Supplementary Material for: Phase-contrast imaging of multiply-scattering extended objects at atomic resolution by reconstruction of the scattering matrix

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I. SUPPLEMENTARY EXPERIMENTAL DATA

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FIG. 1. Simultaneous HAADF-STEM images taken with the 4D-STEM defocal series data for Fig. 3. -9 nm defocus steps are taken from left to right.



FIG. 2. a) Mean diffraction pattern of a single dataset. b) Histogram of the electron counts in the bright-field disk. c) Vacuum probe used for selection of beams and initial intensity.



FIG. 3. Mean of four single-sideband ptychography reconstructions, aligned with subpixel cross correlation. These reconstructions were used to rigidly align the focal series.



FIG. 4. Nine example diffraction patterns from the experimental 4D camera data. The scale bar is $25 \,\mathrm{mrad}$.