

Minutes (Gebhard Moritz)

CBM Dipole meeting November 18-19 2019

Location: GSI KBW building, Annex Room

Participants

BINP:

Alexey Bragin, Mikail Kholopov, Nikolay Mezentsev, Sergey Shiyankov

GSI:

Kalliopi Dermati, Axel Doering (EPS), Mike Faul, Torsten Heinz, Marion Kauschke, Mladen Kis, Peter Kuhl, Carsten Muehle, Hans Mueller, Walter Mueller, Valentin Plyusnin (EPS), Peter Senger, Strahinja Lucic, Kei Sugita, Piotr Szwangruber, Aziz Zaghoul, Eun Jung Cho

Consultant:

Gebhard Moritz

Distribution:

Participants and Mike Faul, Ina Pschorn, Christian Roux, Christina Will, Yu Xiang, Christine Betz

Agenda:

Monday, November 18, 2019

09:00	Status of the work, Design changes since May 2018	A.Bragin
10:00	Iron yoke and support design, iron data	M. Kholopov
11:00	magnetic field calculation results	A. Bragin
11.45	Coffee break	
12:00	Sc cable design and status, coil design and manufacturing, mockup results	A.Bragin
13:00	Lunch	
14:00	Structural analysis of coil and cold mass, choice of 2 support designs	A.Bragin, K. Dermati
15:00	Thermosyphon cooling, cryostat design(including busbars and current leads) and heat loads	A. Bragin
16:00	Coffee break	
16:15	Cooling regimes (cooldown, operating, quench, warm up), safety considerations	A. Bragin
17:15	Design of cryogenic system (branch box, feed box, transfer line), interface to cryogenic control	M. Kholopov
19:00	Dinner	

Tuesday, November 19, 2019

9.00	Results of quench calculations	A. Bragin
9:30	Power Converter and quench protection system	A. Erokhine
10:30	Power converter control, instrumentation, quench detection	A. Volkov, A. Bragin
11:00	Coffee break	

11:15	Assembly, survey, alignment	M. Kholopov, A. Bragin
12:15	FAT/SAT	A. Bragin
13:00	Discussion/Lunch	

Status of the work, Design changes since May 2018

Peter Senger confirms: height of the beam axis/magnet center is 5.7m over the floor level (as given in the contract).

Recommendation: involve TÜV at an early stage, already during design, it may need time

Iron yoke and support design, iron data

Sliding support: PTFE may be replaced by bronze for radiation reason. lubrication not recommended, but this leads to higher friction (factor 0.8??), therefore one needs higher force/torque!!

Comment: 5 gimbal joints may lead to overdetermination -> meeting: Mike Faul, Ina Pschorn, Carsten Muehle

Earthquake protection: static approach: 8-12% of weight in the center of gravity. Walter Mueller has the guideline.

Drawings etc. should be uploaded to EDMS

We want a "laminated" yoke!! The beams should be cut accordingly to the flux flow, perpendicular to the beam. Otherwise one creates additional reluctance.

Reassembly of the magnet must be reproducible (dowel pins etc.), otherwise the field map is obsolete.

Reference surfaces are parallel to the pole surfaces, tolerances must be defined.

Magnetic field calculation

BINP has no measured data of the iron (steel 10, ARMCO) yet.

A meeting (Peter Senger, Carsten Muehle, Alexander Kalimov) decided to separate the magnet design and shielding of the RHICH detector. Alexander Kalimov agreed to perform the calculations.

Remark GM: azimuthal dependence of the vertical force F_z : < 22% or 5%? (slide 7,10,11)

Sc cable design and status, coil design and manufacturing, mockup results

Which winding tension will be used during the winding process?

Cross section of the coil is missing.

Joint in a groove at the bottom part the copper case (upper coil) in the low field region! What happens to the ground insulation?

Details of the planned 2 stage vacuum impregnation are missing. How is the good thermal contact between coil and outer copper ring (it is cut to avoid thermal short cut and eddy current flow) guaranteed? Is glass fiber possibly a better solution for the ground insulation? Where are the grooves for the epoxy flow?

Curing temperature of 160°C is ok for the Kapton insulation?

Glass fiber cloth: impregnated with Silane. why?

The epoxy ("SLAC", what is the official brand name and the chemical composite?) is filled with BN. Which percentage? According Fig. 45 in the CDR (or slide 6 in talk 5 of the meeting) it should be around 35%.

Mockup coil (linear model): The chosen insulation is not the same as planned for the coil.

Structural analysis of coil and cold mass, choice of 2 support designs

New support strut design:

- which are the boundary conditions?
- BINP sees advantages for the new design.

Was the prestress caused by the winding tension taken into account?

Vacuum vessel: stress and deformation should be calculated.

Thermosyphon cooling, cryostat design(including busbars and current leads) and heat loads

Remark GM: would be nice to have a better legend in the 3D pictures (valves, lines,..)

Where are the pumping flanges?

The busbars should be well conduction-cooled. Critical is the part near the HTS leads and the parallel resistive shunts. The conductor must be well insulated from the ground, the highest conductor-to-ground voltage is between the coils.

Movement of the busbars due to electromagnetic forces (parallel conductor and conductor in the magnet field) must be prevented.

heat loads: emissivity of 0.02 is too low. heat load during ramp is only tolerable with an increased ramping time of 4 hours.

GSI wants the thermosyphon flow calculated with the correct geometry.

Cuts in the thermal shield are needed to avoid thermal shortcuts and eddy current flow.

Cooling regimes (cooldown, operating, quench, warm up), safety considerations

GSI delivers a separate note about helium gas mixing.

Design of cryogenic system (branch box, feed box, transfer line), interface to cryogenic control

Discussion: placement of the cryogenic components (branchbox, feedbox, transfer lines) in the CBM cave

Responsible: Mladen Kis, Peter Kuhl, Torsten Heinz

Placement depends on

- the entrance of the transferline from the Distribution Box (DB)
- the radiation level
- position of the magnet
- position tolerance of the magnet (flexibility of the transfer lines)

Peter Senger has a radiation map of the case, GSI delivers the radiation limit of the cryogenic components (warm sealings etc.).

After the meeting: BINP proposes to include the feedbox in the branch box and place it on the balcony. The transferline is placed at the floor of the cave and enters the cryostat from the bottom up. Critical is maybe the helium return line. GSI delivers a 'rooting' of the transferline (3D model of the cave?).

Results of quench calculations

Rmark GM: did BINP take into account the magnetoresistive effect?

Remark GM: slide 9: resistive quench voltage in previous calculations (GSI, CIEMAT) is 1500 V, now only 250 V. What is the explanation?

Piotr Szwangruber asks for additional information (Bottura-fit, high field point, magnetostatic inductance, L2, R2, etc.). He will get it directly from Alexey Bragin.

What happens if a quench starts in the busbars?

How big are the forces due to eddy currents in case of a quench in the coil (copper case) and in the shield??

BINP will install a heater to provoke a quench.

Which actions are taken after a quench occurs?

Power Converter and quench protection system

Alexandr Erokhin stays in close contact with the GSI power supply group (EPS).

'Deionized' water is needed to avoid leakage currents.

Position of the racks must be determined (Peter Senger). The cable between power converter and magnet is part of the delivery by BINP. The height of the rack must be smaller than 2.300 m (no fan on top).

Again: Documents should be uploaded to EDMS

Remark GM: slide 15: magnet should be tested at 700A; dump resistor is 1 Ohm.

Power converter control, instrumentation, quench detection

Voltage taps should be doubled for redundancy.

Danger of simultaneous quenches in both coils!?

Contact persons at GSI:

- for cryogenic operation : Torsten Heinz
- for cryogenic control: Christine Betz
- for power supply control: Axel Döring, Valentin Plyusnin (EPS)

Assembly, survey, alignment

Which are the tolerances for the parallelity of the poles? And the reference surfaces (“geodetic platforms”)?

Transferlines must be sufficiently flexible, so that the magnet can be realigned after settlement.

What is the time for assembly and warm commissioning?

The vertical space for assembly is limited, attention to the lifting tools!

The cryogenic components should be transported with slight overpressure and mechanically fixed!

FAT/SAT

Mapping needs more detailed specification (Peter Senger, GM).

GM reminds BINP at chapter 5 of the specification.

Discussion/Lunch

At December 11th 2019 will be the next meeting at GSI with colleagues from BINP. Please save the date. This is next opportunity to clarify the questions, which were open during the November meeting.

BINP will update the CDR report. The update has all the new information during the FDR preparation. The notes distributed by BINP before should be attached.

The update will be sent to our international experts with the invitation to a formal review in spring 2020.

Special meeting “Cryogenic issues” November 19 2019, 14.00h

Participants:

from BINP: Alexey Bragin, Mikail Kholopov, Nikolay Mezentsev, Sergey Shiyankov
from GSI: Torsten Heinz, Marion Kauschke, Peter Kuch, Kis Laden, Gebhard Moritz

Helium mixing during cooldown

Even at a low cooldown rate the temperature differences in the coil can be too high. Helium gas mixing can avoid this situation. GSI writes a short note about the necessary hardware, with a sketch and a list of the requested components.

Cooldown during FAT: BINP facility does not allow He gas mixing (however, is LN2 mixing possible?). GSI proposes PT sensors to measure the temperature distribution in the coil.

Riser

BINP found a solution after the meeting.

Purging

GSI still wants a specific purging method and will deliver a note.