AbstractID: 13124 Title: Development and verification of functions correlating PET image noise to scan duration and image smoothing for patients with different BMI

Objectives: PET image noise is affected by scan duration (SD), image smoothing (IS) and patient BMI. The aim of this abstract is to develop and verify functions that describe the inter-relationships among these variables.

Methods: 50 patients were imaged on a GE DRX PET/CT scanner. These patients were divided into 5 BMI ranges: <20, 20-25, 25-30, 30-35 and >35kg/m^2, resulting in 10 patients/subgroup. PET images of the bed position covering the patient liver were acquired in 3D for 5 minutes using LIST mode and then rebinned into 5 SD ranging from 1 to 5min with 1min interval. Each PET acquisition was then reconstructed using 3D OSEM (2 iterations 21 subsets) with varying Gaussian post filter (6, 8 and 10mm FWHM). Image noise in the liver (measured in units of g/ml) was determined as the STD of a fixed-size VOI for each patient BMI, SD, and IS. Functions correlating the image noise to the SD & IS for each BMI subgroup were then generated. These functions were verified using data from 4 other patients (2 with BMI 20-25, 2 with BMI 30-35) that had PET SD and IS ranging from 1 to 9min with a 2min intervals and 5 to 13mm with a 2mm interval respectively. The verification was based on comparing the noise in these 4 patients' liver at each SD and IS to that determined from the derived functions.

Results: The inter-relationship among noise, SD, and IS has the following functional form: $noise=k_1-k_2/(SD)^{0.5}-k_3/IS+k_4/(SD)^{0.5}/IS$. The average difference of the noise between the 4 additional patients and the derived function is -0.0136±0.0289 g/ml.

Conclusion: We derived unique and robust functions correlating PET image noise to SD and IS for patients with different BMI. These functions can be used to optimize image quality by minimizing image noise for patients with different BMIs.