AbstractID: 8859 Title: Partial Volume Effect correction in PET using regularized iterative deconvolution with variance control based on local topology

Purpose: To present a new partial volume effect (PVE) correction method for PET with variance control, which is not dependent on prior anatomical information: a necessity for radiation treatment planning. **Method and Materials:** The method performs post-reconstruction iterative deconvolution using a 3D Maximum Likelihood Expectation-Maximization algorithm. To achieve convergence a One Step Late (OSL) regularization procedure that follows the work of Alenius *et al* is used. This technique was further modified to selectively control the variance depending on the local topology of the PET image. Different regularization weights can be selected by the user for different parts of the image based on the signal-to-noise ratio. The procedure was tested for isotropic gaussian deconvolution functions with FWHM ranging from 6.31 mm to infinity. The method was applied to simulated and experimental scans of the NEMA NU-2 image quality phantom with the GE Discovery LS PET/CT scanner and on patient scans. **Results:** Optimal sphere-activity-to-variance ratio was obtained, when the deconvolution function was replaced by a few voxels wide step function. In this case the deconvolution method converged in ~ 3 to 5 iterations for most points in both the simulated and experimental images. For the 1 cm diameter sphere, the contrast recovery improved from 12 % to 36 % and from 21% to 55 % for the simulated and the experimental data respectively. For the larger spheres the recovery coefficients were increased to above 68% and 80%. No increase in variance was observed except for few voxels neighboring strong activity gradients and inside the largest spheres. Testing the method using patient images indicated potential for increasing the visibility of small lesions within a non-uniform background. **Conclusion:** Regularized iterative deconvolution with variance control based on local topology and on estimated image noise is a promising approach for partial volume effect corrections in PET.