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TEMPUS, a Timepix4-based detector for Photon Science

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A new readout chip has been recently produced by the Medipix4 collaboration: Timepix4, which combines photon-counting full-frame readout mode and event-driven time-stamping mode, with greatly enhanced performance over both Medipix3 and Timepix3. The single chip TEMPUS (Timepix4-based Edgeless Multi-Purpose Sensor) detector is being developed as a replacement to LAMBDA. With 512 x 448 pixels, 55 μm pixel size, the chip offers a larger pixel area than its predecessors: 10 times higher count rate in the photon-counting mode, and run up to 40 kHz frame rate. The tests we are reporting here however were done using the event-driven mode. In this mode, a relatively high time resolution can be achieved. Several experiments have already taken place at PETRA III, ESRF and EuXFEL. We were able to capture the electron bunch structure at these facilities. Also, when using a 300 μm p-on-n sensor fully biased, time resolutions as low as few ns were achieved. When running at full speed, the 16 gigabit wireline transmitter (GWT) responsible for sending the data out of the chip, will reach a total bandwidth of over 80 Gbps. Dealing with this large amount of data is one of the main challenges ahead. The chip was also designed to take full advantage of the through silicon vias (TSV) technology and therefore we will be able to fully remove the wirebond connections on the sides, decreasing the dead areas when placing several chips together, which is also planned for future iterations of the prototype.

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