

Is Digital Pathology the Answer?

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Lets discuss

- State of the union- UK Pathology (2017)
- Benefits and concerns: Digital Pathology adoption
- Selection of Scanner and Case Management Software
- Successful Implementation
- Conclusions
- The future of Digital Pathology

- Royal College of Pathologists 2017 census:
 - Ageing Pathologist workforce (25% of all histopathologists are >55)
 - Staff shortages
 - 3% of NHS histopathology departments have enough capacity to meet demand
 - £27 million spent (NHS) to cover shortfall (locums/agency staff, outsourcing reporting)
 - Increasing demand for Pathology services
 - Personalised medicine

The Solution?

UK needed short and long term solution to ensure the high quality and rapid diagnoses remained for its patients

Digital Pathology.....

Elements for building the system of Digital Pathology

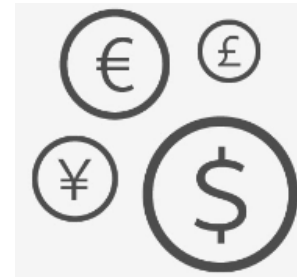
Clarify Purpose



Digital Pathology System



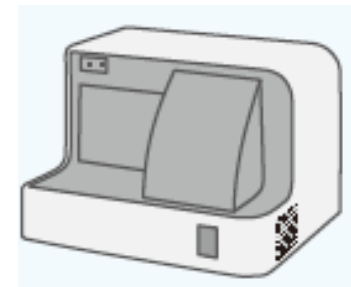
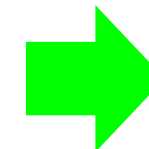
Be aware of Cost



Workflow Design

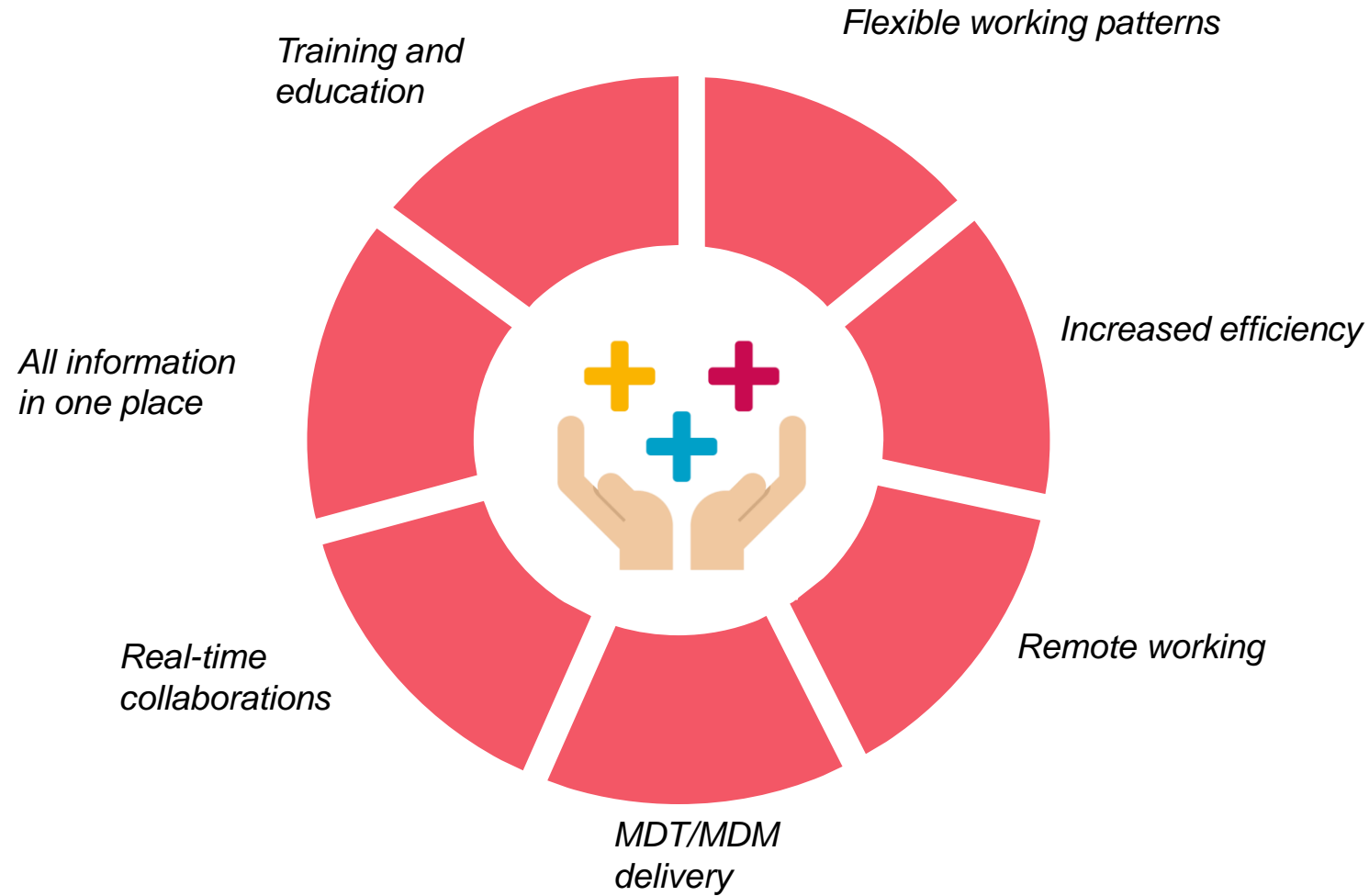


Keep Validating



Scanner is Core!

Benefits of Digital Pathology



Digital pathology is widely regarded as the primary method of utilising the current workforce.

How can Digital Pathology help you and your organization?

- Improved turn around times
- Improved accuracy to aspects such as measurements
- Utilize artificial intelligence to aid in diagnosis
- Easier and quicker to gain second opinions
- Less office clutter
- Removes risk of slide breakages
- Save space and time with slide storage

Concerns in Digital Pathology adoption

Cost

High initial outlay for purchasing scanners, image storage and slide management software

Space

Finding physical room to store slide scanners

Operation

- I. Changes required in laboratory process
- II. Huge jump for Pathologists to move from glass slides to digital images

*“This looks like it will **slow me down**”*

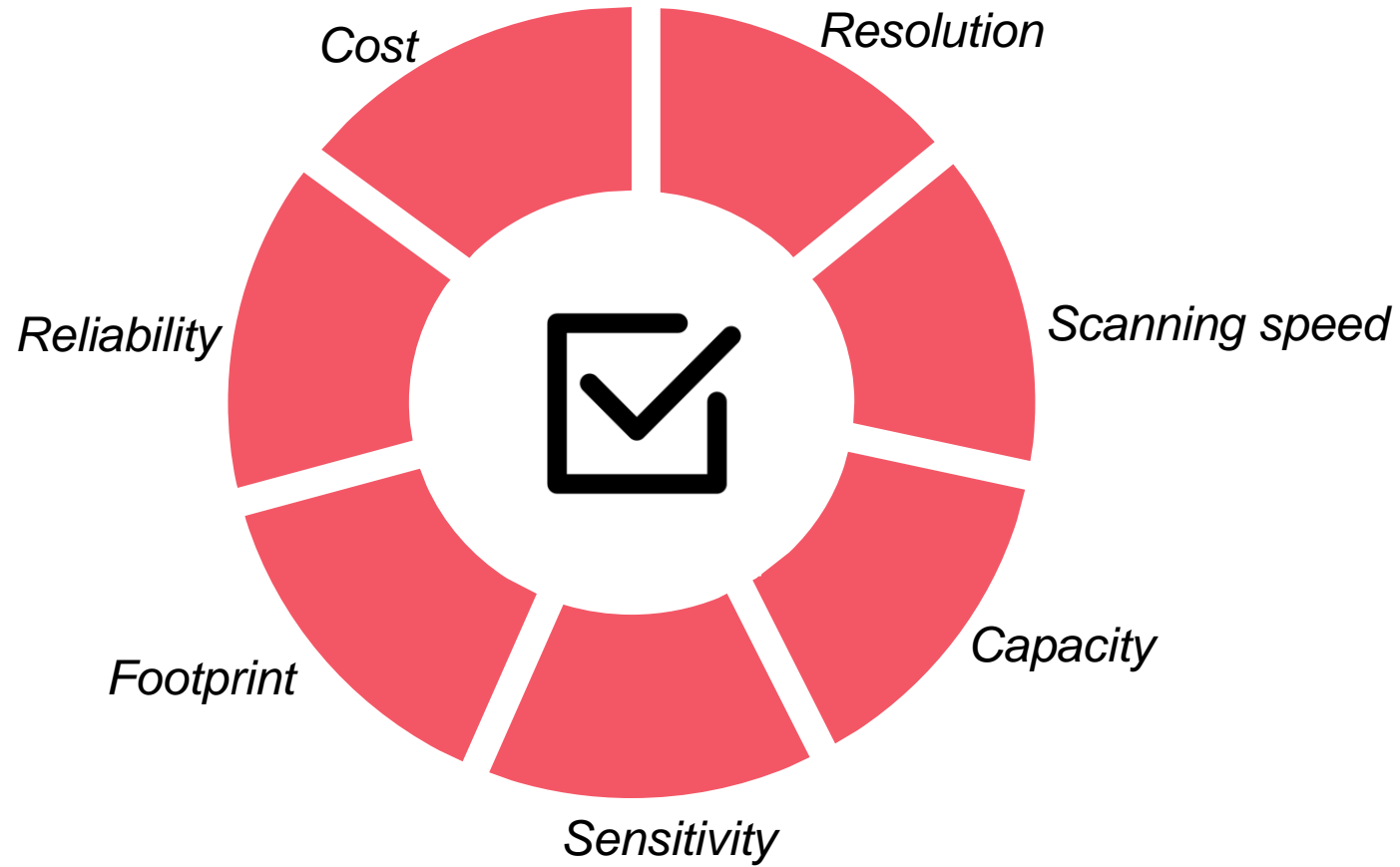
*“I am too **old** to learn this new **technology**”*

*“I am too **busy** to learn about digital pathology”*

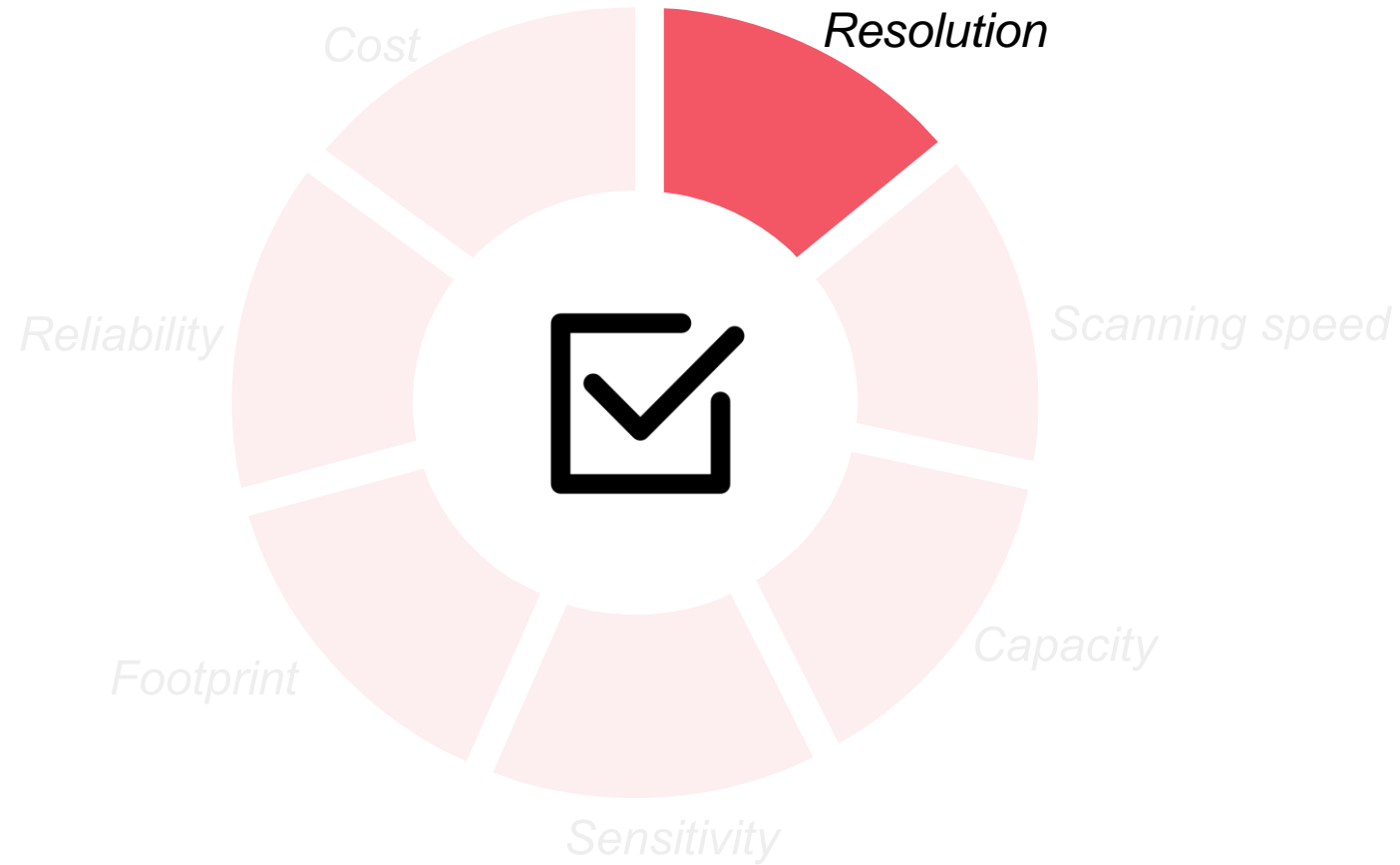
Which Scanner to Choose



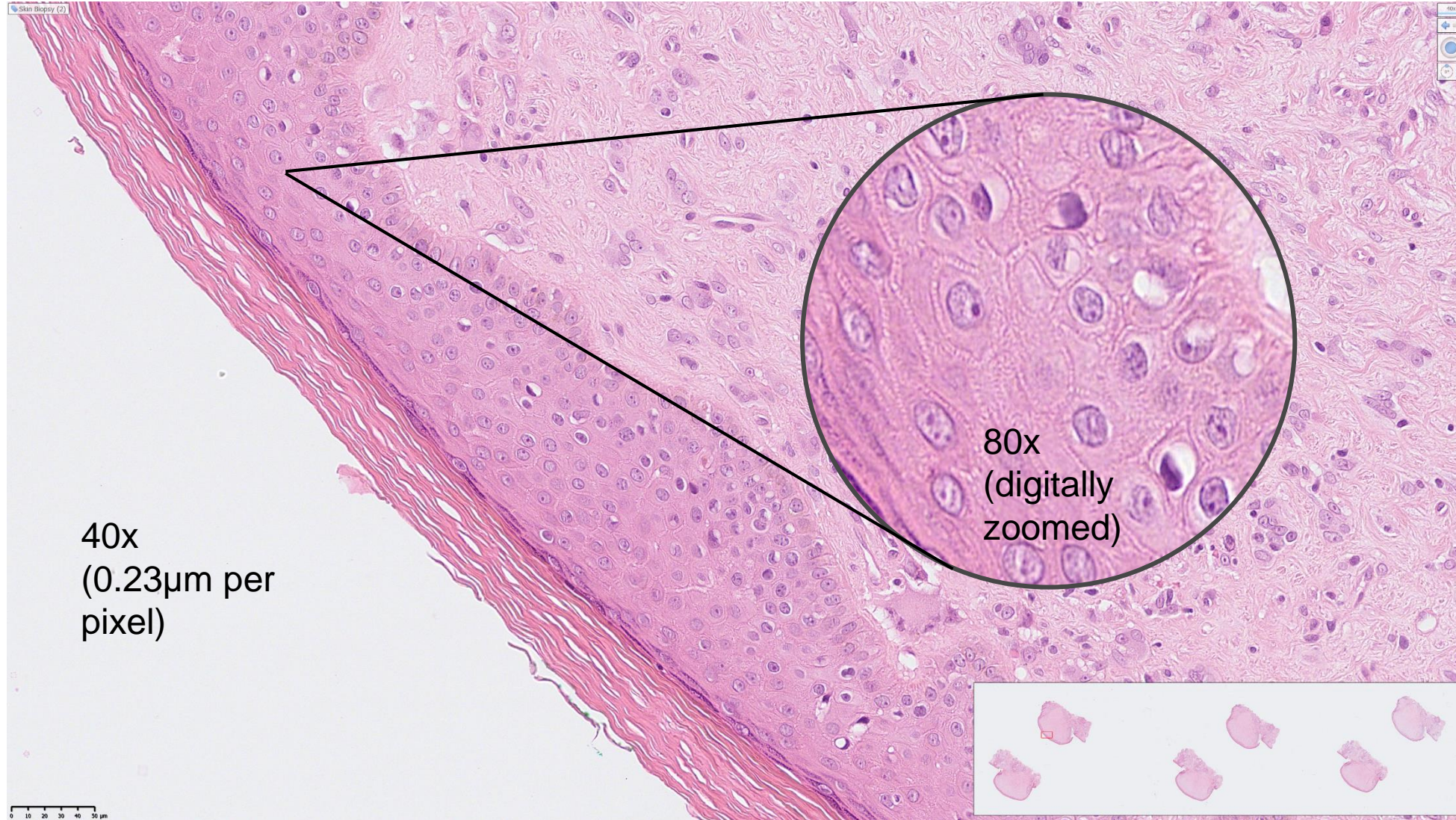
How to select a Scanner



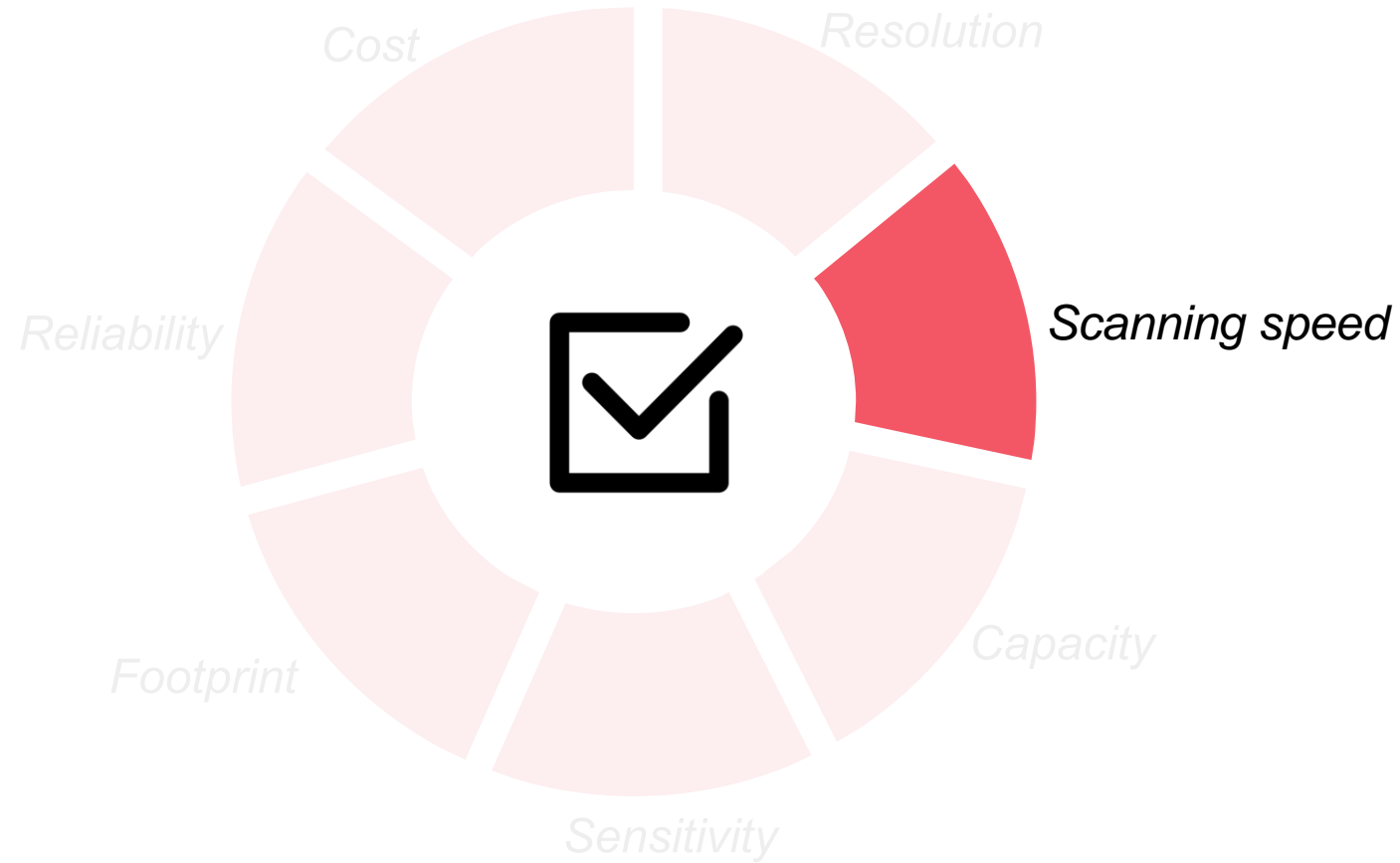
How to select a Scanner



Resolution

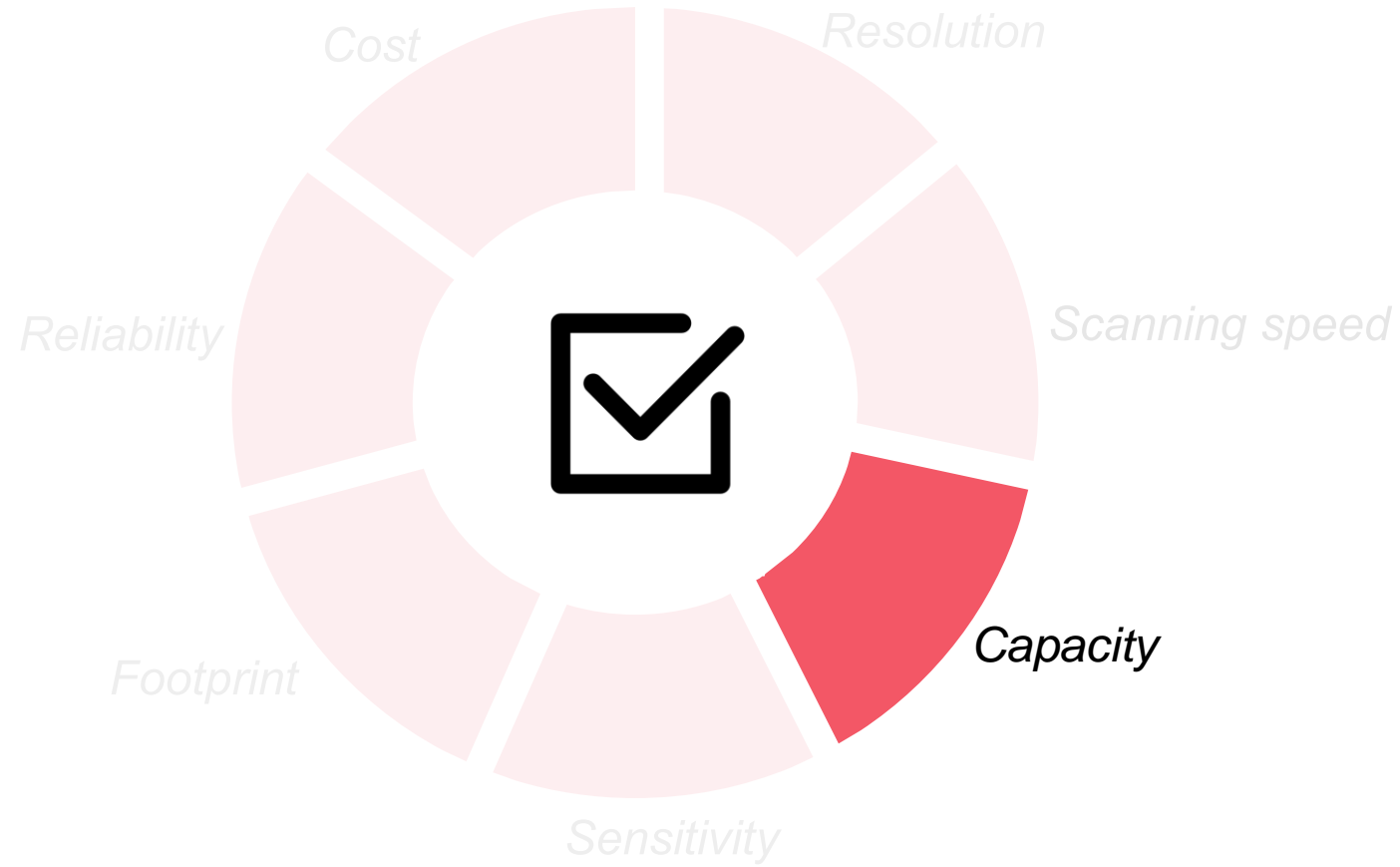


How to select a Scanner



- Industry standard is to scan a 15mm x 15mm area
 - Often does not include focusing time or slide handling time
 - Does a 15 x 15mm piece of tissue exist?
 - What is the “real-life” speed?
 - Physical demo is ideal
 - Vendor to provide metadata
 - Check speed is based on 40x scanning

How to select a Scanner



Capacity

Consider the laboratory workflow and slide volume



Single slide scanner

Which is best?

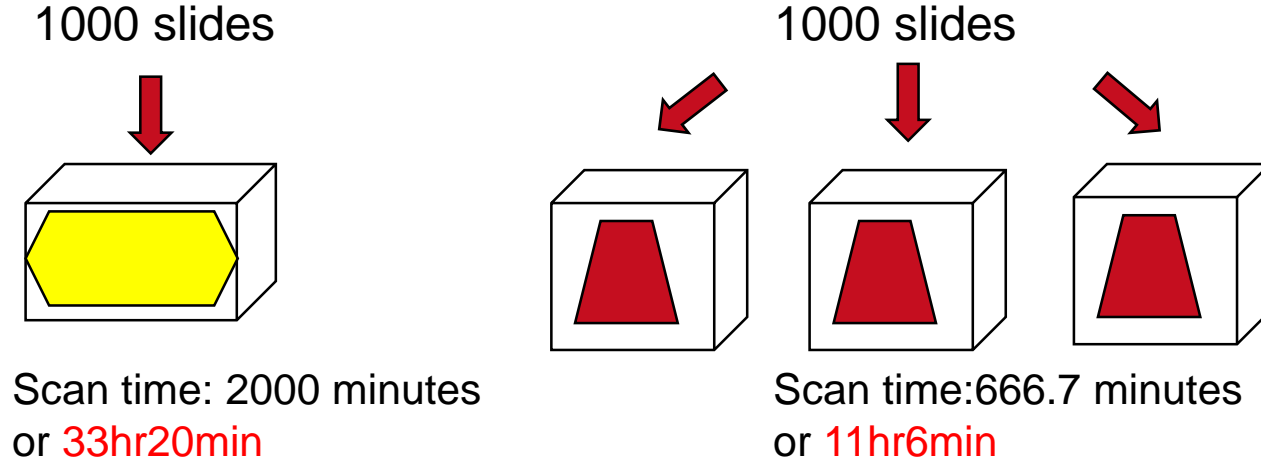


high capacity scanner

Capacity

Consider the laboratory workflow and slide volume

Laboratory A produces 1000 slides per day, working hours 9am – 5pm

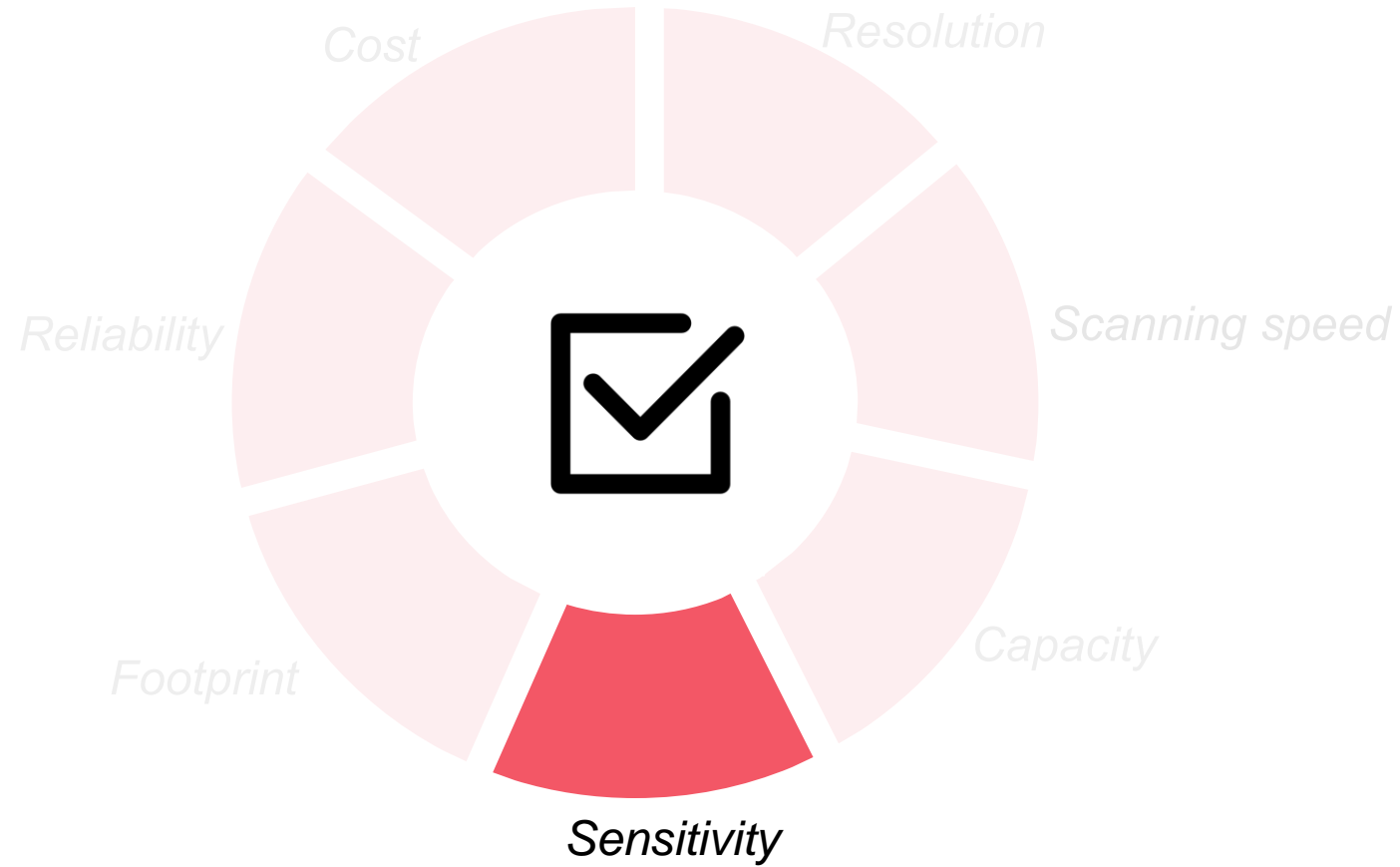


1000 slide capacity scanner
Average 2min per slide

360 slide capacity scanner
Average 2min per slide

Higher capacity isn't always the answer!!!

How to select a Scanner

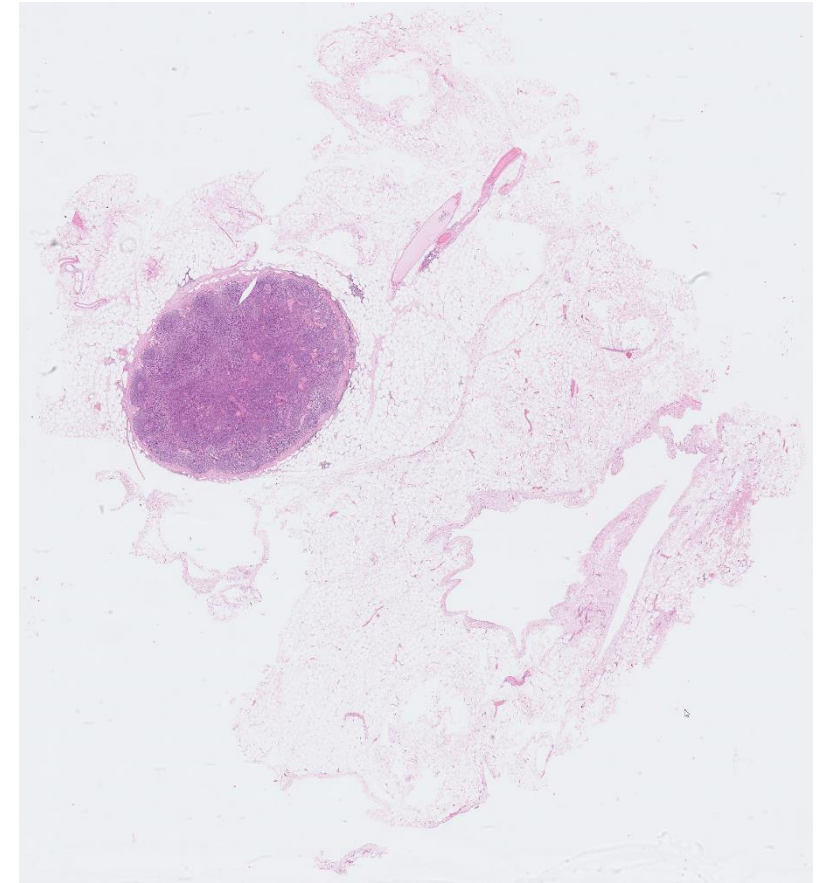


Sensitivity

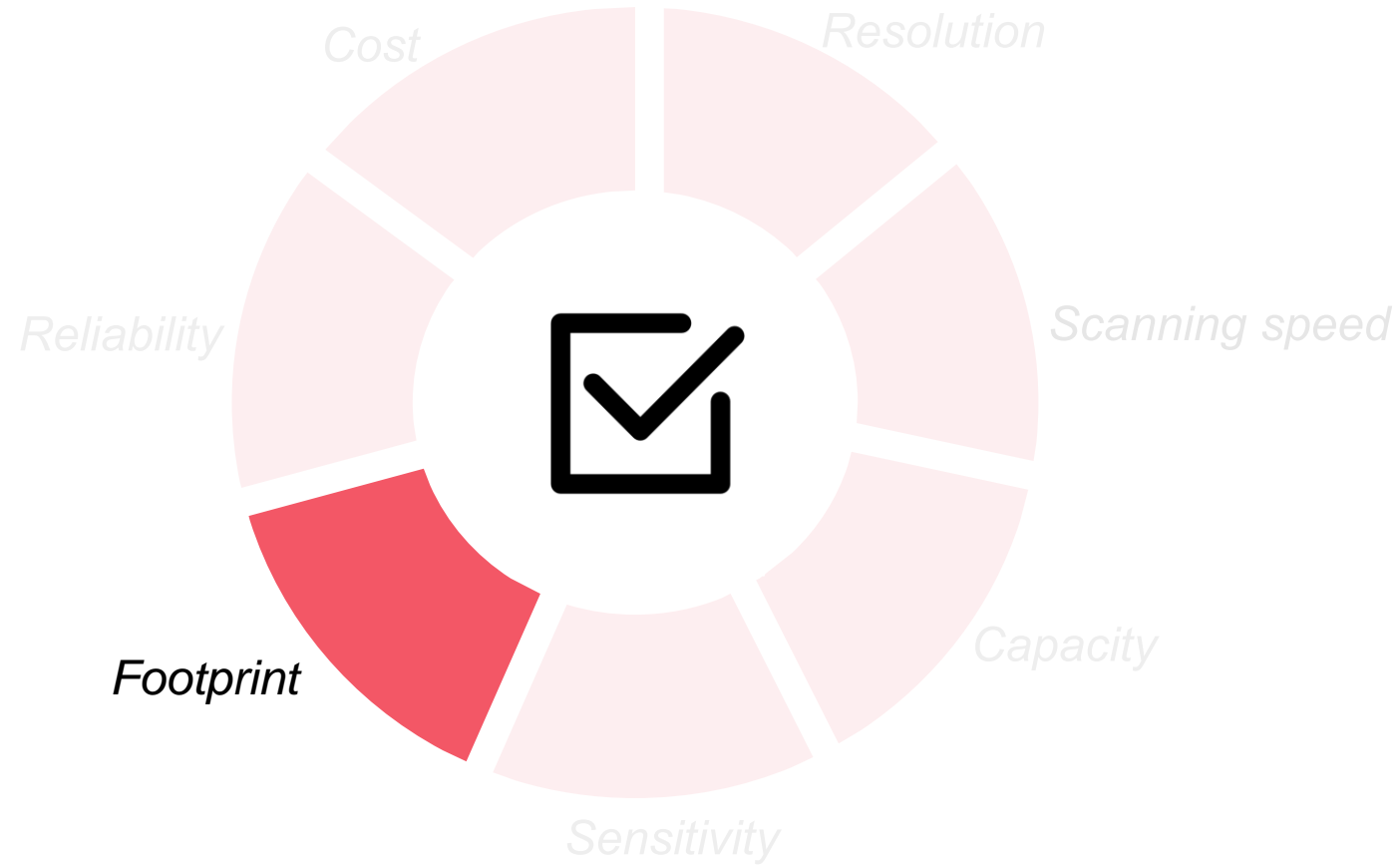
- Tissue detection and focusing
 - Detecting adipose tissue can be difficult
 - IHC slides can also cause problems
- Both have lack of staining definition



For example, a lymph node with surrounding adipose tissue. Node is easily identified, surrounding tissue is much more faint

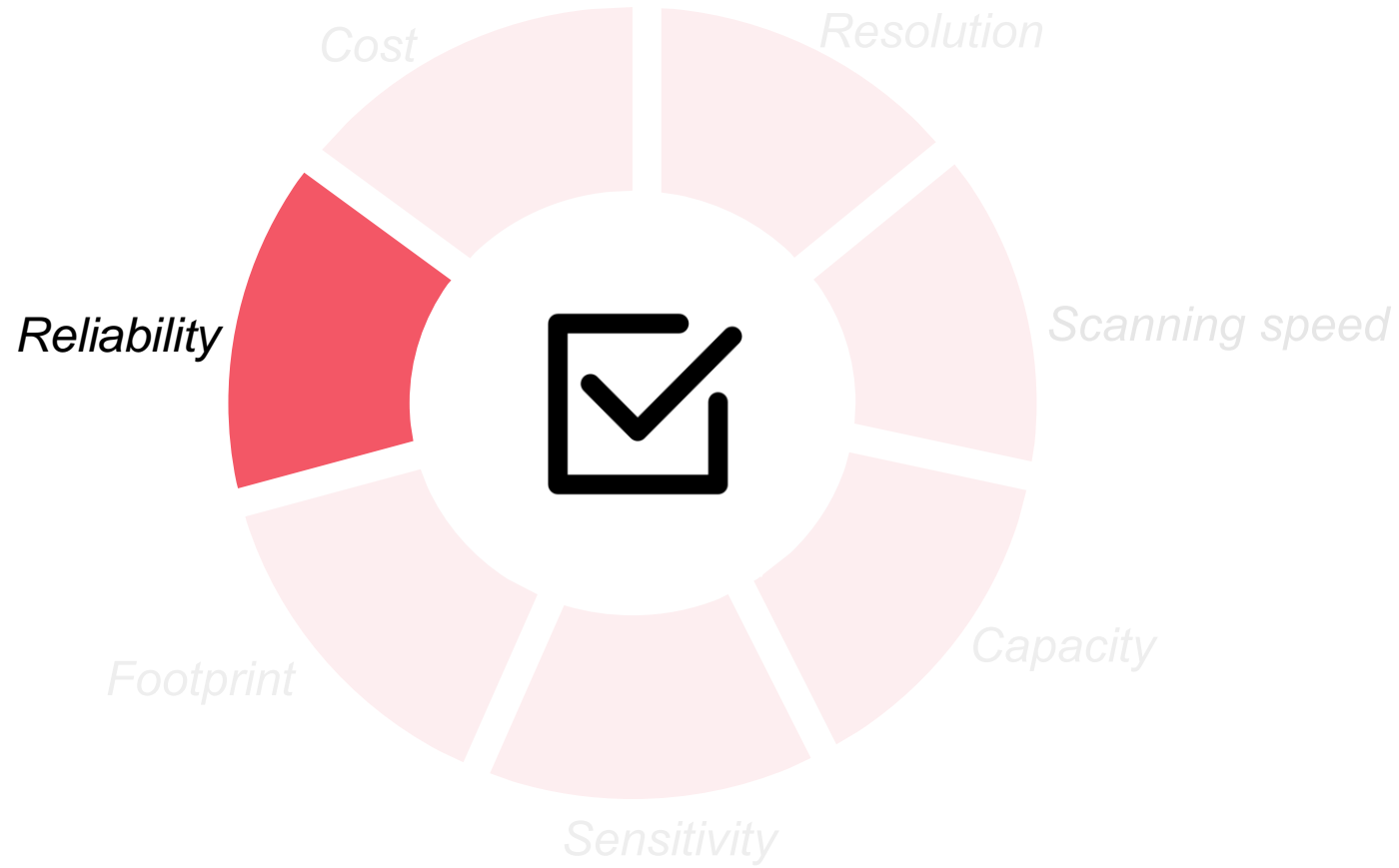


How to select a Scanner



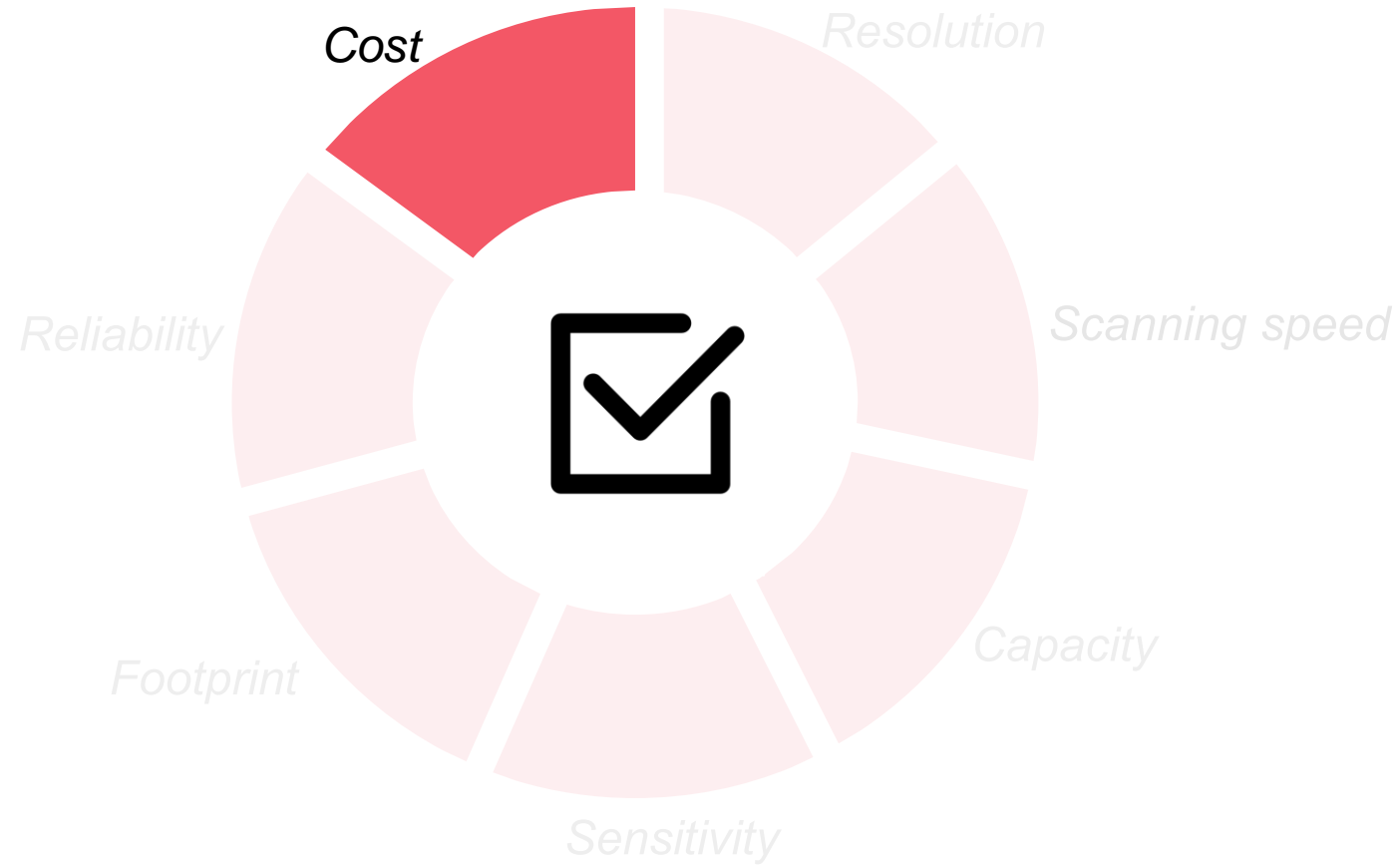
- Laboratory space is often at a premium
- Multiple scanners may be required
- Does each scanner require it's own PC?
- Is access available for service requirements?

How to select a Scanner



- In a clinical setting reliability is important
- Minimal scanner downtime
- Service contracts available?
- Easy access to scanner for maintenance

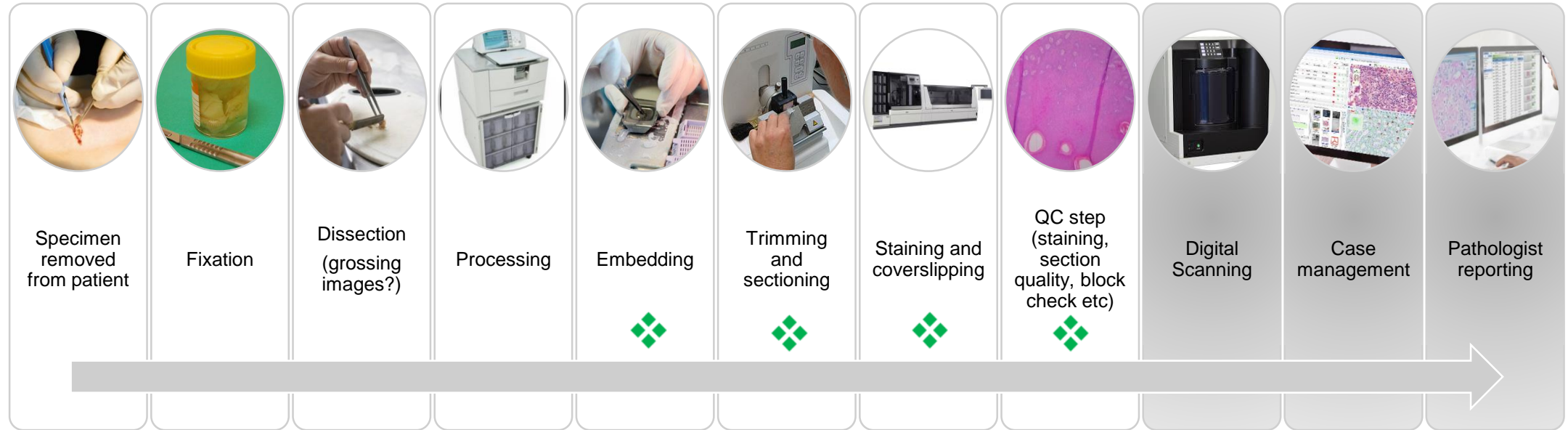
How to select a Scanner



Cost

- Large initial outlay, upwards of £100,000 per large capacity scanner
- Once purchased no consumables required
- Service contracts

Digital pathology Implementation



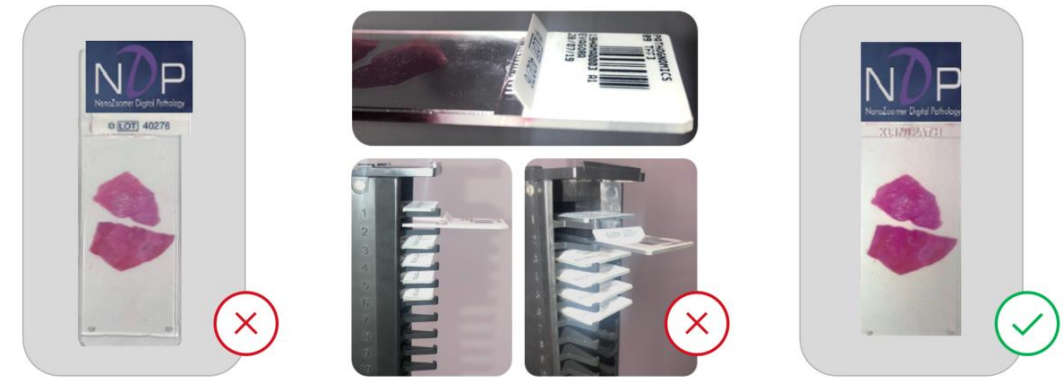
How does **digital pathology** fit into the workflow of your laboratory?

Digital pathology Implementation

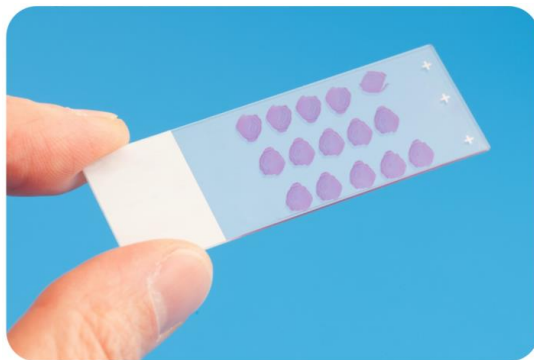
How to position your organization to succeed



Aligned coverslips



Aligned slide labels

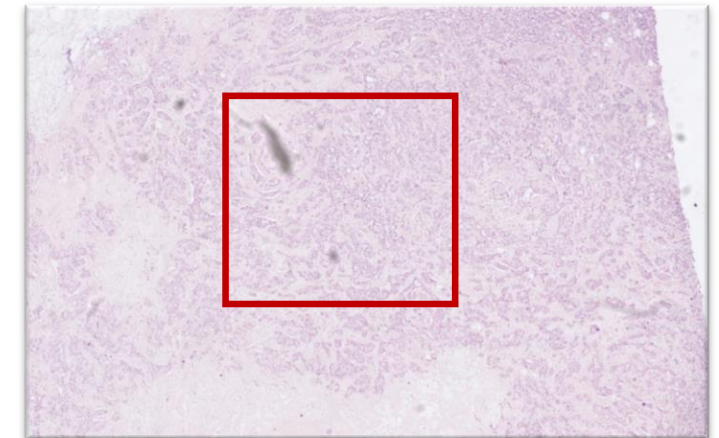
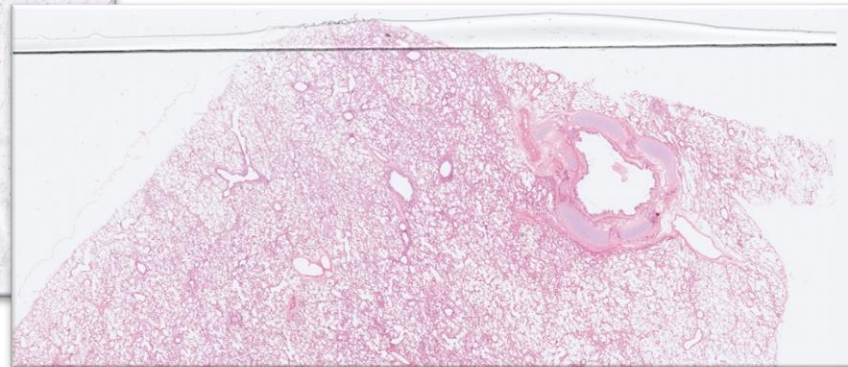
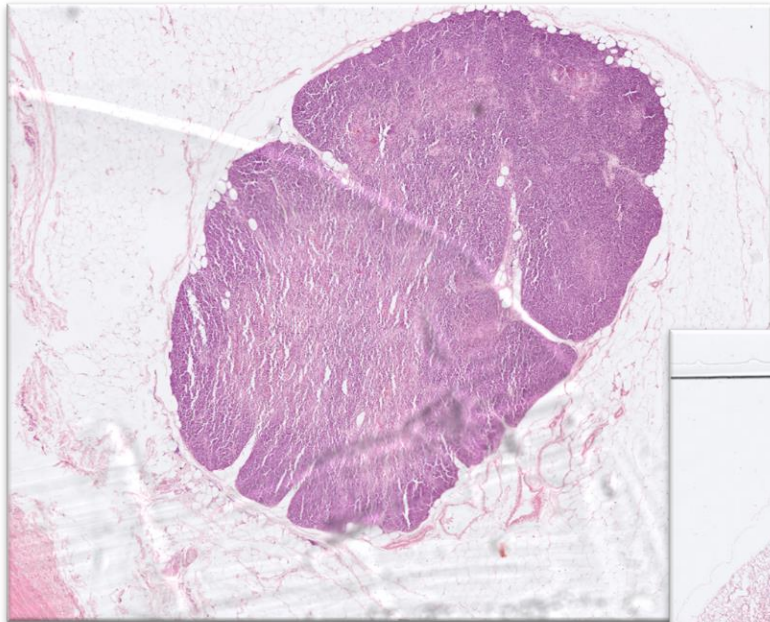
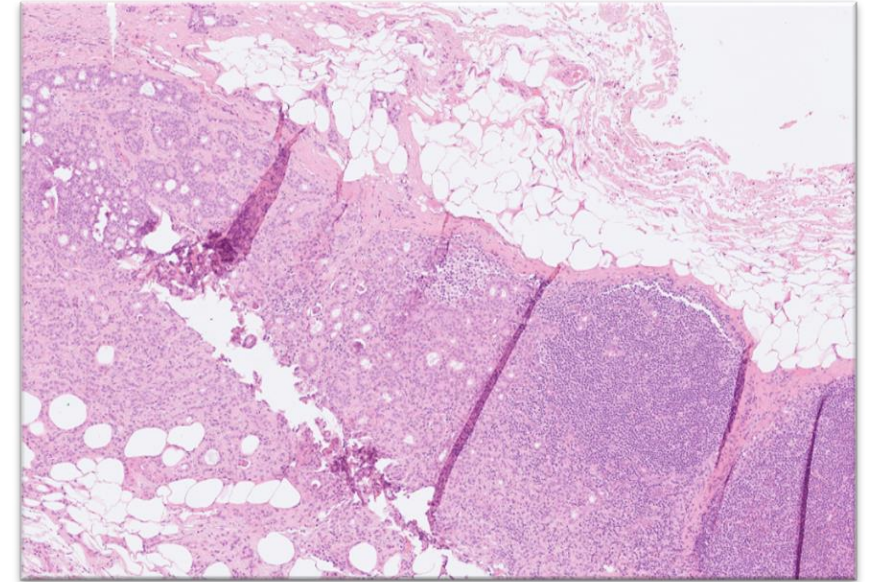
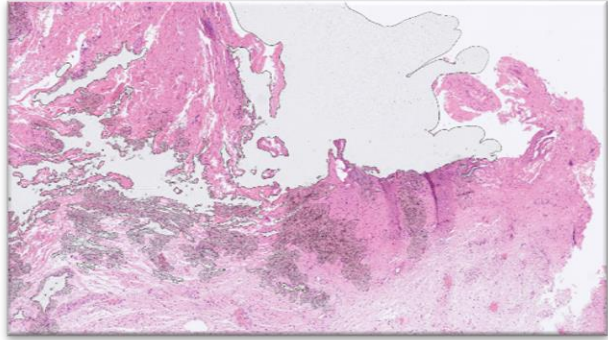


Free of dust and debris



Ideally barcoded slides (but not essential)

Potential Artefacts



Digital pathology Implementation

- Are any changes required to your working practice?
- Develop a robust system for case allocation
- Pathologist engagement is key for success
- Immediate 100% implementation is almost impossible
- Implement one speciality at a time
- MDT review is a good way to ensure Pathologist engagement

Slide and Case management

Minimum requirements:

- Worklist creation
- Case prioritization
- Basic annotation tools
- Image analysis
- Case sharing
- Real-time collaboration
- Direct link to your LIS/LIMS



Scanners (Technical)

- Do they perform as specified in terms of throughput?
- Are the results comparable to when viewed under a microscope? To include colour and resolution.
- Is all tissue on the slide detected?
- All slide barcodes (if used) read?
- What percentage of slides require rescan?
- If more than one scanner do they produce similar results?

Pathologists - Often carried out in at least 2 stages.

- Stage 1

Familiarise themselves with how diagnoses look digitally. A selection of slides per speciality to show the majority of common and complex diagnoses they may come across.

- Stage 2

Begin reporting side by side glass and digital. Number of cases is dependent on the individual and confidence levels, typically 100+.

Final sign off by local Digital Pathology lead.

Case Study – PathLinks, UK

- UK laboratory producing between 1000-1200 slides per day, including up to 40 double width (mega) slides per day.
- Urgent slides are produced throughout the day which are required to be viewed by a Pathologist ASAP.
- One laboratory technician available to load and unload scanners.
- Minimal user interaction required.
- Working day 8.30am – 5pm.
- Laboratory moving vendors from GE Omnyx

Case Study – PathLinks, UK

Scanner set up



S360 Scanner

- 360 routine slide capacity
- Real-time scanning 30 slides per hour
- Slide prioritisation
- Profile based
- Z-stack available
- 40x or 20x magnification

S60 Scanner

- 60 routine slide capacity or 30 double width slides
- 40x or 20x magnification
- Profile based
- Z-stack available

Scanners were installed and tailored to customer slides and utilised a single profile. Only interaction required is to load and unload the slides and to prioritise slides when required.

Note: NanoZoomer S360 and NanoZoomer S60 are CE marked under EU's In Vitro Diagnostics Directive (IVDD) for in vitro diagnostic use.

NanoZoomer S360 and NanoZoomer S60 are for Research Use Only in US and Japan.

For other countries and other models, please consult with Hamamatsu.

Case Study – PathLinks, UK



- Scanner repertoire to include option for high capacity scanning and double width slides.
- Slide prioritisation.
- Fluorescence option available on S60 scanner.
- Image resolution up to 0.23 μ m per pixel on all scanners.
- Z-stacking available on all scanners.
- Profile based scanning can be tailored to customer requirements.
- Easy access side panel for scanner maintenance
- Manual scanning option for troublesome slides.

Take home messages:

1. Scanner selection is important, a physical demo is ideal to gain real-time scanning speeds and experience workflow.
2. Develop a streamlined scanning workflow.
3. Carry out a thorough validation.
4. Have patience, implementation is a long process.
5. Enjoy the benefits of **Digital Pathology**.

The future of Digital Pathology

- Scanners?
- Image Analysis?
- Artificial Intelligence?
- Multiplexing analysis?

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