

# Central Drift Chamber Update

Naomi Jarvis

Carnegie Mellon University

GlueX Collaboration Meeting, Indiana University, May 2011

## The CDC Team



Project Leader: Curtis Meyer

Project Scientist: Naomi Jarvis

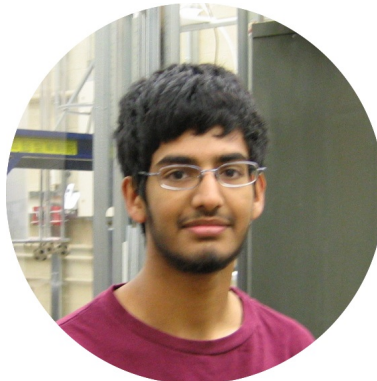
Construction Manager: Gary Wilkin

Technicians: Amy Woodhall, Kaitlin Mueller

Undergraduate Students:

2011: Rahul Kurl, Maddi Brumbaugh

+ ...





## Outline

CDC Construction

Current status

Prep work for next stage

Prototype studies



## CDC Construction: Current status

Phase 1: Mounting and Alignment of Endplates  
complete

Phase 2: Installation of Straws (gas lines + outer shell)  
Completed rows 1-19 of 28  
Used up straws – rest expected soon

Phase 3: Wire Stringing  
Started work on row 1



## CDC Construction: Phase 2 Components

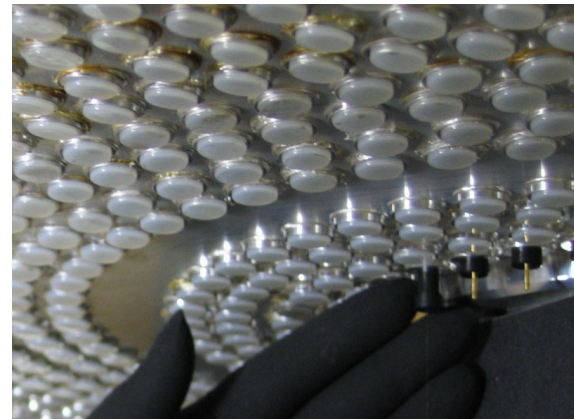
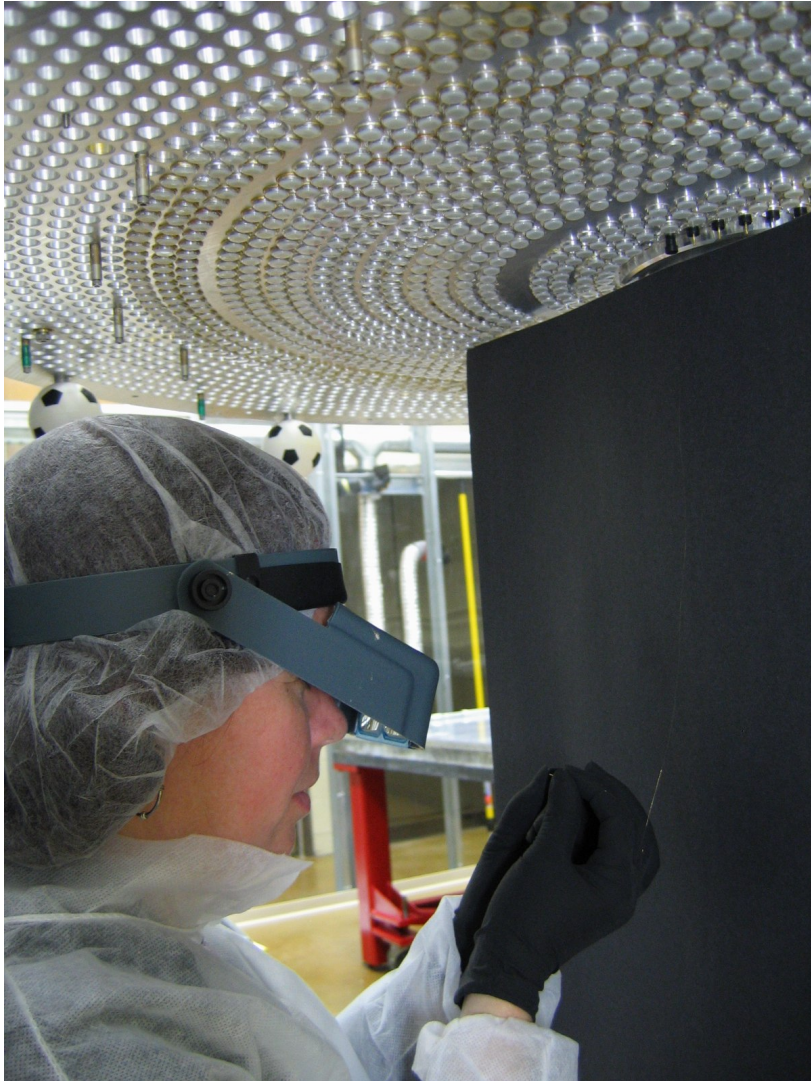
Component	Status	Acceptance
Straws (1900)	Checked, trimmed, installed	82%
Straws (250)	Checked, trimmed, installed	90%
Straws (rest)	Pending	
Al donuts	Checked, cleaned, some installed	~ 100%
Al feedthrus	Checked, cleaned, some installed	~ 100%
Noryl donuts	Checked, cleaned, some installed	~ 100%
Noryl feedthrus	Checked, cleaned, some installed	~ 100%
Gas lines + steel nipples		
Gas line glue widgets	To be made at CMU	
Outer shell	Arrived at CMU 3 <sup>rd</sup> May	
Outer hub material		
Tape for outer shell	Duct tape is at CMU; need Cu tape	



## CDC Construction: Phase 3 Components

Component	Status	Acceptance
Pinholders	85% checked, cleaned, some installed	So far all but 1
Crimp pins	Some in clean storage, some installed	100%
Wire	Some in clean storage, some installed	100%





## CDC Construction: Phase 4 Components

Component	Status	Acceptance
Threaded bushings	At CMU	
O-rings	At CMU	
Lugged ferrules	CMU have ordered these	
Wire	At CMU	100%
Silver balls	At CMU	100%
Heatshrink	At CMU	100%
Standoffs (3 types)		
Standoff screws		
HVBs		



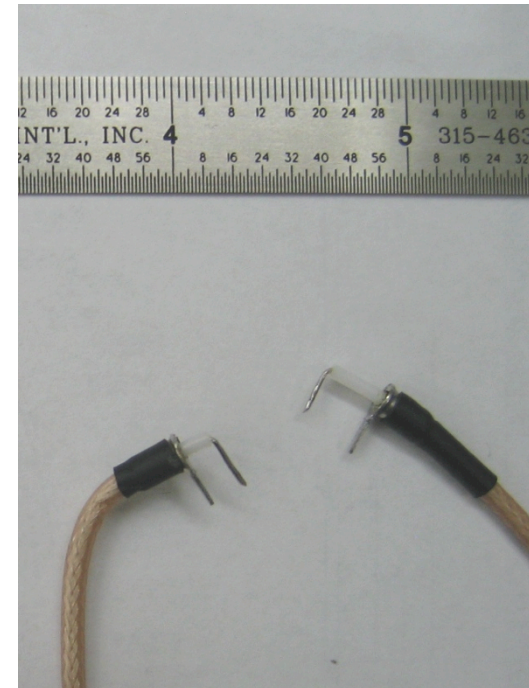
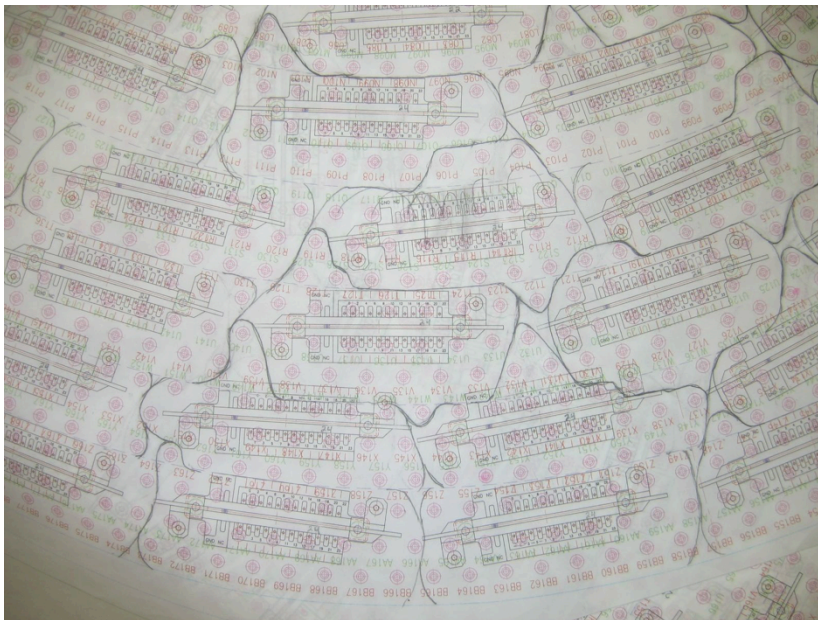
## CDC Construction: Phase 4 Preparations

Hook-up wires

20% are half-made

HVB connection layout

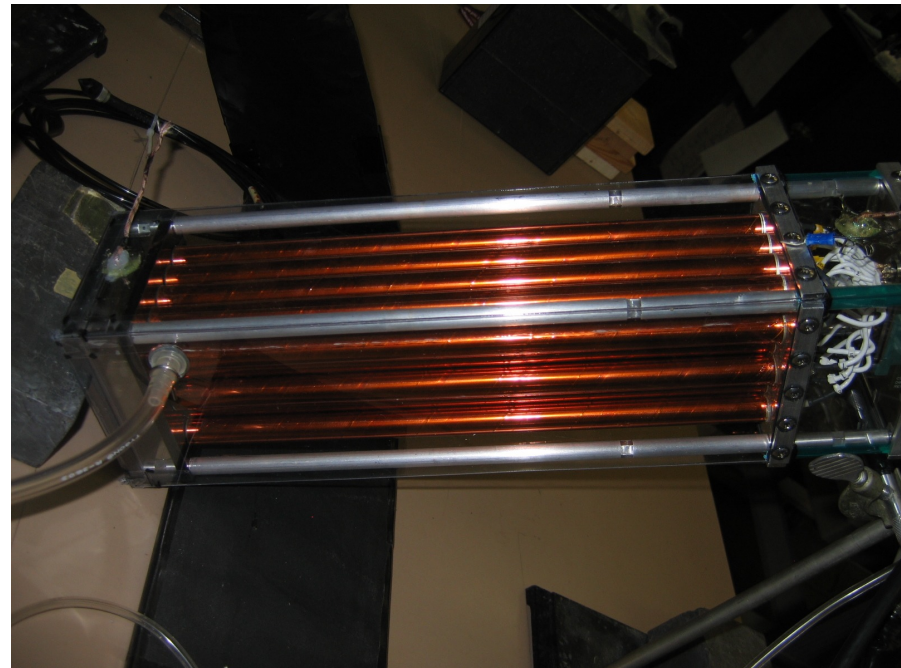
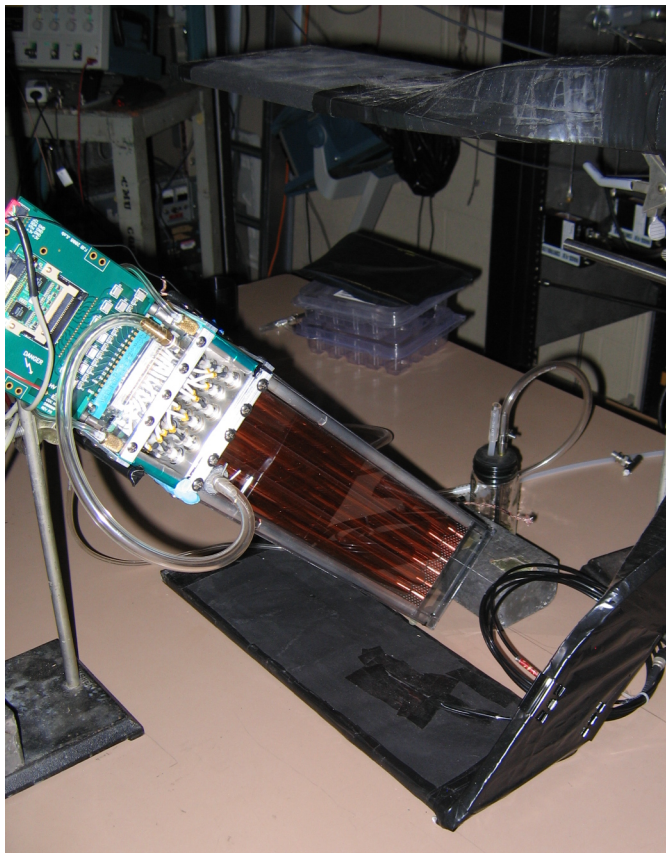
Aim for shortest max wire lengths





## Prototype studies

New fADC125, preamp, plenum, gas MFCs  
CODA 2.5, cosmic ray data, 50/50 Ar/CO<sub>2</sub>

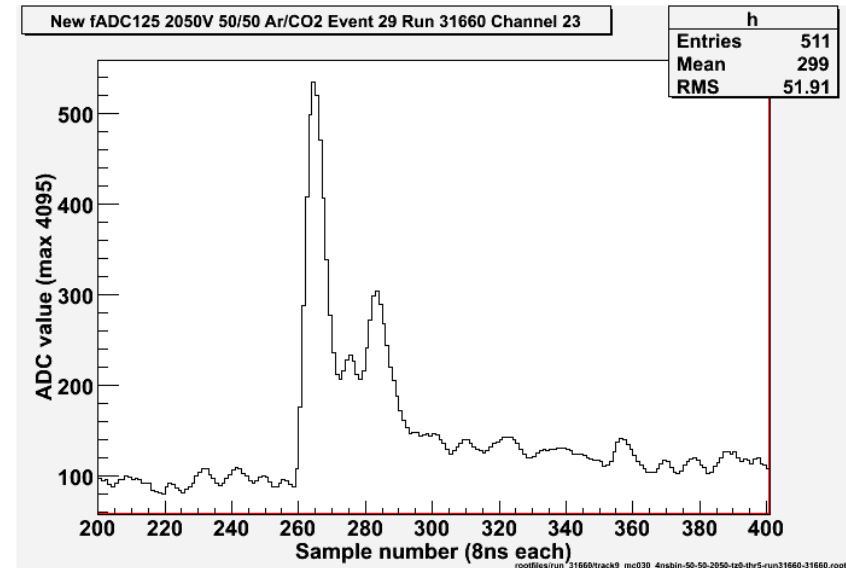
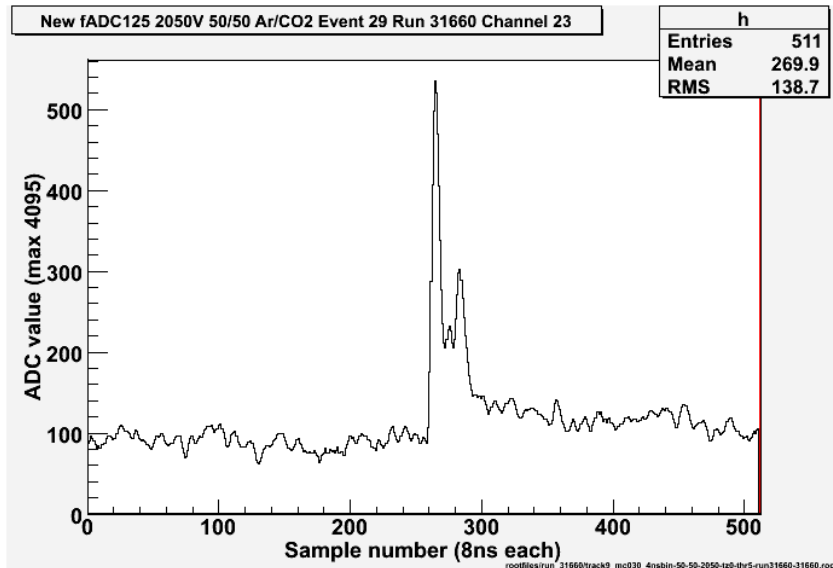


# Event fADC data

Cosmic ray data with small prototype – event in one straw shown

Using 512 x 8ns samples and fADC range 0-4095

Noise is ~ 11 ADC values



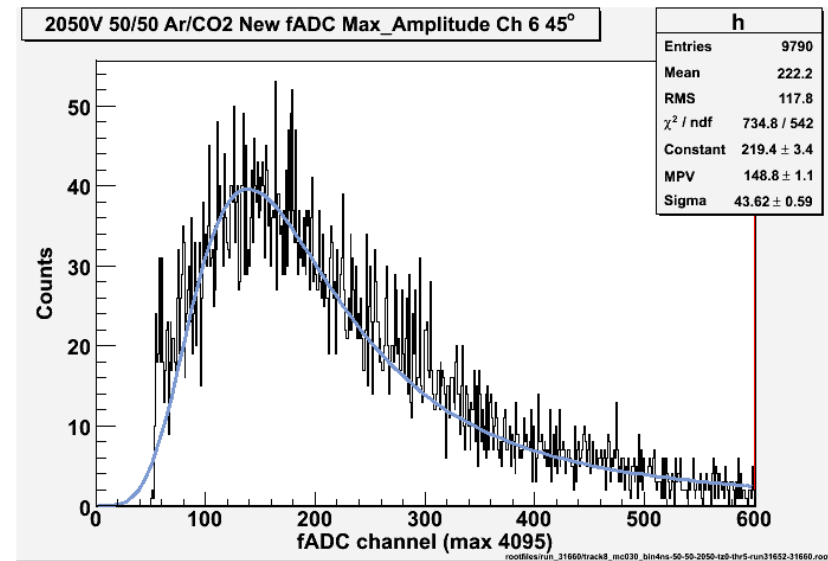
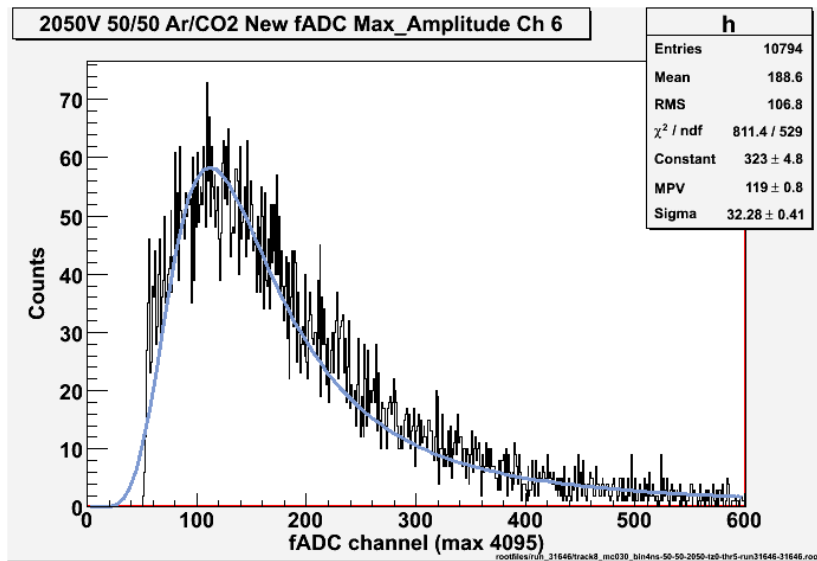
# Amplitude histogram

Calculate mean pedestal for first 100 samples in each 100 events

Subtract pedestal from ADC values

Select event where ADC value rises above a threshold (5 sigma): hit

Histogram the first maximum in the ADC value after crossing the threshold



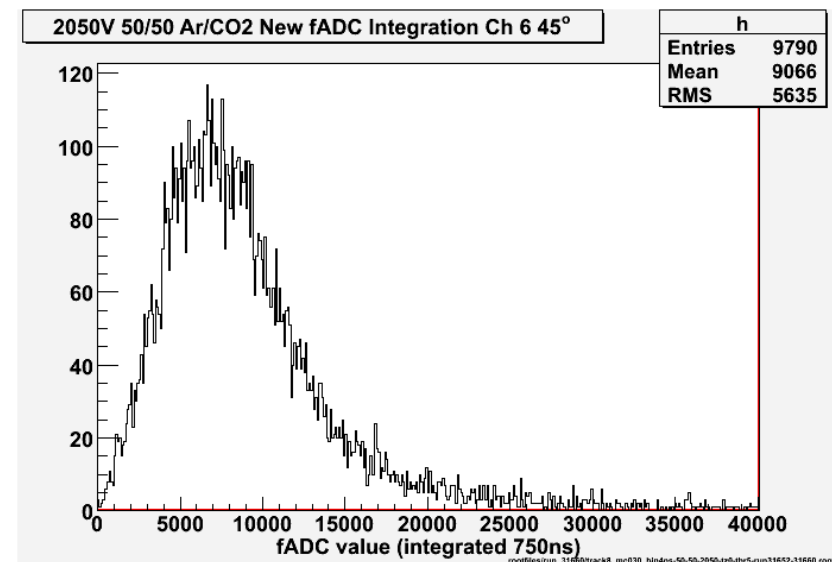
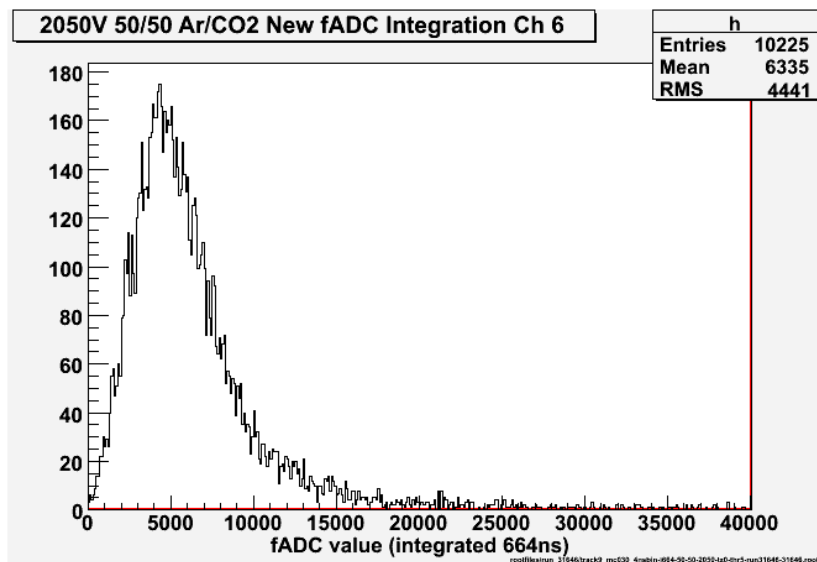


# Integrated amplitude histogram

Subtract mean pedestal from ADC values

Select event where ADC value rises above a threshold (5 sigma): hits

Sum the ADC values from the threshold crossing point out to 664ns later



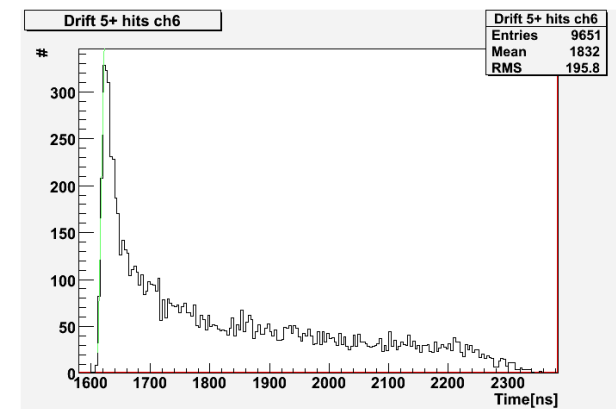
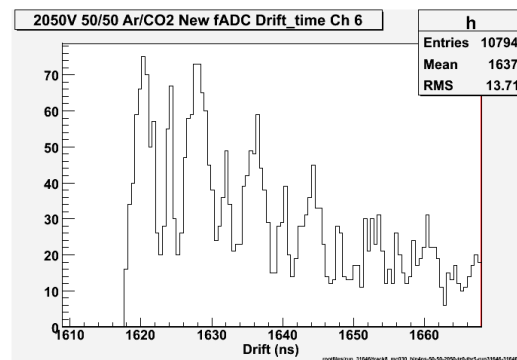
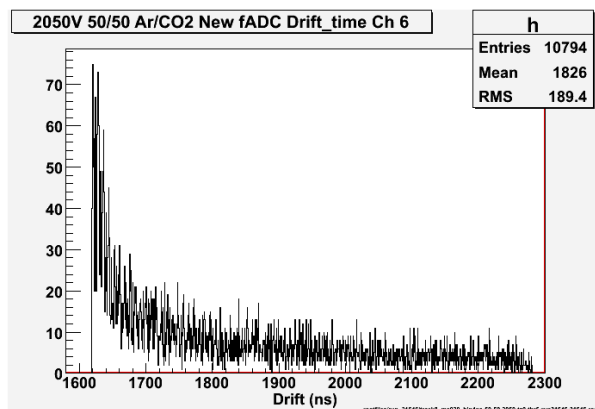
# Drift-time histogram

Define leading edge in ADC data (bins with step > 0.3 x max step)

Extract time by DCOG (average of leading edge bins weighted by step size)

Select events with 5 or more hits

Histogram drift times and extract t-zero from histogram: fit leading edge/  
take point on edge



# Tracking

Select events with 5+ hits

Use Garfield simulation to convert drift time into distance by interpolation

Find track – look at each pair of hits, calculate 2 possible straight line tracks, include other hits, find the most likely track

Fit track – send the most likely track to minuit to fit radius

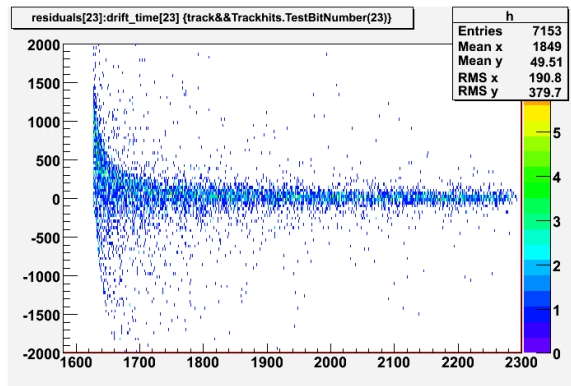
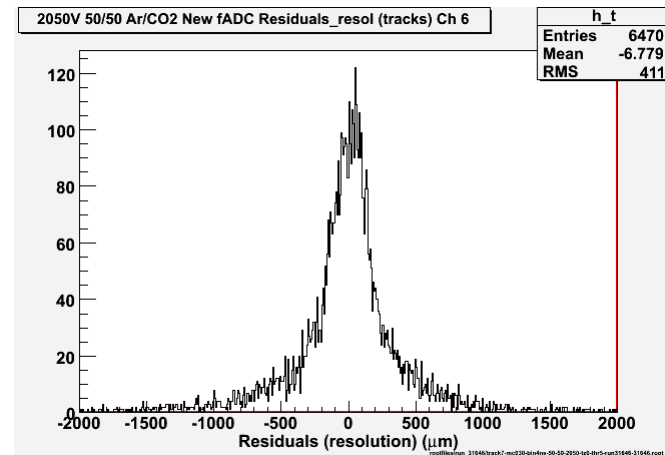
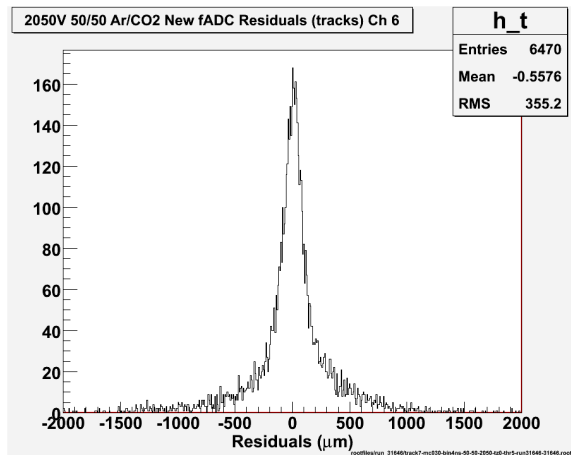
Calculate residuals – distance between fitted track radius and interpolated drift distance, and again after excluding the straw of interest from the fit

Adjust  $t_{zero}$ ? times  $< t_{zero}$  are assigned to  $t_{zero}$



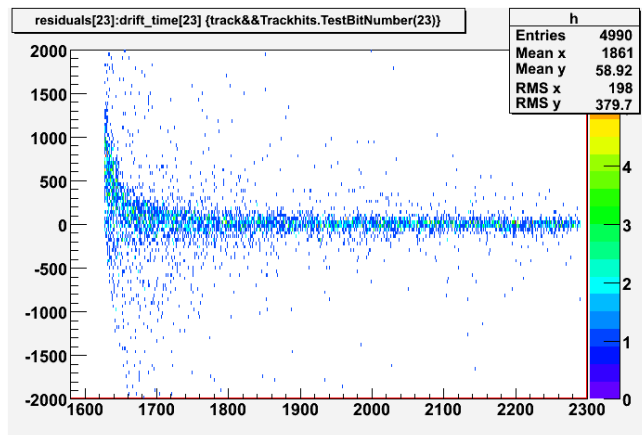
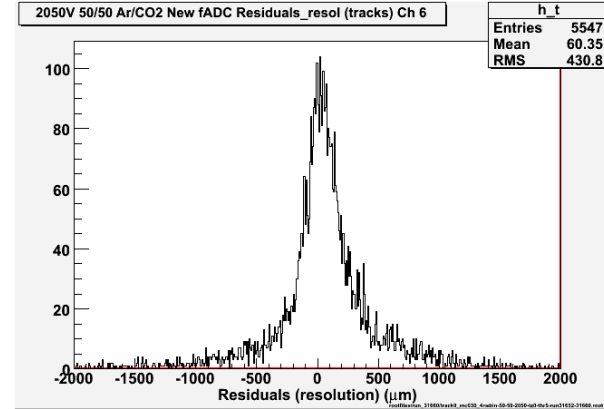
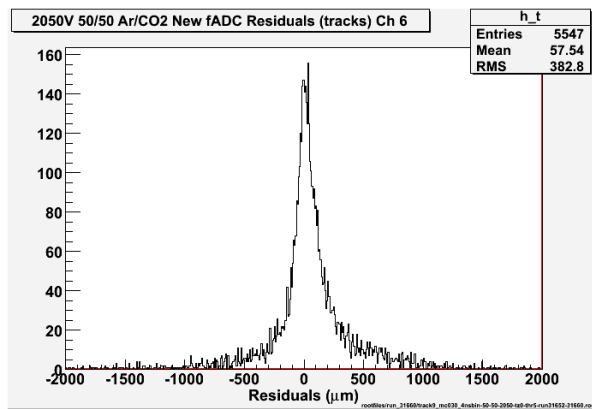
# Resolution

Prototype horizontal, tzero = maximum bin in drift time histogram



# Resolution

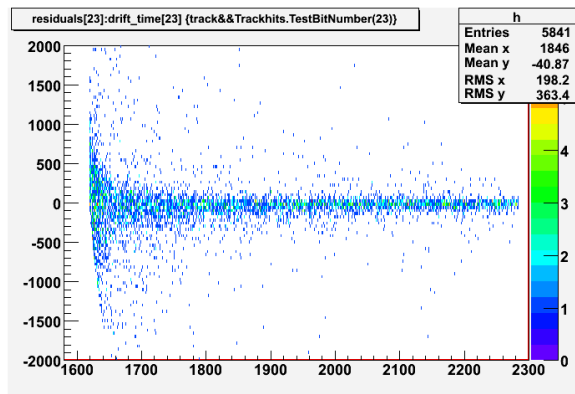
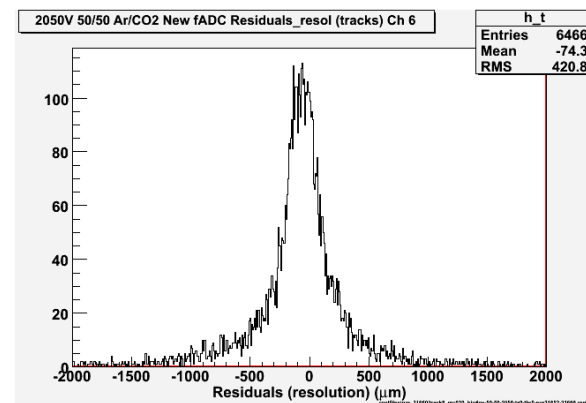
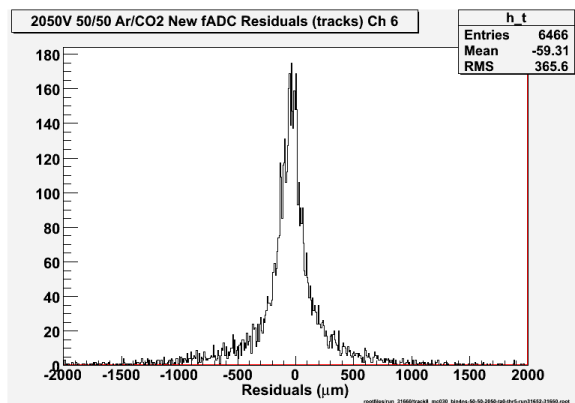
Prototype 45°, tzero = maximum bin in drift time histogram



# Resolution

Prototype 45°, tzero = half-way up leading edge of drift time histogram

Leading edge: counts > 10% of max counts, fit to straight line, find start



## What next?

### Prototype

- Tune the timing methods
- Put algorithm onto fADC
- Revisit integration method
- Revisit gas mix and flow rates

### CDC Phase 2

- Straw installation
- Also need to install gas lines and shell.
- Wire tension tests

### Phase 3 Stringing (2011/2012)

- Phase 4 Electrical hookup
- Some details to be finalized

### Remaining:

- Operational testing, transport

