



# Position Resolution of The ATLAS Endcap E. M. Calorimeter

Tayfun Ince  
University of Victoria  
Supervisor: Dr. Richard K. Keeler

## OUTLINE:

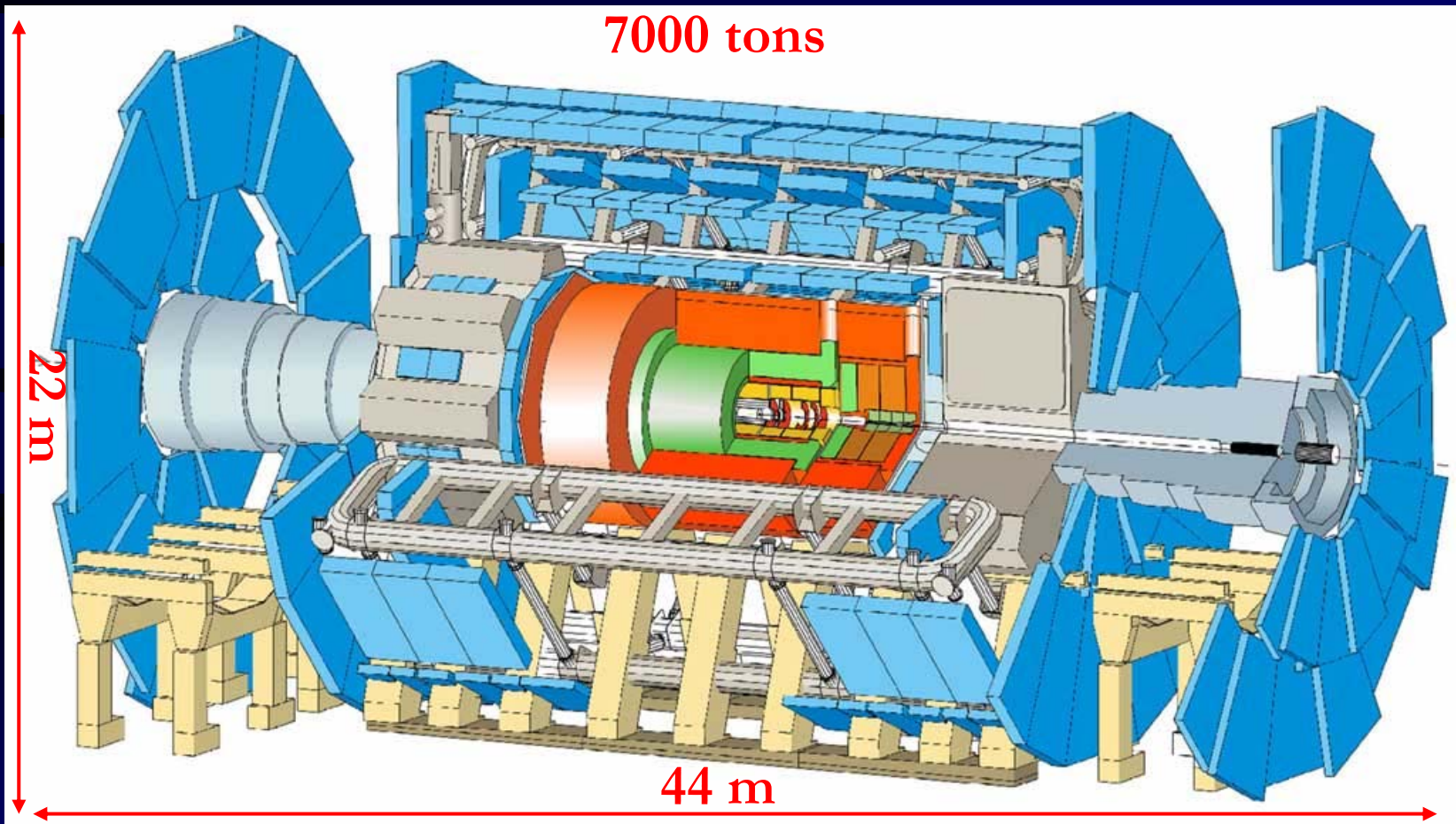
- ATLAS
- Endcap Calorimetry
- Testbeam Layout
- Data
- Analysis
- Preliminary Results
- Conclusions





# ATLAS (A Toroidal LHC ApparatuS)

- Largest collaborative effort ever attempted in the physical sciences
- p-p collisions at 14 TeV center of mass energy





# Endcap E.M. Calorimeter (EMEC)

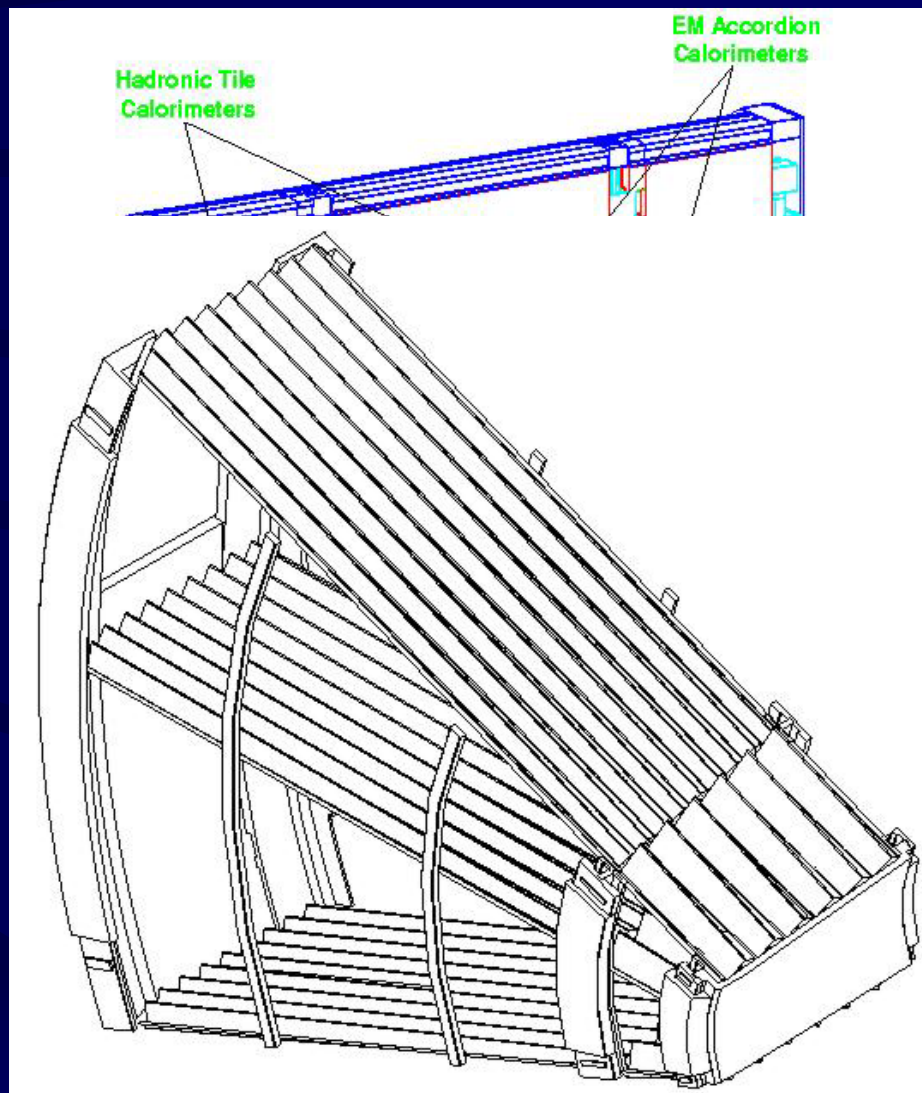
- Accordion design lead-liquid argon
- Pointing geometry
- Pseudo-rapidity  $1.375 \leq |\eta| \leq 3.2$
- Absorbers arranged radially
- Wave height and folding angle varies with radius
- Accordion waves run parallel to the beam axis

## Readout Structure:

- L1 :  $\delta\eta \times \delta\phi = 0.025/8 \times 0.1$
- L2 :  $\delta\eta \times \delta\phi = 0.025 \times 0.025$
- L3 :  $\delta\eta \times \delta\phi = 0.050 \times 0.025$

## Advantage of Accordion:

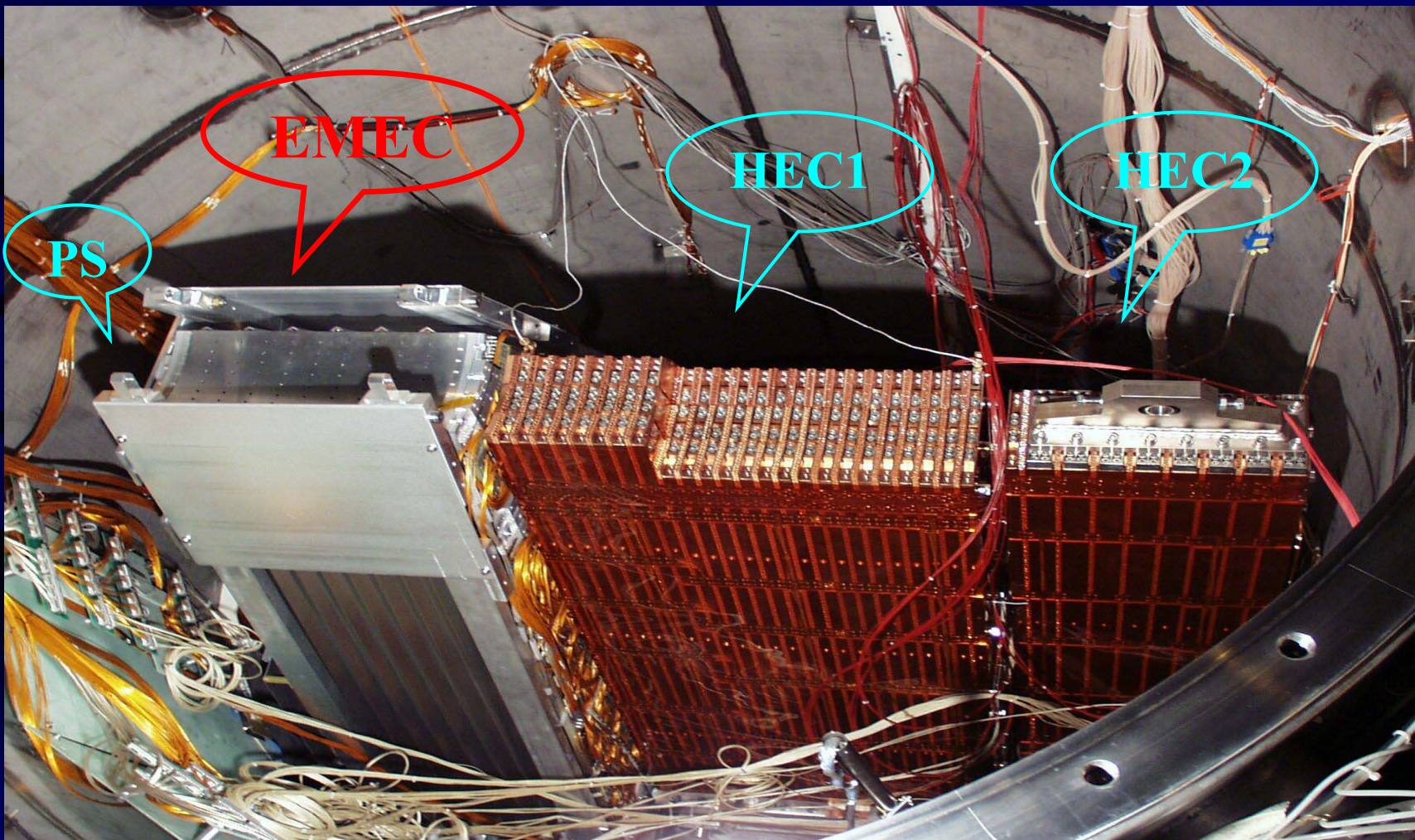
- Cables routed to the front & the back of the calorimeter
- Complete  $\phi$  symmetry without azimuthal cracks





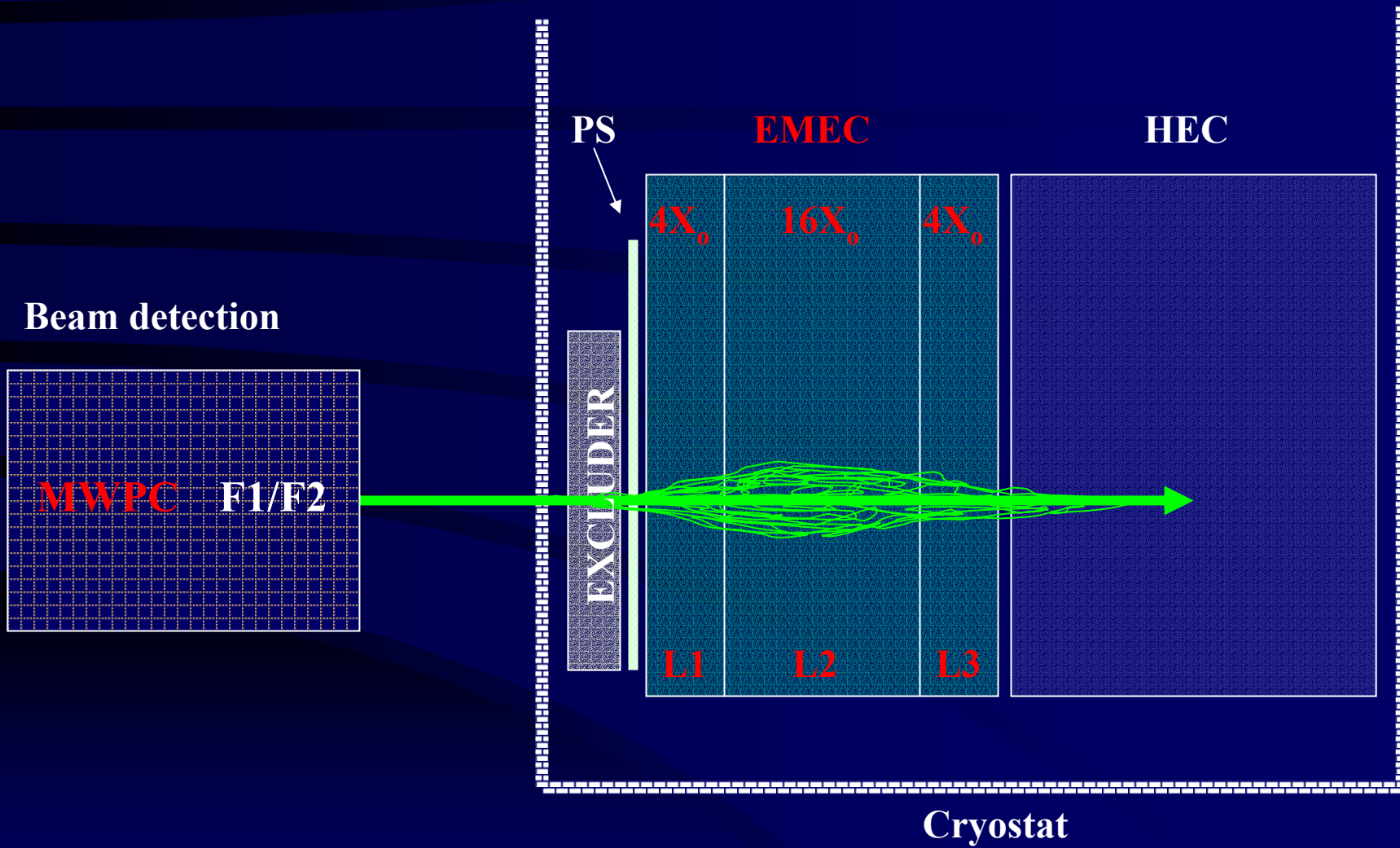
# Testbeam Layout

- Goal: To assess the performance, and find the calibration constants for  $e$  and  $\pi$





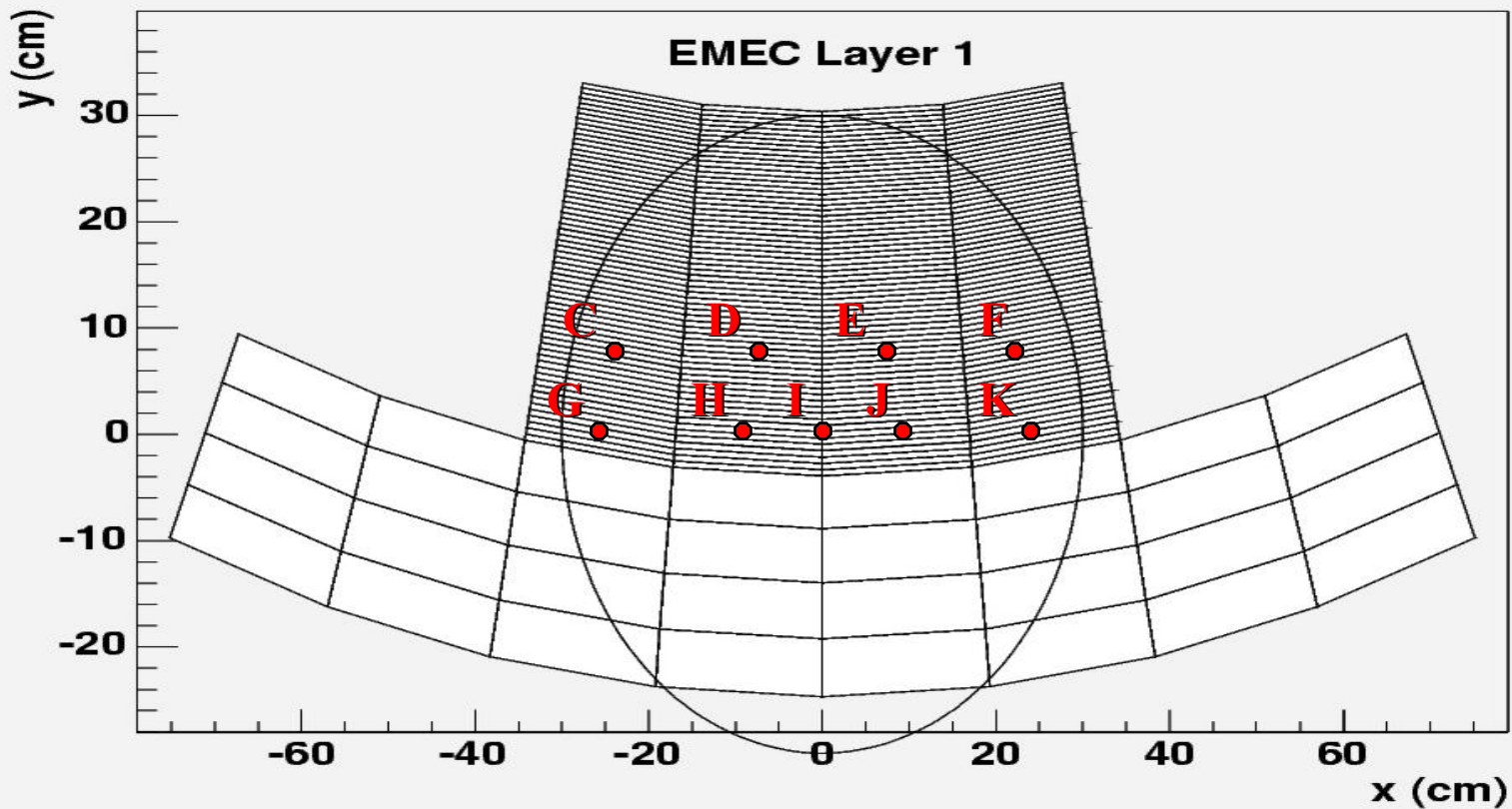
# Testbeam Layout...





# Data

- Electron beams in the energy range -- 6 GeV to 148 GeV
- Beams directed onto the calorimeter at 9 standard impact points
- A complete x scan at 119 GeV with positrons





# Analysis

## Event Selection:

- Good MWPC info
- Good timing info
- Electrons only

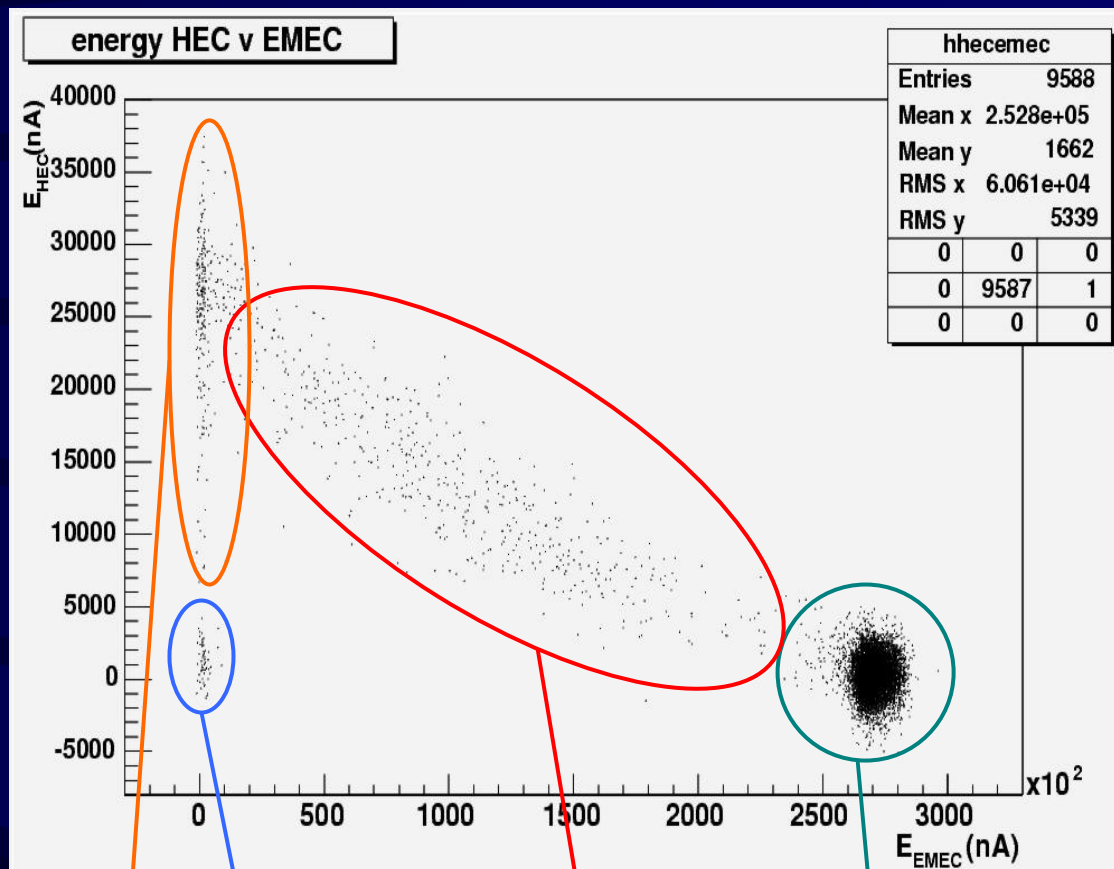
## Clustering:

- Optimized to find position
- Event by event basis
- Significant energy ( $>2\sigma$ )

## Position Reconstruction:

$$x_{MWPC} = a_0 + a_1 z$$

$$x_{CAL} = \frac{\sum_k x_k E_k}{\sum_k E_k}$$



Muons

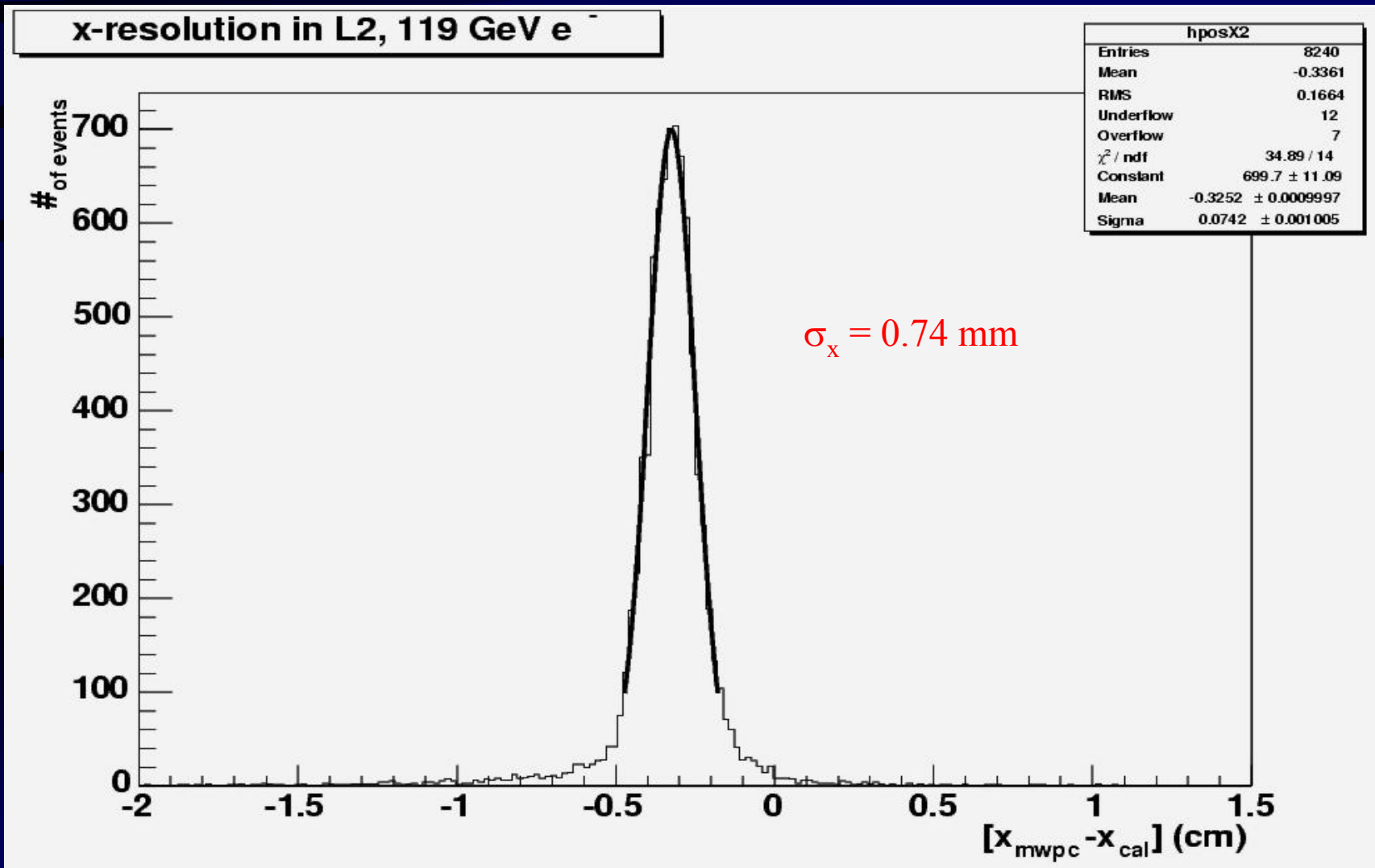
Pions

Electrons

Pions which leave almost no energy in EMEC ~ 22 % theoretically



# Preliminary Results

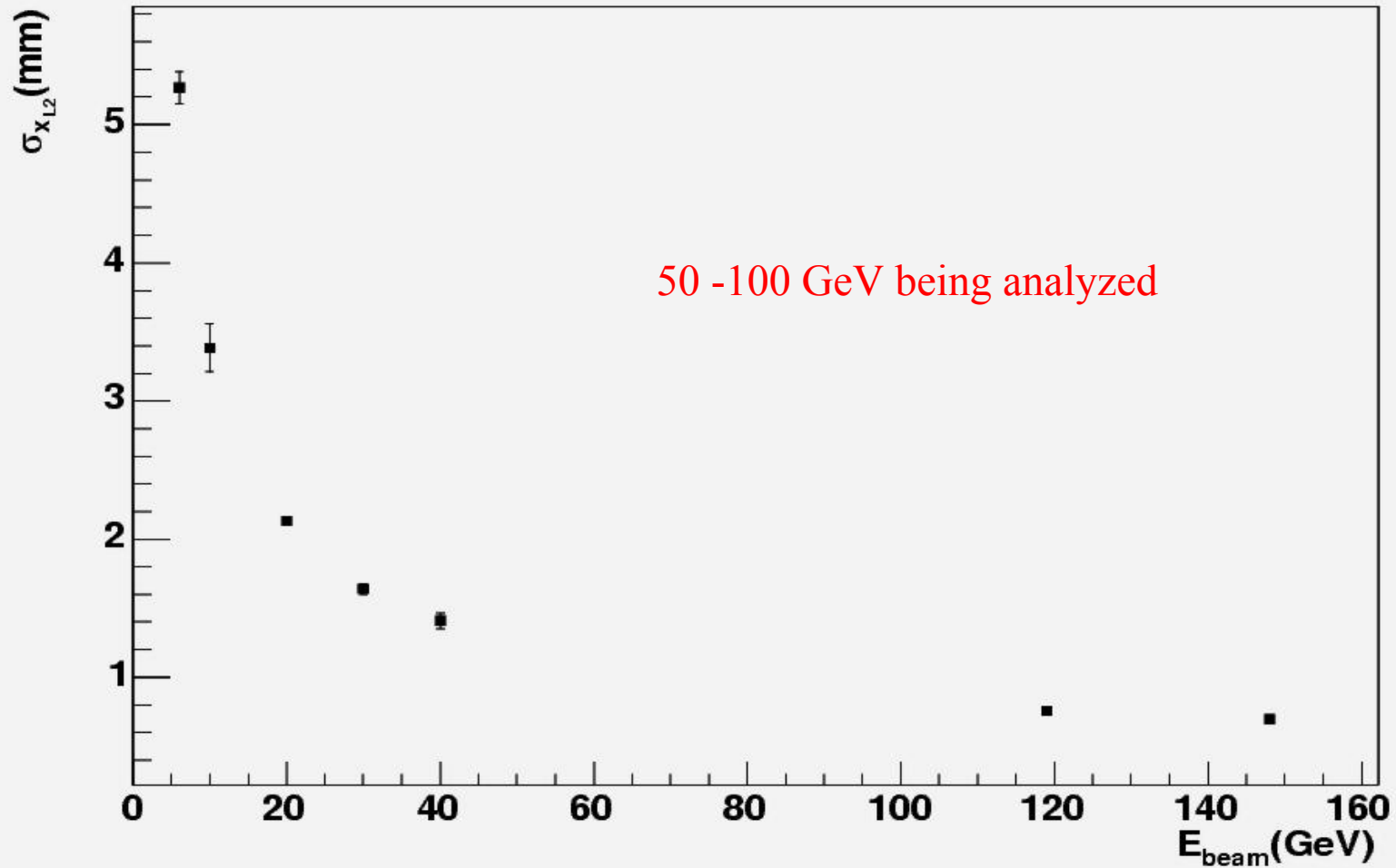






# Preliminary Results...

x-resolution in L2 v beam energy





# Conclusions

- Excellent sub-millimeter position resolution slightly better than predicted by initial design calculations
- The resolution is inversely proportional to the square root of the beam energy
- Final results require further study of systematic effects

