Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

An Efficient and Scalable Synthesis of 2,4-Di-N-acetyl-L-altrose (L-2,4-Alt-DiNAc)

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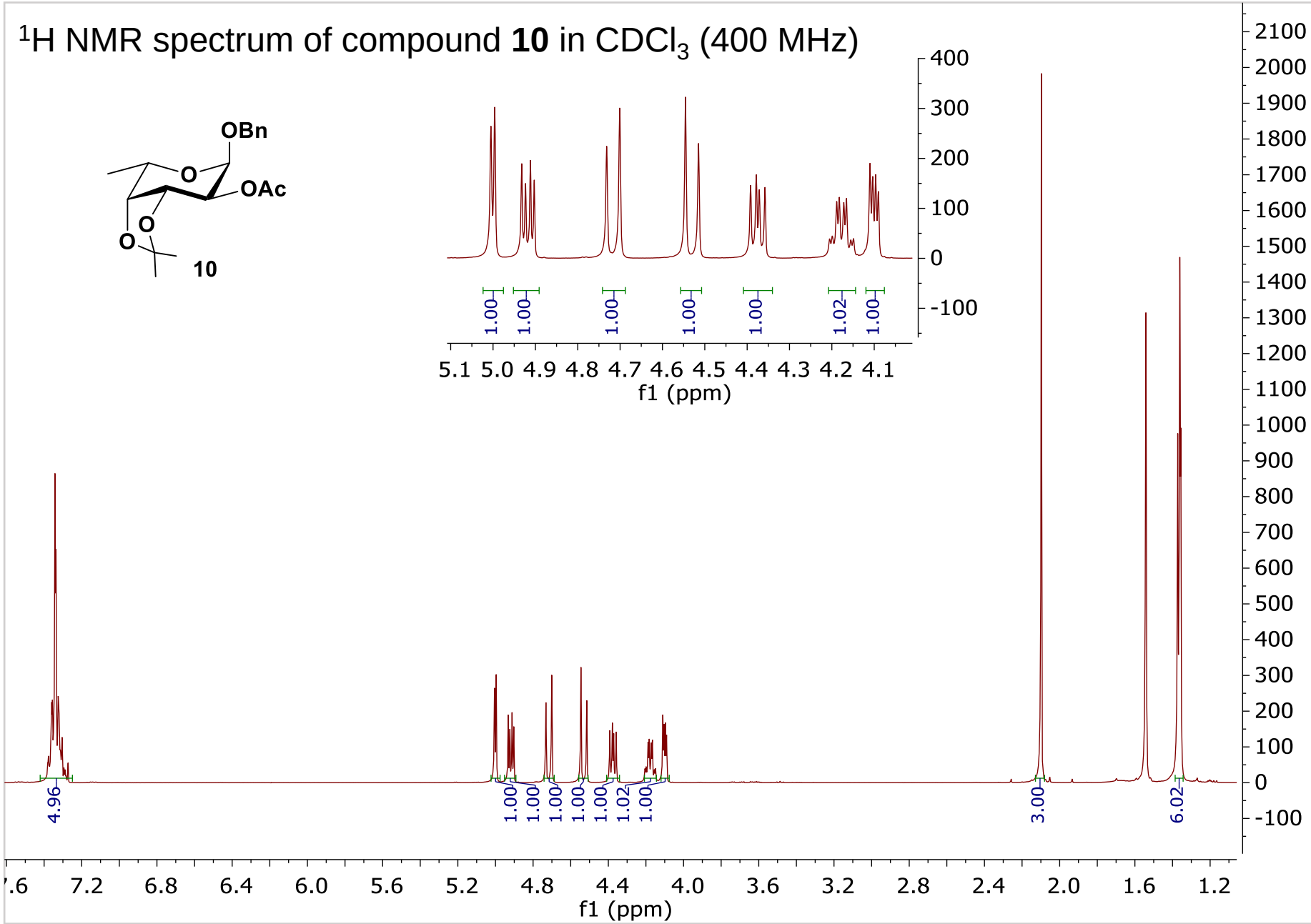
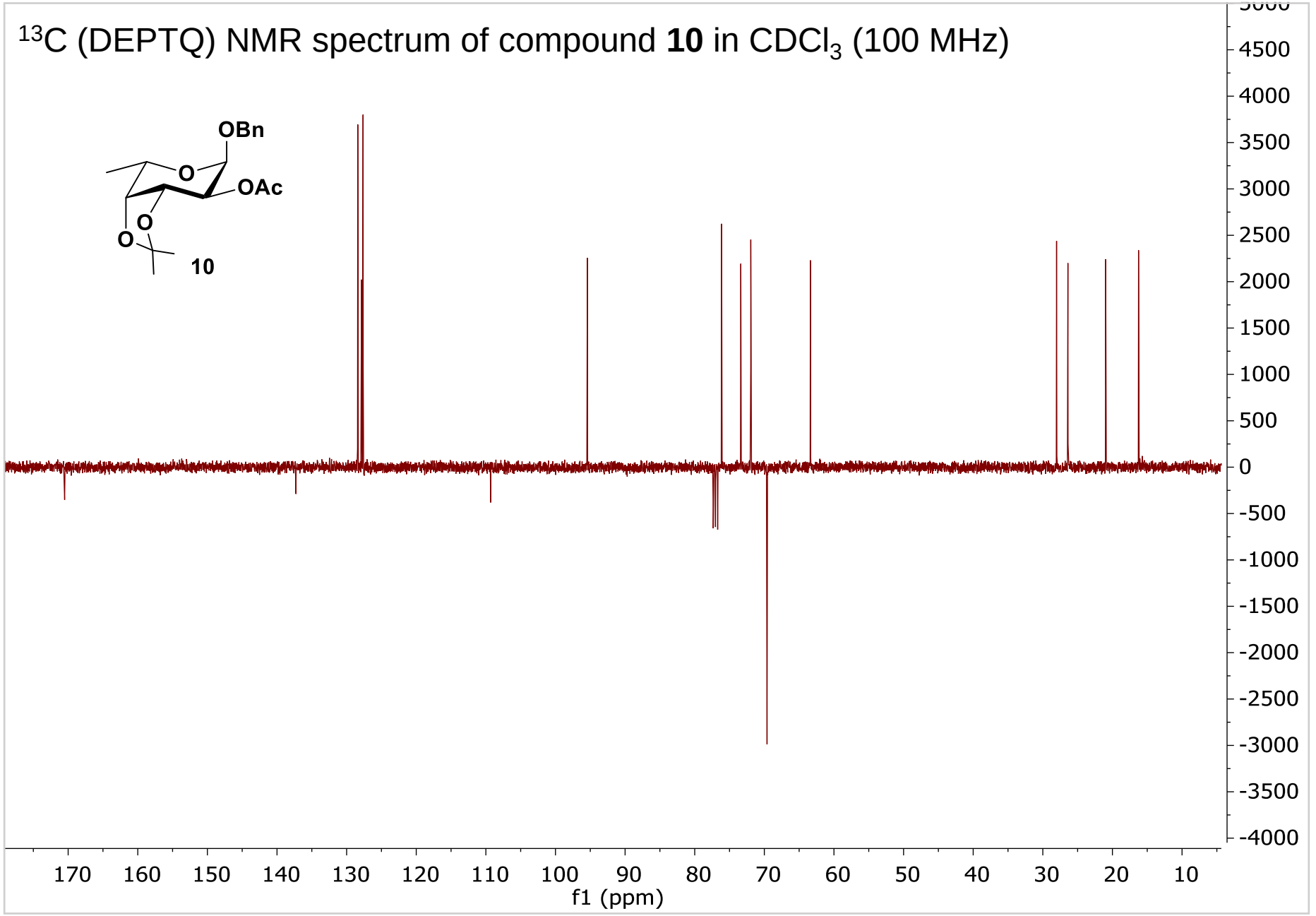
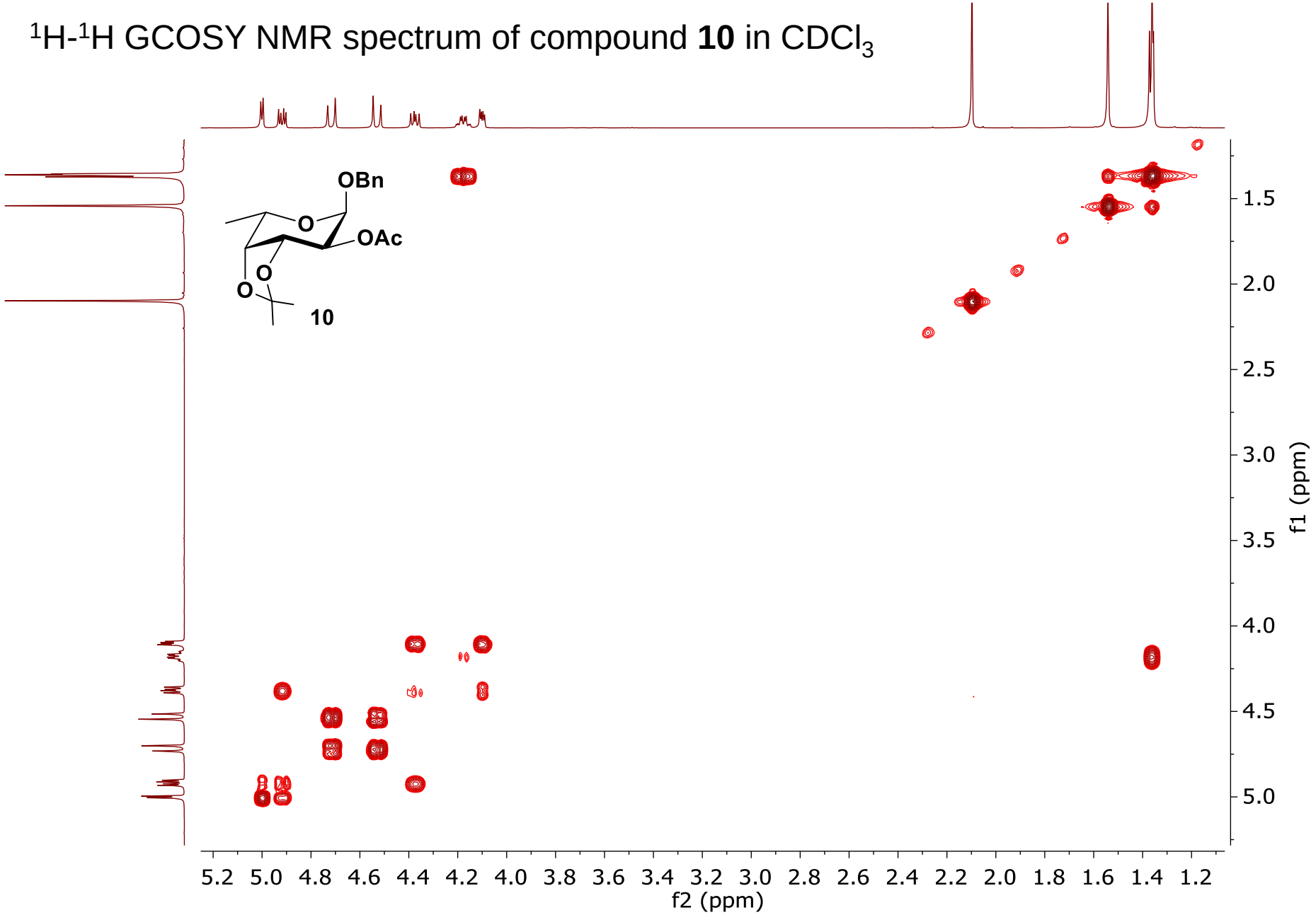
^{1}H NMR spectrum of compound **10** in $CDCl_3$ (400 MHz)

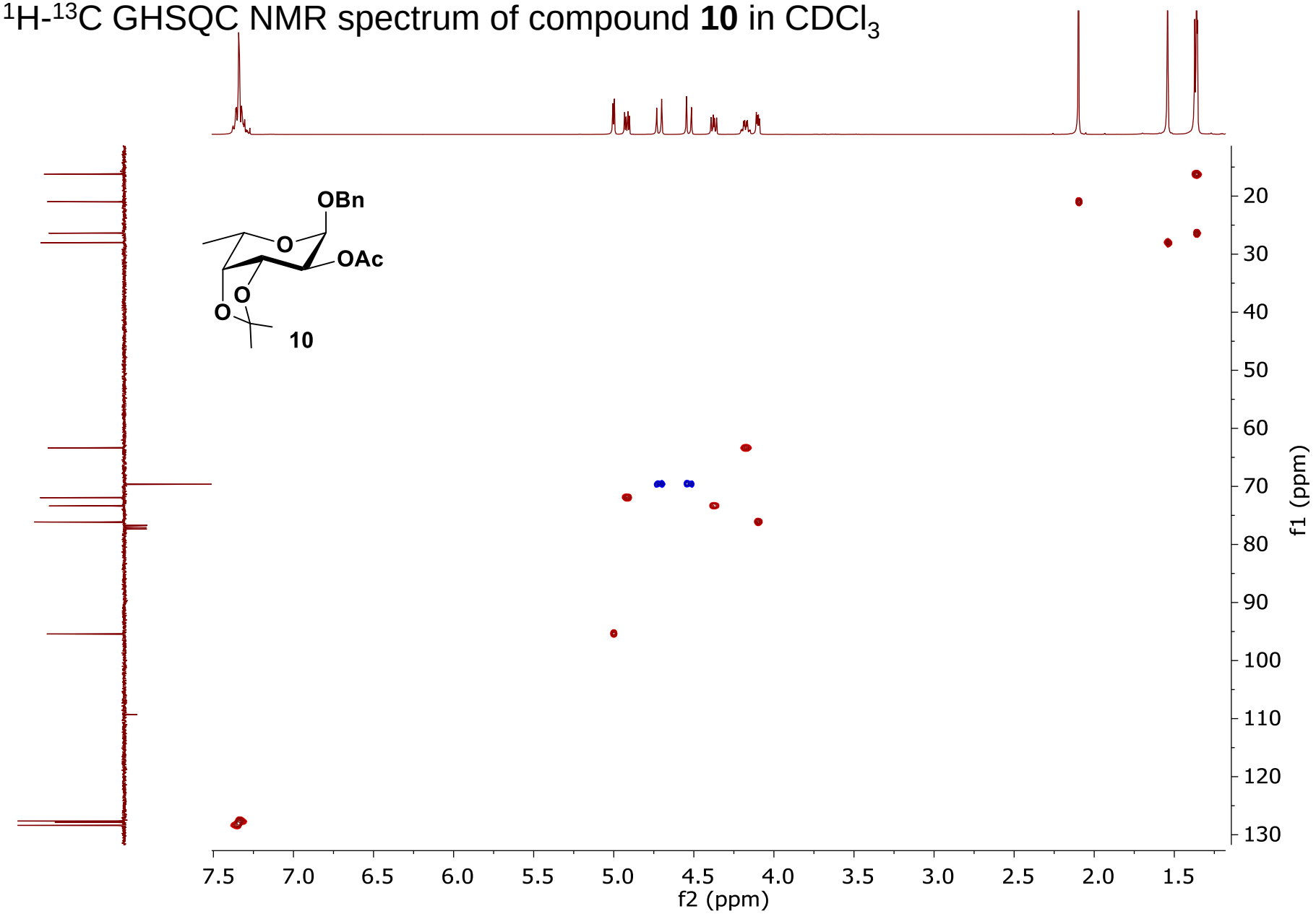



^{13}C (DEPTQ) NMR spectrum of compound **10** in $CDCl_3$ (100 MHz)
OBn
O
OAc
O
O
10
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

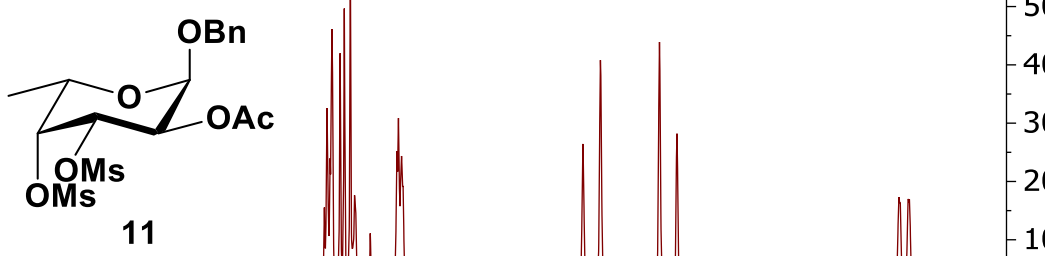
^{1}H-^{1}H GCOSY NMR spectrum of compound **10** in $CDCl_3$



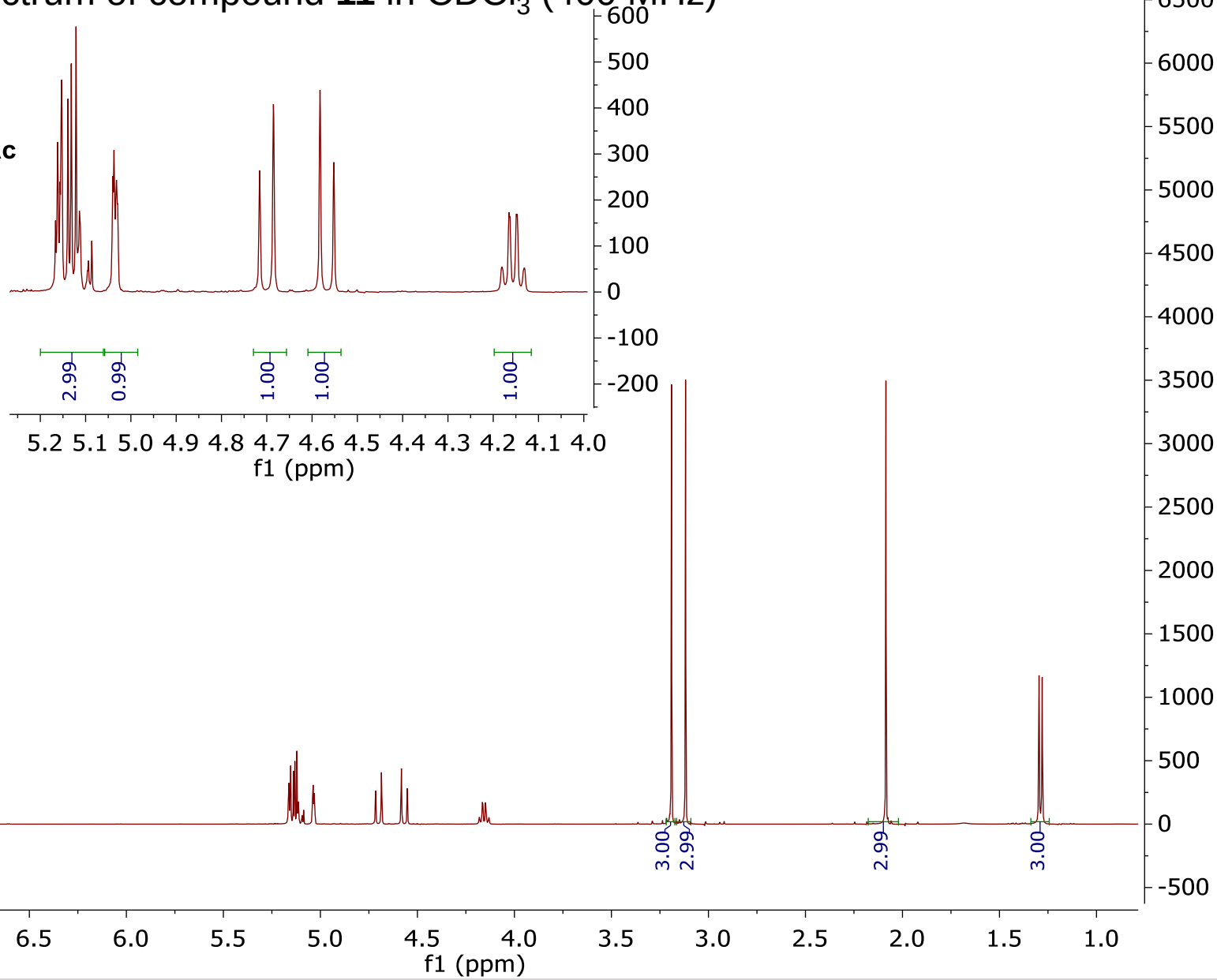
^{1}H-^{13}C GHSQC NMR spectrum of compound **10** in $CDCl_3$

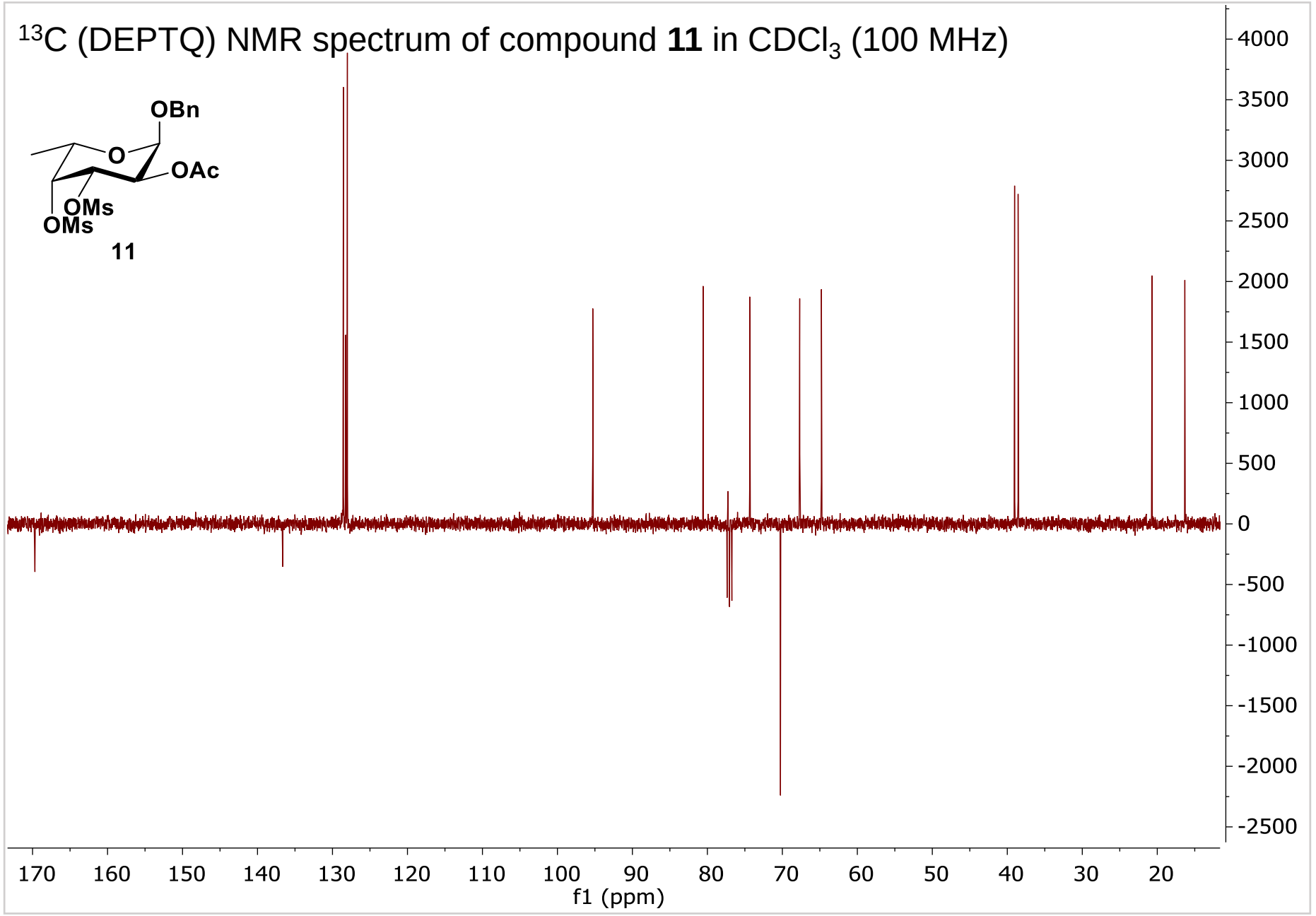


^{1}H NMR spectrum of compound **11** in $CDCl_3$ (400 MHz)

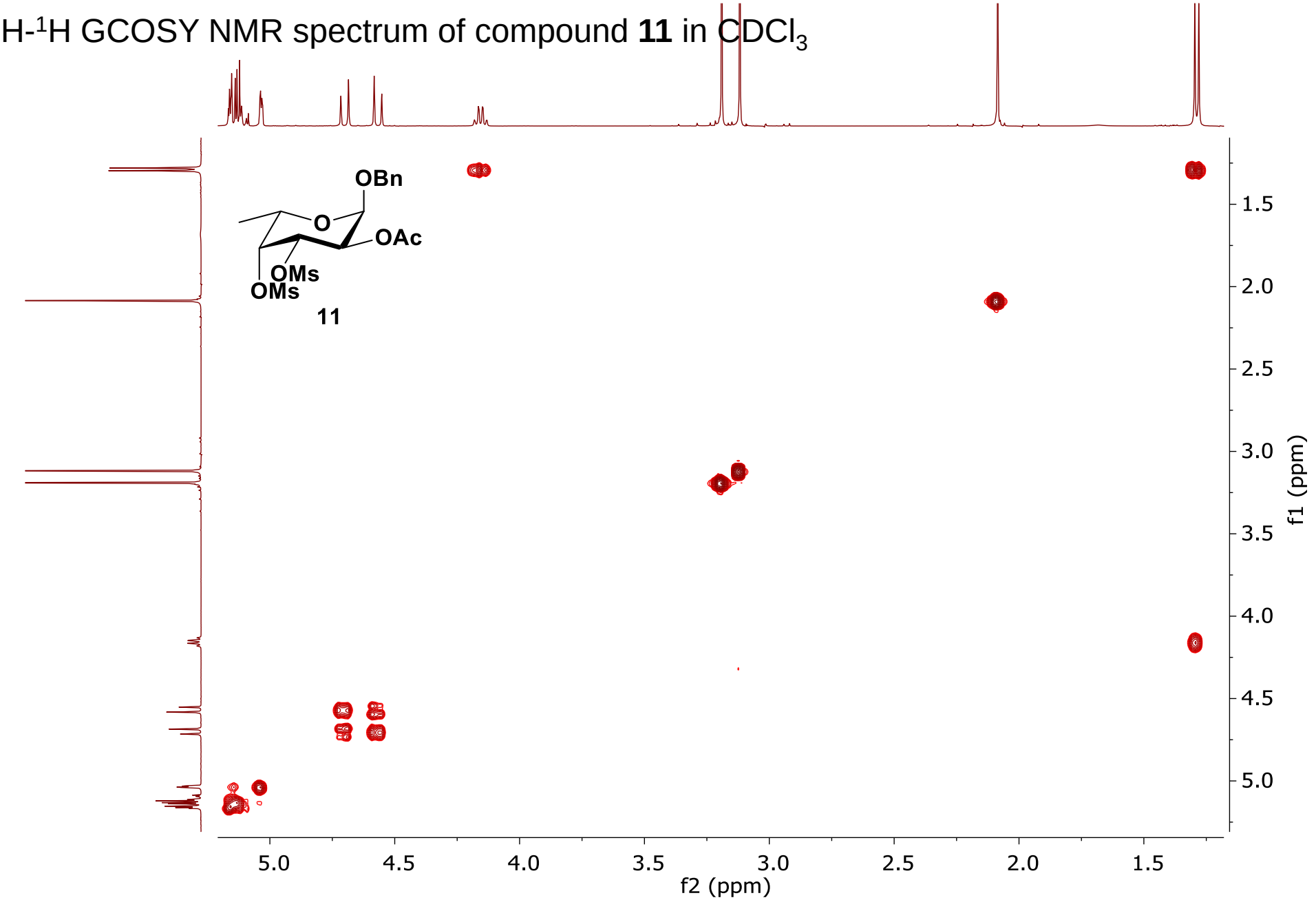


11

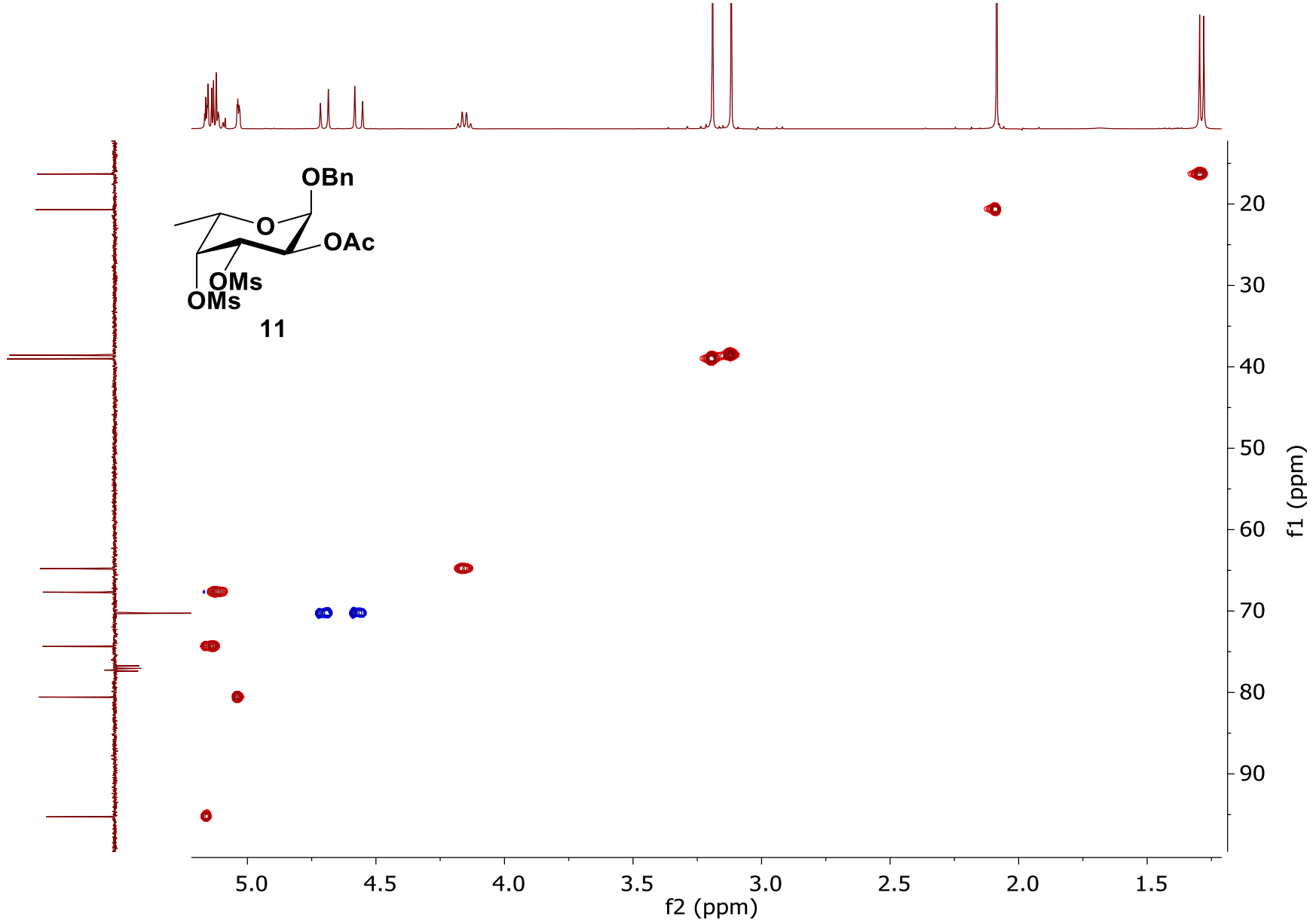



^{13}C (DEPTQ) NMR spectrum of compound **11** in $CDCl_3$ (100 MHz)
OBn
O
OAc
OMs
OMs
11
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **11** in $CDCl_3$

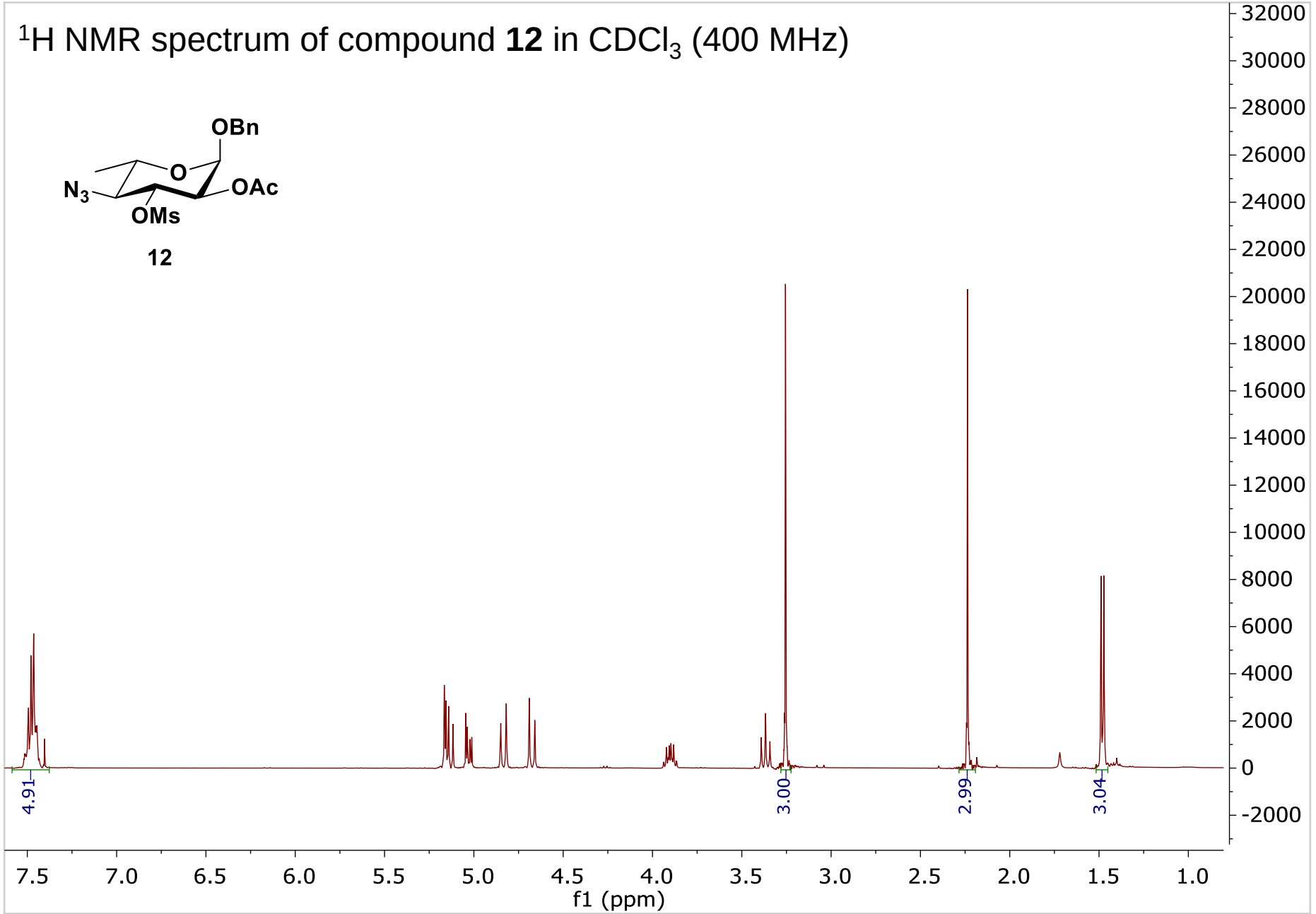


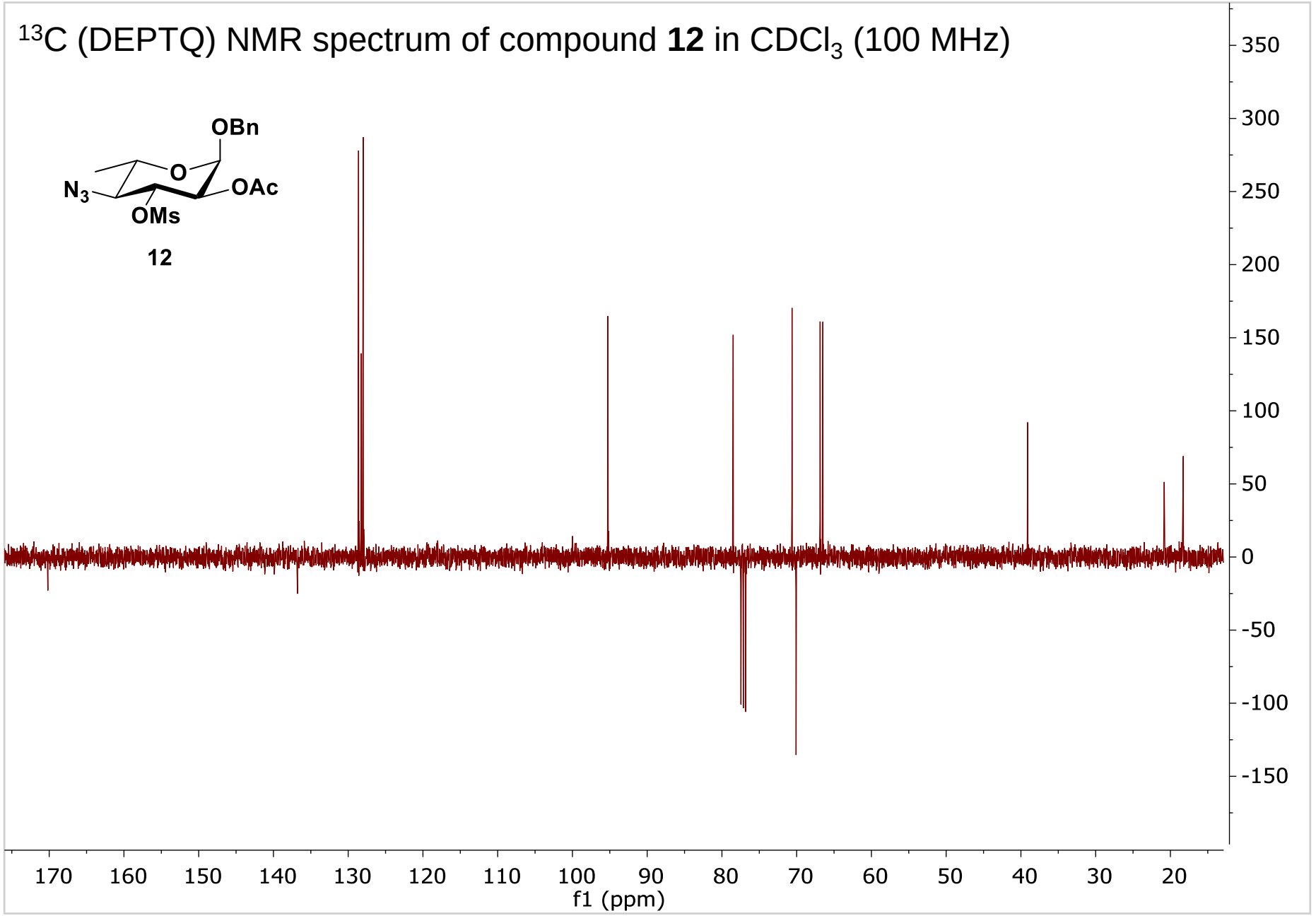
^{1}H-^{13}C GHSQC NMR spectrum of compound **11** in $CDCl_3$



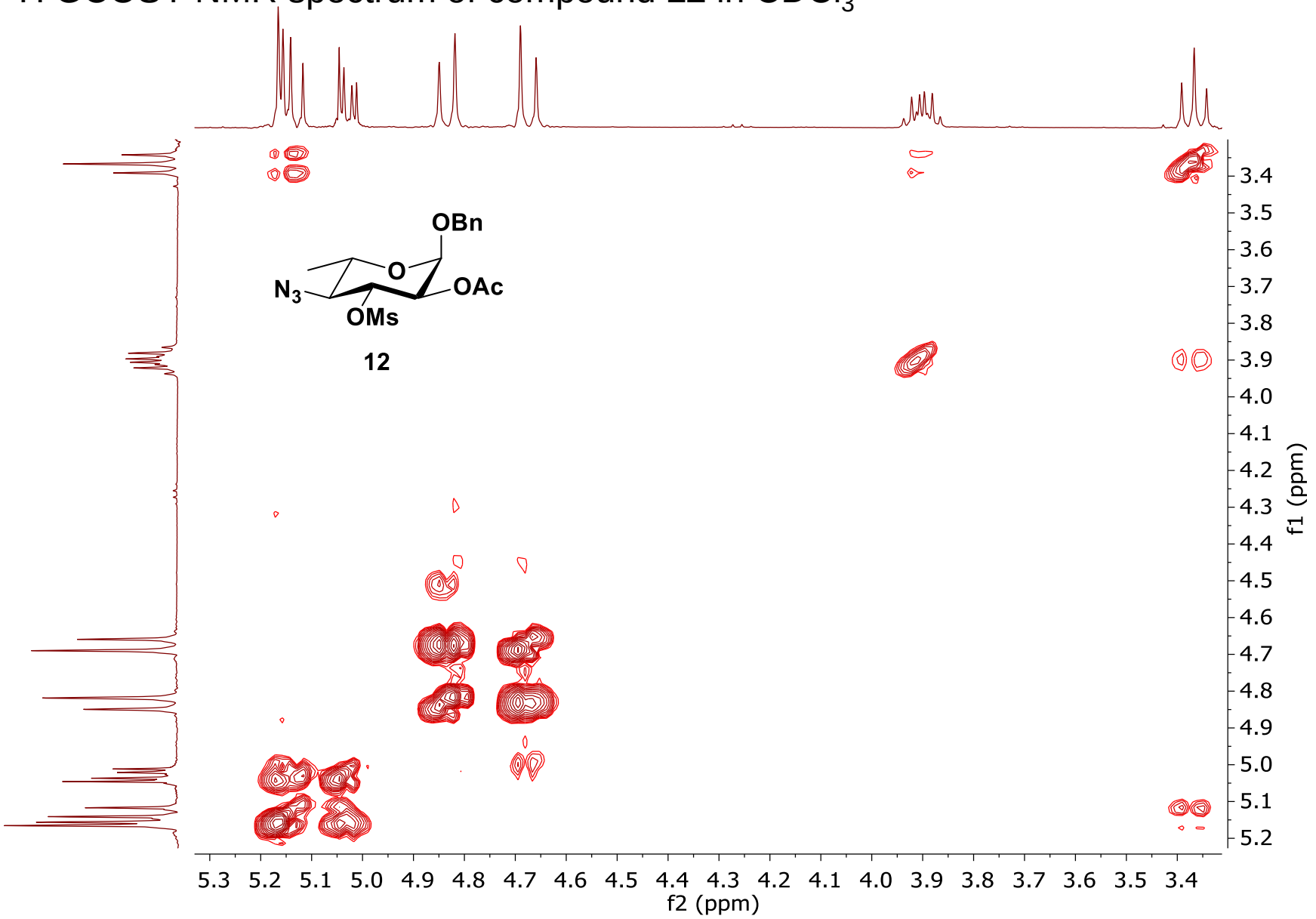
^{1}H NMR spectrum of compound **12** in $CDCl_3$ (400 MHz)

12

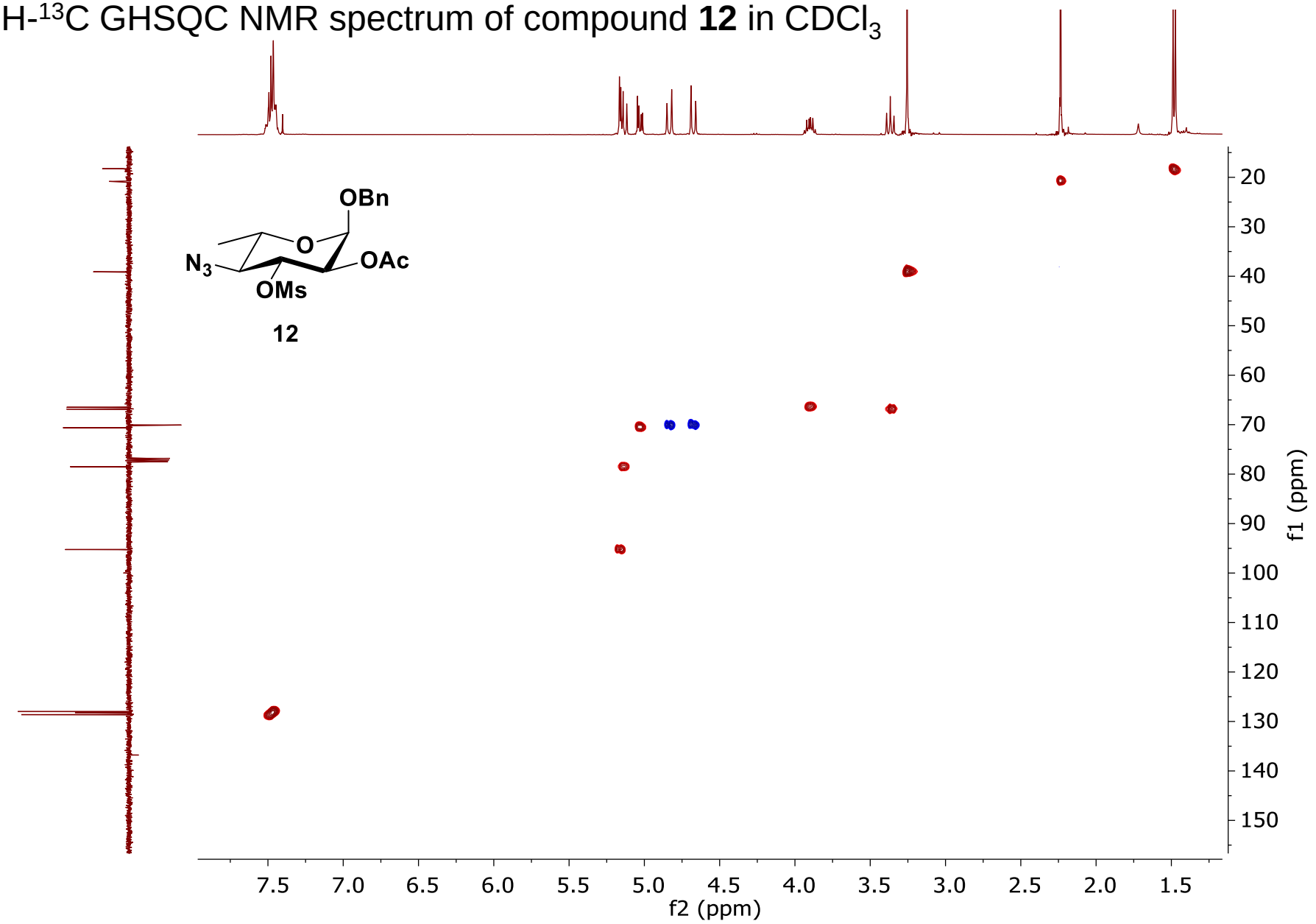



^{13}C (DEPTQ) NMR spectrum of compound **12** in $CDCl_3$ (100 MHz)
OBn
O
OAc
N_3
OMs
12
350
300
250
200
150
100
50
0
-50
-100
-150
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **12** in $CDCl_3$

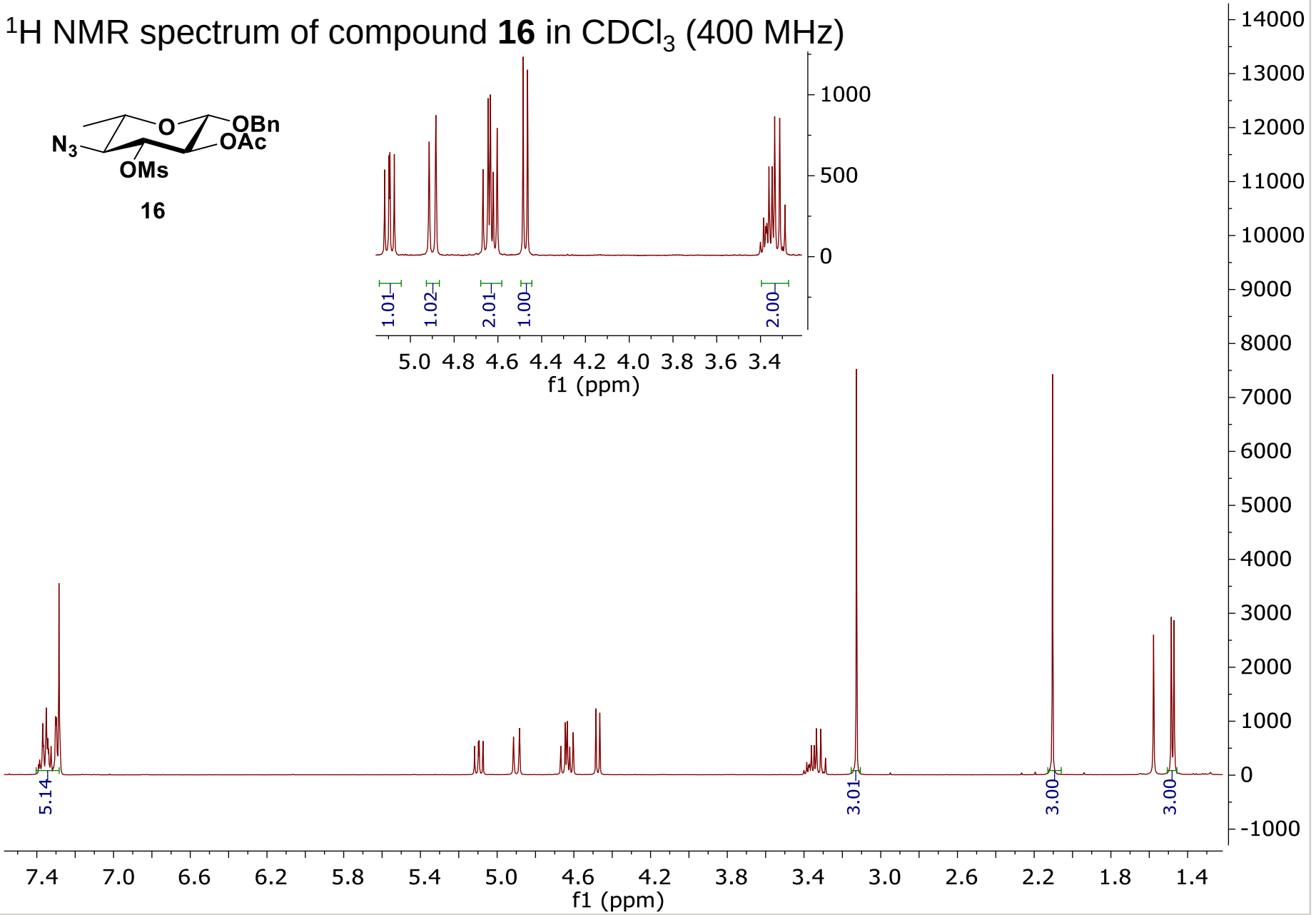


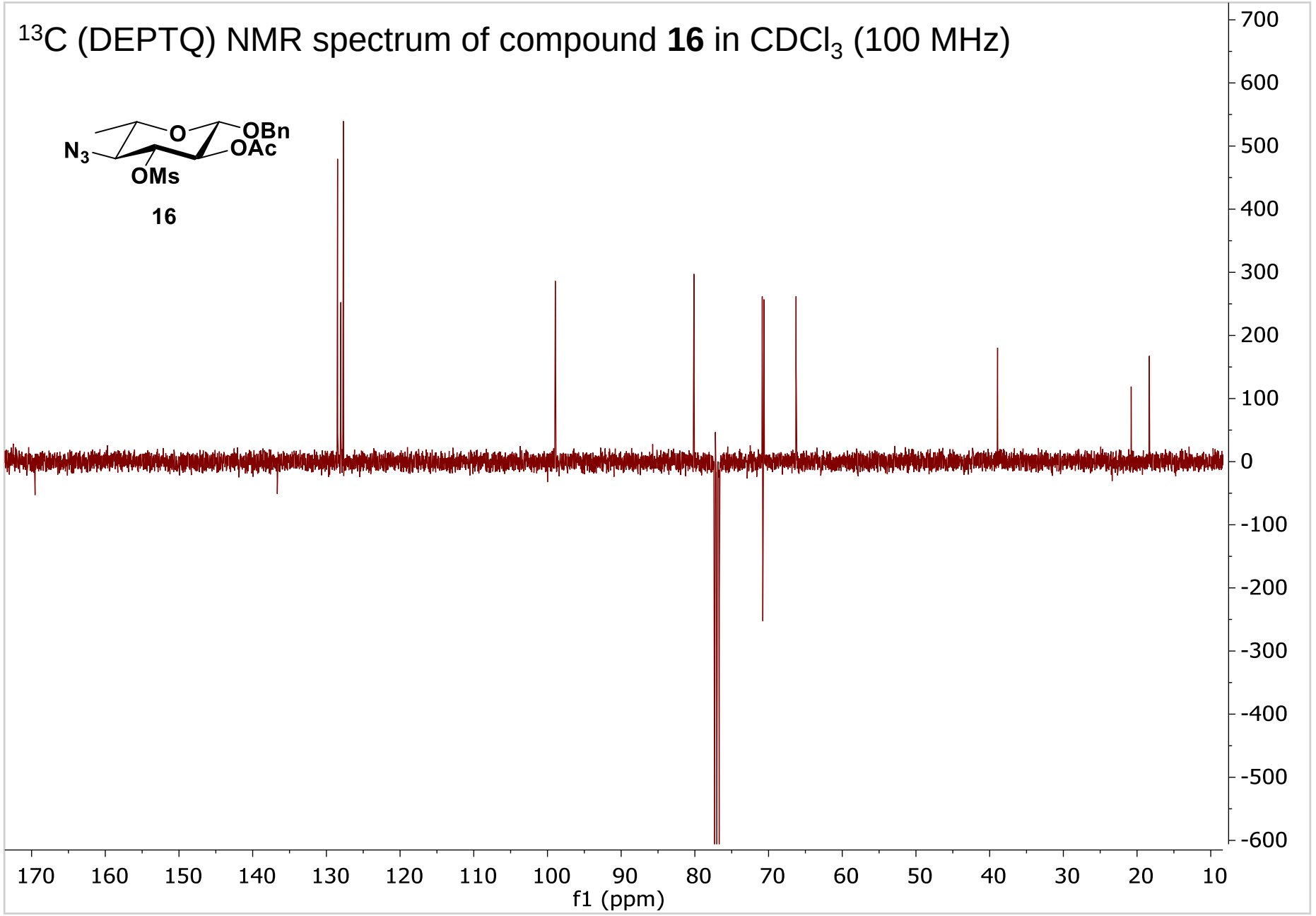
^{1}H-^{13}C GHSQC NMR spectrum of compound **12** in $CDCl_3$



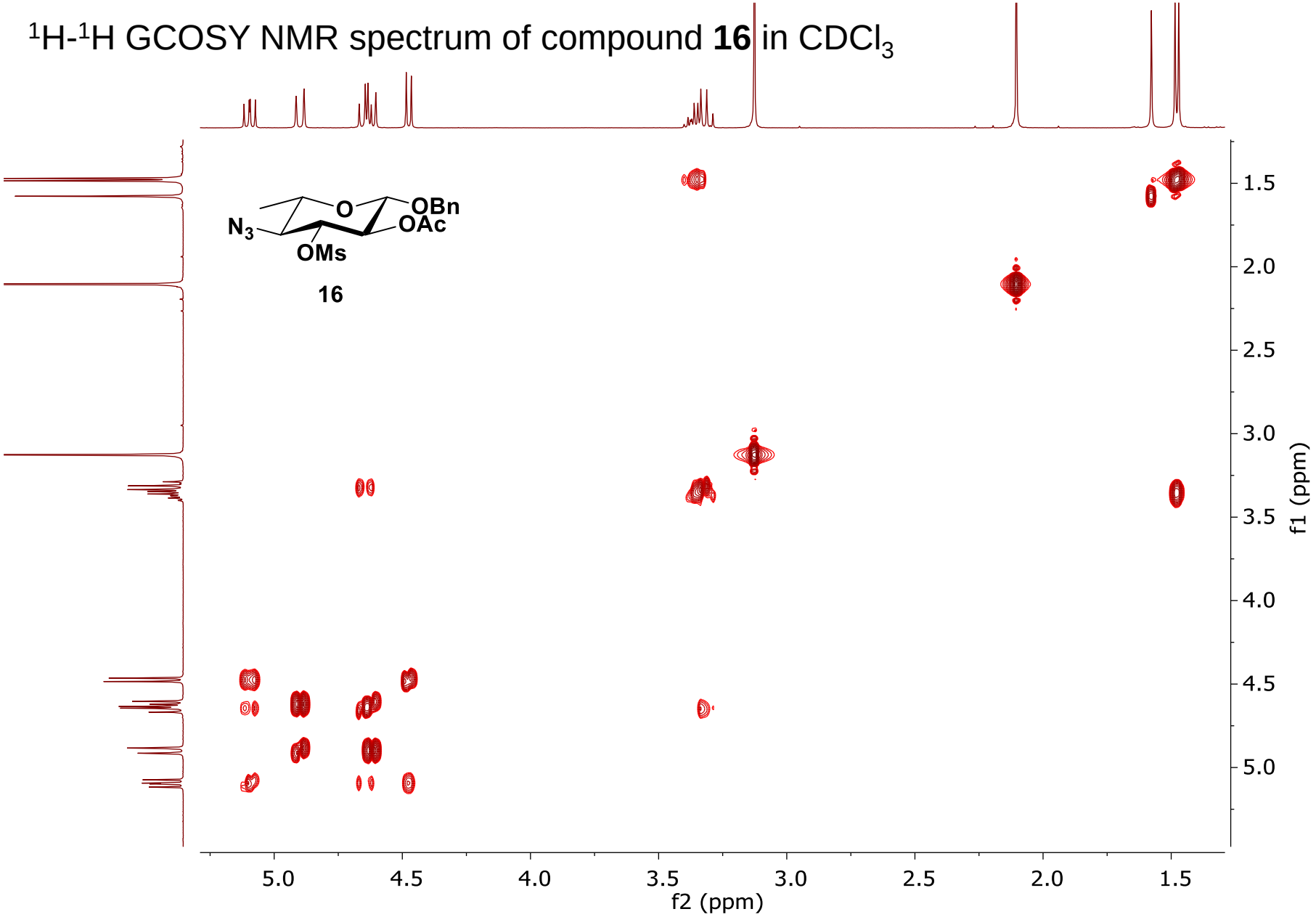
^{1}H NMR spectrum of compound **16** in $CDCl_3$ (400 MHz)

16

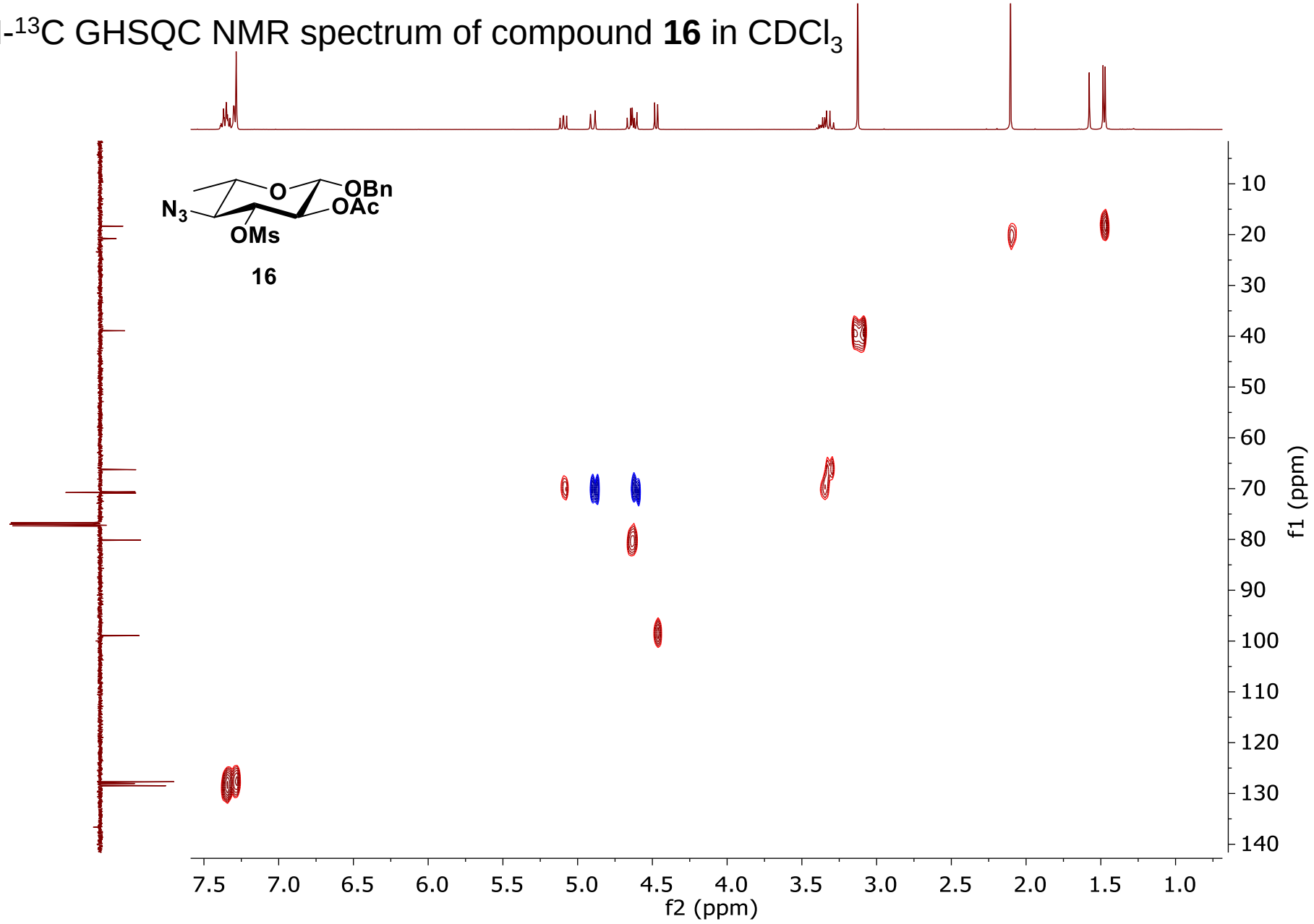



^{13}C (DEPTQ) NMR spectrum of compound **16** in $CDCl_3$ (100 MHz)
O
OBn
OAc
N_3
OMs
16
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **16** in $CDCl_3$

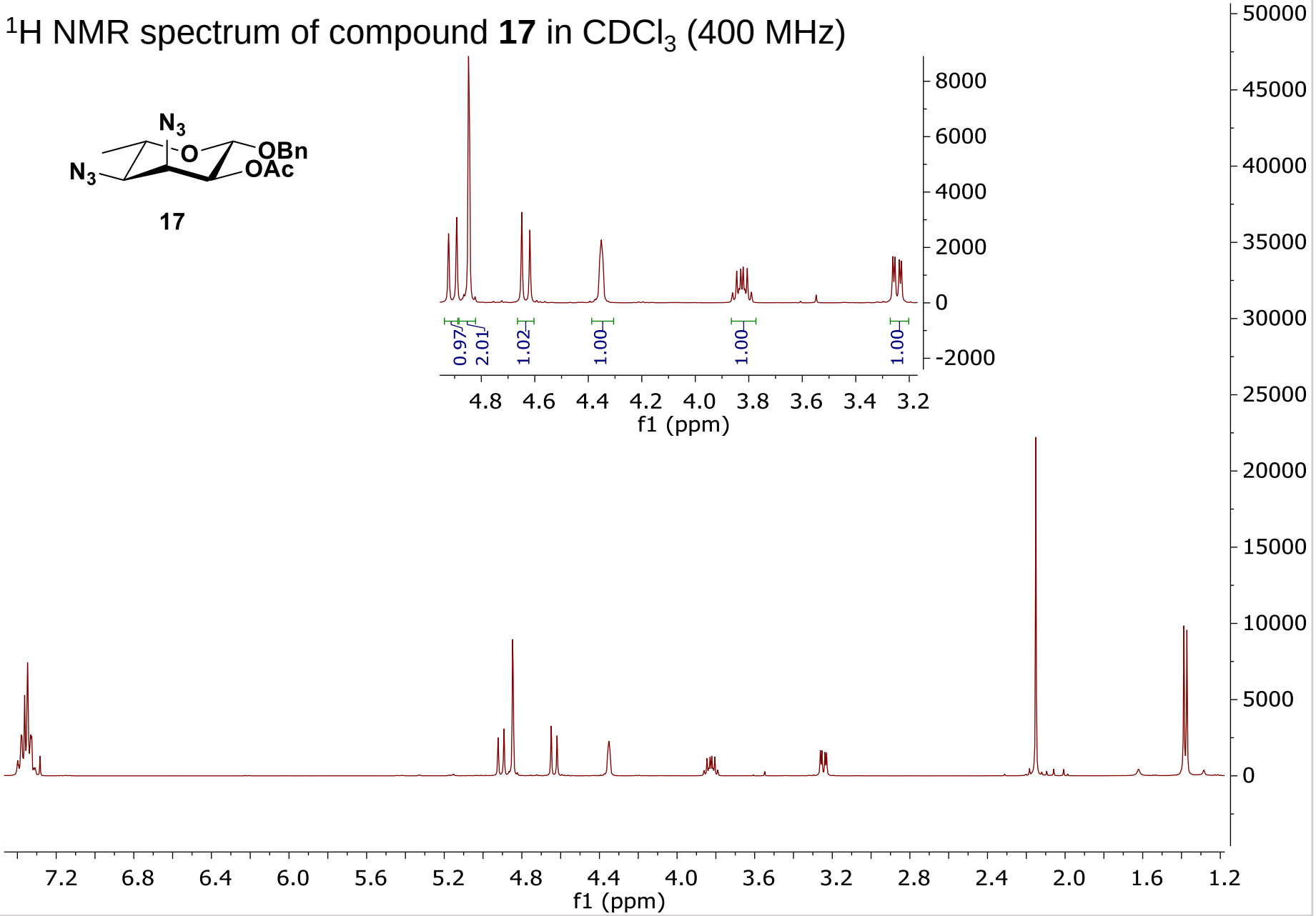


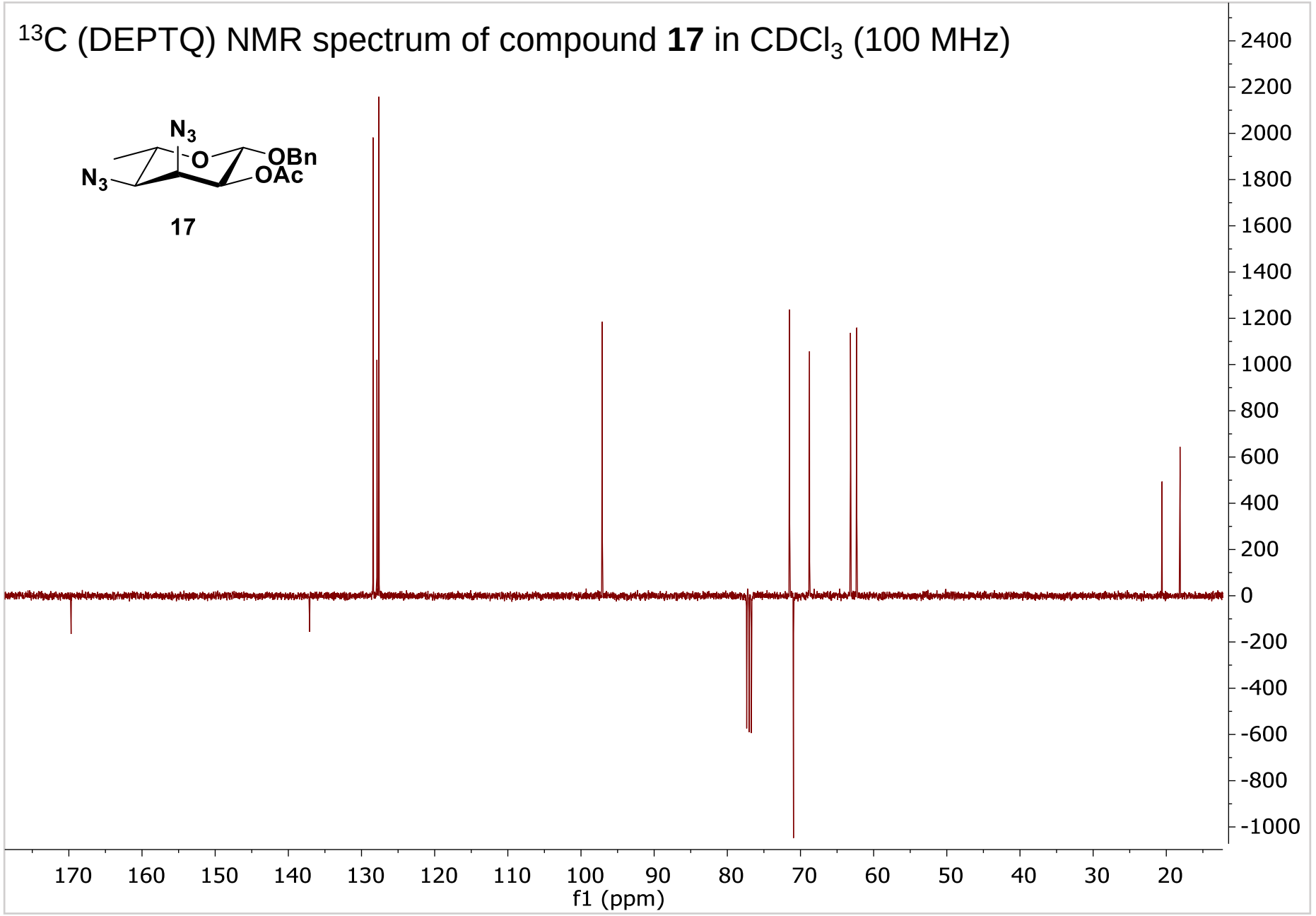
^{1}H-^{13}C GHSQC NMR spectrum of compound **16** in $CDCl_3$



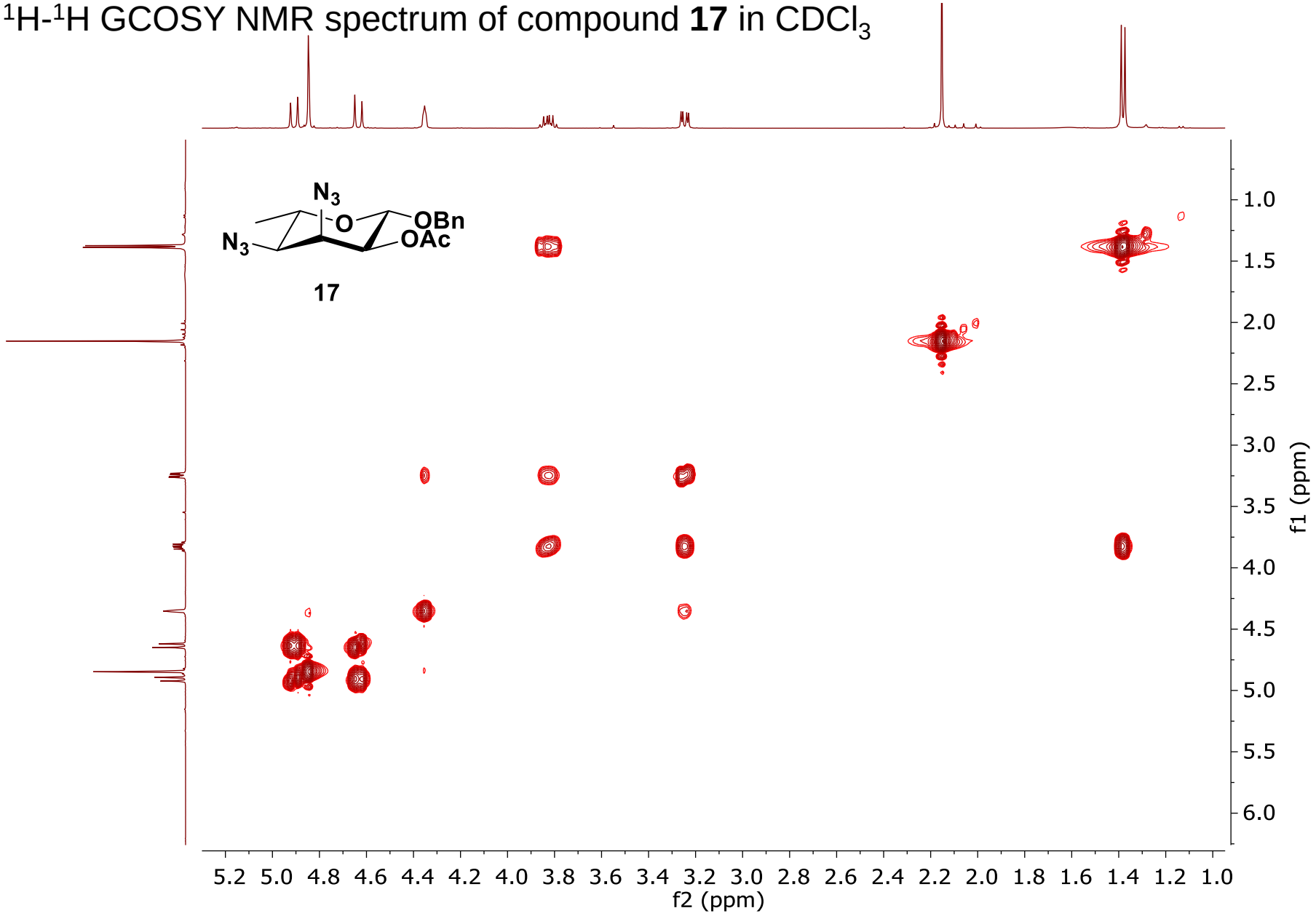
^{1}H NMR spectrum of compound **17** in $CDCl_3$ (400 MHz)

17

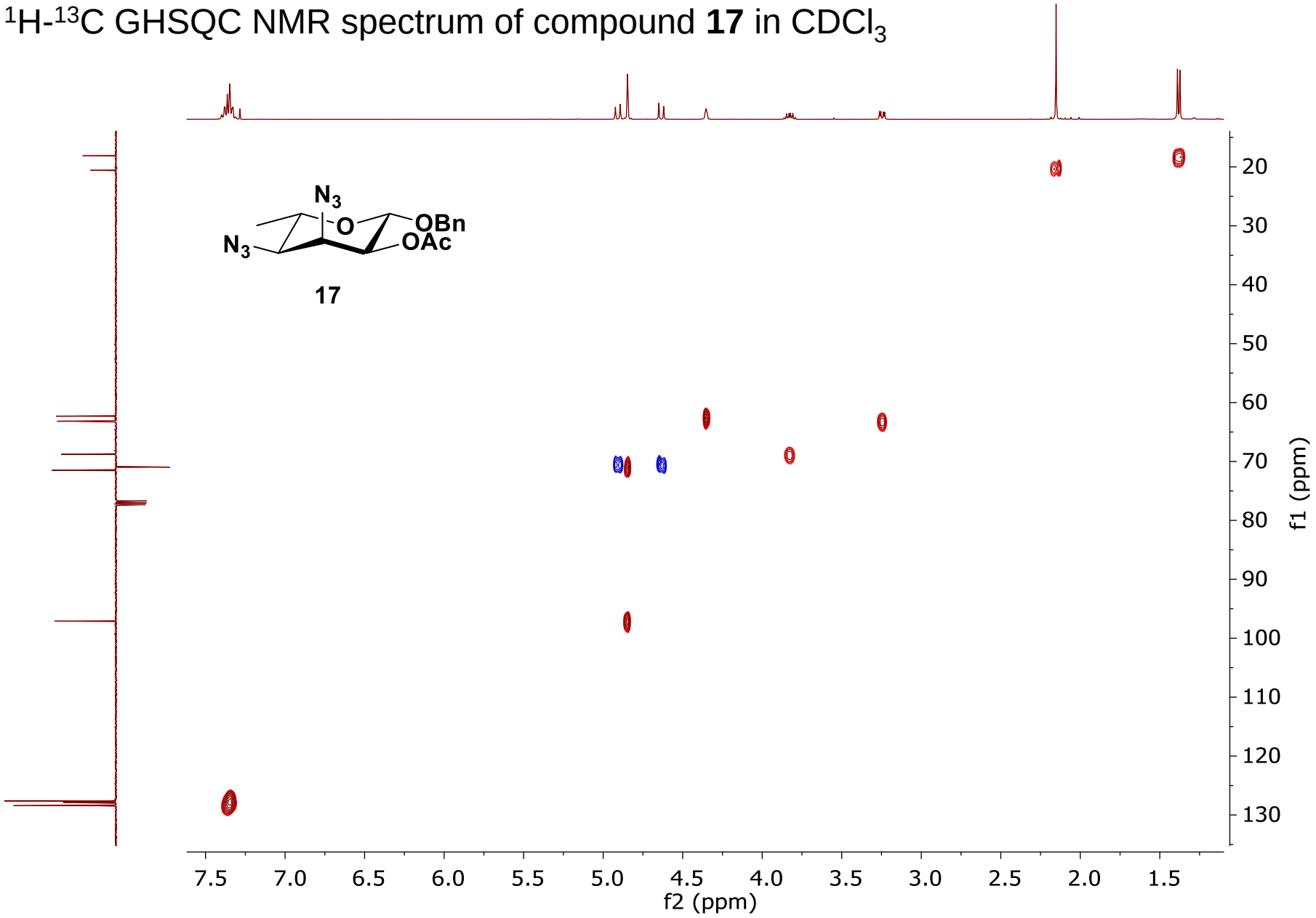



^{13}C (DEPTQ) NMR spectrum of compound **17** in $CDCl_3$ (100 MHz)
N_3
O
OBn
OAc
N_3
17
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **17** in $CDCl_3$

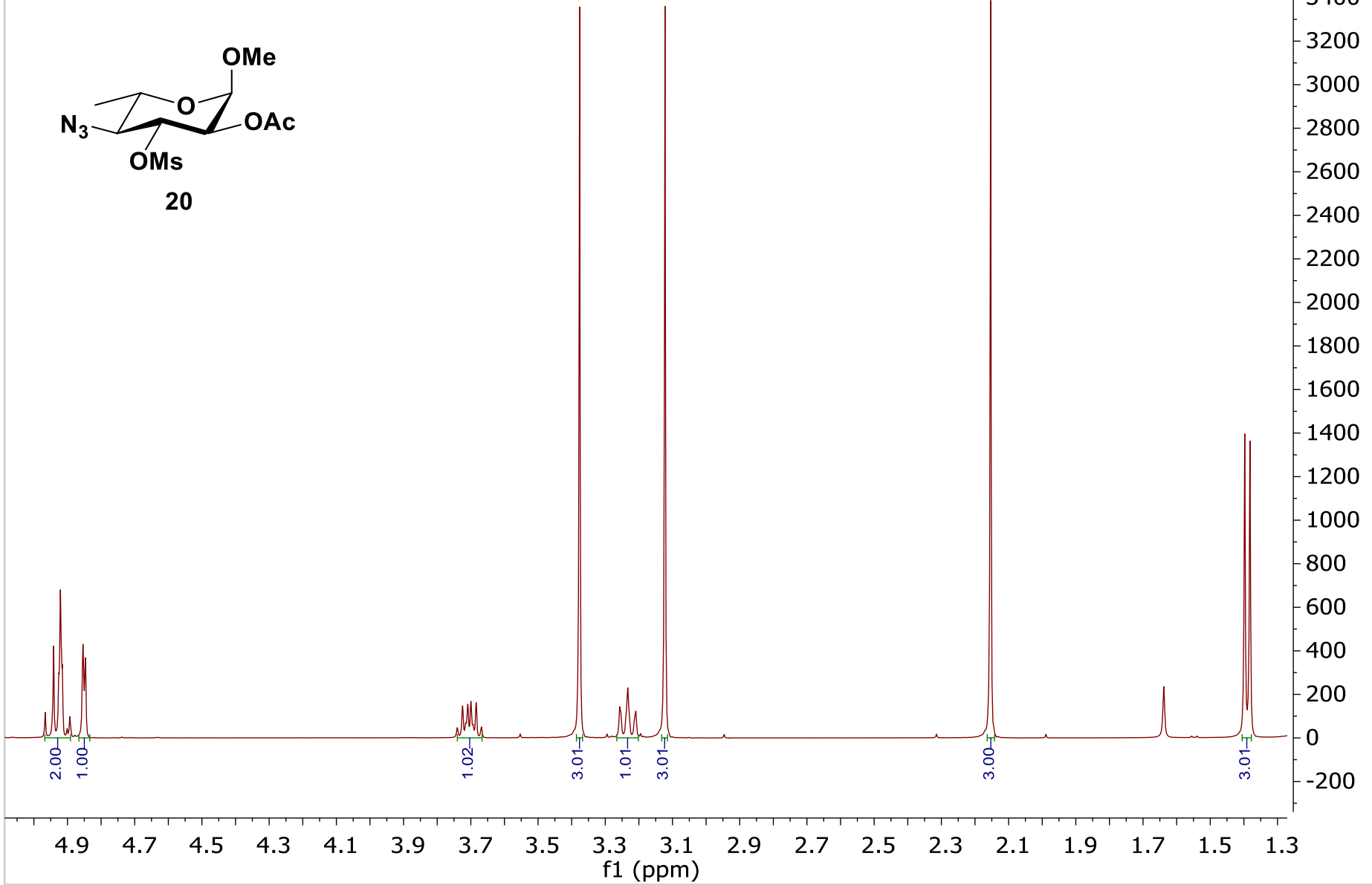


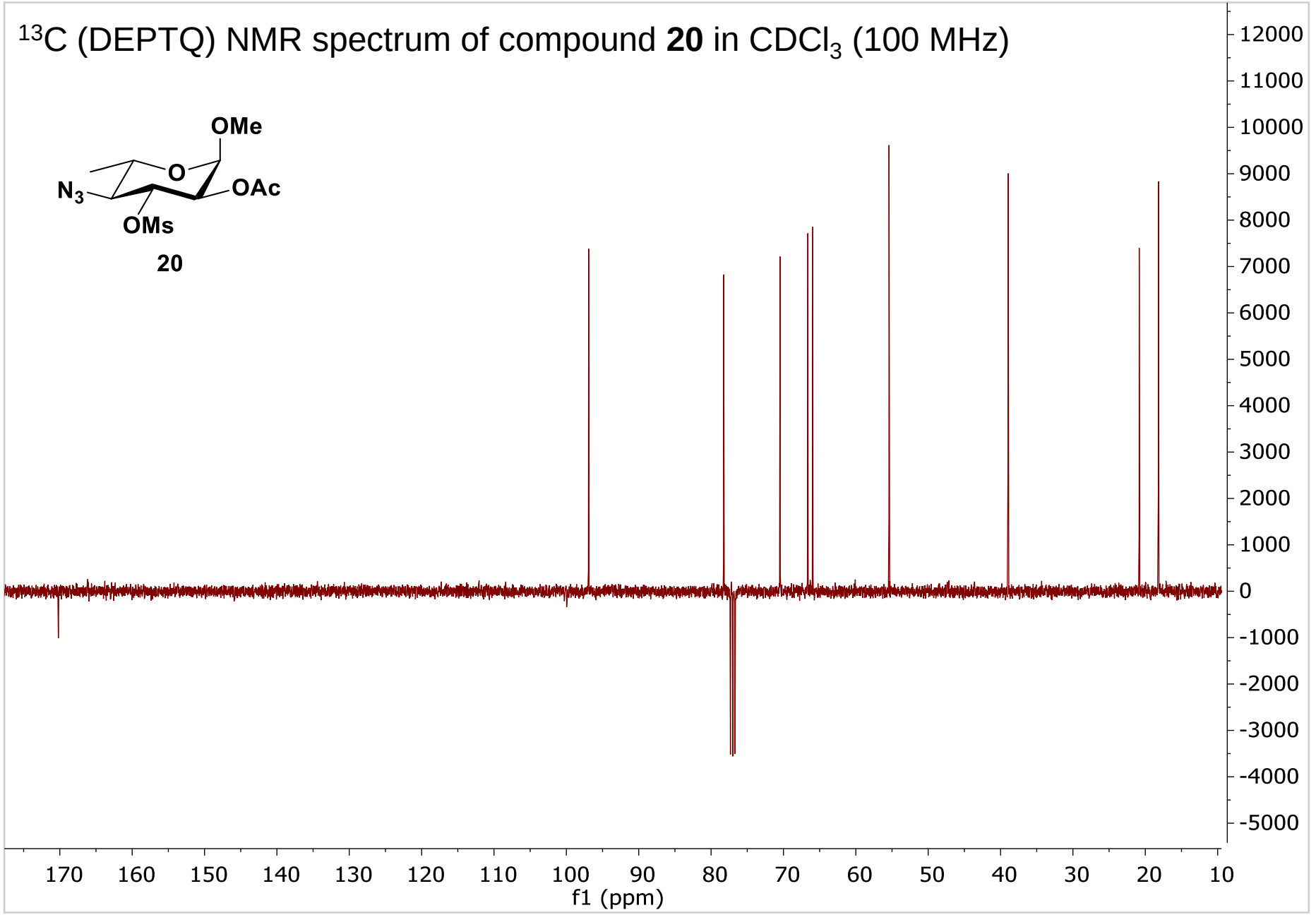
^{1}H-^{13}C GHSQC NMR spectrum of compound **17** in $CDCl_3$



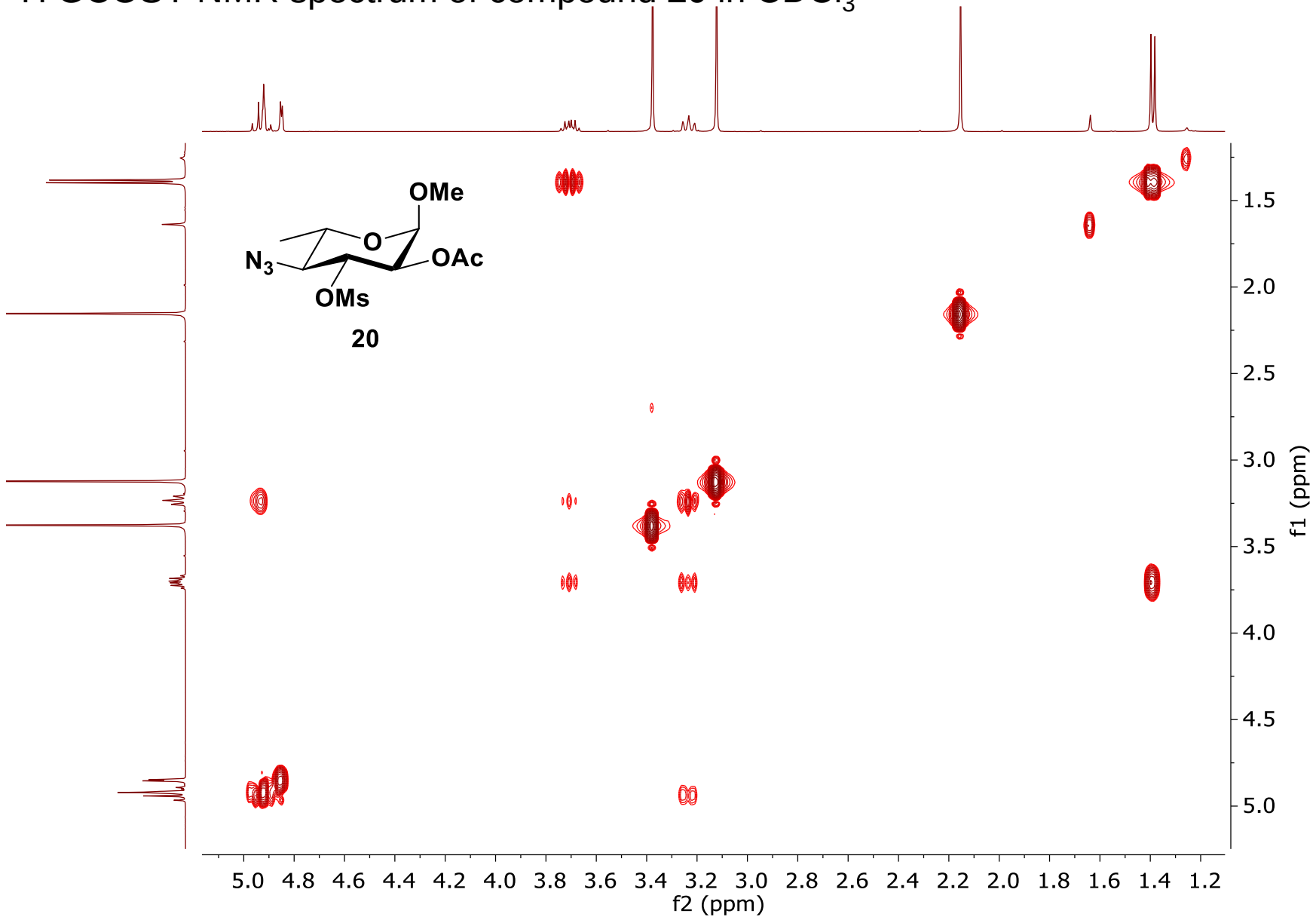
^{1}H NMR spectrum of compound **20** in $CDCl_3$ (400 MHz)

20

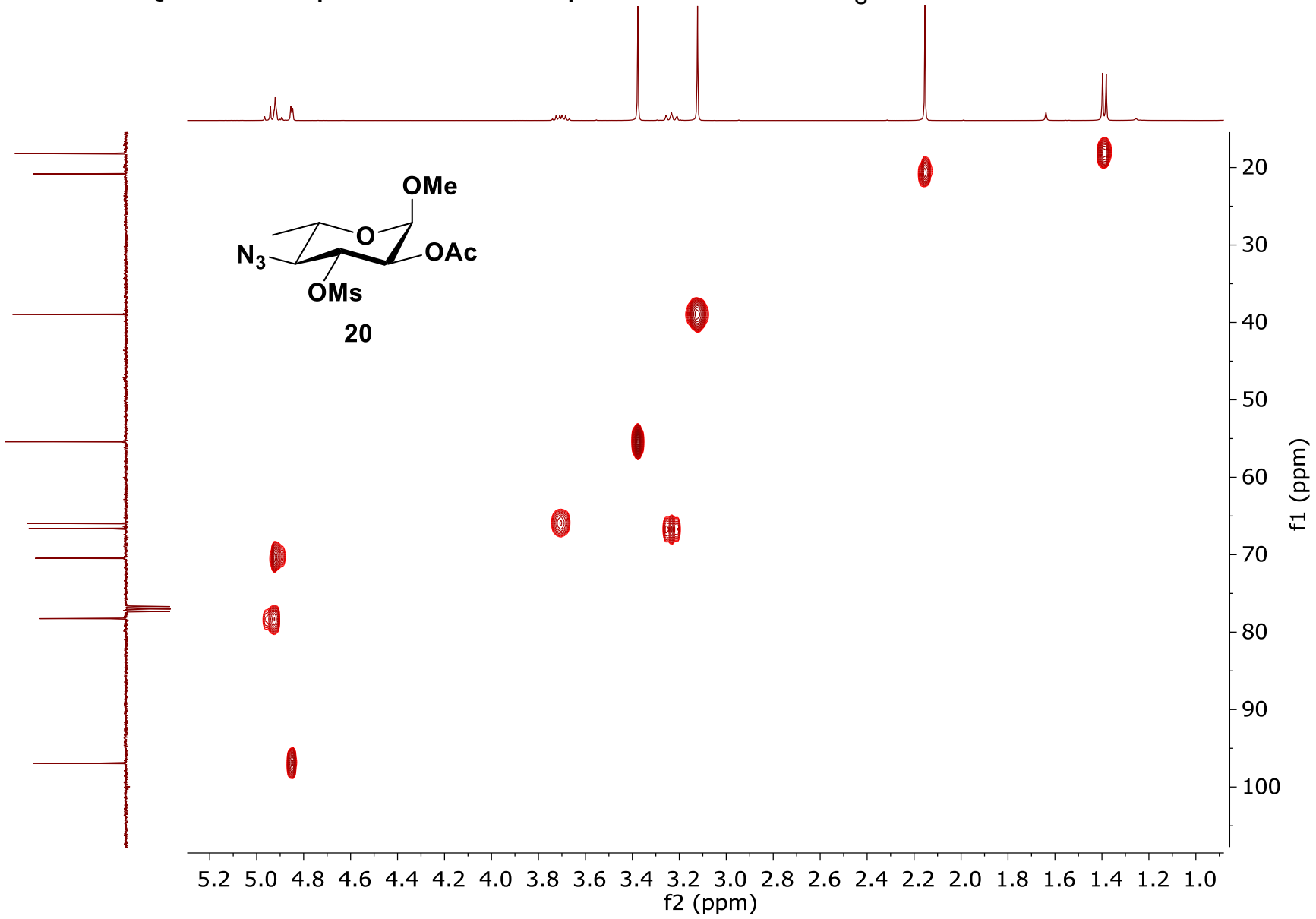



^{13}C (DEPTQ) NMR spectrum of compound **20** in $CDCl_3$ (100 MHz)
OMe
O
N_3
OAc
OMs
20
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **20** in $CDCl_3$

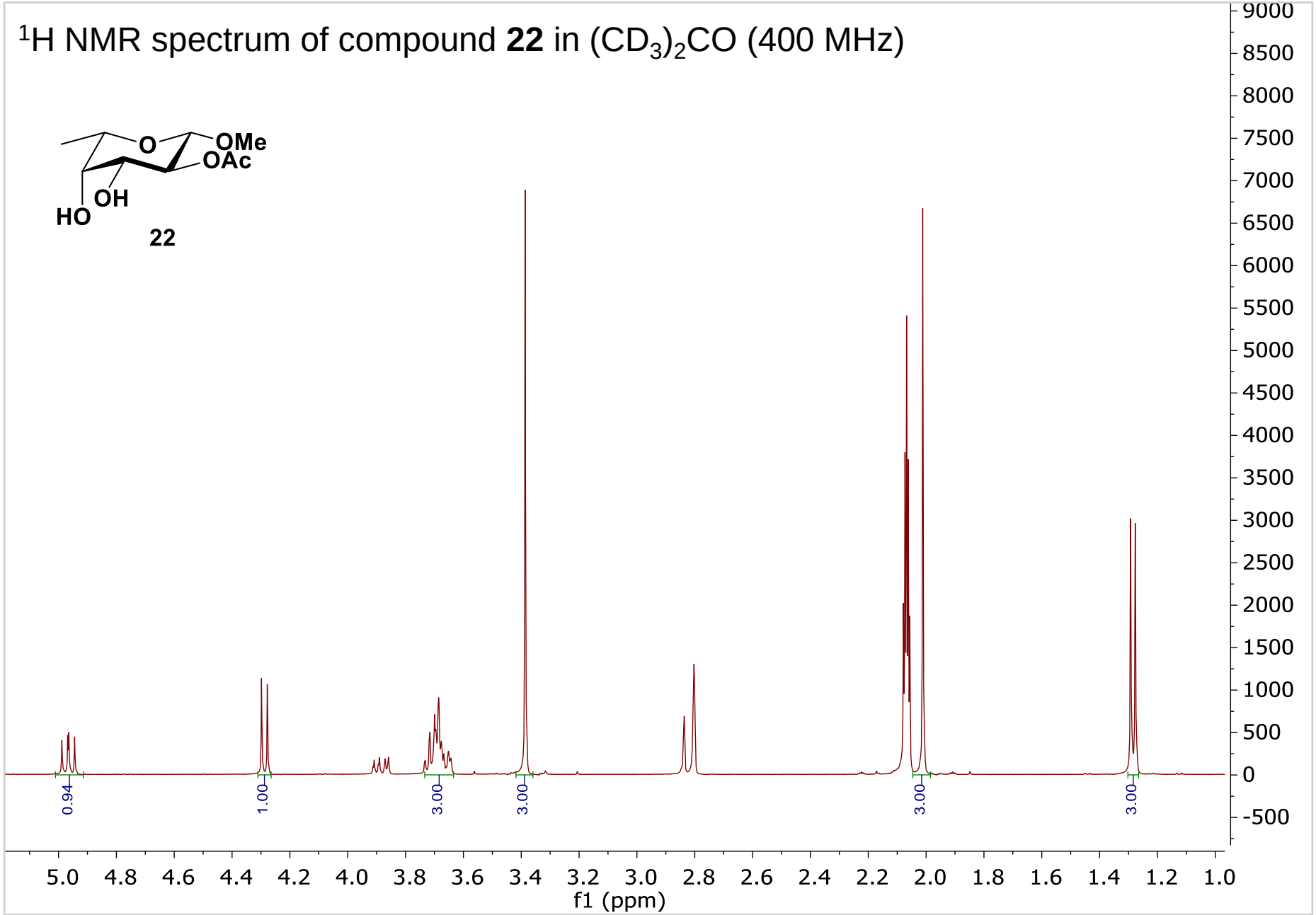


^{1}H-^{13}C GHSQC NMR spectrum of compound **20** in $CDCl_3$



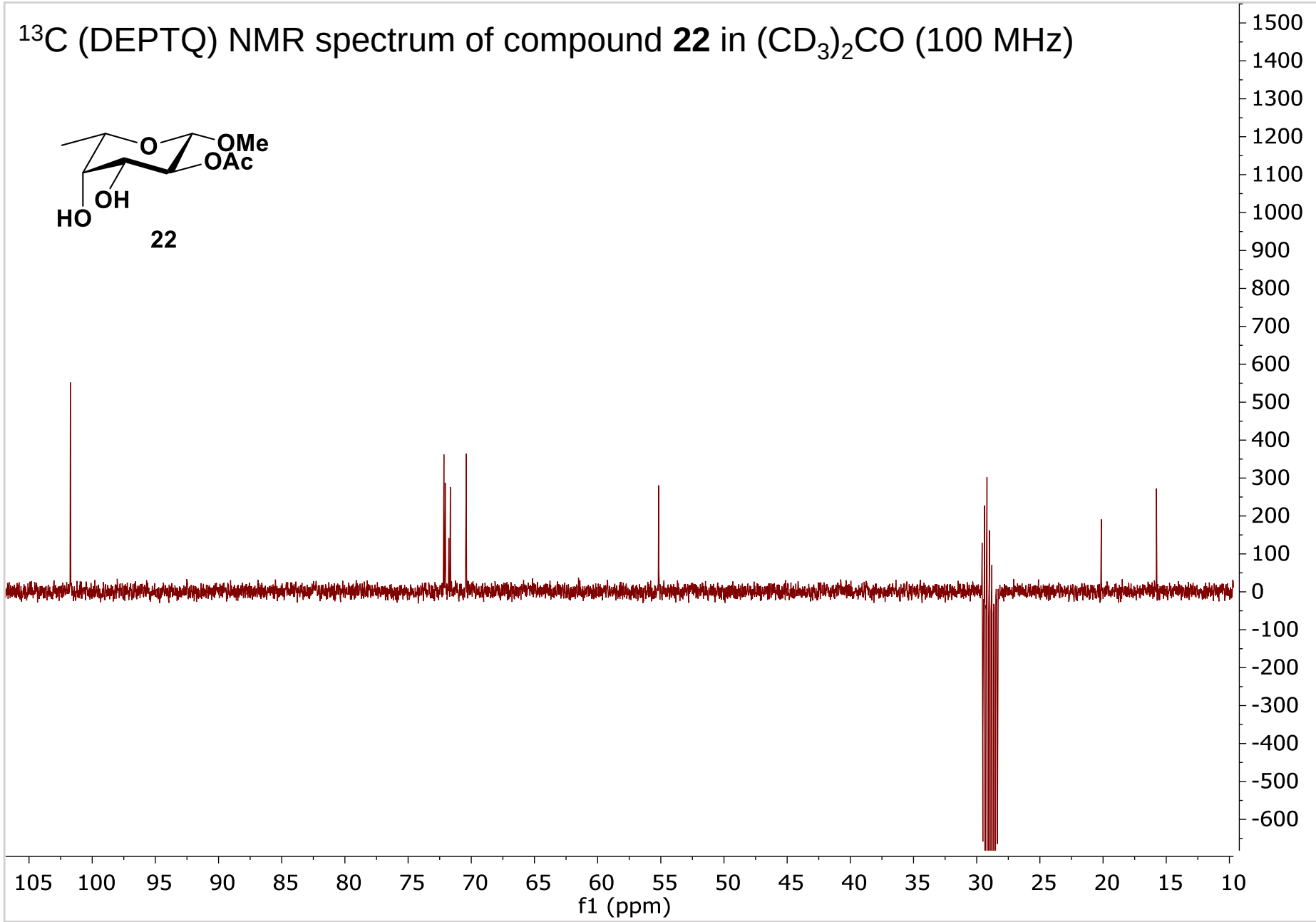
^{1}H NMR spectrum of compound **22** in $(CD_3)_2CO$ (400 MHz)

22

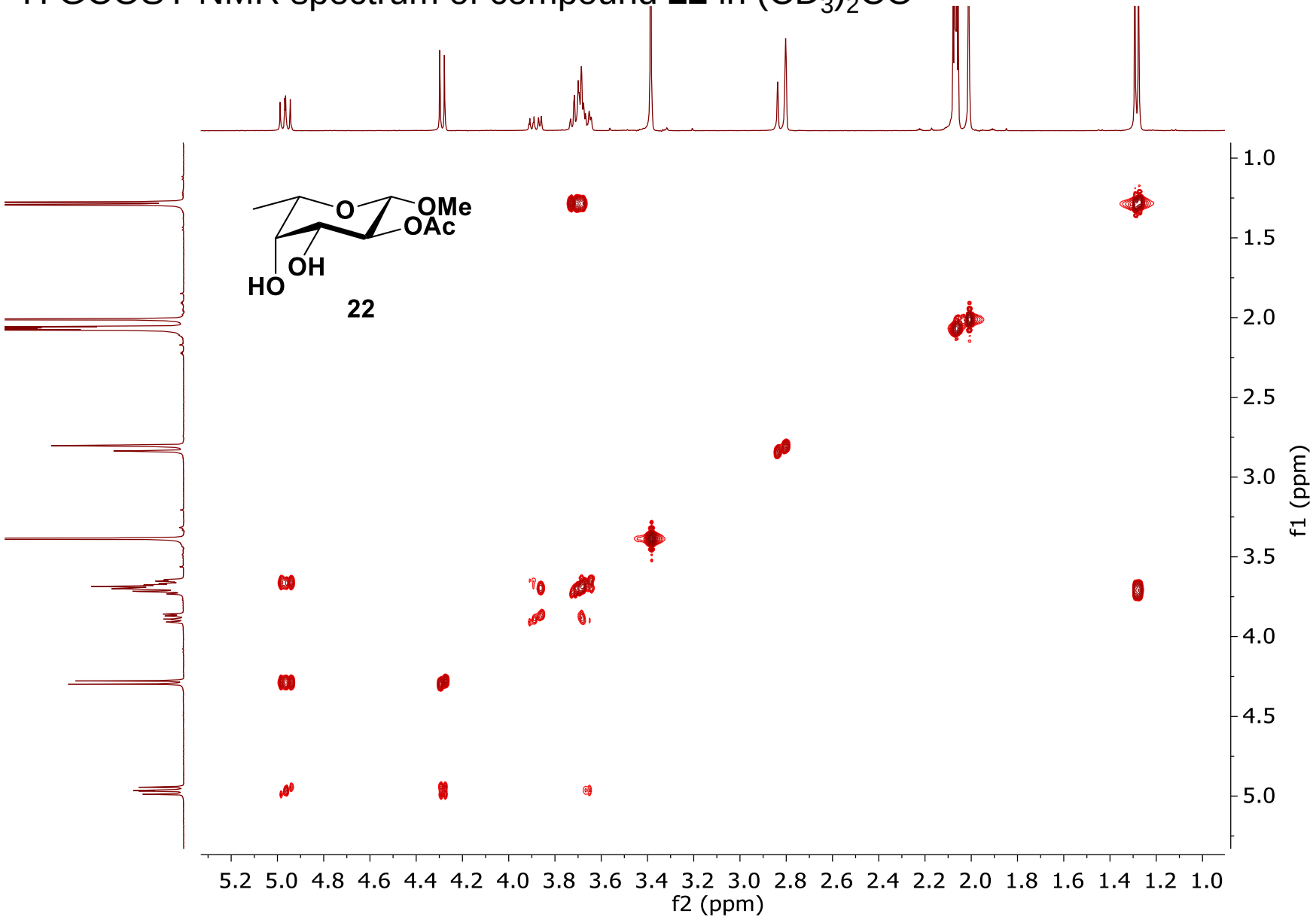


^{13}C (DEPTQ) NMR spectrum of compound **22** in $(CD_3)_2CO$ (100 MHz)

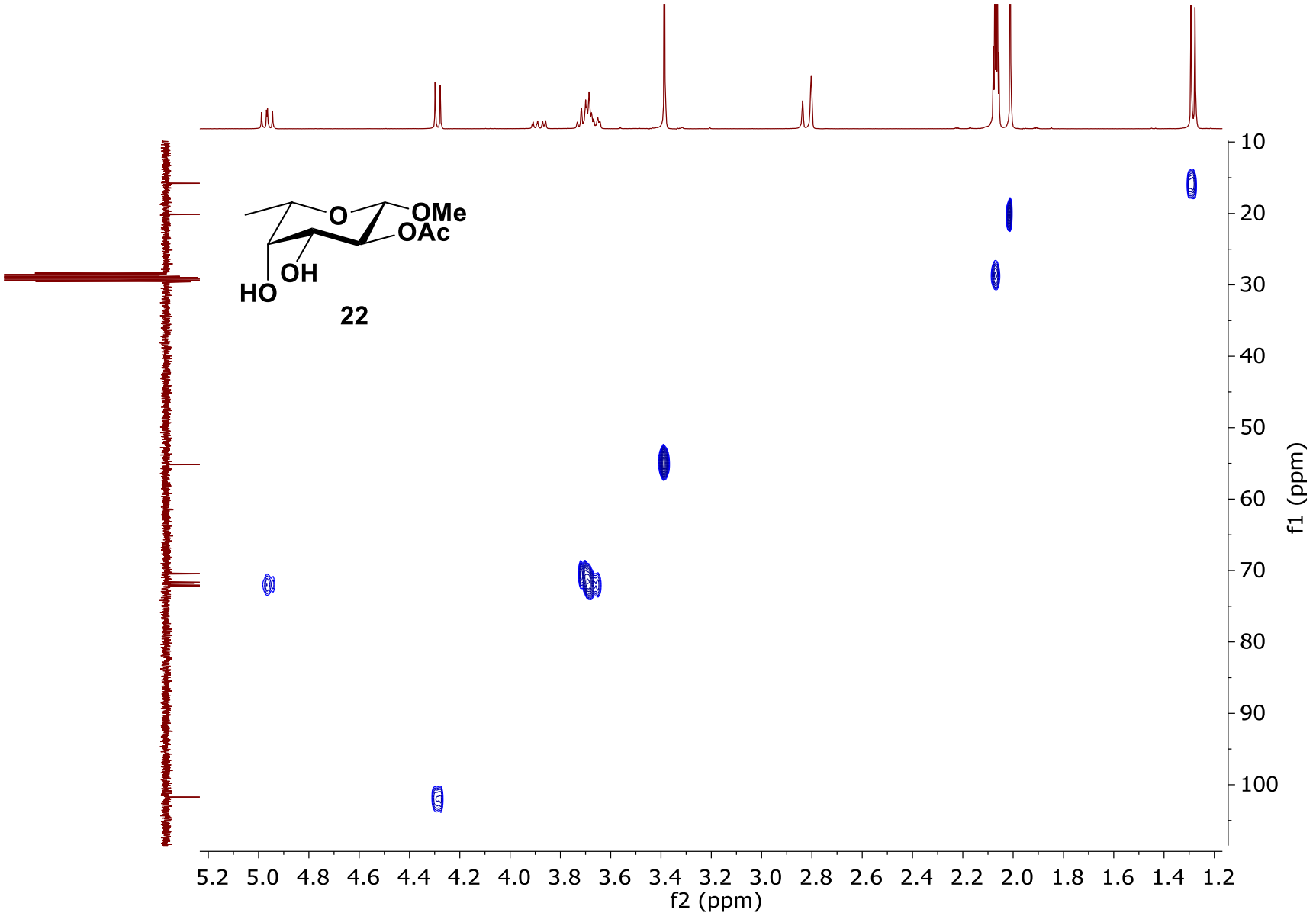
22



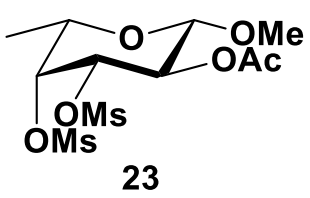
^{1}H-^{1}H GCOSY NMR spectrum of compound **22** in $(CD_3)_2CO$



^{1}H-^{13}C GHSQC NMR spectrum of compound **22** in $(CD_3)_2CO$



^{1}H NMR spectrum of compound **23** in $CDCl_3$ (400 MHz)



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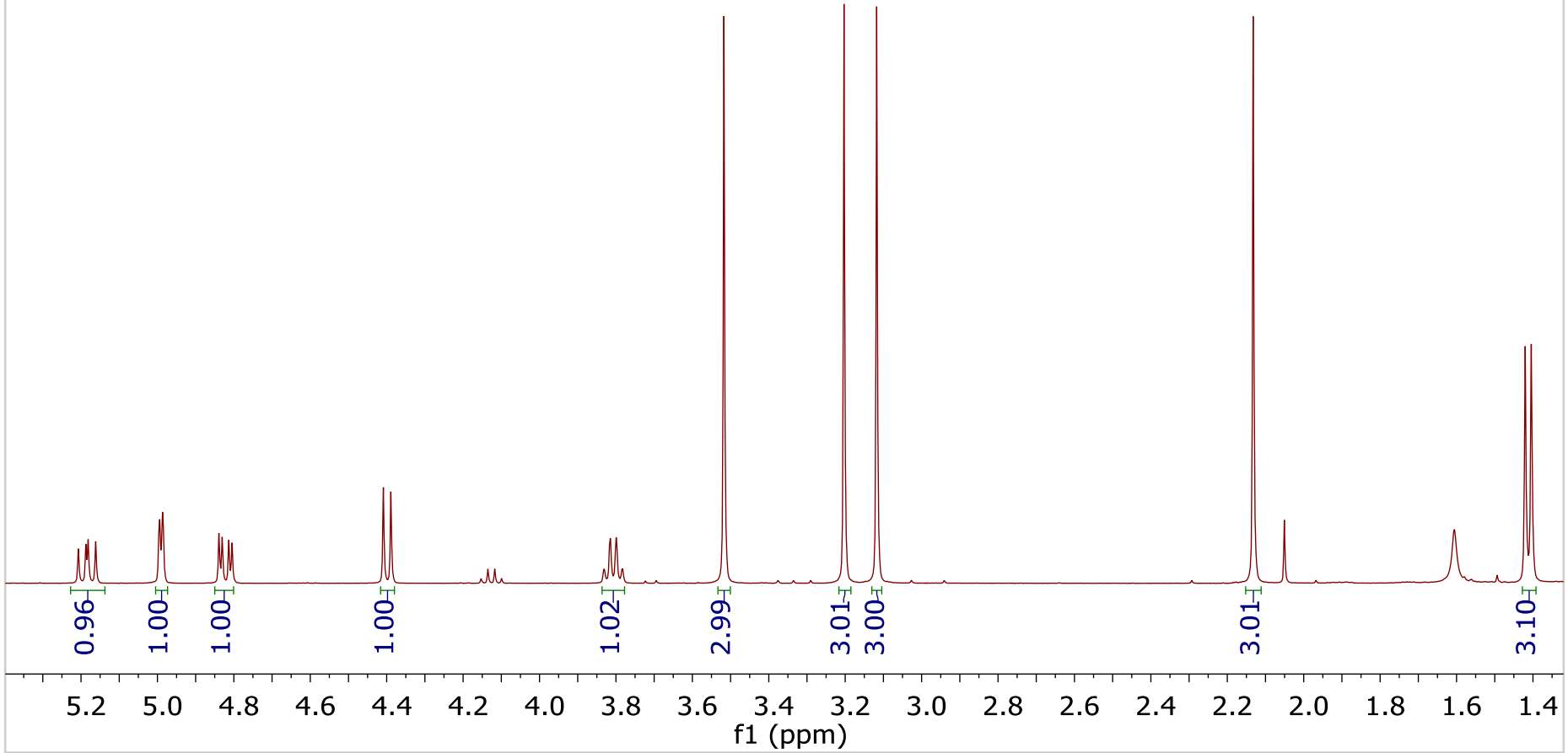
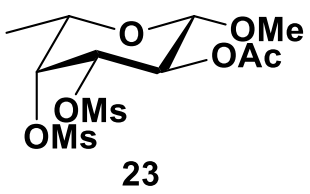


^{13}C (DEPTQ) NMR spectrum of compound **23** in $CDCl_3$ (100 MHz)



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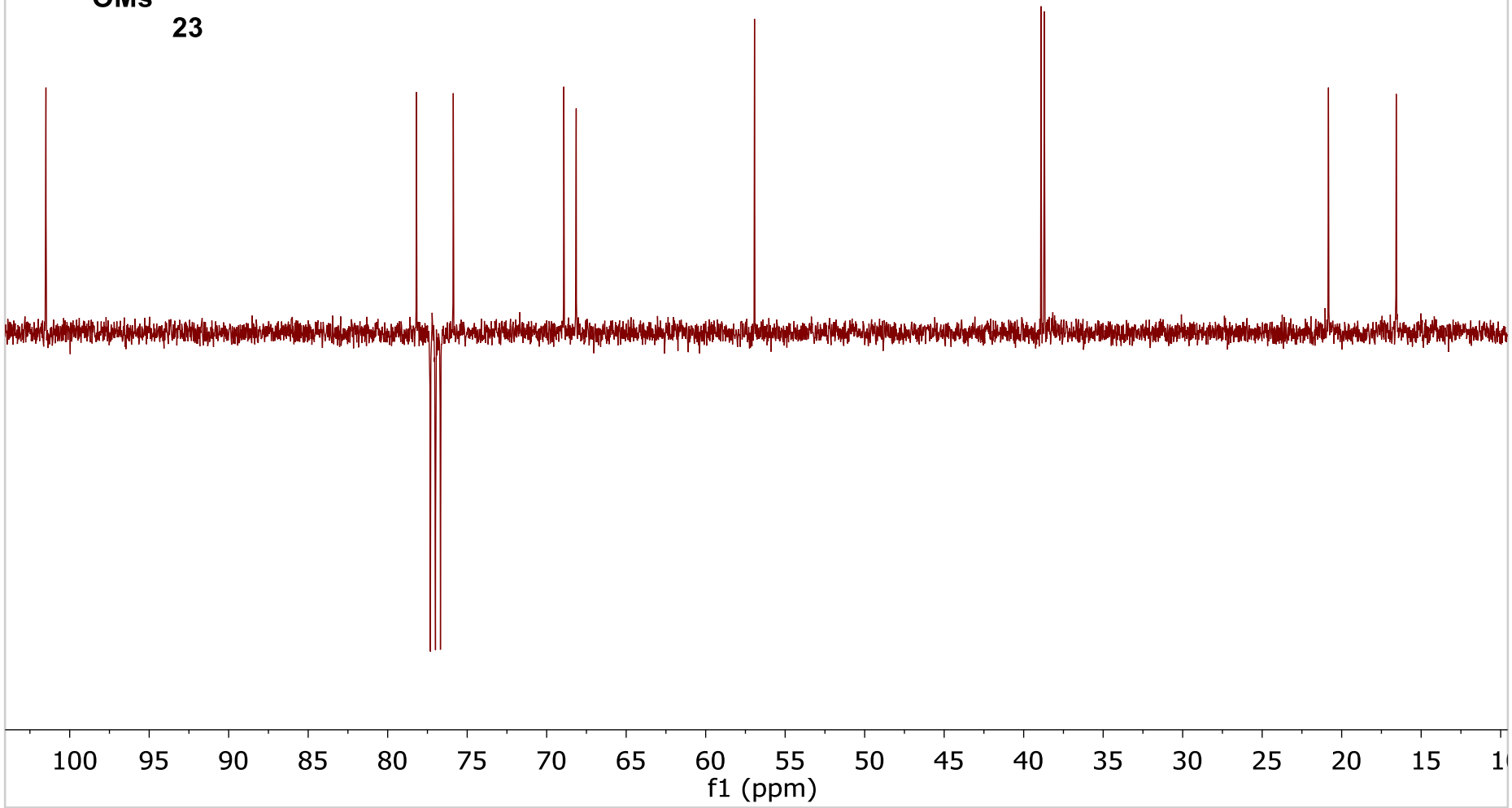
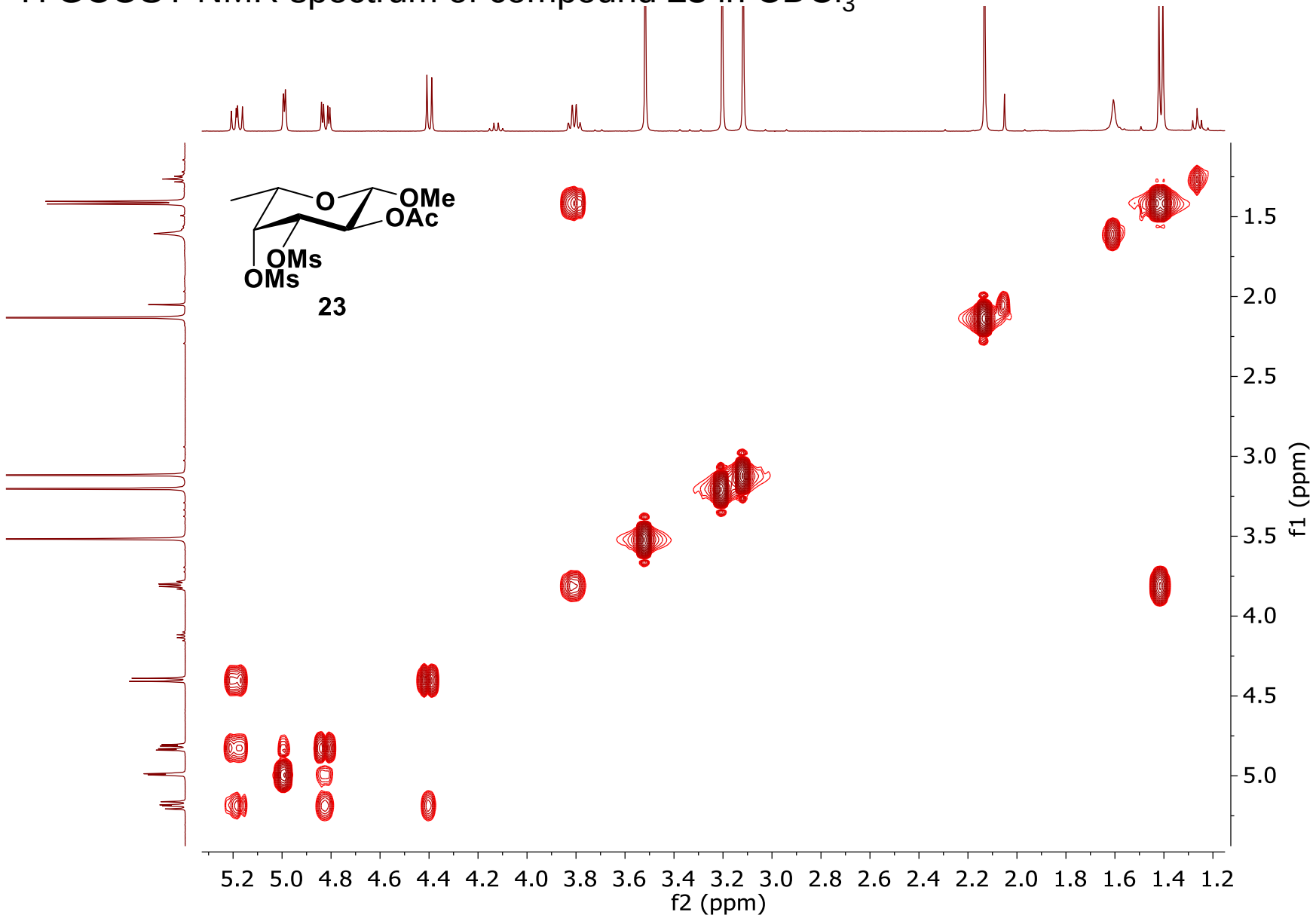
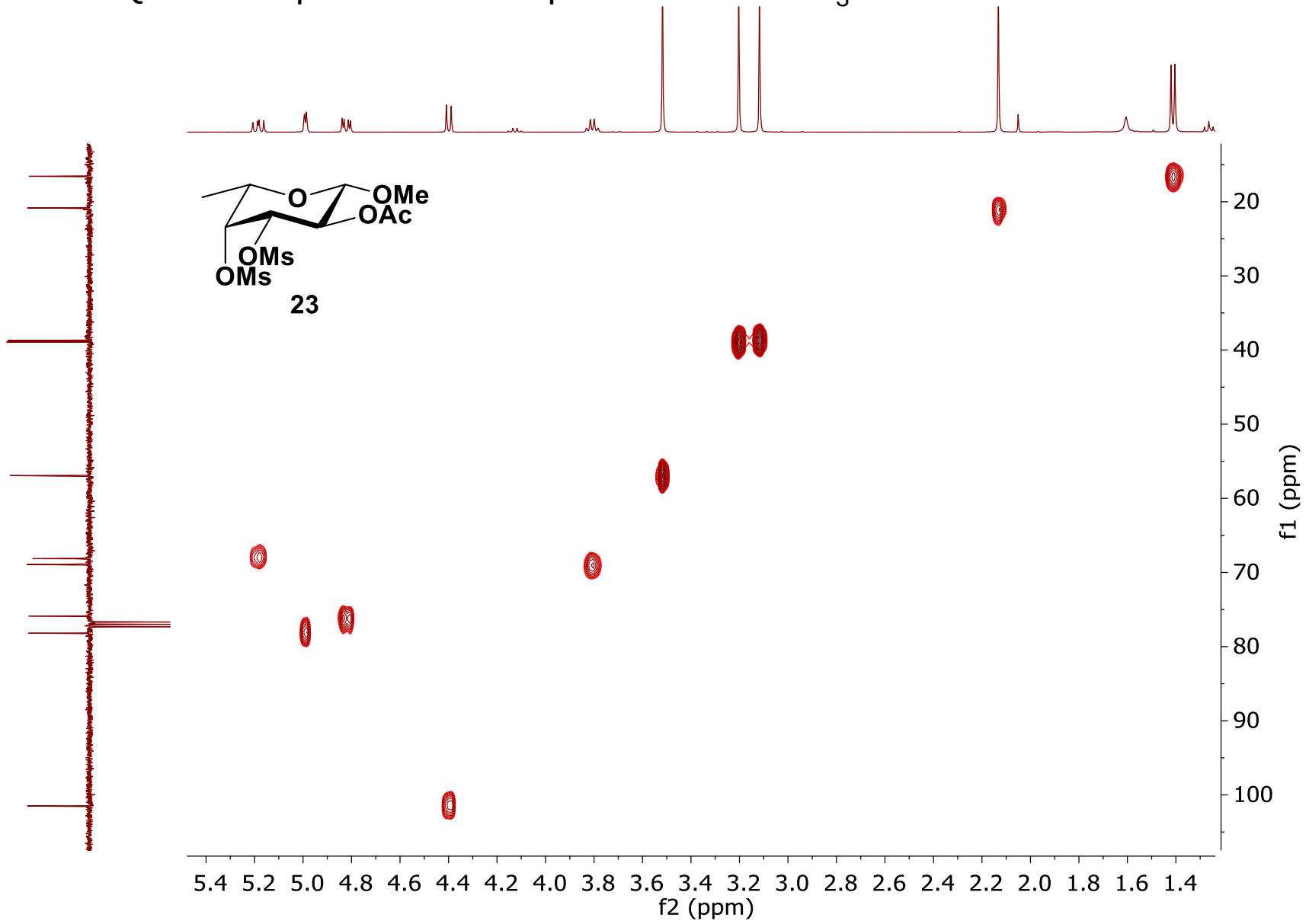
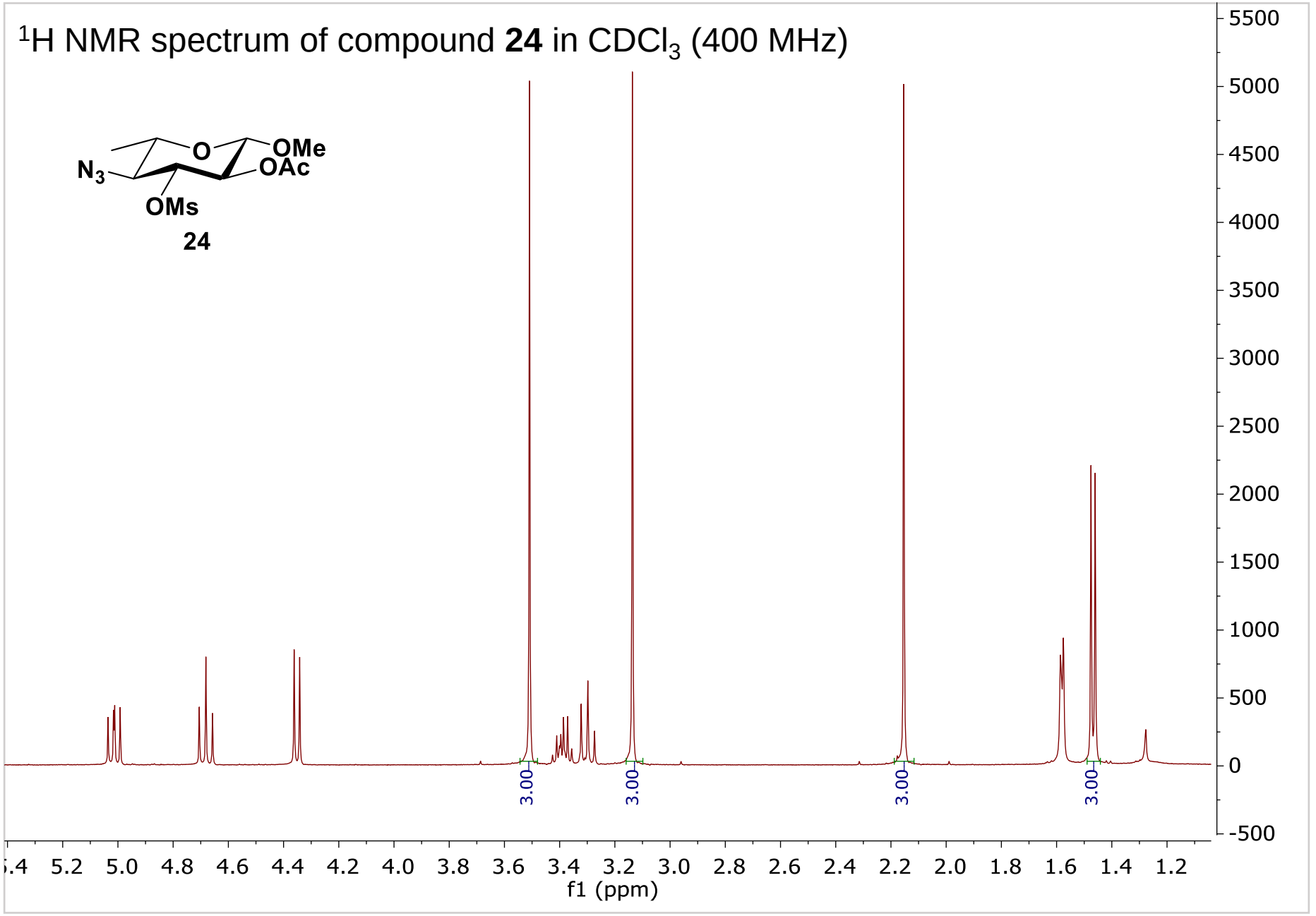


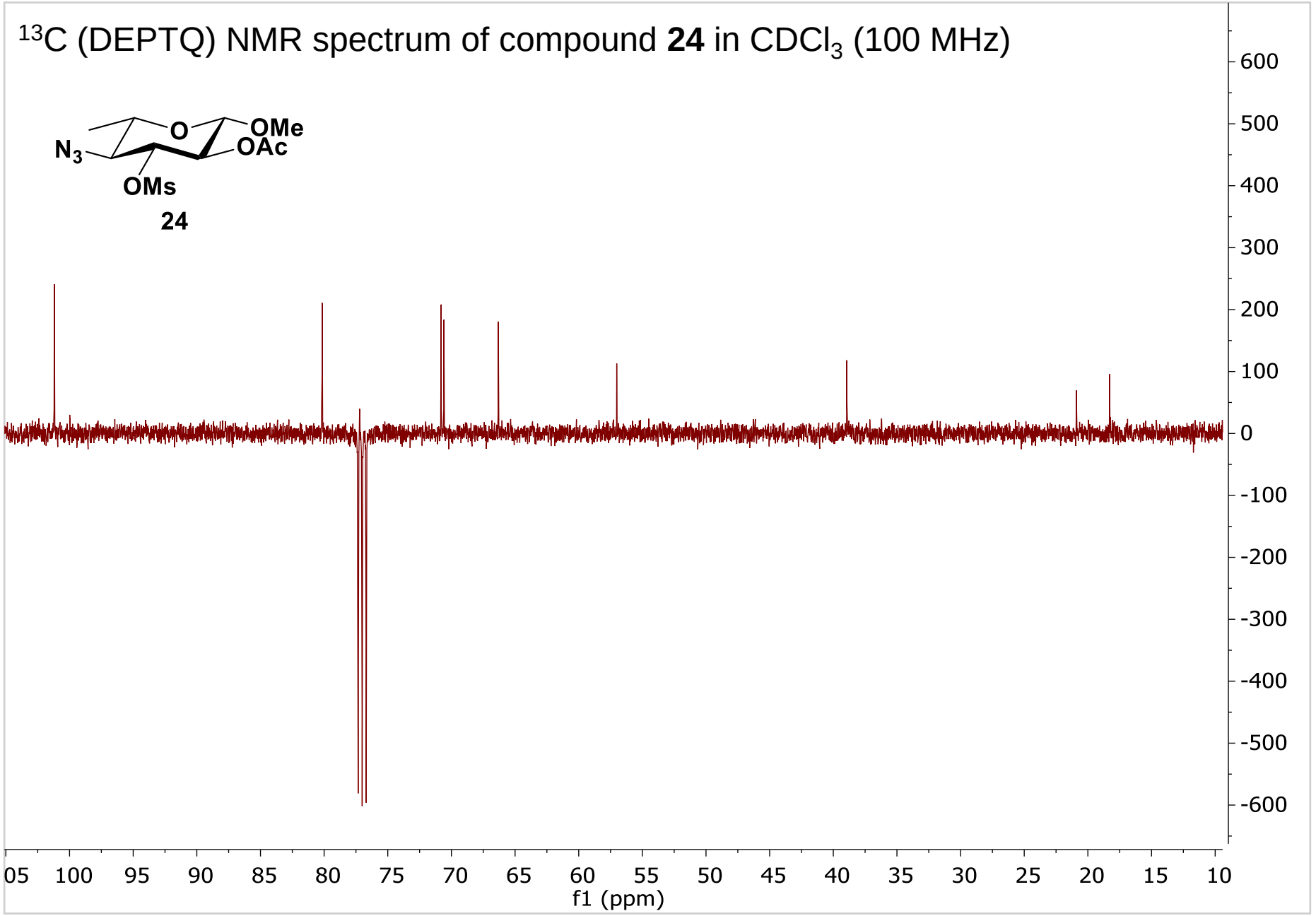
^{1}H-^{1}H GCOSY NMR spectrum of compound **23** in $CDCl_3$



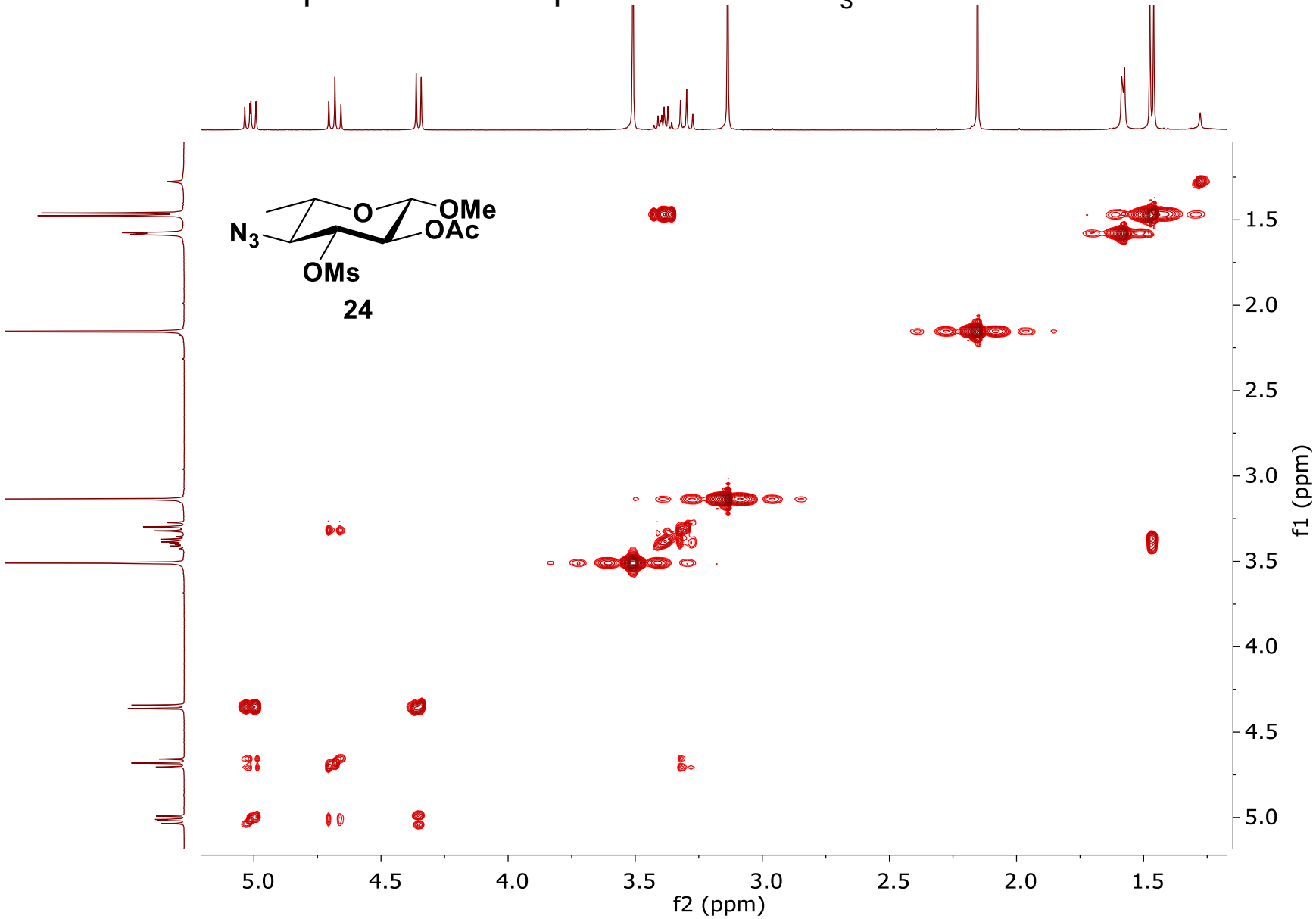
^{1}H-^{13}C GHSQC NMR spectrum of compound **23** in $CDCl_3$



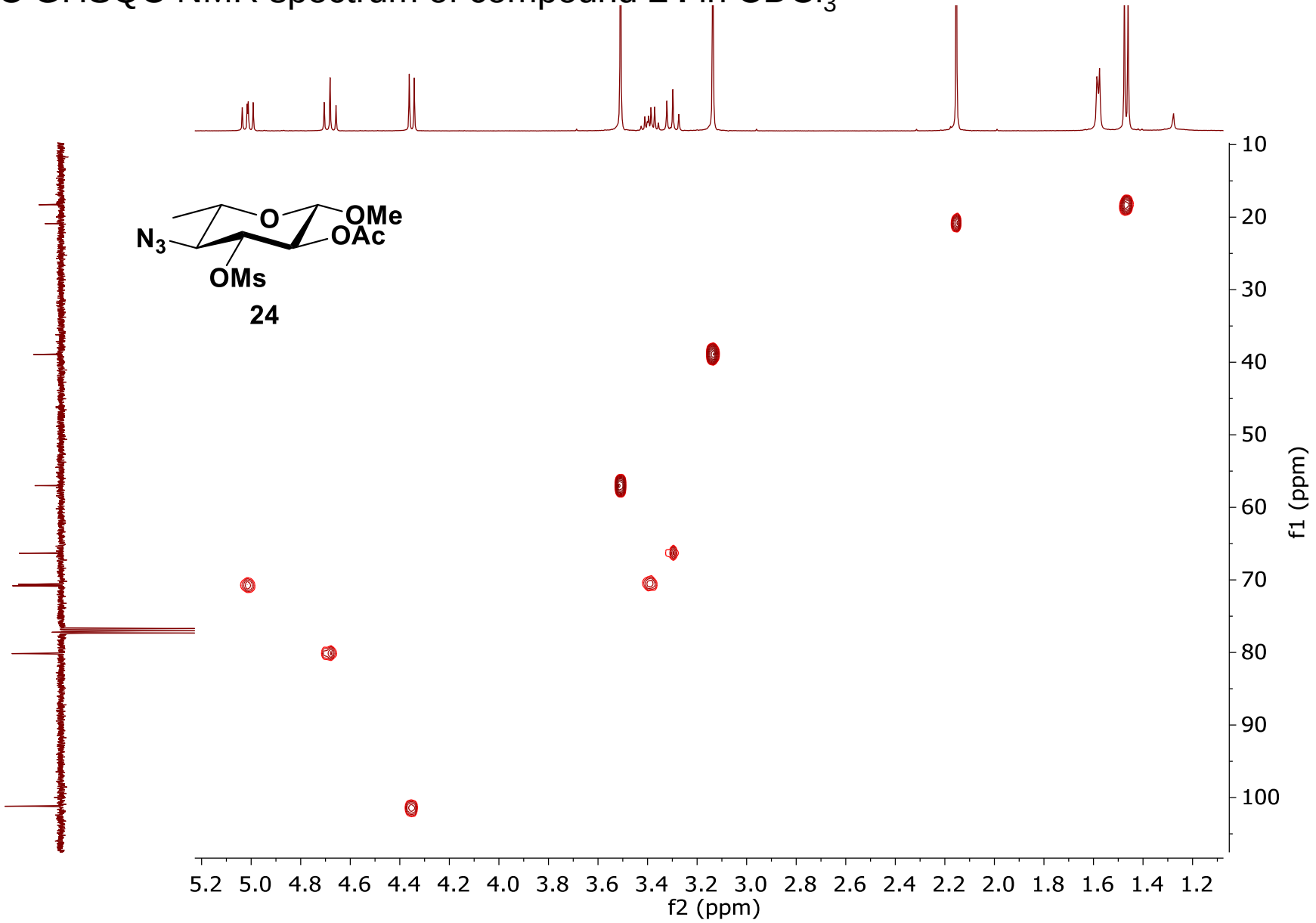

^{1}H NMR spectrum of compound **24** in $CDCl_3$ (400 MHz)
O
OMe
OAc
N_3
OMs
24
3.00
3.00
3.00
3.00
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2
f1 (ppm)


^{13}C (DEPTQ) NMR spectrum of compound **24** in $CDCl_3$ (100 MHz)
O
OMe
OAc
N_3
OMs
24
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
05 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
f1 (ppm)

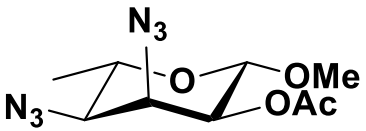
^{1}H-^{1}H GCOSY NMR spectrum of compound **24** in $CDCl_3$



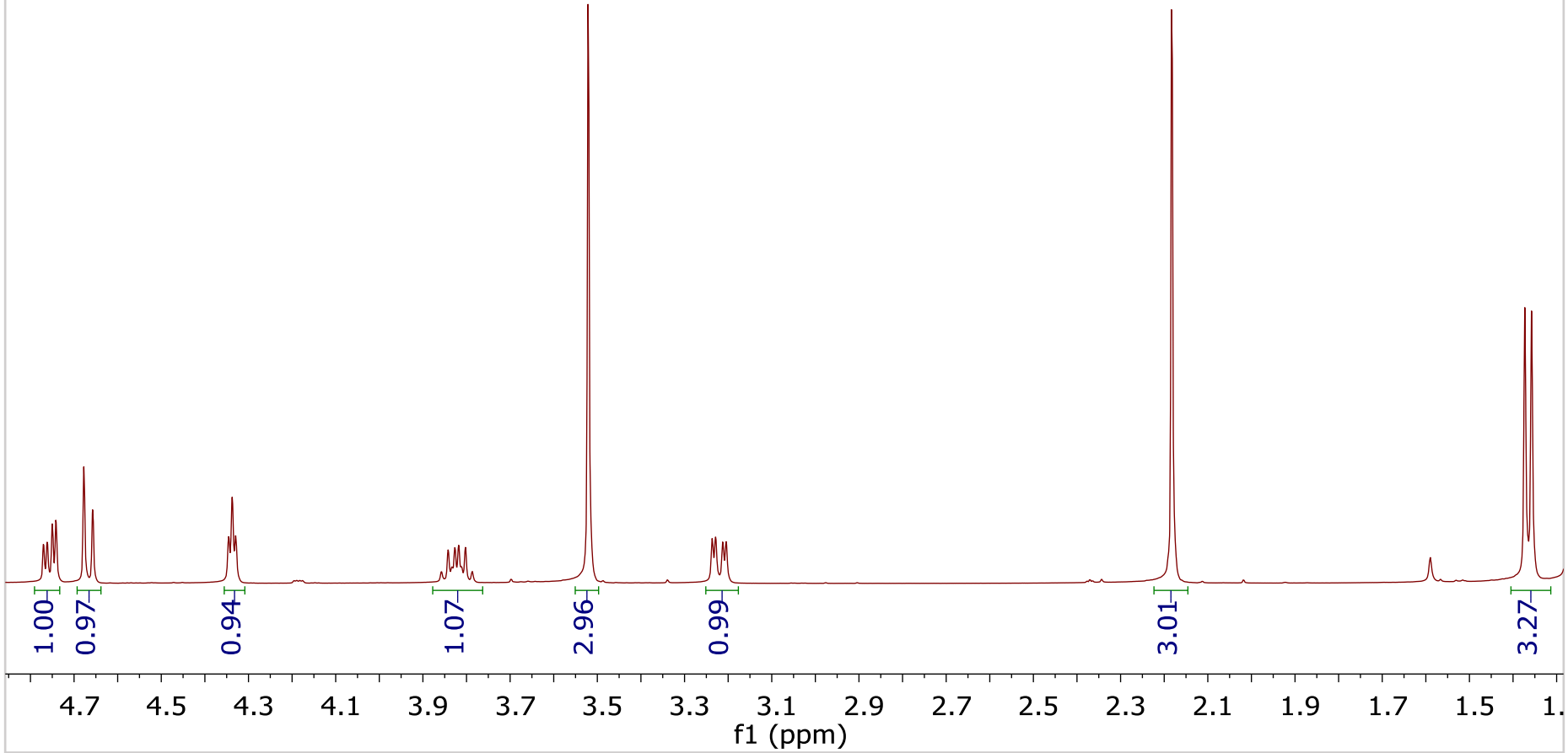
^{1}H-^{13}C GHSQC NMR spectrum of compound **24** in $CDCl_3$



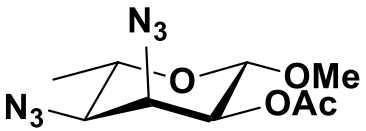
^{1}H NMR spectrum of compound **25** in $CDCl_3$ (400 MHz)



25



^{13}C (DEPTQ) NMR spectrum of compound **25** in $CDCl_3$ (100 MHz)



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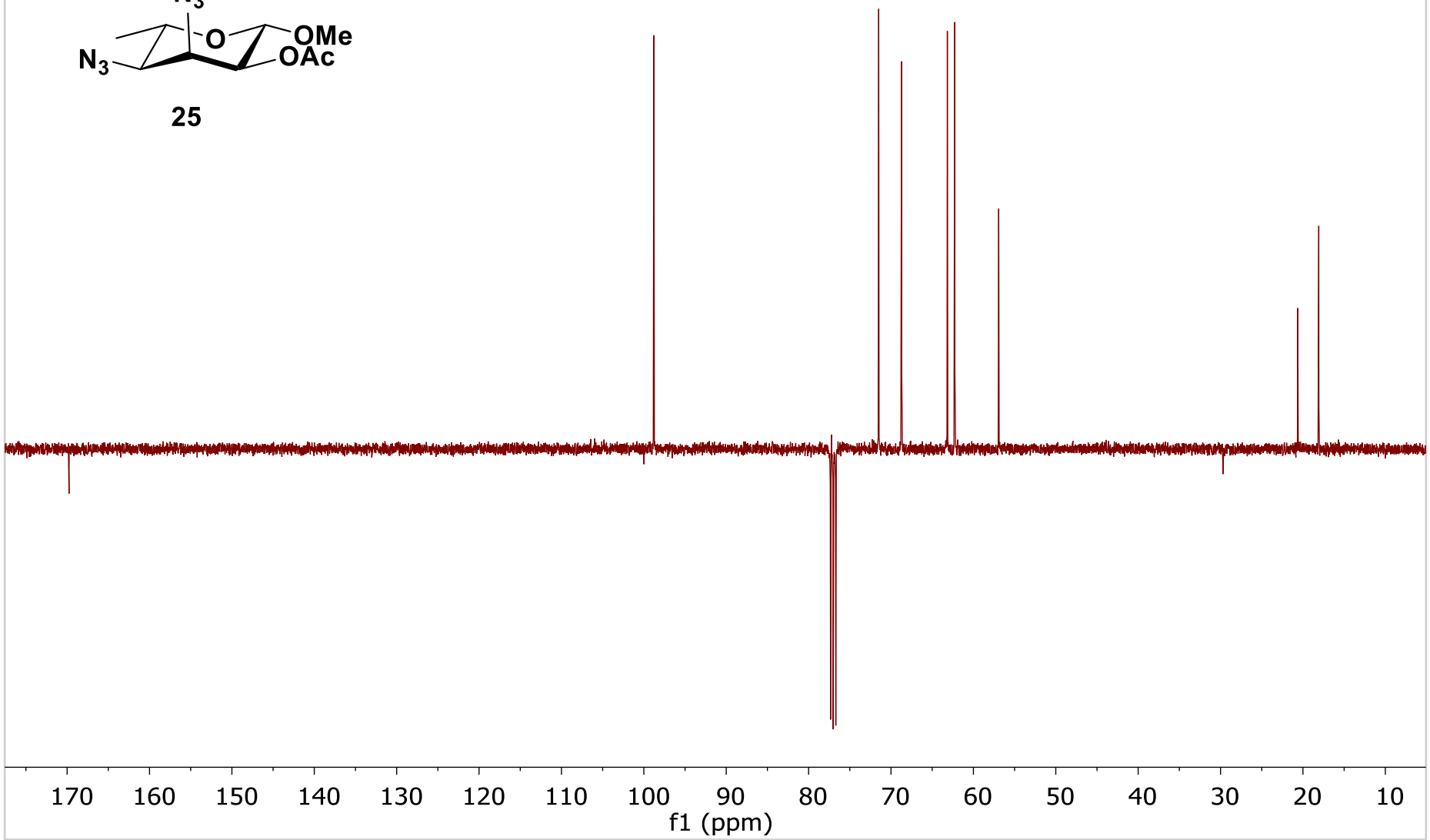
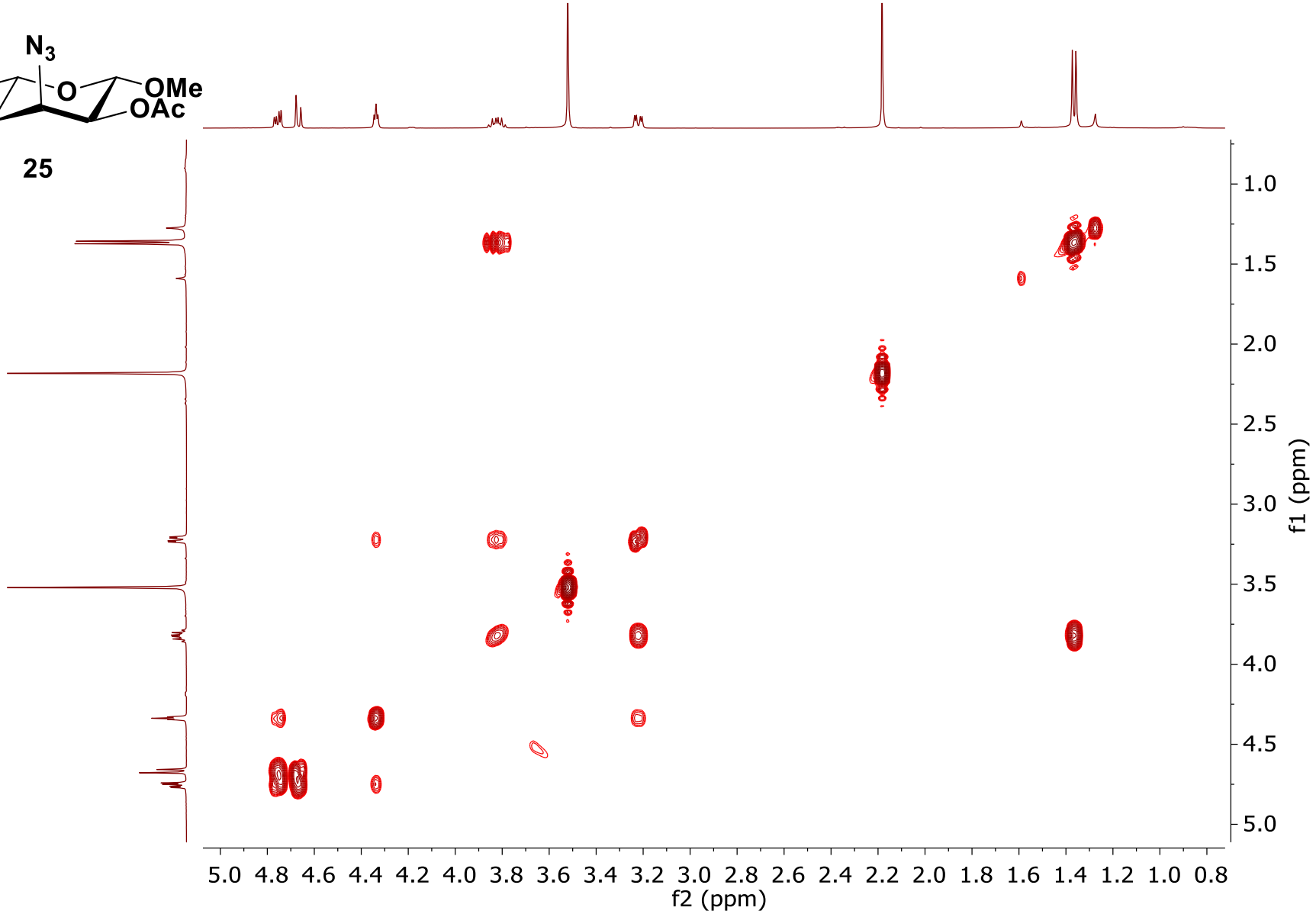
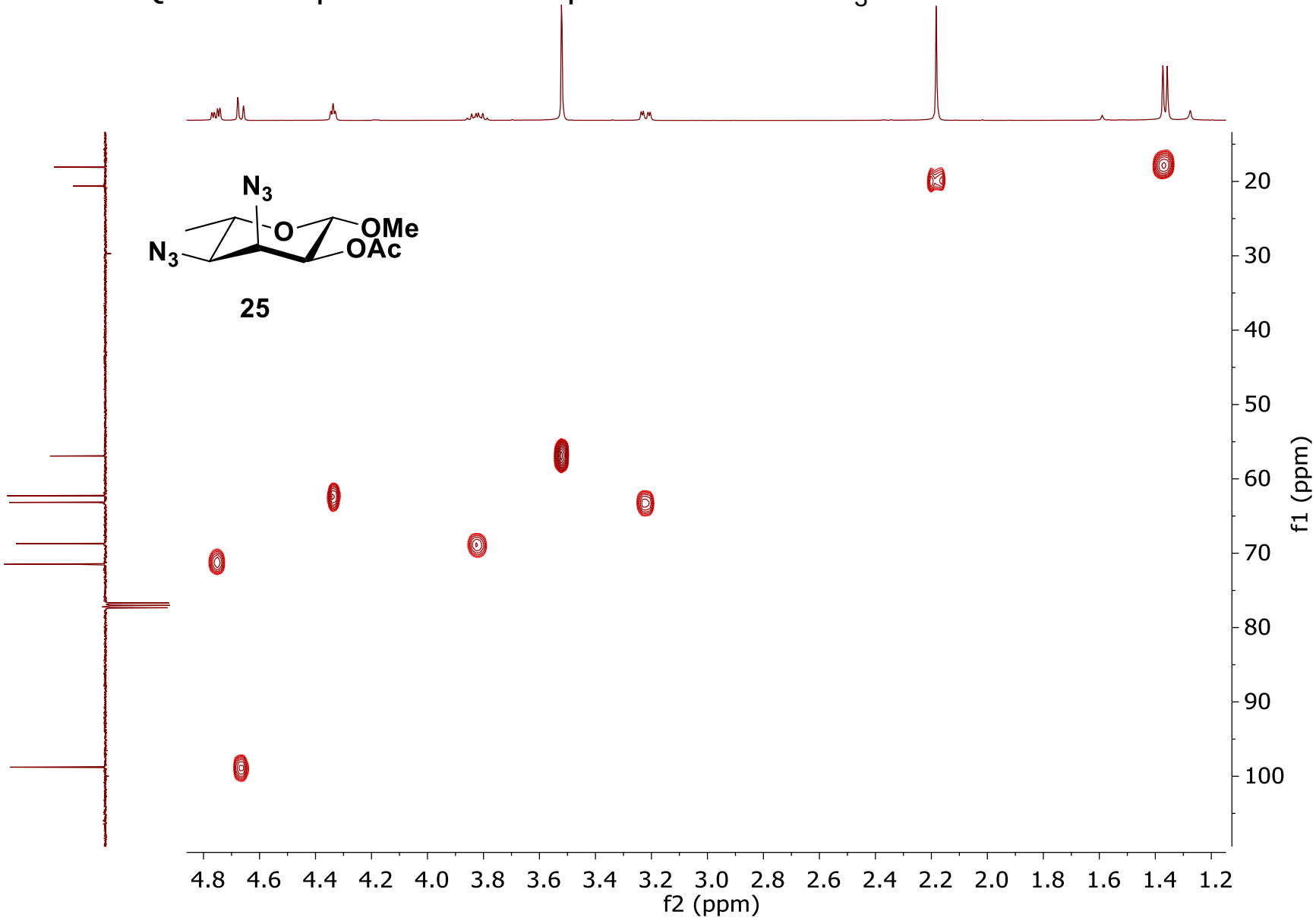


^{1}H-^{1}H GCOSY NMR spectrum of compound **25** in $CDCl_3$

25

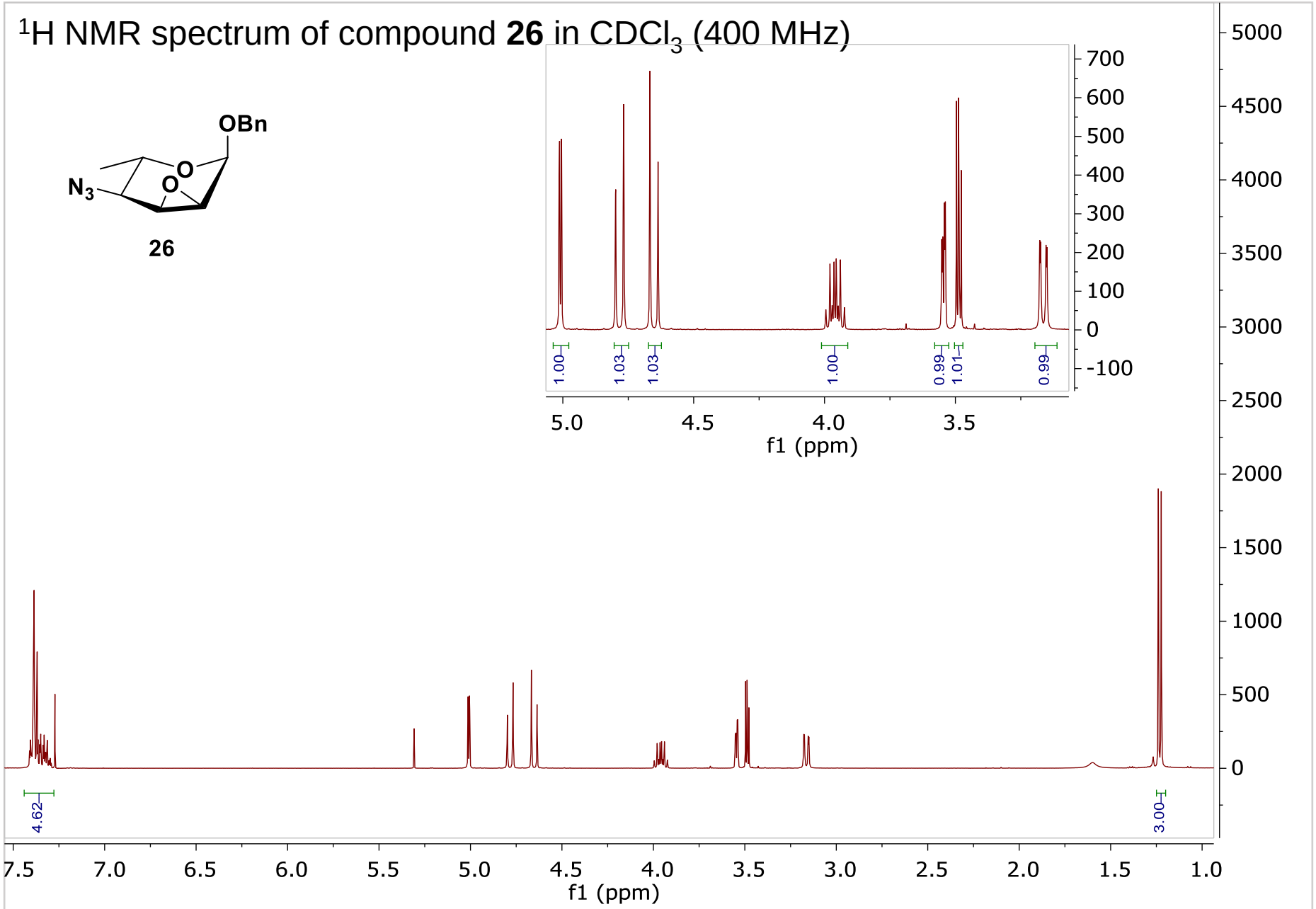


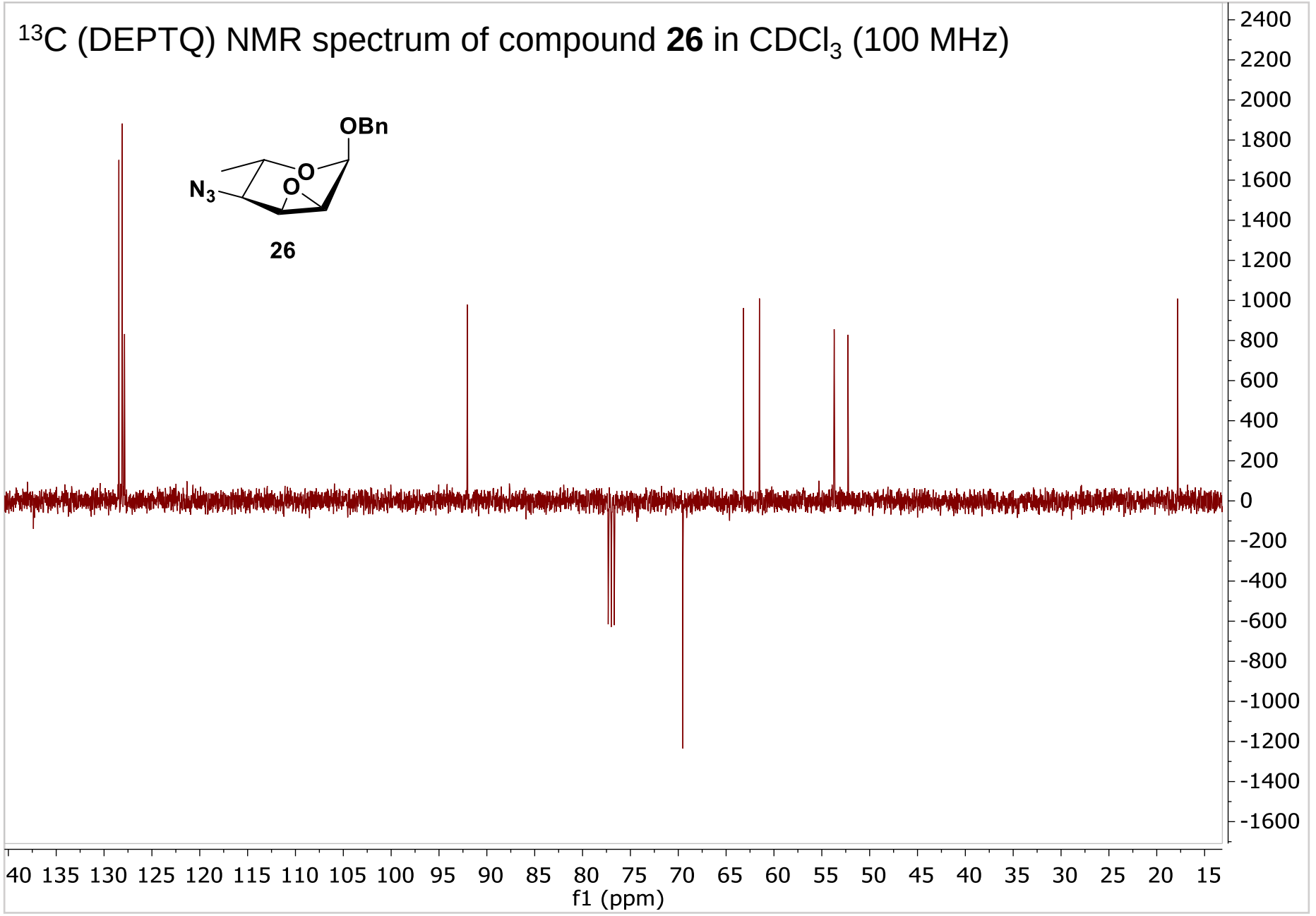
^{1}H-^{13}C GHSQC NMR spectrum of compound **25** in $CDCl_3$



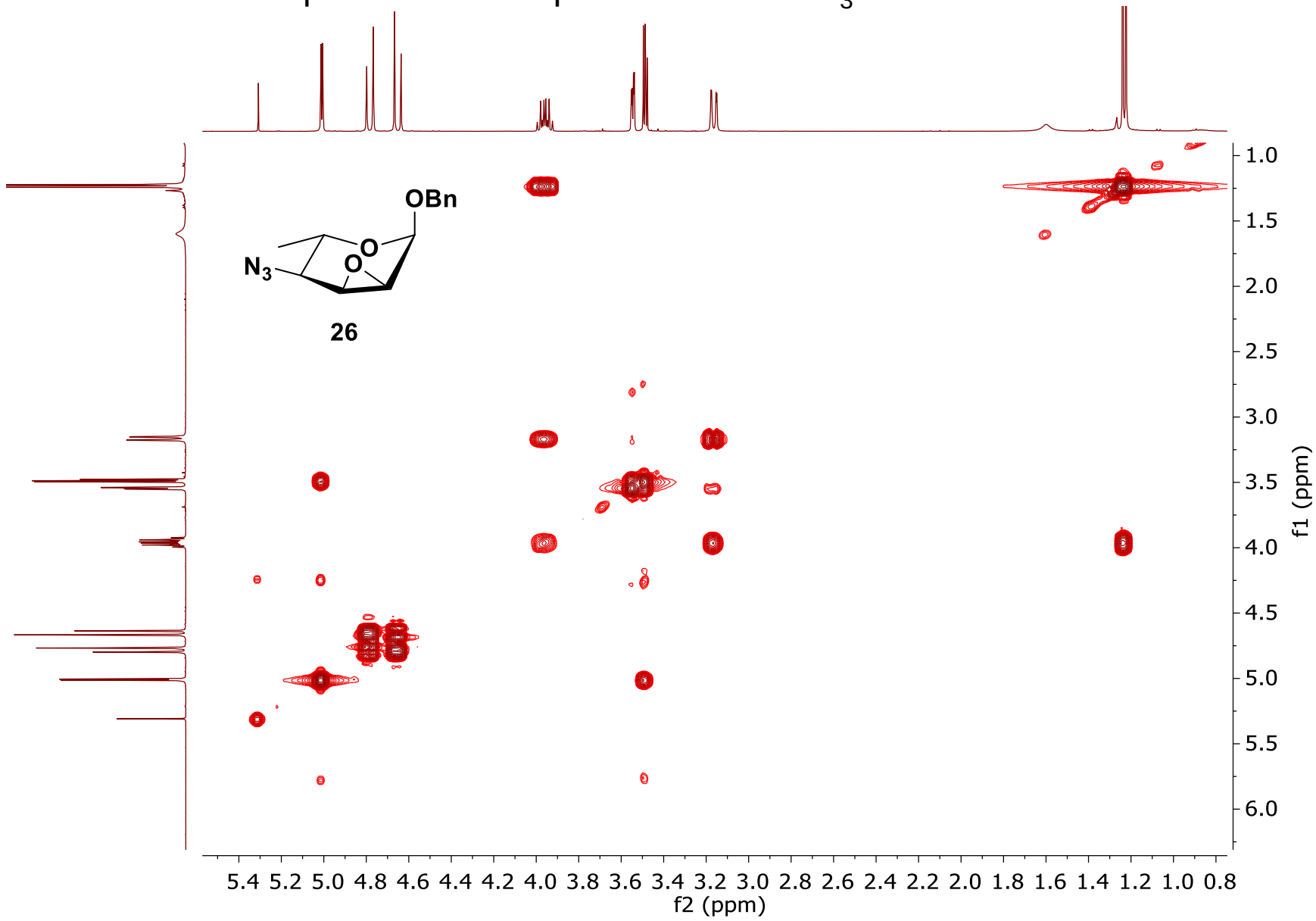
^{1}H NMR spectrum of compound **26** in $CDCl_3$ (400 MHz)

26

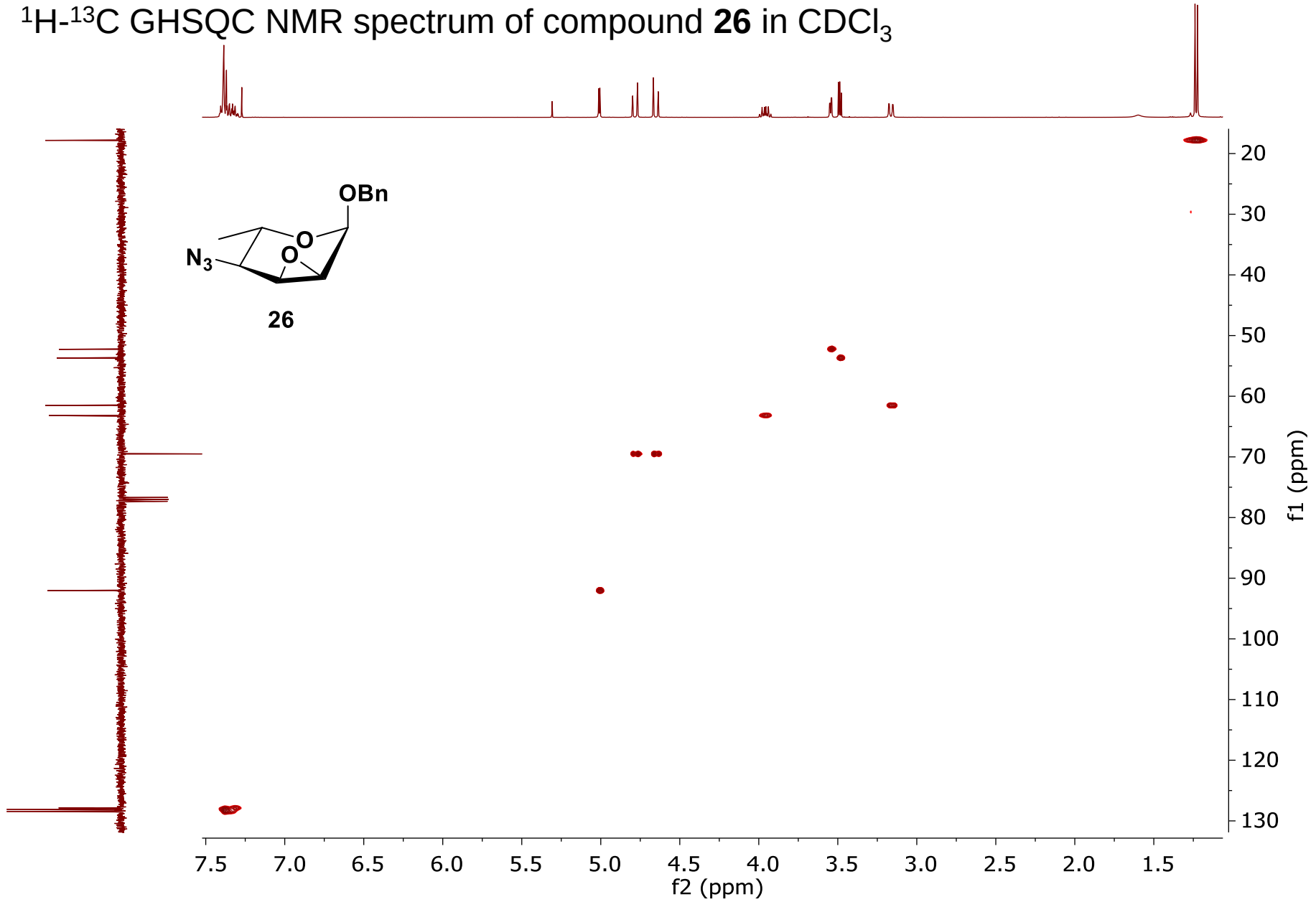



^{13}C (DEPTQ) NMR spectrum of compound **26** in $CDCl_3$ (100 MHz)
OBn
O
O
N_3
26
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
40 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **26** in $CDCl_3$

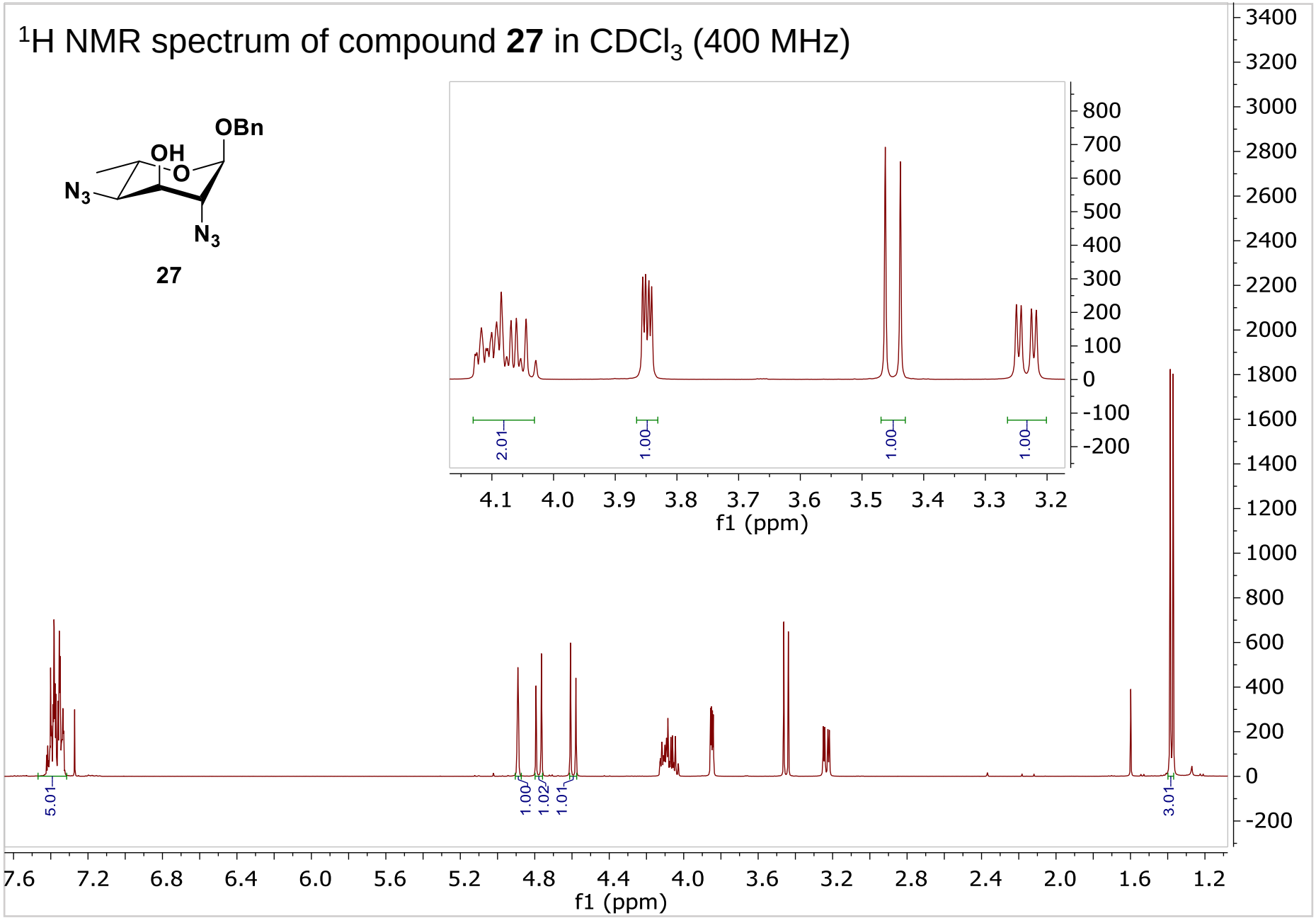


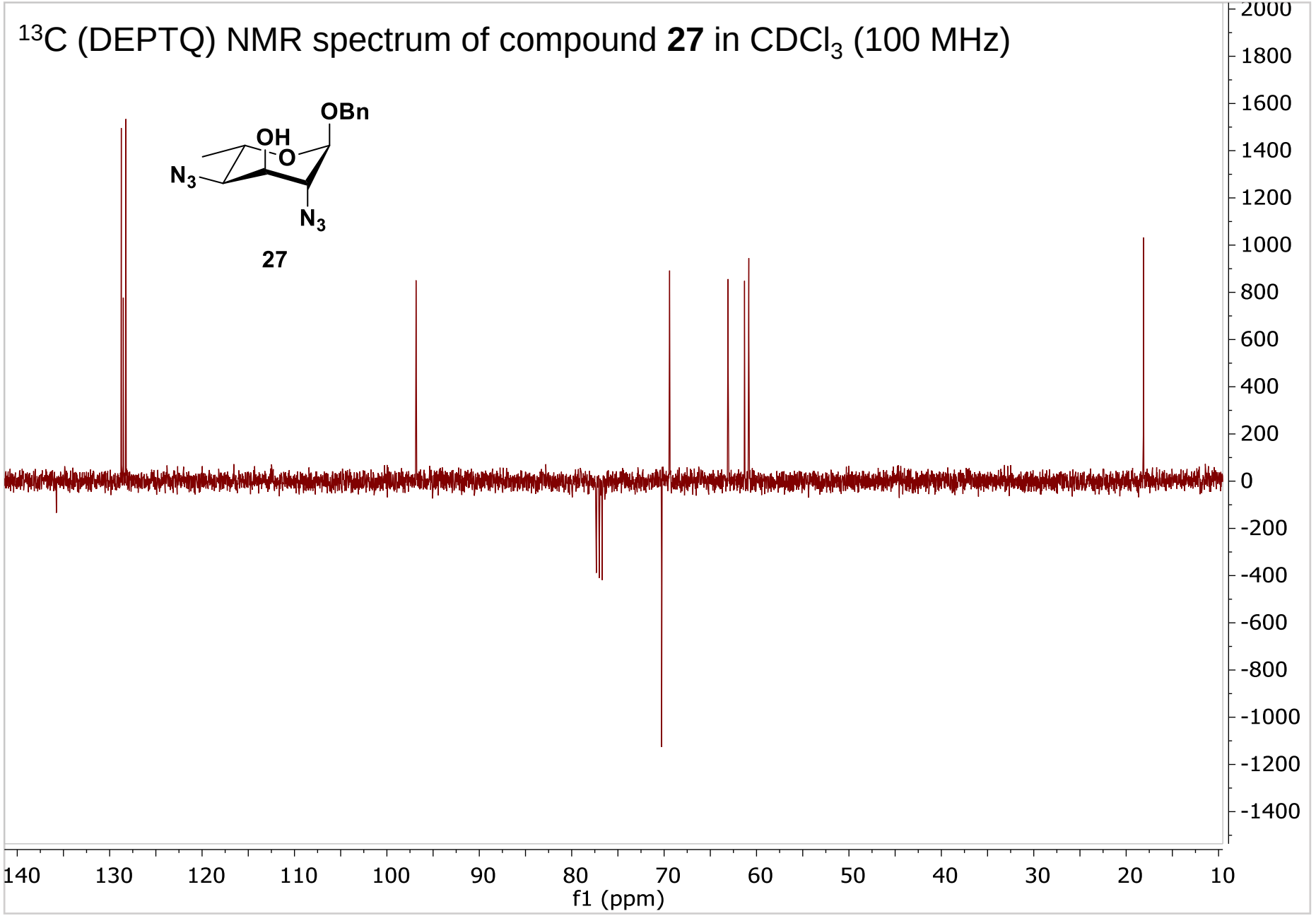
^{1}H-^{13}C GHSQC NMR spectrum of compound **26** in $CDCl_3$



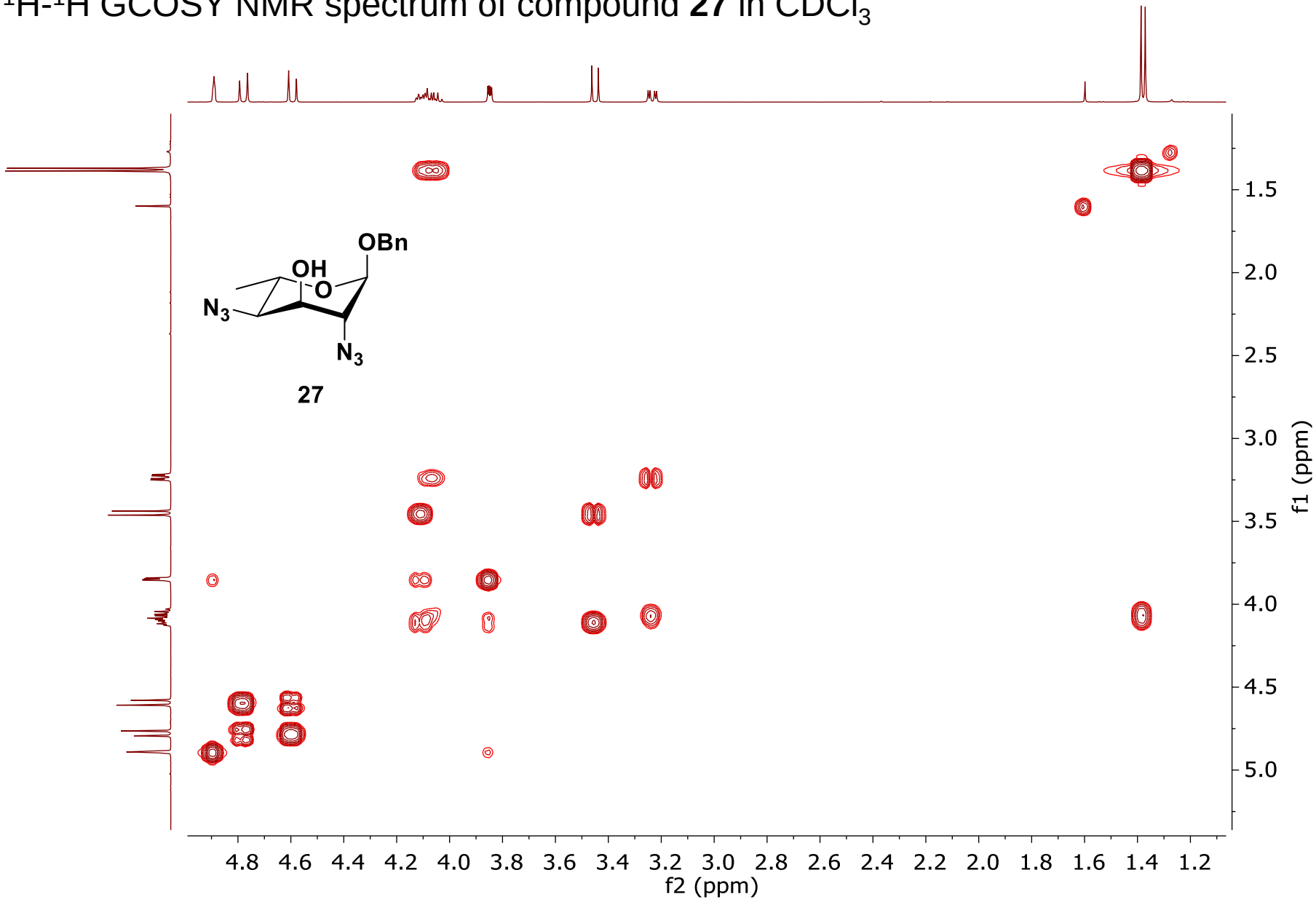
^{1}H NMR spectrum of compound **27** in $CDCl_3$ (400 MHz)

27

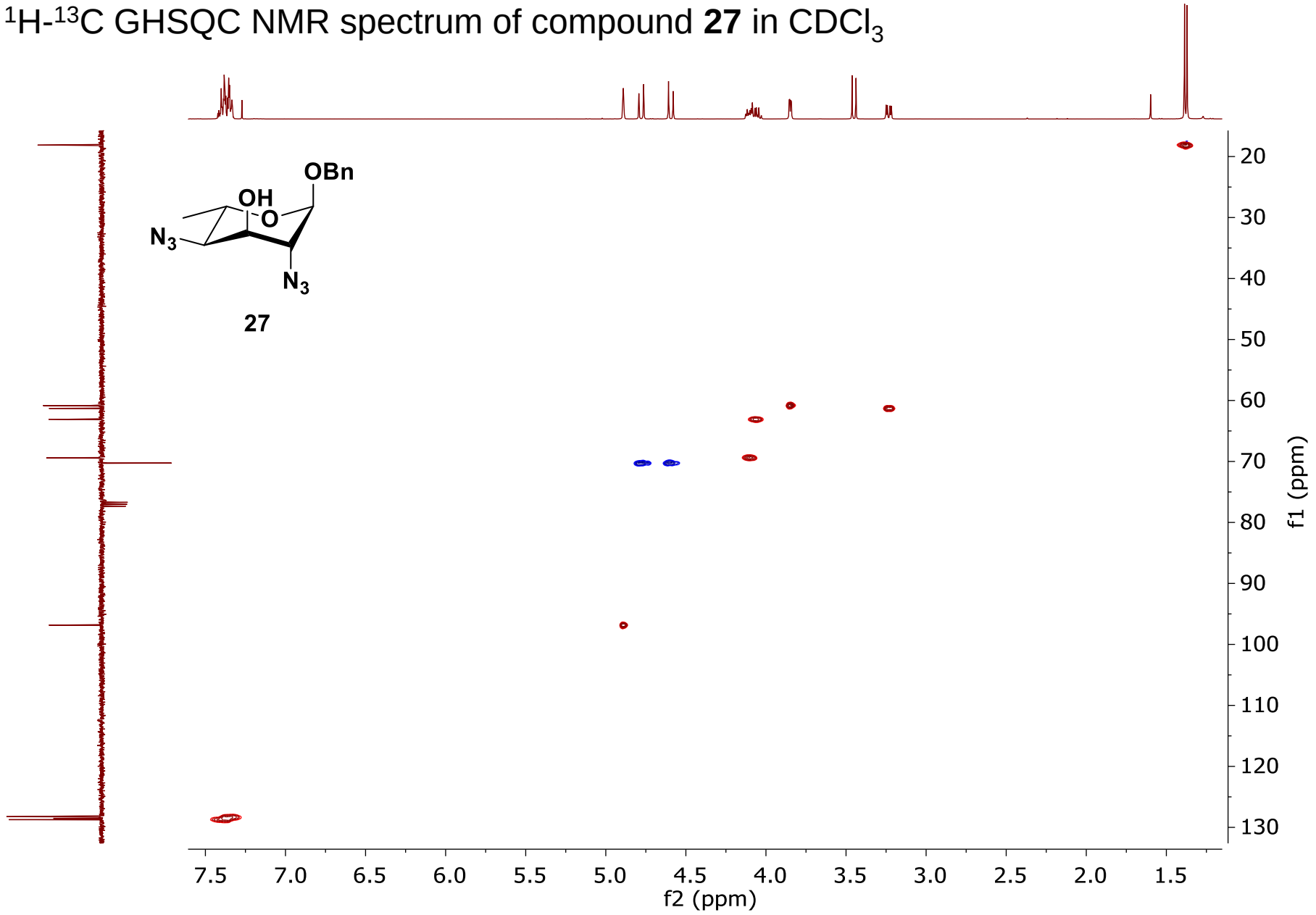



^{13}C (DEPTQ) NMR spectrum of compound **27** in $CDCl_3$ (100 MHz)
OBn
OH
O
N_3
N_3
27
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
-1200
-1400
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

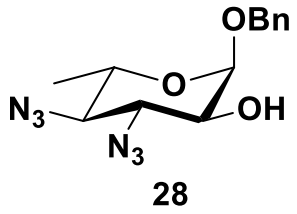
^{1}H-^{1}H GCOSY NMR spectrum of compound **27** in $CDCl_3$



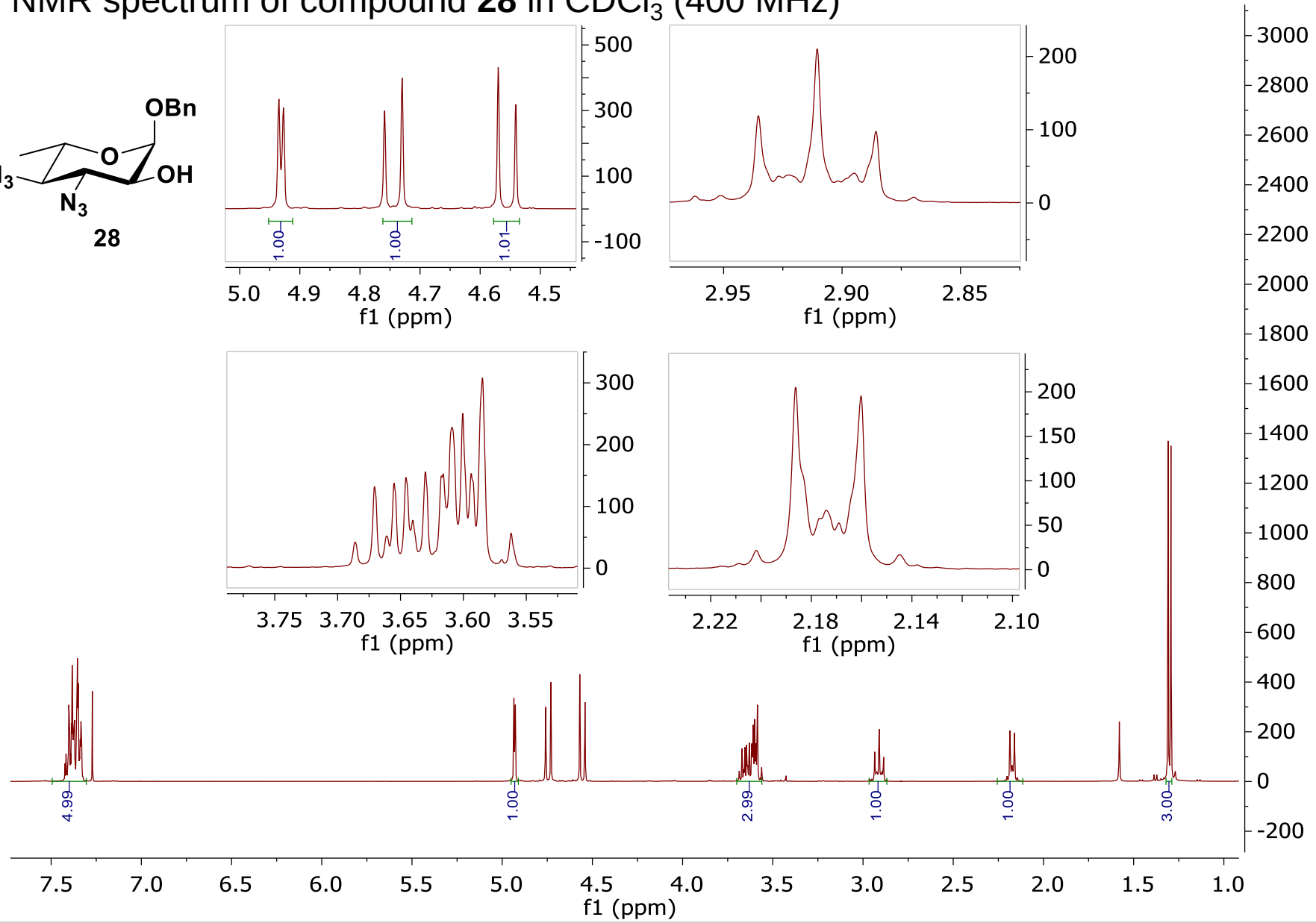
^{1}H-^{13}C GHSQC NMR spectrum of compound **27** in $CDCl_3$

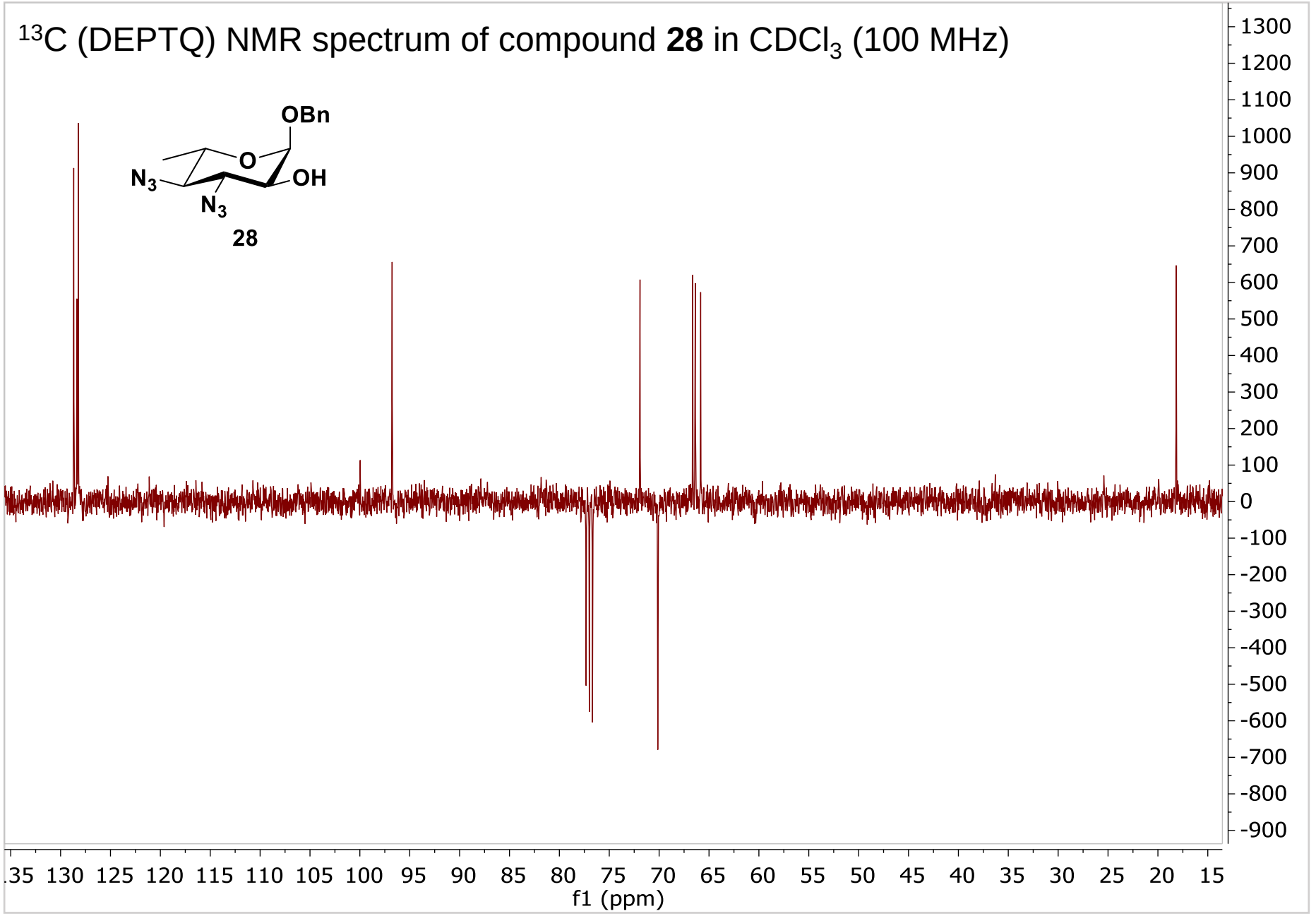


^{1}H NMR spectrum of compound **28** in $CDCl_3$ (400 MHz)

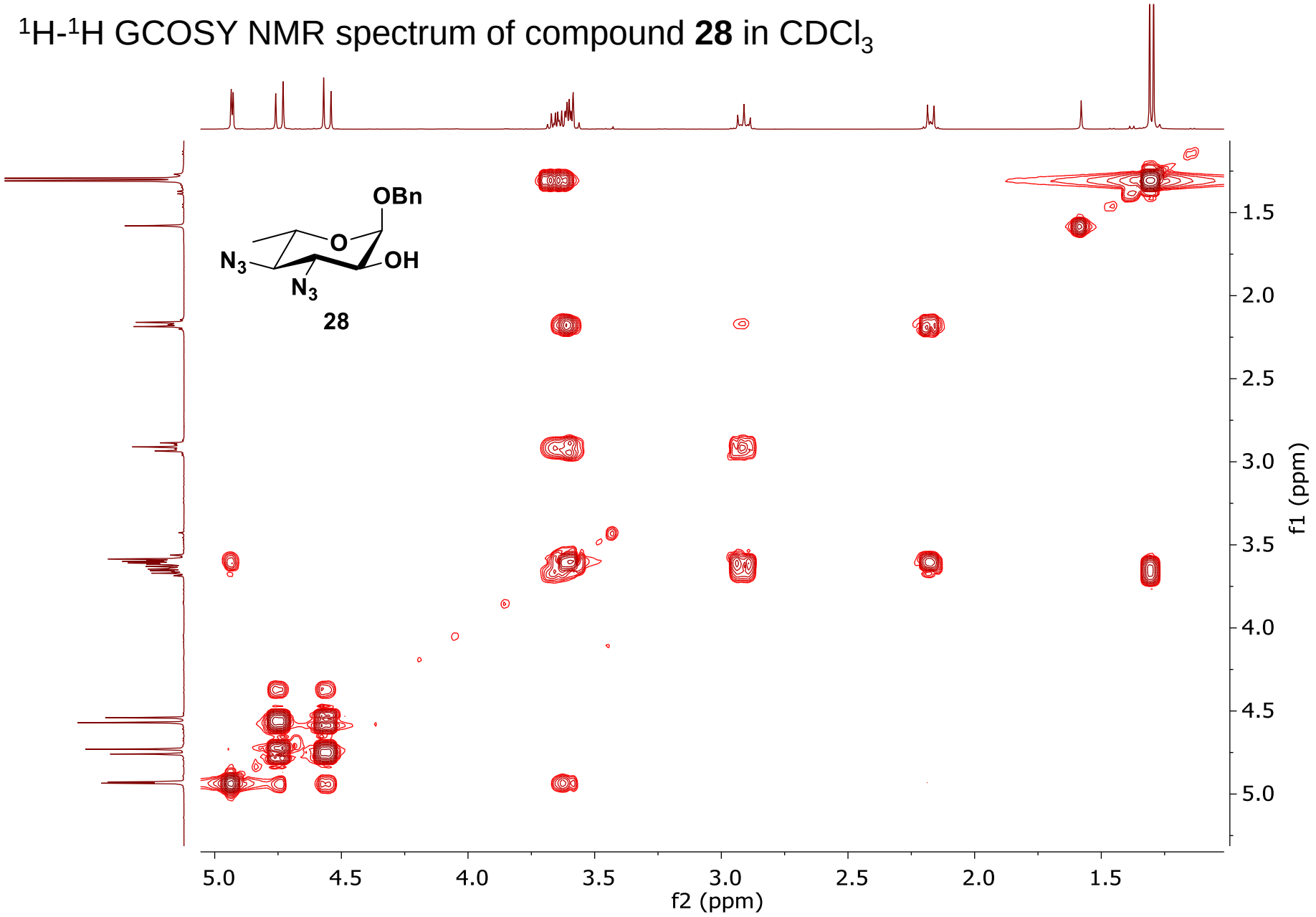


28

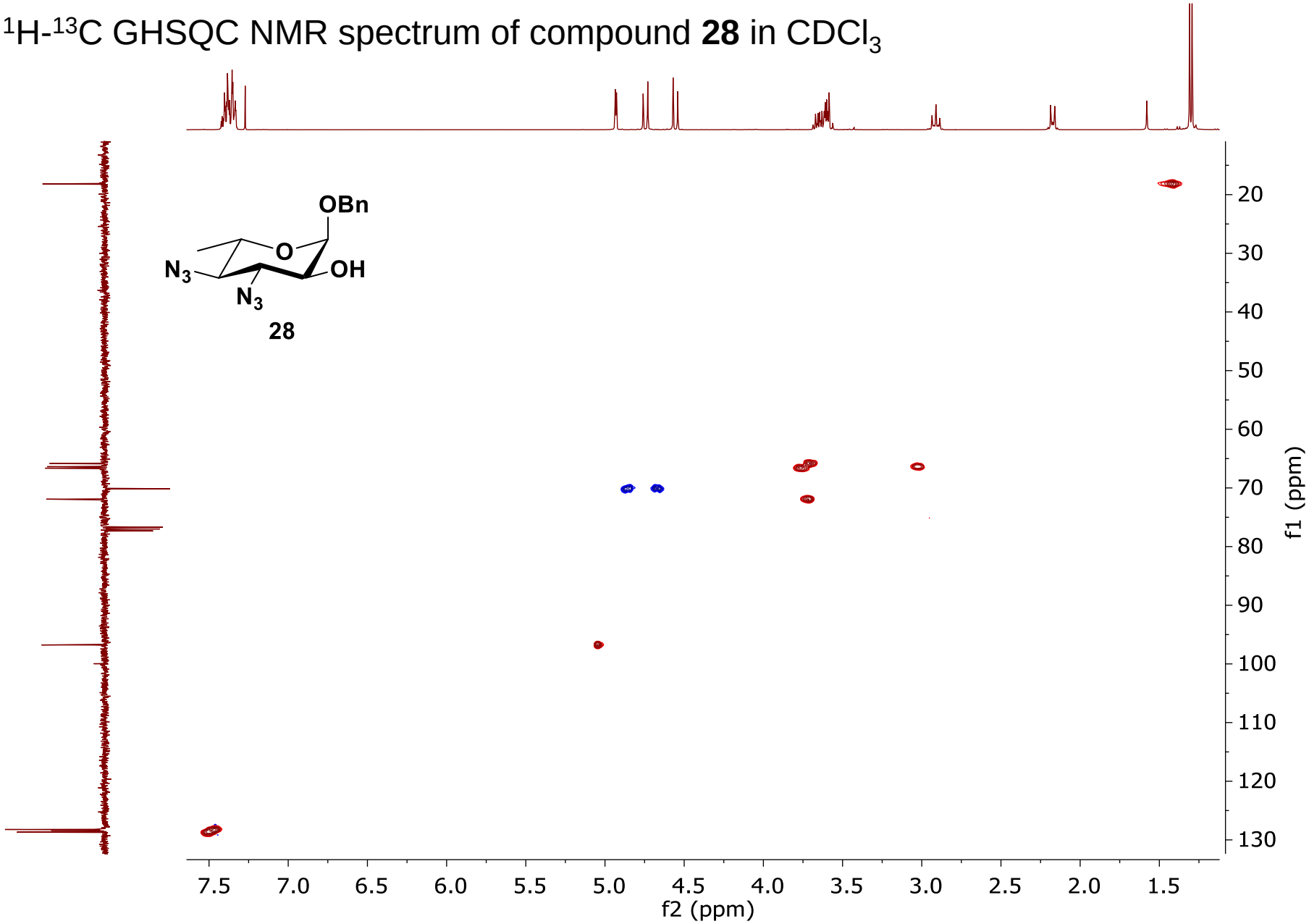



13C (DEPTQ) NMR spectrum of compound 28 in CDCl3 (100 MHz)
OBn
O
N3
OH
N3
28
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **28** in $CDCl_3$

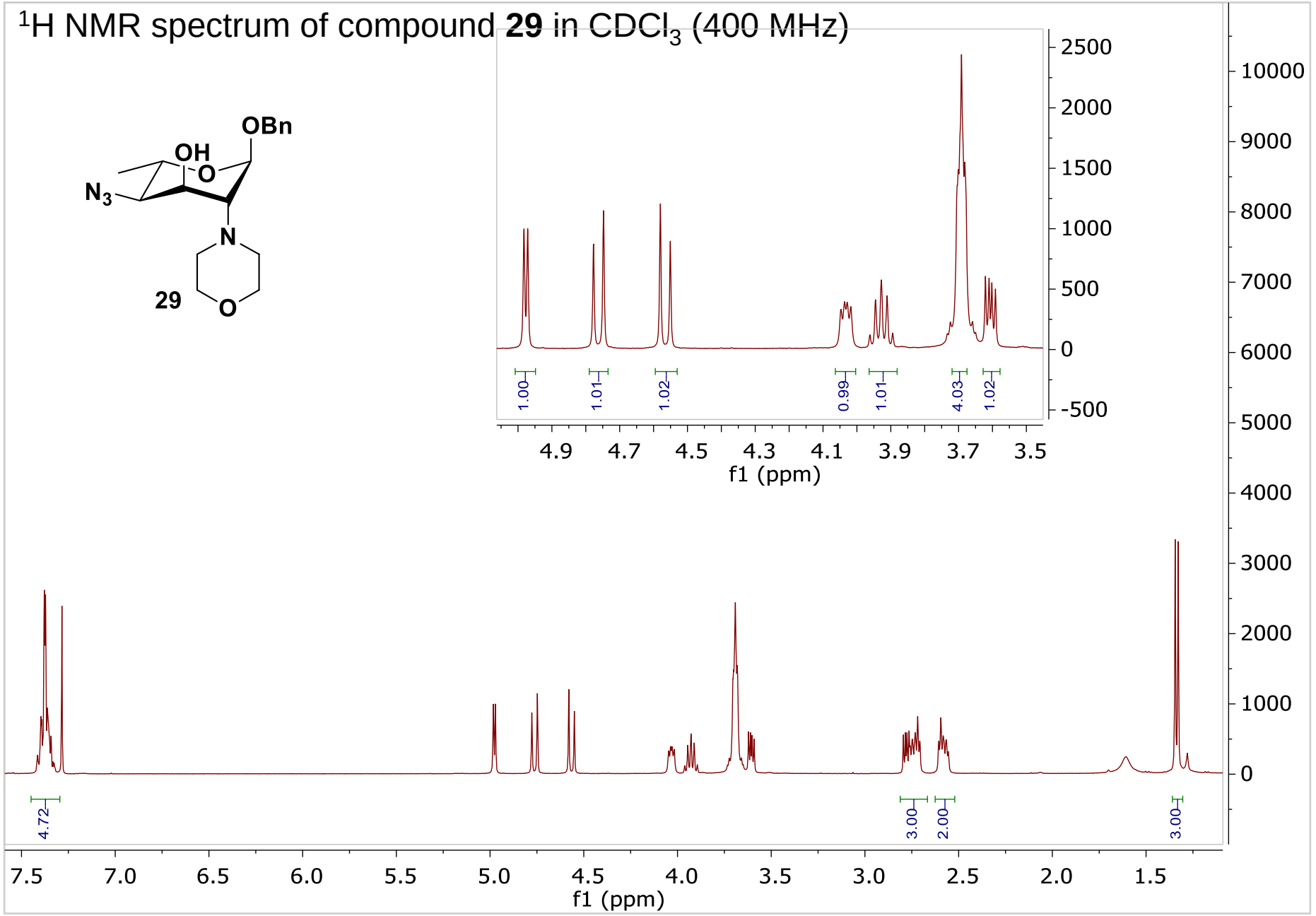


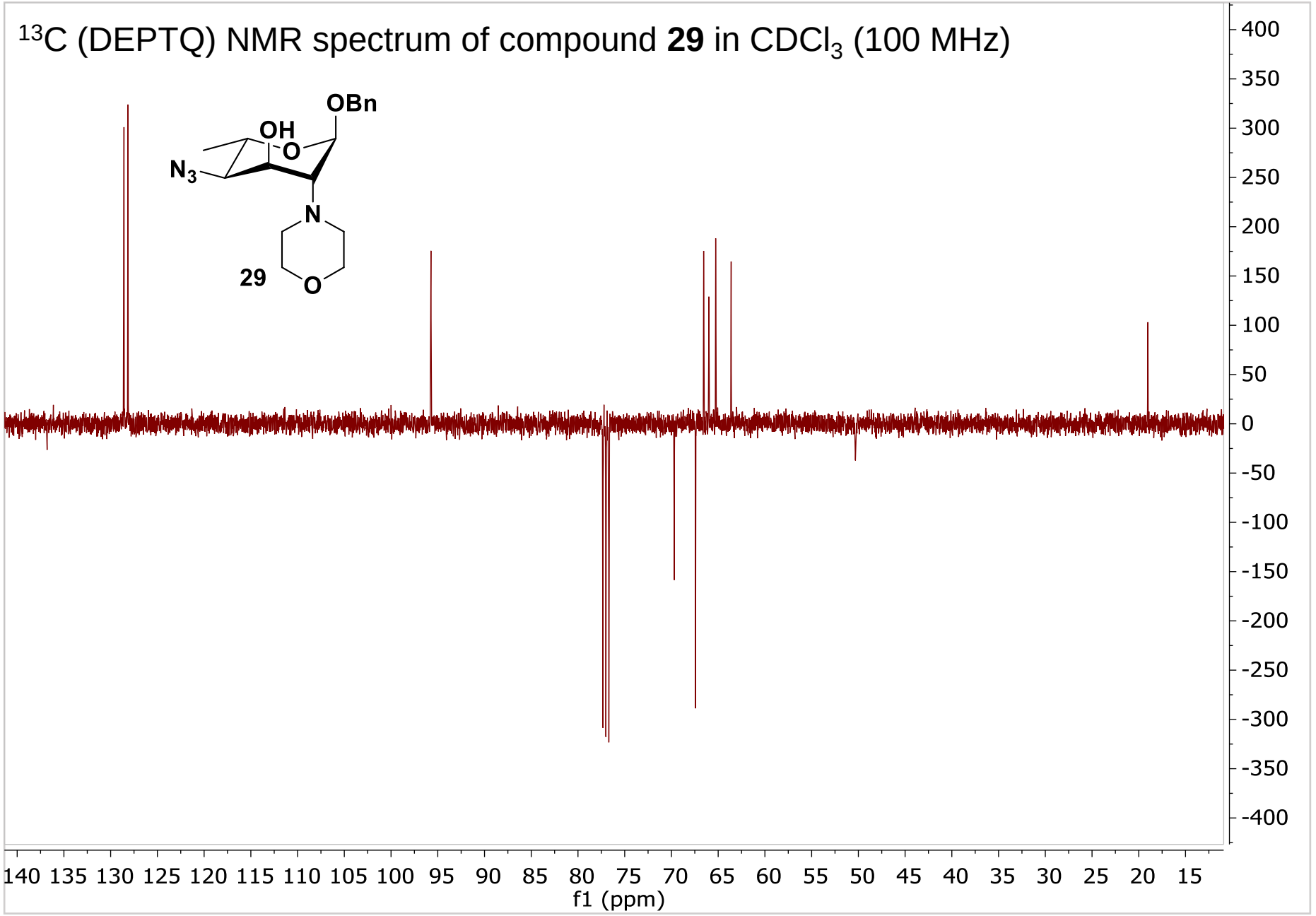
^{1}H-^{13}C GHSQC NMR spectrum of compound **28** in $CDCl_3$



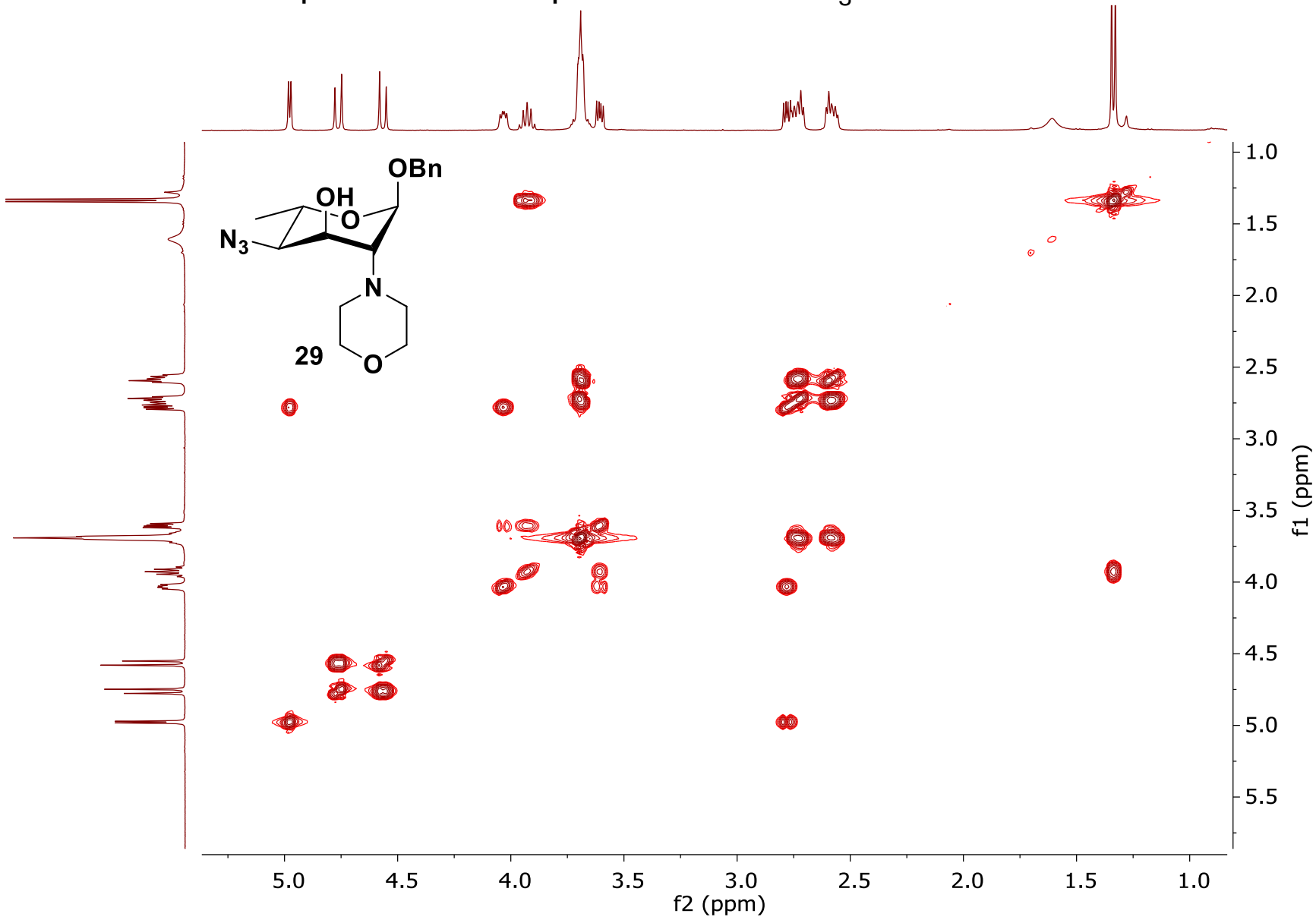
^{1}H NMR spectrum of compound **29** in $CDCl_3$ (400 MHz)

29

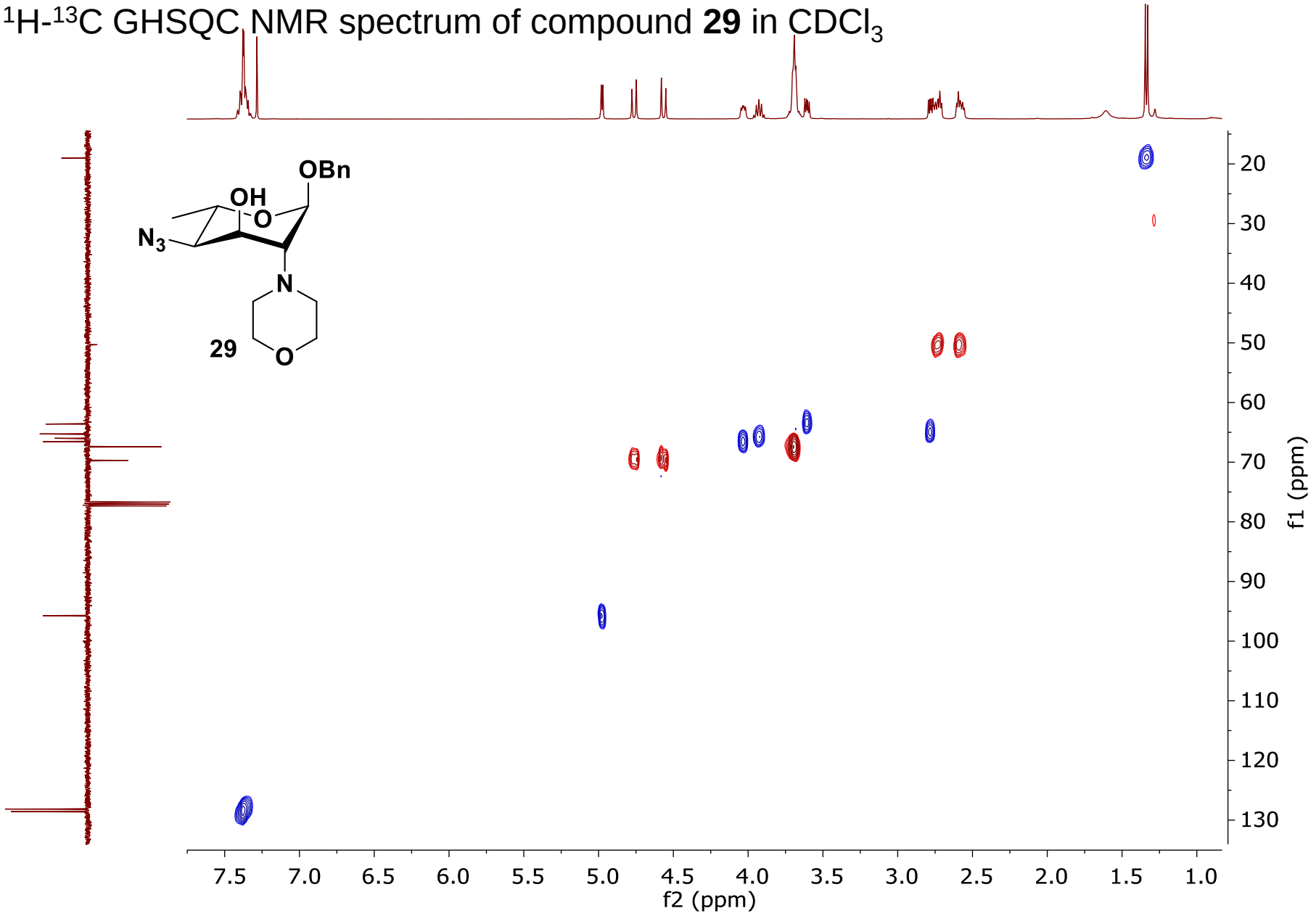



^{13}C (DEPTQ) NMR spectrum of compound **29** in $CDCl_3$ (100 MHz)
OBn
OH
O
N_3
N
O
29
400
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **29** in $CDCl_3$

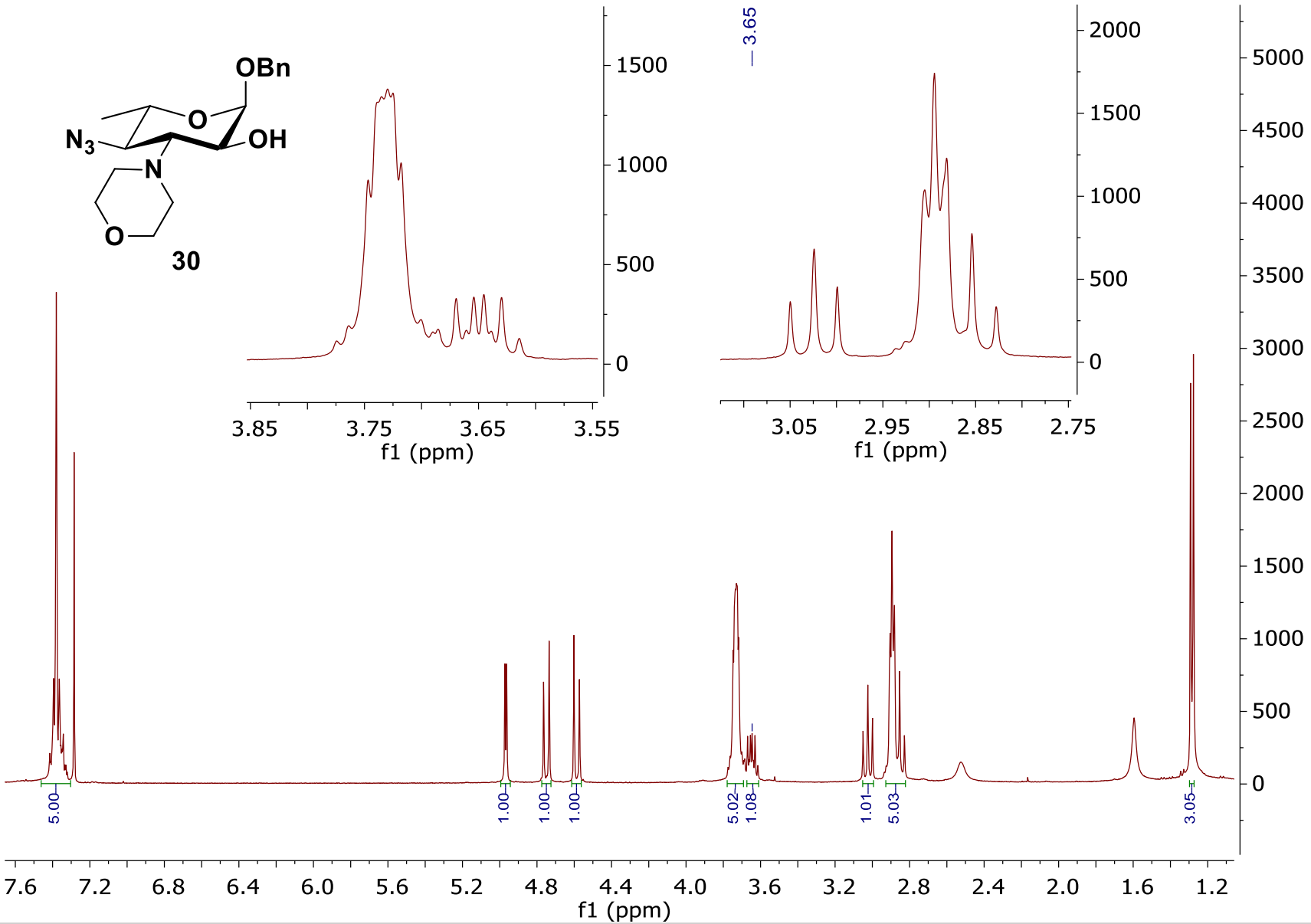


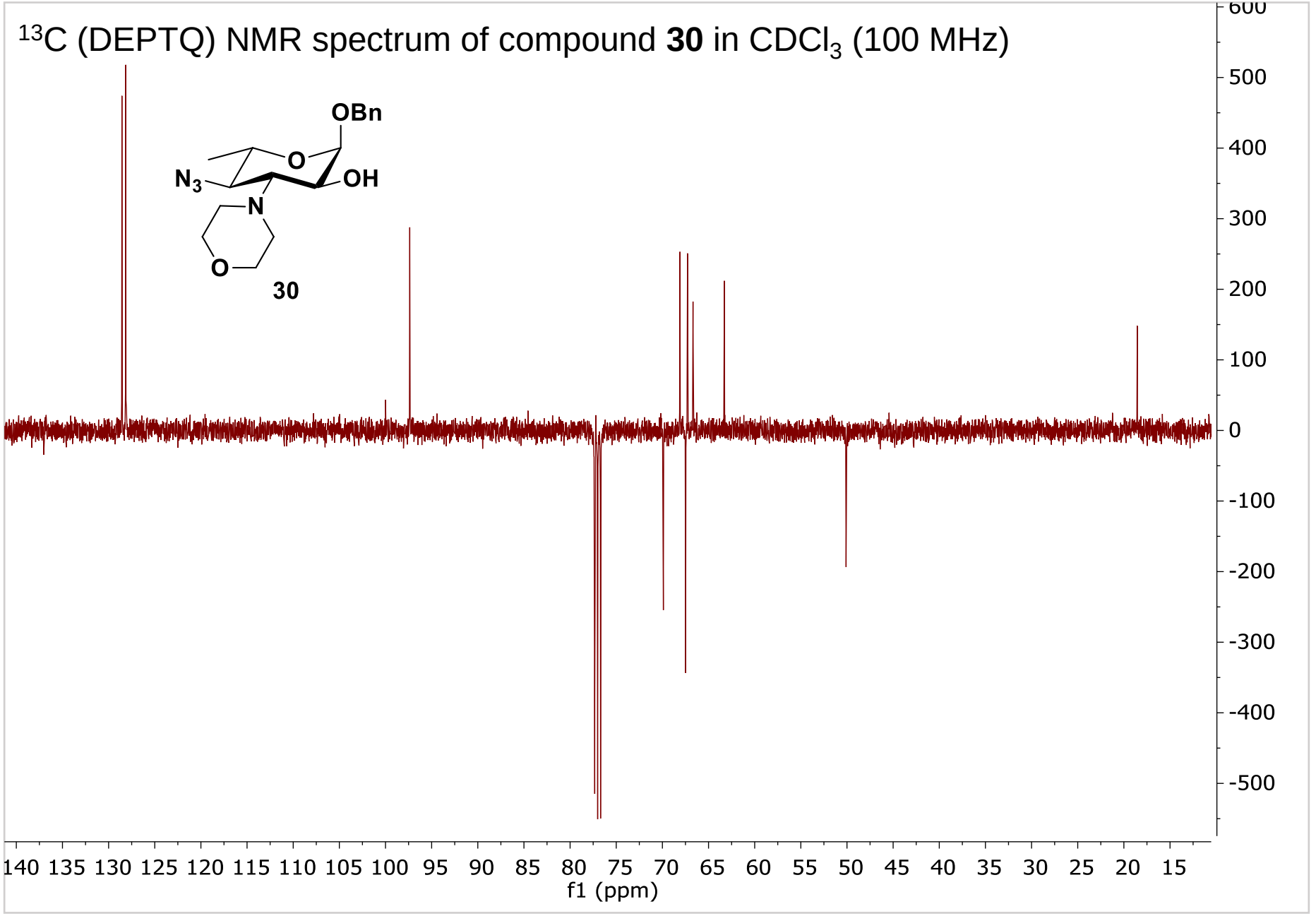
^{1}H-^{13}C GHSQC NMR spectrum of compound **29** in $CDCl_3$



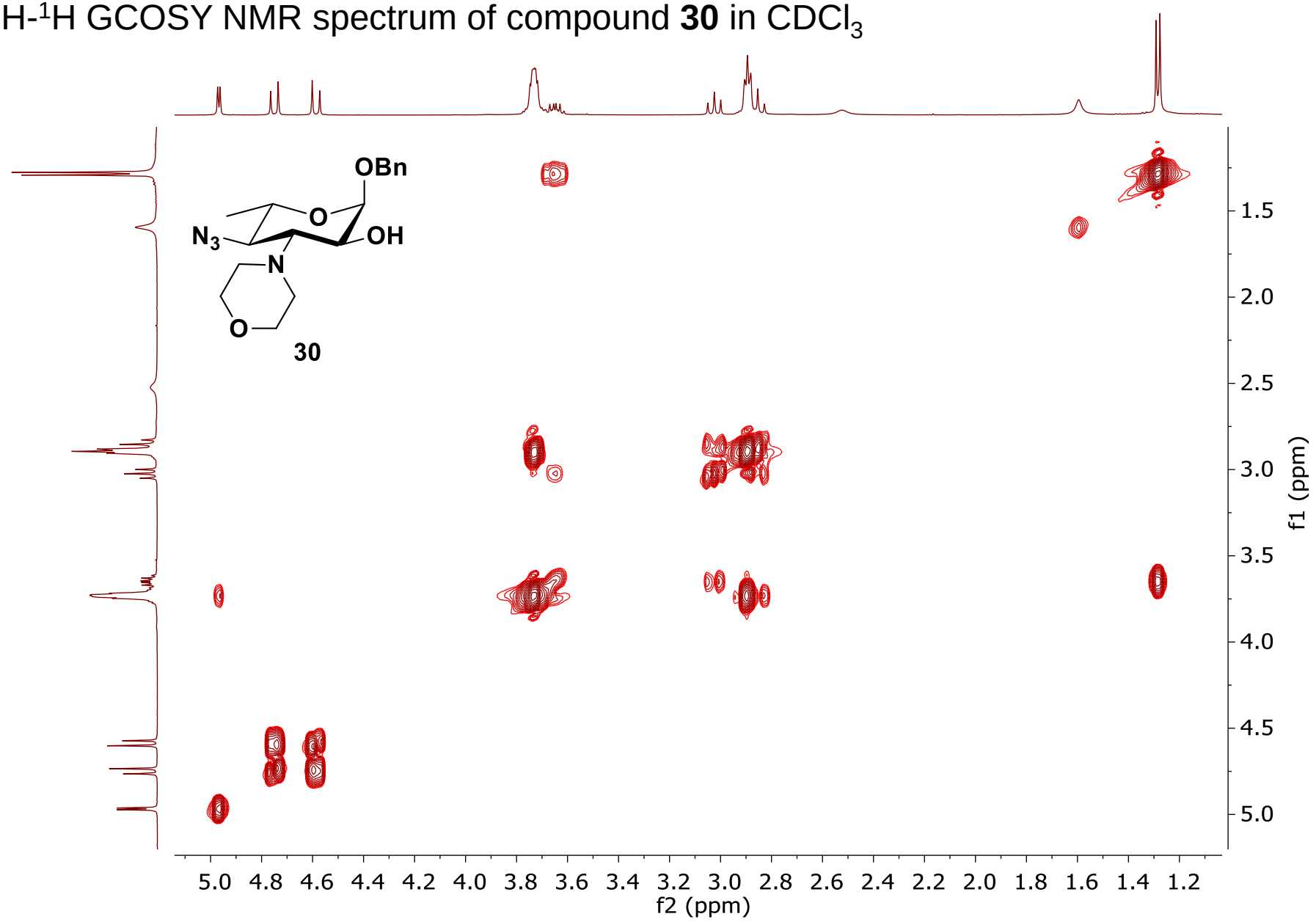
^{1}H NMR spectrum of compound **30** in $CDCl_3$ (400 MHz)

30

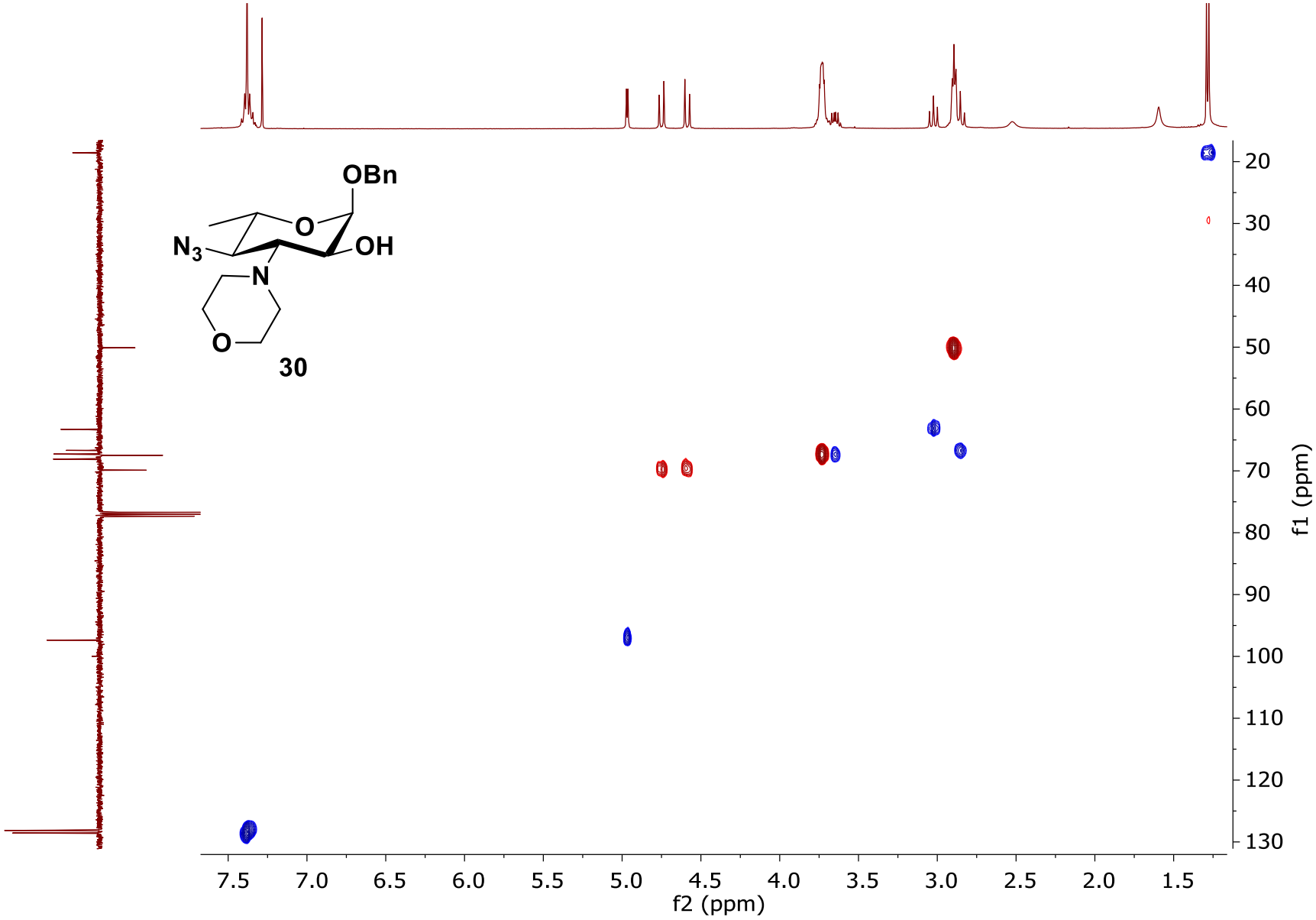



^{13}C (DEPTQ) NMR spectrum of compound **30** in $CDCl_3$ (100 MHz)
OBn
O
OH
N_3
N
O
30
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
f1 (ppm)

^{1}H-^{1}H GCOSY NMR spectrum of compound **30** in $CDCl_3$

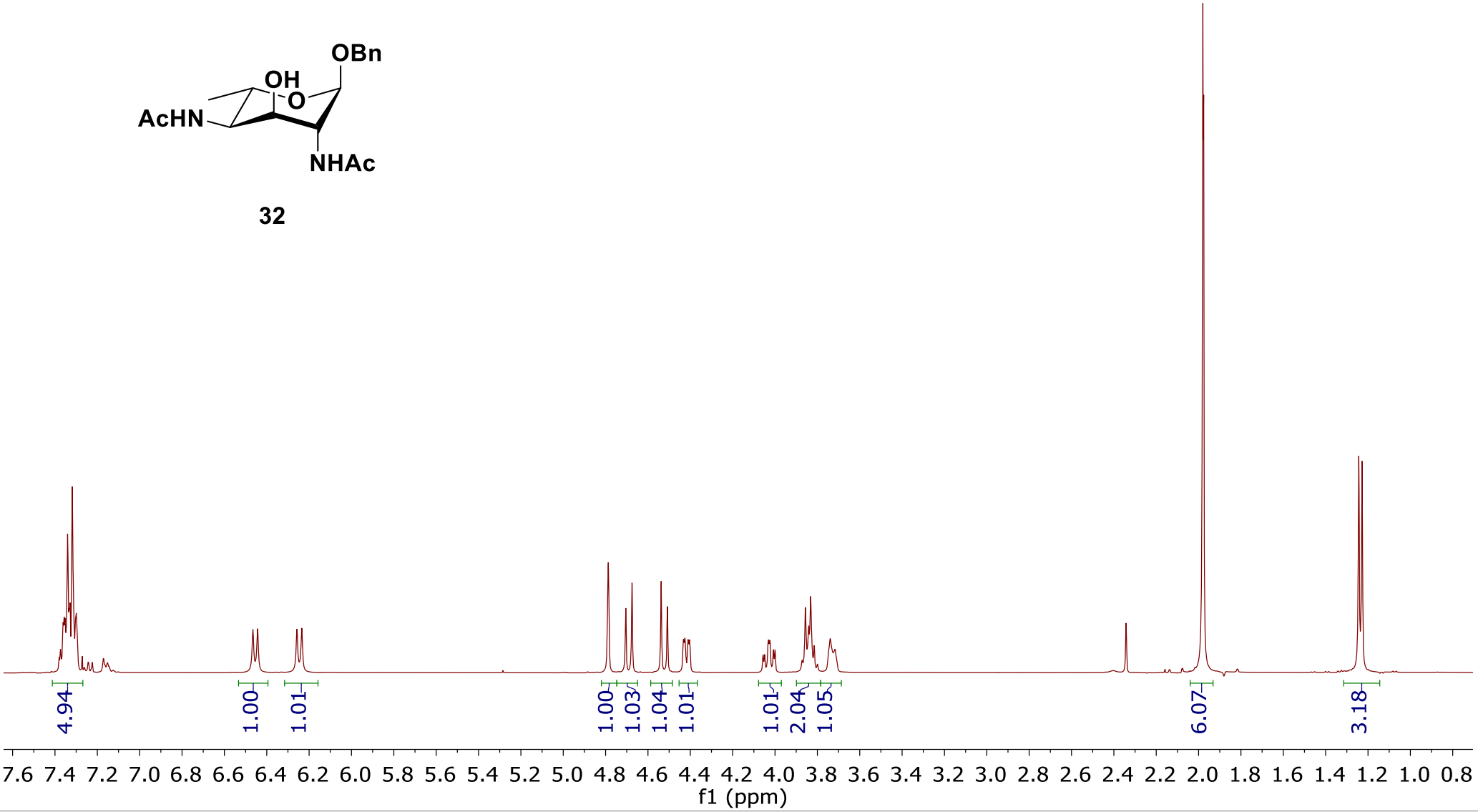


^{1}H-^{13}C GHSQC NMR spectrum of compound **30** in $CDCl_3$



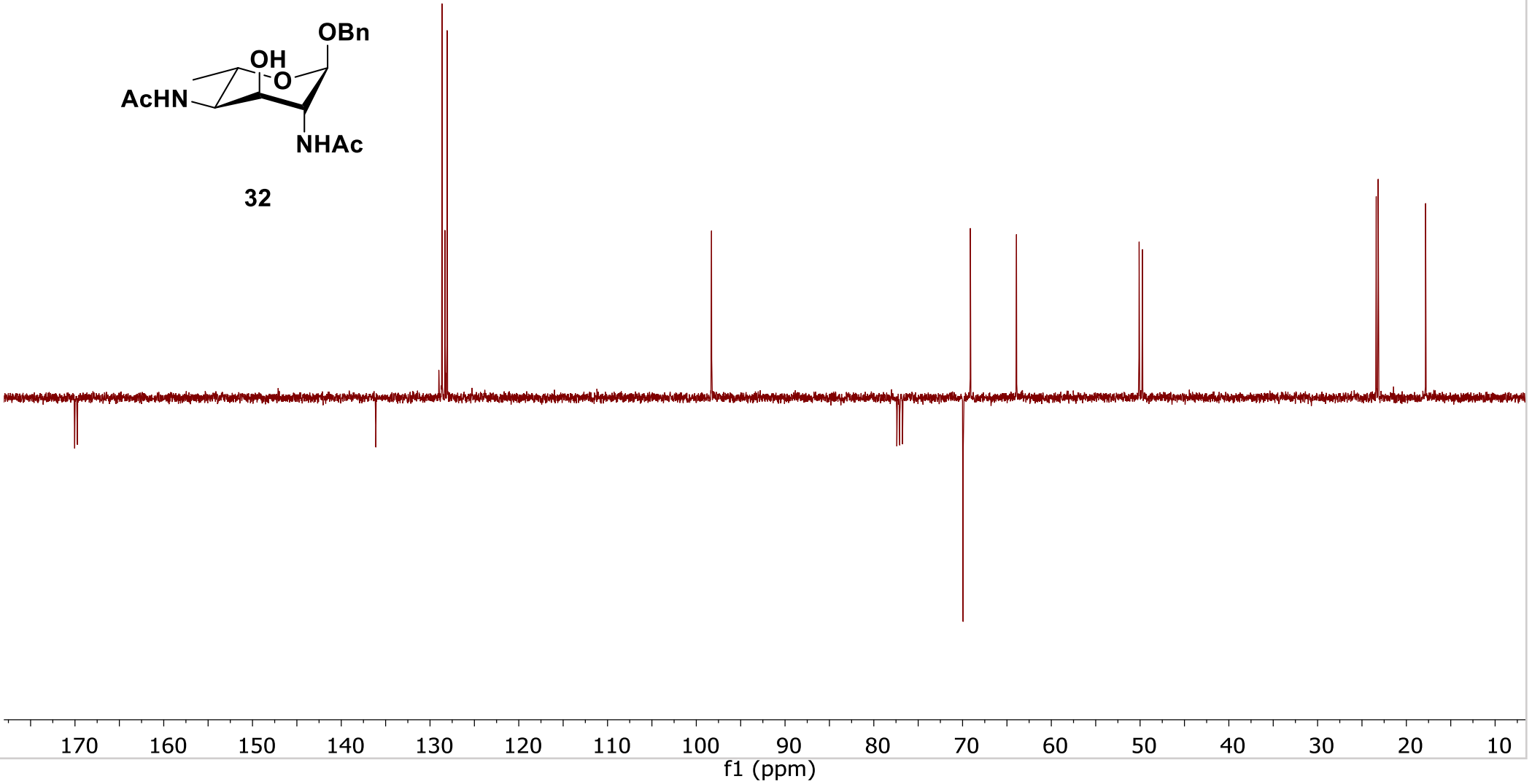
^{1}H NMR spectrum of compound **32** in $CDCl_3$ (400 MHz)

32

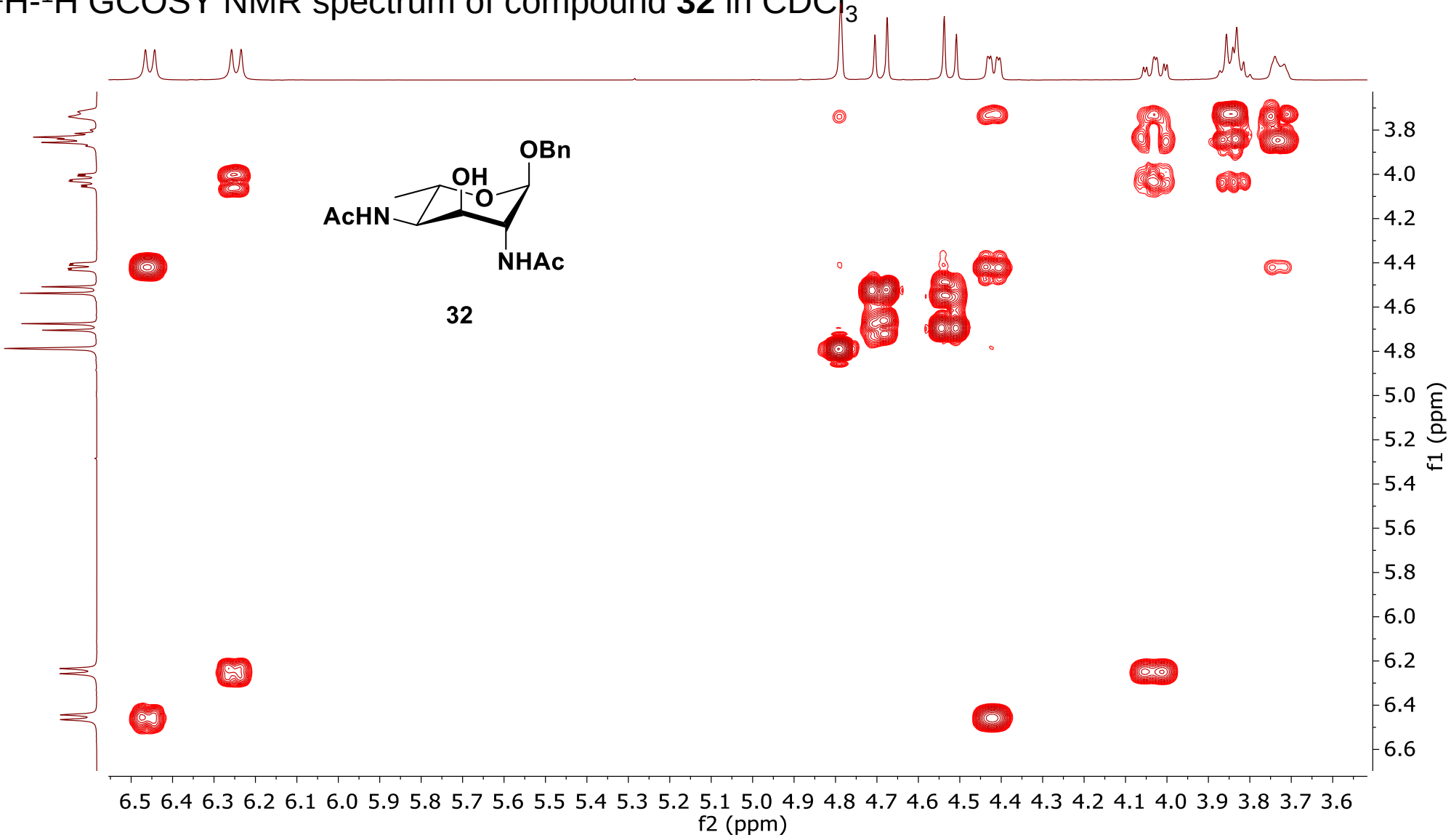


^{13}C (DEPTQ) NMR spectrum of compound **32** in $CDCl_3$ (100 MHz)

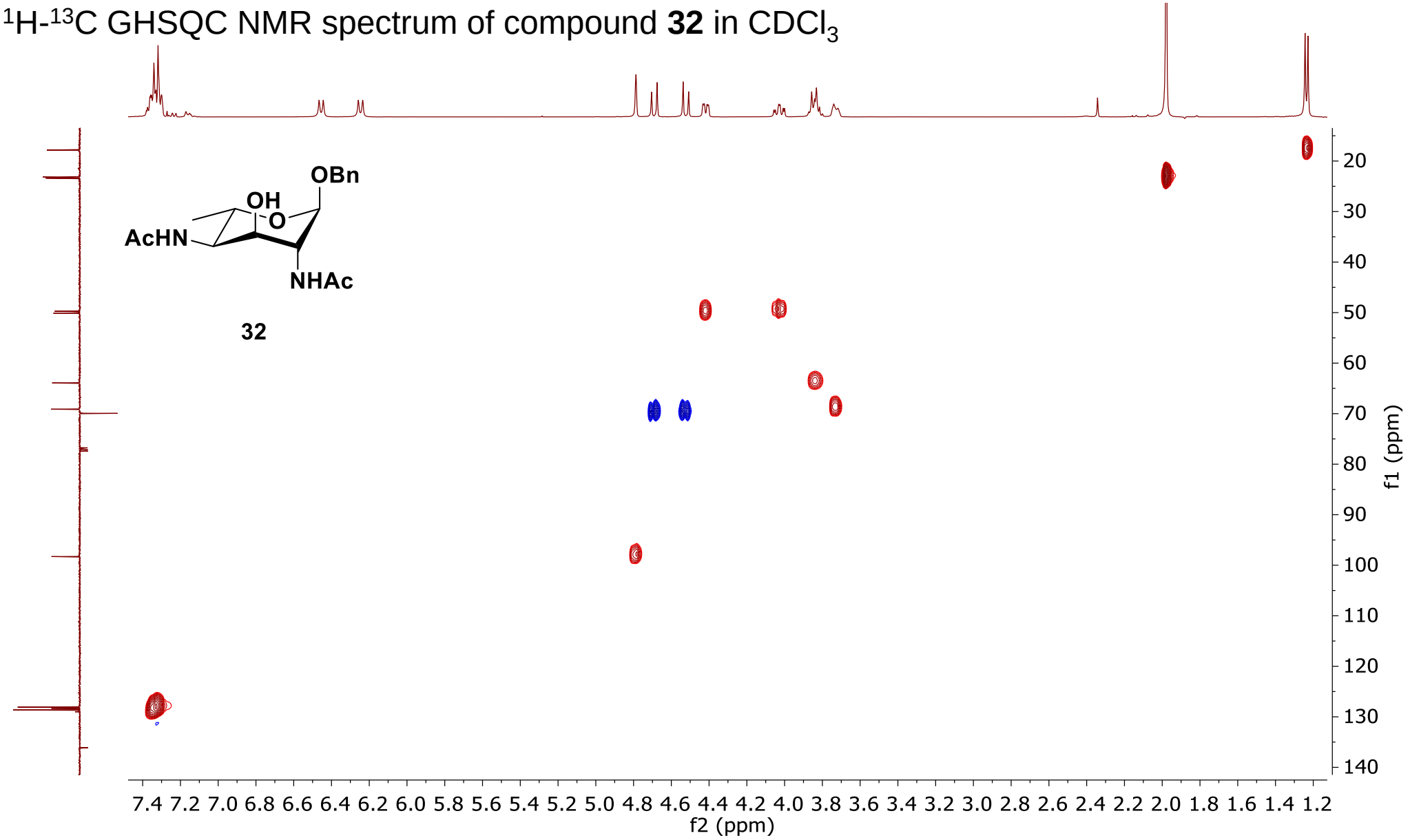
32



^{1}H-^{1}H GCOSY NMR spectrum of compound **32** in $CDCl_3$

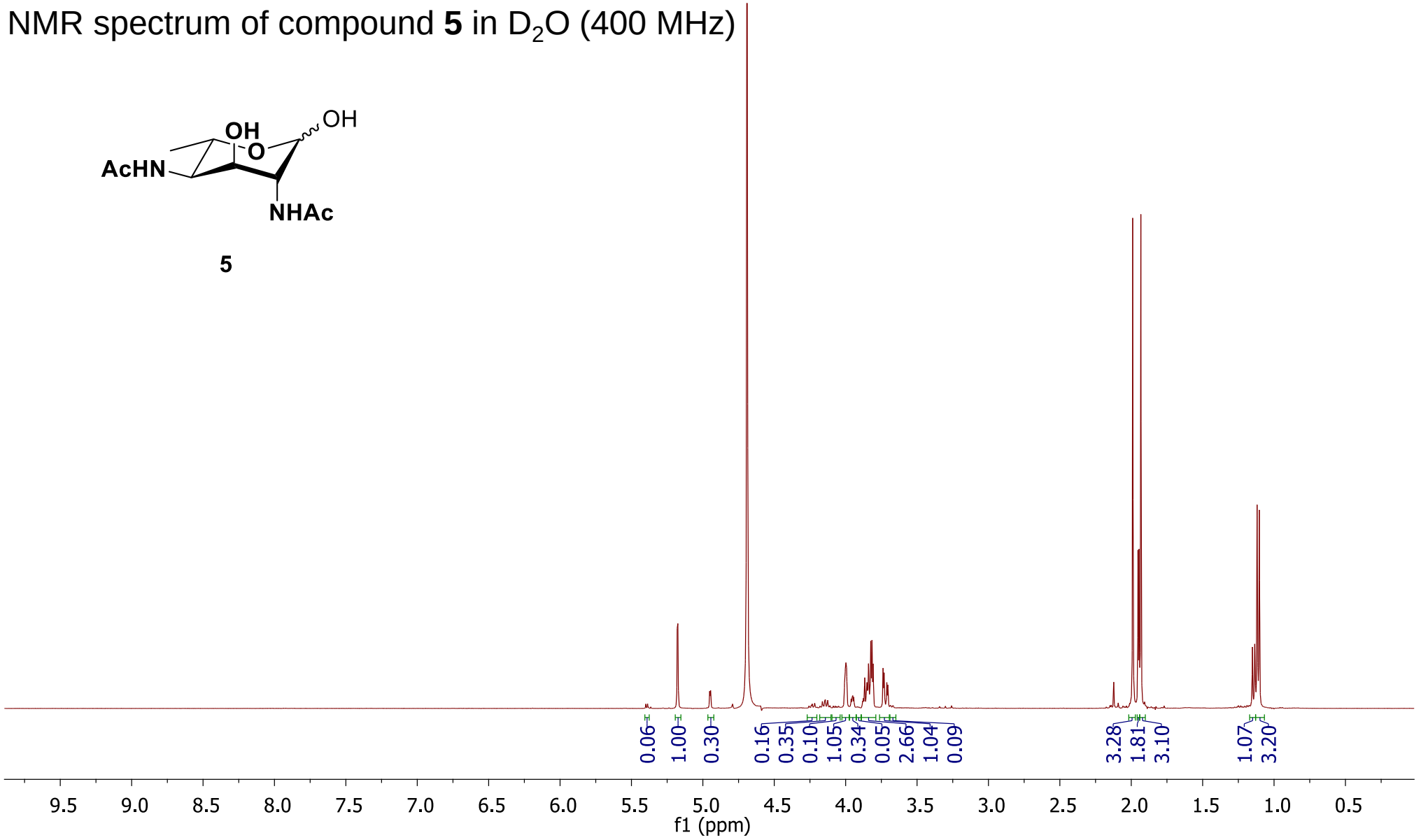


^{1}H-^{13}C GHSQC NMR spectrum of compound **32** in $CDCl_3$

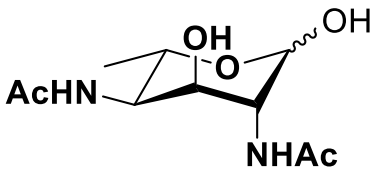


^{1}H NMR spectrum of compound **5** in D_2O (400 MHz)

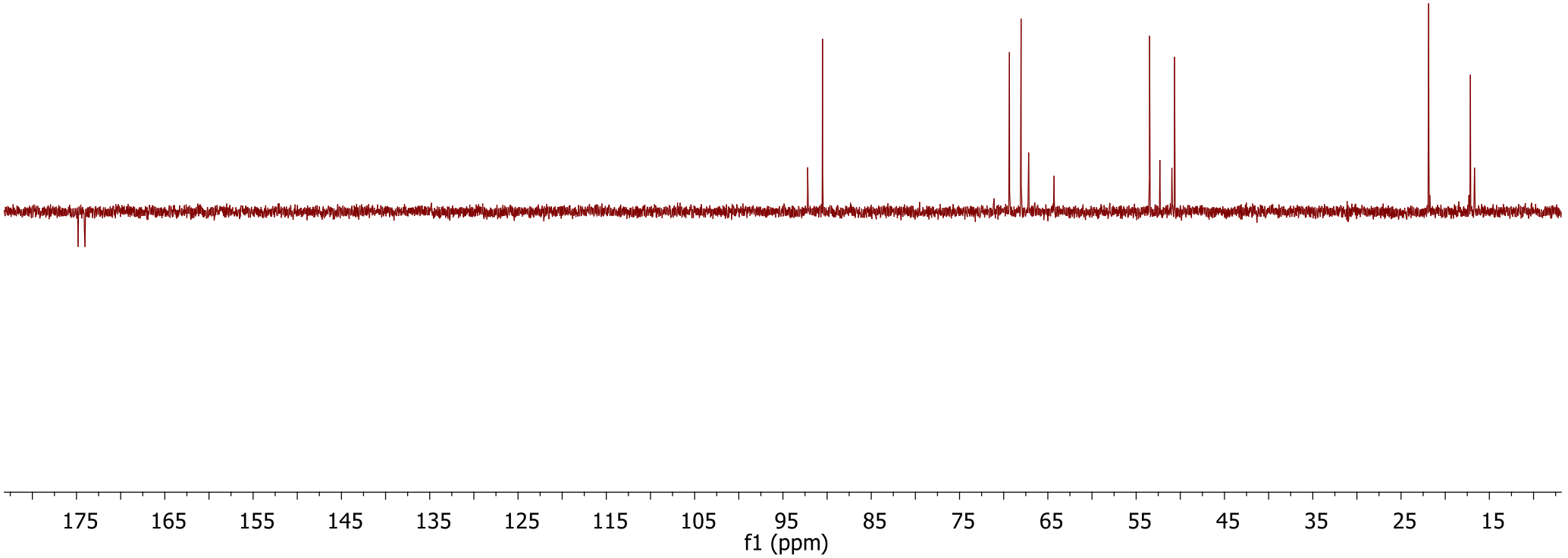
5



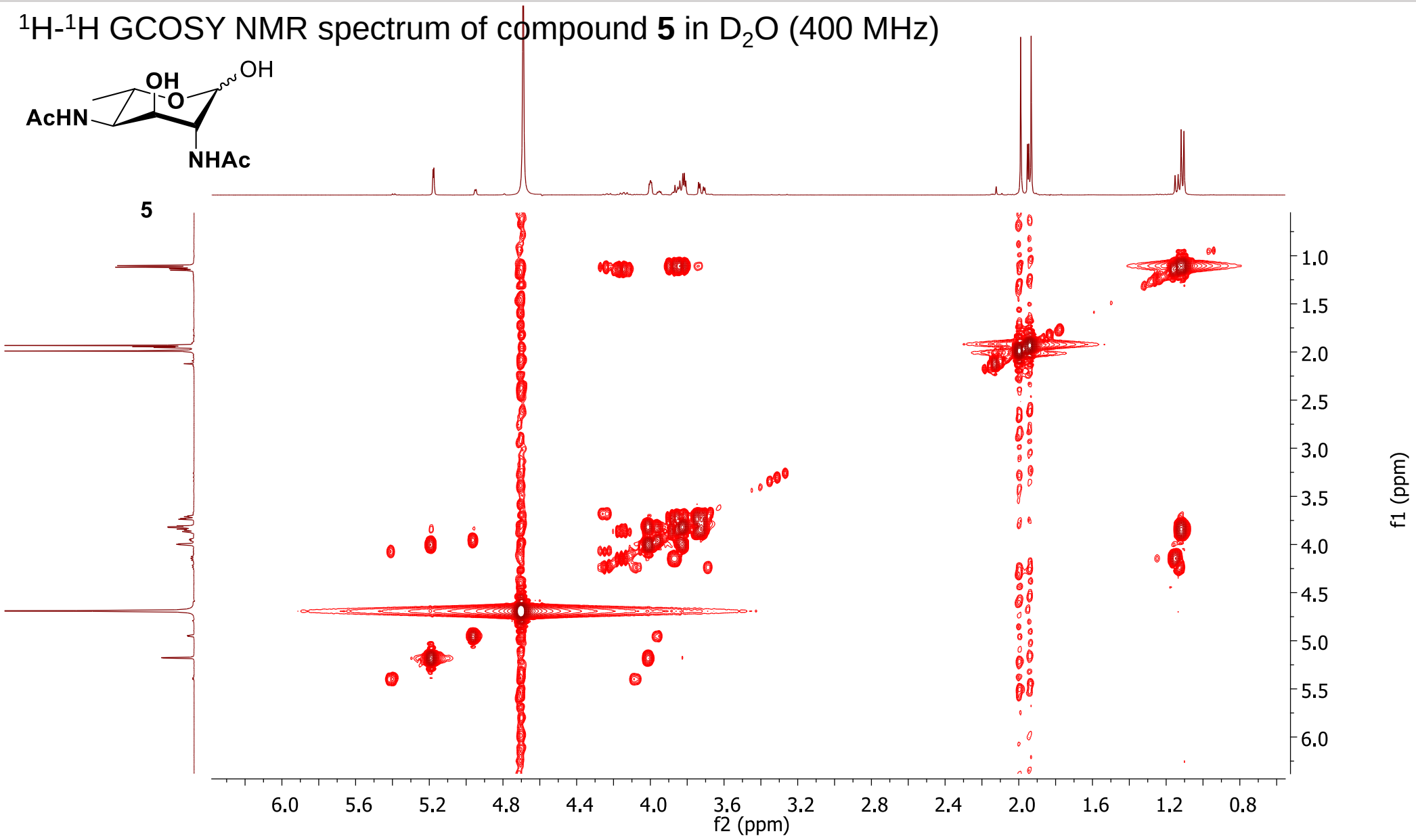
^{13}C (DEPTQ) NMR spectrum of compound **5** in D_2O (100 MHz)



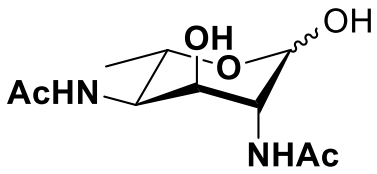
5



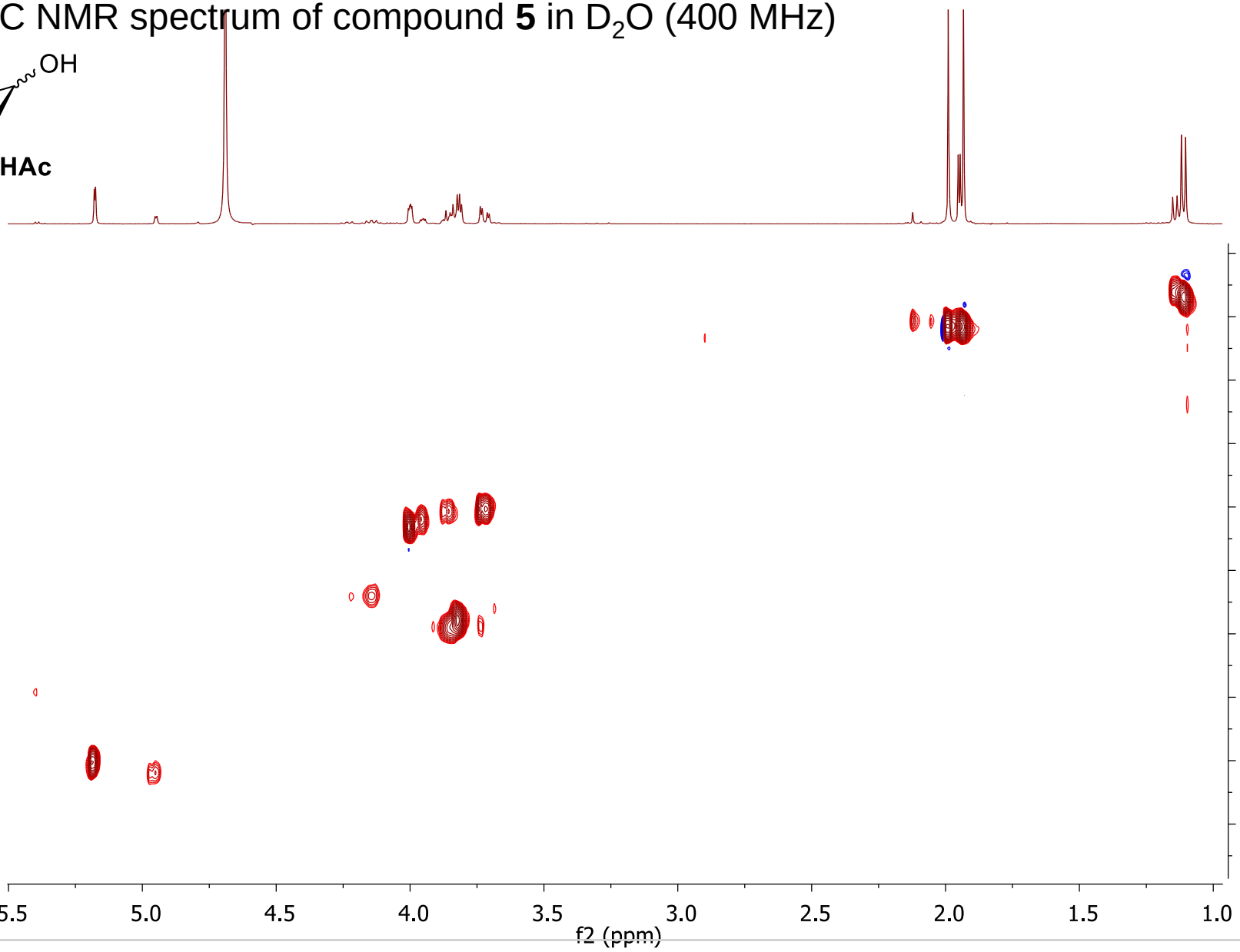
^{1}H-^{1}H GCOSY NMR spectrum of compound **5** in D_2O (400 MHz)



^{1}H-^{13}C GHSQC NMR spectrum of compound **5** in D_2O (400 MHz)

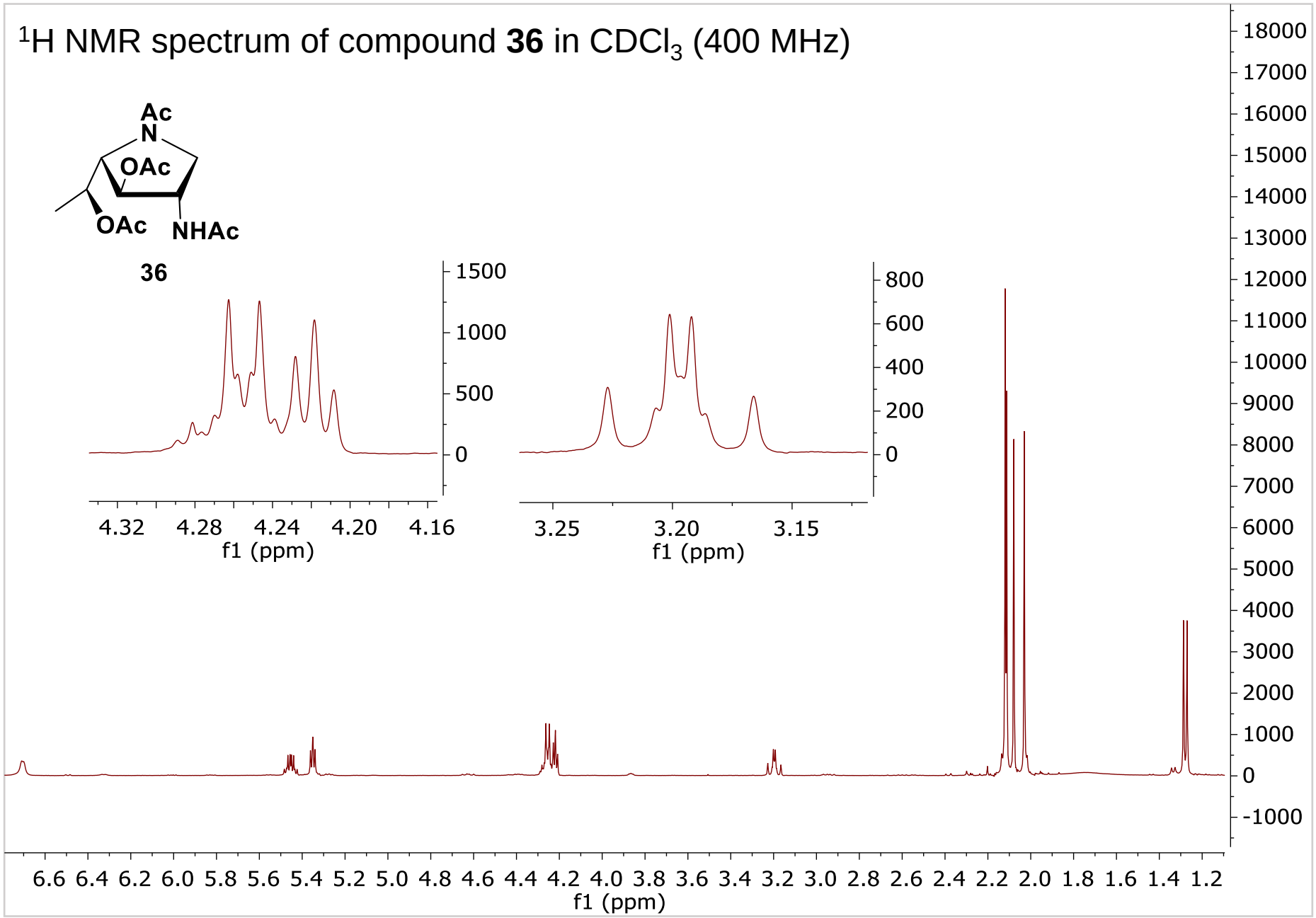


5



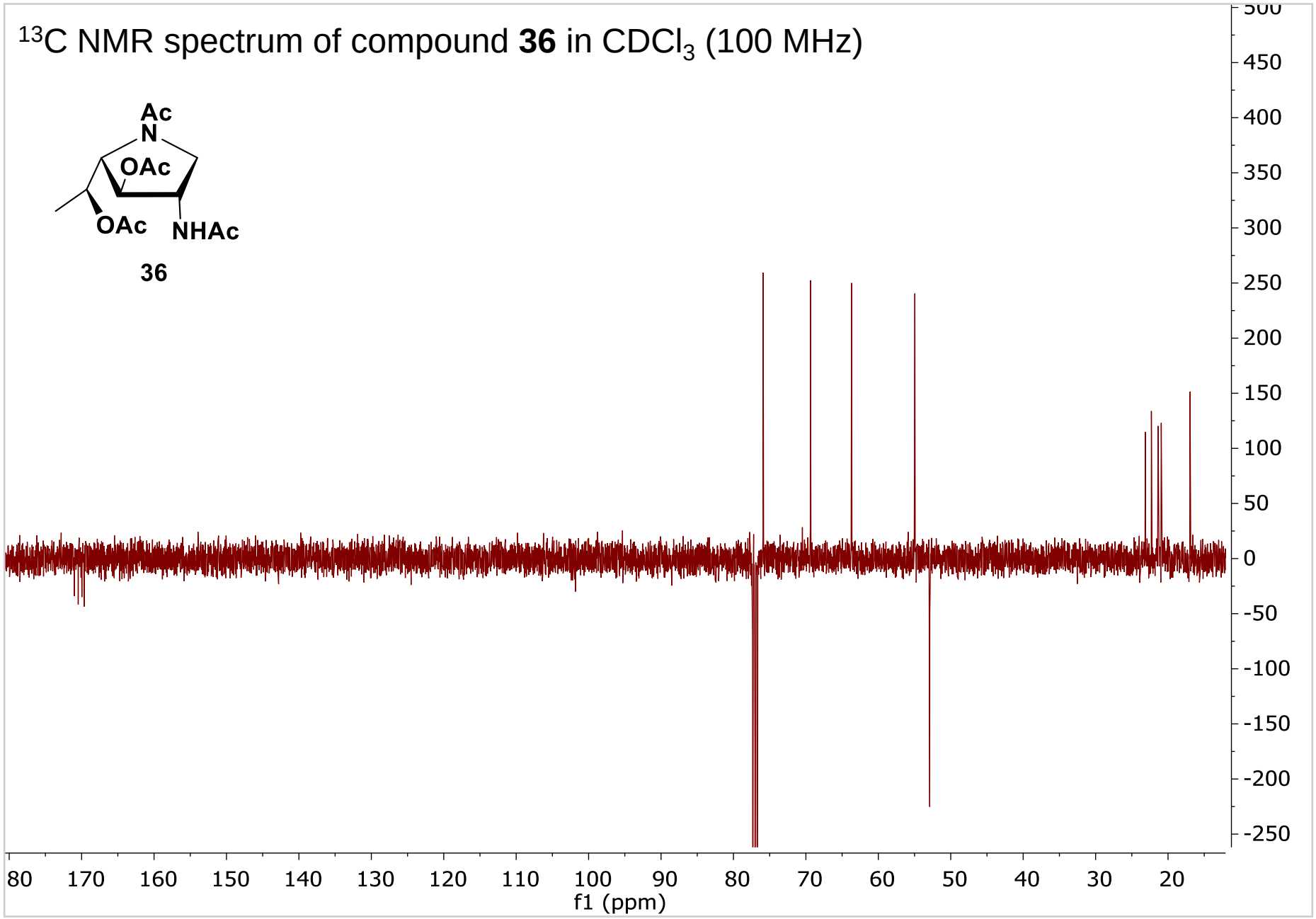
^{1}H NMR spectrum of compound **36** in $CDCl_3$ (400 MHz)

36

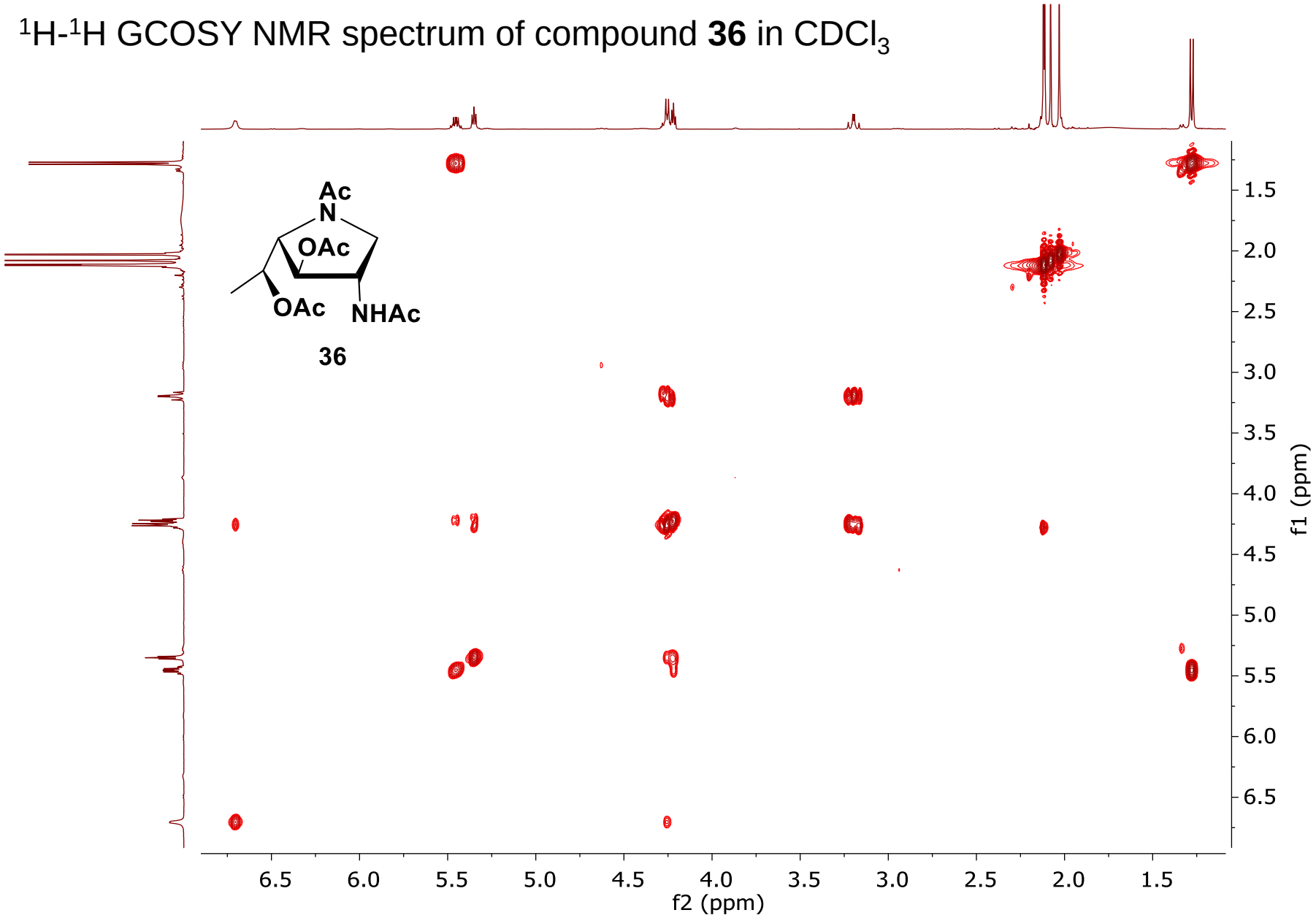


^{13}C NMR spectrum of compound **36** in $CDCl_3$ (100 MHz)

36



^{1}H-^{1}H GCOSY NMR spectrum of compound **36** in $CDCl_3$



^{1}H-^{13}C GHSQC NMR spectrum of compound **36** in $CDCl_3$