Liquid scintillator tiles for high radiation environments

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Abstract

Future experiments in high energy and nuclear physics may require large, inexpensive calorimetery that can operate to 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.

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

1. Introduction

Sampling calorimeters using plastic scintillator tiles with wave length shifting fibers, such as the CDF plug calorimeter [**?**], are popular due to their excellent performance at a reasonable cost. Plastic scintillator is available commercially from companies like Kuraray, St. Gobain, and Eljen. When irradiated, however, the performance of plastic scintillator deteriorates; light self-absorption (yellowing) increases and light output decreases. The resulting damage has been studied for most common plastics[1], [2], [3], [4],[5],[6],[7],[8]. Generally,

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the light output decreases with exponentially with dose, with an decay constant on order of a few Mrad. Future high energy and nuclear experiments, however, may have to operate in environments that will deliver doses of tens of Mrad. In this paper, we present the design and optimization of a liquid scintillator tile, based on EJ-309 liquid scintillator, that can operate in thie kind of environment.

2. Tile design

3. Test beam results

4. Light yield dependence on tile parameters and comparison with simulation

5. Radiation hardness tests

6. Conclusions

7. Acknowledgements

The authors would like to thank Randy Ruchti of Notre Dame for providing the capillaries and Yasar Onel's group at the University of Iowa for help with the test beam. This work was supported in part by U.S. Department of Energy Grant YYYYY.

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