

photocathodes for X-ray image intensifiers

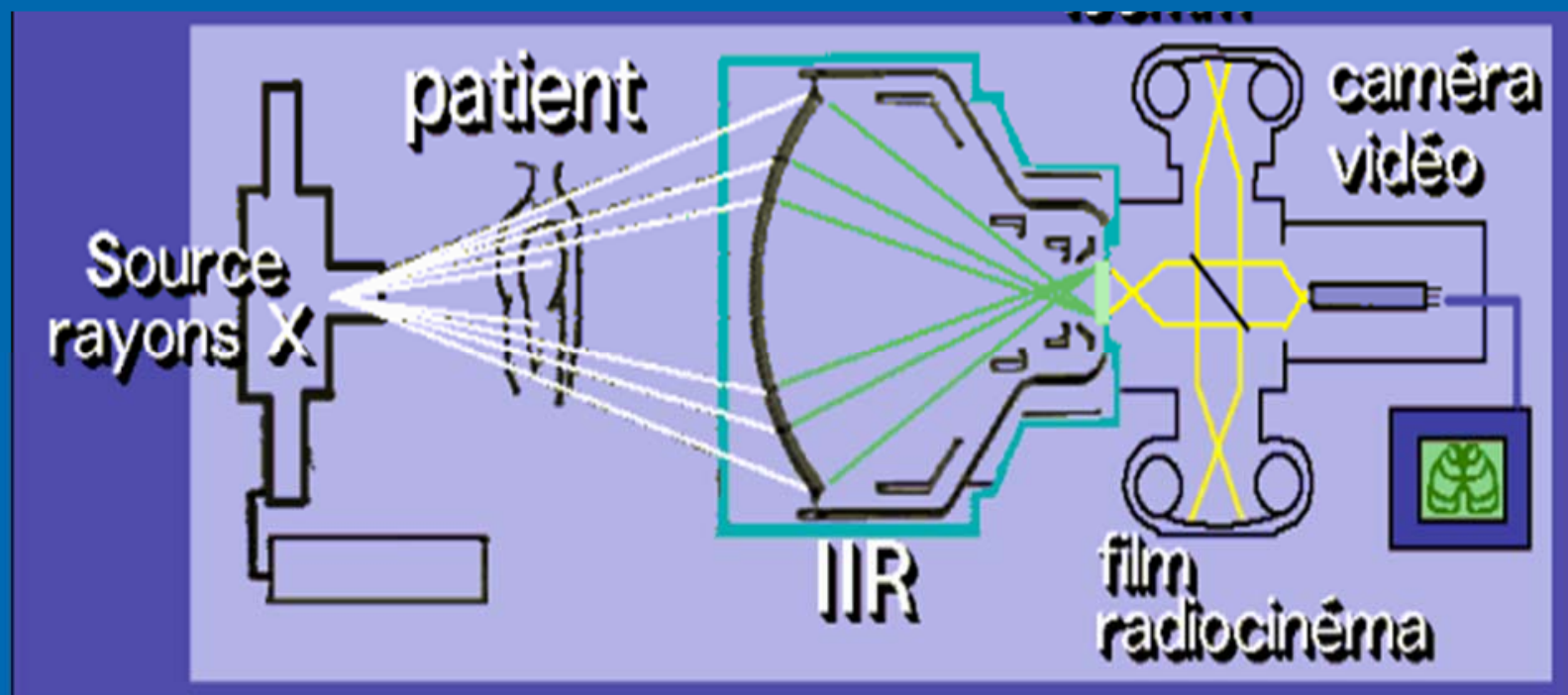
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Modena - Italy

Daniel Gally, Gilbert Colomb and Andreas Koch

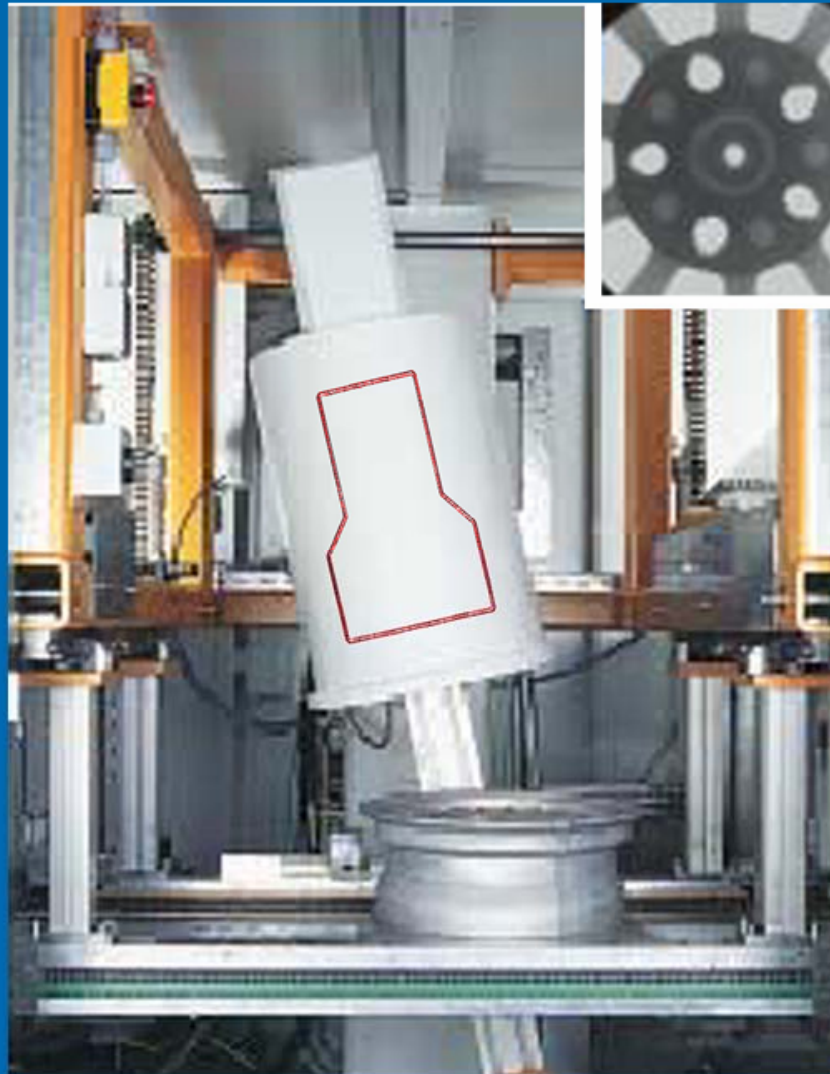
Thales Electron Devices - X-ray Imaging Tubes & Devices
Moirans - France

applications for XRII



radiology (95%)

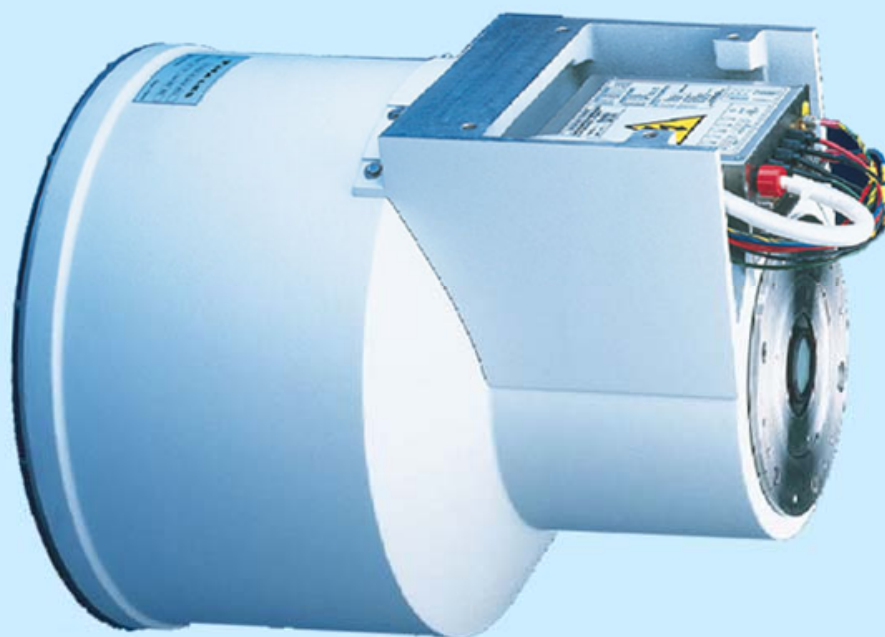
applications for XRII



non-destructive testing (5%)

X-Ray image intensifiers working principle

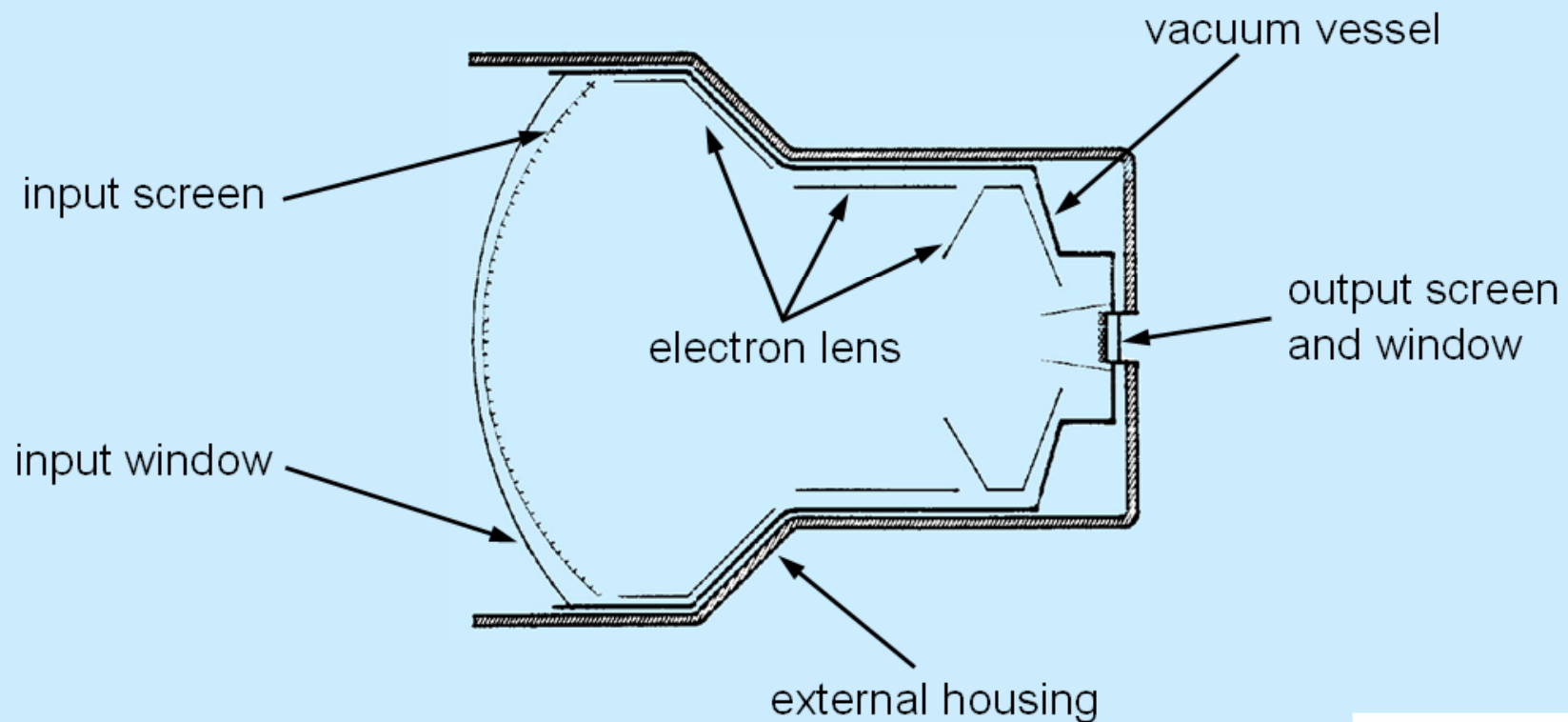
12" X-Ray image intensifier



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ELECTRON DEVICES

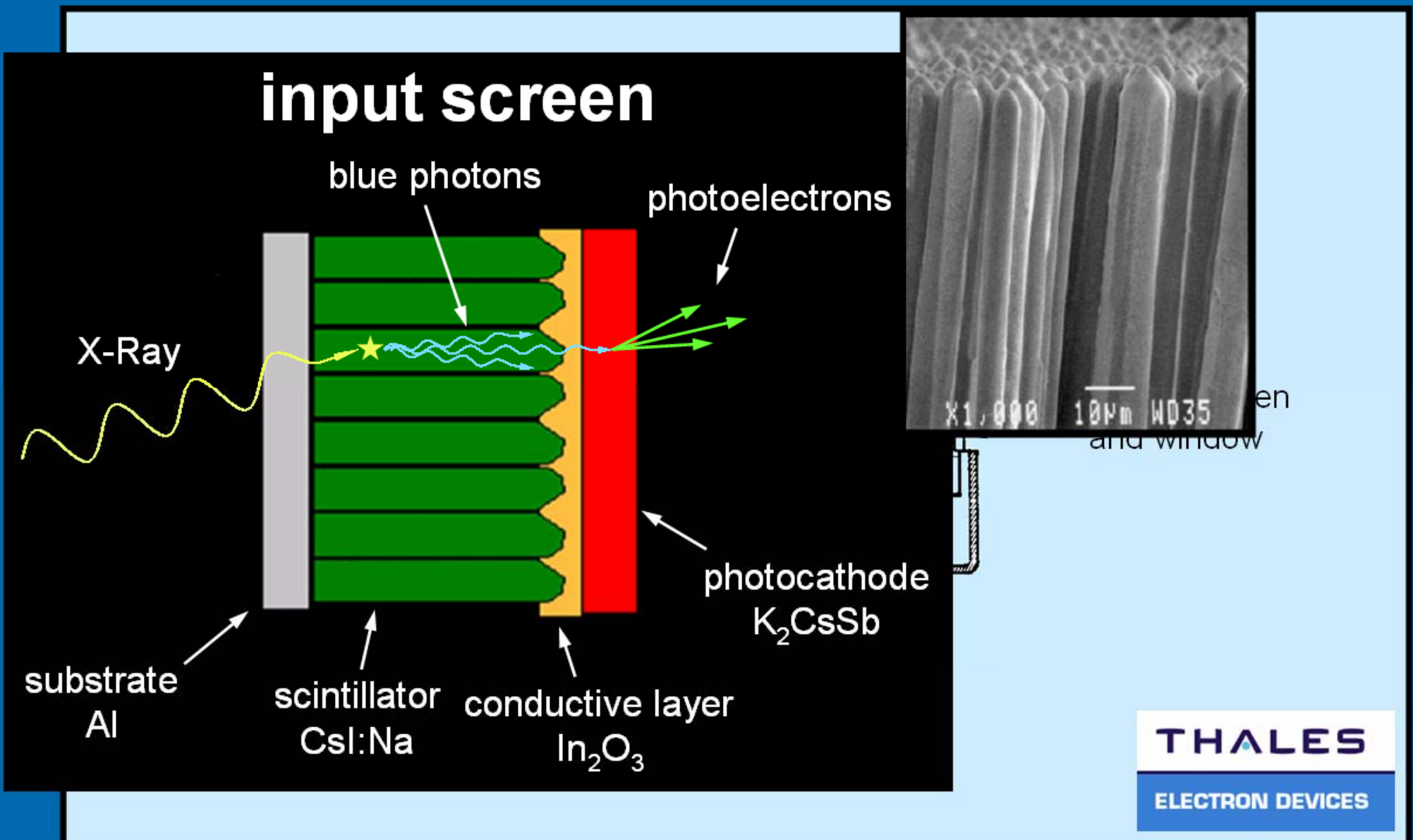
X-Ray image intensifiers working principle

XRII schematic

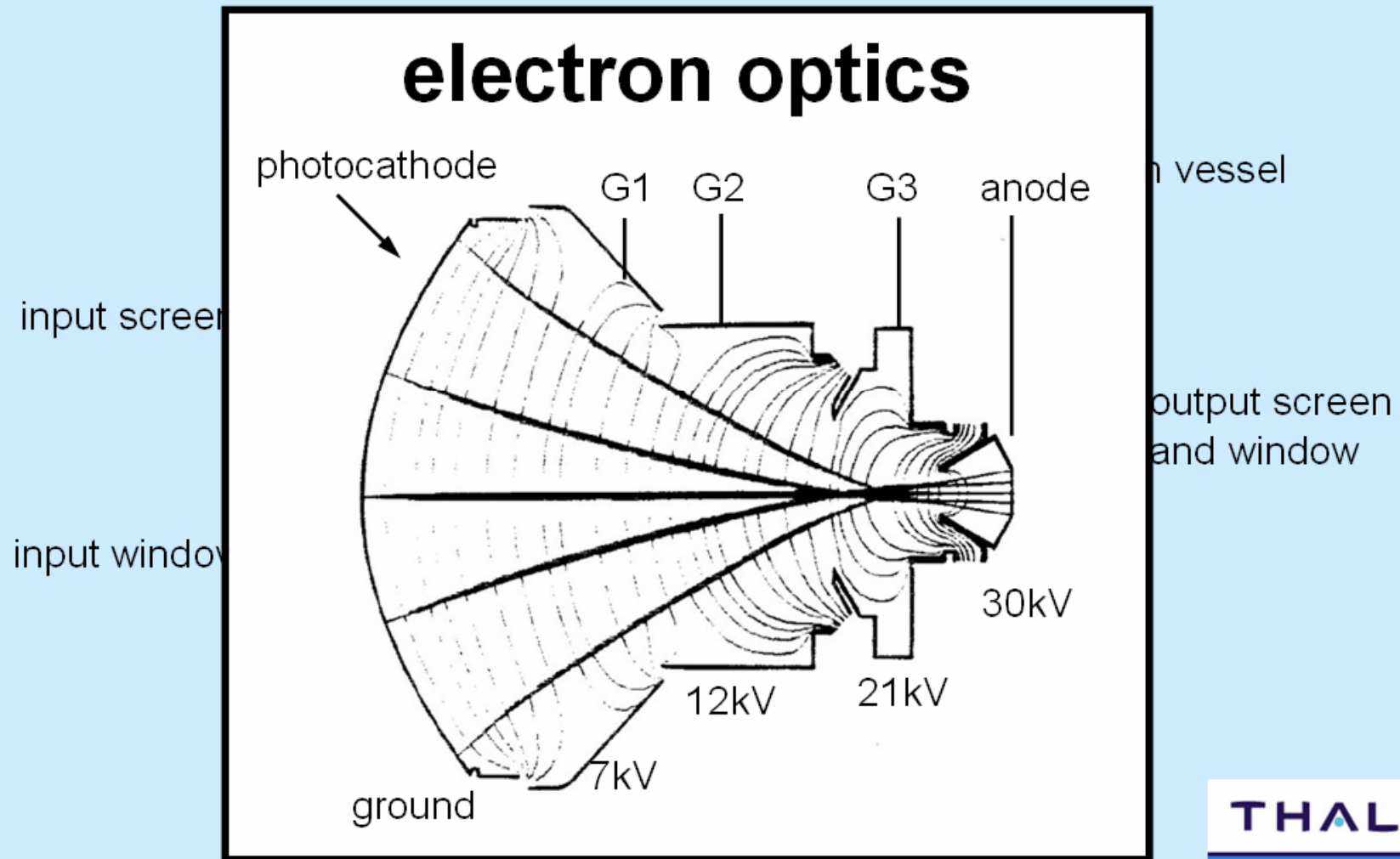


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X-Ray image intensifiers working principle



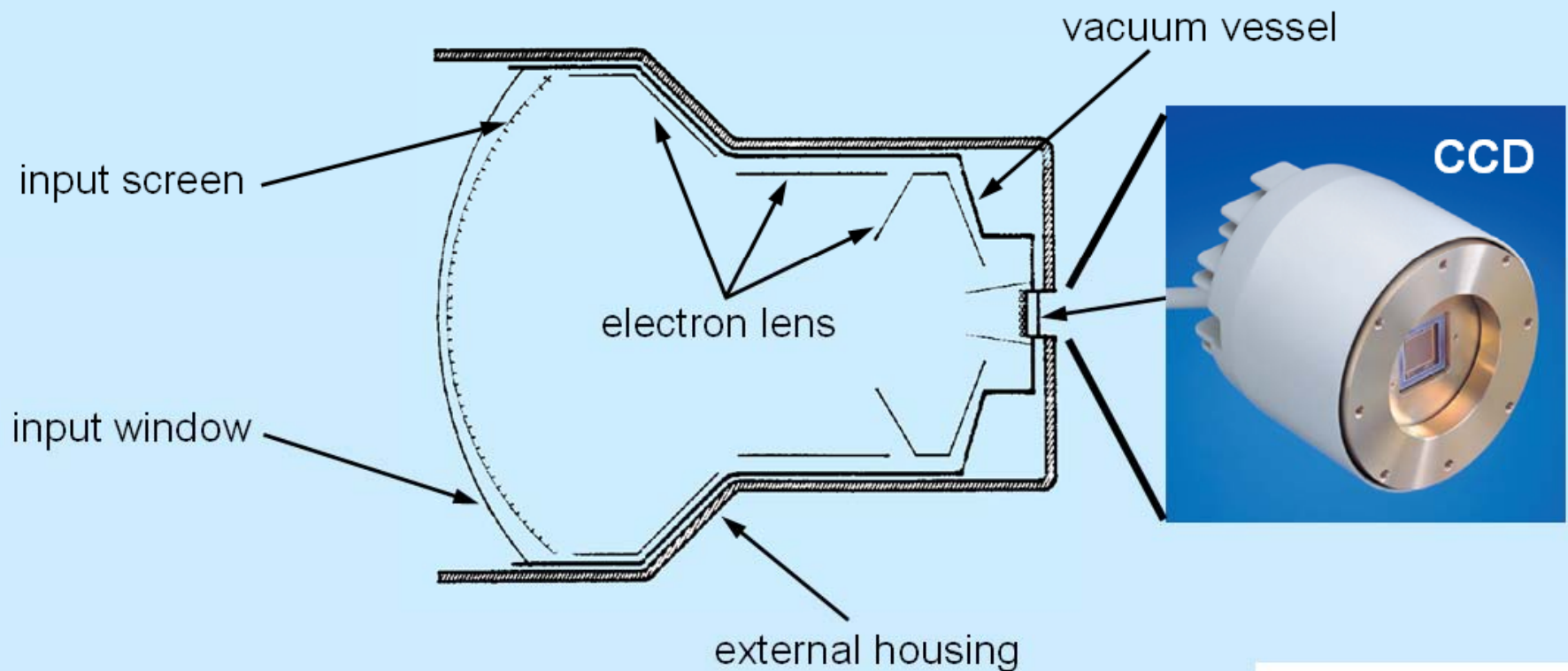
X-Ray image intensifiers working principle



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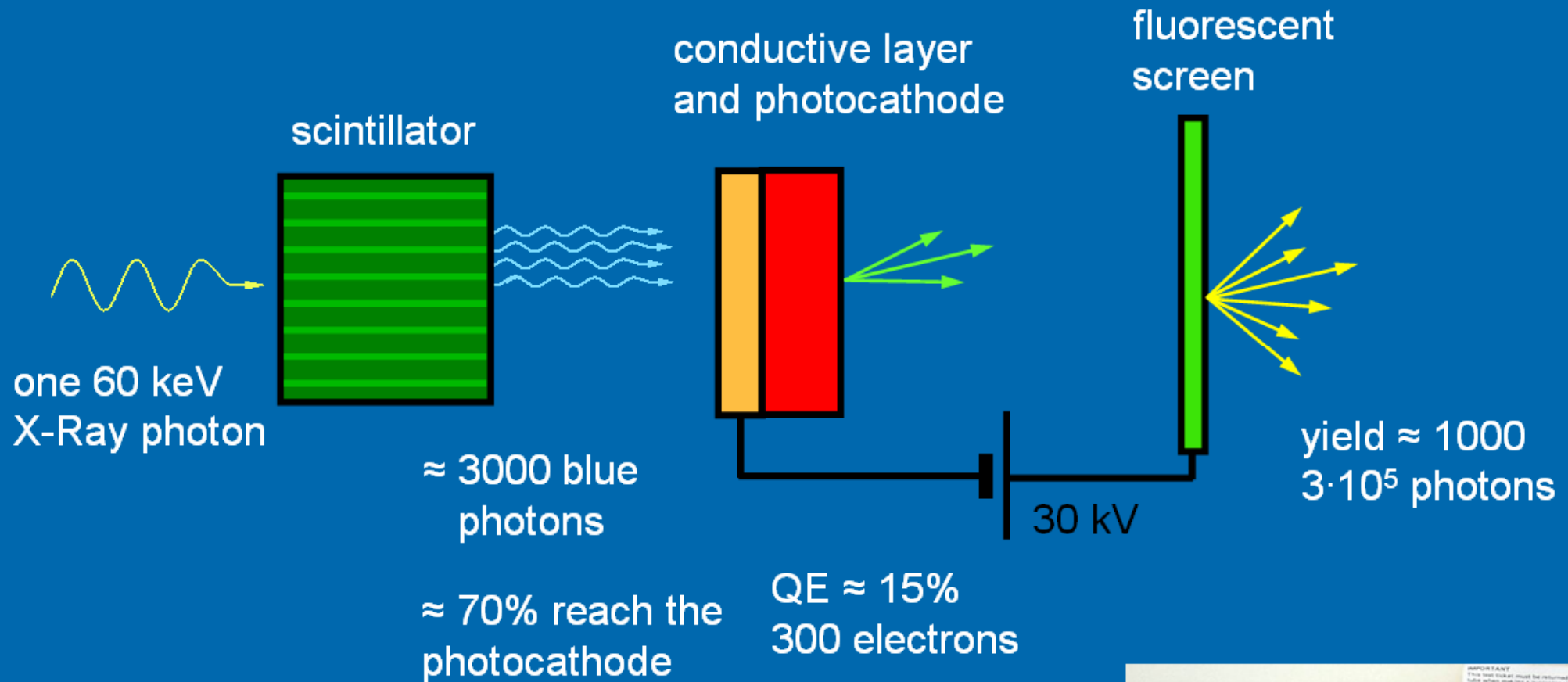
X-Ray image intensifiers working principle

XRII schematic



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typical performances of a XRII



**QE should be ≈ 30%
like in PMT's !**



XRII test tubes at TED

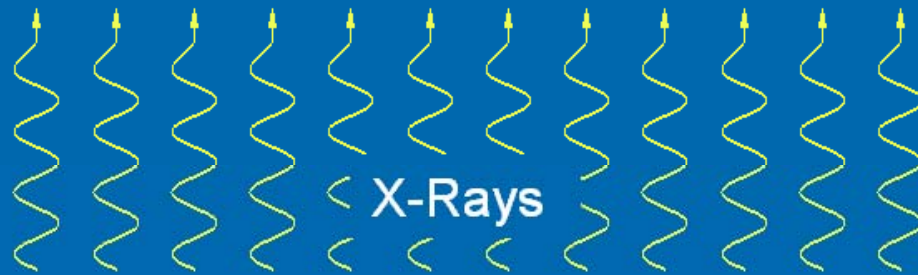
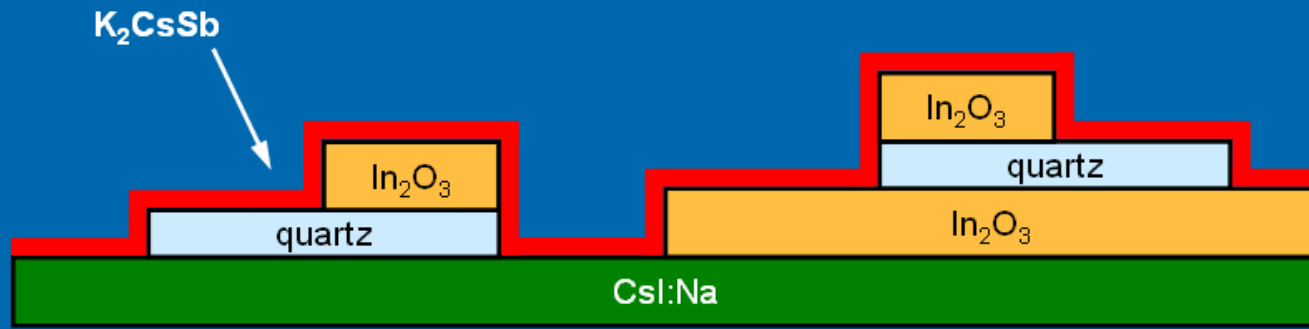
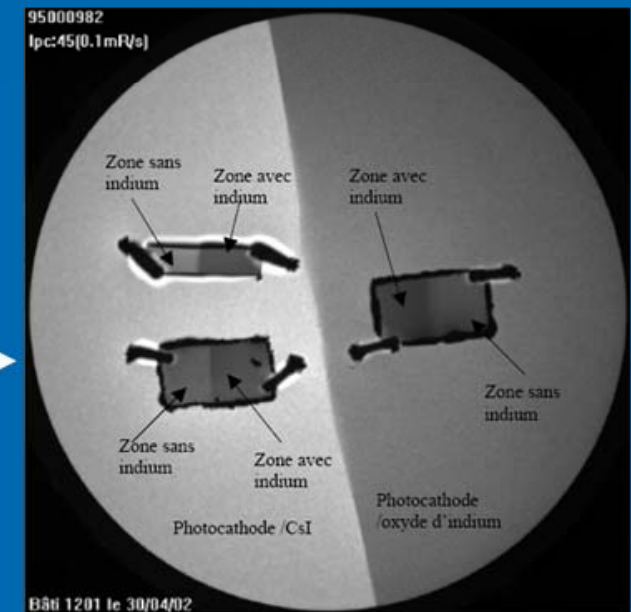


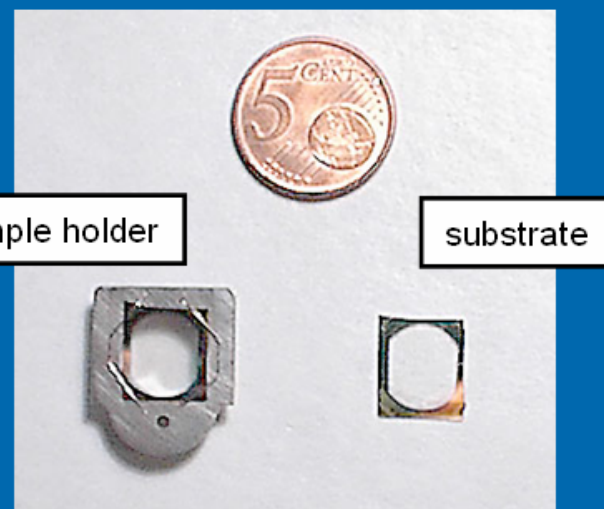
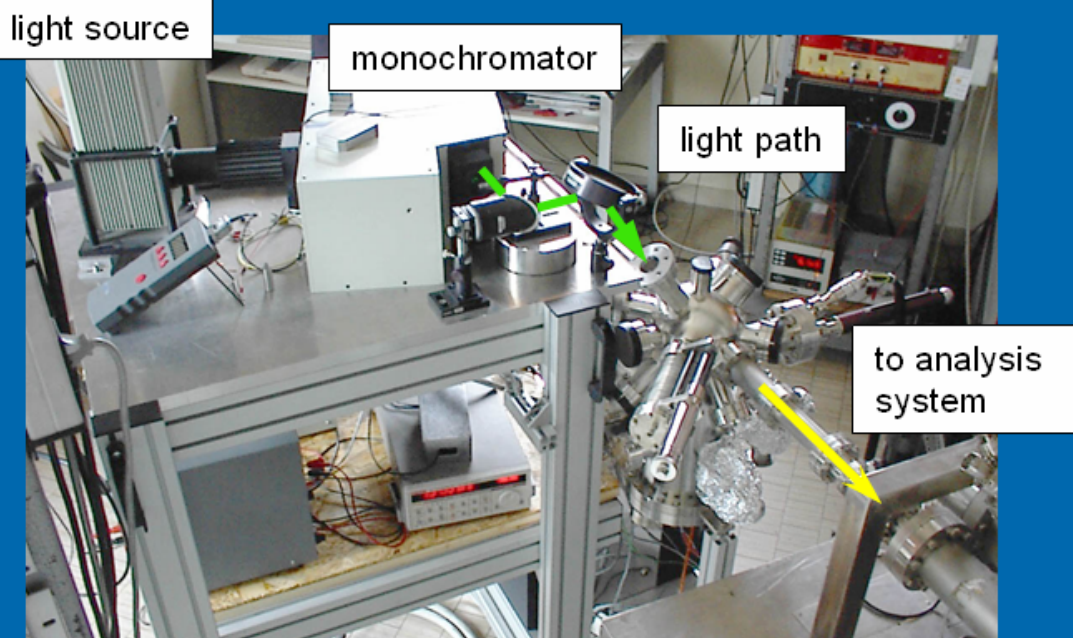
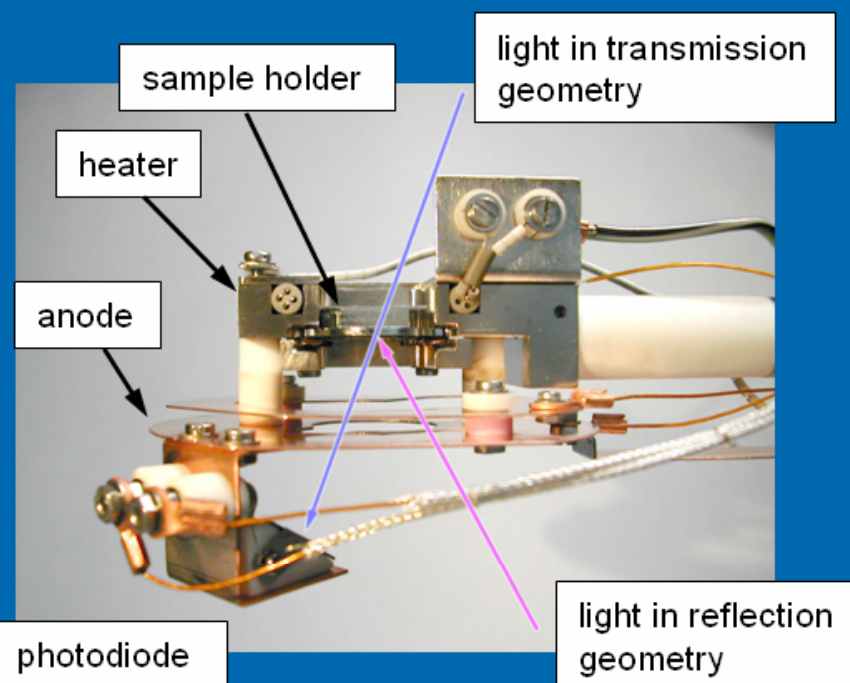
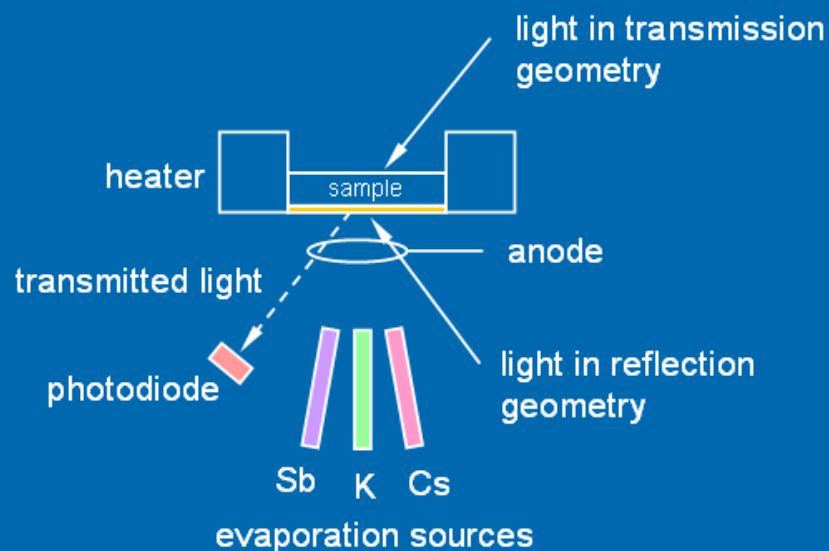
image at the output screen under
uniform X-ray illumination



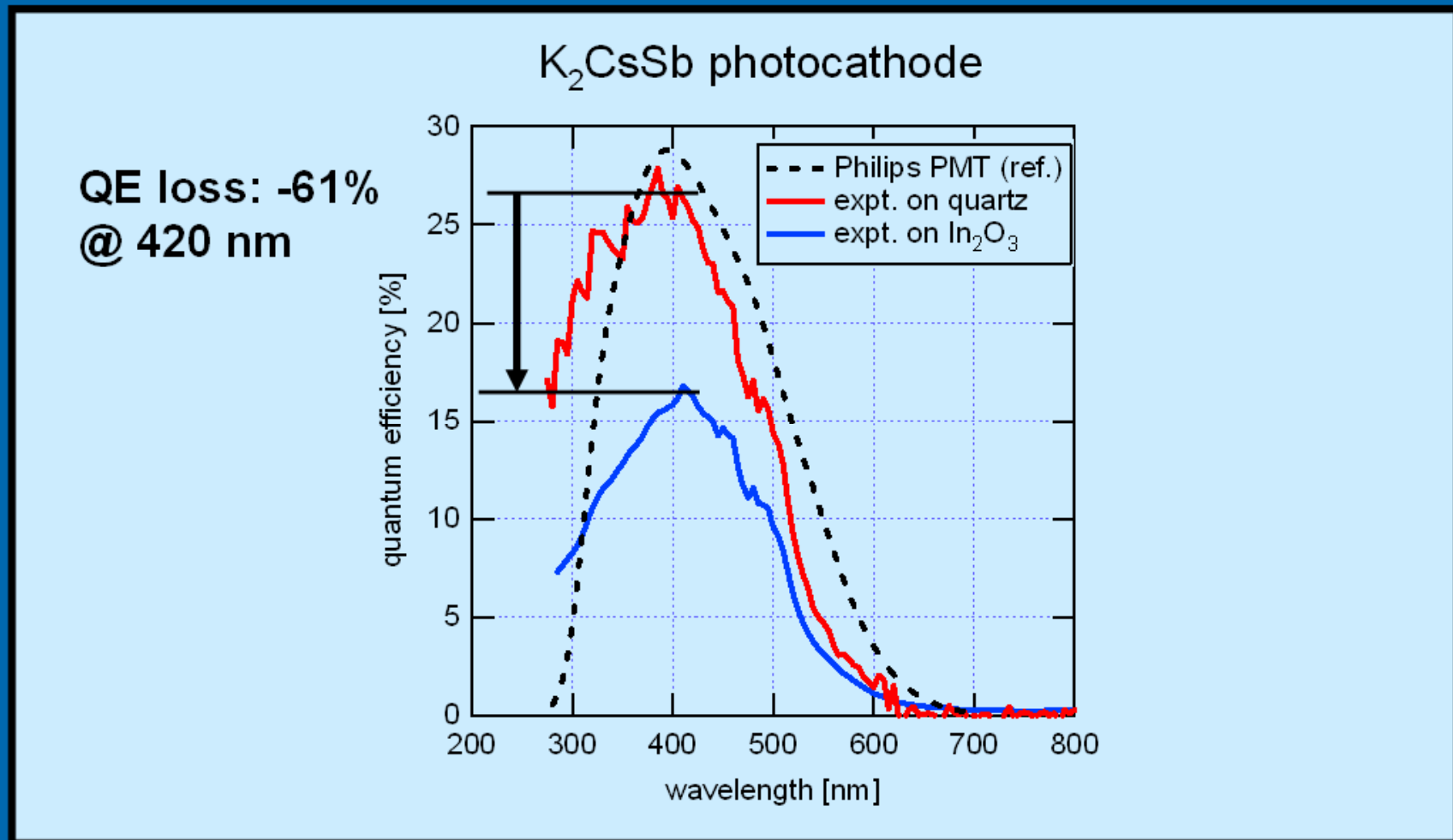
clear evidence of interaction between the
In₂O₃ and the photoemissive material

QE loss due to In₂O₃: 60 ÷ 70% !!!

experiments at INFM

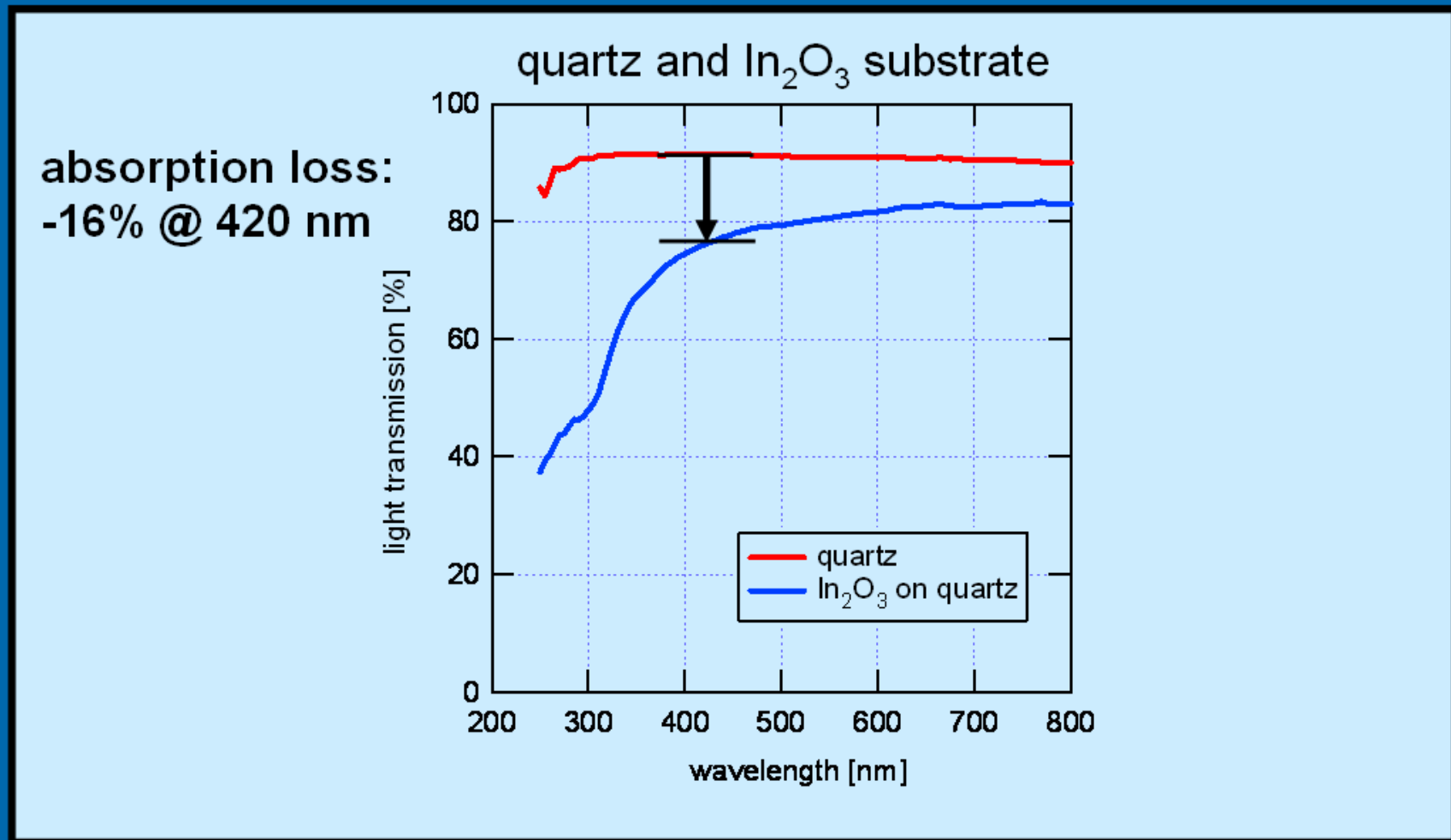


effect of In_2O_3 on QE



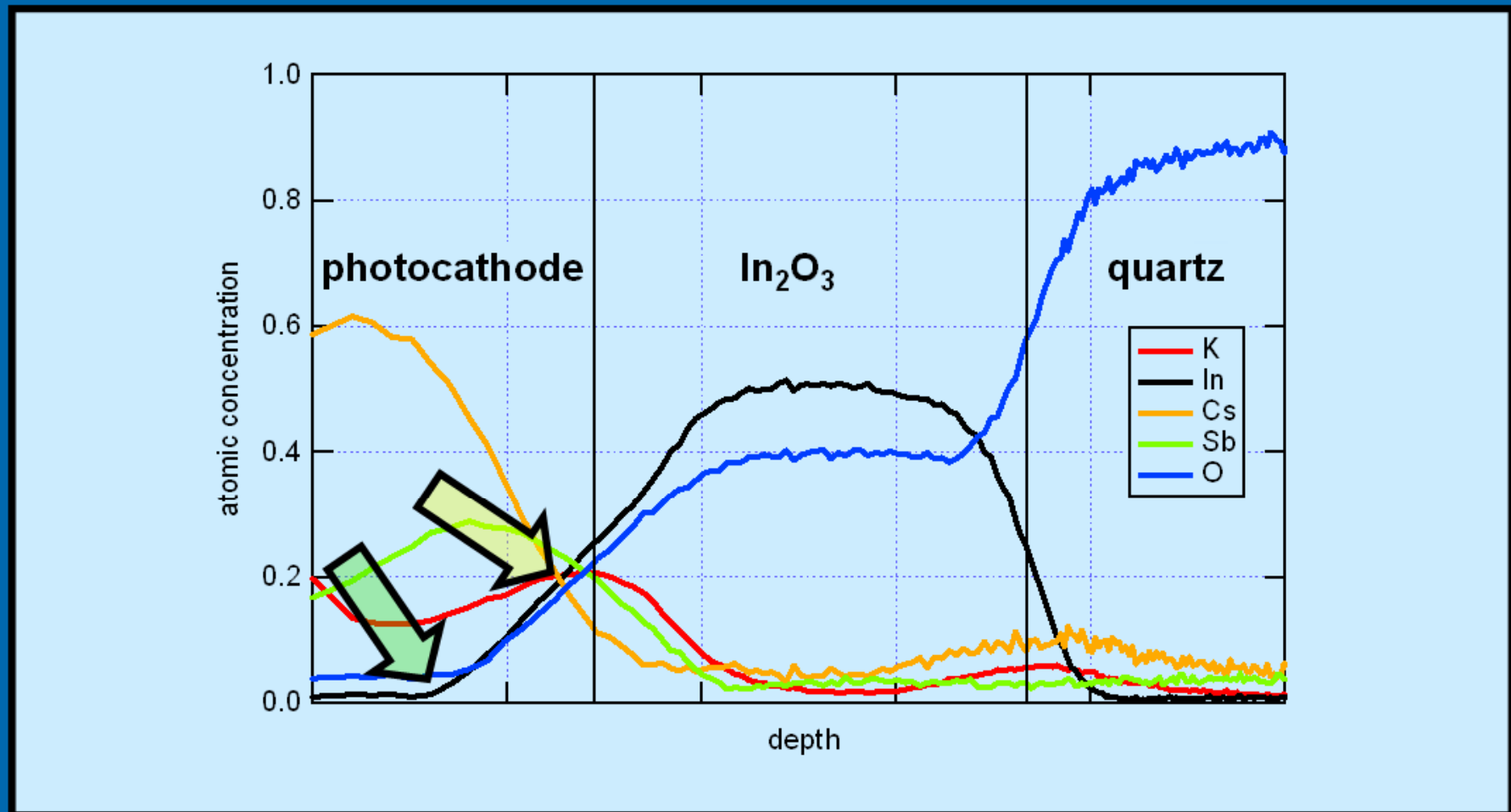
the effect observed at TED, production line, has been reproduced in laboratory

effect of In_2O_3 on light transmission



absorption loss by In_2O_3 do not fully account for the observed QE loss...

depth profile of the photocathode

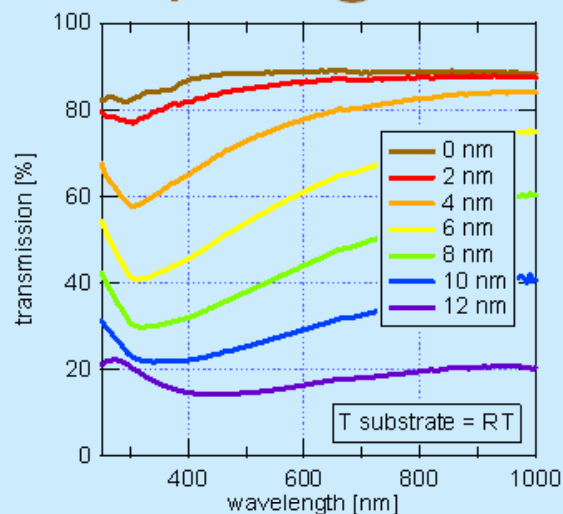


diffusion of In and O in the photoemissive material

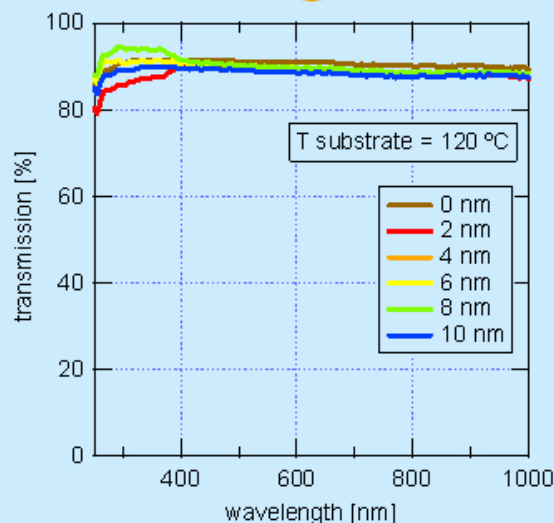
onset of In and O → 50% of the cathode is poisoned

Sb layer on quartz

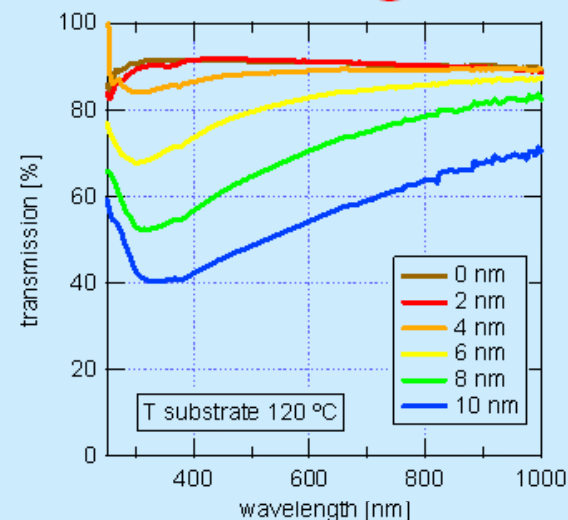
quartz @ RT



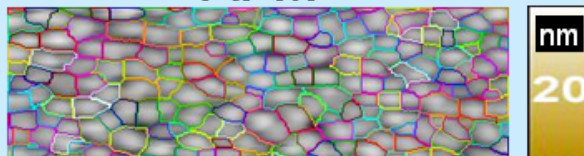
quartz @ 120 °C



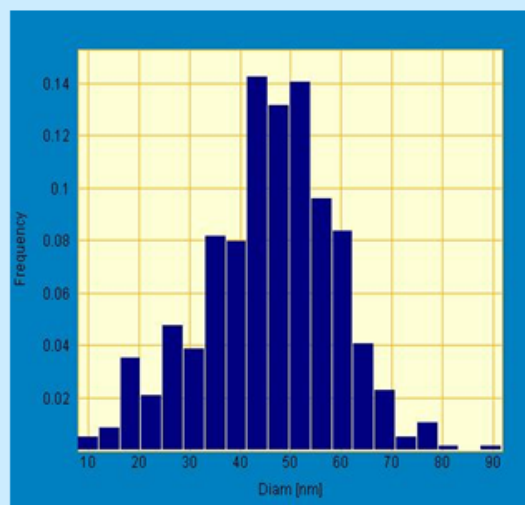
Cs contam. @ 120 °C



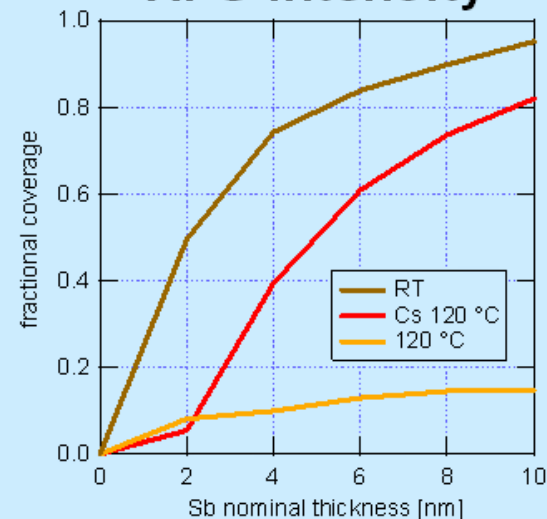
AFM



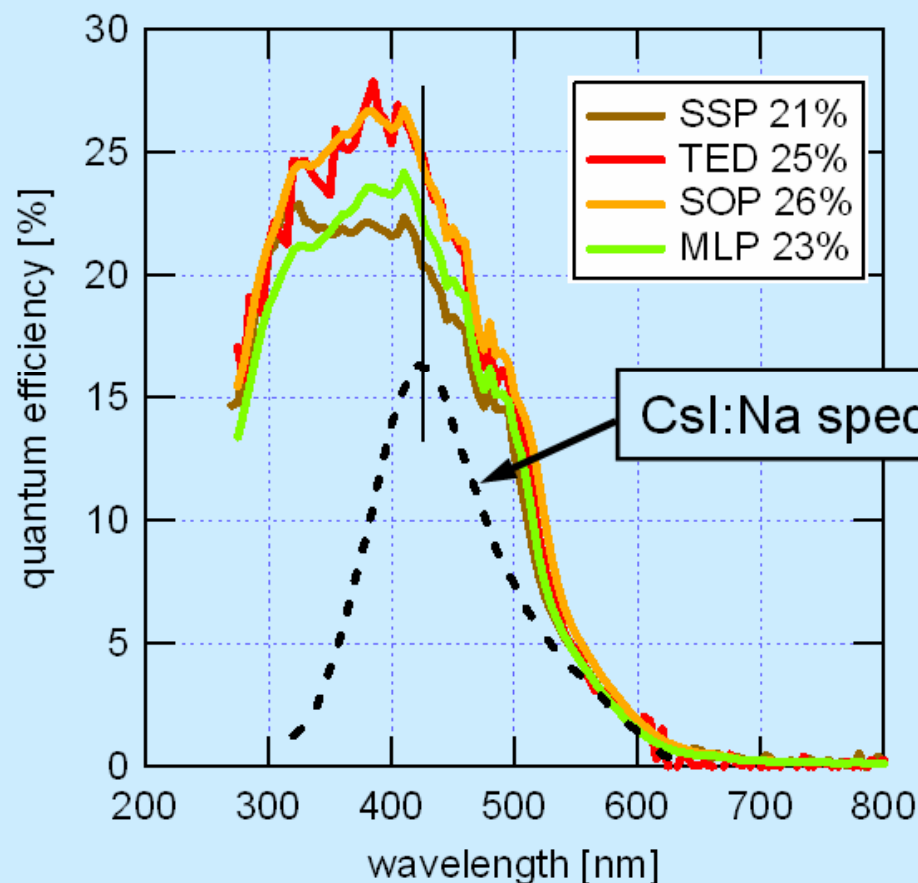
**10 nm Sb deposited @ RT:
average island size: 50 nm
covering 90% of the surface**



XPS intensity



tests of new processes

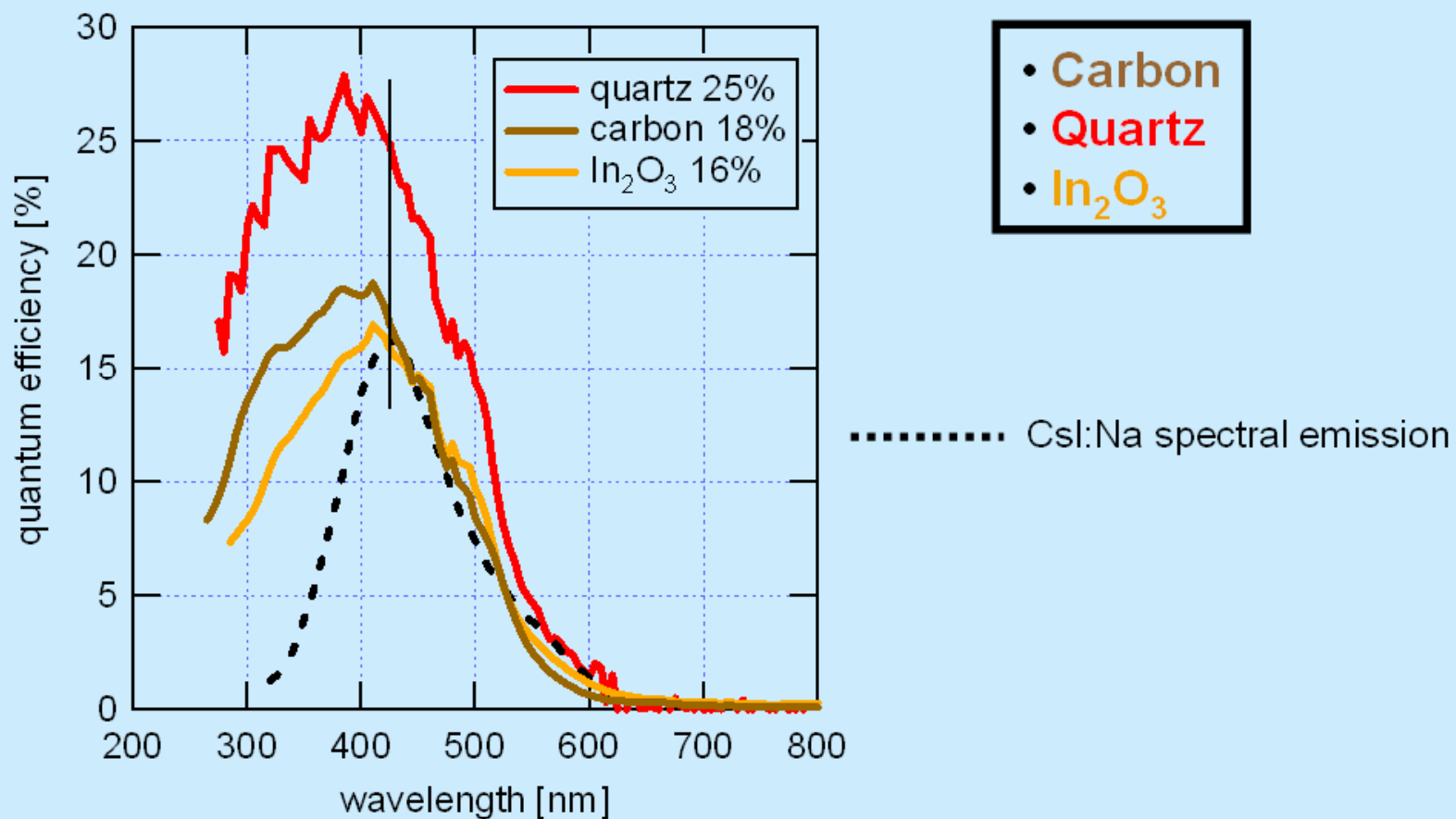


- Single Step Process
- **TED standard process**
- **SOMmer Process**
- **MultiLayer Process**

CsI:Na spectral emission

substrate: quartz

tests of new substrates



conclusions

- there is plenty of room for QE improvement (+60%)
- QE is limited by optical and chemical effects (In_2O_3)
- the fabrication process is OK (laboratory and production)

new perspectives

MnO as conductive layer

- beneficial for QE
- hygroscopic barrier (?)

Cr as conductive layer

- chemically inert for the photocathode
- reasonable absorption/conductivity ratio (5% for $340 \text{ } \Omega / \square$)