



Mirror Cryoshields / Cryolines / LN2 Vessel

Mario Martínez - Juli Mundet - Rafa García

1. Introduction

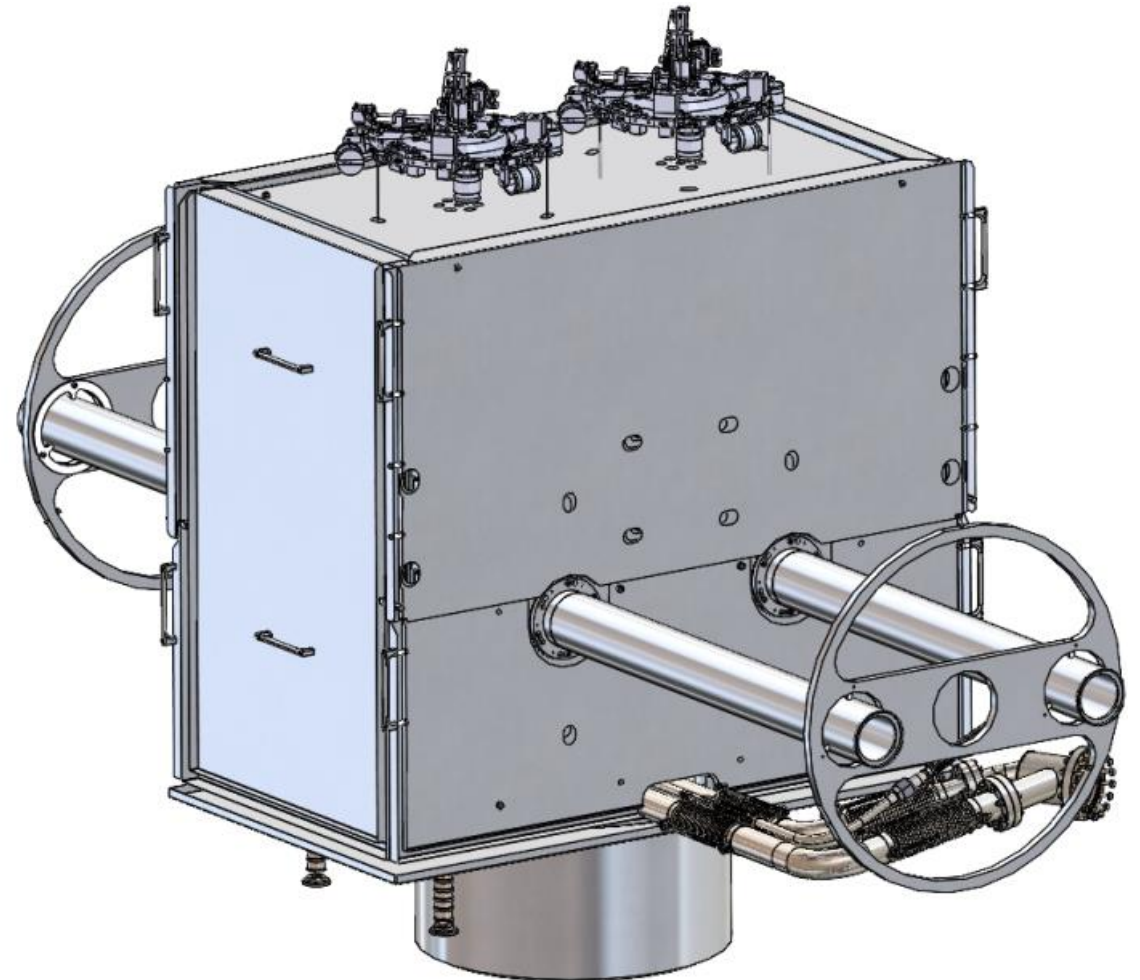
2. Cryoshields

- 290K, 80K, & 40K
- 15K

3. Cryolines

- He stage + KS
- Ne stage
- H₂ stage

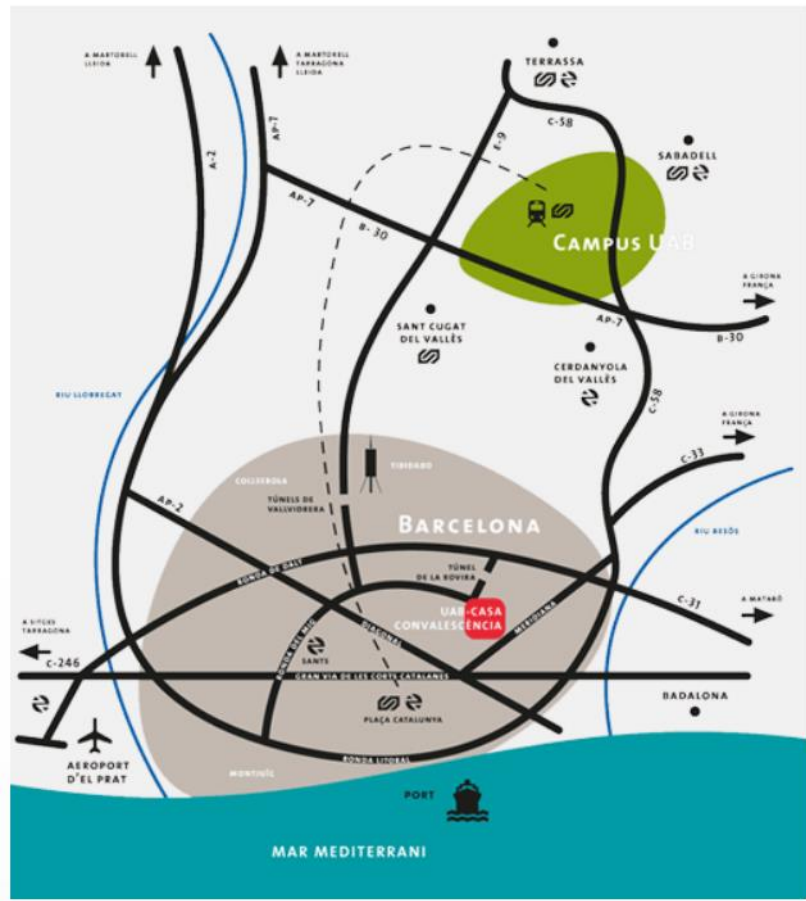
4. LN2 Vessel



IFAE (the Institute for High Energy Physics of Barcelona)

<https://www.ifae.es/>

- IFAE is a consortium of the **Generalitat de Catalunya** and the **UAB** (the **Autonomous University of Barcelona**) created in **1991**.
- Located at **UAB Campus** (30 km away from Barcelona)
- **Research lines**
 - **Particle Physics**
 - Hadron Colliders
 - Neutrinos
 - **Astrophysics & Cosmology**
 - Gamma Ray Astrophysics
 - Gravitational Waves
 - Observational Cosmology
 - **Applied physics**
 - Medical Physics
 - Quantum Computing Technologies



IFAE (the Institute for High Energy Physics of Barcelona)

- **International experiments**
- **150 people**
Researchers, engineers and support personnel
- **IFAE is structured in three divisions** (theoretical, experimental, technical), an **administrative area**, and **manages PIC, jointly with CIEMAT.**
- **PIC Data-processing center**
PIC is part of the Spanish Supercomputing Network, a recognized Singular Scientific and Technical Infrastructure offering advanced data services to the broad scientific community, including many physics groups.



IFAE (the Institute for High Energy Physics of Barcelona)

- **IFAE** is member of the **BIST** (The **Barcelona Institute of Science and Technology**) since 2015, which is an institution of scientific cooperation of seven top research centers committed to creating a collaborative environment of multidisciplinary scientific excellence.

Centre for Genomic Regulation ([CRG](#))

Institute for Bioengineering of Catalonia ([IBEC](#))

Institute of Photonic Sciences ([ICFO](#))

Institute of Chemical Research of Catalonia ([ICIQ](#))

Catalan Institute of Nanoscience and Nanotechnology ([ICN2](#))

Institute for High Energy Physics ([IFAE](#))

Institute for Research in Biomedicine ([IRB Barcelona](#))

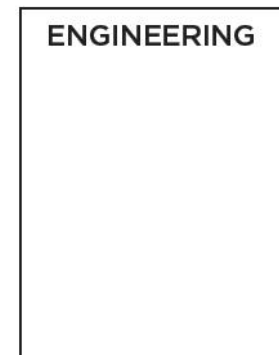
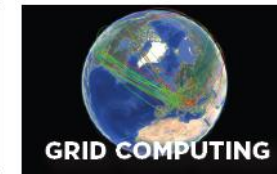
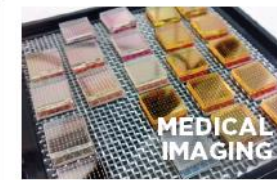
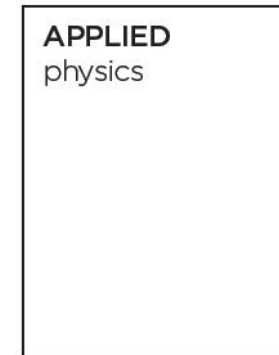


<https://bist.eu/>

IFAE (the Institute for High Energy Physics of Barcelona)

Facilities

- Chip packaging & assembly
- Clean rooms
- Shielded room
- Electronics labs
- Optical lab
- Mechanical workshop (300 m²) Facilities
 - Milling Machine HAAS VF-6/40 CNC (1200 x 800 x 800 mm)
 - Lather Pinacho S90/225 (∅ 450 x 1650 mm)
 - Grinder Danobal RTC-800 (800 x 500 mm)
 - Die-sinking EDM
 - Wire EDM



CTA (Cherenkov Telescope Array) – LST (Large Size Telescope)



LST-1 / Driven bogie



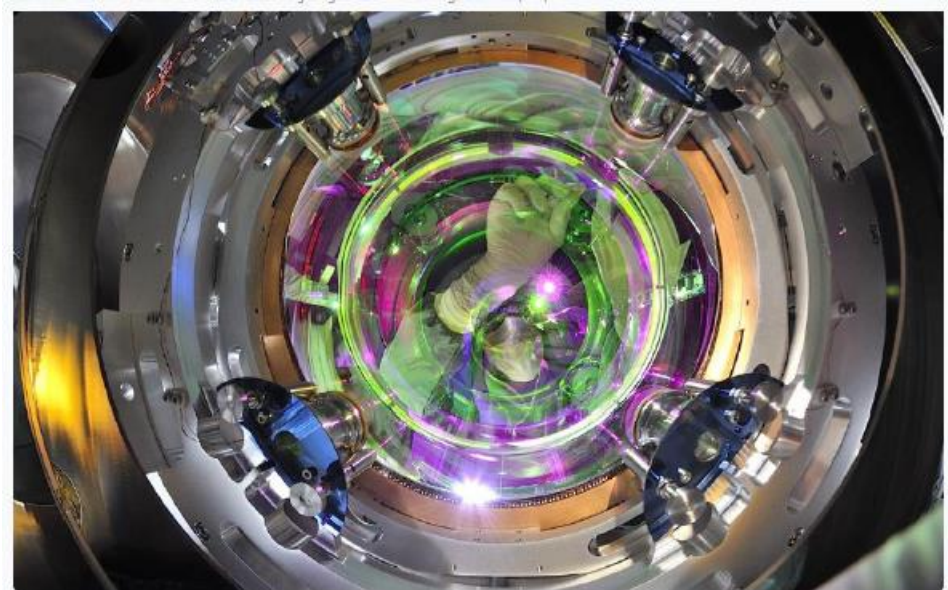
LST-1 / Azimuth Locking System



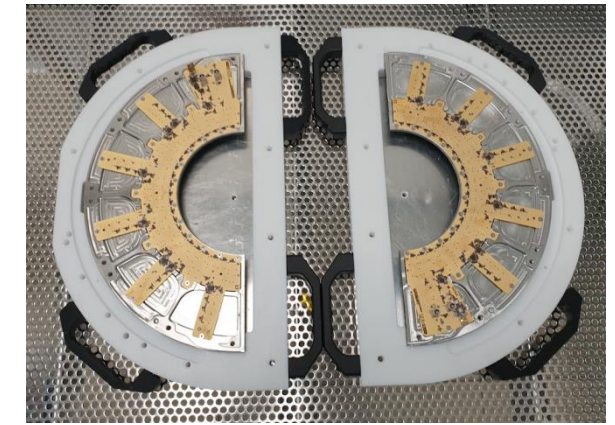
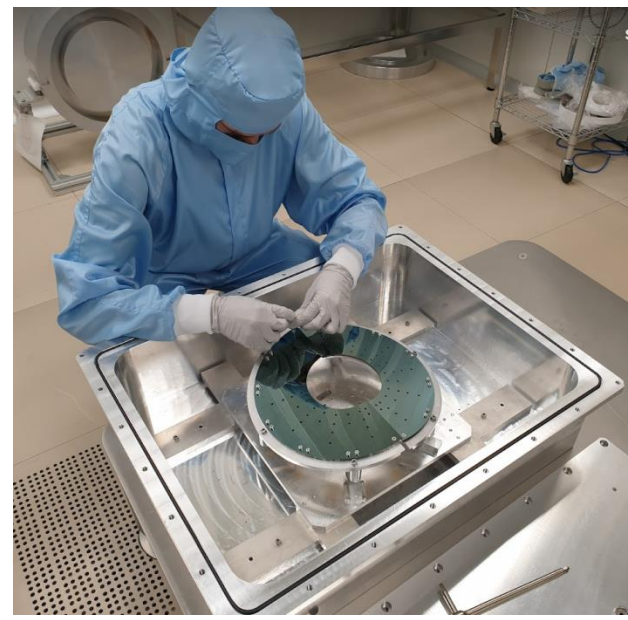
LST-1 / Azimuth Locking System ice falling protection

1. Introduction

Virgo interferometer

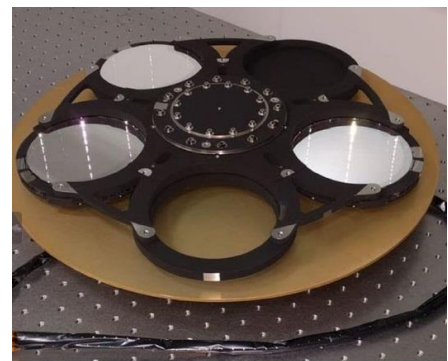
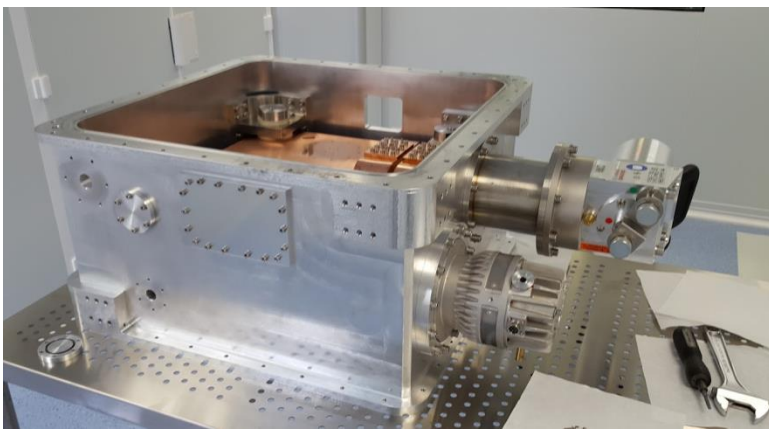


The image shows the rear-side view of a suspended mirror. The coating reflects the Virgo near-infrared laser beam, but is transparent in the visible range. A scientist is finally releasing the safety stops used during installation. The 42kg-mass mirror is suspended from four thin fused-silica fibres, which are bonded to the sides of the mirror. Credit: EGO/Virgo Collaboration/Perciball

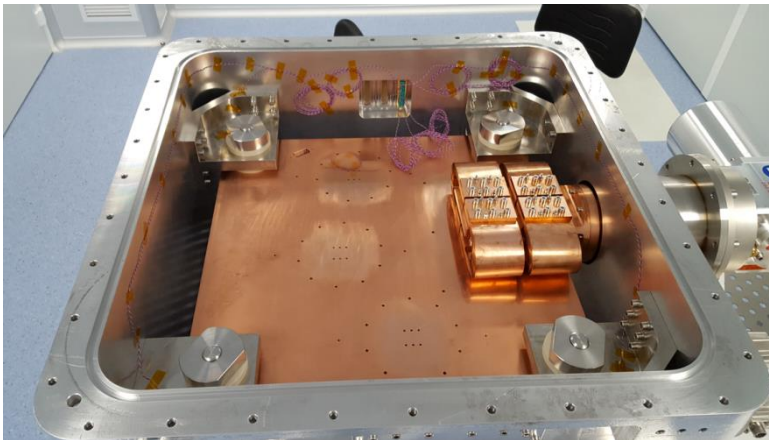


1. Introduction

EUCLID – NISP (Near Infrared Spectrometer and Photometer) – FWA (Flying Wheel Assembly)

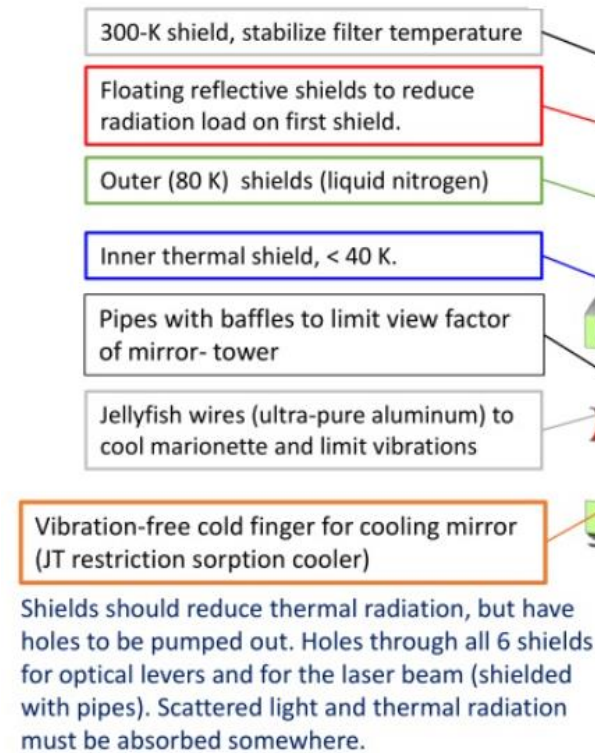


EUCLID – NISP FWA

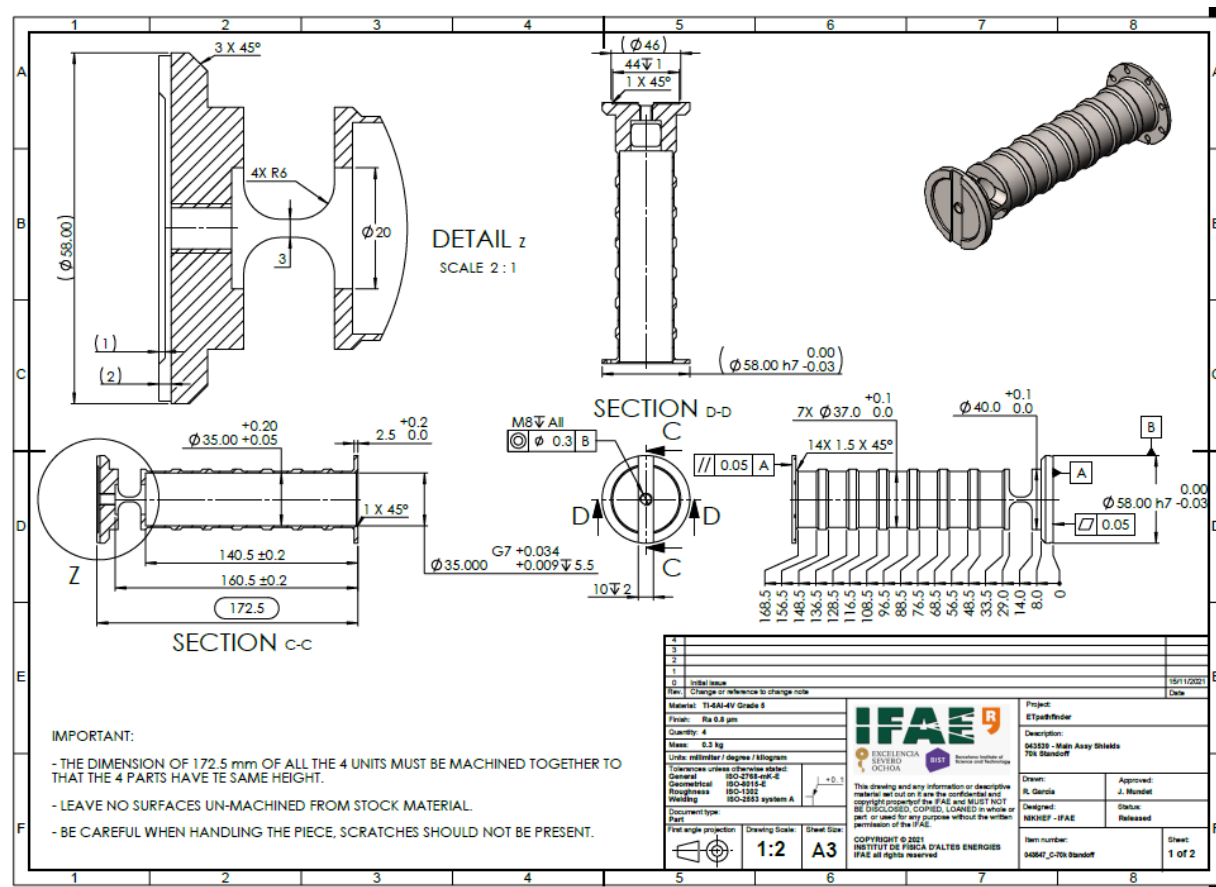


IFAE's contribution to ETPathfinder

- Started in the mid 2021 with the Cryoshields
- The Cryoshields (Floating, 80K & 40K ones) original design (almost final) was taken from Nikhef
- CAD files were converted (redrawn) to our Software
- Design changes proposed by Nikhef were applied
- Design improvements proposed by IFAE were agreed and applied
- Manufacturing drawings were drawn and issued
- First preliminary assembly instructions were handed in



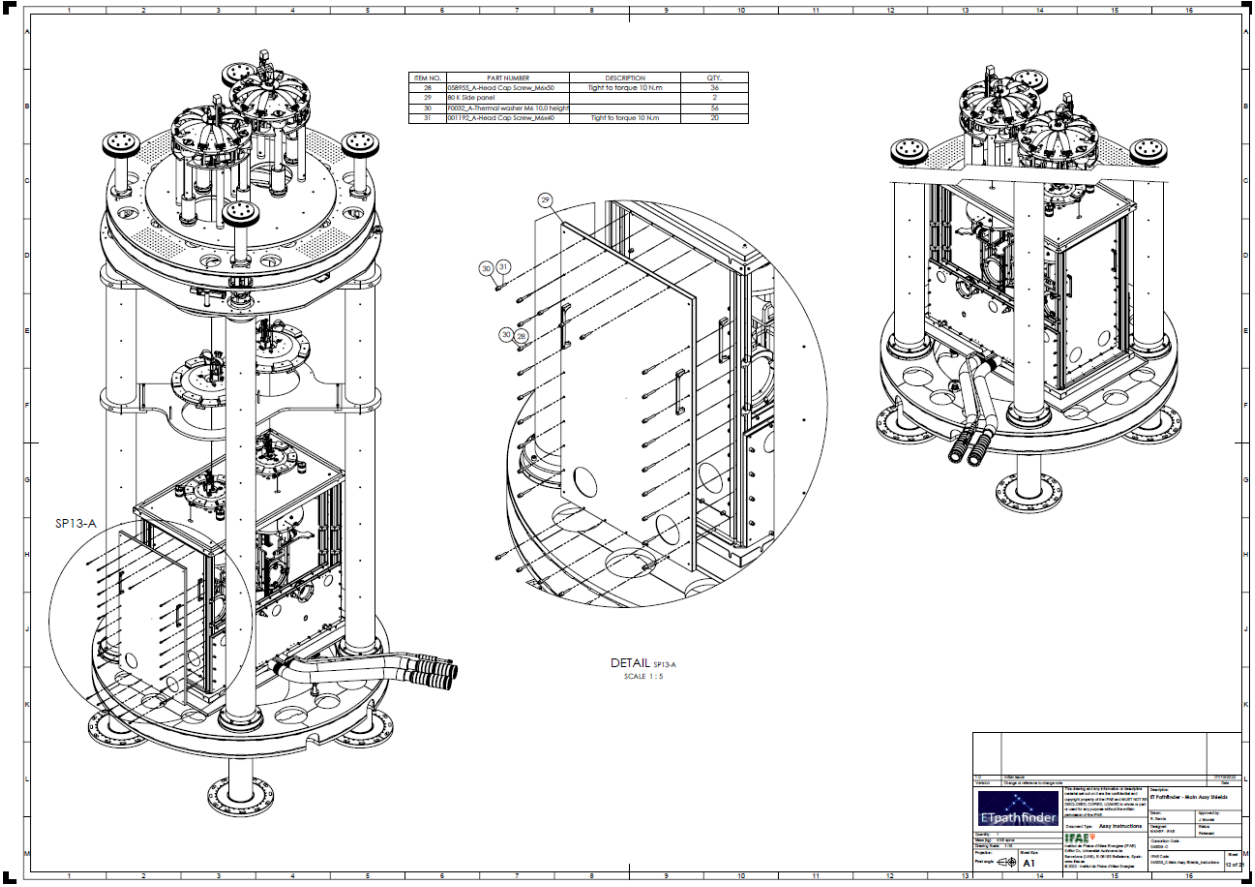
2. Cryoshields



IMPORTANT:

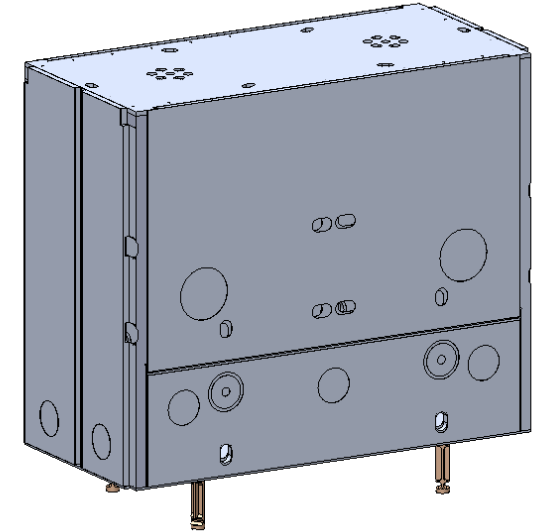
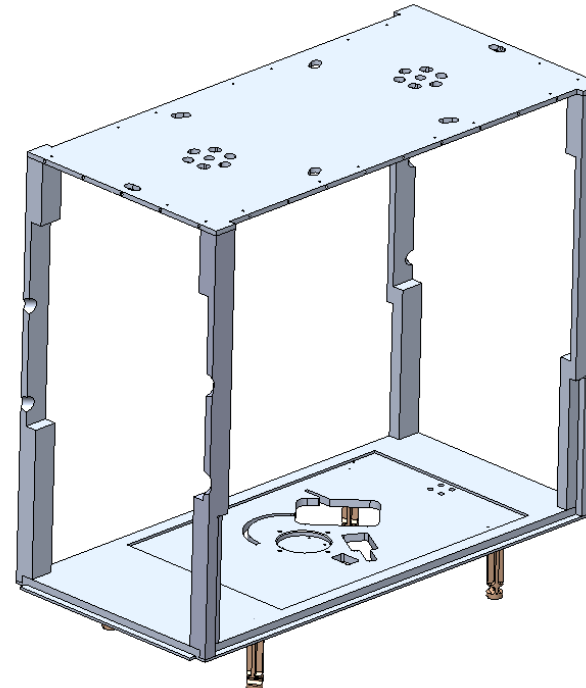
- THE DIMENSION OF 172.5 mm OF ALL THE 4 UNITS MUST BE MACHINED TOGETHER TO THAT THE 4 PARTS HAVE THE SAME HEIGHT.
- LEAVE NO SURFACES UN-MACHINED FROM STOCK MATERIAL.
- BE CAREFUL WHEN HANDLING THE PIECE, SCRATCHES SHOULD NOT BE PRESENT.

Material: T1-44-4V Grade 5	Project: ETpathfinder
Finish: Ra 0.8 µm	Description: 965336 - Main Assy Shields
Quantity: 4	TSI Standard
Mass: 0.3 kg	Drawn: K. Garcia
Units: millimeter / degree / kilogram	Approved: J. Morales
Tolerances unless otherwise stated:	Designed: NIKHEF - IFAE
General: ISO 2768-mS-E	Checked: Released
Geometrical: ISO 4015-E	Item number: 04847_C-TM Standard
Roughness: ISO 3252	Sheet: 1 of 2
Welding: ISO 5855 system A	

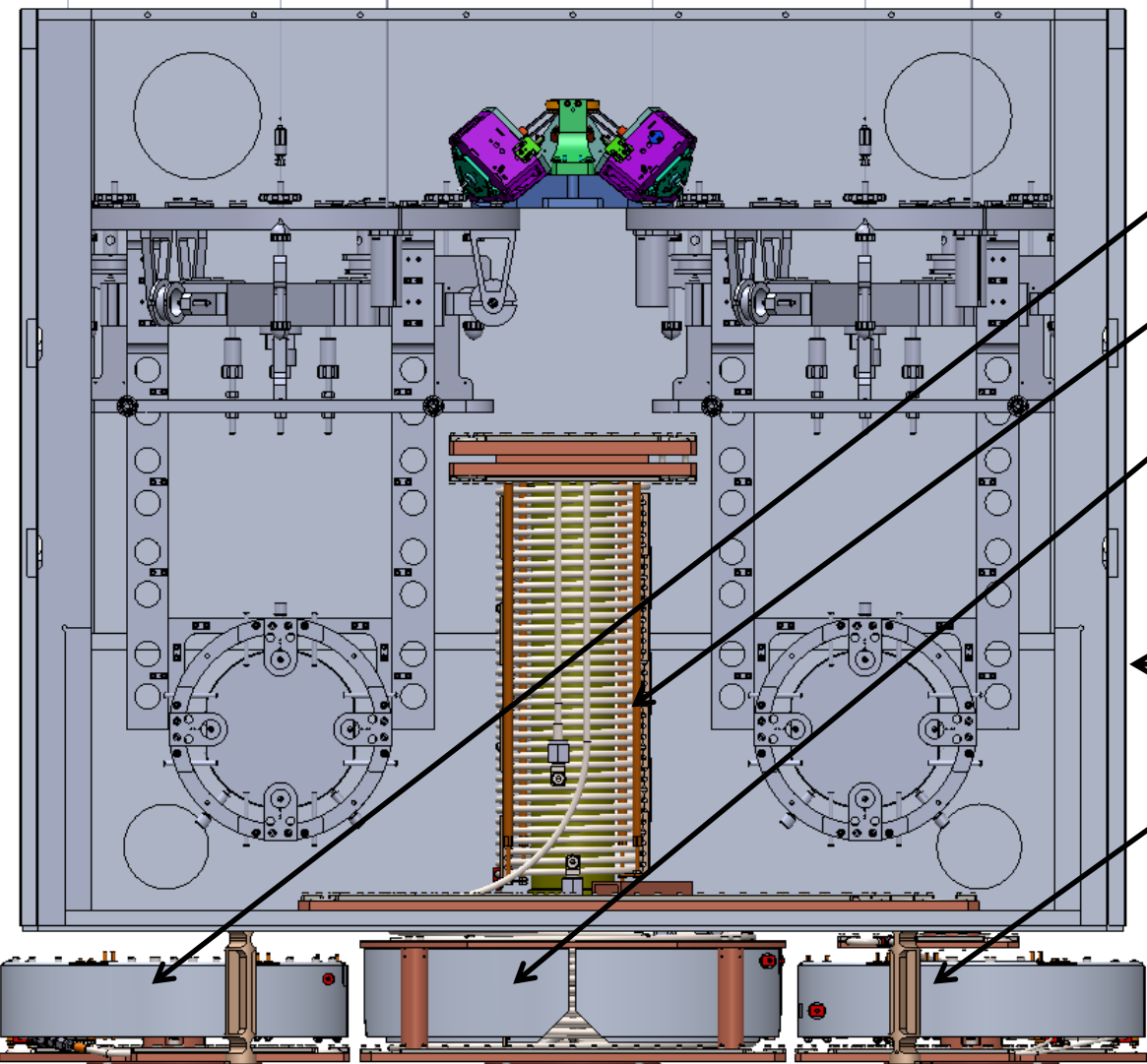


15K Cryoshield (the innermost cryoshield)

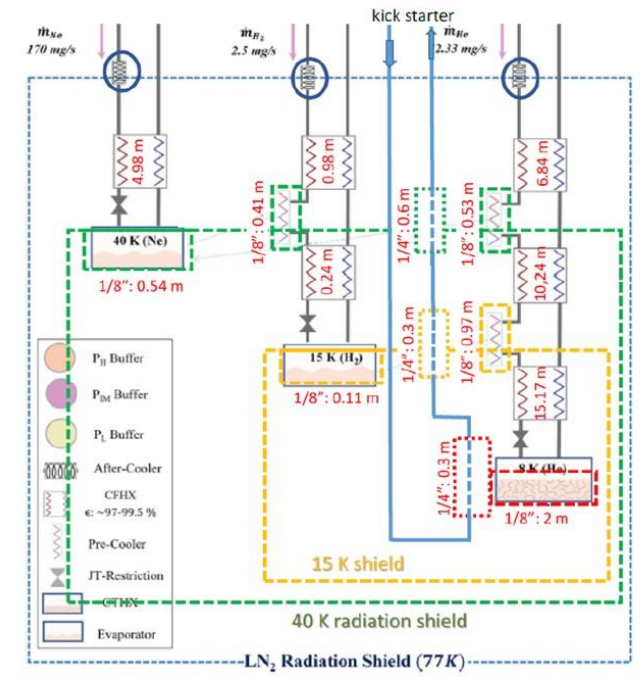
- Design status: preliminary stage
- Double-shielded design (worst case)
- Bulk dimensions: L1040 mm x W494 mm x H867 mm
- Polyimide stand-offs height 125 mm
- Current design has into account Mirror installation (railing system)



3. Cryolines

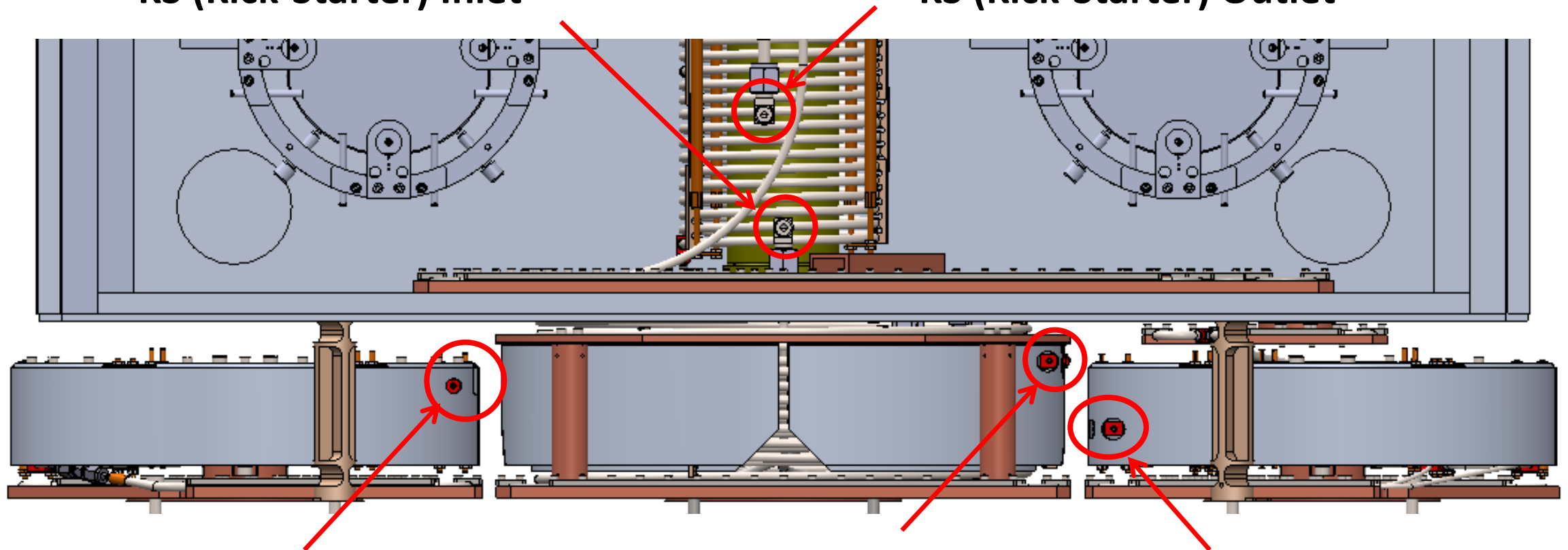


- Ne stage
- He stage + KS
above 15K Shield
- He stage + KS
beneath 15K Shield
- ← 15K Cryoshield
- H₂ stage



KS (Kick-Starter) Inlet

KS (Kick-Starter) Outlet

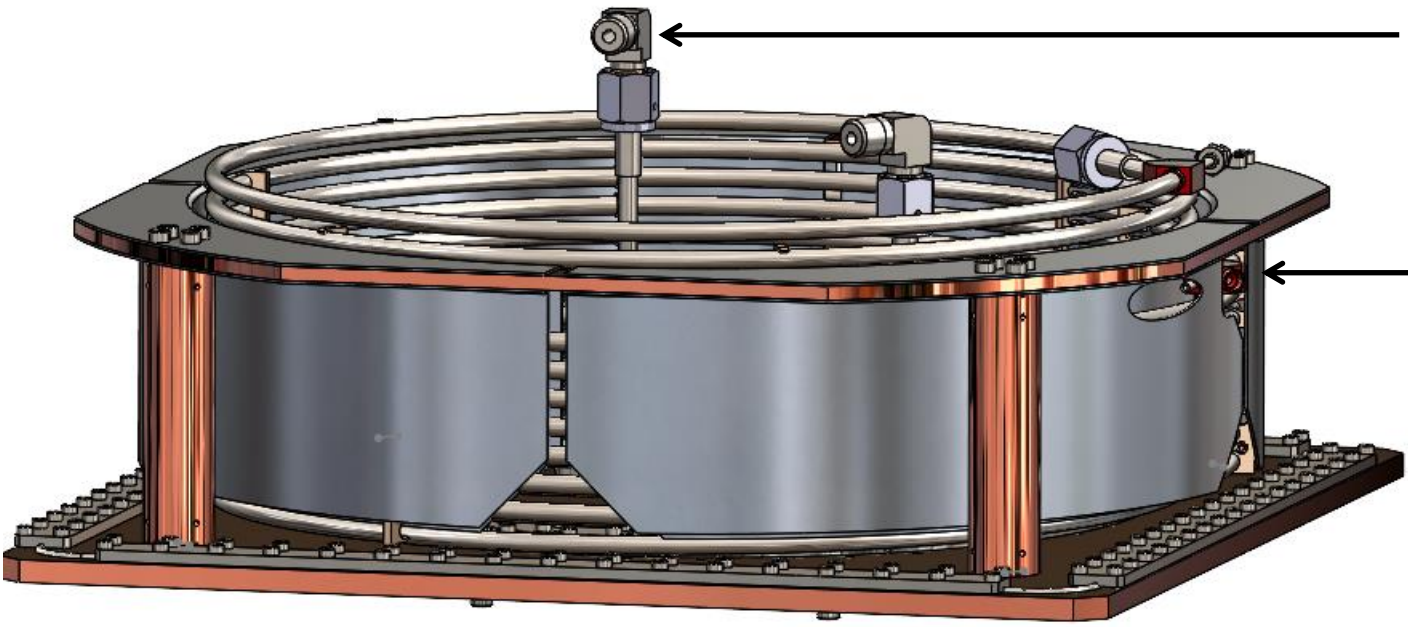


Ne stage Inlet/Outlet

He stage Inlet/Outlet

H₂ stage Inlet/Outlet

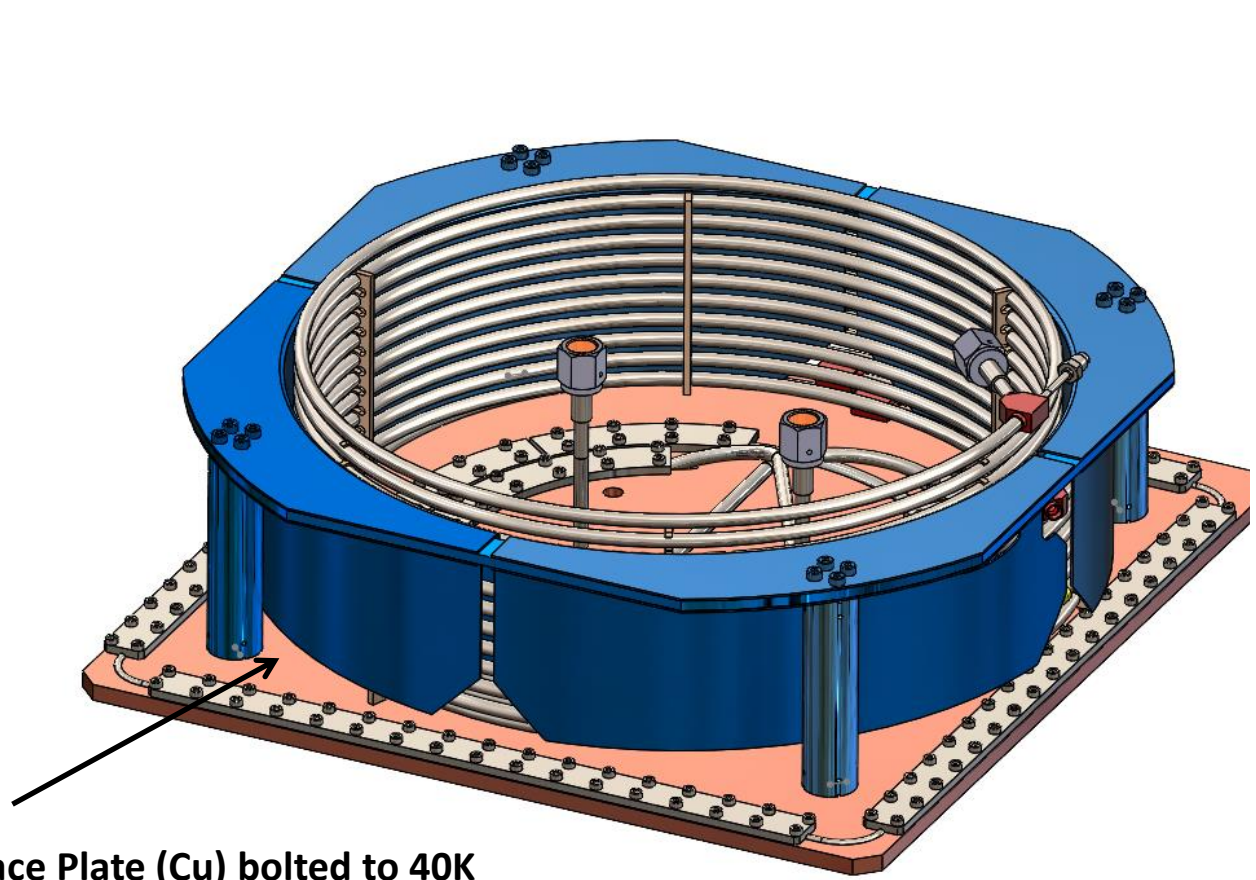
He stage + KS beneath 15 K Shield bottom plate



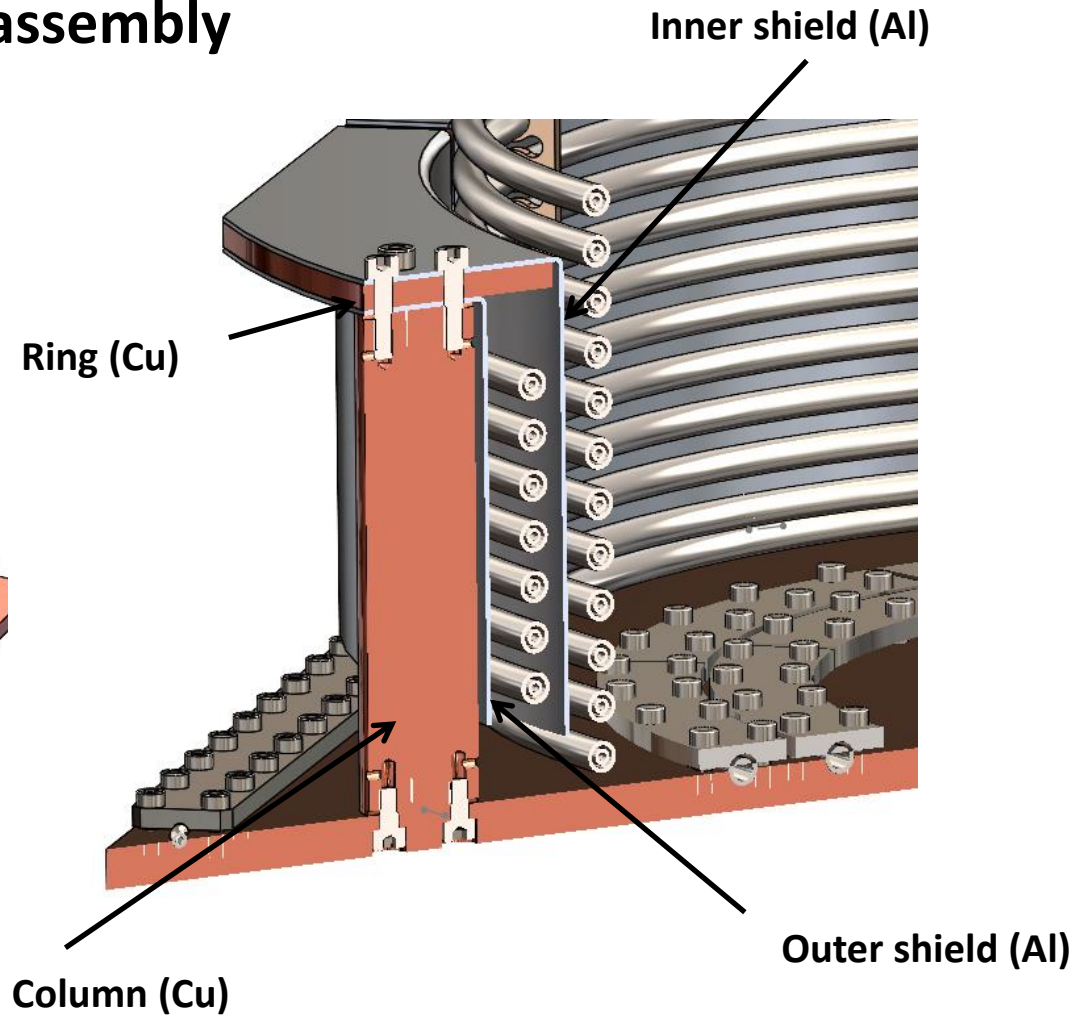
Swagelok VCR connection for KS inlet

- Ne inlet (HP line 1/8" pipe)
- Ne outlet (LP line 1/4" pipe)

He stage + KS beneath 15 K Shield bottom plate – assembly

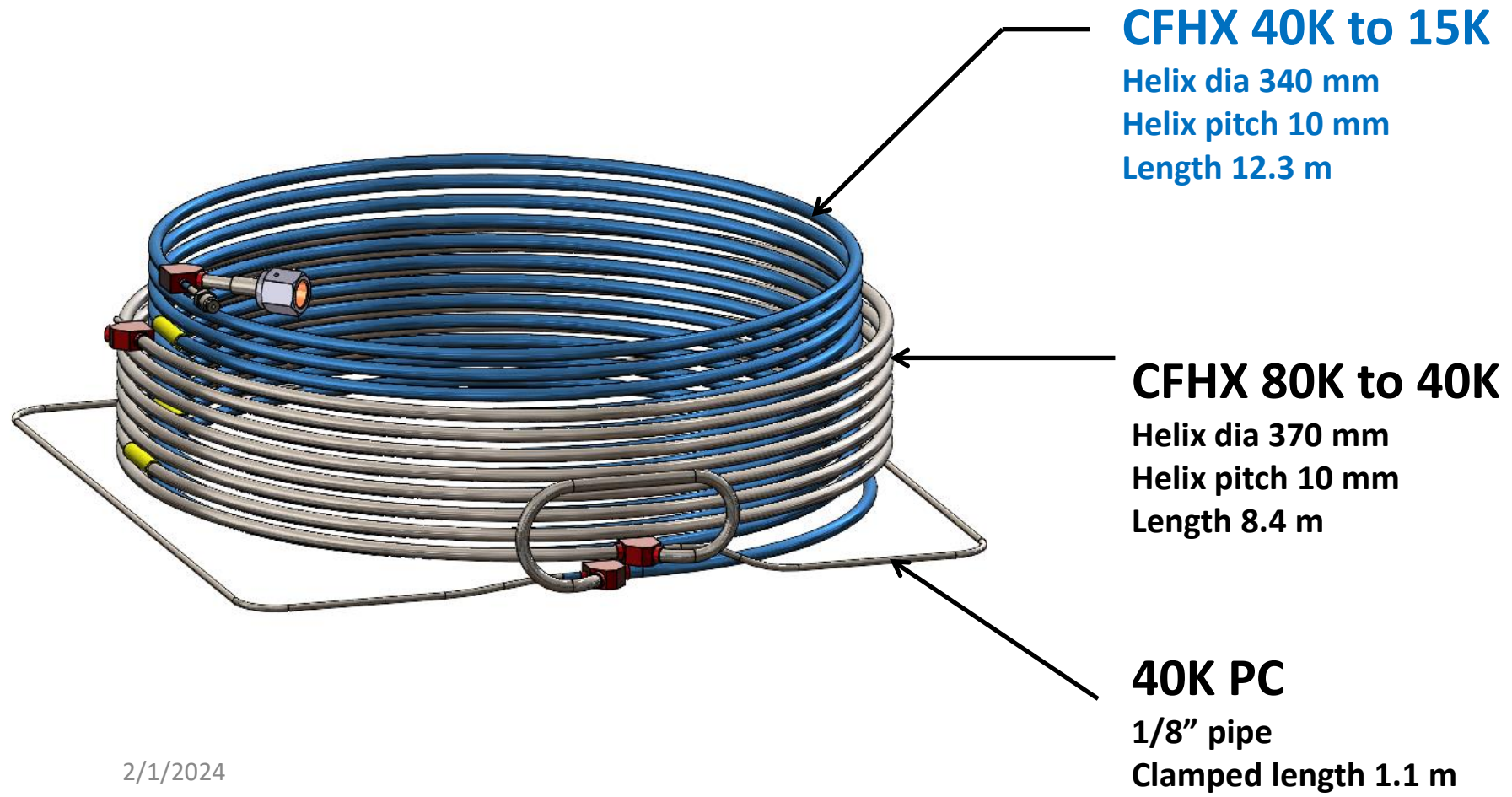


Interface Plate (Cu) bolted to 40K

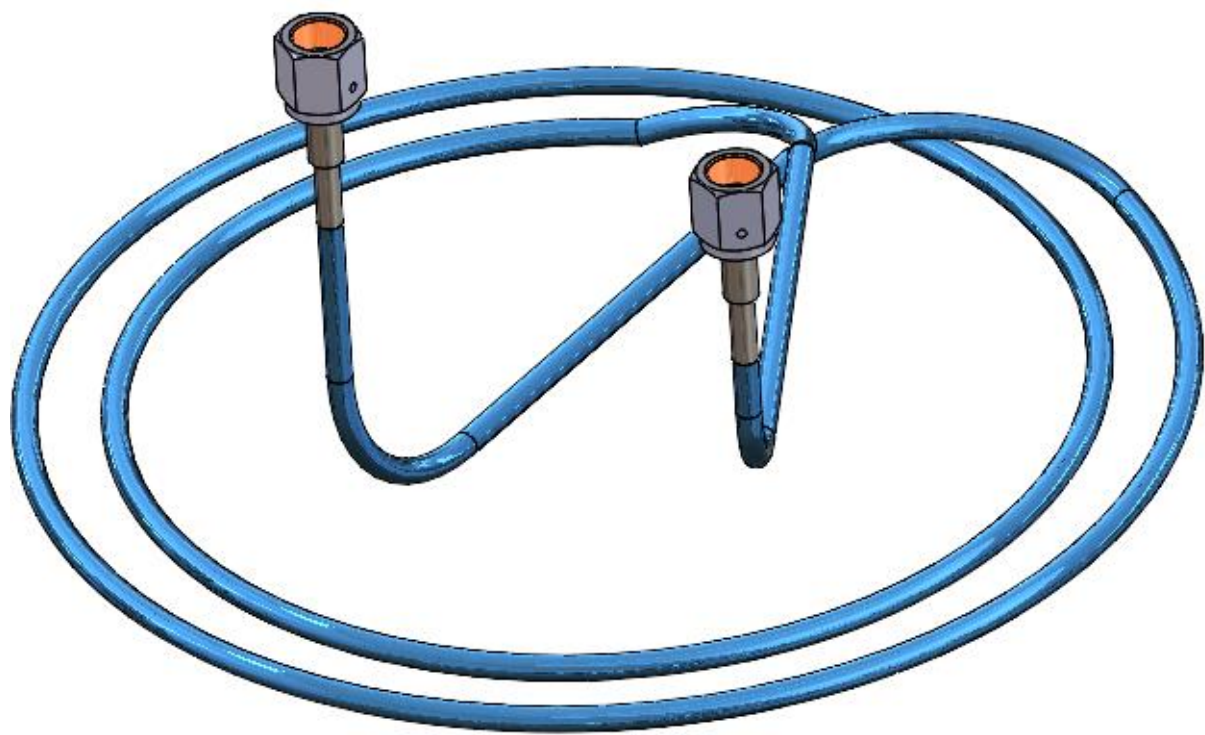


Column (Cu)

He stage beneath 15 K Shield bottom plate – welded assembly



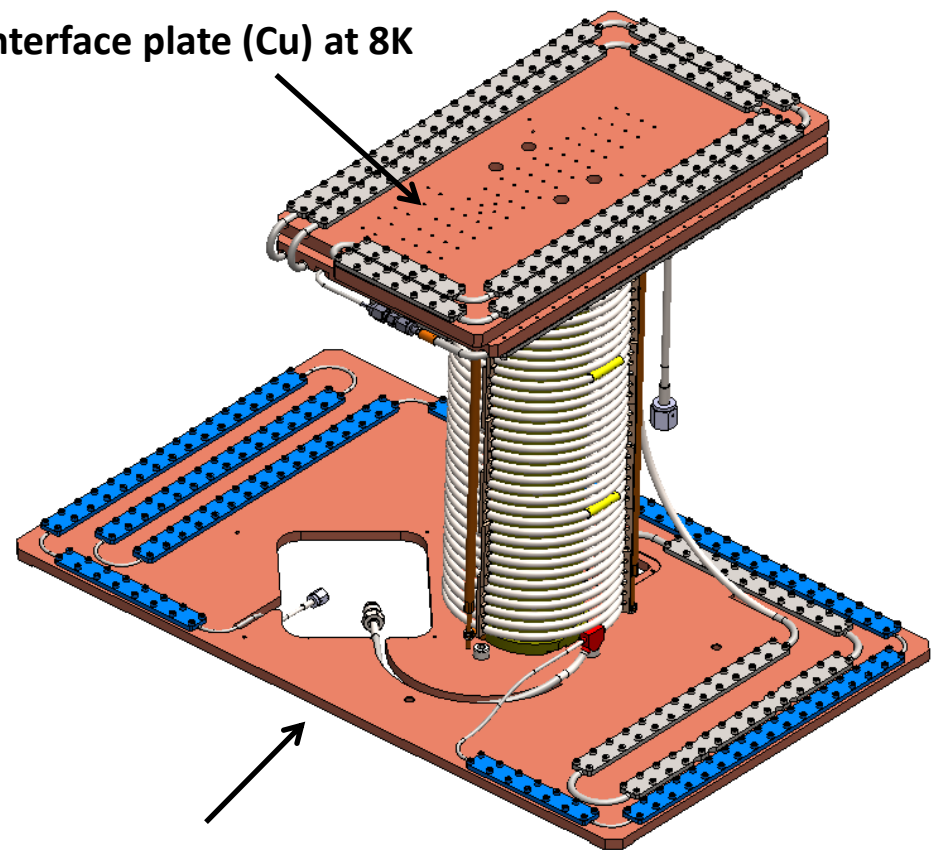
KS beneath 15 K Shield bottom plate – welded assembly



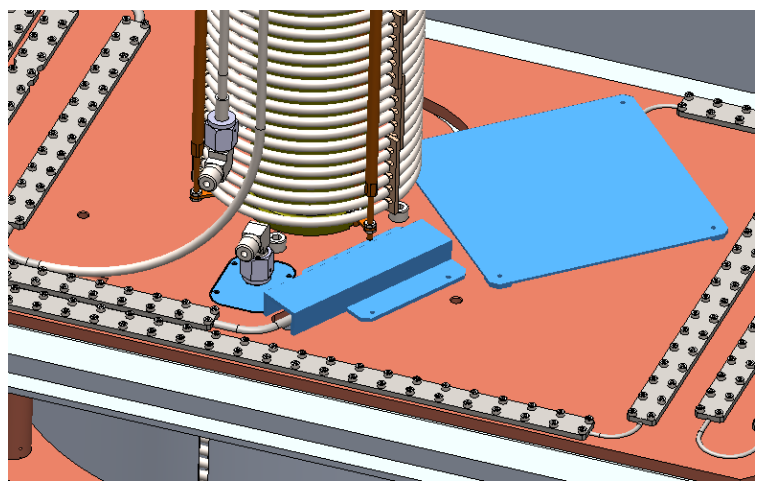
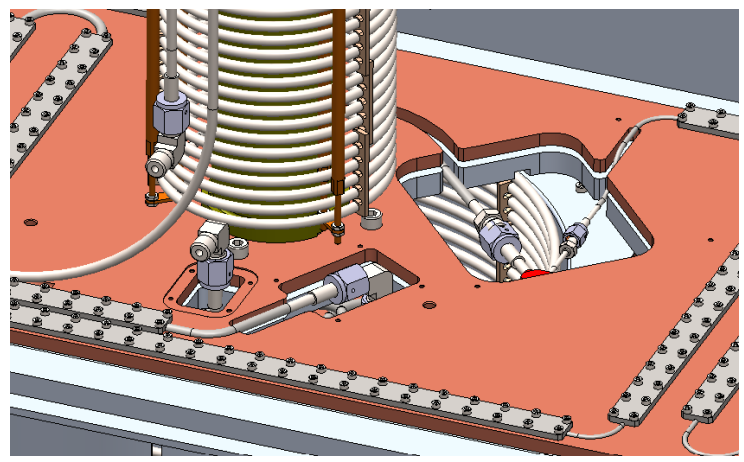
KS
1/4" pipe
Clamped length 1.2 m

He stage + KS above 15 K Shield bottom plate Assy

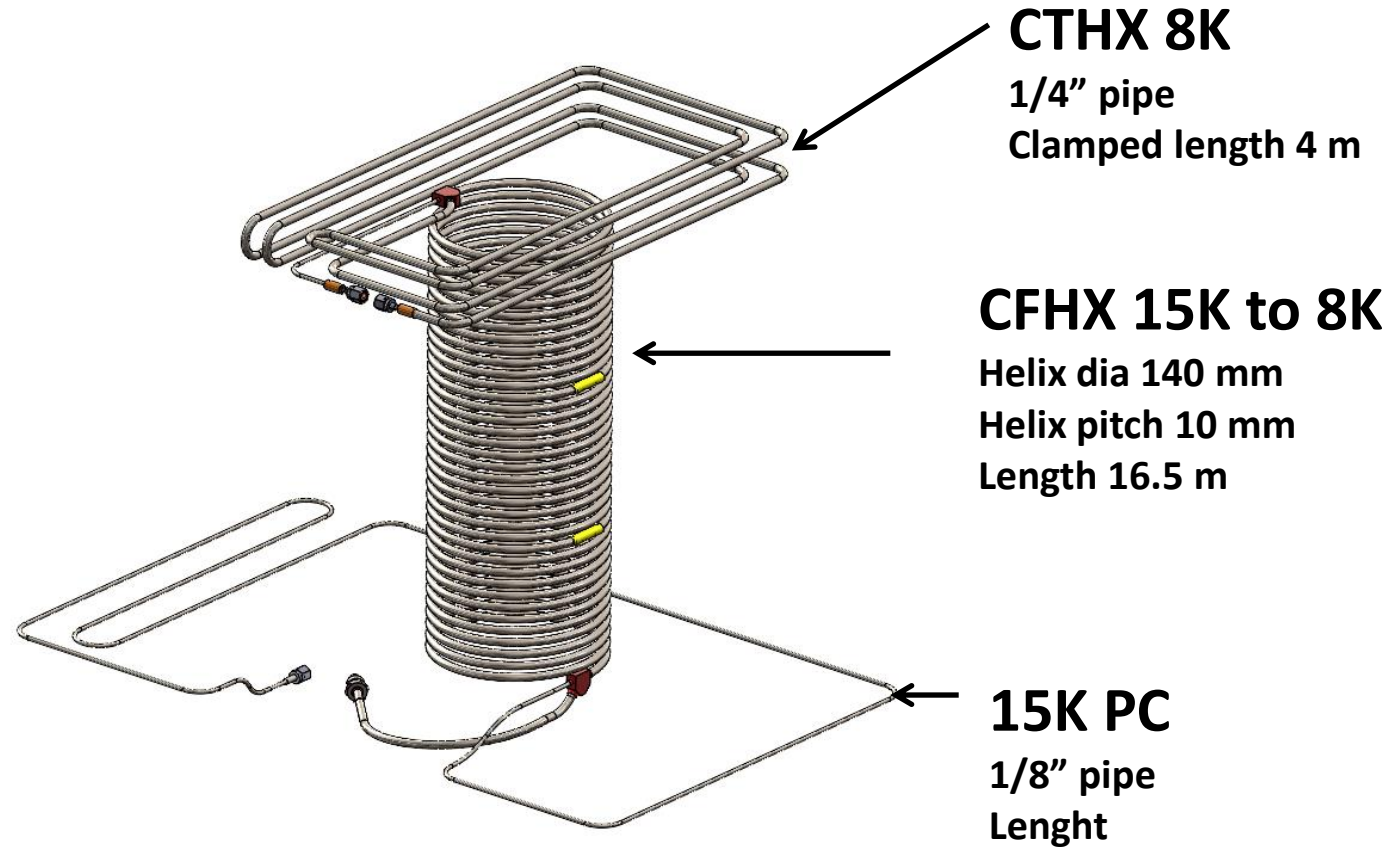
Interface plate (Cu) at 8K



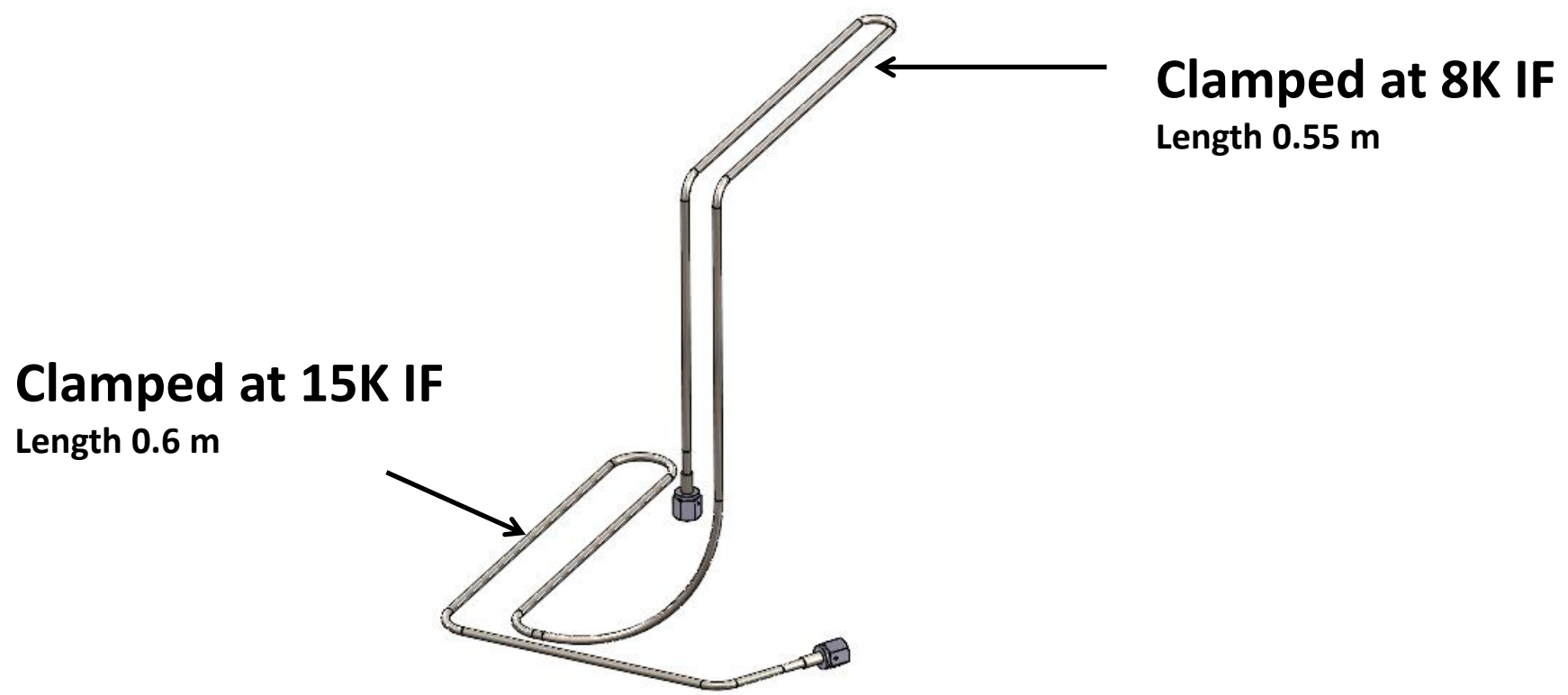
Interface Plate (Cu) bolted to 40K



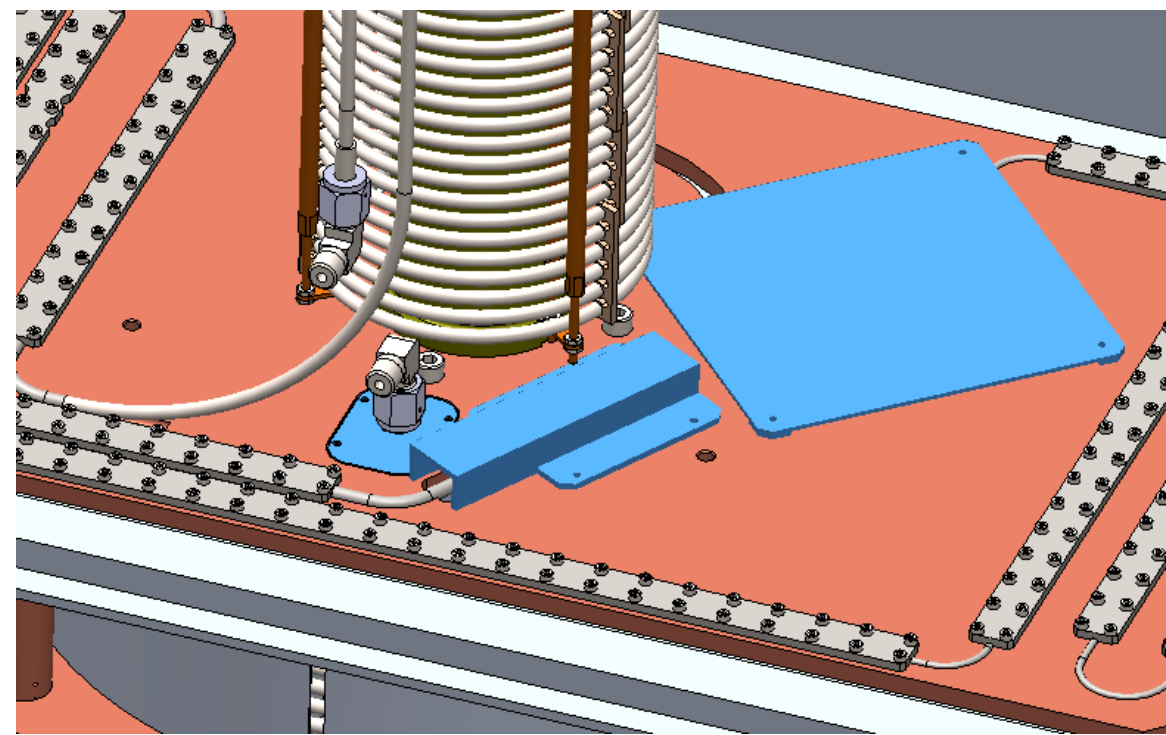
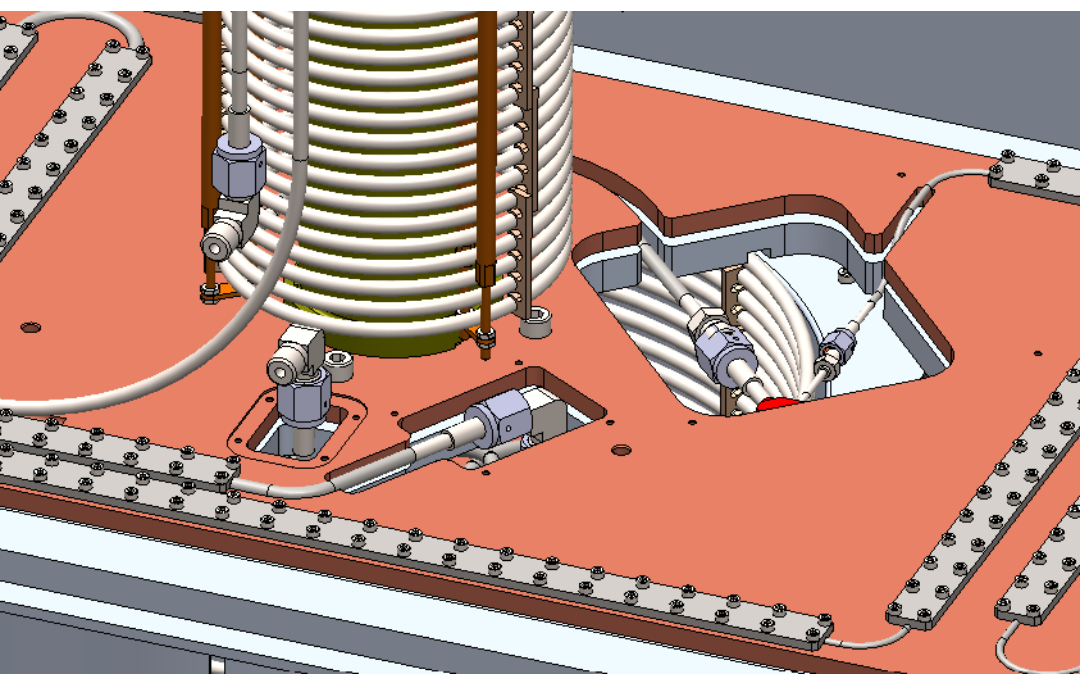
He stage above 15 K Shield bottom plate



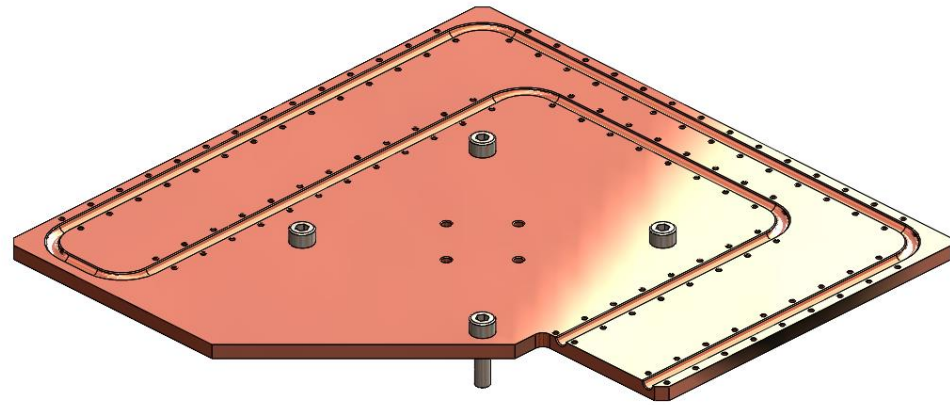
KS above 15 K Shield bottom plate



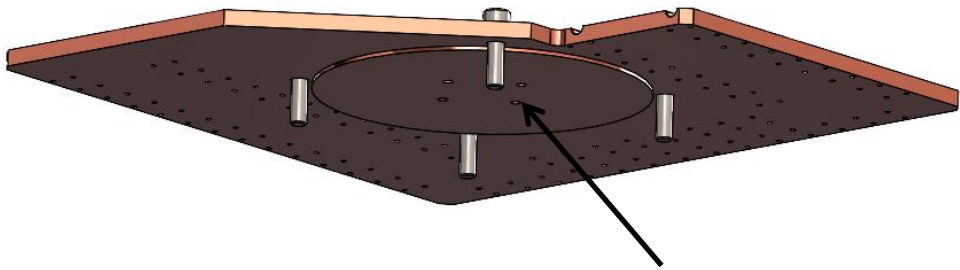
He stage + KS above 15 K Shield bottom plate Assy



Ne stage – 40K Interface plate

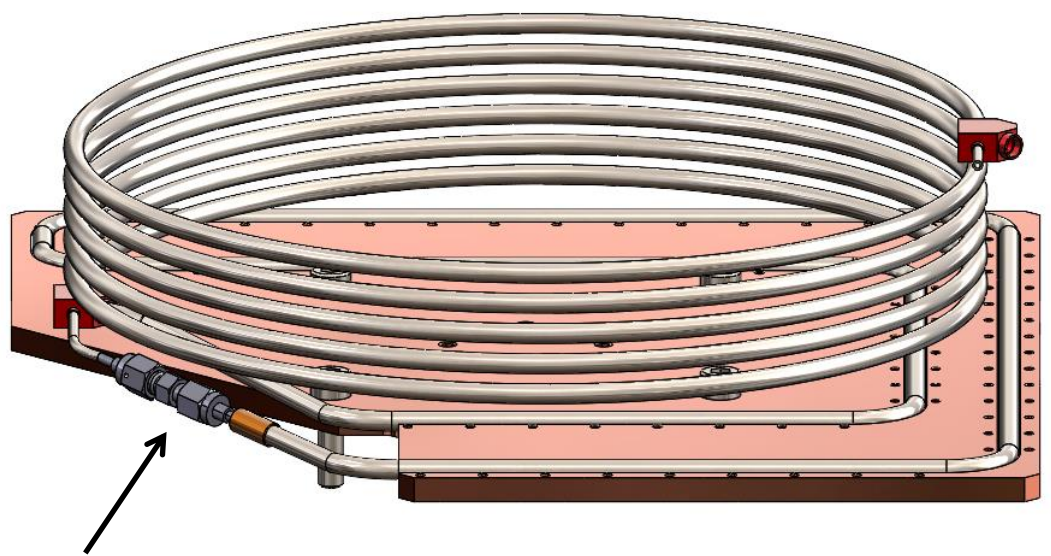


- It is made up of copper.
- Its mass is 6.7 kg.
- It's bolted to 40K Shield Bottom Plate (x4 M8 bolts)
- 0.021 m² contact area (for thermal conduction)



Contact area

Ne stage – Welded assy



JT-Restriction

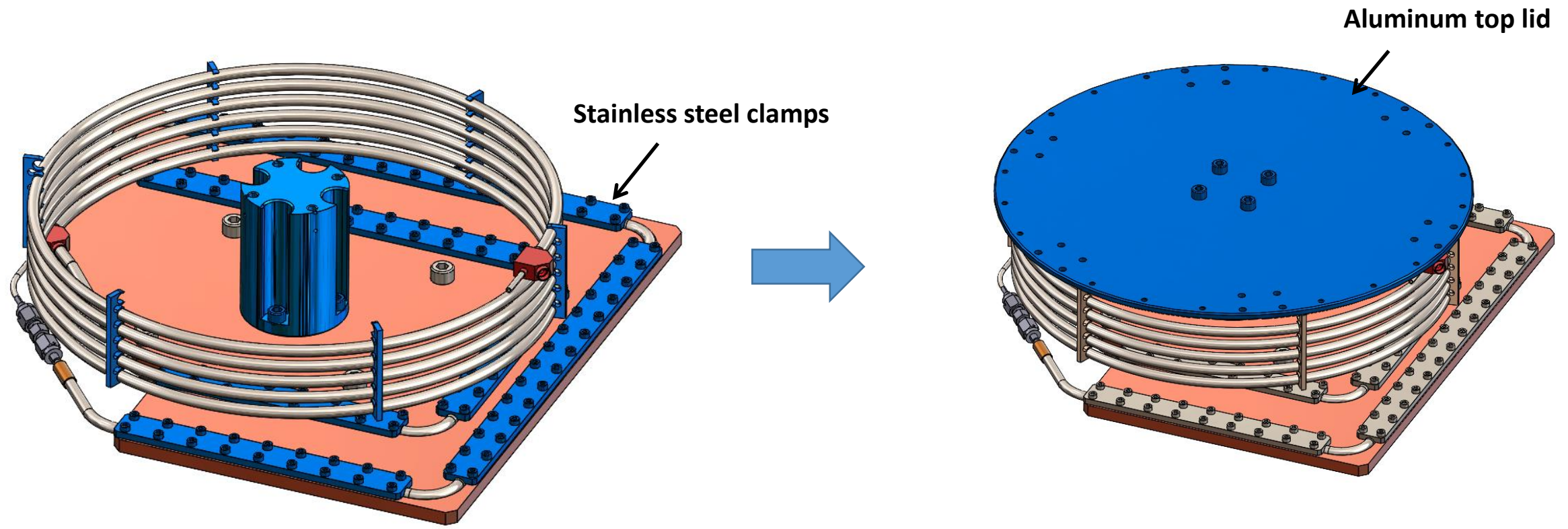
Ne inlet (HP line 1/8" pipe)
Ne outlet (LP line 1/4" pipe)
CFHX 80K to 40K

- Helix dia 290 mm
- Helix pitch 10 mm
- Length 5 m

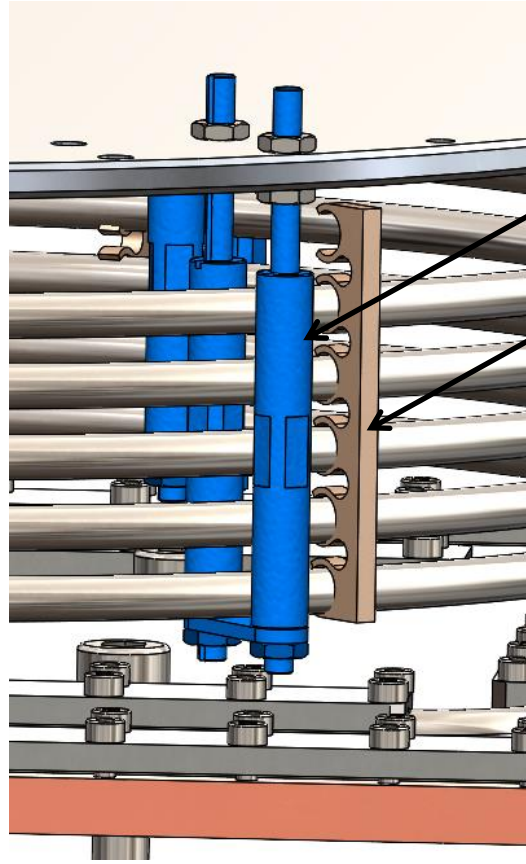
40K Evaporator

- Clamped length 1.2 m
- Clamping Stainless Steel pipes to the copper interface
- 1/4" pipe
- JT-Restriction (pending design)

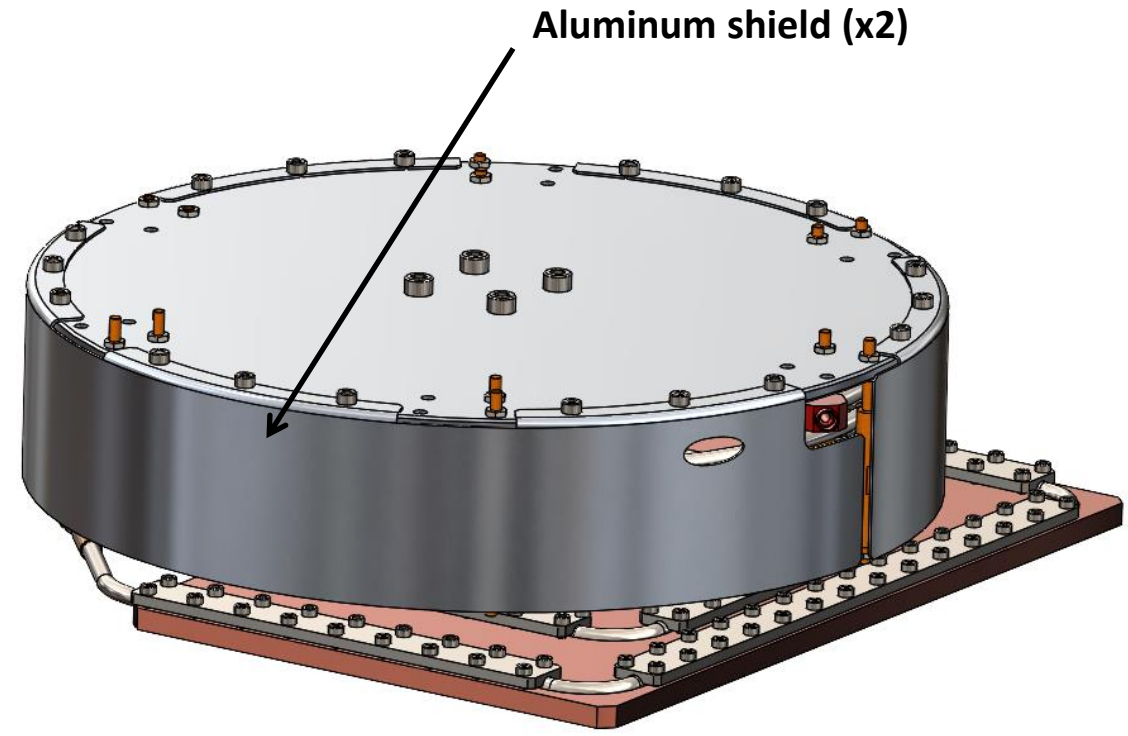
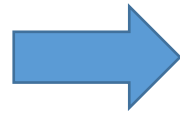
Ne stage – Assy



Ne stage – Assy



Peek holder
Polyimide Push-in strip

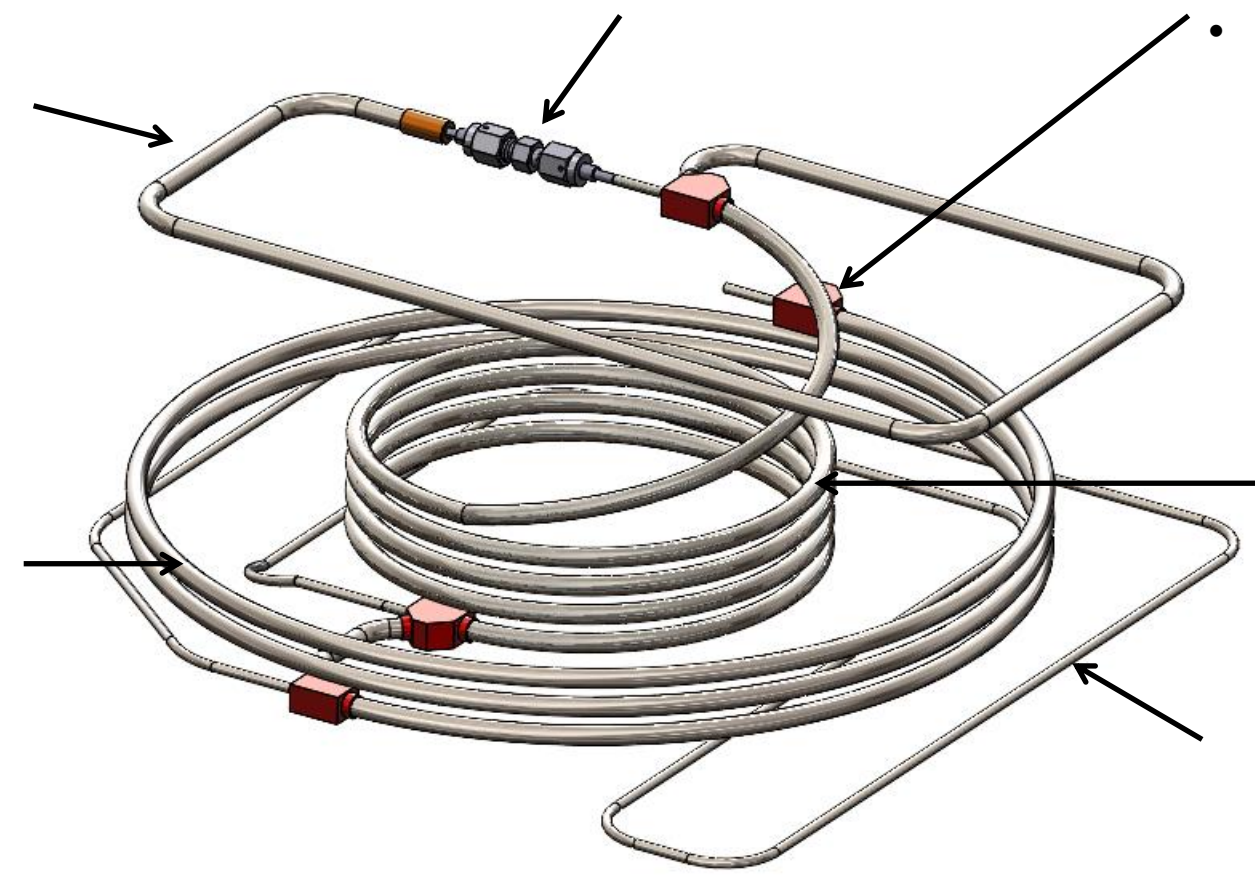


H₂ stage – Welded assy

Evaporator at 15K
¼" pipe
Clamped length 0.5 m

JT-Restriction

- H₂ inlet (HP line 1/8" pipe)
- H₂ outlet (LP line 1/4" pipe)

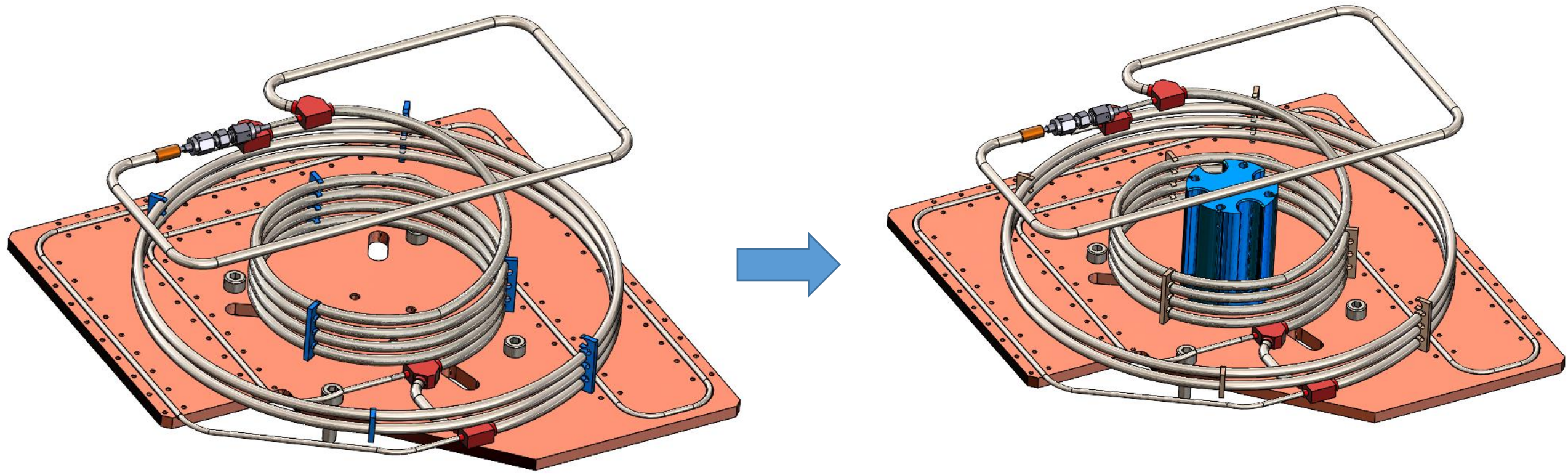


CFHX 40K to 15K
Helix dia 150 mm
Helix pitch 120 mm
Length 0.24

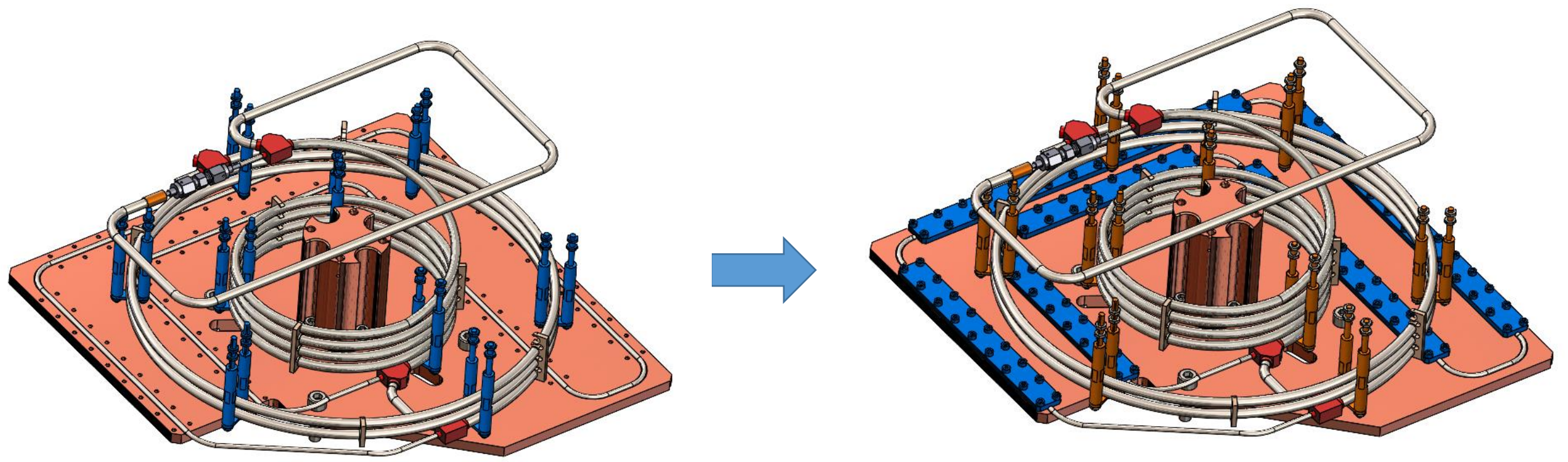
CFHX 80K to 40K
Helix dia 290 mm
Helix pitch 10 mm
Length 2.27 m

40K PC
1/8" pipe
Clamped length 1.2 m

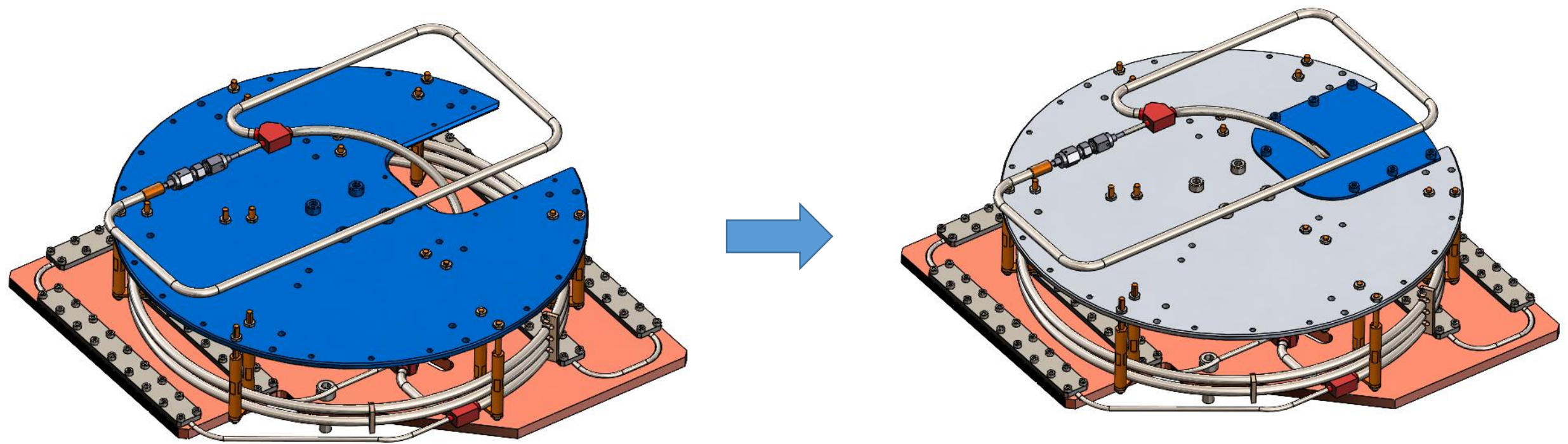
H₂ stage – Assy



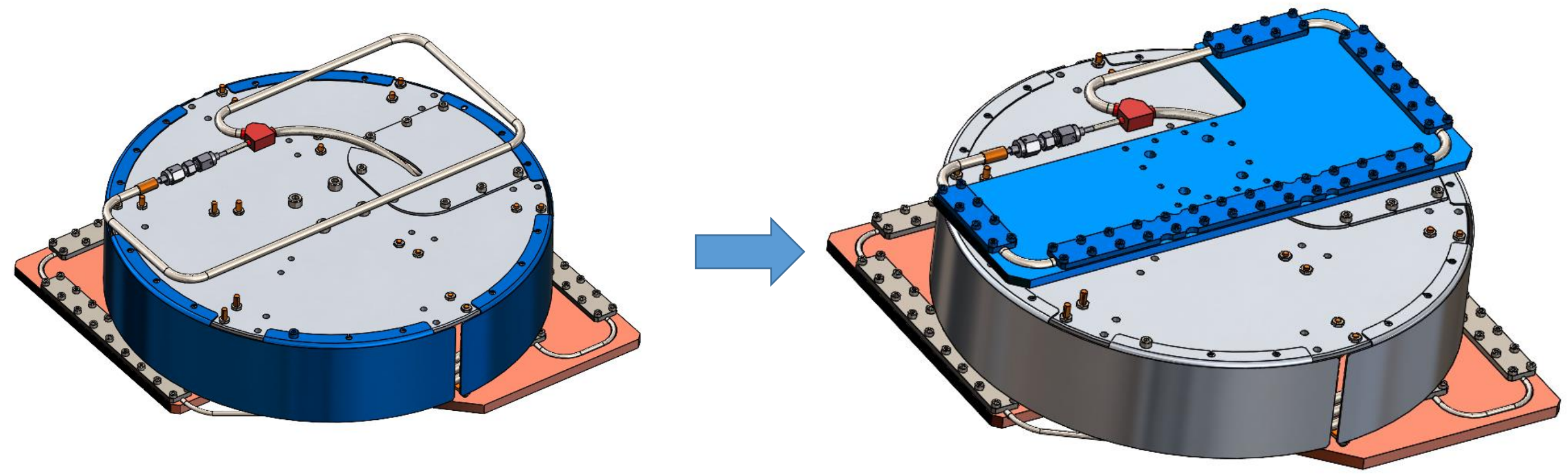
H₂ stage – Assy



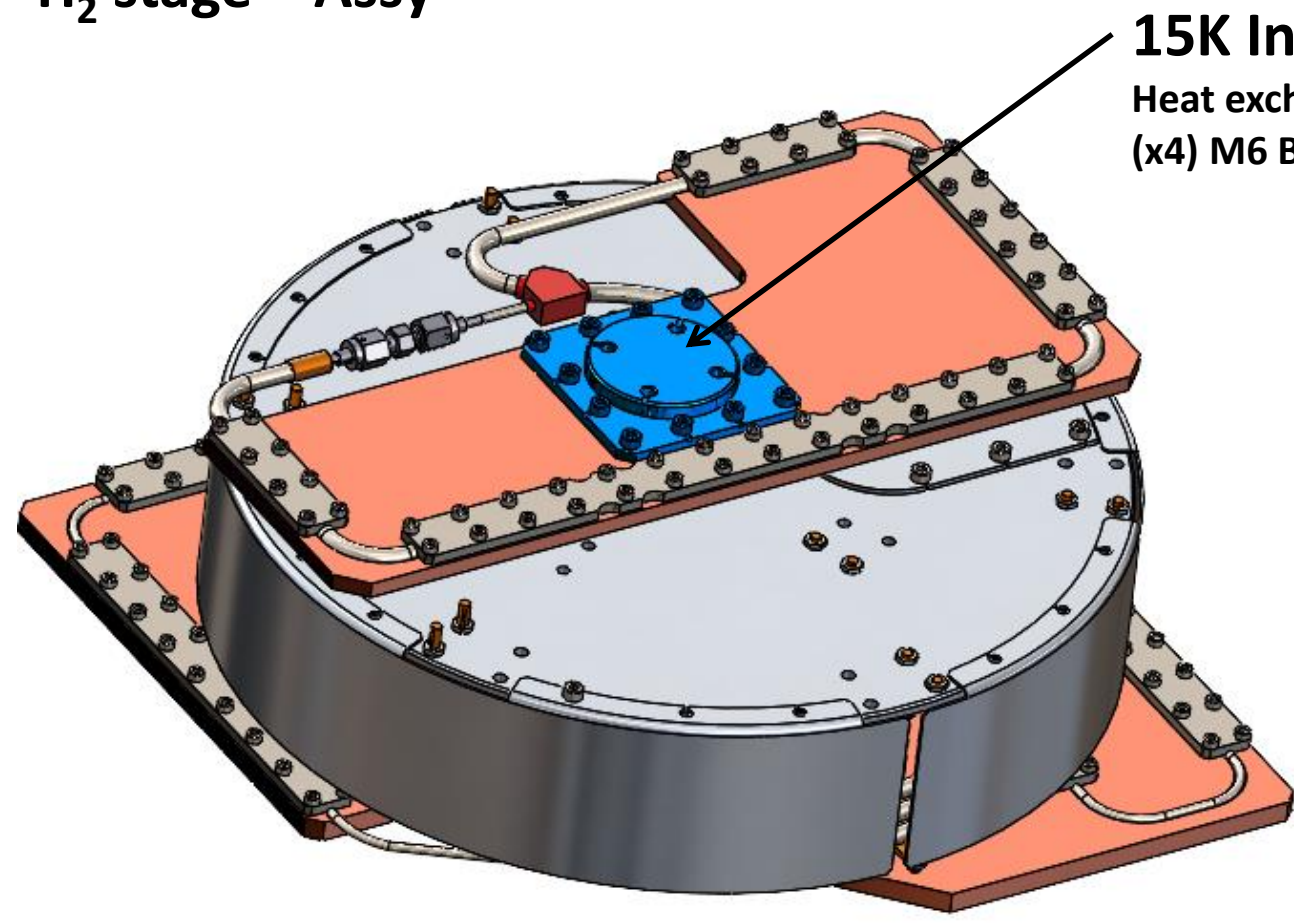
H₂ stage – Assy



H₂ stage – Assy

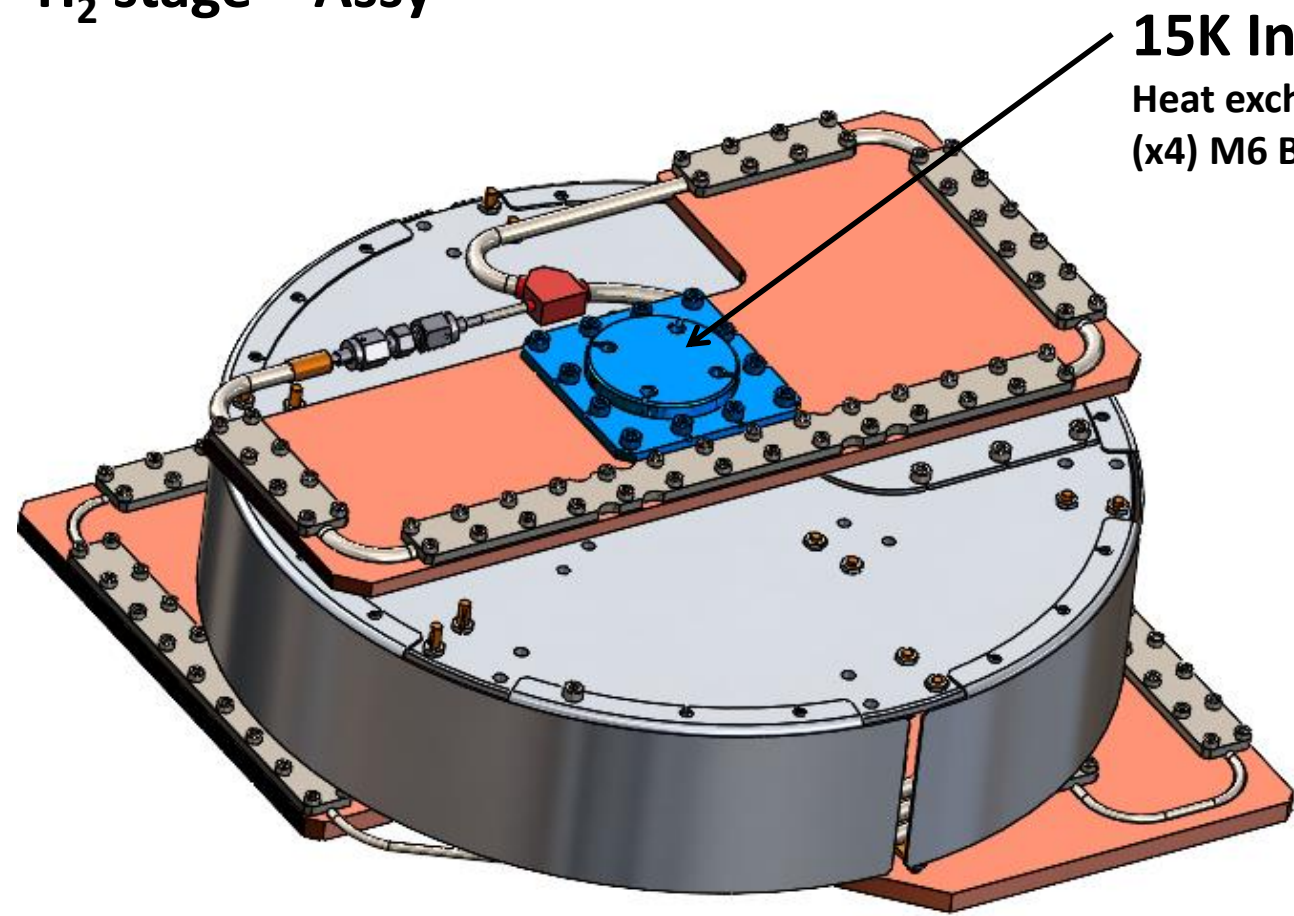


H₂ stage – Assy



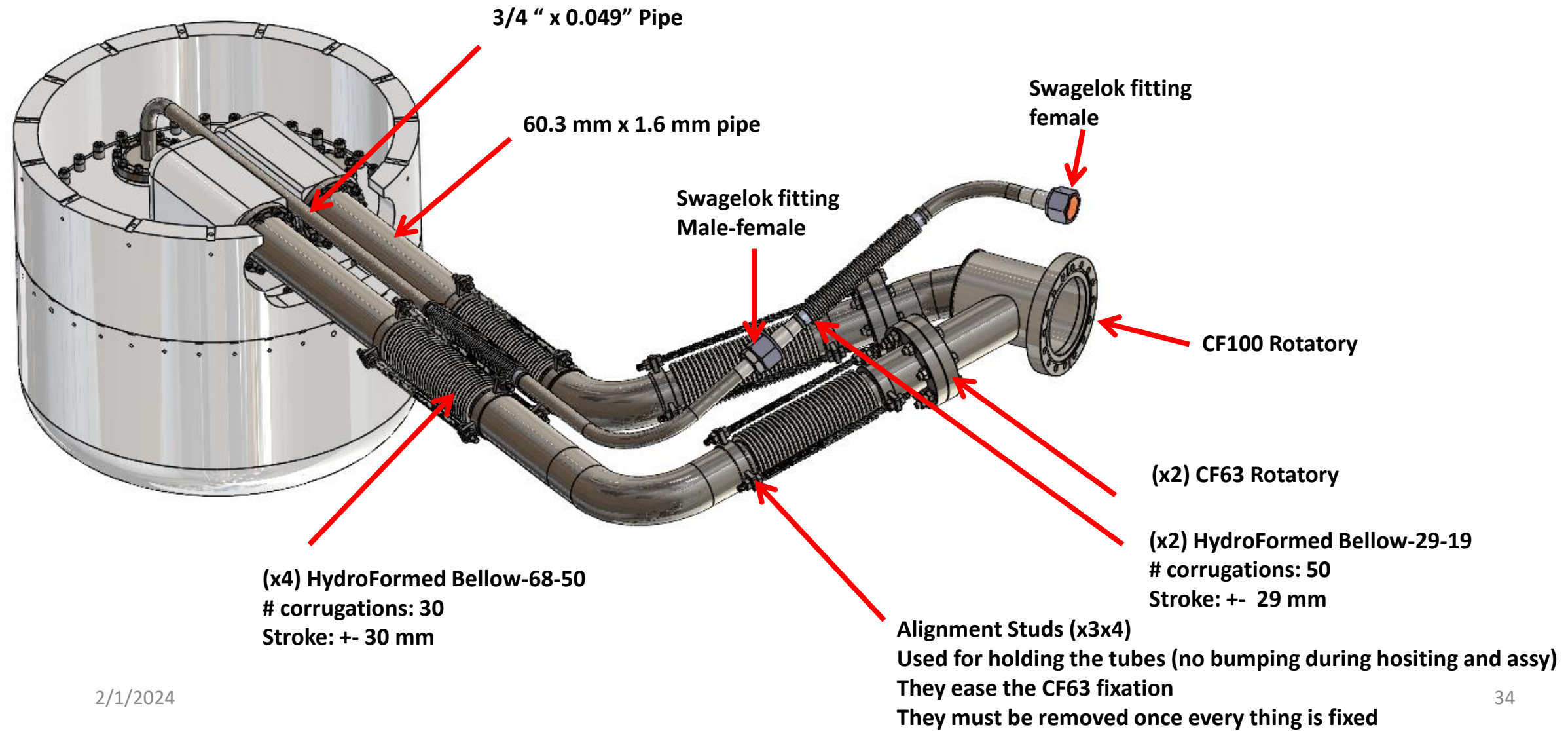
15K Interface Plate with 15K Shield bottom plate
Heat exchange area of contact: 0.002 m²
(x4) M6 Bolts

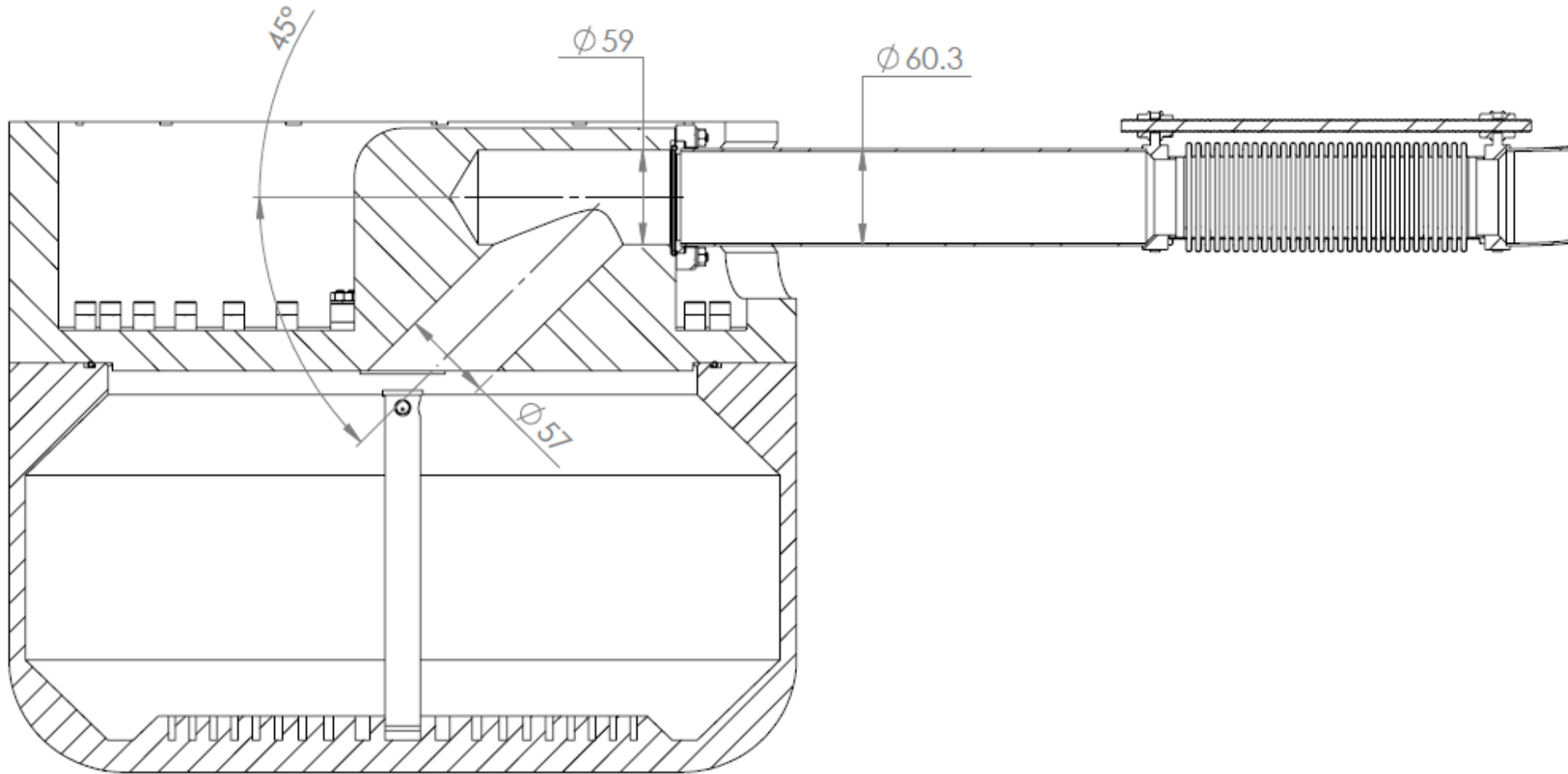
H₂ stage – Assy



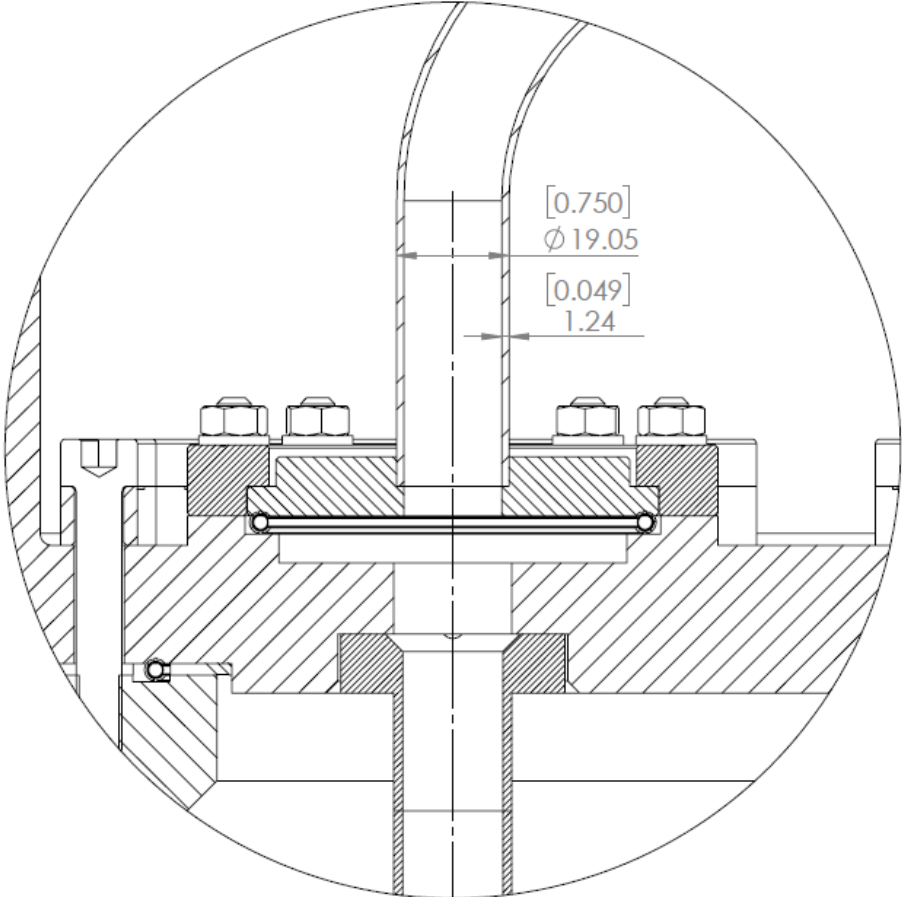
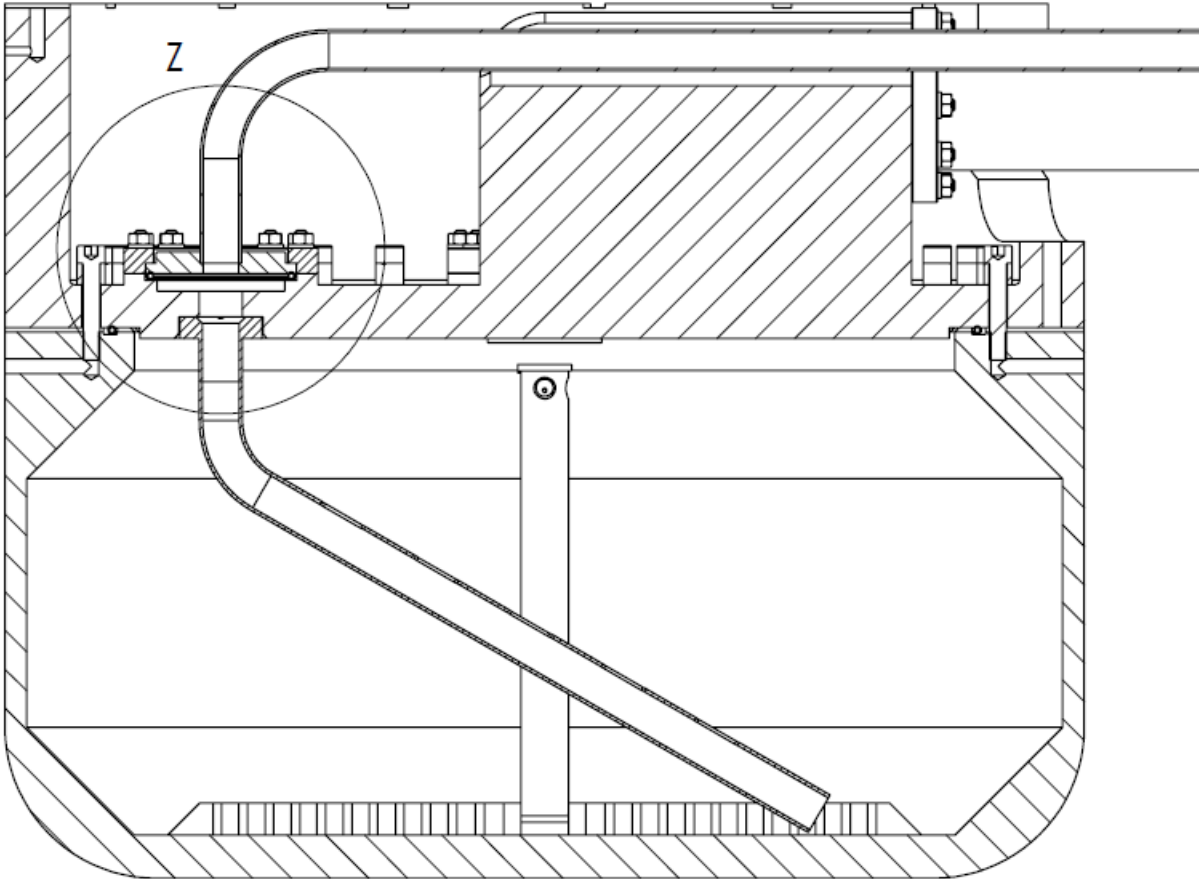
15K Interface Plate with 15K Shield bottom plate
Heat exchange area of contact: 0.002 m²
(x4) M6 Bolts

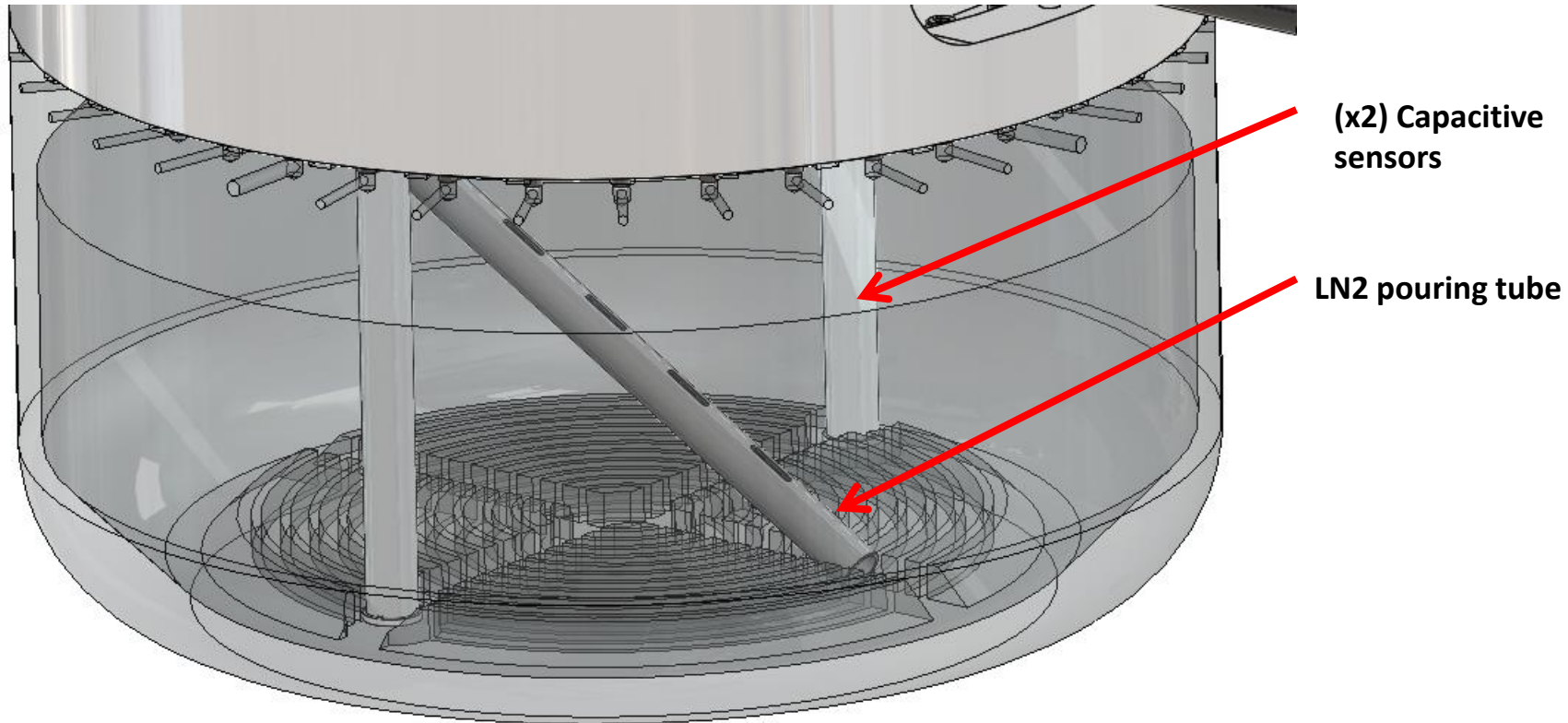
4. LN2 Vessel



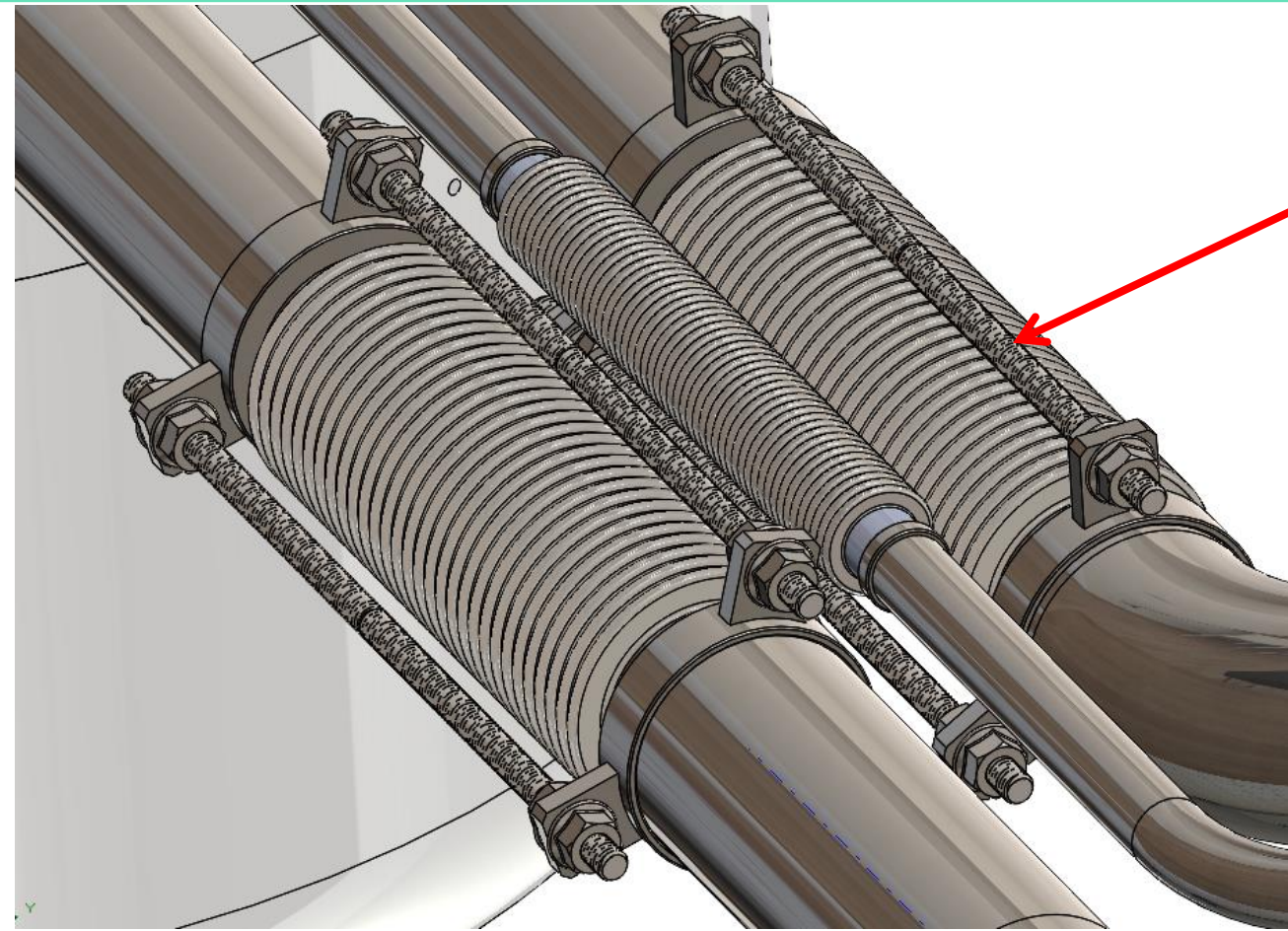


4. LN2 Vessel





4. LN2 Vessel



Aligning studs (M8)
3 of them per each Hydro formed bellow

The aligning studs allows hoisting the whole set (LN2 Vessel Assy) without bumping the tubes.

They also allow the adjustment to ensure the bolting for the CF63 is properly carried out.

They must be removed before the cooling down, otherwise the hydro formed bellows wouldn't take the deformations



Thank you for your attention!