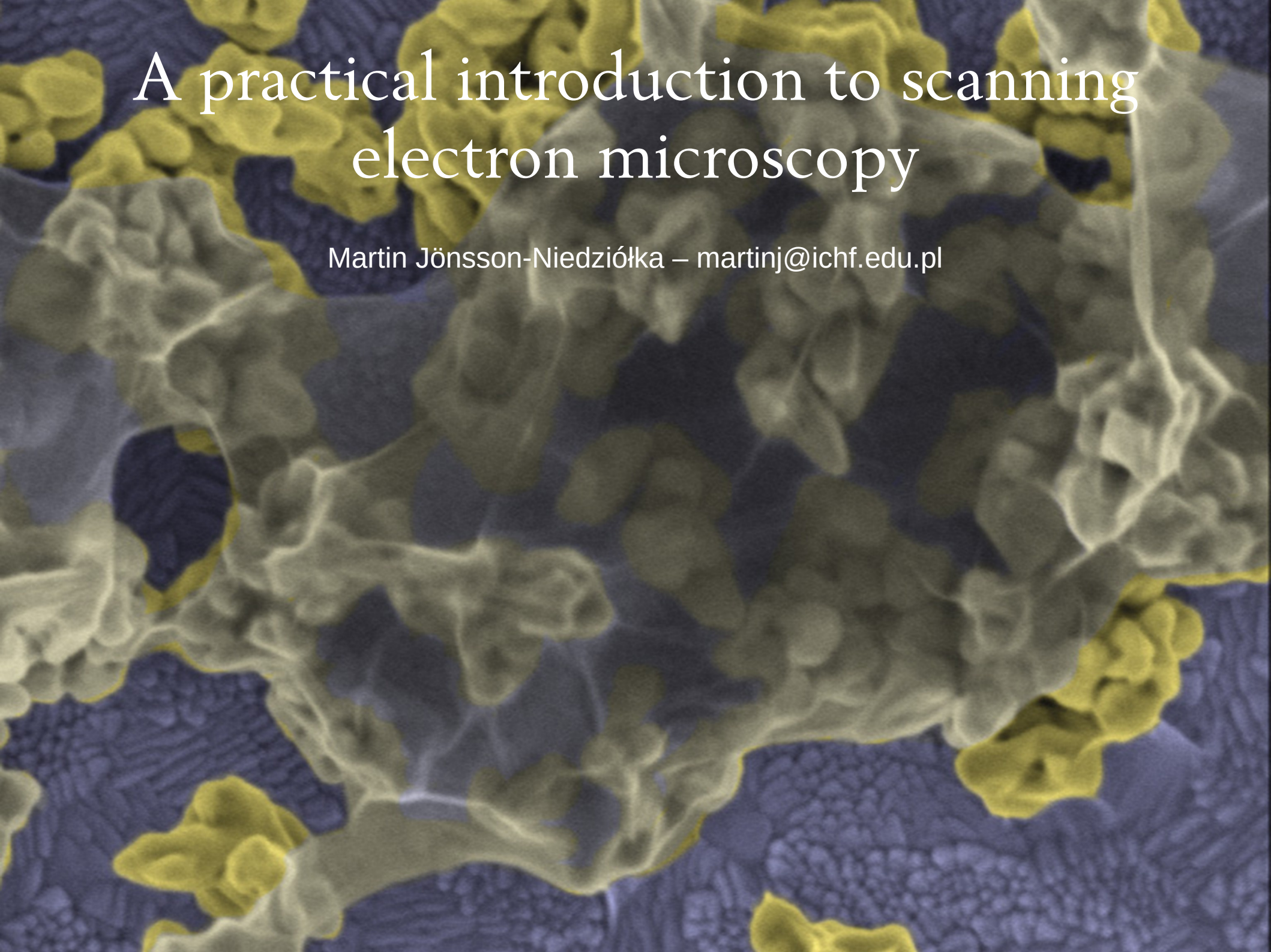

A practical introduction to scanning electron microscopy

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Our system

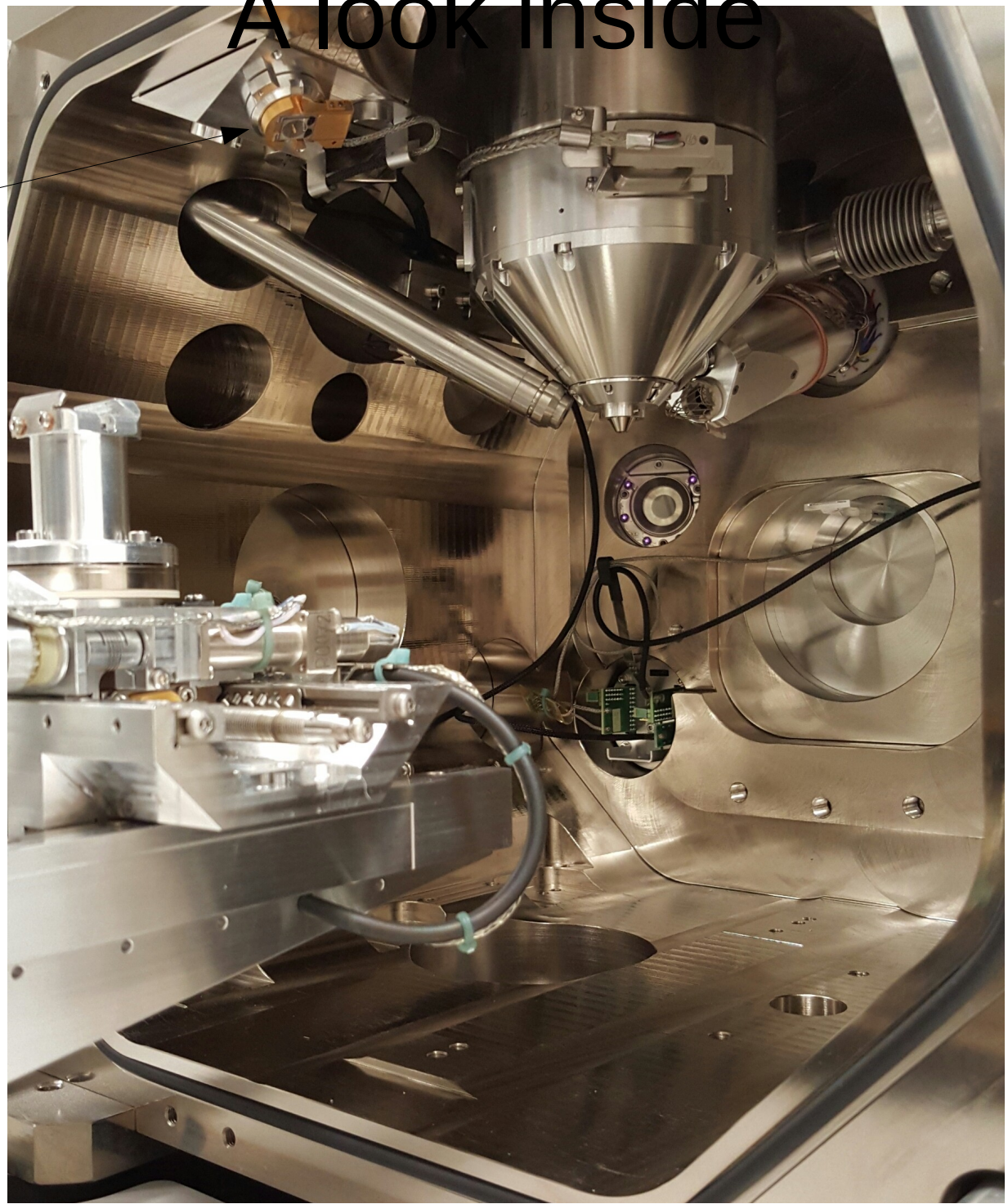
Nova NanoSEM 450

"**The only true High-Resolution Low-Vacuum SEM**" according to FEI :)

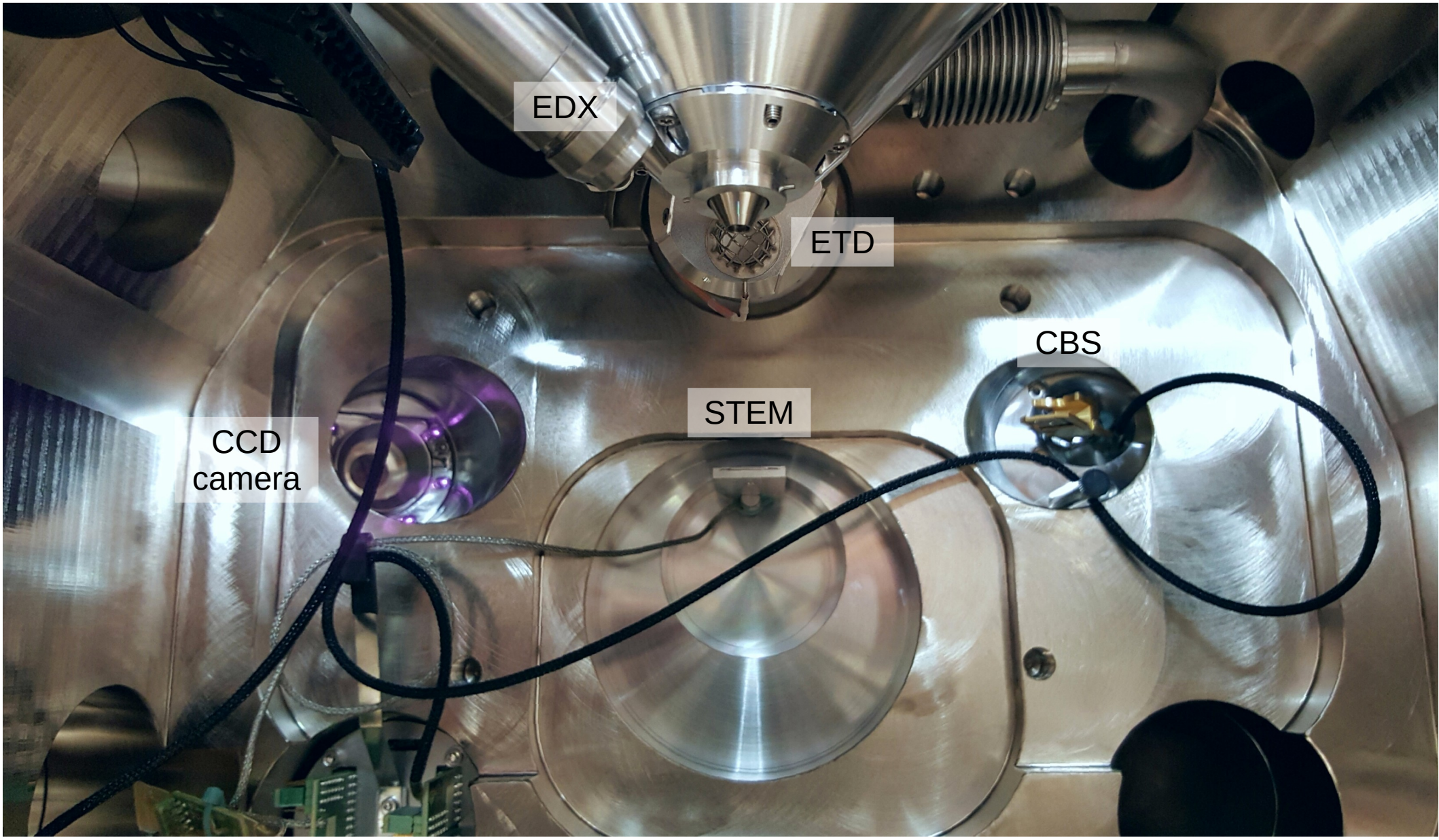
Detectors:
ETD, TLD, CBS, STEM,
EDX & WDX
LVD, GAD, Helix

Load-lock
Plasma cleaner
Cold trap
NavCam

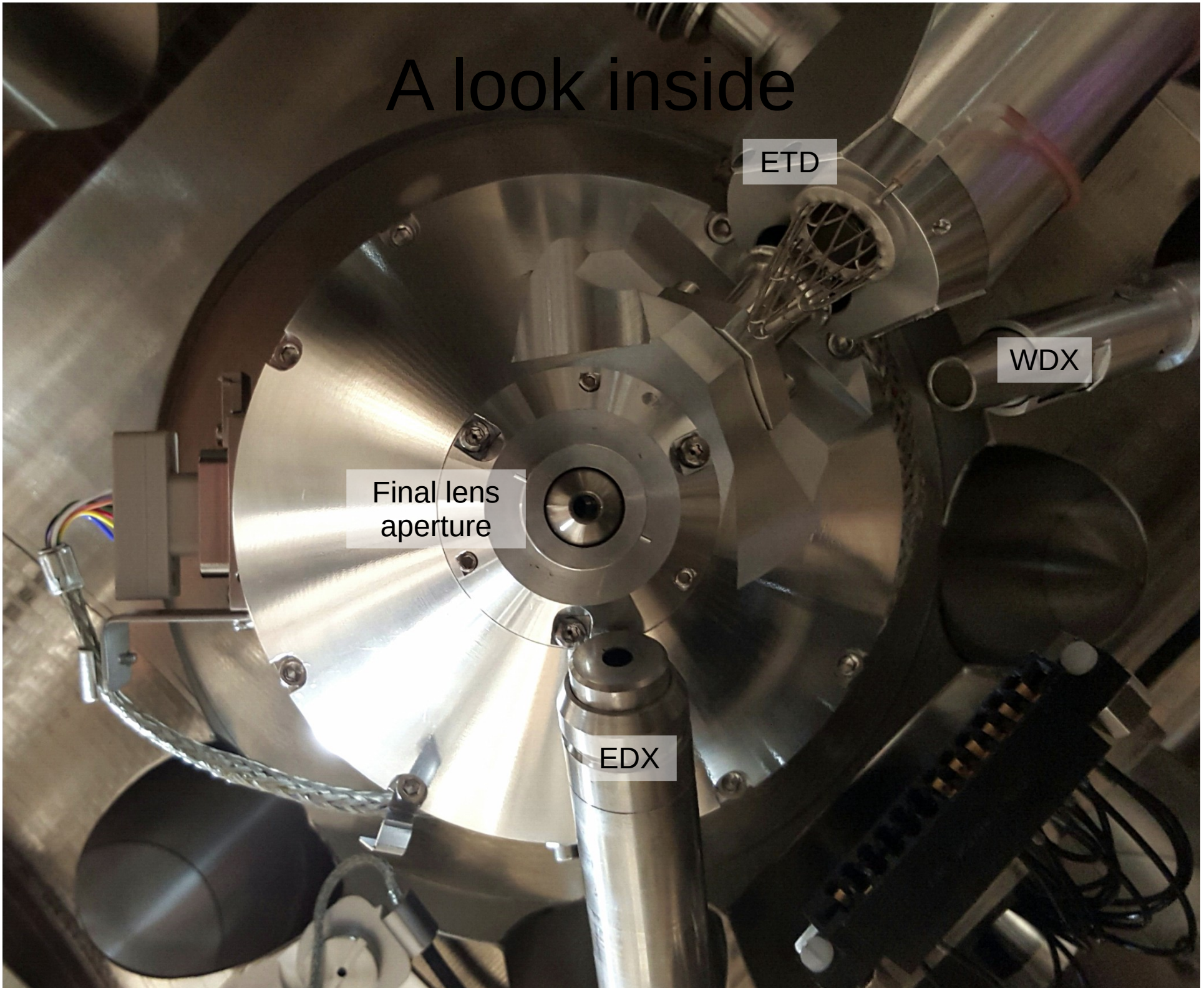
A look inside



A look inside



A look inside



TLD or ET?

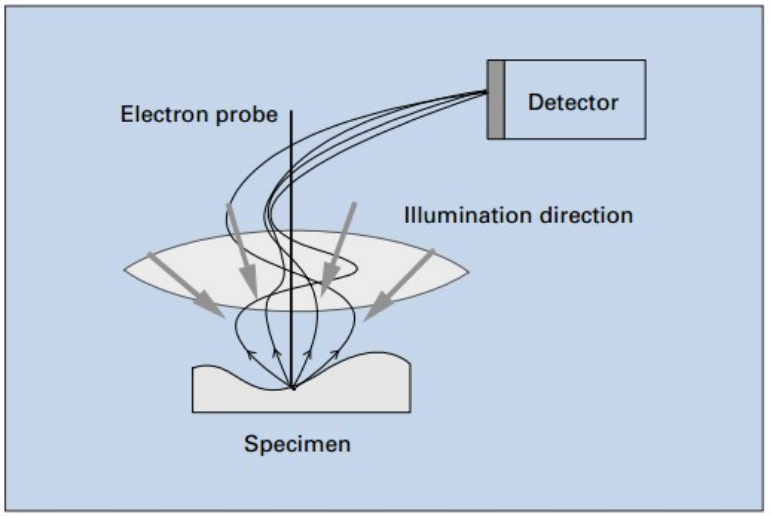


Fig. 26 Illumination effect of a TTL detector.

TLD - "top view" - "flatter" image

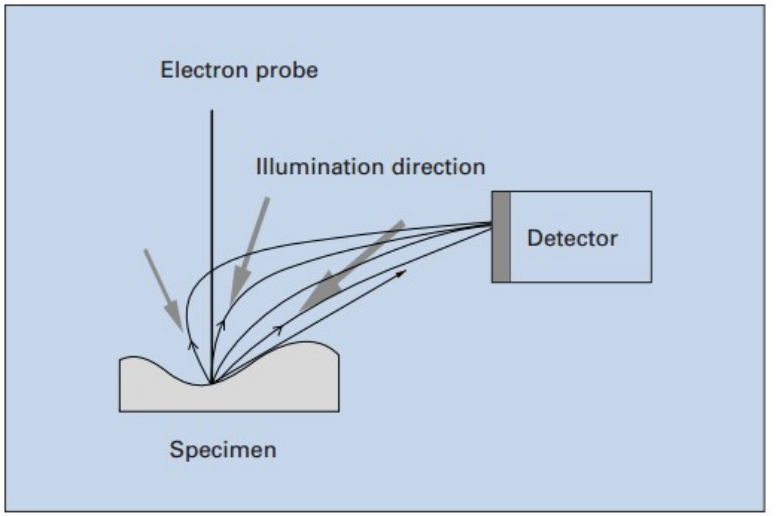
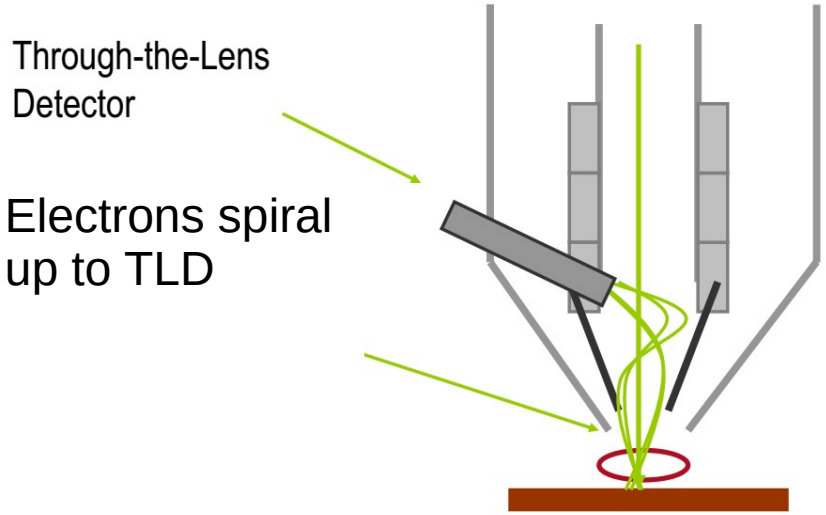


Fig. 25 Illumination effect of the commonly used E-T secondary electron detector.

ET - "Side view" - more topographic contrast



In immersion mode – only TLD. Electrons "guided" up by magnetic lens.

Bias on detector can be changed between +250 and -250 V.

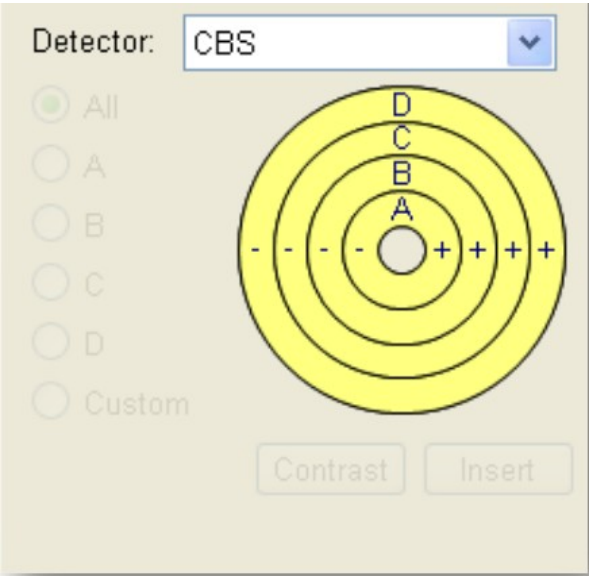
CBS

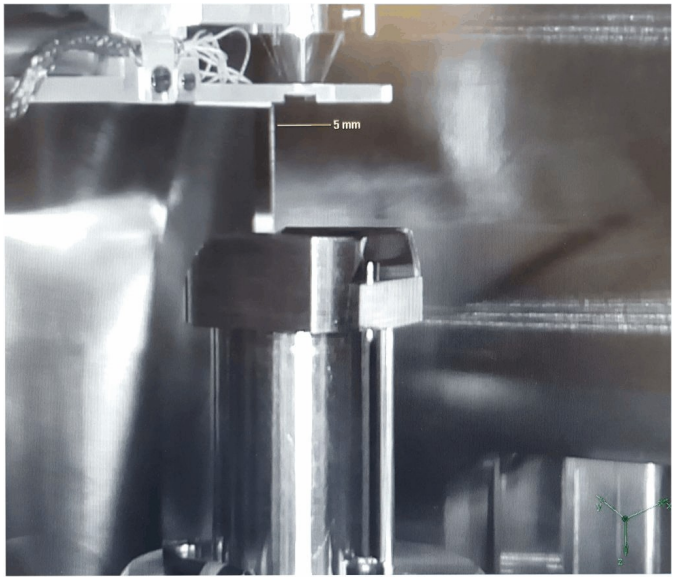
Detector for backscattered electrons.
Inserted between the sample and the final lens.
(It is possible to crash into high samples!!!)

Large area – high sensitivity.

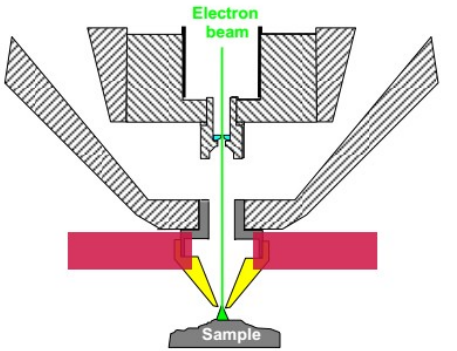
Outer rings – more topography contrast.
Inner rings – more compositional contrast.

Also possible to use as high resolution detector for imaging of poorly conductive samples, with low landing energy.



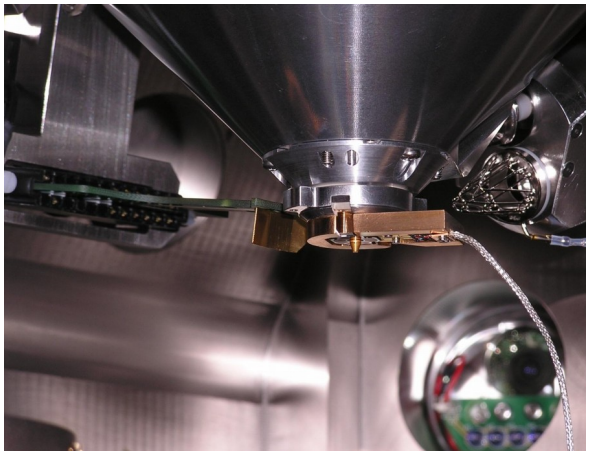


Low vacuum mode



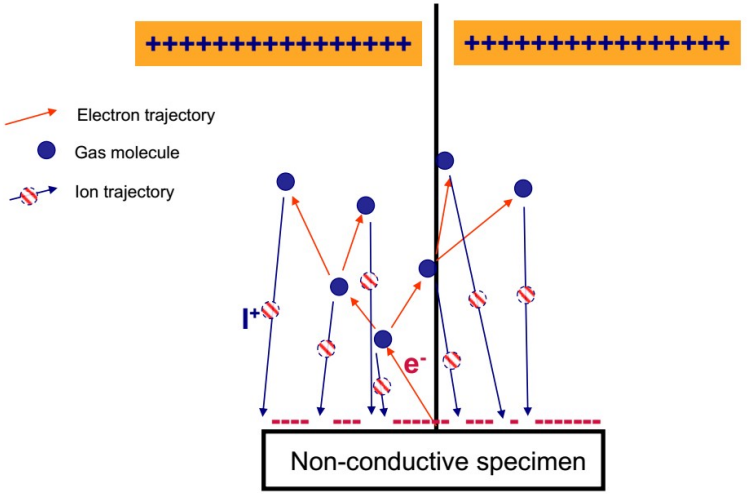
Chamber filled with low pressure water vapour. (10-200 Pa)

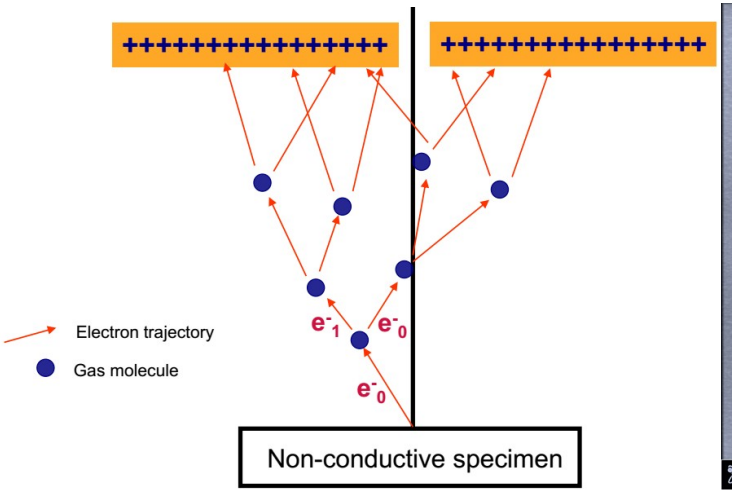
Special cap with pressure limiting aperture attached to final lens. (Requires opening the chamber and fiddling inside.)

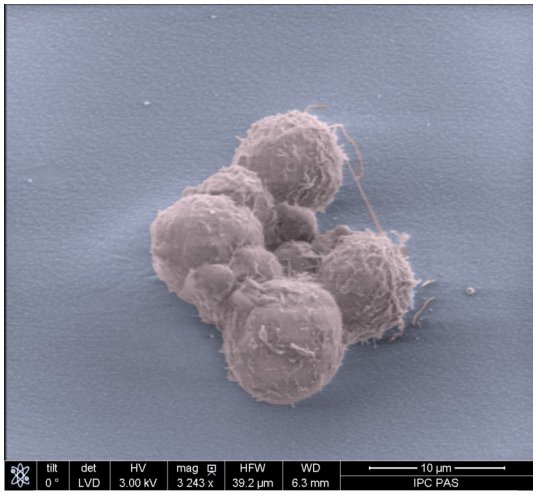


Water gets ionised by primary beam and BSEs. The ions are attracted to charged areas in the sample. Charge neutralisation.

Gas ions can also amplify signal.

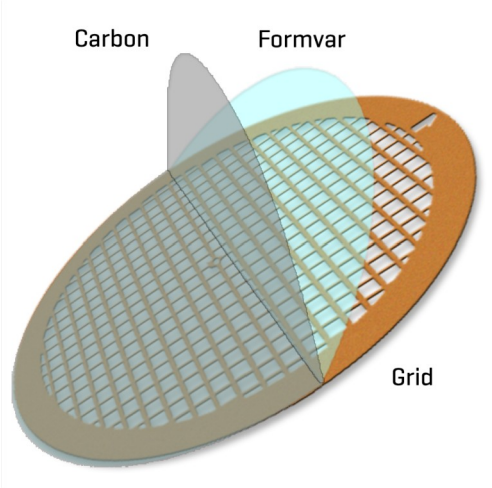






HepG2 cells in gelatine gel.

STEM

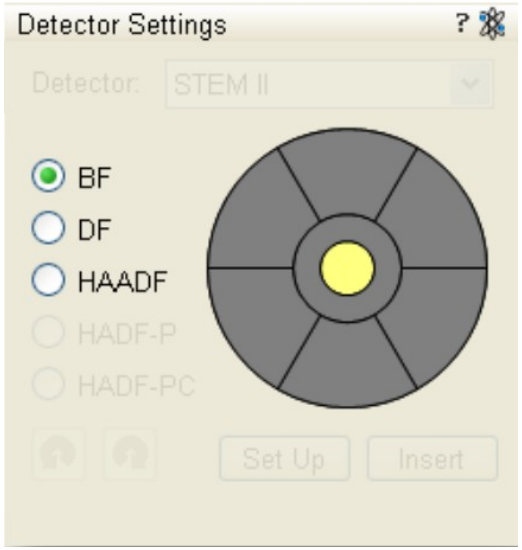


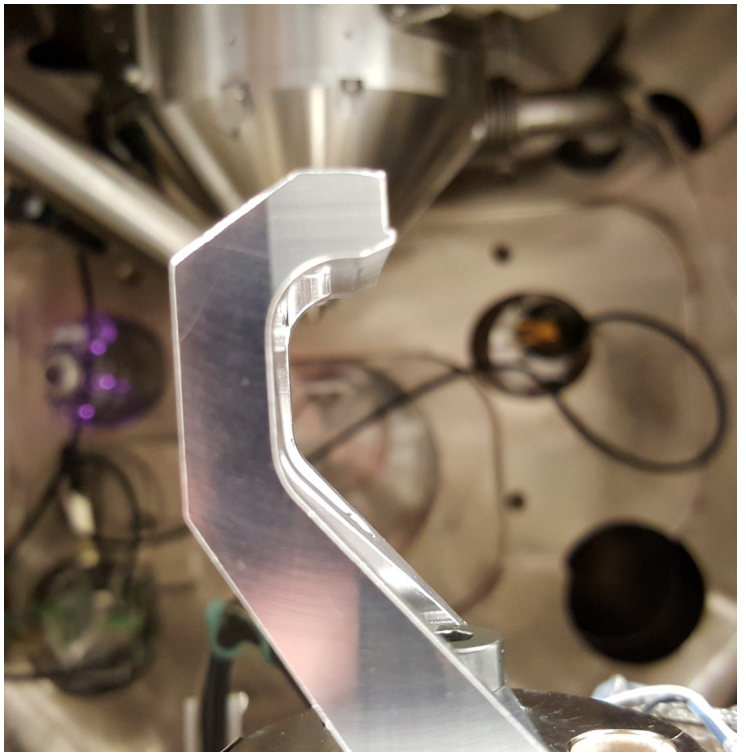
Detector under the sample – looking at electrons that have passed through.

Resolution similar to the SEM.

Several different modes – BF, DF, HAADF

STEM can be used together with other methods, incl. EDX



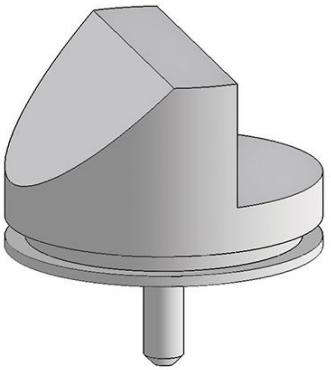


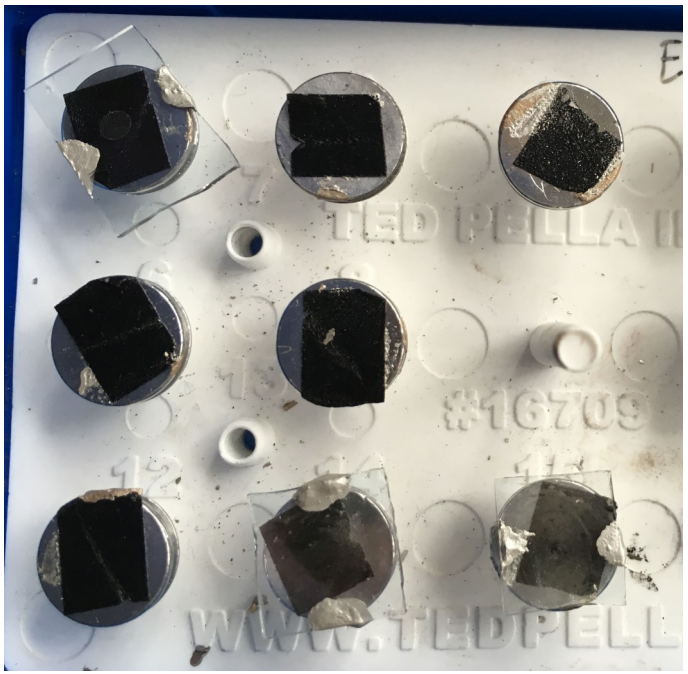
Sample preparation

Stubs – standard size 12.7 mm
Larger stubs are available.

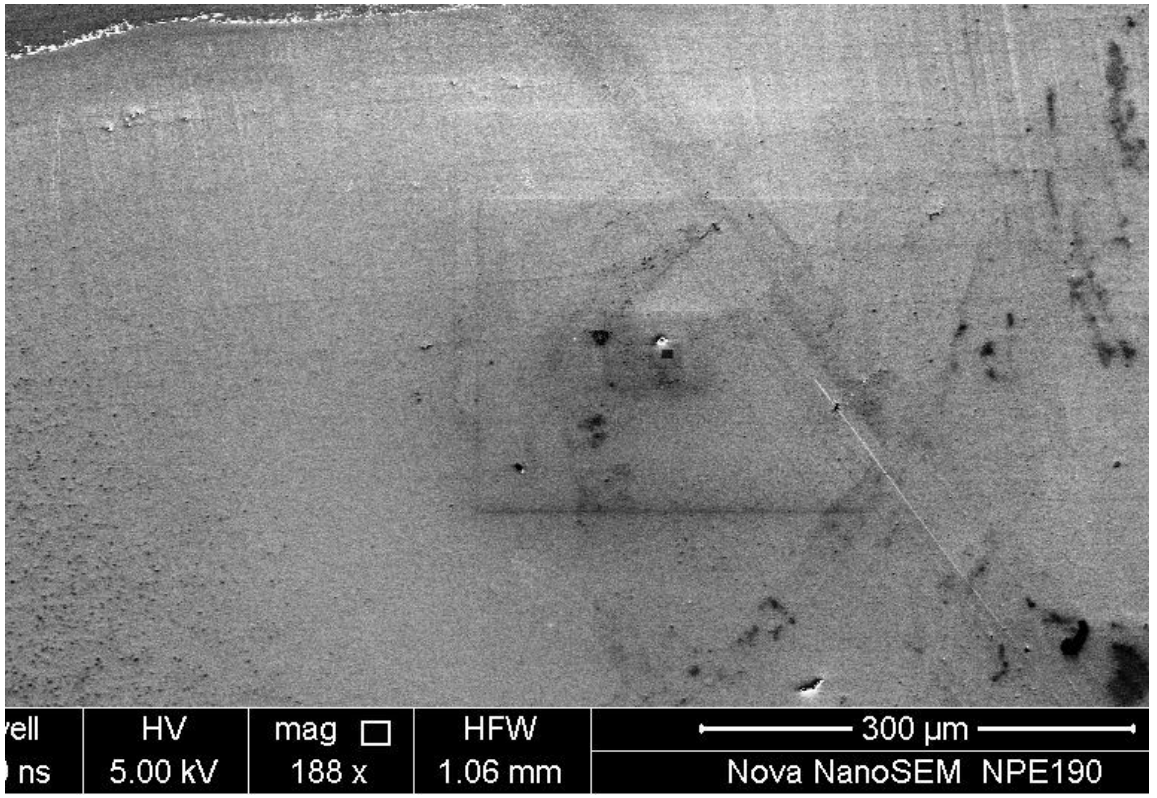
Sample attached with conducting tape (carbon) or silver paint.
Important to have a good conductive path to stub.

If sample is poorly conducting – paint silver paint as close as possible to measurement point.





“Contamination”



Build-up of carbon material during scanning.

“Scan-squares”

Shells

Hard to get highest resolution.

Try to keep samples as clean as possible – not outgassing, no fingerprints.

Keep chamber clean.

Use plasma cleaner.

Cold trap.