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EFFECT OF DEPTH-OF-INTERACTION MEASUREMENT RESOLUTION ON RADIAL ELONGATION IN PET. W.W. Moses and S.E. Derenzo. Research Medicine and Radiation Biophysics Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA.

We have performed a Monte Carlo simulation of the effects of 511 keV photon penetration on the point spread function in a PET ring and studied how the radial elongation artifacts are reduced by measuring the annihilation photon interaction point in the scintillation crystals on an event by event basis. This contrasts a previously described method that removes the effects of crystal penetration on a statistical basis (R.H. Huesman, *et al*., IEEE Trans. Nucl. Sci. 36, p. 1100, 1989). The tomograph ring simulated is the Donner 600 crystal tomograph, which is a 60 cm diameter ring composed of 600 BGO crystals, each 3 mm wide by 25 mm deep by 10 mm high.

Annihilation photons from point sources at distances of 1, 5, 8, and 12 cm from the center of the tomograph were simulated, and their penetration into the BGO crystals and subsequent interactions was described by an exponential distribution with a 1/*e* attenuation length of 1.1 cm. The depth-of-interaction measurement resolution (*i.e.* along the 25 mm dimension) was modeled with a gaussian distribution with various full-width at half maxima (fwhm), and the data re-binned according to the measured positions of the two interaction points. Images were reconstructed with filtered backprojection with a sharp (Shepp-Logan) filter, and the fwhm in the radial and tangential directions were measured.

For this tomograph ring, a depth-of-interaction measurement resolution of 3 mm fwhm removes the radial elongation at radii out to 12 cm, but reducing this resolution below 3 mm provides little additional reduction of the elongation. The radial elongation steadily increases as the depth resolution increases to 9 mm fwhm, at which point it is equal to the elongation obtained if the depth-of-interaction information is ignored during reconstruction. The radial elongation continues to grow as the depth resolution is increased, and is greater than a tomograph without depth-of-interaction information for values above 9 mm.