

Mechanical Design for Coupling Magnet Cooling System

Sun Sen

2010-12-09

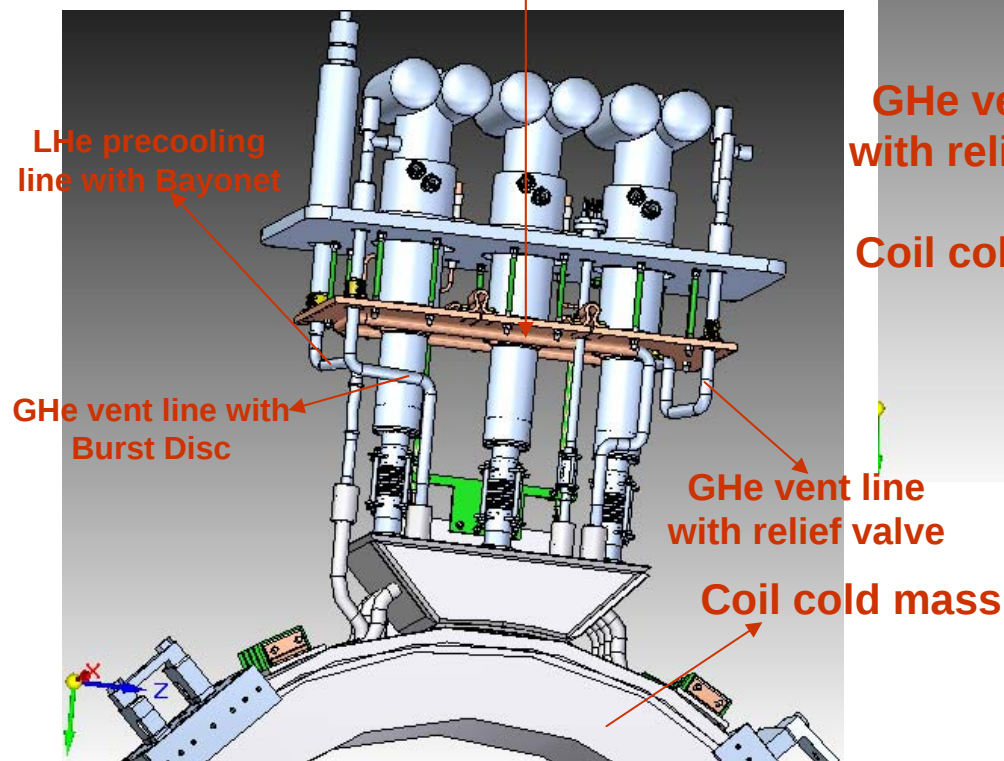
Shanghai Institute of Applied Physics

Chinese Academy of Sciences

P. R. China

- ❖ Main components: Coil cold mass, Cooling system, Current leads

Coiled Cu heat exchanger



GHe vent line with Burst Disc

LHe precooling line with Bayonet

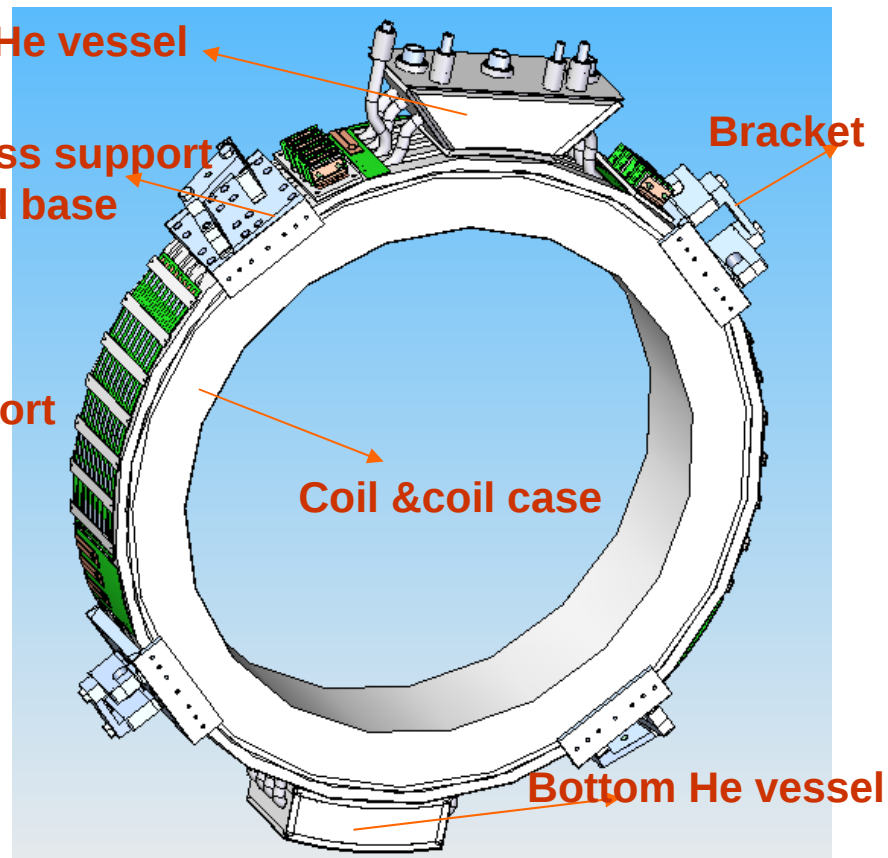
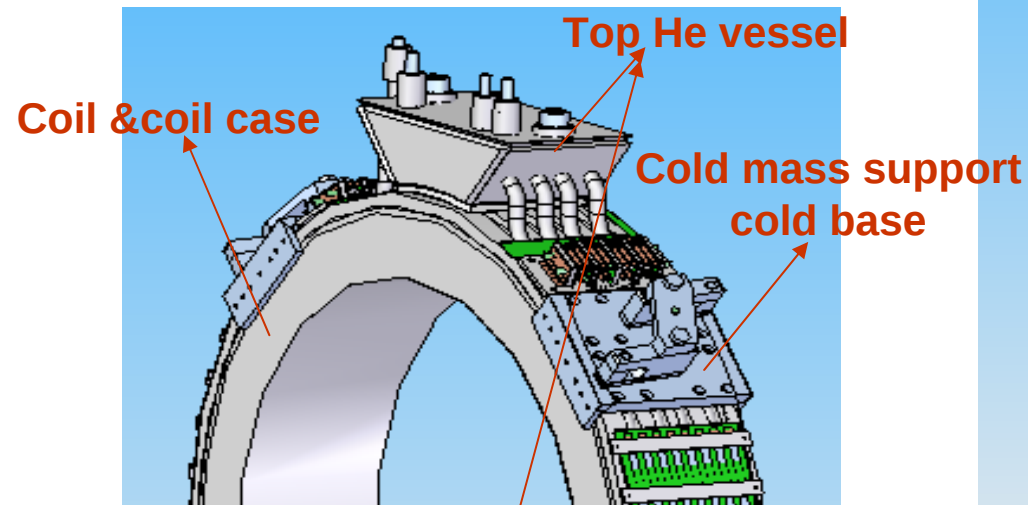
GHe vent line with relief valve

Current leads

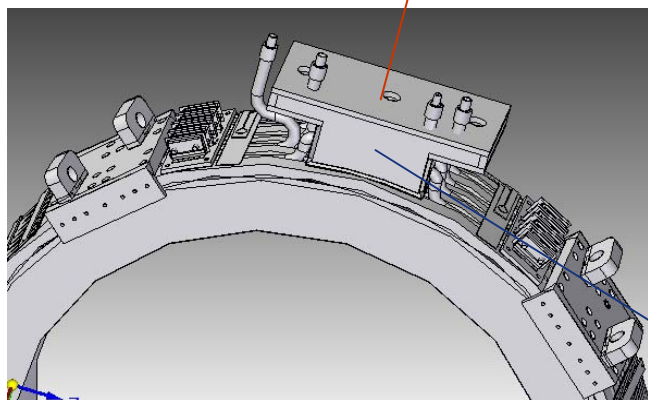
Coil cold mass

3D model for Coupling Magnet Cooling System

- ❖ The design for top He vessel and cold mass support cold base were modified since last review.

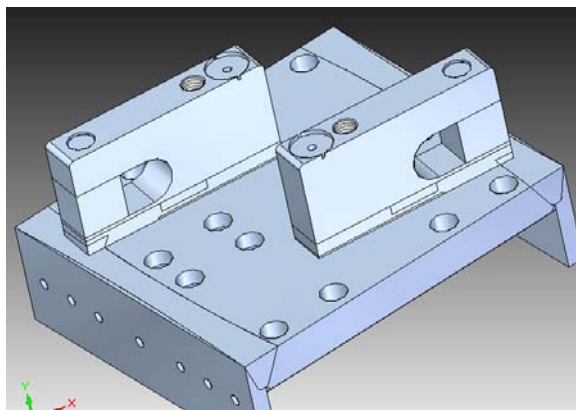
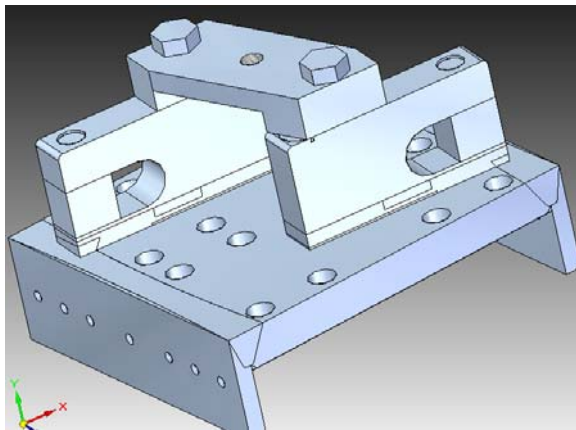


3D model for Coil Cold Mass



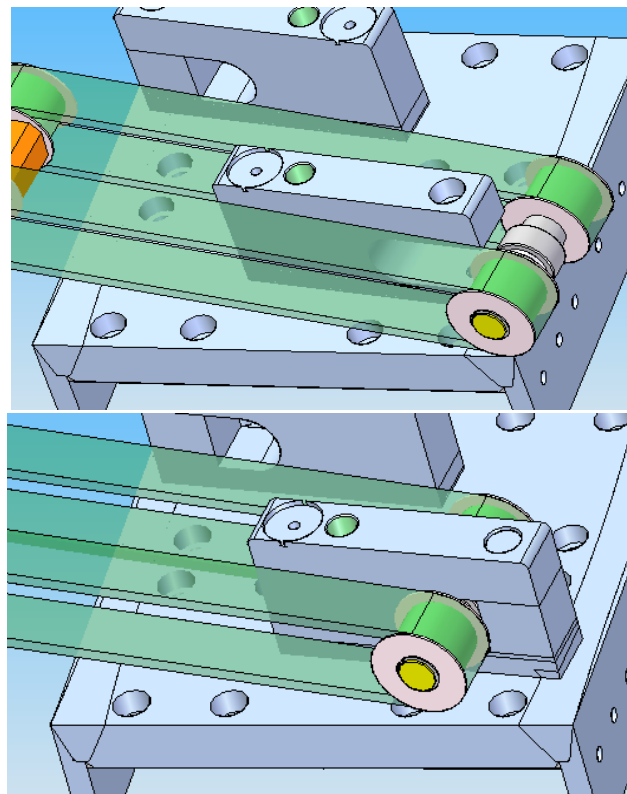
Previous design

- ❖ For installation, we will open one end of the clevis and then assemble it again; the clevis configuration is modified to strengthen.



3D model for Cold mass support cold base

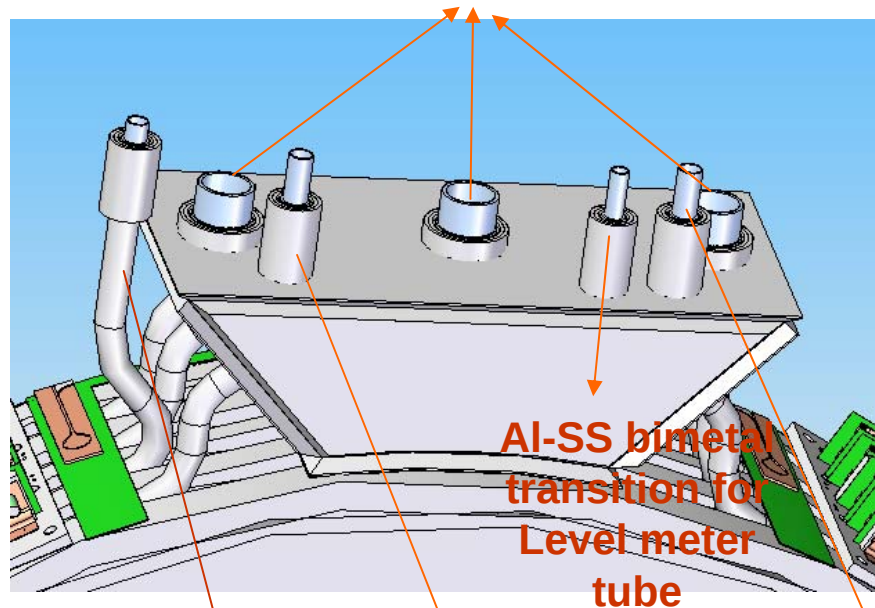
- ❖ A collimator on the clevis, which will be used to transfer the coil mechanical center to the external vacuum chamber.



Installation process

- ❖ The helium container is larger for the piping connection with the coolers
- ❖ The original ladder was removed in order to reduce the welds

Al-SS bimetal transition for pipes connecting He vessel with cooler recondenser

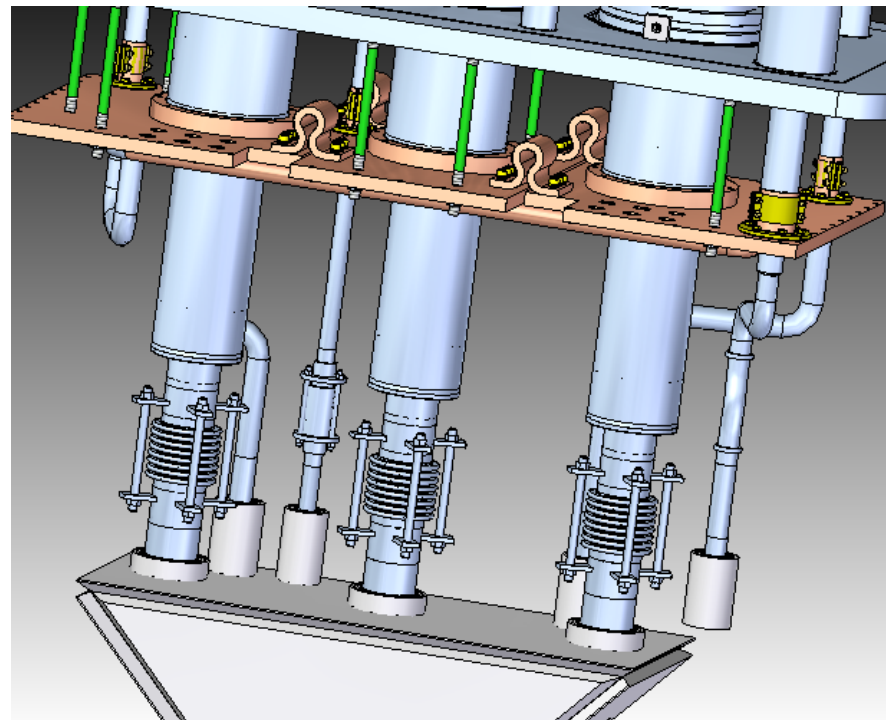


Al-SS bimetal transition for LHe precooling line with Bayonet

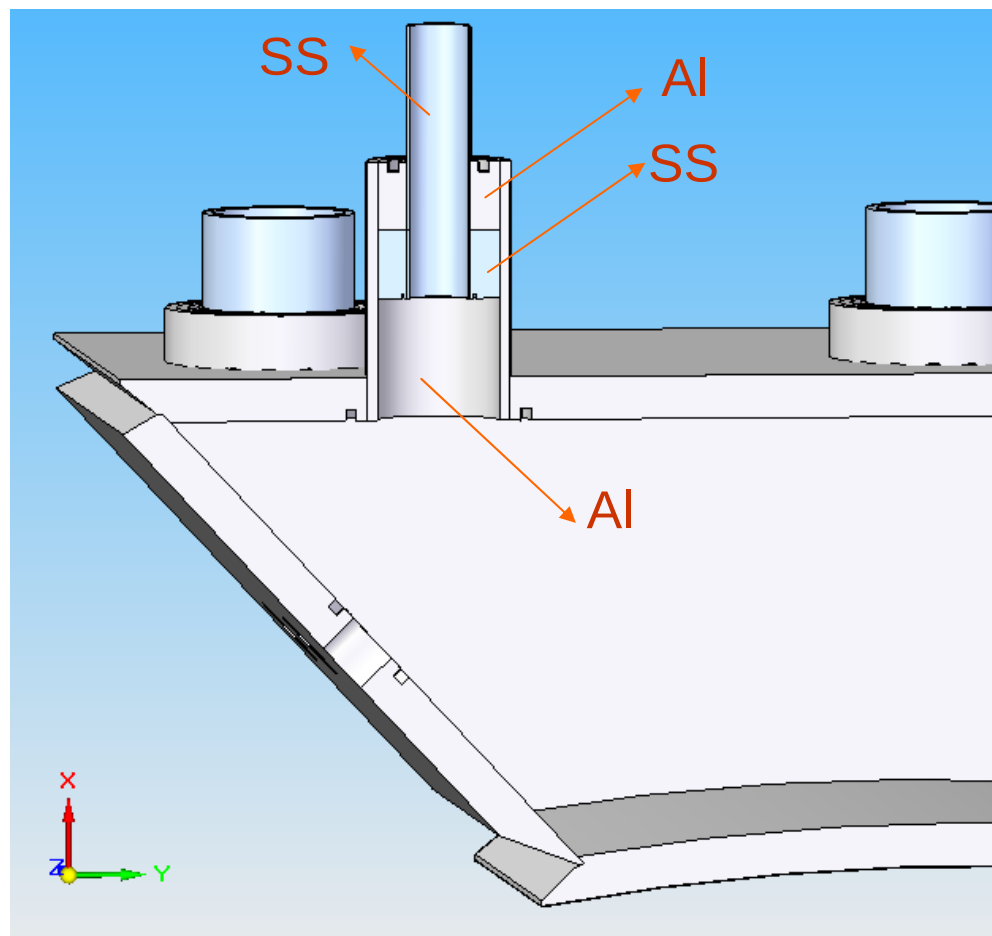
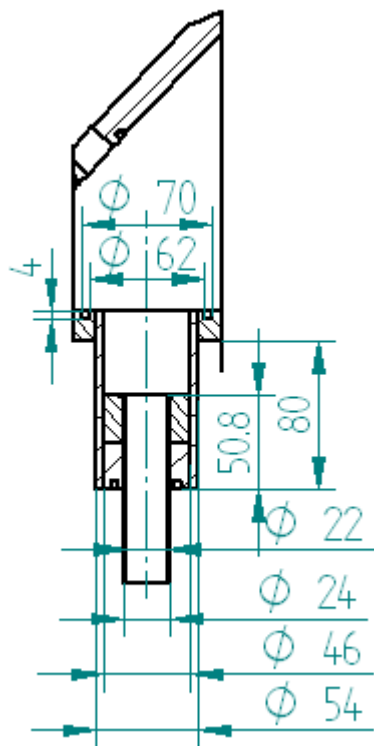
Al-SS bimetal transition for GHe vent line with Burst Disc

Al-SS bimetal transition for GHe vent line with relief valve

3D model for Top He vessel

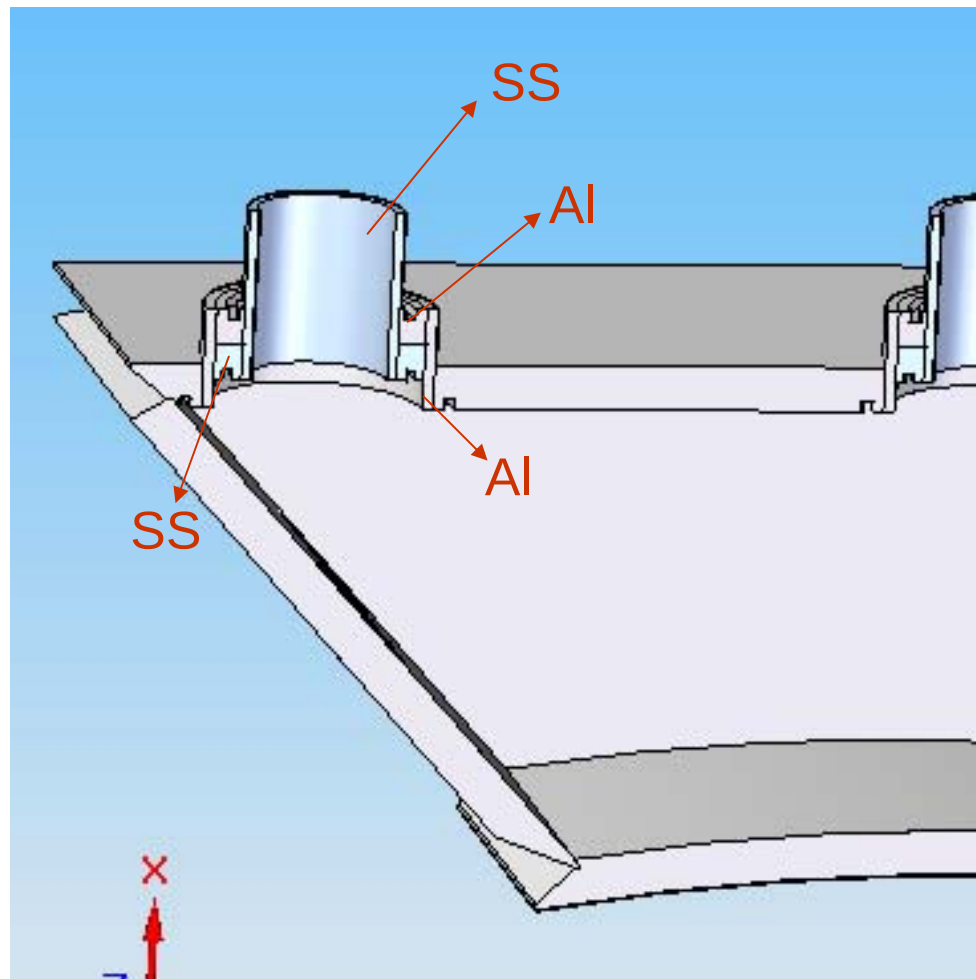
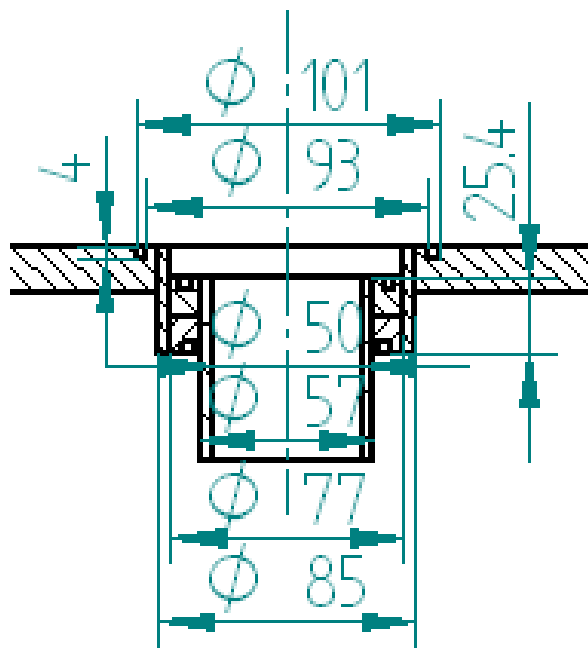


- ❖ The thickness of the SS piping is 1mm, and that of the Al piping is 4 mm. The thickness of Al-SS bimetal transition is 50.8mm, the width is 11mm



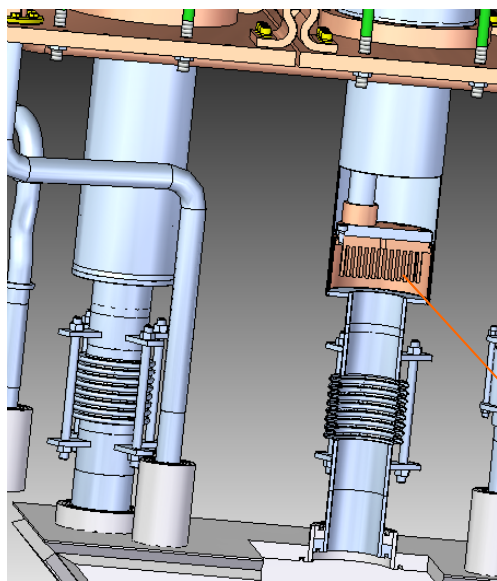
Al-SS bi-metal transition pipe assembly

- ❖ The thickness of the SS piping is 3.5mm, and that of the Al piping is 4 mm. The thickness of Al-SS bimetal transition is 25.4mm, the width is 10mm

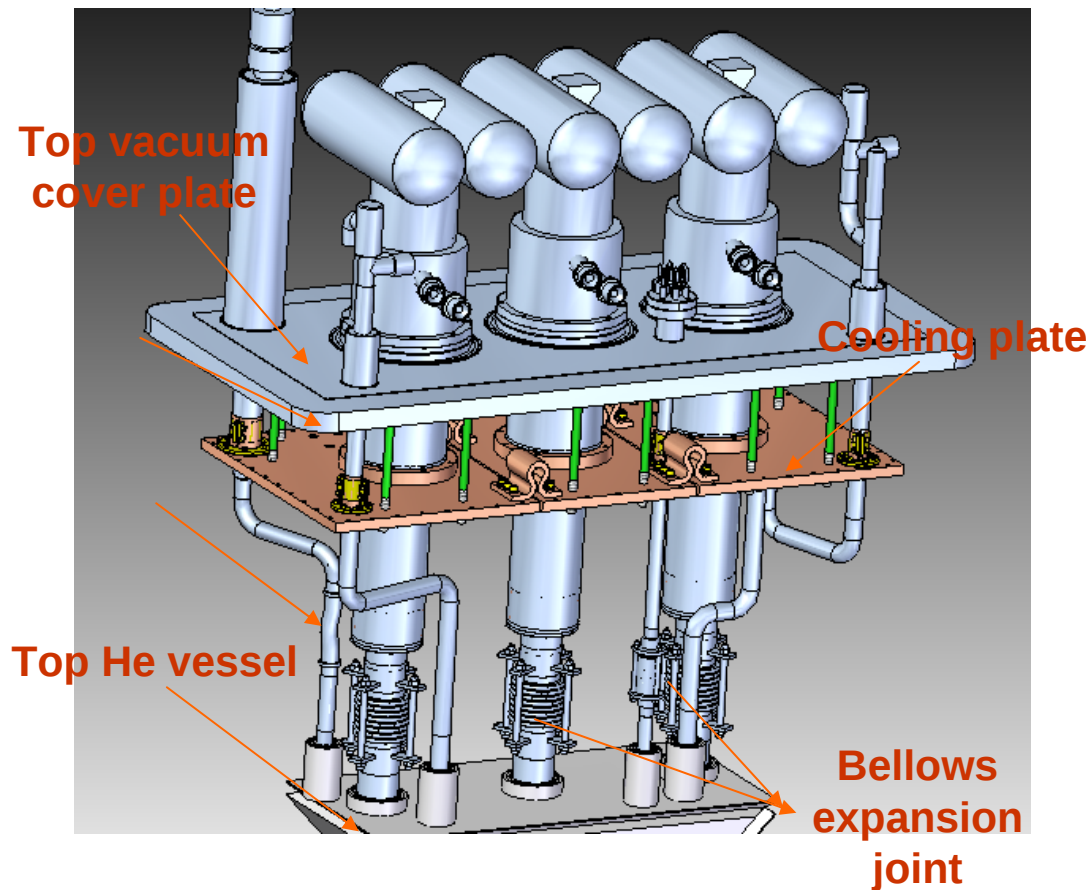


Al-SS bi-metal transition pipe assembly

- ❖ The distance between top vacuum cover plate and top He vessel is 655mm.
- ❖ The bellows will be pre-compressed about 8mm when installed at room temperature
- ❖ The length of the SS piping of both sides of the bellows is 35mm, to replace the bellows more than three times.

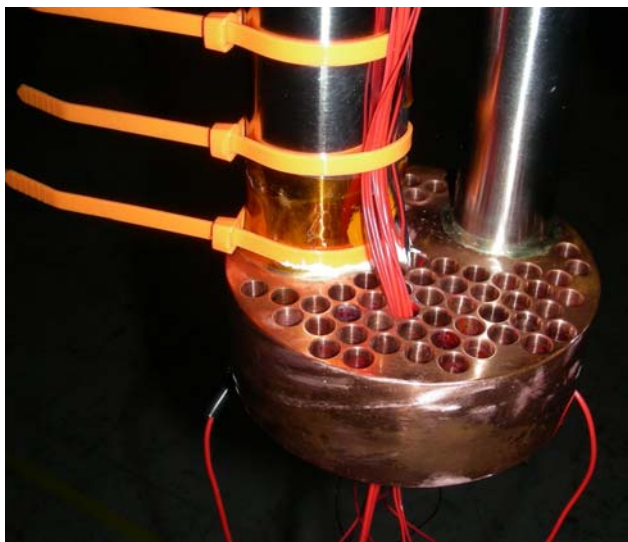


Re-condenser

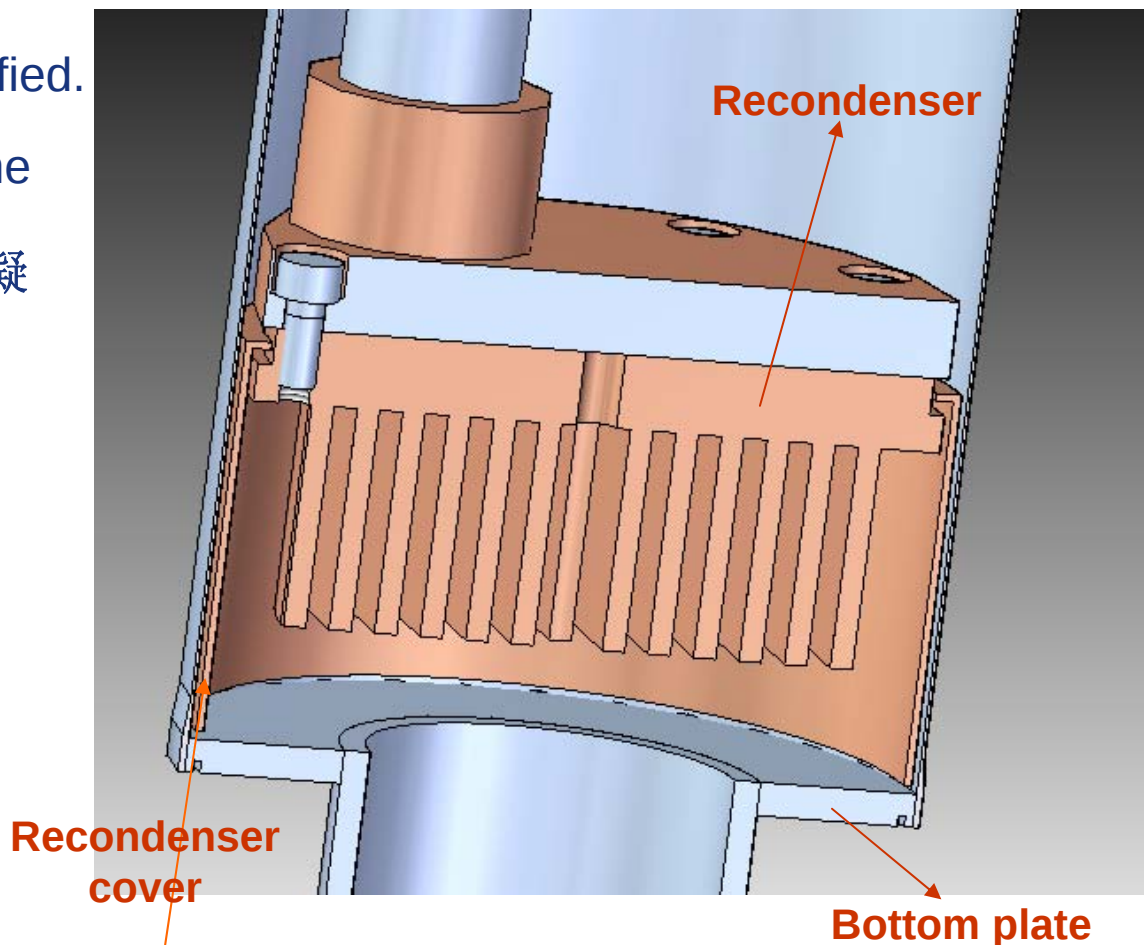


3D model for Cryocooler and cooling piping

- ❖ The configuration of the recondenser has been modified. The condensation area is 56477mm^2 , 1.35 times of the original one.
- ❖ 外部加有冷凝罩，以增强冷凝器内部氦流的冷凝换热效率
- ❖ 冷凝器距下底板16mm



Previous re-condenser

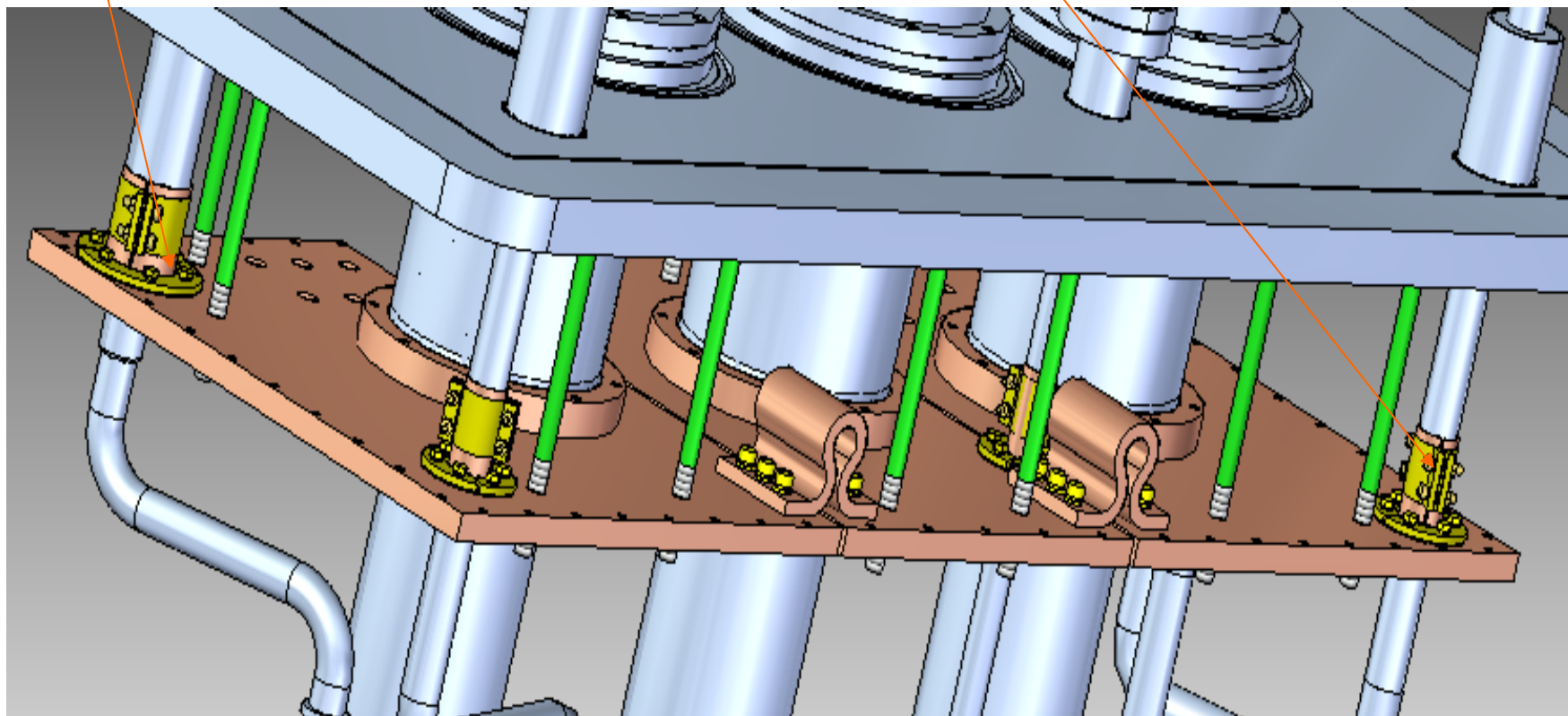


3D model for cryocooler 2-stage cold head re-condenser

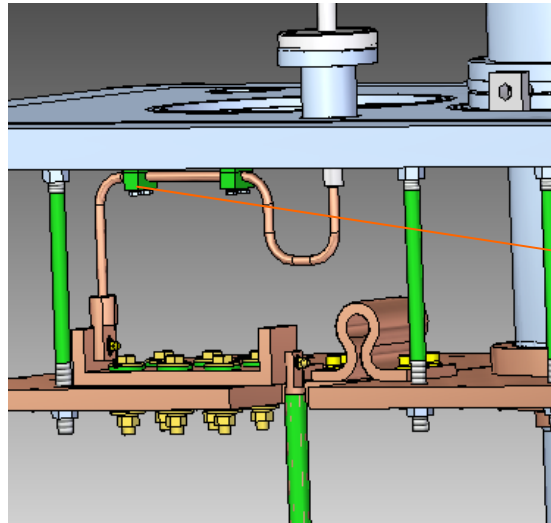
❖ 通过导冷板的四根管道外都增加了热锚组件

Thermal anchor

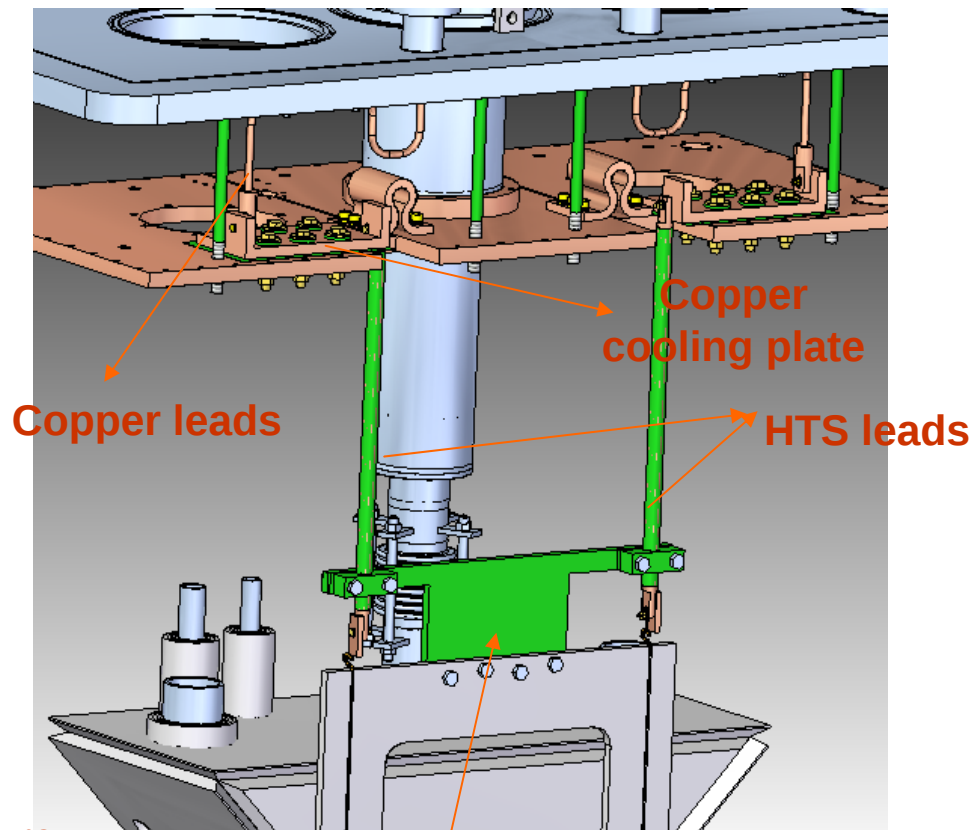
Thermal anchor



- ❖ HTS引线冷端采用夹子结构限位并允许应力释放；铜引线也采用固定件将其限位在室温真空顶盖的内侧壁上
- ❖ 为避免铜引线漏热直接传输至HTS，铜引线冷端与HTS热端分布在导冷铜块的两端



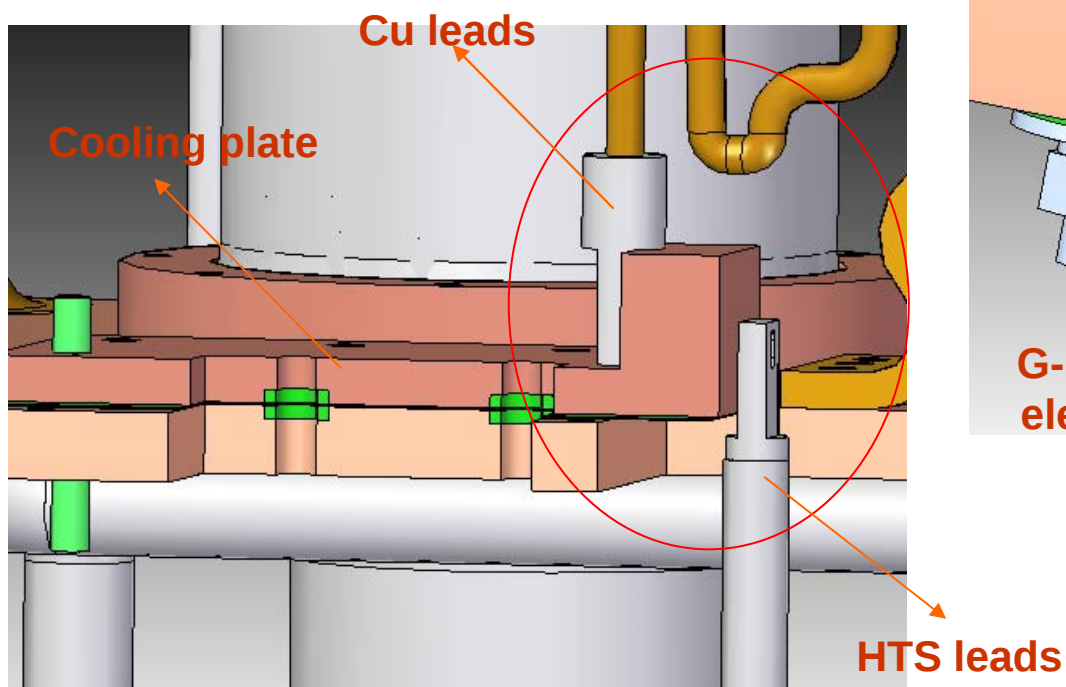
G-10 Fixture for Cu leads



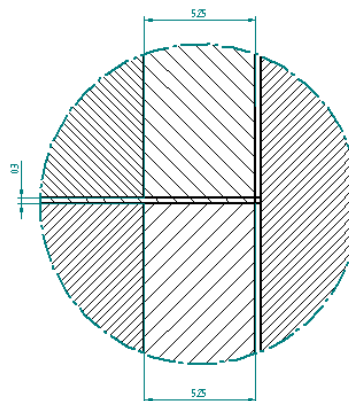
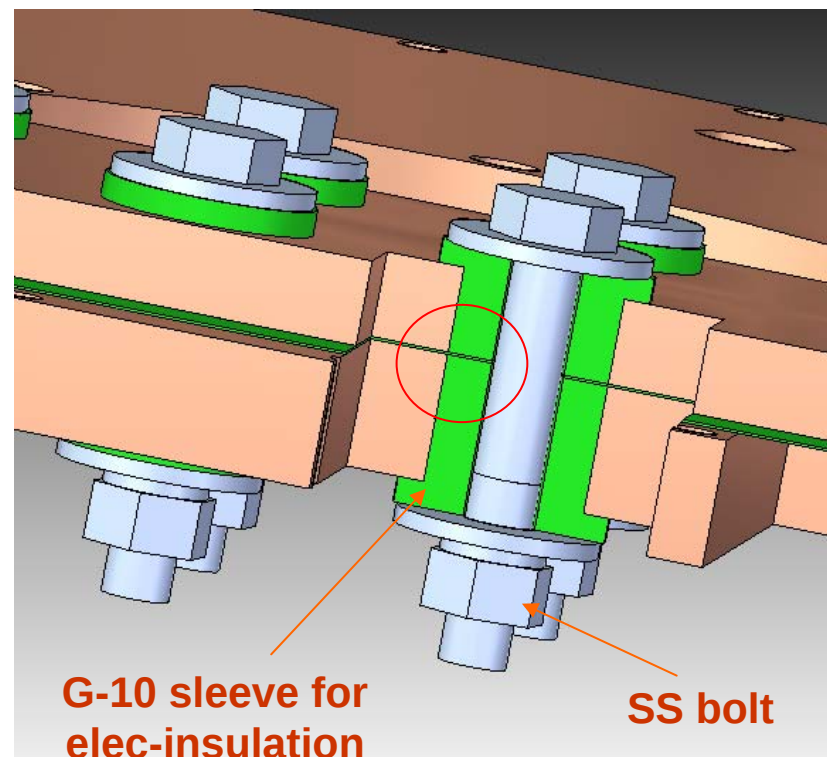
G-10 Fixture for HTS leads' cold ends

3D model for Current leads

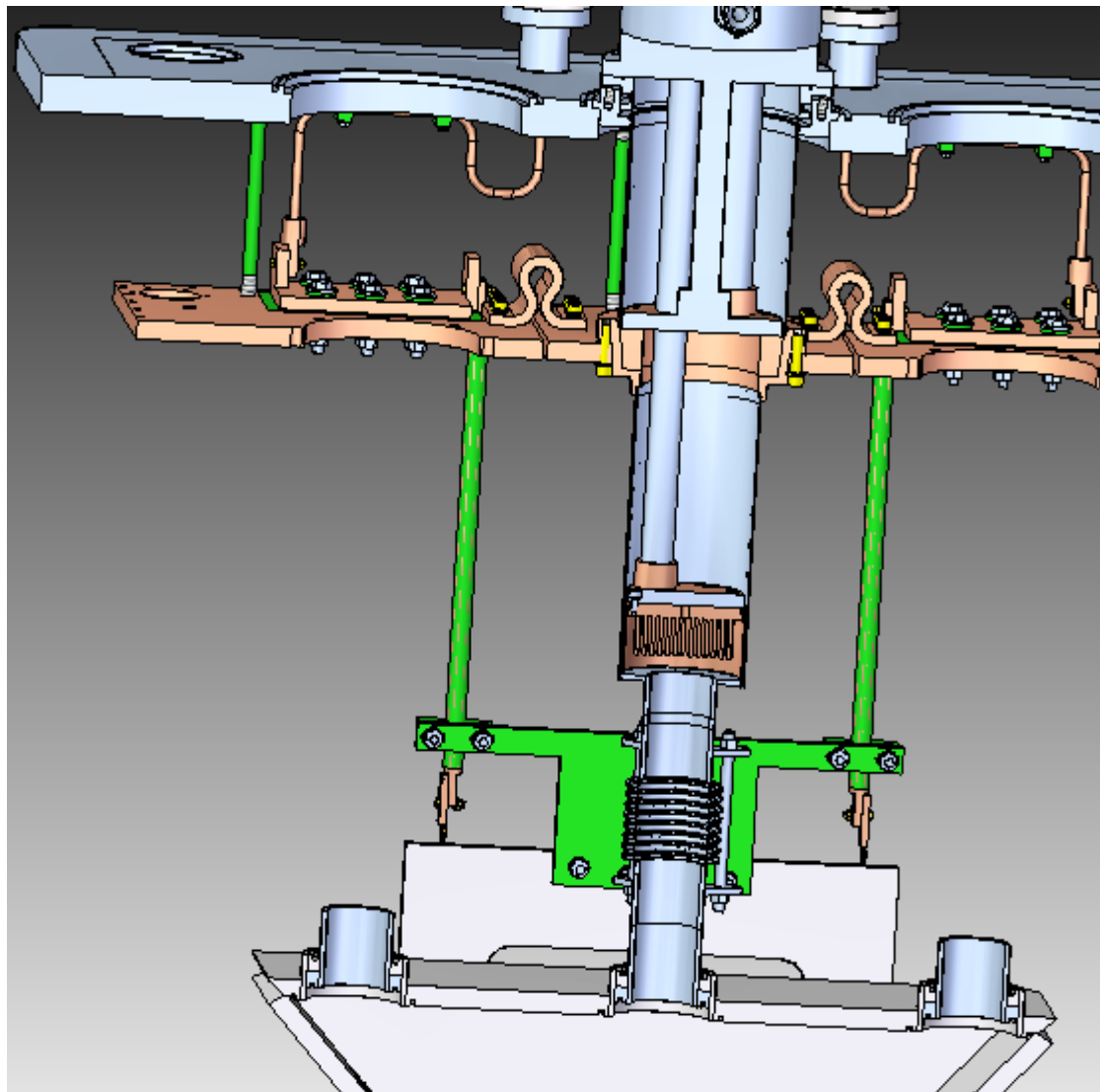
- ❖ 与导冷铜板的电绝缘方式：加G-10套, 采用SS螺栓连接
- ❖ G-10套壁厚5mm



Previous design



- ❖ 制冷机真空套筒的壁厚是0.4mm，不能承受很大的扭转应力，建议加工单位组焊过程中在保证焊接后的位置精度时注意保护真空套筒。



Thank YOU !