Radiation Damage Effects on LGADs and Deep Diffused APDs

M. Carulla[1], M. Centis Vignali[2], M. Fernandez Garcia[2,3], M. Gallinaro[2,4], C. Gallrap[2], B. Harrop[5], S. Hidalgo Villena[1], C. Lu[5], I. Mateu[2], M. McClish[6], K. T. McDonald[5], M. Moll[1], F. M. Newcomer[7], S. Otero Ugobono[2,8], G. Pellegrini[1], A. Ventura Barroso[2,9], I. Vila[3], and S. White[2,10]

[1]Centre Nacional de Microelectronica (IMB-CNM-CSIC), Barcelona, Spain
[2]CERN, Geneva, Switzerland
[3]Universitade de Cantabria, Santander, Spain
[4]LIP, Lisbon, Portugal
[5]Princeton University, Princeton, USA
[6]Radiation Monitoring Devices, Watertown, USA
[7]University of Pennsylvania, Philadelphia, USA
[8]Universidade de Santiago de Compostela, Santiago de Compostela, Spain
[9]Universitat de Barcelona, Barcelona, Spain
[10]University of Virginia, Charlottesville, USA

January 16, 2018

Abstract

For their operation at the CERN High Luminosity Large Hadron Collider (HL-LHC), the ATLAS and CMS experiments are planning to implement dedicated systems to measure the time of arrival of minimum ionizing particles with an accuracy of about 30 ps. The timing detectors will be subjected to radiation levels corresponding up to a 1-MeV neutrons fluence (Φ_{eq}) of $10^{15}\,\mathrm{cm}^{-2}$ for the goal integrated luminosity of HL-LHC of 3000 fb^{-1}. Some of the proposed systems will employ Low Gain Avalanche Detectors (LGADs). The gain of these detectors lies usually between 5 and 50.

This talk summarizes the results obtained in the characterization of LGADs and deep diffused Avalanche Photodiodes (APDs). These APDs have a gain of up to 500 and are used for direct particle detection, without the use of radiating materials. The results obtained with proton-irradiated LGADs and neutron-irradiated APDs irradiated up to $\Phi_{eq} = 10^{15}\,\mathrm{cm}^{-2}$ are reported.