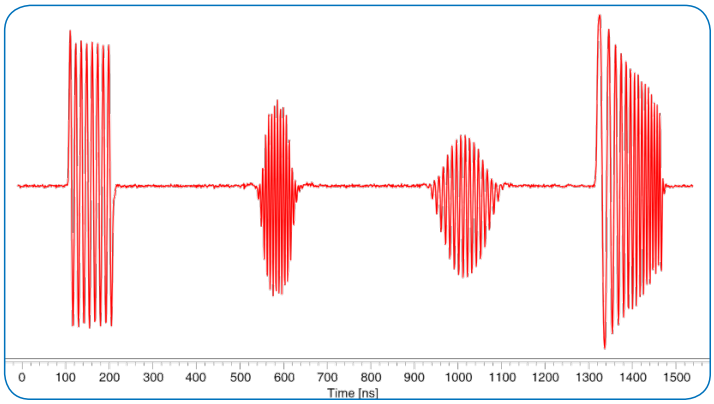
SpinJet-AWG

- The Next Step in Pulse EPR

A New Breakthrough in EPR

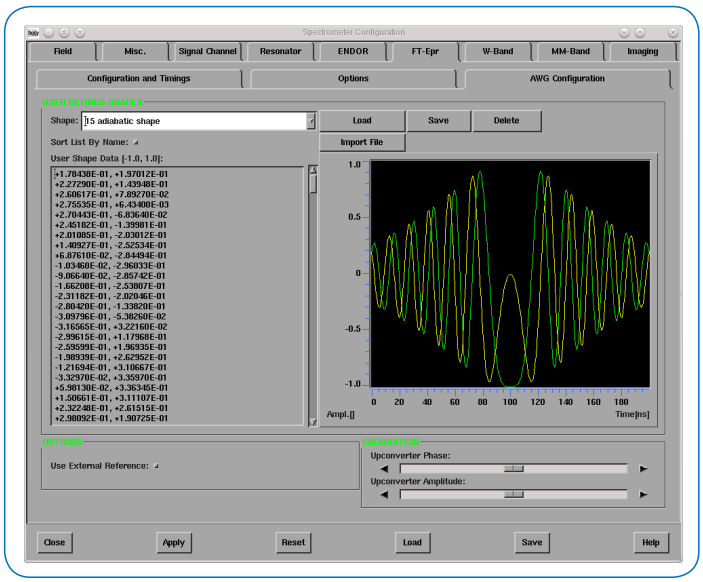
Classical pulse-EPR has been using single frequency, square-shaped microwave pulses for many years. Over the last decade, a second microwave frequency has been widely used for Electron-Electron Double Resonance (ELDOR) experiments, however, the lack of suitable high speed digital technology has limited the desired higher degree of flexibility and pulse shaping. Now, with Arbitrary Waveform Generators (AWG), we can take that next step in pulse-EPR. All waveform features that can be described mathematically can be implemented in a pulse sequence – a true breakthrough in pulse-EPR.

SpinJet-AWG introduces a new era in pulse EPR. With several examples we demonstrate the exciting new opportunities and possibilities. For ease of operation complete control over the pulse parameters, including frequency, shape, phase and amplitude is fully implemented in Xepr User definition of experiments is further extended via PulseSPEL. Compensation of technical limitations and restrictions imposed by sample properties can be addressed via the optimum control methodology. This methodology is expected to lead to significant improvements in all fields of pulse-EPR spectroscopy. The Optimum Control Pulse waveform definition is readily available from the Xepr interface (tables and PulseSPEL).



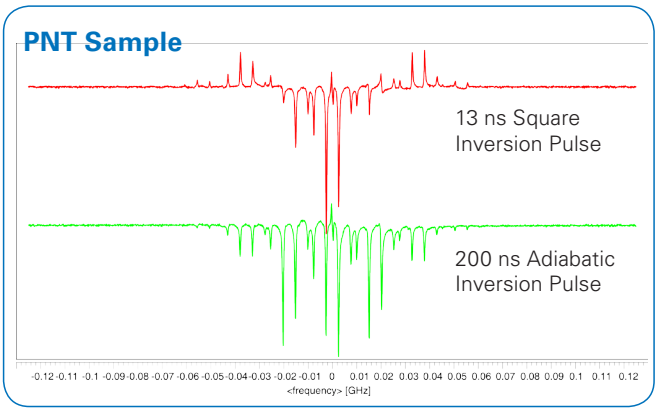
Features

- Frequency definition for each pulse
- High resolution phase setting
- Pulse shapes within shot
- Pulse amplitude control within shot
- Frequency chirps within pulse
- Multiple channel architecture
- Overlapping pulses
- Optimum Control Pulse input function
- Full Xepr implementation
- I/Q vector modulator with LO suppression network

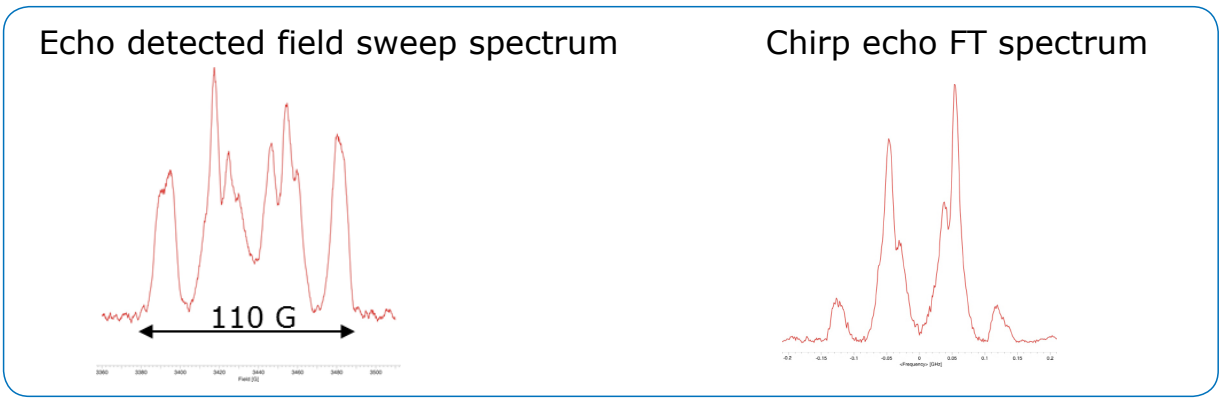


User defined adiabatic inversion pulse. Pulse shape definition is fully supported by Xepr.

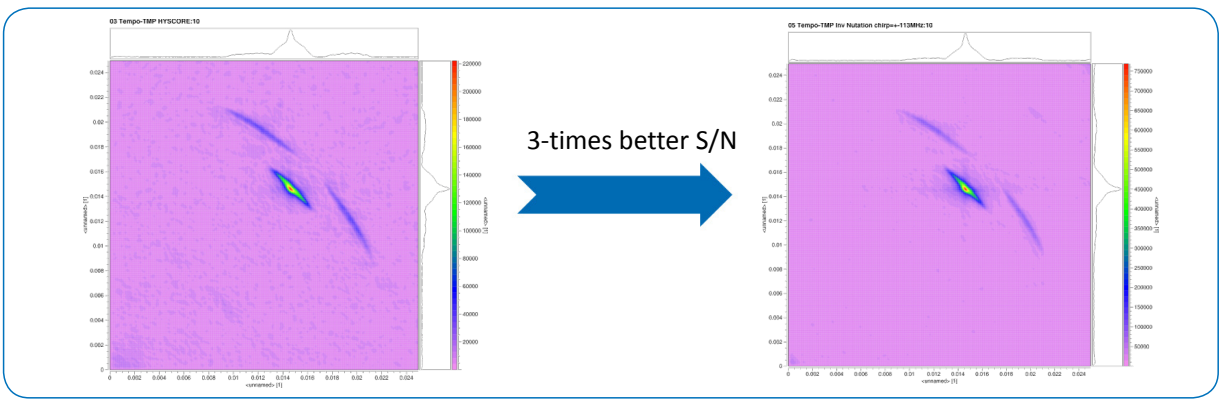
• Real Experiments That Meet Expectation



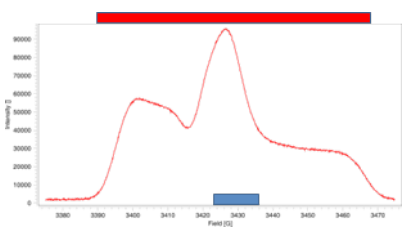
With an adiabatic pulse the full spectrum is inverted while even a very short square pulse only leads to a partial inversion. The achievable inversion bandwidth with the SpinJet-AWG is far beyond anything a square pulse can do.



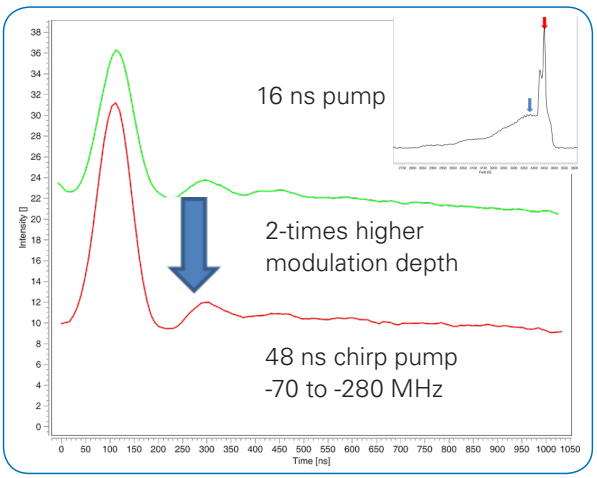
An EPR spectrum of 100 G (280 MHz) width was measured by FT of the chirped echo. In this way measuring time is drastically reduced by the multiplex advantage. There is some amplitude reduction of the outer lies due to receiver bandwidth limitation but such achieved excitation bandwidth is not possible with a single frequency pulse.



^{1}H HYSCORE of nitroxide spin probe: (right) 166 ns Chirped (±113 MHz) inversion pulse and (left) 26 ns standard inversion pulse. The excitation bandwidth of the inversion pulses are indicated on the field sweep spectrum, red = chirped and blue = standard.



AWG Transfers to all Microwave Frequencies



4-Pulse DEER spectra of Spin-labeled Cu containing protein with the pump pulse centered on the nitroxide spectrum (red arrow) and observation in the Cu spectrum (blue arrow). *Sample courtesy Thomas Prisner*

X/Q dual band FT-bridge with SpinJet-AWG

The AWG bandwidth of 800 MHz enables excitation of large g-anisotropy evident at higher frequencies. Combining the AWG with the latest high power, high frequency options will further enhance signal-to-noise and sensitivity for many experiments, e.g. DEER, HYSCORE.

Compatibility

- SpinJet-AWG is an accessory for the X-band FT-EPR bridge. All its features also transfer directly via the IF path to other bands.
- Compatible with the E 580/680/780 instruments, optimized for instruments based on the Linux acquisition server.

Specifications

- Amplitude resolution 14 bit
- Clock 1.6 GS/s
- 0.625 ns time resolution
- Up to 16,384 individual waveforms per acquisition cycle
- Up to 32 channels
- 5 predefined shapes
- Support for custom shapes
- Memory corresponding to 80 ms of continuous pulsing
- ± 400 MHz bandwidth around carrier

Bruker BioSpin

epr@bruker-biospin.de
epr@bruker.com
ww.bruker-biospin.com/epr