Motivation

- Development of high-current ReBCO CORC joints and conductors, for future detector magnet applications.
- Low-resistance joints needed, but challenging due to multi-layered geometry of the conductor.
- A easy-to-use test bench is built, for systematically investigating various joint layouts and their resistance at high currents in multi core cables.

Test bench layout

Available joint length: 300 mm
Total sample length: 800 mm
Quench heater

Secondary coil:
Single turn, Al stabilized NbTi cable, *(ATLAS Barrel Toroid)*
\[ L_{sec} = 1.02 \, \mu H \]
\[ M = 1.03 \, mH, \]
\[ k = 0.44 \]

Primary coil:
4355 turns, Multi-filamentary NbTi/Cu superconductor, \[ L_{prim} = 5.32 \, H \]
Al-5083 flanges

Fig 2. Design of superconducting transformer

Transformer properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductance primary [H]</td>
<td>5.32</td>
</tr>
<tr>
<td>Inductance primary [μH]</td>
<td>1.02 ± 0.04</td>
</tr>
<tr>
<td>Mutual inductance [mH]</td>
<td>1.03 ± 0.04</td>
</tr>
<tr>
<td>Self-field / current secondary [10^{-5} T/A]</td>
<td>3.2</td>
</tr>
<tr>
<td>BT cable secondary, ( I_s ) at self-field [kA]</td>
<td>100</td>
</tr>
<tr>
<td>Maximum current primary [A]</td>
<td>65</td>
</tr>
<tr>
<td>Current multiplication factor</td>
<td>1010</td>
</tr>
<tr>
<td>Maximum current range secondary (Bipolar power supply) [kA]</td>
<td>131</td>
</tr>
</tbody>
</table>

First results

- Transformer tested up to 60 kA, 45 kA in voltage control mode.
- First sample: NbTi ATLAS Barrel Toroid cable.
- Non-linear resistance, likely due to superconducting solder and magneto-resistivity of copper.
- Outlook: bipolar power supply for doubling available secondary current range.

Conclusion

- Transformer for testing of joints at high current built.
- Tested with a first sample up to 60 kA.
- System ready for testing first high current ReBCO cable joints.