



# 100mm Assembly

## BULLKID-DM General meeting

---

PISA – 15/01/25

DANIELE PASCIO TO on behalf of the group

# 100mm Wafer

Technical details:

OD – 100 mm

Thickness – 5 mm

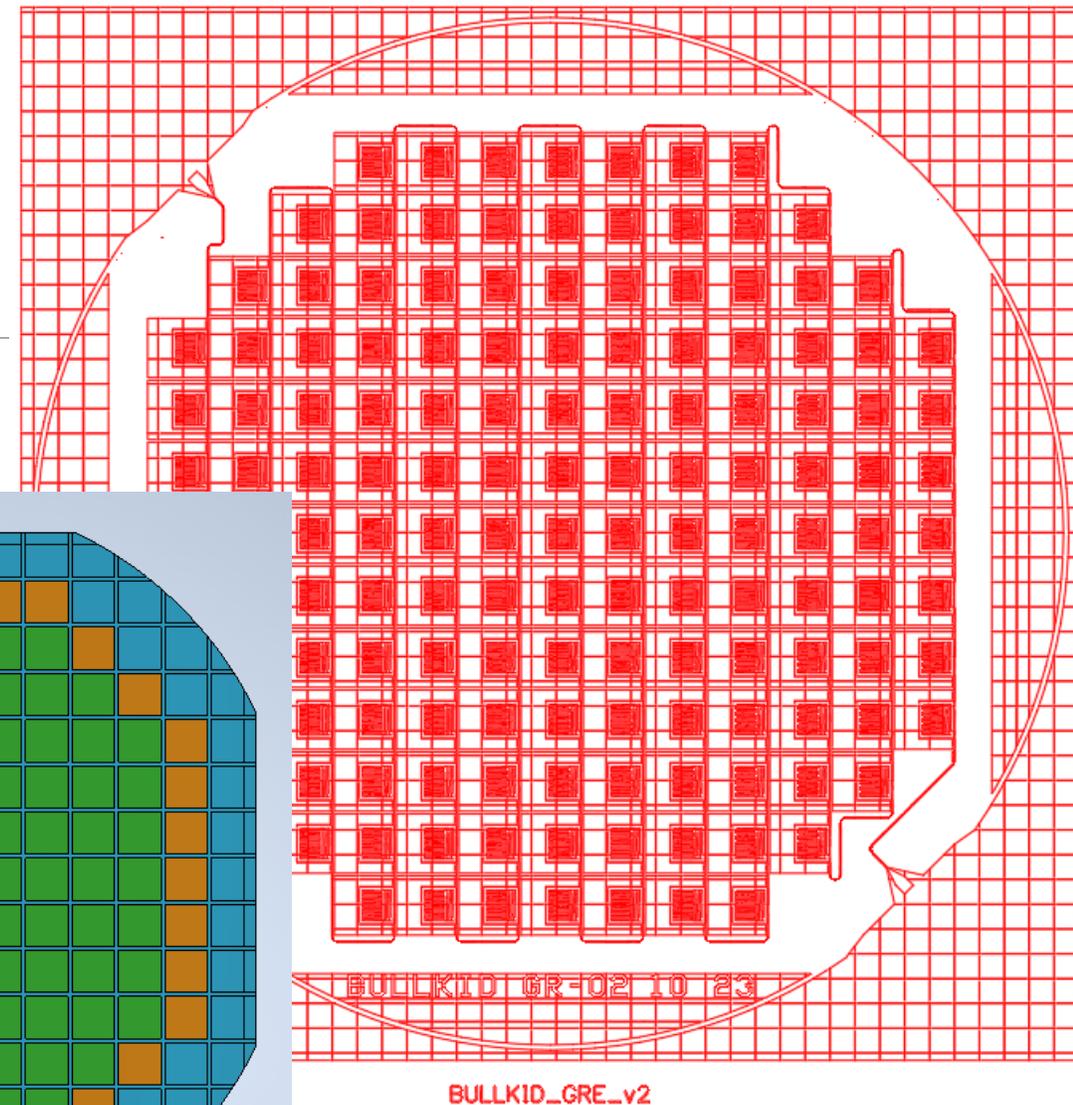
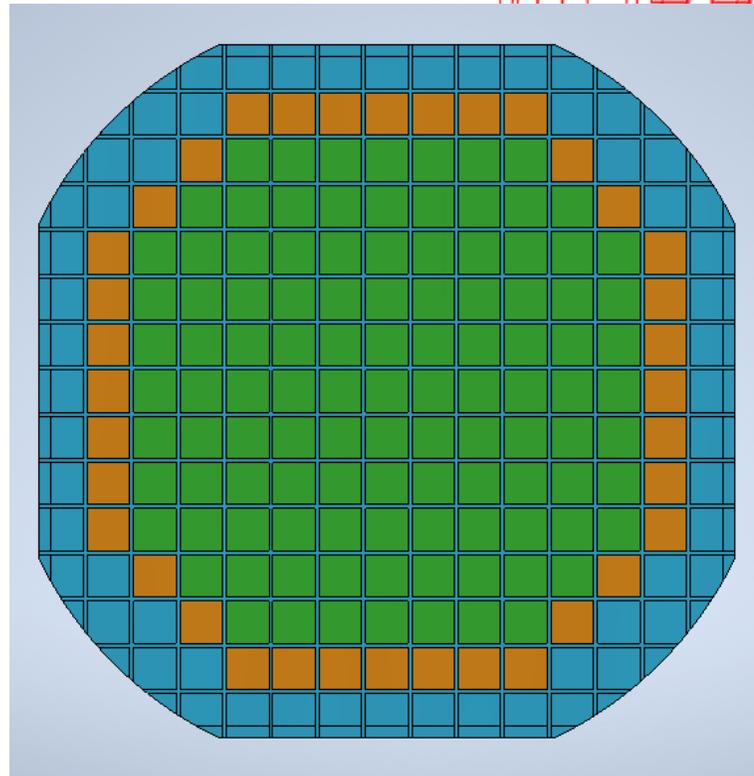
Active Voxels – 145 Units

- 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



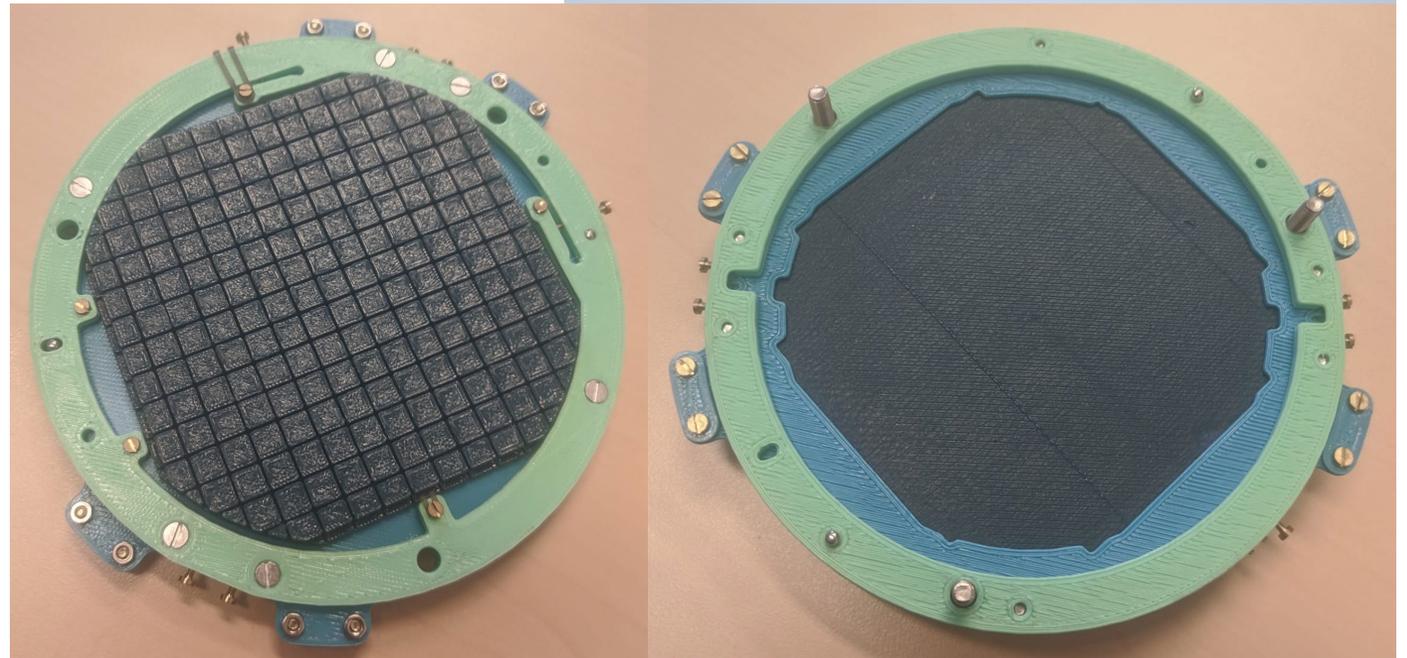
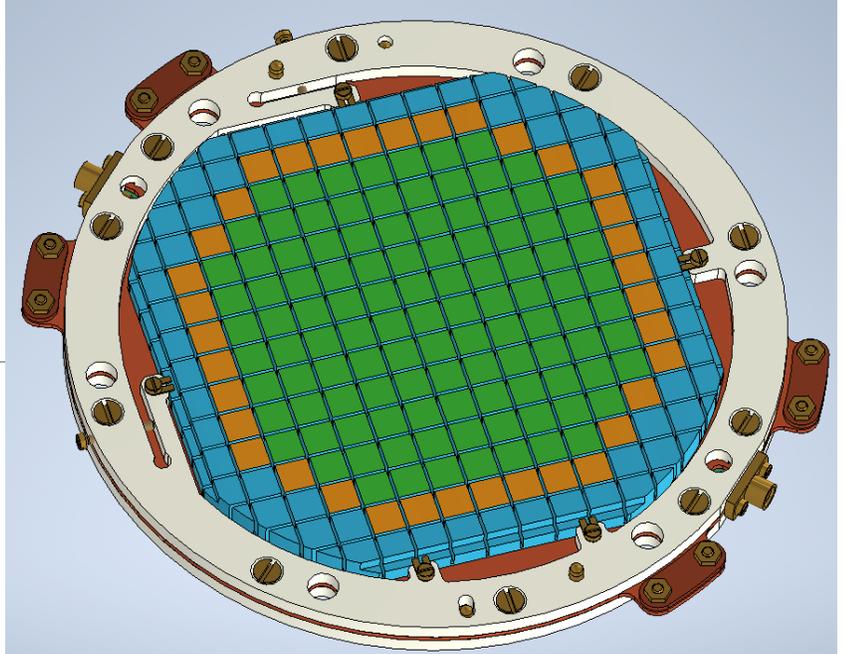
# Old prototype

## 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 (**few units**)
- Optimizing cost
  - Minimizing waste
  - Production with INFN machining technologies

**Issue:** impossible to stack 16 units because of the thermal expansion differences between copper and PTFE

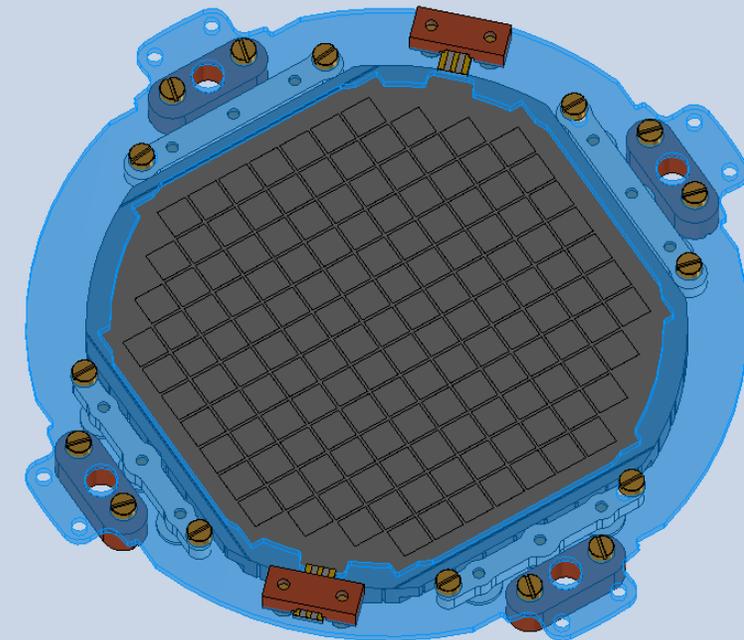
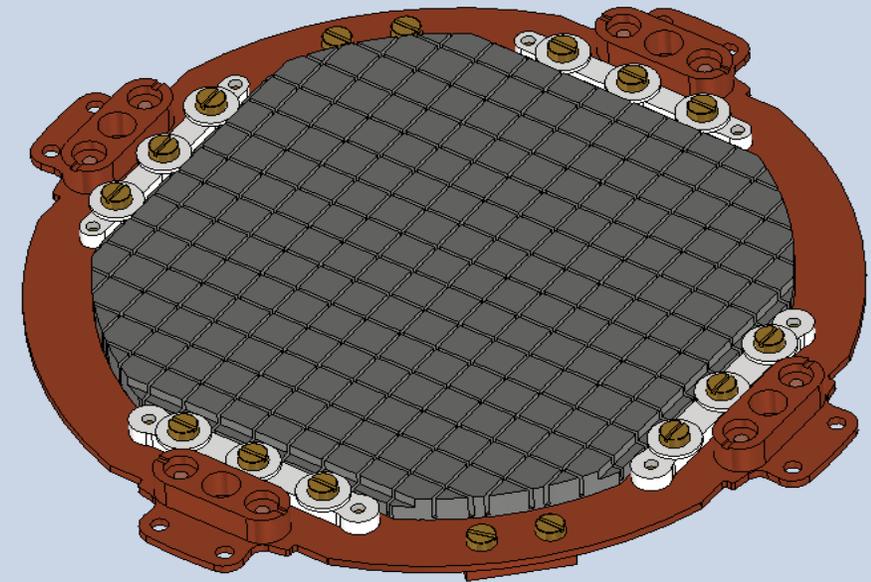
**Loose of thermal contact**



# New 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 (16 units ok!)
- Optimizing cost
  - Minimizing waste
  - The same component is used multiple times
  - Production with INFN machining technologies
- Reduced quantity of PTFE



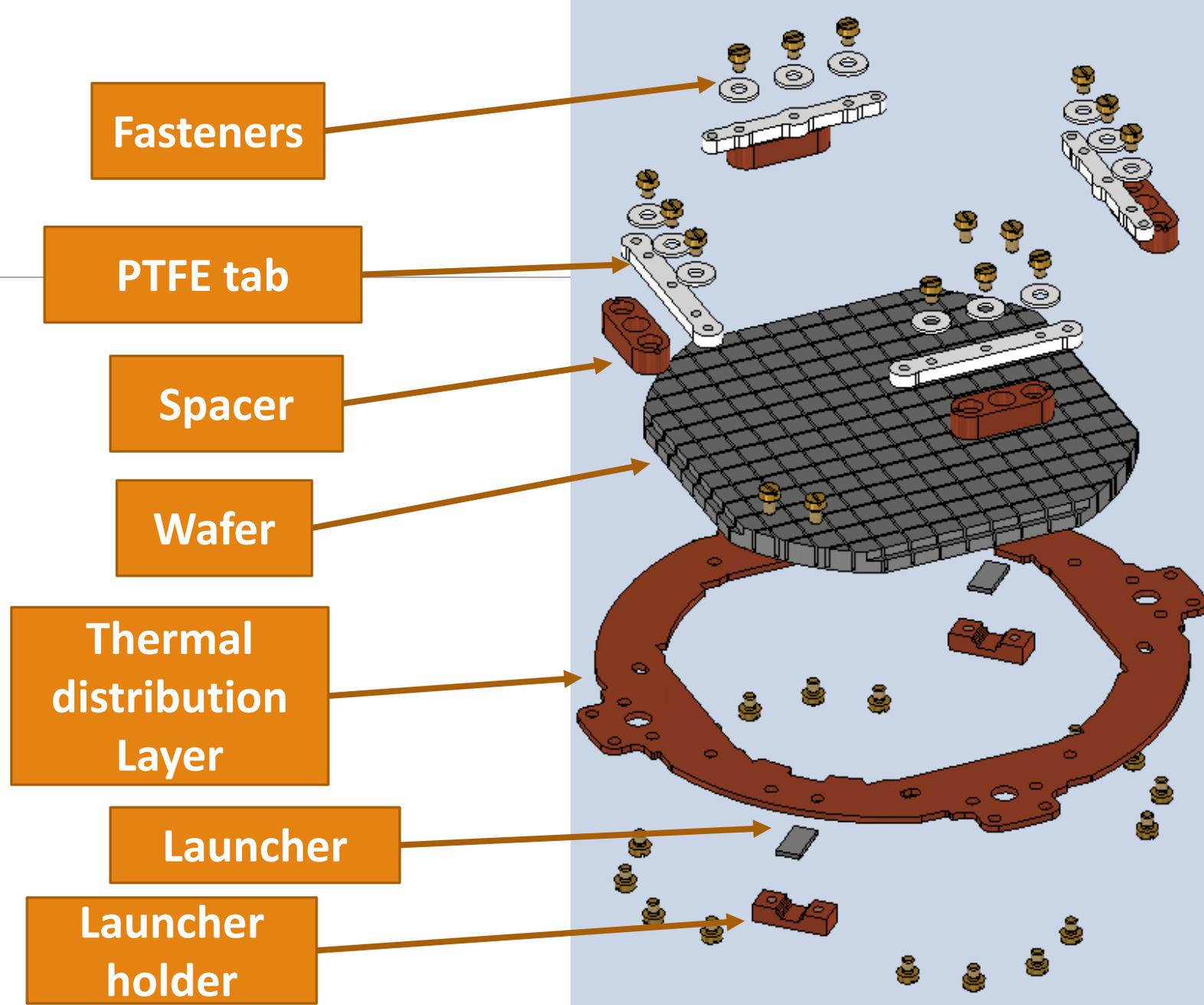
# Single module prototype

## Constraints:

- Vacuum 10-8 mbar
- Temperature 0.02K
- Low radioactive background
- Good mechanical and vibrational stability
- Easiness of mounting and handling

## Materials allowed:

- Copper OFHC
- PTFE



# Thermal distribution Layer

1.5 mm thick layer of OFHC copper

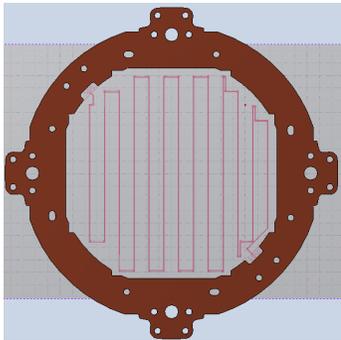
- Low mass structure
- Vacuum and radiation compatible

Machined with EDM

- No mechanical distortion
- High precision

Maximize thermal contact with the Silicon wafer

- No interference with photolithography

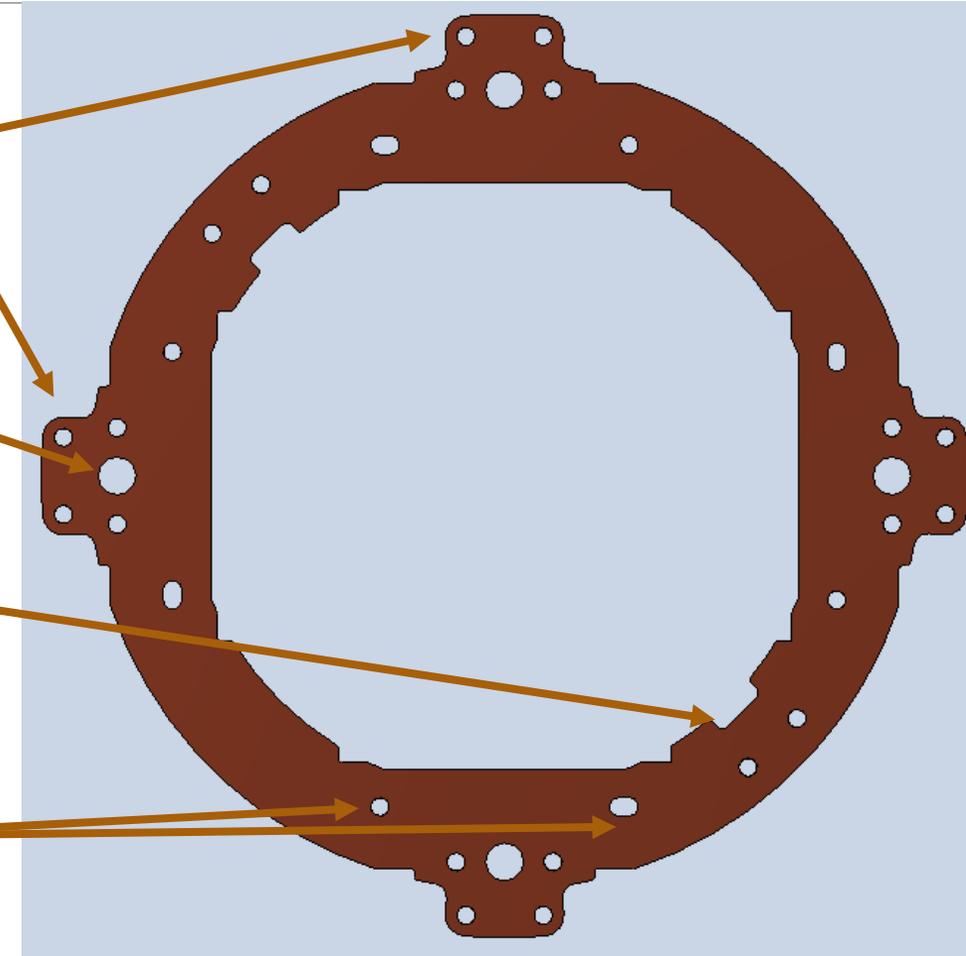


**Thermal contacts  
for daisy-chain  
cooling**

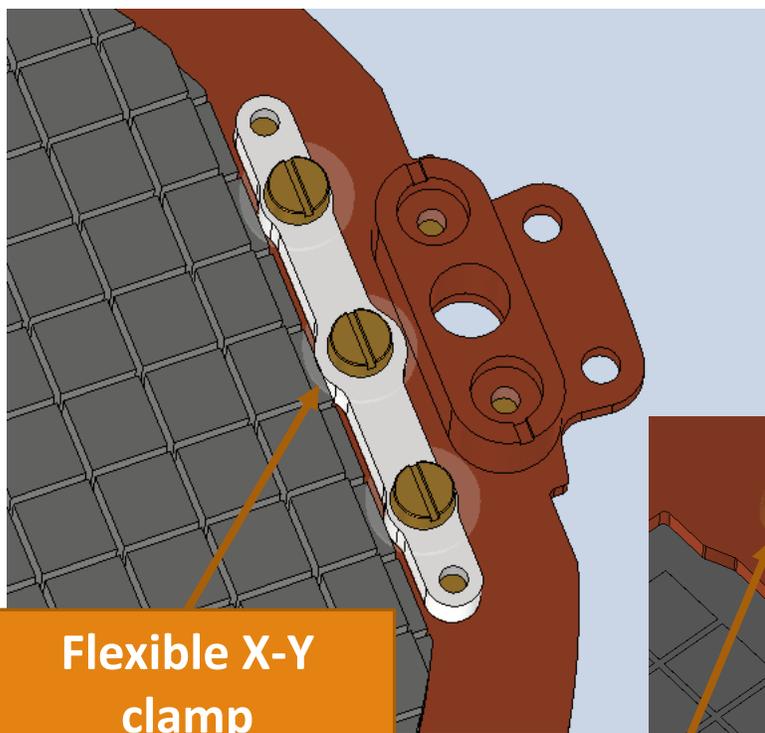
**Hole for stack  
mounting**

**Shape for  
launcher**

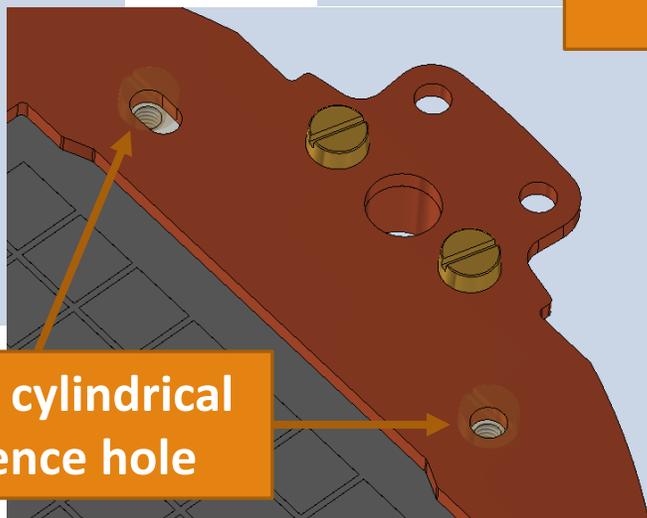
**Hole for  
referencing and  
fastening**



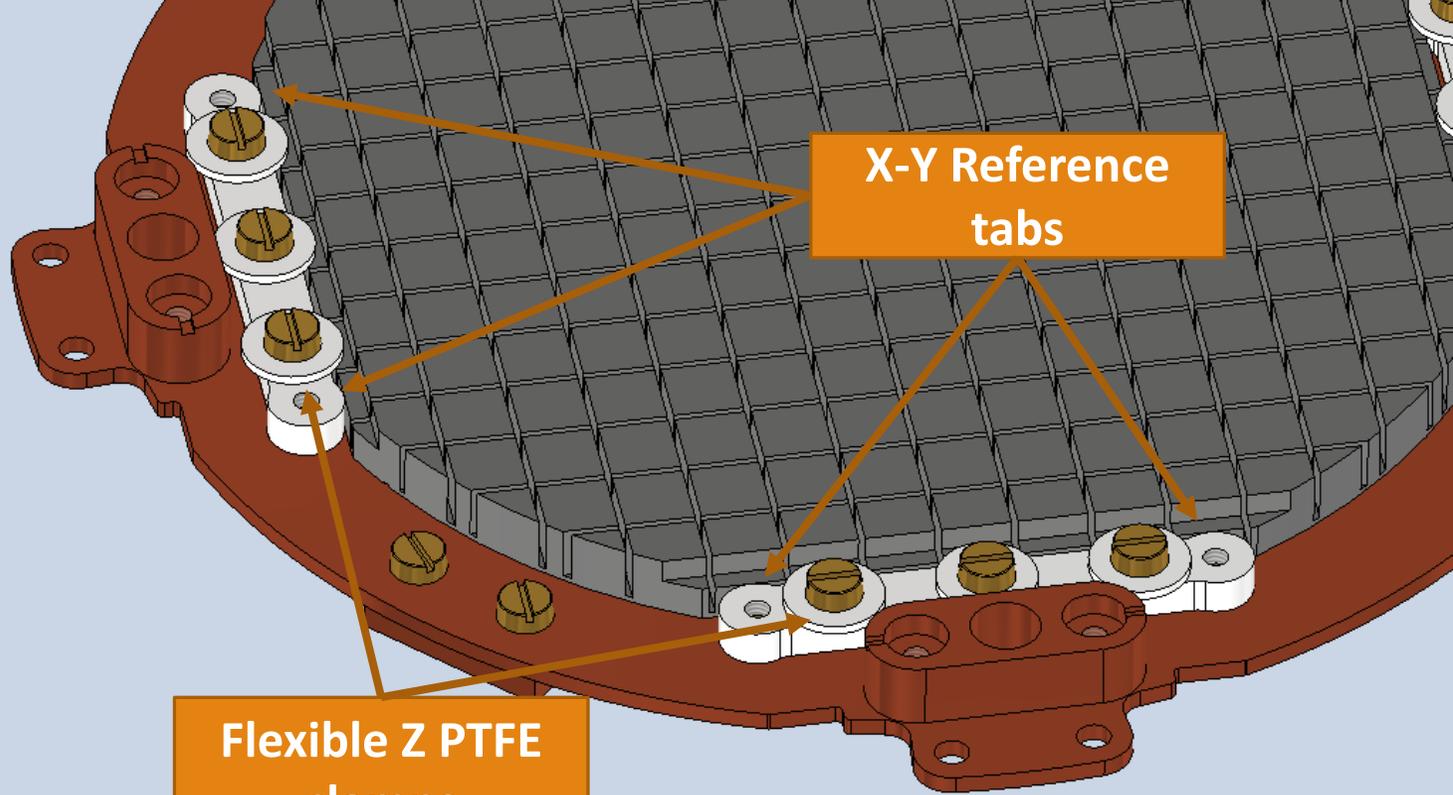
# Details



Flexible X-Y clamp



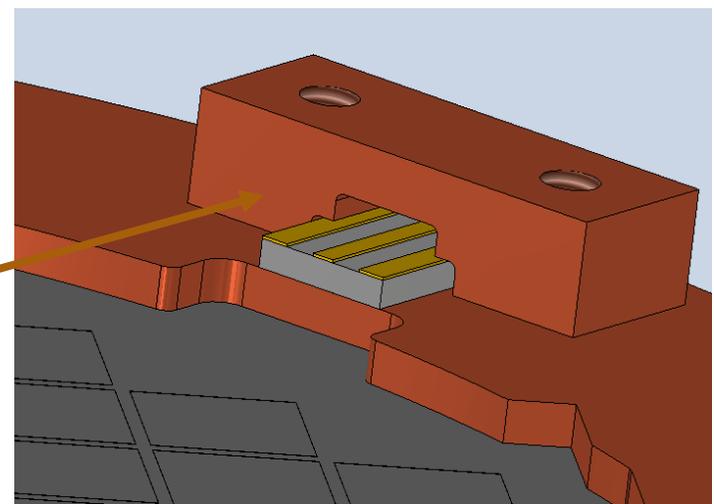
Slotted cylindrical reference hole



X-Y Reference tabs

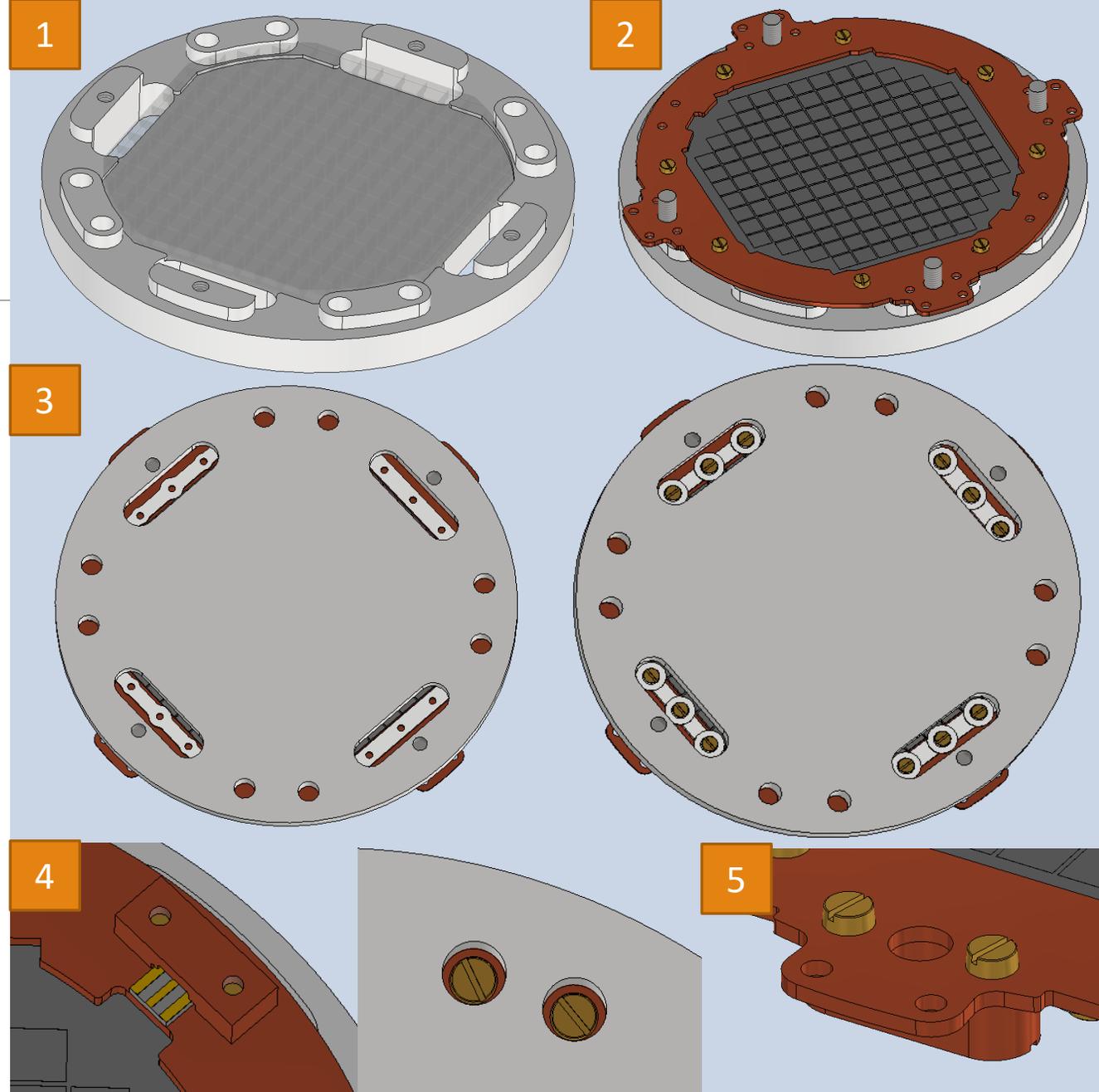
Flexible Z PTFE clamps

Launcher holder RF compatible



# Module assembling

1. Wafer placement on support template. Borders prevent misplacement
2. Placing the thermal distributor with preassembled tabs. Screws help placing and fasten it
3. Once fasten, flip the basement and secure the water with the PTFE washers
4. Install and tight the launchers and their clamps
5. Dismount from the basement and install the copper spacers



# 3-Module stack

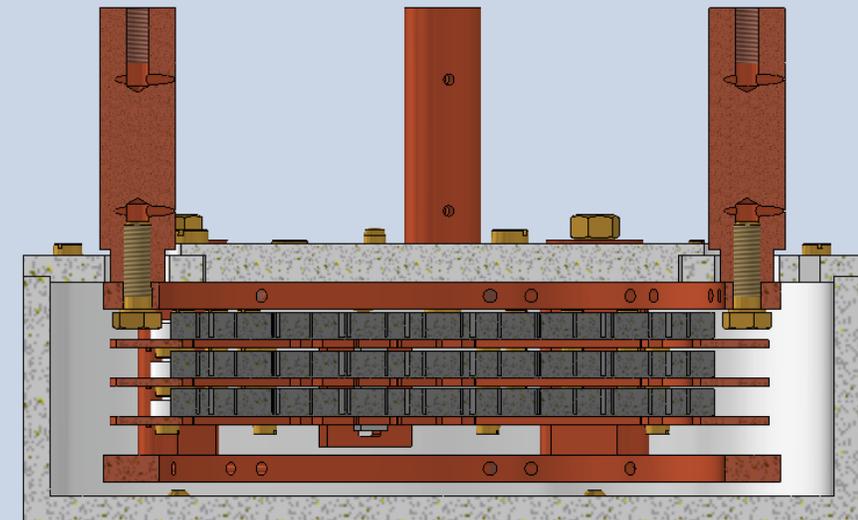
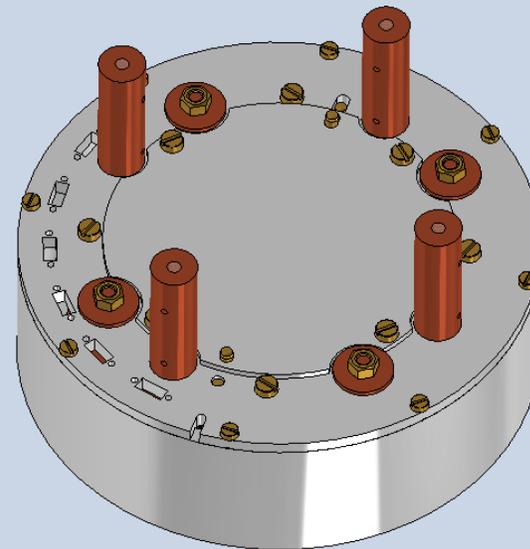
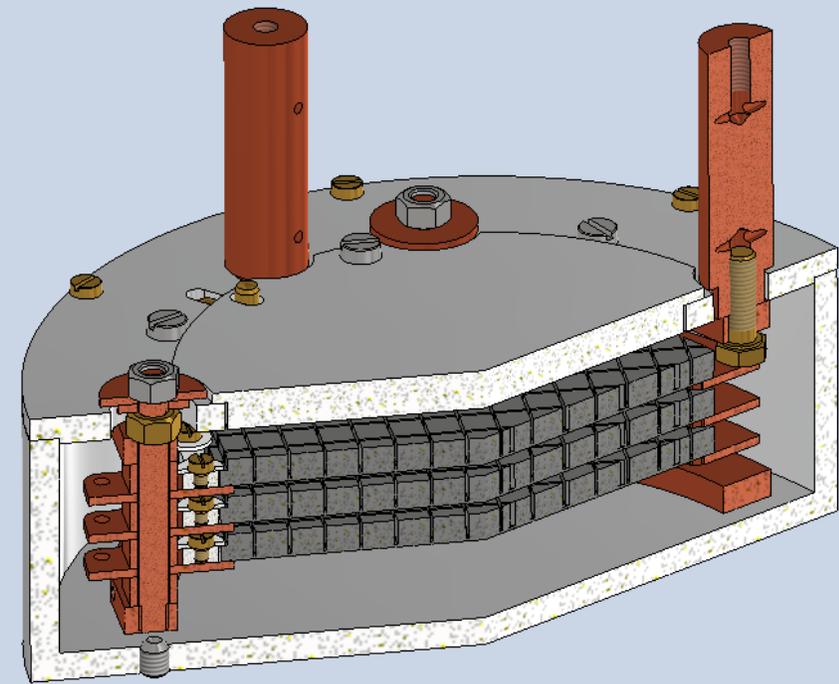
Pure aluminum (1000 series) vessel for shielding

Upper and Lower copper rings

- Stiffer structure for vibrations
- Thermal distributors for cooling

Copper rods for thermal contact with cold plated

Feedthroughs for fibers in the aluminum lid for optical calibration (just a dummy plate in the drawing)



# 3-Module assembling

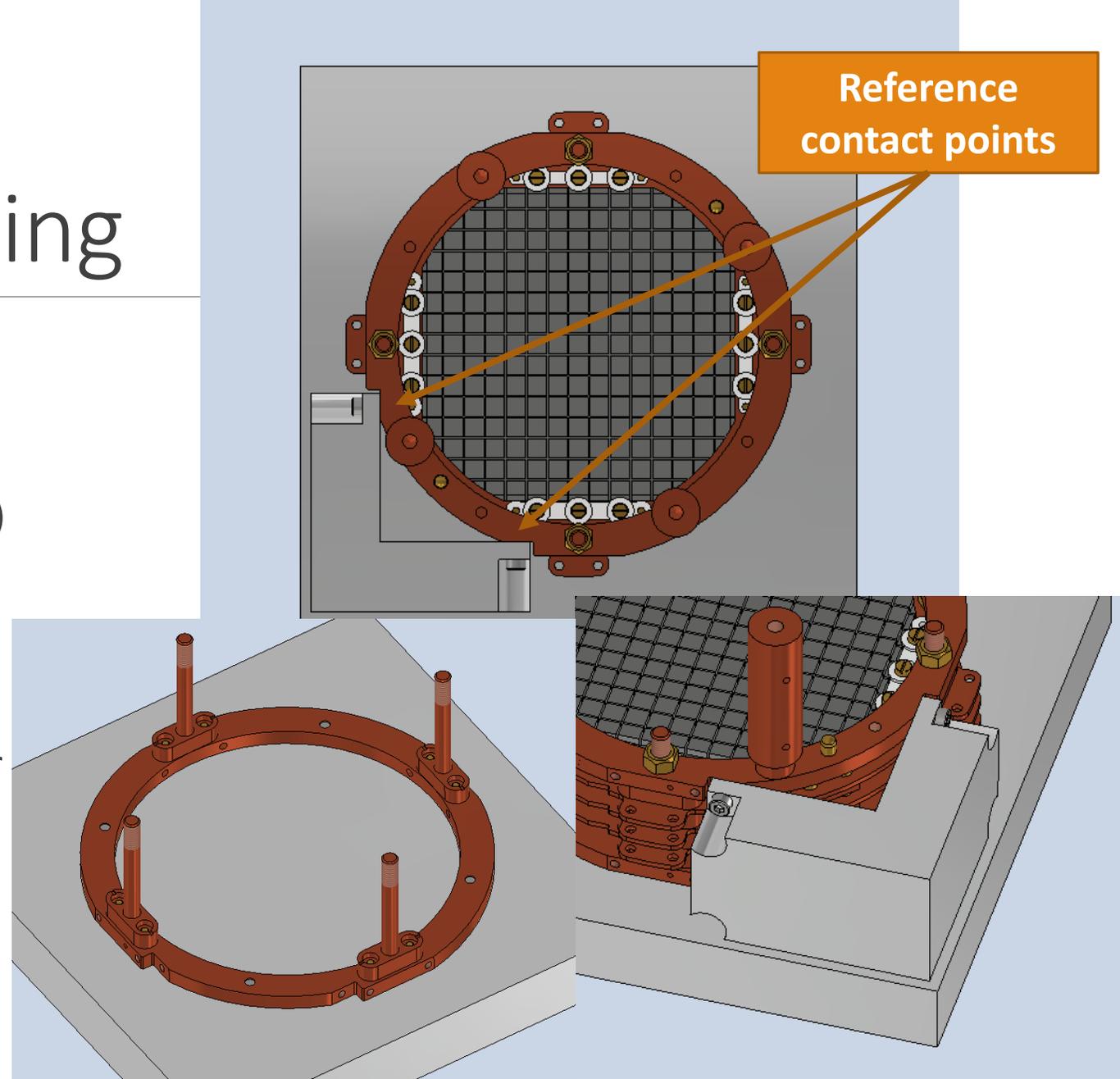
Using an aluminum platform, tight the lower stiffening ring, with the spacers and the columns.

Piling up all the required detector layers (3)

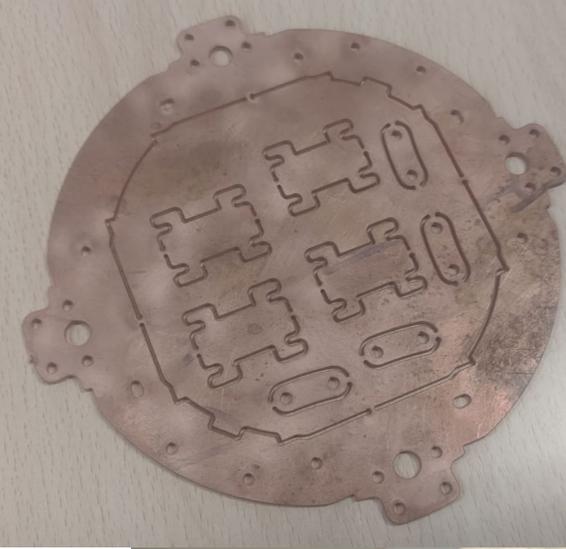
Place the upper stiffening ring with the pillars (for future connecting at the cryostat)

Use a reference square to tight all the layer in referenced position

Untight the detector from the basement and the reference square



# Status



- Design almost complete (small refinement to finalize)
- First prototype's mechanical parts realized
- First prototype thermal test ongoing
- Material procurement (raw copper) done

## To do:

- Material procurement for the Al vessel
- Machining the components for the cryostat connection
- Machining the components for the 3-units stack
- Finalize the design for the fiber support plate



# Thanks for your attention

---

