X-Ray Scattering Tomography for Visualizing Cellulose in Plants

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Cellulose is the primary structural component in plant cell walls. The basic building blocks of crystalline cellulose fibrils form complex hierarchical structures together with other non- crystalline materials. Scattering-based imaging provides direct visualization of the distribution and organization of cellulose, and is therefore a valuable tool in research ranging from the fundamental studies of plant growth and fungal digestion of biomass to practical applications such as extraction of cellulose for bioenergy production. However, creating thin sections to expose the cell wall architecture may not always be feasible and the cellulose fibril orientation introduces complications in data analysis. Virtual sectioning by tomography circumvents both issues, to produce spatially-resolved, per-pixel intensity data for traditional scattering data analysis. The large amount of data collected in these measurements is amenable to the application of machine learning methods to extract deeper insights. Recent results on various plant samples will be presented. The example in the attached image are cross-sections of rice plants. The scale bar is 1 mm and the pixel size is 5 microns.

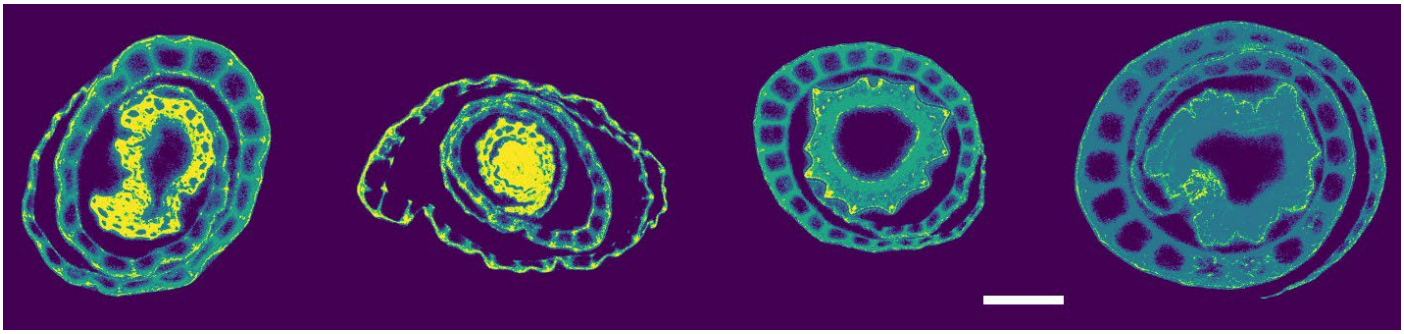

Figure 1