

AbstractID: 10493 Title: Potential improvement of PET imaging quantitative accuracy with an external reference source

Purpose: PET has been increasingly used to assess therapeutic response. As PET suffers from many inaccuracies, it might be difficult to distinguish between actual treatment response and acquisition error. The purpose of this study was to investigate the accuracy improvement of PET imaging with an external reference source.

Method and Materials: A ^{68}Ge reference source was scanned in two different PET/CT scanners: GE Discovery LS (DLS) and GE Discovery VCT (DVCT). The reference source was scanned at various distances from the center of bore and at a fixed position near a scatter phantom filled with ^{18}F . In addition, the reference source was scanned next to patients over the period of two years. A series of scans was performed for each patient. All PET images were reconstructed using 2D-OSEM. A cylindrical region of interest on PET was automatically segmented.

Results: The measured activity was found to be inversely proportional to the distance from the center of the bore. The activity decreased by $0.95 \pm 0.09 \%$ and $0.78 \pm 0.19 \%$ per cm for DLS and DVCT respectively. The measured activity was also found to be related to activity concentration of the phantom. Within each series of patient scans, the position of the reference source varied by 1.1 ± 0.8 (SD) cm leading to 1.0 % variation in activity. However, the observed inter-scan variation of activity was $7.0 \pm 6.4 \%$, which cannot be explained solely by the distance effect.

Conclusion: The observed inter-scan variation for the same patients was greater than that solely due to displacement of the reference indicating a significant intra-scan variation at different time points. The ongoing phantom studies will determine quantitative accuracy of PET imaging, providing a standardized imaging procedure.