

Development of gamma ray detectors for PET with high efficiency

Abstract

We have been developing gamma ray detectors for positron emission tomography. These detectors consist of scintillation crystal plates, wavelength shifting fibers (WLSF) and SiPM's. The positions of the scintillation emissions are measured by the WLSF's covered on the top and bottom surfaces of the crystals with the resolution (FWHM) of 0.5mm. The light yields are measured by the 40 SiPM's attached on the four side surfaces. For 60% of the Compton scattering events, the scattering point can be identified. Not only both photo-absorption events, but also 60% of Compton + photo-absorption events and 36% of both Compton events are used for PET analysis. The scintillation time is measured by 40 SiPM's independently. The time resolution is expected to be less than 100 psec. It is expected that the total dose of our detector is 1/10 or less of that of the conventional PET detectors. Our whole body PET system will consist of 3,072 scintillator plates. The size of each plate is 34mm times 34mm and 4mm thickness. The number of SiPM's attached to the WLSF's is 6,528. The total number of SiPM's attached on the side surfaces is 122,880 and 3,072 channels of ADC and 1,920 channels of TDC are used. It is expected that the total cost is several million dollars.