AxioScan.Z1 from ZEISS

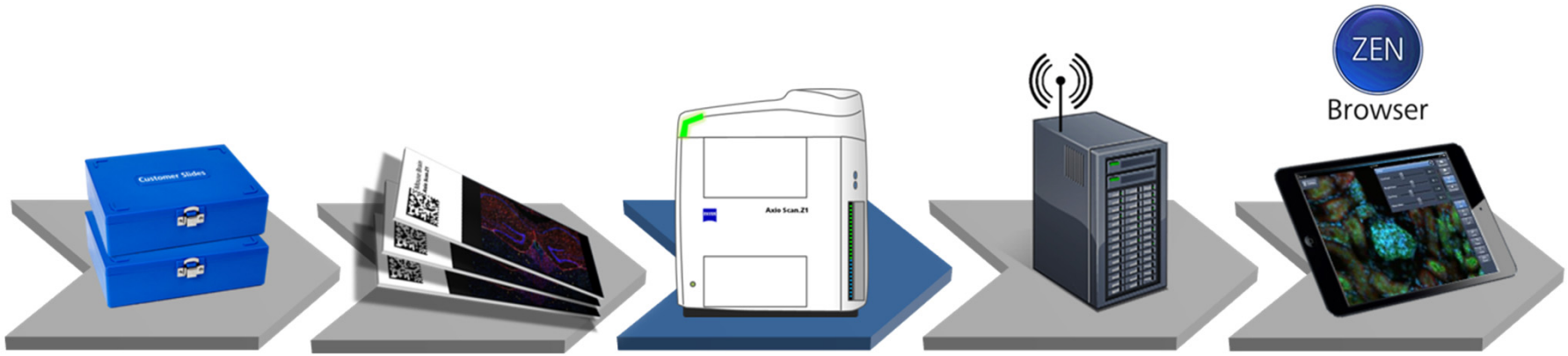
What solution does Carl Zeiss provide for slide scanning?

AxioScan.Z1

A complete system solution for whole slide imaging

Axio Scan.Z1 fits into a work-flow solution

Can I archive and manage experimental image data?



ZEN (Zeiss Efficient Navigation) is the imaging software of Carl Zeiss

Take a closer look

Is it possible to make routine imaging more efficient?

1. Scan status indicator light
2. One-touch function buttons
3. Low energy standby power on/off
4. Port for fluorescence accessories
5. Loading bay door with scan progress lights

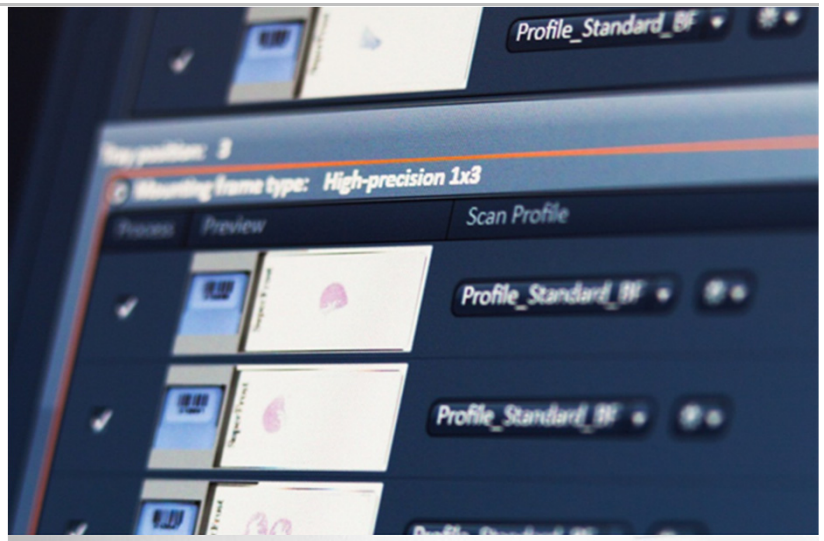
Look across the lab and watch your scan progress

Scan set-up is simple

Is it possible to make routine imaging more efficient?

- Loaded slides are scanned using predefined profiles
- Profile set-up is completed via an intuitive wizard
- Important slides can be easily prioritised
- Preview scans are made for all loaded slides
- Automatic tissue detection and focus strategy

Axio Scan.Z1 runs on ZEN for efficient software navigation



Premium service support

Is it possible to make routine imaging more efficient?

- Axio Scan.Z1 is designed for straight forward maintenance
- Our engineers receive extensive factory training
- Carl Zeiss spare parts logistics reduces down time
- Calibration is a fully automated one-time process
- All upgrades are executable on the customer site

Our global customer service is second-to-none

What can you do with a virtual slide?
Can I really focus on the outcomes of my investigation?

Scanning a microscope slide with **Axio Scan.Z1** will lead to five main outcomes for the researcher, clinician, or educator.

What does Carl Zeiss do to support these outcomes?

Archiving and Management

- **ZEN Browser** is the database for **Axio Scan.Z1**
- Slides are named and indexed for easy retrieval
- Administrators can control access rights to slides
- **ZEN Browser** runs on a Tower or Rack hardware solution
- Start with 22Tb for 22,000 slides at 1Gb/slide

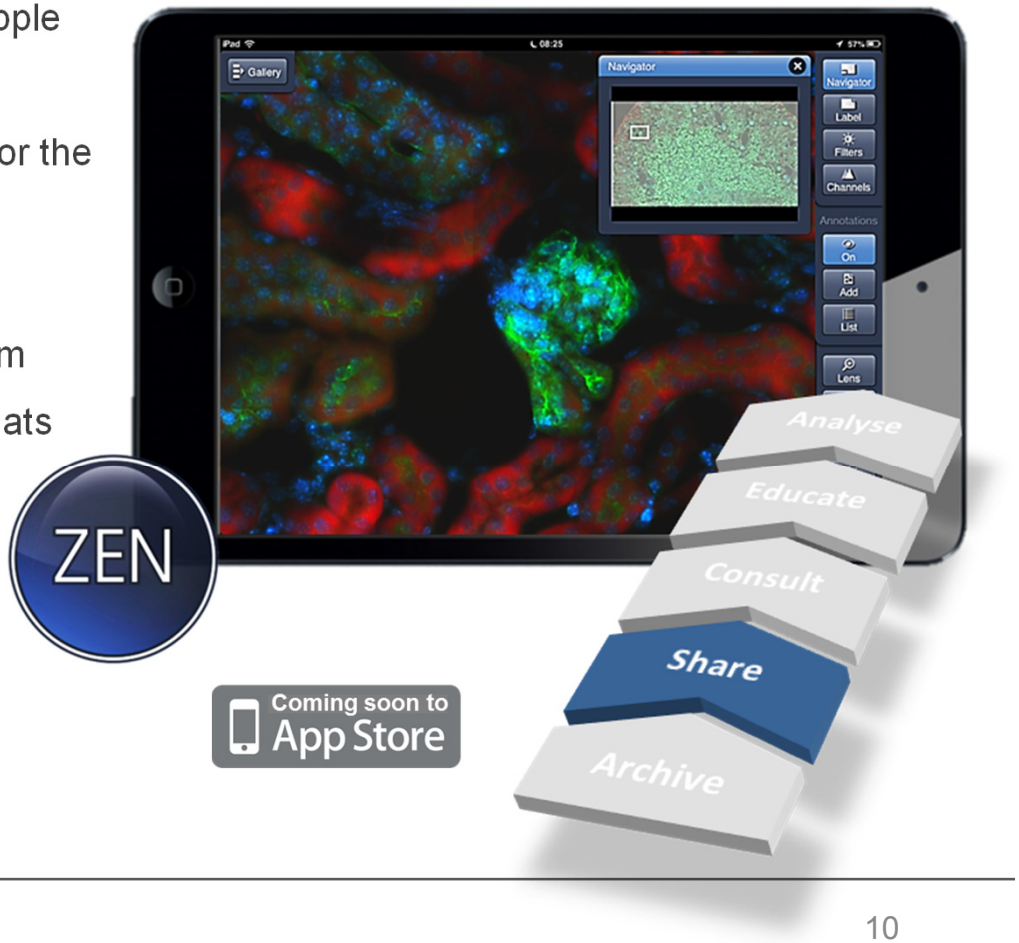
ZEN Browser also runs on your existing compatible server hardware

Sharing and remote viewing

- Use the **ZEN Browser** app available free for Apple iPad
- View slides with **ZEN Browser** Java interface for the web
- Download **ZEN Lite** from zeiss.com
- Open virtual slides in your existing **ZEN** program
- Export images in a wide variety of popular formats

The CZI file format is flexible and open

https://zenbrowser.cloudapp.net/zdb



Consultation and meta data

- Annotate slides using any of the **ZEN** viewing platforms
- Freely store and access virtual slide meta data
- Compare slides side-by-side in **ZEN Gallery View**
- Instant second opinion with global collaborators
- CZI format in your own applications with **ZEN SDK**

Collaboration is global – take your slides with you

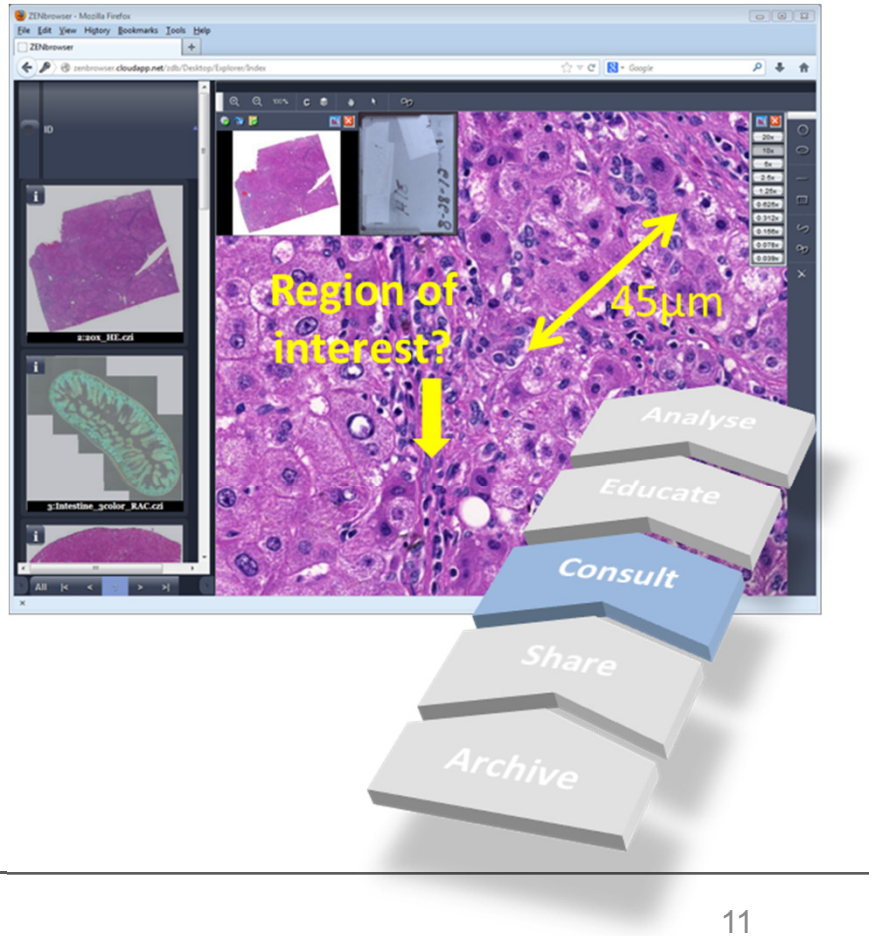
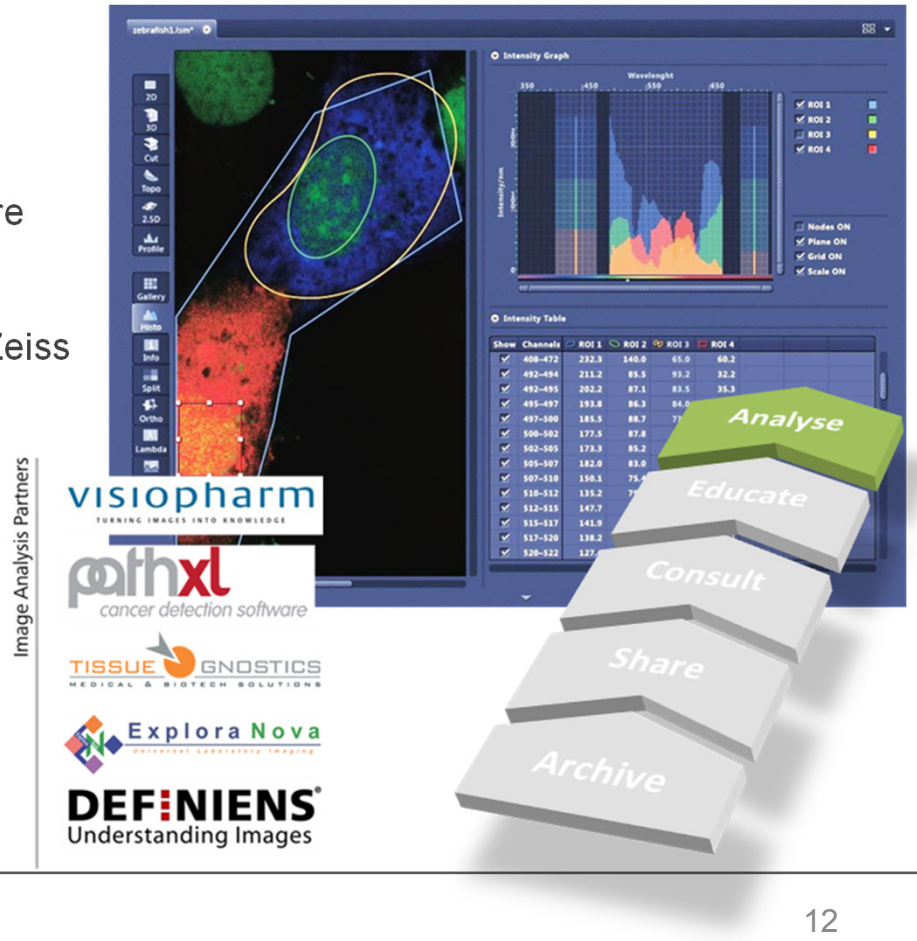


Image Analysis: ZEN and beyond

- ZEN Image Analysis and ZEN Open Application Development
- ZEN is the seamless approach
- Open and process CZI format in third-party software
- Export slides as OME TIFF
- Access specialist development support from Carl Zeiss

You chose the best solution for your investigation



Axio Scan.Z1
Challenges met

Can I archive and manage experimental image data?

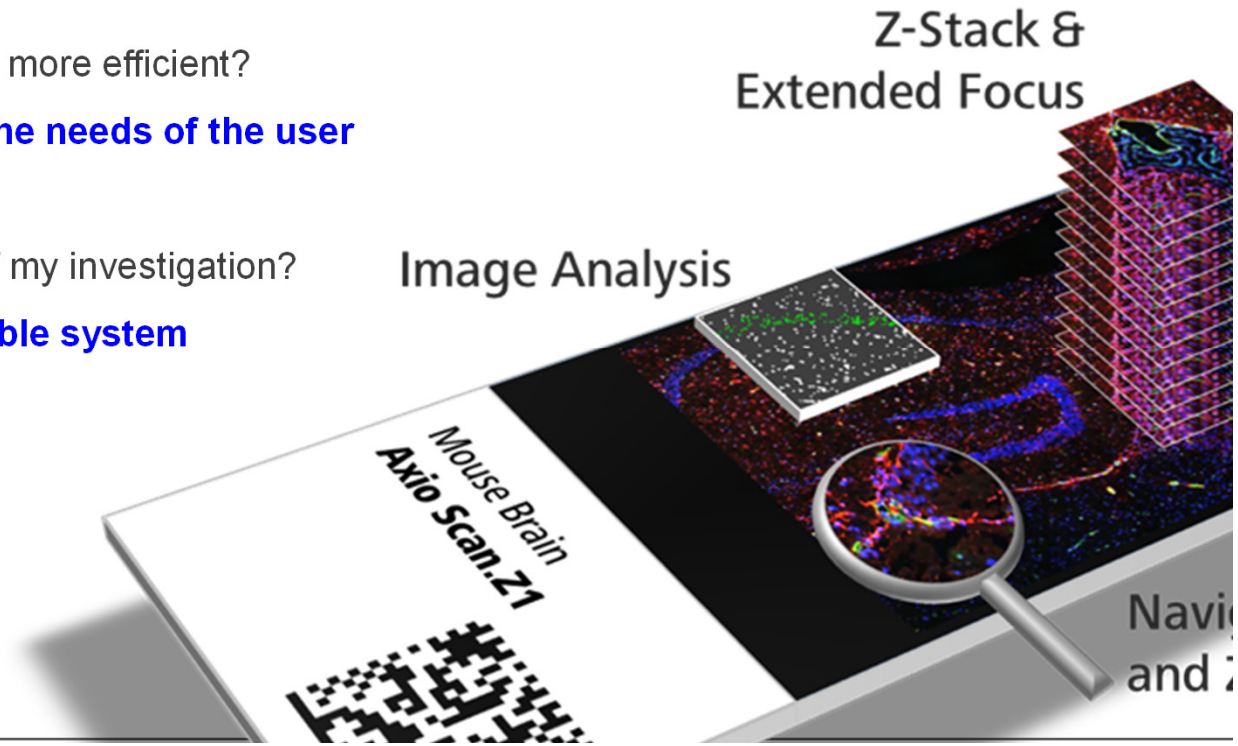
Axio Scan.Z1 creates a workflow solution to scanning slides

Is it possible to make routine imaging more efficient?

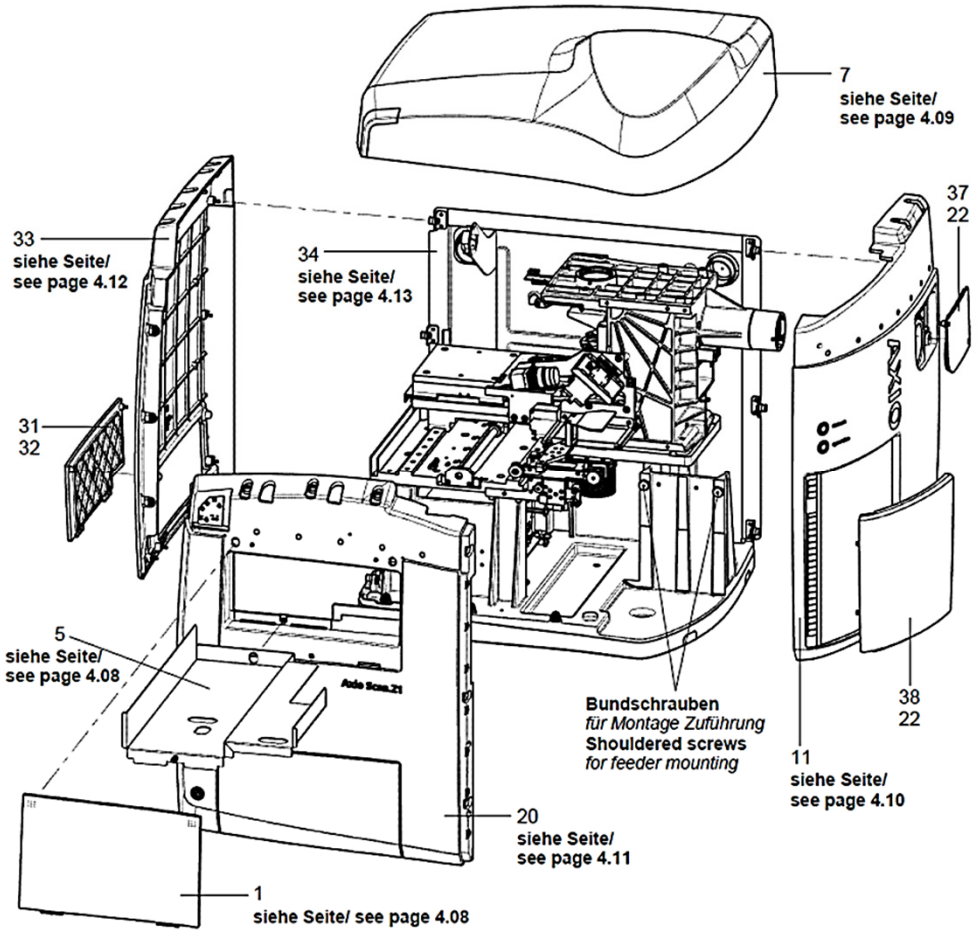
Axio Scan.Z1 is designed around the needs of the user

Can I really focus on the outcomes of my investigation?

Axio Scan.Z1 is an openly compatible system

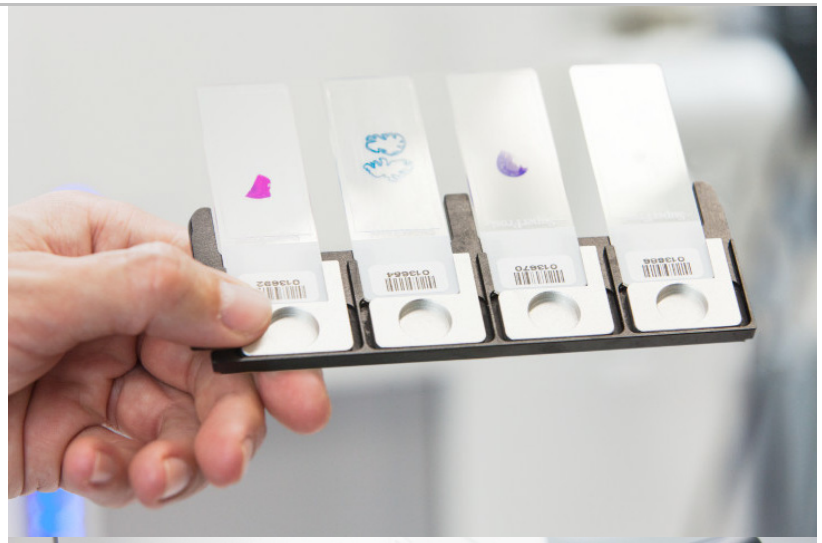


What are the specific details?
3. Technical Appendix



Technical Appendix 1
Slide loading

- Axio Scan.Z1 holds a maximum of 100 slides at any time
- Four standard slides are held in a single frame
- Individual slides are not moved by the slide loader
- Large format slides (50mm x 75mm) can be used
- Slides can be loaded and unloaded during scanning

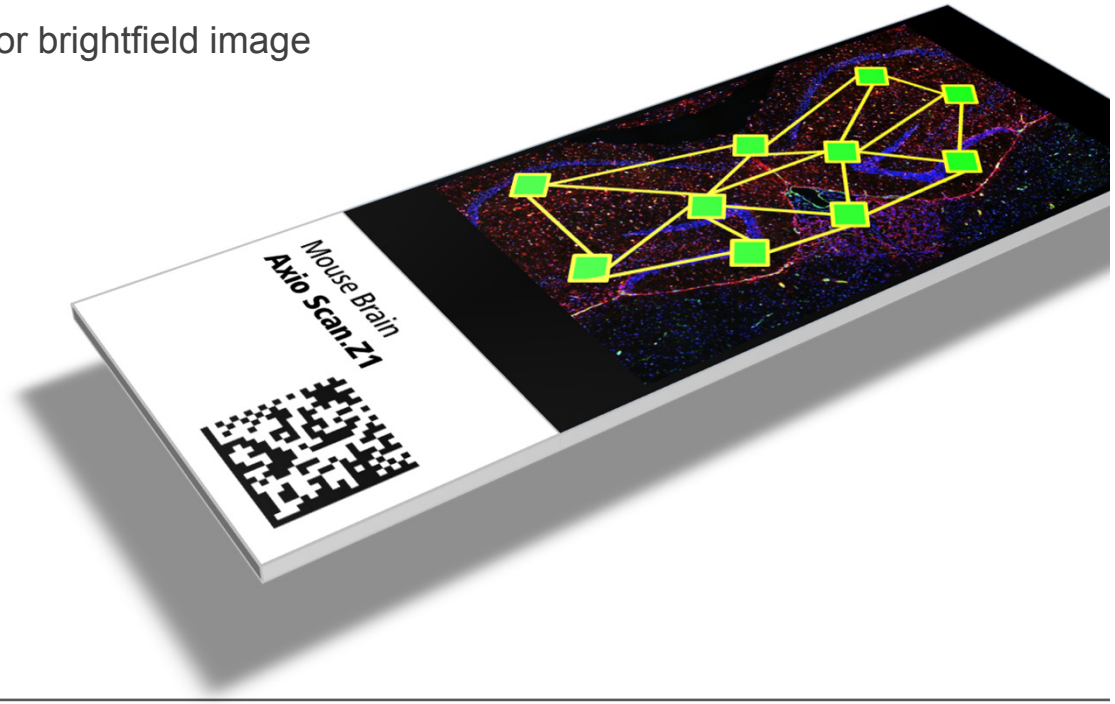


Key advantage:

Carl Zeiss uses a very reliable loading mechanism

Technical Appendix 2
Focus strategy

- Focus map created at low and high magnification for accuracy
- Number of points is variable and relates to sample flatness
- Different spatial distribution algorithms available
- Focus fluorescence by selected channel or brightfield image
- Set-up via intuitive wizard



Key advantage:

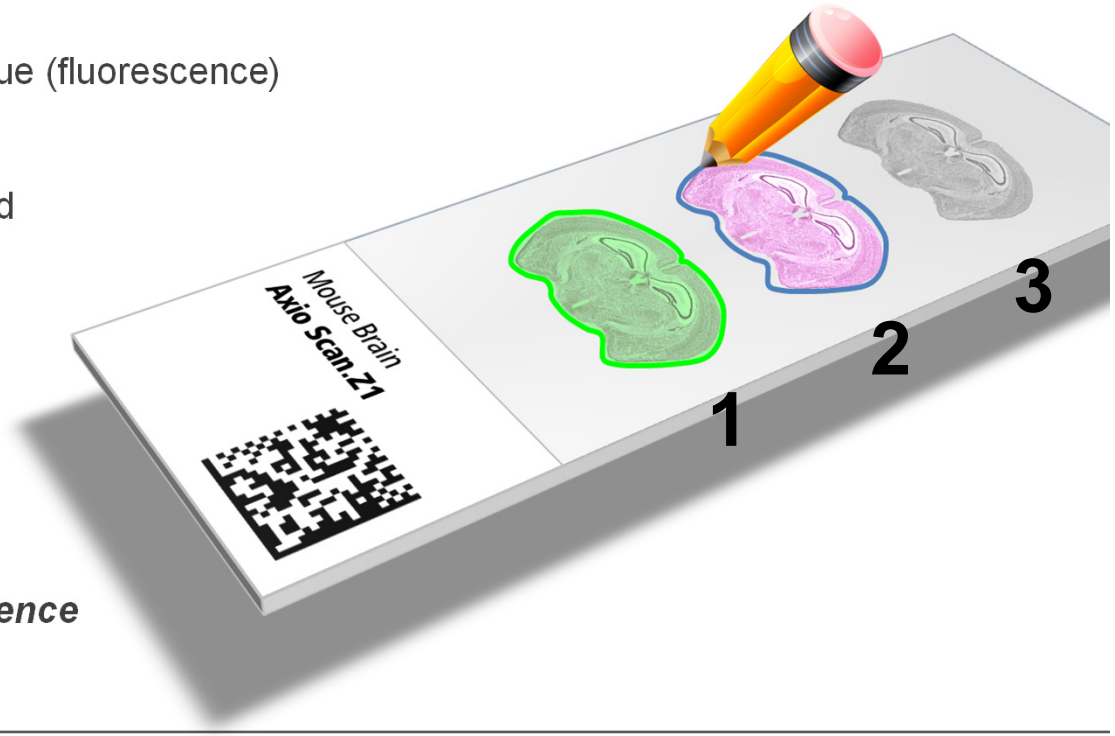
Focusing of specimen is accurate and reproducible with Axio Scan.Z1

Technical Appendix 3
Tissue detection

Three main methods for tissue detection:

1. Automatic threshold
2. Manual identification
3. Ring aperture contrast for unstained tissue (fluorescence)

Each method can be adapted and specialised

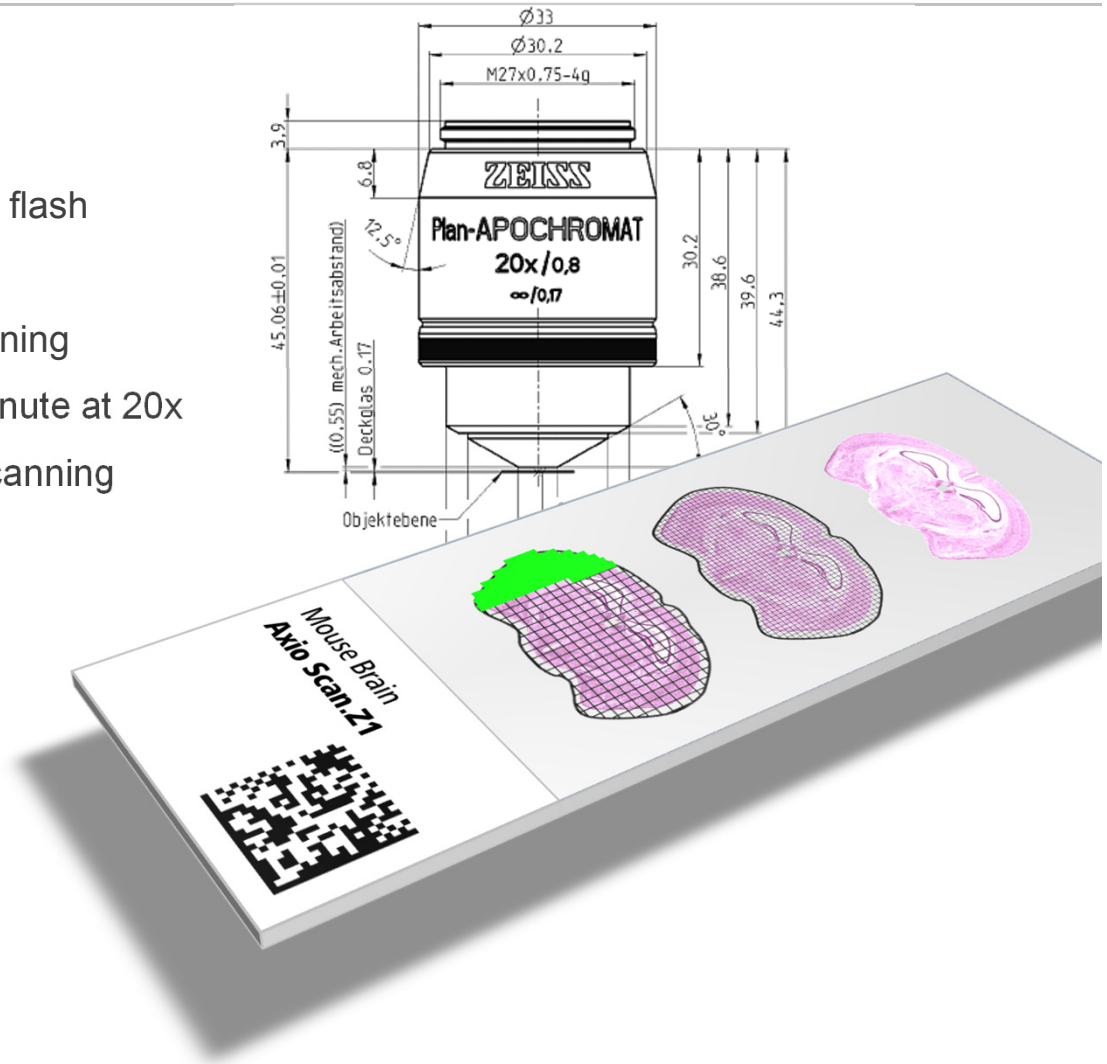


Key advantage:

A wide range of specimen types can be automatically detected including fluorescence

Technical Appendix 4
Scanning

- Axio Scan.Z1 uses continuous movement flash imaging
- Focusing and stitching is done while scanning
- Scan speed is approximately 2cm^2 per minute at 20x
- Z-stack images can be acquired during scanning
- Slides are scanned in a flat position

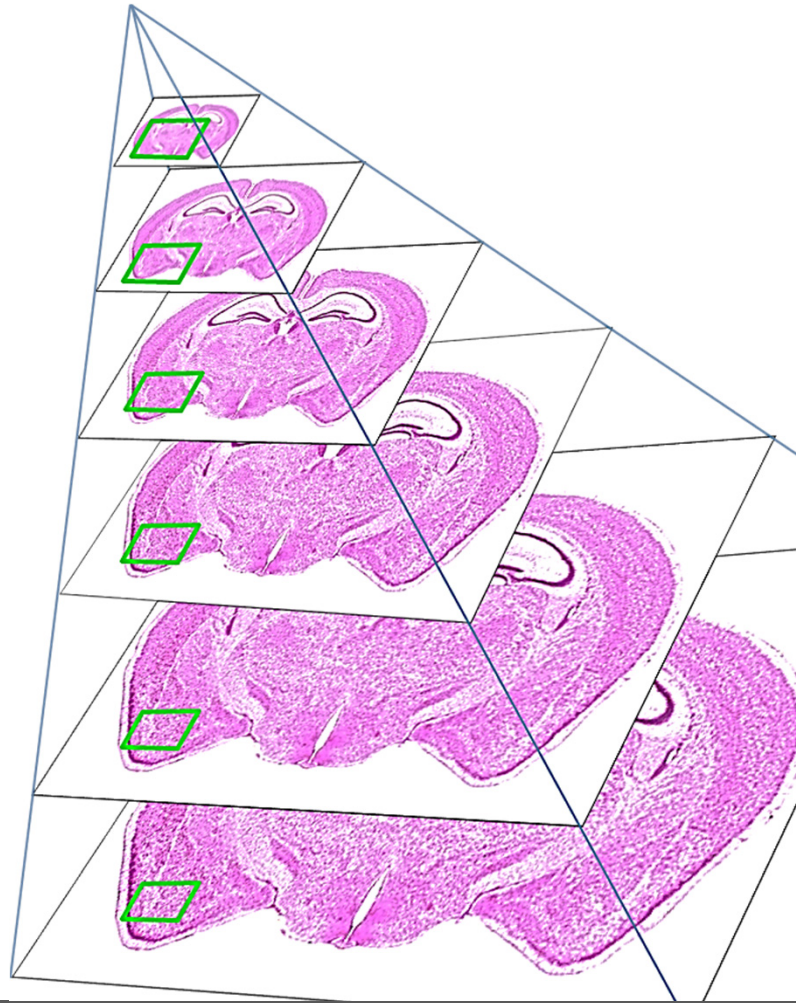


Key advantage:

Axio Scan.Z1 is fast but does not compromise superior image resolution

Technical Appendix 5
CZI File format

- Axio Scan.Z1 generates **pyramidal image** files
- Annotations are stored in a separate image layer
- CZI files can be converted to TIFF, JPEG, and OME TIFF
- SDK permits implementation of CZI into other applications
- CZI allows multidimensional image information (XYZ and λ)



Key advantage:

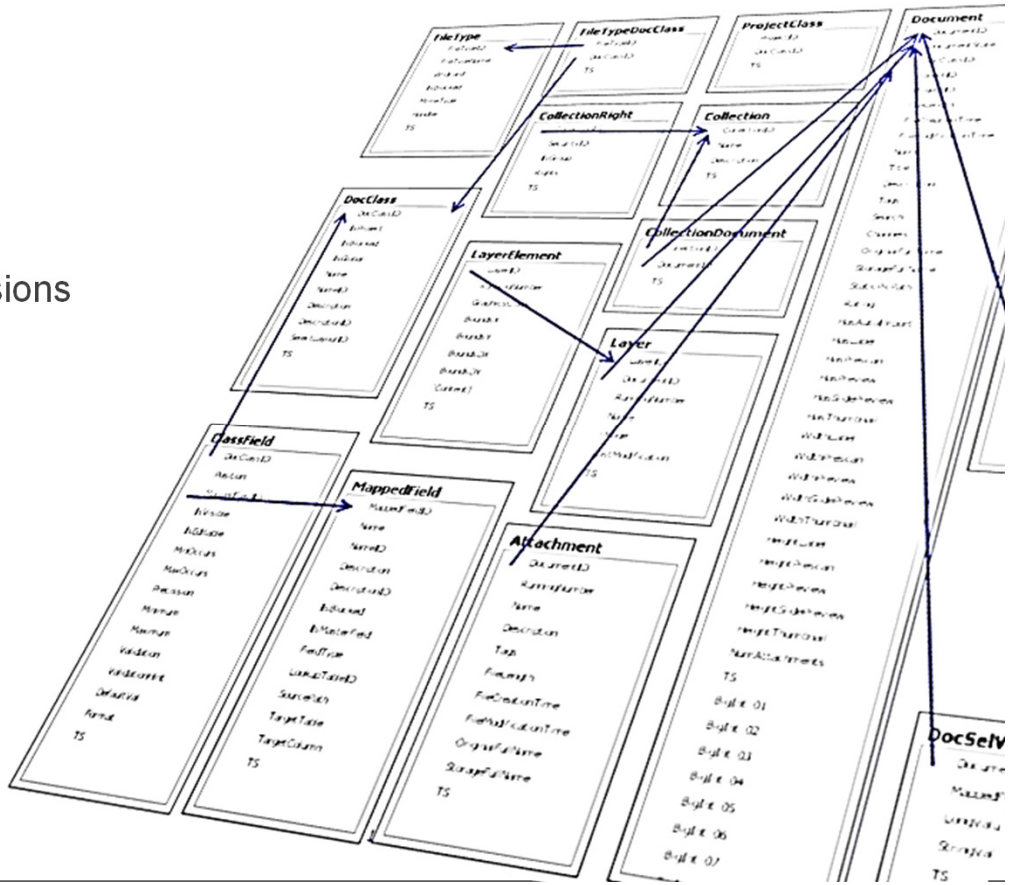
Axio Scan.Z1 images are fast to view and flexible for analysis

Technical Appendix 6
ZEN Browser

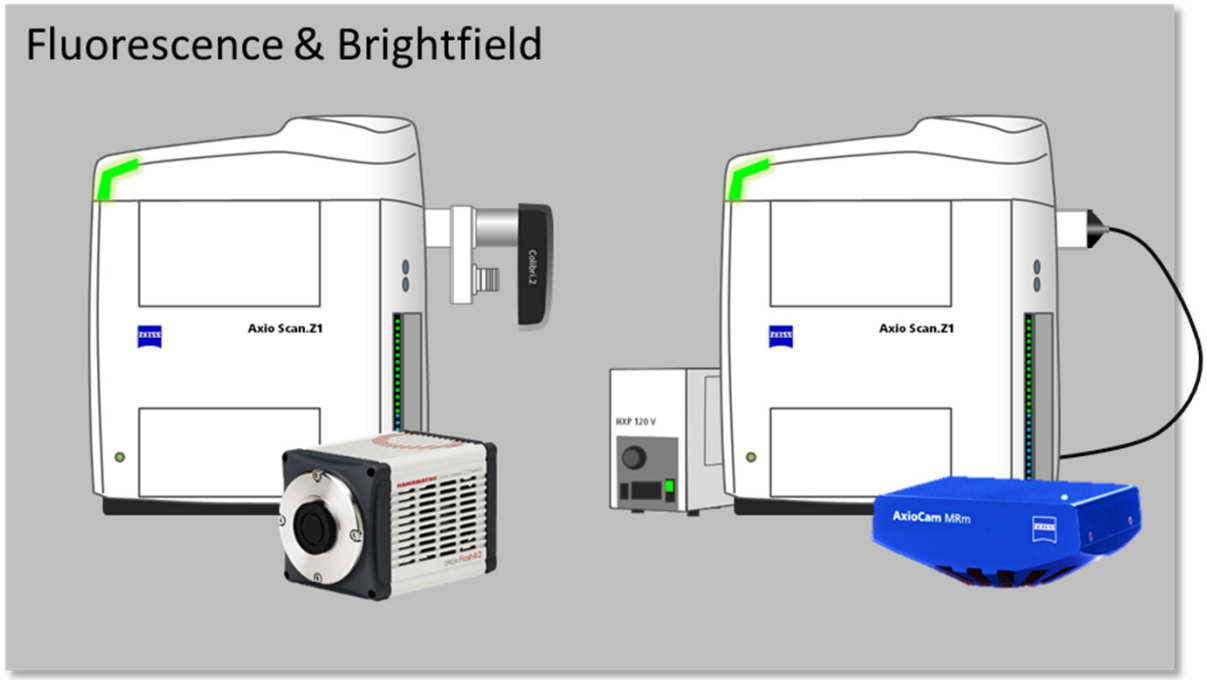
- Runs on 64bit Microsoft Server OS
- Internet Information Server (IIS 7) / ASP.NET framework
- Database is MS SQL Server 2008 Express
- Users organised in groups with specific permissions
- Support for Active Directory users

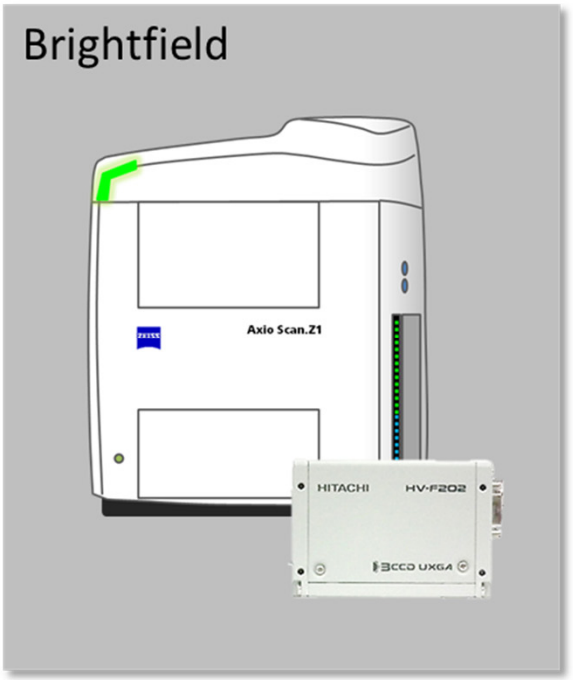
Key advantage:

ZEN Browser can be deployed to your existing server hardware with no fuss



Technical Appendix 7
Configuration overview





Technical Appendix 8
Highest Quality Optics

- 5x Fluar / 0.25 NA
- 10x Plan-Apochromat / 0.45 NA
- 20x Plan-Apochromat / 0.8
- 40x Plan-Apochromat / 0.95

Max. Theoretical Resolution (@520nm light)

Res x,y = λ/2•NA

5x = 1040 nm

10x = 578nm *0.44 µm/pixel*

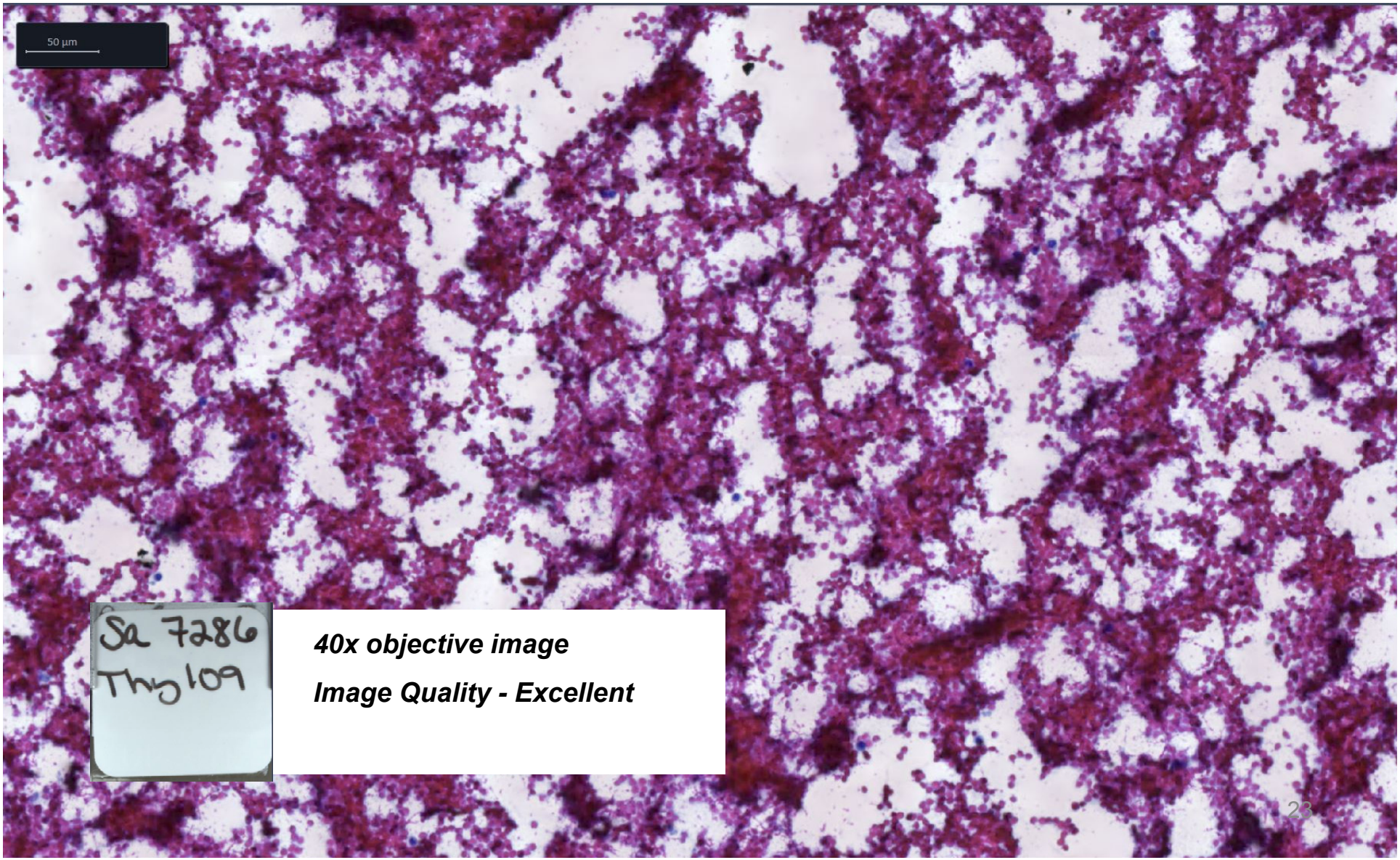
20x = 325nm *0.22 µm/pixel*

40x = 274nm *0.11 µm/pixel*

Key advantage:

No compromises made on image quality

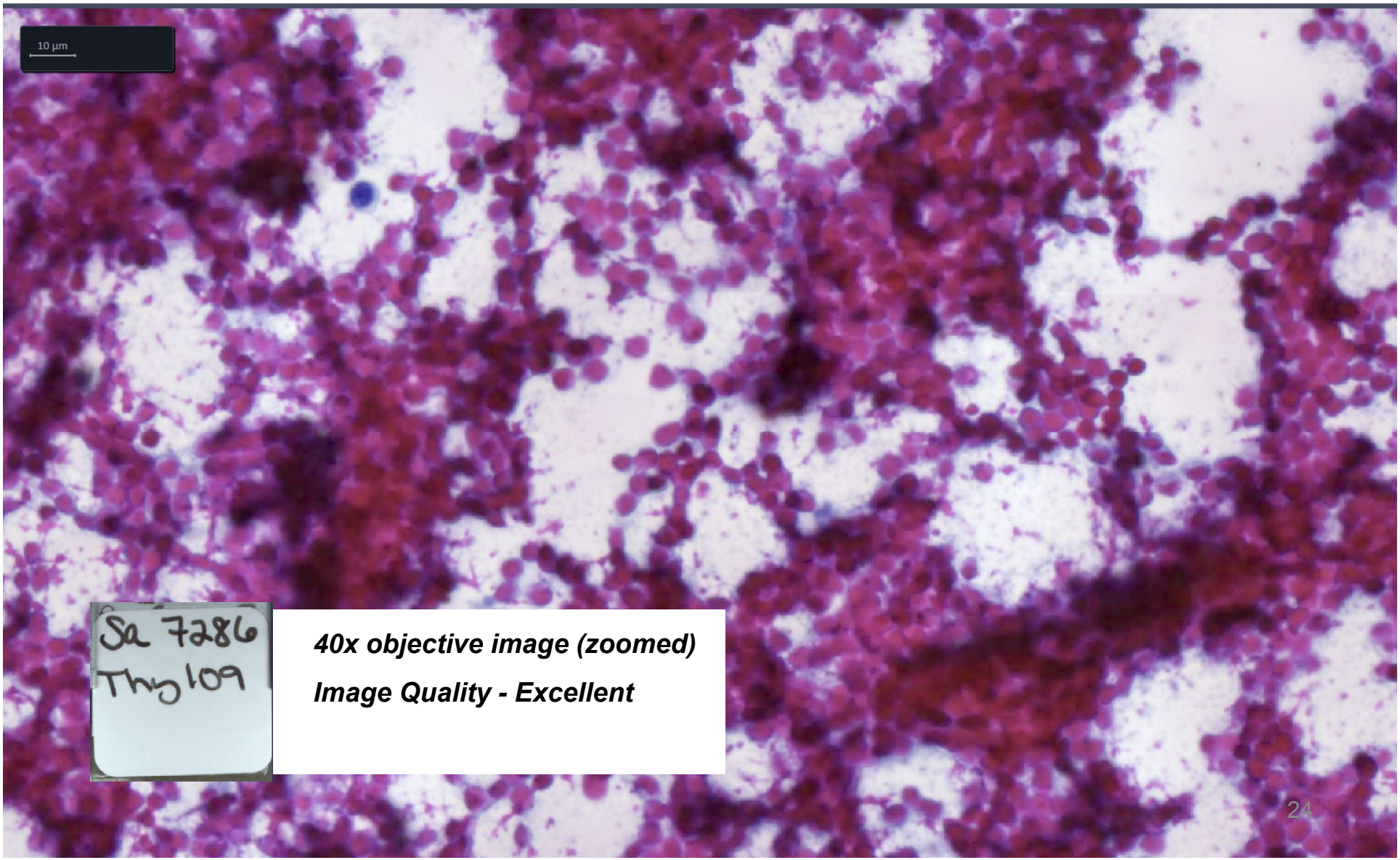
Demo Results
Image Quality



40x objective image

Image Quality - Excellent

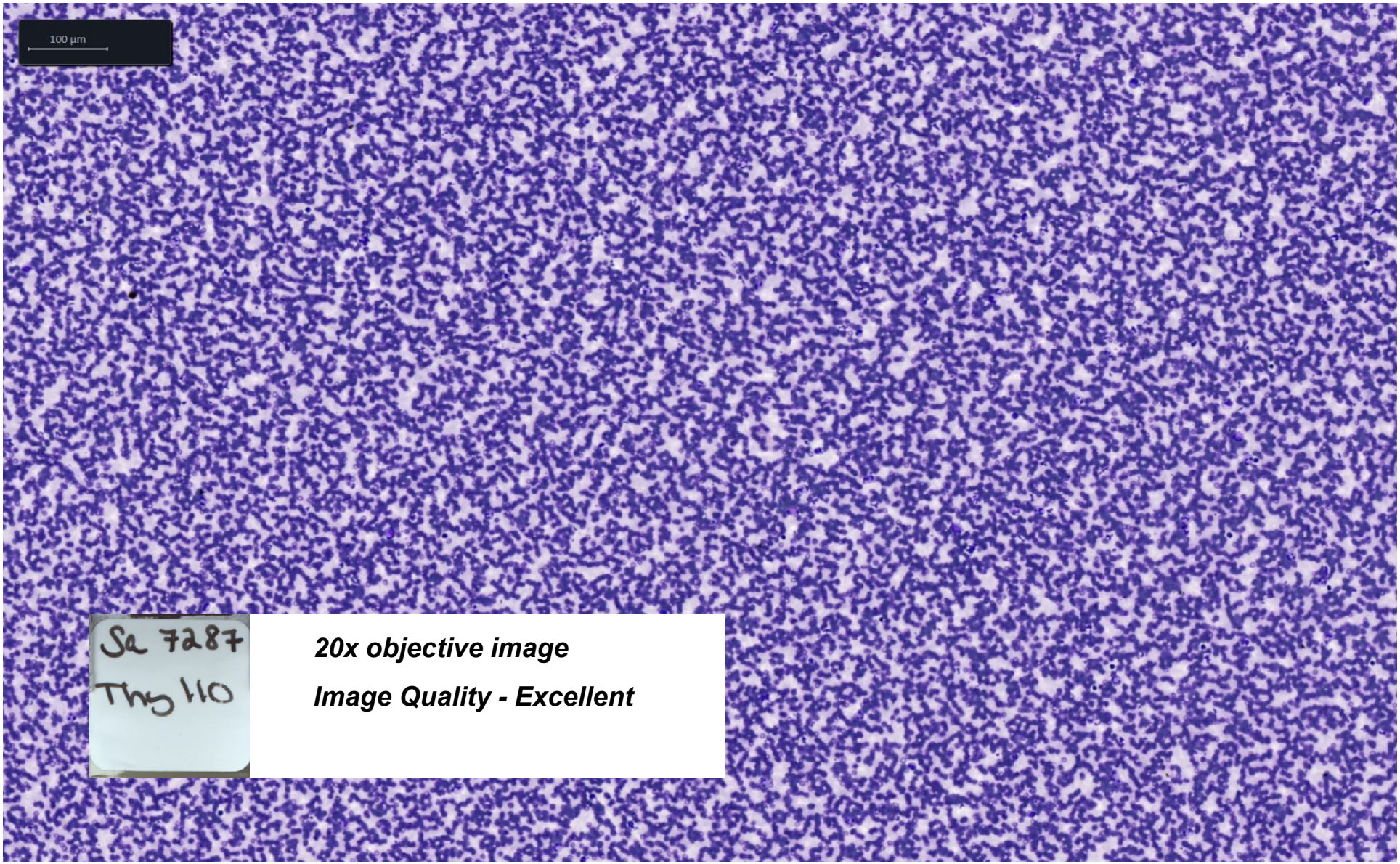
Demo Results
Image Quality



40x objective image (zoomed)

Image Quality - Excellent

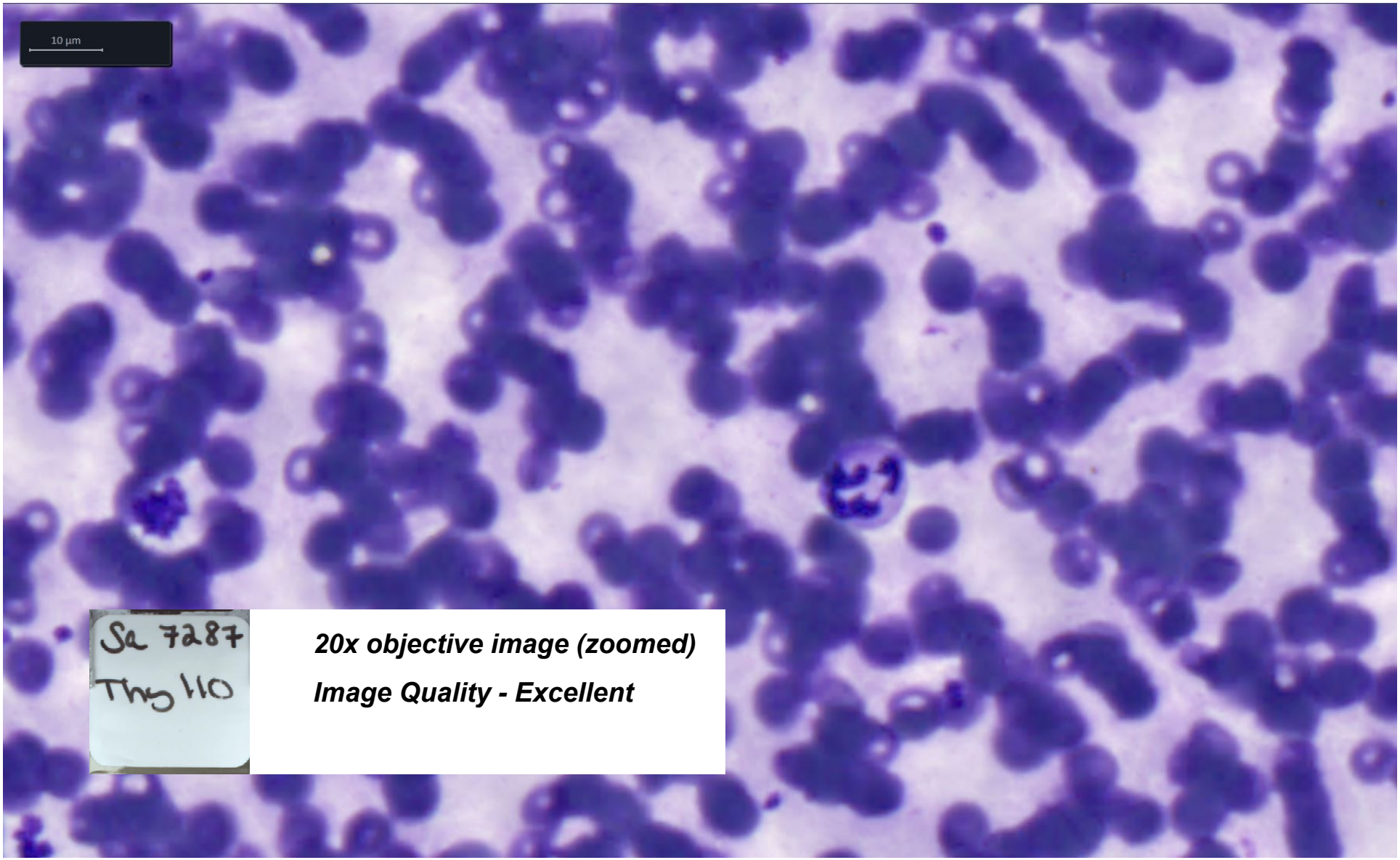
Demo Results
Image Quality



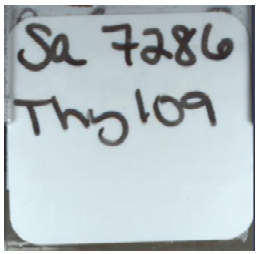
20x objective image

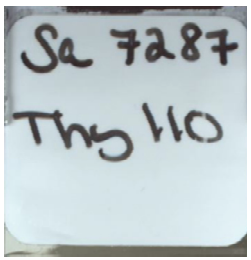
Image Quality - Excellent

Demo Results
Image Quality



Demo Results
Acquisition Speed





Objective	Image size (mm)	Tiles	File Size (GB)	Time(HH:MM)
10x	33.6 x 25.66	2609	2.08	00:30
20x	33.92 x 25.33	10171	3.97	02:25
40x	34.05 x 26.23	41132	7.31	14:15
20x	33.89 x 25.36	10305	3.53	02:07
40x	33.78 x 26.39	41715	4.65	14:24

Samples imaged with Z stacks to capture sample depth ~8-15 microns

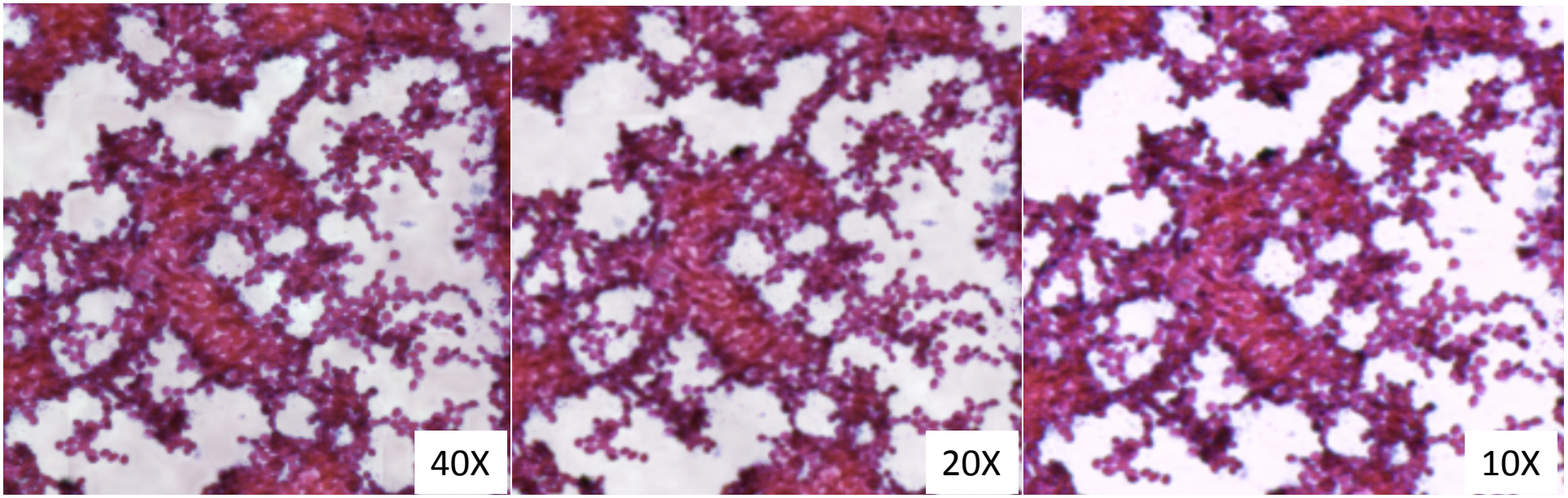
Acquisition followed by Extended Depth of Field Calculation (EDF)

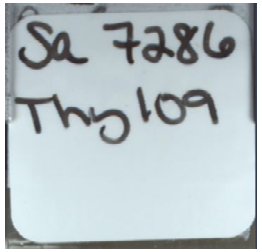
Images compressed with JpgXR

Speed could be optimized further with smaller Z stacks (or none) or choosing alternate objective

Demo Results

How Much Resolution is Needed?
Comparing 10, 20 and 40x





20x and 10x have excellent image quality and resolution and offer a significant time savings in comparison to 40x.

20x is 5 times faster than 40x with only ~15% less resolution

10x is 5 times faster than 20x with only ~40% less resolution

Image Resolution Max.

10x = 578nm

20x = 325nm

40x = 274nm

Thank you for your attention