

Oui, l'histologie peut devenir numérique et utiliser l'IA !

Apport de la numérisation : données dématérialisées dans le laboratoire d'histologie

Apport de l'IA : contrôle qualité automatisé des lames numériques

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Senior principal scientist, pathobiology

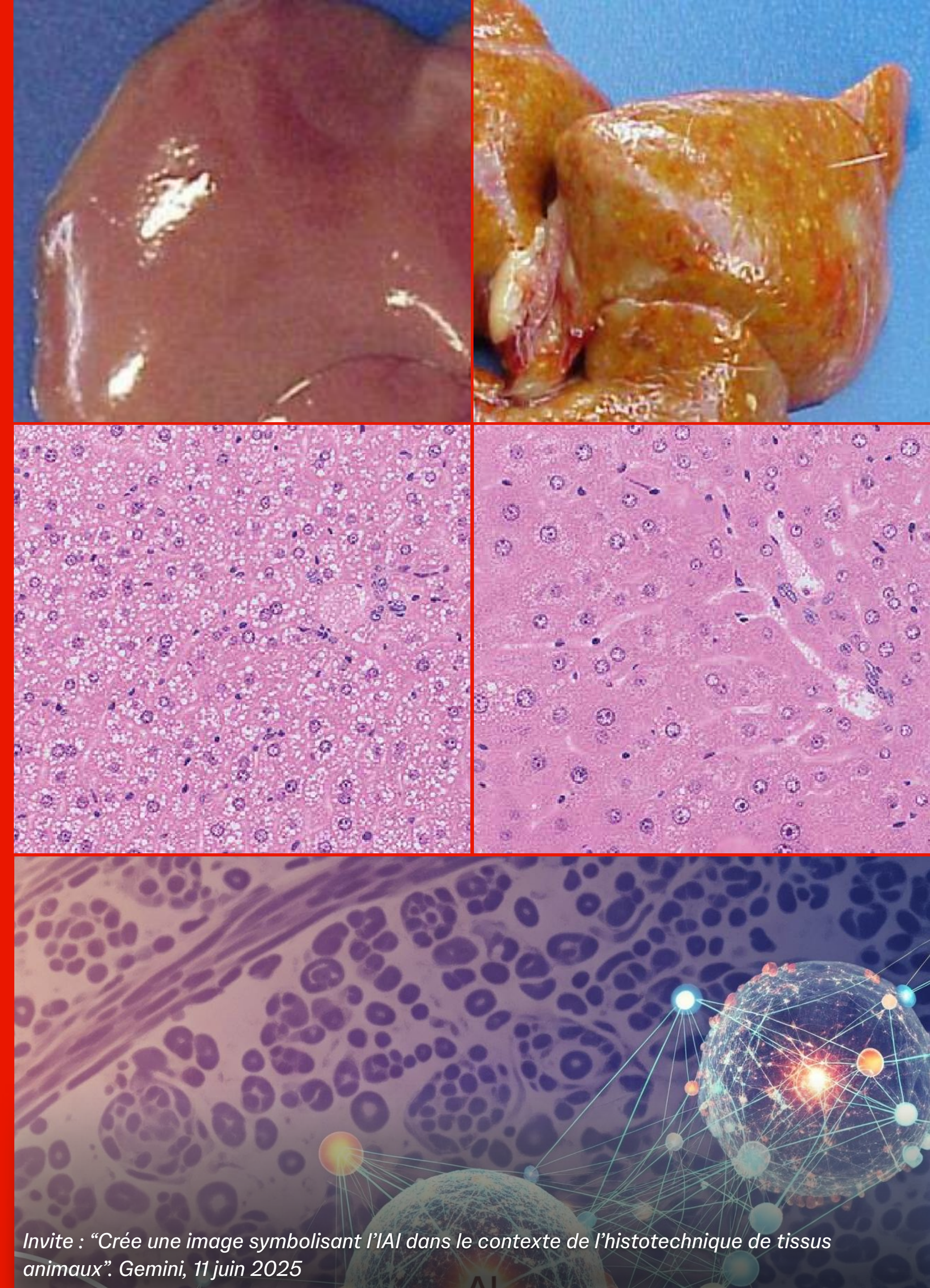
DPDS – Preclinical Sciences & Translational Safety

Congrès de l'Association Française d'Histotechnologie

Palais des Congrès, Grasse – 18-20 juin 2025

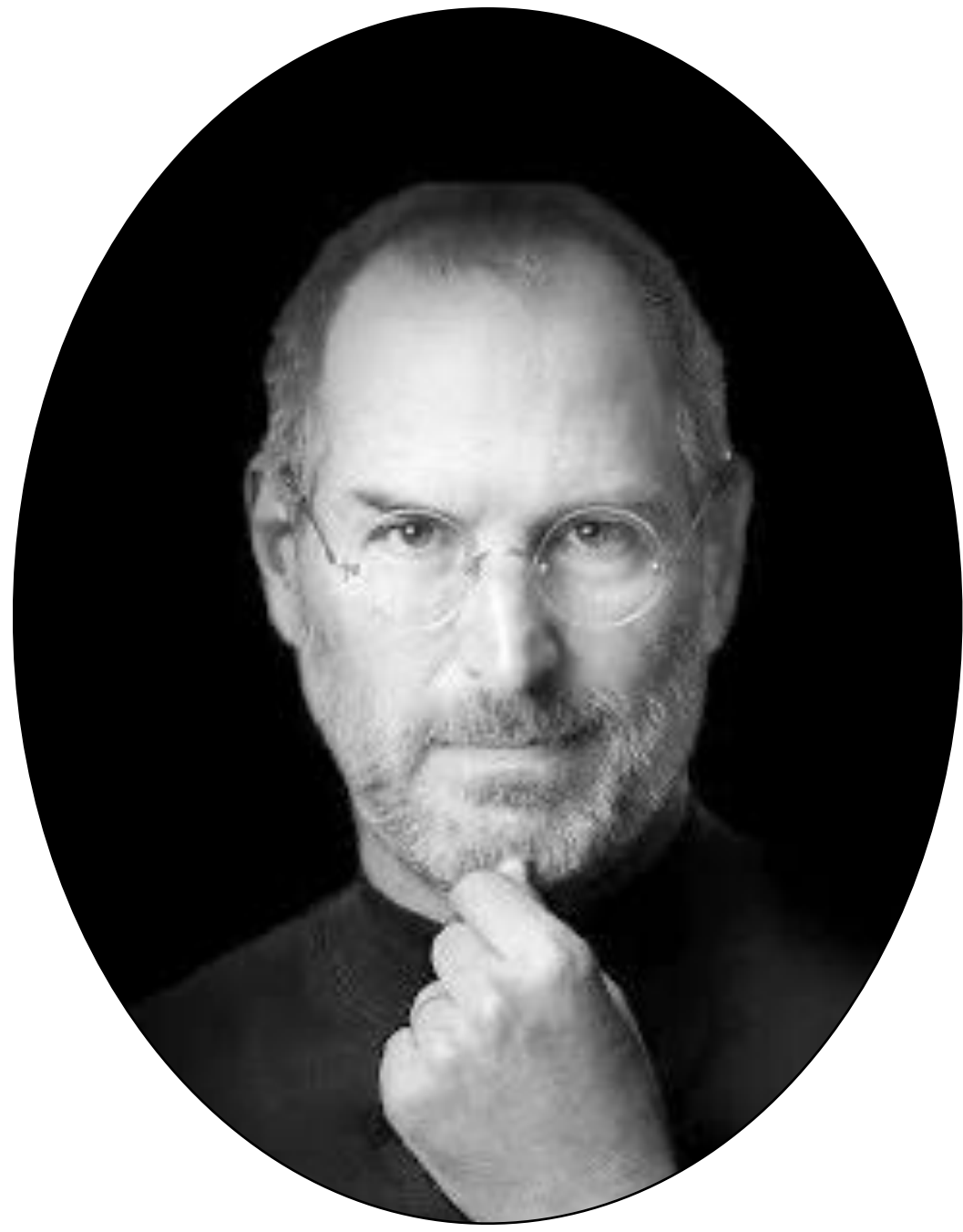
Dernière mise à jour : 23 juin 2025

Johnson&Johnson



Invite : "Crée une image symbolisant l'IAI dans le contexte de l'histotechnique de tissus animaux". Gemini, 11 juin 2025

Steve Jobs, 2005



(co-founder of Apple Inc.)

Address at Stanford University

“Have the courage to follow your *heart* and *intuition*. They somehow already know what you *truly want to become*. Everything else is secondary”

Disclosures

The presenter is

- A full time employee of J&J, owning stock – describing internal projects
- A consultant for ForVizio – without competing interests

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Acknowledgements

Scientific & In Vivo Strategy (IT & infrastructure) – PSTS, J&J

- Benjamin Sommen, Pieter Van Nuffel

Innovative Pathology lab (Histology) – PSTS, J&J

- Ellen Broeckx & team
- Mieke Verslegers & team
- Stephanie Rivera & team

AIRA Matrix

Indica Labs (HALO Link)

Agenda

1 Digitisation and digital data

Workflow from specimen to patho report

Goals and prerequisites

New equipment

The digital workflow

Strengths and weaknesses

Conclusion

2 AI and automated quality control of digital slides

Types of artefacts to detect

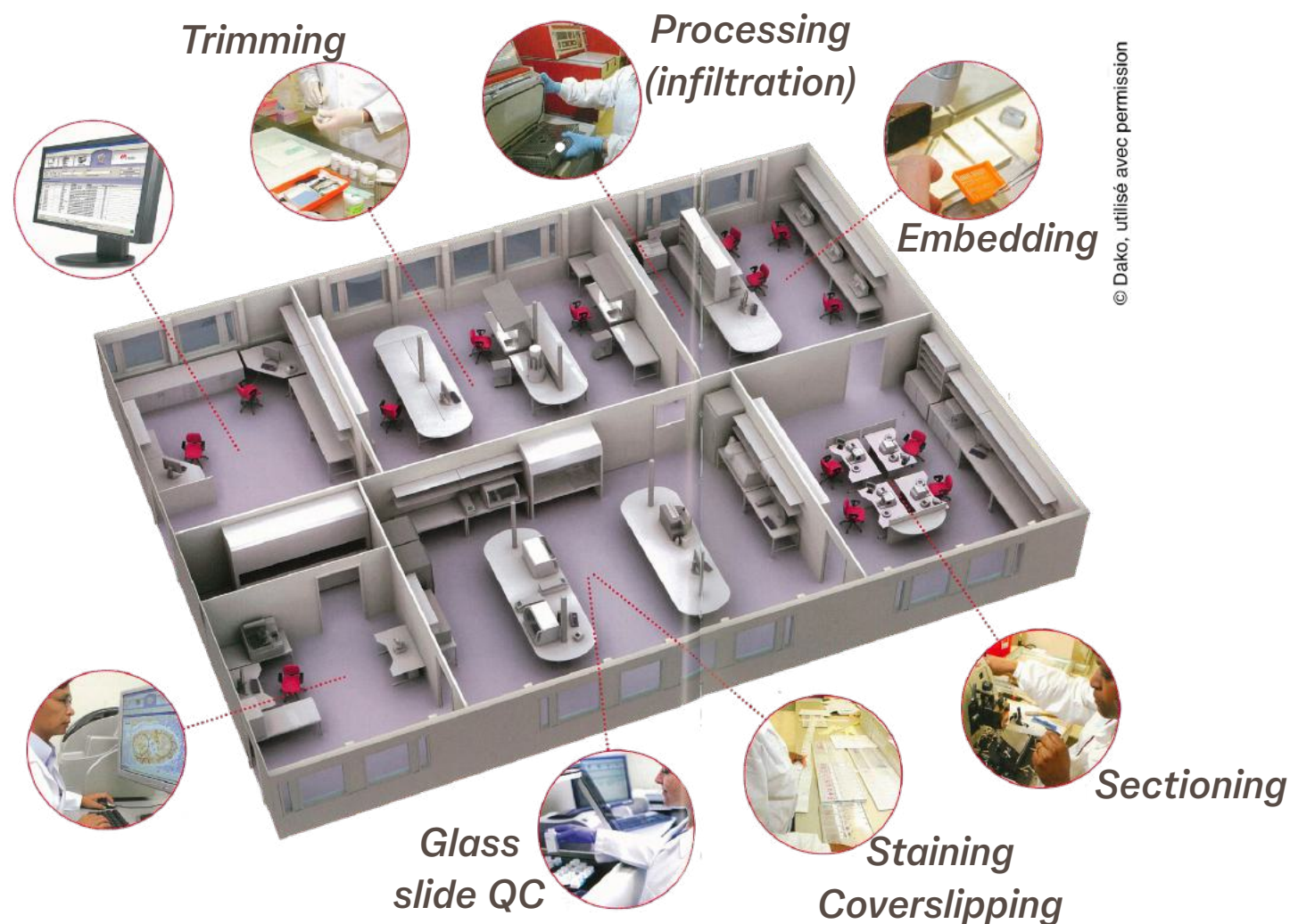
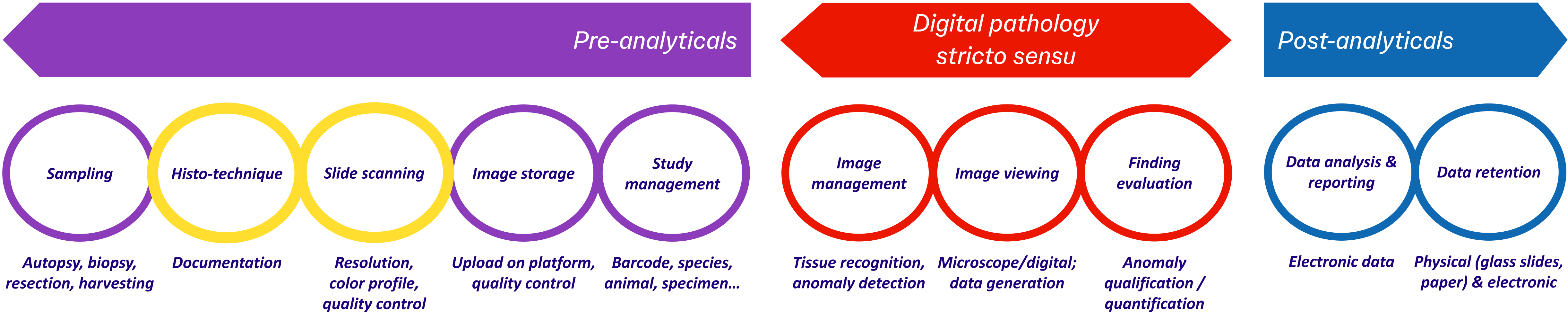
The results

Some metrics

Conclusion

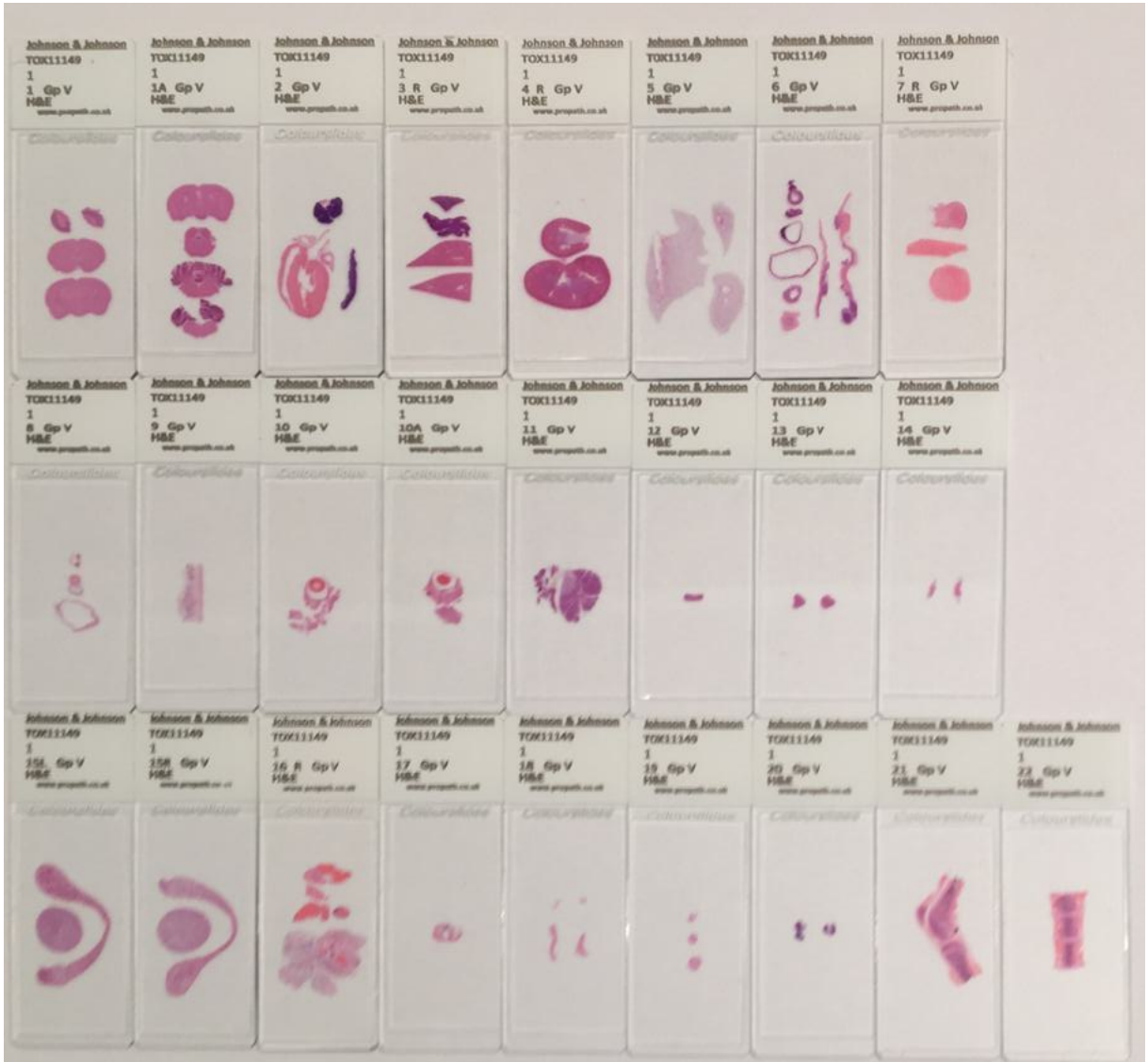
Workflow of anatomic pathology

Some milestones benefitting from digitisation and AI



Toxicology study
25 **slides** for one male rat (with the J&J blocking) →

- 46 specimens (organs/tissues)
- liver has **several sections** on 1 slide
- brain, testis have several sections on **several slides**



Pre-analytical

Digitising the histotechnique documentation (LIS/“paperless histolab”)

Goals

- ***No more manual input*** on paper sheets
- Adapt the automated workflow to the work posts of an histolab
- ***Track the equipment*** (preventative maintenance, productivity)
- Produce ***retrospective*** reports and ***forecasts***
- ***Interface*** with the other digital platforms
- (Internal development by the Safety and In Vivo Strategy (IT) team)

Expected benefits

- Decreased ***lead times***
- Reduced ***costs***
- Improved ***quality*** of the slides
- Increased ***productivity*** of the histolab
- Improved ***precision*** of the pathology results

Digitising histoproces: 2 commercial tools

Fortelinea Prima

Roche Navify

Software Solutions

Prima is specimen tracking and management for the modern laboratory.

Lab Manager

Monitor your lab. Get notified of QA issues in real time. Generate reports and much more

Lab Tech

Reduce paperwork increase efficiency. Automatically log all work.

Pathologist

Advanced QA/QC tracking, See full case history. Easy access to patient history, Request consults and requisition forms

IT Personnel

Information at your fingertips



Diagnostics

SolutionsServicesResponsables ensembleTransformer la santé

navify Pathology Lab Advantage

Tirez le meilleur des instruments de votre laboratoire par un pilotage précis des flux de travail





Prerequisites of the Histology Execution System (HES)

Fill the gap: histotechnique is the only lab still generating paper documentation

User-driven development: features come from their daily experience and processes

- Laboratory-specific!
- Metrics decided by histoteam to prove that the histoprocess is improved

Interfaced in our existing digital pathology tools

- **Barcode** on cassettes, glass slides
- Feeding **metadata of digital slides**
- Other **study databases** (toxicology data, clinical pathology...)

Reduce manual input

- Work with templates and predefined lists
- Best practices / Guidelines
- **INHAND** (tox path societies: BSTP, ESTP, JSTP, STP)
 - Controlled vocabulary for **microscopic findings**
- **SEND** – **CDISC** (supported by FDA)
 - Structured presentation of **nonclinical data** (with controlled vocabularies of each discipline)

Targets

- **Nonclinical** studies
 - Including process validation for studies performed under Good Laboratory Practices
- **Discovery**/investigative studies

The new equipment of the HES Workflow

Existing hardware, interfaced to HES

- ***Central cassette & slide printer***
 - To print accurate 2D barcodes and allow traceability along the whole histoprocess

Specific hardware at each workstation

- ***Barcode reader*** (2D barcodes)
- ***Hardened computer*** with touchscreen, keyboard, mouse on movable stand
- Local ***slide printer***
 - At each microtome workstation, to print a slide on the spot as needed (insufficient quality, broken...)



*Central
cassette
printer*

*Central
slide printer*

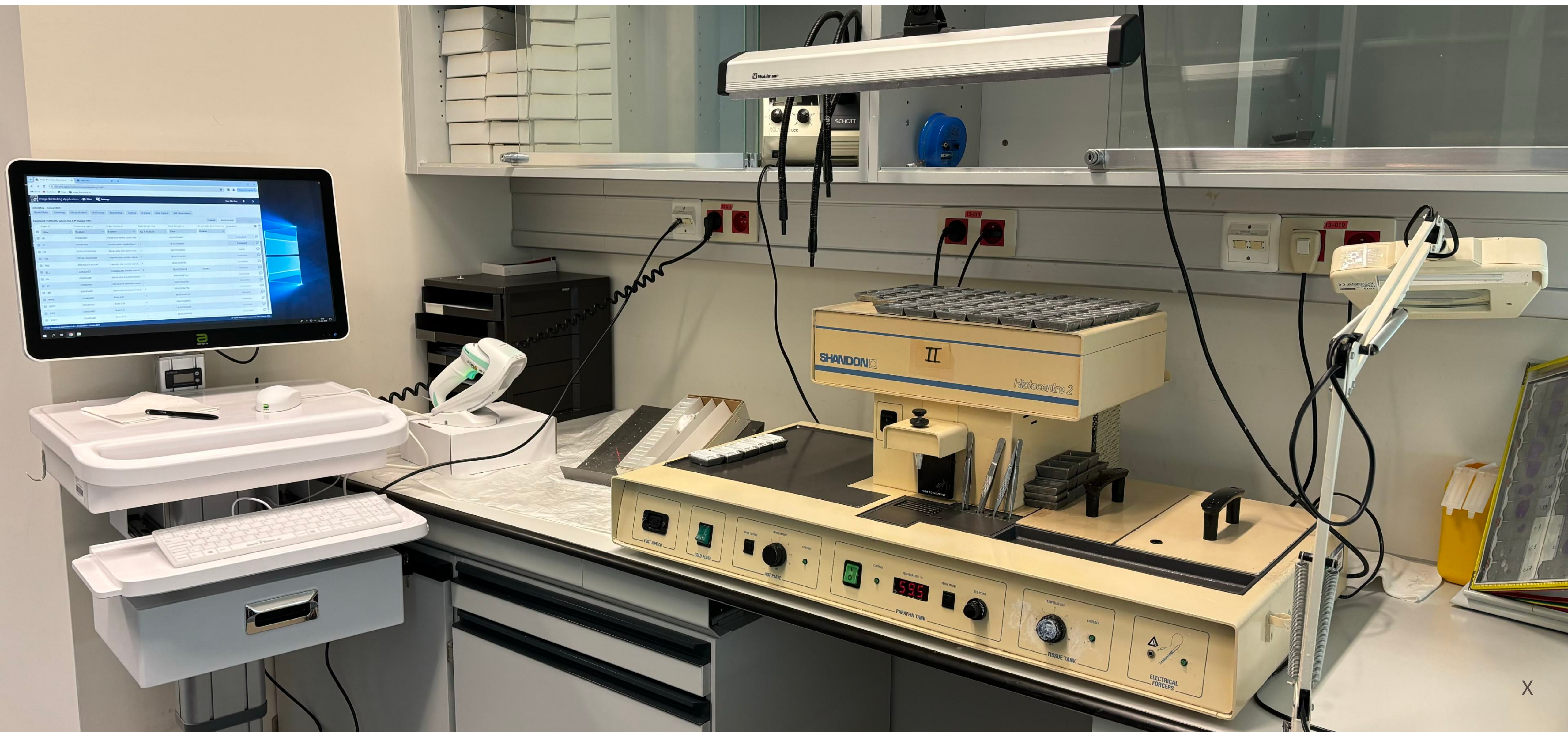
Trimming



*Barcode
reader*

*Tray with
computer and
touchscreen*

Embedding



Sectioning



Local
cassette
printer

Barcode
reader

Staining: H&E

The stainer-specific LIS is not interfaced with HES

- Reagent management
- Preventive maintenance



Staining: molecular pathology

IHC, IF, ISH...



Supplier-specific LIS (protocol management)

The workflow in the Histology Execution System

The study

Image Barcoding Application ViewSettings Barale Erio									
Refresh Experiments Add Experiment									
Experiment Number	Title	Director	Species	Strain	Route of administration	GLP			
Filter	test	Filter	Filter	0 values	Filter	Filter			
PATB24-12	Test muis		Mouse	Not Specified	None	Non-GLP			
PATB24-13	Test hond		Dog	Beagle	None	Non-GLP			
PATB24-15	Test guinea pig		Guinea pig	Not Specified	None	Non-GLP			
PATB24-11	Test rat		Rat	Not Specified	None	Non-GLP			
PATB23-94	Test Elien		Hamster	Not Specified	None	Non-GLP			

Image Barcoding Application 3.0.1 - Production - 21-Mar-2024

All Rights Reserved. Developed by Data Sciences PSTS.

The animals with their slides

- Filtered on brain & liver specimens



Image Barcoding Application

 View

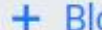
 Settings

Barale Erio



Experiment PATB24-11, species Rat

 Slides

 Block/Slide

 Stain control slide

 Gross Lesion Block

 Blocks/Slides

 Stainer protocol

 Blocks/Slides

 Export ...

	Treatment ▾	Animal # ▾	Organ ▾	Organ names ▾	Block Sample # ▾	Gross Lesion ▾	Barcode ▾	Level ▾	Stain ▾					
	0 values ▾	E.g. 1-10,20,A1-A5,B1	Filter ▾	3 values × ▾	E.g. 1-10,20,30	0 values ▾	Filter	E.g. 1-10,20,30	Filter ▾					
	Group 1	0101	1A	Brain (4x)	1	None	BEA0083698	1	HE					
	Group 1	0101	1B	Brain (3x)	1	None	BEA0083699	1	HE					
	Group 1	0101	3	Liver (2x)	1	None	BEA0083701	1	HE					

Edit a study

Image Barcoding Application

View

Settings

Barale Erio

Refresh Experiments

Add Experiment

Experiment Number	Title	Director	Species	Strain	Route of administration	GLP		
PATB24-12	Test muis		Mouse	Not Specified	None	Non-GLP		
PATB24-13	Test hor					n-GLP		
PATB24-15	Test gu					n-GLP		
PATB24-11	Test rat					n-GLP		
PATB23-94	Test Elie					n-GLP		
TOX-SierraSlide	Study to					n-GLP		
PATB23-64	Test mo					n-GLP		

General

User Roles

Treatments

Animals

Experiment Number

PATB

24-11

Start date

5/APR/2024

Title

Test rat

GLP

Site

BEBE: Belgium - Beerse

Department

NCS Pathology-BE

Director

Test Facility

Beerse

Species

Rat

Route of administration

None

Treatment Duration (in days)

Therapeutic Area

General

User Roles

Treatments

Animals

Treatment	#	Sex	Study Phase
Group 1	0001	MALE	TERMINAL
Group 1	0101	FEMALE	TERMINAL
Group 1	0102	FEMALE	TERMINAL

General

User Roles

Treatments

Animals

Principal Investigator

Compound Pathologist

Study Pathologist

General

User Roles

Treatments

Animals

Code	Name	Compound	Route of Admin	Concentration	Test Article Vehicle
GROUP1	Group 1		None		Aqua based solution

J&J

Histotechnologie : apport de la numérisation et de l'IA
Congrès AFH, Grasse – 18-20 juin 2025

X

User-defined columns

Comment block/ slide

Add new blocks and/or slides

Image Barcoding Application

View

Settings

Barale Erio

Experiment PATB24-11, species Rat

Sex

Treatment Code

Treatment

Animal #

Organ

Organ names

Block Sample #

Gross Lesion

Block remark

Block Barcode

Barcode

Level

Slide remark

Stain

Stain name

Stainer protocol

Creation Date

Treatment	Animal #	Organ names	Block Sample #	Gross Lesion	Barcode	Level	Stain
0 values	E.g. 1-1	3 values	E.g. 1-10,20,30	0 values	Filter	E.g. 1-10,20,30	Filter
Group 1	0101	Brain (4x)	1	None	BEA0083698	1	HE
Group 1	0101	Brain (3x)	1	None	BEA0083699	1	HE
Group 1	0101	Liver (2x)					
Group 1	0102	Brain (4x)					
Group 1	0102	Brain (3x)					
Group 1	0102	Liver (2x)					

+ Block remark

Block remark

Filter

No parathyroid visible

Serial section

Add extra levels to block 10 with sample 1

Animal # 0101

Organ 10 - Skeletal muscle, m. quadriceps fe

Add Slide(s) only

Stain HE x BrdU x Ki67 x KIM-1 x

Levels To Add 1

Add extra sample for block 10

Animal # 0101

Organ 10 - Skeletal muscle, m. quadriceps femoris (2x)

Add Block + Slide(s)

Stain HE x BrdU x Ki67 x KIM-1 x

Levels To Add 1

* ≡

all screen columns can
be toggled on/off by
the users

*

Experiment PATB24-11, species Rat

 Slides

 Block/Slide

 Stain control slide

 Gross Lesion Block

 Blocks/Slides

 Stainer protocol

 Blocks/Slides

 Export ...

	Treatment ▾	Animal # ▾	Organ ▾	Organ names ▾	Block Sample # ▾	Gross Lesion ▾	Barcode ▾	Level ▾	Stain ▾					
	0 values ▾	E.g. 1-10,20,A1-A5,B1	Filter ▾	0 values ▾	E.g. 1-10,20,30	0 values ▾	Filter	E.g. 1-10,20,30	Filter ▾					
	Group 1	0101	10	Skeletal muscle, m. quadri...	1	None	BEA0083708	1	HE					
	Group 1	0101	11	Urinary bladder; Esophagu...	1	None	BEA0083709	1	HE					
	Group 1	0101	12	Eyes (2x); Optic nerve(s); H...	1	None	BEA0083710	1	HE					
	Group 1	0101	13	Mammary gland	1	None	BEA0083711	1	HE					
	Group 1	0101	14	Salivary gland, parotid; Sali...	1	None	BEA0083712	1	HE					
	Group 1	0101	15	Pituitary gland	1	None	BEA0083713	1	HE					
	Group 1	0101	16	Adrenal glands (2x)	1	None	BEA0083714	1	HE					
	Group 1	0101	17	Thyroid glands (2x); Parath...			BEA0083715	1	HE					
	Group 1	0101	18	Pancreas			BEA0083716	1	HE					
	Group 1	0101	1A	Brain (4x)			BEA0083698	1	HE					
	Group 1	0101	1B	Brain (3x)			BEA0083699	1	HE					
	Group 1	0101	2	Heart; Aorta, thoracic			BEA0083700	1	HE					
	Group 1	0101	22	Ovaries (2x)			BEA0083717	1	HE					
	Group 1	0101	23	Uterus (2x); Vagina; Cervix			BEA0083718	1	HE					
	Group 1	0101	24	Oviducts (2x)			BEA0083719	1	HE					
	Group 1	0101	25	Larynx	1	None	BEA0083720	1	HE					
	Group 1	0101	26	Tongue	1	None	BEA0083721	1	HE					
	Group 1	0101	28	Peripheral nerves, sciatic (...)	1	None	BEA0083722	1	HE					
	Group 1	0101	29	Lymph nodes, popliteal (2x)	1	None	BEA0083723	1	HE					
	Group 1	0101	3	Liver (2x)	1	None	BEA0083701	1	HE					
	Group 1	0101	32A	Spinal cord, cervical	1	None	BEA0083724	1	HE					
	Group 1	0101	32B	Spinal cord, thoracic	1	None	BEA0083725	1	HE					
	Group 1	0101	32C	Spinal cord, lumbar	1	None	BEA0083726	1	HE					
	Group 1	0101	33	Bone, stifle with bone marr...	1	None	BEA0083727	1	HE					
	Group 1	0101	34	Bone, sternum with bone m...	1	None	BEA0083728	1	HE					
	Group 1	0101	35	Nose	1	None	BEA0083729	1	HE					
	Group 1	0101	4	Lung (2x)	1	None	BEA0083702	1	HE					

Select gross lesion for organ 10 of animal 0101

Gross Lesion

None ▾

✓ None

Visible

Not-visible

Add blocks and slides in batch – Positive/negative slides (for special stains) – Gross changes

Image Barcoding Application

View

Settings

Barale Erio

Experiment PATB24-11, species Rat

Slides

+ Block/Slide

+ Stain control slide

+ Gross Lesion Block

Blocks/Slides

Stainer protocol

Blocks/Slides

Export ...

Treatment	Animal #	Organ	Organ names	Block Sample #	Gross Lesion	Barcode	Level	Stain				
0 values	E.g. 1-10,20,A1-A5,B1	Filter	0 values	E.g. 1-10,20,30	0 values	Filter	E.g. 1-10,20,30	Filter				

Template

Treatments

Block Samples

Start Block Number at

Slide Levels

+ Create Multi Stain

Rat Full Tissue list

Rat Toleration List

Treatment	Animal #	Sex	Stain
Filter	E.g. 1-10,20,30	Filter	Filter
Group 1	0001	MALE	☒ HE
Group 1	0101	FEMALE	☐ AB
Group 1	0102	FEMALE	☐ AQP1
			☐ ASGR1
			☐ Adip
			☐ BHB
			☐ BLK
			☐ BTK
			☐ BrdU
			☐ CB1
			☐ CD103
			☐ CD11b

Blocks/slides are only created for animals that do not yet have a matching block/slide.

Save & Print

Save

Cancel

Add blocks & slides

Add positive/negative slides

QC outcome

Slide Levels

+ Create Multi Stain

POSITIVE

NEGATIVE

Stain
Filter
☒ HE
☐ AB

Add new gross lesion block with sample 1

Animal #

0001

Organ

Add

Block + Slide(s)

Gross Lesion

Visible

Stain

☒ Visible

Levels To Add

Not-visible

Add block for gross change at necropsy

Manage printers – Generate histosheets and reports

Image Barcoding Application

View

Settings

Barale Erio

Experiment PATB24-11, species Rat

Slides

+ Block/Slide

+ Stain control slide

+ Gross Lesion Block

Blocks/Slides

Stainer protocol

Blocks/Slides

Export ...

Treatment	Animal #	Organ	Organ names	Block Sample #	Gross Lesion	Barcode	Level	Stain
		1-A5,B1	Filter	0 values	E.g. 1-10,20,30	0 values	Filter	E.g. 1-10,20,30

Block Printers

Fa-Tech Vega (BEBE)

Slide Printers

Brady BBP12 Ventana (BEBE)

Leica IP-S New (BEBE)

Leica IP-S Old (BEBE)

Slidebel Duo 1 (BEBE)

Slidebel Duo 2 (BEBE)

Slidebel Duo 3 (BEBE)

Slidebel Duo 4 (BEBE)

Slidebel Duo 5 (BEBE)

Zebra GX430t (BEBE)

Export/print

Create Histo Sheets

Export as Excel

Export as PDF

Export/print Summary of blocks/slides per study

Treatment	Animal #	Organ	Organ names	Block Sample #	Gross Lesion	Barcode	Level	Stain
Group 1	0101	10	Skeletal muscle, m. quadriceps femoris (2x)	1	None	BEA0083708	1	HE
Group 1	0101	11	Urinary bladder; Esophagus; Trachea	1	None	BEA0083709	1	HE

Print Histosheet

AB V	AB NV	Code	Organ name(s)	Stain	P	E	Cu	St
		1A	Brain (4x)	HE				
		1B	Brain (3x)	HE				
		2	Heart	HE				
			Aorta, thoracic	HE				
		3	Liver (2x)	HE				
			Gall bladder	HE				
		4	Lung (3x)	HE				
		5	Spleen	HE				
			Kidneys (2x)	HE				
		6	Stomach (2x)	HE				
			Small intestine, duodenum	HE				
		7	Small intestine, duodenum	HE				
			Small intestine, jejunum with Peyer's patch(es)	HE				
			Small intestine, ileum with Peyer's patch(es)	HE				
		8	Large intestine, cecum	HE				
			Large intestine, colon	HE				
			Large intestine, rectum	HE				
		9	Thymus	HE				
			Lymph node(s), mesenteric (2x)	HE				
		10	Skeletal muscle, m. quadriceps femoris (2x)	HE				
		11	Urinary bladder	HE				
			Esophagus	HE				

Manage printers

Experiment PATB24-11, species Rat

Slides

+ Block/Slide

+ Stain control slide

+ Gross Lesion Block

Blocks/Slides

	Treatment	Animal #	Organ	Organ names	Block Sample #	Gross Lesion	Barcode	Level												
	0 values	E.g. 1-10,20,A1-A5,B1	Filter	0 values	E.g. 1-10,20,30	0 values	Filter	E.g. 1-10,20,30												
	Group 1	0101	10	Skeletal muscle, m. quadri...	1	None	BEA0083708	1	HE											
	Group 1	0101	11	Urinary bladder; Esophagu...	1	None	BEA0083709	1	HE											
	Group 1	0101	12	Eyes (2x); Optic nerve(s); H...	1	None	BEA0083710	1	HE											
	Group 1	0101	13	Mammary gland	1	None	BEA0083711	1	HE											
	Group 1	0101	14	Salivary gland, parotid; Sali...	1	None	BEA0083712	1	HE											
	Group 1	0101	15	Pituitary gland	1	None	BEA0083713	1	HE											
	Group 1	0101	16	Adrenal glands (2x)	1	None	BEA0083714	1	HE											
	Group 1	0101	17	Thyroid glands (2x); Parath...	1	None	BEA0083715	1	HE											
	Group 1	0101	18	Pancreas	1	None	BEA0083716	1	HE											
	Group 1	0101	1A	Brain (4x)	1	None	BEA0083698	1	HE											
	Group 1	0101	1B	Brain (3x)	1	None	BEA0083699	1	HE											
	Group 1	0101	2	Heart; Aorta, thoracic	1	None	BEA0083700	1	HE											
	Group 1	0101	22	Ovaries (2x)	1	None	BEA0083717	1	HE											
	Group 1	0101	23	Uterus (2x); Vagina; Cervix	1	None	BEA0083718	1	HE											
	Group 1	0101	24	Oviducts (2x)	1	None	BEA0083719	1	HE											
	Group 1	0101	25	Larynx	1	None	BEA0083720	1	HE											
	Group 1	0101	26	Tongue	1	None	BEA0083721	1	HE											
	Group 1	0101	28	Peripheral nerves, sciatic (...)	1	None	BEA0083722	1	HE											
	Group 1	0101	29	Lymph nodes, popliteal (2x)	1	None	BEA0083723	1	HE											
	Group 1	0101	3	Liver (2x)	1	None	BEA0083701	1	HE											
	Group 1	0101	32A	Spinal cord, cervical	1	None	BEA0083724	1	HE											
	Group 1	0101	32B	Spinal cord, thoracic	1	None	BEA0083725	1	HE											
	Group 1	0101	32C	Spinal cord, lumbar	1	None	BEA0083726	1	HE											
	Group 1	0101	33	Bone, stifle with bone marr...	1	None	BEA0083727	1	HE											
	Group 1	0101	34	Bone, sternum with bone m...	1	None	BEA0083728	1	HE											
	Group 1	0101	35	Nose	1	None	BEA0083729	1	HE											
	Group 1	0101	4	Lung (2x)	1	None	BEA0083702	1	HE											

NCS Project Portfolio

Image Barcoding Application (IBA) Handleiding

Image Barcoding Application (IBA) Manual

Settings – Specimens (tissues/organs)


Image Barcoding Application
View
Settings

Organs

Organ Codes

Organ Templates

Links

Stains

Stainers

Stainer Protocols

Block/Slide Remarks

Block/Slide Remark

Filter

No parathyroid visible

Serial section

Refresh Remarks

Add remark

Code

Filter

Organ name(s)

Filter

Processing Type

2 values

Bone Smear

Standard

Decalcification

Fixative

Filter

Code	Organ name(s)	Processing Type	Fixative
23b	Vagina		10% buffered formalin
23c	Cervix		10% buffered formalin
24	Oviducts (2x)		10% buffered formalin
25	Larynx		
26	Tongue	Standard	
27	Ureter(s)	Standard	
28	Peripheral nerves, sciatic (4x)	Standard	

Name

Filter

Send Specimen

Filter

Lims Term

Filter

Sex

Filter

Synonyms

Filter

Name	Send Specimen	Lims Term	Sex	Synonyms
Lymph node(s), mandibular	LYMPH NODE, MANDIBULAR	5108 - LYMPH NODE(S), MANDIBULAR		
Lymph node(s), medial iliac	LYMPH NODE, ILIAC			
Lymph node(s), mesenteric	LYMPH NODE, MESENTERIC	5104 - LYMPH NODE(S), MESENTERIC		
Lymph node(s), popliteal	LYMPH NODE, POPLITEAL			
Lymph node(s), tracheobronchial				
Lymph node(s),dorsal superficial cervical				
Lymph node(s)ventral cervical				

Species

Filter

Name

Filter

Species	Name
Dog	Dog Full Tissue list
Dog	Dog Toleration list
Mini-pig	Minipig Full Tissue list
Mini-pig	Minipig Toleration list
Mouse	Mouse Full Tissue list
Mouse	Mouse Toleration list
Rabbit	Full Tissue list
Rabbit	Rabbit Toleration list
Rat	Rat Full Tissue list
Rat	Rat Toleration List

Organ preset for processing & fixative

Organ templates per

Controlled vocabularies: from protocol – from SEND (preferred) – from current pathology LIS

Organ templates per species & study type

Settings – Stains & stainers; Remarks

Image Barcoding Application

View

Settings

Barale Erio

Organs

Organ Codes

Organ Templates

Links

Stains

Stainers

Stainer Protocols

Block/Slide Remarks

Printers

Sites

Users

Block/Slide Remark

Filter

No parathyroid visible

Serial section

Vocabulary for stains

Code	Name
Filter	Filter
FJ	Fluoro-Jade
FOXP3	FOXP3
Fibrin	Fibrinogen
GATA4	GATA Transcription factor 4
GCG	Glucagon
GFAP	Glial Fibrillary Acidic Protein
GFAP+S2	Glial Fibrillary Acidic Protein and Sex deter
GFRAL	GFRAL
GM130	Golgi Matrix 130
GMS	Grocott's Method For Fungi
Giemsa	Giemsa
Giesson	Von Giesson
Gram	Gram
H2AX	H2A histone family member X
HE	Hematoxylin and Eosin Staining Method

List of staining automates

Refresh Remarks

Add remark

Name	Reference	Environment
Filter	Filter	0 values
Mock for Roche Discovery Ultra (localhost)	discovery-ultra-localhost-mock	Development
Roche Discovery Ultra	discovery-ultra-1	Development
Roche Discovery Ultra	discovery-ultra-2	Pre-production
Roche Discovery Ultra	discovery-ultra-3	Production

Predefined list of remarks/comments

Block/Slide Remark

Filter

No parathyroid visible

Serial section

Settings – Management of users & sites

Image Barcoding Application

View

Settings

Barale Erio

Block/Slide Remark

Filter

No parathyroid visible

Serial section

Organs

Organ Codes

Organ Templates

Links

Stains

Stainers

Stainer Protocols

Block/Slide Remarks

Printers

Sites

Users

Refresh Remarks

Add remark

Description	Barcode Prefix
Filter	Filter
Belgium - Beerse	BE
United States of America - La Jolla, CA	UW
United States of America - Spring House, PA	UE

Management of users (roles)

First Name	Last Name	Active
erio	Filter	Filter
Erio	Barale	Yes

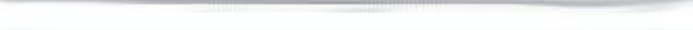
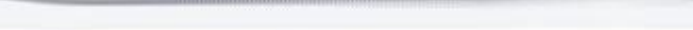
 Refresh Stainer Protocols

 Add Stainer Protocol

Name 	Active 	Validated 	Number 			
Filter 	Filter	Filter	Filter			
CC1 24 min; AB 20 MIN	true	true	171			
CC1 24 min; AB 20 MIN_NEG	true	true	180			
CC1 low T; HQ@rabbit GFAP dispens NEG	true	true	746			
CC1 low T; HQ@rabbit GFAP dispenser	true	true	745			
CC1 low T; HQ@rabbit Iba1 dispens NEG	true	true	750			
CC1 low T; HQ@rabbit Iba1 dispenser	true	true	749			
CC1 low T; HQ@rabbit NeuN dispens NEG	true	true	748			
CC1 low T; HQ@rabbit NeuN dispenser	true	true	747			
CC1,linker + HQ@Rab	true	true	332			
CD8 HUMAN CC1	true	true	269			
PH H00G; HQ@mouse	true	true	95			
PH H00G; HQ@rabbit	true	true	105			
PH H00G; HQ@rabbit Casp3 dispens NEG	true	true	794			
PH H00G; HQ@rabbit Casp3 dispenser	true	true	793			
Rb@human IgG_OMAP@Rb_dispens NEG	true	true	933			
Rb@human IgG_OMAP@Rb_dispenser	true	true	932			
Rt IgG H+L, 32minCC1+IgGt block DISP	false	false	873			
Rt IgG H+L, 32minCC1+IgGt block DISP NEG	false	false	874			
TSPO_OMAP@Rb_dispenser	true	true	913			
TSPO_OMAP@Rb_dispenserNEG	true	true	914			
linker@Ms_OMAP@Rb_PT66_dispens NEG	true	true	846			
linker@Ms_OMAP@Rb_PT66_dispenser	true	true	845			
linker@Ms_OMAP@Rb_SMI dispens NEG	true	true	781			
linker@Ms_OMAP@Rb_SMI dispenser	true	true	780			

 Refresh printers

 Add Printer

Printer Type 	Slide Type 	Driver 	Name 	Location 		
Filter 	Filter 	Filter 	Filter	Filter		
BLOCK	STANDARD	FA_TECH_PULSAR	Fa-Tech Vega	https://  int/cassette		
SLIDE	STANDARD	BARTENDER	Brady BBP12 Ventana	http://  IBA_P...		
SLIDE	STANDARD	BARTENDER	Leica IP-S New	http://  IBA_P...		
SLIDE	STANDARD	BARTENDER	Leica IP-S Old	http://  IBA_P...		
SLIDE	STANDARD	BARTENDER	Slidebel Duo 1	http://  BA_P...		
SLIDE	STANDARD	BARTENDER	Slidebel Duo 2	http://  BA_P...		
SLIDE	STANDARD	BARTENDER	Slidebel Duo 3	http://  IBA_P...		
SLIDE	STANDARD	BARTENDER	Slidebel Duo 4	http://  BA_P...		
SLIDE	STANDARD	BARTENDER	Slidebel Duo 5	http://  IBA_P...		
SLIDE	STANDARD	BARTENDER	Zebra GX430t	http://  IBA_P...		

Strengths

Flexible

- Extension is possible based on new use cases
 - Track devices & stainers
- New samples, new specimen, new species, new vocabularies can be ***added easily***

Satisfy the needs expressed by the users

- No gain in speed to fill the documentation
 - But automated, bulk entry; data immediately available in all J&J systems; improve the continuity of work
- Error-free, or errors are easily corrected
- ***File management*** is far easier than handling papers
 - All along the workflow (sorting, filtering)
 - Even for archiving at the end of the study
- Automated authentication (via connection to J&J network)
 - No need to sign and include date

Weaknesses

Data entry not necessarily quicker

- Recuts, damaged tissue: extra steps
- Comments: free text should be replaced by predefined lists

No dashboard tool

- ***Device*** management
- ***Reagent*** management
- ***Preventive*** maintenance
- Better ***forecast of the workdays*** per process step; per technician

No advanced reporting tool

- Currently, the export only replicates the current paper process
- More ***sophisticated reports*** will be implemented
 - Per device; per workstation; per process step
 - Per week; month; quarter; year

Lessons learned by J&J

from digitising the histotechnique documentation

How HES was implemented at J&J

- 1 lab being leader for the design & features
 - The other labs being involved for additional features
 - **Flexibility** allows to develop the project based on new features requested
- Expect the unexpected!
 - A new digital process allows things which were not possible or not anticipated (“**emerging properties**”)
- Add value to the process and **increase acceptance** by the team
 - The whole histo-pathology process is now fully digital
 - Data flow among several systems
 - Increase the value of the digital slides

Pre-analytical

Quality control of digital slides with HALO Link Slide QC v.3: J&J results

Goals

- ***Detect artefacts automatically*** and early in the pre-analytical workflow
 - Mechanical and digital artefacts; FFPE H&E and IHC
- Help the QC review by ***automatically reporting the artefact percentage***
 - To decide to reject the digital slide and re-digitise, or recut the slide
- ***Create a mask*** on the tissue areas and on the acceptable artefacts
 - To quickly guide the examination to the artefacts
 - To exclude these masked artefact areas from analysis by AI methods

Type of artefacts to detect

Tissue processing artefacts

- ***Air Bubble*** (esp. large, linked to retraction due to long storage)
- Coverslip/Mounting Media
- Dust/Debris
- Knife Line
- Pen Mark
- Thick Spot
- Tissue Fold

Scanning artefacts

- ***Out of Focus***
- Missing Tissue
 - Mostly pale tissue like adipose
 - Incorrect border of the scan (esp. close to slide or coverslip border)
- No tissue

indica labs

HALO Link Slide QC v.3

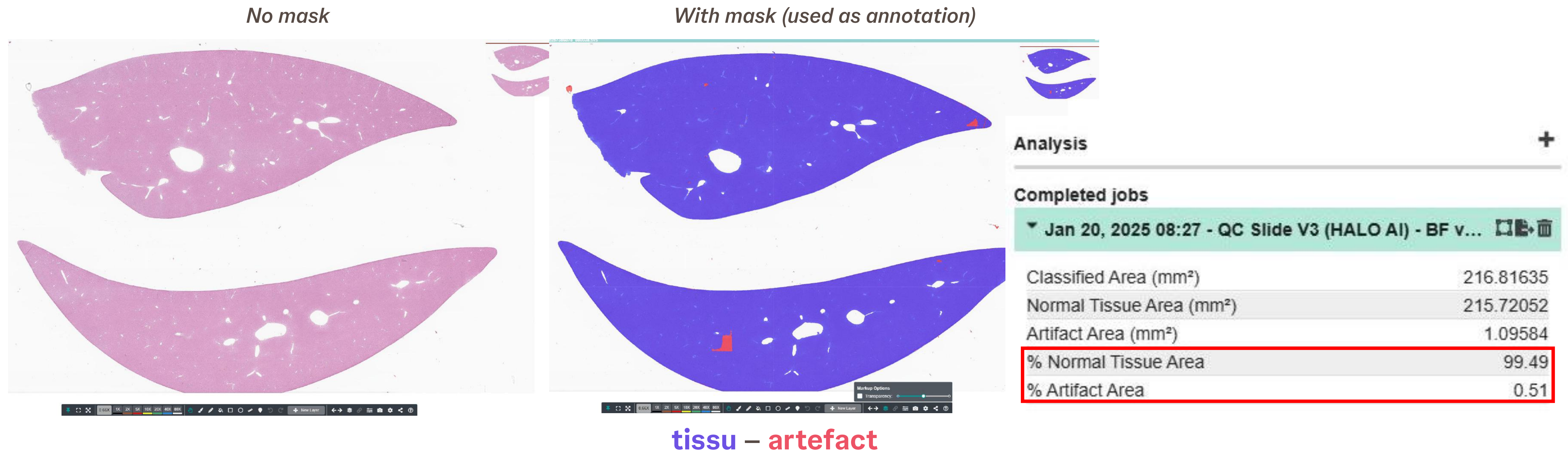
Practical implementation of Slide QC

Application of analysis mask

- Empirical threshold set at 80 % of Normal Tissue Area

In this example: small out of focus area

- Without effect on overall quality of the slide
- Most specimens will have around 1 %, so the 20 % rule is very lax!

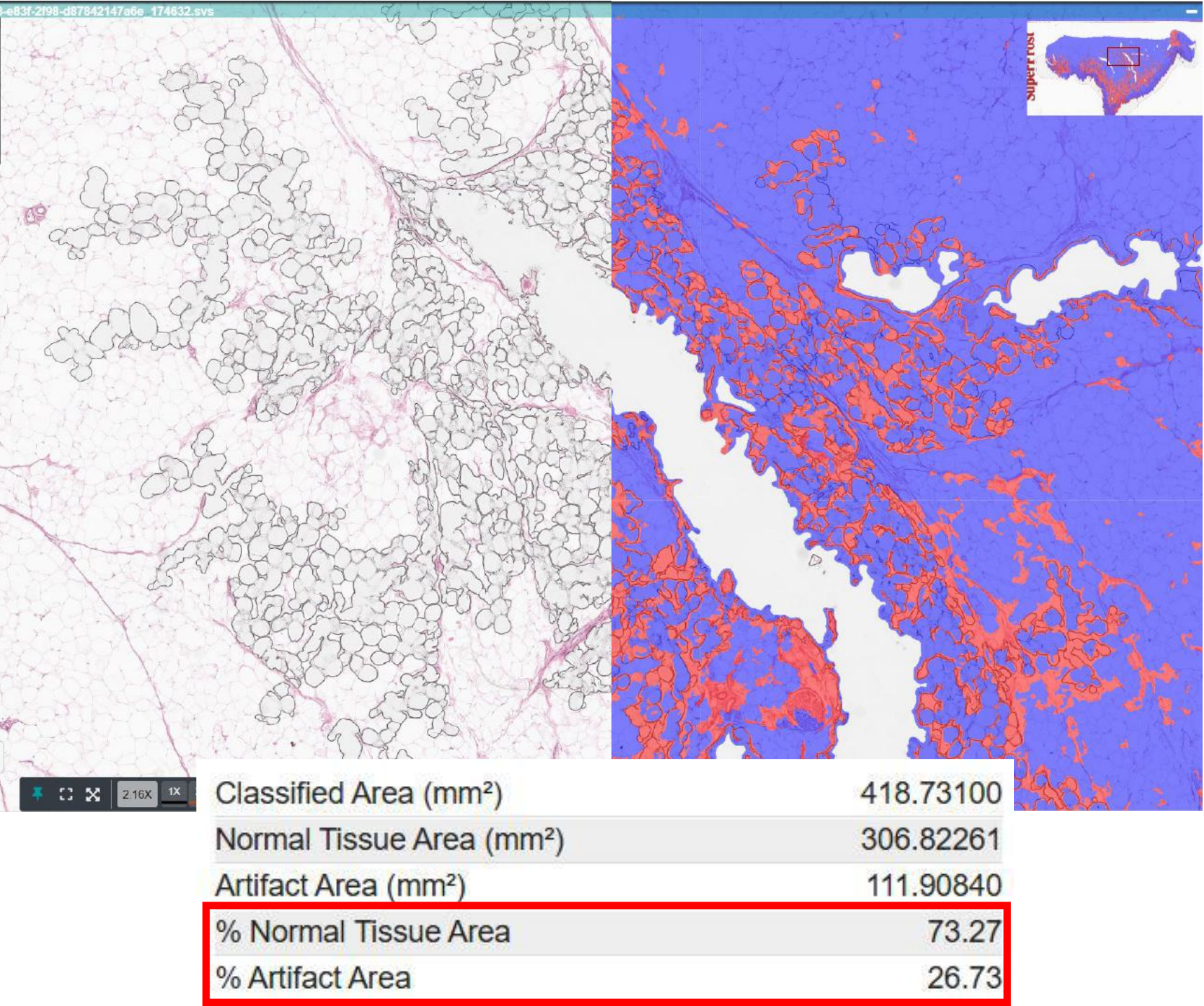


Detection of artefacts

Air bubbles

In this example: mounting medium retraction during long term retention → large number of air bubbles → inadequate quality of tissue

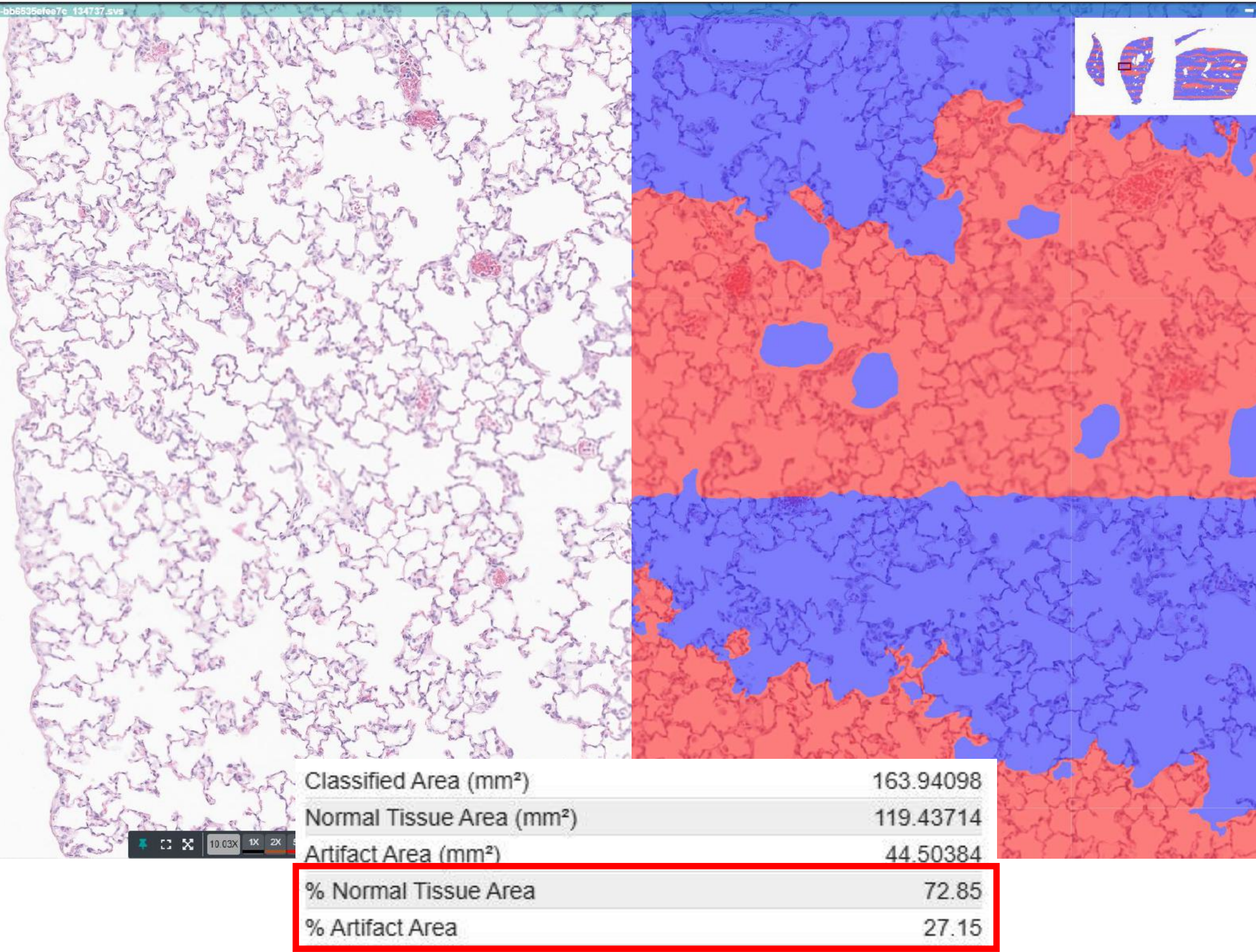
- Probably requires remediation



Out-of-focus areas

In this example: inadequate quality of scanning

- Requires remediation and rescanning of the slide



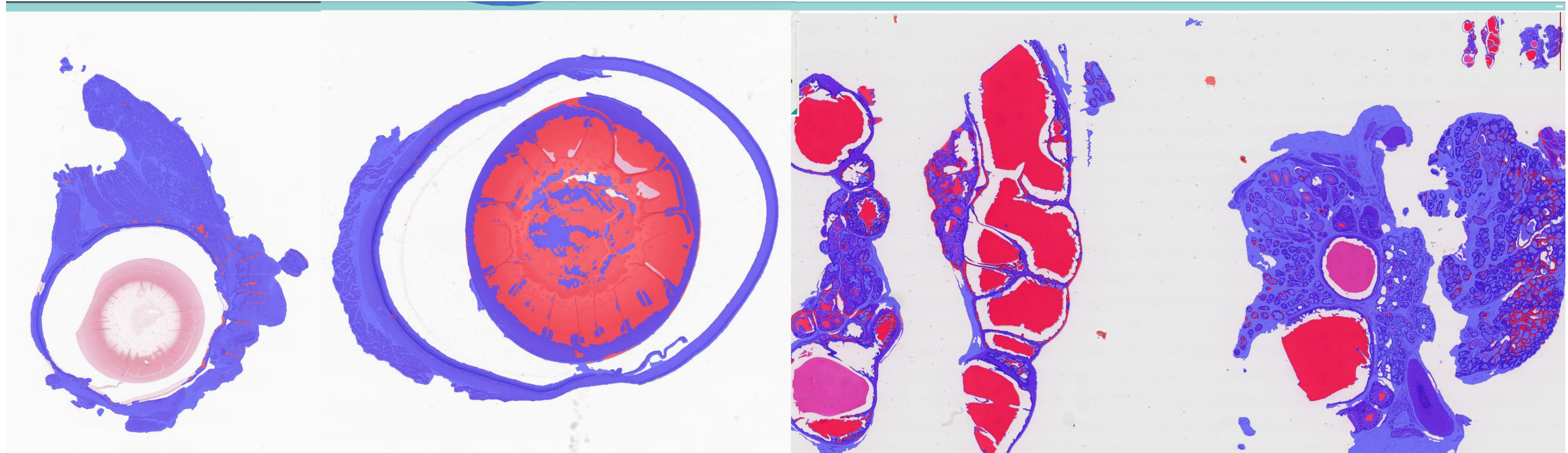
Some limitations: the tissue effect

Due to hard + soft components or to secretion

Lens not recognized

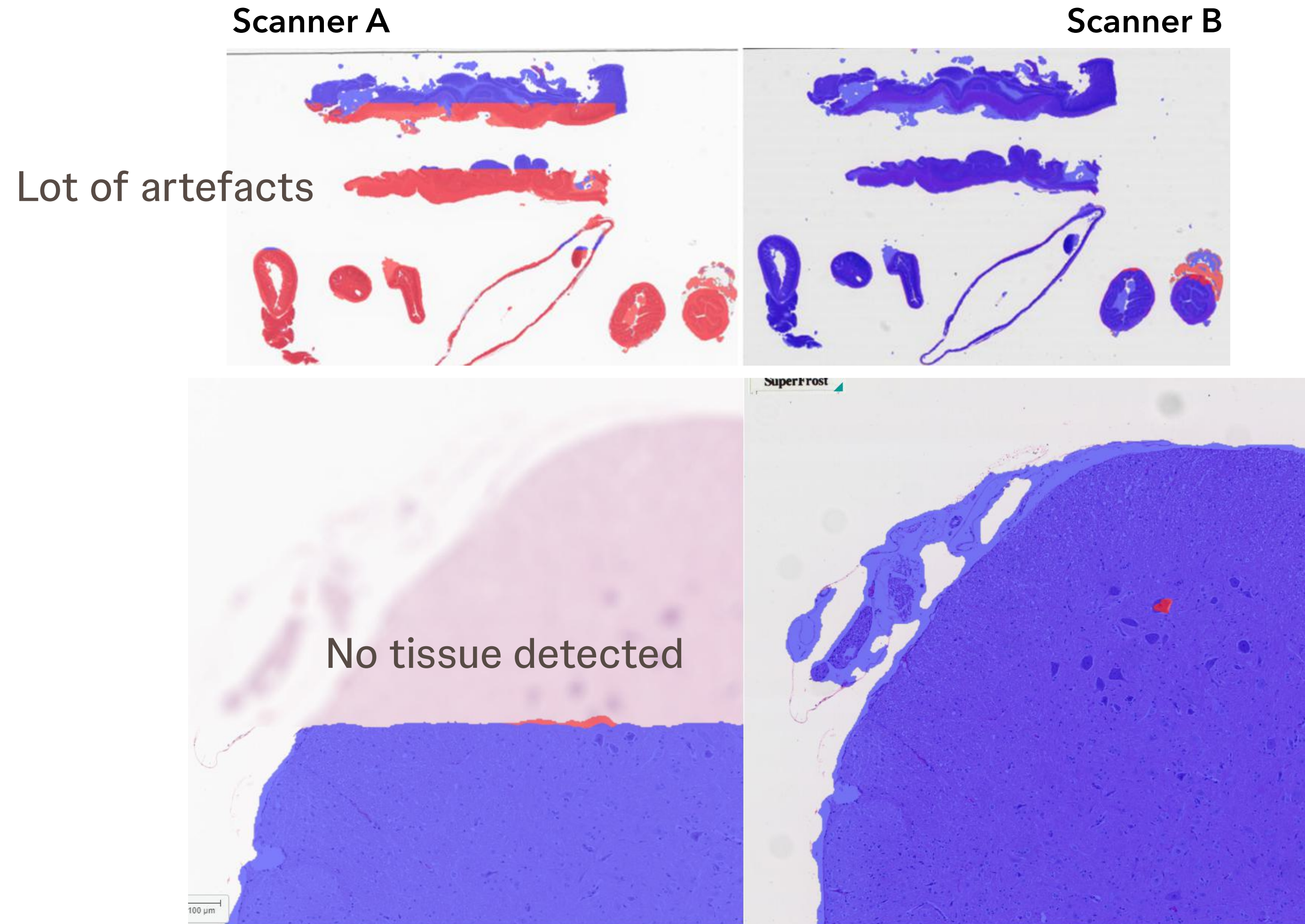
Lens detected as artefact

Prostate gland / seminal vesicle / coagulating gland secretion
detected as artefact



Some limitations: the scanner effect

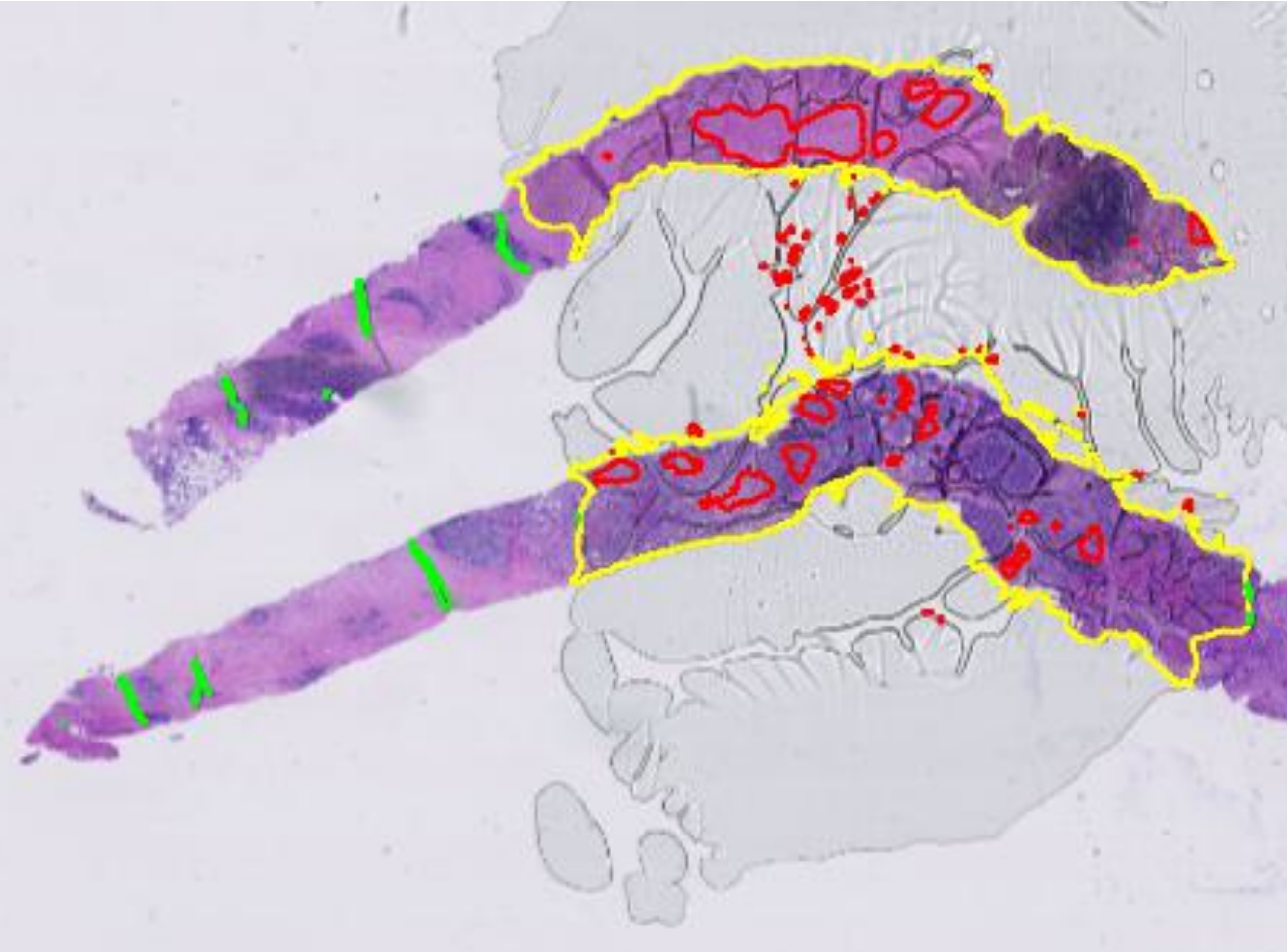
Same slides, different scanners, different artefacts



An alternative QC: the AIRA Matrix solution

Separate the artefacts types clearly in several classes

Annotations Slide Gallery Analysis Result		
Total artefact area: 20.61%		
Color	Feature Name	Value
	Air Bubble	17.72%
	Blur	1.93%
	Fold	0.95%
	Denmark/Dark Spot	0.01%



Some J&J metrics

On a test set of 28,895 slides (31 studies)

- 405 slides failed QC (**1,40 %**)
- Further reduced after rescanning

Throughput of QC check of scanned slides

- Fully manual: < 100 slides per hour, not all day long!
 - **~500/day**
- Automated: ~8 slides/min, 24/7
 - **> 10 000/day**

Lessons learned by J&J

from applying AI to QC of digital slides

The **CS team is crucial to set the automated process!**

Not all scanners are equal in front of artefacts!

Most artefacts are not blocking

- If present on the glass slide (remember that regulators want that the digital slide is a ***faithful replica***, incl. the artefacts)
- ***If the detection can be used as an annotation*** (by artefact type) and the analysis model will exclude them

When a signal present on the glass slide is lost on the digital slide, ***remediation*** is needed

- Blurred, ***out-of-focus*** areas
- ***Large bubbles*** (due to retraction of mounting medium)

Cut-off for failed slides was set empirically at 80 % but this can be refined

Some specimens are difficult

- Secretion (prostate, thyroid glands)
- Hard + soft tissue (bone, eye)

Conclusion

Digital pathology *does not necessarily require AI tools*

- Useful tools do not need to be fancy!

The histo-pathology process

- Multi-step
- Multi-user
- Multi-discipline, numerous techniques
- All stakeholders must be involved to increase the value of the process

A good project require

- Engaged, valued *team members*
- Supportive *management*
 - Decision; budget

The digital data is **FAIR**

- Findable (trouvable)
- Accessible (accessible)
- Interoperable (interopérable)
- Reusable (réutilisable)

ALCOA workflows helps to achieve data quality and integrity

- Attributable (attribuable)
- Legible (lisible)
- Contemporaneous (contemporain)
- Original (original)
- Accurate (précis)
- ALCOA+
 - Complete (complet)

- Consistent (cohérent)
- Enduring (endurant, durable)
- Available (disponible)
- ALCOA++
 - Traceable (traçable)

Why are the ALCOA principles important?

- **GLP** (BPL)
Discovery Data Integrity, DDI (Intégrité des données de découverte)
 - Ensure data integrity
 - Create an audit trail
 - Meet regulatory requirements
 - Improve data quality



Pour finir

Un peu de vocabulaire:

- ***Digitalisation*** (en) = informatisation d'un flux de travail
 - Informatisation de l'histopathologie
- ***Digitisation*** (en) = numérisation d'une étape d'un flux de travail
 - Numérisation des lames de verres

La validation vue par l'auteur (et simplifiée abusivement)

- Chez J&J tout système doit être validé, indépendamment des BPL
 - Garantir aux ***utilisateurs*** la ***performance*** du système
- Les BPL rajoutent une couche de validation
 - Garantir aux ***régulateurs*** la ***fiabilité des données***

Thank you for your attention

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