Synthesis of structurally defined scaffolds for bivalent ligand display based on glucuronic acid anilides. The degree of tertiary amide isomerism and folding depends on the configuration of a glycosyl azide.

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General Experimental Conditions

Optical rotations were determined with at the sodium D line at 20 °C. ^{1}H NMR Spectra were recorded at 300 and 500 MHz and ^{13}C NMR spectra at 75 MHz or 125 MHz. All ^{13}C spectra given are proton-decoupled. Chemical shifts are reported relative to internal Me_4Si in $CDCl_3$ (δ 0.0) or HOD for D_2O (δ 4.79) for ^{1}H and (δ 77.16) for ^{13}C. ^{13}C signals were assigned with the aid of DEPT-135. ^{1}H signals were assigned with the aid of 2D-COSY. Homonuclear coupling constants (Hz) were determined from the corresponding ^{1}H spectra. The use of presaturation for solvent suppression was carried out in recording the ^{1}H-NMR spectrum of **16**. TLC was performed on aluminium sheets precoated with Silica Gel 60 (HF_{254}, E. Merck) and spots visualized by UV and charring with H_2SO_4-EtOH (1:20). Flash Column Chromatography was carried out with Silica Gel 60 (0.040-0.630 mm, E. Merck) and using a stepwise solvent polarity gradient (starting from the conditions indicated in each case and increasing the polarity) correlated with TLC mobility. Chromatography solvents used were EtOAc (Riedel-deHaen), MeOH (Riedel-deHaen) and petroleum ether (b.p. 40-60°C, BDH laboratory supplies). Reaction solvents were freshly dried and distilled where stated: Acetonitrile, toluene and CH_2Cl_2 from calcium hydride, methanol from magnesium turnings and THF from sodium/benzophenone; anhydrous DMF and pyridine were used as purchased from Sigma-Aldrich. Semi-prep HPLC was carried out using acetonitrile/water mixtures as eluant with a flow rate of 10 mL/min. The semi preparative columns used were YMC-Pack C-4 (S-10μm, 250 x 20mm) and YMC-Pack ODS-AQ (S5μm, 250 x 20 mm), both reverse phase. Wavelength for semi preparative HPLC was 220 nm.

NOE and ROE Experiments

These NMR spectra were collected on a 500 MHz Spectrometer. All samples were made up in $CDCl_3$ or D_2O or D_2O:H_2O (10:90) at concentrations of 2.0 – 10.0 mg/mL. The spectra were run at temperatures of 5 °C or 30 °C with water suppression (transmitter presat) where appropriate. 2D NOESY (τ_{mix} = 0.4-1.0 s) and 2D TROESY (transverse-ROESY) spectra (τ_{mix} = 0.4-0.5 s) the phase-sensitive mode using States-TPPI for F1-quadrature detection in the indirect dimension with relaxation delays of 2.5 seconds (2048 in F2 and 1024 in F1 points were used). In the TROESY sequence the strength of the pulsed spin lock field(B1) was 2.2KHz. The 1D-NOE experiments were collected using a double pulsed field gradient spin echo 1D NOE sequence (DPFGNOE).

IR Spectroscopic studies

The data in Table 4 was obtained on an instrument with resolution of 2 cm^{-1} and spectra were recorded from 5000 to 400 cm^{-1}. The solution studies in $CDCl_3$ and $CHCl_3$ were recorded in KBr cells at concentrations of compounds of 1-2 mg/mL and for measurements in CCl_4 were recorded at concentrations <0.5 mg/mL. The absorbtion frequencies obtained for secondary amides were the same over a range of concentrations. Spectra recorded in the solid state were of pure solids and measured by diffuse reflectance.

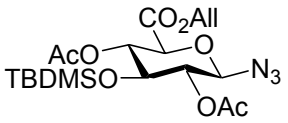
Molecular modelling

Monte Carlo conformational searches were carried out using Macromodel 8.5. The number of conformers generated was 20,000 and each was minimized using Merck Molecular Force Field (MMFF94). Structures greater than 10 kJ/mol above the lowest energy structure found were discarded. The H_4-C_4-O-H torsion was also constrained to both exclude hydrogen bonding with carbonyl group in order to prevent bias towards model structures with only these features.

Calculations were also carried out allowing this hydrogen bonding and low energy conformers with similar features were obtained. The MMFF94 force field was chosen over other force fields as it provided the most reasonable geometries for the azide groups. When conformer minimization had not converged then all structures in the output file were re-minimized using the MULT facility. Selected low energy structures obtained from the conformational search were optimized using DFT at the BLYP level of theory with the 6-31+G** basis set using Jaguar.

General deacetylation procedure: Sodium methoxide (0.01 mL of a freshly prepared 1.0 M solution in MeOH) was added to an ice-cold solution of reactant in methanol and the reactions were left to stir for 1h. The solvent was then evaporated and the residue was dissolved in water. The pH was lowered to 6.0 by adding Amberlite IR-120 (H^+) and filtration and freeze-drying afforded the desired compounds.

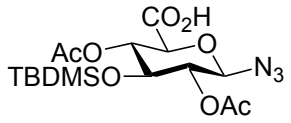
2,4-Di-*O*-acetyl-1-azido-3-*O*-*tert*-butyldimethylsilyl-1-deoxy-β-D-glucopyranuronic acid, allyl ester



To an ice-cold solution of allyl ester **22** (0.311 g, 0.906 mmol) in dry dichloromethane (10 mL), 2,6-lutidine (0.66 mL, 5.685 mmol) and *tert*-butyldimethylsilyl triflate (1.7 mL, 7.402 mmol) were added, respectively. The reaction was kept at 0 ˚C for 20 minutes and then warmed to room temperature. Deionised water (10 mL) was added and the two phases stirred for 10 minutes before separation. The organic layer was dried (Na_2SO_4), filtered and concentrated and the title compound obtained as a colourless syrup (0.485 g). This crude product can be carried on directly to the next step. Purification

by column chromatography (EtOAc: cyclohexane, 1:4) gave a sample for analytical purposes (0.135 g, 21%); ^{1}H-NMR (300 MHz, $CDCl_3$): δ 5.91 (m, 1H, C*H*=CH_2), 5.33 (m, 2H, CH=C*H*$_2$), 5.10 (dd, 1H, $J_{3,4}$ 8.9, H-4), 4.94 (apt t, 1H, $J_{2,3}$ 8.9, H-2), 4.62 (m, 2H, OC*H*$_2$CH=CH_2), 4.46 (d, 1H, $J_{1,2}$ 8.8, H-1), 3.98 (d, 1H, $J_{4,5}$ 10.0, H-5), 3.89 (apt t, 1H, H-3) , 2.12, 2.06 (each s, each 3H, each COC*H*$_3$), 0.81 (s, 9H, SiC(C*H*$_3$)$_3$), 0.05 (s, 6H, Si(C*H*$_3$)$_2$); ^{13}C-NMR ($CDCl_3$): δ 169.3, 169.1 (each s, each *C*OCH_3), 166.4 (s, *C*OOAll), 131.1 (d, *C*H=CH_2), 119.5 (t, CH=*C*H$_2$), 88.0 (d, C-1), 74.5, 72.7, 72.6, 71.6 (each d, C-2— 5), 66.7 (t, O*C*H$_2$CH=CH_2), 25.4 (q, SiC(*C*H$_3$)$_3$), 21.0, 20.9 (each q, each CO*C*H$_3$), 17.7 (s, Si*C*(CH$_3$)$_3$), -4.6, -4.6 (each q, each Si(*C*H$_3$)$_2$); FTIR (CH_2Cl_2 solution): 2956, 2859, 2121, 1755, 1474, 1389, 1220 cm^{-1}; ES-HRMS: Found 480.1788, required 480.1778 $[M+Na]^+$.

2,4-Di-*O*-acetyl-1-azido-3-*O*-*tert*-butyldimethylsilyl-1-deoxy-β-D-glucopyranuronic acid



The allyl ester prepared as described above (0.485 g, ~0.906 mmol) was dissolved in freshly distilled acetonitrile (10 mL) and reacted at 0 ˚C with Pd(Ph$_3$)$_4$ (0.104 g, 0.090 mmol) and pyrrolidine (0.10 mL, 1.200 mmol) for 30 minutes. The mixture was filtered through celite and the solvent evaporated; the yellow oily residue was taken into EtOAc and washed with deionised water. The two layers were separated and the aqueous phase, containing the carbohydrate product, was acidified to pH 2 using Amberlite IR-120. The beads were filtered off and the filtrate shaken with EtOAc to extract the sugar back into organic phase. After drying (Na_2SO_4), filtration and evaporation under reduced pressure of the organic layer gave the title compound as an orange solid (0.259 g, 68% over two steps); $[\alpha]_D$ -40º (*c* 0.2, $(CH_3)_2CO$); ^{1}H-NMR (300 MHz, $CDCl_3$): δ 7.00 (br s, 1H, COO*H*), 5.13 (apt t, 1H, $J_{3,4}$ 8.9, H-4), 4.93 (apt t, 1H, $J_{2,3}$ 8.8, H-2), 4.52 (d, 1H, $J_{1,2}$ 8.8, H-1), 4.03 (d, 1H, $J_{4,5}$ 9.8, H-5), 3.92 (apt t, 1H,

H-3) , 2.13, 2.10 (each s, each 3H, each COC*H*$_3$), 0.82 (s, 9H, SiC(C*H*$_3$)$_3$), 0.05 (s, 6H, Si(C*H*$_3$)$_2$); ^{13}C-NMR ($CDCl_3$): δ 170.1, 170.0 (each s, each *C*OCH$_3$), 169.2 (s, *C*OOH), 87.9 (d, C-1), 73.8, 72.6, 72.5, 71.4 (each d, C-2— 5), 25.4 (q, SiC(*C*H$_3$)$_3$), 21.0, 20.9 (each q, each CO*C*H$_3$), 17.8 (s, Si*C*(CH$_3$)$_3$), -4.6, -4.7 (each q, each Si(*C*H$_3$)$_2$); FTIR (KBr): 3447, 2962, 2916, 2859, 2121, 1753, 1375, 1224, 1093, 1037, 842 cm^{-1}; ES-HRMS: Found 440.1455, required 440.1465 $[M+Na]^+$.

Preparation of 18. 2,4-Di-*O*-acetyl-1-azido-3-*O*-*tert*-butyldimethylsilyl-1-deoxy-β-D-glucopyranuronic acid (0.052 g, 0.125 mmol), HOBt (0.024 g, 0.178 mmol), *p*-phenylendiamine (0.007 g, 0.065 mmol) and DIPEA (0.02 mL, 0.115 mmol) in freshly distilled dichloromethane (1 mL) were reacted under N_2 atmosphere with EDCI (0.031 g, 0.165 mmol) for 30 minutes at 0 ˚C and 3 days at room temperature. The solution was then diluted with dichloromethane (5 mL) and deionised water (5 mL) added: the two phases were vigorously stirred for 10 minutes and separated. The organic layer was dried (Na_2SO_4), filtered and concentrated under reduced pressure: the residue (0.064 g) was purified by slow column chromatography (dichloromethane: EtOAc, 15:1) to give **18** as a white solid (0.021 g, 36%), R_f 0.68 (EtOAc: dichloromethane, 1:4), $[\alpha]_D$ -54º (*c* 0.3, $(CH_3)_2CO$); ^{1}H-NMR (300 MHz, $CDCl_3$): δ 7.99 (s, 2H, N*H*), 7.42 (s, 4H, Ar H), 5.12 (apt t, 2H, $J_{3,4}$ 9.0, H-4), 4.95 (apt t, 2H, $J_{2,3}$ 8.8, H-2), 4.65 (d, 2H, $J_{1,2}$ 9.0, H-1), 4.00 (d, 2H, $J_{4,5}$ 9.6, H-5), 3.95 (apt t, 2H, H-3) , 2.15, 2.13 (each s, each 6H, each COC*H*$_3$), 0.82 (s, 18H, SiC(C*H*$_3$)$_3$), 0.07 (s, 12H, Si(C*H*$_3$)$_2$); ^{13}C-NMR ($CDCl_3$): δ 169.6, 169.1 (each s, each *C*OCH$_3$), 164.3 (s, *C*ONH), 133.4 (s, Ar C), 121.6 (d, Ar *C*H), 88.2 (d, C-1), 75.2, 72.8, 72.5, 71.8 (each d, C-2— 5), 25.4 (q, SiC(*C*H$_3$)$_3$), 21.1, 21.0 (each q, each CO*C*H$_3$), 17.8 (s, Si*C*(CH$_3$)$_3$), -4.6, -4.7 (each q, each Si(*C*H$_3$)$_2$); FTIR (KBr): 3431, 2958, 2947, 2121, 1755, 1671, 1623, 1374, 1251, 1220, 1152, 1091, 1037, 839, 780 cm^{-1}; ES-HRMS: Found 907.3654, required 907.3689 $[M+H]^+$.

Preparation of 19. Compound **18** (0.026 mg, 0.028 mmol) was dissolved in anhydrous DMF (1.0 mL) and cooled to 0 ˚C under nitrogen. Sodium hydride (60 % dispersion in mineral oil, 0.005 g, 0.125 mmol) and methyl iodide (0.01 mL, 0.160 mmol) were added respectively. The reaction was judged to be complete after 40 min and water and EtOAc were added and the layers separated. The organic layer was dried (Na_2SO_4) and the solvent removed: the residual yellow oil was subjected to silica gel chromatography (EtOAc: dichloromethane, 1:15) to give the title compound as a white solid (0.021 g, 80%), $[\alpha]_D$ +21º (*c* 0.8, $(CH_3)_2CO$); FTIR (KBr): 2957, 2932, 2858, 1220, 1756, 1674, 1511, 1373, 1219, 1072, 1036, 841 cm^{-1}; ES-HRMS: Found 935.3959, required 935.4002 $[M+H]^+$;^{1}H-NMR at room temperature displayed very broad signals while at 5 ˚C two sets of signals were detected. For the <u>*EE* symmetric compound</u> (63% by NMR integration)**:** ^{1}H-NMR (500 MHz, $CDCl_3$, 5 ˚C): δ 7.45 (br s, 4H, Ar H), 5.27 (apt t, 2H, $J_{3,4}$ 9.0, H-4), 4.68 (apt t, 2H, $J_{2,3}$ 9.0, H-2), 4.09 (d, 2H, $J_{1,2}$ 8.9, H-1), 4.02 (d, 2H, $J_{4,5}$ 9.9, H-5), 3.79 (apt t, 2H, H-3), 3.29 (s, 6H, NCH_3), 2.12 (s, 6H, COCH_3), 2.06 (s, 6H, COCH_3, overlapping with one COCH_3 of *EZ*), 0.81 (s, 18H, SiC(CH_3)$_3$, overlapping with *EZ* signals), 0.01, 0.00 (each s, each 6H, each Si(CH_3)$_2$); ^{13}C-NMR ($CDCl_3$, 5 ˚C): δ 169.2, 169.0 (each s, each *C*OCH$_3$), 164.8 (s, *C*ONMe), 142.4 (s, Ar C), 128.6 (d, Ar *C*H), 88.1 (d, C-1), 74.2, 72.5, 72.4, 72.0 (each d, C-2— 5), 39.0 (q, N*C*H$_3$), 25.4 (q, SiC(*C*H$_3$)$_3$, overlapping with *EZ* signals), 21.4, 21.1 (each q, each CO*C*H$_3$), 17.8 (s, Si*C*(CH$_3$)$_3$), -4.4, -4.6 (each q, each Si(*C*H$_3$)$_2$); For the <u>*EZ* asymmetric compound</u> (37%)**,** ^{1}H-NMR (500 MHz, $CDCl_3$, 5 ˚C)[1]: δ 7.33 (br s, 4H, Ar H), 5.42 (apt t, 1H, $J_{3,4}$ 9.5, H-4), 5.35 (apt t, 1H, $J_{3',4'}$ 9.5, H-4'), 5.01 (apt t, 1H, $J_{2',3'}$ 9.0, H-2'), 4.80 (apt t, 1H, $J_{2,3}$ 9.0, H-2), 4.54 (d, 1H, $J_{1',2'}$ 8.9, H-1'), 4.32 (d, 1H, $J_{4',5'}$ 9.7, H-5'), 3.99 (d, 1H, $J_{1,2}$ 8.9, H-1), 3.95 (apt t, 1H, H-3'), 3.88 (d, 1H, $J_{4,5}$ 9.4, H-5), 3.69 (apt t, 1H, H-3), 3.60 (s, 3H, NCH_3), 3.29 (s, 3H, NC$H_{3'}$, overlapping with N*Me* of *EE*), 2.17 (s, 3H, COCH_3), 2.09 (s, 3H, COCH_3), 2.06 (two s, each 3H, each

[1] The ' denotes signals belonging to the Z sugar residue.

COC*H*$_3$, overlapping with COC*H*$_3$ of *EE*), 0.84 (two s, each 3H, each SiC(C*H*$_3$)$_3$), 0.81 (four s, each 3H, each SiC(C*H*$_3$)$_3$, overlapping with *EE* signals), 0.08 (two s overlapping, each 3H, each Si(C*H*$_3$)$_2$), 0.06, -0.02 (each s, each 3H, each Si(C*H*$_3$)$_2$); ^{13}C-NMR ($CDCl_3$, 5˚C, selected signals): δ 169.7, 169.5 (each s, each *C*OCH$_3$), 169.2 (s, *C*OCH$_3$, overlapping with *EE* signals), 168.5 (s, *C*OCH$_3$), 165.7, 164.7 (each s, each *C*ONMe), 143.4, 140.9 (each s, each Ar C ipso), 128.2, 127.4 (each d, each Ar *C*H), 88.5, 88.4 (each d, C-1 and C-1'), 72.7 (two signals overlapping), 72.6, 71.1, 71.1 (each d, carbohydrate ring CHs), 38.2, 38.1 (each q, each N*C*H$_3$).

2,3,4,6-Tetra-*O*-acetyl-α-D-mannopyranosyl trichloroacetimidate 23

Penta-*O*-acetyl-α/β-D-mannopyranoside (13.98 g, 35.81 mmol) and benzylamine (5.90 mL, 54.01 mmoles) in THF (140 mL) were stirred for 20 h at room temperature, after which the reaction did not seem to proceed further. The solvent was evaporated and the crude material was taken into dichloromethane and washed progressively with HCl 1.0 M (50 mL x 2), sodium hydrogen carbonate (satd. aq., 50 mL) and deionised water (50 mL). The organic layer was dried over Na_2SO_4 and concentrated leaving a yellow oil (17.97 g) that was subjected to column chromatography (EtOAc: petroleum ether, 1:4) gave 2,3,4,6-tetra-*O*-acetyl-D-mannopyranose (12.48 g, 99%), R_f 0.38 (EtOAc: petroleum ether, 1:1). NMR data (^{1}H and ^{13}C) were in agreement with those described in the literature;[2] ^{1}H-NMR (300 MHz, $CDCl_3$) δ 5.43 (dd, 1H, $J_{2,3}$ 3.2, $J_{3,4}$ 10.0, H-3), 5.31 (apt t, 1H, $J_{4,5}$ 9.5, H-4, overlapping with H-2), 5.28 (dd, 1H, $J_{1,2}$ 1.8, H-2, overlapping with H-4), 5.25 (dd, 1H, $J_{OH,H-1}$ 4.0, H-1), 4.24 (m, 2H, $J_{5,6}$ 2.5, $J_{5,6'}$ 5.0, H-5 and H-6), 4.13 (apt dd, 1H, $J_{6,6'}$ 8.0, H-6'), 3.16 (d, 1H, O*H*), 2.17, 2.11, 2.05, 2.00 (each s, each 3H, each COC*H*$_3$); ^{13}C-NMR ($CDCl_3$): 171.2, 170.5, 170.4, 170.1 (each s, each *C*OCH$_3$), 92.4 (d, C-1), 70.3, 69.0, 68.7, 66.4 (each d, C-2— 5), 62.8 (t, C-

[2] Ponpipom, M. M.; Bugianesi, R. L.; Shen, T. Y. *Carbohydr*. *Res*. **1980**, *82*, 141.

6), 21.1, 21.0, 21.0, 20.9 (each q, each CO*C*H_3). To this hemiacetal (1.243 g, 3.564 mmol) in anhydrous dichloromethane (50 mL), in presence of 4 Å molecular sieves and under N_2, trichloroacetonitrile (4.3 mL, 42.884 mmol) and sodium hydride (60% dispersion in mineral oil, 0.214 g, 5.350 mmol) were added respectively. After an hour the solution was filtered through Celite and concentrated and the crude residue was purified by column chromatography (EtOAc: petroleum ether, 1:2) to yield **24** as a foam (1.264 g, 90%), R_f 0.56 (EtOAc: petroleum ether, 1:1); ^{1}H-NMR (300 MHz, $CDCl_3$) δ 8.79 (s, 1H, N*H*), 6.28 (d, 1H, $J_{1,2}$ 1.8, H-1), 5.43 (m, 1H, H-2), 5.40 (m, 2H, H-3 and H-4), 4.20 (m, 3H, H-5, H-6 and H-6'), 2.20, 2.08, 2.07, 2.01 (each s, each 3H, each COC*H*$_3$); ^{13}C-NMR ($CDCl_3$): 170.8, 170.1, 170.0, 169.9 (each s, each *C*OCH_3), 160.0 (s, *C*NH), 94.8 (d, C-1), 71.5, 69.0, 68.1, 65.6 (each d, C-2— 5), 62.3 (t, C-6), 21.0, 20.9 (two signals overlapping), 20.8 (each s, each CO*C*H_3).

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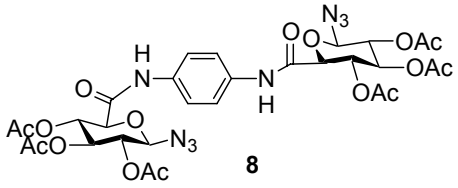

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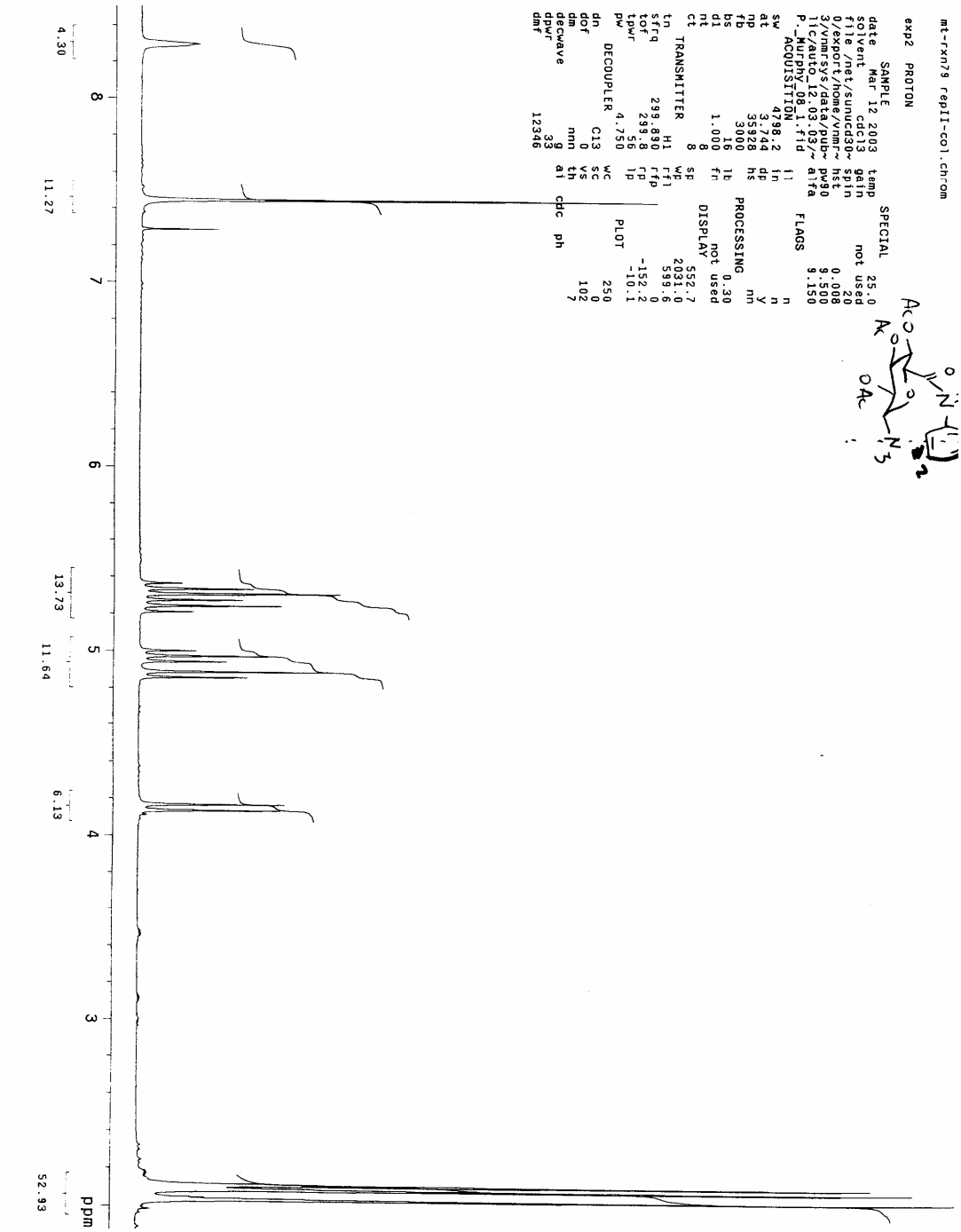
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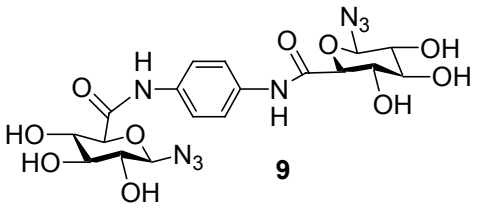

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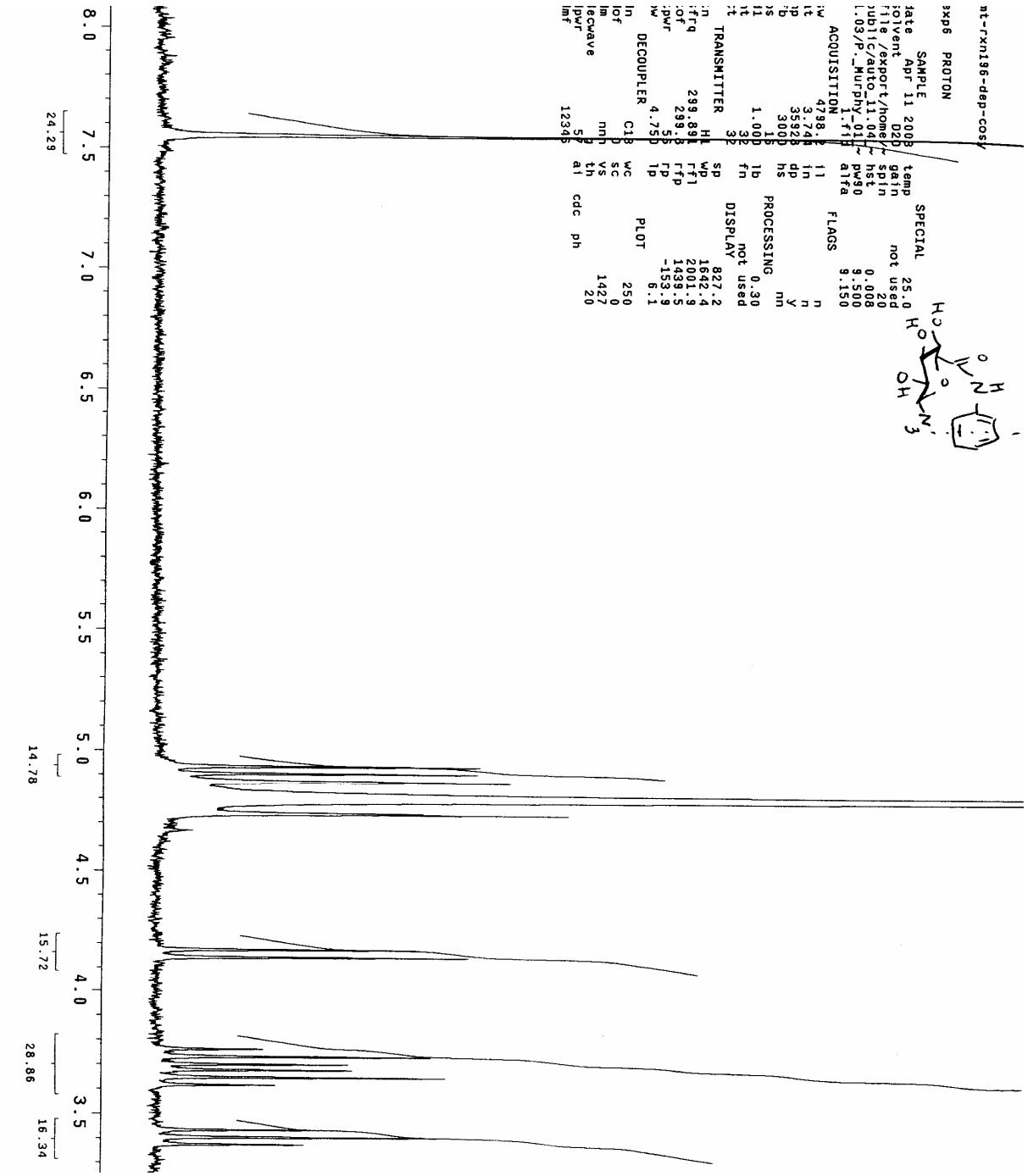
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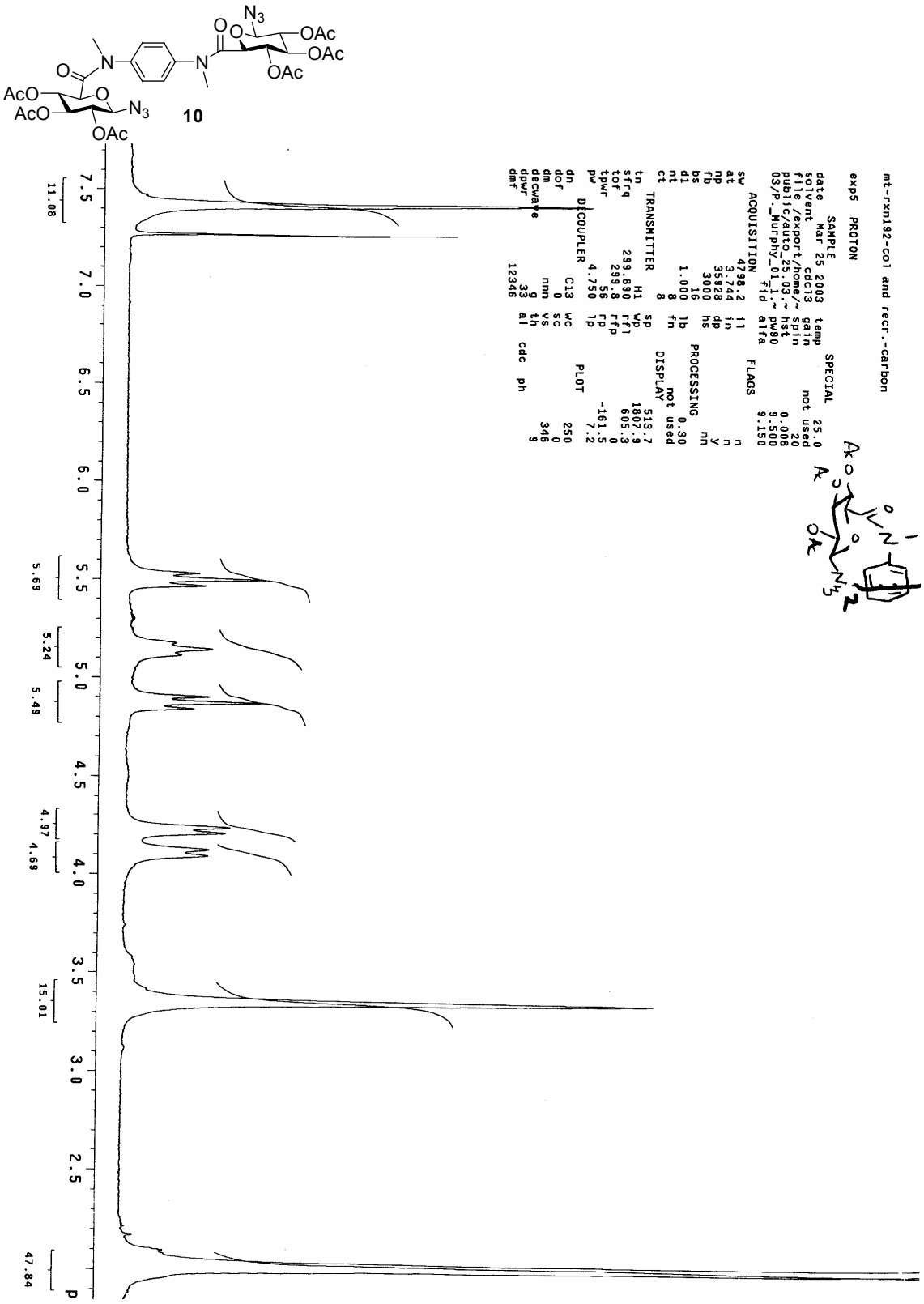
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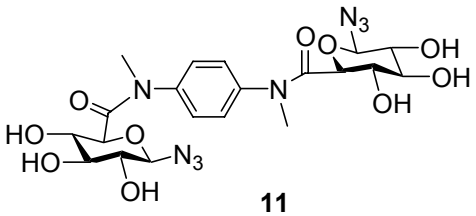
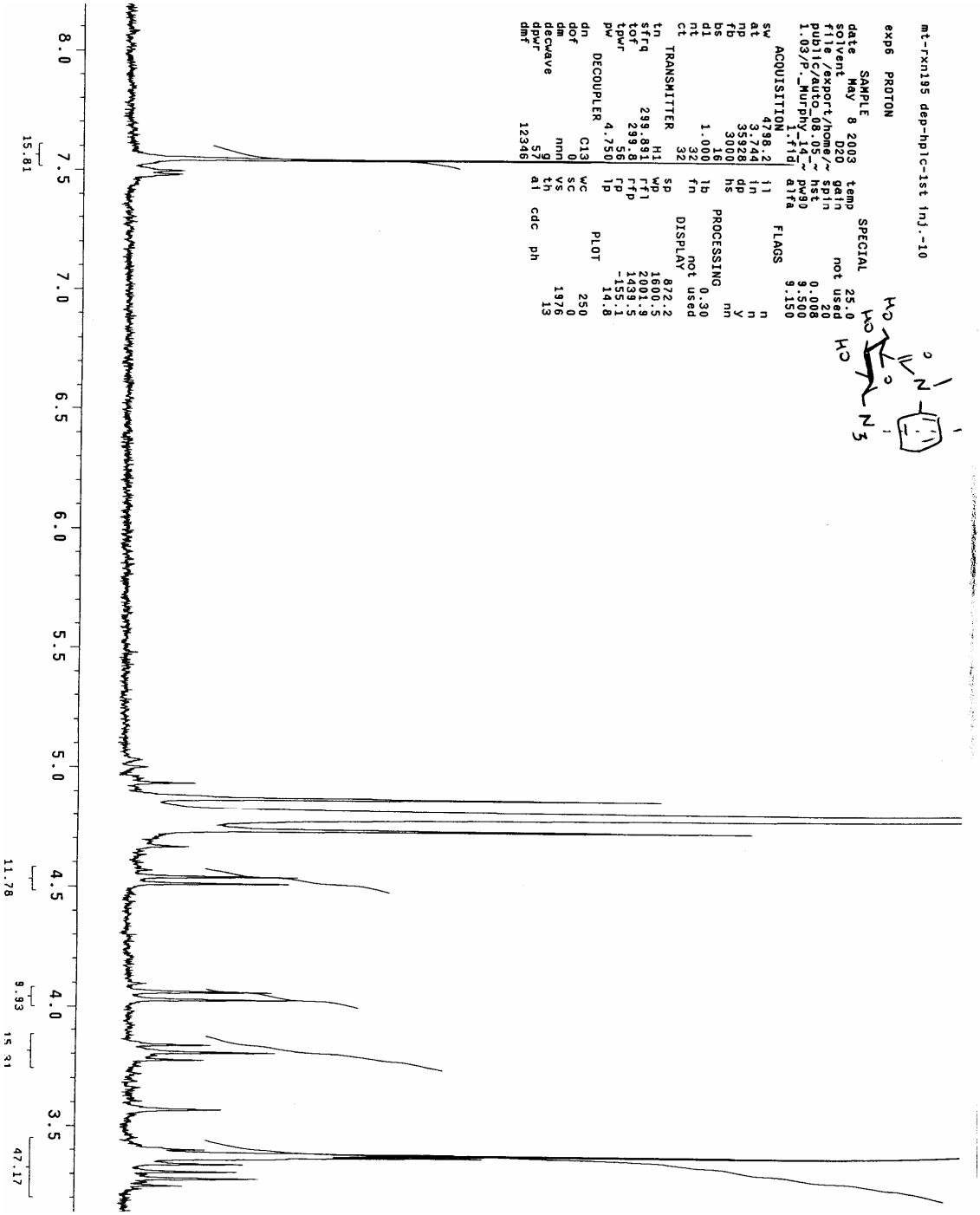
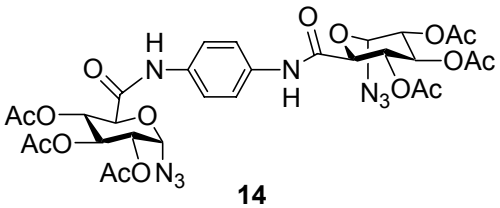


11

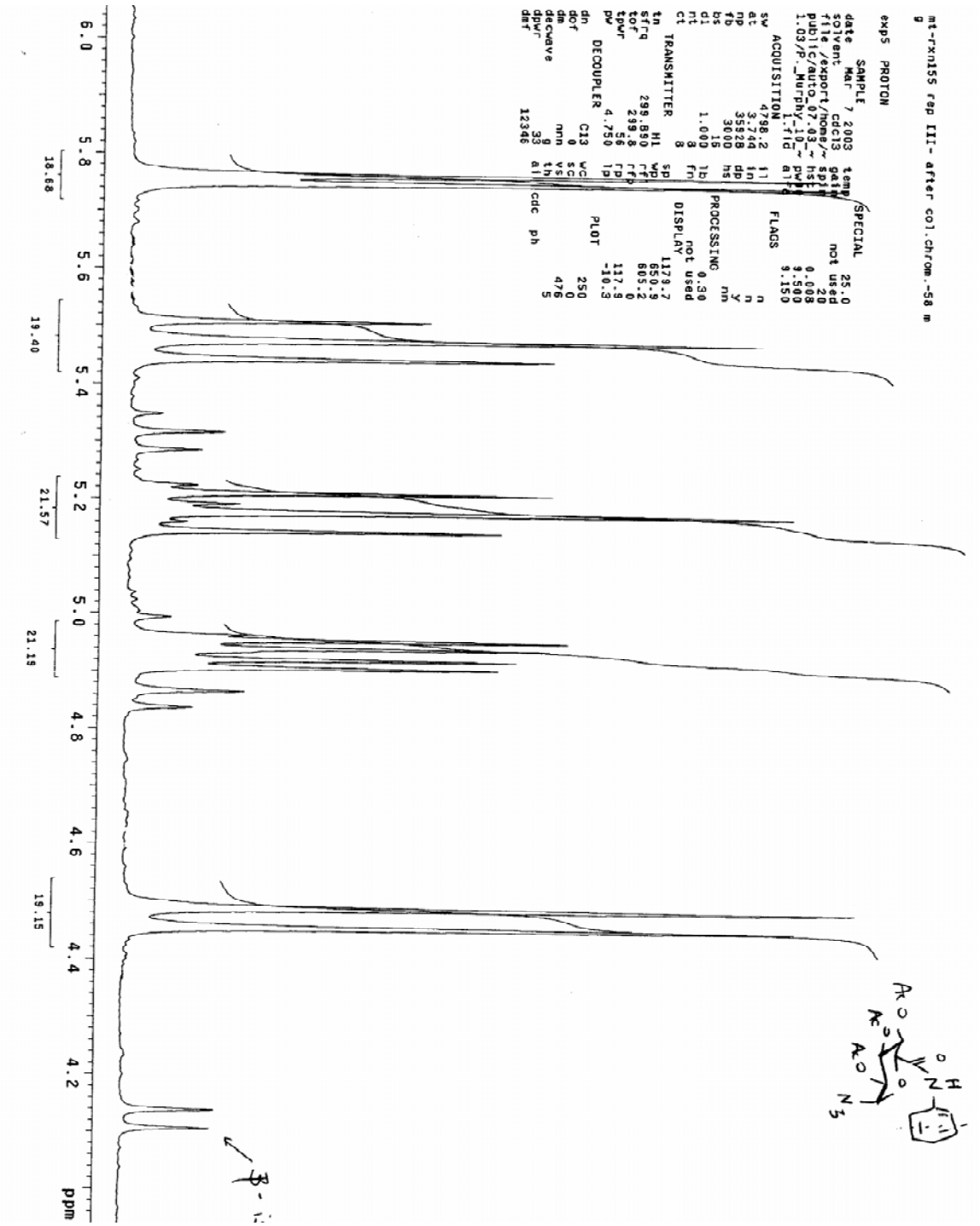

mt-rxn195 dep-hplc-1st inj.-10
exp6 PROTON
SAMPLE
date May 8 2003
solvent D2O
file /export/home/~
public/auto_08.05_~
1.03/P._Murphy_14_~
ACQUISITION
sw 4798.2
at 3.744
np 35928
fb 3000
bs 16
d1 1.000
nt 32
ct 32
TRANSMITTER
tn H1
sfrq 299.891
tof 299.8
tpwr 56
pw 4.750
DECOUPLER
dn C13
dof 0
dm nnn
decwave g
dpwr 57
dmf 12346
SPECIAL
temp 25.0
gain not used
spin 20
hst 0.008
pw90 9.500
alfa 9.150
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 0.30
fn not used
DISPLAY
sp 872.2
wp 1600.5
rfl 2001.9
rfp 1439.5
rp -155.1
lp 14.8
PLOT
wc 250
sc 0
vs 1976
th 13
ai cdc ph
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
15.81
11.78
9.93
47.17

^{1}H-NMR of

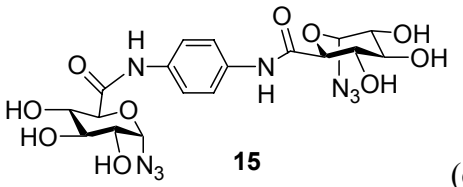


14

(includes 23% of **8**)

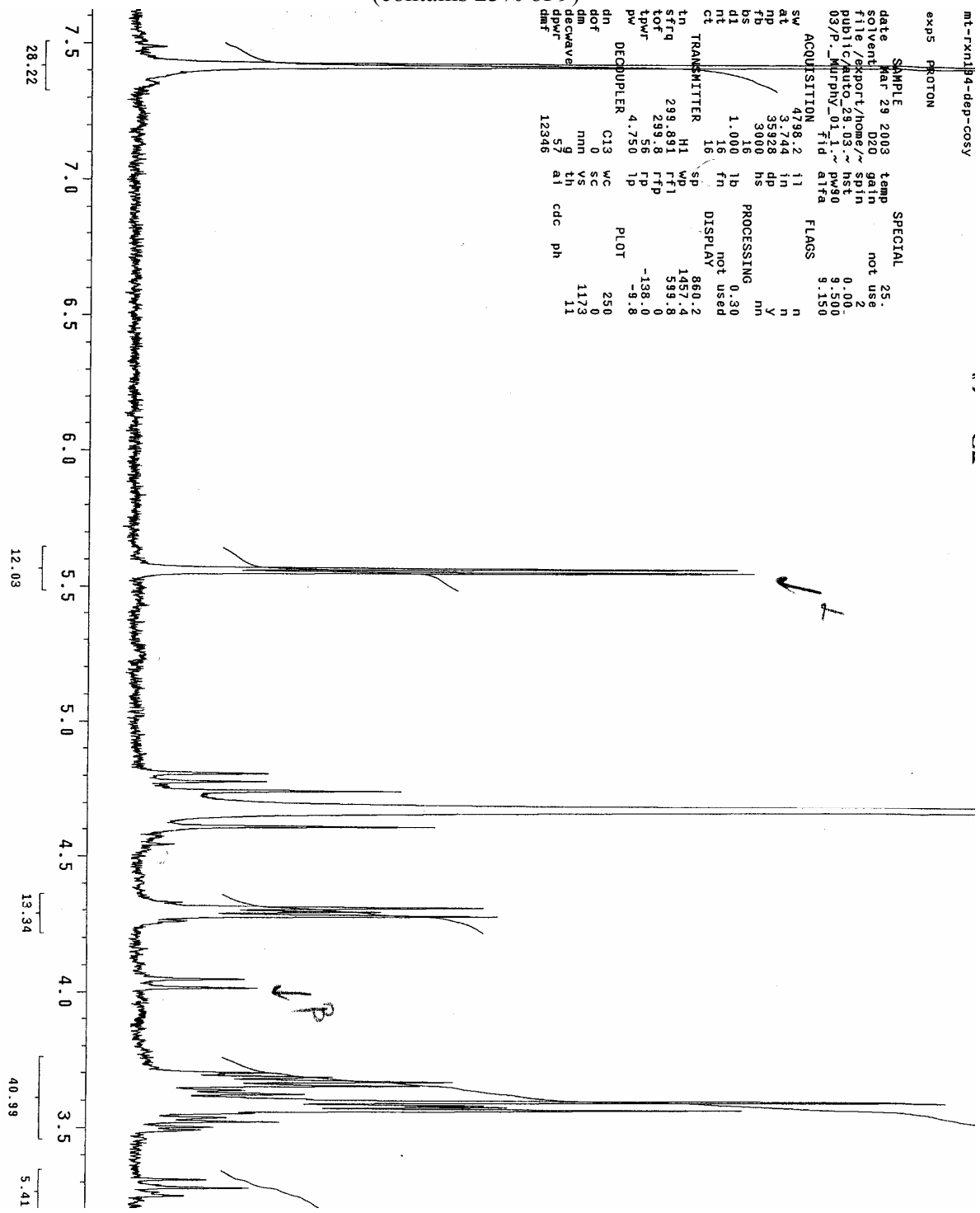


^{1}H-NMR of

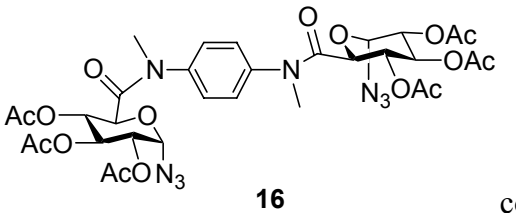


15

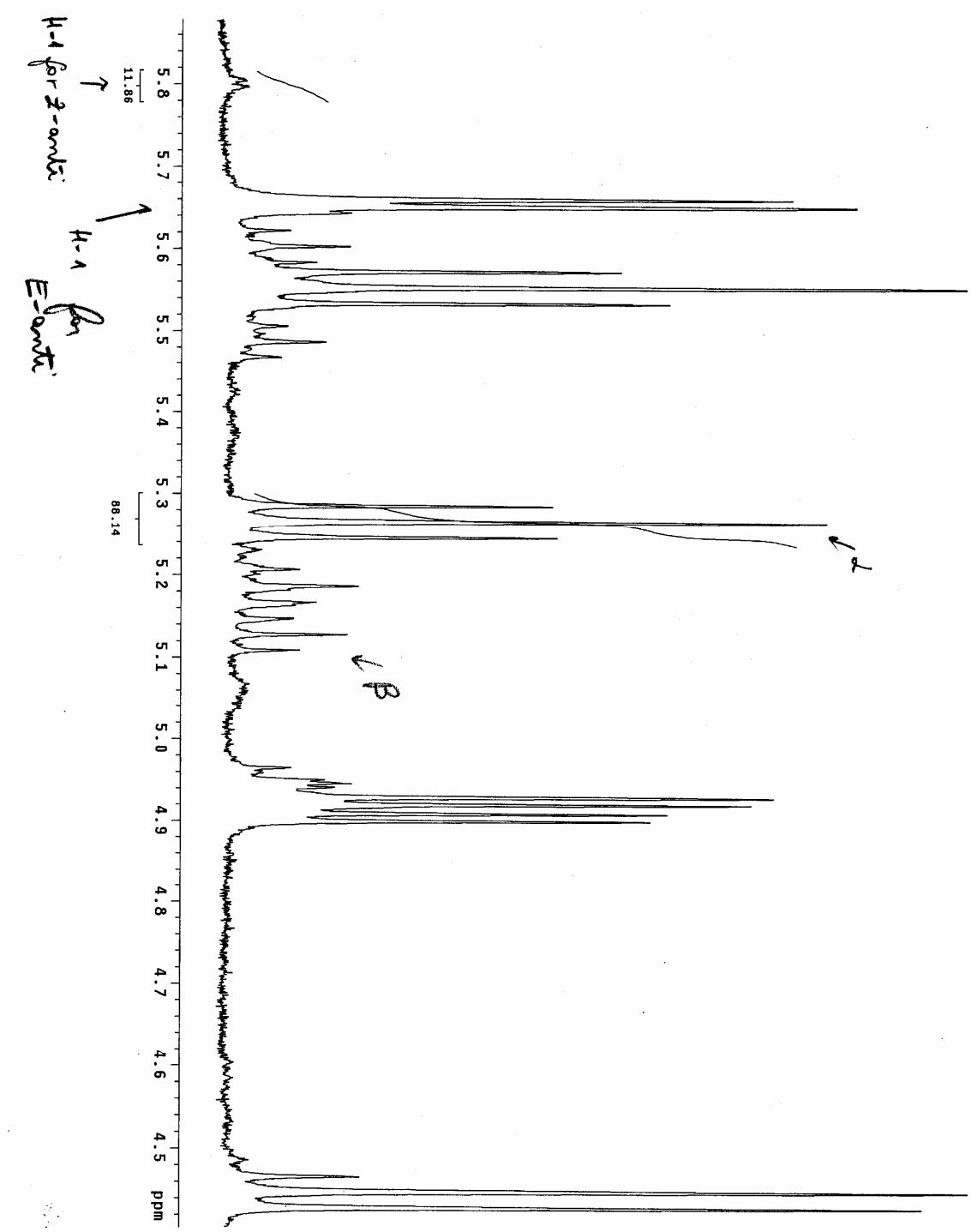
(contains 23% of **9**)



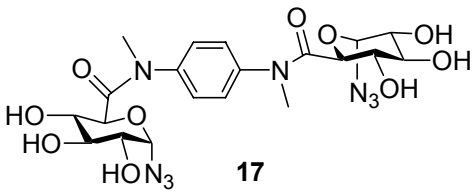
^{1}H-NMR of



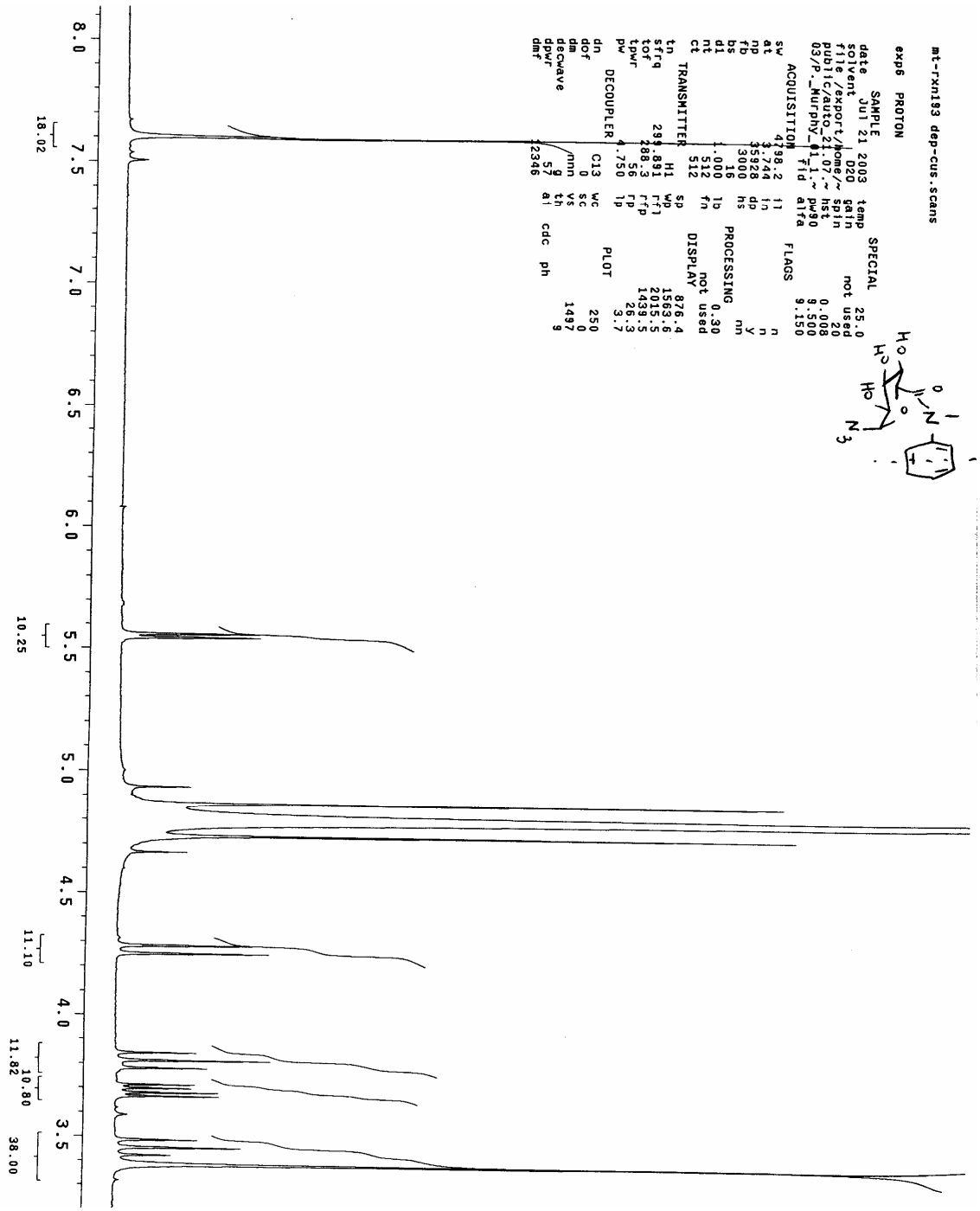
16 containing 23% of **10**



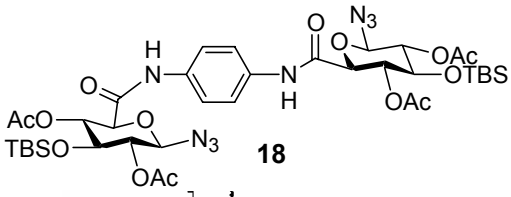
^{1}H-NMR of



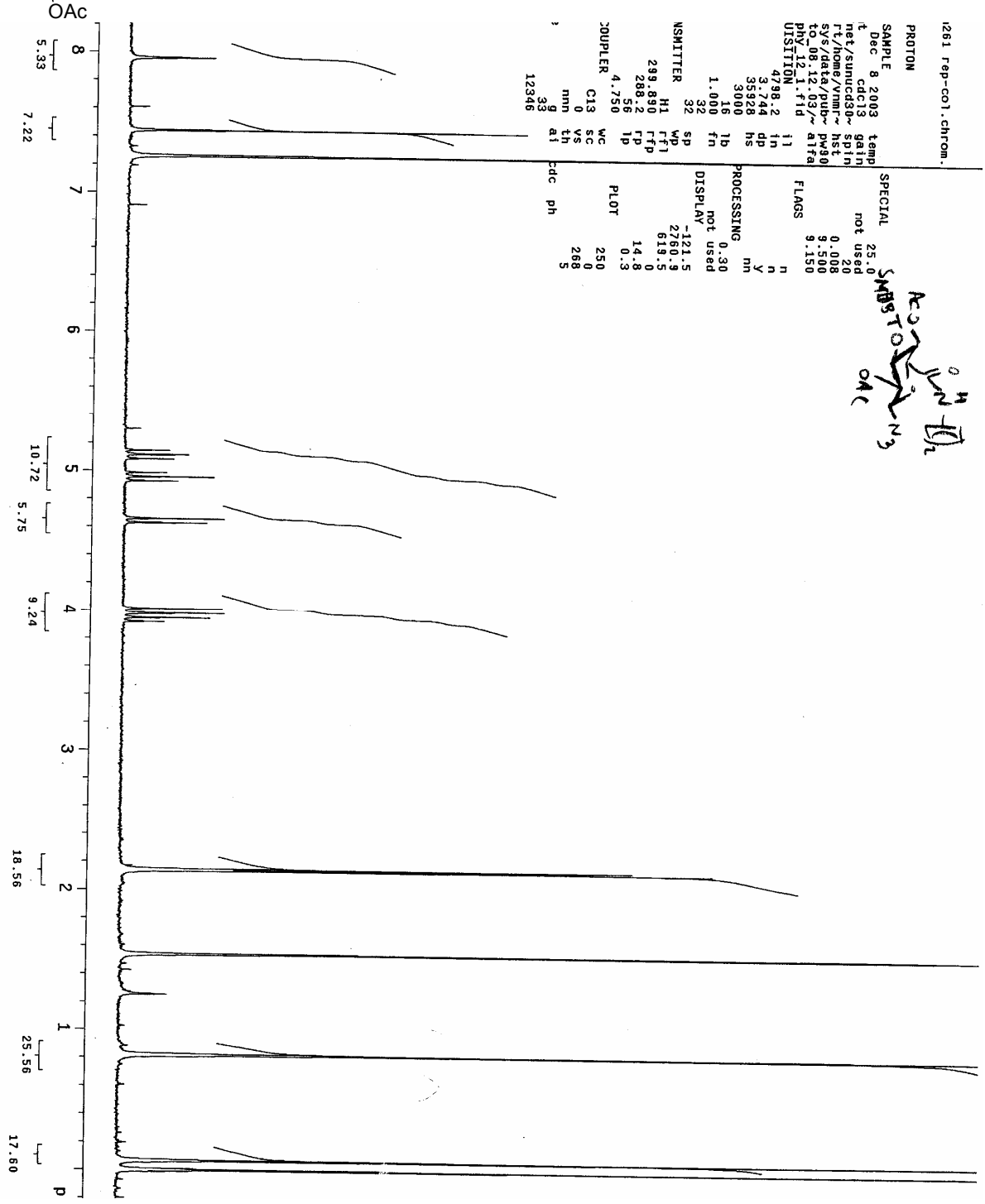
17


mt-rxn193 dep-cus.scans
exp6 PROTON
SAMPLE
date Jul 21 2003
solvent D2O
file /export/home/~
public/auto_21.07.~
03/P._Murphy_01_1.~
ACQUISITION
sw 4798.2
at 3.744
np 35928
fb 3000
bs 16
d1 1.000
nt 512
ct 512
TRANSMITTER
tn H1
sfrq 299.891
tof 288.3
tpwr 56
pw 4.750
DECOUPLER
dn C13
dof 0
dm nnn
decwave g
dpwr 57
dmf 2346
SPECIAL
temp 25.0
gain not used
spin 20
hst 0.008
pw90 9.500
fid alfa 9.150
FLAGS
in n
dp n
hs Y
PROCESSING
lb 0.30
fn not used
DISPLAY
sp 876.4
wp 1563.6
rfl 2015.5
rfp 1439.5
rp 26.3
lp 3.7
PLOT
wc 250
sc 0
vs 1497
th 9
cdc ph
al g
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
18.02
10.25
11.10
11.82
10.80
38.00

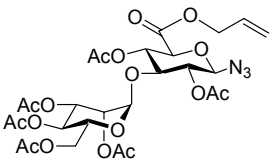
^{1}H-NMR of

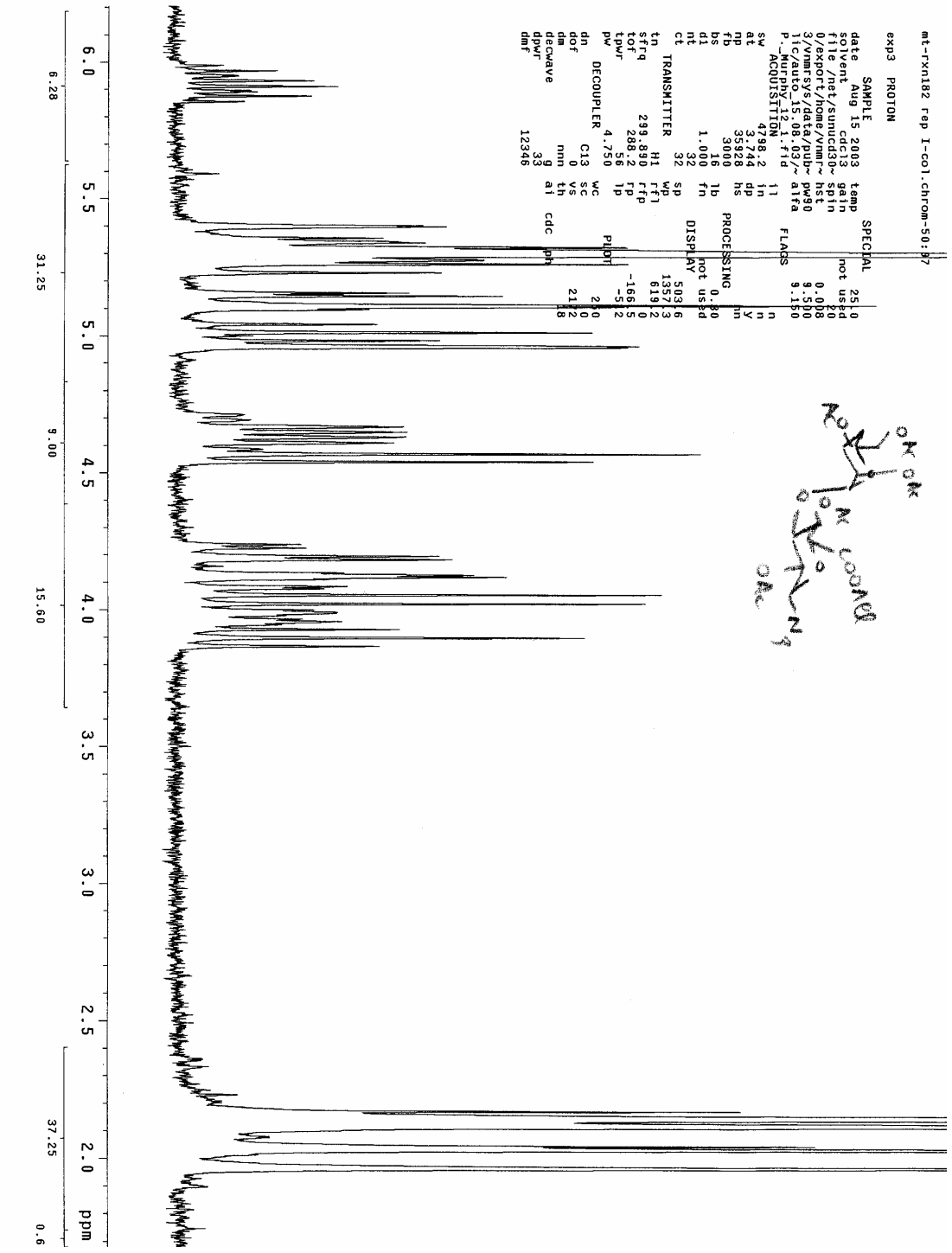

O
N3
O
OAc
OTBS
H
N
N
H
O
OAc
AcO
TBSO
O
N3
OAc

18

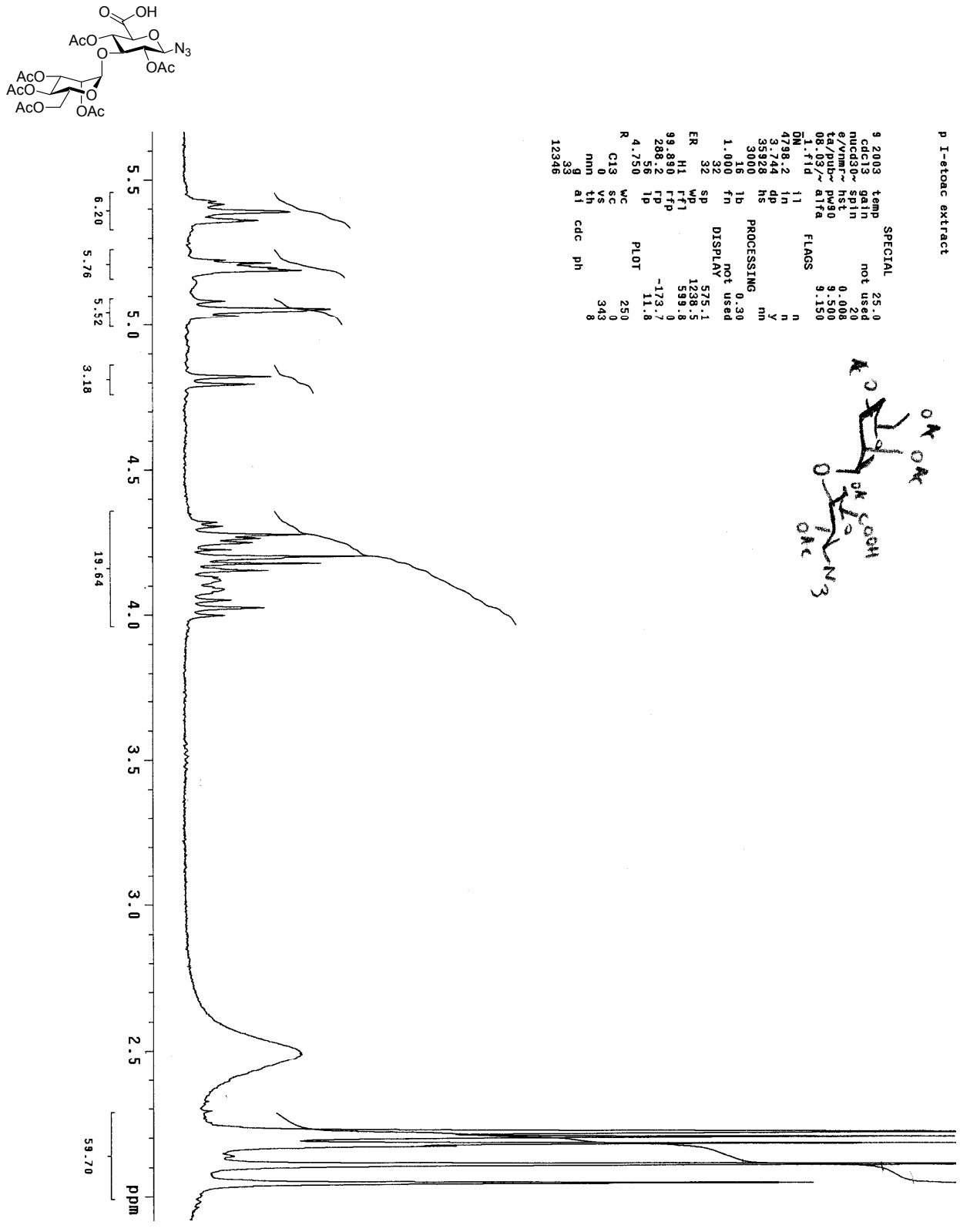

261 rep-col.chrom.
PROTON
SAMPLE
Dec 8 2003
cdcl3
net/sunucd30~
rt/home/vnmr~
sys/data/pub~
to_08.12.03/~
phy_12_1.fid
UISITION
4798.2
3.744
35928
3000
16
1.000
32
299.890
288.2
56
4.750
C13
0
mm
g
33
12346
Edc ph
SPECIAL
25.0
not used
20
0.008
9.500
9.150
FLAGS
n
n
y
nn
PROCESSING
0.30
not used
DISPLAY
-121.5
2760.9
619.5
0
14.8
0.3
PLOT
250
0
268
5
5.33
7.22
10.72
5.75
9.24
18.56
25.56
17.60

^{1}H-NMR of 24

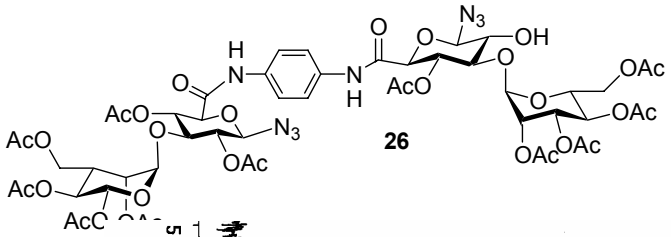

O
O
AcO
O
N3
O
OAc
AcO
AcO
O
AcO
OAc

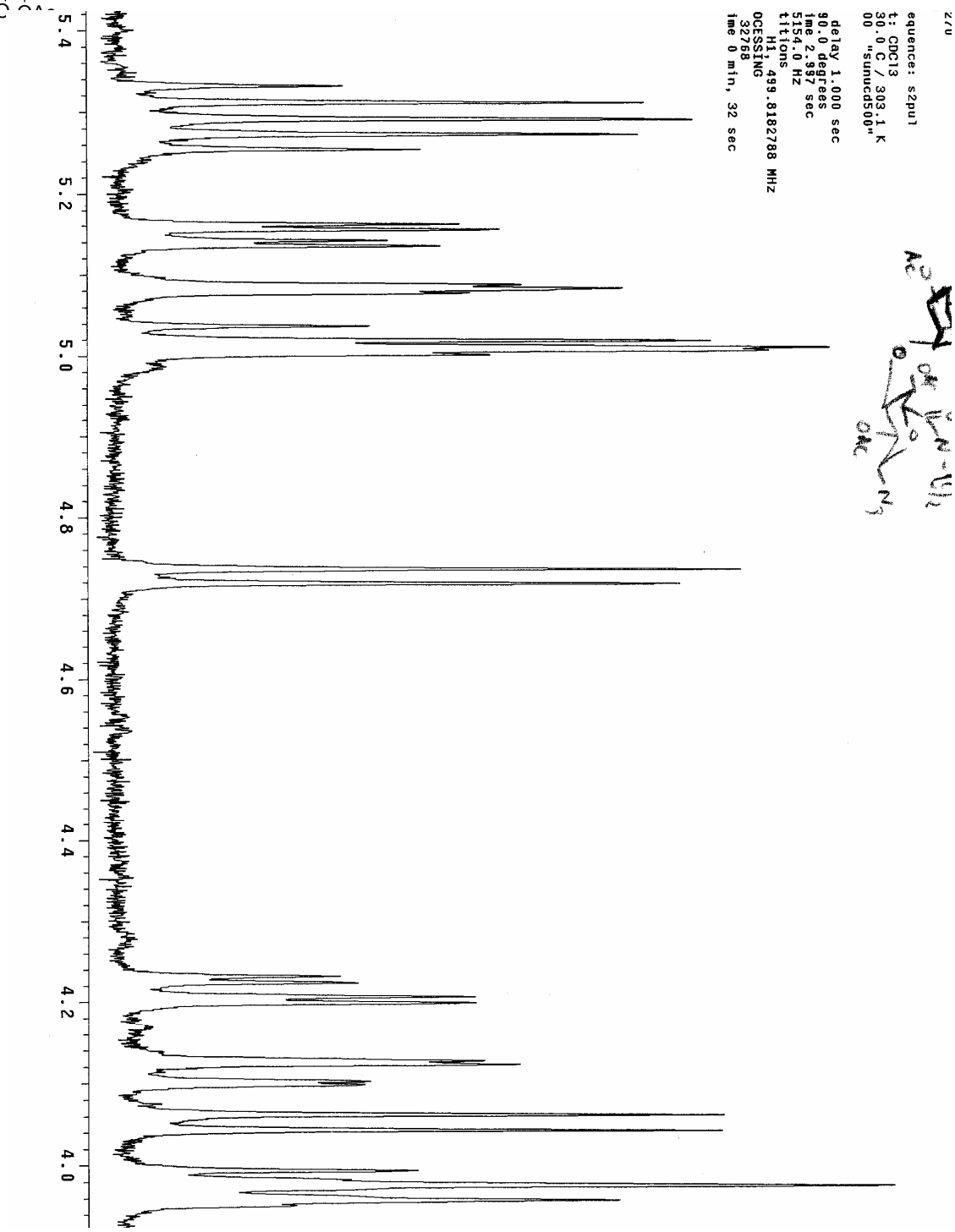

mt-rxn182 rep I-col.chrom-50:87
exp3 PROTON
SAMPLE
date Aug 15 2003
solvent cdcl3
file /net/sunucd30~/export/home/vnmr~/3/vnmrsys/data/pubs~/lic/auto_15.08.03/~P_Murphy_12_1.fid
ACQUISITION
sw 4798.2
at 3.744
np 35928
fb 3000
bs 16
d1 1.000
nt 32
ct 32
TRANSMITTER
tn H1
sfrq 299.890
tof 288.2
tpwr 56
pw 4.750
DECOUPLER
dn C13
dof 0
dm nnn
dmm g
dmf 12346
SPECIAL
temp 25.0
gain not used
spin 20
hst 0.008
pw90 9.500
alfa 9.150
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 0.80
fn not used
DISPLAY
sp 503.6
wp 1357.3
rfl 619.2
rfp -166.5
rp 0
lp -512
PLOT
wc 200
sc 200
vs 2112
th 18
cdc
pltr
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
ppm
6.28
31.25
9.00
15.60
37.25
0.6

^{1}H-NMR of 25

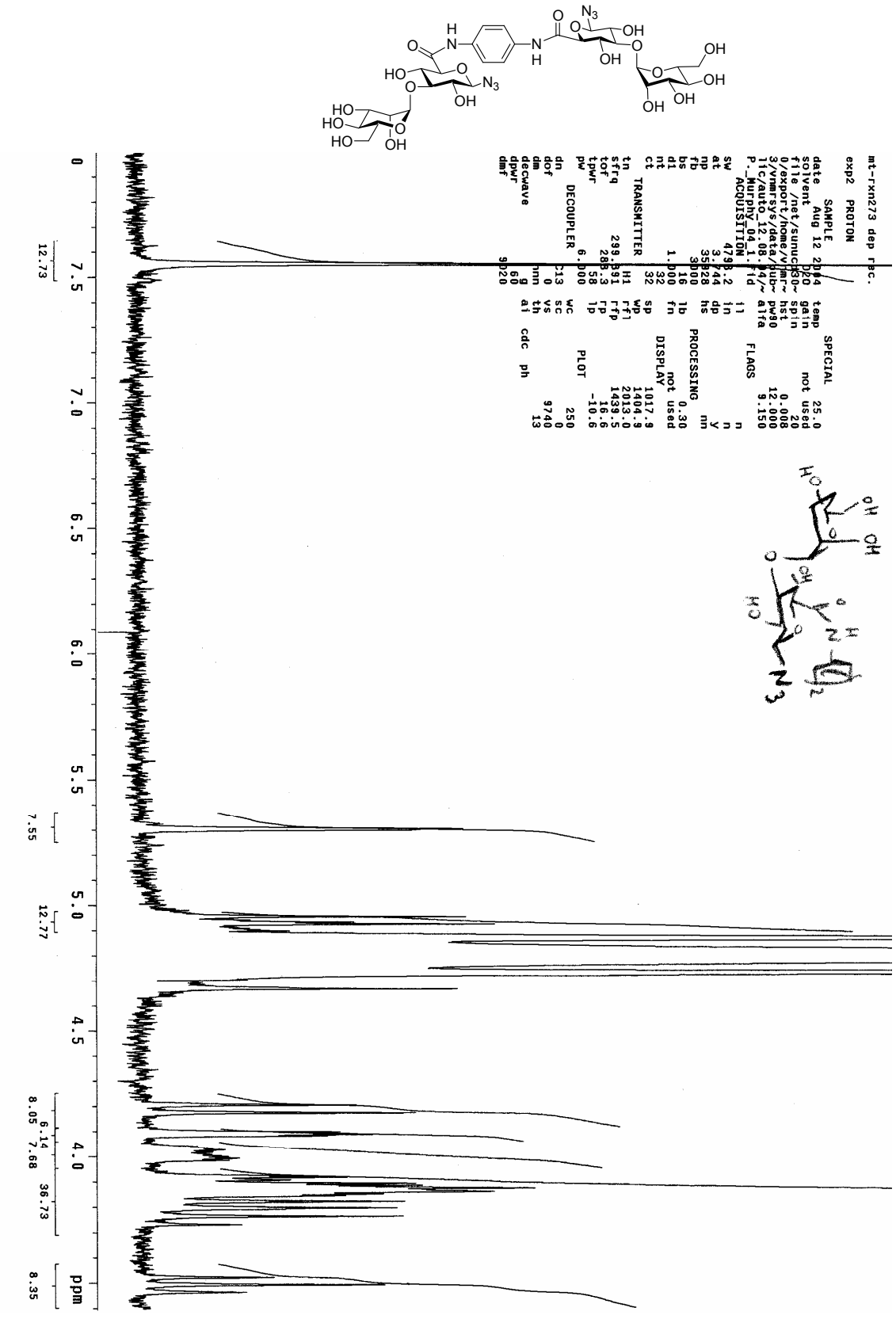

p I-etoac extract
SPECIAL
temp 25.0
gain not used
spin 20
hst 0.008
pw90 9.500
alfa 9.150
FLAGS
PROCESSING
DISPLAY
PLOT
6.20
5.76
5.52
3.18
19.64
59.70
ppm

^{1}H-NMR of



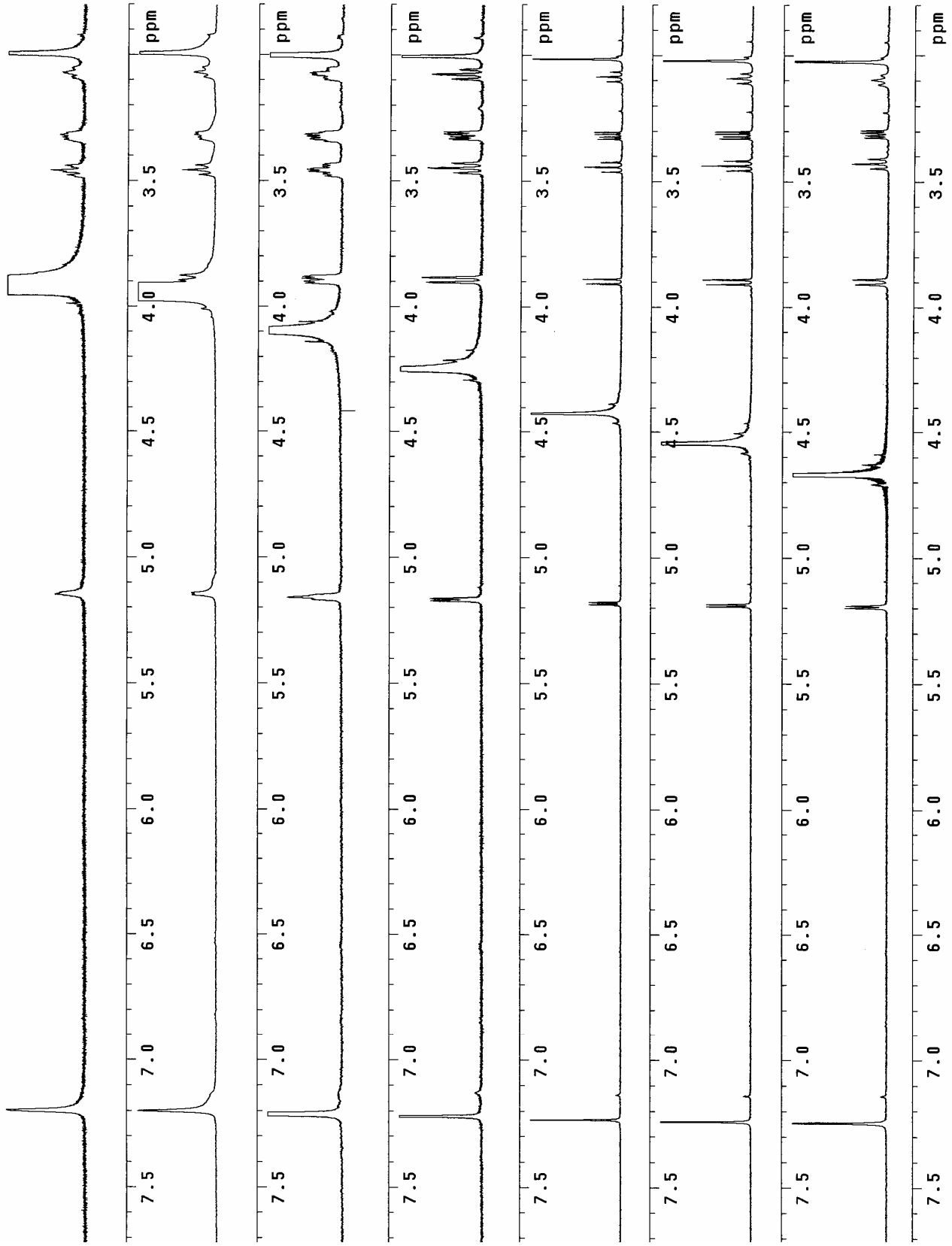


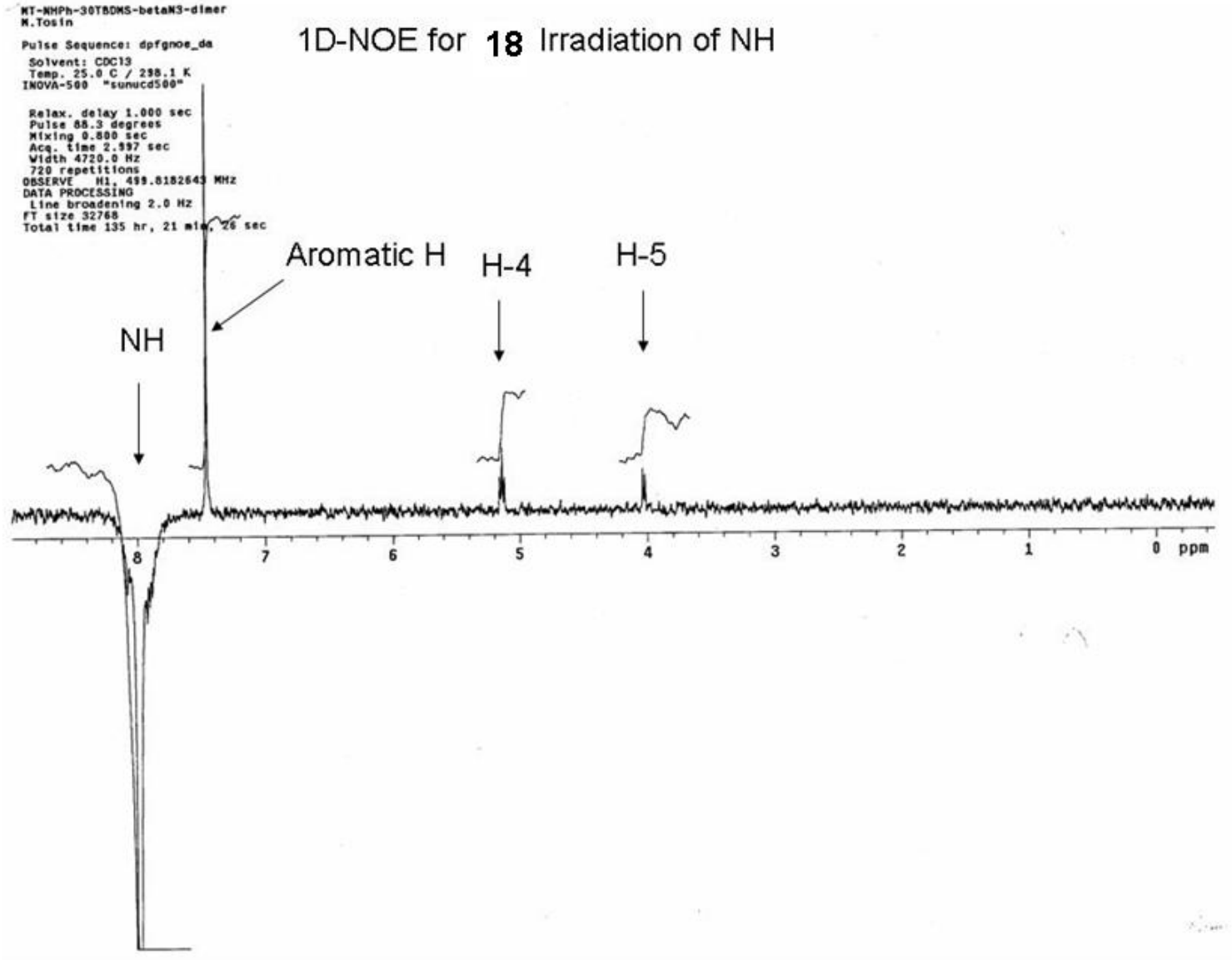
^{1}H-NMR of 6

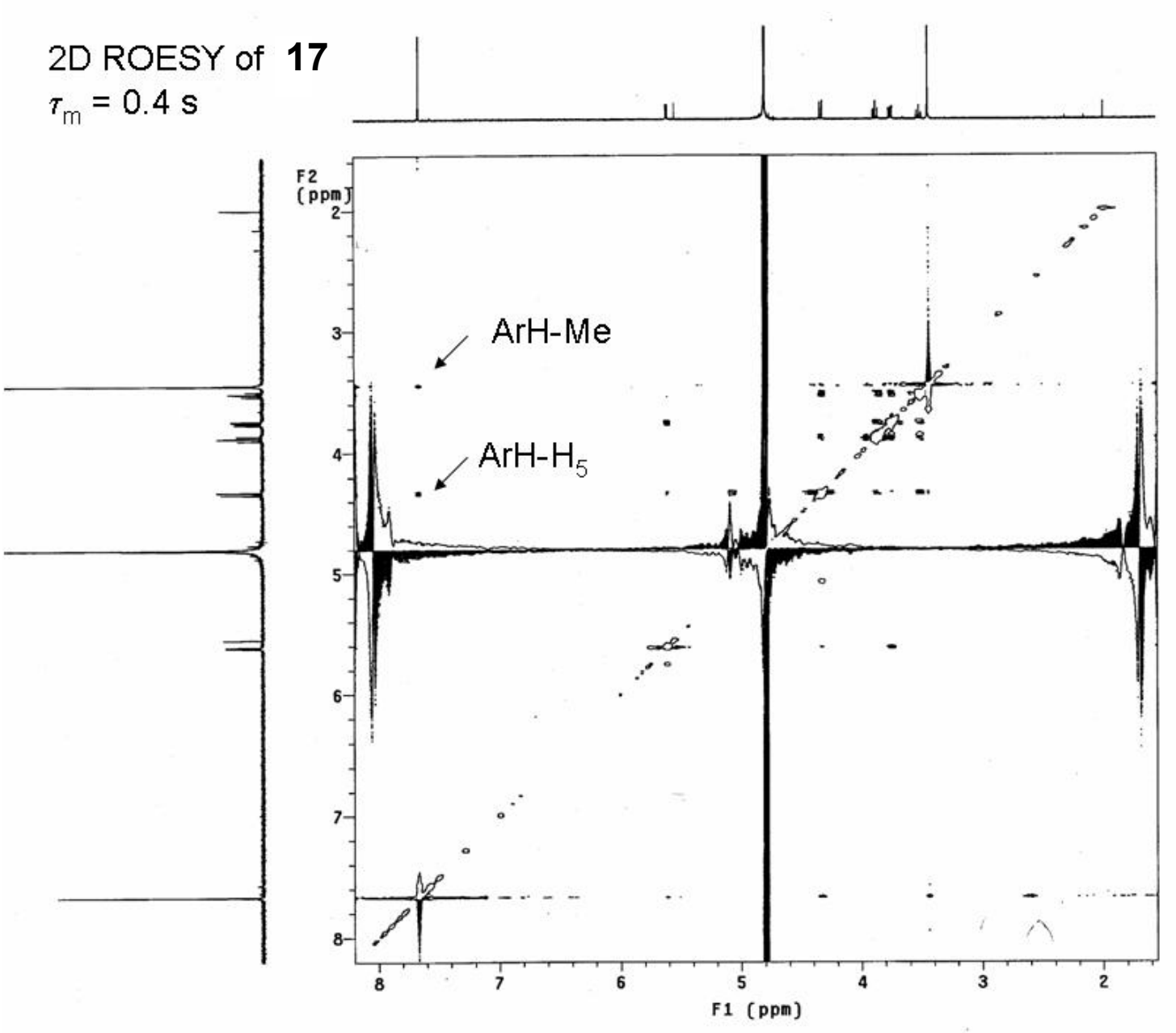

mt-rxn273 dep rsc.
exp2 PROTON
SAMPLE
date Aug 12 2004
solvent D2O
file /net/sumuc30~/export/home/vnmr~/vnmrsys/data/pub~/lic/auto_12.08.04/~P_Murphy_04_1.fid
ACQUISITION
sw 4798.2
at 3.744
np 35928
fb 30000
bs 16
d1 1.000
nt 32
ct
TRANSMITTER
tn H1
sfrq 299.991
tof 283.58
tpwr 48
pw 6.000
DECOUPLER
dn C13
dof 0
dm nnn
decwave g
dpwr 60
dmf 9020
SPECIAL
temp 25.0
gain not used 20
spin 0.008
hst 12.000
pw90 9.150
alfa
FLAGS
il n
in n
dp y
hs nn
PROCESSING
lb 0.30
fn not used
DISPLAY
wp 1017.9
rfp 1404.3
rfl 2033.0
rp 1439.5
lp -16.6
PLOT
wc 250
sc 0
vs 9740
th 13
ai cdc ph
12.73
7.55
12.77
6.14
8.05 7.68 36.73
8.35
ppm

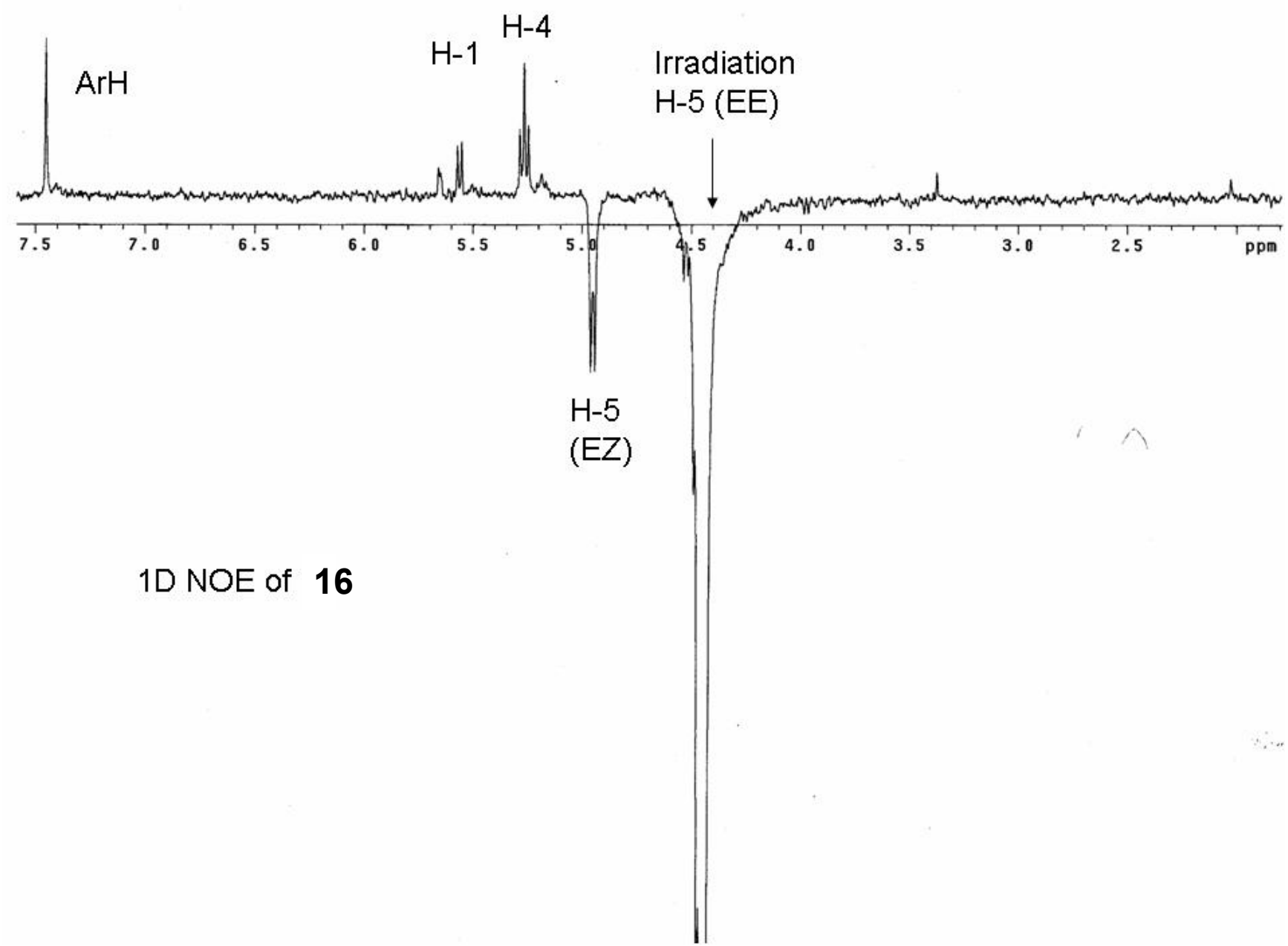
Variable temperature study for **11** (5-70 °C)

Variable temperature study for **17** (5-70 °C)

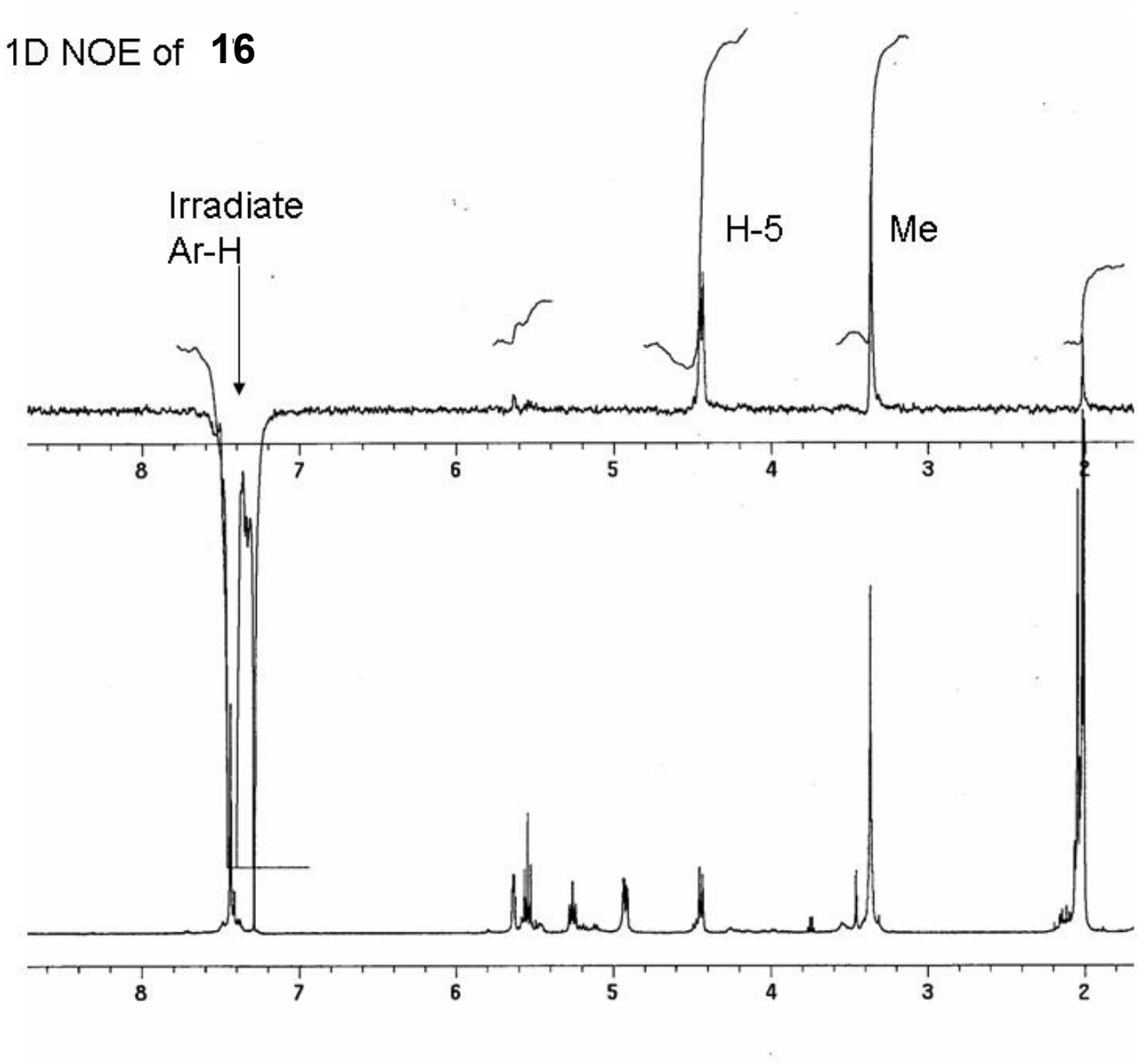


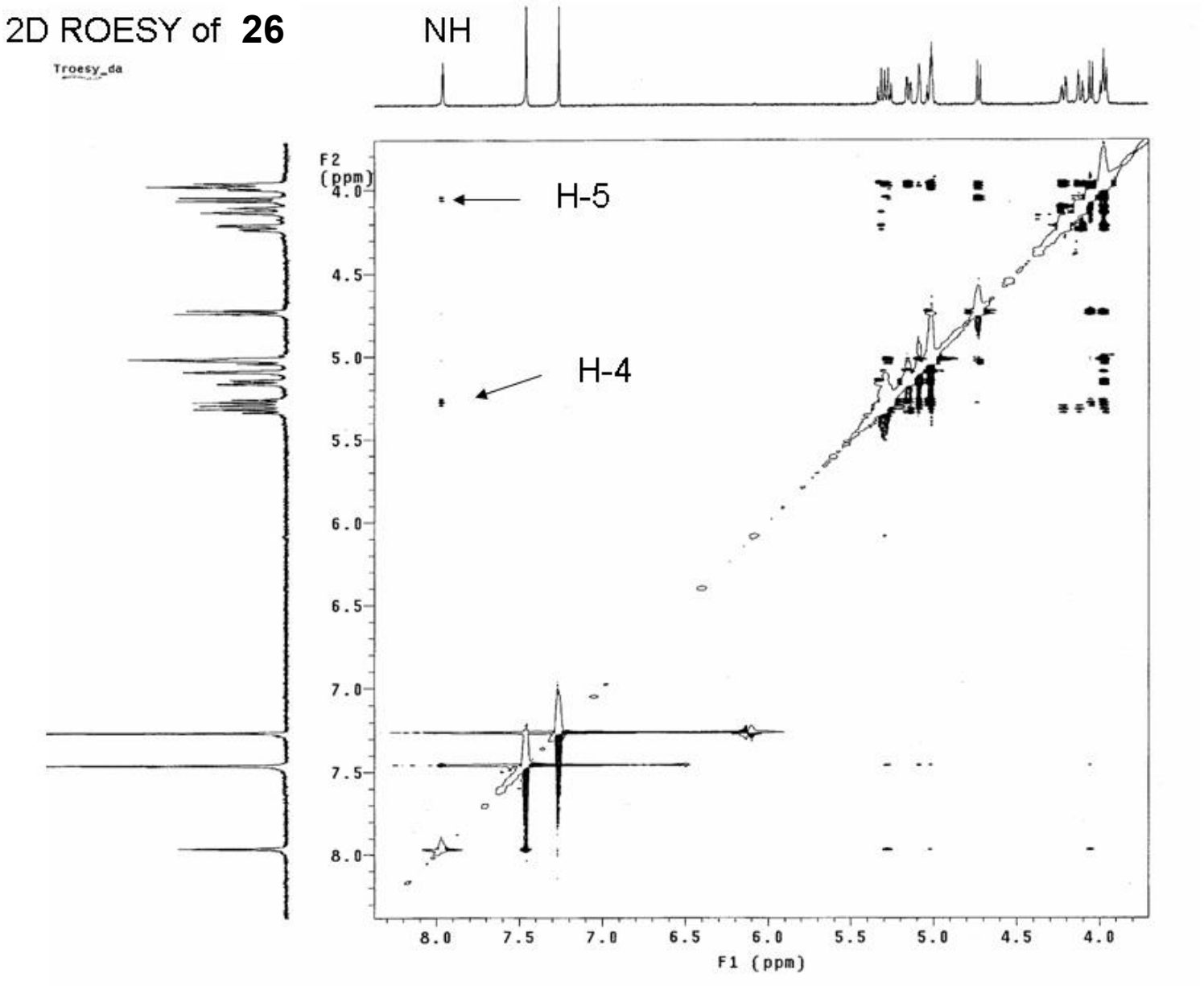

MT-NHPh-30TBDMS-betaN3-dimer
M.Tosin
Pulse Sequence: dpfgnoe_da
Solvent: CDCl3
Temp. 25.0 C / 298.1 K
INOVA-500 "sunucd500"
Relax. delay 1.000 sec
Pulse 88.3 degrees
Mixing 0.800 sec
Acq. time 2.997 sec
Width 4720.0 Hz
720 repetitions
OBSERVE H1, 499.8182643 MHz
DATA PROCESSING
Line broadening 2.0 Hz
FT size 32768
Total time 135 hr, 21 min, 26 sec
1D-NOE for 18 Irradiation of NH
Aromatic H
H-4
H-5
NH
8
7
6
5
4
3
2
1
0 ppm

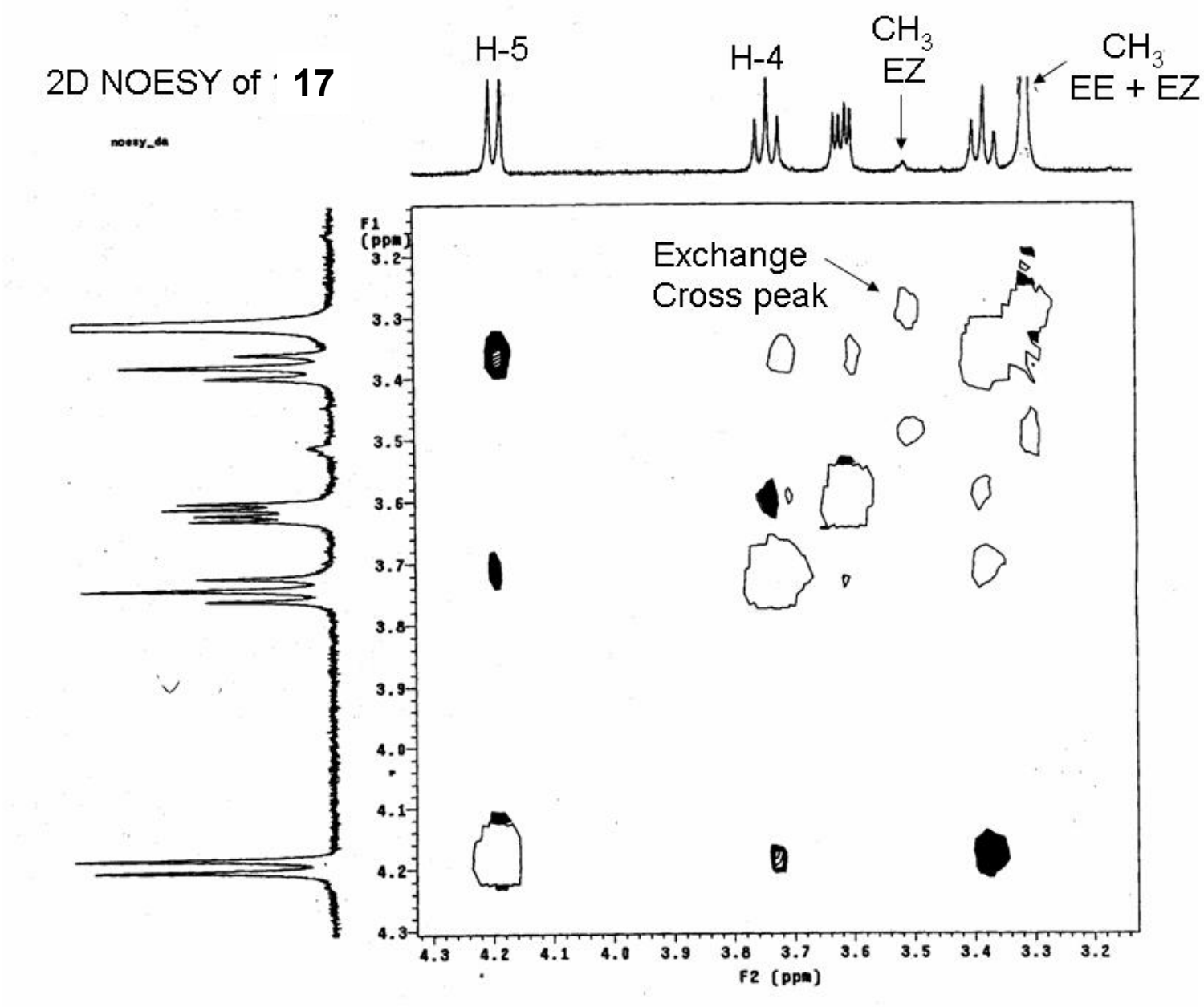

2D ROESY of 17
τ_m = 0.4 s
F2 (ppm)
ArH-Me
ArH-H5
F1 (ppm)

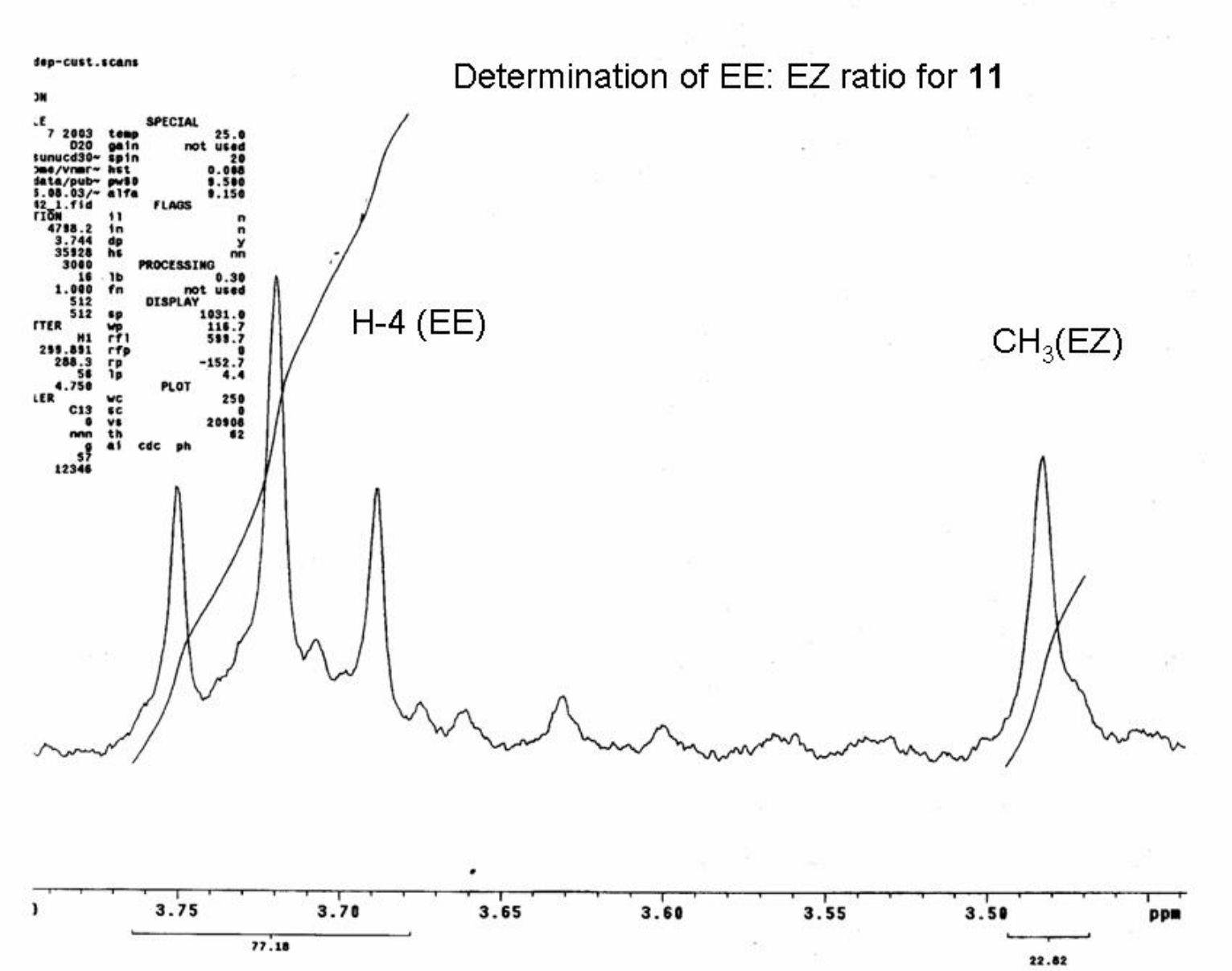

ArH
H-1
H-4
Irradiation
H-5 (EE)
H-5
(EZ)
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
ppm

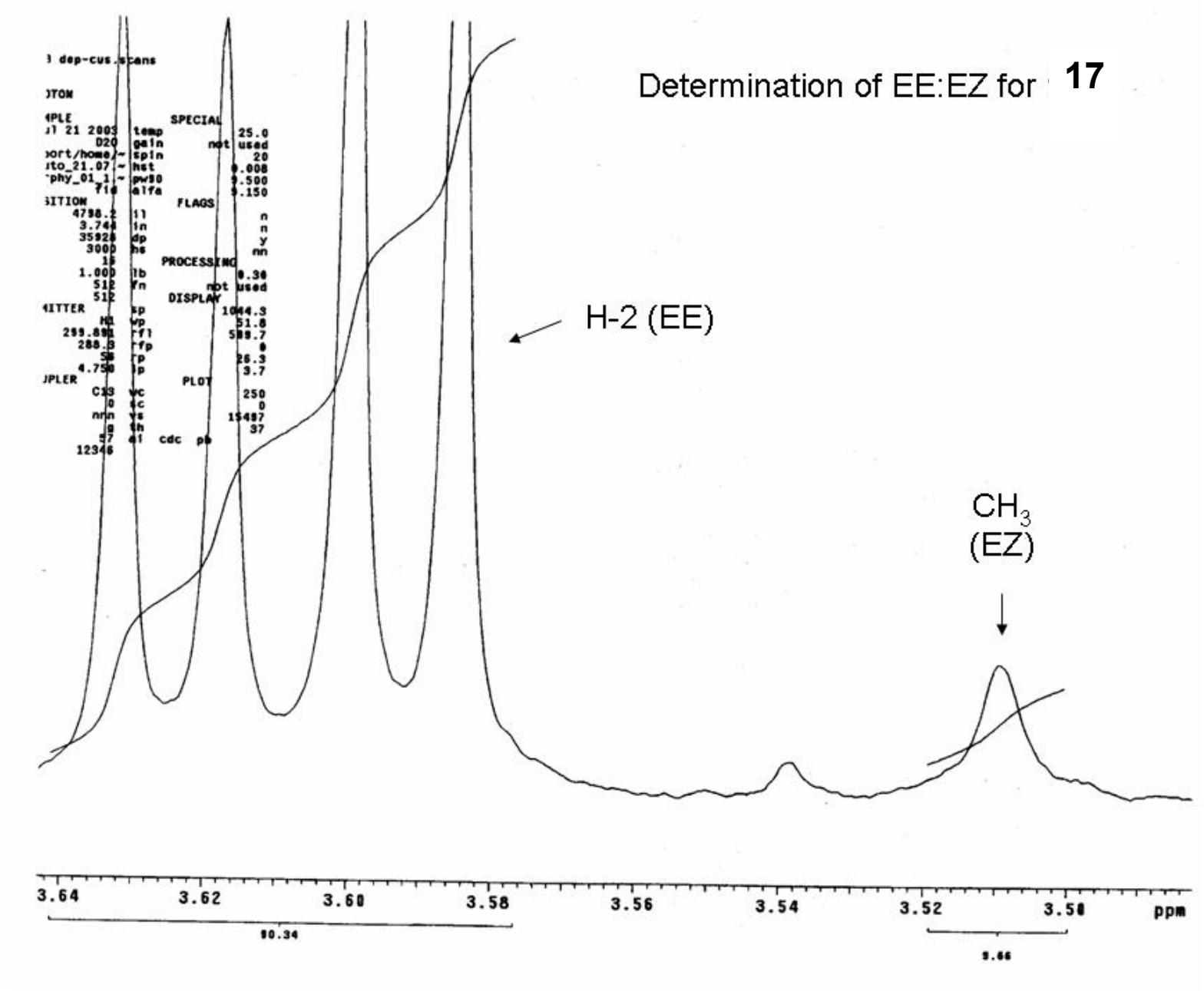
1D NOE of **16**


1D NOE of 16
Irradiate
Ar-H
H-5
Me
8
7
6
5
4
3
2
8
7
6
5
4
3
2


2D ROESY of 26
Troesy_da
NH
H-5
H-4
F2 (ppm)
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
F1 (ppm)


2D NOESY of 17
noesy_da
H-5
H-4
CH3
EZ
CH3
EE + EZ
Exchange
Cross peak
F1
(ppm)
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.3 4.2 4.1 4.0 3.9 3.8 3.7 3.6 3.5 3.4 3.3 3.2
F2 (ppm)


Determination of EE: EZ ratio for **11**
H-4 (EE)
CH_3(EZ)
3.75
3.70
3.65
3.60
3.55
3.50
ppm
77.18
22.62


Determination of EE:EZ for 17
H-2 (EE)
CH3
(EZ)
3.64
3.62
3.60
3.58
3.56
3.54
3.52
3.50
ppm
80.34
9.66

2D NOESY 9

Recorded in D_2O:H_2O (10:90)