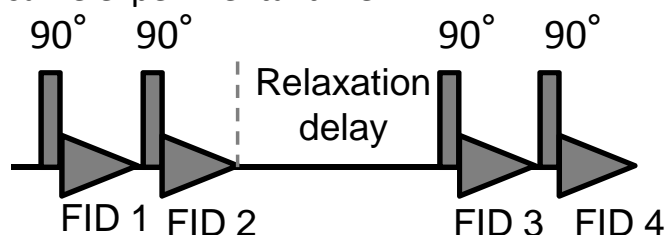


## EASY Background Suppression in Solid-State NMR

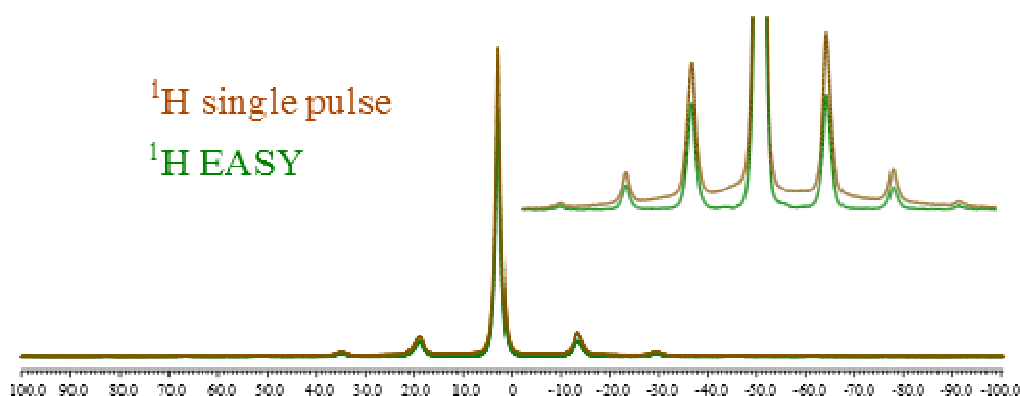
C. Jaeger *et al.* have very recently introduced a new technique to suppress probe background signals, spectral distortions due to deadtime ringdown effects and acoustic ringing artifacts [1]. The method named *EASY* (Elimination of Artifacts in NMR Spectroscopy) does not require lengthy phase cycling, is rather easy to implement and is suitable for quantitative NMR studies. This application note demonstrates the background suppression with *EASY*.

The pulse sequence is shown in Figure 1. It consists of acquiring two FIDs, FID 1 and FID 2, without any relaxation delay between them. While the first FID contains signals of the sample and the probe background, the second one represents the background signal only, because background experiences small flip angles and tends to have short  $T_1$  relaxation times. These two FIDs are subtracted to produce the spectrum of the sample. This basic unit can be followed by a relaxation delay and repeated to increase signal-to-noise ratio. The most appealing feature of the experiment is that background signals are subtracted immediately, in every unit, and virtually within the same experimental time.

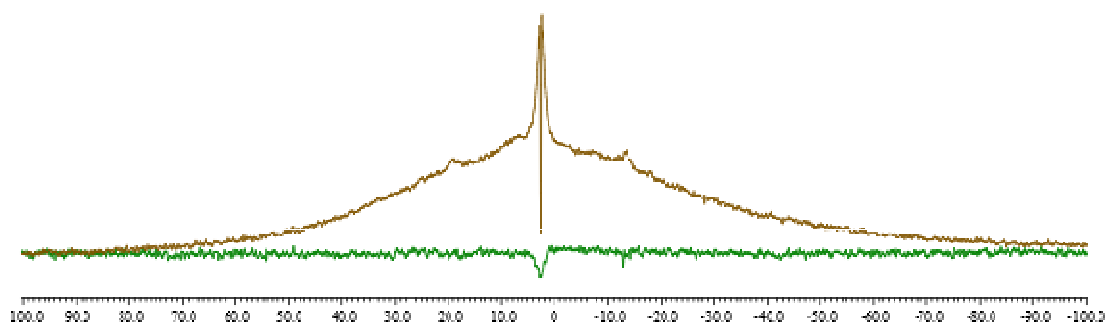


**Figure 1.** *EASY* pulse sequence. FID 1 and FID 2 are recorded without any delay and subtracted to remove background signals. The pulse sequence can be repeated to accumulate spectra after a relaxation delay. Flip angles of  $90^\circ$  are preferable.

Figure 2 shows a comparison of  $^1\text{H}$  single pulse and *EASY* spectra recorded on a 500 MHz spectrometer (ECA500II) equipped with a 3.2 mm CPMAS probe. The spectra of adamantane were recorded at MAS 8 kHz with one scan. While the single pulse spectrum shown in brown contains a broad background signal due to construction materials of the probe, this signal is greatly eliminated by the *EASY* pulse sequence as shown in green.



**Figure 2.**  $^1\text{H}$  single pulse (brown) and *EASY* (green) spectra of adamantane recorded with one scan at MAS 8 kHz with a 3.2 mm HXMAS probe.



**Figure 3.**  $^1\text{H}$  saturation recovery (brown) and *EASY* saturation recovery (green) spectra of adamantane recorded with one scan and delay of 1 ms.

Figure 3 demonstrates that the *EASY* approach can be implemented successfully into other solid-state NMR experiments. The example given here is a saturation recovery experiment allowing one to measure  $T_1$  relaxation time. The spectra were recorded with a very short delay to saturate the peaks of adamantane. For this reason, the ordinary saturation recovery spectrum shows the very broad background signal, while the *EASY* version is free of any signal.

[1] C. Jaeger, F. Hemmann, *Solid State Nucl. Magn. Reson.* **57-58** (2014) 22-28.