

T493 Test of PbF₂ crystals

Although a PbF₂ crystal has no scintillating emission, its application to a cherenkov shower calorimeter instead of a lead glass is expected because of its good properties; e.g. a good transparency, a large density (7.77 g/cm³), a short radiation length (0.95 cm), a short time response (<10 ns) and a good radiation hardness (>10⁵ Rad).

The performance of a calorimeter prototype of PbF₂ crystals was tested by using electrons, pions and protons with momenta between 1.0 and 4.0 GeV/c. The test was made in the ϕ 2 beam line area at KEK-PS. The calorimeter comprised nine crystals, each 20mm x 20mm x 100mm (X₀=10.5), arranged in a 3 x 3 matrix. 6 plastic counters were used for triggers and measurements of the TOF of the beam particles. 2 cherenkov counters were used for particle identification between electrons and hadrons. Beam momentum was calibrated by using TOF data of pions and protons. Trajectories of beam particles were measured by using 3 MWPCs on the beam line.

An energy calibration of the calorimeter was made by comparing with ADC data of 9 crystals for minimum ionizing particles (MIP) passing through the calorimeter each other. For electrons, the energy response of the calorimeter showed a good linearity. The photoelectron number (the light output of the crystals) was measured to be $N_{pe} \sim 1.5/\text{MeV}$. This value indicates better properties of PbF₂ crystals than those of lead glasses.

Photo 1

A PbF₂ crystal (20mm x 20mm x 100mm)

