

## 15th Summary of Meeting for S1-Global module design, Cryomodule and Cryogenics (20090623)

Date: 2009/06/23

Time: 22:00-23:30 (Japan Time)

Attendant: Jim Kerby, Tom Peterson, Tug Arkan, Carlo Pagani, Paolo Pierini, Serena Barbanotti, Tetsuo Shidara, Hirotaka Nakai, Kiyosumi Tsuchiya, Hitoshi Hayano, Norihito Ohuchi

All presentations are unloaded in the INDICO site:

<http://ilcagenda.linearcollider.org/conferenceDisplay.py?confid=3674>

### Agenda

1. Updated construction status of Module-C (Serena Barbanotti)
2. Module-A design progress (Norihito Ohuchi)
3. Summary of material study-2 (Hirotaka Nakai)
4. Alignment measurement in Module-B (Kiyosumi Tsuchiya)

### Discussion

#### (1) Updated construction status of Module-C (Serena)

- The photos of the components are uploaded in the above INDICO site.
- Thermal shields: cut and bended, ready for pre-assembly.
- The gas return pipe:
  - a. 2 ends have been machined, and shapes preassembled.
  - b. In the next week, the welding of the shapes on the GRP starts.
- MLI ready.
- Vessel
  - a. The end flanges have been welded, and all components (brackets, nozzles, ...) are ready.
  - b. The openings for the nozzles are being cut.
- The cold mass final machining should start after the welding of the shapes on the GRP, in 2-3 weeks from now.
- After the final machining the preassembly takes place.
- TO BE CONFIRMED AT NEXT MEETING: preassembly at the end of July.

#### (2) Updated sensor list (Norihito)

- Designs of two types of KEK cavities have been completed, and the data are incorporated into the module design.
  - From the design work of Module-A, the gas return pipe and the vacuum vessel of Module-A are scheduled to be re-machined and modified.
  - Based on the module design, the company will start making the drawings of the components in one or two months.
  - In the cross connection pipes from liquid helium supply pipes to the helium jackets, the Ti-SUS junctions are used.
  - The locations of the tuner drive shaft are fixed. On the vacuum vessel, the ports for the shafts are welded, and the working windows for assembling the set of shafts are made.
  - There are two interferences in the module-C components:
    - a. The pipe for KEK WPMs penetrates the tuner motors of FNAL cavities. In case of impossibility to rotate the motor, the WPMs for KEK cavities will be canceled. However, the WPMs for GRPs are assembled.
    - b. The tuner motor for DESY cavity at the end of the module has an interference with the 5K shield.
- C: The 5K shield can be cut to accommodate the motor. SI covers these components.

#### (3) Summary of material study-2 (Hirotaka Nakai)

- The charpy impact tests, which have been performed in KEK, are summarized.
- The tested materials: Nb, Ti, NbTi alloy, Nb-Nb joint (EBW), Nb-Ti joint (EBW), Ti-Ti joint (TIG welding), Nb-SS316L joint (HIP)
- Test temperature: 300K, 77K and 4.2K

- b. Standard width of notch section: 8 mm.
- c. Standard cross section: 0.8 cm<sup>2</sup>.
- Subsize widths: 2.5mm, 5mm, 7.5mm
- All data are plotted in the presentation. Please see the material of the presentation.
- Summary of the presentation
  - a. A series of impact tests have been carried out at a Japanese company (Kawaju Techno Service Corp.) with metal materials and welded materials for application of special approval in accordance with high pressure safety regulations in Japan.
  - b. The high pressure gas safety institute (KHK) requires information on whether samples were completely fractured or not, and also on brittle fracture surface ratio with test temperature.

#### (4) Alignment measurement in Module-B (Kiyosumi Tsuchiya)

##### (Deflection measurement of GRP in the STF-cryostat B)

- The gas return pipe deflection from the cool-down to the warm-up were measured with the 2 laser displacement sensors, 5 wire position monitors and 5 optical targets.
- The measurements were performed from 8 April to 13 May. Cool down conditions are as follows:
  - a. April 8 and 9: The cold mass was cooled with GHe at ~80K and the mass flow rate of ~1 g/sec.
  - b. From April 10: The cold mass was cooled with LHe at 4.2 K and 0.35 g/s and after reaching 4.2K, with LHe at 2K and 0.4 g/s.
  - c. As the feature of the cooling, system was operated only in the daytime (intermittent cooling).
- Summary of the presentation
  - a. Deflection of the gas return pipe
    - Laser displacement sensor (LD): vertical displacement
      1. Rather large deflection (max 9mm) was observed at the end of GRP during cooldown.
      2. Deflection at the GRP center: 0 mm (before cooling), 0.3 mm (at 4.2K), 0.2 mm (at 2K), 0 mm (after warm up)
      3. Deflection at the GRP end: 0 mm (before cooling), 0.5 mm (at 4.2K), 0.58 mm (at 2K), -0.08 mm (after warm up)
    - Optical target measurement: horizontal and vertical displacement
      1. Horizontal displacement at cold: 0.5~0.6 mm.
      2. Vertical displacement at cold: almost the same values as those by LD.
      3. Accuracy of this measurement was 0.2~0.3 mm.

Banana shape vertical deflection of GRP can be seen in the data.
    - The deflection of the GRP must be due to the temperature difference between the top and the bottom of the GRP.
  - b. Sensors:
    - Laser displacement sensor is very reliable.
    - Accuracy of optical measurement was 0.2~0.3 mm.
    - Improvement of KEK WPM system is necessary to get reliable data.
  - c. Next step:
    - At this point we do not have enough data to fully understand the deflection of the GRP. No data about the stability of the GRP position at cold and the reproducibility of the position change after thermal cycles. (More detailed study of the GRP position at 2K should be performed if ILC requires the alignment accuracy of <0.1mm.)

#### Next meeting date

Meeting Date: 7 July 2009 22:00 (Japan time), 8:00 (FNAL), 15:00 (INFN and DESY)

##### Discussion items

- Updated construction status of Module-C (Serena Barbanotti/Paolo Pierini)
- Updated assembly schedule of S1-C cryomodules (Norihito Obuchi)