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Exploring the limits of hybrid pixel detectors with MÖNCH

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TMÖNCH is a novel hybrid silicon pixel detector based on charge integration and analog readout featuring a challengingly small pixel size of $25x25 \mu m^2$, aimed at exploring the limits of current hybrid silicon detector technology.

Two prototypes have been designed and produced in UMC 110nm technology. MOENCH02 is a fully functional prototype of 4x4mm2, containing an array of 160x160 pixels. This array is subdivided in five sub blocks, each featuring a different pixel architecture. The first block targets high resolution, low flux synchrotron applications, as RIXS (resonant inelastic X-ray scattering) or X-ray tomography with X-ray tubes. In this case the charge sharing effect between pixels, together with the signal analog readout, can be exploited to interpolate the hit position with a precision that can reach the sub-µm resolution.

MÖNCH03 has an active area of 10x10mm2 and it contains an array of 400x400 identical pixels, based on the first block of MÖNCH02. It will be read out with a frame rate of ~8 kHz.

The high bump-bonding yield and the extremely good noise performance of ~35 e- make hybrid detectors competitive with monolithic detectors and with CCDs in the fields of high resolution imaging and soft X-ray detection (several hundreds of eV).

Characterization results in terms of bump-bonding yield, linearity, dynamic range, noise and energy resolution will be shown. The development of large area systems based on MÖNCH targeted to specific applications will also be discussed.

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