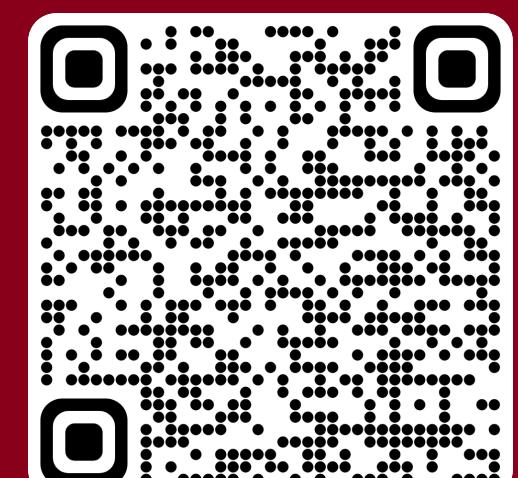




# Diamond Anvil Cell Program at GSECARS after APS-U

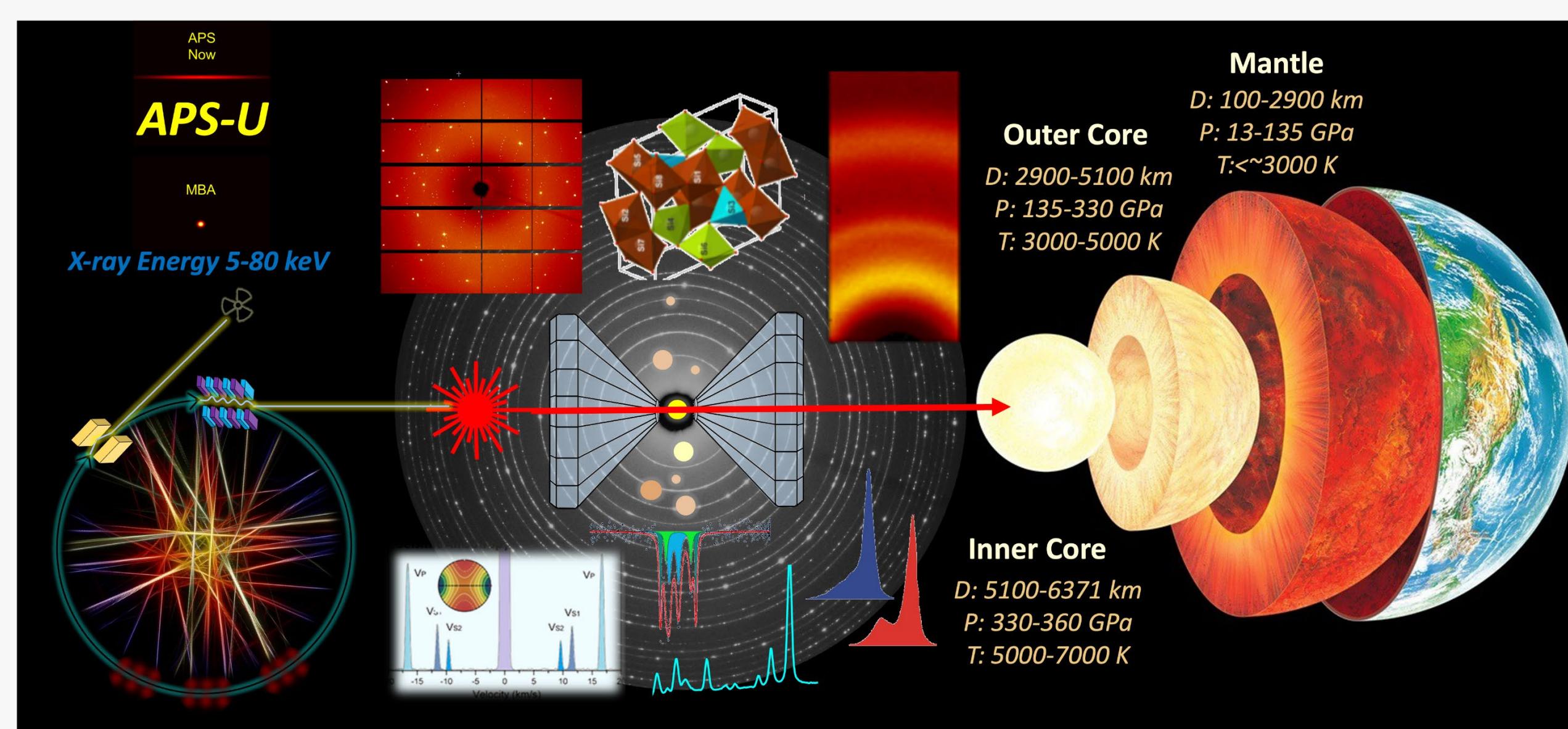
Vitali B. Prakapenka, Stella Chariton, Young Jay Ryu and Dongzhou Zhang

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Understanding the complex nature of the deep interiors of the Earth and other planets requires the knowledge of the physical and chemical properties of their constituting elements and compounds at relevant conditions.

To provide new constraints on models for planetary evolution and origin, key properties (melting, structure, phase relation, chemical reactions and kinetics, transport, elastic, electronic and optical properties) of a wide range of minerals must be studied *in-situ* at extreme conditions of pressure and temperature.

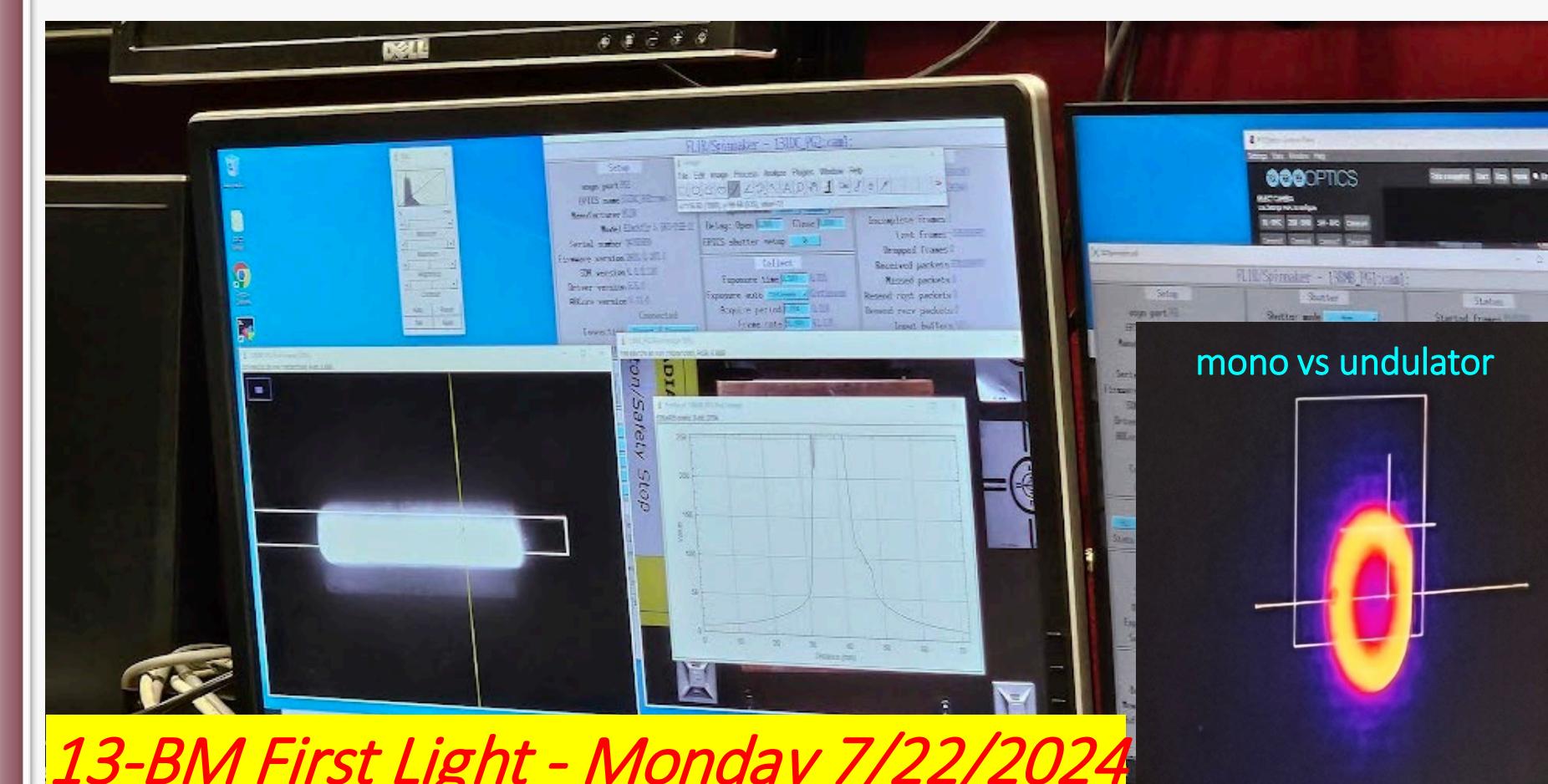


Combination of X-ray, electrical and optical probes coupled with *ex situ* characterization of sample texture and composition provides a powerful approach for acquiring the kinds of multi-faceted data needed to develop realistic models of how the interior of Earth and other planets formed, evolved, and currently operates

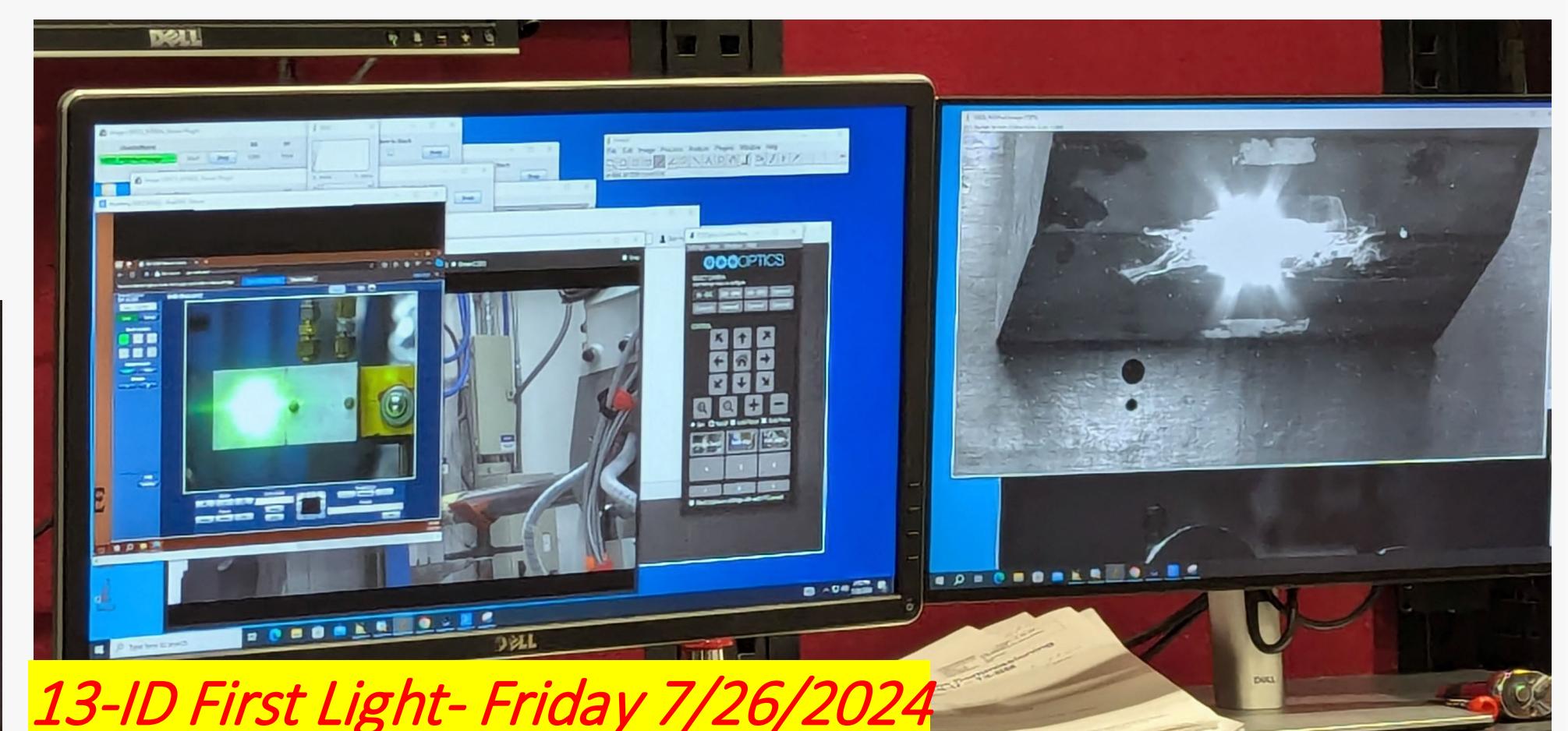


GSECARS- 7/26/2024

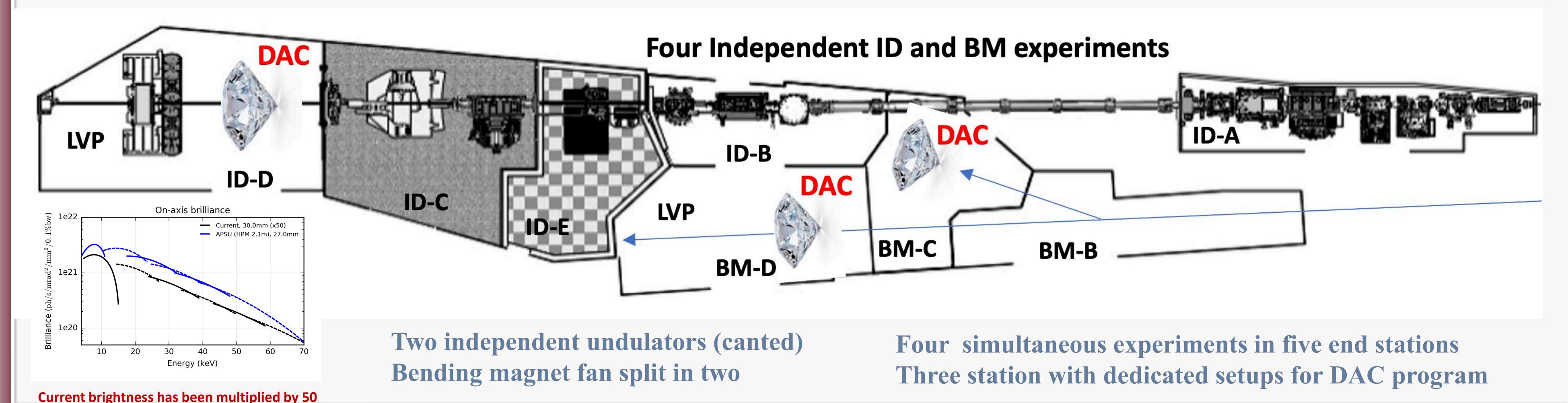
June 17, 2024



13-BM First Light - Monday 7/22/2024



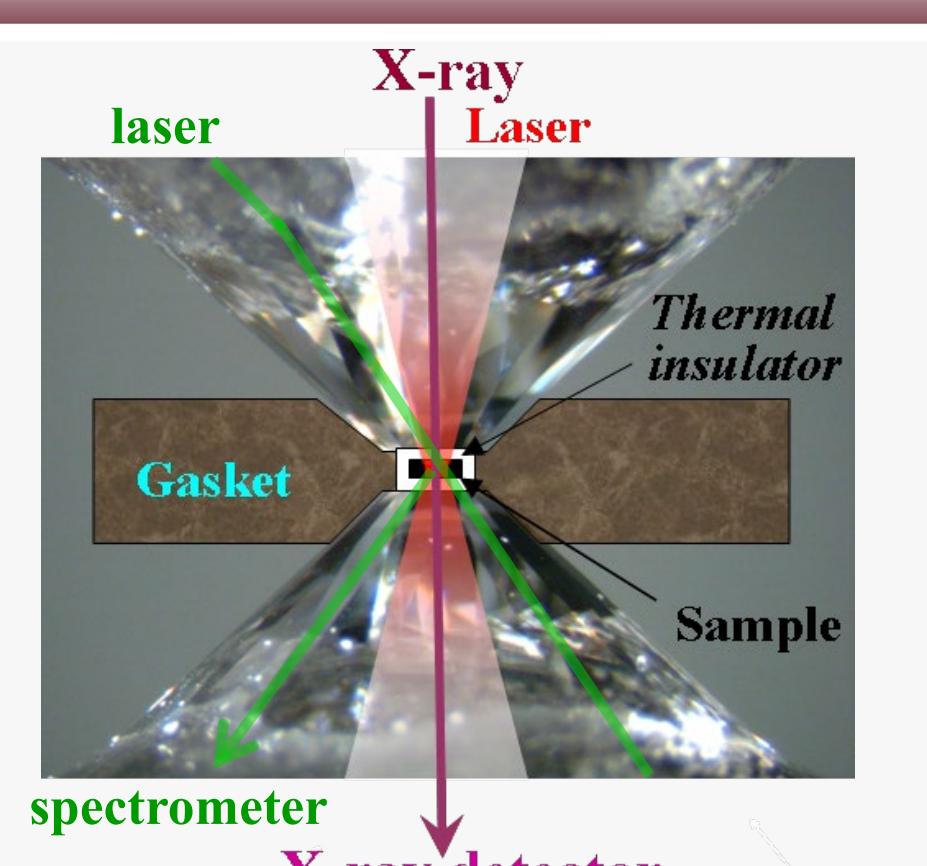
13-ID First Light- Friday 7/26/2024



Two independent undulators (canted)  
Bending magnet fan split in two

Four simultaneous experiments in five end stations  
Three station with dedicated setups for DAC program

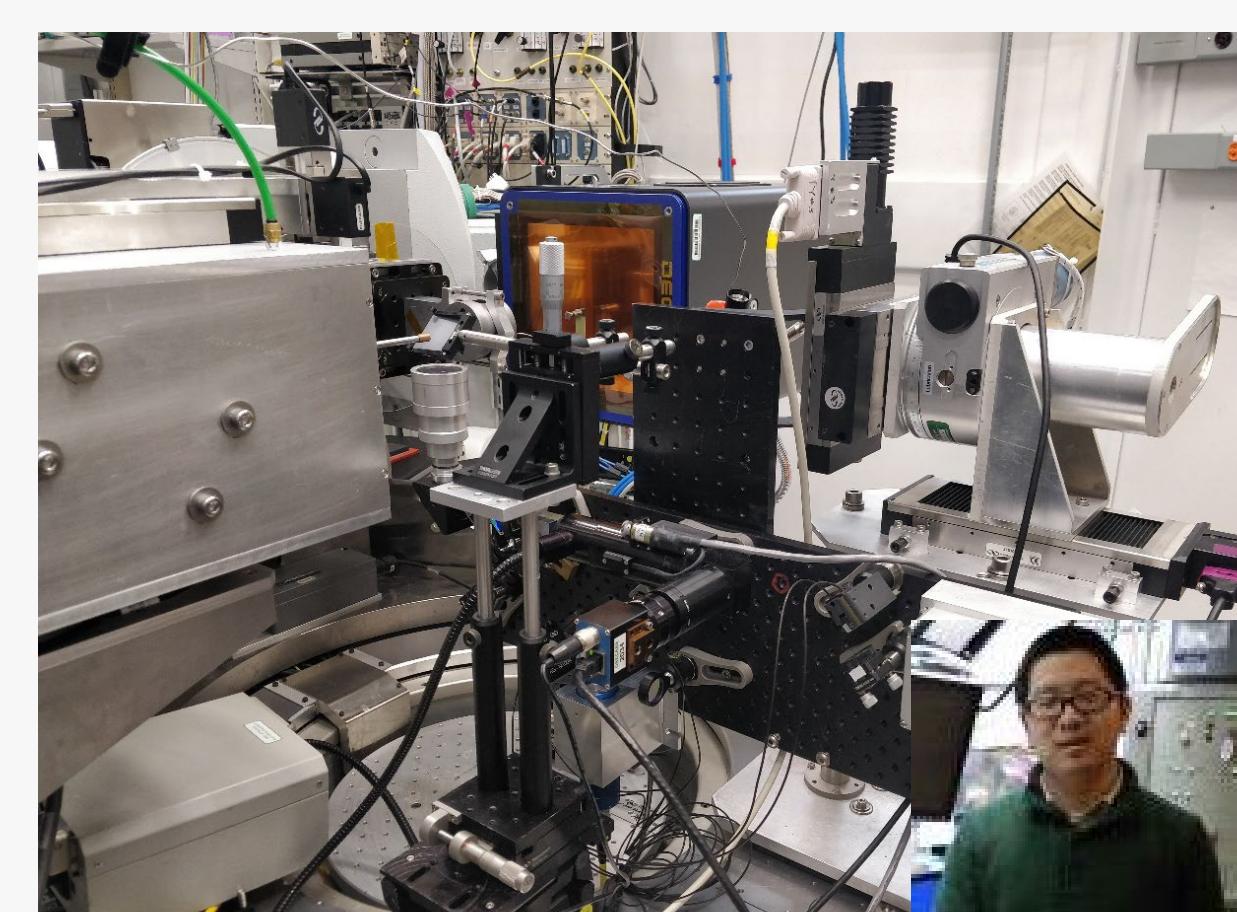
Multiple optical axes (X-ray, lasers, spectroscopy and imaging) should be aligned with **sub-micron precision** on the sample inside the diamond anvil cell.



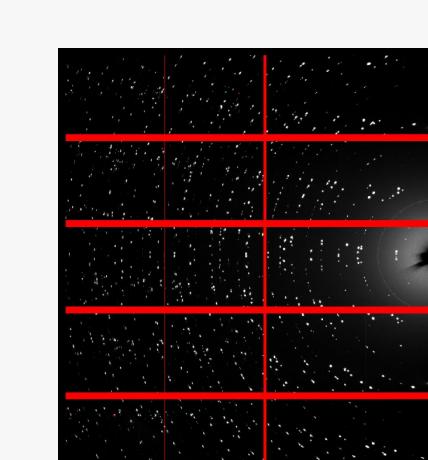
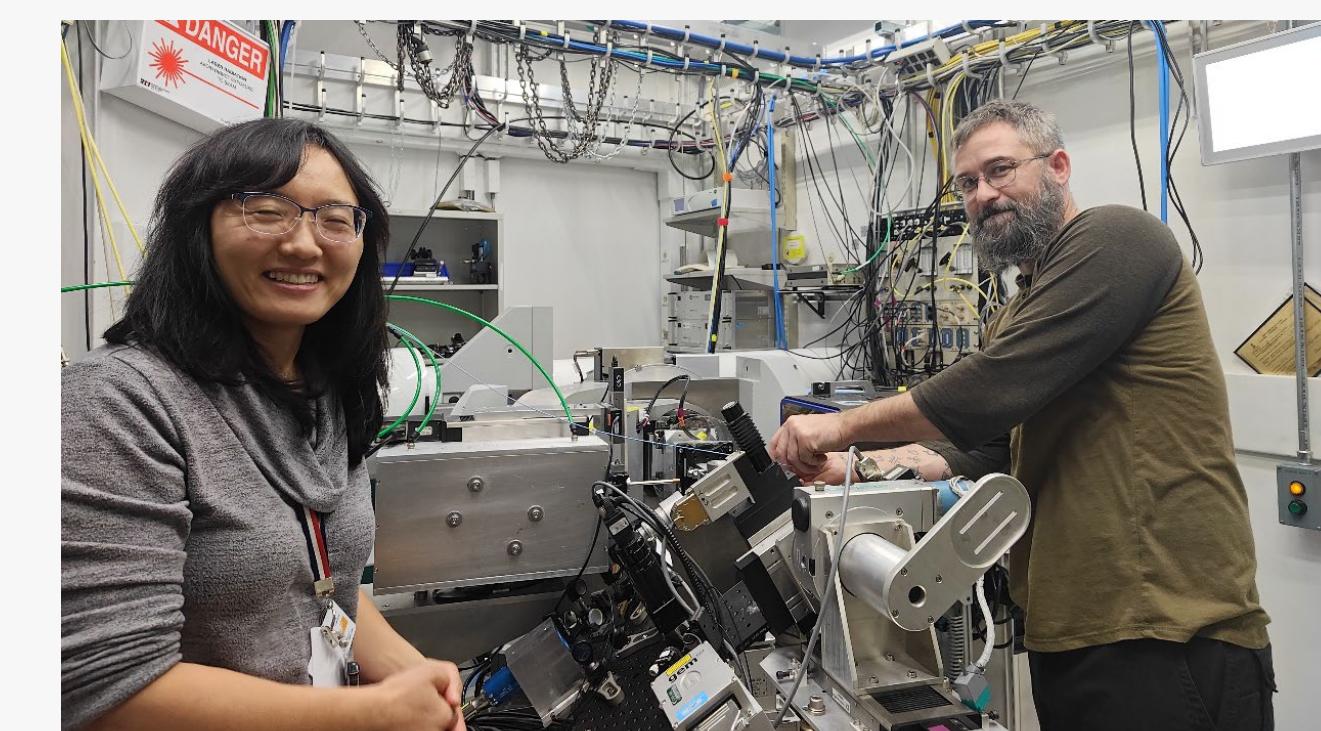
## 13-BMC

X-ray energy 28.6 keV, beam size  $\sim 10 \mu\text{m}$   
SCXRD, radiography, on-line laser heating, Raman and VIS spectroscopy

- ✓ High energy X-ray efficient Pilatus3 1 M CdTe detector will be available for most DAC experiments
- ✓ Fast shutter-less gated optical detector PI-MAX3 will be installed for radiometric temperature measurements above 1000 K with optional synchronization with laser heating pulses
- ✓ Updated enclosure for precise high temperature experiments with resistive heating DAC up to 1400 K
- ✓ Compact cryostat for low temperature DAC experiments with rotation capabilities for SCXRD measurements
- ✓ Rowland circle monochromator upgrade: adding another Si crystal to enable energy  $>35$  keV.

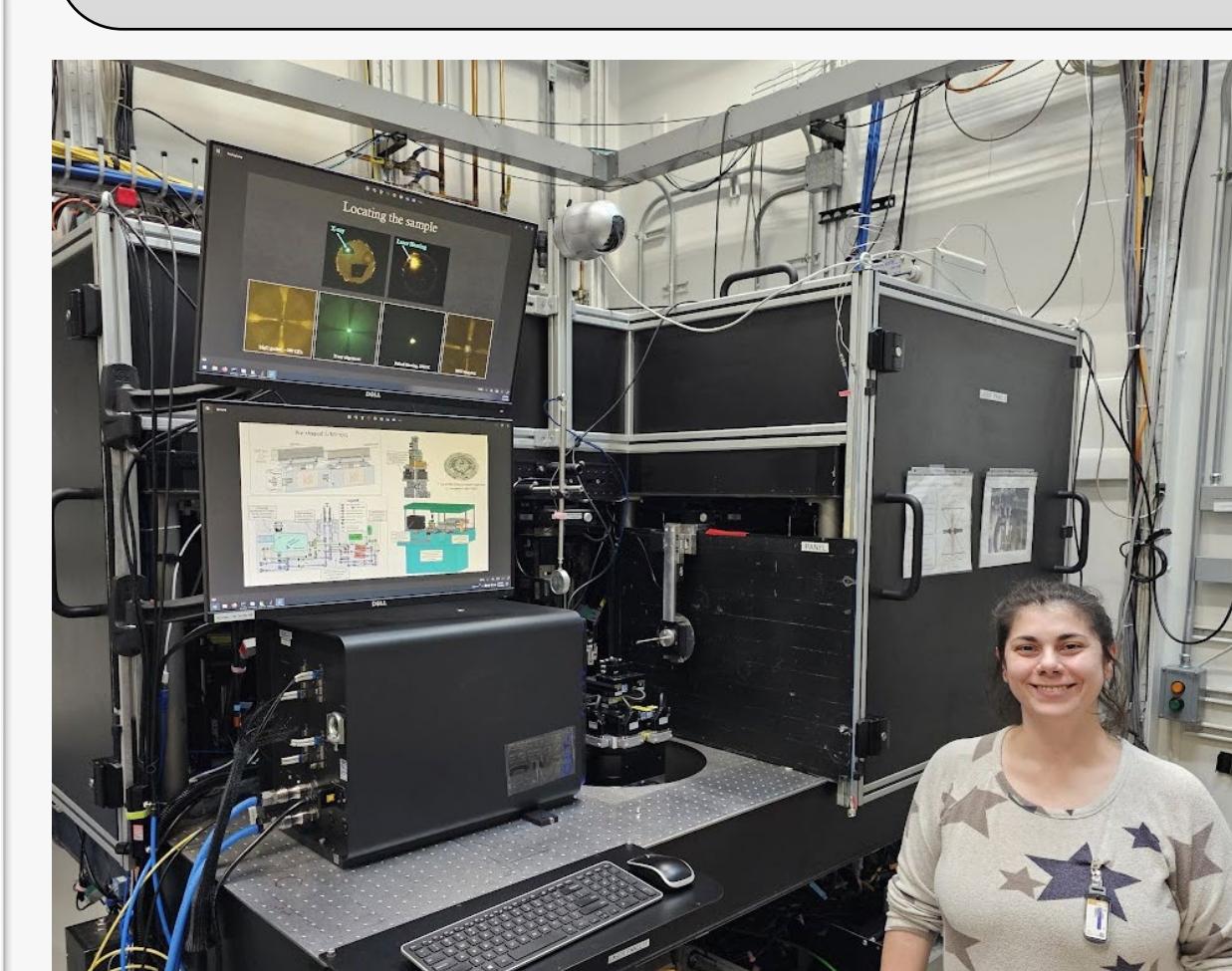


BMC welcomes first scientific commissioning users:  
W. Bi and J. Petri from, U Alabama

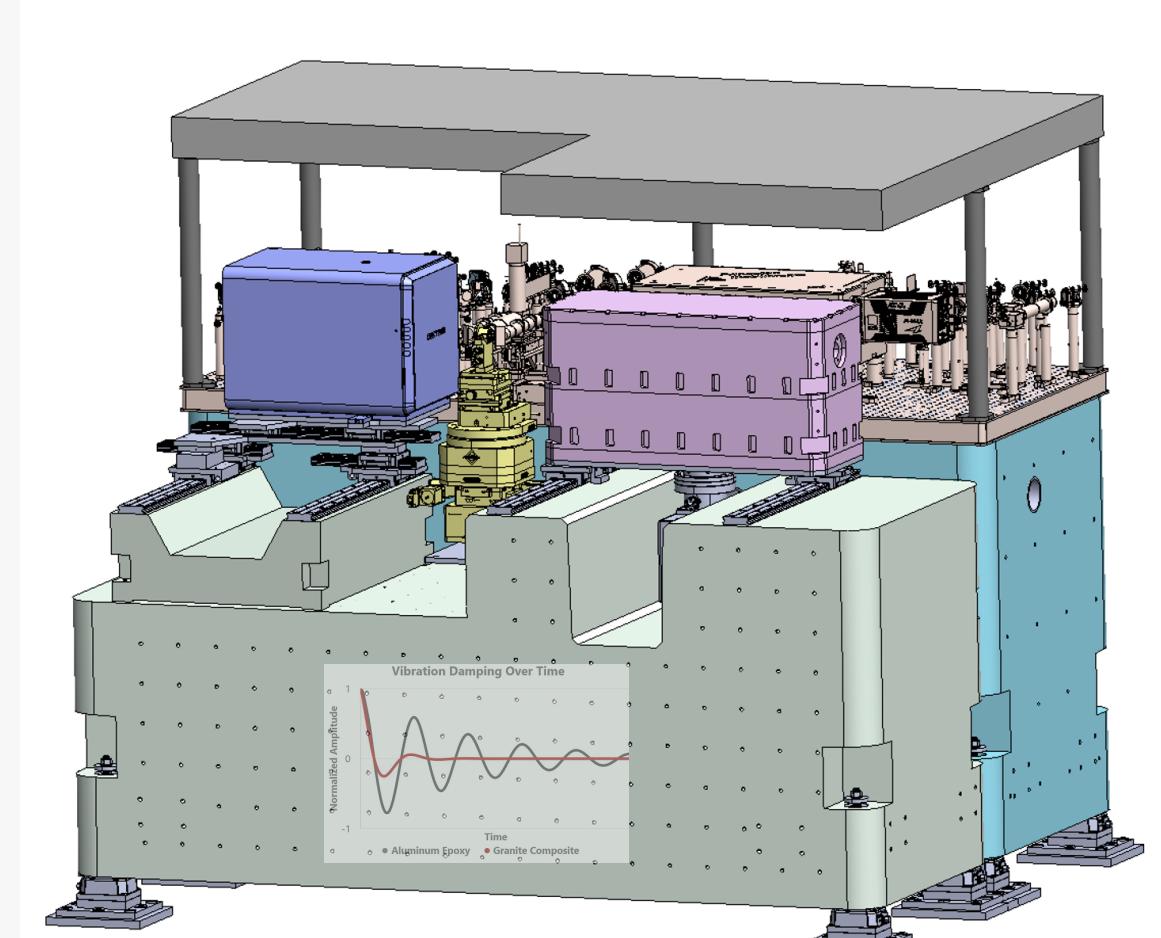


## 13-IDD

X-ray energy 5 - 55 keV, beam size 300 nm  
XRD, SCXRD, XES, on-line laser heating, Raman and VIS-IR spectroscopy



2024 → 2025



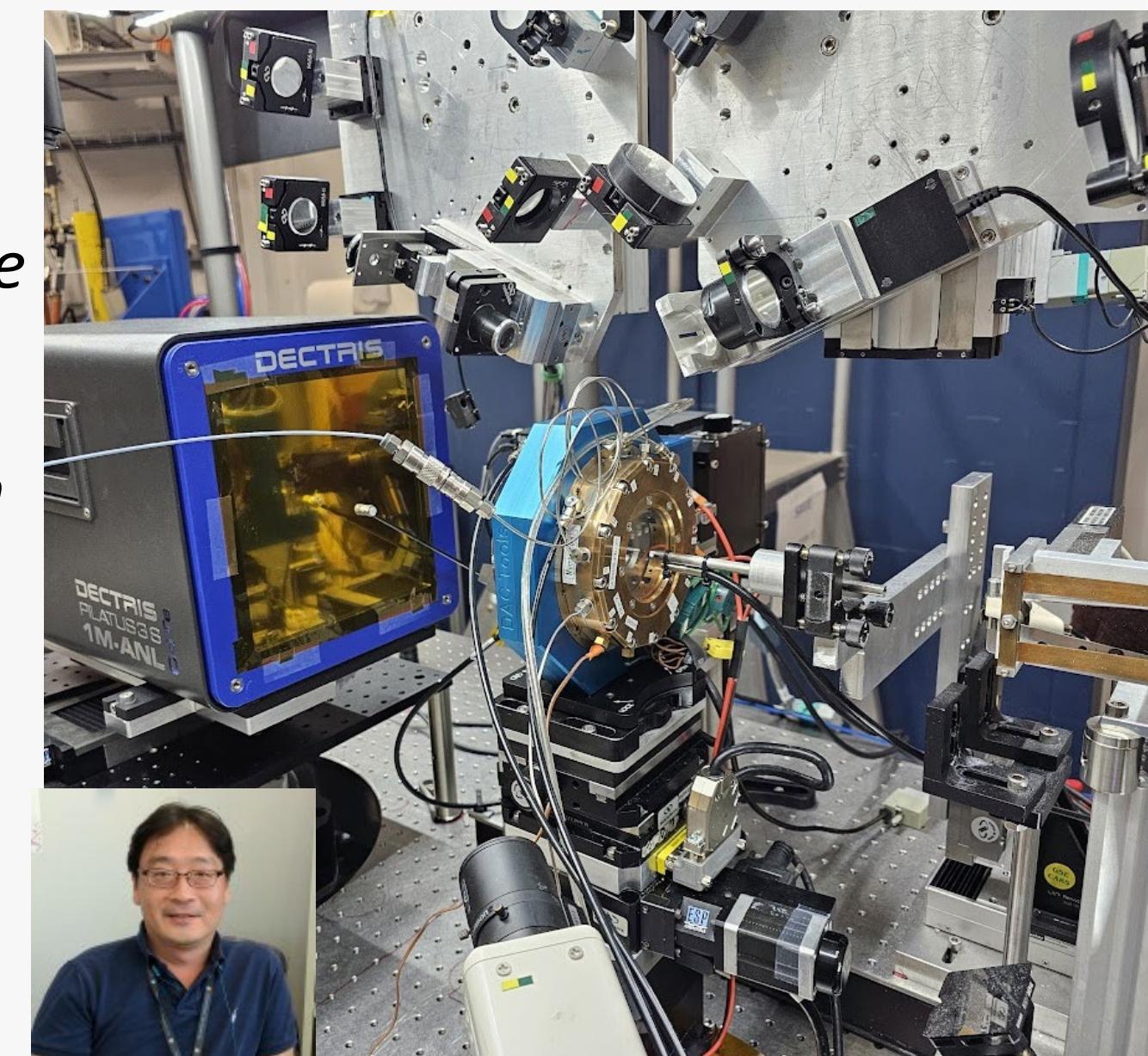
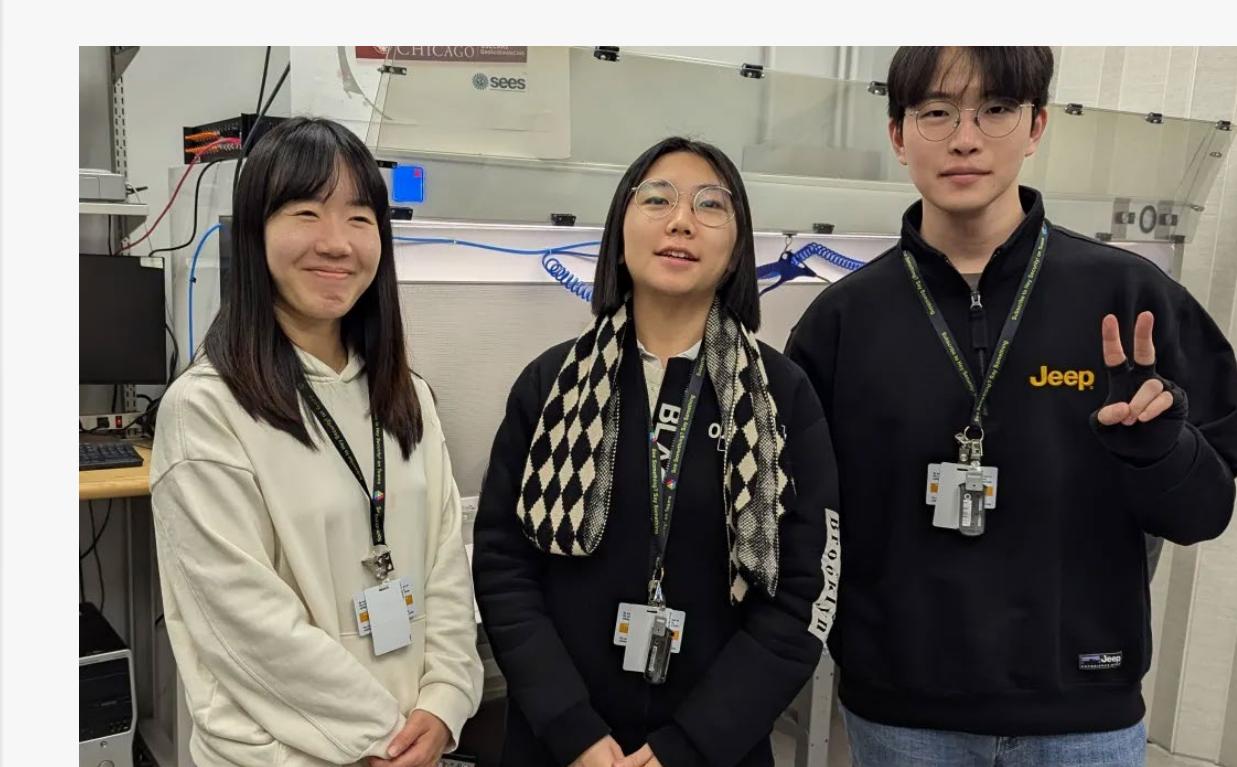
See more details on poster #MR31B-297 presented by Stella Chariton

## 13-BMD

X-ray energy 5 - 80 keV, beam size  $2 \times 10 \mu\text{m}$   
XRD, SCXRD, 3D tomography with SCXRD, on-line Brillouin, Raman and VIS-IR spectroscopy

- ✓ High resolution (spatial and spectral) Raman spectroscopy in backscattering geometry with dedicated optical path
- ✓ High precision motorized stages for 12x zoom microscope to improve sample imaging, alignment and reproducibility
- ✓ Modification of the focusing and collecting platforms in the Brillouin system to fit new large high temperature enclosure for externally heated DAC with custom designed rotation stage. The system has been developed in collaboration with DACTools and Hanyang Univ
- ✓ Combination of 3D computer tomography with tightly focused XRD (single-crystal or powder) to study micro-inclusions inside bulky matrix

BMD welcomes first scientific commissioning users: H Sim, S Yun and B Go (Yonsei U)



First experiment at BMD  
Young Jay Ryu, The University of Chicago  
horizontal focus 2  $\mu\text{m}$ , vertical slitted 40  $\mu\text{m}$

## Acknowledgments:

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