A spectral geometric model for Compton single scatter in PET based on the single scatter simulation approximation

We investigate the idealized mathematical model of single scatter in PET for a detector system possessing excellent energy resolution. The model has the form of integral transforms estimating the distribution of photons undergoing a single Compton scattering with a certain angle. The total single scatter is interpreted as the volume integral over scatter points that constitute a rotation body with a football shape, while single scattering with a certain angle is evaluated as the surface integral over the boundary of the rotation body. The equations for total and sample single scatter calculations are derived using a single scatter simulation approximation. We show that the three-dimensional slice-by-slice filtered backprojection algorithm is applicable for scatter data inversion provided that the attenuation map is assumed to be constant. The results of the numerical experiments are presented.

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