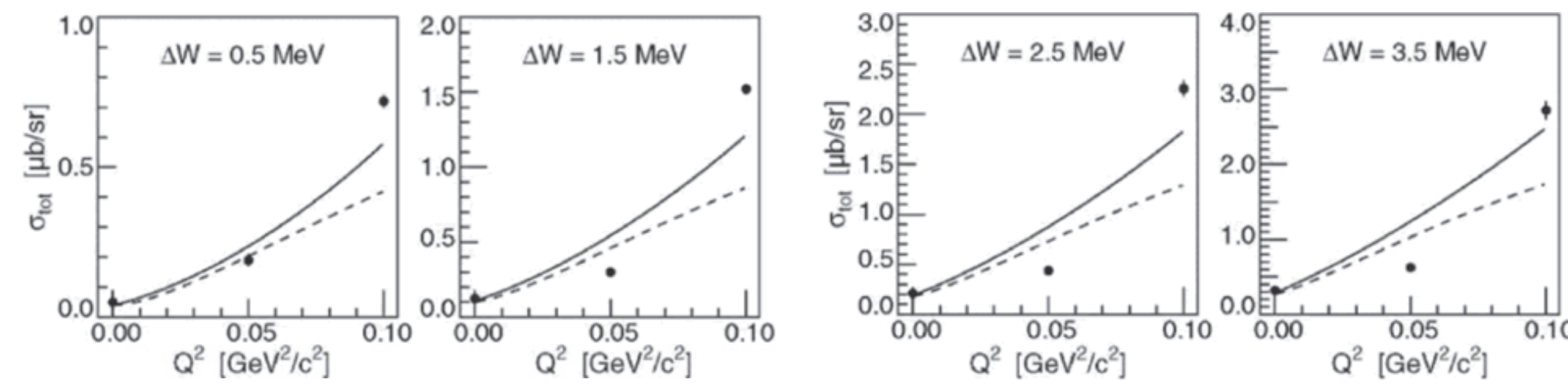


Precision Measurement of the Electroproduction of π^0 near Threshold

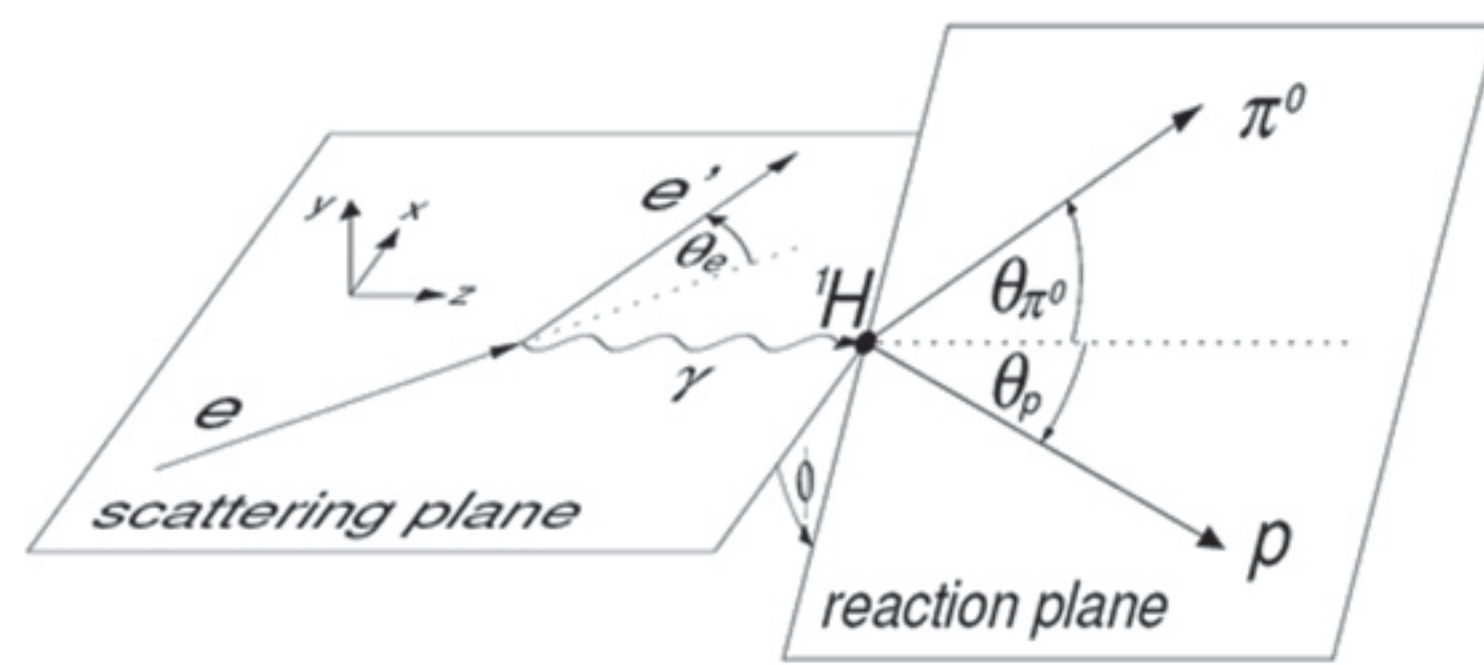
Motivation

Experiment E04-007, in Hall A at Jefferson Lab, is a high precision measurement of the reaction $H(e,e')\pi^0$ from the threshold to 20MeV above, and Q^2 values between 0.05 $(\text{GeV}/c)^2$ and 0.15 $(\text{GeV}/c)^2$. Threshold measurement of electroproduction of neutral pion off the proton at low Q^2 is to test the Chiral Perturbation Theory (ChPT), as earlier measurements showed disagreements with ChPT predictions (shown below).



Solid lines: ChPT predictions; Dashed Lines: MAID; Data points: MAINZ

Obtaining the total cross section involves the determination of the structure functions, $\sigma_T + \varepsilon_T \sigma_{TT}$, σ_{TL} , and σ_{TT} for which the out of plane ϕ dependence of the cross sections will be used (see the lab coordinates scheme below)



The desired "five-fold" cross section is related to the mentioned structure functions through

$$\frac{d\sigma_v}{d\Omega_\pi^*} = \frac{d\sigma_T}{d\Omega_\pi^*} + \varepsilon_L \frac{d\sigma_L}{d\Omega_\pi^*} + \left[2\varepsilon_L(1+\varepsilon) \right]^{1/2} \frac{d\sigma_{TL}}{d\Omega_\pi^*} \cos\phi + \varepsilon \frac{d\sigma_{TT}}{d\Omega_\pi^*} \cos 2\phi$$

Which appears in the cross section as

$$\frac{d\sigma}{d\Omega_e d\Omega_\pi^* dE'} = \Gamma \frac{d\sigma_v}{d\Omega_\pi^*}$$

where

$$\Gamma = \frac{\alpha E' k_\gamma}{2\pi^2 E Q^2 (1-\varepsilon)}$$

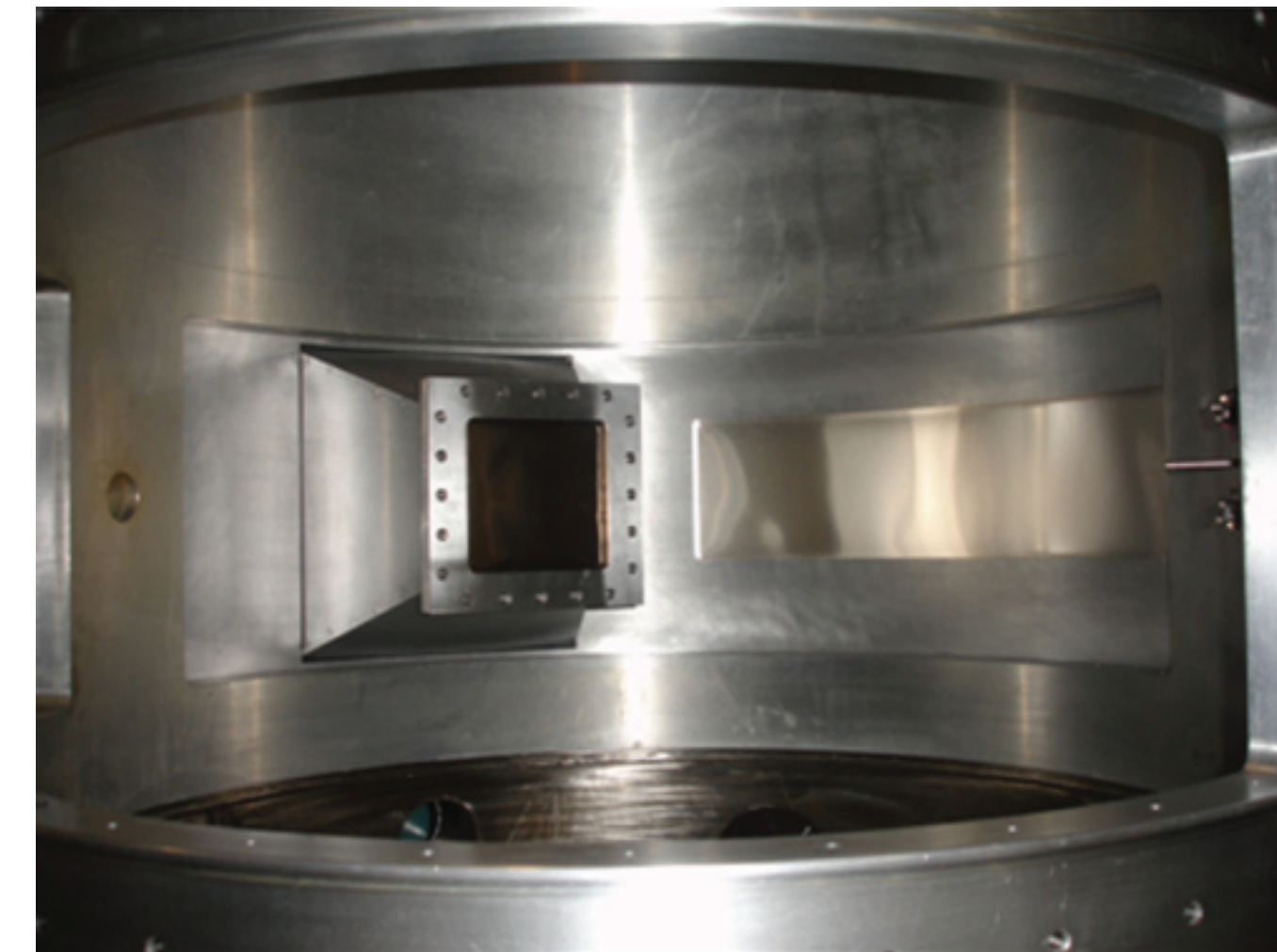
Layout:

- LHRS defines $Q^2, \Delta W$
- RHRS was used as luminosity monitor
- BigBite detects low momentum protons

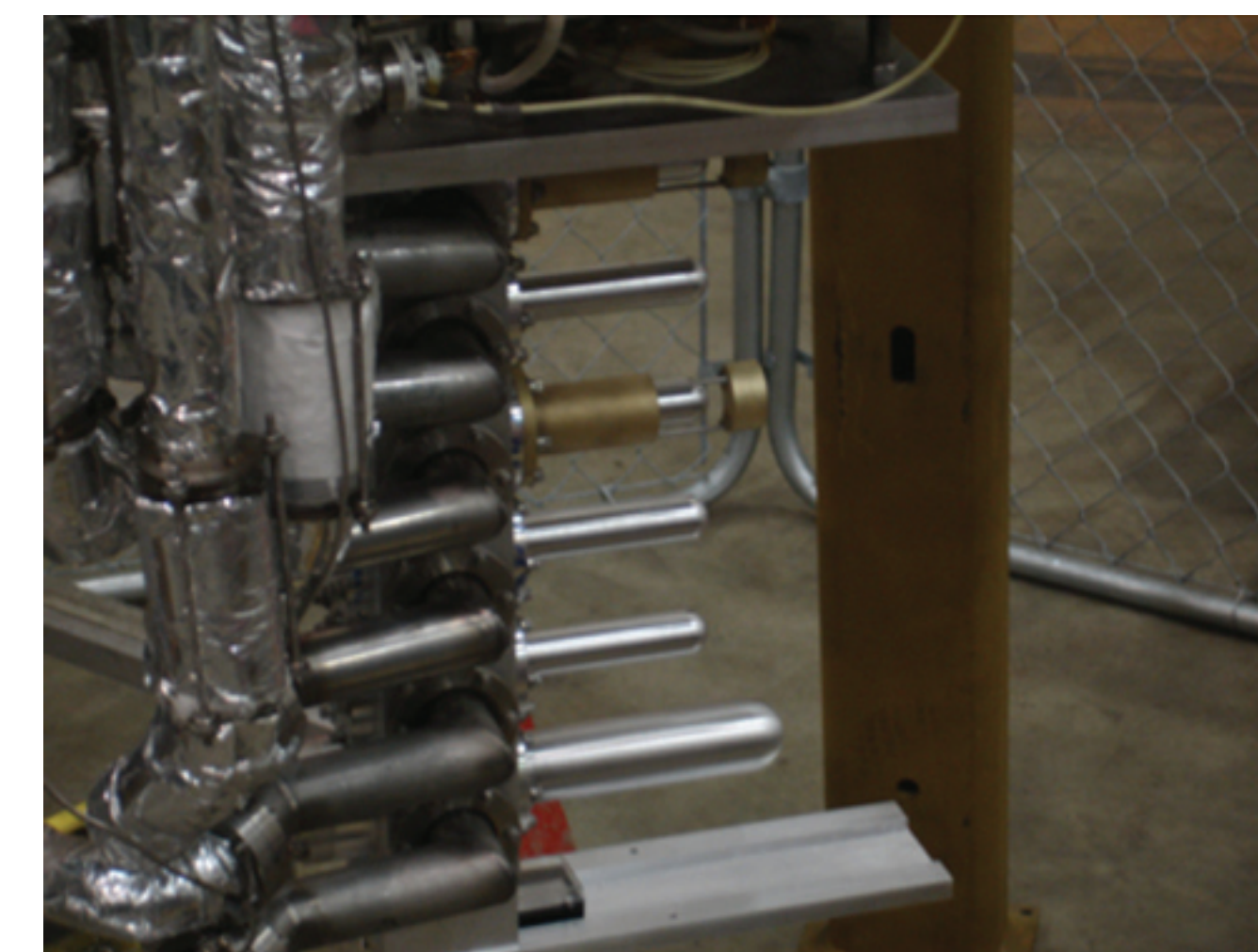
Mitra Shabestari
for E04-007 collaboration
University of Virginia

Experiment

Target:



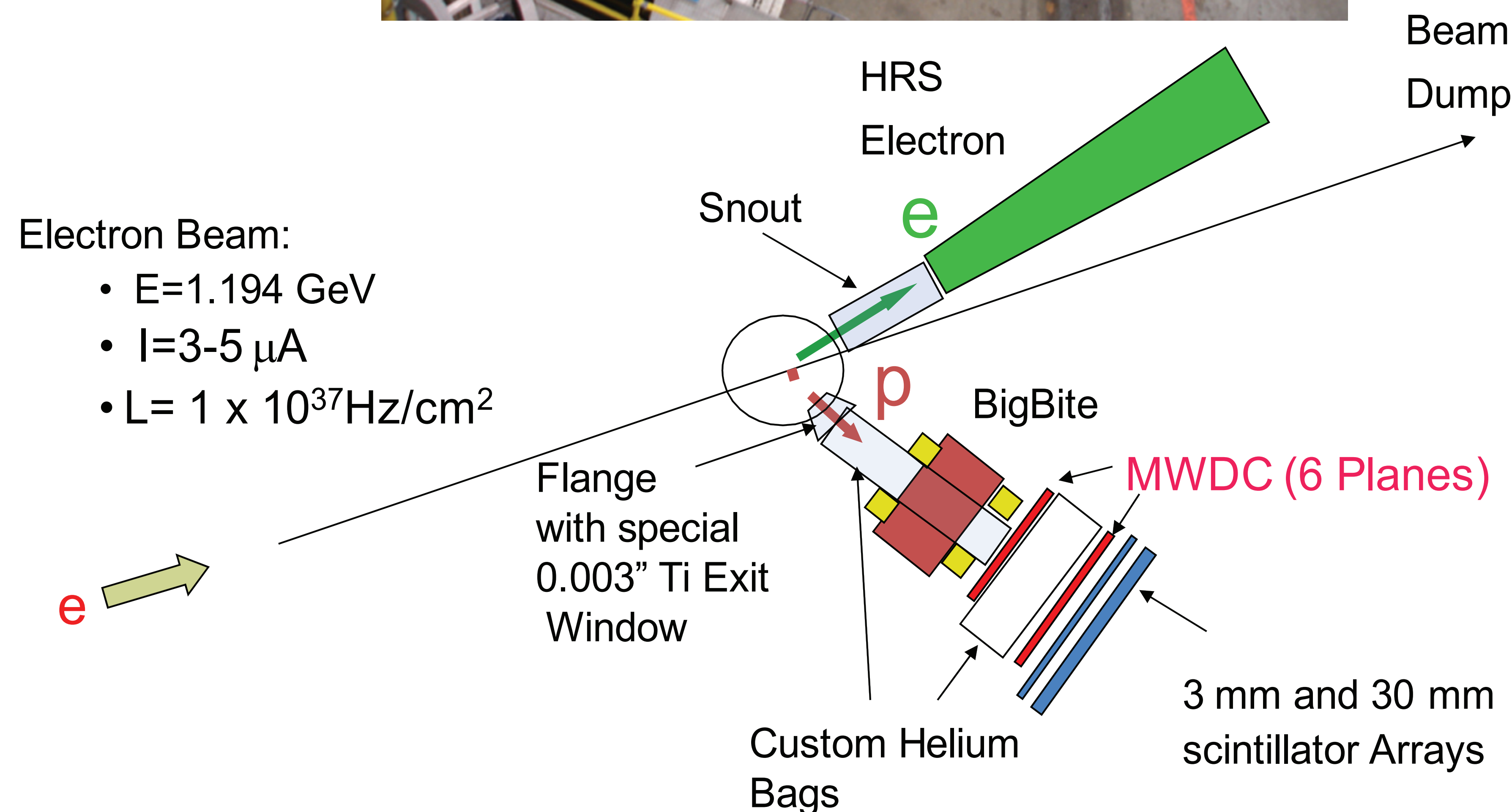
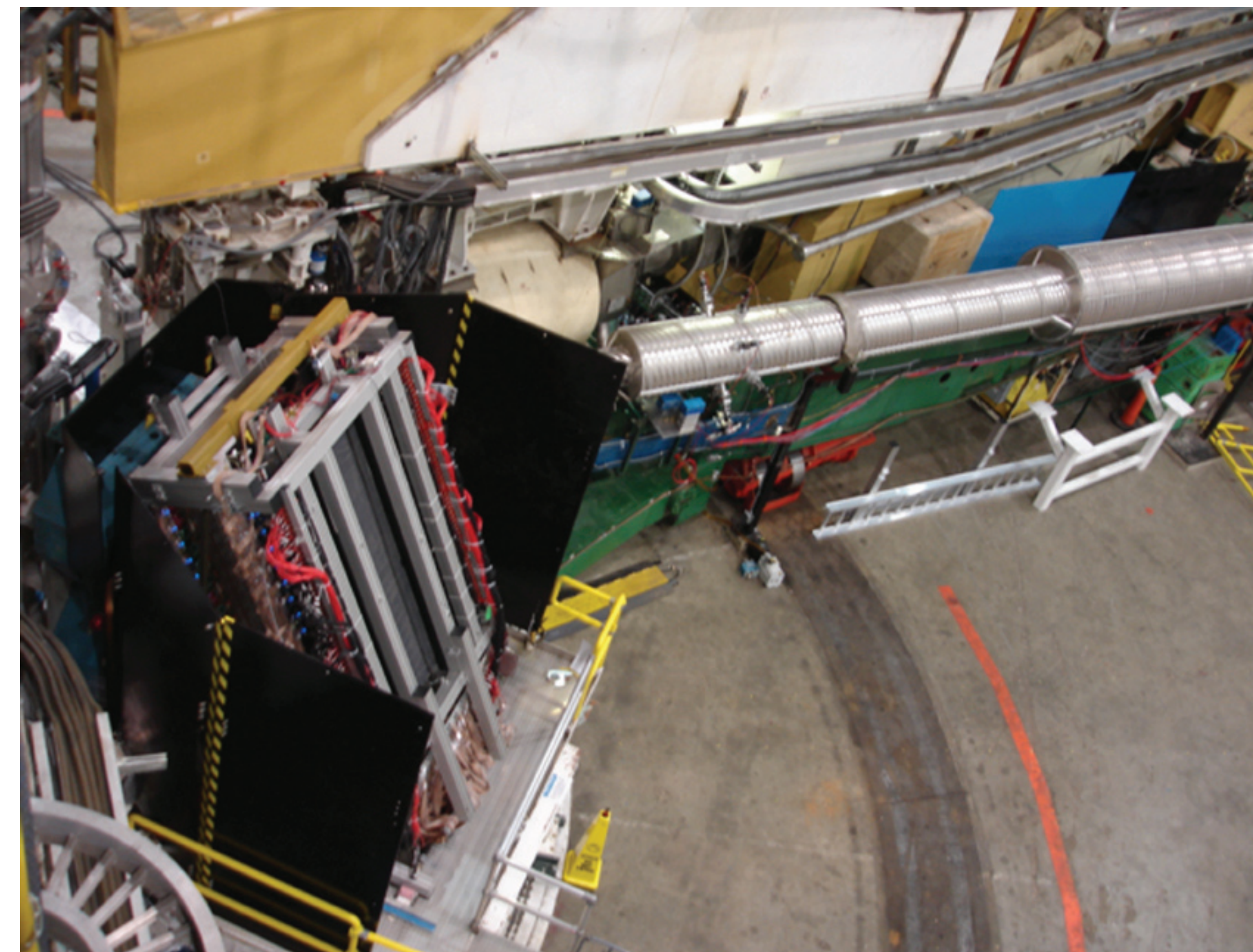
Special flange with 0.003" Ti window



1 inch diameter, 6 cm LH2 cell

BigBite Spectrometer:

- Steel Shield Walls
- 1 Tesla Dipole
- Hadron Detector Package

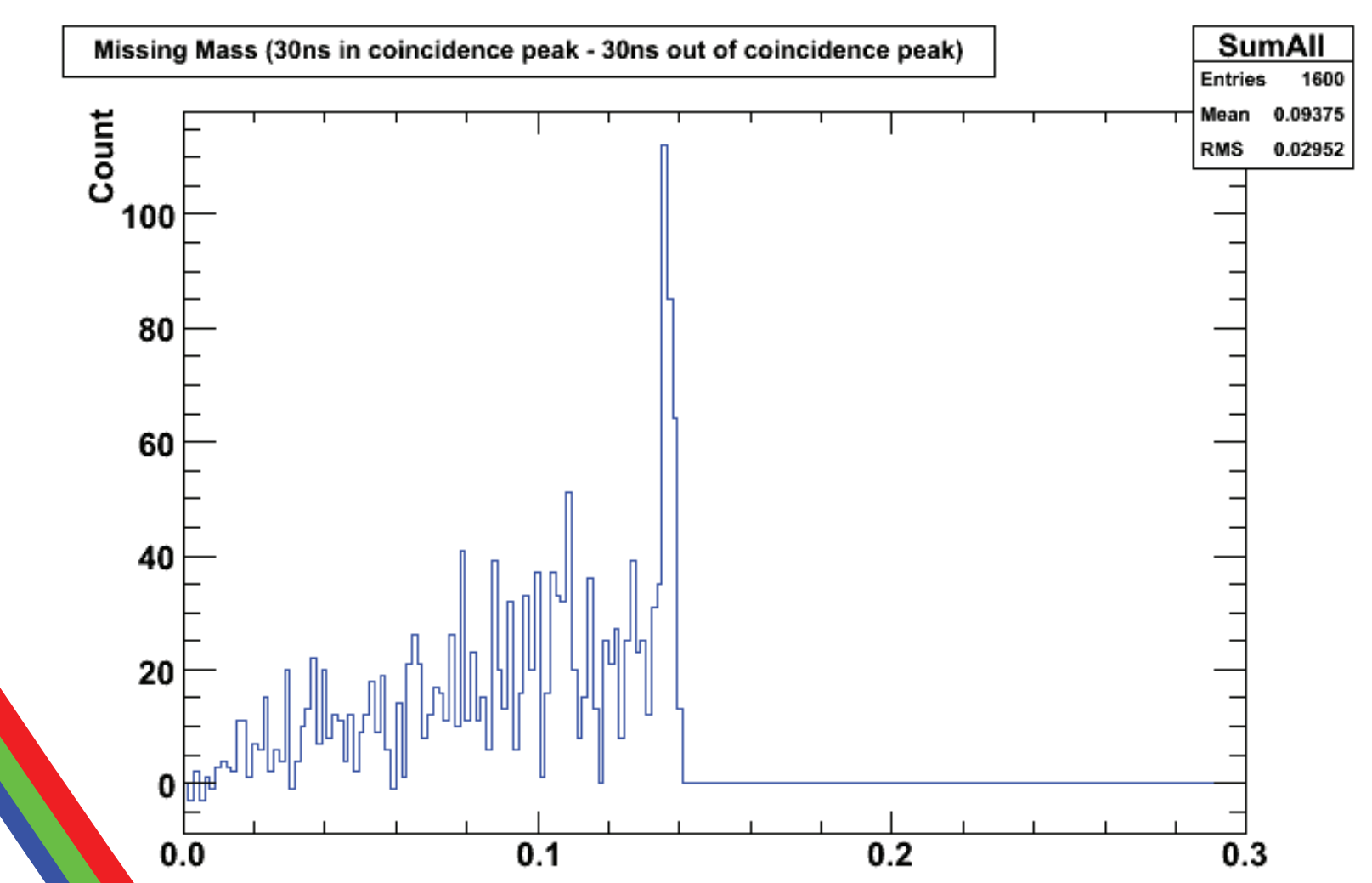
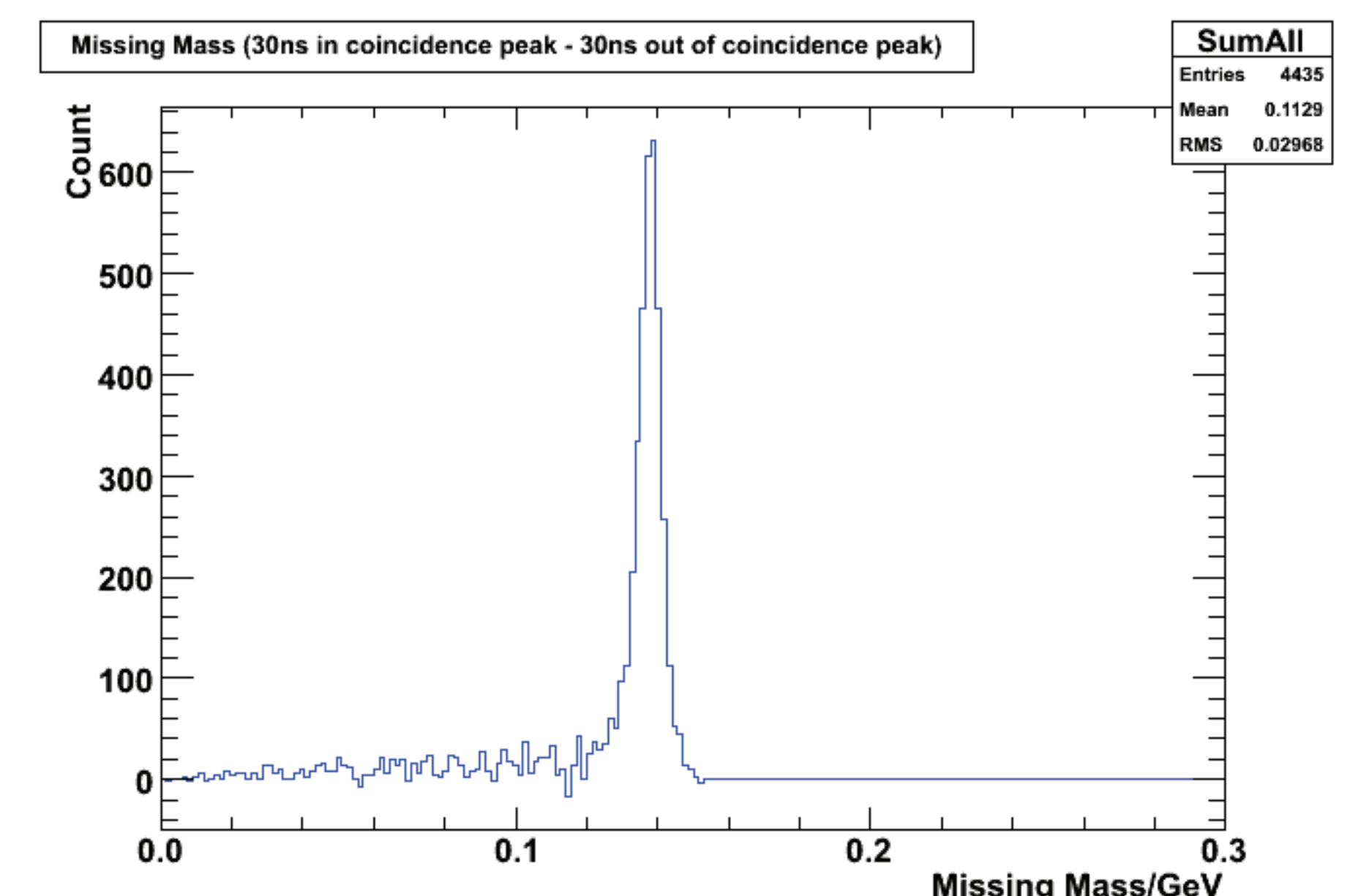
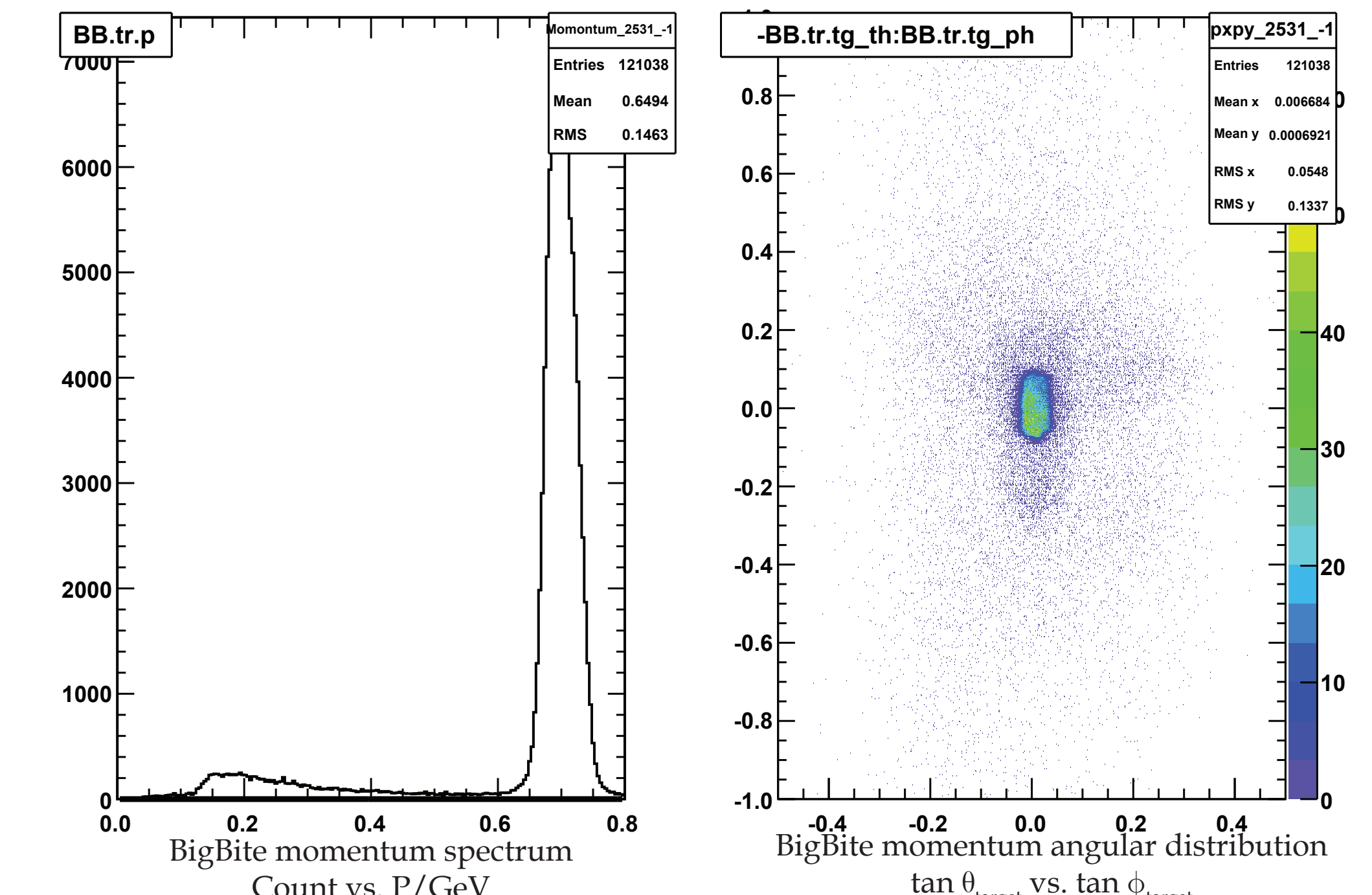


Electron Beam:

- $E=1.194 \text{ GeV}$
- $I=3-5 \mu\text{A}$
- $L= 1 \times 10^{37} \text{ Hz/cm}^2$

Results

We are in the detector calibration phase of data analysis; therefore, results shown below are very preliminary.



π^0 missing mass for

- 1070 MeV $< W < 1080$ MeV
- 1080 MeV $< W < 1090$ MeV

