



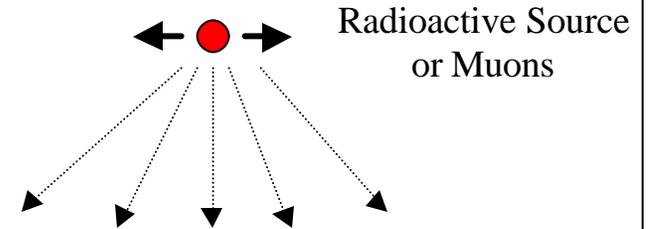
# The MEGA Prototype II: Initial Calibration Results and Plans for Beam Tests and a Balloon Flight

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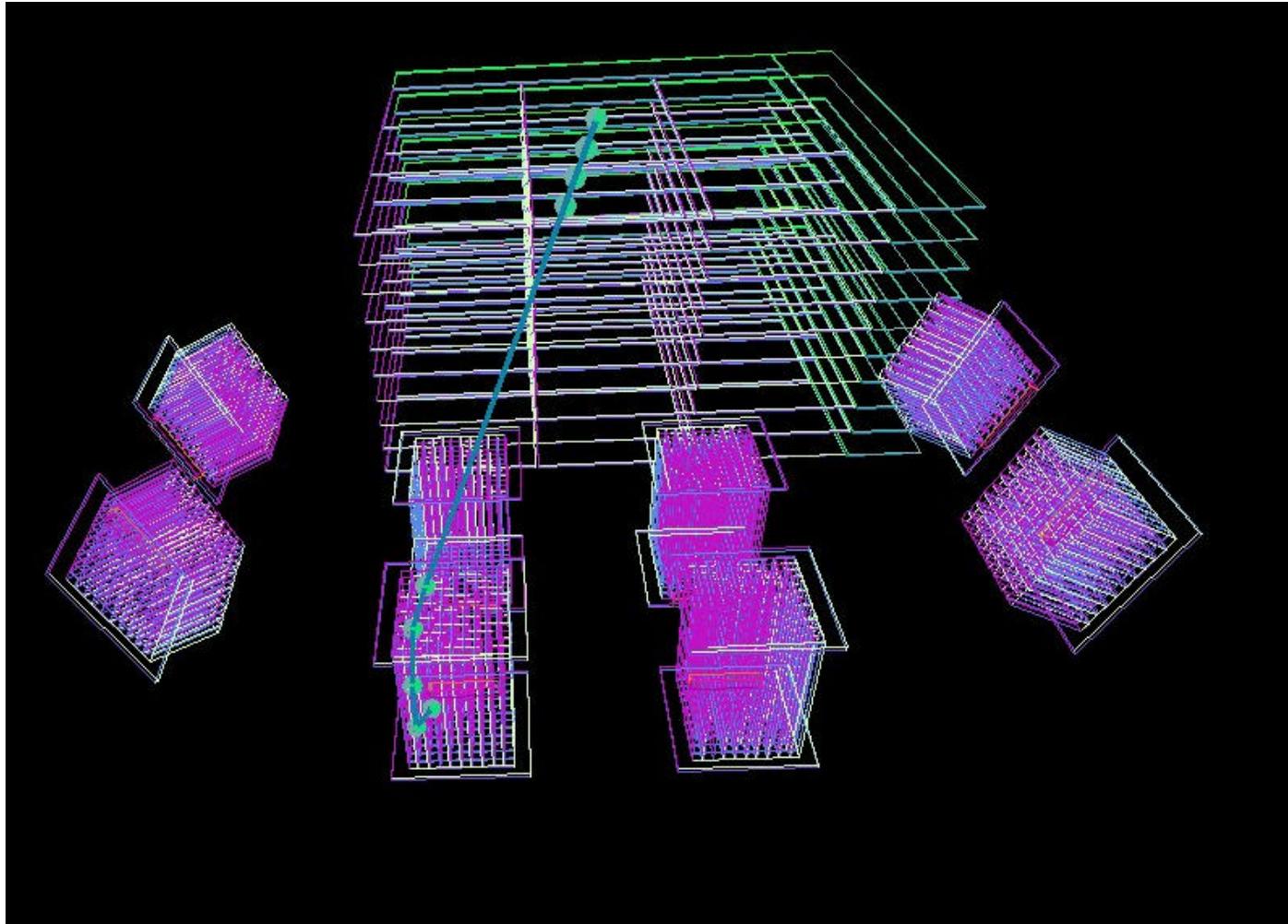
# Laboratory Calibration of the MEGA Prototype

- D1 and D2 first calibrated separately:  $^{57}\text{Co}$  (122 keV) for D1,  $^{137}\text{Cs}$  (662 keV) and  $^{22}\text{Na}$  (511 keV) for D2
- Complete instrument calibrated in coincidence:  $^{137}\text{Cs}$ ,  $^{22}\text{Na}$  (511 keV, 1.275 MeV),  $^{88}\text{Y}$  (898 keV, 1.836 MeV)
- Wide coincidence window ( $\sim 3\mu\text{s}$ ) used, and D2-D1 time delay recorded for each event



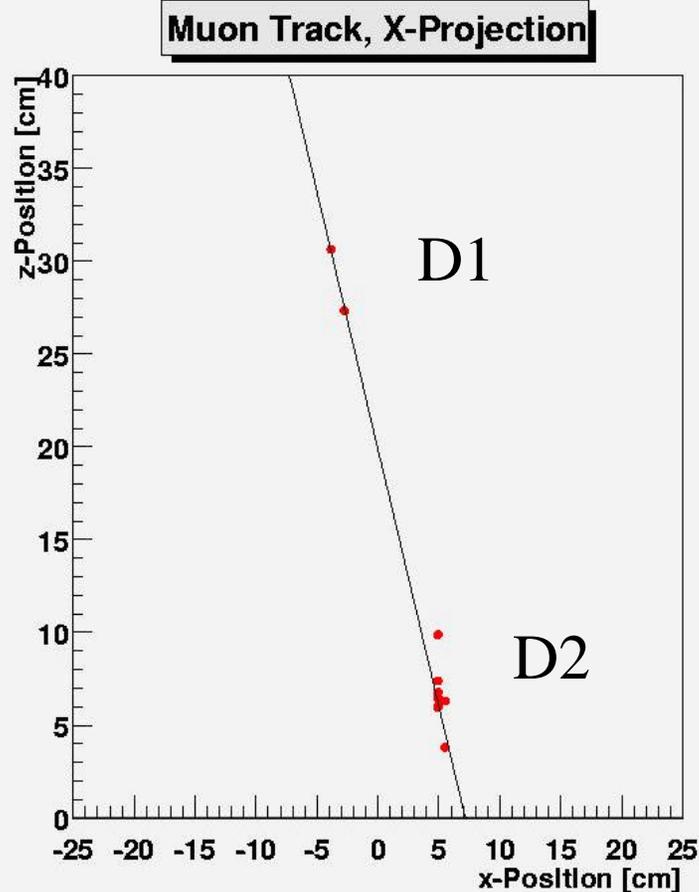


# Muon Track in the Prototype

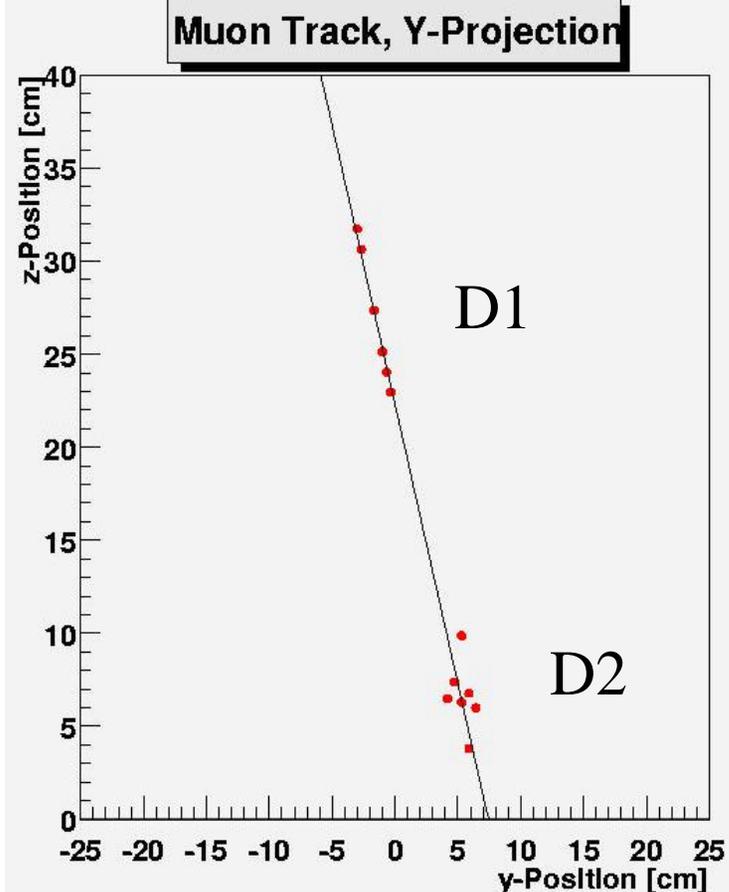




# Testing D1: Muon Tracks in the Tracker



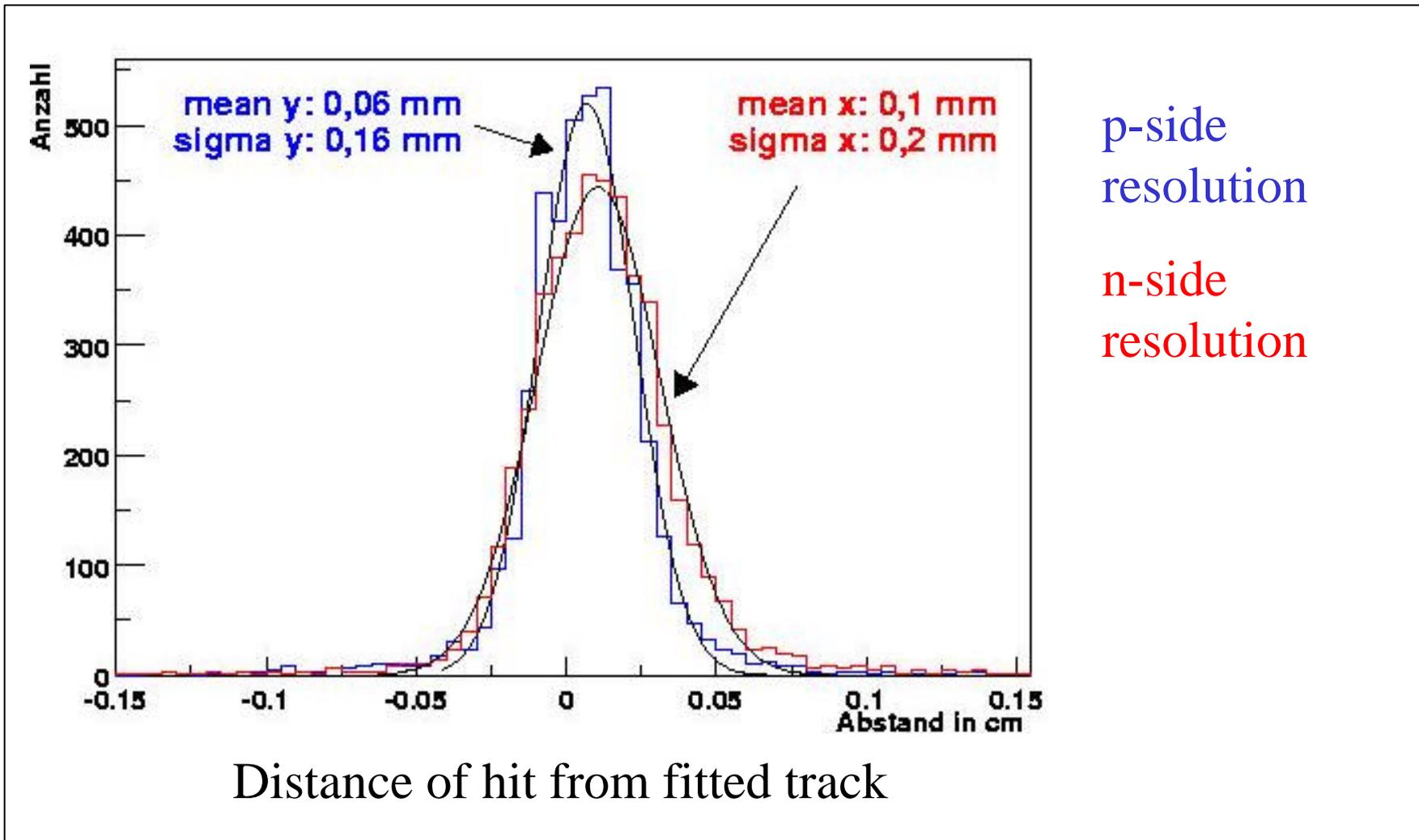
n-side with fit



p-side with fit

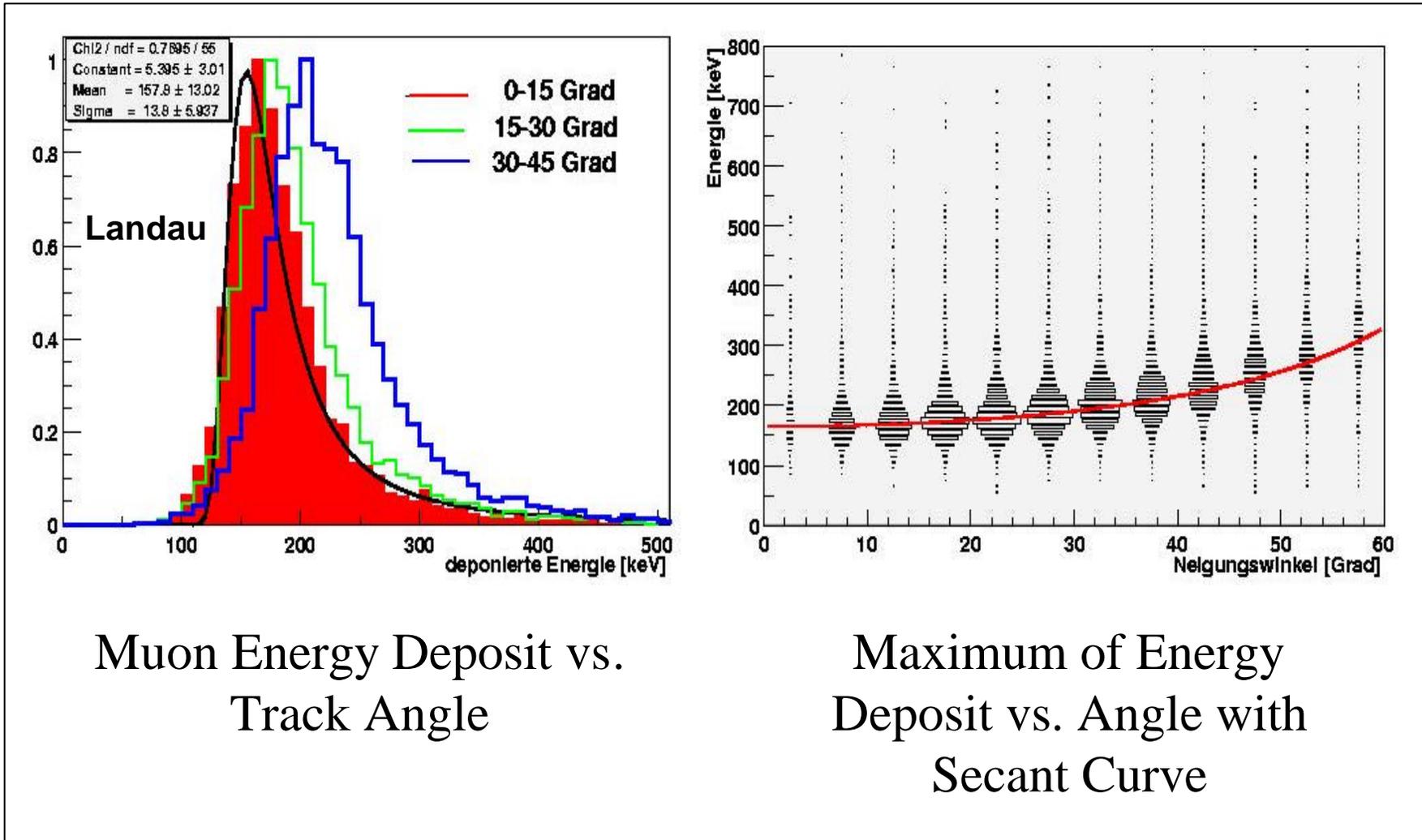


# Position Resolution of the Tracker from Muons



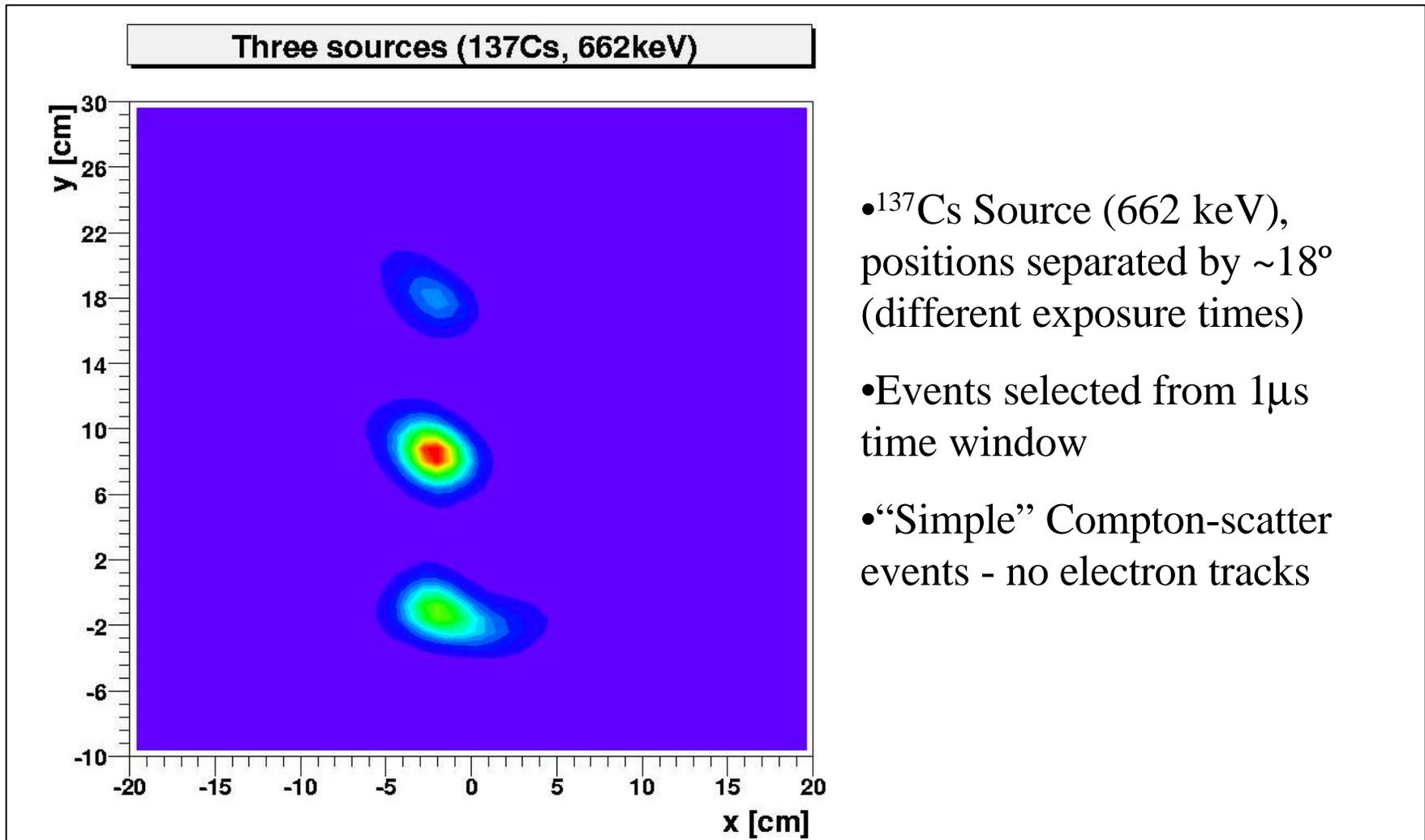


# Muon Energy Deposit in Tracker



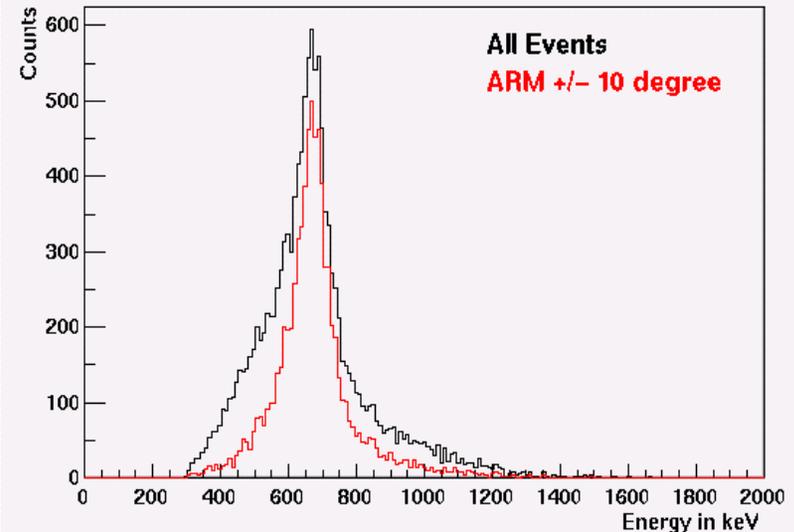
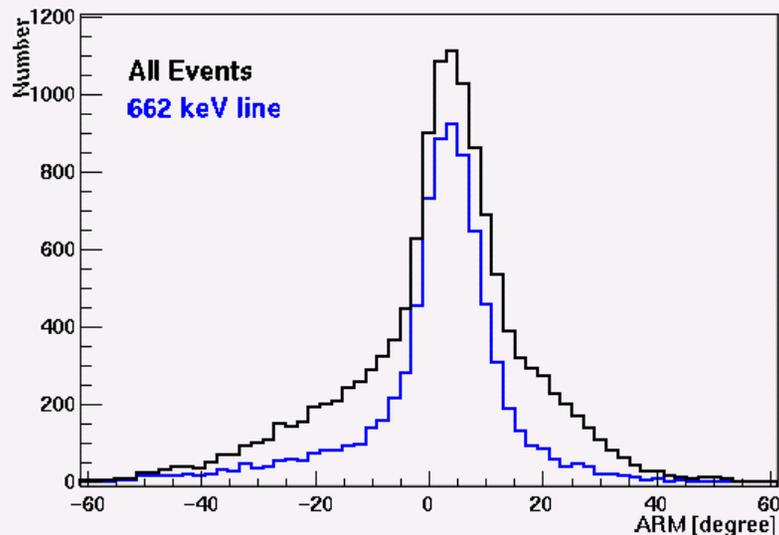


# Gamma-ray Calibration: Without Tracks





# $^{137}\text{Cs}$ ARM Distribution and Spectrum



Angular Resolution Measure (ARM)

FWHM  $\sim 12^\circ$  for events in line

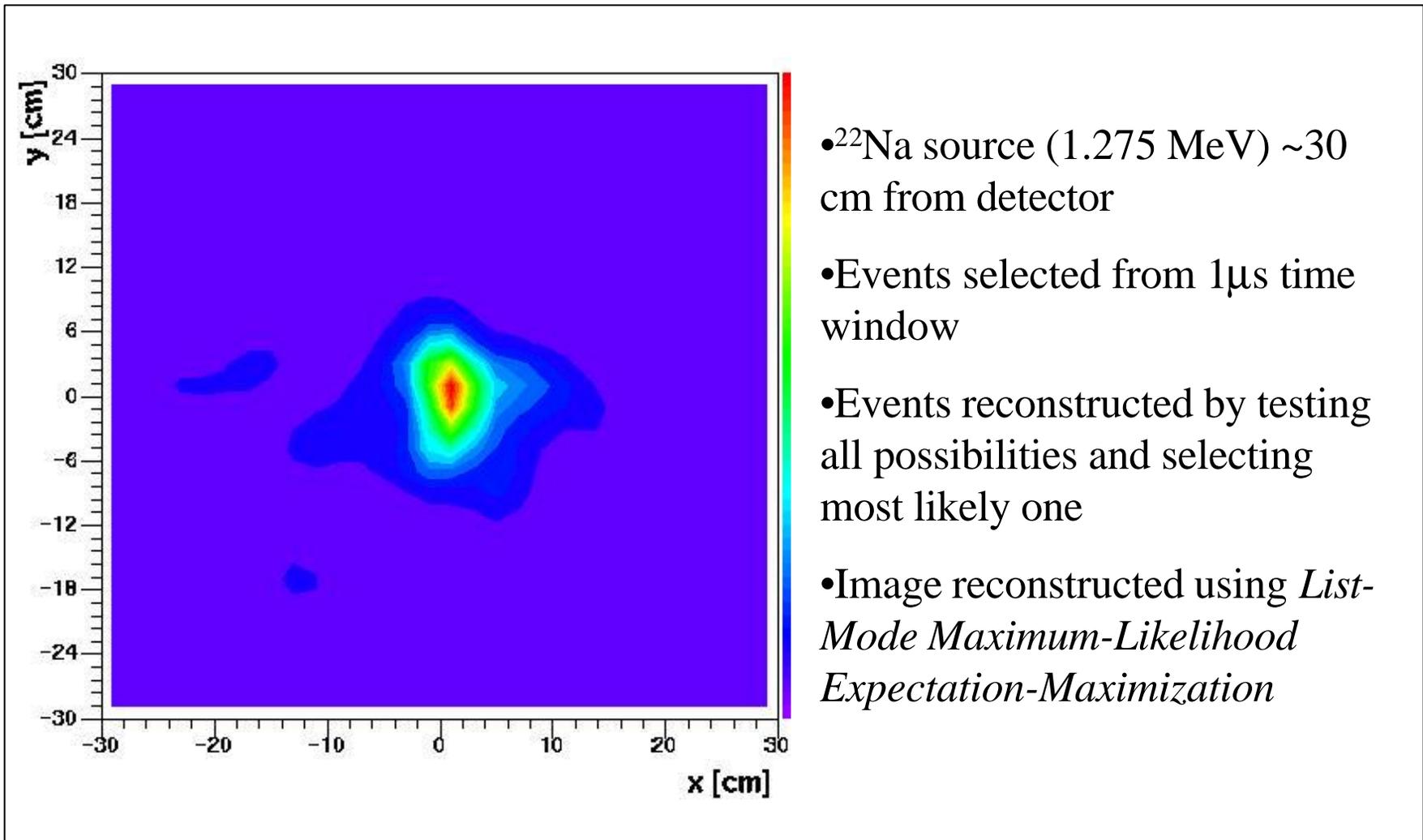
Energy Spectrum ( $E_{D1} + E_{D2}$ )

Energy Resolution  $\sim 17\%$

Background reduced by ARM cut

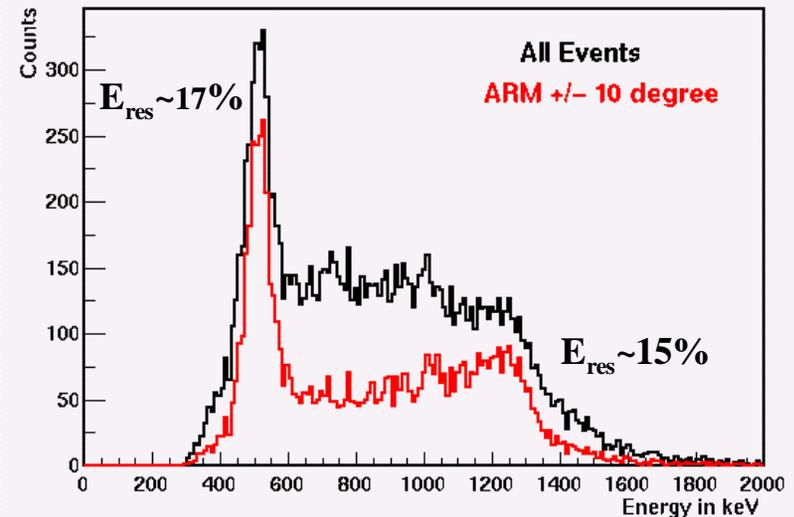
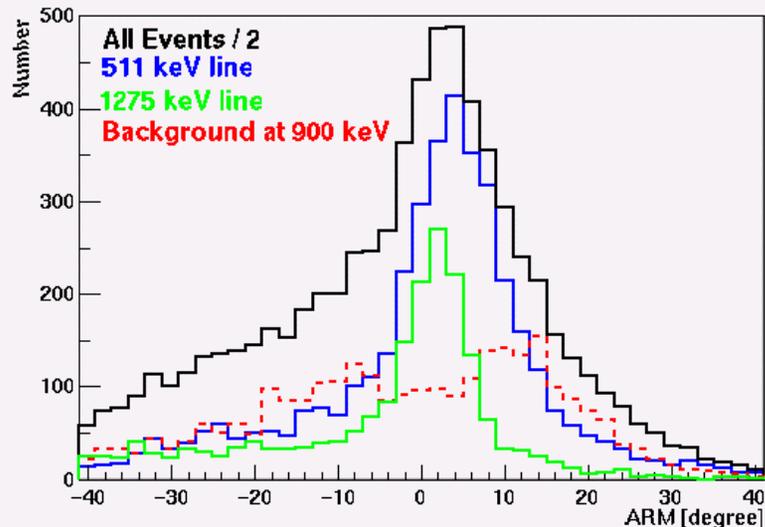


# Gamma-ray Calibration: Tracked Events





## $^{22}\text{Na}$ ARM Distribution and Spectrum



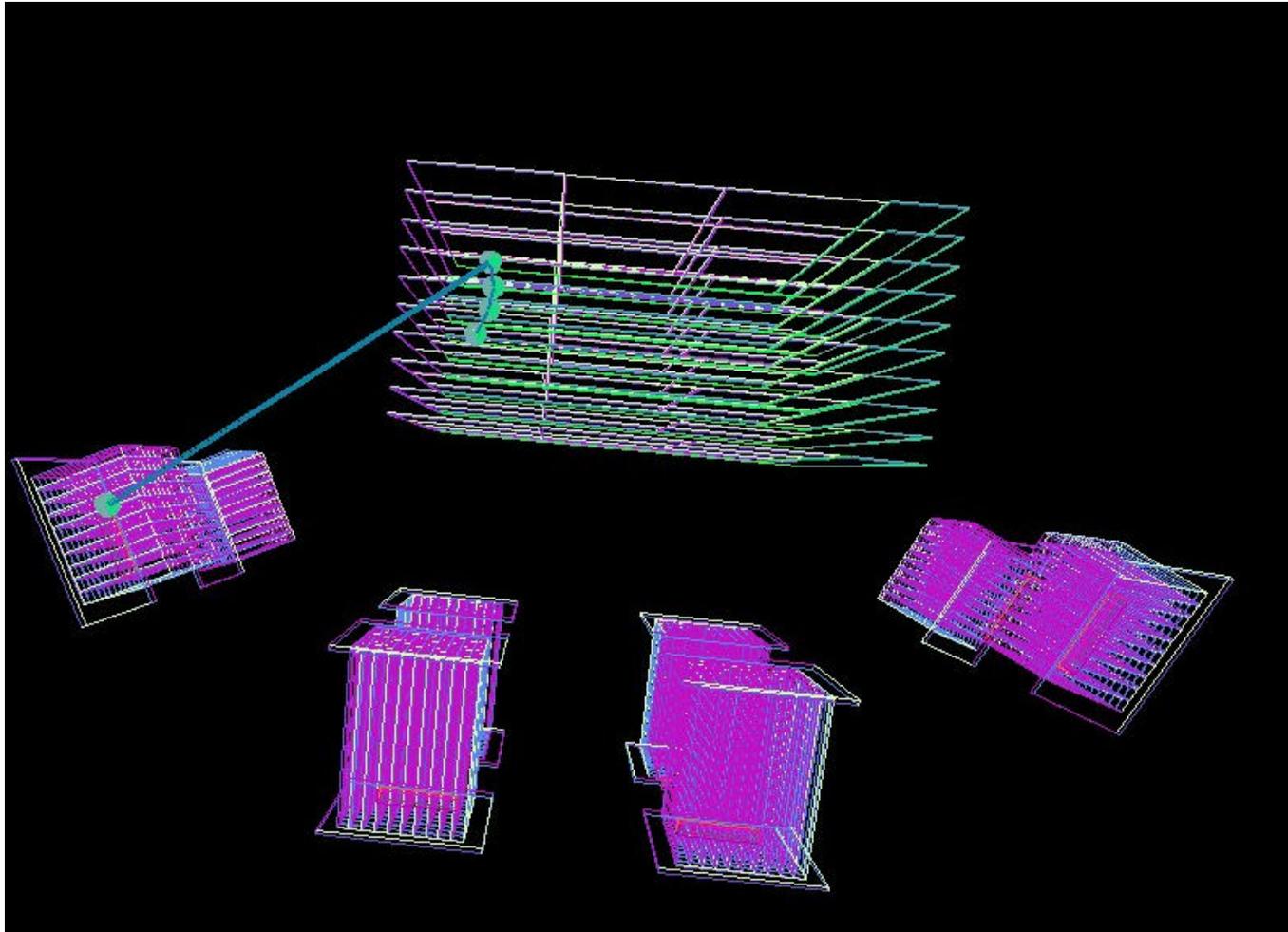
ARM of background is broader,  
double-peaked (not shifted only to  
higher values)

Large background below 1.275 MeV  
line, greatly reduced by ARM cut

→ We appear to be losing energy from  
1.275 MeV line in *both* D1 and D2

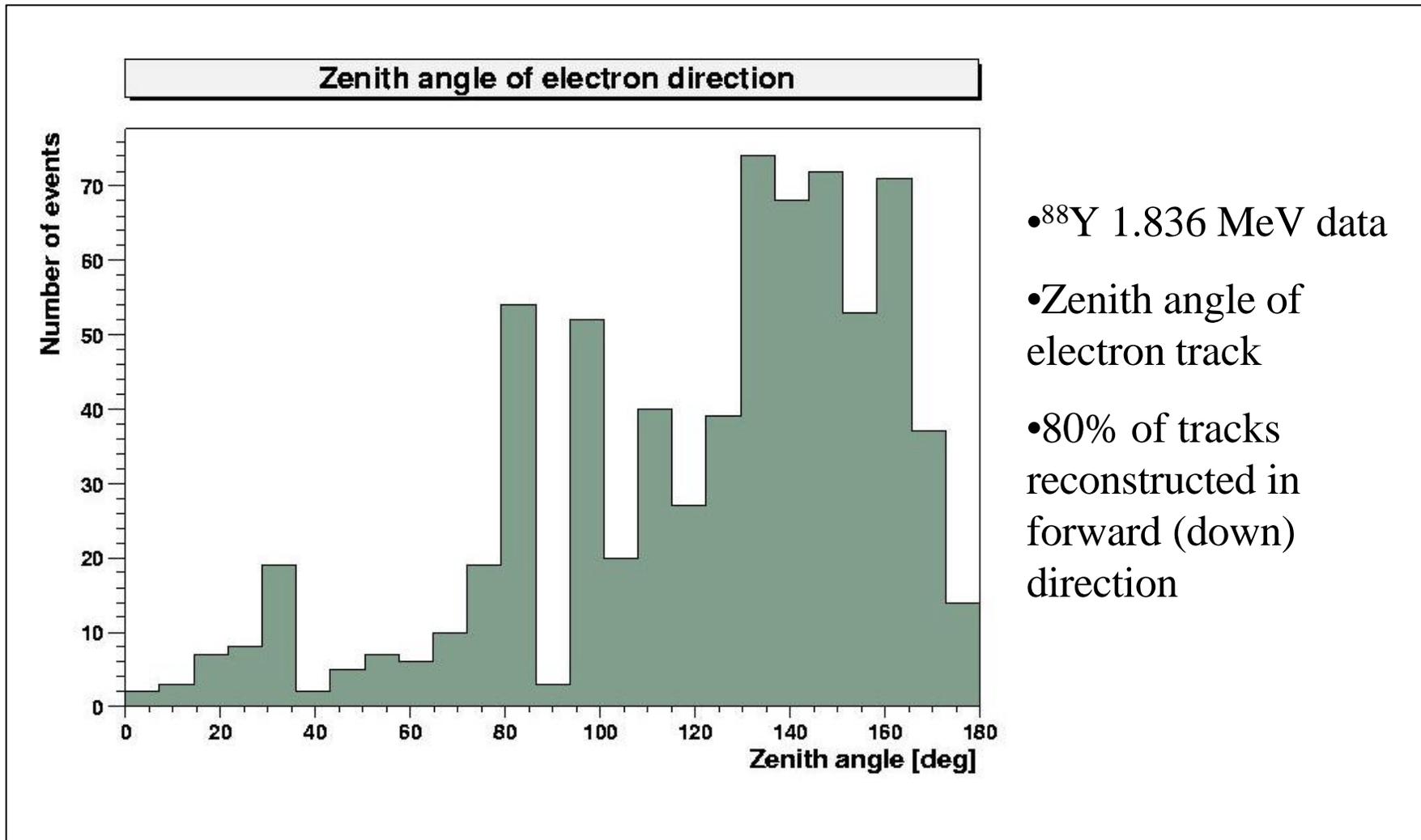


# Tracked $^{88}\text{Y}$ Event in MEGA Prototype





# Direction of Motion of Reconstructed Tracks





## MEGA Prototype Plans for 2001/2002

- May 2001: Gamma-ray beam measurements (2-10 MeV) at University of Stuttgart
- End of 2001: Gamma-ray beam measurements (2-50 MeV) at Duke University
- Summer 2002: Balloon test flight (with CESR)



## Beam Measurements in Stuttgart

- In May 2001, take MEGA Prototype to gamma-ray beam facility at the University of Stuttgart
- Proton beam produces gamma-ray activation lines in various targets
- Probable targets and main lines:
  - $^{13}\text{C}$  (8.082 MeV, 9.170 MeV)
  - $^{19}\text{F}$  (6.130 MeV)
  - $^{27}\text{Al}$  (1.779 MeV, 10.762 MeV)
- Vary incidence angle, compare measurements to simulations of response

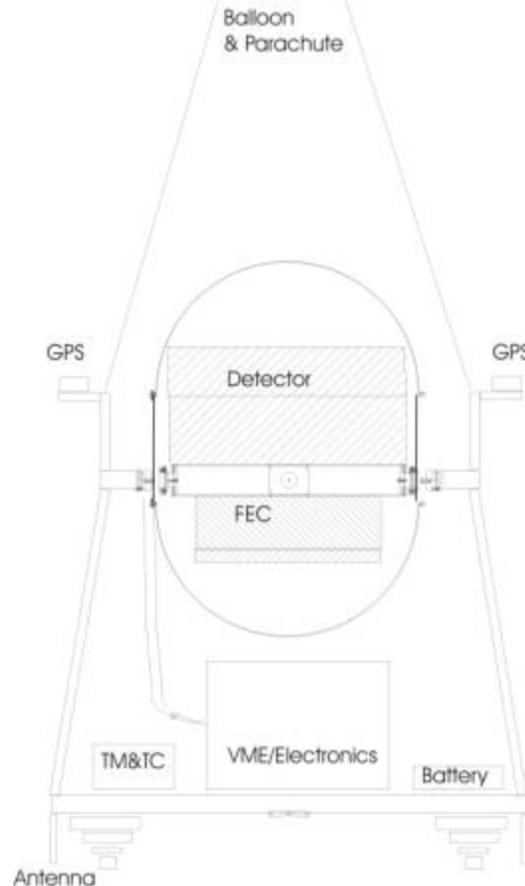


## Beam Measurements at Duke University

- In December 2001/January 2002, take MEGA Prototype to gamma-ray beam at Duke Free Electron Laser Laboratory
- Inverse Compton scattering of UV photons off electrons in a GeV storage ring produces gamma-rays: 2-55 MeV
- Energy tunable to  $< 1\%$  FWHM
- Map detector response over entire energy range in flight configuration (and compare to simulations)
- Gamma-rays are highly polarized (perhaps tunable): ability to test polarimetry capabilities



# MEGA Prototype Balloon Flight

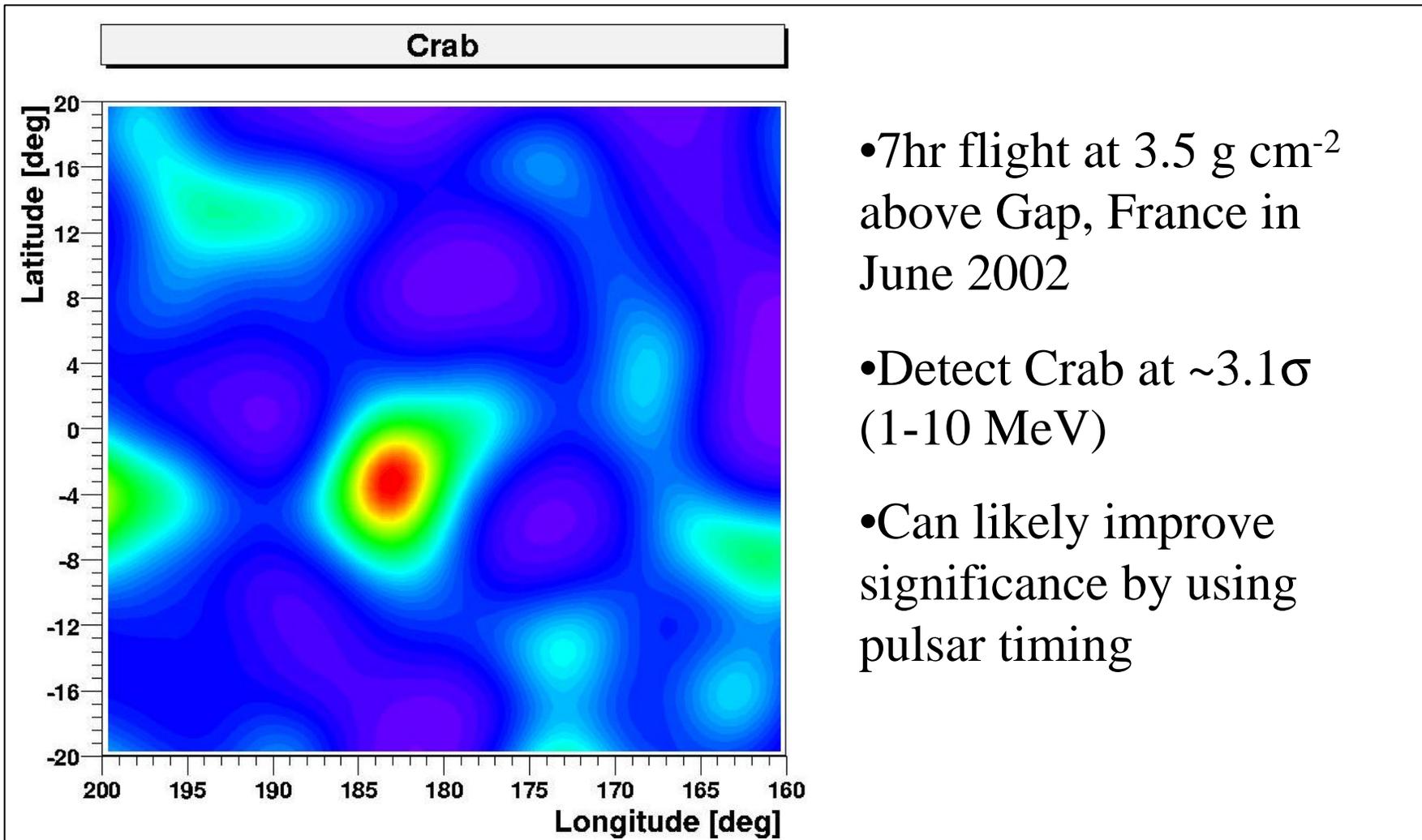


MEGA Prototype Balloon Payload  
Status Mar. 2001 / Flight June 2002

- Test detector technology under flight conditions (noise, thermal & mechanical stress)
- Measure in-flight background and test reduction techniques (ACS, event reconstruction)
- Image Crab Nebula to test response and sensitivity simulations



## Simulated Balloon Flight Observation of Crab



- 7hr flight at  $3.5 \text{ g cm}^{-2}$  above Gap, France in June 2002
- Detect Crab at  $\sim 3.1\sigma$  (1-10 MeV)
- Can likely improve significance by using pulsar timing