

Abstract

Silicon photomultipliers (SiPMs) combine all of the features necessary for the light detection of a high resolution scintillating fibre tracker. Two SiPM manufacturers, Hamamatsu and KETEK have developed customized devices for SciFi Tracker application in the context of the LHCb tracker upgrade. These devices were customized and optimized for high photon detection efficiency (PDE) in a large wavelength range, low cross-talk and after-pulsing and a large temperature operation range. They are packaged in a high density multi-channel package that allows to equip large non-overlapping tracking planes and keeping the dead region below 1%. There are several challenging requirements placed on the photo-detector mainly due to the neutron radiation environment and the low light output of the long scintillating fibre modules. New devices with the latest technological improvements implemented are available in spring 2014. This includes devices with different optical isolation between pixels (trenches), different pixel sizes and prototypes based on technologies that are candidates to improve the spectral response for longer wavelength and degrade less due to radiation. The dark noise rate (DCR) increases strongly with irradiation and the noise cluster rate of the tracking device can only be kept sufficiently low at temperatures of order of -40°C . We present the results on PDE, cross-talk, and noise before and after neutron irradiation at various temperatures. The results are compared with those obtained with standard technology devices.