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Neutron Imaging and Diffraction through Advanced Event-Mode Data Acquisition

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With the transformative development of event-based detectors, new perspectives for detection systems for various types of radiation were opened up. A recently developed event-driven imaging system based on Timepix3 sensor technology is capable of observing and time-stamping the optical signal induced by particle interactions in scintillator materials with nanosecond temporal and micrometer spatial resolution, providing a pathway to fuse the benefits of integrating camera type with counting type detectors. In this approach, the reconstruction of the interaction position of a neutron with the scintillator with sub-pixel accuracy can provide a precise determination in location, as well as in time-of-arrival of the individual neutrons. Utilizing such a principle, it was shown that spatial and temporal resolution can be improved beyond the classical limits of "regular"neutron imaging. Additionally, a significant increase of signal-to-noise ratio was achieved using the unique potential of event-mode detection to discriminate gamma background from neutron signal based on the spatiotemporal signature of single neutron events produced in the scintillator. Here, we present the most recent results in utilizing this concept for imaging applications and scintillator characterization measurements. It is considered that this novel concept will replace regular cameras in neutron imaging detectors as it provides superior detection capabilities compared to conventional camera systems.

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Sitzung Einordnung: Session 5: Instrumentation & Data Management II (Chairs: Tobias Neuwirth & Artur Gregor Glavic)

Track Klassifizierung: Instrumentation & Data Management