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Uncovering Hidden In Vivo Resonances Using Editing Based on Localized TOCSY

Malgorzata Marjanska,^{1*} Pierre-Gilles Henry,¹ Patrick J. Bolan,¹ Brooks Vaughan,² Elizabeth R. Seaquist,² Rolf Gruetter,¹ Kamil Uğurbil,¹ and Michael Garwood¹

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Abstract

A novel single-shot spectral editing technique for in vivo proton NMR is proposed to recover resonances of low-concentration metabolites obscured by very strong resonances. With this new method, editing is performed by transferring transverse magnetization to J-coupled spins from selected coupling partners using a homonuclear Hartmann-Hahn polarization transfer with adiabatic pulses. The current implementation uses 1D-TOCSY with single-voxel localization based on LASER to recover the H1 proton of β -glucose at 4.63 ppm from under water and the lactate methyl resonances from beneath a strong lipid signal. The method can be extended to further spin systems where conventional editing methods are difficult to perform.

Keywords: editing, spectroscopy, TOCSY, glucose, lactate, adiabatic pulses

Low-concentration metabolites examined by in vivo proton NMR spectra are often obscured by very strong resonances. In the context of glucose metabolism studies, glucose signals are mostly covered by water and lactate by lipid resonances. One way to obtain information about such overlapped signals is to remove the strong resonance via spectral editing. A variety of different editing techniques have been developed (see (1) and (2), and references therein). Water suppression and spatial localization can be considered the simplest spectral editing technique. For example, such a technique was used to directly detect the glucose (H1 α -glucose) signal at 5.23 ppm in human brain at 4 T (3) with proton NMR. This accomplishment relied on excellent spatial localization and good shimming within the volume of

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When the resonance overlap precludes direct detection approaches, more complex editing strategies can be employed. To

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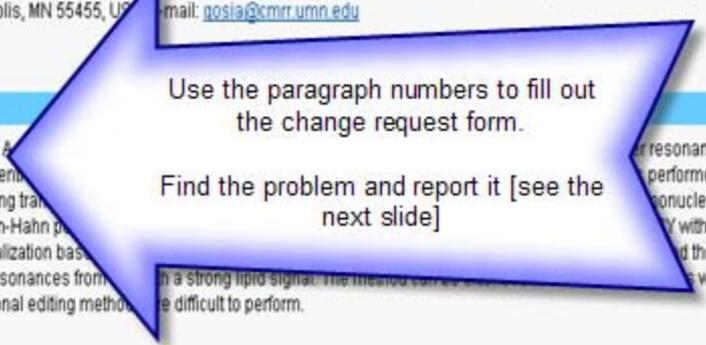
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S1

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