The implementation of the STEM imaging mode in the SEM for electron tomography

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The operation of the SEM microscope in the scanning-transmission imaging mode (STEM) offers a valid complement for the three-dimensional investigation of microscopic samples to the more complicated “slice-and-view” techniques, which require a dual FIB-SEM instrument. The proposed approach is based on the acquisition of a series of STEM images at different tilt angles, followed by calculation of the mass distribution of the sample using the backprojection algorithm of tomography.
The basic requirement for the implementation of electron tomography in the SEM is the projective feature of the STEM imaging system, which should be preserved over the large tilt range for the sample and is ensured by the use of solid-state silicon-based electron detector specifically developed for the purpose. The reconstruction workflow could take advantage to the recent algorithmic refinements as is the case of compressed sensing, which was used to solve the undetermined problem of structure reconstruction from few projections and was proved capable to overcome the limitations arising from the sampling scheme. As a result of this flexibility, the system finds application in both biological and physical science.