AbstractID: 5296 Title: Relative SNR benefits of dynamic arterial spin labeling at 3T as determined by simulation and comparison with imaging at 1.5T

Purpose: To demonstrate the benefits of brain perfusion imaging at high magnetic field MR scanner using Dynamic Flow-sensitive alternating Inversion Recovery (FAIR) spin labeling technique as compared to standard FAIR at lower field.

Method and Materials: FAIR signal behavior as a function of the inflow time (TI) at 1.5T and 3T were simulated for both dynamic and standard FAIR methods. Simulations were performed considering initial inversion of the magnetization, it's subsequent T1 recovery, in-flow of blood into the slice and signal reduction due to repetitive RF excitations (Look-Locker sampling) in dynamic FAIR. Experimental brain perfusion imaging of healthy volunteers (n=3) was performed on GE scanners.

Results: The results showed overall signal behavior in dynamic FAIR is almost independent of readout rate. This means the temporal resolution of imaging can be increased to any desired amount as far as the scanner hardware permits. On the other hand multiple small readout flip angles will induce smaller perturbations than larger flip angles however for a given magnetic field dynamic FAIR with small flip angles lead to lower SNR as compared to standard FAIR. But given the same noise level a low flip angle dynamic FAIR would lead to higher SNR as compared to standard FAIR at 1.5T. For flip angle=20 the relative SNR of dynamic FAIR at 3T to standard FAIR at 1.5 for TI=500, 1200 would be 1.42 and 1.60 respectively.

Conclusions: Significant increase in temporal resolution and SNR in FAIR arterial spin labeling technique can be achieved by performing multiple (dynamic) readouts after FAIR preparation. By implementing dynamic FAIR at higher field strength the quality of FAIR images in terms of SNR would be even much higher than standard FAIR imaging at lower field strength. This improvement can be further enhanced by repeating the dynamic FAIR more and averaging the results.