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Particle detection and imaging using the Medipix and Timepix ASICs: design, challenges and applications

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September 2019 marks 20 years since the signature of the Medipix2 Collaboration agreement. Since then 3 generations of pixel detector readout chips have been or are being developed: Medipix2 and Timepix (with recently the addition of Timepix2), Medipix3 and Timepix3 and finally Medipix4 and Timepix4. The Medipix chips have sought to provide high-rate spectroscopic photon counting with hit-by-hit on-pixel energy binning. The Timepix chips, on the other hand, aim to transmit as much hit information as possible off-chip (pixel coordinates, arrival time, time-over threshold). The chip architectures and some of the design choices made will be described. Of course, in spite of our best efforts, we have faced and overcome significant technical challenges over the years and some of these will be discussed. Finally, a large number of applications –both foreseen and unforeseen, within and beyond high energy physics –have been addressed and a selection of those will be described.

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