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Hardware orchestration architecture for fly and step scan at SIRIUS beamlines: a distributed, multi-platform system for sub-micrometer motion and data acquisition synchronization in on-the-fly synchrotron measurements

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X-ray absorption spectroscopy (XAS) is one of the techniques that require multiple beamline devices to operate in tight synchronization to maximize beam flux, focus, and reliable measurements. These devices, such as the undulator, monochromator, quarter-wave plate, and detectors, exhibit a variety of behaviors, phenomena, capabilities, and controller platforms, ranging from the photon source to the sample holder. First, this work aims to provide an overview of the existing methods, detailing the adopted synchronization definition, and then demonstrates top-notch commissioning results for critical on-the-fly synchrotron measurements – impacting significantly EMA (extreme conditions), QUATI (quick-EXAFS) and SABIA (XMCD) Sirius beamlines. Additionally, the paper highlights the architecture's adaptability, enabling integration across a range of devices while maintaining custom, precise temporal and energy calibration, ensuring short scan duration and minimizing sample damage.

Footnotes

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