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(U*) POS-D27 – Moving toward faster measurements of micron-sized axon diameters in vivo

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Autopsy studies indicate that the distribution of axons throughout the brain could differ in brains with and without schizophrenia. MRI has inferred axon diameters and distribution in the brain, typically for axons larger than 5 μm in diameter. The goal of this work is to modify these methods to adapt oscillating gradients (OG) to target small axons (1 to 2 μm range) which constitute the majority of cortical connections and shorten the data acquisition time so that the method can be used to measure axon diameters in *vivo*.
Methods to determine micron-sized axon radii using oscillating gradients were too time-consuming for in *vivo* mouse imaging. The methods use many gradient frequencies, and a geometric model called AxCaliber which uses intracellular and extracellular compartments. Through simulations, we found that fewer gradient frequencies for data provided a good fit to the intracellular model, and in some cases, fewer frequencies led to a better fit to the model than more frequencies. A moderate correlation was found between the predicted axonal radius from the model and the actual axonal radius used in the simulations. In conclusion, reducing the number of gradient frequencies and gradient strengths appears to be possible, in theory, to reduce the imaging time by a factor of 4.16 without a significant change in the precision of the inferred axon radii. The method proposed here requires *a priori* knowledge of the desired cell sizes to be inferred. Imaging data, as well as electron microscopy data, need to be collected after reopening the lab after the pandemic to verify the theoretical predictions. This work is the first step to reducing the imaging time so that OG can be used with the AxCaliber model to infer 1-2 μm axon sizes.
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