

Investigations on the radiation hardness of the flat tile scintillators for HGICAL CMS

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The results of irradiation of plastic scintillators with flat tile configuration are presented here. Radiation-resistant scintillators are required for the upgrade of the CMS Hadron Endcap Calorimeter for the work at the HL-LHC (Upgrade Phase-II). Given the scintillation part dimensions of the CMS detector, the results of this work are extremely relevant.

According to these conditions, the response of the scintillator samples (light yield) to the minimum ionizing particles before and after irradiation has been investigated. Irradiation has been performed in IBR-2 reactor in the last two years. Thus, the radiation hardness of BC-408 (Bicron, US) and EJ-260 (Eljen, US) scintillator samples based on polyvinyl toluene, and UPS-923A (Ukraine analogue BC-408), SCSN-81 (Kuraray, Japan), SC-301 and SC-307 (Protvino, Russia) scintillator samples based on polystyrene has been studied.

For this purpose a special test bench was developed. Scintillator tiles were read out on this bench by individual Hamamatsu silicon photomultipliers (SiPMs). It is possible to test several dozen samples at the same time. Before test each tile was wrapped in the reflecting foil, and the SiPM was coupled directly to the dimple side of the scintillator. The dimple is a lens for light collection on the sensitive area of SiPM. In addition, the research on the optimization of geometry of the scintillation SiPM-on-tile detector, which is increasingly popular in modern calorimetric devices, was carried out. Thus, there were studies on the dependence of the light output on the size of the light-gathering dimple and dependence of the light output on thickness of scintillator tile.

In addition, the new fast scintillation material (EJ-262), which seems very perspective for using in high-intense radiation fields, has been tested.

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