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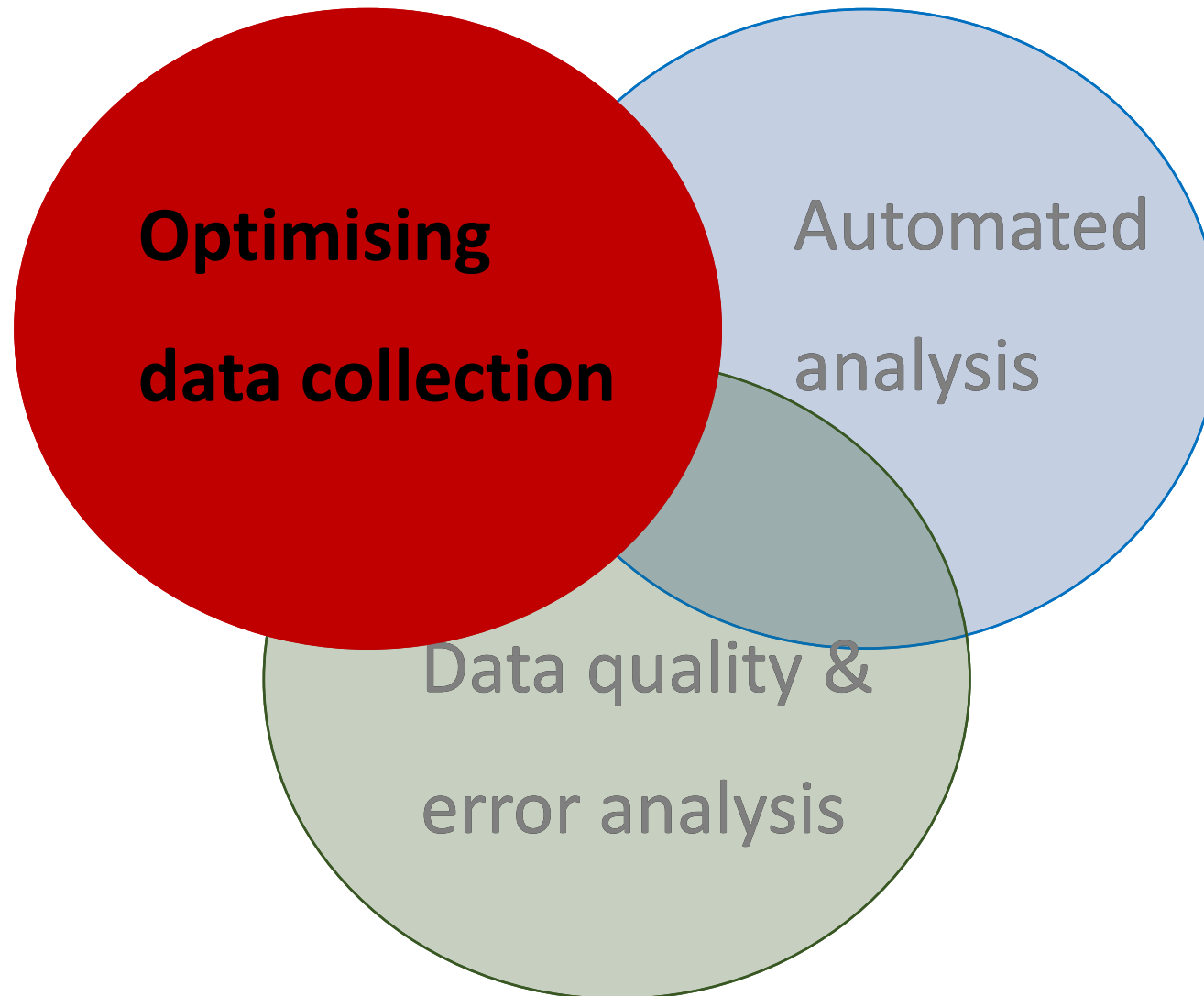
The University of Manchester

**HENRY · · · ·
ROYCE · · · ·
INSTITUTE**

Optimisation of X-ray CT data collection and automated analysis

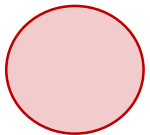
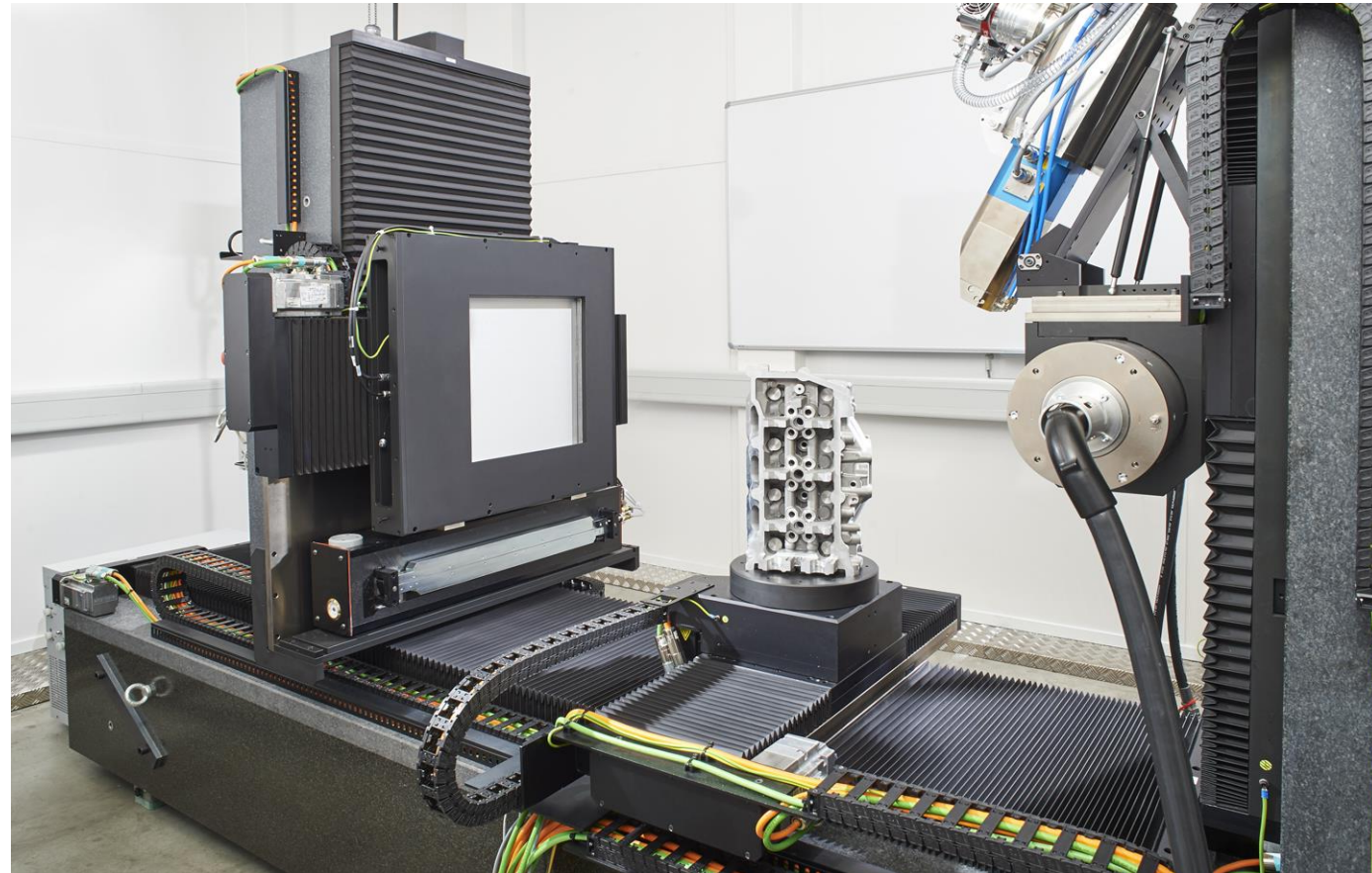
Tristan Lowe, Peter Westenberger, Sam Johnson, Ryan Warr, Andrew Ramsey, Nico Wagner Mark Dickinson
& Philip J. Withers

Overview

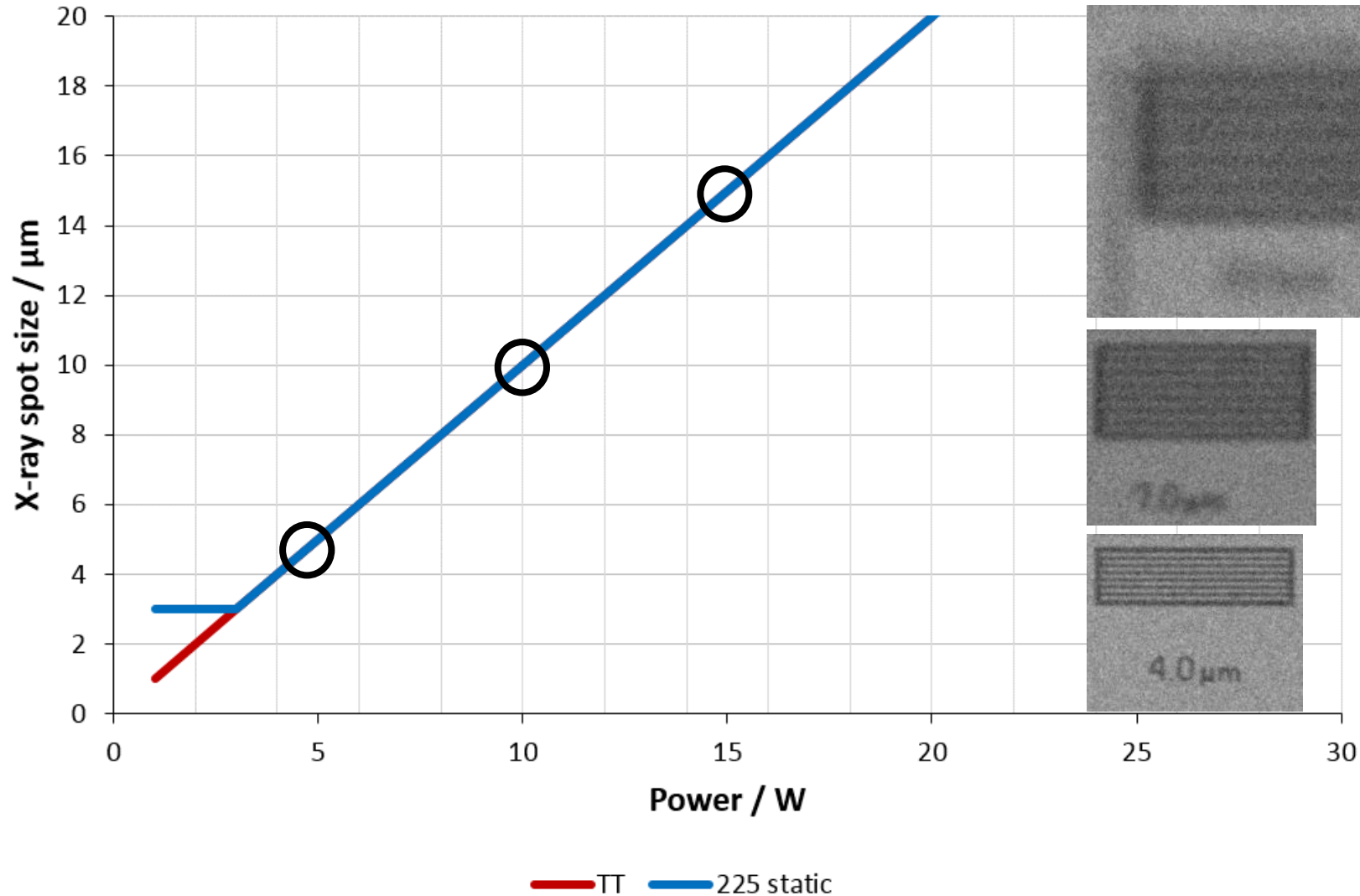


Optimising data collection

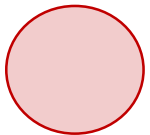
- The detector sensitivity & response
- Spot size, shape, focus & X-ray flux
- Image noise is minimal
- Spatial resolution is 3X the pixel size



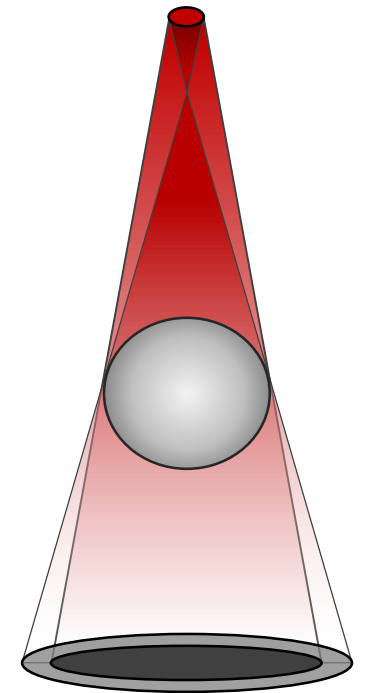
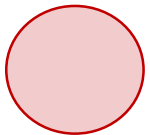
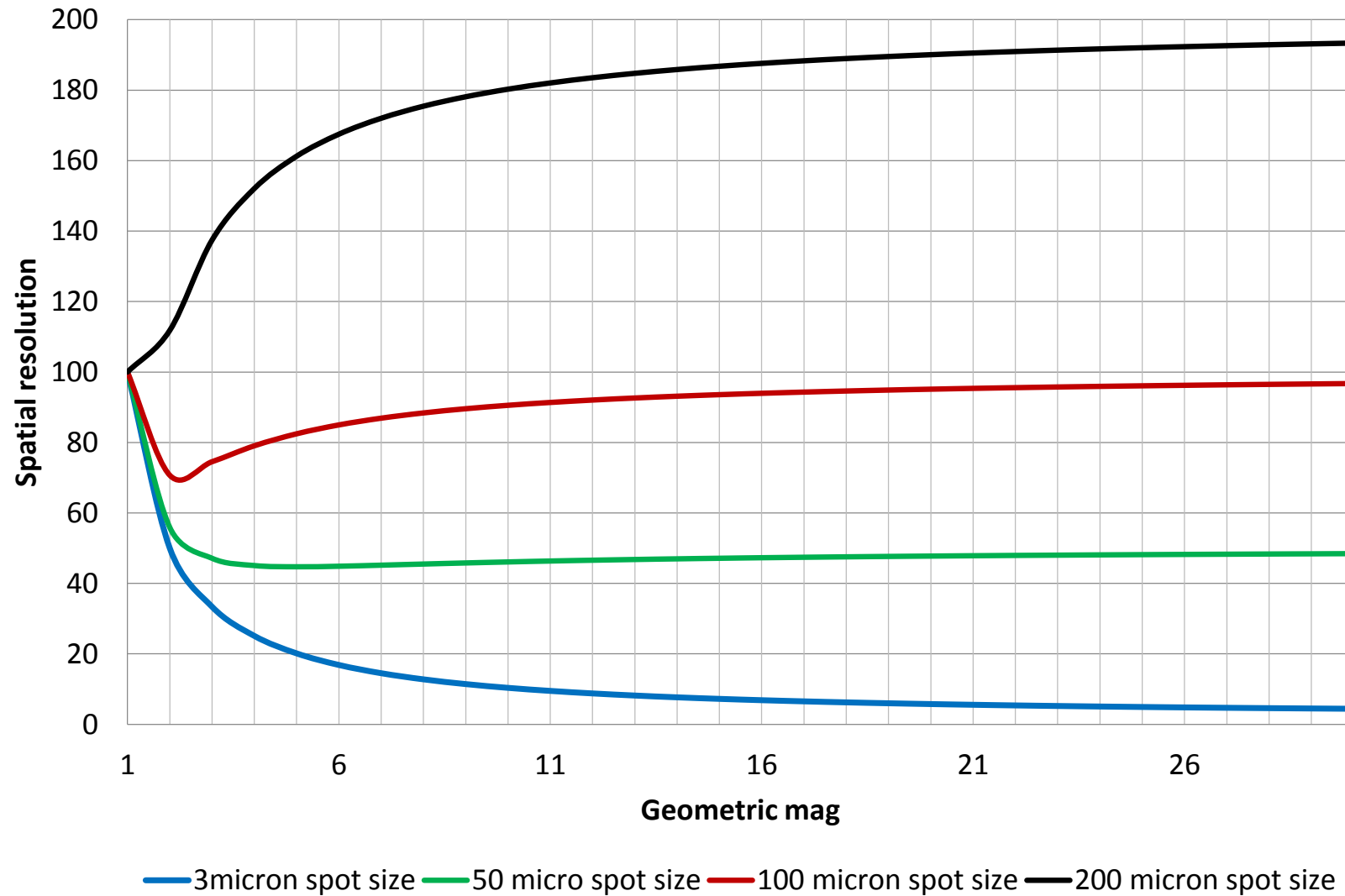
Spot size effect



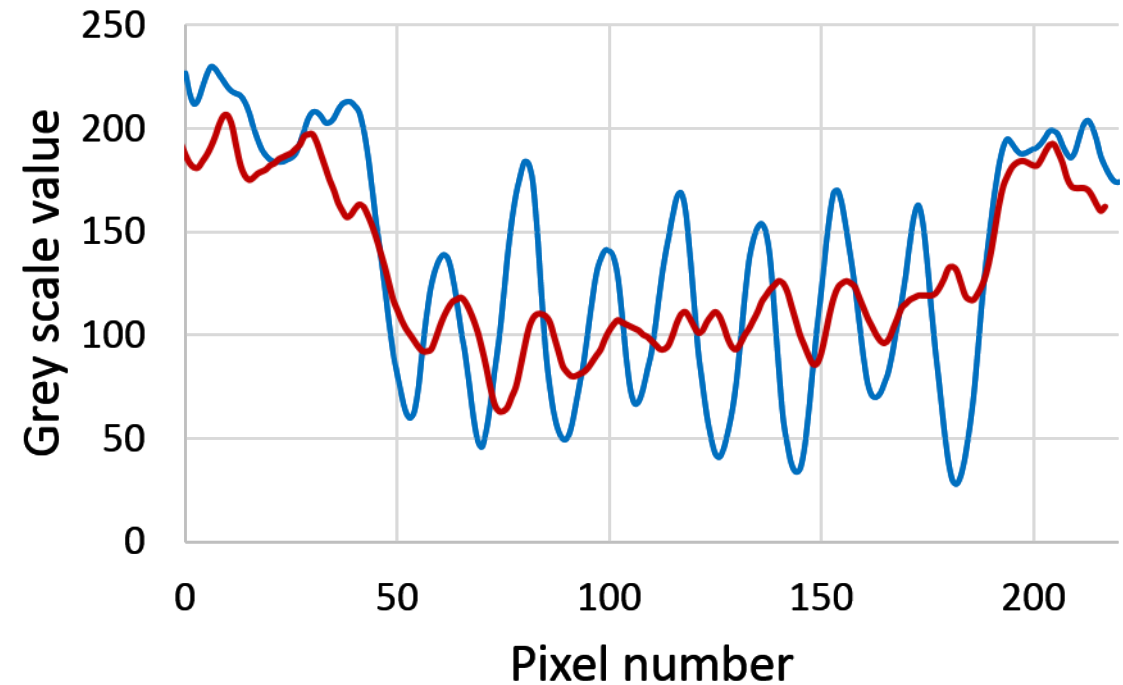
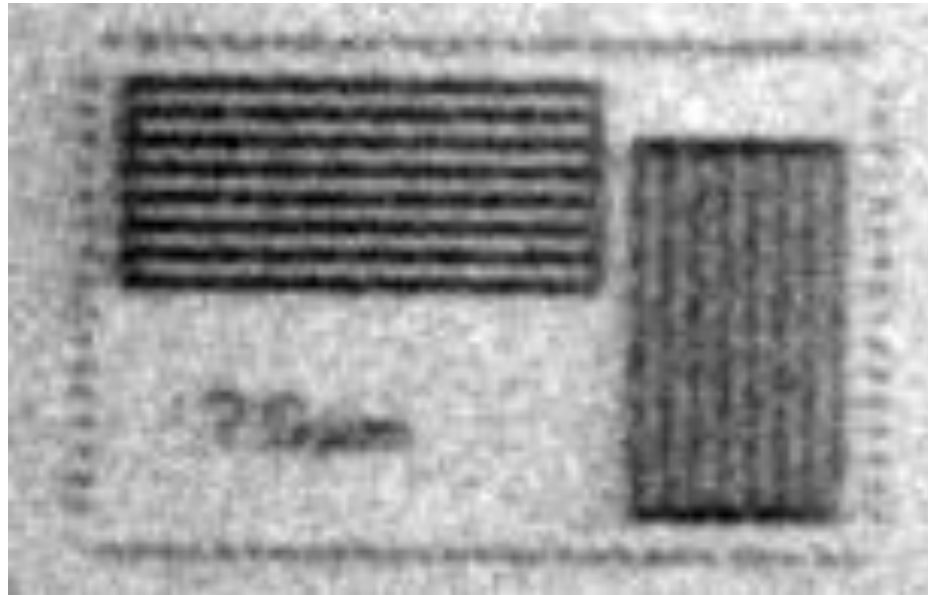
$$b = (M-1)f$$



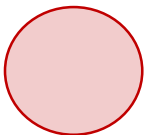
Optimising imaging positions



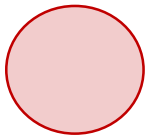
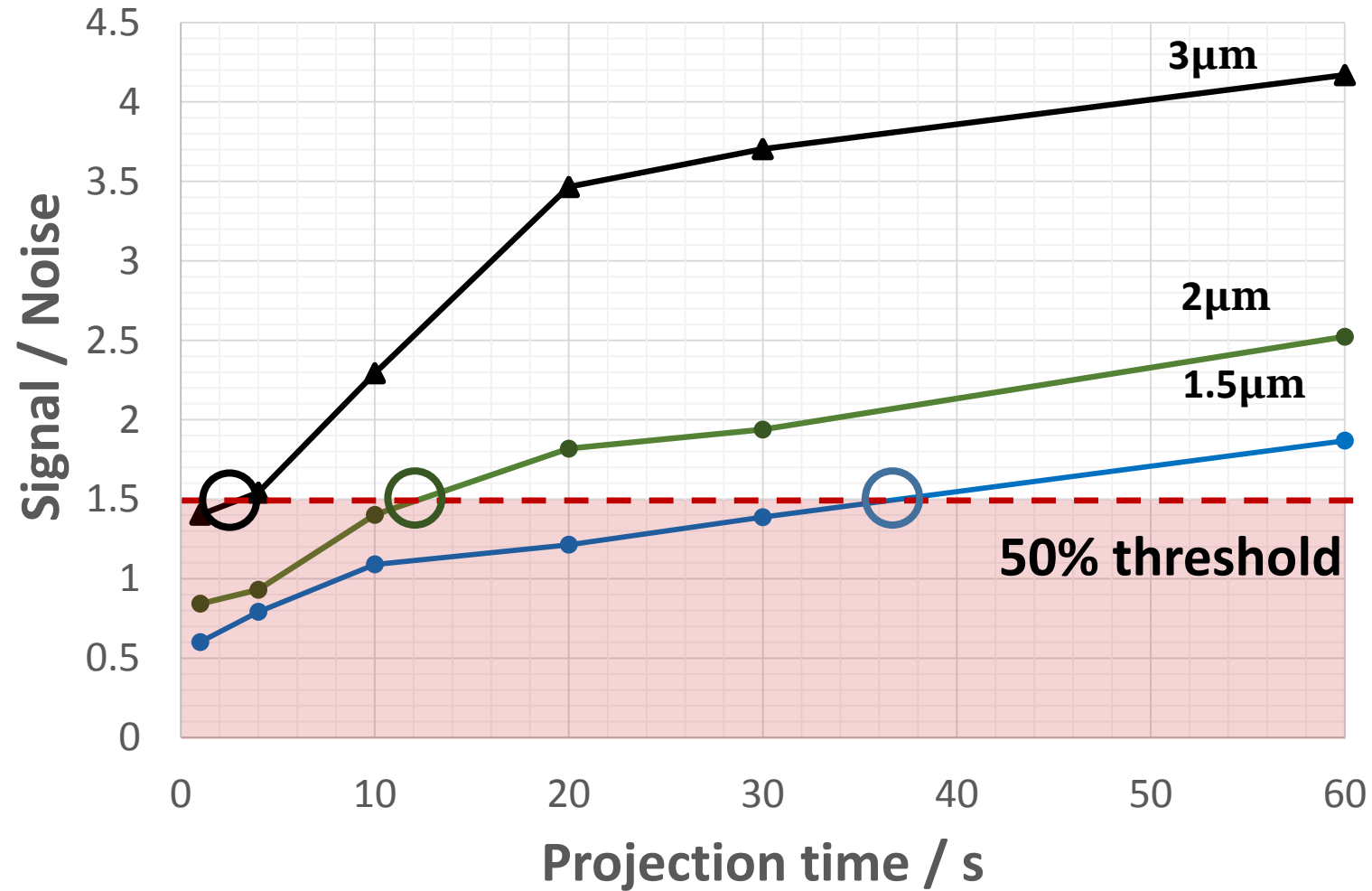
Radiograph resolution

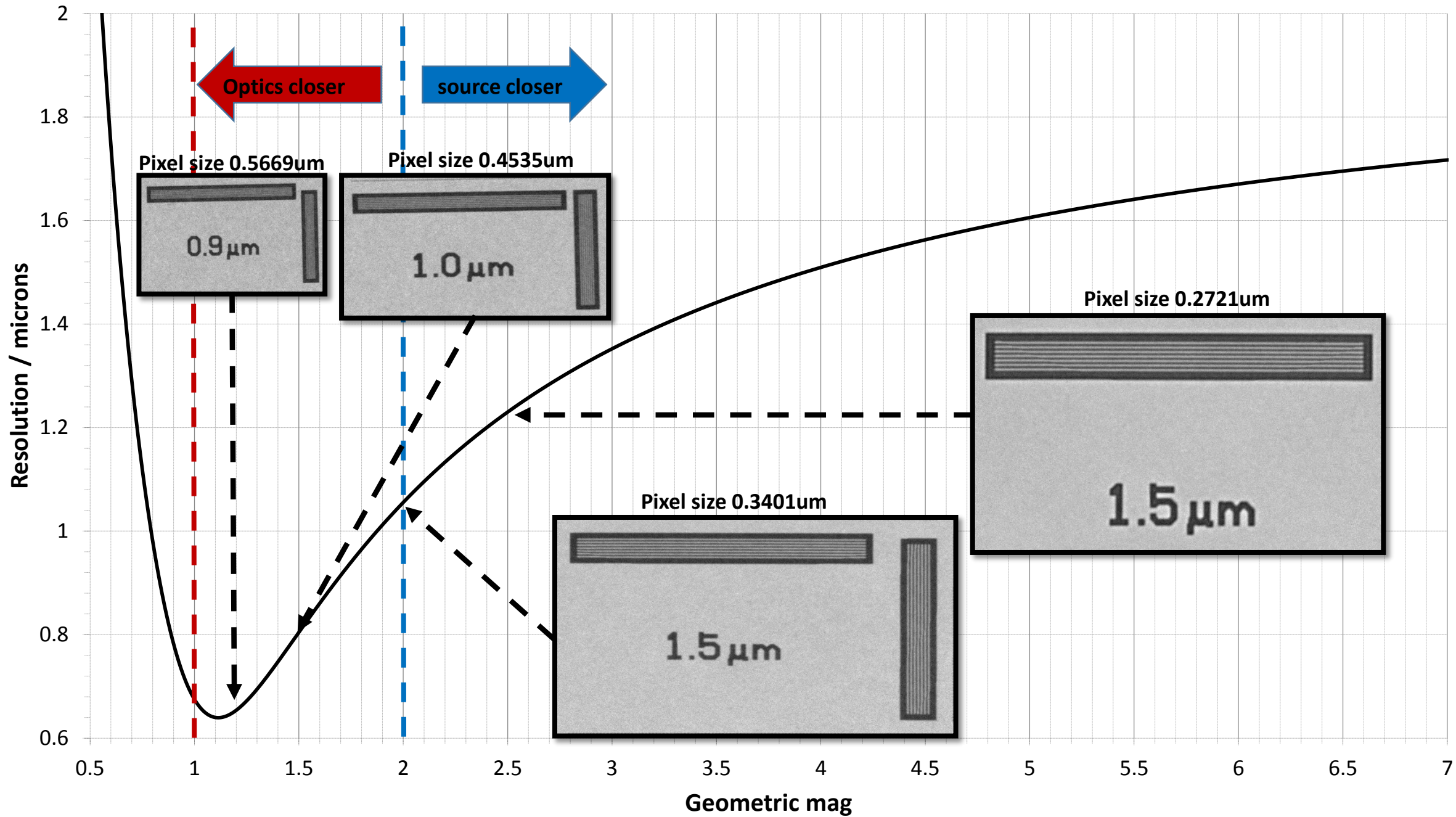


- Radiograph quality is essential for good spatial resolution
- Significantly affects post processing time, repeatability & errors
- Numerical characterisation is essential

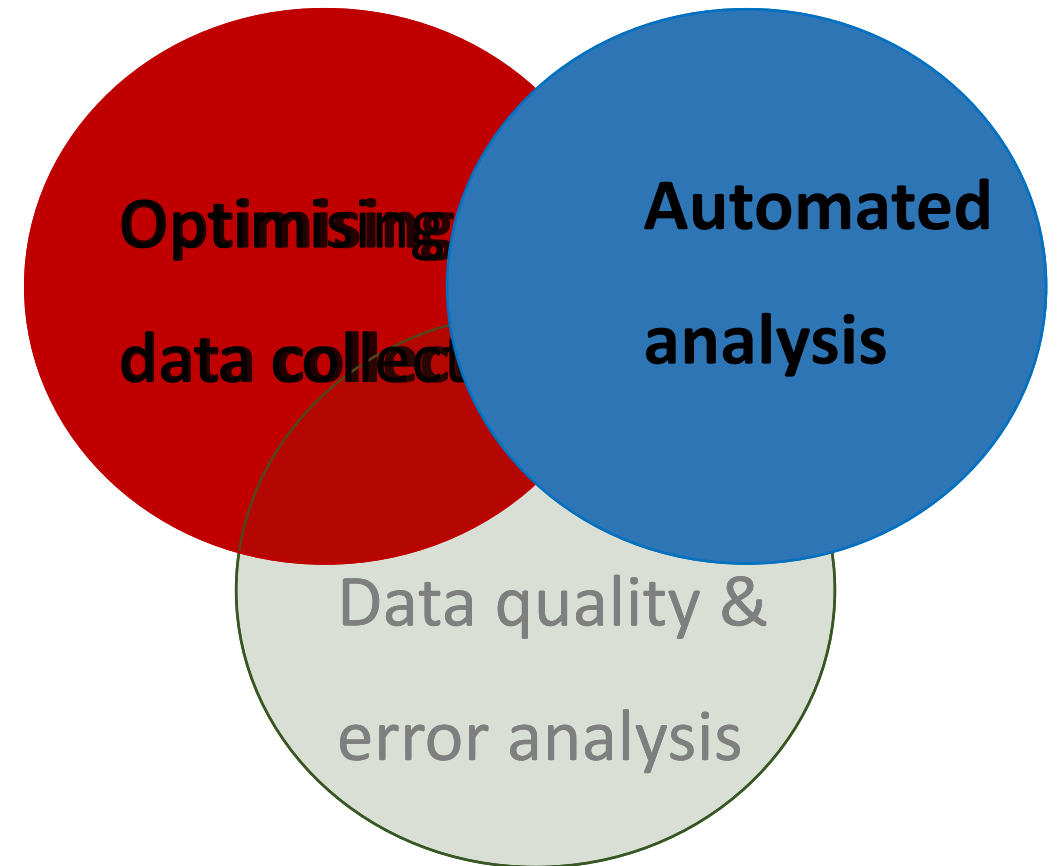


Optimising scan times

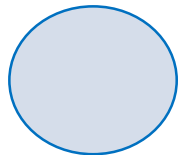




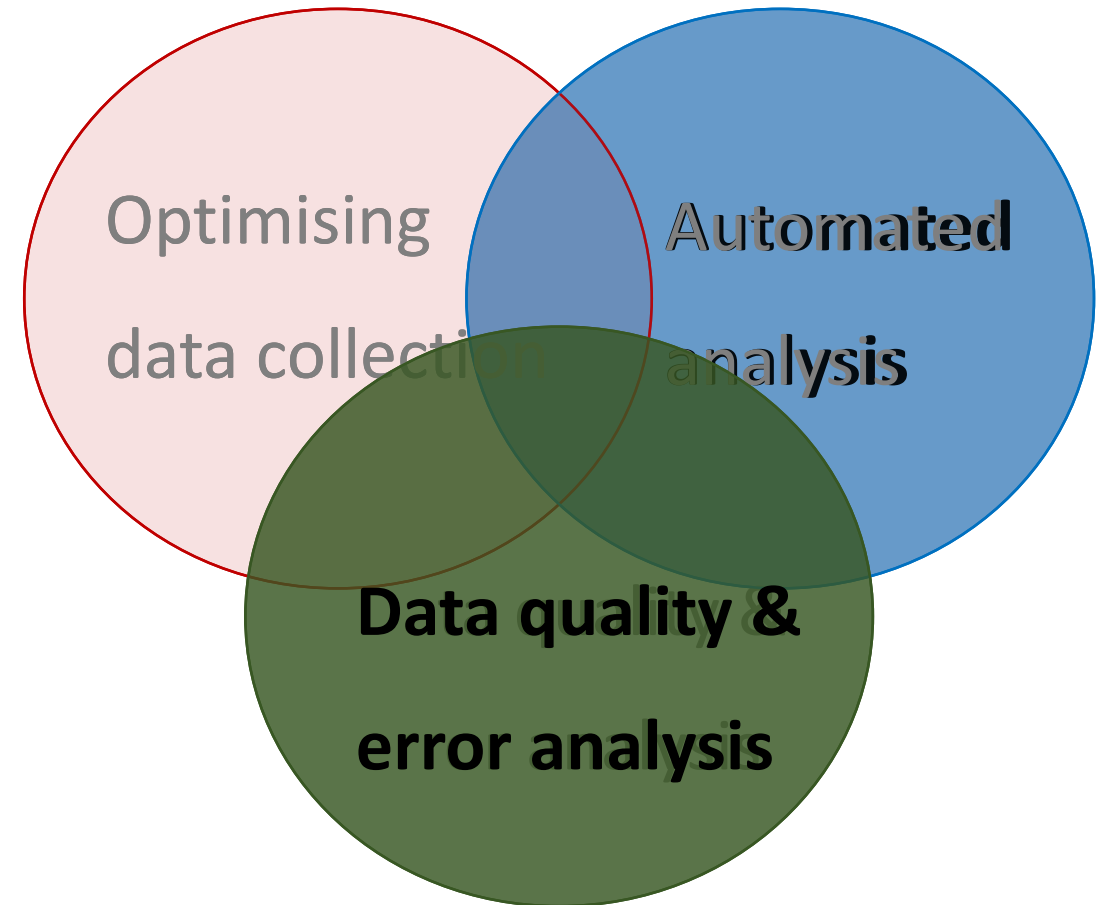
- Understanding the X-ray source and detector to optimize scanning positions
- Use of resolution target to optimise scan times
- Clean data minimises analysis time



Automated analysis

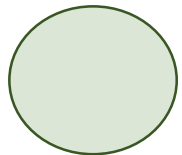
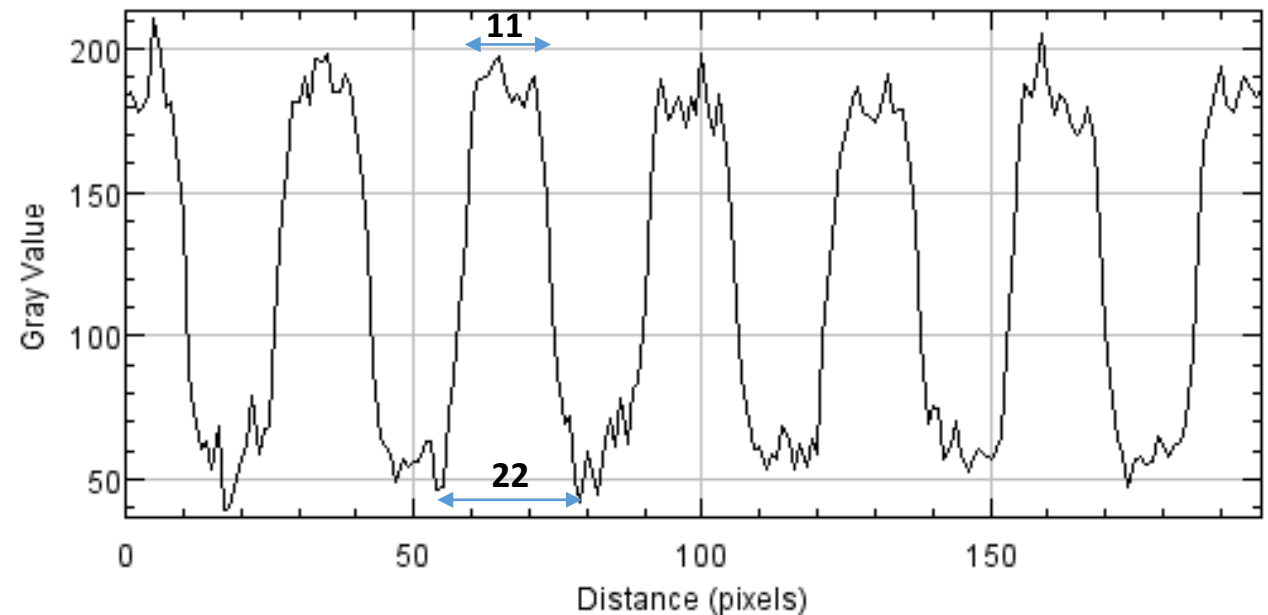
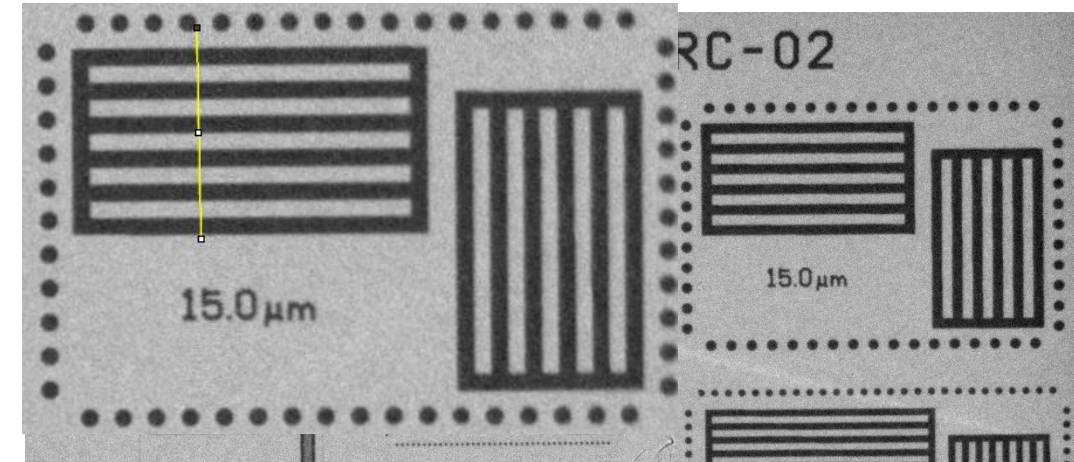


- Optimised data allows automated inspection workflows
- Advanced workflows allow reliable automatic flaw detection
- Automated error analysis



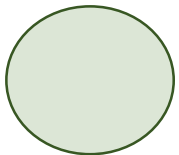
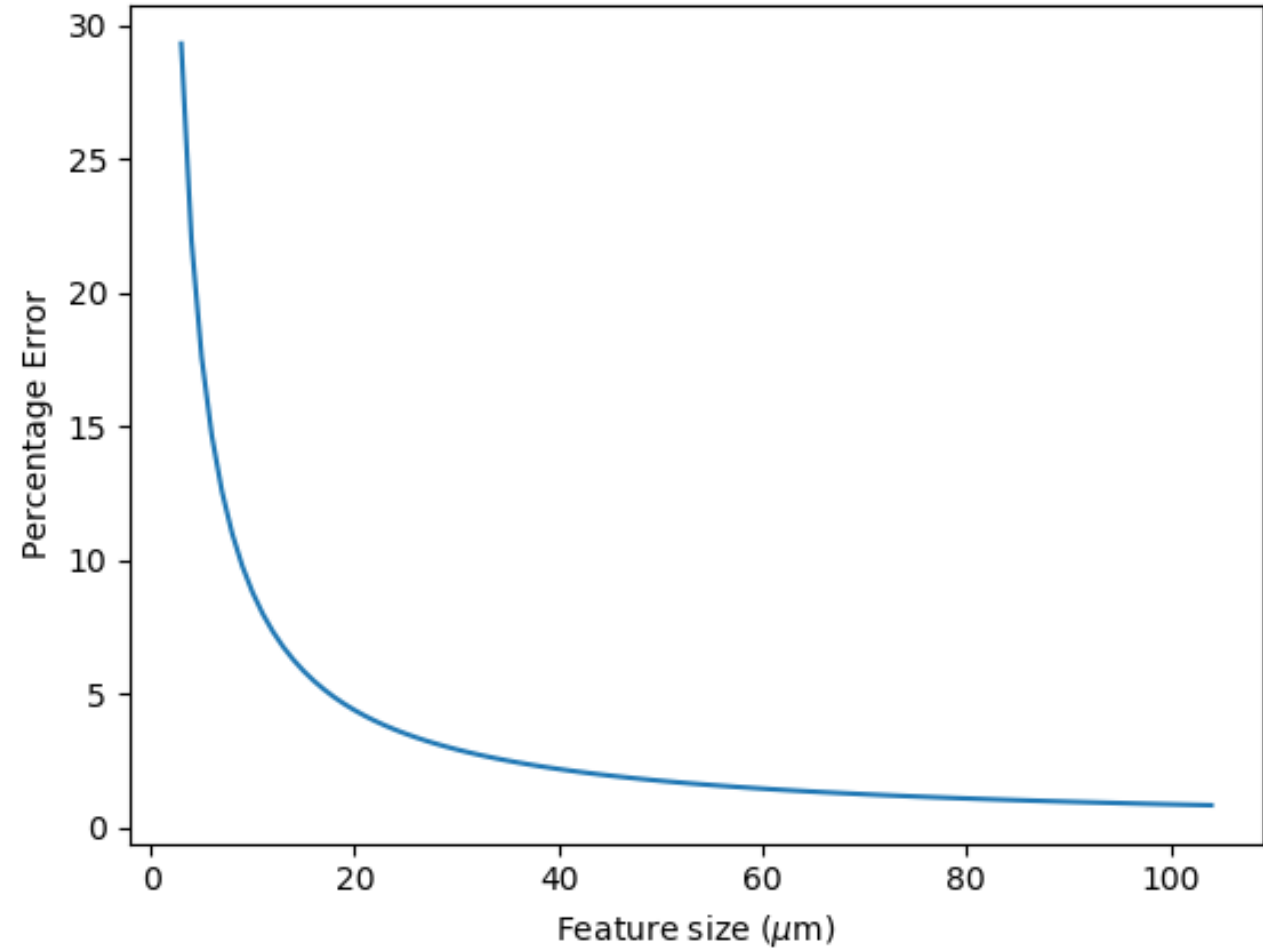
Direct 2D data analysis

- Spatial Resolution targets provide a measurement of the degree of blurring
- Errors can be extracted on these measurements
- Allows the definition of limits in which we can detect features

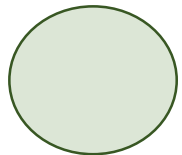
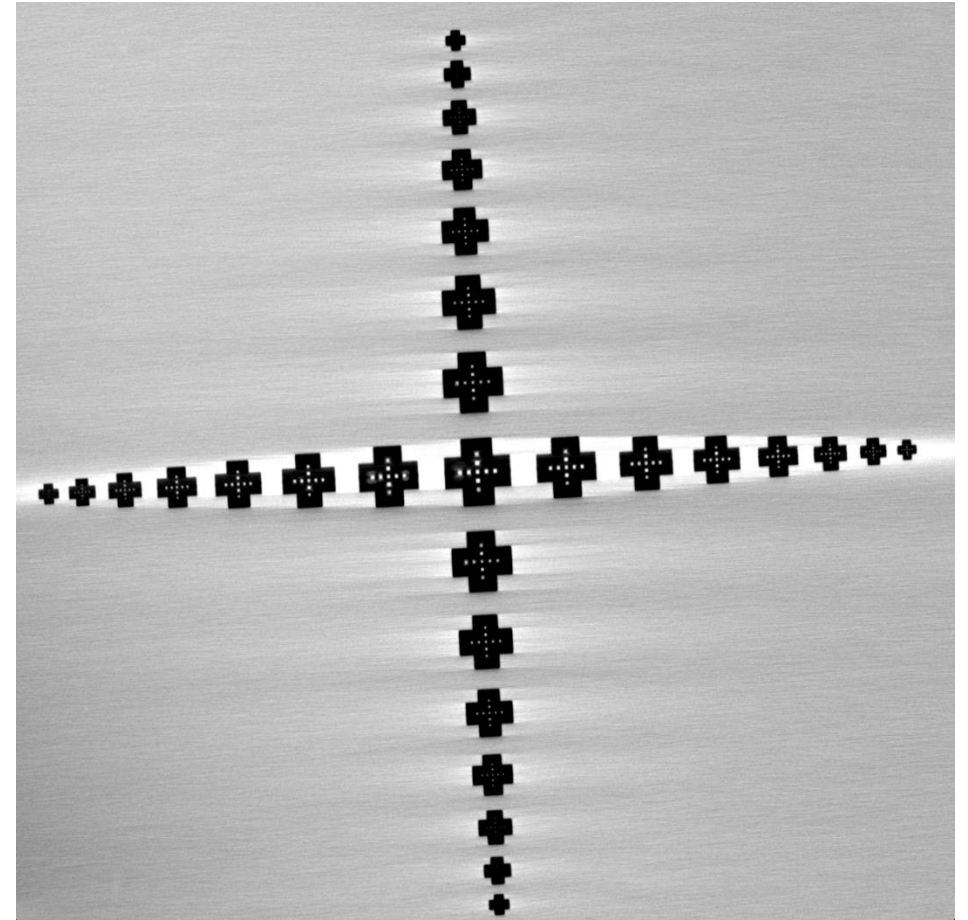
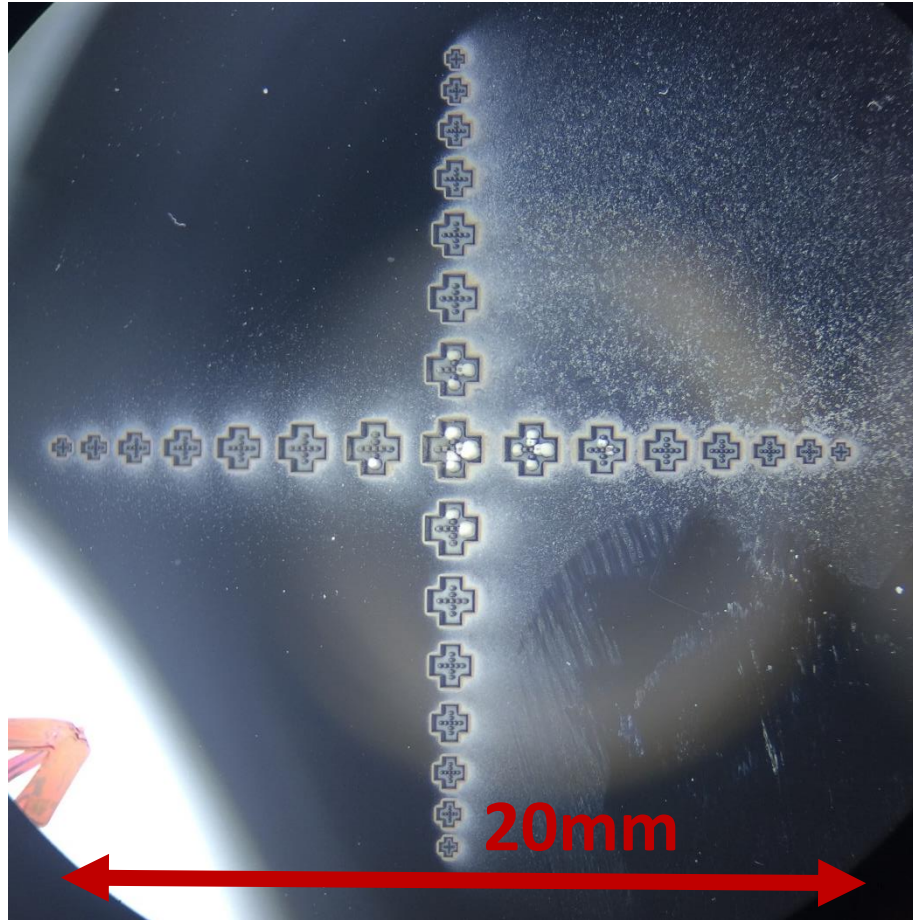


Case Example

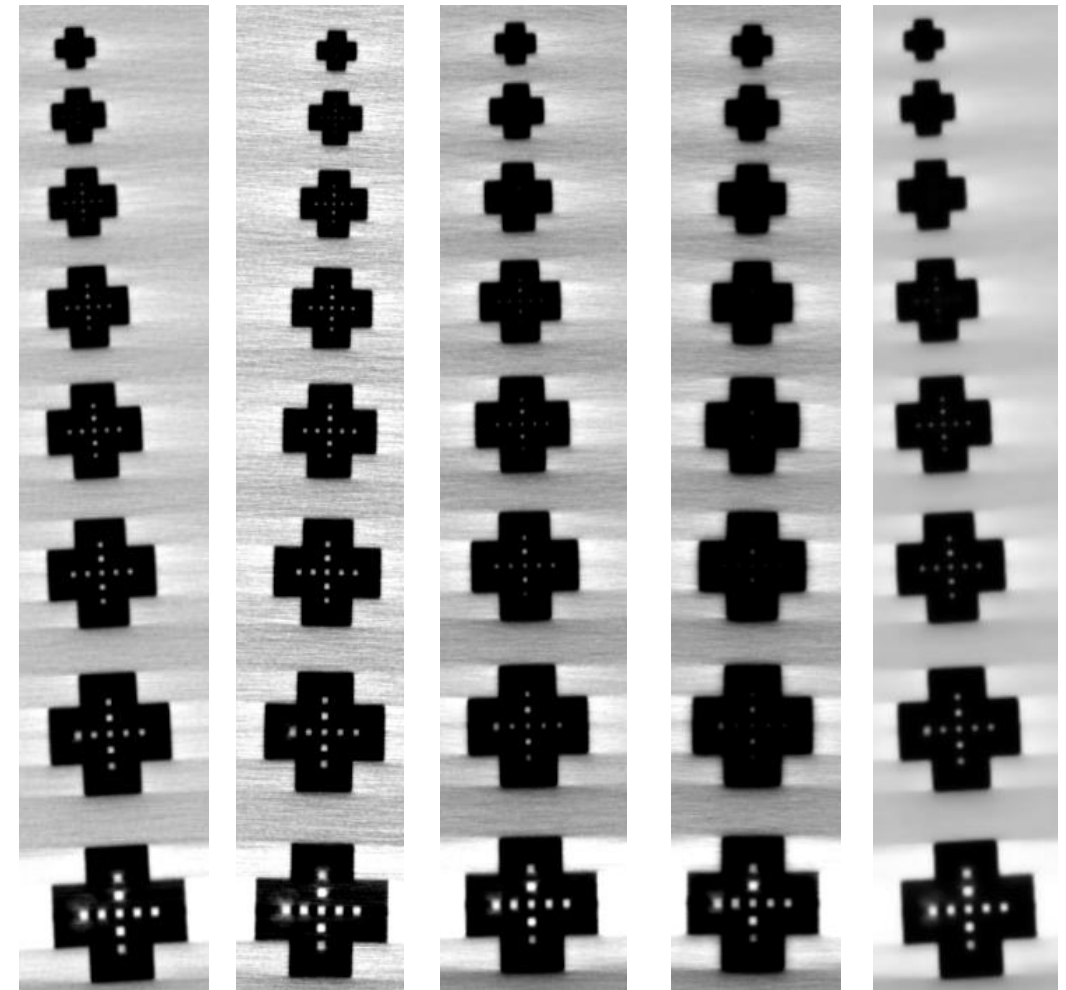
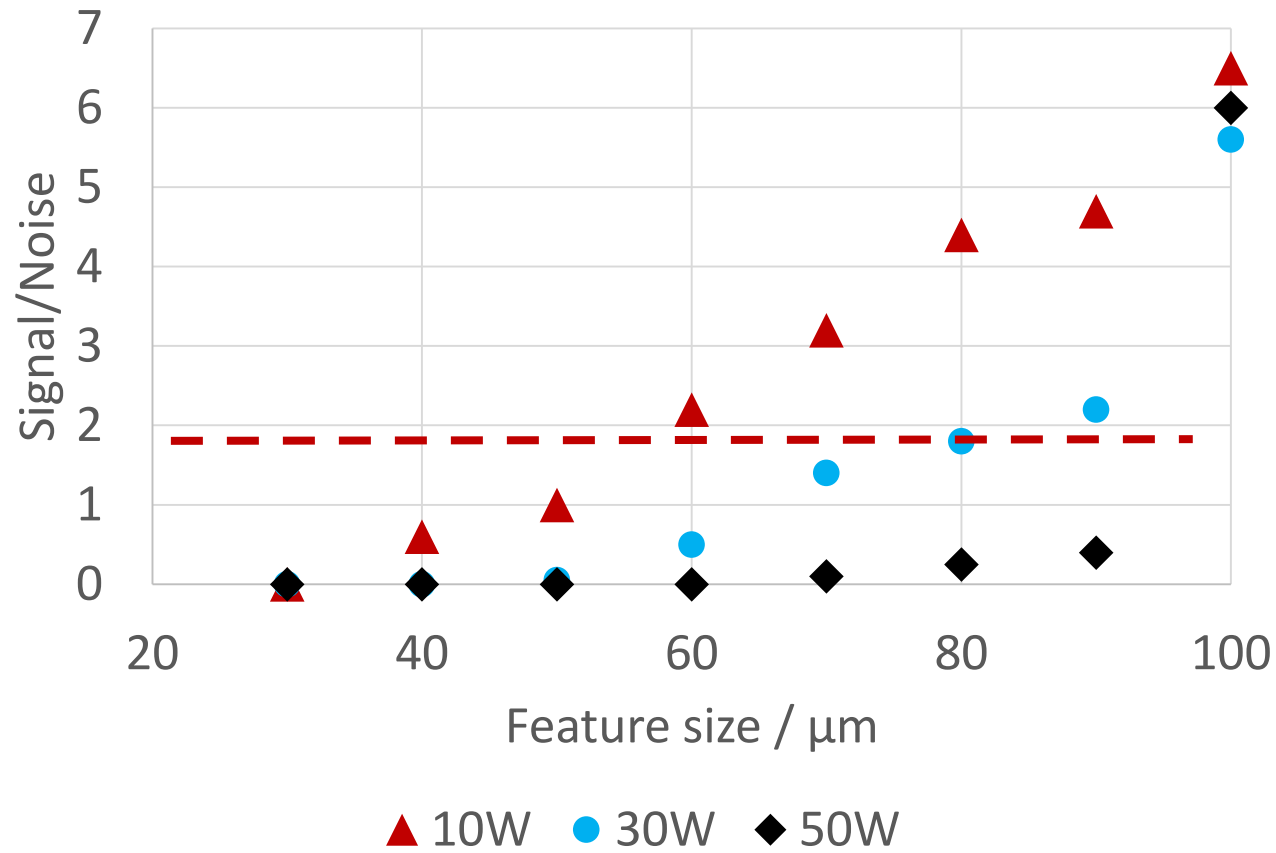
- Pixel size = $1.30\ \mu\text{m}$
- Spatial Resolution = $4.57 \pm 0.88\ \mu\text{m}$
- Measurability limit improves with feature size



Preliminary use of 3D targets



Extracting information



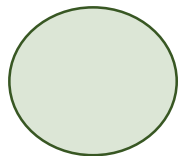
Avg 8

Step scan

30W

50W

Filter



Summary

- Understanding of raw data quality is essential to optimising parameters
- Automated analysis is an essential step in industrial applications
- Understanding of data quality and resolution
 - Detectability and measurability limits
 - Errors associated with analysis

