

## X-ray detectors at the European XFEL: user operation and optimization

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The European XFEL facility started operation in 2017 and provides 10 Hz trains of unprecedented high brilliance X-ray pulses at MHz repetition rate to seven different experimental end stations. Such unique beam delivery capabilities provide new research opportunities in numerous fields and namely Biology, Chemistry, Material Science but also Physics and Astrophysics. The megahertz operation combined with the high photon intensity required the development of specific X-ray detectors to complete the detectors already available on the market. Those specific detectors show namely low noise, high dynamic range and the capability to store hundreds of frames in the front-end electronics. Using those new detectors in the framework of a user research facility that requires high quality experimental data, multiple operation modes and long run reliability is challenging and needs a strong commitment of detector experts to ensure successful user experiments.

We organized the detector expert teams' effort around three main axes: before the beamtime, according to the experiments' specifications, they calibrate the detectors and set up the required operating scenarios. During the beamtime they provide support to ensure the success of the user experiment data taking. After the beamtime, based on the Instruments Scientists feedback, they propose and conduct improvements. The presentation describes the state-of-the-art X-ray detectors at the European XFEL, namely the implemented technologies, their scientific usage and how reliable detector operation and high-quality scientific data production for our users is ensured.

Pre-beamtime overall tests sessions are implemented after the European XFEL maintenance periods. Those sessions, combined with our Data Operation Center - providing direct expert support during the user experiments - increased the reliability of the detector experimental setups. In addition, the analysis of the user experiments feedback permitted to implement new detector features and operating modes.

The effective work on the support to experiments and the instruments scientists feedback improves the detector data quality we provide to our users and is therefore a major priority. To answer the new research challenges, our detectors are also in constant evolution and new development projects are starting to move towards higher photons energies and continuous beam delivery at MHz repetition rates.

### Summary

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