# Three Dimensional Spectral Imaging with Synchrotron FTIR Microtomography

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Development of a three dimensional imaging technique which includes rich spectral information has been a dream of many. 2D infrared spectromicroscopy imaging has become significantly faster in recent years via the use of MCT focal plane array detectors, and even higher quality spectral images are now possible by using a specialized synchrotron infrared beamline, IRENI, developed at the SRC facility. To take spectral imaging into the third dimension, we have exploited this rapid 2D spectral image acquisition capability to enable acquiring a large number of transmission images as a sample is precisely rotated through 180 (or more) degrees. Projections images for each wavelength within this large data set as a function of sample angle corresponds to a complete tomographic data set and can be reconstructed into a full three dimensional version of the sample at that wavelength. And since we collect a full mid-IR spectrum for each data point, we can reconstruct the collected data into a four dimensional reconstruction: 3 dimensions plus FTIR spectra for every voxel. We have therefore created a spectral-micro-tomography technique which provides not only the rich spectral information and chemical fingerprinting of FTIR spectroscopy, but this information in a truly three dimensional spectral view of the sample.

In this talk I will present our first proof of principle experiments, and then we will briefly discuss spectral tomographic reconstructions obtained from a variety of samples from biology, geology, plant sciences, natural minerals, polymers, and how this novel technique may impact other scientific disciplines.