

Minutes:

Discussion on SIS 300 curved Model Dipole Cryostat,
06.02.2008, GSI

Participants

U. Gambardella (INFN), E. Floch, G. Hess, M. Kauschke, J. P. Meier, G. Moritz, P. Schnizer,
C. Schröder, H. Müller

CC:

P. Fabbriatore, J. Kaugerts, I. Pschorn, P. Spiller, A. Stafiniak

Recorded by:

J. P. Meier

Date and Location

Date: 06.02.2008, 9.00 – 16.00

Location: GSI, C26, 2.014

Responsibilities

INFN Contributors:

U. Gambardella (gamba@sa.infn.it): Development of the SIS 300 sc dipole model magnet and cryostat.

GSI contributors:

E. Floch (E.Floch@gsi.de): Quench detection and protection

G. Hess (G.Hess@gsi.de): Designing engineer, cryostats

J. Kaugerts (J.Kaugerts@gsi.de): Project coordinator sc SIS 300 magnets

M. Kauschke (M.Kauschke@gsi.de): Cryogenic supply and distribution

J. P. Meier (J.P.Meier@gsi.de): Project engineer, cryostats

G. Moritz (G.Moritz@gsi.de): Group leader magnet technology

I. Pschorn (I.Pschorn@gsi.de): Survey and alignment

P. Schnizer (P.Schnizer@gsi.de): Magnetic measurement

C. Schröder (C.Schroeder@gsi.de): SC Magnet test facility

A. Stafiniak (A.Stafiniak@gsi.de): Coordinator SC magnet testing

Session schedule

9.00 – 11.45 *Morning session*
11.45 – 12.30 *Lunch break*
12.30 – 13.15 *Visiting the GSI sc magnet test facility*
13.15 – 15.45 *Afternoon session*

Topics

Opening and introduction (J.P. Meier). Short presentation on aims and requirements for the SIS300 dipole model magnet cryostat

Discussion on topics introduced by INFN

- thermal budget for the magnet - how many watts available at low and intermediate temperatures, i.e. mass flow rates and pressures.

Supply capacities of the test bench are:

Up to 200 g/s supercritical He

3.8 – 5 K at the inlet of the magnet

Inlet pressure from 1.4-4.0 bar absolute

2 Phase He up to 10 g/s

Shield cooling with ~0.1 g/s GHe by sidelining a portion from the 4.5K line with suitable piping and heater

- vessel materials and technologies for cooling/shielding – outer vessel material, shield material, MLI insulation type and position

The pipe for the outer vessel shall be of dimensions and materials available on the market.

Cryostat vessel material: low carbon steel with improved low temperature properties (see LHC standards).

Thermal Shield: Al appropriate for the application.

MLI blankets (3 x 10 Layers) with fabric interlayer and punched foil for optimized degassing.

- cryo line interfaces (@ 4.5K and shield temp) - kind of matching between cryostat and GSI cryo plant

The 4.5 K He supply at the GSI test bench is combined with bus bars coming from the current leads. For a proper connection of the cold mass to the test bench the He flow needs to be split by using a Y – tube. This layout has to be considered again in view of the presence of the 3 bus bars in the cold mass and the recooling pipe for the 2 phase He.

- diagnostic line, vacuum ports – ports and feed through required for diagnostic and measurements

Definition of general interfaces, instrumentation and flange interfaces shall be defined as soon as possible by GSI. This concerns Cryostat

- main flanges
- additional vacuum pumping port
- vacuum measurement port
- instrumentation interfaces

Cryostat end cap is included in the model magnet cryostat and shall already adapt the magnetic measurement to the cryostat (See test bench drawing).

Cryostat end cap: The Cryostat needs an end cap housing several equipment, e.g. cold mass terminator with short cut and an end cap shield. Adaptation between cold mass and adjacent devices need to be realised adjacent to the cold mass end caps.

The dimensional structure for the cold mass end cap interfaces shall be derived from information taken from B. Skoczen reports. Named reports will be transferred to INFN.

- current bias feed through – design and technology to be adopted, thermal budget for current leads

Based on INFN's experiences from past projects the current leads produce the highest amount of heat load. GSI provides current leads within the test bench. There is no need to design current leads.

- room inside the cryostat for protection - cold diode?

Presentation by E. Floch (see addendum). The diode box shall be designed by INFN. The Diode stack is a topic for the next session. One important aiming for the cold diodes is on the diode cooling.

- Magnetic measurements – do they require a warm bore?

Warm bore is provided by GSI, INFN will give dimensions of the beam tube as soon as possible. However beam pipe dimensions will be set by available pipe dimensions commercially available (88.9 mm O.D. is suggested by GSI)

- perspectives and requirements for final cryostats - fiducials, tolerances, supports, available room in the tunnel, etc.

End cap is included in the model magnet cryostat and shall already adapt the magnetic measurement to the cryostat (See test bench drawing).

High voltage feed throughs shall withstand a voltage 3 kV.

Definition of the fiducials, tolerances, supports, available room in the tunnel, etc. was given in the introductory presentation.

Discussion on topics introduced by GSI

Cold Mass topics:

Recooling has to be integrated in upper He line in the yoke. Thus the diameter will be increased from the present 60 mm (the recooling pipe foreseen has a O.D. of 70 mm).

From GSI point of view the magnet should be as close as possible to a series magnet. It is foreseen to use it in the string test. Therefore the magnet has to be equipped with additional bus bars (three pair altogether) and cold diodes. Furthermore the length of the interconnections should be the same as in the ring.

P. Schnizer needs to know the inner diameter of the bore tube. Available standard materials should be used for the bore tube.

Magnet design: There is the need for detailed definition of requirements for the magnet cooling and He recooling (Contact: INFN / P. Fabbriatore, Coordination GSI H. Müller). This topics need to be discussed in further sessions.

Magnet configuration: Upper middle position -> 2 Phase tube. 3 bus bar tubes are located in three quadrants (to be specified by GSI). The beam tube bore is located in the centre. The lower middle position bore needs to be blocked in the iron (no He mass flow). For requirements of symmetry it needs to be introduced but will not be used as He-channel.

Super critical helium is fed through the bus bar tubes. An additional super critical reflow line (not included in the yoke) needs to be introduced. There should be enough space to integrate it (between the cold mass and the Al shield).

Cold mass end cap is equipped with three bus bar feedthroughs for the magnet in the ring. This scheme should ensure the possibility for reuse of the model dipole in a string test.

Definition of flange interfaces shall be prepared by GSI as soon as possible.

Vacuum Vessel Topics:

Based on the actual design status the flanges of the cryostat vessel need to be tilted. The most probable solution is a straight cryostat with tilted flanges.

Additional pumping flange and cable feed through (1 or 2) for instrumentation are required. Feed through flanges will be equipped with LV and HV feed through connectors.

- Magnet support concept (LHC – type)

G11 supports (LHC Type , RHIC Type) is the intended concept for supporting the cold mass.

The model magnet should be equipped with one fixed (maybe rotatable) post and one sliding post (maybe guided sliding). The behaviour of such systems must be investigated and discussed carefully. This shall take place in close cooperation with GSI. FEM simulation and according analysis should be done by INFN.

A first CAD based concept of the cryostat shall be delivered by GSI. A first version of a cryostat specification will be developed by GSI during the running development process. One aim of the whole development process shall be a basic specification for the final ring type cryostat. Such specification must not exceed the INFN budget for the development. Thus the developed specification will finally not describe the model type but a basic ring type.

- Defining the future communication and data exchange structure between parties concerned

Engineering will be performed by CRIS (Ansaldo / Napoli). INFN provides information on their CAD System. Preferred 3D data format is CATIA V5 or STEP.

Each communication concerning engineering tasks has to be coordinated with U. Gambardella.

Information should be distributed always cc to J. Kaugerts, H. Müller, U. Gambardella and P. Fabricatore. Information on the cryostat development shall always go at least cc to J. P. Meier.

Minutes and records of INFN activity will always be published at <http://www.ge.infn.it/~discorap>

Other important topics:

The model magnet shall be designed as close as possible aiming to the ring magnet design so that it can be reused in the string test.

First tests shall be performed at INFN in a bath cooled cryostat (shall be discussed with P. Fabricatore in the next session).

Diagnostic thermometers (type and positions), voltage taps, etc.

Data handed out to U. Gambardella

Introduction_presentation_v01.ppt
SIS300_Stack_dimensions.ppt
SIS300_Reecooling.ppt
Teststand mit BNG Magnet.pdf
Kalte Magnetverbindung SIS 300.pdf
Kalte Magnetverbindung.bmp
SIS 300 mit Diodenbox.pdf