

AbstractID: 3450 Title: Uncertainties in measuring activity concentrations of a moving phantom acquired with standard clinical PET/CT protocol

Purpose: We have evaluated the magnitude of errors associated with measuring activities in moving objects in PET/CT images acquired using standard helical/clinical CT data.

Methods and Materials: In this study we used 2001 NEMA IEC Body phantom which has six fillable spheres with diameters of 37, 28, 22, 17, 13 and 10 mm. The target-to-background ^{18}F FDG activity in a phantom was 8:1. A motorized platform moved the phantom with motion amplitude and period set to 2 cm and 5 s. All data was acquired using standard helical/clinical protocol: helical CT follow by PET emission scan. To determine uncertainties in activity measurements in stationary phantom we have acquired PET/CT scans of a phantom at 5 different positions. To evaluate the magnitude of errors in moving phantom we have reconstructed a PET image using emission data for the moving phantom and data for 30 different helical/clinical CT scans of the moving phantom acquired at random.

Results: The uncertainties in measuring activities in the stationary phantom ranged from 9% for the largest sphere to 47% for the sphere with smallest diameter. The errors in measuring activity in the sphere in the moving phantom from 30 PET/CT image ranged from 10% to 33 % depending on the sphere's size. We have estimated the maximum possible observable error between the activity in stationary and moving phantom to be 21% for the largest and 75% for the smaller size sphere.

Conclusion: The CT acquisition is on an order seconds and is fast enough that it will not acquire a motion-average CT scan. PET emission scan on the other hand is a motion-average data. As a result, activity measured from PET/CT data acquired with standard helical/clinical protocol will vary depending on a start-time of the CT acquisition with respect to the phase of the motion cycle.