



Contribution ID: **10** Contribution code: **THAT1**

Type: **Tutorial**

Latest achievements in femtosecond synchronization of large scale facilities

Thursday, 12 September 2024 09:00 (50 minutes)

This tutorial addresses the realm of electrical, hybrid and specifically optical schemes for achieving a facility-wide synchronisation on the femtosecond level at free-electron lasers (FELs).

After a brief introduction to the fundamental principles behind FEL operation and the significance of synchronisation for fully utilising their capabilities. Subsequently, it discusses various methods employed to achieve femtosecond-precision synchronisation, including low-noise timing references, different active stabilisation techniques, and advanced feedback algorithms.

In addition, the tutorial provides an overview of the numerous challenges encountered in femtosecond optical synchronisation and solutions developed to overcome them. It discusses technological developments, such as ultra-stable optical lasers or timing diagnostics both for optical pulses and electron beams.

Moreover, practical considerations for implementing such systems in FEL facilities are addressed, including stability requirements, scalability, and integration with experimental setups. Results from recent studies highlighting successful synchronisation implementations at prominent FEL facilities are presented.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: THA: Longitudinal Diagnostics and Synchronization

Track Classification: MC5: Longitudinal Diagnostics and Synchronization