

Characterization of Centronics high-pressure ionization chambers

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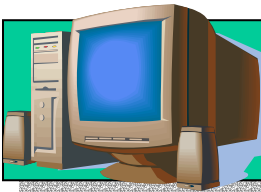
TIS/RP



Overview



Motivation



FLUKA simulation model



Experimental setup at CERF



Results

Motivation

Current status

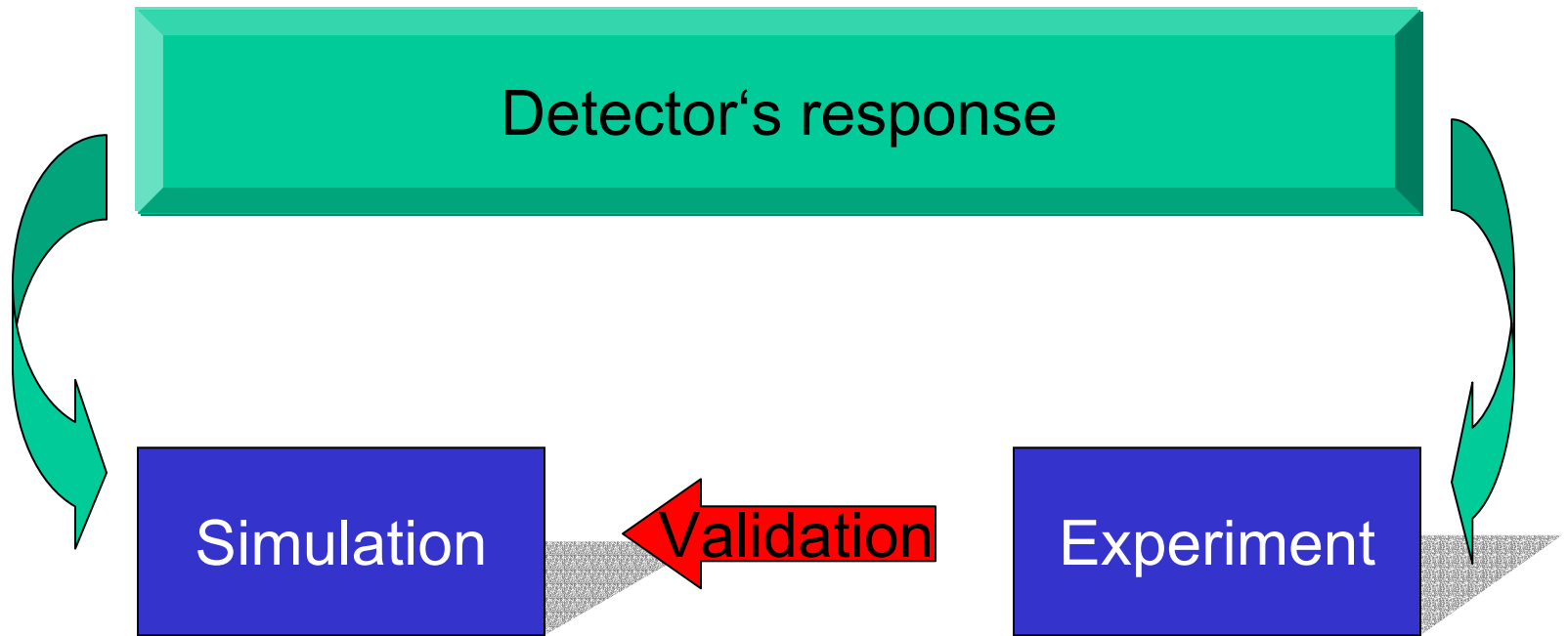
Chambers characterized by **two** calibration coefficients:

- ✓ **Photons** (using a Cs 137 & a Co 60 source)
- ✓ **Neutrons** (using 1 Pu-Be source)

Goal

- **Particle specific** response function over a wide energy range.
- Characterization of behavior in a mixed radiation field.

Motivation



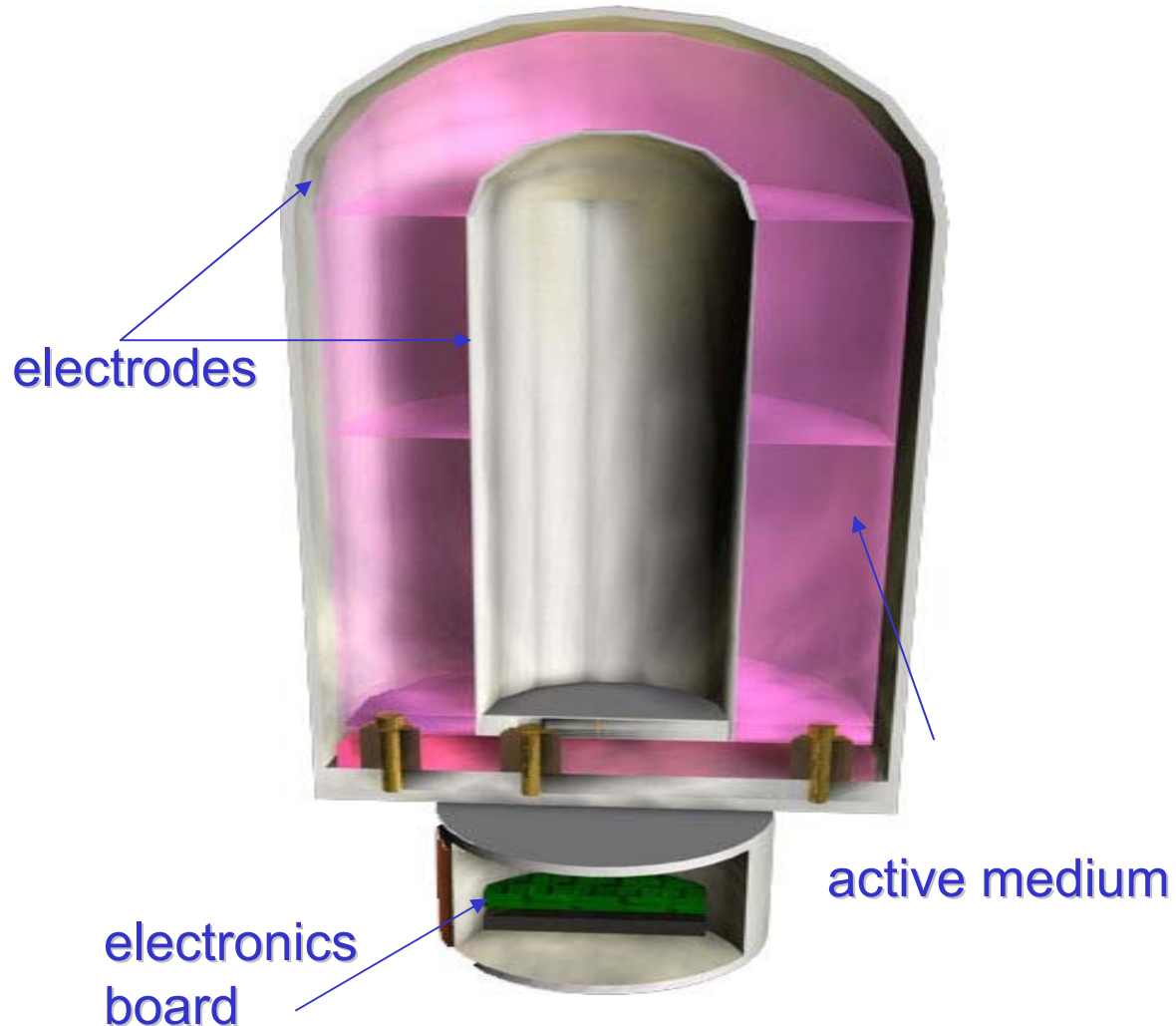
IG5 - Geometry

Properties

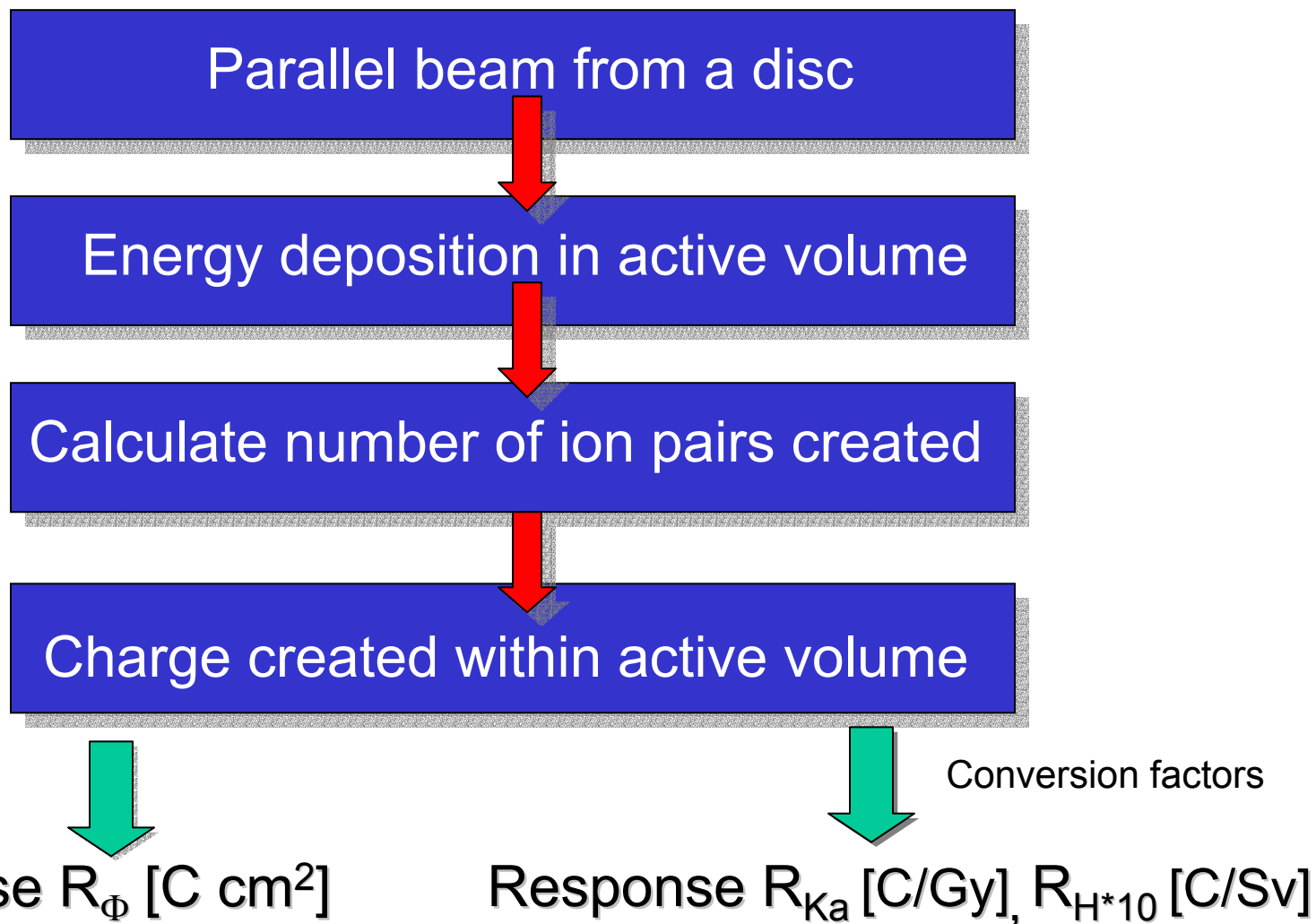
5,2 l active volume
2 types (Ar or H filled)
pressurized at 20 bar
1200 V high voltage

Dimensions

diameter – 18.33 cm
height – 45.6 cm



Simulation Response



Calculated response functions

ρ , π^+ , π^- , μ^+ , μ^- , e^-

(1 MeV \rightarrow 1 GeV)

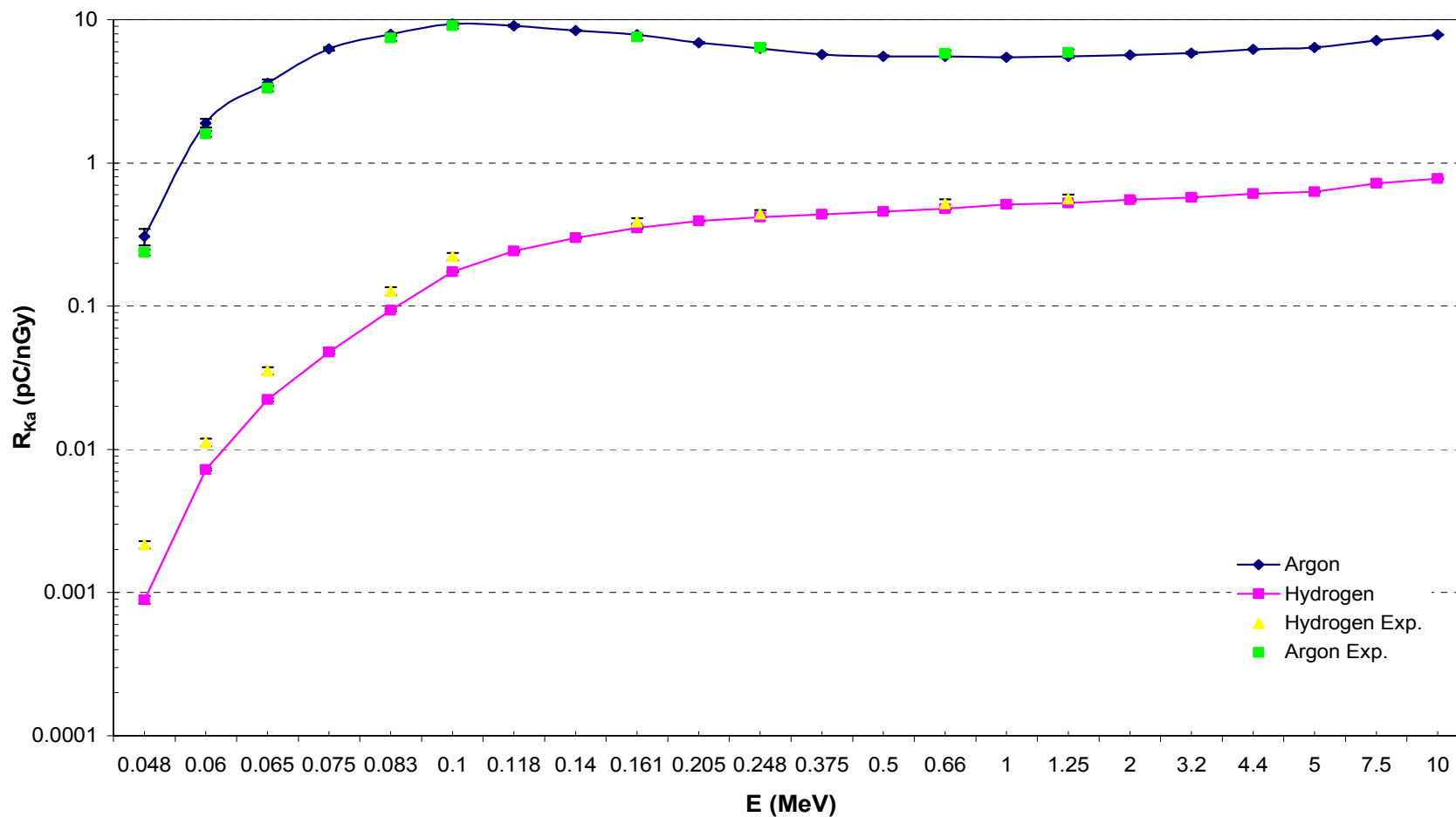
Neutrons

(thermals \rightarrow 5 GeV)

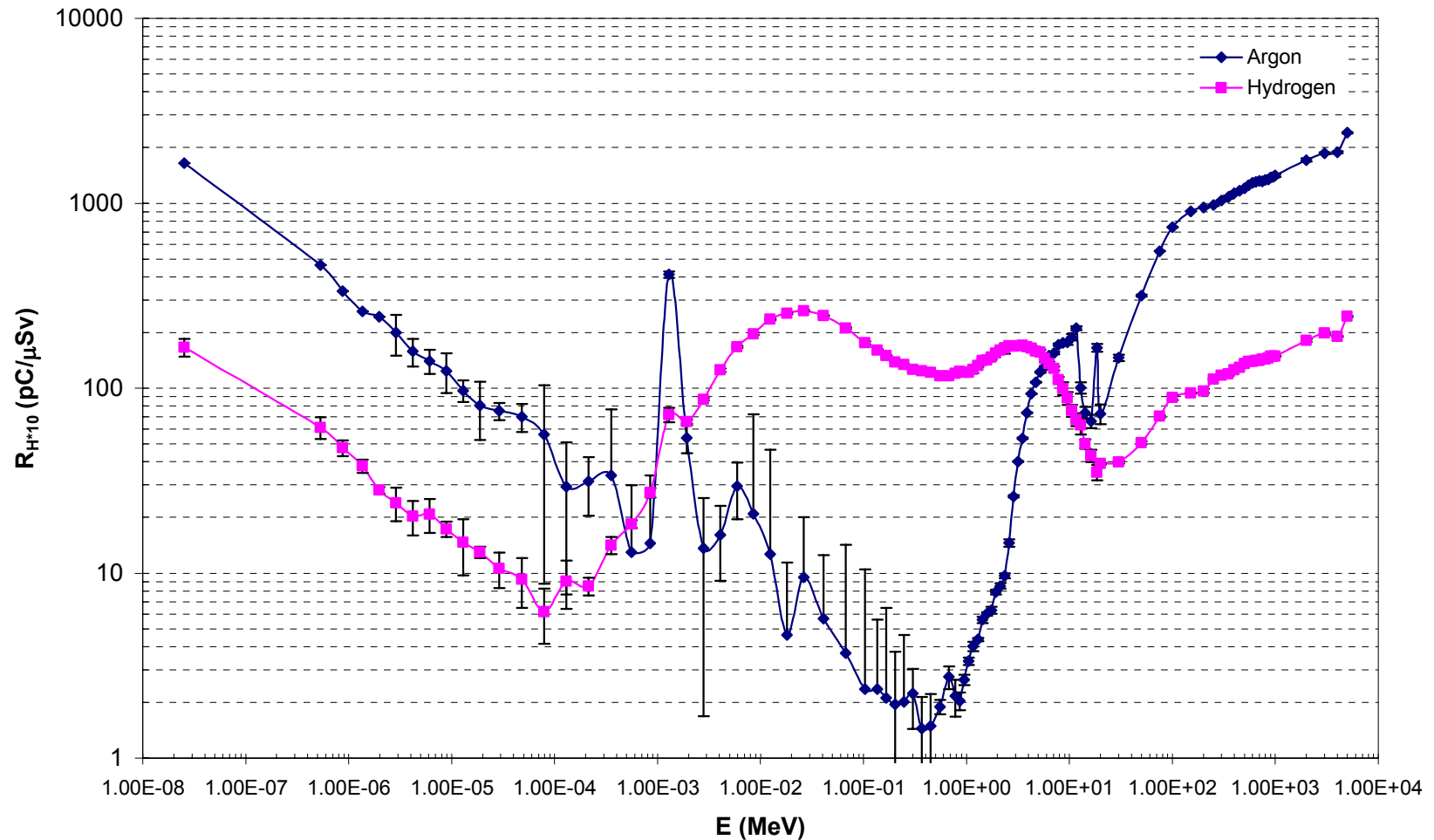
Photons

(X ray spectra \rightarrow 10 MeV)

Photon response



Neutron response



Roadmap CERF 2003



Place Ar- & H-filled chambers at certain positions

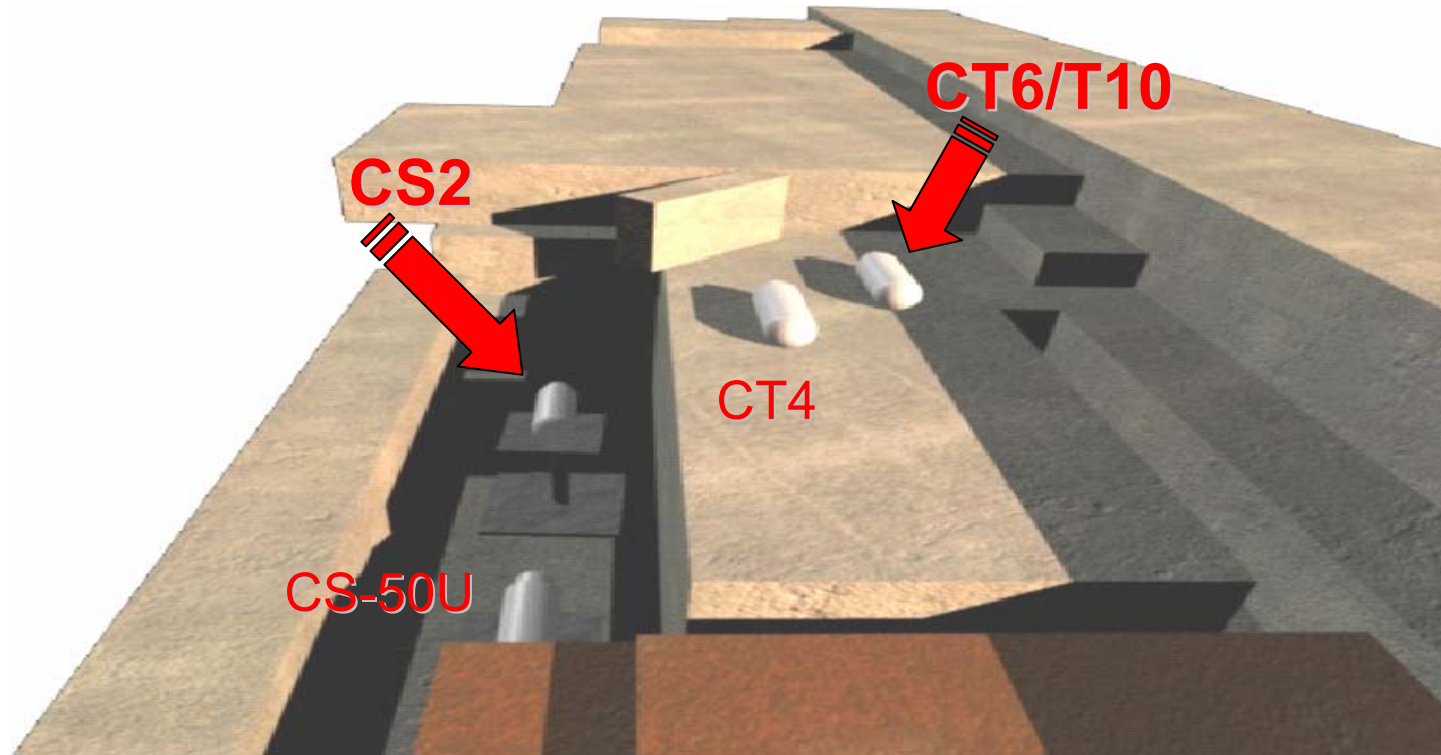
Record counts with respect to position & beam intensity



Calculate particle spectra at selected positions

Convolute spectra with fluence response

The CERF facility

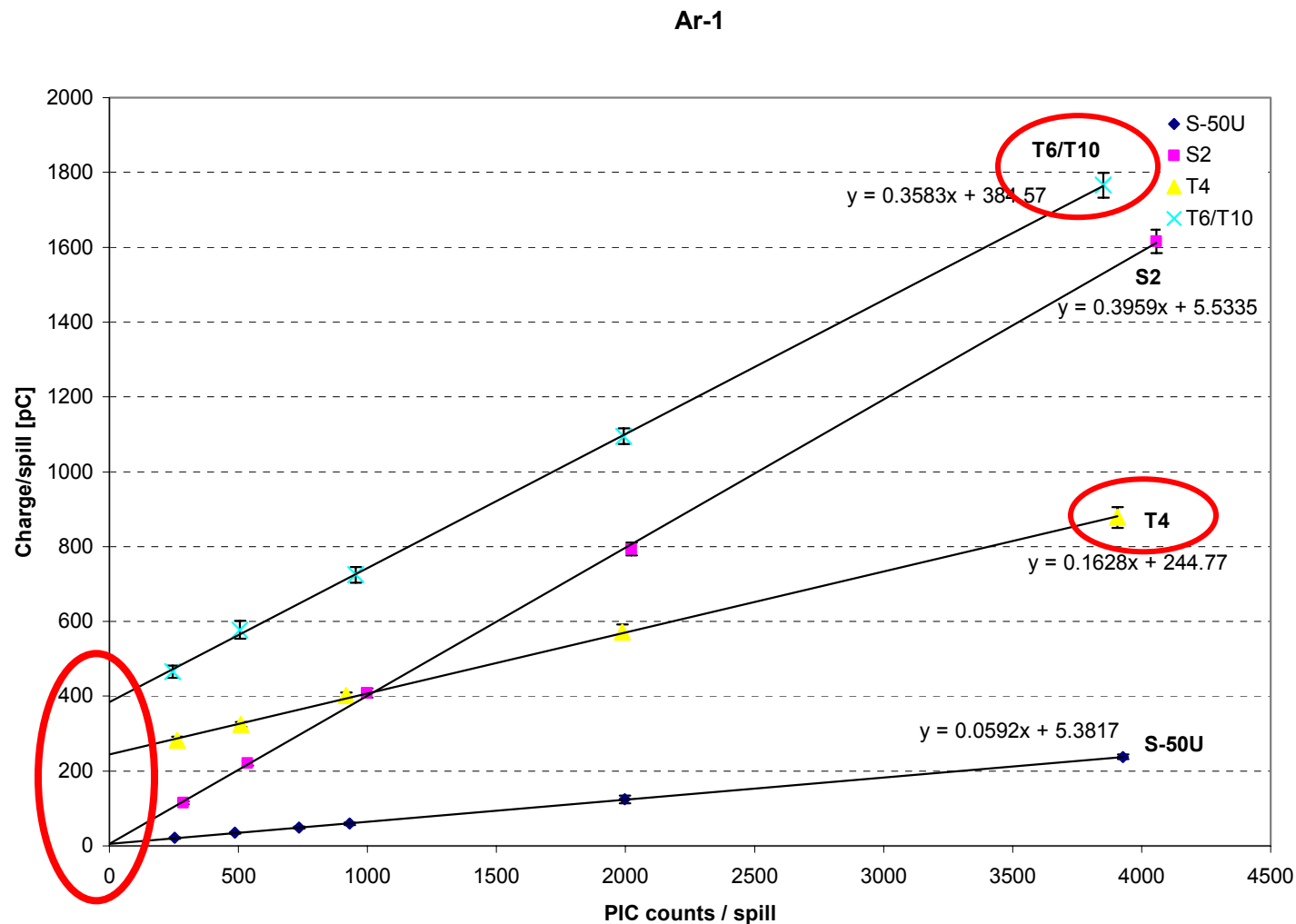


Beam momentum **120 GeV/c**

Beam composition 60.7% π^+ , 34.8% p, 4.5% K^+

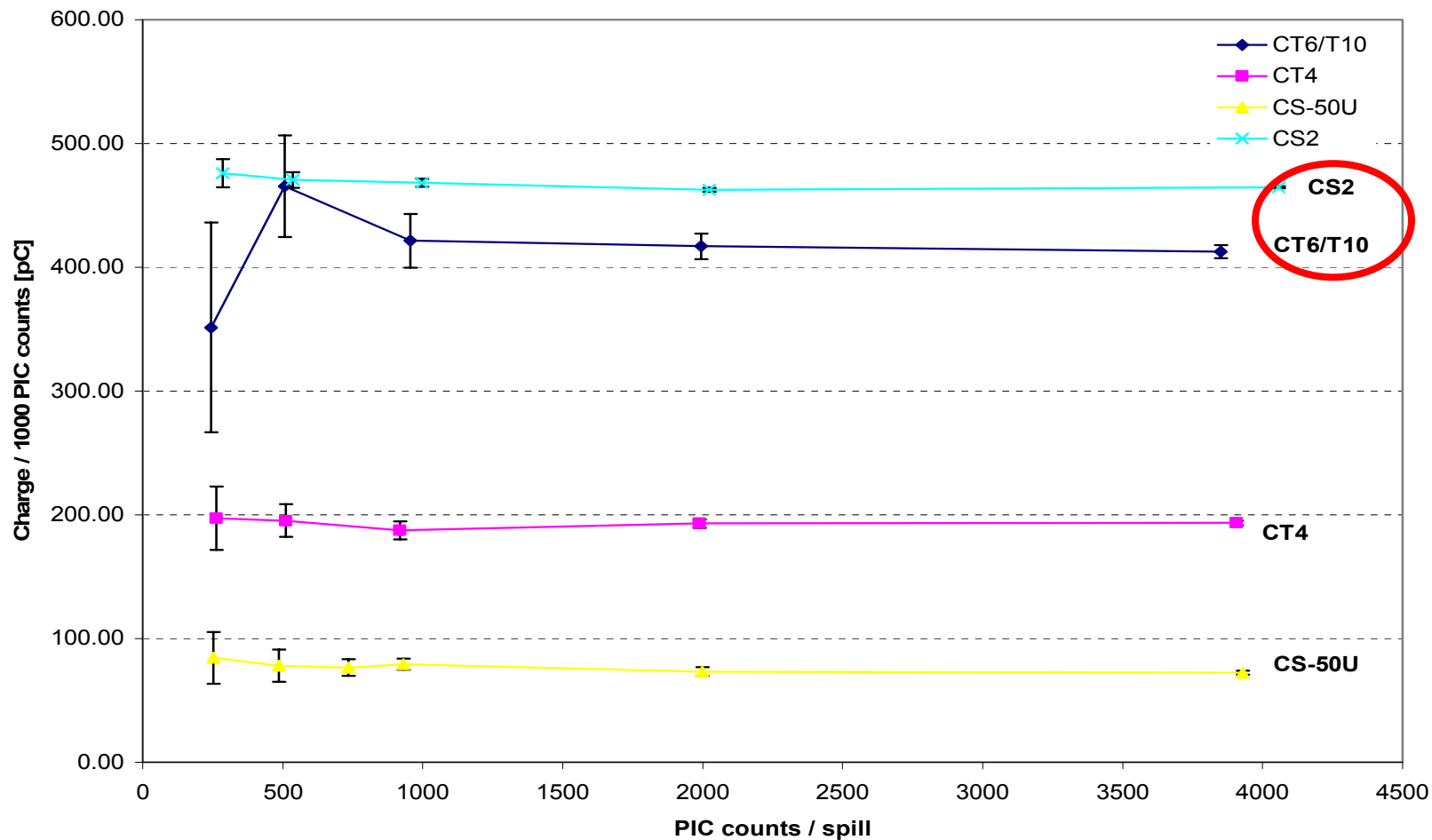
Beam intensity given in PIC counts. **1 PIC \approx 23000 particles (\pm 10%)**

Background correction

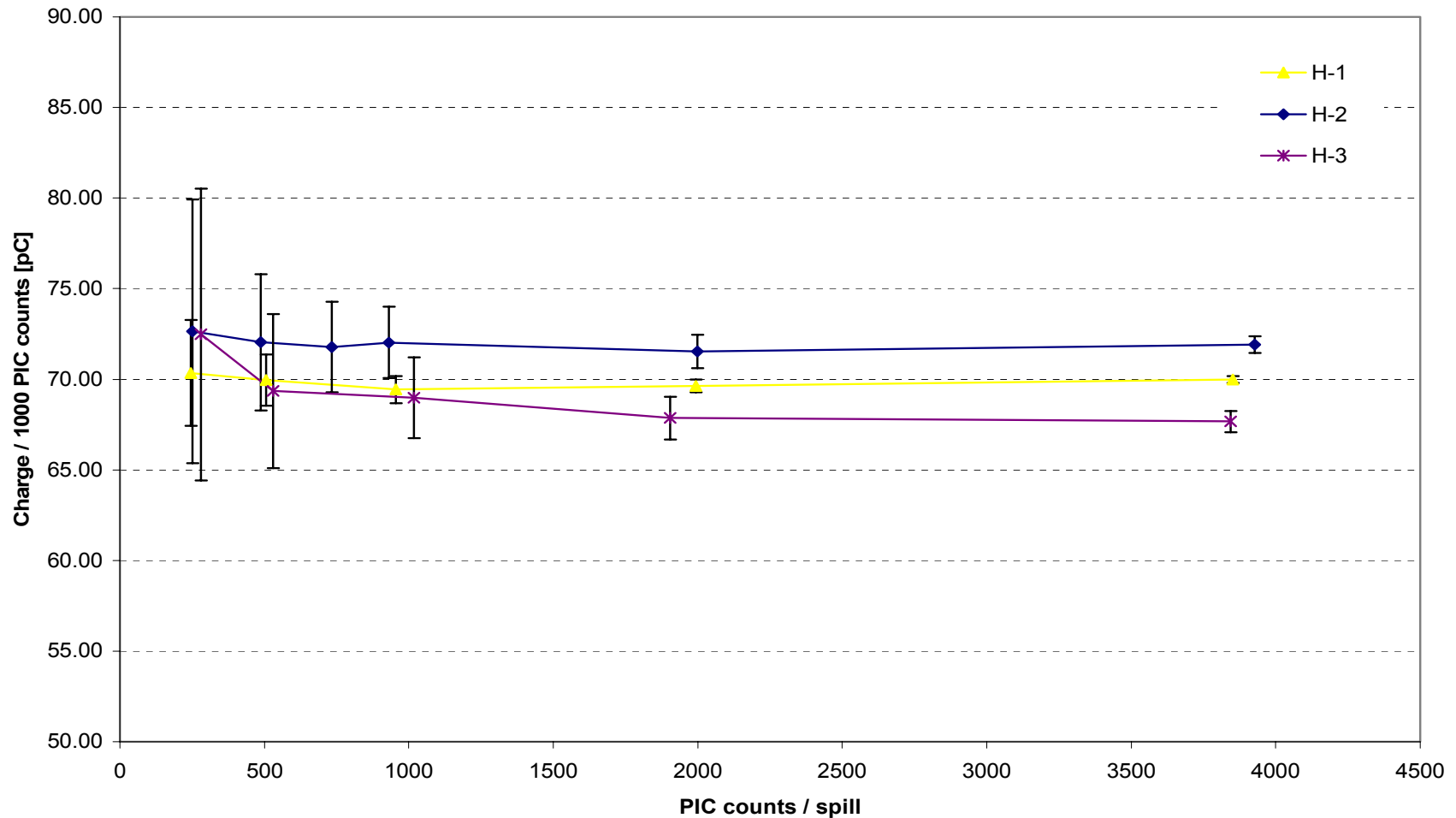


Created charge at various positions

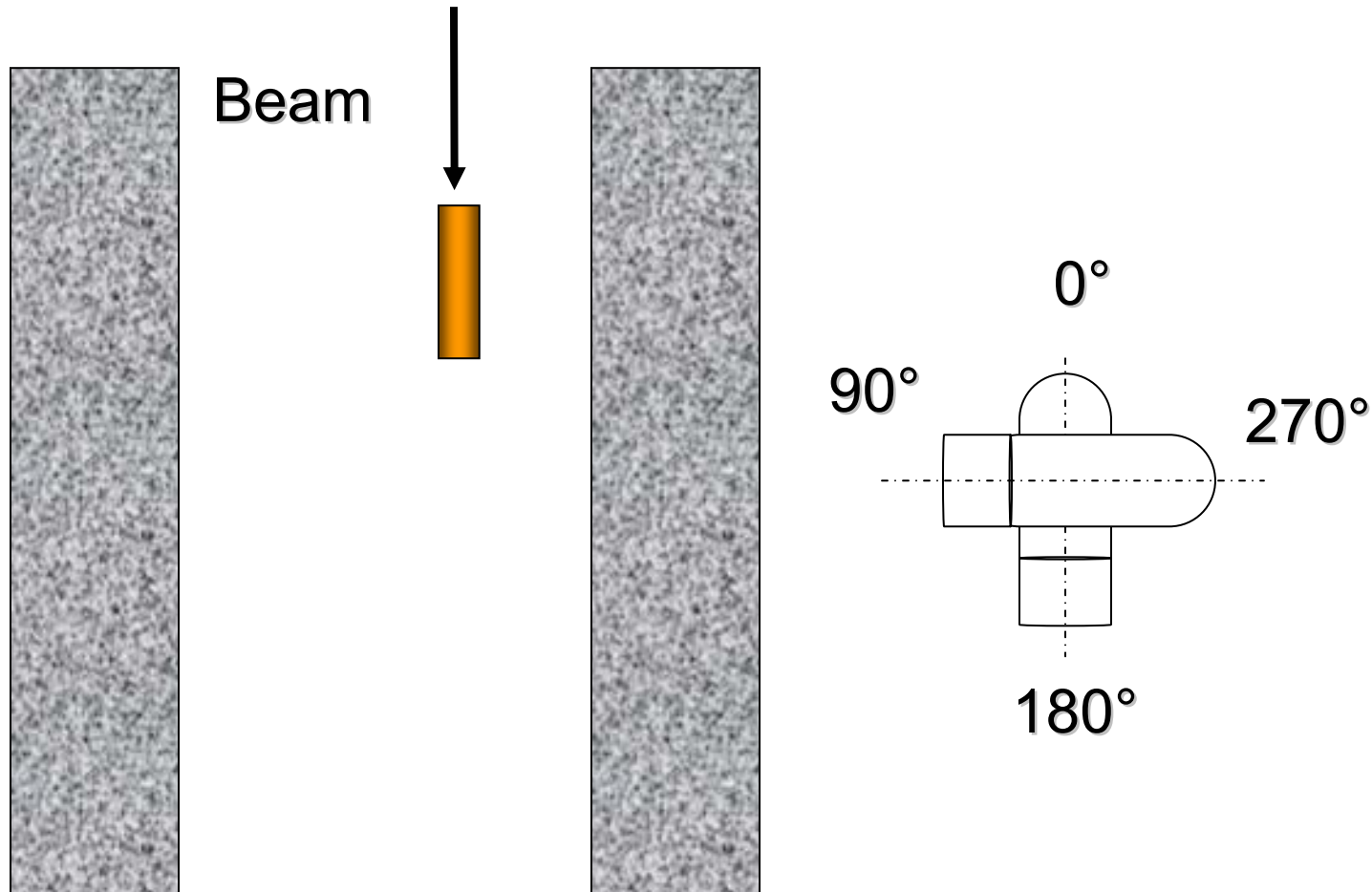
Ar-1



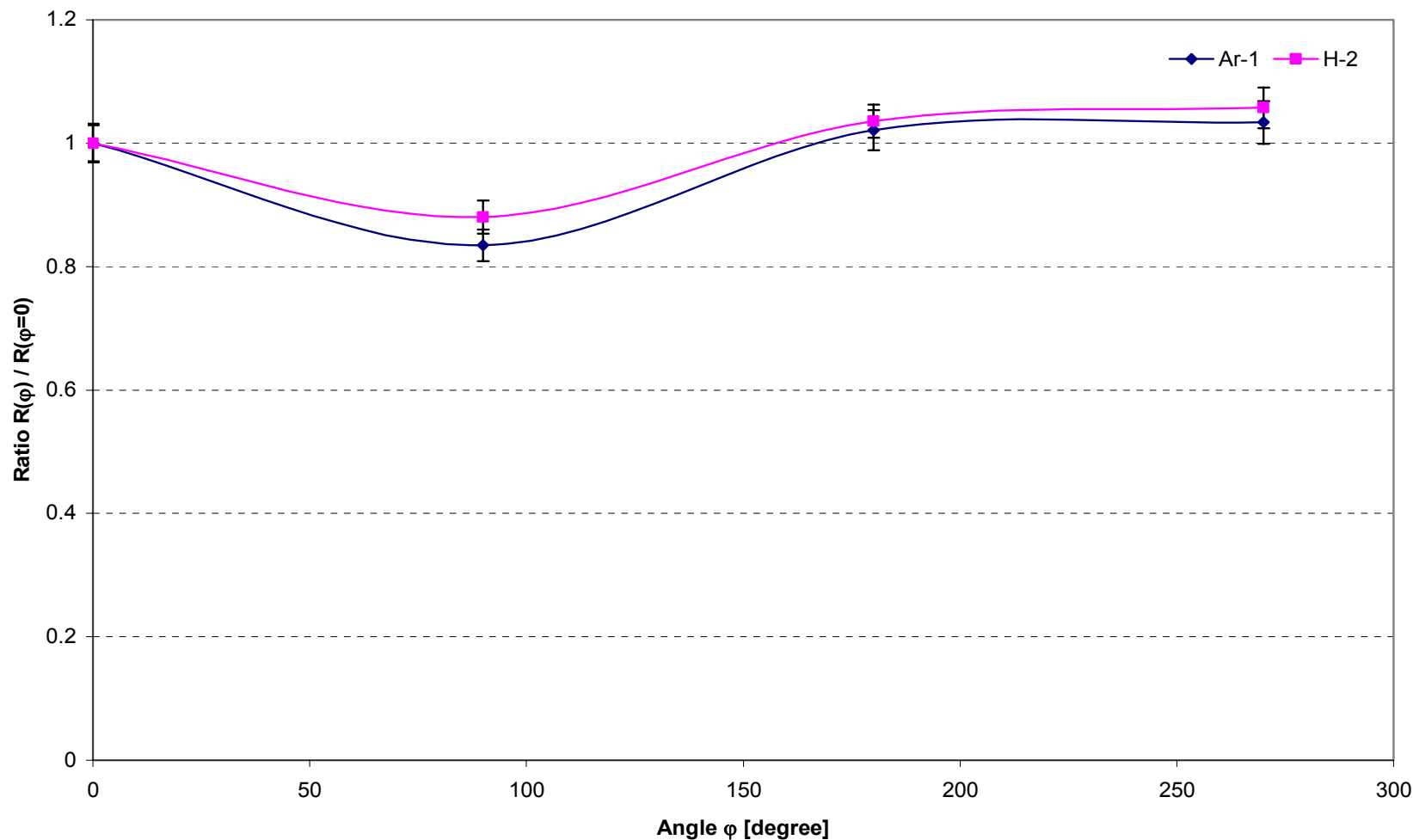
Created charge at CS2 (hydrogen-filled monitors)



Angular dependence



Angular dependence



Comparison to simulation

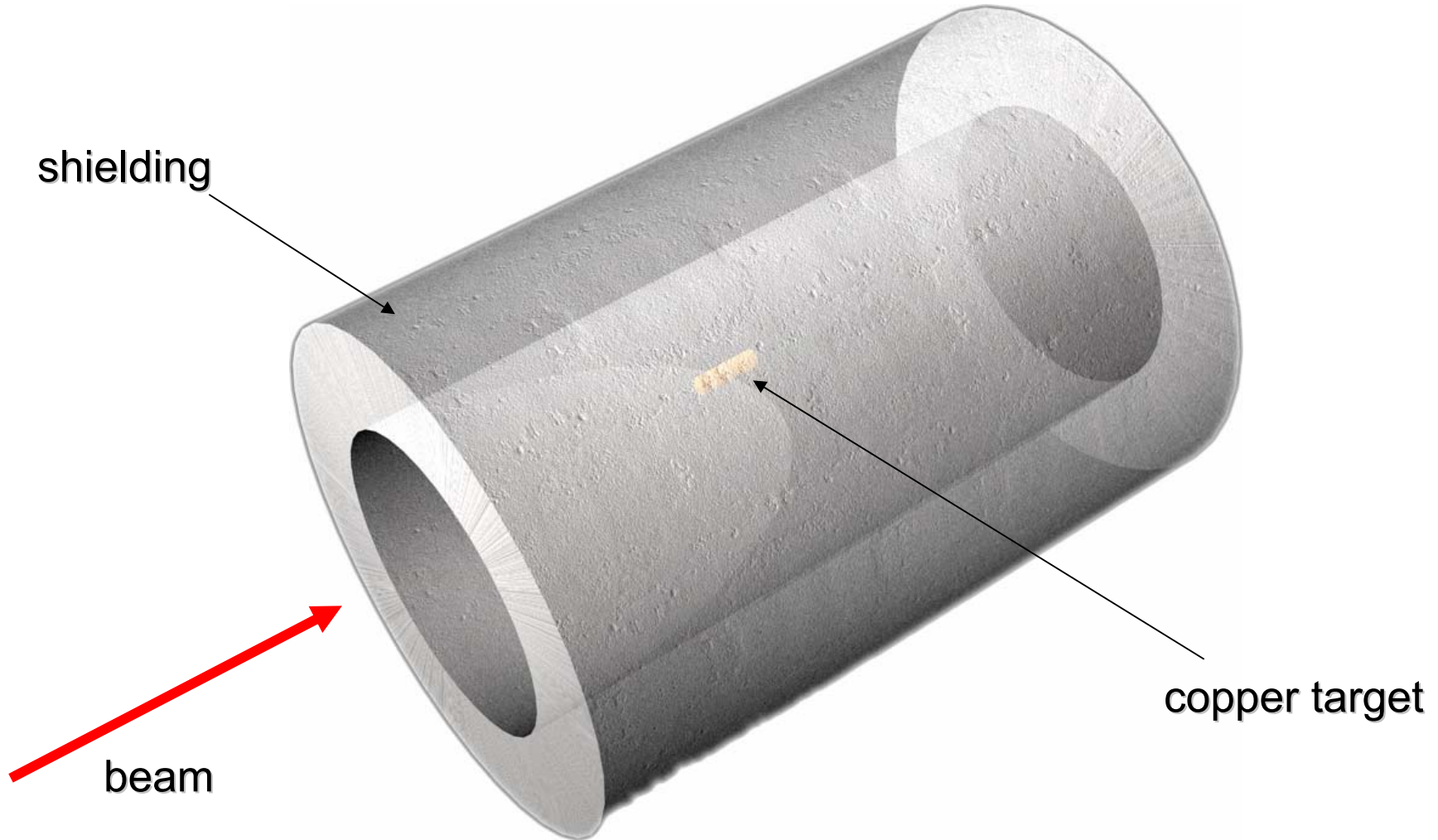
Calculate expected spectra [cm^{-2}]
simplified geometry, **detailed** CERF geometry

Convolute with fluence response [C cm^2]

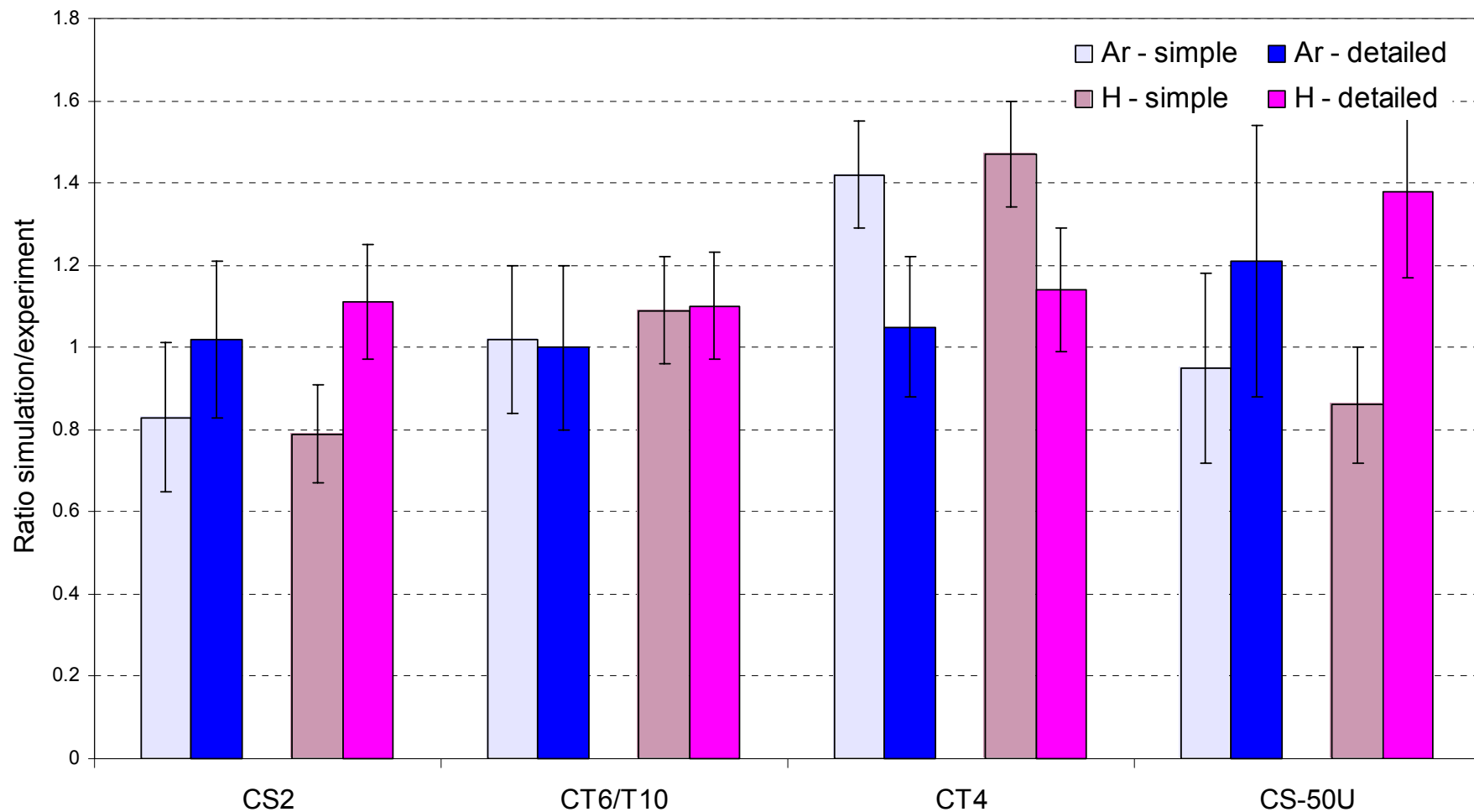
$$\int dE \frac{d\phi}{dE} R_{\phi}(E)$$

Created charge [C] in the active volume

Simplified geometry



Ratio sim/exp for a simplified & detailed geometry



Summary

- ✓ Good agreement of calibration measurements and simulation for photons
- ✓ Reasonable agreement using a very simplified geometry for mixed fields
- ✓ Good agreement using a detailed geometry for mixed fields

Outlook & Conclusions

- ☑ MC simulations allow a good prediction of the monitor response in mixed fields.
- ☑ A suitable reference calibration can be calculated.
- ☑ Studies of neutron calibration are under way