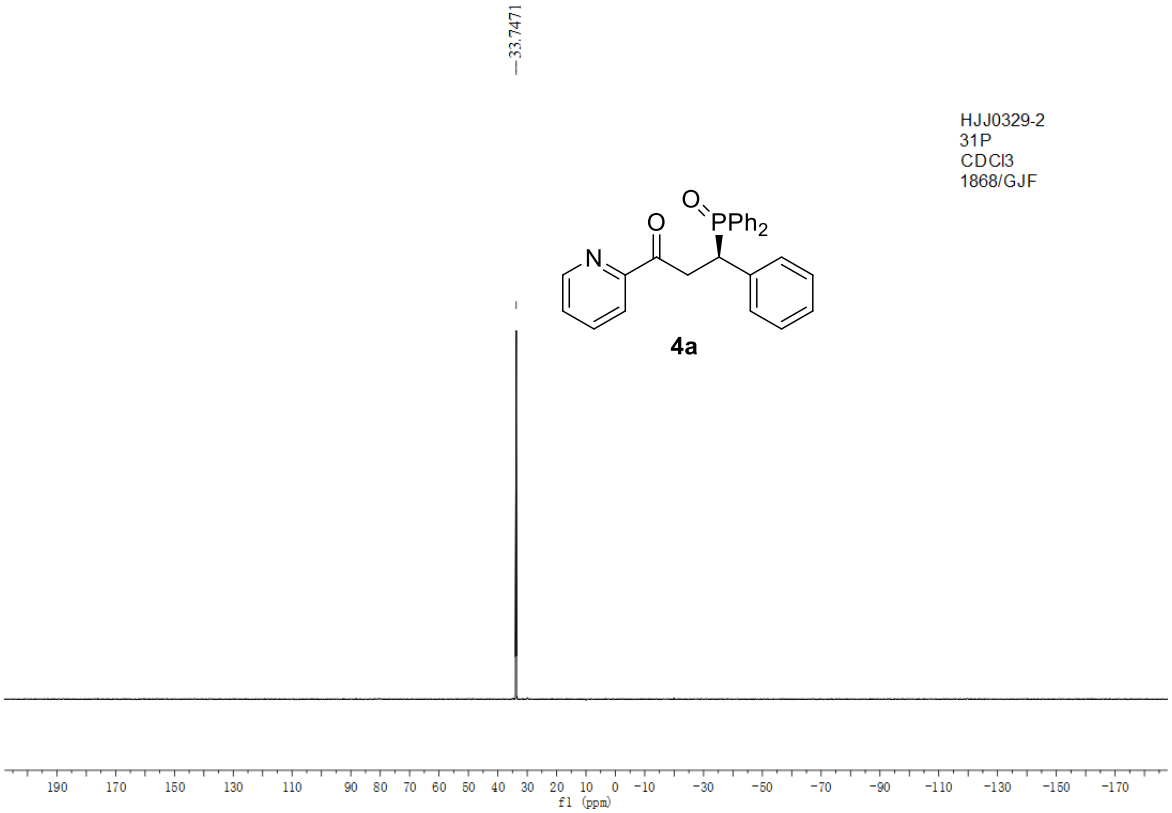
$^{31}P\{^{1}H\}$ NMR spectrum of **3l** (162 MHz, $CDCl_3$)



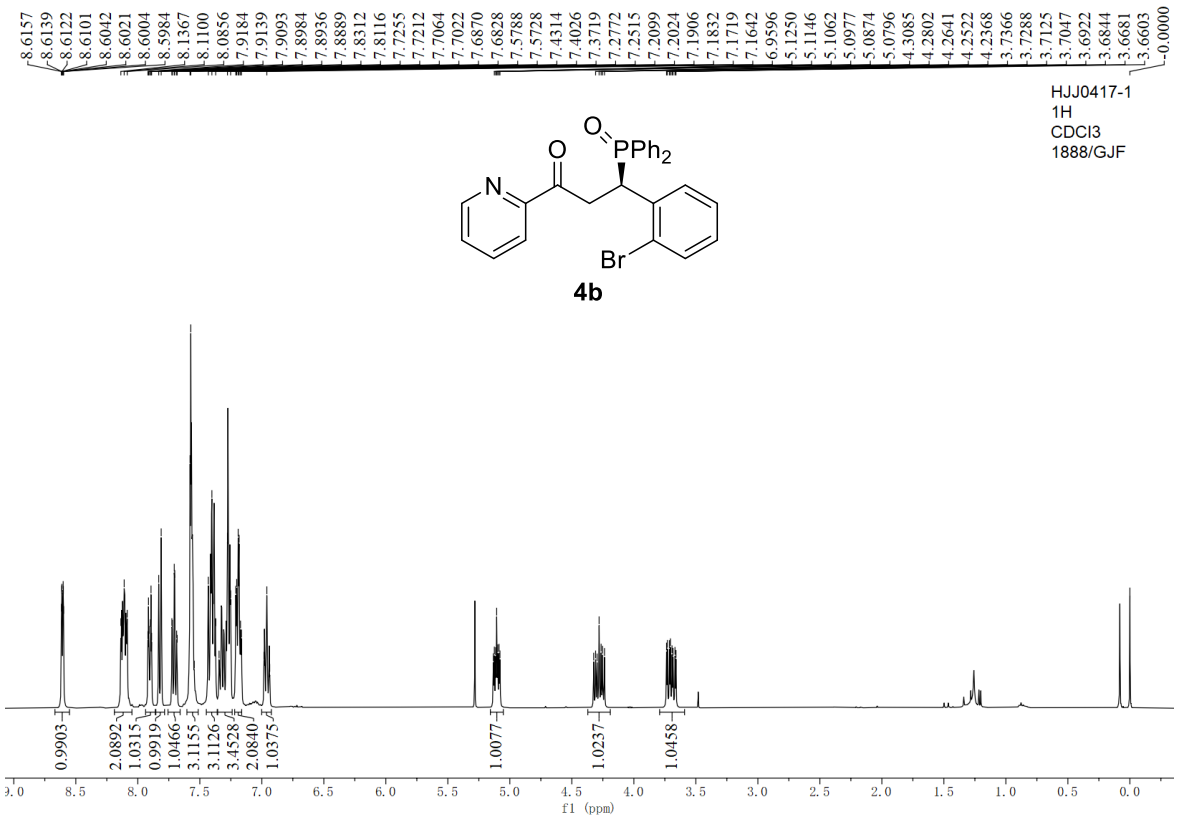
^{1}H NMR spectrum of **4a** (400 MHz, $CDCl_3$)



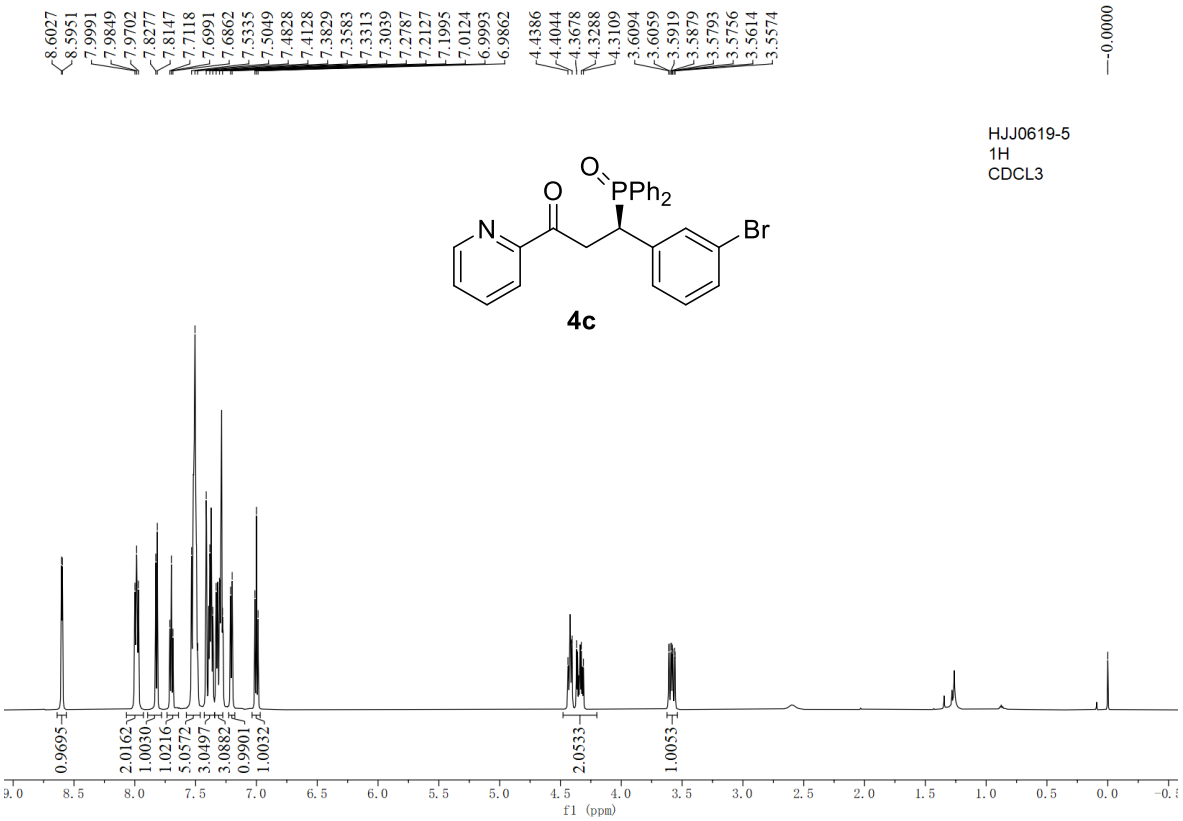
^{13}C{^{1}H} NMR spectrum of **4a** (100 MHz, $CDCl_3$)



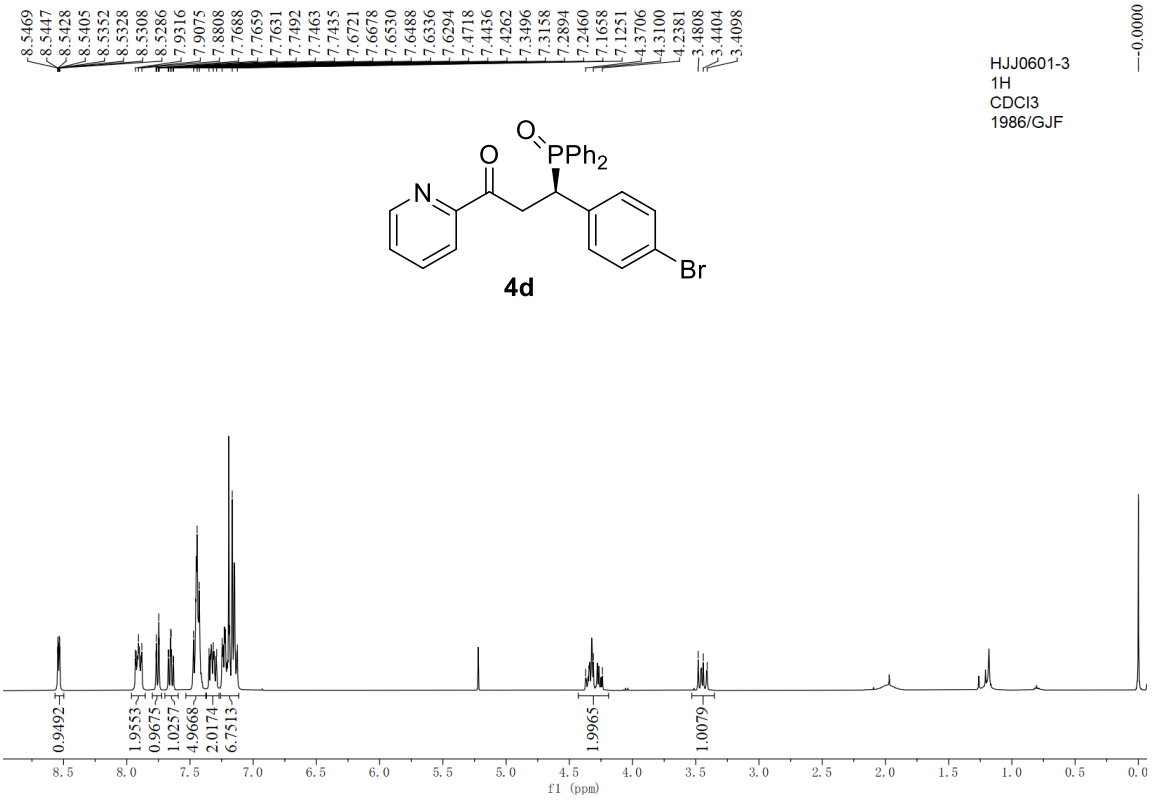
$^{31}P\{^{1}H\}$ NMR spectrum of **4a** (162 MHz, $CDCl_3$)



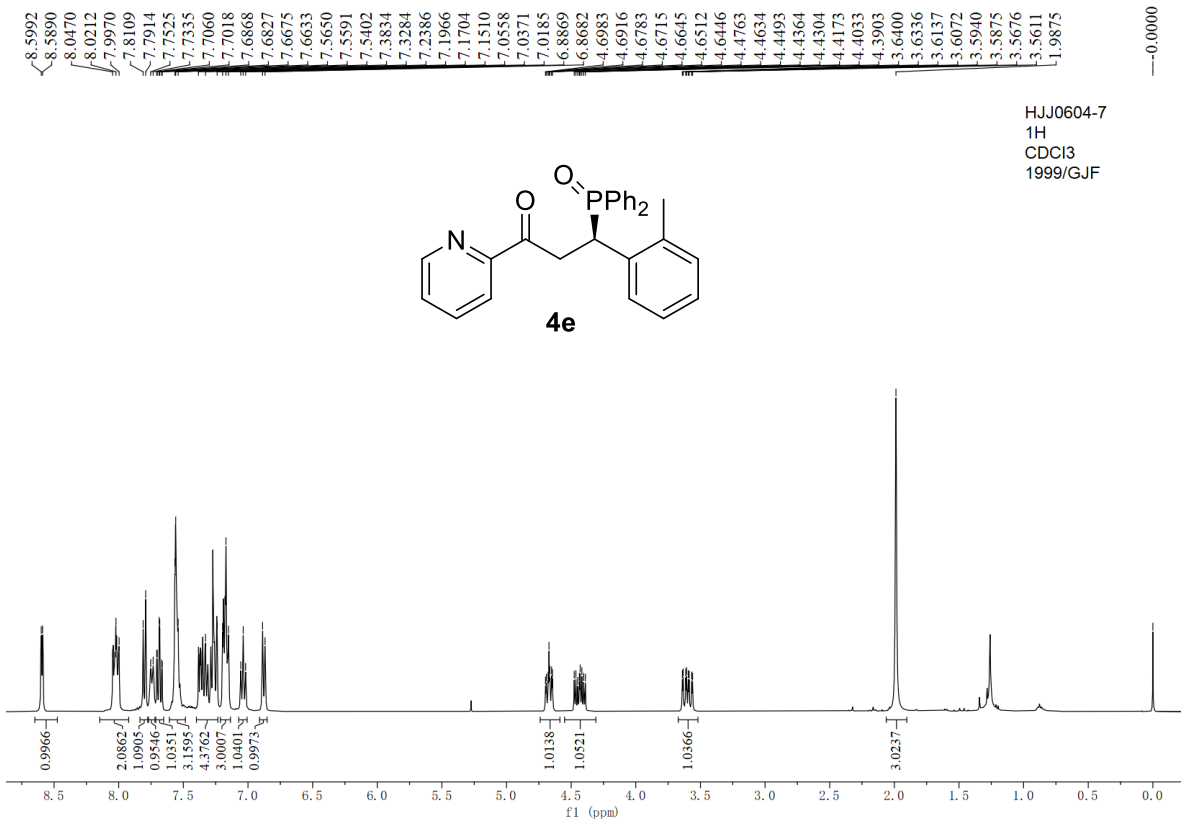
^{1}H NMR spectrum of **4b** (400 MHz, $CDCl_3$)



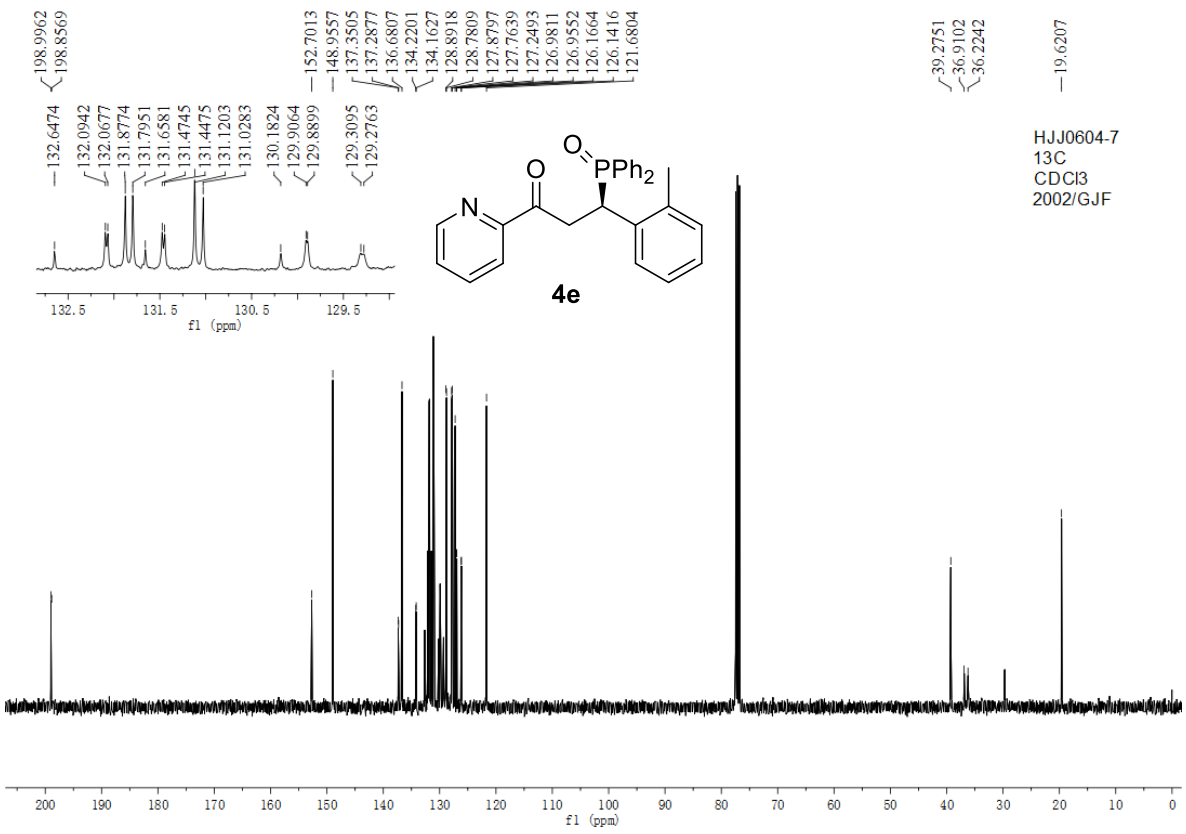
^{1}H NMR spectrum of **4c** (600 MHz, $CDCl_3$)



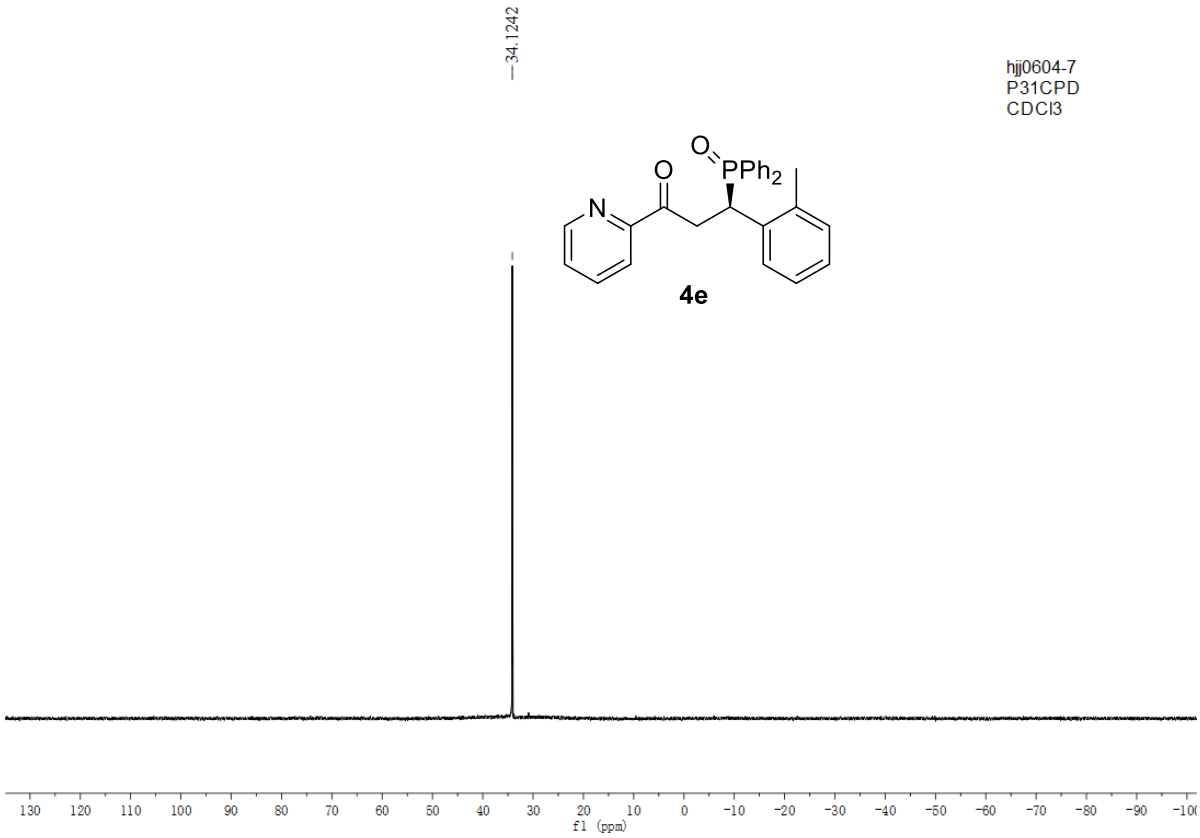
^{1}H NMR spectrum of **4d** (400 MHz, $CDCl_3$)



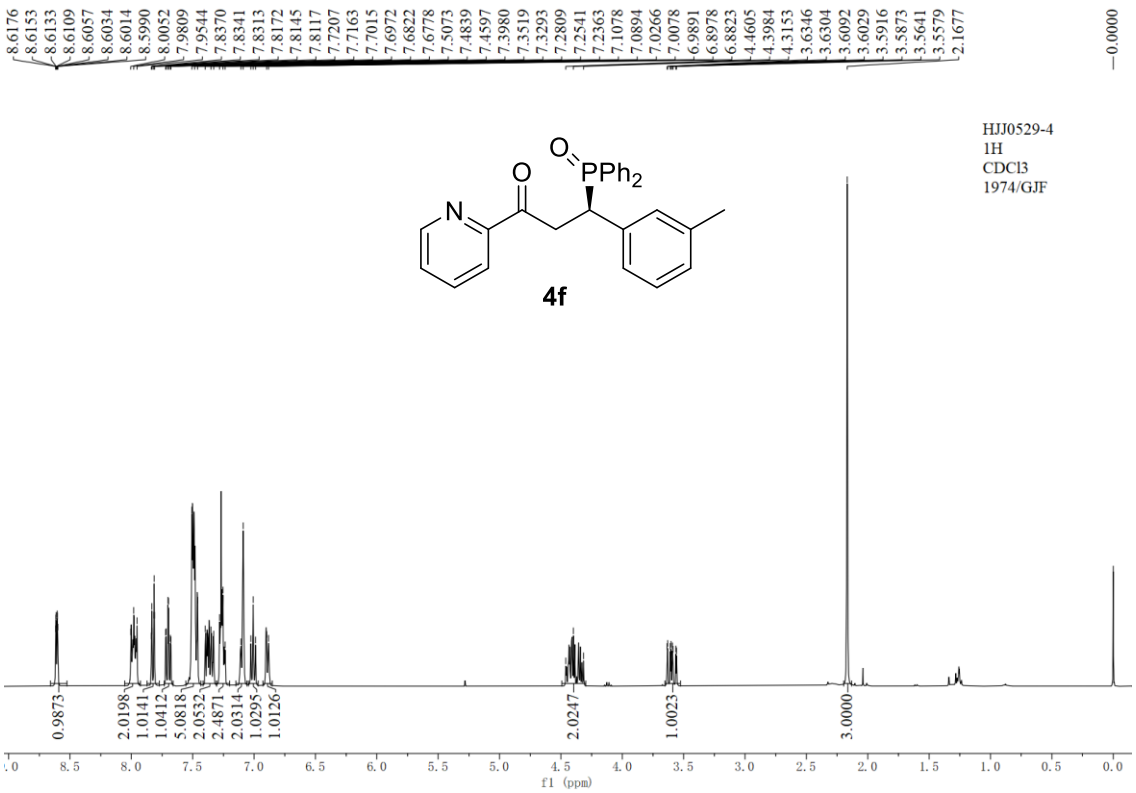
^{1}H NMR spectrum of **4e** (400 MHz, $CDCl_3$)



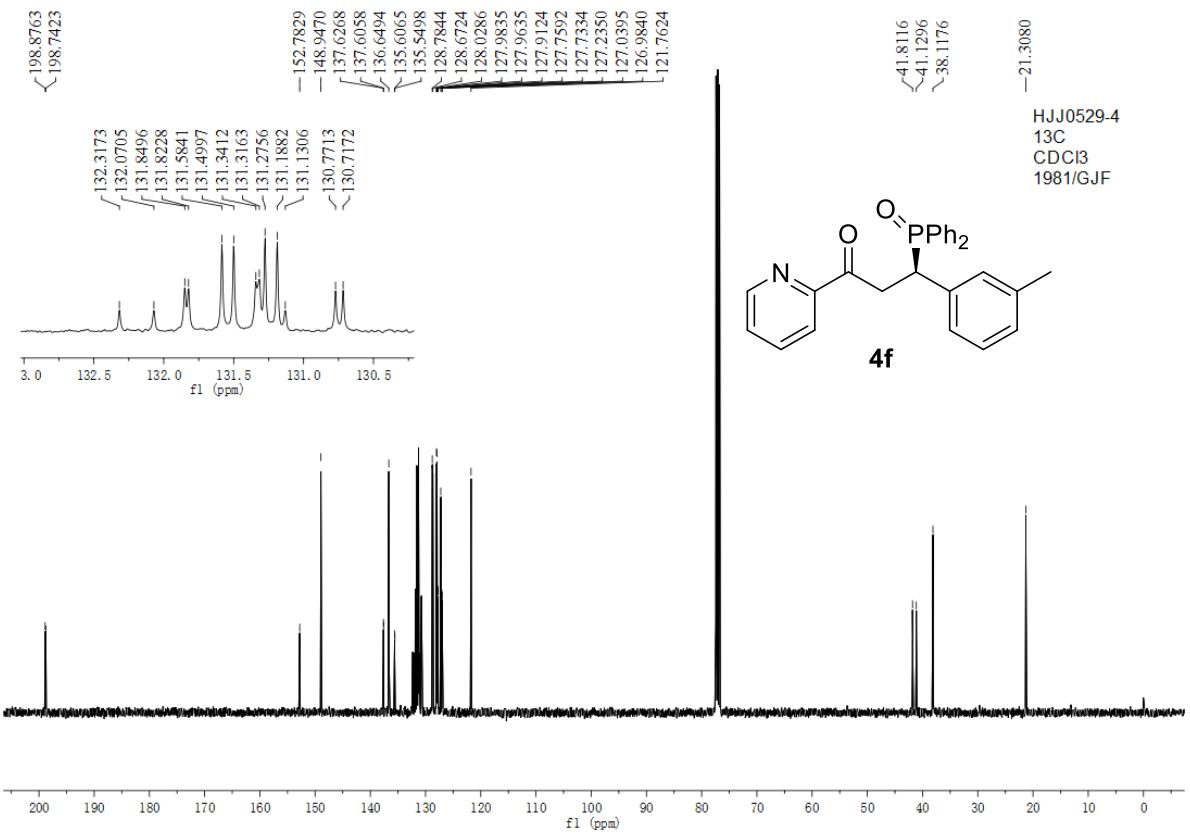
$^{13}C\{^{1}H\}$ NMR spectrum of **4e** (100 MHz, $CDCl_3$)



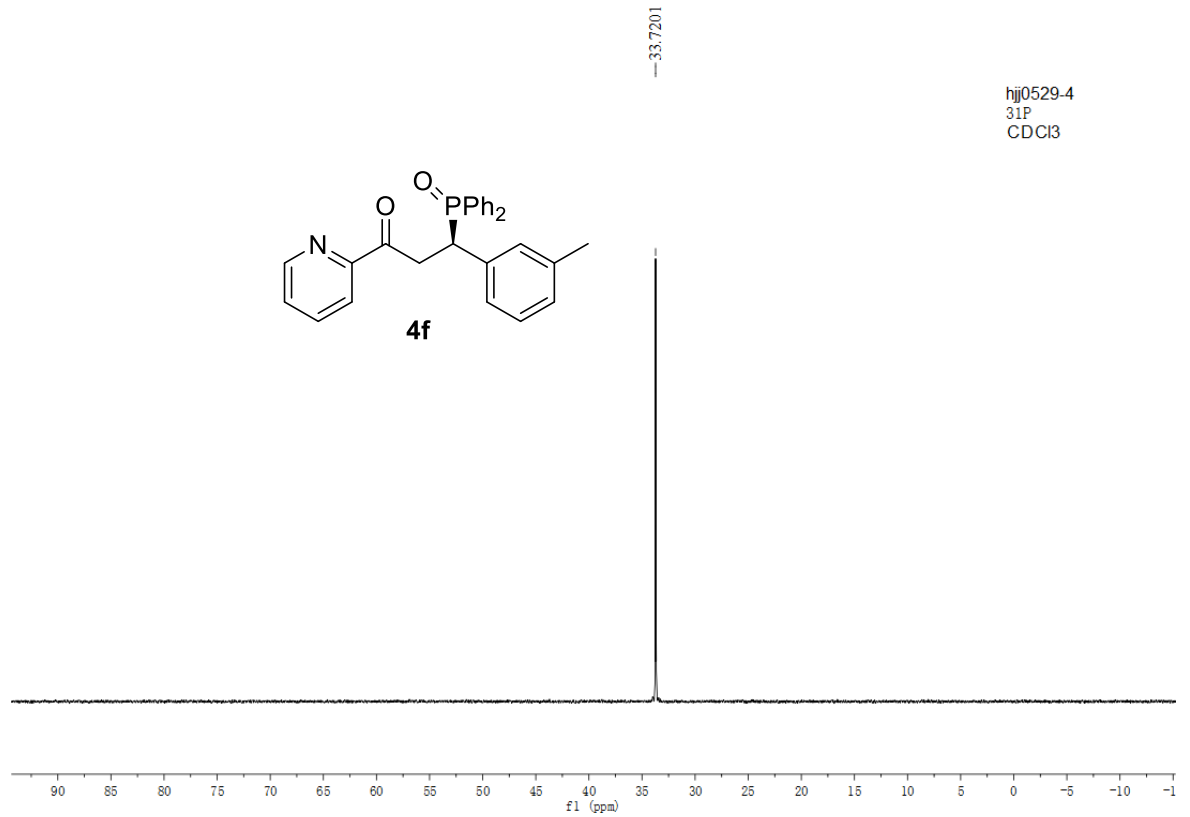
$^{31}P\{^{1}H\}$ NMR spectrum of **4e** (162 MHz, $CDCl_3$)



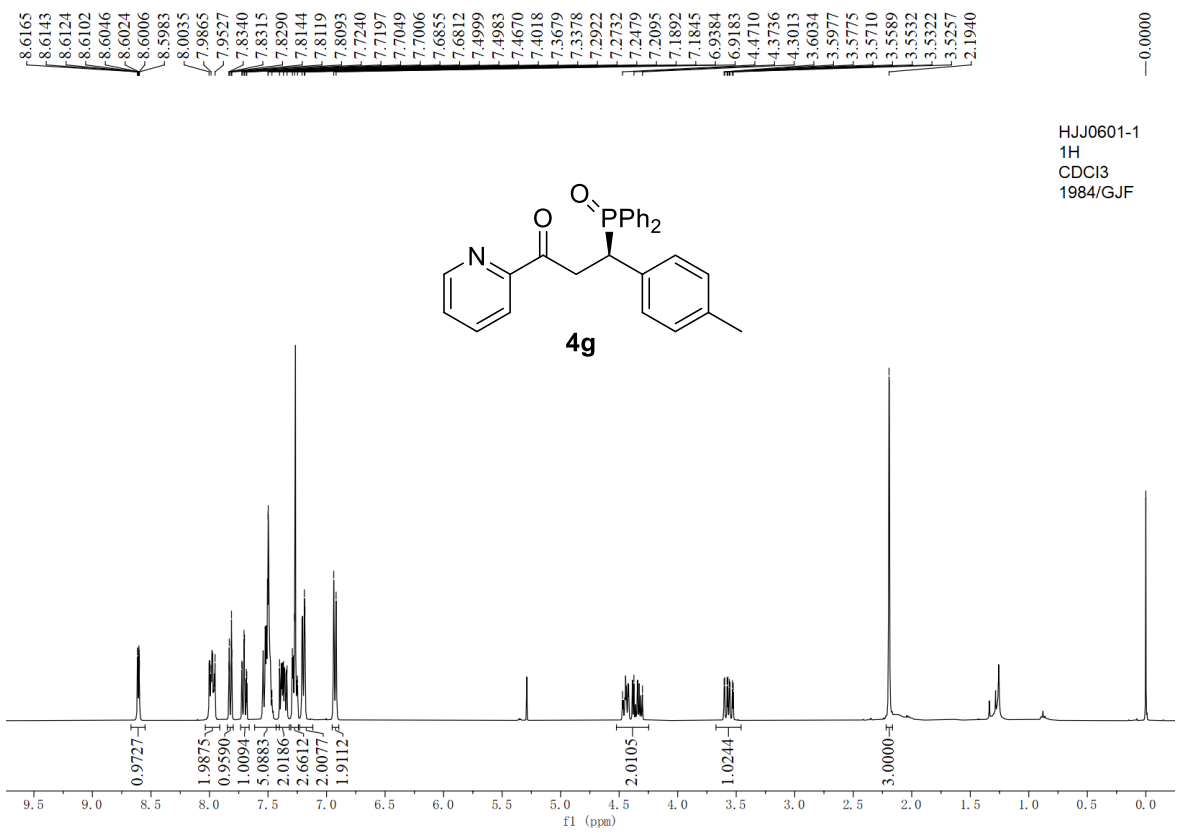
^{1}H NMR spectrum of **4f** (400 MHz, $CDCl_3$)



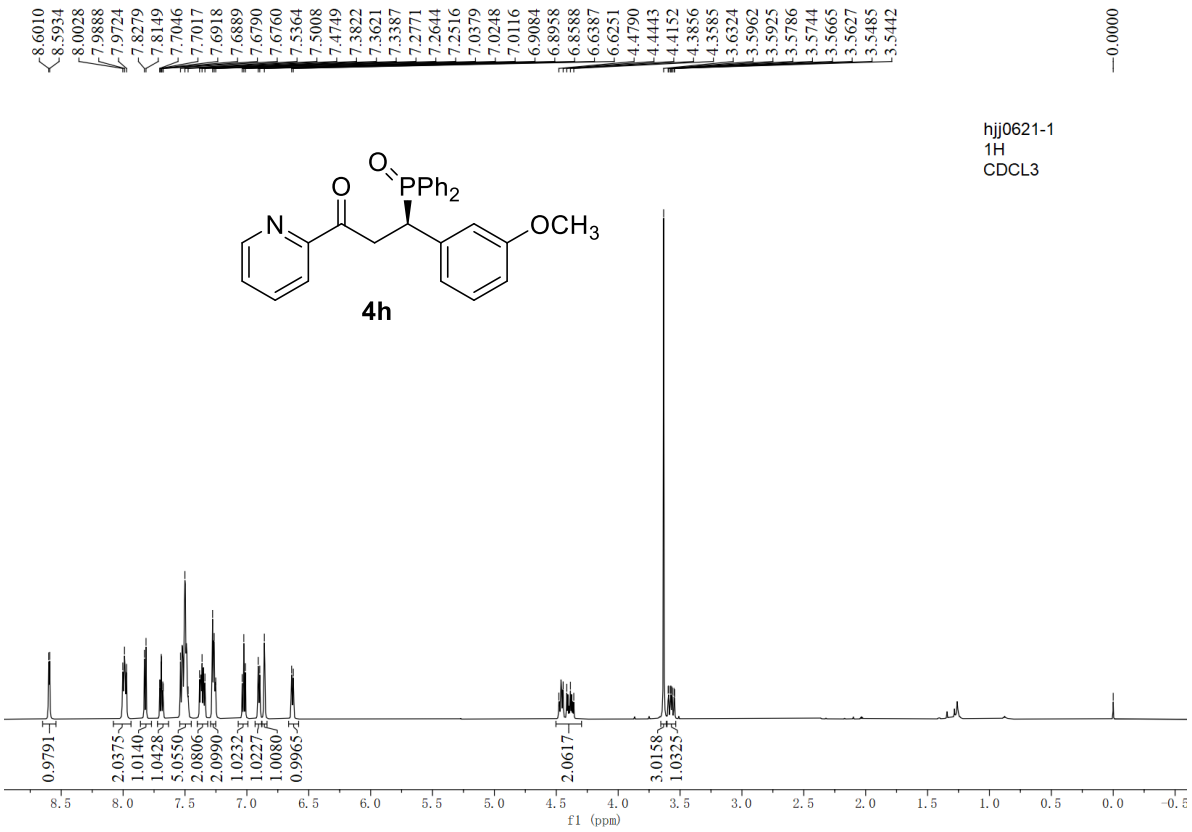
$^{13}C\{^{1}H\}$ NMR spectrum of **4f** (100 MHz, $CDCl_3$)



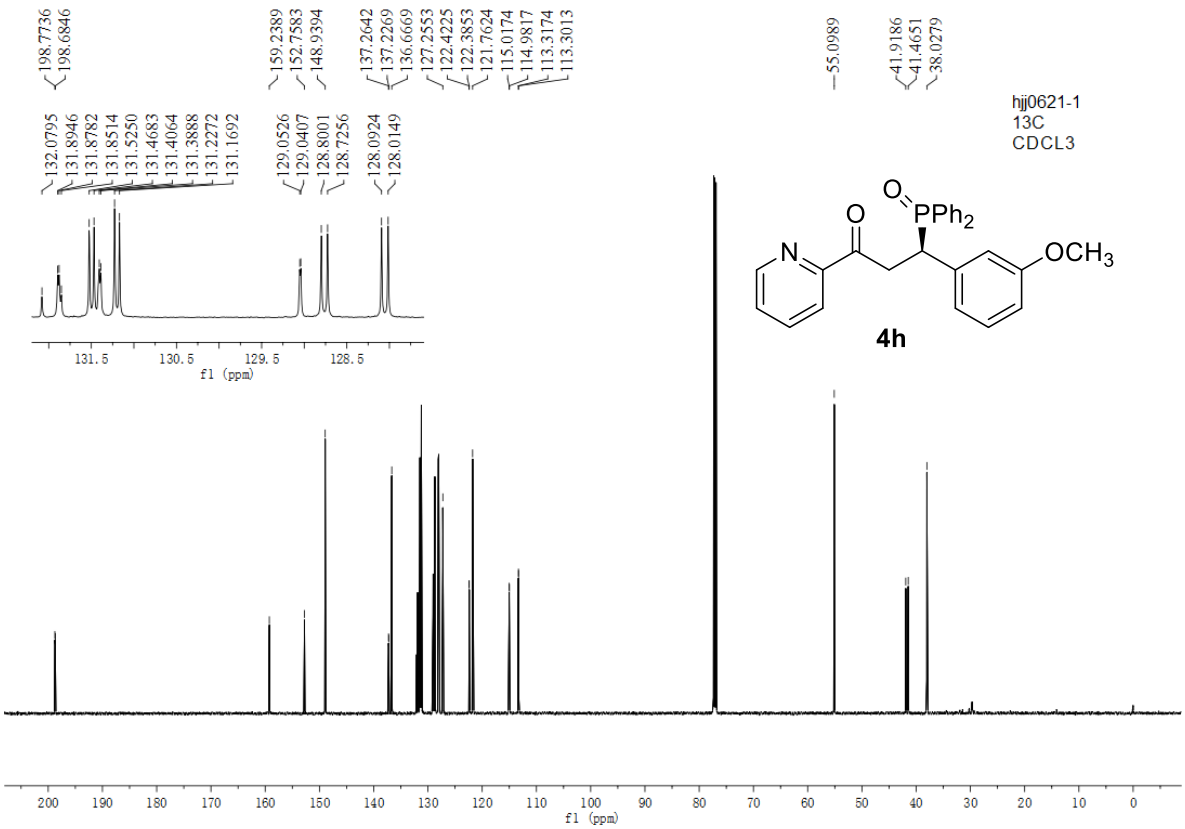
$^{31}P\{^{1}H\}$ NMR spectrum of **4f** (162 MHz, $CDCl_3$)



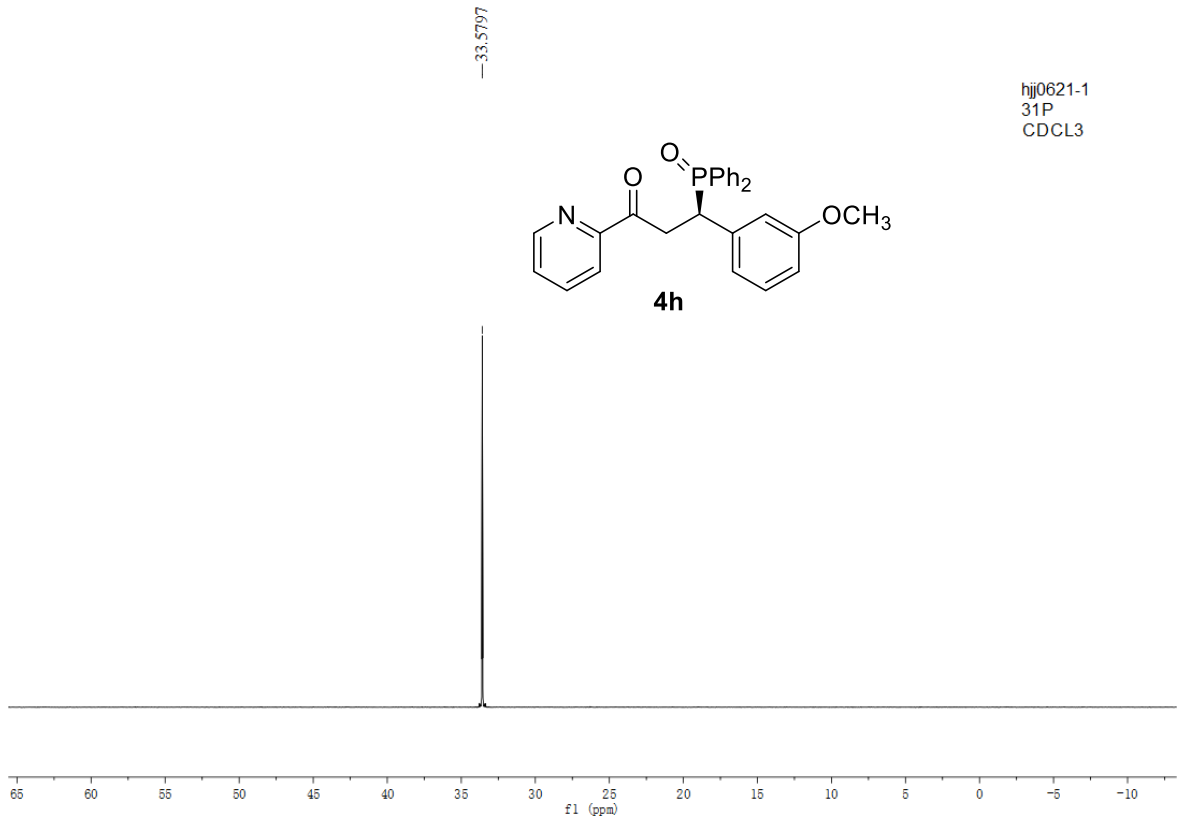
^{1}H NMR spectrum of **4g** (400 MHz, $CDCl_3$)



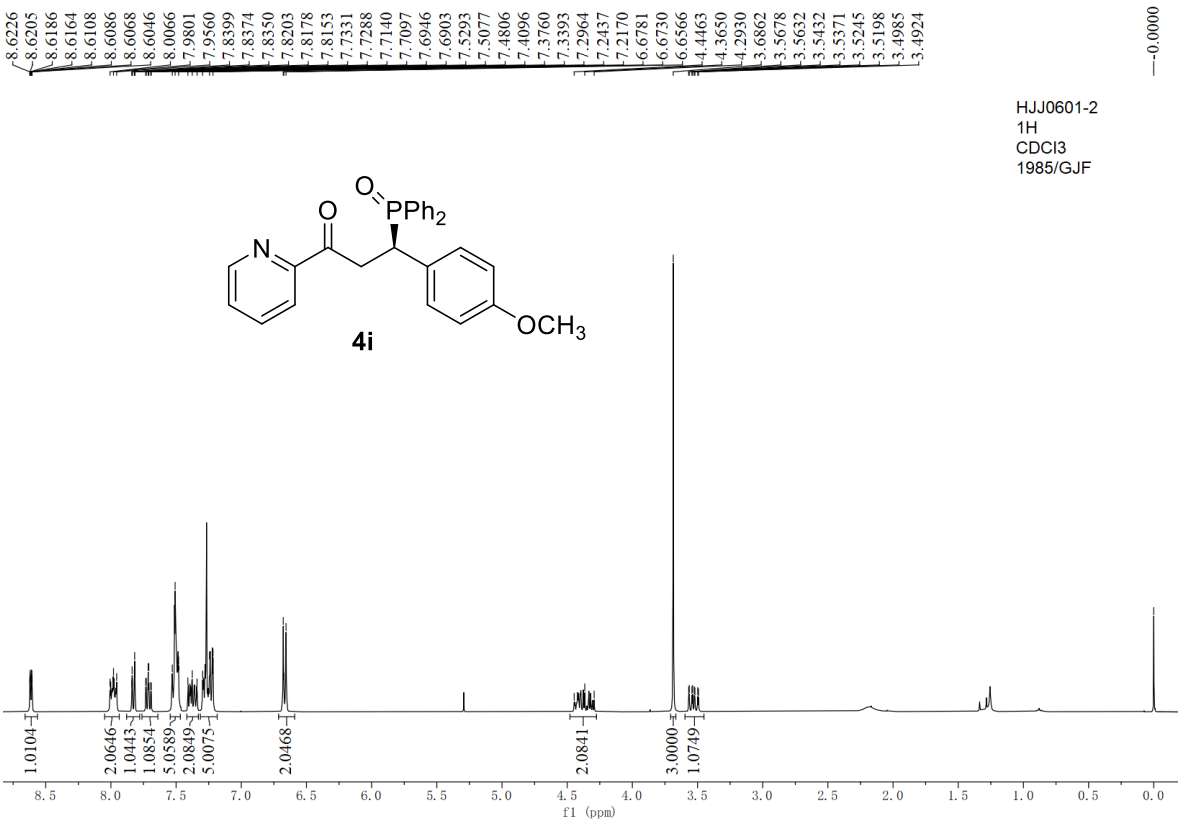
^{1}H NMR spectrum of **4h** (600 MHz, $CDCl_3$)



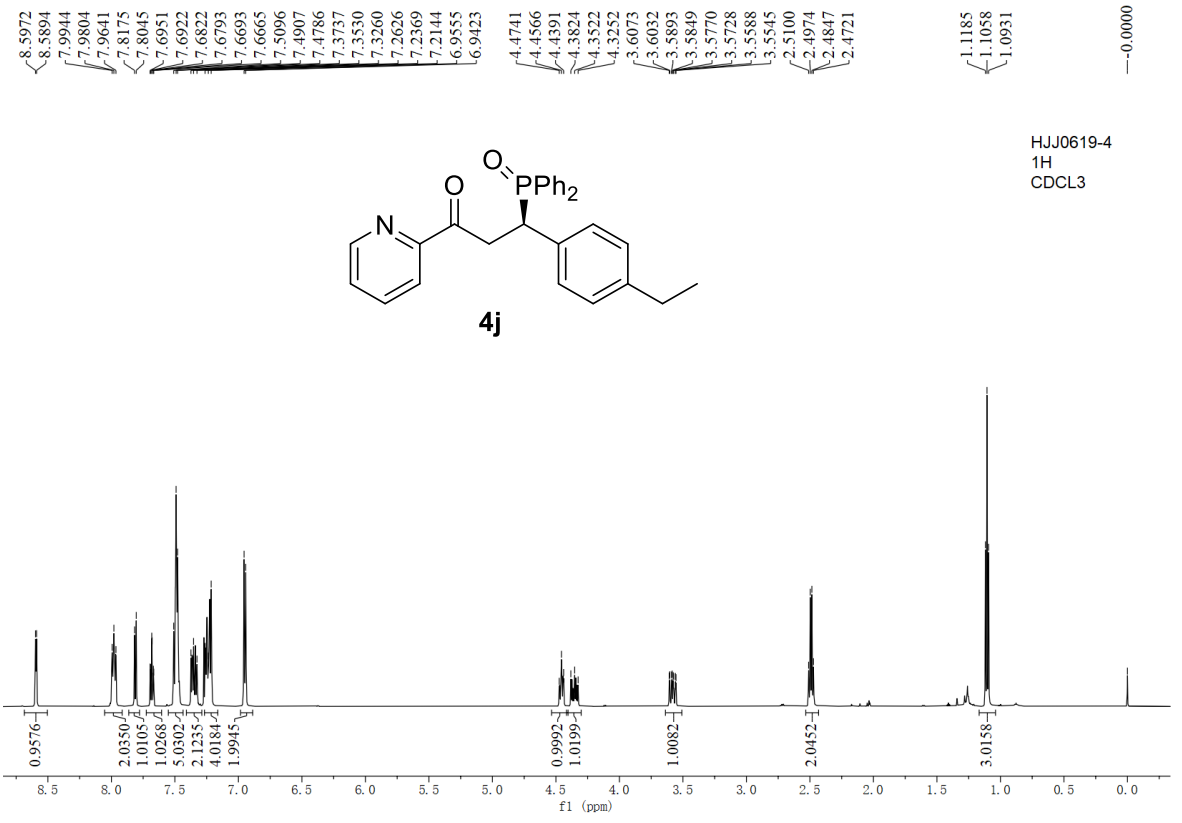
$^{13}C\{^{1}H\}$ NMR spectrum of **4h** (150 MHz, $CDCl_3$)



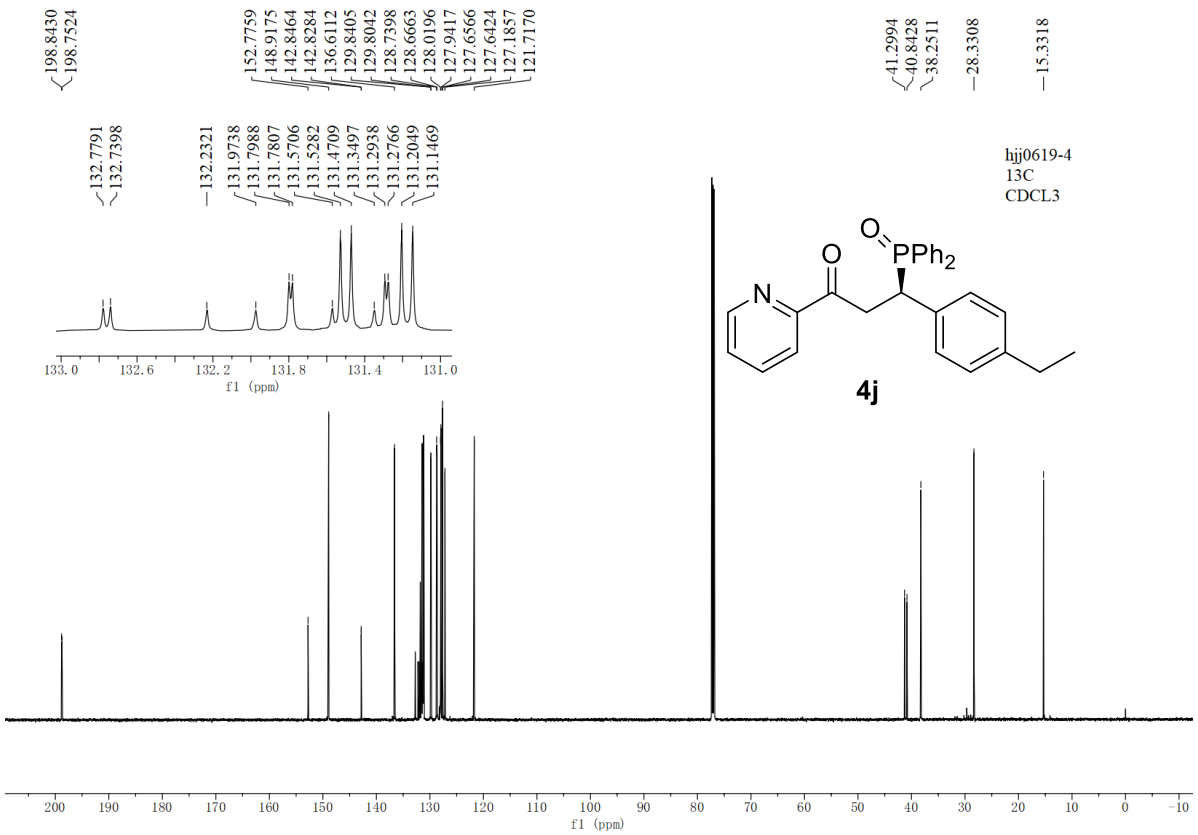
$^{31}P\{^{1}H\}$ NMR spectrum of **4h** (243 MHz, $CDCl_3$)



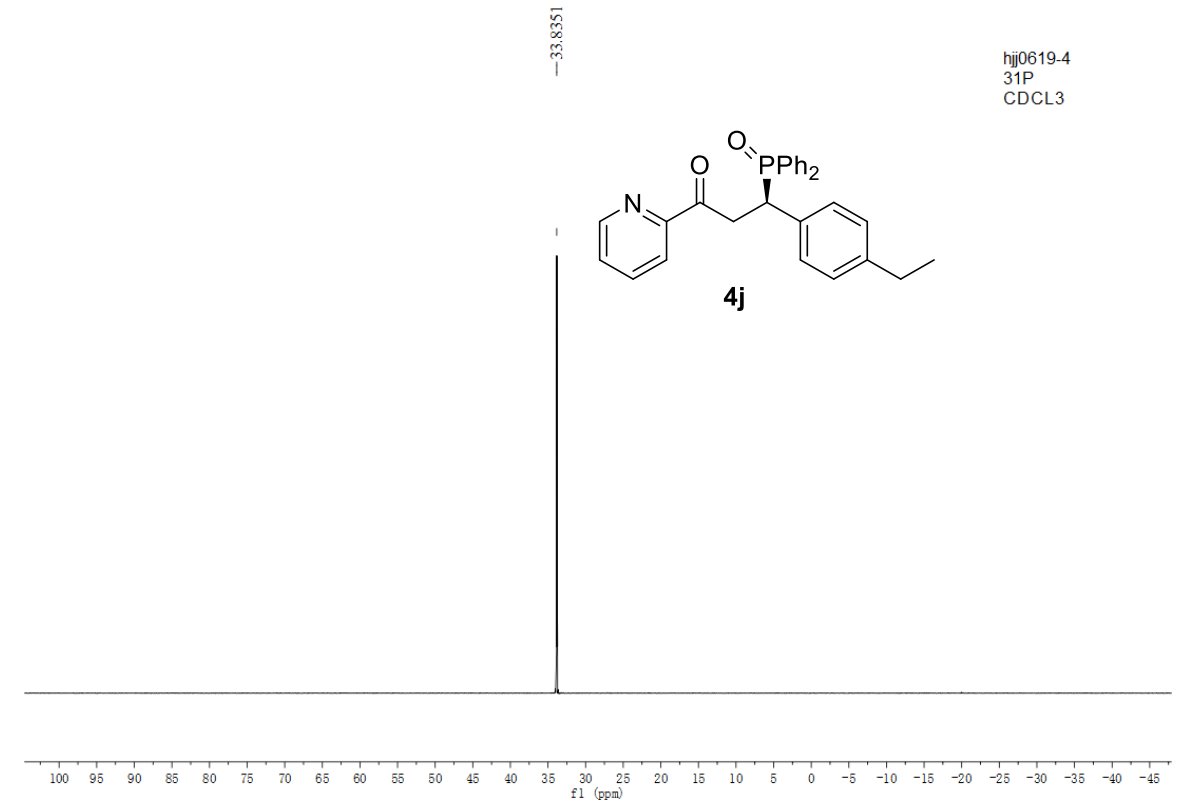
^{1}H NMR spectrum of **4i** (600 MHz, $CDCl_3$)



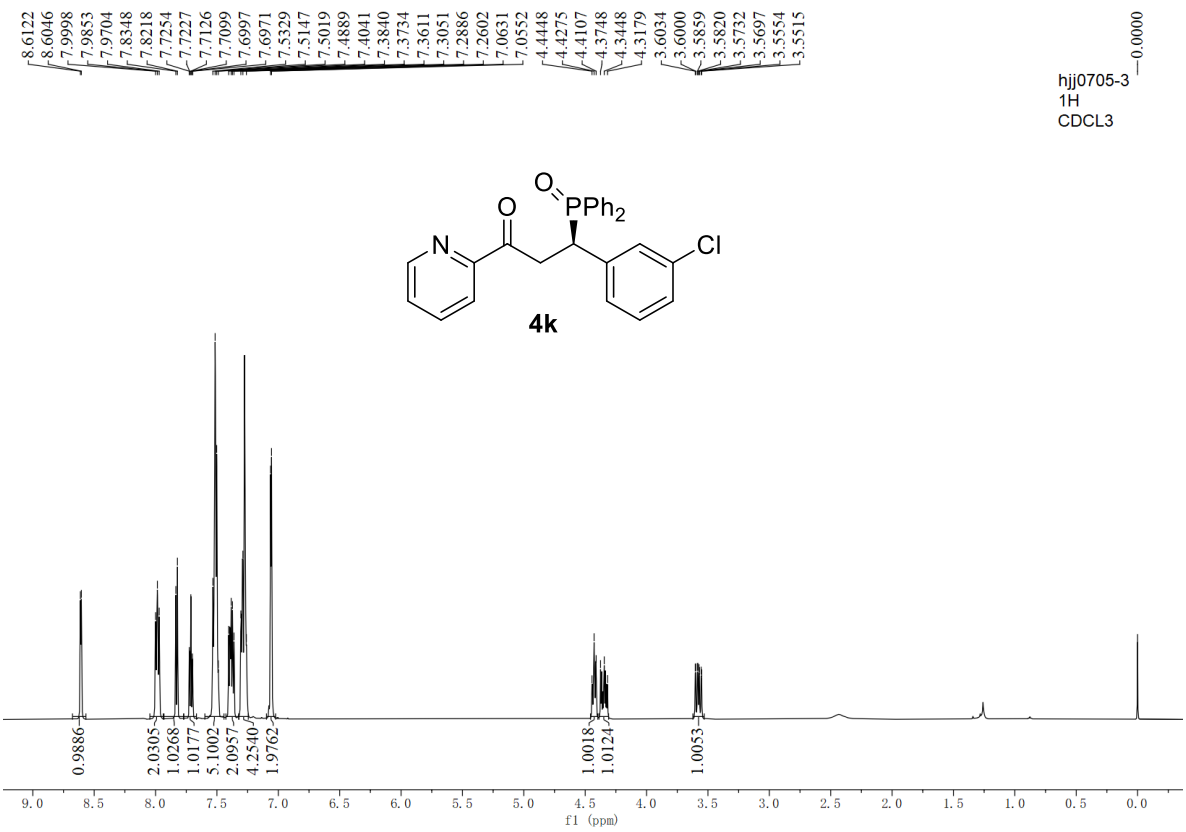
^{1}H NMR spectrum of **4j** (600 MHz, $CDCl_3$)



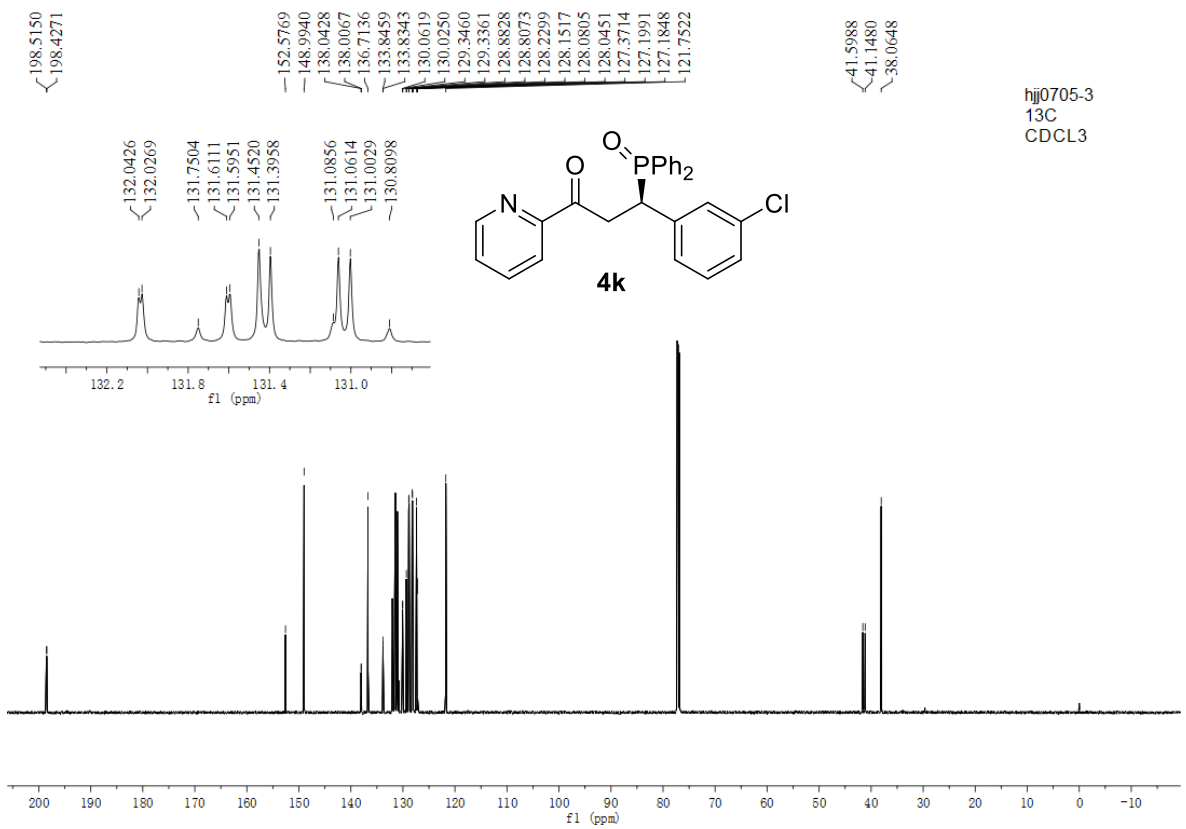
$^{13}C\{^{1}H\}$ NMR spectrum of **4j** (150 MHz, $CDCl_3$)



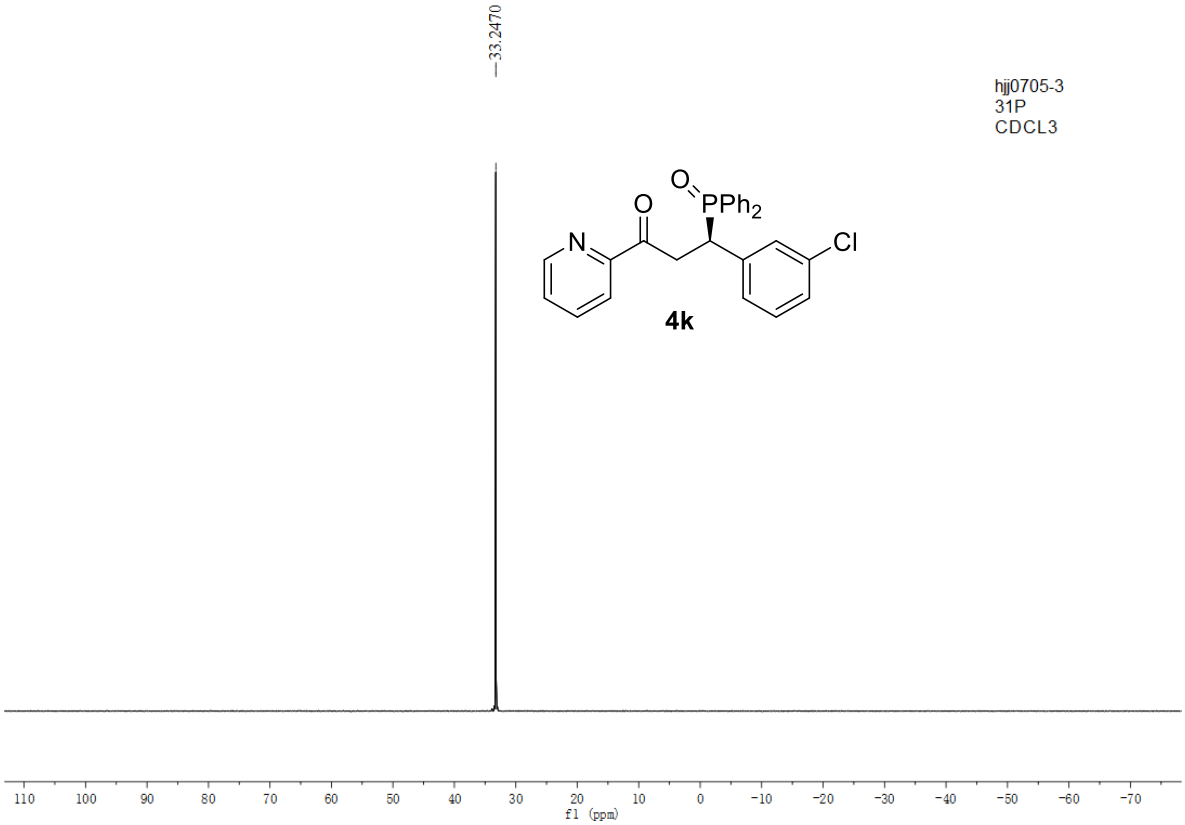
$^{31}P\{^{1}H\}$ NMR spectrum of **4j** (243 MHz, $CDCl_3$)



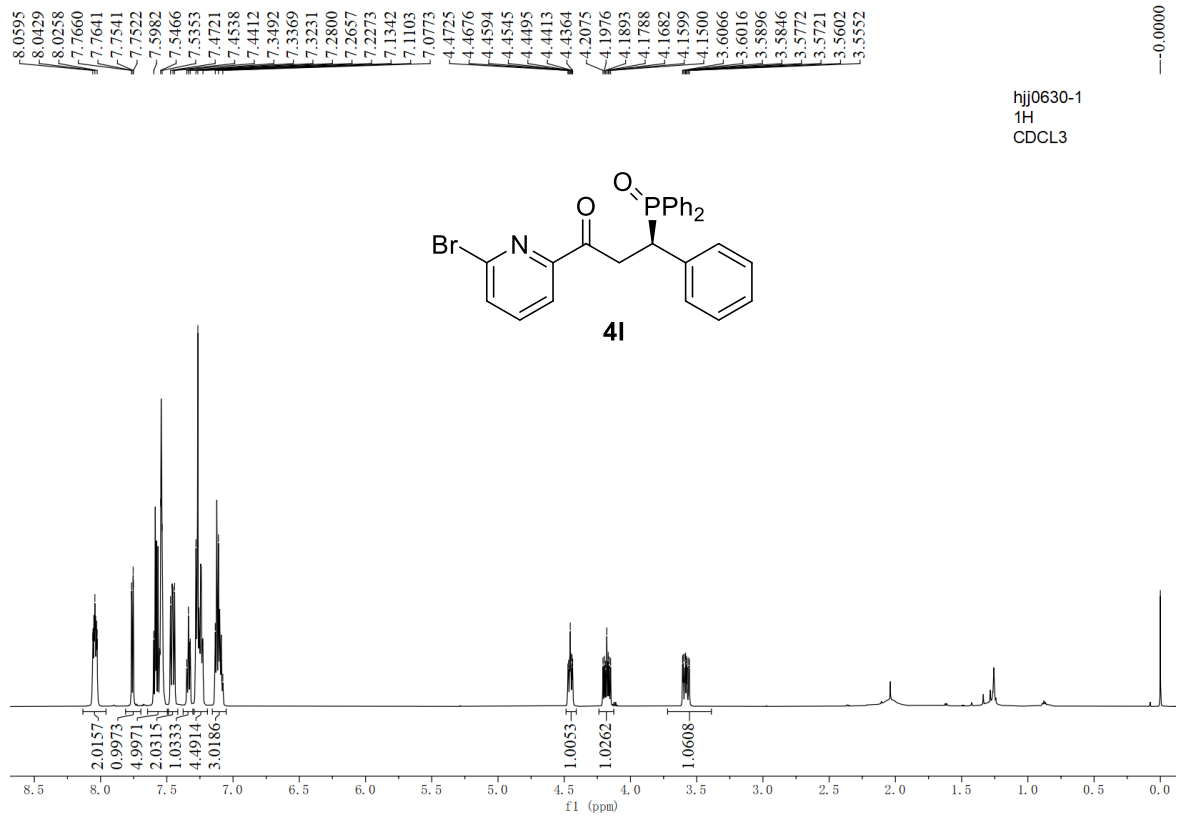
^{1}H NMR spectrum of **4k** (600 MHz, $CDCl_3$)



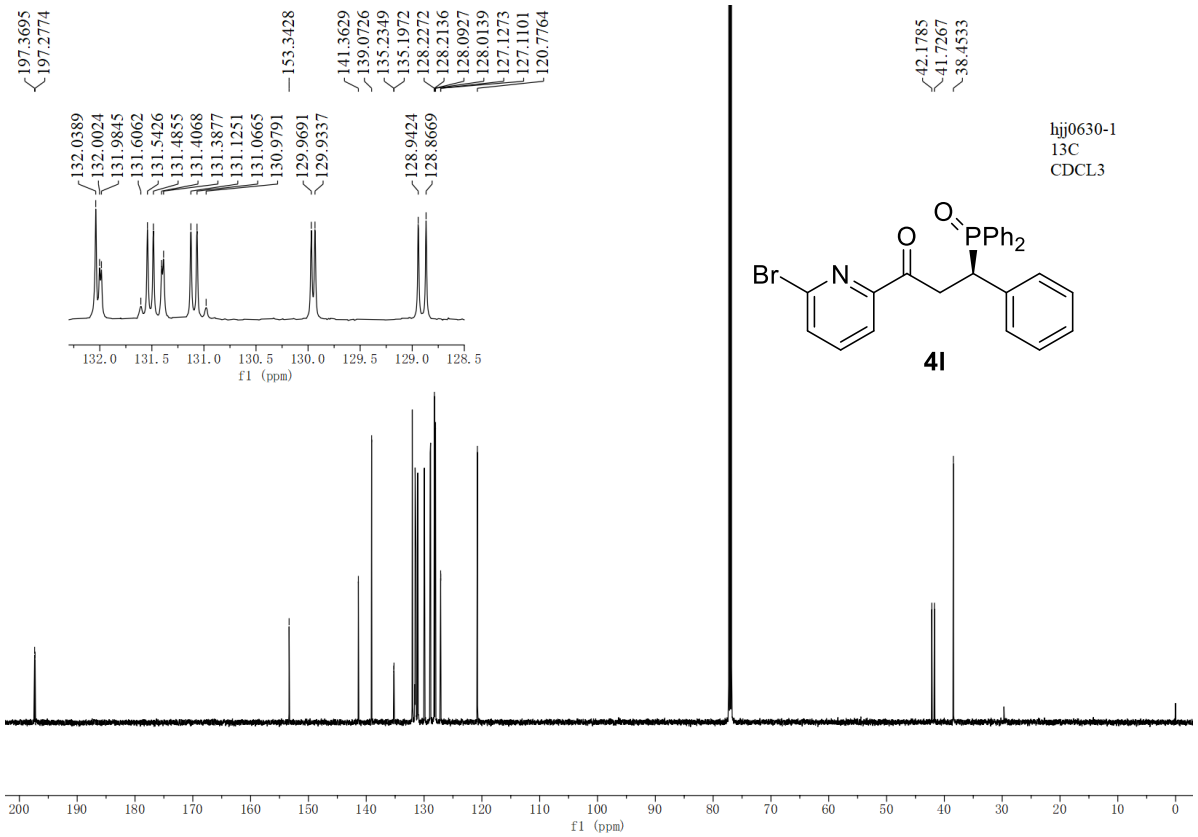
$^{13}C\{^{1}H\}$ NMR spectrum of **4k** (150 MHz, $CDCl_3$)



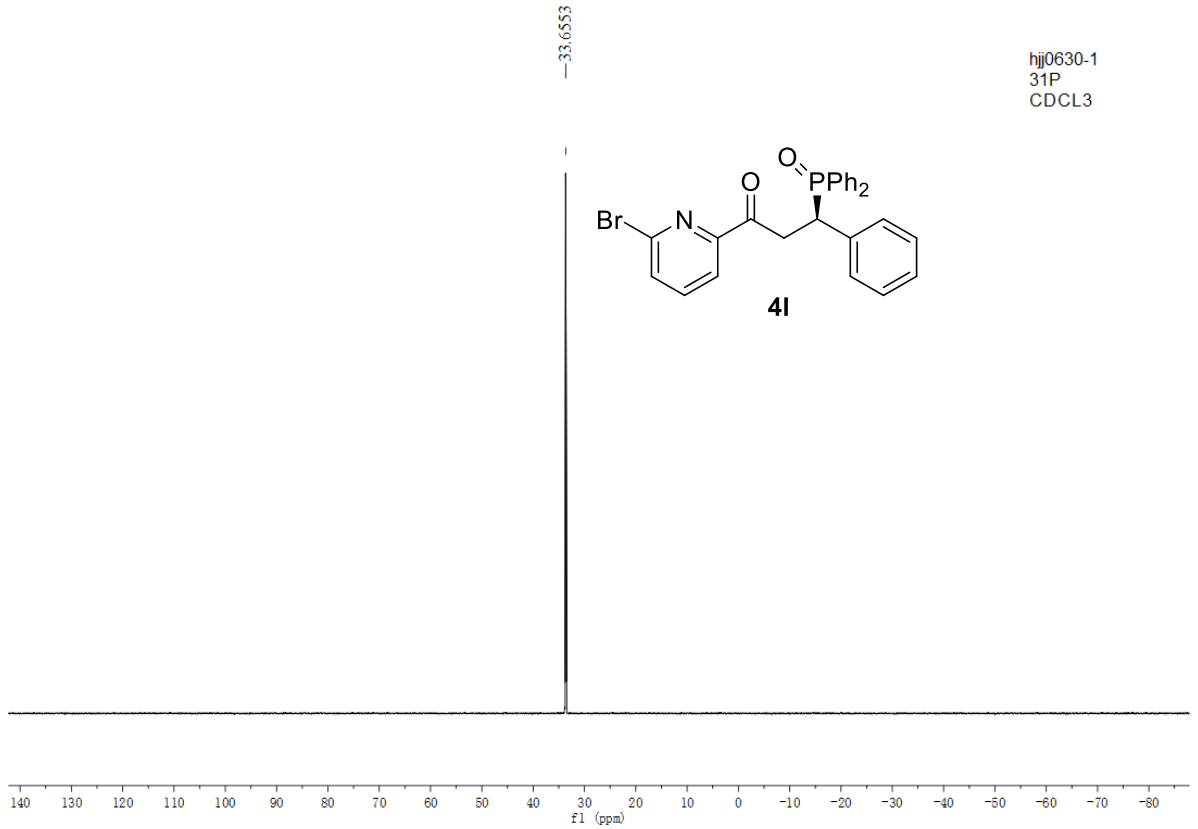
$^{31}P\{^{1}H\}$ NMR spectrum of **4k** (243 MHz, $CDCl_3$)



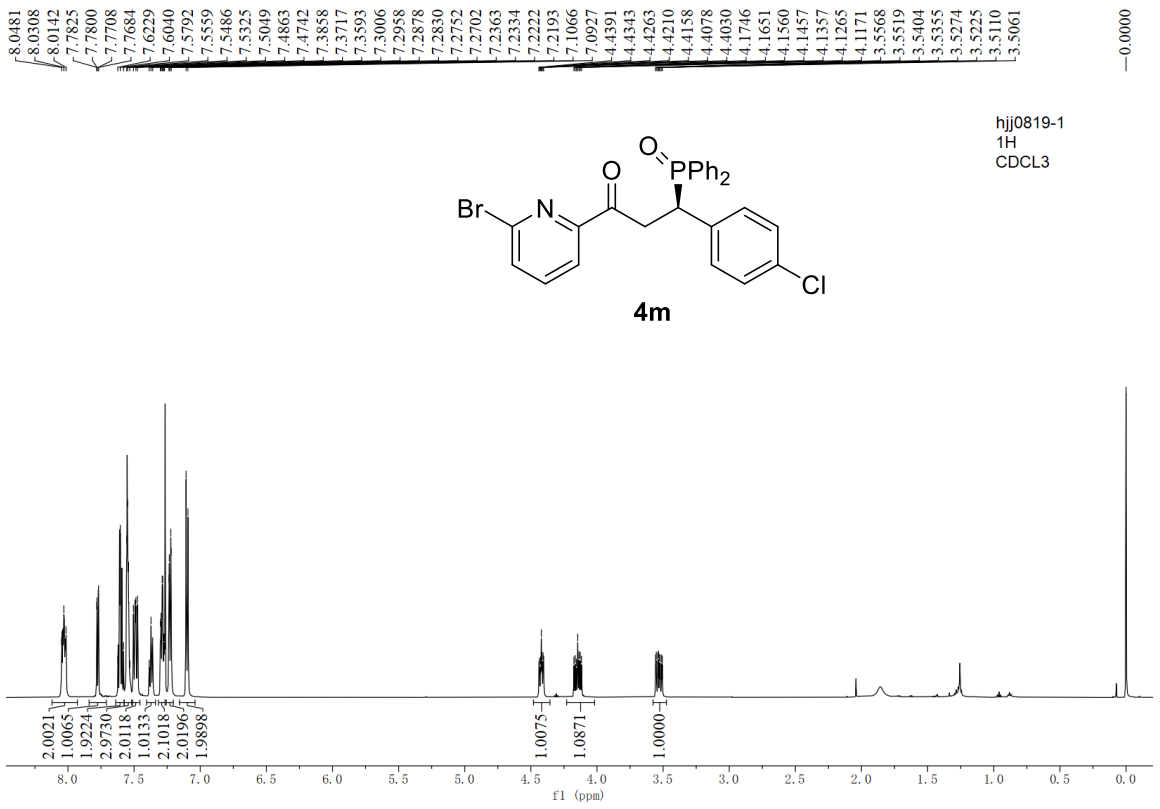
^{1}H NMR spectrum of **4l** (600 MHz, $CDCl_3$)



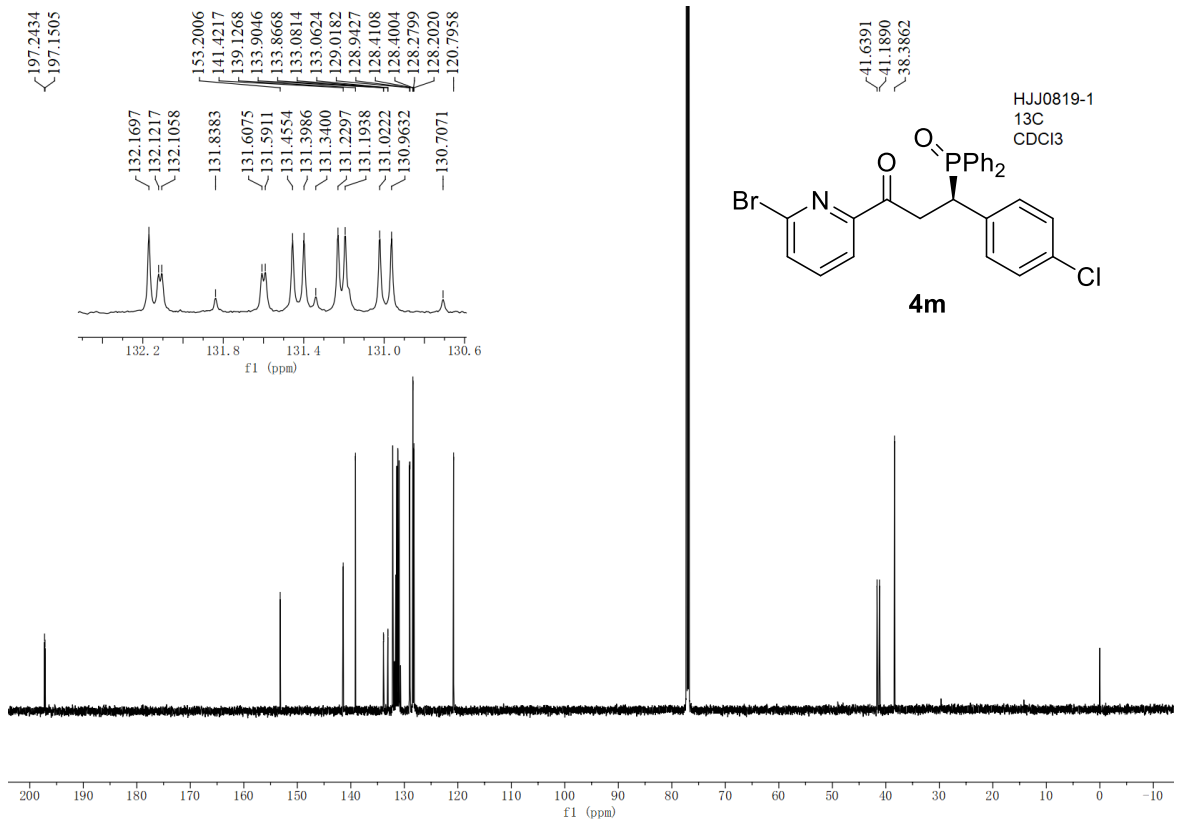
$^{13}C\{^{1}H\}$ NMR spectrum of **4l** (150 MHz, $CDCl_3$)



$^{31}P\{^{1}H\}$ NMR spectrum of **4l** (243 MHz, $CDCl_3$)

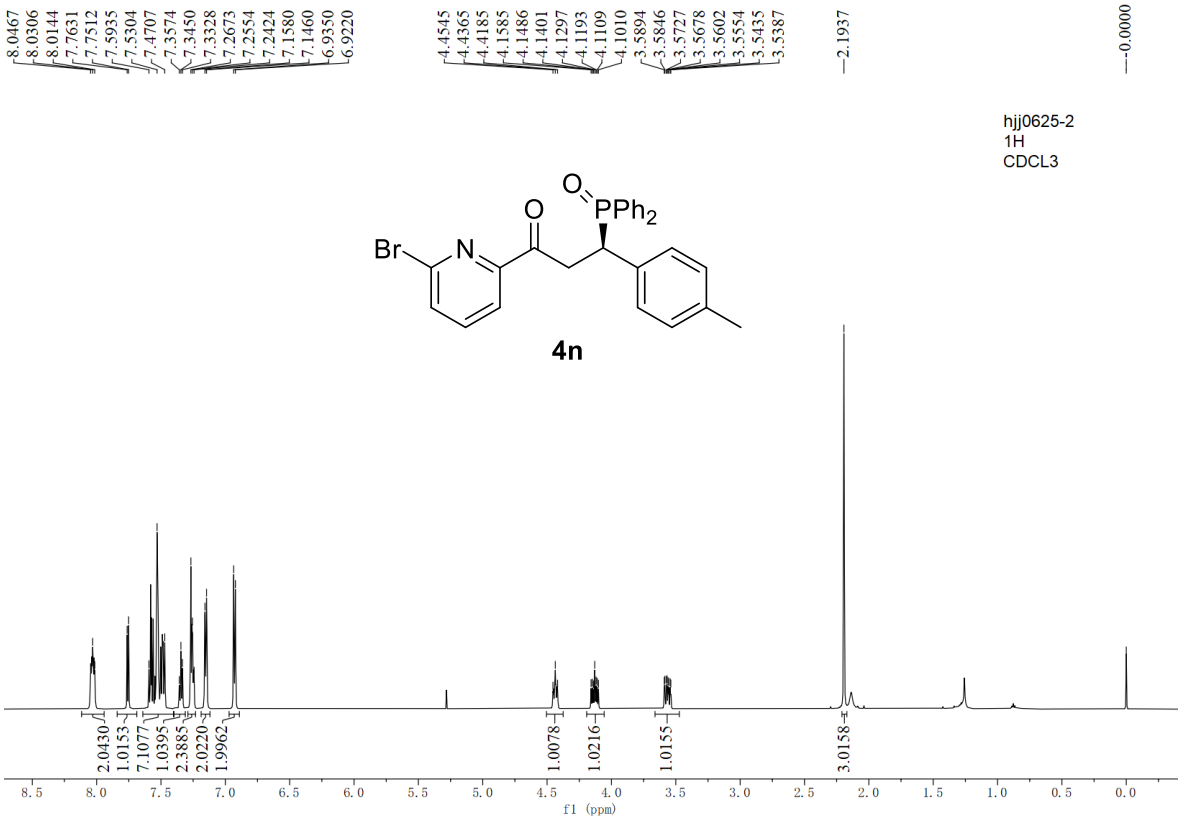


^{1}H NMR spectrum of **4m** (600 MHz, $CDCl_3$)

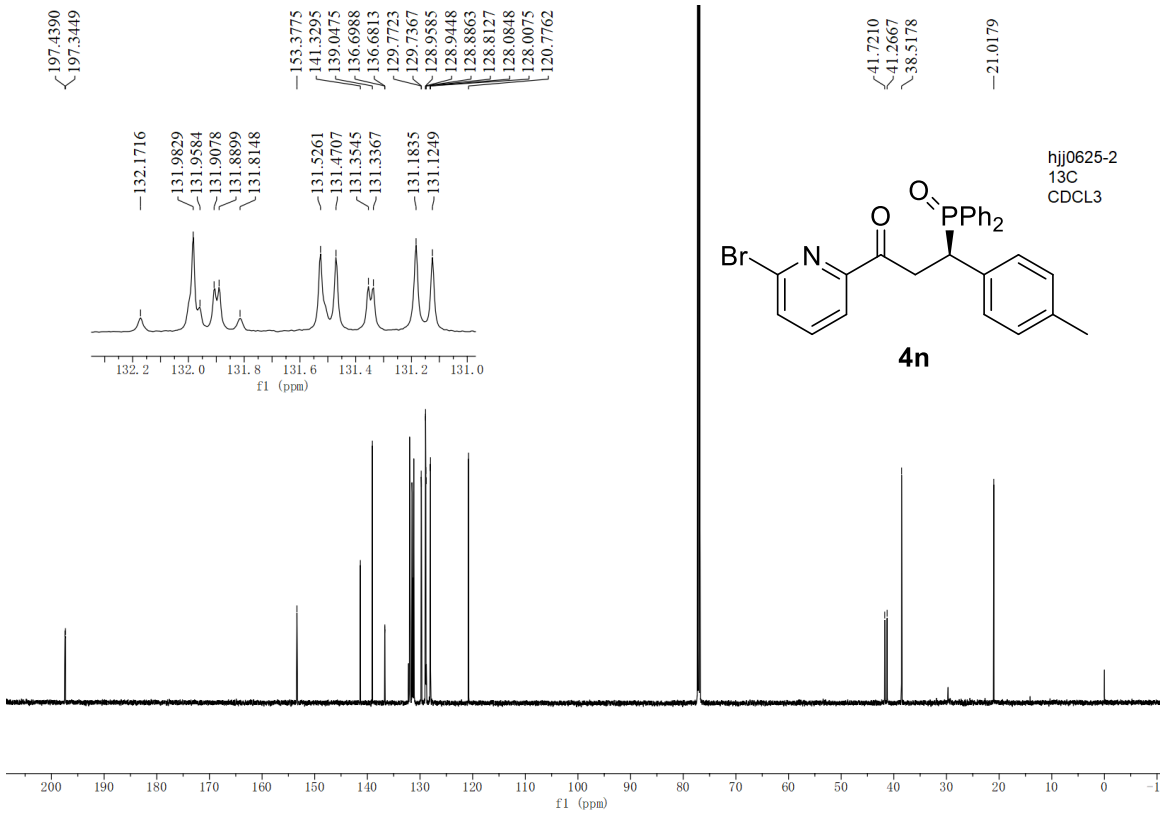


$^{13}C\{^{1}H\}$ NMR spectrum of **4m** (150 MHz, $CDCl_3$)

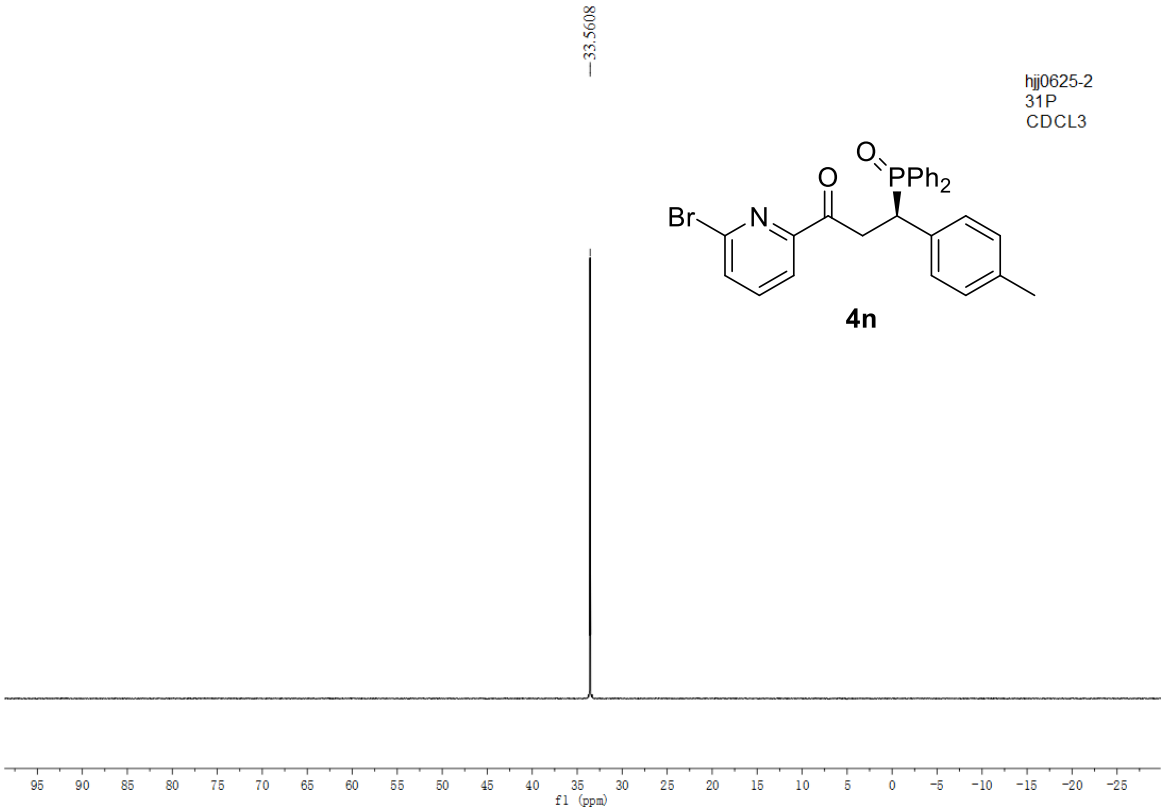
$^{31}P\{^{1}H\}$ NMR spectrum of **4m** (243 MHz, $CDCl_3$)



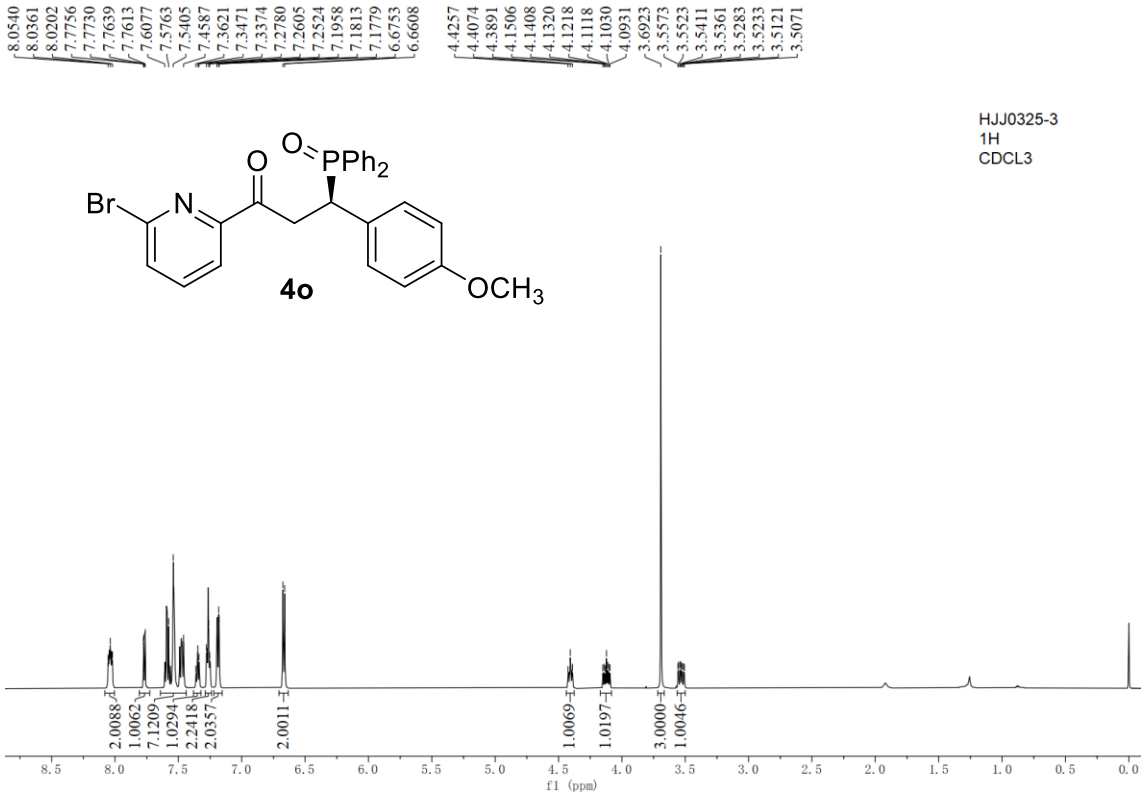
^{1}H NMR spectrum of **4n** (600 MHz, $CDCl_3$)



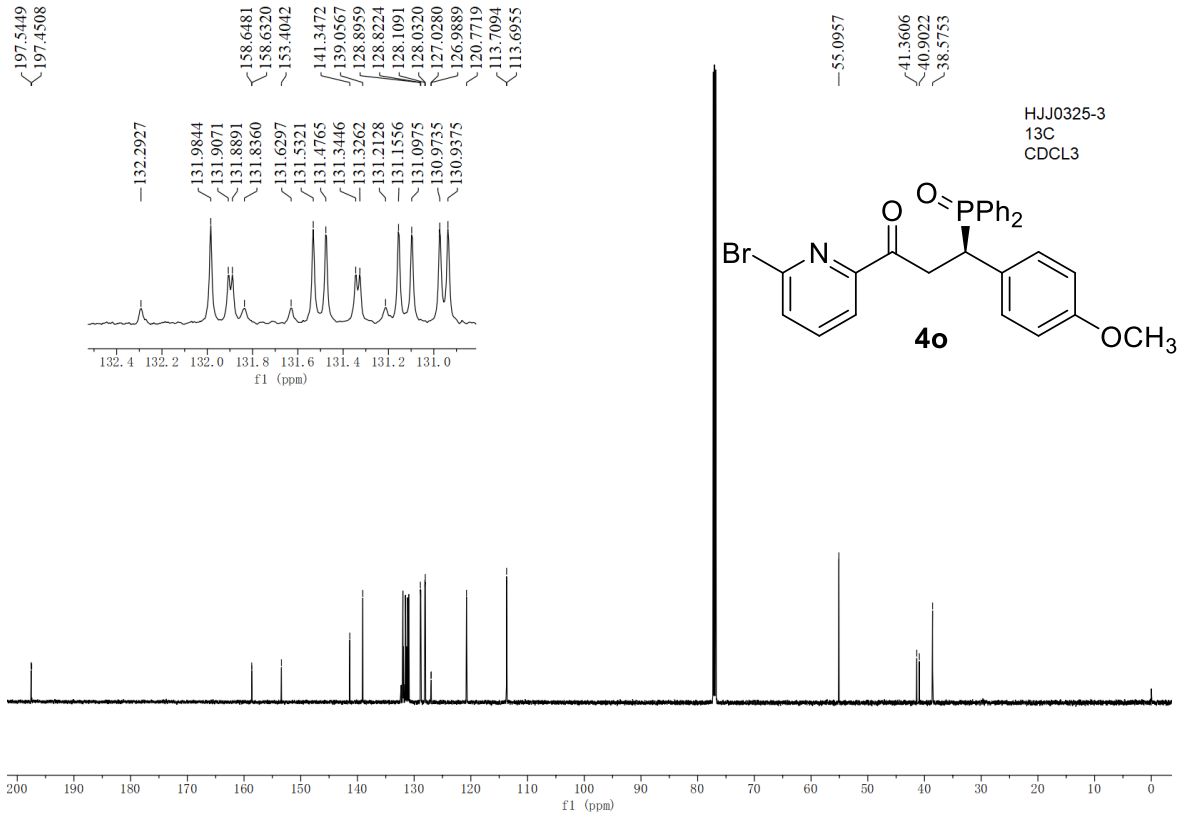
$^{13}C\{^{1}H\}$ NMR spectrum of **4n** (150 MHz, $CDCl_3$)



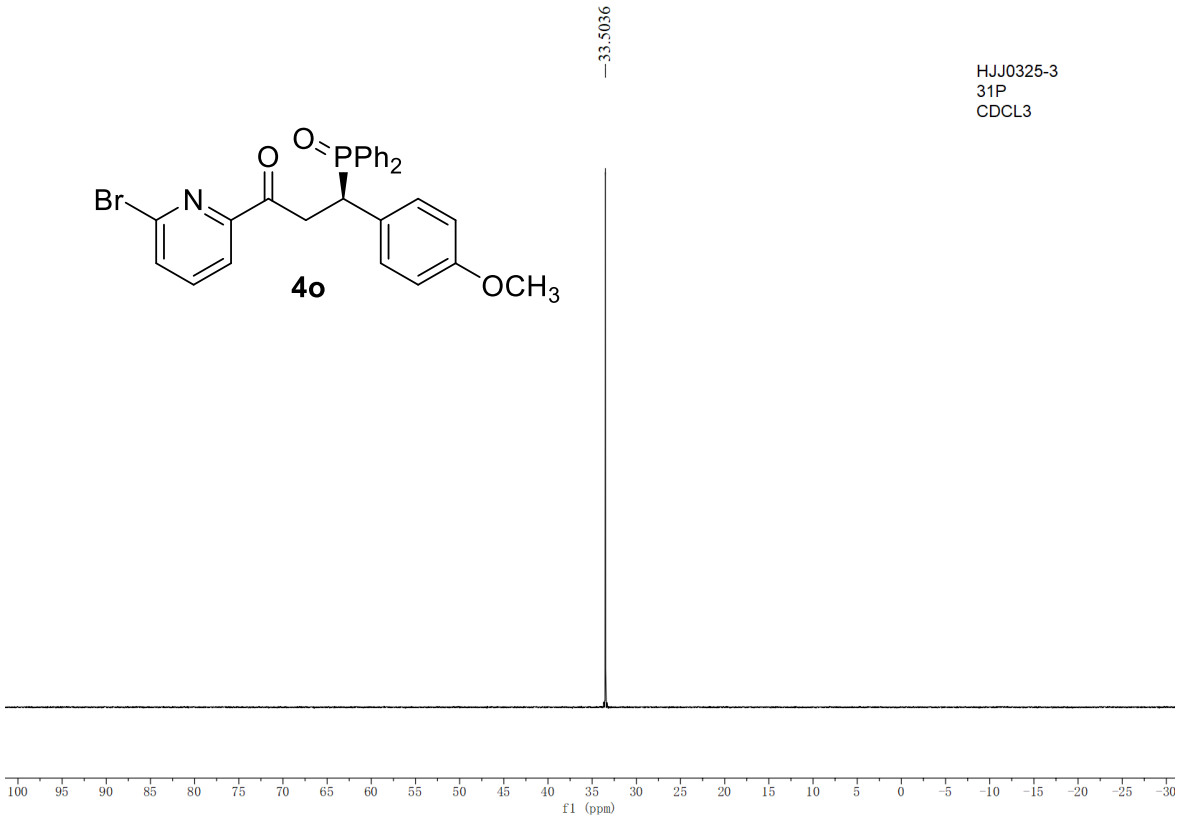
$^{31}P\{^{1}H\}$ NMR spectrum of **4n** (243 MHz, $CDCl_3$)



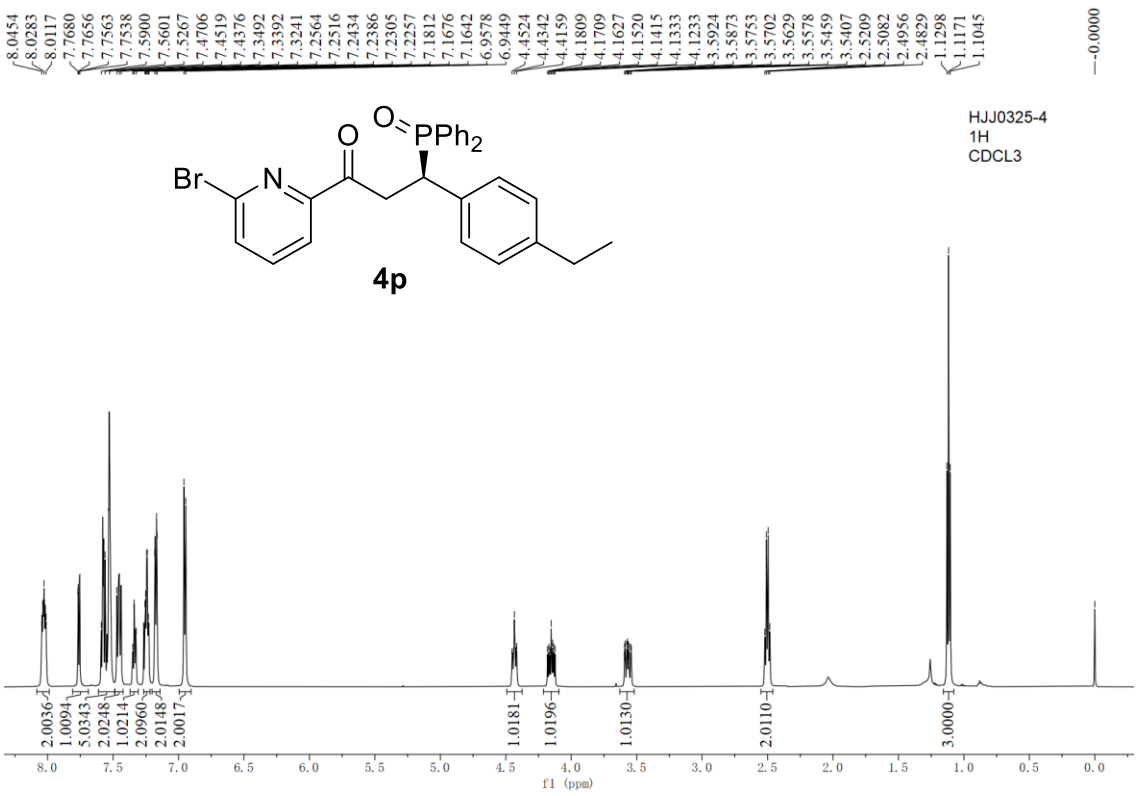
^{1}H NMR spectrum of **4o** (600 MHz, $CDCl_3$)



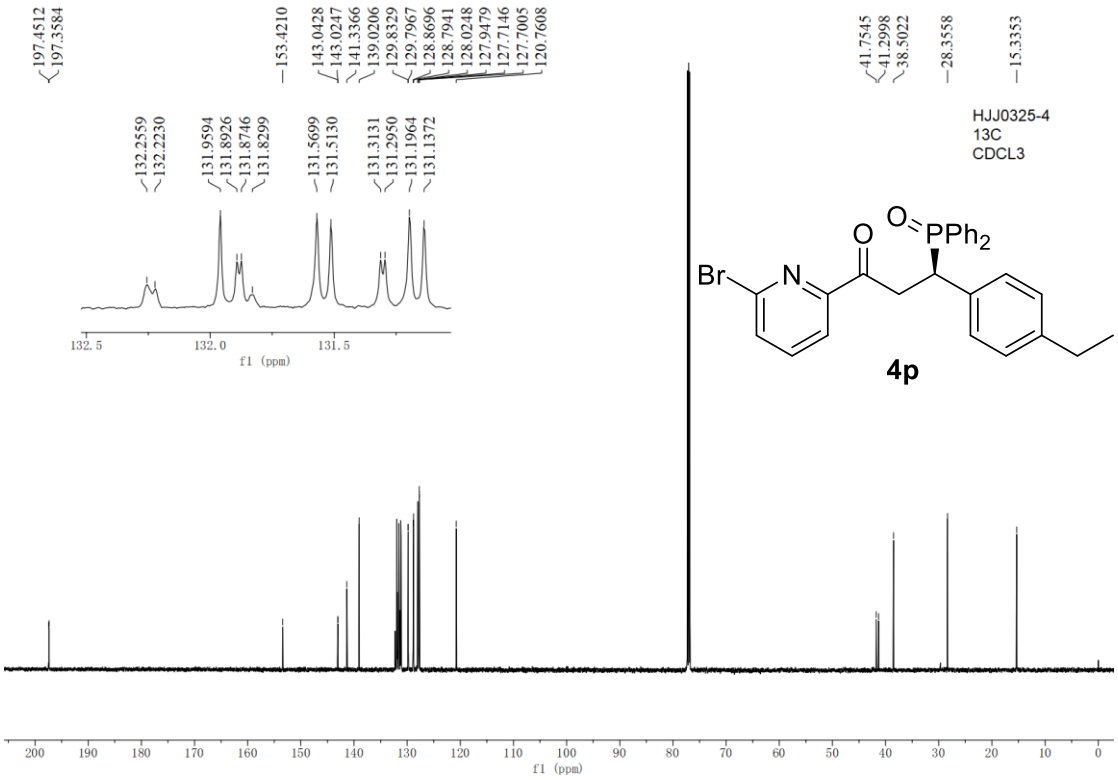
^{13}C{^{1}H} NMR spectrum of **4o** (150 MHz, $CDCl_3$)



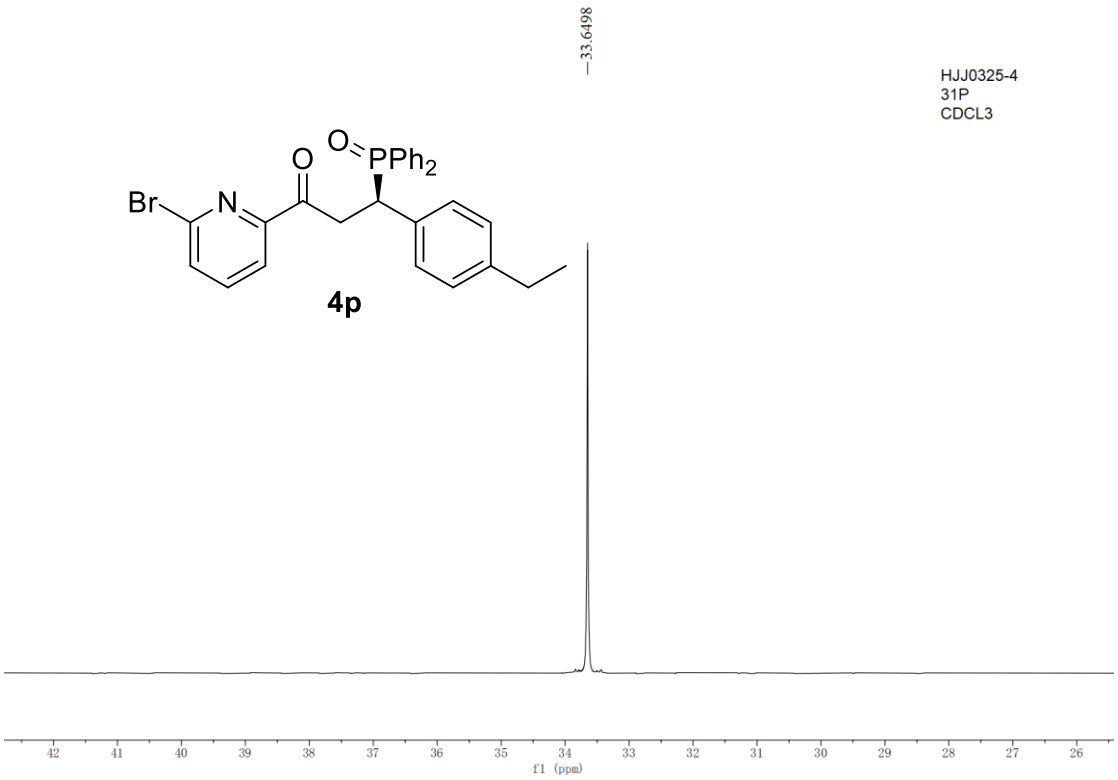
$^{31}P\{^{1}H\}$ NMR spectrum of **4o** (243 MHz, $CDCl_3$)



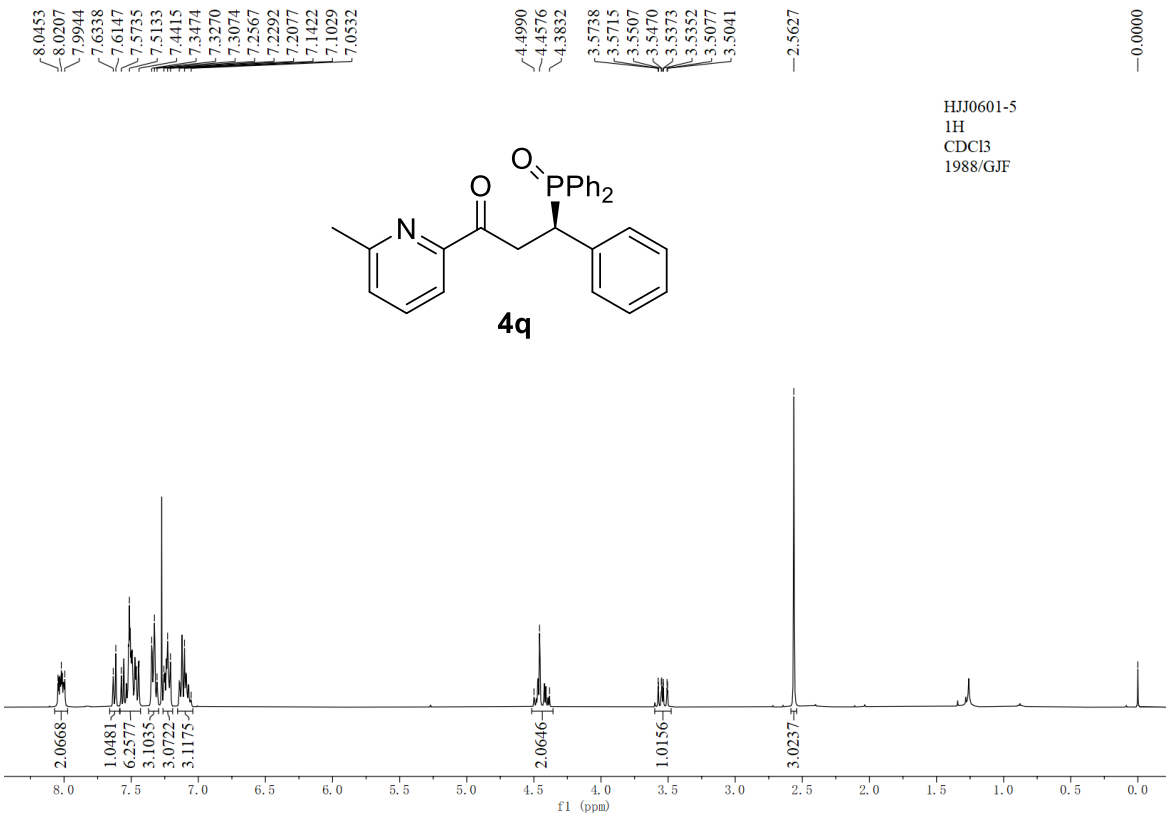
^{1}H NMR spectrum of **4p** (600 MHz, $CDCl_3$)



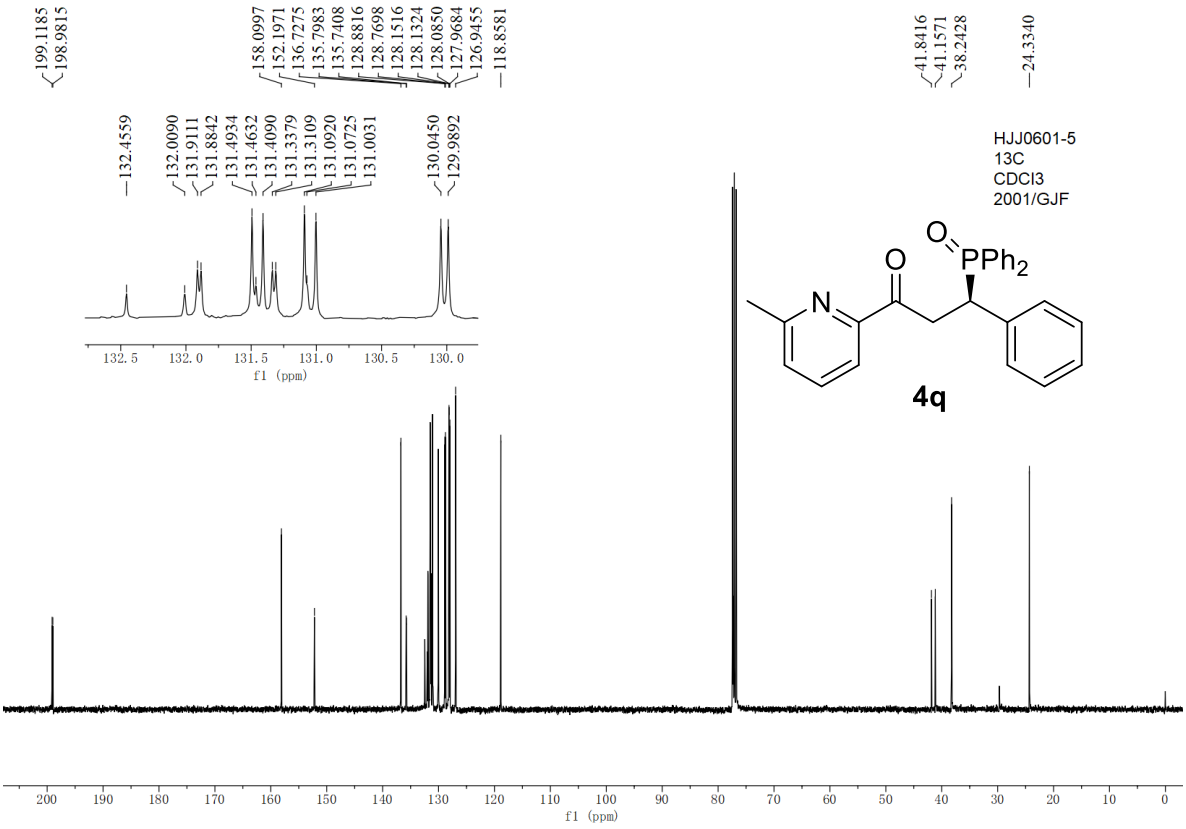
$^{13}C\{^{1}H\}$ NMR spectrum of **4p** (150 MHz, $CDCl_3$)



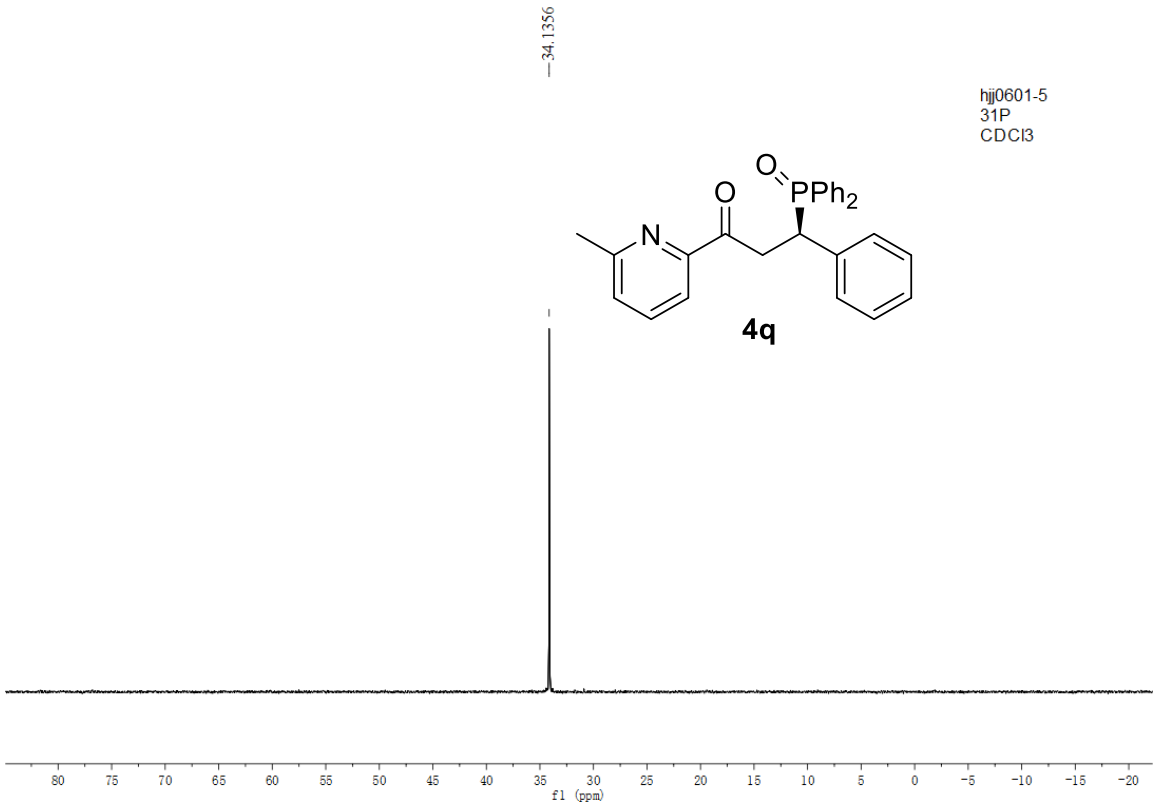
$^{31}P\{^{1}H\}$ NMR spectrum of **4p** (243 MHz, $CDCl_3$)



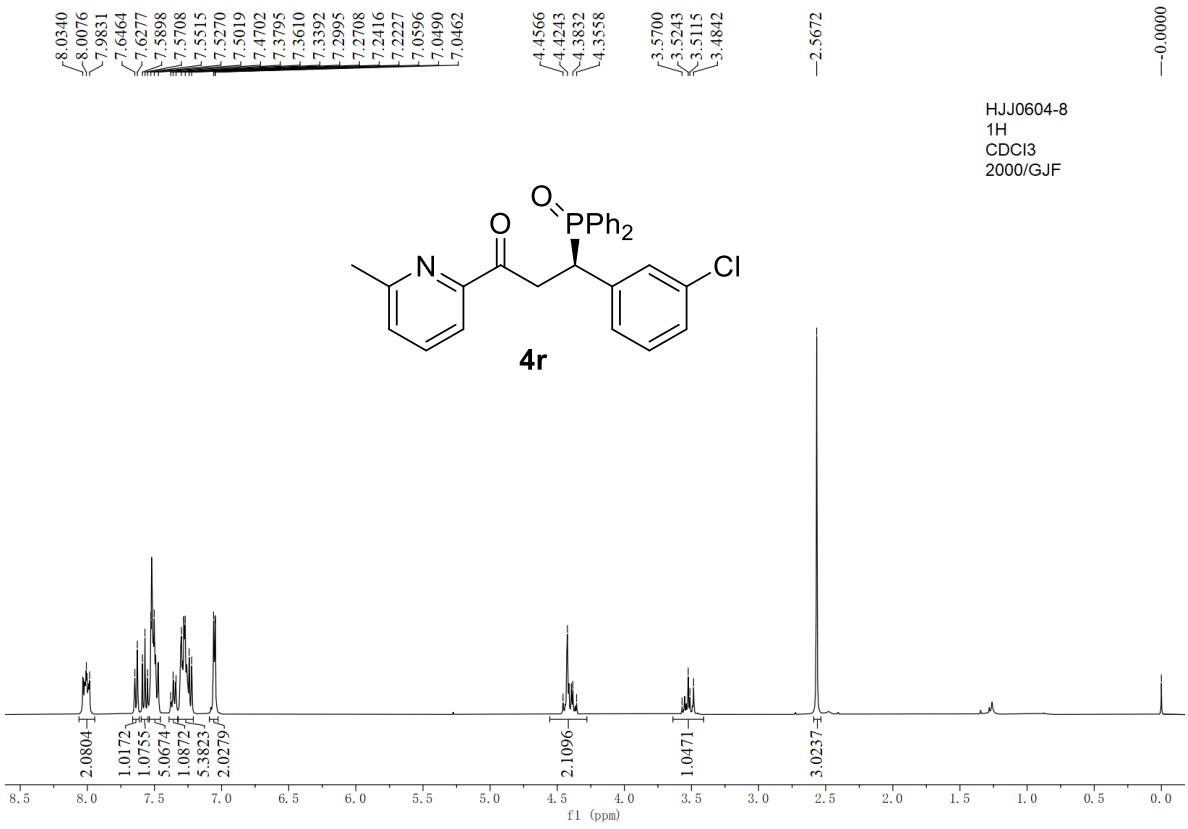
^{1}H NMR spectrum of **4q** (400 MHz, $CDCl_3$)



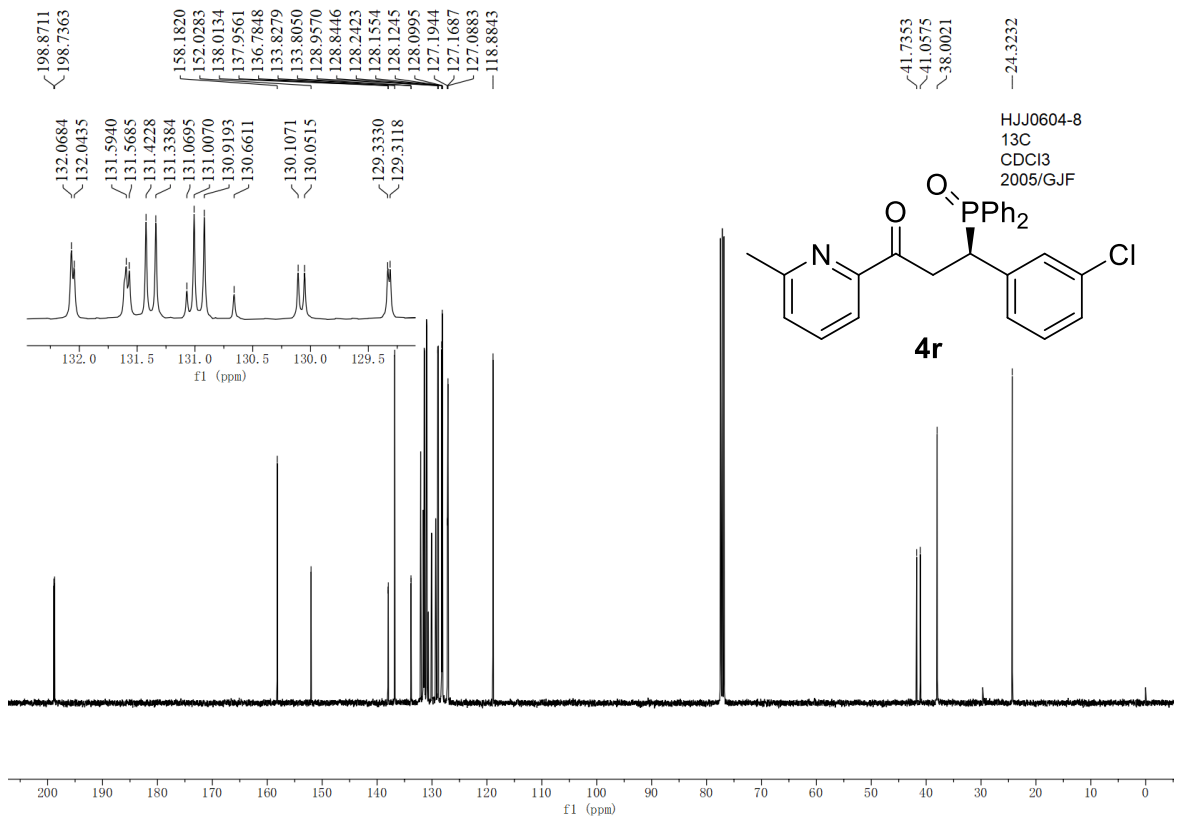
$^{13}C\{^{1}H\}$ NMR spectrum of **4q** (100 MHz, $CDCl_3$)



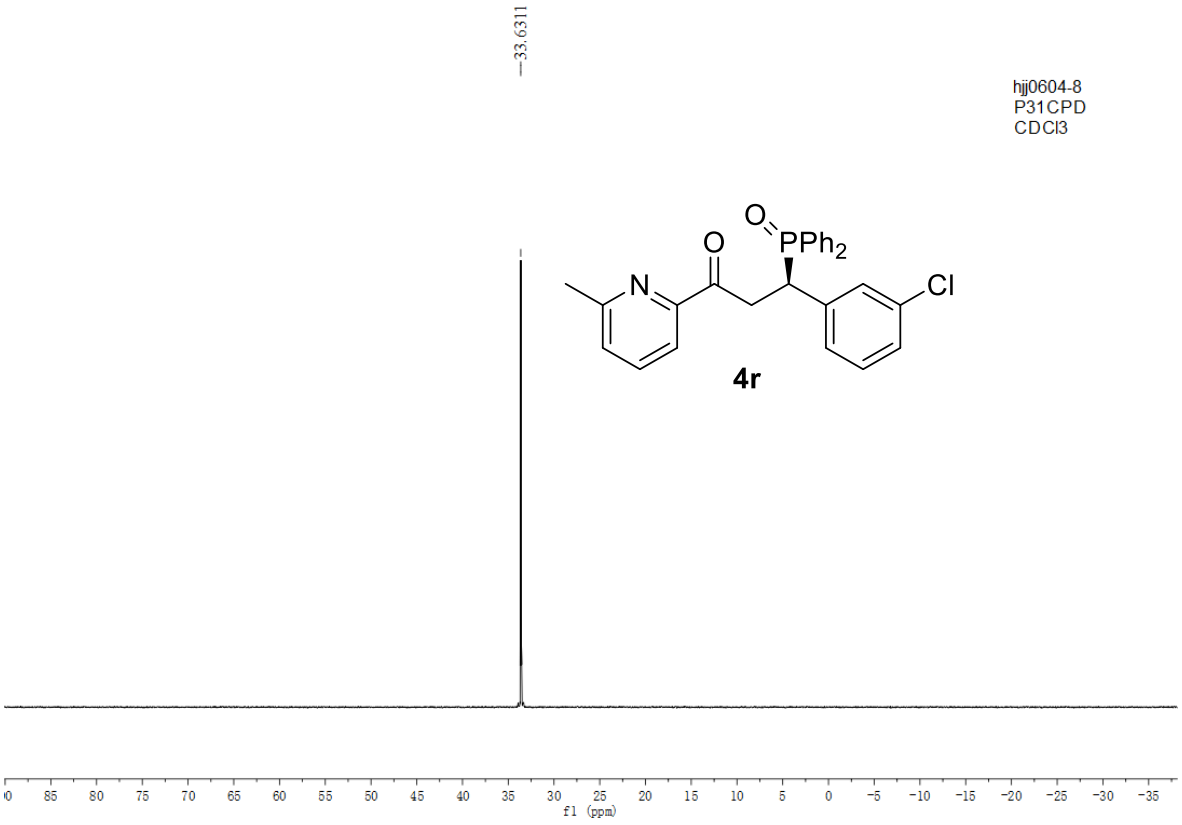
$^{31}P\{^{1}H\}$ NMR spectrum of **4q** (163 MHz, $CDCl_3$)



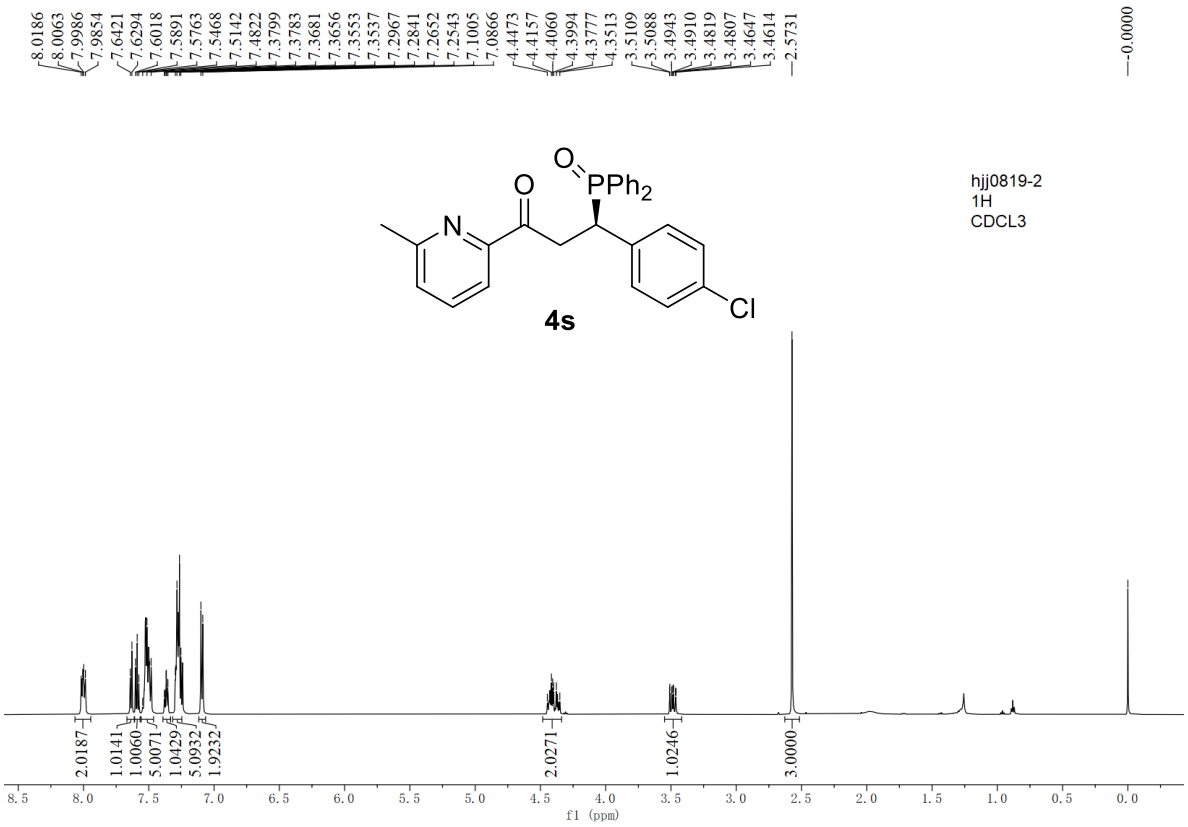
^{1}H NMR spectrum of **4r** (400 MHz, $CDCl_3$)



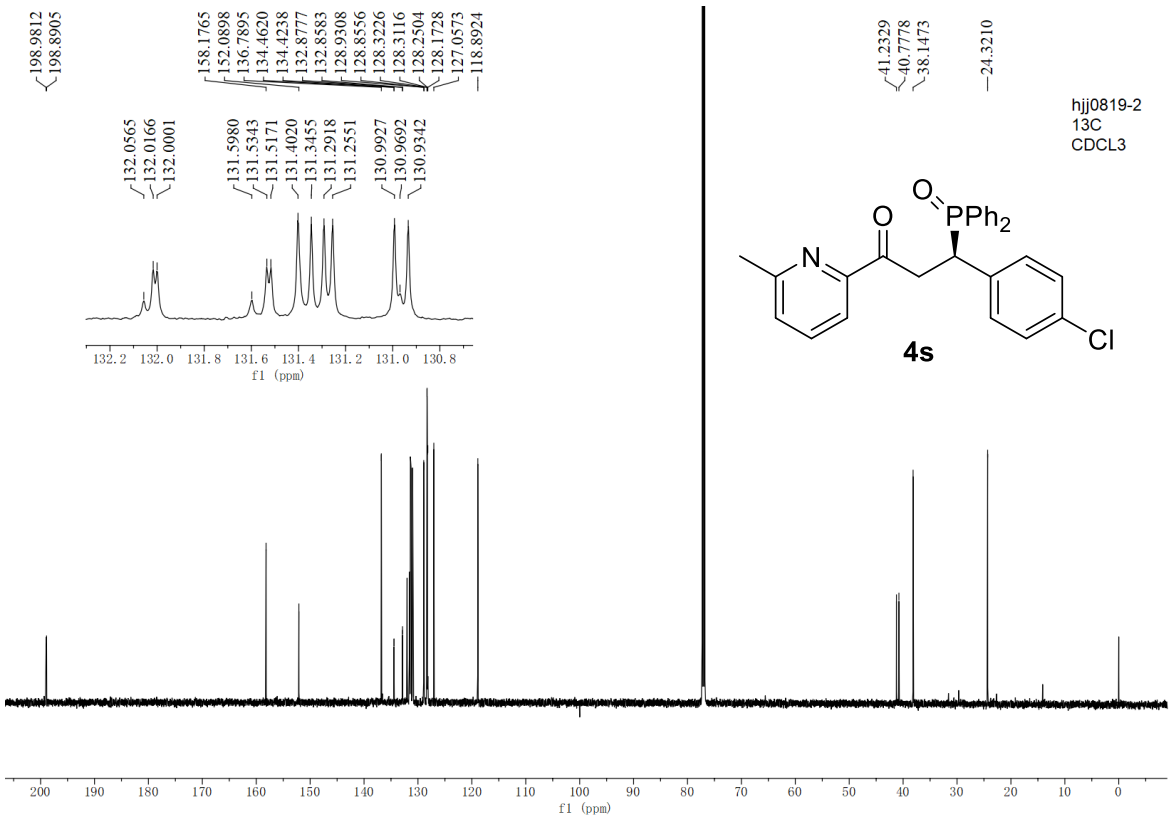
$^{13}C\{^{1}H\}$ NMR spectrum of **4r** (100 MHz, $CDCl_3$)



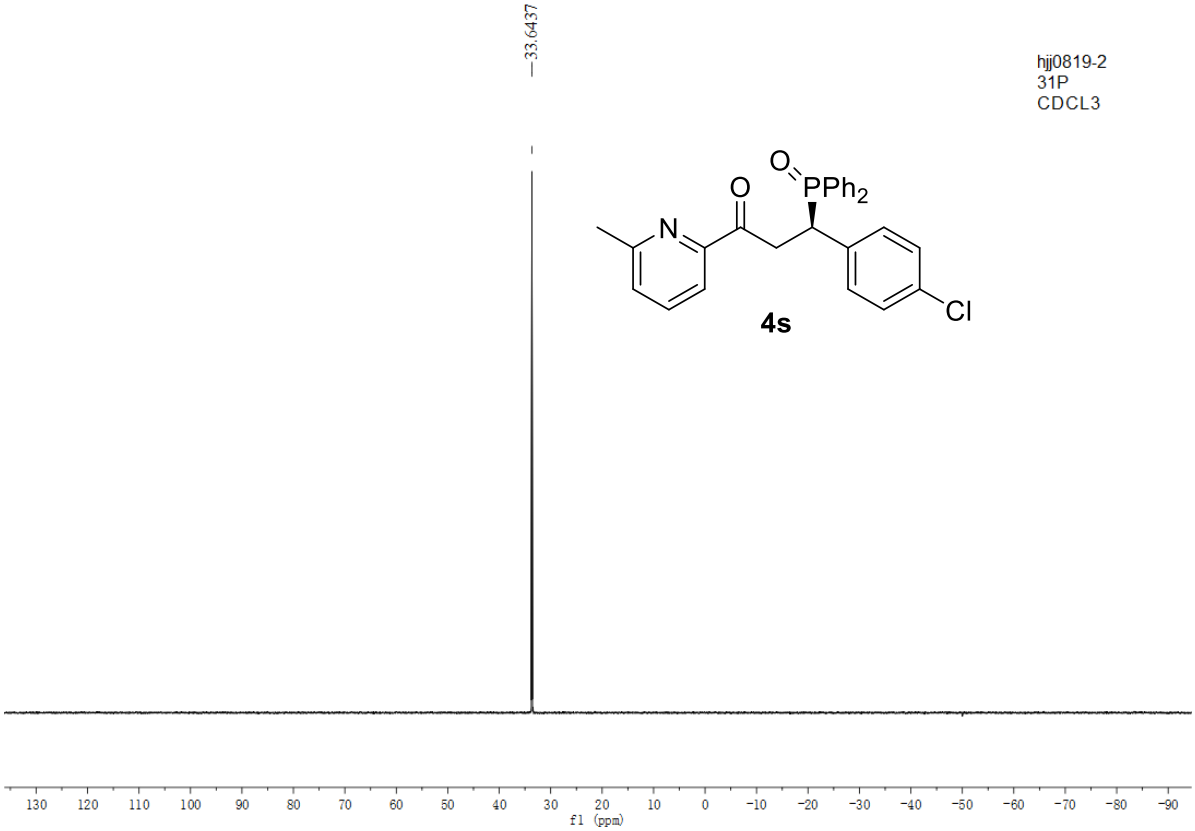
$^{31}P\{^{1}H\}$ NMR spectrum of **4r** (163 MHz, $CDCl_3$)



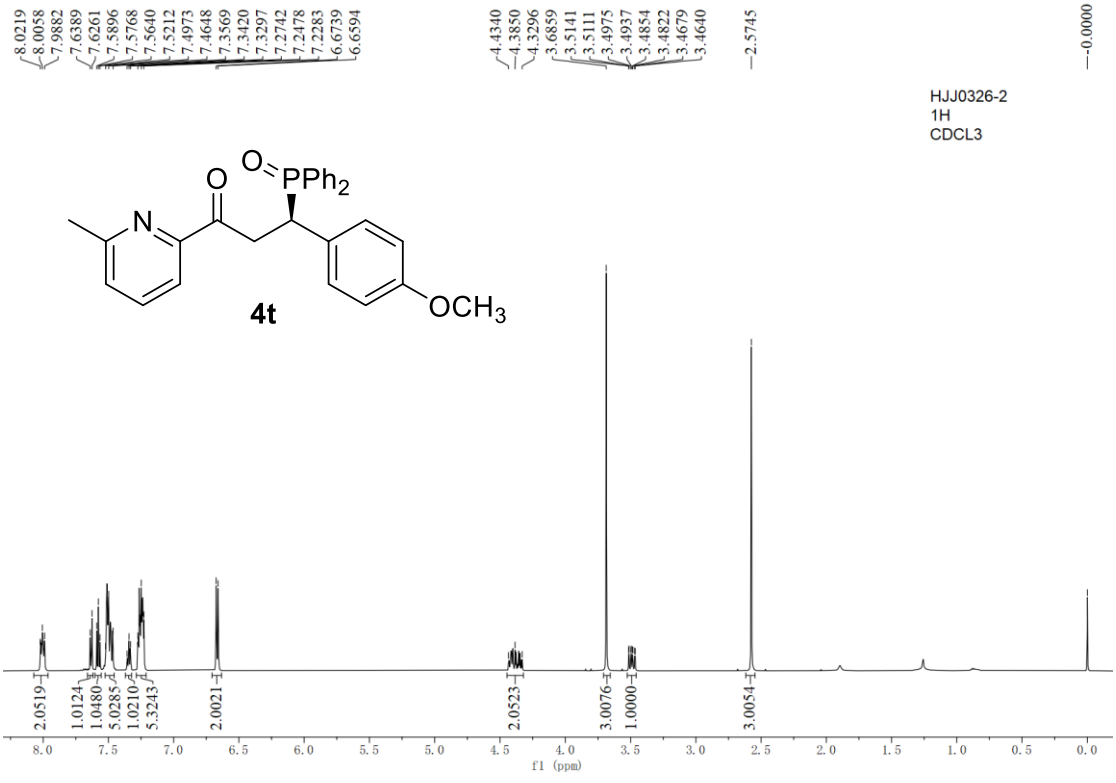
^{1}H NMR spectrum of **4s** (600 MHz, $CDCl_3$)



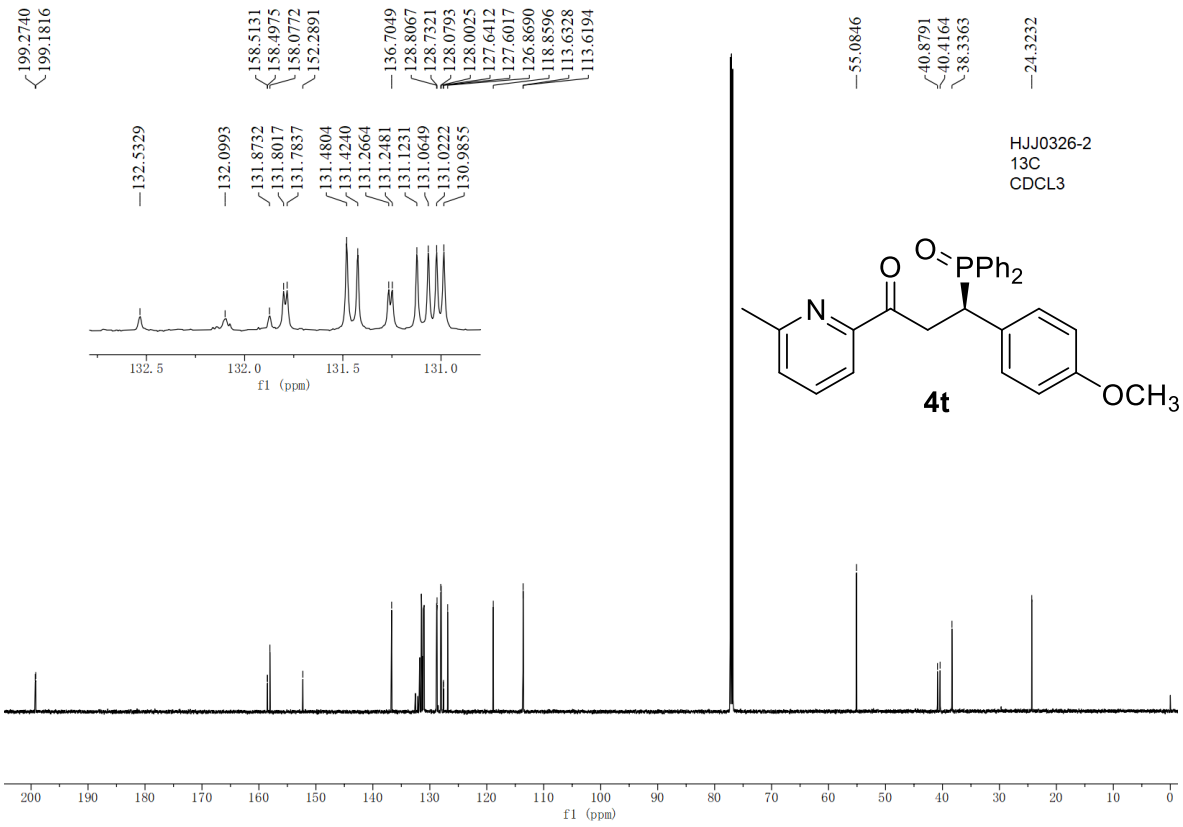
$^{13}C\{^{1}H\}$ NMR spectrum of **4s** (150 MHz, $CDCl_3$)



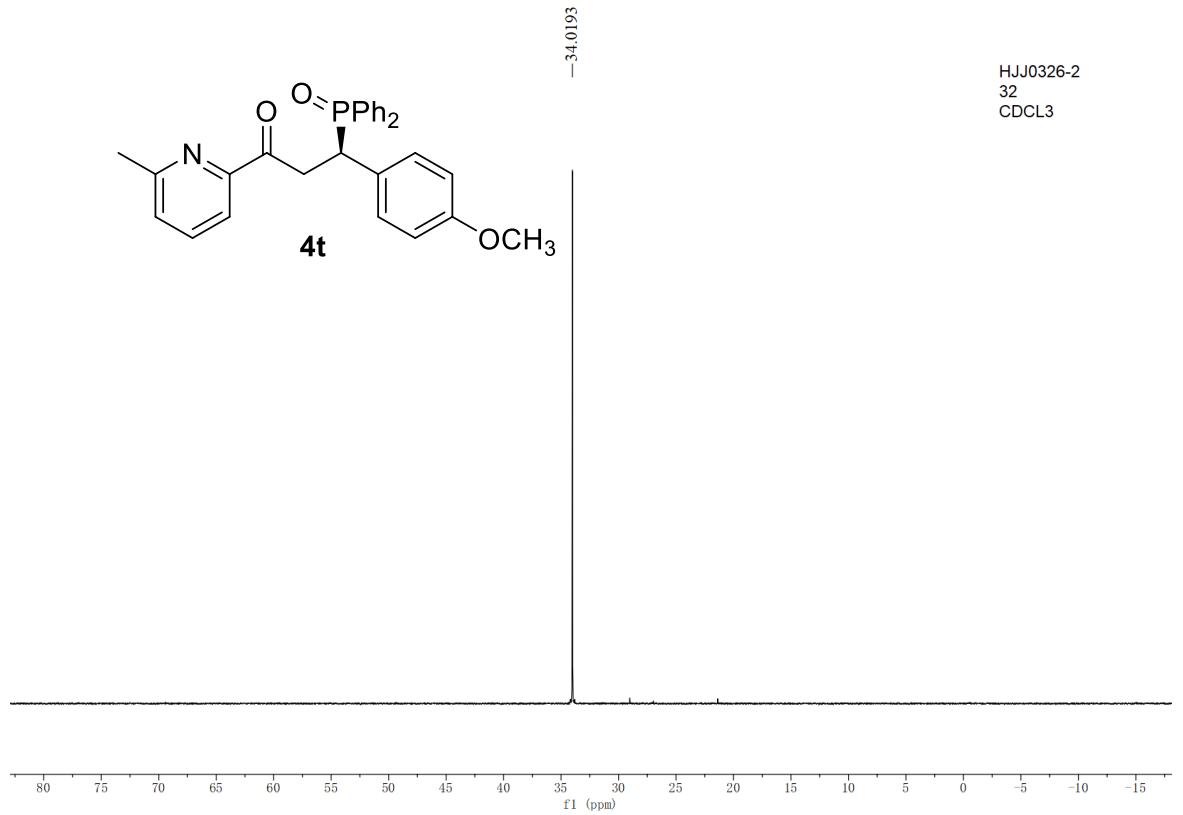
$^{31}P\{^{1}H\}$ NMR spectrum of **4s** (243 MHz, $CDCl_3$)



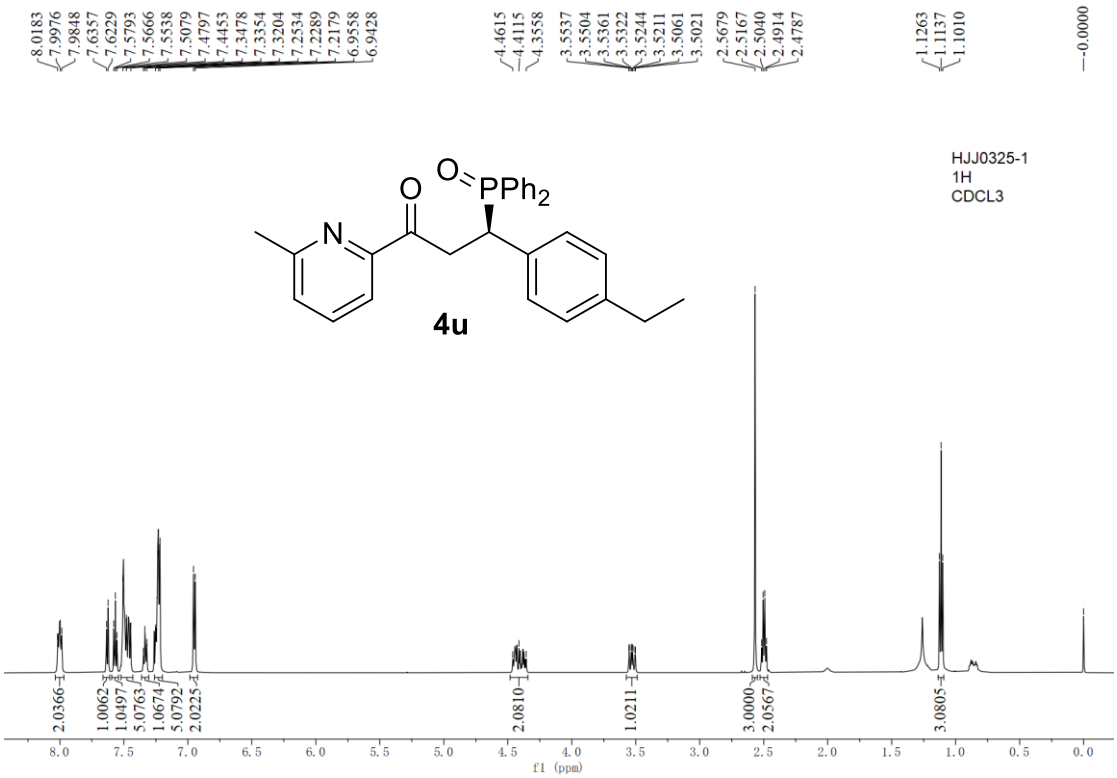
^{1}H NMR spectrum of **4t** (600 MHz, $CDCl_3$)



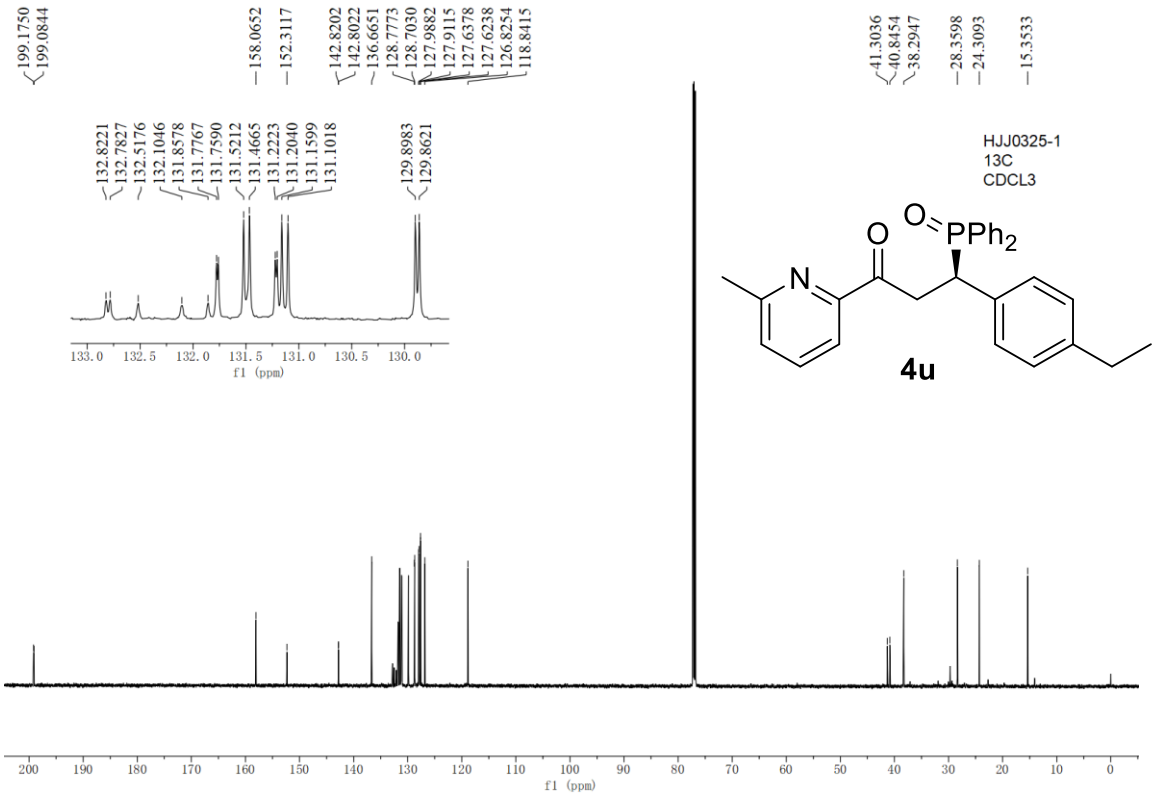
$^{13}C\{^{1}H\}$ NMR spectrum of **4t** (150 MHz, $CDCl_3$)



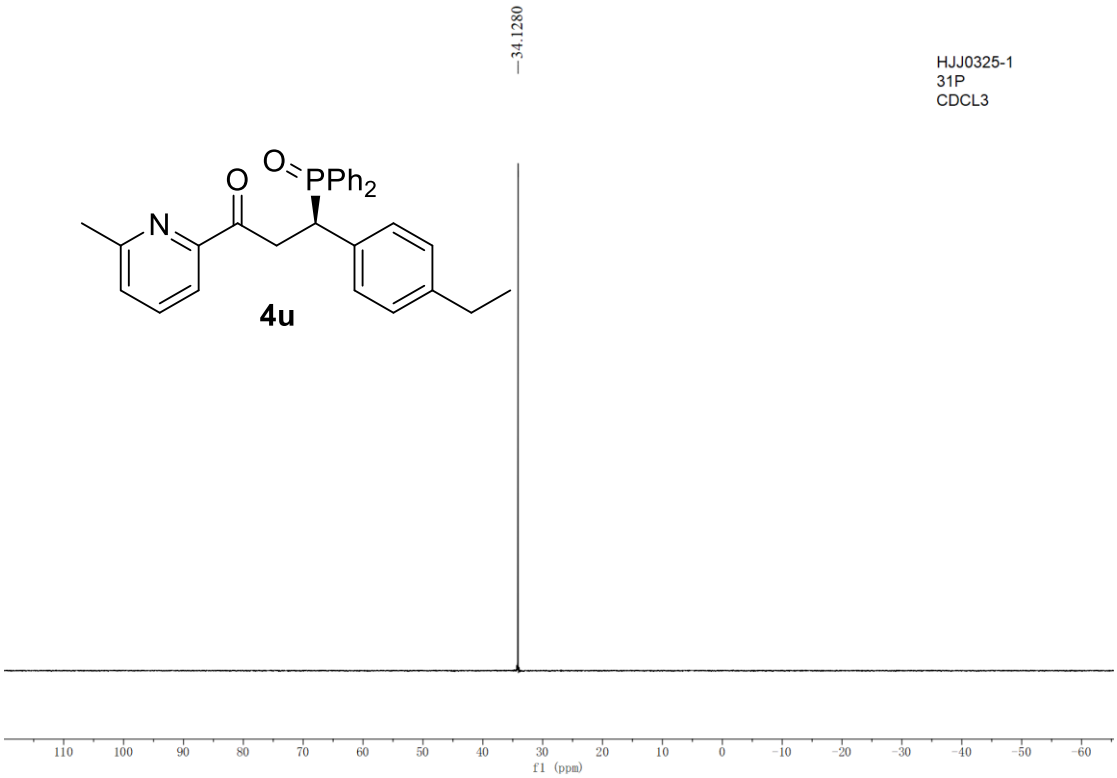
$^{31}P\{^{1}H\}$ NMR spectrum of **4t** (243 MHz, $CDCl_3$)



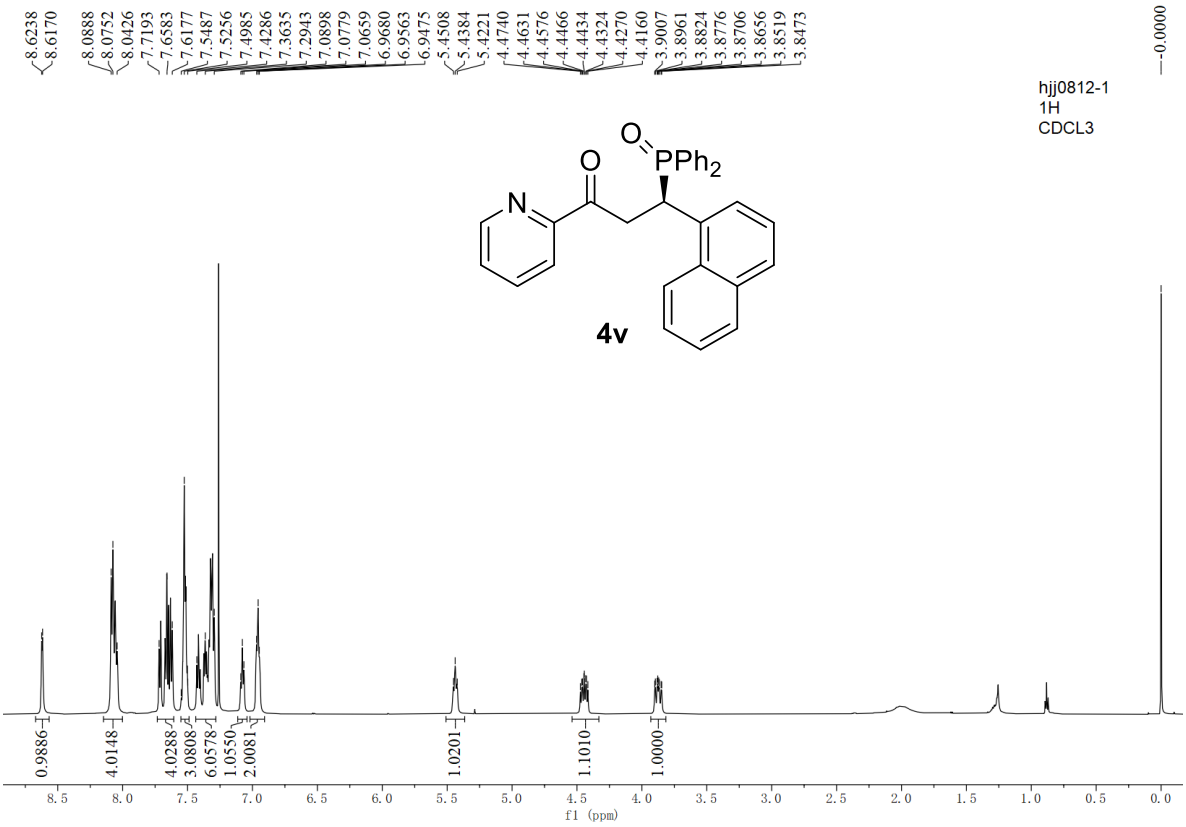
^{1}H NMR spectrum of **4u** (600 MHz, $CDCl_3$)



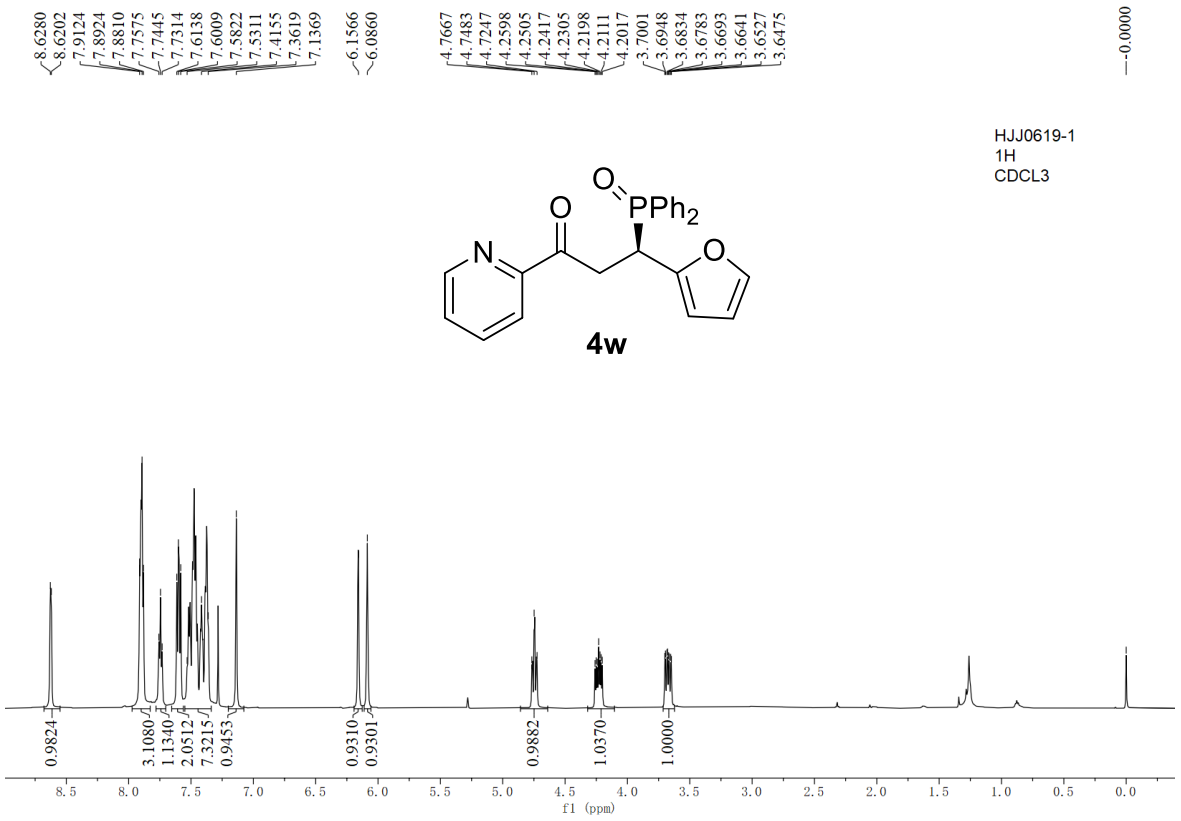
$^{13}C\{^{1}H\}$ NMR spectrum of **4u** (150 MHz, $CDCl_3$)



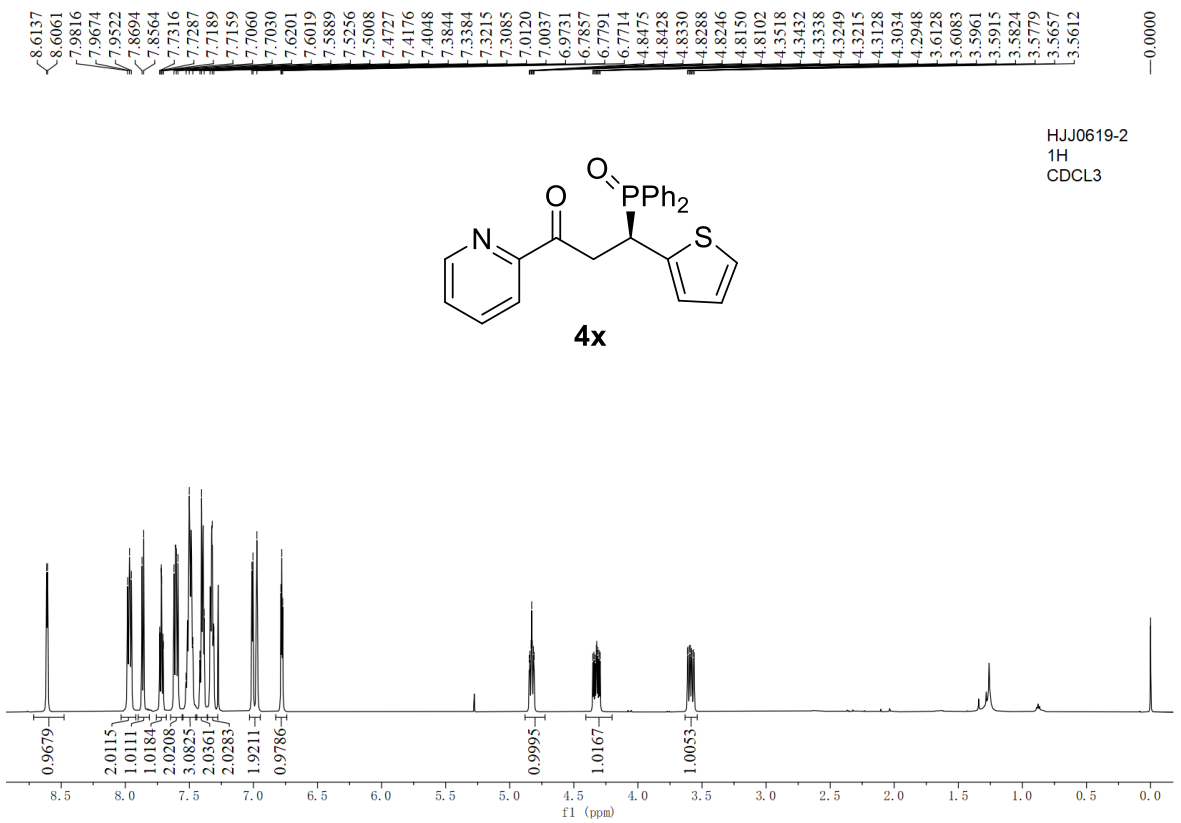
$^{31}P\{^{1}H\}$ NMR spectrum of **4u** (243 MHz, $CDCl_3$)



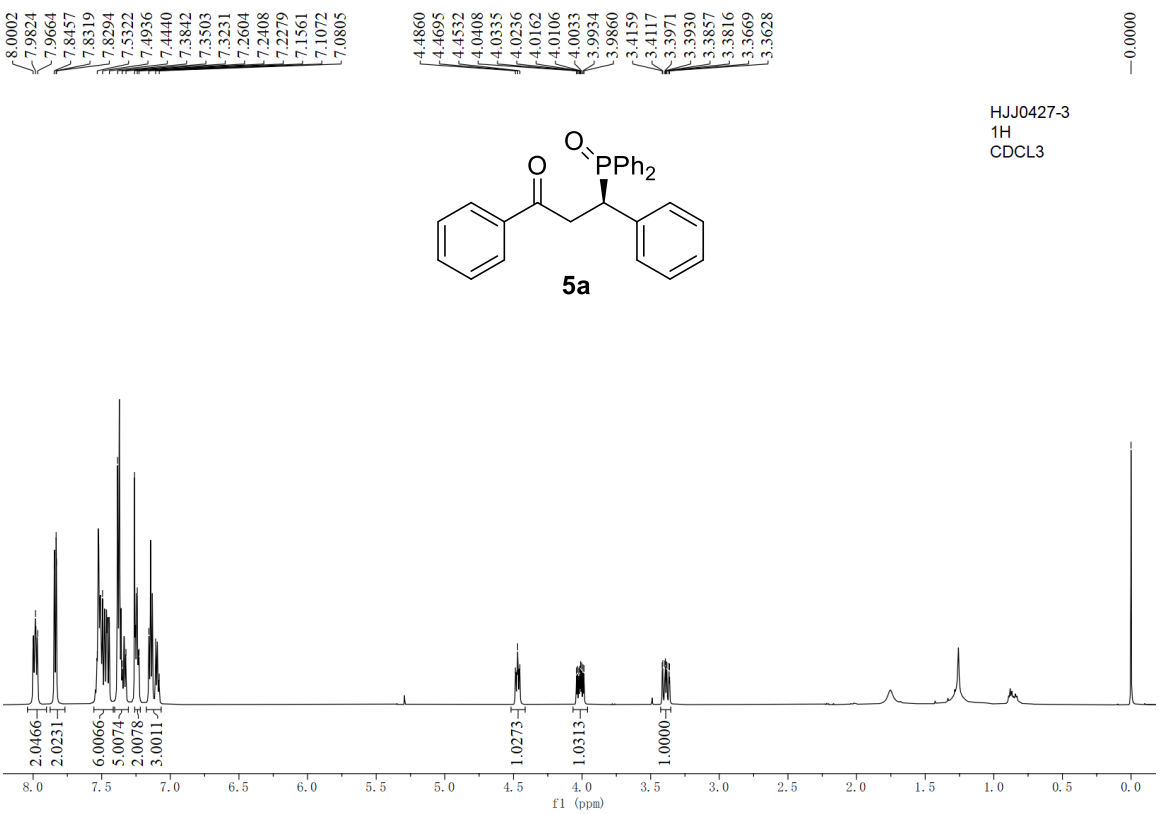
^{1}H NMR spectrum of **4v** (600 MHz, $CDCl_3$)



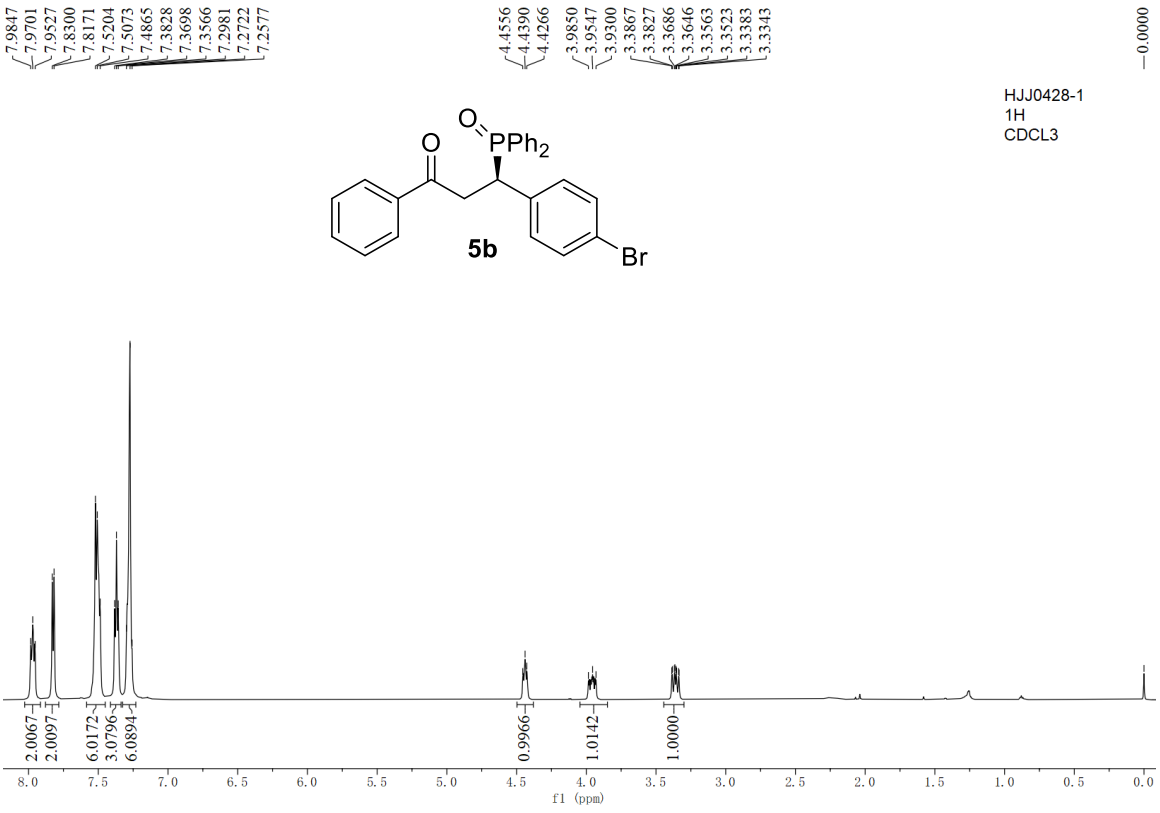
^{1}H NMR spectrum of **4w** (600 MHz, $CDCl_3$)



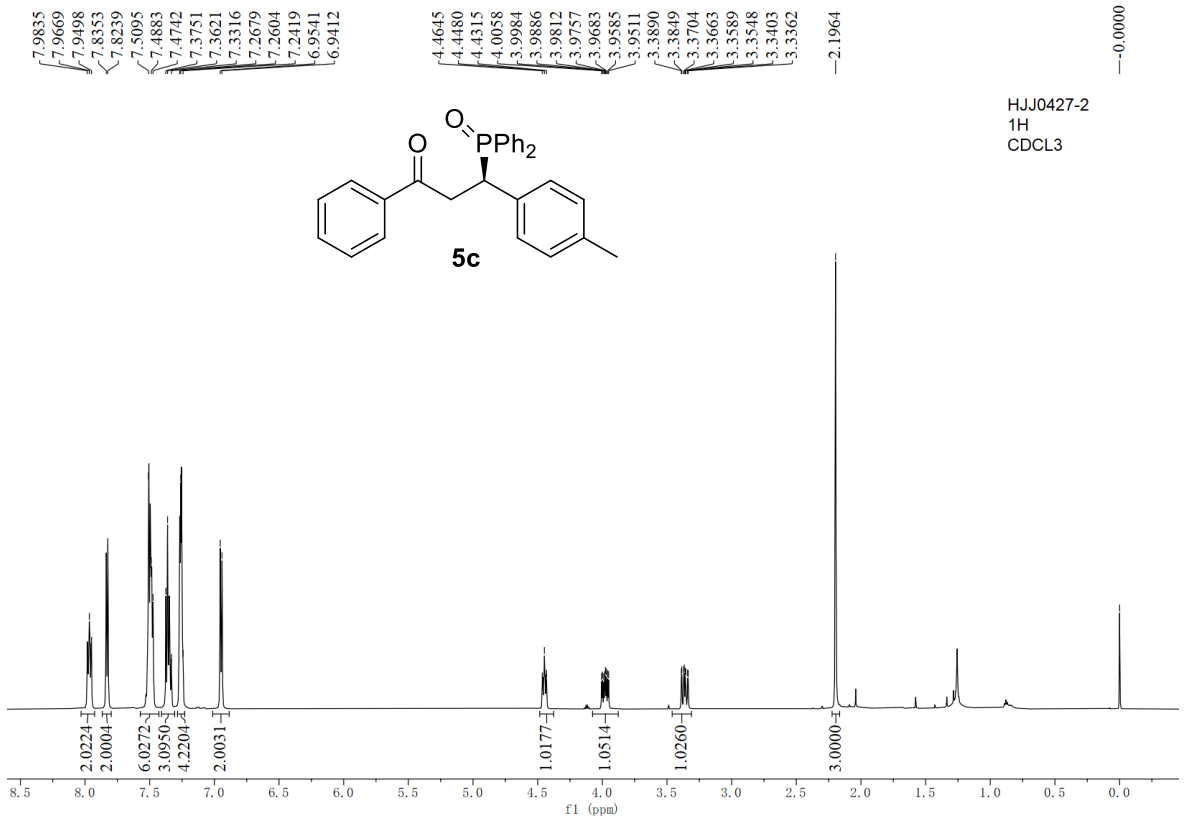
^{1}H NMR spectrum of **4x** (600 MHz, $CDCl_3$)



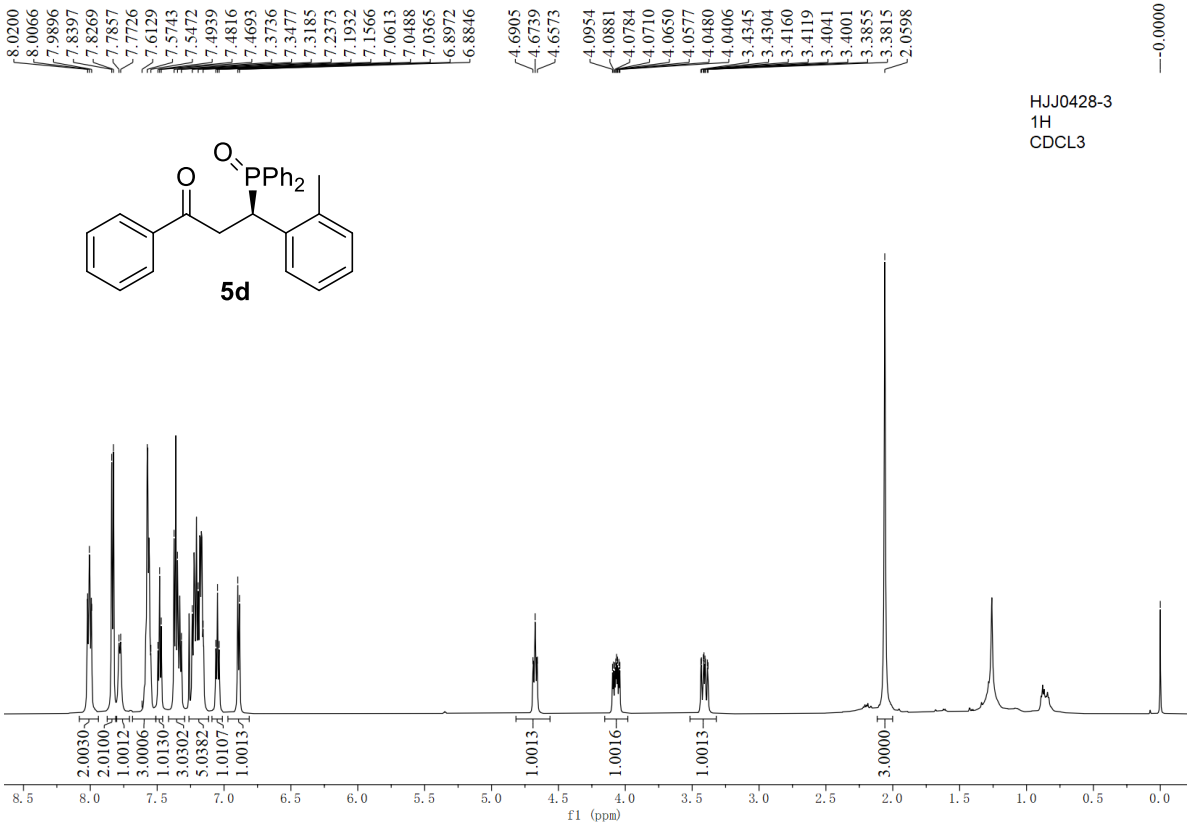
^{1}H NMR spectrum of **5a** (600 MHz, $CDCl_3$)



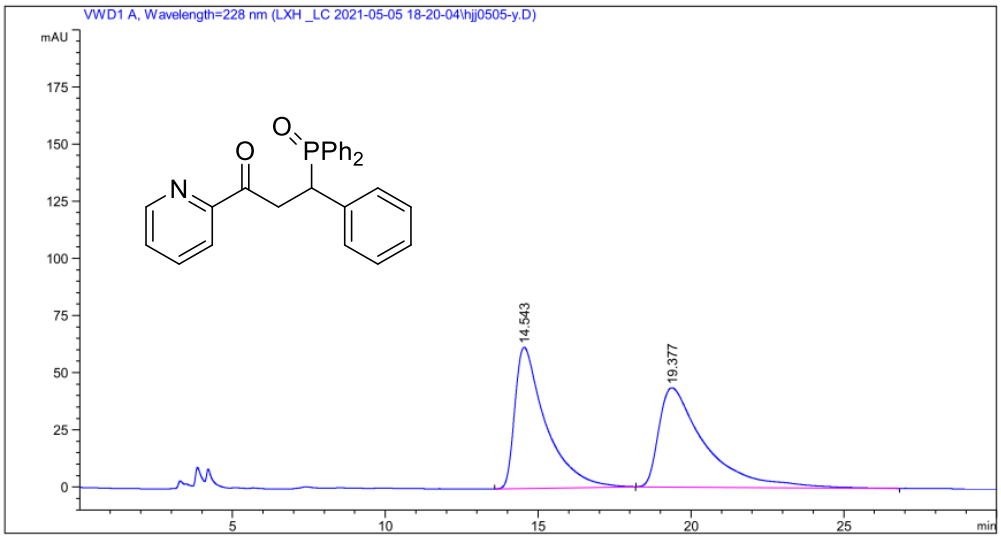
^{1}H NMR spectrum of **5b** (600 MHz, $CDCl_3$)



^{1}H NMR spectrum of **5c** (600 MHz, $CDCl_3$)

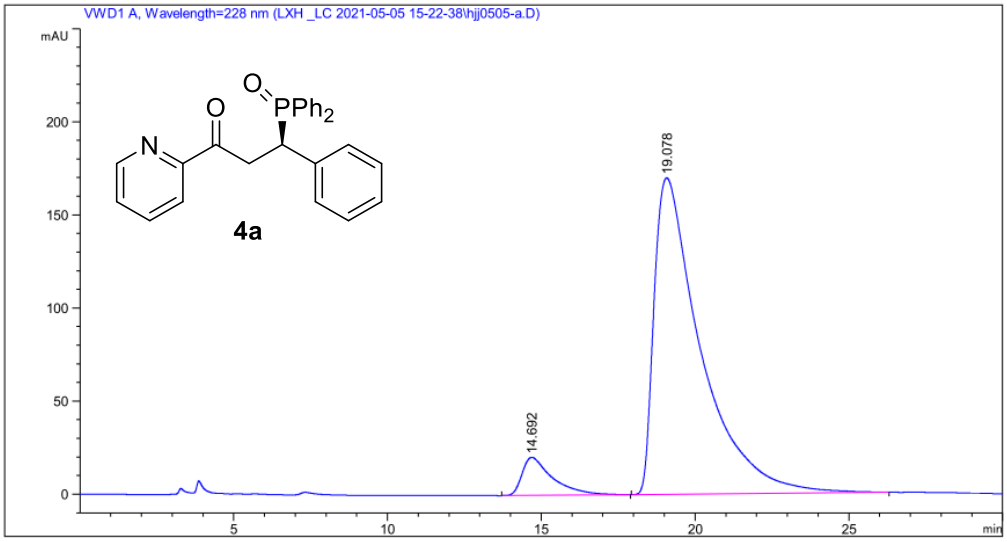


^{1}H NMR spectrum of **5d** (600 MHz, $CDCl_3$)



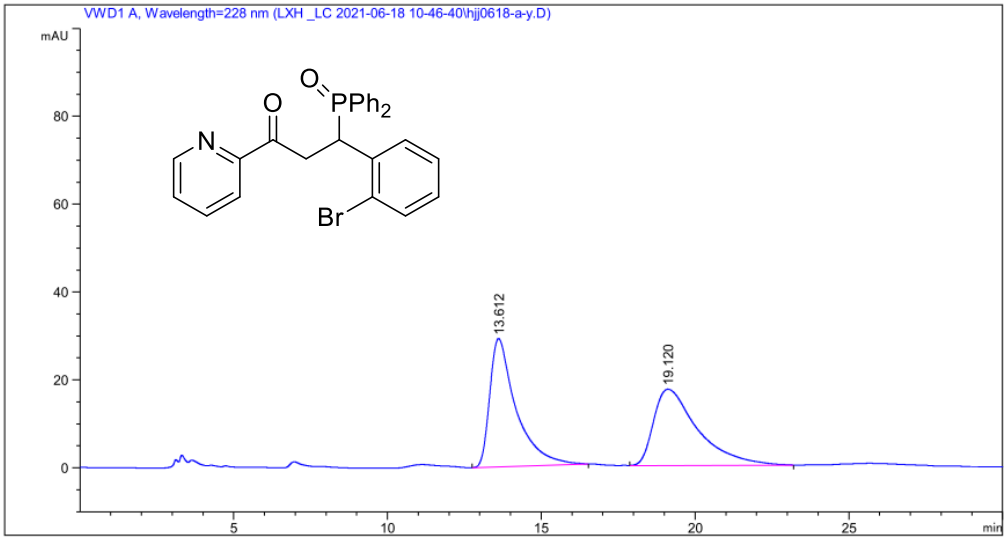
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	14.543	4338.86328	61.76144	48.9106
2	19.377	4532.14697	43.36746	51.0894

Chiral HPLC chromatogram for racemic **4a**



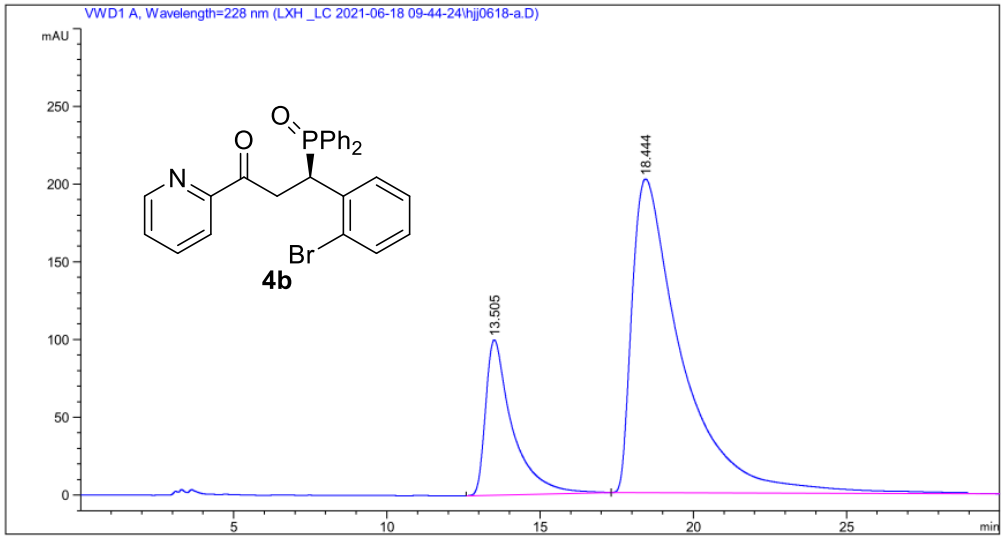
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	14.692	1409.67017	20.44440	7.3034
2	19.078	1.78920e4	170.00290	92.6966

Chiral HPLC chromatogram for enantioenriched **4a**



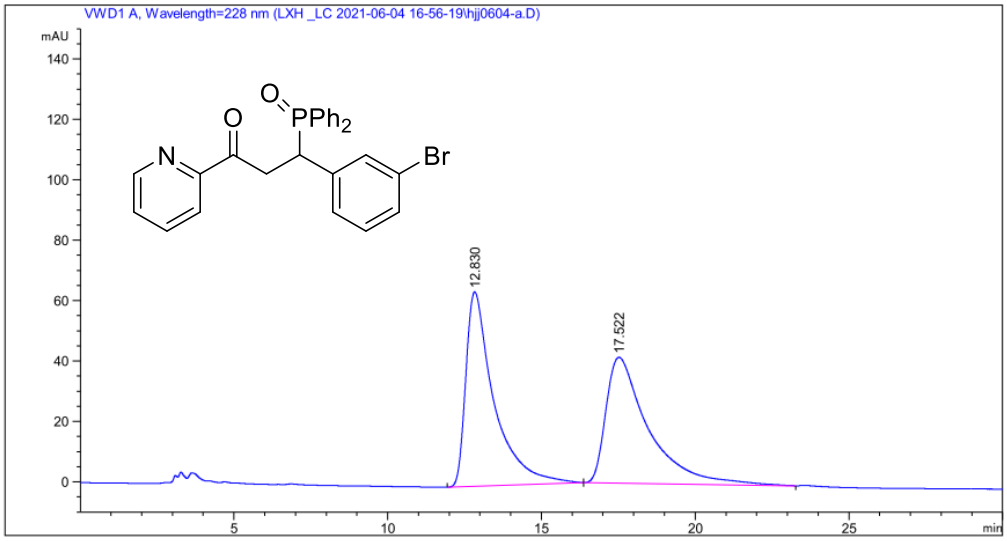
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	13.612	1737.38477	29.20243	50.2192
2	19.120	1722.21887	17.33938	49.7808

Chiral HPLC chromatogram for racemic **4b**



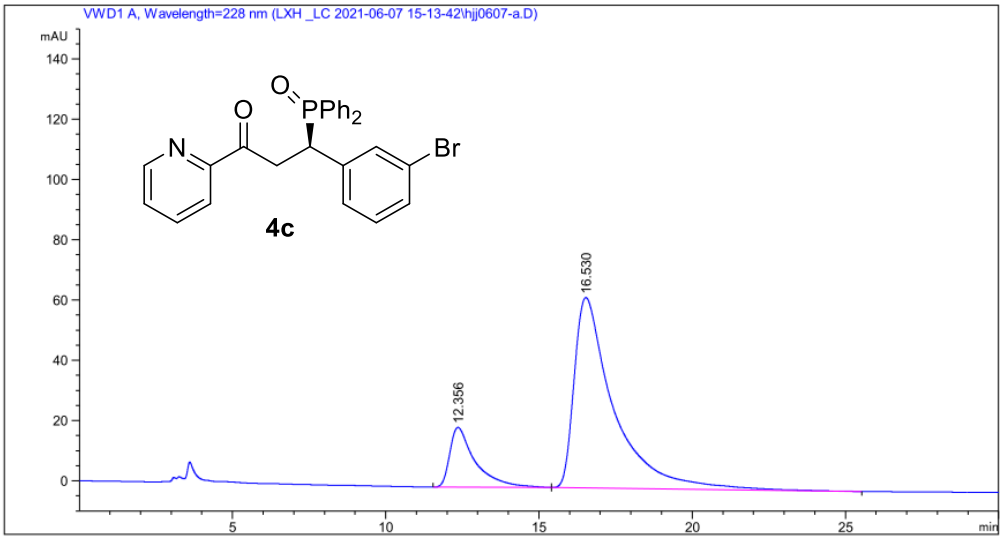
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	13.505	6059.80762	99.86134	21.0260
2	18.444	2.27607e4	201.68936	78.9740

Chiral HPLC chromatogram for enantioenriched **4b**



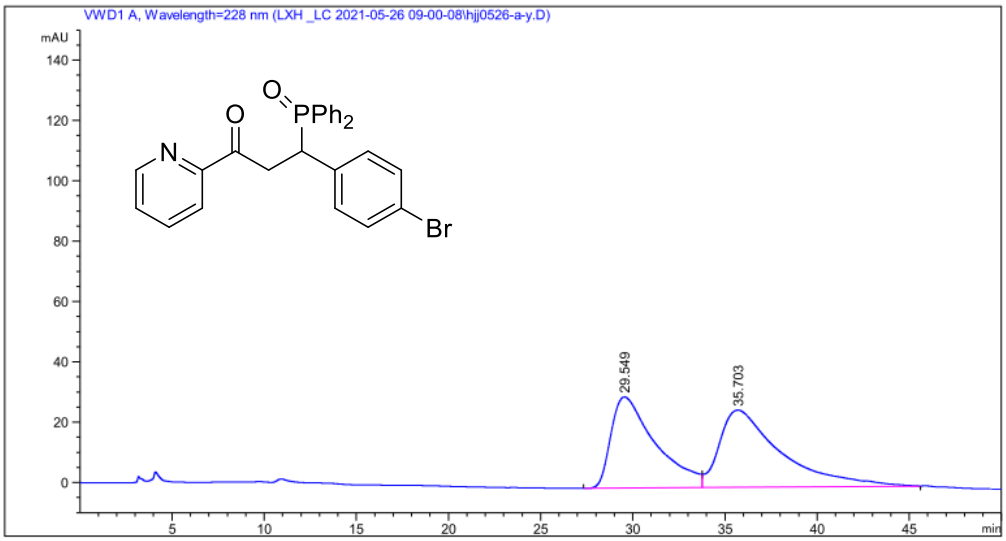
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	12.830	4098.35791	64.34928	50.6686
2	17.522	3990.20532	41.68118	49.3314

Chiral HPLC chromatogram for racemic **4c**



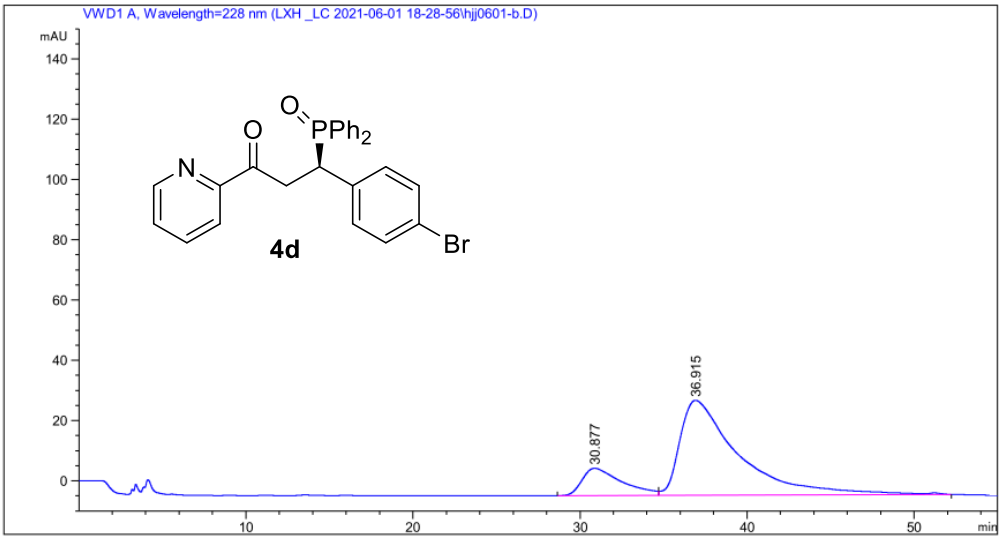
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	12.356	1147.78784	19.87691	16.7586
2	16.530	5701.14941	63.21720	83.2414

Chiral HPLC chromatogram for enantioenriched **4c**



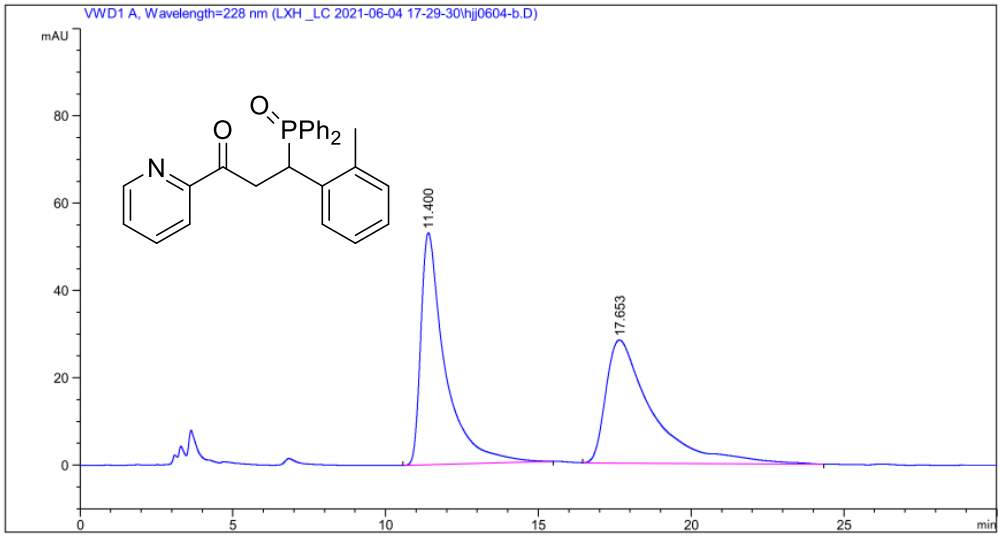
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	29.549	5067.33154	30.21894	46.1654
2	35.703	5909.14844	25.57130	53.8346

Chiral HPLC chromatogram for racemic **4d**



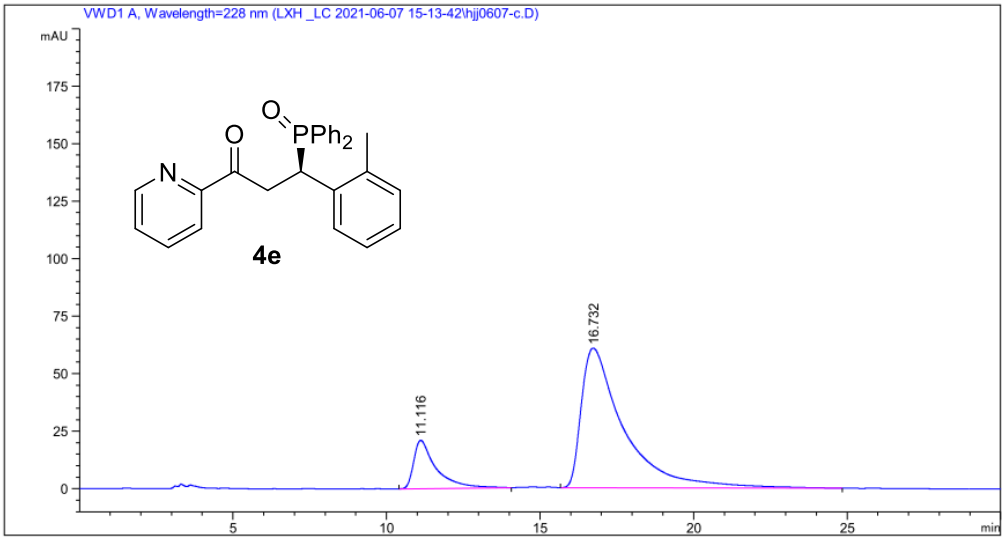
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	30.877	1500.17310	9.07932	16.3542
2	36.915	7672.85986	31.50071	83.6458

Chiral HPLC chromatogram for enantioenriched **4d**



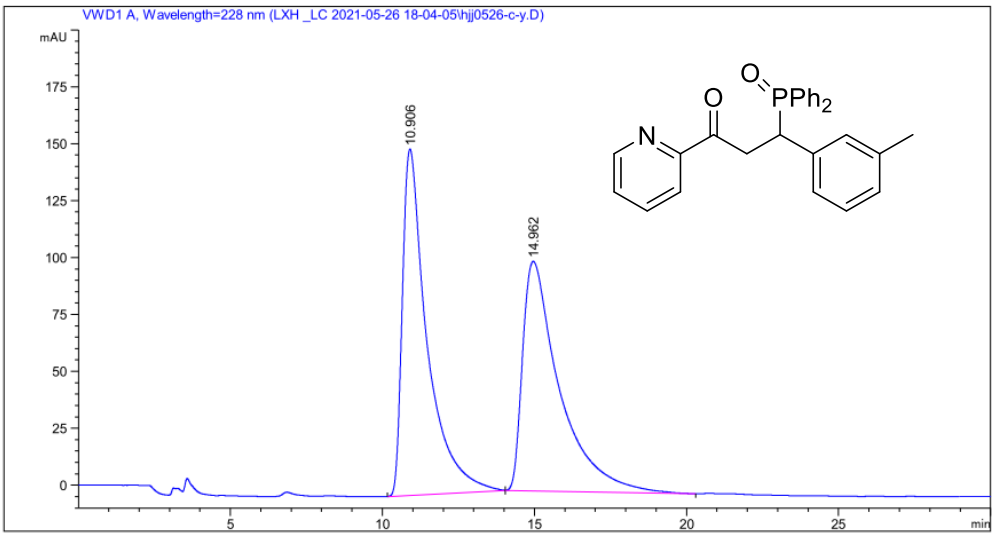
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	11.400	2936.97095	53.12720	49.7166
2	17.653	2970.45483	28.16958	50.2834

Chiral HPLC chromatogram for racemic **4e**



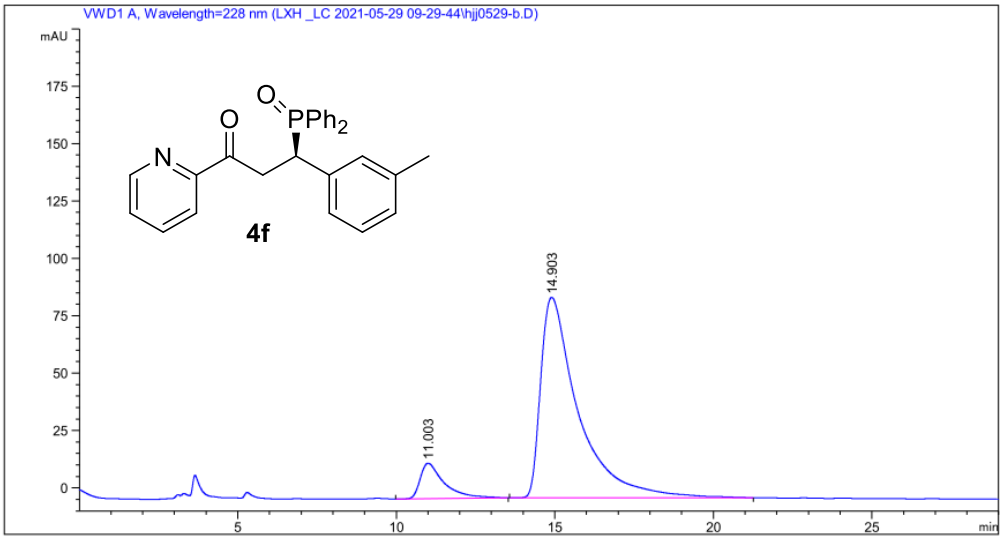
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	11.116	1058.98669	20.99481	15.3497
2	16.732	5840.08154	60.67751	84.6503

Chiral HPLC chromatogram for enantioenriched **4e**



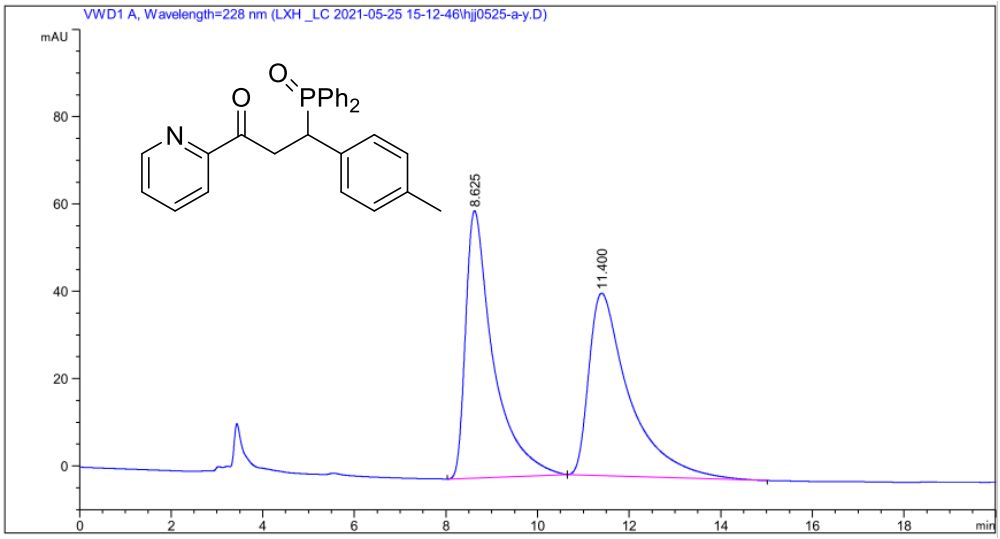
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.906	8583.00391	152.13066	50.2152
2	14.962	8509.45215	100.78463	49.7848

Chiral HPLC chromatogram for racemic **4f**



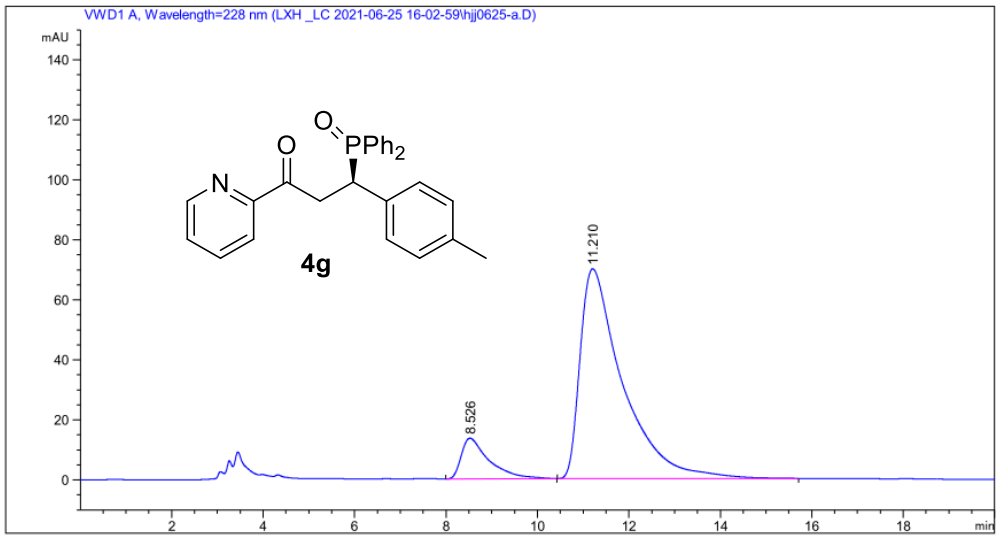
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	11.003	807.63409	15.4145	10.0869
2	14.903	7199.14160	87.30708	89.9131

Chiral HPLC chromatogram for enantioenriched **4f**



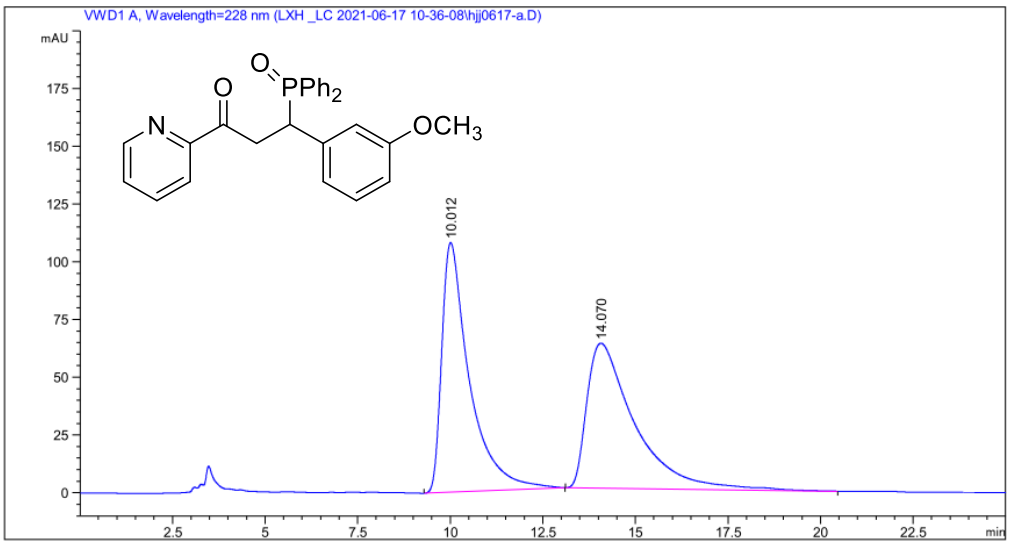
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.625	2566.92993	61.21783	50.1187
2	11.400	2554.76660	41.77489	49.8813

Chiral HPLC chromatogram for racemic **4g**



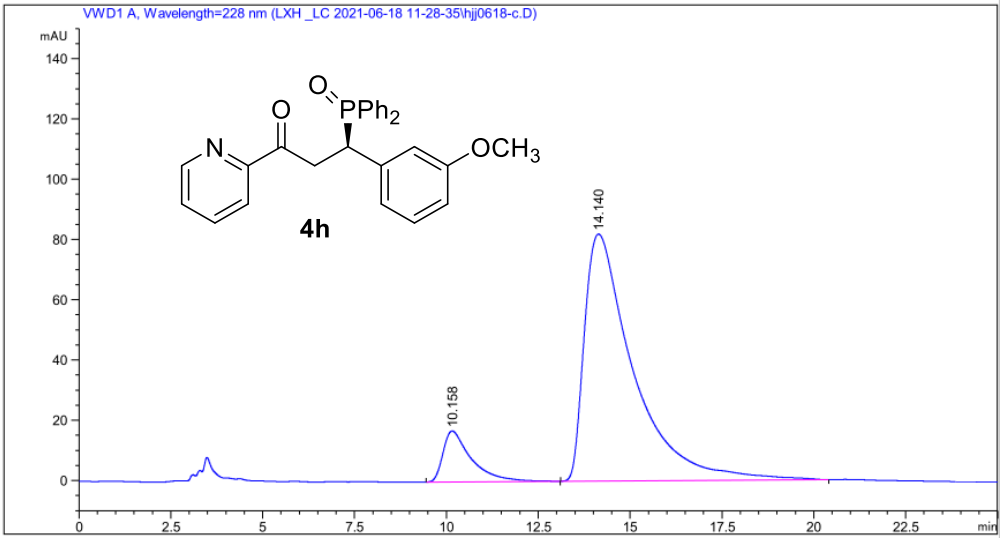
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.526	580.35913	13.63197	11.3664
2	11.210	4525.54688	69.95989	88.6336

Chiral HPLC chromatogram for enantioenriched **4g**



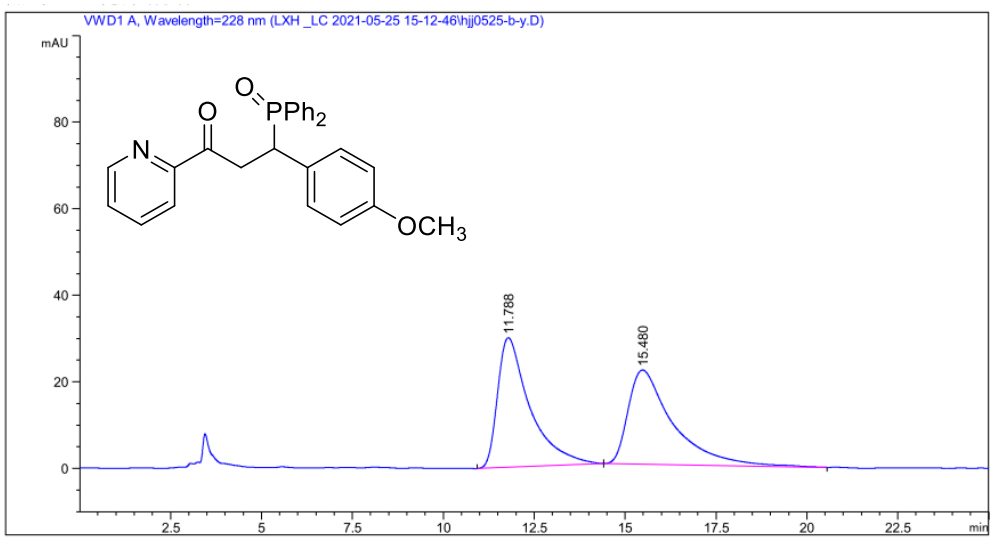
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.012	5627.56934	108.02071	50.0106
2	14.070	5625.17432	62.76397	49.9894

Chiral HPLC chromatogram for racemic **4h**



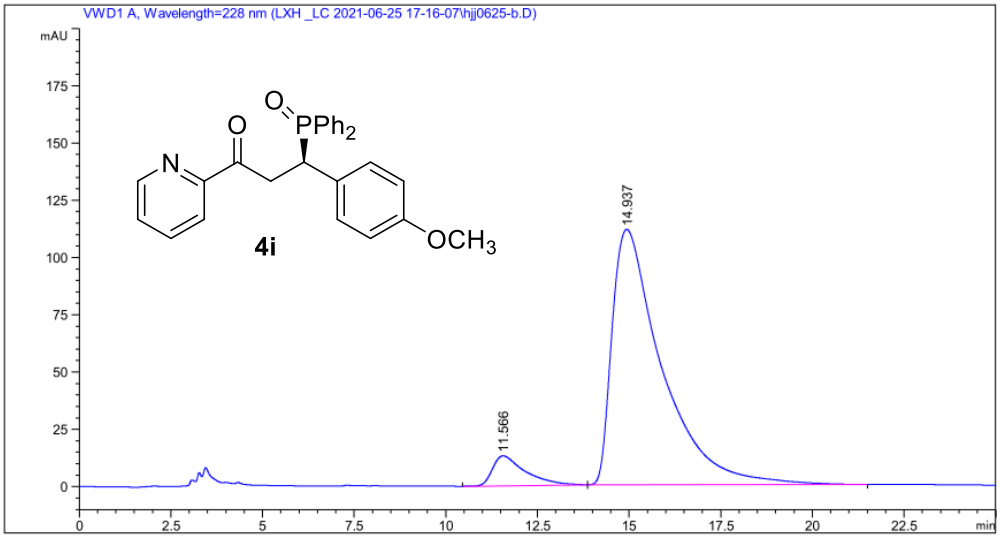
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.158	899.75726	16.88532	10.6014
2	14.140	7587.41797	81.93791	89.3986

Chiral HPLC chromatogram for enantioenriched **4h**



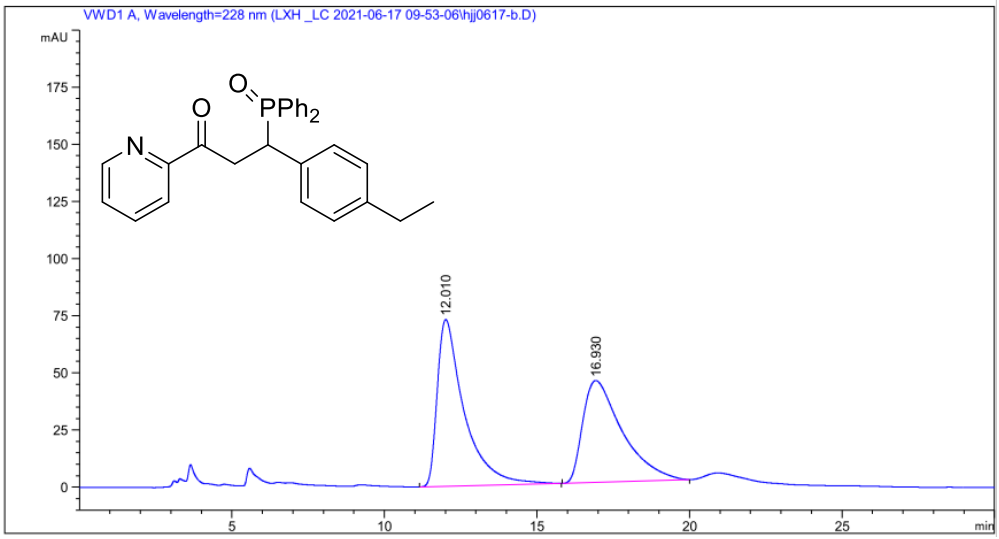
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	11.788	1853.45801	29.96197	49.8913
2	15.480	1861.53418	21.77329	50.1087

Chiral HPLC chromatogram for racemic **4i**



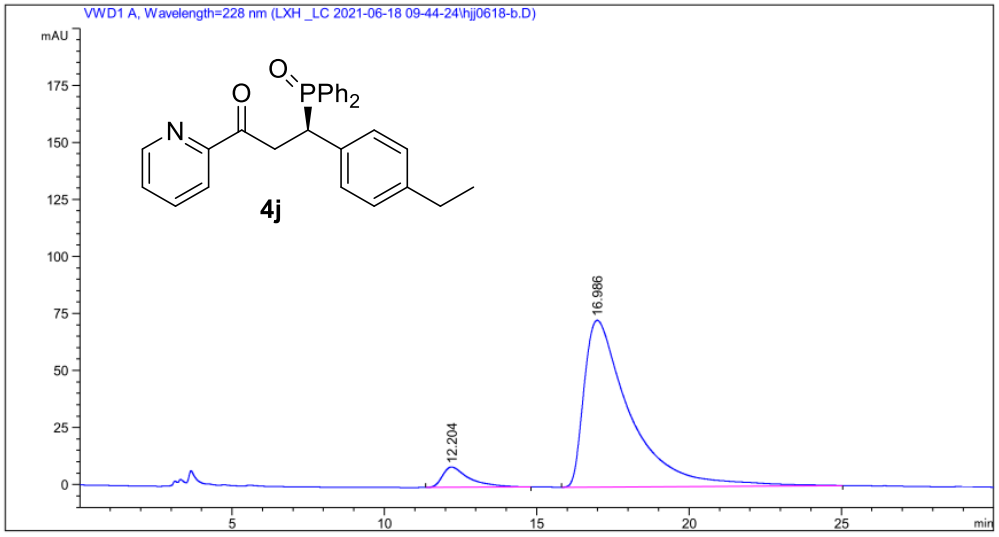
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	11.566	806.14996	13.07797	7.1100
2	14.937	1.05321e4	111.46671	92.8900

Chiral HPLC chromatogram for enantioenriched **4i**



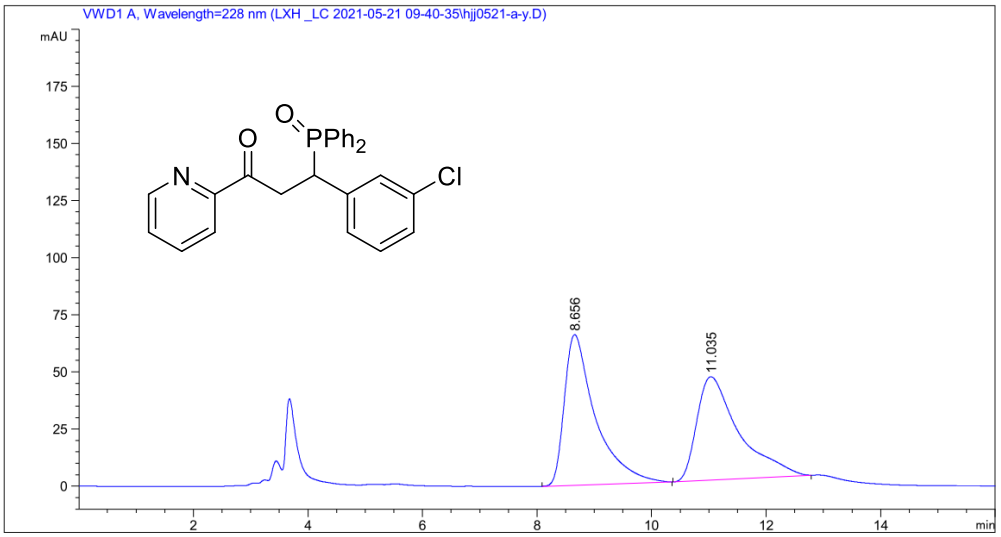
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	12.010	4493.66455	72.98086	52.8322
2	16.930	4011.88037	44.59854	47.1678

Chiral HPLC chromatogram for racemic **4j**



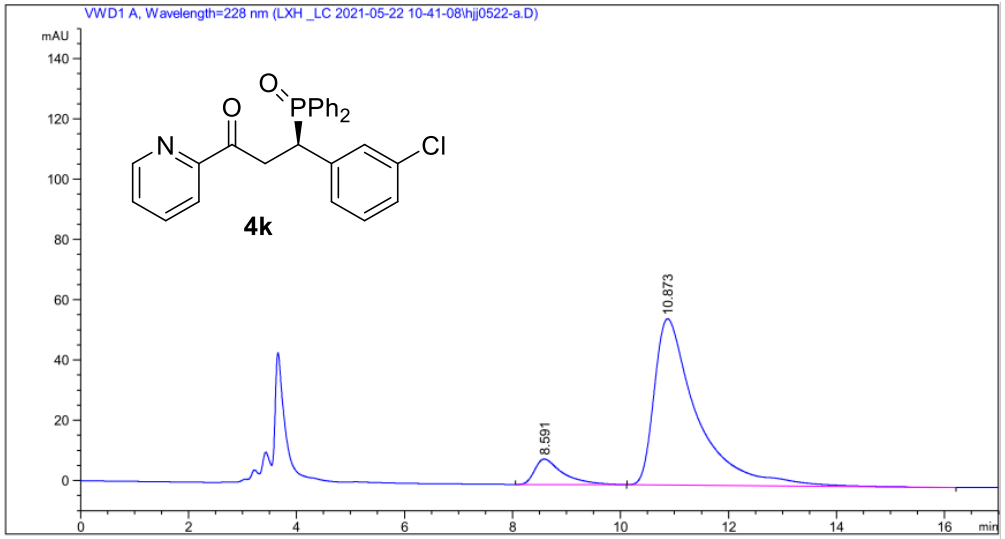
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	12.204	540.19489	8.89561	6.5767
2	16.986	7673.62354	73.10091	93.4233

Chiral HPLC chromatogram for enantioenriched **4j**



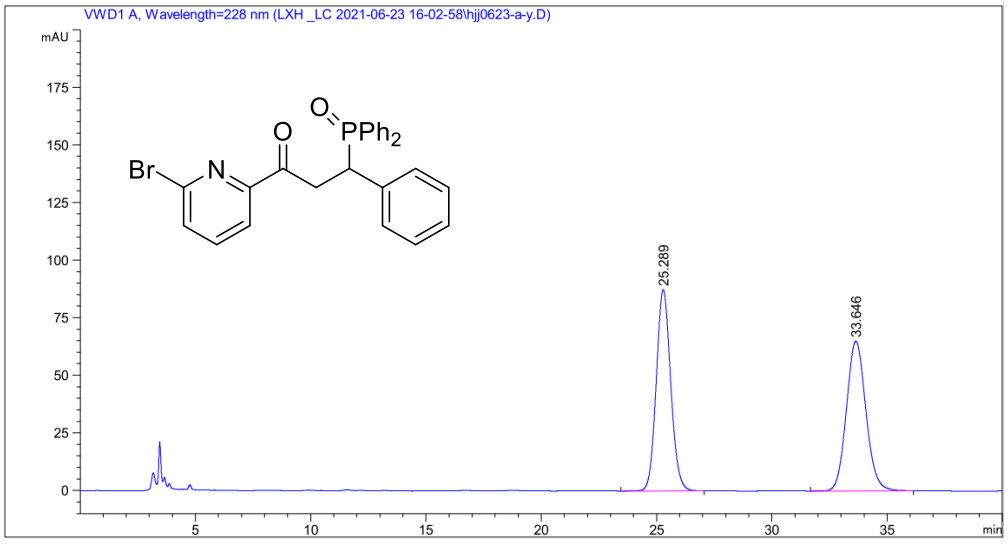
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.656	2486.69409	65.91425	51.9093
2	11.035	2303.76978	45.26632	48.0907

Chiral HPLC chromatogram for racemic **4k**



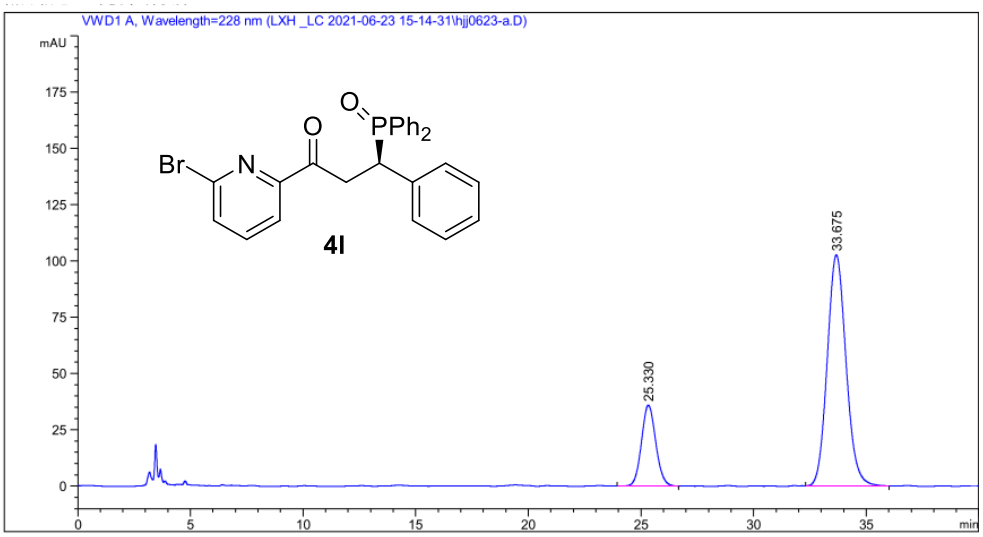
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.591	307.52338	8.46919	9.2396
2	10.873	3020.80786	55.16140	90.7604

Chiral HPLC chromatogram for enantioenriched **4k**



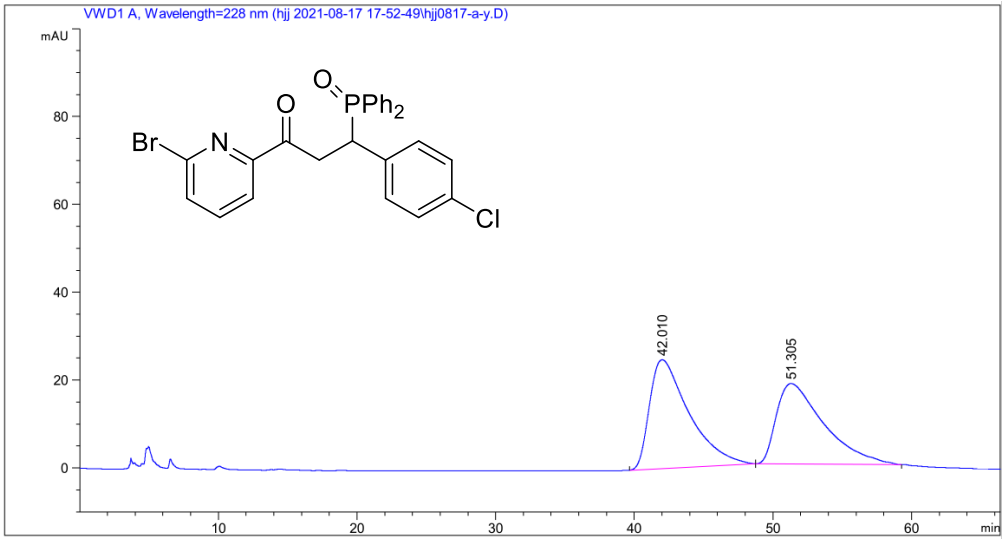
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	25.289	3811.75024	87.34692	49.9614
2	33.646	3817.64233	64.98469	50.0386

Chiral HPLC chromatogram for racemic **4l**



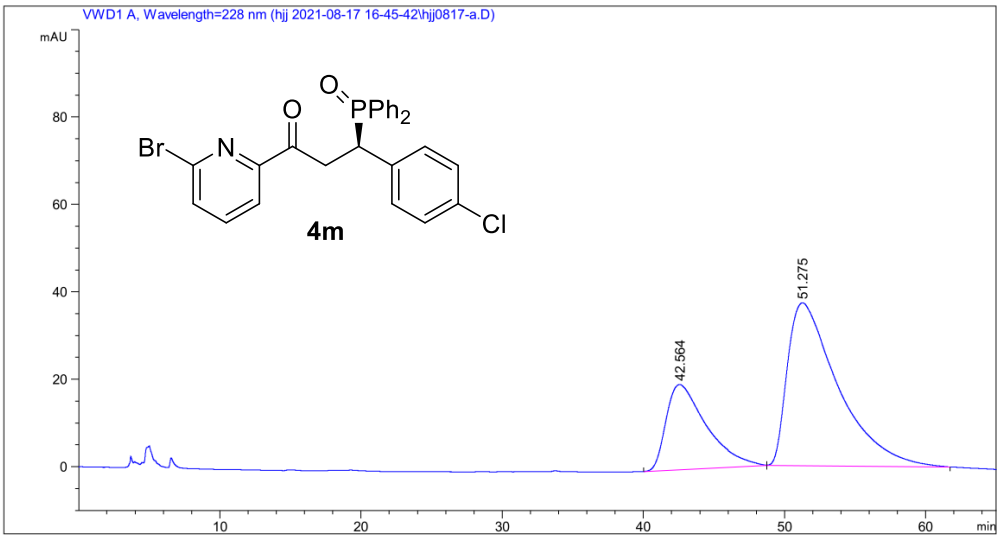
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	25.330	1587.89038	35.96258	21.0770
2	33.675	5945.85449	102.54272	78.9230

Chiral HPLC chromatogram for enantioenriched **4l**



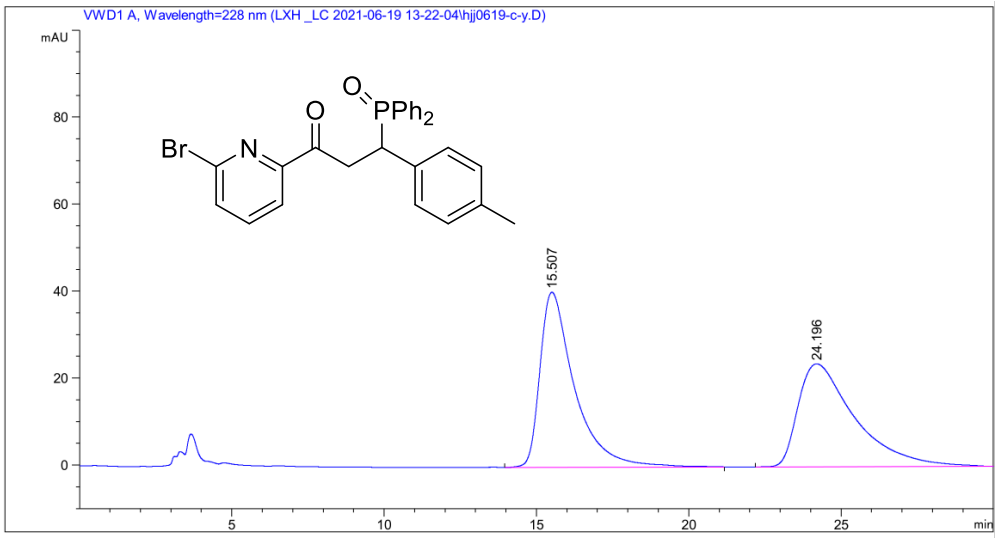
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	42.010	4905.75342	24.76257	52.8728
2	51.3051	4372.64990	18.33787	47.1272

Chiral HPLC chromatogram for racemic **4m**



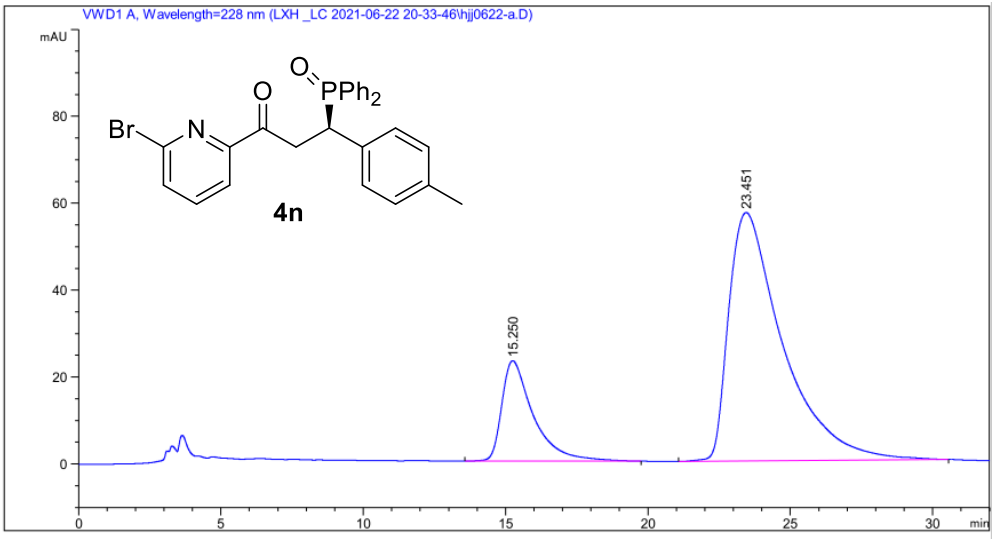
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	42.564	3842.41357	19.47927	29.2509
2	51.275	9293.63477	37.23388	70.7491

Chiral HPLC chromatogram for enantioenriched **4m**



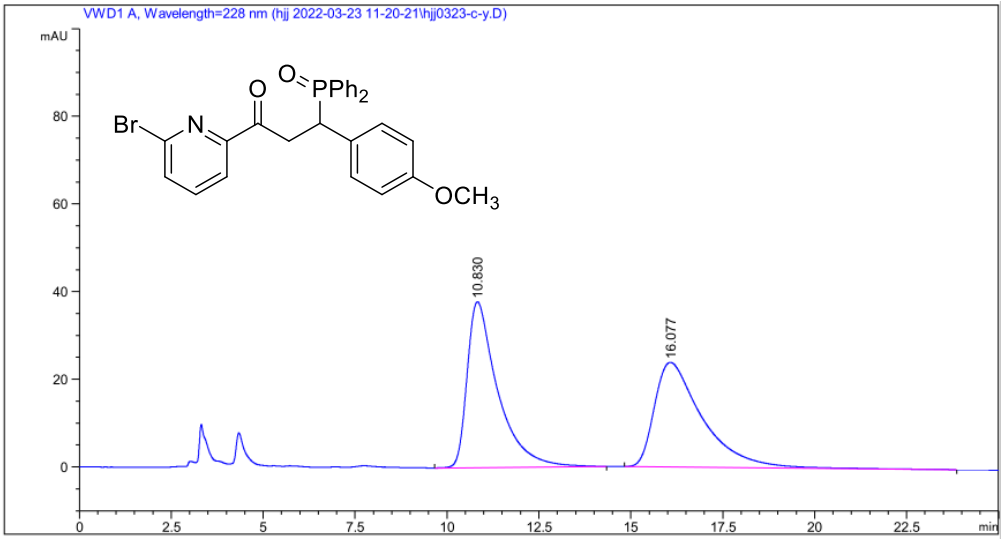
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	15.507	3184.20508	40.29589	50.9556
2	24.196	3064.77148	23.65708	49.0444

Chiral HPLC chromatogram for racemic **4n**



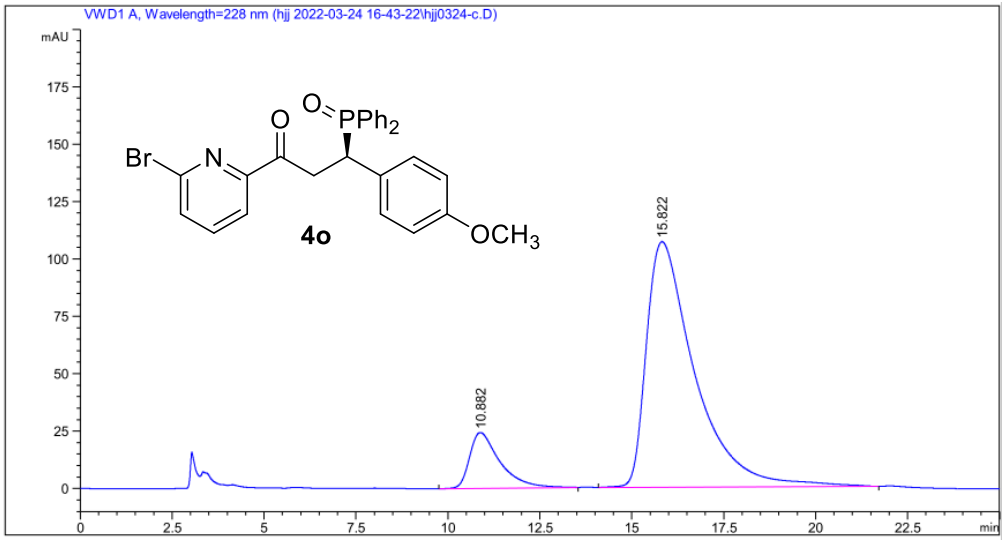
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	15.250	1780.59644	23.09826	19.0620
2	23.451	7560.46826	57.18015	80.9380

Chiral HPLC chromatogram for enantioenriched **4n**



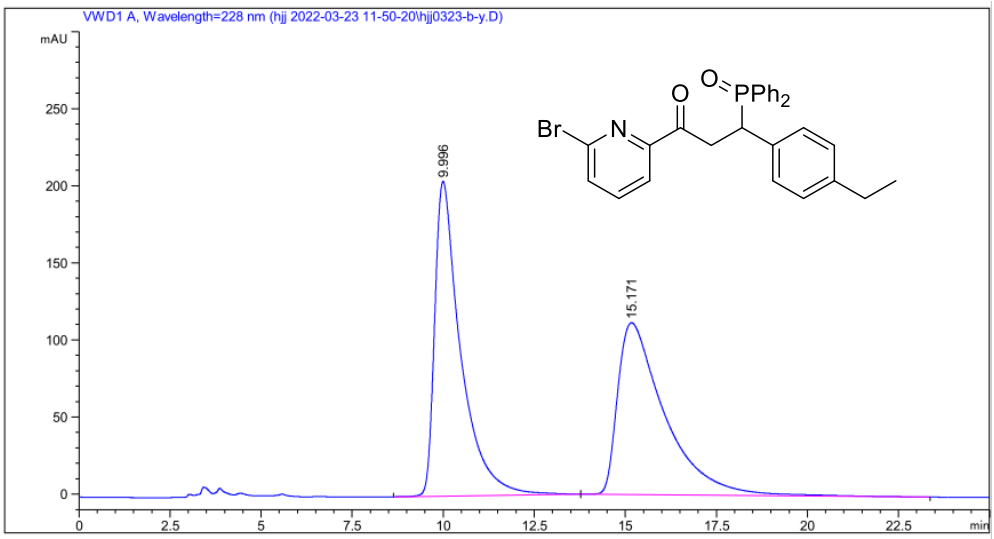
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.830	2189.66211	37.82795	50.3462
2	16.077	2159.54492	23.85839	49.6538

Chiral HPLC chromatogram for racemic **4o**



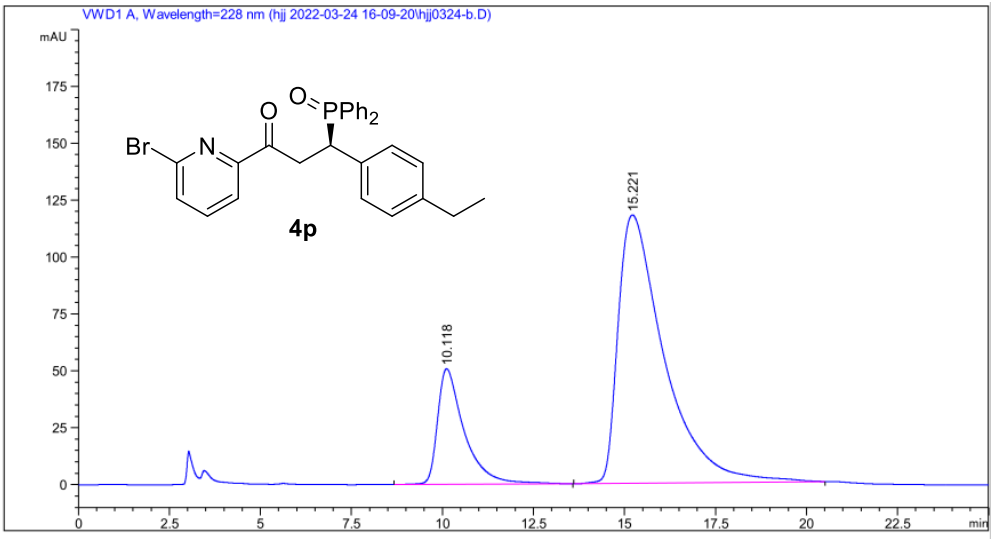
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.882	1392.42065	24.30182	12.4570
2	15.822	9785.39453	106.91105	87.5430

Chiral HPLC chromatogram for enantioenriched **4o**



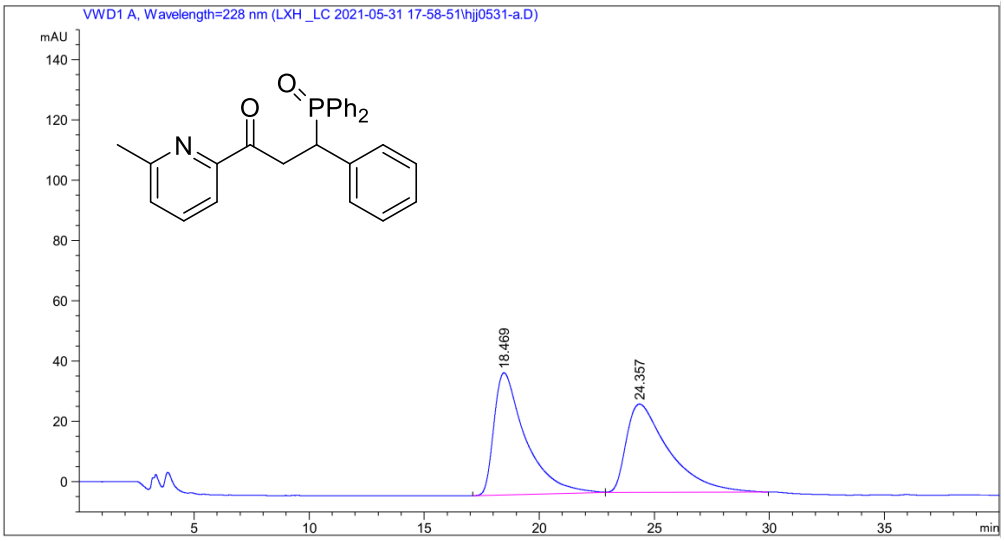
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	9.996	1.01281e4	204.05437	50.2544
2	15.171	1.00255e4	111.44259	49.7456

Chiral HPLC chromatogram for racemic **4p**



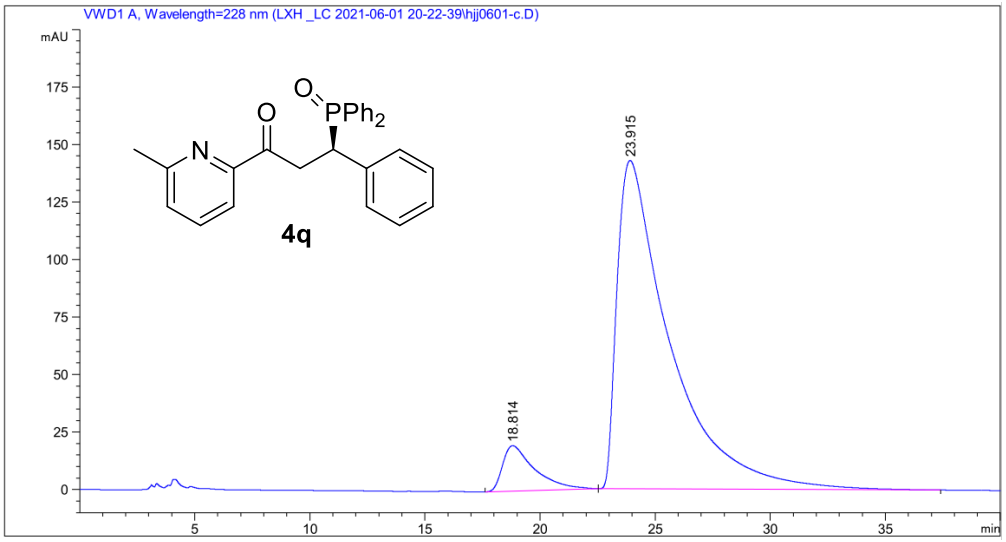
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	10.118	2590.84888	50.73385	19.9893
2	15.221	1.03703e4	117.92656	80.0107

Chiral HPLC chromatogram for enantioenriched **4p**



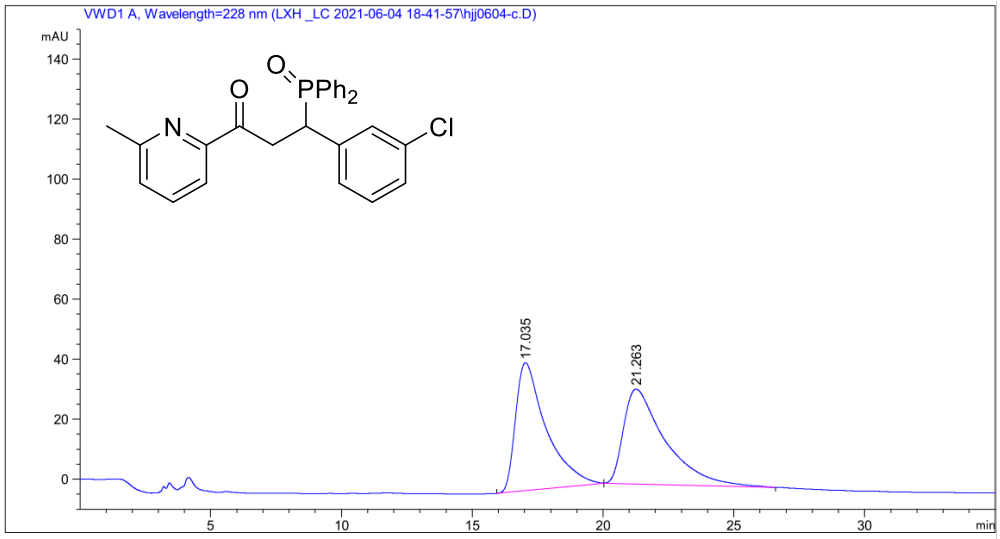
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	18.469	3860.53613	40.51168	50.7978
2	24.357	3739.28101	29.25183	49.2022

Chiral HPLC chromatogram for racemic **4q**



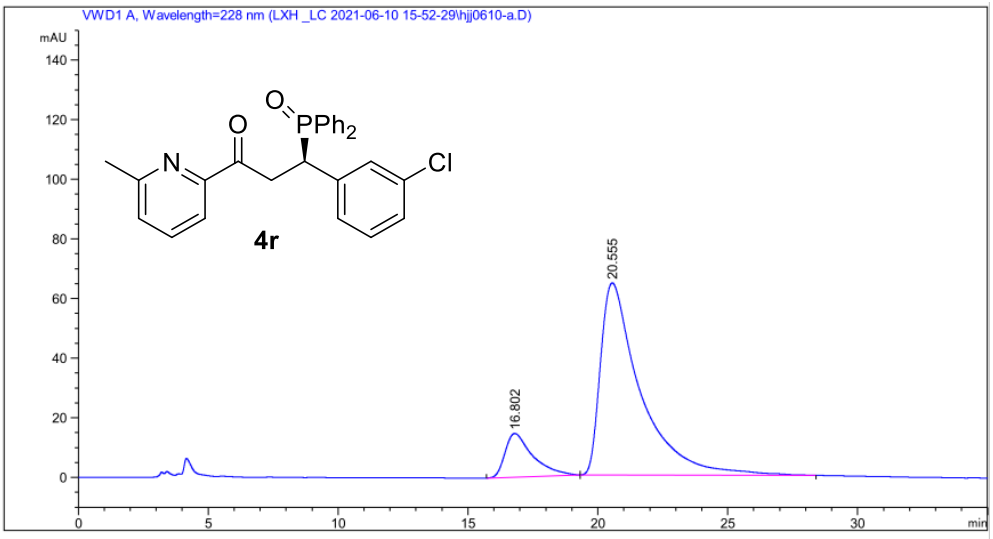
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	18.814	1915.61938	19.78741	7.7345
2	23.915	2.28515e4	142.73439	92.2655

Chiral HPLC chromatogram for enantioenriched **4q**



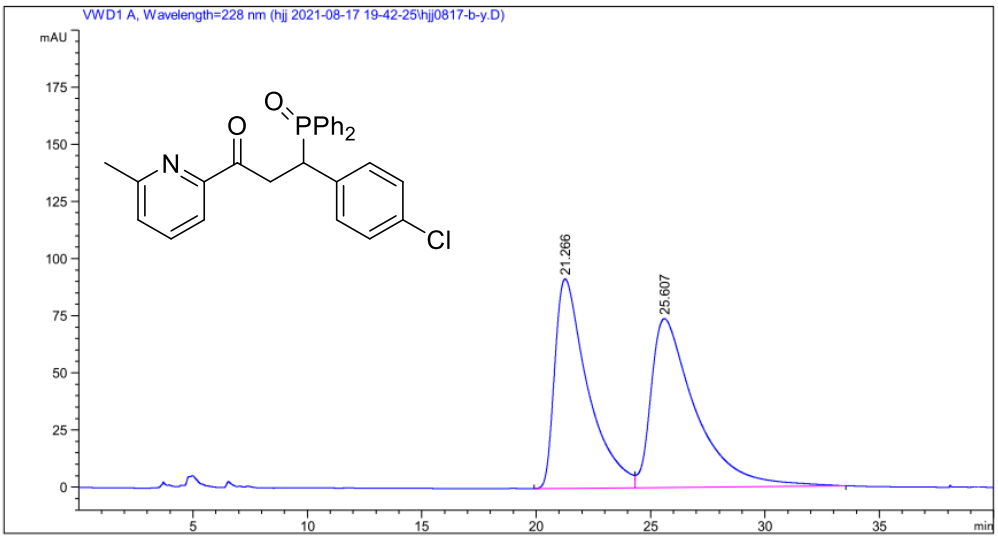
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	17.035	3465.36206	42.64062	49.7566
2	21.263	3499.26733	31.62767	50.2434

Chiral HPLC chromatogram for racemic **4r**



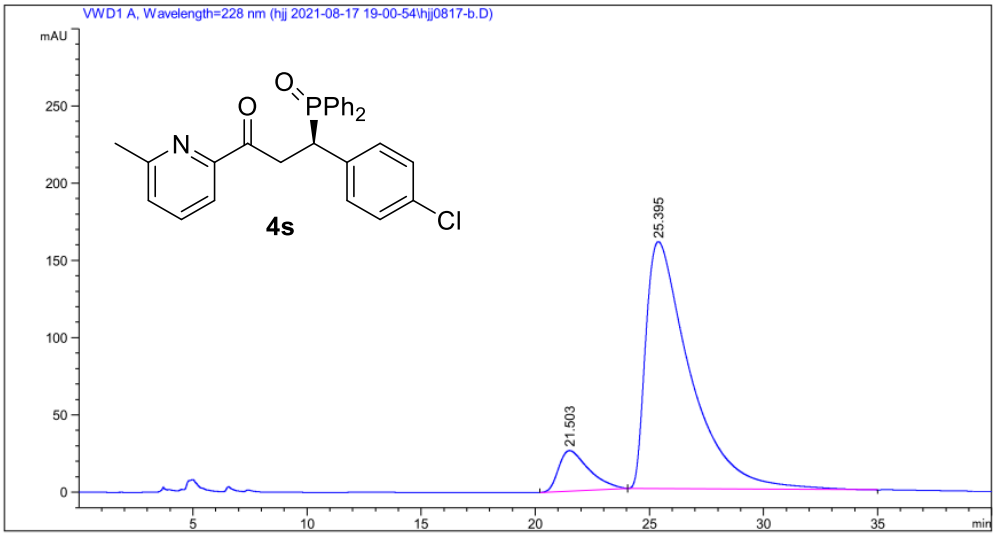
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	16.802	1082.29248	14.63081	13.5396
2	20.555	6911.22852	64.43866	86.4604

Chiral HPLC chromatogram for enantioenriched **4r**



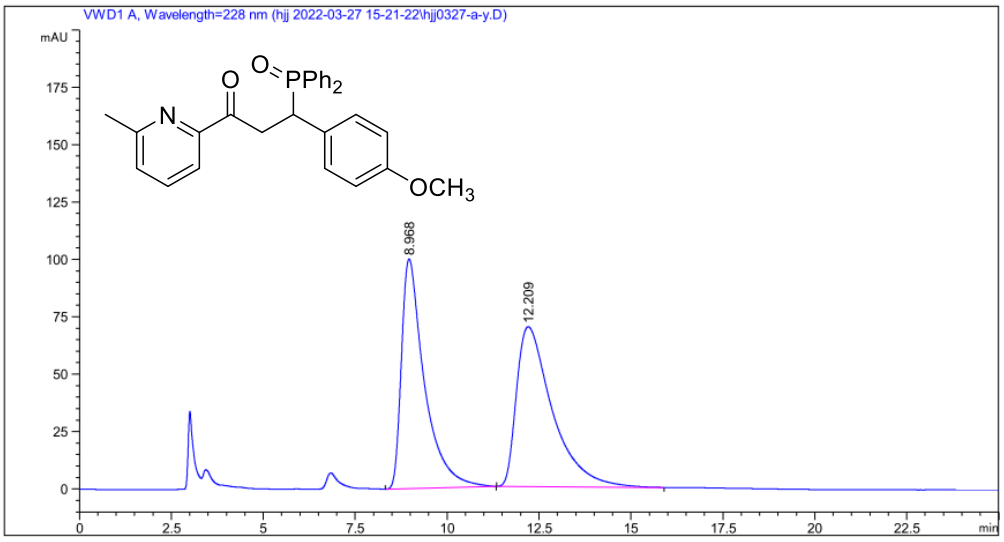
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	21.266	9166.23340	91.55959	47.8588
2	25.607	9986.43750	73.84183	52.1412

Chiral HPLC chromatogram for racemic **4s**



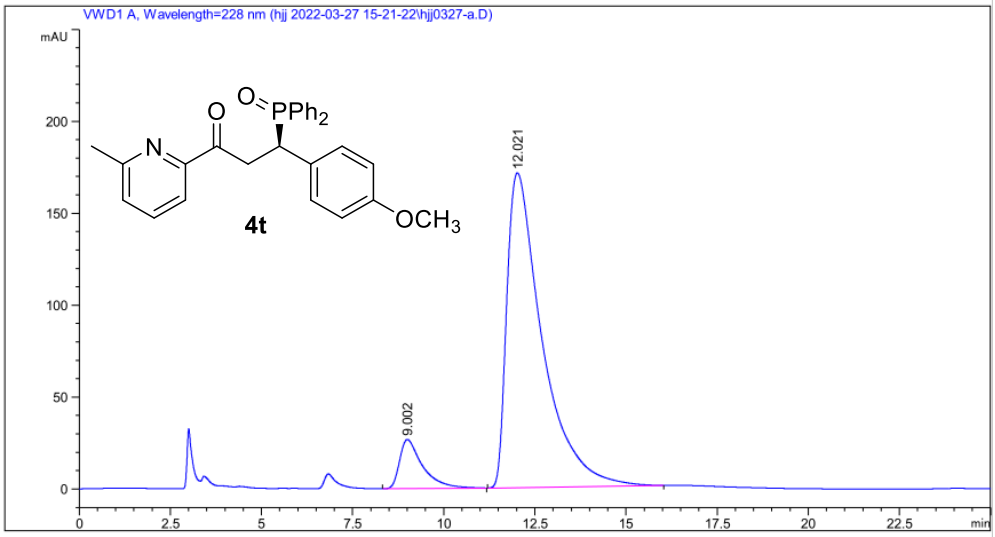
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	21.503	2404.58569	26.22631	10.0221
2	25.395	2.15883e4	159.79312	89.9779

Chiral HPLC chromatogram for enantioenriched **4s**



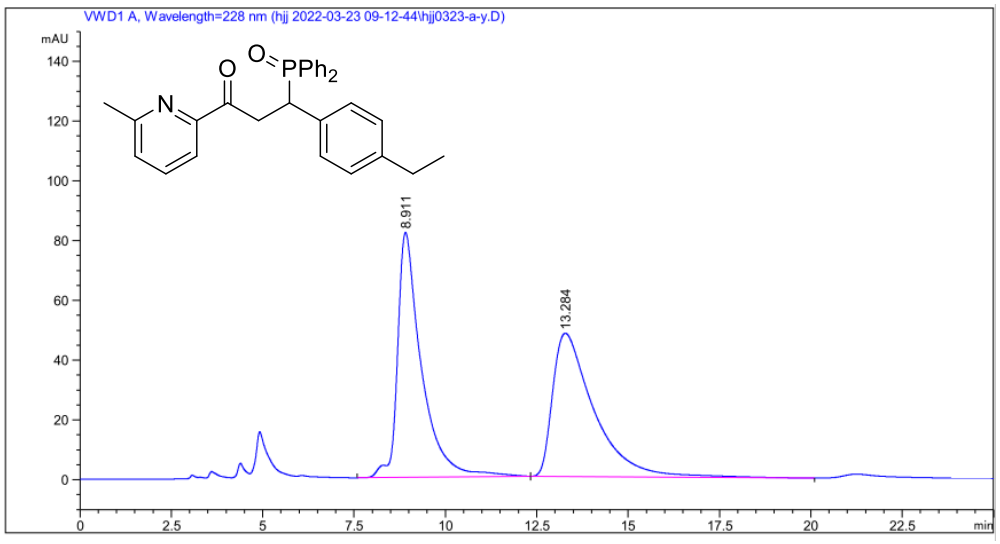
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.968	4341.99561	100.05734	47.8886
2	12.209	4724.86963	69.62543	52.1114

Chiral HPLC chromatogram for racemic **4t**



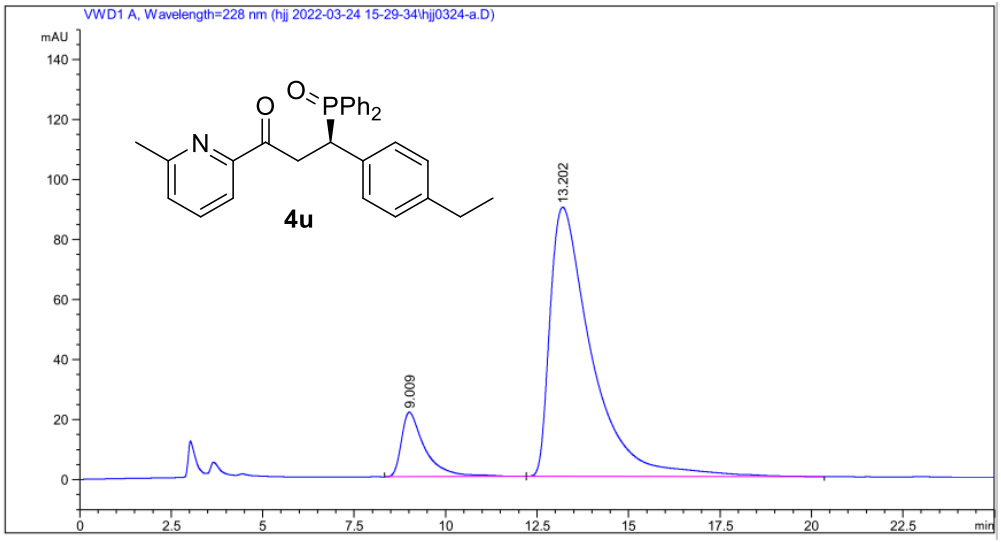
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	9.002	1168.56824	26.66911	9.2120
2	12.021	1.15168e4	171.21254	90.7880

Chiral HPLC chromatogram for enantioenriched **4t**



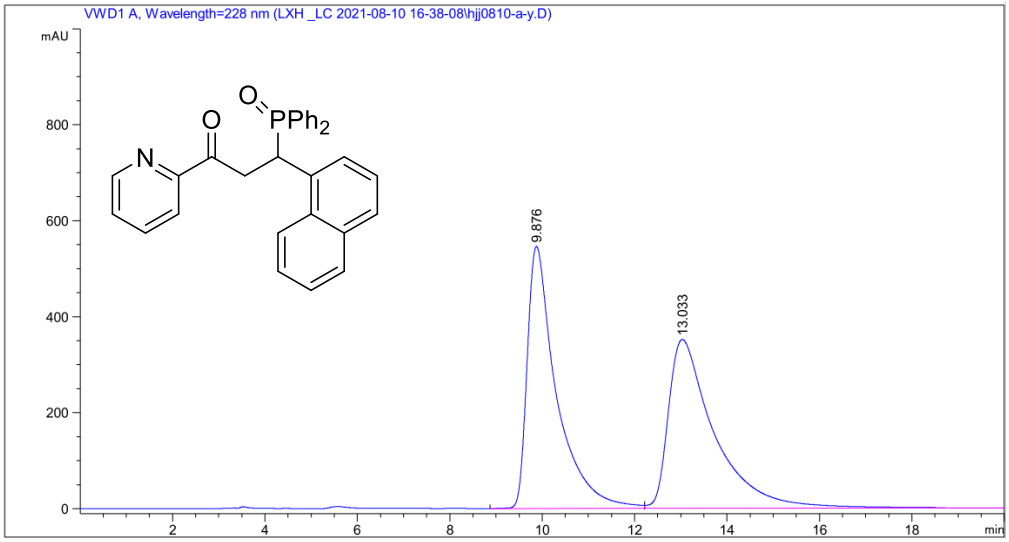
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	8.911	3729.27075	81.94225	49.7325
2	13.284	3769.39185	47.94542	50.2675

Chiral HPLC chromatogram for racemic **4u**



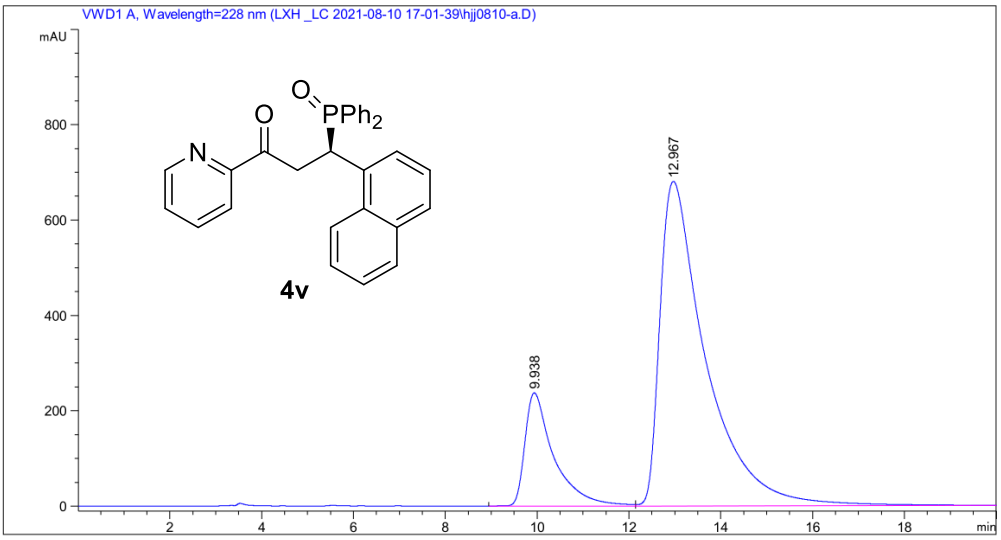
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	9.009	962.50079	21.51051	11.9458
2	13.202	7094.70605	89.74668	88.0542

Chiral HPLC chromatogram for enantioenriched **4u**



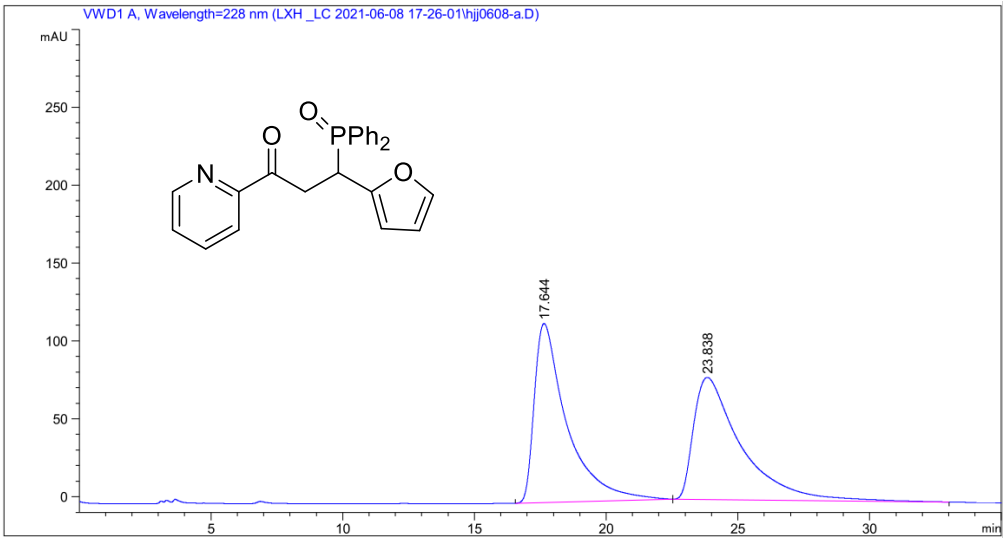
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	9.876	2.39921e4	545.91876	49.6591
2	13.033	2.43214e4	351.67474	50.3409

Chiral HPLC chromatogram for racemic **4v**



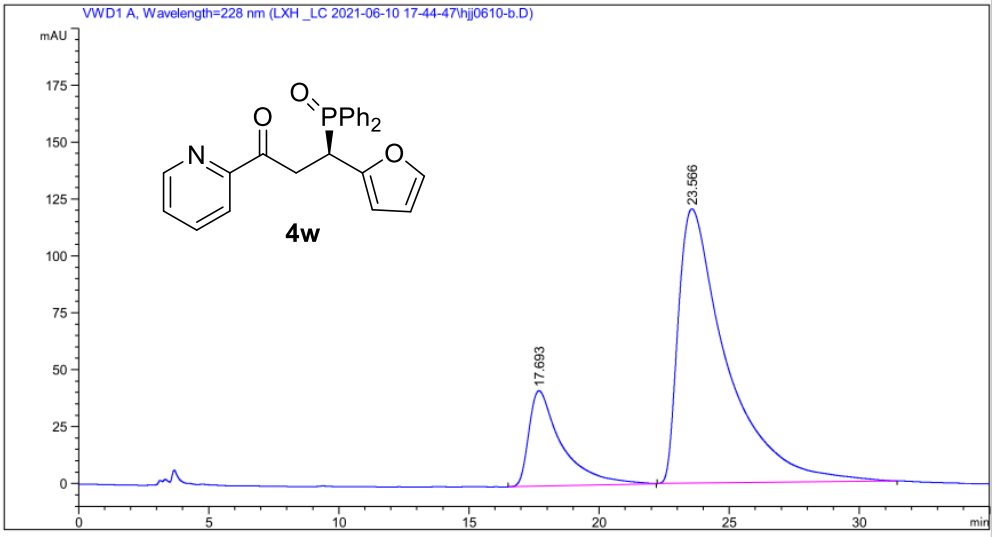
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	9.938	1.04670e4	237.66782	18.0997
2	12.967	4.73628e4	680.71143	81.9003

Chiral HPLC chromatogram for enantioenriched **4v**



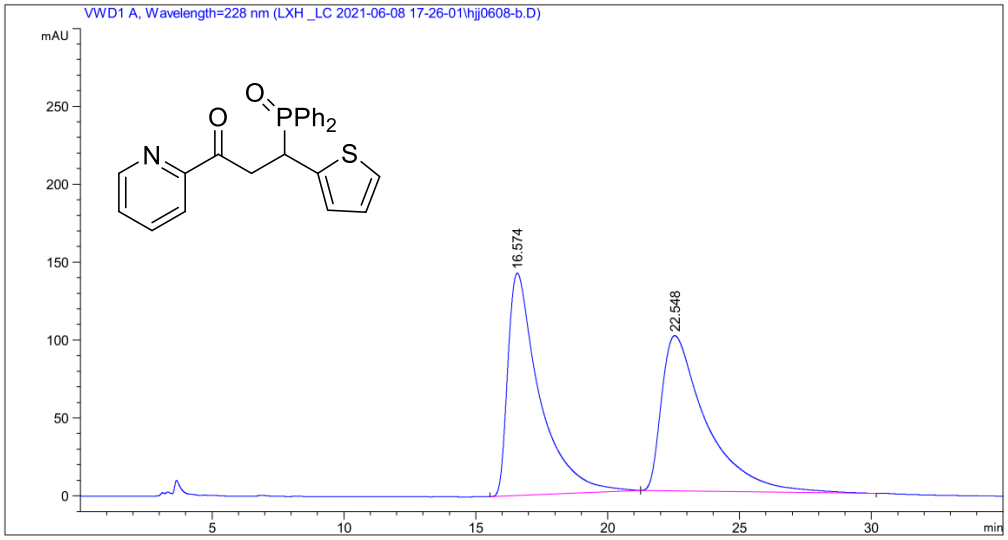
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	17.644	9886.85547	114.82163	50.1791
2	23.838	9816.27637	78.41051	49.8209

Chiral HPLC chromatogram for racemic **4w**



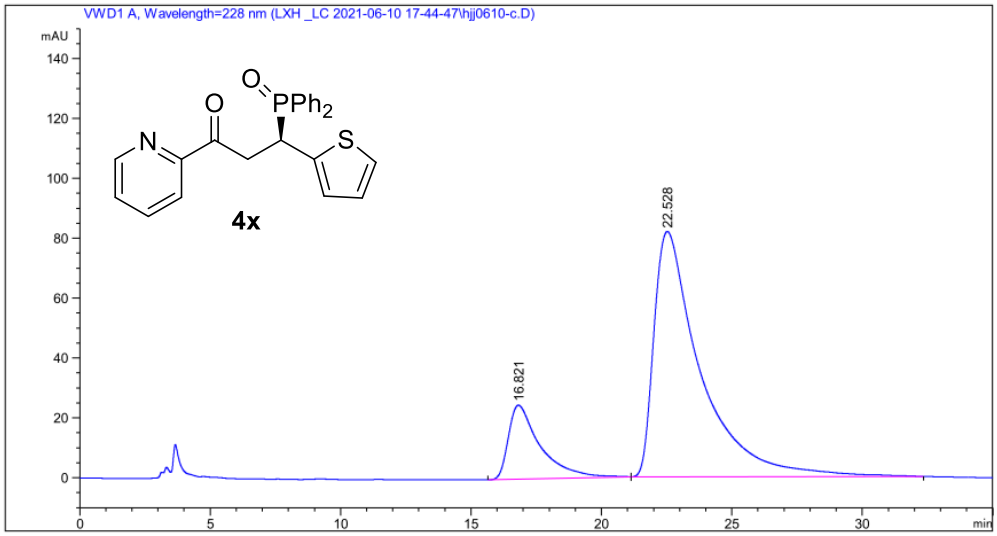
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	17.693	3673.76025	41.93661	19.1074
2	23.566	1.55532e4	120.54111	80.8926

Chiral HPLC chromatogram for enantioenriched **4w**



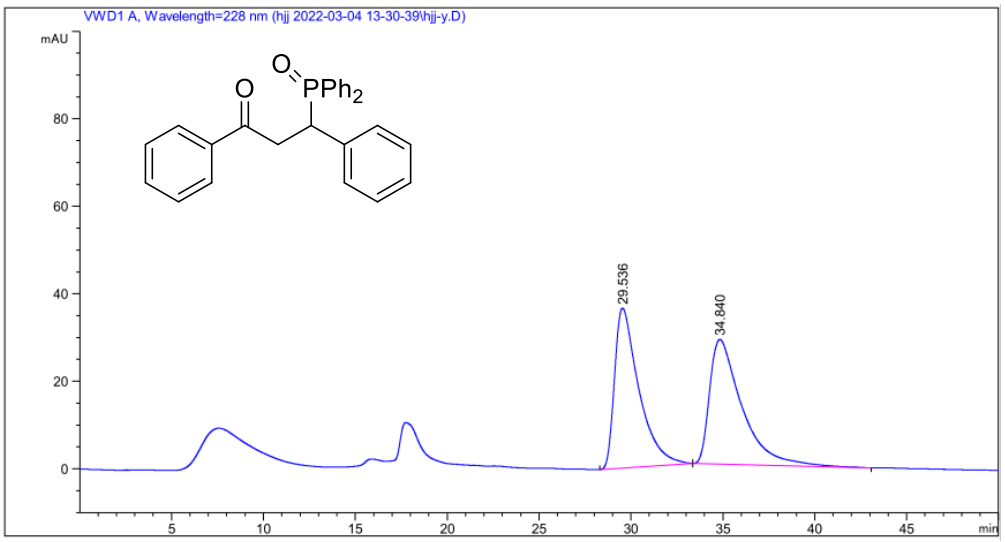
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	16.574	1.19259e4	142.83899	50.4197
2	22.548	1.17273e4	99.68768	49.5803

Chiral HPLC chromatogram for racemic **4x**



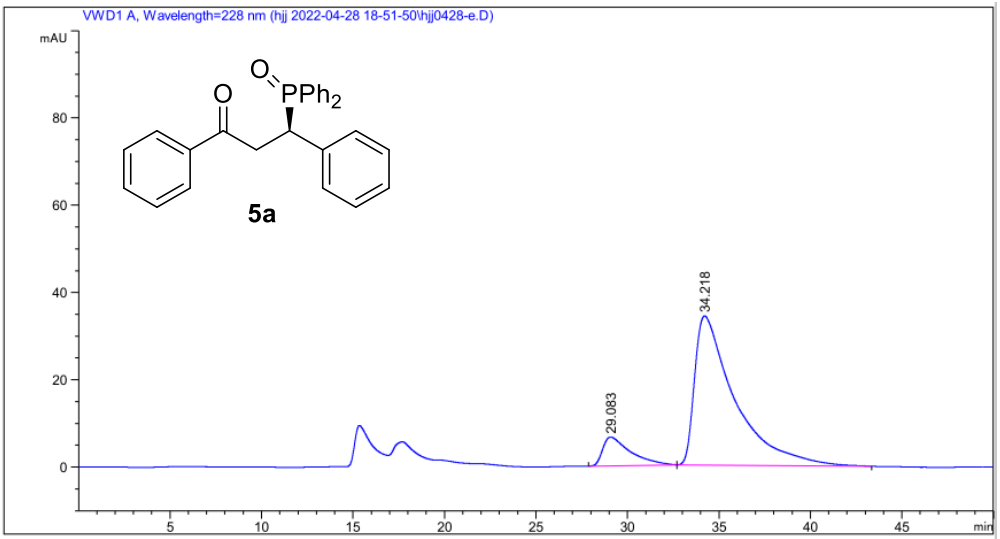
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	16.821	2093.94336	24.73447	17.0778
2	22.528	1.01673e4	81.90807	82.9222

Chiral HPLC chromatogram for enantioenriched **4x**



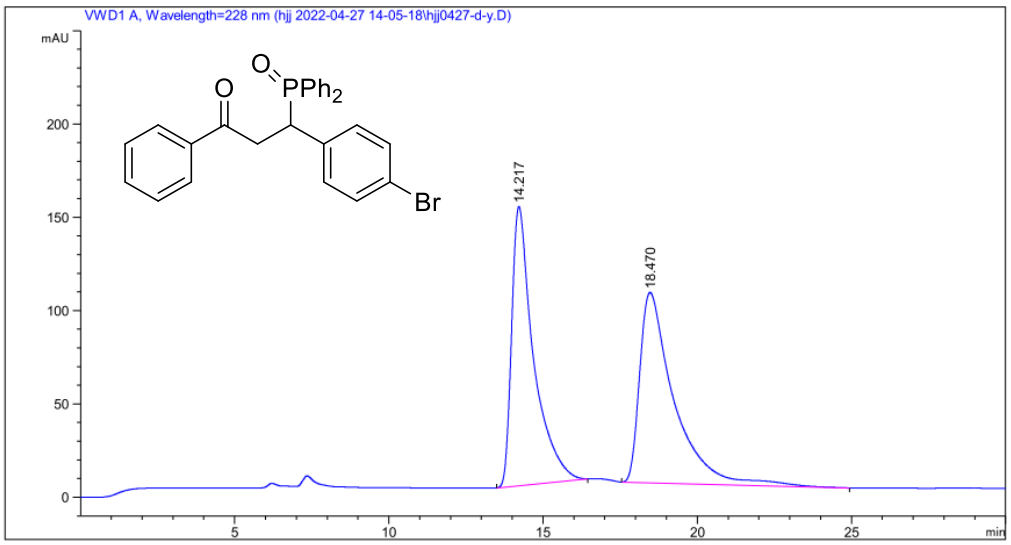
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	29.536	3362.55151	149.61864	48.3184
2	34.840	3478.23486	102.04332	51.6816

Chiral HPLC chromatogram for racemic **5a**



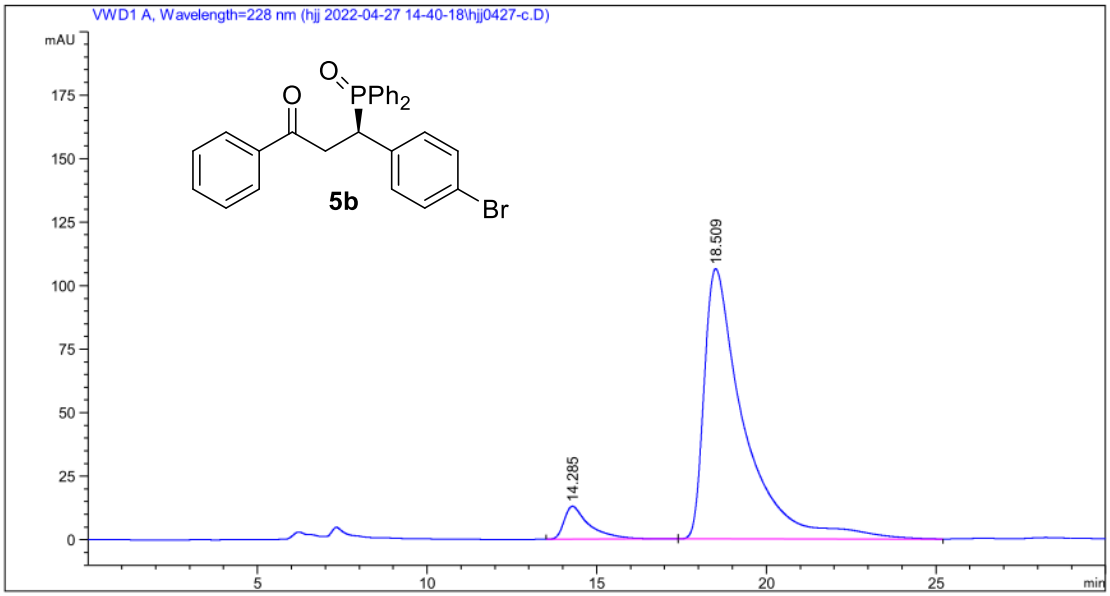
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	29.083	686.48273	6.56768	11.6566
2	34.218	5202.76123	34.14554	88.3434

Chiral HPLC chromatogram for enantioenriched **5a**



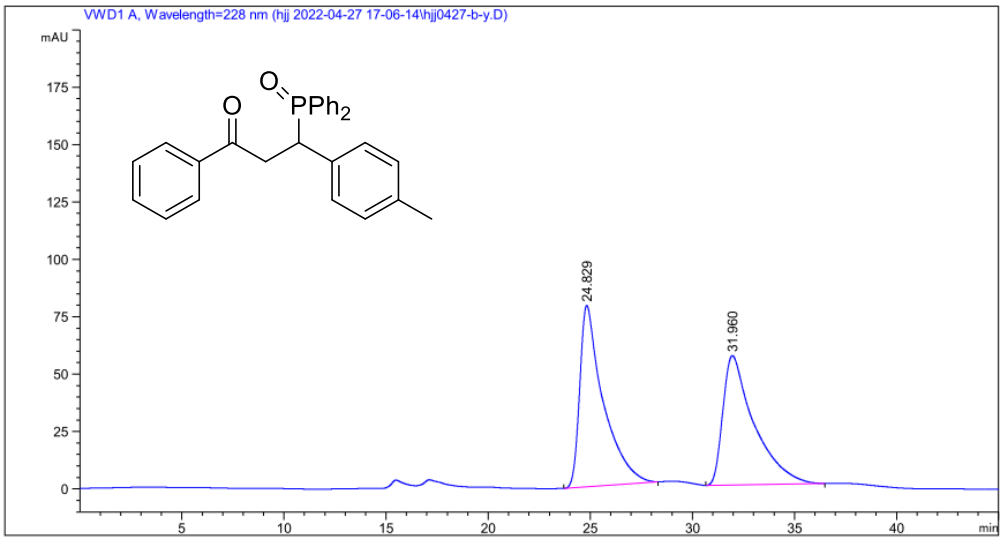
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	14.217	7367.39697	149.61864	48.3184
2	18.470	7880.20166	102.04332	51.6816

Chiral HPLC chromatogram for racemic **5b**



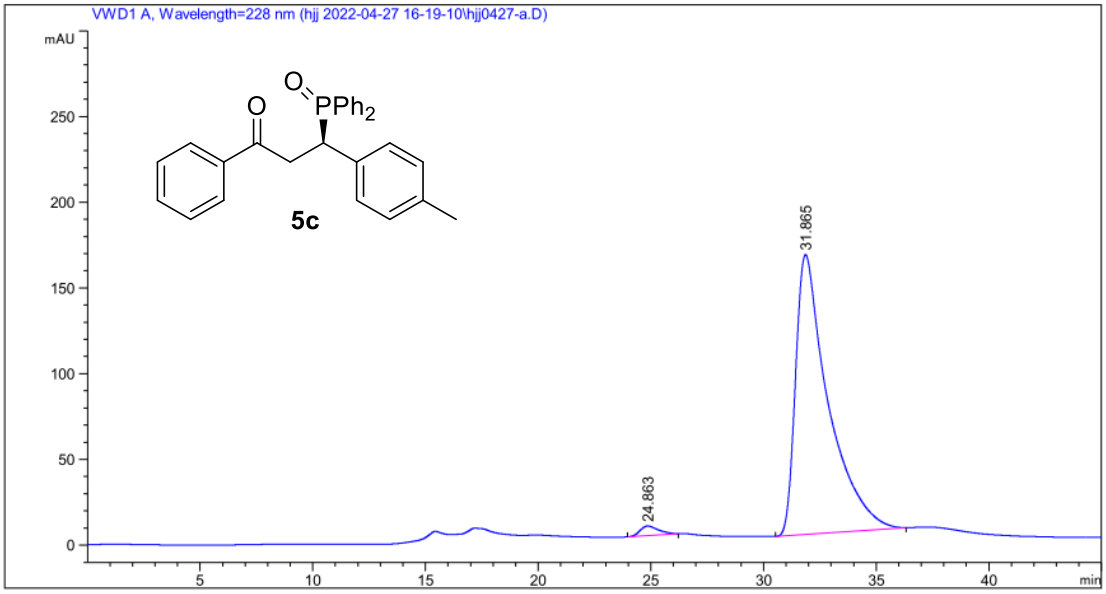
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	14.285	669.51398	12.96331	7.1524
2	18.509	8691.23926	106.29477	92.8476

Chiral HPLC chromatogram for enantioenriched **5b**



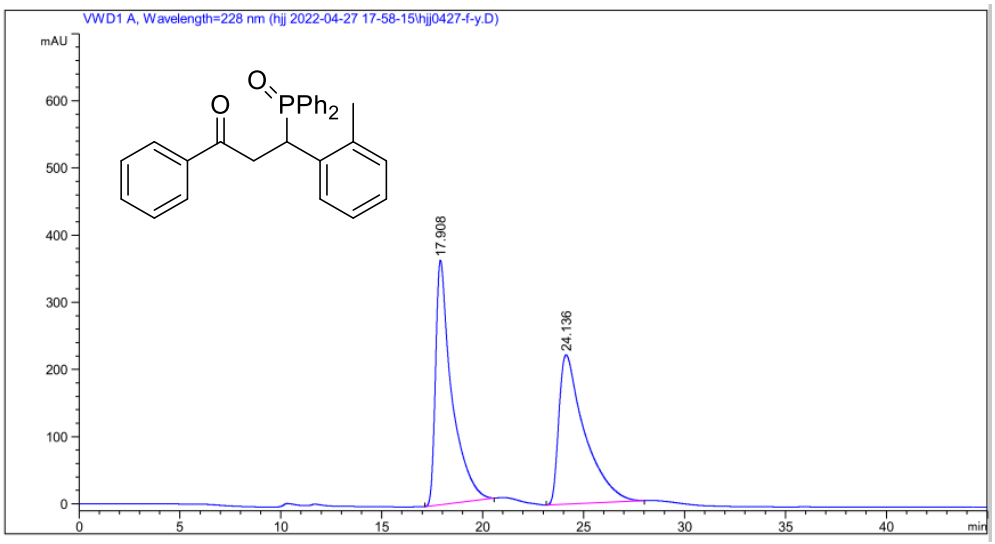
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	24.829	6301.59131	78.94345	51.3500
2	31.960	5970.25342	56.35709	48.6500

Chiral HPLC chromatogram for racemic **5c**



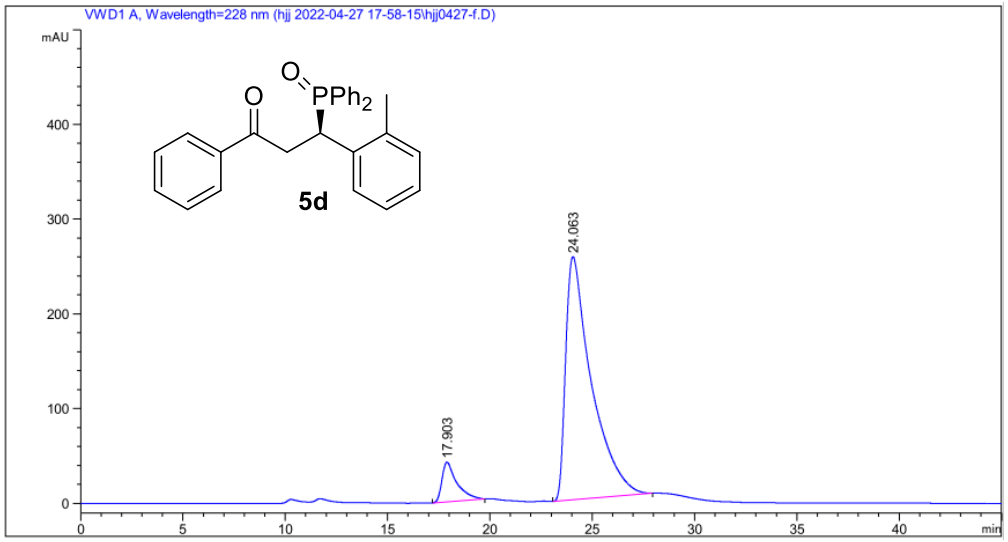
PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	24.863	316.61862	5.62219	1.8914
2	31.865	1.64237e4	163.20700	98.1086

Chiral HPLC chromatogram for enantioenriched **5c**



PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	17.908	2.02667e4	363.83209	50.7136
2	24.136	1.96963e4	222.19511	49.2864

Chiral HPLC chromatogram for racemic **5d**



PeakNO.	Ret.Time	PeakArea	PeakHeight	Area%
1	17.903	2114.00415	41.86325	8.5767
2	24.063	2.25343e4	256.58746	91.4233

Chiral HPLC chromatogram for enantioenriched **5d**