AbstractID: 10713 Title: Tradeoff between noise and resolution in CT images – Comparison of Filtered Backprojection and the Penalized Alternating Minimization Algorithm

Purpose: Relative to linear reconstructions, statistical image reconstruction algorithms have been shown to produce images with less error, artifacts and noise for similar high-contrast resolution as measured with the MTF. This study compares the noise and resolution, using the edge blur, of images reconstructed using filtered backprojection (FBP) and a new statistical algorithm, Alternating Minimization (AM) [O'Sullivan IEEE TMI vol: 26, #3]. **Method and Materials:** Monoenergetic projection data were simulated for two phantoms, each with a high and low-contrast insert. Two levels of simple Poisson noise were added to simulate low and clinical-dose protocols. To study image noise and resolution, FBP was performed with a Gaussian blurred ramp filter of varying FWHM. The penalized AM algorithm was run with a range of penalty strengths. Reconstructed pixel size was also varied. Image noise was quantified as the percent standard deviation in the phantom background. Resolution was evaluated by measuring edge blur at contrast boundaries. Blur was quantified as the FWHM of the Gaussian that, when convolved with the known truth image, gives the highest correlation between reconstructed and convolved images for pixels surrounding the edge. Blur was calculated independently around each contrast boundary. AM and FBP image noise is compared as a function of edge blur. **Results:** For high resolution images (small edge blur), the AM algorithm reconstructs images with up to 50% less noise than FBP for similar resolution. For all conditions (varying pixel size, projection noise, and contrast inserts), AM exhibits an advantage. **Conclusion:** Edge blur is used as a metric of CT image resolution for both high and low contrast inserts. The penalized AM algorithm is shown to reduce image noise with less edge blurring than FBP. Future work will extend the use of edge blur to compare AM performance in experimentally acquired CT data.