1. Introduction

The time constant T_2 is the transverse or spin-spin relaxation time. Any process that causes loss of magnetization on the x-y plane contributes to T_2. The magnetization follows an exponential decay:

$$M = M_0 e^{-t/T_2} \qquad (1)$$

However, the inhomogeneity of the static field also causes a loss of the transverse magnetization, which is written as T_2*. Since spin echoes remove the effects of inhomogeneity, the time constant that results from the decay envelope of a series of spin echoes is the real T_2. This experiment is regarded as Carr-Purcell-Meiboom-Gill (CPMG) experiment.

(Method 1)

2. Pulse sequence

Figure 1 shows an approach to apply the CPMG method for measuring T_2: A series of echoes follows the 90° pulse and the NMR signal is acquired at the center of each echo. One scan will have *n* acquisitions for *n* echoes.

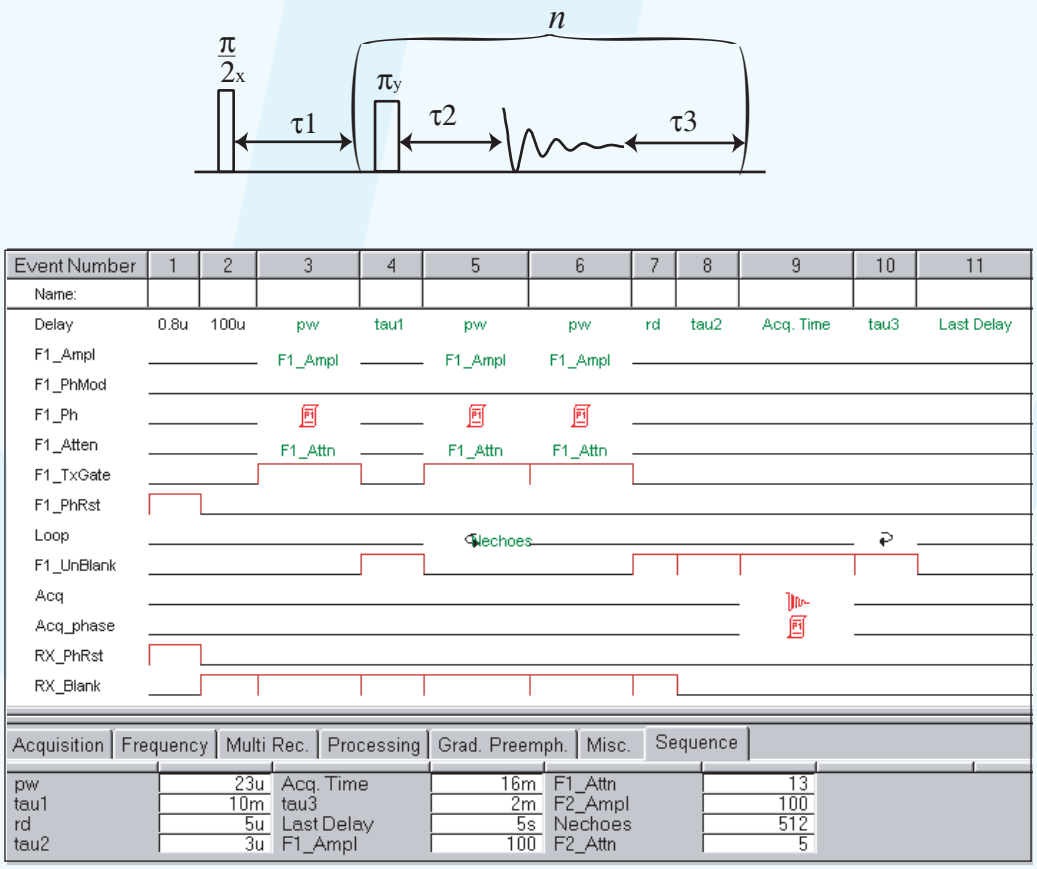

Fig. 1 The CPMG pulse sequence for Method 1.

3. Experiment and results

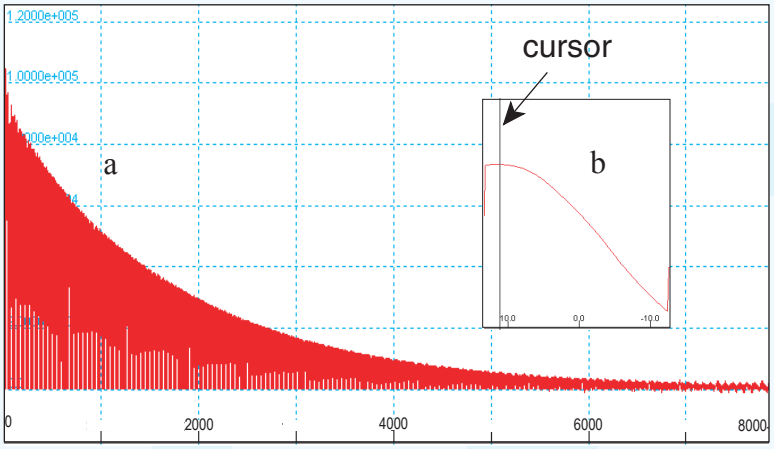

Fig. 2 a: H_2O ^1H CPMG data acquired with the pulse sequence in Fig.1. b: Expansion of one echo from a.

Sample: H_2O
90^o pulse = 23 µs
$\tau 1$ = 10 ms
$\tau 2$ = 2 ms
$\tau 3$ = 3 ms
Number of echoes/acquisitions: 512

Data processing:

1. Separate the data into a 512-record 2D data file using "Separate Records" (Fig.2b).

2. Create variable "Echo Interval" with a value of one echo time, and an empty 2D delay table "tau-T2" in the sequence. "Echo Interval" is introduced as a local variable with the mathematical expression, Echo Interval = 2pw + $\tau 2$ + $\tau 3$.

3. Run the script "CPMG proc setup" to fill table "tau-T2" with delays for all the echoes.

4. Locate the cursor at the position of the desired intensity used to calculate T_2 at any of the records (see Fig. 2b).
(As H_2O has only one peak, the FID is directly used to calculate T_2.)

5. Click on "NMR Data Analysis", select the appropriate settings, and click on "Draw".

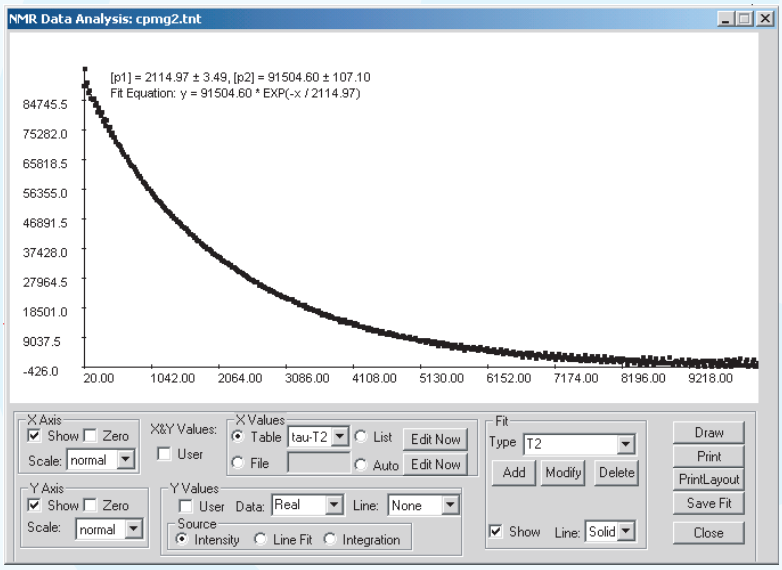

Fig. 4 NMR data Analysis window showing the T_2 fitting for H_2O and T_2 = 2.1 s.

4. Reference

1. Derome, A., "Modern NMR Techniques for Chemistry Research", Pergamon Press, New York, 1987.