



Cryomodule CM1 instrumentation and test plan

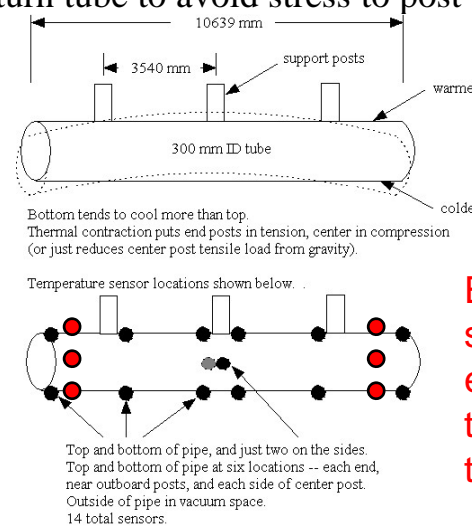
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10 March 2009





CM1 instrumentation

Proposal	Primary Objective
<p>COOLDOWN T-SENSORS</p> <p><u>Thermal Shields</u> 2 CERNOX at bottom of 5 K shield, 2 Pt at bottom of 80 K shield</p> <p><u>GHe Return Pipe</u> Preferred: Install 14 Platinum RTDs on the outside wall of GHe Return Pipe (as specified in T. Peterson's note of 8/27/07)</p> <p>Minimum: 2 CERNOX at lower middle GHe return pipe, 3 CERNOX at each end, inside the pipe, wires coming out of feed and return box.</p>	<p>Control Top-to-Bottom thermal gradient in 300mm GHe return tube to avoid stress to post supports</p>  <p>Ended up with six sensors, three at each end, on inside of pipe, to detect vertical temperature gradient</p>
<p>COOLDOWN STRAIN GAUGES</p> <p>Install a total of 5 Strain gauges: 3 axial on column supports 1, 2, & 3; 1 transverse on the 5K shield and 80K shield at the fingers.</p>	<p>The results of this test are to validate the stress model on cool down with the goal of optimizing the cool down rate.</p>
<p>HOM T-SENSORS</p> <p>Install one CERNOX RTD on each HOM coupler, 16 total</p>	<p>To monitor the temperatures of the HOM cavity couplers.</p>



Comments on CM tests

- Goal of instrumentation in single cryomodule operation is observation and control of cool-down and warm-up
- We do not expect to measure heat loads accurately with a single cryomodule
 - **End effects dominate, such as thermal radiation into the cryomodule from the ends**
 - **We will monitor total system conditions but will not be able to attribute heat specifically to the cryomodule**
- LN2 (2-phase) on the 80 K thermal shield in NML will limit the ability to measure that heat load



Comments on CM tests -- 2

- Measurement of 2 K heat via boiloff rate may miss heat entering above liquid level
 - **Such as support posts to 300 mm tube**
- With three cryomodules in NML we may have a better measurement of heat loads on the central CM
 - **But of course an even longer string (more than three) would provide a better heat load signal**
- Goal of CM1 test is quite basic -- cool down to 2 K and operate a CM with RF and a good accelerating gradient (my opinion)
 - **Commission the NML system**