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## Multispectral Photon-Counting for Medical Imaging and Beam Characterization - A Project Review

Central focus of the MPMIB project - funded via the Academy of Finland's RADDESS 2018-2021 programme - has been research towards a next-generation radiation detection system operating in a photon-counting (PC) multispectral mode: The extraction of energy spectrum per detector pixel can be an important asset for diagnostic imaging and radiotherapy, enabling better diagnostic outcome with lower radiation dose and more versatile characterization of the radiation beam leading e.g. to more accurate patient dosimetry.

We will give a critical review of our achievements, challenges and lessons learned. We present our approach of fabricating direct-conversion detectors based on Cadmium Telluride (CdTe) semiconductor material, hybridized with PC mode capable ASICs. However, although CdTe has excellent photon radiation absorption properties, it is a brittle material that can include large concentrations of defects. A material assessment prior to detector processing is therefore essential. The CdTe crystals were processed at Micronova Nanofabrication Centre in Espoo, Finland, employing techniques such as surface passivation via atomic layer deposition, and flip-chip bonding of processed sensors to read-out chips.

We will further discuss our quality assessment of CdTe crystals and processed detectors, and present experimental data obtained with prototype detectors in x-ray and Co-60 beams at a standards laboratory. We will conclude with possible next steps for a follow-up project.

### Primary experiment

**Author:** KIRSCHENMANN, Stefanie (Helsinki Institute of Physics (FI))

**Co-authors:** GÄDDA, Akiko (Helsinki Institute of Physics); WINKLER, Alex; KARADZHINOVA-FERRER, Aneliya (Helsinki Institute of Physics (FI)); PETROW, Henri Markus (Lappeenranta University of Technology (FI)); OTT, Jennifer (University of California, Santa Cruz (US)); BRUCKEN, Jens Erik (Helsinki Institute of Physics (FI)); TIKKANEN, Joonas (STUK); GOLOVLEVA, Maria; BEZAK, Mihaela (Helsinki Institute of Physics (HIP)); EMZIR, Muhammad (muhammad.emzir@aalto.fi); LUUKKA, Panja (Lappeenranta University of Technology (FI)); BHARTHUAR, Shudhashil (Helsinki Institute of Physics (FI)); SÄRKKÄ, Simo; SIISKONEN, Teemu (STUK); TUUVA, Tuure (Lappeenranta University of Technology (FI))

**Presenter:** KIRSCHENMANN, Stefanie (Helsinki Institute of Physics (FI))

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