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High-resolution Large-area Medipix3 Camera for X-ray Spectral Imaging of fast-moving Objects

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A new generation of a modular high-resolution spectral imaging camera has been developed from synchronized array of pixel detectors Medipix3 within the European Union Horizon 2020 project X-mine. The aim of the project was to increase the potential of European mineral resources without generating adverse environmental impact by supporting more efficient ore extraction in existing mining operations, making the mining of smaller deposits economically feasible. The presented Medipix3 based camera can be operated in Time-Delayed-Integration mode allowing for continuous imaging of fast-moving objects such as rocks carried on conveyor belt. The modular architecture of the camera enables to build imagers with essentially unlimited size and no spacing gaps between the camera segments. The camera was assembled in single chip-row architecture of several Medipix3 chips for total width size: 7 cm (1×5), 14 cm (1×10), 21 cm (1×15) and 42 cm (1×30). The aim is to analyse the composition and recognize the content of valuable minerals during the mining extraction process. The pixel-level spatial resolution of 55 μm makes possible to image and analyse the internal structure of the rock particles and directly detect intrusions of minerals and metals like copper, zinc, lead or even gold [1]. A theoretical maximum scanning speed of the camera is about 5 m/s. A series of measurements were performed with a speed of 3.5 m/s in laboratory conditions. This level corresponds to imaging and analysing a total area of 1.5 m² per second. Results of these experiments will be presented. The hybrid chip-sensor architecture enables the possibility of usage different sensor materials like CdTe, Si or GaAs of varying thickness for customized configuration of a large variety of implementations. Applications include continuous moving X-ray inspection and dynamic X-ray robotic scanning in medical imaging, food inspection, automotive industry and more. The USB3 communication interface ensures high speed data transfer preserving universality of connection.

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