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EIGER: High frame rate pixel detector for synchrotron and electron microscopy applications

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The hybrid pixel detector EIGER, featuring 75×75 μm^2 pixel size, is a photon counter designed for use at synchrotrons. The chip and the complete readout system were designed at the Paul Scherrer Institut, Switzerland. A single chip consists of 256×256 pixels and can acquire data at 22000˜frame/s with 4-bit counter depth. In a full module, 4×2 chips are bonded to a single 320 μm thin Si sensor. The readout electronics of a module has been specifically developed to preserve the high frame rate capability of the chip. Larger modules systems, up to 9 Mpixels, have been built tiling modules together and preserving the high frame rate capability.
EIGER has been tested also as a detector for electrons both at low energies (8—20 keV targeting photo-emission electron microscopy) and higher energies (100—300˜keV, typical for transmission electron microscopes). The stopping power of electrons varies a lot at these energies and the multiple scattering can be substantial. Up to 20 keV, the Si sensor needs to be optimized to reduce its entrance window, where low energy electrons stop or scatter. For higher energies up to 100 keV, EIGER shows single pixel resolution. At 200 or 300 keV, the multiple scattering of the electron in the sensor spoils the spatial resolution and a cluster of pixels is recorded per electron. However, EIGER is still suitable for diffraction applications at these energies thanks to the high frame rate capability.

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