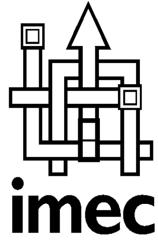

Chemical Analysis on Focused Ion Beam Cross-Sections by Scanning Auger Microscopy

H. Bender

IMEC, Leuven, Belgium

EFUG2001

1 October 2001, Arcachon, France

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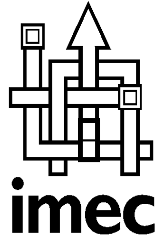

Outline

- Introduction
- FIB and AES configurations
- Application : Cu dual damascene chain
- Conclusions

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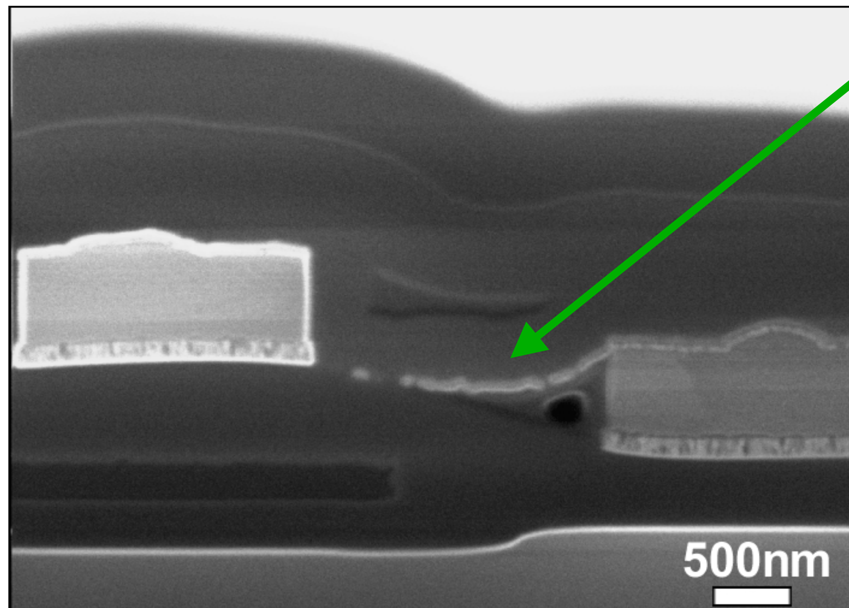
Introduction



- what is this ?
- analysis :
  - FIB contrast
  - SIMS (in-situ)
  - EDS (in-situ or ex-situ)
  - AES (ex-situ) :
    - best lateral resolution
    - sensitive to all elements
    - surface sensitive

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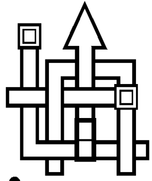
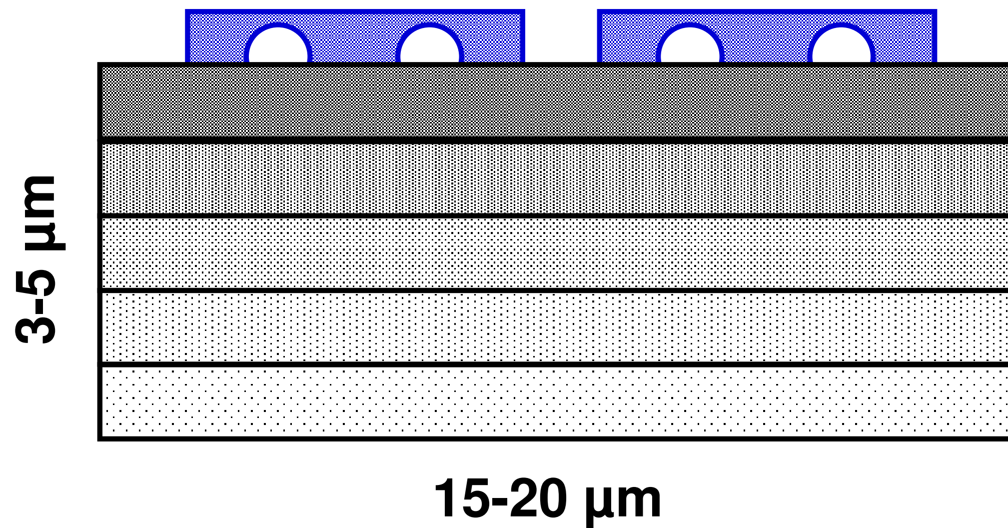
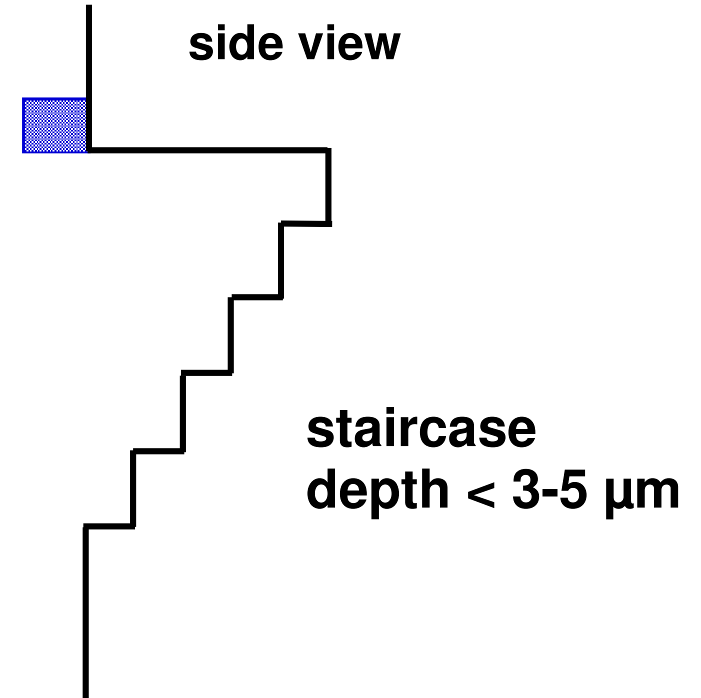


Typical crater sputtering

top view





45° tilted

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AES configuration

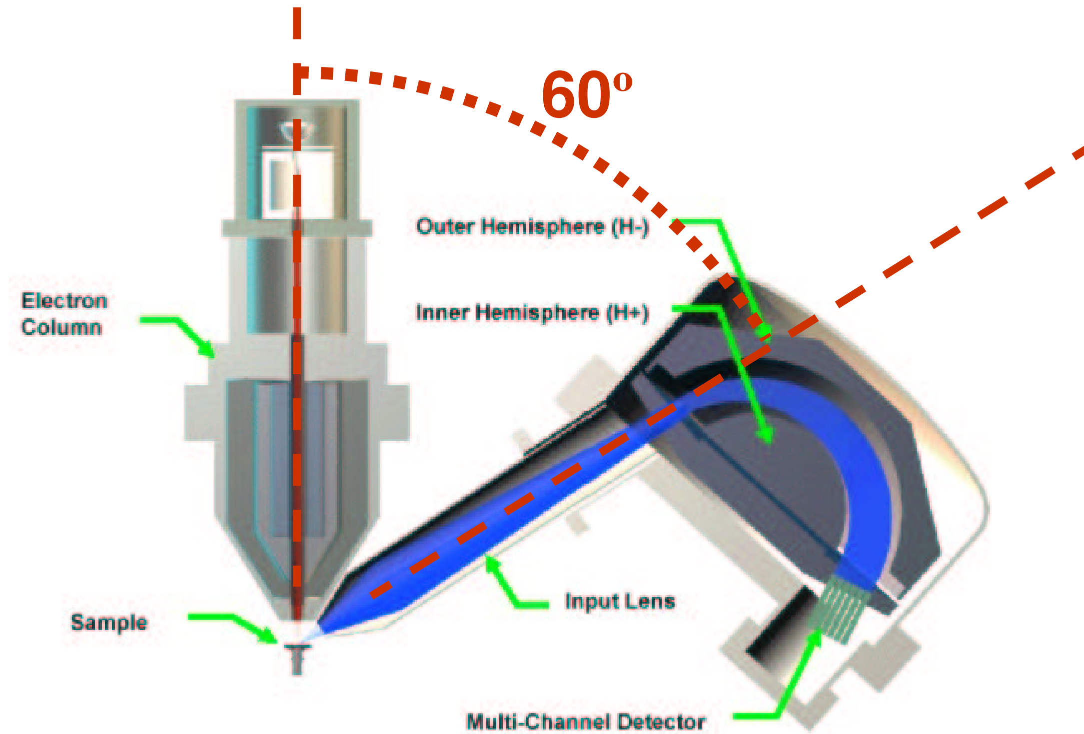

Figure : Courtesy Thermo VG Scientific

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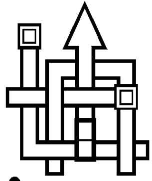
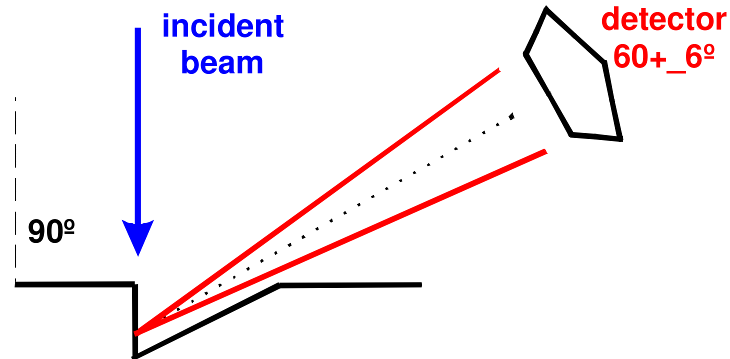


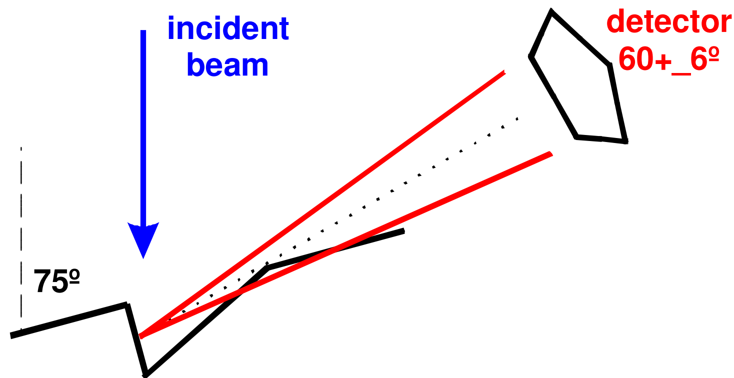
Configuration FIB crater - analyser

2:1 aspect ratio crater

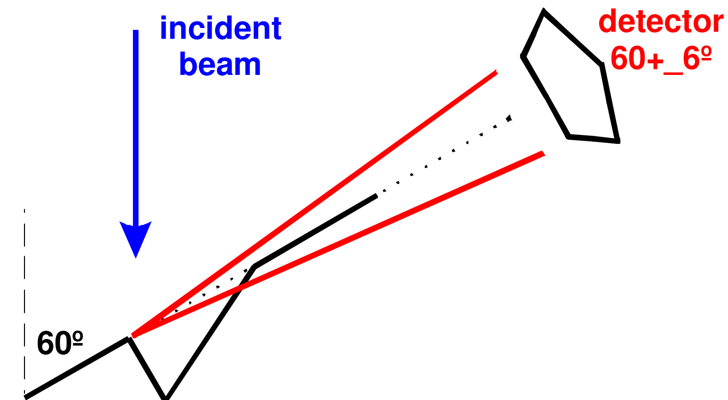
no image :

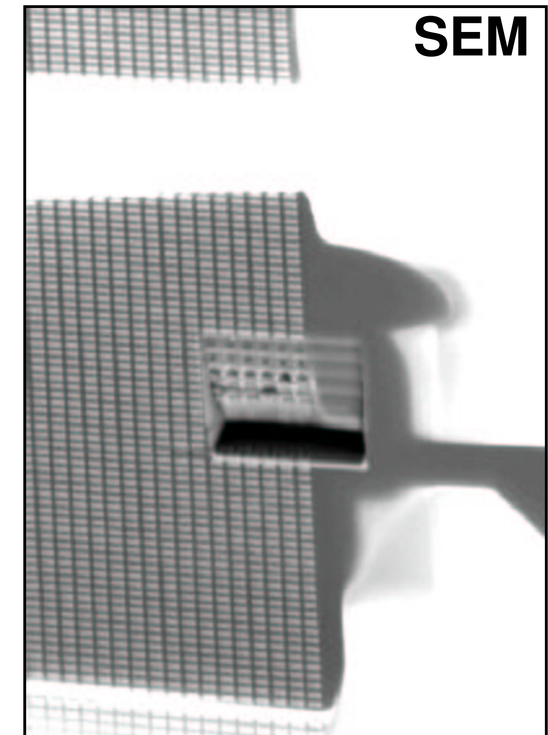


partial detection :



no detection:





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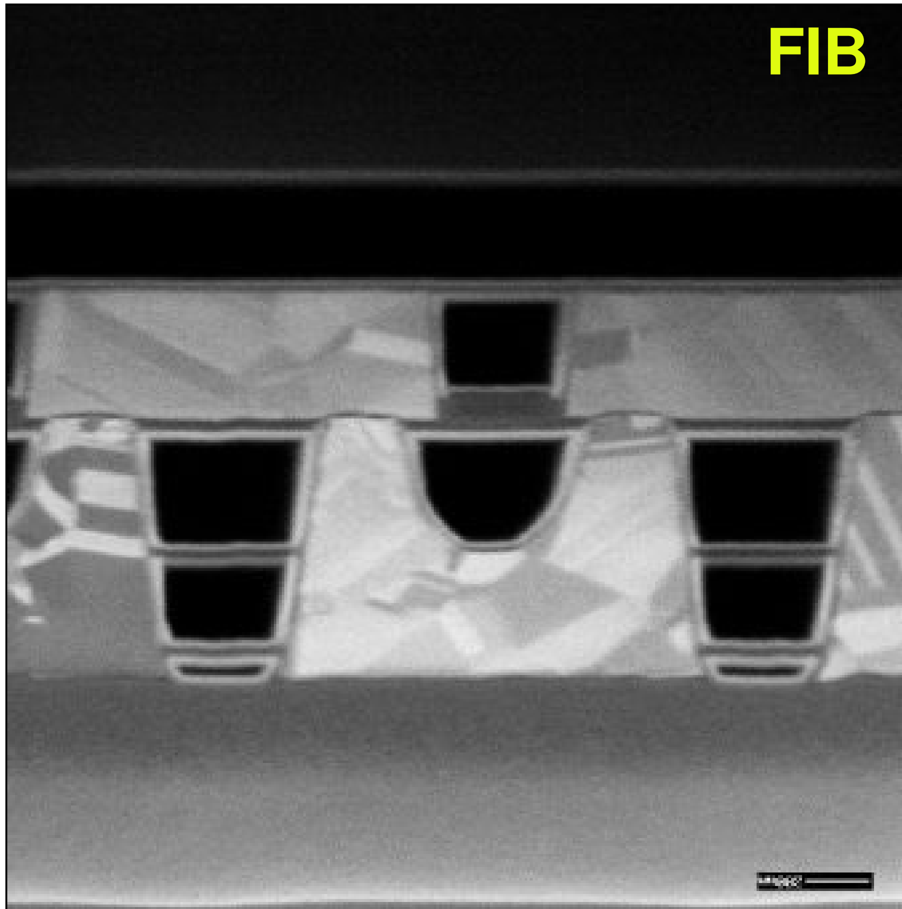
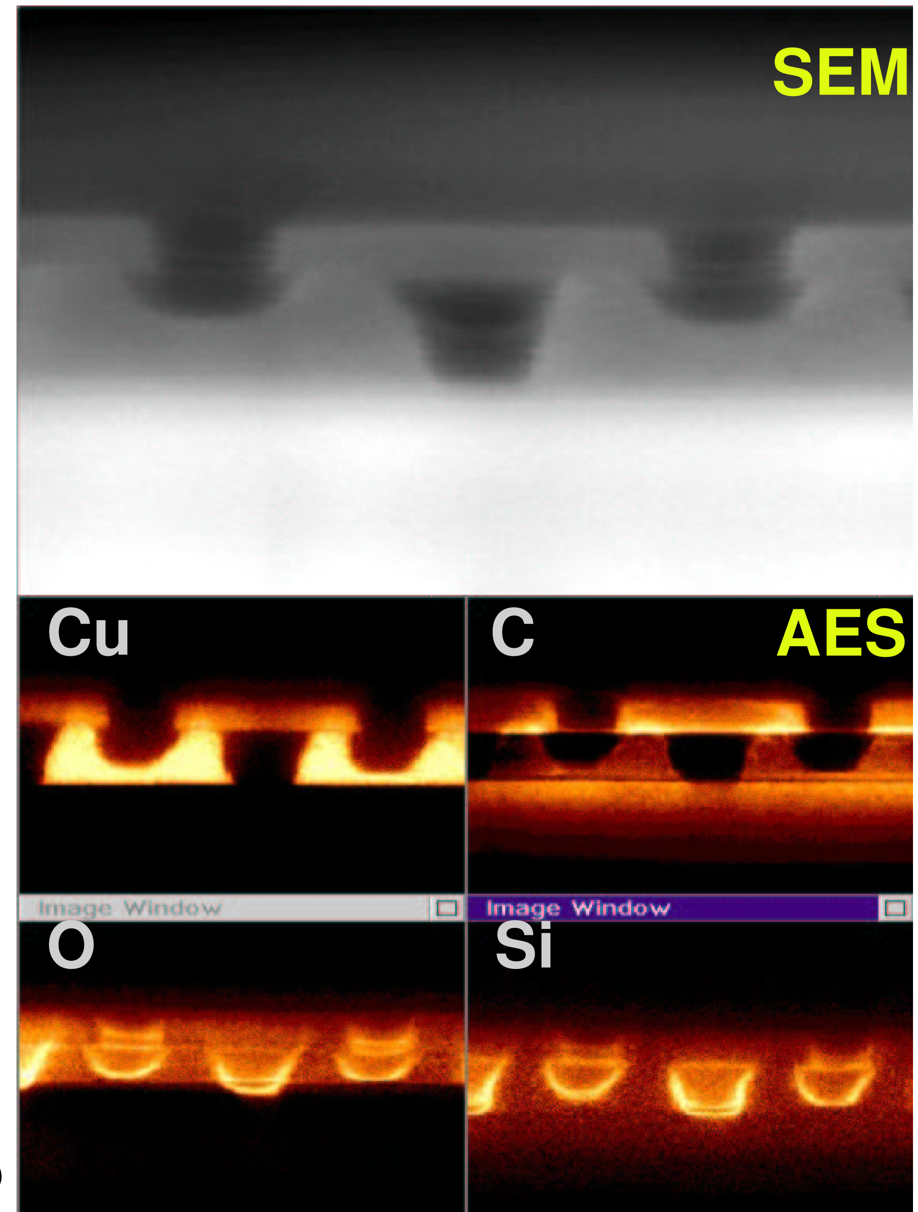
FIB - AES Cu chains





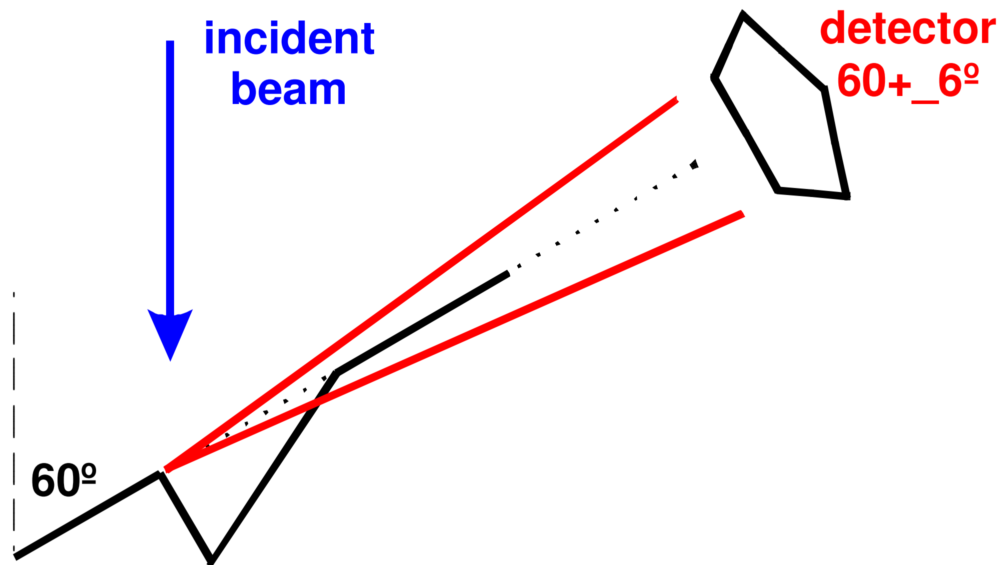
analyser on top

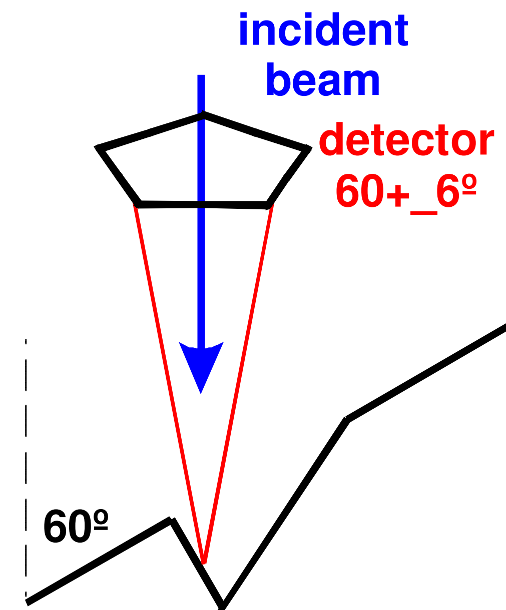
Alternative configuration

imec

30º tilt : no detection

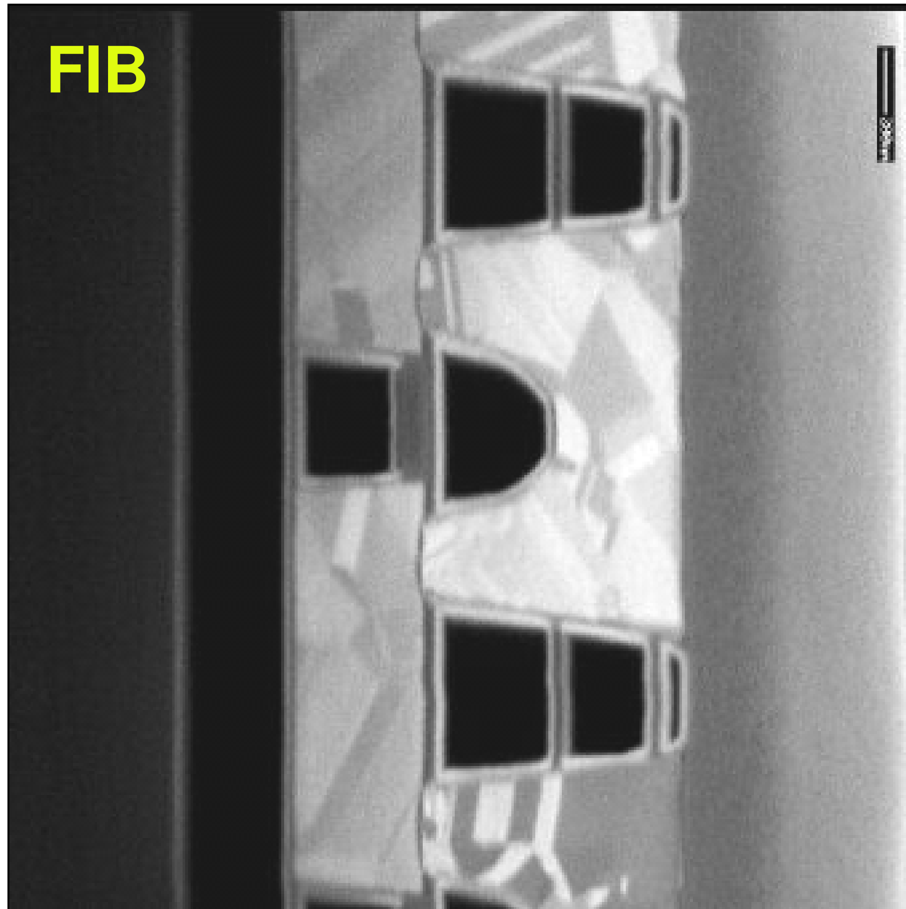
30º pre-tilt holder
sample 90º rotated

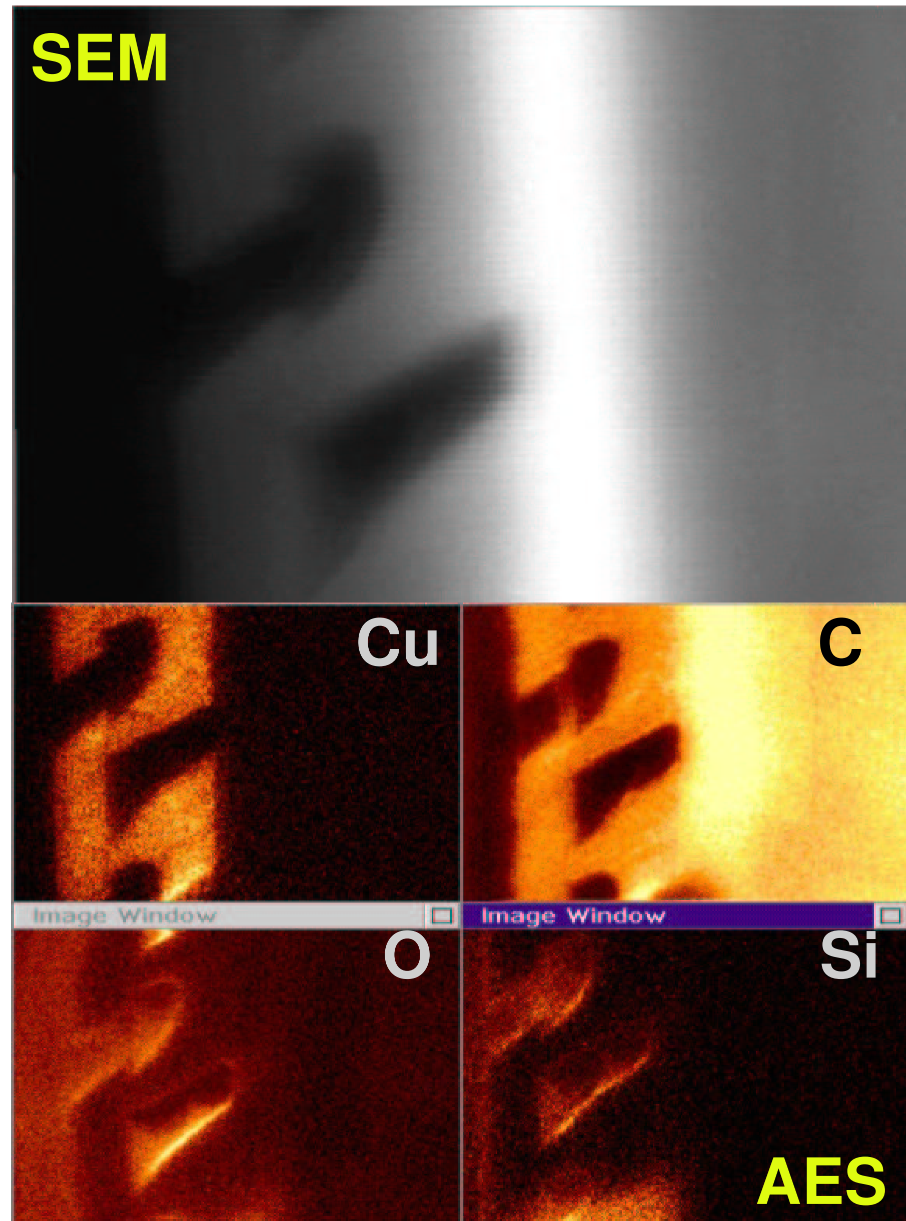




FIB - AES Cu chains

imec





analyser on top

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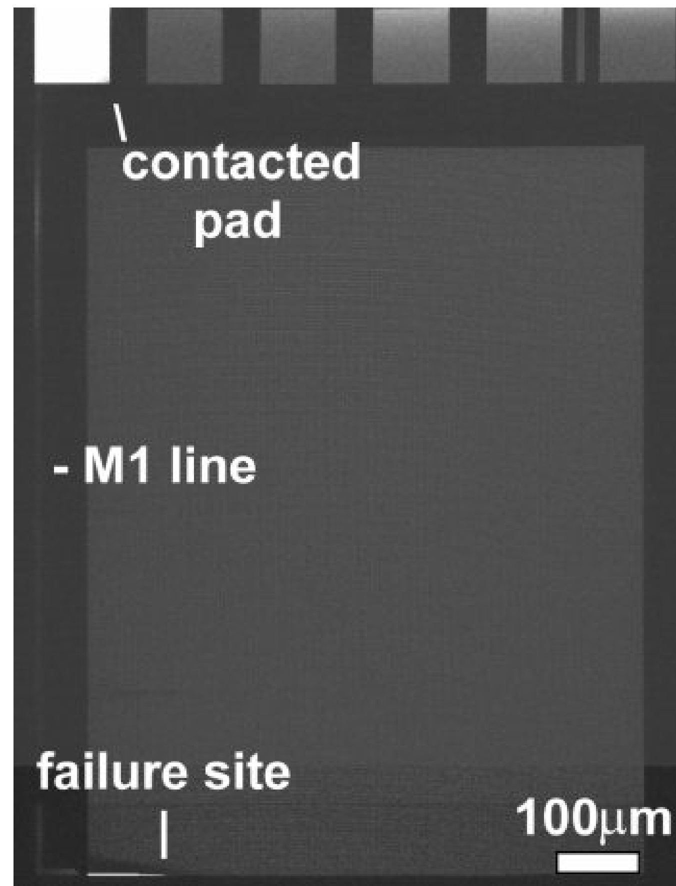
Failure analysis Cu DD via chain



voltage contrast

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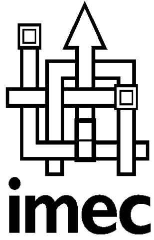
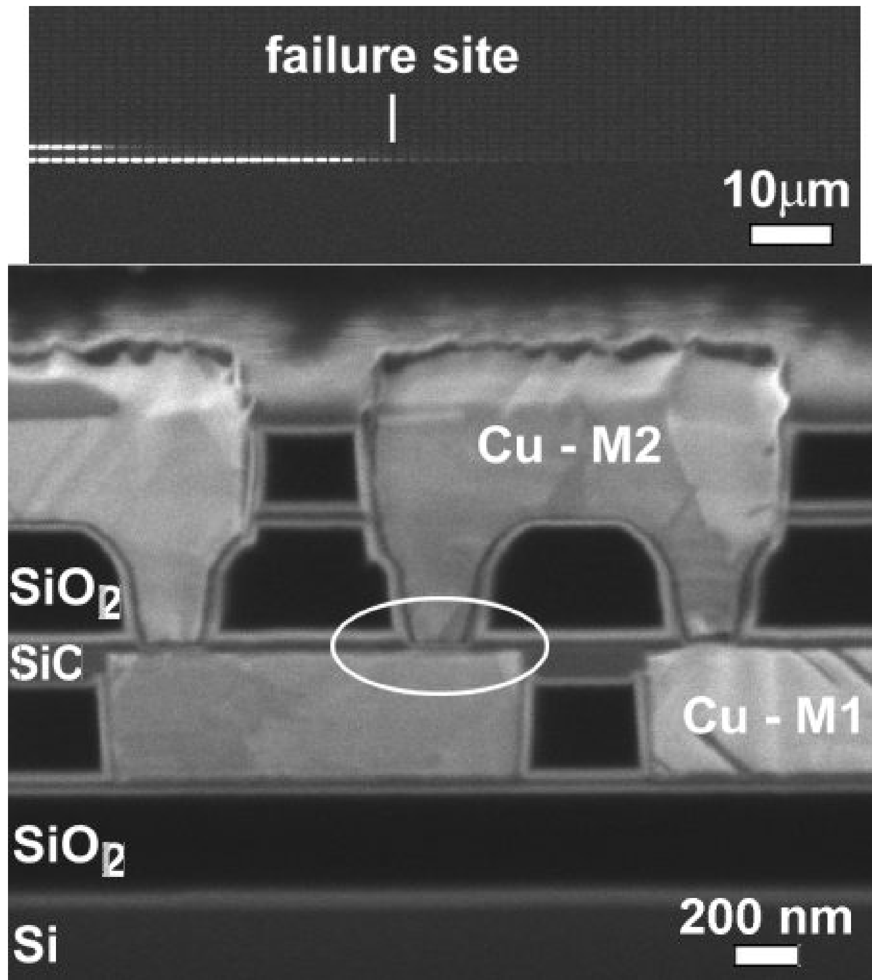
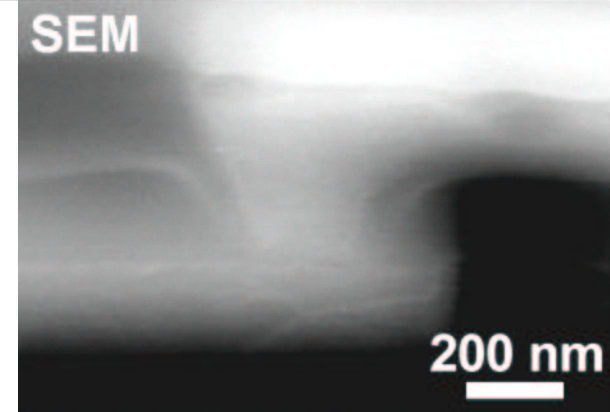
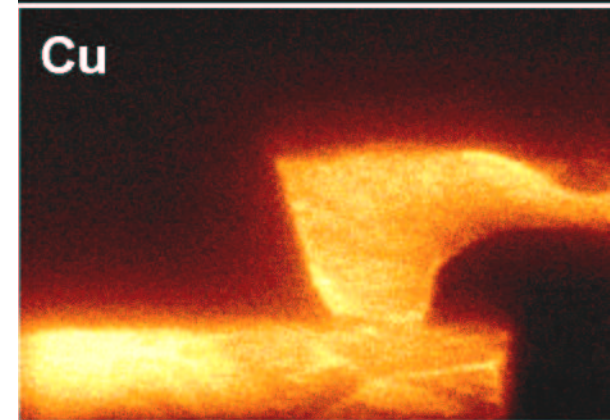
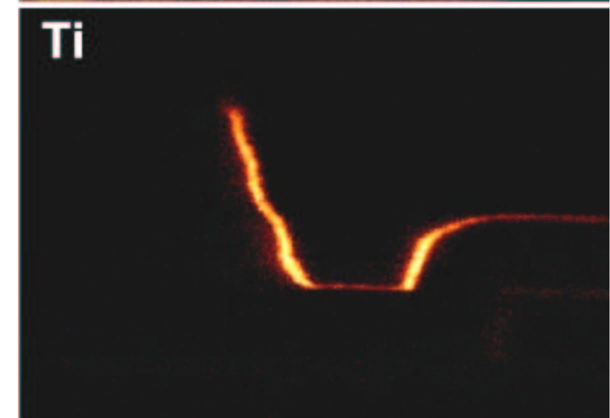


Failure analysis Cu DD via chain









analyser on bottom

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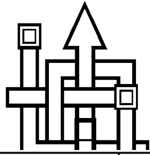
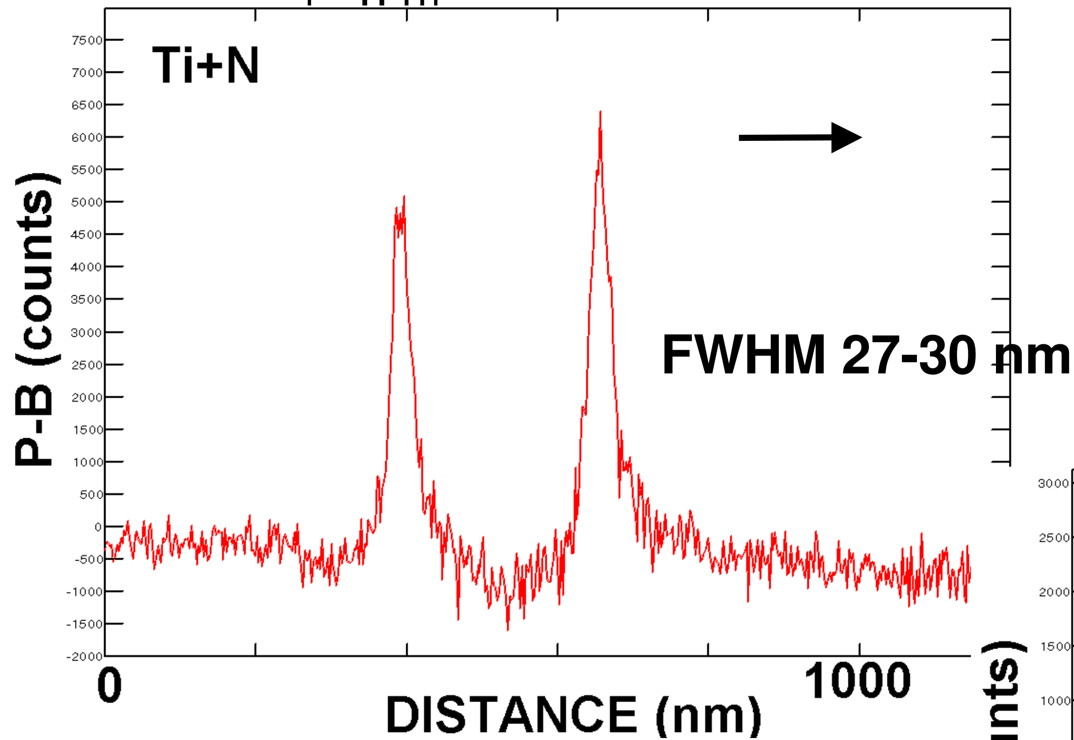
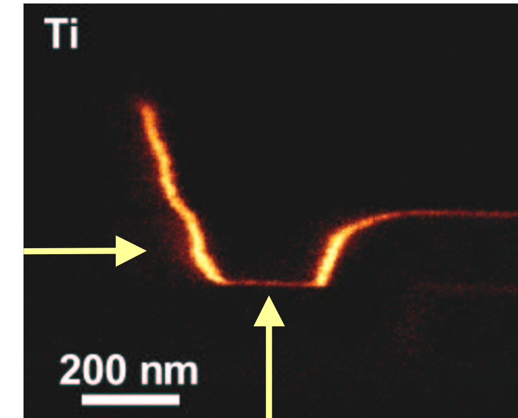
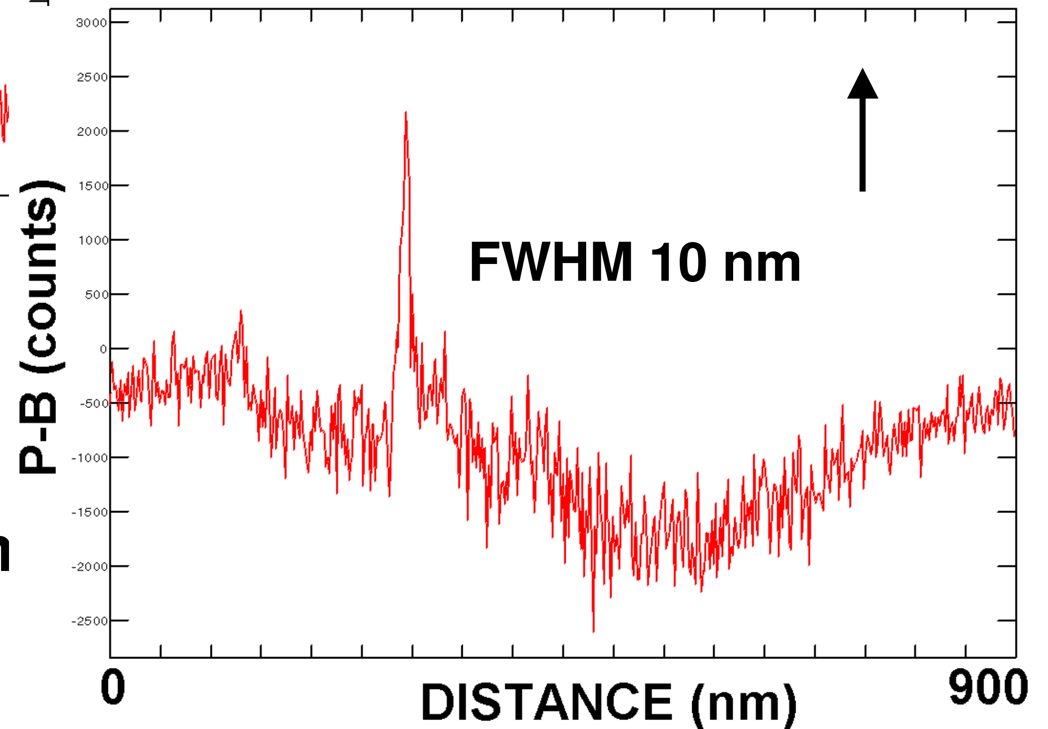


Failure analysis Cu DD via chain

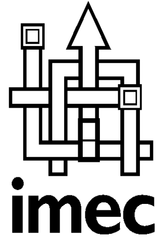




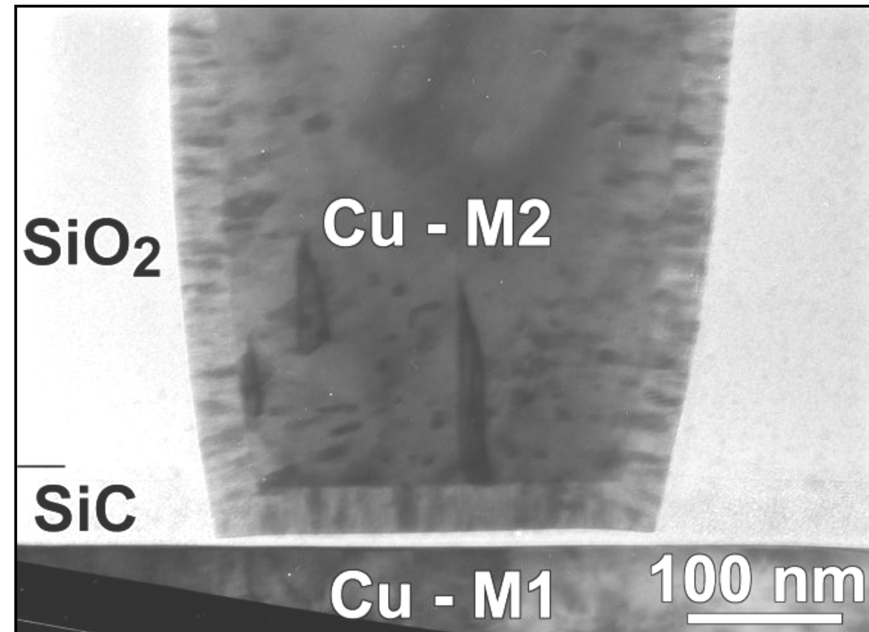


incidence angle 75º

i.e. width = 10/cos75º ~ 38 nm



Failure analysis Cu DD via chain

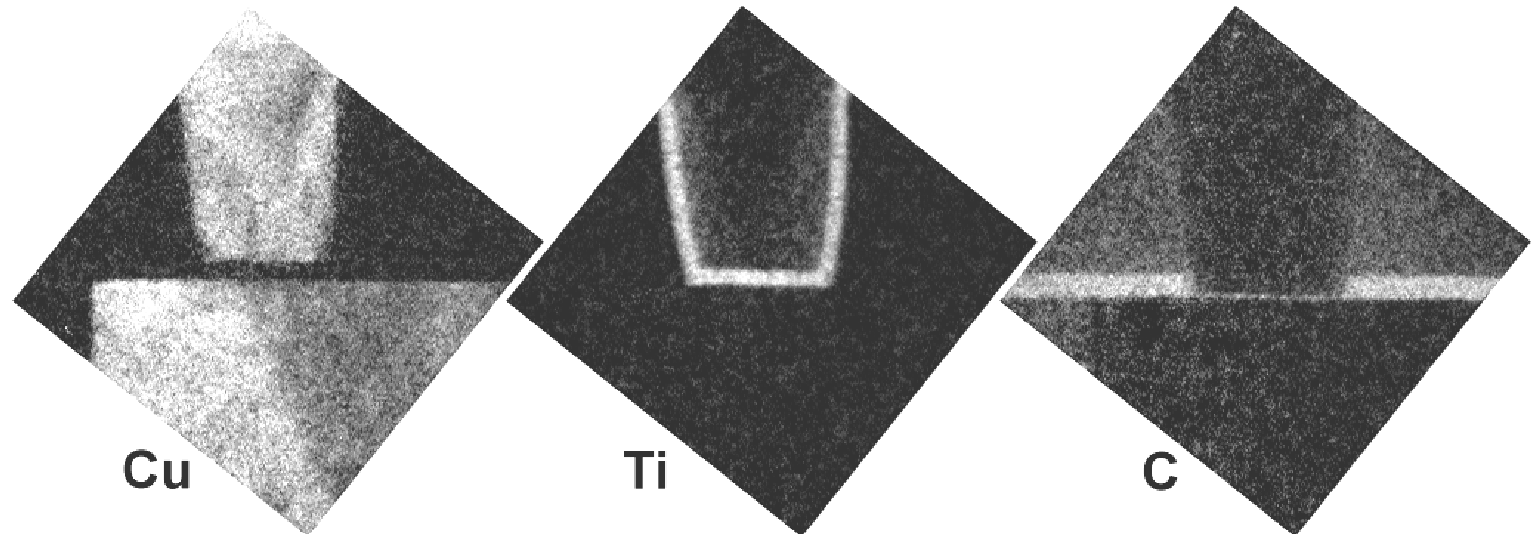


TEM cross-section

barrier : ~ 25 nm

SiC : 5-8 nm

EELS



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Conclusions

- **AES analysis standard FIB crater**
  - 15º configuration : no detection deeper in the crater
  - 30º pre-tilt / 90º rotation : detection on full crater wall, asymmetry effects
  - drawbacks : C/O contamination from air exposure : no sputter cleaning possible
  - analysis 10 nm layers possible
  - thinner layers : TEM required
- **AES on FIB cleaned edges (cleaving or polishing) : avoids crater shape limitations, but not generally possible**

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