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Avalanche piselated sensors and dedicated front-end electronics as imaging detectors for time resolved experiments

Novel fast imaging detectors are necessary for X-ray time resolved experiments. Diamond Light Source, the UK synchrotron radiation facility, approved recently a project to develop a large area imaging detector based on the Timepix3 ASIC for time resolved experiments. This detector will enable time resolved experiments to access comfortably time resolution from tens of nanoseconds to milliseconds and will reduce by order of magnitudes the time that it takes to collect a data set in pump and probe time resolved experiments.
Although this detector will be a major improvement with respect to the present detector technology it will still have limitations such as the dead time between two events mainly due to the duration of the analogue pulse. The development of pixelated avalanche sensors working in proportional regime and dedicated front-end electronics can overcome this limitation by shortening considerably the duration of the analogue pulse. This will require considerable R&D efforts. The Attract initiative is the ideal framework to pursue a long term development programme that is required to develop detectors that are pushing the boundary of the technology.
In this talk I will report the reasons why synchrotron facilities need fast imaging detectors, I will give an overview of Timepix3 and its capabilities, and I will put forward some ideas on how to build a more effective detector for time resolved experiments based on avalanche sensors.

Summary

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