software package for simulating nuclear processes. However, P-32 bremsstrahlung spectrum has not validated with GATE and MCNP yet.
Methods: The n-type HPGe detector considered for the Monte Carlo calculations. The characteristics of the detector can be described by average of seven main parameters: diameter and height of the crystal, diameter and height of the internal core, thickness of the beryllium window, distance from the crystal top to the Be window, and the thickness of the dead layer of Ge. In the MCNP code, the F8 tally (energy distribution of pulses in detector) is used to simulate bremsstrahlung spectra of water in Marinelli geometry in HPGe detector. In the GATE code, the root output is used to read bremsstrahlung spectra of water in Marinelli geometry.
Results and Conclusion: The simulation energy spectrums in Gate and MCNP have a significant correlation with experiment energy spectrum achieve experimentally. Comparing bremsstrahlung spectrum of water in experiment and simulation using Man-Withney test shows great agreement (more than 99%).

OP 096

Friday, May 18, 2012

11:30-13:30, Hall 4

Towards parametric whole-body imaging in clinical PET

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Clinical whole-body PET protocols commonly involve a static scan starting at a fixed time after tracer administration. This fixed uptake period is intended to allow for the radiotracer (e.g. FDG) to accumulate in regions (notably tumors) that exhibit high uptake, while allowing for the tracer to wash-out from normal tissue. However, dynamic PET acquisition has the ability to directly measure tracer kinetic information and to lead to more robust and quantitative characterization of tumors and assessment of treatment response. Nonetheless, dynamic protocols have not translated to the clinic, in part due to their increased complexity, particularly those involving invasive blood sampling to measure the plasma input function (PIF). Moreover, dynamic PET acquisition is generally confined to a single bed-position, and anatomic coverage is therefore limited (typically 15-20cm). We propose a transition to dynamic whole-body PET parametric imaging using novel and clinically feasible data acquisition and parameter estimation techniques that can potentially allow for routine adoption of dynamic PET imaging.
We have optimized and evaluated the proposed methodology using Monte Carlo simulations. Furthermore, n=6 dynamic whole-body FDG PET/CT patient studies have so far been performed under an ongoing research protocol. The protocol involves: initial 6min scan over the heart (to capture early PIF dynamics), followed by 6 whole-body passes (45 sec/bed; 7 beds/pass). We use a small region-of-interest in the atrium to quantify the PIF, including use of interpolations when the heart is not in the field-of-view. We subsequently generate parametric images using the Patlak plot, substituting the semi-quantitative standard uptake value (SUV) with the tracer influx constant Ki. Simulations and clinical data have indicated significantly increased tumor-to-background ratios. However, abovementioned acquisitions are achieved in ~45min, whereas we aim for ~30min acquisitions to facilitate routine adoption. Furthermore, standard regressions can lead to higher noise levels that can complicate clinical tasks. To tackle this, we are actively seeking enhanced parametric imaging using (a) advanced spatial-constraint regularization, (b) Patlak correlation analysis to filter voxels exhibiting poor correlations in the Patlak plot, and (c) directly estimating parametric images from dynamic sinograms (direct 4D approach). The proposed approach to parametric whole-body imaging promises to open up a wealth of kinetic information with the potential to provide enhanced quantitative surrogate markers of disease.

OP 097

Sunday, May 20, 2012

9:30-10:30, Sa'di Hall

Role of ^{18}F-FDG PET-CT in detection of occult multifocal tubercular involvement in skeletal tuberculosis

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