

Meeting Report: EUCALL Annual Meeting 2017

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Abstract

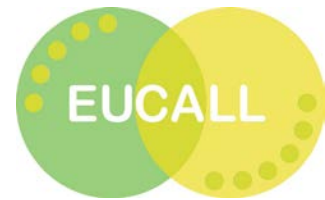
The European Cluster of Advanced Laser Light Sources (EUCALL), which groups accelerator- and laser-driven light sources, held its 2nd Annual Meeting at ESRF during 7-9 June 2017. At the meeting, status and progress reports were given for each of EUCALL's technical working groups, and presentations about properties and application of x-ray radiation generated at accelerator and optical-laser facilities were made. Possibilities for future collaboration between accelerator and laser communities after the end of the EUCALL project were also discussed.

The European Cluster of Advanced Laser Light Sources (EUCALL) held its 2nd Annual Meeting at ESRF during 7-9 June 2017 (Figure 1). EUCALL groups accelerator- and laser-driven light sources, and consists of European XFEL, DESY, the Extreme Light Infrastructure (ELI), ESRF, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Lund University, PSI, and Elettra Synchrotron, as well as the European networks *LaserLab-Europe* and *FELs of Europe*. EUCALL's partners are illustrated in Figure 2.

Within the EUCALL project, the laser and accelerator communities collaborate for the first time in a comprehensive way on technical, scientific, and strategic issues. These activities primarily relate to technical developments for advanced software and hardware for use at the different types of light source. A further focus is on identification of synergies between the two communities, for optimization and efficient use of the consortium of facilities. At the 2nd Annual Meeting, 64 scientists and engineers from the participating facilities gathered at the ESRF to discuss the progress of their joint activities, to plan for the final 16 months of the project, and to propose possible future collaborations following the end of EUCALL's EU funding period in October 2018.

The meeting was opened by EUCALL's director, Thomas Tschentscher (Scientific Director at European XFEL) who presented scientific highlights from the previous year and emphasized EUCALL's success during the first 18 month project period. The recent submission of EUCALL's Mid-Term Report was reported, as well as the very positive comments about the project by EUCALL's scientific advisory committee following their first meeting in September 2016. The work package leaders of each of EUCALL's technical groups then presented progress in each of these activities to the entire consortium.





Carsten Fortmann-Grote (European XFEL) of EUCALL's simulation of experiments (SIMEX) group presented the current status of new open source simulation platform for users and facility operators to simulate experiments "from source to detector" at advanced light sources [1,2,3]. SIMEX integrates separate simulation modules for the description of the entire chain from the source, over the beam transport to sample interaction with the intense x-ray beam and scattering, the detector response and on to observing scientific results from the detected data. It includes software developed at the different light sources and combines them into one a single tool with user interfaces. SIMEX currently supports simulations of coherent diffractive imaging, as well as of imaging and scattering experiments on laser excited or compressed matter. SIMEX is publicly available for download at www.github.com/eucall-software/simex_platform.

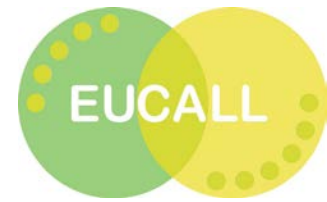
Michael Bussmann (HZDR), leader of the ultrafast data acquisition (UFDAC) group reported UFDAC's progress in bridging the communities of FPGA and GPU firmware development, with an overall goal to advance algorithms supporting data transfer at MHz pulse repetition rates [4,5,6]. Two test examples were detailed – one which exemplarily discusses an FPGA analysis of digitizer data for x-ray pulse characterization at 7.8 MHz, and one GPU analysis using a raw signal to photon count conversion algorithm for 12 GB/s image data rate. UFDAC hosted an open GPU-FPGA workshop in November 2016 and is planning a follow-up workshop on "Communication technologies and high-speed data transfer", expected to be held later in 2017.

EUCALL's high repetition rate sample delivery (HIREP) group co-leader Joachim Schulz (European XFEL) reported HIREP's progress in development of a unified sample characterization and positioning system which will provide external users with simplified access to EUCALL's facilities [7,8,9]. HIREP's software for characterization of samples and to drive the high-precision positioning system was presented, while designs of the sample frames and holders were shown as well as the progress in development and testing of prototypes.

Kai Tiedtke (DESY), leader of EUCALL's pulse characterization and control group (PUCCA) presented the development of new tools for advanced beam diagnostics at EUCALL's facilities. Three different femtosecond-resolved pulse arrival timing tools are being investigated – two based on flat-sheet liquid jet detectors (led by European XFEL and ELI-Beamlines) and one using a THz streaking method (from HZDR) [6,7,10]. A speckle-tracking wavefront sensor for hard x-rays and its operating software, jointly developed by ESRF and Elettra have been compiled and already tested with synchrotron radiation. A transparent gas intensity monitor for hard x-rays has been designed at DESY and is planned for use at both European XFEL and at ELI Beamlines [11]. These systems shall be tested during the commissioning of European XFEL's Femtosecond X-ray Experiment (FXE) instrument during summer 2017.

All of EUCALL's submitted deliverable reports on these technical developments to date are publicly accessible at www.eucall.eu/organisation/deliverables. Final versions of EUCALL's





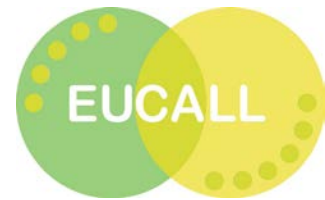
developed technologies will be completed and made available by the end of the EUCALL's current funding period on 30 September 2018.

Federico Canova (ELI-DC) of EUCALL's high level "Synergy of Laser Light Sources" group reported in particular on the creation of a large spreadsheet which contains technical information about 121 beamlines/instruments at selected FEL, synchrotron and optical laser facilities. The data collected will be analyzed by expert users to identify duplications and missing elements, or new research opportunities arising from the combination of offers by different facilities. It was also decided to provide access to this data to the scientific community – the data will be incorporated into the www.wayforlight.eu database which as a result will display information about ELI and some Laserlab-Europe instruments. EUCALL will also enhance the functionality of the database to provide up-to-date instrument data. Furthermore he reported about several open workshops under planning within the Synergy work package, including one on the topic of "Biology at Advanced Laser Light Sources" (30 November 2017 at European XFEL). The focus on biology applications was selected since these are currently of very high relevance to all of the participating facilities. The workshop will allow understanding of what the synergies between the different sub-groups are, as well as how to identify and develop them and later to extend these synergies into other communities. A second workshop on "High Impact Science at Advanced Laser Light Sources" will address urgent scientific and societal challenges and how EUCALL's facilities could contribute to solving these. A further topic deals with building a network for target delivery at high repetition rate laser facilities [12]. Full details of EUCALL's upcoming workshops can be found at www.eucall.eu/events.

The participants also took part in a poster session, in which all work performed under EUCALL was presented in detail to the entire group of project members. Site visits to various ESRF beamlines, control rooms and other infrastructure complimented this part of the program. EUCALL's Steering Committee held a face-to-face meeting on the first day, while members of the EUCALL Scientific Advisory Committee attended the whole Annual Meeting and met for a closed session after the Meeting.

While much of the 2nd Annual Meeting was dedicated to parallel Work Package sessions and committee meetings, in which technical and synergy developments were discussed in closed working groups, on the second day the participants reconvened for a series of invited presentations on photon beam characteristics and applications at the different types of light source. Harald Reichert (ESRF) presented the properties of diffraction limited storage rings for generating x-rays and their scientific application. Wilfried Wurth (DESY) discussed free-electron laser radiation, with a particular focus on application of beams of coherent UV and x-radiation. Dimitri Batani (Uni. Bordeaux) then described the production and application of x-rays driven by long-pulse lasers. He discussed the advancement in France's "Laser MegaJoule/PETawatt Aquitaine Laser" (LMJ/PETAL) project and the perspectives of using laser-driven x-ray sources for backlighting experiments at laser facilities. Finally, Arie Irman (HZDR) presented the production and application of x-rays driven by short-pulse lasers, with an emphasis on betatron and plasma-wakefield accelerated sources.





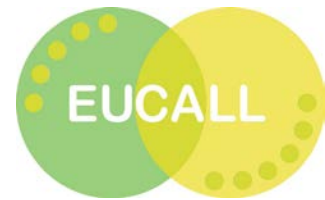
The meeting participants emphasized that this session was a welcomed overview of the differences and commonalities between the different types of light source, as these comparisons are not always clear for a typical scientist or engineer working at an individual synchrotron, free-electron laser or optical laser facility.

This plenary session was continued by Thomas Tschentscher, in a presentation about future possibilities to extend EUCALL's activities beyond its present funding period. Possibilities include new proposals for Horizon2020 funding from a subset of EUCALL's partners, a continuation of a EUCALL-like collaboration with the laser community within future synchrotron/FEL cluster initiatives, or the formation of the "EUCALL Network" for regular meetings to discuss possible collaborations and proposals for alternative funding. In the open discussion following, it was unanimously agreed by the participants to continue EUCALL's collaboration in the future.

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Figure Captions

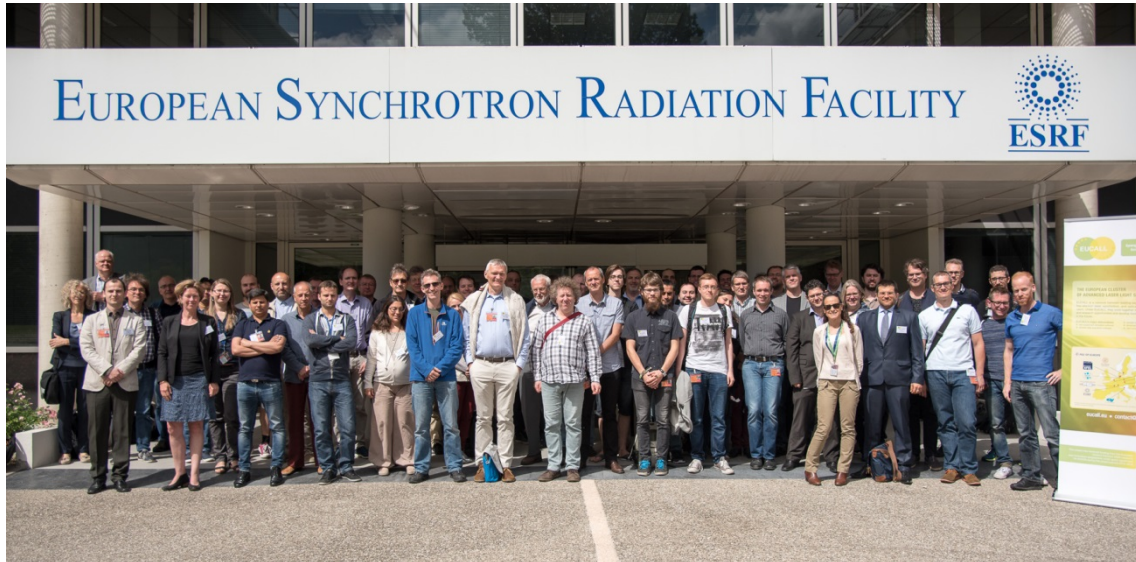


Figure 1: EUCALL’s project participants gathered at the 2nd Annual Meeting at ESRF.

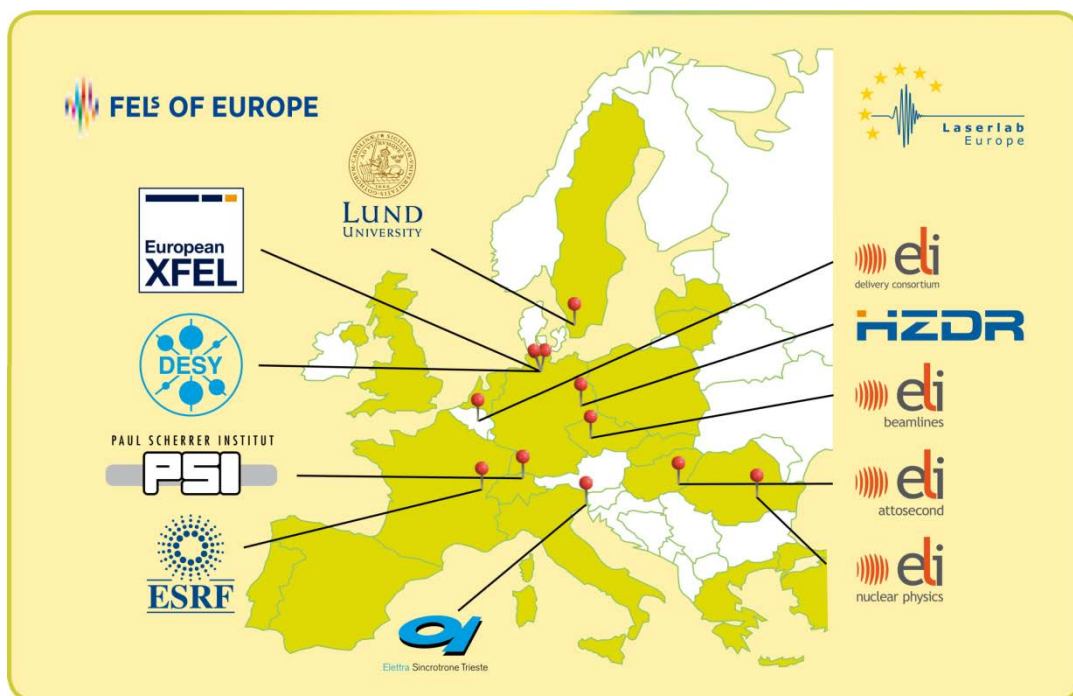


Figure 2: EUCALL’s eleven research facilities (red pins). Member countries of the clusters *FELs of Europe* or *Laserlab-Europe* are coloured.