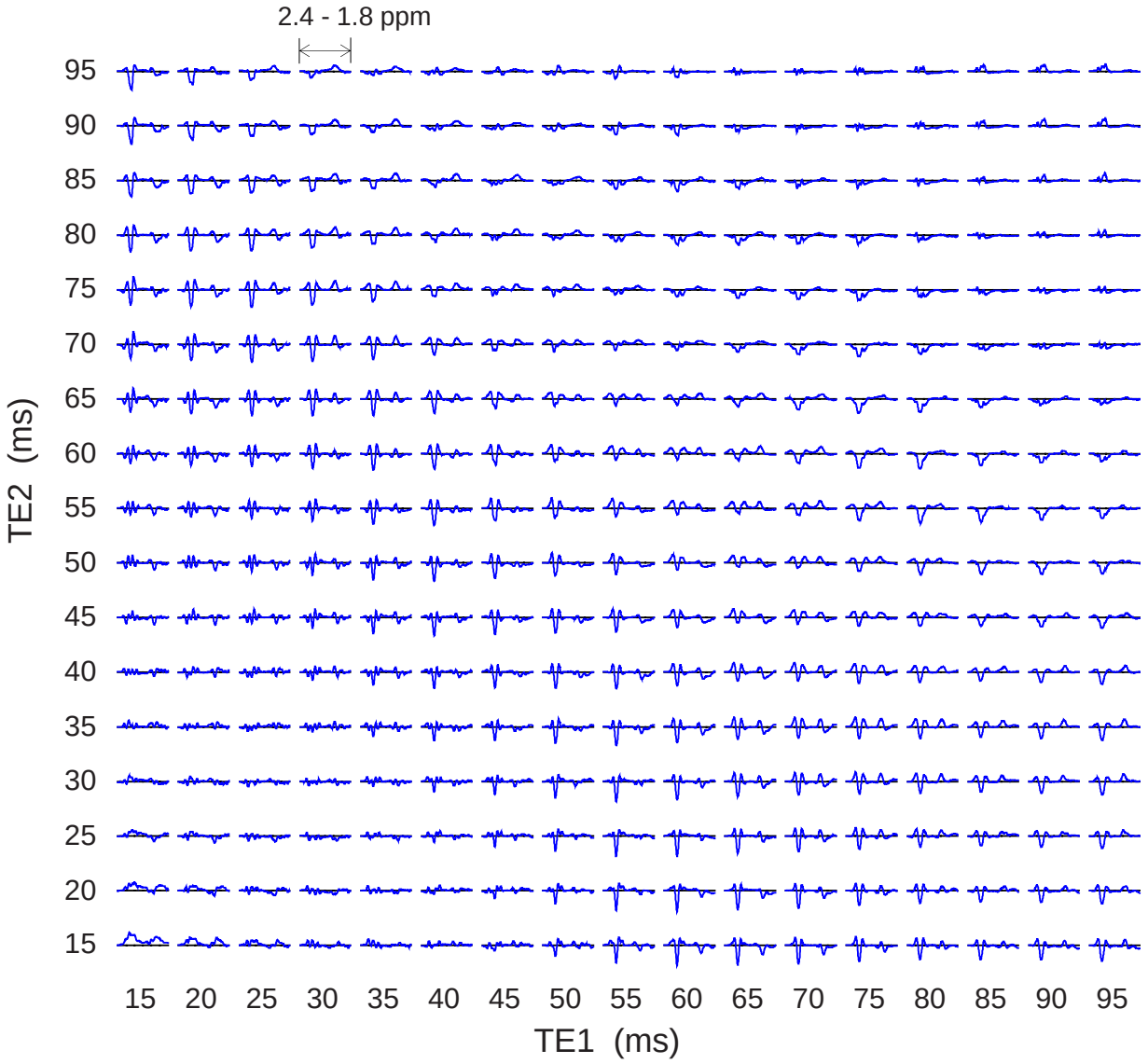
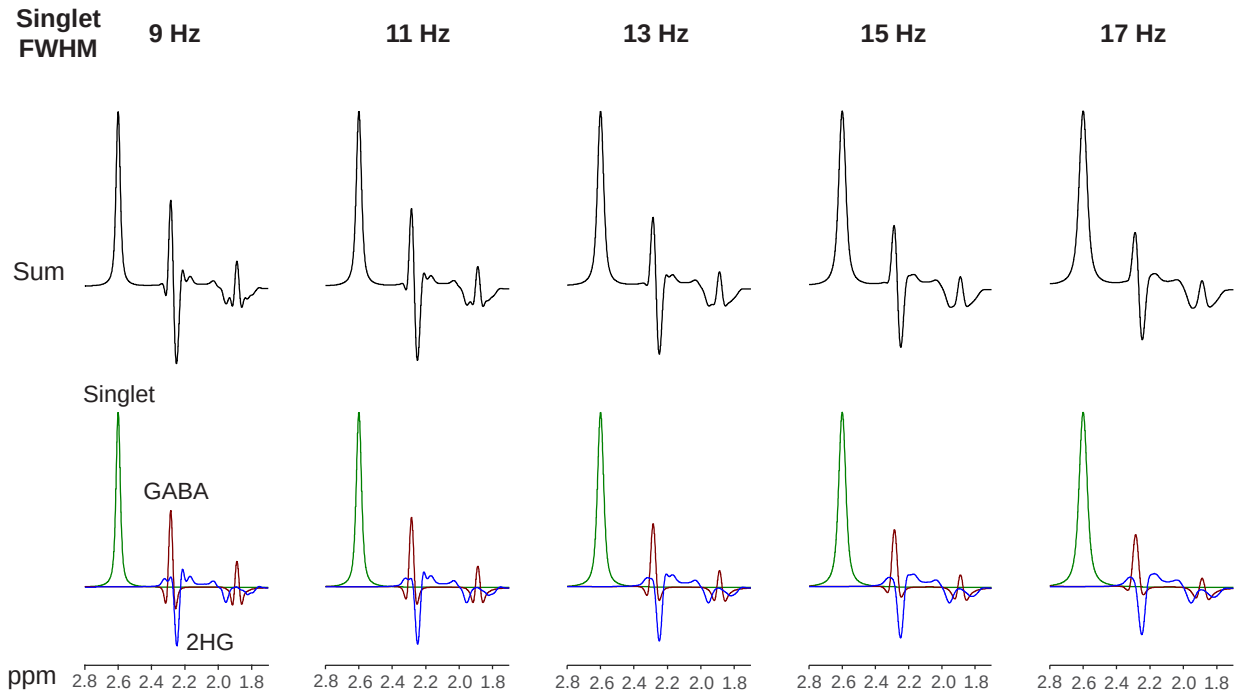
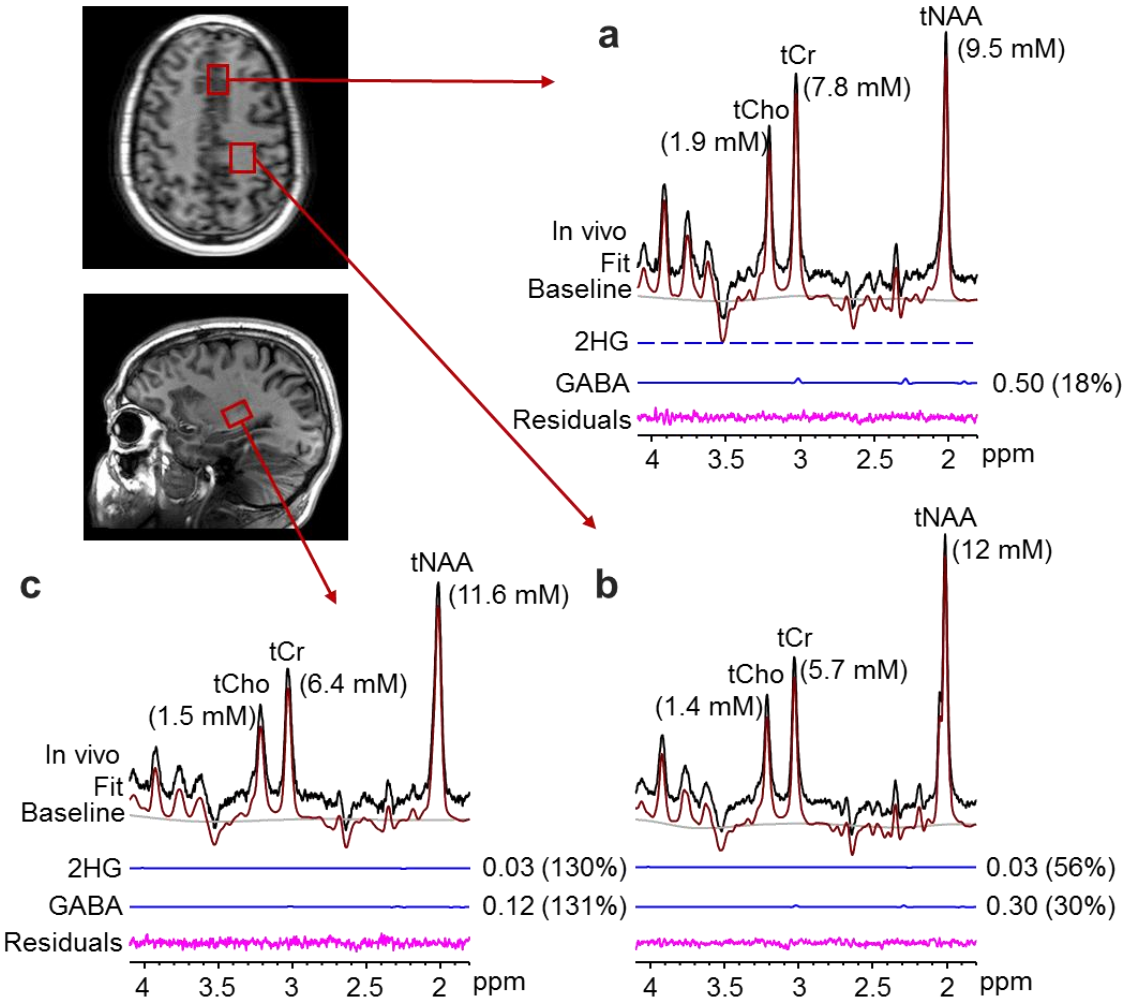


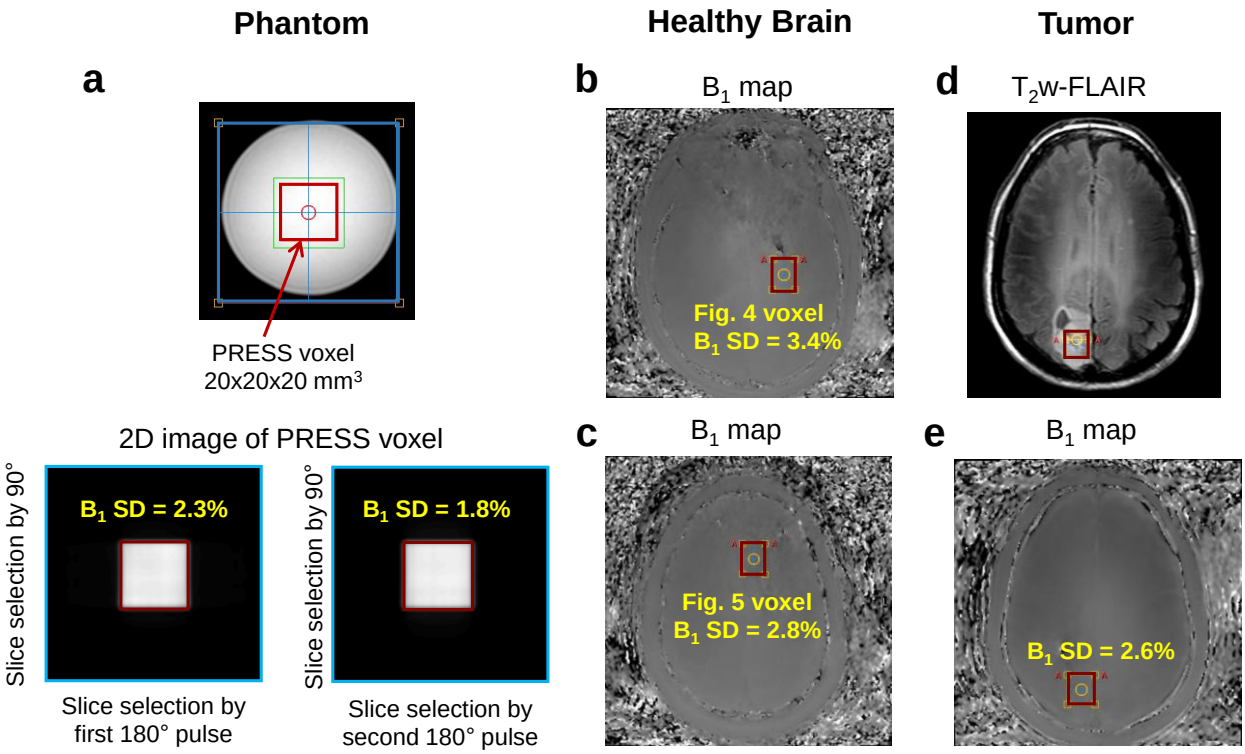
Supporting Figure S1. Numerically-calculated spectra of the 2HG C4-/C3-proton resonances are displayed *vs*. the subecho times TE_1 and TE_2 of the PRESS sequence used in the study. Spectra were broadened to singlet FWHM of 9 Hz.



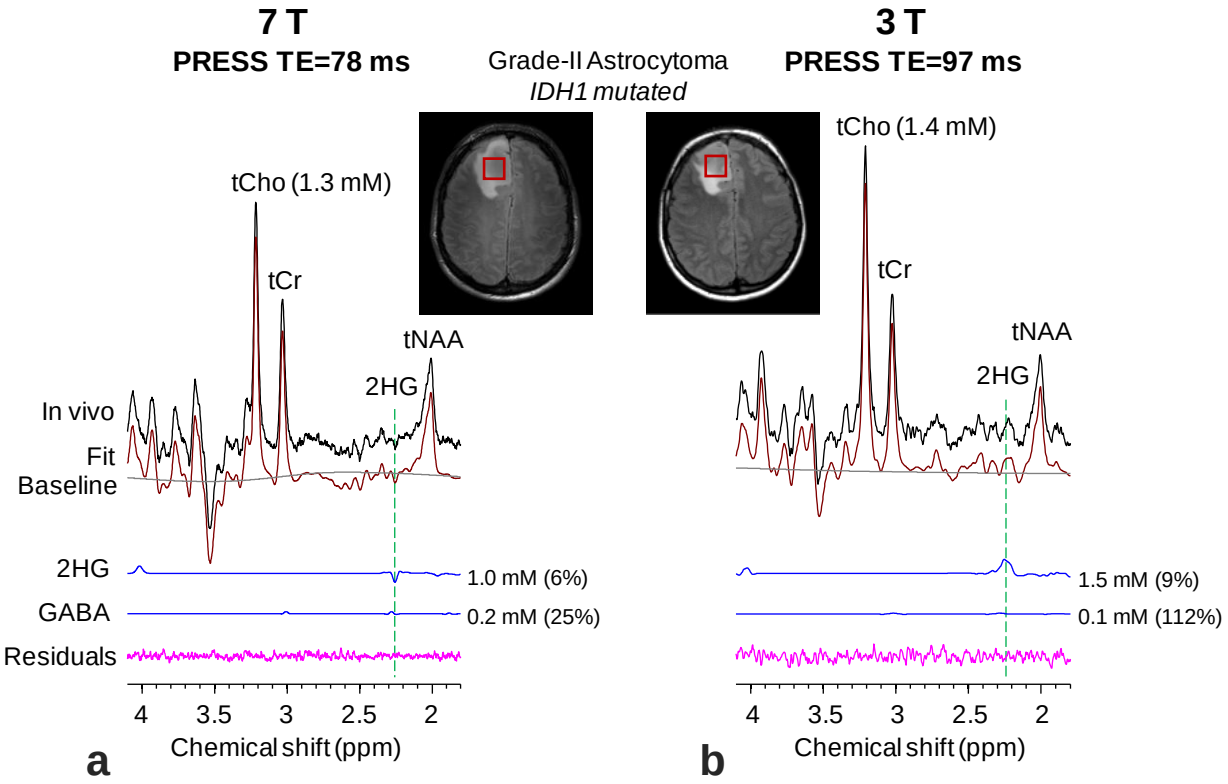
Supporting Figure S2. Numerically-calculated PRESS (TE_1, TE_2) = (58, 20) ms spectra of 2HG and GABA at equal concentrations are shown, together with an artificial singlet at 2.6 ppm (green), for various singlet linewidths (FWHM). Spectra are normalized to the singlet in each FWHM.



Supporting Figure S3. *In-vivo* spectra from a healthy brain are shown together with LCModel outputs and individual spectra of 2HG, and GABA from three brain regions (frontal, temporal and posterior). 2HG was undetectable in all three spectra. The voxel size was 4.5 mL for frontal and temporal and 5.9 mL for posterior. Data were acquired with NSA = 64.



Supporting Figure S4. **(a)** 2D images of a PRESS localized voxel (8 mL) in a phantom solution. The standard deviation (SD) of B_1 within the voxel was approximately 2% with respect to the mean value. **(b,c)** B_1 map data from a healthy brain. The B_1 SDs for the voxels of Figs. 4 and 5 of this paper were ~3%. **(d,e)** T_2w-FLAIR and B_1 map data from a tumor patient. The B_1 SD within a PRESS voxel within the tumor was estimated to be < 3%.



Supporting Figure S5. *In-vivo* spectra at 7T and 3T from an IDH-mutated grade-II astrocytoma patient are presented with LCModel outputs and spectra of 2HG and GABA. At 3T, the spectrum was acquired using a TE = 97 ms PRESS method and metabolites were quantified similarly as in our prior study [Choi *et al*. Nat Med 2012;64:624-629]. Spectra were scaled with respect to short-TE water for each B_0. The voxel size, TR and NSA were 8 mL, 2.5 s and 64 at 7T, and 8 mL, 2 s and 80 at 3T. Data were acquired using 16- and 8-channel coils at 7T and 3T, respectively, which were combined using an in-house channel-combination method.