AKBP 13: Free Electron Lasers

Time: Wednesday 16:30–18:00 Location: MOL 213

AKBP 13.1 Wed 16:30 MOL 213

Electron beam characterisation based on seeded FEL properties — •Mathis Mewes — Universität Hamburg, Hamburg, Germany

The performance of high gain FELs strongly depends on the electron bunch properties. In seeded FEL mode the electron bunches are usually much longer than the XUV-pulse and therefore only the properties of the seeded slices are relevant to the lasing process. If complete time resolved electron beam diagnostics is not available one can try to characterize the electron bunch slices indirectly by analyzing the FEL output radiation. This approach has been used to determine the electron beam slice emittance and energy spread at the HGHG seeding experiment (sFLASH) at the Free-electron Laser in Hamburg. Furthermore time resolved measurements of the contrast of the seeded FEL with respect to SASE mode give the possibility to estimate the initial bunching factor and henceforth the induced energy modulation by the seeding laser pulse.

AKBP 13.2 Wed 16:45 MOL 213

HTS undulators: status of prototype coils for compact FELs — •Sebastian C. Richter[1,2], Daniel Schoerling[1], Axel Bernhard[2], Kantaphon Damminsek[2], Julian Gethmann[2], and Anke-Susanne Müller[2,3] — [1]CERN, Geneva, Switzerland — [2]LAS, KIT, Karlsruhe, Germany — [3]IBPT, KIT, Karlsruhe, Germany

Compact free electron lasers (FELs) require short-period high-field undulators in combination with shorter accelerator structures to produce coherent light up-to X-rays. Applying high-temperature superconductor (HTS) in form of coated REBCO tape conductors allows reaching higher magnetic fields and larger operating margins. This contribution discusses and summarizes the potential of HTS for the major superconducting undulator geometries (horizontal, vertical racetrack and helical) as well as the status of prototype coils for each type, to be wound with REBCO tape.

AKBP 13.3 Wed 17:00 MOL 213

Simulation results of an HGHG Seeded Oscillator-Amplifier — •Georgia Paraskaki[1], Vanessa Grattoni[1], Bart Faatz[1], Christoph Lechner[1], Johann Zemella[1], Sven Ackermann[1], and Wolfgang Hillert[2] — [1]DESY — [2]University of Hamburg

External seeding techniques are drawing the attention of the FEL community due to the higher brightness and improved longitudinal coherence of the output FEL pulse, and at the same time, there is an interest in higher repetition rates. Since the seed lasers currently available cannot offer sufficient energy in repetition rates of superconducting machines, at the moment one has to decide between seeded FEL radiation and higher flux. In order to overcome this dilemma, we discuss the concept of an HGHG seeded Oscillator-Amplifier, with the aim of achieving high repetition rate seeding. With this scheme, we can use a seed laser of 10 Hz and a resonator to feedback the radiation at repetition rates of superconducting machines instead of using an external seed at these high-repetition rates. The first simulation results with final wavelengths between 4.17 nm and 60 nm will be presented.

AKBP 13.4 Wed 17:15 MOL 213

Status of the CompactLight Design Study — •Regina Rochow and Gerardo D'Auria — Elettra Sincrotrone Trieste, Trieste, Italy

CompactLight (XLS) is a H2020 Design Study funded by the European Union under grant agreement 777431 and carried out by an International Collaboration of 24 partners and 5 third parties. The project started in January 2018 with a duration of 36 months and aims at designing an innovative, cost-effective and compact hard X-ray FEL facility beyond today's state of the art. This will be achieved using an advanced C-band photo-injector, high gradient X-band accelerating structures, and novel short period undulators. The hard X-ray FEL will be complemented by a soft X-ray source that can be operated up to 1 KHz pulse repetition rate. The presentation, held on behalf of the CompactLight Consortium, will give an overview of the state of the project, focusing in particular on the facility design and its potential regarding future user needs.

AKBP 13.5 Wed 17:30 MOL 213

Potential of variable polarizing undulators as afterburners — •Julian Gethmann[1], Sebastian C. Richter[1,2], Axel Bernhard[1], and Anke-Susanne Müller[1] — [1]LAS, KIT, Karlsruhe — [2]CERN, Geneva

As part of the EU funded Compact Light project, pros and cons of superconducting undulators with variable polarisation as afterburners for compact Free-Electron Lasers are discussed. For Free-Electron Lasers that use superconducting undulators for compactness, afterburners are the most promising way to provide variable polarized light. Until now, afterburners only exist as permanent magnet undulators which might limit the advantages of using superconducting undulators as main amplifiers in Free-Electron Lasers. However, variably polarizing superconducting undulators have been shown to be feasible. In this contribution we discuss the findings of our simulations and parameter studies exploring the potential of superconducting variably polarizing undulators as afterburners for compact Free-Electron Lasers.

AKBP 13.6 Wed 17:45 MOL 213

Seeding bei FLASH2020+ — •Sven Ackermann — Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607 Hamburg, Deutschland

Sven Ackermann für das FLASH2020+ Seeding Team

Seit mehr als einer Dekade stellt der Freie-Elektronen-Laser FLASH am Helmholtz-Zentrum DESY Wissenschaftlern aus aller Welt hochintensive, ultrakurz gepulste Strahlung im extremen Ultraviolett und im weichen Röntgenbereich zur Verfügung. FLASH war weltweit der erste Freie-Elektronen Laser (FEL), der in den Bereich dieser kurzen Wellenlängen vorstoßen konnte.

Unter dem Namen FLASH2020+ wird die zukünftige Ausrichtung der über 300 Meter langen FEL-Anlage erarbeitet. Um die gestiegenen Anforderungen der Experimente auch weiterhin befriedigen zu können soll in der ersten der zwei Strahlführungen mittels Einstrahlung externer Laserpulse ("Seeding") die Ladungsdichteverteilung der Elektronenpakete so manipuliert werden, dass im Undulator insbesondere longitudinal kohärente Strahlung bis in den weichen Röntgenbereich emittiert wird. Dabei sollen auch in diesem Betriebsmodus die durch die supraleitende Beschleunigungstechnologie möglichen hohen Wiederholraten erreicht werden. Ferner soll der Einsatz entsprechender Undulatoren eine frei wählbare zirkulare Polarisation der FEL-Pulse ermöglichen.

In diesem Beitrag werden die vorgeschlagenen Seeding-Schemata und ihre technische Realisierung diskutiert, sowie Einblicke in Simulationen zur Leistungsfähigkeit der geplanten Anlage präsentiert.