Scan me!

Characteristics of a PADC-based neutron dosimetry system developed at the PSI (#102)
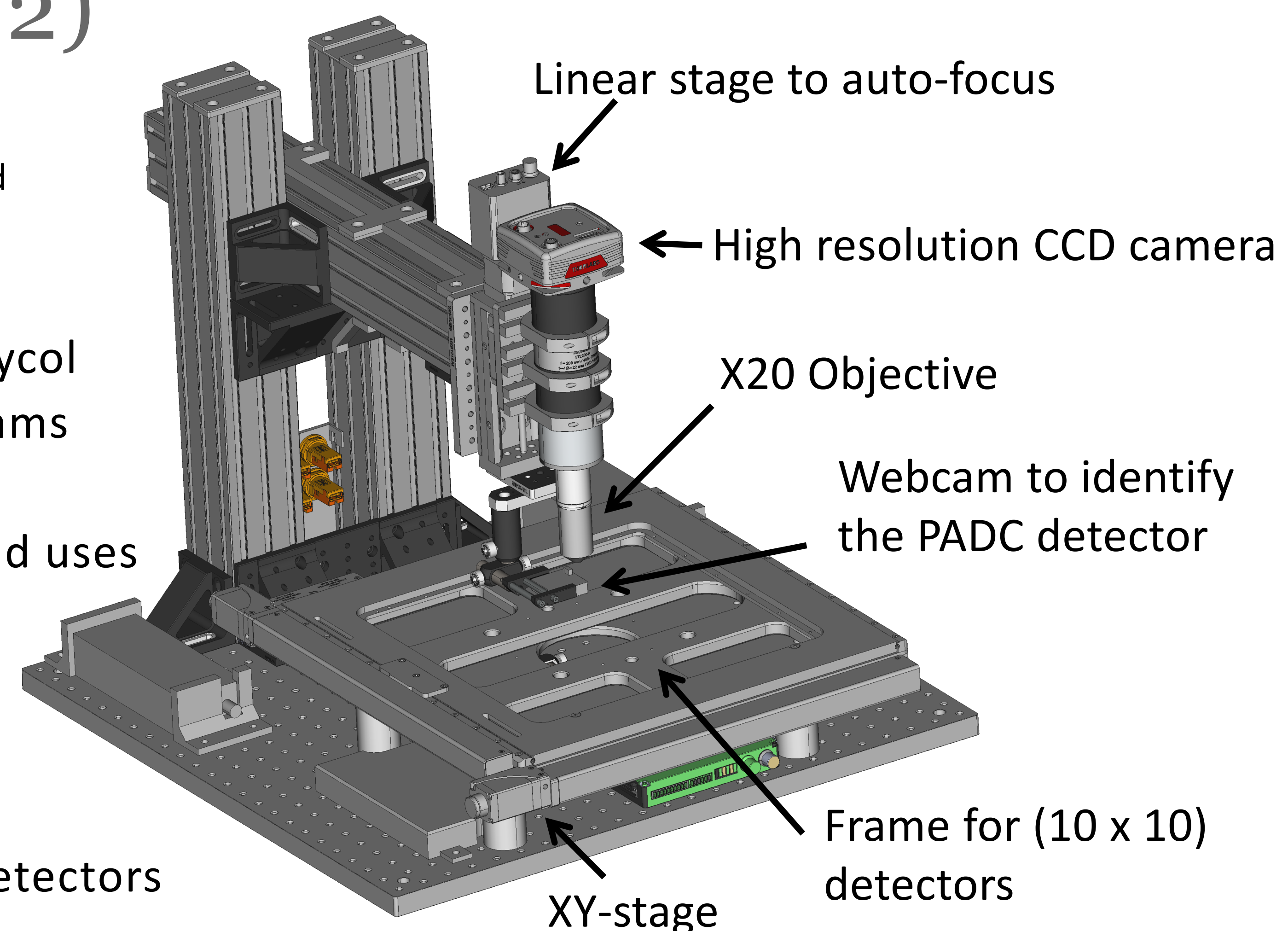
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Objective

The new neutron dosimetry is able to scan different Poly-Allyl Diglycol Carbonate (PADC) detector materials, and its customisable algorithms makes it applicable for both routine or research operations.

The system accommodates up to 100 detectors per readout and uses a sequence of algorithms to:

1) Identify the detector
2) Autofocus and scan the detector
3) Save a set of parameters for each possible track
4) Evaluate the dose of each detector with respect to reference detectors

Linear stage to auto-focus
High resolution CCD camera
X20 Objective
Webcam to identify the PADC detector
Frame for (10 x 10) detectors
XY-stage

1) Identification

Depending on the detector type, the number is identified through a binary code, optical character recognition (OCR), or a data matrix.


7 1 4 4 6 2 4

2^3
2^2
2^1
2^0

Parity dots
Location dots
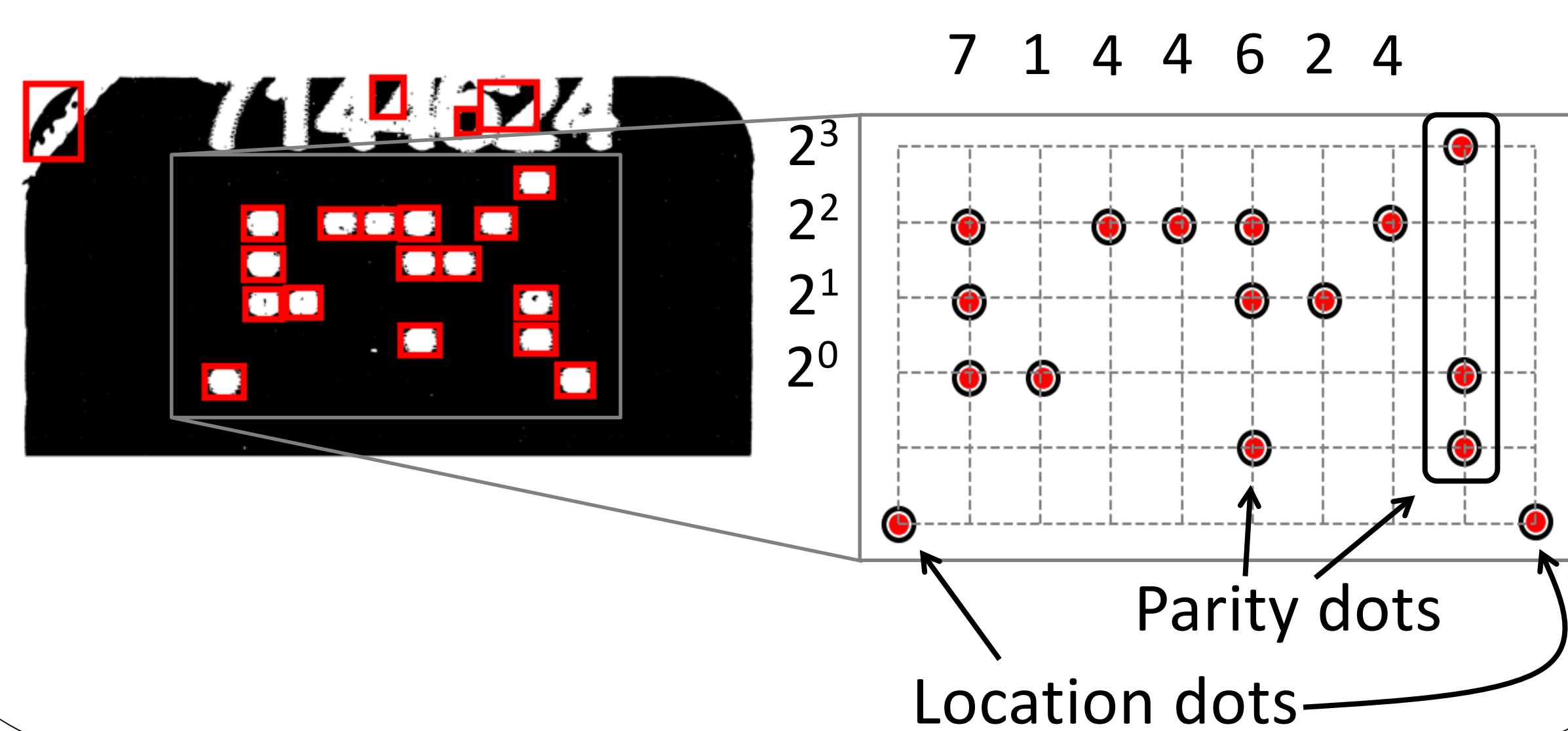
2) Image acquisition

The system autofocuses using either a noise sorting or Fourier transformation-based algorithm.

Focus points

123456

Noise sorting
FFT magnitude

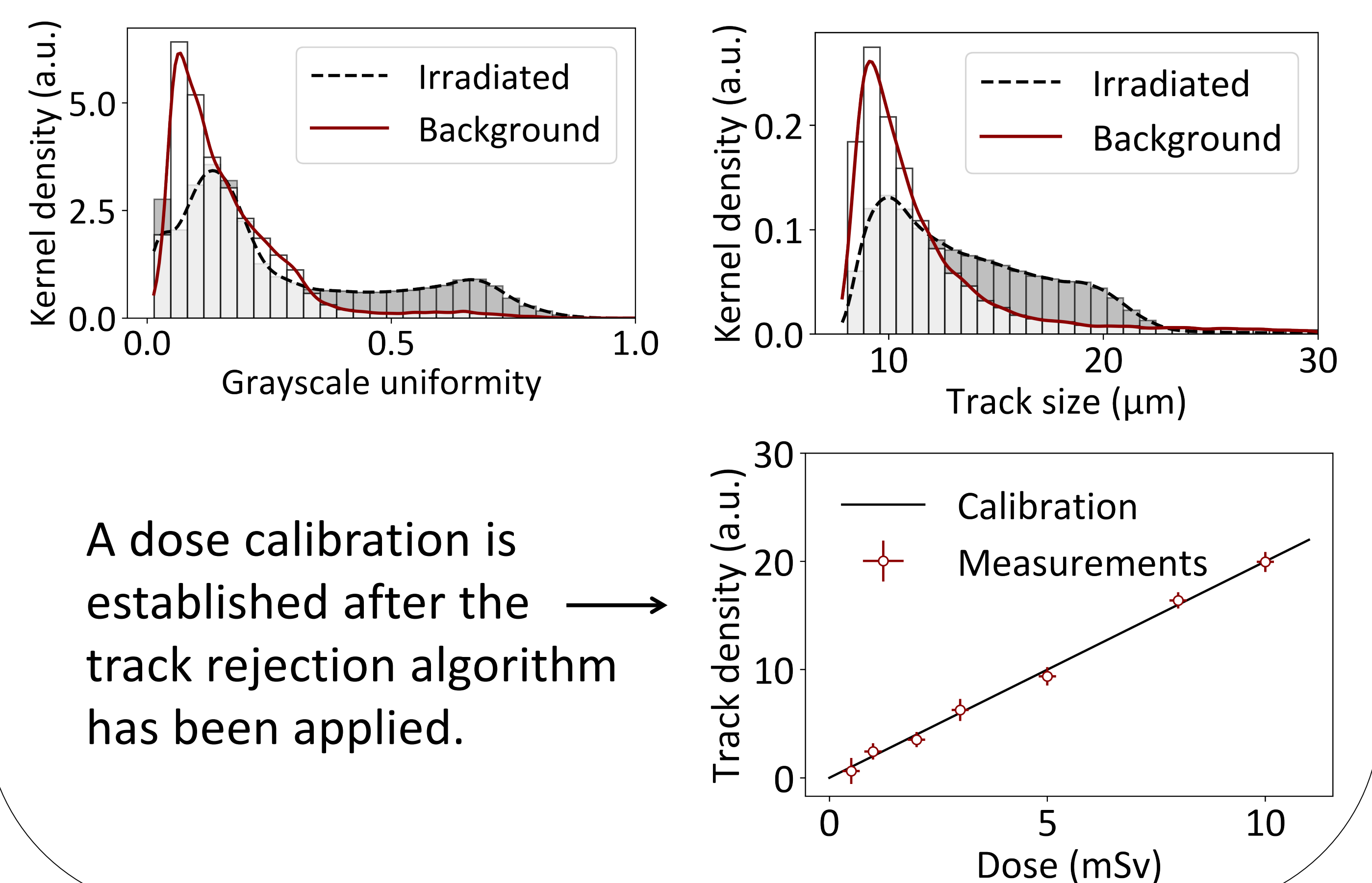Focus score (a.u.)
Relative camera height (μm)
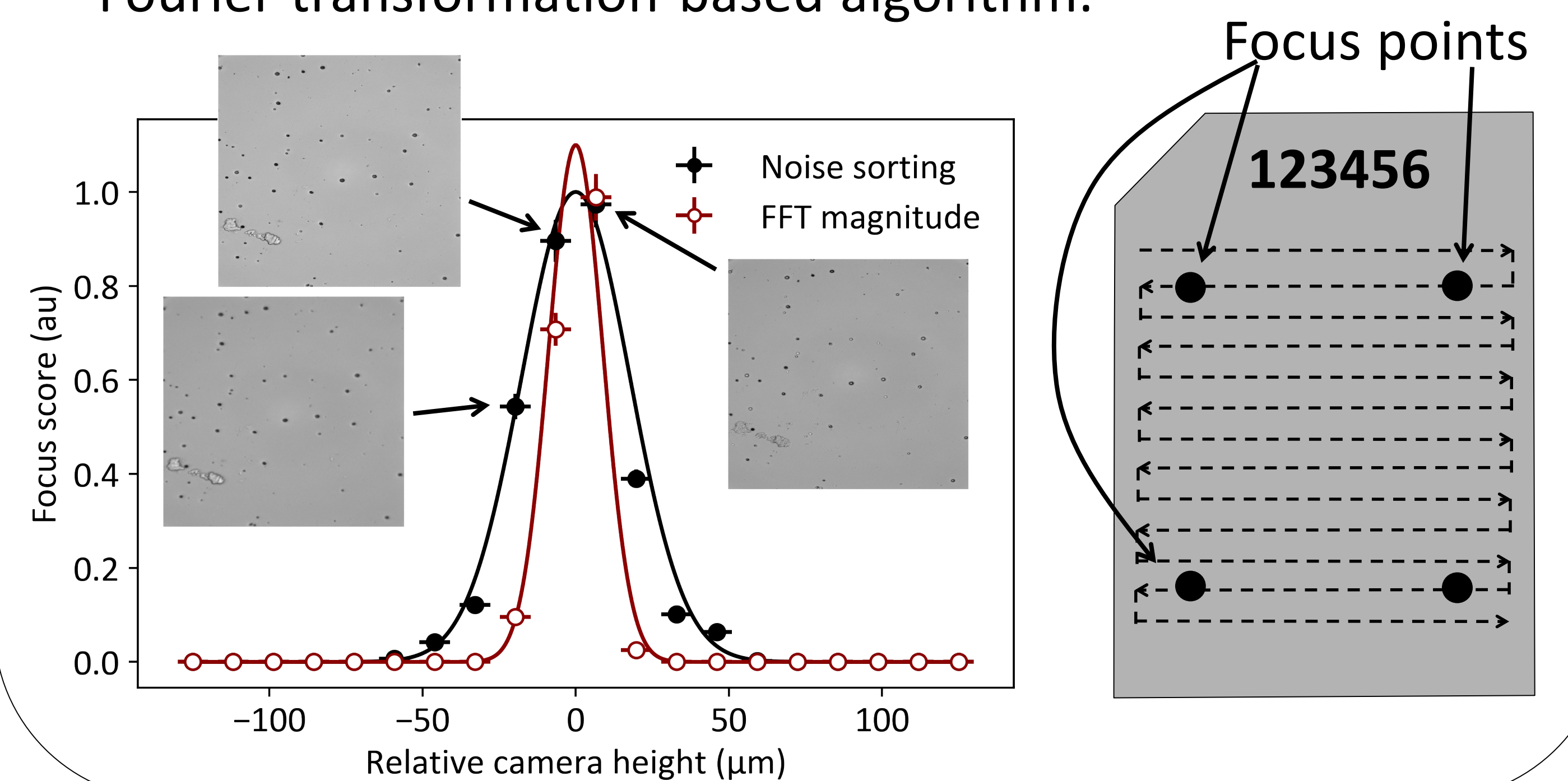
3) Track search

Track-looking elements are identified through a series of morphological operations. Possible artifacts (blue) are immediately discarded while possible tracks (red) are saved to a data frame along with their parameters.

200 μm

30 μm
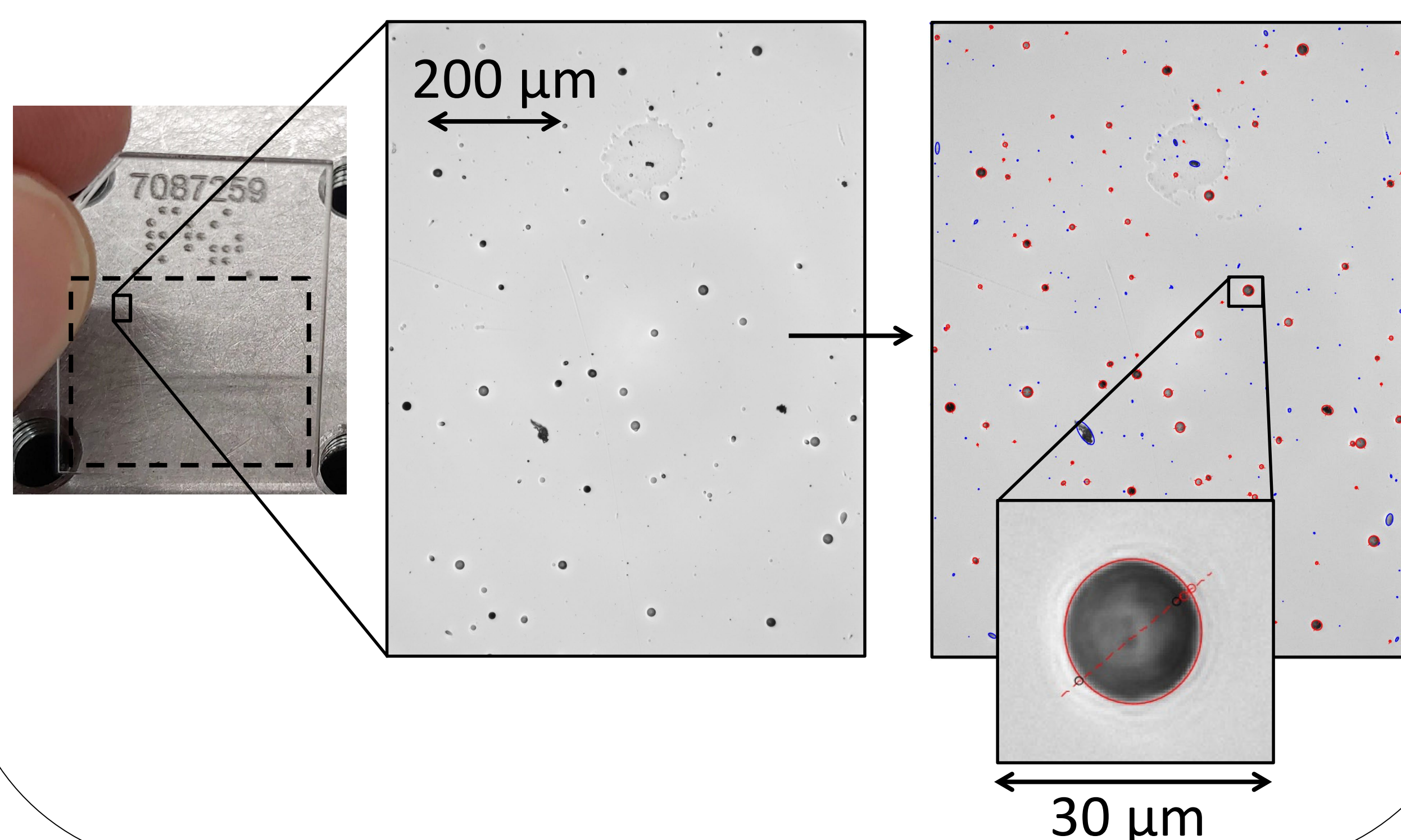
4) Dose algorithm

The parameters of each possible track are compared to reference distributions to accept or reject it as a *real* track.

Kernel density (a.u.)
Grayscale uniformity
Irradiated
Background

Kernel density (a.u.)
Track size (μm)
Irradiated
Background

A dose calibration is established after the track rejection algorithm has been applied.

Track density (a.u.)
Dose (mSv)
Calibration
Measurements

Conclusion

The new neutron dosimetry reader at PSI is capable of scanning different PADC detector materials having full control over all parameters. The system is intended to be used for both routine and research purposes in the (0.1 – 10) mSv dose range.