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1. Introduction

The Distortionless Enhancement by Polarization Transfer (DEPT) sequence uses polarization transfer from protons to other nuclei via one covalent bond to increase signal strength. The experiment is typically used for CH_n multiplicity determination. The ¹³C DEPT-135 experiment on cholesterol is described herein. This example demonstrates the basic procedure of double resonance 1D NMR data acquisition and processing on Tecmag spectrometers.

2. Pulse sequence

(a) $P1 P2 P3$ (b) $P1 P2 P3$ P2 P3 P1 P2 P3 P2 P3 P3 P3 P		
(b) Pulse width and phase cycle: P1 (H90°): 0 P2 (H180°): phH2 = 0, 2, 1, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 3, 3, 3, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 3, 3, 3, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 3, 3, 3, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 1, 1, 3, 3, 3, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 1, 1, 1, 3, 3, 3, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,		
Pulse width and phase cycle:P4P5P1 (H90°):0 $WALTZ-16 = RR\bar{R}\bar{R}RR\bar{R}R\bar{R}R\bar{R}R\bar{R}R,$ $R = 90_x 180_{-x} 270_x$ P3 (H135°):phH3 = 1, 1, 1, 1, 3, 3, 3, 3.		
P1 (H90°): 0 P2 (H180°): phH2 = 0, 2, 1, 3. P3 (H135°): phH3 = 1, 1, 1, 1, 3, 3, 3, 3. WALTZ-16 = RR \overline{R} $\overline{R}RR\overline{R}$ R $\overline{R}RR$ $\overline{R}RRR$, R = 90 _x 180 _{-x} 270 _x		
$P2 (H180^{\circ}): phH2 = 0, 2, 1, 3.$ $P3 (H135^{\circ}): phH3 = 1, 1, 1, 1, 3, 3, 3, 3.$ WAL1Z-16 = RRRR RRRR RRRR RRRR RRRR, RRR, RR,		
P3 (H135°): $phH3 = 1, 1, 1, 1, 3, 3, 3, 3$.		
P4 (C90°): $phC1 = (0)_8, (2)_8, (1)_8, (3)_8.$		
P5 (C180°): $phC2 = (0, 2)_4, (1, 3)_4.$		
Receiver: $phRX = (1)_2, (3)_4, (1)_2, (2)_2, (1)_4, (2)_2, (3)_2,$ Event Number 1 2 3 4 5		
$(1)_4, (3)_2, (0)_2, (2)_4, (0)_2.$		
(phH2, phH3, phC1, phC2 phRX are 1D phase tables.		
All tables are in 4 step mode.)		
Event Number 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16		
Name: Image: Image: <thimage:< th=""> Image: Image:</thimage:<>		
$[F1_Amp] = F1 amp = F1 amp F$		
F1_PhMod AS		
F1_rn X phH2 phH2 phH2 phH3 phH3 phH3 F1_Atten F1 attn0 F1 attn0 F1 attn0 F1 attn0 F1 attn0 F1 attn0 F1 attn F1 attn F1 attn		
F1_TxGate		
F1_PhRst		
Acq		
Acq_phase pho:		
RX_PhRst		
F2_Ampl F2 amp		
F2_PhphC1phC2		
F2_PhRst		
F2_Atten F2 attn F2 attn F2 attn		
F2_UnBlank		
Acquisition Frequency Multi Rec. Processing Grad. Preemph. Misc. Sequence Global Variables		
H90 18u H67.5' =[H90]*135/180-[C90] ad 25u F1 attn0 8		
tau 3.5m C180 =[C90]*2 Acq. Time 1.235354s F1 attn 15		
H30 =[H30][U_30]/2 tau' 34500 Last Delay 2s F2 amp 100 C90 4.2u rd 25u F1 amp 100 F2 attn 16		

Fig. 1. (a) The ¹³C DEPT-135 sequence with WALTZ-16 sequence for ¹H decoupling. (b) The sequence realized in the NTNMR sequence editor.



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SOLUTION APPLICATION

3. Experiment

Sample:	Cholesterol in CDCl ₃ (50mg/ml)
Spectrometer:	7 Tesla Magnet with Tecmag HF3 discovery
Probe:	Naloac D300-5 OWB 5mm 1 H/ 13 C Switchable probe
¹ H hard pulse:	13.9 kHz (90° = 18 μ s @ 5W)
¹ H decoupling field:	5.6 kHz (90° = 45 μ s @ 800 mW)
¹³ C hard pulse:	59.5 kHz (90° = $4.2 \mu s (a) 250 W$)
τ:	3.5 ms (= 1/2JC,H = 140 Hz)
SW +/-:	± 6.5kHz
Last Delay:	2s HO Cholesterol
Scans 1D:	512

Notes:

- 1. Before editing the sequence (Fig. 1b), calibrate the 90° pulse widths of ¹H and ¹³C using the nutation experiment (see note, "One Pulse Experiment and Pulse Calibration").
- 2. Set up the WALTZ sequence according to the note, "¹³C NMR Spectra with ¹H WALTZ Decoupling".
- 3. The center of pulses P2 and P4 (also P3 and P5) should be aligned. Since P2 > P4 (and P3 > P5) P2 (and P3) have to split into 3 pulses. The delay of P2's (and P3's) middle pulse equals to P4 (and P5), and the delay of both sides is (P2 P4)/2 [and (P3 P5)/2]. The middle pulse of P2 (and P3) falls on the same event as P4 (and P5).



CH Fig. 2. The ¹³C DEPT-135 spectrum of cholesterol obtained using the sequence shown in Fig.1. Since signals are generated from proton polarization, both quaternary carbons and the solvent peak do not appear.

5. References

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