

Satellite Workshop
On
Scientific Instrument Proposals
for
Extreme Pressures and Temperatures Research
at PETRA IV

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November 5-6th 2020

Abstract

This satellite workshop is dedicated to exploring the science cases and instrumentation for Extreme Conditions research using high pressure devices such as Diamond Anvil Cells (DAC) and Large Volume Presses (LVP) at PETRA IV. Scientific case studies will benefit from 1) the exceptional brightness and coherence from very small gap undulators with a maximum length of 10 m (signature beamlines) delivering high energy flux, enabling focused micro- to nano-sized beams on the sample, as well as 2) offering the chance to use an entire suite of coherent diffraction and imaging techniques that have so far not been possible at high energies. We will summarize and critical discuss the 5 key areas proposed in Scientific Instrumentation Proposals (SIP) drafts, offering the community the chance to view, comment and provide feedback before the submission deadline (1st December 2020):

- LVP Instruments (diffraction/imaging in the 6-ram LVP & dedicated imaging/diffraction in a PE-type press)
- High-P, high-T DAC X-ray diffraction and imaging microscope
- A high pressure PETRA IV endstation combining Spectroscopy and Diffraction
- A dynamic Compression X-ray Diffraction/Imaging Microscope
- Non-resonant Inelastic X-ray Scattering (NIXS) and Nuclear Resonance Scattering (NMR) in a DAC

Topics of discussion will be considered within the framework of the CDR chapters on Earth and Environment and Materials for Energy and Transport Technology. Discussions include high-pressure investigation of materials structure, physical properties and kinetics of transformational processes using X-ray diffraction, spectroscopy and imaging techniques. Particular consideration will be given to the emergence of new and advanced techniques, such as time-resolved microtomography, phase contrast, coherent Bragg diffraction imaging, ptychography, and synchrotron Mössbauer spectroscopy. Technological advances in high pressure generation in conjunction of with PETRA IV, processes the driving forces leading to novel phase discoveries and the study of complex geological materials to explore a wider (towards smaller) length and time scales than currently possible.

After the workshops, the SIPs will be finalized for submission with the aim to support new, dedicated, instruments for Extreme Conditions Research at PETRA IV in order to meet upcoming challenges and demand by the community in this rapidly growing field of research.

Tentative Schedule

as of 25.08.2020

Thursday Nov. 5 th		
8:30 – 9:00	Registration and Coffee	
9:00 – 9:05	Welcome	All
9:05 – 9:20	Introduction	TBD
Session 1: Research at extreme pressure and temperatures in the LVP Chair:		
9:20 – 9:40	Towards advanced in situ X-ray diffraction experiments by combination of a multi-anvil press and high-density monochromatic X-ray beams (15 min + 5)	T. Katsura (BGI)
9:40 – 10:00	Novel horizons/Opportunities of Synchrotron Research Using Large Volume Presses for deformation: from earthquakes to earth convection (15 min + 5)	N. Hilairet (Uni. of Lille, CNRS)
10:00 – 10:15	Coffee Break	
10:15 – 11:35	How detailed in situ microstructure analysis at extreme conditions can be at PETRA IV (15 min + 5)	D. Rafaja
11:35 – 12:00	Summary Instrumentation (20 + 5 min)	R. Farla (DESY)
12:00 – 12:15	Discussion (15 min)	TBD
12:15 – 13:15	Lunch Break	
Session 2: Research at extreme pressure and temperatures at the high-p and high-T microscope Chair: K. Glazyrin (DESY)		
13:15 – 13:35	Understanding the interior of planetary bodies using tDAC & dsDAC in conjunction with X-ray diffraction and imaging” (15 + 5 min)	L. Dubrovinsky (BGI, Uni. Bayreuth)
13:35 – 13:55	Insight into material synthesis in the DAC via X-ray diffraction and imaging (15 + 5 min)	M. Bykov (Carnegie Institute)
13:55 – 14:15	Exploring the role of volatiles in the Earth using x-ray diffraction and imaging in the DAC (15 + 5 min)	C. S. Valles
14:15 – 14:40	Using x-ray scattering and imaging to explore the density distribution of planetary interiors (15 + 5 min)	S. Pettitgirad (ETH)
14:40 – 14:55	Summary of Beam Parameters and Other	C. Prescher

	Requirements (20 + 5 min)	(DESY)
14:55 – 15:10	Discussion (15 min)	K. Glazyrin DESY
15:10 – 15:25	Coffee Break	
Session 3: Dynamic compression microscope for research at extreme pressure and temperatures at the		
Chair: K. Appel		
15:25 – 15:45	Simulating the interior of giant planets using dynamic compression (15 + 5 min)	D. Kraus (Uni. Rostock, HZDR)
15:45 – 16:05	Material properties under dynamic compression (15 + 5 min)	M. McMahon (Uni. Edinburgh)
16:05 – 16:25	Simulating Asteroid and Meteorite Impacts with shock and dDAC drivers (15 + 5 min)	TBD
16:25 – 16:45	Studying earth material properties using time-resolved x-ray diffraction (15 + 5 min)	H. Marquardt (Uni. of Oxford)
16: 45 – 17:10	Summary of Beam Parameters and Other Requirements (20 + 5 min)	H. P. Liermann (DESY)
17: 10 – 17:25	Discussion (15 min)	K. Appel (EuXFEL)
Session 4: Discussion and close out		
Chair:		
17:25 – 17:45	Discussion and close out 1 st day (20 min)	TBD
17:45 – 19:00	Virtual Poster Session	

Friday Nov. 6 th		
Session 5: Research at extreme pressure and temperatures at the diffraction spectroscopy instrument		
Chair: TBD		
9:00 – 9:20	X-ray spectroscopy of glasses and melts at extreme conditions at PETRA-IV (15 + 5 min)	Ch. Sternemann (Uni. Dortmund)
9:20 – 9:40	Investigating chemical properties of magmas under pressure using XAS and XRF (15 + 5 min)	C. Sanloup (Uni. Paris)
9:40 – 10:00	Advanced Imaging techniques for high pressure samples: the prospects of now and the PETRA-IV (15 + 5 min)	S. Petitgirard (ETH)
10:00 – 10:20	The initiative of a PETRA-IV endstation merging the access to spectroscopy and diffraction for high pressure science (15 + 5 min)	T. Meier (BGI)
10:20 – 10:40	Technical aspects of the endstation merging the access to spectroscopy and diffraction for high pressure science (15 + 5 min)	K. Glazyrin (DESY)
10:40 – 11:00	Discussion	TBD
11:00 – 11:15	Coffee Break	
Session 6: Research at extreme pressure and temperatures at the inelastic scattering instrument		
Chair:		
11:15 – 13:15	TBA	
Session 7: Discussion and close out		
Chair:		
13:15 – 13:30	Discussion and close out	