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INVITED: Detectors for the future European XFEL

Monday, June 26, 2023 11:00 AM (30 minutes)

The European XFEL is a state-of-the-art facility that produces brilliant X-ray flashes with unprecedented brilliance and pulse duration. It delivers up to 27,000 pulses per second in 10 trains per second, with each train containing up to 2700 pulses at a rate of up to 4.5 MHz. This has opened up new opportunities for scientific research in fields such as materials science, structural biology, and quantum technology. To fully exploit its potential, the facility employs advanced detectors based on cutting-edge technology. These detectors are designed to cope with the high repetition rate of the machine while providing low noise and high dynamic range.

Growing demand for intense and ultrafast light sources with a wide range of photon energies pushes and forms further advancements of the European XFEL. To cover this demand and stay up-front among leading free-electron laser facilities, European XFEL foresees offering beams with hard X-rays up to, or even greater than, 40 keV, keeping the MHz pulse rate with a possibly different pulse and train structure, to be defined in the near future. On the instrumentation side, the starting development program of the next generation of detectors will be devoted in the next few years to testing different technologies to identify the best solutions to encompass the needs emerging from the XFEL advancements. Building on the successes of the current state-of-the-art technology detectors in use at the facility, and incorporating the lessons learned from the first 5 years of operation, we aim at optimizing detector performance and operability while ensuring compatibility with existing systems and infrastructure.

The objective of achieving excellent data quality for users is a shared goal among detector developers, users, and instrument scientists. The success in this endeavor depends on the ability to combine diverse areas of expertise and perspectives to design and develop next-generation detectors that can deliver high-quality data while maintaining robustness and ease of operation. These requirements are underpinned by the need to reduce the enormous quantity of data produced at the source.

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