Synthesis

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Supporting Information

for DOI: 10.1055/a-2149-4586

Georg Thieme Verlag KG, Rüdigerstraße 14, 70469 Stuttgart, Germany

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Supporting Information

C-5 Epimerisation of D-Mannopyranosyl Fluorides: The Influence of Anomeric Configuration on Radical Reactivity

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1. Computational details

A conformational search was initially performed using MacroModel[1] for **7α** and **7β**. The conformers for each anomer were optimized by DFT at the B3LYP/6-31G(d,p) level of theory in vacuum after which a single point energy calculation was performed using M062X/def2tzvp with chloroform solvent (IEF-PCM). High energy conformers were removed (> 5 kcal/mol) resulting in one conformer for each anomer. We initially calculated the chemical shifts of the 1H signals for **7α** and **7β**. The magnetic field tensors were calculated using mpw1pw91/6-311+g(2d,p) and ωB97XD/6-311+g(2d,p) for ^{1}H and ^{13}C respectively, with chloroform solvent (IEF-PCM) as implicit solvent. The unscaled chemical shifts (δ_u) were computed from the magnetic field tensors using TMS as reference standard according to $\delta_u = \sigma_0 - \sigma_x$, where σ_x is the Boltzmann averaged magnetic field tensors (over all significantly populated conformations, in this case there was only one) and σ_0 is the magnetic field tensor of TMS computed at the same level of theory employed for σ_x. The scaled chemical shifts (δ_s) were computed as $\delta_s = \delta_u m - b$, where m and b are the slope and intercept, respectively, resulting from a linear regression calculation on a plot of δ_u against δ_{exp}. [2, 3] The results are shown in Tables S1 and S2.

	Chemical shift (δ, ppm)		
Nucleus	Experimental (**6α**)	Calculated (**7α**)	Calculated (**7β**)
H-1	5.87	6.41	6.18
H-2	5.86	5.45	5.57
H-3	5.92	5.44	5.26
H-4	6.21	5.69	5.76
H-5	4.61	4.71	4.52
H-6a	4.78	5.19	5.37
H-6b	4.49	4.86	5.08
	MAE	0.41	0.43

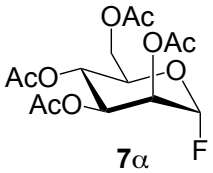
Table S1. Experimental ^{1}H NMR chemical shifts measured for **6α** and DFT-calculated values for **7α** and **7β**

	Chemical shift (δ, ppm)		
Nucleus	Experimental (**6α**)	Calculated (**7α**)	Calculated (**7β**)
C-1	104.8	104.3	104.2
C-2	68.5	70.0	70.1
C-3	69.1	70.4	70.3
C-4	65.7	66.0	65.7
C-5	71.1	70.2	71.1
C-6	62.0	60.3	59.9
	MAE	1.03	0.93

Table S2. Experimental ^{13}C NMR chemical shifts measured for **6α** and DFT-calculated values for **7α** and **7β**

Little difference was noted between the calculated chemical shifts of both anomers. Therefore, the C-F coupling constants of **7α** and **7β** were calculated using BHandH/6-311++G(2d,p) with chloroform solvent (IEF-PCM). The results are shown in Table 1 of the main text.

2. Cartesian coordinates



7α

O	-1.4473180000	-1.1276110000	1.3847390000
C	-1.2396060000	0.2982790000	1.3887970000
C	-0.1347410000	0.6648410000	0.3807790000
C	1.1461270000	-0.0919740000	0.7423640000
C	0.8596200000	-1.6011860000	0.7418320000
C	-0.3270760000	-1.8879160000	1.6733990000
H	-0.9319420000	0.6125720000	2.3949270000
H	-0.4547470000	0.3750660000	-0.6189590000

H 1.4641580000 0.1946740000 1.7481180000
H 1.7323660000 -2.1505420000 1.1037460000
H -0.6353980000 -2.9343680000 1.6183880000
F 0.1153550000 -1.6214270000 2.9717300000
O 0.4502770000 -2.0373970000 -0.5502800000
C 1.2949190000 -2.6127360000 -1.4831380000
O 0.8268590000 -2.8568380000 -2.5625080000
C 2.7246830000 -2.9078460000 -1.0915990000
H 3.1762430000 -3.4634130000 -1.9122700000
H 3.2757560000 -1.9760680000 -0.9401040000
H 2.7902880000 -3.5062840000 -0.1776010000
O 2.1720910000 0.1613970000 -0.2168780000
C 3.2797950000 0.9491910000 0.0307280000
O 4.1554400000 0.9307280000 -0.7947020000
C 3.3157800000 1.7754120000 1.2964770000
H 4.1992750000 2.4100730000 1.2454000000
H 2.4182090000 2.3903960000 1.3975850000
H 3.3971950000 1.1370020000 2.1829770000
O 0.1051760000 2.0676440000 0.4841550000
C 0.1220760000 2.9203760000 -0.6089980000
O 0.4271300000 4.0640820000 -0.3918720000
C -0.2381490000 2.3647770000 -1.9653990000
H -0.1892700000 3.1875540000 -2.6771480000
H 0.4673830000 1.5855450000 -2.2699740000
H -1.2443230000 1.9345760000 -1.9676290000
C -2.5752600000 0.9664420000 1.0871590000
H -3.3510710000 0.5234320000 1.7157070000
H -2.4943810000 2.0286400000 1.3288030000
O -2.9015460000 0.9065860000 -0.3028720000
C -3.7434960000 -0.0258590000 -0.8615670000
O -3.8420470000 -0.0298200000 -2.0613970000
C -4.5058960000 -0.9521350000 0.0590490000
H -5.1070090000 -1.6125870000 -0.5640170000
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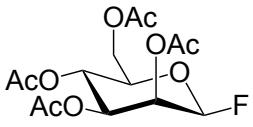
H -5.1686280000 -0.3891910000 0.7248910000



7β

O 1.5593200000 -0.3900720000 -1.4090700000
C 0.7620260000 0.7980950000 -1.4641230000
C -0.3692950000 0.7219640000 -0.4181750000
C -1.2016720000 -0.5413980000 -0.6665950000
C -0.2831130000 -1.7699410000 -0.6354570000
C 0.8386340000 -1.5618430000 -1.6640770000
H 0.3121810000 0.8945760000 -2.4671630000
H 0.0683740000 0.6721960000 0.5772100000
H -1.6530400000 -0.4744830000 -1.6627760000
H -0.8598520000 -2.6632460000 -0.8913740000
H 0.4296520000 -1.5527210000 -2.6893140000
F 1.7357610000 -2.5917480000 -1.5734840000
O 0.2879460000 -1.8555470000 0.6618920000
C 0.5958760000 -3.0486060000 1.2803870000
O 1.1983910000 -2.9956120000 2.3183350000
C 0.1312600000 -4.3344930000 0.6321030000
H 0.4565580000 -5.1568940000 1.2673130000
H -0.9598950000 -4.3621060000 0.5447410000
H 0.5636670000 -4.4510740000 -0.3646260000
O -2.1978990000 -0.7013280000 0.3368660000
C -3.5294670000 -0.3858510000 0.1512280000
O -4.2661060000 -0.5445230000 1.0882830000
C -3.9778170000 0.1270580000 -1.2005880000
H -5.0447640000 0.3330280000 -1.1302490000
H -3.4446110000 1.0417140000 -1.4729000000
H -3.8143080000 -0.6170520000 -1.9876480000
O -1.1995910000 1.8687850000 -0.5890560000

C	-1.5452560000	2.7232360000	0.4494940000
O	-2.2822880000	3.6320940000	0.1703850000
C	-0.9854800000	2.4518230000	1.8242470000
H	-1.3807810000	3.2156600000	2.4922620000
H	-1.2899300000	1.4647430000	2.1855250000
H	0.1081110000	2.4952860000	1.8245020000
C	1.6844070000	1.9973160000	-1.2631330000
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H	1.1558650000	2.8994030000	-1.5791000000
O	2.0073310000	2.2015050000	0.1123670000
C	3.1508040000	1.7340500000	0.7204280000
O	3.2354900000	1.8810730000	1.9120860000
C	4.2204490000	1.1038070000	-0.1416560000
H	5.0405290000	0.8133430000	0.5131680000
H	3.8341850000	0.2247450000	-0.6633230000
H	4.5937720000	1.8112000000	-0.8897500000

References

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2. Grimblat, N.; Sarotti, A. M. Computational Chemistry to the Rescue: Modern Toolboxes for the Assignment of Complex Molecules by GIAO NMR Calculations. *Chem. Eur. J.* **2016**, *22* (35), 12246-12261.

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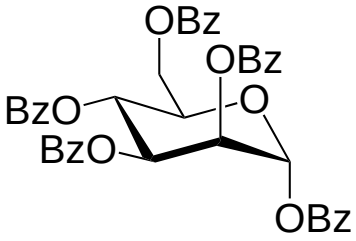
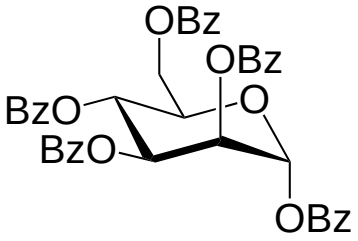


4

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



4

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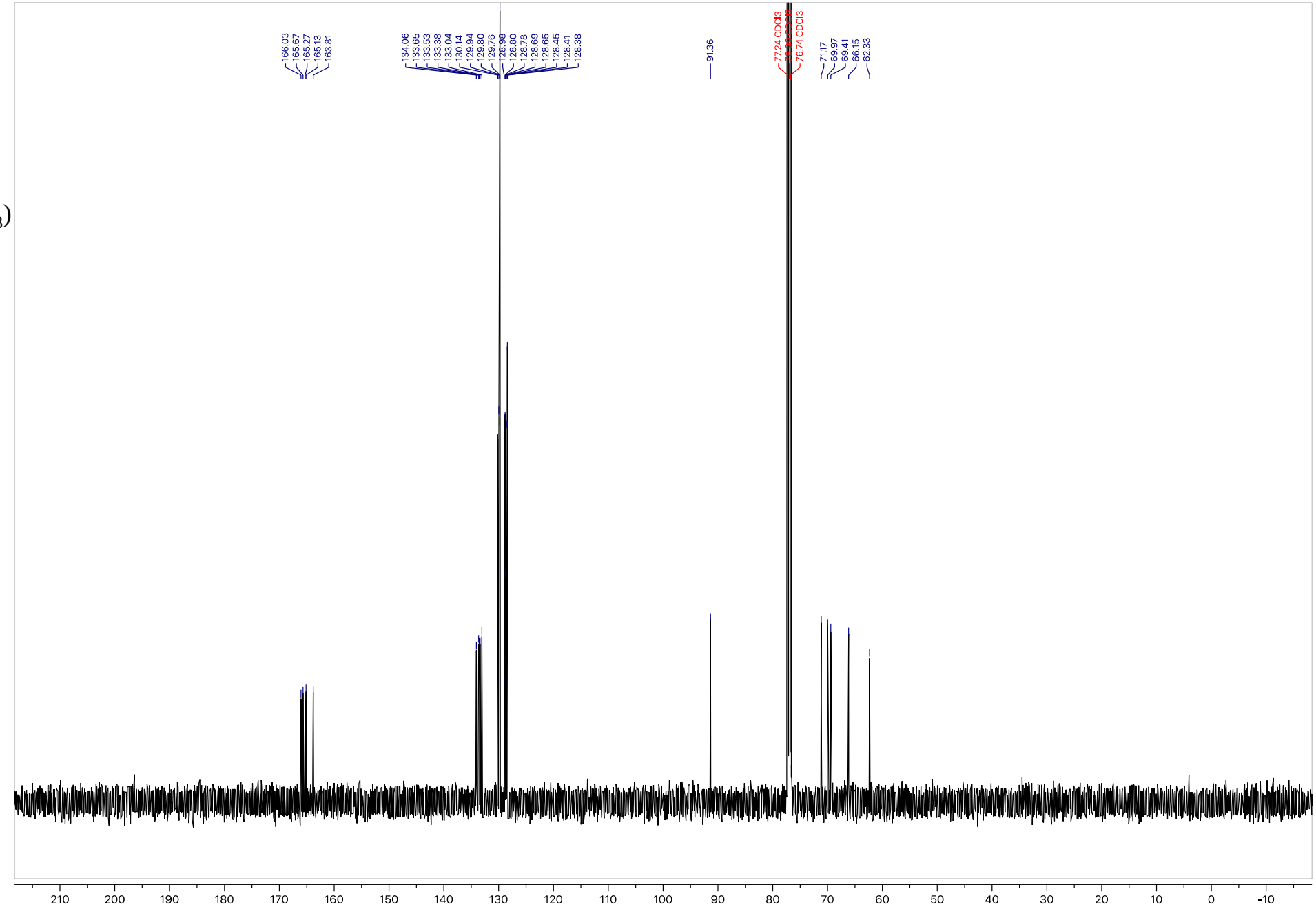

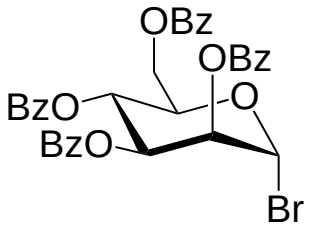

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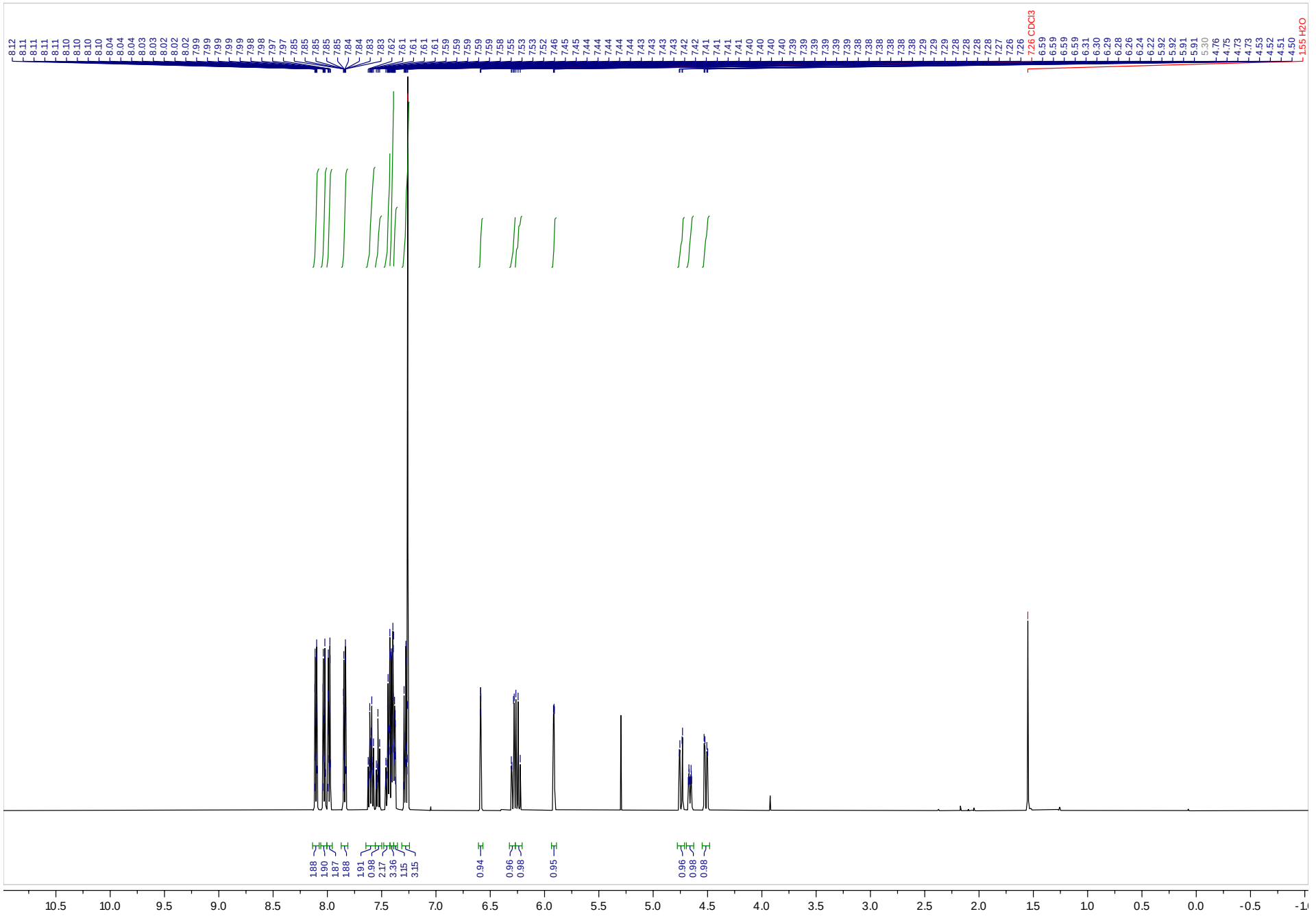

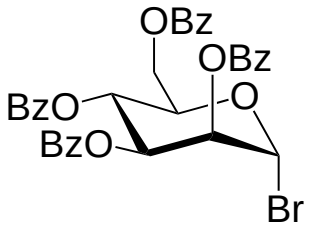

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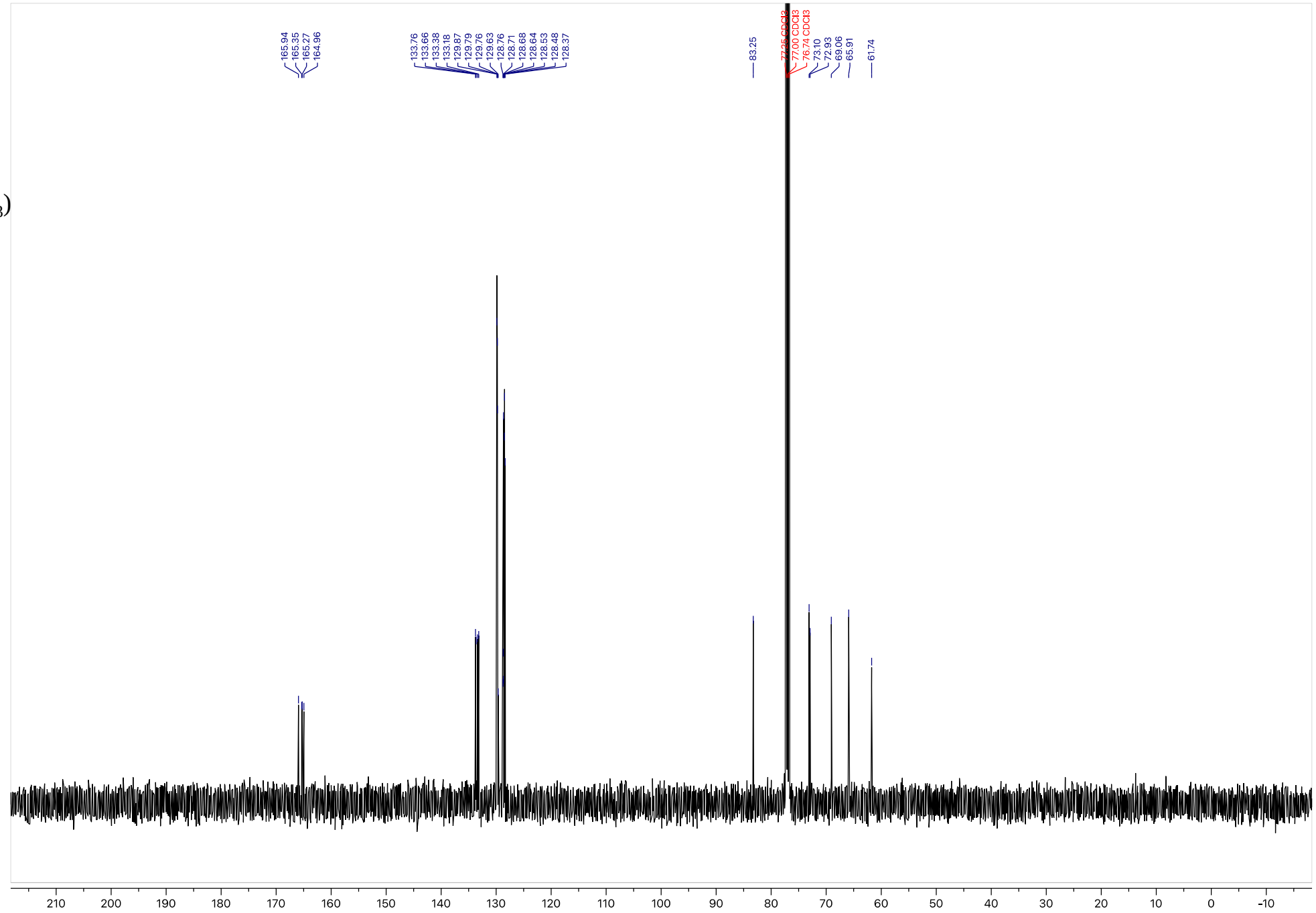
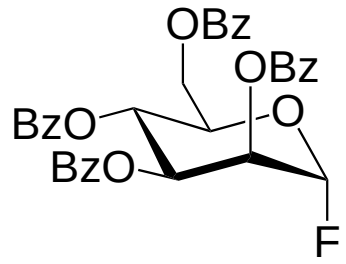
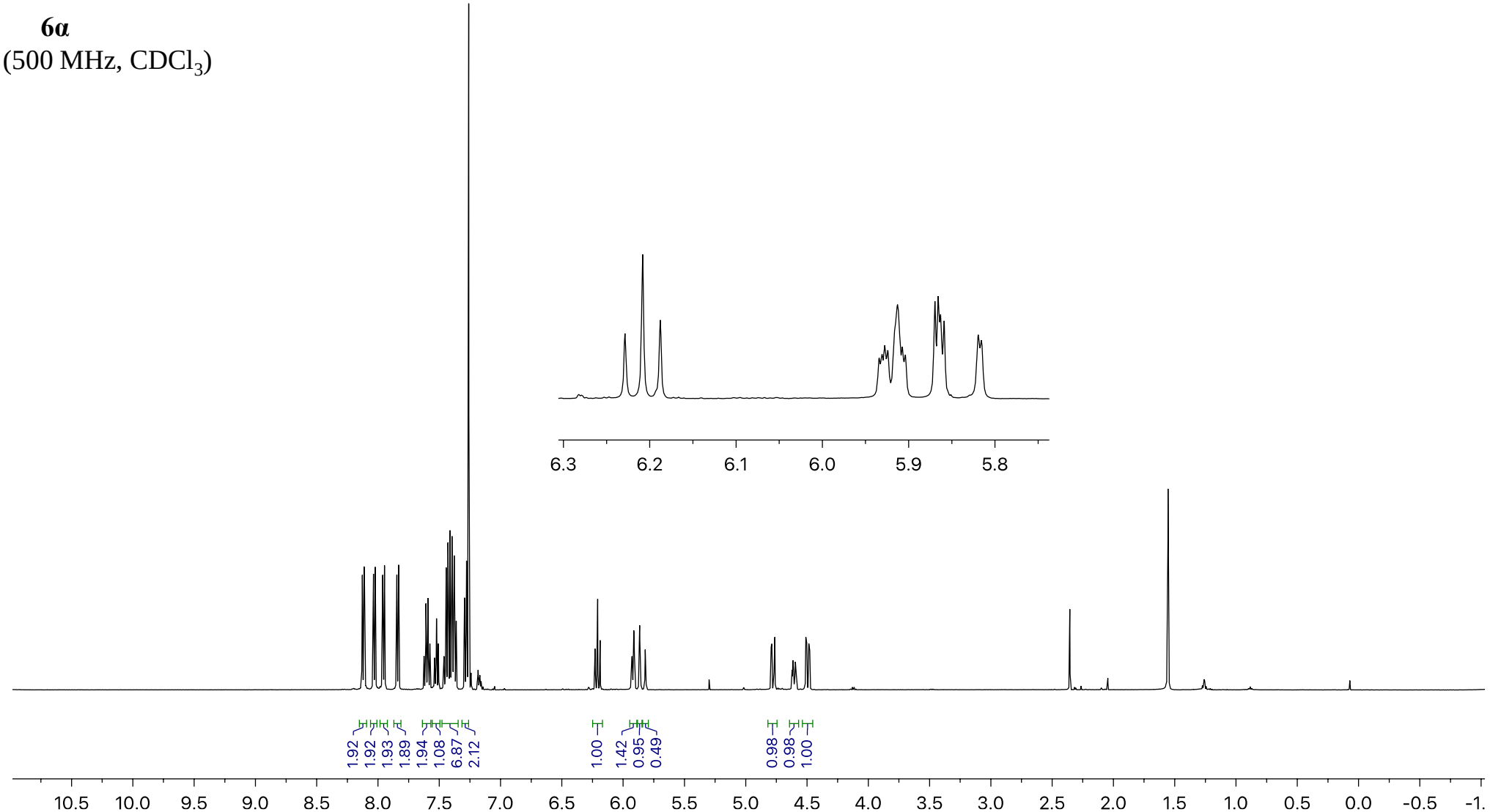
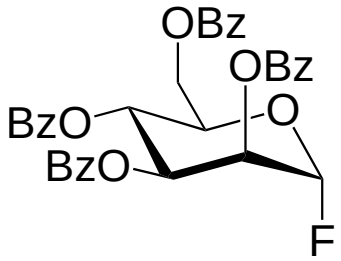




6α

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





6α

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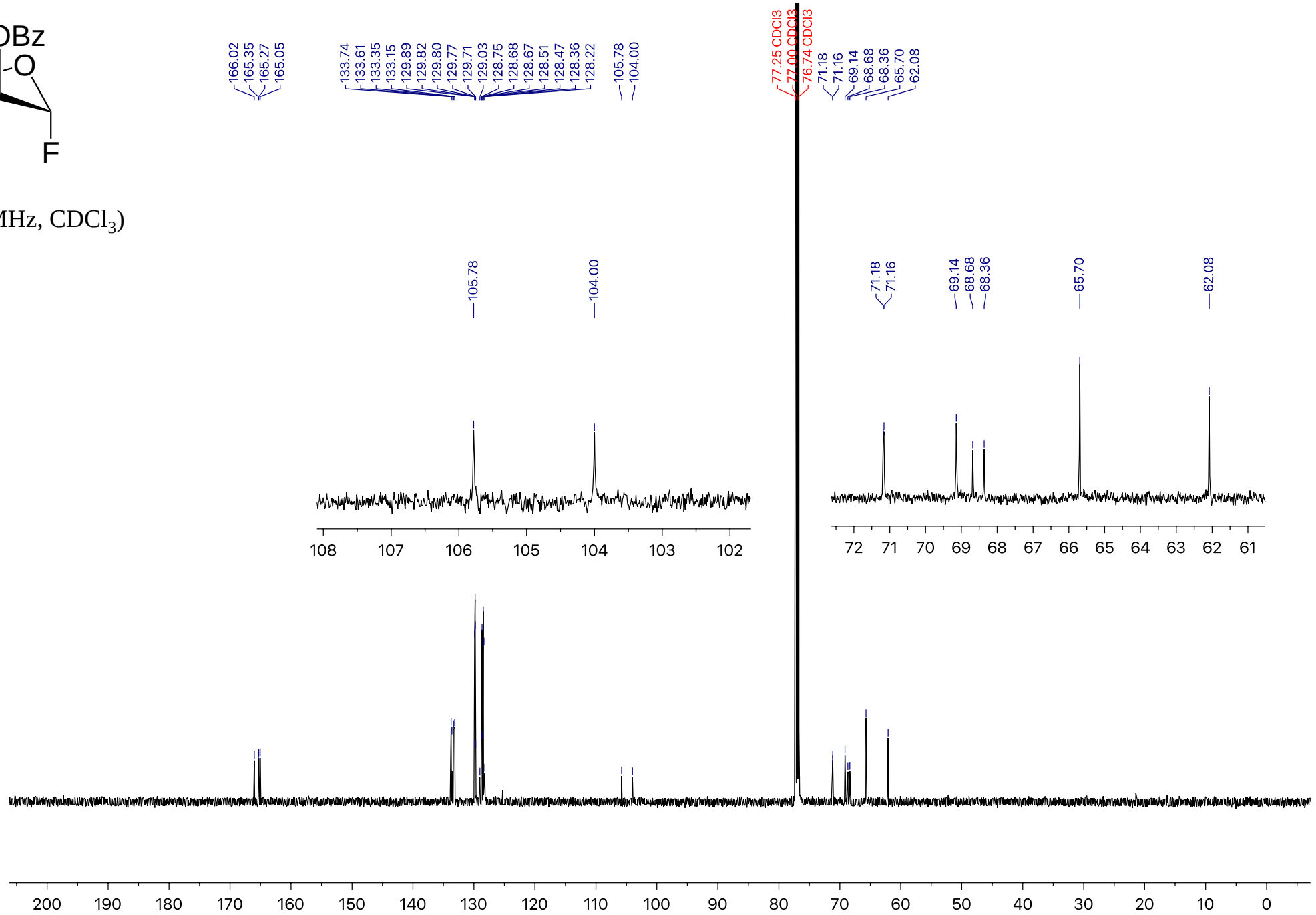
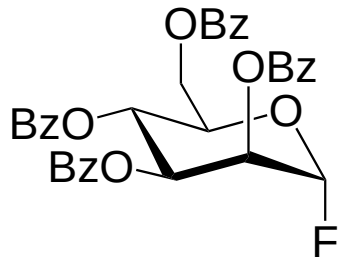
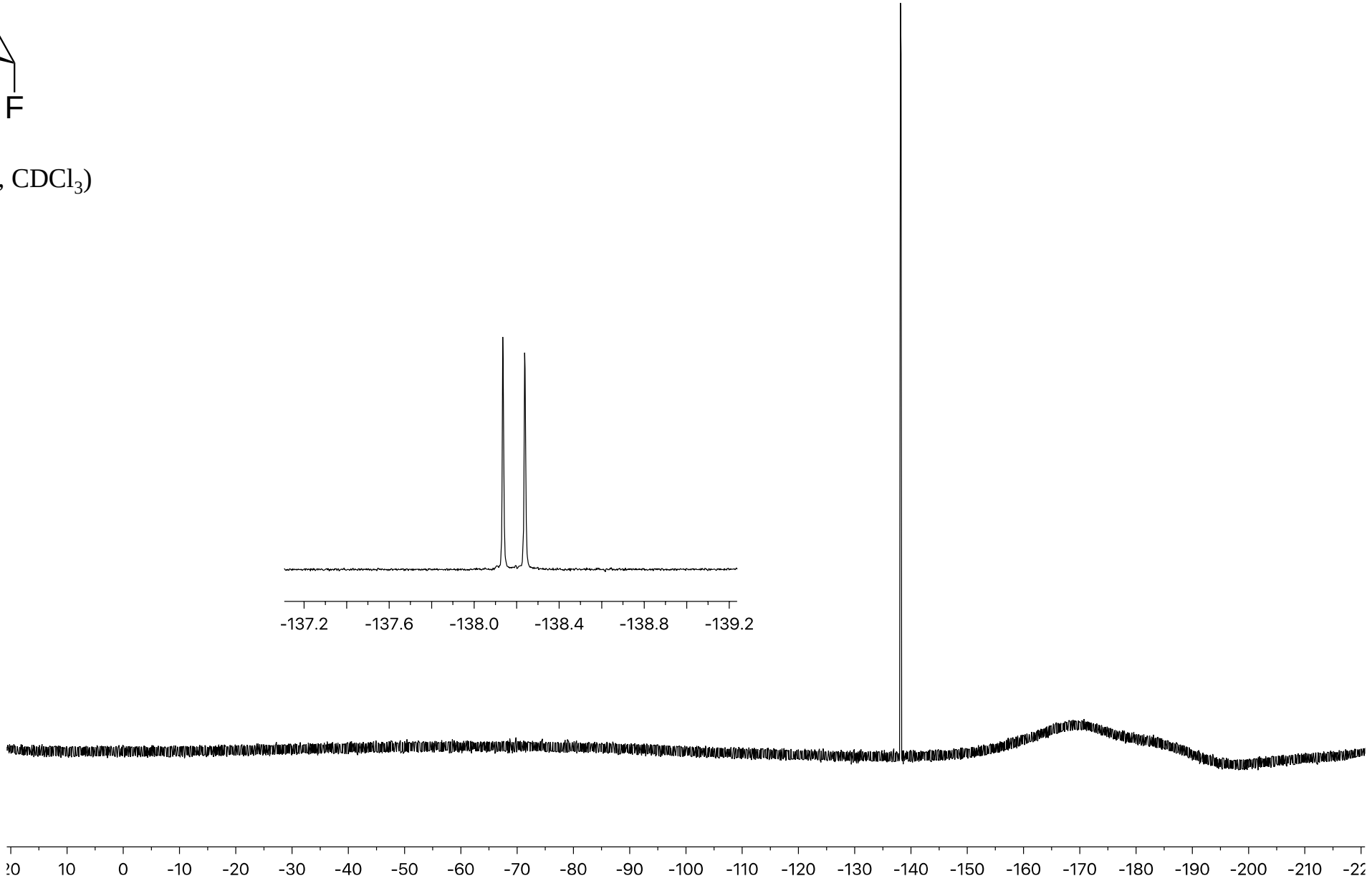
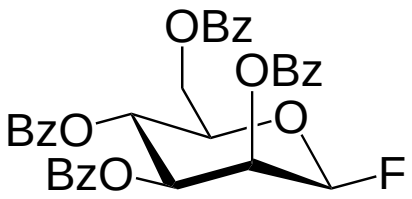




6α

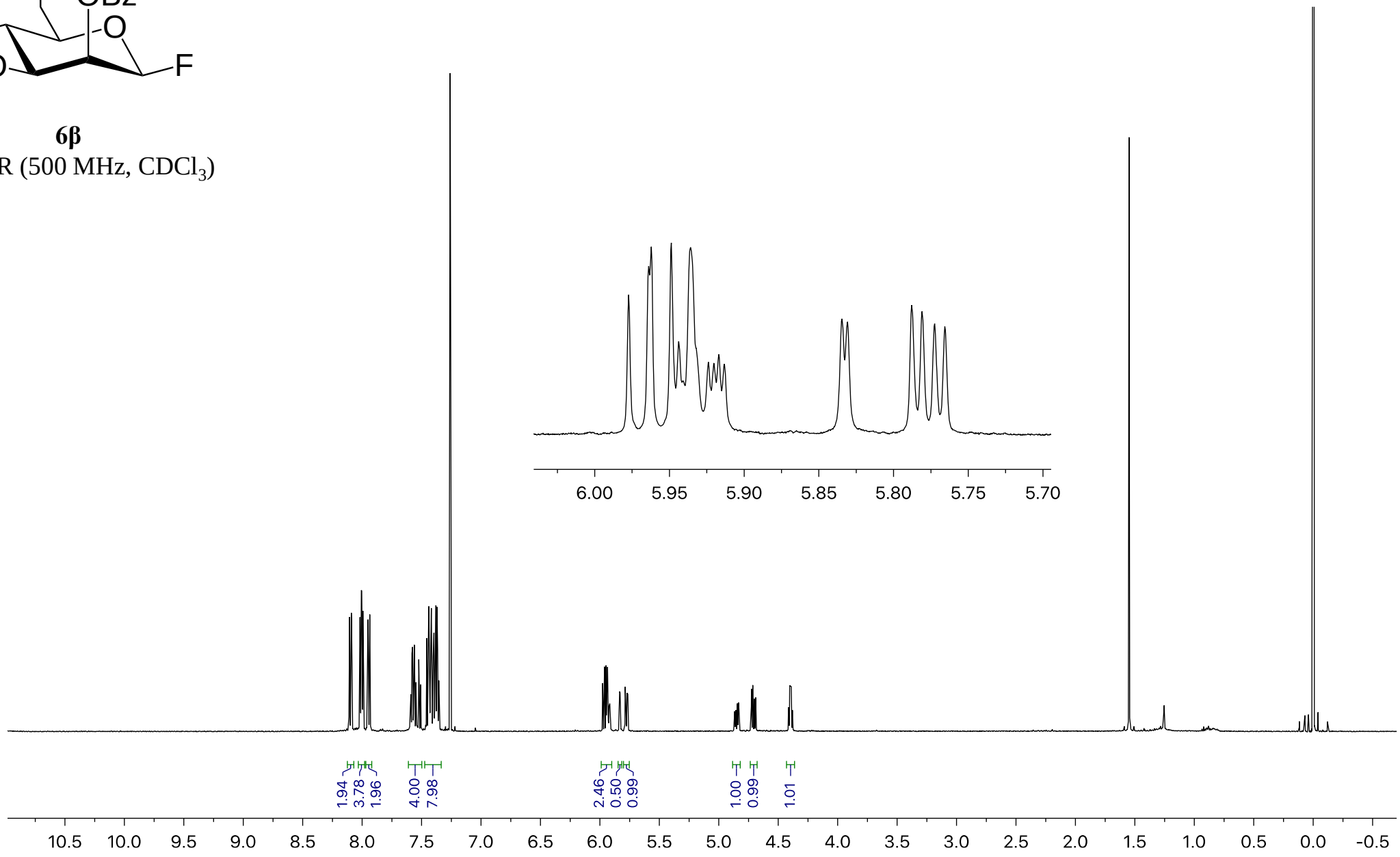
^{19}F NMR (470 MHz, $CDCl_3$)

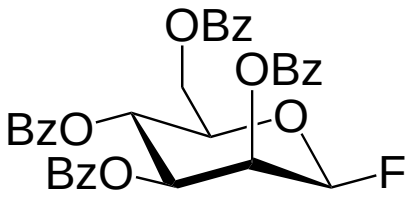




6β

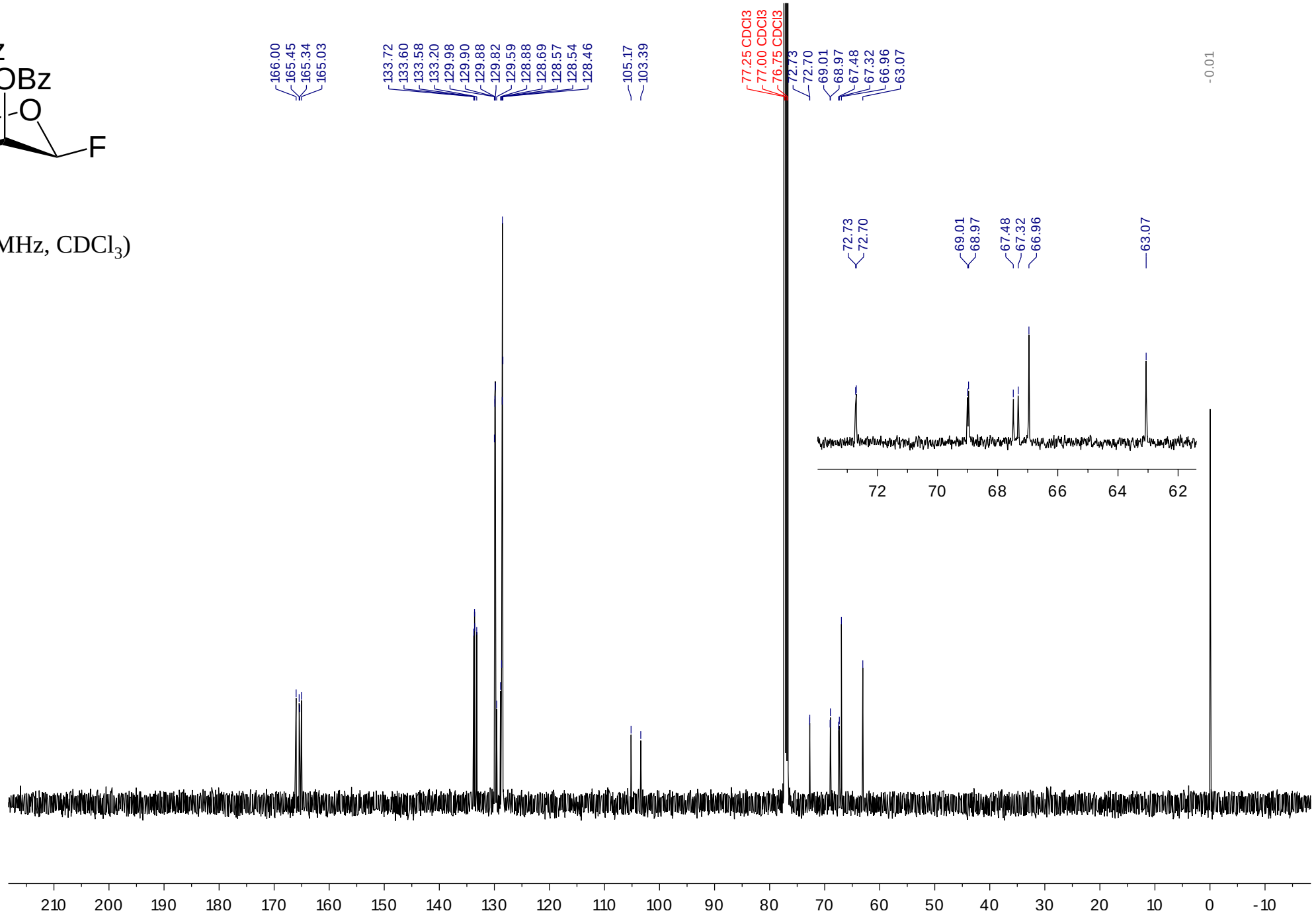
^{1}H NMR (500 MHz, $CDCl_3$)

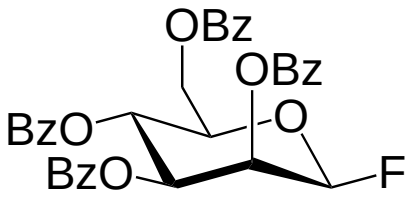




6β

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





6β

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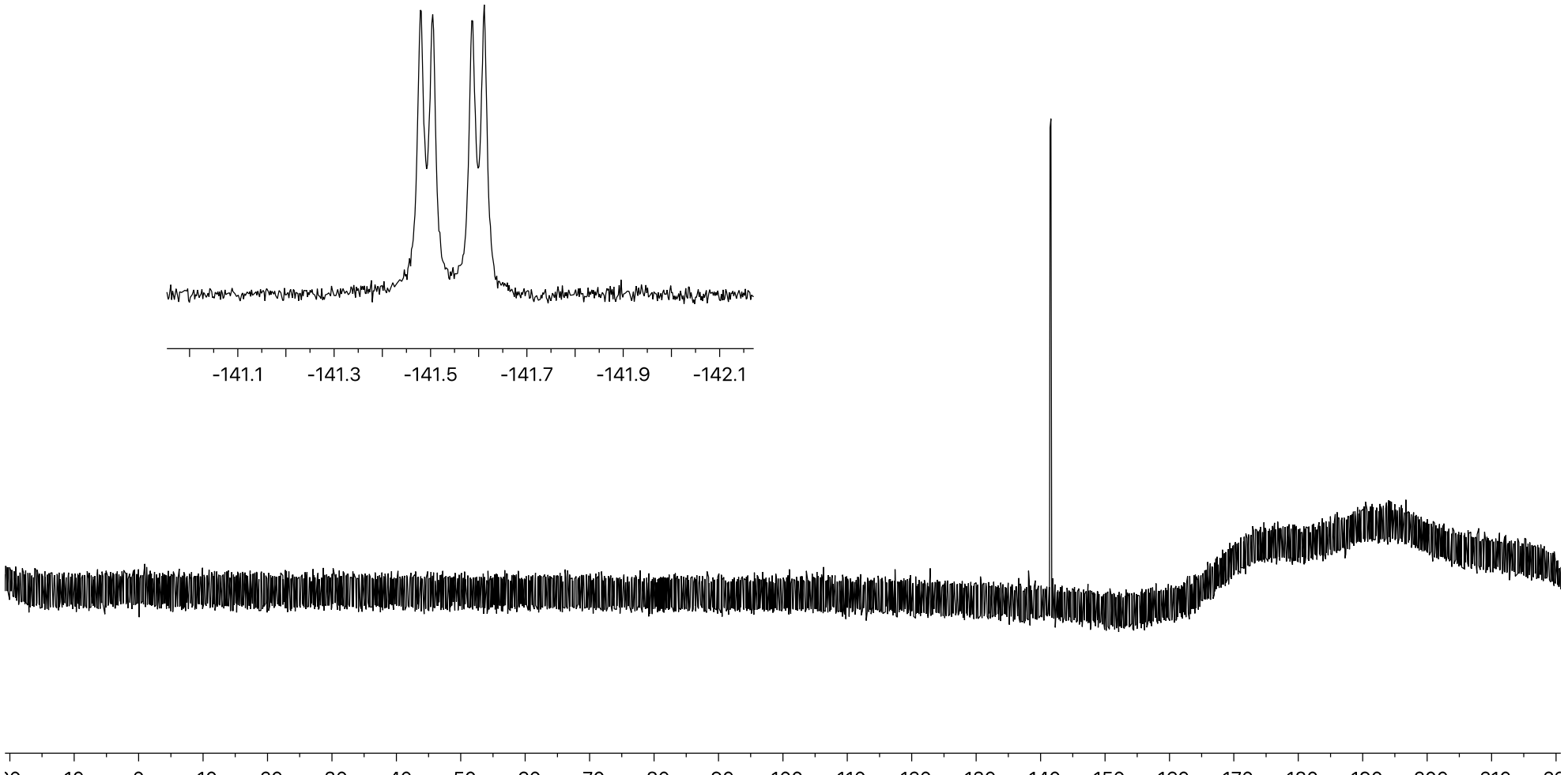

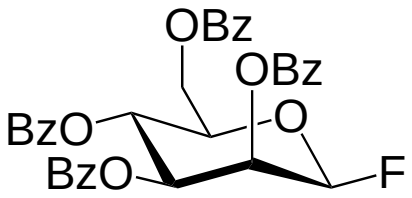

6β

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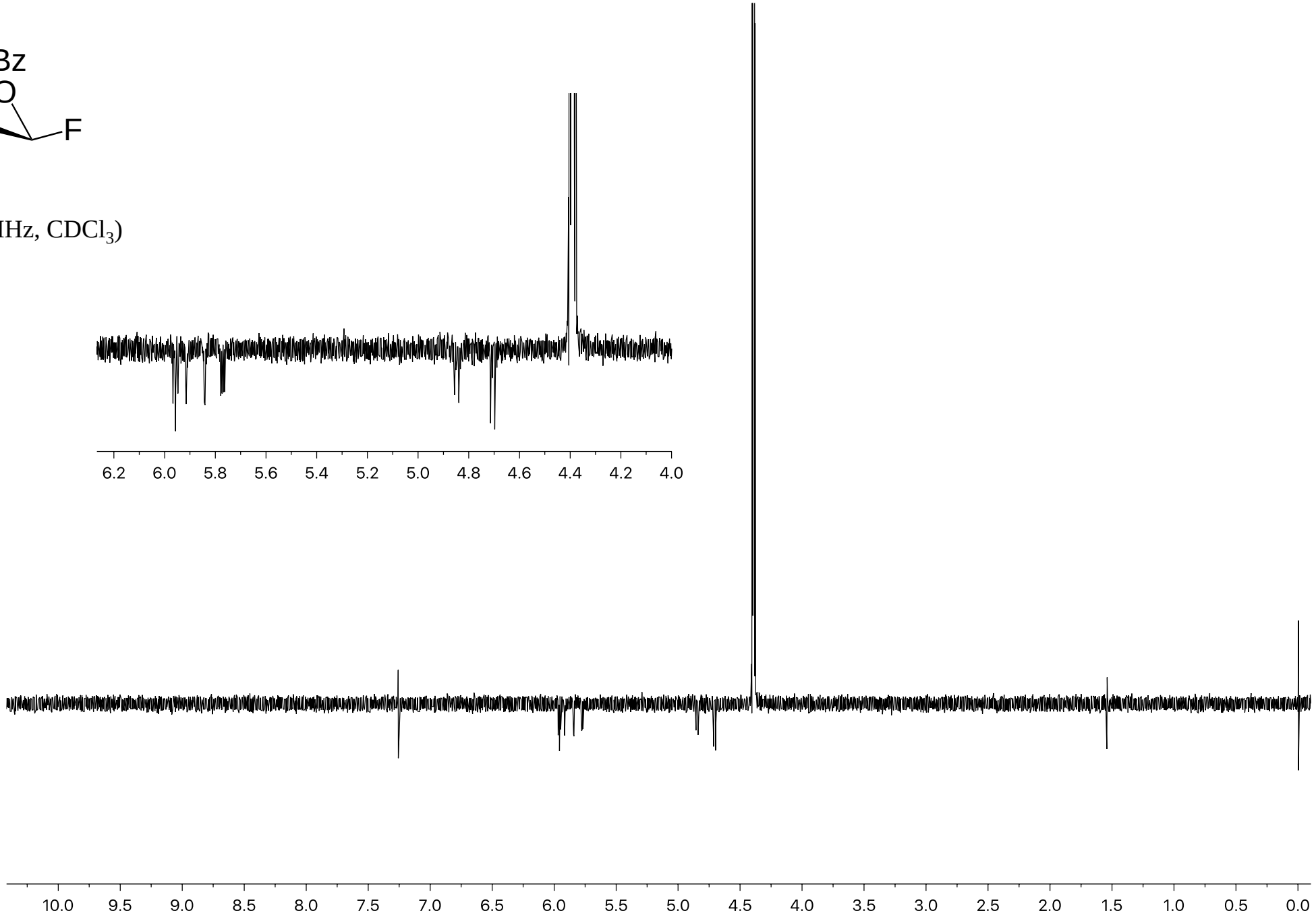
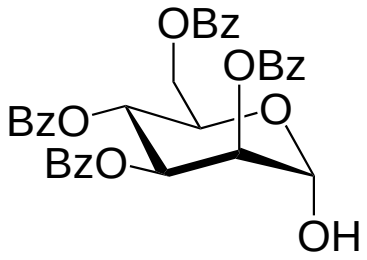
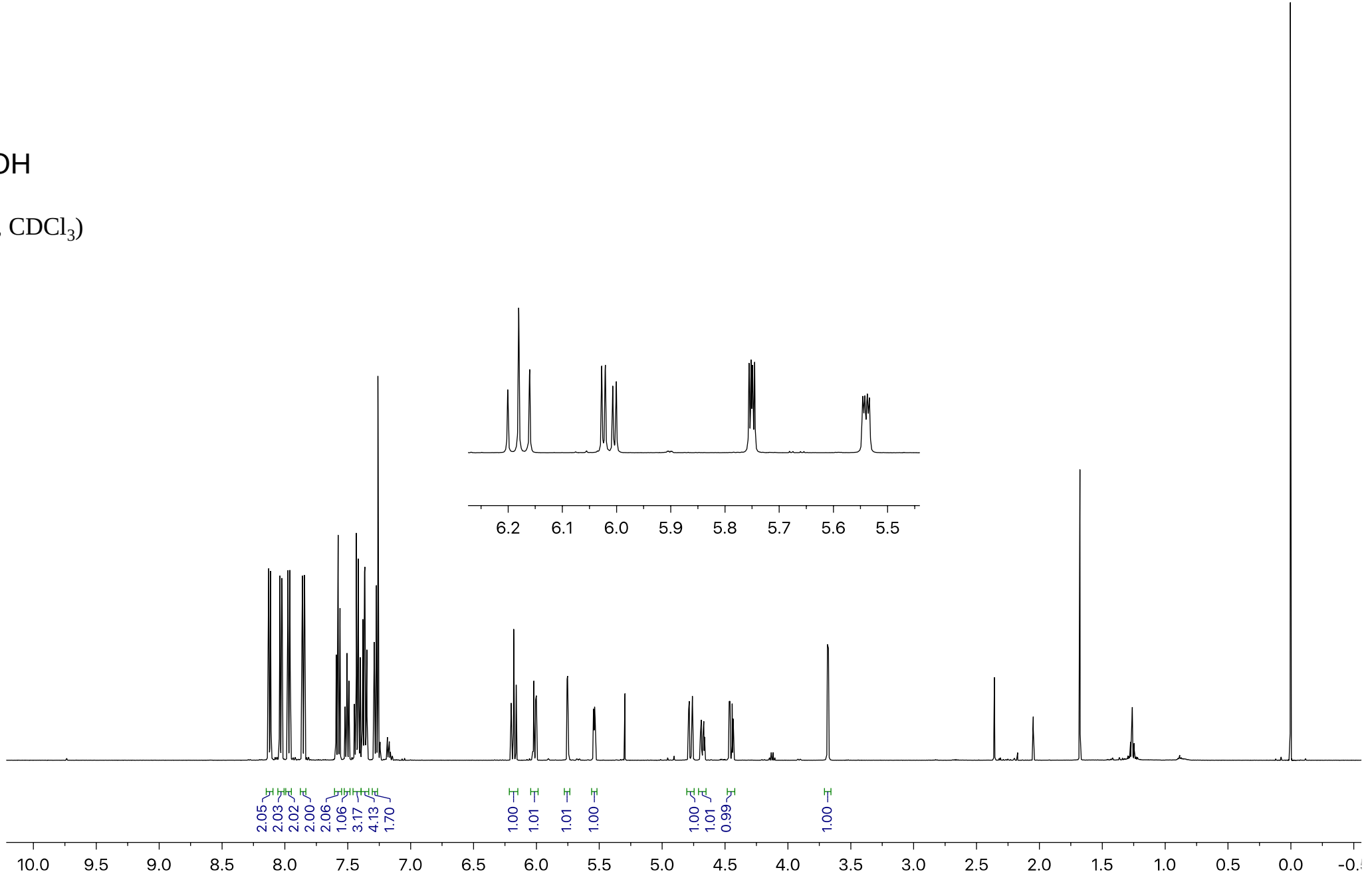
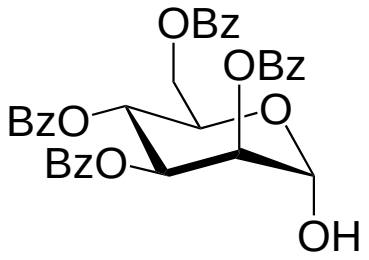




8

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





8

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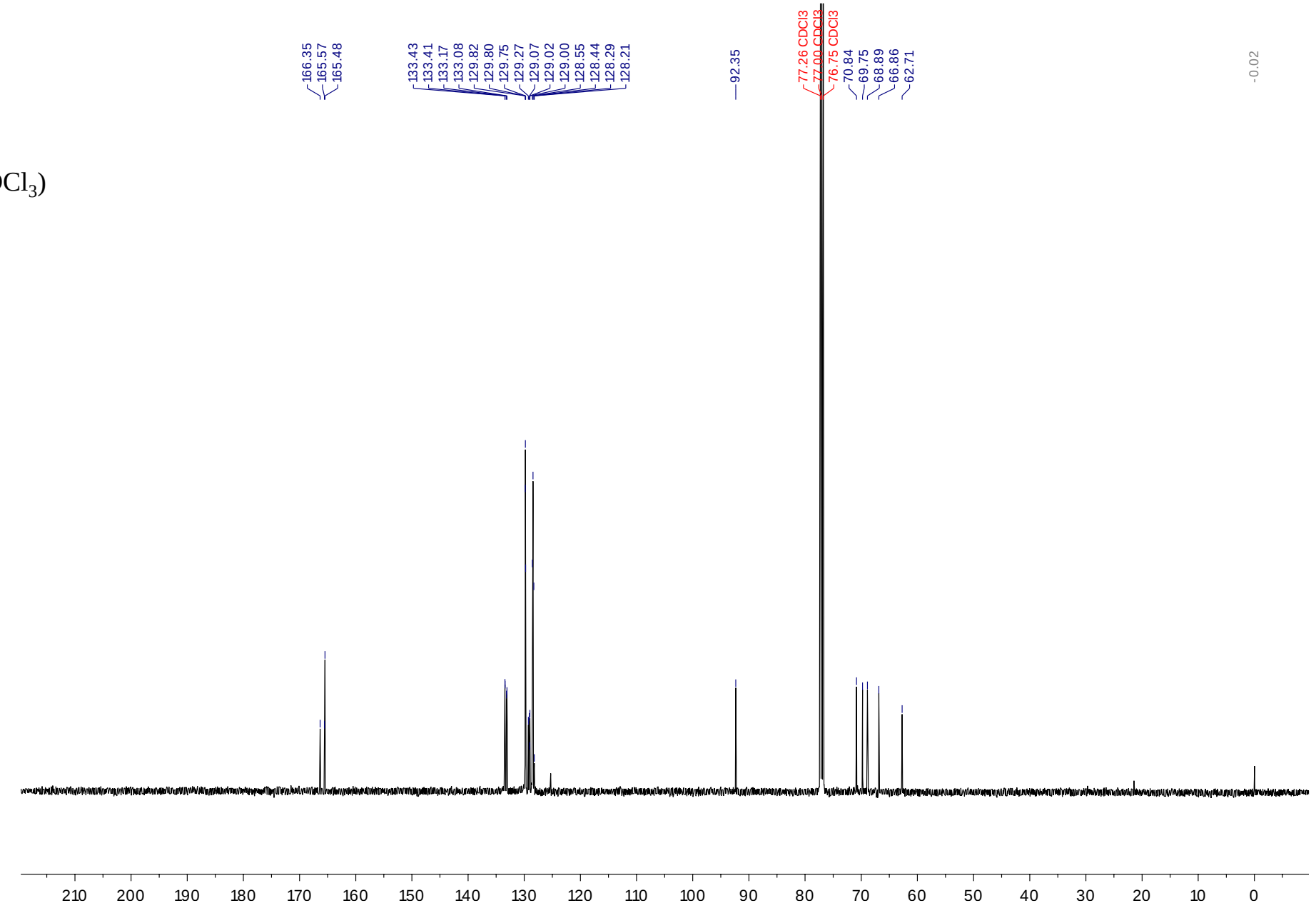
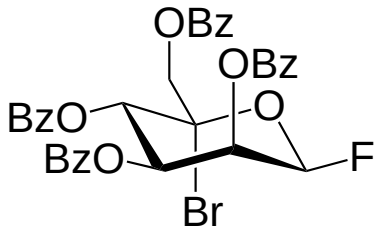
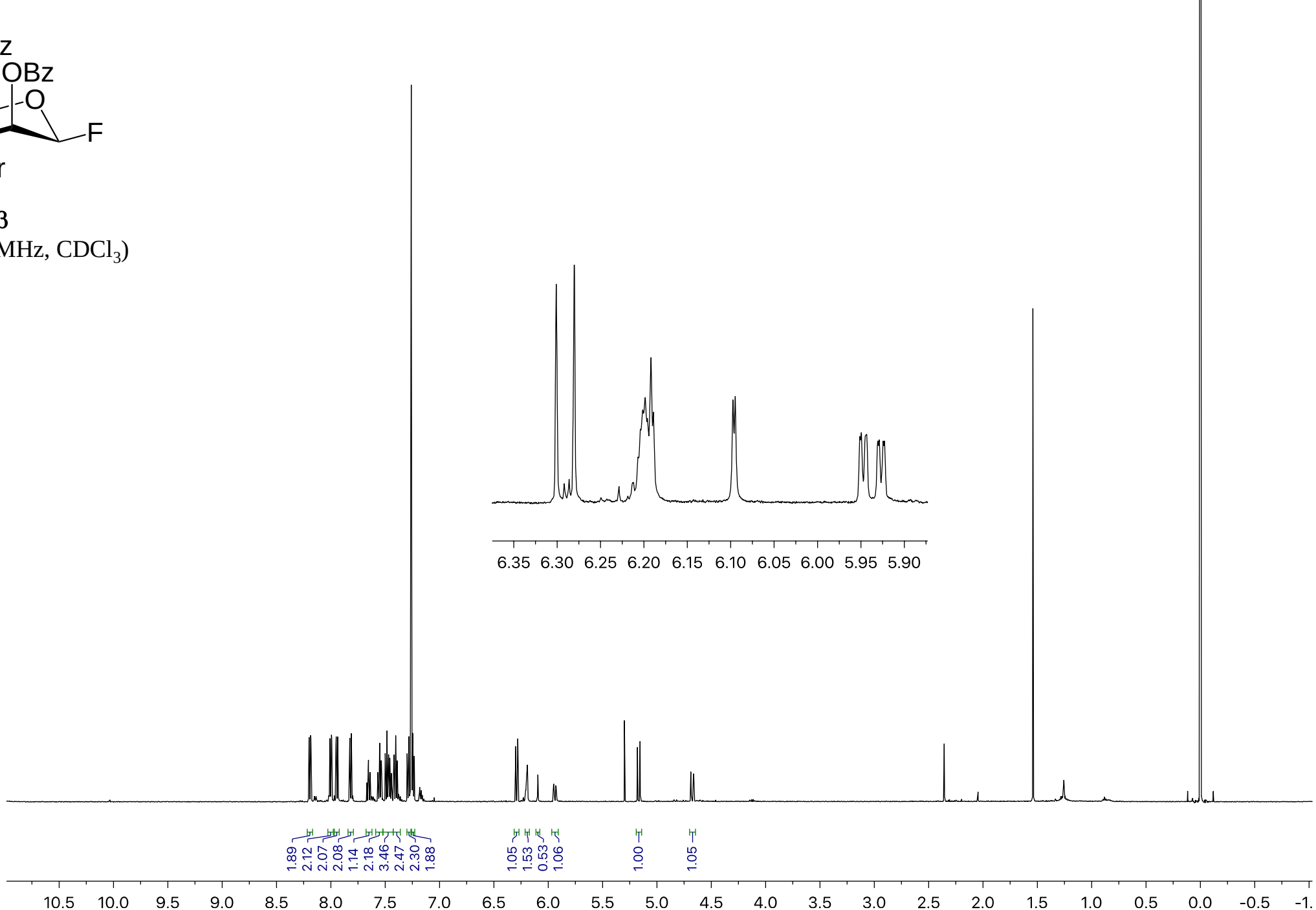
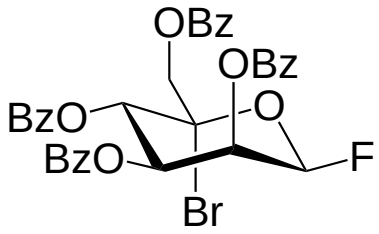




11β

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





11β

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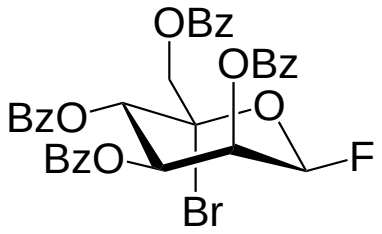

11β

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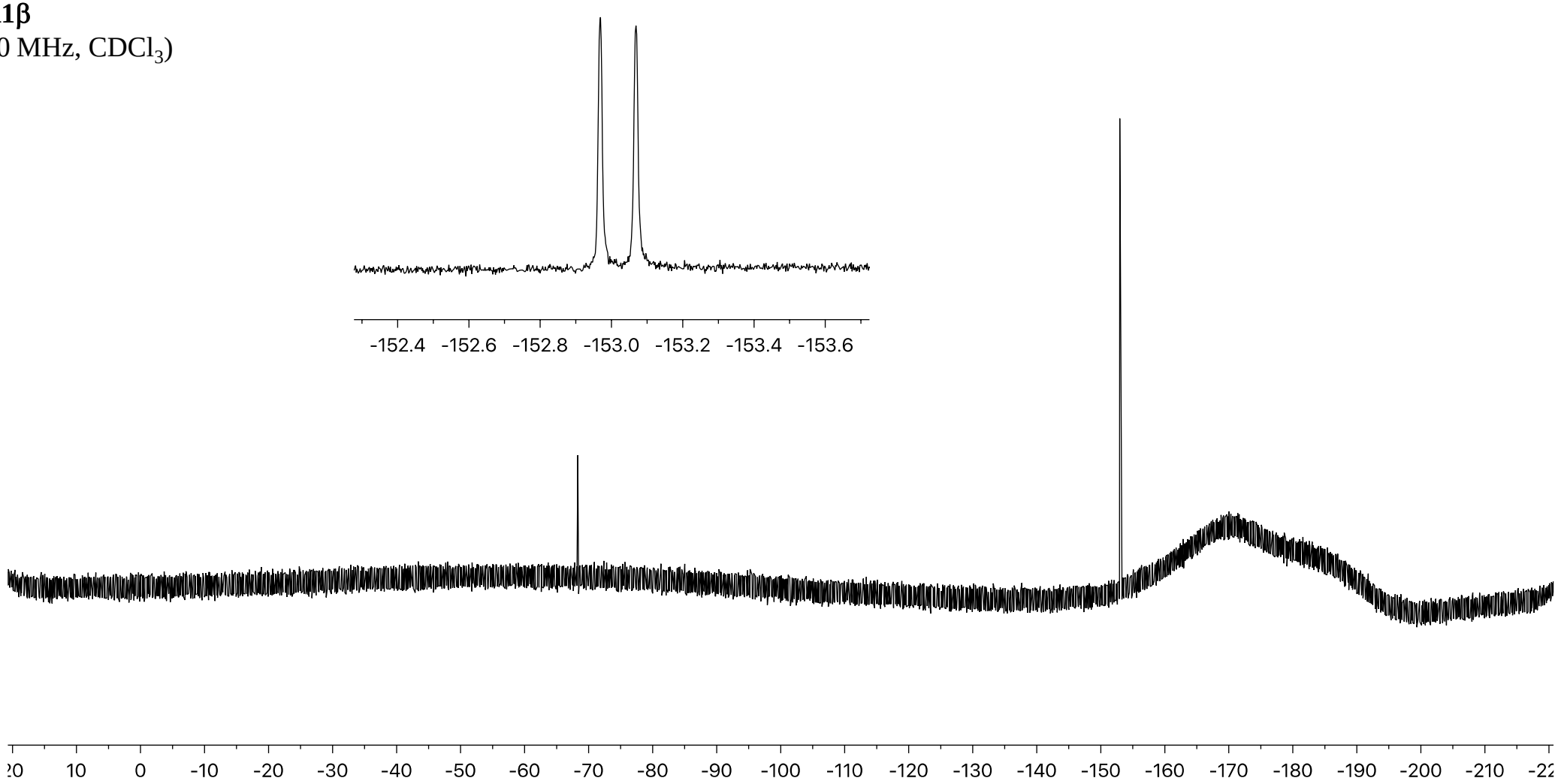

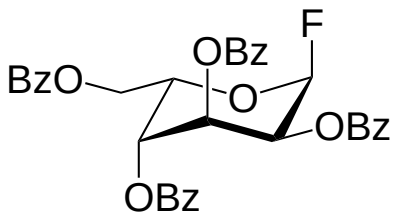

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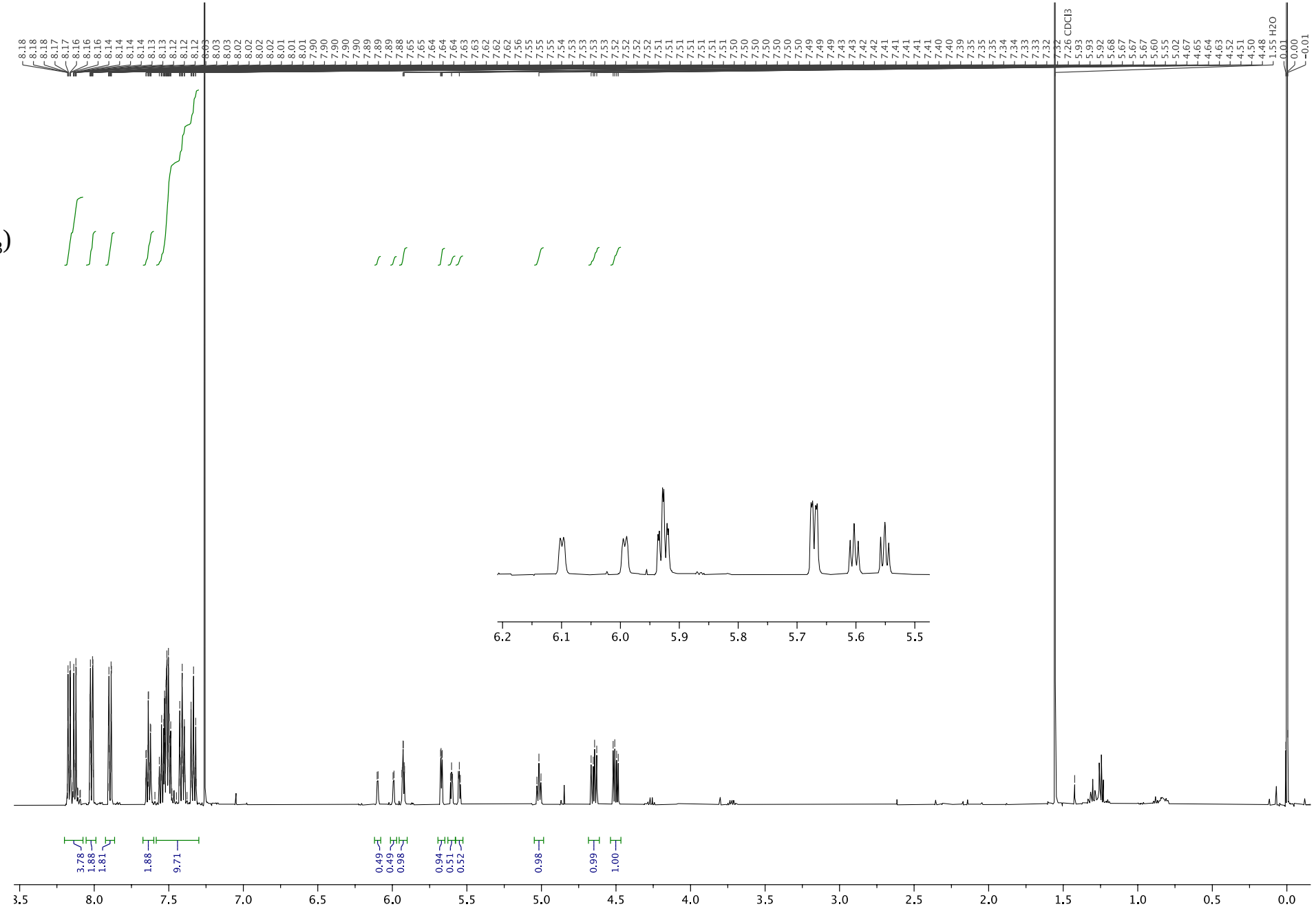
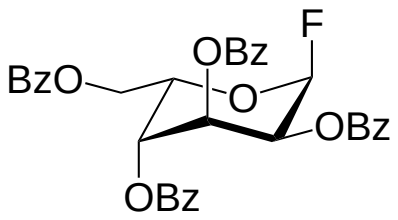
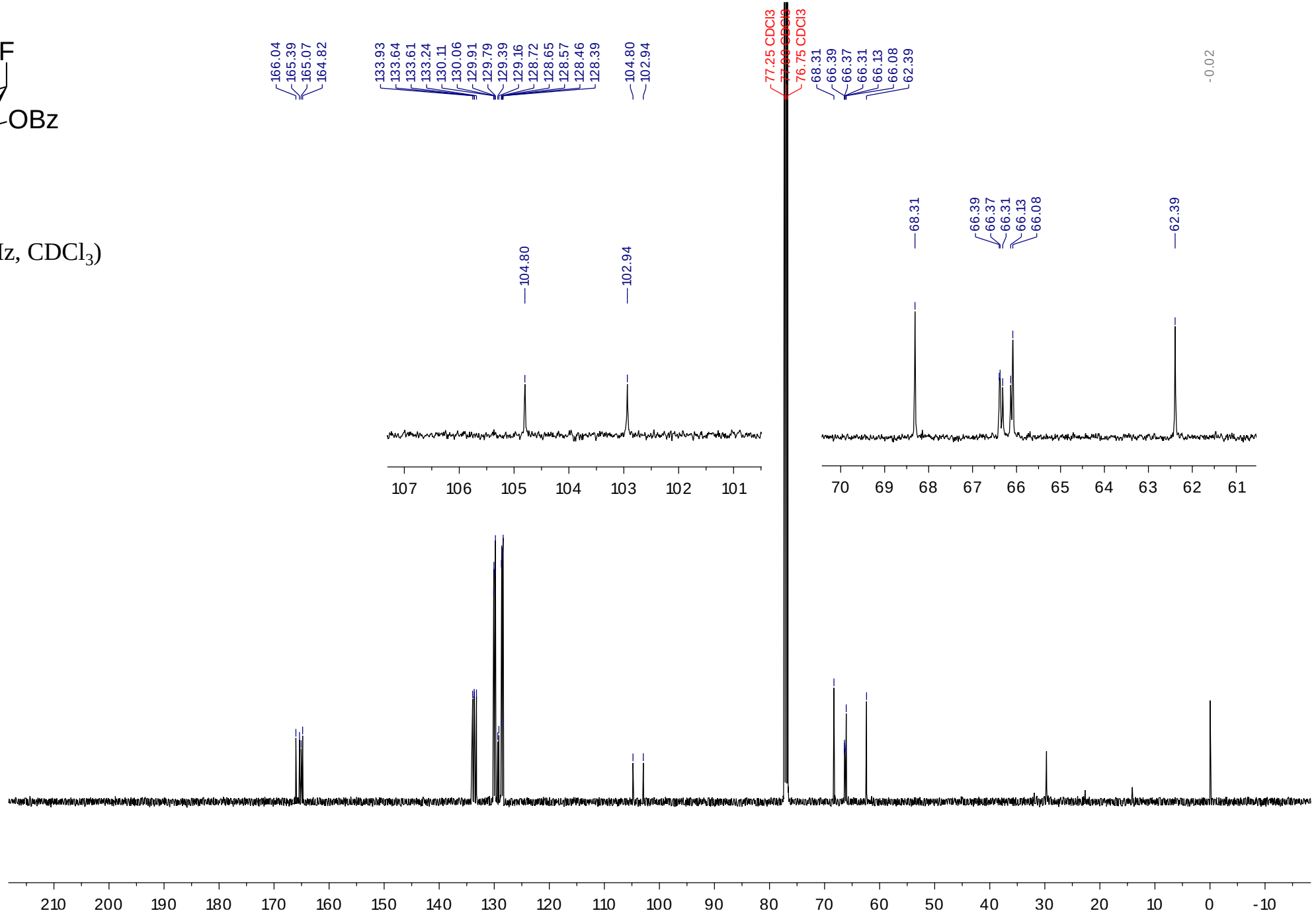
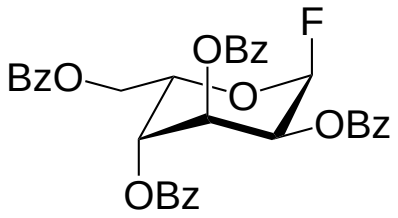




2

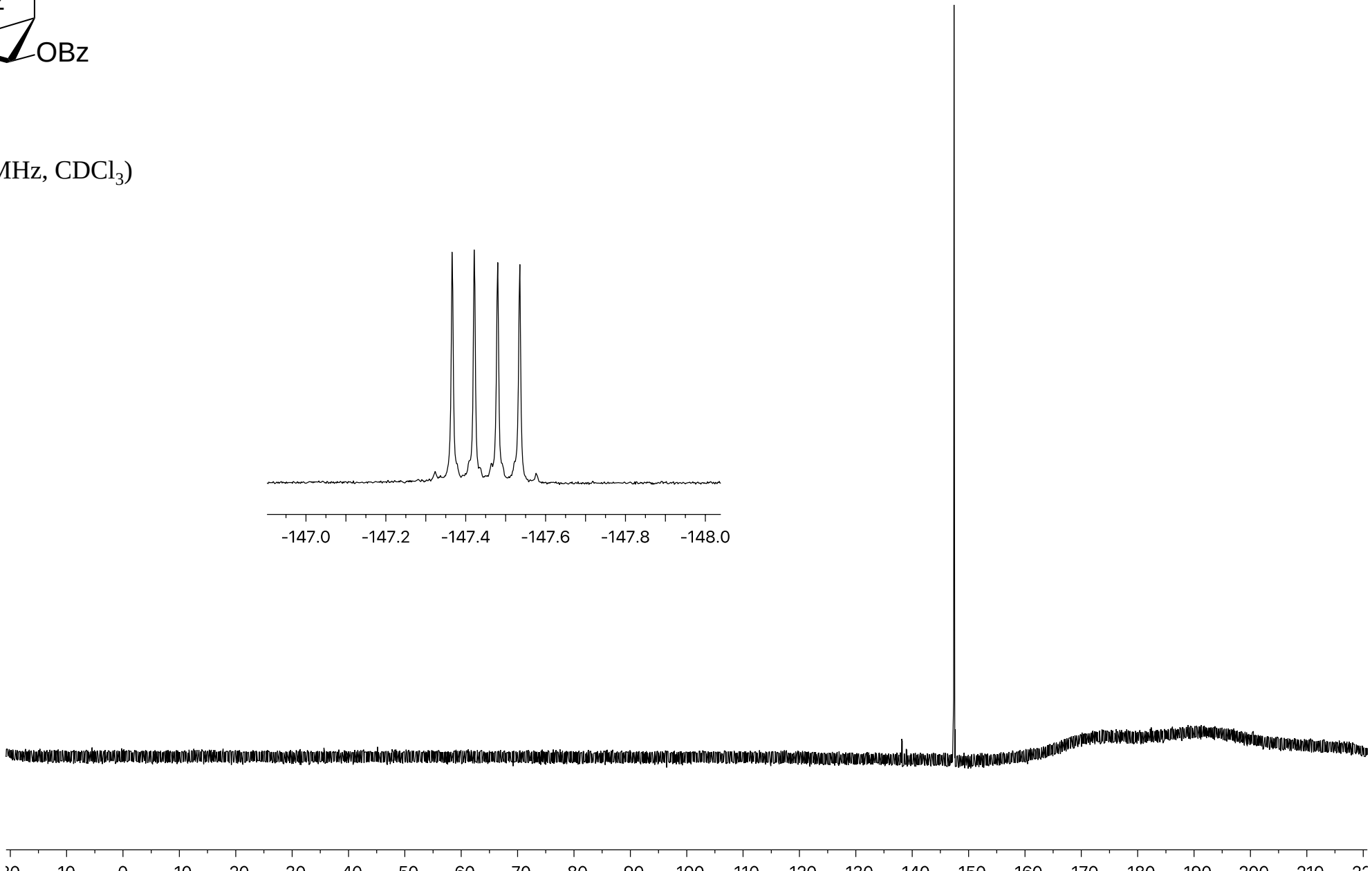
^{13}C NMR (125 MHz, $CDCl_3$)

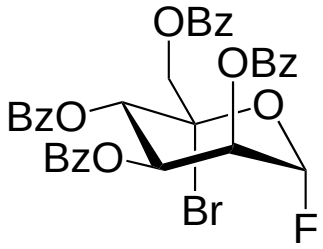




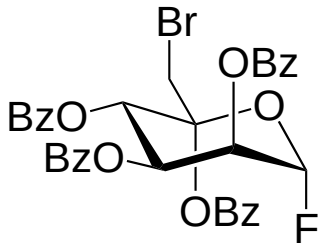
2

^{19}F NMR (470 MHz, $CDCl_3$)



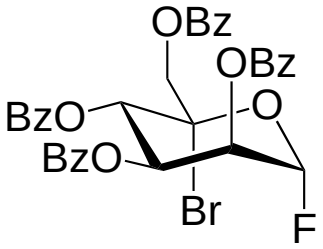


11α

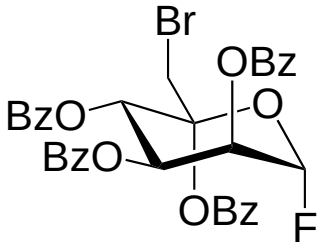


12

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

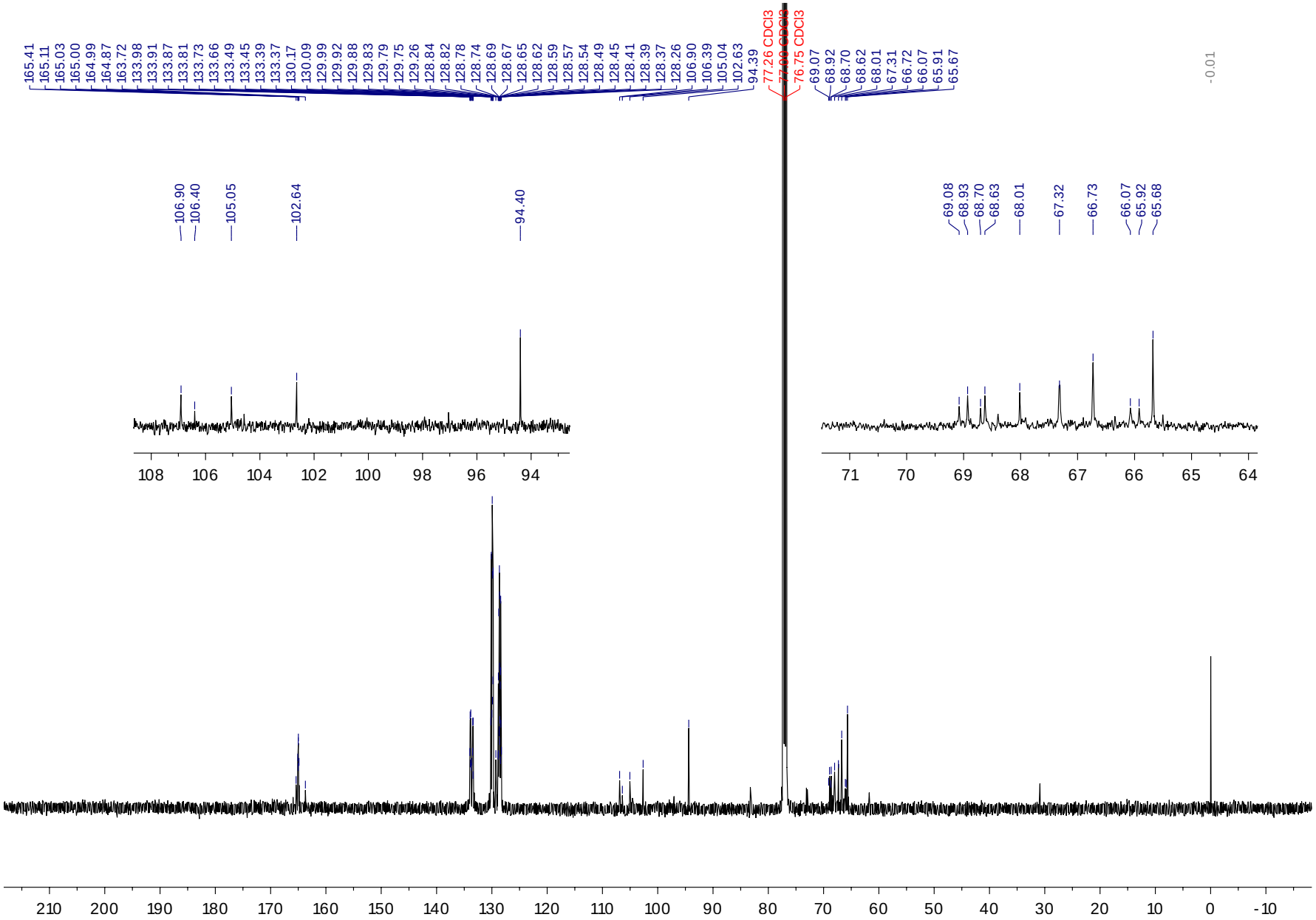


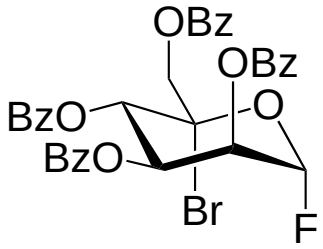
11α



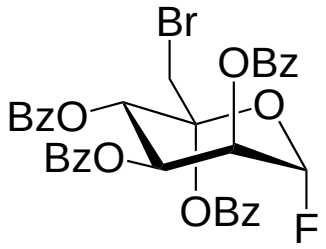
12

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



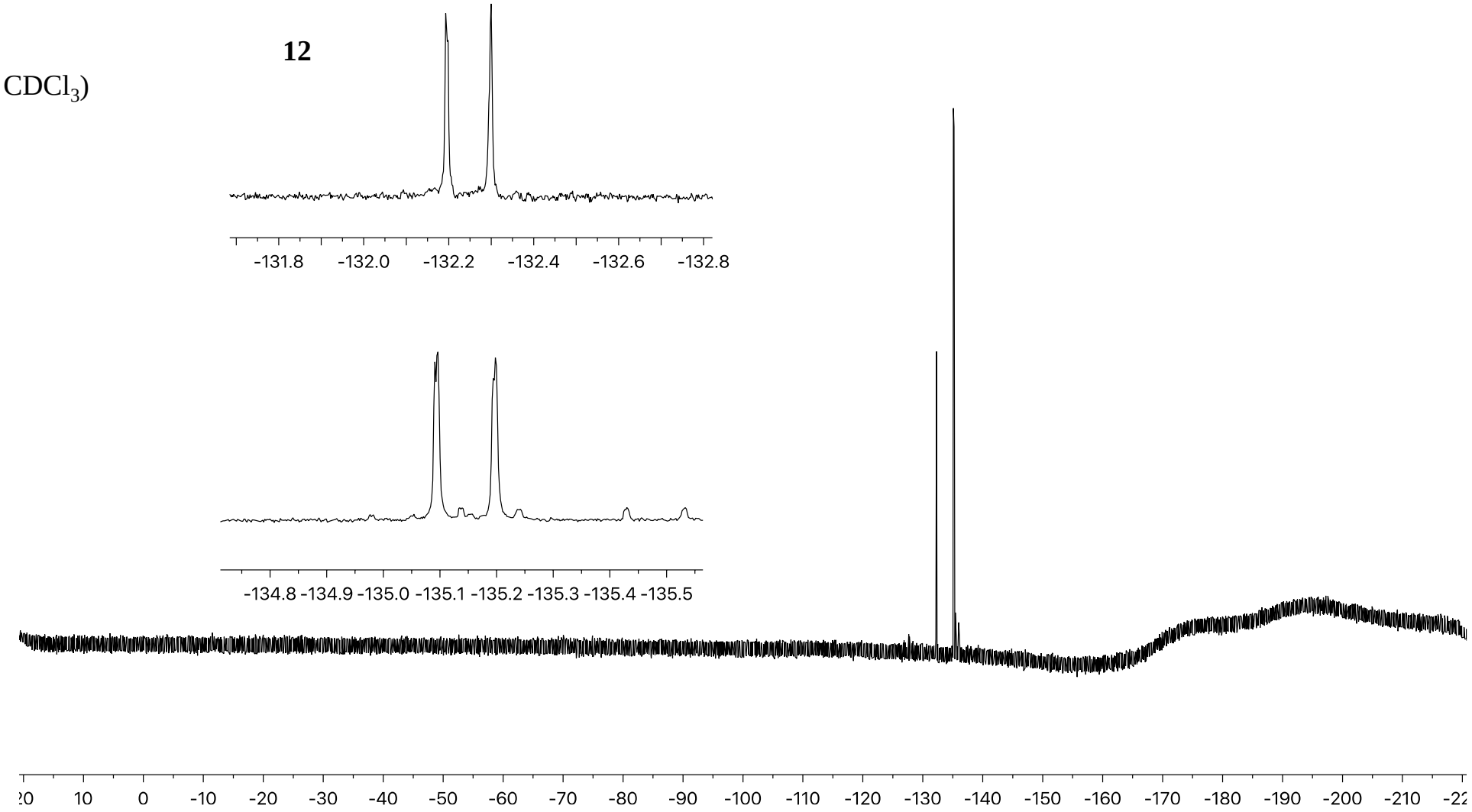


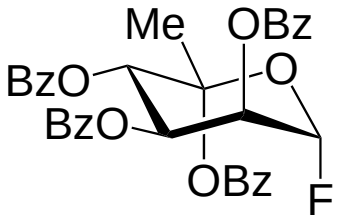
11α



12

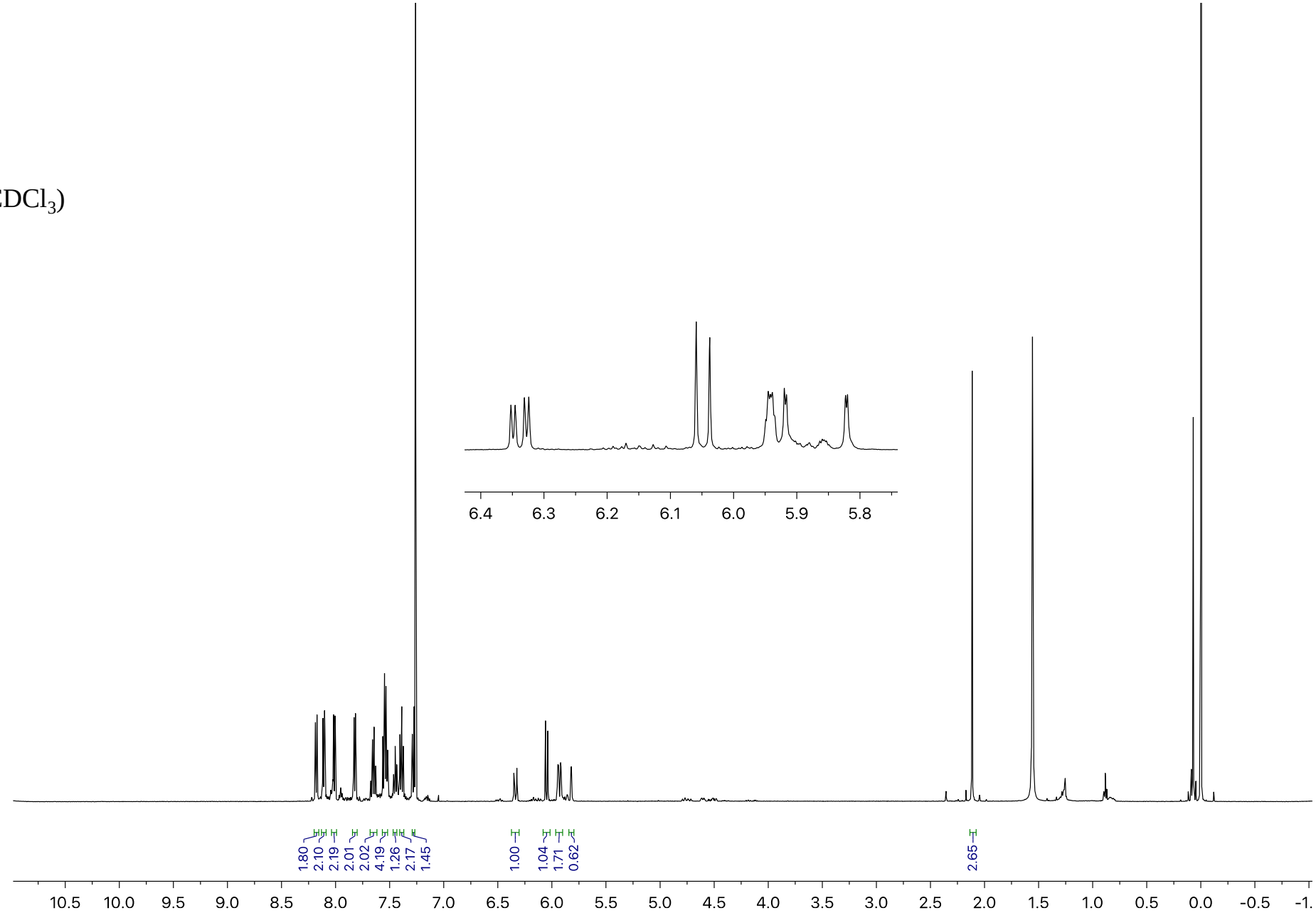
^{19}F NMR (470 MHz, $CDCl_3$)

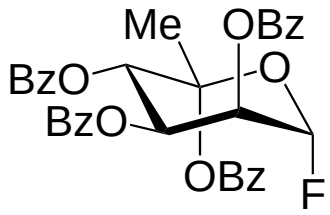




15

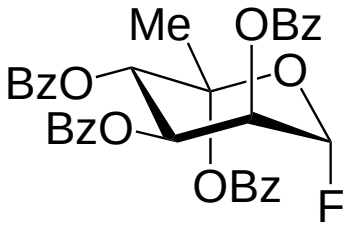
^{1}H NMR (500 MHz, $CDCl_3$)





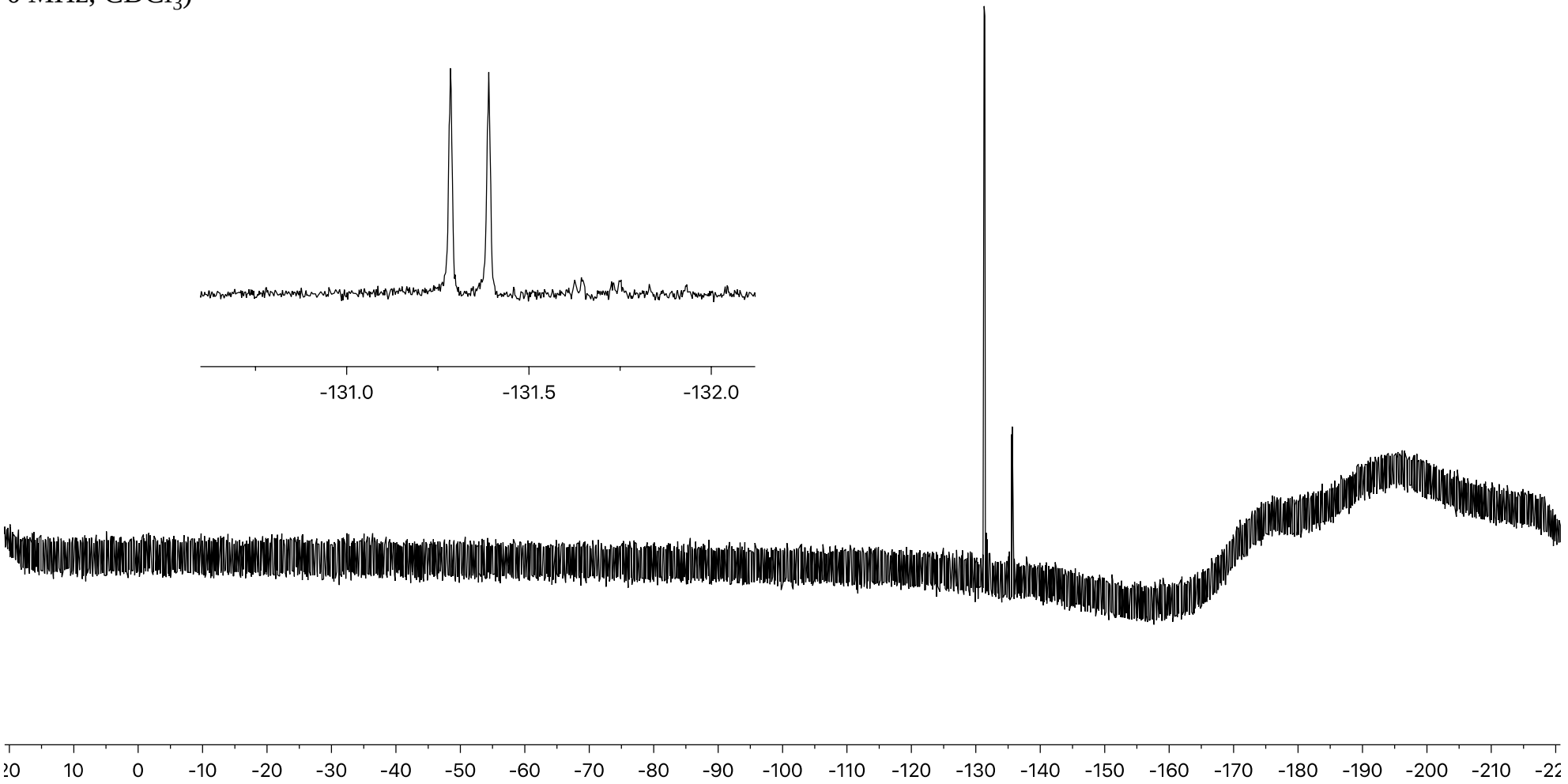
15

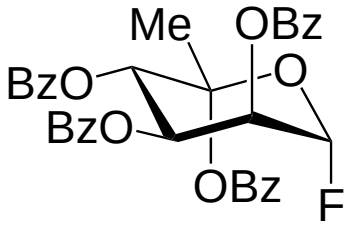
^{13}C NMR (125 MHz, $CDCl_3$)



15

^{19}F NMR (470 MHz, $CDCl_3$)





15

2-D NOESY (500 MHz, $CDCl_3$)