☐ **Talk** ☒ **Poster**

Multimodal imaging at LiX for plant and environmental sciences

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In the last few years, the LiX beamline at NSLS-II has developed capabilities for scanning imaging and tomography based on both scattering [1,2] and fluorescence contrasts. This is accomplished using fly-scanning with a typical beam size of 5 microns, and simultaneous data collection on a pair of Pilatus detectors (Dectris) for small- and wide-angle X-ray scattering, as well as two two-channel silicon drift detectors (Rayspec), located on either side of the sample, for X-ray fluorescence. A software pipeline is provided to enable users to extract relevant features from the scattering data as the contrast mechanism for imaging. In addition to characteristic diffraction peaks for well-known materials (e.g. cellulose and starch), these features can also be based on components derived from machine learning algorithms. So far LiX users have published their studies on wood [3,4] and growing plant stems [5]. More active research is on-going to explore the application of scattering imaging to plant seeds, leaves, roots, as well as soil samples. Scanning imaging is time-consuming, limiting the throughput of user experiments and sometimes resulting in obvious radiation damage to the samples. We therefore are implementing a micro-tomography detector to allow for rapid full-filed imaging of the sample based on absorption contrast, to guide subsequent X-ray scattering and fluorescence data collection. We also plan to pursue correlative imaging on the same samples using chemical imaging techniques to help interpret the scattering data to maximize the information content from multi-modal imaging data collected at LiX.

References

[1] L. Yang et al., *J. Synch. Rad.*, **29**(2), 540-548 (2022)
[2] L. Yang, *J. Synch. Rad.*, **31**(4), 936-947 (2004)
[3] N.Z. Plaza et al., *Wood & Fire Safety 2024*, p. 3-10 (2024)
[4] Y. Sang et.al. *Environ. Sci. Tech.*, **59**(23), 11561-11573 (2025)
[4] D. Tadesse et al., *Plant Biotech. J.*, in press (2025)