

GSECARS X-ray Microprobe and Tomography Program

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The GSECARS X-ray Microprobe and Tomography program encompasses research at station 13-ID-E, which houses a dedicated X-ray microprobe where users conduct experiments using microXRF, microXAFS, and microXRD techniques in point, mapping and microtomographic modalities, and efforts at station 13-BM-D, where full field X-ray computed microtomography experiments are hosted for a fraction of the available beamtime (shared with experiments using our 250-ton Multi-anvil Press and Externally Heated Diamond Anvil Cell Diffractometer). 13-ID-E provides Earth scientists the ability for characterization of elemental abundances, chemical speciation, and mineralogy in samples that are typically heterogeneous at the micrometer and sub-micrometer scale. The 13-ID-E microprobe capabilities have supported Earth science research in soil science, contaminant geochemistry, biogeochemistry, oceanography, petrology, volcanology, ore deposit geochemistry, hydrothermal geochemistry, oceanography, paleontology, medical mineralogy, and cosmochemistry. The 13-BM-D tomography capabilities provide Earth scientists the ability to image the structure of materials using full field X-ray tomographic methods at high spatial resolution and at high speed. This instrument has been extensively used for research in soil science, petrology, volcanology, meteorites, paleontology, and granular materials relevant to civil engineering and other fields. Almost 40% of all users of the GSECARS microprobe and microtomography program have NSF EAR funding and 95% of experiments in this program are focused on Earth, planetary and environmental science research.

The 13-ID-E microprobe and tomography program has been supported by NSF/EAR/IF as part of the GSECARS co-operative agreement and we are requesting continuation of this support at similar funding levels as part of the new agreement. The 13-ID-E microprobe program is run by two full-time FTE's, Matt Newville (lead) and Tony Lanzirotti, along with Steve Sutton providing partial effort. For the tomography program Mark Rivers is the lead. Additional administrative and technical support are provided for the microprobe and tomography programs by key personnel that are shared among the different programs supported by GSECARS. The request for the new cooperative agreement anticipates similar levels of FTE support for this program.

Both the microprobe and tomography endstations have benefited from a number of technology upgrades over the past five years, so we consider them to be at state-of-the-art. The capital equipment budget request for these programs for the new cooperative agreement are largely geared towards ensuring that these instruments can take maximum advantage of the upcoming APS multi-bend achromat storage ring upgrade and in providing users new sample environments to enable new types of experiments. This includes:

- Improved mechanical stability and thermal management of the 13-ID-E monochromator.
- Design and install permanent, dedicated sample enclosure with controlled atmosphere.
- Develop a dedicated hydrothermal cell for fluorescence XAS work.
- Install a dedicated 200 Tb storage system and enable access to a 100+ node compute machine for machine-learning based analysis data.