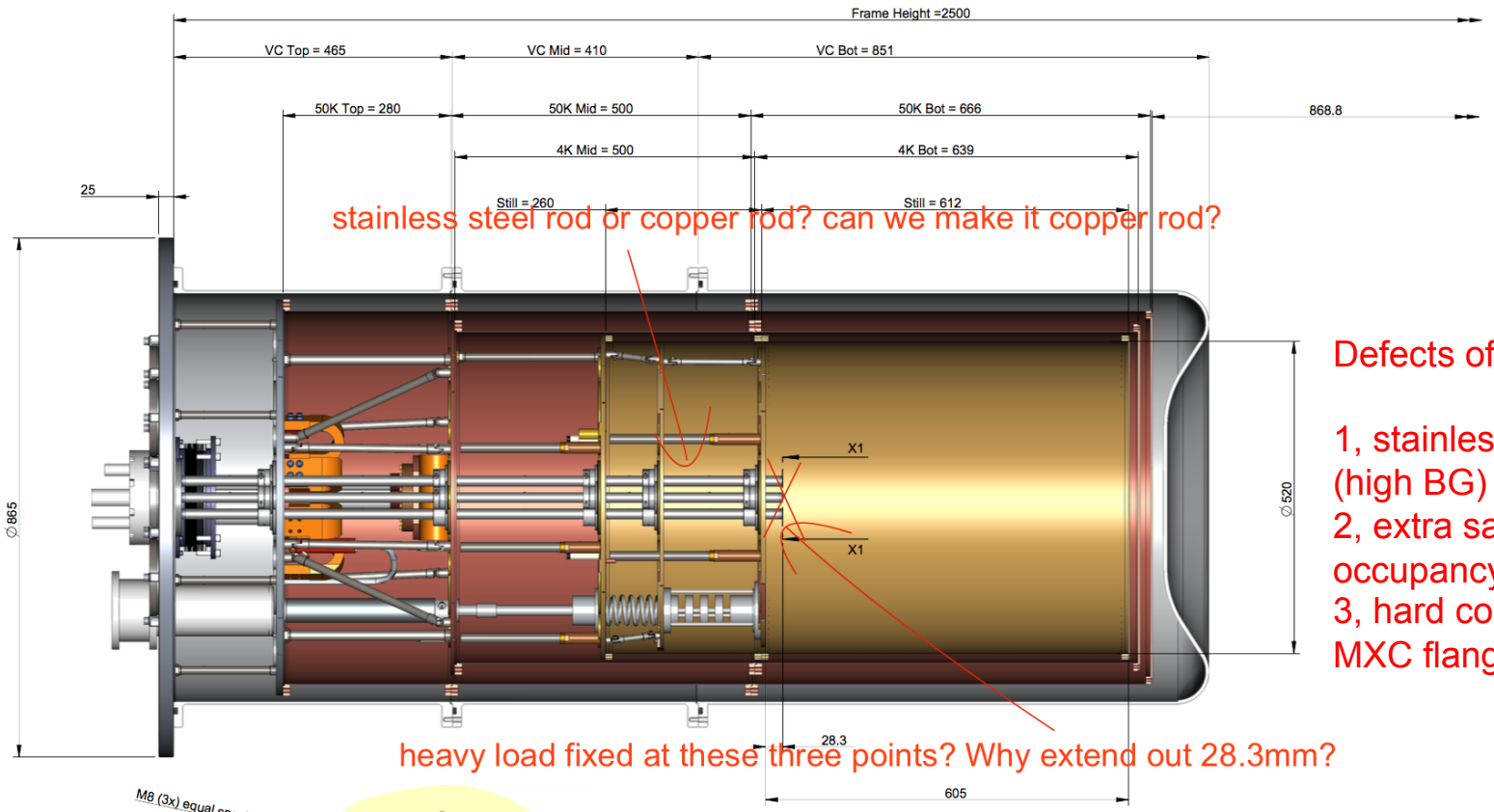
Update on the cryogenic system

Long Ma

2020.05.29

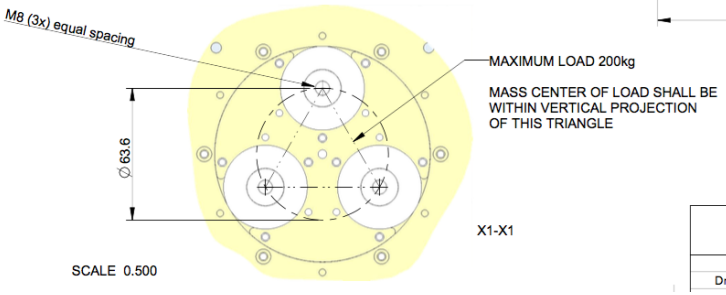
Heavy load design for top shield

Old design



Defects of the design：

1, stainless steel flange (high BG)
2, extra sample space occupancy
3, hard connection with MXC flange

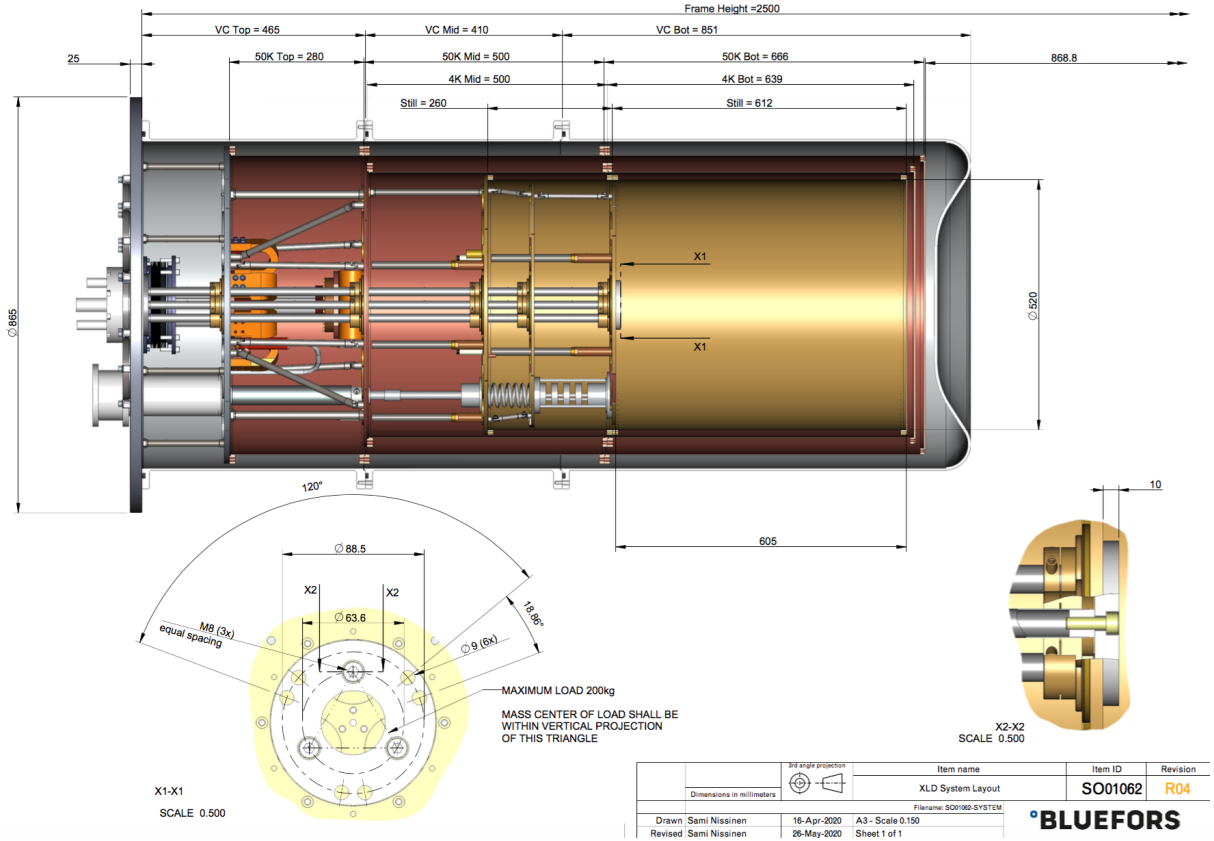


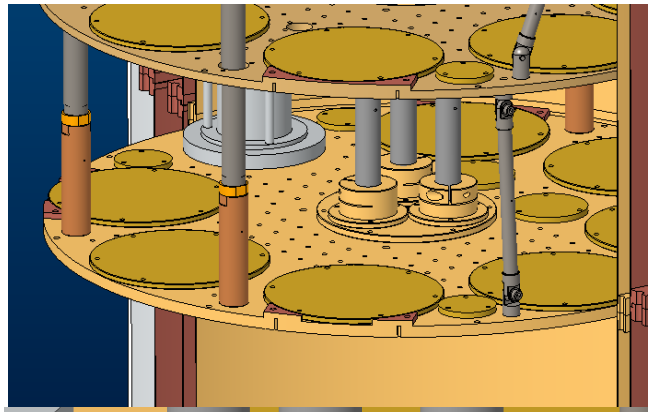
PRELIMINARY

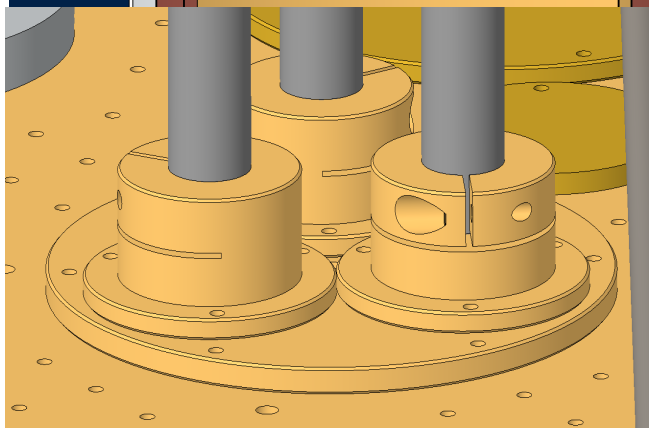
		3rd angle projection	Item name	Item ID	Revision
	Dimensions in millimeters		XLD System Layout	SO01062	R02
		Filename: SO01062-SYSTEM			
Drawn	Sami Nissinen	16-Apr-2020	A3 - Scale 0.150	BLUEFORS	

Heavy load design for top shield

New design





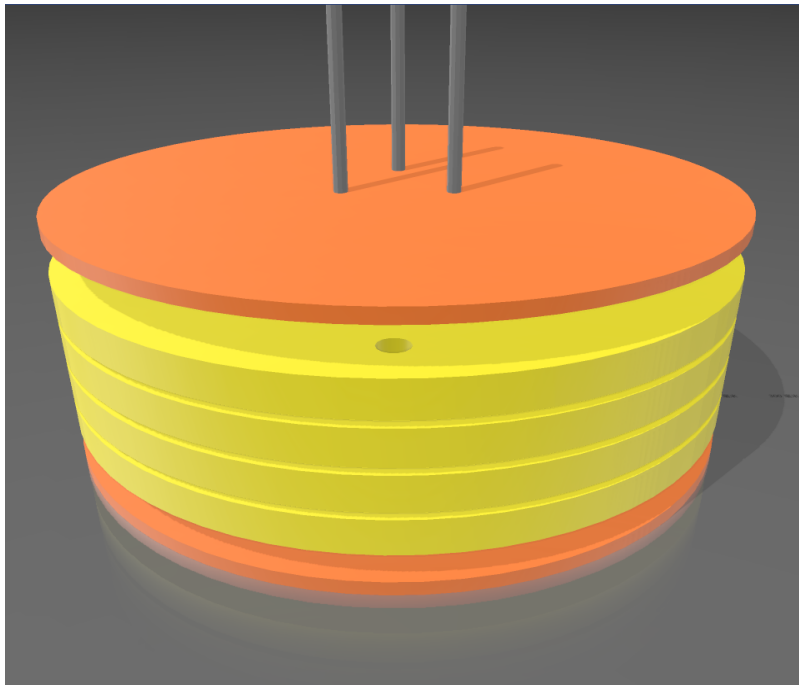


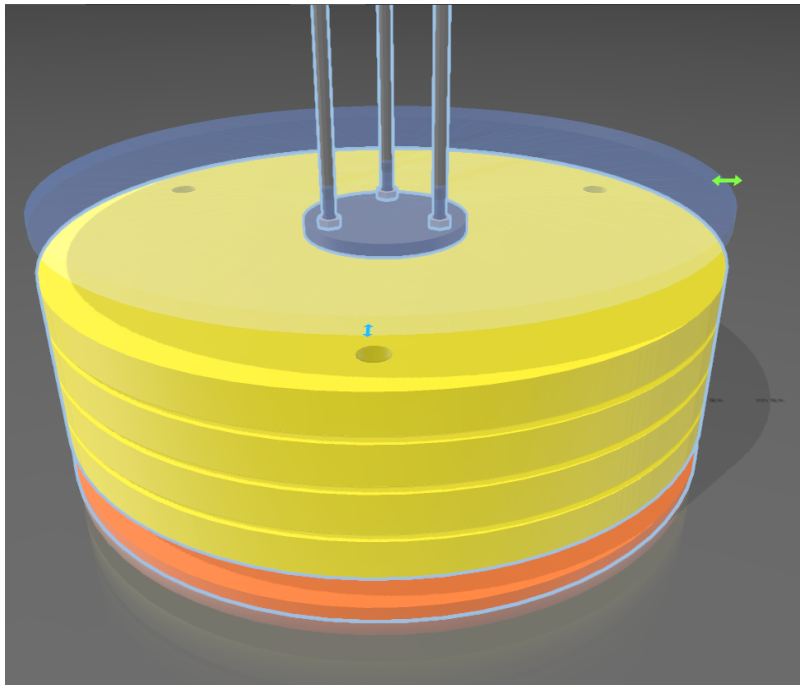
1, G10 material instead of SS (can be replaced with copper if possible)

2, Detached flange (from MXC plate)

Heavy load design for top shield

In courtesy of Shihong Fu





Screw holes reserved for mounting copper shield

Wiring Plan

Cryogenic Wire:
- minimize heat leak into the sensor and cryogenic system
- much lower thermal conductivity (and higher electrical resistivity) than usual copper wire

The most common type of cryogenic wire:
- phosphor bronze
- manganin, nichrome heater wire et al.

Some other concerns:
- read-out connection: welding is challenging for microD connector (twisted pair wire) , one possible solution is connecting directly to PCB
- heat load

Ke's suggestion : buy some and make some

Cryogenic Wire

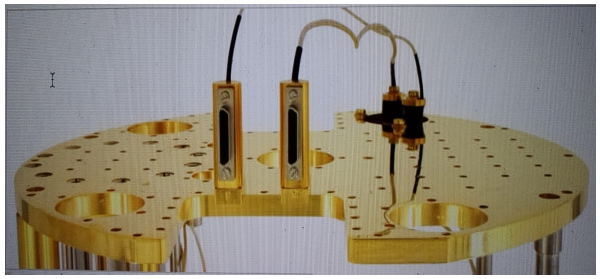
Wiring Plan

Commercial wiring solutions (Bluefors):

Standard twisted pair wiring options:

- **36 AWG phosphor-bronze**
  Room temperature - 4K: 14 / 12 Ohm/wire (RT / cold)
  4K - MXC: 9 / 8 Ohm/wire (RT / cold)
  Room temperature – MXC: 23 / 20 Ohm/wire (RT / cold)
- **35 AWG copper**
  Room temperature – 4K: 3 / <1 Ohm/wire (RT / cold)
  Note: Includes additional thermal anchoring stage to pulse tube.
- **Low-Ohmic**
  35 AWG Cu from RT to 4K (see above) + NbTi/CuNi (superconducting) from 4K to MXC:
  50 / <1 Ohm/wire (RT / cold)
  Note: Includes connectorized break-out at 4K.

3300€



Bluefors MicroD connector

Other providers： Calfinewire, Lake Shore

Duo-Twist™ cryogenic wire — WDT-32, WDT-36

- Phosphor bronze wire
- Non-ferromagnetic
- Single twisted pair (2 wires)
- Color coded (cathode-green, anode-clear)
- Minimizes pickup noise
- 32 and 36 AWG
- Polyimide insulation

Duo-Twist™ wire

Duo-Twist™ is a single twisted pair (2 leads) of 32 or 36 AWG phosphor bronze wire twisted at 3.15 twists per centimeter (8 twists per inch). This wire is a good choice when any possibility of pickup noise to a diode sensor or sample by induced currents through the leads needs to be minimized.

Single strand cryogenic wire — WSL-32, WSL-36

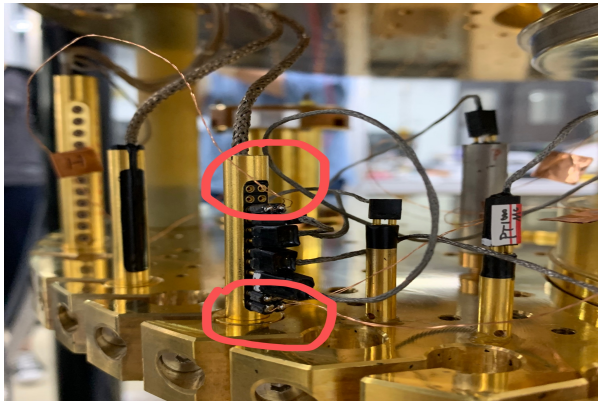
- Phosphor bronze wire
- Non-ferromagnetic
- Single strand
- 32 and 36 AWG
- Polyimide insulation (WSL-32)
- Formvar® insulation, clear (WSL-36)

Non-magnetic wire

Lake Shore non-magnetic (NM) single lead (SL) wire is a phosphor bronze (CuSnP alloy) wire. This wire has a relatively low temperature dependence of its resistance from room temperature to helium temperatures.

WSL-32 can be used for sensor installations requiring stronger and more 'rugged' leads.

WSL-36 wire is recommended for general sensor installation.



Oxford 24-pin flat cable connector

Next Plan

- New sample testing in progress in SINAP
- Testing vibration damping (Phosphorus-hydrogen copper spring)
- Testing cooling down (copper bulk /USTC ground DR facility)
- Lab layout/water cooling system/in-situ facilities