

# Servicio de Salud de Castilla-La Mancha

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## Telepathology network of Castilla-La Mancha

MARCIAL GARCÍA ROJO

Chief. Pathology Department  
Hospital General de Ciudad Real  
[marcial@cim.es](mailto:marcial@cim.es)

# Introduction

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New **technologies** in Pathology (information systems, digital photography, digital slides) allow a more efficient work in Pathology Departments.

There is a growing **automation** in the specialty.

Digital Image of good quality allow diagnoses similar to the use of conventional microscopes

In 2004, the Public Health Service of Castilla-La Mancha (SESCAM) created an Pathology Information Technology Innovation Centre.





# Current status of slide scanning

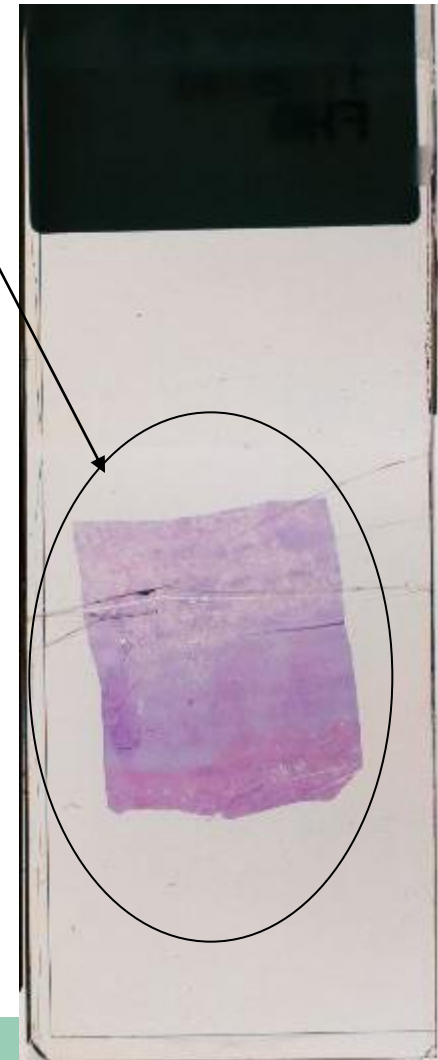
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Advantages and disadvantages vs. traditional microscopy

- In clinical practice (63% of digital pathology users)
- In education (72%)

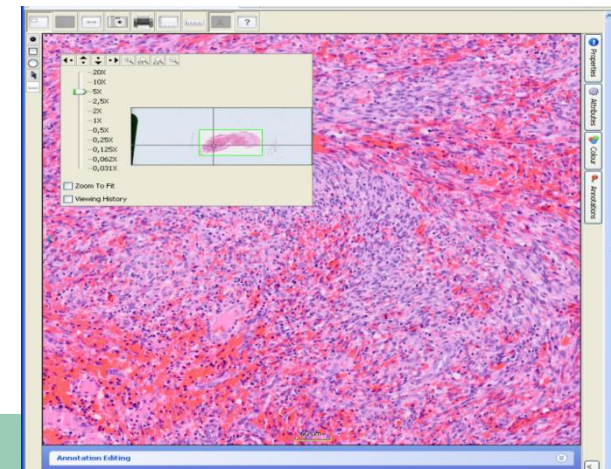
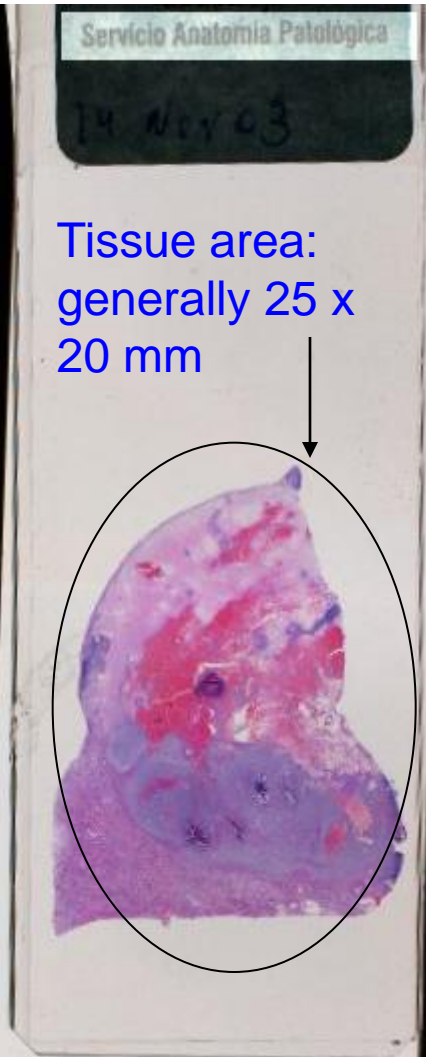
# Drawbacks of glass slides

- Conventional glass slides are fragile
- They are not permanent: immunofluorescence, crystal studies in joint effusions
- In cytology, distributing copies of the same specimen is not possible



# Advantages of digital slides

- Low magnifications with extraordinary quality
- Dynamic map of the slide
- Optimization of network bandwidth: high resolutions areas are sent of request area only.
- Record and reproduce slide navigation (traceability of diagnosis)
- Images are permanently stored without any loss of quality
- Annotations are also saved permanently.



# A digital (“virtual”) slide is a real slide, and physically it is...

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**A folder with a set of files.** Generally JPEG files, and a coordinates file used to reconstruct the complete slide.

Advantages: Flexibility (one folder per Z plane, or per magnification)

Disadvantages: Difficult to copy and distribute

No real standard. Used by Zoomify or similar (MS Silverlight) → DICOM

**A single file (SVS, JPEG2000, Philips...)**

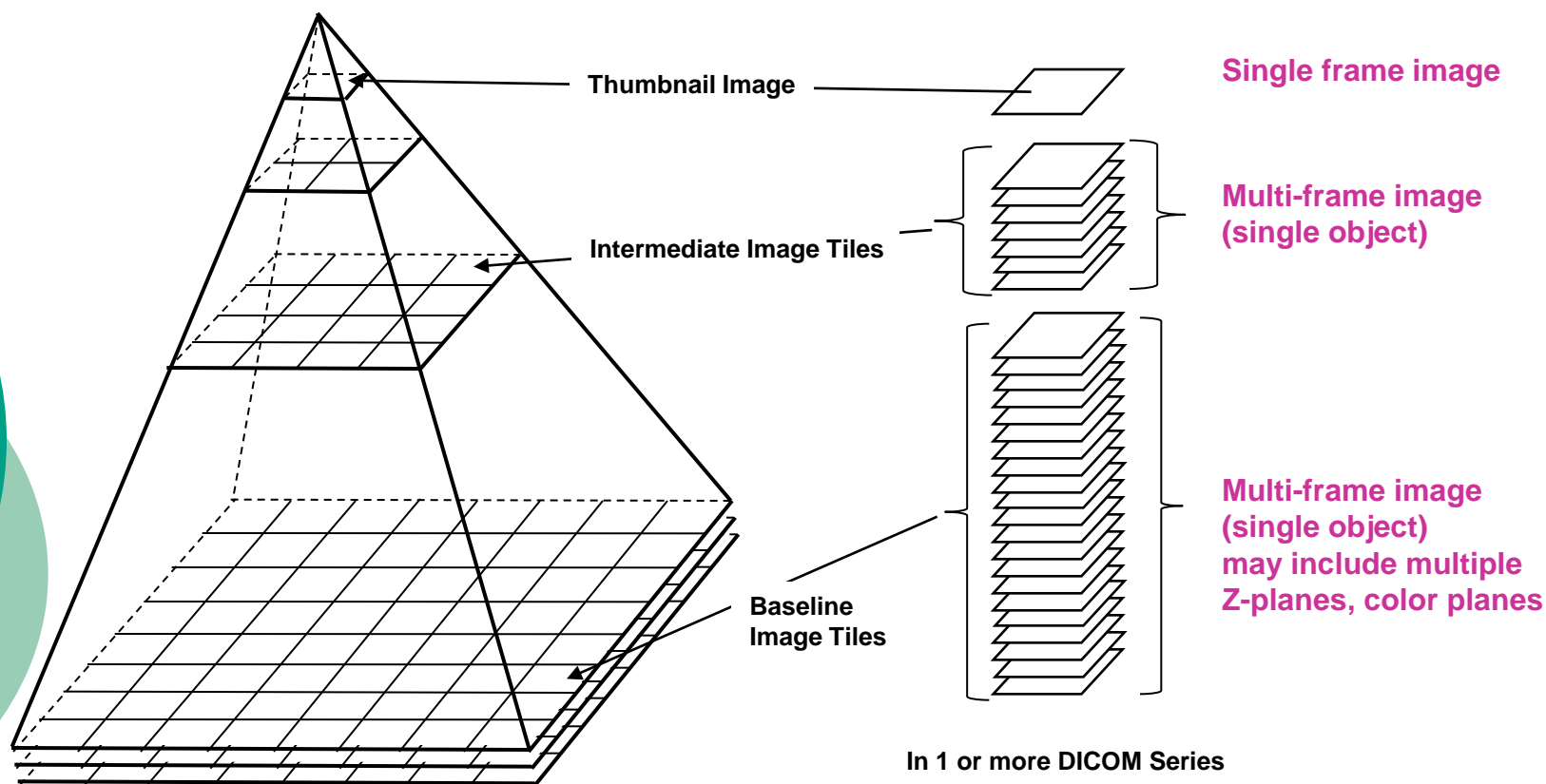
multiresolution, containing also all information associated with the image

Advantages: Easy to distribute. JPEG2000 is a standard

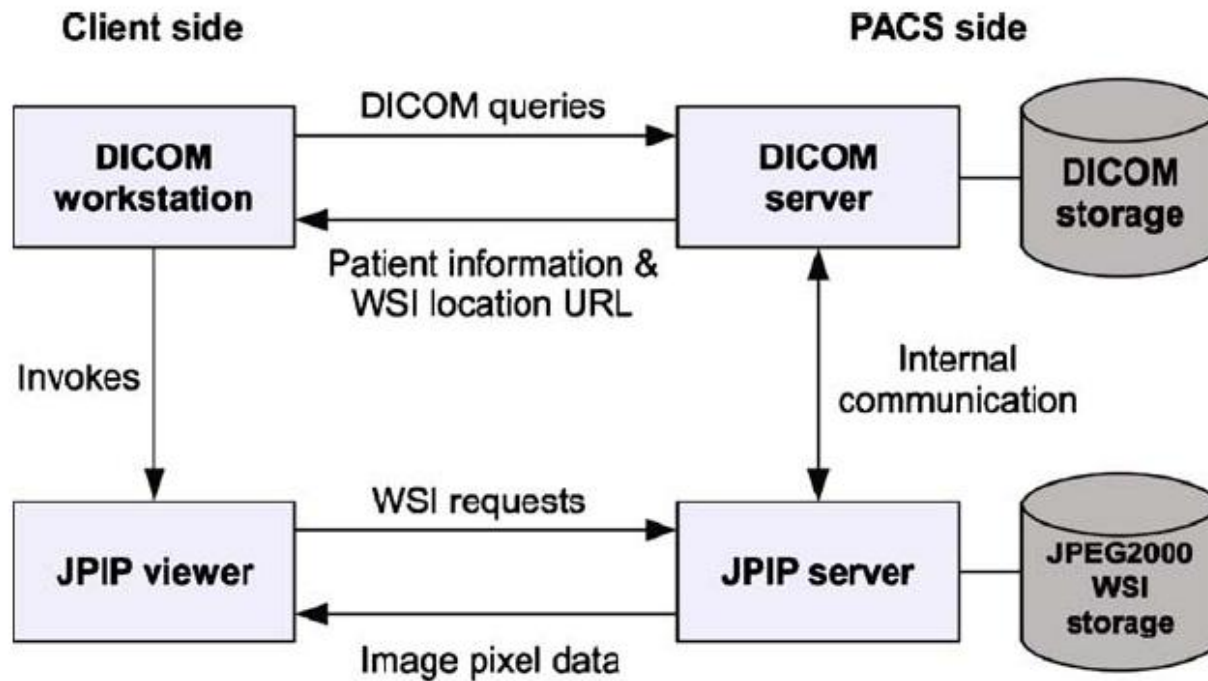
Disadvantages: Performance issues in JPEG2000

# DICOM Sup145 multi-frame tiling

Use multi-frame image objects (not object per tile)



# DICOM. Supplement 122. Single file: JPEG2000/JPIP





# When no compression is applied, large storage amount is needed

<b>Magnification</b>	<b>Numerical Aperture</b>	<b>Optical Resolution (microns)</b>	<b>Minimum store needed to save all those pixels (24-bits colour)</b>
4x	0,2	1,7	2,08 GB
10x	0,45	0,75	11 GB
20x	0,5	0,67	13 GB
40x	0,75	0,45	30 GB

Many image analysis algorithms can be applied using compressed images

# Clinical practice

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European network: Action IC0604: Telepathology Network (EURO-TELEPATH)

<http://www.conganat.org/eurotelepath>

Telepathology in Castilla-La Mancha.

## **Serendipia project in SESCAM**

Main objective: Creating a professional communication tool connecting all Pathology Departments using a web platform and all needed devices or systems.

Following existing standards

**Digitalización**



Macroscopía



Microscopía



Preparaciones virtuales

**Discusión**



Consultar Casos HCR



Consultar Foro Público



Consultar Sesiones Clínicas



Temas



Nueva Consulta 2ª Opinión



Nueva Consulta Pública



Nueva Sesión Clínica

**Informes**



Consulta informes

**Formación**



Nuevo Caso de interes



Consultar Biblioteca



Nuevo Examen



Consultar Exámenes



admin

DATOS DE LA MUESTRA



Estudio B09-80

Ver Imágenes Micro y Virtual Slide

Filtrar Muestra

Muestra	Bloque	Porta	Fecha	Modalidad	Máquina	Estado
A	1	4	03/11/2009	Micro	Maquina 1 Micro - Lab 0	Pedidas
A	1	7	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	10	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	12	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	13	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas

Tipo de Estudio

Valoración

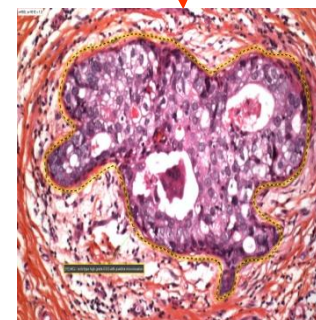
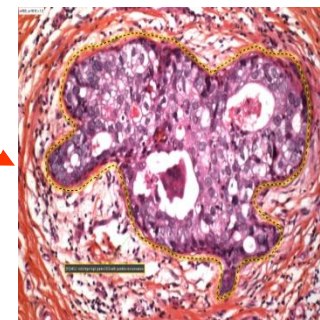
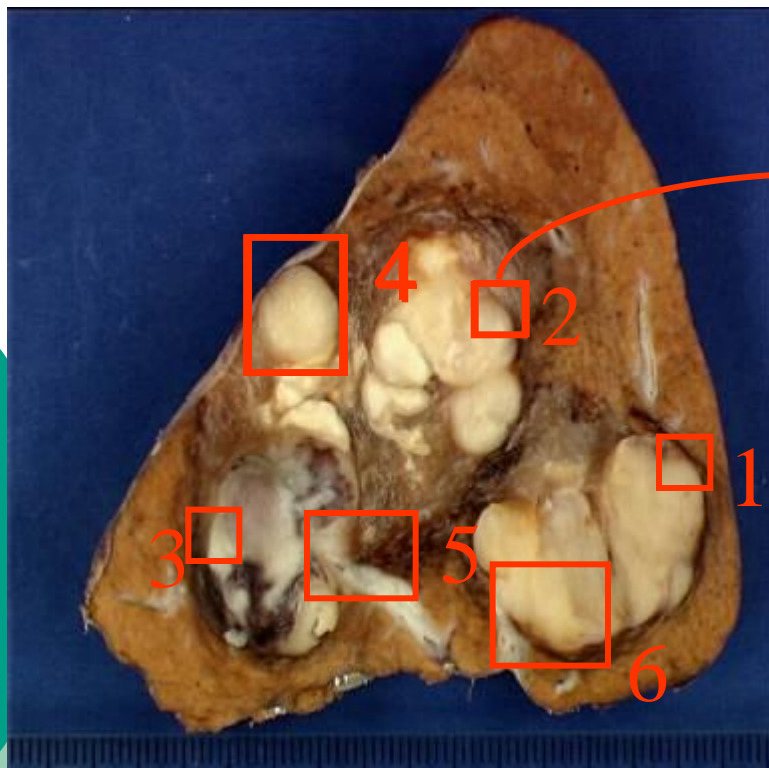
Macro Micro Di

Realizada por

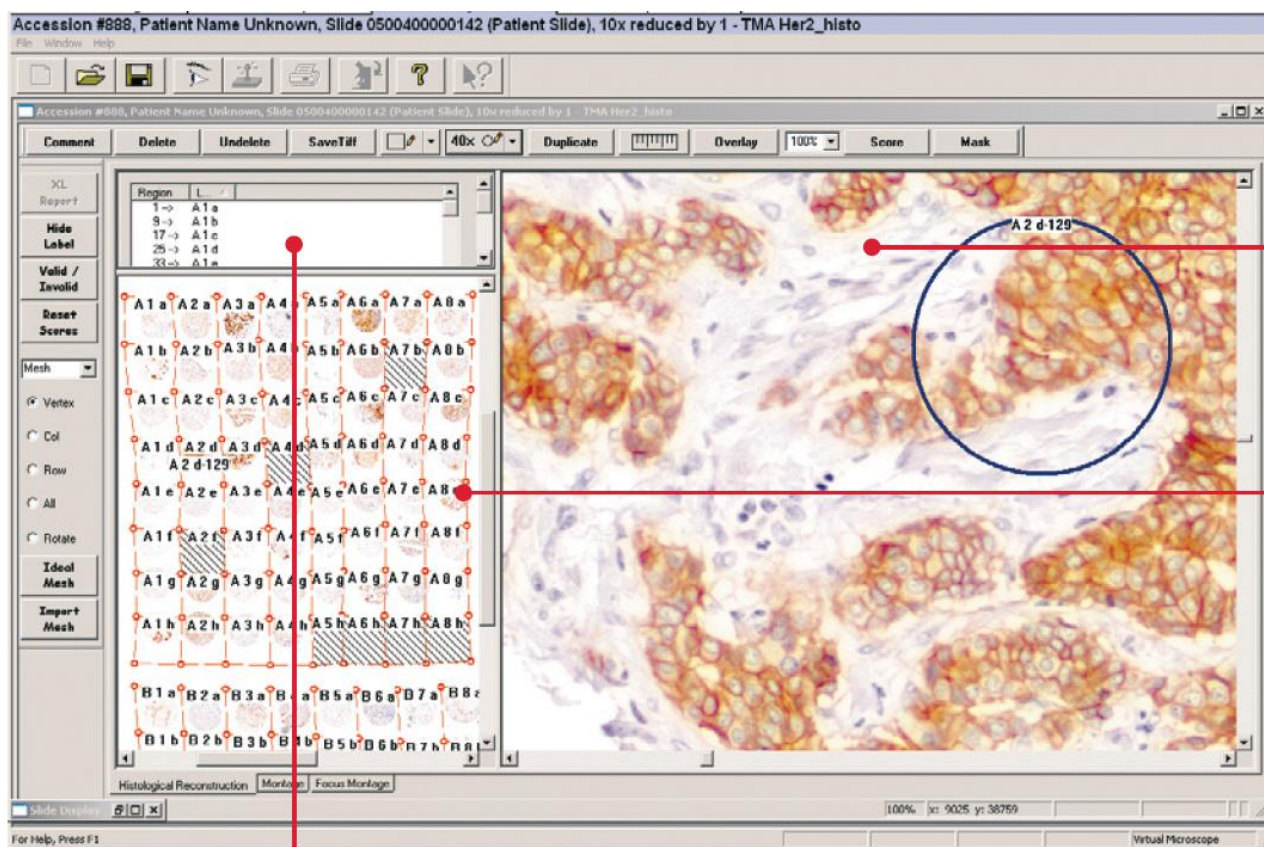
Integration with Pathology Information system in a web environment

View gross pictures and digital slides

# Integration of all kind of images



# Image Analysis



# Measure, quantify and analyze

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Tools to measure:

Melanomas: Breslow thickness

Sentinel lymph nodes: Localize and distinguish between isolated cells and micrometastasis

Image analysis (immunohistochemistry) algorithms: Her2, oestrogen and progesterone receptors (62% users of digital pathology apply quantitative immunohistochemistry for HER2 scoring)

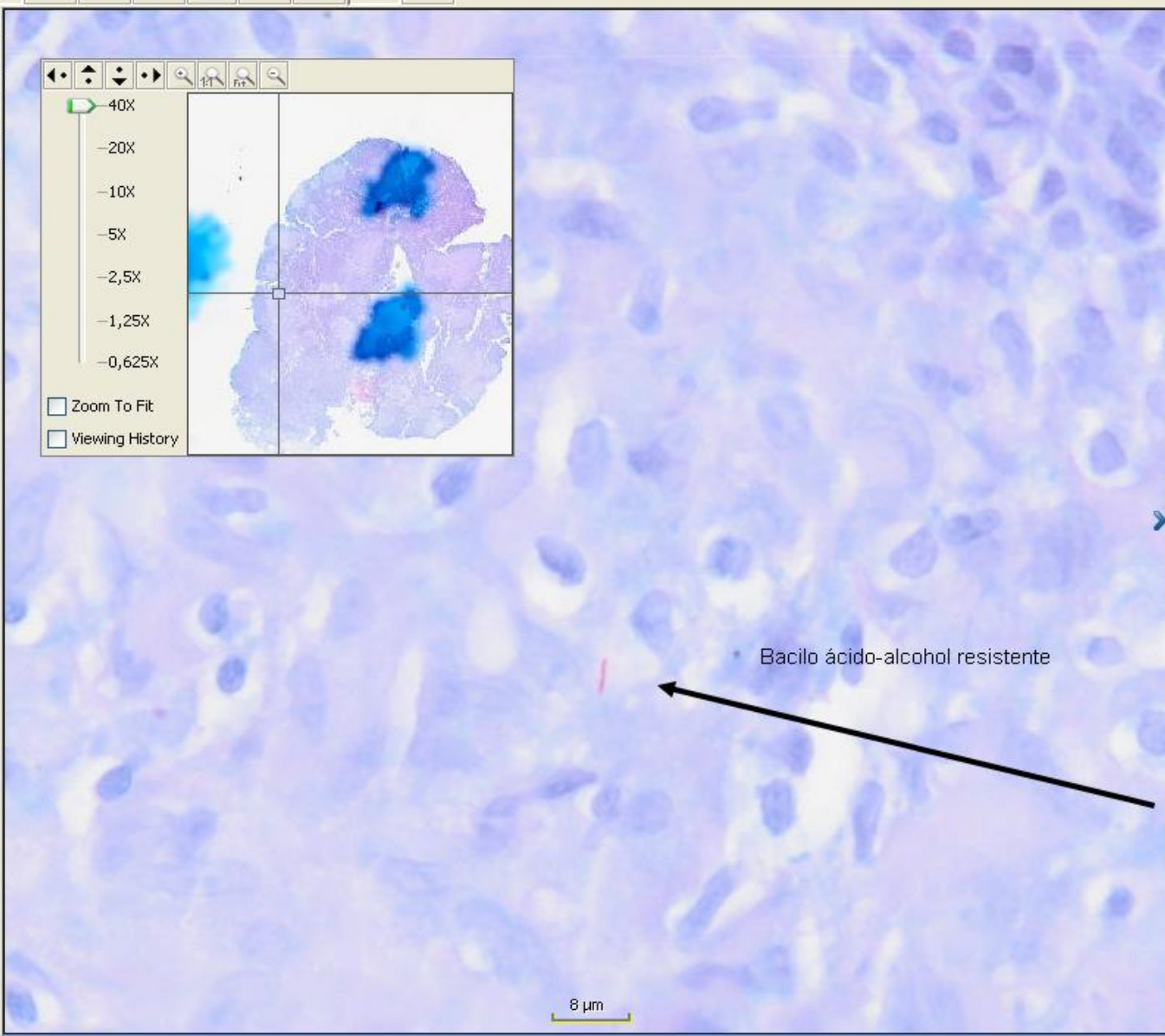
Detection of areas of interest (cytology)



Navigation and zoom controls:

- 40X
- 20X
- 10X
- 5X
- 2,5X
- 1,25X
- 0,625X

Zoom To Fit  
 Viewing History



### Collaboration

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#### Collaboration Users

patologo

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#### Public

Note that any messages you type in the public chat tab can be viewable by any other user viewing the same media.viewer.media=Media

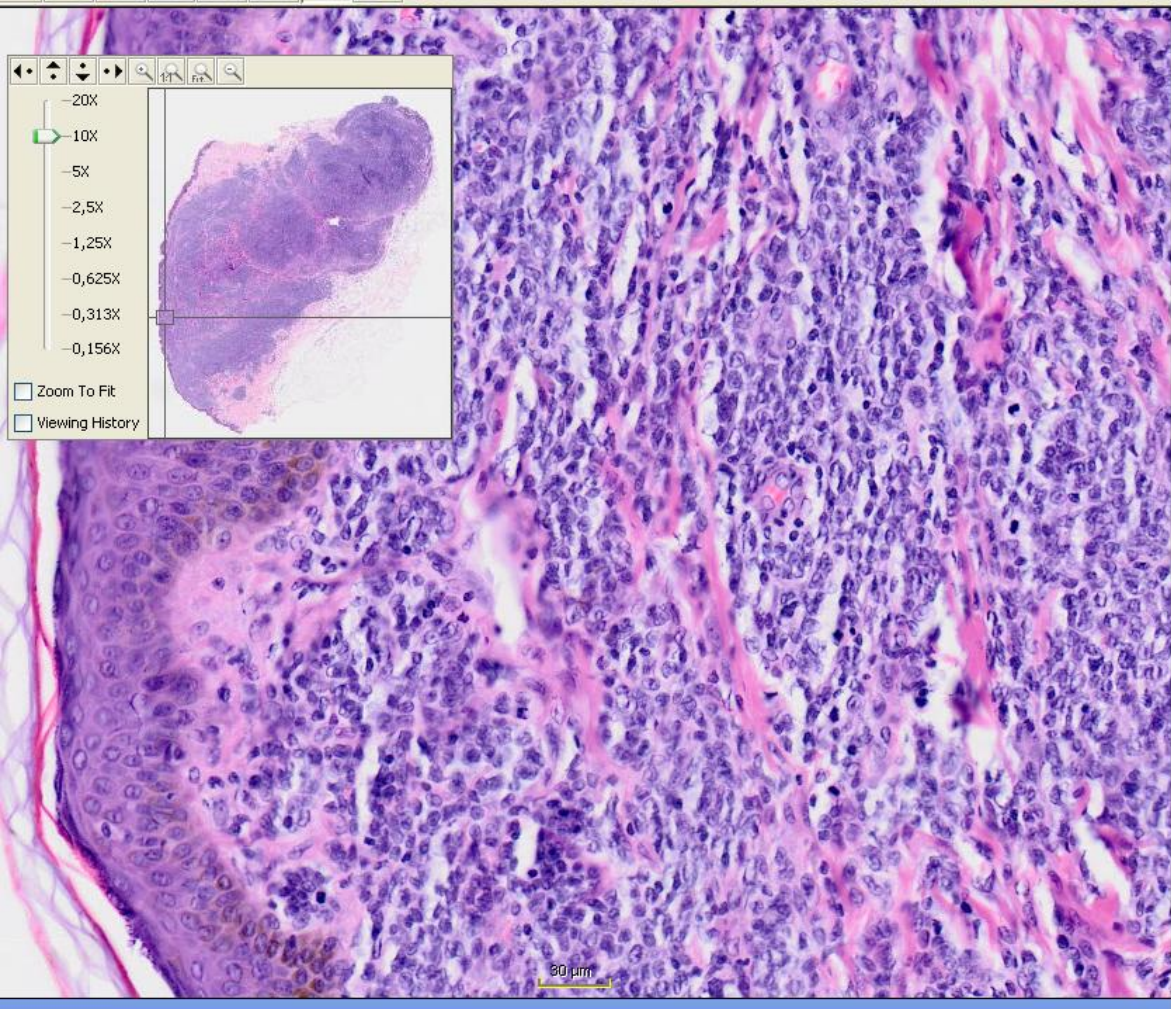
**(23:27:29) patologo:**  
This is the only acid-fast bacillus we could find in this biopsy

Properties  
Attributes  
Colour  
Collaboration (1)  
Annotations

Annotation Editing



# 10B0XXXX-3 HE\_02.vsi



Navigation and zoom controls:

- Zoom levels: 20X, 10X, 5X, 2.5X, 1.25X, 0.625X, 0.313X, 0.156X
- Buttons: Zoom To Fit, Viewing History

Image Properties

Name	Value
Mag. Scanned	20X
Mag. Onscreen	10X
Image Size	32800x38560
Pix. Area	1264768000
View Area	1283x1085

- Properties
- Atributos
- Colour
- Collaboration
- Annotations

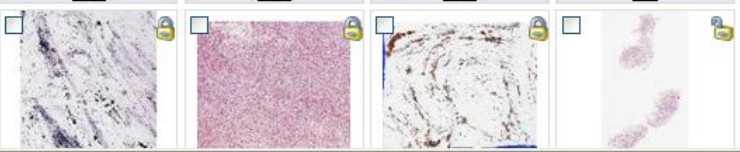
Navigation and search options:

- SEAP | Inicio | Administración | Desconectarse
- Buscar
- + Agregar una carpeta
- 10B07291-3 HE\_02
- Atributos | Asociaciones | Detalles
- Público: Si
- Talla del archivo: 367,83 MB
- Nombre: 10B07291-3 HE\_02
- Copyright Owner:
- Nombre del archivo:
- D:\medias\imagenes\mscope\upload\229\10B07291-3 HE\_02.vsi
- Camino: /Recepcion/
- Del servidor: Default MSC Media Server
- Fecha de creación: jun 18, 2010 5:32:18 p.m.
- Fecha de ingreso: jun 18, 2010 5:58:39 p.m.
- Enviado por: Administrator
- Fecha de envío: jun 18, 2010 5:58:39 p.m.
- Fue publicada por:
- Fecha de publicación:
- Privatizado por: Administrator SEAP
- Fecha de privatización: jun 18, 2010 5:58:39 p.m.

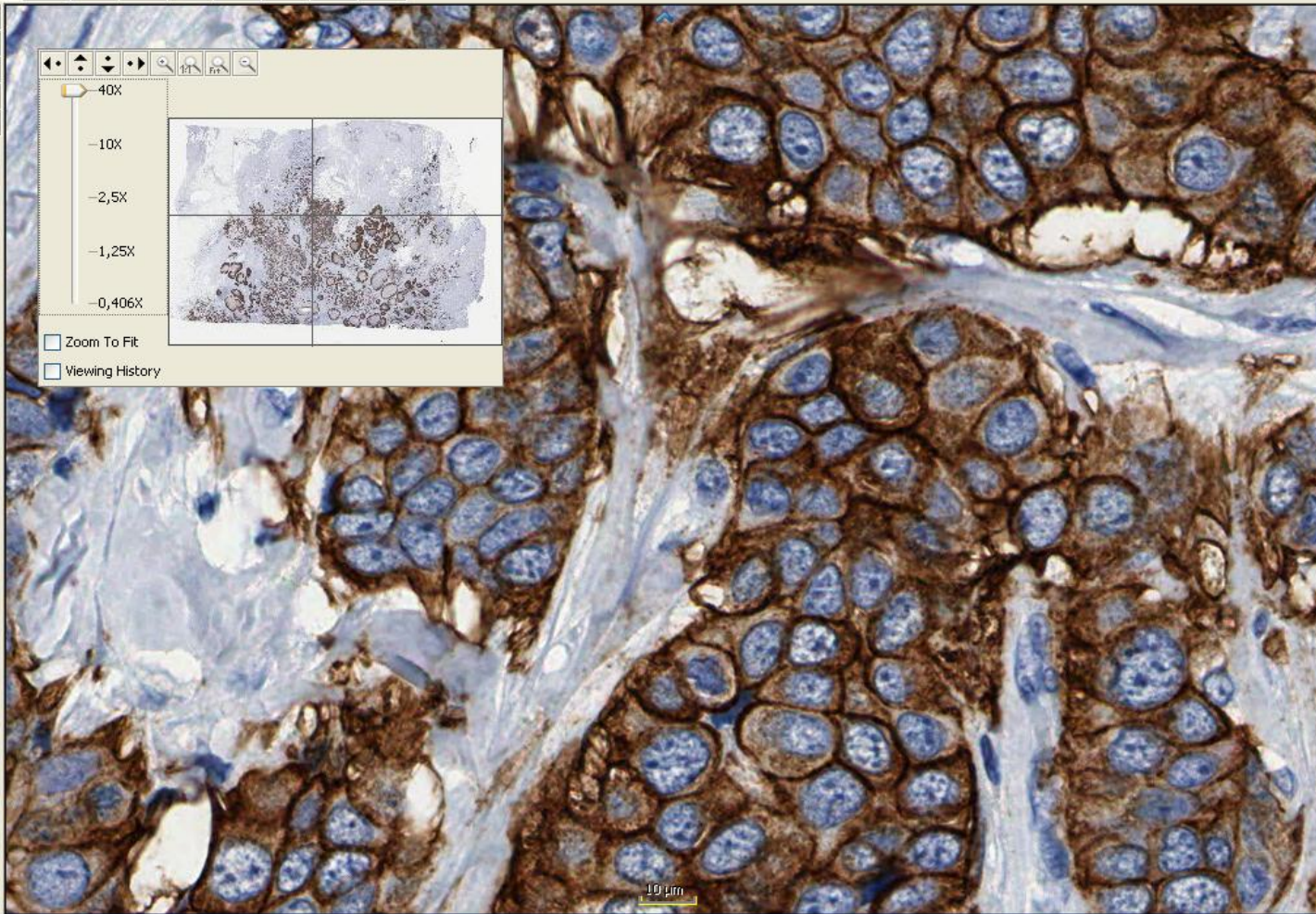
Annotation Editing

x: 2.704; y: 25.019

# Olympus dotslide



# HER2\Caso1.svs



Zoom controls and thumbnails:

- 40X
- 10X
- 2,5X
- 1,25X
- 0,406X

Zoom To Fit  
 Viewing History

- Properties
- Attributes
- Colour
- Collaboration
- Annotations

SEIS Más complementos Elsevier

SEAP Inicio Administración Desconectarse

Buscar

+ Agregar una carpeta

Caso1

**Atributos Asociaciones Detalles**

Público: Si  
Talla del archivo: 903,28 MB  
Nombre: Caso1  
Copyright Owner:  
Nombre del archivo: d:\medias\imagenes\aperio\HER2\Caso1.svs  
Camino: /Recepcion/  
Del servidor: Default MSC Media Server

Fecha de creación: sep 8, 2008 5:43:27 p.m.  
Fecha de ingreso: sep 16, 2008 12:22:01 a.m.  
Enviado por: Administrator SEAP  
Fecha de envío: sep 18, 2008 8:16:19 p.m.  
Fue publicada por: Administrator SEAP  
Fecha de publicación: sep 18, 2008 8:16:19 p.m.  
Privatizado por:  
Fecha de privatización:

HGUGM1 HGUGM2 HGUGM3 Vall d Hebron1

# Second opinion and teleconsultation

**sescam**  
Servicios de Salud Castilla la Mancha

Bienvenido Juan Herrero Herrera (Hospital Manzanares)

[Digitalización](#)
[Solicitudes](#)
[Informes](#)
[Discusión](#)
[Formación](#)
[Desconexión](#)

- Casos HMA
- Consulta pública
- Consulta 2ª Opinión**
- Foro Discusión
- Temas

Consulta 2ª Opinión

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**Detalle del caso:**

**Tema:**


Tema: (Seleccione)
   
 Experto: (Seleccione)
   

  
 Prioridad de la consulta: (Prioridad de la consulta)

**Estudio:**

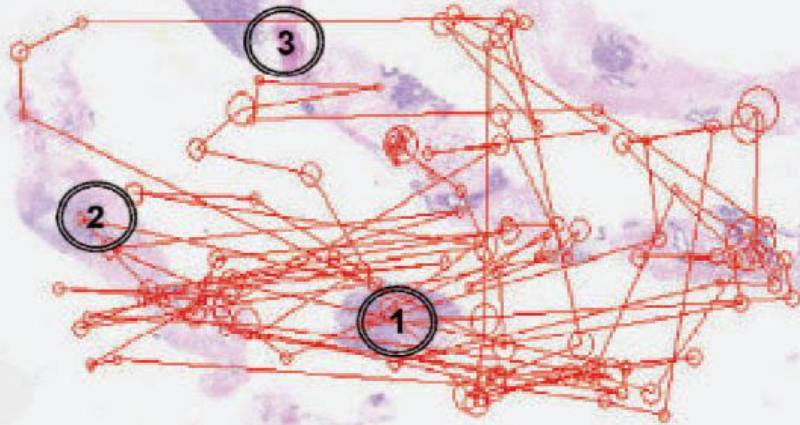
**Imágenes:**

Listado de imágenes capturadas



# Education

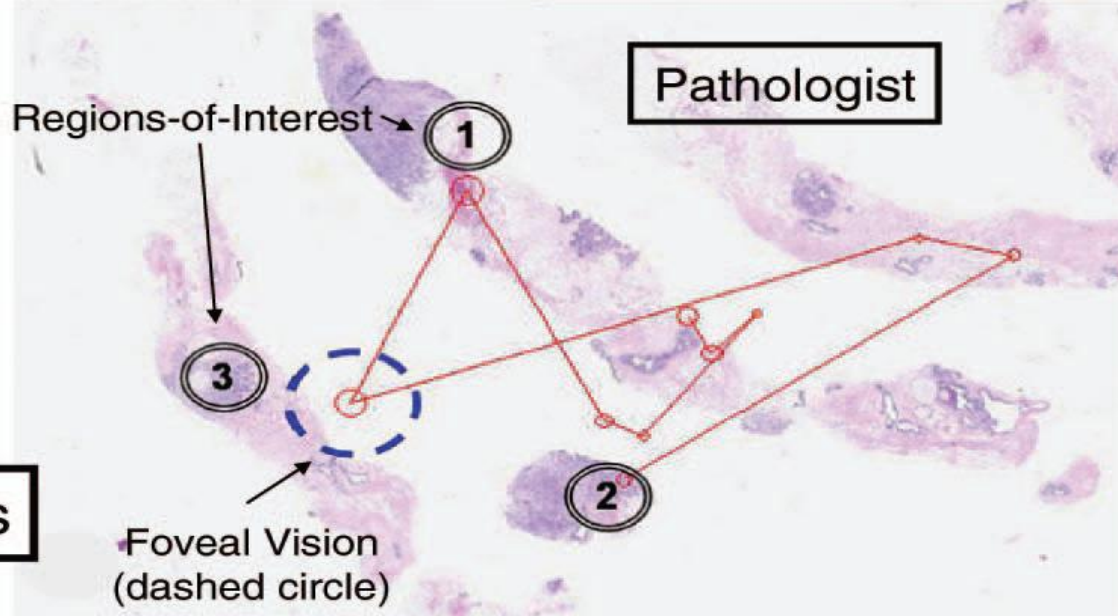
Medical Student



Resident



Pathologist



Scan-Paths

# Library of interesting virtual slides

## Biblioteca pedagógica

Bienvenido Juan Herrero Herrera (Hospital Manzanares)

[Digitalización](#)
[Solicitudes](#)
[Informes](#)
[Discusión](#)
[Formación](#)
[Desconexión](#)

Caso de interes

**Biblioteca pedagógica**




Biblioteca pedagógica

Filtrado de casos

(Número de estudio)  AUTOPSIA  Juan Herrero Herre

Citología cérvico-vag  (Órgano)  (Diagnóstico codificado)  (Texto)

16/04/2008   Coordinados por mí

 [Nuevo Caso de interes](#)
 [Nueva Consulta pública](#)
 [Nueva Consulta 2ª Opinión](#)

### Tema

Tema	Mensajes	Último mensaje	Coordinadores
 <a href="#">Citología cérvico-vaginal</a> Análisis de patologías de cérvix uterina	1	11/03/2008 14:16 por prueba	Patologo Uno Uno
 <a href="#">Partes Blandas</a> Análisis de patologías de partes blandas.	2	01/04/2008 15:58 por prueba	Juan Herrero Herrera

# Main problems with existing scanners

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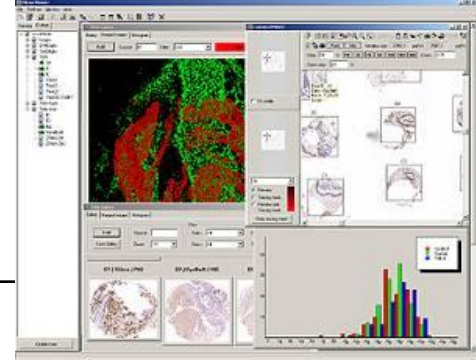
- Slow 40x scanning process (up to 90 min / cytology specimen)
- Out of focus areas
- Stitching artefacts
- Multiple Z planes may be necessary
- File formats are not standards
- Integration with other systems
- Costs

# Main criteria in scanner purchasing

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- Image quality: Avoid stitching artefacts and out-of-focus areas
- Scanning speed at 40x
- Image managing
- Price
- Integration capabilities (LIS, PACS): Standards
- Maintenance and support
- Upgrading policy: software updates and access to new versions of the scanner

# Automated image analysis



- IHQ quantification
- CISH/SISH analysis
- Fluorescence (FISH, Skin, Kidney)
- TMA

*FDA Clearance  
Her2/neu,  
Ostrogen and  
Progesterone  
Receptors*

## ○ Open solutions:

- Image analysis software should be able to read multiple digital slide file formats
- Image analysis results should be integrated with LIS reports
- Annotation should be interchangeable between different vendors (no standard!)
- Integration with cytology solutions: Hologic ThinPrep Imaging System, Civagen FocalPoint







# Scanning solutions

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- Spectrum of different scanner options (autoloader, oil, fluorescence): 3DHistech, Aperio, BioImagene
- Good quality: Hamamatsu, Leica
- Easy to use: Philips, Claro
- Flexibility: Olympus dotslide
- Fast: Philips
- Cheap: None!

# Future of slide scanning field

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Digital pathology adoption trends

Slide scanning technology

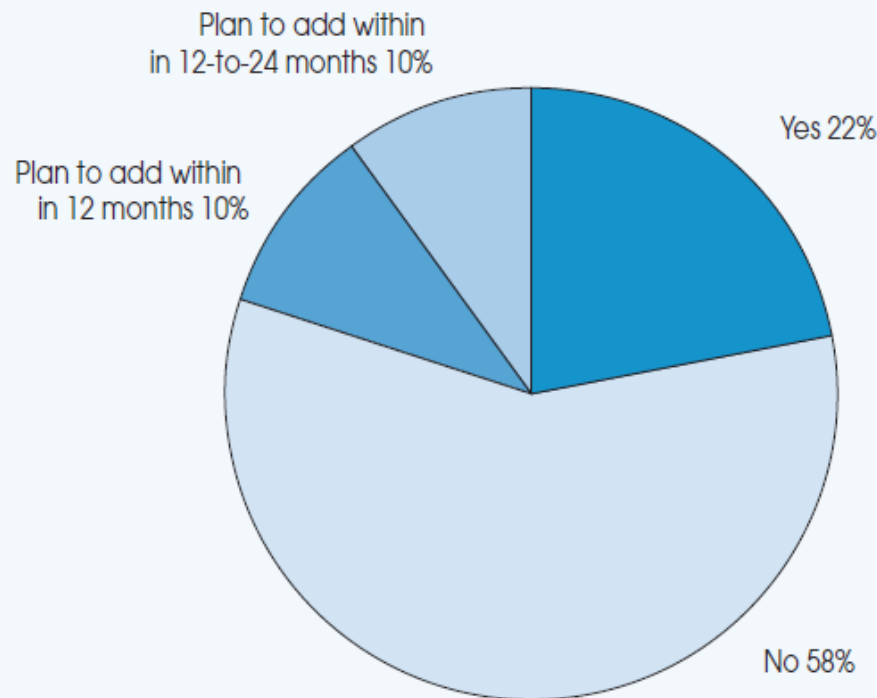
Information (data) management: integration,  
computer-aided diagnosis

Image management: compression, processing  
and analysis, storage

# Digital pathology adoption

The biggest barrier to more clinical use is **the cost** of scanning digital slides, which don't eliminate the **need to first prepare glass slides.**

## Does your lab use digital pathology?



Source: *LE's Digital Pathology Trends Survey*, June 2010; n=255



# Barriers to digital pathology adoption

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<b>Too expensive</b> .....	52%
Traditional pathology/microscope works fine.....	36%
<b>Integration concerns with LIS</b> .....	23%
<b>Too slow</b> .....	15%
Reimbursement issues.....	13%
Limited validated clinical tests.....	8%
Large data/image storage concerns.....	5%
No time/patience to learn.....	5%
Concerns about image resolution.....	3%

\*Survey respondents were able to select multiple answers  
Source: *LE's Digital Pathology Trends Survey, June 2010;*  
*n=255*

# Scanning technology

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- If speed and quality needs are reached, then glass slide step can be skipped.
- Increase automation in Lab workflow

Now, many manual steps:

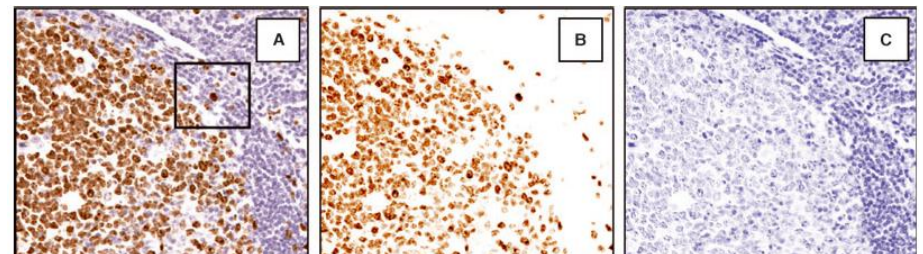
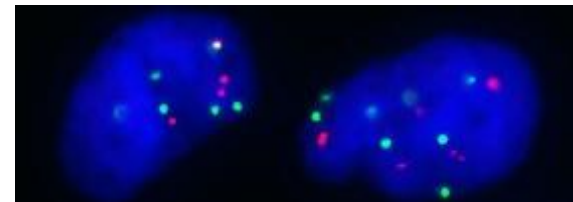
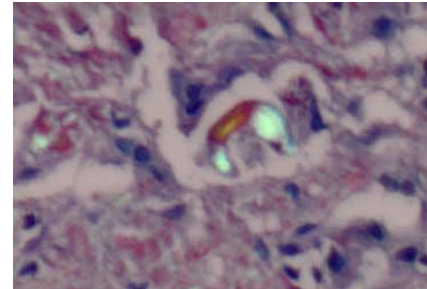
Embedding → Cutting → Staining → Permanent Mounting → Scanning → Reading → Store Glass slide

In the future, all automated steps:

Embedding → Cutting → Staining → **Temporal** Mounting → Scanning → Reading → Store tissue slice only when needed. No glass slide production

# Slide scanning technology

- Polarized light
  - Amiloidosis
  - Synovial effusions
- Fluorescence scanning
  - FISH
  - Skin and kidney diseases
- **Multispectral imaging:** A series of 3-20 images are taken from blue to the red (e.g. 420–700 nm) → Multiplexing: unmixing of three or more chromogens





# Future work: Integration with...

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- Pathology information system: Specimen managing, laboratory workflow, and reporting
- E-Health record: Unique patient database, electronic order of pathology studies, pathology report and images linked with health record, also available from Primary Care

# Future work: Integration with...

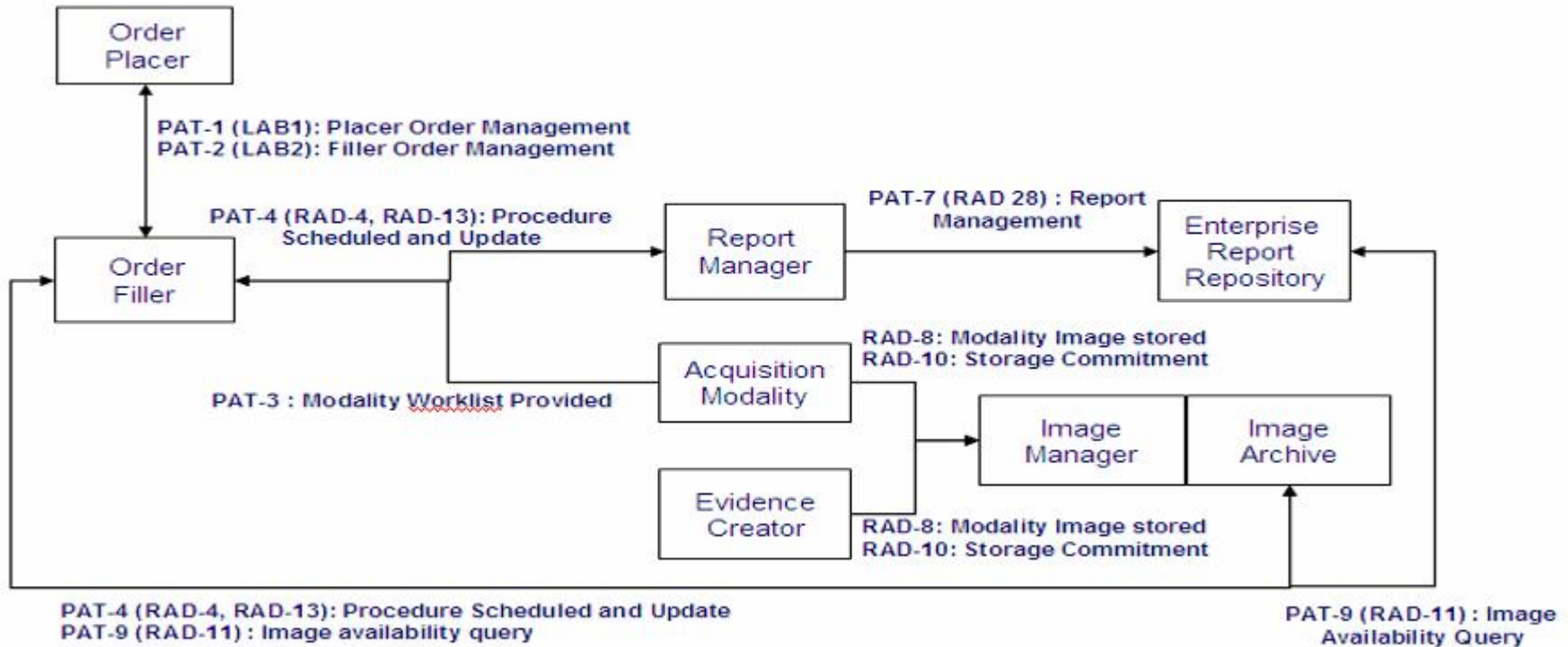
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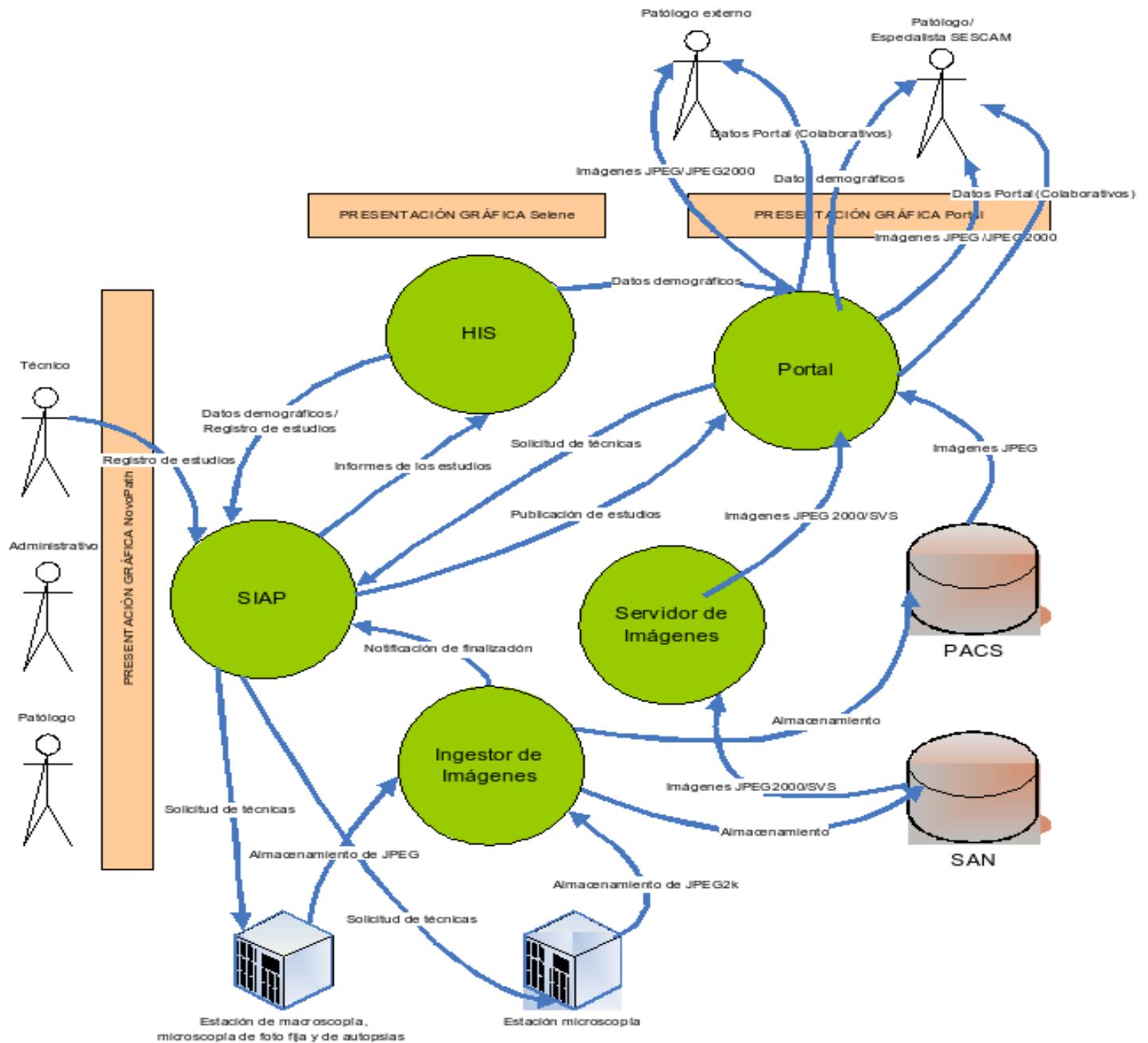
- Laboratory devices (stainers, inclusion)
- PACS: Image Servers
- Telepathology Portal (telemedicine)
- Hospital Tumour Registry
- Biobanks (tumour and tissue banks)
- Quality Assurance program
- Image libraries (e.g. education)
- Clinical guidelines
- Datawarehouse → Data mining



# Standards: IHE

## Integrating Healthcare Enterprise

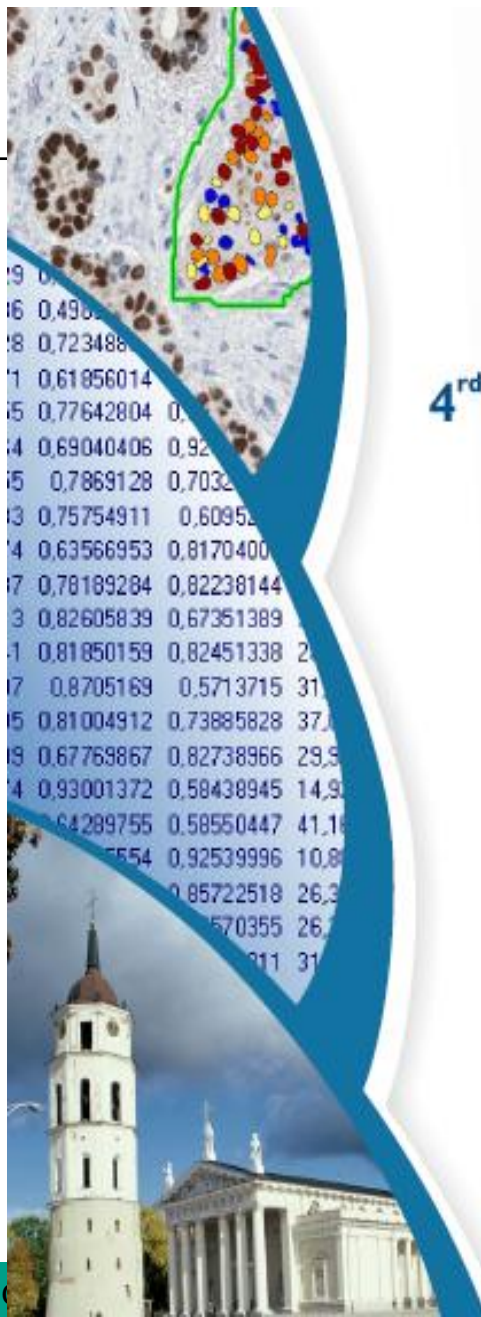




# Benefits of digital pathology

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- **Automating** critical processes to optimize and minimize possible sources of error.
- **Diagnosis** and **therapeutic** and **prognostic** evaluation **faster and with more quality**, especially relevant in intraoperative studies.
- Facilitates intra- and interdepartment **consultation**
- Better **monitoring** of the diagnostic process.
- Introducing the use of **processing and image analysis tools** to aid in diagnostic pathology.



# 10<sup>th</sup> European Congress on Telepathology and 4<sup>rd</sup> International Congress on Virtual Microscopy

Reval Hotel Lietuva  
Vilnius, Lithuania | 1-3 July, 2010

From Analogue to Digital -  
Enabling Precision in Pathology

**ANNOUNCEMENT**  
[www.telepathology2010.com](http://www.telepathology2010.com)



# Muchas gracias.

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[marcial@cim.es](mailto:marcial@cim.es)

**sescam**  
Servicio de Salud de Castilla-La Mancha

