Random-beam STEM acquisition method for tomographic reconstruction based on compressive sensing

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Abstract
Scanning transmission electron microscopy (STEM) is nowadays becoming a powerful tool for electron tomography in biology. It allows the observation of thick (more than 700 nm) resin embedded samples [1] and is also valuable for cryo-electron tomography [2]. STEM is based on dot acquisition during a scanning process, which is well adapted to perform projection measurements by randomly scanning pixel subsets at every tilt view for tomography. This acquisition procedure, call random-beam STEM (RB-STEM) allows to reduce the electron radiation dosage required for accurate imaging of frozen-hydrated biological nano-structures and it is compatible with compressive sensing approaches [3]. Here we present a tomographic acquisition and reconstruction pipeline based on RB-STEM, fully exploiting compressive sensing principles. This pipeline opens the path for the development of optimized low-dose cryo-STEM tomography adapted for thick biological samples.

1. Trépout *et al.* (2015). Micron 77:9-15.
2. Wolf S. *et al*. (2014) Nature Methods 11, 423
3. Donati *et al.* (2017). Ultramicroscopy 179:47–56.