

Optimisation of SiPM intrinsic and coincidence time resolution using digital techniques

Thursday 14 June 2012 15:30 (40 minutes)

A variety of modern physics applications, ranging from medical to high energy physics, require very fast light sensors, characterised by a response in the range of tens of picoseconds. Silicon Photomultipliers (SiPMs, or Multi pixel photon counters (MPPCs)) are a relatively new solid-state pixellated detector type that satisfies this requirement, with the advantage of being compact, cheap, operating at low bias and insensitive to magnetic fields. Moreover, the device's high photodetection efficiency and high signal to noise ratio (SNR) make it a suitable candidate as scintillating crystal readout detector, in place of traditional Photomultiplier Tubes (PMT). In this work the timing properties of two different Hamamatsu MPPCs are studied. In particular, the intrinsic time resolution, i.e. the time required for the pulse formation under a light stimulus and the coincidence between a pair of sensors were measured, using a femto second pulse laser (Ti:Sapphire). Digital filters were used to improve the SNR and the time jitter of the digitised signals and three different algorithms for the time stamp pick-up were developed and evaluated. Very good intrinsic time resolution, of the order of 35 ps and coincidence time resolution of the order of 45 ps were found. These values are strongly dependent on the choice of the values of the filter parameters, precisely the cut-off frequency. The main limitation to the time resolution is then represented by the high frequency noise affecting the signals, which deteriorates the SNR, and not by the bandwidth of the readout electronics.

Author: Ms AVELLA, Paola (University of Surrey)

Co-authors: Dr LOHSTROH, Annika (University of Surrey); Dr DE SANTO, Antonella (University of Sussex); Mr SAJJAD, Muhammad T. (Advanced Technology Institute, University of Surrey); Prof. SELLIN, Paul J. (University of Surrey)

Presenter: Ms AVELLA, Paola (University of Surrey)

Session Classification: Posters B