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Similarities and Differences of Recent Pixel Detectors for X-ray and High Energy Physics

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Hybrid pixel detectors are being developed for both photon science and high energy physics. In the talk we will cover similarities and differences in pixel detectors for both applications using as examples two of the pixel detectors developed at Paul Scherrer Institute (Switzerland): the EIGER photon counting detector and the psi46dig chip, which has been developed for the Compact Muon Solenoid (CMS) tracking pixel detector upgrade.

EIGER is a single photon counting hybrid pixel detector for applications at synchrotron light sources in an energy range from a few to 25 keV. It is characterized by a small pixel size, high count rate capability (10^6 counts/pixel/s)
and very high data rate, which reaches 6 Gb/s for a 256×256 pixel chip.
The CMS pixel detector has been designed to provide charge information from the pixels in the harsh Large Hadron Collider environment. The short time between bunches of 25 ns and the high event rate at peak luminosities up to $10^{34}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ require a fast detector, which retain timestamp information for the hits. The readout architecture is based on the transfer of hits from the pixels to the periphery, where the trigger verification is performed before the data transfer. The data rates of the digitized output reach 160 Mb/s for a 52×80 pixel chip.

In addition to address the specific timing and rate requirements for the detectors, the talk will cover the analog performances (minimum threshold, threshold dispersion and noise), power consumption and radiation hardness requirements. To conclude, an overview on the future developments based on mutual learning and common solutions will be discussed.

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