AbstractID: 11563 Title: Slow Diffusion Enhancement for Approximated Returning to the Origin Probability (ARTOP)

Purpose: This study introduces a filtering method that enhances slow/fast diffusion contrast for the q-space analysis, ARTOP (*A*pproximated *R*eturning *T*o the *O*rigin *P*robability), in clinical studies. **Background:** Most clinical diffusion image analyses are based on the apparent diffusion coefficient (ADC), which uses a Gaussian model for its ensemble probability density function (PDF). However an ADC-related modality becomes problematic when it is applied to high-diffusion MRI studies (b>3ksec/mm^2) due to its complexity in modeling. q-space analysis is model-independent; i.e. the Fourier transformation between data profile in q-space and its displacement PDF has no modeling assumptions. Nevertheless the traditional q-space analysis also poses some difficulties in clinical implementation. Therefore we have been developing a clinical feasible q-space analysis, ARTOP, for high diffusion studies. This study improves ARTOP by increasing the slow-diffusion contrast for better imaging quality, and shortens scanning time as well. **Methods and Materials:** The contrast of slow/fast diffusion signal is enhanced by a high-pass filter in q-space (b >=1ksec/mm^2), which most fast diffusion signals diminish over that weighting range. The effect was applied on research patient datasets. Patient datasets were collected using a Siemens Trio 3T magnet and were processed by offline homemade codes. The 9-level diffusion weighting ranges were 1~4k sec/mm^2. **Results:** The slow/fast contrast was defined by the ratio of slow/fast ARTOP signal. The filtered ARTOP contrast is more than 7 times greater than the one without filtering; i.e. 15 versus 2 for the filtered versus non-filtered data. **Conclusion:** The better imaging quality of filtered ARTOP is suitable for radiological examination or treatment planning contour, and its quantitative information can be easily retrieved from non-filtered ARTOP map. The quantity can be used for white matter diseases, e.g. for monitoring the glioma treatment response, as in our other studies.