

AI-Driven Automation for Multimodal Imaging and Advanced Investigation

The exponential growth of imaging data in both life sciences and materials science demands scalable, automated, and intelligent approaches to extract meaningful insights. This presentation explores how advanced investigation technologies and AI-powered workflows are transforming our characterization approach - from data acquisition to quantitative analysis - by integrating deep learning, multimodal correlation, and automated processing.

We present a comprehensive framework that combines X-ray microscopy (XRM), electron microscopy (SEM/FIB), and light microscopy (LM) with cutting-edge software tools enabling AI-enhanced image quality improvement, segmentation, tomographic reconstruction, object classification. These workflows are designed to be modular, reproducible, and interoperable across different imaging modalities and resolutions.

Key applications include non-destructive phase identification in complex samples, high-resolution tomographic reconstruction from minimal projections, and multimodal correlation for 3D morpho-chemical analysis. Through AI-guided automation, it becomes possible to accelerate characterization, improve reproducibility, and reduce manual intervention - crucial for domains such as energy materials, electronics, photonics, critical raw materials, and biomedical research.

This talk will demonstrate how AI-driven imaging pipelines are not only boosting scientific productivity but also reshaping the way we approach complex, data-intensive research challenges.