# AbstractID: 8864 Title: A Novel Approach to Multi-Parametric Dynamic Chemical Shift Imaging

**Purpose:** To integrate modern super-resolution spectral quantification techniques with multi-echo magnetic resonance imaging in order to provide multi-parametric chemical shift imaging in real-time. **Methods and Materials:** A technique integrating the Steiglitz-McBride algorithm and Cauchy's Calculus of Residues was developed to determine the proton resonance frequency(PRF), T2*, and T1-wieghted amplitude for multiple species in a chemical shift MR signal encoded using multiple gradient echoes. Monte Carlo simulation was implemented evaluating the performance of the algorithm under varying acquisition parameters and results compared to the Cramer-Rao lower bound (CRLB). The PRF values in a mayonnaise-lemon juice phantom were measured during heating demonstrating the ability of performing PRF thermometry in the presence of lipid. Phantom scans were performed comparing the T2* values from this technique and from spoiled gradient echo(SPGR) acquisitions. To demonstrate the use of this technique for temperature imaging *in vivo*, an image-guided laser treatment in a canine brain was performed. Temperature maps were created at spatial resolutions of $1.5x1.5x4mm^3$ every five seconds in addition to T1-weighted and T2* images providing multi-parametric monitoring during treatment. **Results:** The technique achieves the CRLB demonstrating robust estimation of the PRF and T2* in the presence of noise. The uncertainty of the technique was theoretically and experimentally shown to be inversely proportional to the image SNR. The mayonnaise-lemon juice phantom showed a PRF shift with temperature consistent to published literature. T2* values provided by the technique did not statistically differ from SPGR-based T2* mapping. Monitoring of the canine brain treatment was successful providing highly sensitive temperature measurements. T2*-corrected T1-W images detected a treatment-induced hemorrhage demonstrating the importance of multi-parametric monitoring. **Conclusion:** A technique is presented that provides chemical shift imaging at higher spatiotemporal resolutions than what was previously available. The ability of this technique to provide multiple parameters demonstrates great promise for image-guided thermal therapies.