AKBP 7: Experiments for Advanced Light Sources

Time: Wednesday 14:00–15:30 Location: HSZ/0304

Group Report AKBP 7.1 Wed 14:00 HSZ/0304

Seeded free-electron laser driven by laser-plasma accelerators - a quest to compact high-brilliance x-ray lasers — •Arie Irman[1], Amin Ghaith[1], Marie Labat[2], Eléonore Roussel[3], Jurjen Couperus-Cabadag[1], Alexandre Loulergue[2], Susanne Schöbel[1], Maxwell LaBerge[1], Patrick Ufer[1], Yen-Yu Chang[1], Nicolas Hubert[2], Moussa El Ajjouri[2], Anthony Berlioux[2], Mathieu Valléau[2], Philippe Berteaud[2], Fréderic Blache[2], Sébastien Corde[4], Alexander Debus[1], Carlos De Oliviera[2], Jean-Pierre Duval[2], Yannick Dietrich[2], Christopher Eisenmann[1], Julien Gautier[2], René Gebhardt[1], Simon Grams[1], Uwe Helbig[1], Christian Herbeaux[2], Charles Kitégi[2], Olena Kononenko[4], Michael Kuntzsch[1], Stéphane Lê[2], Bruno Leluan[2], Fabrice Marteau[2], Manh Huy Nguyen[2], Richard Pausch[1], Pascal Rousseau[4], Mourad Sebdaoui[2], Klaus Steiniger[1], Keihan Tavakoli[2], Cédric Thaury[4], Marc Vandenberghe[2], José Vétéran[2], Victor Malka[4], Driss Oumbarek-Espinos[2], Damien Pereira[2], Thomas Püschel[1], Jean-Paul Ricaud[2], Patrick Rommeluère[2], and Ulrich Schramm[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf e. V. (Germany); — [2]Synchrotron SOLEIL (France) — [3]Lab. de Physique des Lasers, Atomes et Molécules (France) — [4]Lab. d'Optique Appliquée (France);

Free-electron lasers (FELs) produce high-brilliance coherent light pulses, serving as versatile research tools in fundamental science and applications. The recent development of short-wavelength seeded FEL now allows for unprecedented levels of control on longitudinal coherence, opening new scientific avenues such as ultra-fast dynamics on complex systems and X-ray nonlinear optics. Although those devices rely on state-of-the-art large-scale accelerators, advancements on laser-plasma accelerators, which harness gigavolt-per-centimetre accelerating fields, showcase a promising technology as compact drivers for FELs. This talk will review the current status of global effort toward realization of compact FELs. In particular, we present the development of high-quality laser-plasma accelerated electron beams and the commissioning of the COXINEL - FEL beamline, as well as experimental demonstration of FEL lasing at 270 nm in a seeded configuration. Control over the radiation wavelength is achieved with an improved bandwidth stability. Furthermore, the appearance of interference fringes, resulting from the interaction between the phase-locked emitted radiation and the seed, confirms longitudinal coherence, representing a key feature of such a seeded FEL. We anticipate a navigable pathway toward smaller-scale free-electron lasers at extreme ultraviolet wavelengths.

Group Report AKBP 7.2 Wed 14:30 HSZ/0304

KIT accelerators and research highlights - an overview — •Härer Bastian — Karlsruhe Institute of Technology, KIT

The Institute for Beam Physics and Technology (IBPT) at the Karlsruhe Institute of Technology (KIT) operates the Karlsruhe Research Accelerator (KARA) and the short-bunch linear accelerator, Ferninfrarot Linac- und Test-Experiment (FLUTE). In addition, a new compact storage ring will be realised in the context of the cSTART project and a new laser plasma accelerator will be the stepping stone for R&D based on novel acceleration techniques. This contribution gives an overview of current and future facilities and highlight respective accelerator physics research activities.

Group Report AKBP 7.3 Wed 15:00 HSZ/0304

Recent Highlights at the Photo Injector Test Facility at DESY in Zeuthen (PITZ) — •Li Xiangkun — on behalf of the PITZ team, DESY, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY in Zeuthen (PITZ) develops high brightness photocathode RF guns, advanced diagnostics and applications of the high brightness electron beams, which currently can be accelerated up to 22 MeV. In this talk, we will focus on the two main experiments in 2022: the worldwide first high-power THz SASE free-electron laser (FEL) and a new R&D platform for FLASH radiation therapy and radiation biology. The THz SASE FEL aims at producing high power tunable narrow band THz pulses with an energy of hundreds of *J per pulse. This can be realized by transporting and matching an electron beam with a bunch charge of 2 to 4 nC and a peak current up to 200 A into an undulator. Methods have been developed at PITZ for the beam envelop and trajectory optimization of the strongly space charge dominated electron beam. Results from first lasing, seeding studies and even saturation at 3 THz will be presented. The R&D platform FLASHlab@PITZ for radiation biology and electron FLASH radiation therapy is being prepared at PITZ. PITZ can provide a uniquely wide parameter range for studying this newest modality of radiation treatment against cancer. A startup beamline has been installed, first successful experiments have been done and an upgrade plan for exploiting the full capability of PITZ was developed. All this will be summarized in the talk.