Interleaving Device
Simultaneous and Interleaved Acquisition of NMR Signals from Different Nuclei

Description

Our PD-DDS frequency synthesizer is an upgrade for Siemens MRI scanners that will enable truly simultaneous or rapidly interleaved (i.e. within the same pulse sequence) acquisition of signal from two different nuclear species. It is designed for Siemens MRI systems fitted with the MNO (multinuclear) option running the VB platform (e.g. Avanto, TIM Trio, 7T). The approach is general; therefore the device may potentially be applied with other manufacturers’ MRI scanners.

Using the PD-DDS will overcome the limitation of acquiring only one signal from only one nuclear species per pulse sequence.

This enables, for example the implementation of:

- Interleaved acquisition of 13C or 31P and 1H spectra or images.
- 31P CSI interleaved with 1H navigators for online motion correction or dynamic shimming.
- Simultaneous acquisition of 23Na and 1H images for improved 23Na image reconstruction.
- And potentially other applications.

The PD-DDS device may be installed or removed from the scanner in approximately a minute, requiring only a few cable connections to be changed. When the installed device is powered off the MRI scanner will work the same way as if the device was removed.

Only the receive chain of the scanner is modified; the safety-critical transmit chain is not changed in any way, so the device has no implications for RF safety supervision. The device is compatible with all multinuclear-capable RF coils, requiring no alteration to their hardware, leaves the scanner’s performance unchanged and is fully transparent to normal scanner operation.

It may be used with anything from a simple single-channel coils to more complex multichannel receive arrays.
How it works

The device is connected to the scanner receive chain. Before running a sequence, the device is programmed with the operating frequency for the particular nucleus. The device operates in two modes: passive and active. When passive, the scanner receive channels operate as normal, with no performance degradation. When the device is active, the receive channel detection frequency is altered to detect signal from the second nucleus of interest. The device is switched between passive and active modes within milliseconds under control of the pulse sequence, which is programmed by the user.

Publications

*Simultaneous and Interleaved Acquisition of NMR Signals from Different Nuclei with a Clinical MRI Scanner;* Martin Meyerspeer, Arthur W. Magill, Andre Kuehne, Rolf Gruetter, Ewald Moser, and Albrecht Ingo Schmid
Magnetic Resonance in Medicine 76: 1636–1641