Motion Control at European XFEL
Motion Workshop at ICALEPCS 2019

Dr. Nicola Coppola
Electronic and Electrical Engineering
(Scientific instrumentations and equipment integrator)

New York, October 6th 2019

The structure of the European XFEL

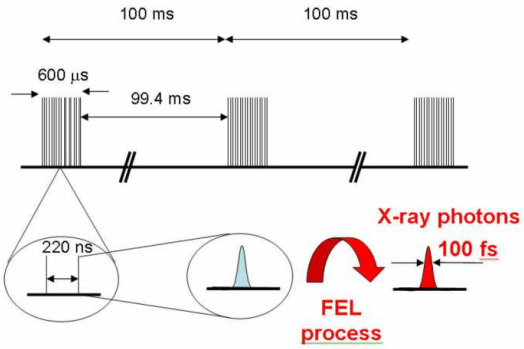
The European XFEL project is a 4th generation light source.

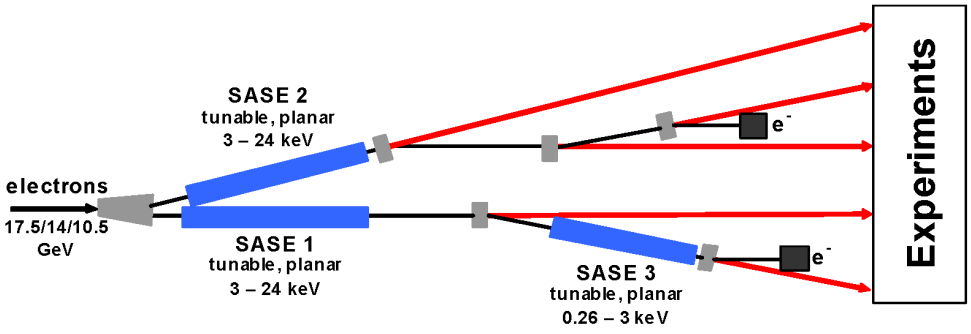
Spatially coherent <100 fs short photon pulses

Peak brilliance of 10^{32}-10^{34} photons/s/mm^2/mrad^2/0.1% BW

Energy range from 0.26 to 29.2 keV @ electron beam energies of 10.5 GeV, 14 GeV, or 17.5 GeV

Electron bunch time pattern with 10 Hz repetition rate and up to 2700 bunches in a 0.6 ms bunch train





- 5 photons beams produced by means of undulator systems (3 installed & fully running) SASE4 & SASE5 to be installed & instrumented in the future
- Photon beam transport and diagnostics
- 7 broad scientific experiments and R&D on X-ray instrumentation (installed and taking data, some 10-25% components still to be installed & commissioned)
- Up to other 8 experiments could still be installed

Philosophy

The motion control system at European XFEL is based on industrial components produced by Beckhoff Automation GmbH and a PLC implemented with TwinCAT(mainly TC3.1, TC2.11 in undulator systems).

- State of the art motion control
- Widely used in Automation Industry
- EtherCAT Fieldbus - fast and truly open communication standard
- TwinCAT based software with full-fledged diagnostic tools
- Wide variety of control terminals and motors available off the shelf (servos, steppers, ADCs, DACs, encoders, I/O…..)
- Provides a cost effective solutions

Already installed equipment in photon systems (undulators not included)

- Stepper motors: >2200
- Piezo motors: >220
- DC motors: ~3
- Servo motors: ~10-15x linear, ~ 6x 3-phase
- Incremental encoders: >1000
- Absolute encoders: >230

Day2 components, upgrades or new instruments **still to come**

Wish list and expectation from other institutions

- **The community should push vendors:**
  - **to use modern interfaces in a modern fashion**
  - **to use common protocols**
  - **to use open-software solutions**
  - **to use modern standards (ie EtherCAT or similar) for controllers**
  - **allow for interchangeability of motors-stages and controllers**