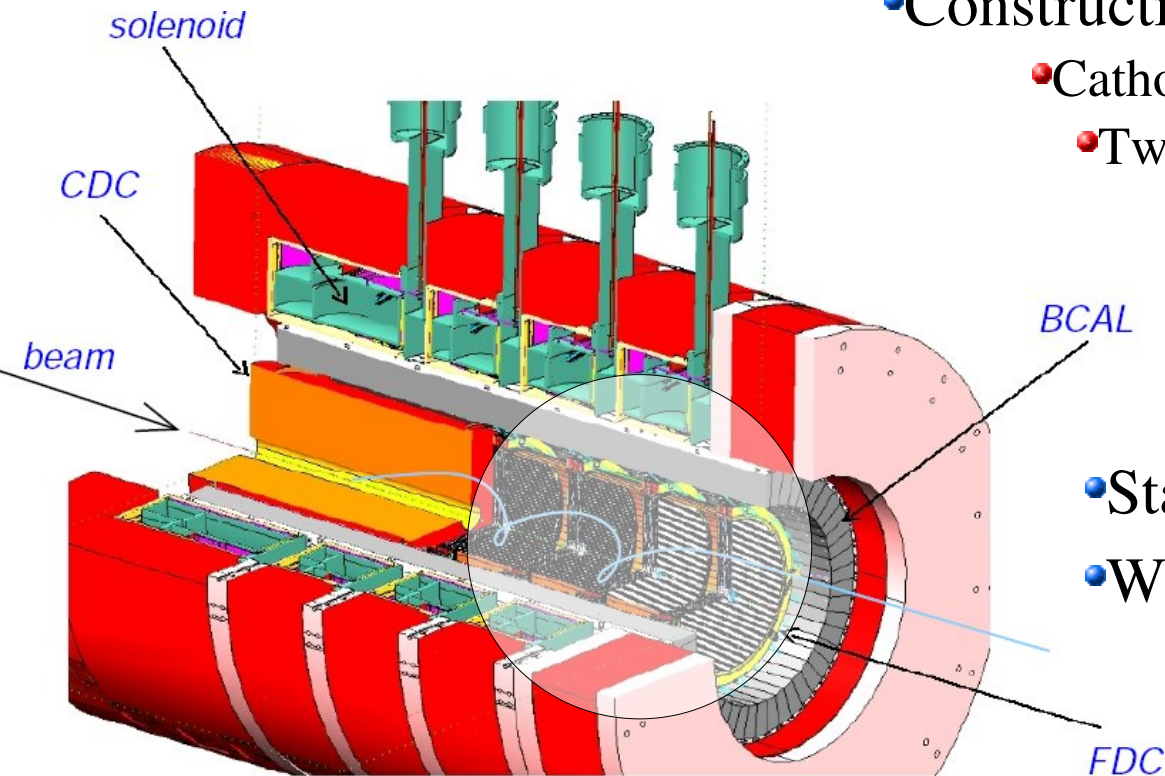


# FDC Status

Simon Taylor / JLAB

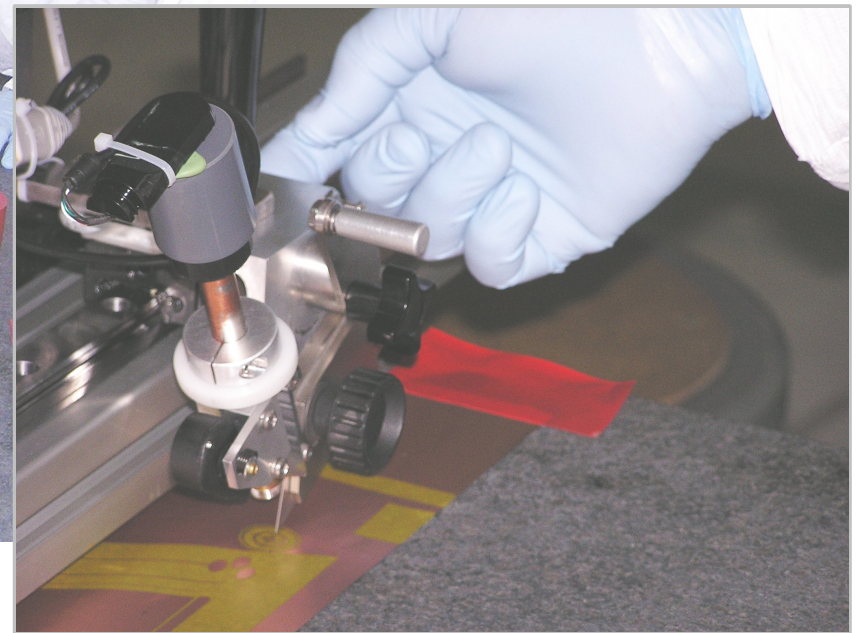


- Construction of full-scale prototype
  - Cathode boards
    - Two-cathode sandwich construction
      - Exit window
      - Rigid-flex assemblies
      - Wire frames
- Status of cosmic-ray test stand
- Wire staggering study

# Cathode Trimming

- All the full-scale prototype cathode boards were successfully trimmed

- Web cam, fiducial marks allow for precise alignment of blade relative to last strip on flex-board



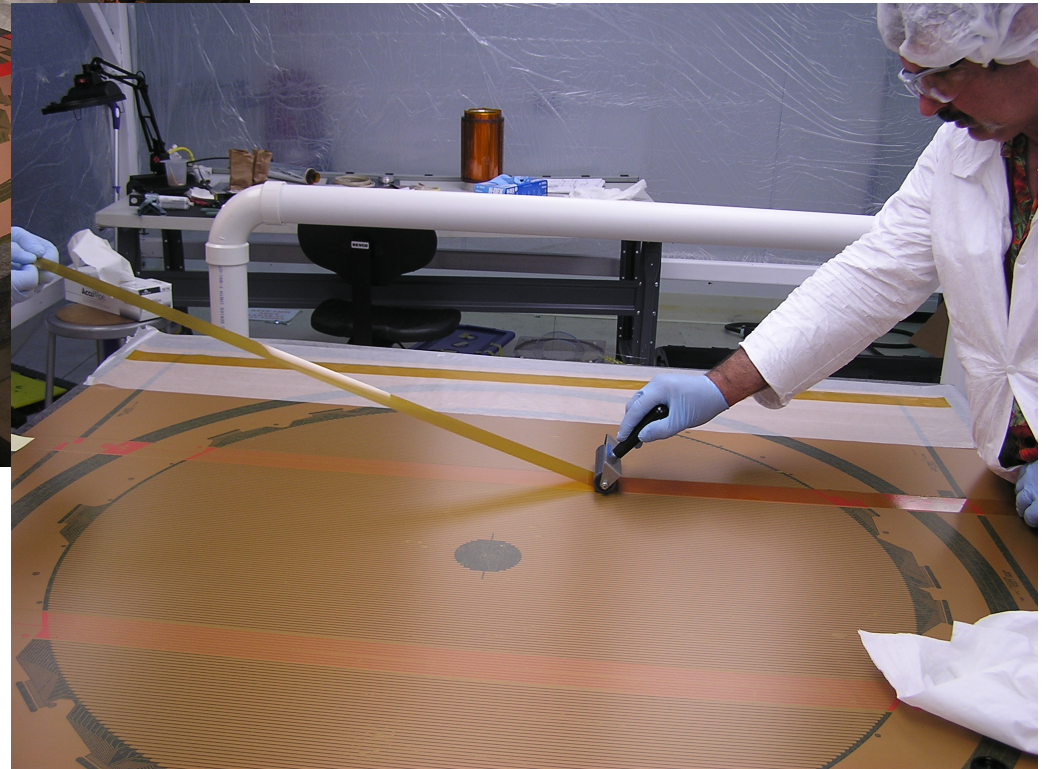
*Trim accuracy ~2 mils*

# Three-piece cathode assembly

- Procedure for attaching 3 cathode boards together has been finalized



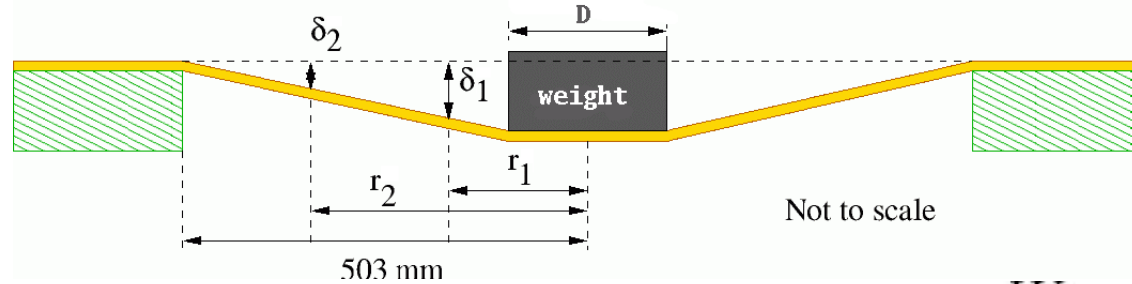
- Three pieces butted together
- Temporary **low-tack tape** on copper side to prevent epoxy seepage onto electrode



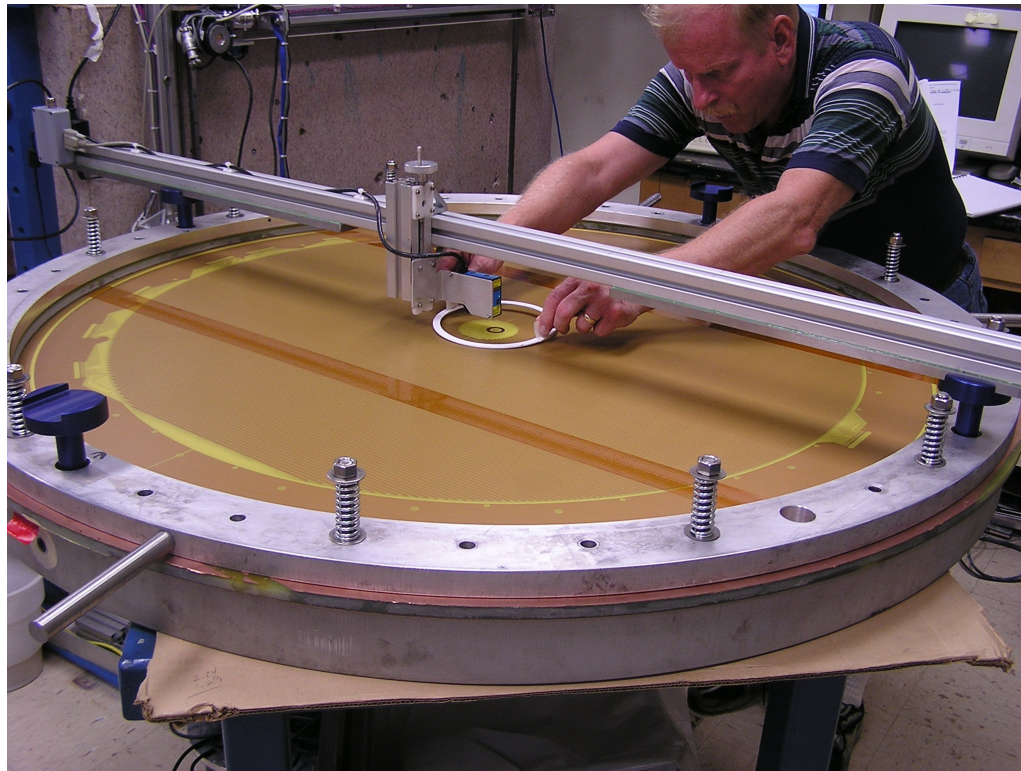
- Permanently attached together with **home-made tape** on back side

# Tensioning the Cathodes

- Procedure for tensioning the cathodes has been established



$$\delta(r) = \frac{W}{2\pi T} \cdot \log \frac{r}{R}$$



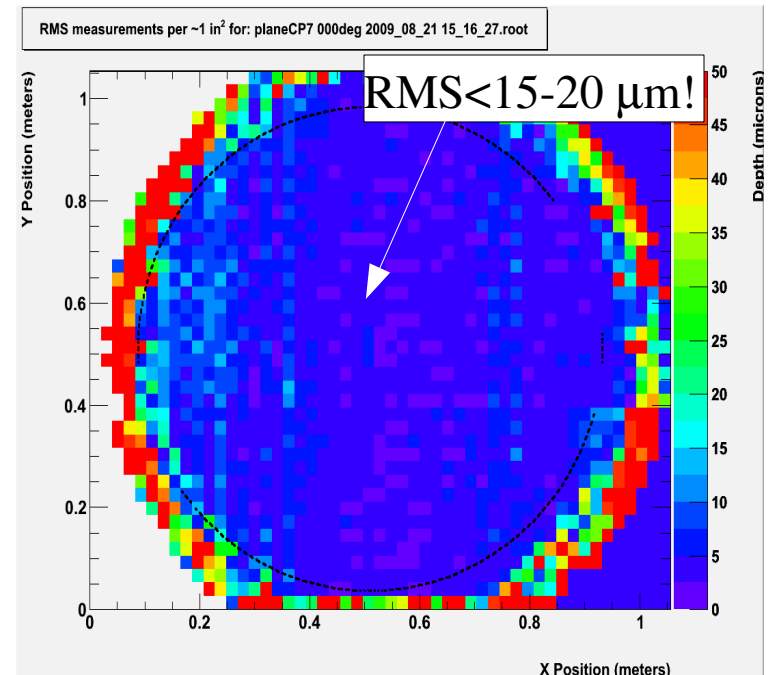
- Use laser sensor to measure deflection
- Set tension to  $\sim 550$  N/m

*All available cathode boards have been tensioned and epoxied to composite frames*

# Flatness Scans

- Automated scanning in two dimensions using laser scattering  
→ check for local variations in flatness (*want no wrinkles!*)

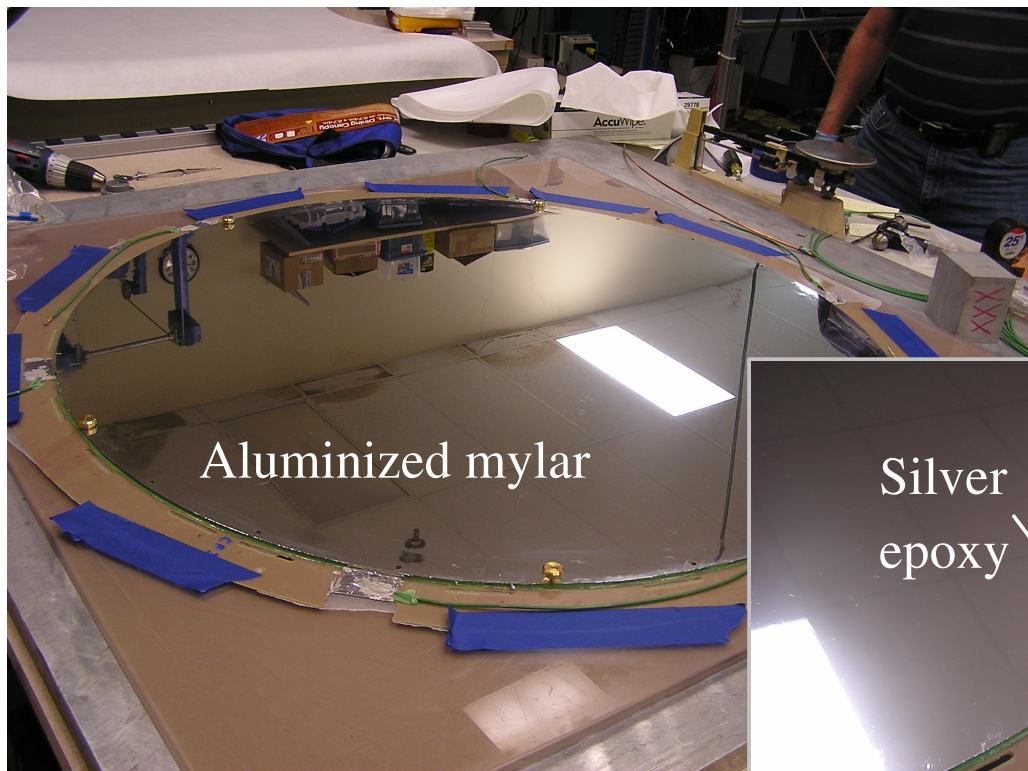
**Goal: local flatness < 200  $\mu\text{m}$**



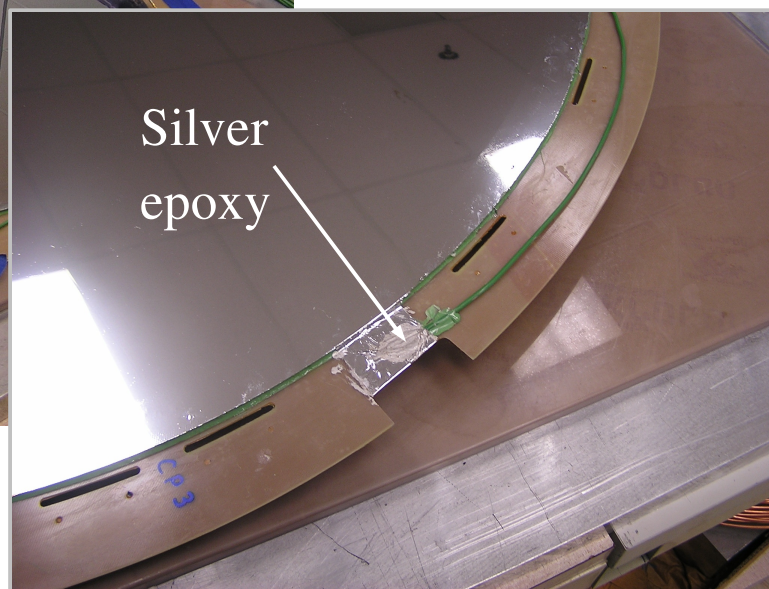
*Systematic problem on LHS of flatness measurement is not real → under investigation...*

# Ground Planes

- Designed to isolate one cathode plane from the next immediately adjacent one

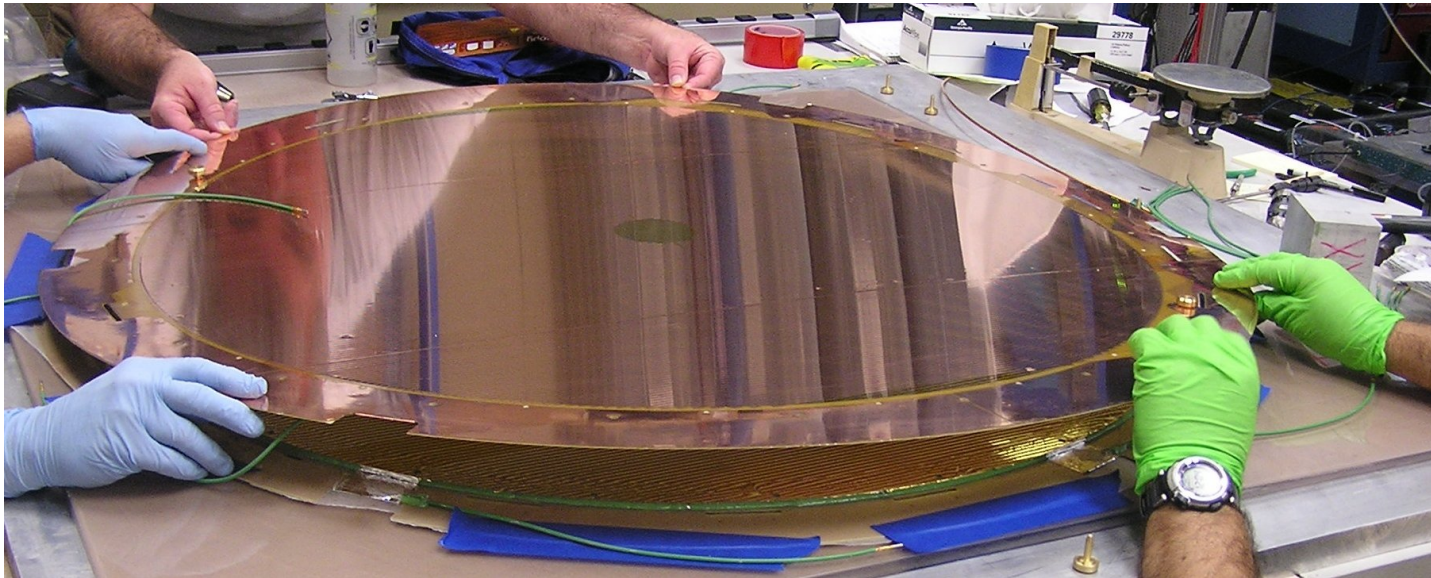
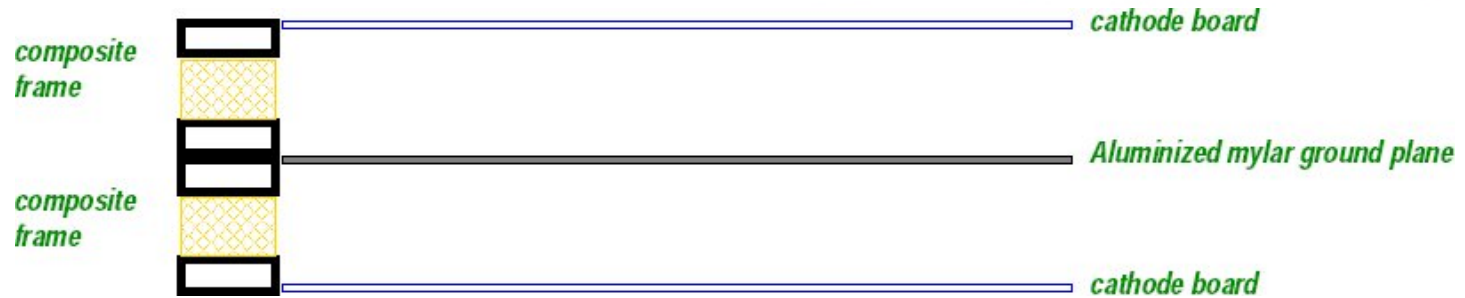


- Ground planes and ground pours for back-to-back cathodes tied together in several places
- Pigtails connect to common ground



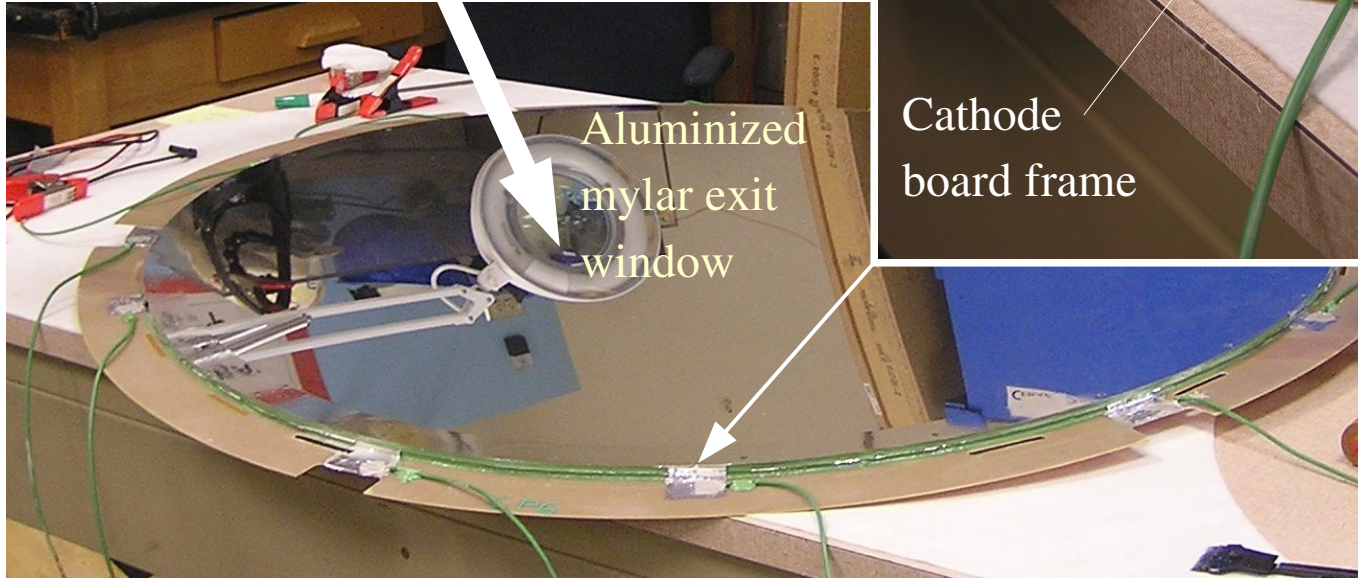
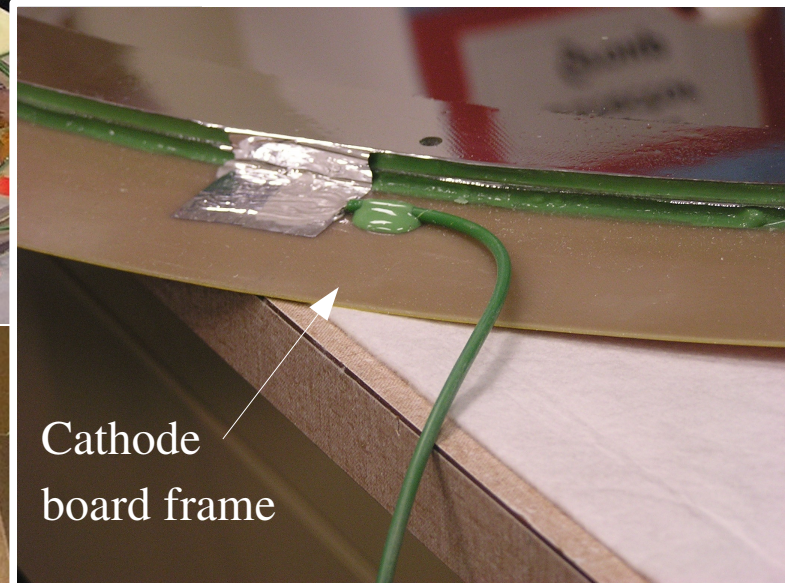
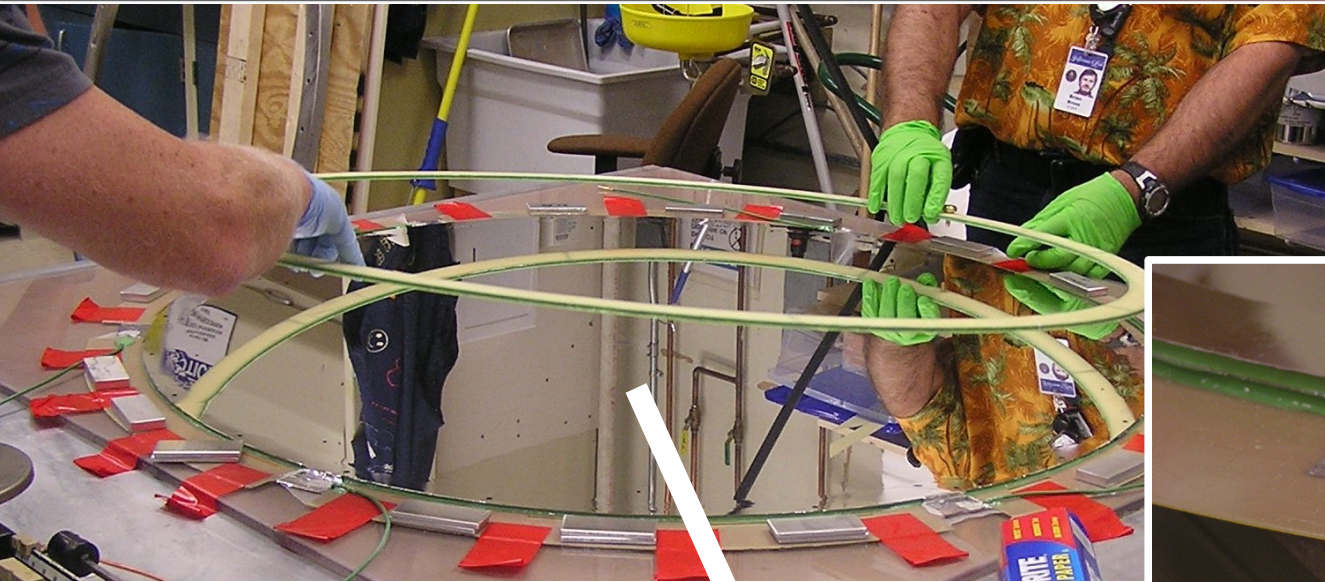
*Very thin layers!*

# Cathode Sandwich Construction



Two cathode sandwiches have been constructed!

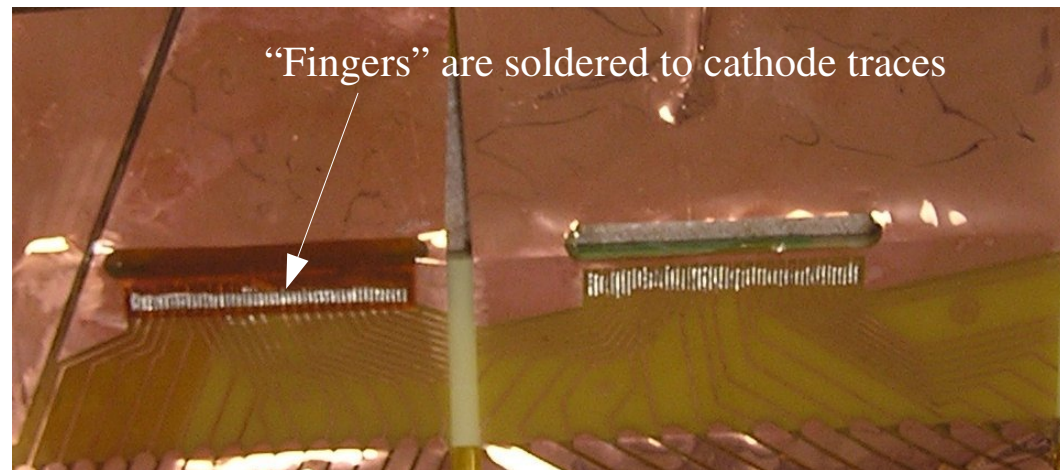
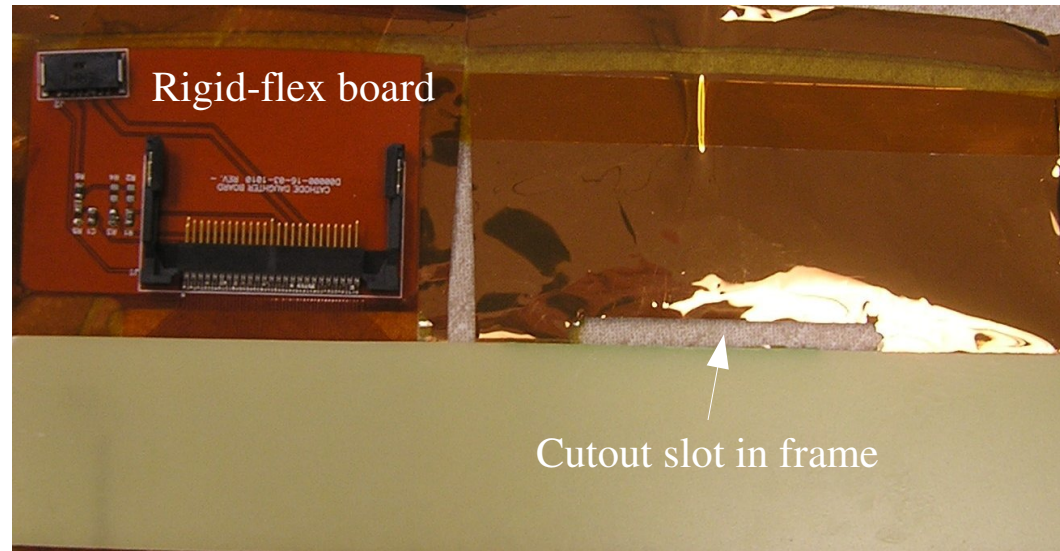
# Exit window+cathode assembly





# Rigid-flex board attachment

- Designed to place connector for the amplifier daughter board on other side of cathode frame relative to the strips
  - For cathode strip readout
  - Space constraints dictate design and placement
  - We are learning how to do the soldering to the traces on the cathode boards

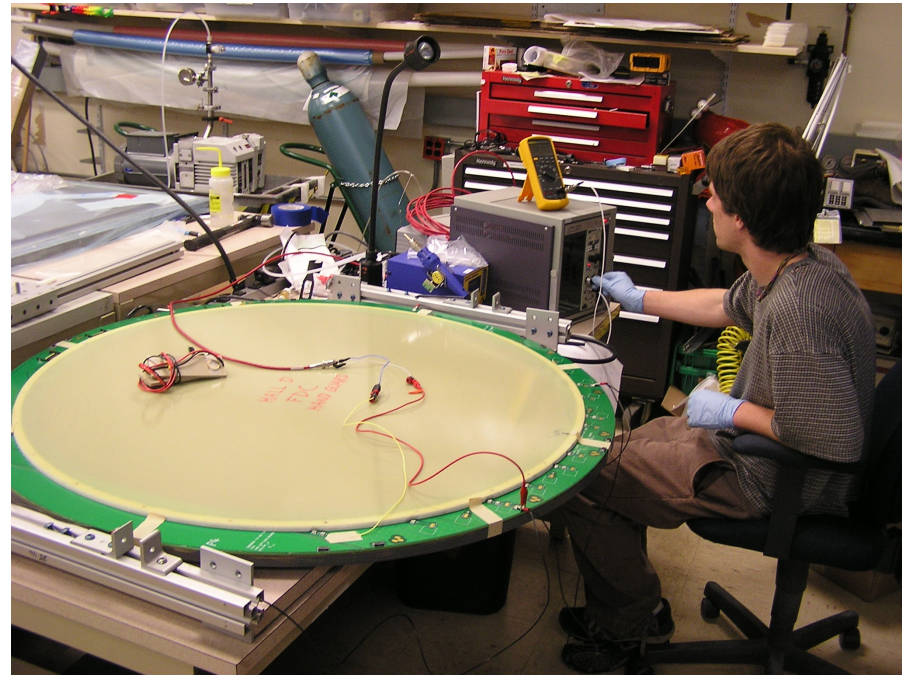


# Wire Board Issues



- Numerous wire solder joints per board needed repair
- Solder flux not cleaned off immediately after soldering at IUCF → we needed to do our own cleaning weeks after the fact...

- Initial HV tests → buses drew too much current for wire boards to be usable
  - Further cleaning and HV tests by summer student Rich Rines → current draw reduced
  - Low enough currents only achieved after keeping wire frames in dry environment for ~2 weeks



# Wire Board Issues



- Numerous wire solder joints per board needed repair
- Solder flux not cleaned off immediately after soldering at JUCF → we needed to do our own cleaning 2 weeks after the fact...

Current problems on wire frames not yet solved -- some busses still draw significant currents.

*Need to solve this before planes are usable!*



- Initial HV tests → buses draw too much current for wire boards to be usable
  - Further cleaning and HV tests by summer student Rich Rines → current draw reduced
  - Low enough currents only achieved after keeping wire frames in dry environment for ~2 weeks

# Phase-3 Wire Winding

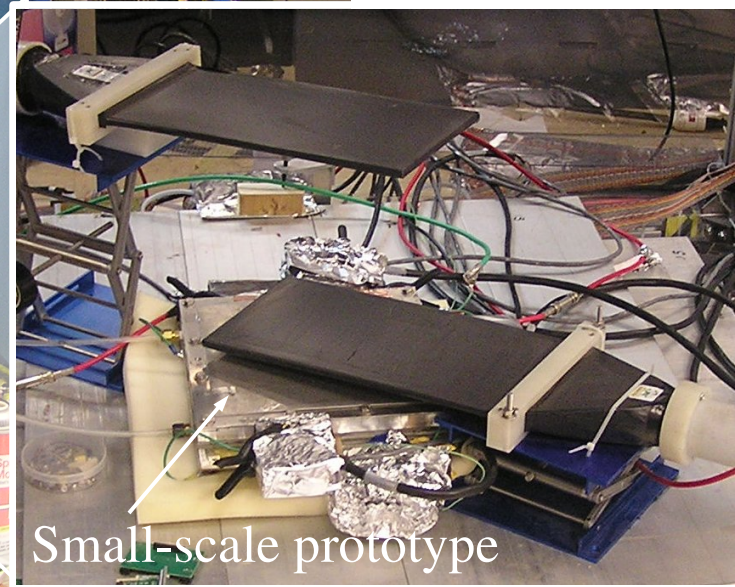
- We are sub-contracting the winding of the wire frames for the real FDC detector out to IUCF
  - Work to set up Phase 3 contract taking place this Fall
  - Hope to start wire winding toward end of 2010
  - Several remaining issues need to be addressed:
    - Plane flatness issues
    - Design of wire positioning combs
    - New strongback design
    - UCF winding facility modifications (e.g. control electronics)
    - Board cleaning specifications

# Test Stand Status



Noise reduction and grounding improvements are in progress.

External drift chambers



Small-scale prototype

Test stand now operational in EEL after move from Test Lab

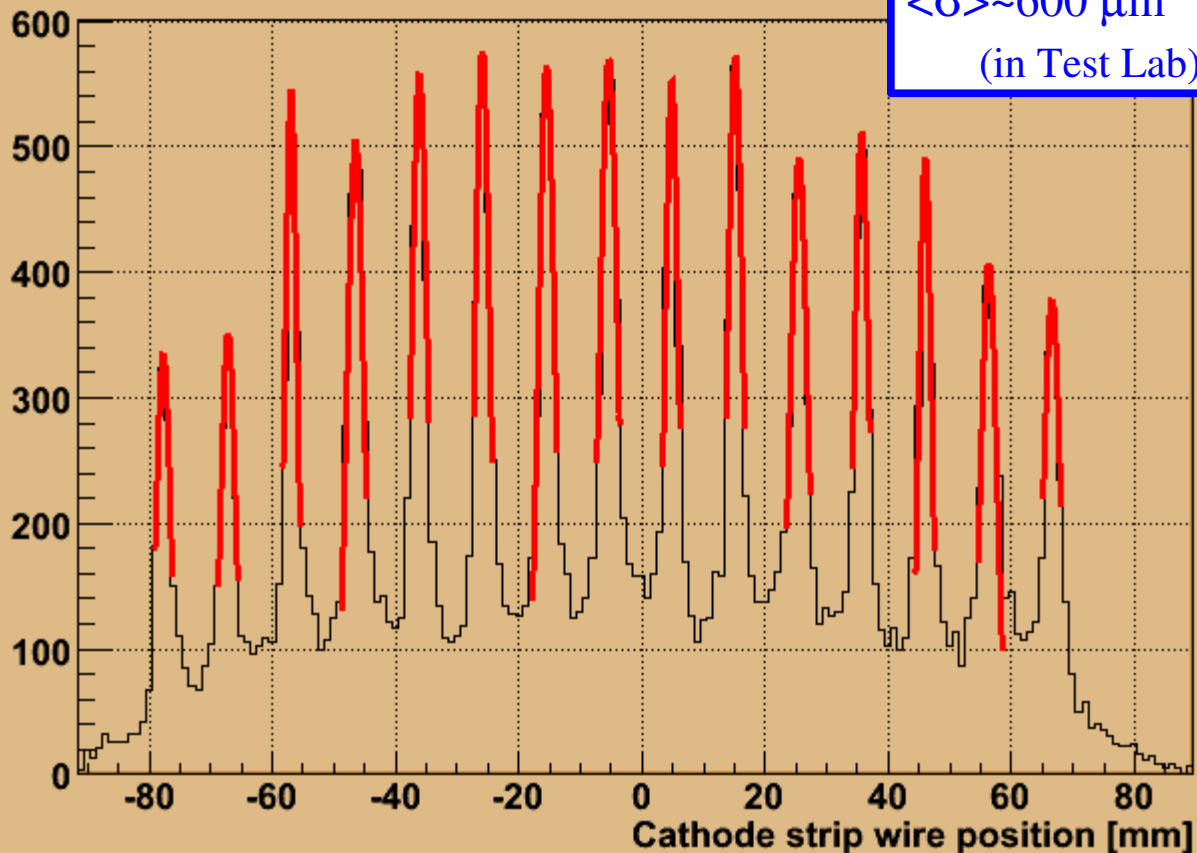
# Results for Small-scale Prototype

- Cathode centroids used to compute wire position

- No strip-to-strip gain calibration yet...

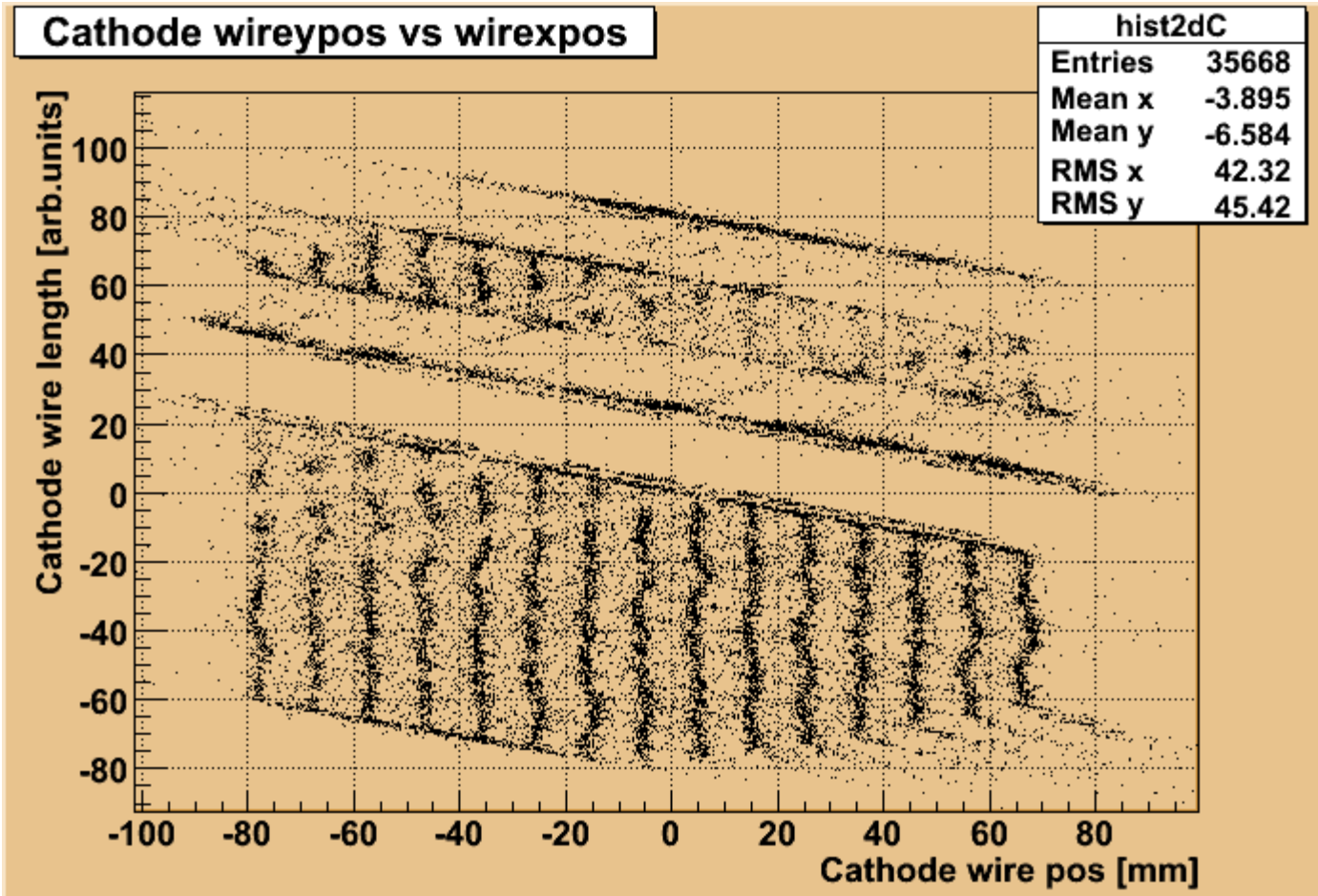
Cathode wire position X

Previous result:  
 $\langle \sigma \rangle \sim 600 \mu\text{m}$   
(in Test Lab)



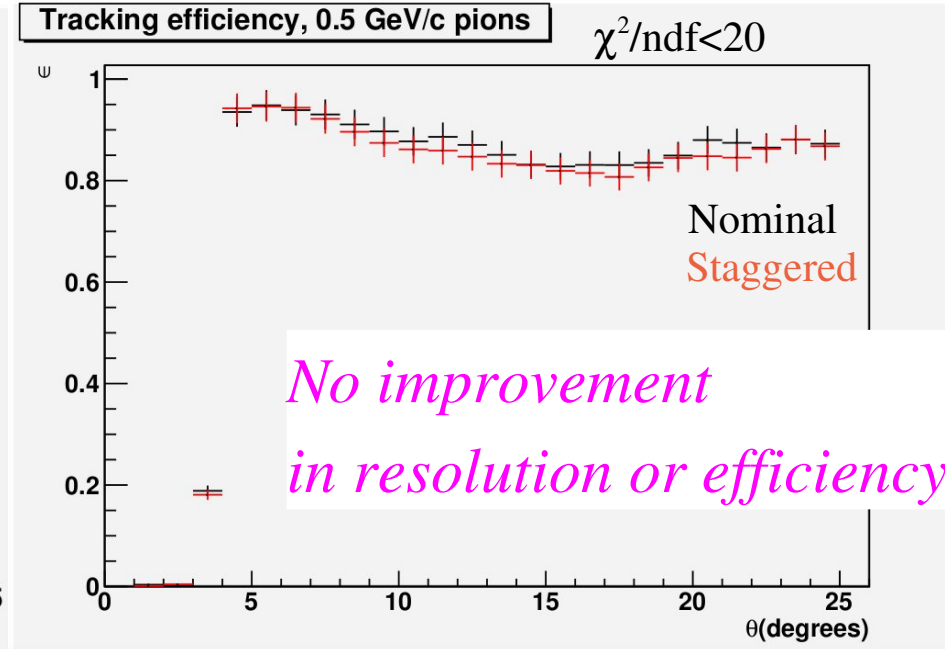
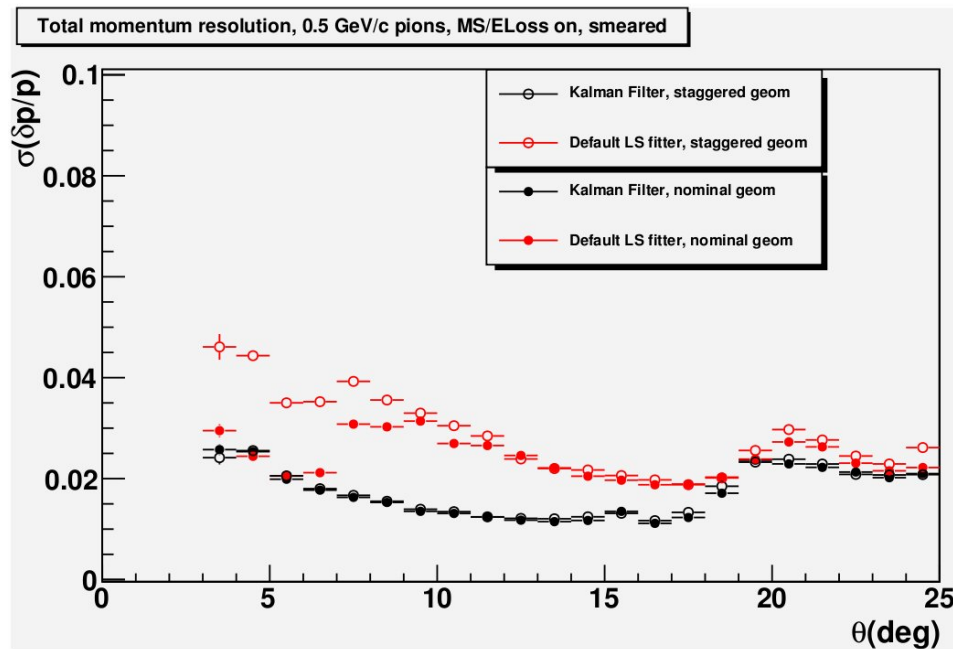
wire	pos(mm)	$\sigma$ (mm)
0	-77.7	1.2
1	-67.2	1.2
2	-57.0	1.0
3	-46.5	1.4
4	-36.1	1.3
5	-25.9	1.2
6	-15.5	1.3
7	-5.4	1.5
8	4.8	1.1
9	15.1	1.3
10	25.5	1.4
11	35.6	1.2
12	46.0	1.0
13	56.3	1.3
14	66.7	1.4

# Reconstructed Wire Pattern



# Staggered wire position option

- Many drift chamber designs have a 'UU' configuration where wires in 2 adjacent planes are parallel but offset by a half-cell → aid in resolving “Left-right ambiguity”
- Nominal FDC design: adjacent planes are rotated with respect to each other, but no wire stagger → should we do the wire stagger also?



**Wire staggering is not recommended for FDC design**



# Summary and Outlook

- Much progress over the last few months in construction of full-scale prototype
  - This represents the much-appreciated work of many people:
    - Fernando Barbosa, Stephen Burnett, Dan Carman, Eugene Chudakov, Bill Crahen, Roger Flood, Brian Kross, Rich Rines, Kim Shinault, Armen Stepanyan, Mark Stevens, Simon Taylor, Micah Veilleux, Herun Yang, Beni Zihlmann...
- Cosmic-ray test stand almost fully operational, will be ready to use when prototype is completed
- Production winding of wire frames will likely take place toward the end of 2010