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Time-Resolved Experiments Using Unique Pulse Structure at the SPB/SFX Scientific Instrument of the European XFEL

Friday 30 August 2024 15:00 (15 minutes)

The Single Particles, Clusters, and Biomolecules and the Serial Femtosecond Crystallography (SPB/SFX) instrument at the European XFEL (EuXFEL) has been in operation since 2017 [1]. This instrument is focused on coherent diffractive imaging (CDI) and serial femtosecond crystallography (SFX) methods. Intense (mJ), ultrashort (fs) and MHz X-ray FEL pulses at the European XFEL also allow the collection of damage-free data with fast data acquisition. The combined experiment with optical lasers gives the opportunity for ultrafast pump-probe measurements [2]-[3]. EuXFEL operates in the so-called 'burst mode'with a burst duration of 600 ☒s at a repetition rate of 10 Hz. Each burst can have a single pulse or a train of pulses with an intra-burst repetition rate of up to 4.5 MHz. This unique pulse structure opened MHz data rate measurement and also microsecond time-resolution experiments [4]-[5]. Recently, MHz X-ray microscopy was established and opened for user program [6]-[7]. We will introduce laser-induced fragmentation of droplet experiment using unique pulse structure and discuss on microsecond measurements at the SPB/SFX instrument of the EuXFEL.
[1] A. P. Mancuso et al.:"The Single Particles, Clusters and Biomolecules and Serial Femtosecond Crystallography instrument of the European XFEL: initial installation," J. Synchrotron Radiat. **26**, 660–676 (2019)
[2] S. Pandey et al.: "Time-resolved serial femtosecond crystallography at the European XFEL," Nature Methods **17**, 73–78 (2020).
[3] J. Koliyadu et al.:"Pump–probe capabilities at the SPB/SFX instrument of the European XFEL", J Synchrotron Rad **29**, 1273–1283 (2022).
[4] P. Vagovič et al.: "Megahertz x-ray microscopy at x-ray free-electron laser and synchrotron sources," Optica, OPTICA **6**, 1106–1109 (2019).
[5] M. Kuramochi et al.: "Direct observation of 890 ns dynamics of carbon black and polybutadiene in rubber materials using diffracted x-ray blinking," Applied Physics Letters **123**, 101601-1-9 (2023).
[6] F. Reuter et al.: "Laser-induced, single droplet fragmentation dynamics revealed through megahertz x-ray microscopy," Physics of Fluids **35**, 113323-1-9 (2023).
[7] H. Soyama et al.: "Revealing the origins of vortex cavitation in a Venturi tube by high speed X-ray imaging," Ultrasonics Sonochemistry **101**, 106715-1-16 (2023).

I plan to submit also conference proceedings

No

Primary authors: SATO, Tokushi (Eur.XFEL (European XFEL)); LETRUN, Romain (Eur.XFEL (European XFEL)); KOLIYADU, Jayanath (Eur.XFEL (European XFEL)); BIELECKI, Johan (EuXFEL); BIRNSTEINOVA, Sarlota (Eur.XFEL (European XFEL)); KIM, Chan (Eur.XFEL (European XFEL)); SIKORSKI, Marcin (Eur.XFEL (European XFEL)); Dr VAGOVIC, Patrik (Center for Free Electron Laser Science); BEAN, Richard (Eur.XFEL (European XFEL))

Presenter: SATO, Tokushi (Eur.XFEL (European XFEL))

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