Mu2e Construction: The Summer Plan

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Critical path is Solenoid Design, Construction and Commissioning
Tracker Production Schedule

8/1/16 Single Panel Prototype Evaluation Complete
12/1/16 Single Plane Prototype Evaluation Complete
6/5/17 Production Straws ready for assembly
6/13/17 LV power supplies received
7/13/17 Production preamps tested
10/30/17 All panels complete and tested
5/23/18 Straw Assemblies Complete
7/6/18 LV System installed
7/20/18 Cooling system installed and tested
7/24/18 Gas System Installed and Tested
8/31/18 HV system installed
2/25/19 Electronic Installation Complete
2/25/19 Implementation Tasks Complete
4/10/20 Ready for Cosmic Ray Test
10/15/20 Ready for Operations
Tracker construction

U. Minnesota
York
PPG
Duke
Rice, U. H.
Rice, U. H. assemble panels
U. Mn Straw QC
Cut and terminate straws
York Straw ends
Vacuum feedthroughs
Vacuum test straws
PPG wind straws
Duke Work with PPG
Locate wires (x-ray)
Fermilab Assemble planes
Assemble tracker
Production at Minnesota

• QC for straws
  ▪ Leak Testing
  ▪ Resistance Testing
• Cutting the straws to length:
  ▪ Laser cutting
• Install End Pieces
• Record in Production Database
Minnesota Straw Processing Factory

- Dedicated Lab in the MN’s new physics building
- A very clean environment with temperature and humidity control
- Processing 100 straws a day (assuming 8 hour shift)
- Labor force and facilities to increase production >200% if needed

PPG ships straws

Storage

Put on pallet and remove paper

Straw Conductivity Measurement

Install CO₂ Endpieces

CO₂ Leak Test

Laser Cutting

Install Termination Pieces

Termination Conductivity Check

Left over pieces of straws saved for density measurement

York Sends Termination Pieces

a few %

To York for Vacuum Test

Ship to Rice for Panel Construction
Mu2e Straws

Physical description:

- 15 \( \mu \text{m} \) thick Mylar straws
- 5 mm diameter
- Length from 45 to 120 cm
- 500 Å of aluminum on both inside and outside
- An additional 200 Å of gold on the inside

The outside aluminization of the Mylar straws act as additional electrostatic shielding and reduces leak rate of straws.
Mu2e Tracker and Leak Requirements

<table>
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<tr>
<th>Tracker Unit</th>
<th>Qty</th>
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<tbody>
<tr>
<td>Stations</td>
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<tr>
<td>Planes</td>
<td>36</td>
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<tr>
<td>Panels</td>
<td>216</td>
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<tr>
<td>Straws</td>
<td>20736</td>
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</tbody>
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Throughout the tracker, the straws have a total surface area of over 3 million cm².

The straws must hold in the Argon-CO₂ (80:20) gas for the tracker and maintain a 1 atm pressure difference with the vacuum.

In order to maintain a steady state vacuum in the detector solenoid, the entire tracker’s leak rate must be below 7 cc/min.
After being cut to length, endpieces need to be connected to straws. Endpieces are attached to the straw with silver epoxy to ensure conductive connection to the straw wall.
Goals

• Cut 100 Straws and send to Fermilab in 2 weeks. (Very hard)
• Significant improvement to the factory setup.
• All stations clean and fully operational by August for inspection.
• 600 straws completed by the end of the summer.
• All stations documented and work time is estimated.
Rough Outline of Summer Plan

Week 1: Introduction, Laser Cutting Calibration, Start Individual projects, Clean room,
Week 2: Laser cutting Calibrations, Start official cuts and Termination epoxy procedure
   Would be great to have the first 100 straws done.
Week 3: Fermilab CD3-c Review. Finish calibrating and documenting. Start setting up all stations
Week 4-5: Improve Factory aspects, New projects
Week 6: Second 100 straws, Full Factory processes, (Wrapped straws, leak test, ....)
Week 7-8: Improve Factory aspects
Week 9: Third 100 straws
Week 10: Fourth 100 straws, continue improvement
Week 11: Make sure everything is set for Fermilab Site visit
Week 12: Straws 400-600 complete.
Week 13: Finish up projects, make sure everything done over the summer was documented if not done during
Laser Cutting

a) Come up with a set of criteria to judge a straw cut.
b) Test Power, speed, multiple cuts.
c) Move into new room. Set up ventilation properly.
First Set of Personal Projects

a) Create a Stand that holds 2 straws (140 cm) and have the laser be able to align and cut to length.
b) Setup Temperature and humidity sensor. Have recorded information update to a database. Work on analyzing and creating room stability.
c) Determine consistent method of testing conductivity of the inside and outside of straw, both with and without termination pieces.