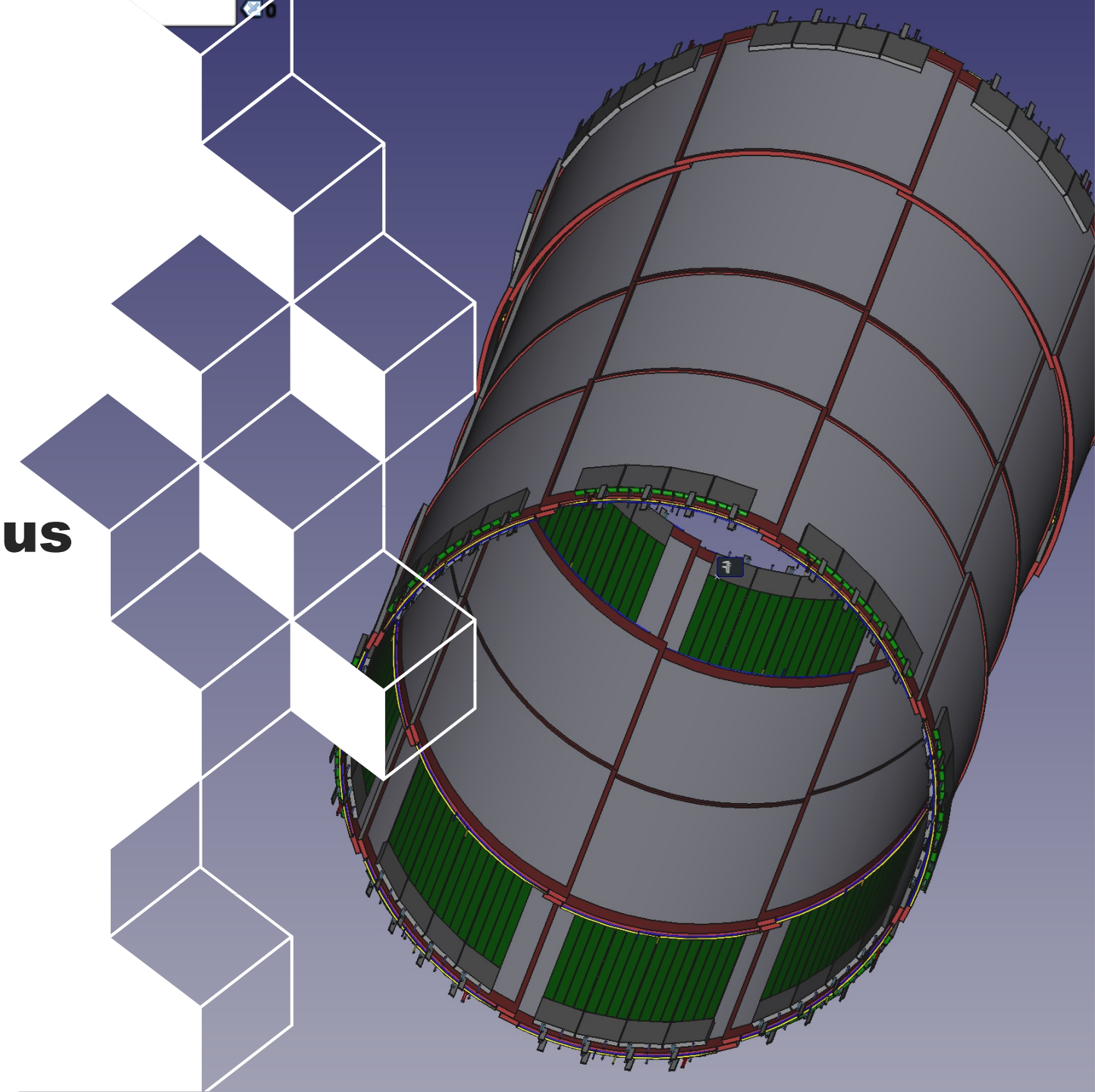
Inner MPGD CyMBaL status

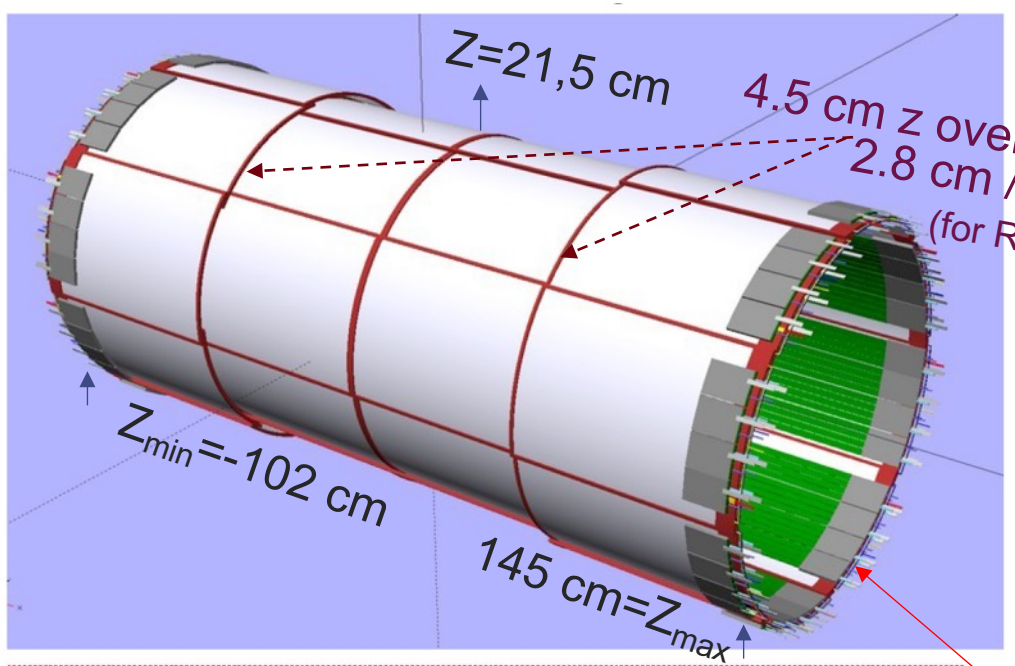
Alain Delbart, for the CEA/Saclay IRFU team

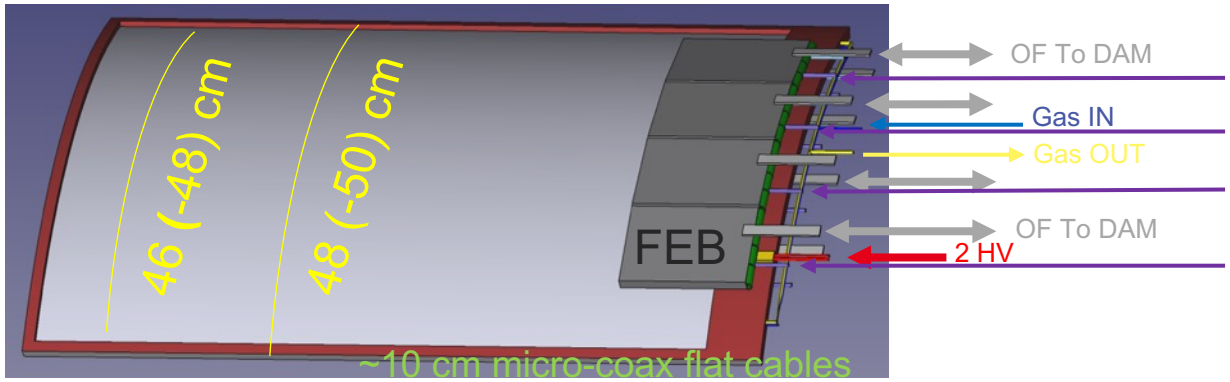
- ❑ Preliminary study of tiles' assembly
- ❑ CyMBaL tile update

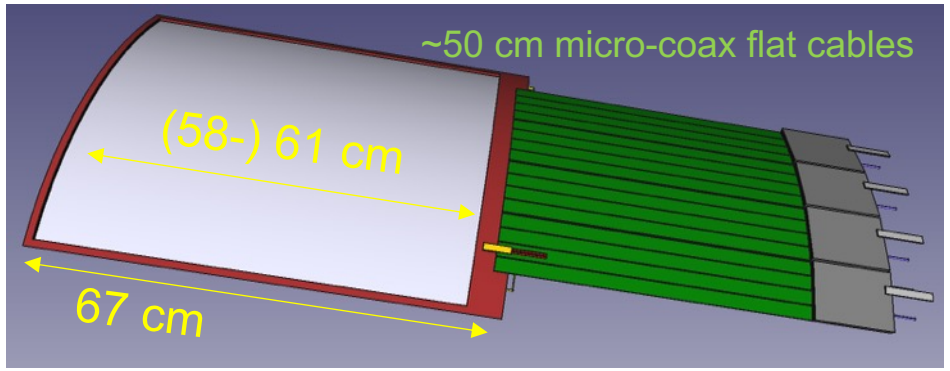
EIC/EPIC 3I meeting, 28 april 2025



CyMBaL barrel design update (46x67 cm² baseline)

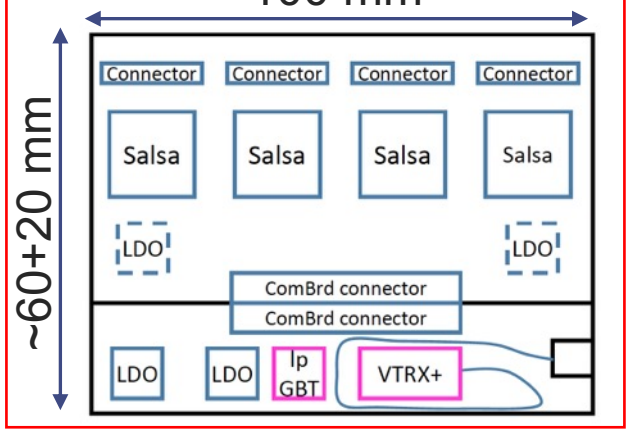






- 32 module: 8 modules in ϕ times 4 modules in z
- Overlaps in ϕ and in z for hermeticity
- 1024 readout channels/module
- 32K readout channels
- 128 FEBs (2x32 on each side - 4/tile)

FEB (~10 mm thick)



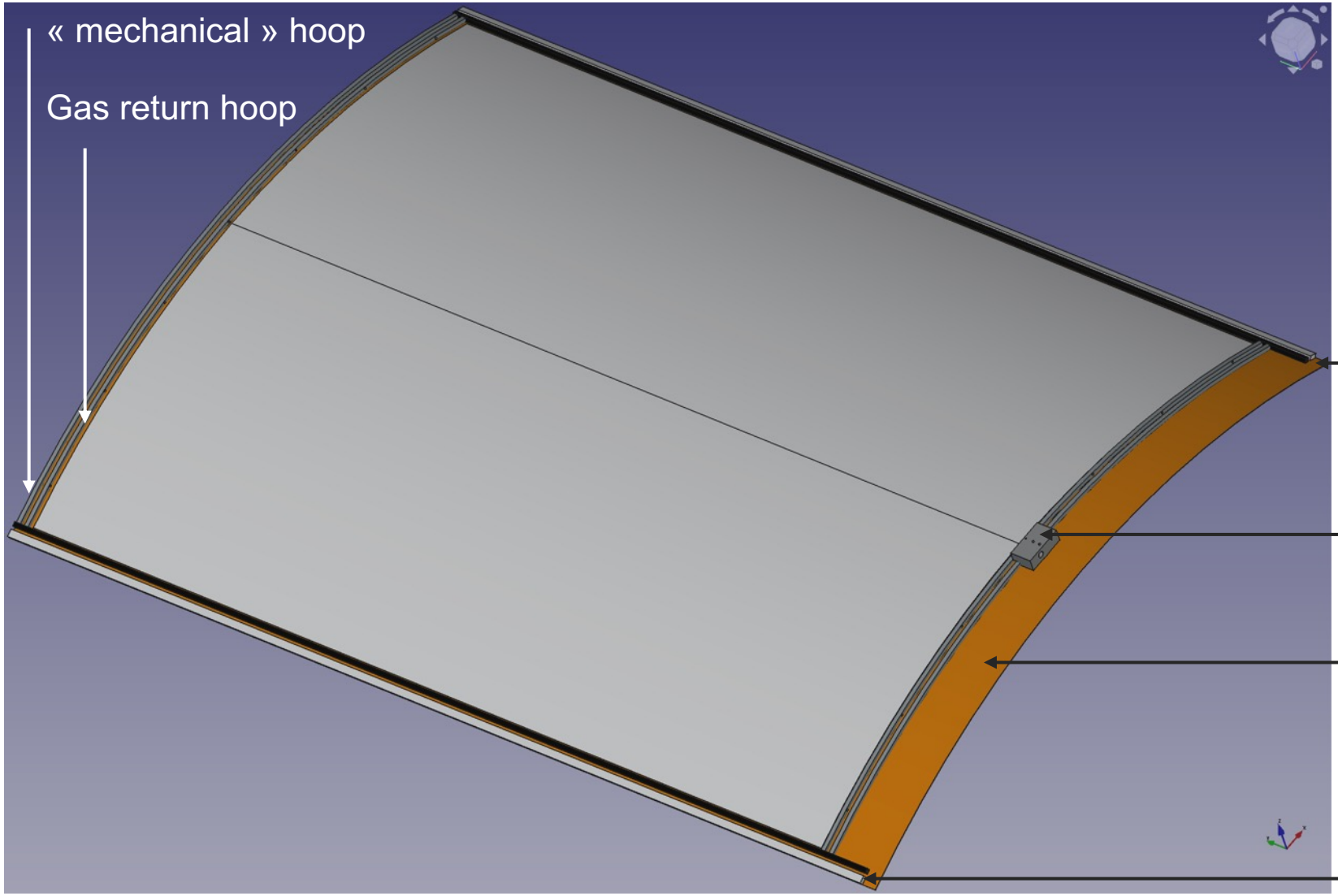
weight estimates

- Raw tile	~1 kg
- FEB PCB	~0.3 kg
- Cooling plate+fluid tube	~0.3 kg

(*rough estimate for 3 mm Al cooling plate + copper tubes, **thermal simulations Tbd***)

On each side of the barrel	**~40 kg**
Cymbal	**~110 kg**

CyMBaL tile baseline design update



Design guideline :
have same design for all 32 tiles

Gas OUT longeron
3x3 mm^2

GAS IN + buffer hoops

« Services » area

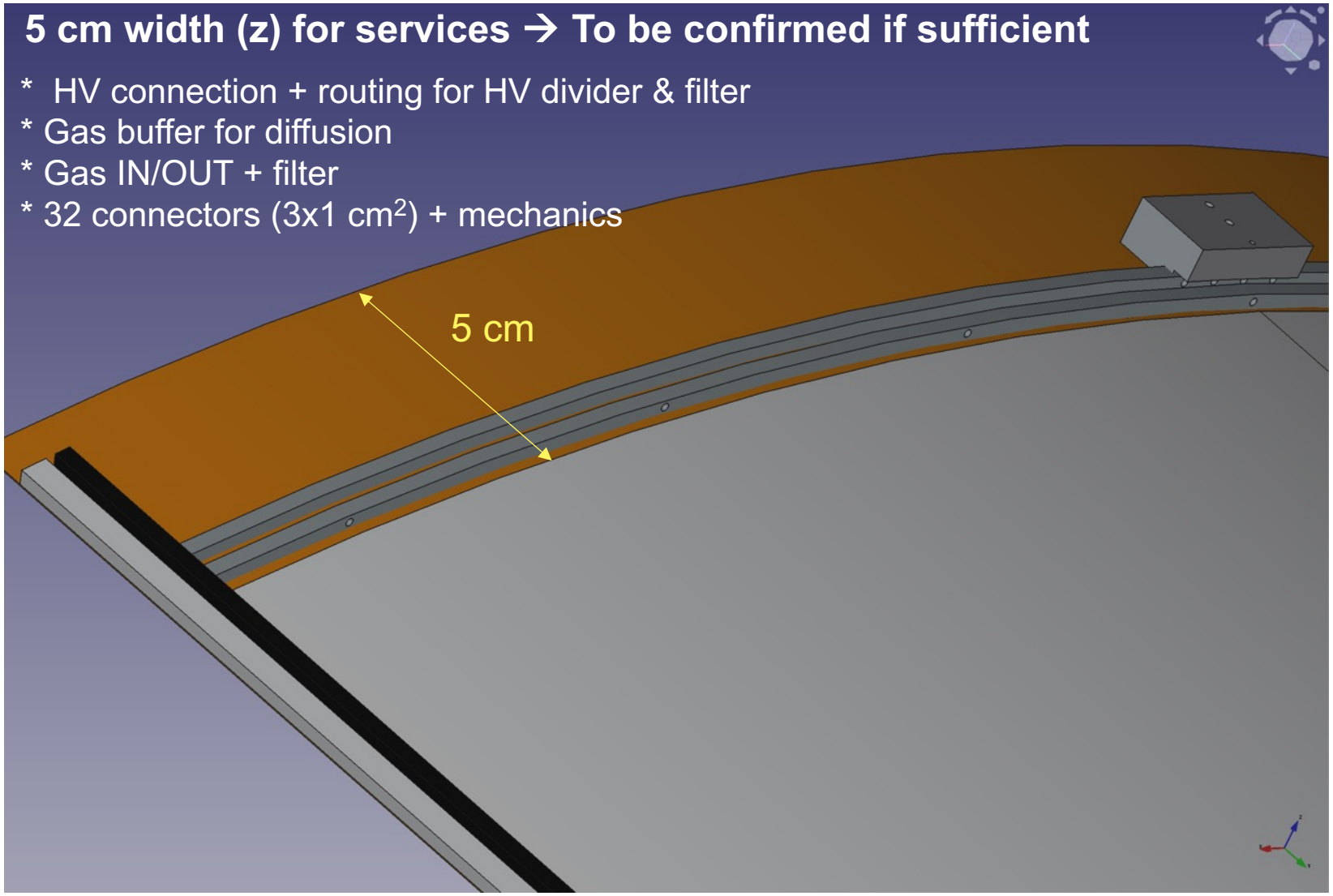
« mechanical » longeron
5x3 mm^2

« Mechanical » hoops and longerons to be used for tile fixations on PST or between tiles

CyMBaL tile : « services » area

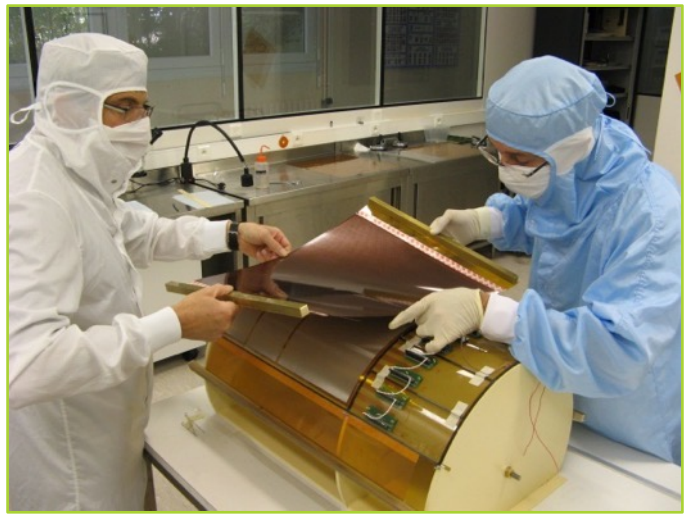
5 cm width (z) for services → To be confirmed if sufficient

* HV connection + routing for HV divider & filter
* Gas buffer for diffusion
* Gas IN/OUT + filter
* 32 connectors (3x1 cm^2) + mechanics



CyMBaL – Toward a scale 1:1 prototype

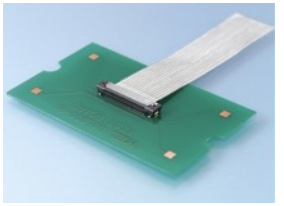
Based on CLAS12 construction process



- Bulk of a metallic and a resistive CLAS12 PCB
- Bent in shape

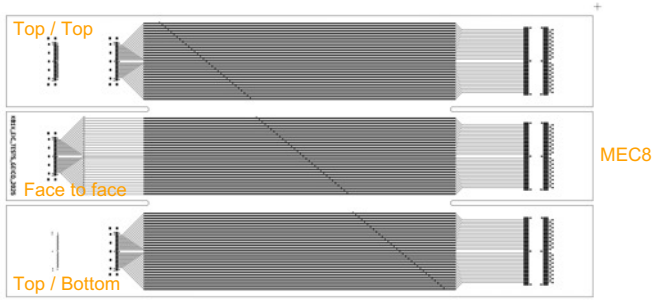
Needed to design the « services » area

Under production (exp. in june)



Small mechanical prototype

- Connector KEL validation
- Different connectors orienta
- Robustness of soldering
- Connection feasibility
- Holders needed?

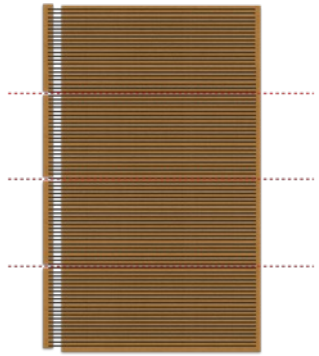


Size 1 prototype:

Needed for HV connection + routing for HV divider & filter

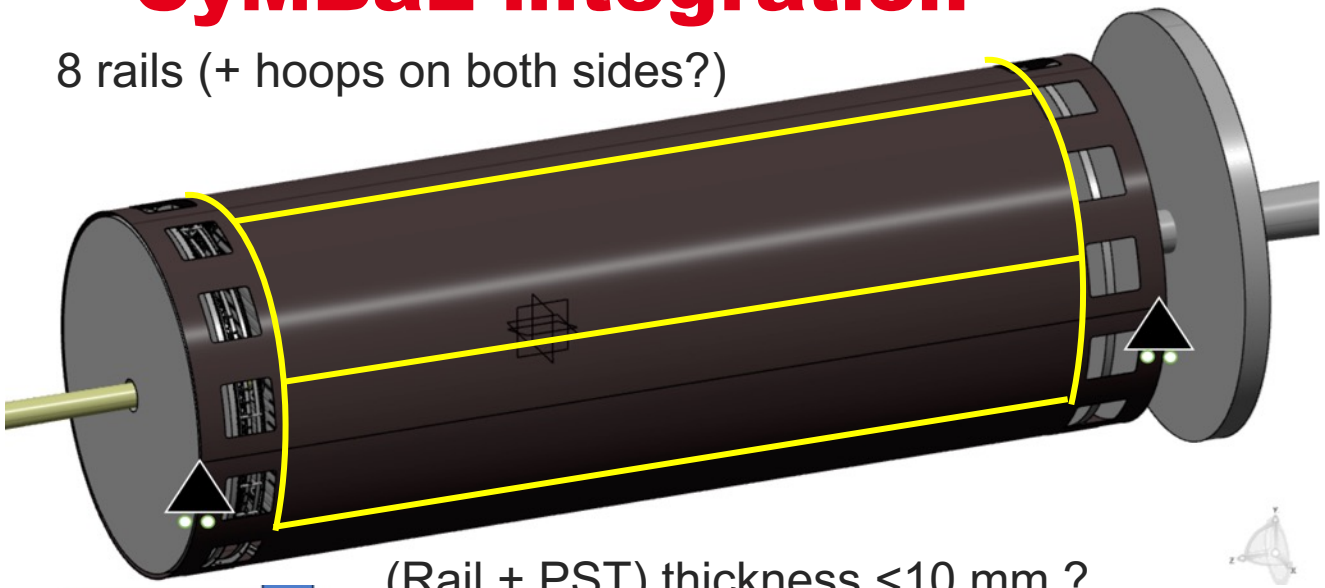
- Working prototype
  - Readout plane validation
  - HV segmentation
  - Drift design
- Mechanical prototype
  - Curving tooling and procedure
  - **Interfaces design (fixation**, cooling, gas,…)

Segmented resistive layer

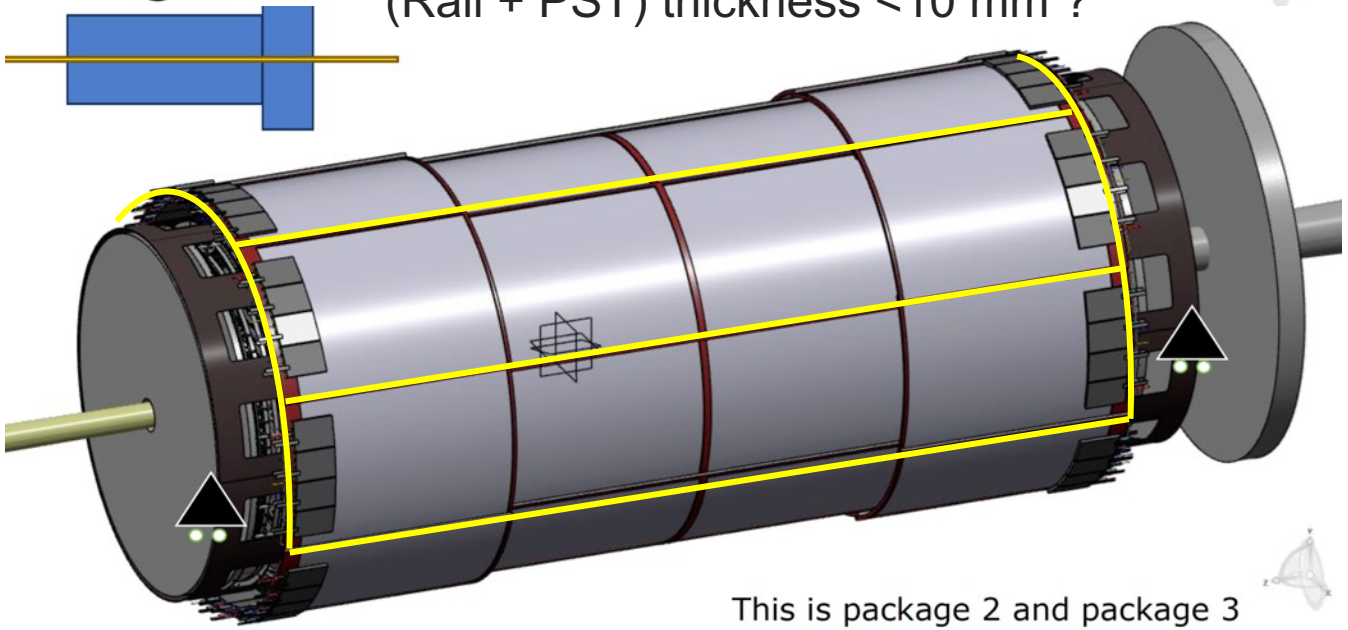


CyMBaL integration

8 rails (+ hoops on both sides?)



(Rail + PST) thickness <10 mm ?

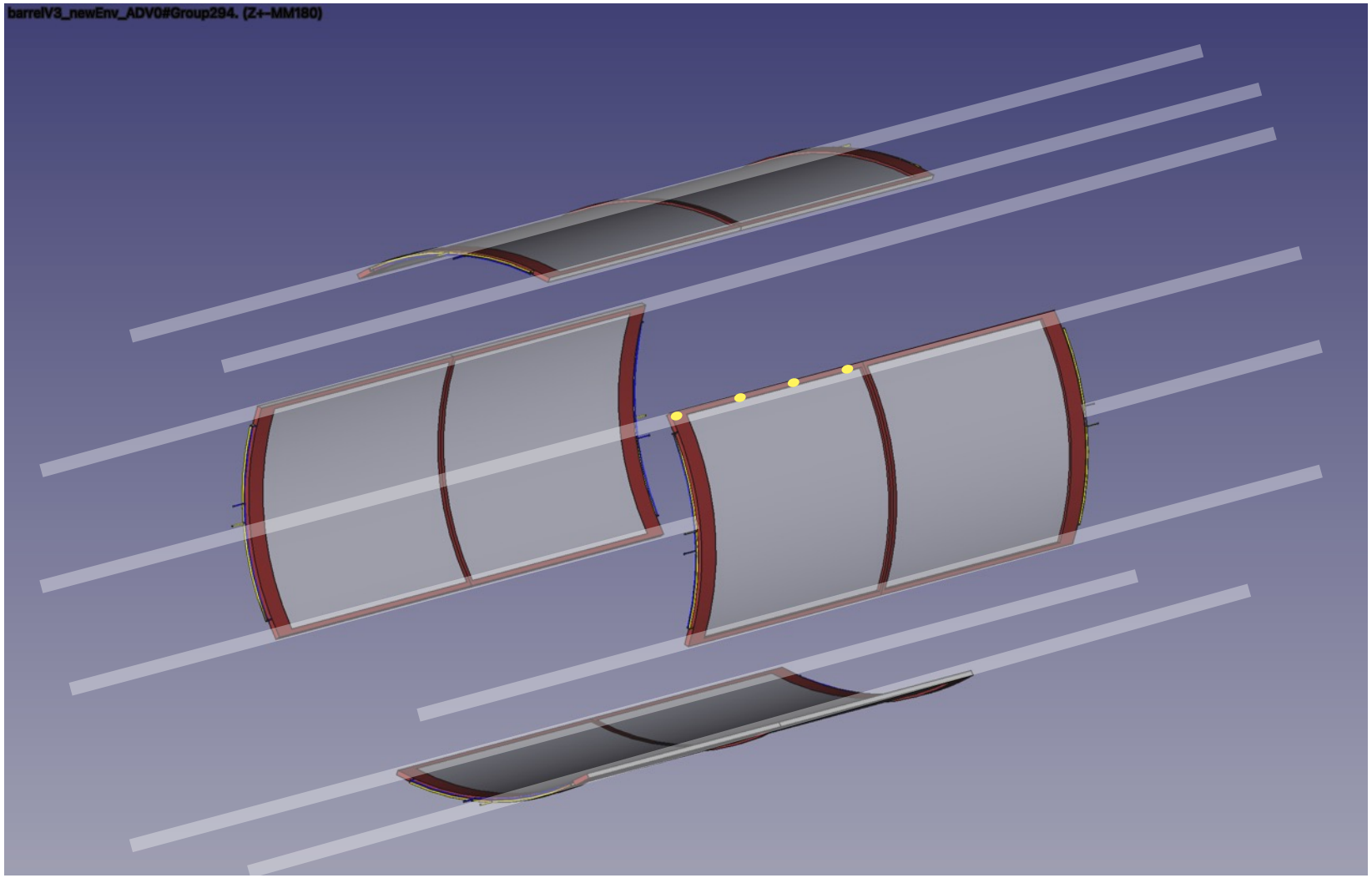


This is package 2 and package 3 completed

- CyMBaL tiles **mounted on PST rails**
- **FEB cards** connected to CyMBaL micro-coax flat cables & **to be fixed on each CyMBal barrel side edges** :
  - "light" hoops connecting rails ?
  - Other structure mounted on PST ?
  - … taking into account the cabling of all the services (SVT + CyMBaL) in these very crowded areas
- FEB cards (incl. cooling plate) thickness to be fixed by thermal simulations (baseline is 15 mm max)

- **Need** current CAD models of **PST and GST** to start with **for FEB cards integration**

Proposed CyMBaL Assemby on PST support tube



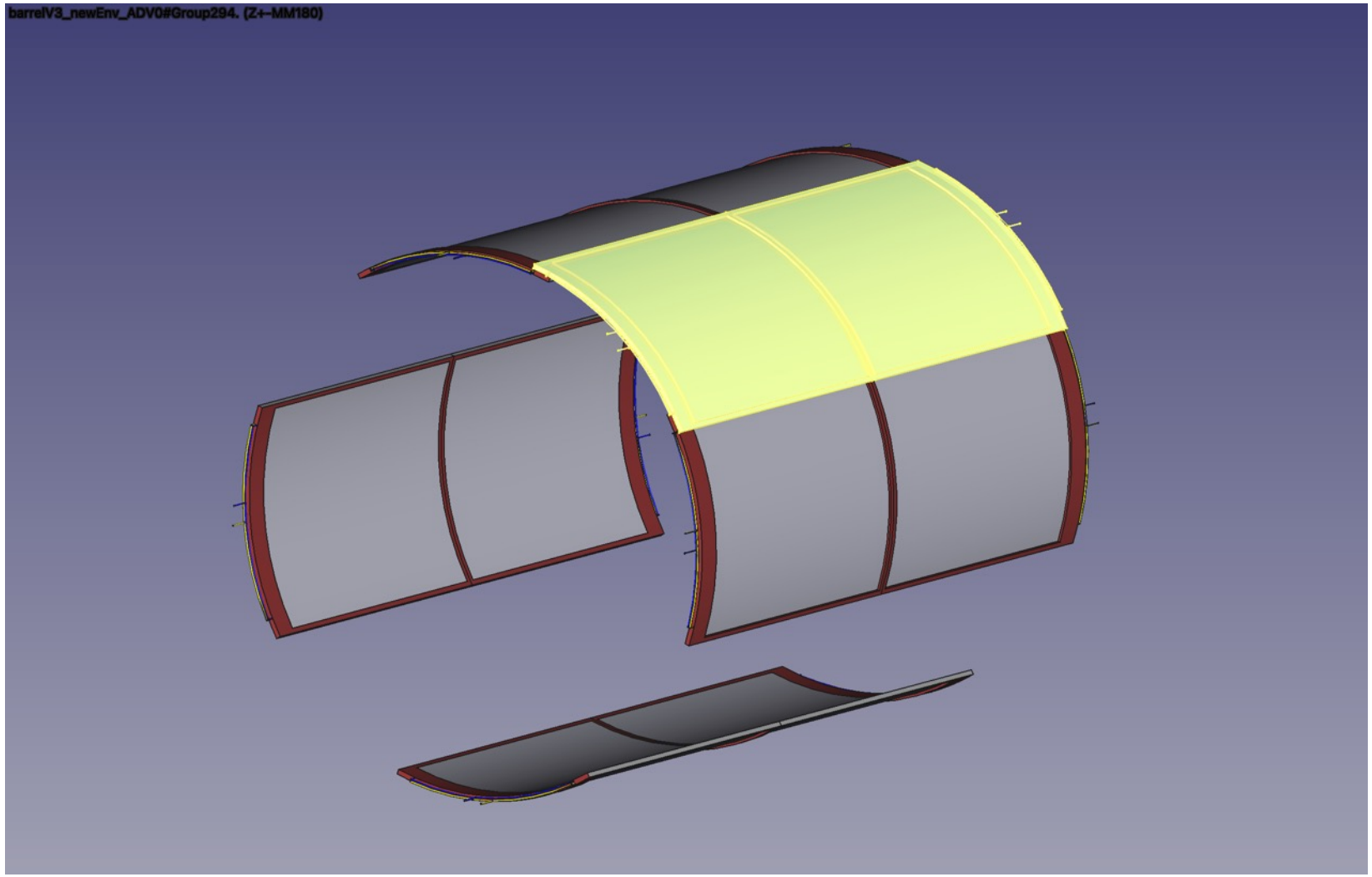
Fixation on the 2 PST rails

4 x M2 (or M3 screws)
+ washers ? / longeron

4 Oblong holes in CyMBaL tiles'
« mechanical » longerons

Locations to be in accordance with threads needed for fixation of upper layer tile

Proposed CyMBaL Assemby on PST support tube



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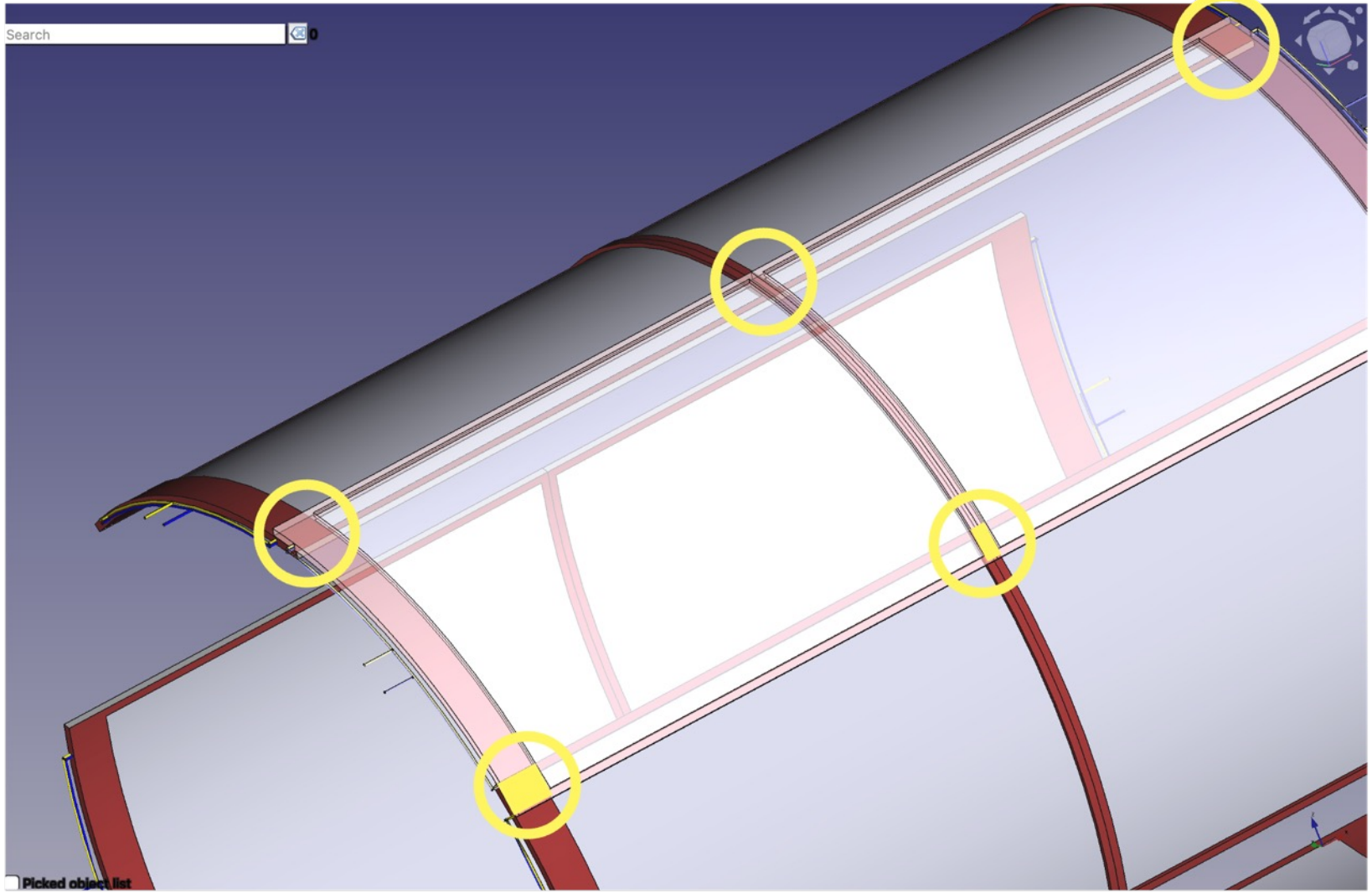


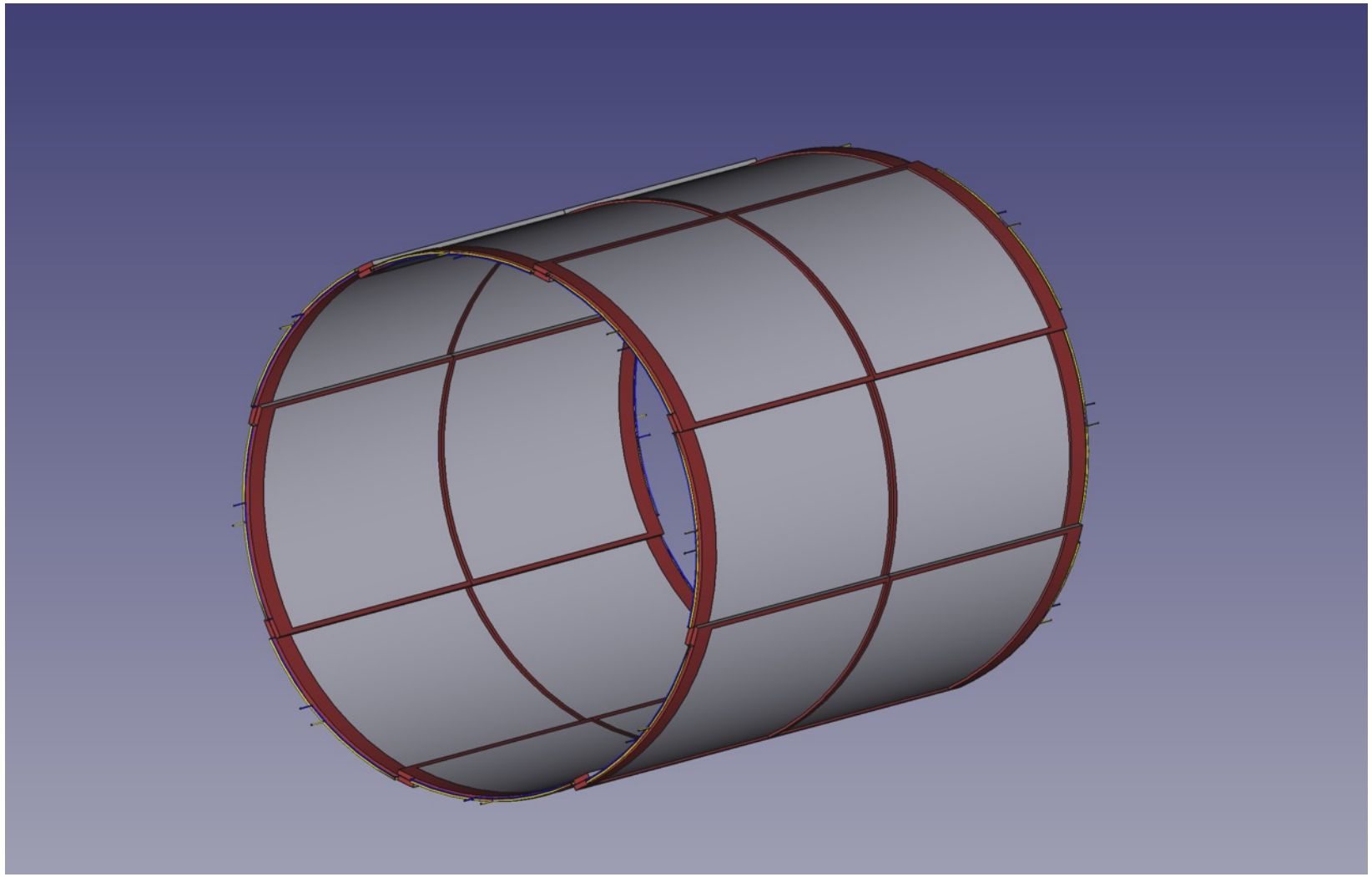
Fixation « tiles on tiles »

4 x M2 (or M3 screws)
+ washers ? in corners

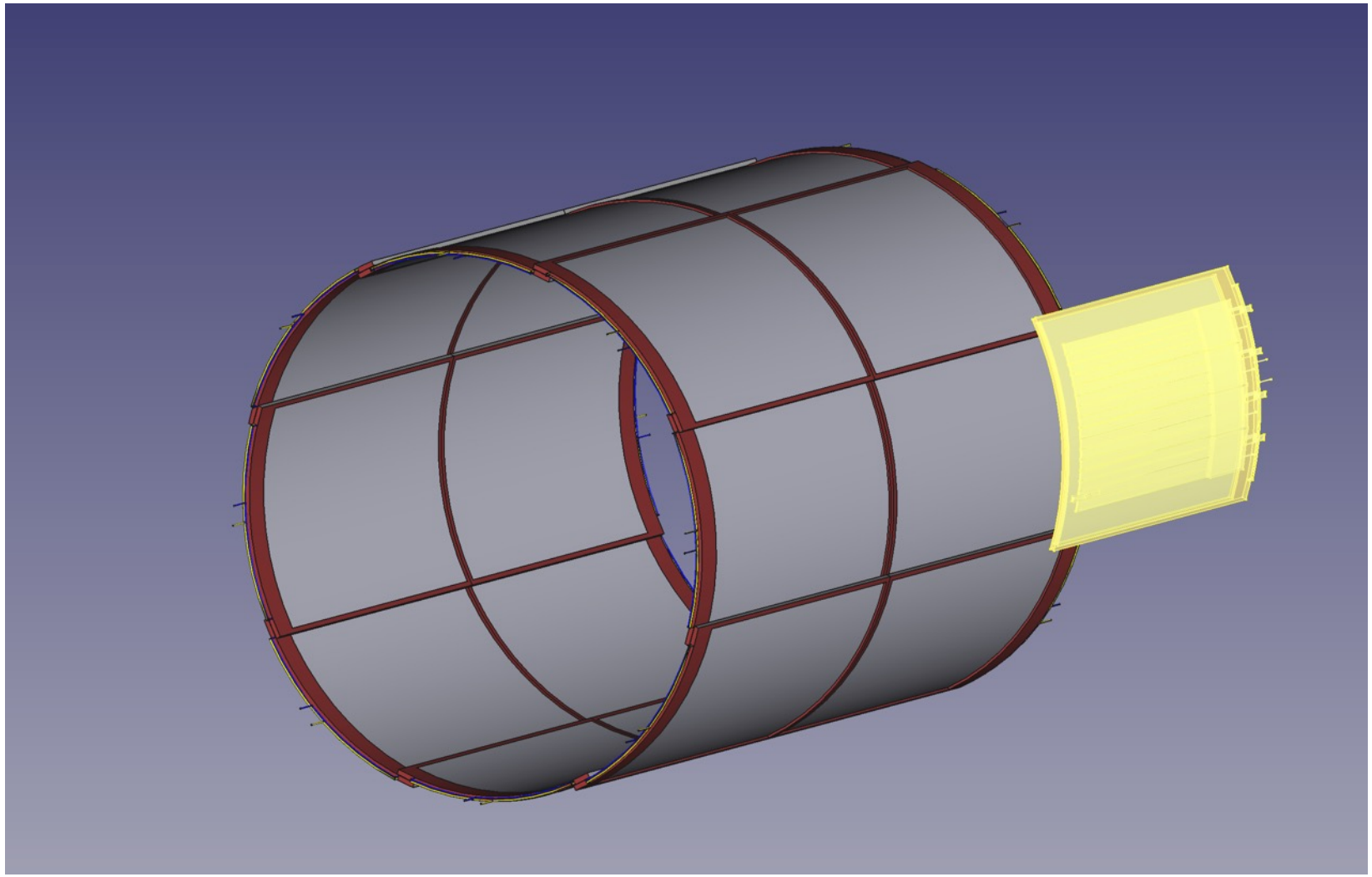
Use 2 new oblong holes in corners of longerons or in hoops

+ 2 M2(or M3) corresponding threads for fixation on lower layer tile

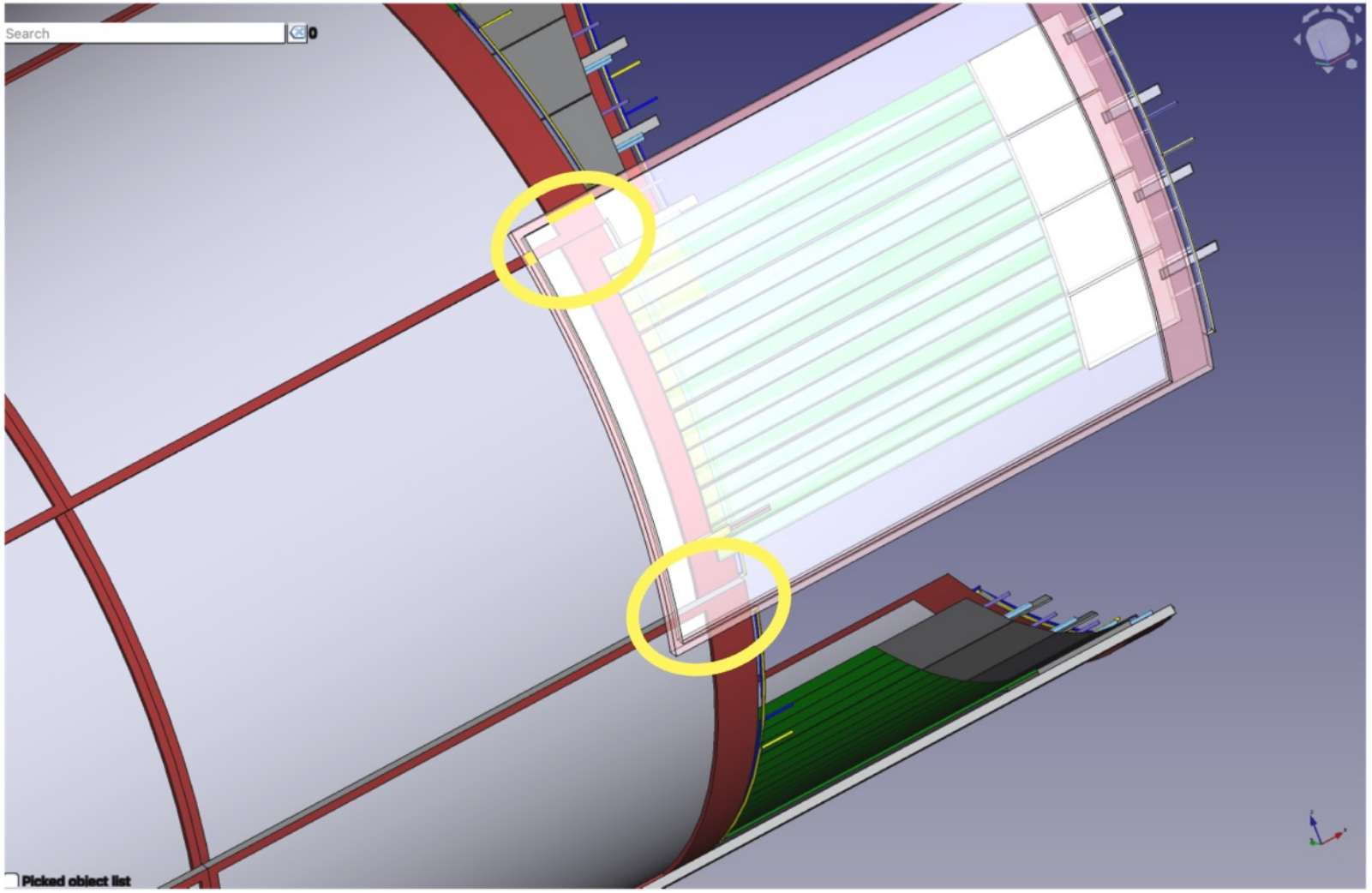
Proposed CyMBaL Assemby on PST support tube



Proposed CyMBaL Assemby on PST support tube



Proposed CyMBaL Assemby on PST support tube



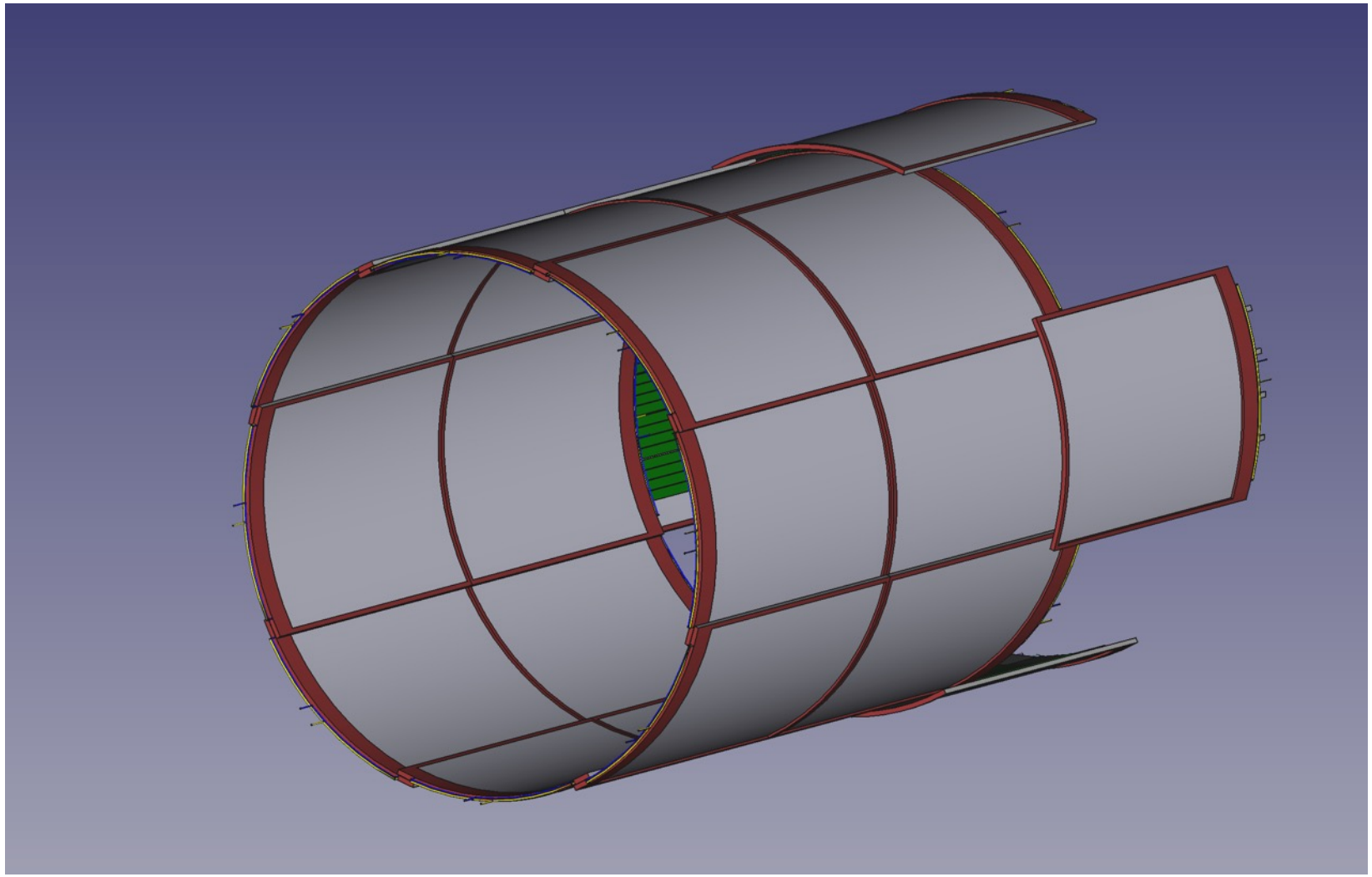
2 fixations « tiles on tiles »
& 2 fixations on PST rail or hoop

4 x M2 (or M3 screws)
+ washers ?

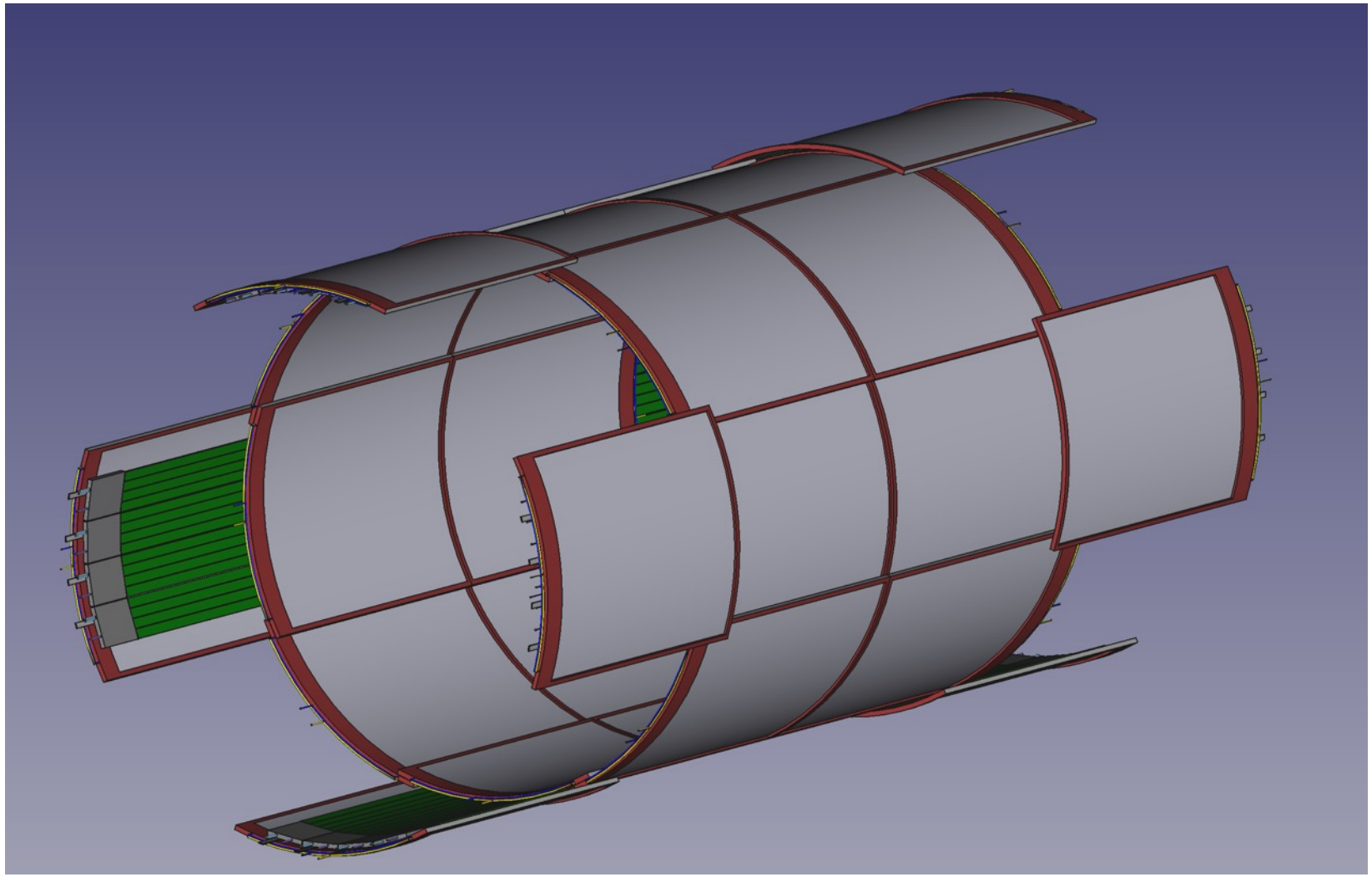
On intersection areas
of « mechanical » longerons
or hoops

+ 2 M2(or M3) corresponding
threads for fixation on
lower layer tile

Proposed CyMBaL Assemby on PST support tube



Proposed CyMBaL Assemby on PST support tube



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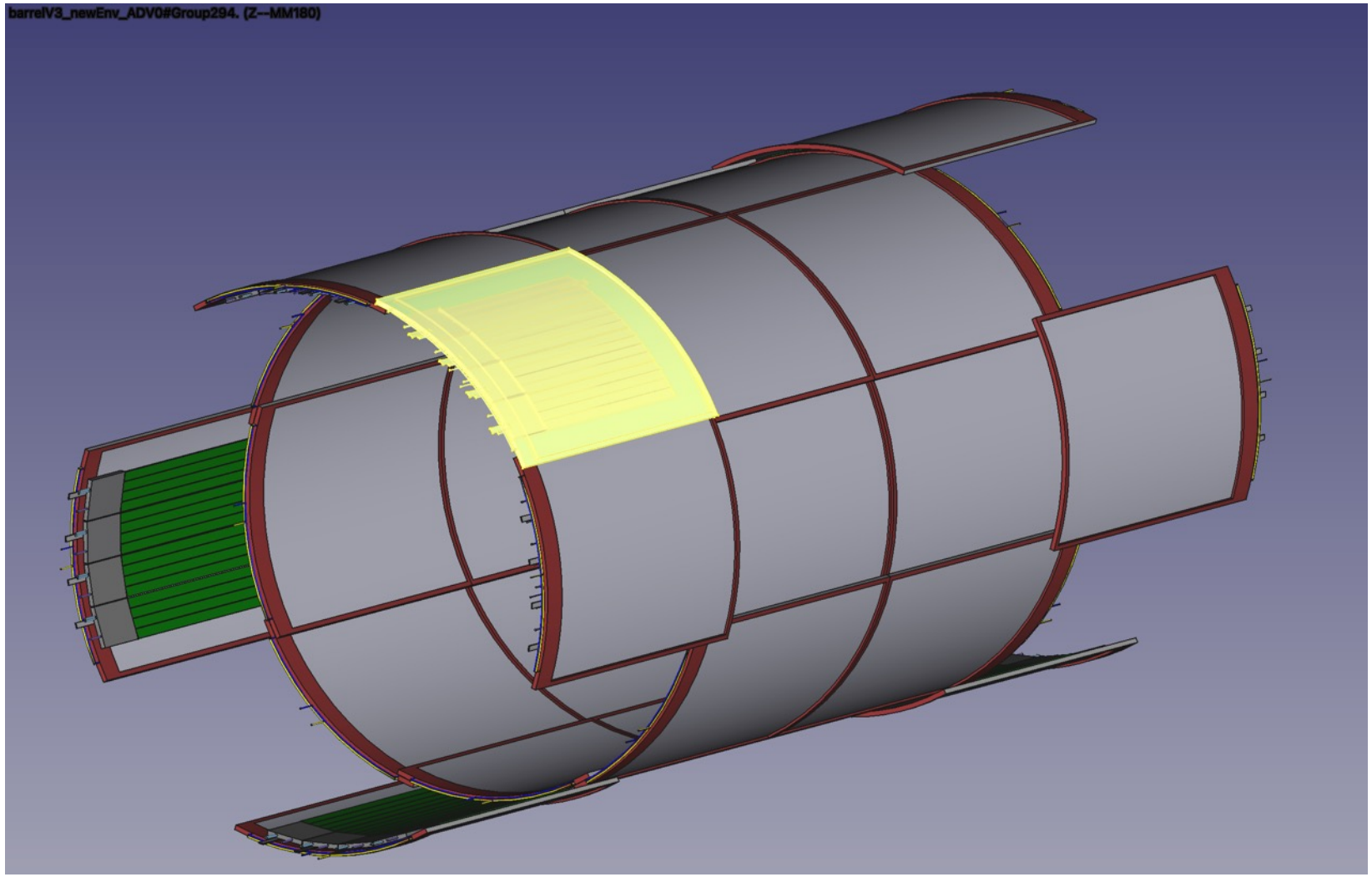
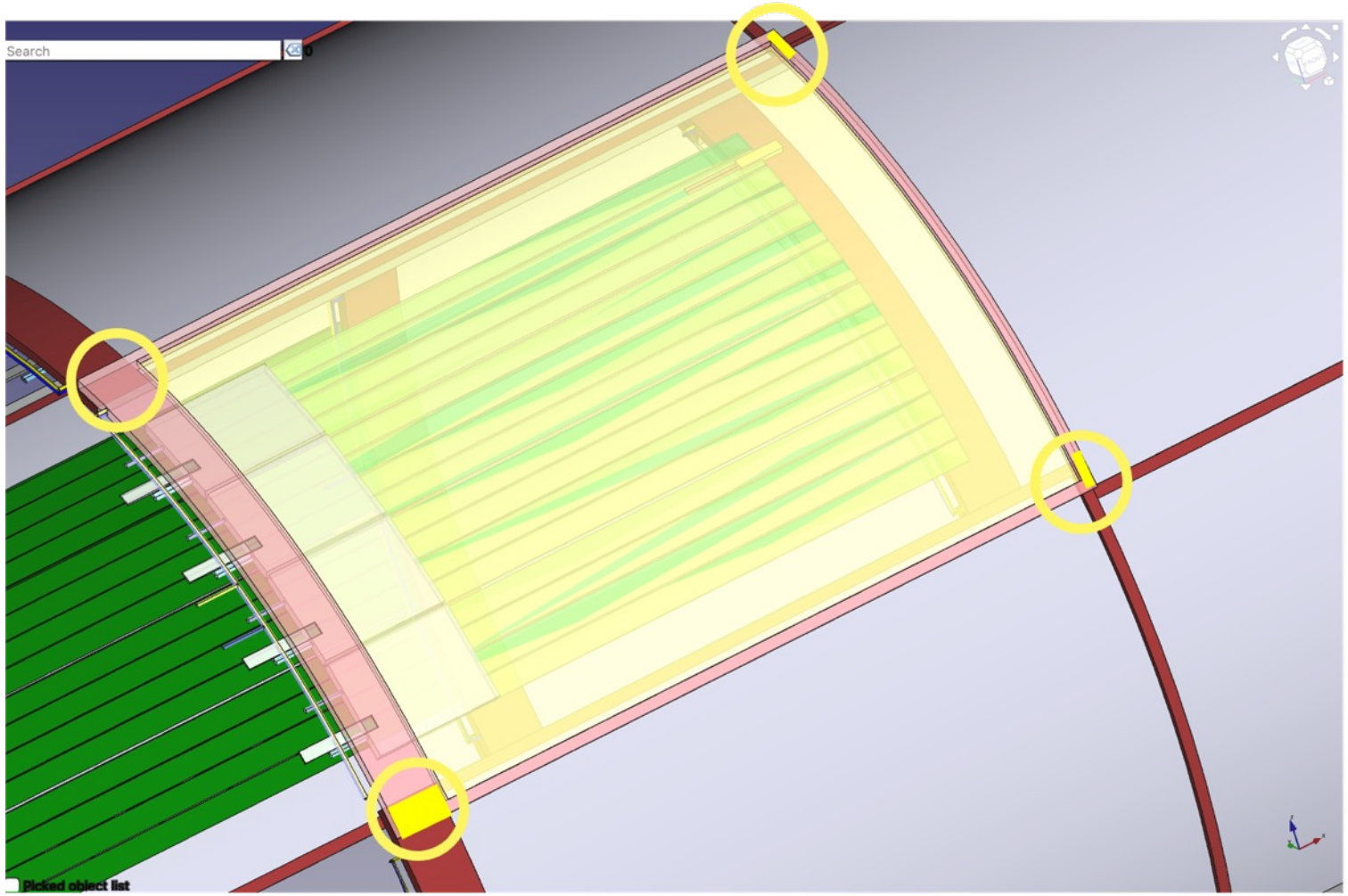


Proposed CyMBaL Assemby on PST support tube



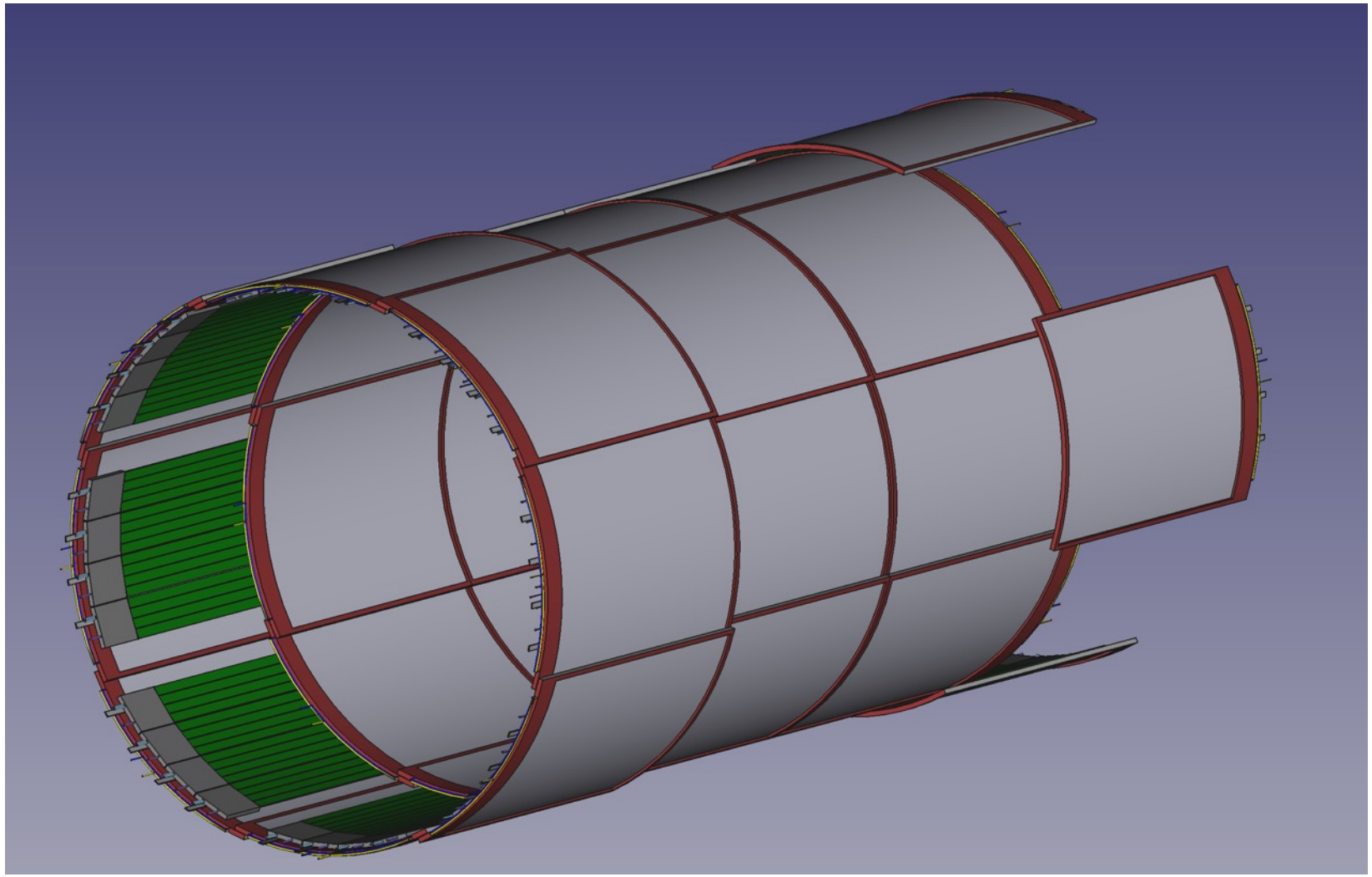
2 fixations « tiles on tiles »
& 2 fixations on PST rail or hoop

4 x M2 (or M3 screws)
+ washers ?

On intersection areas in corners
« mechanical » longerons
or hoops

+ 2 M2(or M3) corresponding threads
for fixation on lower layer tile

Proposed CyMBaL Assemby on PST support tube



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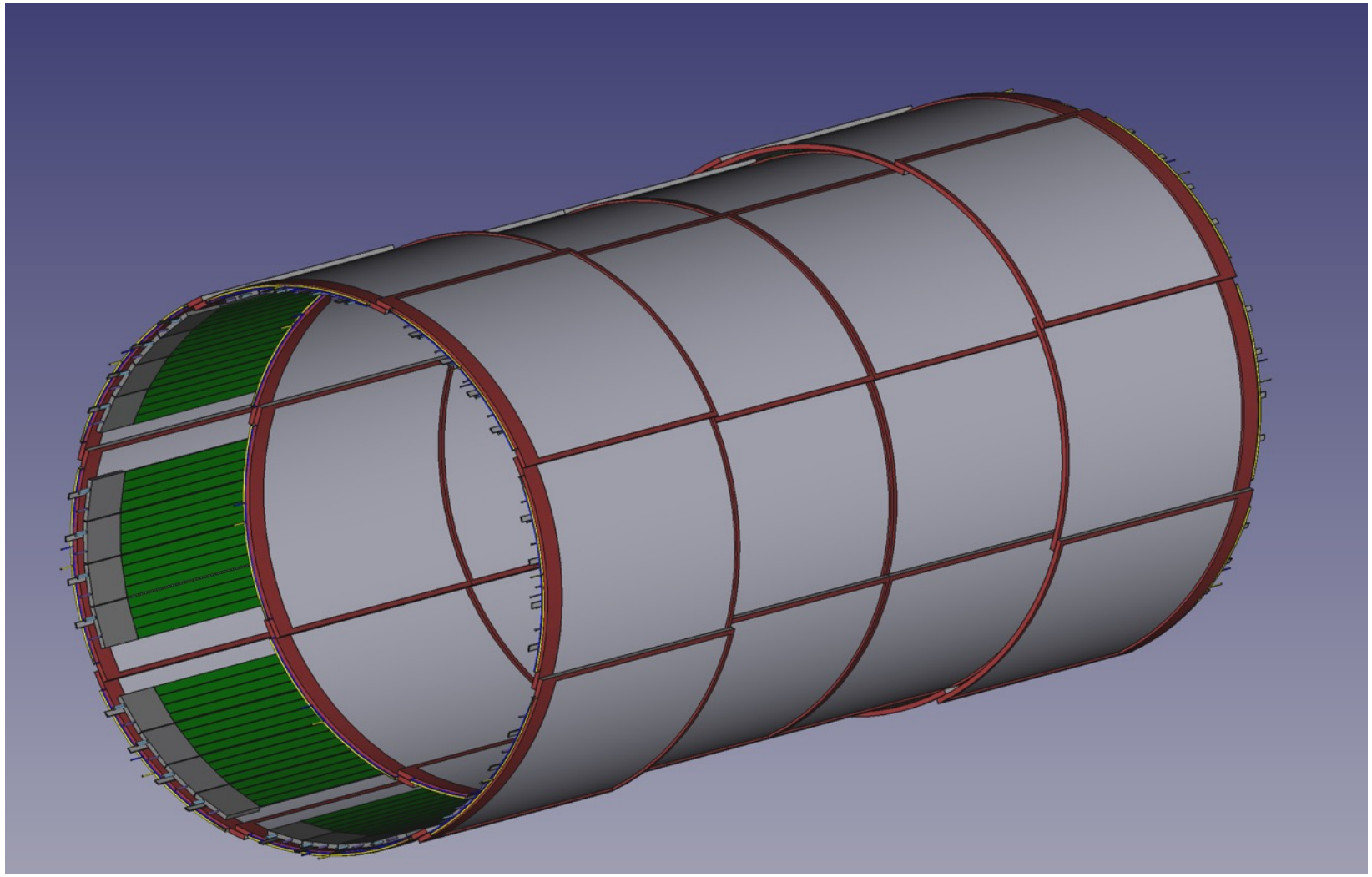

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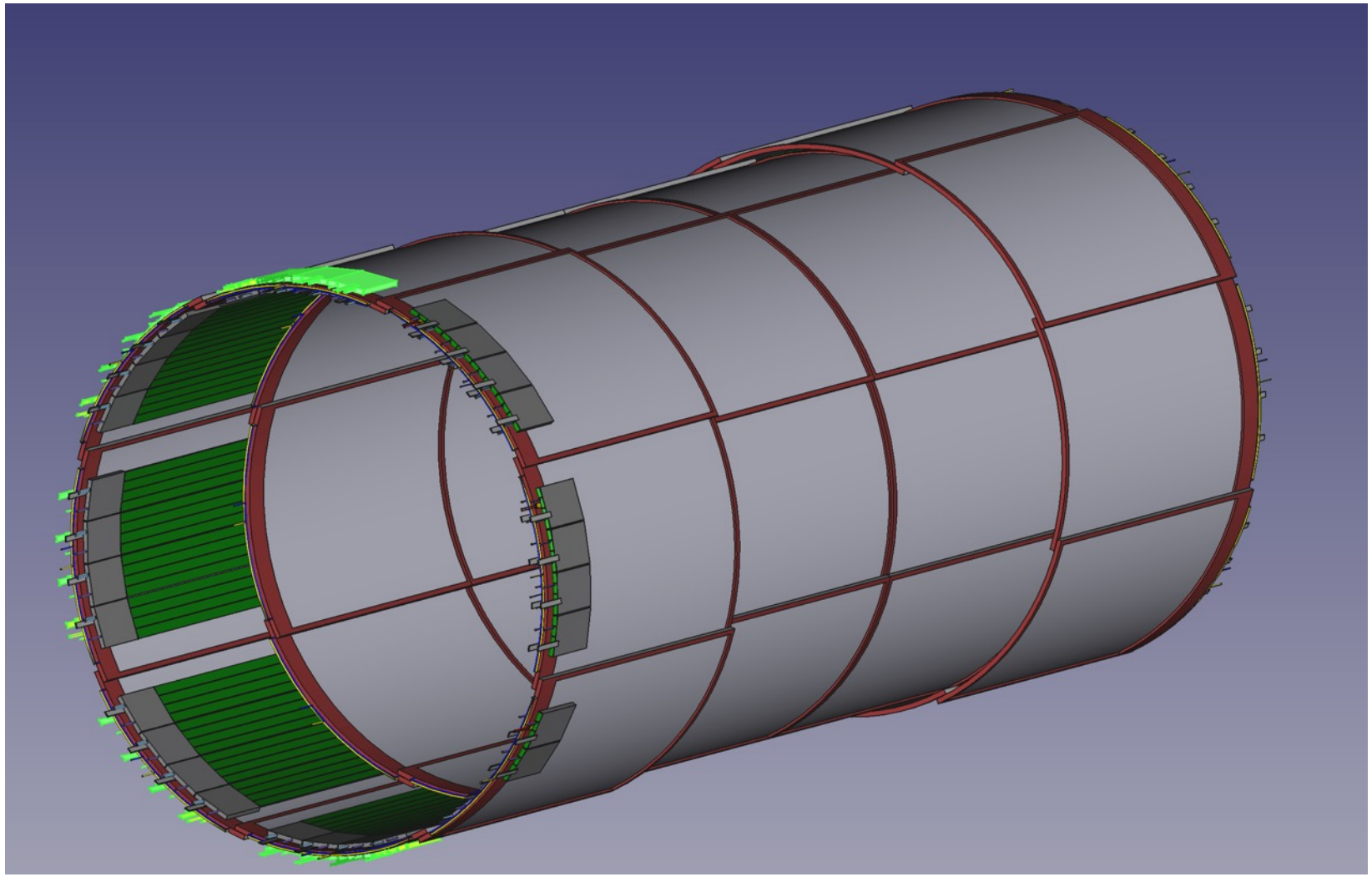

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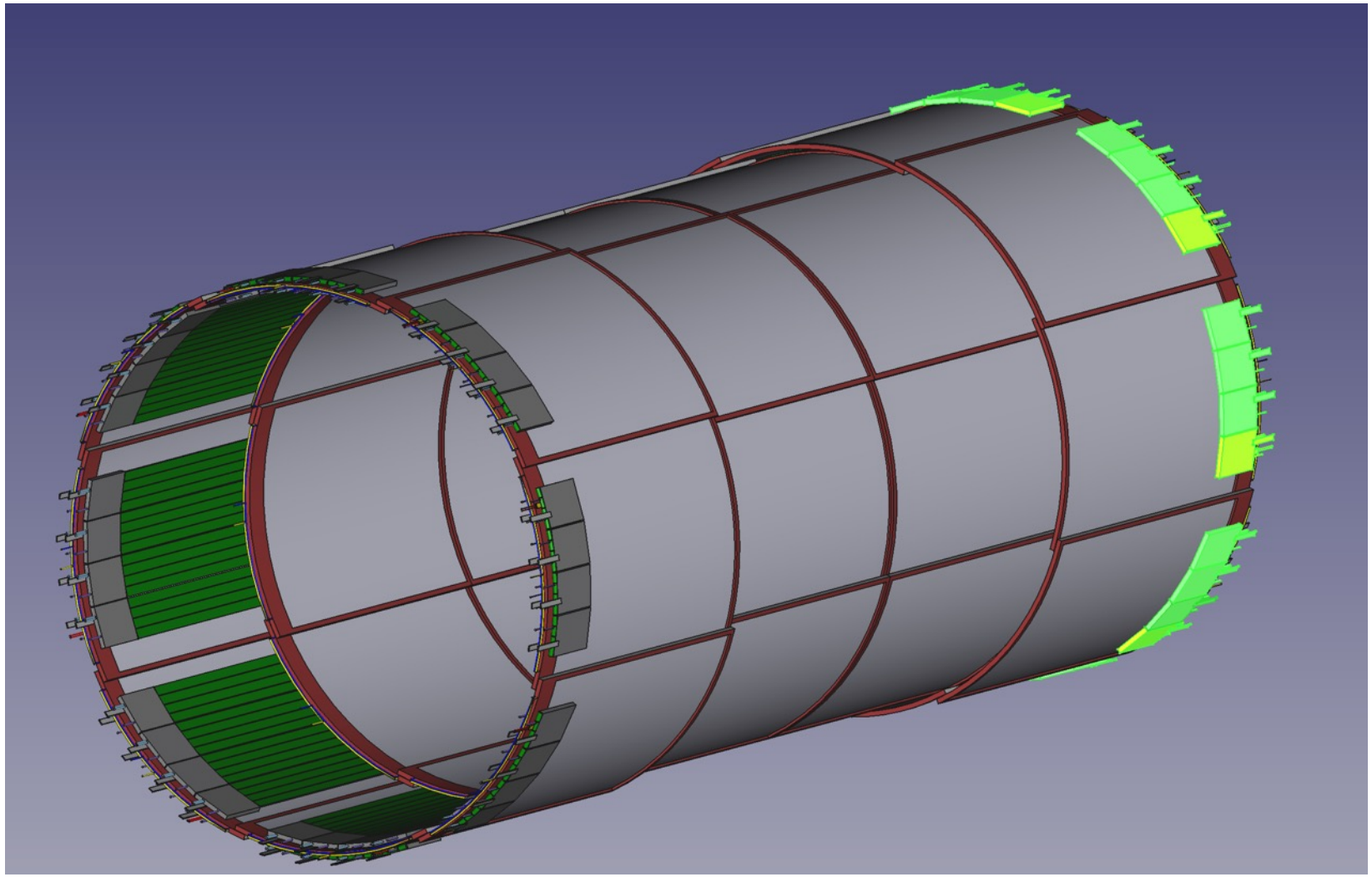
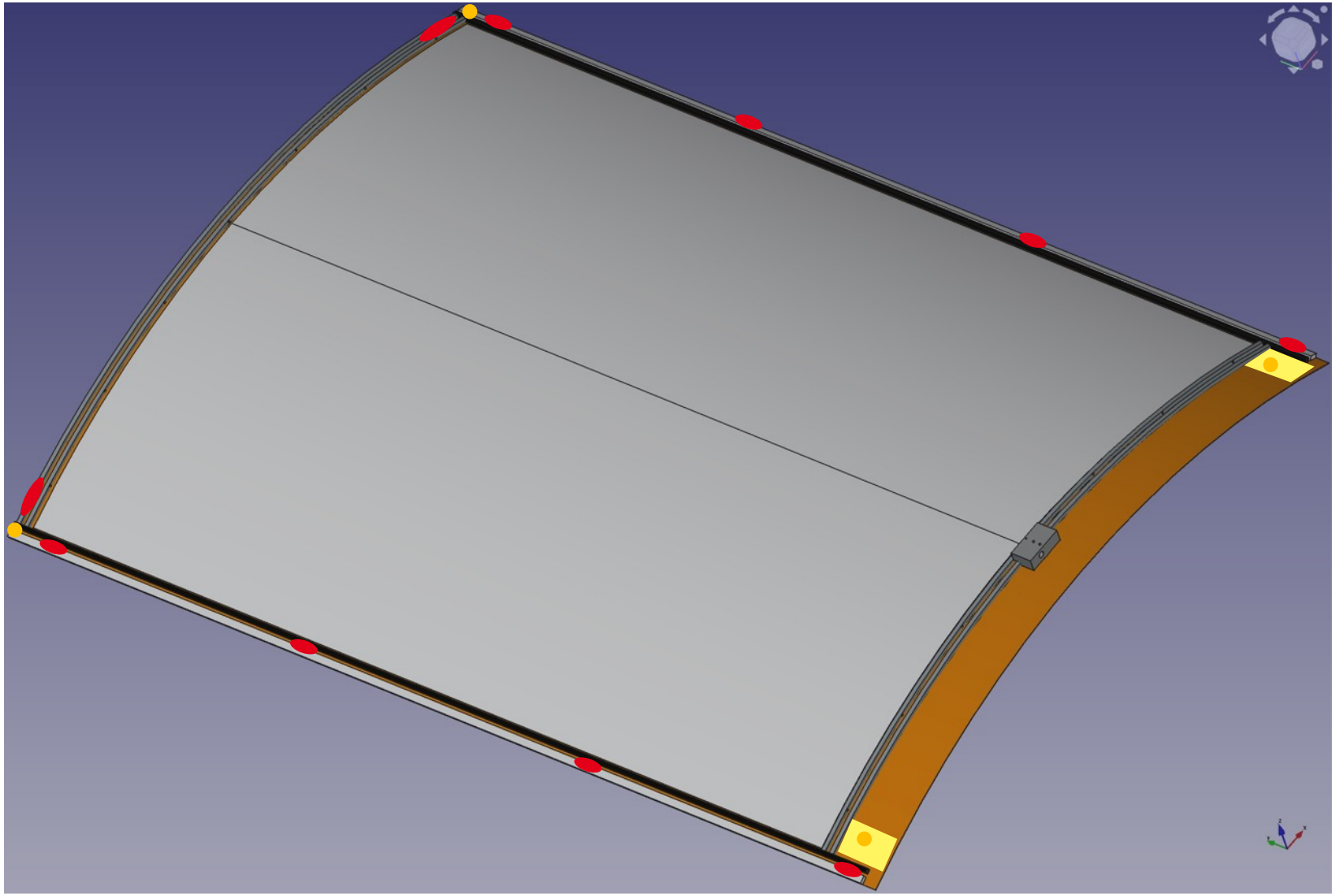


CyMBaL tile baseline design update



- Oblong holes
- Threads
- Areas to use for fixation with holes and threads

+ threads in PST rails (& hoops ?)

CyMBaL – Milestones

- T2/25: Small mechanical prototypes to test connectors vs geometry vs bending
- T3/25: re-manufacturing of RD4 PCB to tune bulk process and prepare test beam

  June 2025 : Seraphin Vetter (mechanical Engineer) joins the team to start :
  → thermal simulations and design of FEB cooling
  → Detailed design of CyMBaL tiles' asssembly & integration in EPIC
- T3/25: new protos design and manufacturing in preparation of november test beam
- T4/25: test beam (several 2D readout tested on flat small size prototypes)
- T4/25: Finalisation design size 1 prototype 0 (GEIC0)
- T1/26: production and test of GEIC0
- T3/26: developement and production of size 1 prototype 1 (GEIC1), including feedback from RDx test beam and GEIC0

F. Jeanneau (Irfu), ePIC EIC Project R&D Day, Apr 16th 2025