

Proton Induced Radiation Damage up to $8E+15$ p/cm² in Various Crystal Scintillators

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Future high energy physics experiments at the energy and intensity frontiers will face challenges of a severe radiation environment from both ionization dose and charged and neutral hadrons. This paper reports an investigation on proton induced radiation damage in various crystal scintillators. Large size BGO, CeF₃, LYSO and PWO crystals of 15 to 22 cm long were irradiated by 800 MeV protons at the Weapons Neutron Research facility of Los Alamos Neutron Science Center up to 3×10^{15} p/cm² with degradation and recovery of their longitudinal transmittance measured in situ. LYSO plates of $14 \times 14 \times 1.5$ mm³ were irradiated by 67 MeV protons at Crocker facility of UC Davis up to 9.5×10^{13} p/cm², and by 24 GeV protons at the IRRAD facility at CERN up to 8.2×10^{15} p/cm². Degradations in both transmittance and light output are reported. The results show an excellent radiation hardness of LYSO crystals against charged hadrons.

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