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Development of Radiation-Hard Scintillators and Wavelength Shifting Fibers

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We have been performing research on the radiation-hard active media for calorimetry by exploring intrinsically radiation-hard materials and their mixtures. The first samples we probed were Polyethylene Naphthalate (PEN), Polyethylene Terephthalate (PET) and thin sheets of HEM. These materials have been reported to have promising performance under high radiation conditions. Recently, we developed a new scintillator material doping Peroxide-cured polysiloxane bases with the primary fluors p-terphenyl (pTP), p-quarterphenyl (pQP), or 2.5-Diphenyloxazole (PPO) and/or the secondary fluors 3-HF or bis-MSB. The scintillation yield of the pTP/bis-MSB sample was compared to a BGO crystal and was measured to yield roughly 50% better light production compared to the BGO crystal. Various scintillator tiles were exposed to the gammas from a 137Cs source at the University of Iowa Hospitals and Clinics up to 1 and 10 MRad. The results are within expectations and exhibit sufficiently high performance for implementations in the future/upgrade hadron/lepton collider detectors.

We have also identified materials with proven radiation resistance, long Stokes shifts to enable long self-absorption lengths, with decay constants ˜10 ns or less for development of radiation-hard wavelength shifting fibers.

Here we report on the recent advancements in the development and testing of radiation-hard scintillators and wavelength shifting fibers and discuss possible future implementations.

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