AbstractID: 4712 Title: False positive analysis of functional MRI during simulated deep brain stimulation

Purpose: Recent studies showed that MRI can be safely performed on patients with deep brain stimulation (DBS) device in place when the stimulator is turned off. By interleaving the DBS and echo-planar imaging (EPI) acquisition, functional MRI (fMRI) may be a useful tool for understanding the mechanism of DBS as well as helping the localization of electrodes. This study aimed to investigate the possible false positive activations due to the limited time interval between the end of DBS and the start of EPI acquisition.

Method and Materials: The study was performed using a 1.5-T Philips MRI scanner with a DBS electrode (Medtronic, Minneapolis MN) positioned in the center of a gel-filled phantom. The experimental run consisted of alternative 5 stimulation-off and 4 stimulation-on blocks (the stimulator was turned on for 2 seconds immediately after each readout). The control run consisted of total stimulation-off blocks. A single-shot GE EPI (TR/TE = 6000ms/60ms, FOV = 192mm, matrix = 64x64, SW = 3mm) was used, with 10/30 slices per measurement in for long/short inter-scan waiting times (ISWT). Data were analyzed using SPM2. False activation and deactivation volumes were computed at different statistical thresholds.

Results: For both activation and deactivation, no false positive voxels were detected for all conditions at corrected $p < 0.05$ or uncorrected $p < 0.001$. For uncorrected $p > 0.001$, number of false activated/deactivated voxels increased with p-value increased. No increased trend was observed with the experimental conditions as compared to the control conditions. Similar trends were observed when comparing activation vs. deactivation and long vs. short ISWT.

Conclusion: An ISWT of 2230 ms (TR= 6s, 30-slice acquisition) was found to be sufficient for placing a 2-s DBS without increased false positive detections of activation/deactivation. A statistical threshold of $p < 0.001$ or tighter is recommended for fMRI involving the similar amount of total voxels as this study.