Software Development with VBA for Carl Zeiss AxioVision 4.x Customized Applications in Quantitative Microstructure Analysis

Demands in state-of-the-art QMA meet AxioVision

New requirements for classic QMA due to ongoing material engineering and increasing standards in quality assurance demand
- Fast and reliable image acquisition
- Increasing scan-areas with upscaling to entire parts
- Increasing magnification up to resolution-limits
- Reliable focus over large areas at high magnification
- Complex detection/measurement in advanced image analysis
- User friendly applications - QMA for non-highly-trained personnel
- High transparency for control of processes
- Easy data management
- Tailored reporting

AxioVision 4 is an extensive software platform able to fulfill these requirements. Its functionality covers control of Carl Zeiss light microscopes and cameras and provides a wide range of image analysis. AV4 can be programmed via VBA to generate customized applications to create automated solutions even for the most sophisticated problems in materials microscopy. Basically designed for light microscopy it also has been possible to create an interface for a LEO Gemini SEM to be operated via an AxioVision 4 VBA project.

Two Carl Zeiss AxioImager (light-) Microscopes for Material Microscopy

LEO Gemini Scanning Electron Microscope at HTW-Aalen

Taking the next step – solutions with AxioVision

Automated image acquisition

Module **Cluster Acquisition** processing of large areas	Module **Multifocus** reliable focus, high magnifications	Module **Intelligent Acquisition** acquisition of large areas, smart mode, batch mode

Image analysis, measurement and visualization

| Module **Image Processing** menu based and automated	Module **Measurement** chord-, fiber length, layer thickness, grain size, NMI, etc.	Module **Visualizing Objects** detection and visualization of objects

Data processing

Module **Data** reports in AxioVision, Excel and Word

Work flow of an application

Interfaces

Module **AxioVision – SEM** connecting AxioVision to a LEO Gemini SEM
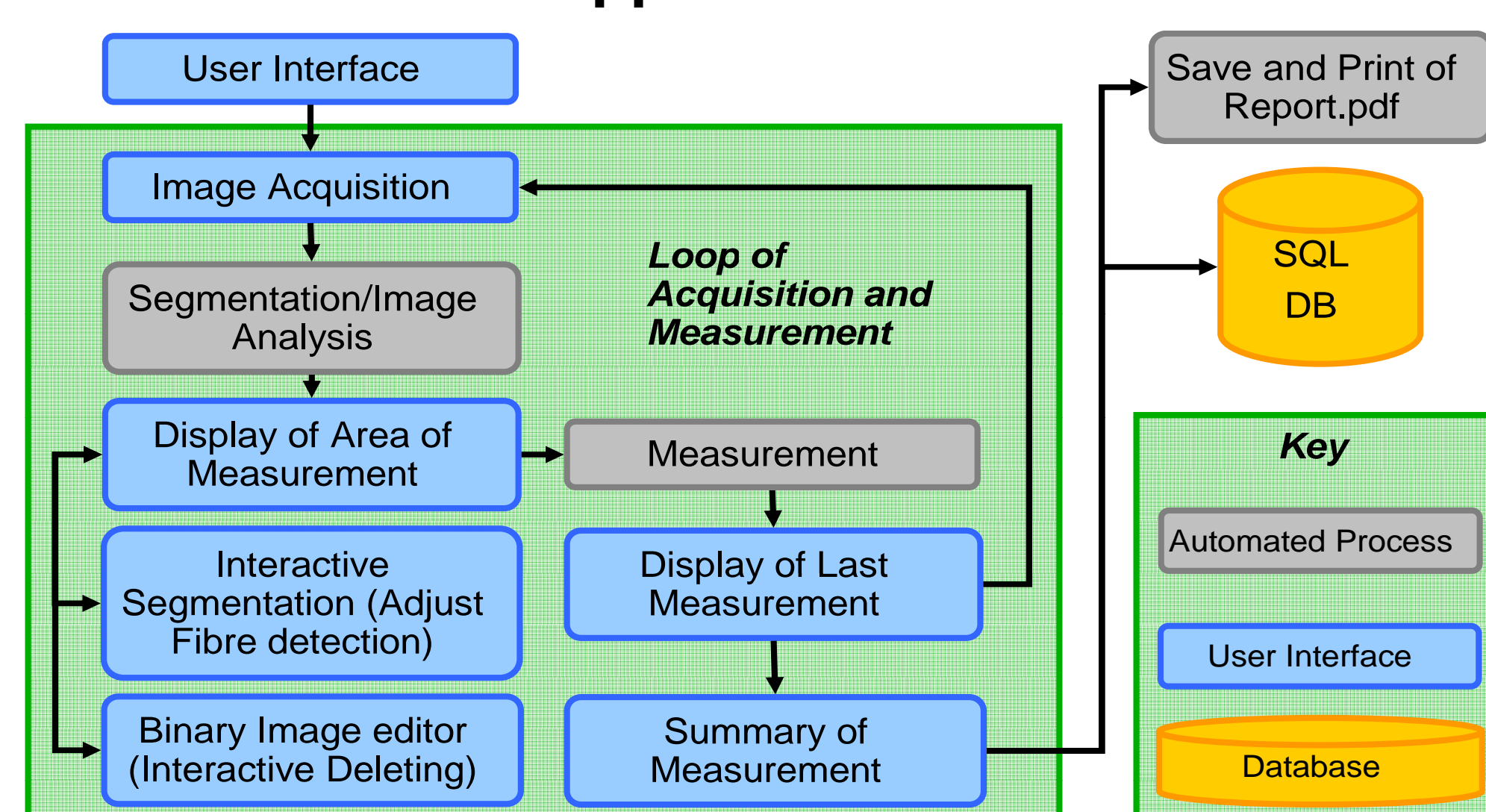
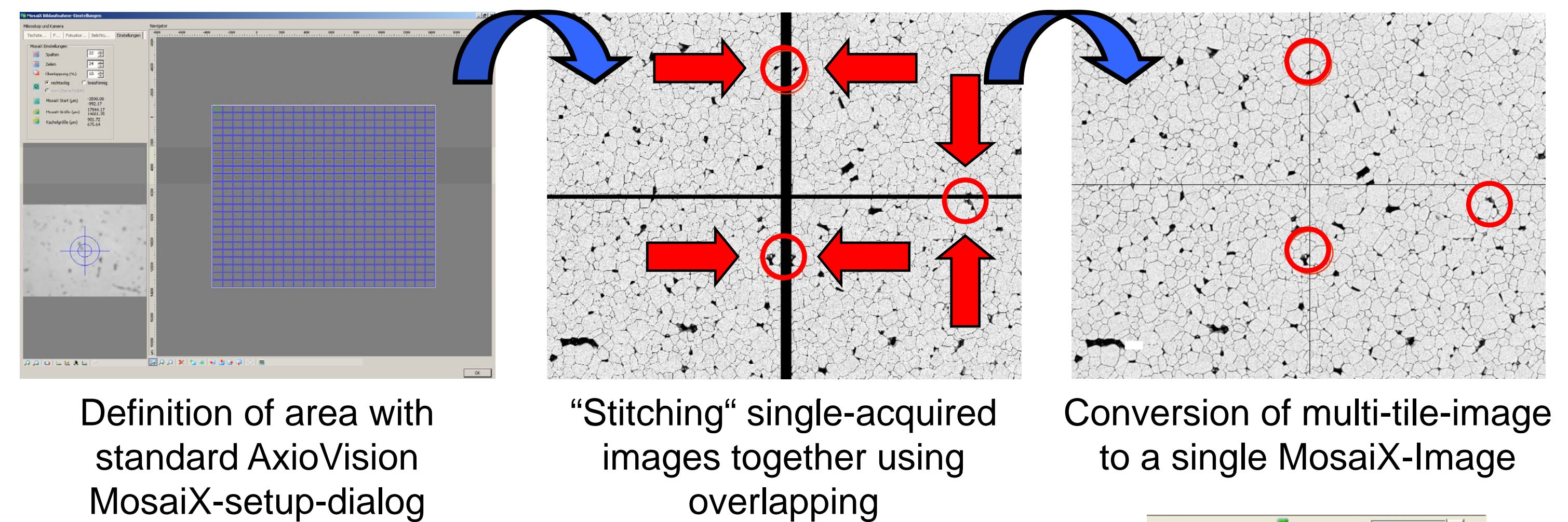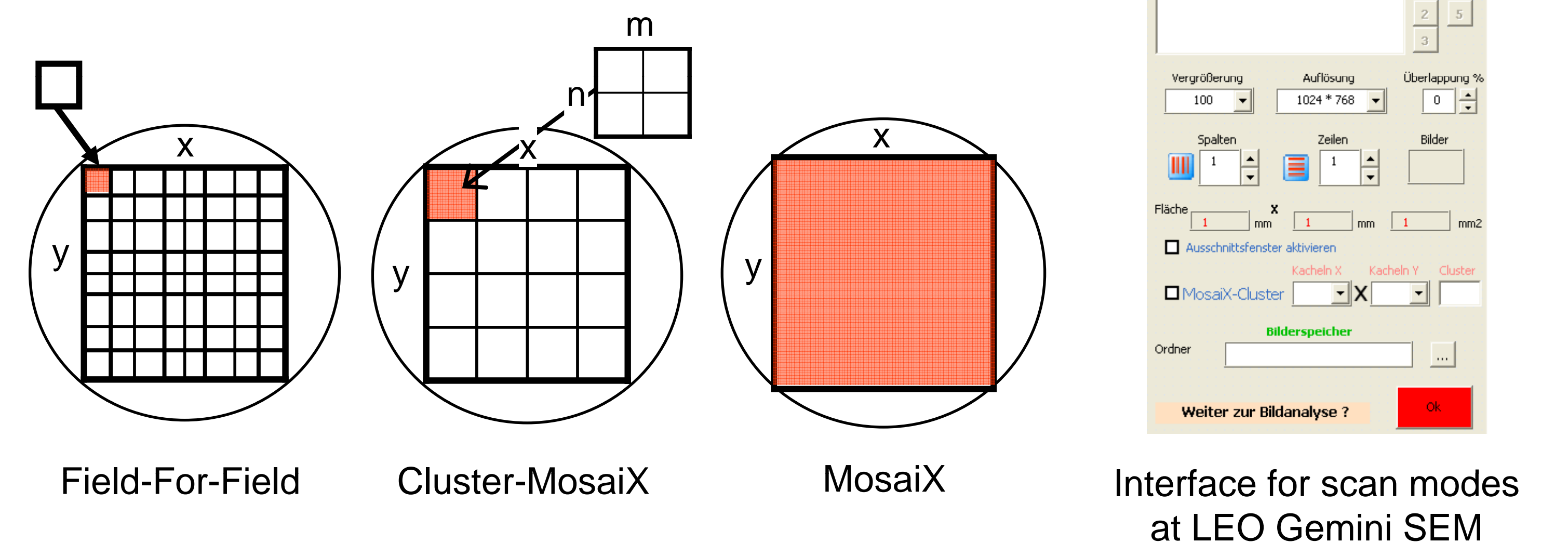**High modularity allows efficient development of customized applications**

Automated image acquisition – Cluster Acquisition

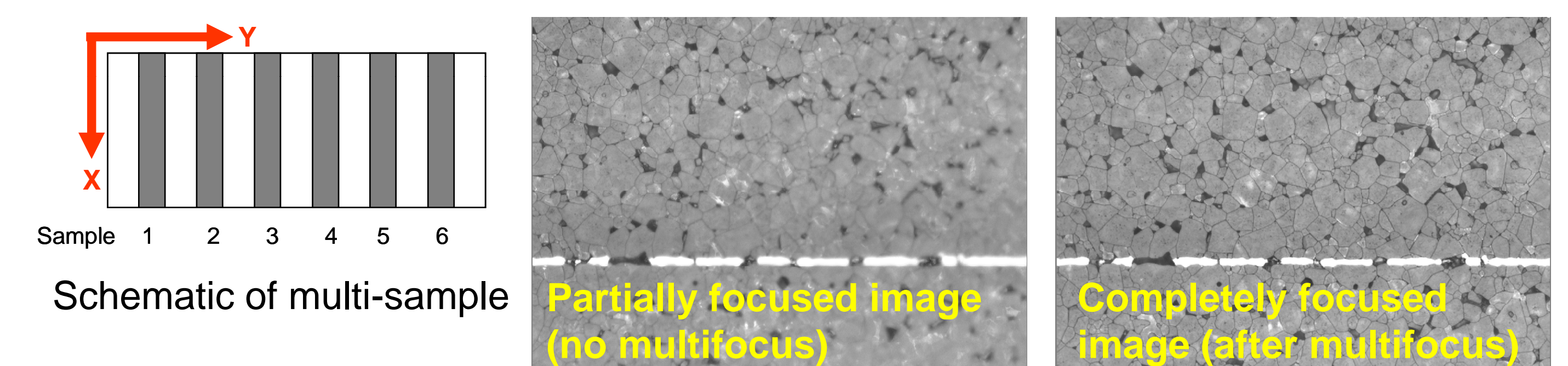**Processing large areas with AxioVision MosaiX-feature**

Definition of area with standard AxioVision MosaiX-setup-dialog

"Stitching" single-acquired images together using overlapping

Conversion of multi-tile-image to a single MosaiX-Image

Different scan modes to suit different applications

Field-For-Field   Cluster-MosaiX   MosaiX   Interface for scan modes at LEO Gemini SEM

Automated image acquisition – Multifocus
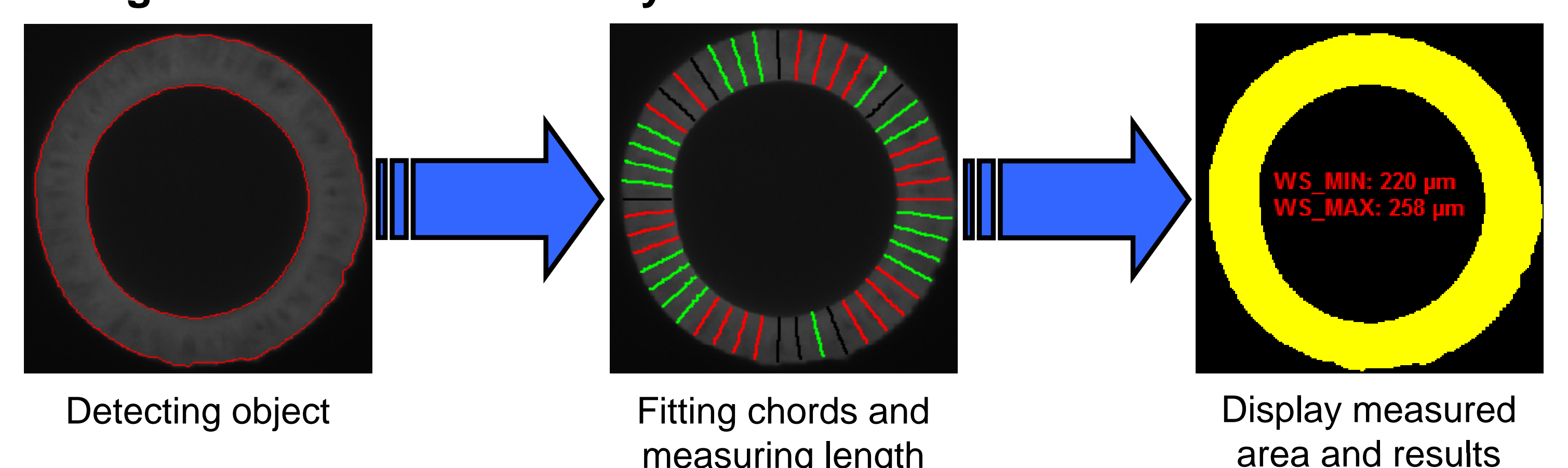
Challenge: multi-sample-scanning (approx. 70000 µm x 35000 µm)
- Topographic unevenness minimum 4 µm
- Deviation in level ca. 200 µm (entire multisample)
- Focus depth at 500x magnification: approx. 0.54 µm
- Topographic unevenness within single measure-field: >> 0.54 µm

Sample 1 2 3 4 5 6
Schematic of multi-sample

Partially focused image (no multifocus)

Completely focused image (after multifocus)

Solution: combination of all focus functions in AV → "Multifocus" + automated image-acquisition of multi-sample → "Batchmode"

Image analysis, measurement and visualization

Using chords to determine layer thickness

Detecting object   Fitting chords and measuring length   Display measured area and results

Examples for detection and visualization

Classification of fibers via different colors   Reconstruction of ceramic grains   Visualization of defects in ceramics