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Low energy and high resolution performance of the MOENCH hybrid pixel detector

MÖNCH is a hybrid silicon pixel detector based on charge integration and with analog readout, featuring a pixel size of 25x25 μm2. The latest working prototype consists of an array of 400×400 identical pixels for a total active area of 1×1 cm2. Its design is optimized for the single photon regime.
An exhaustive characterization of this large area prototype has been conducted in the past months, and it confirms an ENC in the order of 35 electrons RMS and a dynamic range of ~4×12 keV photons in high gain mode, which increases to ~100×12 keV photons with the lowest gain setting.
The low noise levels of MÖNCH make it a suitable candidate for X-ray detection at energies around 1 keV and below. Its energy reconstruction and imaging capabilities have been tested for the first time at a low energy beamline at PSI, with photon energies between 1.75 keV and 3.5 keV, and results will be shown.
Imaging applications in particular can benefit significantly from the use of MÖNCH: due to its extremely small pixel pitch, the detector intrinsically offers excellent position resolution. Moreover, in low flux conditions, charge sharing between neighboring pixels allows the use of position interpolation algorithms which grant a resolution at the micrometer-level. Therefore, in order to precisely quantify the position resolution achievable with this method, a dedicated scan across one pixel using an X-ray beam with ~100 nm wide focus has been conducted. The outcomes of this test will also be presented. The same scan also provided a first indication of the radiation hardness of the device, and with its nanometric focal spot provided a good opportunity to identify possible radiation sensitive pixel components.
Finally, the prospects for future design optimization and commissioning of a larger area module will be discussed.

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