Editor comments

The authors selected 6 samples to illustrate the enhancement. For ethanol, which is the only sample with different NMR signals of scalar coupled nuclear spins, the enhancement was very modest. This is not commented on in the manuscript and T1 data are not reported. The authors assumed that the individual T1 times of the nuclei are independent of the magnetic field. However, this is not true for scalar coupled spin systems, as in ethanol, in field cycling experiments. The difference in the Zeeman frequencies of the nuclear spins is proportional to the external magnetic field, while the scalar coupling constant is independent of the magnetic field. Therefore, for spins weakly coupled in high magnetic fields (5 T and 1.4 T), the coupling conditions change from weak to strong coupling while passing the stray field of the HTS magnet. If the difference in the Zeeman frequencies of the nuclear spins becomes comparable to or smaller than the scalar coupling constant, these nuclear spins become strongly coupled and such a spin system goes out of equilibrium, since in a strong field their individual T1 times differ. Scalar couplings cause a coherent polarization transfer between the spins, and the relaxation of the nuclear spins of a strongly coupled spin system becomes non-exponential and can no longer be characterized by T1 in a strong field. To neglect oscillations in time evolution of scalar coupled spin system (in a simplified description), the residence time in such a field range must be shorter than the inverse coupling constant. For protons with a chemical shift difference of 2 ppm and a scalar coupling constant of 10 Hz, the condition of strong coupling is fulfilled in a magnetic field below 0.1 T. That is, everywhere on the way between the two magnets (5 T and 1.4 T)! At typical values of 5-10 Hz, the transfer time must be in the millisecond range to neglect the coherent polarization transfer between strongly coupled spins, but it was 2 seconds.

This overlooked but ubiquitous phenomenon may be the reason for the complete failure of the obvious advantages of the brute force prepolarization method proposed by the authors in case of ethanol. In hyperpolarization (for example CIDNP or PHIP) of liquids sample, such kind of polarization transfer among strongly coupled spins in diamagnetic molecules may result the polarization distribution from initially hyperpolarized spins over all spins of the entire molecules.