SUMMARY OF Technology and Operation Session

Heunk-Sik Kang
Winni Decking

Design Strategies for Athos (by Sven Reiche / PSI)

- SwissFEL beam distribution dogleg, kicker/septum injection, adjustable R56, …

- ATHOS beamline with chicanes and Apple X undulator to support various operation modes

Harmonic Lasing in XFELs (by Evgeny Schneidmiller / DESY

- Contrary to nonlinear harmonics similar photon beam quality as fundamental
- Proposed starting in the 1980s but than forgotten because of the e-beam quality needs
- Successful experiment at FLASH
- Easy to tune, ‘poor man’s’ road to higher photon energies

Reverse Taper Experiment at FLASH (by Evgeny Schneidmiller / DESY

- Verifies reverse taper functionality to suppress lasing while preserving micro-bunching

Apple X Undulator for Athos and SASE3 (by Thomas Schmidt / PSI)

- 4 yaw motion design with accessible field region for field measurement and tuning

- Design for SwissFEL and European XFEL

LCLS Seeding R&D (by Jerry Hastings / SLAC)

- Working group to evaluate SXRS Options for LCLS-II

Self Seeding implementation at European XFEL (by Shan Liu / DESY)

- Preparation for HXRSS installation at SASE2 in 2018

- Efficiency of halo collimation investigated to predict minimum chicane delay

Two Bunches in Two RF Buckets Setups for Different Experiments (by Franz-Josef Decker / SLAC)

- There were four experiments in 2016 (May, June, July, Oct) which had two bunches with up to 122 ns separation

- RF pulse length

  - Most RF is lengthened to allow 150 ns bunch separation

  - Gun RF should be flat for about 200 ns

- BPM Response at longer separation (>50 ns)

  • Since the Raw BPM signal is only 200 ns long, it doesn’t add up

- Vertical Bunch Separation with TCAV3 (which is off-frequency)

  • Both bunches have equal peak performance (2 mJ)

Pulse-by-pulse control of linear accelerator at SACLA (by Hitoshi Tanaka / Spring-8)

- Objectives
  - enabling standardization of undulator segments
  - enabling use of the SACLA linac as a high performance injector to SPring-8-II
- Five major R&D under way
  - Timing synchronization by FM modulation
    - Synchronizing SACLA beam extraction timing to specified RF bucket of the Storage Ring
    - Prototype of the synchronization system tested at SACLA.
  - Bunch length pulse-by-pulse control by phase switching
  - Beam root pulse-by-pulse control
    - RF parameters and root switching magnets only changed in a pulse-by-pulse manner
  - Beam energy pulse by pulse control by trigger ON/OFF
    - this scheme has already released to SACLA routine operations
  - CSR suppressing Beam Transport
- Test beam injections from SACLA to the current storage ring will be performed in FT2018, prior to shutdown of the current SPring-8 accelerator complex

Machine learning at LCLS (by D. Ratner / SLAC)

- Optimizer model

  - Bayesian approach with probabilistic model

    → more efficient search of high dimensional space

  - Gaussian process optimizer: instance based learning method

- Machine Tuning Automation
  - Already as good as best human operators
  - Expand to more complicated optimization problems (laser profiles, multi-objective functions, etc.)

- Hoping to develop international collaborations on shared online tuning algorithm for accelerators!

High Level Applications for commissioning & operation (by Raimund Kammering / DESY)

- Requirement

  • **hide complexity / automate** well understood procedures / offer **physical** and "**smart knobs**" / **evaluate** and **monitor** key **performance parameter**

- Machine optimization using HLS
  - First tests using OCELOT have been done at FLASH
  - OCELOT developers started to work in close collaboration with HLS team

- With the **Virtual XFEL** we have a **great environment** to do prior test and debug high level software