EU Patent (EP 1058854, modified claims from US 6366872)

Claims:

1. A method of establishing a processed data set (12, 14) of L data derived from a set of K oversampled actual data (12) representing a phase resolved NMR transient nuclear spin precession impulse response for subsequent transformation to the frequency domain, wherein the number of L data in the processed data set (12, 14) is higher than the number of K actual data (12), the method comprising,

(a) applying an NMR excitation impulse with a finite time width containing a physical time origin,

(b) after a quiescent time interval T_q from said physical time origin to a measurement start time t_q during which data acquisition is precluded, directing the nuclear spin precession impulse response through a phase resolving receiver and analog filter apparatus (80-90) to pass the frequency content of oversampled phase resolved quadrature components therethrough,

(c) sampling said quadrature components to ADC apparatus (92, 94) at an oversampling rate ω_s to obtain the first and subsequent actual data (12), whereby each said actual data experiences a delay in propagation through said receiver, analog filter and ADC apparatus, and whereby said set of actual data (12) having ordinate values A_1, A_2, A_3, …, A_K at respective discrete abscissa values are established at uniform intervals of $1/\omega_s$ commencing at the measurement start time t_q,

(d) prepending to said actual data (12) L-K pseudo data (14) at intervals of $1/\omega_s$ from $t_p = t_q-((L-K)/\omega_s)$ to t_q-1/ω_s, wherein no actual data are available in the interval t_p to t_q,

(e) passing said actual data (12) including said prepended pseudo data (14) through a digital filter (96) of length 2p+1, to generate downsampled data (16) beginning at $t_p + p/\omega_s$;

characterized in that said supplying the pseudo data (14) comprises:

copying and complex conjugating L-K actual data beginning from the second actual datum into the L-K pseudo data in reverse order at intervals $1/\omega_s$, commencing at $t_q - 1/\omega_s$;

calculating a phase correction factor $e^{i2\phi}$, where

(i) ϕ is the phase of the first of said K actual data or, if this first actual datum is distorted, the phase of the second or subsequent datum, or

(ii) ϕ is obtained from the first several of said K actual data;

performing a phase correction on said complex conjugated pseudo data (14) by multiplying said complex conjugate by said phase correction factor $e^{i2\phi}$, thereby exhibiting continuity of said phase corrected and complex conjugated pseudo data (14) with said actual data (12).

2. The method of claim 1 wherein said complex conjugate formed pseudo data are modulated by a selected weight function prior to passage through said digital filter (96).

3. The method of claim 2 wherein said selected weight function is proportional to $1/g(t)$ where $g(t)$ represents a function of the time dependence of a portion of the envelope of said actually measured data (12).