Return of the lysergamides. Part I: Analytical and behavioral characterization of 1-propionyl-*d*-lysergic acid diethylamide (1P-LSD)

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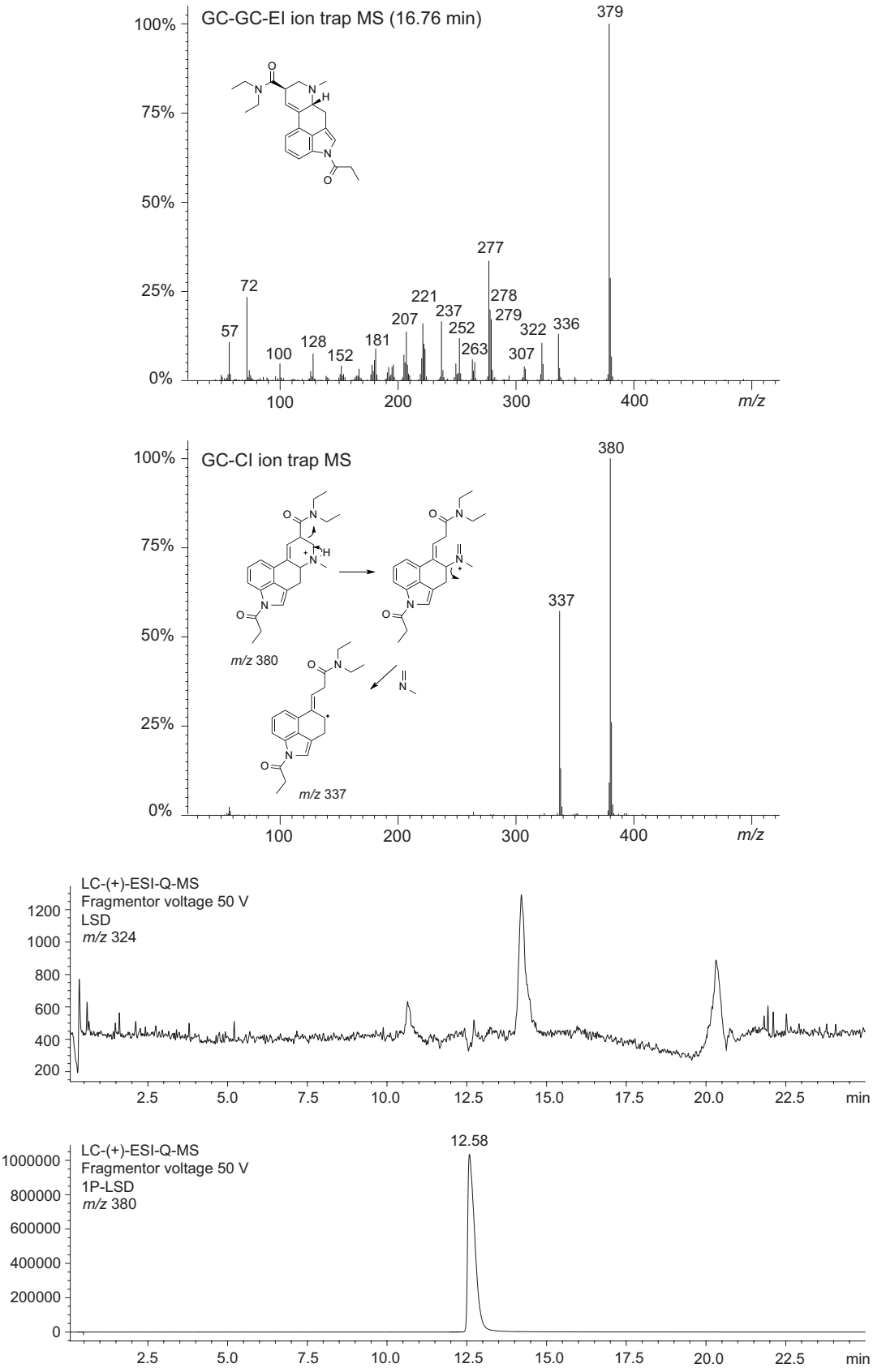
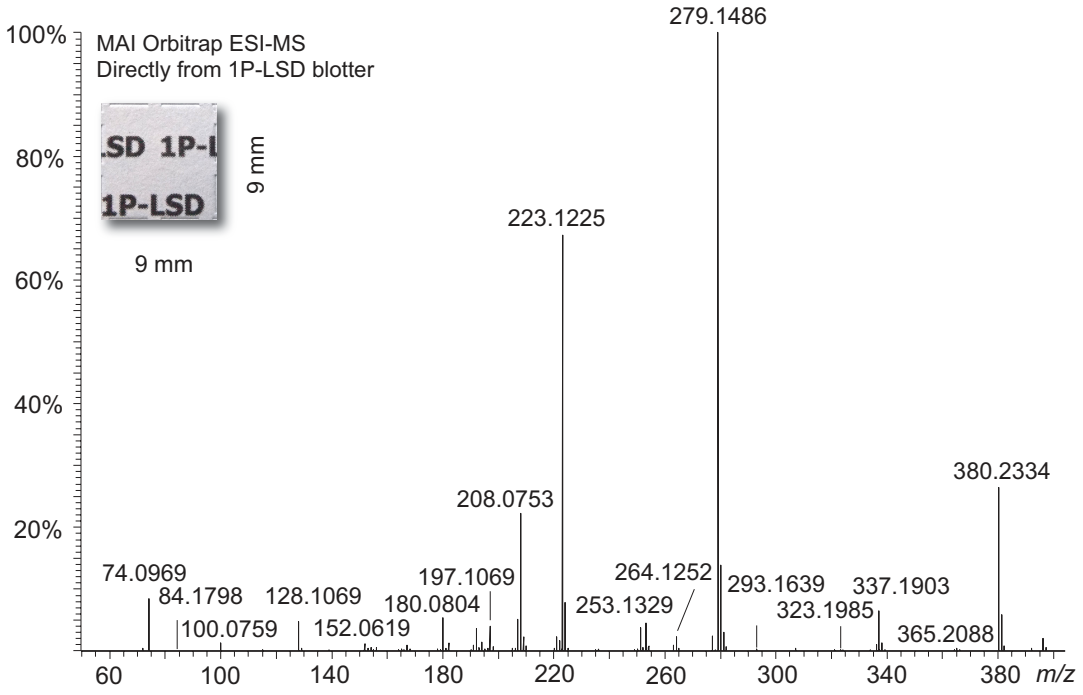
* 1P-LSD = hemitartrate salt (powder); LSD = tartrate salt (powder).	



GC-MS (EI/CI) and LC-single quadrupole MS trace of 1P-LSD



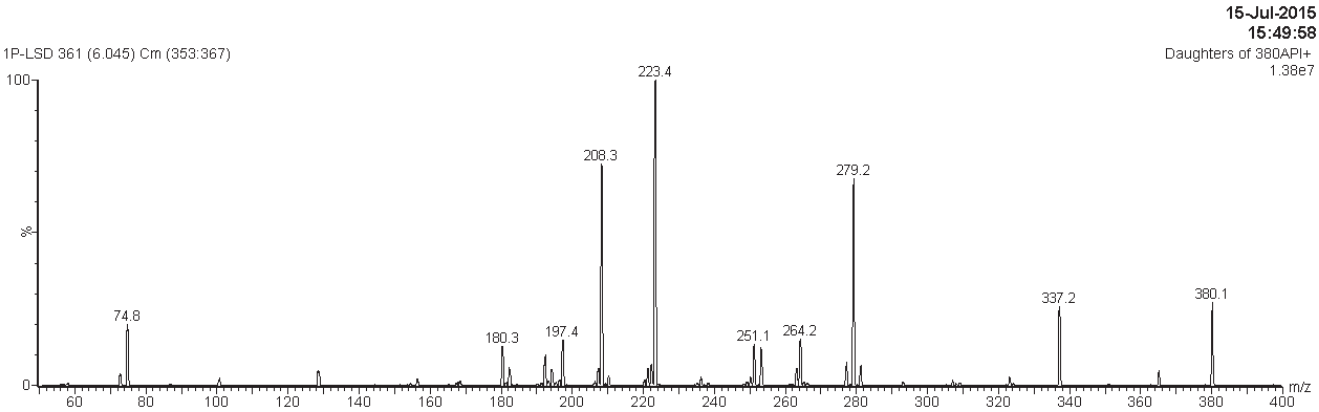
Matrix assisted ionization mass spectrum (MAI-MS) of 1P-LSD obtained from direct analysis of a 1P-LSD blotter.

Matrix assisted ionization mass spectrometry (MAI-MS)

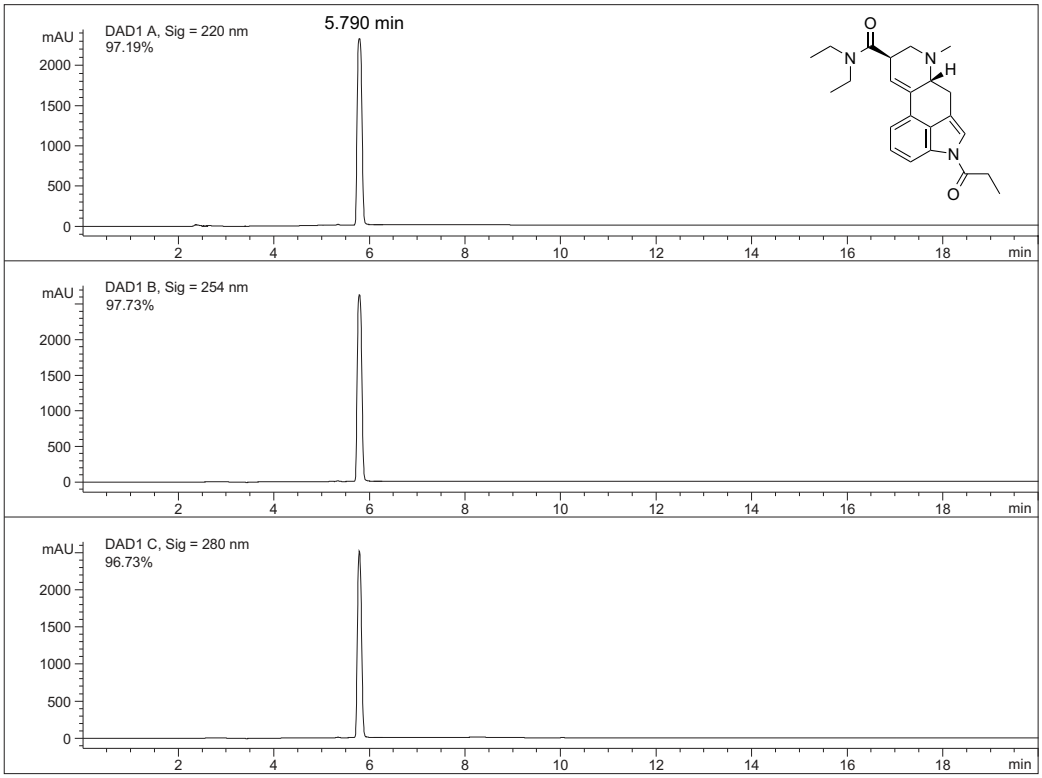
A Thermo Scientific Exactive™ mass spectrometer (Thermo Fisher Scientific, Bremen, Germany) was modified by removing the Ion Max source to expose the inlet capillary for sample introduction using glass slides. The trap fill time was set at 1000 ms to correspond with the 1 s required to achieve a resolution of 100,000 (50% FWHH, *m/z* 200). The sheath, auxillary, and sweep gas flow rates, as well as the electrospray ionization spray voltage, were set to zero. The inlet capillary temperature was set at 70 °C. The capillary, tube lens and skimmer voltages were optimized at 30, 60, and 18 V, respectively, and acquisition time was set to continuous mode. The higher-energy collisional dissociation (HCD) parameter was set at 35 eV to induce dissociation.

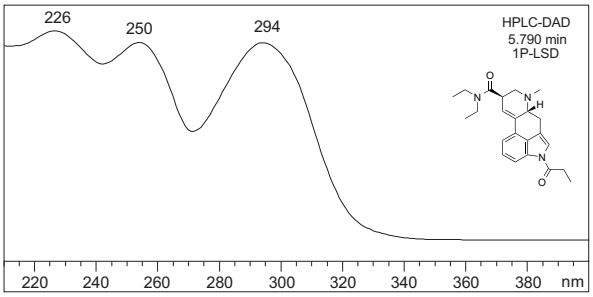
Blotter preparation for MAI-MS analysis

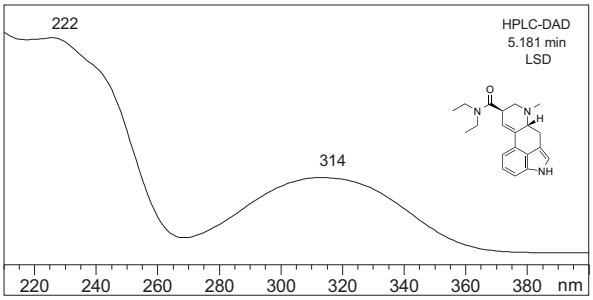
3-Nitrobenzonitrile was used as the matrix and prepared at a 0.6 mg/mL concentration with acetonitrile/water (1:1). For direct MAI-MS analysis, 1 µL of matrix solution was added onto the surface of the 1P-LSD blotter and allowed to air-dry.



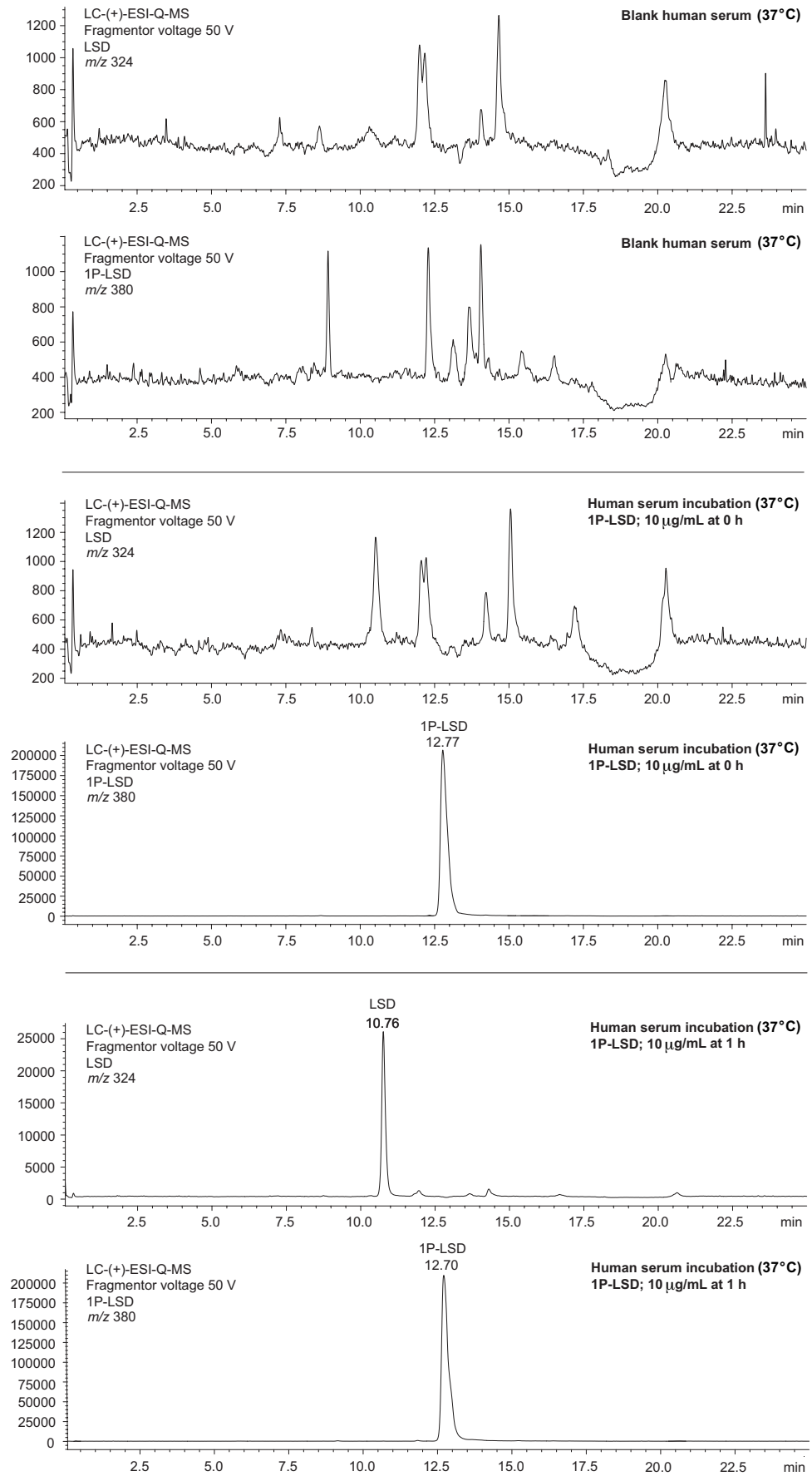
ESI-QqQ-MS/MS of 1P-LSD



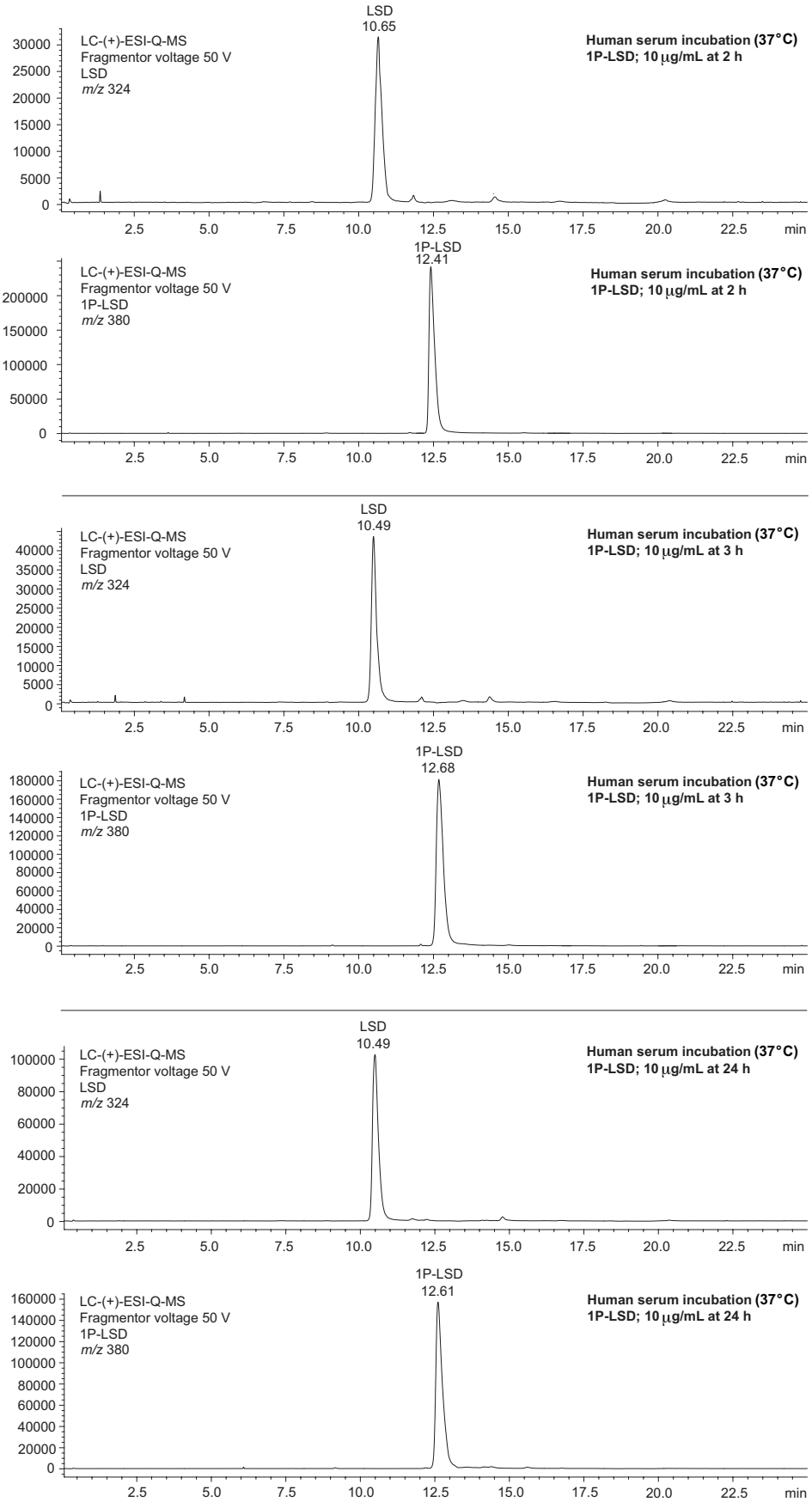




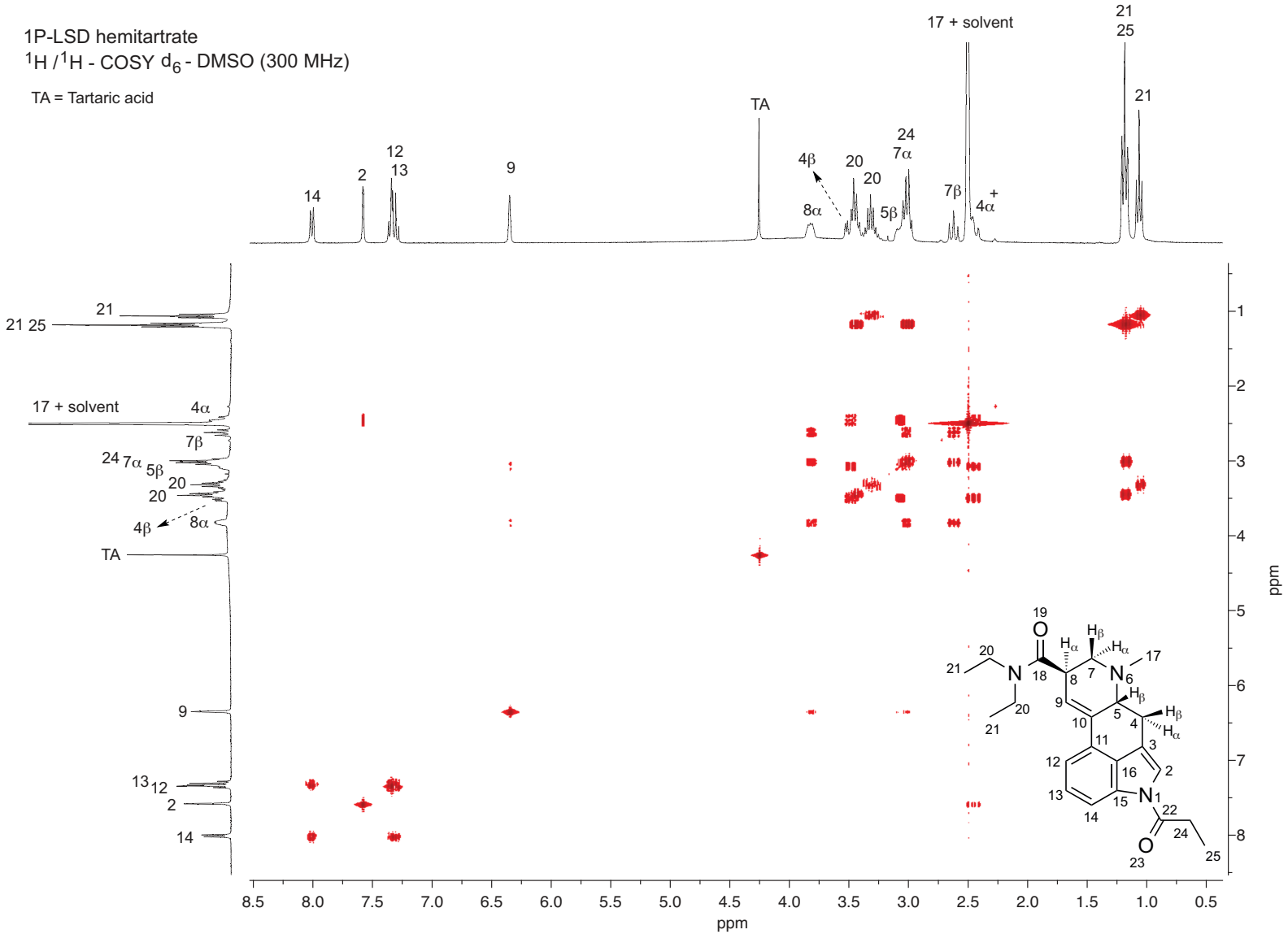
HPLC-UV (1P-LSD) traces and DAD spectra (1P-LSD vs. LSD)

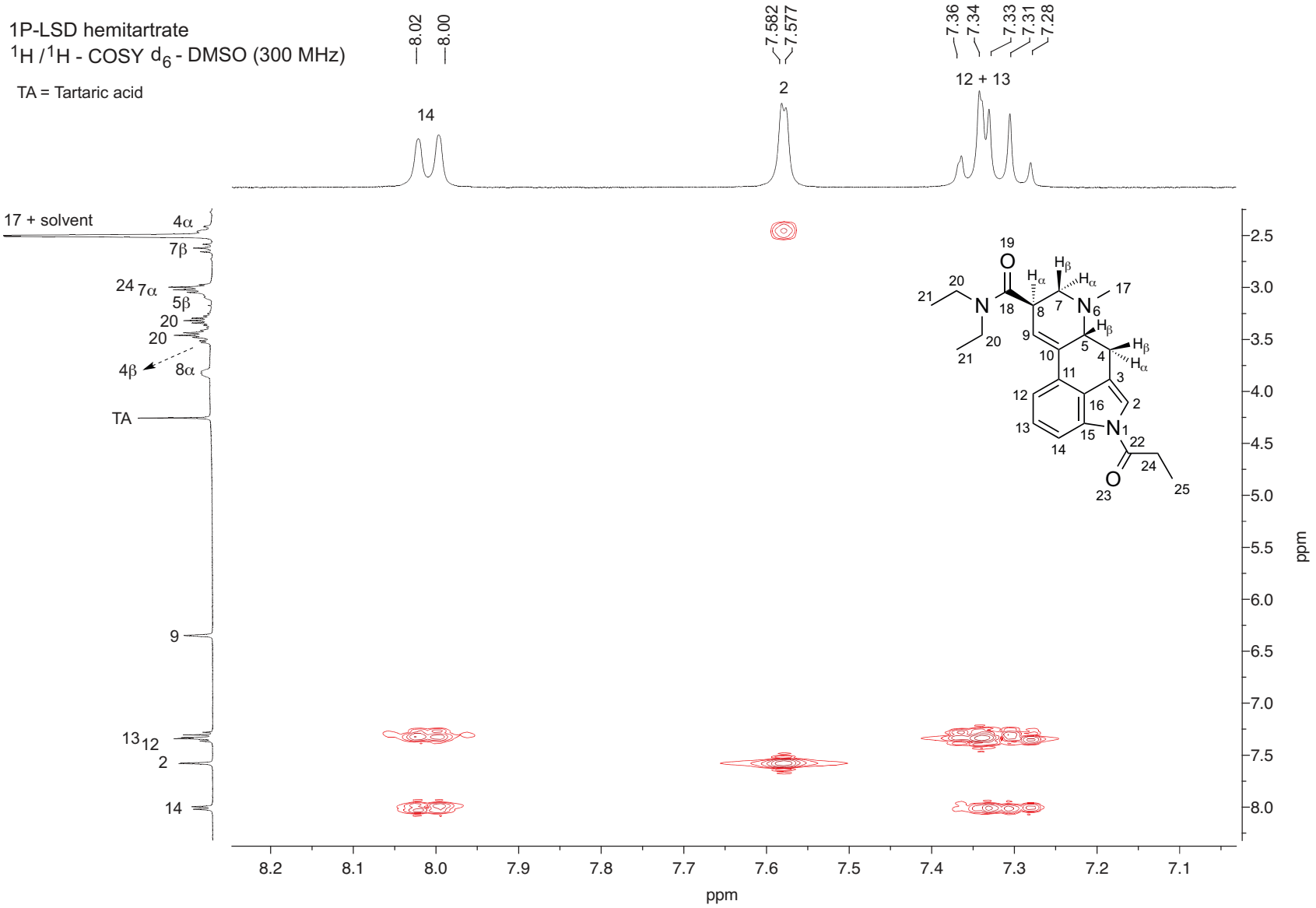


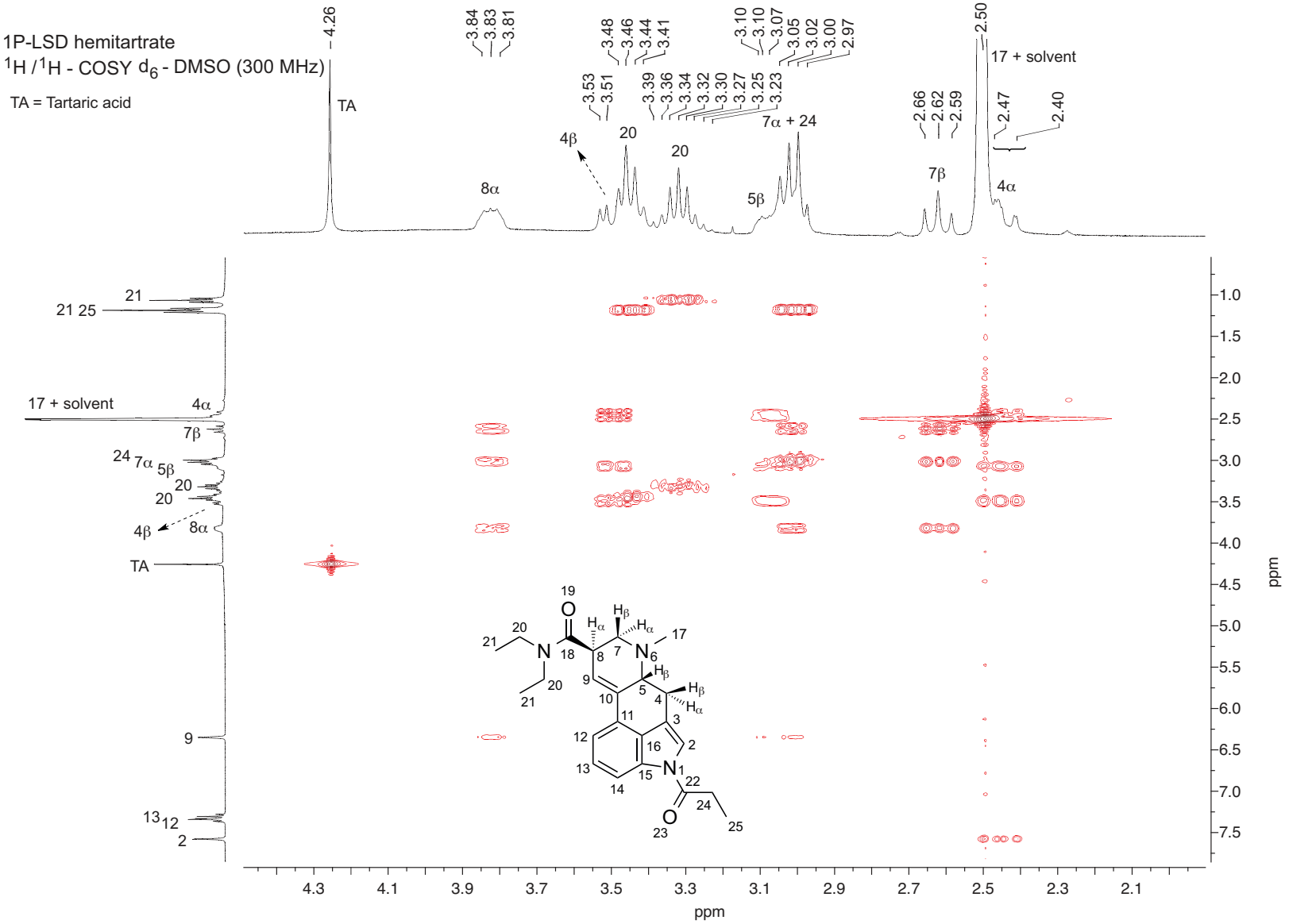
Incubation of 1P-LSD in human serum at 37 °C and analysis of 1P-LSD vs. LSD using LC single quadrupole MS (blank serum, 0 h and 1h)

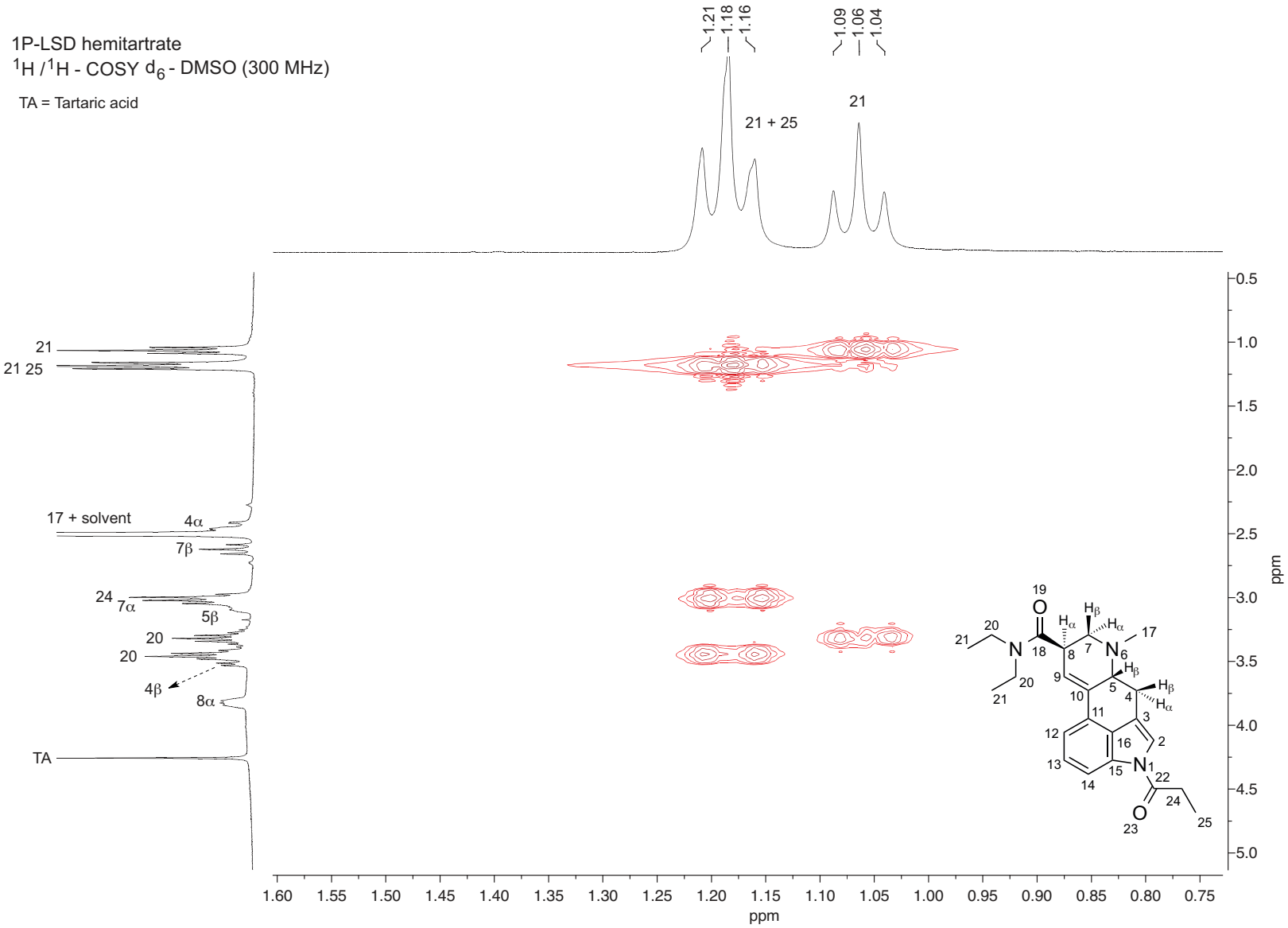


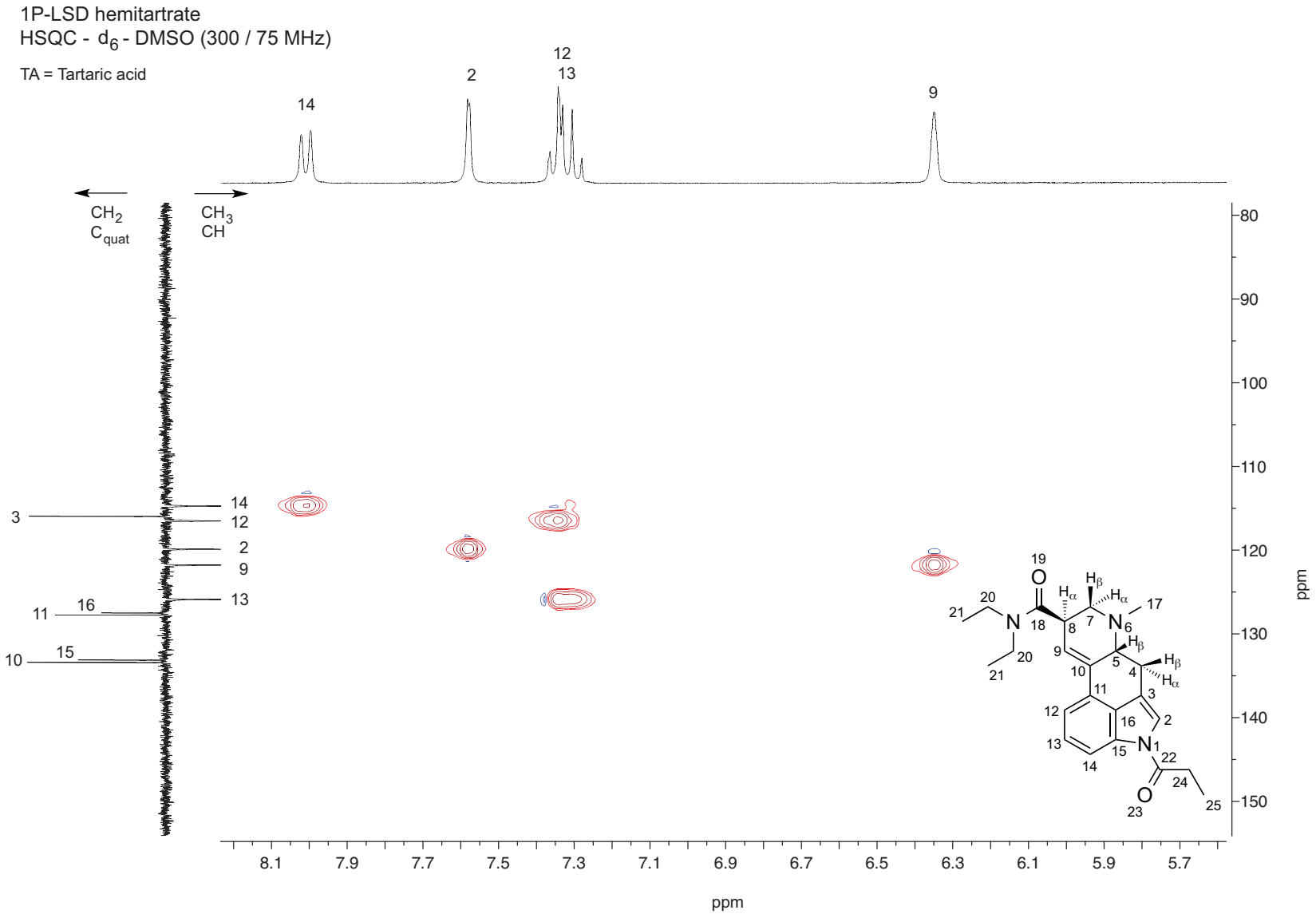
Incubation of 1P-LSD in human serum at 37 °C and analysis of 1P-LSD vs. LSD using LC single quadrupole MS (2 h, 3 h and 24h)

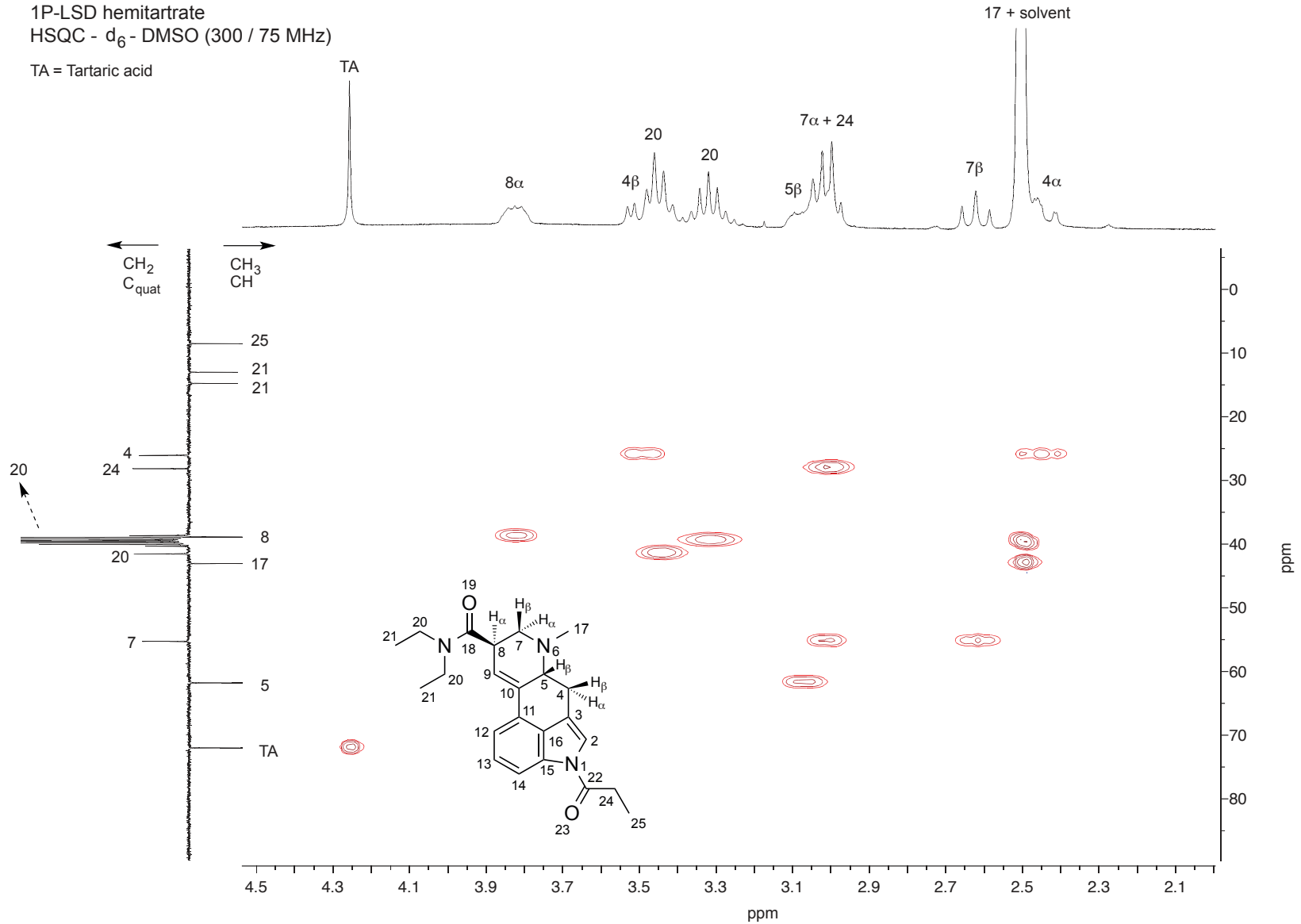

1P-LSD hemitartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
ppm
ppm

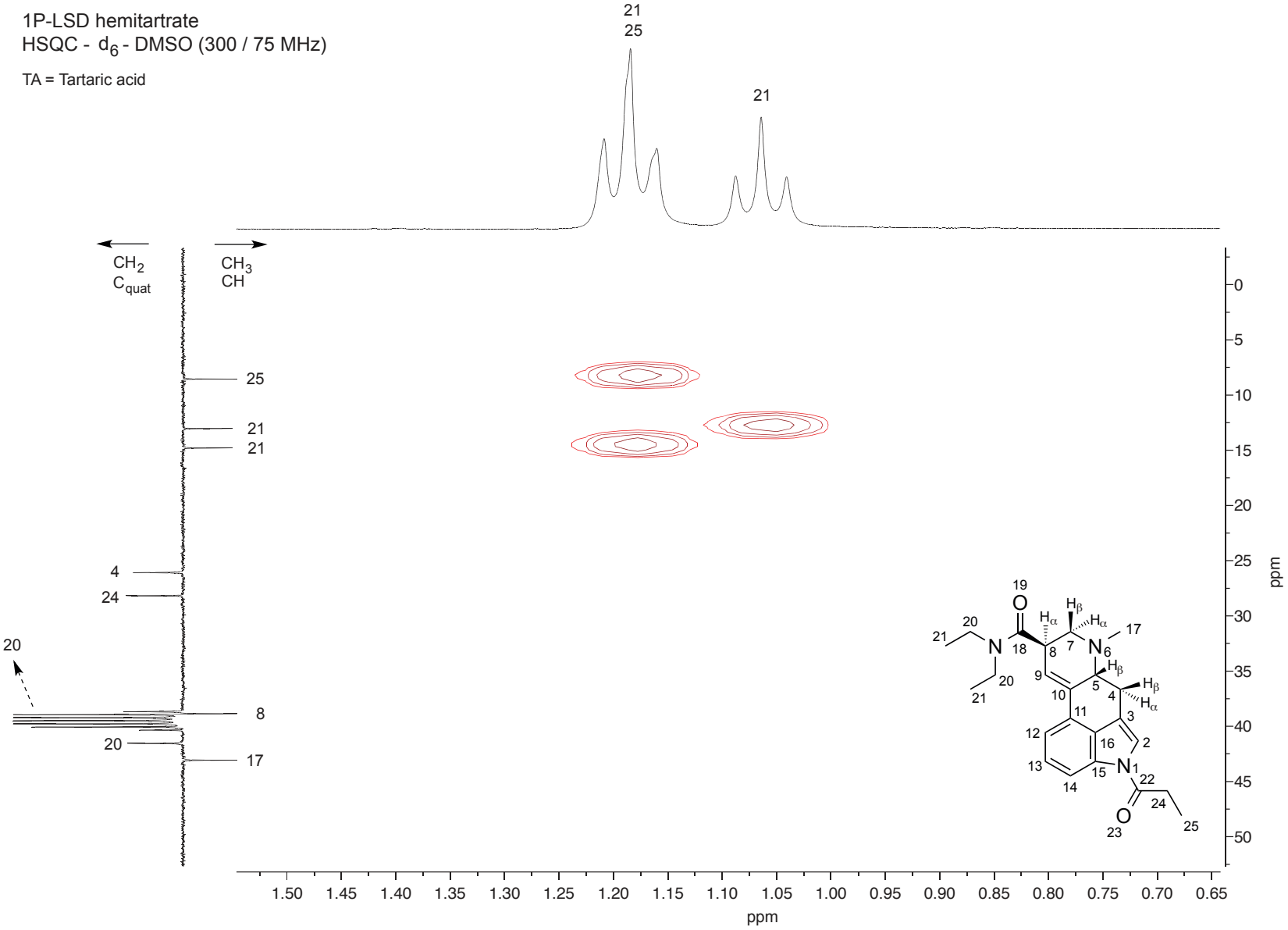

1P-LSD hemitartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
8.02
8.00
7.582
7.577
7.36
7.34
7.33
7.31
7.28
14
2
12 + 13
17 + solvent
4α
7β
24
7α
5β
20
20
4β
8α
TA
9
13
12
2
14
ppm
ppm

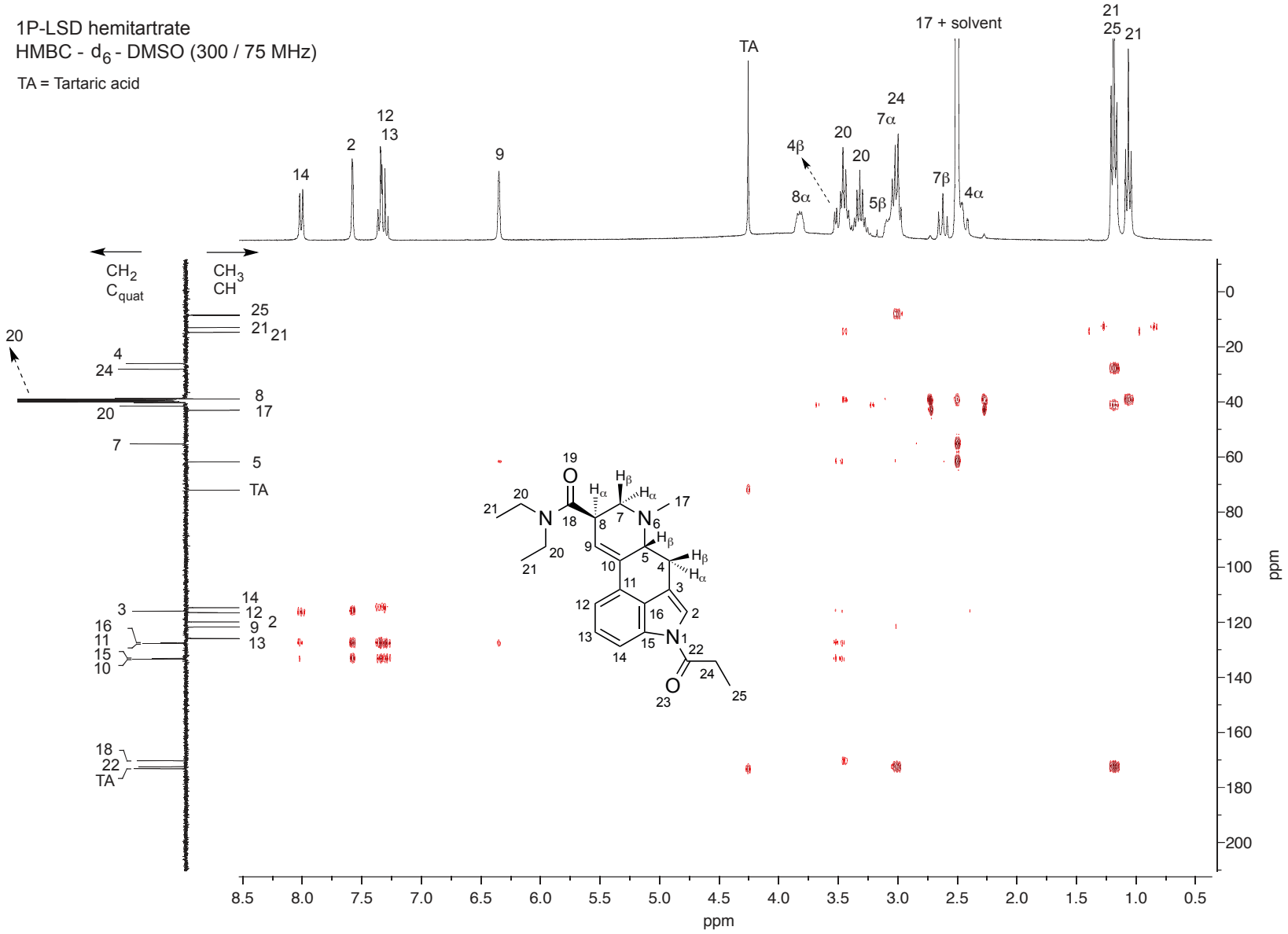

1P-LSD hemitartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
4.26
TA
3.84
3.83
3.81
3.53
3.51
3.48
3.46
3.44
3.41
3.39
3.36
3.34
3.32
3.30
3.27
3.25
3.23
3.10
3.10
3.07
3.05
3.02
3.00
2.97
2.66
2.62
2.59
2.50
17 + solvent
2.47
2.40
4β
20
20
8α
5β
7α + 24
7β
4α
21
21 25
17 + solvent
4α
7β
24
7α
5β
20
20
4β
8α
TA
9
13
12
2
ppm
ppm


1P-LSD hemitartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
1.21
1.18
1.16
1.09
1.06
1.04
21 + 25
21
21
21 25
17 + solvent
4α
7β
24
7α
5β
20
20
4β
8α
TA
ppm
ppm


1P-LSD hemitartrate
HSQC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
CH2
Cquat
CH3
CH
14
2
12
13
9
3
11
16
10
15
ppm
8.1
7.9
7.7
7.5
7.3
7.1
6.9
6.7
6.5
6.3
6.1
5.9
5.7
80
90
100
110
120
130
140
150
ppm

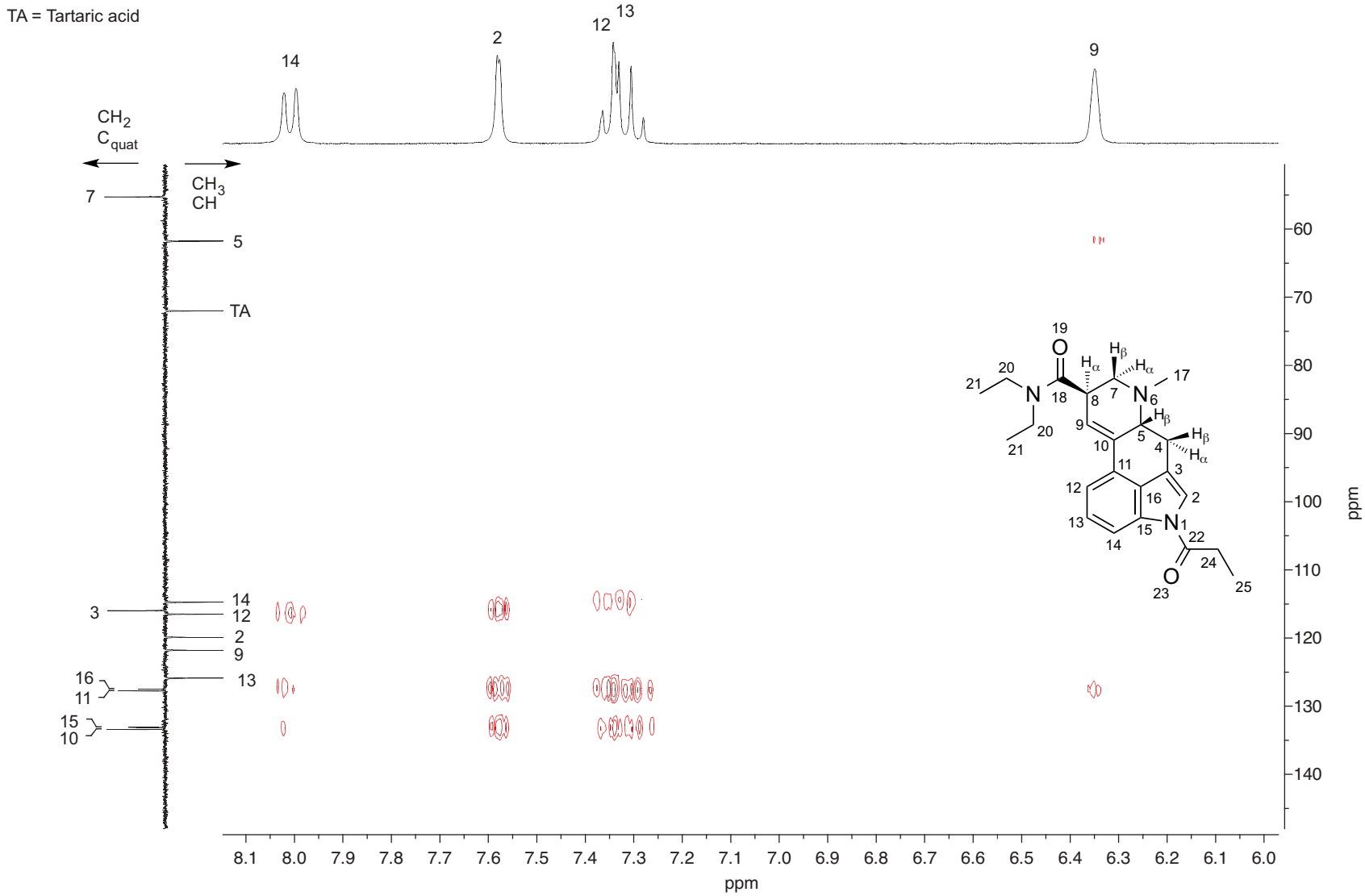

1P-LSD hemitartrate
HSQC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
TA
8α
20
4β
20
5β
7α + 24
7β
17 + solvent
4α
CH2
Cquat
CH3
CH
25
21
21
4
24
20
8
20
17
7
5
TA
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
2.5
2.3
2.1
ppm
0
10
20
30
40
50
60
70
80
ppm

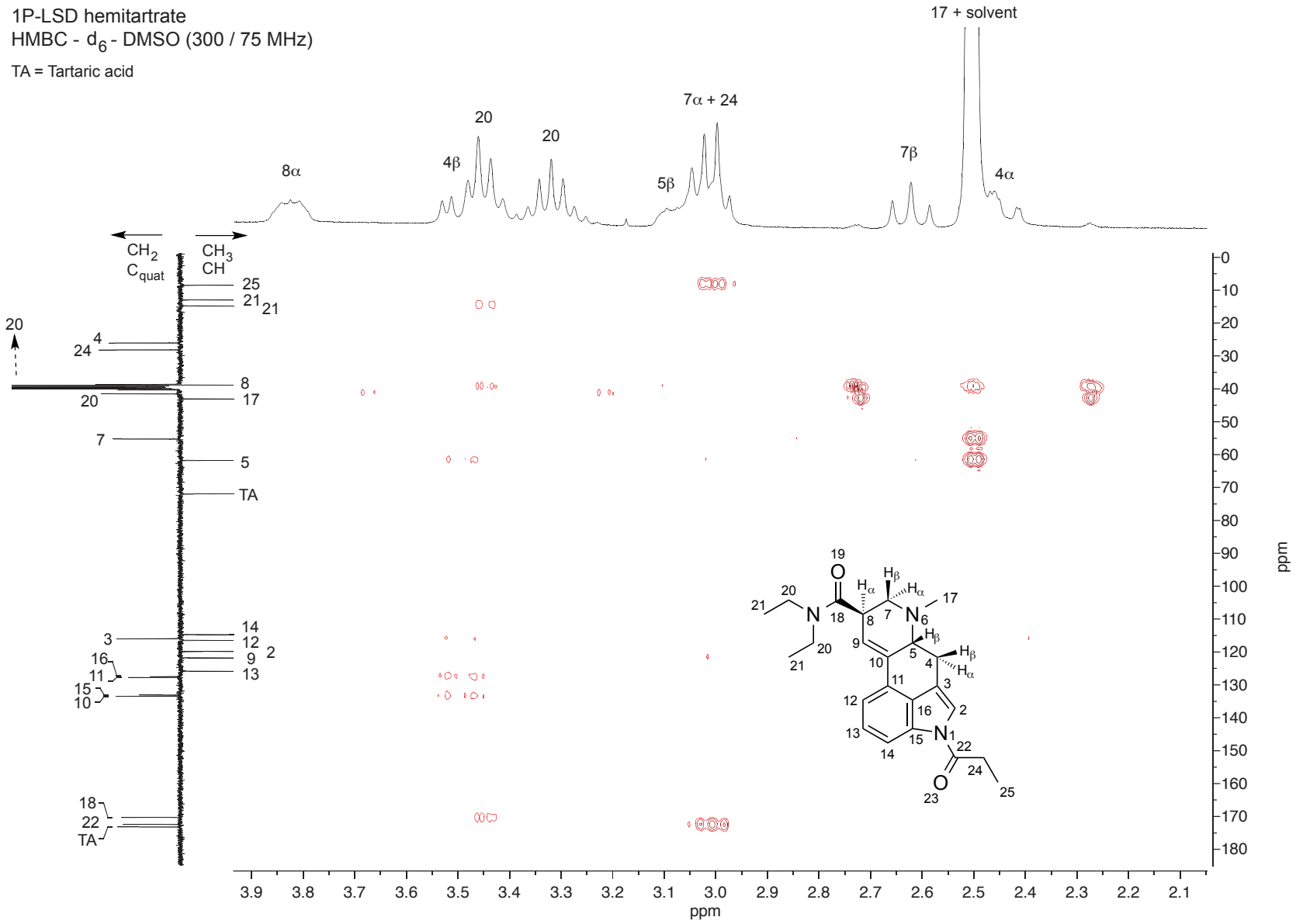

1P-LSD hemitartrate
HSQC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
21
25
21
CH2
Cquat
CH3
CH
25
21
21
4
24
20
8
20
17
1.50 1.45 1.40 1.35 1.30 1.25 1.20 1.15 1.10 1.05 1.00 0.95 0.90 0.85 0.80 0.75 0.70 0.65
ppm
0 5 10 15 20 25 30 35 40 45 50
ppm

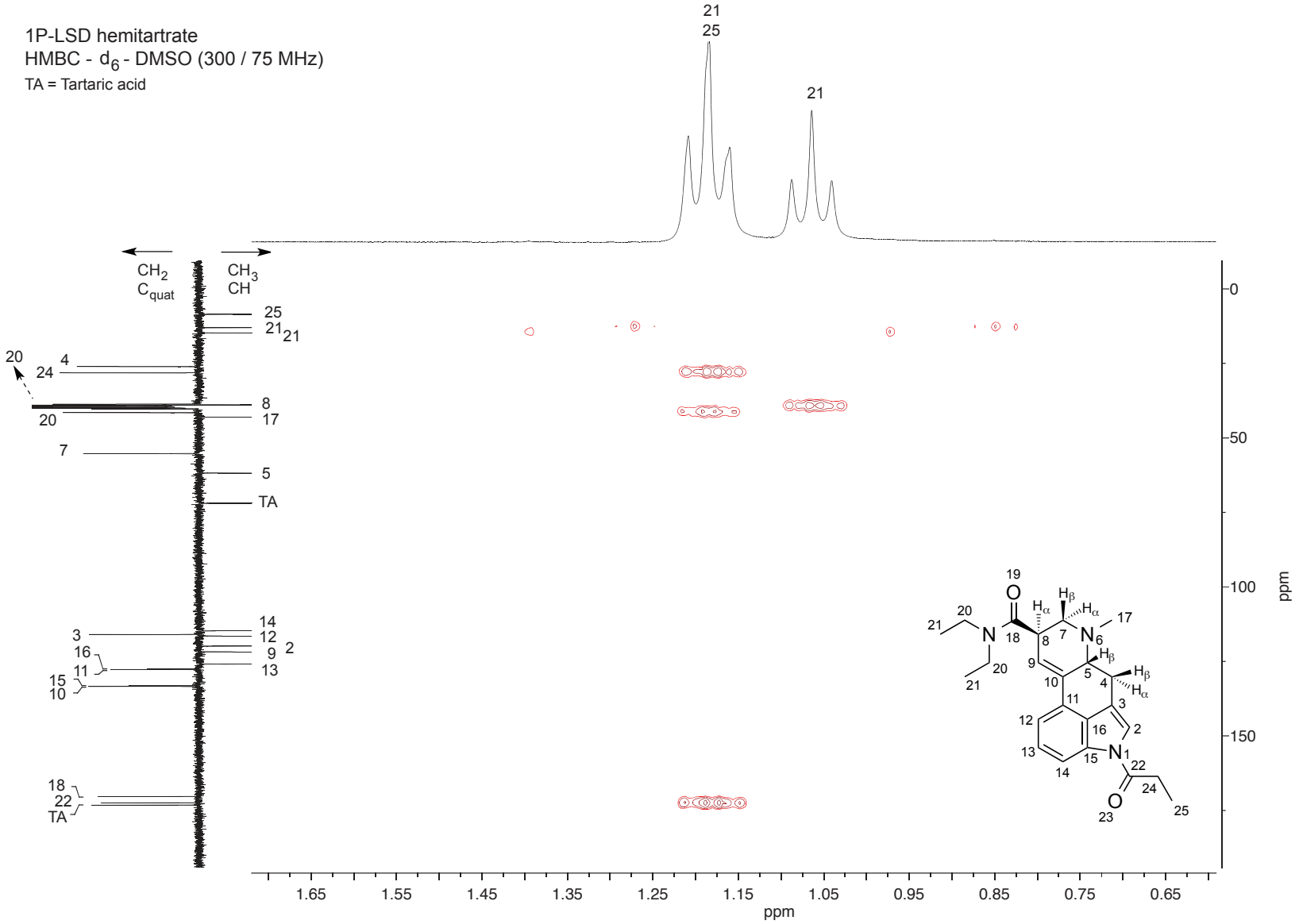

1P-LSD hemitartrate
HMBC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
CH2
Cquat
CH3
CH
ppm

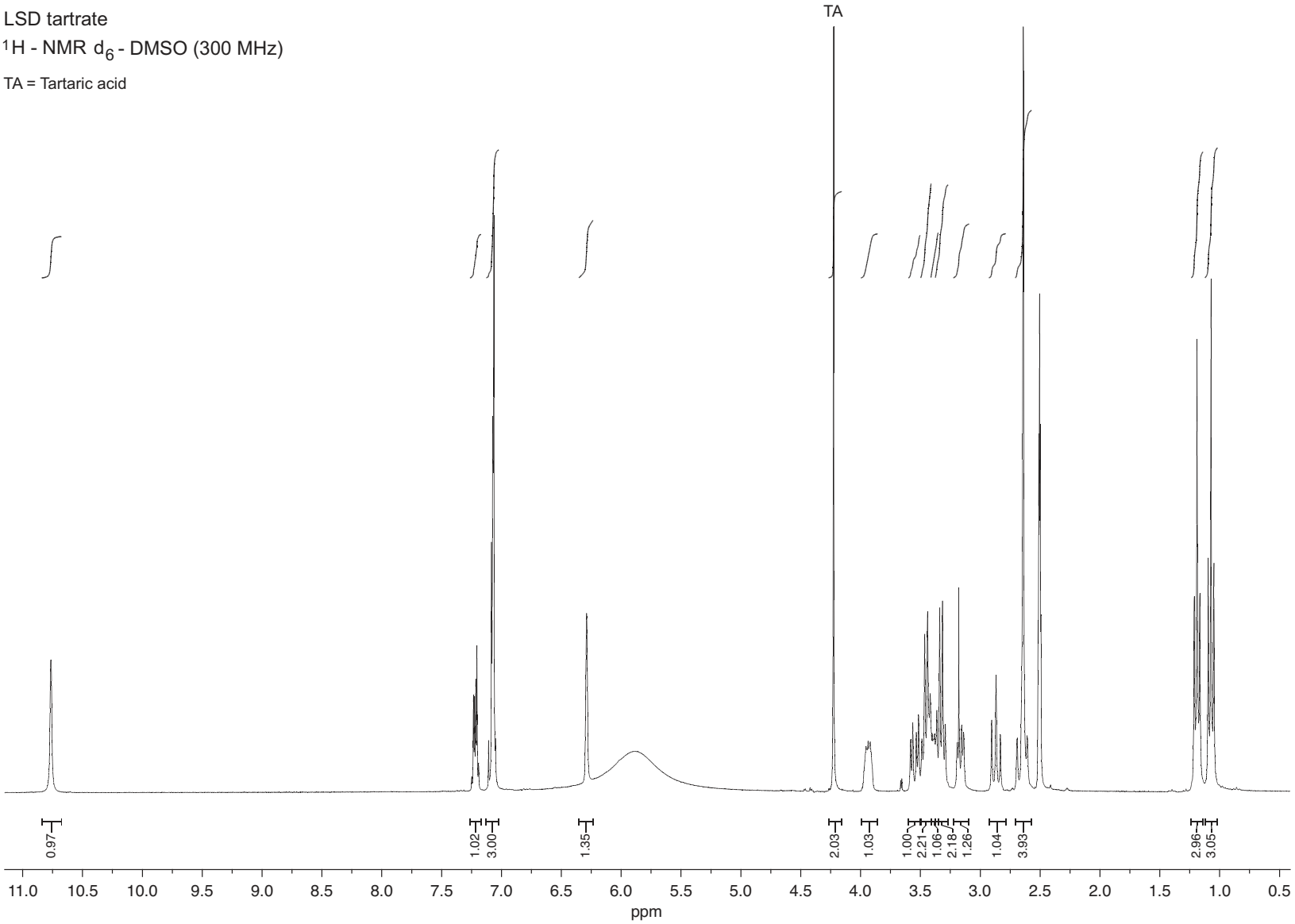
1P-LSD hemitartrate
HMBC - d_6 - DMSO (300 / 75 MHz)

TA = Tartaric acid



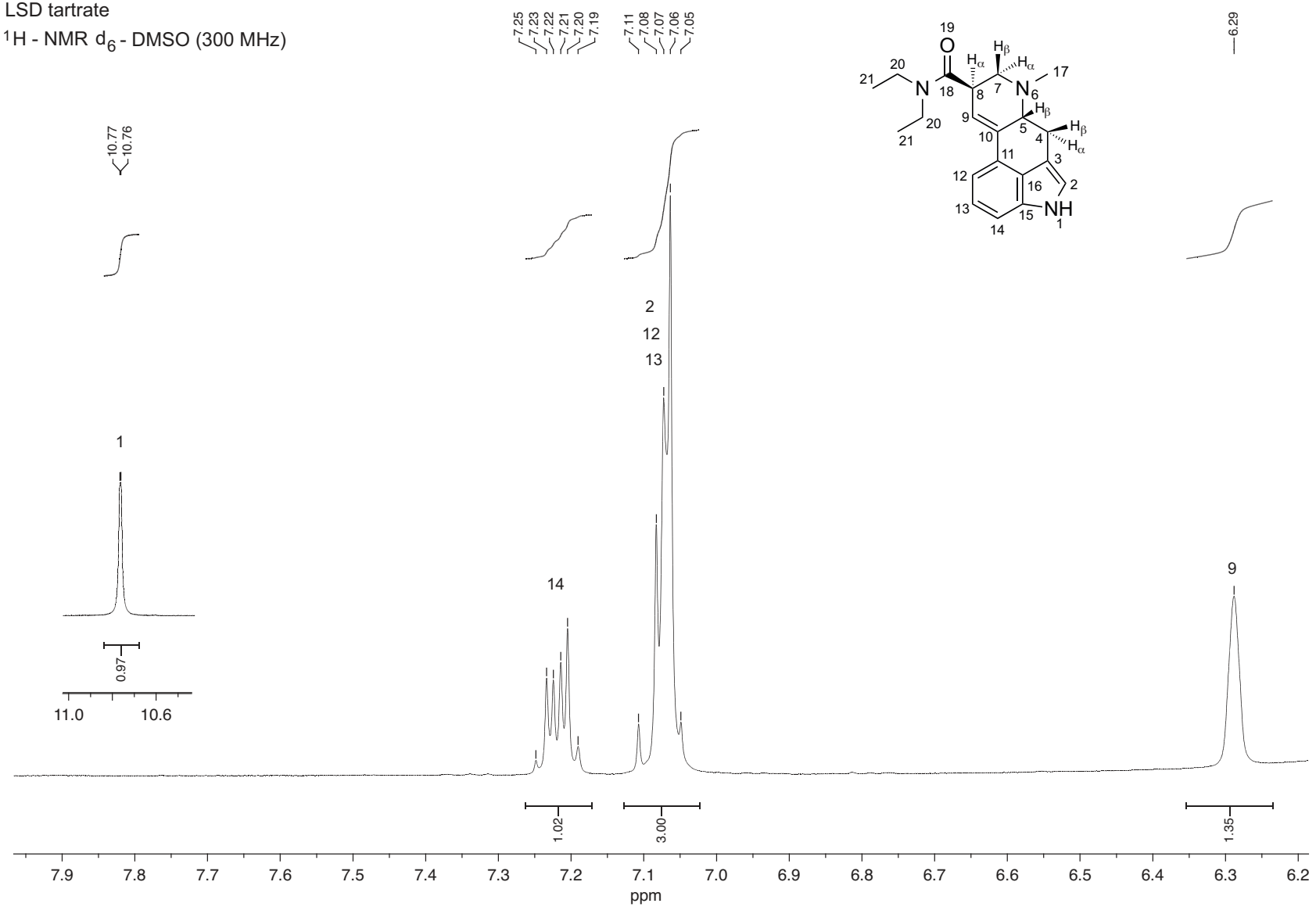

1P-LSD hemitartrate
HMBC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
17 + solvent
7α + 24
20
20
8α
4β
5β
7β
4α
CH2
Cquat
CH3
CH
ppm
ppm

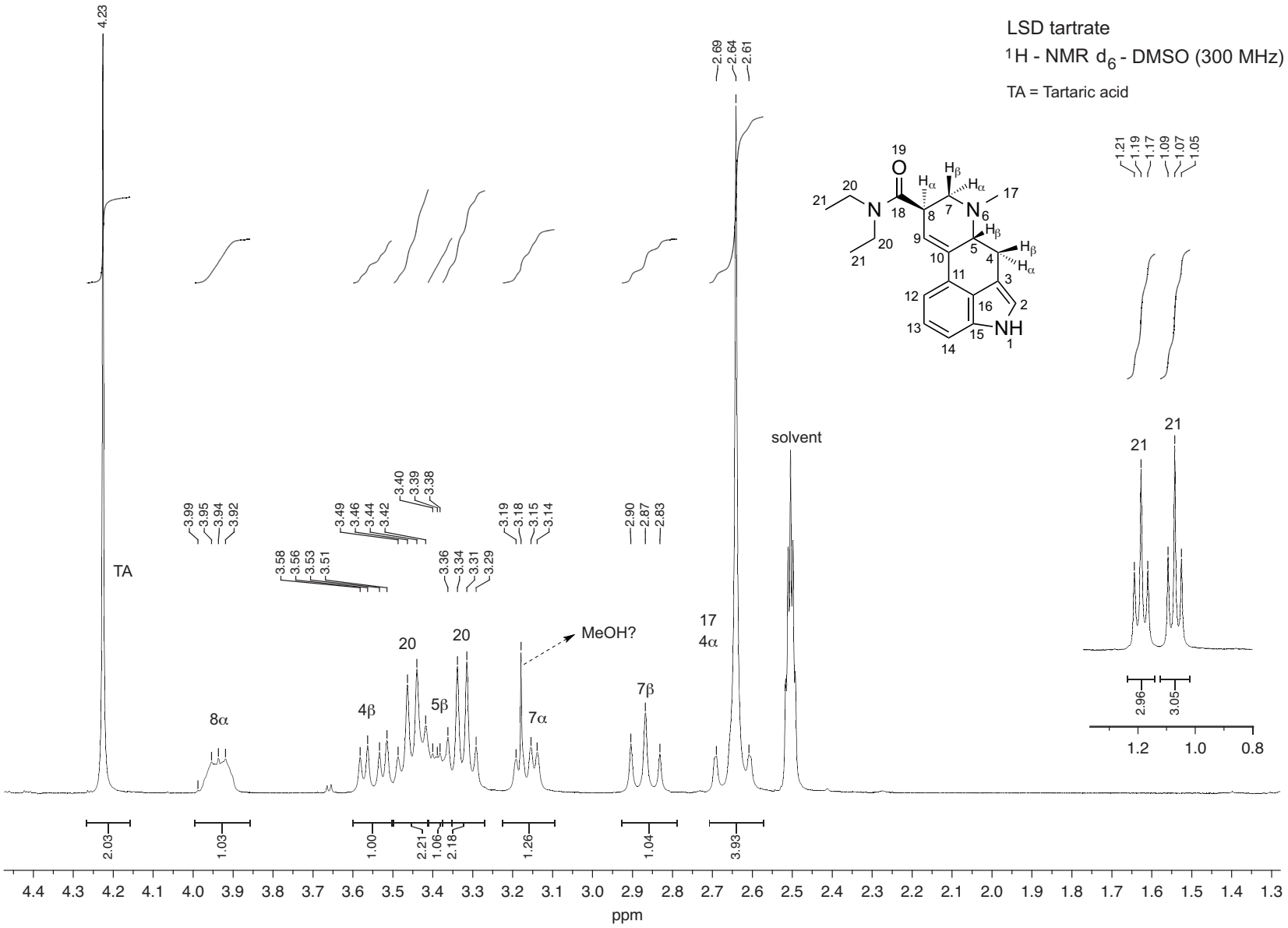

1P-LSD hemitartrate
HMBC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
21
25
21
CH2
Cquat
CH3
CH
25
21
21
20
4
24
8
17
20
7
5
TA
14
12
9
13
2
3
16
11
15
10
18
22
TA
1.65
1.55
1.45
1.35
1.25
1.15
1.05
0.95
0.85
0.75
0.65
ppm
0
50
100
150
ppm


LSD tartrate
1H - NMR d6 - DMSO (300 MHz)
TA = Tartaric acid
TA
0.97
1.02
3.00
1.35
2.03
1.03
1.00
2.21
1.06
2.18
1.26
1.04
3.93
2.96
3.05
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
ppm

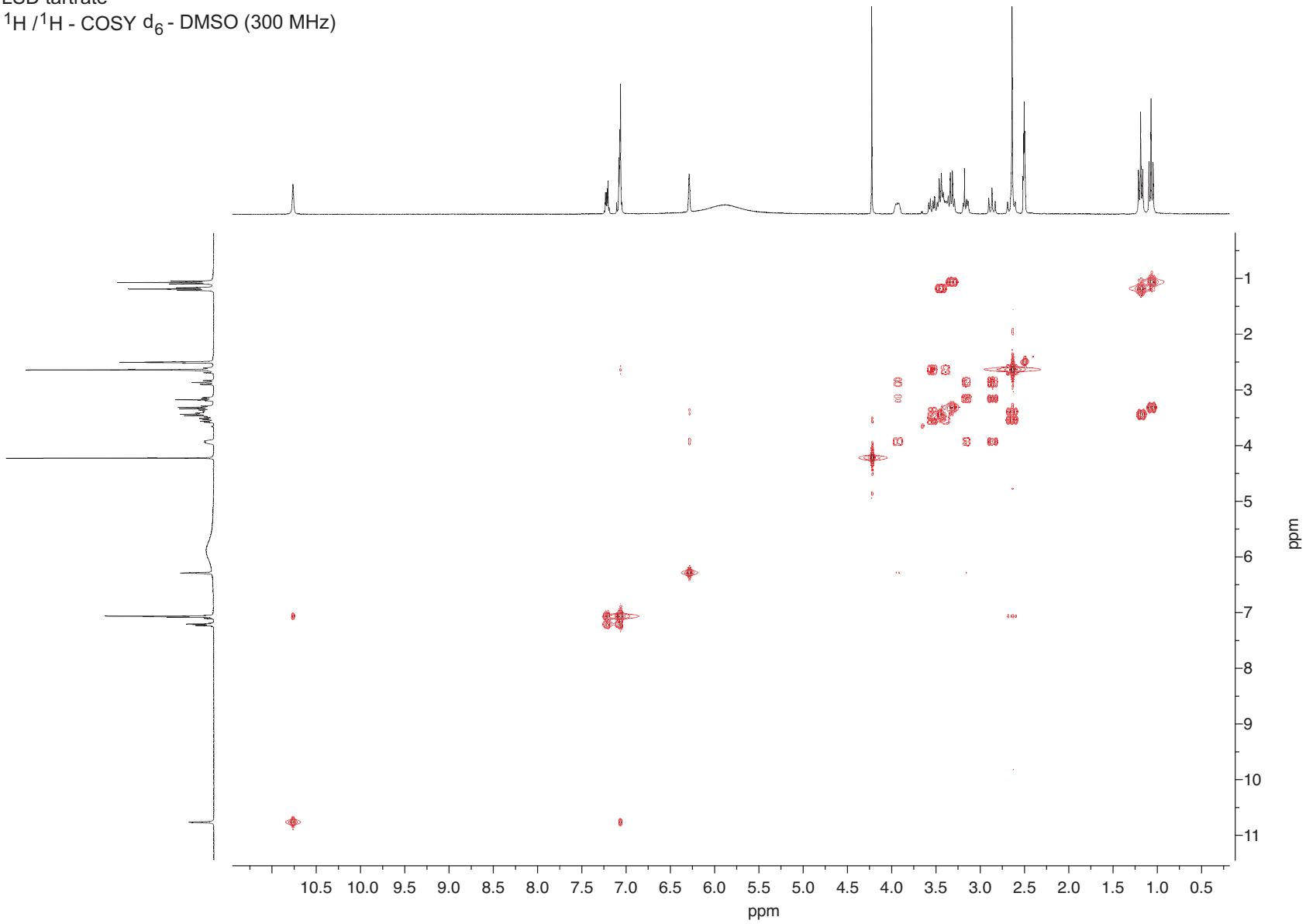
LSD tartrate

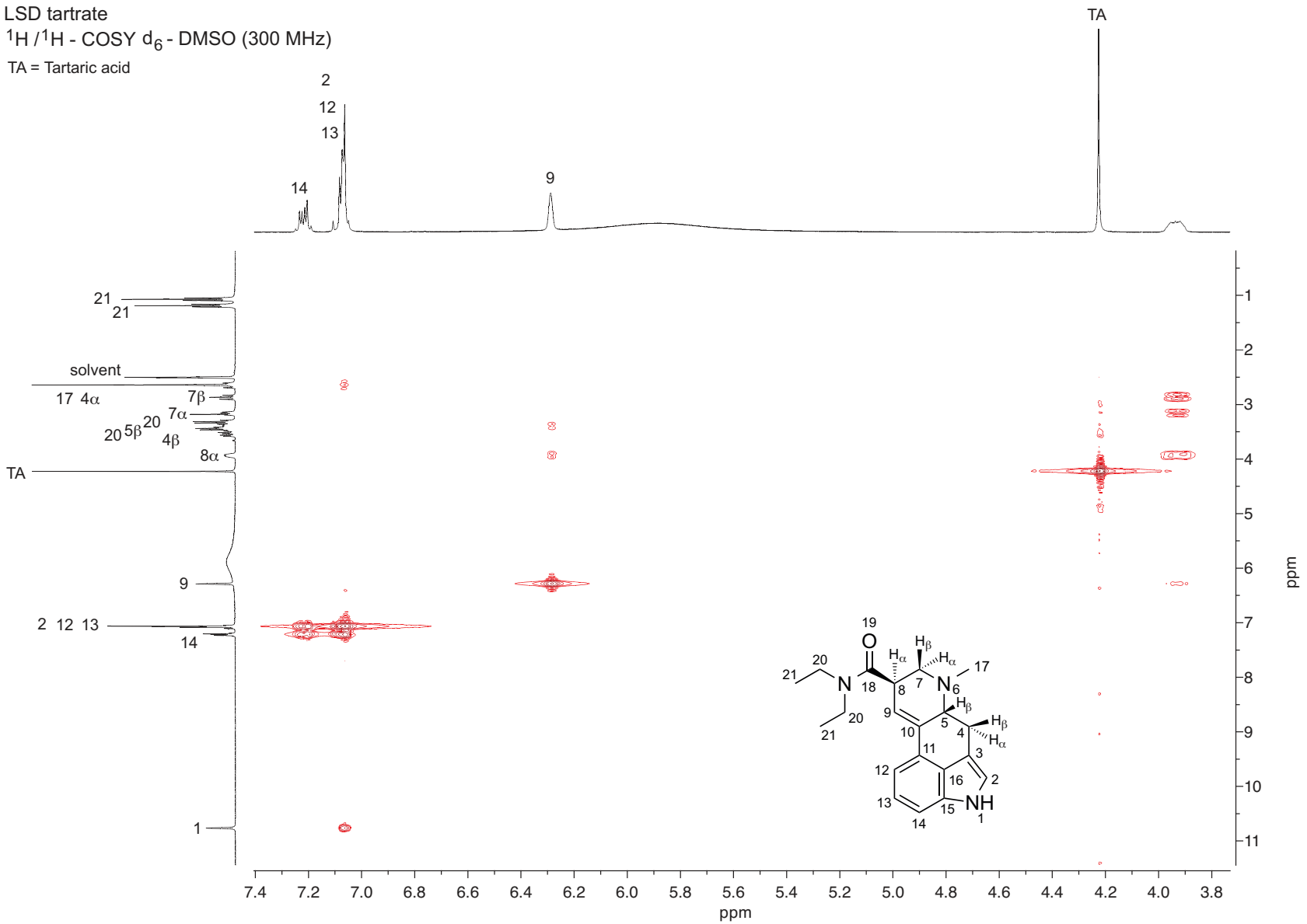
^{1}H - NMR d_6 - DMSO (300 MHz)




LSD tartrate
1H - NMR d6 - DMSO (300 MHz)
TA = Tartaric acid
TA
8α
4β
20
5β
20
7α
MeOH?
7β
17
4α
solvent
21
21
ppm

LSD tartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)

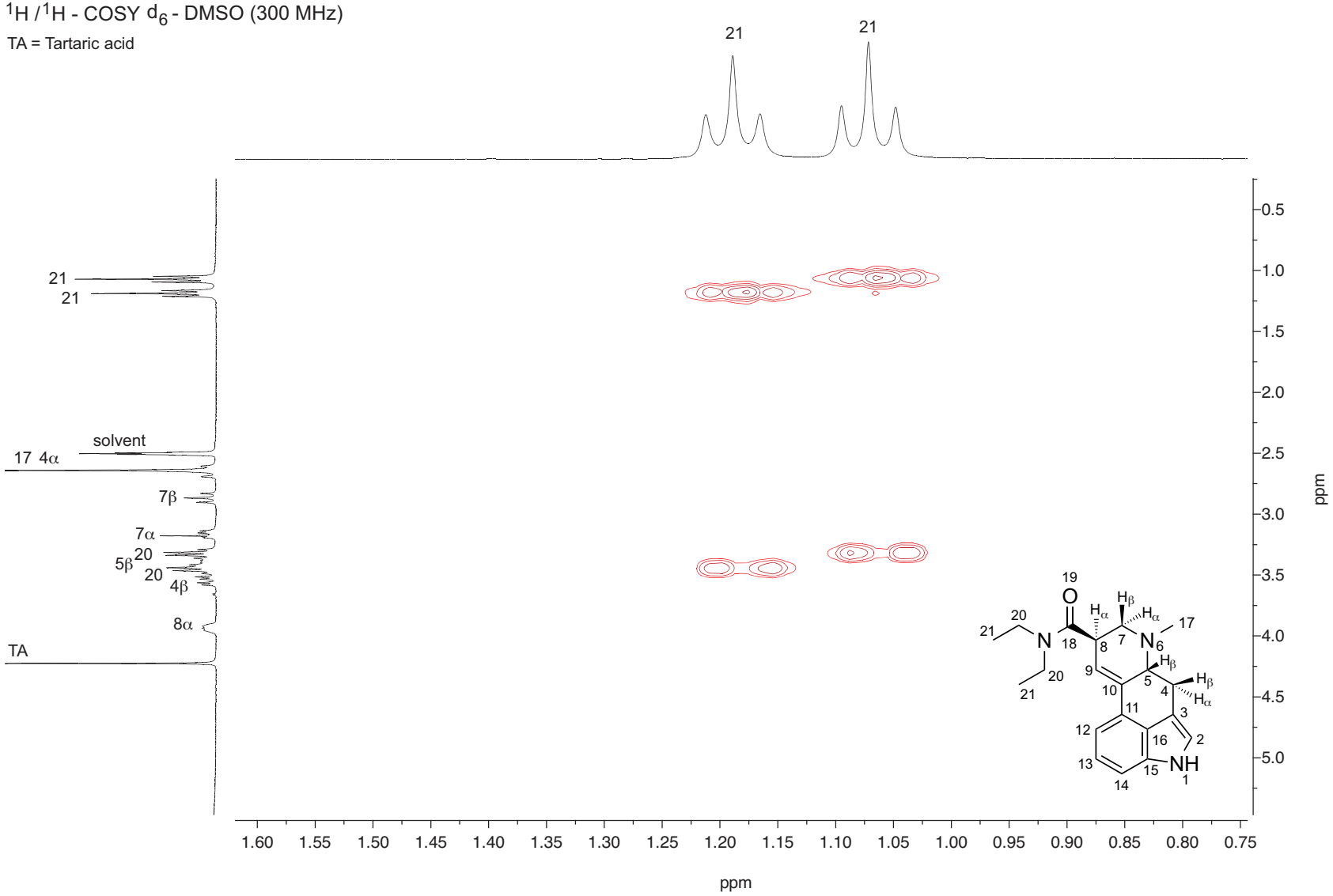


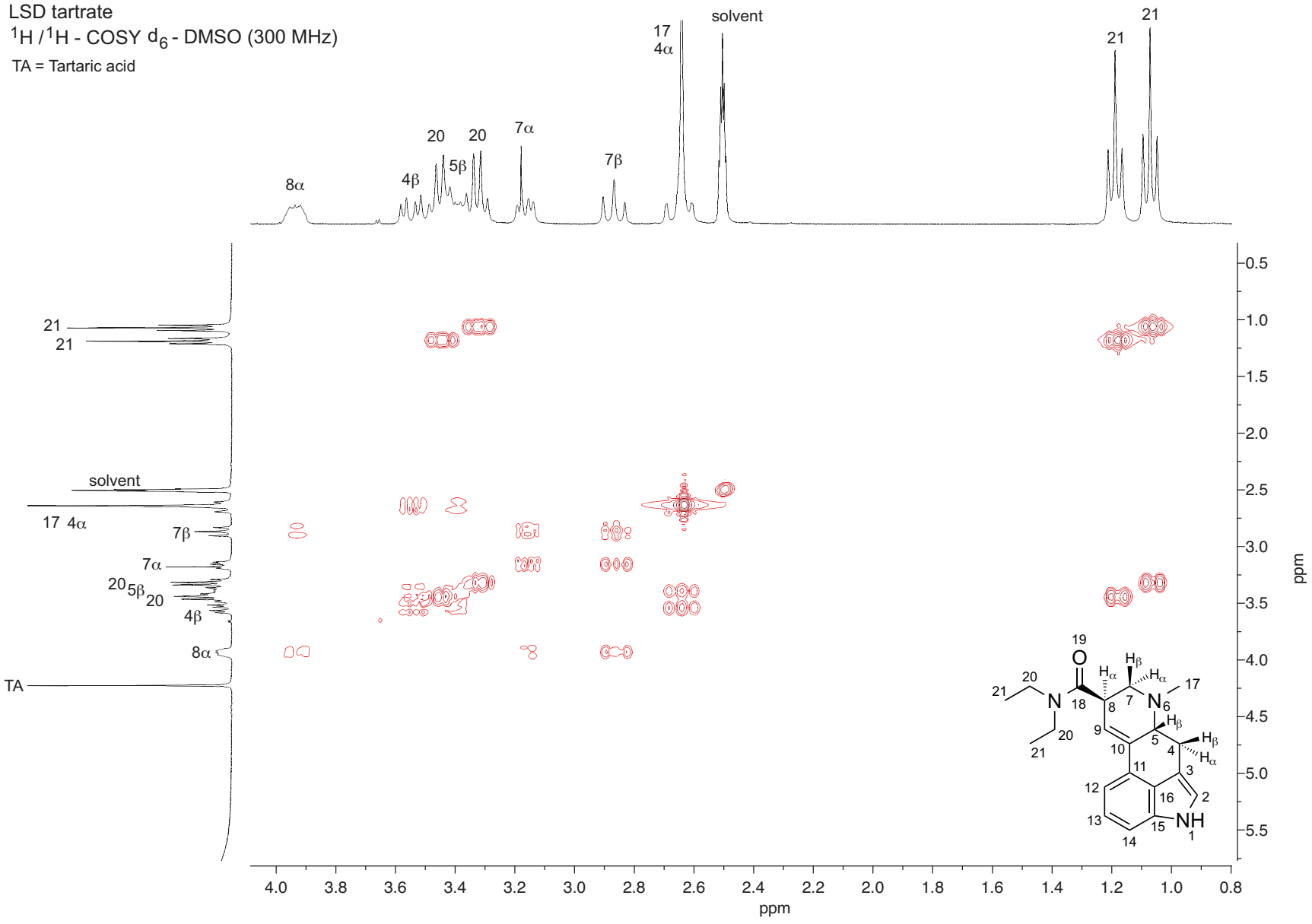

LSD tartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
TA
2
12
13
14
9
21
21
solvent
17 4α
7β
7α
20 5β 20
4β
8α
TA
9
2 12 13
14
1
ppm
ppm

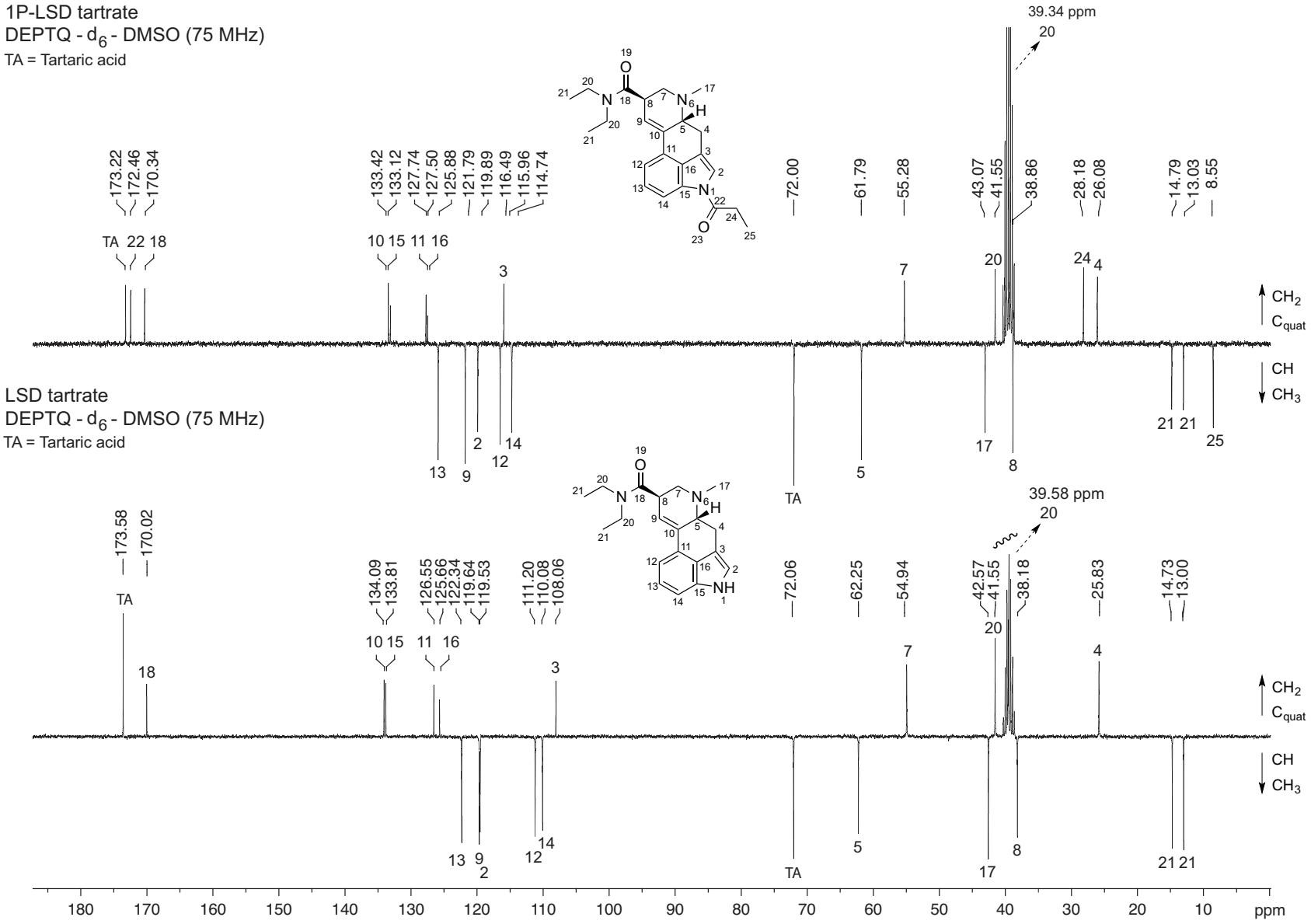
LSD tartrate

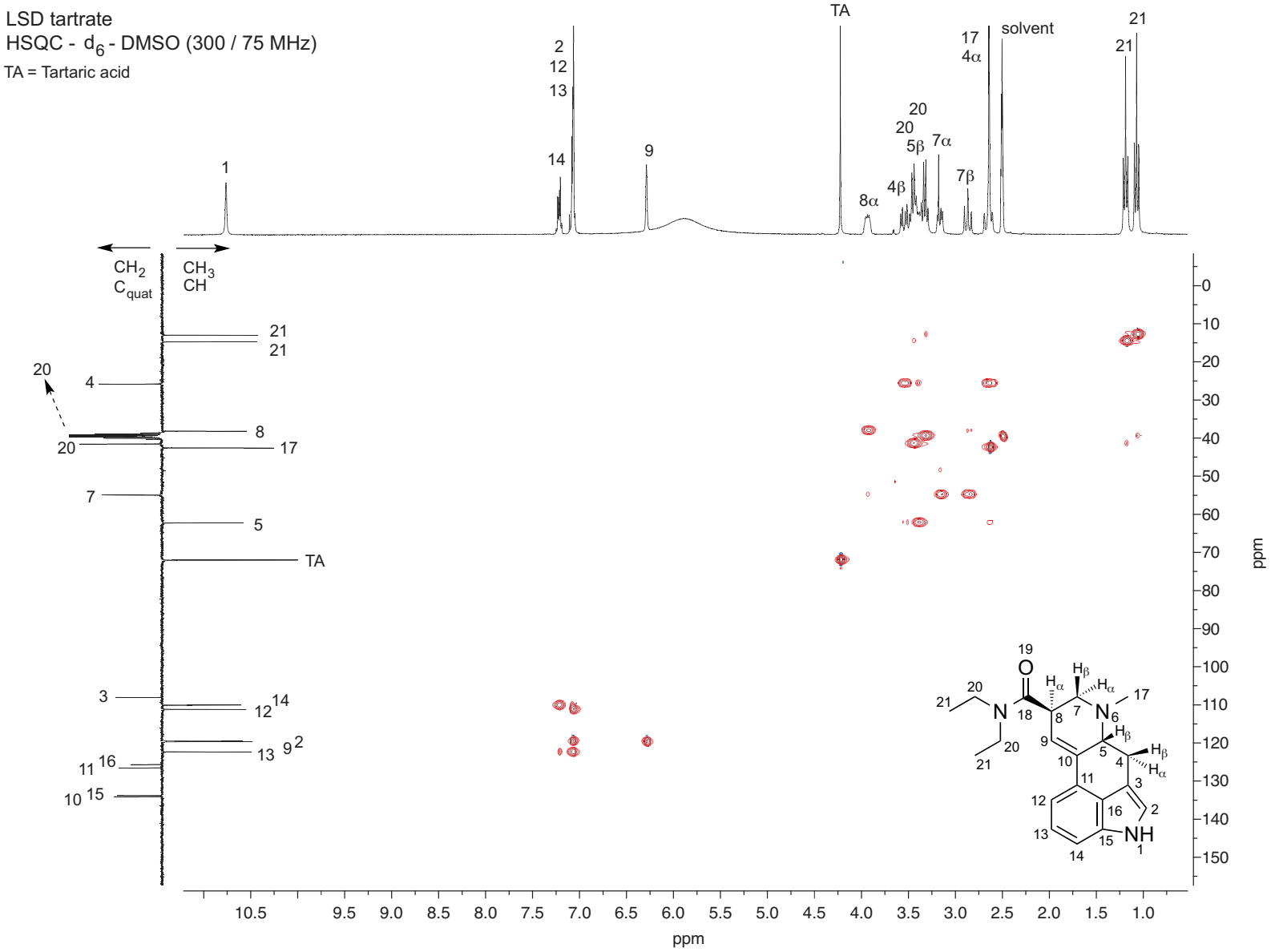
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)

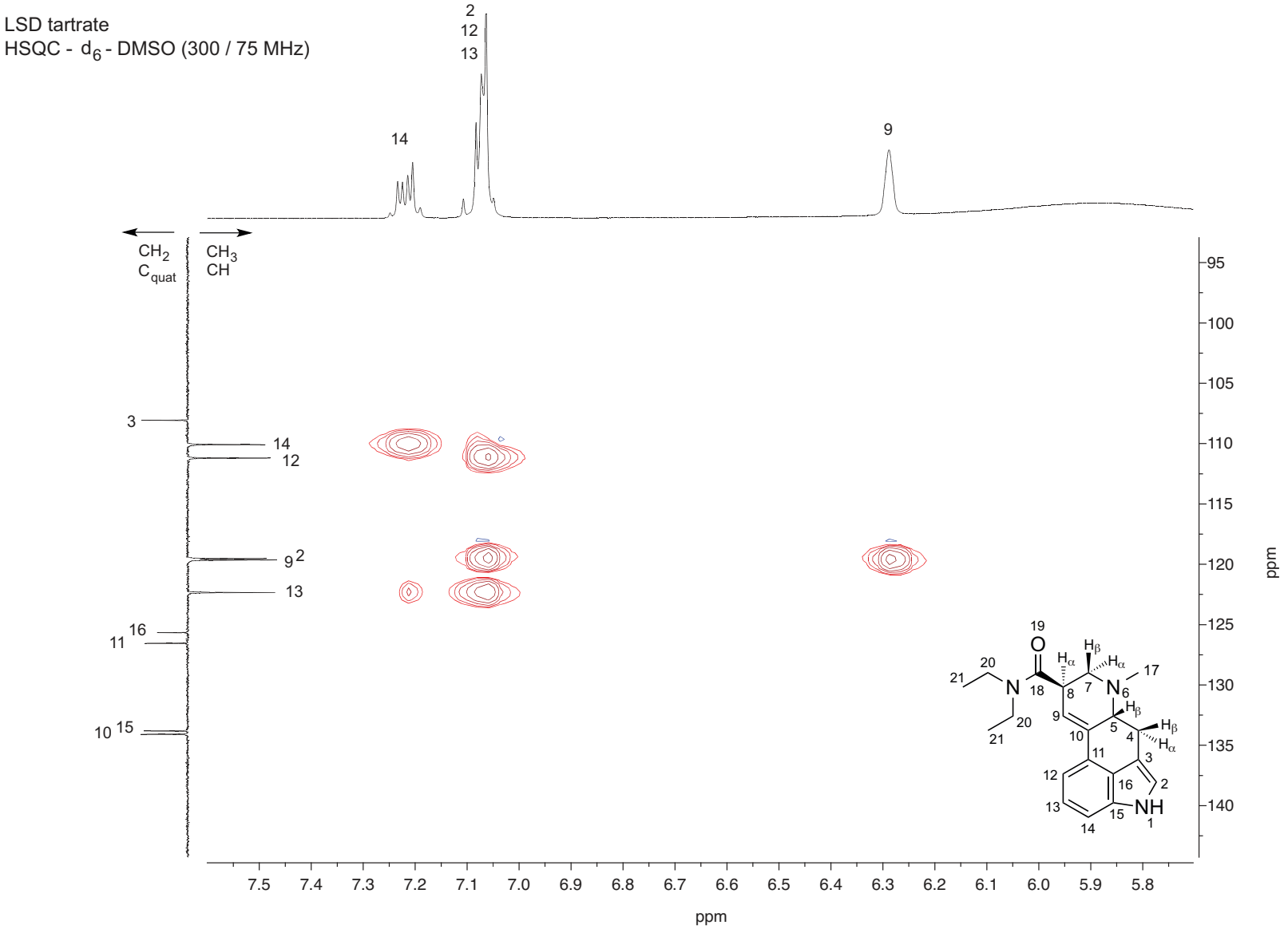
TA = Tartaric acid

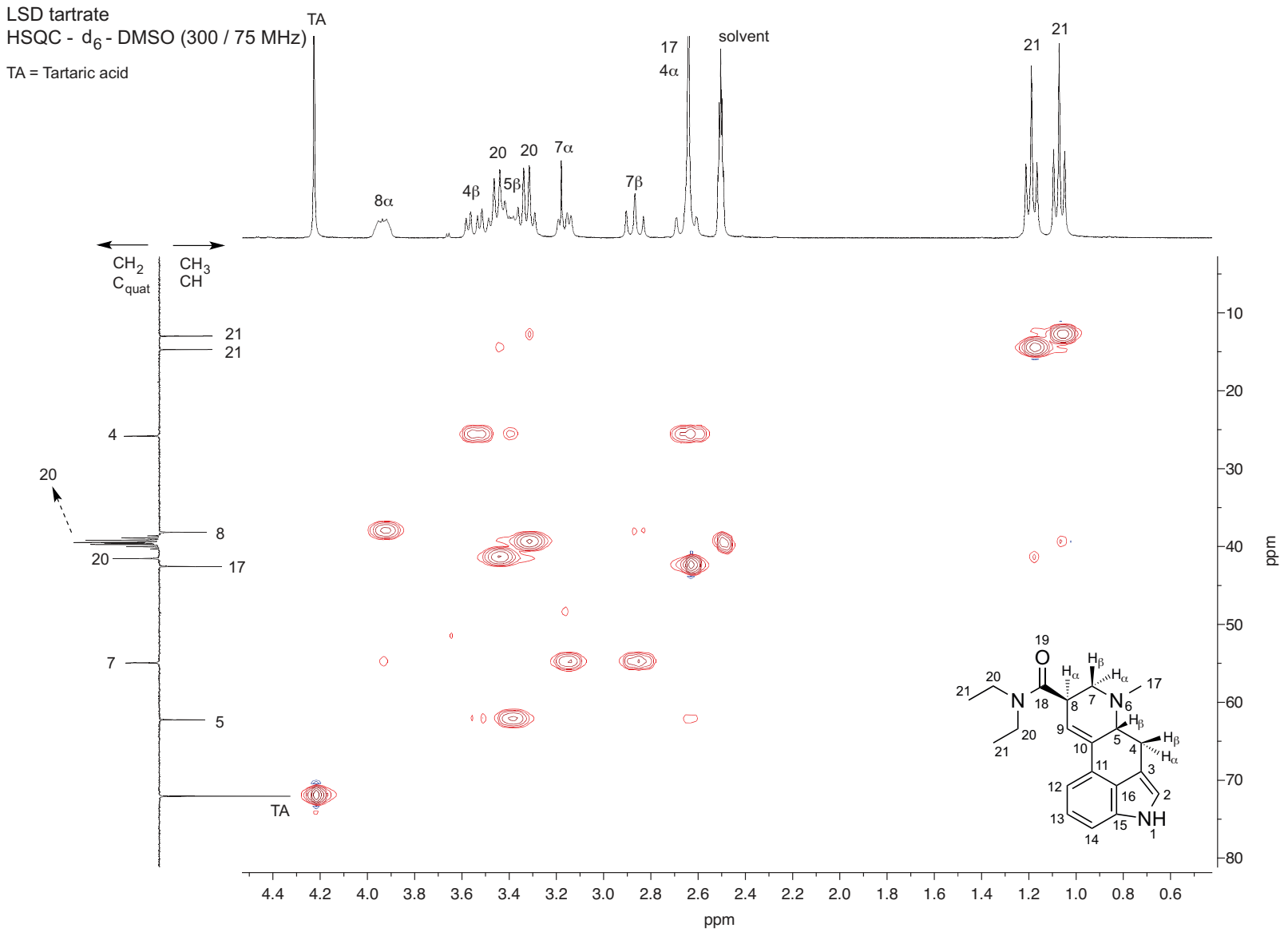



LSD tartrate
^{1}H /^{1}H - COSY d_6 - DMSO (300 MHz)
TA = Tartaric acid
8α
4β
20
5β
20
7α
7β
17
4α
solvent
21
21
21
21
solvent
17 4α
7β
7α
20
5β
20
4β
8α
TA
ppm
ppm

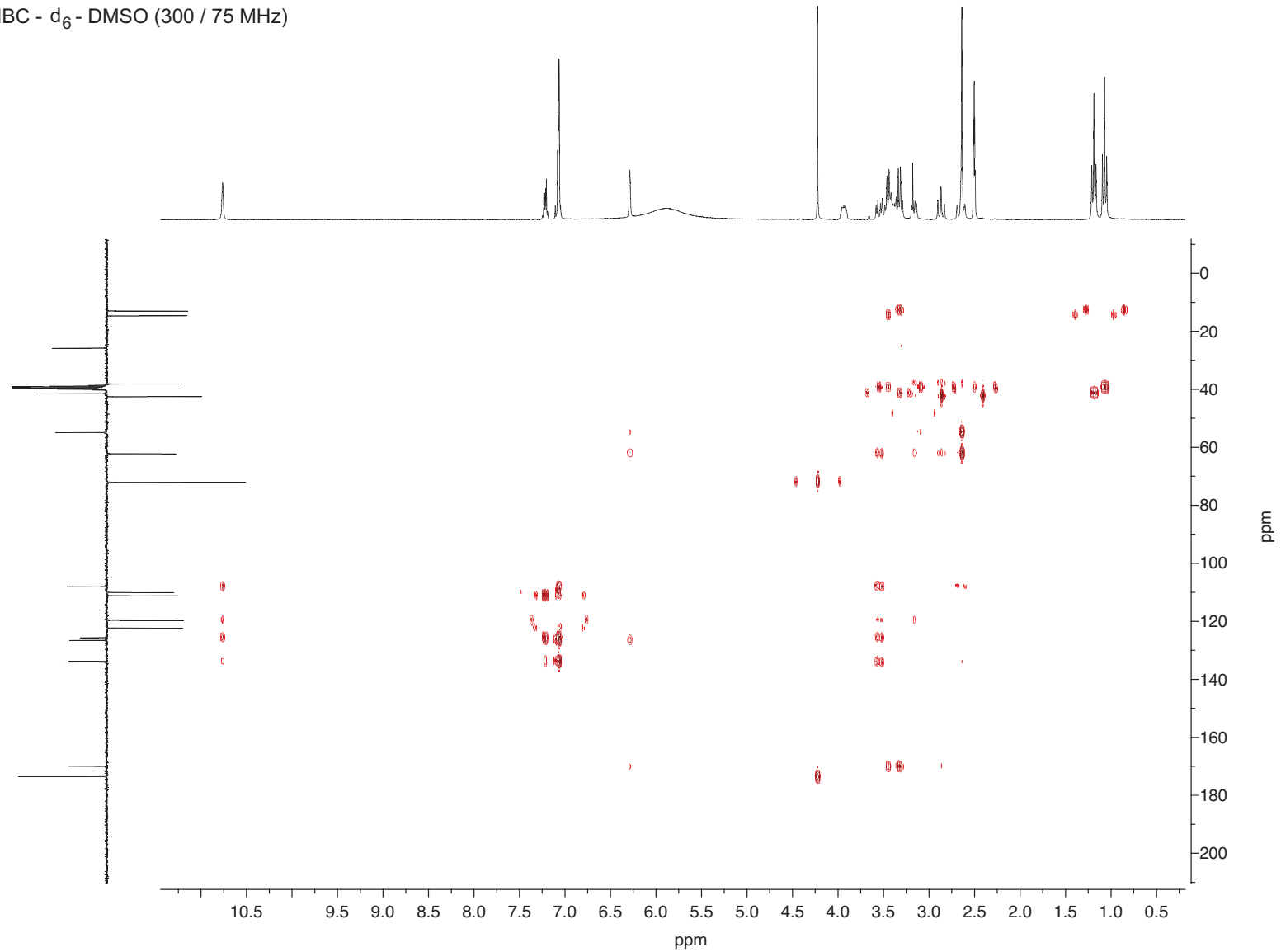

1P-LSD tartrate
DEPTQ - d6 - DMSO (75 MHz)
TA = Tartaric acid
39.34 ppm
173.22
172.46
170.34
133.42
133.12
127.74
127.50
125.88
121.79
119.89
116.49
115.96
114.74
72.00
61.79
55.28
43.07
41.55
38.86
28.18
26.08
14.79
13.03
8.55
TA 22 18
10 15 11 16
3
7
20
24
4
CH2
Cquat
CH
CH3
21 21
25
17
8
13
9
2
12
14
5
TA
LSD tartrate
DEPTQ - d6 - DMSO (75 MHz)
TA = Tartaric acid
39.58 ppm
173.58
170.02
134.09
133.81
126.55
125.66
122.34
119.64
119.53
111.20
110.08
108.06
72.06
62.25
54.94
42.57
41.55
38.18
25.83
14.73
13.00
TA
18
10 15
11
16
3
7
20
4
CH2
Cquat
CH
CH3
13
9
2
12
14
5
TA
17
8
21 21
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

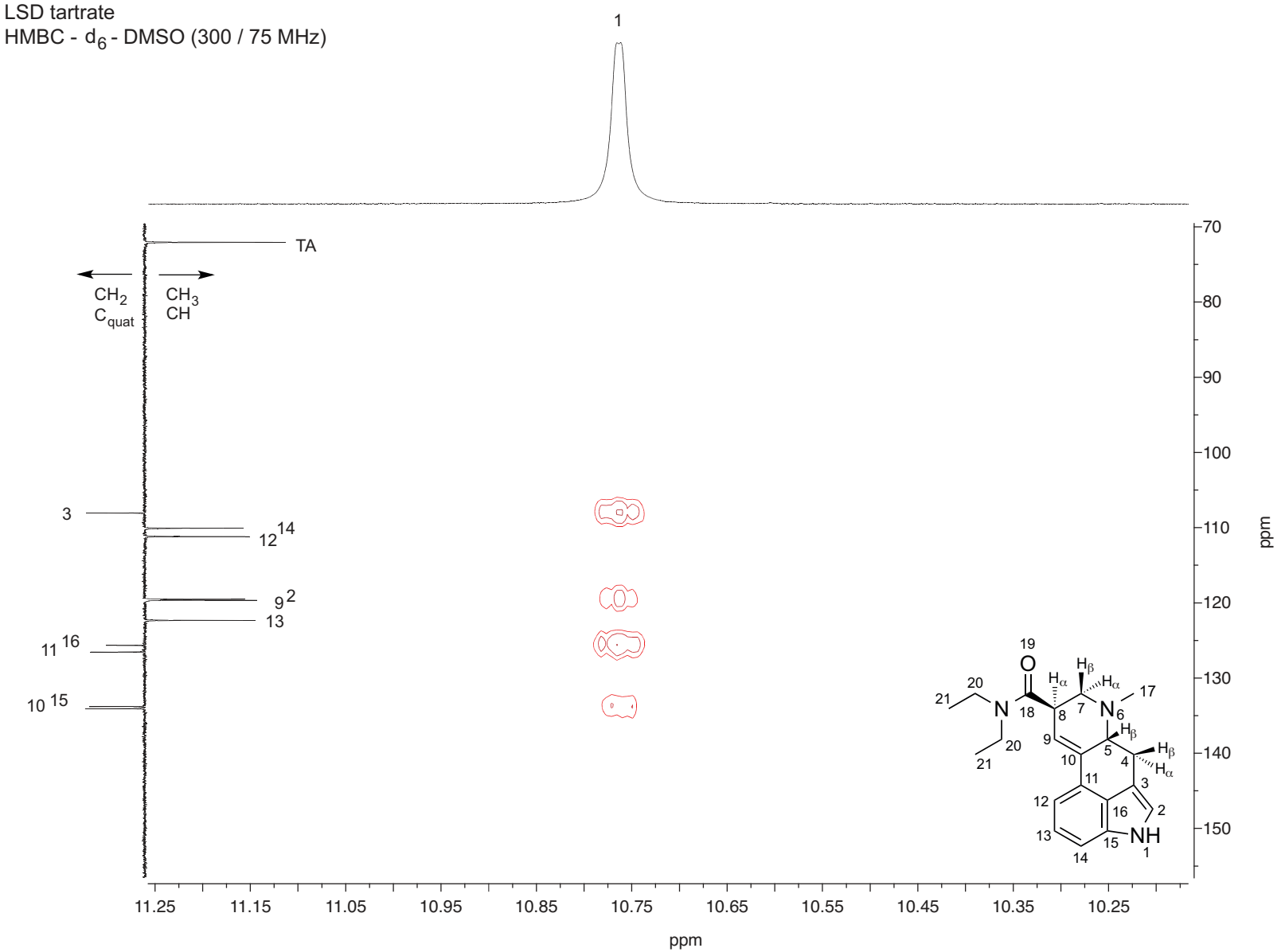

LSD tartrate
HSQC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
TA
solvent
CH2 Cquat
CH3 CH
ppm

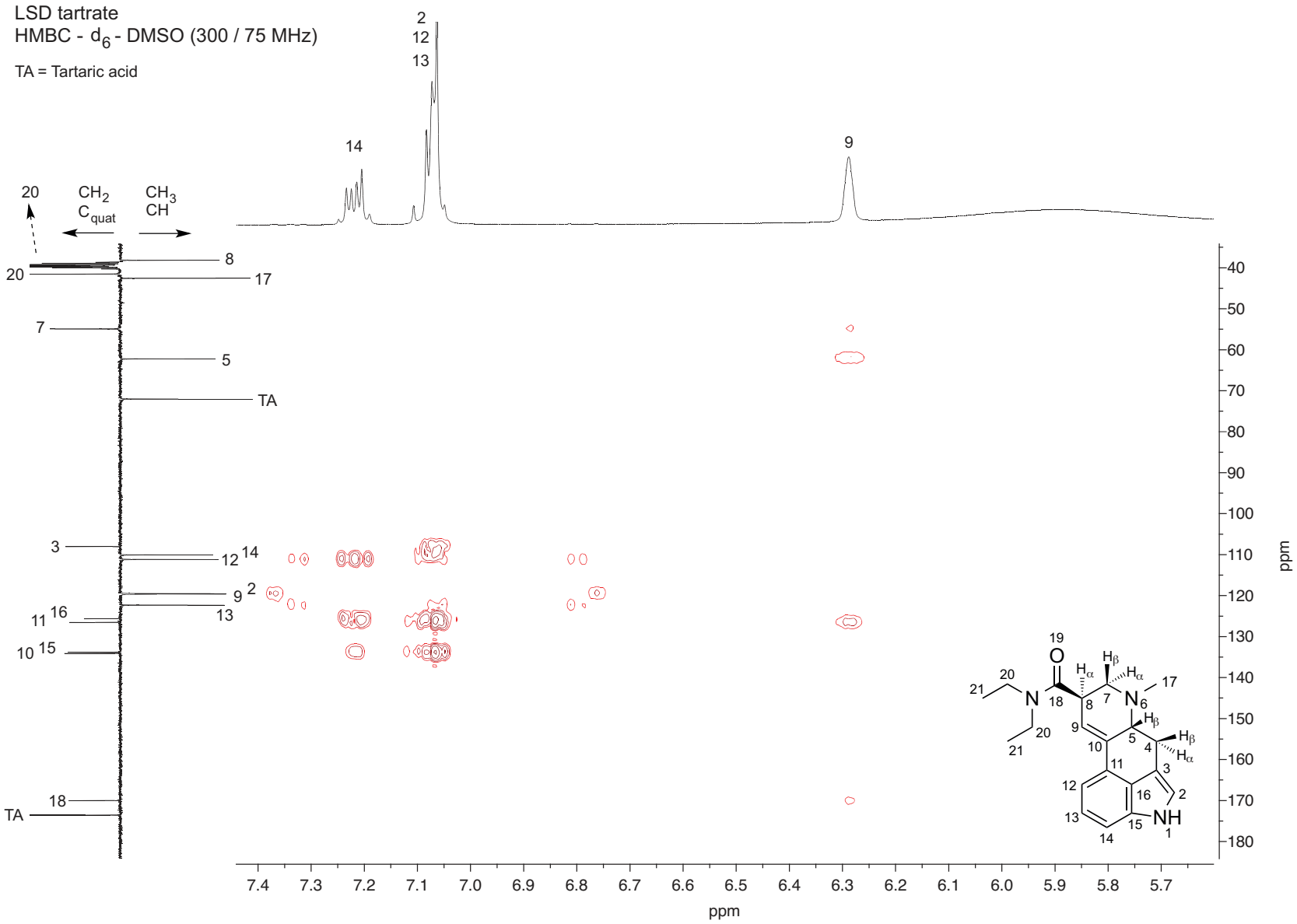

LSD tartrate
HSQC - d6 - DMSO (300 / 75 MHz)
2
12
13
14
9
CH2
Cquat
CH3
CH
3
14
12
9
2
13
16
11
10
15
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
ppm
95
100
105
110
115
120
125
130
135
140
ppm

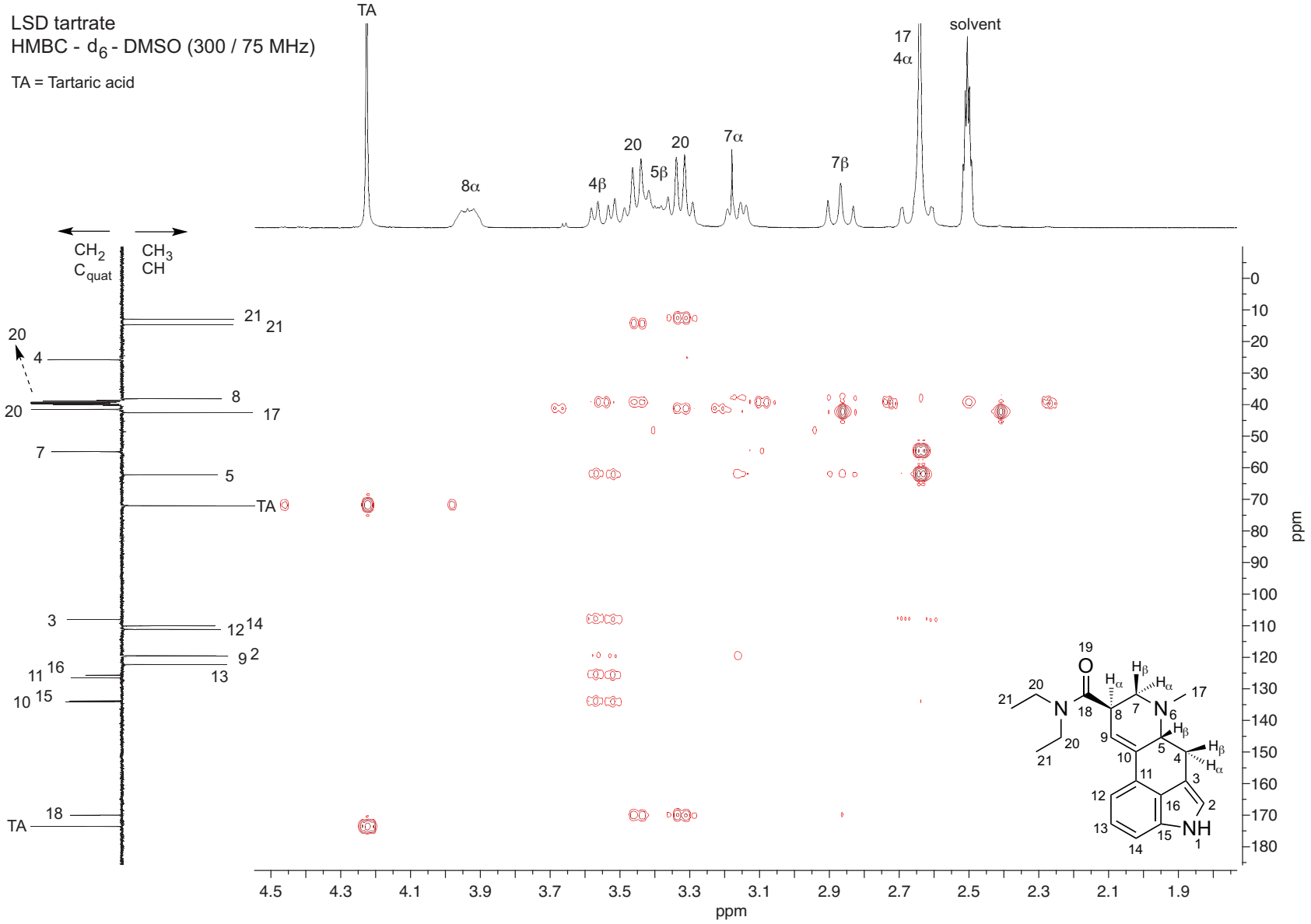

LSD tartrate
HSQC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
TA
8α
4β
20
20
5β
7α
7β
17
4α
solvent
21
21
CH2
Cquat
CH3
CH
21
21
4
20
8
20
17
7
5
TA
ppm
ppm

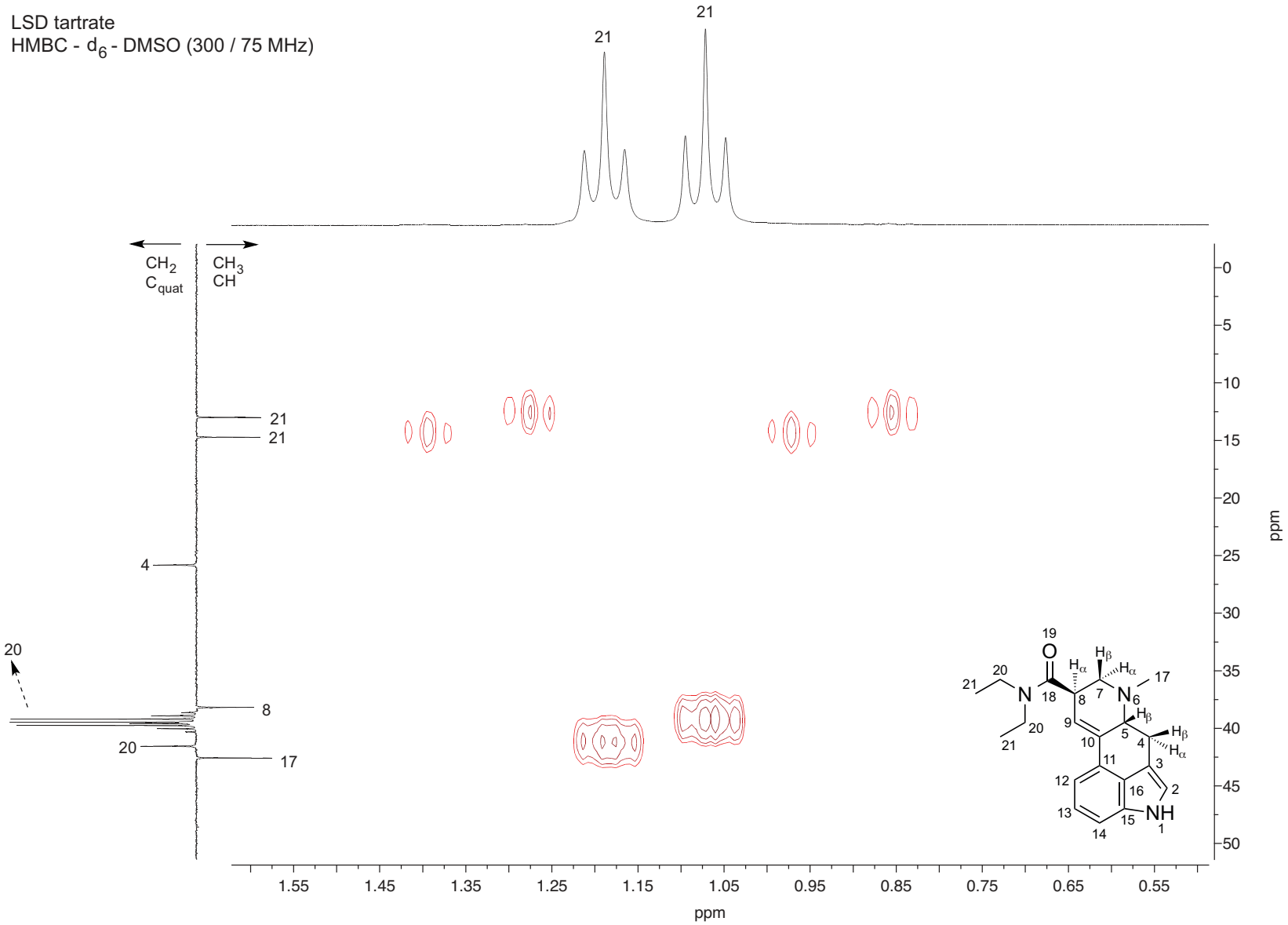
LSD tartrate
HMBC - d_6 - DMSO (300 / 75 MHz)




LSD tartrate
HMBC - d6 - DMSO (300 / 75 MHz)
1
TA
CH2
Cquat
CH3
CH
3
12
14
9
2
13
11
16
10
15
11.25
11.15
11.05
10.95
10.85
10.75
10.65
10.55
10.45
10.35
10.25
ppm
70
80
90
100
110
120
130
140
150
ppm


LSD tartrate
HMBC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
CH2 Cquat
CH3 CH
ppm
ppm


LSD tartrate
HMBC - d6 - DMSO (300 / 75 MHz)
TA = Tartaric acid
TA
8α
4β
20
5β
20
7α
7β
17
4α
solvent
CH2
Cquat
CH3
CH
21
21
20
4
8
20
17
7
5
TA
3
12
14
9
2
11
16
13
10
15
TA
18
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
2.5
2.3
2.1
1.9
ppm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
ppm


LSD tartrate
HMBC - d6 - DMSO (300 / 75 MHz)
21
21
CH2
Cquat
CH3
CH
21
21
4
20
8
20
17
1.55
1.45
1.35
1.25
1.15
1.05
0.95
0.85
0.75
0.65
0.55
ppm
0
5
10
15
20
25
30
35
40
45
50
ppm