9th Summary of Meeting for S1-Global module design, Cryomodule and Cryogenics (20090310)

Date: 2009/03/10
Time: 22:00-23:00 (Japan Time)
Attendant: Jim Kerby, Tom Peterson, Tug Arkan, Paolo Pierini, Serena Barbanotti, Prashant Khare, Tetsuo Shidara, Hirotaka Nakai, Norihito Ohuchi

Agenda

1. Status of FNAL-CM1 cold test (Tom Peterson)
2. Thermal analysis of S1-G cryomodule (Serena Barbanotti)
3. S1-G cryomodule design by Zanon
4. Others:RF cable table update and S1-G drawings by KEK (Norihito Ohuchi)

Discussion

(1) Status of FNAL-CM1 cold test [briefly report of cryomodule CM1 instrumentation and test plan] (Tom)

・One of the main concerns for the first cool down of CM1 is an understanding of the cool down control with avoiding bowing of the 300mm Gas Return Pipe, GRP.

・14 Platinum RTDs on the outside wall of GRP are installed.

・The deformation of the GRP will be calculated by the temperature distribution during cool down.

・During cool down, the temperature difference through the GRP will be limited within 50 degree K as same as DESY.

Q: How much is the mass flow rate of He Gas during cool down?

A: The small liquefier will be used, and the expected mass flow rate is a few g/s.

・FNAL does not plan to measure heat loads accurately with a single cryomodule because the end effects dominate, such as thermal radiation into the cryomodule from end cans. FNAL will monitor total system conditions but will not be able to attribute heat specifically to the cryomodule.

・LN_2 (2-phase) on the 80K thermal shield in NML will limit the ability to measure that heat load.

・Measurement of 2K heat via boil off rate may miss heat entering above liquid level, such as support posts to 300 mm tube. Nevertheless, FNAL will try to measure the heat load with this method in order to understand the system.

・With three cryomodules in NML, FNAL may have a better measurement of heat loads on the central CM.

・Goal of CM1 test is quite basic—cool down to 2K and operate a CM with RF and a good accelerating gradient; commissioning the NML system (Opinion by Tom).

Q: Is there the idea of instruments on the shields like GRP?

A: FNAL has some instruments on the shields.

C: In the DESY experiment, there was a big thermal gradient on the 70K shield at the quick cool down.

C: FNAL has a set of parameters for cooling the module for limiting the cool down rate from DESY. FNAL will follow the same procedure.

Q: When will be the commissioning of NML?

A: There is no good answer for this question. FNAL has just received the end box. It will be in a few months, but it is not exact.

(2) Thermal analysis of S1-G cryomodule (Serena)

・The starting design is UGS NX4 simplified 3D model.

・The included components of the S1-G cryomodule model are 2 support posts, 70K shield, 5K shield. GRP, Invar rod, Helium tanks and beam pipe between tanks with coupler ports.

・Heat loads conditions are;
Temperature: 300K at upper post disk, 77K at finned pipe surface, 4K at finned pipe surface and 2K at GRP and tank surface.
Heat flux (radiation): 1W/m^2 at 77 K shield surface, 0.05 W/m^2 at 4K shield surface (from CERN data)
Heat flow (conduction of RF cables and couplers): 0.5W at 2K coupler edge, 2.8W at 4K coupler opening edges and 16.3 W at 77K coupler opening edges.
・Preliminary results of the heat loads; 0.5W at 2K, 5.8W at 4K, 50.7W at 77K and 21.8W at 300K.
・Next steps;
Verify heat loads for the static simulation (fill Tom table with S1 global data and confirm RF cable design)
Implement cool down and warm procedure at the KEK facility for the transient simulation.
Verify the calculated data with the experimental data collected by KEK.

Q: What does that mean "At 300K: 21.8W"?

A: The upper part of the support post was fixed at 300K in the vacuum vessel. This is the support post conduction heat load.

C: In the STF system, the mass flow rate is very small with compared to FNAL and DESY systems for the transient analysis of this module. KEK group will report the previous experimental data for this analysis.

(3) S1-G cryomodule design by Zanon (Serena)

・The drawings of the module-C by Zanon are 70% ready.
・For completing the drawings, it will take a couple of weeks.

(4) Others:RF cable table update and S1-G drawings by KEK (Norihito)

・The updated summary table of RF cables includes the dimensions, attenuation, heat conduction data of copper and iron, CW power and phase change by temperature for two RF cables.
・Dimensions of KEK RF cable (SUCOFLEX103) were measured by disassembling the cable. The cross section area of the copper was 3.02 mm^2, and this value was a half of the previous value by KEK cavity-group.
・The cryomodule and cryogenics groups asked the cavity and cavity-integration groups to discuss the RF cables for the ILC with this table. The performances of these two cables will be directly measured and compared in the S1-G tests.
・The most updated drawings for the Module-C were shown. These drawings have WPM components and the distance change between posts from 3200 mm to 3210 mm.

C: We do not have any CAD data for the beam pipe bellows between cavities in order to complete these assembly drawings. Who can provide the data? Whom should I ask the data for FNAL and DESY cavities?

C: For the FNAL side, Tom will ask the concerned people, and for the DESY side, Paolo will ask these people for getting the data.

C: The DESY cavity is longer than the FNAL cavity, and then the bellow lengths are different in a few cm.

Next meeting date

Meeting Date: 23 March 2009 22:00 (Japan time), 8:00 (FNAL), 15:00 (INFN and DESY)

Discussion items
・Subjects of the cryomodule and cryogenics parallel session in TILC09 (All)
・Brief report of KEK cavities in Module-A (Norihito Ohuchi)
・Material study in the cavity vessel (Hirotaka Nakai)
・S1-G cryomodule drawings by Zanon (Serena Barbanotti)