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A look at single photon counting detectors for SLS2.0

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Starting this autumn, the Swiss Light Source is undergoing an upgrade to a diffraction limited light source and with this the coherent flux will increase with up to two orders of magnitude. This poses a huge challenge for single photon counting detectors which despite being incredibly successful still suffers from pulse pile-up at high rates. In this talk we present our strategy for single photon counting at SLS2.0 which includes: the Matterhorn ASIC, a 100Gbit/s readout system and iLGAD sensors for single photon counting with soft X-rays.

The Matterhorn (v0.1) prototype, designed in UMC110, features four 16 bit counters per pixel which can be used for pile-up tracking, energy windowing or gating with four independent gates. The prototype has a pixel matrix of 64x64 square pixels at a 75um pitch. For the final detector we target 256x256 ASICS from which we build 4x8cm2 modules by bump bonding 8 ASICS to a single silicon sensor. Matterhorn is compatible with both electron and hole collection and can be combined with high Z sensors for operation above 20 keV. We present first results with the prototype and the road to full detector.

Another challange for single photon counters is the sensitivity to low energy photons. Due to the noise the lowest possible threshold is usually somewhere in the 2-3 keV range. To solve this, we have worked closely together with FBK to develop silicon sensors with internal amplification (LGADs) with the aim of bringing single photon counting down to 250 eV. Here we show that with a 512x512 pixel sensor bump bonded to EIGER it is possible to do phytography at 700 eV.

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