

# Leica

## BIO SYSTEMS

Advancing Cancer Diagnostics  
Improving Lives

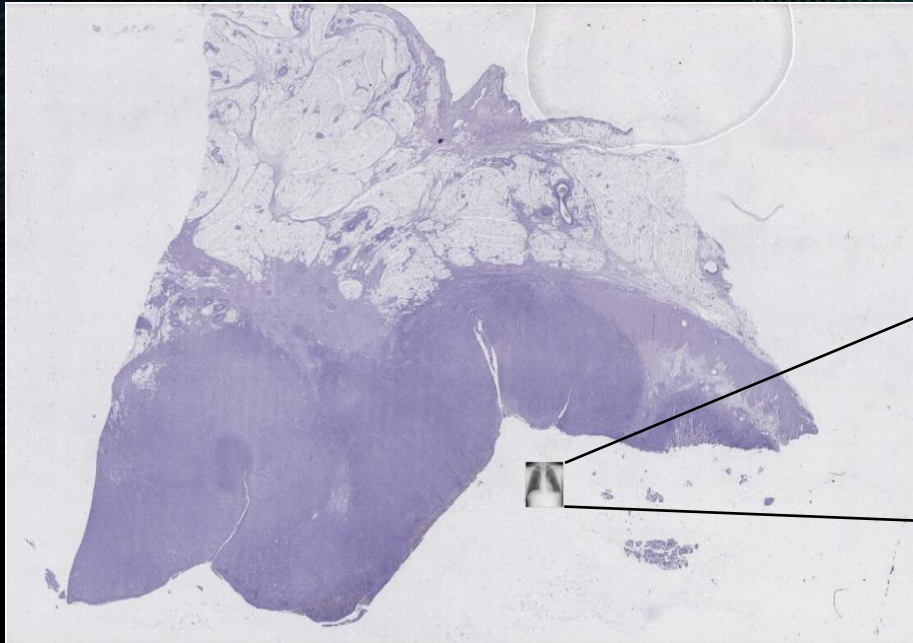
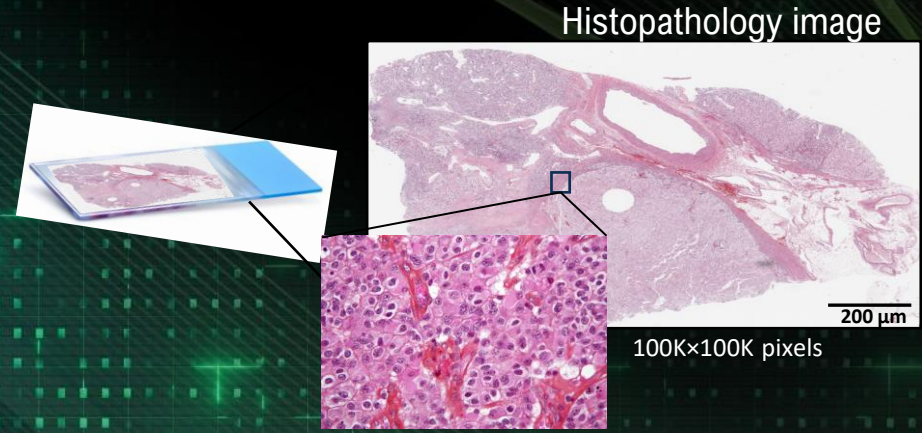
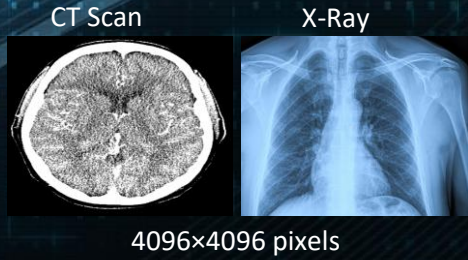


### STORAGE OPTIMIZATION IN DIGITAL PATHOLOGY



For Research Use Only. Not for use in diagnostic procedures.. Confidential -  
Company Proprietary

# SIZE OF DIGITAL PATHOLOGY IMAGES



Humongous size images  
Giga-pixel images

# FACTORS THAT INFLUENCE STORAGE REQUIREMENTS

- Scan area: Linear with area;
- Magnification/Resolution: Quadruples with magnification;
- Z-layers/Fluo channel: Linear with the amount of layers;
- File format / Compression: Type and amount of compression;
- Storage time / Policy: How long do I need to store the images?

# SCAN AREAS

## Selective Scanning

- ✓ Scan only areas of interest
- ✓ Autodetect tissue accuracy

## Tissue Finder Need to Exclude\*:

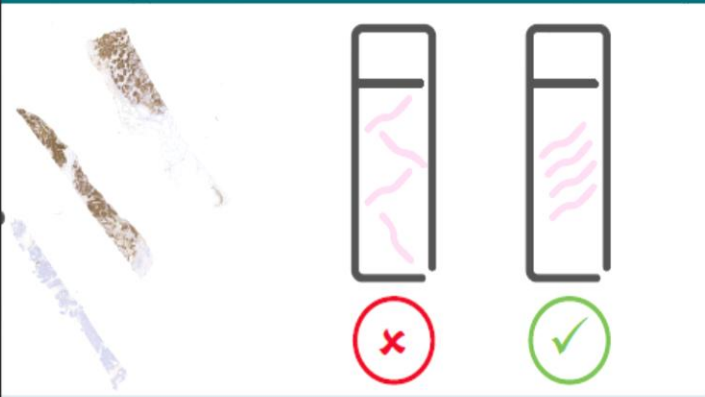
- ✓ Dust on coverslip
- ✓ Fingerprints on coverslip
- ✓ Stain residue on coverslip
- ✓ Ink on coverslip
- ✓ Scratches on coverslip



\* VP-0450 study protocol

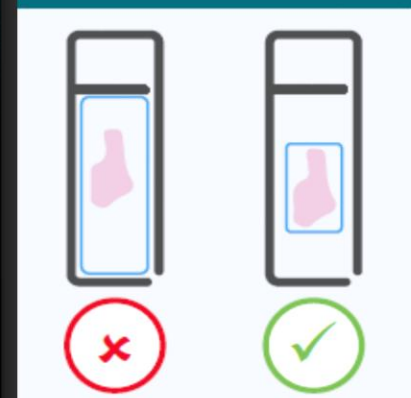
# SCAN AREA

## Align samples



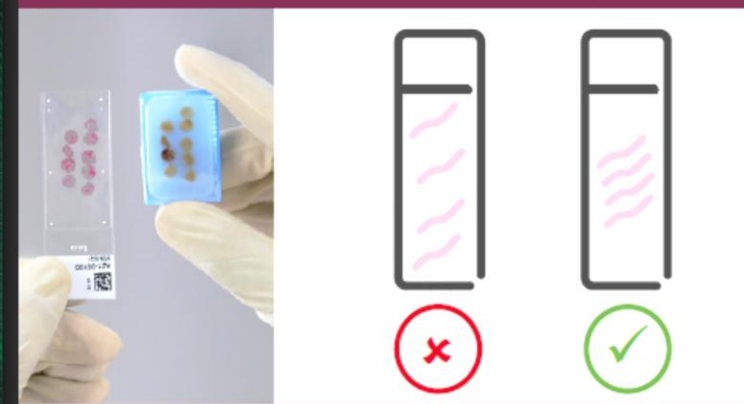
Place multiple samples in the same orientation where possible as this will enable optimal positioning at microtomy to match the tissue detection and focusing methodology of the scanner.

## Smallest area, 1 focal plane



Minimize scan time and storage requirements

## Cluster samples



The samples should be placed close together without overlap in the center of the cassette. This will ultimately enable a smaller scan region for the final slide and ensure all parts of the sample are within the scan region on the slide.

# MAGNIFICATION

Magnification is the ability of a microscope to produce an image of an object at a scale larger than its actual size.

Rigorous international standards have been documented. Many of these standards also apply to digital microscopy.

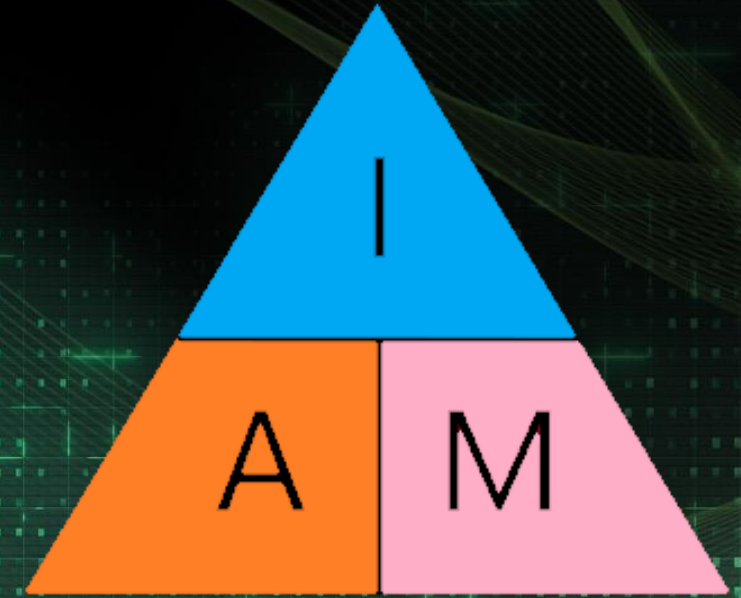
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## Size quadruples with magnification

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“Cases should be scanned at a magnification appropriate for the task being performed (e.g. immunohistochemistry may be assessed at 20x, but detailed cytological examinations may require 40x)”

“The Royal College of Pathologists”

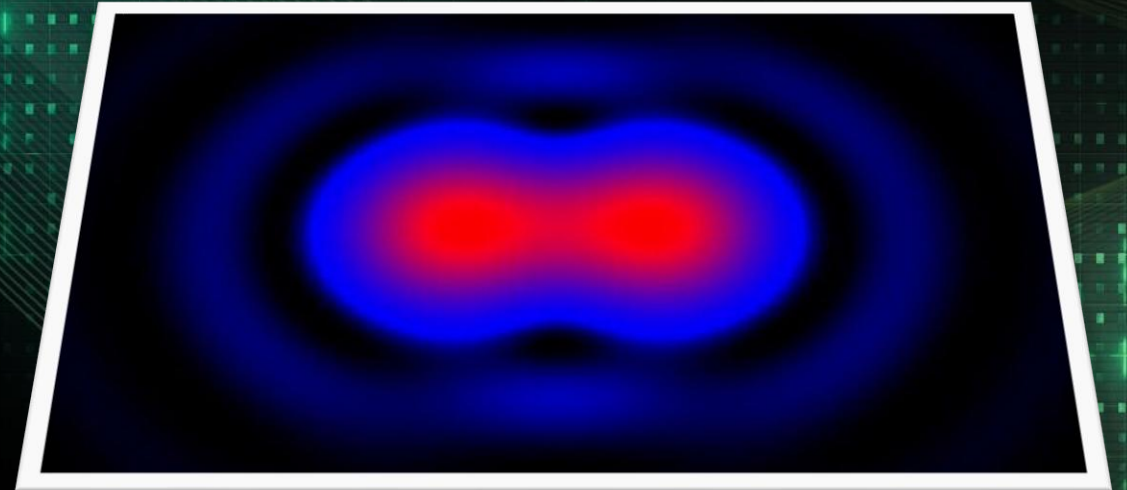


# RESOLUTION

## OPTICAL RESOLUTION

The ability of a microscope to distinguish details of a specimen or sample.

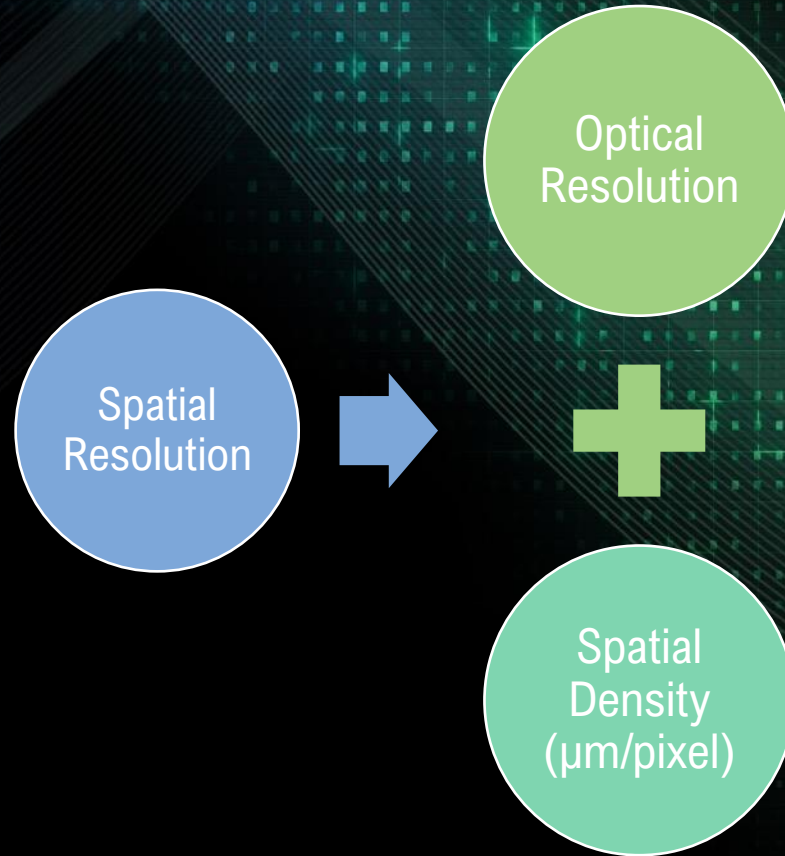
The minimum distance between 2 distinct points of a specimen where they can still be seen as separate entities.



[Understanding Clearly the Magnification of Microscopy | Science Lab | Leica Microsystems \(leica-microsystems.com\)](#)

# SPATIAL RESOLUTION

The number of pixels utilized in construction of the image





# SPATIAL RESOLUTION

40x scans with 0.26  $\mu\text{m}/\text{pixel}$  resolution

## UNDERSAMPLED

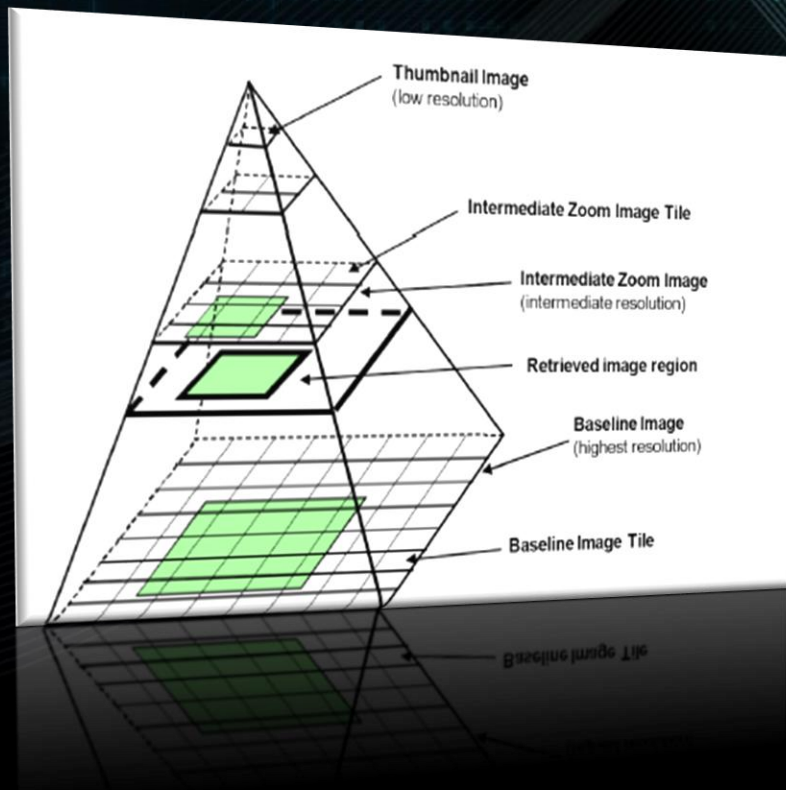
If too few pixels are utilized to acquire the sample, then all of the spatial details comprising the specimen will not be present in the final image.

## OVERSAMPLED

If too many pixels are gathered by the imaging device (often as a result of excessive optical magnification), no additional spatial information is afforded, and the image is said to have been **oversampled**.

Kenneth R. Spring -[Spatial Resolution in Digital Imaging](#) | [Nikon's MicroscopyU](#)

# FILE FORMAT



Aperio ScanScope Virtual Slide (SVS)

Nikon (ND2)

3D Histech (MRXS)

Olympus (VSI)

Hamamatsu (NDPI, NDPIS)

Zeiss (CZI)

Ventana (BIF)

Philips (iSyntax, i2Syntax)

KFBIO (KFB, KFBF)

DICOM WSI (suppl. 145)

# COMPRESSION

## Lossless Compression

- Reduces file size without losing image quality

## Lossy Compression

- Further reduces file size with some loss of quality

LZW ✓

Typical compression ratio is about 2.

JPEG ✓

The baseline image, intermediate levels, thumbnail and macro images could be compressed with JPEG.

JPEG2000 ✓

The baseline image and intermediate levels could be compressed with JPEG2000.

# Z-STACK



Z stack scanning adds a third dimension to the scanned images of your samples.

Along with width and length, z stack technology acquires images at selected depths within the sample.

Storage increases with the amount of layers

*\* VP-0450 study protocol*

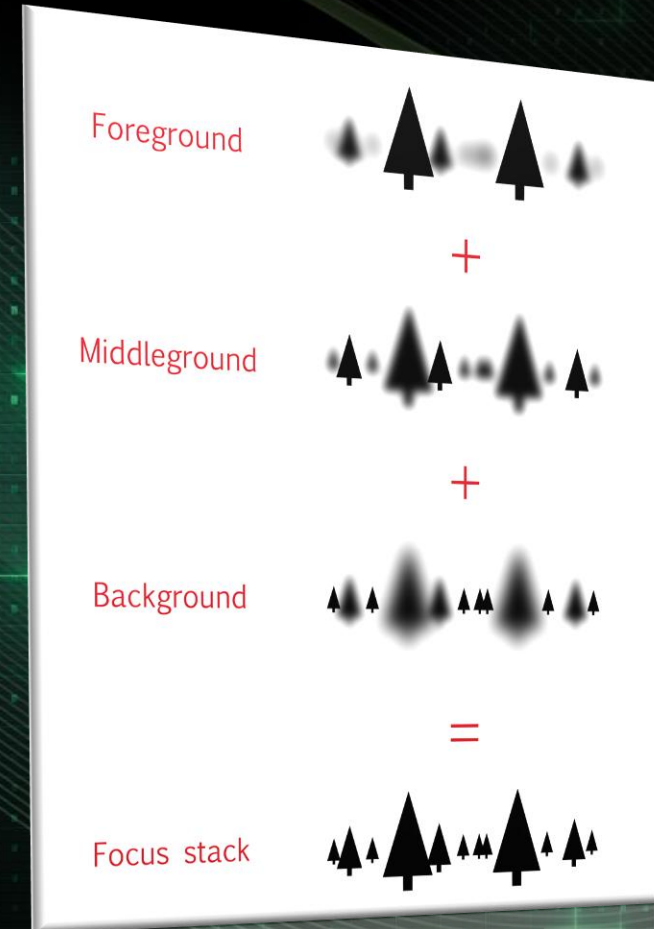
# EXTENDED FOCUS

## WHAT IS EXTENDED FOCUS?

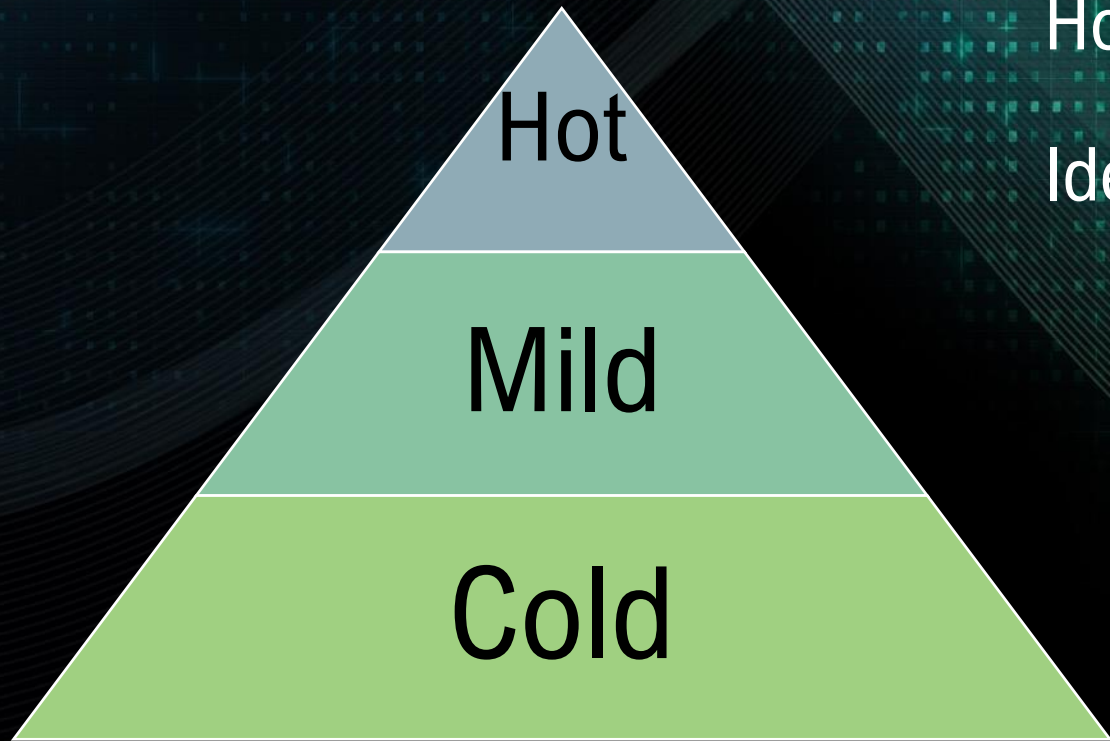
- Extended Focus is also widely known in the field as Focus Stacking
- An alternative or addition to Z-Stacked Images
- A process by which we analyze the different Z-Layers of a scan, and keep only the parts of each layer which are in focus

## WHAT ARE THE BENEFIT OF EXTENDED FOCUS?

- Reduced file size of the output image
- Takes up less space on storage media, costing customers less money to store their data
- Transfer times are reduced when sharing files between doctors, speeding up collaboration between pathologists



# STORAGE TECHNOLOGY



**Hot Storage: Rapid Access**

Ideal for frequent and rapid slide access

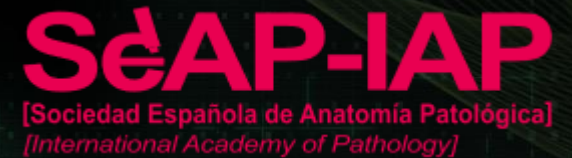
**Cold Storage: Long-Term Preservation**

Optimized for infrequent slide retrieval

# IMAGE RETENTION POLICIES

Best practice recommendations for implementing digital pathology January 2018

“College recommendations are currently to retain glass slides for at least 10 years.”



Recomendaciones del Club de Patología Digital de la SEAP

“The image of the patient must be available for at least 5 years from the last visit or care process of each patient, as indicated by Law 41/2002. [...] Ideally, we should be able to store pathological anatomy images for at least 30 years.”

# CONCLUSION

## SCANNER FACTORS

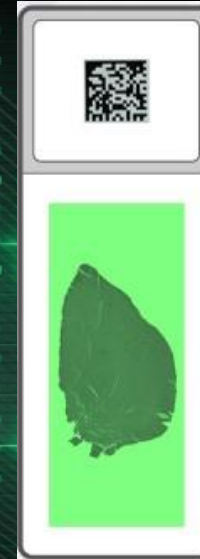
FILE FORMAT  
RESOLUTION  
COMPRESSION

## LAB FACTORS

TISSUE AREA  
MAGNIFICATION  
Z-STACK

## IT FACTORS

STORAGE POLICY  
TECHNOLOGY







We envision a world where comprehensive insights enrich cancer diagnosis and offer reassurance to all patients.

Accelerate Your Journey, Imagine The Possibilities

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