AbstractID: 9876 Title: Data correction and image reconstruction methods for PET

There are several undesired physical effects inherent to the process of detecting annihilation photons. These factors include photon attenuation, detector response non-uniformity, detector saturation, random and scattered photons, and isotope decay. Acquired PET data must be corrected for these physical factors either before or during image reconstruction in order to achieve qualitative accuracy. Quantitative accuracy of PET image data further relies upon factors such as proper calibration to true isotope activity and correction for resolution blurring. We will begin this lecture with an overview of undesired physical factors affecting PET data and methods to reduce or remove their effects through measurements and software algorithms. We will then give an overview of image reconstruction strategies in PET. We will discuss two classes of PET reconstruction algorithms: analytical and iterative. Analytic approaches model the acquisition process as an analytic transform operator and treat both the measurement and reconstructed image as continuous functions. The analytical image reconstruction algorithm is based on direct computation of the inverse transform formula. Iterative techniques consider the above functions as discrete and may incorporate statistical methods and possibly accurate system models to find the best solution. Iterative approaches may be appropriate for photon count limited data and for PET systems with non-standard geometry. The analytic methods are typically more computationally efficient. For both data correction and image reconstruction, we will focus only on those techniques implemented in the current state-of-the-art commercial PET systems

Educational Objectives:

1. To become familiar with physical effects that degrade the accuracy of PET data.
2. To understand common approaches taken to reduce or remove these unwanted effects.
3. To understand the problem of image reconstruction in PET.
4. To become acquainted with analytic and iterative image reconstruction strategies for PET.