



POSTER #17

## 3D DECONVOLUTION OF CRYO-SCANNING TRANSMISSION ELECTRON TOMOGRAPHY RECONSTRUCTIONS

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Electron cryo-tomography is the premier technique for three dimensional analysis of cell structures. In conventional phase contrast transmission EM (TEM) the sample is required to be thinner than most cells of interest. The scanning transmission mode of imaging (CSTET), on the other hand, offers a multitude of advantages such as longer focal depth, dynamic focusing at high tilts, and relative immunity to haze coming from inelastic scattering processes. The technique has recently been extended to specimens with thickness exceeding 1 micron.

In common with conventional TEM cryo-tomography, CSTET suffers from artifacts inherent to the tilt geometry, in particular, a limited number of projections acquired over a limited range of angles. Three dimensional reconstructions generated from this incomplete data-set produces distinct types of artifacts, such as “ghost” contrast expanding from dense objects into adjacent out-of focal planes.

Qualitatively, at least, these “ghost” artifacts in tomograms resemble out-of-focus haze in wide-field optical fluorescence microscopy. We show that the fluorescence deconvolution approach, with a few modification in input parameters, is equally suitable for STEM-tomogram improvement. A synthetic point spread function adapted to tomography reduces this out-of-plane blur, as well as criss-cross noise coming from distant objects. The contrast improvement is demonstrated using simulated data, a model specimen, and cellular tomograms. CSTET deconvolution offers another step toward whole-cell cryo-tomography at macromolecular resolution.