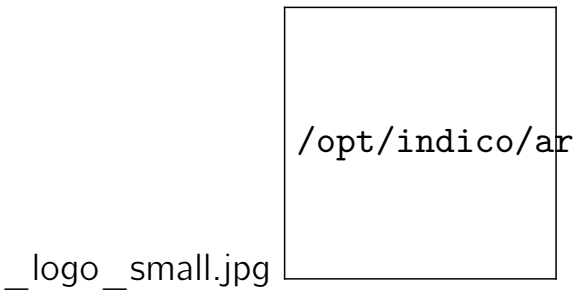

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Novel Fast Response and Radiation-resistant Scintillator Detector for Beam Loss Monitor

Tuesday, 28 February 2017 17:00 (1:00)

Content

At high luminosity era, beam loss monitor with fast response and good radiation resistance is crucial for smooth and safe operation of collider. Due to high intensity of the beam, even a small amount of beam loss may cause cooling issue and serious damage to accelerator components and radiation sensitive equipment. The ultimate goal of a beam loss monitor system at a high intensity beam is to identify the loss level and, if possible, the loss location and time structure and to be able to protect the machine at uncontrolled loss (detect the uncontrolled loss as soon as possible and shut down the accelerator in microsecond level). This requires the beam loss monitor has fast response and excellent radiation resistance. The traditional ionization chamber, plastic (liquid) scintillator+PMT, PIN diodes etc has difficulties to satisfy all of the requirements.

In this talk, we will report the design and test results of a fast response and radiation-resistant scintillator detector as the beam loss monitor of high intensity beam at low energy part such as RFQ. The detector is consistent of a 2cm x 2cm x 0.5 cm LYSO crystal readout by a 0.6 cm x 0.6 cm Silicon photomultiplier (SiPM). LYSO features high light yield, short decay time, relative dense and very good radiation resistance (2 orders of magnate higher than plastic scintillator). And SiPM has many advantages compared to PMT. It is compact, economy, insensitive to magnetic field and has low working voltage, good charge resolution and broad spectra response. The detectors we constructed have been tested with various radioactive sources. The test results show that the detector has good sensitivity to photon at energy range of a few keV to tens of MeV and charged particles with good linearity and energy resolution (23% for 60 keV X-ray). Two detectors (one parallel to and the other perpendicular to the beam) are installed outside of the vacuum chamber shell of a 800 MeV electron storage ring and tested. The detail of the test and results will also be reported. Furthermore, the implication in the electromagnetic calorimeter based on fast response crystal and SiPM readout for the high intensity electron positron accelerator facility in China will be discussed.

Summary

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