TPC studies @ Carleton

Point resolution with MicroMegas-TPC using resistive anode

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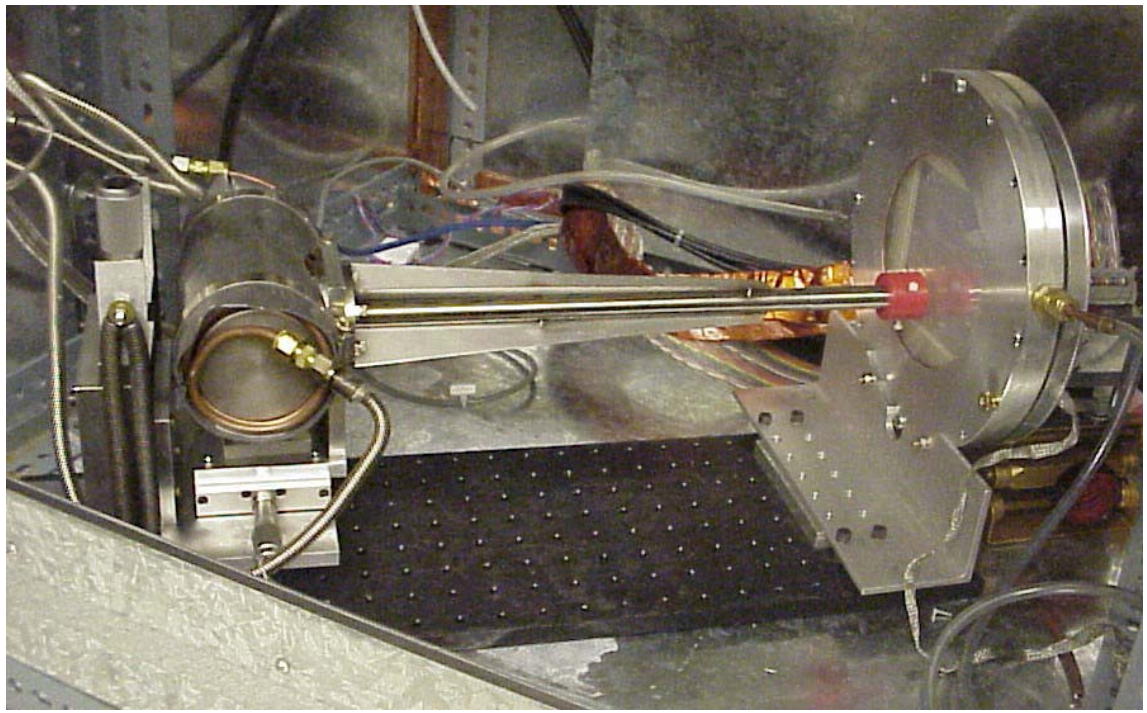
Test-Cell

- Point resolution, short drift distance
- X-ray source, collimated
  photon conversion creates electron cloud, size ~50μm
- TPC test cell, 5mm drift distance, gas: Ar:CO_2 (90:10)
- double GEM
  MicroMegas
- resistive anode



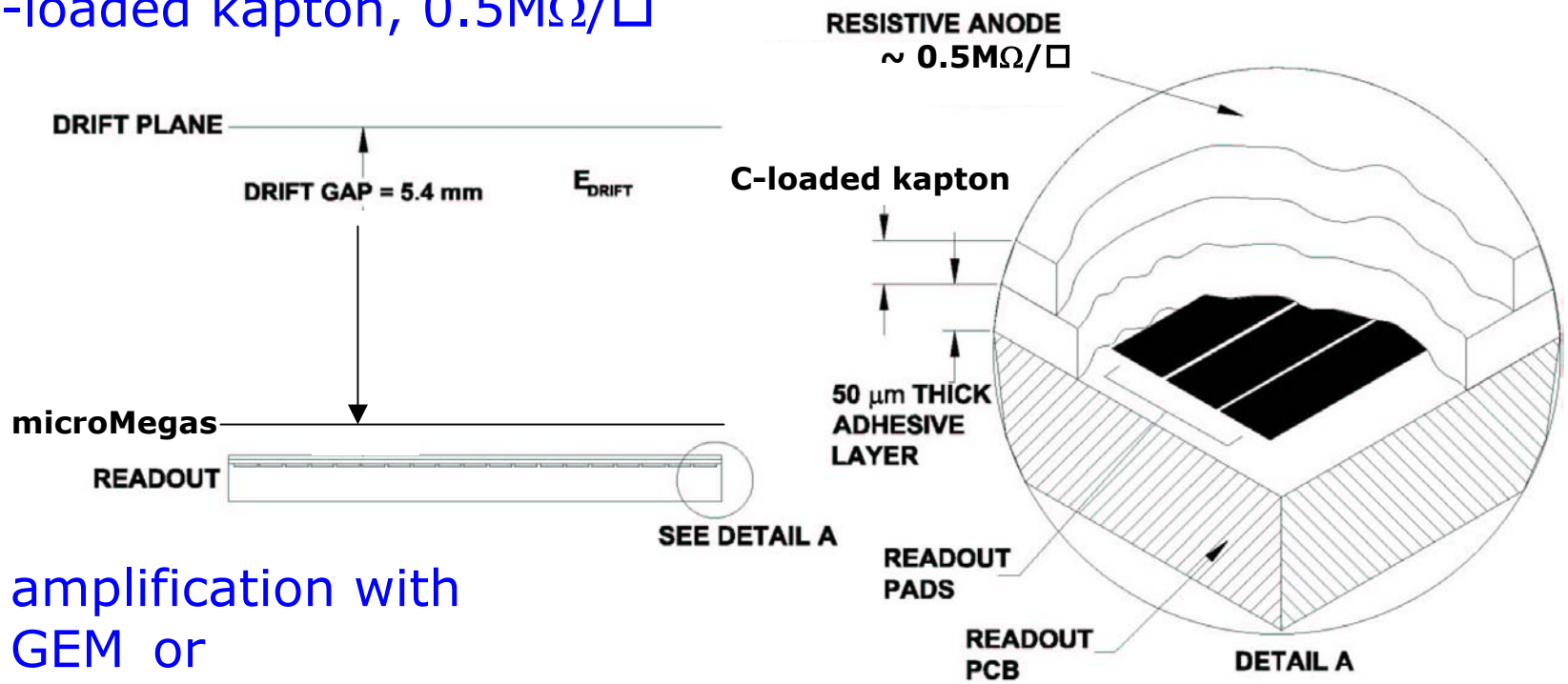
Last results presented at
IEEE, Portland
TPC Symposium, Berkeley

Setup

resistive anode spreads signal after amplification
better charge sharing between pads

especially for MicroMegas - almost no transverse diffusion

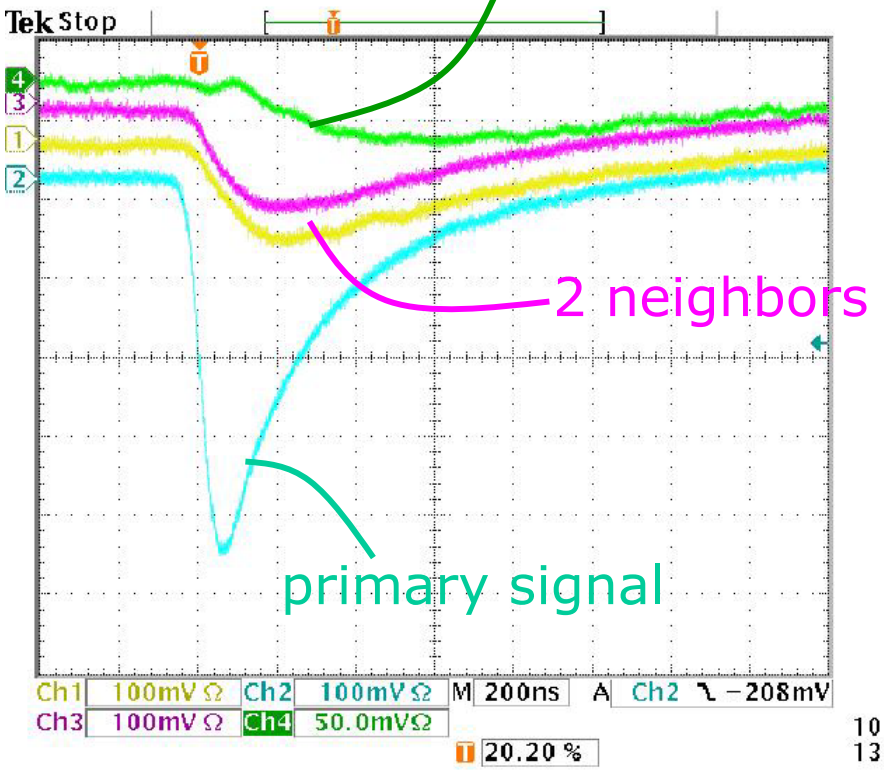
C-loaded kapton, 0.5MΩ/□

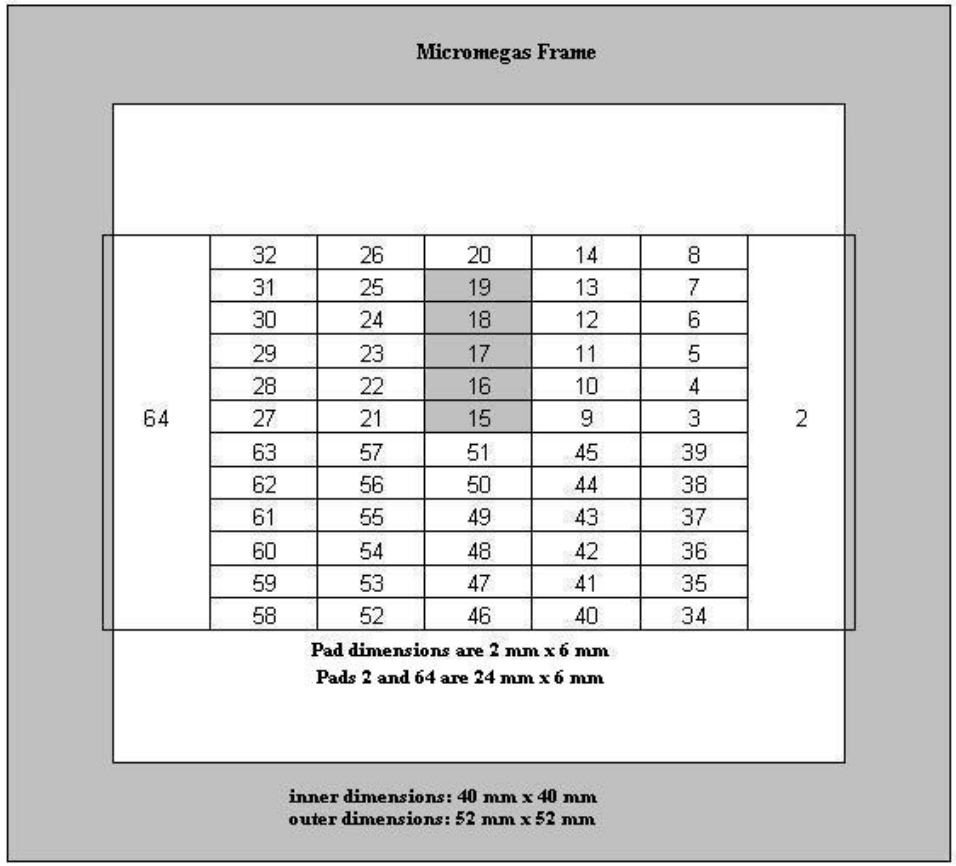


amplification with
GEM or
MicroMegas

Pad layout & signals

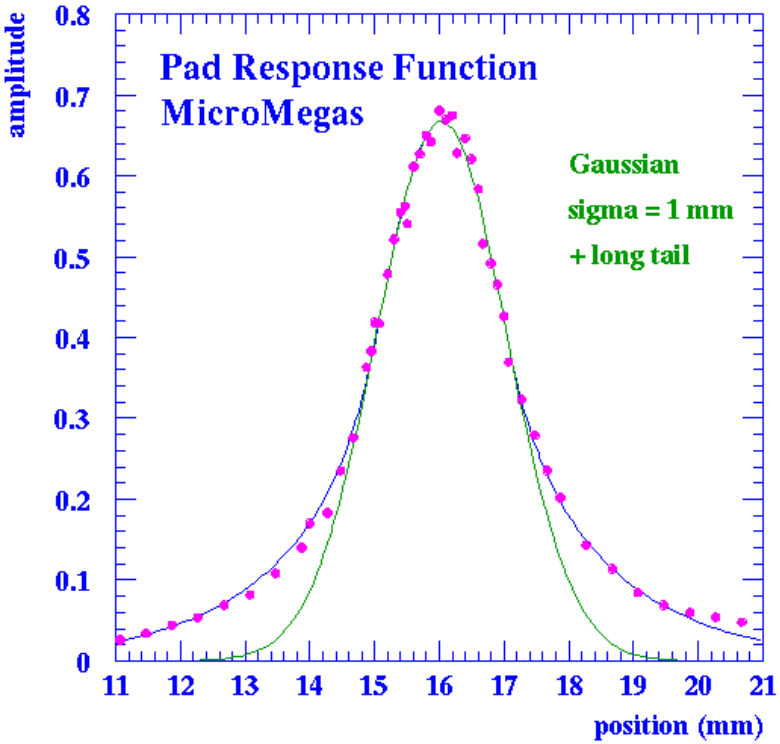
clean signals on 3-4 pads





pads: 2 x 6 mm
small MicroMegas frame

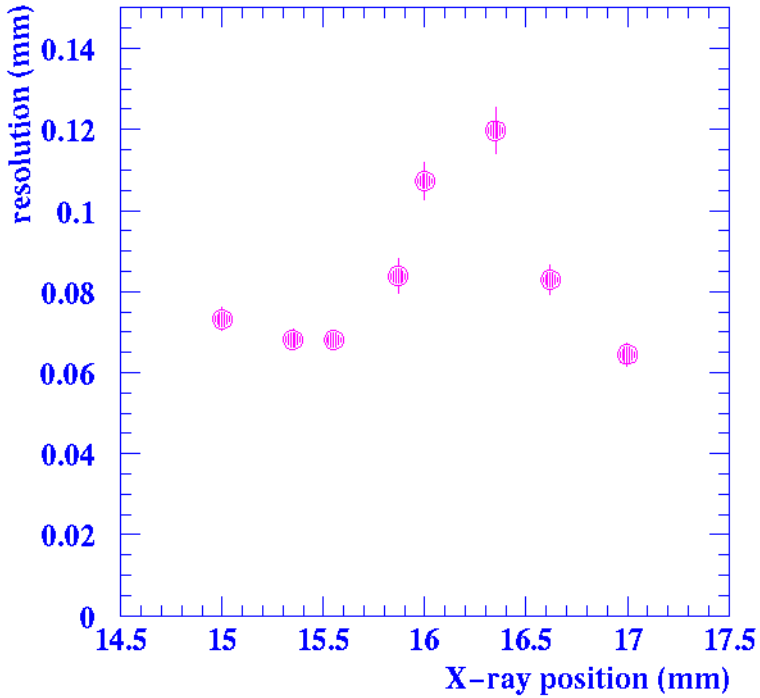
1st Results MM (October 03)



determine pad response function

amplitude as function of x-ray position
scan over 10 mm = 5 pads

central Gaussian: sigma = 1mm + tail



fit PRF to observed amplitudes
use signals of all 5 pads

resolution varies between
~70 and 120 μm

New Results

scan over 4 pads; simple and robust method:

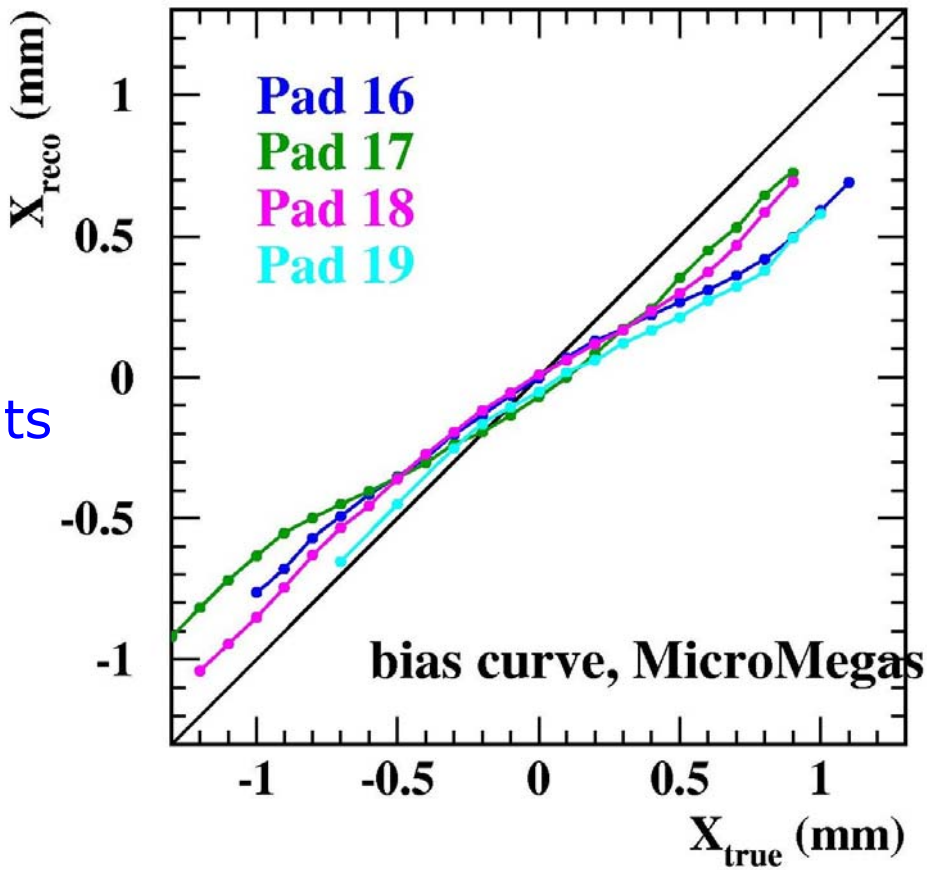
choose 3 adjacent pads depending on x-ray position
calculate centroid of signals

$$X_{reco} = \sum_{i=1,3} X_i * A_i \Big/ \sum_{i=1,3} A_i$$

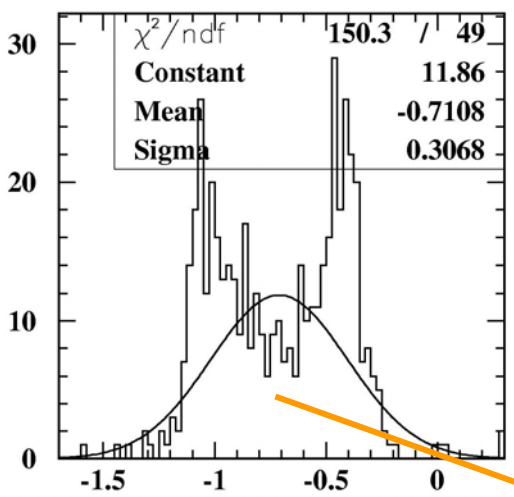
bias correction $X_{reco} \rightarrow X_{true}$
using extrapolation between points

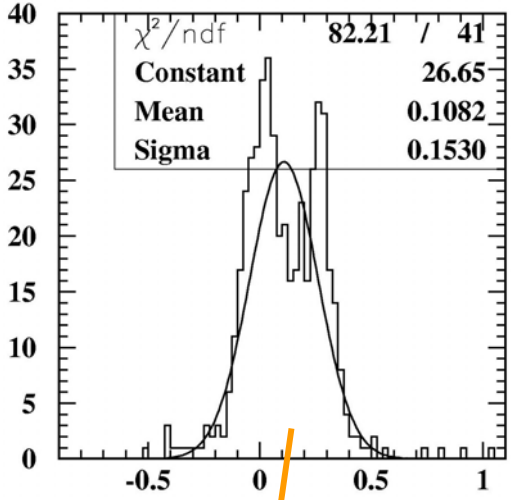
bias different from pad to pad
→ local corrections needed

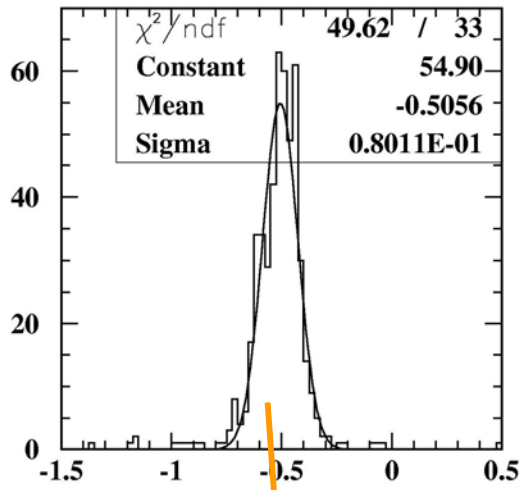
looks OK



MM Point-Resolution



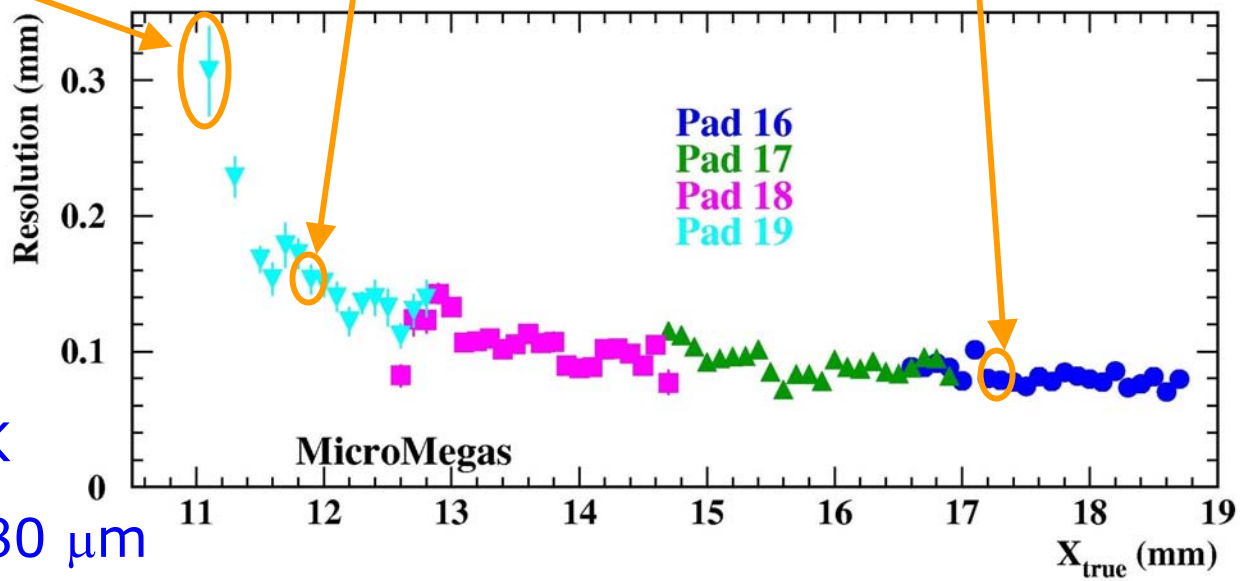




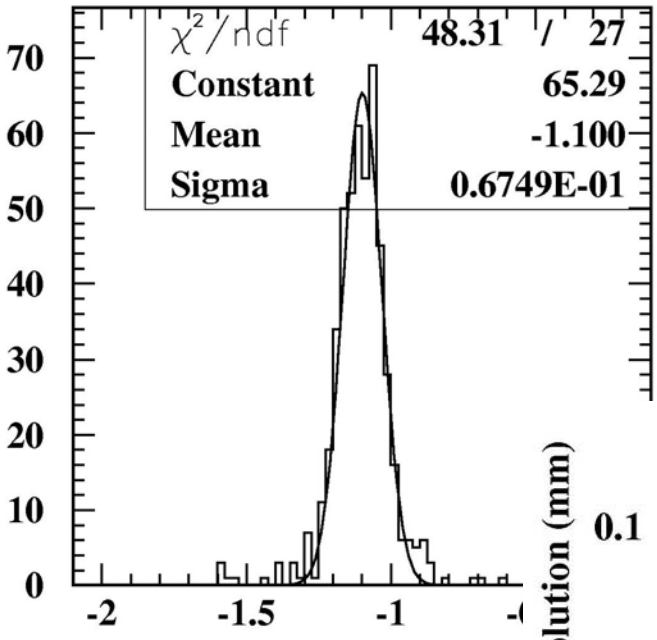
pad 19 closest to frame, uses data from pads 18,19,20

for bad distributions: distortions for some events, others are OK

pad 16: resolution ~80 μm



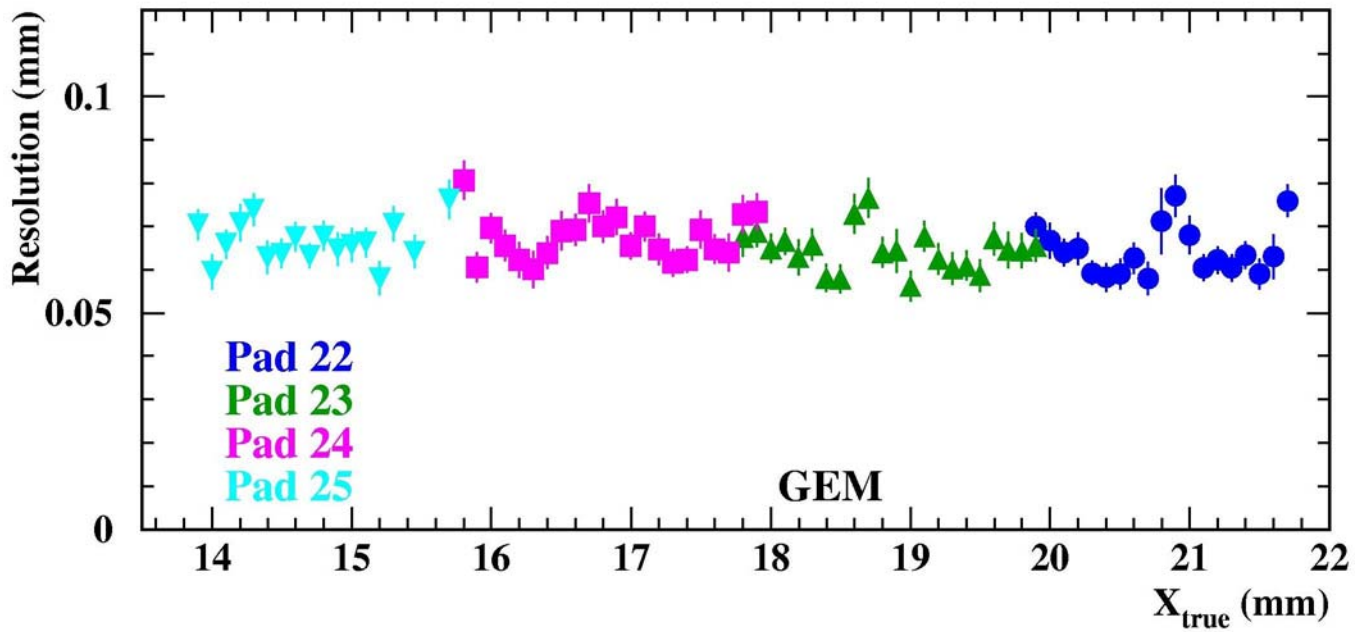
GEM Point-Resolution



no such effect with GEM

GEM frame much larger

resolution 60-80 μm
2mm wide pads



Conclusion / Plans

- Point resolution of 80 μm obtained with MicroMegas and resistive foil, 2 mm wide pads
- Resolution is not uniform
  most likely field distortions due to small MM frame
- Design new frame for MicroMegas
  in cooperation with Saclay/Orsay
- Point resolution tests with x-ray source (test-cell)
  confirm homogeneity and stability
- First tracking tests with Cosmics (TPC)
  endplate of test-cell fits into TPC
  need to ensure homogeneous drift field in TPC (frame design)
- Resolution of ~70 μm with MicroMegas and
  2 mm wide pads seams feasible