

Early DAC Experiments at the HED Instrument of the European XFEL

Jointly organized by European XFEL and DESY

May 15th morning – May 16th afternoon
Bldg. 28f (Flash Seminar Room)
DESY, Hamburg, Germany

Introduction:

The High-Energy Density (HED) science instrument at European XFEL is dedicated to studies of matter at extreme conditions. Major instrumentation of HED is made available by the user consortium “Helmholtz International Beamline for Extreme Fields (HIBEF)” which is headed by Helmholtz Zentrum Dresden Rossendorf (HZDR) with DESY as a strong partner. HIBEF is part of the Helmholtz International Beamline (HIB) User Consortia that brings cutting edge research capabilities to different instruments at the European XFEL.

One of the drivers envisioned for the HED instrument are Diamond Anvil Cells (DAC) that are dynamically driven, e.g. through pulsed laser heating, isochoric heating or dynamically compressed DACs or a combination thereof. Within the framework of the HIBEF project, DESY organized a first workshop for the DAC community in 2016, to discuss the possible science and technical feasibility of such studies described in a conceptual design report ([CDR](#)). As an outcome of this and later workshops, it was agreed that a second interaction area (IA2) could be, in part, dedicated to and optimized for X-ray diffraction experiments. IA2 will increase the capabilities of the multipurpose main interaction area (IA1) of HED that enables both diffraction and spectroscopy experiments. After the above workshops, a team of scientist and engineers at DESY, European XFEL and HZDR worked on developing an experimental setup to conduct the proposed experiments.

In September 2017, the European XFEL started user operation at the two of the six instruments. The HED science instrument is expected to open for first user commissioning experiments in summer 2019. Among the first capabilities are diffraction and spectroscopy experiments in DACs.

From May 2018 until the end of June, European XFEL is expected to open a call for proposals for the HED instrument for this period. In order to inform potential users of the initial capabilities of the different DAC setups at the HED instrument, we are organizing the workshop “Early DAC experiments at the HED Instrument of the European XFEL”. The XFEL management has suggested during the last user meeting that it is highly desirable to submit so called “Community Proposals” by groups of people that have common interest in a particular instrumental setup (including “User Assisted Commissioning”) in order to share the burden and risk of these early experiments. Thus, the workshop is also intended to serve as a vehicle to organize and prepare community proposals for first DAC experiments. Since proposals will be rated on the basis of scientific motivation and technical challenges, it is seen as most advantageous to draft the proposal with a targetable scientific objective in mind. For this reason, we have asked several users from the community that have been actively participating and supporting a DAC setup at the European XFEL to present potential scientific cases for a community proposal. Towards the end of the workshop, we plan to form user groups that will convene in working groups to start drafting the community proposal. In order to make effective

use of these breakout sessions, we are limiting the workshop to a maximum of 40 people and we asked each interested user group to send no more than 2 representatives that can speak on behalf of the user group.

Final Schedule

(as of 13.05.2018)

Tuesday May 15 th		
8:30 – 9:00	Registration and Coffee	
9:00 – 9:10	Welcome	E. Weckert (DESY) & T. Tschentscher (XFEL)
9:10 – 9:20	Introduction	U. Zastrau (XFEL) & C. Strohm (DESY)
Session 1: Scientific Cases for Pulsed Laser Heating Setup		
Chair: Z. Konopkova & K. Appel		
9:20 – 9:45	"High temperature experiments under pressure using pulse laser heating at European XFEL"	S. McWilliams (Uni. Edinburgh) 15 + 10 min
9:45 – 10:10	"Accessing new P-T regimes, and new science, in the alkali metals at the European XFEL"	M. McMahon (Uni. Edinburgh) 15 + 10 min
10:10 – 10:35	Coffee Break	
10:35 – 11:00	"Novel experimental setups for studying silicates and iron alloys under extreme conditions"	G. Fiquet (IMPIC) 15 + 10 min
11:00 – 11:25	"Probing of melting, superionicity, and liquid-liquid phase transitions at XFEL using pulsed internal resistive and laser heating in DAC"	A. Goncharov (Geophysical Laboratory) 15 + 10 min
11:25 – 11:50	"Valence-to-core XES spectra of dynamically compressed amorphous GeO ₂ to 200 GPa"	G. Spiekermann (Uni. Potsdam) 15 + 10 min
11:50 – 13:00	Lunch in DESY Canteen	
Session 2: Scientific Cases for dDAC Setup		
Chair: H. P. Liermann		
13:00 – 13:25	"Phase transitions in metals at high (~100 TPa/s) compression rates in the dynamic Diamond Anvil Cell"	Z. Jenei (LLNL) 15 + 10 min
13:25 – 13:50	"Strain-Rate Tuning of the Jahn-Teller Distortion in Metalloids"	M. Gorman (LLNL) 15 + 10 min
13:50 – 14:15	"Novel Chemistry in Quantum Solid Mixtures"	C.-S. Yoo (Washington State Uni.) 15 + 10 min
14:15 – 14:40	"Crystallization of bismuth and water at ms-timescale using a dDAC"	C. Pépin (CEA) 15 + 10 min
14:40 – 15:10	Coffee Break	

Session 3: Day One Technical DAC Capabilities		
Chair: C. U. Zastrau		
15:10 – 15:40	Day one X-ray and spectroscopy capabilities anticipated for the HED instrument	K. Appel (XFEL) 20 + 10 min
15:40 – 16:10	"Dynamic DAC X-ray diffraction setup at IC2"	H. P. Liermann (DESY) 20 + 10 min
16:10 – 16:40	"Interaction Chamber 1 + 2 and pulsed laser heating X-ray capabilities"	Z. Konopkova (XFEL) 20 + 10 min
16:40 – 17:10	Coffee Break	
17:10 – 18:00	Initial Discussions 1 st day	All
18:30 – open	Dinner in the DESY Cafeteria	

Wednesday May 16 th		
8:45 – 9:00	Coffee, Announcements	U. Zastrau, C. Strohm
Session 4: Community Proposal Groups		
Chair: H.-P. Liermann		
9:00 – 9:15	Description and Aim of Community Proposals and Example	U. Zastrau (XFEL) 15 min
9:15 – 9:45	Discussion about Community Proposals and formation of potentially 3 proposals groups	C. Strohm (DESY) 30 min
9:45 – 10:15	Coffee Break	
10:15 – 12:15	Breakout sessions to discuss scientific cases for community proposals and selection of PIs and Co-PIs	K. Appel (XFEL), Z. Konopkova (XFEL), H. P. Liermann (DESY)
Session 5: Drafting of Community Proposals		
Chair: O. C. Strohm & U. Zastrau		
12:15 – 13:15	Lunch in DESY Canteen	
13:15 – 14:15	Comparison and adjustment of science cases between the three different community proposals	PIs
14:15 – 16:00	Start writing community proposals	All
16:00 – 16:30	Closing Discussion	U. Zastrau (XFEL), C. Strohm (DESY)

Poster

(to be presented during coffee breaks)

Title	Presenter
Laser-Heated Rapid-Compression Experiments in Olivine and Plagioclase.	M. Sims, Stony Brook Uni.
Melting phase relations of simple silicates and its implications for studying early stages of planetary mantle formation.	A. Marzen, IMPMC
Complex Molecular Mixtures in Planetary Interiors	M. Bethkenhagen, Uni. of Rostock

Map of the DESY Campus
with the location and walk way (red line) to the Venue (Flash Seminar Room)
from the DESY side entrance.

Workshop: Early DAC Experiments at the HED Instrument of the European XFEL (Bldg. 28 c, Flash Seminar Room).

