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# High speed cameras for X-rays: AGIPD and others

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For the scattering experiments of X-rays at FELS's new instruments, cameras are currently being developed to record two dimensional images with increased picture rate and the feature to store scatterings of individual X-ray bunches on the targets. Combined with the very intense bunches of FEL's this will allow to extract the structure of the target from scattering of individual bunches.
The talk will be based on AGIPD - a multi-national consortium of DESY, PSI, University of Hamburg and University of Bonn. This group develops Si-sensors, ASIC's, PCB's and FGPA's for a 1Mega-pixel camera with 200µm sized pixels, which will be able to record individual pictures for the bunch interval of the Eu-XFEL, 222ns. The accelerator will deliver bunches in a trained structure of 10 trains/second with each 2700 bunches. Out of them AGIPD will store 324 pictures/train and by that 3240 pictures/second. An ASIC behind the sensor will store the signals into capacitors for each pixel and bunch. Since the ASIC area for each pixel is its own size, the number of storage cells is limited. Random access will allow keeping the best scatterings for later processing. After each train the kept signals will be digitized with 33MS/s by 1024 ADC's mounted onto PCB's generating a total data stream of 0.5Tbit/s. 16 FPGA's within the detector head, each for a detector module representing a geometrical region, will do first processing and sorting. Using the full time between trains each FPGA sends its data formatted to 10GbE/UPD out of the detector-head. An ATCA based FPGA system collects them and sort them to full geometrical pictures and trains.
For Eu-XFEL two other consortia develop similar cameras, LPD with larger pixels and more area for electronics and DSSC integrated the ADC's already into each pixel. AGIPD's digital electronics with its high data throughput is also requested to be integrated into cameras used at synchrotrons. DESY contributes to the developments of PERCIVAL using MAPs techniques and to LAMBDA aiming for a combination of the MEDIPIX chips with high-Z sensors.

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