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SiC MiniPIX-Timepix3 Radiation Camera: detection resolving power to neutrons, ions, protons and electrons

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Detection and spectrometry measurements of mixed-radiation fields of high fluence and harsh radiation environments present challenges of detection selectivity and radiation damage. Silicon Carbide (SiC) as semiconductor sensor material exhibits particular advantages [1-2] of high radiation hardness, stable and high temperature operation. Available first as single pad devices, SiC pixel sensor has been newly fabricated [3] attached to Timepix3 readout chip into a position-sensitive and tracking detector used in miniaturized radiation camera MiniPIX-Timepix3 SiC [4]. The response in terms of energy-sensitive particle tracking and particle-type recognition is examined and evaluated in well-defined reference radiation fields –such as low-energy protons (8-31 MeV) [4], tunable mono-energetic fast neutrons in selected energy regions in the range 0.5 –18 MeV produced from D-D, D-T and p-T reactions (at the Van-de-Graaff light ion accelerator, IEAP CTU Prague), energetic light ions (at MedAustron, Wiener Neustadt), energetic heavy ions (at the NSRL radiation facility, Brookhaven Nat. Lab.), protons (at the light ion cyclotron, NPI Rez) and energetic 3-22 MeV electrons (at the Microtron accelerator, NPI Rez) –see Figs 1-2. In this work we examine and describe the detection response in wide-range and resolving power of particle-type discrimination. The results, calibrations performed and developed methodology enable the use of SiC as a particle tracking and imaging detector for application in complex and harsh radiation fields produced at particle accelerators, nuclear reactors, radiotherapy facilities, radionuclide-source environments including neutrons.

References
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Primary authors: Dr GRANJA, Carlos (ADVACAM); Ms BARBER, Corinne (Department of Physics and Astronomy, Louisiana State University); BARNA, Sandra (Medical University of Vienna); Dr CHANCELLOR, Jeff (Department of Physics and Astronomy, Louisiana State University); CHVATIL, David (Nuclear Physics Institute, Czech Academy of Sciences); GREVILLOT, Loïc (MedAustron Ion Therapy Centre); INZALACO, David (Brookhaven National Laboratory); JAKUBEK, Jan; KOHOUT, Zdenek (Czech Technical University of Prague (CTU)); MAGRIN, Giulio (MedAustron Ion Therapy Centre); MAREK, Lukas (ADVACAM); MIHAI, Radu (Institute of Experimental and Applied Physics, Czech Technical University in Prague); OANCEA, Cristina (ADVACAM); Mr OLŠANSKÝ, Václav (Nuclear Physics Institute CAS p.r.i.); OLSEN, Trevor (Brookhaven National Laboratory); POKLOP, Dusan (Nuclear Physics Institute, Czech Academy of Sciences); POSPISIL, Stanislav (Institute of Experimental and Applied Physics, Czech Technical University in Prague); RESCH, Andreas (MedAustron Ion Therapy Centre); SAGATOVA, Andrea (Slovak University of Technology in Bratislava); Dr SIVERTZ, Michael (Brookhaven National Laboratory); STURSA, Jan; SYKORA, Rudolf (Institute of Experimental and Applied Physics, Czech Technical University in Prague); ZACH, Vaclav (Nuclear Physics Institute, Czech Academy of Sciences); Dr ZATKO, Bohumir (Institute of Electrical Engineering, Slovak Academy of Sciences)

Presenter: Dr GRANJA, Carlos (ADVACAM)

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