Supplementary Material: Water mobility spectral imaging of the spinal cord: parametrization of model-free Laplace MRI

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1. The use of a Gaussian model

Instead of fitting the spectra to a bimodal lognormal function, Stanisz and Henkelman suggested to fit their T_2 decay signal directly to a two-component model [1], naming it the Gaussian model. We re-implemented the Gaussian model fitting procedure, converted it to apply to diffusion signal decay, and performed it on a voxelwise manner in the case of perpendicular diffusion (Fig. S1). We note that the main difference between the Gaussian model method and the current approach is in fitting the acquired signal directly to a bimodal function with 6 free parameters, which can be quite challenging, especially if the signal-to-noise-ratio (SNR) is not high. Regularization cannot be used when directly fitting the signal, which led to unwarranted spikes in the reconstructed spectra (Figs. S1A and B). In addition, from an optimization standpoint, fitting a smooth curve (i.e., the ILT-obtained regularized spectra) is preferable to fitting a noisy curve (i.e., the noisy data). These limitations resulted in much noisier quantitative images of $I^{\perp}_{slow}$ and $I^{\perp}_{fast}$ (Fig. S1C), compared to the ones obtained by using the parametric fitting of the spectra (Fig. 4 in the main paper).

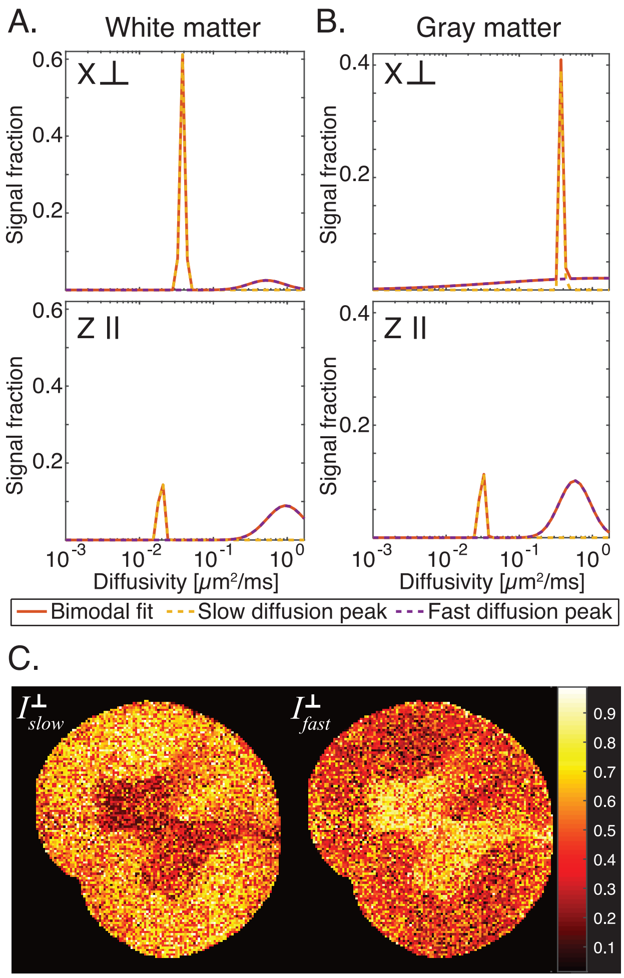

Figure S1: The results from fitting the signal attenuation to a sum two lognormal decay functions [1]. For consistency and to allow a direct comparison, the spectra in (A) and (B) correspond to the same WM and GM voxels shown in Figs. 3B and C, respectively. (C) The bottom panel contains the quantitative images of $I^{\perp}_{slow}$ and $I^{\perp}_{fast}$ that were obtained by using this method, which should be compared with the corresponding images in Fig. 4.

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References

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