

Asymmetric Synthesis of Cyclopentanones through Dual Lewis Acid-Catalysed [3 + 2]-Cycloaddition of Donor-Acceptor Cyclopropanes with Ketenes

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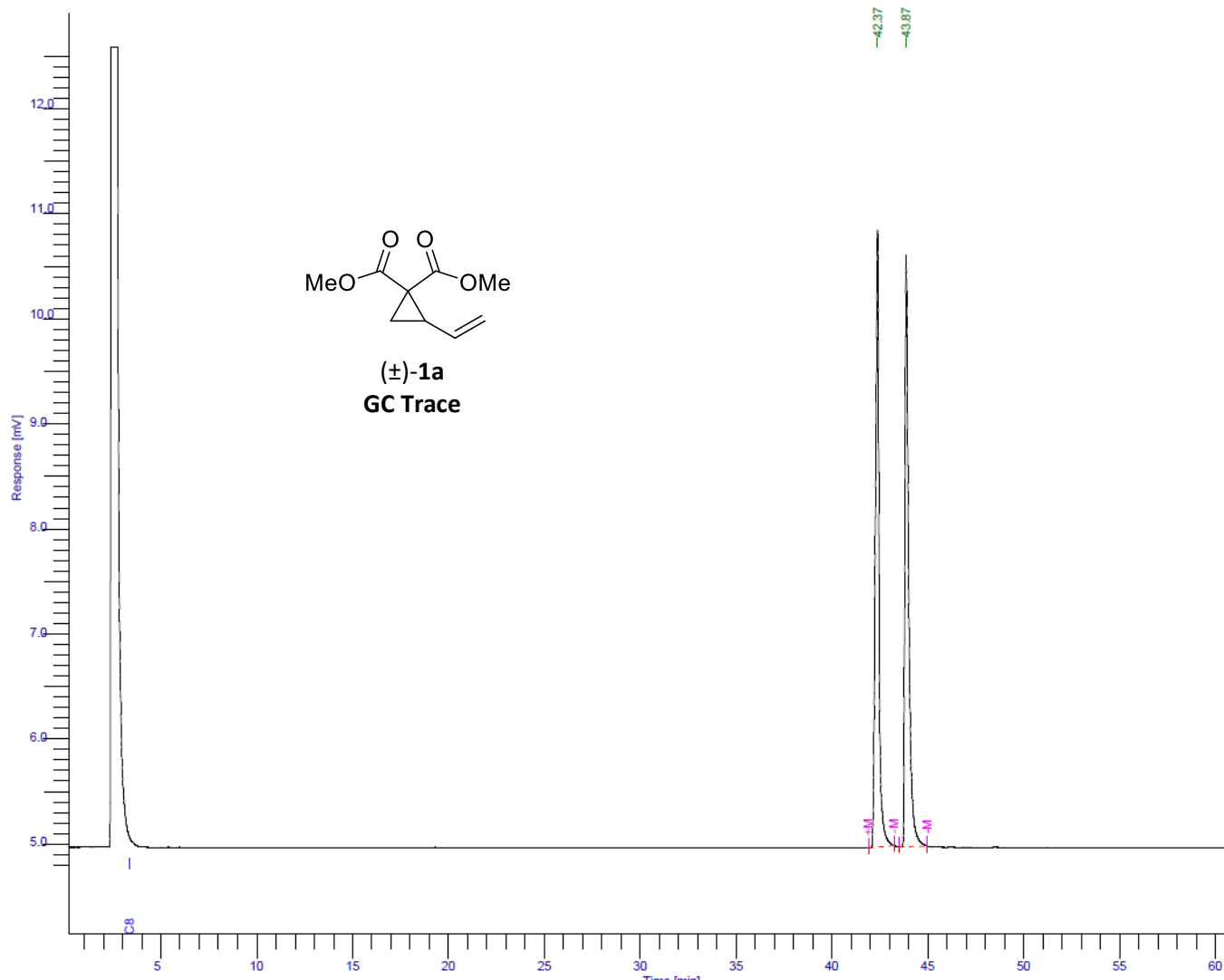
NMR and GC/HPLC spectra

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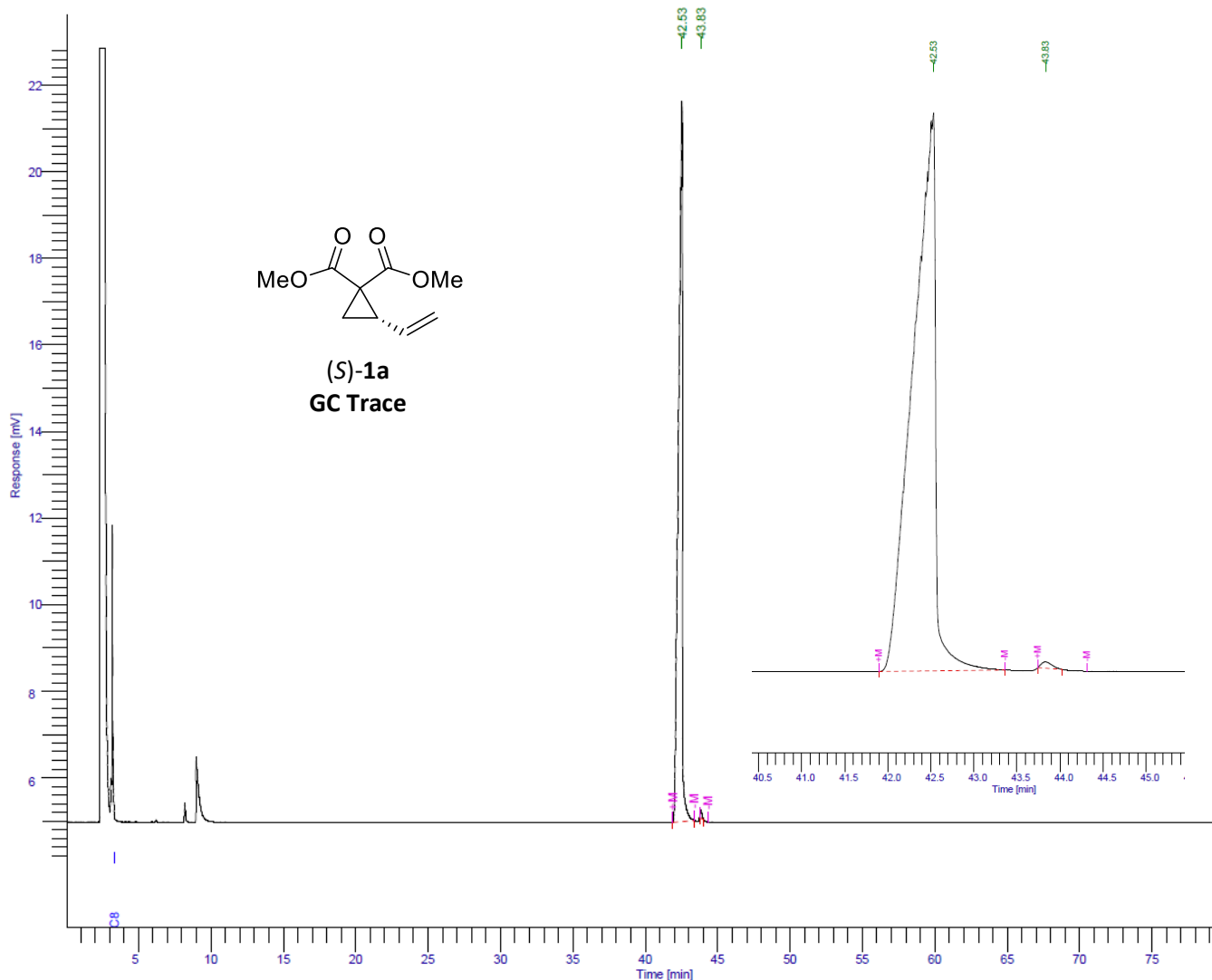
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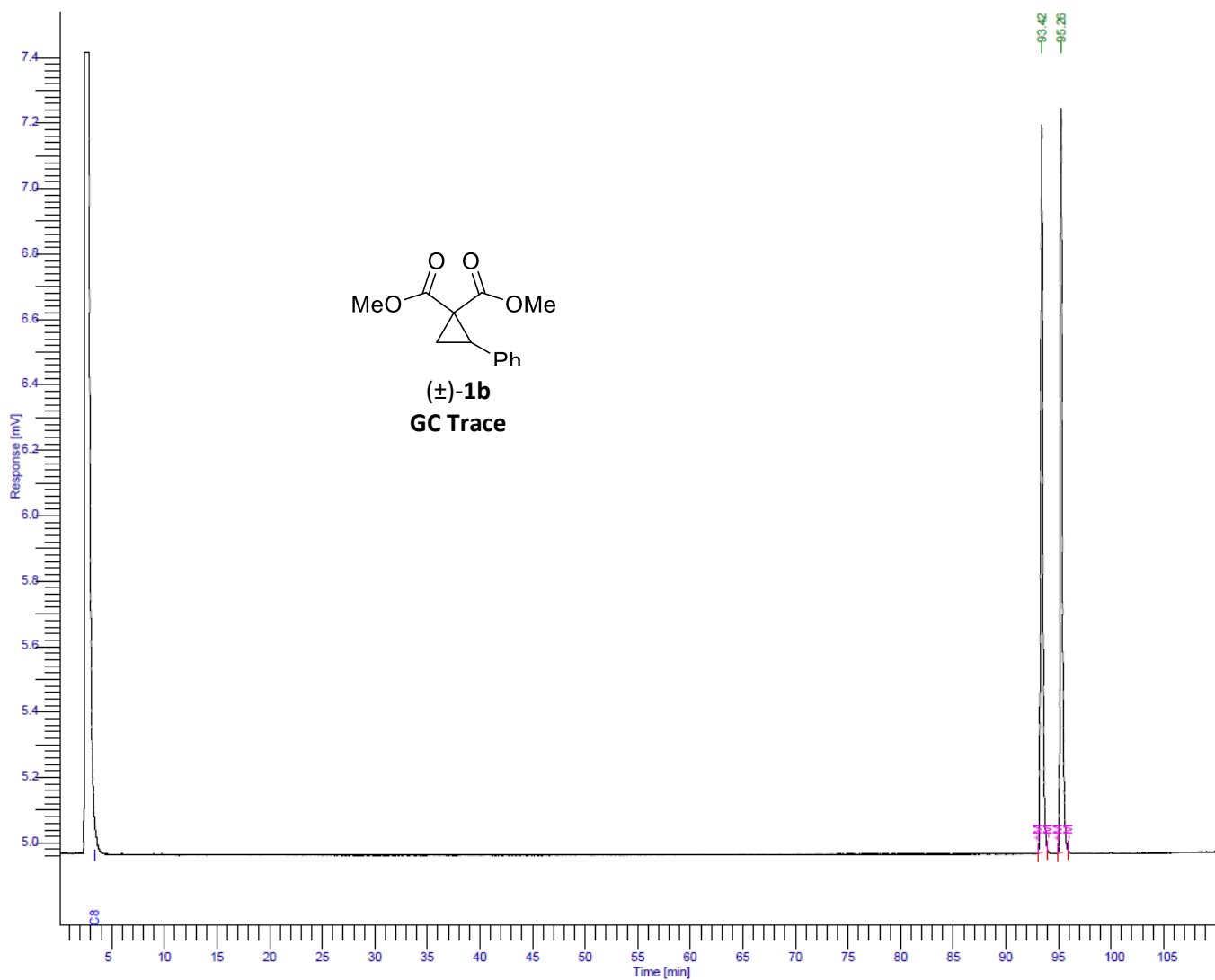
HPLC of (-)- 4t	S60
HPLC of (+)- 4v	S61
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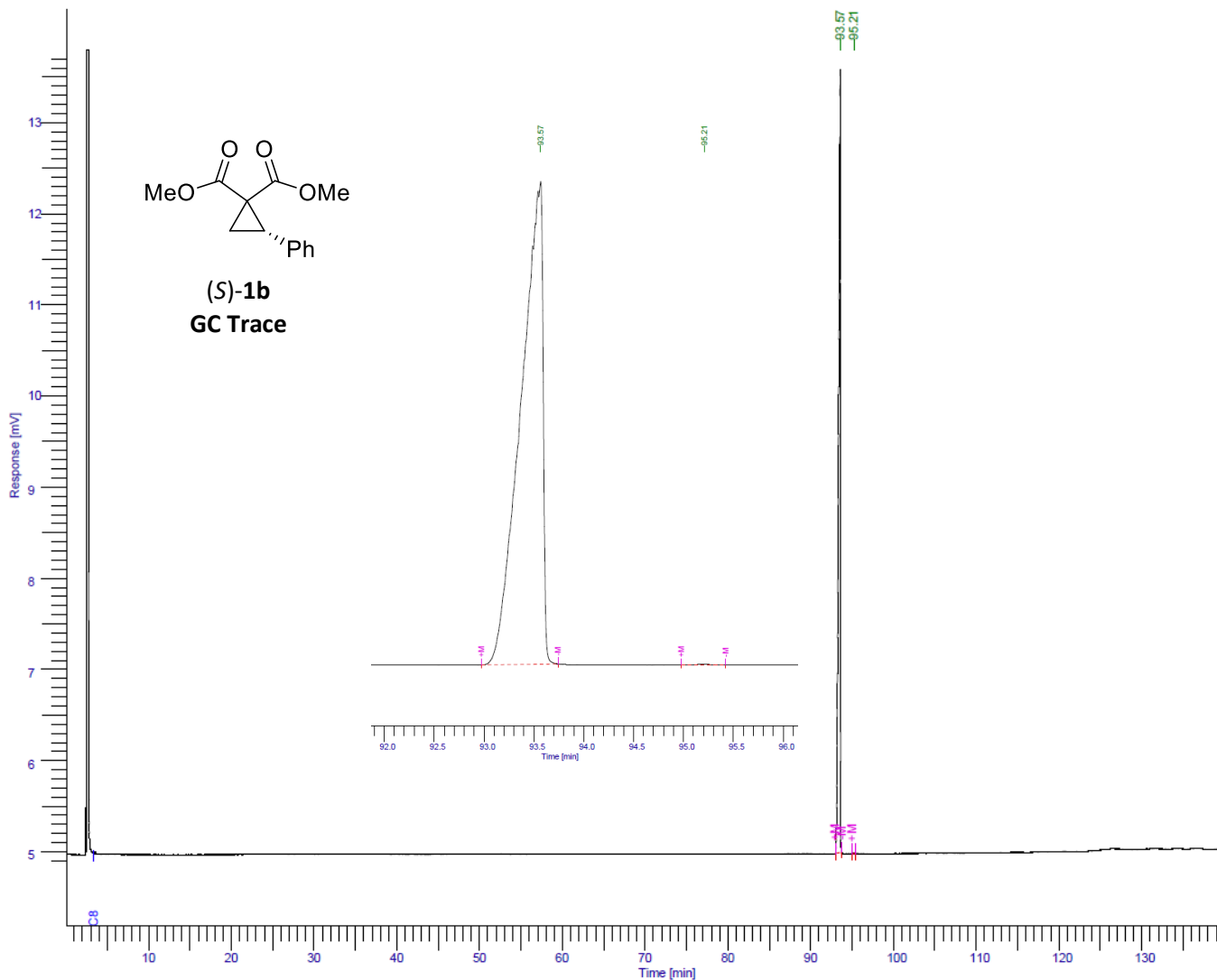
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1		42.373	75937.53	5871.94	-----	-----
2		43.866	75994.95	5618.09	1.0000e+06	0.0760
			151932.48	11490.03	1.0000e+06	0.0760



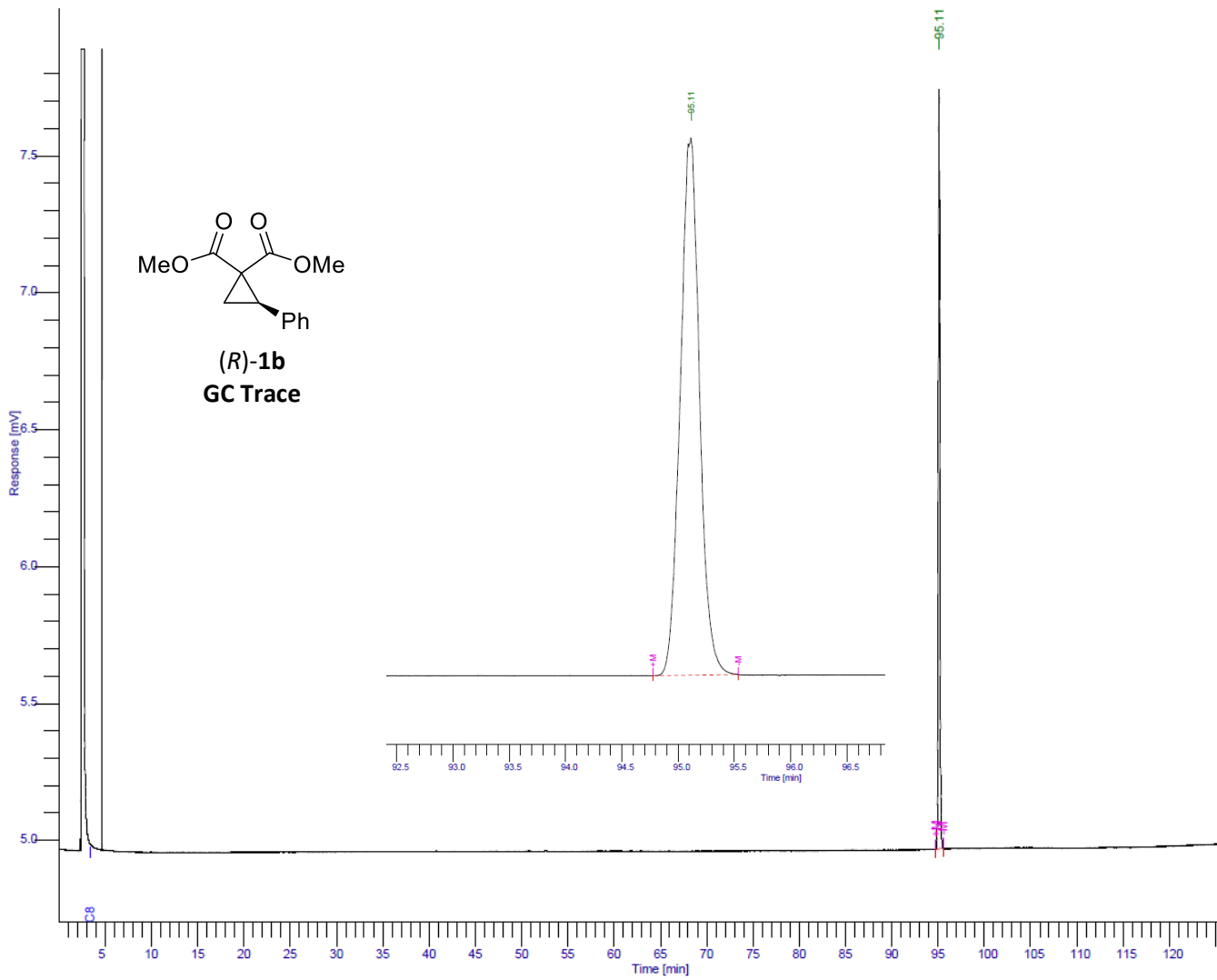
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1		42.533	303975.63	16636.36	-----	-----
2		43.832	1613.44	186.37	1.0000e+06	0.0016
			305589.07	16822.72	1.0000e+06	0.0016



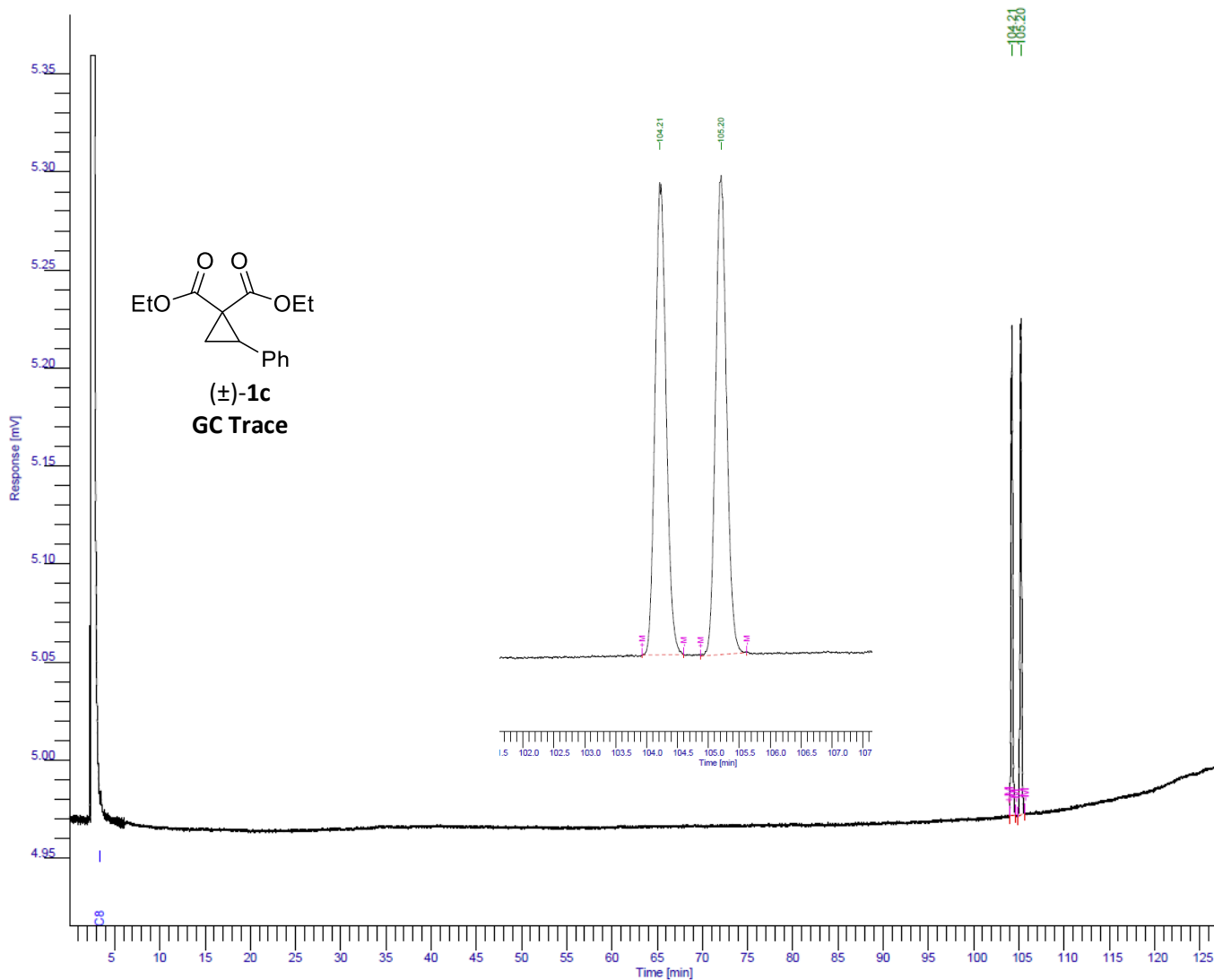
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1		93.424	32665.53	2223.41	-----	-----
2		95.260	32816.79	2269.33	1.0000e+06	0.0328
			65482.32	4492.73	1.0000e+06	0.0328



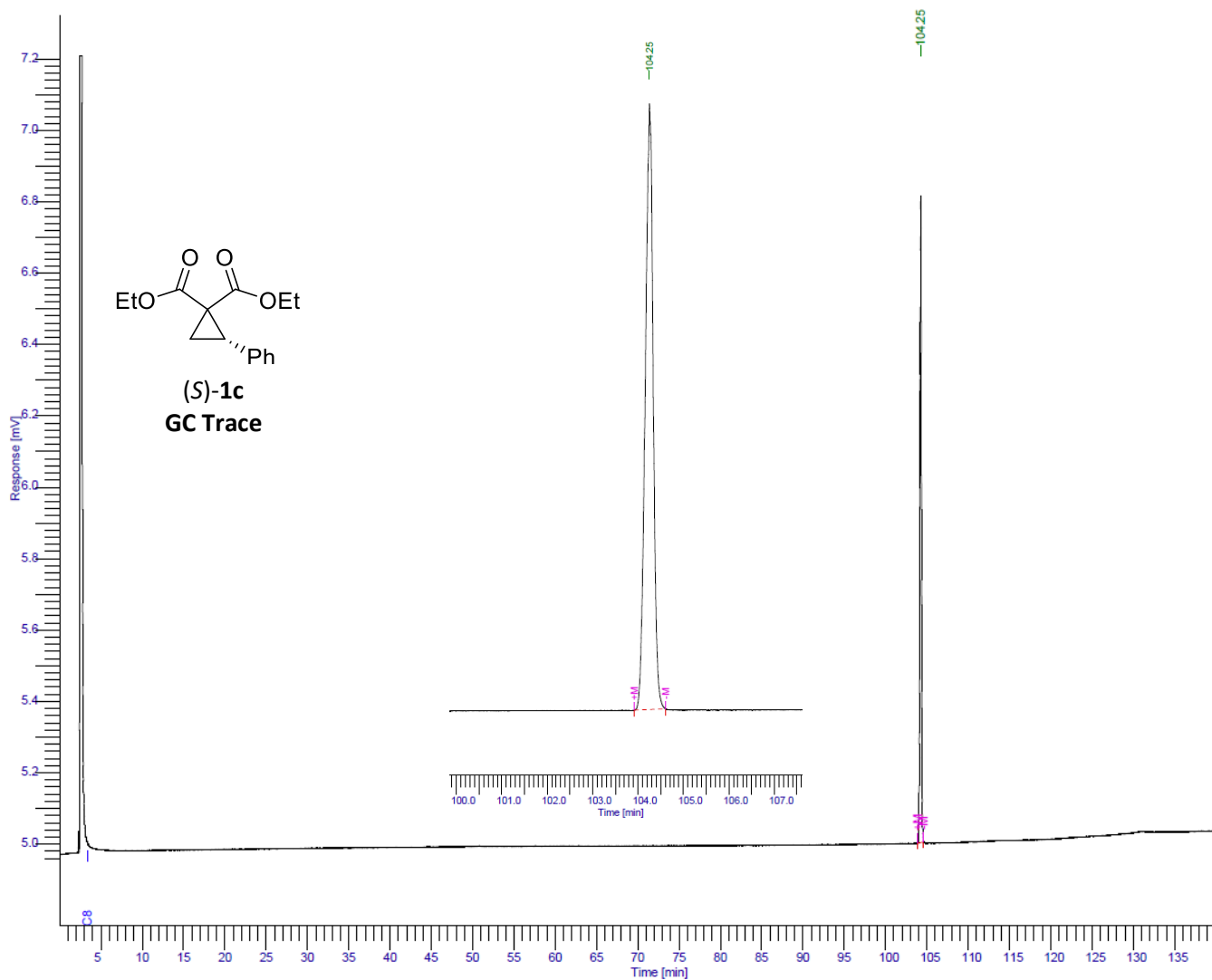
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1		93.566	130901.92	8618.43	1.0000e+06	0.1309
2		95.208	99.12	8.53	1.0000e+06	0.0001
			131001.05	8626.95	2.0000e+06	0.1310



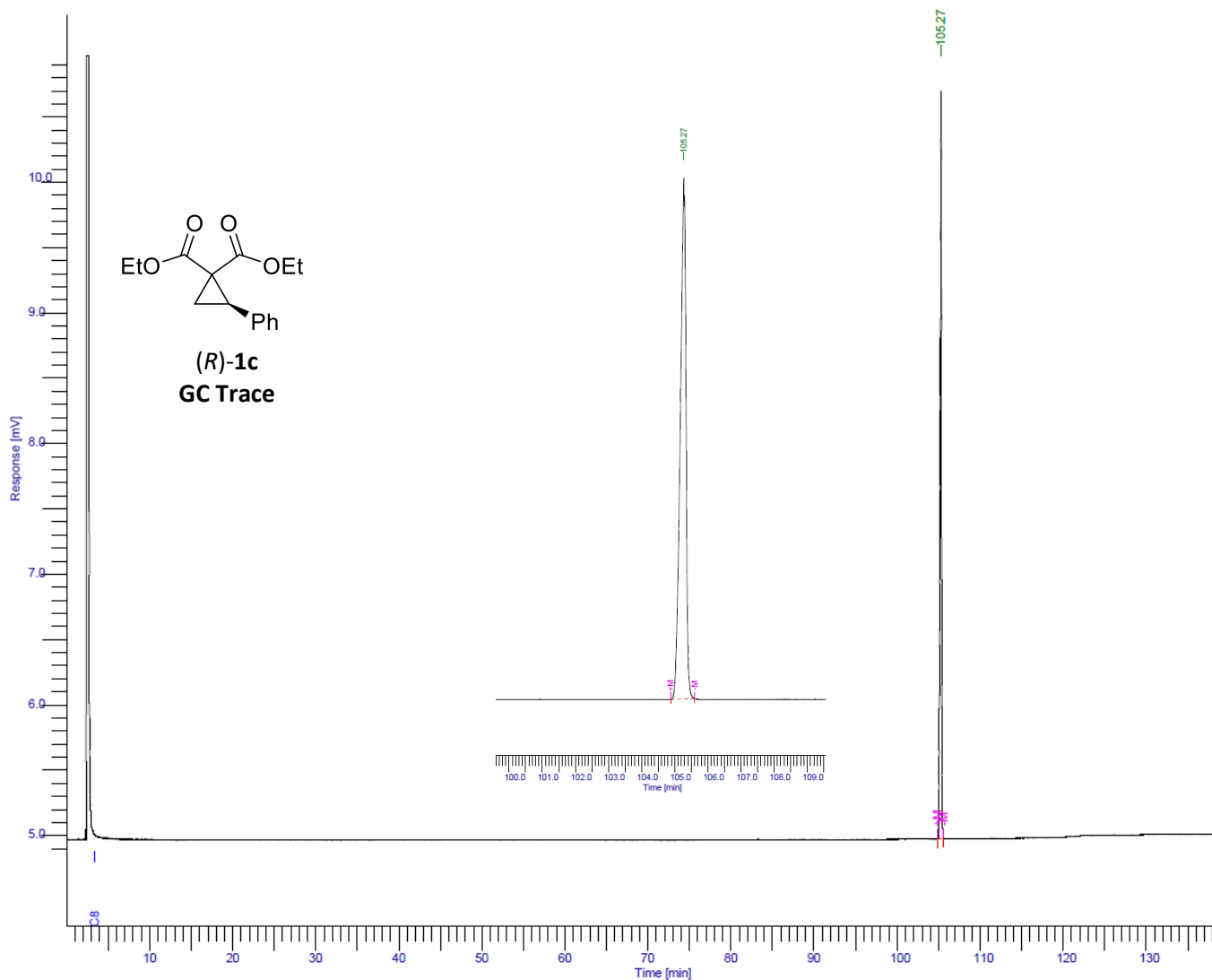
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1		95.115	32944.05	2772.52	-----	-----
			32944.05	2772.52	0.0000	0.0000



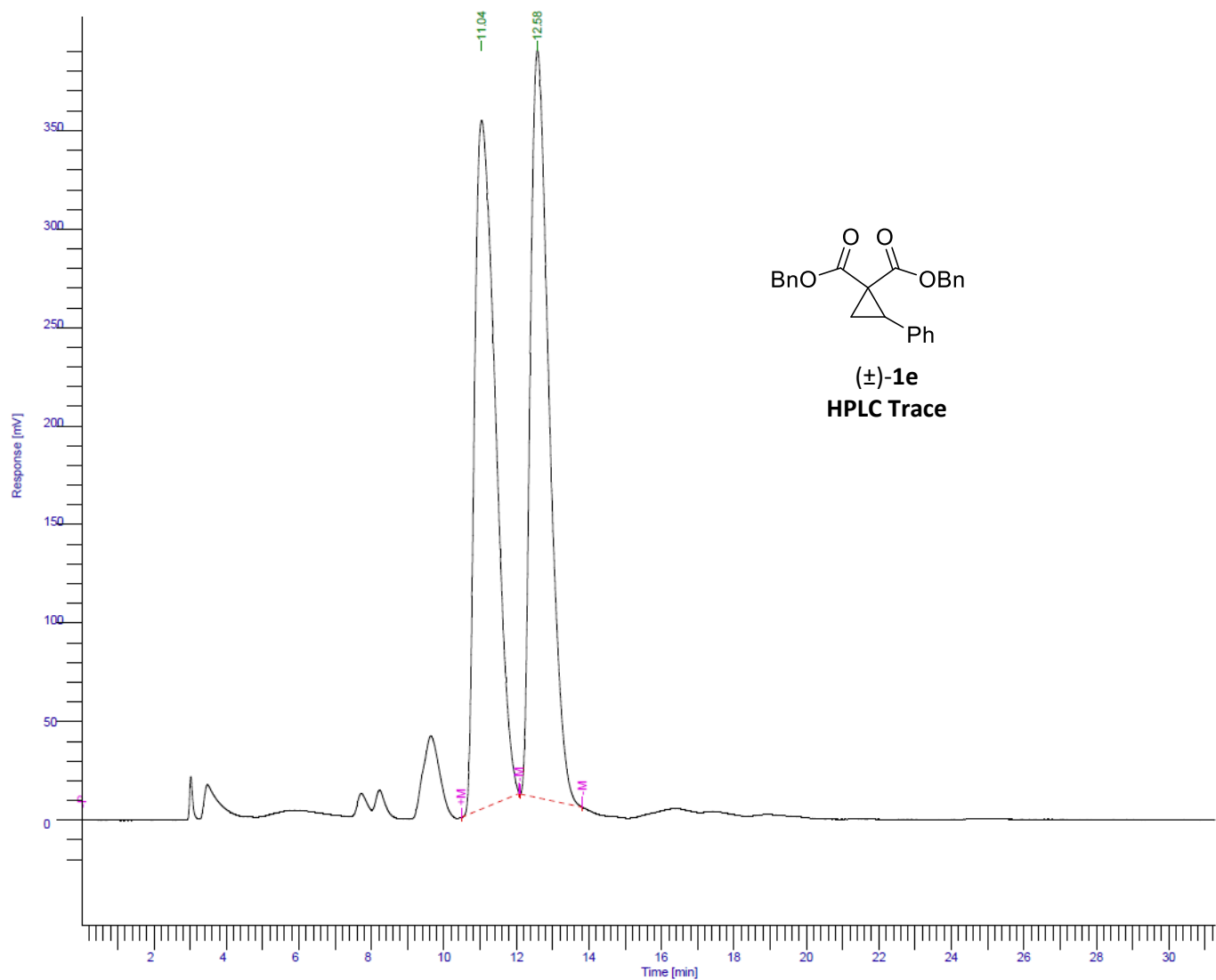
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1		104.213	3096.40	250.04	-----	-----
2		105.205	3118.00	253.33	1.0000e+06	0.0031
			6214.40	503.37	1.0000e+06	0.0031



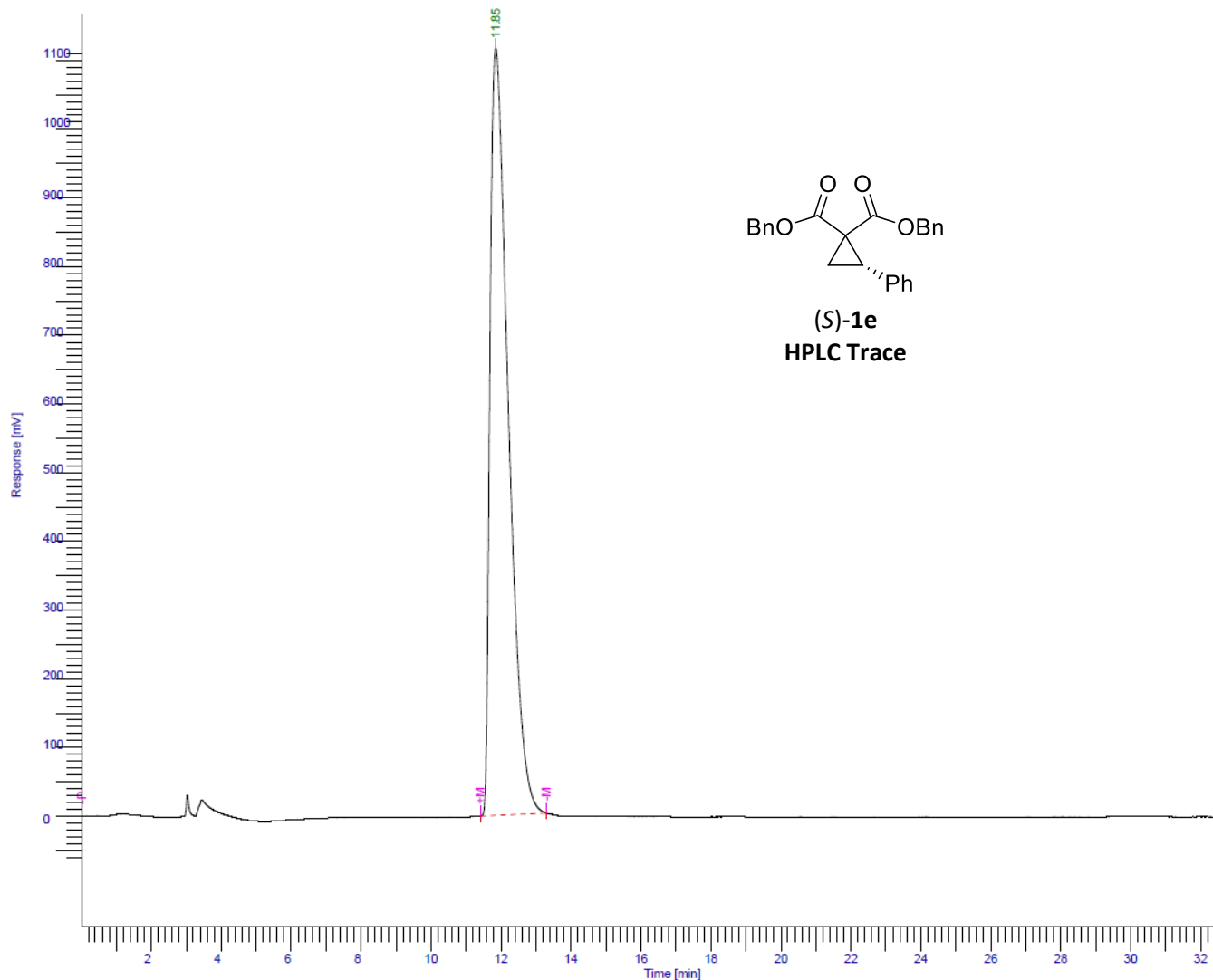
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1		104.251	21959.00	1810.75	-----	-----
			21959.00	1810.75	0.0000	0.0000



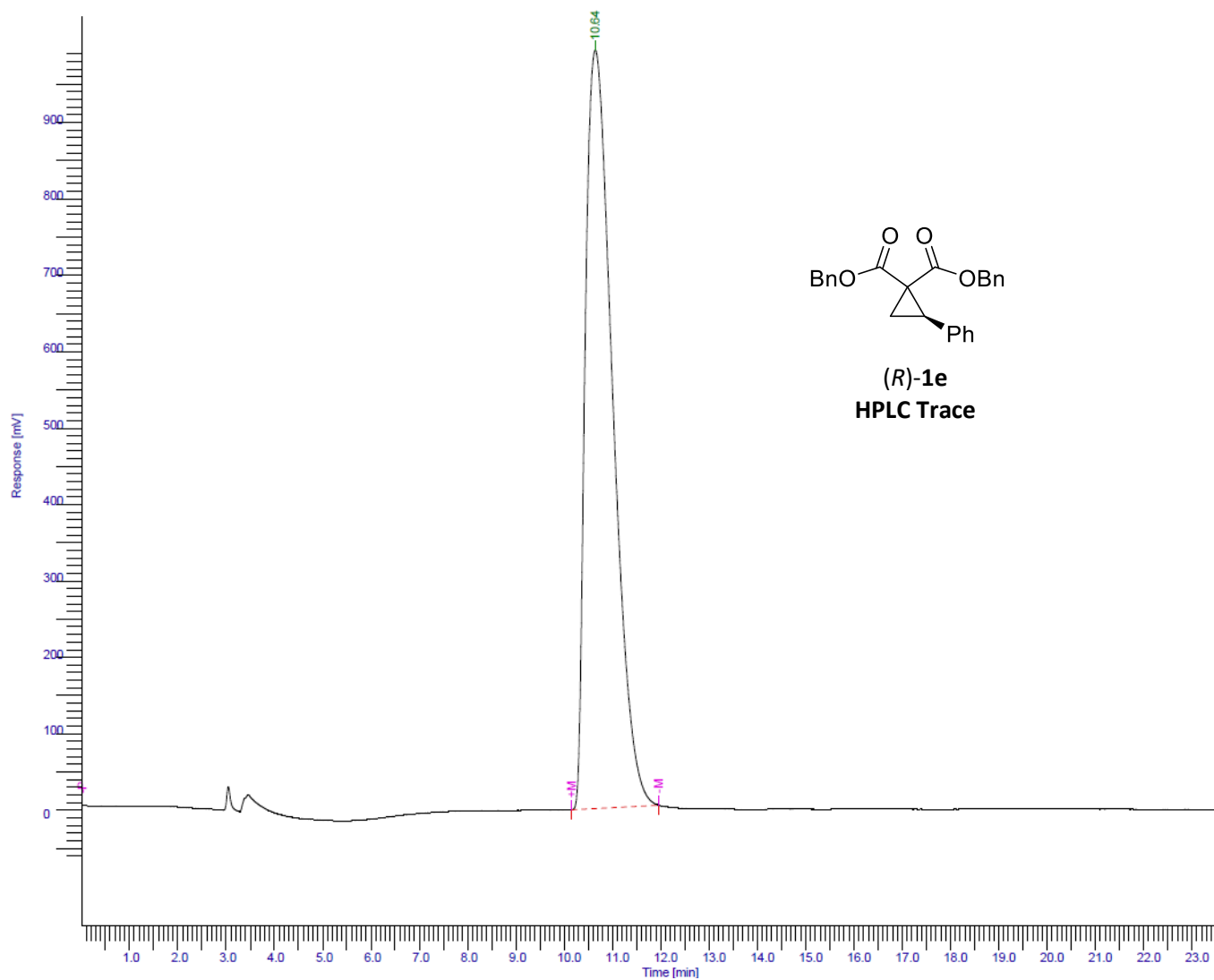
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1		105.275	67763.04	5715.64	-----	-----
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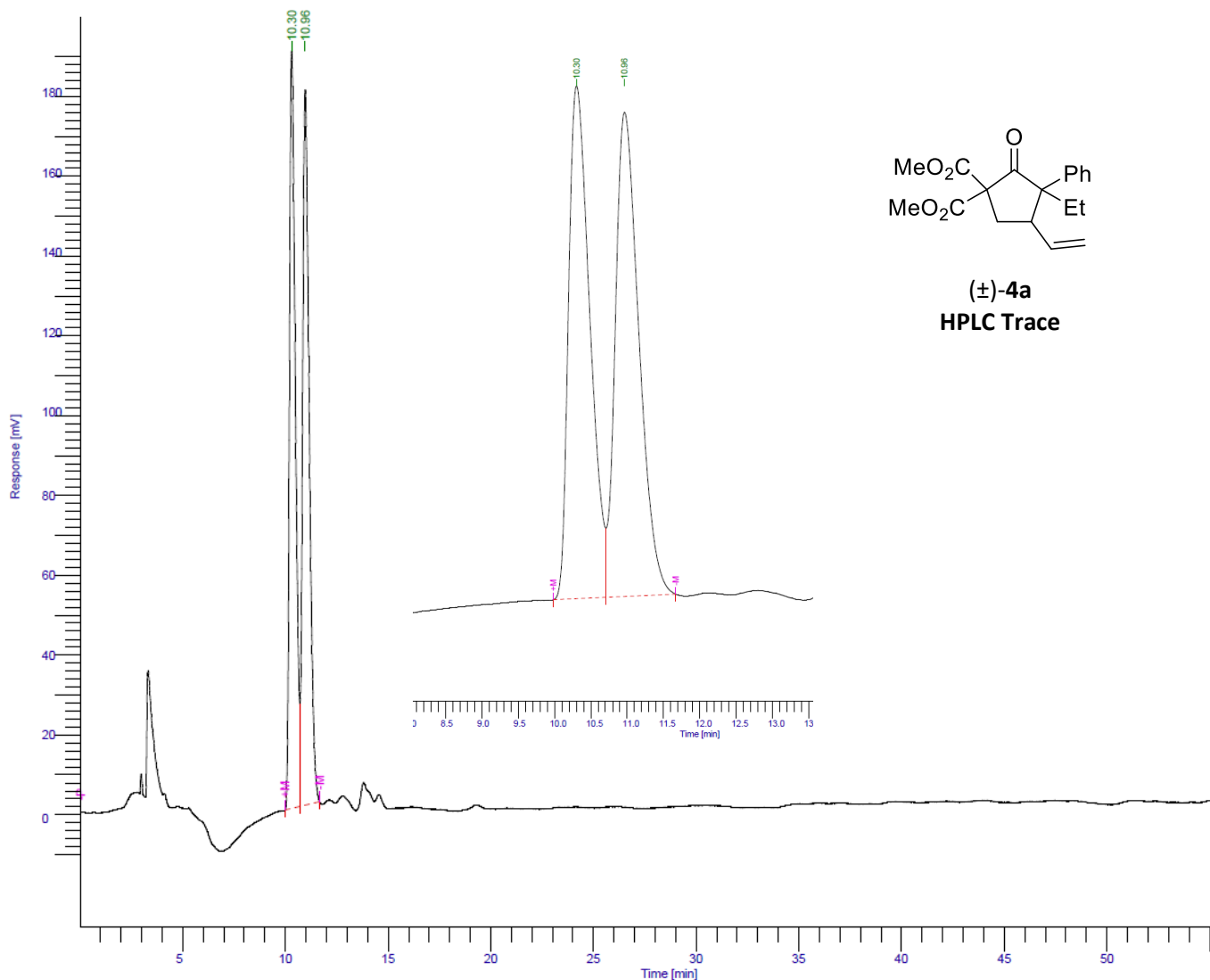
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1	11.038	13922359.21	349547.44	50.45	50.45	*BB	39.8297
2	12.578	13673302.72	379202.99	49.55	49.55	*BB	36.0580
		27595661.93	728750.43	100.00	100.00		



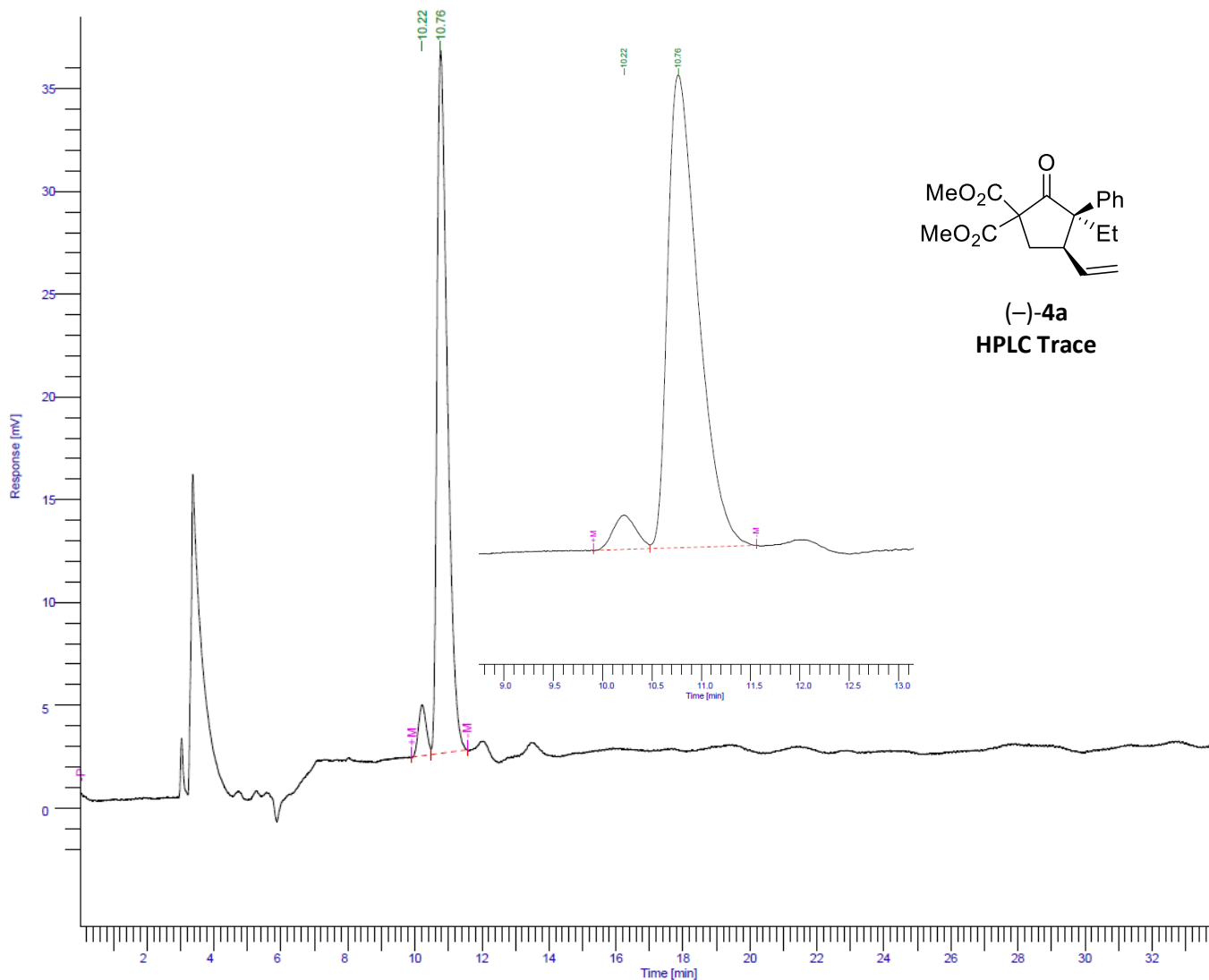
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1	11.848	40553116.91	1.12e+06	100.00	100.00	*BB	36.3099
		40553116.91	1.12e+06	100.00	100.00		



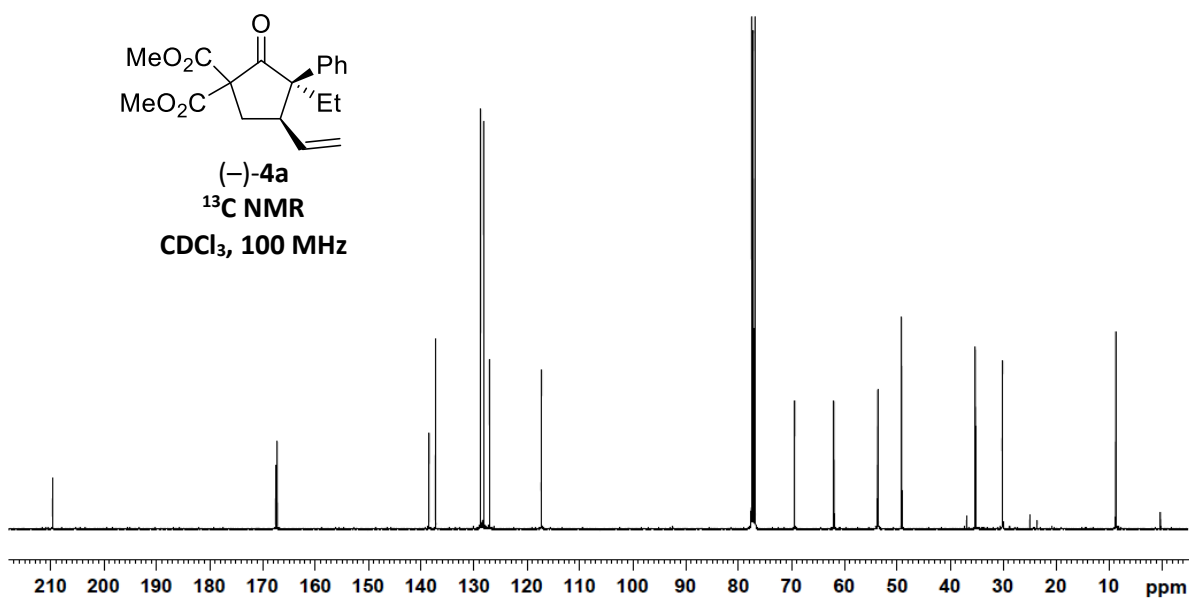
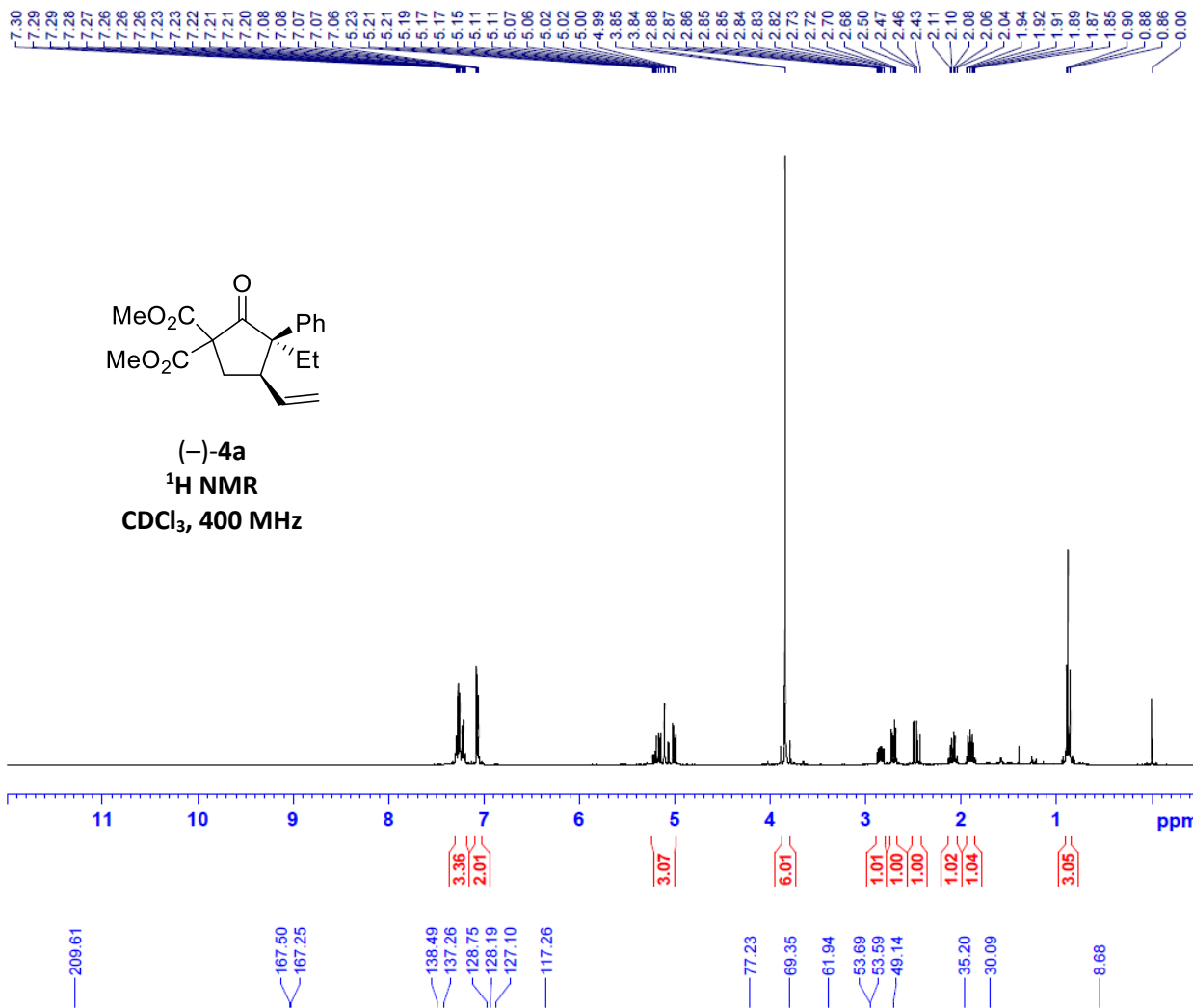
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1	10.644	39003673.13	992772.33	100.00	100.00	*BB	39.2876
		39003673.13	992772.33	100.00	100.00		

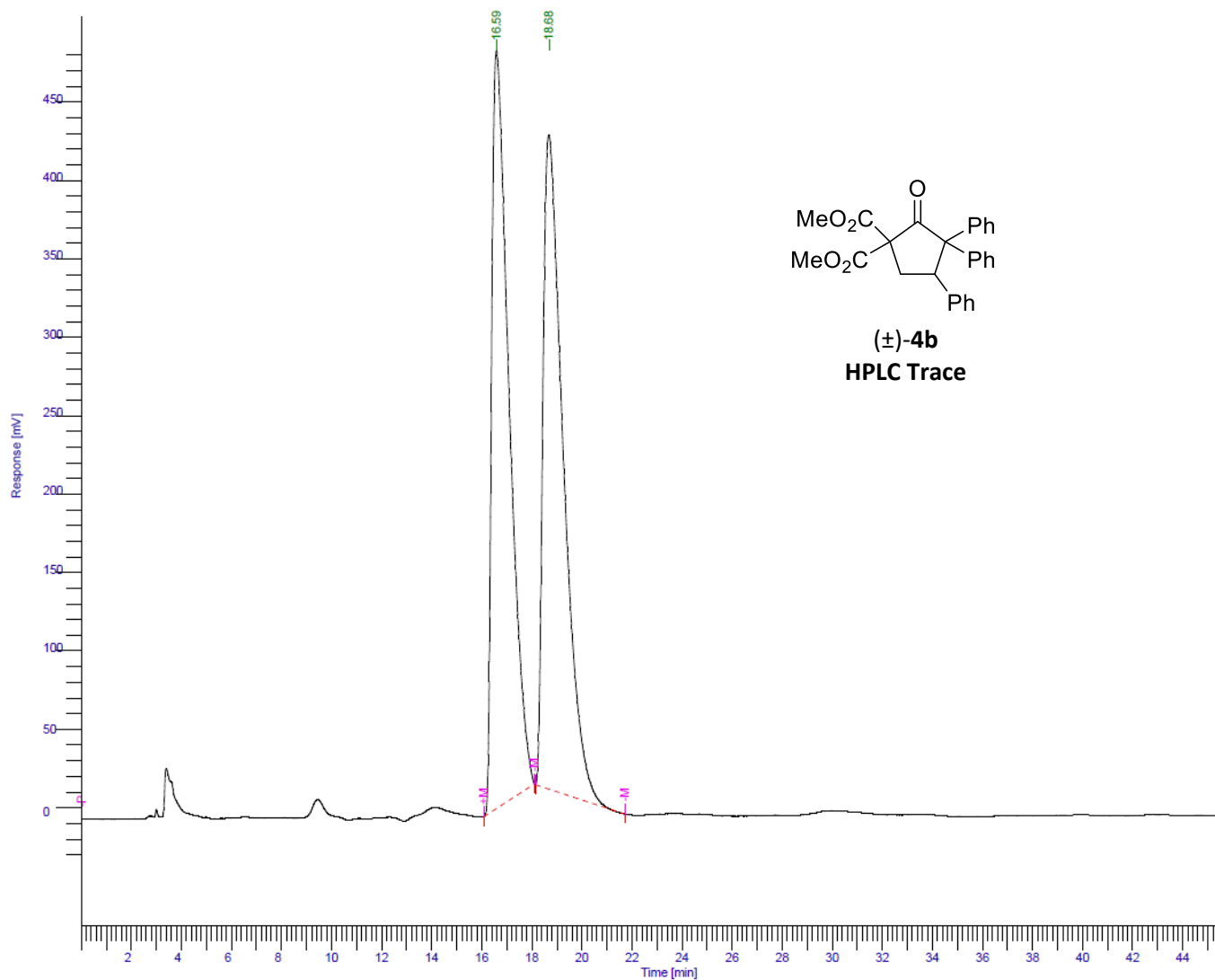


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1	10.303	3850775.90	189894.89	48.75	48.75	*BV	20.2785
2	10.963	4048079.43	179315.58	51.25	51.25	*VB	22.5752
		7898855.33	369210.47	100.00	100.00		

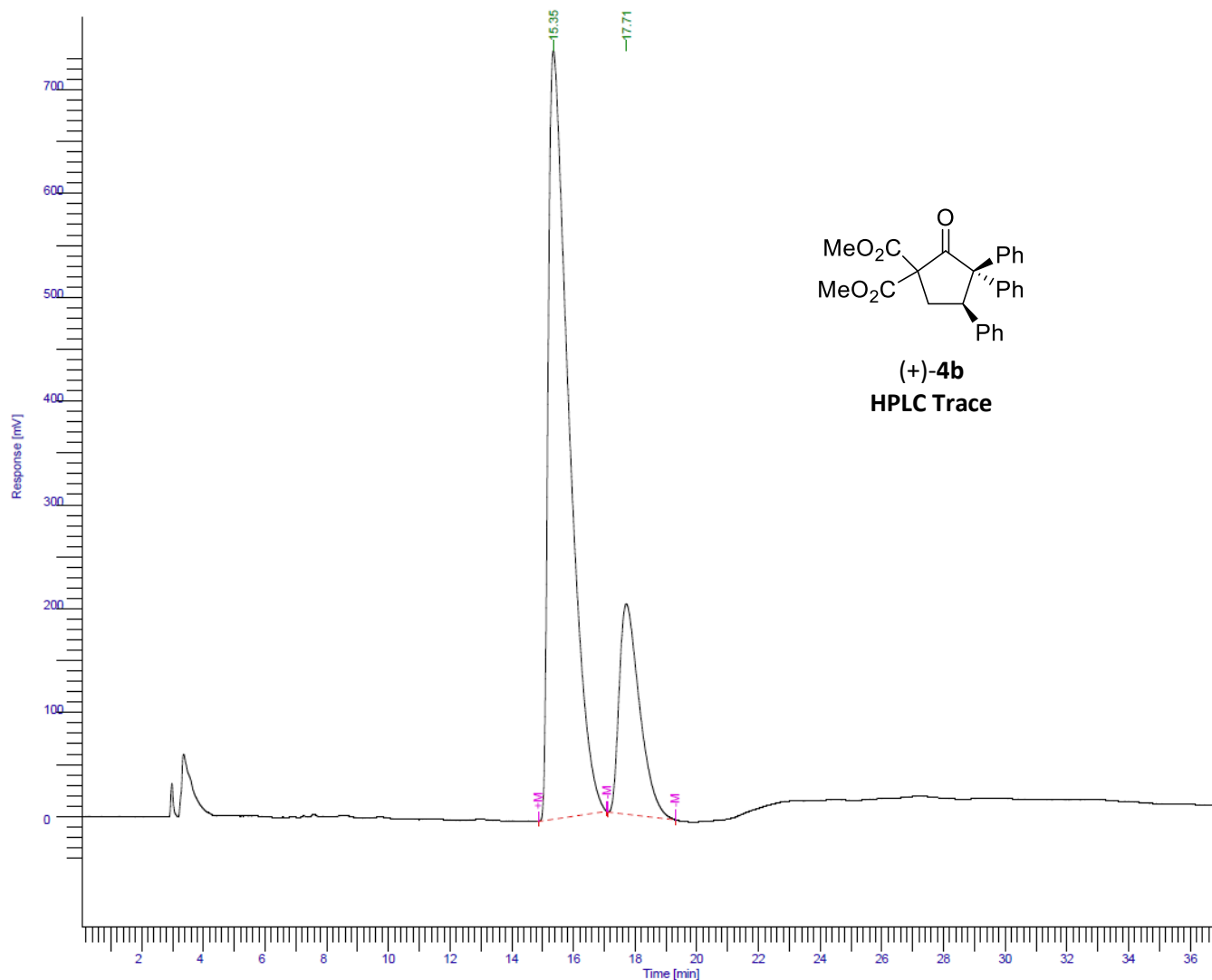


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1	10.216	40307.47	2470.21	5.20	5.20	*BV	16.3174
2	10.765	735487.83	34188.20	94.80	94.80	*VB	21.5129
		775795.29	36658.40	100.00	100.00		

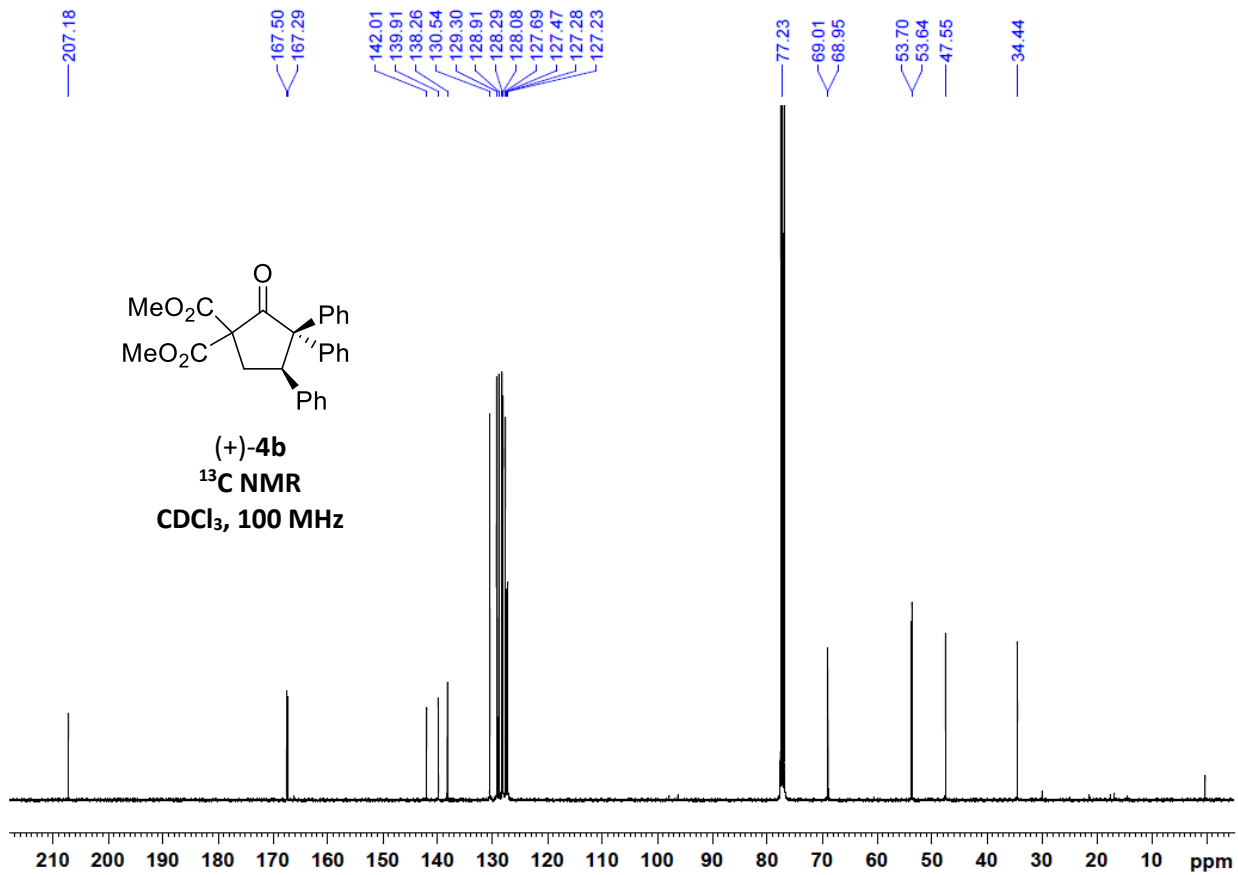
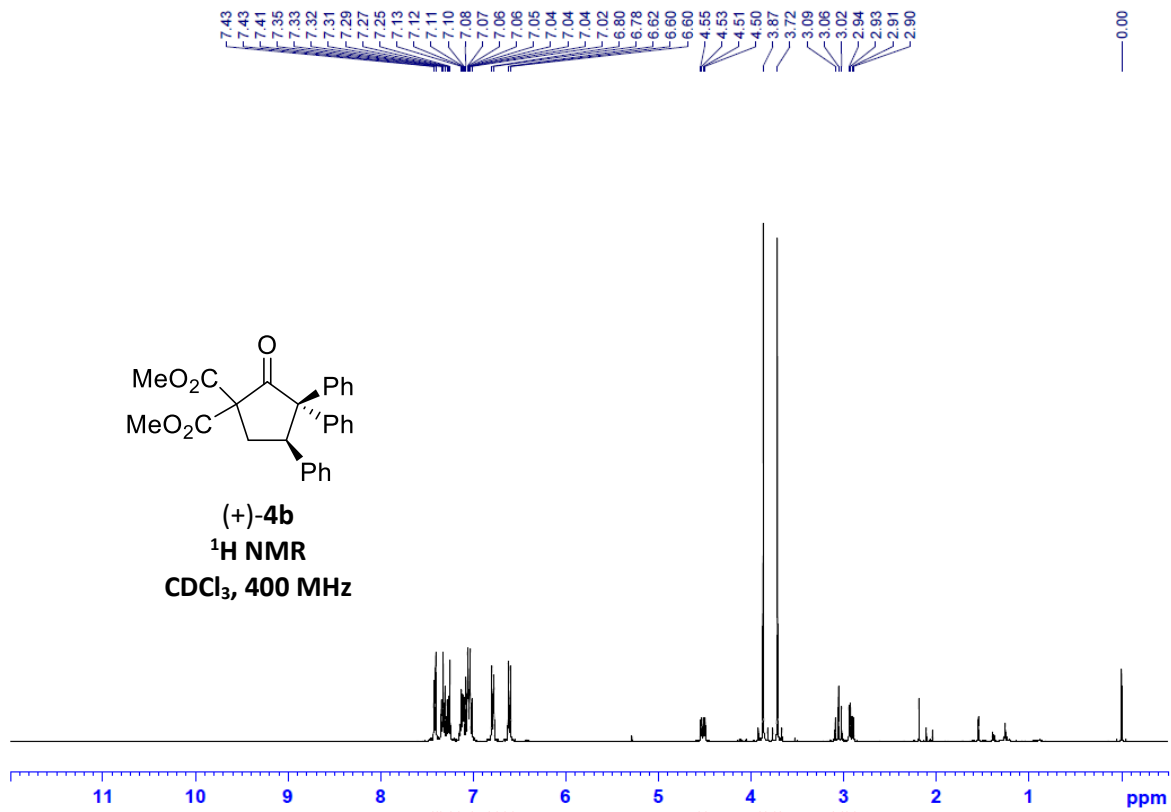


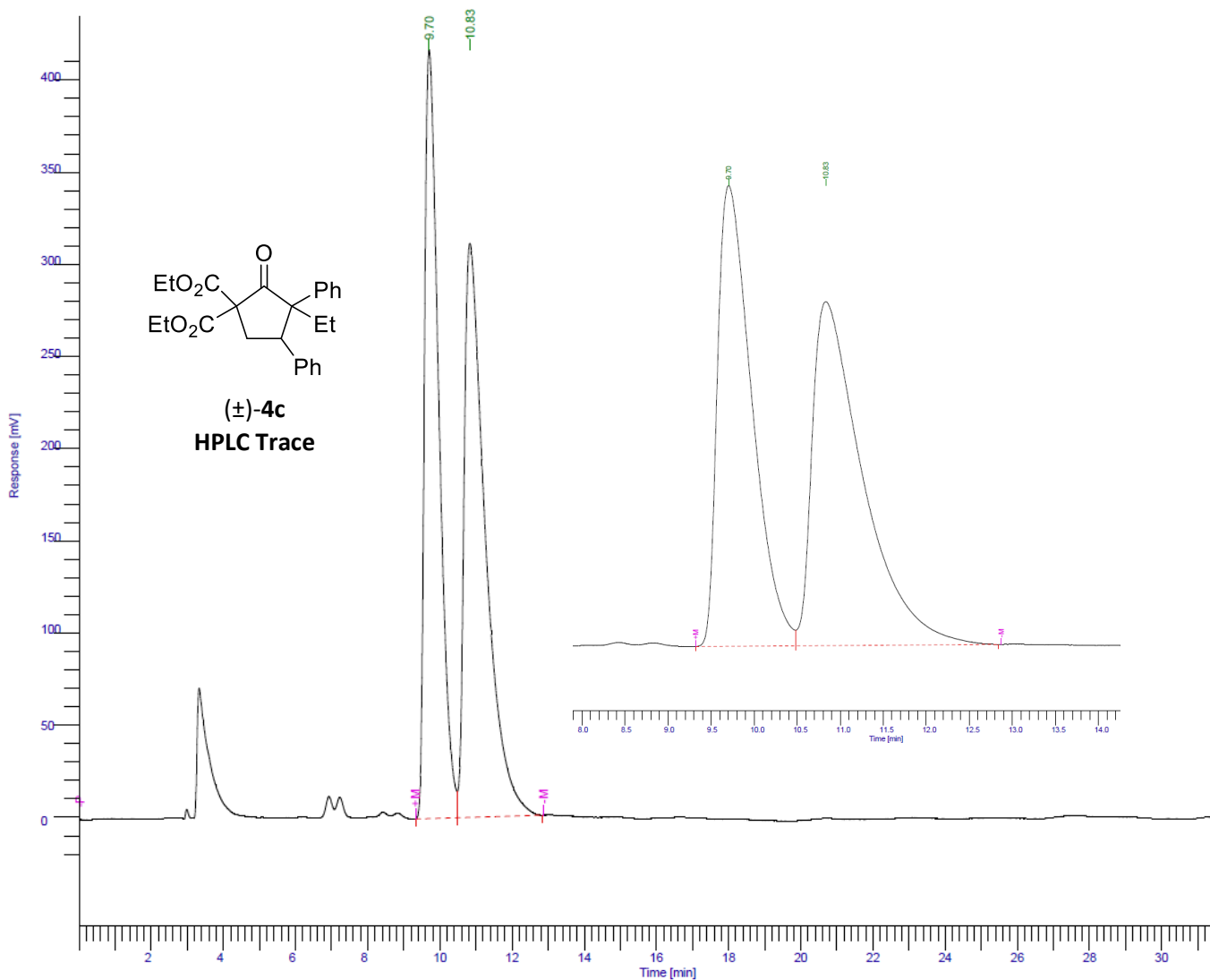


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1	16.587	23386096.44	483605.24	49.86	49.86	*BB	48.3578
2	18.678	23518633.48	417248.10	50.14	50.14	*BB	56.3661
		46904729.92	900853.35	100.00	100.00		

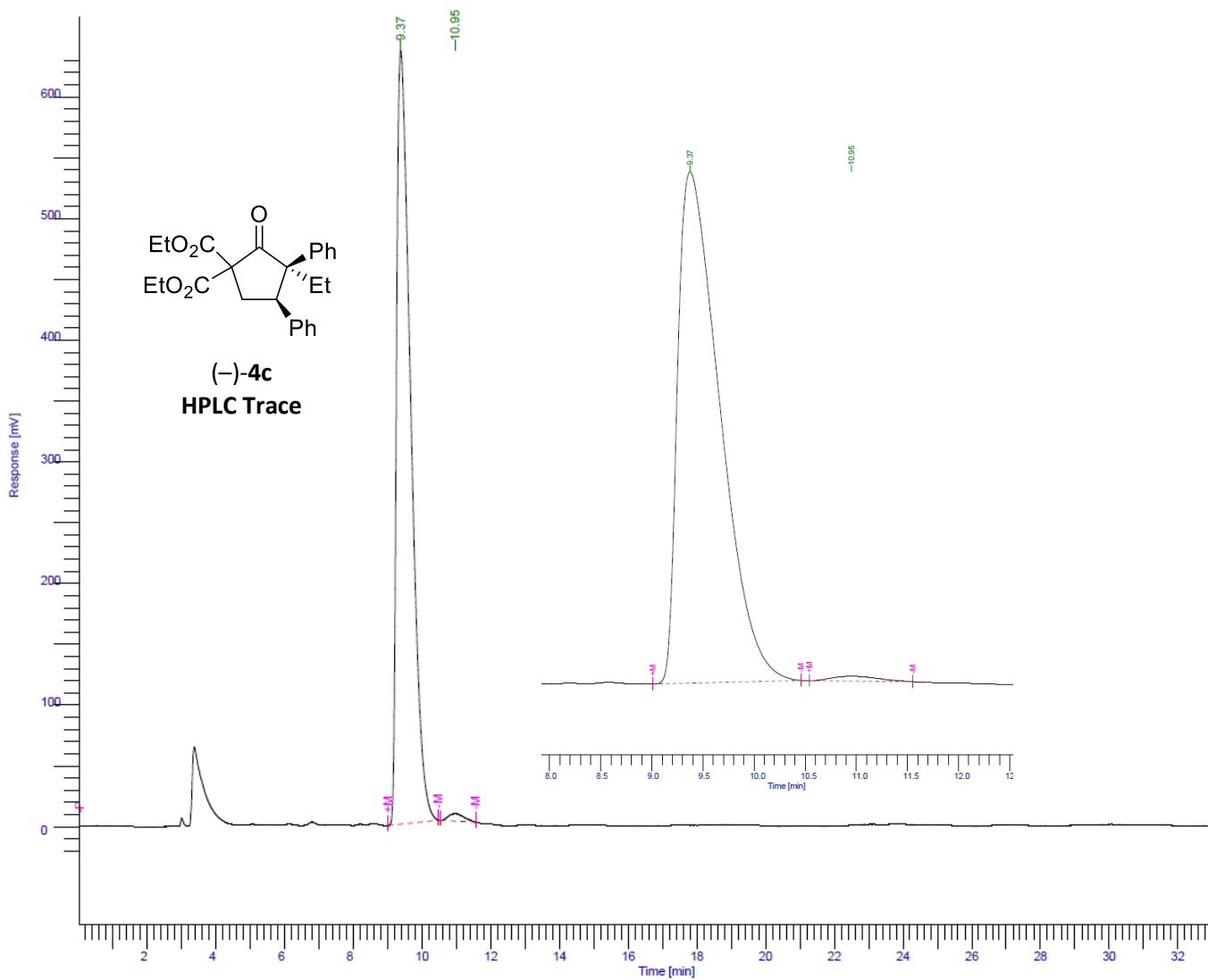


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1	15.349	34602069.19	740107.91	78.78	78.78	*BB	46.7527
2	17.713	9318954.79	202468.55	21.22	21.22	*BB	46.0267
		43921023.97	942576.46	100.00	100.00		

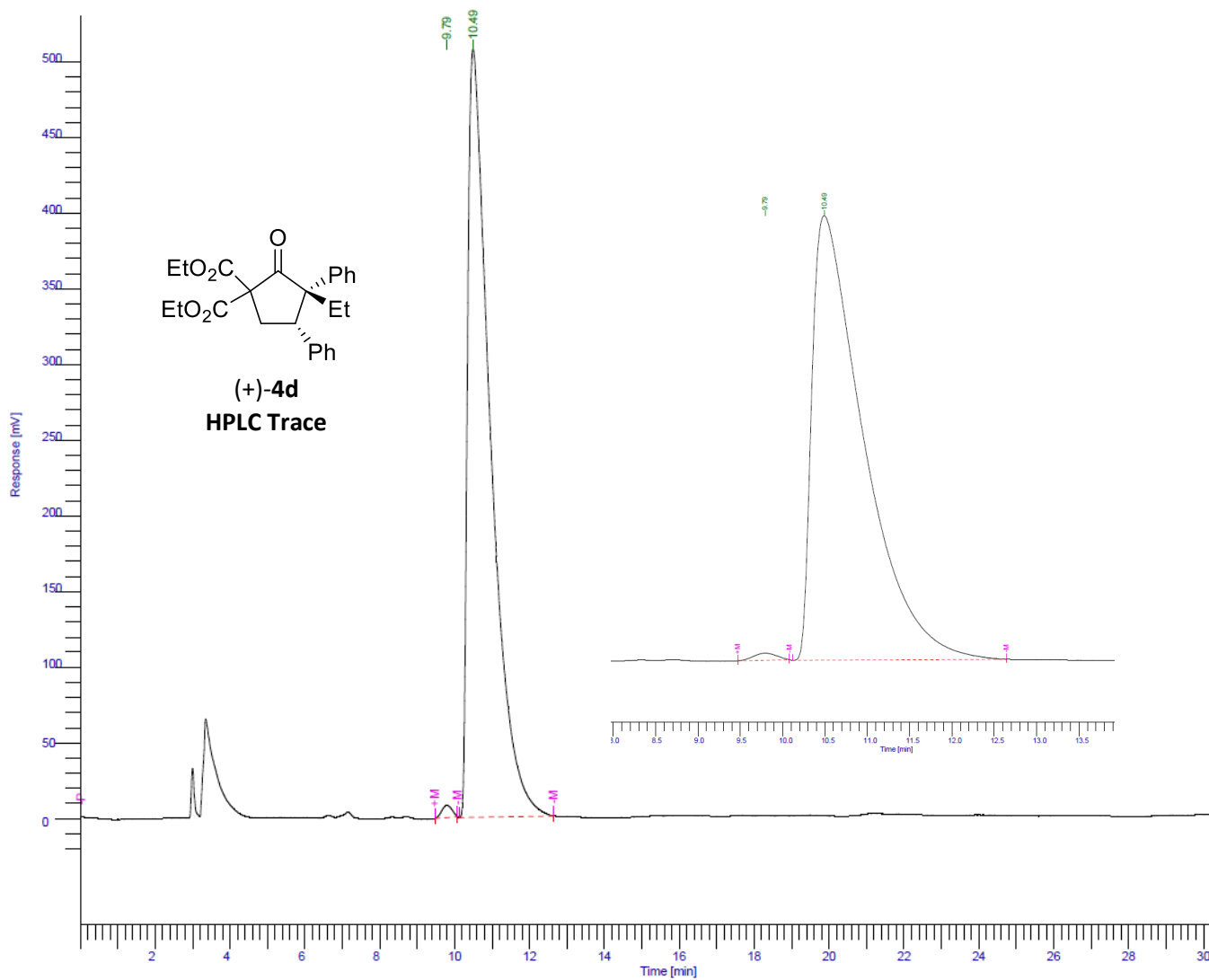




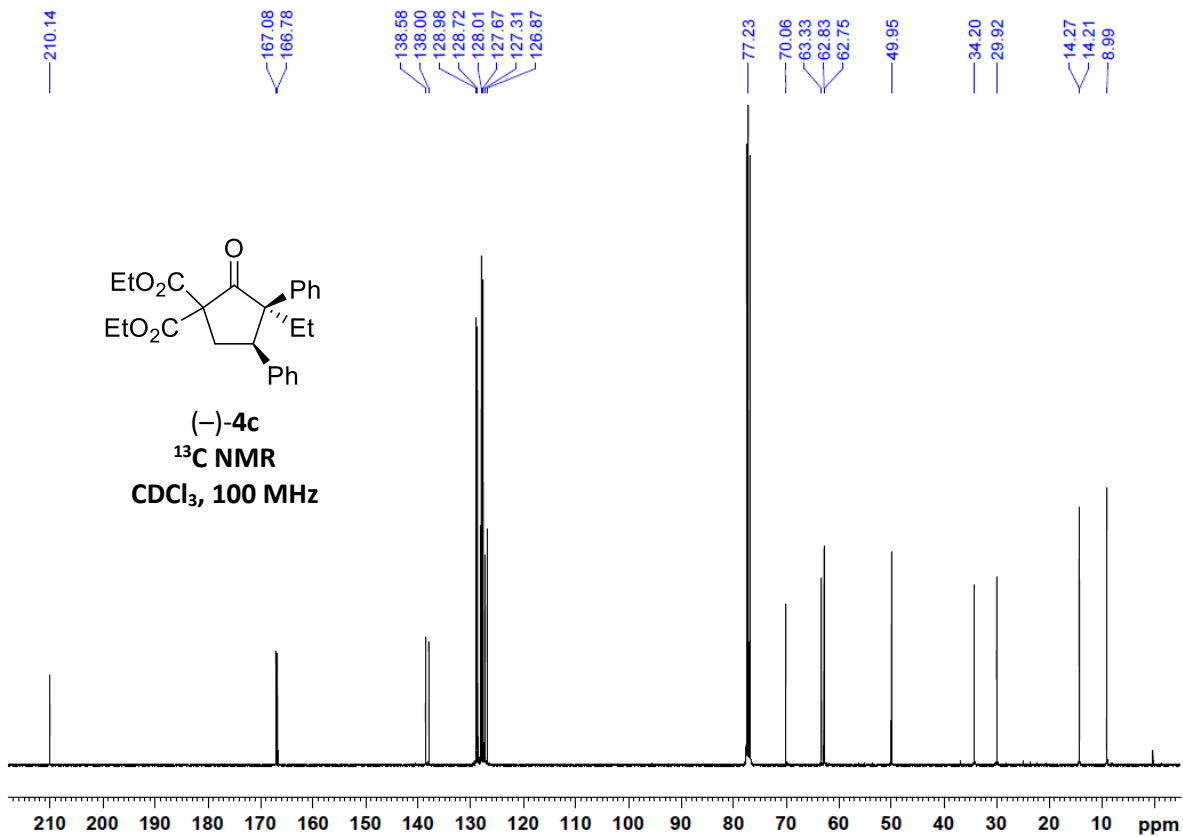
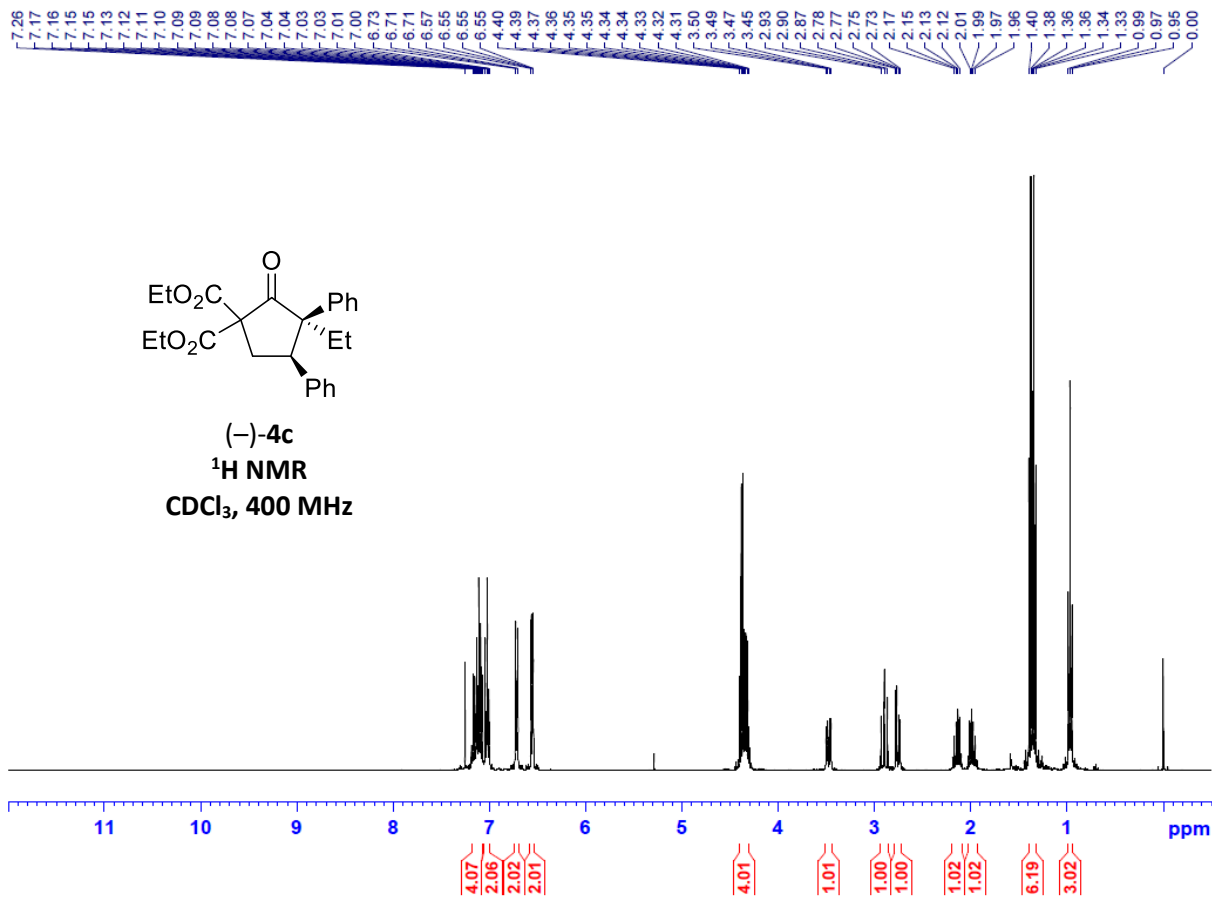
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1	9.704	11569596.84	416888.13	47.67	47.67	*BV	27.7523
2	10.833	12702248.48	311243.59	52.33	52.33	*VB	40.8113
		24271845.32	728131.72	100.00	100.00		

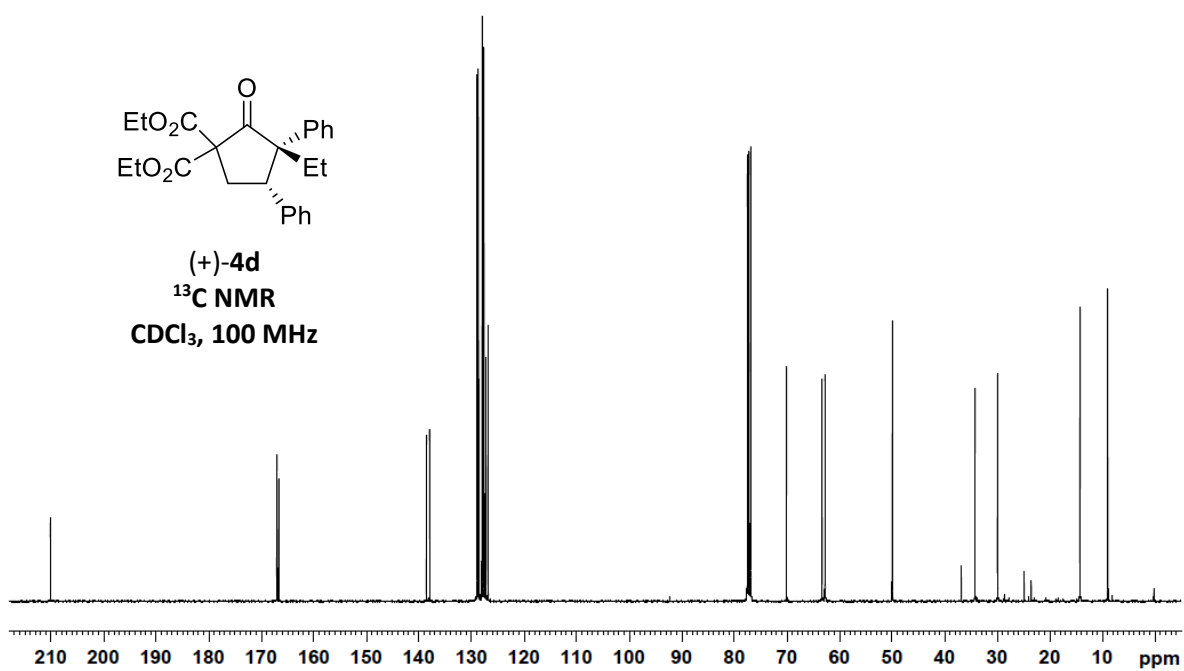
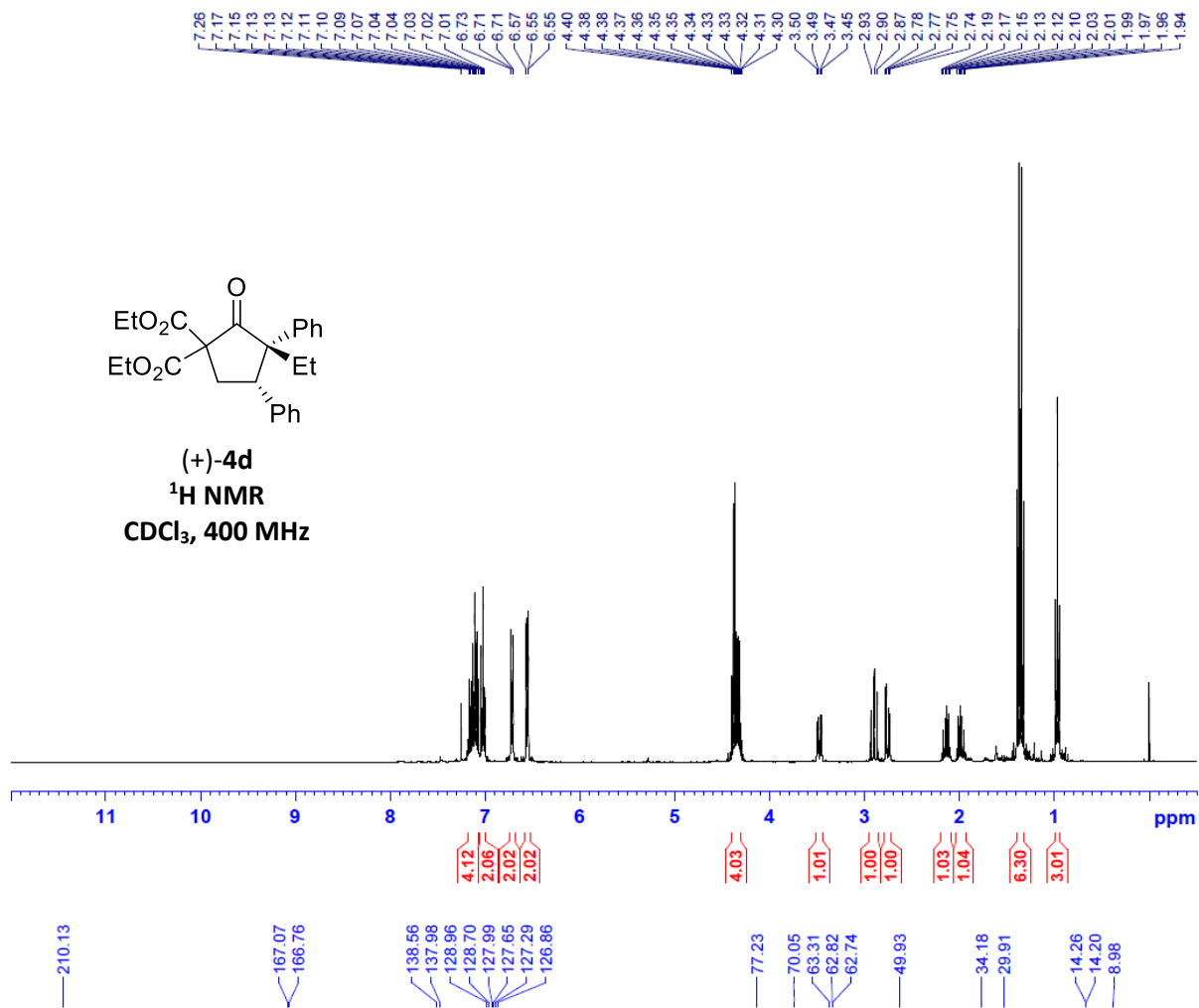


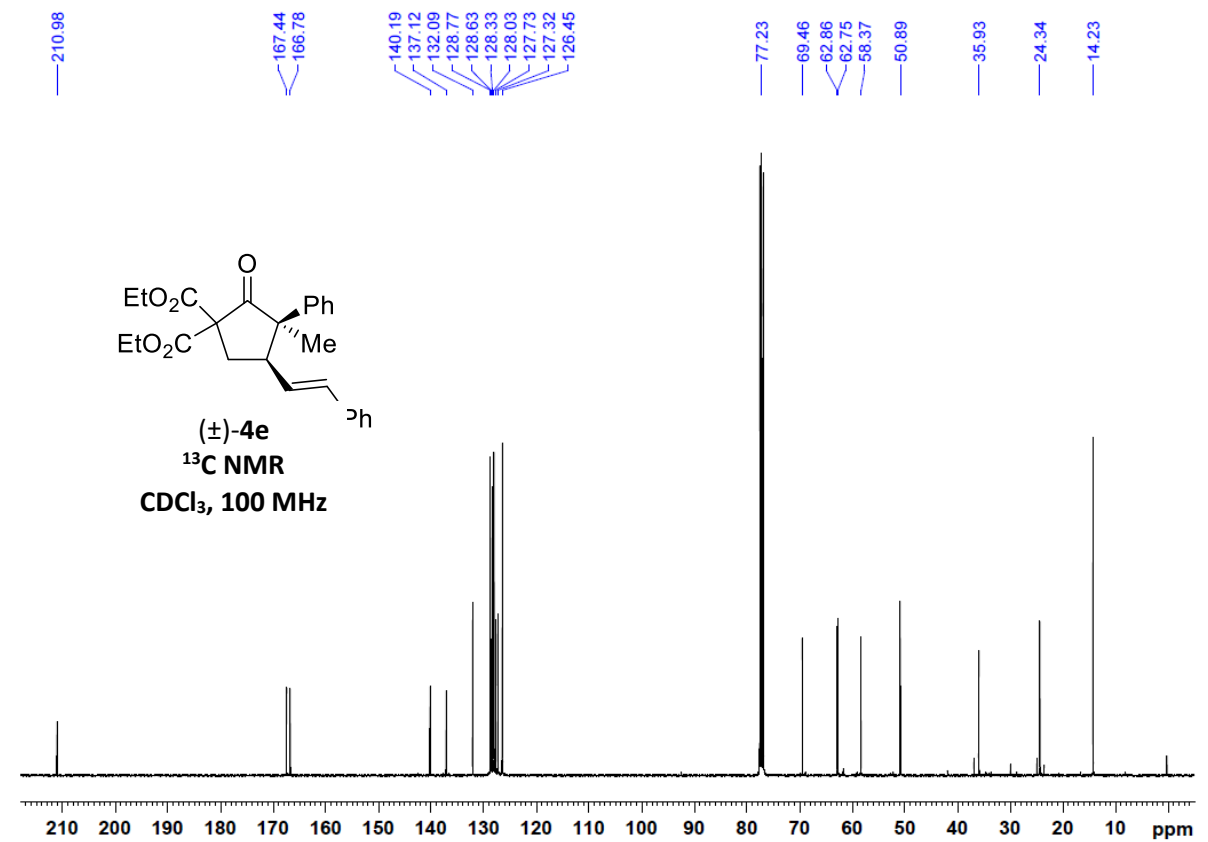
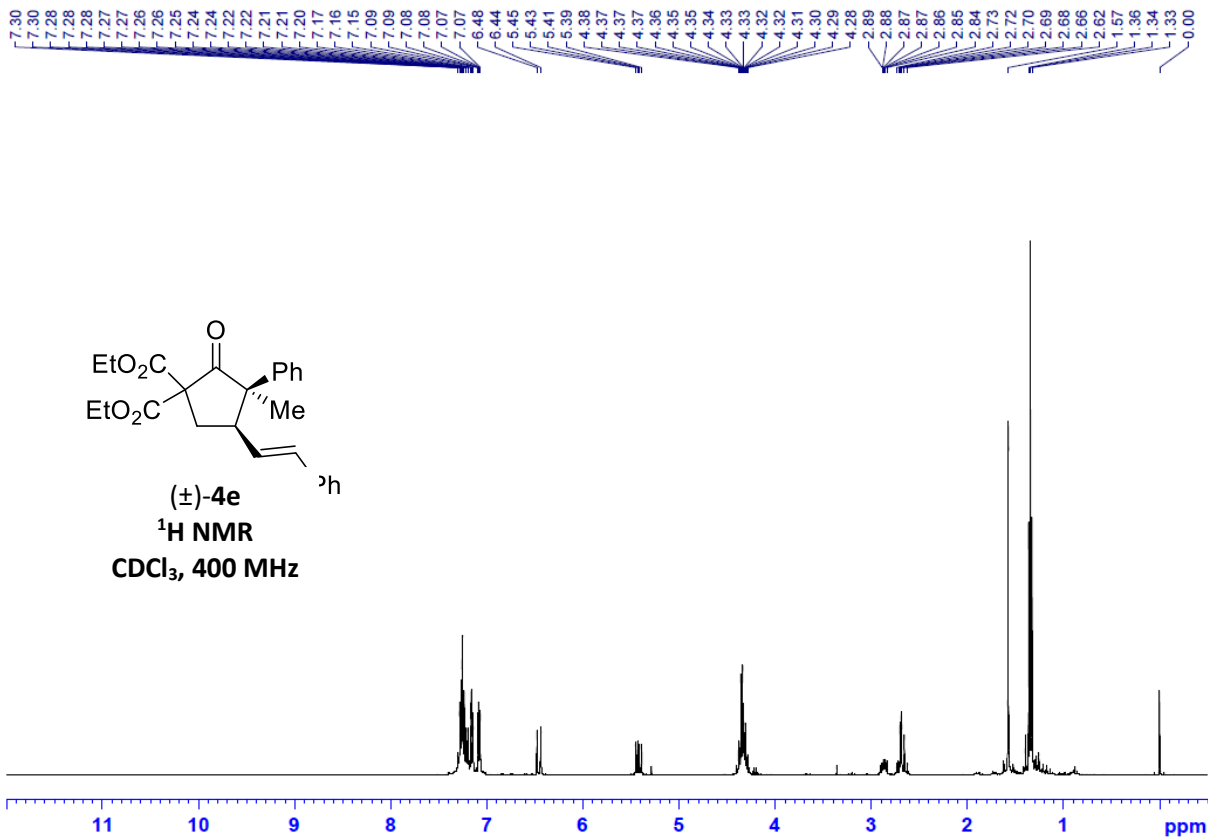
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1	9.373	18184209.90	636253.20	98.94	98.94	*BB	28.5801
2	10.952	194580.66	6161.40	1.06	1.06	*BB	31.5806
		18378790.56	642414.60	100.00	100.00		

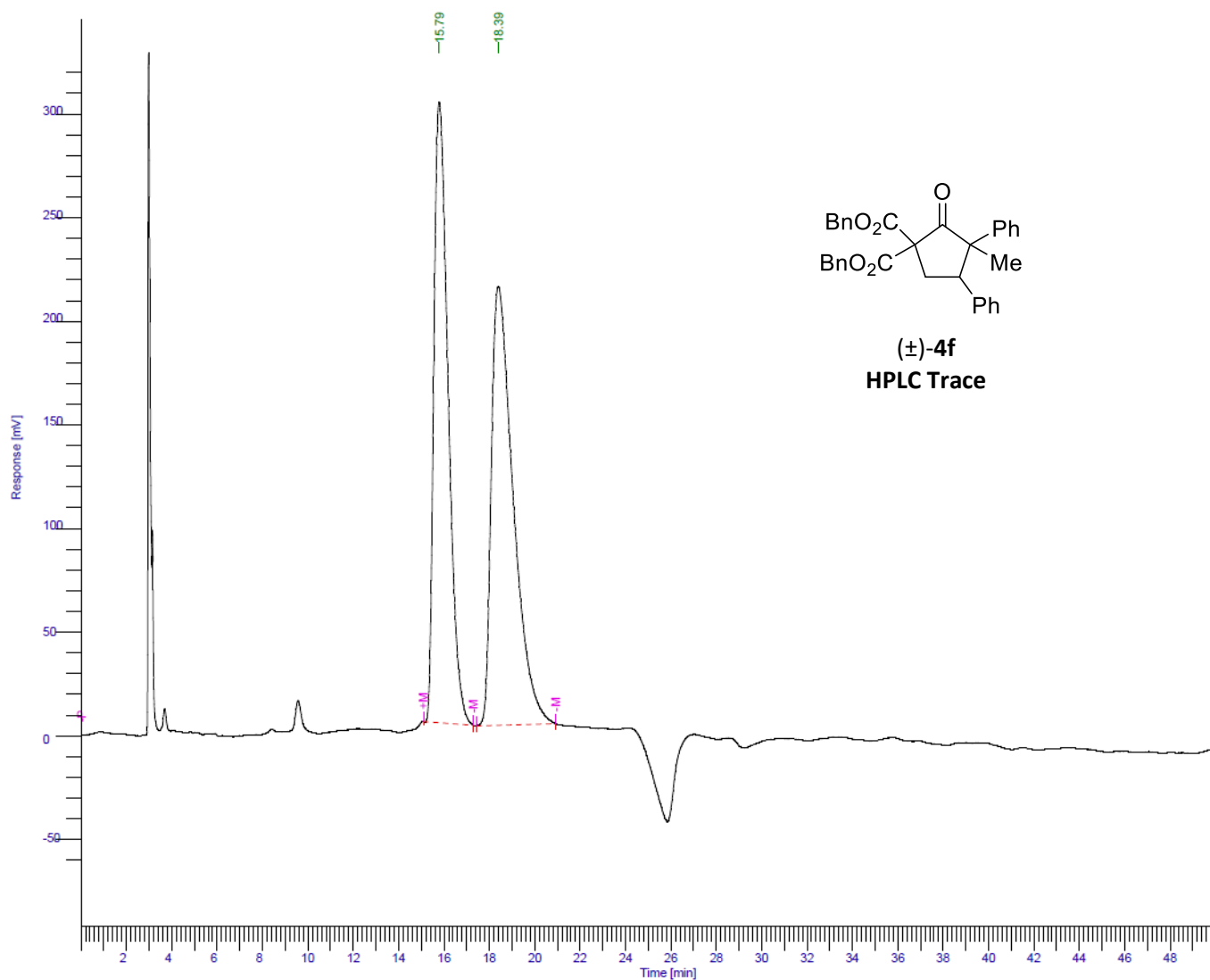


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1	9.791	152214.89	7995.07	0.70	0.70	*BB	19.0386
2	10.491	21440723.67	507392.20	99.30	99.30	*BB	42.2567
		21592938.56	515387.27	100.00	100.00		

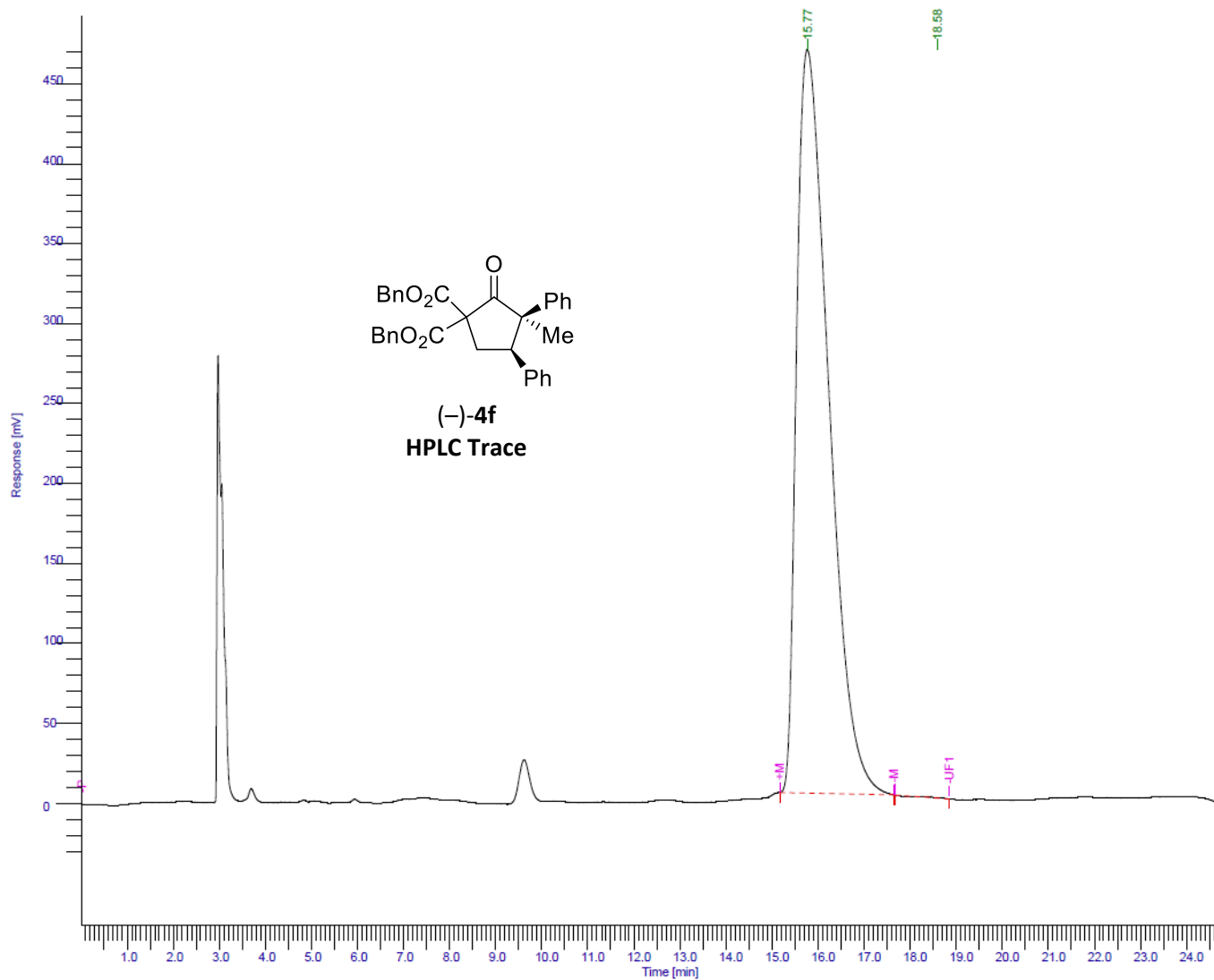




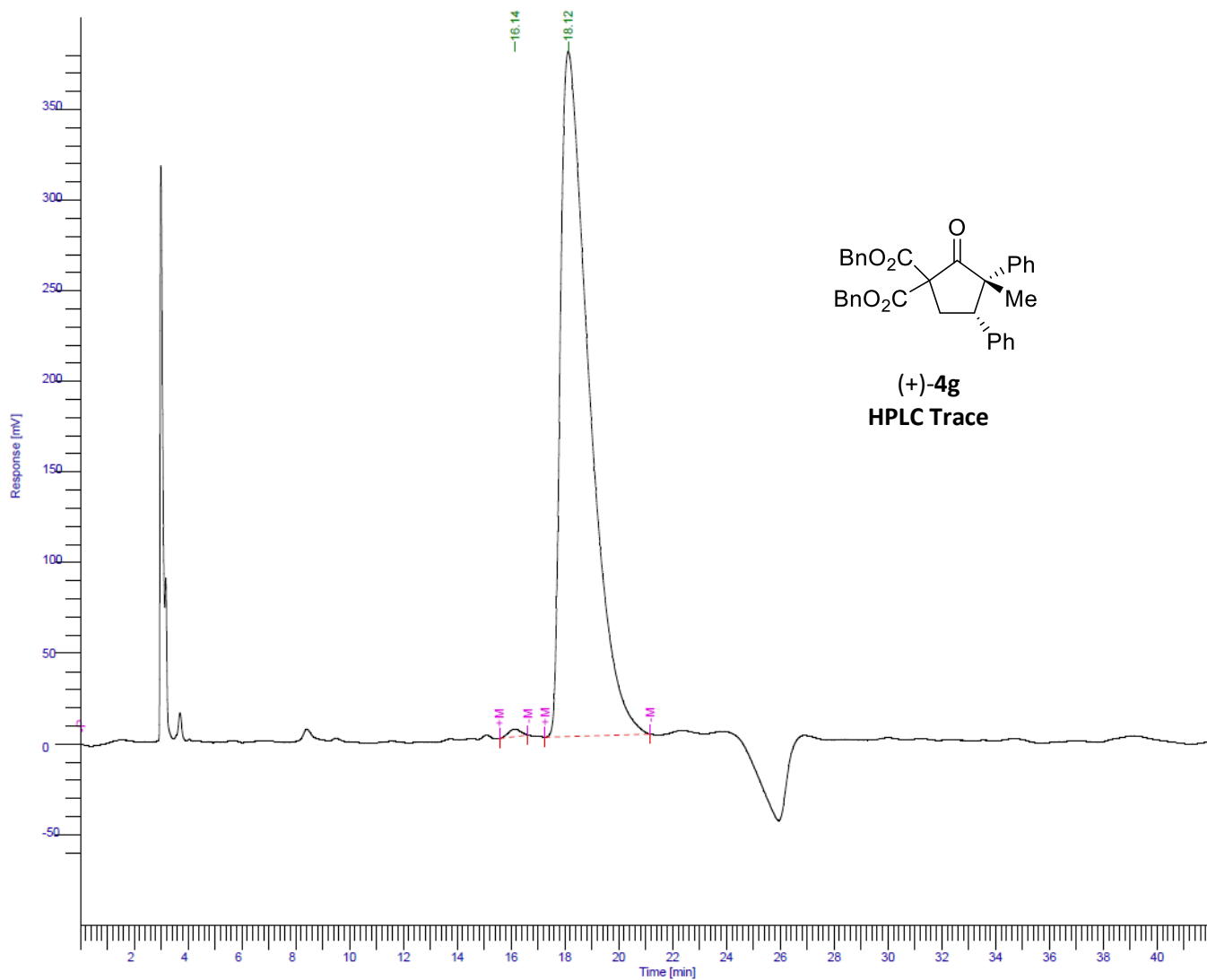




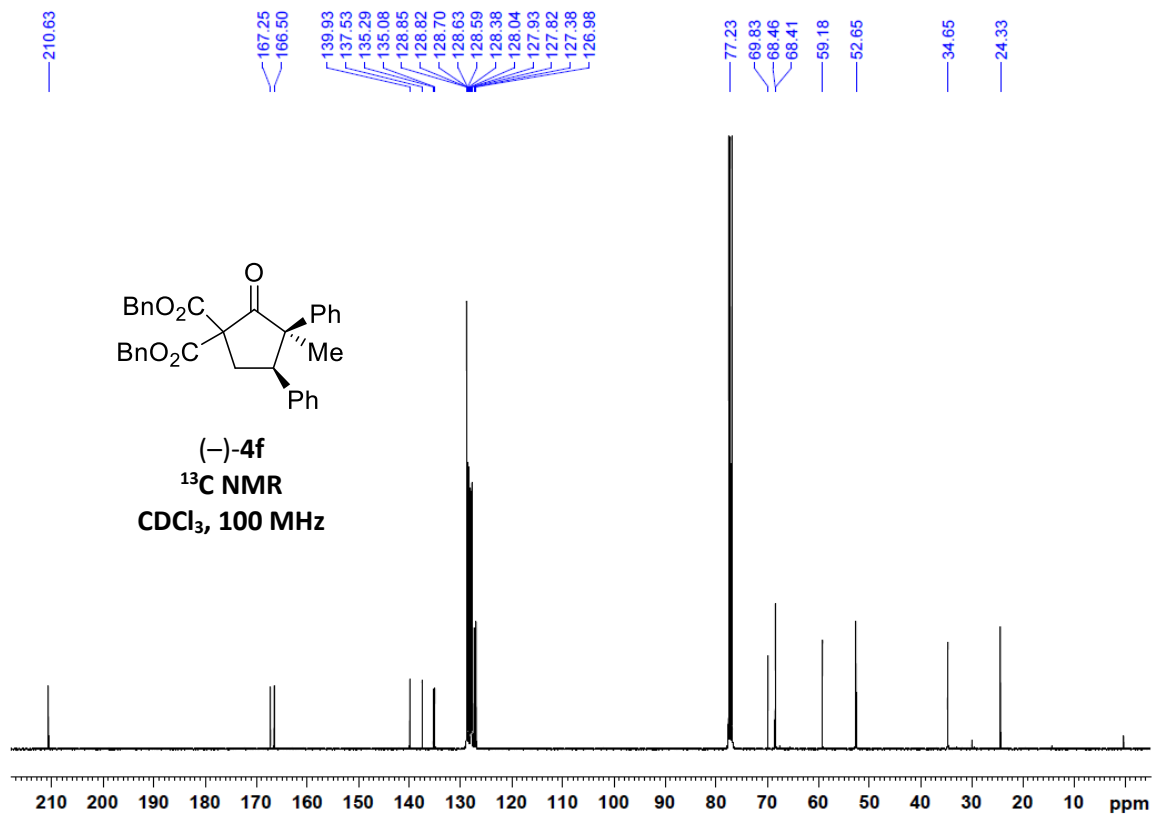
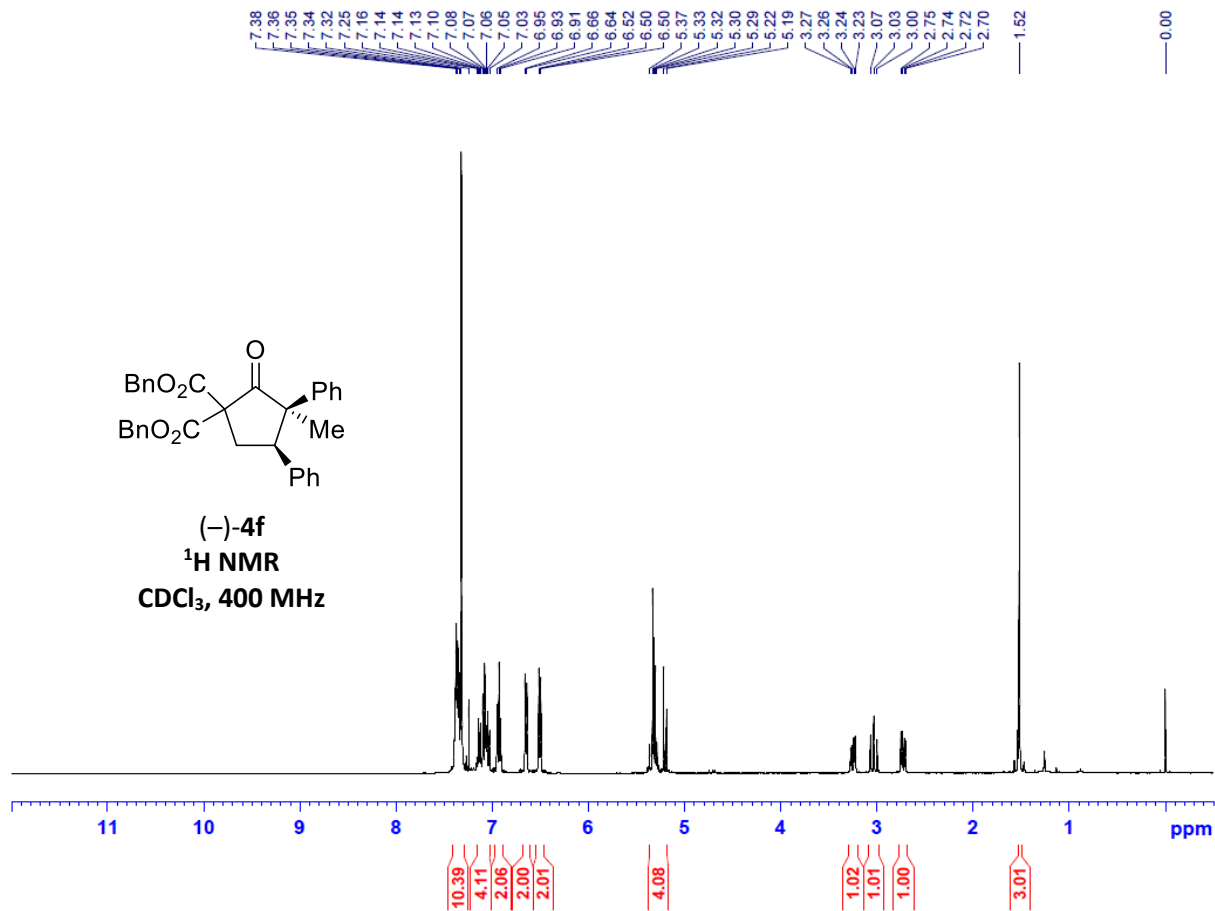
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1	15.787	13069936.86	299608.69	47.96	47.96	*BB	43.6234
2	18.390	14184331.50	211820.11	52.04	52.04	*BB	66.9640
		27254268.35	511428.81	100.00	100.00		

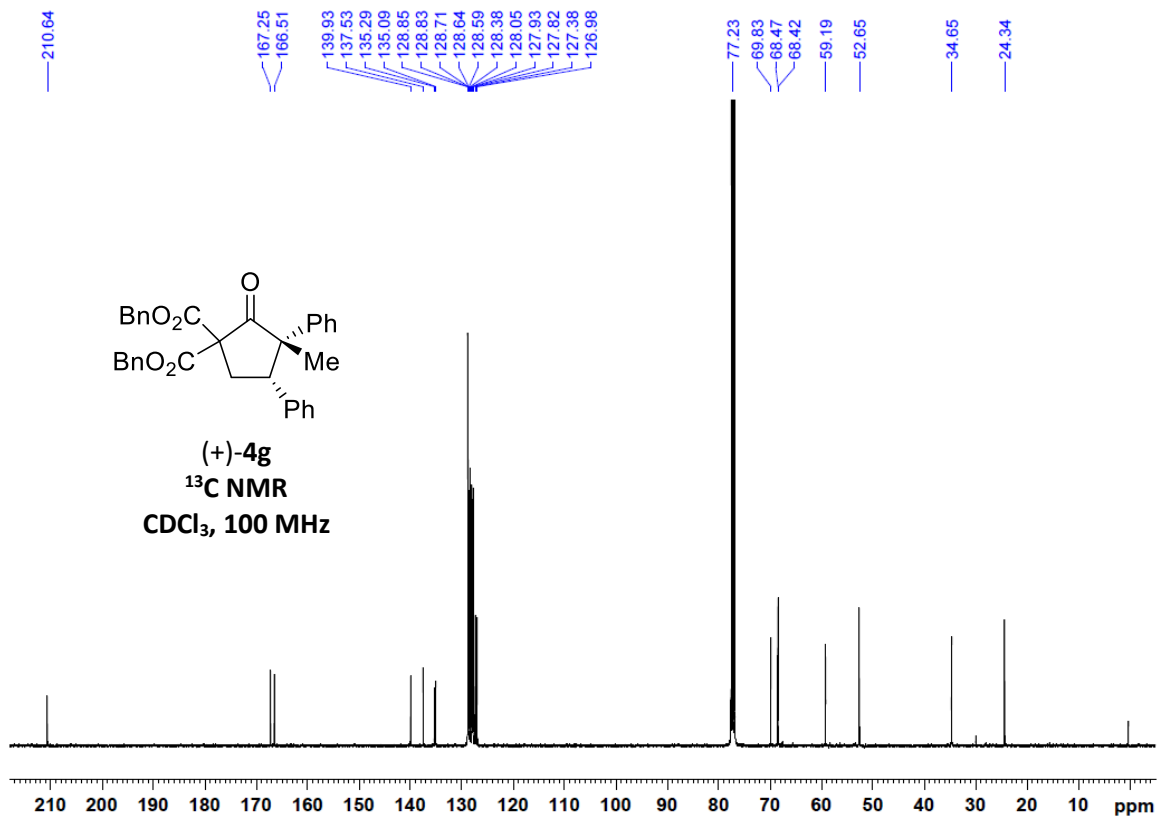
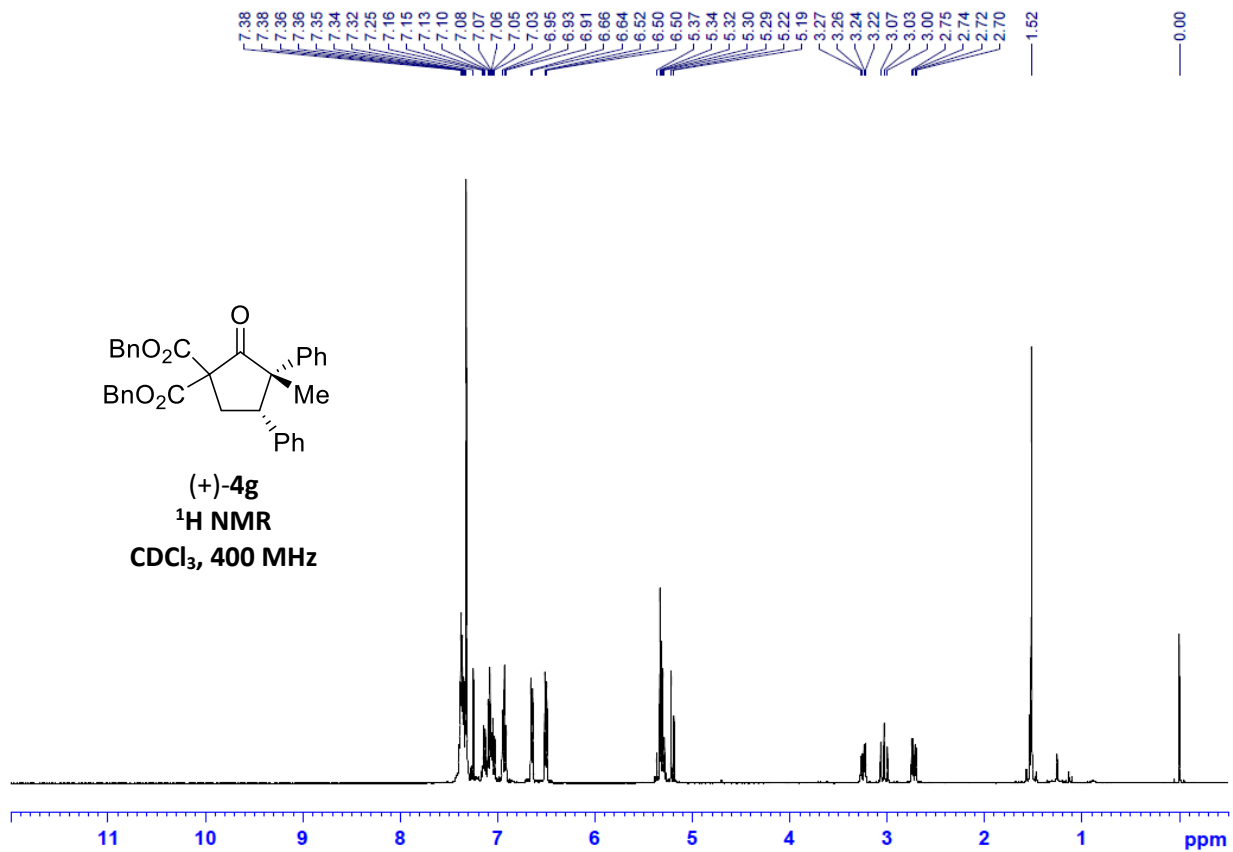


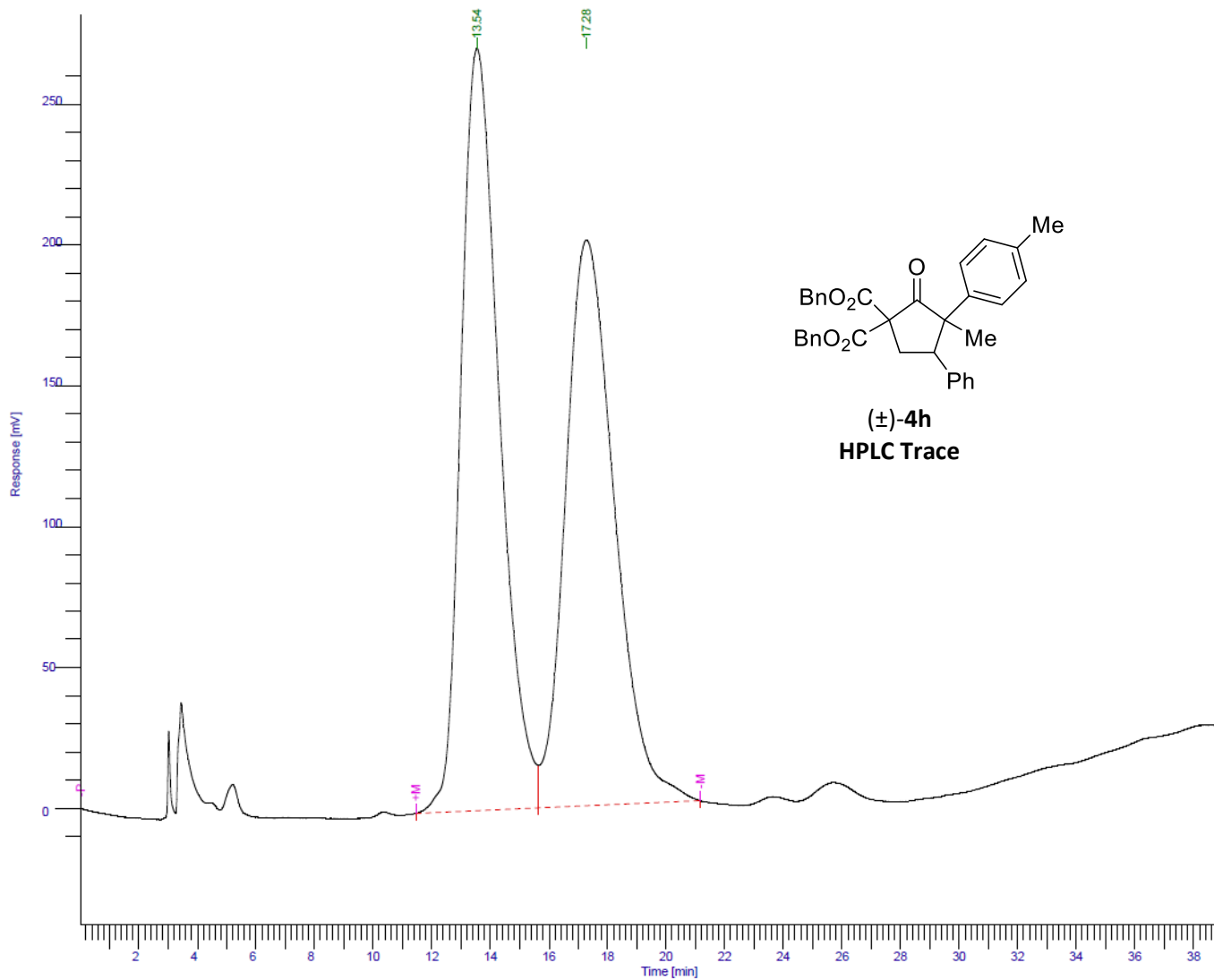
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1	15.767	22522981.11	465004.14	99.97	99.97	*BB	48.4361
2	18.583	7487.58	358.23	0.03	0.03	*MM	20.9019
		22530468.69	465362.36	100.00	100.00		



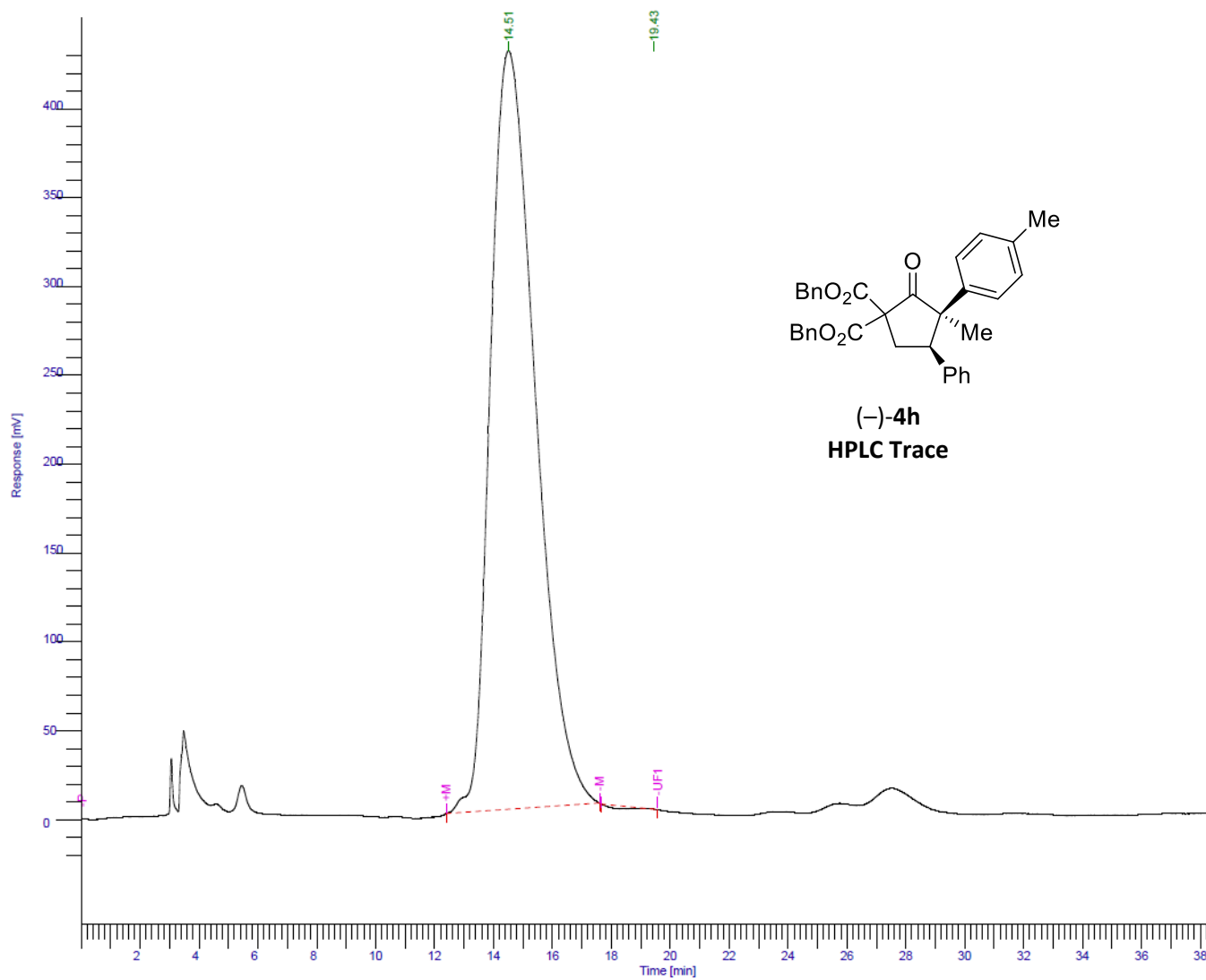
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1	16.143	135074.83	4123.13	0.48	0.48	*BB	32.7603
2	18.121	27881097.37	377989.68	99.52	99.52	*BB	73.7615
		28016172.20	382112.81	100.00	100.00		



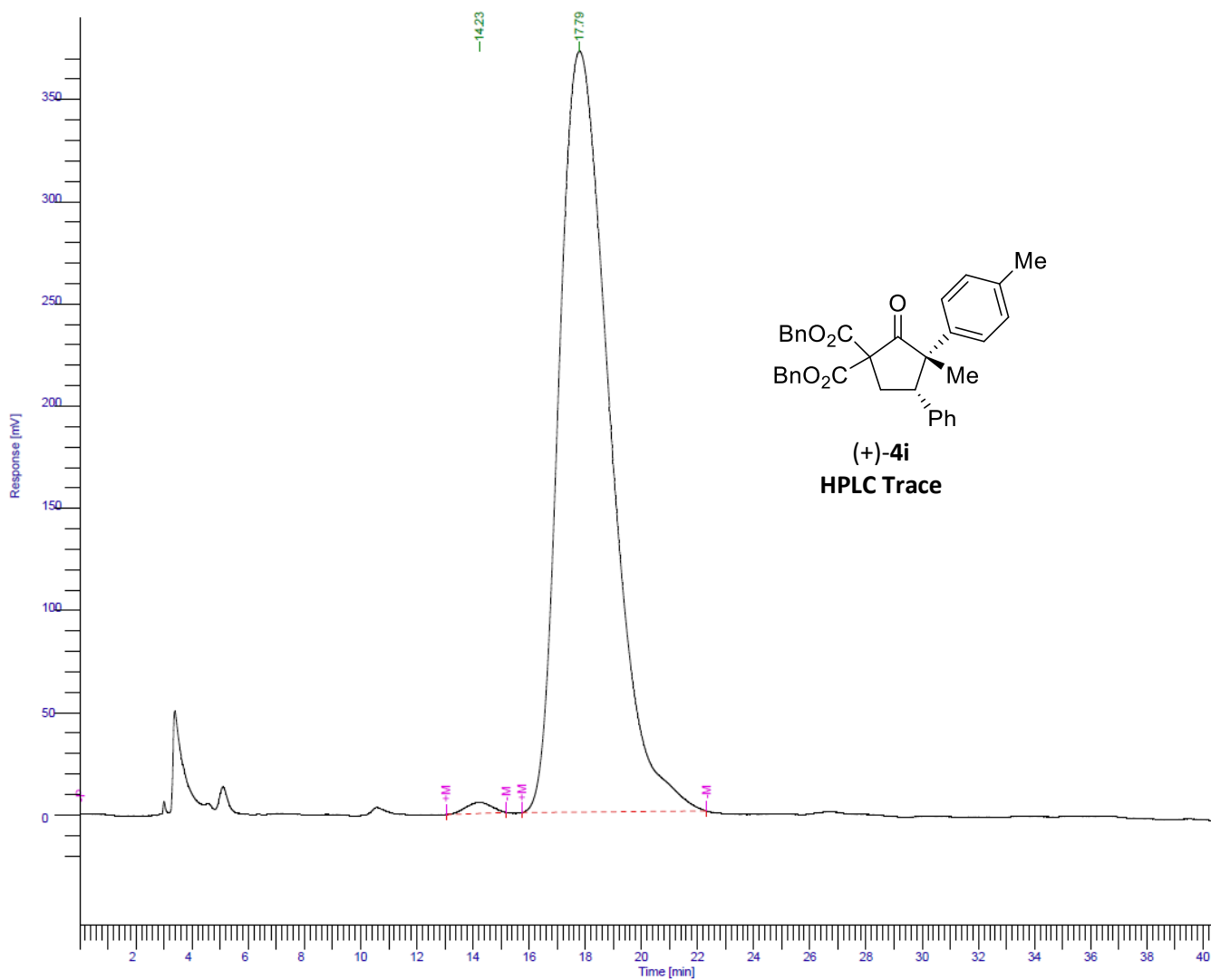




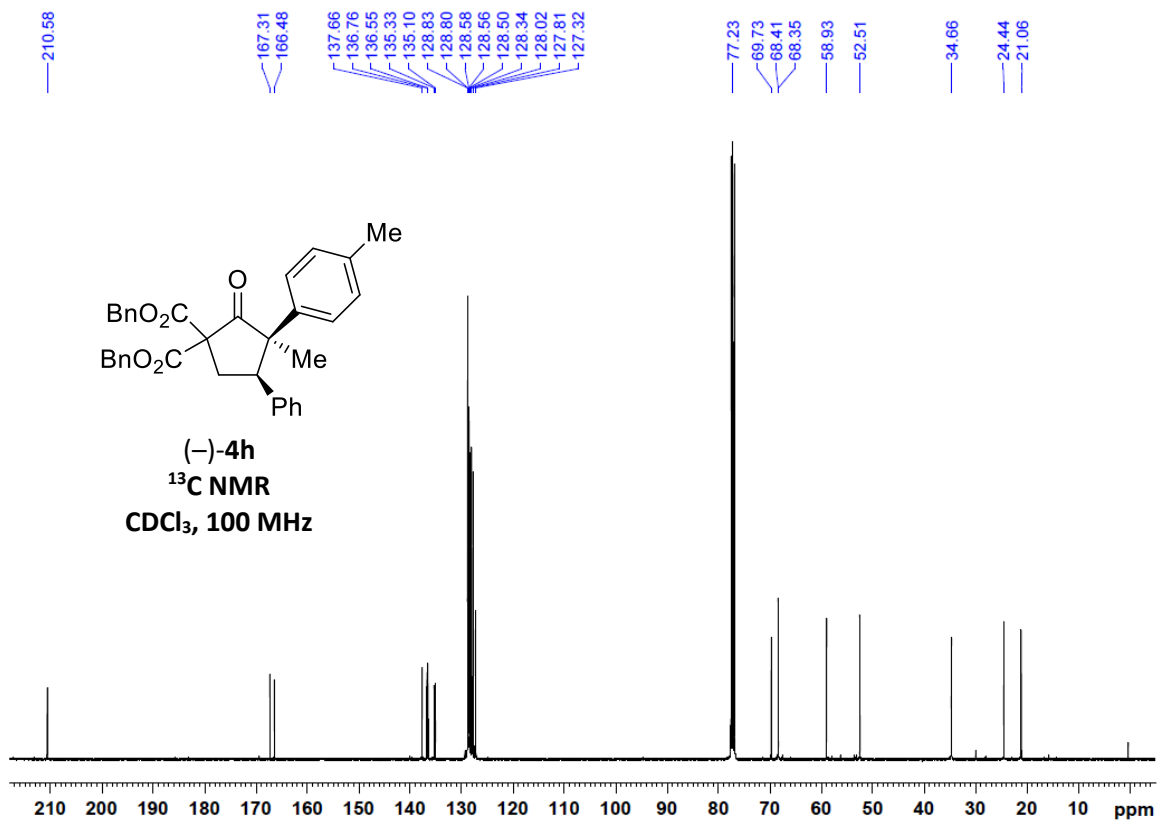
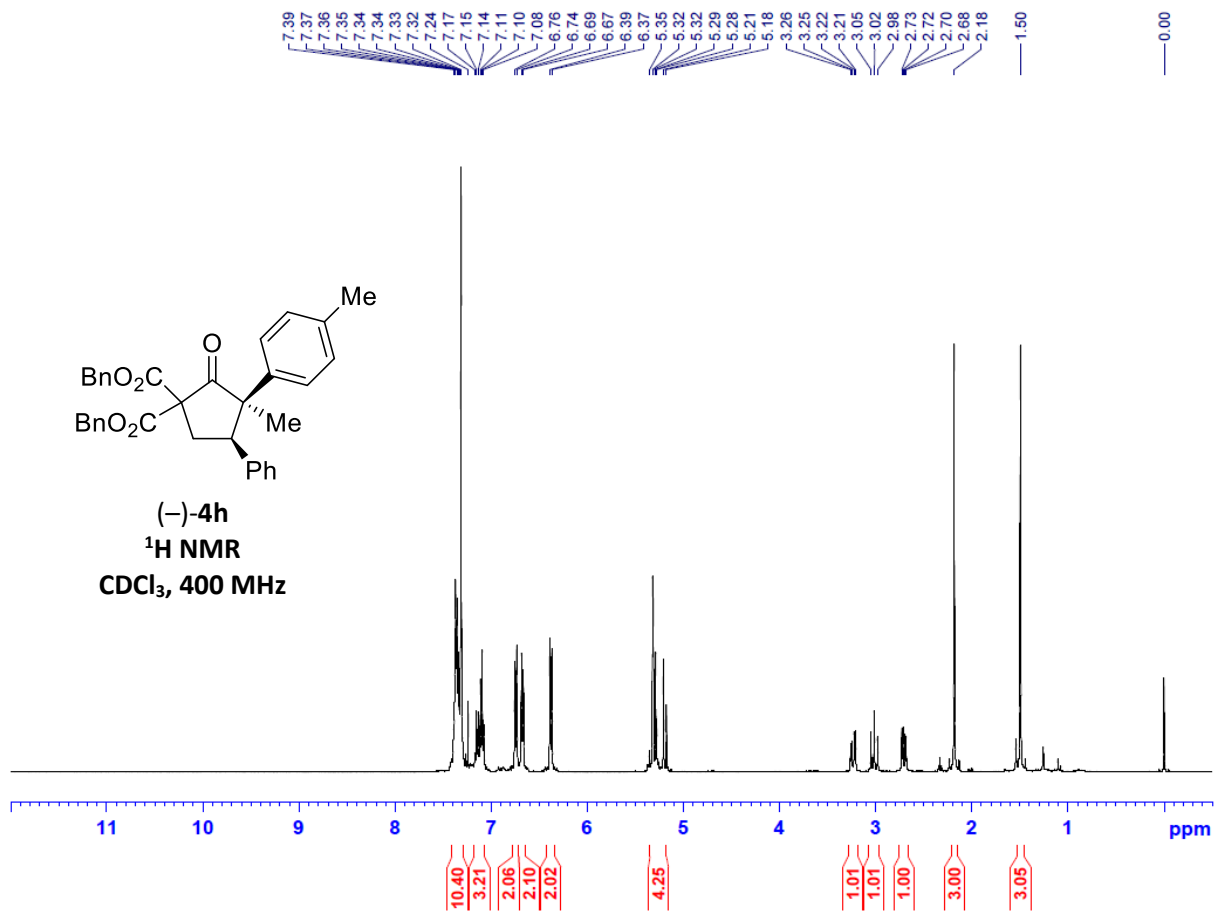
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1	13.543	24640510.45	270626.27	51.35	51.35	*BV	91.0500
2	17.283	23340288.76	200856.88	48.65	48.65	*VB	116.2036
		47980799.21	471483.14	100.00	100.00		

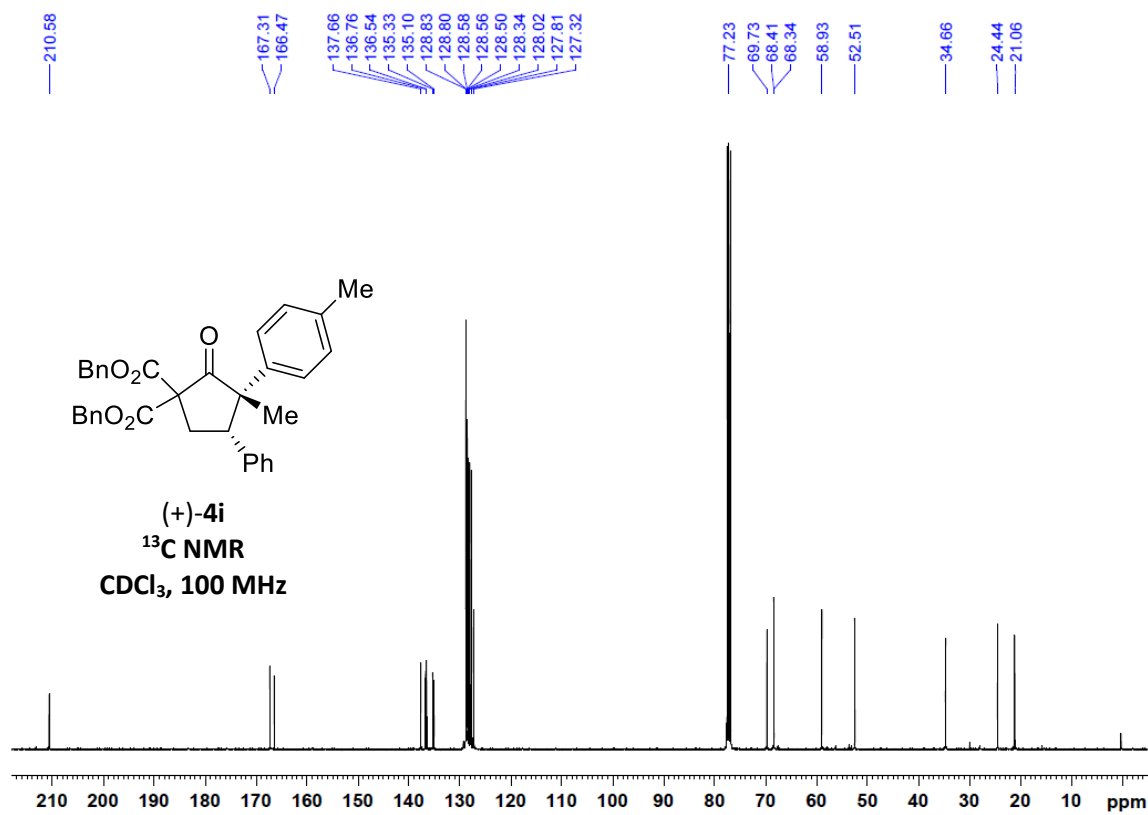
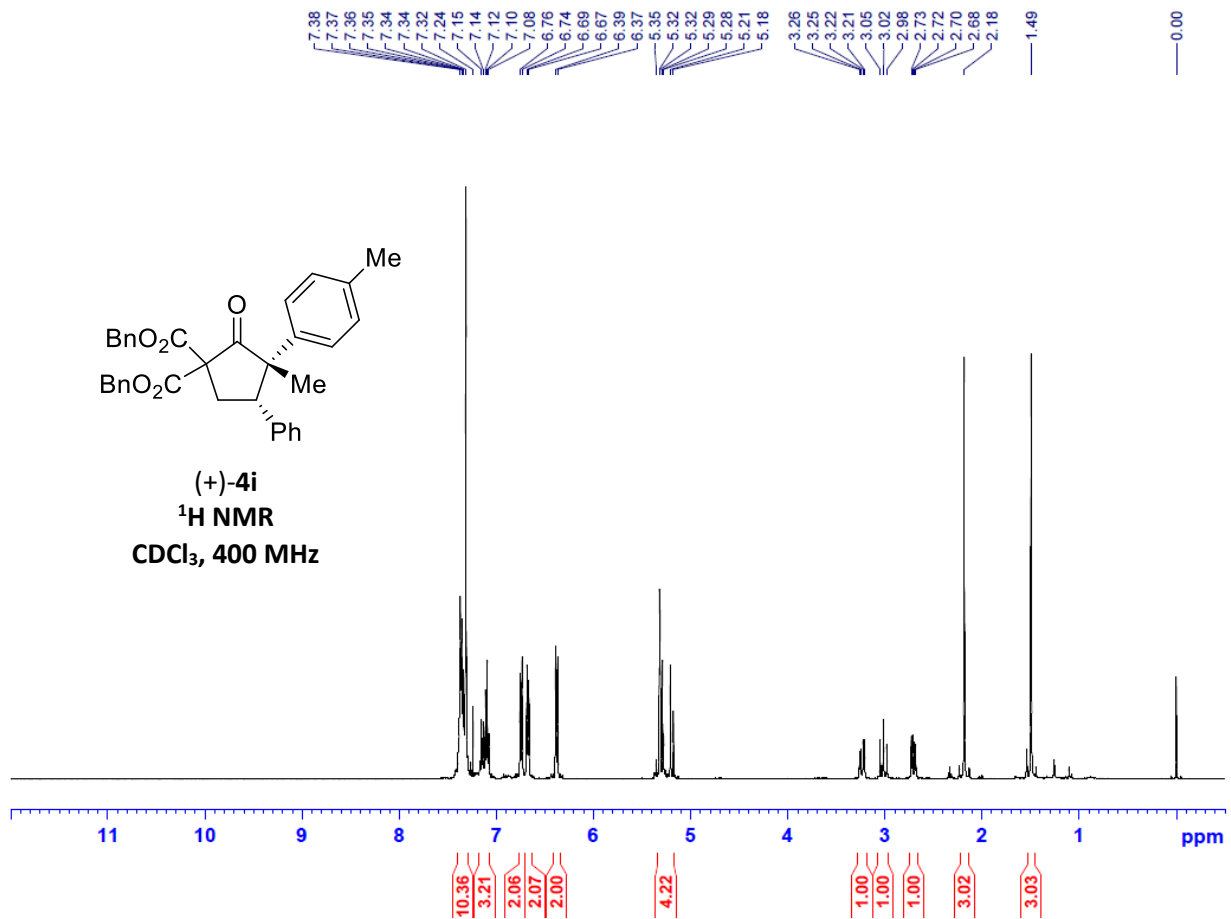


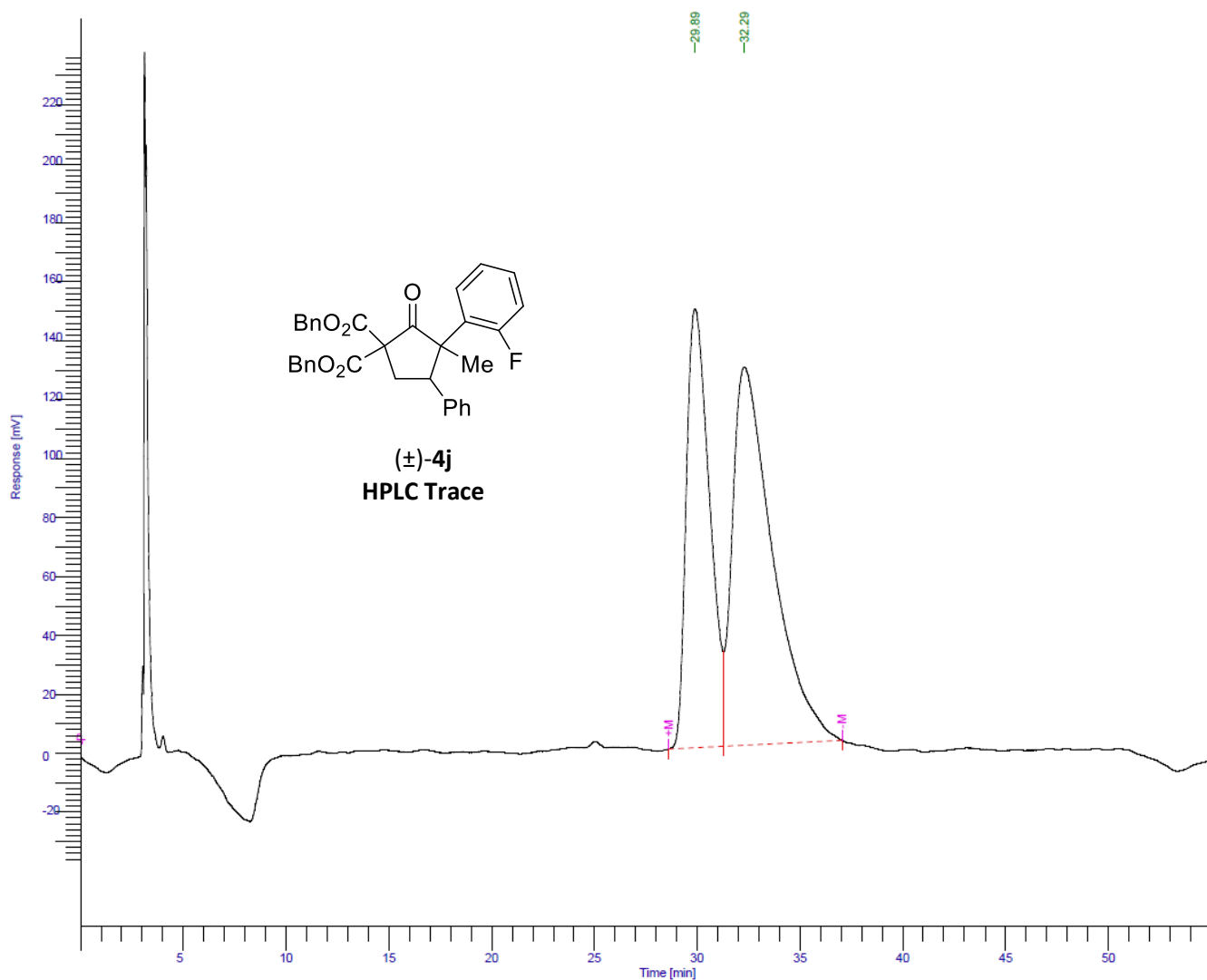
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1	14.509	45365346.74	426678.74	100.00	100.00	*BB	106.3220
2	19.433	1524.54	158.69	0.00	0.00	*MM	9.6070
		45366871.28	426837.43	100.00	100.00		



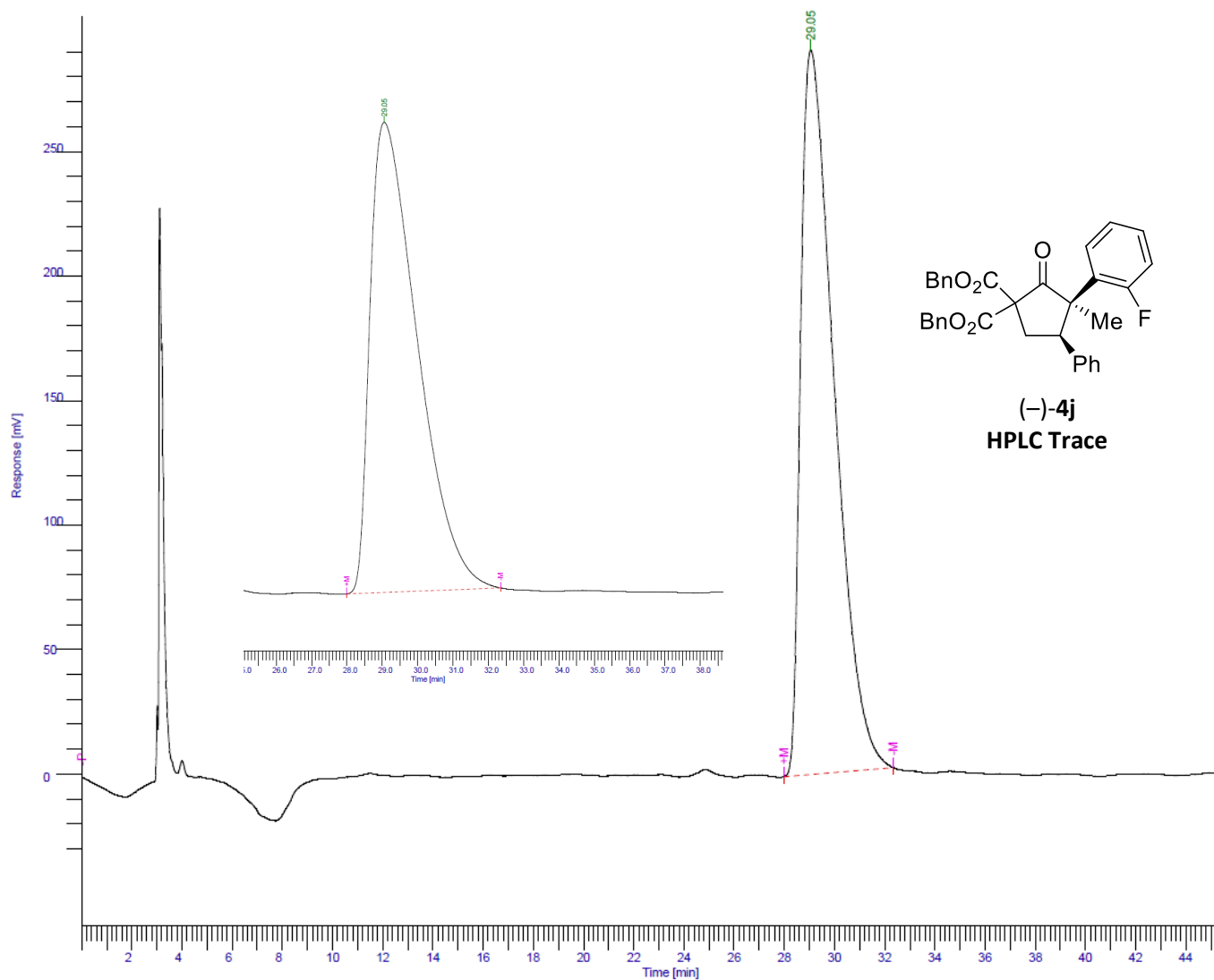
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1	14.227	344968.72	5443.82	0.74	0.74	*BB	63.3688
2	17.793	46464412.31	372354.64	99.26	99.26	*BB	124.7854
		46809381.03	377798.46	100.00	100.00		



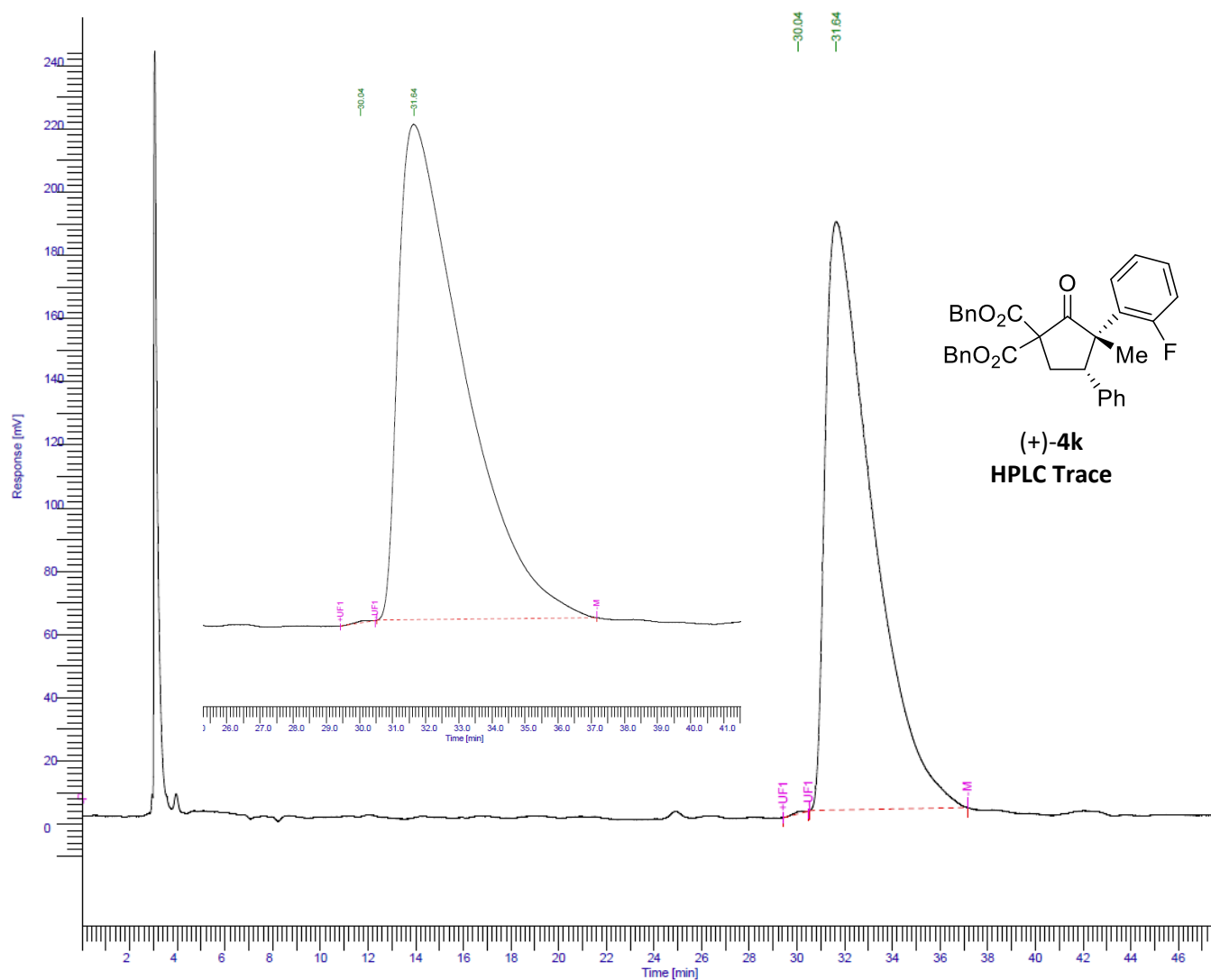




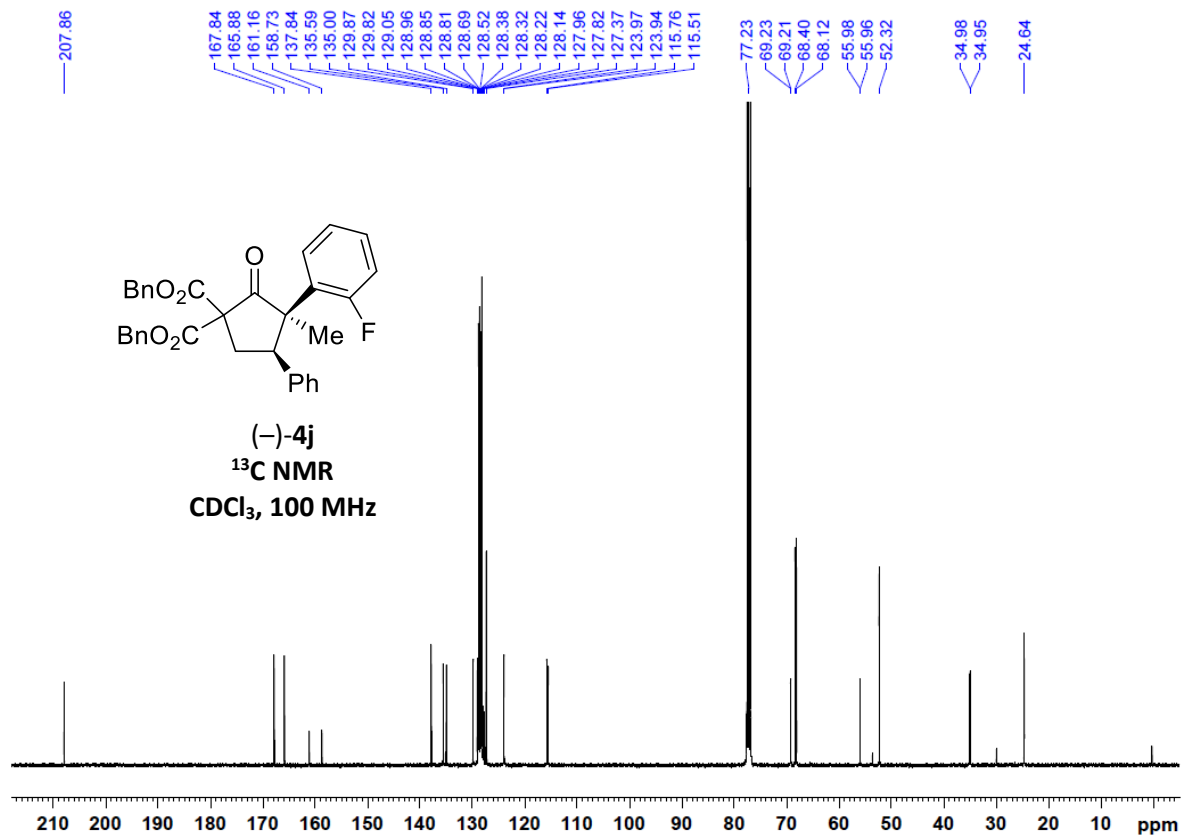
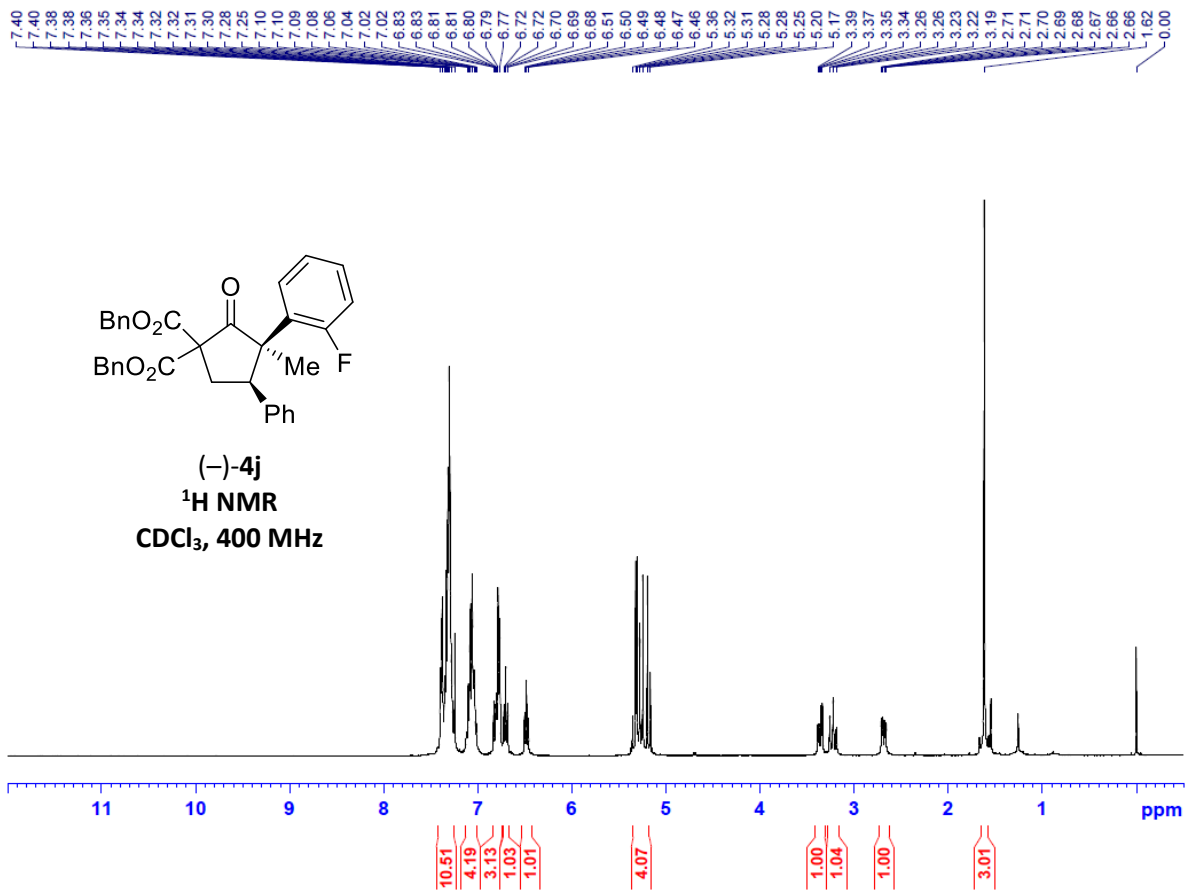
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	29.890	11673090.11	148973.42	40.12	40.12	*BV	78.3569
2	32.295	17421798.46	128398.24	59.88	59.88	*VB	135.6856
		29094888.57	277371.66	100.00	100.00		

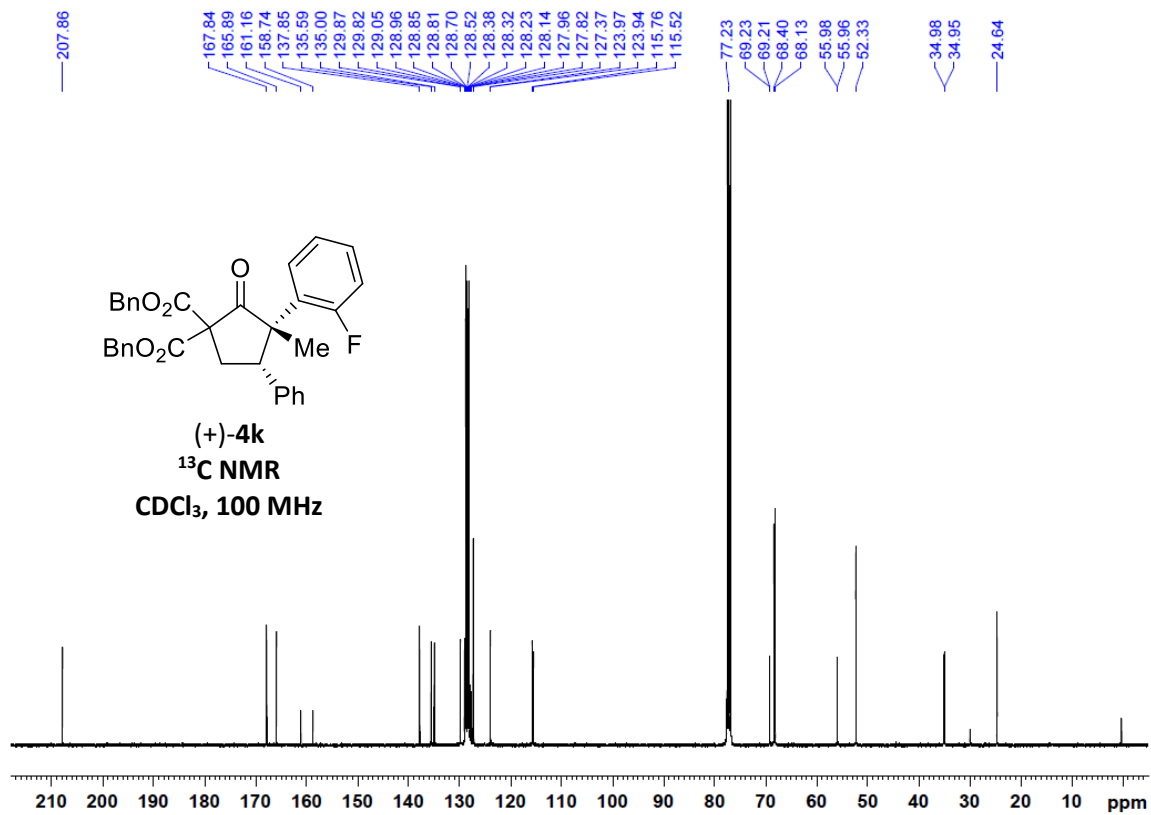
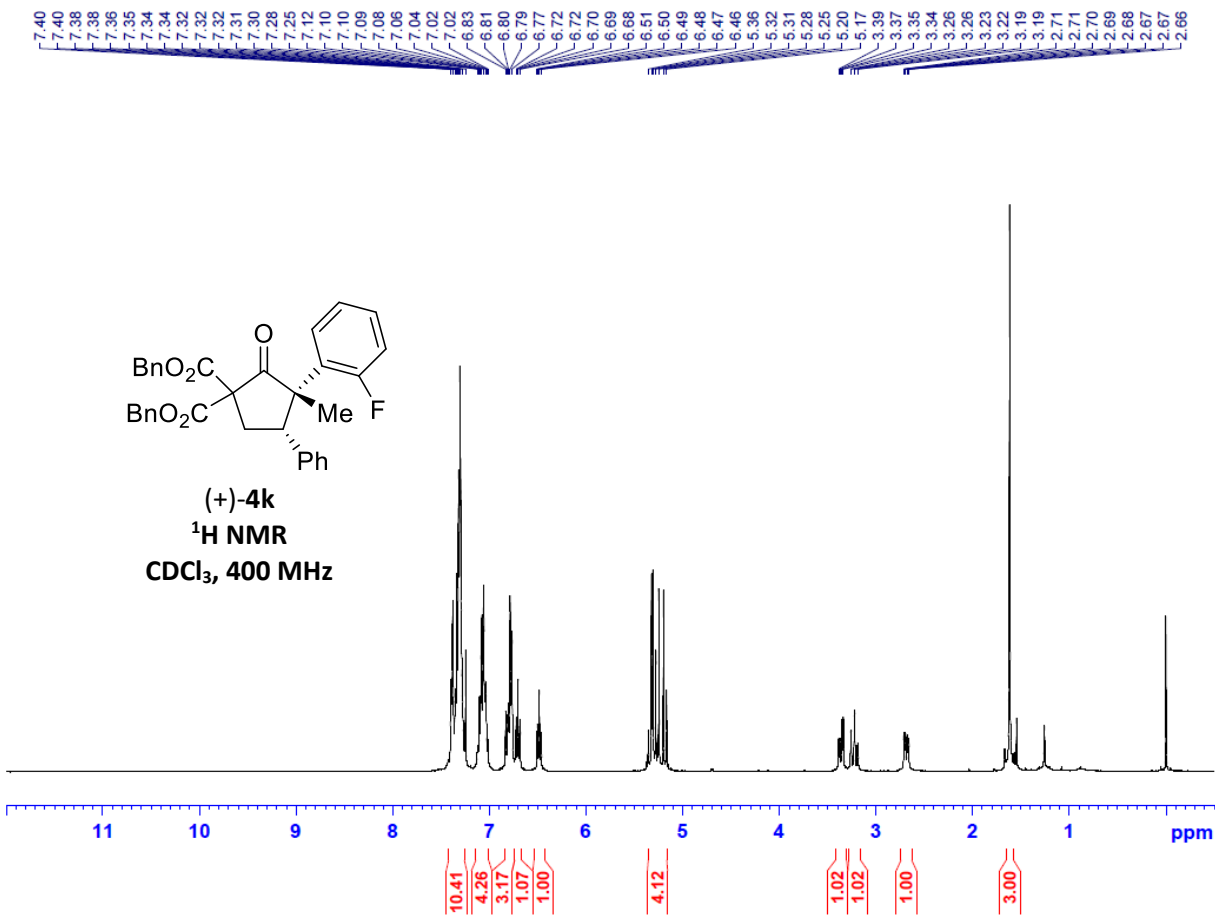


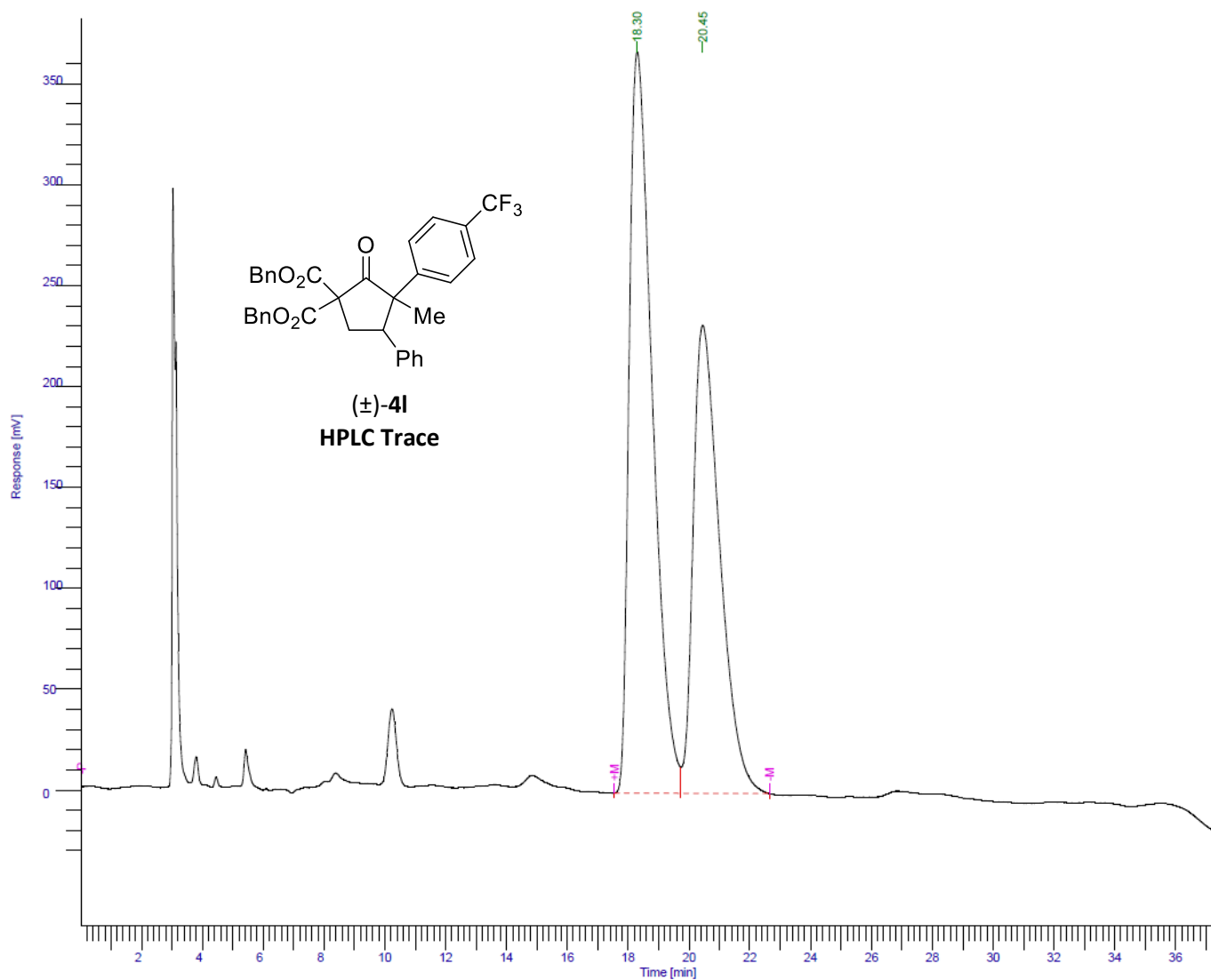
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	29.053	26967187.47	290943.86	100.00	100.00	*BB	92.6886
		26967187.47	290943.86	100.00	100.00		



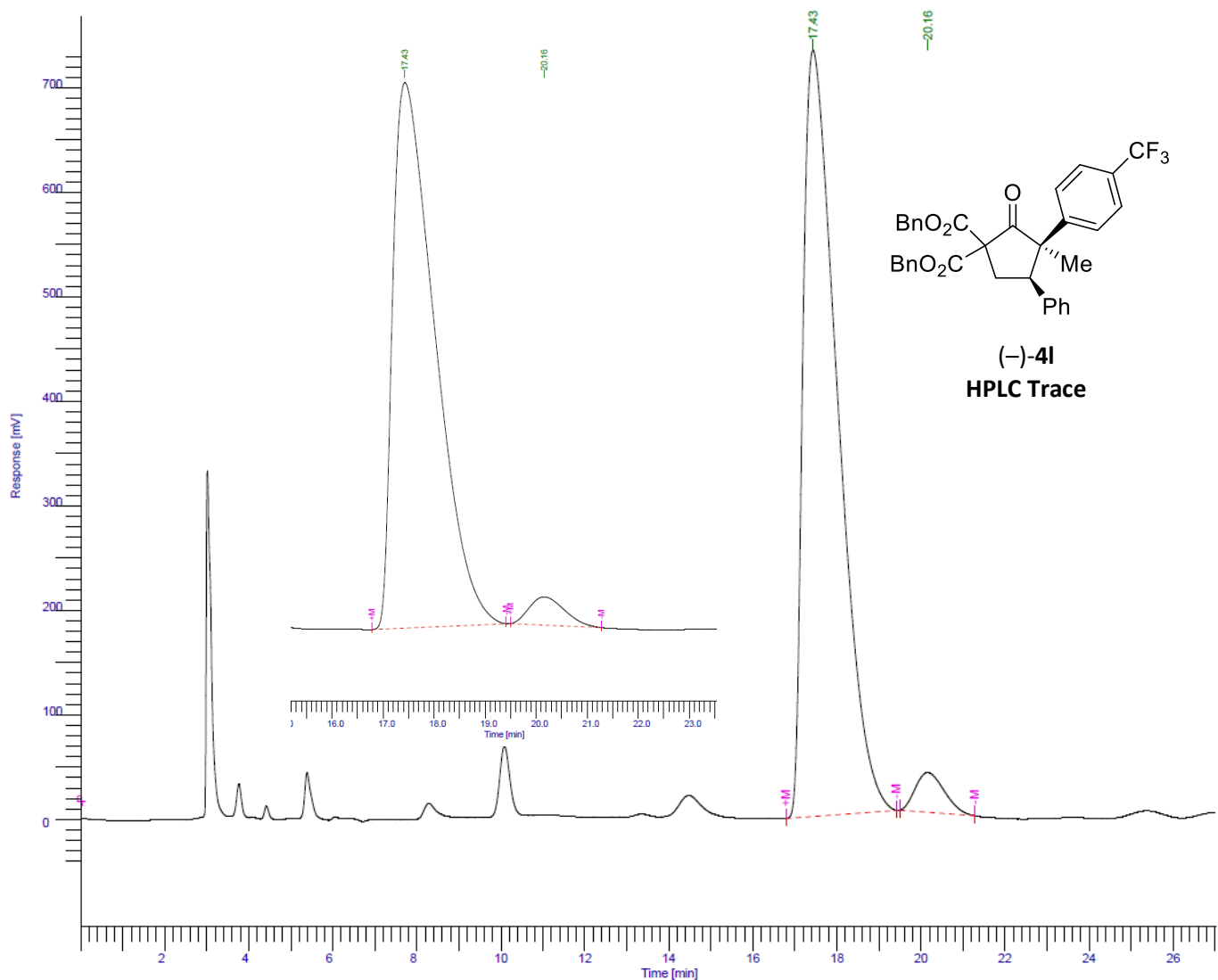
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	30.045	18578.76	669.54	0.07	0.07	*MM	27.7487
2	31.641	25469099.85	186192.75	99.93	99.93	*BB	136.7889
		25487678.61	186862.29	100.00	100.00		



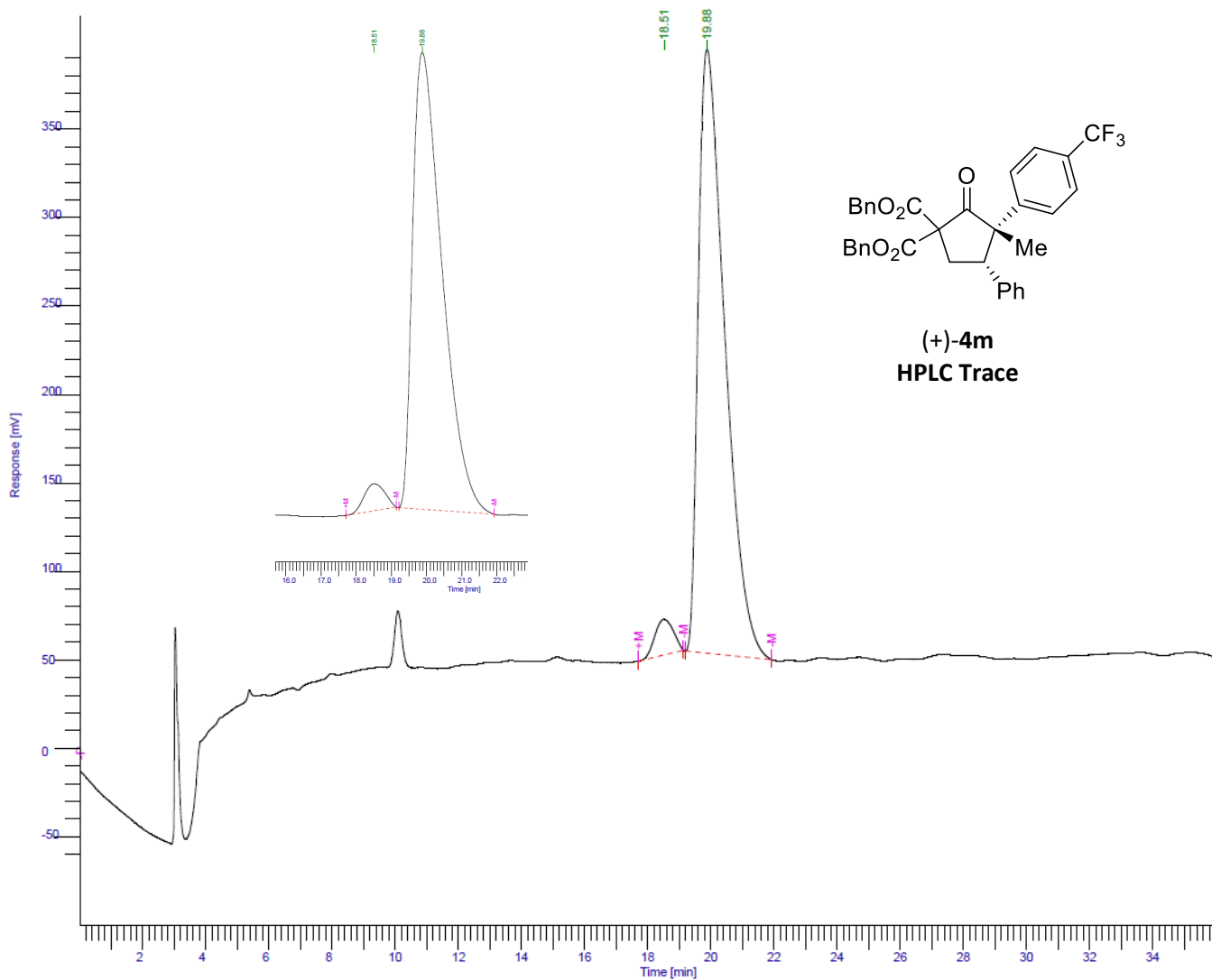




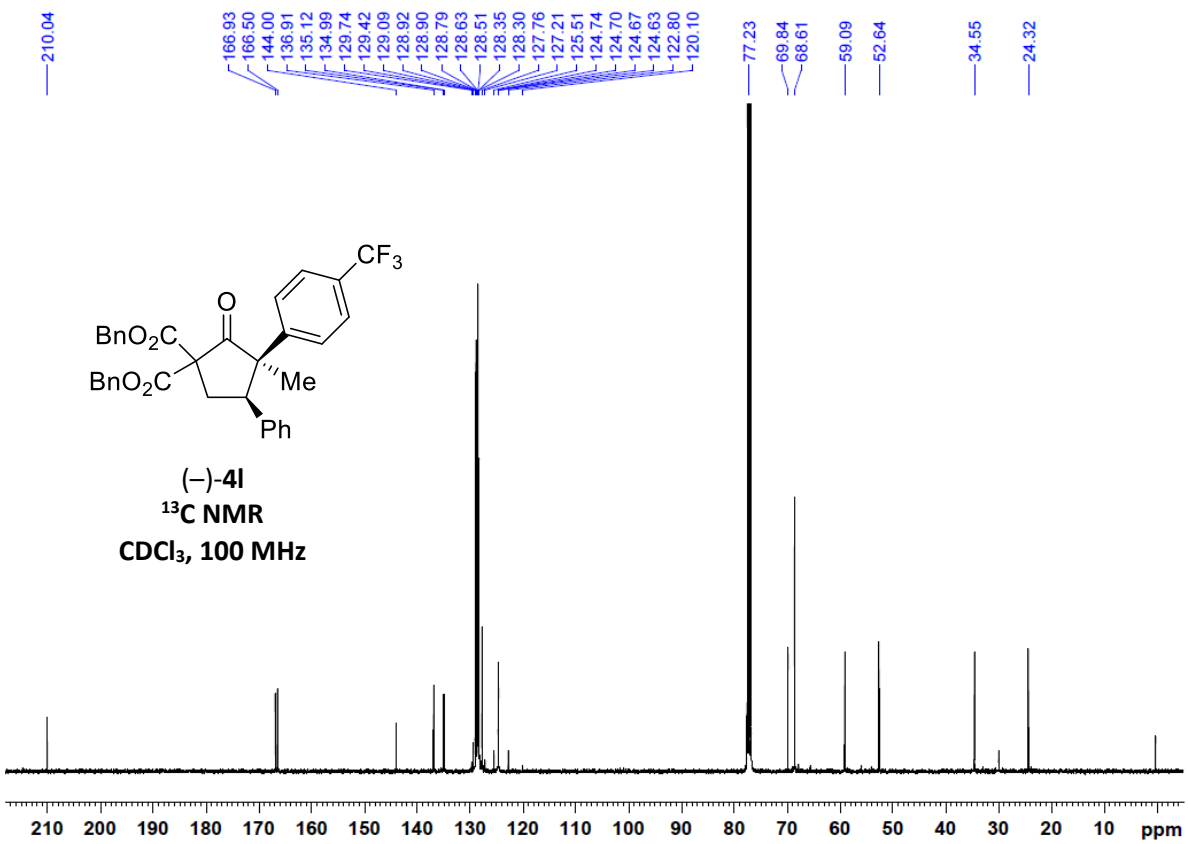
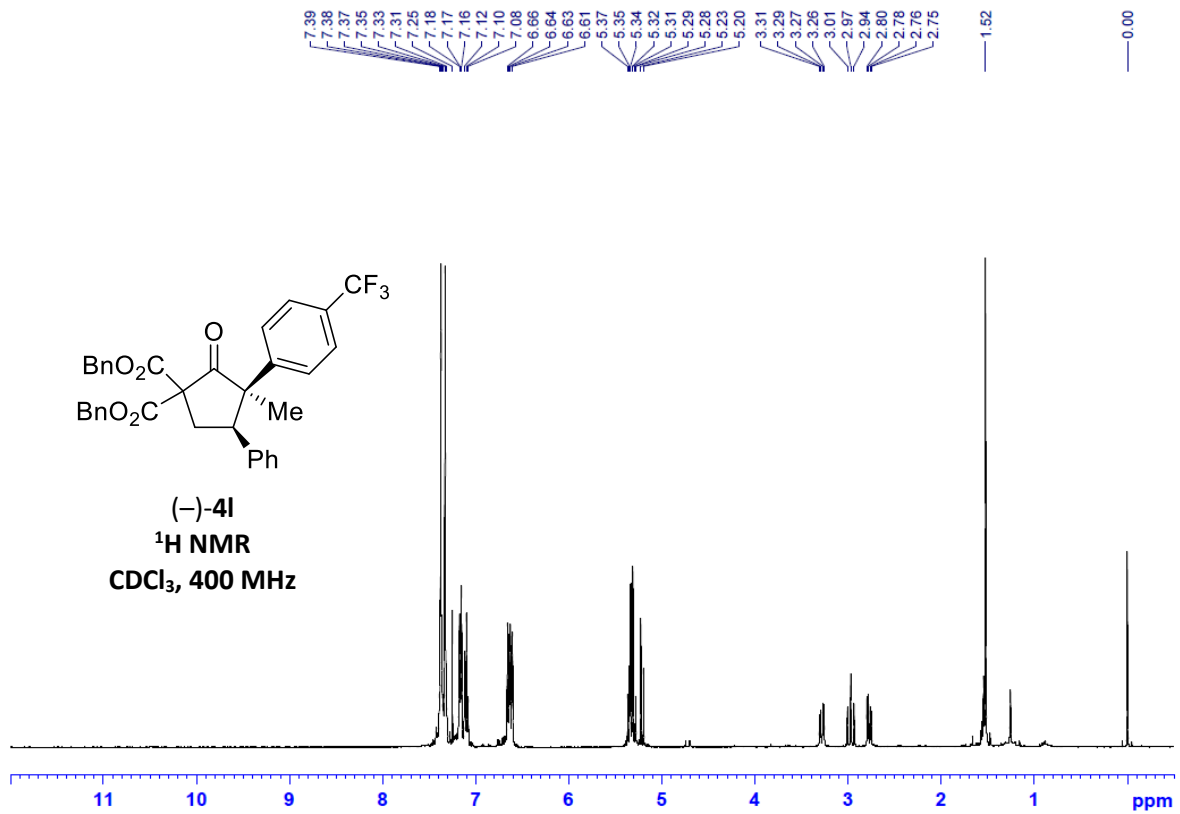
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	18.300	19462830.75	367425.03	57.97	57.97	*BV	52.9709
2	20.453	14110257.46	232062.66	42.03	42.03	*VB	60.8037
		33573088.21	599487.69	100.00	100.00		

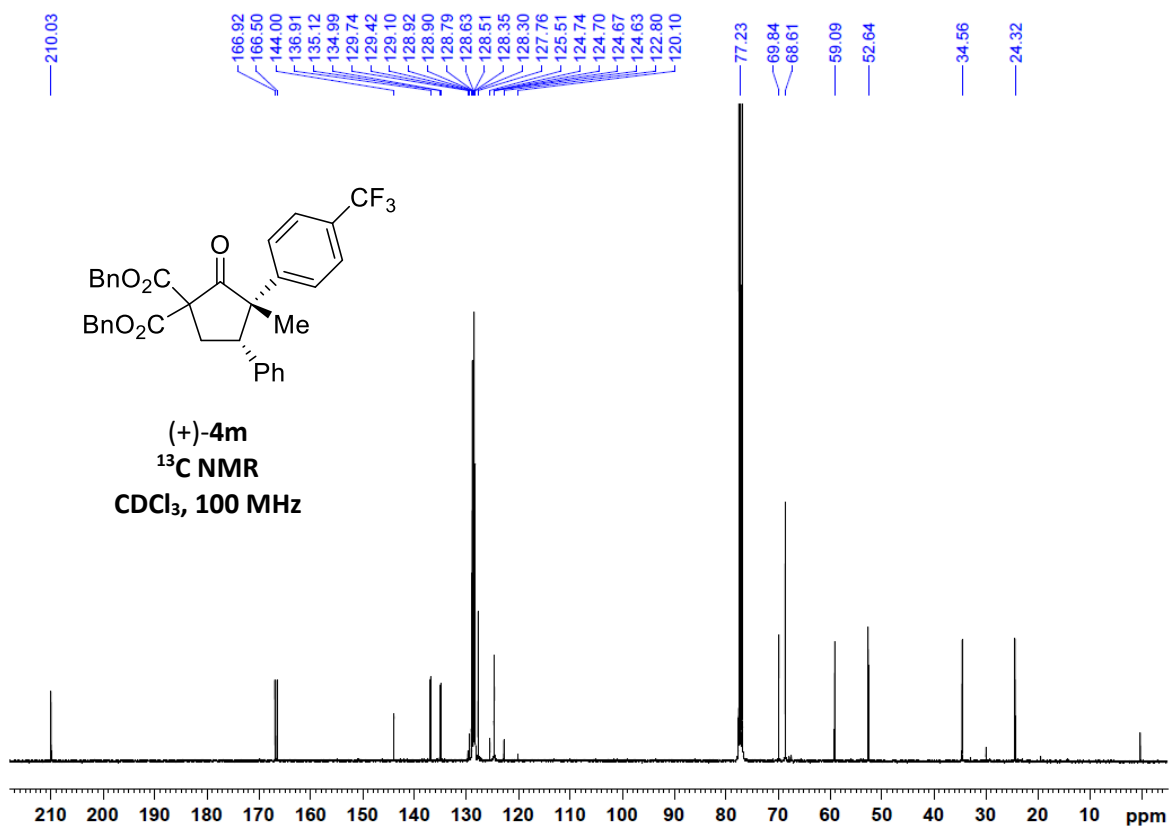
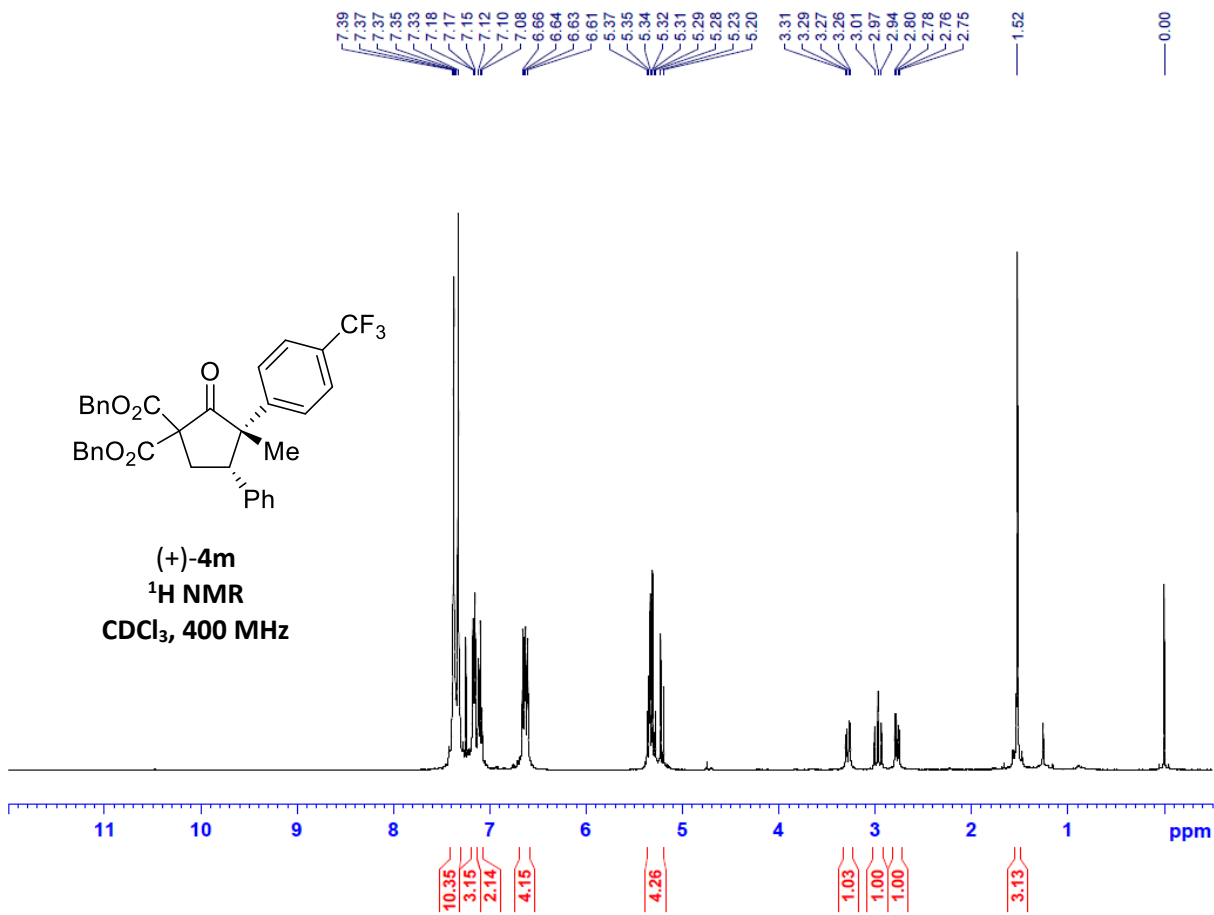


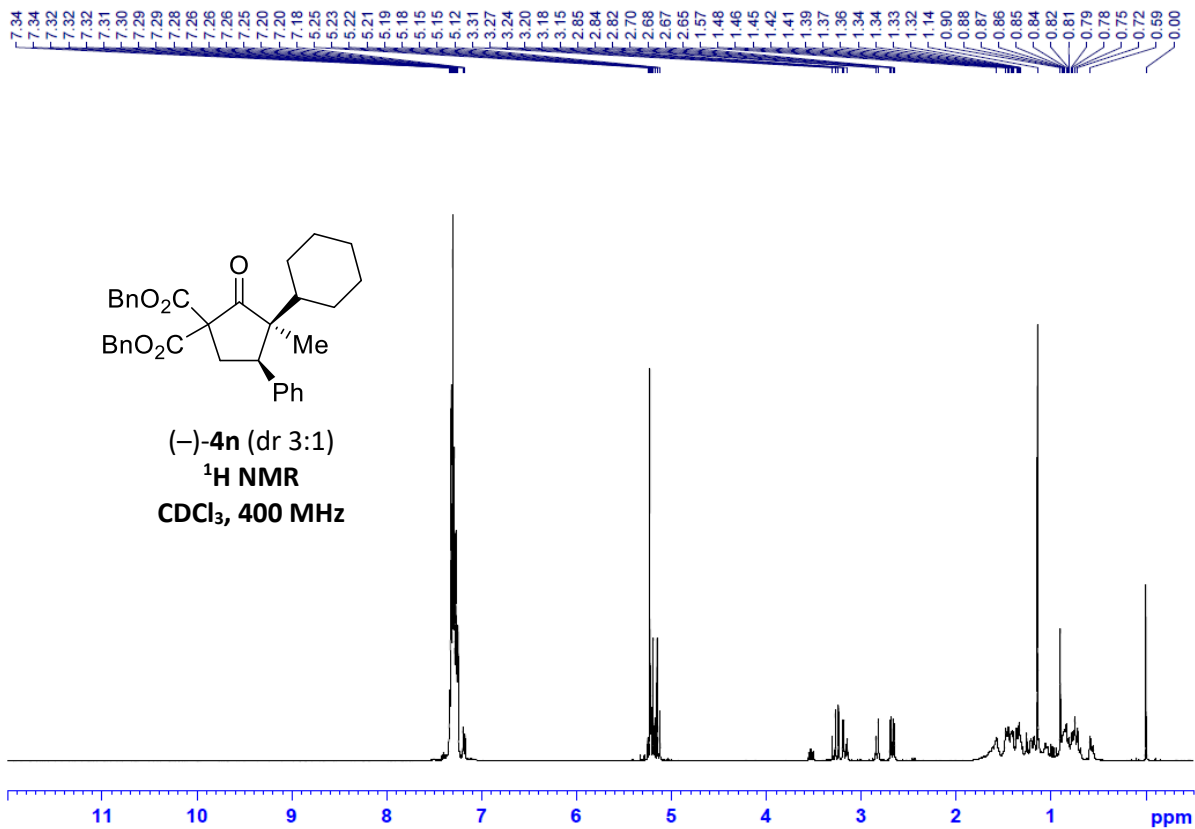
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	17.429	41966998.33	733367.94	95.82	95.82	*BB	57.2250
2	20.162	1828747.66	37953.04	4.18	4.18	*BB	48.1845
		43795745.99	771320.98	100.00	100.00		



Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	18.513	823021.21	20160.83	3.97	3.97	*BB	40.8228
2	19.878	19902007.63	341104.01	96.03	96.03	*BB	58.3459
		20725028.83	361264.84	100.00	100.00		





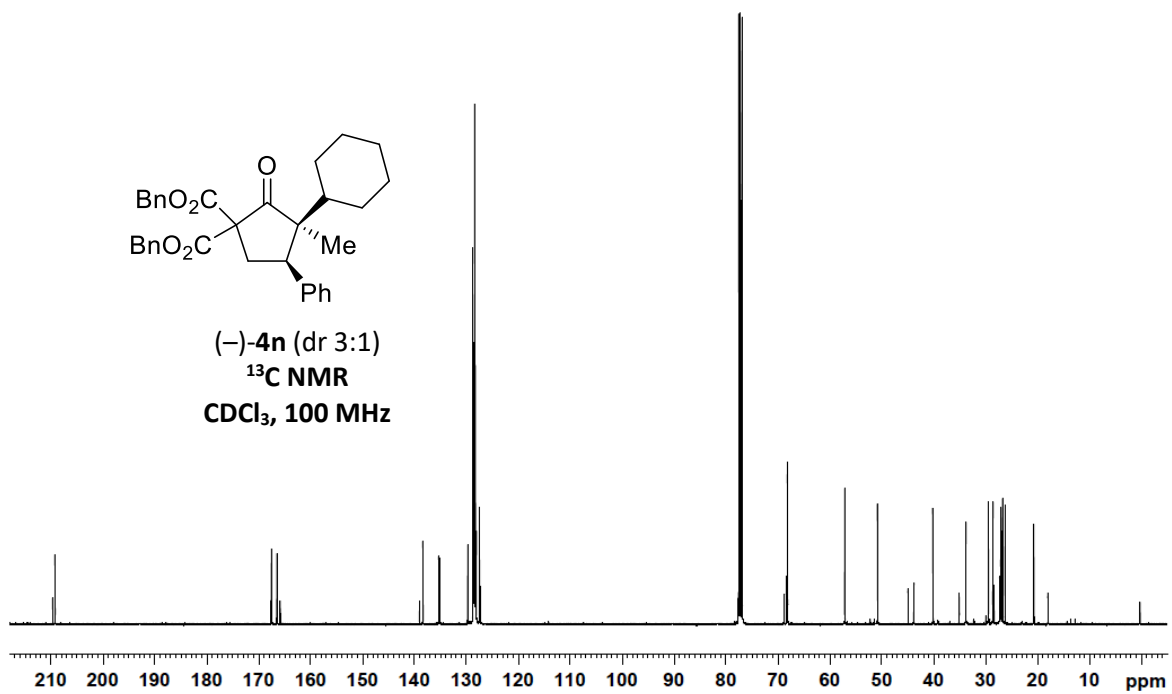


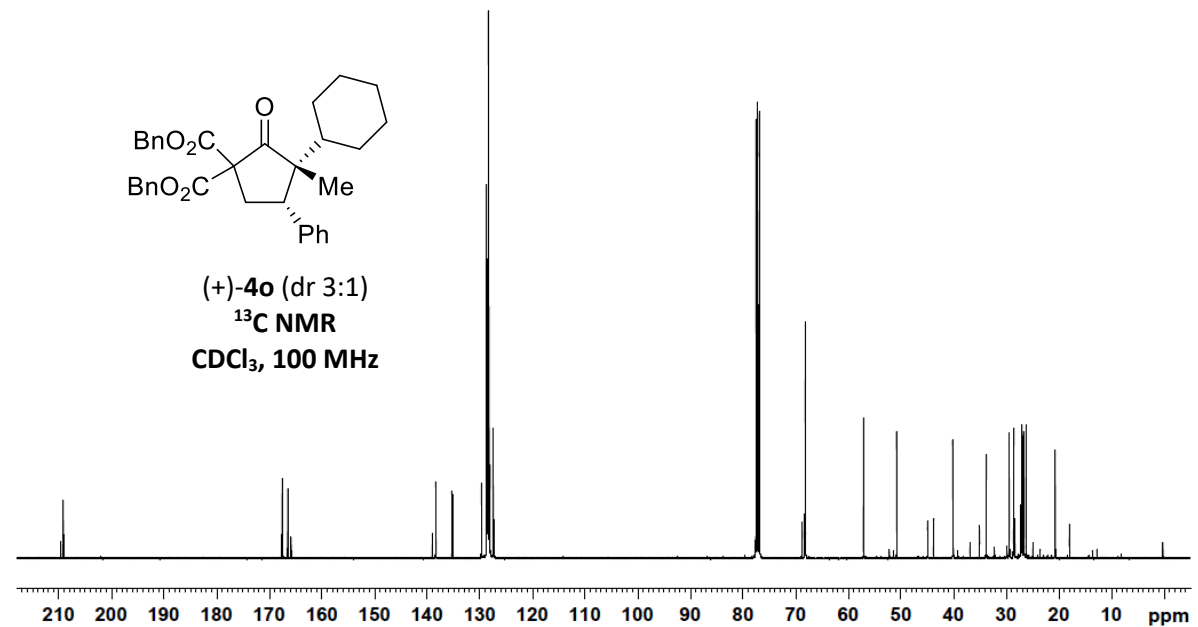
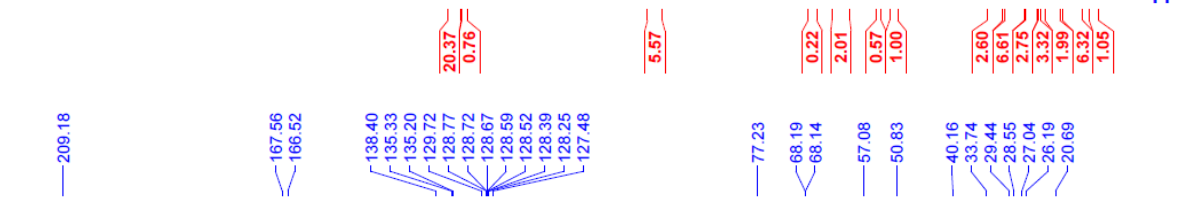
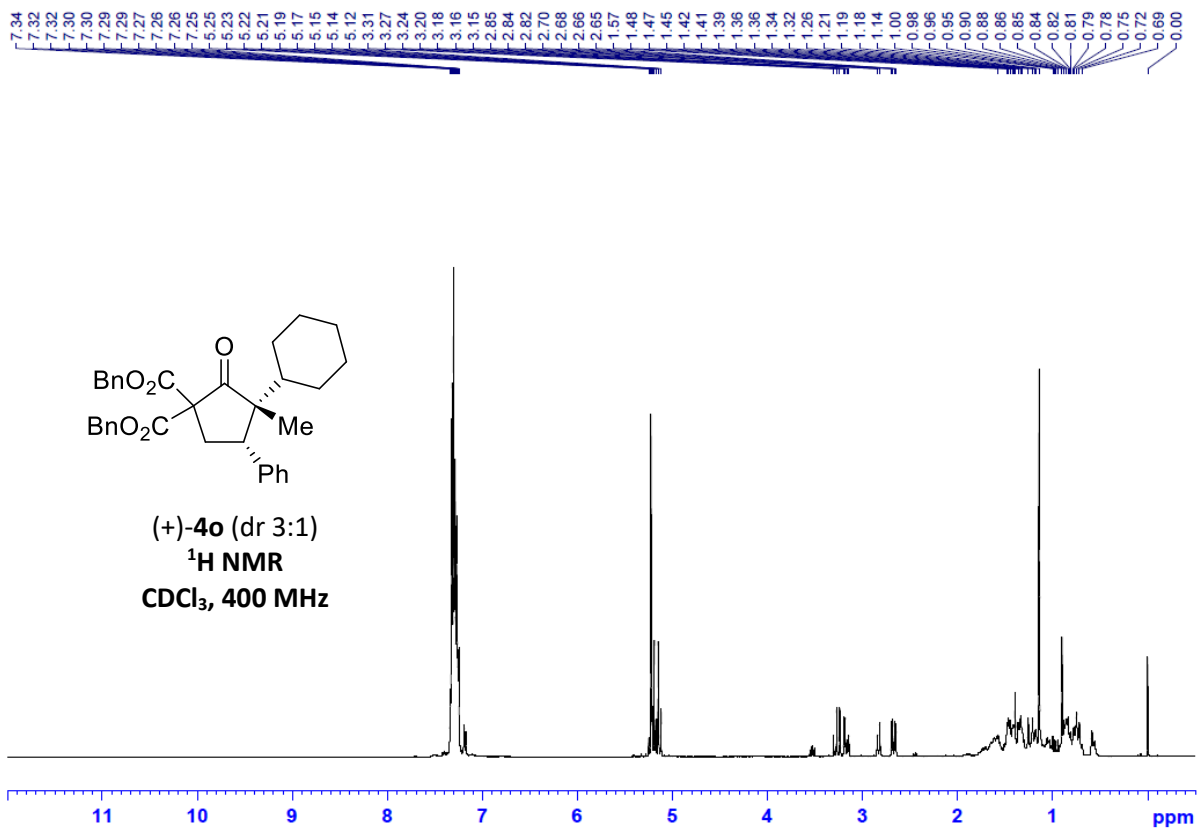
209.19

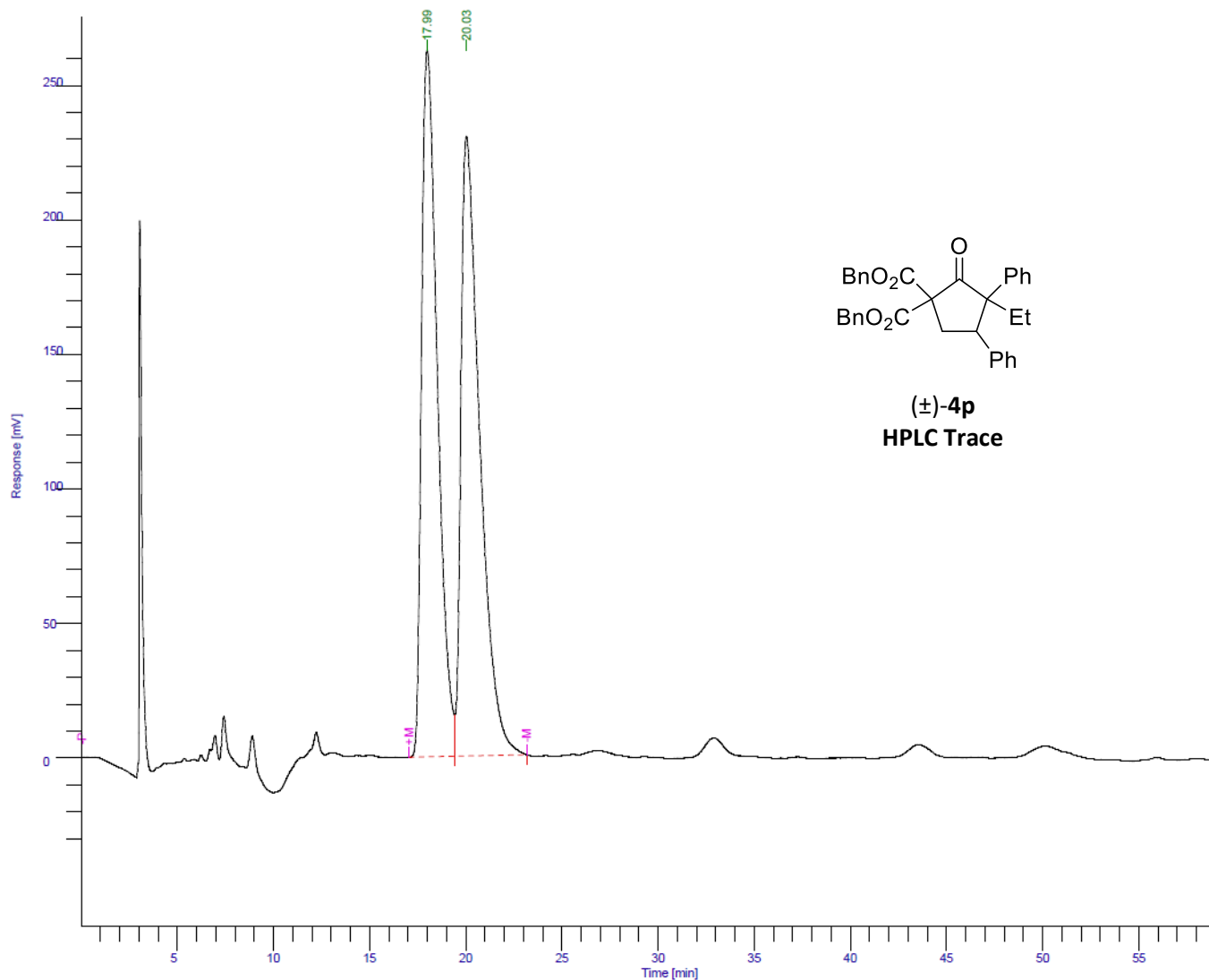
167.57
166.52

138.40
135.33
135.20
129.72
128.77
128.73
128.68
128.59
128.52
128.40
128.26
127.49

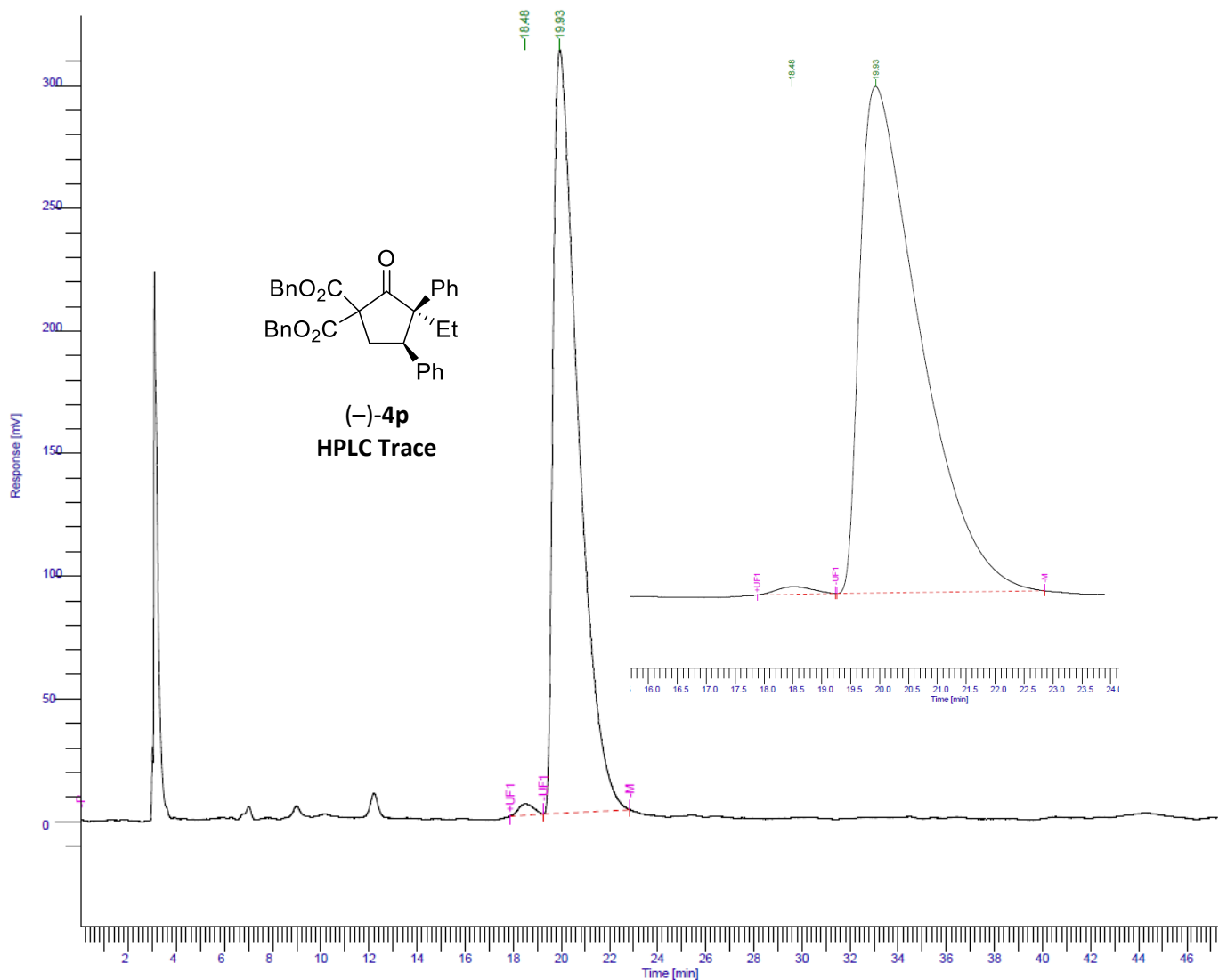
77.23
68.19
68.14
57.08
50.83
40.15
33.74
29.44
28.55
27.04
26.19
20.69



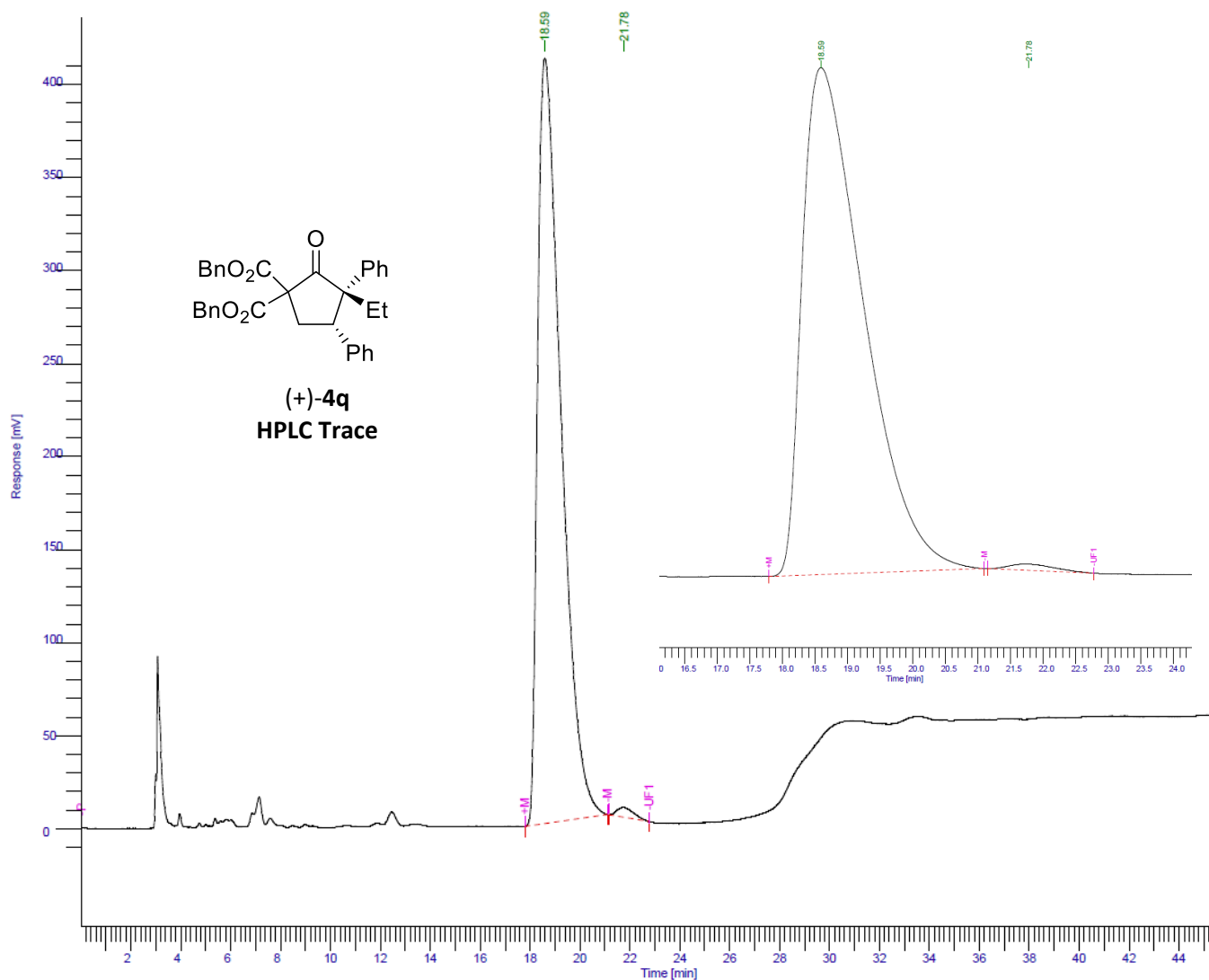




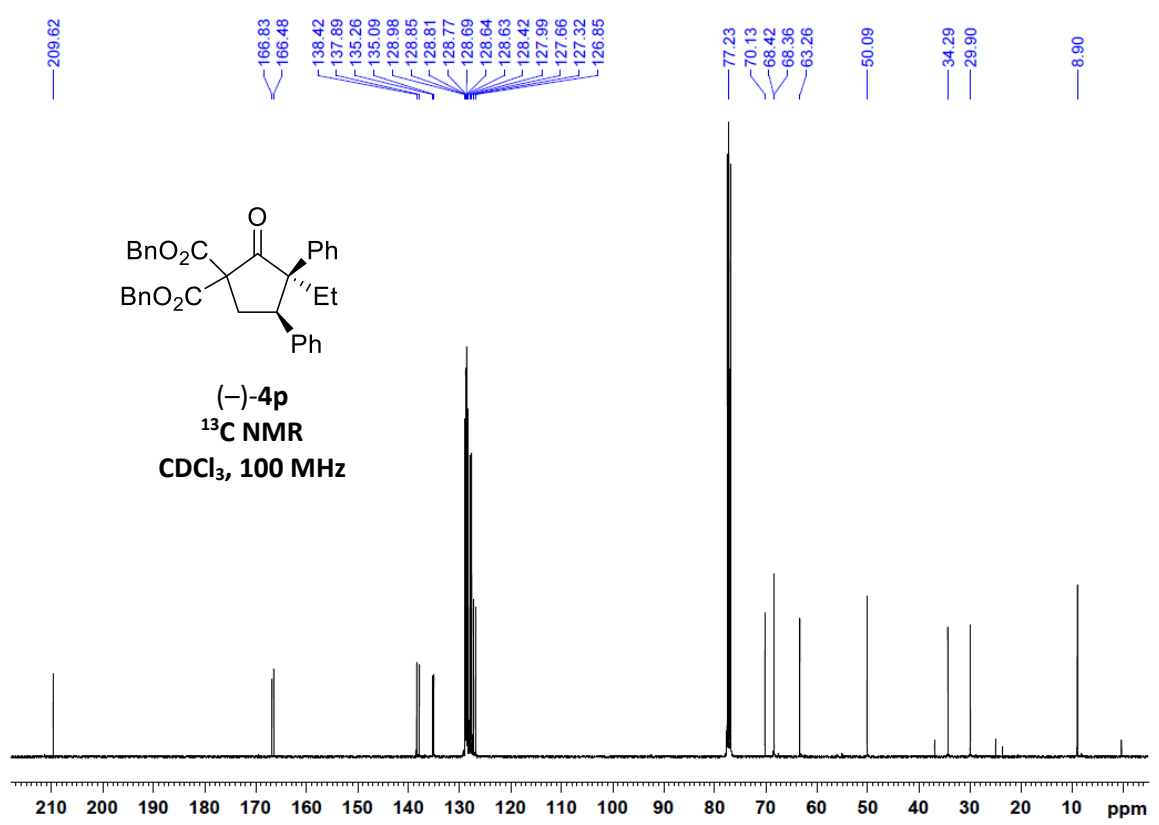
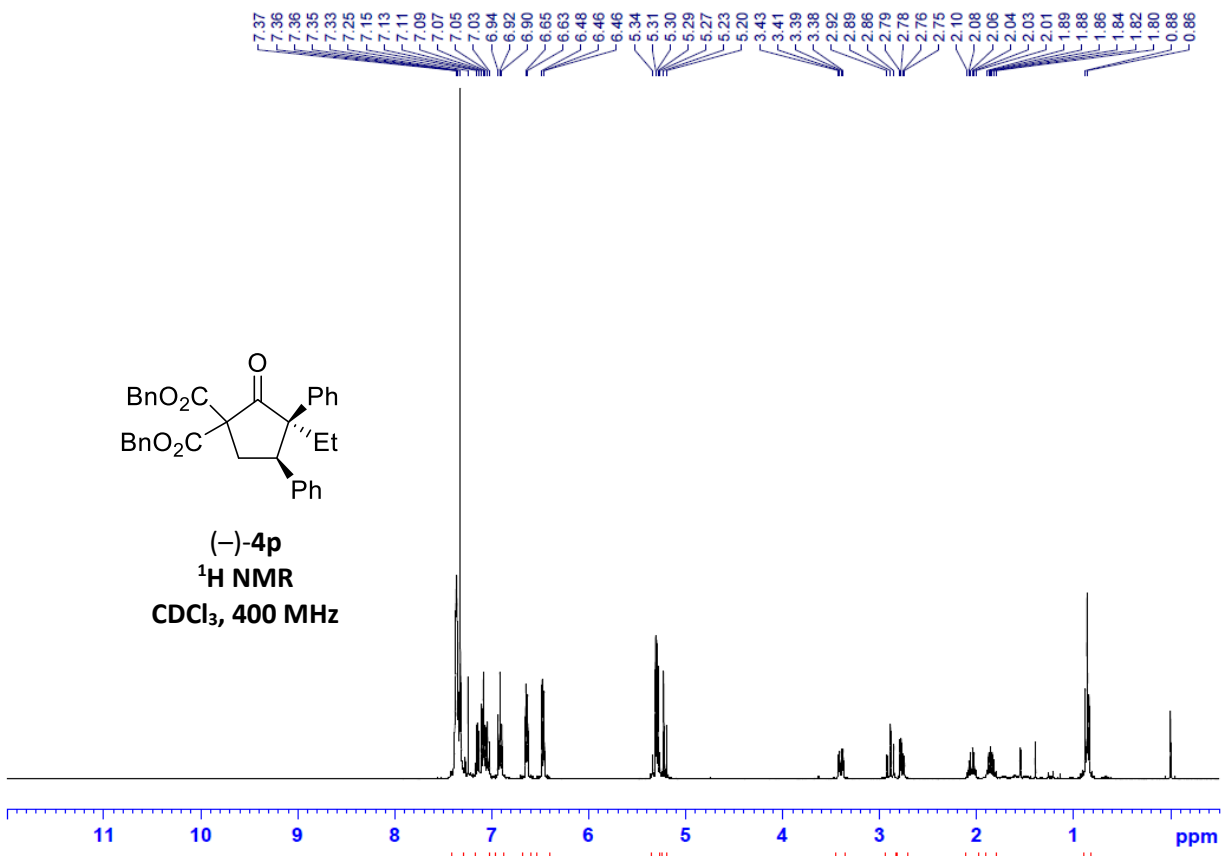
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	17.994	15085492.58	262558.31	48.94	48.94	*BV	57.4558
2	20.032	15741271.05	230413.11	51.06	51.06	*VB	68.3176
		30826763.62	492971.42	100.00	100.00		

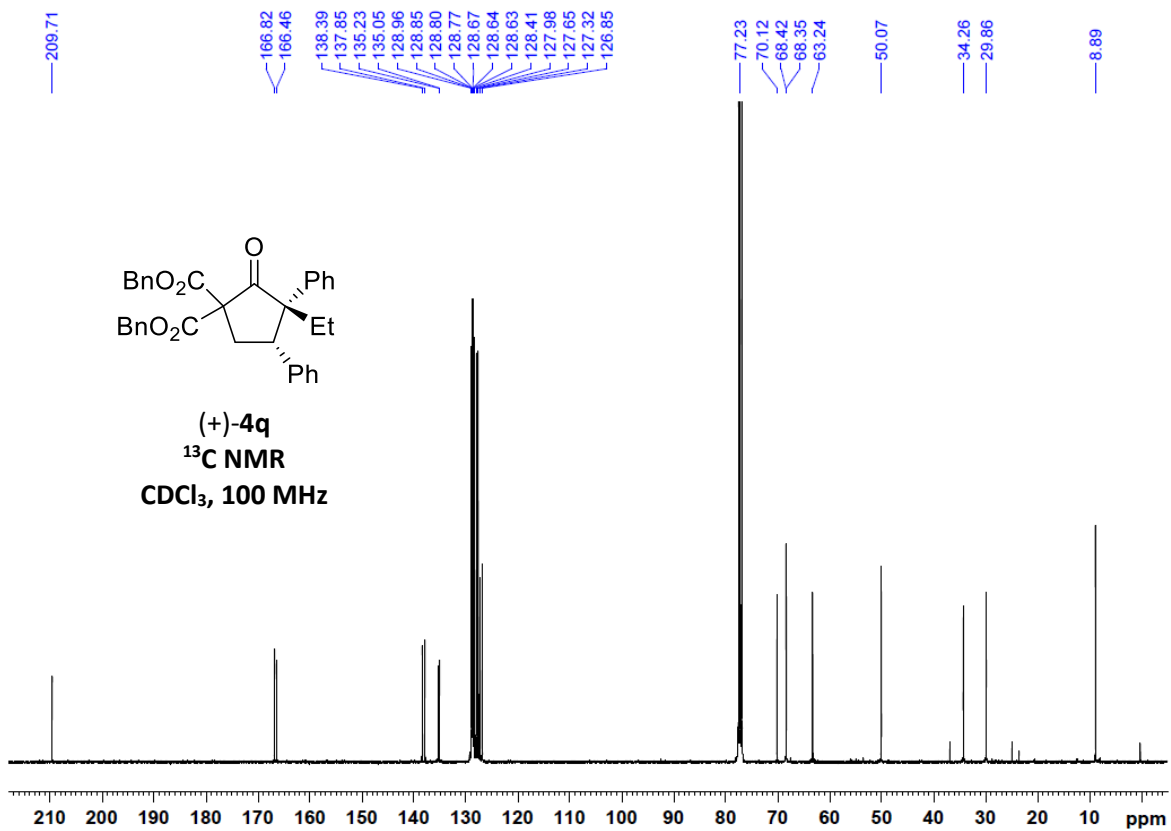
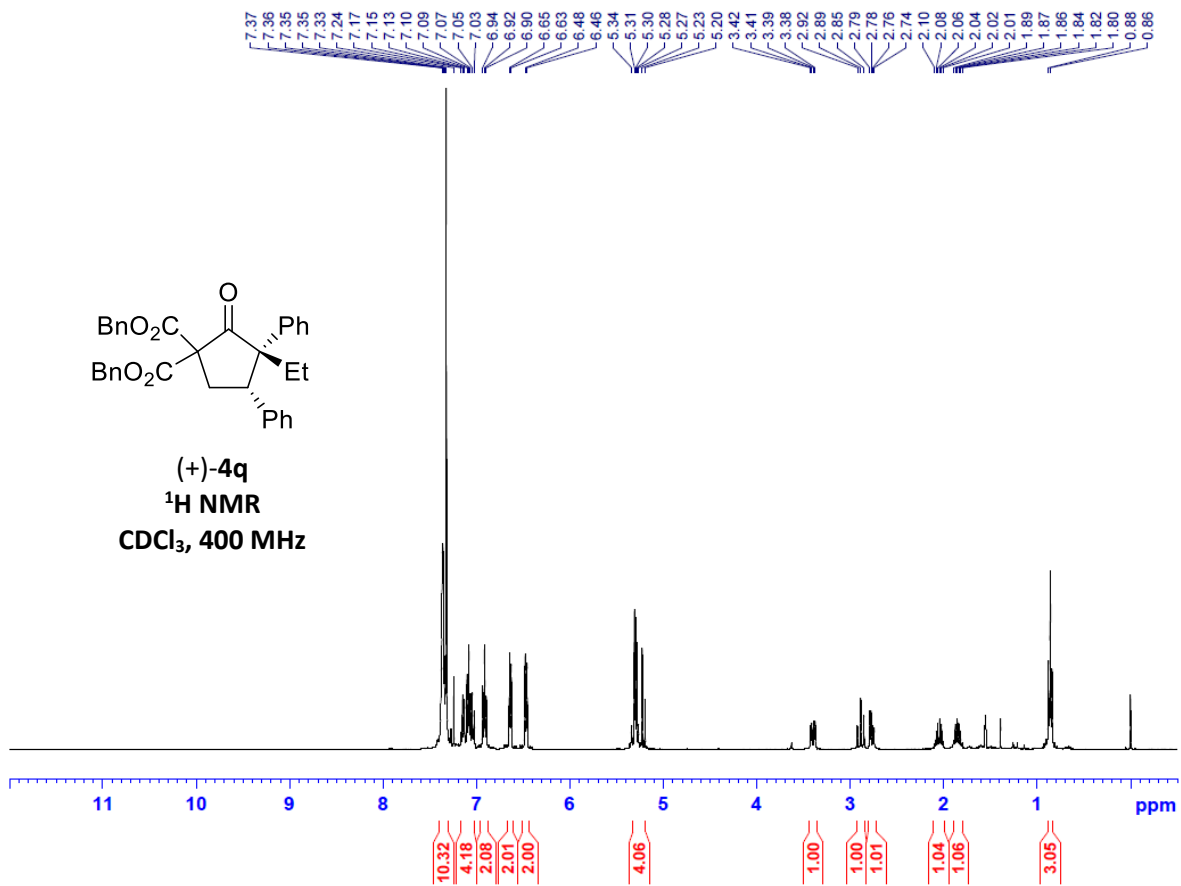


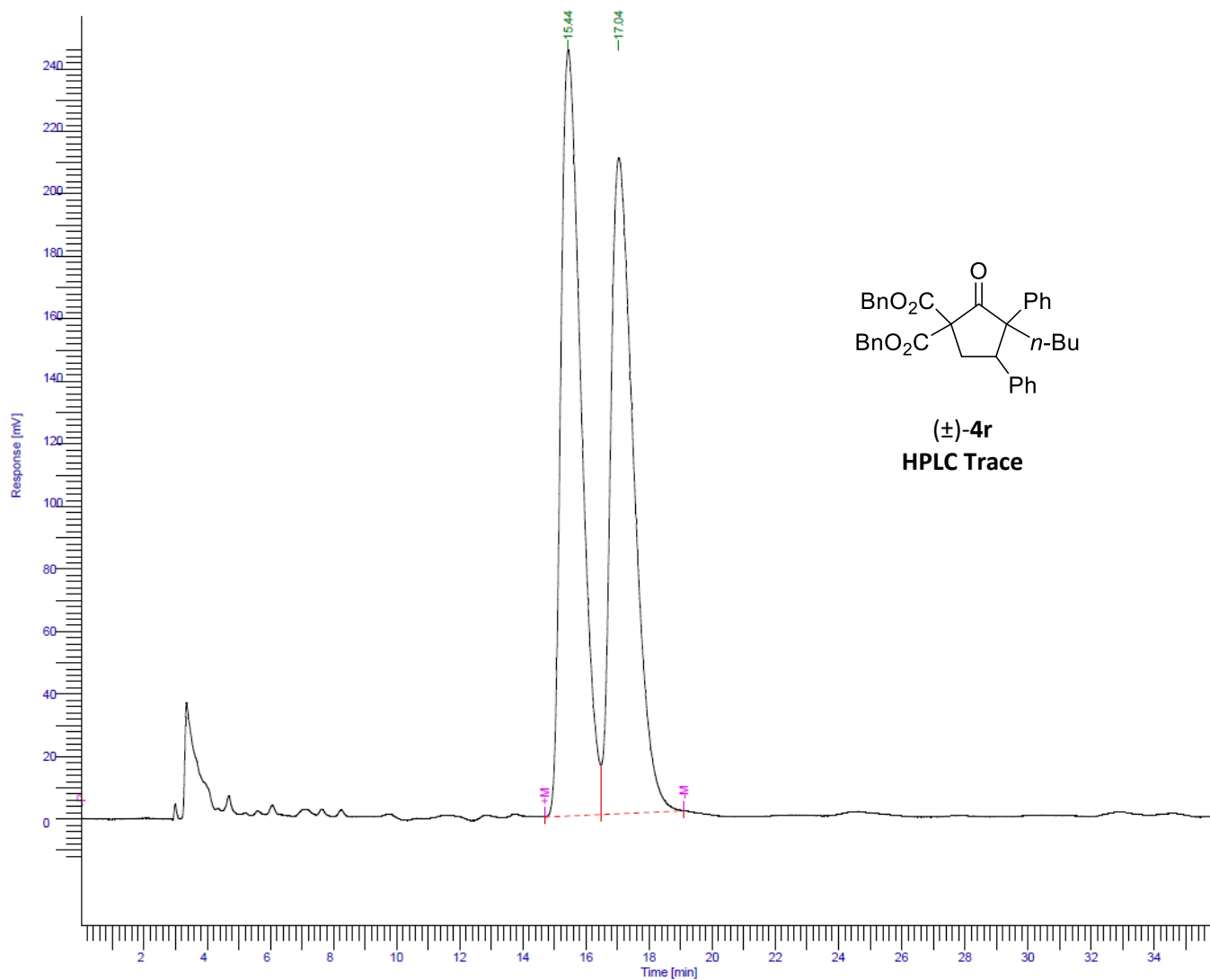
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	18.480	201989.73	4727.87	0.89	0.89	*MM	42.7232
2	19.931	22469819.16	311458.36	99.11	99.11	*BB	72.1439
		22671808.89	316186.23	100.00	100.00		



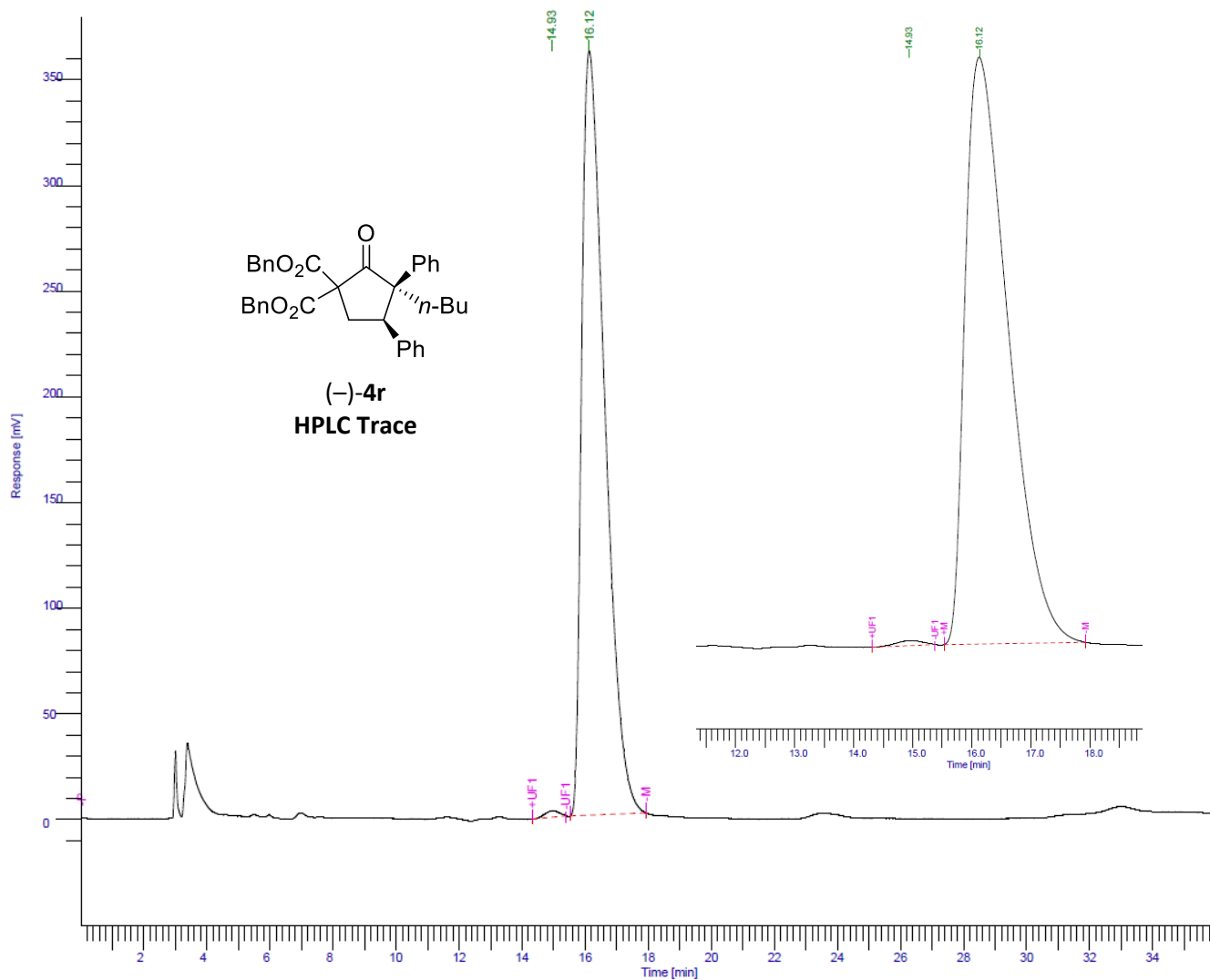
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	18.590	26822297.81	411237.38	99.08	99.08	*BB	65.2234
2	21.780	248278.57	5190.94	0.92	0.92	*MM	47.8292
		27070576.38	416428.33	100.00	100.00		



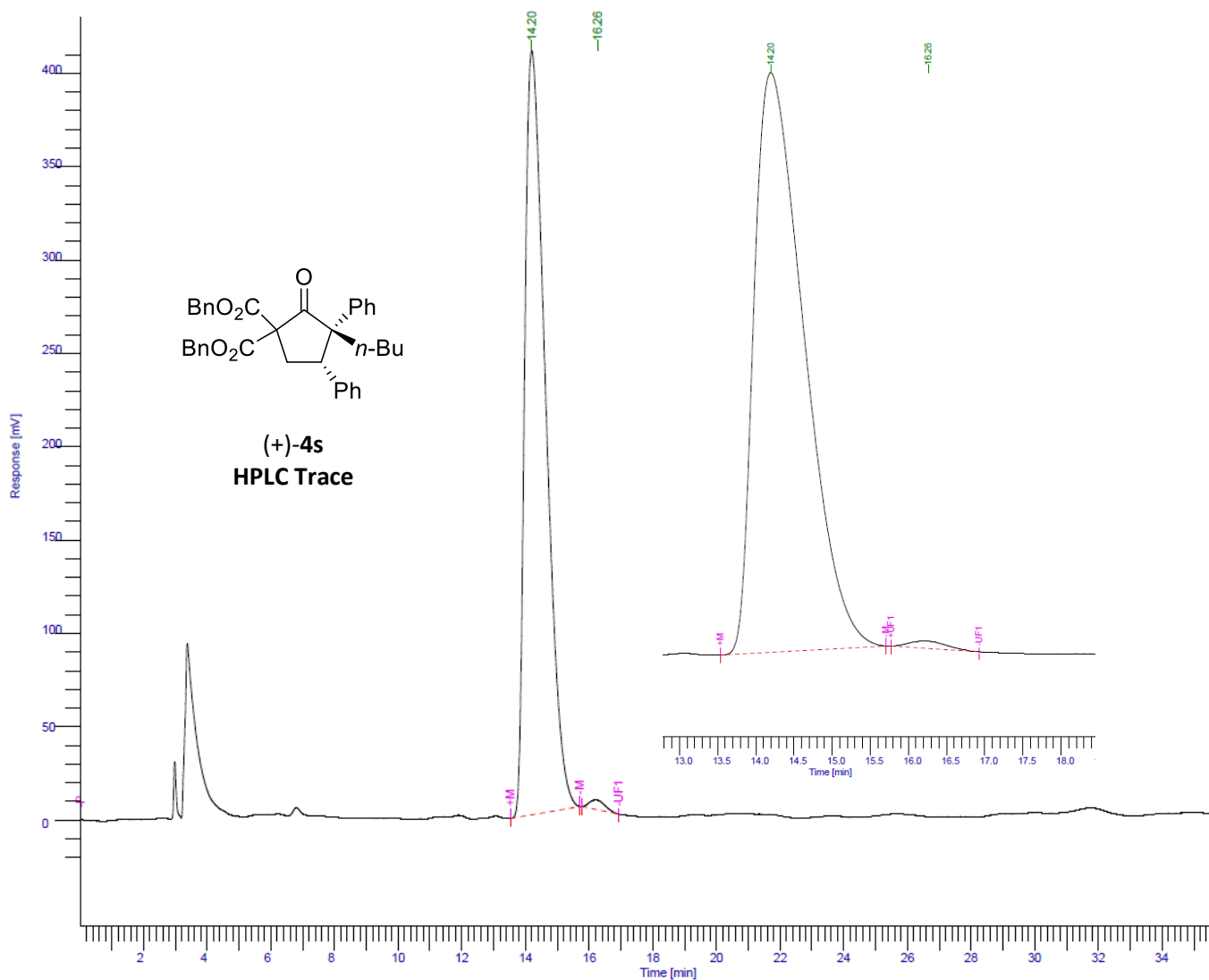




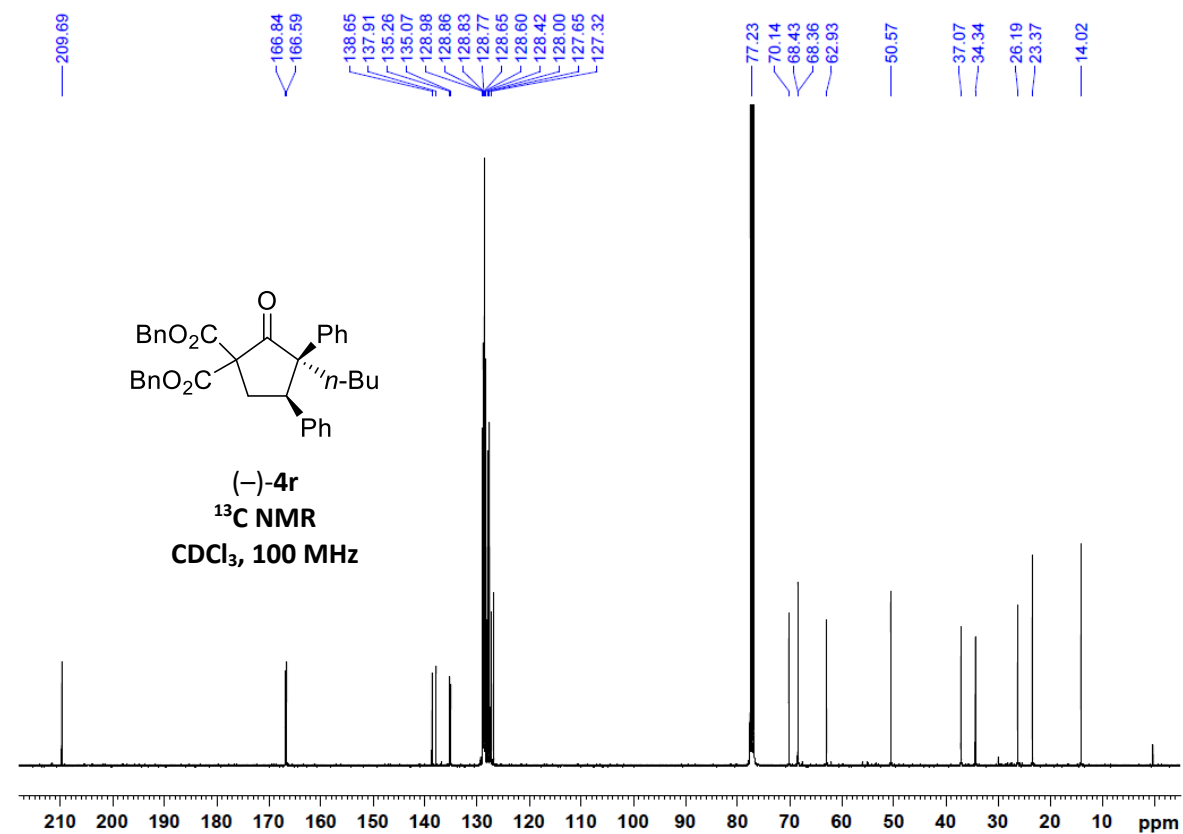
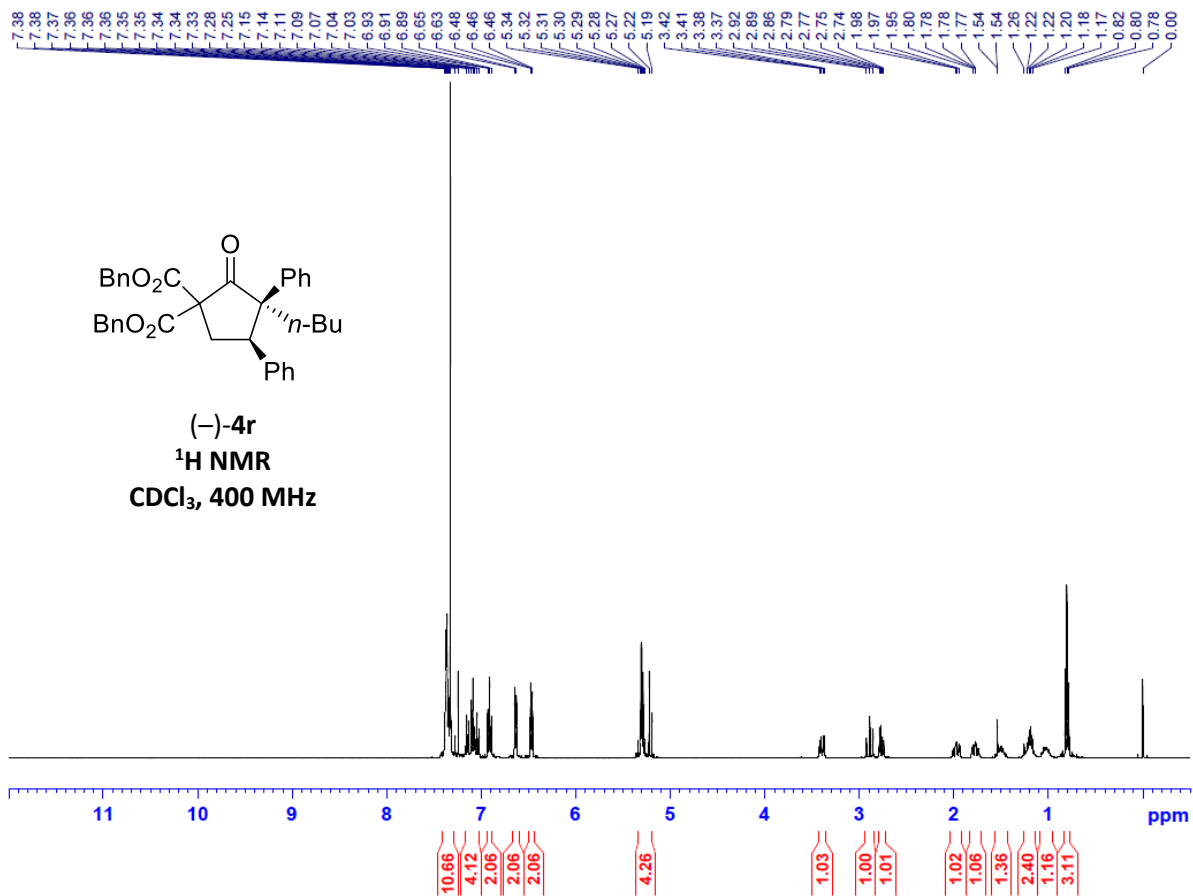
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	15.438	10964327.66	245057.12	50.54	50.54	*BV	44.7419
2	17.039	10730991.86	209876.99	49.46	49.46	*VB	51.1299
		21695319.52	454934.11	100.00	100.00		

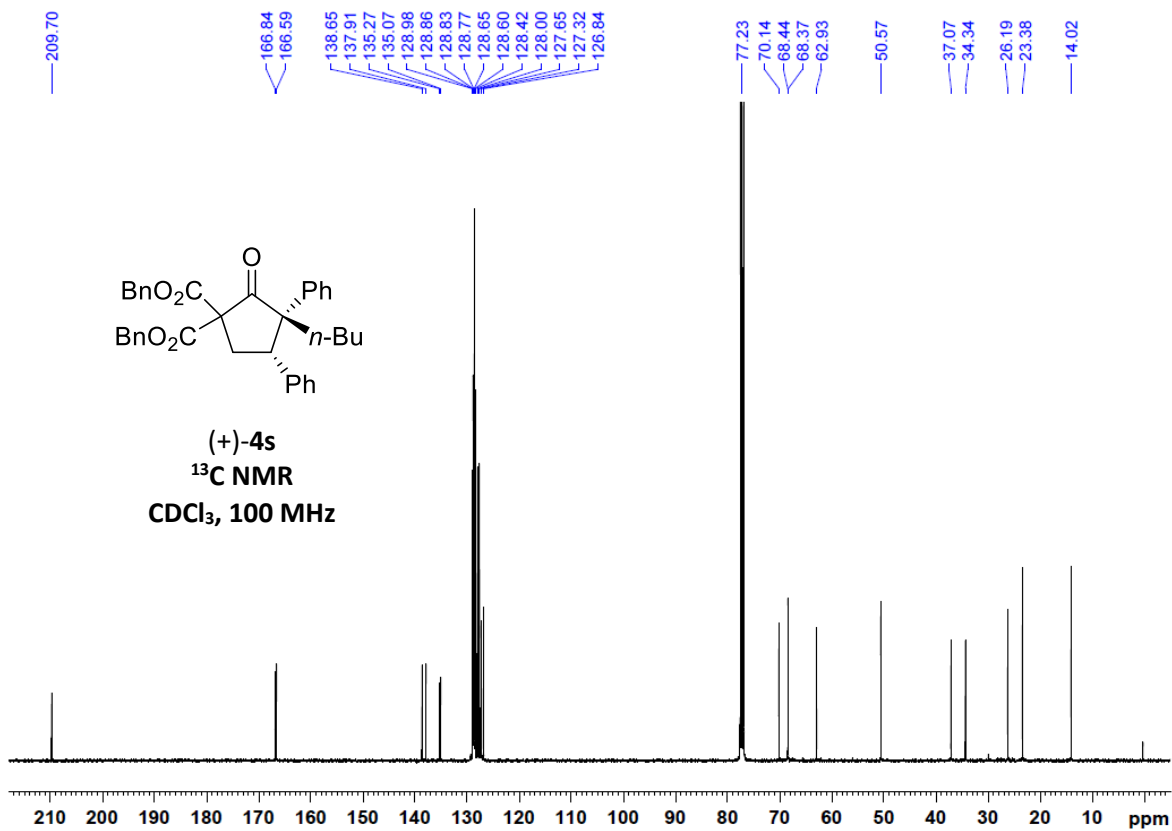
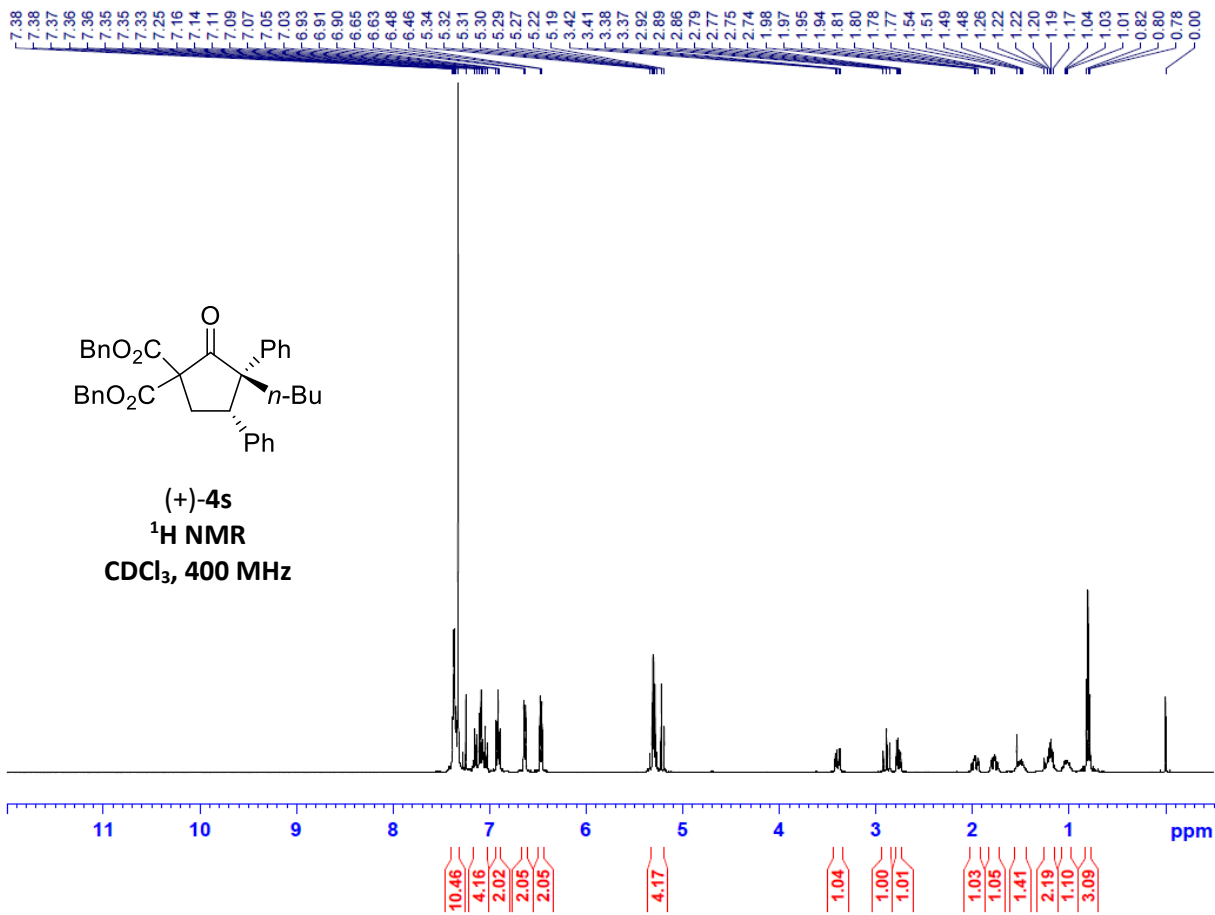


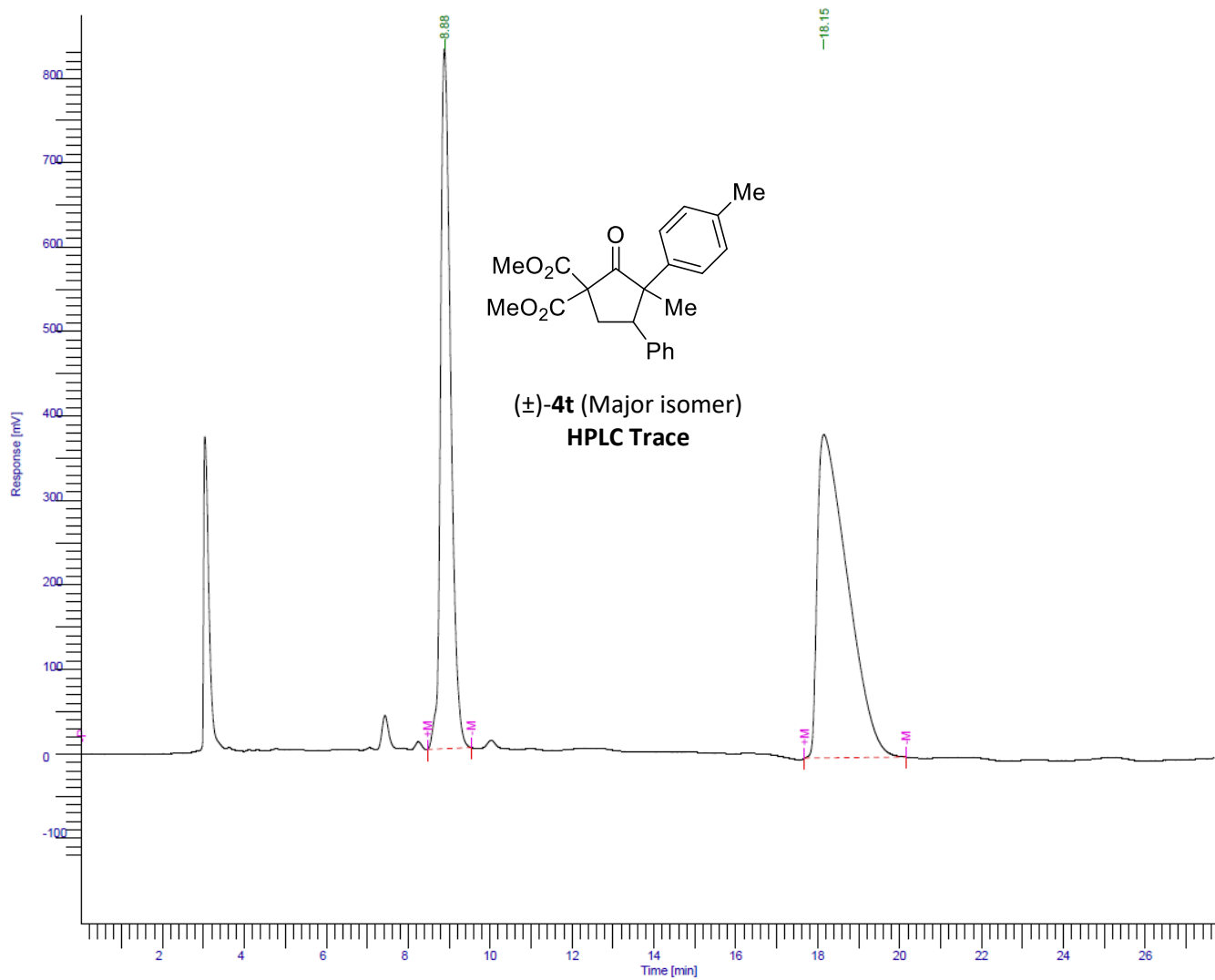
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	14.931	93511.21	3023.97	0.51	0.51	*MM	30.9233
2	16.125	18344000.77	361621.01	99.49	99.49	*BB	50.7271
		18437511.98	364644.98	100.00	100.00		



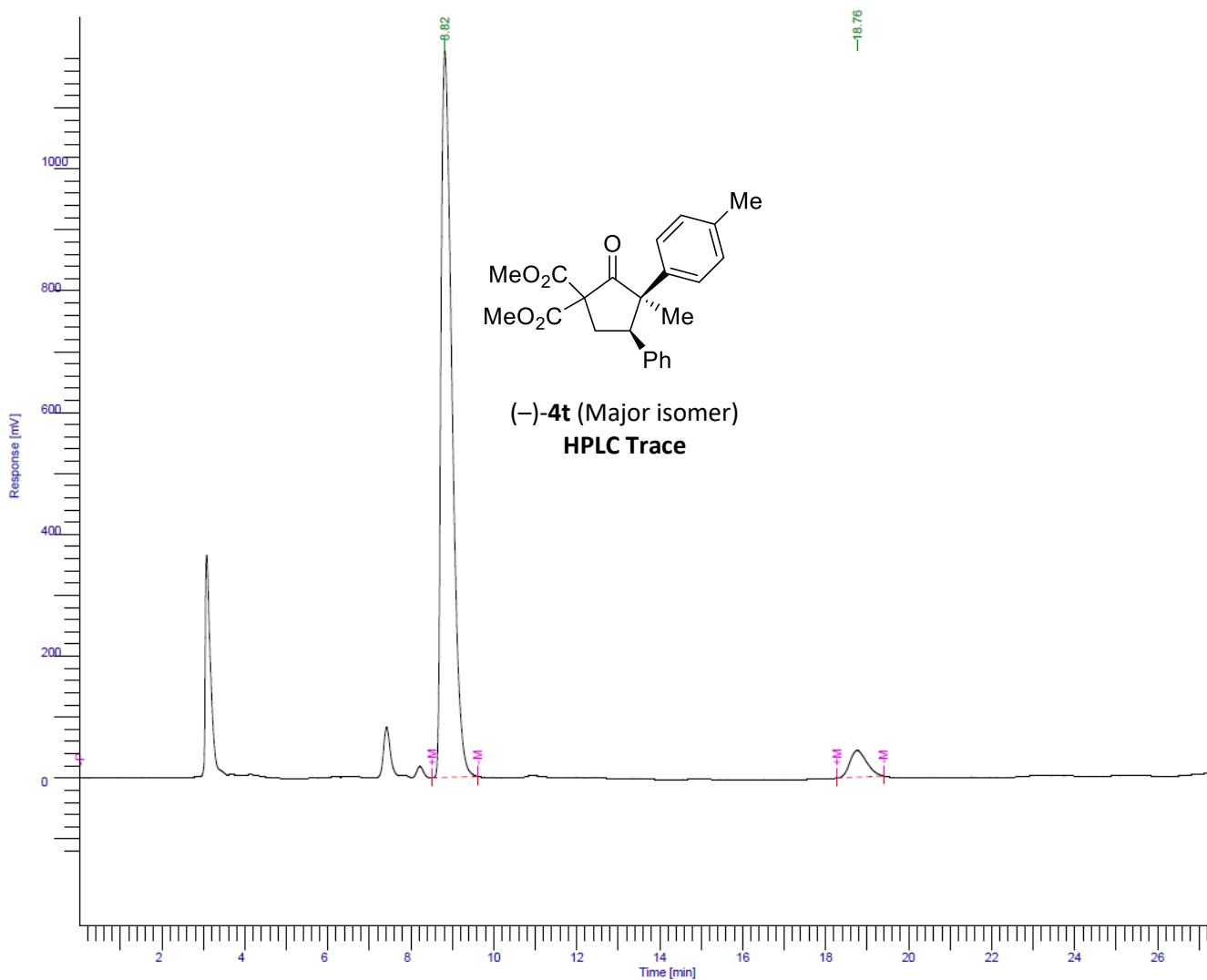
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	14.195	18607849.50	409338.15	99.06	99.06	*BB	45.4584
2	16.258	175692.55	5202.93	0.94	0.94	*MM	33.7680
		18783542.05	414541.08	100.00	100.00		



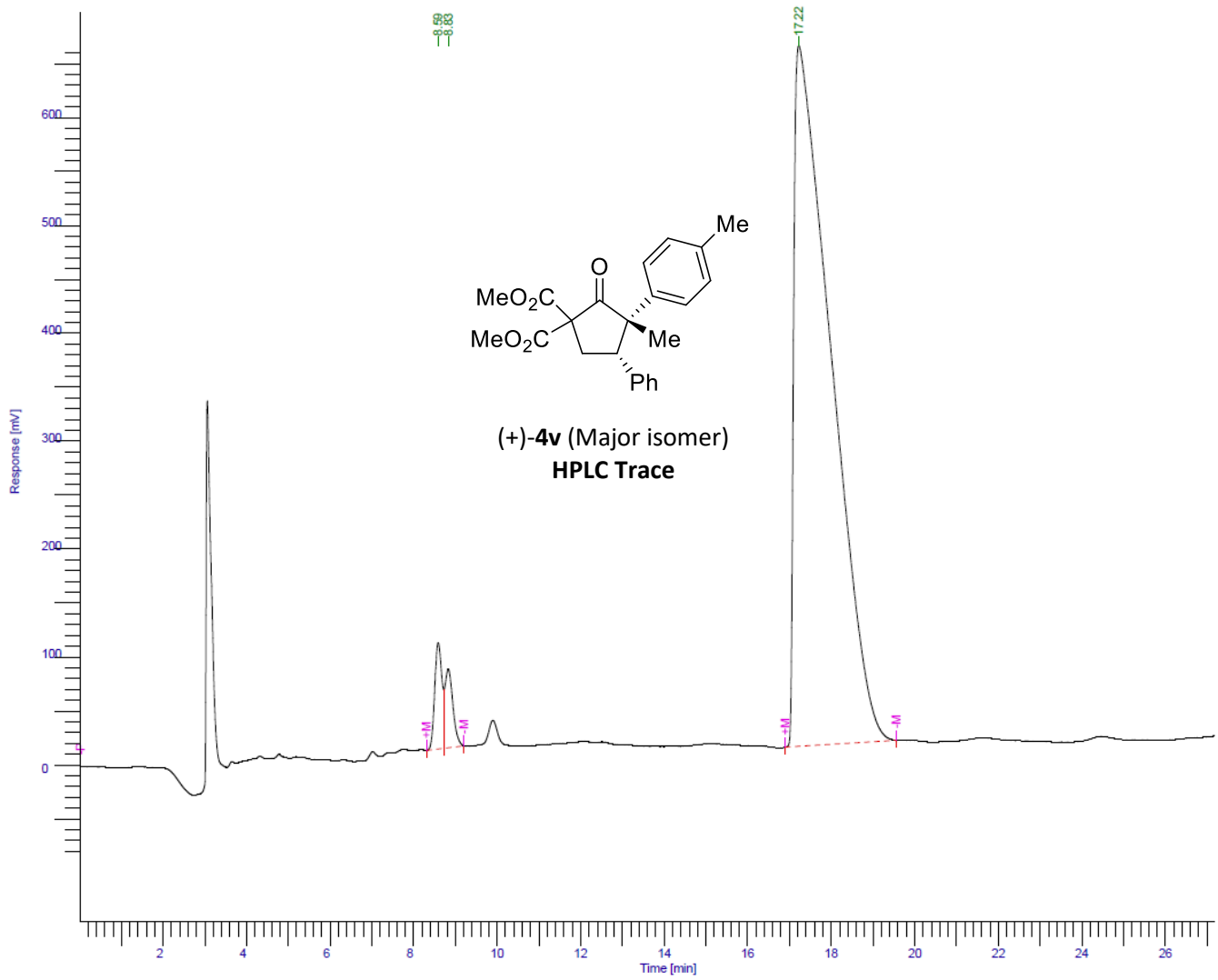




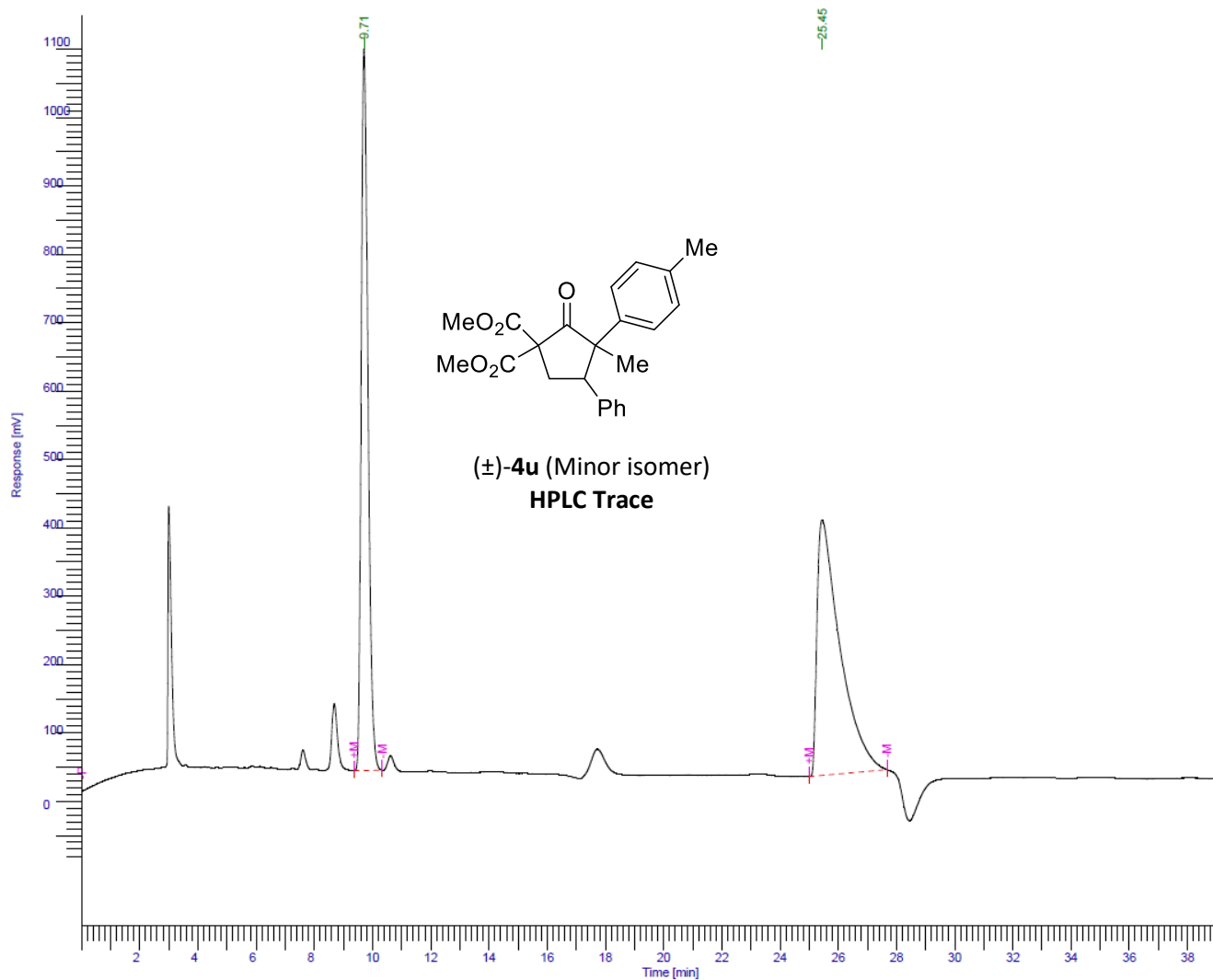
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	8.883	14322479.16	828458.06	42.26	42.26	*BB	17.2881
2	18.147	19572471.34	382773.89	57.74	57.74	*BB	51.1332
		33894950.50	1.21e+06	100.00	100.00		



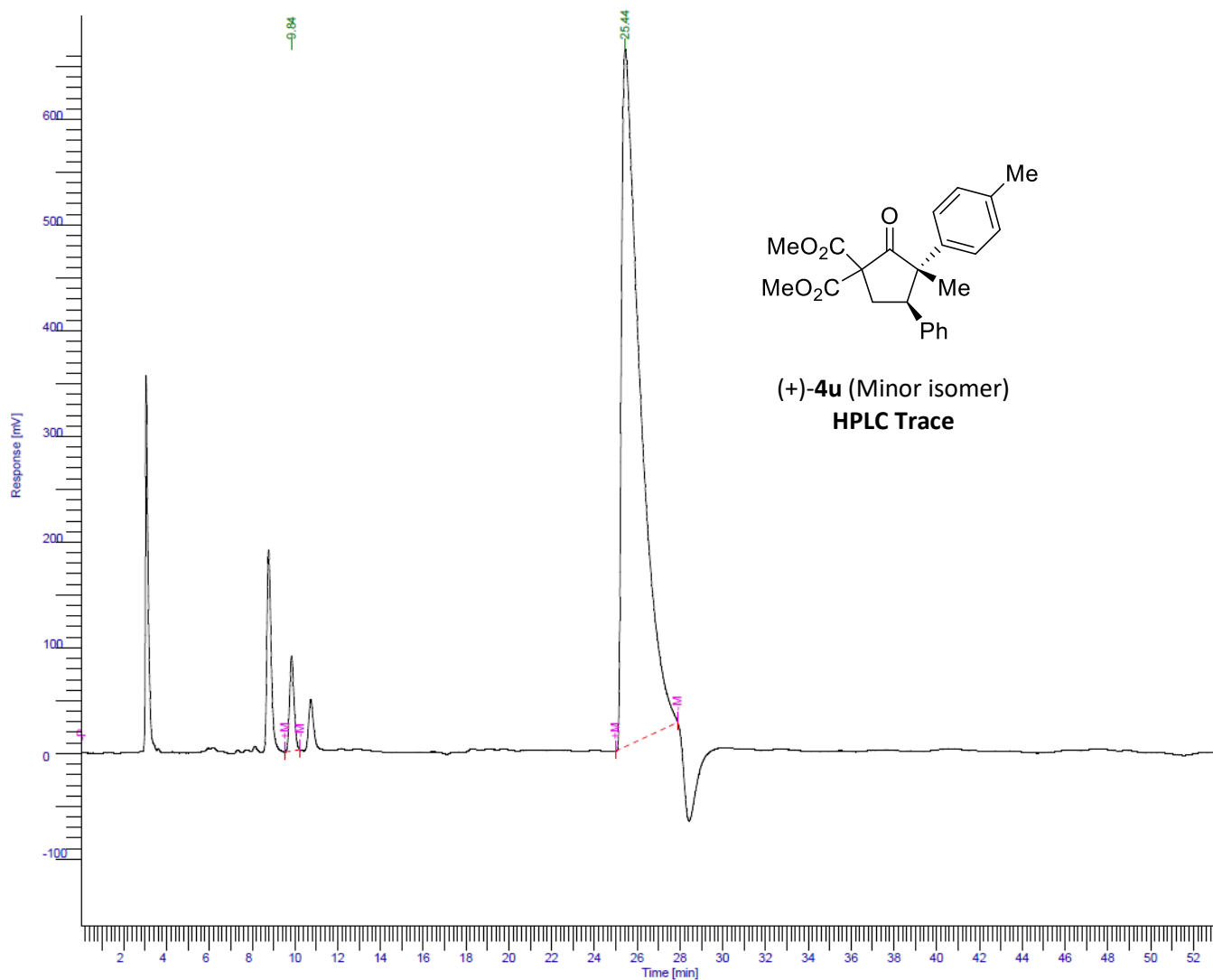
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	8.818	21888751.01	1.19e+06	94.68	94.68	*BB	18.3379
2	18.758	1230157.69	43591.60	5.32	5.32	*BB	28.2201
		23118908.70	1.24e+06	100.00	100.00		



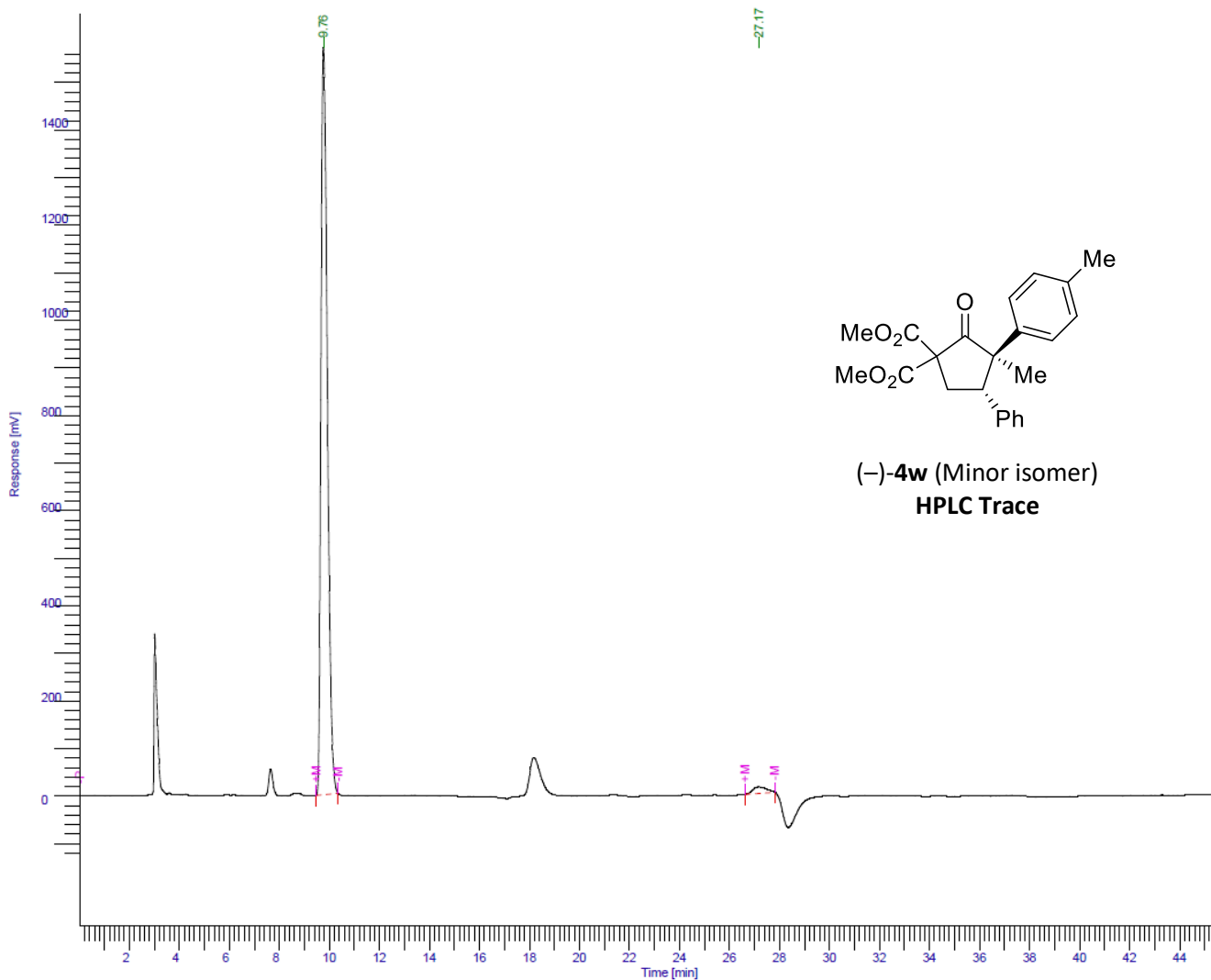
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	8.588	1184251.19	98528.17	2.81	2.81	*BV	12.0194
2	8.828	980576.11	72790.40	2.33	2.33	*VB	13.4712
3	17.222	39972194.75	649360.76	94.86	94.86	*BB	61.5562
		42137022.05	820679.32	100.00	100.00		



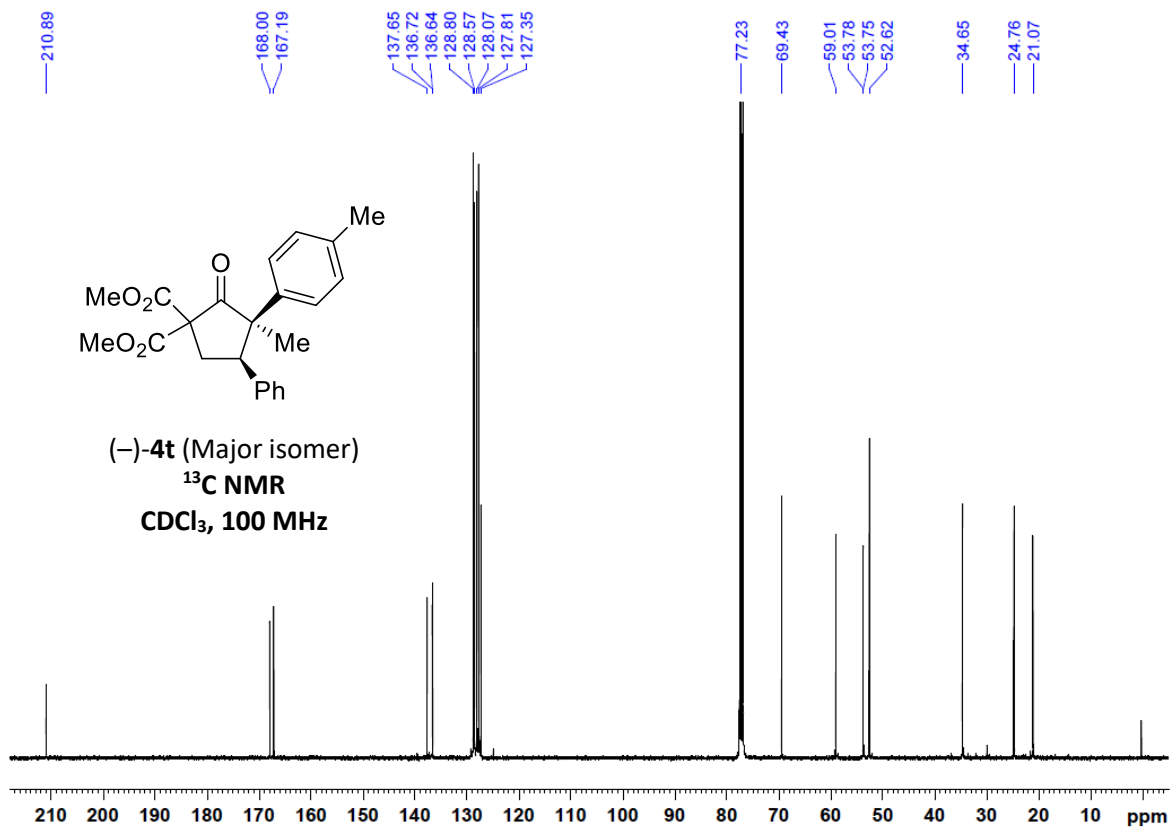
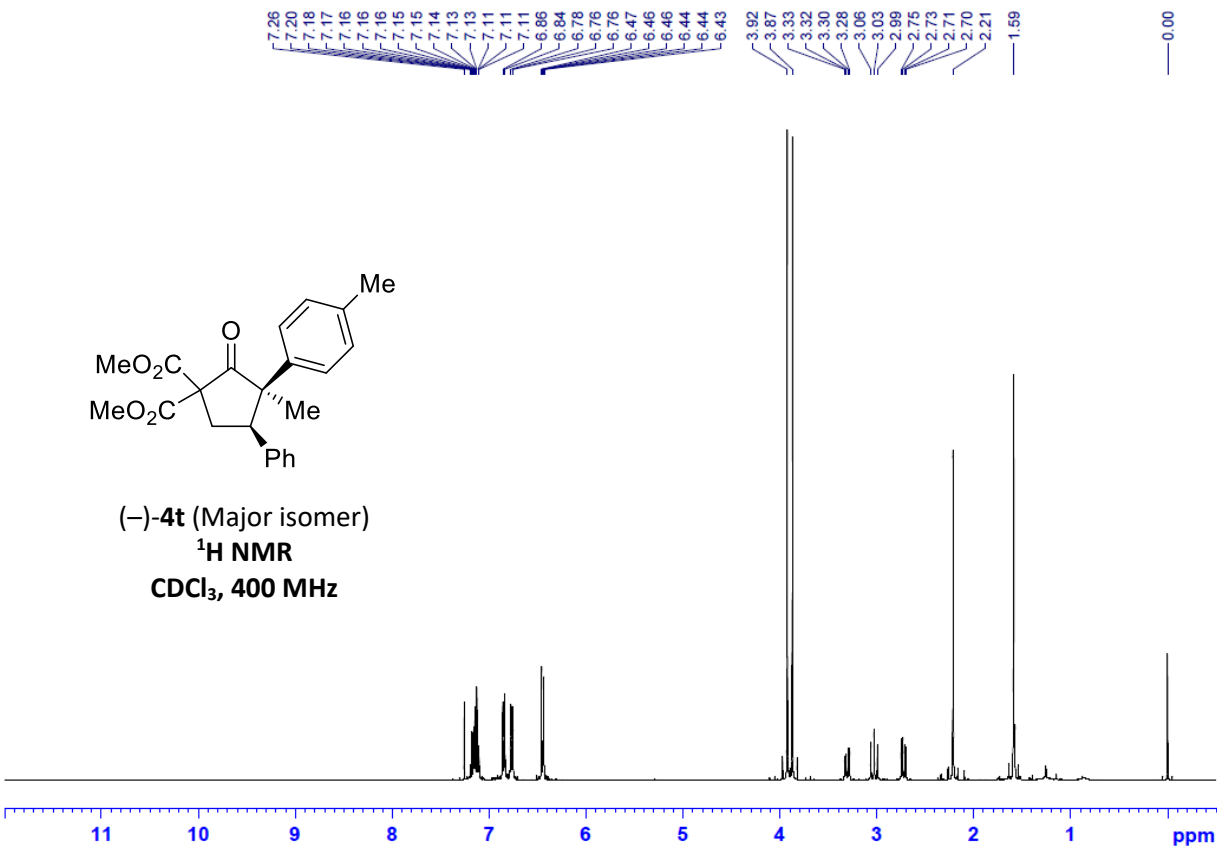
Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	9.706	17169640.96	1.06e+06	45.55	45.55	*BB	16.2644
2	25.447	20523936.73	373694.76	54.45	54.45	*BB	54.9217
		37693577.69	1.43e+06	100.00	100.00		

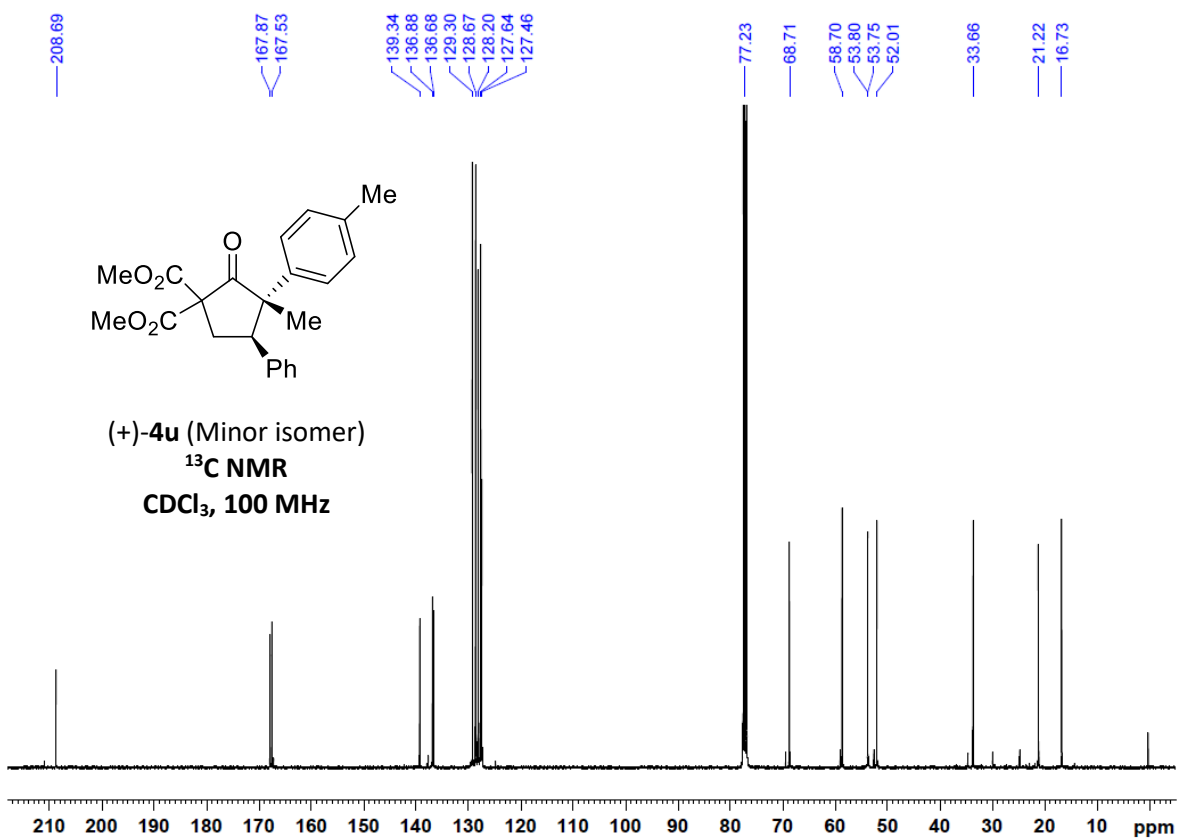
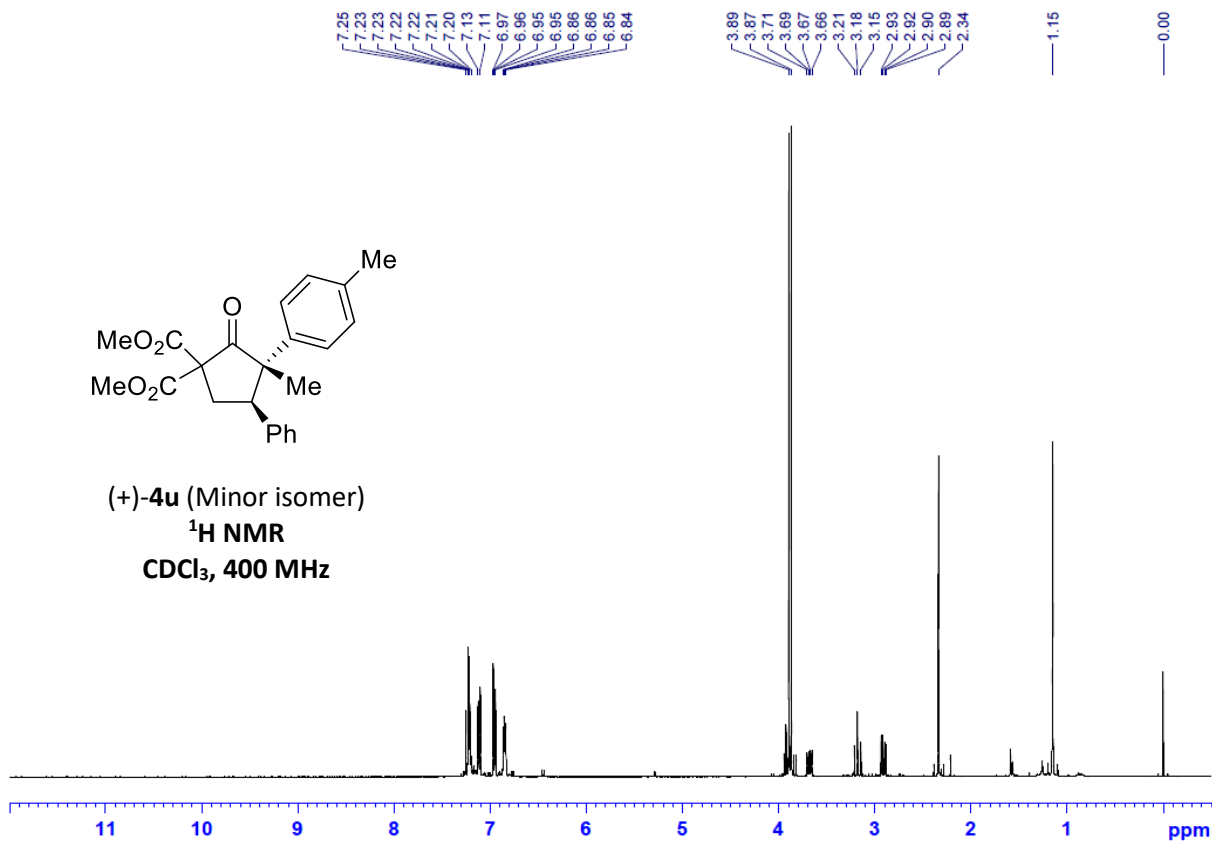


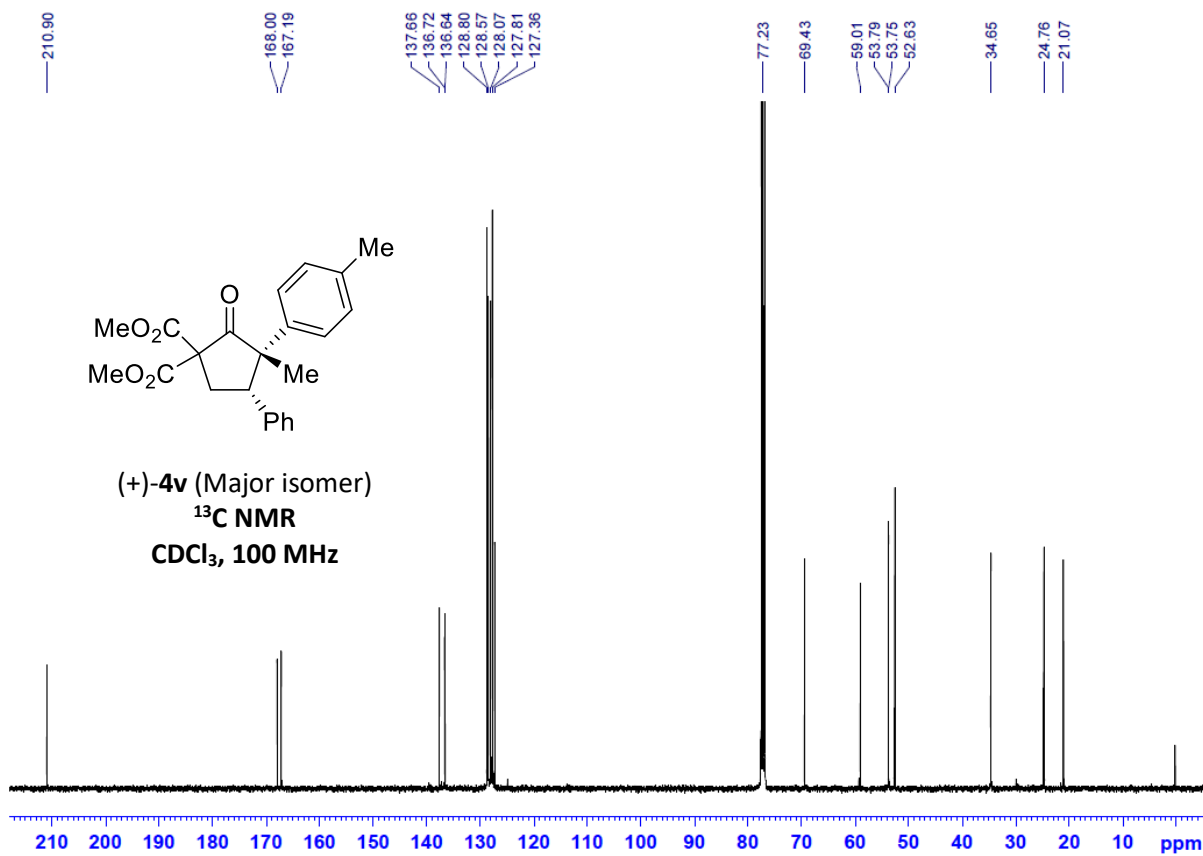
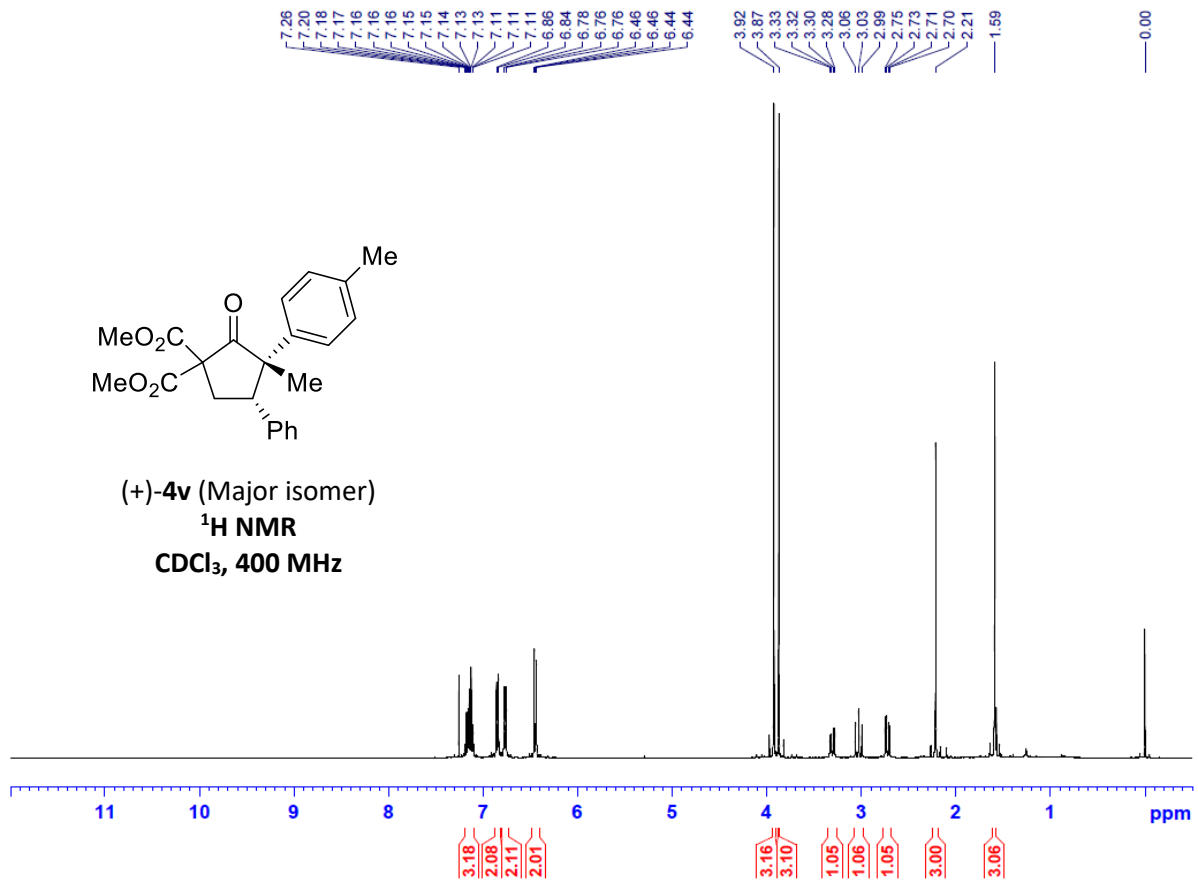
Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	9.845	1298140.78	89973.30	3.14	3.14	*BB	14.4281
2	25.441	40100299.77	659849.34	96.86	96.86	*BB	60.7719
		41398440.55	749822.65	100.00	100.00		

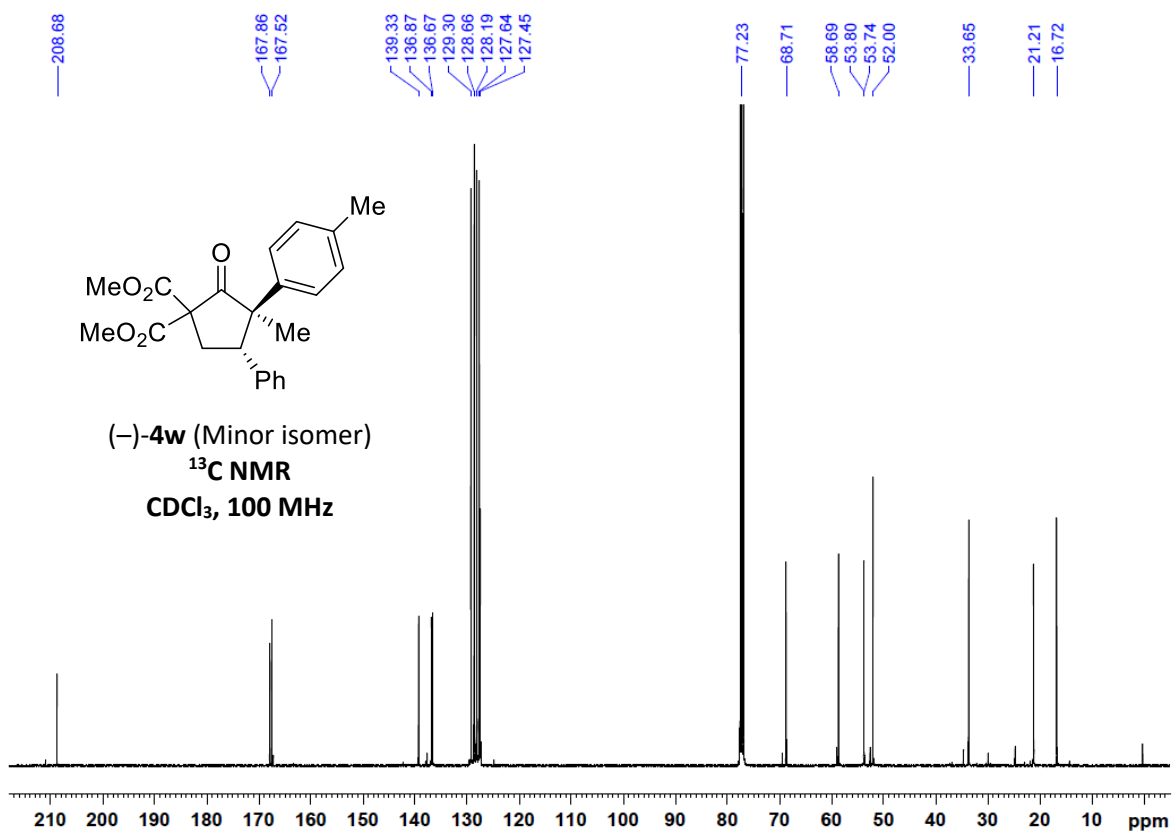
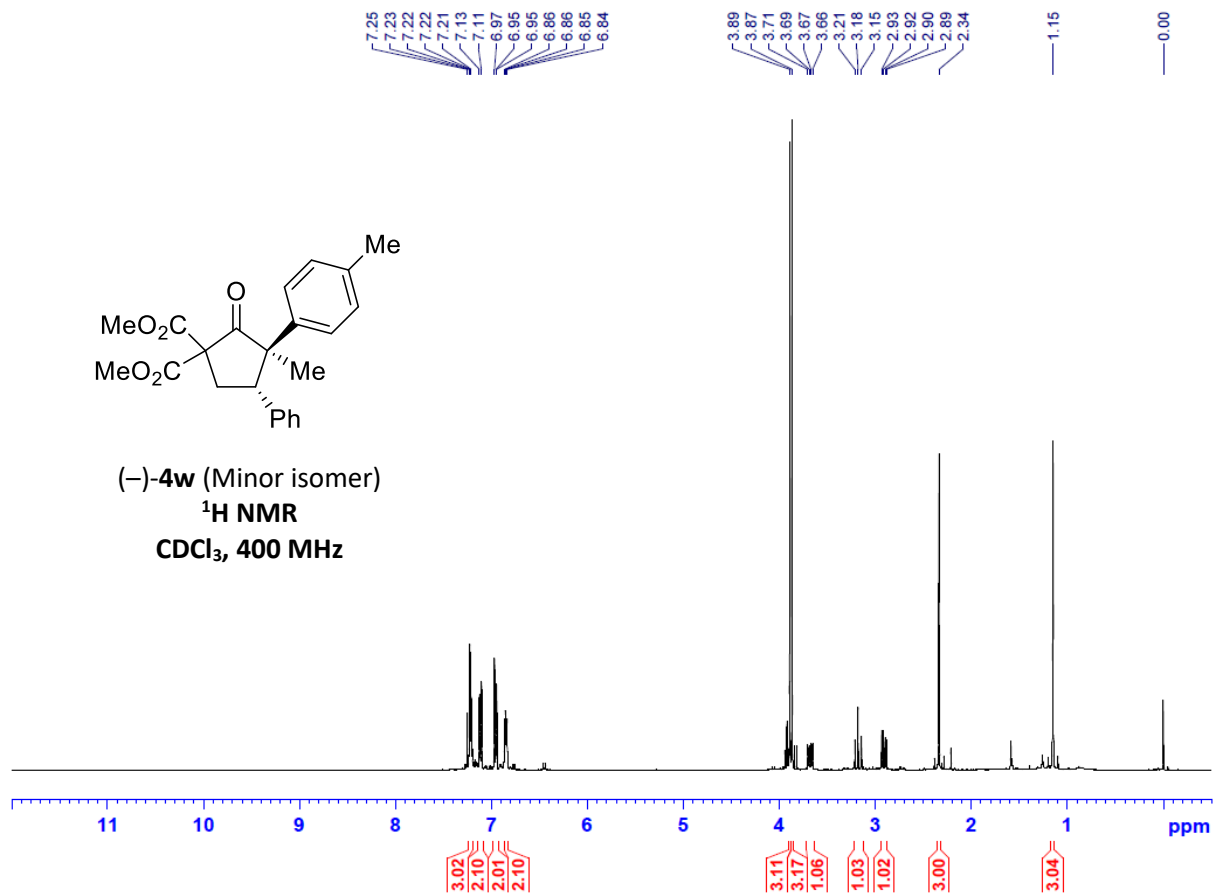


Peak #	Time [min]	Area [$\mu\text{V}\cdot\text{s}$]	Height [μV]	Area [%]	Norm. Area [%]	BL	Area/Height [s]
1	9.758	28052123.39	1.57e+06	98.22	98.22	*BB	17.8604
2	27.175	509531.00	13433.20	1.78	1.78	*BB	37.9307
		28561654.39	1.58e+06	100.00	100.00		

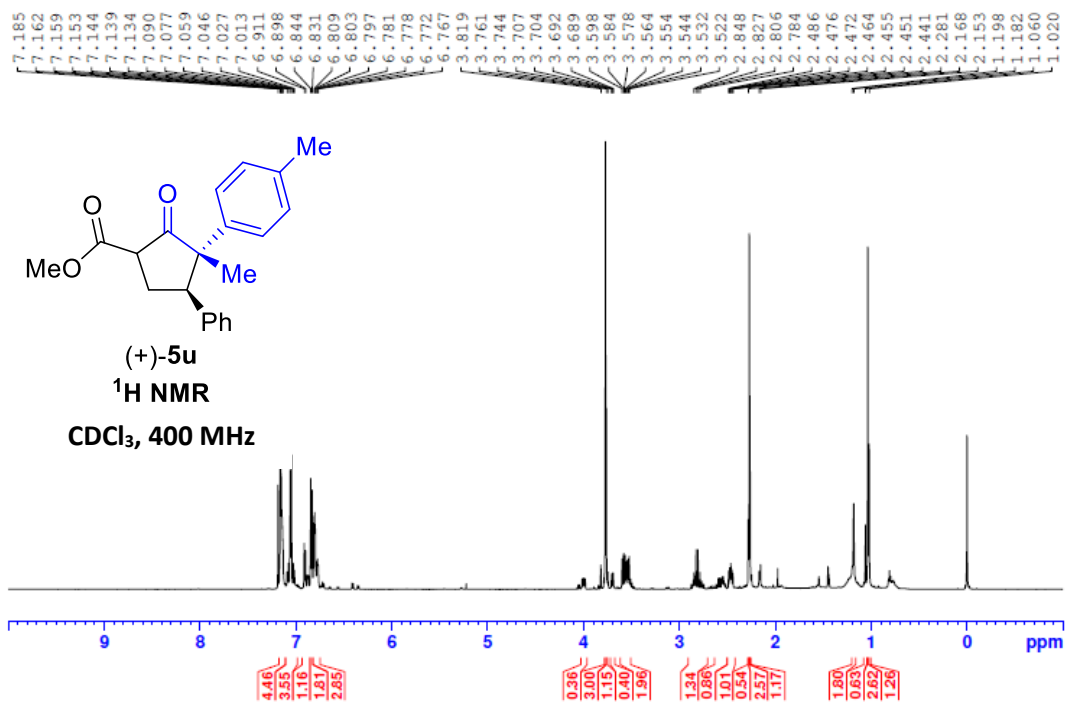








NK1-91-0 ESTER PROTON



NK1-91-0

