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
- Use laser sensor to measure deflection
- Set tension to ~550 N/m

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

**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 μm

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

RMS < 15-20 μm!
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
- Pigtailed connect to common ground

Aluminized mylar

Very thin layers!

Silver epoxy
Cathode Sandwich Construction

Two cathode sandwiches have been constructed!

Two cathode sandwiches have been constructed!
Exit window+cathode assembly

- Cathode board frame
- Aluminized mylar exit window
- Cathode board frame
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

![Rigid-flex board](image1)

- Cutout slot in frame

- “Fingers” are soldered to cathode traces

![Rigid-flex board](image2)
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
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Current problems on wire frames not yet solved -- some buses still draw significant currents.

Need to solve this before planes are usable!
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
    - IUCF winding facility modifications (e.g. control electronics)
    - Board cleaning specifications
Test Stand Status

Test stand now operational in EEL after move from Test Lab

External drift chambers

Small-scale prototype

Noise reduction and grounding improvements are in progress.
Results for Small-scale Prototype

- Cathode centroids used to compute wire position
- No strip-to-strip gain calibration yet...

Previous result:
\(<\sigma>\sim 600 \, \mu m\)
(in Test Lab)

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<tr>
<th>wire</th>
<th>pos(mm)</th>
<th>(\sigma)(mm)</th>
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<tr>
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Reconstructed Wire Pattern

Wiggles seen in Test Lab results as well... under investigation
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?

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<table>
<thead>
<tr>
<th>Tracking efficiency, 0.5 GeV/c pions</th>
<th>$\chi^2$/ndf&lt;20</th>
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<td>No improvement</td>
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<tr>
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<td>in resolution or efficiency</td>
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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