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iPadPix - A Novel Educational Tool to Visualise Radioactivity Measured by a Hybrid Pixel Detector

With the ability to attribute signatures of ionising radiation to certain particle types, pixel detectors offer a unique advantage over the traditional use of Geiger-Mueller tubes also in educational settings. We demonstrate in this work how a Timepix [1] readout chip combined with a standard 300 μm pixelated silicon sensor can be used to visualise radioactivity in real-time and by means of augmented reality. This chip family is the result of technology transfer from High Energy Physics at CERN and facilitated by the Medipix Collaboration. In the described prototype, a small Timepix detector assembly [2] is mounted next to the camera on the back of a tablet computer. The fields of view of both imaging sensors overlap such that traces of traversing particles recorded by the hybrid pixel detector can be shown as an overlay on the camera's live video feed. Particles with energies above ~ 4 keV are able to produce a signal in the detector and often create clusters consisting of several pixels. The cluster shapes and energies are evaluated in a classification process, which the iPadPix application uses to calculate count rates for identified alpha particles, electrons, photons and muons. Drawings of individual pixel clusters are animated and accompanied with particle type and energy information on the display.

This article summarizes the technical setup of the developed prototype based on an iPad mini and open source software [3]. Appropriate experimental activities that explore natural radioactivity and every-day objects are described to demonstrate the use of this new tool in educational settings.

[1] Xavier Cudie Llopart et al., Timepix, a 65k programmable pixel readout chip for arrival time, energy and/or photon counting measurements, Nucl. Instr. and Meth. A 581 (2007) 485–494

[2] Zdenek Vykydal et al., USB Lite - Miniaturized readout interface for Medipix2 detector, Nucl. Instr. and Meth. A 633 (2011) 48–49

[3] Oliver Keller, Visualisation of Radioactivity in Real-Time on a Tablet Measured by a Hybrid Pixel Detector, (2015) CERN-THESIS-2015-169

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