Contribution ID: **40** Type: **not specified**

Beam tests of proton-irradiated PbWO4 crystals and evaluation of double side read-out technique for mitigation of radiation damage effects

Thursday 19 May 2016 13:50 (20 minutes)

The harsh radiation environment in which detectors will have to operate during the High Luminosity phase of LHC (HL-LHC) represents a crucial challenge for many calorimeter technologies. In the CMS forward calorimeters, ionizing doses and hadron fluences will reach up to 300 kGy (at a dose rate of 30 Gy/h) and 2x10^{14} cm^{-2}, respectively, at the pseudo-rapidity region of |η|=2.6.
To evaluate the evolution of the CMS ECAL performance in such conditions, a set of PbWO_{4} crystals, exposed to 24 GeV protons up to integrated fluences between 2.1x10^{13} cm^{-2} and 1.3x10^{14} cm^{-2}, has been studied in beam tests.
A degradation of the energy resolution and a non-linear response to electron showers are observed in damaged crystals. Direct measurements of the light output from the crystals show the amplitude decreasing and pulse becoming faster as the fluence increases. The evolution of the PbWO_{4} crystals calorimetric performance has been well understood and parameterized in terms of increasing light absorption inside the crystal volume.
A double side read-out configuration, in which two identical photodetectors are coupled to the opposite ends of each crystal, has also been tested. The separate and simultaneous read out of the light from the two sides of the crystal allows to correct for longitudinal shower fluctuations and to mitigate the degradation of energy resolution in highly damaged crystals. The non-linear response to electromagnetic showers, arising from high non-uniformity of light collection efficiency along the longitudinal axis of irradiated crystals, can also be corrected by means of the double side read-out technique.

Primary author: LUCCHINI, Marco Toliman (CERN)

Presenter: LUCCHINI, Marco Toliman (CERN)

Session Classification: Challenges for calorimeters