Liquid scintillator tiles for high radiation environments

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Abstract

Future experiments in high energy and nuclear physics may require large, inexpensive calorimeters that can continue to operate after receiving doses of 50 Mrad or more. We present the results of a study of a scintillator tile based on EJ-309 liquid scintillator using cosmic rays, test beam, and ^{60}Co irradiations that shows little degradation of light output under irradiation.

Keywords: organic scintillator, liquid scintillator, radiation hardness, calorimetry

1. Introduction

During the running of the LHC from its commissioning in 2009 through 2012, the CMS detector was exposed to an integrated luminosity of 25 fb^{-1}. Parts of the CMS endcap calorimeter are estimated to have received doses of 0.1 to 0.2 Mrad [1]. Studies of the radiation hardness of scintillator tiles prior to installation in the detector, using an electron linac and ^{60}Co sources, indicated

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an exponential reduction in light output with accumulated dose, with a exponential constant of around 7 Mrad [2, 3]. However, although the dose received by the CMS tiles was small compared to this number, significant light loss was observed [4].

2. Tile designs

3. Conclusions

We presented results for a liquid scintillating tile using WLS fiber readout. For our nominal design, 1.7 ± 0.2 pe's were produced for minimum ionizing particles.

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