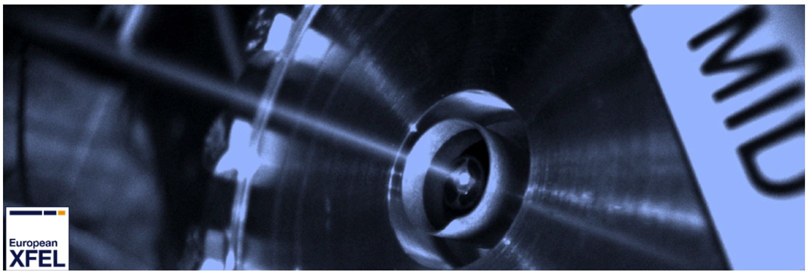

Contribution ID: **3** Type: **Talk**

MHz radioscopy using hard synchrotron radiation: instrumentation and applications

Thursday 19 January 2023 15:05 (20 minutes)

The use of polychromatic hard synchrotron radiation from insertion devices of high-energy storage rings such as The European Synchrotron - ESRF (France) or the Advanced Photon Source (USA) enables radioscopy with MHz repetition rates and nanosecond exposure time. Thanks to the availability of ultra-high speed cameras as well as highly dense scintillator materials with high light yield and short afterglow, individual X-ray flashes originating each from a single electron bunch in the storage ring can be isolated by indirect X-ray imaging detectors. This frequently termed single-bunch imaging approach allows for working with an effective exposure time in the order of 100 ps, i.e. several orders of magnitude shorter than the integration window of the detector applied. Together with the so-called timing modes, where commonly highly populated electron bunches are stored, synchrotron-based single-bunch imaging offers sufficient image contrast and signal-to-noise ratio to track ultra-fast phenomena in dense samples in combination with sensitive X-ray phase contrast modes. Recent examples covered in this presentation include cavity collapse by impact, laser-induced compression waves, shock waves induced by energetic materials or wire explosion, fracture by shear-stress loading as well as brittle facture in wafers.
The successful study of such processes requires high-level X-ray imaging instrumentation as well as sophisticated sample environments which include frequently medium-scale gas launchers, ns-pulsed lasers, or Split-Hopkinson pressure bars. At the ESRF beamline ID19, those platforms are made available via a new access mode, the so-called Block Allocation Group (BAG): a community-driven approach where besides the instrumentation the facility also offers regular access to beamtime for a consortium that internally decides on the experiments to be carried out and studies to be followed.
In the frame of this presentation, we shall outline the established capabilities at synchrotron light sources. Consequently, the need for very hard X-ray FEL radiation can be introduced, i.e. in order to go substantially beyond the current state-of-the-art single-bunch X-ray imaging.

Primary author: RACK, Alexander (European Synchrotron Radiation Facility)

Presenter: RACK, Alexander (European Synchrotron Radiation Facility)

Session Classification: Techniques and instrumentation

Track Classification: Techniques and instrumentation