PIBETA NOTE: **Energy Lineshape Differences Between $\pi^+ \to e^+\nu_e$ Positrons and $\pi\beta$ Photons**

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This note summarizes some cosmic tomography measurements done and analysed by E. Frlež up to June 1995.

Note on Optical Non-Uniformity FWHM Contribution to Lineshapes of 70 MeV Positrons and Photons

The optical non-uniformity, mapping the average energy deposited by the minimum ionizing particle in the volume cells of the detector, has being measured for 40 available CsI crystals using our cosmic muon tomography apparatus. This function has been convolved with the GEANT shower energy distributions of positrons and photons in the PIBETA detector. Results, showing the contribution of crystal optical non-uniformities to the energy lineshapes, are shown on Figures 1. and 2. The typical FWHM contribution for 70 MeV positrons is 3.0%. $\pi\beta$ photons are more probable to probe the deeper volume elements of the detector resulting in 4.3% FWHM optical non-uniformity contribution to the energy spectrum and the longer tail. The currently measured full FWHM of ~6.5% is not likely affected by this difference.

We are determining the light response non-uniformity function for each individual crystal in our 3D tomography system. The results will be used to predict the energy lineshapes for different shower-generating particles in the PIBETA detector.

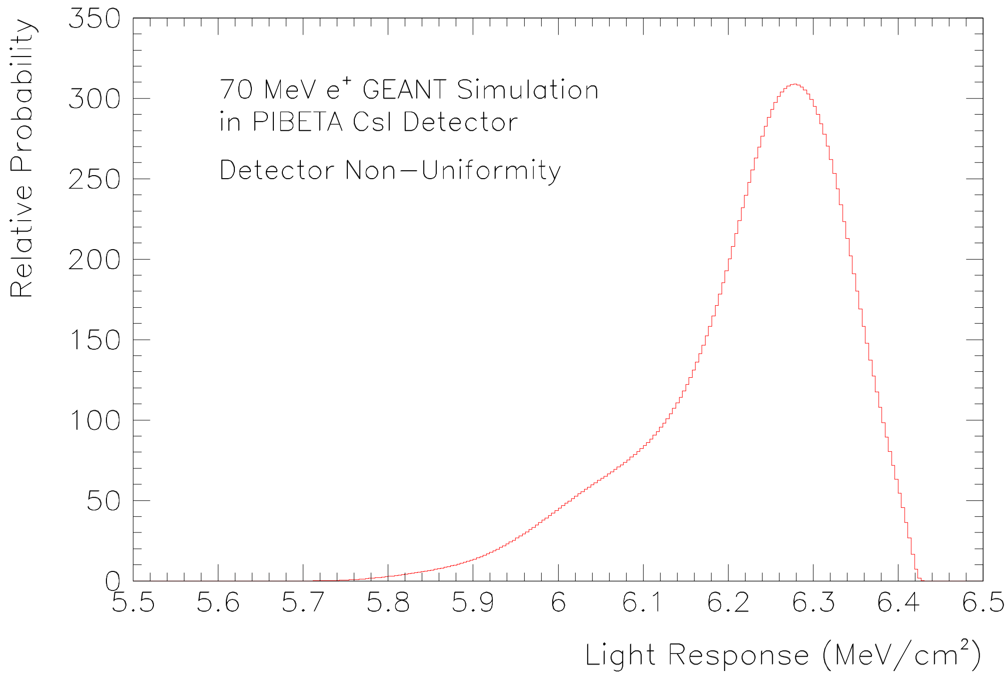

FIGURE 1.

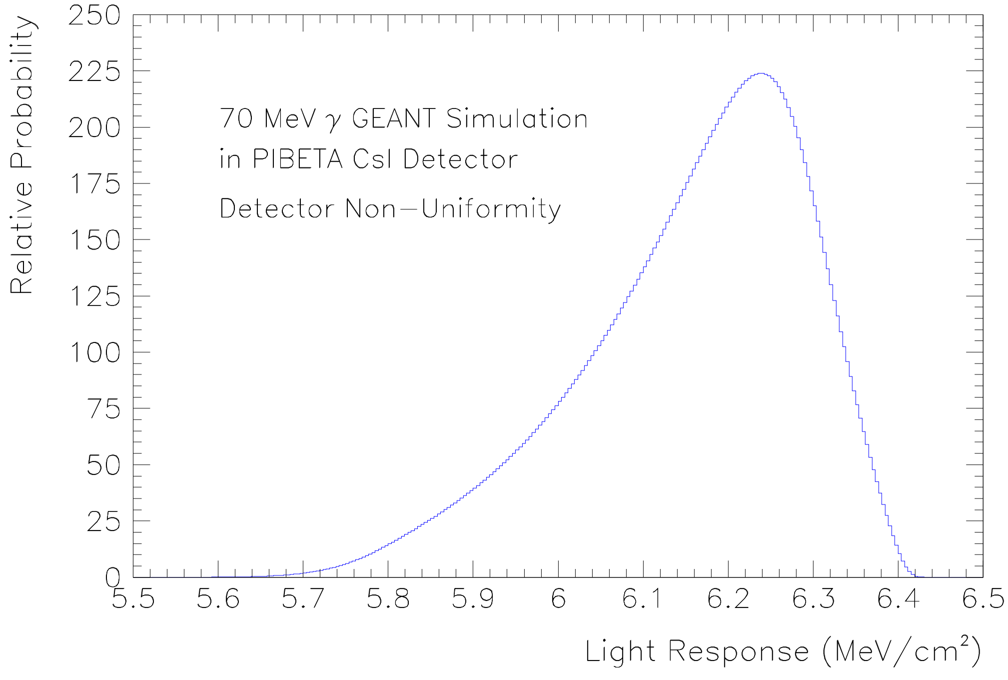

FIGURE 2.