

Design of the cryogenic system of the CBM magnet

Alexey Bragin, Mikhail Kholopov

Budker Institute of Nuclear Physics, Novosibirsk,
Russia

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Cryogenic diagram

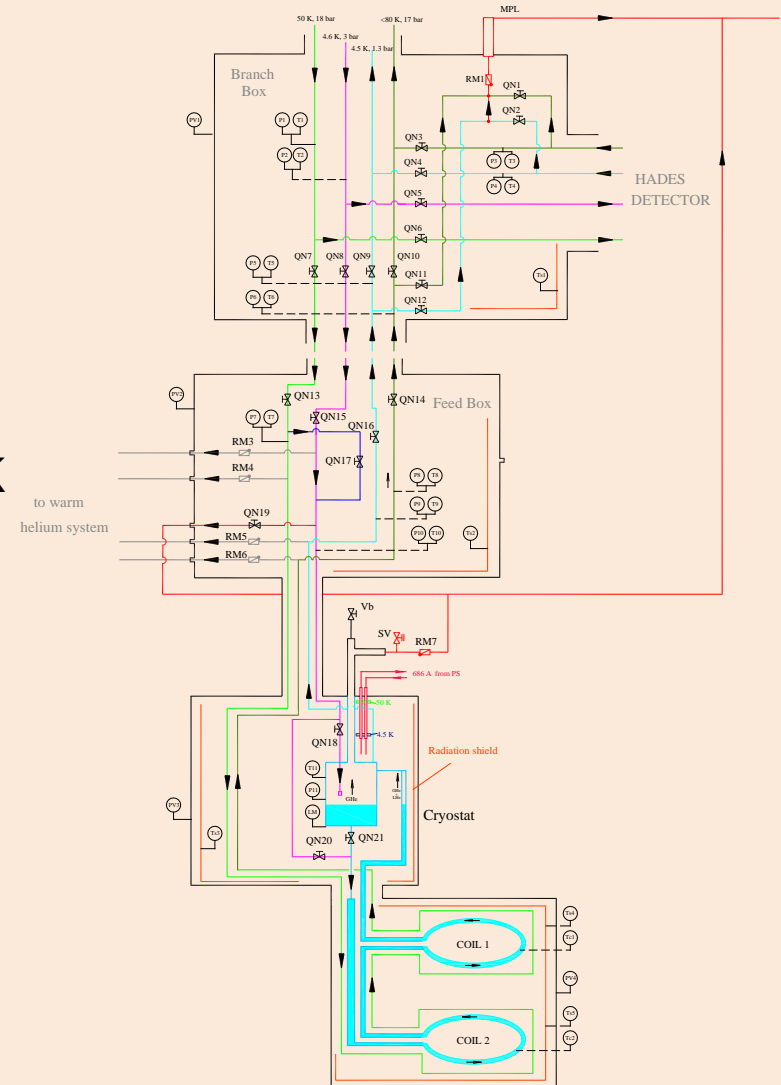
For the transfer line the most tubes were chosen to be DN15 STD, so OD = 21.34 mm, ID = 15.8 mm.

The valves are of PN25 type.
Valves stems have interceptions at ~ 65 K temperatures.

Pressure drop about 0.006 bar at nominal operation

Heat transfer to the radiation shields is on return 50 K line.

The return line will have about 60 K



Total heat loads

Table 3 Heat loads on 4.5 K helium from both coils and the cryostat

Heat load from	Values
Thermal radiation on the LHe case, W	0.12
Support struts, W	13
Tie rods, W	0.05
Soldering connection of the cable (at least 6 short splices), W	0.12
Thermal radiation on the cryostat, W	0.015
Cryostat suspension, W	<0.1
Current leads, W	0.5
Measurements wires, W	<0.1
Heat bridges of the cryostat neck and others connections, W	<0.1
Total, W	~ 14.1

Table 4 Heat loads on 50 K helium from both coils and the cryostat

Heat load from	Values
Thermal radiation on the shields from the vacuum vessel, W	10
Support struts, W	38
Tie rods, W	0.5
Thermal radiation on the cryostat shield, W	1.5
Cryostat suspension, W	2
Current leads, W	50
Measurements wires, W	0.5
Heat bridges of the cryostat neck and others connections, W	1
Total, W	~ 104

*) It will be corrected after detailed design of the current leads

Table 5 Heat loads on 4.6 K helium from the Branch Box, the Feed Box and the transfer line

Heat load from	Values
Thermal radiation on 4.5 K surfaces from the shields on the FB and BB, W	0.15
Supports and suspensions, W	< 2
Control Valves, W	15.2
Check Valves, W	0.9
Measurement wires, W	< 0.01
Heat bridges of the cryostat neck and others connections, W	< 1
Total, W	19.26

Table 6 Heat loads on the 60 K helium (return line) from the Branch Box, the Feed Box and the transfer line

Heat load from	Values
Thermal radiation on the shields from the vacuum vessel, W	7
Support and suspensions, W	20
Control valves, W	38
Check valves, W	11
Measurement wires, W	< 1
Heat bridges of the cryostat neck and others connections, W	5
Total, W	82

Total heat loads:

for 4.6 K He is 33.4 W

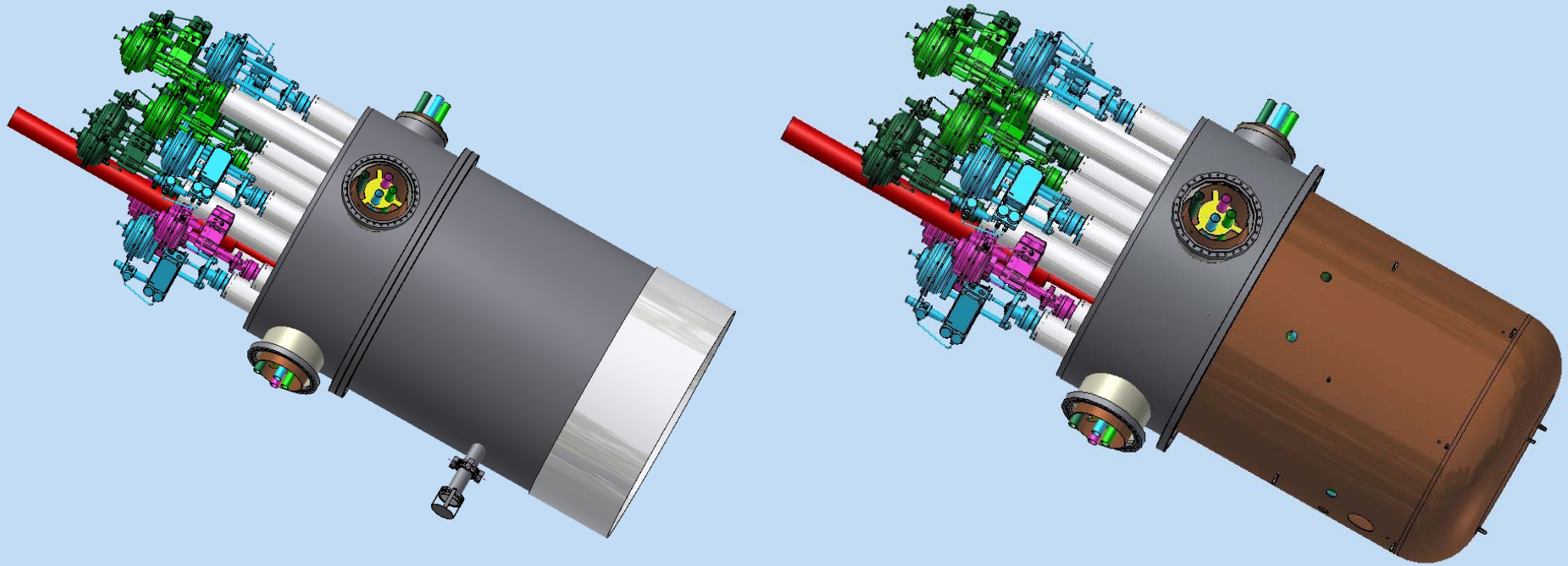
for 50 K He is 186 W

Mass rates:

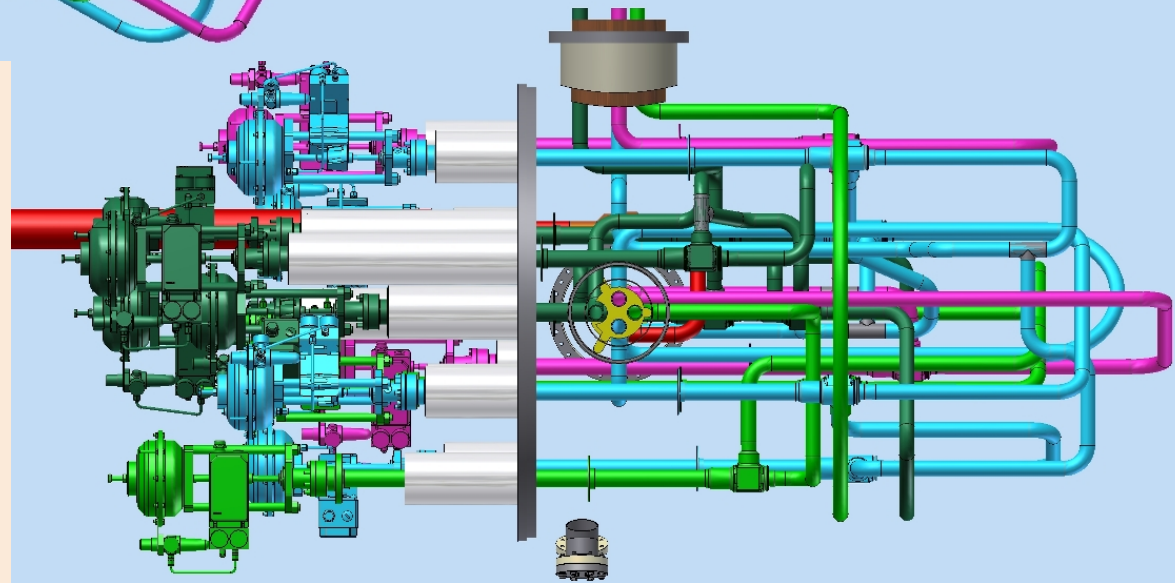
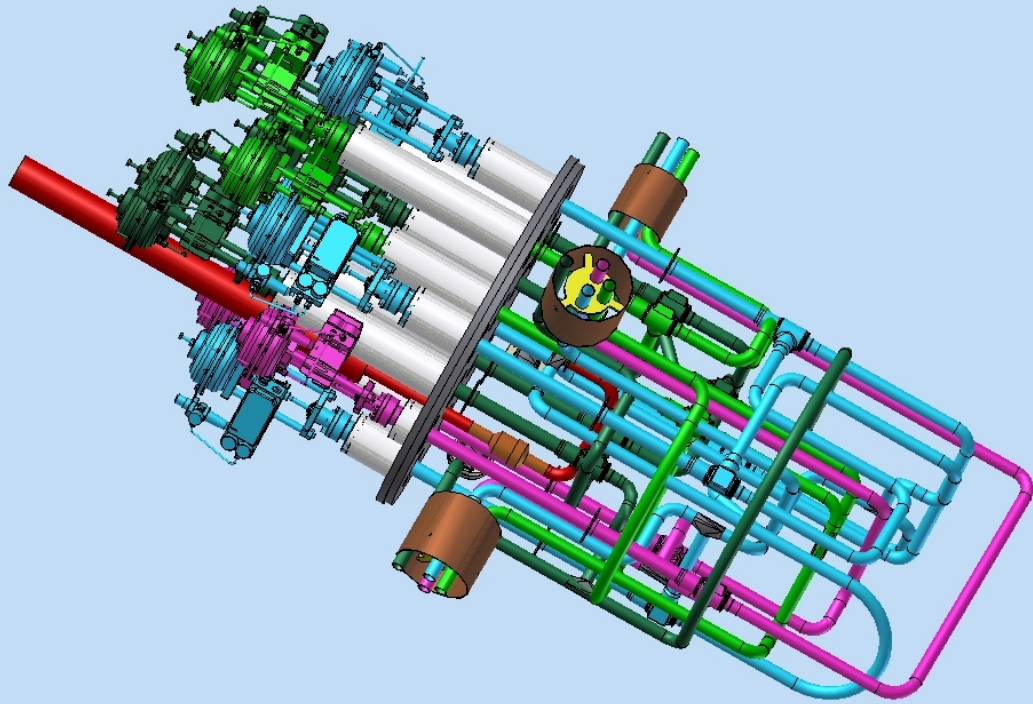
for 4.6 K He is 1.7 g/s

for 50 K He is 1.8 g/s

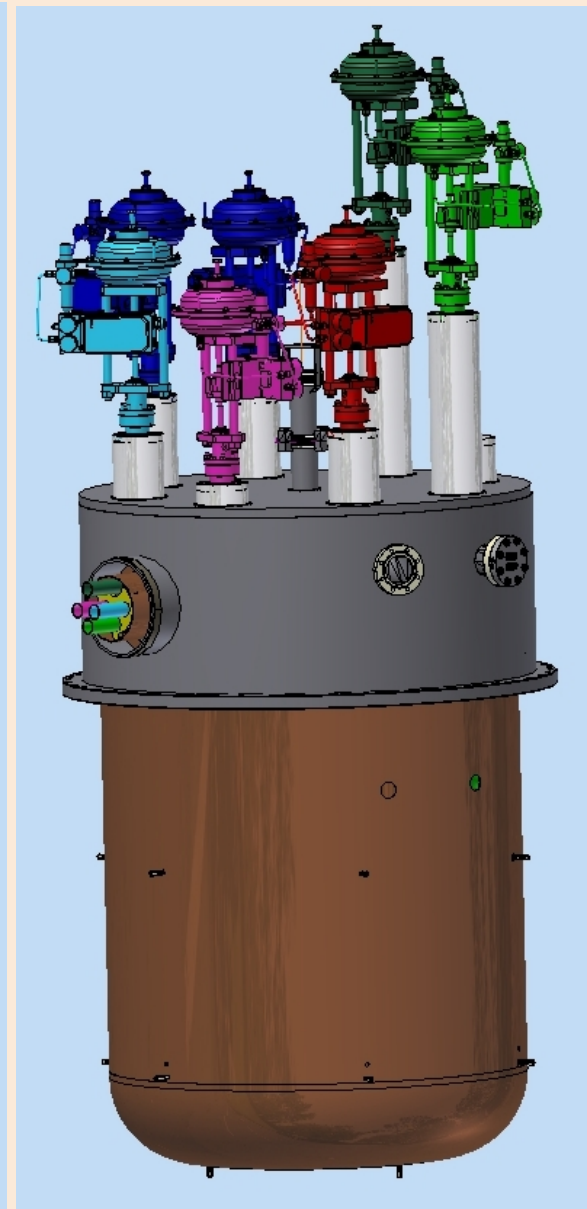
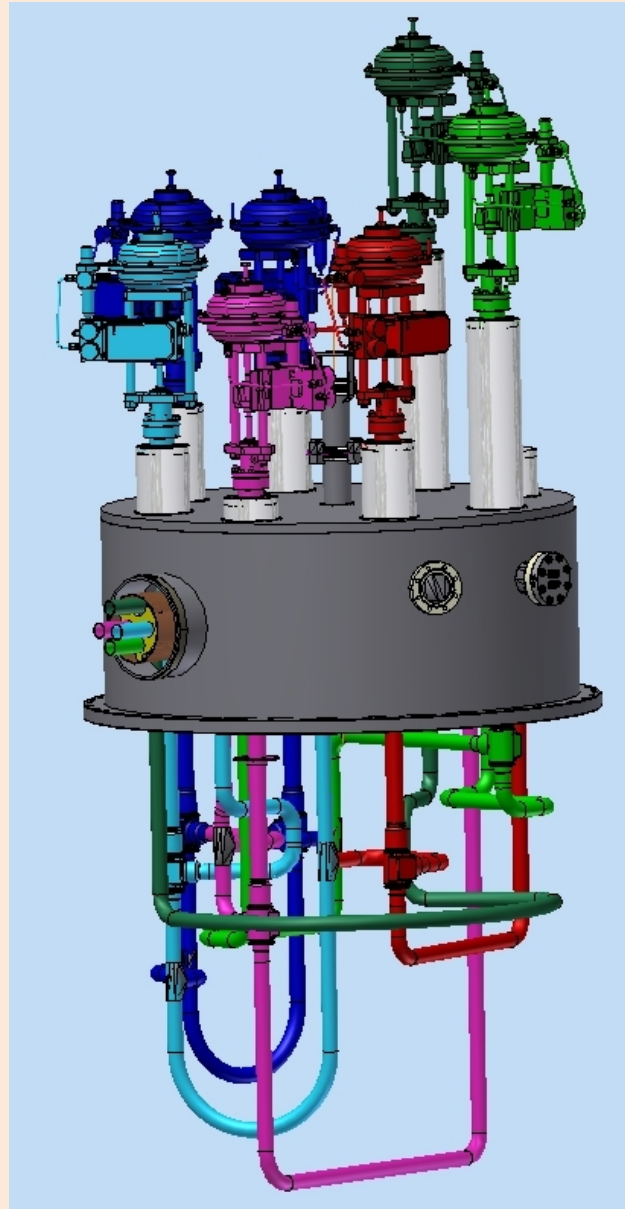
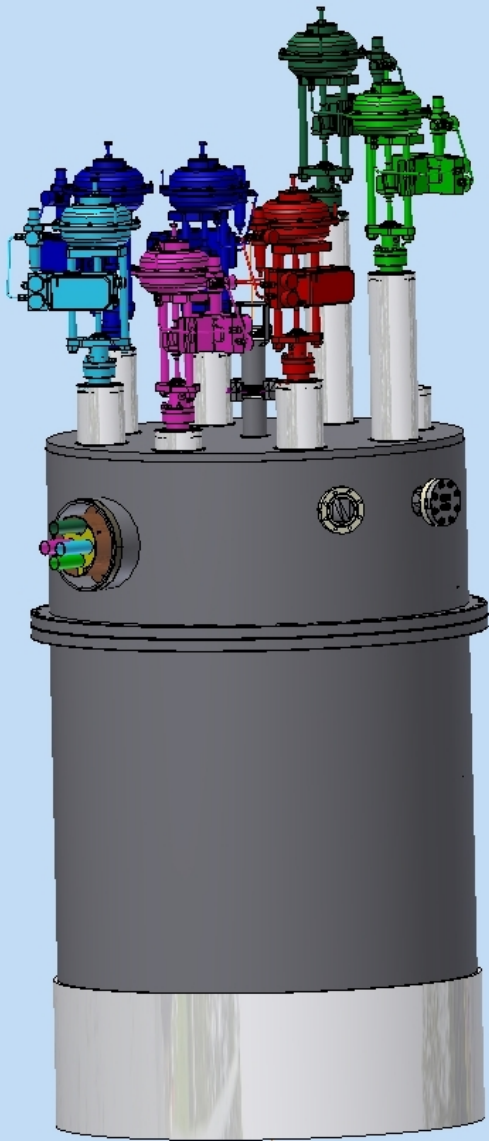
Design of the Branch Box, view 1



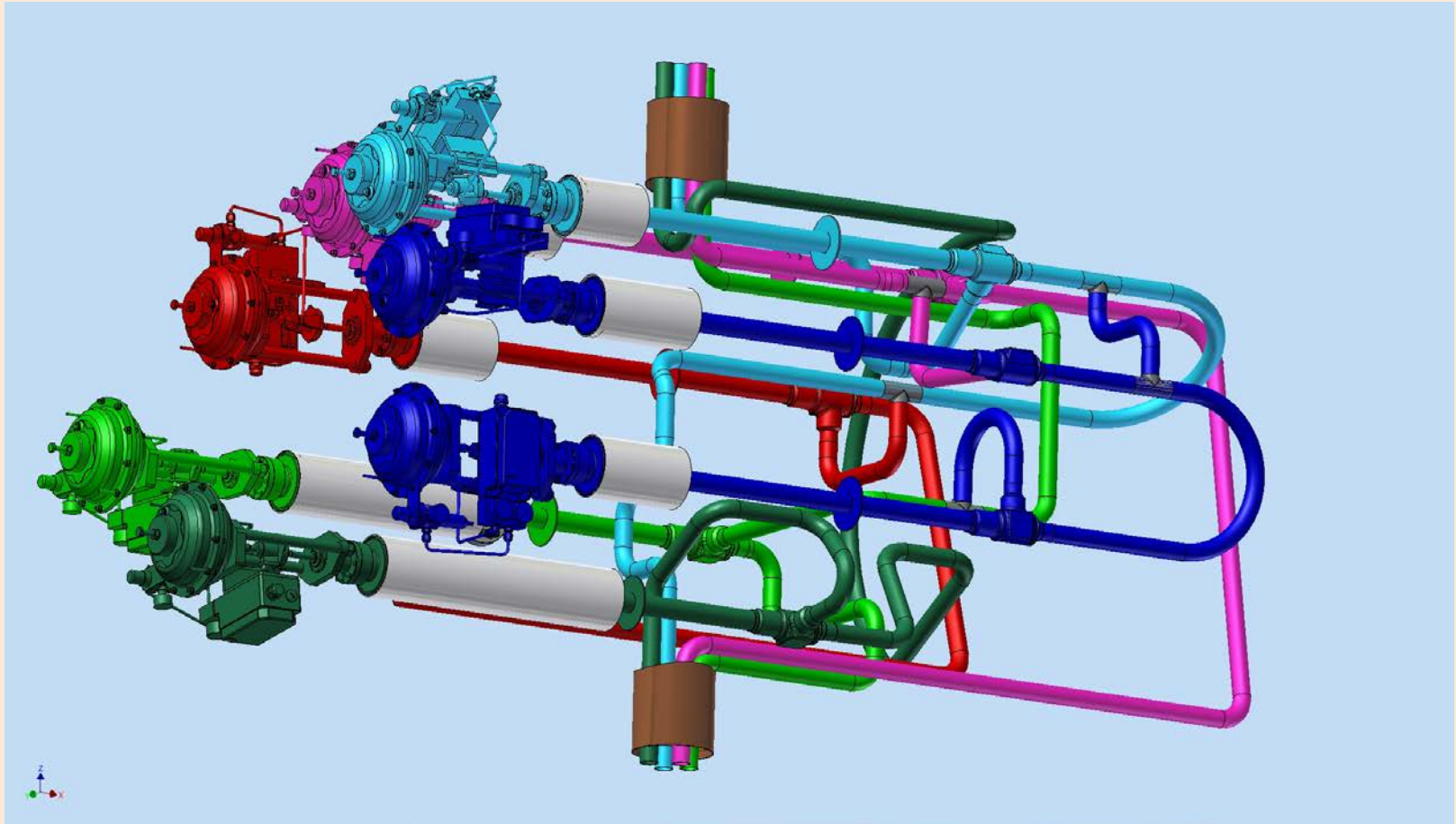
Design of the Branch Box, view 2



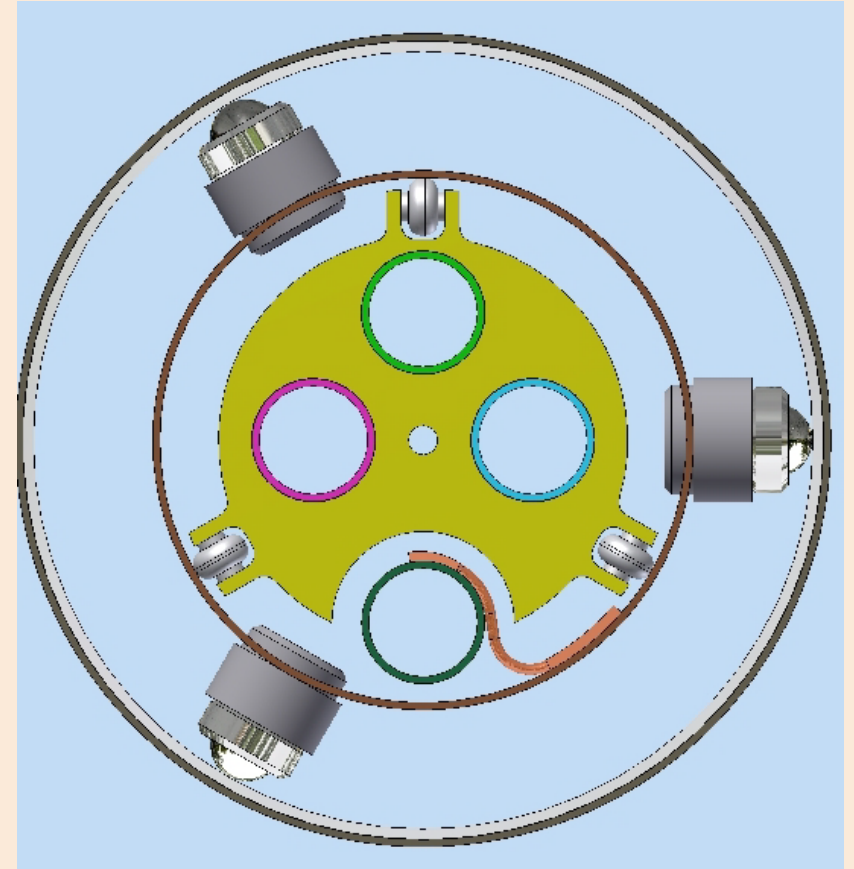
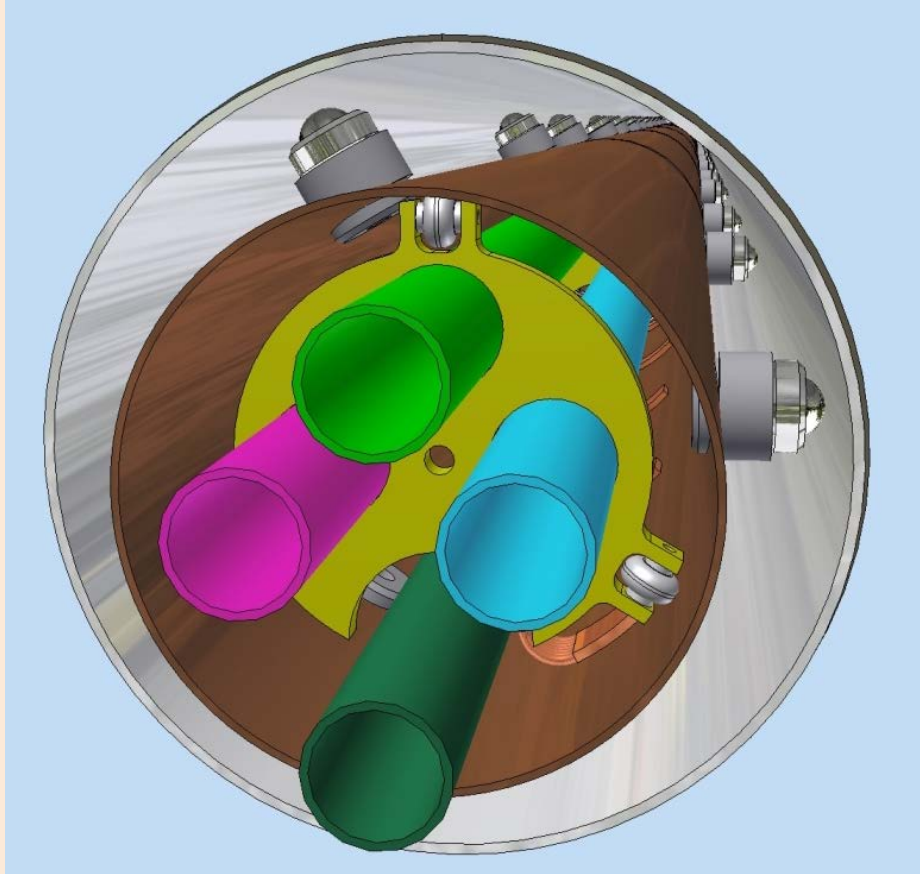
Design of the Feed Box, view 1



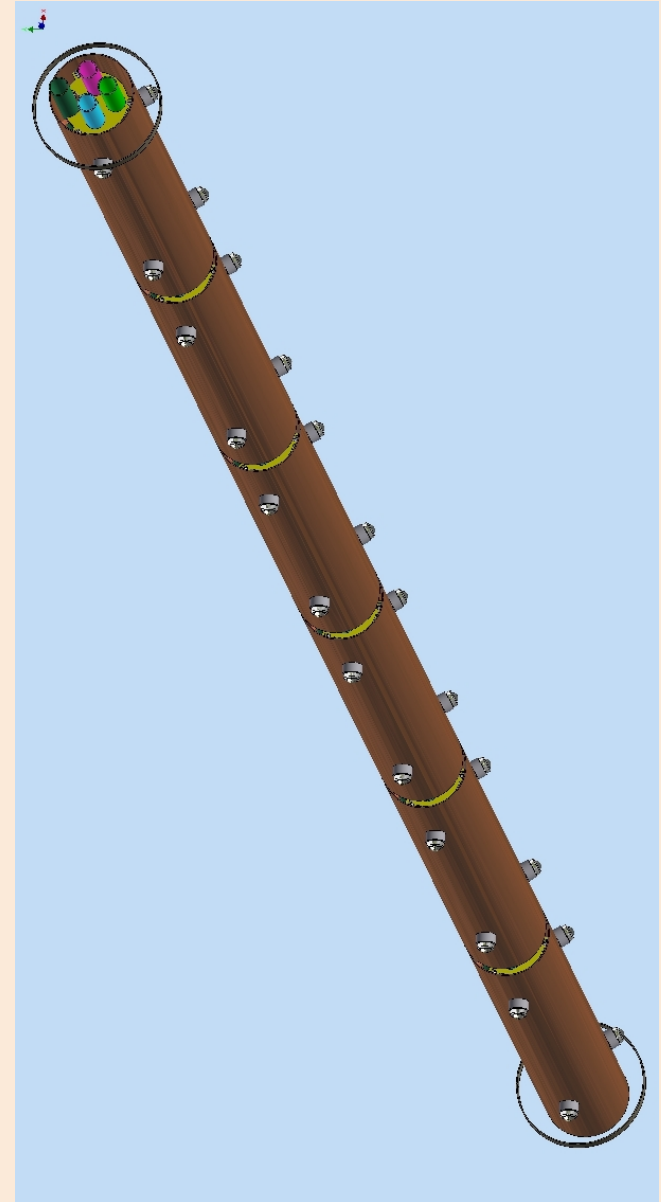
Design of the Feed Box, view 2



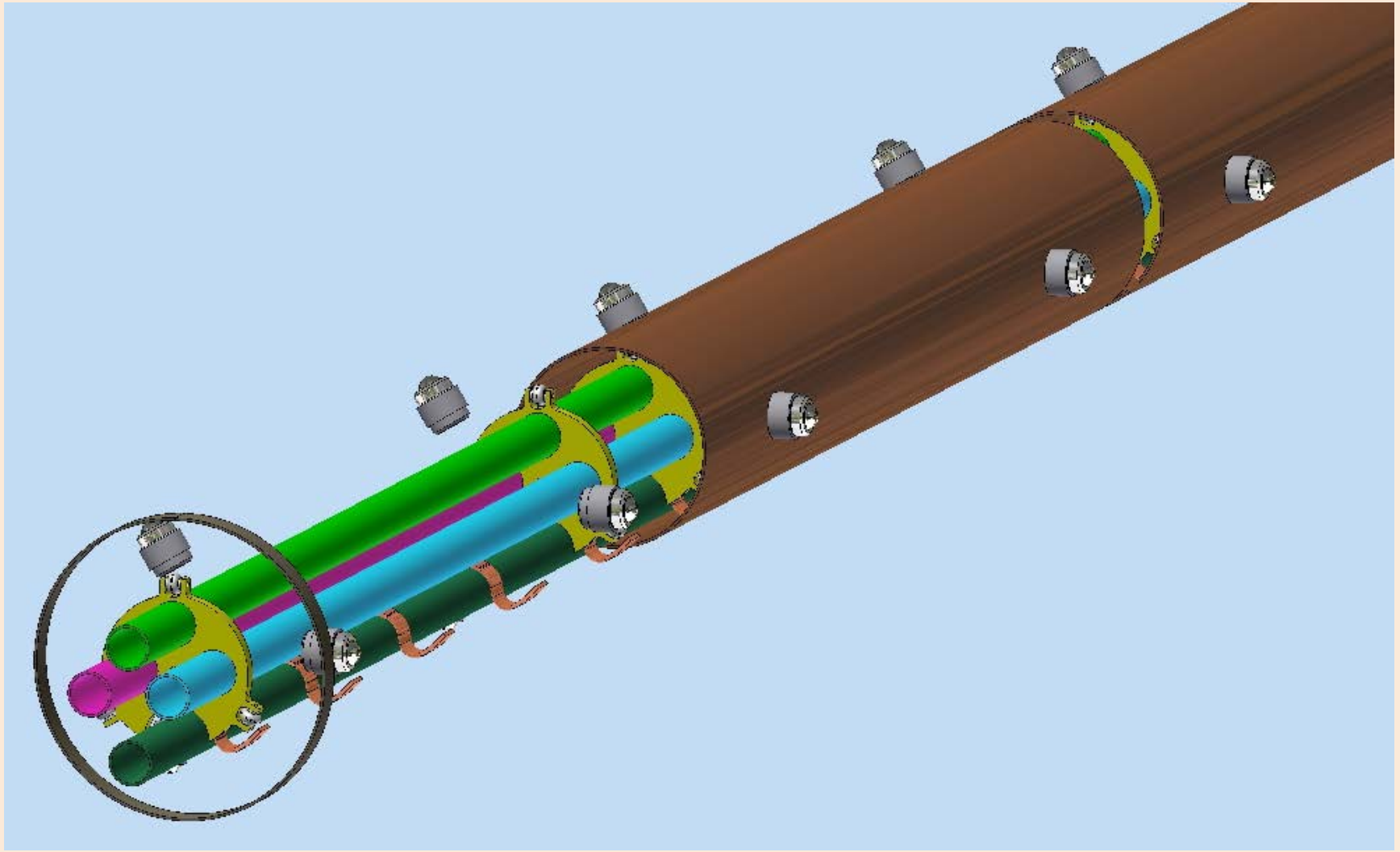
Design of the transfer line, view 1



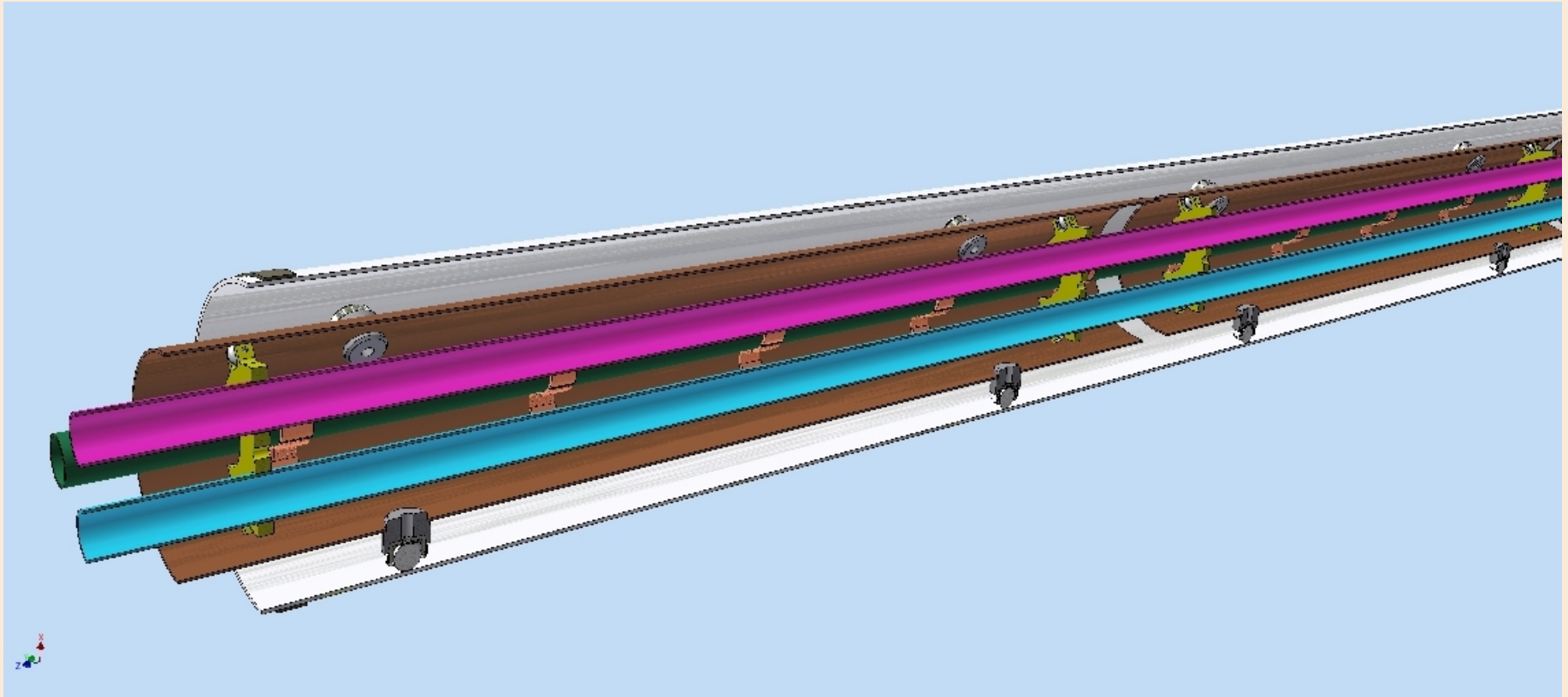
Design of the transfer line, view 2



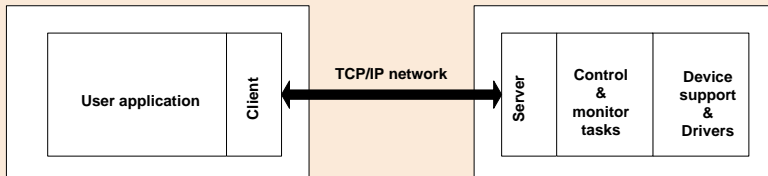
Design of the transfer line, view 3



Design of the transfer line, view 4



Interface (as example)



The working folder contains:

- T_test.exe – executable code;
- Server.uir – user interface resources;
- Port.cfg – configuration file for RS232 connection;
- T_data.cfg – configuration file for temperature sensors (JB channels, data files etc.);
- Mntr.cfg – configuration file for JB channels (Pressure, GHe Flow, Vacuum);
- Field.dat – field ramping table;
- T_PROBES – temperature response curves folder.

SCW server application main functions:

- Monitoring of all cryostat & magnet parameters;
- PSU's control & monitoring;
- Cryo-compressors monitoring;
- Field ramping task;
- Software interlock logic;
- Client/Server communication.

