



Studies on Photon-Proton Cross Sections at HERA

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ZEUS



Outline

- Total cross section
- ZEUS
- My work – rho meson
- Acceptance
- Overlaps
- Results and Summary

Total cross section - σ_{tot}

- **Goal:**

measure the photon-proton cross section, σ_{tot} .

- **Motivation:**

- strong interactions
(test\develop QCD calculations)
- better understanding of future colliders physics
(for example LHC)

Total cross section - σ_{tot}

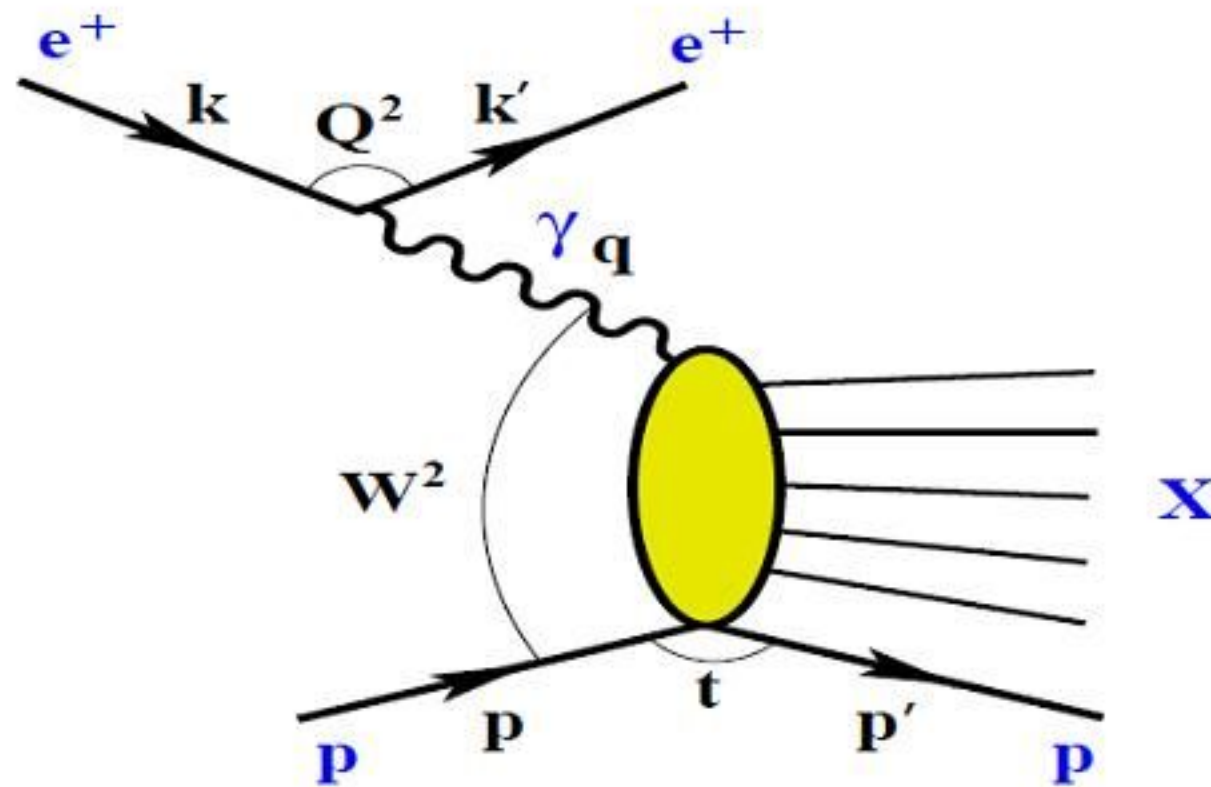
- Basic process - PhotoProduction:

$$ep \rightarrow eX, \text{ low } Q^2$$

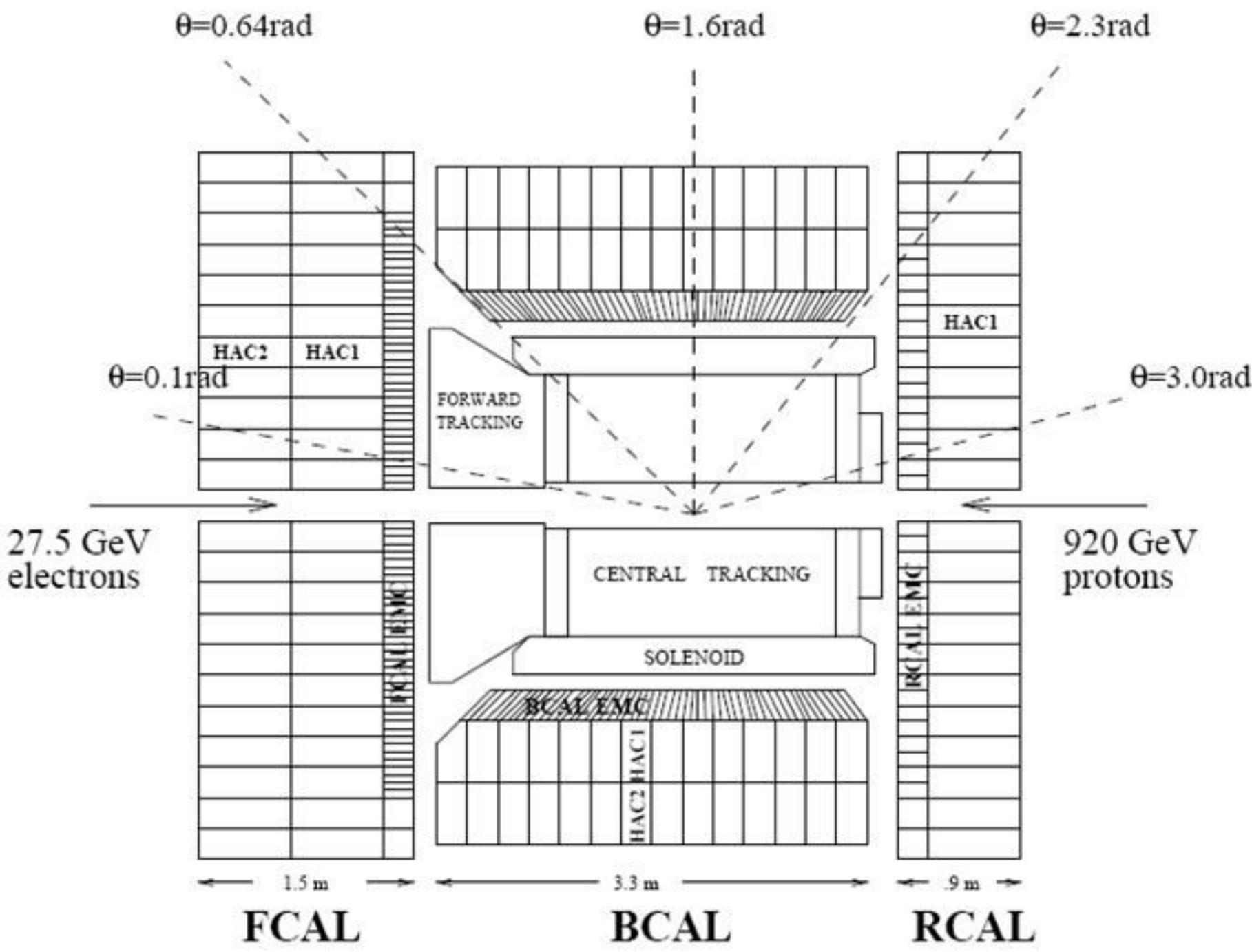
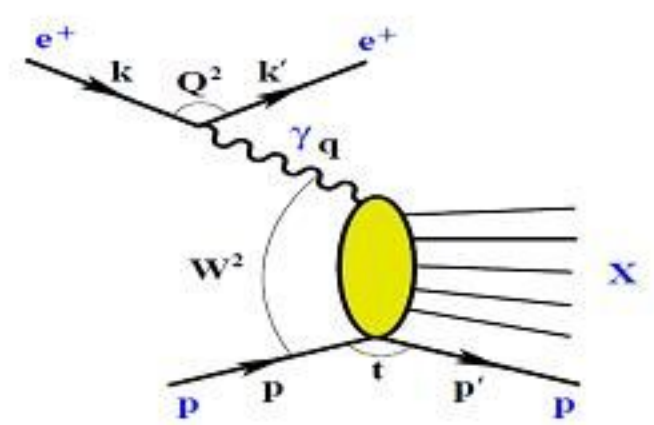
(meaning γ^* almost real)

PhotoProduction

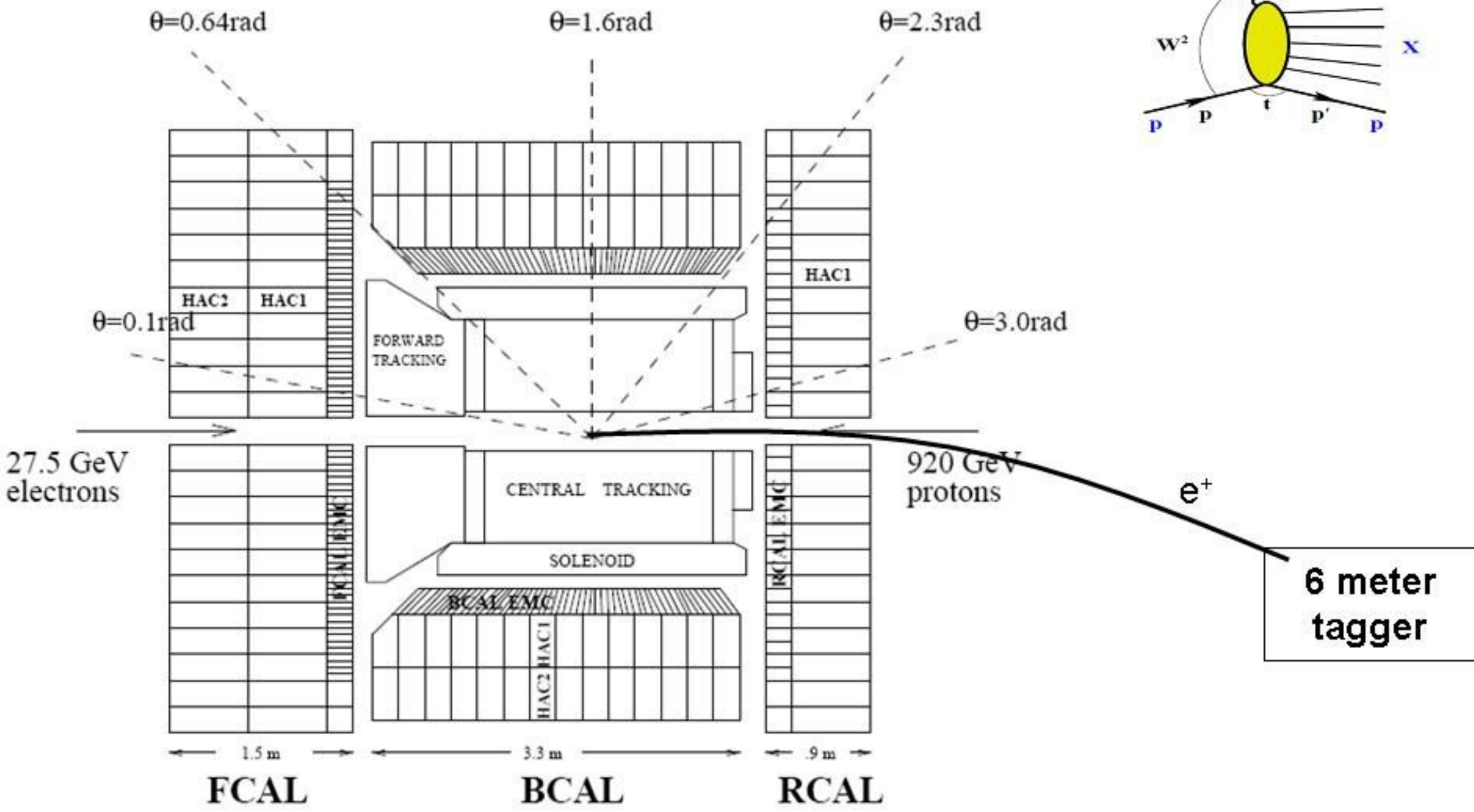
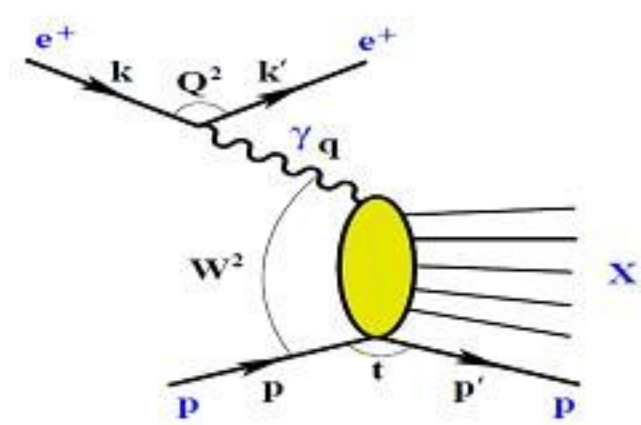
$Q^2 \rightarrow 0$



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Total cross section - σ_{tot}

$$ep \rightarrow eX, \text{ low } Q^2$$

(meaning γ^* almost real)

- Measure σ^{ep}
- Use the Weizsäcker-Williams approximation to extract $\sigma_{\text{tot}}(\gamma p)$ from σ^{ep}

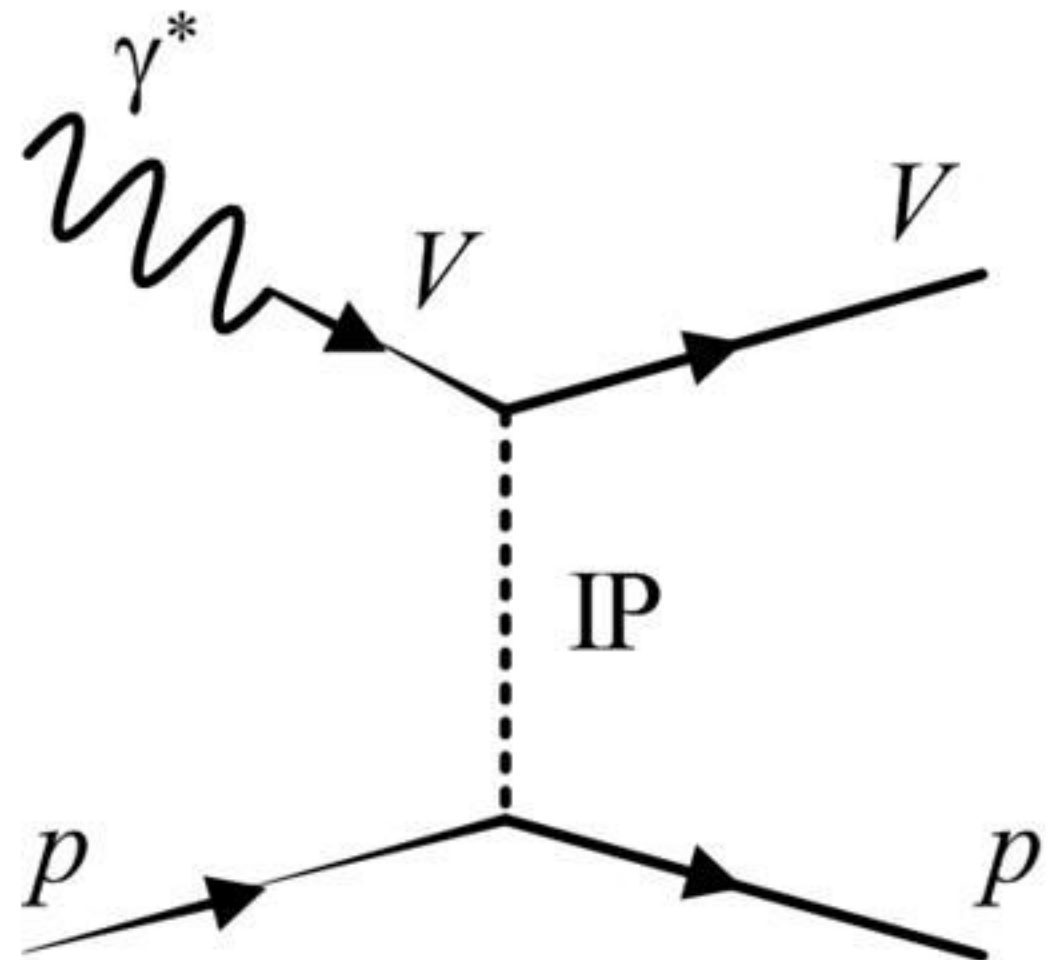
Contributions to total cross section

- Processes:
 - Diffractive
 - Resolved photon
 - Direct photon

Contributions to total cross section

- Processes:

- Diffractive →



My work – rho meson

- $\rho^0(770)$

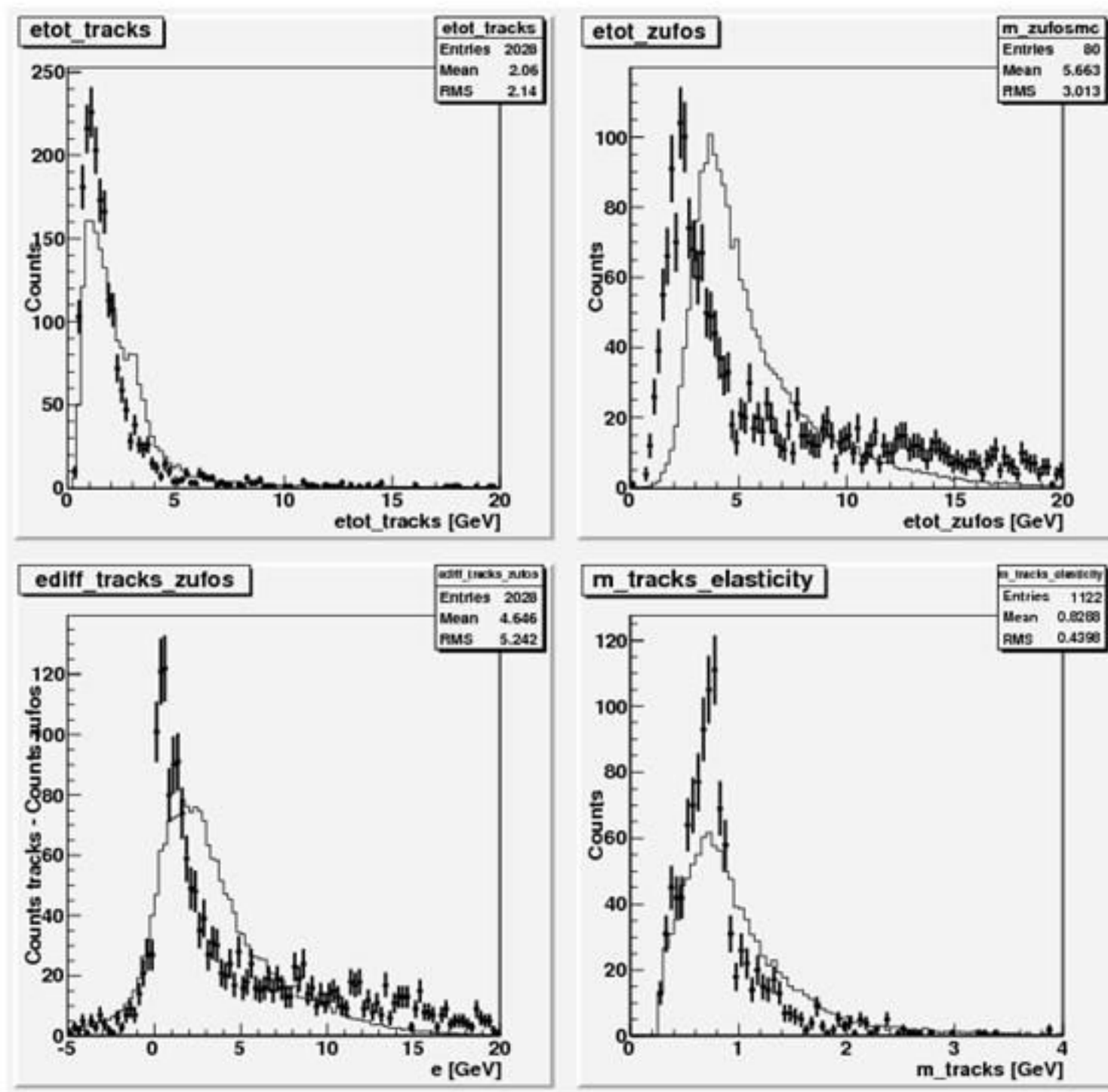
– Mass: 775.49 MeV
 (± 0.34)

– Decay process: $\rho^0 \rightarrow \pi^+ \pi^-$

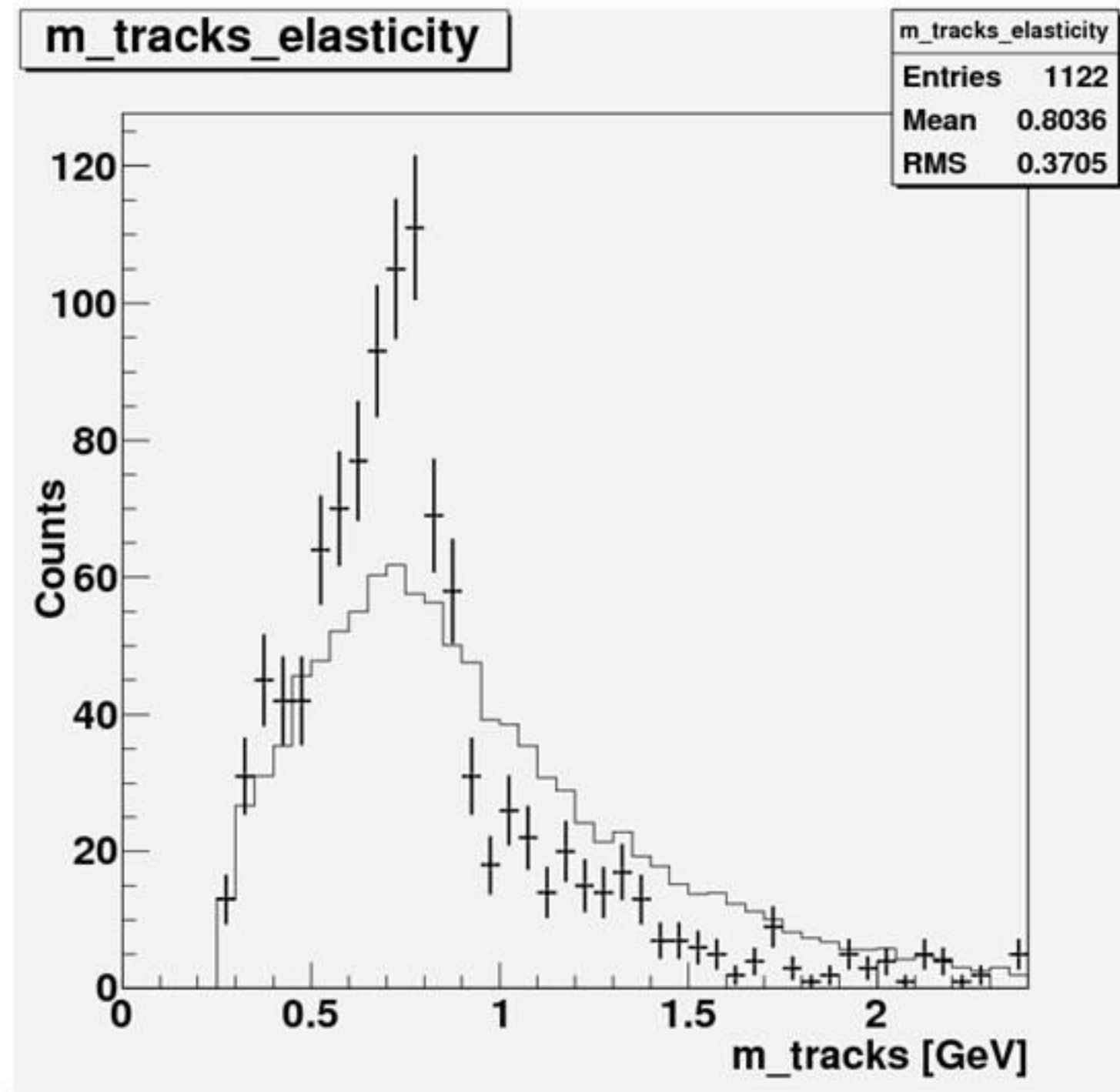
My work – rho meson

- ways to find the rho meson:
 - Tracking
 - Zufo's
(optimized combination of tracking and calorimetry)

My work – rho meson

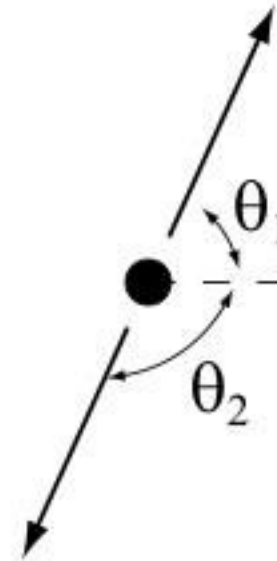
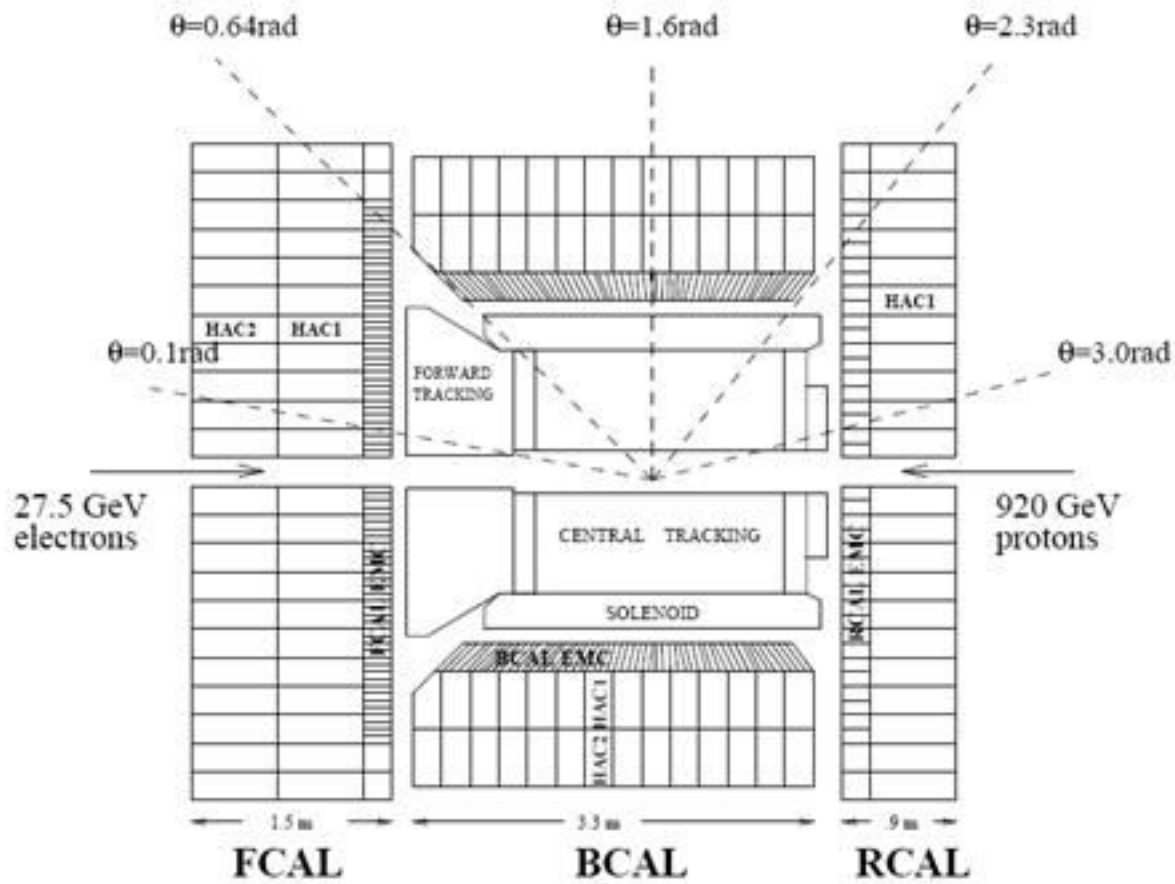


My work – rho meson

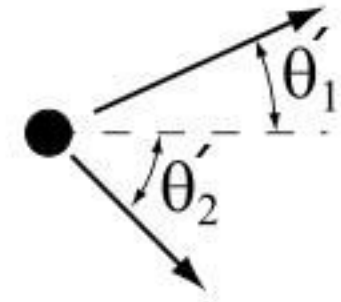
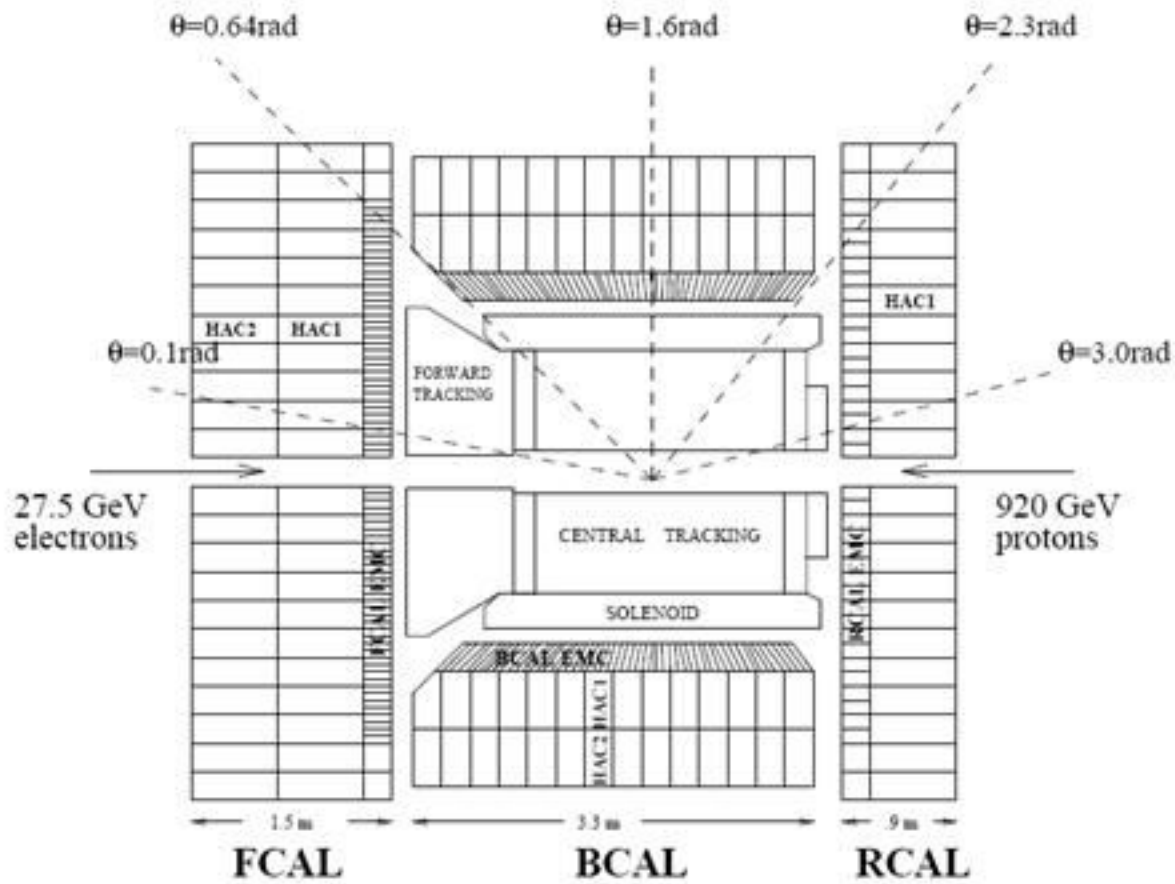


Acceptance

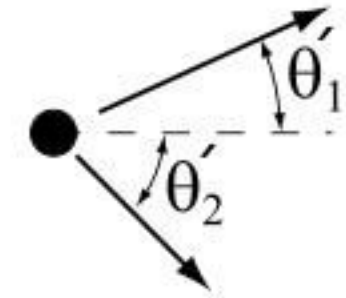
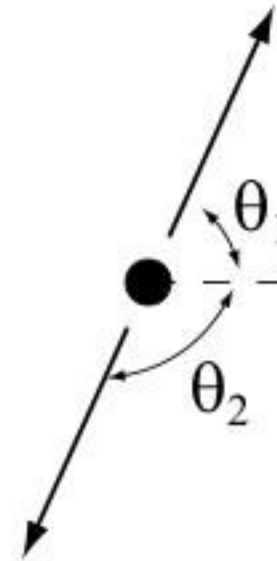
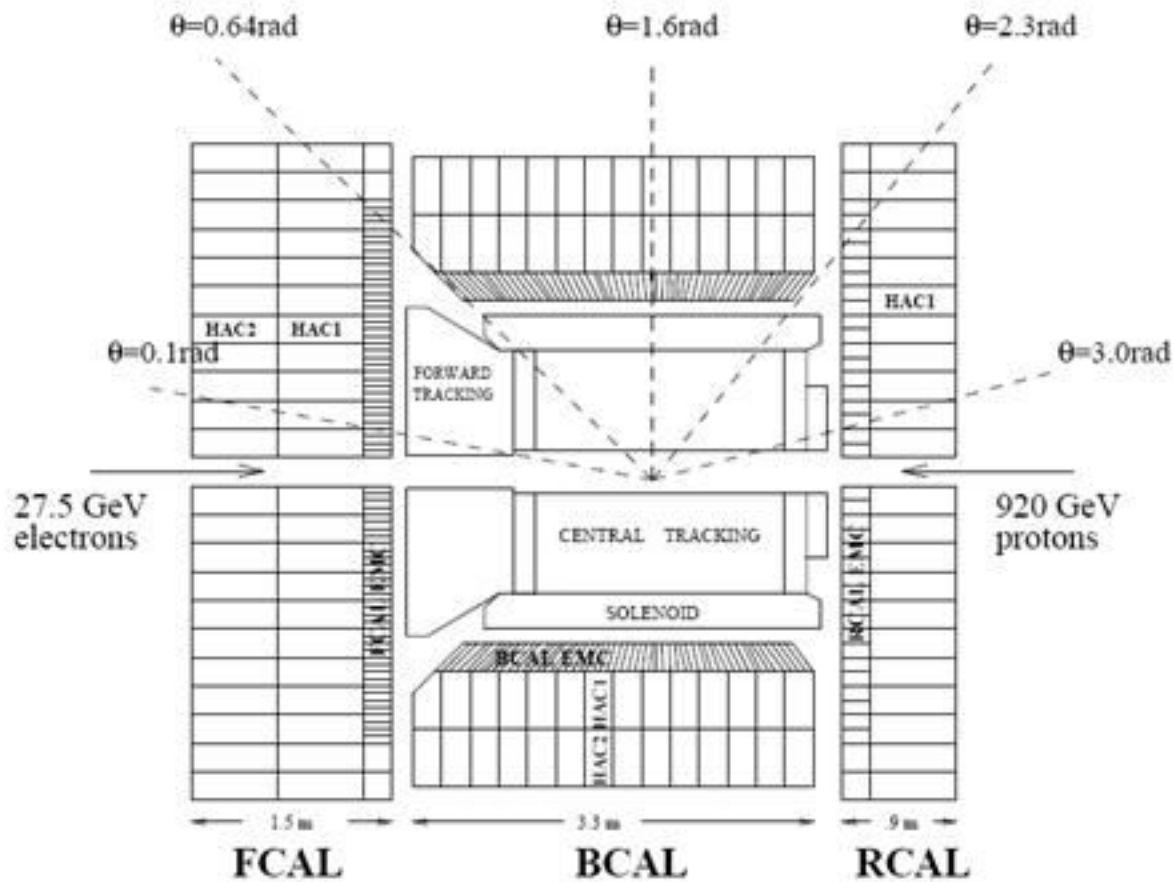
Acceptance



Acceptance

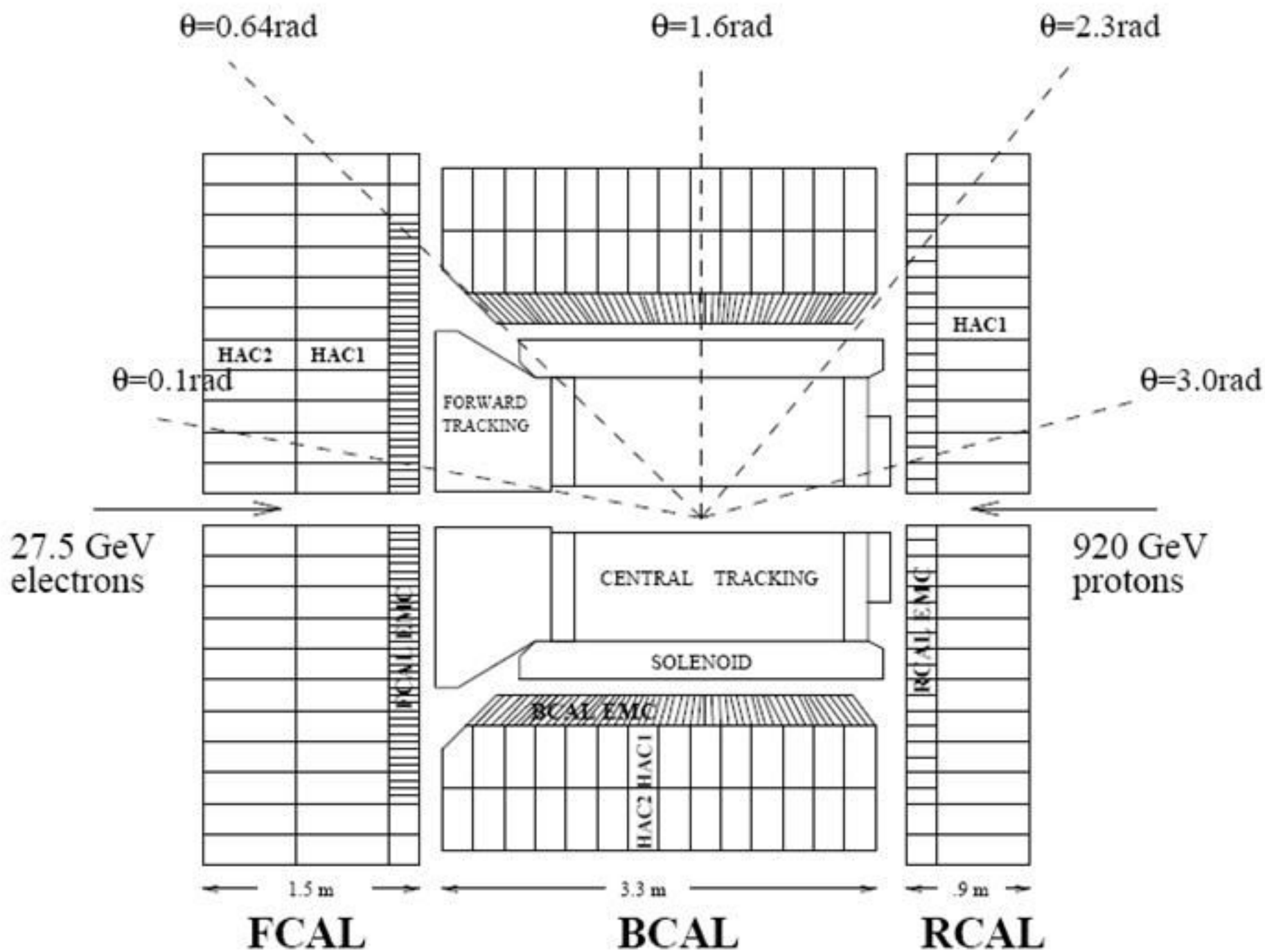


Acceptance

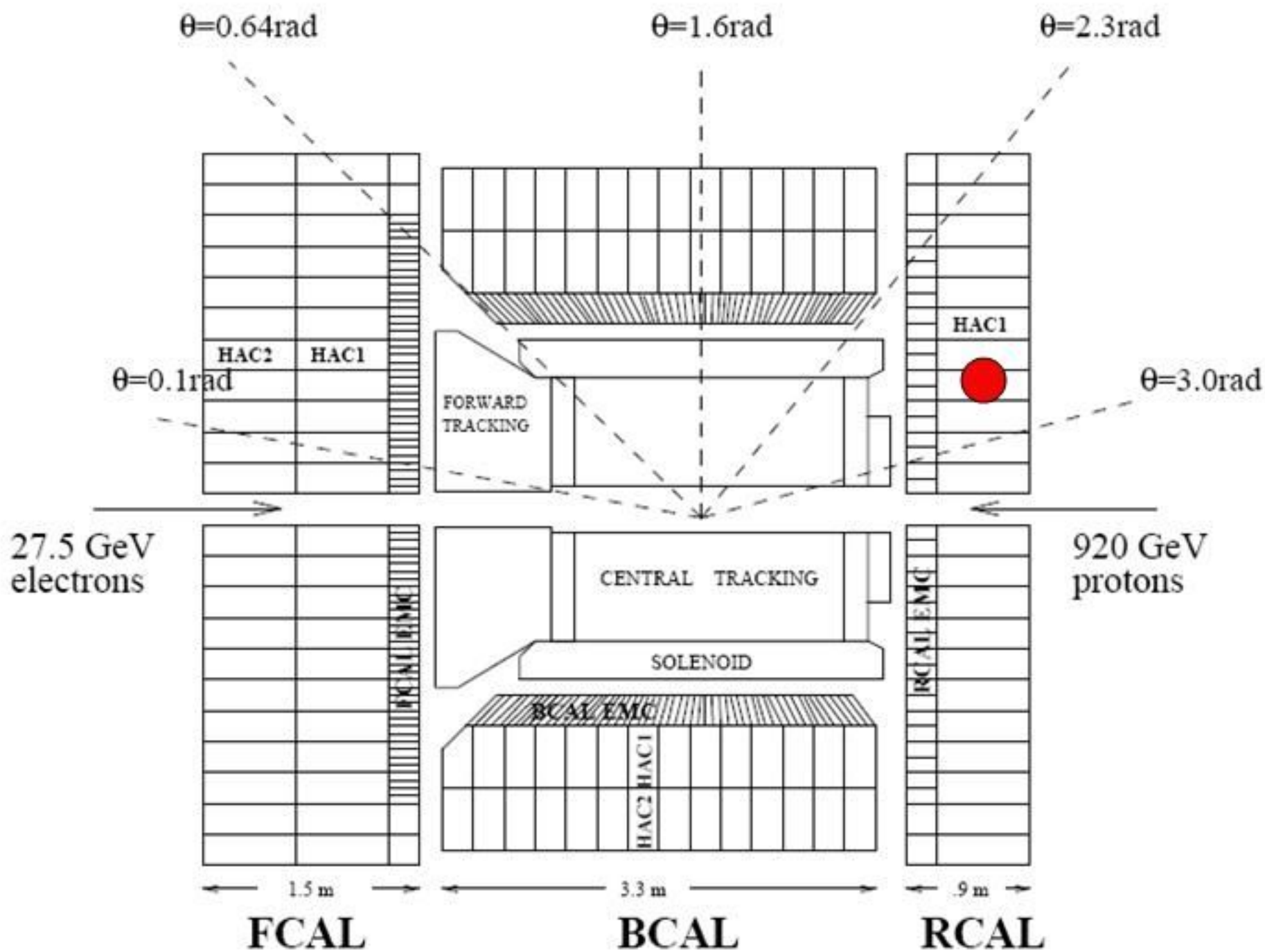


$$\tan \theta' = \frac{\sin \theta}{\gamma \cos \theta + \gamma \beta \frac{1}{\sqrt{1 - \frac{4m_\pi^2}{m_\rho^2}}}}$$

Overlaps

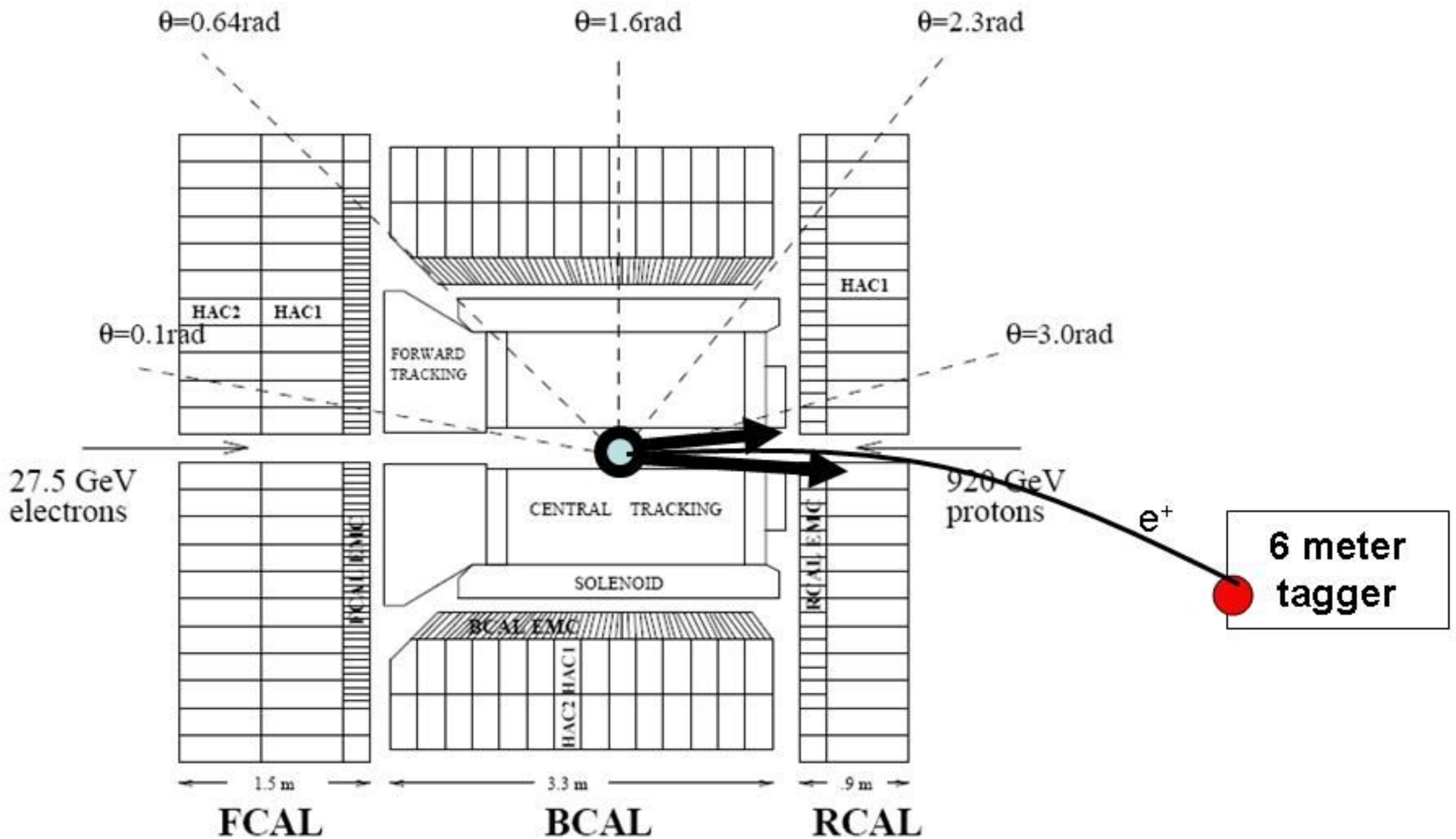


**6 meter
tagger**

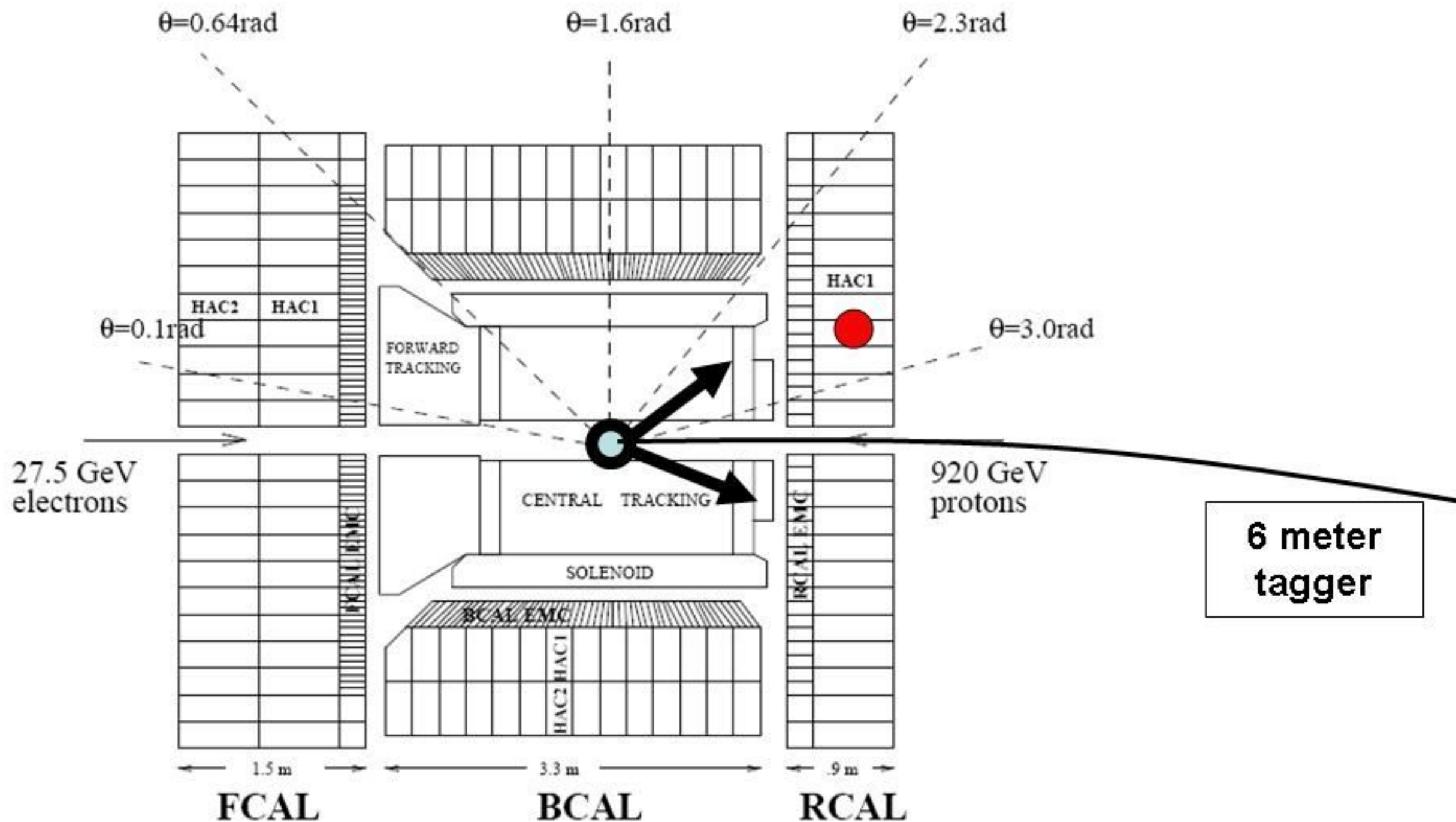


6 meter tagger

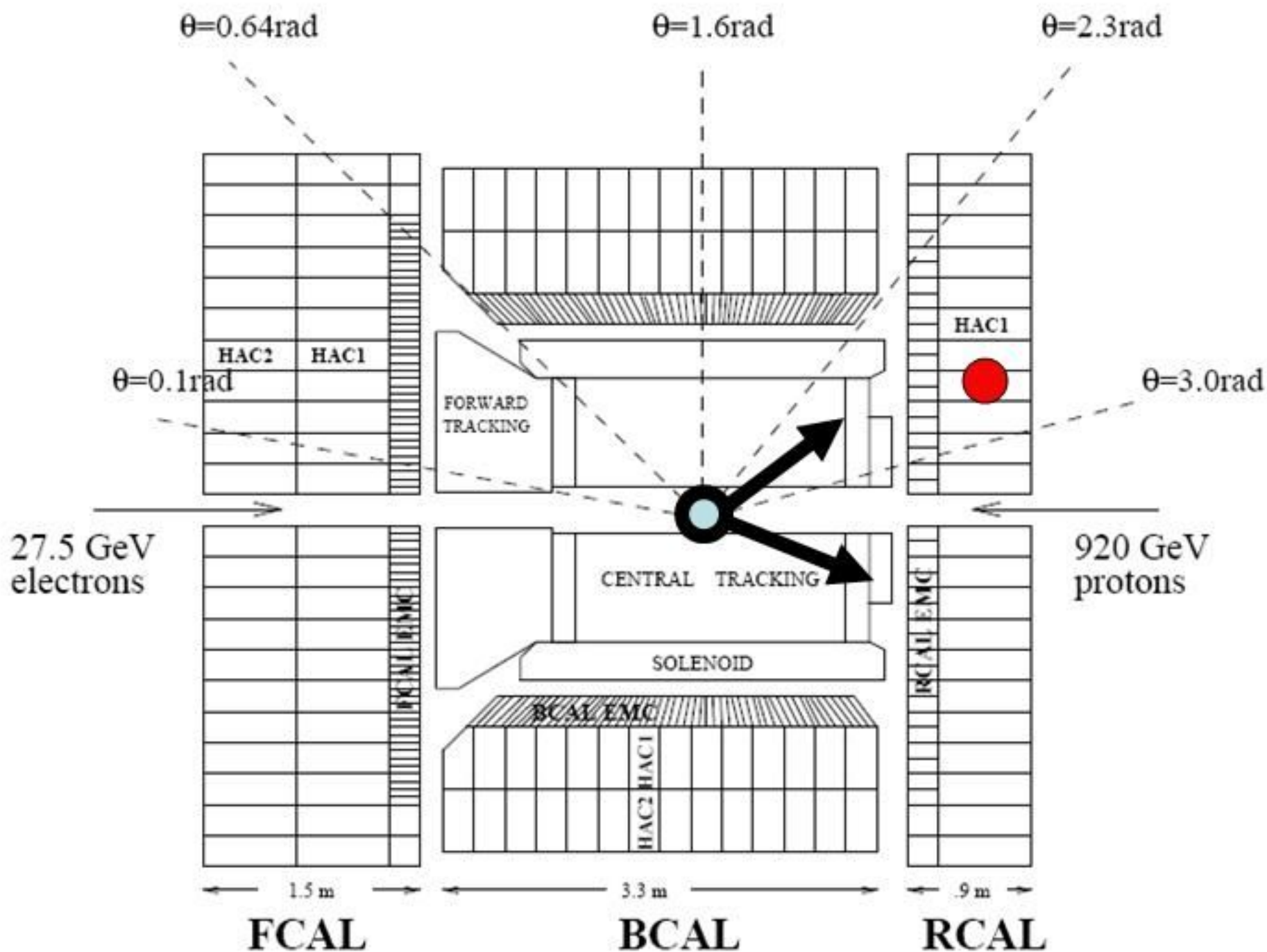
High W



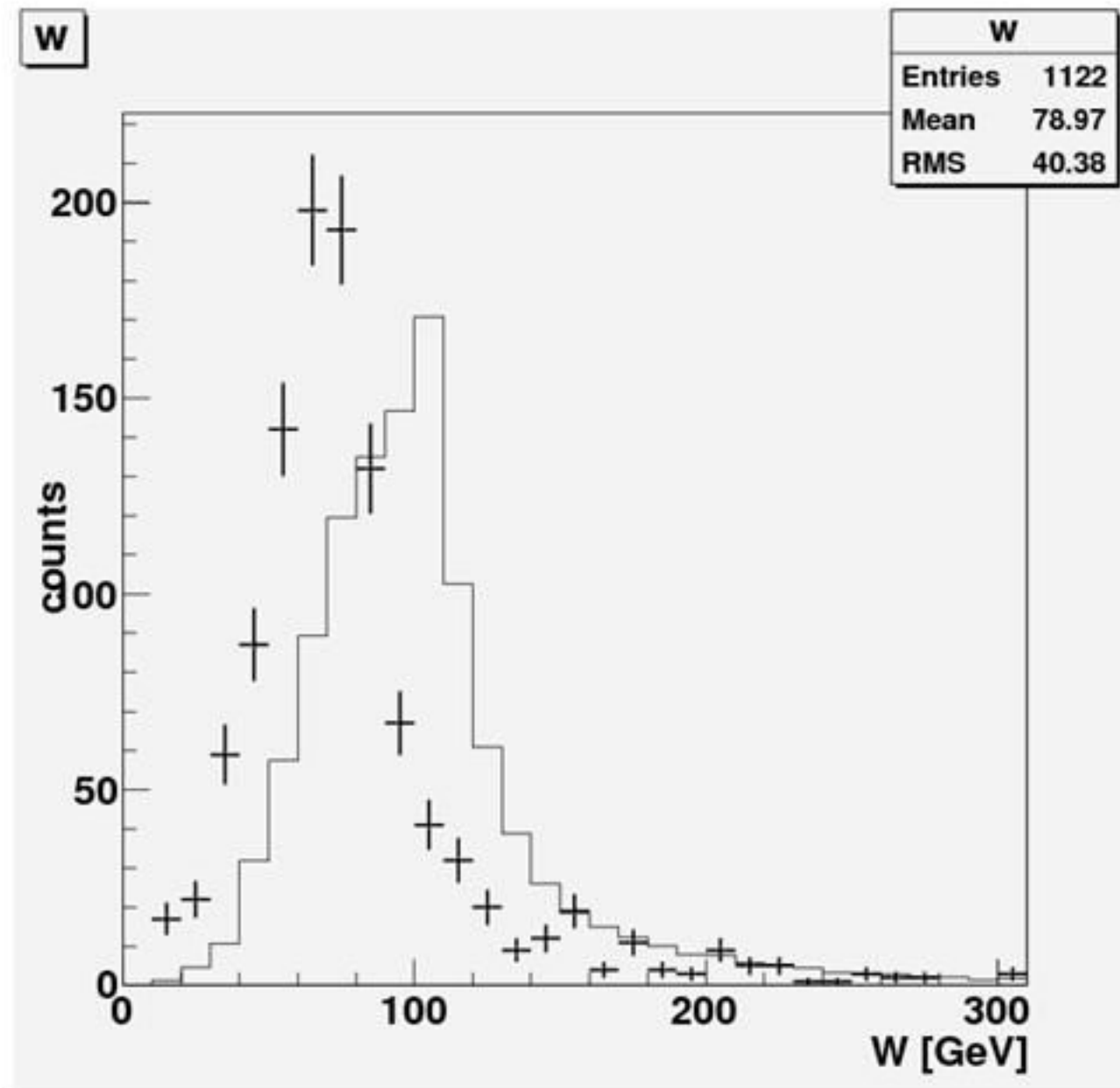
Low W



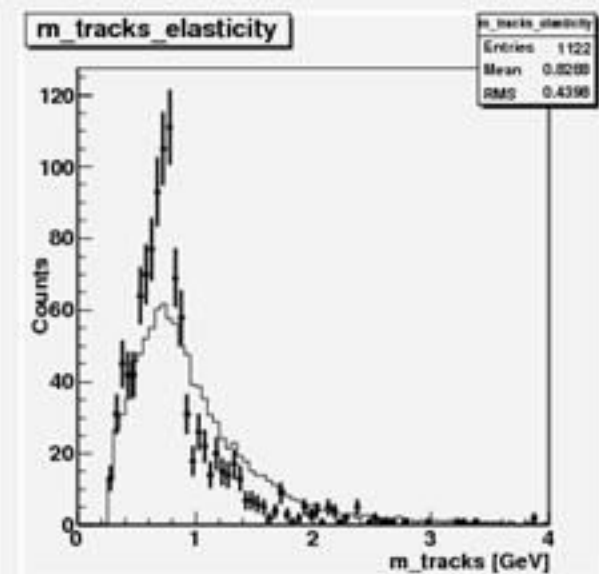
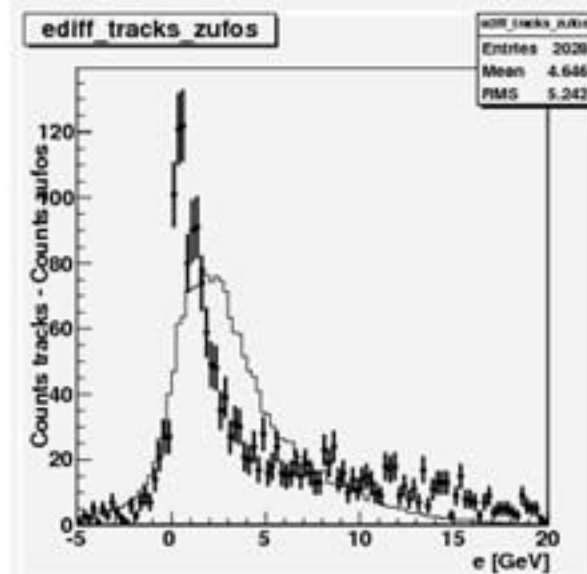
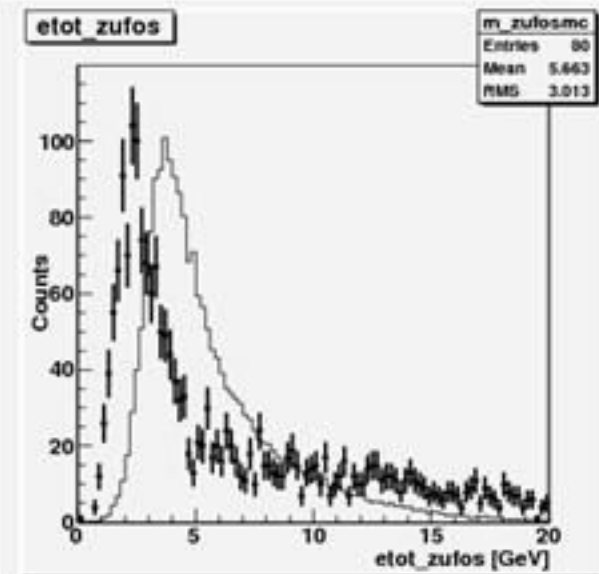
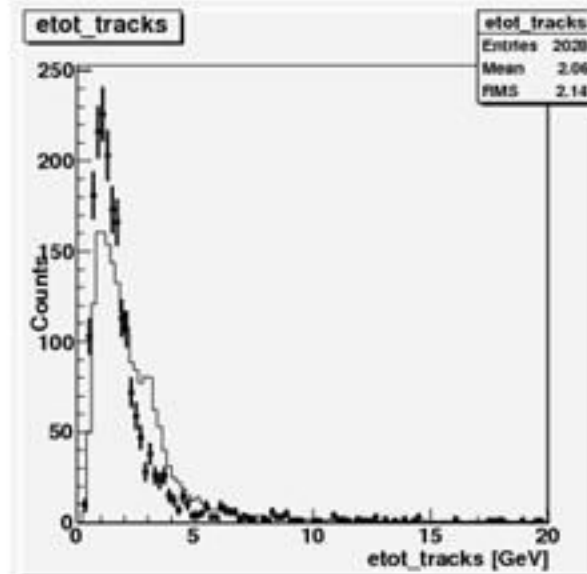
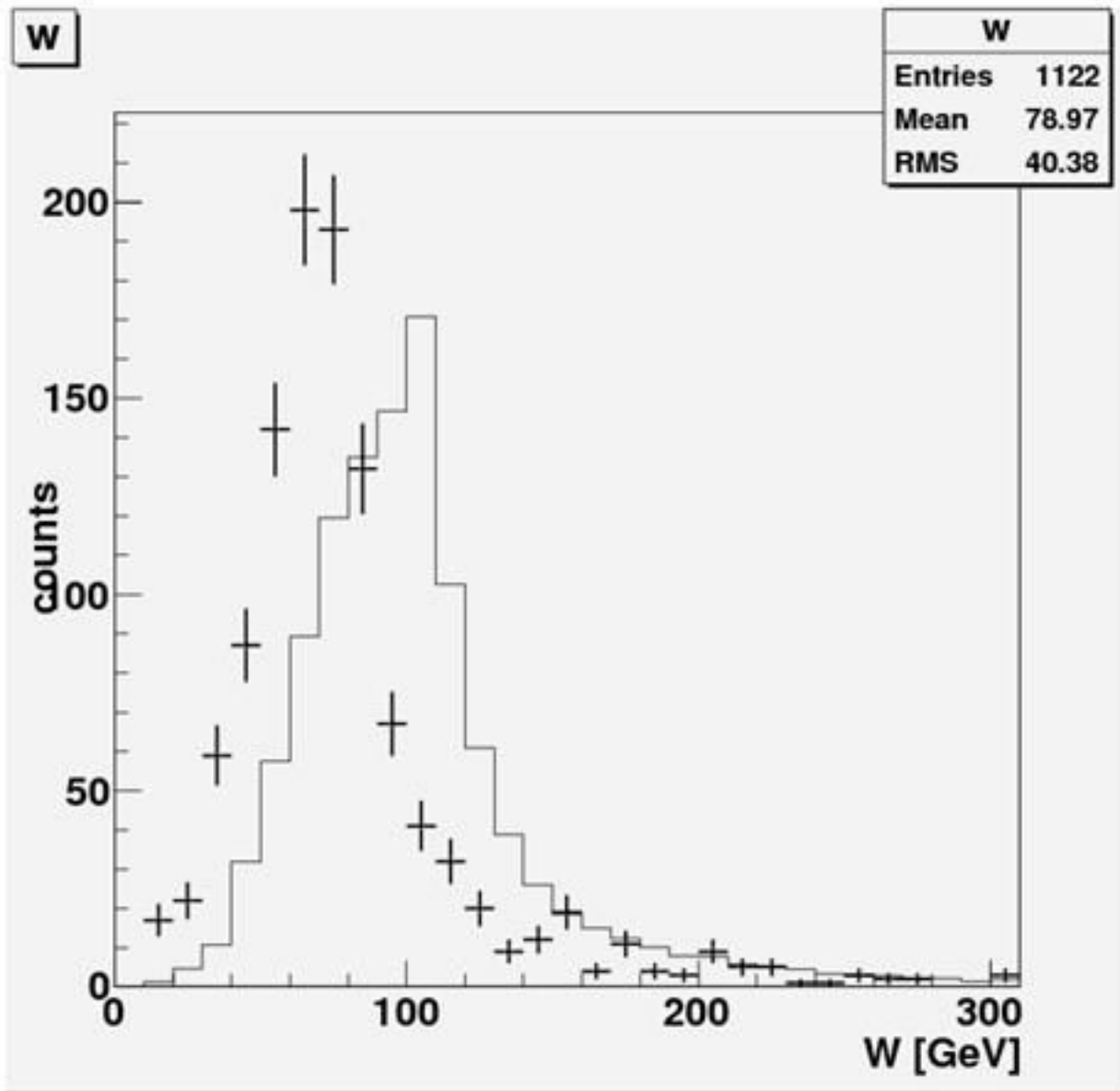
Low W + $ep \rightarrow e\gamma$



Low W + $ep \rightarrow ep$



Results



Summary

- Results
 - $\rho^0(770)$ can be seen in ZEUS ntuples.
 - The W region is limited, due to detector acceptance.
- Further analysis
 - Re-weight energy distributions to match data and mc.
 - extract the elastic contribution to σ_{tot} , and continue to next processes.



Thank you !

