

AbstractID: 8679 Title: Multiple Stepped Magnetic Field Technique Applied to Enhance the Resolution of Electron Spin Echo Oxygen Imaging (ESEOI) at 250MHz

Purpose: The knowledge of local partial oxygen pressure (pO_2) in malignant tumors is important due to the effect of hypoxia, or low oxygen concentration on tumor aggressiveness and response to radiation therapy. Three dimensional ESEOI is one of the few noninvasive modalities that provide a quantitative, spatially resolved measure of pO_2 inside tumor. The spatial resolution is defined by the gradient field magnitude and therefore is limited by the imager frequency bandwidth. By using the multiple magnetic field B_0 technique (MB0) we have extended the effective bandwidth of the imager and acquired images with better spatial resolution. **Method and Materials:** A phantom with the same spin probe (OX063H) used for small animal imaging was also employed in this study. Our pulse imager design allows us to use high microwave power and achieve frequency bandwidth of 20MHz. This bandwidth is sufficient to image a 2cm long sample using 50 mT/m gradient in the single B_0 (SB0) technique. In the MB0 technique, the same experiment is repeated at multiple B_0 values to increase the efficient acquisition bandwidth. **Results:** Using SB0 and MB0 methods, we obtained 3D images of our phantom with spatial resolution of 0.5mm. This is a large improvement compared to the 1.4mm resolution for current ESEOI protocol and 1.3mm resolution of continuous wave EPROI, both used in small animal imaging. The measured T_2 uncertainty was about 5%. **Conclusion:** The MB0 method was found to be technically more complicated than the SB0 method but less susceptible to instrumental limitations in applying larger gradient fields. These results pave the way for high resolution ESEOI in small animal imaging. This makes ESEOI a more powerful tool for understanding the tumor physiology based on 3D pO_2 imaging.