



PhenoScout: foundation AI models for end-to-end tissue analysis of multiplex IF slides



CONCEPT LIFE
SCIENCES

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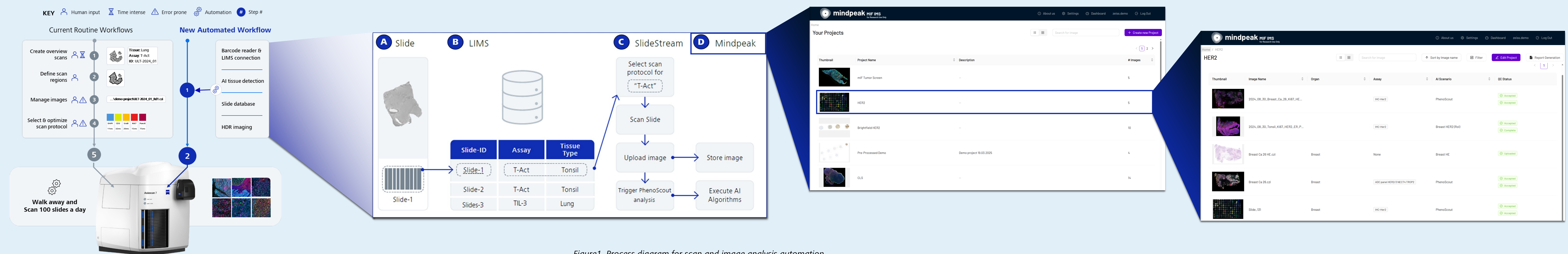
Background

Digital pathology has enabled reliable and robust routine workflows for high-throughput, remote analysis of H&E and IHC stained tissue slides supporting clinical research and diagnostics. However, for complex staining protocols like multiplex immunofluorescence (mIF), no such routines are available as of now. Key challenges include heterogeneous antibody panels and difficulty generalizing algorithms across different chemistries. To address this, we present a novel end-to-end workflow combining ZEISS Axioscan 7 spatial biology, SlideStream scan automation software, and Mindpeak's PhenoScout AI system. At the core is PhenoScout, a library of foundation AI models designed for tissue analytics across wide variety of mIF and Immunohistochemistry (IHC) stainings, requiring no prior image analysis experience.

Methods

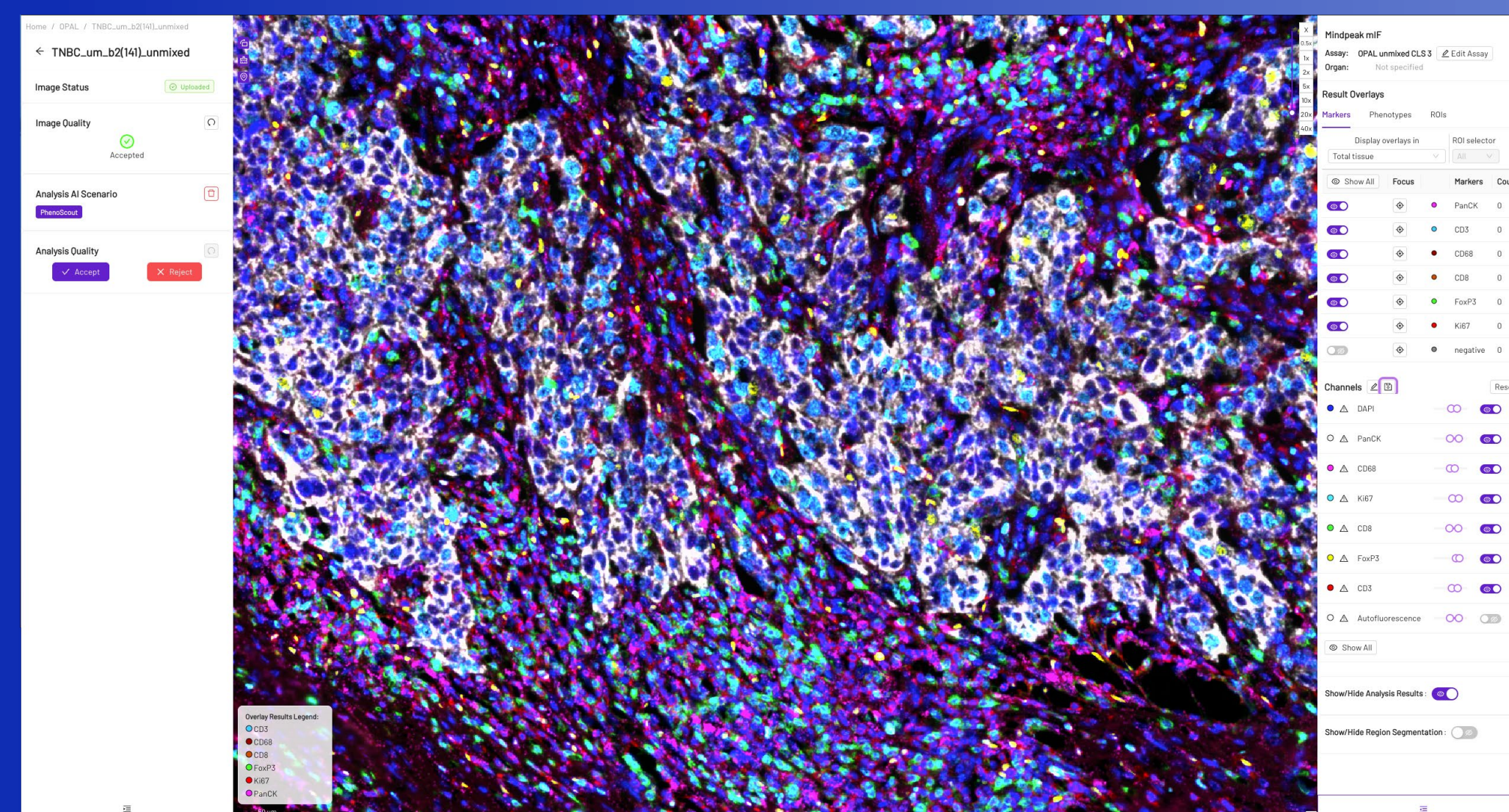
An antibody panel, representative for interrogation of tumor microenvironment phenotypes (FOXP3, CD3, Ki67, CD8, CD68, PanCK) was identified. Protocols for mIF staining of all markers and separate IHC stainings were developed and used to stain a cohort of tumor tissue sections. Slides were digitized using the ZEISS Axioscan 7 spatial biology system with SlideStream workflow automation software (Figure1), ensuring consistent, automated, high resolution image capture. Images were processed through PhenoScout's foundation models, which have NOT been trained on this image set. PhenoScout includes pre-trained AI modules for epithelial region detection using cytokeratin markers, cell center detection using nuclear staining and marker positivity classification for stainings with a nuclear (e.g. FoxP3, ER, PR) or membrane (e.g. CD3, Her2, PD-L1) morphology. The results were reviewed qualitatively for accuracy of positive cell detection and representative examples are displayed below.

Automated scan and analysis process enhancing workflow efficiency and reproducibility



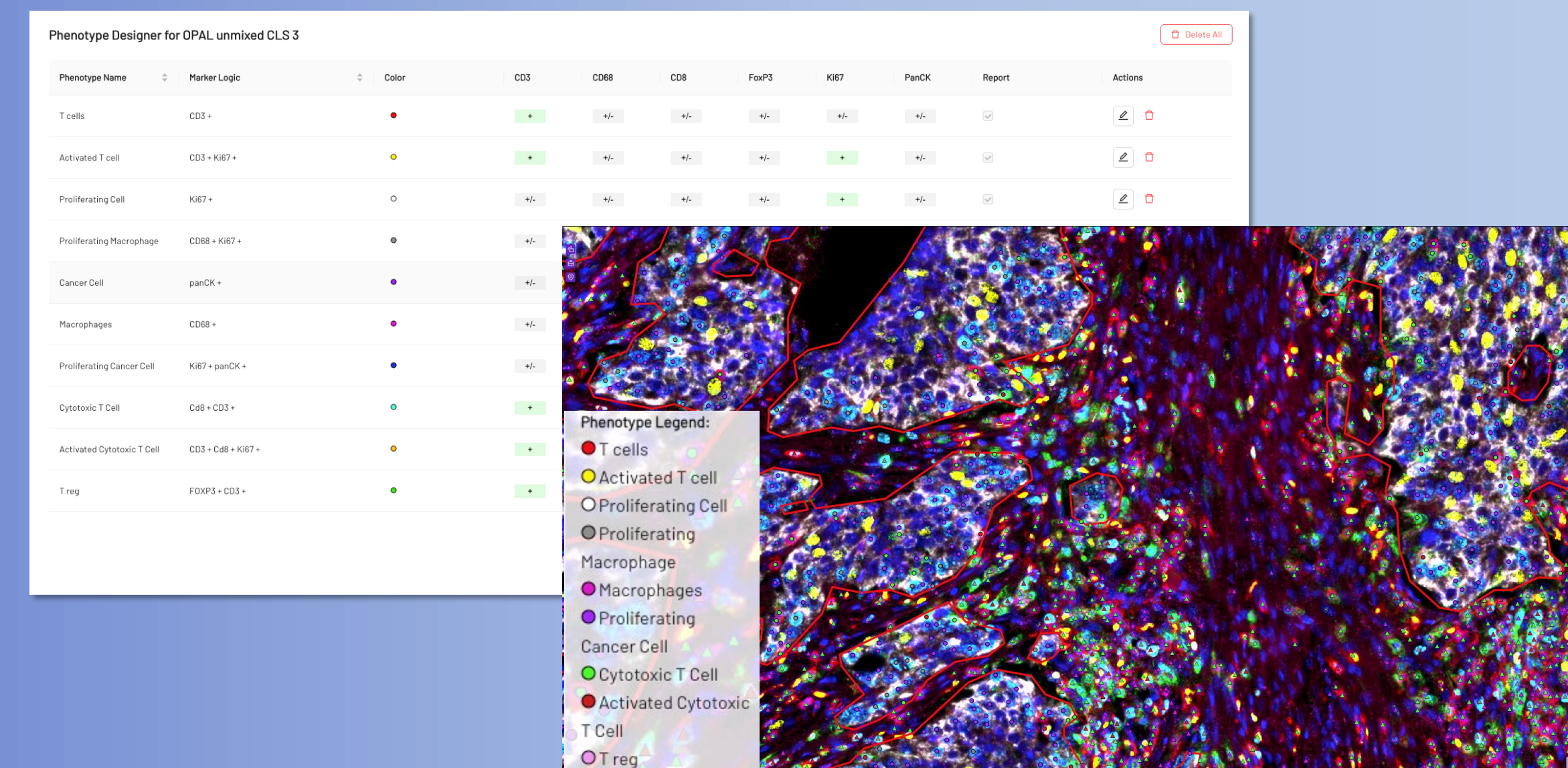
Three-Step Image Analysis Process on Mindpeak mIF platform with correlating example of a representative IO-assay at Concept Life Sciences

1 Image Quality Review



Intuitive and efficient UI to review multichannel images. Only accepted images proceed to automated AI analysis.

2 Analysis Quality Review



Inspect single-marker positive cells, define custom phenotypes and optionally annotate ROIs for subregion reporting.

3 Batch Report Generation

