SPINMASTER FFC2000 1T C/DC

The Fast Field Cycling NMR relaxometer

SPINMASTER FFC2000 1T C/DC is a unique NMR instrument designed to measure the field dependence of NMR spin-lattice and spin-spin relaxation time T1 and T2 (Nuclear Magnetic Relaxation Dispersion – NMRD – profiles), from earth field to a maximum operating magnetic field of 42.6 MHz (1H Larmor frequency)

The present Compact system represents the evolution of the previous instruments whose introduction in '97 has given a decisive contribution to the development and the diffusion of the Field Cycling NMR in the last years.

The superb performance offered by Spinmaster FFC2000-1T will further contribute to stimulate new applications in many fields of NMR investigation.

Highlights

- Very compact design and smaller lab space.
- SPINMASTER FFC2000 1T C/DC features the latest research grade versatility, digital NMR console PC-NMR and offers new improved performances and new experiments like Field Cycling Spin Echo
- Multi-nuclear operations
- Efficient and accurate temperature control (-140 to +140°C with a 0.1°C resolution)
- Measurements of relaxation times ranging from several seconds to fraction of milliseconds
- Simplicity of use (fully automated acquisition of T1 NMRD)
- Field Cycling Spin Echo Experiments
- Minimum operating costs and effort (no cryogenic gases)
- Short measurement time
- Full-fledged NMR Windows software

Main specifications

MAGNET
Resistive, low inductivity, 4 layers air-core solenoid, suitable for Fast Field Cycling NMR measurements. The magnet is housed into a special glass-Perspex container and percolated by a special cooling liquid.

Access bore :	20 mm.
Max Field Bo :	1 Tesla +/-5%
Homogeneity :	< 150 ppm over 1cm3
Field slew rate :	< 150 us * MHz

POWER SUPPLY
High stability computer controlled bipolar current source. The system is fully software controlled by means of external parallel port and TTL lines

Max. Power :	22 kW
Max. Current :	430 A
Max voltage :	53 V
Current stability:	< 50 ppm
Switchable levels:	4 levels (off, Bpol, Brelax, Bacq)

each level is software controlled

Switching time :	< 150 us / MHz
Mains :	400 VAC / 22 kW 50/60 Hz

COOLING SYSTEM
Dual independent, thermally coupled loops. The hermetically closed secondary circuit uses a room temperature cooling fluid. The primary circuit uses tap water with regulated
- Min water request : < 1000 l/hr at 15°C (0.7bar) @20KW

NMR console
research grade versatility, digital NMR console PC-NMR (refer to the specific datasheet)
-Digital receiver with direct detetion from 500 KHz to 90MHz with a maximum spectral width of 10 MHz
- n.3 (three) independent RF TX channels singularly and separately programmable from DC to 90MHz.
- 128bit/20ns/7loops levels pulser.
- 250 W RF linear power pulse transmitter from 500KHz to 150 MHz
- NMR software package with a large sequence/experiment library is supplied for Fast Field Cycling experiment as well as for most classical NMR, NMR diffusion and NQR applications including mobile NMR.

- VTC90 Sample temperature controller
Standard Gas flow system
Range* : -120 to +140°C precision and stability : 0.1°C

- **10 mm probes** tunable from 3 to 25 Mhz (special probe available on request)

Please contact Stelar for more detailed specifications

STELAR

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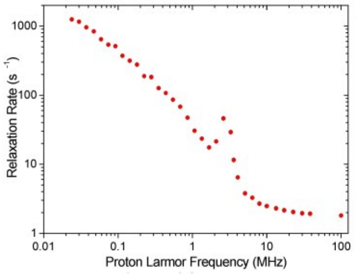
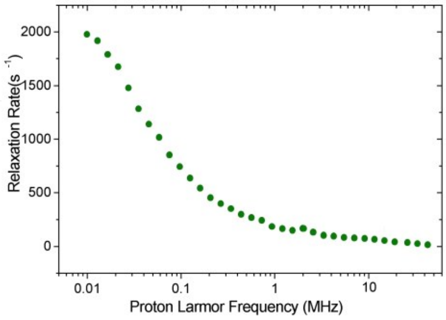
The innovation in NMR

The Fast Field Cycling NMR relaxometry

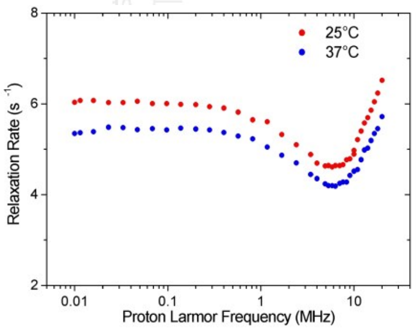


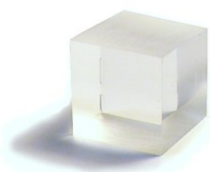
NMRD profile of l-leucinammide sample at 25 °C. This rigid solid exhibits an extremely steep dispersion with very pronounced ^{14}N glitches

NMRD profile of dried egg albumen.

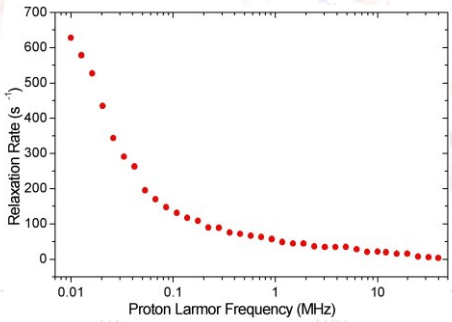


NMRD profile of a commercial MRI contrast agent





NMRD profile of Perspex™ at 25°C



With the ongoing growth of studies of complex systems in biochemistry and materials research, we witness an increasing interest in NMR relaxometry and,in particular, in variable-field relaxometry.

All NMR studies exploiting nuclear relaxation indicate the convenience of measuring nuclear relaxation time (T_1) as a function of the magnetic field B_r in which they occur (NMRD profile).

Since such "dispersion" curves retrace essentially the distribution of molecular motions in terms of frequency (the so called spectral densities), they provide an unusually direct way to "sampling" such distributions. Quantitative evaluations lead to important data about the interactions which couple molecular motions with nuclear spins.

In order to fully exploit information of variable field relaxometry, the relaxation field values should cover a range of 4-5 orders of magnitude.

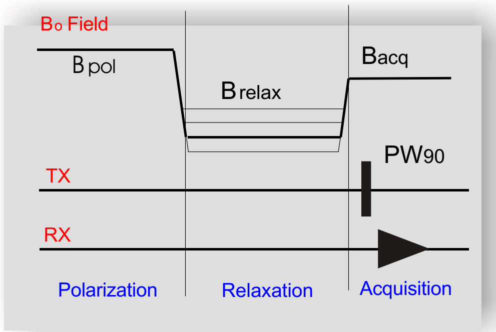
Moreover measurements in extremely low fields are particularly interesting since they reflect very slow motions and one would like to cover, in a single experiment, field values ranging from a few kHz to tens of MHz (Proton Larmor frequency).

It's evident that no conventional NMR spectrometer can produce such information.

The NMR Field Cycling is the only method capable to acquire T_1 dispersion curves as a function of magnetic field strength

The NMR FC method

In the basic NMR Field Cycling experiment the Zeeman field Bo, which is applied to the sample, is cycling through three different values. In the first period, a high magnetic field ***Bpol*** (polarization field) is applied to pre-polarize the sample in order to boost signal intensity. Thereafter, the sample is allowed to relax in a second field ***Brelax*** (relaxation field) which can be set to any desired value, including zero. In the last period the field is set to the detection field ***Bacq*** for signal acquisition.



Fields of application

- Paramagnetics: studies of the hydration of paramagnetic metal ions and their organometallic complexes in water solutions. Benefits include the development of **contrast agents** for clinical MR Imaging. ***- Liquid crystals:*** The complex molecular dynamics in liquid crystals is intimately related to the macroscopic characteristics of their various phases. ***- Biochemistry:*** The function of **proteins** and other natural macromolecules present in cells and their membranes is often critically dependent upon their dynamics. **- Polymers:** Molecular motions in bulk **polymers** have a profound effect on their properties. Physical properties of elastomers, for example, cannot be understood at all without a knowledge of their molecular mobility **- Materials research:** There are numerous classes of technological materials whose properties depend intimately on molecular dynamics (for example, emulsions, lubricants, coatings, etc). **- Surface phenomena:** Molecular mobility at solid-liquid interfaces is important in catalysis, petrology and other fields (for example, relaxation data are already used to assay the distribution of pore sizes in rocks).

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