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Dependence on the incidence angle and pressure of Relative Extraction Efficiency of photoelectrons from a CsI photocathode

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Introduction

Radiation Detectors

Radiation input to electrical output

Photocathodes
- quantum efficiency

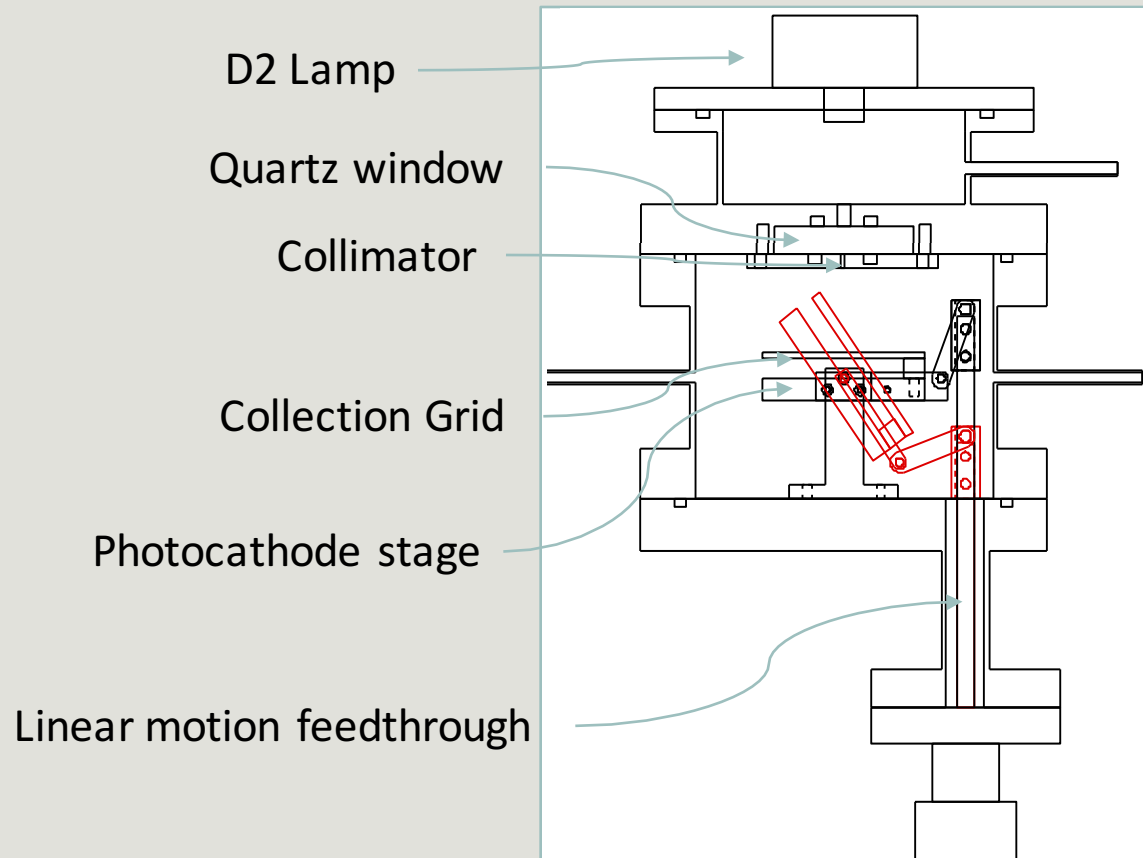
$$\frac{\# \text{ emitted } e^{-}}{\# \text{ photons}}$$

Variation with incidence angle for various atmospheres

Photoelectric Effect

- Important for optimising the performance of detectors
- Few data available in the literature

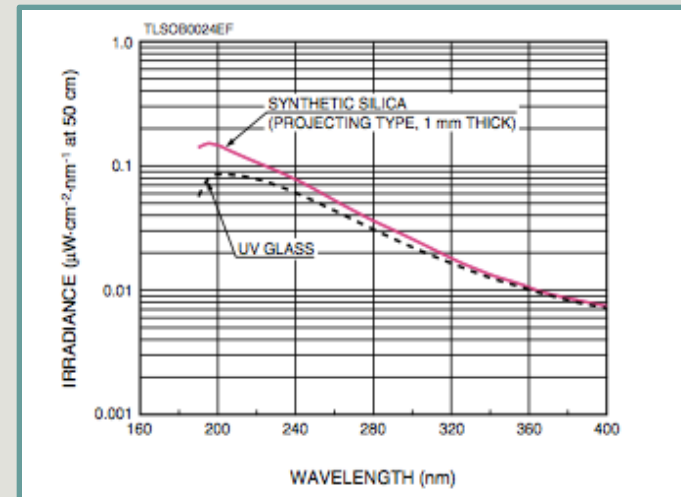
Experimental Setup



Experimental Setup

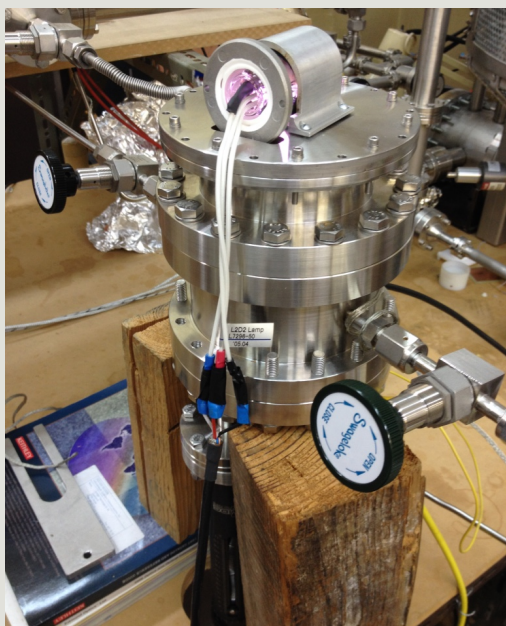
Limitations:

- Broad Spectral distribution of the lamp
- Complexity of the vacuum system -> poor control and knowledge of the vacuum level
- Evaporation of the photocathode has to be done outside the system



D2 Lamp spectral distribution

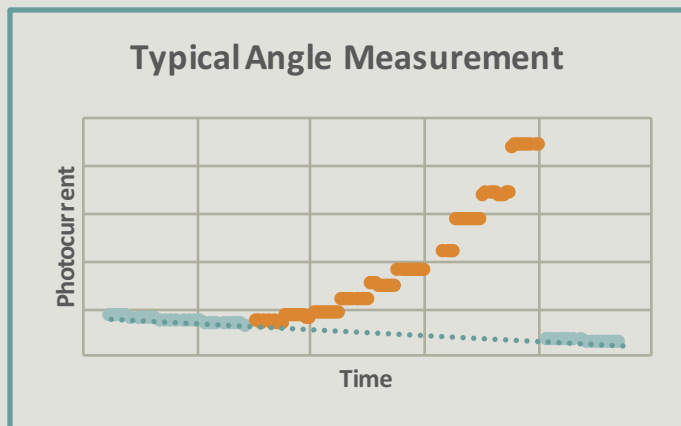
Experimental Setup



Method

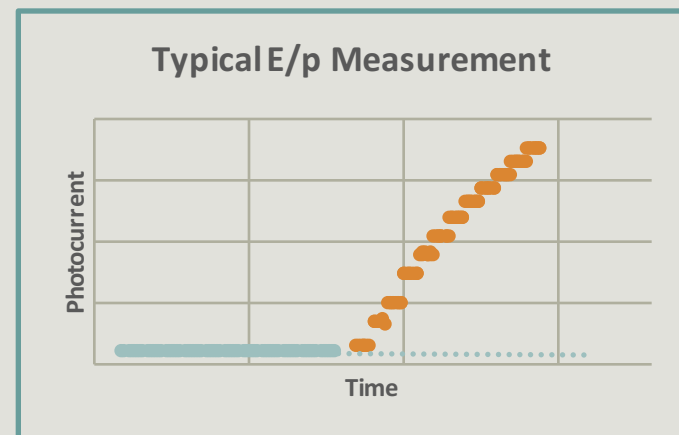
Angle variation Measurement:

- 1) Measure the photocurrent for 0°
- 2) Measure the photocurrent varying the angle by 5°
- 3) Compare those with 0° measures



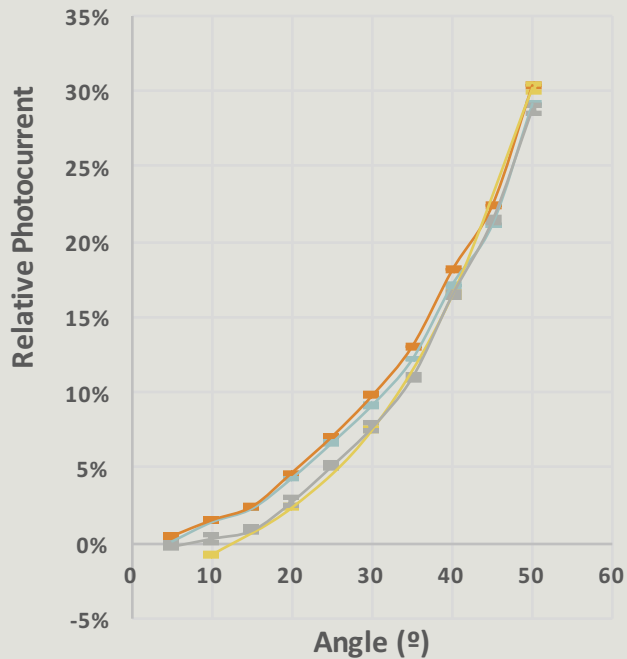
E/p variation Measurement:

- 1) Measure the photocurrent for very low reduced electric field (E/p)
- 2) Vary E/p and take some values for each E/p
- 3) Compare those with the reference

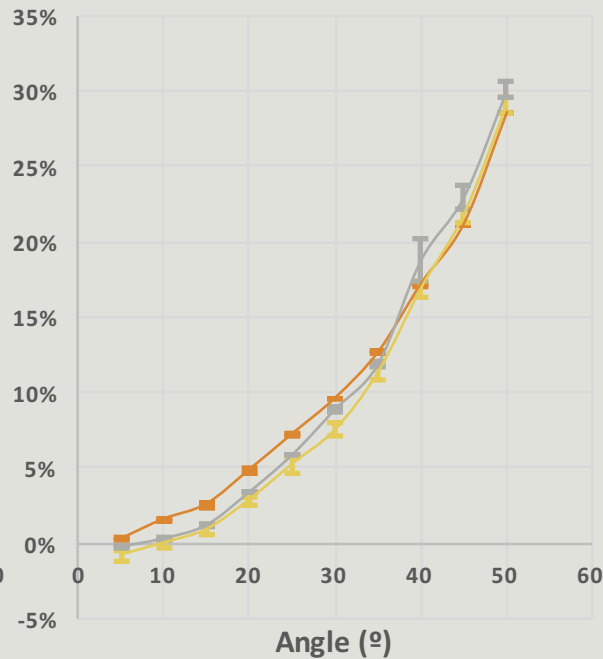


For now we measured

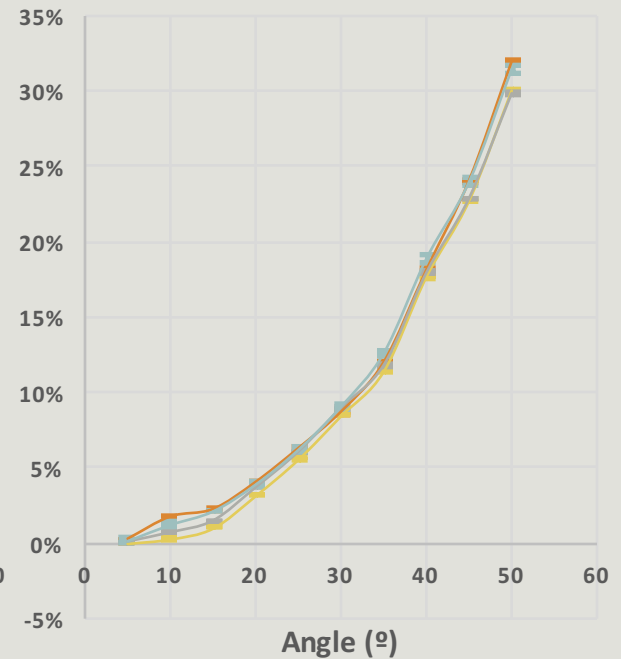
Xe - 1 bar



Xe - 2 bar



Xe - 3 bar

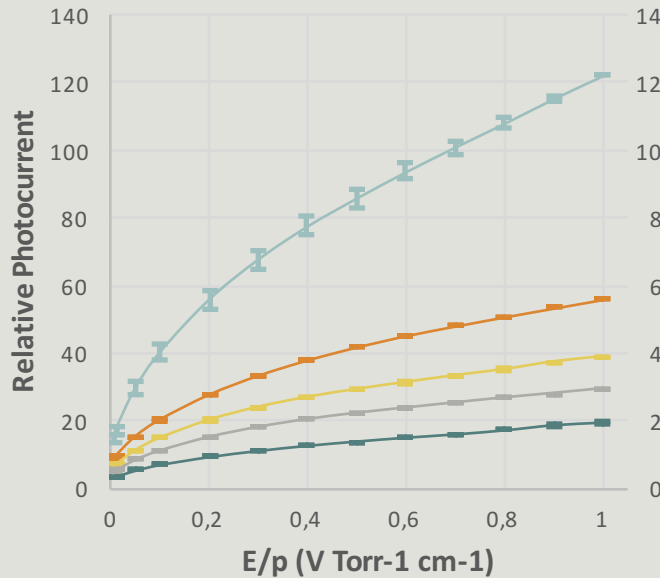


— E/p=0,05 — E/p=0,1 — E/p=0,5 — E/p=1,0
($V \cdot Torr^{-1} \cdot cm^{-1}$)

For now we measured

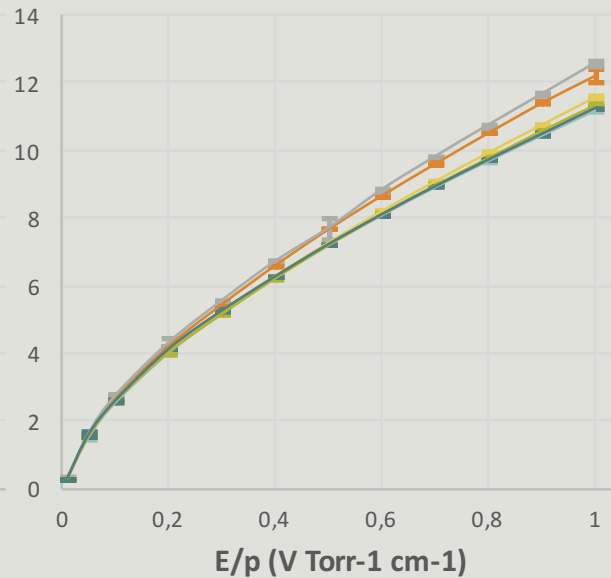
Xe - 1 bar

(Reference: $E/p=0$)



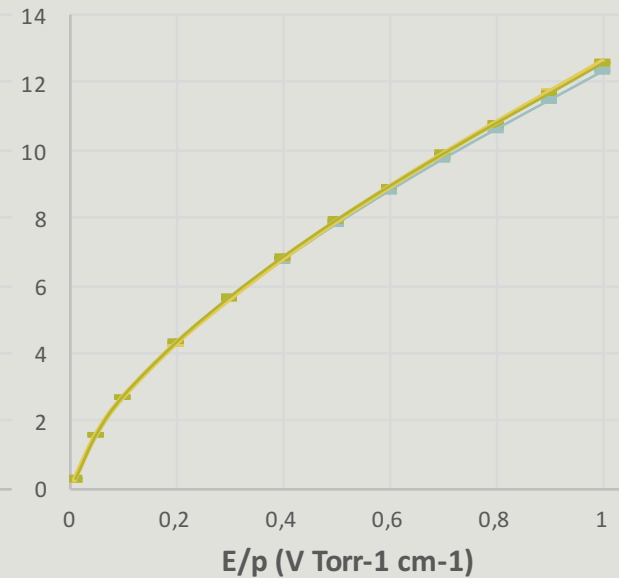
Xe - 2 bar

(Reference: $E/p=0,005$)



Xe - 3 bar

(Reference: $E/p=0,005$)



— 0° — 10° — 20° — 30° — 40° — 50°

In the future

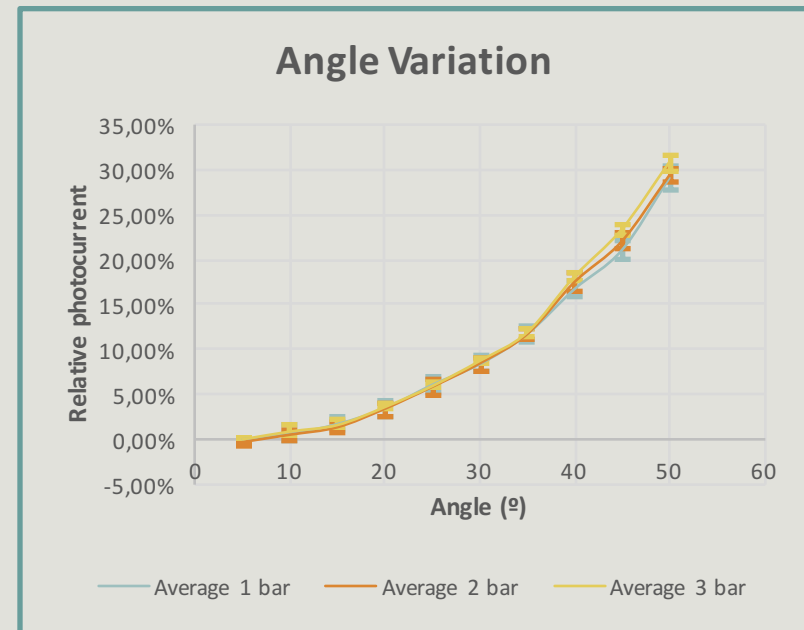
In the near future we want to keep this kind of measurements for some other **gaseous atmospheres** and later maybe adapt the system so we can get **absolute measurements.**

With this setup we can also study the response of the photocathode with the incident angle for some other parameters:

- aging
- humidity
- substrate
- heating
- ...

Conclusions

- An experimental system to measure the variation of the Relative Extraction Efficiency (REE) in photocathodes with the light incidence angle was developed.
- The system give very precise reproducible results.
- Measurements for Xe at 1, 2 and 3 bar were performed showing similar behaviour.
- The variation of REE with E/p is not angle dependent.



Thank you...

