Bus Status Update

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Review

- Thermal expansion calculations simulations performed
  - Used to perform initial design of hold down locations
- Initial design for hold down fixtures for return end and lead end structure were performed
- Initial prototyping had begun
- Simulations verifying splice fixtures have been performed
- Anthony has continued to make progress in the assembly of the mock up
Q2 Bus
Connection Spider

- Prototype of connection spider made
- Design seems successful
  - Additional fine tuning of parts may be needed for actual materials
Lead End Design
Return End Design

- Return end hold down fixture has been designed and modified for mock up.
  - Small hold down fixture and spines used to hold down and align fixture and maintain shape
Bus Splice
Testing of fixture has been completed. It is currently 8 meters long, will be expanded to 11 meters. The parts to expand the fixture to 11 meters are expected to arrive in September.

The soldering fixture was demonstrated to Christian Scheuerlein during his trip to Fermilab from June 25-28.
Q1/Q2/Q3 bus splice solder placement

Soldering is done by placing strips of .010 inch (250 um) thick sheets of 96Sn4xx solder between the cables.

3 different configurations were tried as shown below (for example, the middle is 0 bottom 2 middle and 1 top).

0B2M0T was chosen and used successfully on the demonstrator. These samples will be potted, sectioned, polished and observed to examine the solder fill. Also, strands will be cut to further examine the fill inside and verify the design.
Bus Assembly with Clips

The bus housing for the Q2 cold masses is made in a similar manner to the earlier LHCIR Quads. Aluminum “clips” are used to hold the housing in place. Based on analysis, the bus housing exterior dimensions have been increased (still well within the flow budget).

The drawing shows the bus housing for the Q1/Q3, ready to release. The Q2 bus housing will be identical, except the length is slightly shorter and the shape of the twist will be included within the housing on the lead end.
Twist Manufacturing

The Q2 bus needs to be twisted on the lead end to allow the bus to exit the cold mass at the correct angle. The initial design was to compress the cable into a soldering fixture which formed the cable into the twisted shape.

This worked when tested, but was tested by twisting the cable in the “tightening” direction. Unfortunately, the twist needed for the Q2 needs to be in the “loosening” direction, so the cable could not be made to fit into the fixture.

The twists are now being made by soldering the bus pair while flat, and twisting after soldering. The twists shown above were made in this manner. They will be etched and the filaments examined to ensure that there is no damage.
## Instrumentation List for Q1/Q3

<table>
<thead>
<tr>
<th>Item</th>
<th>Wires per end</th>
<th>Gauge</th>
<th>Length</th>
<th>Description</th>
<th>Twisted/not</th>
<th>Label</th>
<th>Exit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLIQ Leads</td>
<td>2 cables</td>
<td>8.6 mm OD</td>
<td>2 m</td>
<td>Habia Cable 700061251</td>
<td>Not</td>
<td>CLIQ</td>
<td>CLIQ/K-mod port</td>
<td>US-HiLumi – doc 998</td>
</tr>
<tr>
<td>Volt Taps for Splices</td>
<td>16</td>
<td>26 AWG</td>
<td>4.5 m</td>
<td>Axon HH2619-LH</td>
<td>Not</td>
<td>EE</td>
<td>IFS Capillary</td>
<td>US-HiLumi - doc 1603</td>
</tr>
<tr>
<td>Quench Detection VT</td>
<td>3</td>
<td>26 AWG</td>
<td>4.5 m</td>
<td>Axon HH2618-LH</td>
<td>Not</td>
<td>EE</td>
<td>IFS Capillary</td>
<td>US-HiLumi - doc 1603</td>
</tr>
<tr>
<td>Quench Protection Heaters</td>
<td>16</td>
<td>18 AWG</td>
<td>4.5 m</td>
<td>Axon HH1819-LH</td>
<td>Not</td>
<td>YT</td>
<td>IFS Capillary</td>
<td>US-HiLumi - doc 1603</td>
</tr>
<tr>
<td>K-mod (Trim leads)</td>
<td>2 or 0</td>
<td></td>
<td>2 m?</td>
<td></td>
<td></td>
<td>TRM</td>
<td>CLIQ/K-mod port</td>
<td></td>
</tr>
<tr>
<td>Warmup Heaters</td>
<td>4</td>
<td></td>
<td>4.5 m</td>
<td></td>
<td></td>
<td>EH</td>
<td>IFS Capillary</td>
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<tr>
<td>Temperature Sensors</td>
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<td></td>
<td>4.5 m</td>
<td></td>
<td></td>
<td>TT</td>
<td>IFS Capillary</td>
<td></td>
</tr>
</tbody>
</table>