Vectra® Polaris™ Automated Quantitative Pathology Imaging System

PRODUCT NOTE

Quantitative Pathology Imaging and Analysis

Key Features:

- State of the art multispectral imaging to easily detect and measure multiple overlapping biomarkers within a single tissue section
- High speed digital whole-slide scanning at 10x - 40x in brightfield or fluorescence
- Enclosed system with built in touchless automation allows users to safely visualize, analyze, quantify, and phenotype immune cells *in situ* with maximum reliability to meet your workflow needs
- Trainable feature-recognition inForm software allowing for automatic identification of specific cell and tissue types
- Supports PerkinElmer's Phenoptics™ workflow solution for Cancer Immunology Research

A New Standard in Tissue Imaging

The fully automated Vectra Polaris Quantitative Pathology Imaging System is a new class of tissue imager which provides clinicians, oncologists, immunologists, and pathologists unparalleled speed, performance, and versatility for extracting proteomic and morphometric information from intact FFPE tissue sections or TMAs. Vectra Polaris is the only instrument on the market that goes beyond basic functions, like whole slide, brightfield, and fluorescence imaging. It integrates the power of multispectral imaging in a simplified elegant workflow. Coupled with the proven power of inForm software analysis this multiplexing capability enables identification and quantification of multiple biomarkers and reveals spatial context within a digital workflow to assist researchers with faster, more informative studies.

PerkinElmer has developed Vectra Polaris to be a unique standalone platform, purpose-built to provide all the essential tools needed in advancing the fields of immuno-oncology and digital pathology now and in the future.

PerkinElmer®
For the Better

The First All-in-One Solution for Immuno-Oncology

The Vectra Polaris Automated Quantitative Pathology Imaging System has been designed for clinicians, oncologists, immunologists, and pathologists in immuno-oncology translational research. Vectra Polaris is a cutting edge tool for revealing the cell-to-cell biology driving tumor progression, immune interactions, and response to therapeutic interventions such as with checkpoint inhibitors. It is the only tissue imaging platform that combines multiplexing to capture this biology with a workflow that supports the volume and throughput demands of clinical studies and that can be translated into a practical clinical application once appropriate validations and clearances are obtained.

Example Applications

- Phenotyping immune cells for cancer immunology research
- Transduction signaling pathway activity: (pAKT, pERK, pS6, p13K/mTOR, MAPK, or EGFR)
- Apoptosis and/or proliferation assays
- Necrosis and fibrosis using conventional stains
- Cell cycle characterization
- DNA damage determination
- Inflammation
- Lymph node metastasis
- Autoimmune diseases

Discover New Tissue Biomarkers in Context

For cancer immunology researchers who are seeking to understand the role of immune cells within solid tumors and their microenvironment, the Vectra Polaris analyses, quantifies and phenotypes immune cells *in situ,* in FFPE tissue sections and TMAs. Vectra Polaris utilizes multispectral technology, coupled with multicolor IHC reagents designed for best signal isolation. This allows researchers see up to seven markers in a tissue section (Figure 1); revealing cell types, spatial context, quantification of multiple biomarkers and cell-to-cell interactions (Figure 2). Vectra Polaris seamlessly integrates this data into a digital pathology workflow and can provide whole section context, in BF and FL modes.

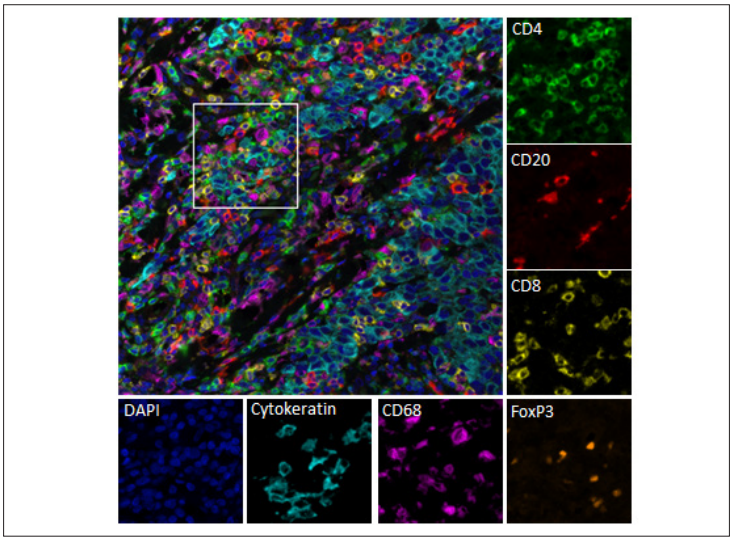


Figure 1. Unmixed multispectral image of human breast cancer tissue stained against CD4 (Green), CD20 (Red), CD8 (Yellow), FoxP3 (Orange), CD68 (Purple), Cytokeratin (Light Blue), and DAPI (Dark Blue).

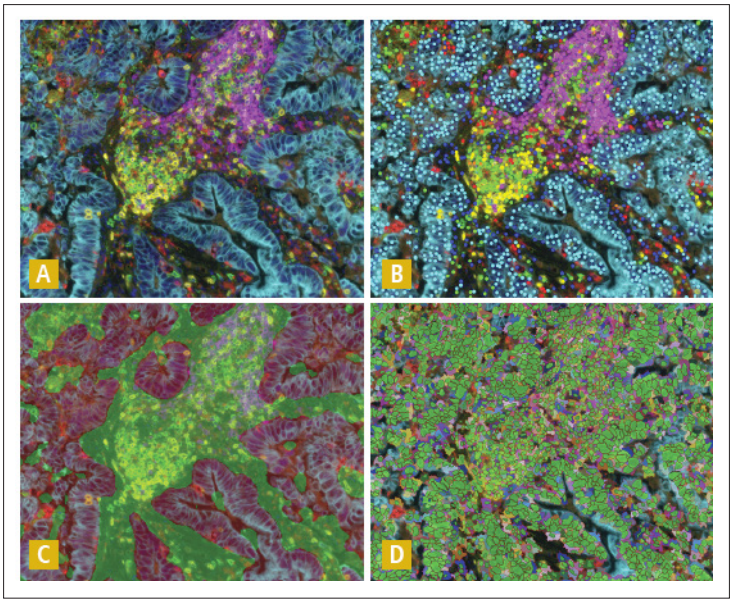


Figure 2. Per-cell analysis in complex tissue architectures 1. Cell Segmentation 2. Cell Phenotyping 3. Tissue Segmentation.

Get Accurate and Reliable Results, Fast

Vectra Polaris utilizes intelligent automation and patented technology for hands-off, error-free scanning, and an optical configuration designed specifically for accurate signal measurements and unparalleled sample protection. Coupled with advanced machine learning based approaches to analyze images, this produces quantitative data that accurately capture the biology of interest.

Integrated, Closed System Design

- No user adjustments, minimizing user error
- Isolated optics minimize environmental interferences

Patent-Pending Technology for Reliable Focusing

- Height sensing optics allow for consistent and reliable image focusing, regardless of slide or sample condition
- Perfect registration from one FL band to another

Unparalleled Slide Protection Technology

- Ultra-bright pulsed LED excitation minimizes photobleaching
- Utilization of touchless automation and unique 4-slide carriers ensures the security and stability of every sample (Figure 3)

Meet the Demands of Today's High Throughput Clinical Studies

Vectra Polaris uses the most advanced optics, mechanical design, and imaging sensors to deliver high performance whole-slide scanning (Figure 4), combined with focused multispectral analysis. It can be programmed to suit your unique study requirements. Choose from a flexible array of scanning options, including whole slide imaging and pattern-recognition guided multispectral (MSI) region selection and acquisition. The human interface designed for the demands and dynamics of translational labs, with a workflow that efficiently integrates pathologist oversight (Figure 5).

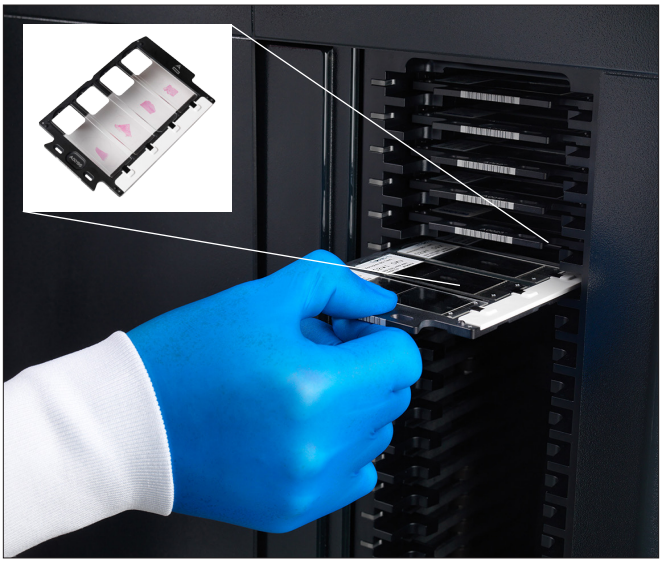


Figure 3. Vectra Polaris slide carrier and slide hotel.

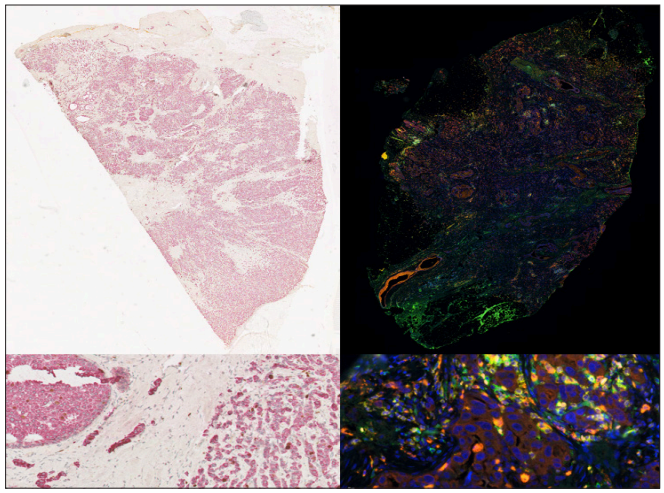


Figure 4. Whole slide scans of breast cancer tissue in BF (left) and FL (right). For BF, tissue was stained against cytokeratin (Fast Red) and Ki67 (DAB) with hematoxylin counterstain. For FL, tissue was stained with the Opal 7-color fIHC kit. Lower panels show zoomed in views of the whole slide scans. Typical whole slide imaging speeds @ 20X: FL, eight slides/hr (4 colors); BF, 15 slides/hr.

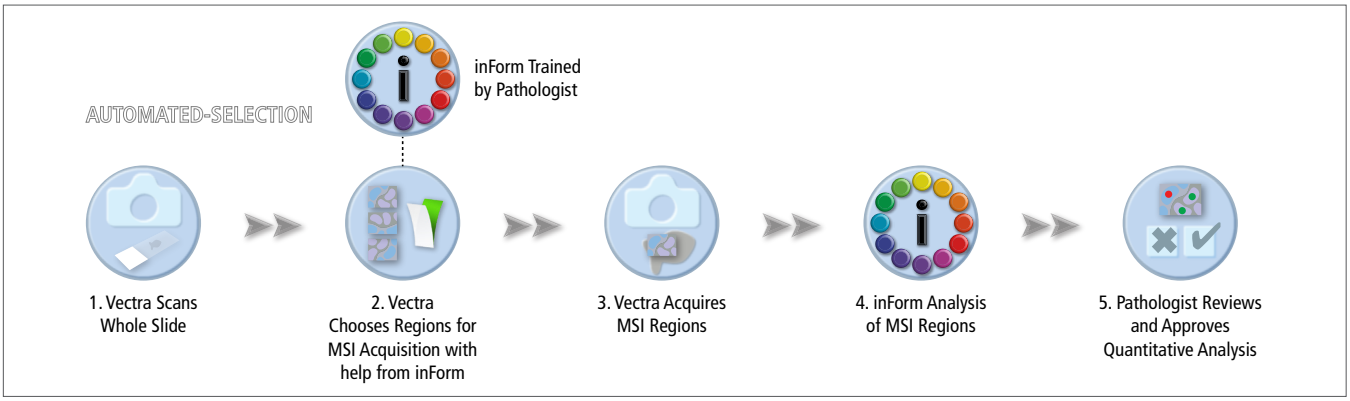


Figure 5. Vectra Polaris features an intuitive yet flexible workflow that allows the pathologist to view a whole-slide contextual scan and select regions of interest for multispectral acquisition: shown here in the Pathologist-Selection workflow (top). Another option is to enable selection and acquisition of multispectral regions by Vectra Polaris with help from inForm: shown here in the Automated-Selection workflow (bottom). inForm can be trained by the pathologist to recognize regions of interest and the algorithm stored for Vectra Polaris' use in selecting regions that meet the desired criteria. In all scenarios, the pathologist can review and ultimately approve the results of the quantitative analysis. The benefit to automated selection is consistency and much greater throughput while retaining the option for review at each step by the pathologist.

inForm Quantifies Biomarkers in Tissue Sections

Vectra Polaris utilizes inForm software analysis to combine the power of multiplexed biomarker imaging and quantitative analysis all within a familiar digital workflow to accelerate immuno-oncology research.

inForm allows users to accurately and reliably separate multiple biomarker signals from one another and from autofluorescence in multiplexed assays (seven colors). Extract per-cell multiparameter data from one or more cell compartments in order to generate tissue-based analysis that retains the architectural context of the intact tissue.

inForm Tissue Finder automates the detection and segmentation of specific tissue types using patented user-trainable algorithms that can recognize morphological patterns. It includes per-cell phenotyping functionality to differentiate marked cell types (e.g. T-cells, macrophages) within a segmented area (e.g. tumor versus stroma) (Figure 6).

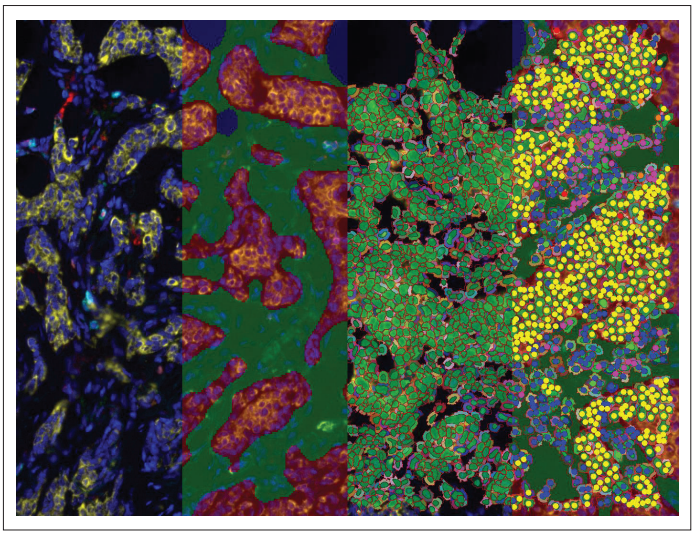


Figure 6. Breast cancer tissue labeled with the Opal 7-Color Multiplexed IHC Kit. Left to right: spectrally unmixed composite image with nuclei (Spectral DAPI, blue), PDL1 (Opal 520, green), PD1 (Opal 540, cyan), CD8 (Opal 570, magenta), FoxP3 (Opal 620, orange), CD68 (Opal 650, red), and cytokeratin (Opal 690, yellow); tissue-segmented image with tumor (red) and stroma (green); cell-segmented image (green); and overlaid phenotyping of each cell with CD68+ (red), CD8+/FoxP3- (magenta), CD8+/FoxP3+ (green), FoxP3+/CD8- (orange), CK+ tumor cells (yellow), and other cells (blue).

Features of inForm Tissue Finder Software:

- User-trained feature recognition algorithms enable automatic identification of specific tissue types based on tissue morphology
- Quantitative per-cell analysis of biomarker expression in tissue sections and TMAs
- Per-cell phenotyping to differentiate cell types
- Pathology Views™ renders immunofluorescence (IF) images as simulated H&E or DAB and hematoxylin, to provide views more familiar to you
- Separates weakly expressing and overlapping markers
- Enables cellular analysis of H&E, IHC, and IF in FFPE tissue sections
- Automatically classifies cell phenotypes using machine learning algorithms
- Push acquired images from Vectra to inForm in order to develop algorithms for automation

inForm Cell Analysis is designed to meet the workflow and throughput needs of research pathology, oncology, immunology, enabling researchers to make faster discoveries. inForm can be tailored to your individual projects using the Configure Project tool. Users select from multiple options depending on the data output being sought (Figure 7).

PerkinElmer digital slide data (.qptiff) can be exported seamlessly into a variety of whole slide analysis software including: Indica HALO, Visiopharm and Definiens. This flexibility enables users to select analysis modules from an extensive list based on their analysis needs and add additional modules as required in the future.

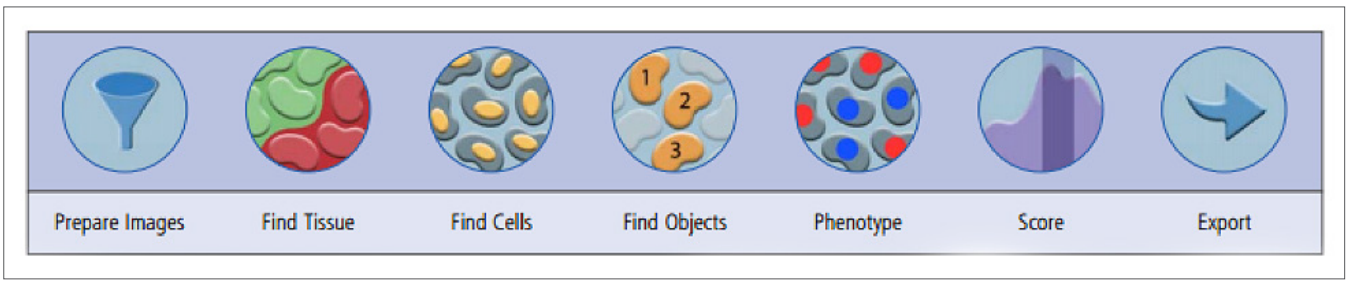


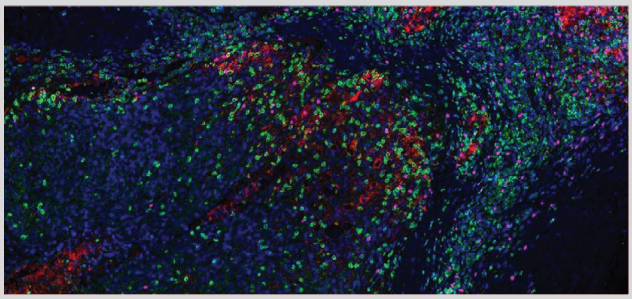
Figure 7. Some of the options available using the Configure Project tool within inForm.

PerkinElmer's Solutions for Quantitative Pathology Imaging and Analysis

The Vectra Polaris Automated Quantitative Pathology Imaging System is a part of PerkinElmer's Phenoptics™ Research Solution for Cancer Immunology and Immunotherapy. Our complete end-to-end solution includes multiplexed staining reagents and methodologies, instrumentation with industry leading MSI technology and whole slide scanning capabilities (BF and FL), advanced image analysis software that can be trained to phenotype cells within the tumor microenvironment, as well as contract research services to support high throughput research studies.

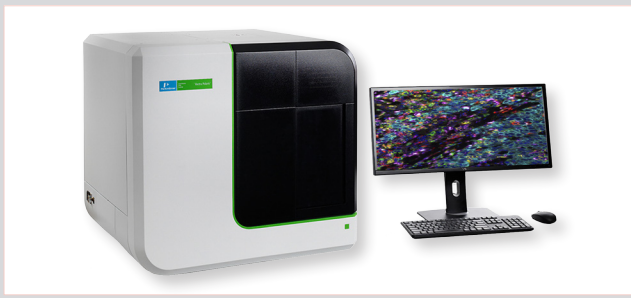
PerkinElmer has developed the Phenoptics workflow solution to meet the needs of both today and tomorrow that are essential in advancing the field of immuno-oncology; all in a unique standalone portfolio.

PerkinElmer's Phenoptics Solutions for Quantitative Pathology Imaging and Analysis



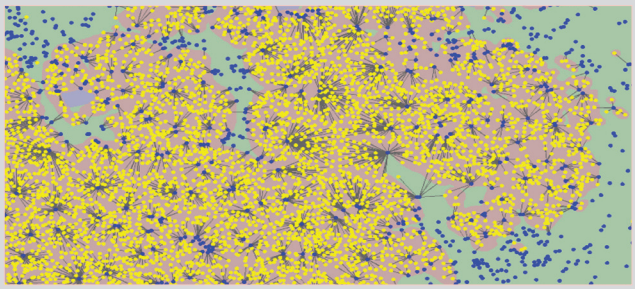
Stain

The Opal™ method is a practical approach for specific staining of multiple tissue biomarkers up to 6-plex and beyond in a single tissue section.



Image

The Vectra Polaris Quantitative Pathology Imaging System as well as the Mantra Workstation enable simultaneous quantitative measurement of multiple biomarkers within a single FFPE tissue section.



Analyze

Analysis, quantification, visualization and phenotyping of cells *in situ* enabled by inForm Cell Analysis and Tissue Finder software.

Research Services

Don't have the time or resources to do the work yourself? Our in-house experts can perform multiplexed staining, imaging and analysis to move your research to the next stage.

Vectra Polaris Specifications

Table 1. Vectra Specifications.

Tissue Formats	Tissue microarrays (TMAs) and tissue sections
Multispectral Range	440 – 720 nm (tunable)
Modality	Brightfield and Fluorescence (multispectral or color)
Florescence Whole Side Scanning Speed (1.5 cm x 1.5 cm sample at 20X)	8 slides/hour (4-5 colors)
Brightfield Whole Slide Scanning Speed (1.5 cm x 1.5 cm sample at 20X)	15 slide/hour
Automation	Touchless automation with walk-away image acquisition
Slide Capacity	80 slide capacity with continuous loading technology
Multiplexing Capability	Separates up to 7 colors, even if overlapping
Image Analysis Software (inForm)	Intuitive learn-by-example interface to automatically segment and quantitate tissue structures, cells and sub-cellular signatures
Resolution	10X (1.0 um/pixel), 20X (0.5 um/pixel) and 40X (0.25um/pixel)
File Format	PerkinElmer Whole slide scan image (qptiff), PerkinElmer multispectral images (.im3), monochrome or color images (JPEG, single-layer TIFF, BMP, PNG)
Operating System	Microsoft® Windows® 10 Pro

Note: Product specifications subject to change. Refer to the PerkinElmer's website for current information.

Vectra Polaris

CLS143455

(includes instrument, training, one year warranty)

- Automated microscope system with an integrated multispectral imaging camera system
  - Custom designed optics with a 10-position epi-filter wheel
  - Patented active slide surface sensing technology for improved FL focus
  - PL-APO objectives
  - 0.20 NA objective - provides 10x image resolution
  - 0.45 NA objective - provides 20x image resolution
  - 0.75 NA objective - provides 40x image resolution
  - XYZ motorized stage
- Five filter cubes (FITC, Cy3, DAPI, Texas Red, Cy5) with five available expansion positions
- Blue and yellow fluorescence reference slide with built-in bead calibration
- Photobleaching protection
- Vectra software for controlling the microscope and acquiring multispectral images of FFPE tissue sections and TMAs
- Phenochart viewer
  - View BF and FL whole slide imagery
  - Select fields for multispectral acquisition, review and approve/reject fields prior to acquisition
  - TMAs
- inForm Tissue Finder license with two seats

Includes Functionality For:

- Processing spectral cubes or conventional color images
- Phenotyping of individual cell types, with easy training and validation
- Spectral library development with measured or synthetic spectra
- Exporting per-region and per-cell data for individual stain components
- Batch processing of images
- Pathology views (simulated IHC) of multiplexed fluorescent samples

- 24'' monitor, keyboard and mouse
- Computer (Microsoft® Windows® 10 Pro),

For research use only. Not for use in diagnostic procedures.

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