Scintillating properties of a Y-doped PbWO4 crystal

T. Sugitate, Y. Furuhashi, K. Homma, R. Kohara, T. Maeda and Y. Tsuchimoto
Hiroshima University, Higashi-Hiroshima 739-8526, Japan

Since of high density, short radiation length and fast response of scintillation lights, a lead-tungstate (PWO) crystal is considered to be the best candidate for a high-granulated electro-magnetic calorimeter to be applied into high-energy particle experiments nowadays. The scintillating properties and radiation hardness have been extensively studied in the last decade. There are a few manufactures in the world, providing such crystals on a commercial basis, but properties of their products seem not to be firmly established yet.

We are interested in applying such a crystal to measurements of neutral energies in high-energy nuclear collisions. Its small Moliere radius enables us to distinguish two electro-magnetic particles at a short distance under a high particle-multiplicity environment, thereby improving a resolution of mass reconstructions for neutral mesons. It would turn out to improve a capability of detecting isolated single photons from an exotic nuclear matter.

We have manufactured a couple of Y-doped PWO crystals of 20x20x200 mm at Furukawa co. in Japan. The crystal was coupled with a single photon sensitive photomultiplier tube (Hamamatsu R7056) with a UV window, and fundamental properties of scintillating lights were studied with gamma-rays from a RI source and with electron and hadron beams. The light yield was found to be 8.2 pe/MeV. In general, an effort increasing light yields turns out increasing slow scintillating components. We studied a decay characteristic of the light emissions and measured three components; decay constants of 1.2 ns at a relative magnitude of 16%, 5.9 ns (81%) and 38.2 ns (3%) at a room temperature. We will discuss on the temperature dependence of the light yield and decay constants to optimize the detector operation and also about the detector performance of a 3 by 3 prototype for a 150 MeV electron beam.