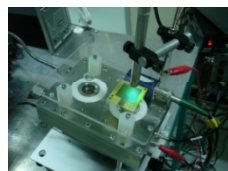
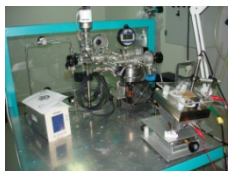


# Photoelectron extraction efficiency from CsI photochatodes in noble gases (Ar, Xe) up to 10 bars

**D.S. Covita, C.D.R. Azevedo, C.C. Caldas and J.F.C.A. Veloso**

**I3N, Physics Department – University of Aveiro**



# Motivation

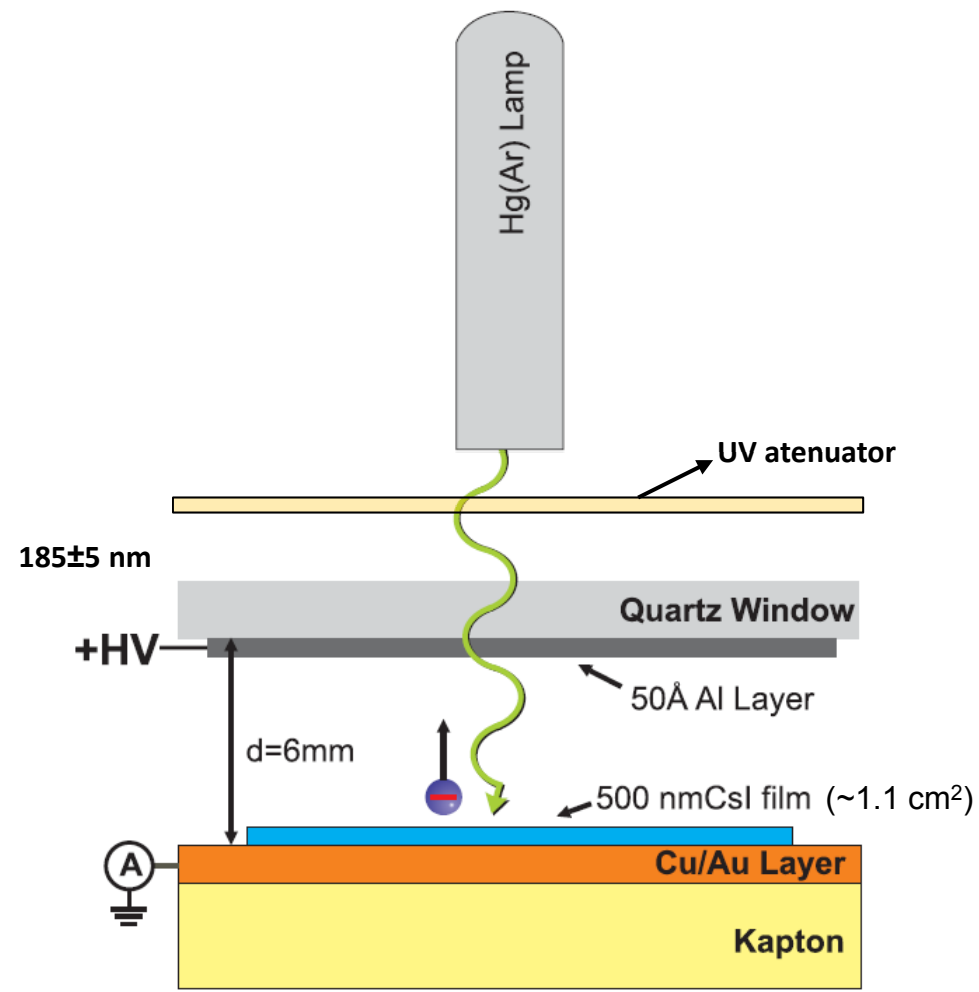
**CsI are widely used as photocathodes  
in radiation detectors based in scintillation photons from noble gases**

- **Medical imaging**
- **Particle physics**
- **Radiation detection in general**
  - **Dual phase detectors (Dark matter experiments)**
  - **Micro-pattern gas detectors**

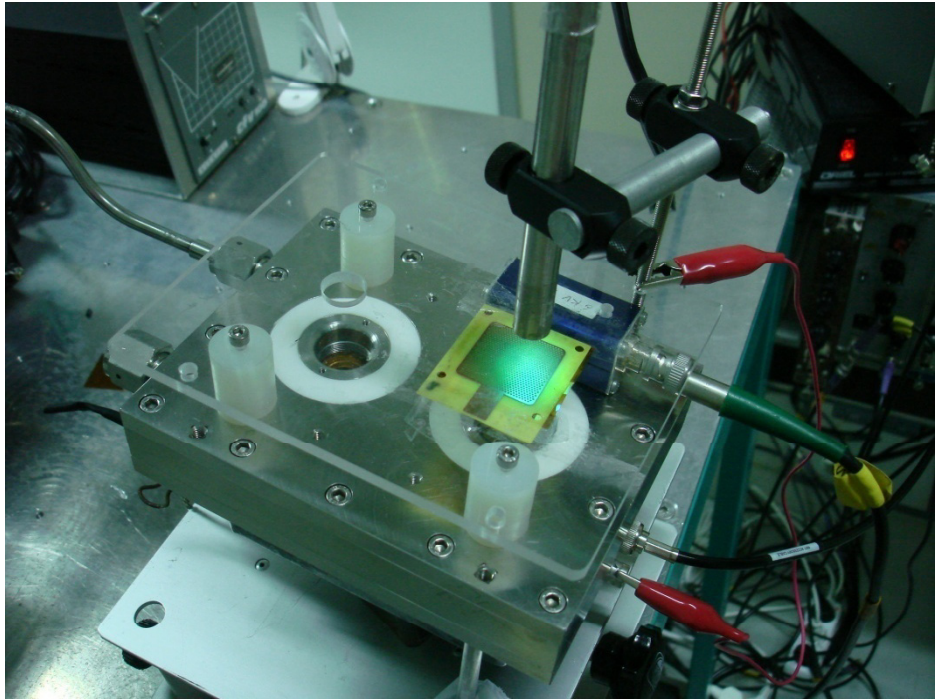
**Applications for hard X-rays may require high pressure**

- ❑ **Simulations do exist on the photoelectron extraction efficiency from CsI into noble gases and mixtures with organics as function of  $E/p$**
- ❑ **No experimental data is available beyond 1 atm!**
- ❑ **The available results fairly agree**
  - **e.g. discrepancies of ~20% are seen at  $E/p=1\text{Vcm}^{-1}\text{Torr}^{-1}$  for (Ar, Xe)**

# Experimental setup and method



# Experimental setup and method

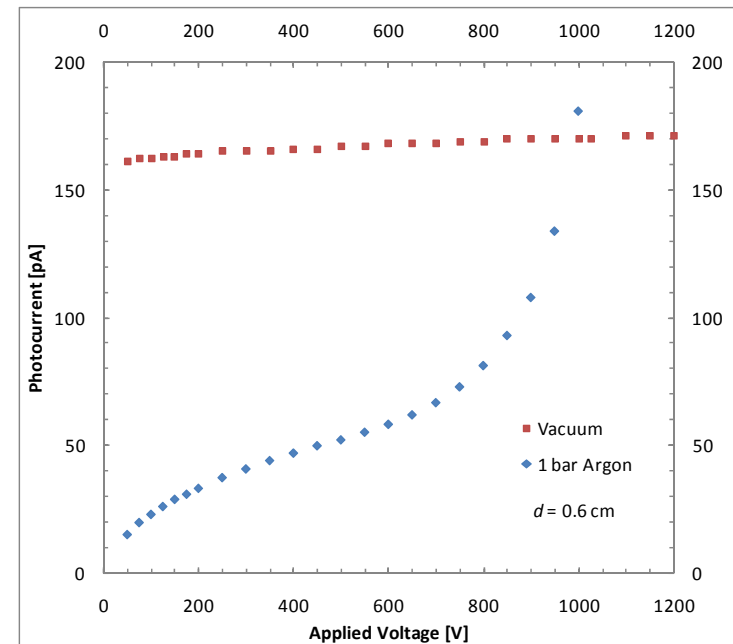




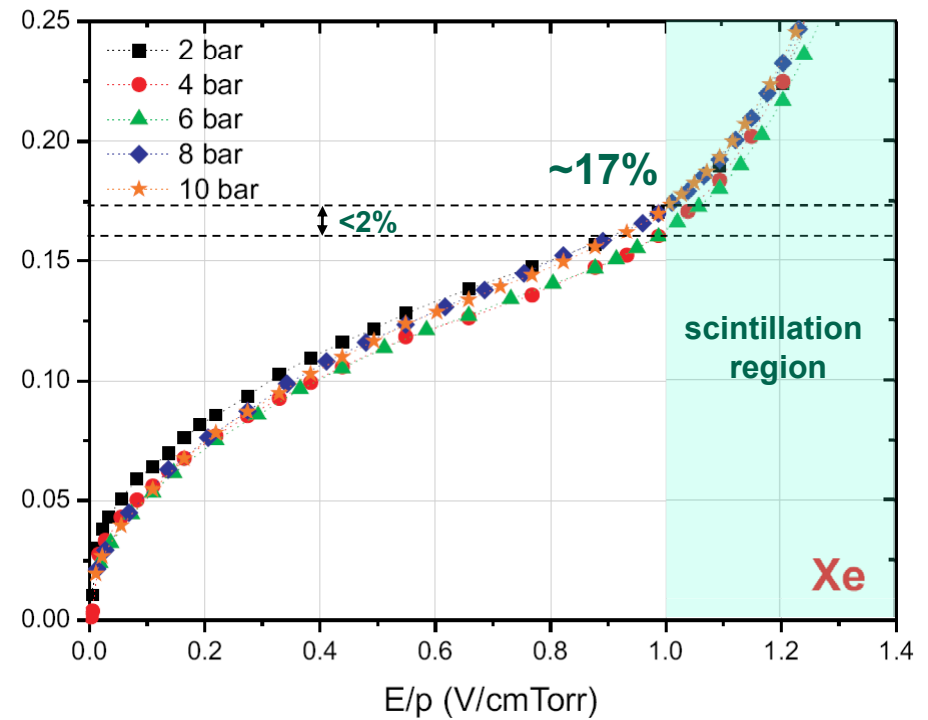
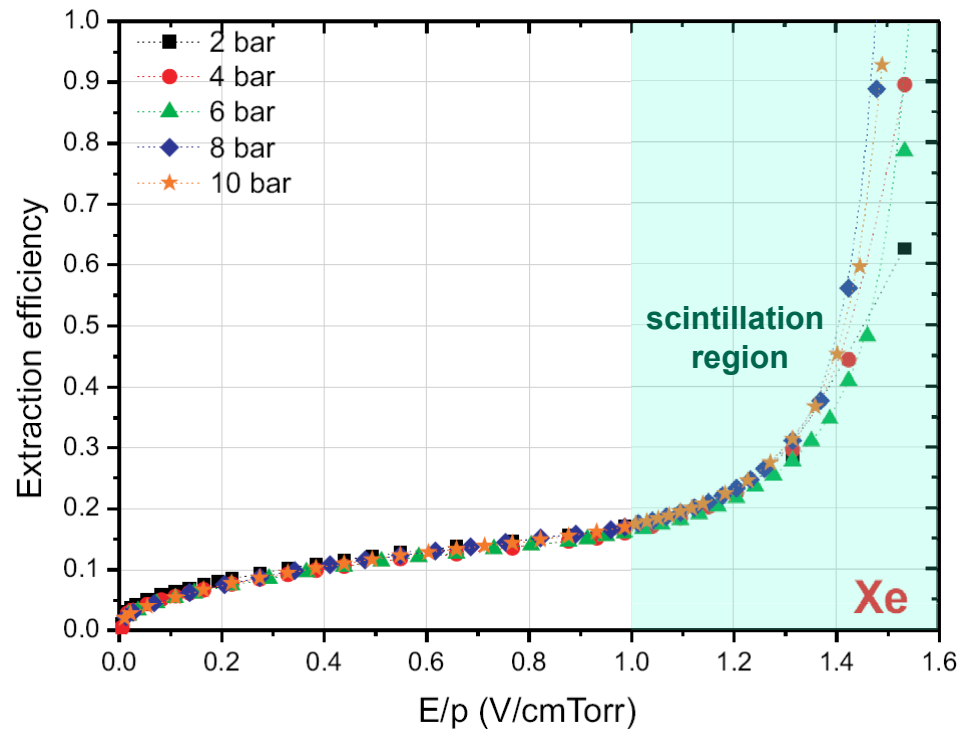
# Experimental setup and method

- 1) Pump the system bellow  $10^{-5}$  mbar
- 2) Measure the photocurrent *vs*  $E/p$
- 3) Fill the system with high purity Ar/Xe
- 4) Re-measure the photocurrent *vs*  $E/p$
- 5) Repeat for different pressures up to 10 bar
- 6) Complete 3 series of measurements (1...10 bar)
- 7) Take the average of  $I(E/p)$  to obtain the photoelectron extraction

efficiency curve

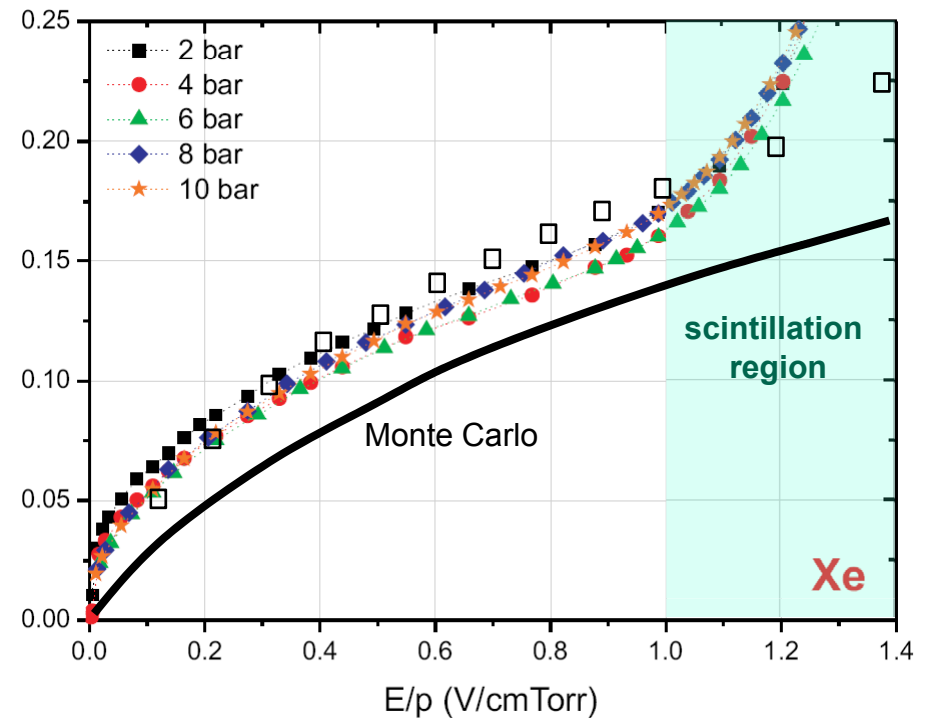
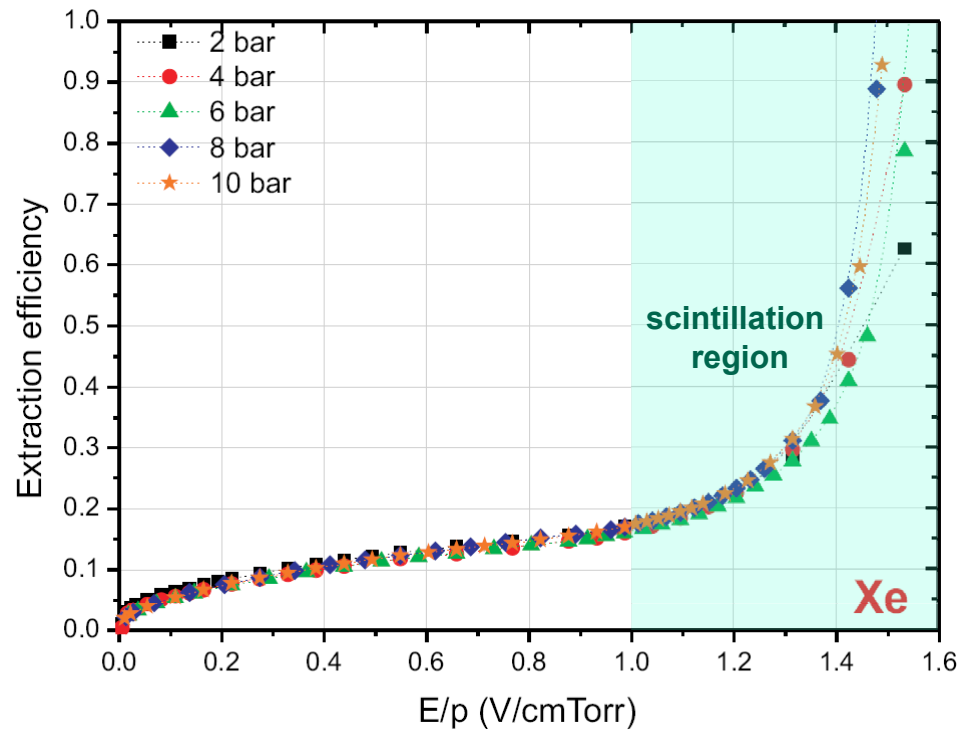


# Results in Xe



✓ The extraction efficiency is confirmed to be independent from the Xe pressure (up to 10 bar)

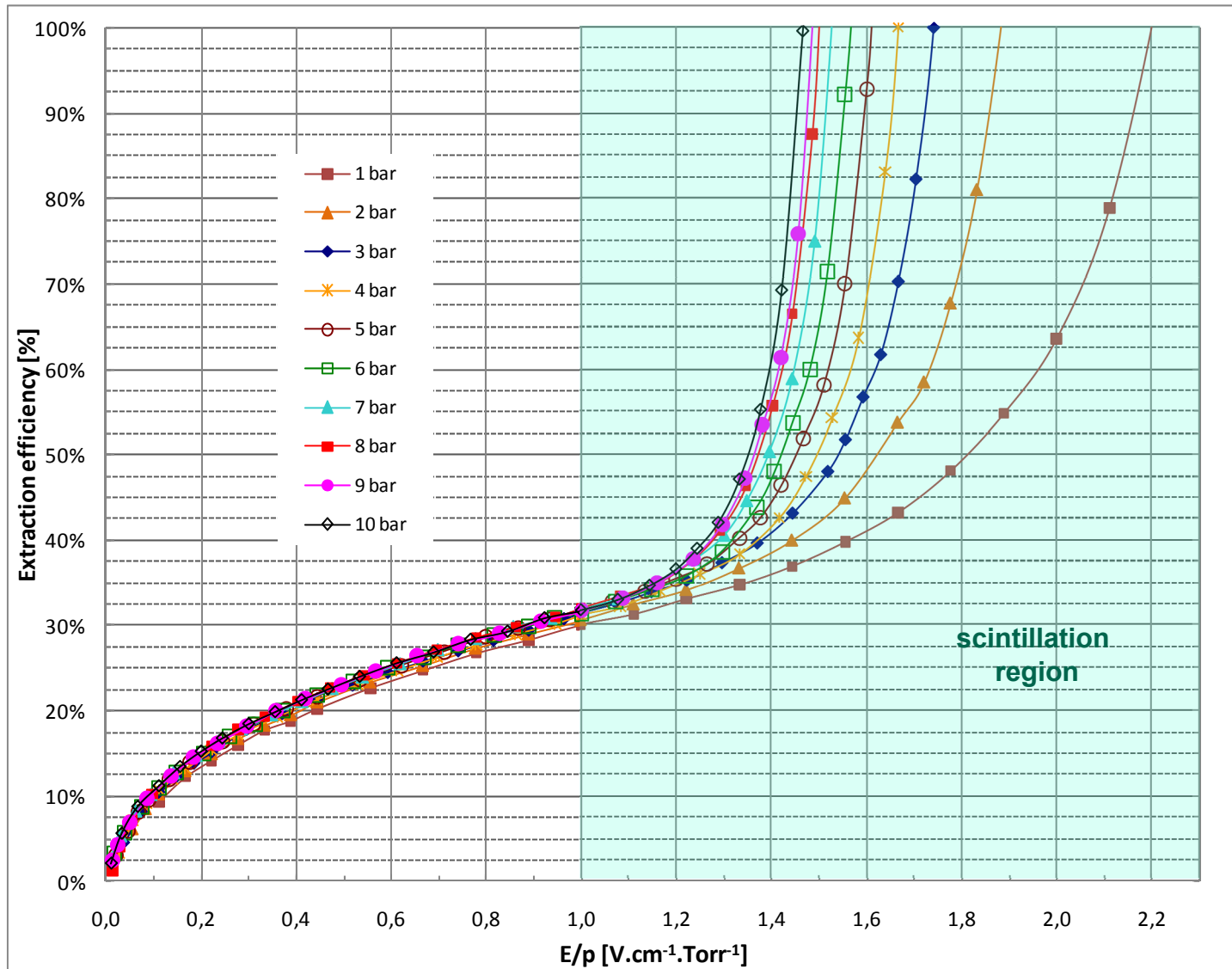
# Results in Xe



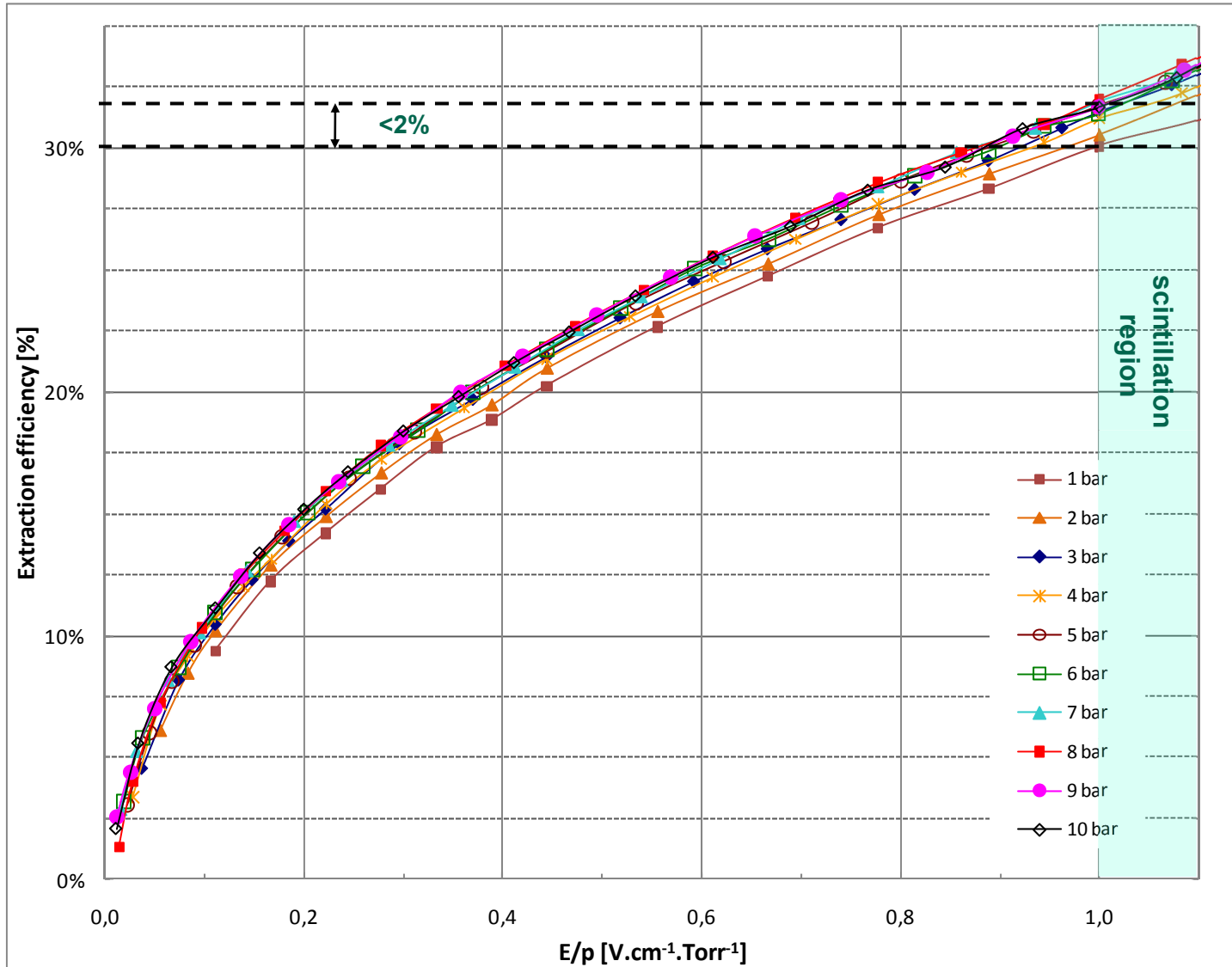
□ L.C.C. Coelho et al., *NIM A* 607 (2009)  
 — J. Escada et al., *J. Phys. D: Appl. Phys.* 43 (2010)

- ✓ The extraction efficiency is confirmed to be independent from the Xe pressure (up to 10 bar)
- ✓ Still some discrepancies from the simulation results

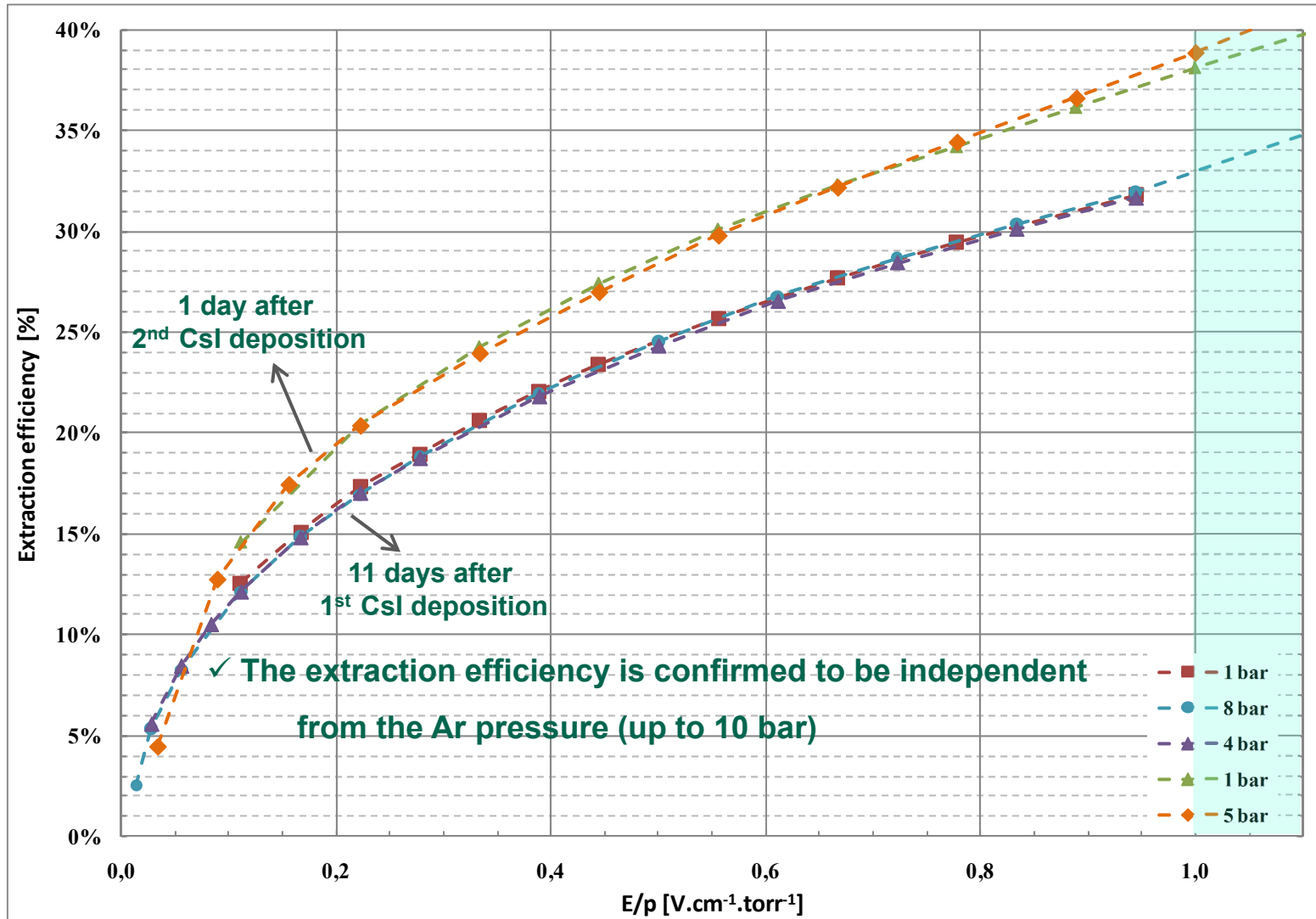
# Results in Ar



# Results in Ar

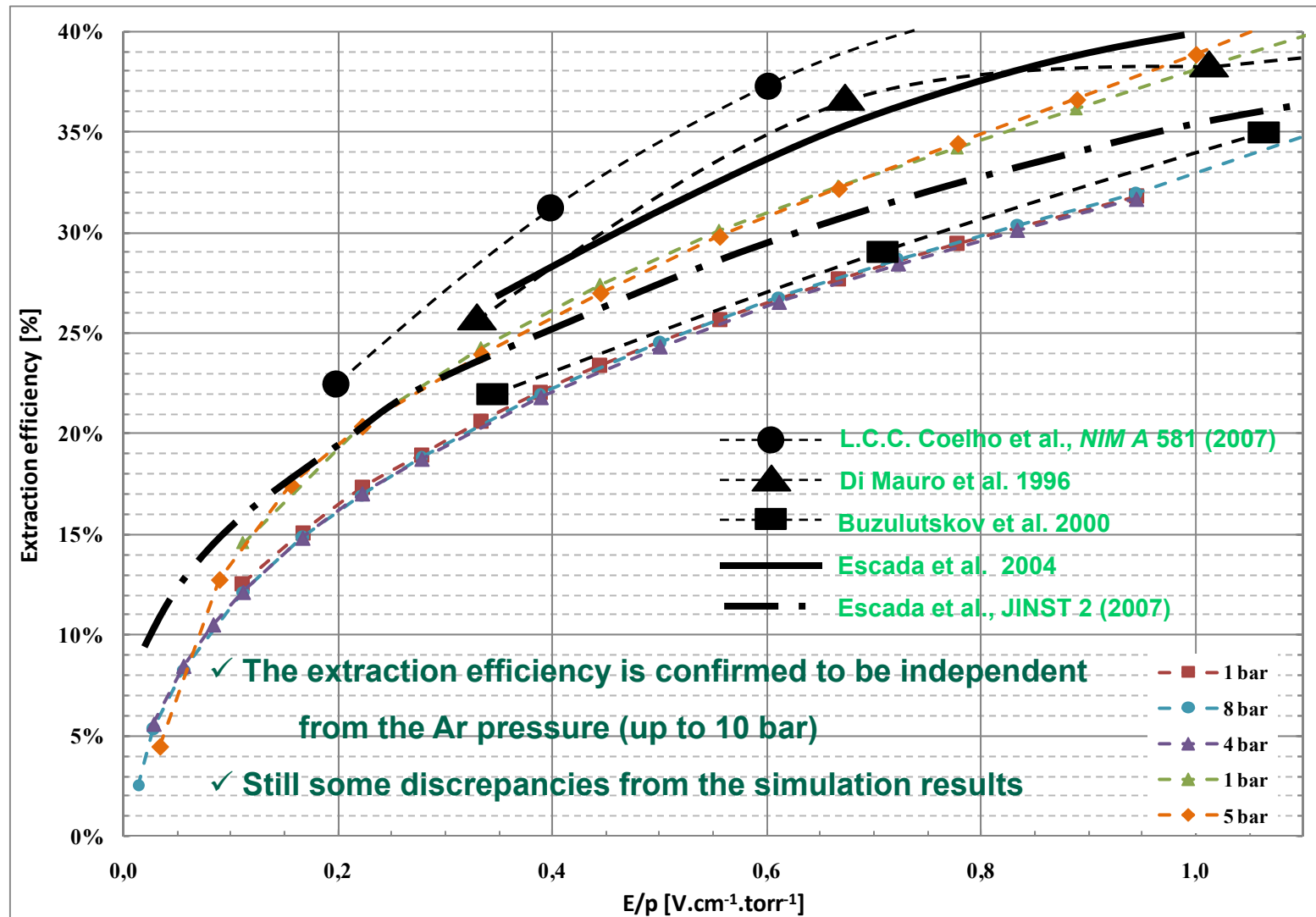


# Results in Ar

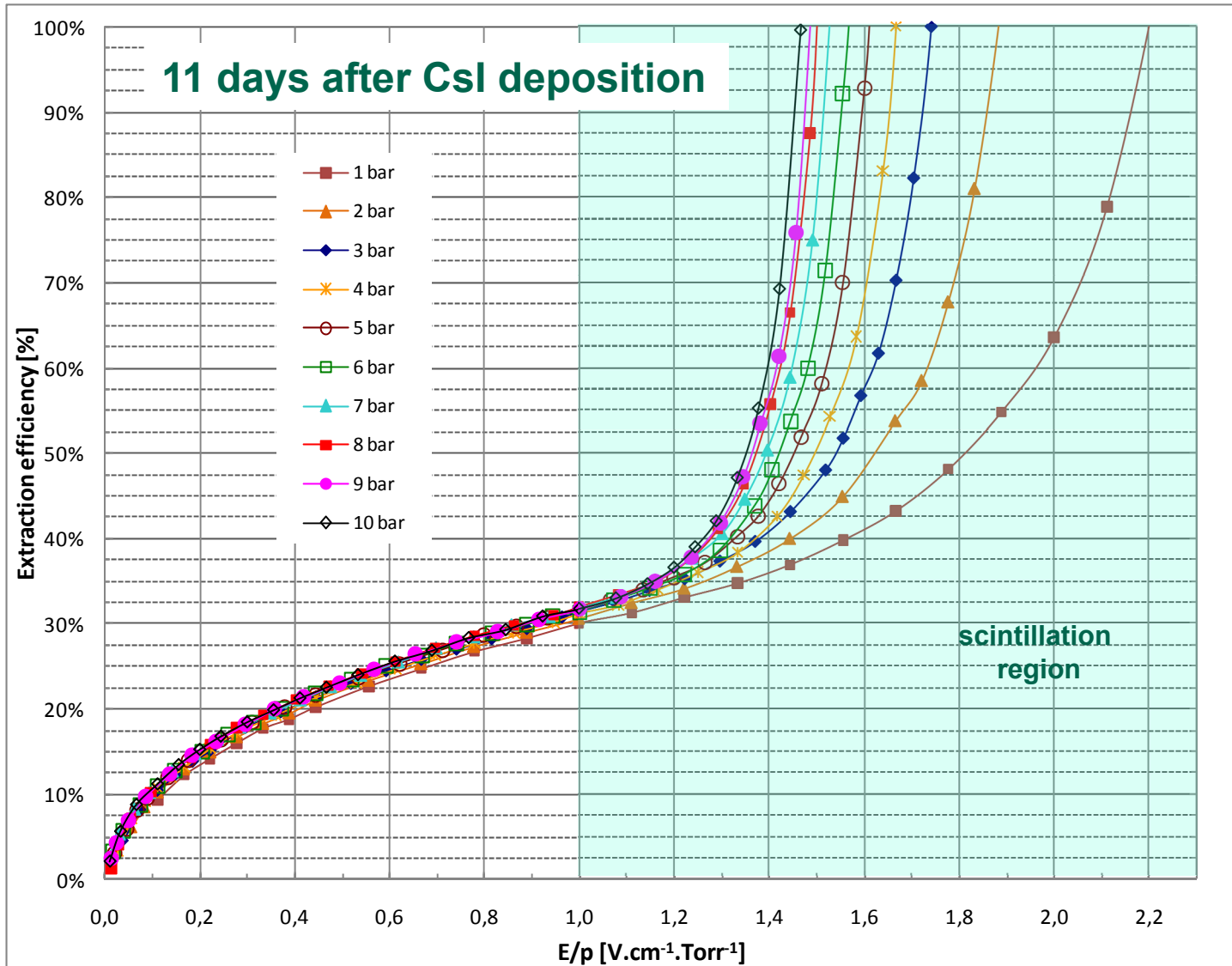




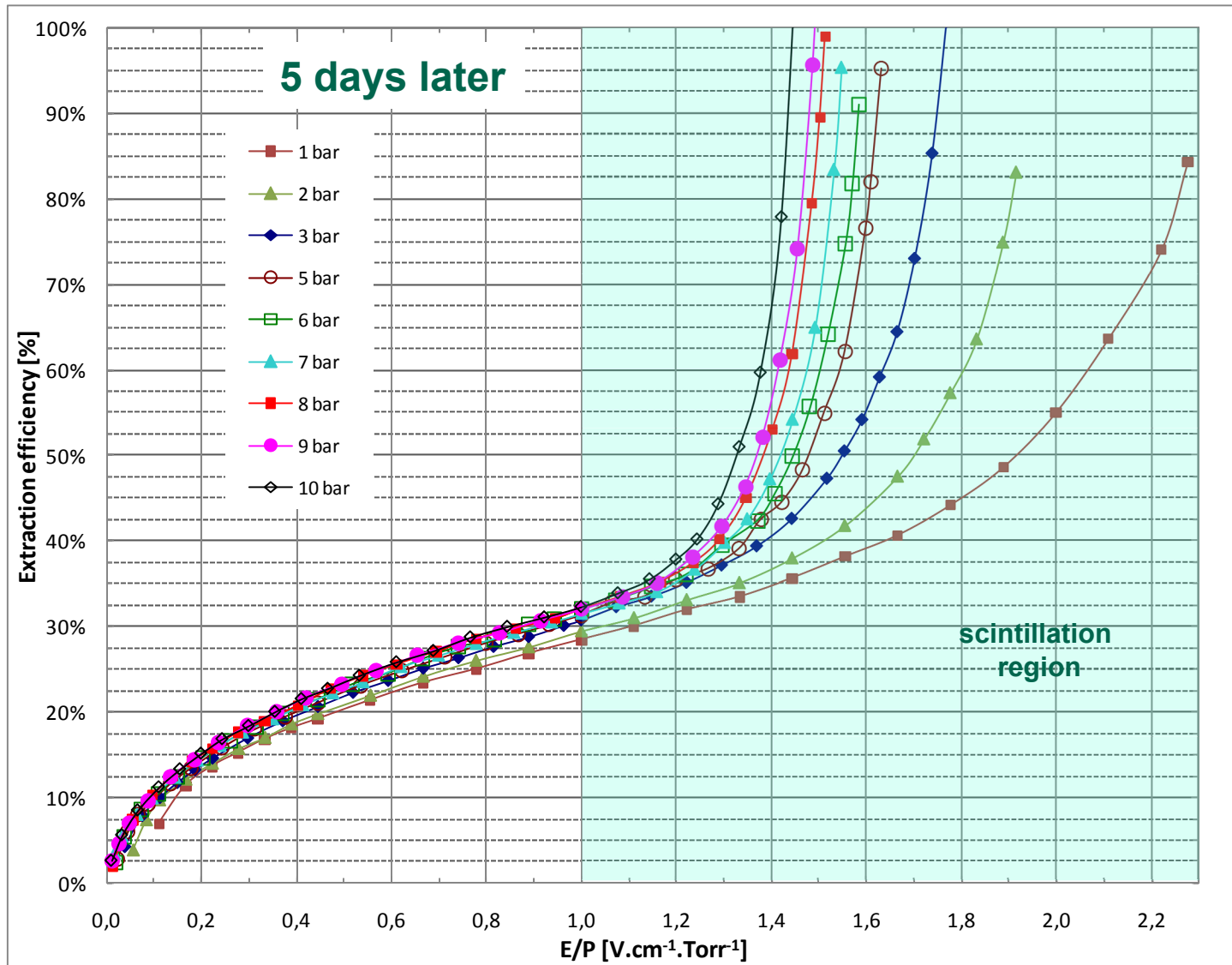
# Results in Ar



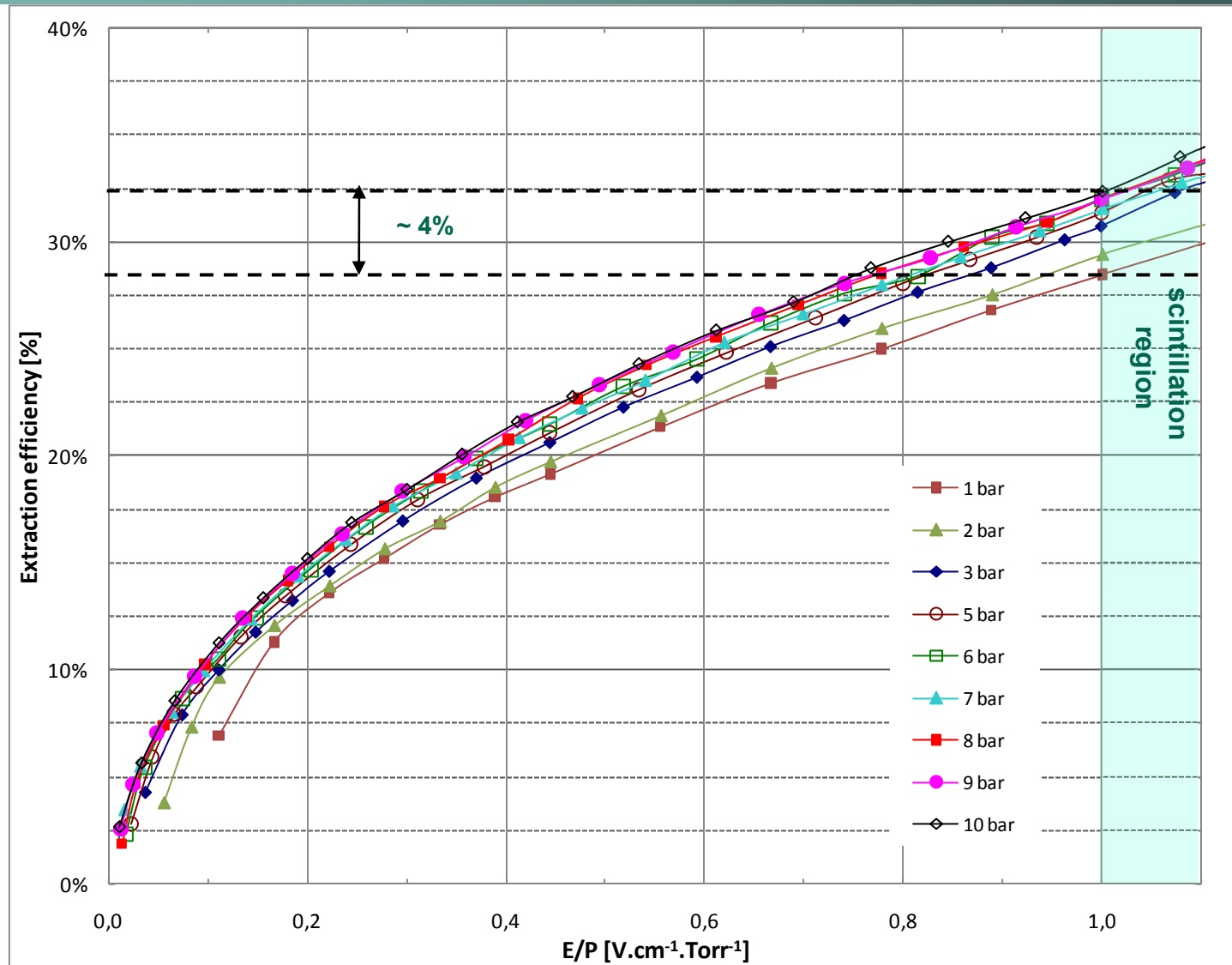
# Results in Ar



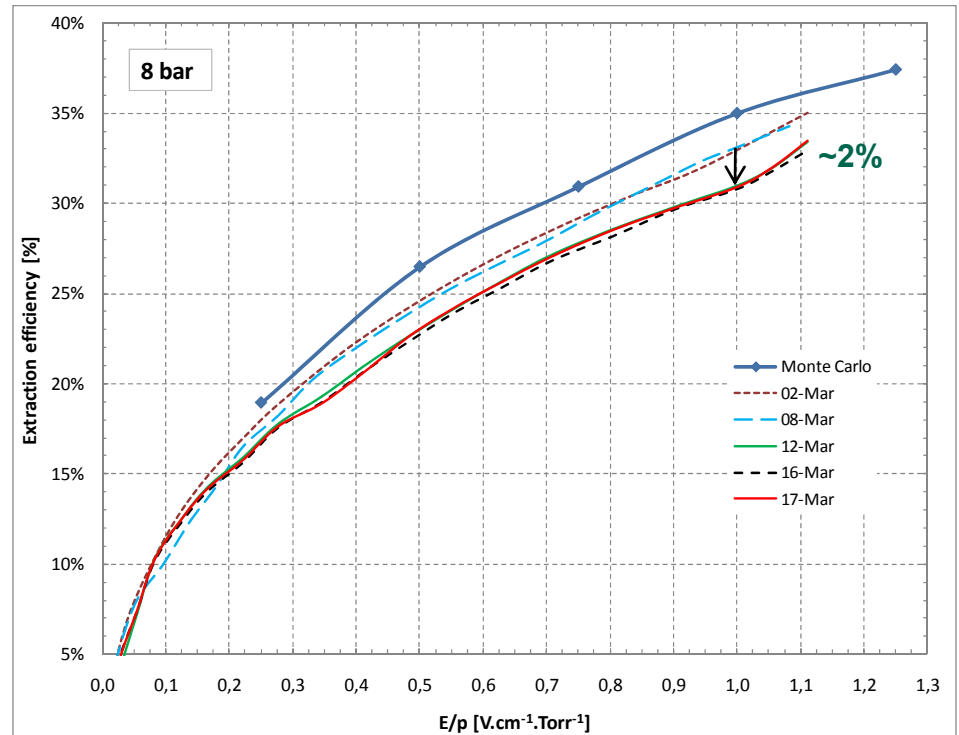
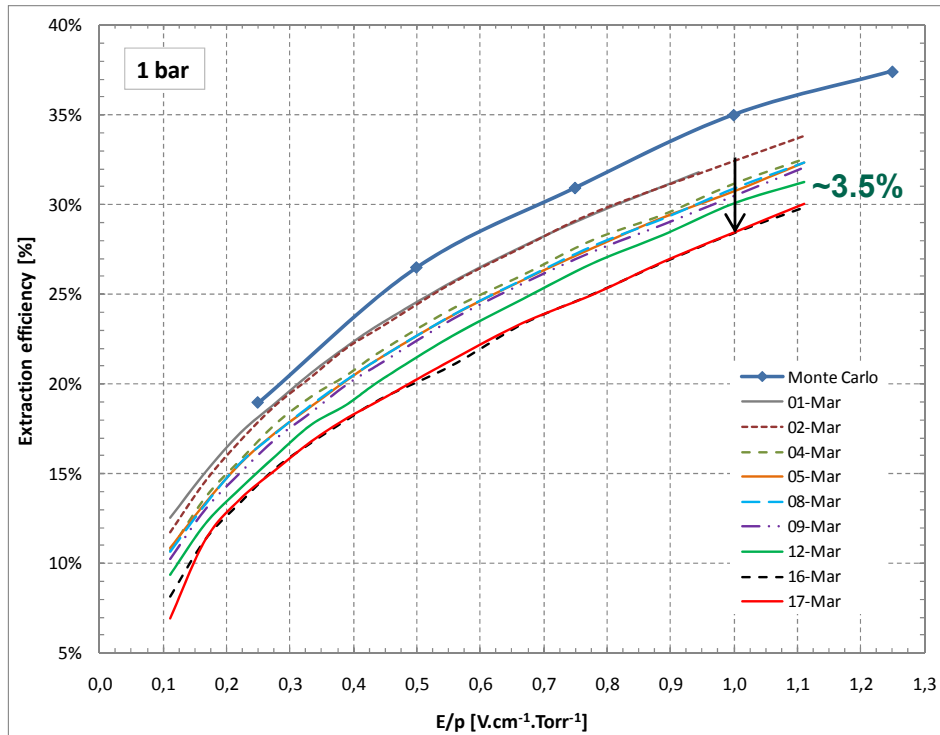
# Results in Ar



# Results in Ar



# Results in Ar



- May aging affect the photoelectron extraction efficiency !??
- May the effect be much stronger at lower pressures !??

# Conclusions and future work

## Conclusions

- ✓ The photoelectron extraction efficiency was confirmed to be pressure independent within 2% in Xenon and Argon
- ✓ So far, the measurements indicate that aging may affect the photoelectron extraction efficiency

## Future

- Systematic aging studies in Argon and Xenon
- Extend the studies to Ne, Kr and mixtures with organics (e.g. CH<sub>4</sub> and CF<sub>4</sub>)



# Thanks for your attention

