

Factory acceptance test (FAT) and site acceptance test (SAT)

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Schedule of the work FAT and SAT

Factory acceptance tests in BINP will be During 2022.

the cryostat will be modified to use LN2 instead of 50 K helium (evaporating helium may be used)

a cryocooler will be used for the current leads cooling.

Details of magnetic field mapping should be discussed: **what region and step size?**

Site acceptance test:

Transportation to GSI in September-November 2022

Assembling December 2022 – March 2023

Cryogenics test in GSI during April – December, 2023

FAT place in BINP



July 2019

The building is being renovated.

The works will be finished by March 2020



November 2019



July 2019

CBM magnet test place



November 2019

FAT tests cooling conditions

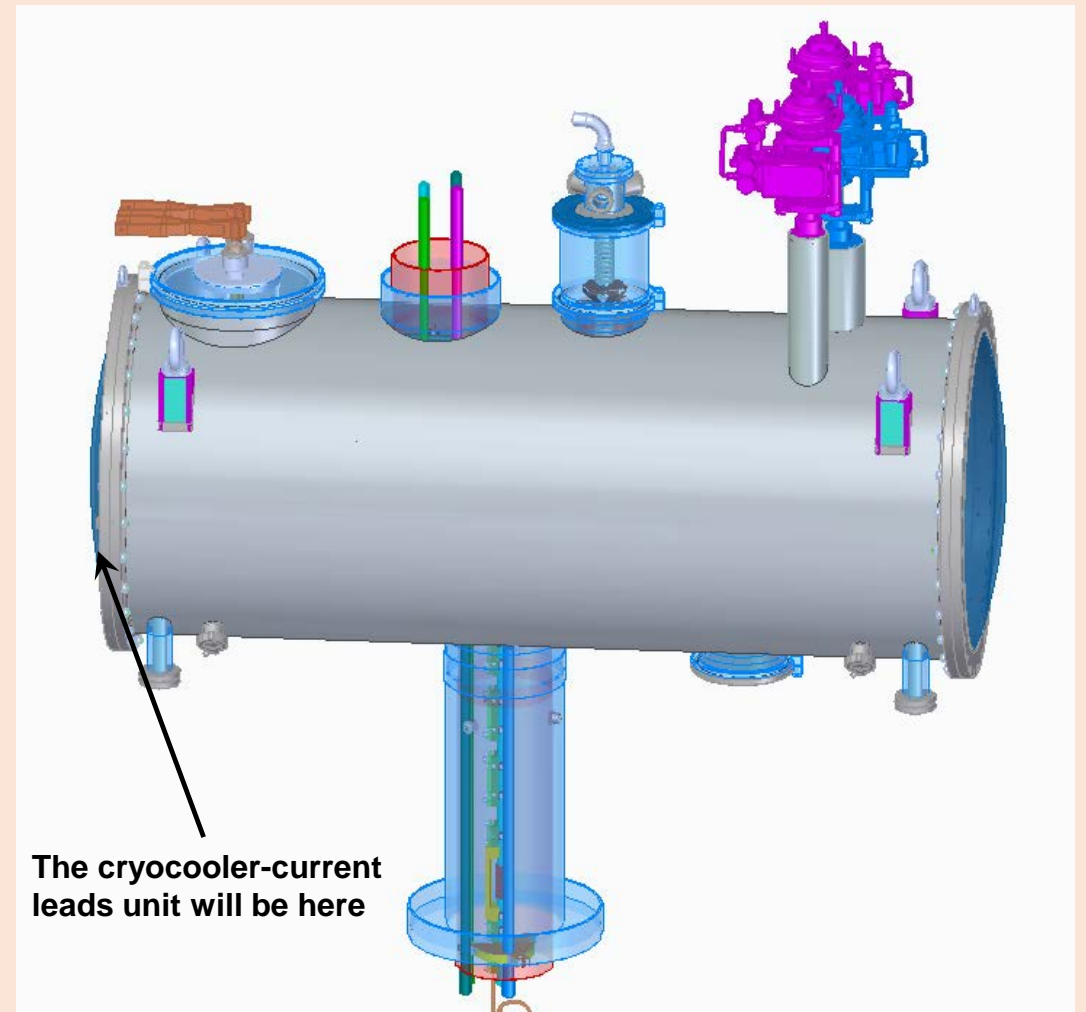
BINP has a cryoplant producing ~ 100-200 l of LHe per hour.

There is no 50 K helium in BINP with continuous supply.

The CBM magnet tests will be based on using 4.2 K helium and liquid nitrogen.

The cryocooler will be used for cooling the current leads, and will be placed on the side lid of the cryostat.

The cryostat piping will be not touched, as they will be already tested on the 28 bars pressure and welding seems quality.

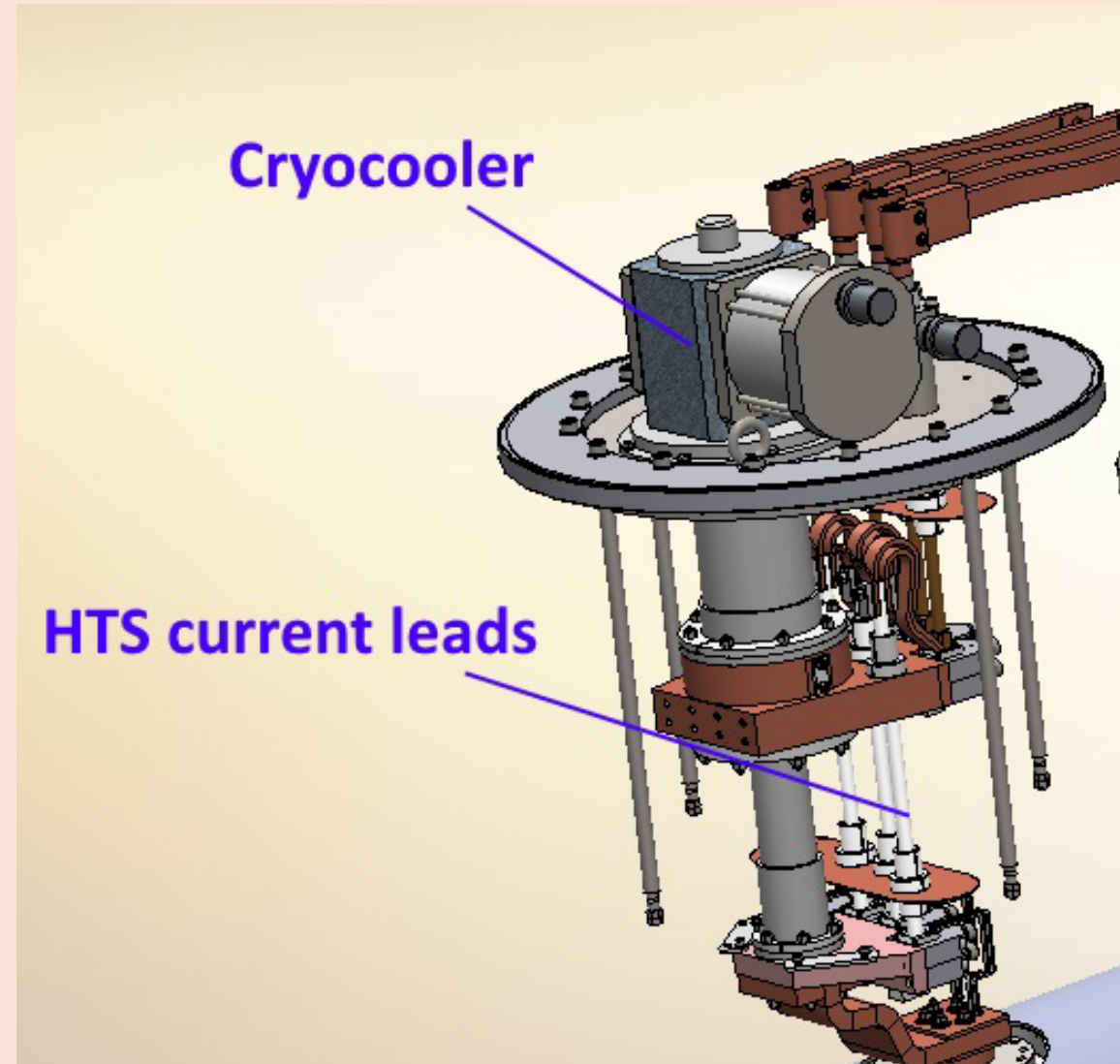
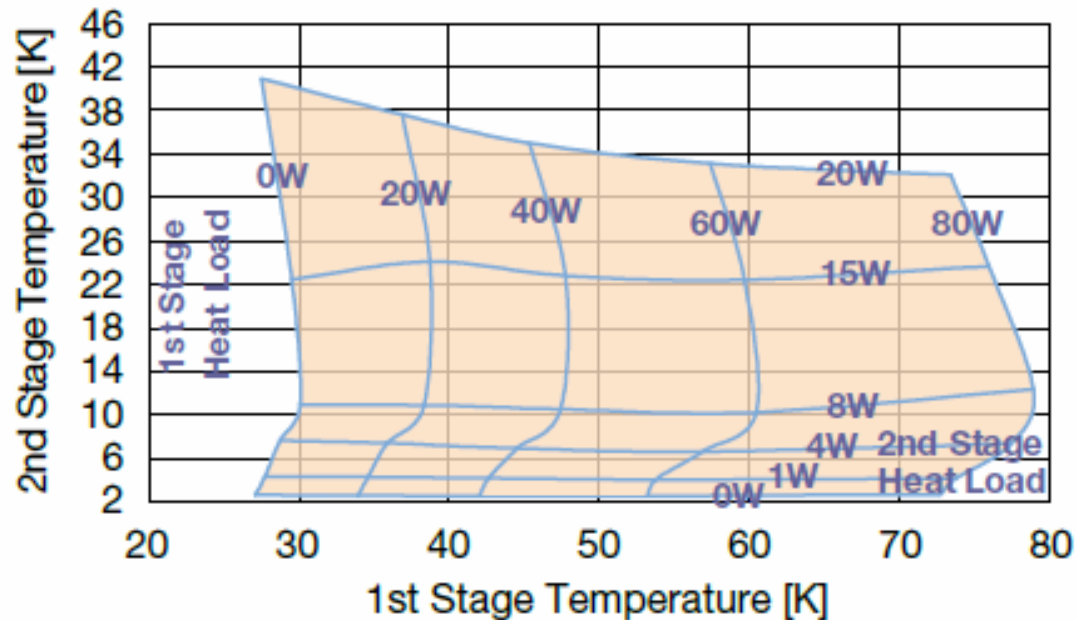


The current leads-cryocooler unit

The current leads-cryocooler unit is used for SC wigglers for two decades.

The cryocooler is available in BINP for this purpose, a kind of SRDK-408D2.

SRDK-408D2 Cold Head Capacity Map (50 Hz)



FAT tests cooling option 1

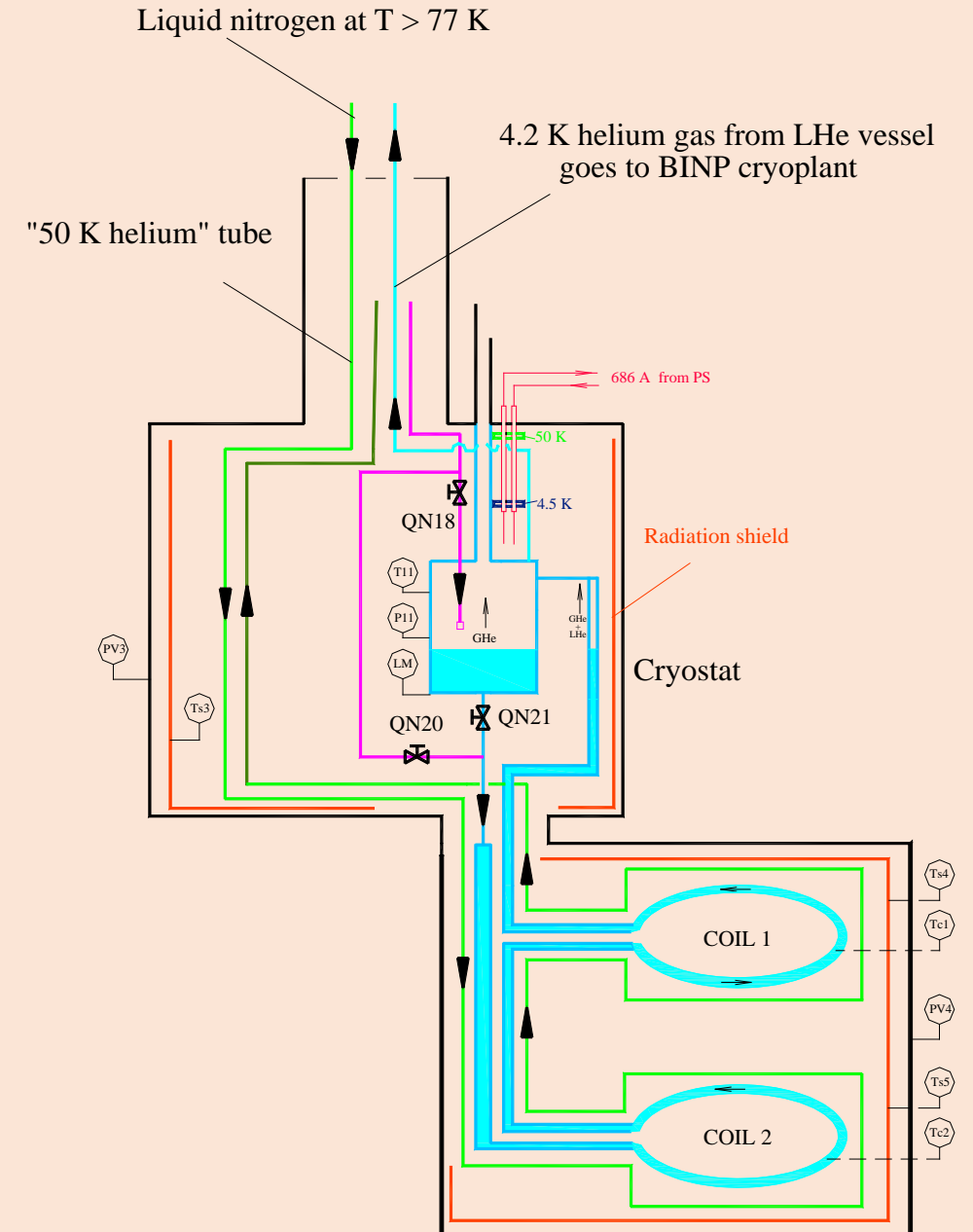
The liquid nitrogen at temperature ~ 80 K goes into the tubes to cool radiation shields and support struts.

The temperature of the shields will be > 80 K. The liquid helium losses will be > 15 W by a factor of 1.5. I.e. the helium consumption will be $15 \cdot 1.5 \cdot 1.4 = 31.4$ l/h.

So, the helium refilling time will be about 5 hours!

Conclusion the liquid nitrogen is not desirable for the FAT routine tests.

In the cooling down regime it can be used with care.



FAT tests cooling option 2

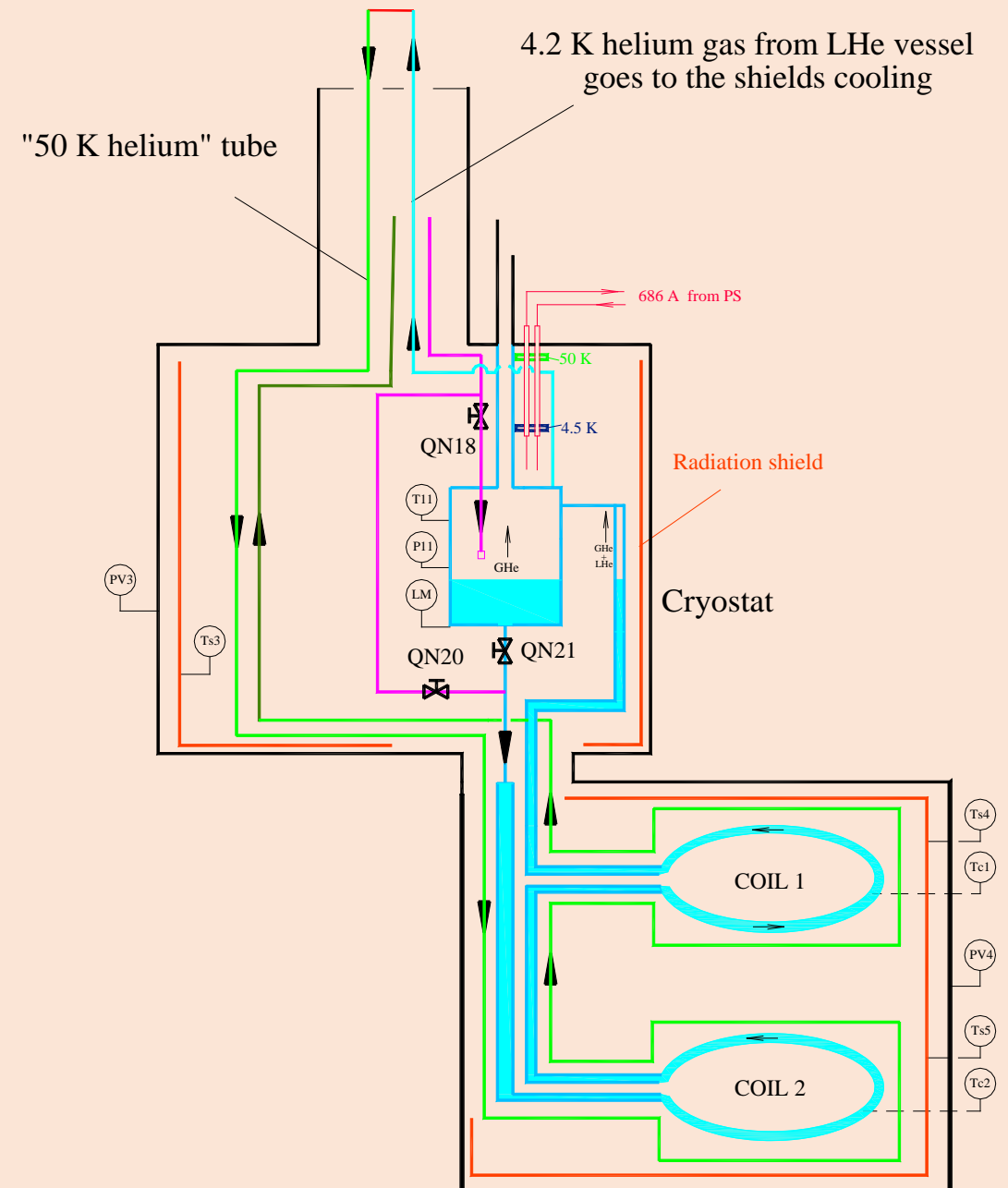
It was estimated in the CDR report that the heat loads on the 50 K surfaces are ~ 120 W.

At 11 W of LHe consumption, the enthalpy of gas helium in 4.2-45 K range is also about 120 W.

It will be useful to return this helium for the radiation shields and support struts cooling.

The helium consumption will be optimal. The temperatures of the shields and the strut interceptions will be close to the SAT conditions.

Such cryogenic design is used in the SC solenoid of the CMD-3 detector (BINP).



Field mapping

The test conditions is shown on the photo.
Concrete walls influence?

It would be helpful to specify the mapping conditions in geometrical details:

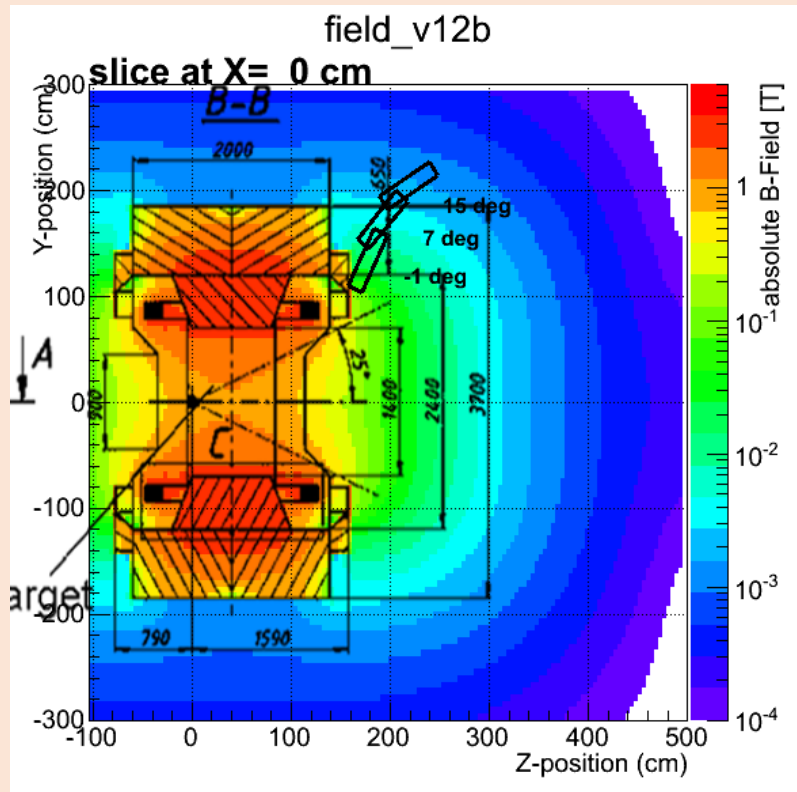
x1-x2 range?

y1-y2 range?

z1-z2 range?

What step size?

The mapping tools will be manufactured according these specifications.



Contract conditions:

All three components will be measured. The field region of interest is shown in Figure 12. We distinguish 2 different areas:

- Area inside the opening angles
- Area downstream fringe field

The field data close to the coil allow to determine the high field point in the coil.
The map is requested only at the nominal field level of about 1 T.

Site tests

Works should be done:

Transportation to GSI in September-November 2022

(vibration care?)

Assembling December 2022 – March 2023

(assembling with Roentgen control of the welding seems, E. Pyata has experience with Germany company)

Cryogenics test in GSI during April – December, 2023

Conclusions

The BINP conditions of the FAT tests are described.

The GHe return cooling is very preferable.

The cryocooler will be used for the current leads.

The field mapping details should be specified according measuring tools for Hall sensor movements.

SAT has common questions, now.