^{13}C-MQC Polarimeter

Specifically designed to interface with Oxford Instruments' Dynamic Nuclear Polariser (DNP) HyperSense®,

our new Polarimeter enables the user to routinely measure the level of polarisation in the liquid state sample after hyperpolarisation. This is particularly useful in the liquid state analysis of new compounds after hyperpolarisation, qualifying the polarisation performance of your HyperSense and in analyzing samples where a high-resolution spectrometer is not available.

A key feature of the Polarimeter is that it automatically calculates the level of sample hyperpolarisation, allowing rapid and consistent polarisation determination (calculation based on Pyruvic Acid).

The Polarimeter is a permanent magnet based, compact NMR spectrometer specially configured for calculating liquid state DNP.

The Polarimeter is a portable system with easy to use software, that can be located next to the DNP system or at a distance away.

After dissolution and transfer into the Polarimeter, the percentage liquid state polarisation is displayed. The Polarimeter has three calculation modes:

- Measurement of a reference sample for system calibration (normally $^{13}C_2$-DMSO)
- Measurement of polarisation enhancement of an aliquot (usually 0.5 to 4ml Pyruvic Acid solution) of a sample dissolved by HyperSense
- Measurement of all the sample dissolved by HyperSense to monitor the effective level of polarisation ($^{13}C_1$ Pyruvic Acid)

Key enabling features of the Polarimeter are:

- Dedicated software which is easy to use by any operator
- Enhancements referenced to a standard so is independent of spectrometer performance
- Better SNR relative to the noisier thermal enhancement method at low NMR frequencies
- Larger 18mm probe so total sample volume is within the active coil area giving better accuracy

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Calculation overview

Monitoring the polarisation enhancement can be achieved by a number of methods, e.g. enhancement over thermal NMR spectrum, or polarisation spin population.

We have chosen to use spin polarisation as the benchmark because this can be calculated independently of the measuring spectrometer.

Example

A $^{13}C_1$ Pyruvic Acid (PA) sample is polarised whilst at the same time monitoring the solid state polarisation build-up in order to predict the maximum level of solid state polarisation.

After about 60 minutes the PA sample is dissolved into an 18mm NMR tube and the signal measured using the ^{13}C-MQC Polarimeter. Then a sealed 4.0ml sample of $^{13}C_2$-DMSO is measured in the MQC and used as a comparison. From the integrals of these two samples the predicted liquid state polarisation at saturation is determined.

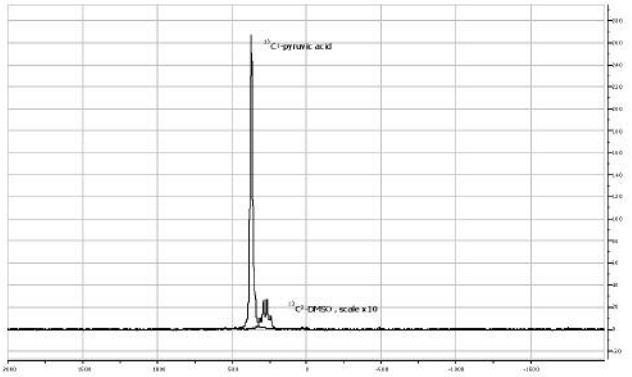

Figure 1: Hyperpolarised ^{13}C NMR spectrum of PA (receiver gain 25) and $^{13}C_2$-DMSO (receiver gain 45) data obtained on the Polarimeter and processed.

^{13}C-MQC Polarimeter Specifications

Use	Designed for use with the HyperSense DNP system
Electrical	Europe: 230V, 50Hz, USA: 110V, 60Hz, Japan: 100V+/- 10%, 50-60Hz
Magnet	0.55T permanent ^{13}C observe 18mm probe
Spectrometer	Single channel MQC spectrometer

RF Power amplifier

Single channel output	Nominal 300W at 6MHz 1% duty cycle pulsed at 100% power
Pulse length range	up to 100µs
Time resolution	0.1µs

Receiver

Gain	adjustable up to 72dB nominal in steps of 1dB from 12 to 72dB
Acquisition time	Maximum 40ms
ADC Resolution	14 bits

Dimensions

Magnet	W 362mm X D 344mm X H 342mm
Electronics unit	W 300mm X D 327mm X H 406mm
Weight	100Kg

Calibration sample

$^{13}C_2$-DMSO 4.0ml

If you would like to know more about the Polarimeter or to discuss the application further please contact us.

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