Pulse EPR console for imaging and other applications

Connecting Spectrometers to People

Boris Epel[*], Igor Gromov[**], Stefan Stoll[**] and Daniella Goldfarb[***]

[*]University of Chicago, USA; [**]Swiss Federal Institute of Technology (ETH Zürich), Switzerland; [***]Weizmann Institute of Science, Israel. Contact e-mail: bepel@uchicago.edu

Every pulse spectrometer has a console for pulse generation and detection of time domain signals. In this poster we present an affordable pulse EPR console built from general purpose components that works as a single unit. Major components of the console are:

- **SpecMan4EPR (www.esr.ethz.ch, www.geocities.com/boep777/sm_main.html)** – versatile control and acquisition software for pulse EPR experiments[1]. Distributed by Scientific Software Services (www.scientific-software.com, reef@scientific-software.com)
- **PulseBlasterESR-Pro 400 MHz,** SpinCore Technologies, Inc (**www.spincore.com**) – universal pulse programmer. 2.5 ns time resolution. 21 independent channels. Large memory allows storage of more than 2000 pulses. Low programming delays (about 50 µs for a typical pulse sequence)
- **AP235 averager**, Agilent Technologies (**www.acqiris.com**) – 1 GS/s for 1 channel acquisition, 0.5 GS/s for 2 channels acquisition. Fast data transfer rate (up to 133 MB/s, at least 70 MB/s on average with SpecMan4EPR)

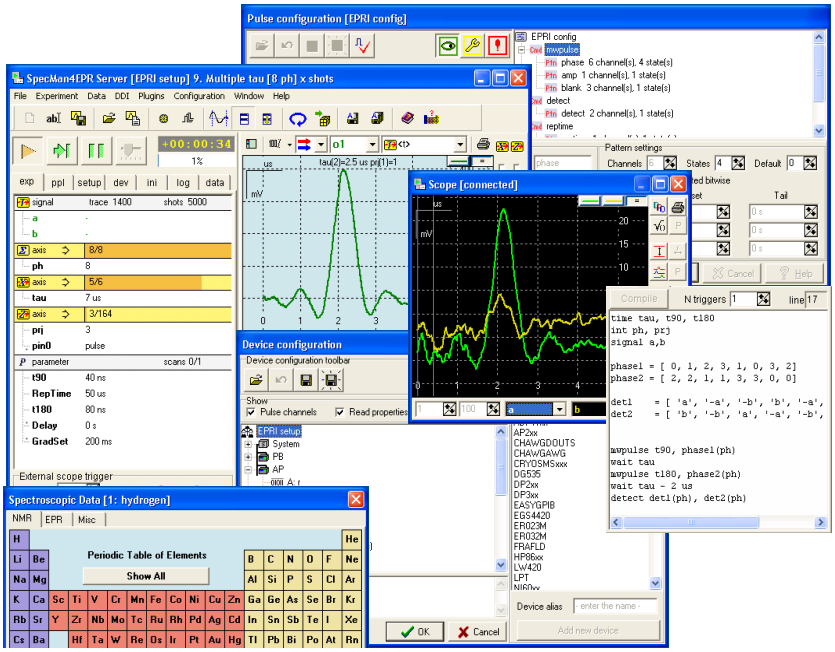

Fig. 1. Front end of the **SpecMan4EPR**

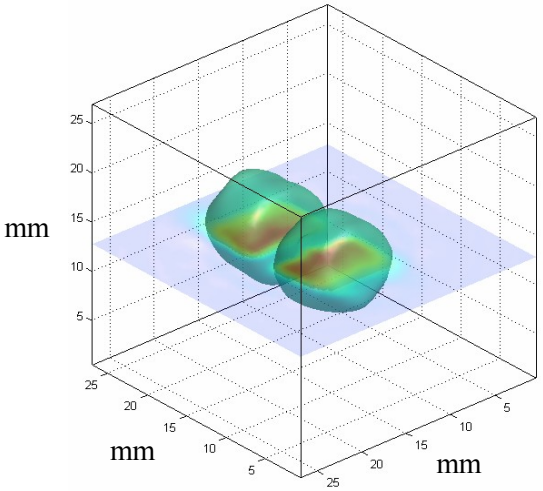

Fig. 2. 3D EPRI image of 1 mM FIND and 1 mM OX63 radical in H_2O samples in 8 mm bottles (bottom to bottom). 250 MHz imager, two-pulse echo sequence (8 step phase cycle, 16000 shots, 40 µs rep. time), 164 projections. Reconstructed using FBP algorithm. Acquisition time for T_2 mapping 36 min (overall 20 images with different delays between pulses acquired, 35 min of pure measurement time, gradient settling time 25 s)

- **Complete pulse console inside one computer case**
- **Easy upgrade and expandability, control of external devices using standard buses (USB/GPIB). Single system for all kinds of spectrometers**
- **Device-independent pulse programming language**
- **ANY parameter of device or experiment can be used as independent variable of experiment**
- **Four-dimensional experiments. Linear, logarithmic or list-based definition of sweep parameters**
- **Random acquisition, run-time baseline correction, signal integration and FFT**
- **NEW! Remote control of experiment over LAN or Internet**
- **NEW! Acquisition of multiple time traces during single pulse sequence**
- **NEW! Multiple sequences are programmed at once to reduce reprogramming time**

[1]Epel B. *et al.*, J. Magn. Reson., **164**, 78 (2003); Epel B. *et al.*, Concepts in Magnetic Resonance, **26B**, 36 (2005)