

10CUBED

10CUBED is a dedicated Scanning Transmission X-ray Microscopy (STXM) beamline featuring a pair of microscopes optimised for different sample environments. Both will share the same high-brilliance, highly monochromatic illumination that will enable a 10 nm spot size with 10 ps time resolution (leveraging the short electron bunches at BESSY III) and will allow imaging in 3D using tomography/laminography as well as boosting resolution to a few nanometers using ptychography. The UHV branch is optimized for quantum materials experiments, featuring a helium cryostat (down to 10 K), superconducting magnets and a non-ferrous design, rendering it an ideal tool to study dynamic excitations. A second chamber is envisioned for *operando* studies of energy materials for ultra-high fidelity *operando* and *in-situ* measurements in gas and liquids. 10CUBED will strongly profit from the increased brilliance and coherence at BESSY III, for both STXM and ptychography. The 10CUBED specifications will likely be unique since short bunches of around 10 ps are not foreseen at most 4th-generation sources. The *operando* experiments on energy materials will connect to the BESSY III campus concept.

Instrument	10CUBED (<i>Coherent Universal Beam for Energy Materials and Dynamics</i>)
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Source(s)	Undulator IVUE42 (150 – 6000 eV, fully variable polarisation)
Beamline capabilities	• Energy range: 250 – 3500 eV • Resolving power: >10000 • Flux on zone plate: $\approx 10^{12}$ ph/s
Techniques	• STXM (10 nm spatial and 10 ps time resolution) • Ptychography (few nm resolution) • Pump-and-probe for time-resolved detection • Tomography/laminography for 3D imaging
Sample environment	Branch 1 (UHV chamber): • Liquid helium cryostat for temperatures down to 10 K • High-frequency electronics (up to 100 GHz) and fs laser excitation • Selectable Bias Magnet Field Systems: ○ 3D fields: 10 mT (via coils) ○ 2D fields: 500 mT (via permanent magnet assembly) ○ 1D field: More than 2 T (via superconducting magnet) Branch 2 (<i>operando</i> chamber): • Heating stage for temperatures up to 1000 K • Gas flow cell with temperature control and electrical contacts • Liquid cell with temperature control and electrical contacts • High-frequency electronics and fs laser excitation