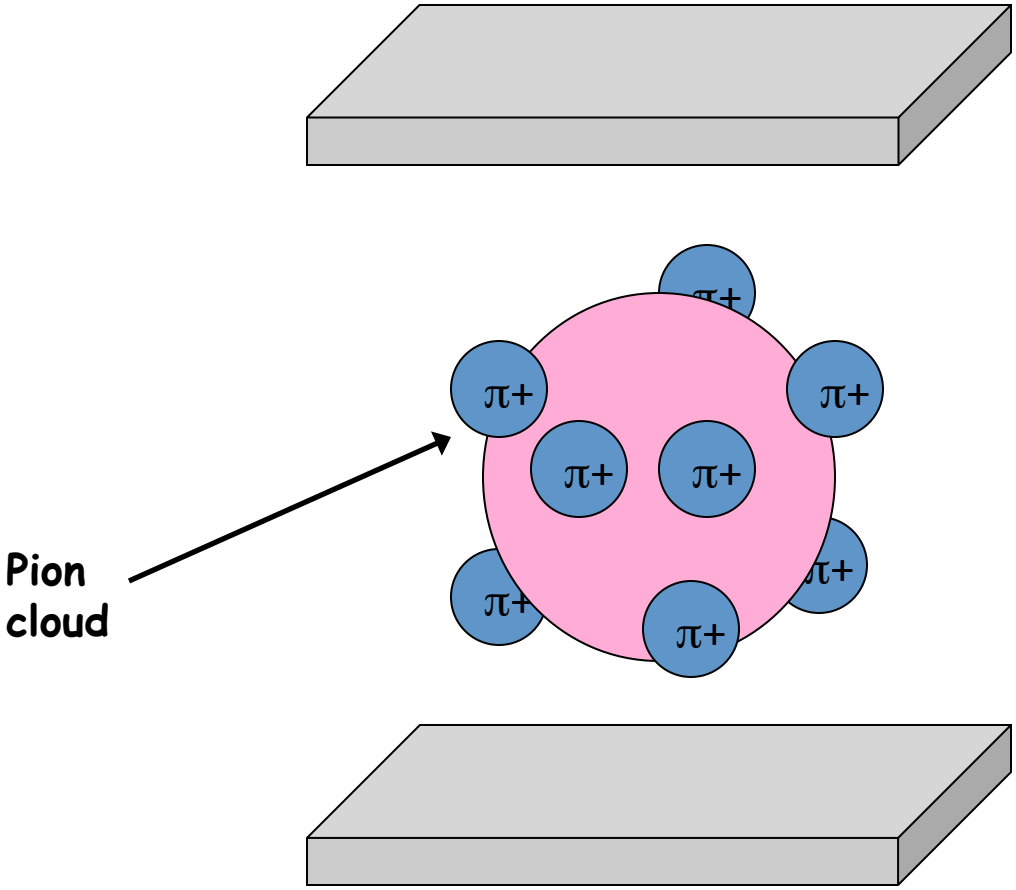
Proton electric polarizability



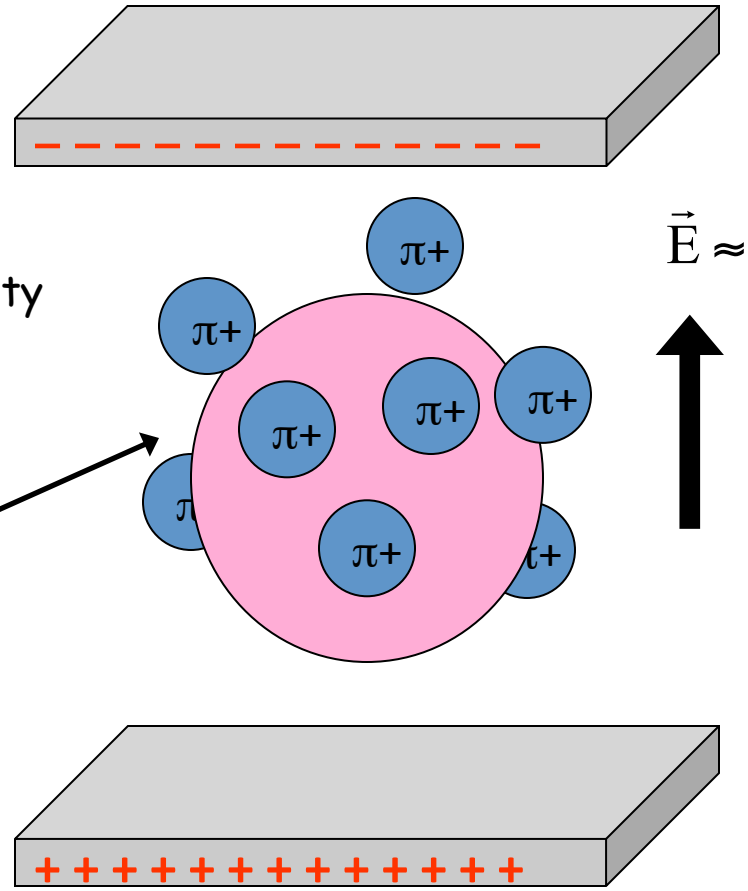
Electric polarizability: proton between charged parallel plates

Proton electric polarizability

$\vec{D} = \alpha \vec{E}$

α = electric polarizability

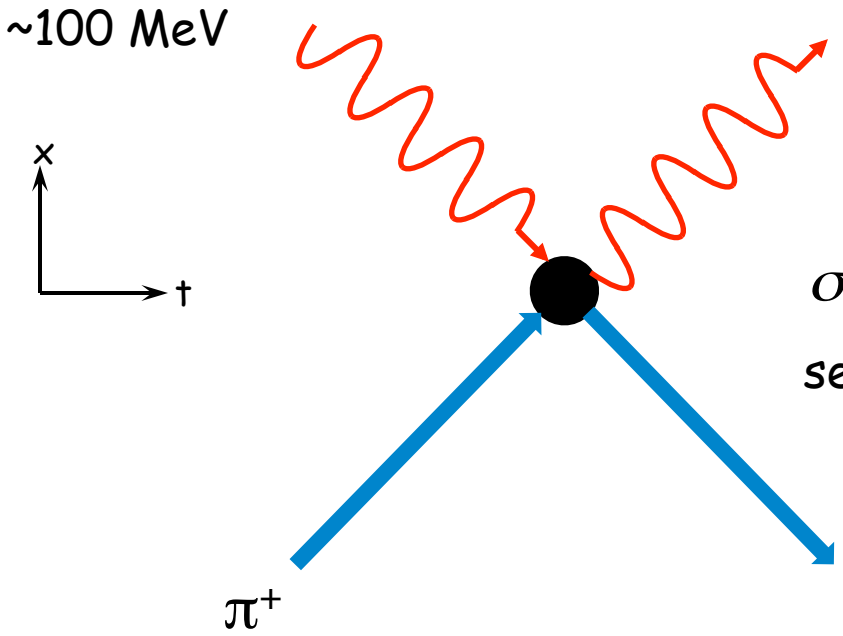
= 10 × Volume × 10^{-4}



$$\vec{E} \approx \frac{100\text{MeV}}{1\text{fm}} = 10^{23}\,\text{volts/m}$$

Electric polarizability: proton between charged parallel plates

Compton Scattering on the pion



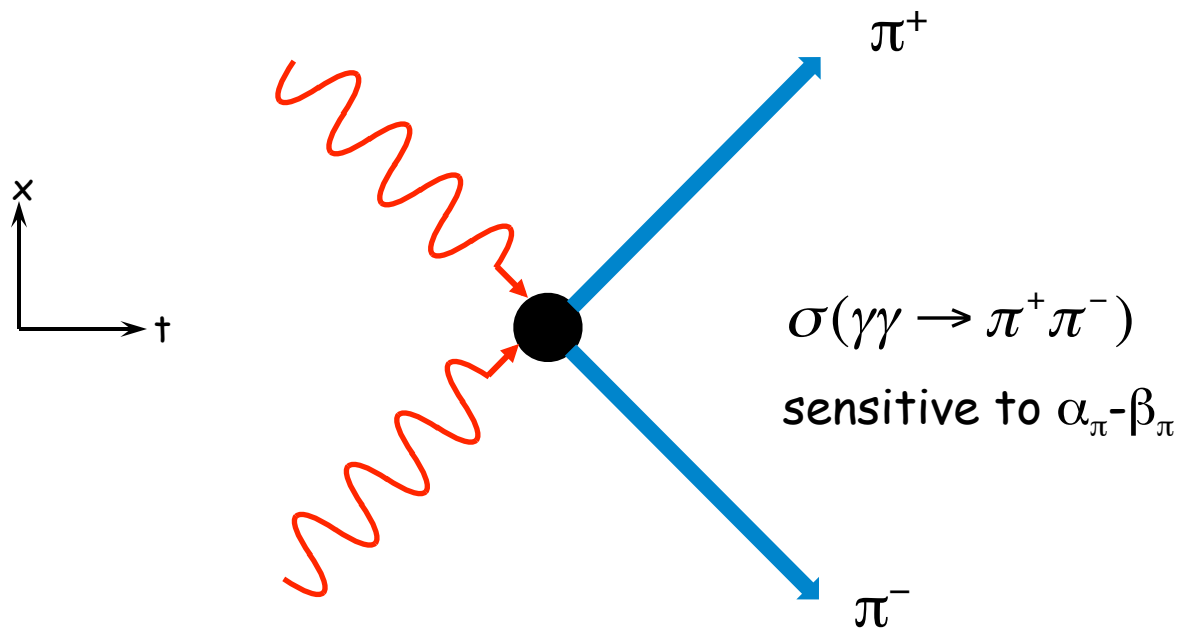
$\sigma(\gamma\pi^+ \to \gamma\pi^-)$

sensitive to α_π and β_π

$$H = H_{Born}\left(e,\vec{\mu}\right) - 4\pi\left(\frac{1}{2}\alpha_\pi \vec{E}^2 + \frac{1}{2}\beta_\pi \vec{H}^2\right)$$

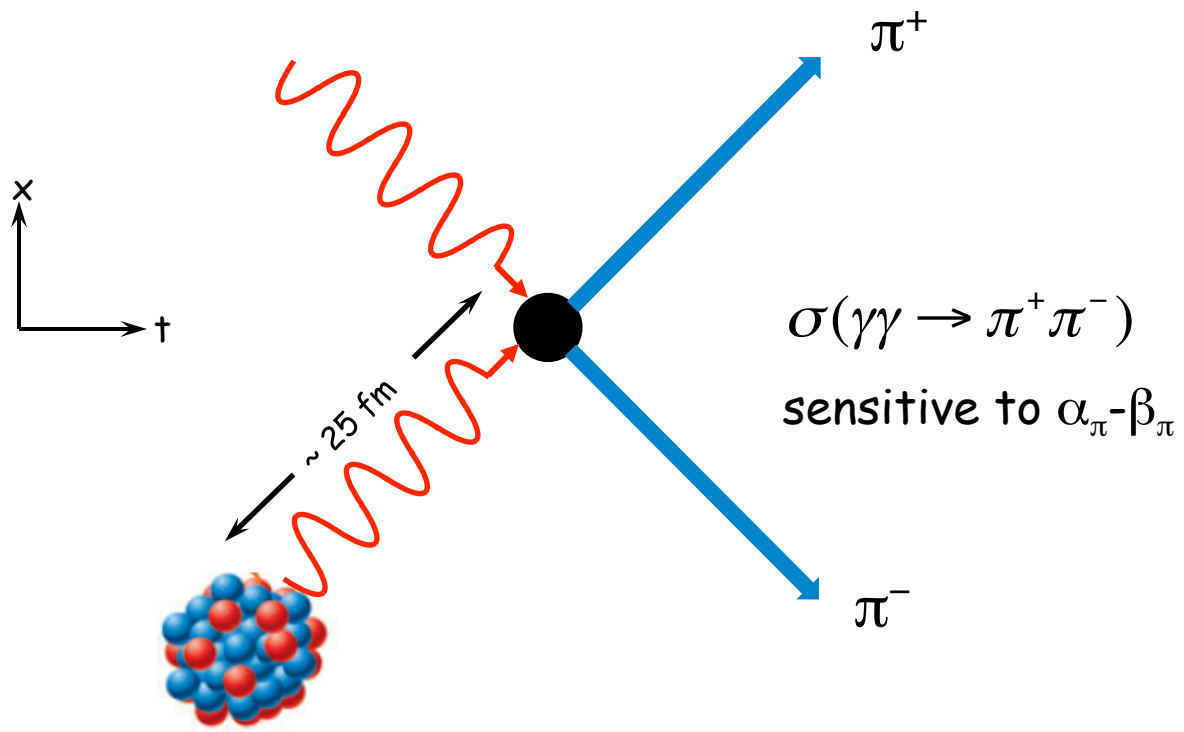
Crossing symmetry x ↔ t

Compton scattering amplitude ⟺ $A(\gamma\gamma \to \pi^+\pi^-)$



The Jefferson Lab CPP Experiment

Primakoff production $\gamma A \rightarrow \pi^+\pi^- A$

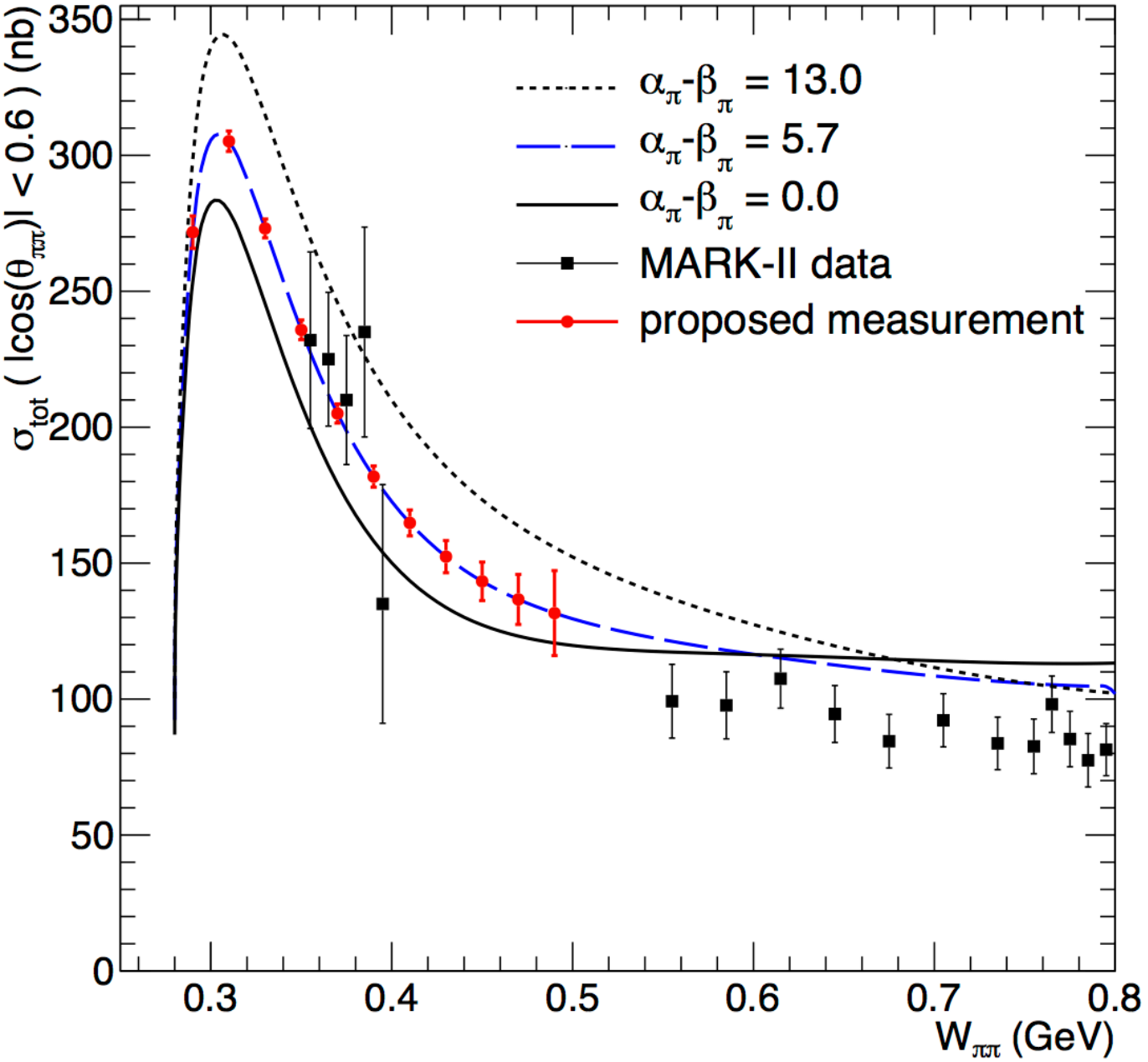


$\sigma(\gamma\gamma \rightarrow \pi^+\pi^-)$

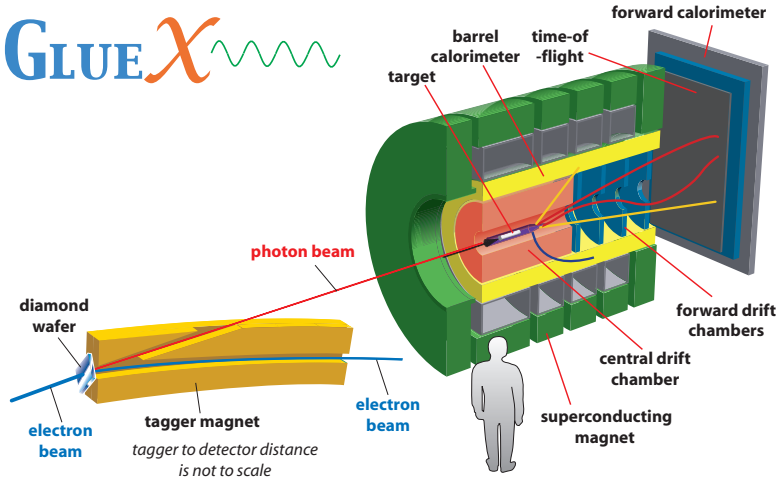
sensitive to α_π-β_π

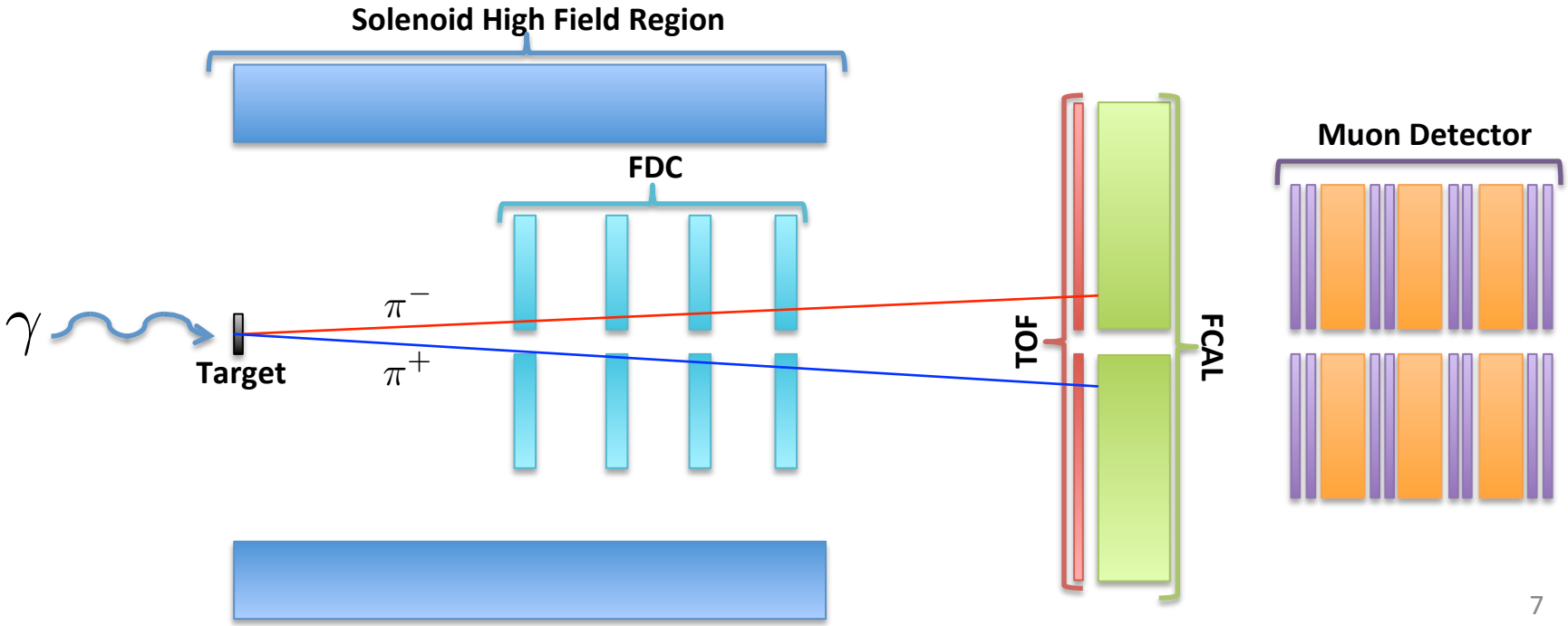
$$\frac{d^2\sigma_{Primakoff}}{d\Omega dM} = \frac{2\alpha Z^2}{\pi^2}\frac{E_\gamma^4\beta^2}{M}\frac{\sin^2\theta}{Q^4}\left|F(Q^2)\right|^2\left(1+P_\gamma\cos 2\varphi_{\pi\pi}\right)\sigma(\gamma\gamma\rightarrow\pi\pi)$$

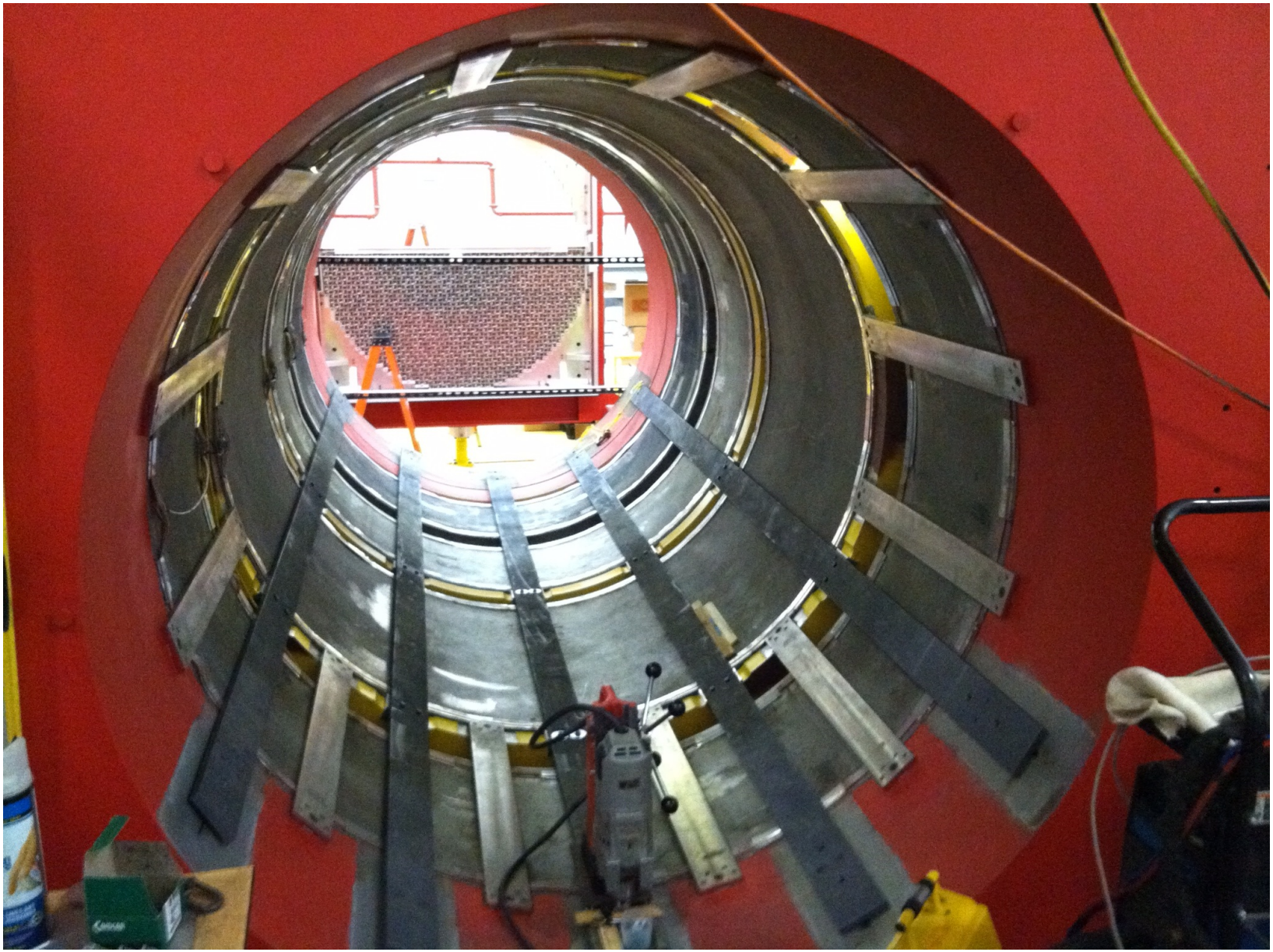
$\gamma + \gamma \rightarrow \pi^+ + \pi^-$

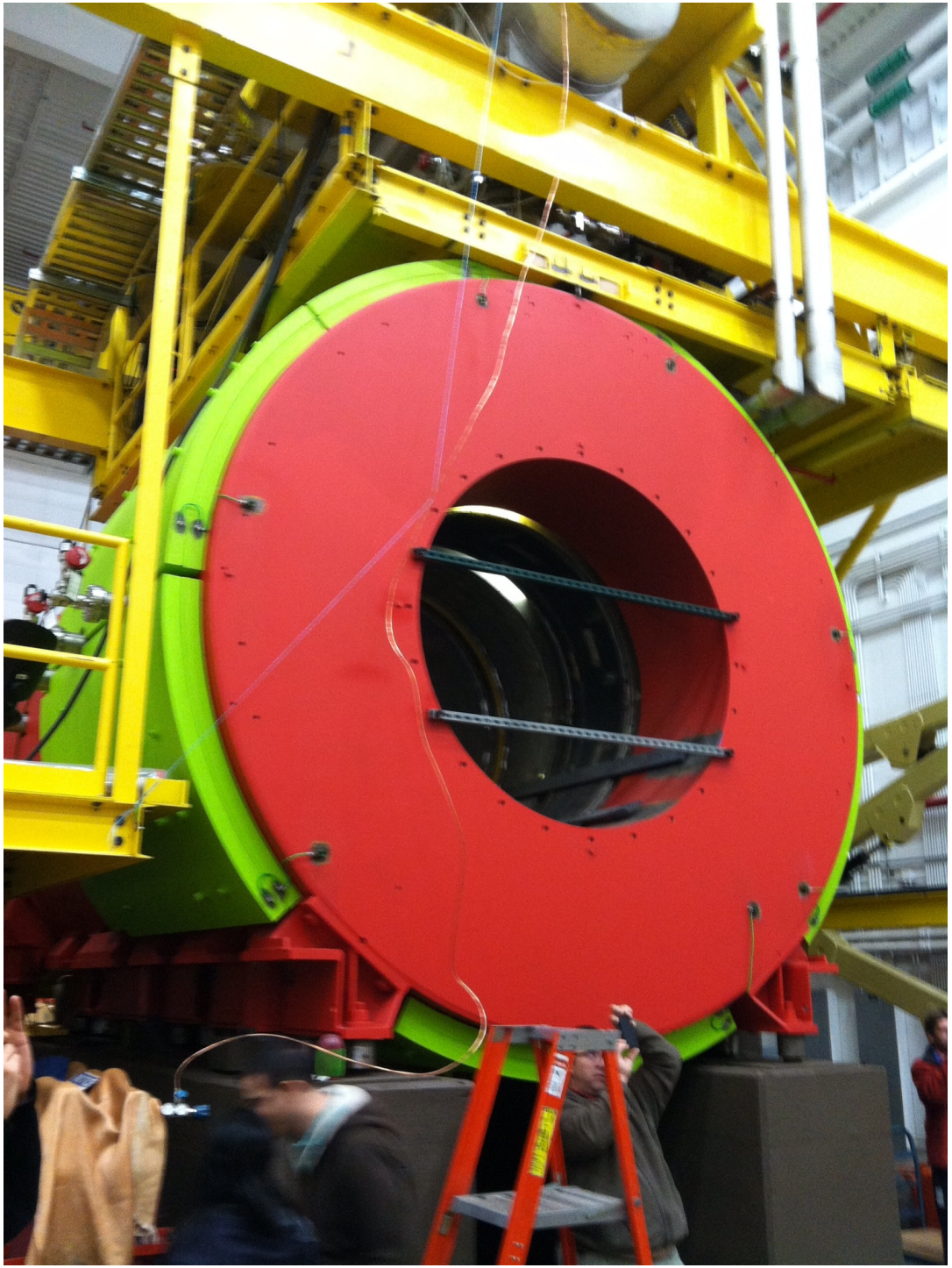


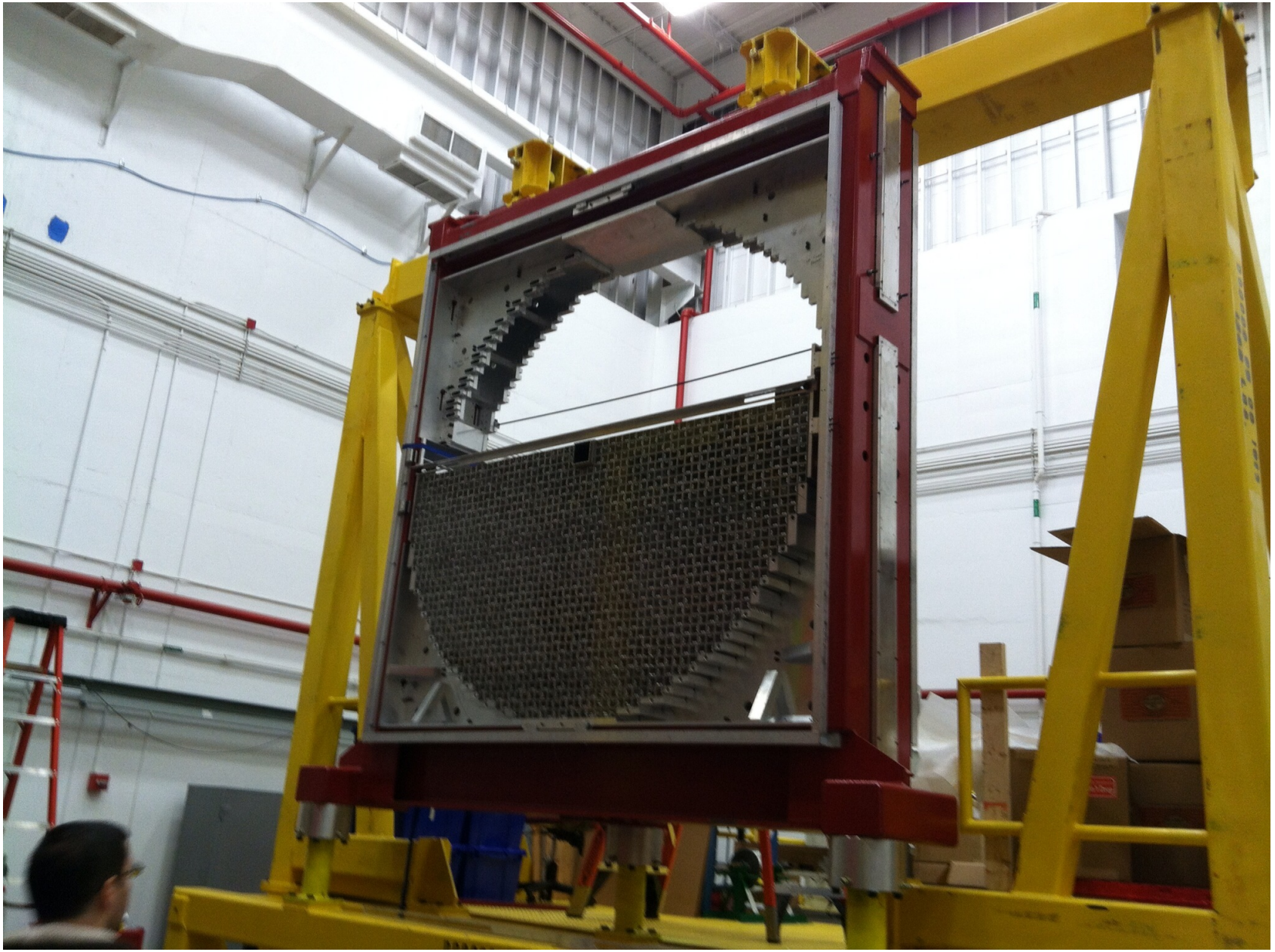
The Jefferson Lab CPP Experiment



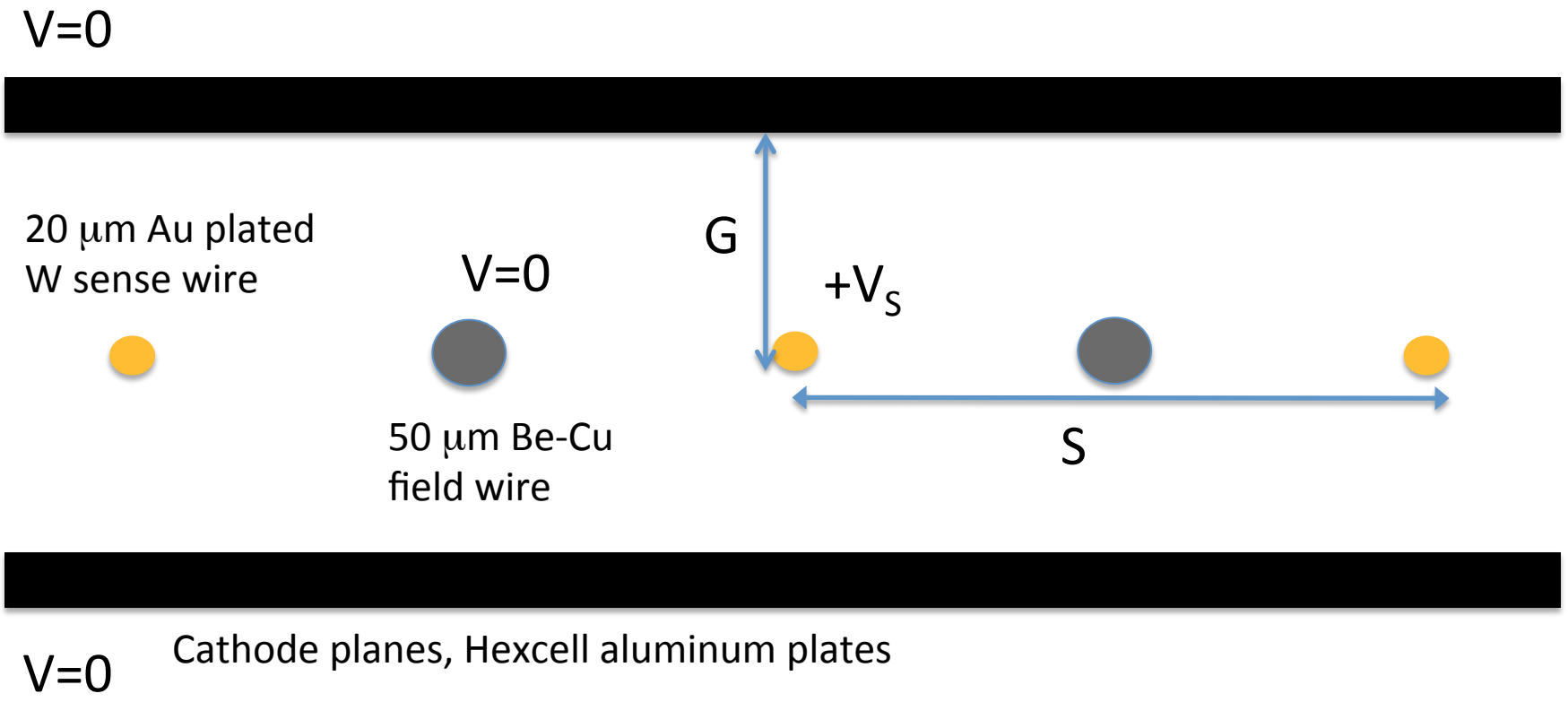


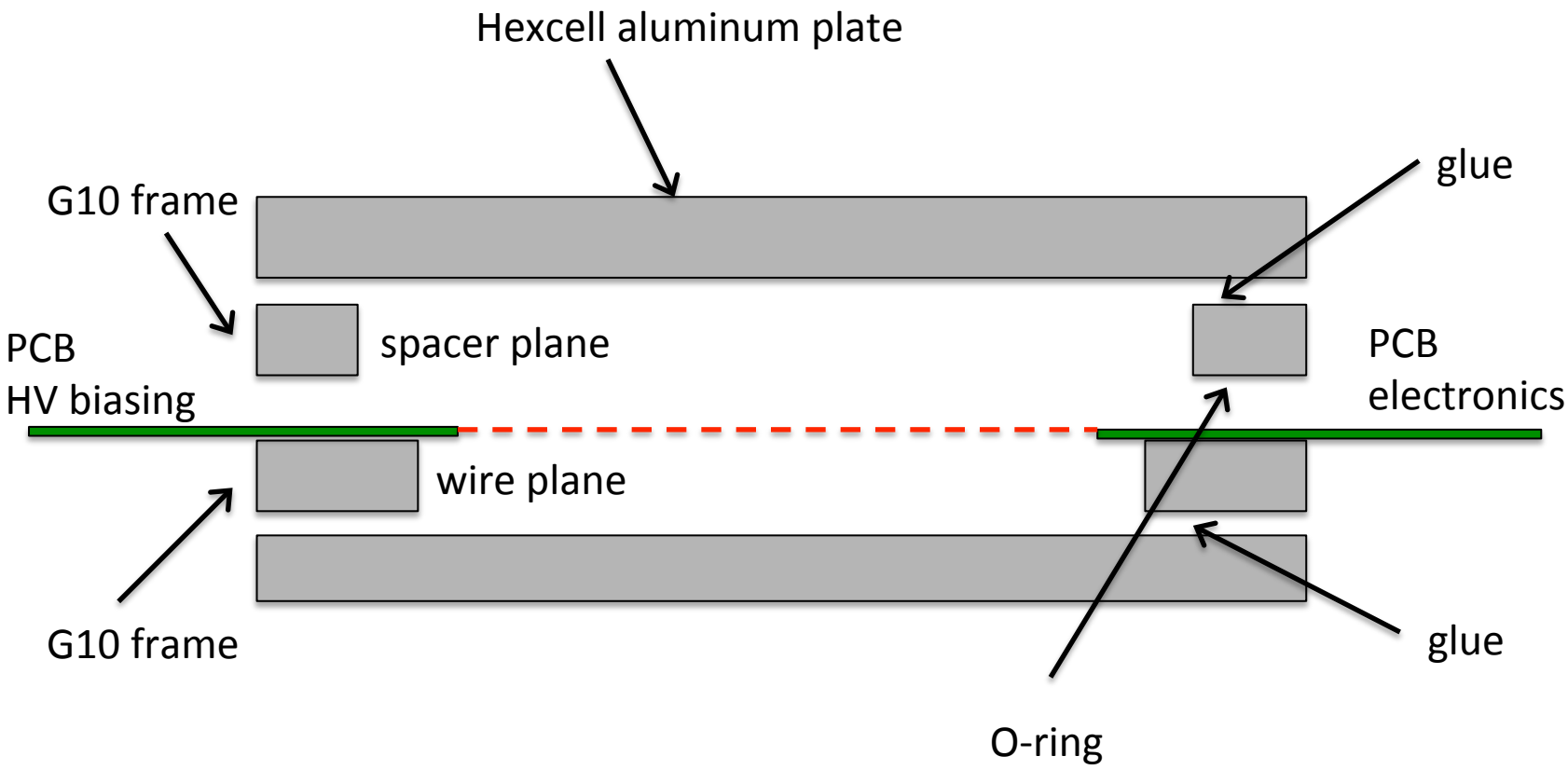






Chamber geometry




Hexcell aluminum plate
G10 frame
glue
PCB
HV biasing
spacer plane
PCB
electronics
wire plane
G10 frame
glue
O-ring

Short term projects 6/30/2017

Andrew: Data analysis, getting Scope-out running again (for all the students)

Nick: GEANT4 simulation, and help Andrew with Scope-out

Ike and Sahar: getting your detector ready (epoxy the HV bias board to the frame), “learning” Eagle CAD (Alexander is here Wednesday, and Bobby here late next week), start working on cosmic ray studies with NaI (scintillating crystal) and photo-multiplier tube, working with a scope, then helping me in the clean room with the large detector.

Rory: fixed the bad wire and detector sustains 1500 V. Painting in the detector with epoxy paint for gas sealing.