Distributed calibration of probe microscope scanner in nanometer range

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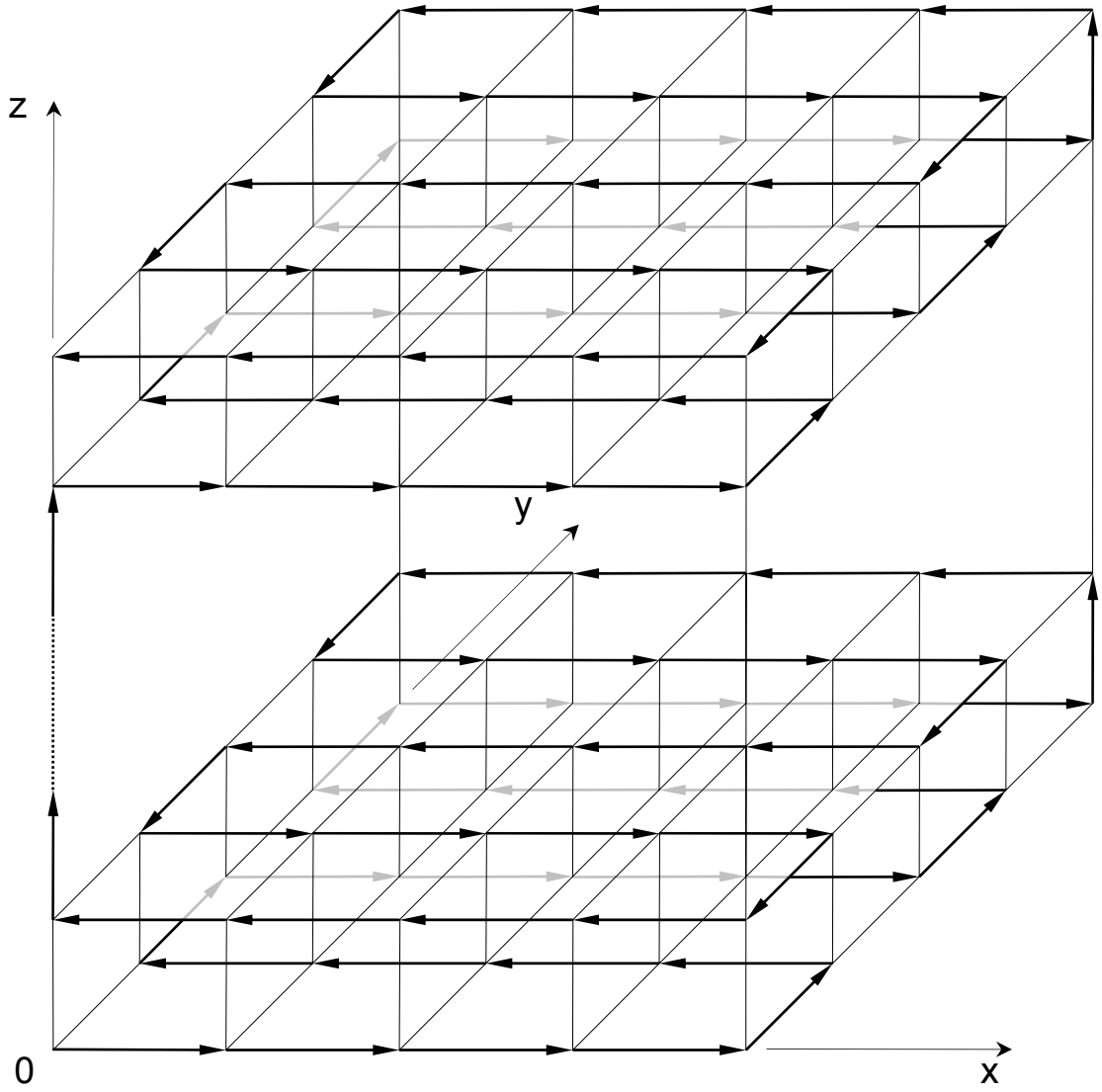
Main features

- Calibration in nanometer and subnanometer ranges
- Each point of scanner movement space is characterized by its own set of calibration coefficients
- Negative influence of thermal drift and creep is excluded during calibration process
- Using of natural standards – crystalline lattice constants as length measures
- Complete automation of measurements

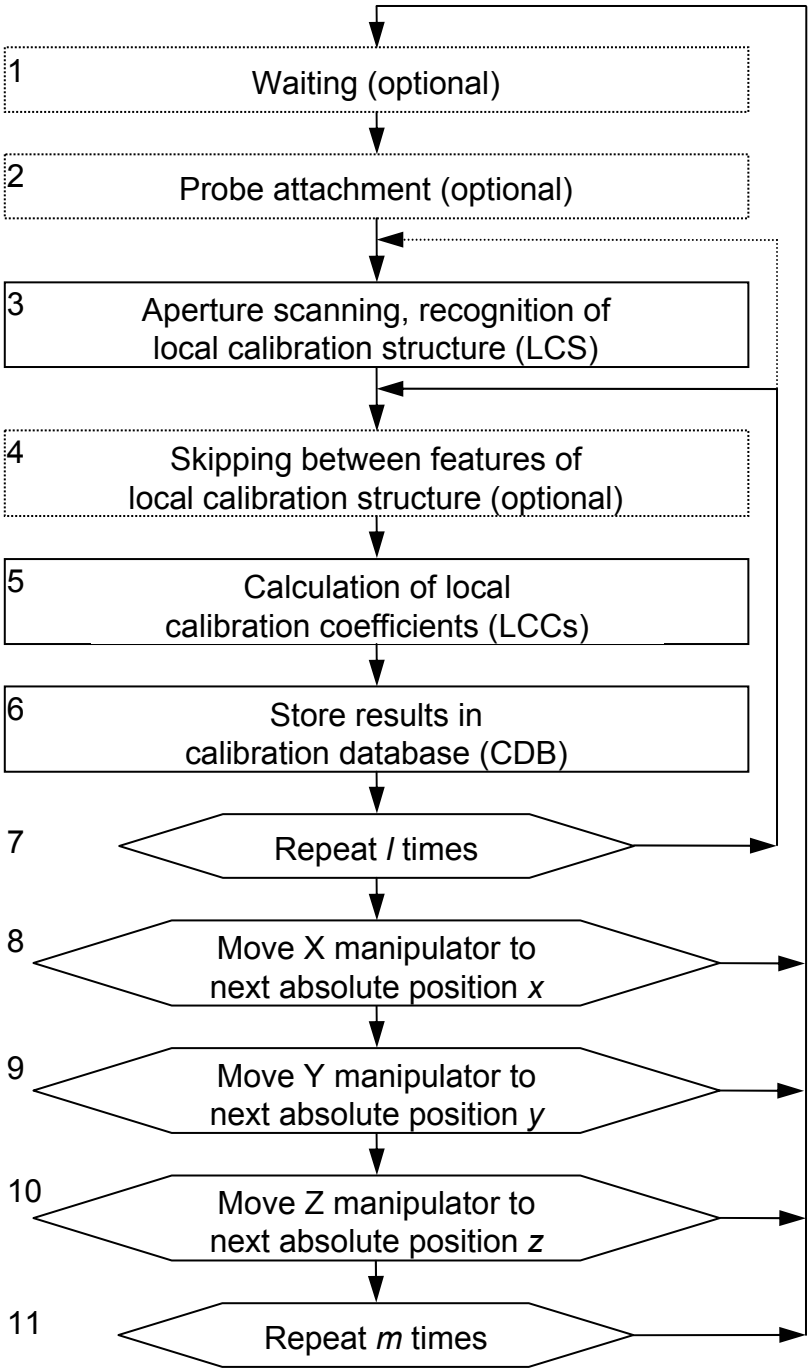
Applied methods

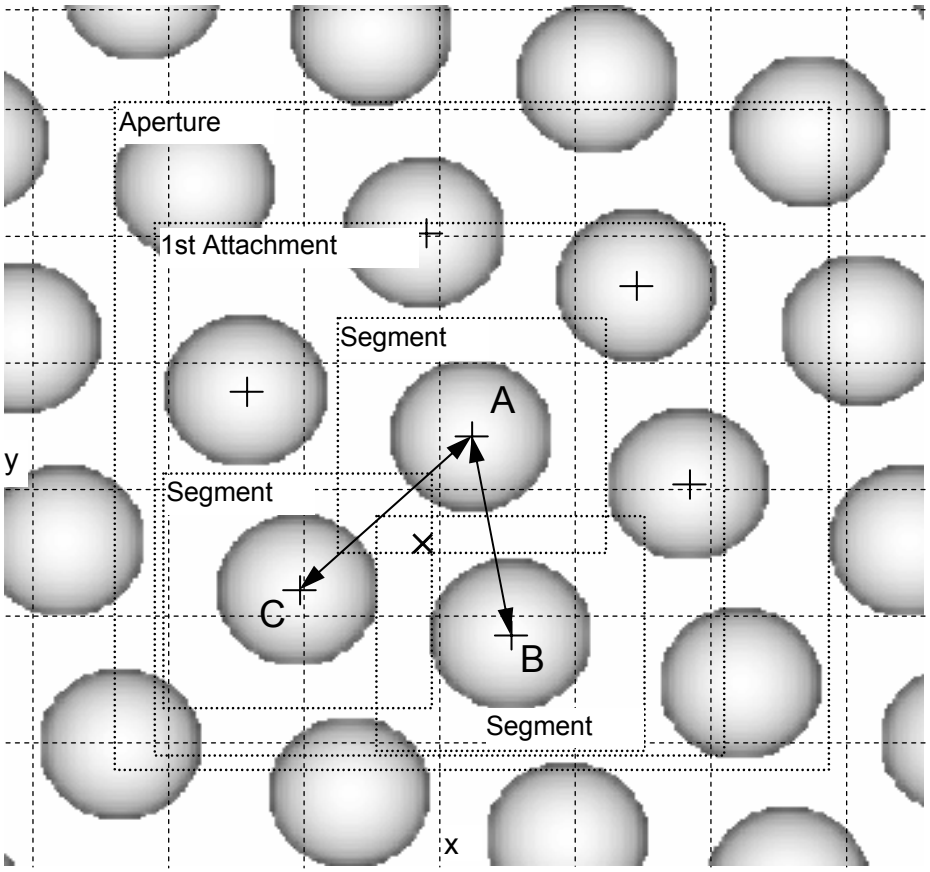
- Feature-oriented scanning (FOS)
- Feature-oriented positioning (FOP)
- Counter-scanned images (CSIs)

Partition of scanner movement space

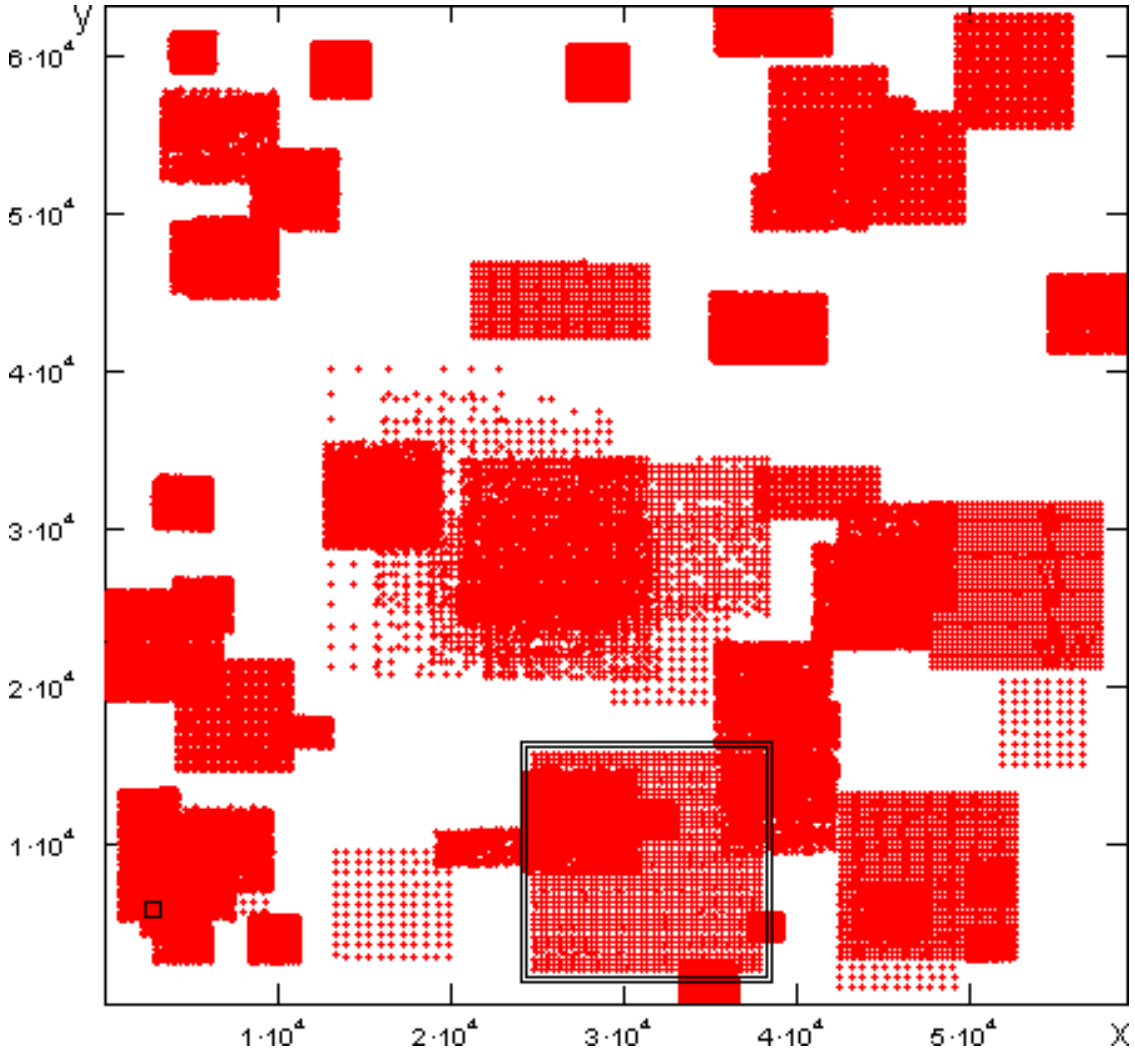


Algorithm flowchart of distributed calibration

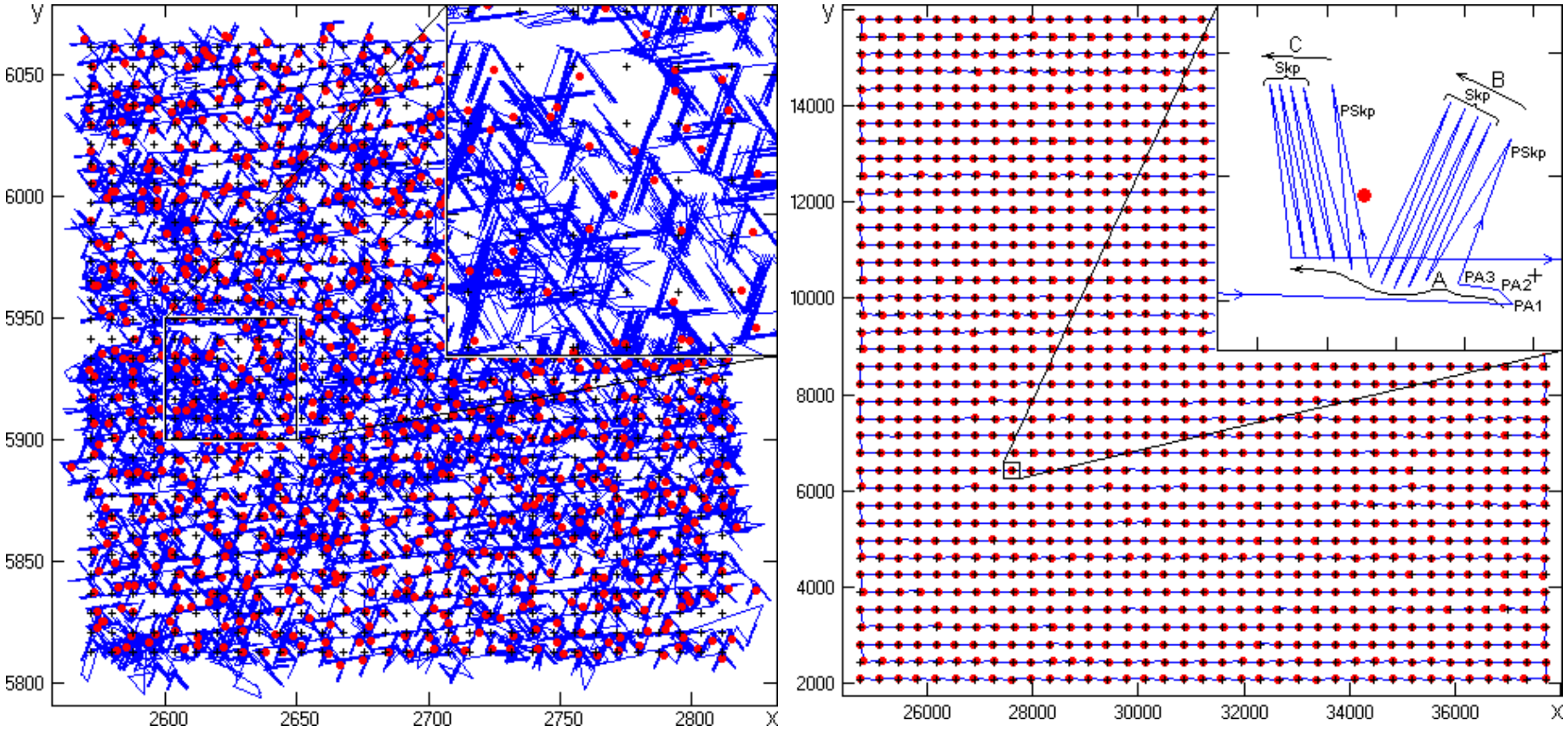




Areas where distributed calibrations were carried out

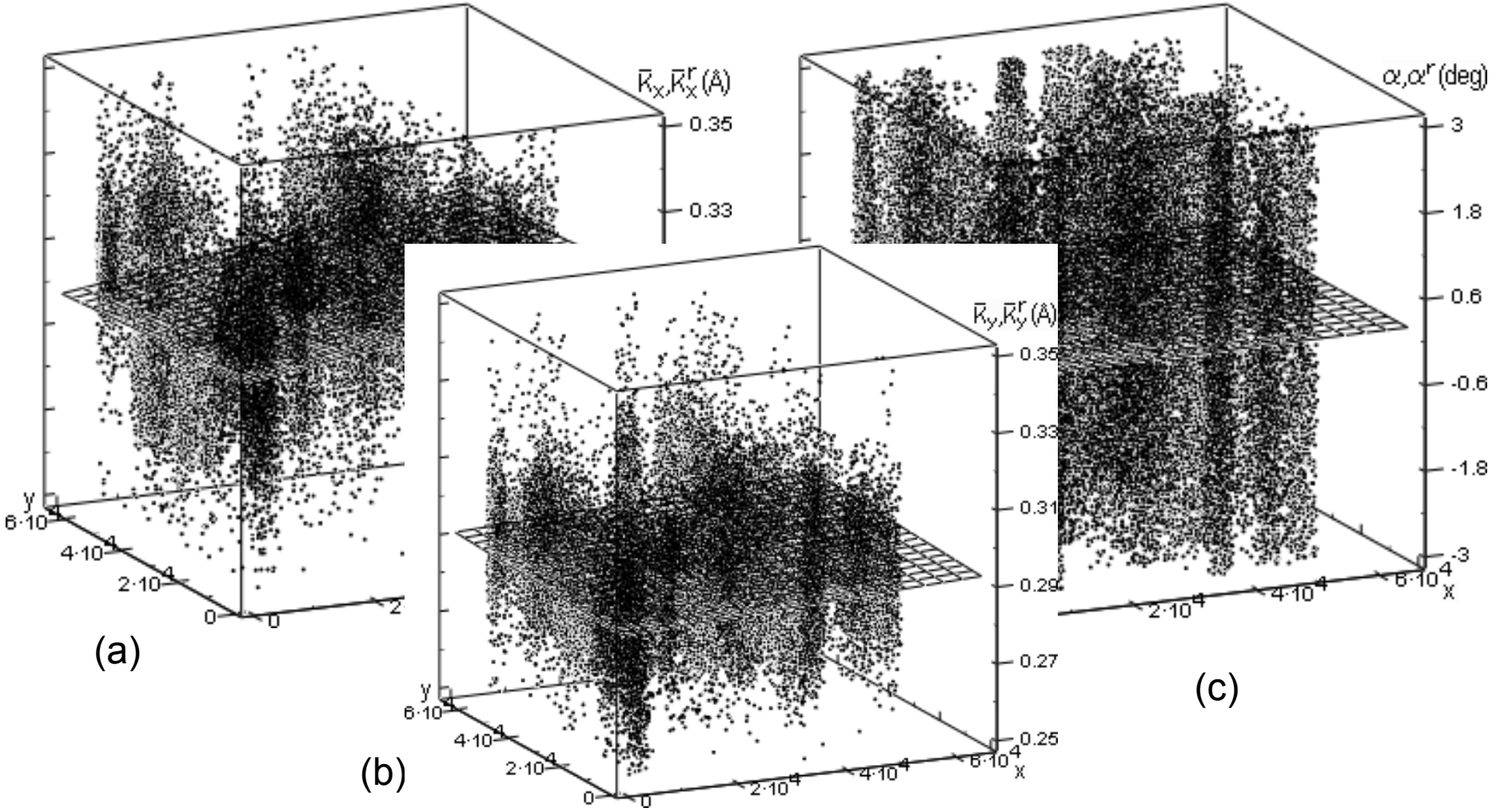


Examples of distributed calibration with (a) small step 8 positions (~2.44 Å), (b) large step 361 positions (~110 Å)

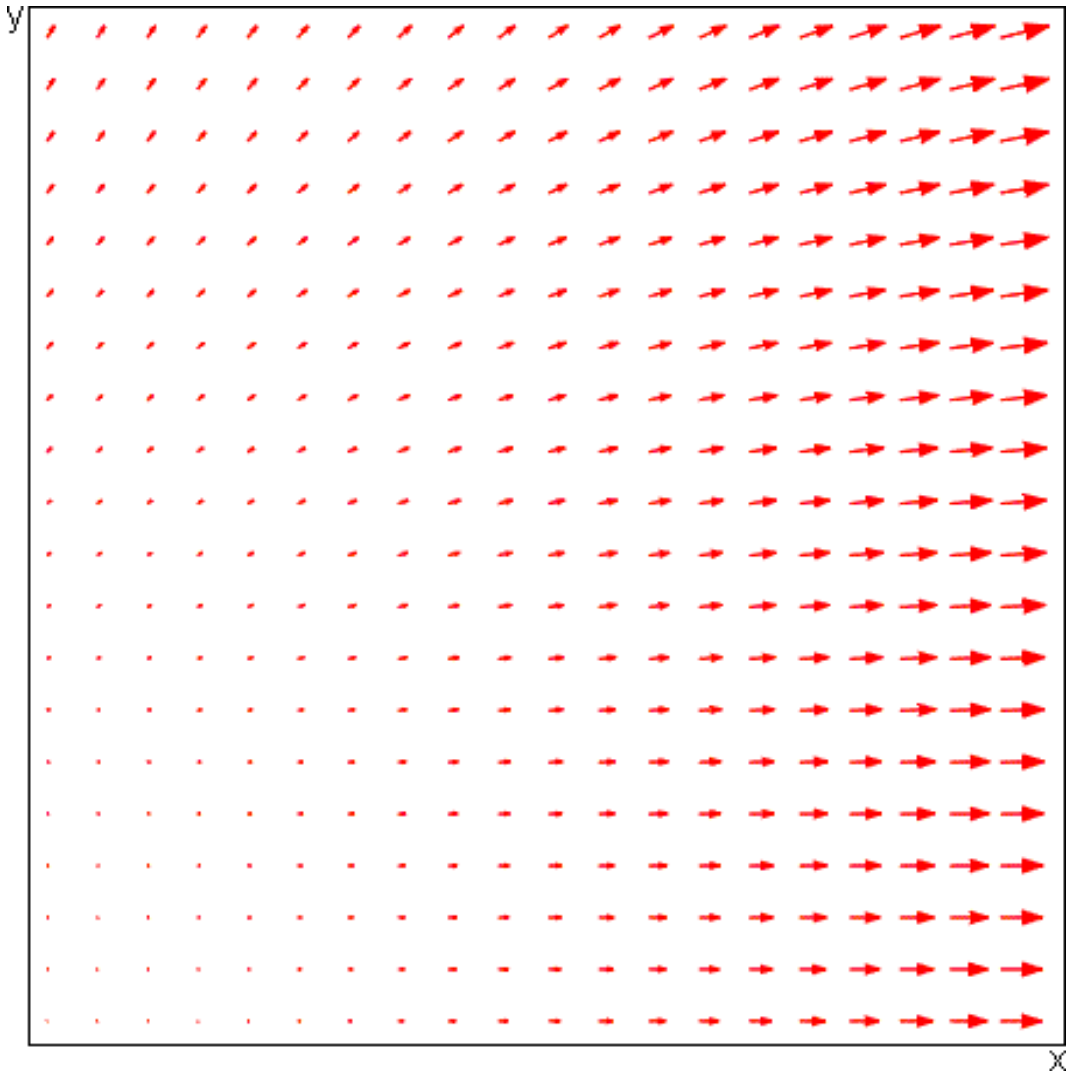


(a) (b)

Searched for regression surfaces drawn through local calibration coefficients (a) K_x, (b) K_y, and (c) local nonorthogonality α



Static distortions of probe microscope piezoscanner in lateral plane



Application fields

- Accurate calibration of probe microscope scanner in nanometer and subnanometer ranges
- Automatic characterization of lattice crystal parameters and surface defects
- Analysis and certification of SPM operation – measurements of thermal drifts, creeps, nonlinearities, and spurious couplings