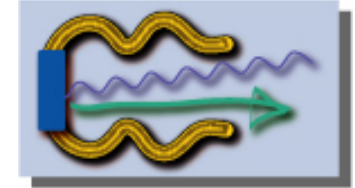


# Photoinjector General + Photocathodes

presented by Konrad Elsener (CERN-AB)



## Acknowledgements (PHIN)



We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 “Structuring the European Research Area” programme (CARE, contract number RII3-CT-2003-506395).



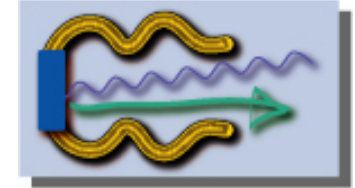
CCLRC

Rutherford Appleton Laboratory





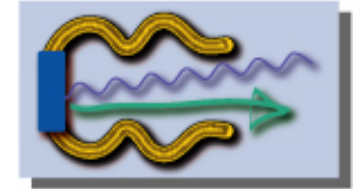
# Outline



- Overview
- Photocathodes: Status + Outlook  
(photocathode for CLEX)
- PHIN in CTF2
- Summary

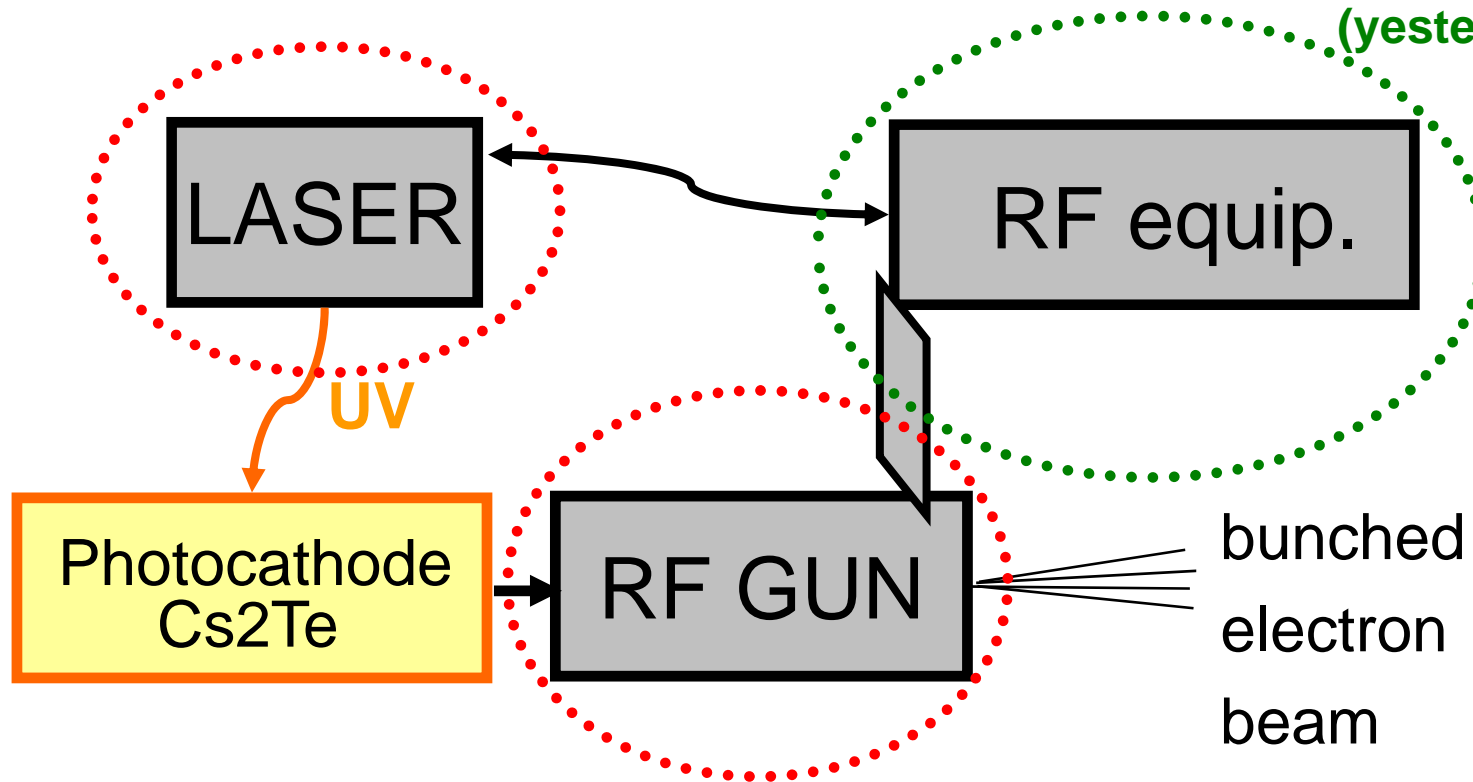


# Overview



## “Photoinjector”

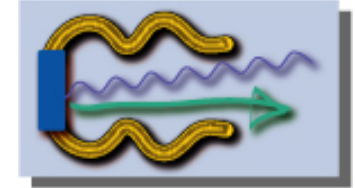
G. McMonagle  
(yesterday)



...cf. next two talks...



# Photocathodes



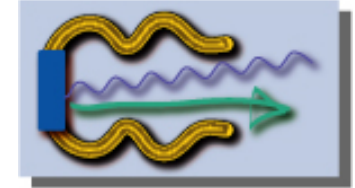
many thanks to Eric Chevallay

- cf. presentation by R. Losito, 17 Jan. 2007
- HIGHLIGHT end of 2006:  
Photocathode No. 166 produced  
(after > 3 years interruption)  
**Cs-Te cathode**, co-evaporation,  
Quantum Efficiency > 6%

very detailed description of No. 166: **CTF3-Note-089**



## Photocathodes – No. 167



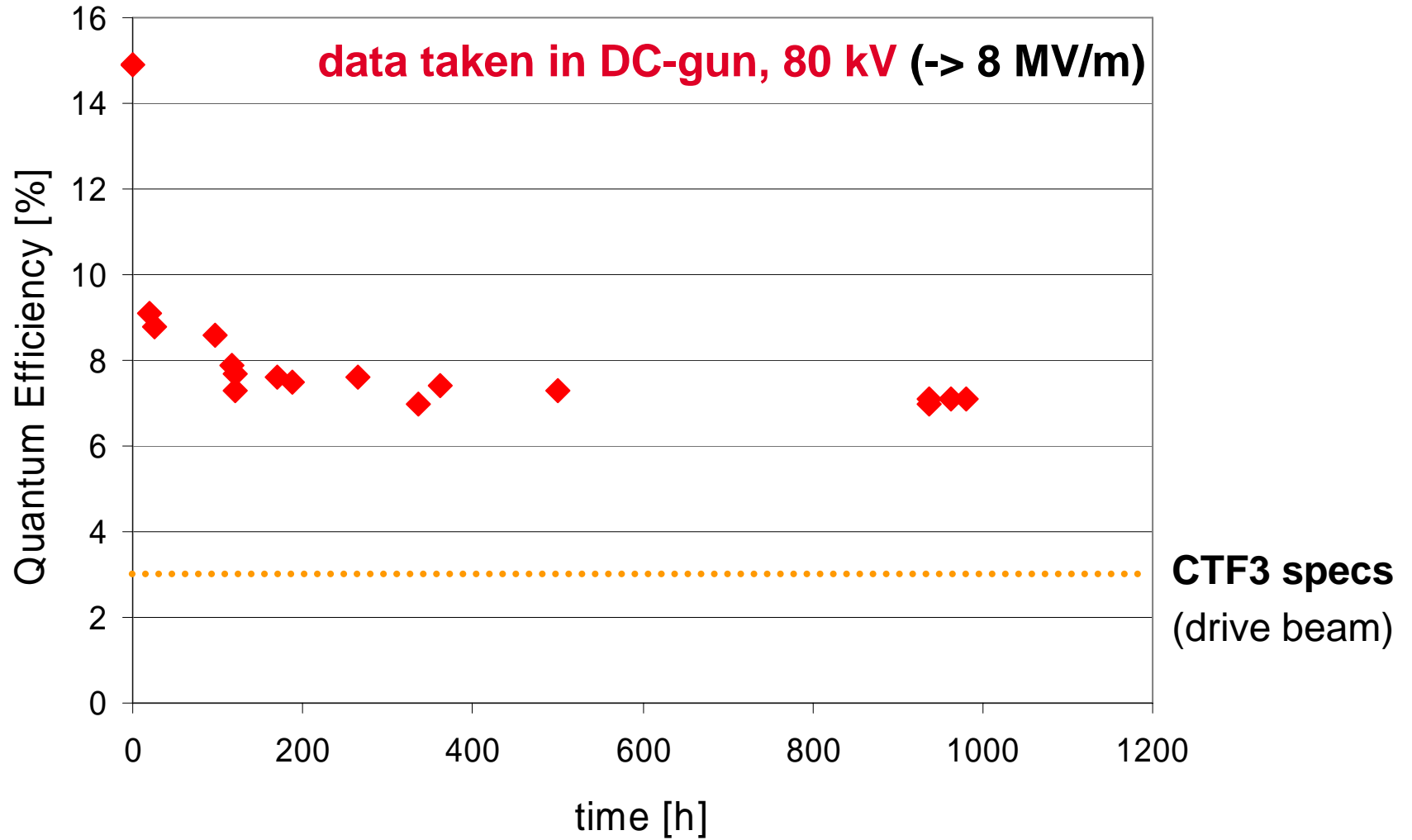
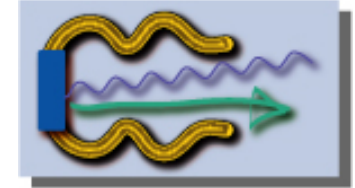
- **HIGHLIGHT 2007:**

Photocathode No. 167 produced 29 November  
(**Cs-Te cathode**, co-evaporation)

Quantum Efficiency Lifetime  
measured during 1000 hours



# Photocathodes - No. 167



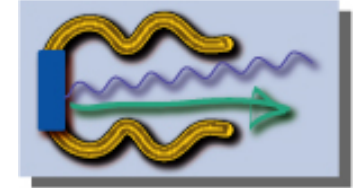
29 Nov. 2007

Xmas break

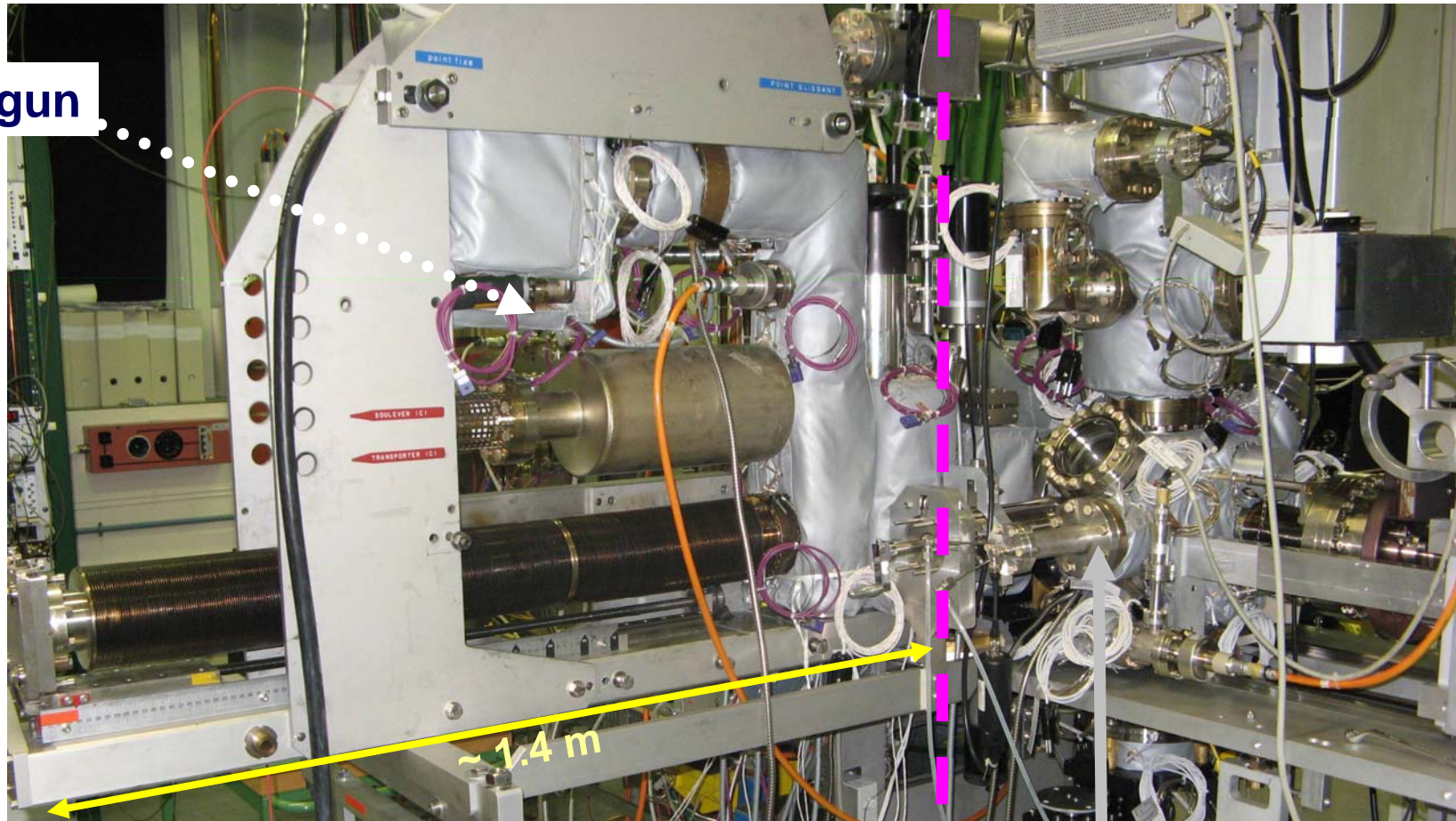
9 Jan. 2008



# Photocathodes – No. 167



DC- gun



~ 1.4 m

transport  
carrier

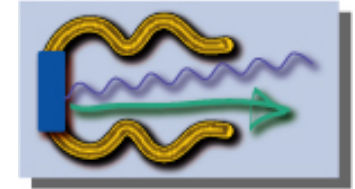
preparation  
chamber

manipulator

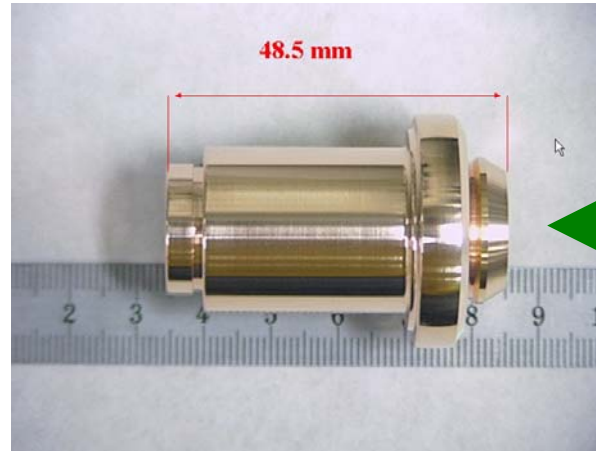




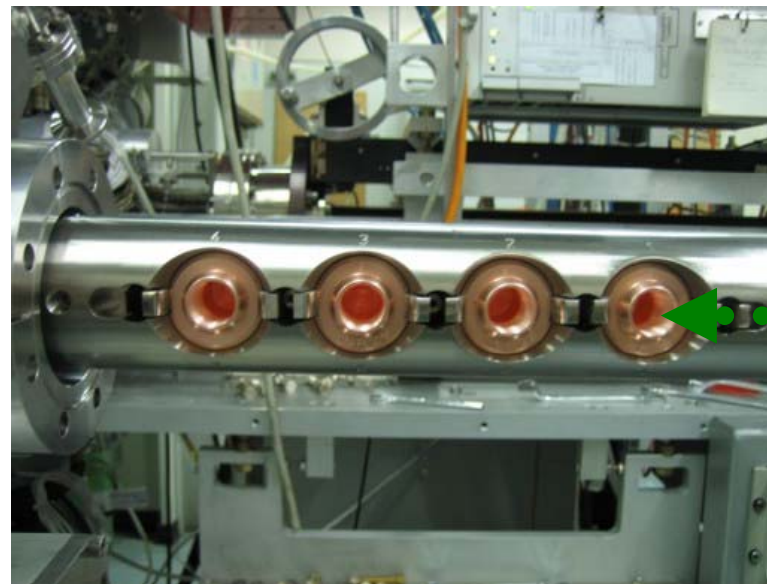
# Photocathodes - No. 167



basic unit: **Cu “plug”**

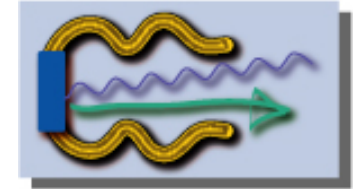


on the “arm” inside  
the transport carrier:  
up to **4 plugs**





# Photocathodes



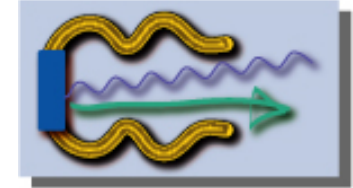
## Process Control and Reproducibility

(A. Barbiero and E. Chevallay)

- cleanliness / UHV vacuum

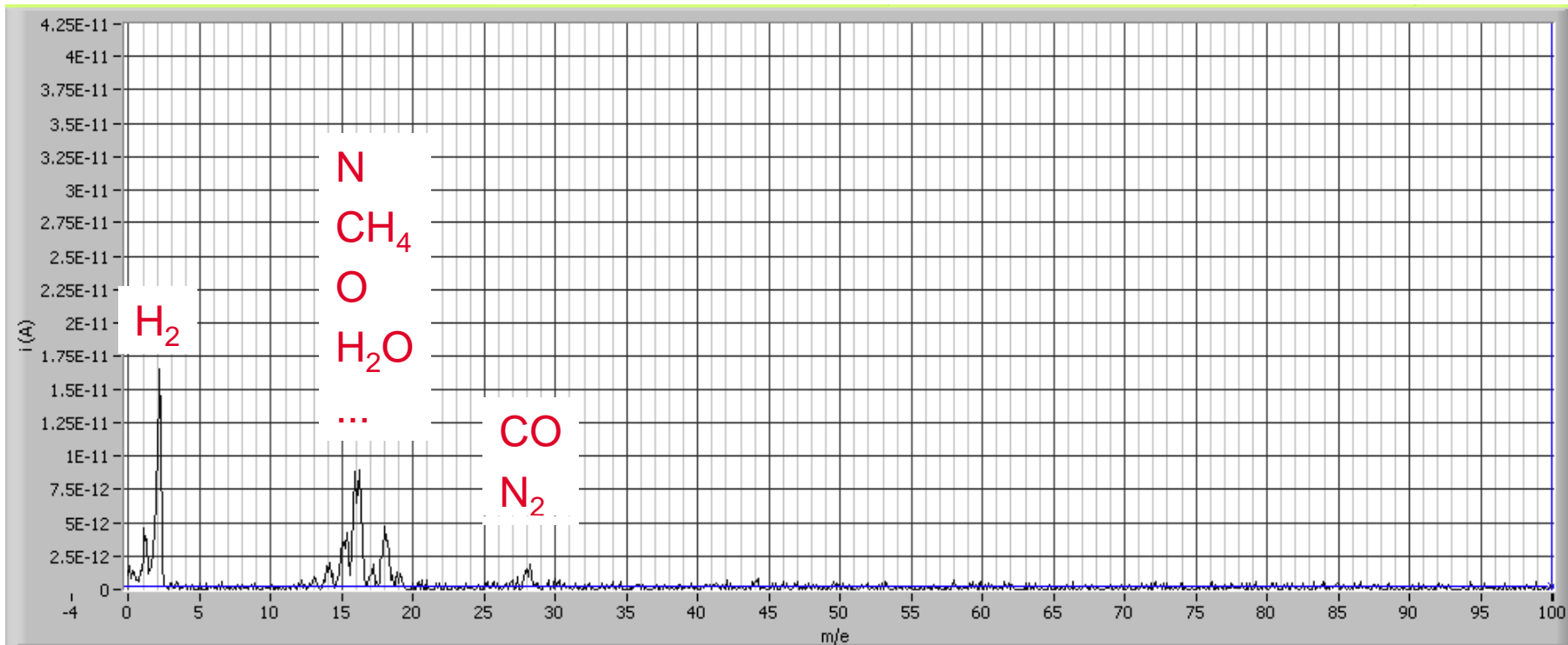


## Photocathodes - vacuum



a long period of improvements, pumping, leak testing, baking-out, leak testing, repair, pumping, baking out, ...

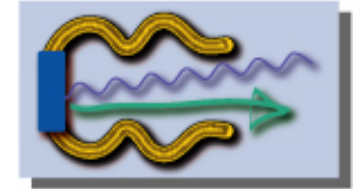
**vacuum before cathode preparation:  $< 3 \times 10^{-11}$  mbar**



**residual gas analysis in preparation chamber (29 Nov. 2007)**



## Photocathodes – film thickness



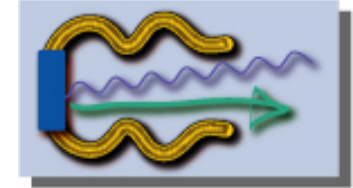
# Process Control and Reproducibility

(A. Barbiero and E. Chevallay)

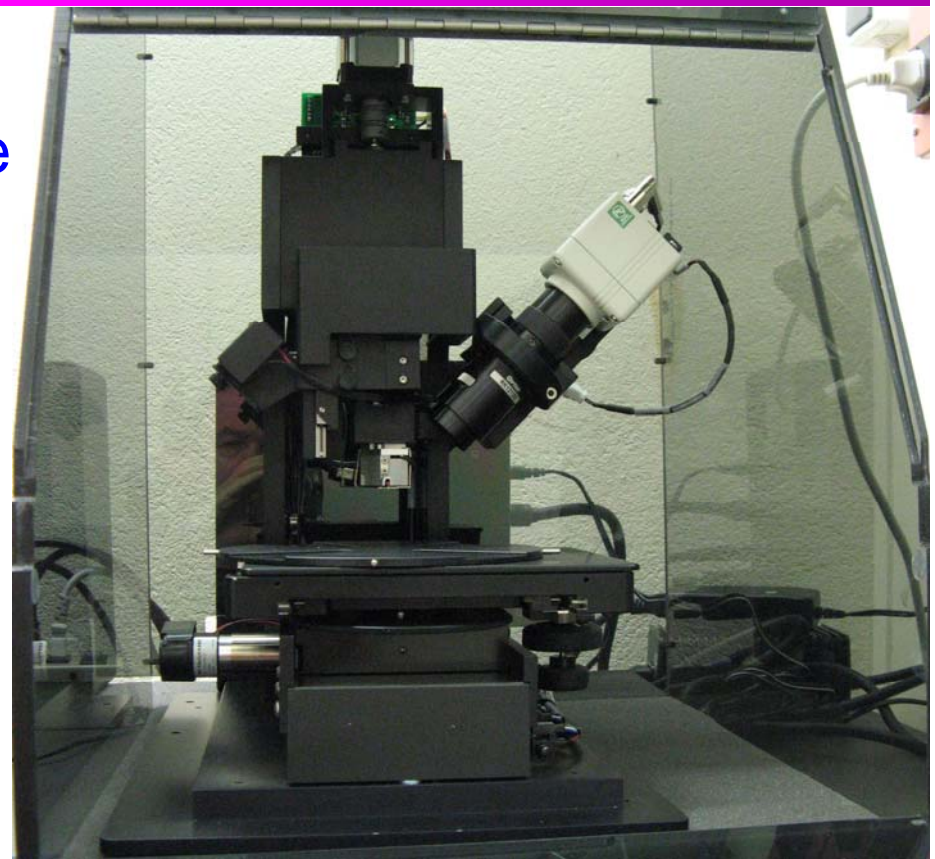
- cleanliness / UHV vacuum
- film thickness monitoring (Te, not Cs)
  - > new stylus profilometer, calibrated



## Photocathodes - film thickness



Te films on  
quartz substrate

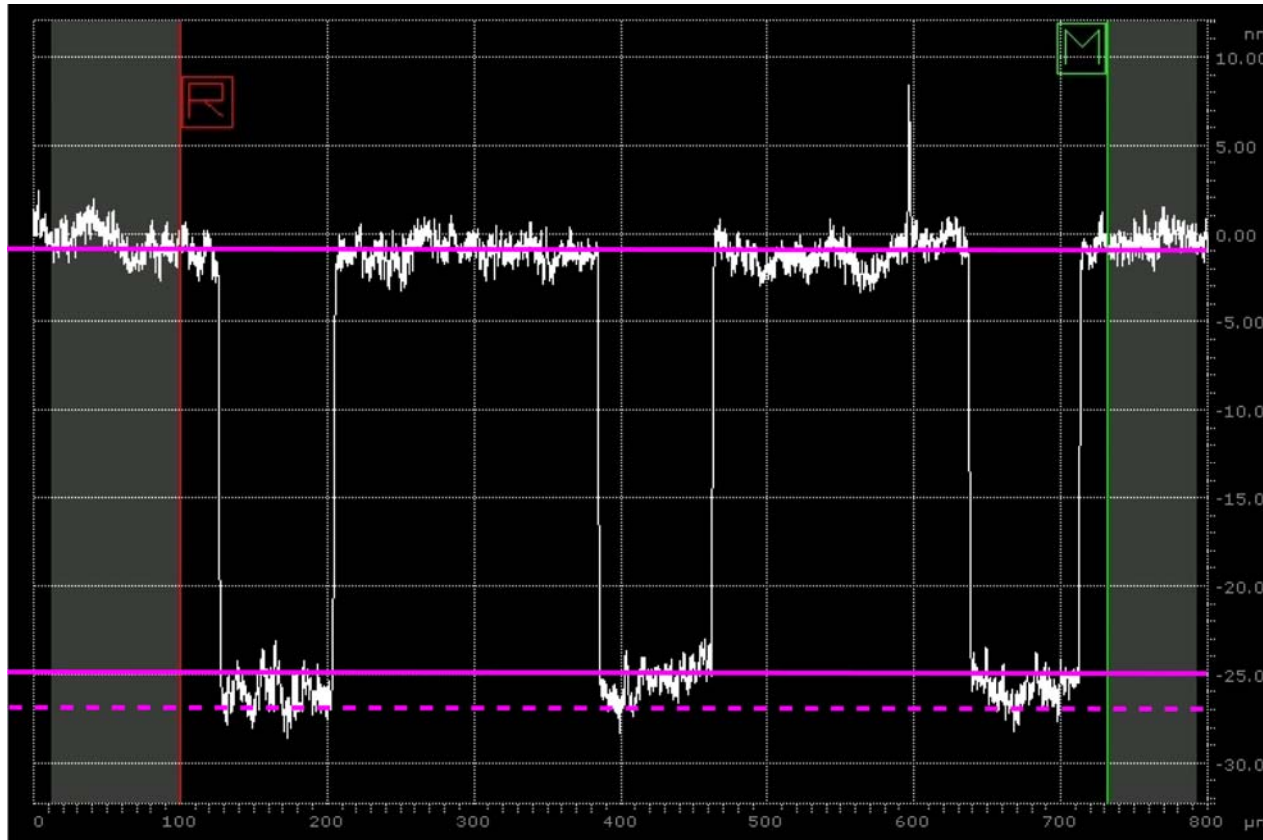
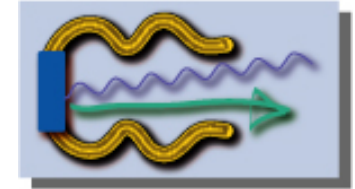


new Stylus Profilometer





## Photocathodes – film thickness



solid lines:  $\Delta=24$  nm

dashed line:  $\Delta=26$  nm

**Result:**

Profilometer  
intrinsic error < 2 nm

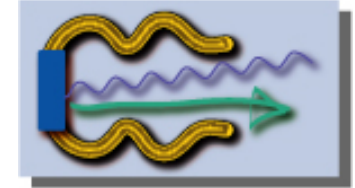
← 0.5 mm →

cross-check of Stylus Profiler using a calibrated sample\* (Rank Taylor Hobson)  
with 3 grooves, 24 nm each

\* sample on loan from CERN-TS/MME (W. Vollenberg)



## Photocathodes – transfer arm



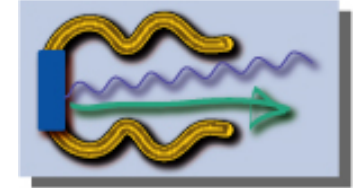
### Process Control and Reproducibility

(A. Barbiero and E. Chevallay)

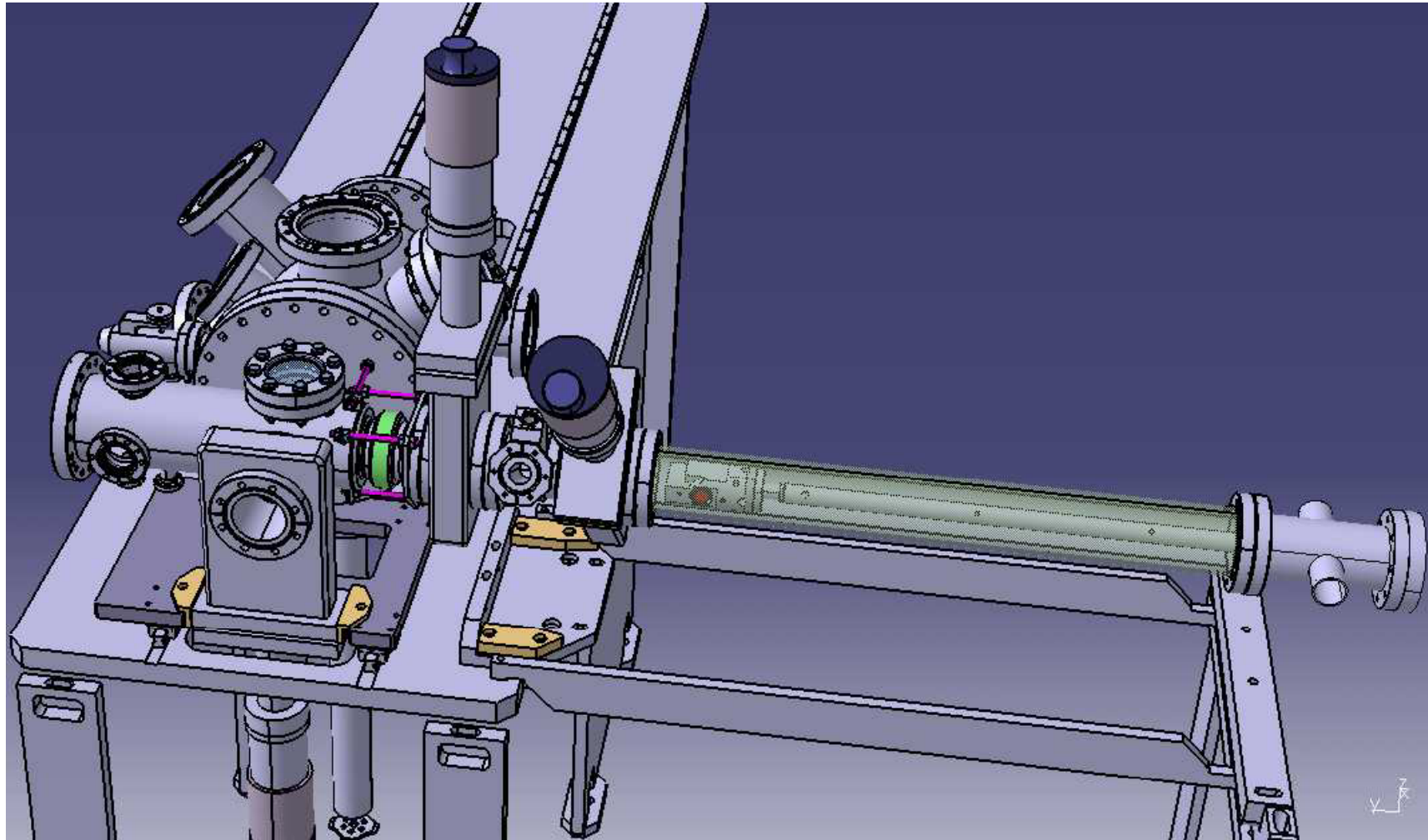
- cleanliness / UHV vacuum
- film thickness monitoring
  - > stylus profilometer, calibrated
- possibility of cathode chemical analysis (X-ray Photoel. Spectr.)
  - > new, smaller transfer arm (for 1 plug)  
(collaboration with team of M. Taborelli / TS-MME)



## Photocathodes – transfer arm



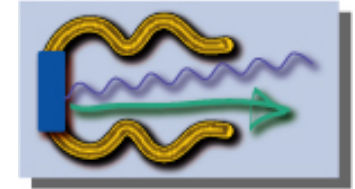
(attached to preparation chamber) (courtesy A. Barbiero)







## Photocathodes – plug surfaces



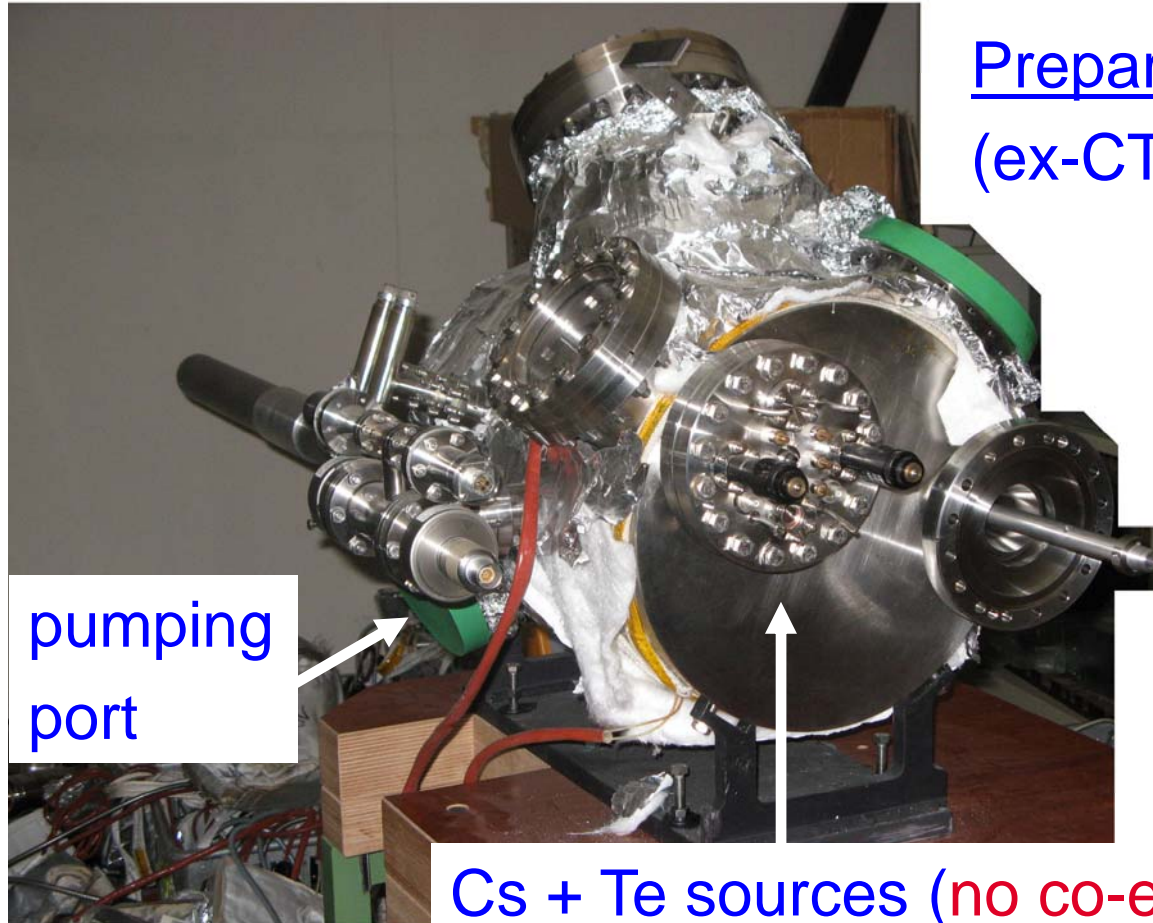
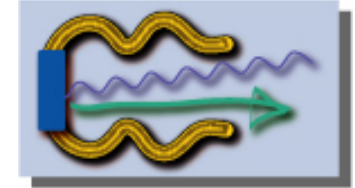
### Process Control and Reproducibility

(A. Barbiero and E. Chevallay)

- cleanliness / UHV vacuum
  - film thickness monitoring
    - > stylus profilometer, calibrated
  - possibility of cathode chemical analysis (XPS)
    - > new transfer arm
  - reproducible “plug” surface
    - > test programme on surface preparation + analysis
- (work in progress - No. 166 and No. 167 are very different)



# photocathode for CLEX



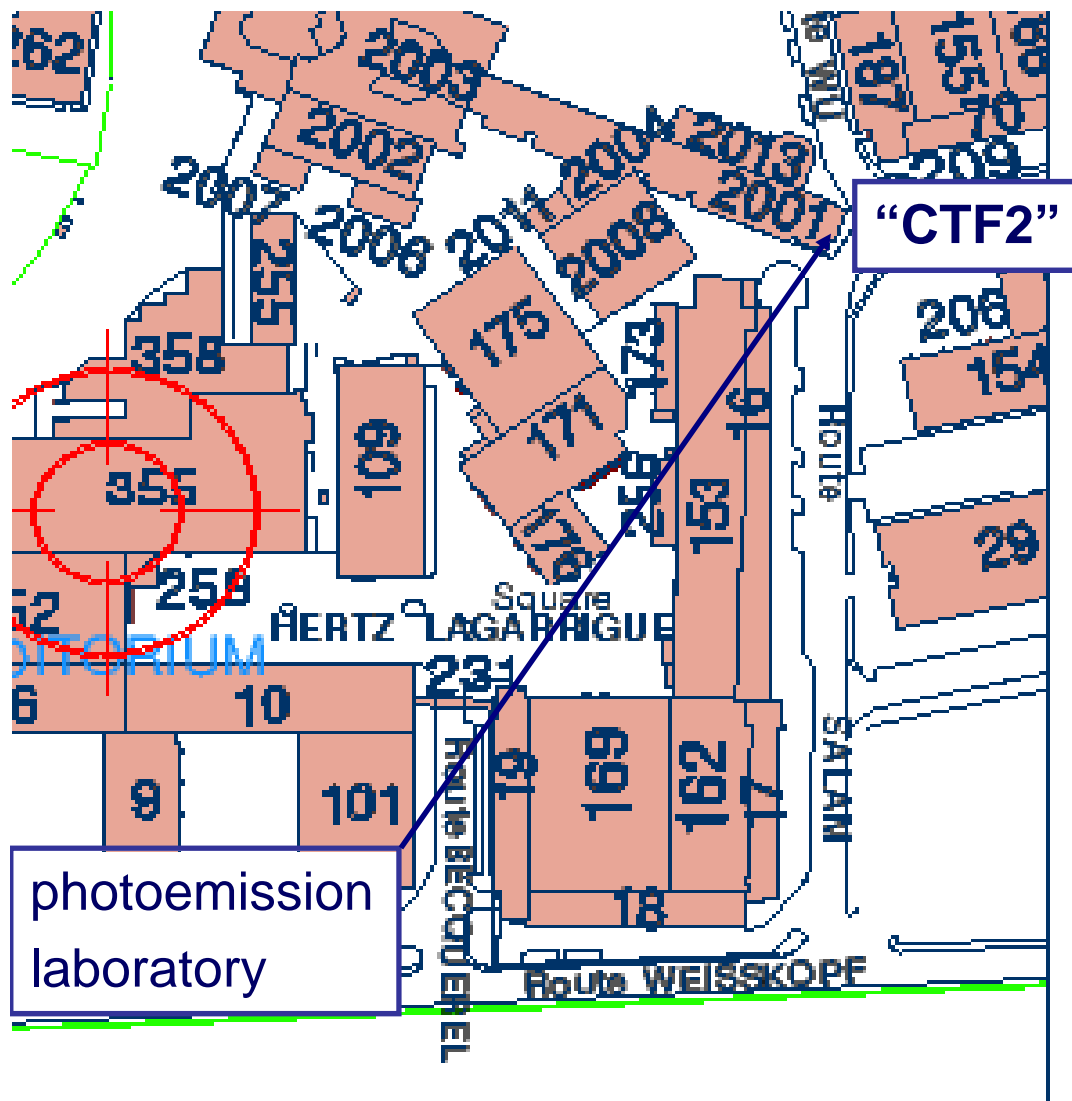
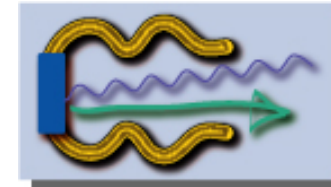
Preparation chamber for CLEX  
(ex-CTF2 Probe-Beam)

manipulator arm  
(position for “plug”)

Cs + Te sources (no co-evaporation);  
1 quartz thickness monitor (DN 100 flange)

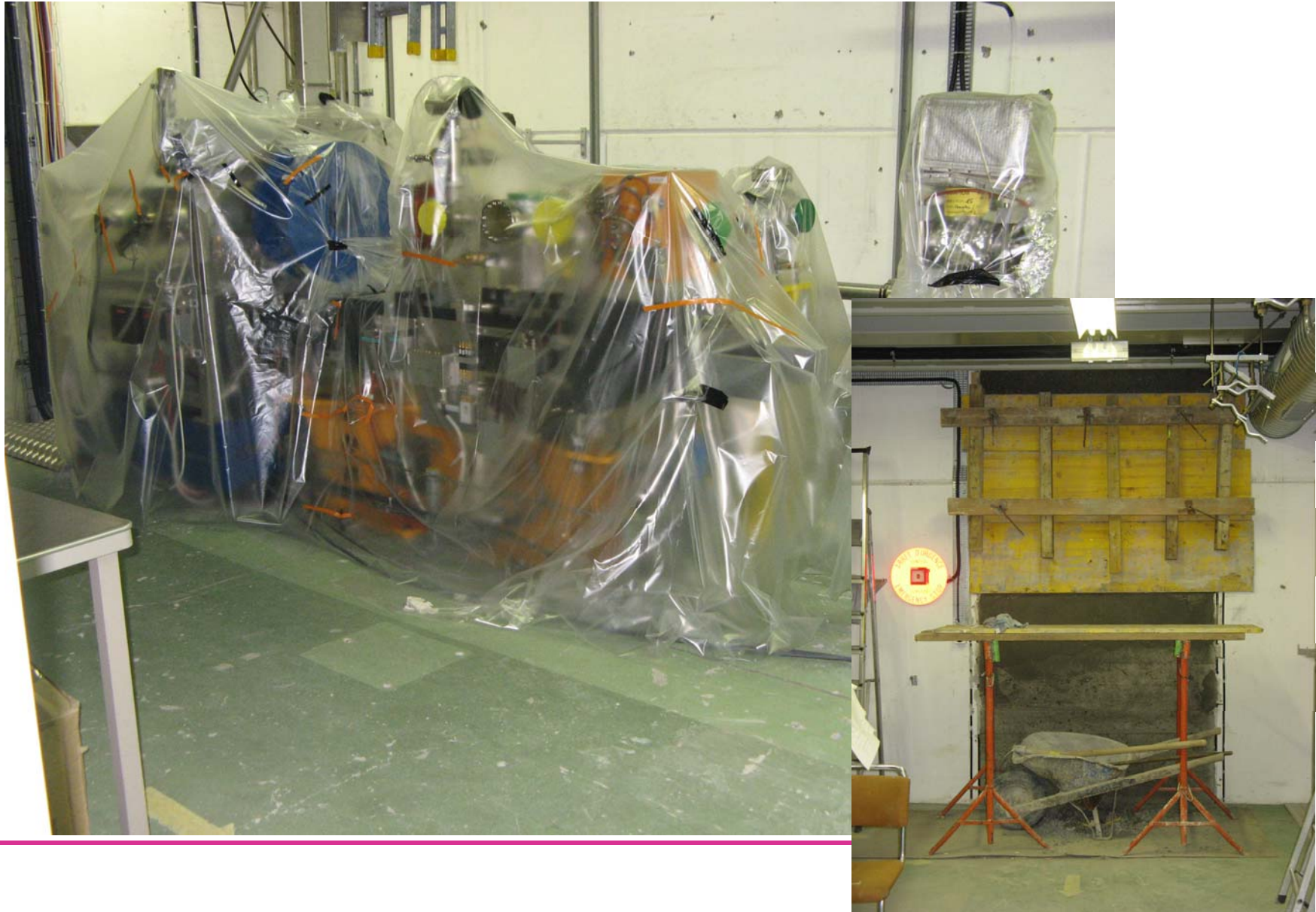
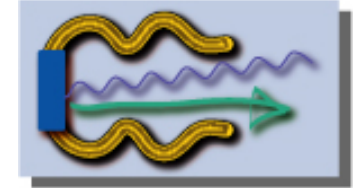


# "CTF2"



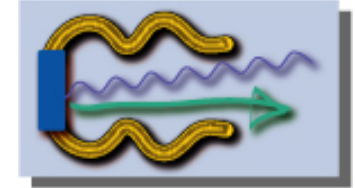


# “CTF2” - status





# Acknowledgments

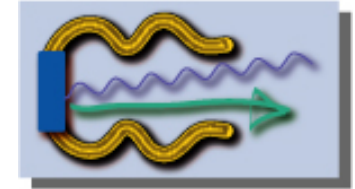


**Nathalie Lebas:** expert help with the laser

**Arnaud Brielmann:** expert help with controls  
and interlocks  
(for equipment safety)



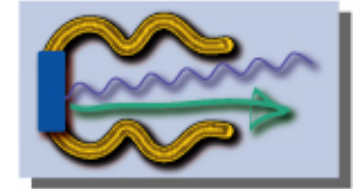
# Summary + Outlook



- Photoemission Laboratory:  
**ready for production of cathodes**
- Cs-Te cathode No. 167: ready for PHIN
- work in progress to improve reproducibility
- near future: **CLEX cathode**
  
- continue contributions to PHIN in “CTF2”

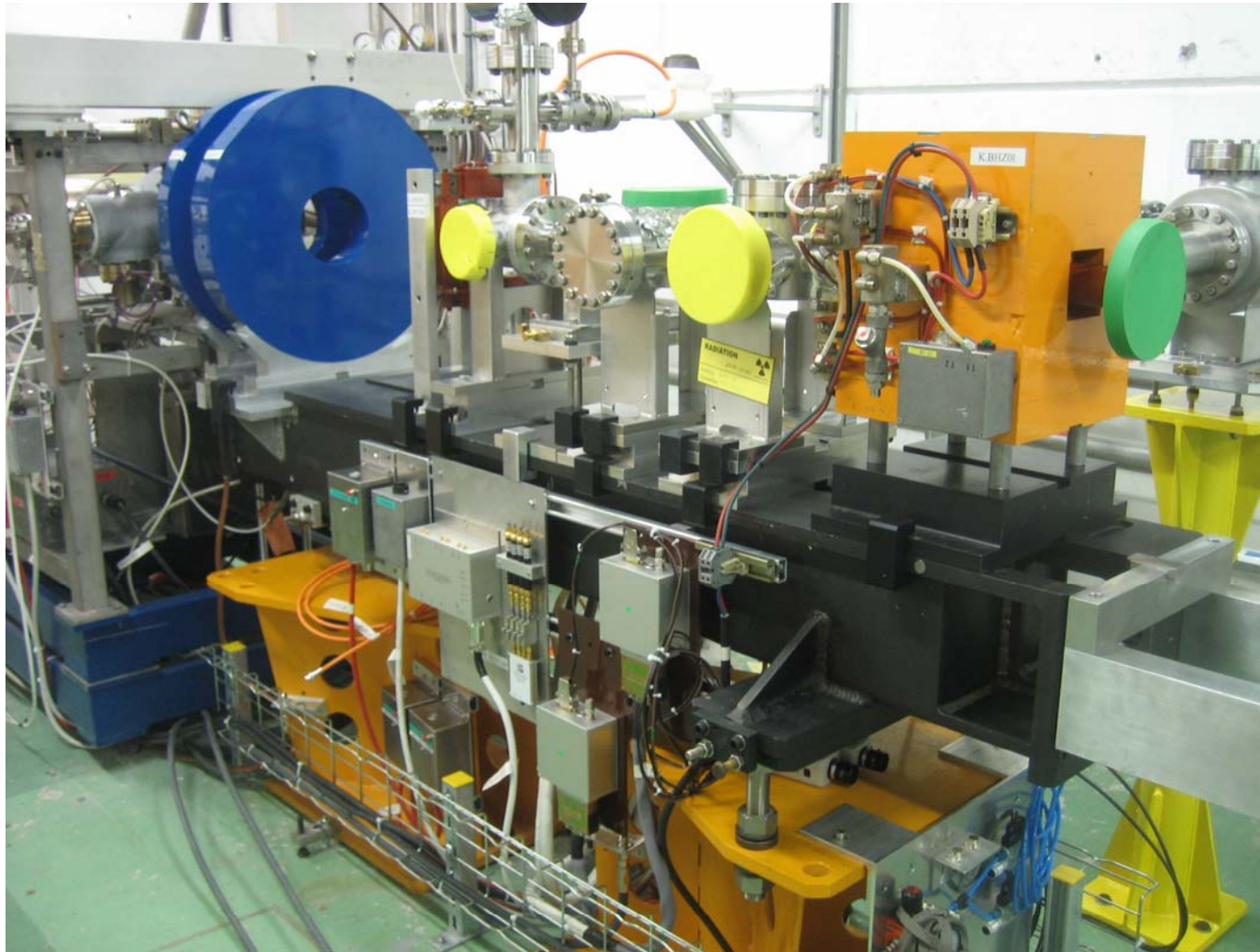
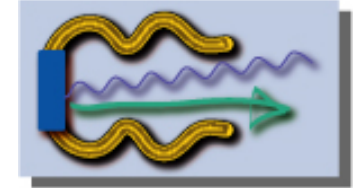


# spare slides





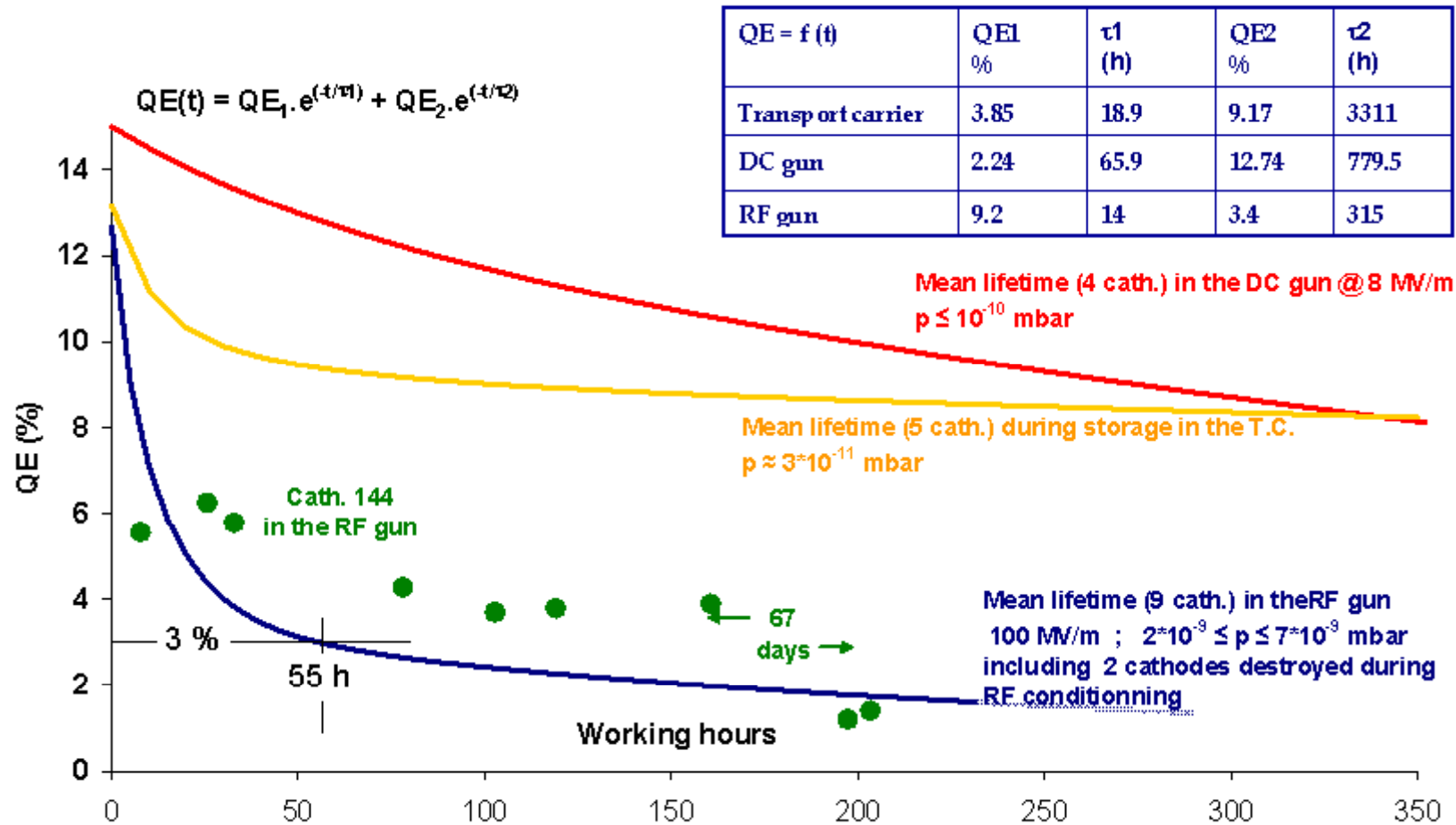
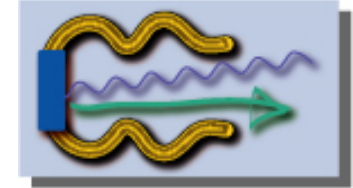
# spare slides



**8 Nov. 2007**

EDMS No. 888499







# PHIN overview

