Supporting Information

Proportionality of hybrid and sensitivity methods for a “perfect” EPG-simulated RARE SI model

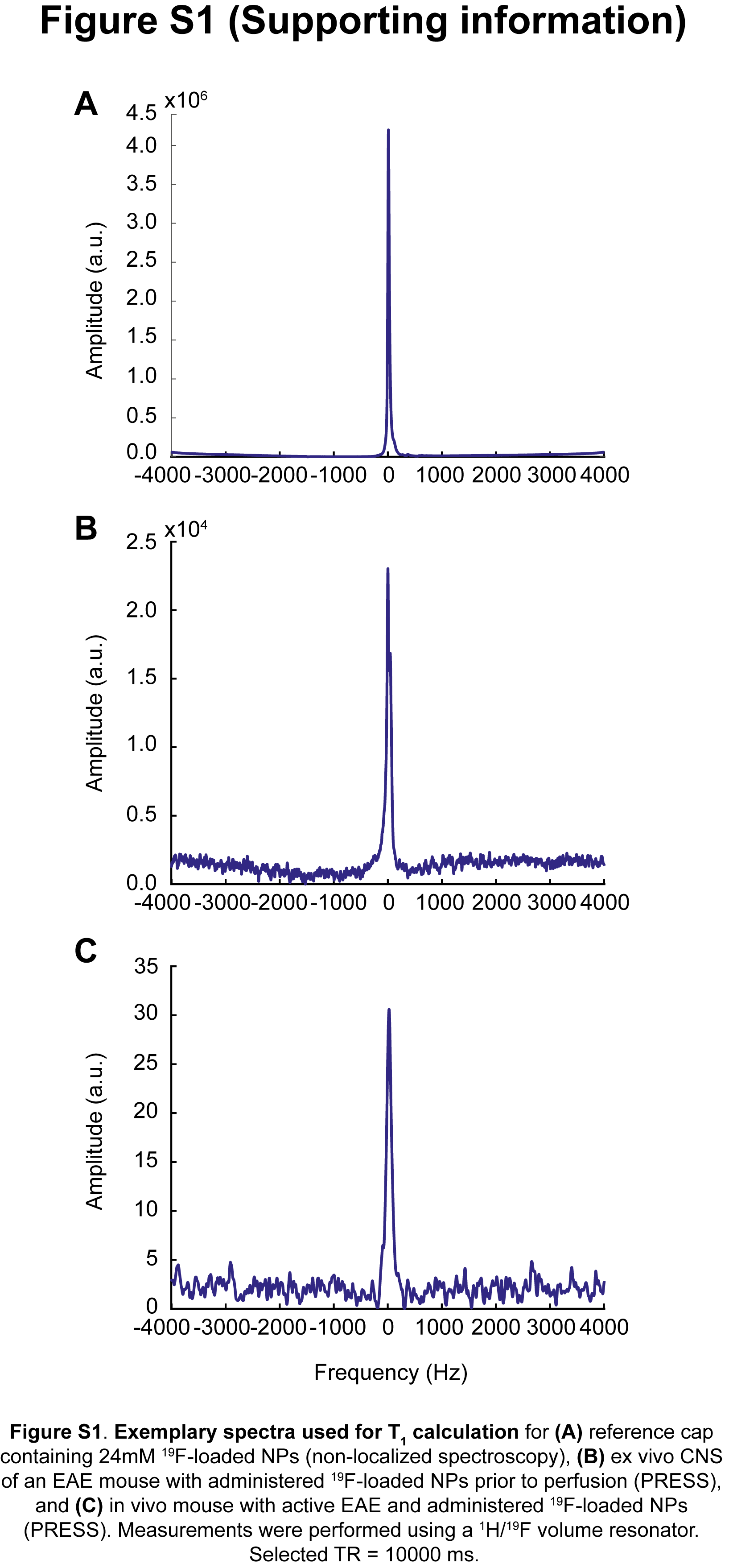
The *hybrid method* is proportional to the *sensitivity method* when the RARE SI model is calculated using simulations and does not have a bias introduced by measurements.

Both correction methods can be expressed as:

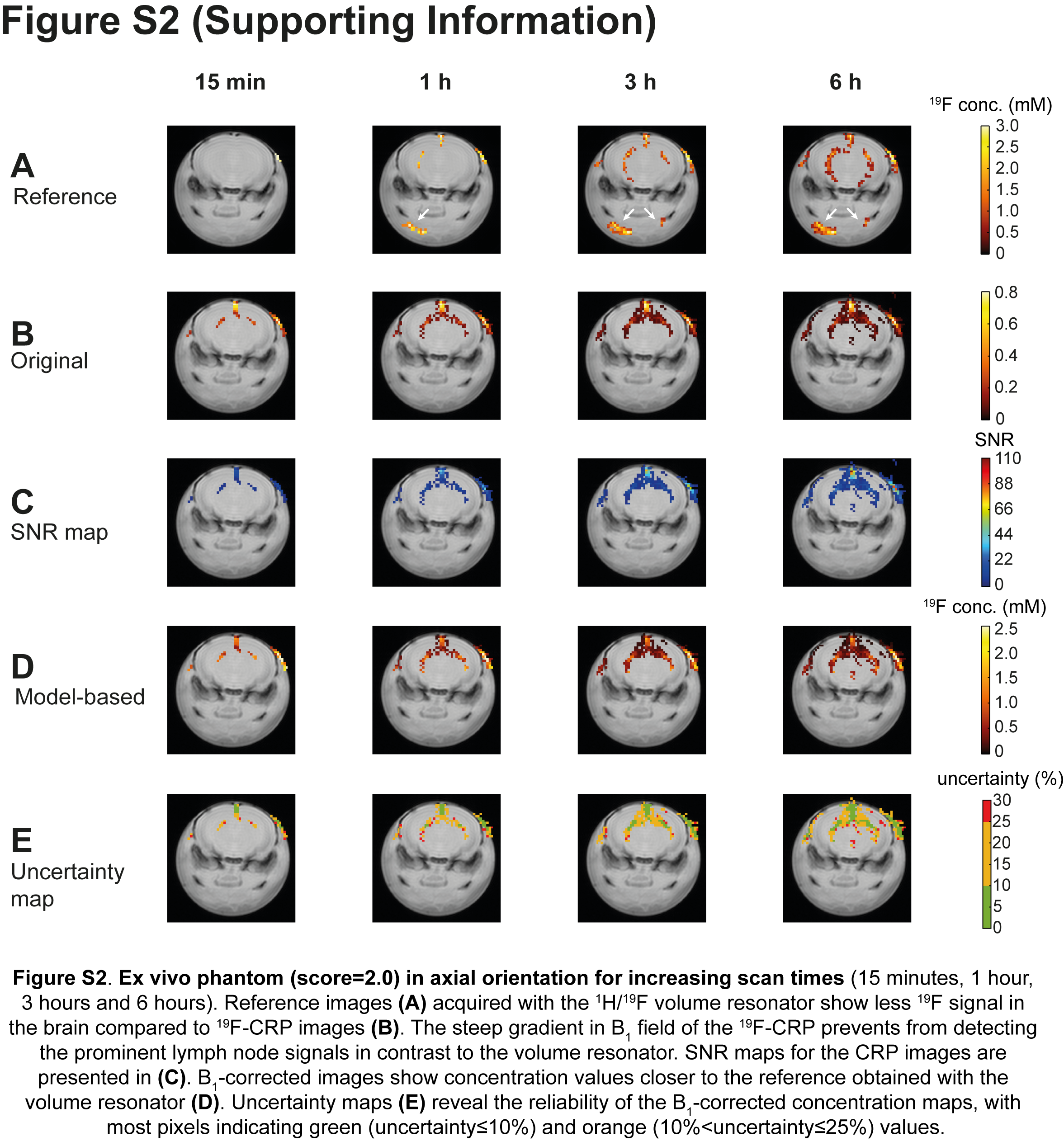
being and the image to be corrected and the uniform phantom image used for *sensitivity correction*, respectively.

Replacing the B1+ corrections by their definitions[23](#_ENREF_23) as:

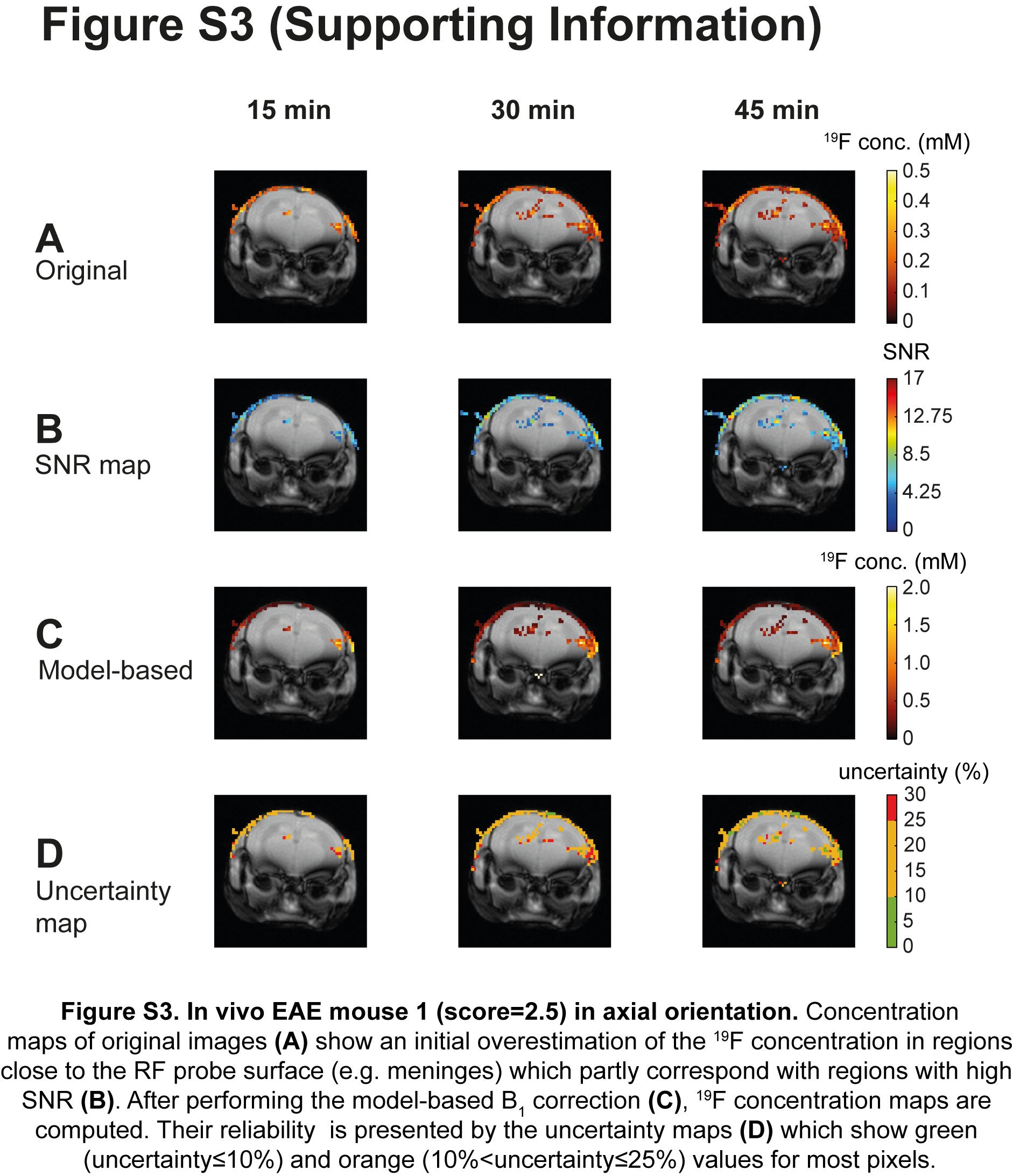
Since and are the SIs for perfect 90º excitations and both samples have constant T1 relaxation times, they can be replaced by a constant. Similarly, and are the SIs for the actual excitations FA which equal to a constant for each pixel. Thus:



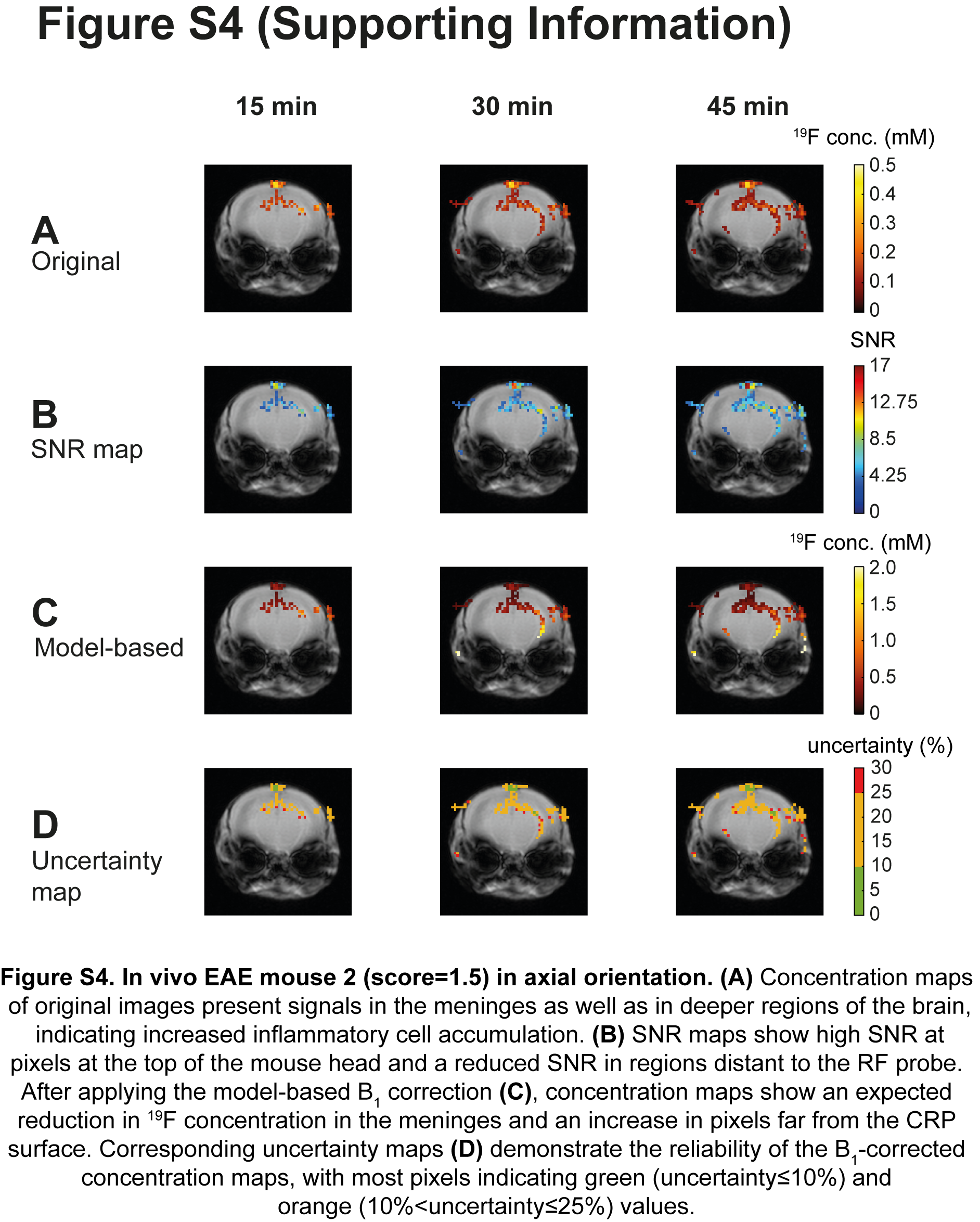
**Figure S1. Exemplary spectra used for T1 calculation** for **(A)** reference cap containing 24mM 19F-loaded NPs (non-localized spectroscopy), **(B)** ex vivo CNS of an EAE mouse with administered 19F-loaded NPs prior to perfusion (PRESS), and **(C)** in vivo mouse with active EAE and administered 19F-loaded NPs (PRESS). Measurements were performed using a1H/19F volume resonator. Selected TR = 10000 ms.



**Figure S2. Ex vivo phantom (score=2.0) in axial orientation** for increasing scan times (15 minutes, 1 hour, 3 hours and 6 hours). Reference images **(A)** acquired with the 1H/19F volume resonator show less 19F signal in the brain compared to 19F-CRP images **(B)**. The steep gradient in B1 field of the 19F-CRP prevents from detecting the prominent lymph node signals in contrast to the volume resonator. SNR maps for the CRP images are presented in **(C)**. B1-corrected images show concentration values closer to the reference obtained with the volume resonator **(D)**. Uncertainty maps **(E)** reveal the reliability of the B1-corrected concentration maps, with most pixels indicating green (uncertainty≤10%) and orange (10%<uncertainty≤25%) values.



**Figure S3. In vivo EAE mouse 1 (score=2.5) in axial orientation.** Concentration maps of original images **(A)** show an initial overestimation of the 19F concentration in regions close to the RF probe surface (e.g. meninges) which partly correspond with regions with high SNR **(B)**. After performing the *model-based B1 correction* **(C)**, 19F concentration maps are computed. Their reliability is presented by the uncertainty maps **(D)** which show green (uncertainty≤10%) and orange (10%<uncertainty≤25%) values for most pixels.



**Figure S4. In vivo EAE mouse 2 (score=1.5) in axial orientation.** **(A)** Concentration maps of original images present signals in the meninges as well as in deeper regions of the brain, indicating increased inflammatory cell accumulation. **(B)** SNR maps show high SNR at pixels at the top of the mouse head and a reduced SNR in regions distant to the RF probe. After applying the *model-based B1 correction* **(C)**,concentration maps show an expected reduction in 19F concentration in the meninges and an increase in pixels far from the CRP surface. Corresponding uncertainty maps **(D)** demonstrate the reliability of the B1-corrected concentration maps, with most pixels indicating green (uncertainty≤10%) and orange (10%<uncertainty≤25%) values.