Scanning Mapping and Tomographic Imaging of Cellulose in Plant Tissues

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Biological tissues are multi-component, heterogeneous structures. The structural components, such as cellulose in plant cell walls, often exhibit periodicity and corresponding scattering signatures that identify the specific component. Therefore scattering data collected in raster scans can be used to quantify the spatial distribution of the abundance and orientation of these structural components. This kind of scanning mapping measurement in effect amounts to an imaging method. However, the data analysis workflow must be tailored based on the expected material composition, in order for the structural maps to reveal meaningful information. Tomographic imaging can also be accomplished by combining raster scanning and sample rotation. At the Life Science X-ray Scattering (LiX) beamline, we have built instrumentation and software to facilitate these experiments. I will describe on-going effort to characterize the cellulose structures in tomographic virtual sections of plants. Since the orientation of cellulose fibers can deviate from the growth direction, which is also the rotation axis in our measurements, the reconstruction algorithm must take into account of the changes in the expected scattering pattern depending on the orientation of the local structure and sample rotation.