



# 4" Stack

## **BULLKID-DM Kick-off meeting**

---

LNGS – 19/03/24

DANIELE PASCIUTO on behalf of the group

# 4" Wafer

Technical details:

OD – 100 mm

Thickness – 5 mm

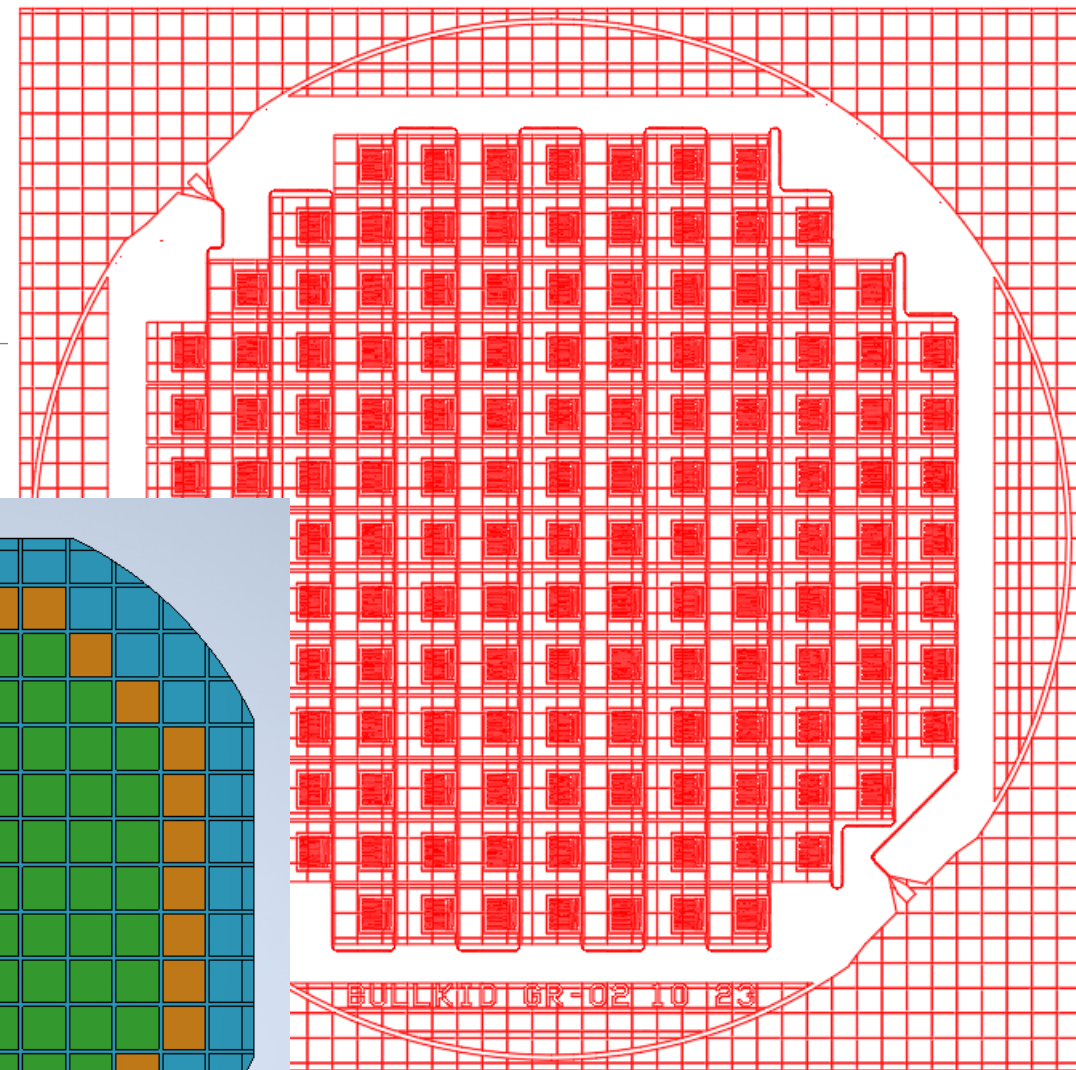
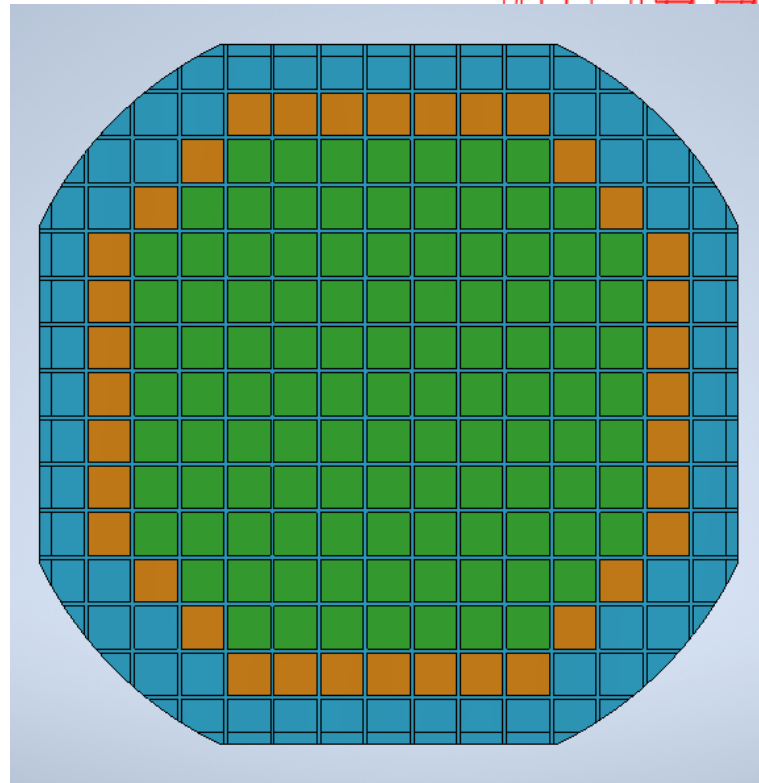
Active Voxels – 145 Units

- 109 fiducialized
- 36 external veto

Voxel area – 5.5 mm x 5.5 mm

Groove size – 0.5 mm x 4.5 mm

Common silicon common layer – 0.5 mm

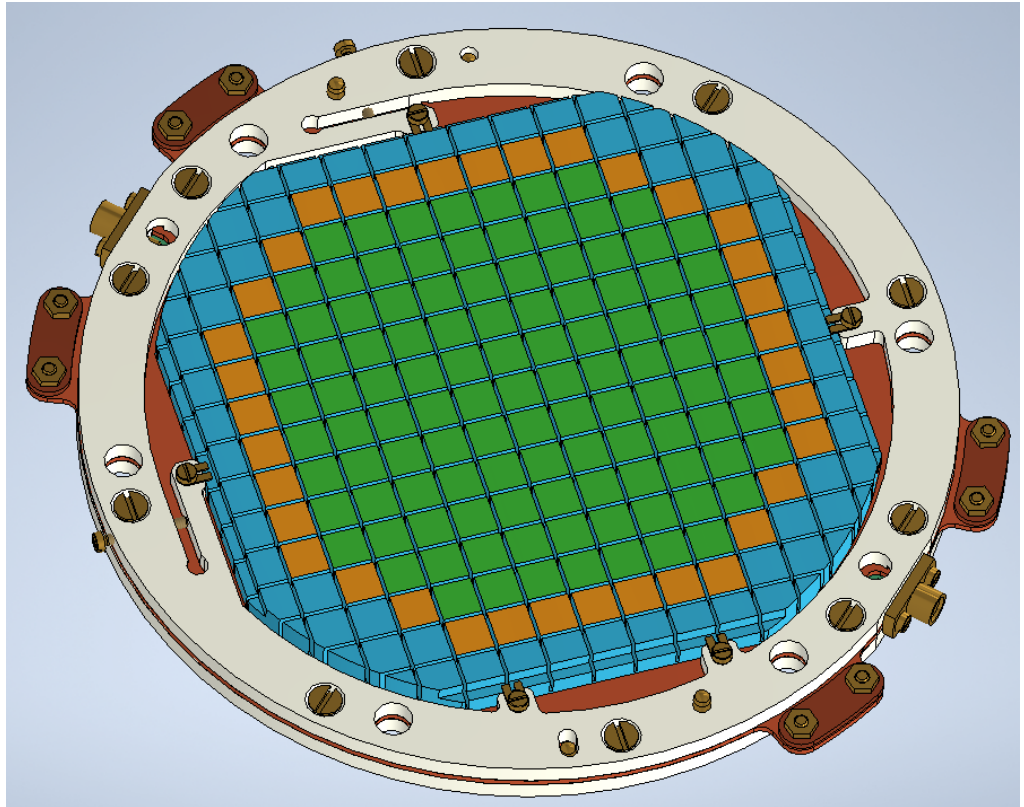


BULLKID\_GRE\_v2

# Single module prototype

## Main characteristics:

- Minimize materials with impurities (e.g. Cu)
- Optimize thermal contact between the holder and the silicon
- Referable and reproducible structure
- Symmetrical structure to avoid thermal distortion
- Stackable
- Optimizing cost
  - Minimizing waste
  - Production with INFN machining technologies



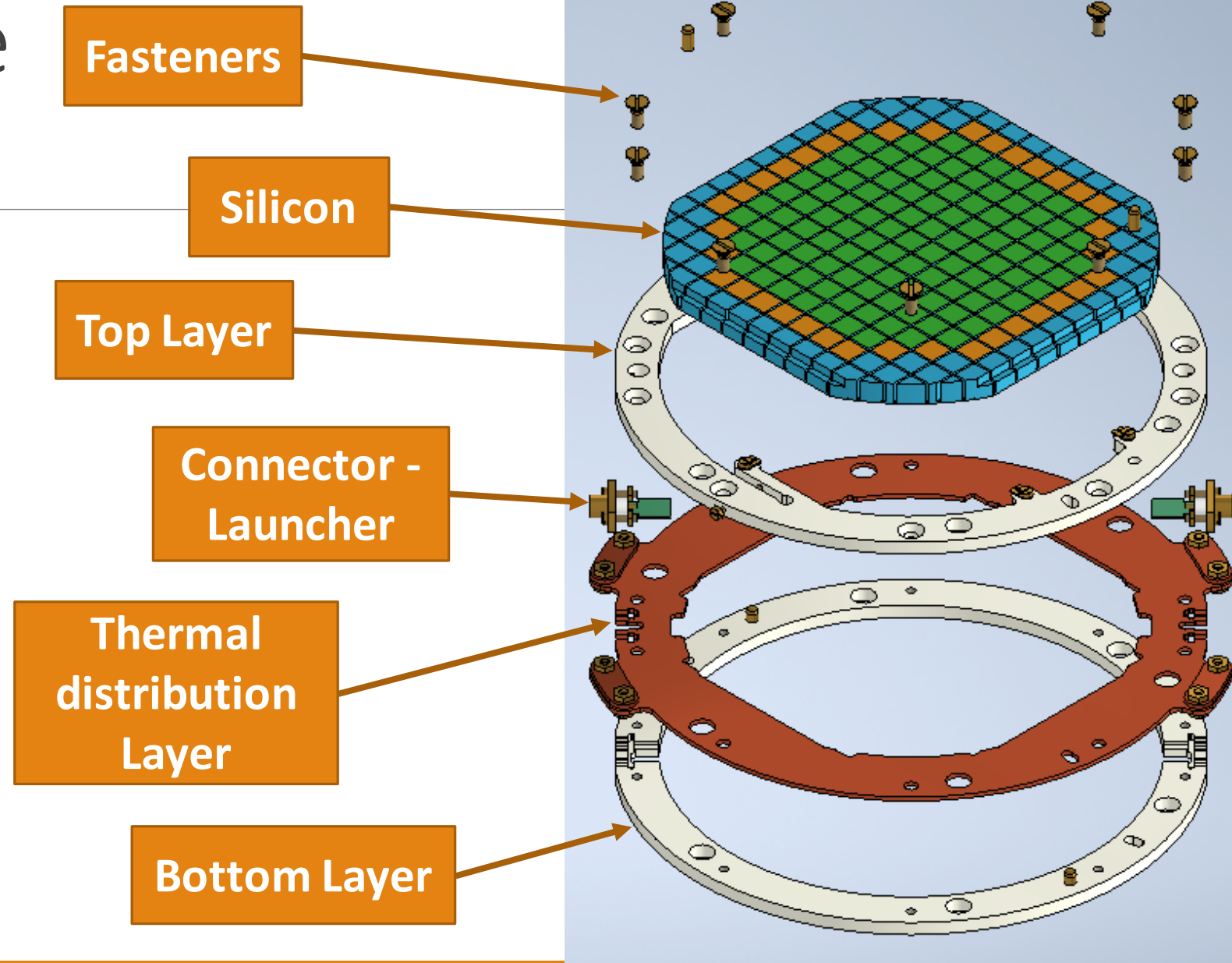
# Single module prototype

## Constraints:

- Vacuum 10<sup>-9</sup> mbar
- Temperature 0.2K
- Low radioactive background
- Good mechanical and vibrational stability
- Easiness of mounting and handling

## Materials allowed:

- Copper OFHC
- PTFE



# Thermal distribution Layer

1 mm thick layer of OFHC copper

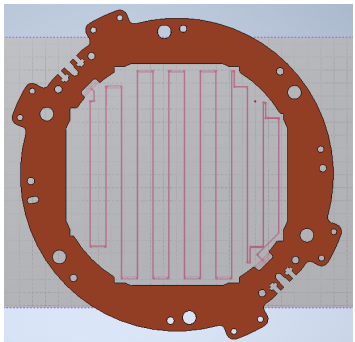
- Low mass structure
- Vacuum and radiation compatible

Machined with EDM

- No mechanical distortion
- High precision

Maximize thermal contact with the Silicon wafer

- No interference with photolithography

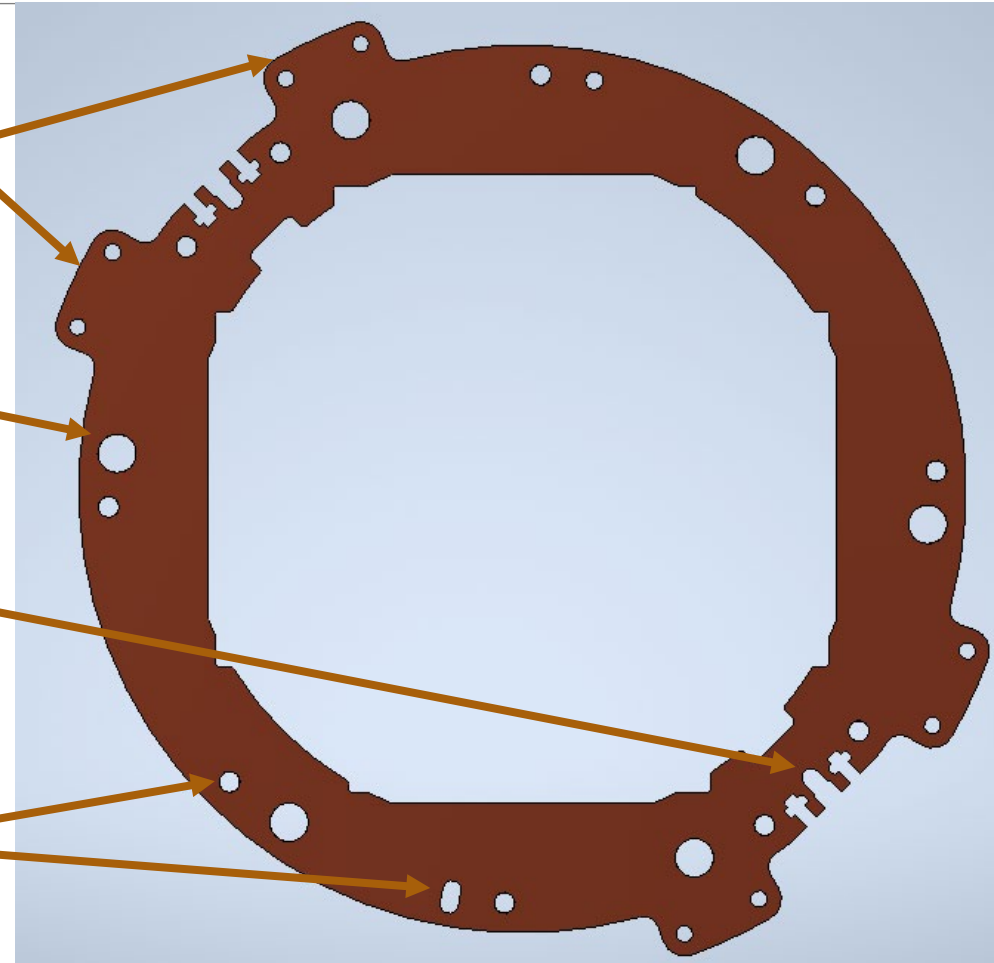


Thermal contacts  
for daisy-chain  
cooling

Hole for stack  
mounting

Shape for nut  
and launcher  
insertion

Hole for  
referencing and  
fastening



# Upper Layer

PTFE 3mm thick

Access for soldering

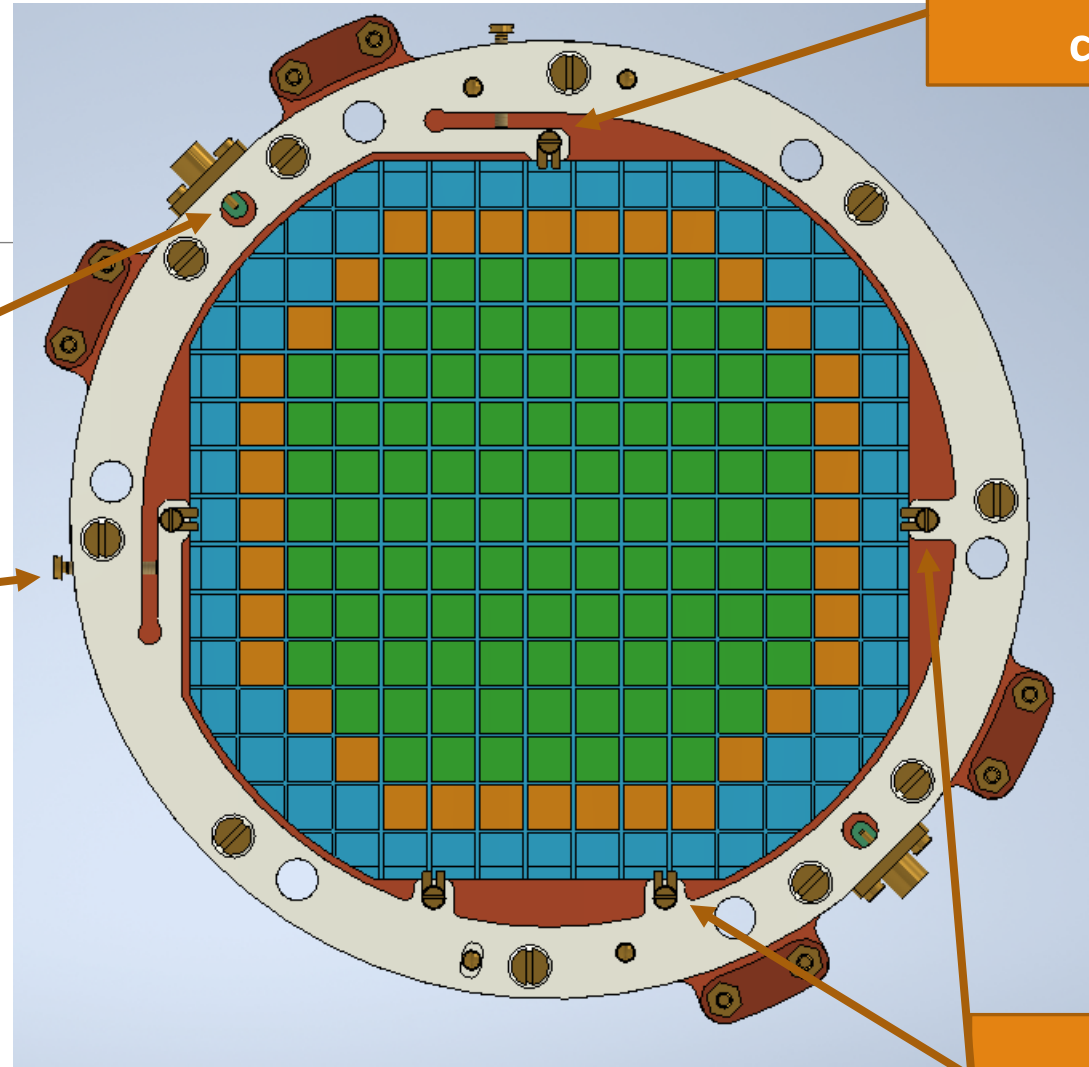
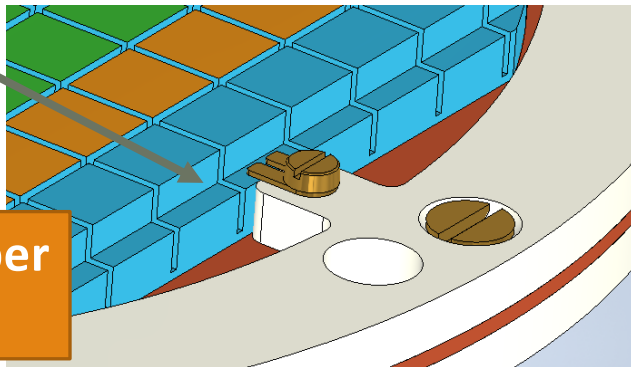
Registration clamp stiffener

Side silicon notch for clamping

Flexible Z copper clamp

Flexible X-Y clamp

3 points reference

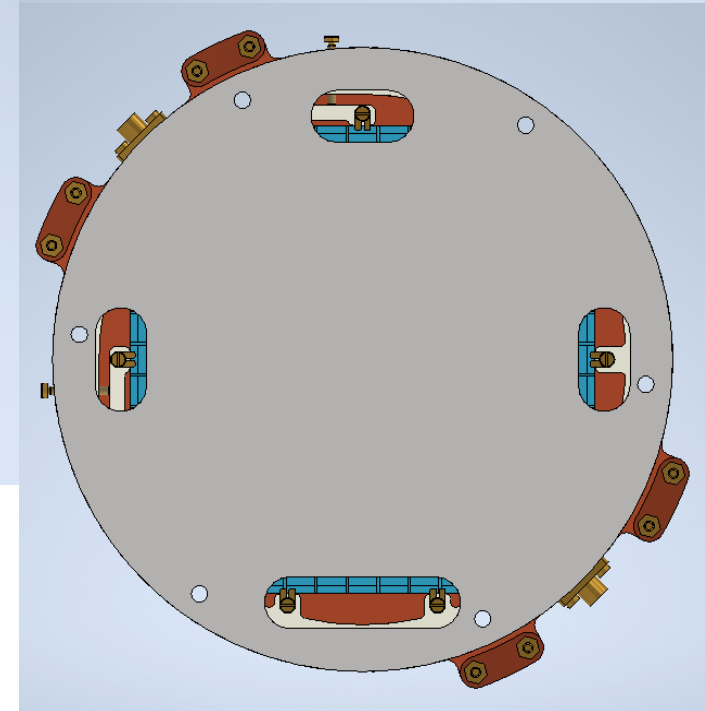
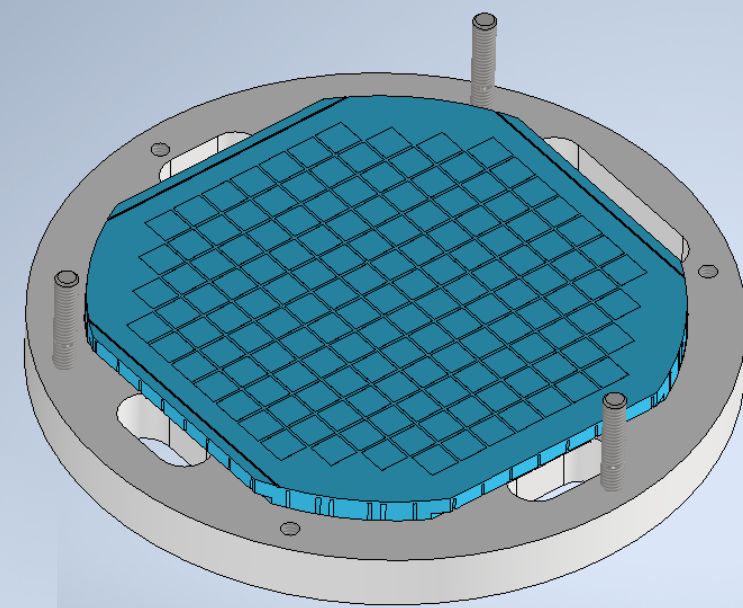
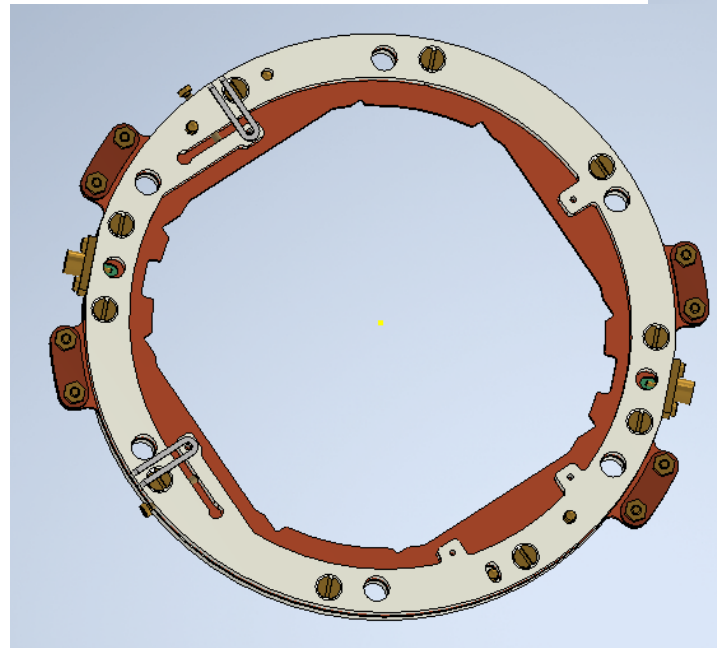


# Module assembling

Support template for mounting  
with reference surfaces for wafer  
placement

Inserting preassembled structure  
with clamps to keep wafer fixture  
clamps open

Once the wafer has been secured  
with fasteners, mounting Z-  
clamps using the dedicated  
support windows



# 3-Module stack

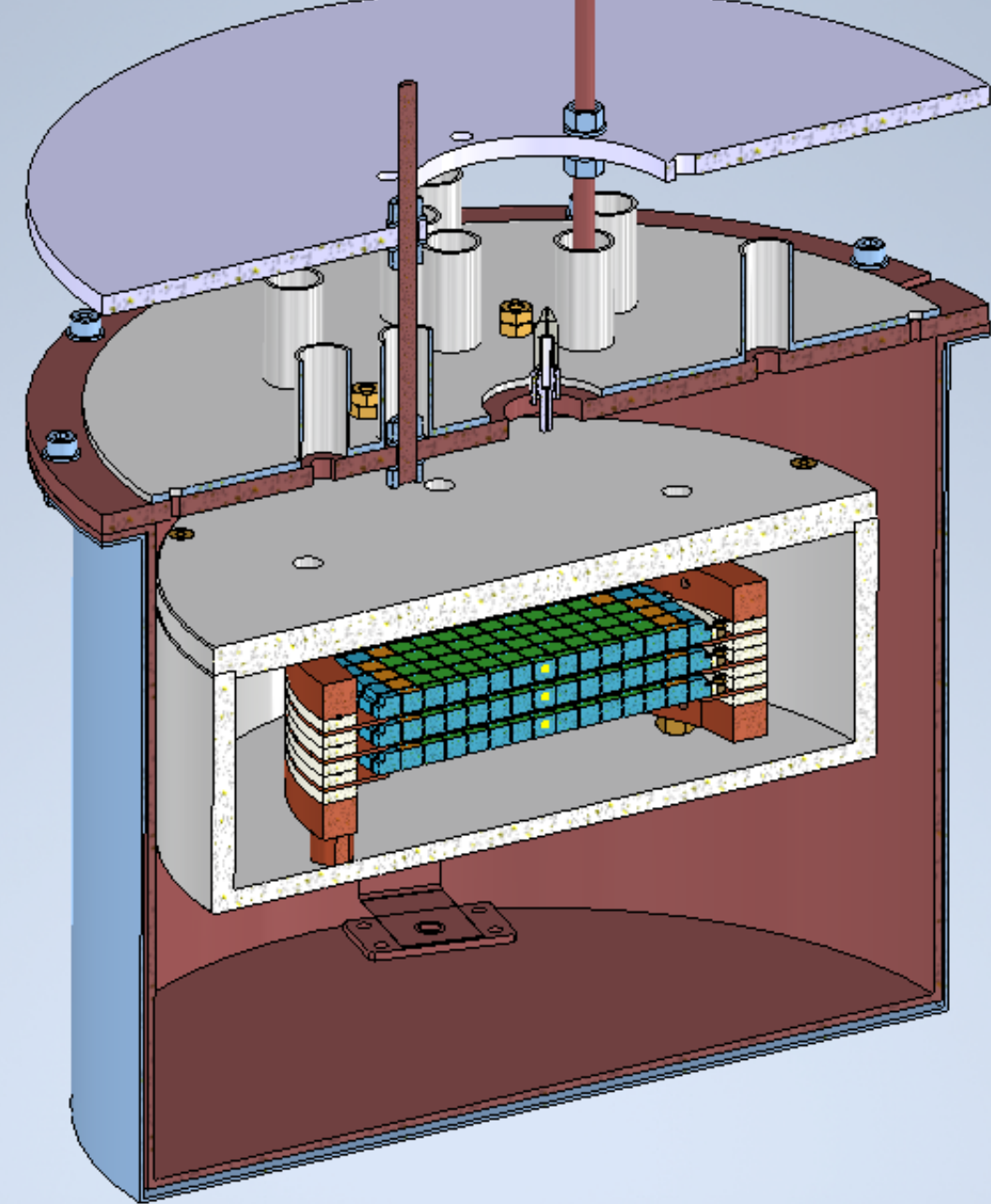
Pure aluminum (1000 series) vessel for shielding

Upper and Lower copper rings

- Stiffer structure for vibrations
- Thermal distributors for cooling

Copper rods for thermal contact with cold plated (missing in the drawing)

Feedthroughs for fibers in the aluminum lid (missing in the drawing) for optical calibration





# Ongoing

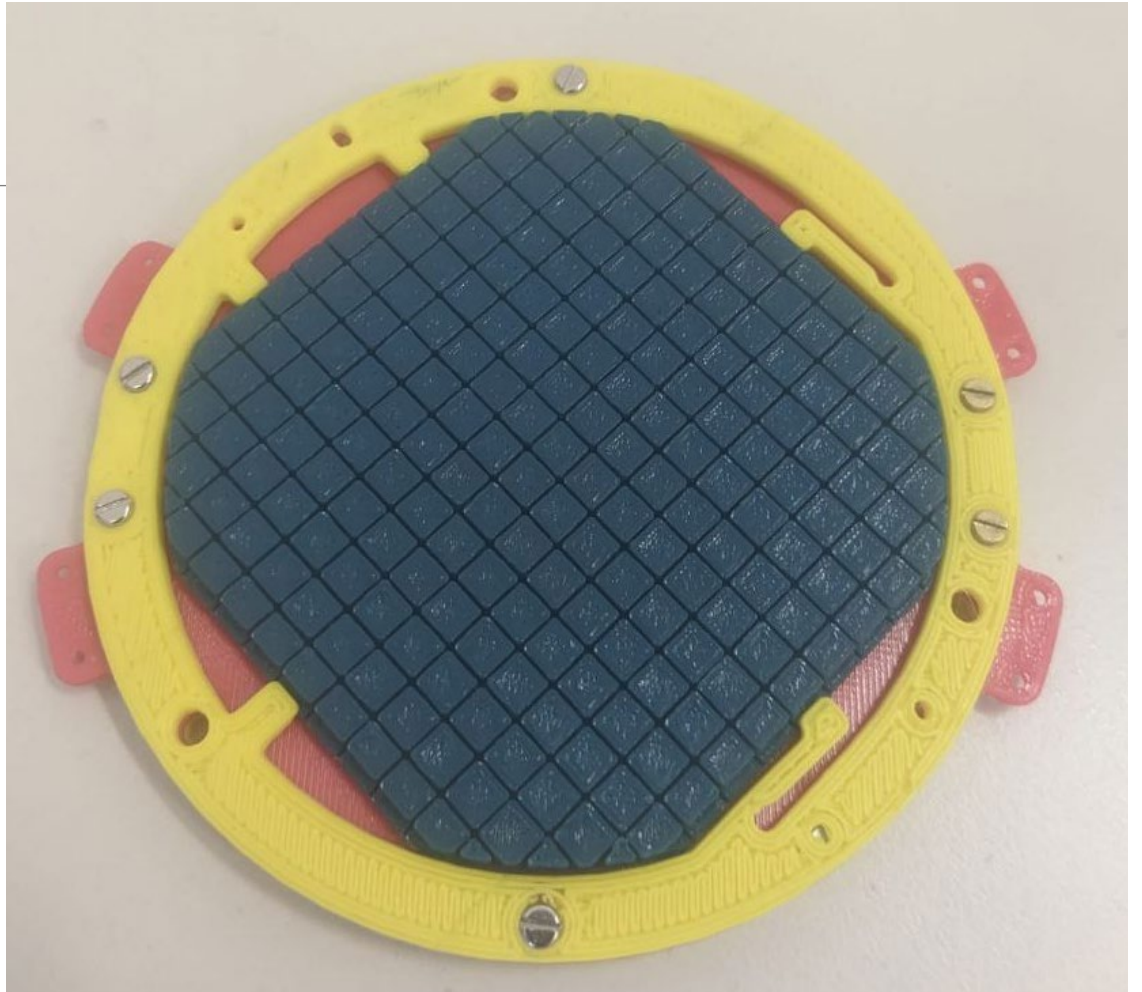
---

Thermomechanical FEM analysis

3D Printed Prototype for handling and mounting procedures

Manufacturing validation at INFN machine shop

Substituting MCX connectors with clamped Cables



# Thanks for your attention

---

