

## Supplementary Information

# NXO beta structure mimicry: An ultra-short turn/hairpin mimic that folds in water

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## Materials and Methods

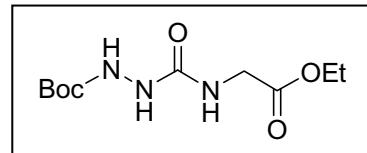
All reactions were carried out in oven-dried glassware under argon unless otherwise noted. Melting points were measured on a Buchi B-545 melting point apparatus and are uncorrected. Infrared spectra were recorded on an FT-IR spectrometer and are reported in wave numbers ( $\text{cm}^{-1}$ ). Circular Dichroism was measured on a JASCO J-815 (cell length 10mm), from 190-260nm, at 295K and at a concentration of 0.1mmol. Routine  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectra were recorded on a Bruker AC-200 (at 200 MHz and 50 MHz, respectively) pulse Fourier-transform NMR spectrometer. Chemical shifts  $\delta$  are reported in ppm relative to the resonance of tetramethylsilane (TMS). For compound **1**, NMR experiments were also performed on an Agilent/Varian VNMRS 600 MHz spectrometer equipped with inverse HCN probe, using standard vendor-supplied pulse sequences. For 1D-NOESY, ROESY and TOCSY experiments selective excitation of chosen protons was performed by a DPFGSE excitation block using selective gaussian inversion pulses optimized for the selected spectral region. In both 1D-, 2D-NOESY and ROESY experiments zero-order coherences were suppressed by a scheme proposed by Keeler, see: Thrippleton, M. J.; Keeler, J. *Angew. Chem. Int. Ed.* **2003**, 42, 3938. Combustion analyses were performed by the analytical laboratory, Vienna University. Mass spectra were obtained by MALDI-TOF-MS (on an Axima TOF<sup>2</sup>) using the matrix  $\alpha$ -cyano-4-hydroxycinnamic acid dissolved in methanol and *i*-propanol. Crude residues were purified by flash chromatography using silica gel 40-63 $\mu\text{m}$  and distilled reagent grade petroleum ether (bp 40-60°C) and ethyl acetate.

Conformation searching and Molecular Dynamics calculations were performed using Molecular Operating Environment, Version 2007.09 (MOE, © 1997-2007 [Chemical Computing Group Inc.](#)). To obtain input geometries, stochastic conformational searches employing the OPLS-AA forcefield potential parameters were performed with soft distance constraints derived from qualitatively assigned experimental NOE intensities. Criteria were thus registered from the assignment of crosspeaks in the ROESY experiment (for details *vide infra*) as very weak, weak, weak to medium, medium, medium to strong, strong with restraints below 5.5, 5, 4.5, 4, 3.5 and 3 $\text{\AA}$ , respectively. Conformational space was explored with an energy cutoff of 20kcal using 0.0001 $\text{\AA}$  Cartesian perturbation before 0.001 $\text{\AA}$  RMS-gradient minimization with full dihedral minimization and bond rotation in 30° steps for a minimum of

$>10^6$  random geometries. The lowest energy conformers thus obtained were freed of restraints, partial charges on titratable groups adjusted according to standardized pK<sub>A</sub> values and then subjected to Molecular Dynamics simulations in an NVT ensemble. Solvents as in the NMR experiment were treated implicitly by a generalized Born solvation model setting the exterior dielectric to the value of  $\epsilon = 78.5$  or 47 Debye for water and dimethylsulfoxide, respectively. Calculations were run for the indicated time of 100ns, excluding any atom constraints in the OPLS-AA forcefield. Dynamics were run at 290K and 297K with a timestep of 0.001ps, using the Nose-Poincaré-Anderson algorithm for solving the equations of motion. Pressure and temperature responses were set to 0.5 and 0.1ps relaxation time, respectively. Trajectory coordinates were stored at 0.5ps intervals for data analysis. Qualitatively assessed NOE intensities were compared to the calculated distances by an  $r^{-6}$  time-averaged treatment of calculated distances. The occurrence of a hydrogen bond was registered if the donor-acceptor distance was  $<3.5\text{\AA}$  with a donor-hydrogen-acceptor angle of  $90^\circ < \text{angle} < 180^\circ$ . *Ab initio* (at HF/B3LYP/MP2 levels of theory using 6-31G and 6-311G++ (d,p) basis sets) calculations were performed using the GAUSSIAN G09 program package (see: Frisch M. J., *et al.* Gaussian 09, Revision A.1, **2009**. Gaussian, Inc., Wallingford CT). Continuum solvents (water, dimethylsulfoxide, methanol ( $\epsilon = 32.5$  Debye)) were model by an SCRF approach.

### Preparation of compound 3

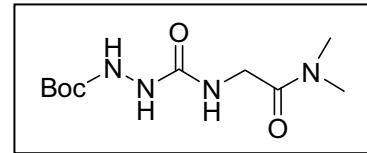
A solution of glycine ethyl ester hydrochloride (4.0 g, 28.66 mmol) and DIPEA (14.87 mL, 85.97 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (15 mL) was added slowly over a period of 30mins to a triphosgene solution (3.4 g, 11.46 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL). After stirring further for 15mins under argon, a solution of Boc-hydrazine (3.79 g, 28.66 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (15 mL) was added in one portion. The reaction mixture was further refluxed for 2hrs, evaporated to dryness and the residue obtained was dissolved in ethyl acetate (50 mL). The ethyl acetate solution was washed with 10% aq. NaHCO<sub>3</sub> (15 mL), brine (15mL), dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated to give 5.6 g of crude compound which was purified by column chromatography to give **3** as an off-white solid (3.63 g, 48%).



mp 137-138°C. Elemental analysis found: C, 45.71; H, 7.28; N, 16.48. Calc. for C<sub>10</sub>H<sub>19</sub>N<sub>3</sub>O<sub>5</sub>: C, 45.97; H, 7.33; N, 16.08. <sup>1</sup>H NMR (200 MHz, CDCl<sub>3</sub>): δ<sub>H</sub>=7.2 (bs, 1H), 7.05 (s, 1H), 6.2 (t, J=5.5 Hz, 1H), 4.11 (q, J=7 Hz, 2H), 3.92 (d, J=5.7 Hz, 2H), 1.39 (s, 9H), 1.2 (t, J=7 Hz, 3H); <sup>13</sup>C NMR (50 MHz, CDCl<sub>3</sub>): δ<sub>C</sub>=171.1, 158.9, 156.4, 81.5, 61.2, 41.8, 28.1, 14.0;

### Preparation of compound 4

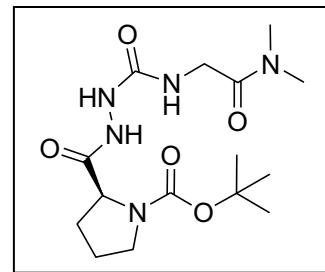
The solution of **3** (3.8 g, 14.54 mmol) in 33% w/v dimethylamine in ethanol (20 mL) was stirred overnight at room temperature. The solvent was removed by rotary evaporation and was well dried under high vacuum to give **4** as an off-white solid (3.78g, quant.).



mp 134-135°C. Elemental analysis found: C, 45.82; H, 7.39; N, 21.39. Calc. for C<sub>10</sub>H<sub>20</sub>N<sub>4</sub>O<sub>4</sub>: C, 46.14; H, 7.74; N, 21.52. <sup>1</sup>H NMR (200 MHz, CDCl<sub>3</sub>): δ<sub>H</sub>=7.35 (bs, 1H), 7.07 (s, 1H), 6.48 (t, J=4.3 Hz, 1H), 4.0 (d, J=4.3 Hz, 2H), 2.92 (s, 3H), 2.89 (s, 3H), 1.38 (s, 9H); <sup>13</sup>C NMR (50 MHz, CDCl<sub>3</sub>): δ<sub>C</sub>=169.2, 158.7, 156.3, 81.1, 41.8, 36.0, 35.6, 28.1;

### Preparation of compound 6

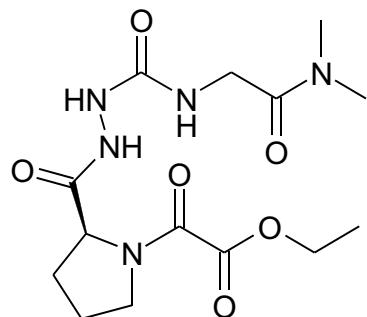
Ethyl acetate saturated with HCl (10 mL) was added slowly with stirring at 0°C to the solution of **4** (1.87 g, 7.2 mmol) in ethyl acetate (10 mL). The reaction mixture was stirred at room temperature for 30mins. Solvent was evaporated and the reaction mixture was well dried under high vacuum to afford hydrochloride salt **5** in quantitative yield. It was then dissolved in CH<sub>2</sub>Cl<sub>2</sub> (15 mL) and triethylamine (3.0 mL, 21.6 mmol) was added to free the amine group.



In another flask, Boc-L-proline (1.55 g, 7.2 mmol), HOBr (1.02 g, 7.56 mmol) and DCC (Dicyclohexylcarbodiimide, 1.56 g, 7.56 mmol) were dissolved in CH<sub>2</sub>Cl<sub>2</sub> (15 mL) and stirred for 15 mins at room temperature under argon. To this mixture, the above-mentioned solution of free amine was added at once and the resulting mixture stirred overnight under argon at room temperature. The precipitated DCHU (Dicyclohexylurea) was removed by filtration and the filtrate was evaporated. Additional DCHU was removed by subsequent trituration with cold ethyl acetate and filtration. The ethyl acetate solution was concentrated and the crude compound obtained was purified by column chromatography to give **6** as a white solid (2.1g, 81%).

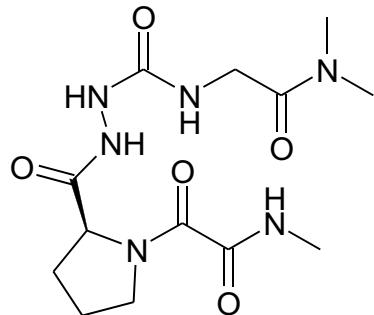
mp 74-75°C. Elemental analysis found: C, 50.21; H, 6.96; N, 19.43. Calc. for C<sub>15</sub>H<sub>27</sub>N<sub>5</sub>O<sub>5</sub>: C, 50.41; H, 7.61; N, 19.59. <sup>1</sup>H NMR (200 MHz, CDCl<sub>3</sub>): δ<sub>H</sub>=8.89 (bs, 1H), 7.75 (bs, 1H), 6.56 (bs, 1H), 3.87-4.22 (m, 3H), 3.41 (m, 2H), 2.91 (s, 3H), 2.88 (s, 3H), 1.68-2.1 (m, 4H), 1.36 (s, 9H); <sup>13</sup>C NMR (50 MHz, CDCl<sub>3</sub>): δ<sub>C</sub>=172.5, 169.1, 158.3, 155.3, 80.3, 58.7, 53.4, 47.1, 41.8, 36.1, 35.7, 28.3, 24.5.

### Preparation of compound 8



To the solution of **6** (3.79 g, 10.6 mmol) in ethyl acetate (10 mL), ethyl acetate saturated with HCl (10 mL) was added slowly with stirring at 0°C. The reaction mixture was stirred further at room temperature for 30mins. Solvent was evaporated and the reaction mixture was well dried under high vacuum to afford hydrochloride salt **7** in quantitative yield. It was then dissolved in DMF (30 mL), and with good stirring sodium bicarbonate (4.5 g, 53.02 mmol) was added. The reaction mixture was cooled to 0°C and ethyl oxalylchloride (1.4 mL, 12.73 mmol) was added slowly with stirring and the resulting mixture stirred for further 30mins under argon at room temperature. The mixture was diluted with ethyl acetate (100 mL) and filtered through celite to remove excess sodium bicarbonate and by-product salts. The filtrate was concentrated under reduced pressure to afford crude **8** as a thick sticky mass (1.1 g, 29%). Compound **8** was found to be unstable and was used for further reaction without purification.

## Preparation of compound 1



To the solution of crude **8** (1.1 g, 3.08 mmol) in ethanol (10 mL), 33% methylamine solution in ethanol (10 mL) was added. The reaction mixture was stirred at room temperature for 30mins. The white solid precipitated was filtered and washed with ethanol (10 mL) to afford **1** as a white solid (0.75g, 71%).

mp 201-202°C. Elemental analysis found: C, 43.54; H, 6.16; N, 22.88. Calc. for C<sub>13</sub>H<sub>22</sub>N<sub>6</sub>O<sub>5</sub>.H<sub>2</sub>O: C, 43.33; H, 6.71; N, 23.32. IR (KBr)  $\nu_{\text{max}}/\text{cm}^{-1}$  4000-3336, 3214, 3016, 1640, 1554, 1436, 1412, 1340, 1257, 1126, 994, 816, 758, 731, 611.

<sup>1</sup>H NMR (400 MHz, d<sub>6</sub>-DMSO):  $\delta_{\text{H}}$  = 9.82 (bs, 1H), 9.74 (bs, 1H), 8.63 (d, *J*=1.5Hz, 1H), 8.57 (d, *J*=1.5Hz, 1H), 8.12 (s, 1H), 8.07 (s, 1H), 6.38 (s, 1H), 6.31 (s, 1H), 4.94 (bs, 1H), 4.34 (bs, 1H), 3.95-3.77 (m, 6H), 3.57-3.50 (m, 2H), 2.95 (s, 6H), 2.86 (s, 6H), 2.68 (d, *J*=1.5Hz, 3H), 2.60 (d, *J*=1.5Hz, 3H), 2.27-1.78 (m, 8H).

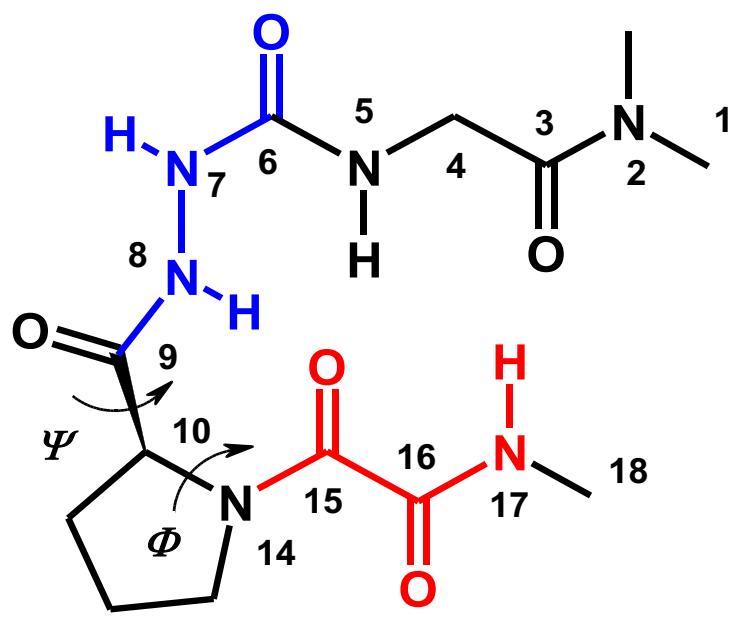
<sup>13</sup>C NMR (100 MHz, d<sub>6</sub>-DMSO):  $\delta_{\text{C}}$  = 172.9, 171.8, 169.5, 169.4, 162.7, 162.1, 161.6, 160.9, 158.7, 158.5, 60.7, 60.3, 49.5, 49.0, 42.1, 36.5, 35.9, 32.9, 29.6, 26.4, 26.3, 25.7, 25.3; MS (MALDI-TOF): *m/z* found 365.15 (100) [M+Na<sup>+</sup>]; calc. for C<sub>13</sub>H<sub>22</sub>N<sub>6</sub>O<sub>5</sub>+Na<sup>+</sup>: 365.15.

The D-Proline-derived analog of **1**, compound **9**, was prepared entirely analogously using Boc-D-proline. The final step yielded white solid material in 18% yield, mp 202-203°C.

MS (MALDI-TOF): *m/z* found 365.15 (100) [M+Na<sup>+</sup>]; calc. for C<sub>13</sub>H<sub>22</sub>N<sub>6</sub>O<sub>5</sub>+Na<sup>+</sup>: 365.15.

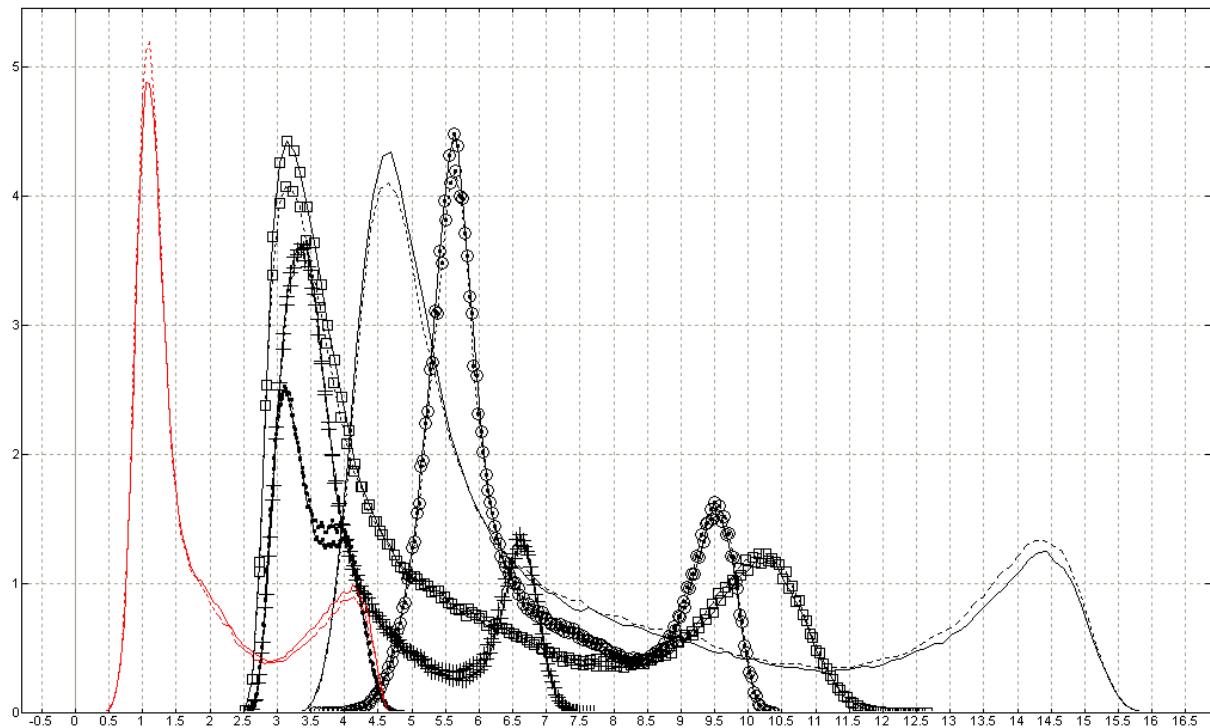
Atom	Chemical shift, ppm		Atom	Chemical shift, ppm	
	<b>13C</b>	<b>1H</b>		<b>13C</b>	<b>1H</b>
Conformer	<b>1a</b>		Conformer	<b>1b</b>	
1a	35,980	2,927	1a	35,980	2,918
1b	35,482	2,842	1b	35,482	2,821
3	169,075	-	3	168,960	-
4	41,640	3,920 3,870	4	41,640	3,920 3,800
5	-	6,300	5	-	6,343
6	157,977	-	6	158,169	-
7	-	8,118	7	-	8,075
8	-	9,807	8	-	9,733
9	171,389	-	9	172,455	-
10	59,846	4,314	10	60,191	4,940
11	29,105	2,078 1,825	11	32,416	2,190 1,983
12	25,220	1,913 1,847	12	21,878	1,767 1,740
13	49,001	3,802 3,802	13	48,534	3,515 3,453
15	161,051	-	15	160,407	-
16	161,549	-	16	162,246	-
17	-	8,679	17	-	8,590
18	25,994	2,578	18	25,909	2,656

**Table 1.** 600 MHz (<sup>1</sup>H NMR) and 150 MHz (<sup>13</sup>C NMR), respectively, chemical shifts  $\delta$  of ensemble conformers **1a** and **1b** in d<sub>6</sub>-DMSO, measured at 5mM concentration.

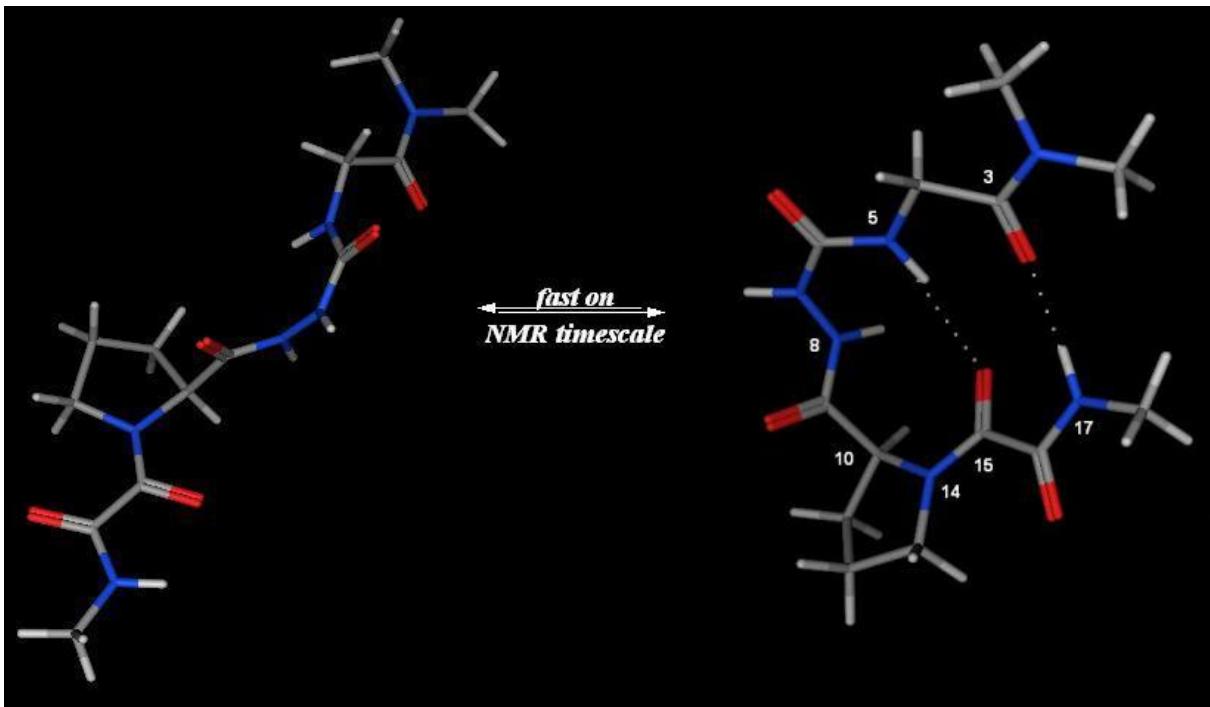


**N<sup>L</sup>-Pro O-modified  $\beta$ -turn mimic 1**

**Figure 1.** Numbering of **1** as used throughout the text.



**Figure 2. 1**, percentage-weighted histogram of all-atom RMSD (red lines) and selected distances (black, abscissa values in Å) from a 100ns Molecular Dynamics run. Solid and dotted lines indicate H<sub>2</sub>O (290K) and DMSO (297K) trajectories, respectively. Distances (atoms, graph markers): 1-18, lines; 3-17, hollow squares; 5-15, hollow crosses; 4-16, hollow circles; 8-15, dots.



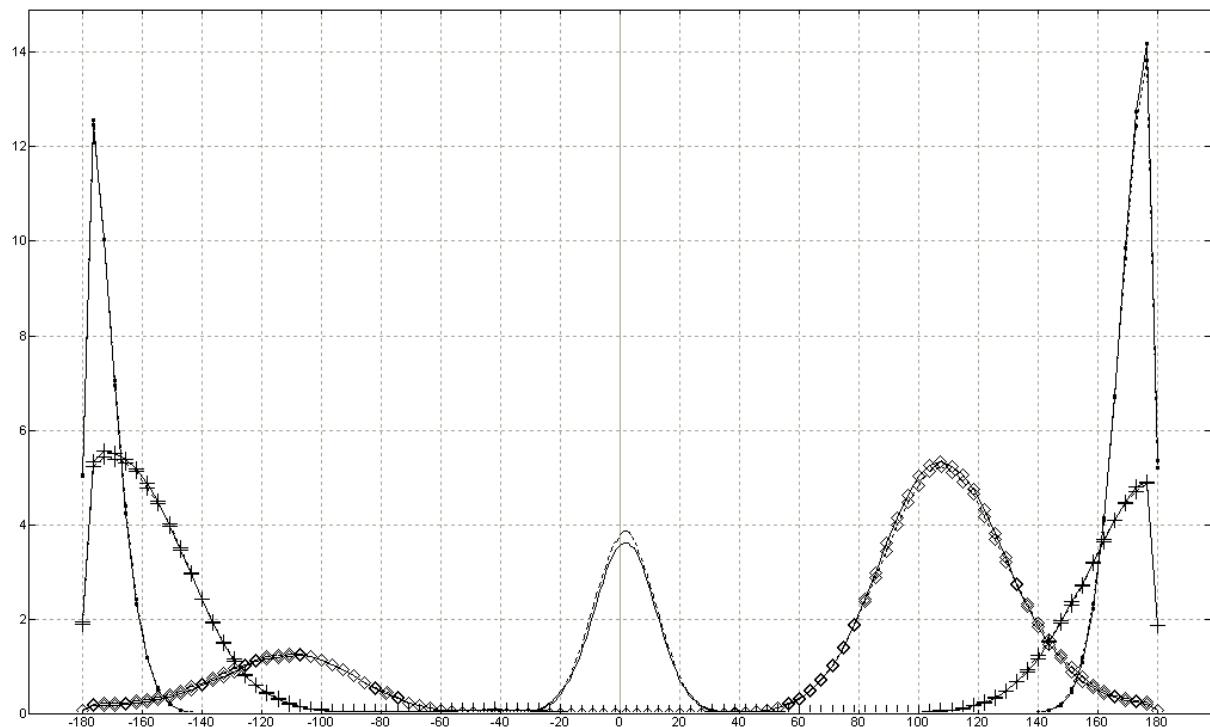
**Figure 3.** The open-fold equilibrium in **1**, from a 100ns MD trajectory in water at 290K with the OPLS-AA parameter set. At this temperature, the open-fold interconversion rate was simulated in the order of magnitude of  $10^{-11}$ s. Dotted lines indicate hydrogen bonding.

	H <sub>2</sub> O, extended, 290K	H <sub>2</sub> O, folded, 290K	DMSO, extended, 297K	DMSO, folded, 297K
<b>E, total potential energy</b>	-41.74	-44.15	-41.55	-44.0
<b>E, angle bend</b>	10.03	9.08	10.03	9.08
<b>E, torsion (proper and improper)</b>	2.25	5.44	2.26	5.43
<b>E, van der Waals</b>	10.29	7.78	10.30	7.81
<b>E, electrostatic</b>	-45.15	-51.16	-45.18	-51.25
<b>E, solvation</b>	-21.72	-17.68	-21.51	-17.47

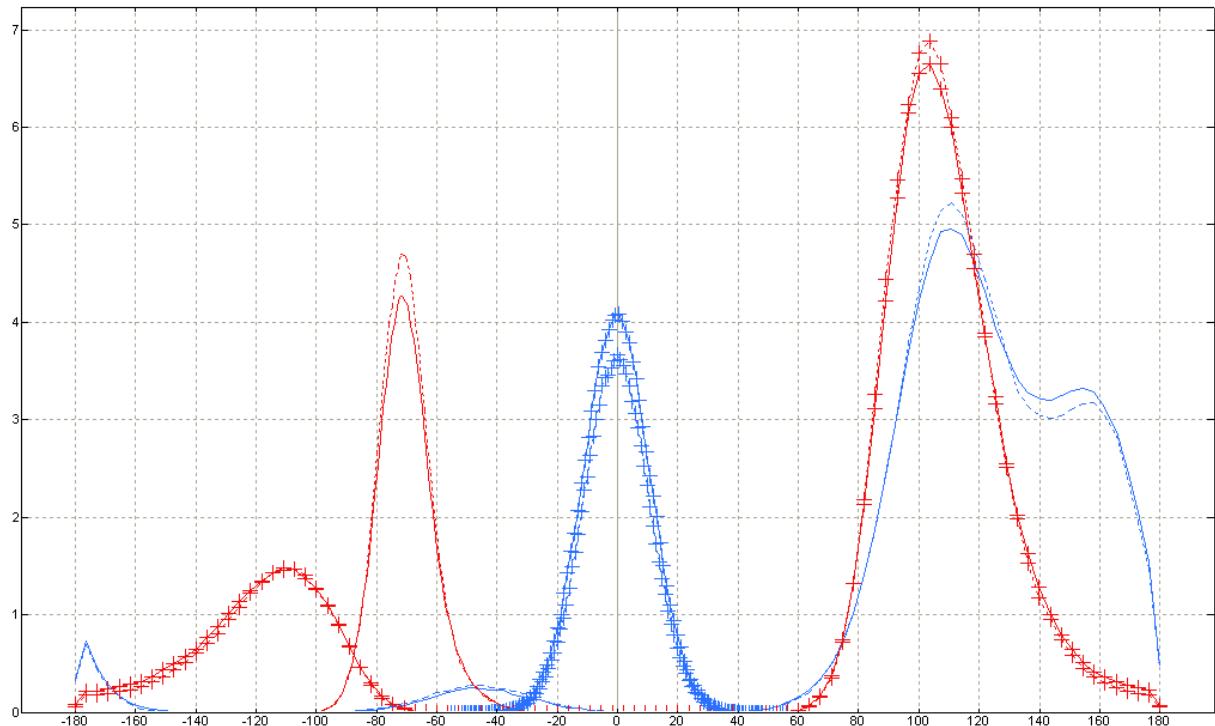
**Table 2.** Energies in the folded and unfolded conformers of **1** from MD. For structures see Picture above. Calculated by minimizing the most abundantly sampled conformation in RMSD around the respective extended and folded RMSD peak values with OPLS-AA parameters and implicitly treated solvation using the Born model. All values are in kcalmol<sup>-1</sup>.

	H <sub>2</sub> O, 290K	DMSO, 297K
<b>(C15)O←HN5, % sampled</b>	38.8	37.2
<b>(C15)O←HN5, visits</b>	29368	28637
<b>(C15)O←HN5, avg. lifetime [ps]</b>	2.80	2.74
<b>(C15)O←HN8, % sampled</b>	35.2	34.9
<b>(C15)O←HN8, visits</b>	34504	33576
<b>(C15)O←HN8, avg. lifetime</b>	2.09	2.12
<b>(C3)O←HN17, % sampled</b>	26.2	24.8
<b>(C3)O←HN17, visits</b>	26516	25258
<b>(C3)O←HN17, avg. lifetime</b>	2.06	2.09

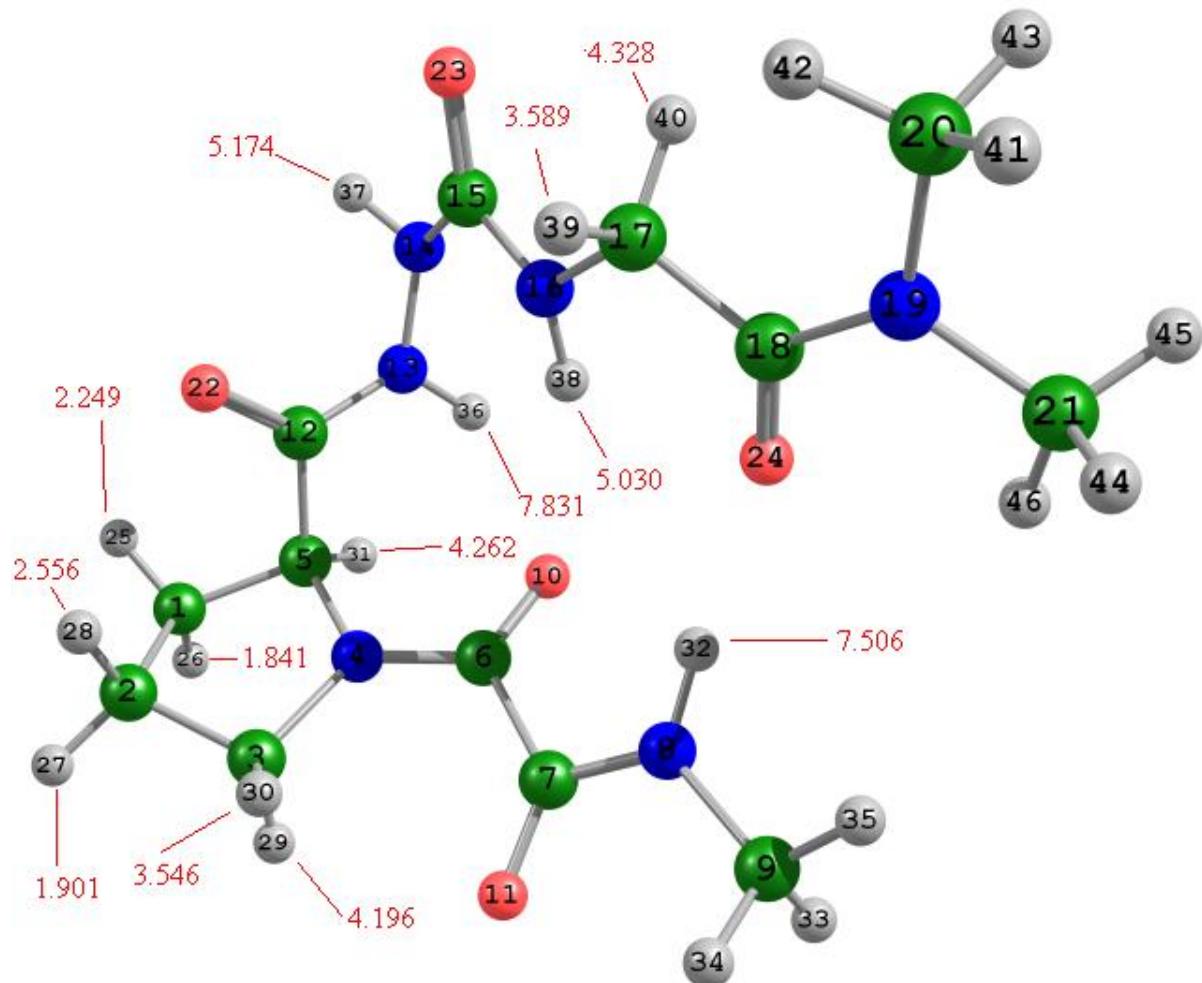
**Table 3.** Hydrogen bonding characteristics of the folded conformer of **1** during 100ns MD runs with OPLS-AA parameters using the Born model of solvation.



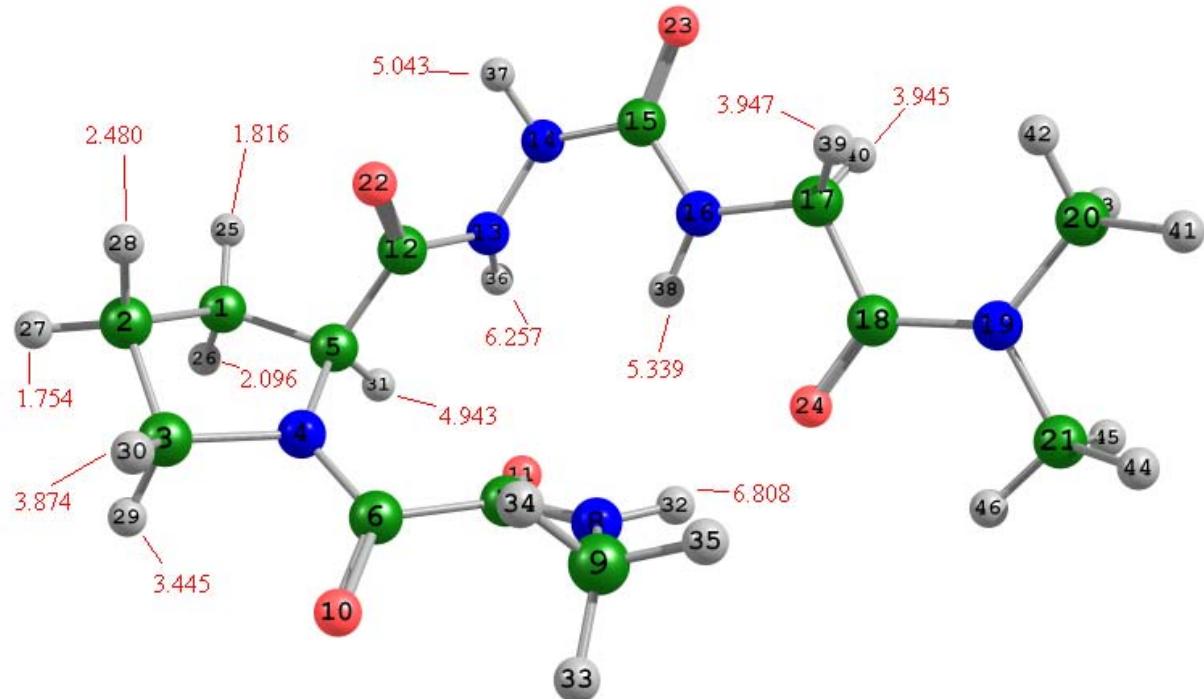
**Figure 4. 1**, percentage-weighted histogram of selected torsions during the MD runs. Solid and dotted lines indicate H<sub>2</sub>O (290K) and DMSO (297K) trajectories, respectively. H-N7-N8-H: diamonds; O15-C15-C16-O16: crosses; H-N7-C6-N5: dots; H8-N8-C9-C10: solid lines.



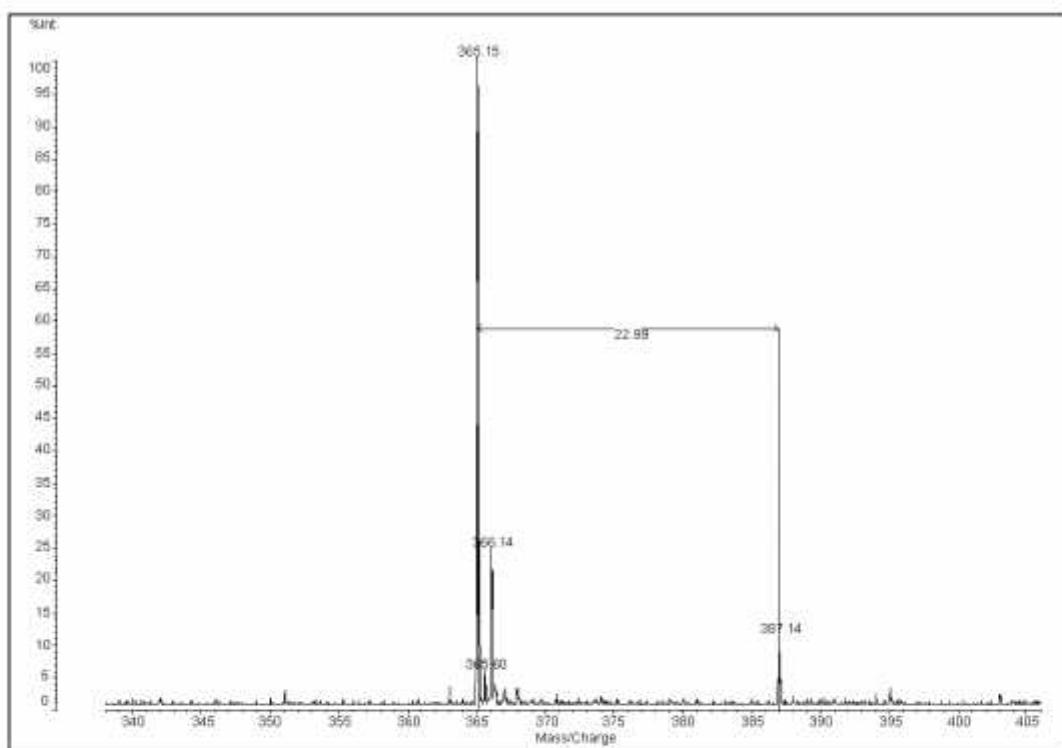
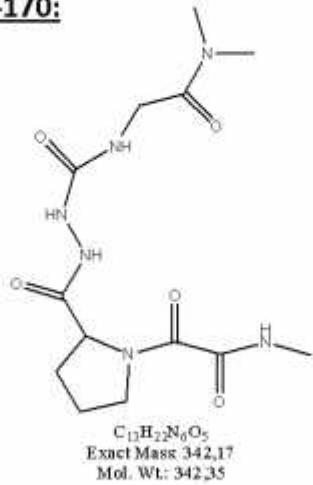
**Figure 5. 1**, percentage-weighted histogram of backbone  $\Phi$  (red) and  $\Psi$  (blue) during the MD runs. Dotted and solid lines indicate H<sub>2</sub>O (290K) and DMSO (297K) trajectories, respectively.  $\Phi$  or  $\Psi$  ( $i+1$ ): no markers;  $\Phi$  or  $\Psi$  ( $i+2$ ): crosses.



**Figure 6.** Relative minimum geometry from *ab initio* calculations at B3LYP/6-311G++(d,p) and substantiated as equilibrium conformer **1a** by comparison with MD and NMR. Given in the figure is the calculated value of the <sup>1</sup>H NMR chemical shift in ppm relative to TMS.

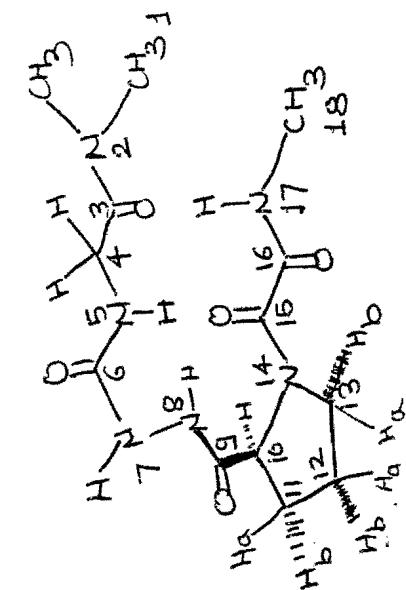


**Figure 7.** Relative minimum geometry from *ab initio* calculations at B3LYP/6-311G++(d,p) and substantiated as equilibrium conformer **1b** by comparison with MD and NMR. Given in the figure is the calculated value of the  $^1\text{H}$  NMR chemical shift in ppm relative to TMS.

JP-170:

The theoretical molecular ion of JP-170 ( $[M+H]^+$  343.17) was not detected. The peak at m/z 365.15 might represent an alkali adduct of the synthesized substance ( $[M+Na]^+$  theor. 365.15) and m/z 387.14 might represent another Na adduct ( $[M+2Na-H]^+$ ). No further relevant m/z values were detected.

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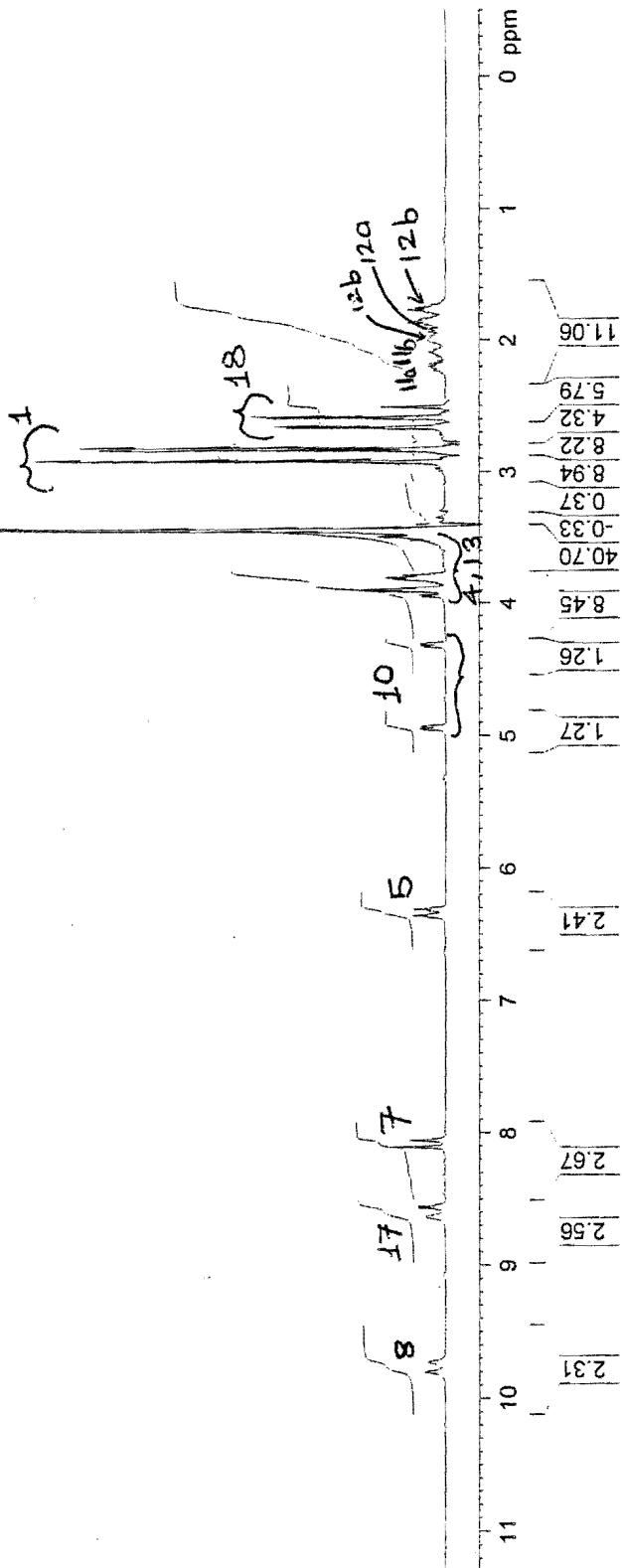


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FK70 DMSO - 13C 17C

Sample Name:

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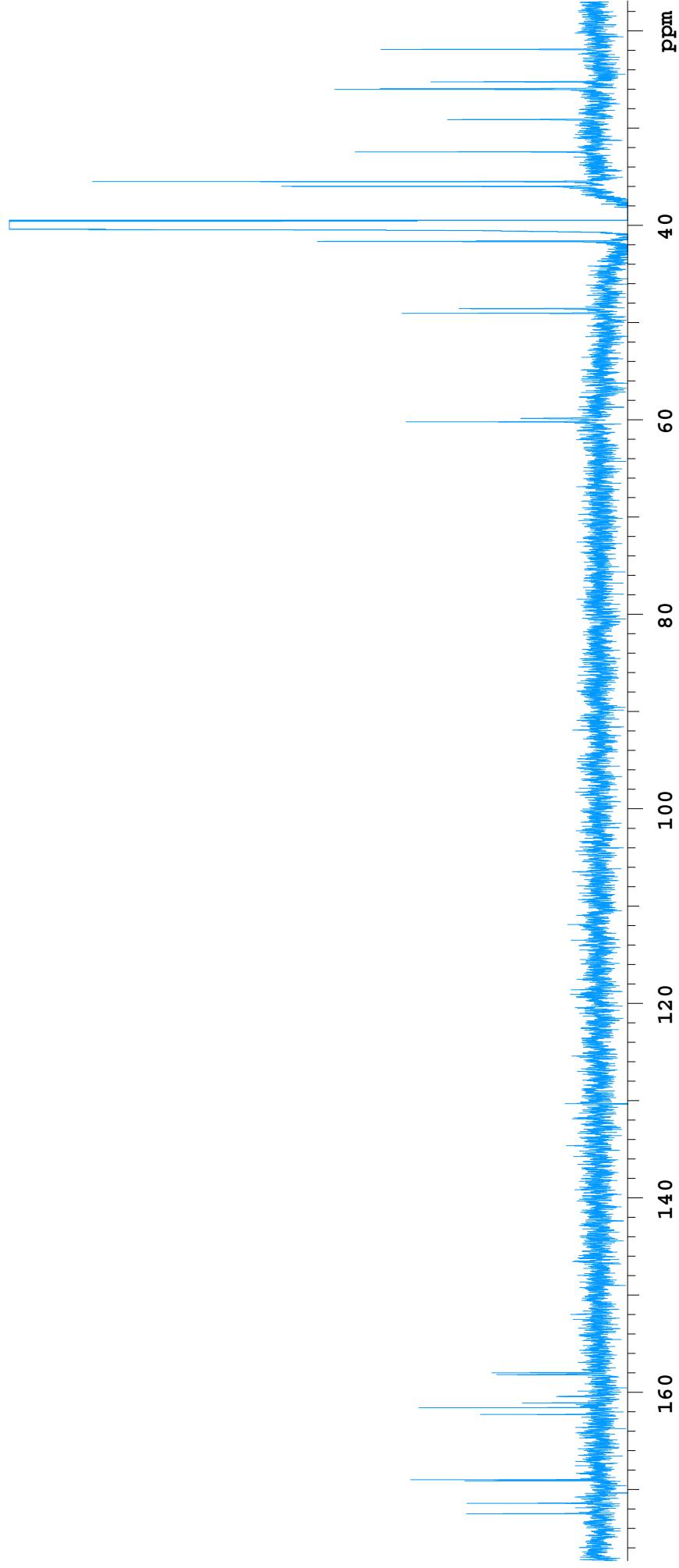
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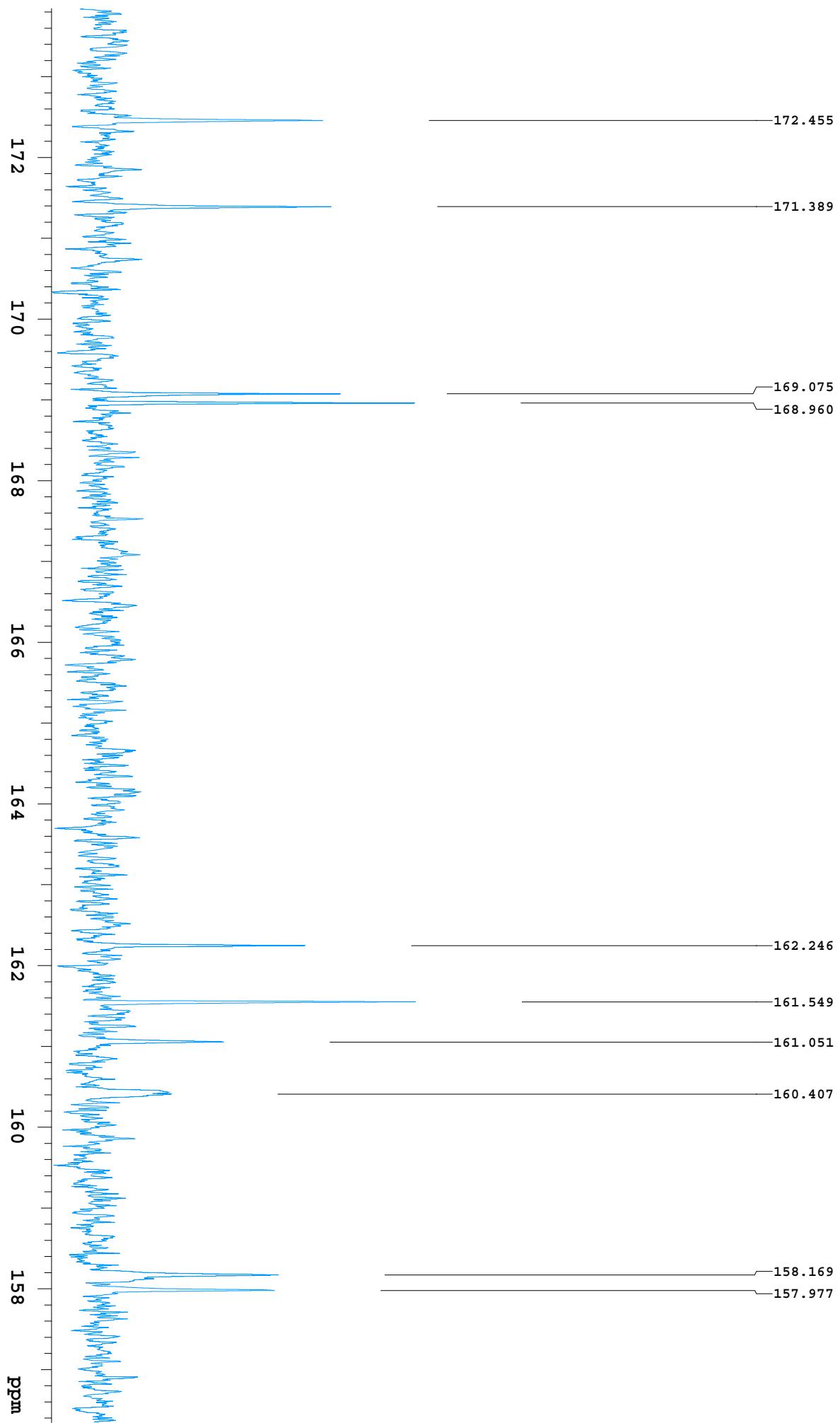
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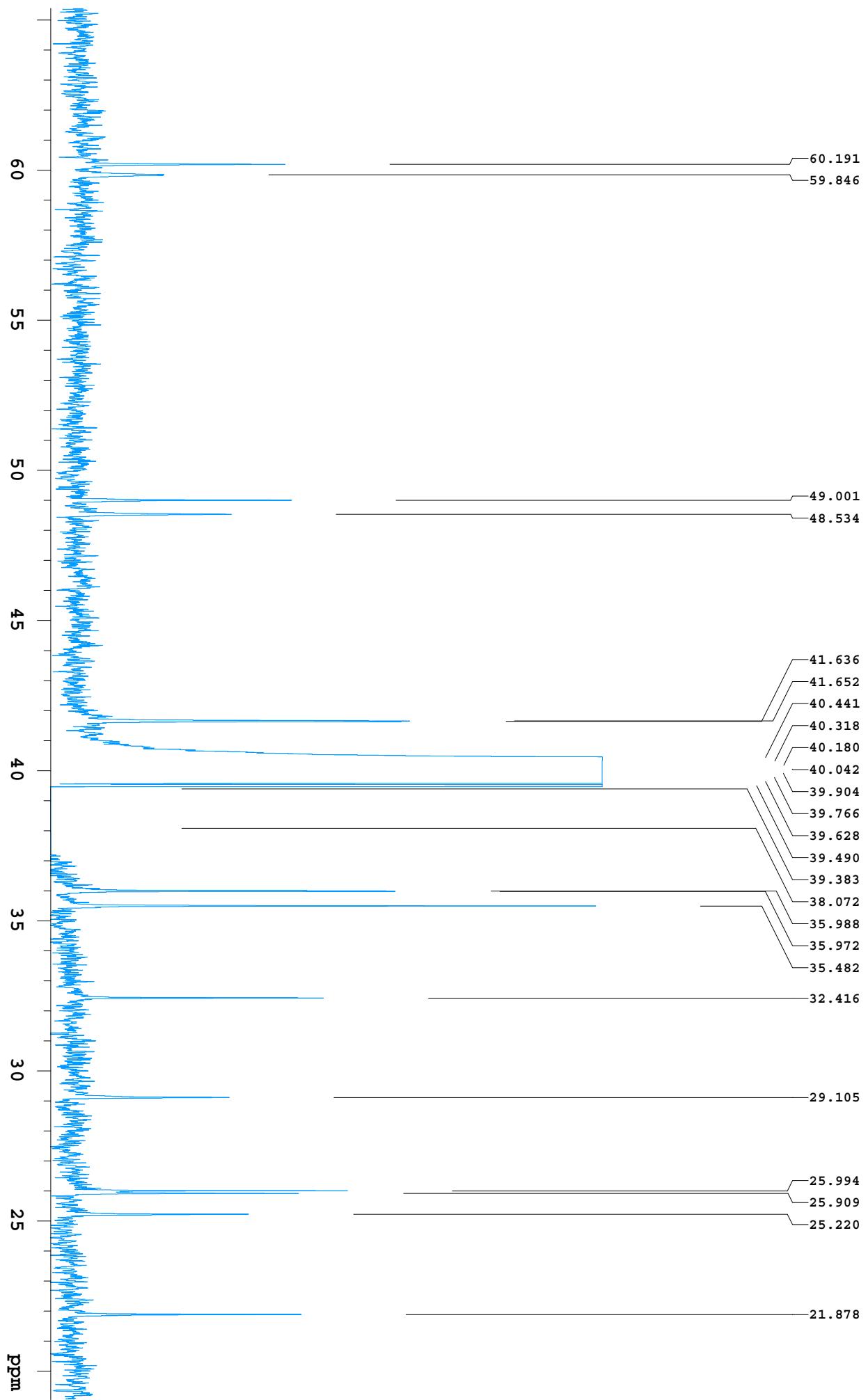
Pulse Sequence: CARBON (s2pul)

Solvent: dmso

Data Collected on: May 28 2010







PK70 dmso 1H 17C

**Sample Name:**

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

**Sample directory:**

**FidFile:** FK50\_DMSO\_H1\_17C

**Pulse Sequence:** PROTON (s2pul)

**Solvent:** dmso

**Data collected on:** May 28 2010

Temp. 17.0 C / 290.1 K  
Operator: servis

Relax. delay 1.000 sec

Pulse 45.0 degrees

Acq. time 1.704 sec

Width 9615.4 Hz

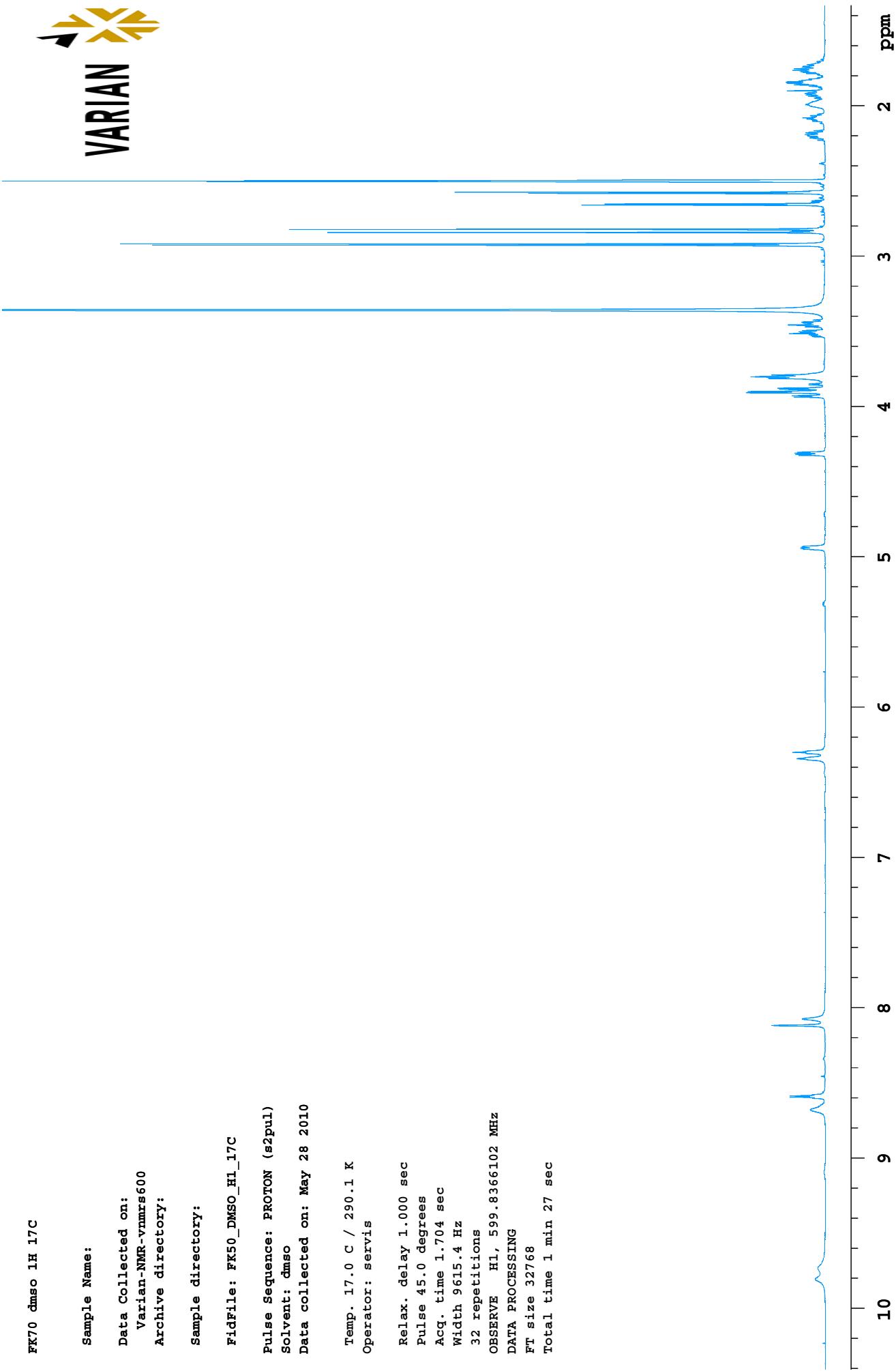
32 repetitions

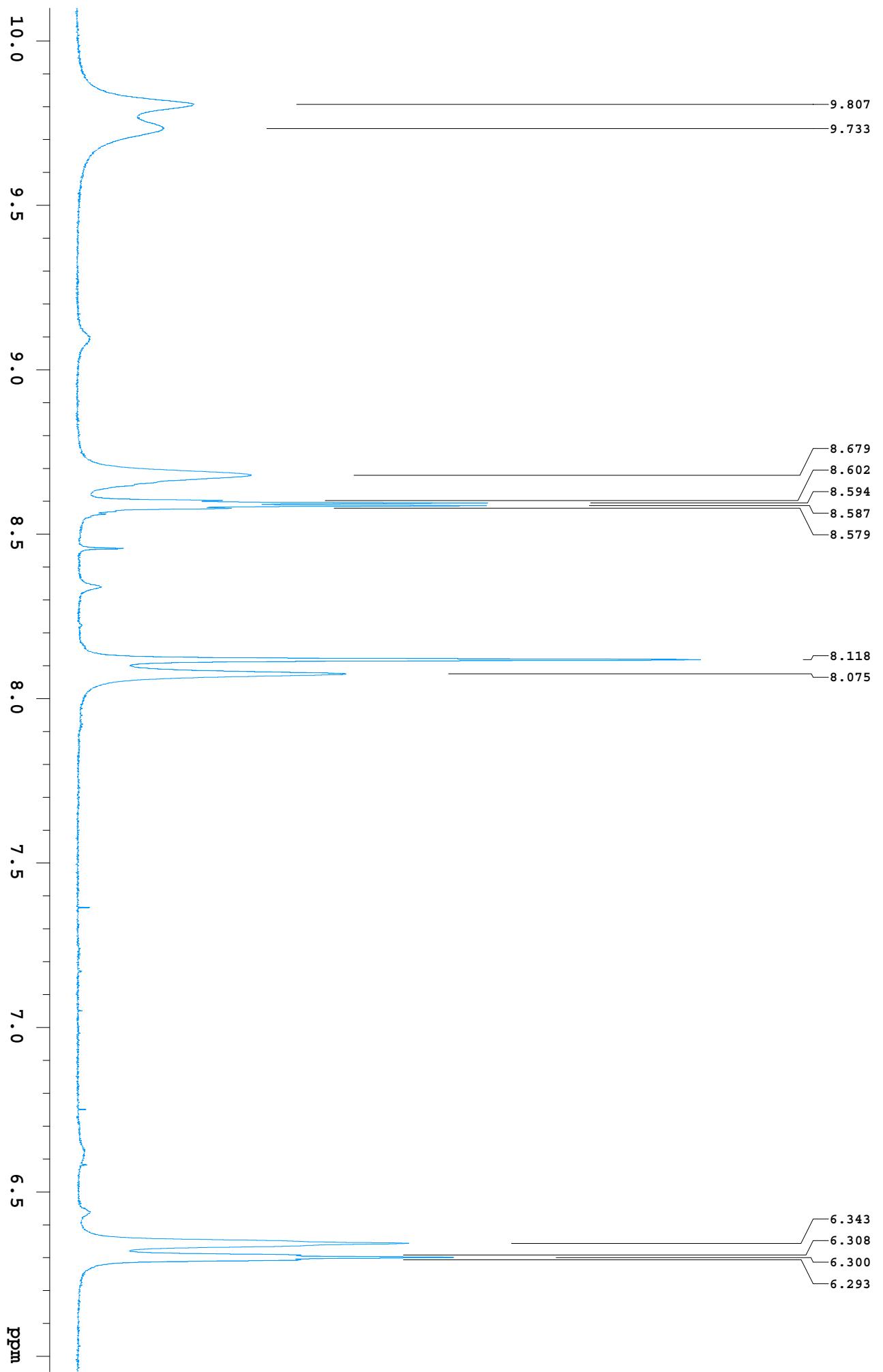
OBSERVE H1, 599.8366102 MHz

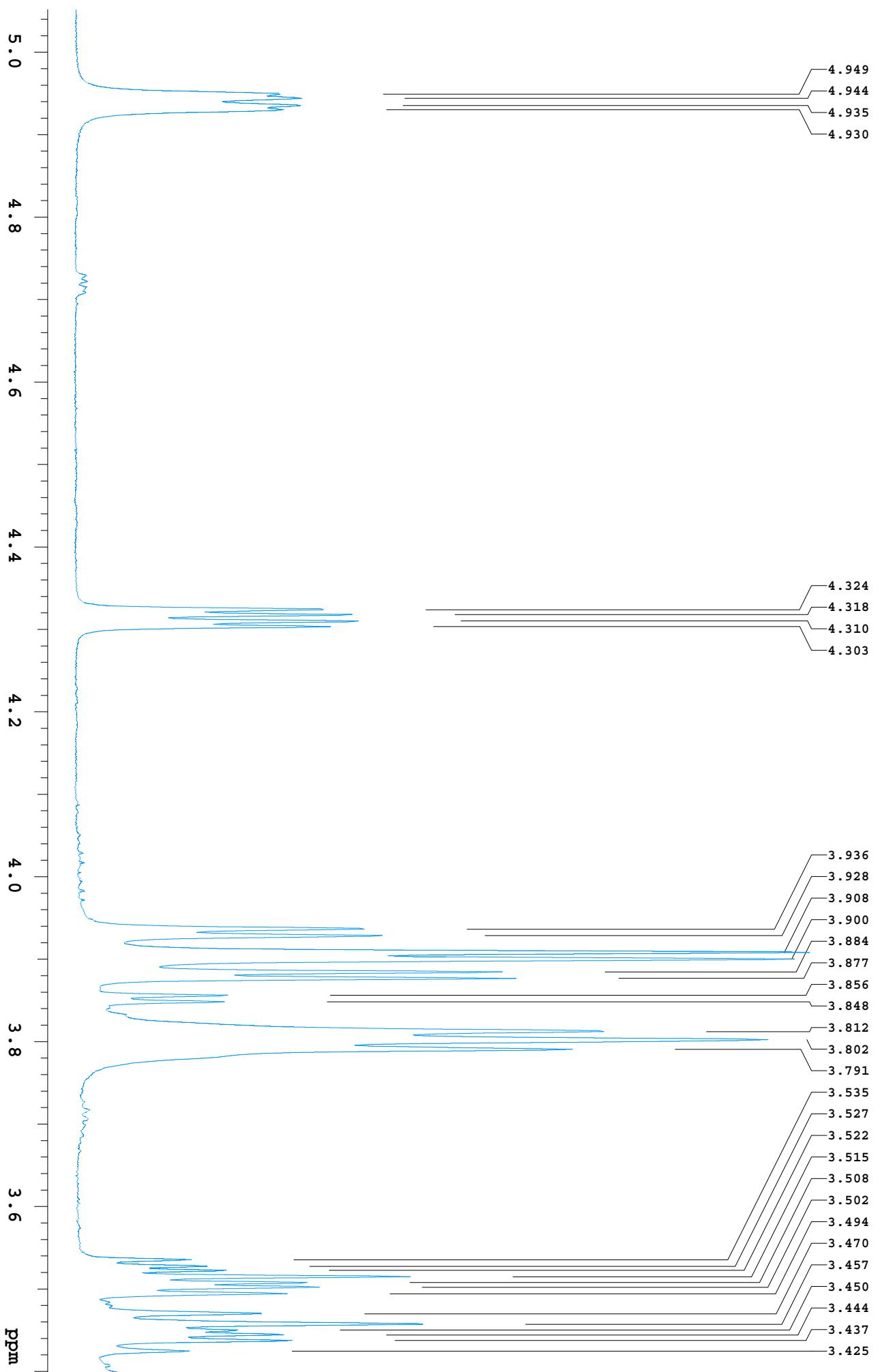
DATA PROCESSING

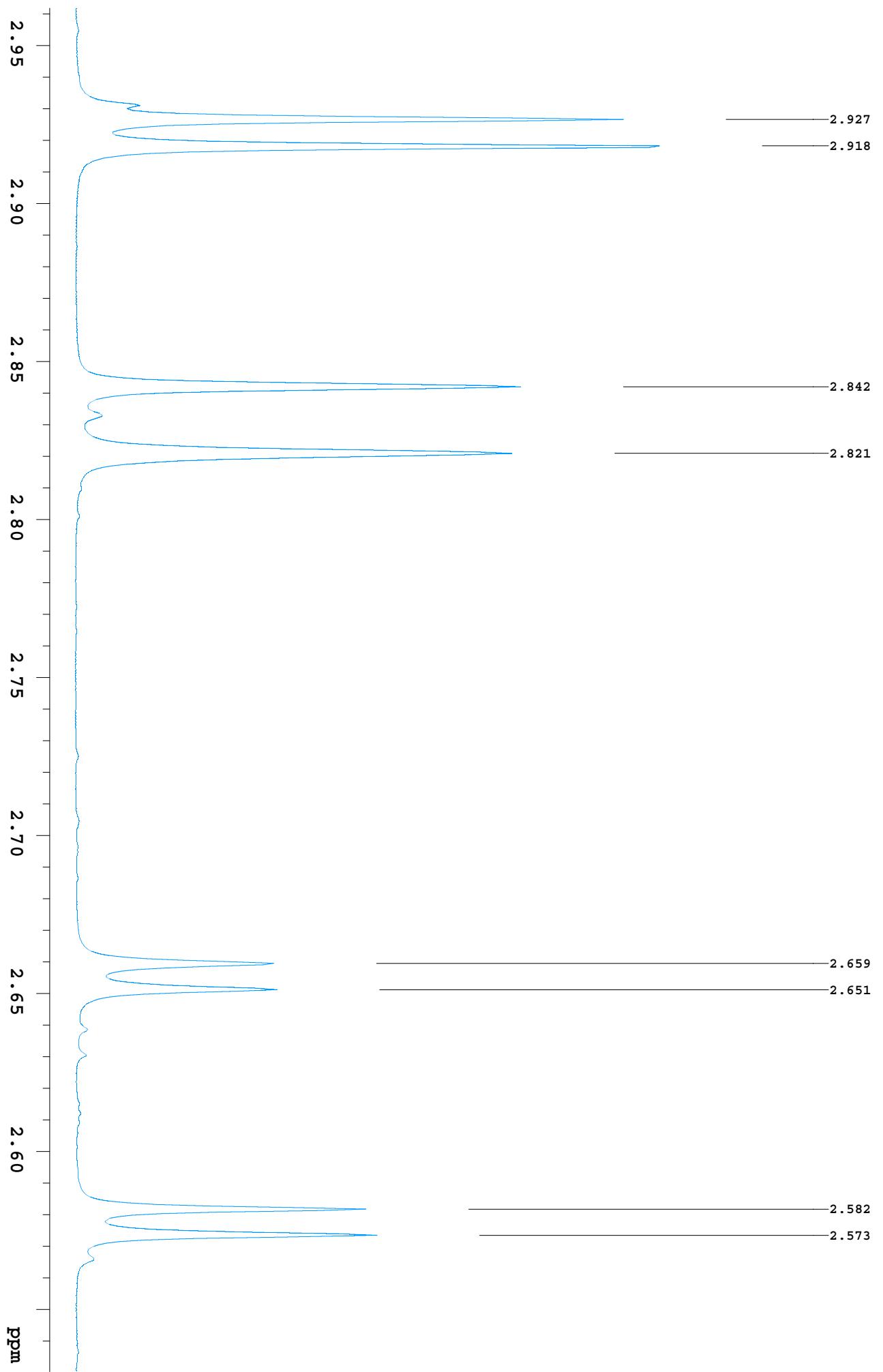
FT size 32768

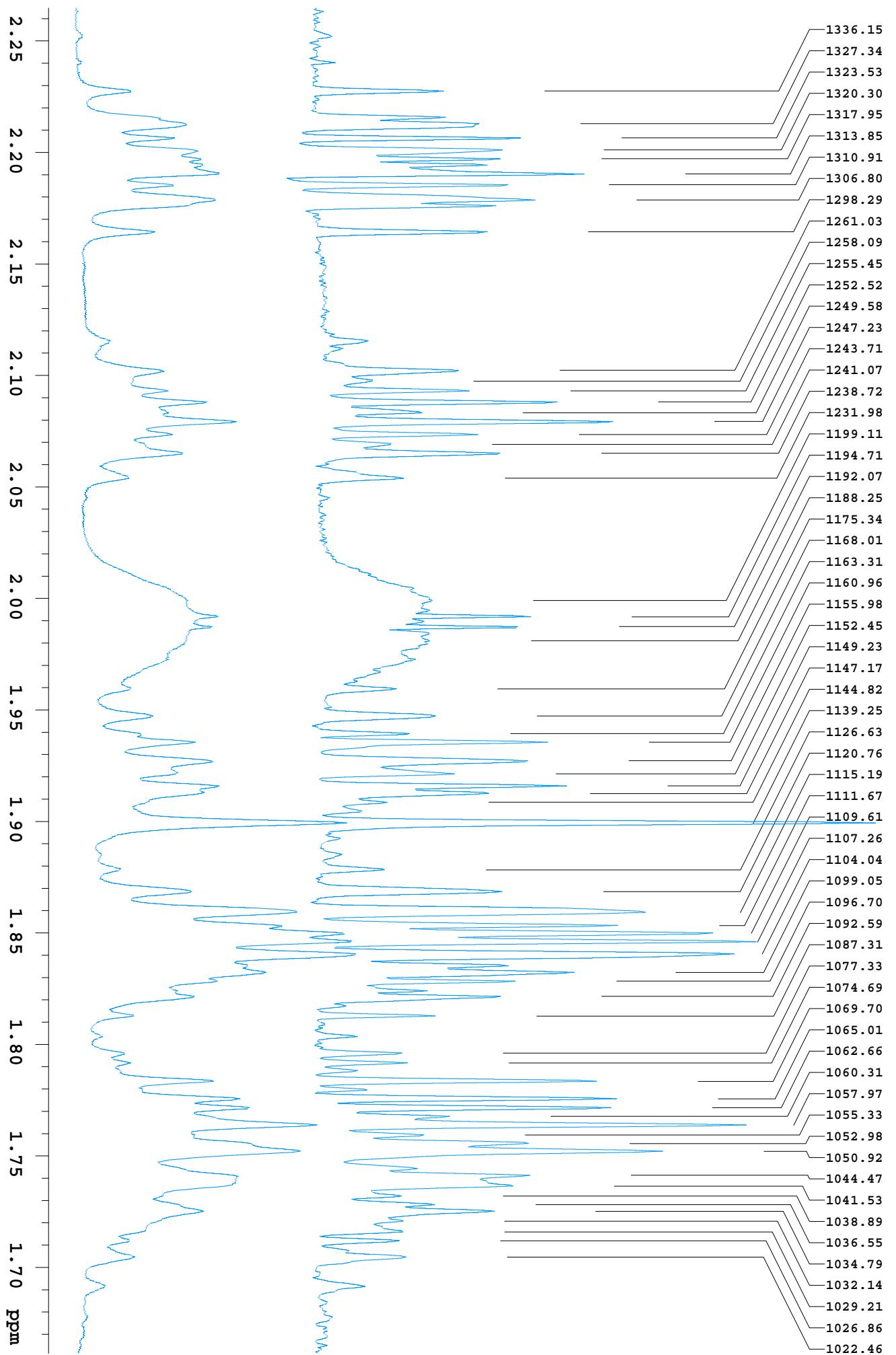
Total time 1 min 27 sec











FK70\_dmso\_37C\_DQCOBY  
28.05.2010

Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

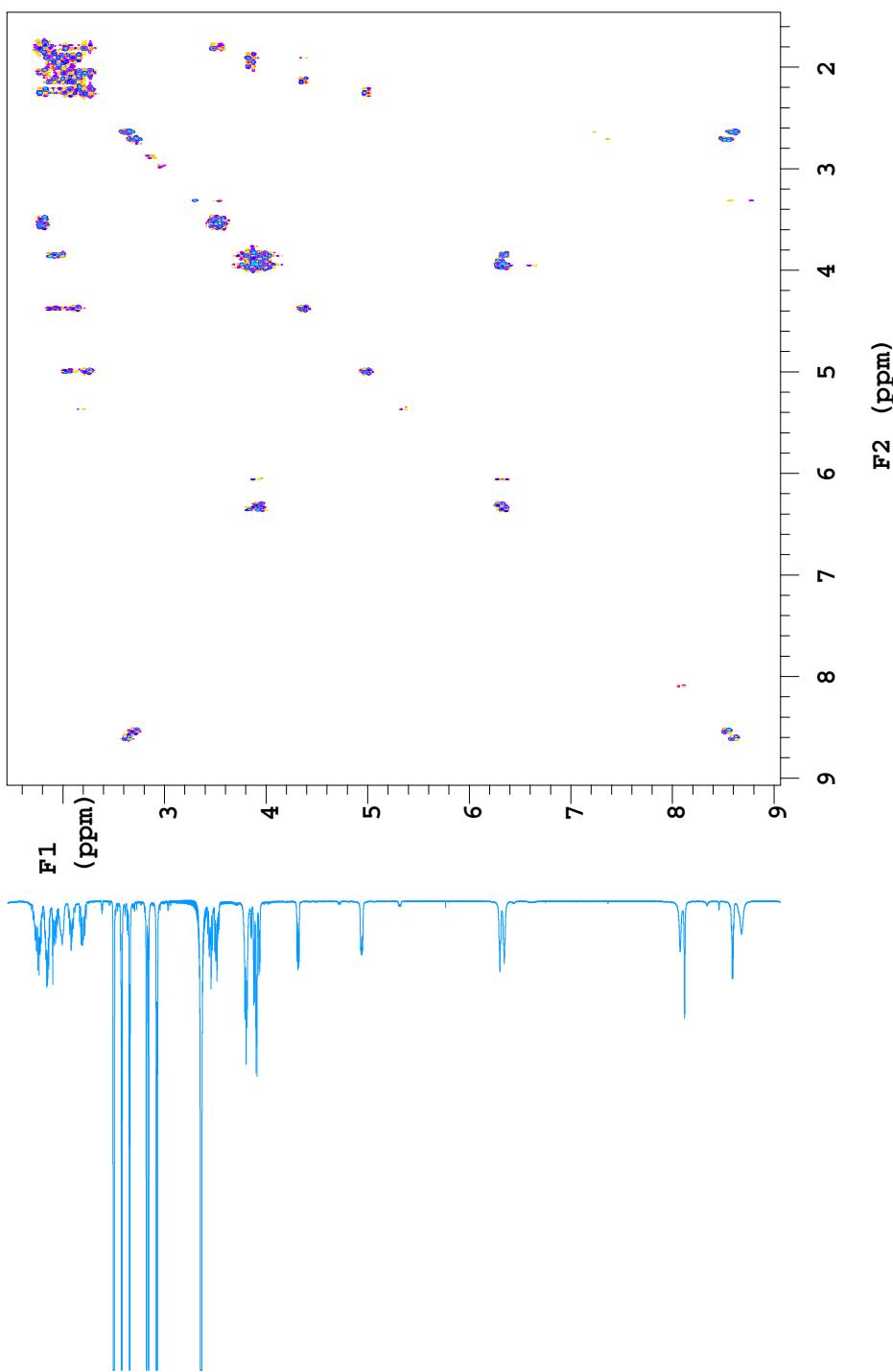
FidFile: FK70\_dmso\_37C\_DQCOBY\_28May2010

Pulse Sequence: gDQCOBY

Solvent: dmso

Data collected on: May 28 2010  
Temp. 37.0 C / 310.1 K  
Operator: servis

Relax. delay 1.000 sec  
Mixing 0.080 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
Single scan  
2 x 200 increments  
OBSERVE H1, 599.8365881 MHz  
DATA PROCESSING  
Sq. sine bell 0.125 sec  
Shifted by -0.100 sec  
F1 DATA PROCESSING  
Sq. sine bell 0.035 sec  
Shifted by -0.028 sec  
FT size 4096 x 4096  
Total time 8 min 27 sec



FK70\_dmso\_37C\_DQCOBY  
28.05.2010

Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

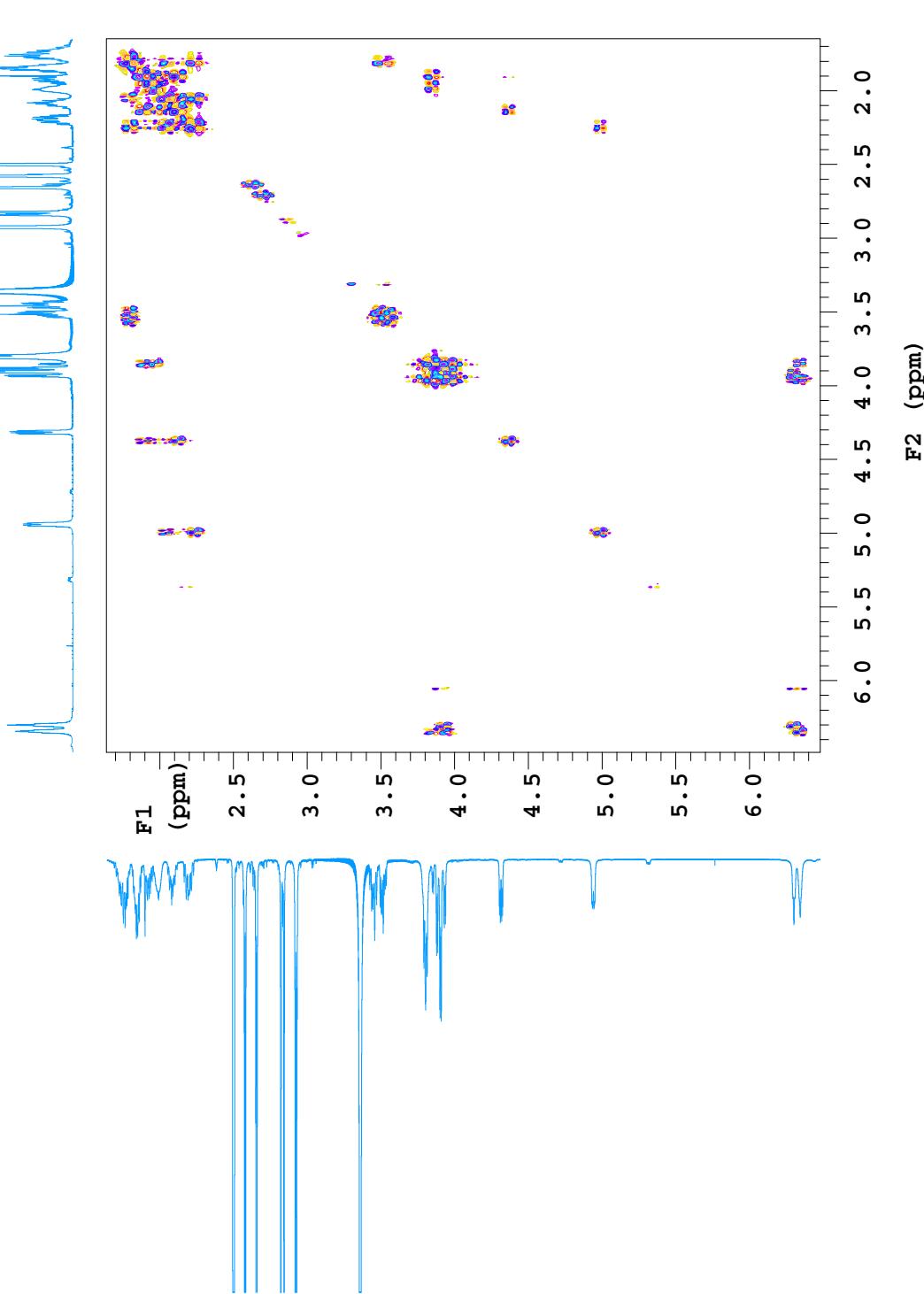
FidFile: FK70\_dmso\_37C\_DQCOBY\_28May2010

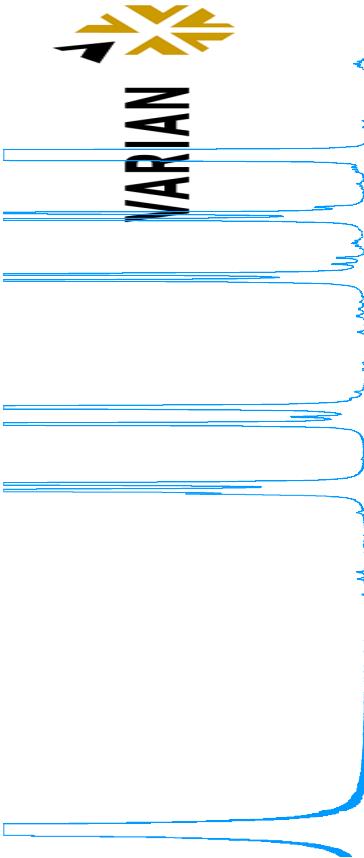
Pulse Sequence: gDQCOBY

Solvent: dmso

Data collected on: May 28 2010  
Temp. 37.0 C / 310.1 K  
Operator: servis

Relax. delay 1.000 sec  
Mixing 0.080 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
Single scan  
2 x 200 increments  
OBSERVE H1, 599.8365881 MHz  
DATA PROCESSING  
Sq. sine bell 0.125 sec  
Shifted by -0.100 sec  
F1 DATA PROCESSING  
Sq. sine bell 0.035 sec  
Shifted by -0.028 sec  
FT size 4096 x 4096  
Total time 8 min 27 sec





Sample Name:  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:  
Sample directory:

FidFile: FK70\_dimso\_37C\_DQCOBY\_28May2010

Pulse Sequence: gDQCOBY

Solvent: dimso

Data collected on: May 28 2010

Temp. 37.0 C / 310.1 K  
Operator: servis

Relax. delay 1.000 sec

Mixing 0.080 sec

Acq. time 0.150 sec

Width 9615.4 Hz

2D Width 9615.4 Hz

Single scan

2 x 200 increments

OBSERVE H1, 599.8365881 MHz

DATA PROCESSING

Sq. sine bell 0.125 sec

Shifted by -0.100 sec

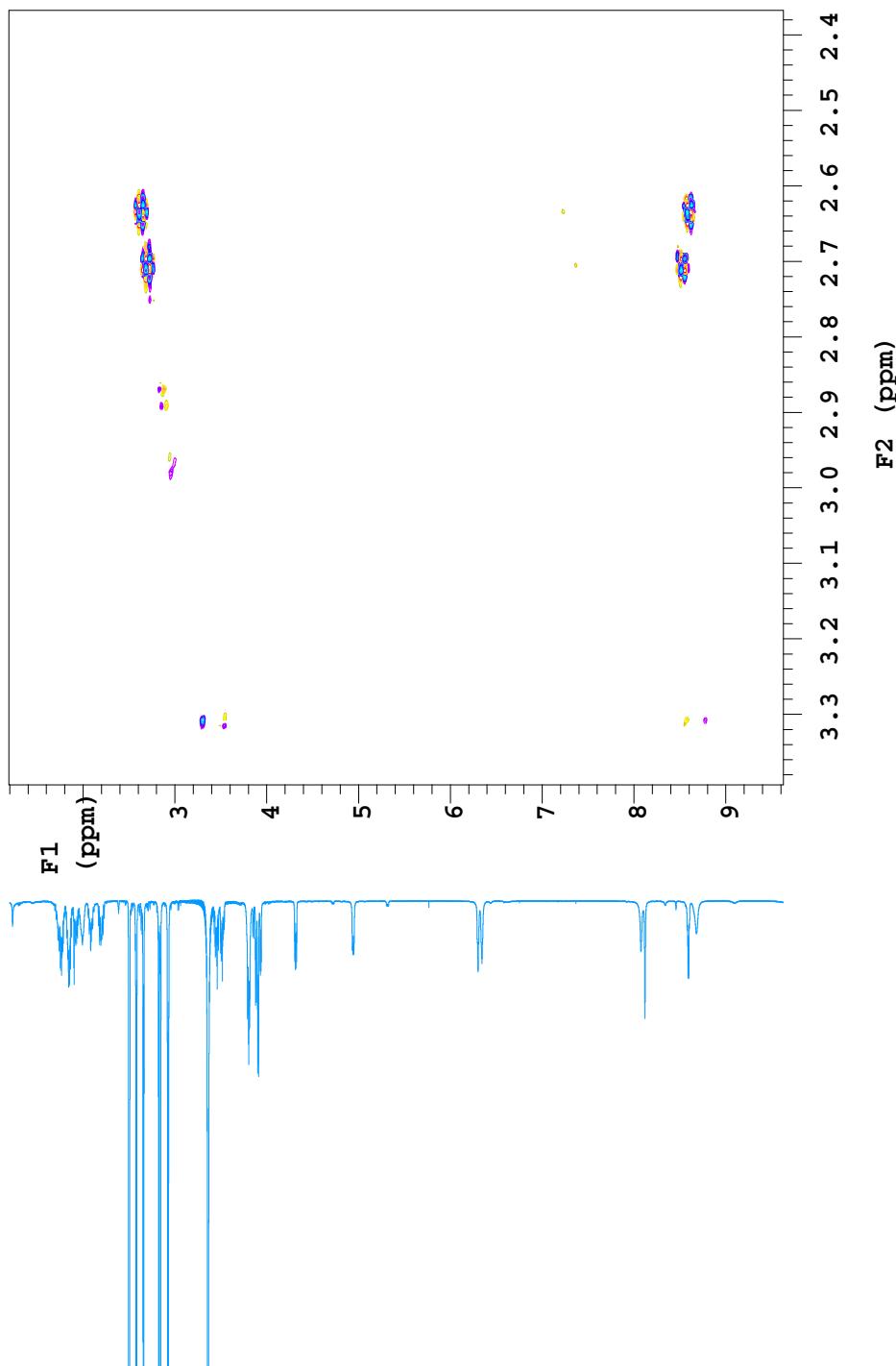
F1 DATA PROCESSING

Sq. sine bell 0.035 sec

Shifted by -0.028 sec

FT size 4096 x 4096

Total time 8 min 27 sec



FK70\_dmso\_37C\_DQCOBY  
28.05.2010

Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: FK70\_dmso\_37C\_DQCOBY\_28May2010

Pulse Sequence: gDQCOBY

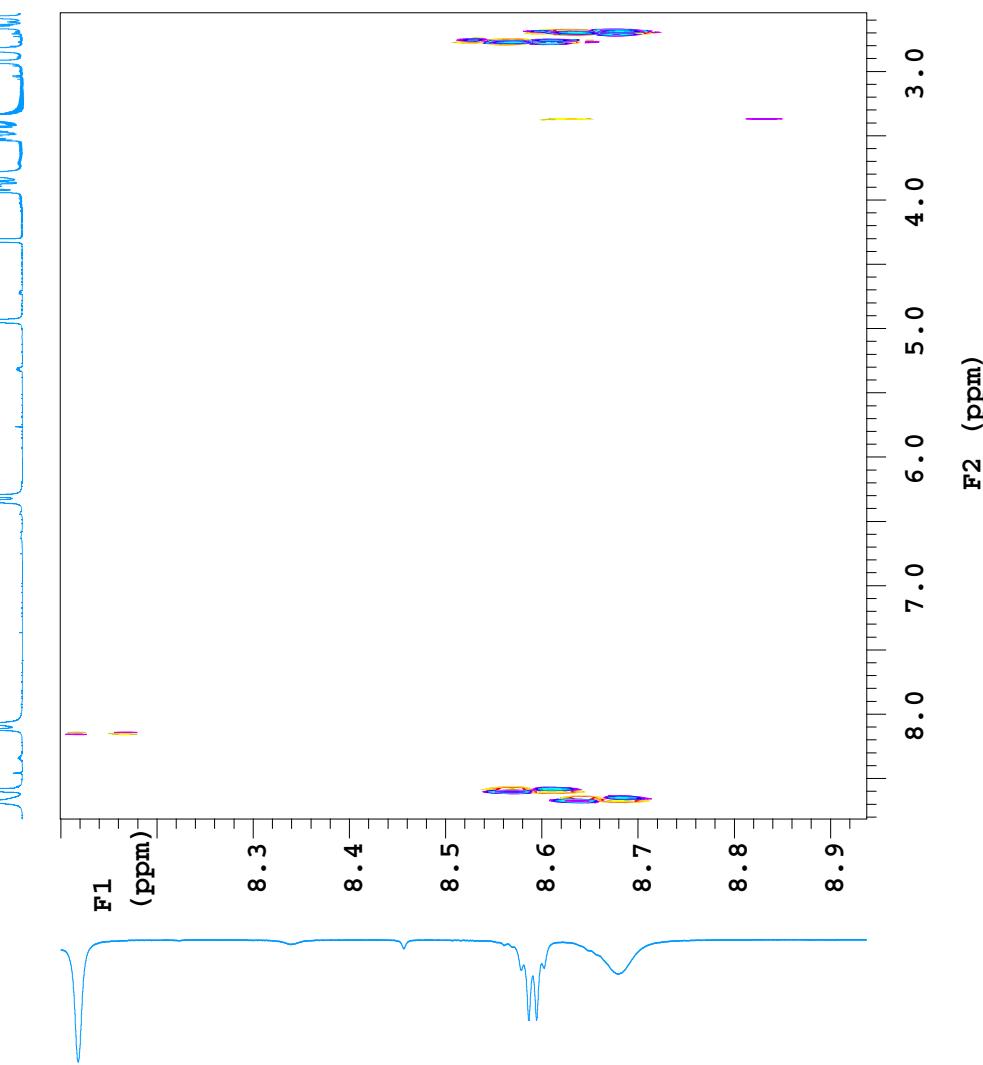
Solvent: dmso

Data collected on: May 28 2010

Temp. 37.0 C / 310.1 K

Operator: servis

Relax. delay 1.000 sec  
Mixing 0.080 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
Single scan  
2 x 200 increments  
OBSERVE H1, 599.8365530 MHz  
DATA PROCESSING  
Sq. sine bell 0.125 sec  
Shifted by -0.100 sec  
F1 DATA PROCESSING  
Sq. sine bell 0.035 sec  
Shifted by -0.028 sec  
FT size 4096 x 4096  
Total time 8 min 27 sec





VARIAN

FK70\_dmso\_37C\_DQCO<sup>SY</sup>  
28.05.2010

## Sample Name:

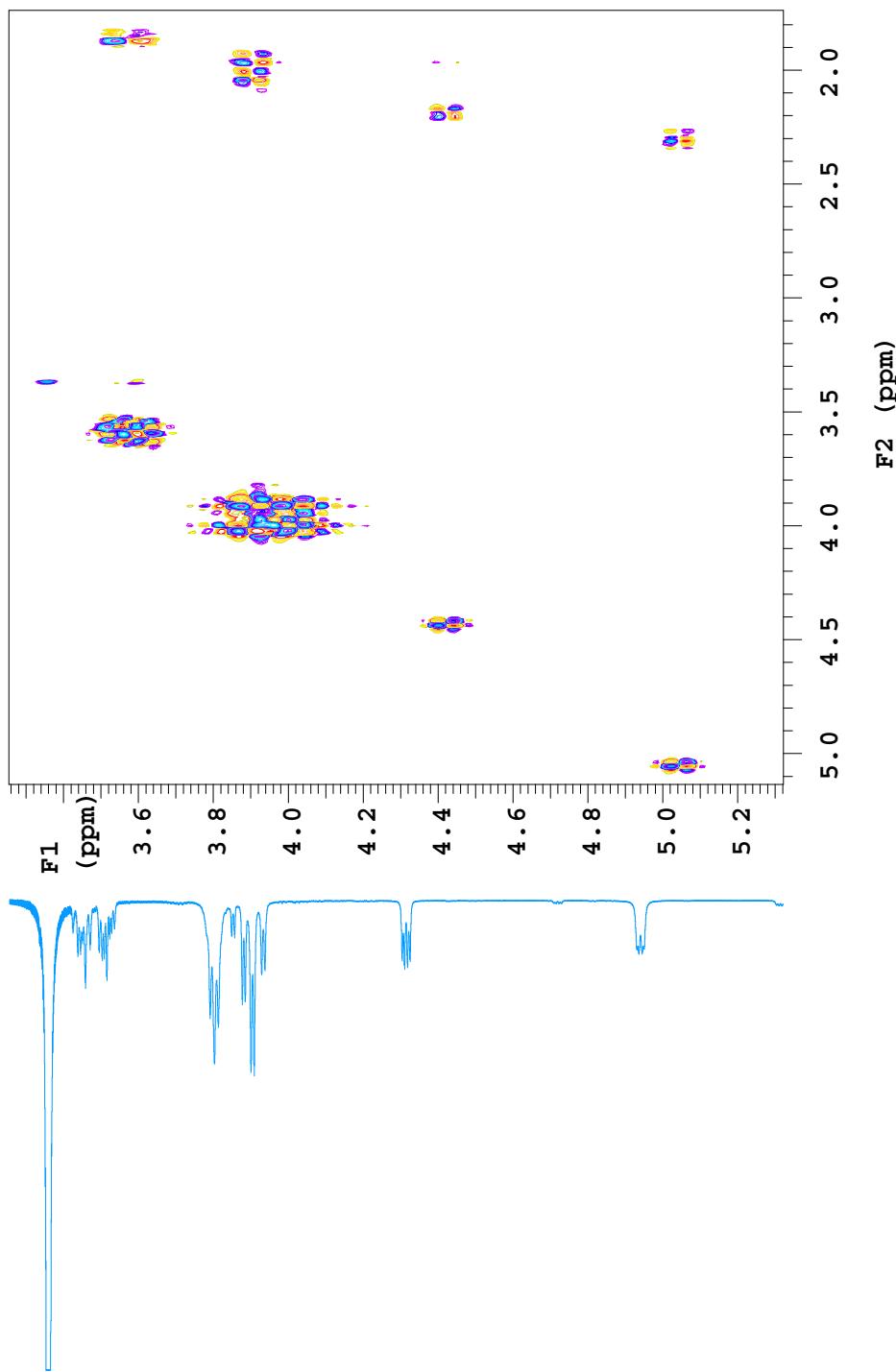
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

## Sample directory:

FidFile: FK70\_dmso\_37C\_DQCO<sup>SY</sup>\_28May2010Pulse Sequence: gDQCO<sup>SY</sup>

Solvent: dmso

Data collected on: May 28 2010

Temp. 37.0 C / 310.1 K  
Operator: servisRelax. delay 1.000 sec  
Mixing 0.080 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
Single scan  
2 x 200 increments  
OBSERVE H1, 599.8365530 MHz  
DATA PROCESSING  
Sq. sine bell 0.125 sec  
Shifted by -0.100 sec  
F1 DATA PROCESSING  
Sq. sine bell 0.035 sec  
Shifted by -0.028 sec  
FT size 4096 x 4096  
Total time 8 min 27 sec



FK70 dmso 17C HMBC  
28.05.2010

Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: FK50\_DMSO\_HMBCAD\_17C

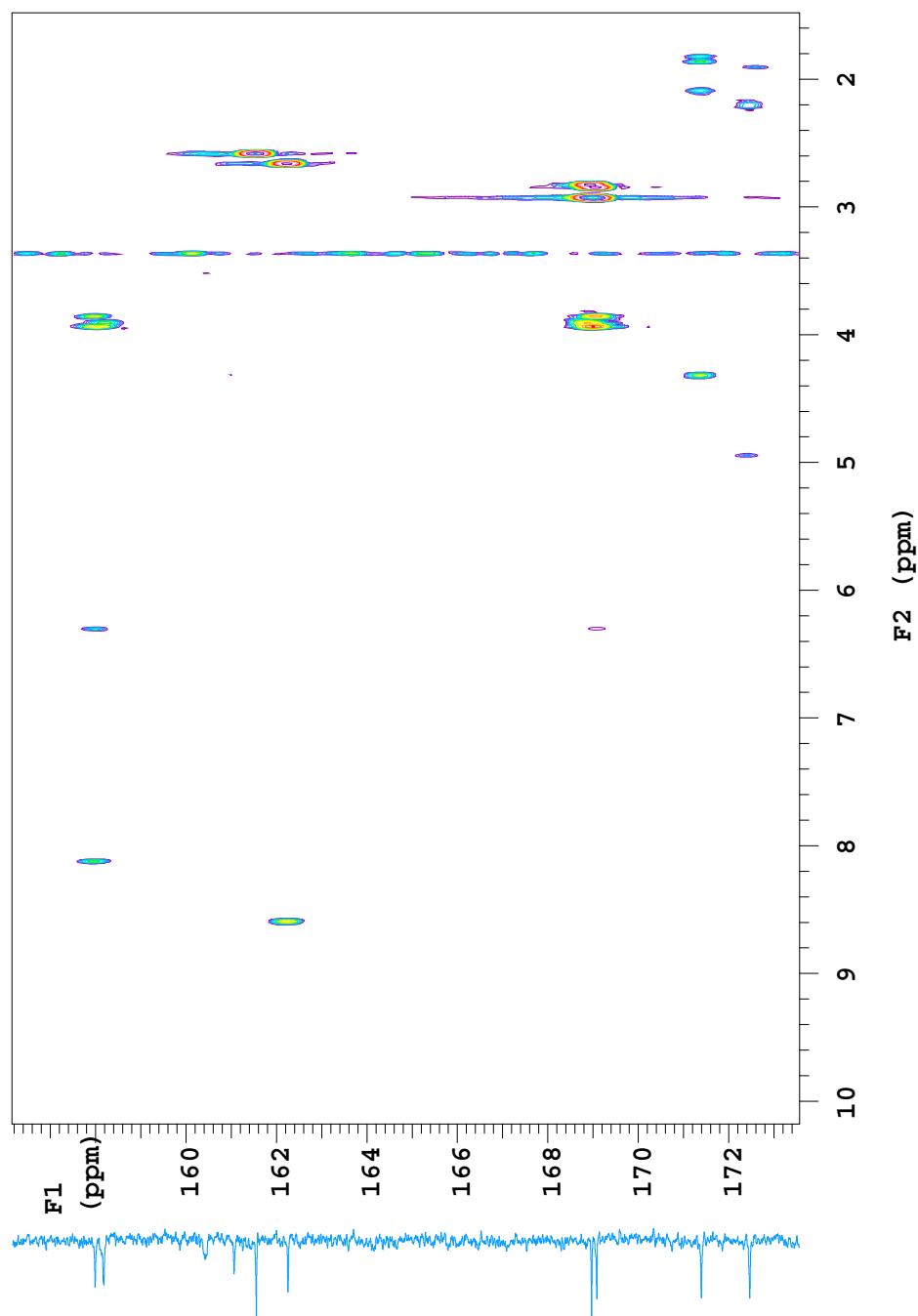
Pulse Sequence: gHMBCAD

Solvent: dmso

Data collected on: May 28 2010

Temp. 17.0 C / 290.1 K  
Operator: servis

Relax. delay 1.000 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 27146.3 Hz  
16 repetitions  
2 x 256 increments  
OBSERVE H1, 599.8366087 MHz  
DATA PROCESSING  
Sq. sine bell 0.075 sec  
F1 DATA PROCESSING  
Gauss apodization 0.009 sec  
FT size 4096 x 4096  
Total time 2 hr, 54 min





VARIAN

FK70 dmso 17C HMBC  
28.05.2010

Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: FK50\_DMSO\_HMBCAD\_17C

Pulse Sequence: gHMBCAD

Solvent: dmso

Data collected on: May 28 2010

Temp. 17.0 C / 290.1 K  
Operator: servis

Relax. delay 1.000 sec

Acq. time 0.150 sec

Width 9615.4 Hz

2D Width 27146.3 Hz

16 repetitions

2 x 256 increments

OBSERVE H1, 599.8366087 MHz

DATA PROCESSING

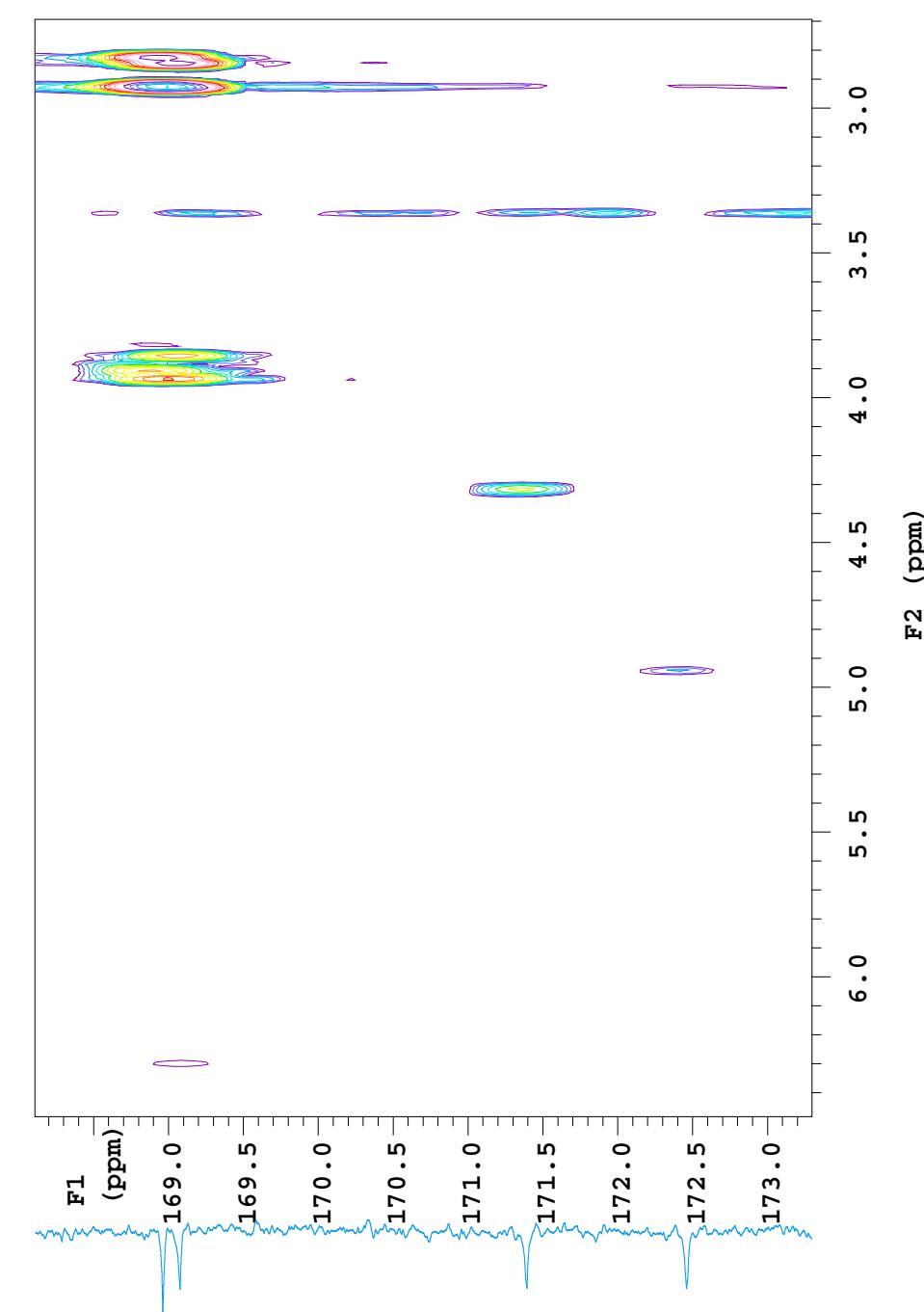
Sq. sine bell 0.075 sec

F1 DATA PROCESSING

Gauss apodization 0.009 sec

FT size 4096 x 4096

Total time 2 hr, 54 min





FK70 dmso 17C HMBC  
28.05.2010

Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: FK50\_DMSO\_HMBCAD\_17C

Pulse Sequence: gHMBCAD

Solvent: dmso

Data collected on: May 28 2010

Temp. 17.0 C / 290.1 K  
Operator: servis

Relax. delay 1.000 sec  
Acq. time 0.150 sec

Width 9615.4 Hz

2D Width 27146.3 Hz

16 repetitions

2 x 256 increments

OBSERVE H1, 599.8366087 MHz  
DATA PROCESSING

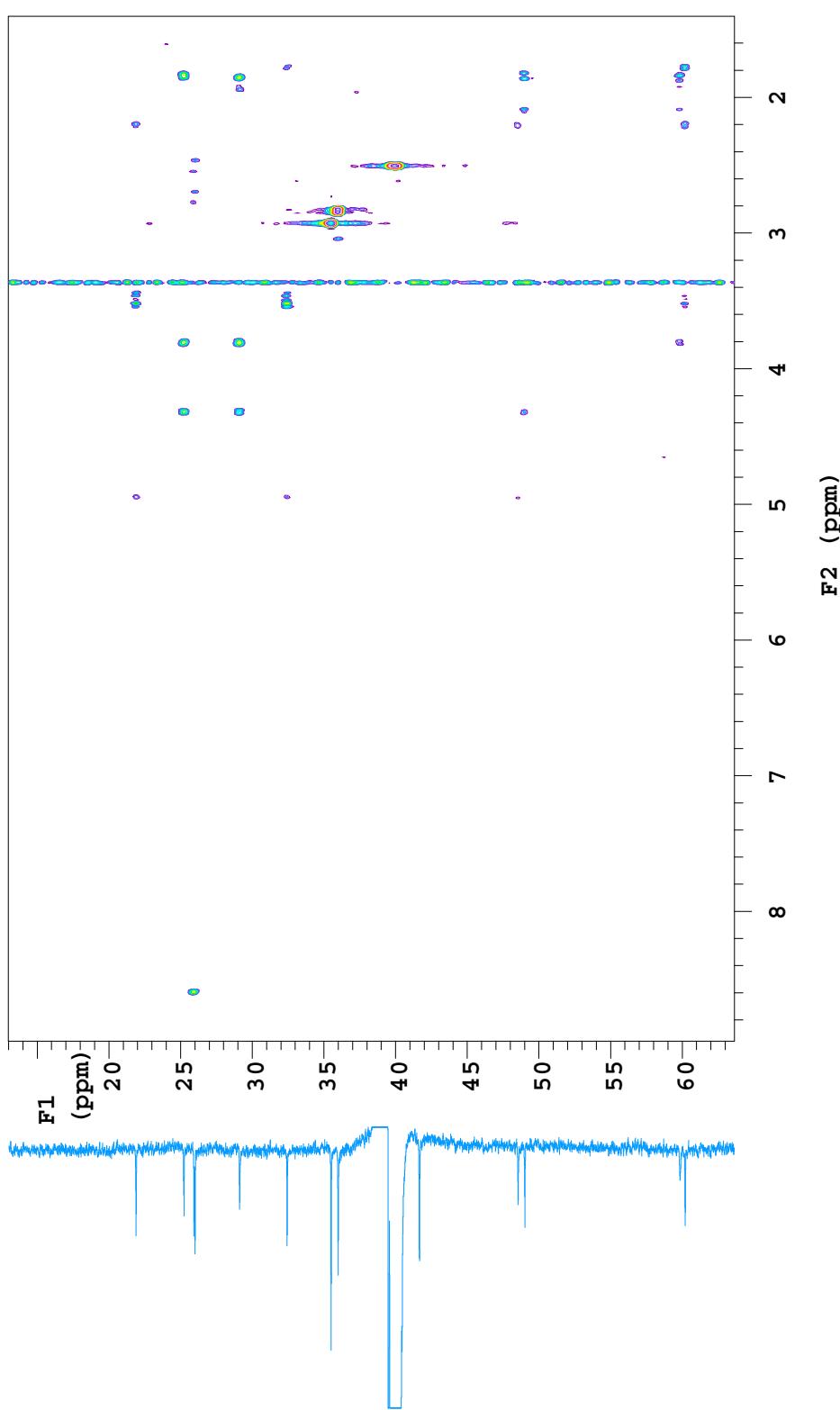
Sq. sine bell 0.075 sec

F1 DATA PROCESSING

Gauss apodization 0.009 sec

FT size 4096 x 4096

Total time 2 hr, 54 min

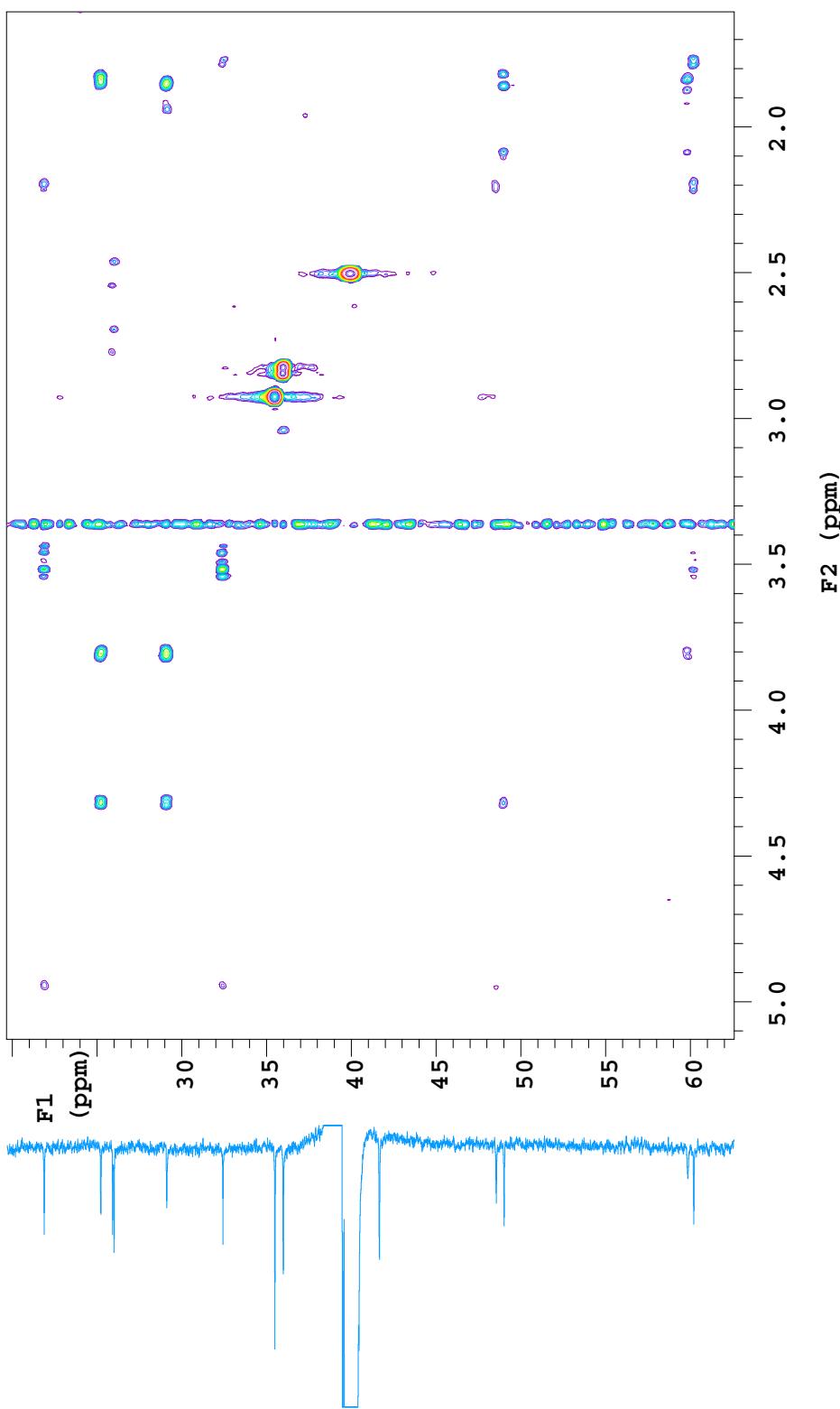


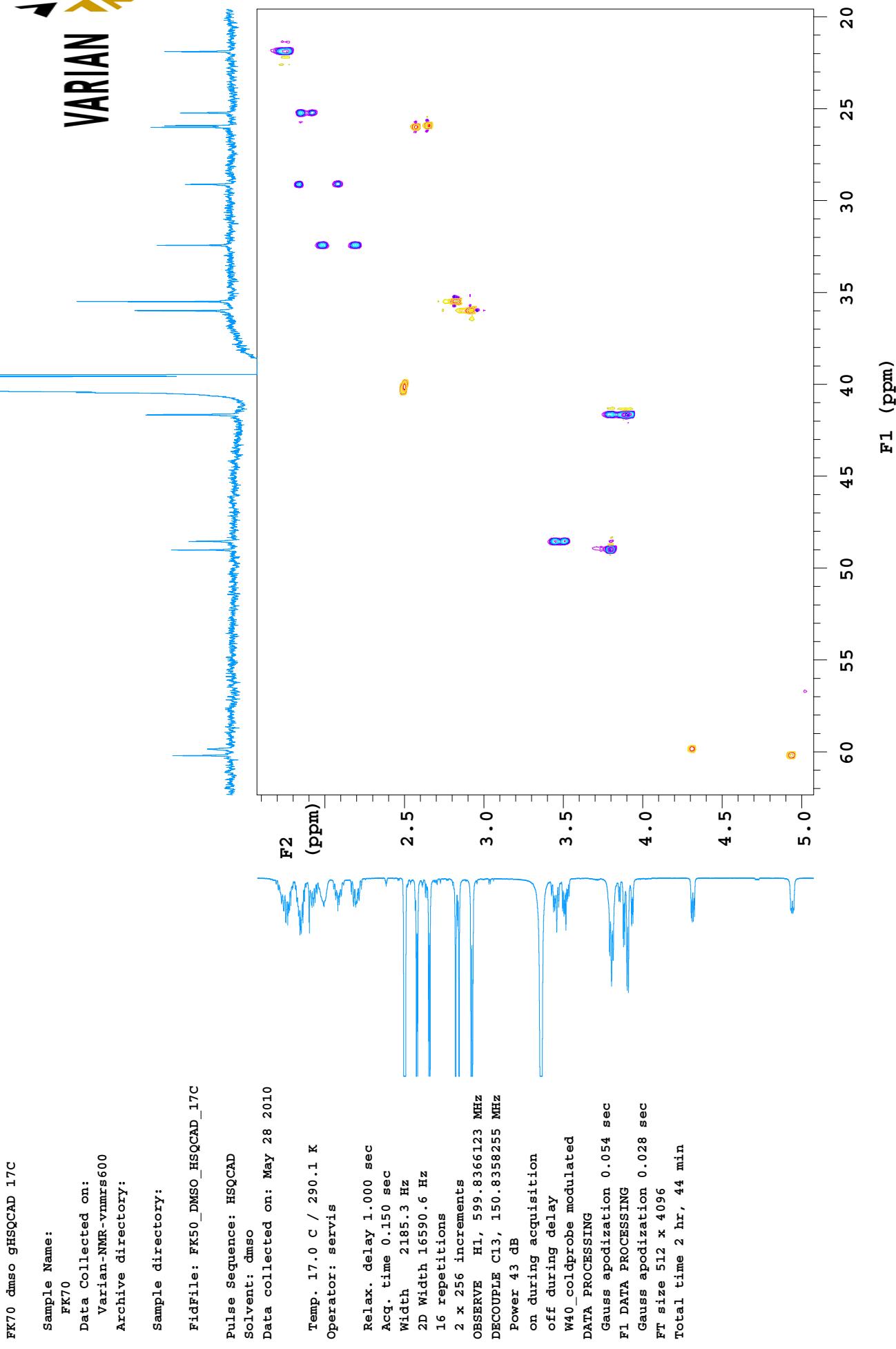


**VARIAN**

FK70\_dmso\_17C\_HMBC  
28.05.2010

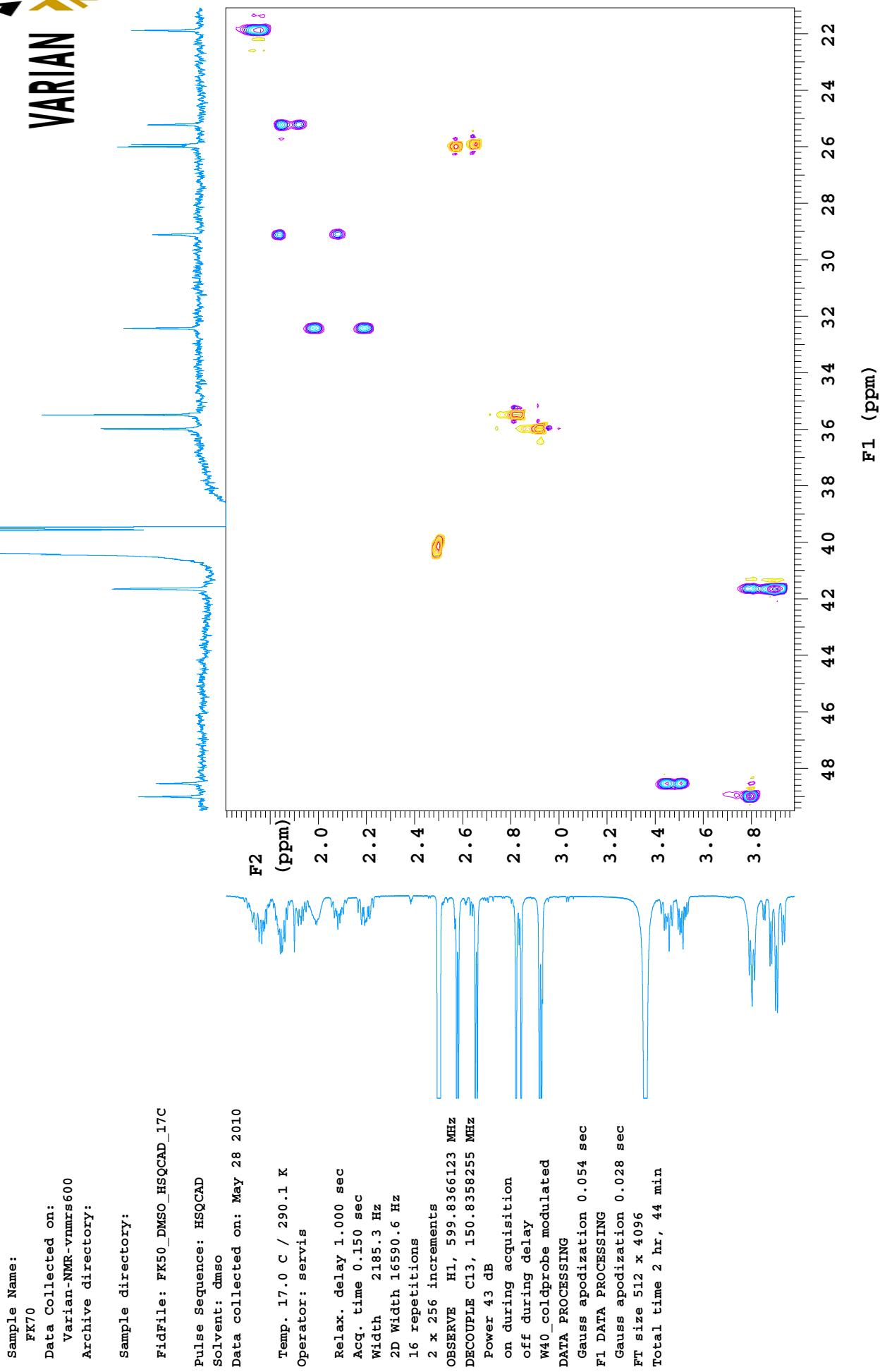
Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:  
  
Sample directory:  
  
FidFile: FK50\_DMSO\_HMBCAD\_17C  
  
Pulse Sequence: gHMBCAD  
Solvent: dmso  
Data collected on: May 28 2010  
  
Temp. 17.0 C / 290.1 K  
Operator: servis  
  
Relax. delay 1.000 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 27146.3 Hz  
16 repetitions  
2 x 256 increments  
OBSERVE H1, 599.8366087 MHz  
DATA PROCESSING  
Sq. sine bell 0.075 sec  
F1 DATA PROCESSING  
Gauss apodization 0.009 sec  
FT size 4096 x 4096  
Total time 2 hr, 54 min





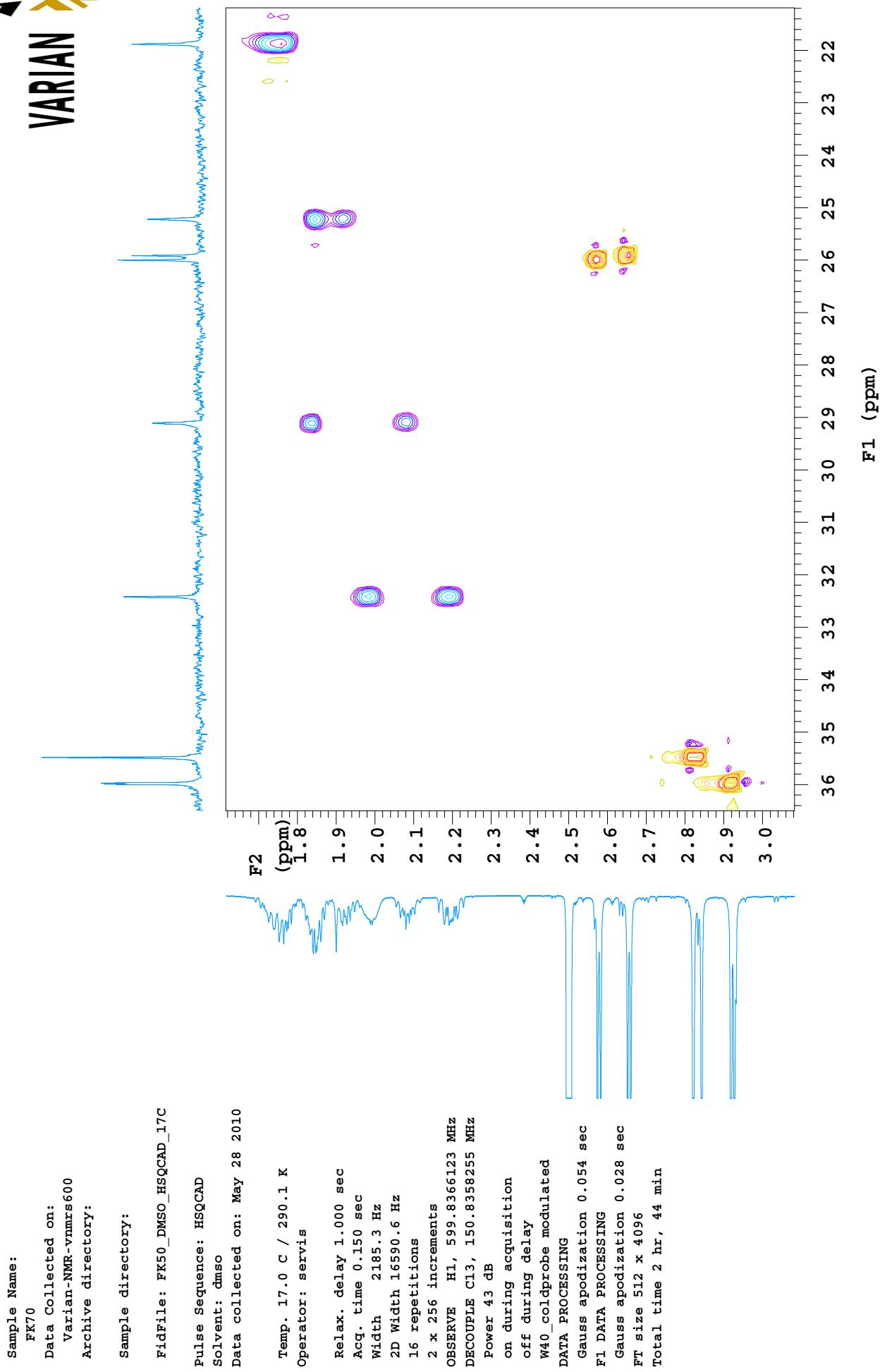


FK70 dmso gHSQCAD 17C





FK70 dmso gHSQCAD 17C

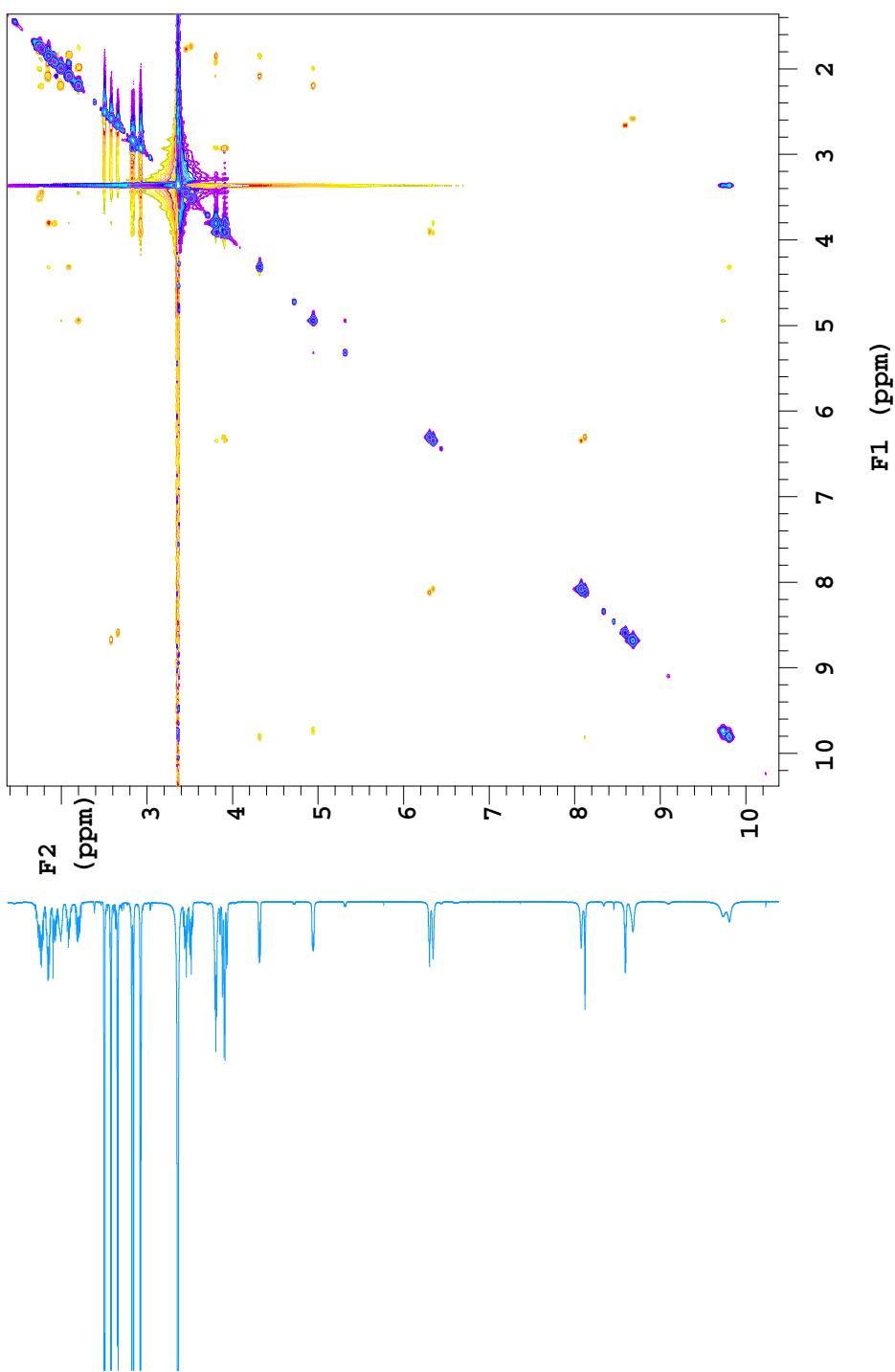


FK70\_dmso\_17C\_ROESYAD  
28.05.2010

Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:  
/home/servis/vnmrsys/data  
Sample directory:  
FK70\_20100528\_01  
Fidfile: FK50\_DMSO\_ROESY\_17C

Pulse Sequence: ROESYAD  
Solvent: dmso  
Data collected on: May 31 2010

Temp. 17.0 C / 290.1 K  
Operator: servis  
Relax. delay 1.000 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
12 repetitions  
2 x 256 increments  
OBSERVE H1, 599.8366109 MHz  
DATA PROCESSING  
Gauss apodization 0.069 sec  
F1 DATA PROCESSING  
Gauss apodization 0.025 sec  
FT size 4096 x 4096  
Total time 2 hr, 41 min



FK70\_dmso\_17C\_ROESYAD  
28.05.2010

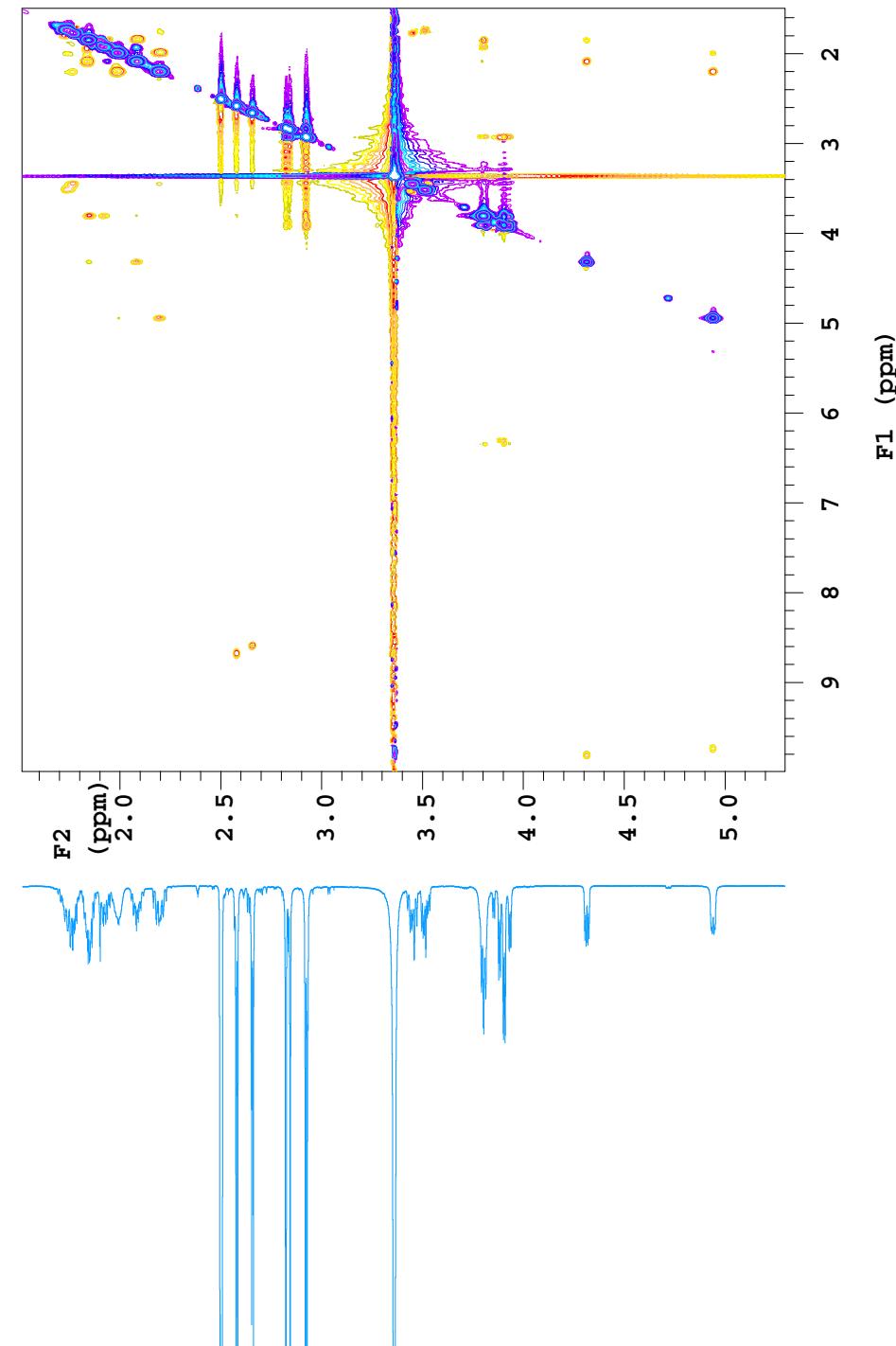
Sample Name:  
FK70  
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:  
/home/servis/vnmrsys/data  
Sample directory:  
FK70\_20100528\_01  
FidFile: FK50\_DMSO\_ROESY\_17C

Pulse Sequence: ROESYAD

Solvent: dmso

Data collected on: May 31 2010  
Temp. 17.0 C / 290.1 K  
Operator: servis

Relax. delay 1.000 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
12 repetitions  
2 x 256 increments  
OBSERVE H1, 599.8366109 MHz  
DATA PROCESSING  
Gauss apodization 0.069 sec  
F1 DATA PROCESSING  
Gauss apodization 0.025 sec  
FT size 4096 x 4096  
Total time 2 hr, 41 min





VARIAN

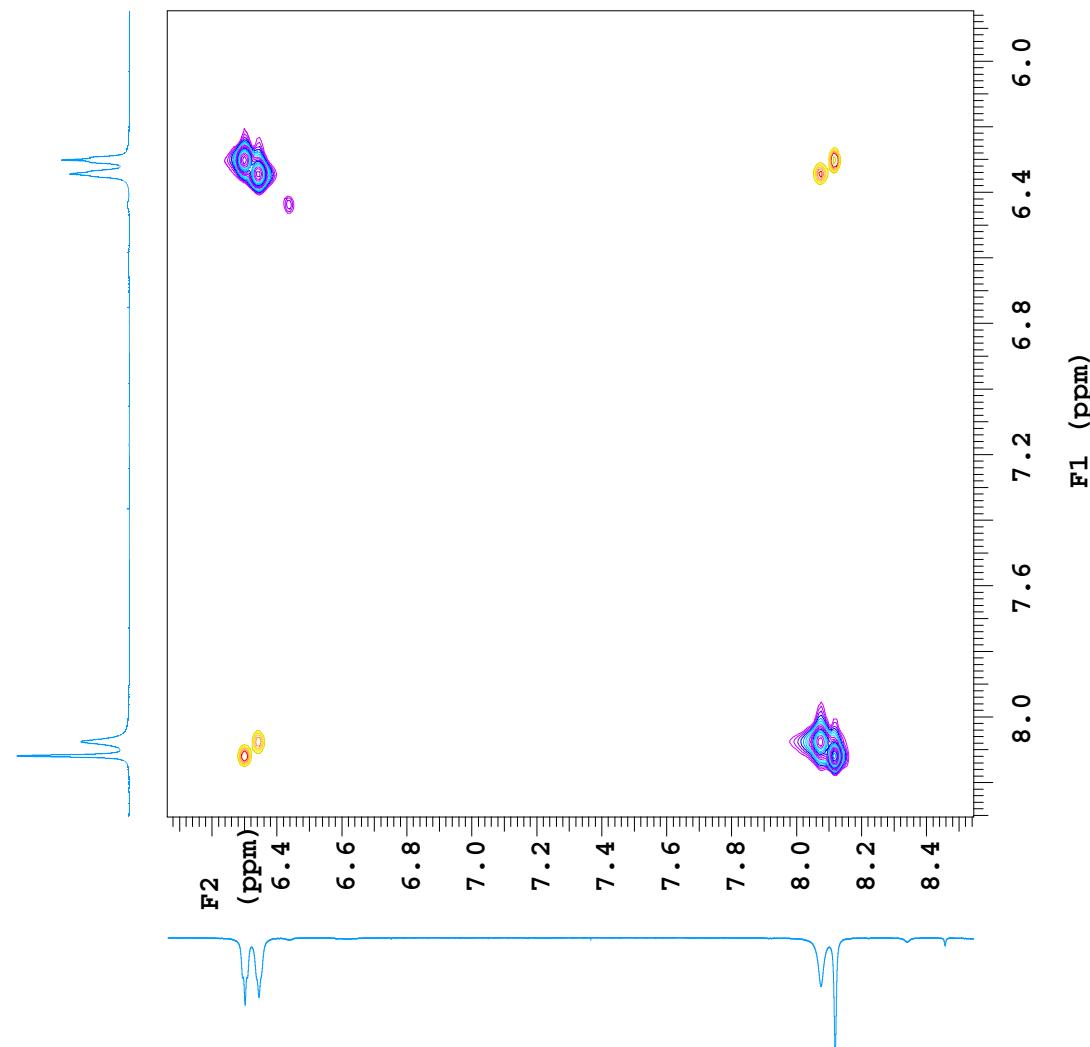
FK70\_dmso\_17C\_ROESYAD  
28.05.2010

Sample Name: FK70  
Data Collected on: Varian-NMR-vnmrs600  
Archive directory: /home/servis/vnmrsys/data  
Sample directory: FK70\_20100528\_01  
FidFile: FK50\_DMSO\_ROESY\_17C

Pulse Sequence: ROESYAD  
Solvent: dmso  
Data collected on: May 31 2010

Temp. 17.0 C / 290.1 K  
Operator: servis

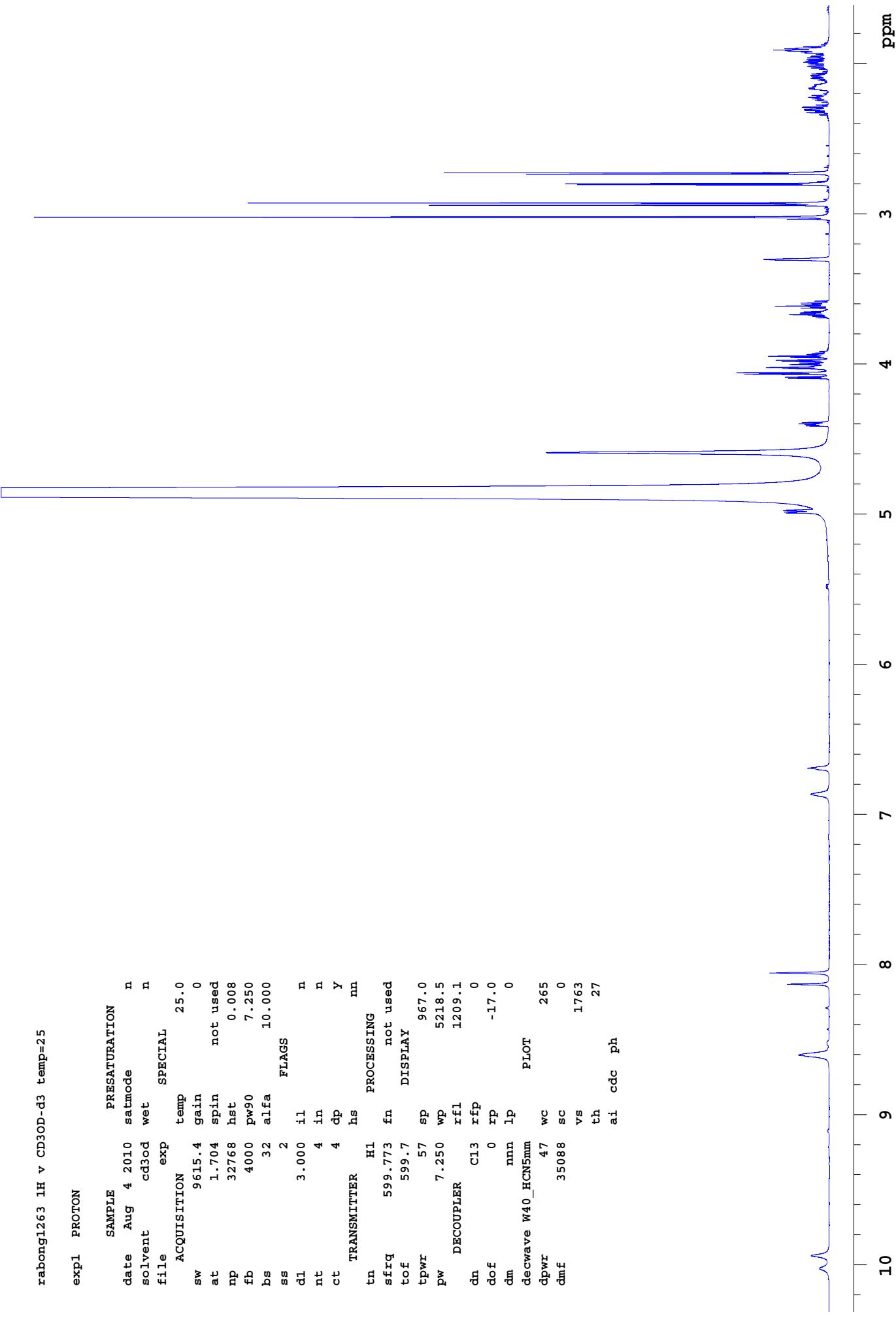
Relax. delay 1.000 sec  
Acq. time 0.150 sec  
Width 9615.4 Hz  
2D Width 9615.4 Hz  
12 repetitions  
2 x 256 increments  
OBSERVE H1, 599.8366109 MHz  
DATA PROCESSING  
Gauss apodization 0.069 sec  
F1 DATA PROCESSING  
Gauss apodization 0.025 sec  
FT size 4096 x 4096  
Total time 2 hr, 41 min



rabong1263 1H v CD3OD-d3 temp=25

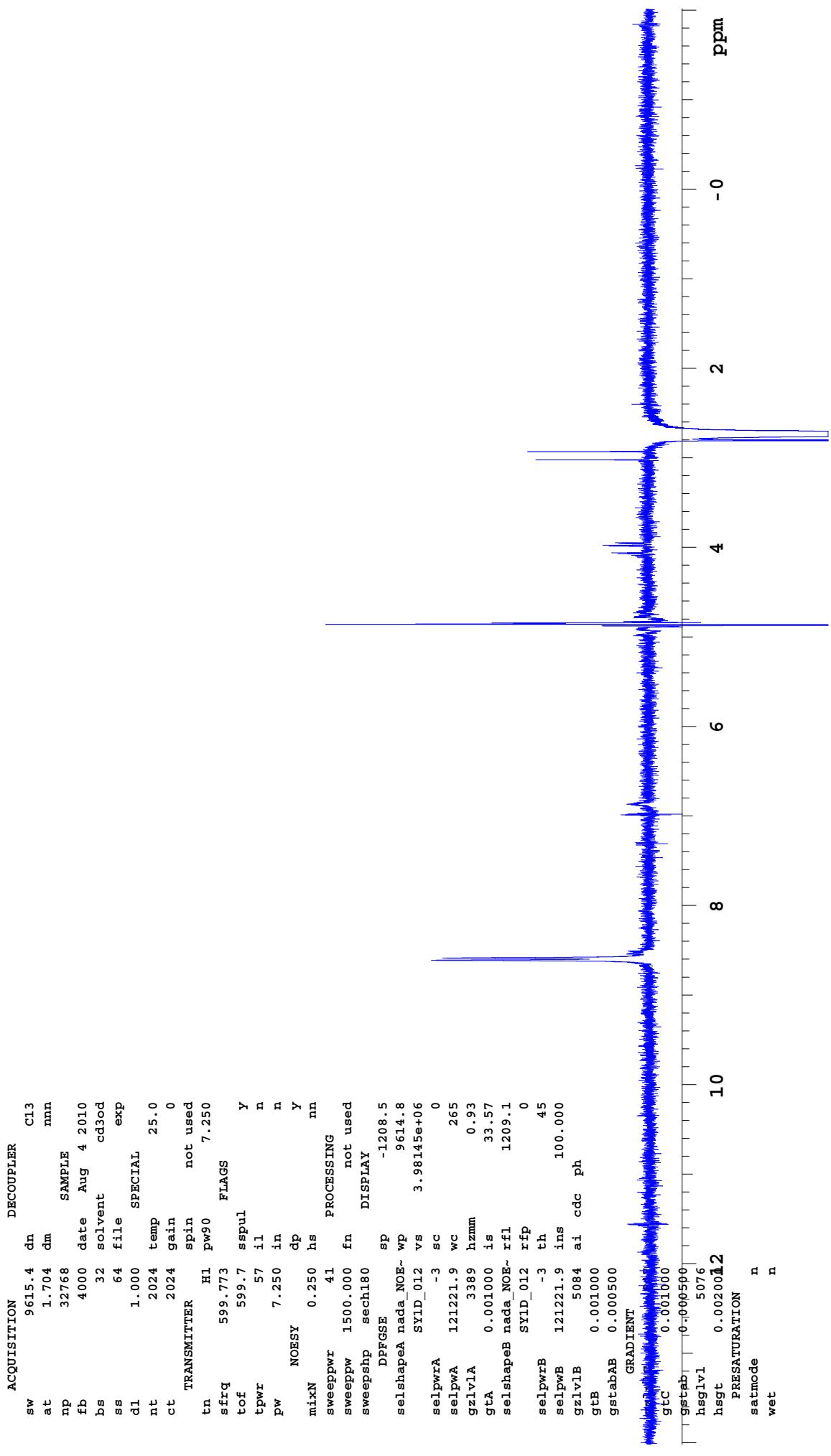
exp1 PROTON

SAMPLE	PRESATURATION
date Aug 4 2010	satmode n
solvent cd3od	wet n
file exp	SPECIAL
ACQUISITION	temp 25.0
sw 9615.4	gain 0
at 1.704	spin not used
np 32768	hst 0.008
fb 4000	pw90 7.250
bs 32	alfa 10.000
ss 2	FLAGS
d1 3.000	i1 n
nt 4	in n
ct 4	dp y
TRANSMITTER	hs mn
tn H1	PROCESSING
sfrq 599.773	fn not used
tof 599.7	DISPLAY
tpwr 57	sp 967.0
pw 7.250	wp 5218.5
DECOUPLER	rfl 1209.1
dn C13	rfp 0
do f 0	rp -17.0
dm nnn	lp 0
decwave W40 HCN5mm	PLOT
dpwr 47	wc 265
dmf 35088	sc 0
	vs 1763
	th 27
	ai cdc ph



1H CD3OD-d3 temp=25  
Selective band center: 2.73 (ppm); width  
: 29.7 (Hz)

### exp2 NOESY1D



1H CD3OD-d3 temp=25  
Selective band center: 2.73 (ppm); width: 29.7 (Hz)

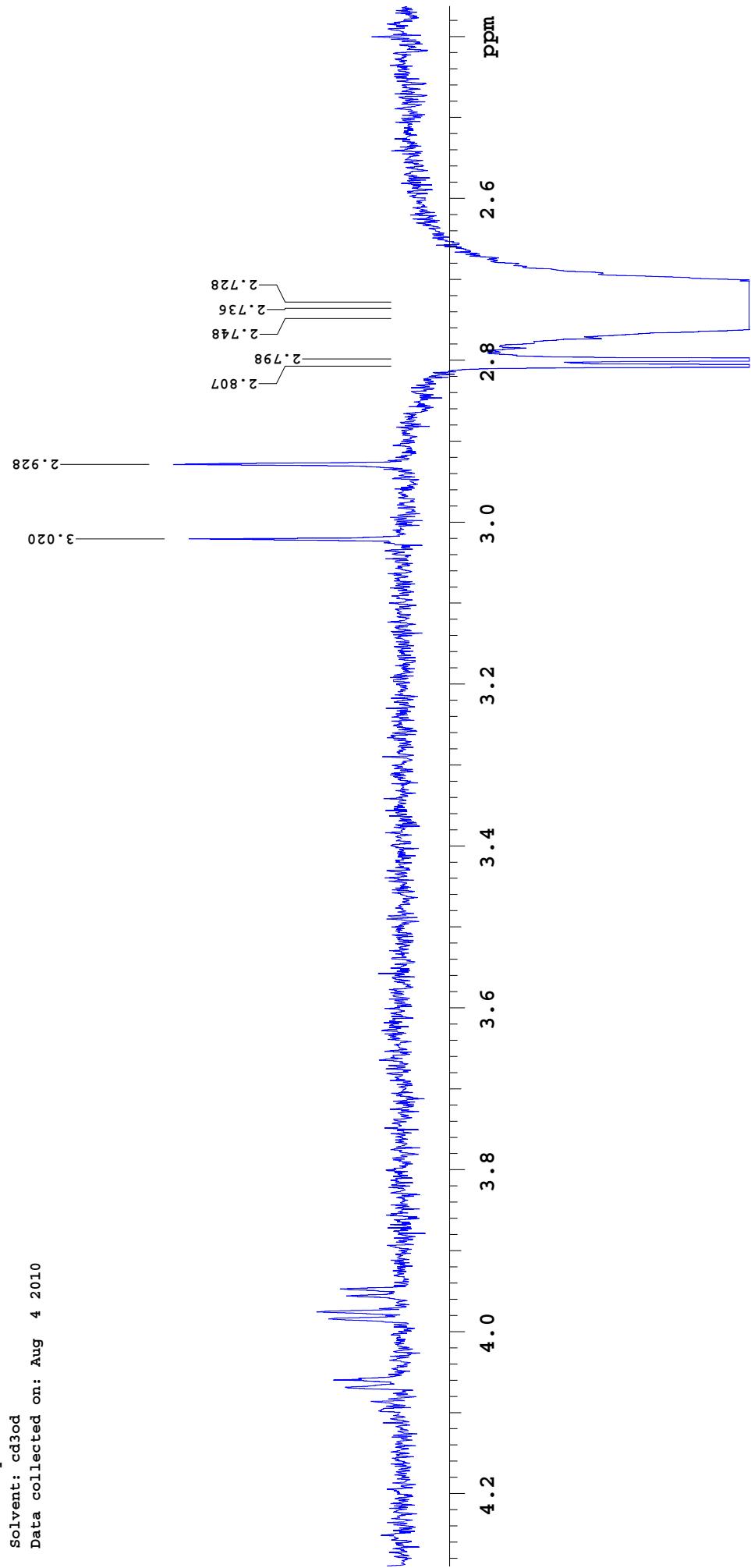
Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

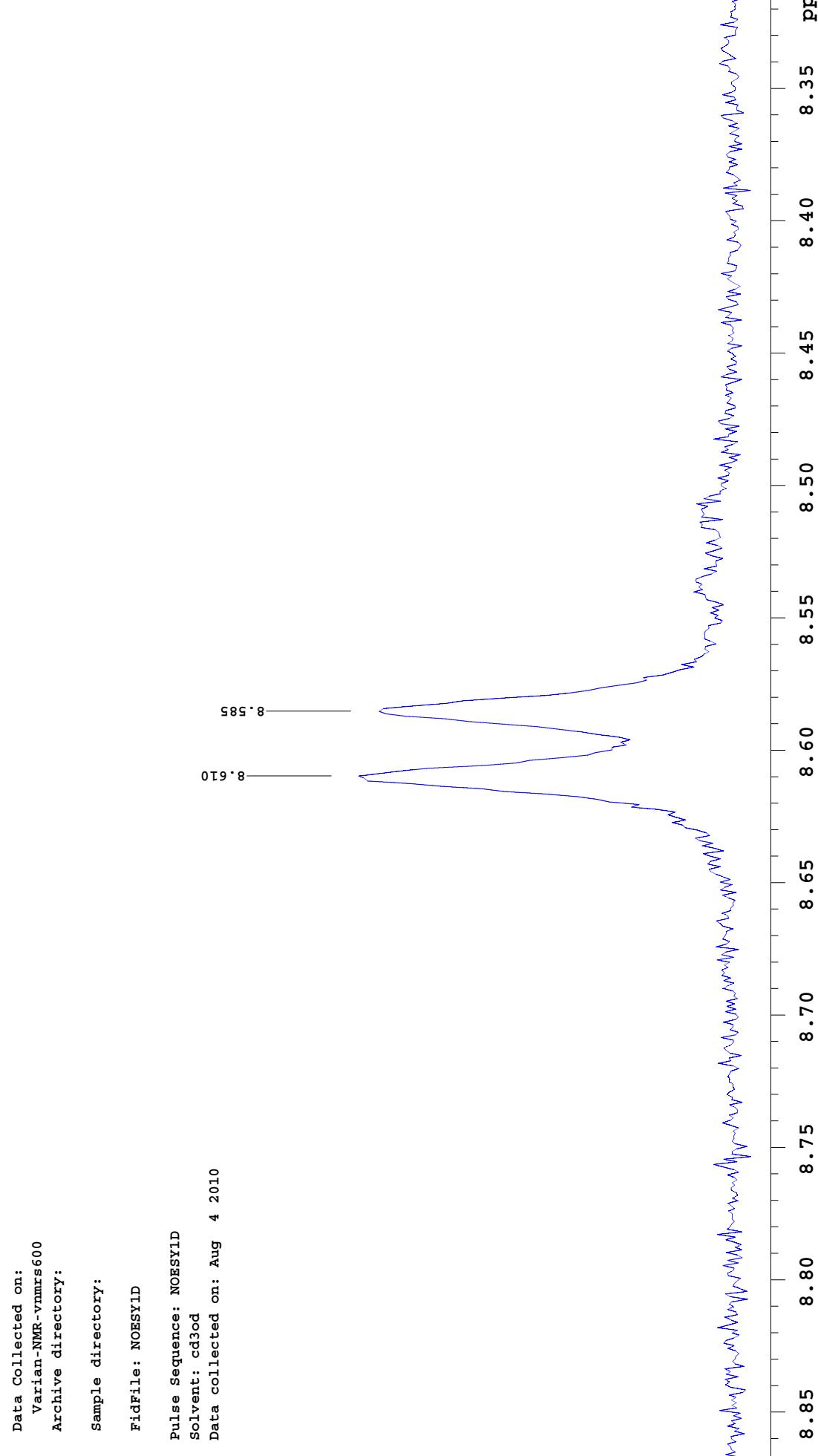
FidFile: NOESY1D

Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: Aug 4 2010



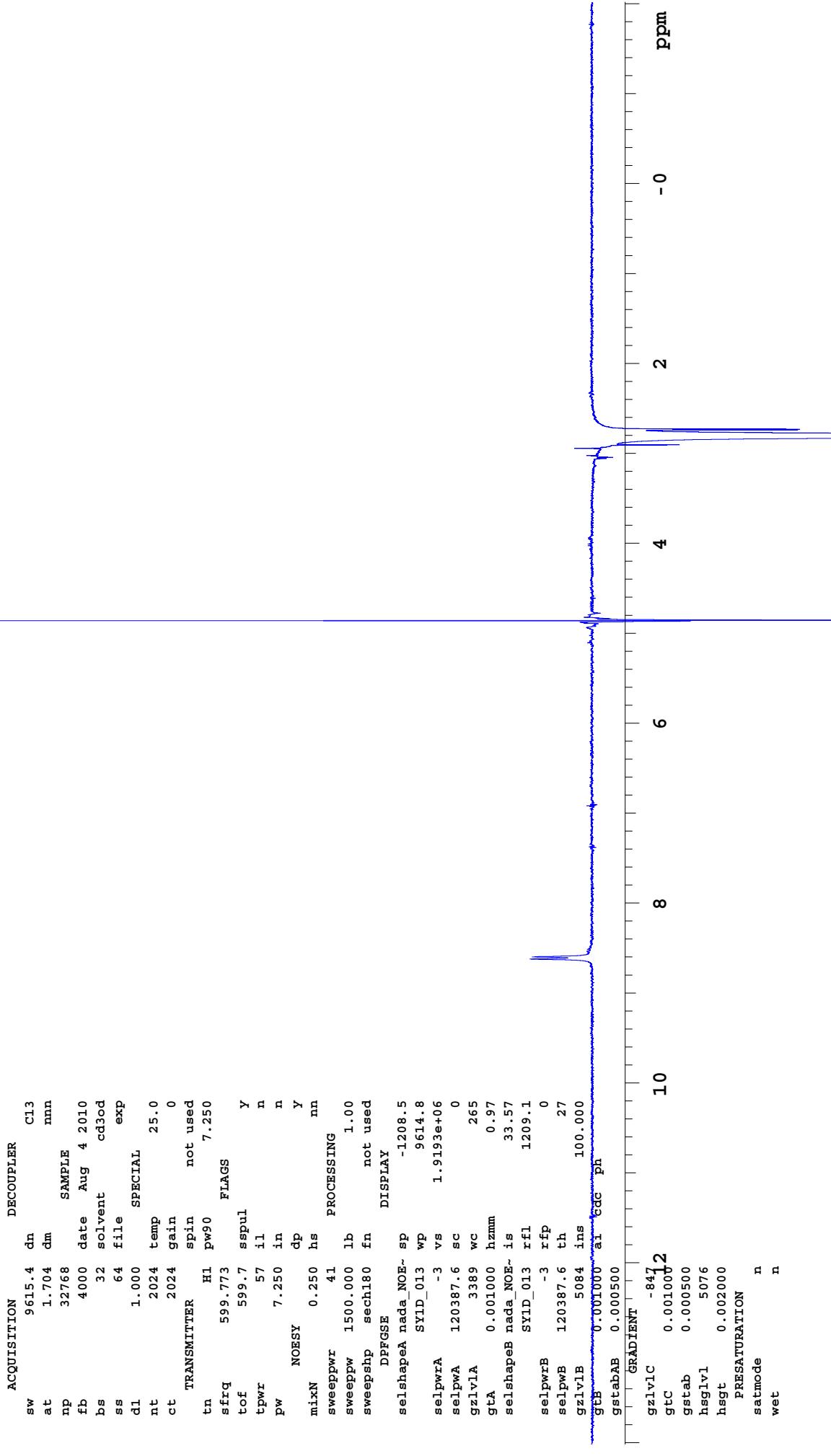
1H CD3OD-d3 temp=25  
Selective band center: 2.73 (ppm); width: 29.7 (Hz)

Sample Name:



1H v CD3OD-d3 temp=25  
 Selective band center: 2.80 (ppm); width  
 : 29.9 (Hz)

**exp3 NOESY1D**



1H v CD3OD-d3 temp=25  
Selective band center: 2.80 (ppm); width: 29.9 (Hz)

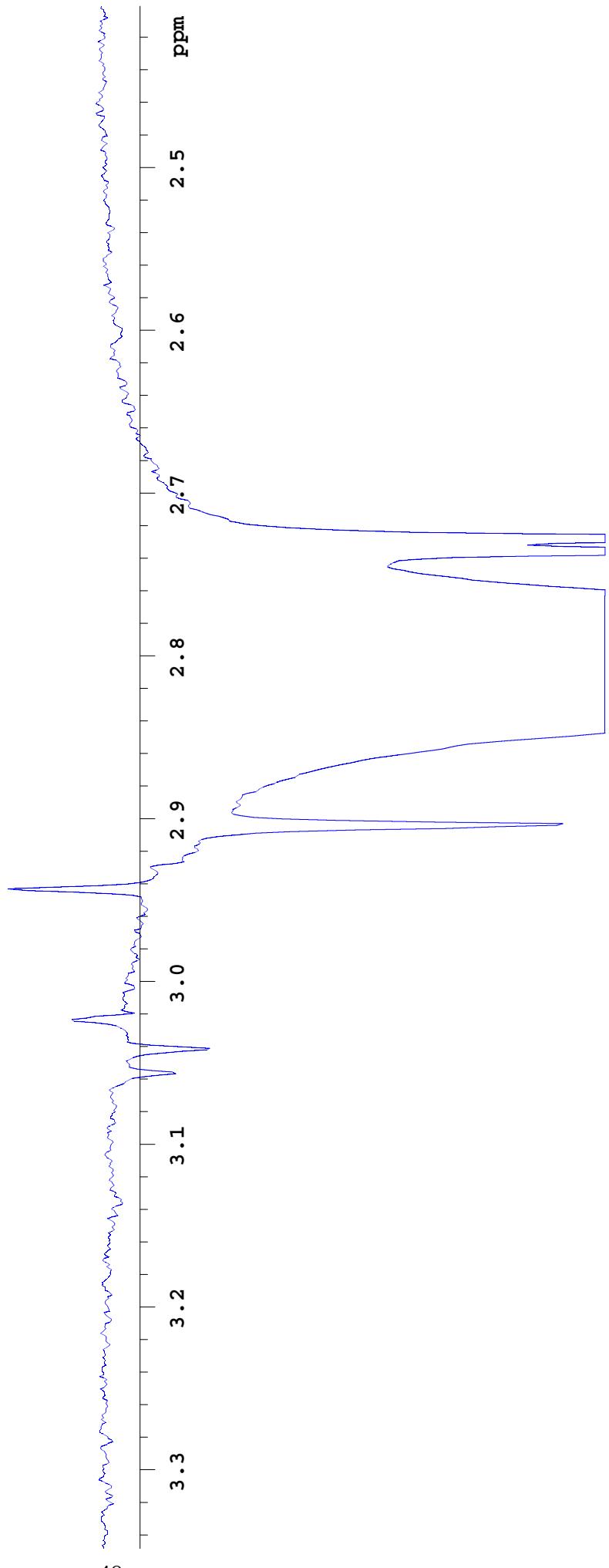
Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

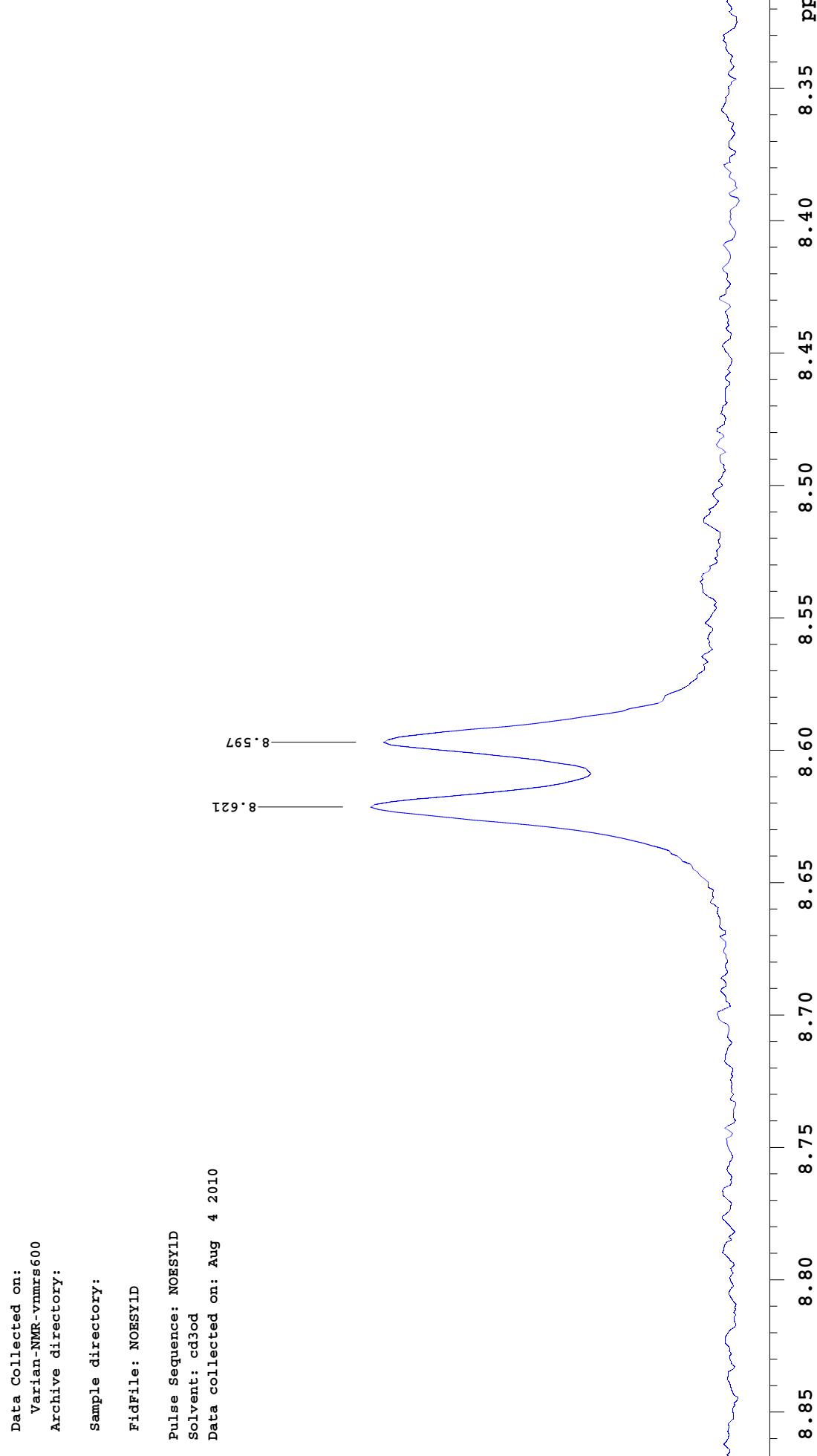
FidFile: NOESY1D

Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: Aug 4 2010



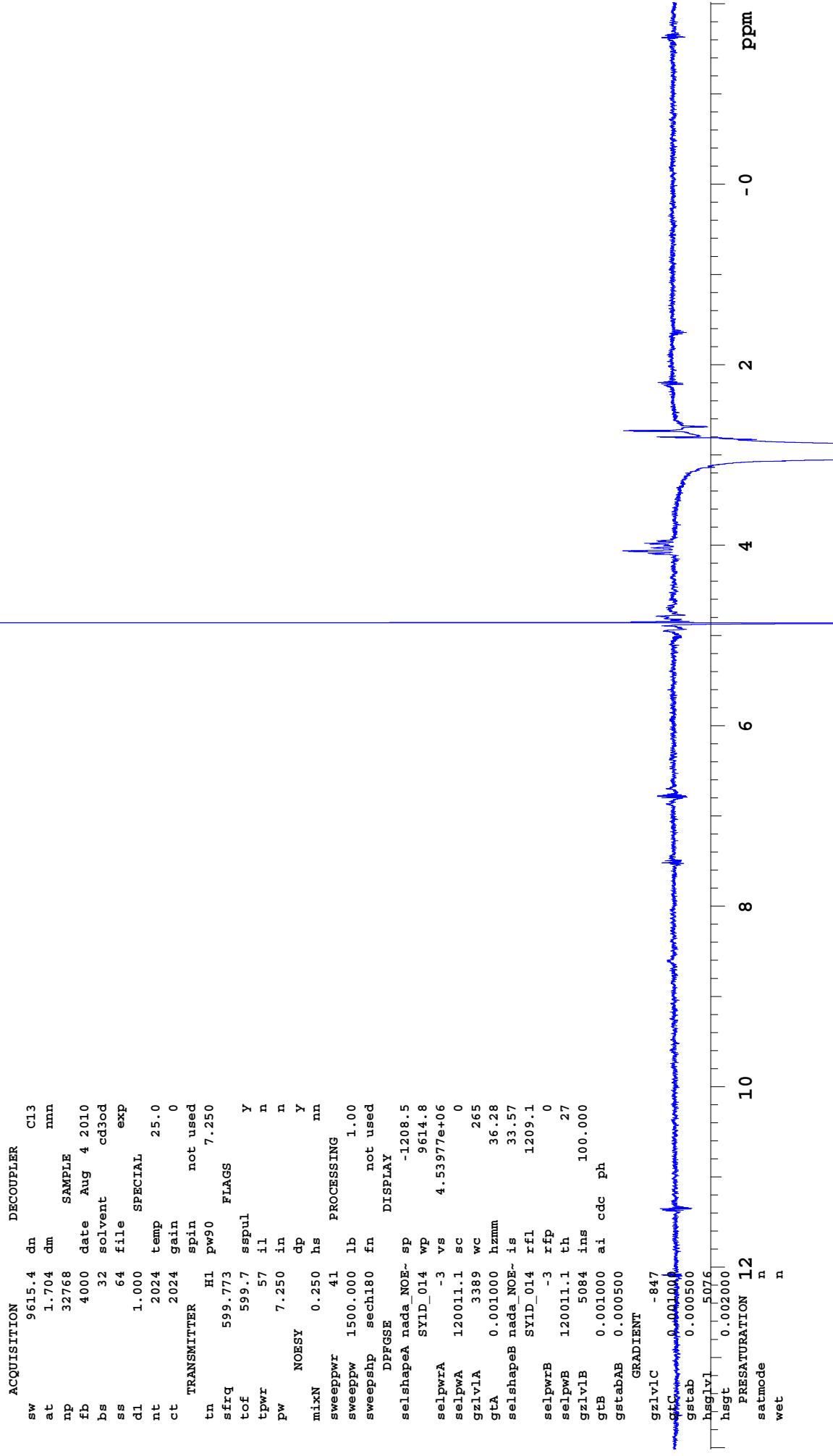
1H v CD3OD-d3 temp=25  
Selective band center: 2.80 (ppm); width: 29.9 (Hz)

Sample Name:



H CD3OD-d3 temp=25  
Selective band center: 2.93 (ppm); width  
: 30.0 (Hz)

**exp4 NOESY1D**



H CD3OD-d3 temp=25  
Selective band center: 2.93 (ppm); width: 30.0 (Hz)

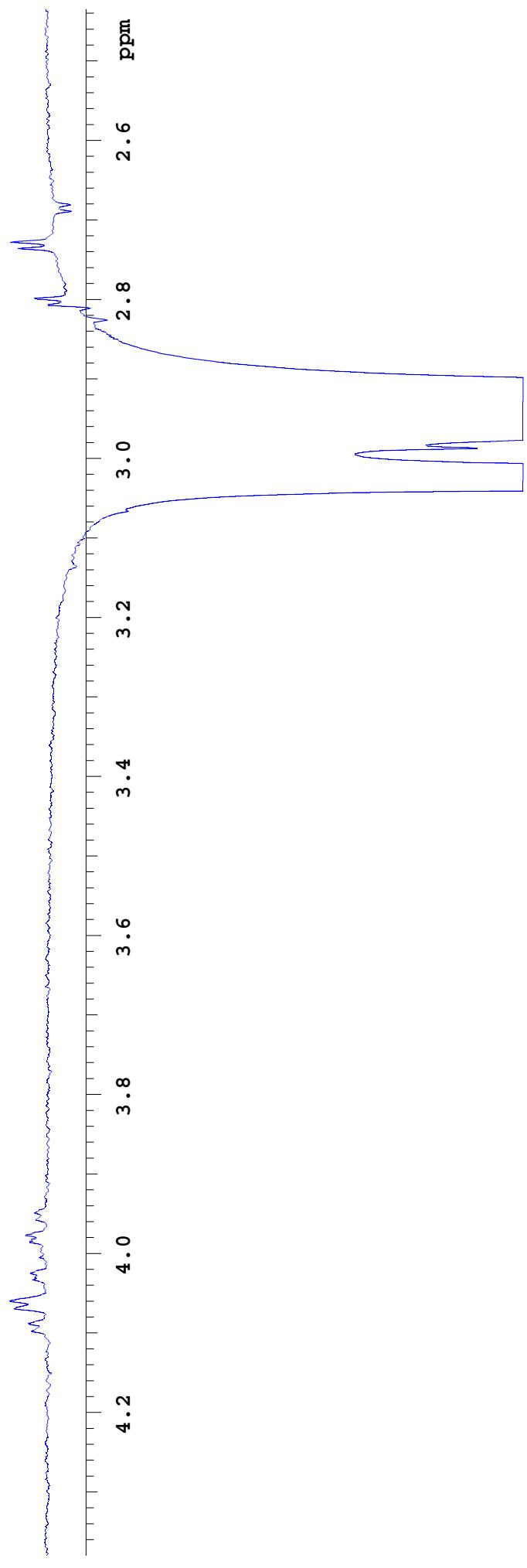
Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

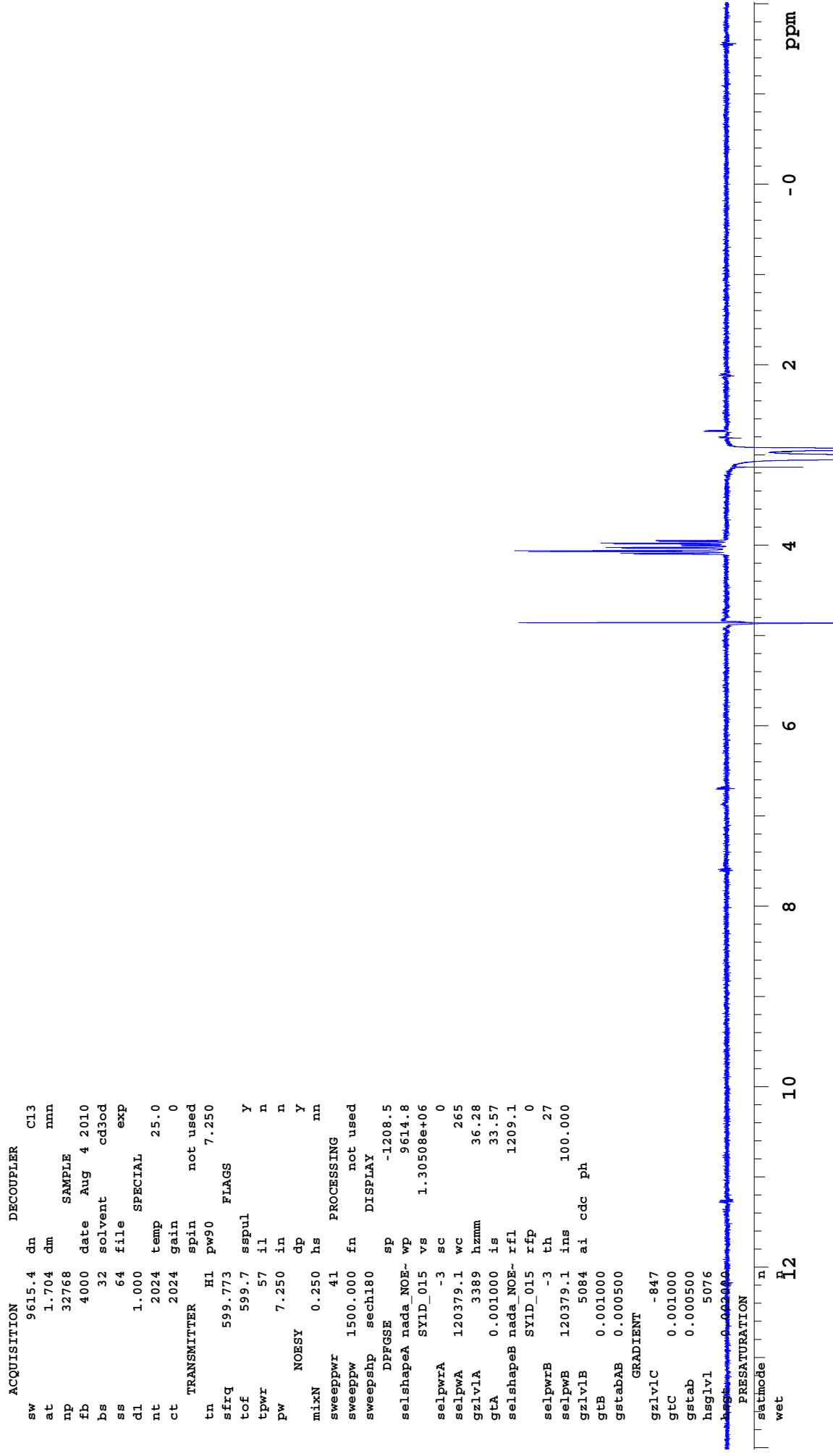
FidFile: NOESY1D

Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: Aug 4 2010



rabong1263 1H v CD3OD-d3 temp=25  
 Selective band center: 3.02 (ppm); wid  
 th: 29.9 (Hz)

### exp5 NOESY1D



rabong1263 1H v CD3OD-d3 temp=25  
Selective band center: 3.02 (ppm); width: 29.9 (Hz)

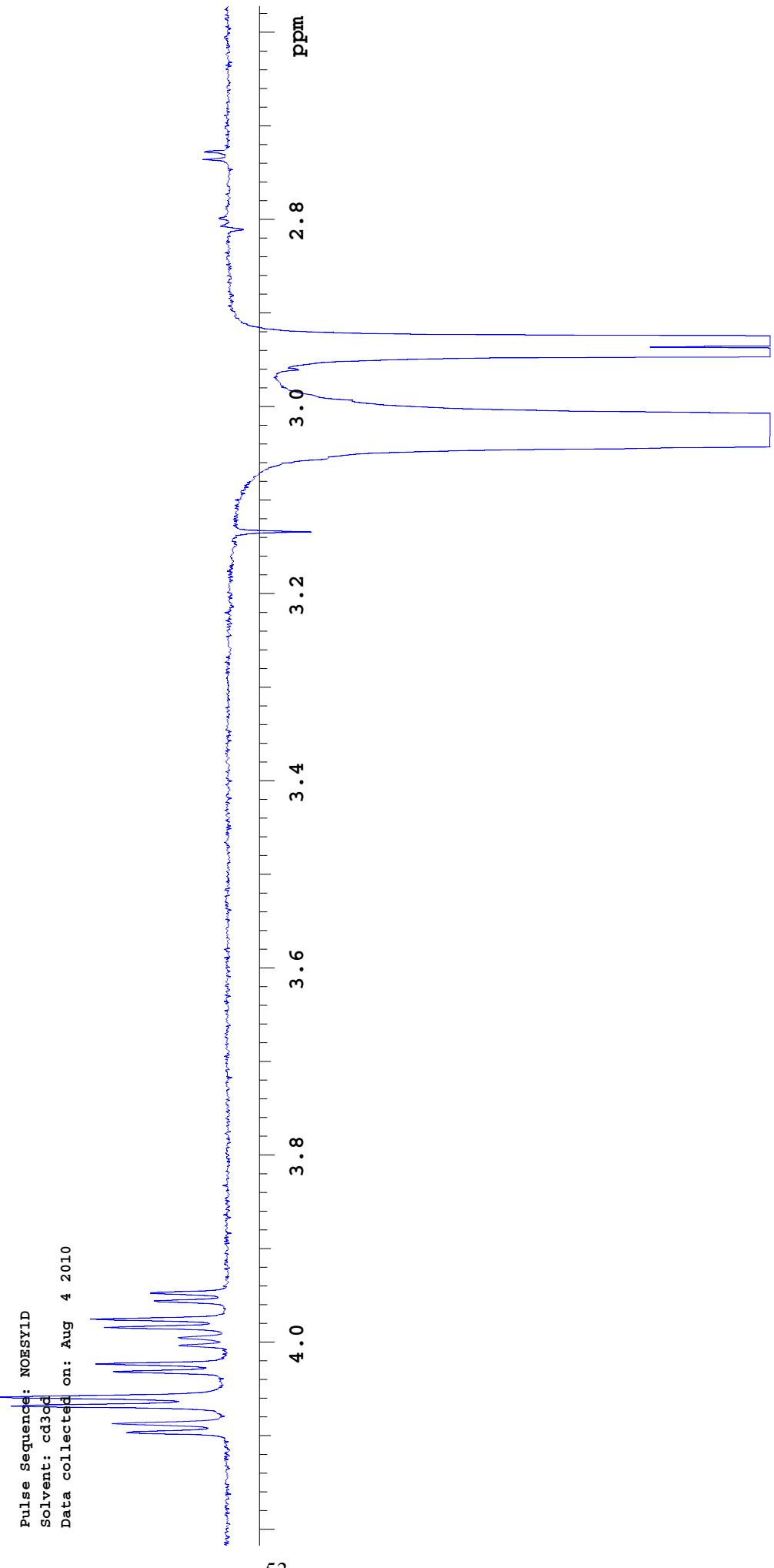
Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

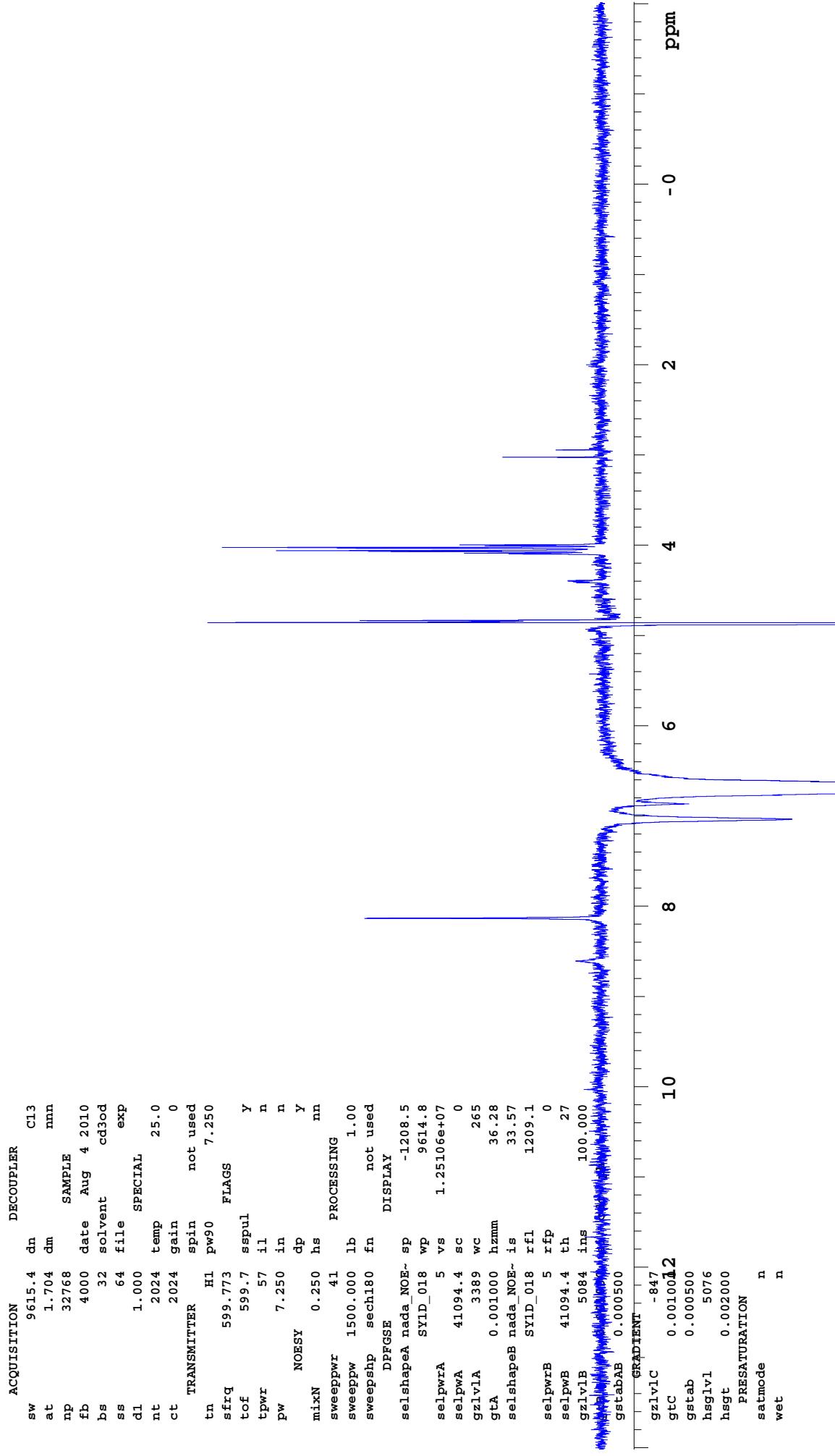
FidFile: NOESY1D

Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: Aug 4 2010



rabong1263 1H v CD3OD-d3 temp=25  
 Selective band center: 6.69 (ppm); wid  
 th: 87.6 (Hz)

### exp8 NOESY1D



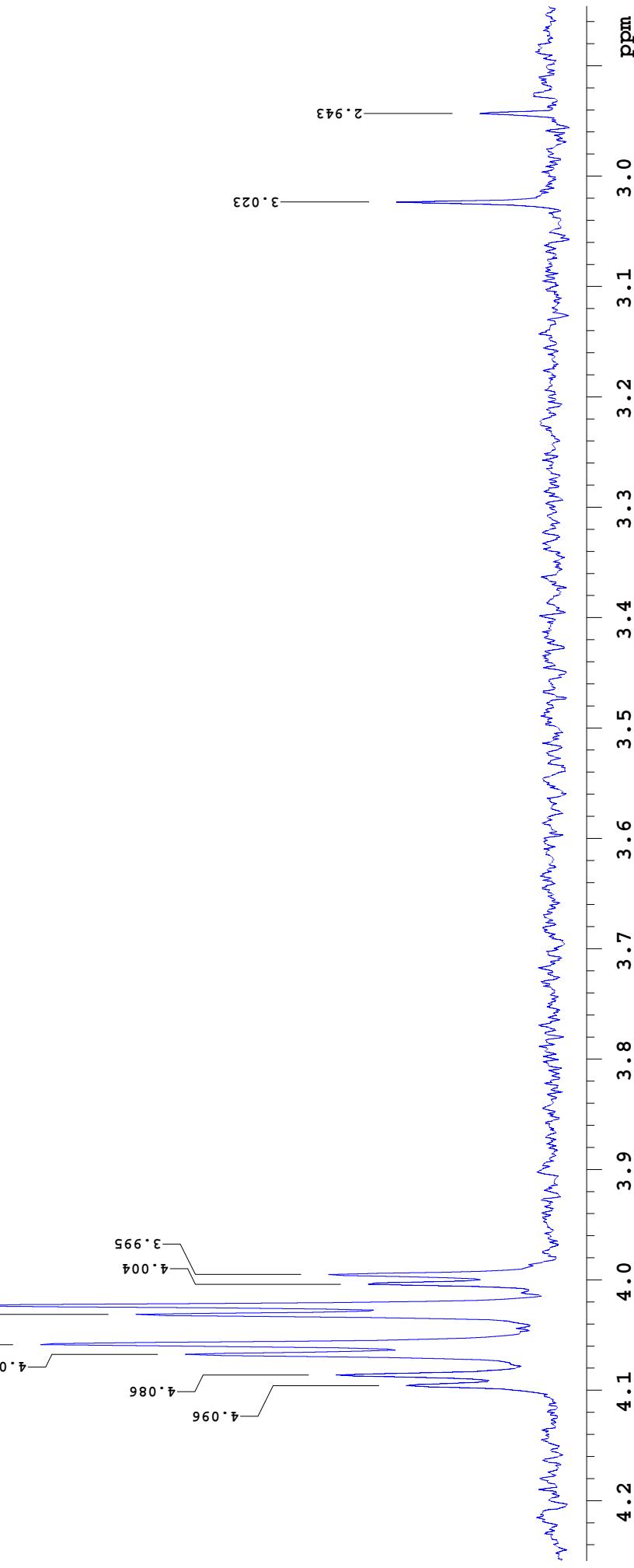
Selective band center: 6.69 (ppm); width: 87.6 (Hz)

Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: NOESY1D  
Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: 2 Aug 2010



Selective band center: 6.69 (ppm); width: 87.6 (Hz)

Sample Name:

Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: NOESY1D

Pulse Sequence: NOESY1D

Solvent: cd3od

Data collected on: Aug 4 2010

8.132

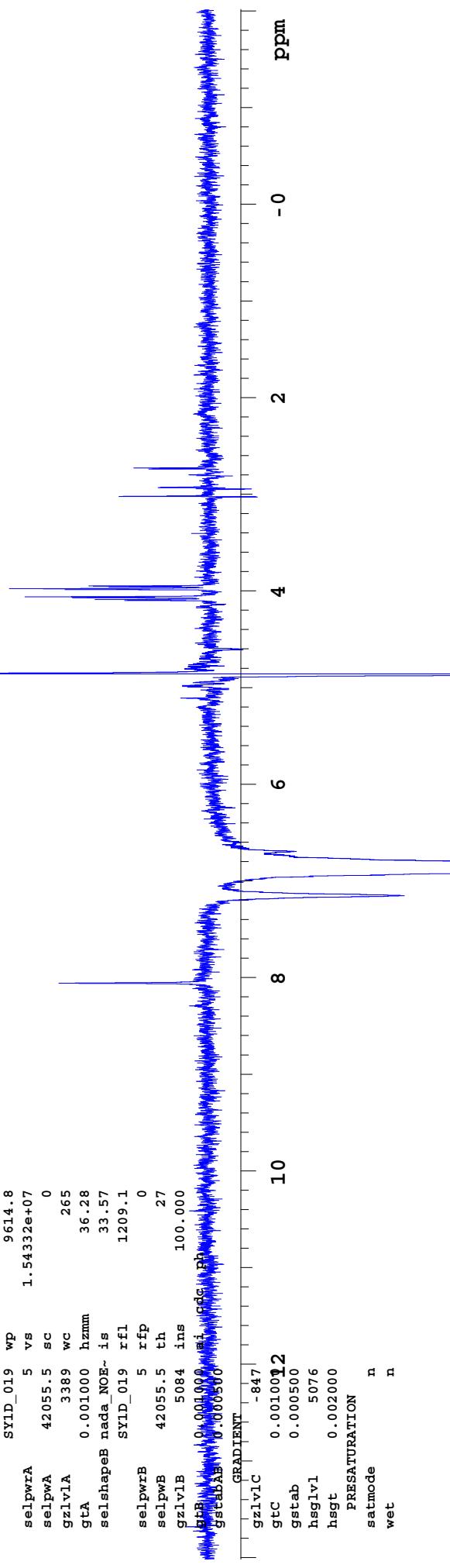
8.098

8.8 8.7 8.6 8.5 8.4 8.3 8.2 8.1 8.0 7.9 ppm

rabong1263 1H v CD3OD-d3 temp=25  
Selective band center: 6.86 (ppm); wid  
th: 85.6 (Hz)

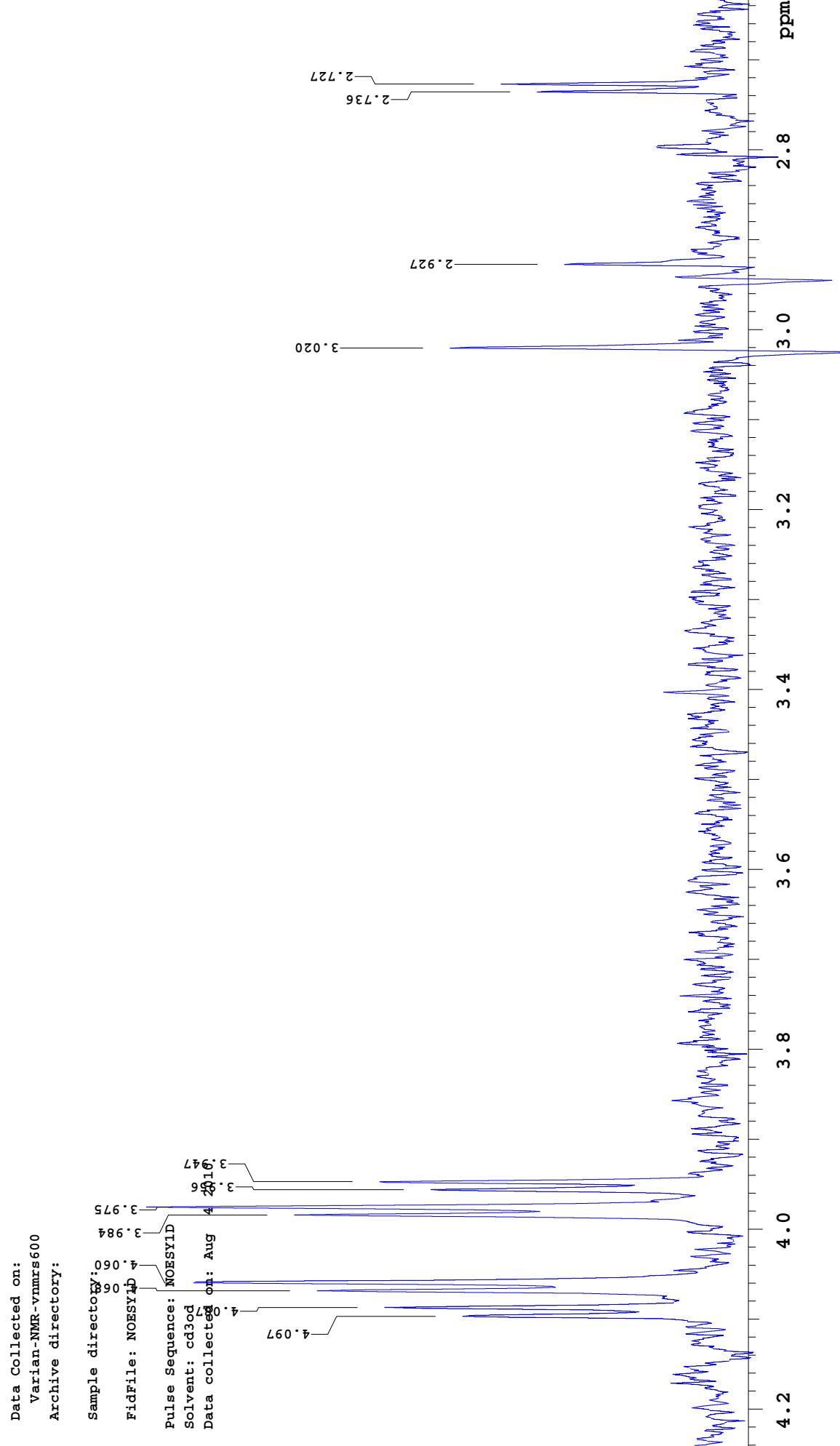
exp9 NOESTD

	ACQUISITION	DECOPPLER	
sw	9615.4	dn	C1.3
at	1.704	dn	nnn
np	32768	SAMPLE	
fb	4000	date Aug 4 2010	
bs	32	solvent cd3od	
ss	64	file exp	
d1	1.000	SPECIAL	
nt	2024	temp 25.0	
ct	2024	gain 0	
TRANSMITTER	spin not used		
tn.	H1		
sfrq	599.773	FLAGS	
tref	599.7	spol	
tpwrf	57	i1	y
pw	7.250	in	n
NOESY	dp	y	n
mixN	0.250	hs nn	
sweepppr	4.1	PROCESSING	
sweepppw	1500.000	1b 1.00	
sweepship	sech180	fn not used	
DPRFSE		DISPLAY	
selshapea	nada NOE- sp	-1208.5	
STID_019	wp	9614.8	
selpwrA	5	vs 1.543328+07	
selpwrA	42055.5	sc 0	
g21v1A	3.389	wc 265	
gta	0.001000	hznm 36.28	
selshapeB	nada NOE- is	33.57	
STID_019	rfl	1209.1	
selpwrB	5	rfp 0	
selpwrB	42055.5	th 27	
g21v1B	5084	ins 100.000	
gr21v1B	0.001000	ai 100.000	
gr21v1B	0.001000	adc 100.000	
gradient	-847		
g21v1C	gtc 0.001000	2	
gstab	0.000500		
hsg1v1	5.076		
hsgt	0.002000		
PRESATURATION			
satmode	n		
water	n		



rabong1263 1H v CD3OD-d3 temp=25  
Selective band center: 6.86 (ppm); width: 85.6 (Hz)

Sample Name:



rabong1263 1H v CD3OD-d3 temp=25  
Selective band center: 6.86 (ppm); width: 85.6 (Hz)

Sample Name:

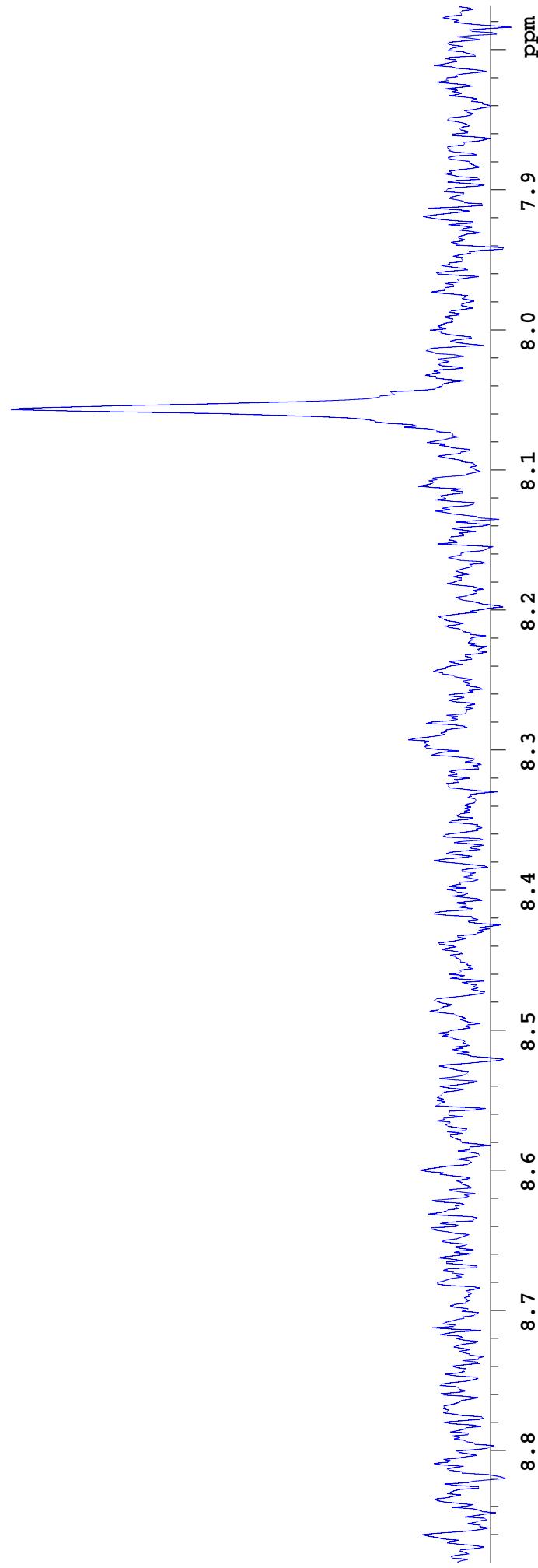
Data Collected on:  
Varian-NMR-vnmrs600  
Archive directory:

Sample directory:

FidFile: NOESY1D

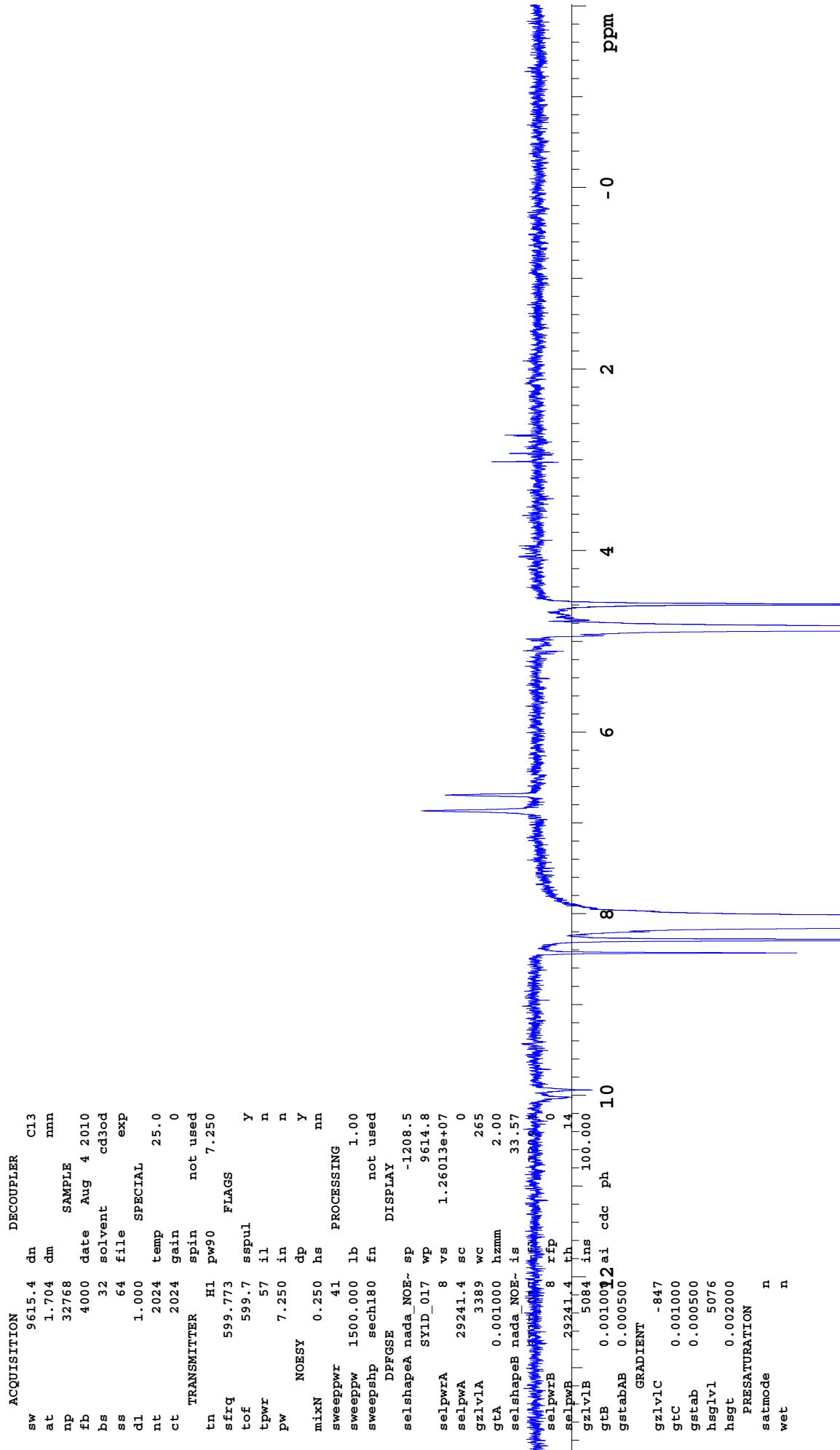
Pulse Sequence: NOESY1D  
Solvent: cd3od  
Data collected on: Aug 4 2010

8.057



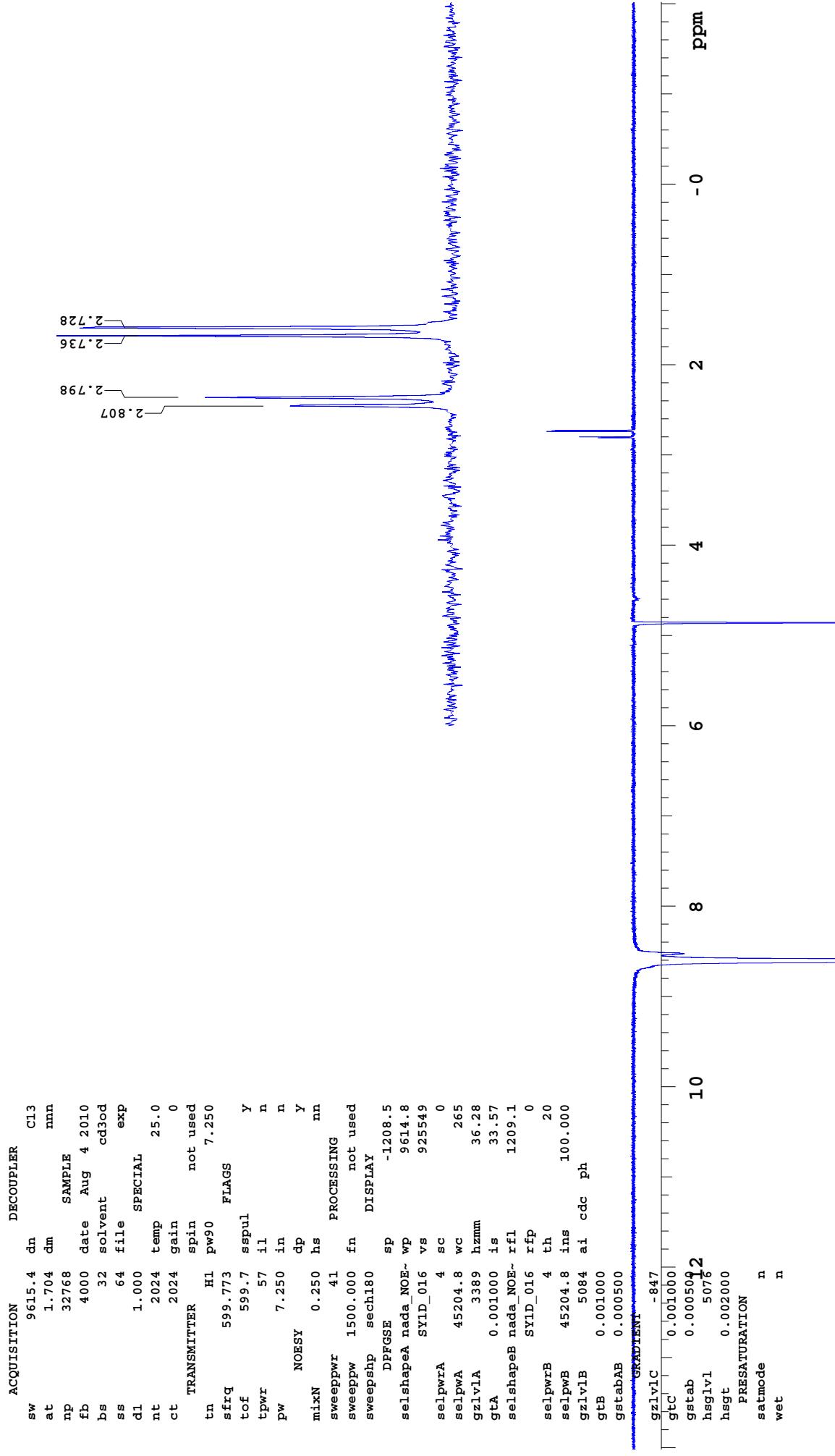
rabong1263 1H v CD3OD-d3 temp=25  
 Selective band center: 8.10 (ppm); wid  
 th: 123.1 (Hz)

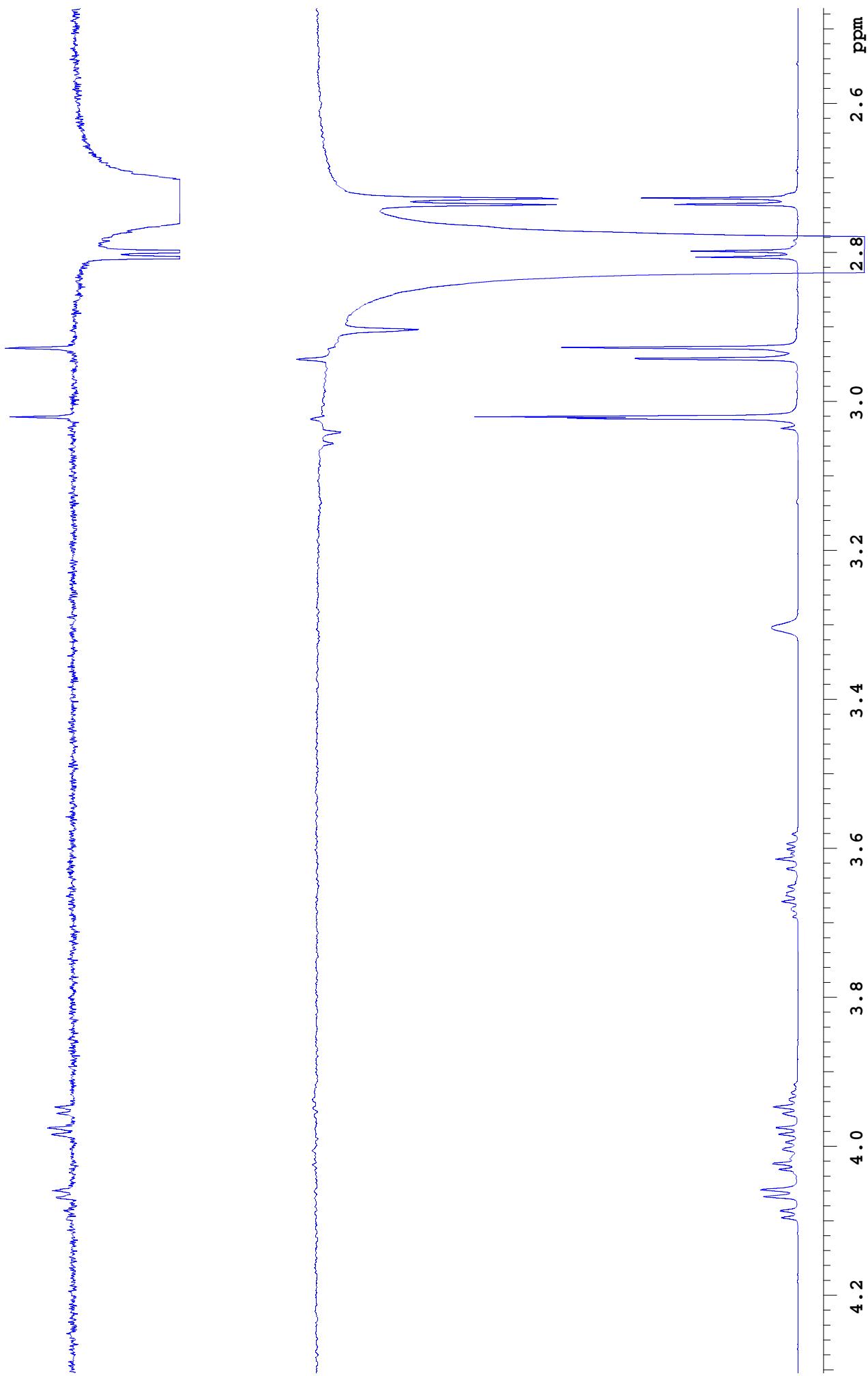
### exp7 NOESY1D

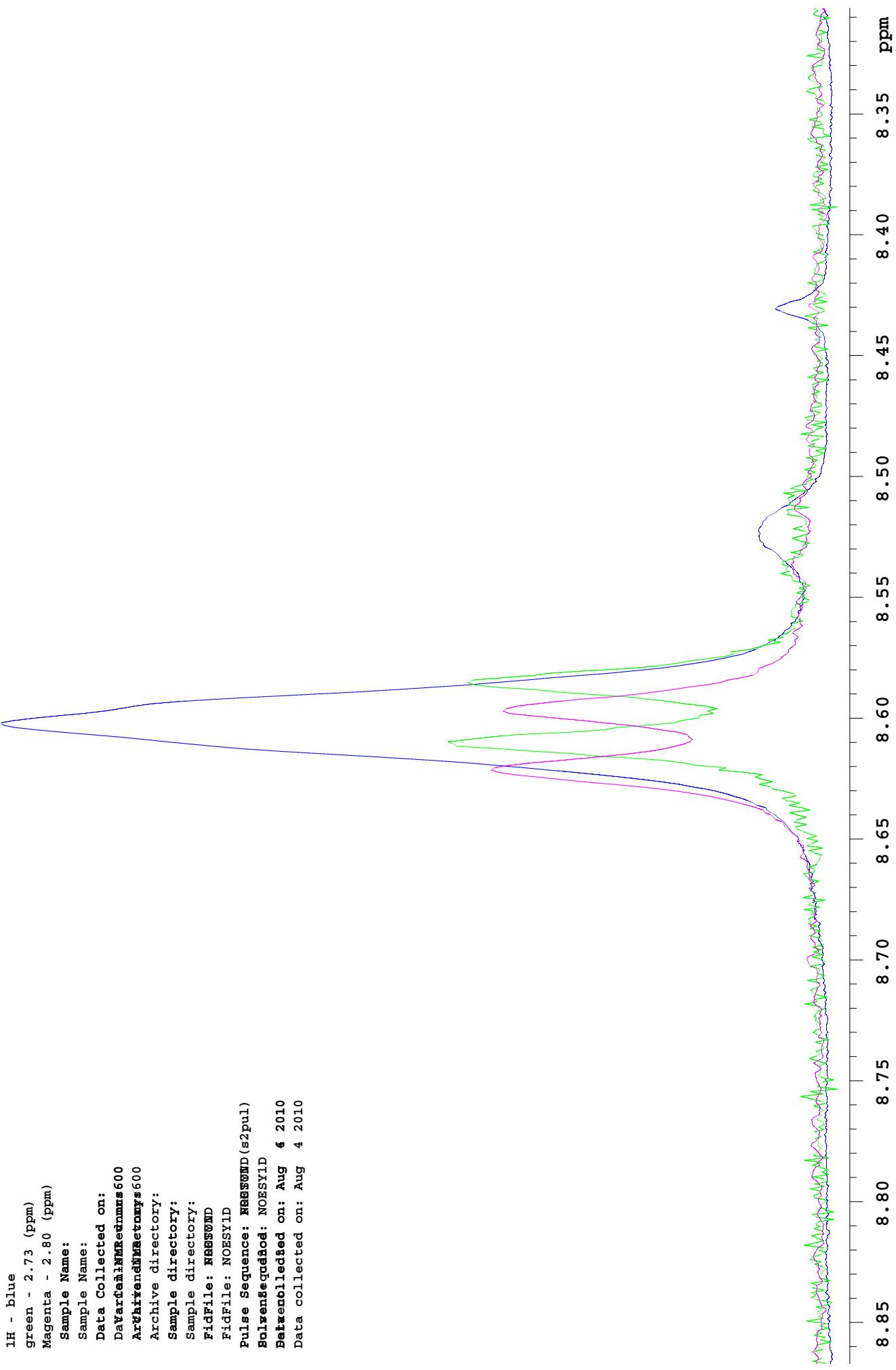


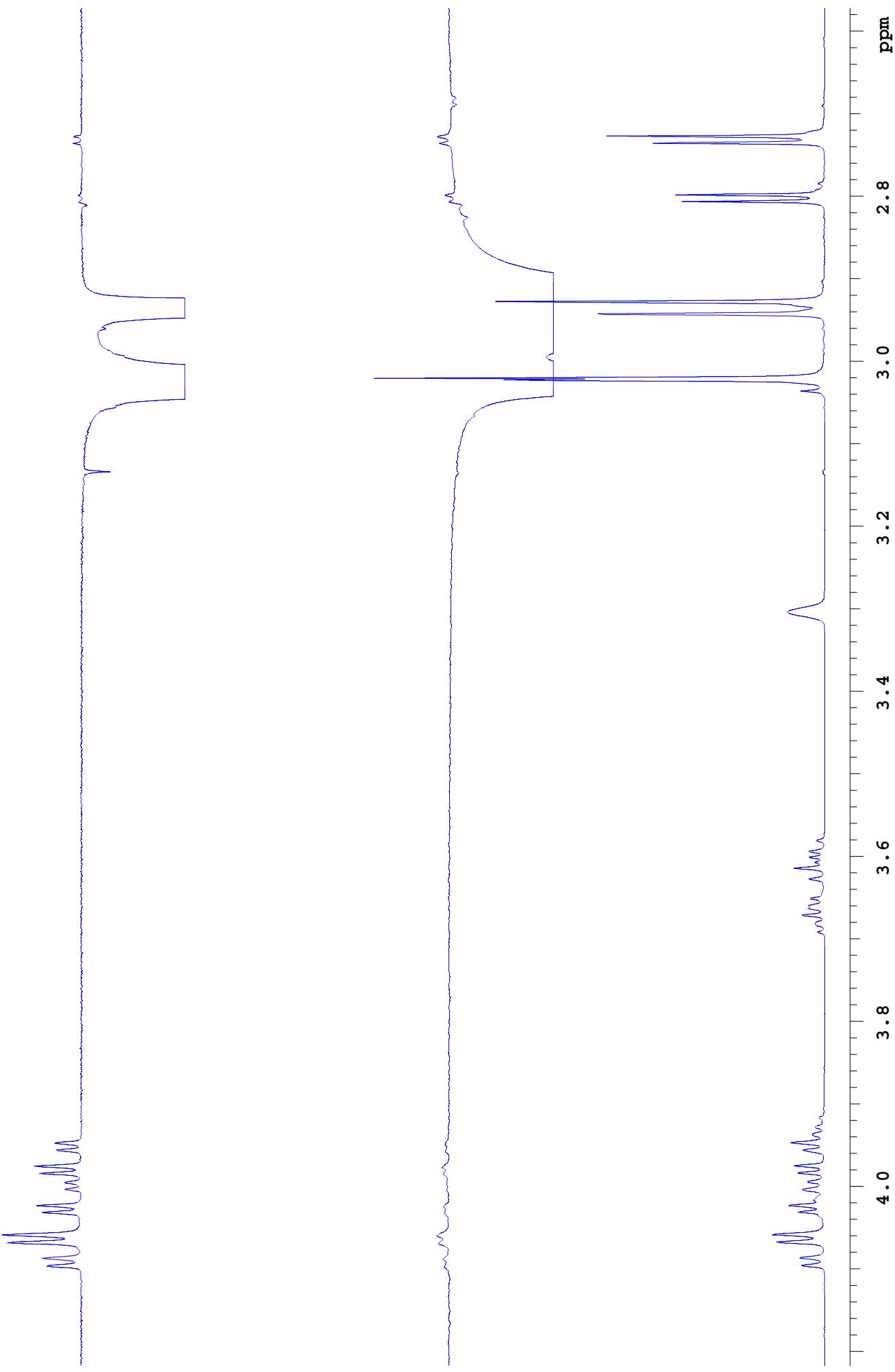
rabong1263 1H v CD3OD-d3 temp=25  
 Selective band center: 8.61 (ppm); wid  
 th: 79.6 (Hz)

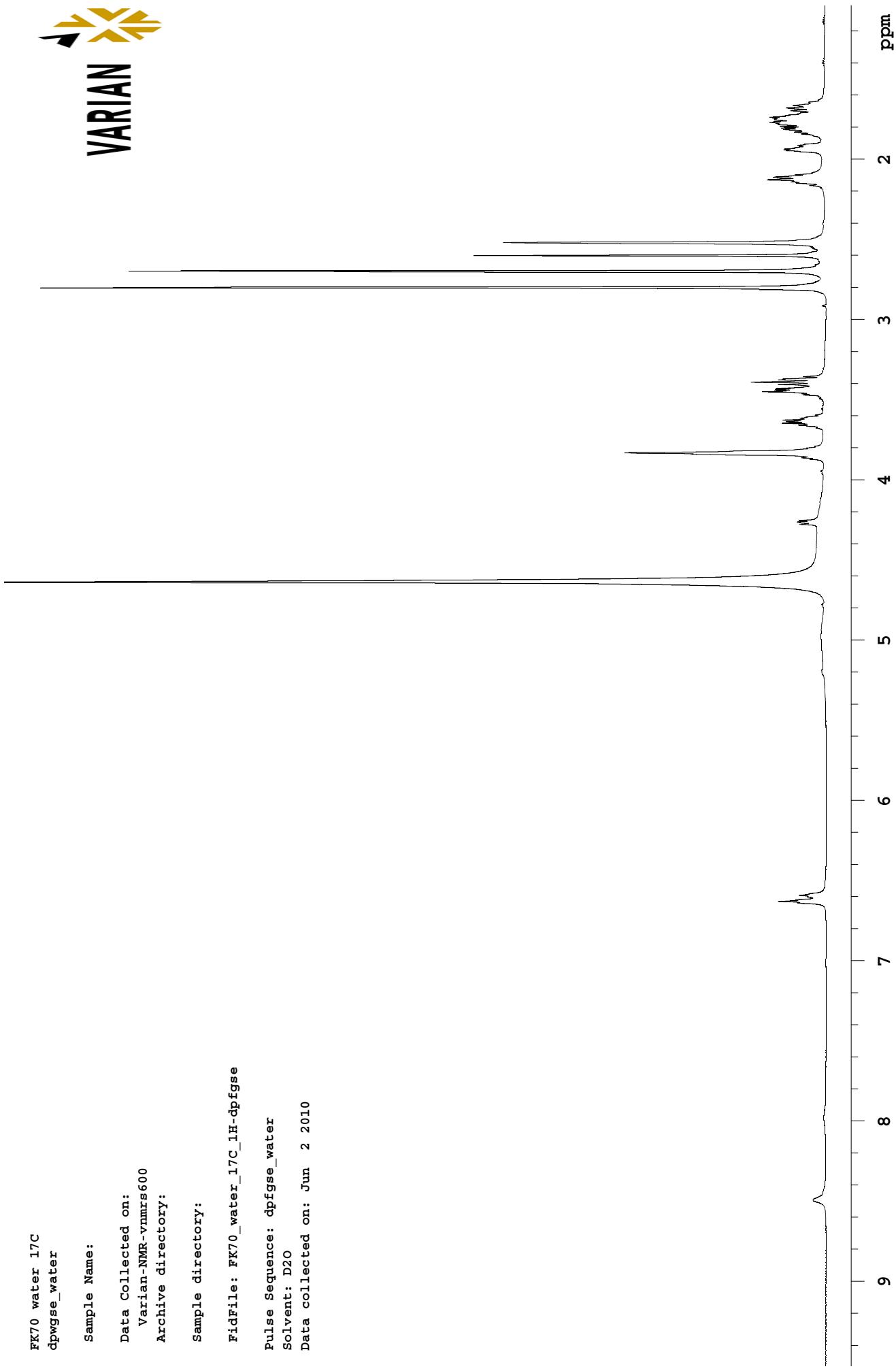
### exp6 NOESY1D

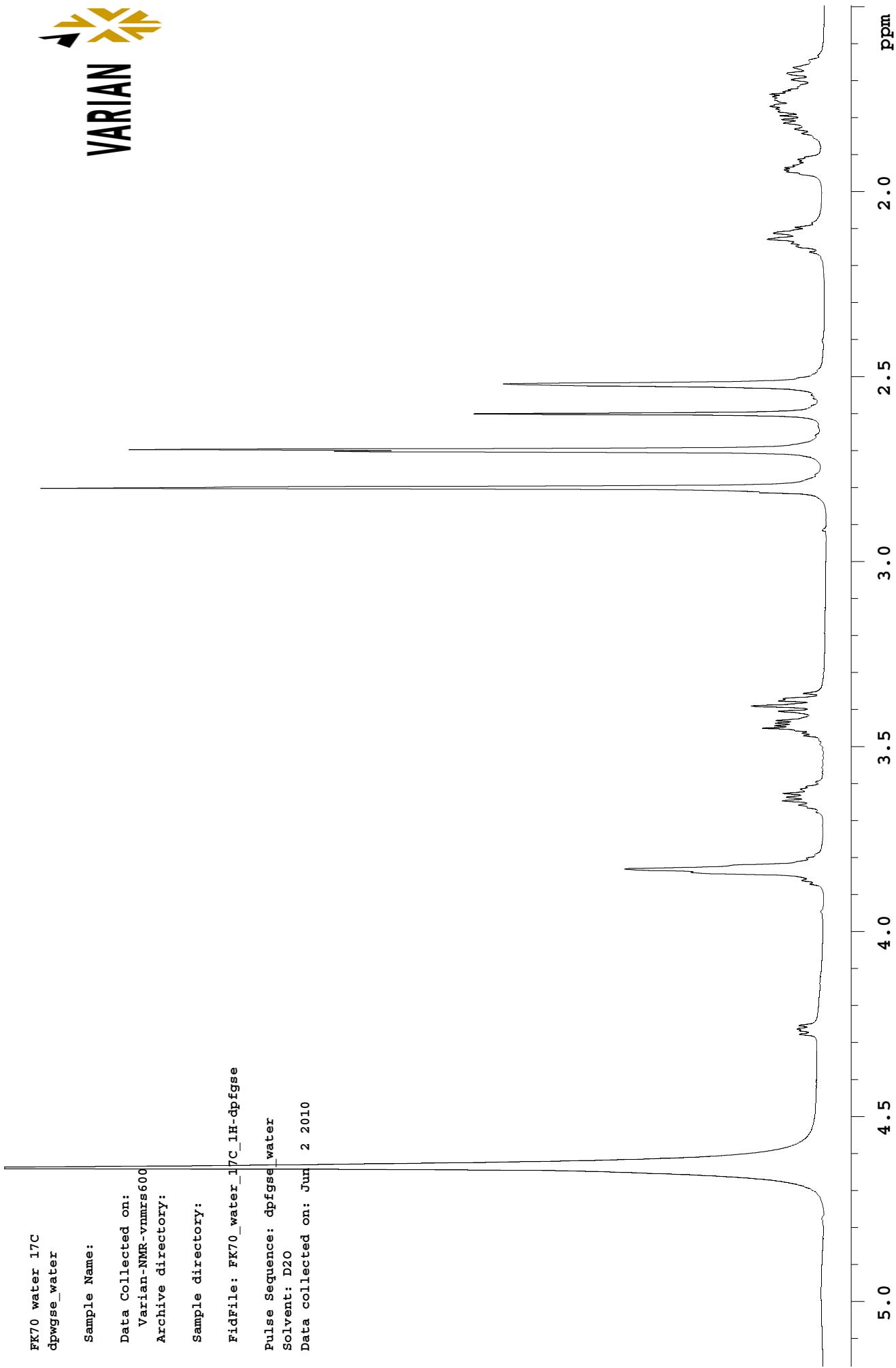










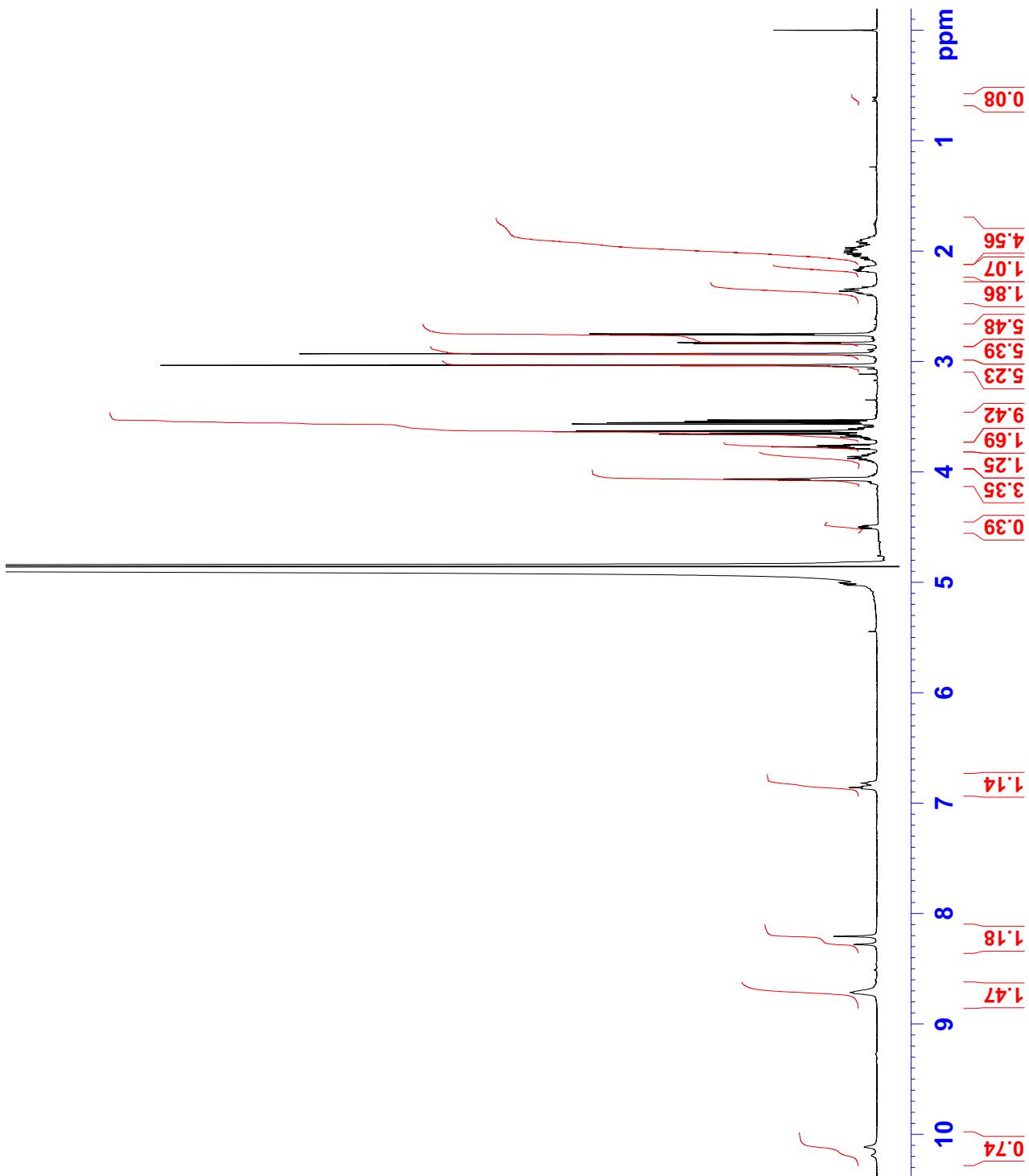




Current Data Parameters  
 NAME NB\_JP-170  
 EXPNO 51  
 PROCNO 1

F2 - Acquisition Parameters  
 Date 20070321  
 Time 15.14  
 INSTRUM spect  
 PROBHD 5 mm BBI 1H/2H  
 PULPROG ZGPR.ok  
 TD 32768  
 SOLVENT H2O  
 NS 128  
 DS 2  
 SWH 10000.000 Hz  
 FIDRES 0.305176 Hz  
 AQ 1.638500 sec  
 RG 32  
 DW 50.000 usec  
 DE 6.00 usec  
 TE 290.0 K  
 D1 3.0000000 sec  
 d12 0.0002000 sec  
 d13 0.00000300 sec

===== CHANNEL f1 ======  
 NUC1 1H  
 P1 7.25 usec  
 PL1 0.00 dB  
 PL9 55.00 dB  
 SFO1 500.2523524 MHz  
 F2 - Processing parameters  
 SI 65536  
 SF 500.2499213 MHz  
 WDW no  
 SSB 0  
 LB 0.00 Hz  
 GB 0  
 PC 1.00





```

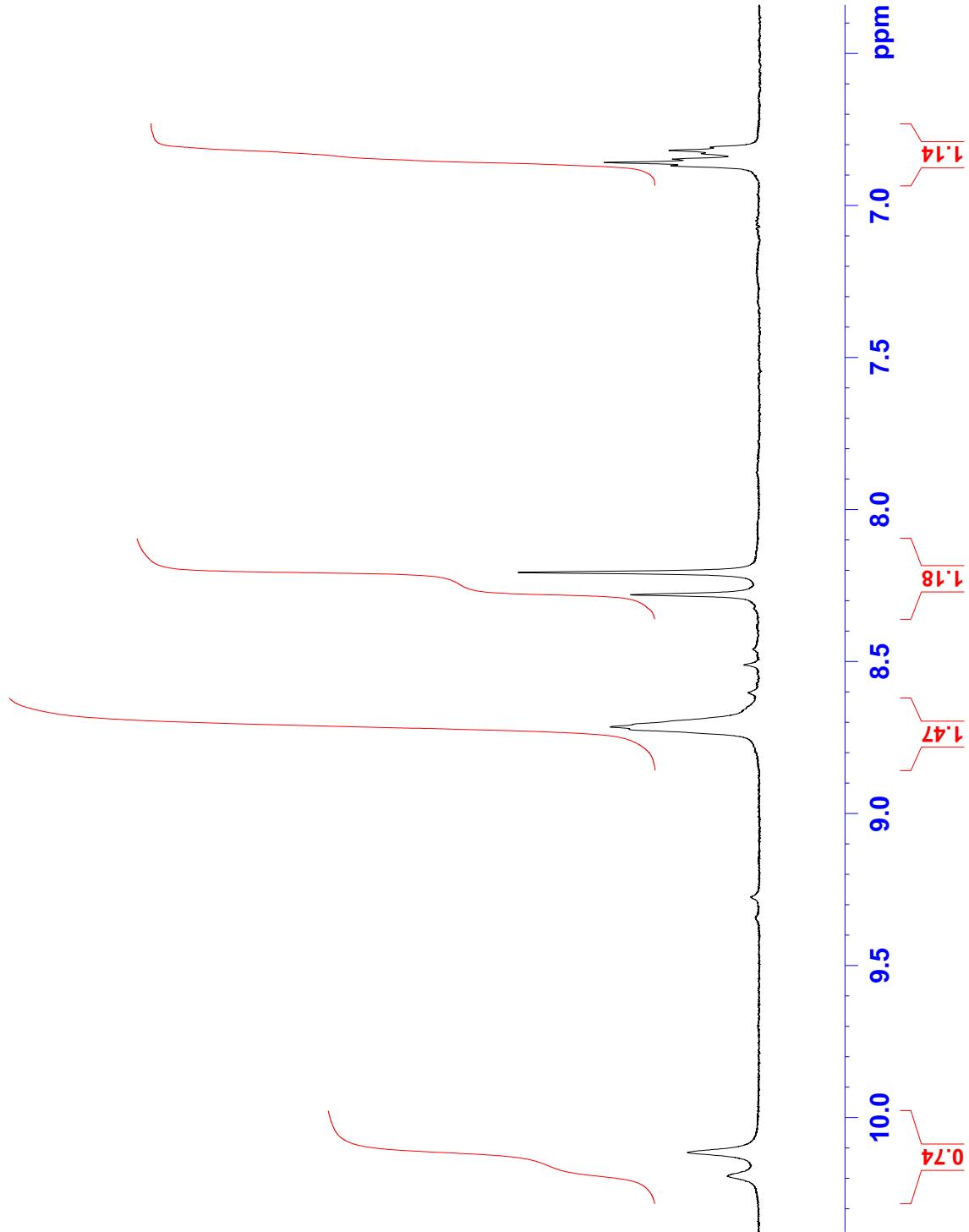
Current Data Parameters
NAME      NB_JP-170
EXPNO     51
PROCNO    1

F2 - Acquisition Parameters
Date      2007/03/21
Time      15.14
INSTRUM  spect
PROBHD   5 mm BBI 1H/2H
PULPROG  zgpr.ok
TD       32768
SOLVENT  H2O
NS        128
DS         2
SWH      10000.000 Hz
FIDRES  0.305176 Hz
AQ       1.638500 sec
RG        32
DW       50.000 usec
DE       6.000 usec
TE       290.0 K
D1      3.00000000 sec
d12     0.00002000 sec
d13     0.00000300 sec

===== CHANNEL f1 =====
NUC1      1H
P1        7.25 usec
PL1      0.00 dB
PL9      55.00 dB
SFO1    500.2523524 MHz

F2 - Processing parameters
SI       65536
SF      500.2499213 MHz
WDW      no
SSB      0
LB       0.00 Hz
GB      0
PC      1.00

```





```

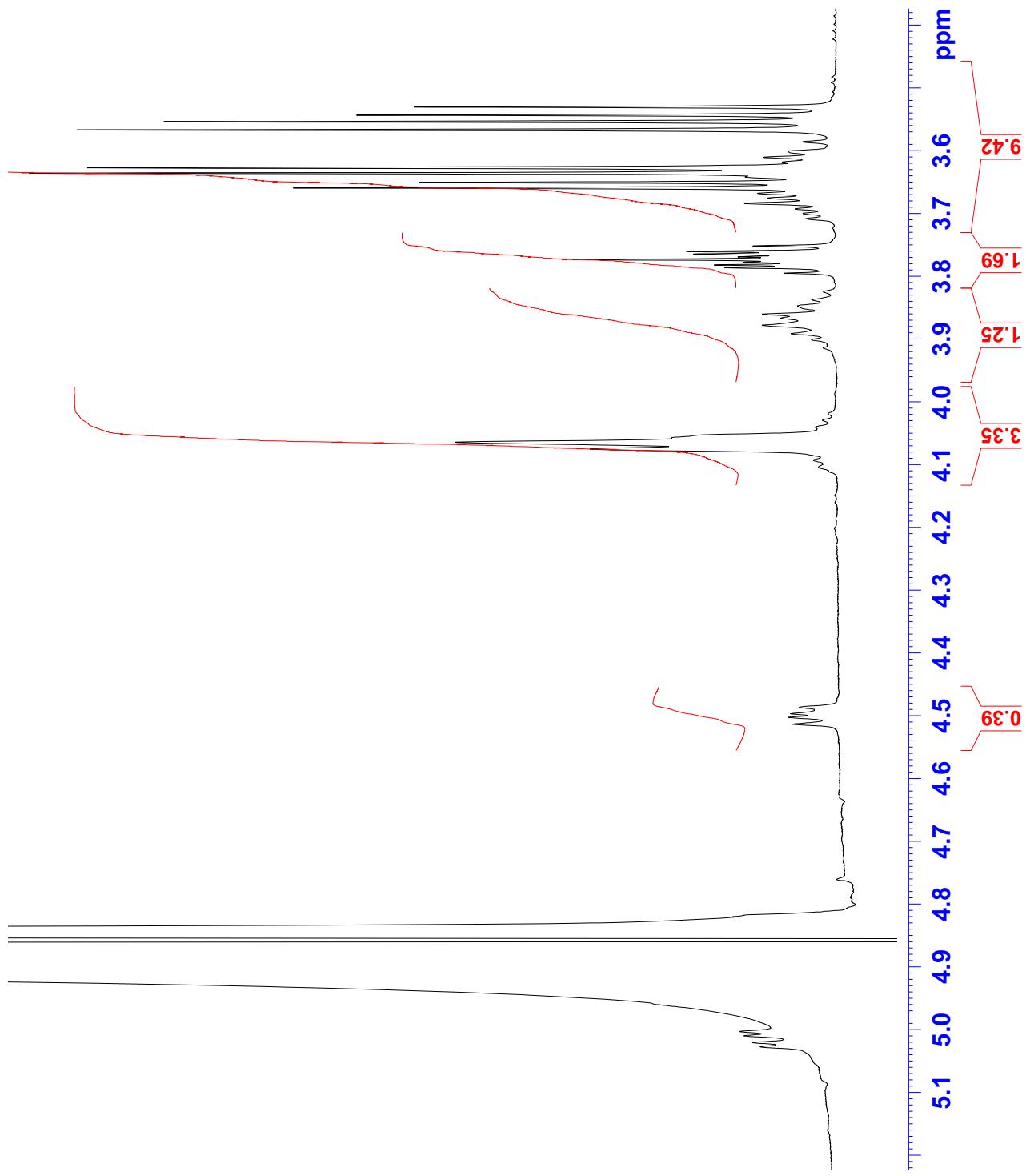
Current Data Parameters
NAME      NB_JP-170
EXPNO     51
PROCNO    1

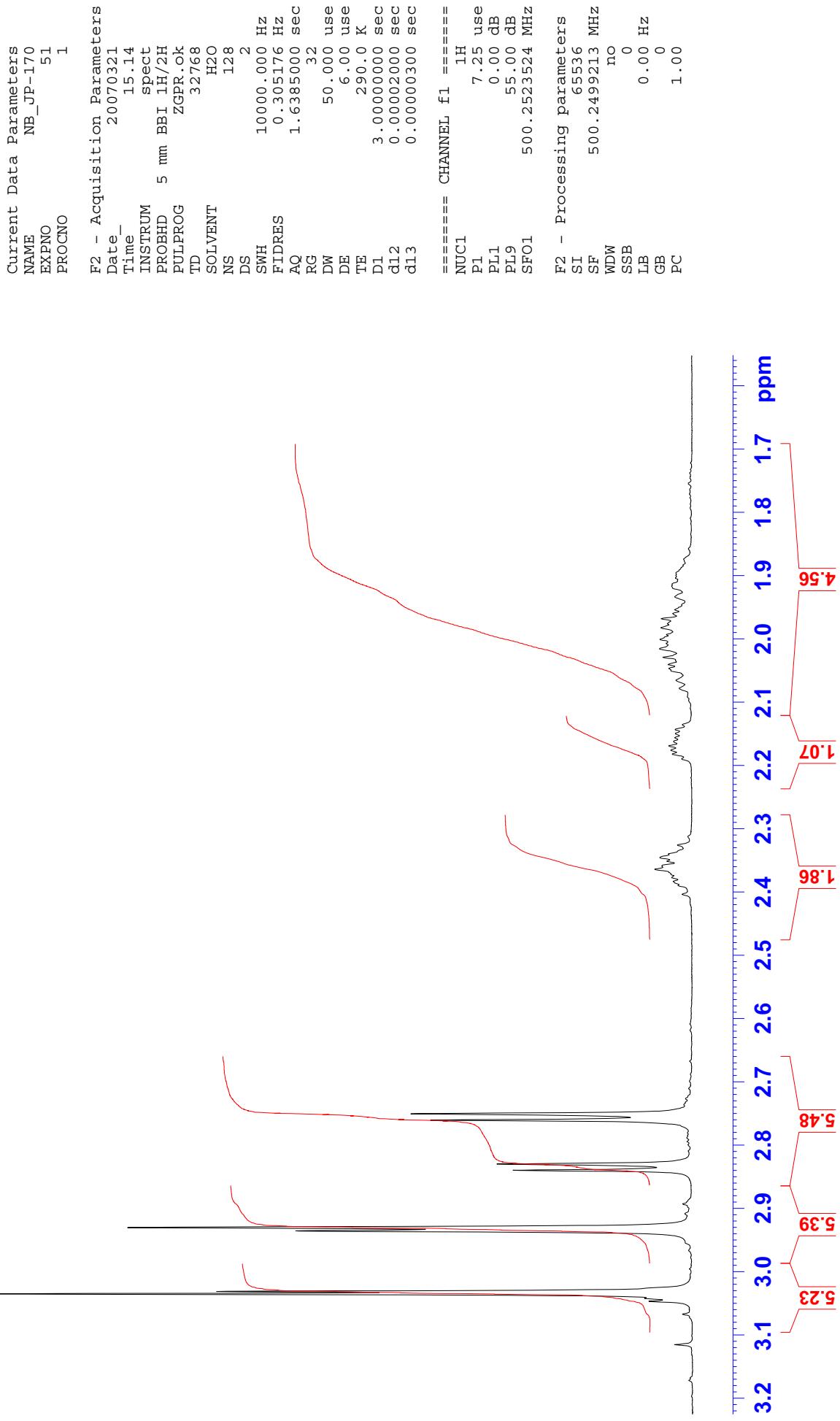
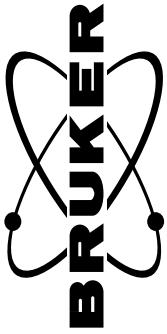
F2 - Acquisition Parameters
Date      2007/03/21
Time      15.14
INSTRUM spect
PROBHD  5 mm BBI 1H/2H
PULPROG ZGPR.ok
TD       32768
SOLVENT H2O
NS        128
DS         2
SWH      10000.000 Hz
FIDRES  0.305176 Hz
AQ       1.638500 sec
RG        32
DW       50.000 usec
DE       6.000 usec
TE       290.0 K
TEC      3.0000000 sec
D1      0.0000200 sec
d12     0.00000300 sec
d13     0.00000300 sec

===== CHANNEL f1 =====
NUC1      1H
P1        7.25 usec
PL1      0.00 dB
PL9      55.00 dB
SFO1    500.2523524 MHz

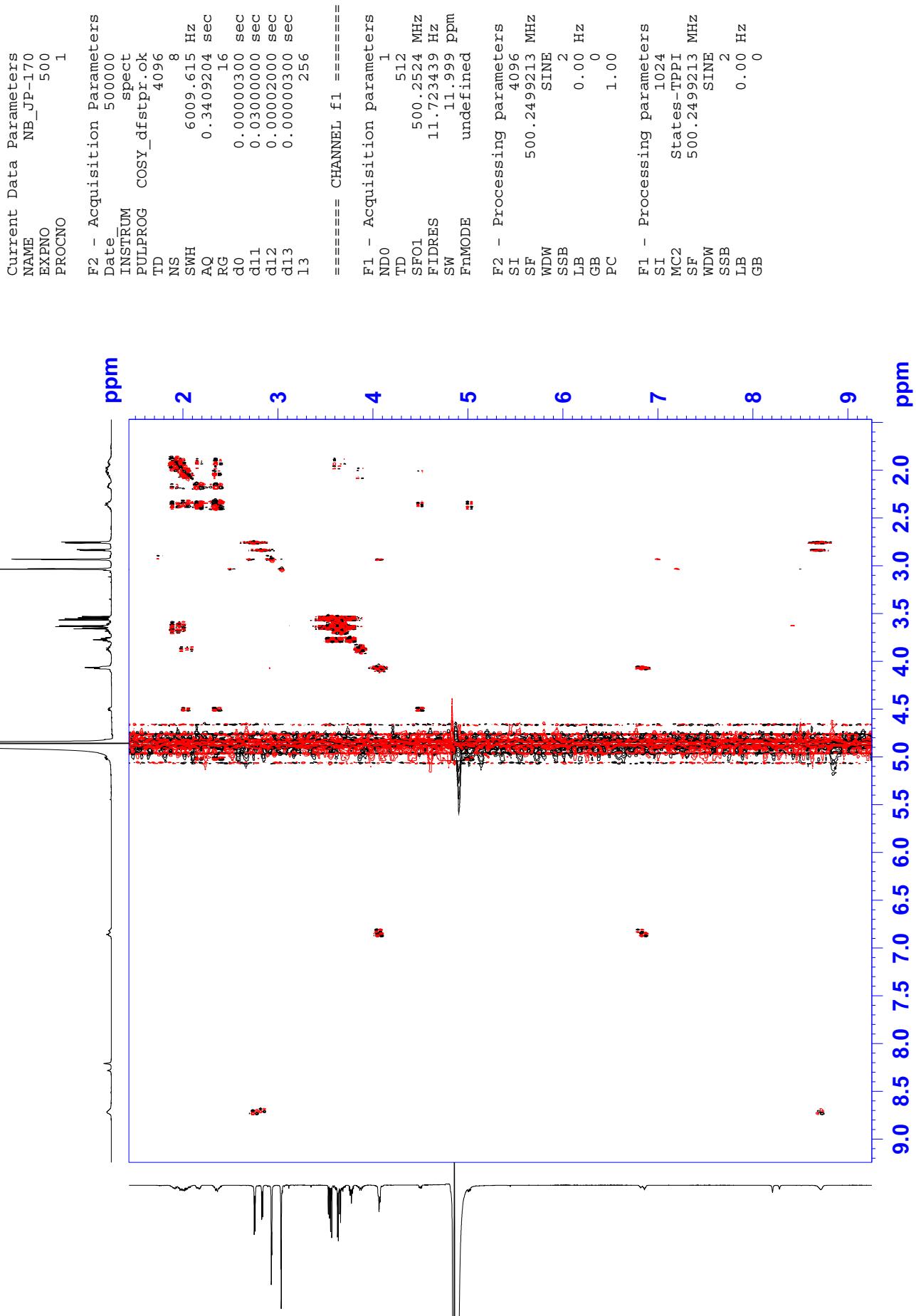
F2 - Processing parameters
SI       65536
SF      500.2499213 MHz
WDW      no
SSB      0
LB      0.00 Hz
GB      0
PC      1.00

```

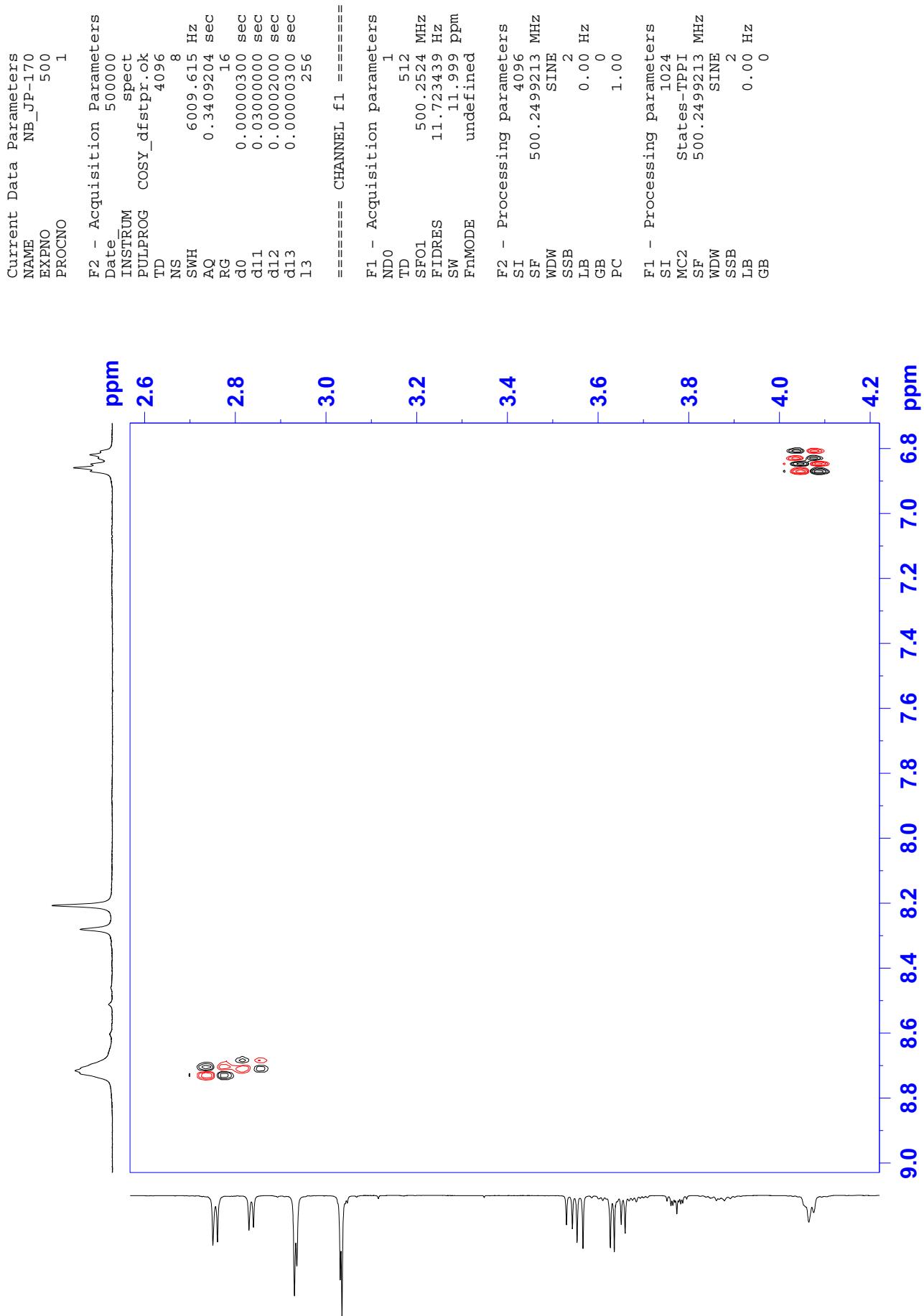




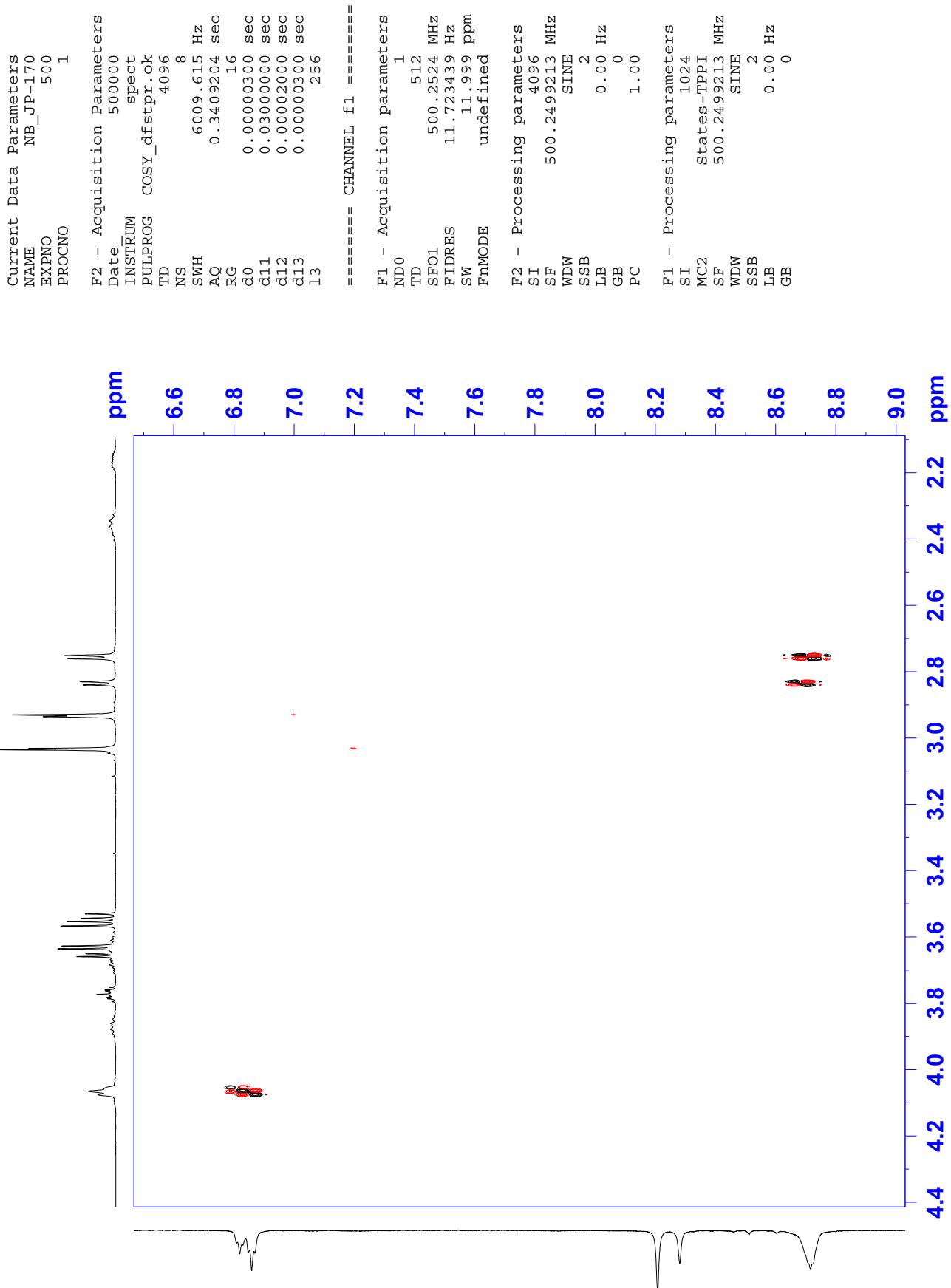
DRX-500: DQF-COSY with presaturation of JP-170 ( $\text{H}_2\text{O}/\text{D}_2\text{O}=9/1$ , 290K)



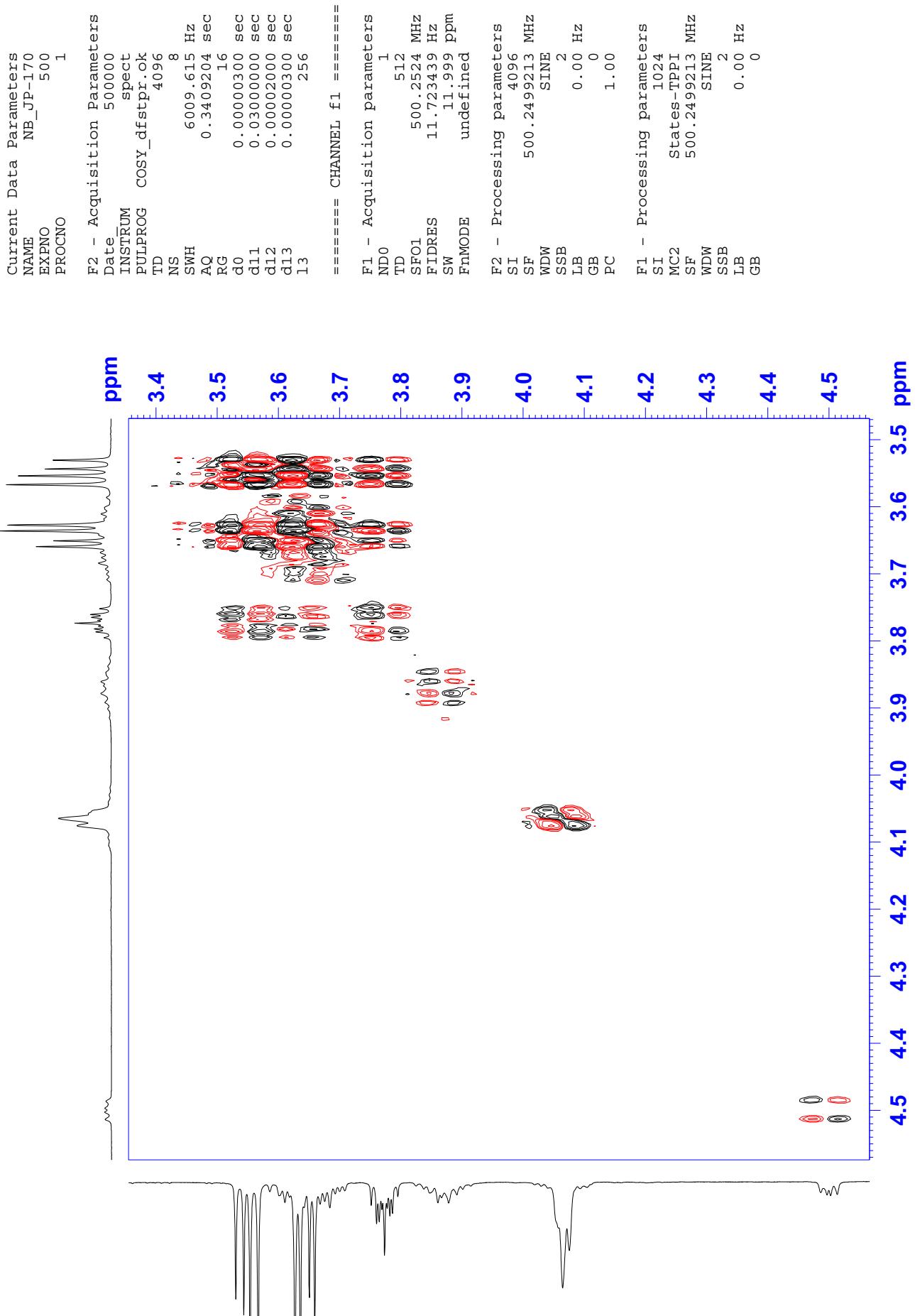
DRX-500: DQF-COSY with presaturation of JP-170 ( $\text{H}_2\text{O}/\text{D}_2\text{O}=9/1$ , 290K)



DRX-500: DQF-COSY with presaturation of JP-170 (H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K)



DRX-500: DQF-COSY with presaturation of JP-170 ( $\text{H}_2\text{O}/\text{D}_2\text{O}=9/1$ , 290K)



DRX-500: DQF-COSY with presaturation of JP-170 ( $H_2O/D2O=9/1$ , 290K)

Current Data Parameters  
NAME NB\_JP-170  
EXPNO 500  
PROCNO 1

F2 - Acquisition Parameters  
Date 500000  
INSTRUM spect  
PROBPRG COSY\_dfstpr.ok  
TD 4096  
NS 8  
SWH 6009.615 Hz  
AQ 0.3409204 sec  
RG 16  
d0 0.00000300 sec  
d11 0.03000000 sec  
d12 0.000002000 sec  
d13 0.00000300 sec  
d13 256

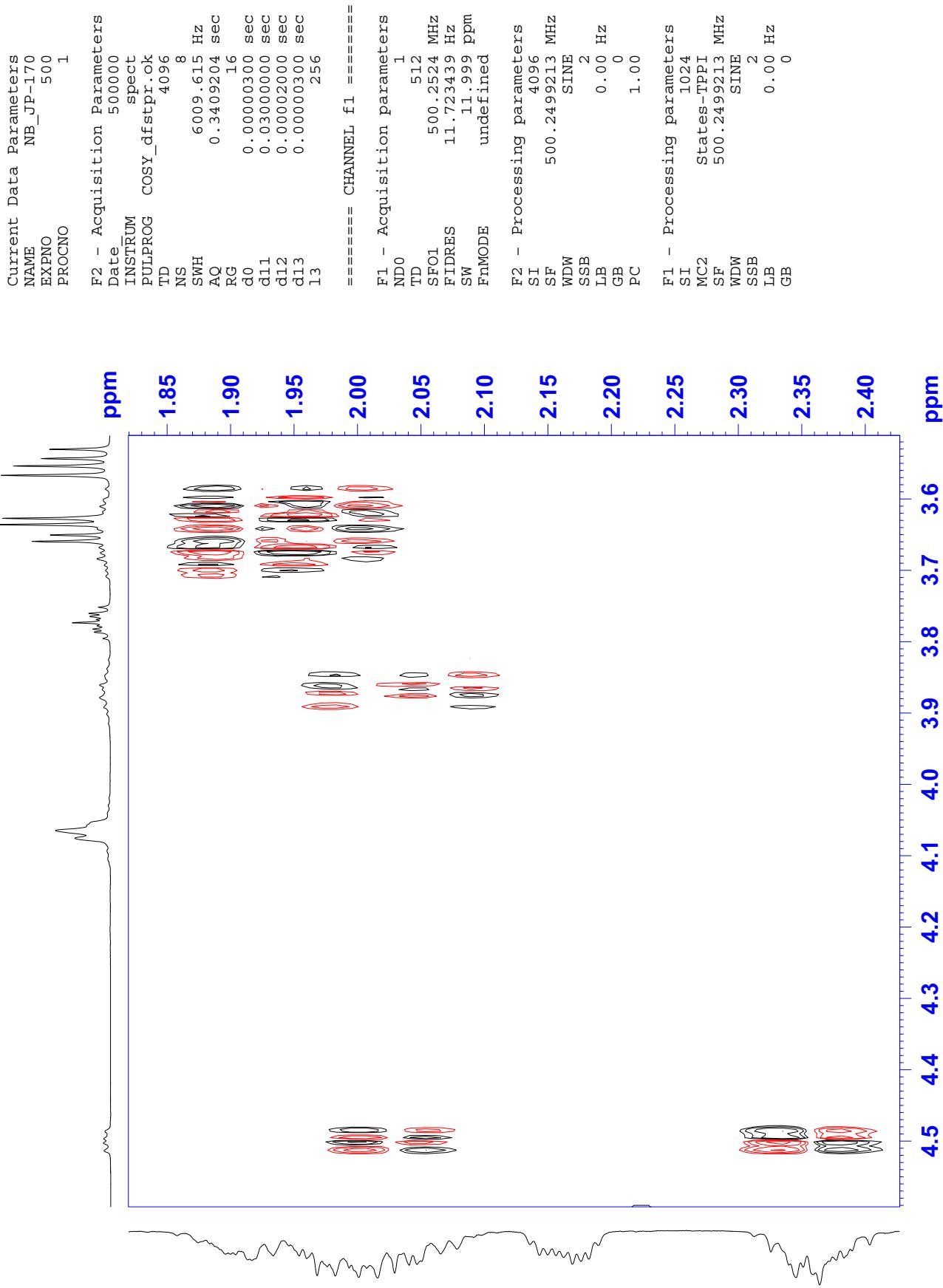
===== CHANNEL f1 =====

F1 - Acquisition parameters  
ND0 1  
TD 512  
SF01 500.2524 MHz  
FIDRES 11.723439 Hz  
SW 11.999 ppm  
FnMODE undefined

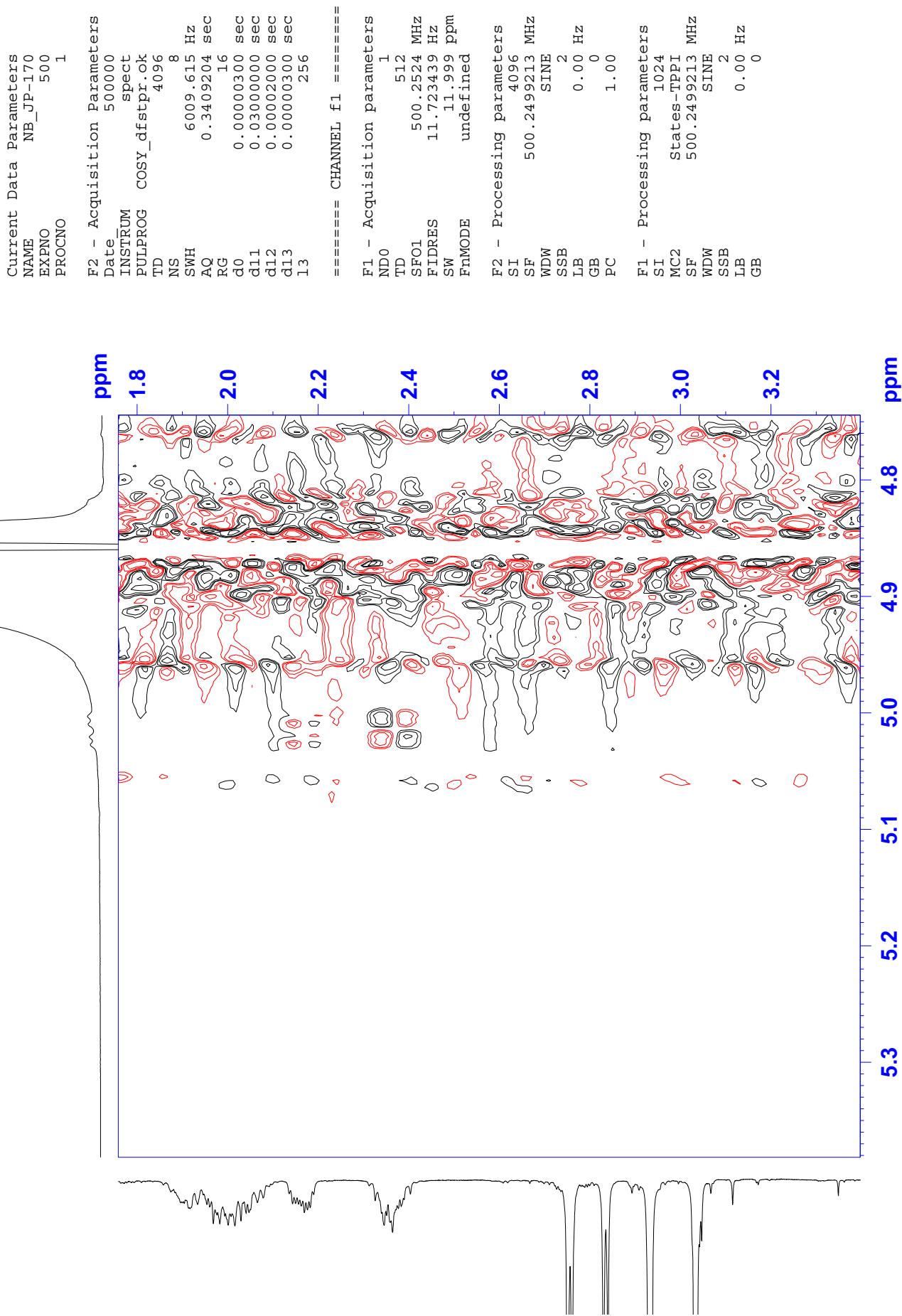
F2 - Processing parameters  
SI 4096  
SF 500.2499213 MHz  
WDW SINE  
SSB 2  
LB 0.00 Hz  
GB 0  
PC 1.00

F1 - Processing parameters  
SI 1024  
MC2 States-TPPPI  
SF 500.2499213 MHz  
WDW SINE  
SSB 2  
LB 0.00 Hz  
GB 0

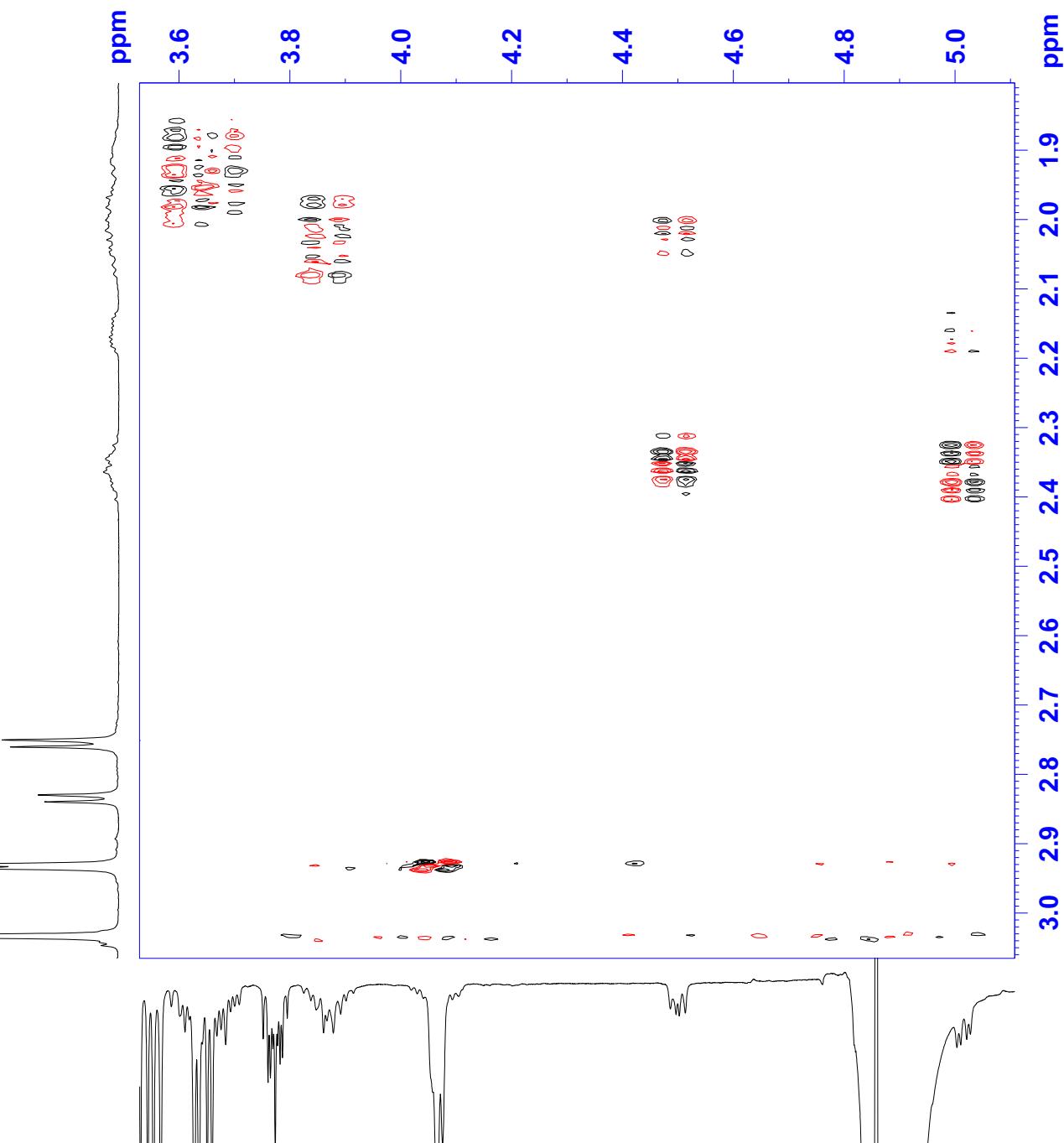
DRX-500: DQF-COSY with presaturation of JP-170 (H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K)



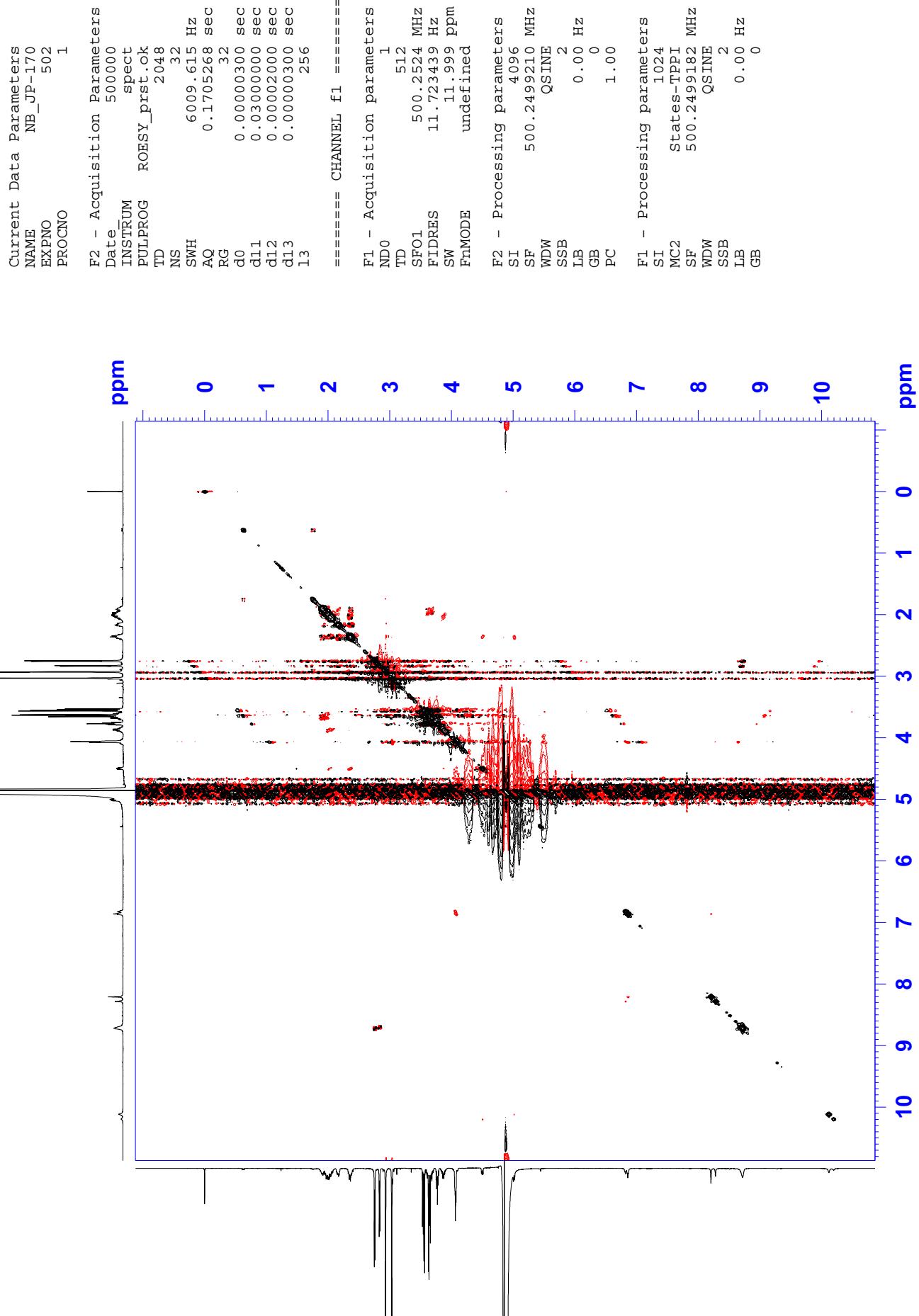
DRX-500: DQF-COSY with presaturation of JP-170 (H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K)



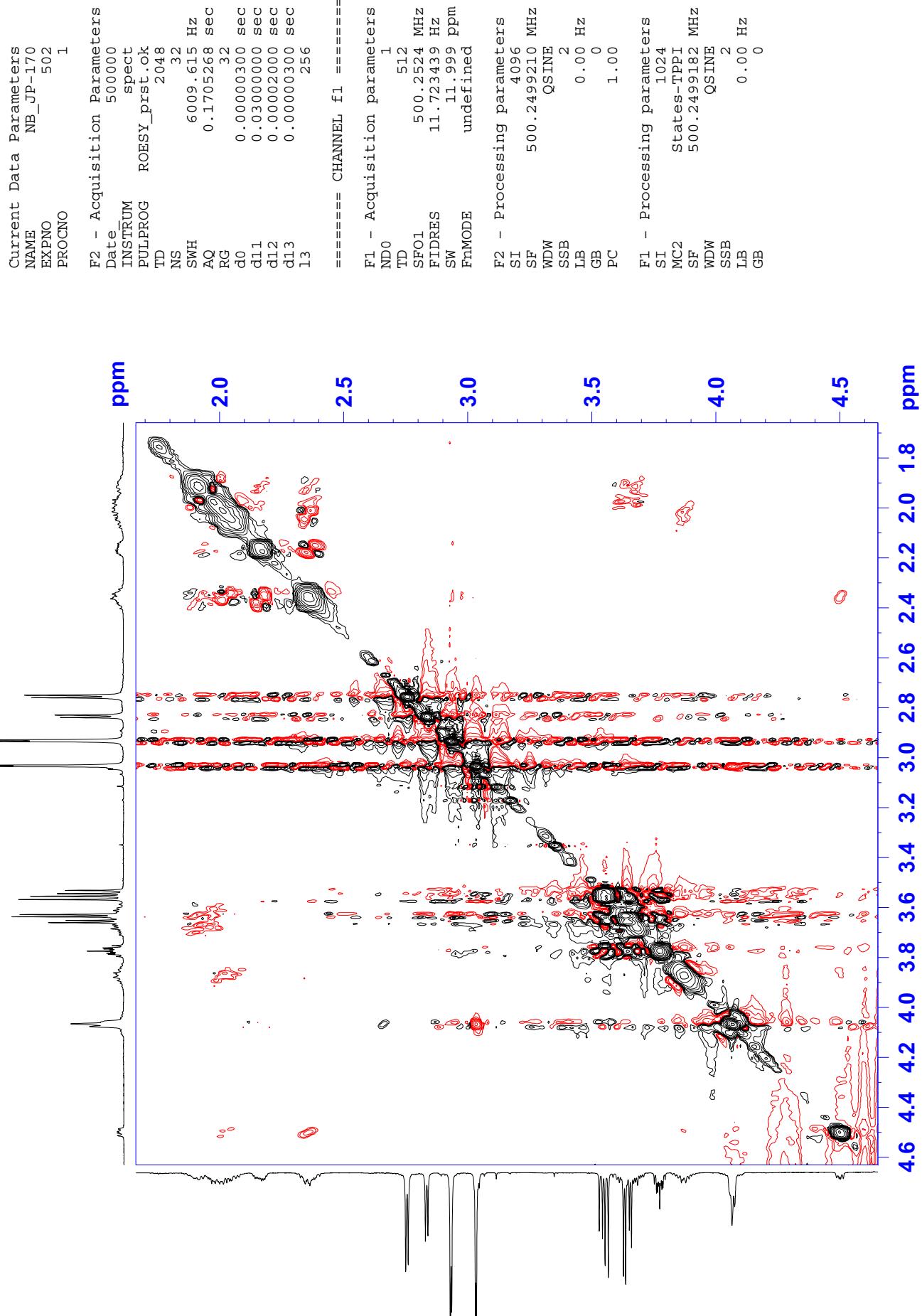
DRX-500: DQF-COSY with presaturation of JP-170 (H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K)



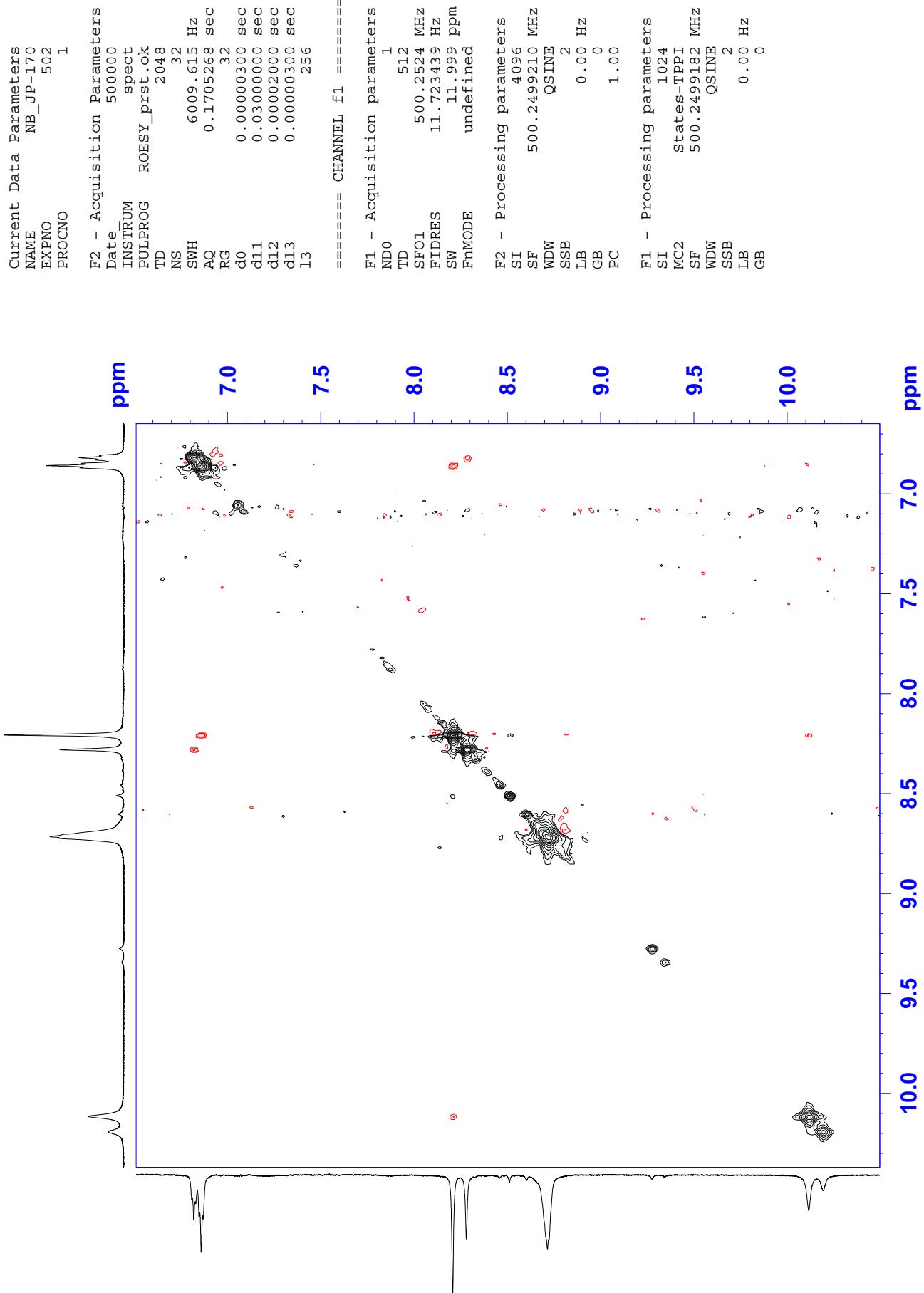
DRX-500: ROESY with presaturation of JP-170 (mixing time=250ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K



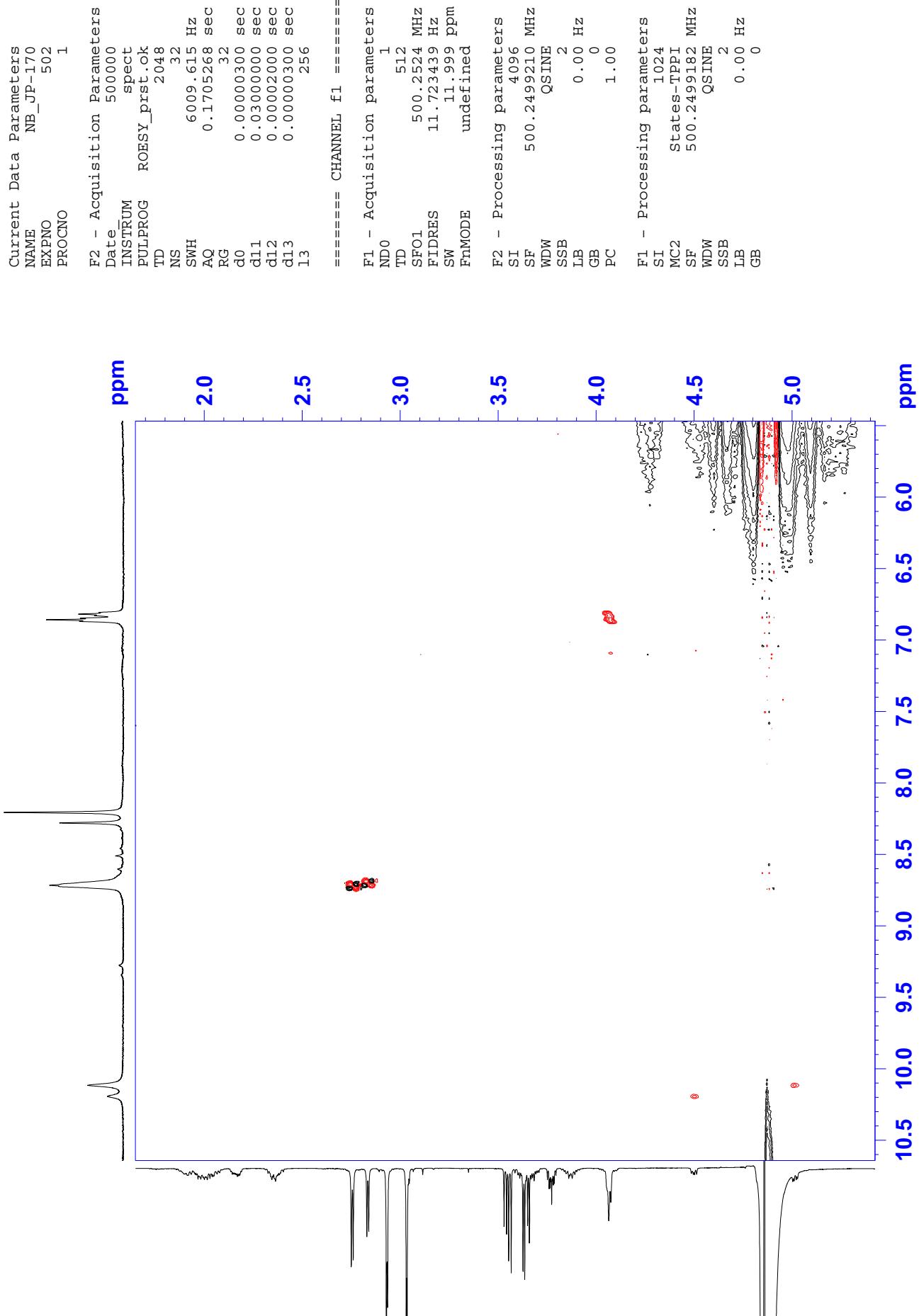
DRX-500: ROESY with presaturation of JPP-170 (mixing time=250ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K



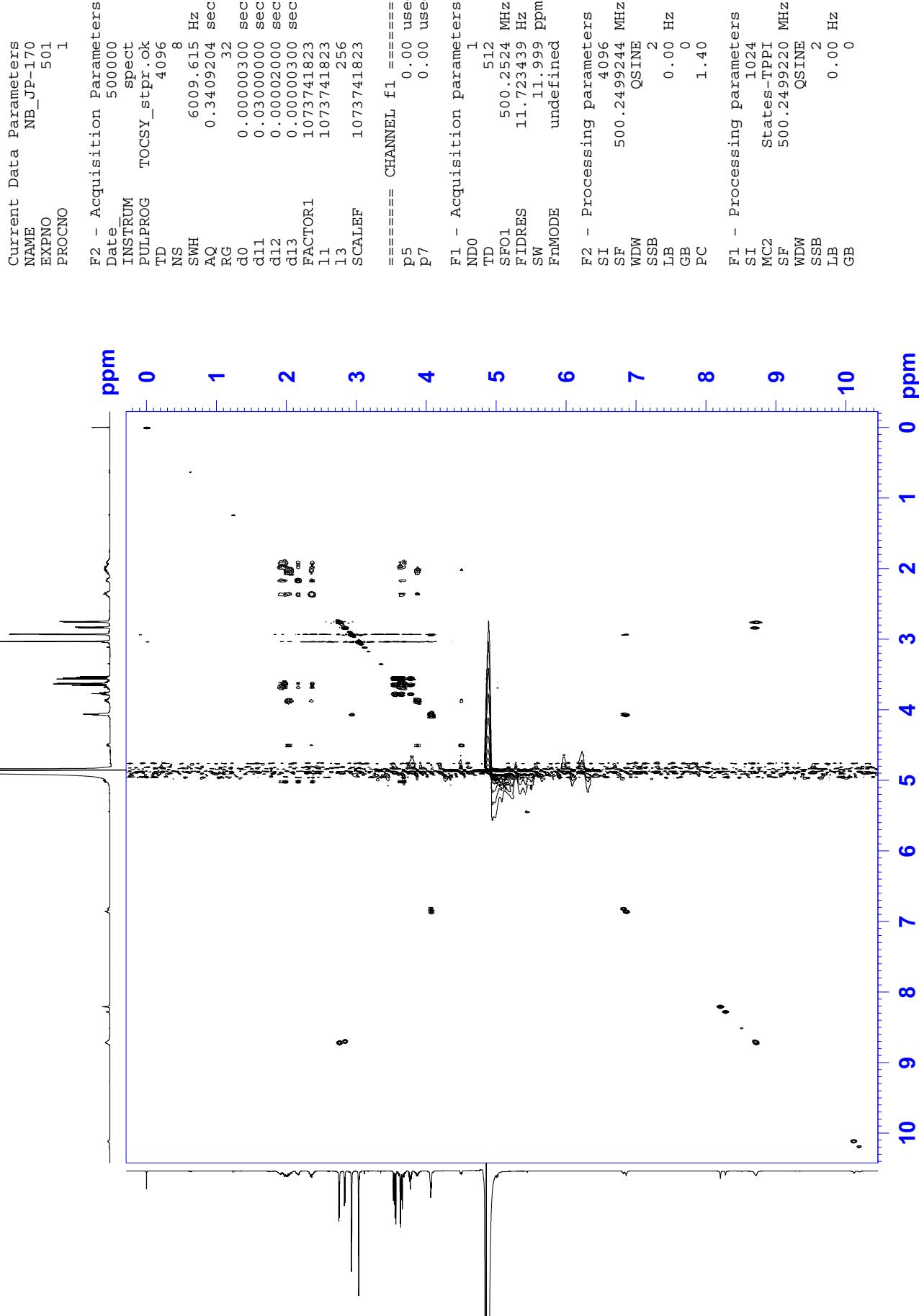
DRX-500: ROESY with presaturation of JP-170 (mixing time=250ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K



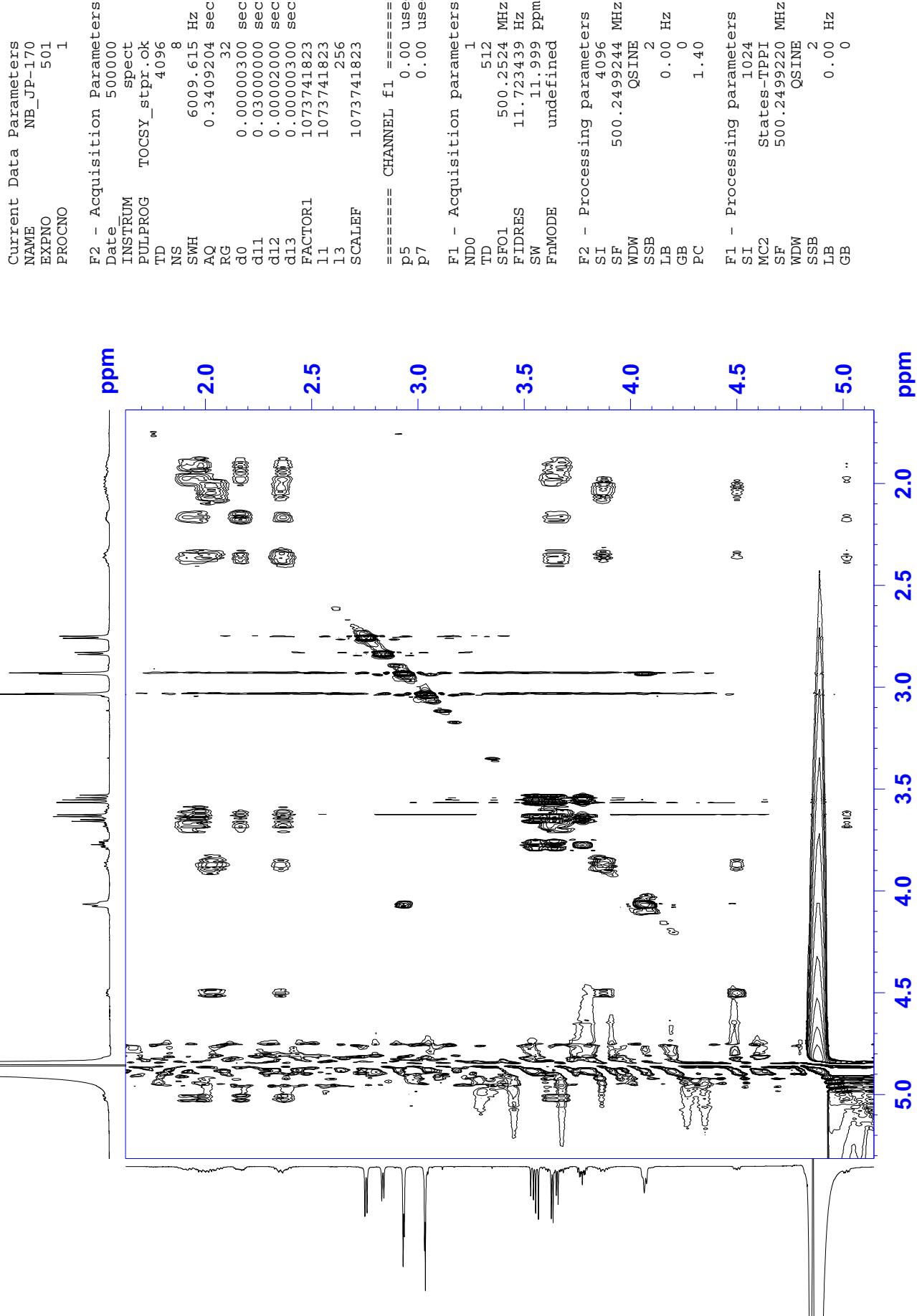
DRX-500: ROESY with presaturation of JP-170 (mixing time=250ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 290K



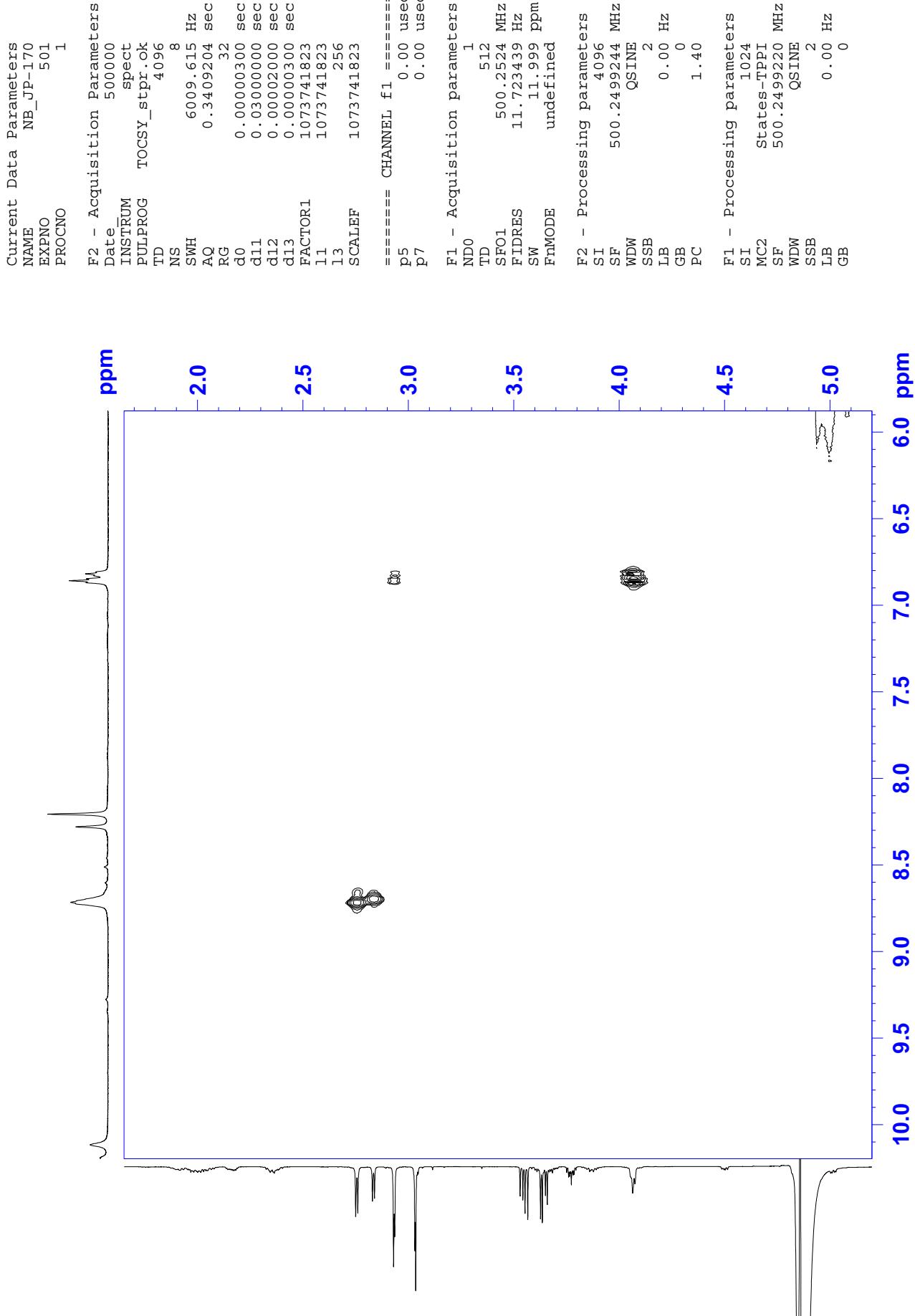
DRX-500: TOCSY with presaturation of JP-170 (mixing time=100ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 2

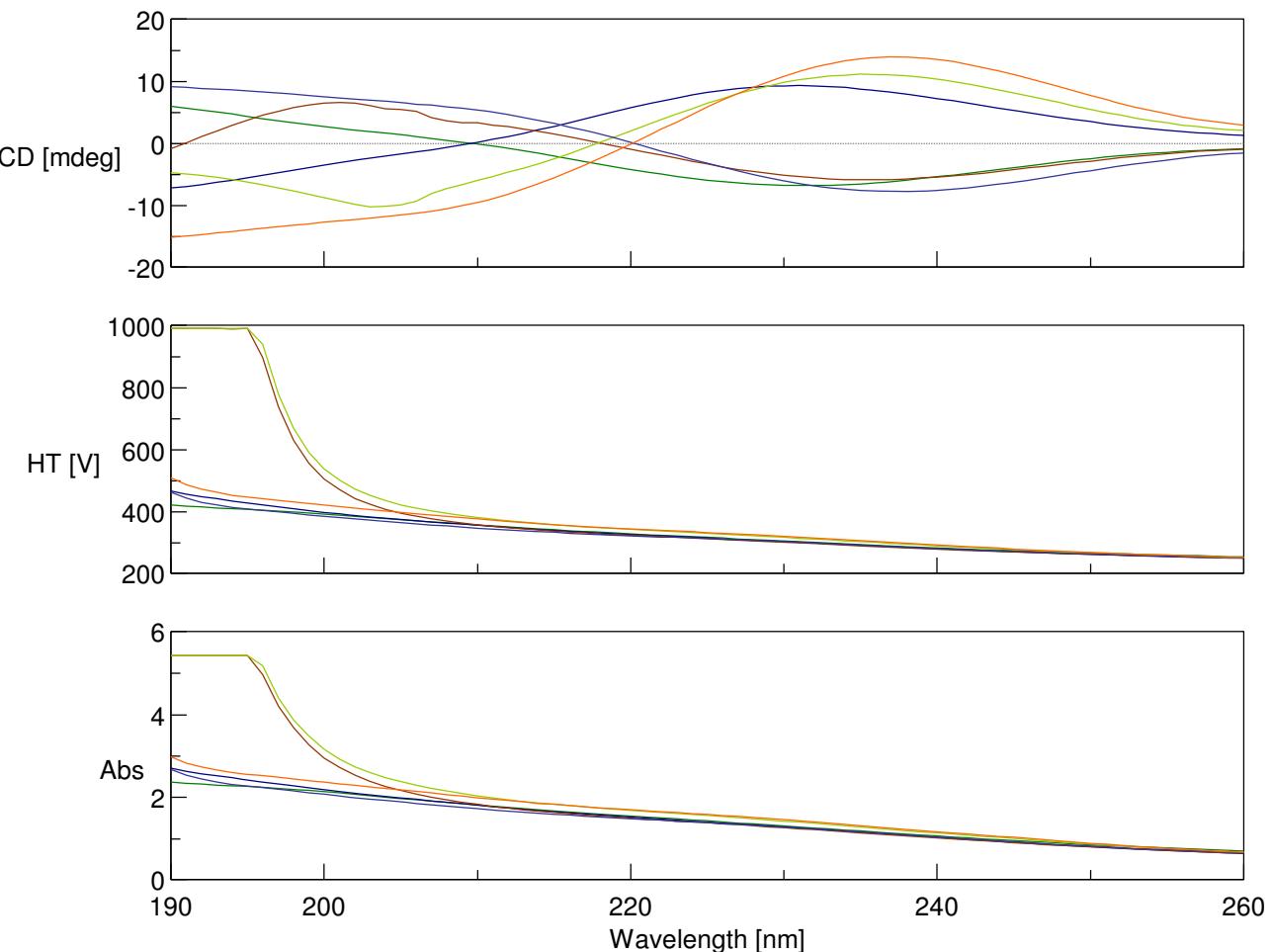


DRX-500: TOCSY with presaturation of JP-170 (mixing time=100ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 2



DRX-500: TOCSY with presaturation of JP-170 (mixing time=100ms, H<sub>2</sub>O/D<sub>2</sub>O=9/1, 2





#### [Measurement Information]

Comments  
 Instrument Name J-815  
 Sample Name FK 172  
 Model Name J-815  
 Comment  
 Serial No.  
 User B046961168  
 Division  
 Accessory CDF-426S  
 Company tu-wien  
 Accessory S/N A011561183  
 Temperature 21.99 C  
 Control Sonor Holder  
 Monitor Sensor Holder  
 Start Mode Start immediately  
 Cell Length 10 mm

FK 172.jws  
 FK 166.jws  
 FK 172.jws  
 FK 166.jws  
 FK 172.jws  
 FK 166.jws

#### [Detailed Information]

Creation date 21.12.2011 15:06

Measurement date 21.12.2011 15:03

Data array type Linear data array \* 3

Photometric Mode CD, HT, Abs  
 Measure Range 260 - 190 nm  
 Data pitch 1 nm  
 Sensitivity Standard  
 D.I.T. 1 sec  
 Bandwidth 1.00 nm  
 Start Mode Immediately  
 Scanning Speed 50 nm/min  
 Baseline Correction None  
 Shutter Control Auto  
 CD Detector PMT  
 PMT Voltage Auto  
 Accumulations 4  
 Concentration 100 umol/L

Horizontal axis Wavelength [nm]  
 Vertical axis(1) CD [mdeg]  
 Vertical axis(2) HT [V]  
 Vertical axis(3) Abs  
 Start 260 nm  
 End 190 nm  
 Data interval 1 nm  
 Data points 71