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Study of the spectral sensitivity of G-APDs in the wavelength range from 250 to 800 nm

Geiger-mode operated Avalanche Photo Diodes (G-APD), also called Silicon photomultipliers (SiPM), are a new type of photon counting device which eventually may replace the traditional photo multiplier tube in many applications. In the last years this new sensor has come into focus for many applications in nuclear/particle physics as well as in medical imaging. Due to its hight photon detection efficiency (PDE), insensitive to high magnetic fields, its ruggedness and low voltage operation and its excellent properties for fast timing application the SiPM is being considered as potential candidate for readout of the DIRC Cherenkov counter and the ToF-barrel of the PANDA experiment which is one of the large experiments at FAIR, the new international facility to be built at GSI, Darmstadt.
An important property of the sensor is the dependence of the PDE as function of the photon wavelength which has been discussed controversially in the past. Therefore, we have performed detailed studies of the spectral sensitivity of Hamamatsu and Zecotek sensors in the wavelength region between 250 and 800 nm. The apparatus used was a Xenon lamp followed by a monochromator as a calibrated, continuously variable spectral photon source. The output light is coupled via three fiber light guides to the SiPM and in parallel to two calibrated photo diodes. The photo currents measured at fixed bias voltage and ambient temperature are converted into spectral sensitivity values.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

New photon detectors –Geiger mode operated avalanche micro-pixel photo sensor matrices (AMPD), also called silicon photo multipliers (SiPM) –are ideally suited for future photonics systems in a broad field of basic science in physics, especially in hadron physics. They also have the potential for novel and advanced applications in many other fields. These devices combine performances of traditional phototubes like high quantum efficiency and signal amplification with extremely important features like low-cost voltage supply and electronics. Contrary to photomultiplier the device is insensitive to magnetic fields and mechanically robust thus suitable for harsh environments. Therefore, the possible applications of these devices cover space research, biology, medical diagnostics and eventually environmental technology.
Together with 15 European institutions GSI participates in a FP7-EU-project called 'Matrix Geiger-Mode Avalanche Micro-Pixel Photo Diodes for Frontier Detector Systems' . The idea is to perform R&D on prototypes of advanced particles detectors for hadron physic exploiting the strengths of the new photon sensor and pushing against the present deficiencies. The EU proposal covers 5 different subprojects going to be persue:
• Low-level light detection and single photon read-out with SiPM
• SiPM-coupled advanced scintillating fiber detectors
• SiPM for fast calorimetry
• Photon read-out of crystalline fibers with SiPM
• Ultra-fast timing with plastic scintillators for TOF-applications

The paper submitted to this conference is part of this research.

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Author: Dr ROY, Bidyut (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291 Darmstadt)

Co-authors: Dr WILMS, Andrea (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291 Darmstadt); Dr SCHWARZ, Carsten (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291 Darmstadt); Prof. ORTH, Herbert (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291 Darmstadt); Prof. PETERS, Klaus (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291

Darmstadt)

Presenter: Dr ROY, Bidyut (GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Planckstr.1, 64291 Darmstadt)