



3DHISTECH

Quantitative analysis of digital images: supporting the pathologist

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3DHISTECH - Sysmex



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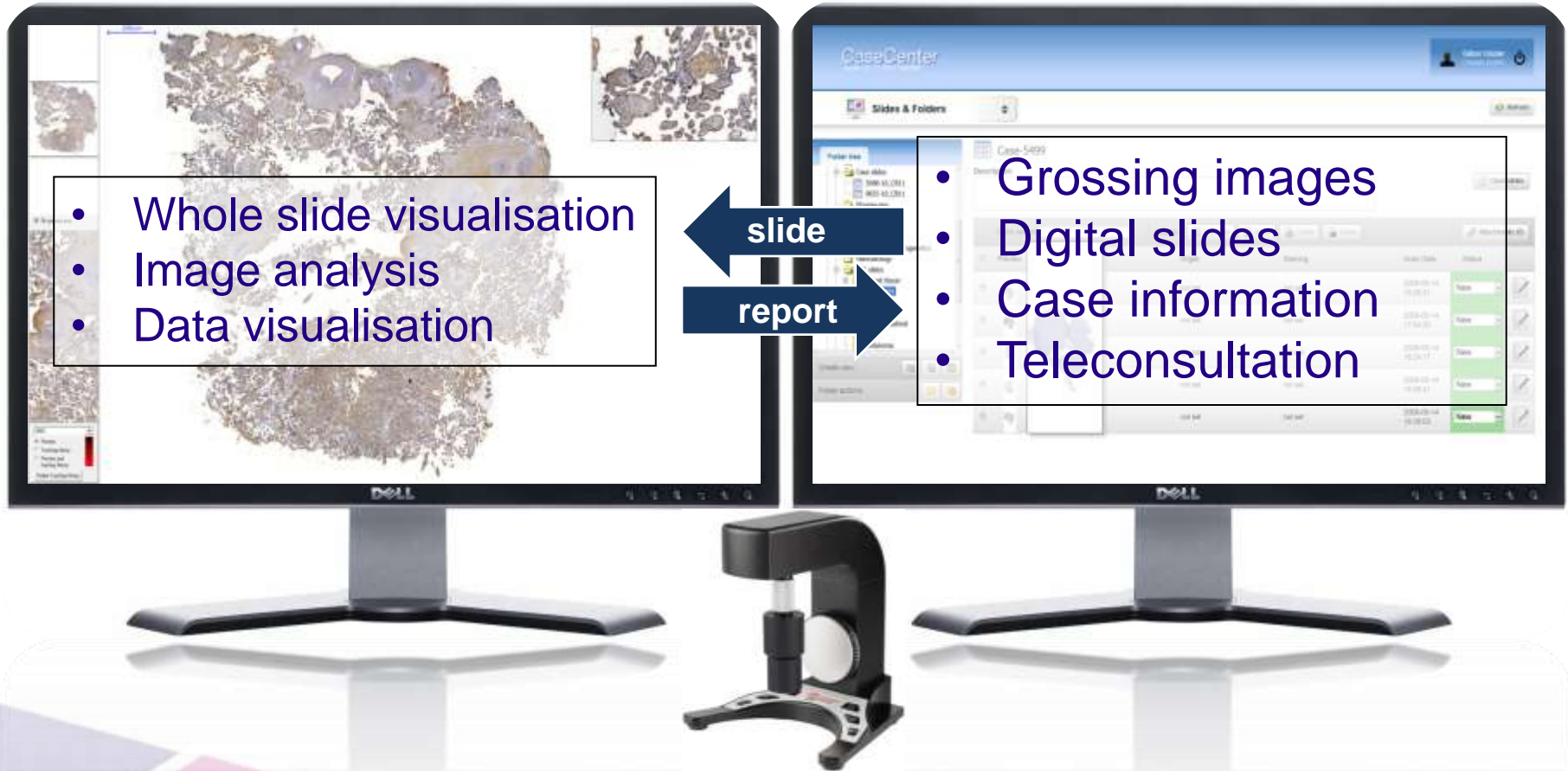
A good digital pathology solution

- **Scanner**
 - **Fast**
 - **Excellent image quality**
 - **Compact, BF and FL in one package**
- **Server**
 - **Instant availability on LAN, WAN**
 - **Management and Organization of slides**
 - **Supports pathology workflow**
 - **Integrates with HIS/LIS system**
- **Pathology workstation**
- **Image analysis**
 - **Quantification**
 - **Report**



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The Pathology workstation



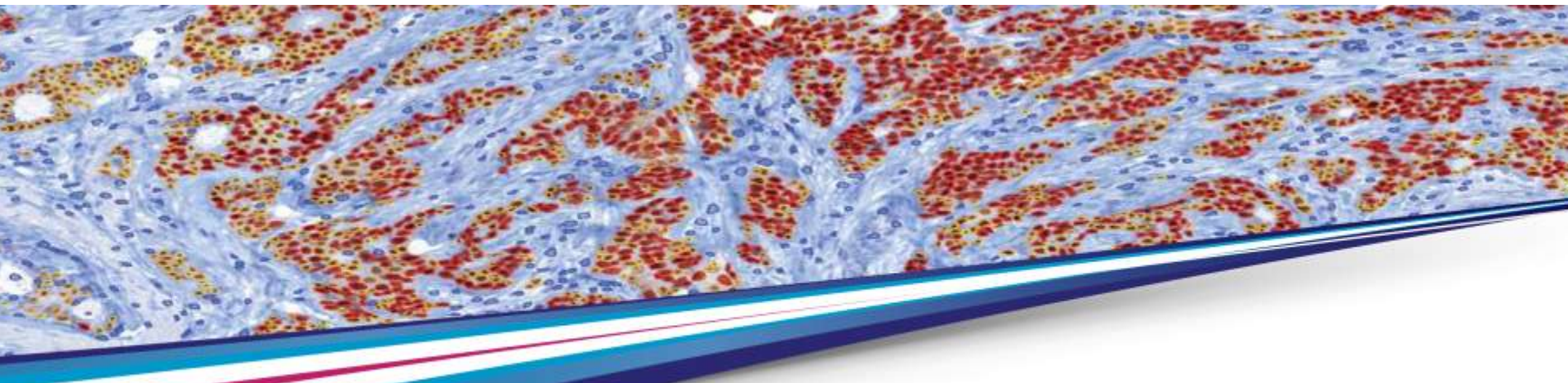


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Quantitative Microscopy

Aims:

- **To make pathological diagnosis more objective and comparable by measurements**
- **To bring dedicated solutions to pathologists' desks**
- **To reduce diagnostic procedure**





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The Quantification Applications



Research Clinical

IHC

FISH

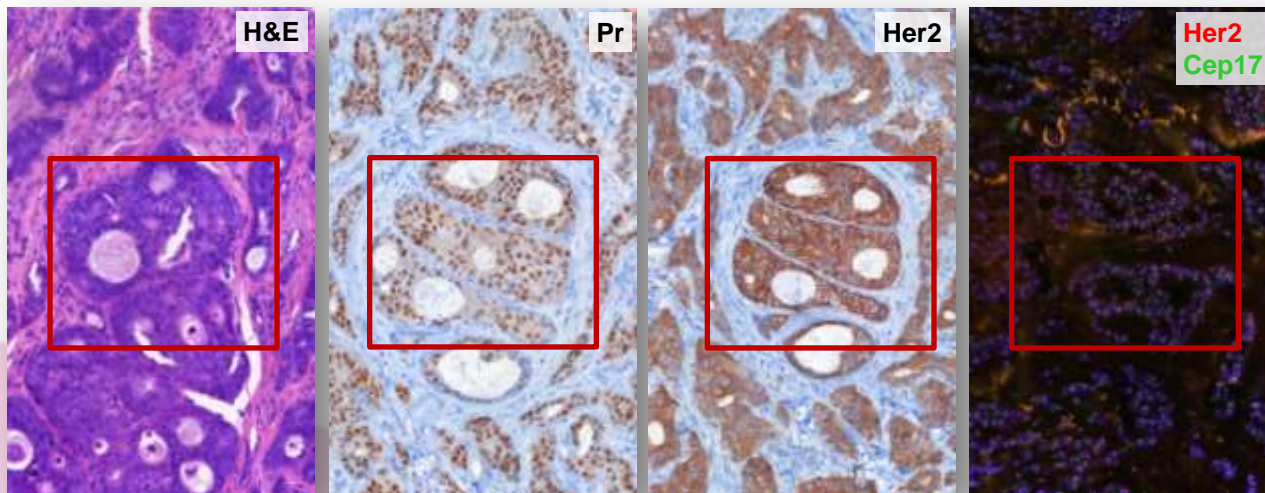
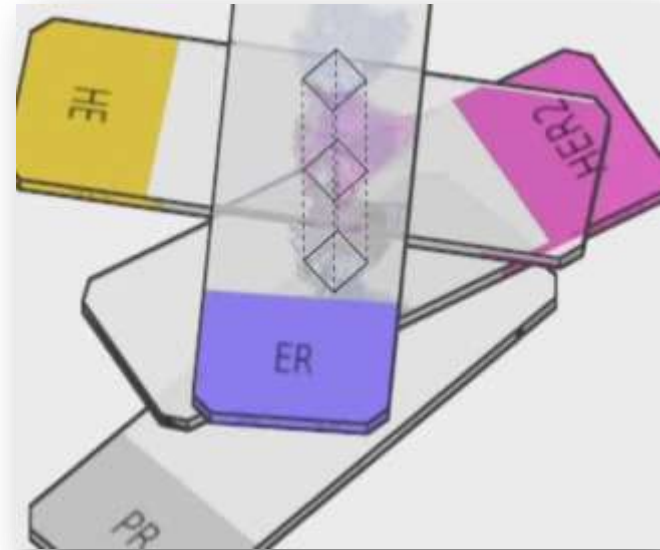


The Digital Case

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Case Study:

- ROI definition on brightfield sample
- Slide rotation and alignment
- Similar region of interest
- Comparable stains and measurements





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Image Analysis, Quantification Solutions

- **HistoQuant**
 - **General, Versatile solution**
- **NuclearQuant**
 - **Nuclei stains**
- **MembraneQuant**
 - **Membrane stains**
- **FISHQuant**
 - **FISH stains**
- **3D reconstruction**



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Easy 3-Step Workflow

I. Load Define ROI(s) for calibration

Ia. Configure Calibrate the solution on selected training set(s)

II. Run Run the analysis (in batch mode)

III. Review Browse the result (in Viewer or Gallery)



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HistoQuant

- **Sophisticated solution for special problems**
- **Multiple uses**



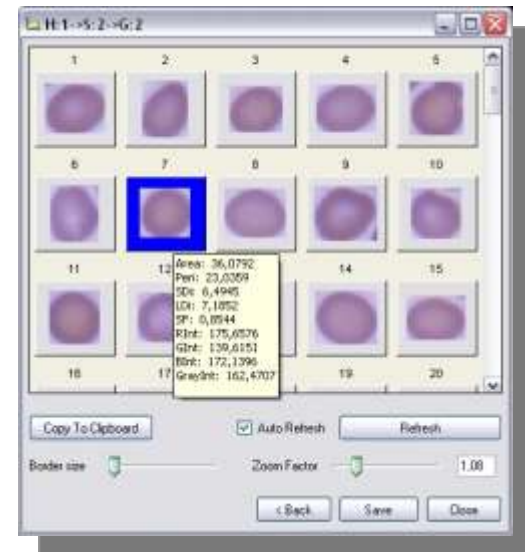
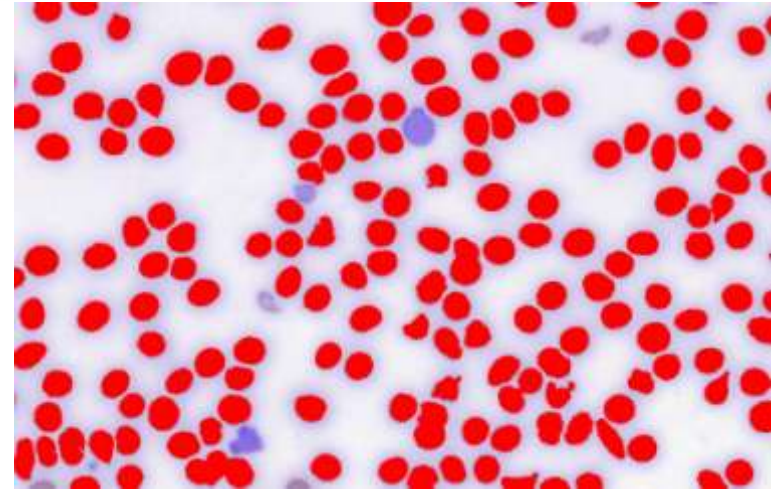
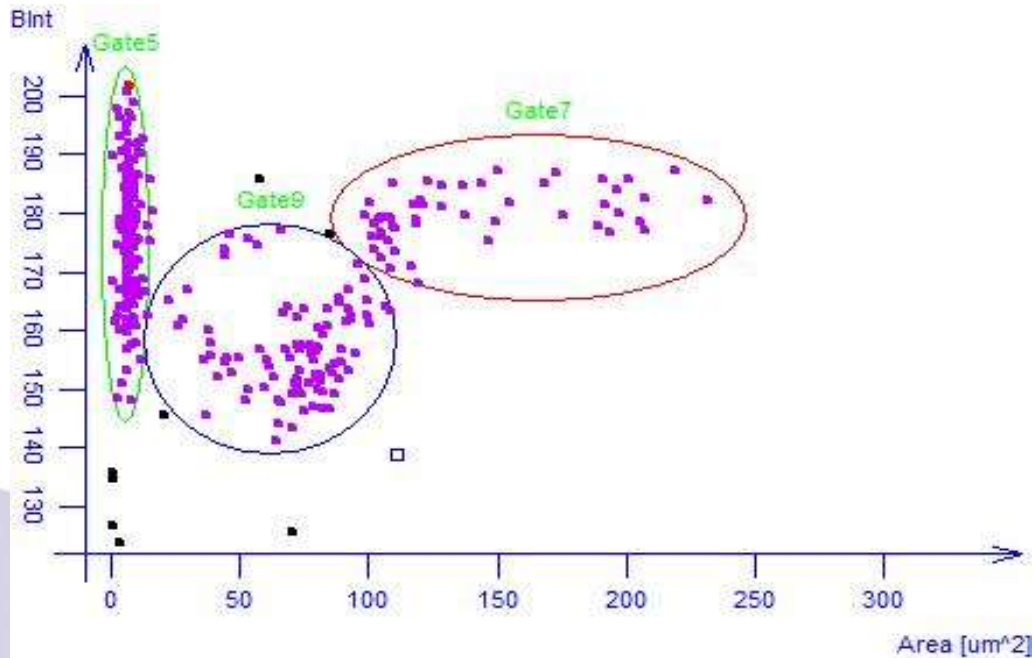


HistoQuant for Hematology

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- Blood smear analysis

Image Cytometry

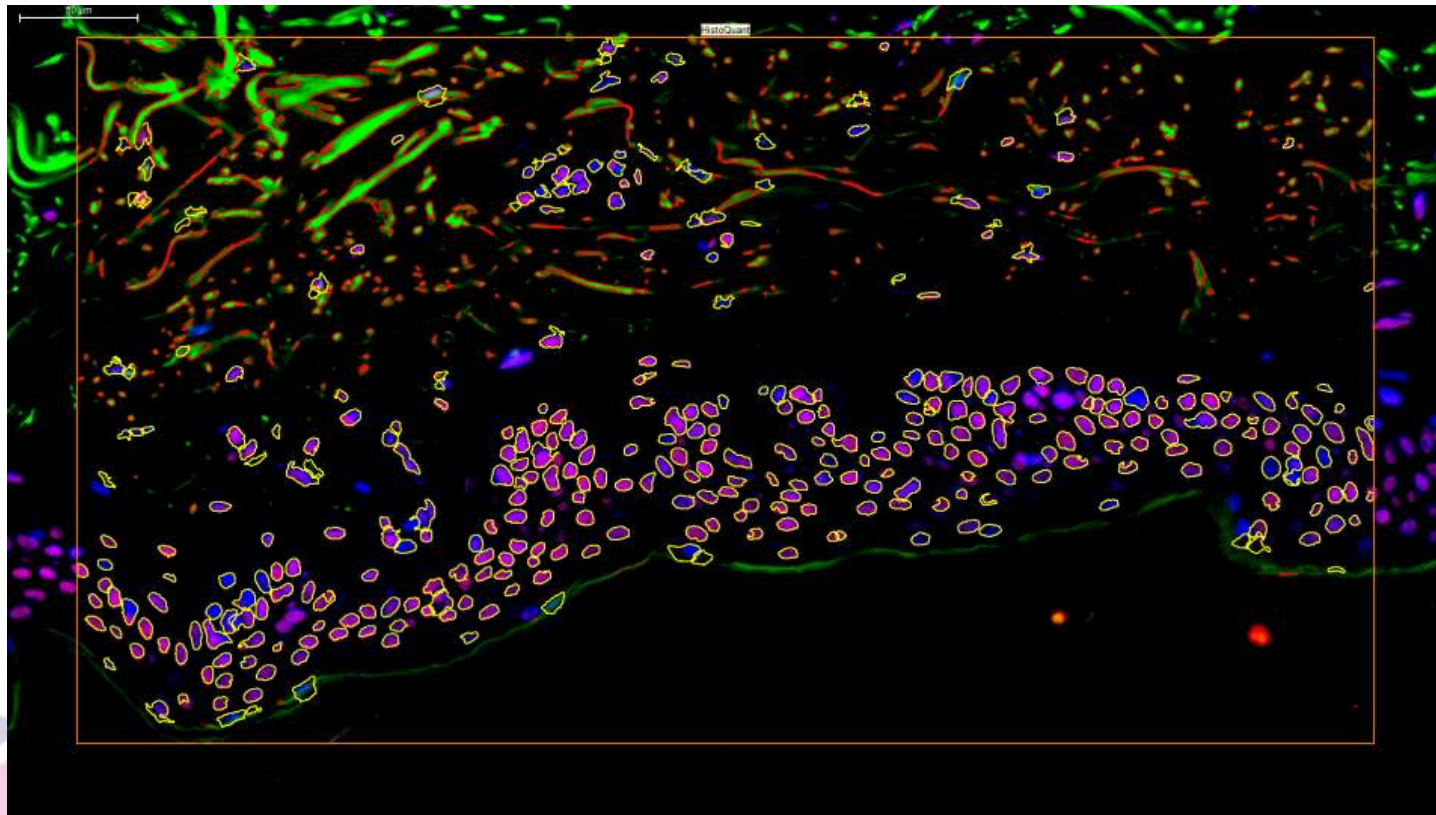




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HistoQuant for Fluorescence

Fluorescence investigation on original, or enhanced color slide





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NuclearQuant

Aims:

- **To quantify nuclear markers on immunostained samples**
- **To give a useful tool to determine the Er, Pr status**

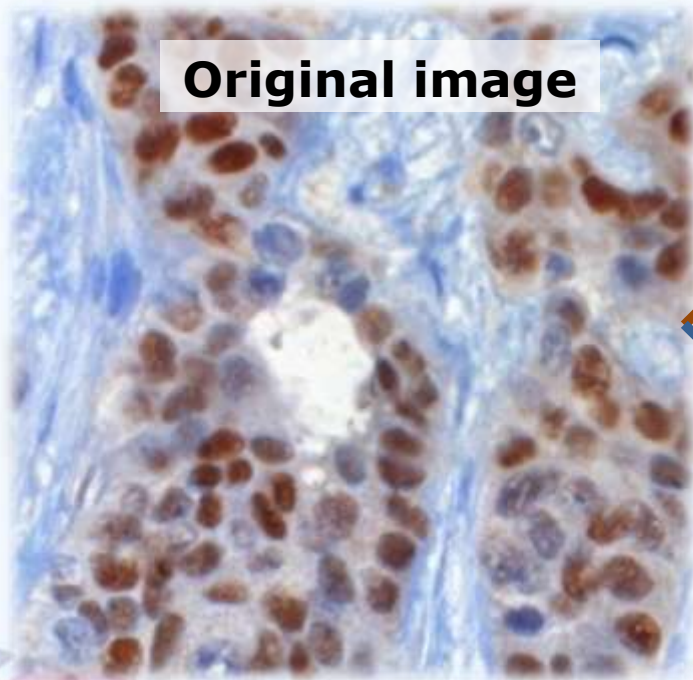




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About the algorithm

Color Deconvolution adjusts the software to the intensity of the applied stain





NuclearQuant in practice

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- Object detection:



Detection Scoring

Nuclei Settings

Radius - μm

min Nuclei Area μm^2

min Circularity

Smooth

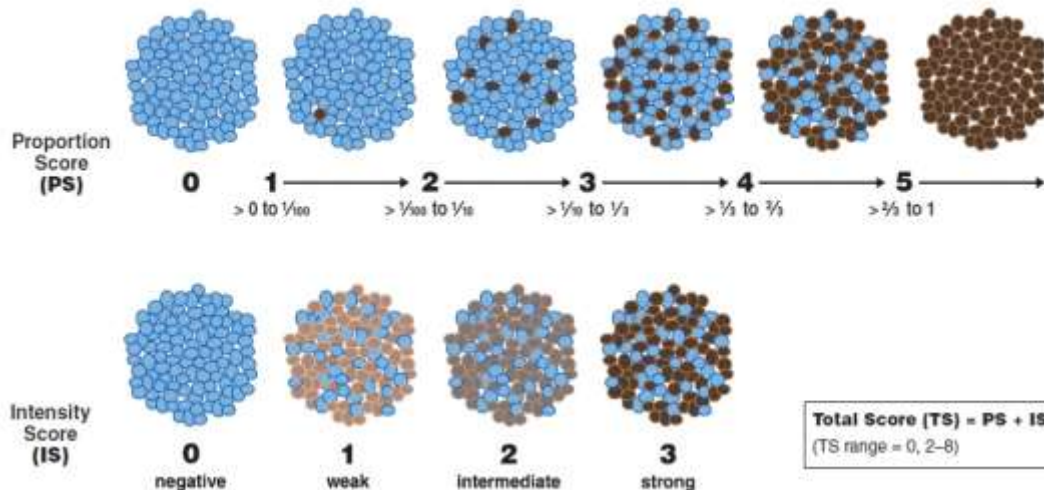
Separation

Image Settings

min Contrast

min Intensity

- Score settings:



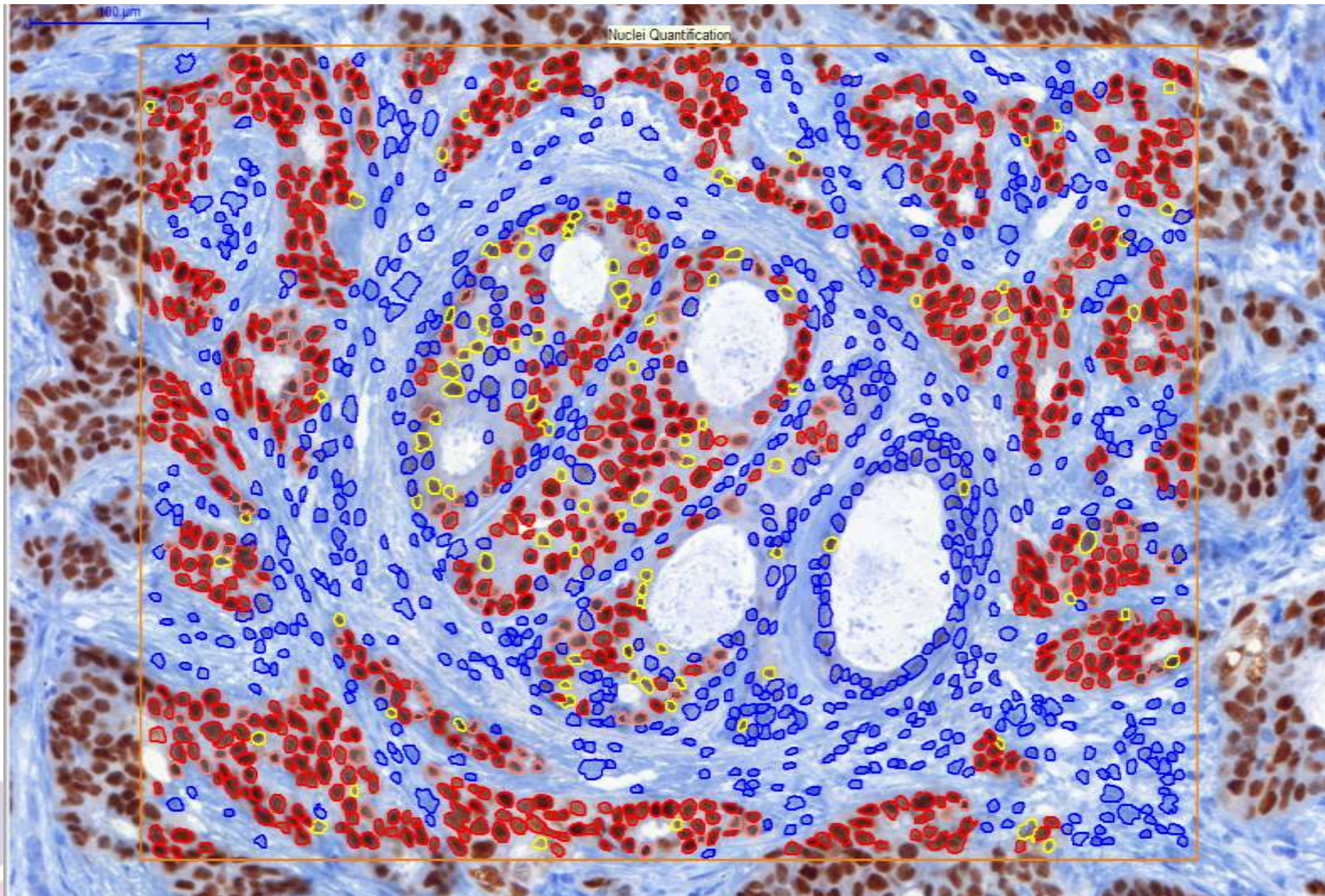
Detection Scoring

	0	None of below
	+1	Average Intensity < <input type="text" value="225"/>
	+2	Average Intensity < <input type="text" value="215"/>
	+3	Average Intensity < <input type="text" value="160"/>



NuclearQuant example

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- ER stained breast tissue



MembraneQuant

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Aims:

- **To quantify membrane immunostain**
- **To give a useful tool to determine eg. HER2 status**

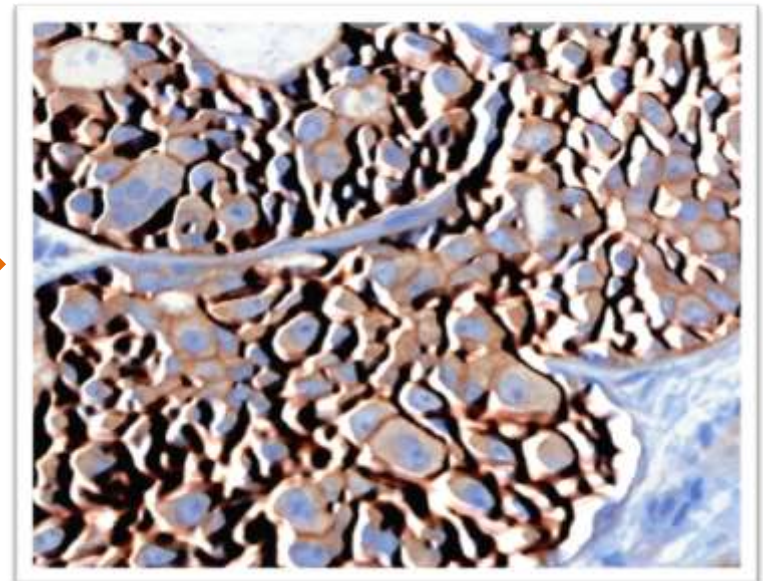
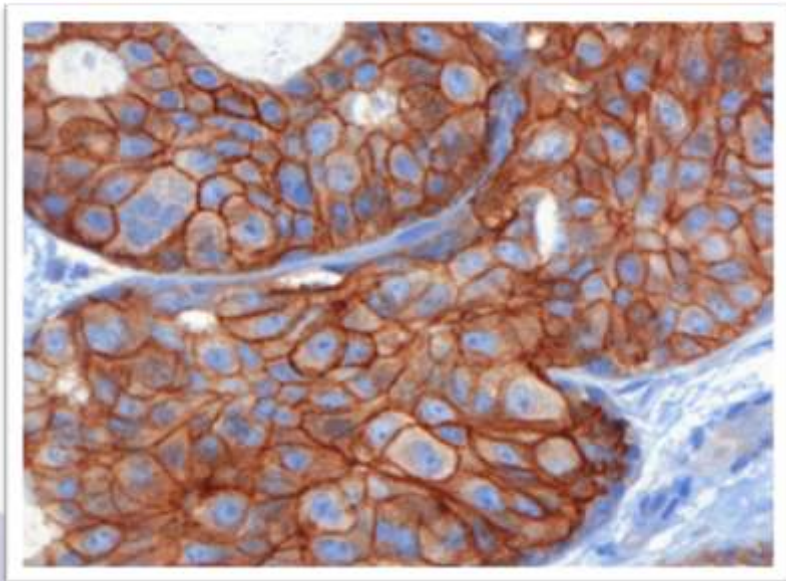




About the algorithm

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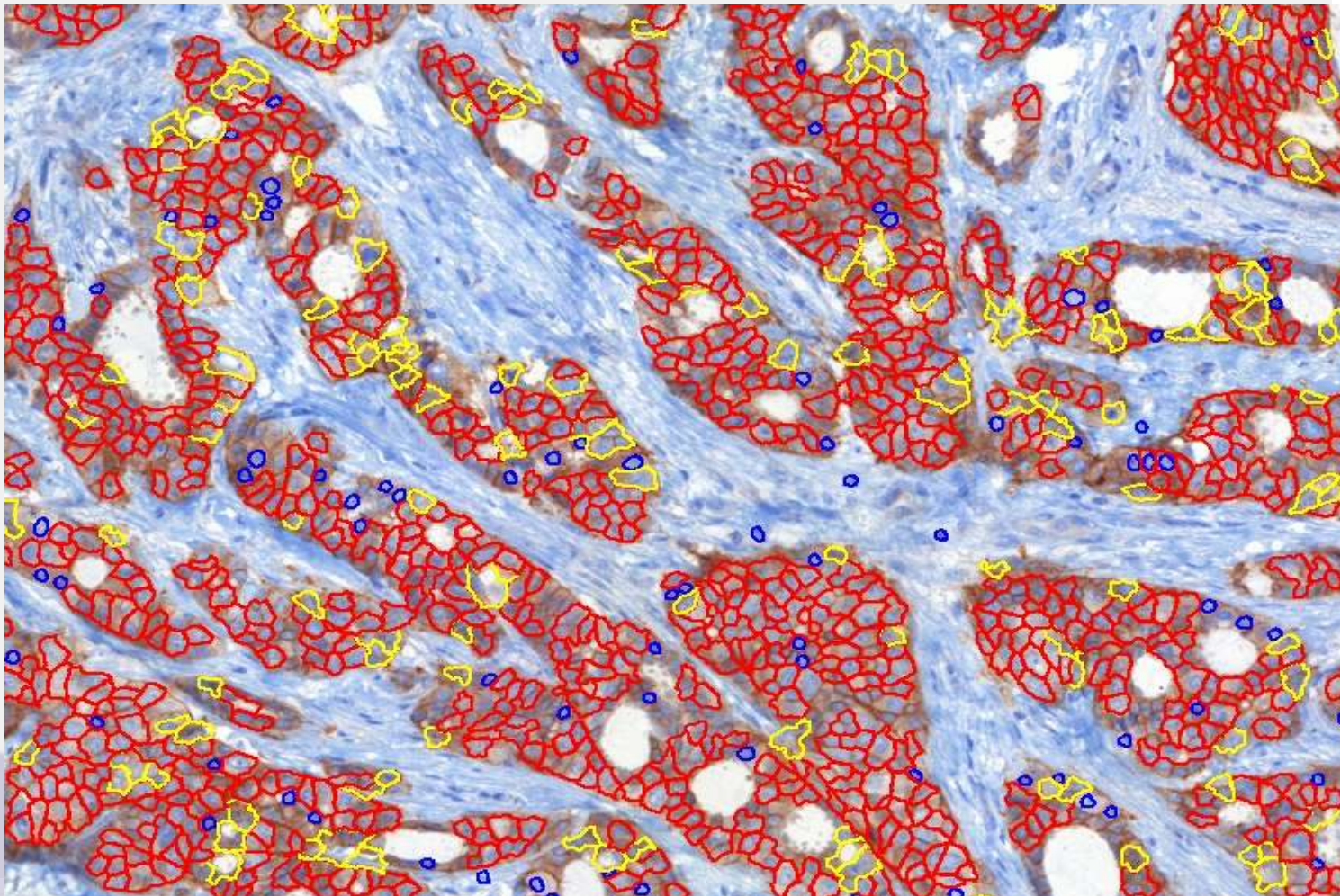
- **Color deconvolution**
- **Intensity based topographical analysis**

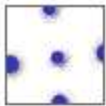
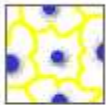
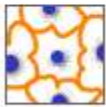
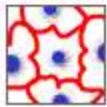




Scoring

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	0
	+1
	+2
	+3



Final review

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The screenshot displays the 3DHISTECH software interface. On the left is a large histology image of tissue with brown-stained nuclei. On the right is a classification gallery with a grid of small images, each labeled with a number (e.g., 228, 229, 234, 236). A tooltip over one image shows: Area: 43.41, Per: 25.44, SF: 0.58. At the bottom right is a 'Field Parameters' table.

Item	Value
FA	0.15
MA	0.03
ND	768
rMA	19.98
INO	5106.33
Hzcote	165.79
rHOPos	71.74
rMAPos	72.69
CNO-0	217
CNO-1+	72
CNO-2+	205
CNO-3+	274
CMA-0	1024.62
CMA-1+	2628.19
CMA-2+	1043.19
CMA-3+	11075.91
CAugPos-0	223.68
CAugPos-1+	165.49
CAugPos-2+	128.32
CAugPos-3+	83.41
Abred_PS	9
Abred_JS	3
Abred_TS	8

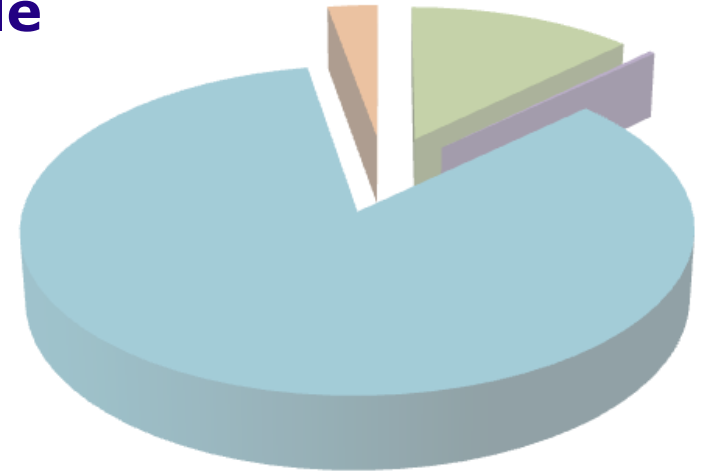
- **Nuclei/membrane relocalisation**
- **Classification Gallery**
- **Measurement Visualization**



Export data

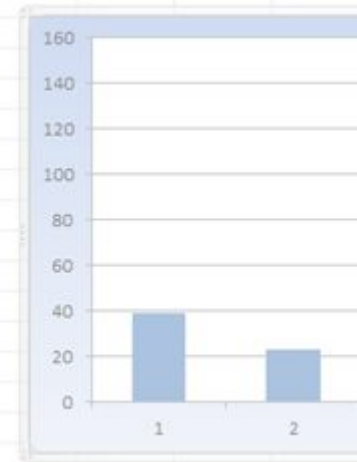
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- **.CSV file export, Office compatible**
- **Region specific measurements:**
 - **Field area**
 - **Number of detected objects**
 - **Field score, H-score**
- **Object specific measurement:**
 - **Area, perimeter, shape factor**
 - **Intensity parameters**
 - **Score**
 - **Etc.**



Slide Path 10301_ER
MISP File: ER12(142024_06112012)
Date Of M 2012.11.23 9:10

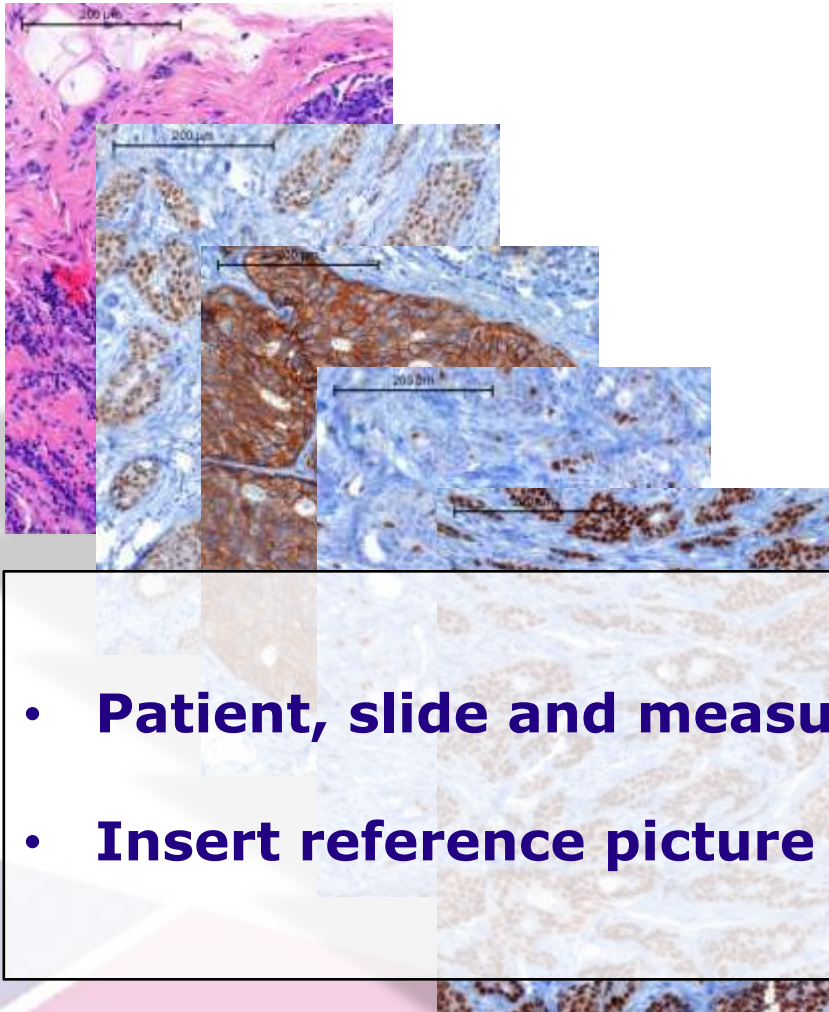
Area	Peri	SF	CDBrownI	CDBlueInt	Score
32,1635	20,9512	0,9208	97,3731	241,1529	3+
42,0017	23,854	0,9276	93,2677	250,0656	3+
29,7309	20,0776	0,9268	79,2545	243,3545	3+



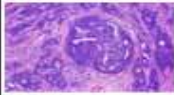


Case Report

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Patient name:	Anna Kovács	Date of Birth:	10.11.1948.
Sex:	female	Race:	eur.
Patient ID:	122425	Case number:	425111
Requester:	Dr. Tibor Tóth		

Block ID:	1231232	Procedure:	biopsy	Final Score	Her2 pos.
Slide ID:	10301-07_HE_I-1	Staining:	H/E	Comment:	
	Test Name	Assisted score			
	ER	8			
	HER-2	3			
	KI-67	5			
	PR	8			

Slide ID:	10301-07_ER_I	Staining:	ER	Comment:	8
					

Slide ID:	10301-07_HER2_I	Staining:	HER-2	Comment:	3
					

Slide ID:	10301-07_KI-67_I	Staining:	KI-67	Comment:	5
					

Slide ID:	10301-07_PR_I	Staining:	PR	Comment:	8
					

Diagnosis:				
Inv. Her2 pos. Carc.				
2010.06.29 15:47:30				Dr. Imre Horváth

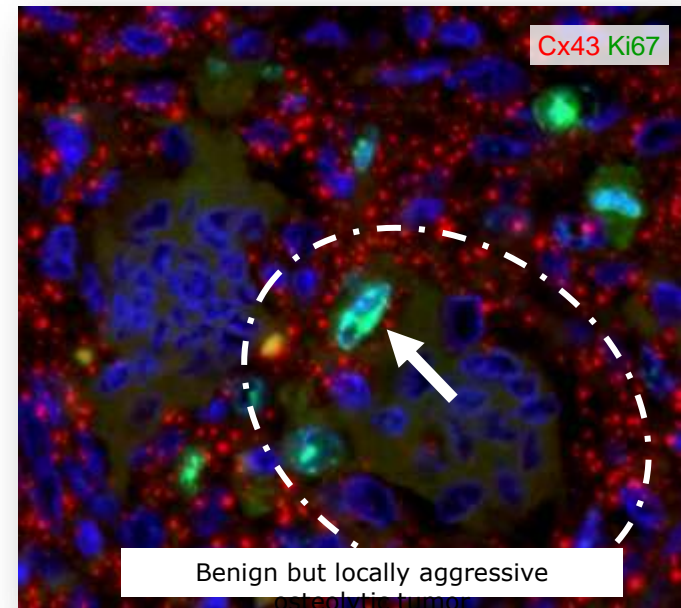
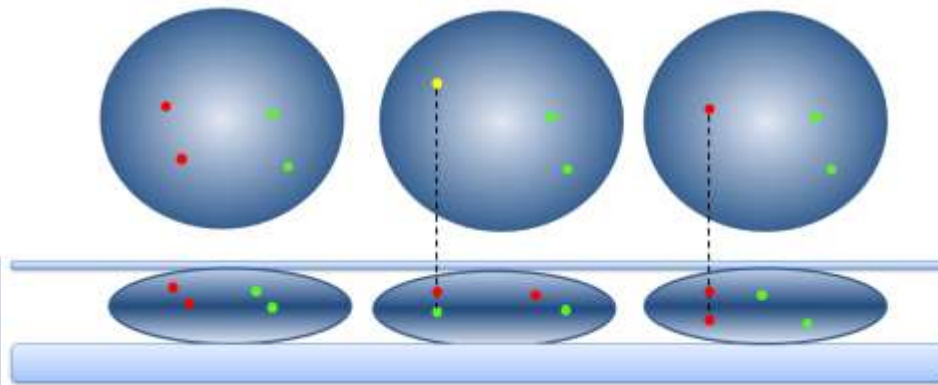
- Patient, slide and measurement data in one table
- Insert reference picture from slides



Fluorescence Quantification Problems

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- **Small signals**
- **Signal overlapping**
- **Digital still images - sampling bias**
- **Random colocalization**
- **Truncation effect**

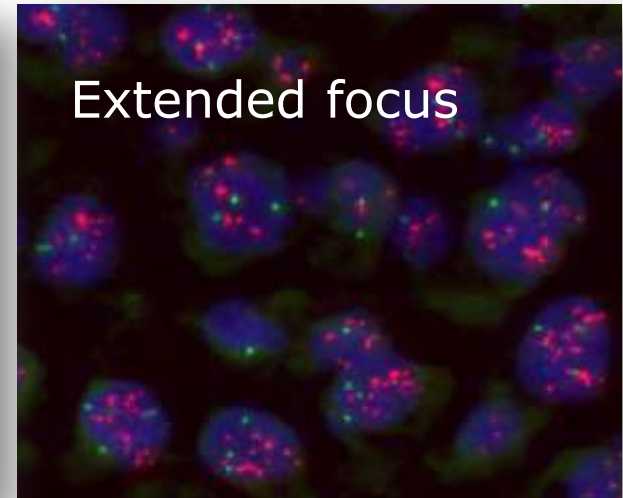
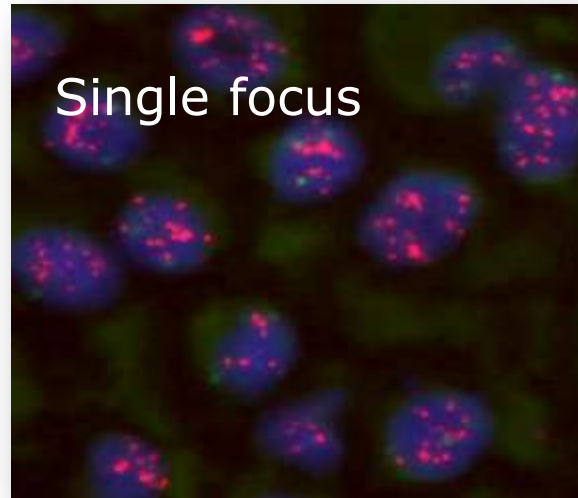




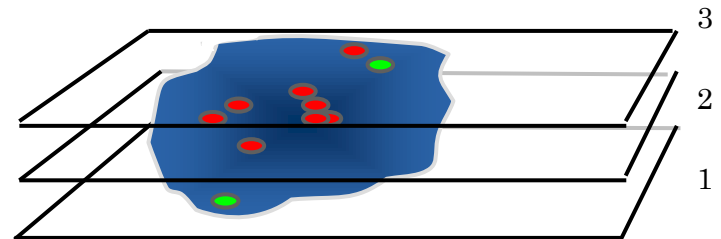
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Area sensor in Fluorescence application

- **Extended focus**



- **Z-stack scanning**

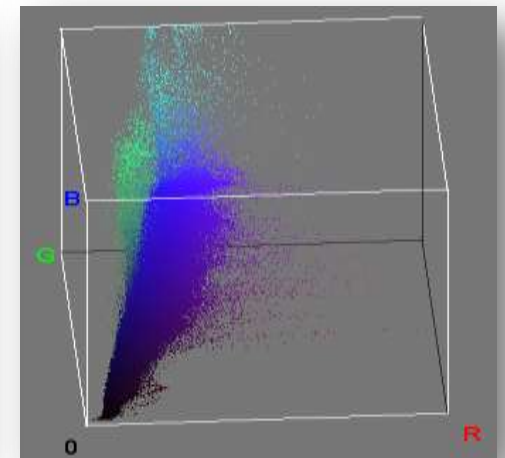
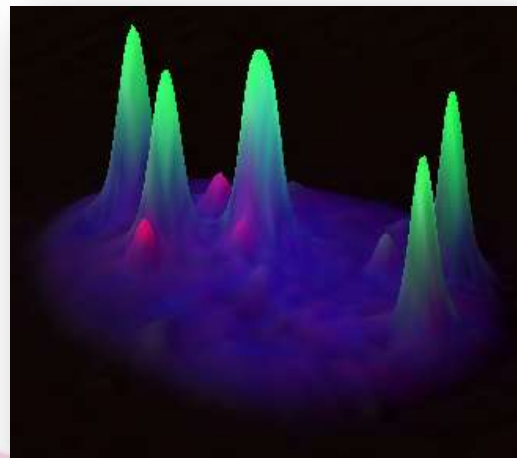
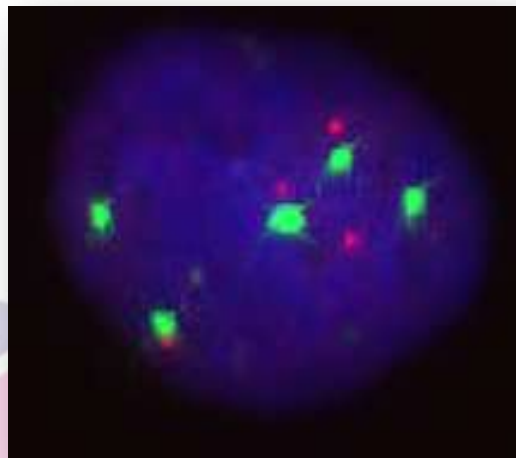
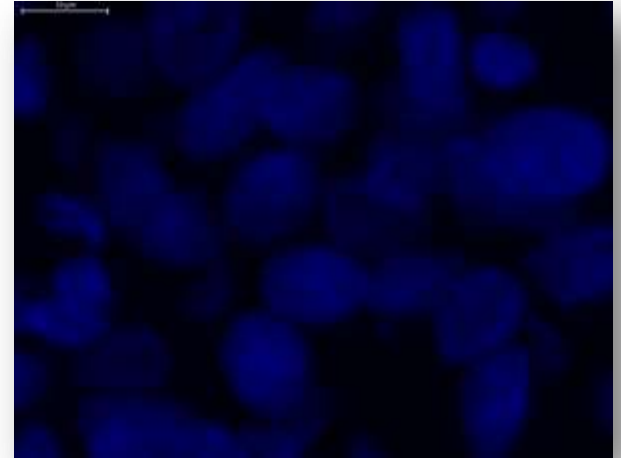




FISHQuant

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- **Cell nuclei detection** in DAPI channel
 - Morphological characteristics of the cell's nuclei
- **FISH spot detection** – threshold
 - Intensity amplification





FISHQuant Module

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Segmentation

Show Results Show Advanced Settings

Clusters

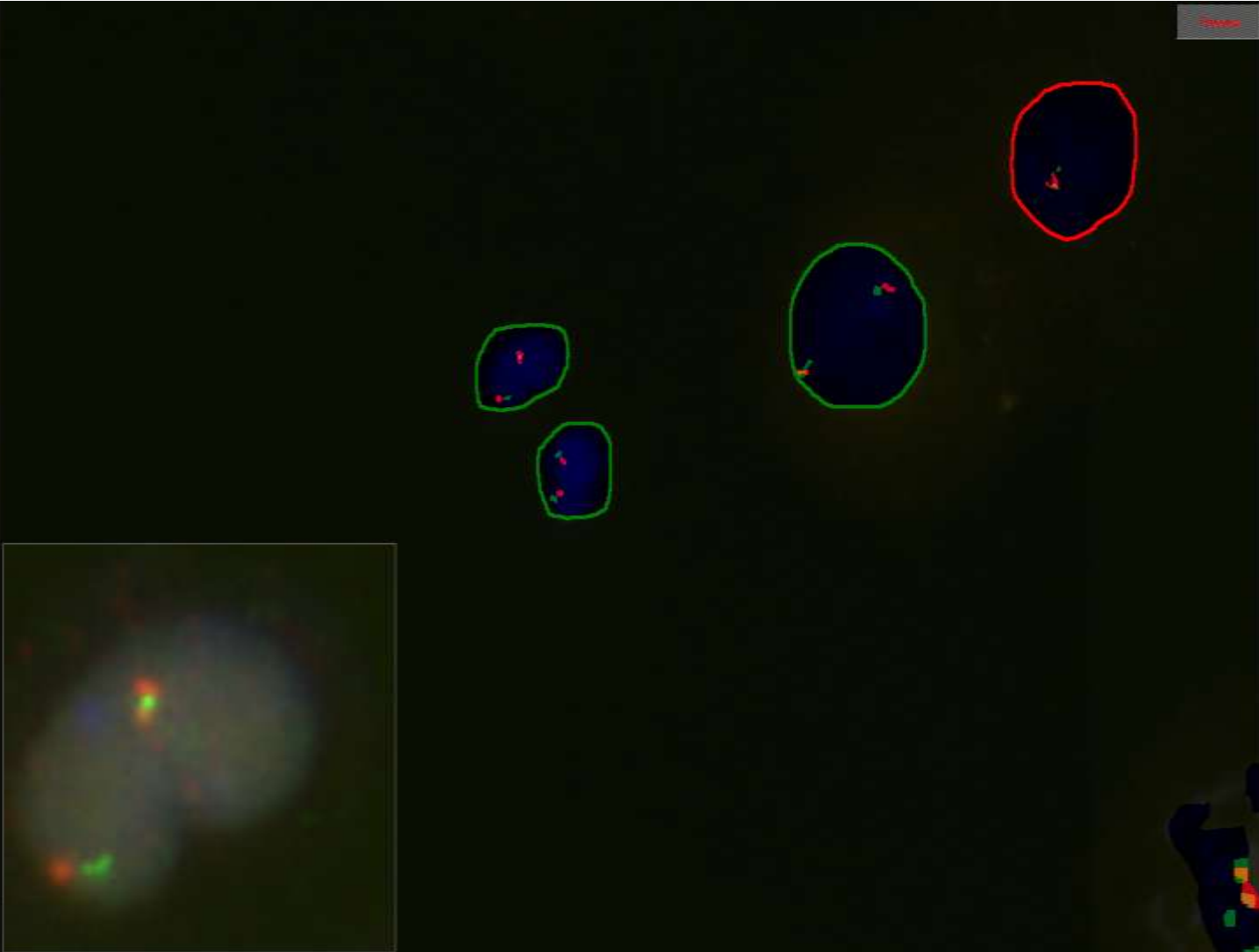
Negative Positive Artefact

Show warning when Artefact > %

Stop when object count >

Gallery Settings

Addition Mode	Show/Hide Gallery
Remove	<input type="checkbox"/>
Gallery Element Count: <input type="text" value="0"/>	
Gallery ROI Size (μm): <input type="text" value="30"/>	





FISHQuant classification gallery

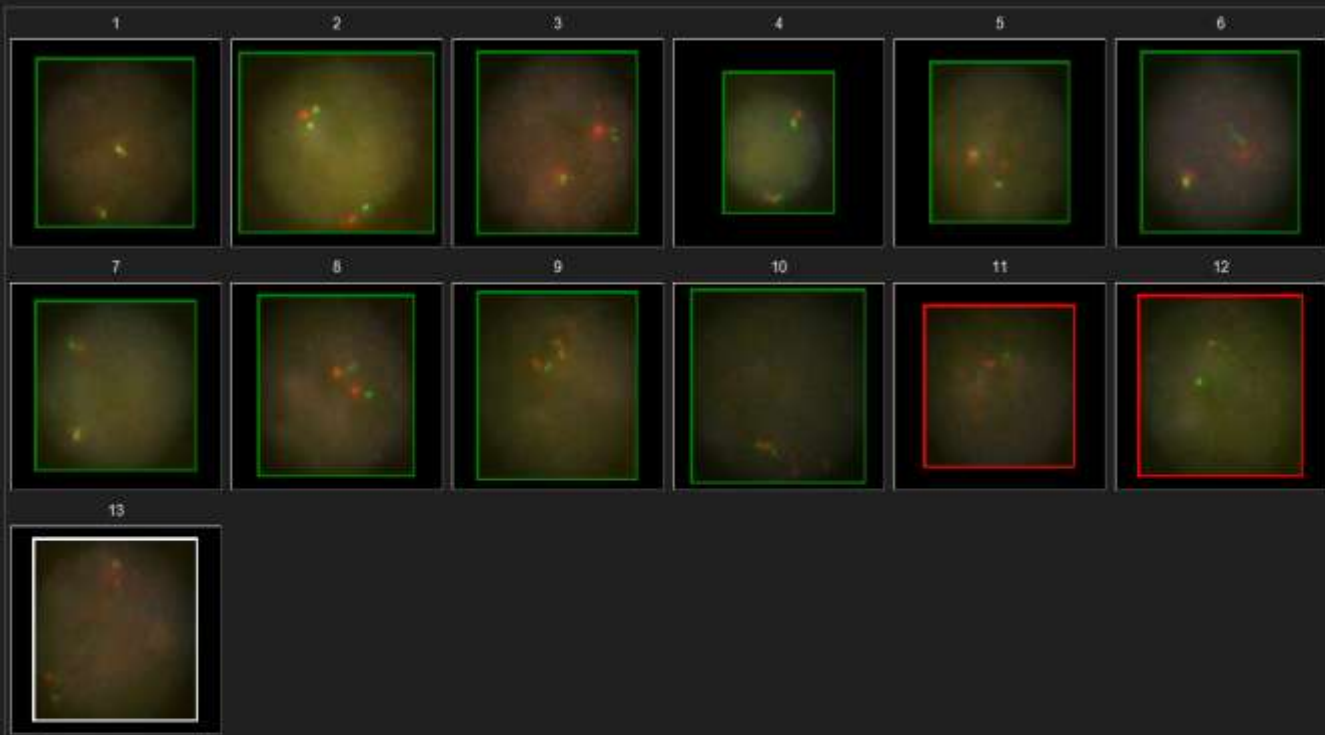
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Slide Tools: Auto Save, Save to

Slide Visual Tools: SlideView, Boundary, Outline

Gallery Tools: Border Size, Zoom

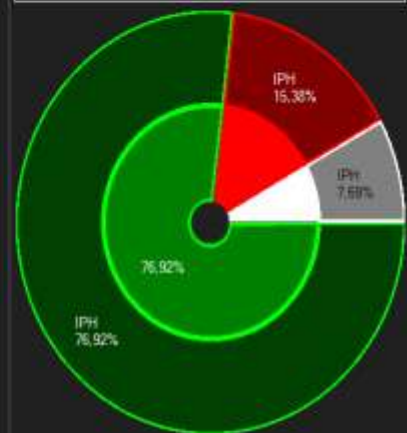
Group Select, Tooltip, Zoom to fit



All	Metaphase	Interphase
Negative	Metaphase, Negative	Interphase, Negative
Positive	Metaphase, Positive	Interphase, Positive
Artefact	Metaphase, Artefact	Interphase, Artefact

Name	Percent	Count
Negative	76,92 %	10
Interphase	100 %	10
Positive	15,38 %	2
Interphase	100 %	2
Artefact	7,69 %	1

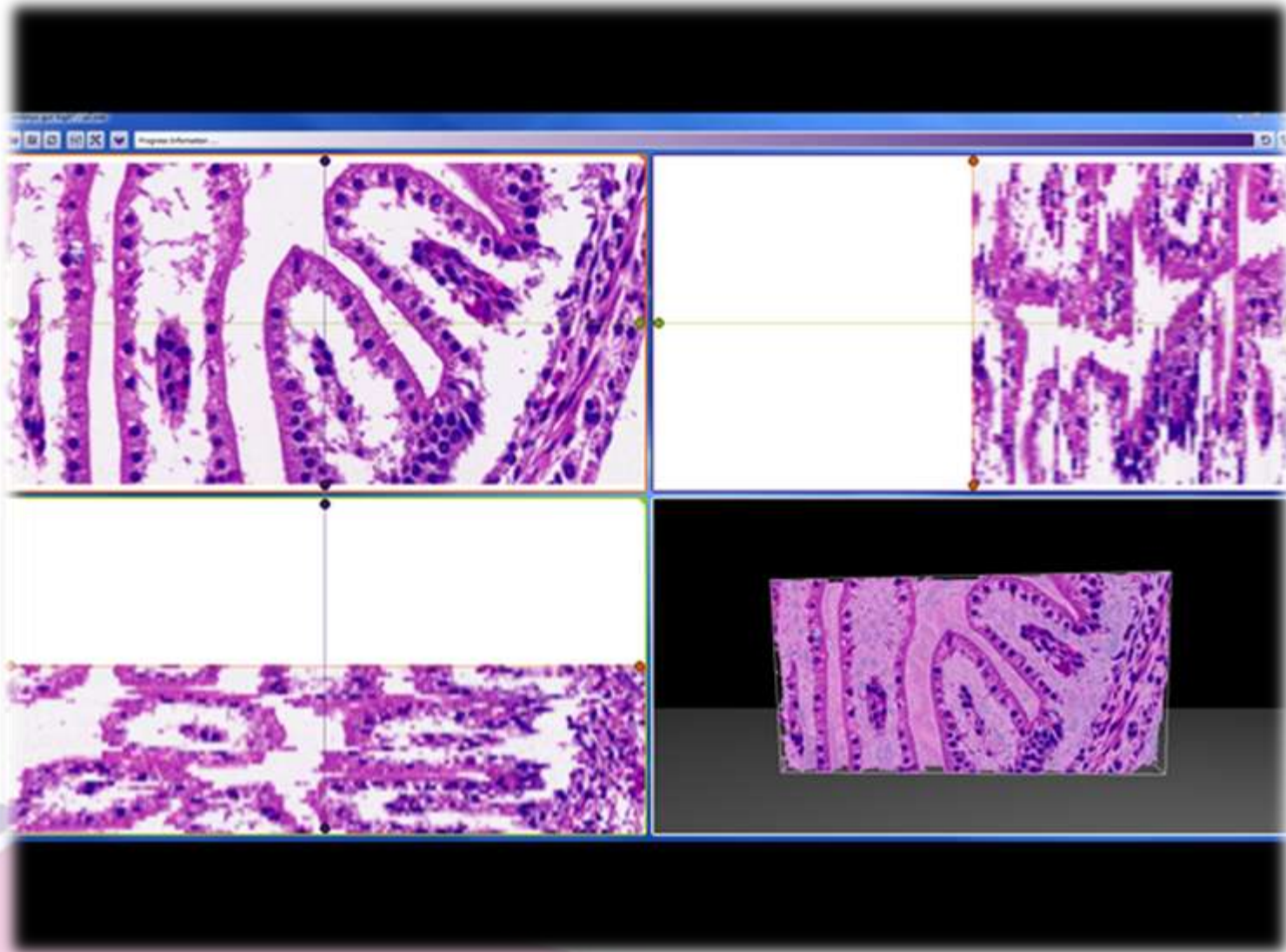
Copy Data to Clipboard





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3D Reconstruction and image analysis





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Thank you for your attention!

Questions?

Please visit the Sysmex booth for live scans and demos!

<http://www.3dhitech.com>

<http://pathonet.org>

<http://slides.3dhitech.com/casecenter>

<http://www.sysmex-lifescience.com/>

<http://scanner-contest.charite.de/en/>