

# SCD Meeting

19/09/2022

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A white 3D CAD model of a mechanical part, possibly a bracket or a housing, shown in an isometric view. It has a rectangular base with a vertical wall and a horizontal top surface.

# Mechanical design

INFN

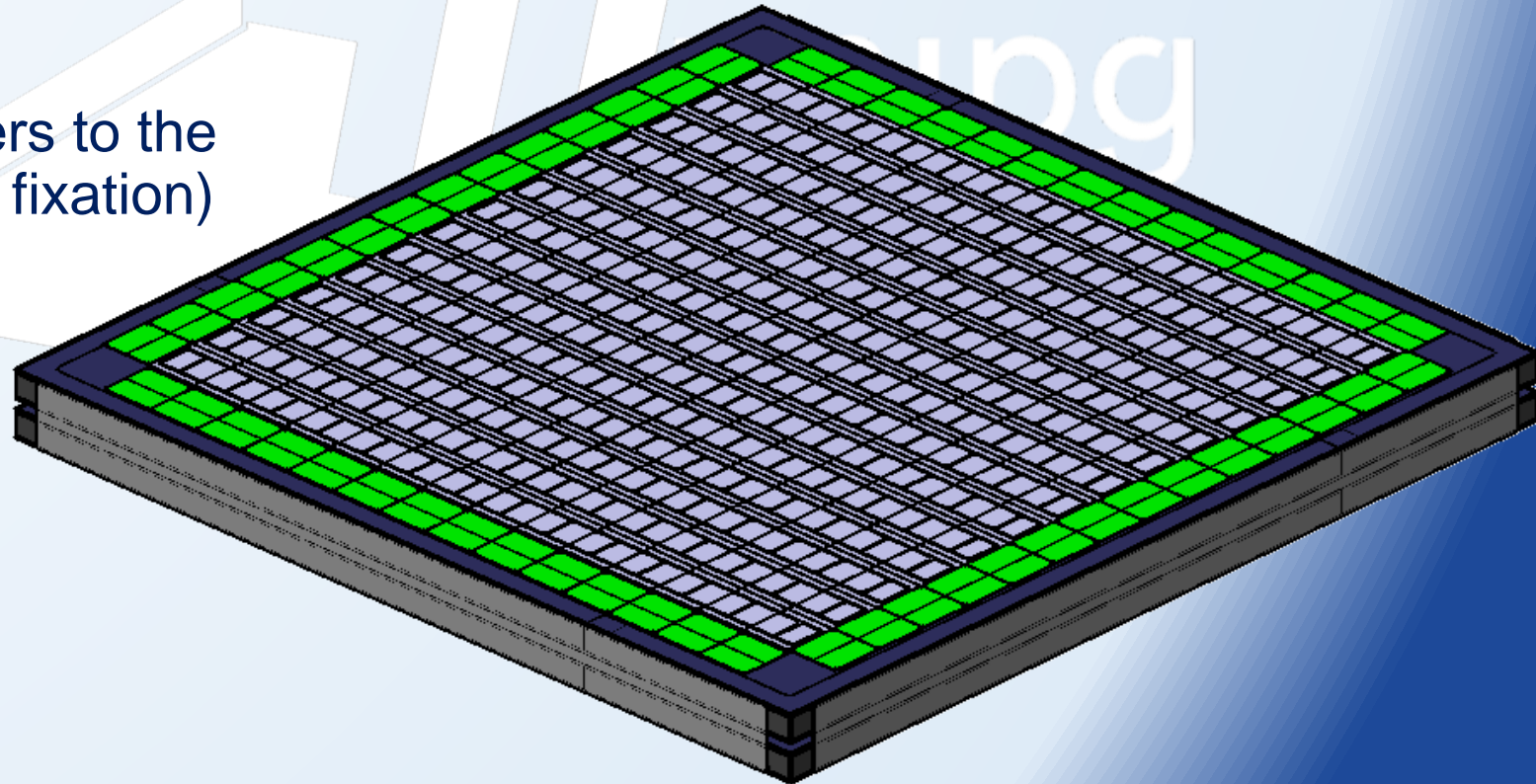
A.D. 1308

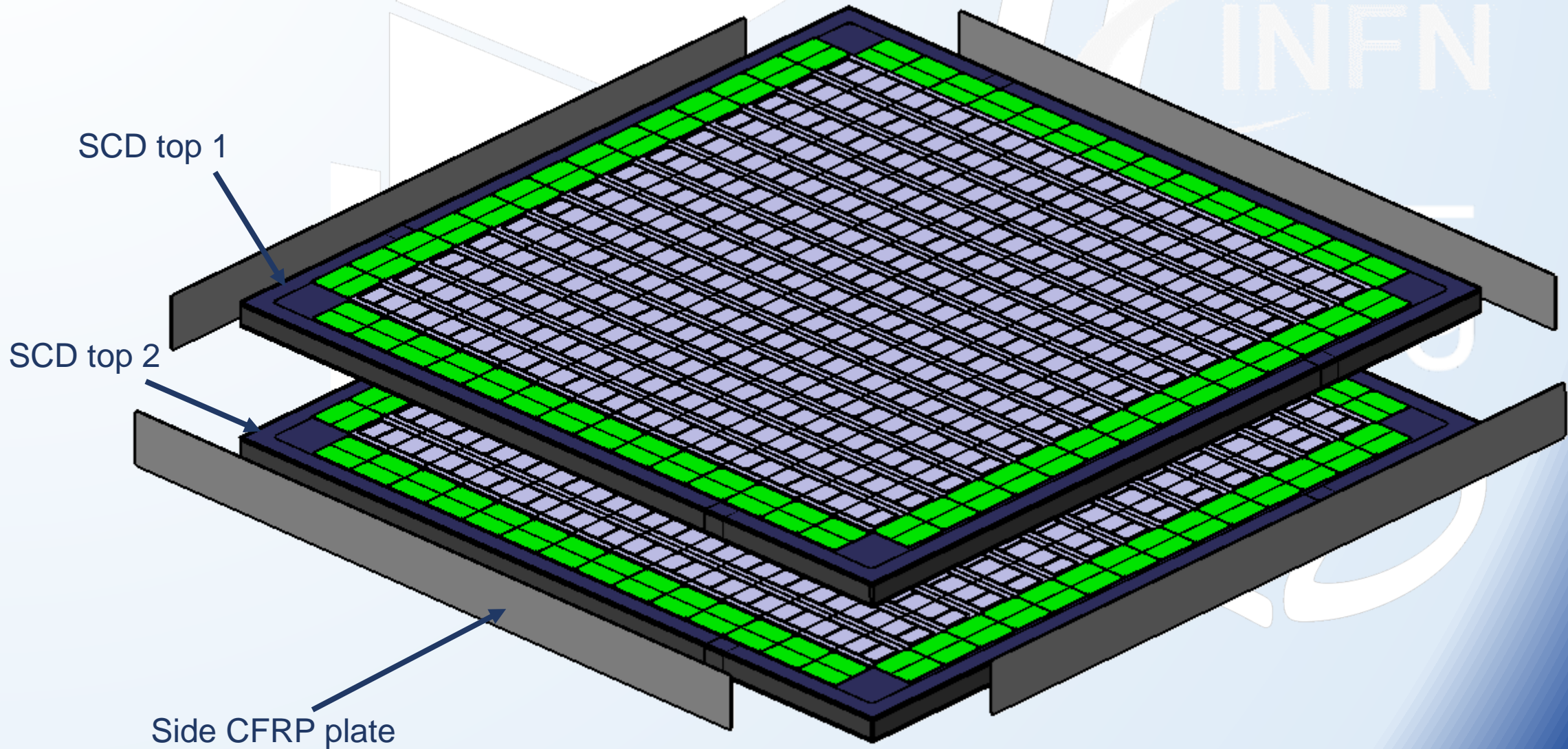
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TERD

## Top plane model:

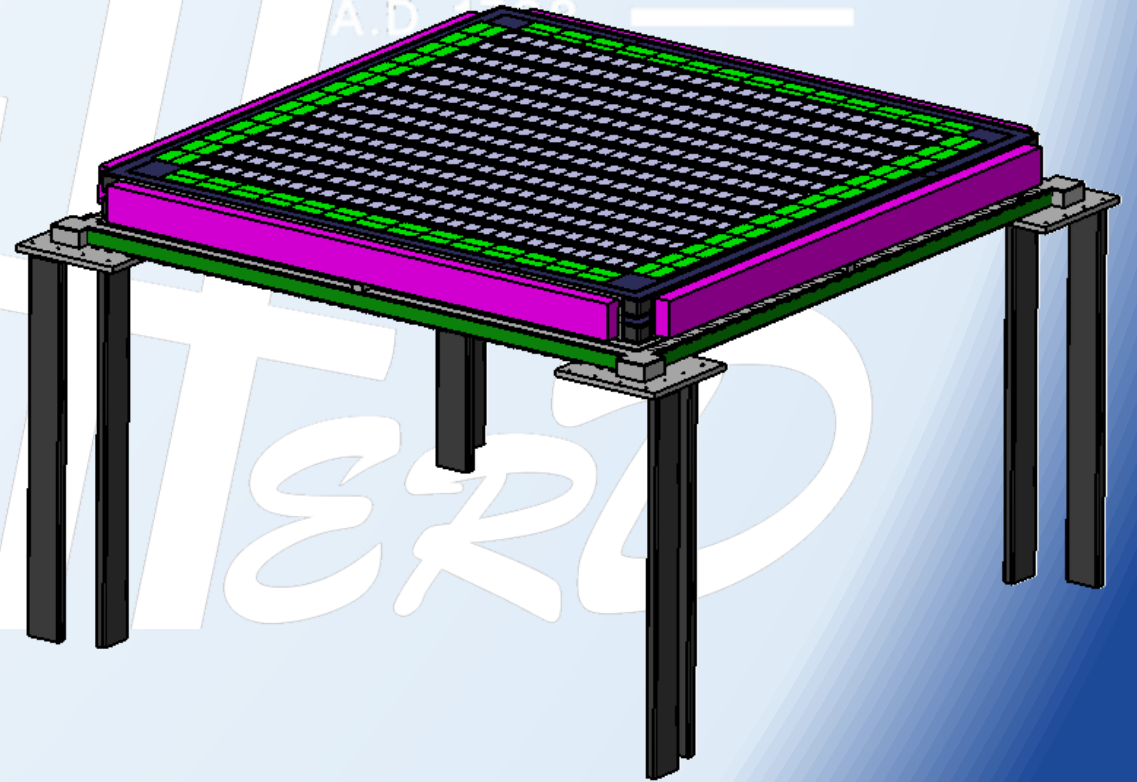
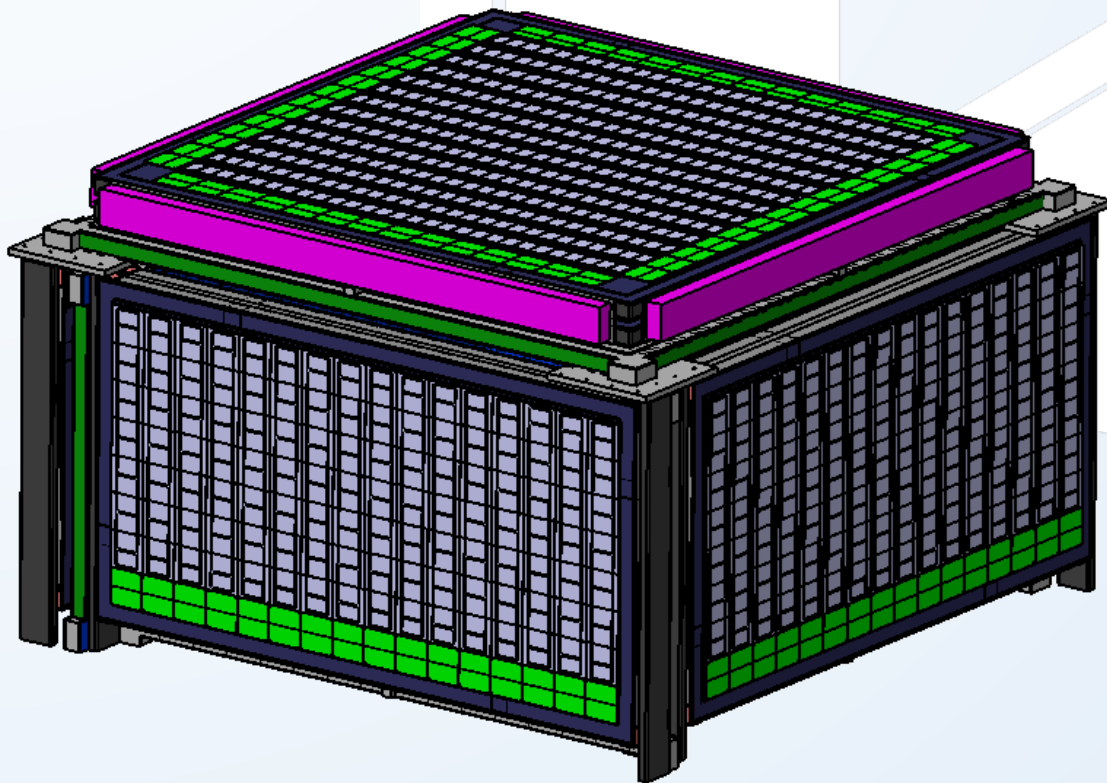
- 1700x1700 mm<sup>2</sup>
- Plane thickness 50 mm
- 2 interconnected planes (laterally constrained together)
- SCD “top pack” fixed on the corners to the supporting structure (DAMPE-like fixation)
- SCD envelope 140 mm





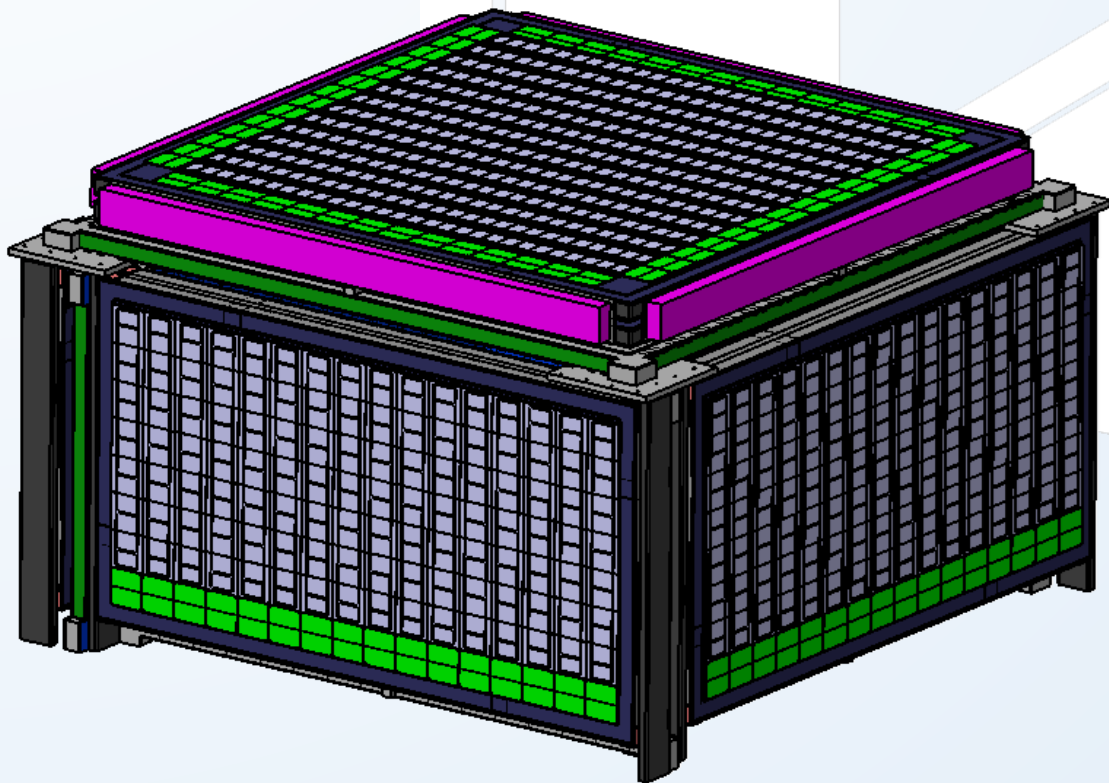
# SCD supporting structure 1/2

Supporting structure. SCD panels fixed together and then connected to the structures on their corners



# SCD supporting structure 1/2

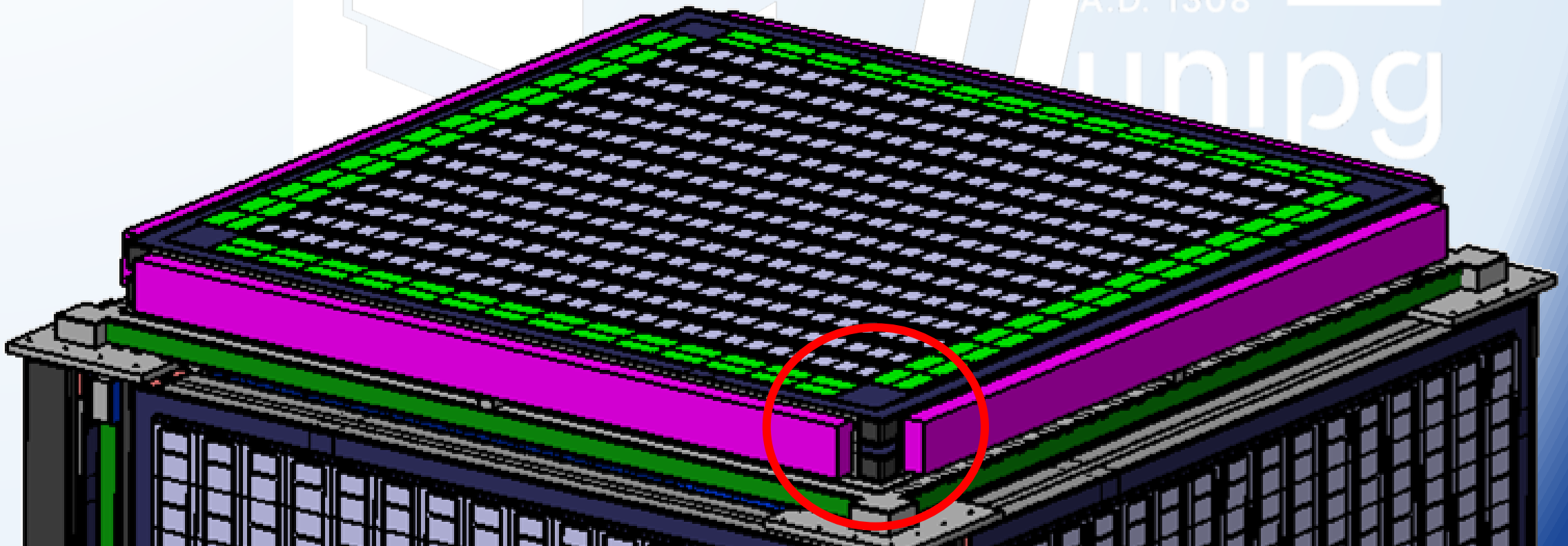
Supporting structure. SCD panels fixed together and then connected to the structures on their corners



- Planes free to deform on their sides (no fixation to the external structure) – To be verified through the complete simulation
- The mechanical load is passed through the supporting structure and not to the SCD lateral planes

# Top-to-the-structure fixation

- Fixation of top SCD to the plates TBD. Required iteration with the PSD team



# Side constraint layout

Plane-to-plane fixation

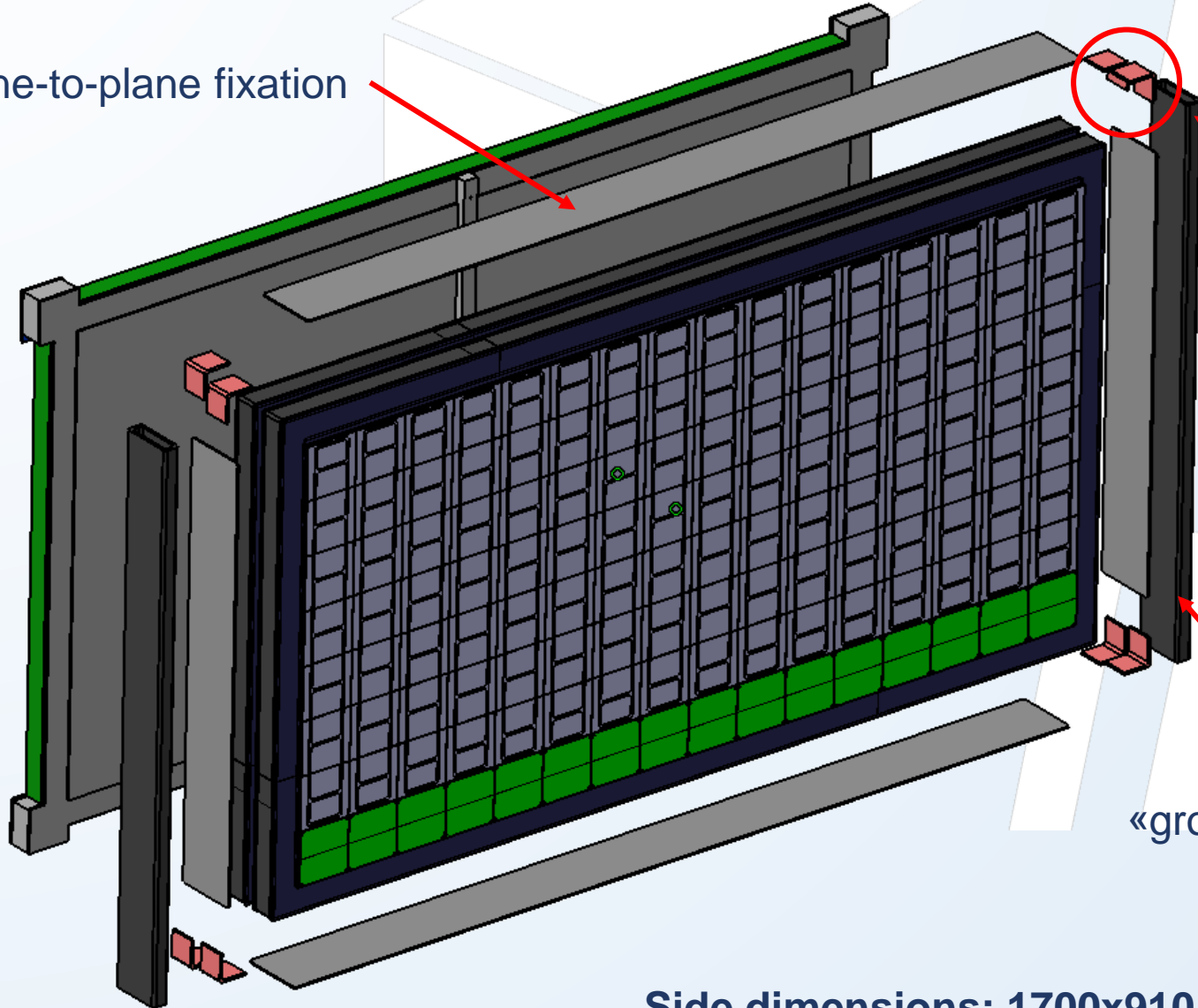
Detector-to-ground fixation

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ERD

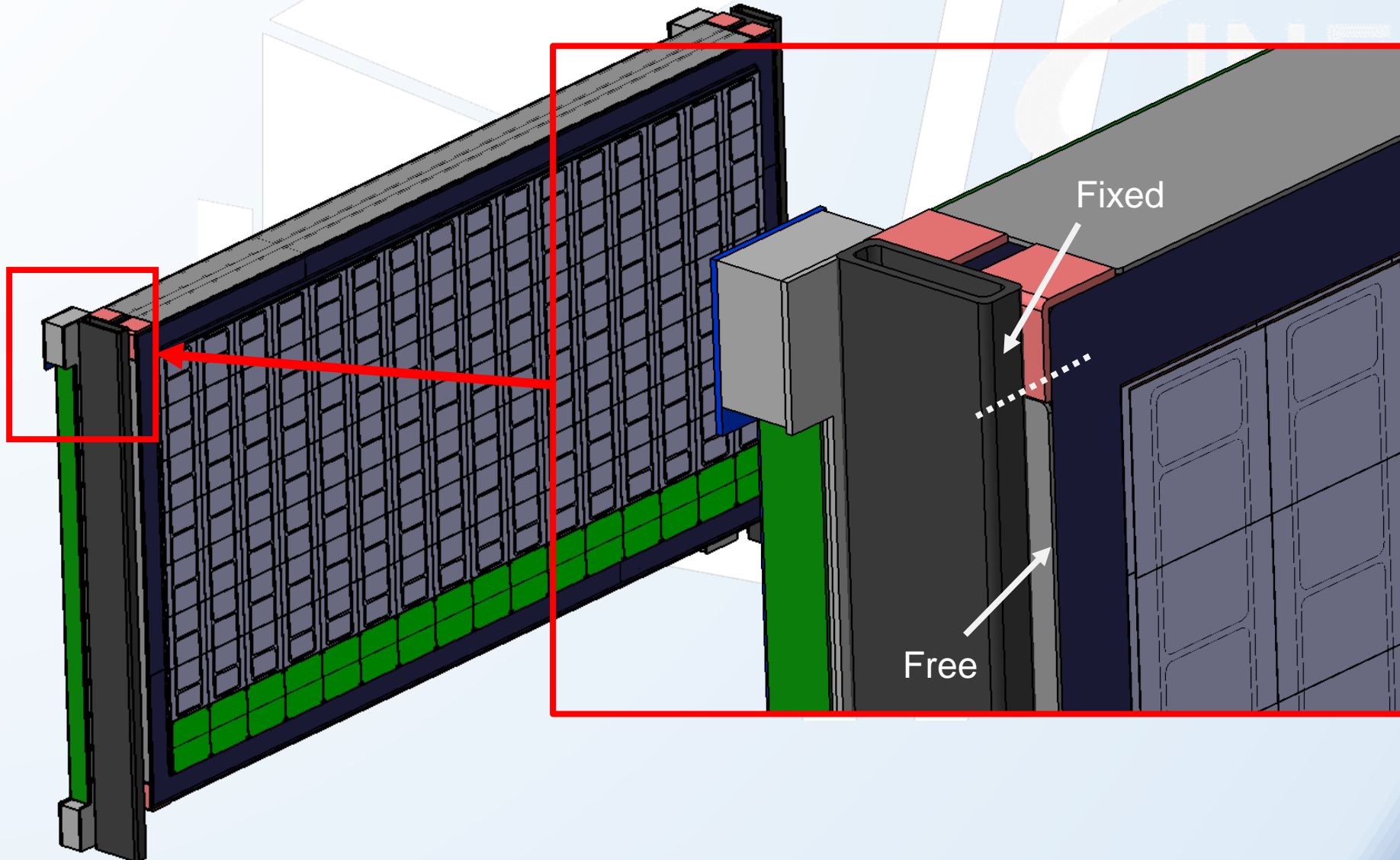
«ground» supporting structure



Side dimensions: 1700x910 mm<sup>2</sup>



# Discussion on the mechanics 4



# Questions

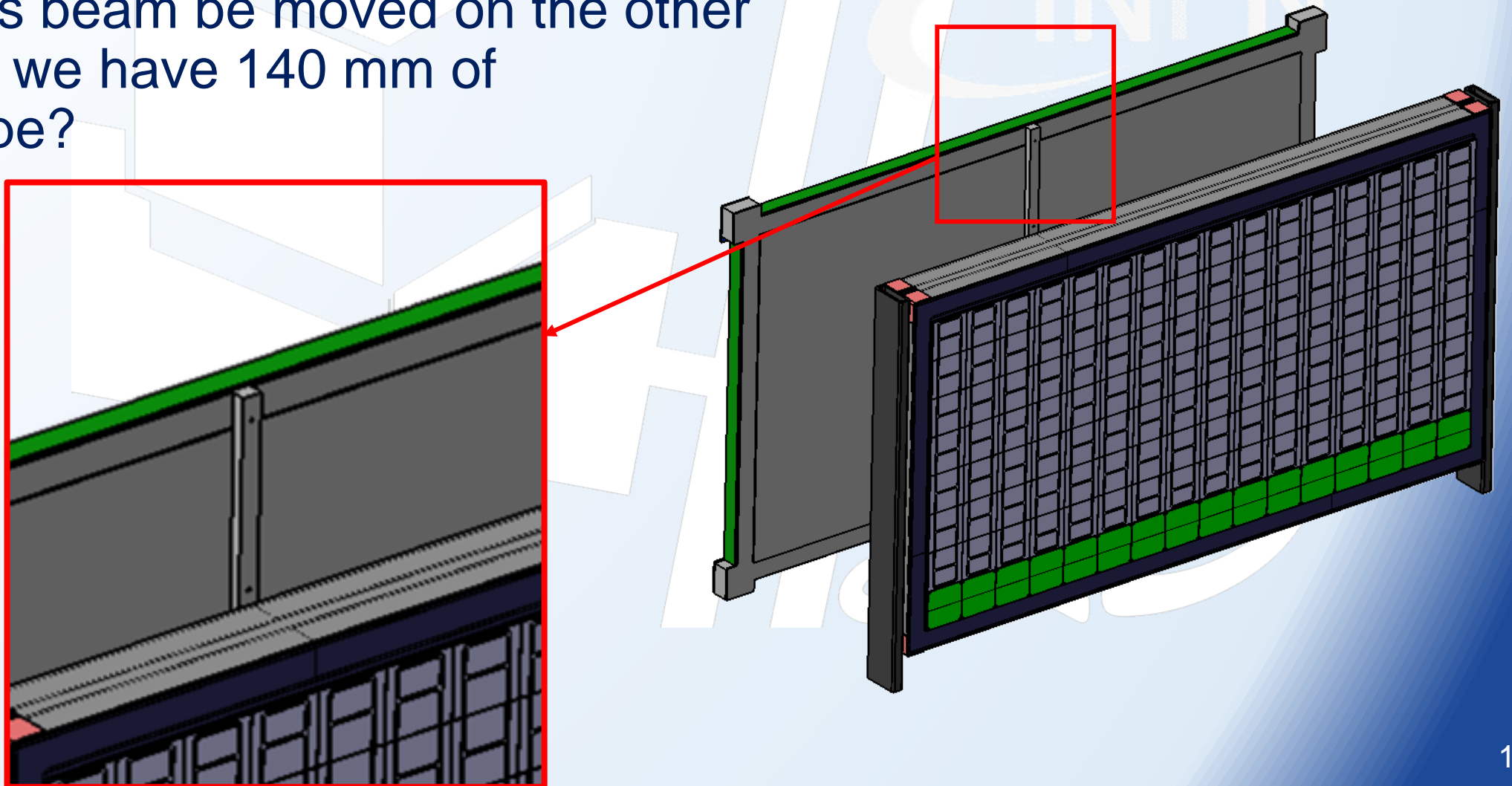


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- Can this beam be moved on the other side so we have 140 mm of envelope?



# Mechanical loads and design

- Do we know the loads to be applied to the structure?

Being more specific, we should need the load which are foreseen on the whole experiment. We would like to apply this load to the SCD supporting structure

# Simulation



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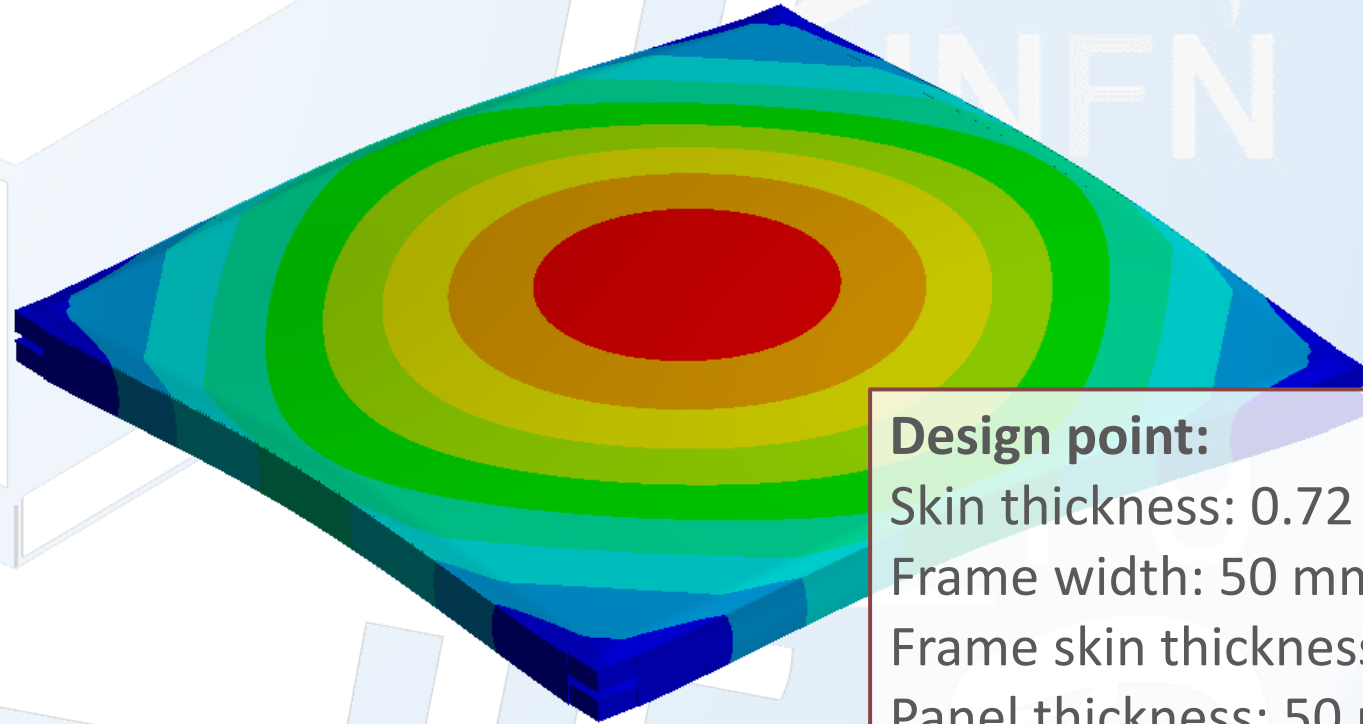
2 simulations were performed:

1<sup>st</sup> simulation:

- Nodes = 249318
- Elements = 121508
- CFRP skin - surface elements (ACP)
- CFRP frame - surface elements (ACP)
- Honeycomb core – solid object
- 1<sup>st</sup> natural frequency = 94.49 Hz
- Max deformation = 0.864 mm

2<sup>nd</sup> simulation, simplified:

- Nodes = 7328
- Elements = 6514
- CFRP skin + Core - surface elements (ACP)
- CFRP frame – beam elements, constant properties
- 1<sup>st</sup> natural frequency = 94.37 Hz
- Max deformation = 0.866 mm



**Design point:**  
 Skin thickness: 0.72 mm  
 Frame width: 50 mm  
 Frame skin thickness: 2 mm  
 Panel thickness: 50 mm

Sim	1 <sup>st</sup> resonance	Error	Max. def.	Error
Full	94.49 Hz	-	0.846 mm	-
Simplified	94.37 Hz	0.12%	0.866	2.36%

# Mechanical parameters

- **Skin thickness:** 0.72 mm – constrained by physics (material budget)
- **Frame width:** 50 mm - constrained by physics (detective area)
- **Frame skin thickness:** 2 mm – constrained by manufacturing
- **Panel thickness:** 50 mm – constrained by the envelope dimensions

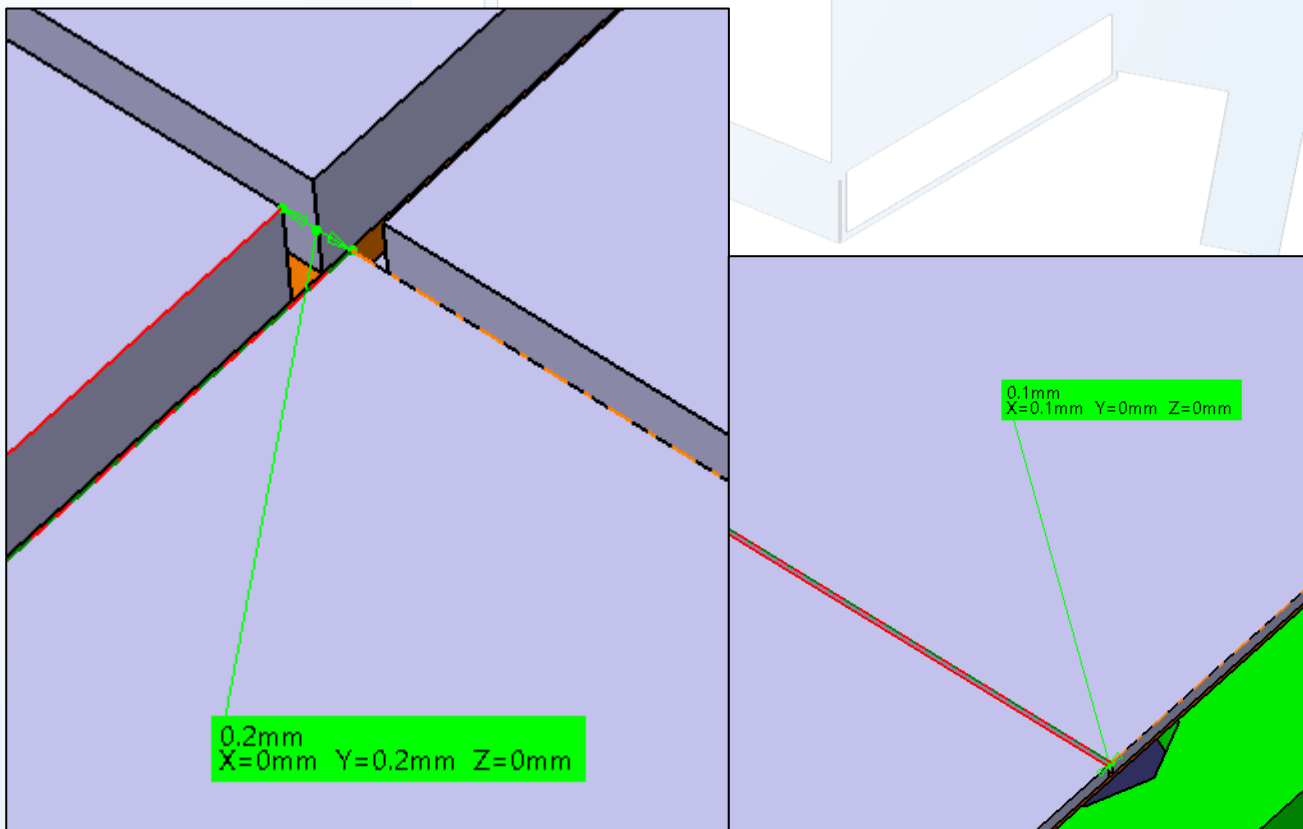
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# Silicon positioning and quantity



Side	LinesxRows	Total
Top	(14x14x4)	784
Side	(16x7x4)x4	1792

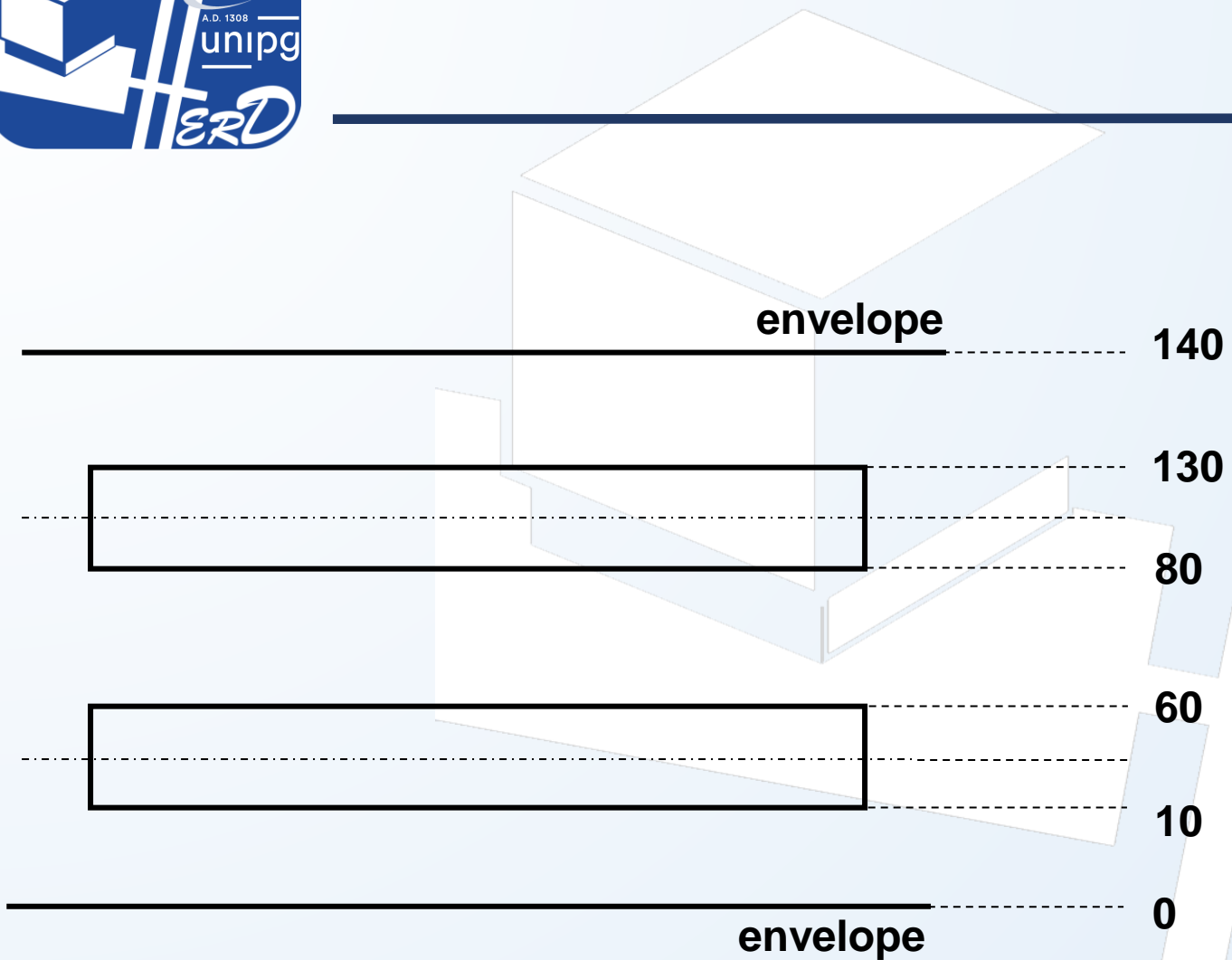


Total: 2576 silicon tiles

## Note:

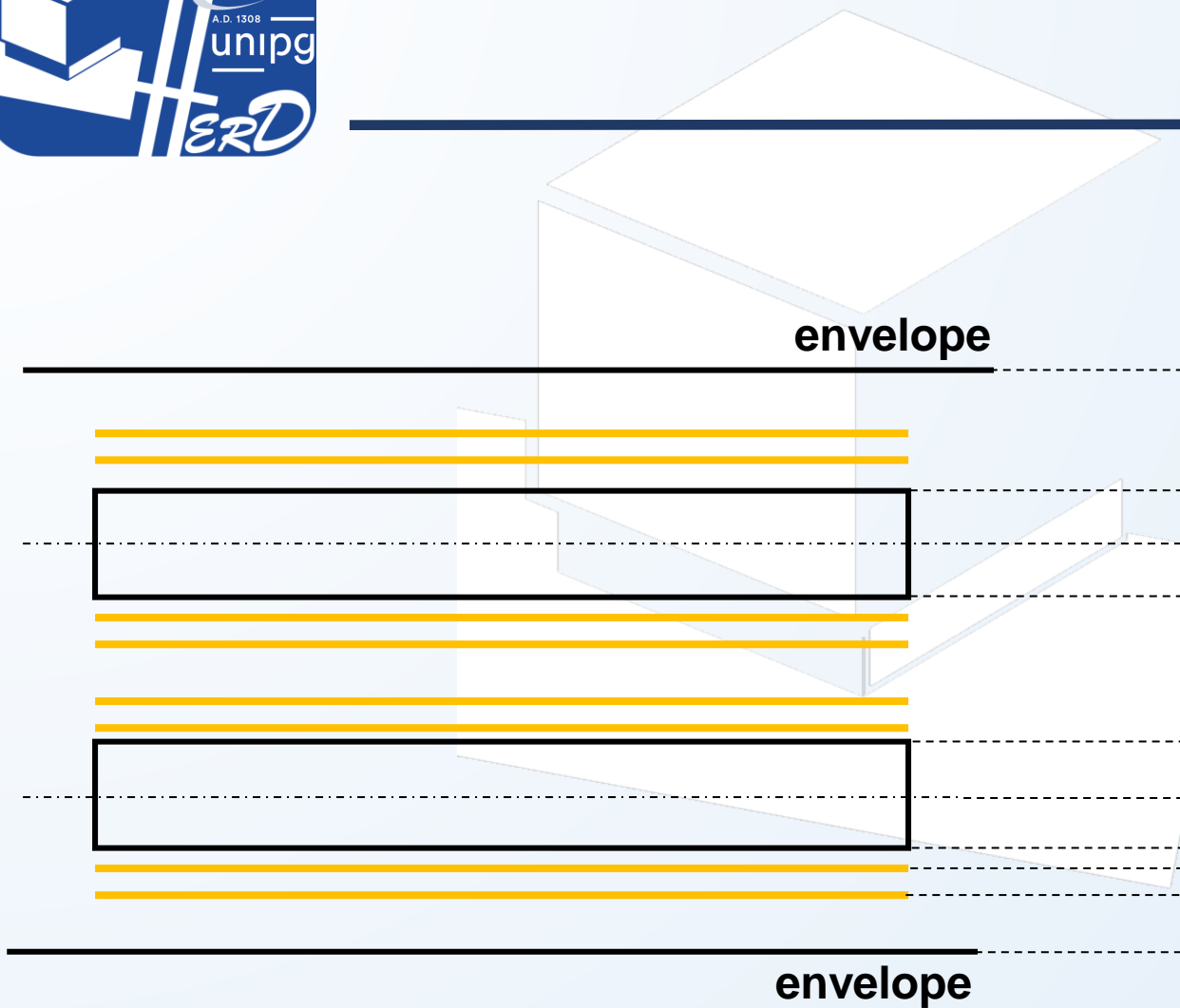
- Considered silicon size: **100 x 100 mm<sup>2</sup>**
- Considered front end size: **100 x 100 mm<sup>2</sup>**
- Distance between same-ladder silicons: **.1 mm**
- Distance between ladders: **.2 mm**

# Silicon positions

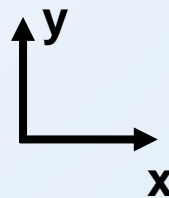


**!All units are in mm!  
Not in scale!**

# Silicon positions

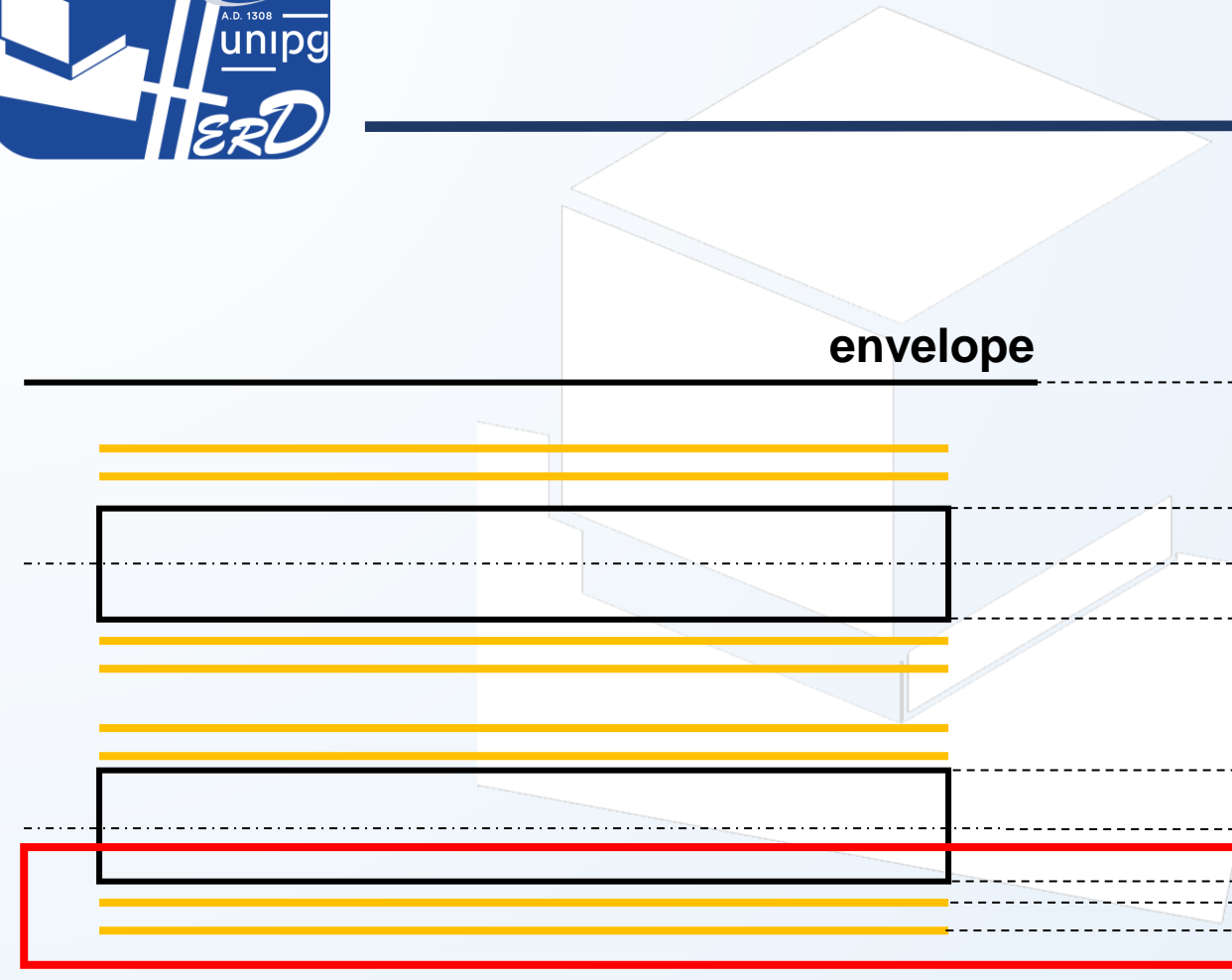


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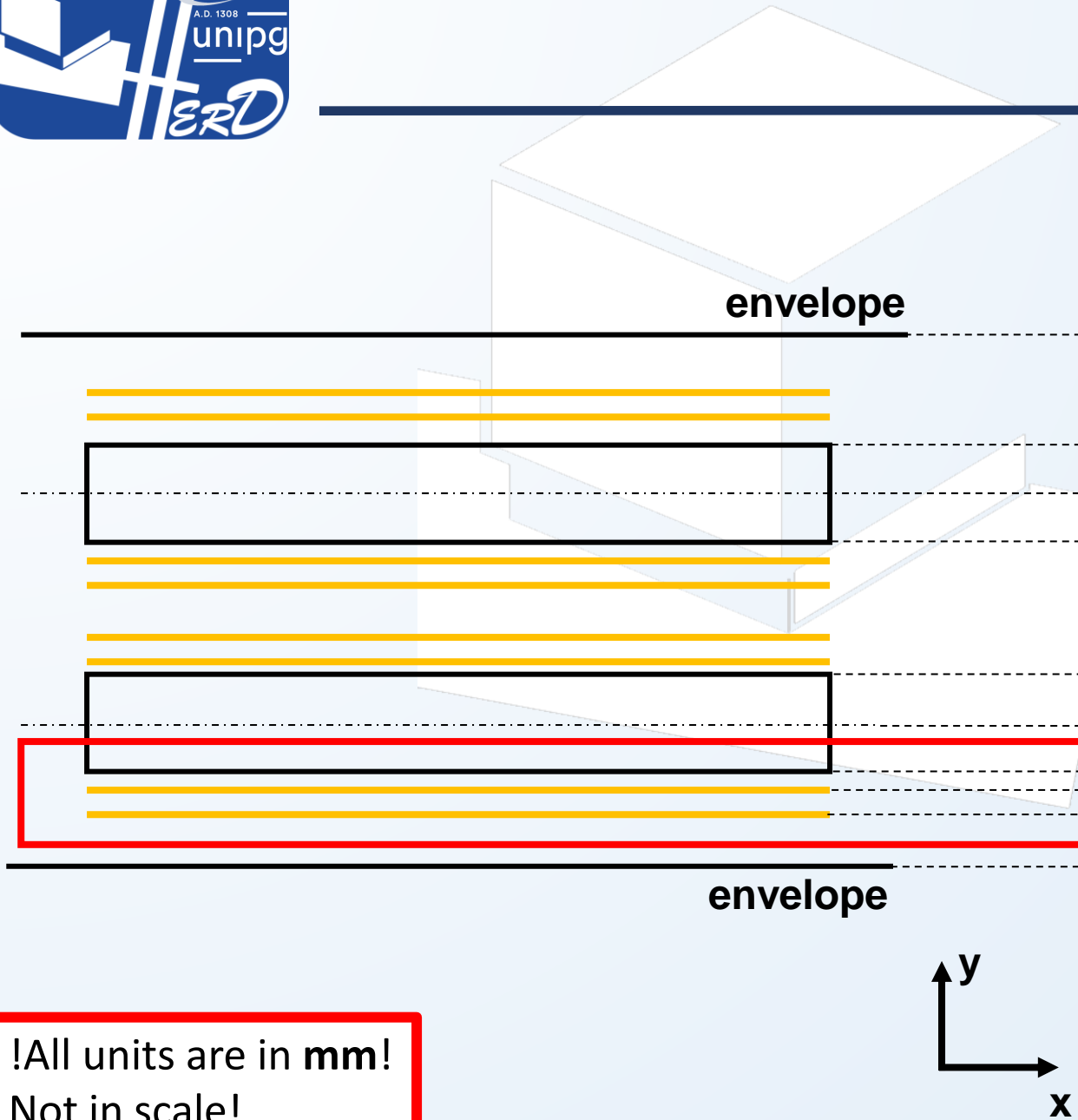
**!All units are in mm!  
Not in scale!**

# Silicon positions



**!All units are in mm!  
Not in scale!**

# Silicon positions



For what concerns the positioning of the SCD planes inside the experiment, refer the file: «DetectiveSCDSurfaces.stp»

**!All units are in mm!  
Not in scale!**

## Question

- Which are the qualification loads to be applied to the full object/subproducts?
- Can PSD stiffener be removed?

## Future work

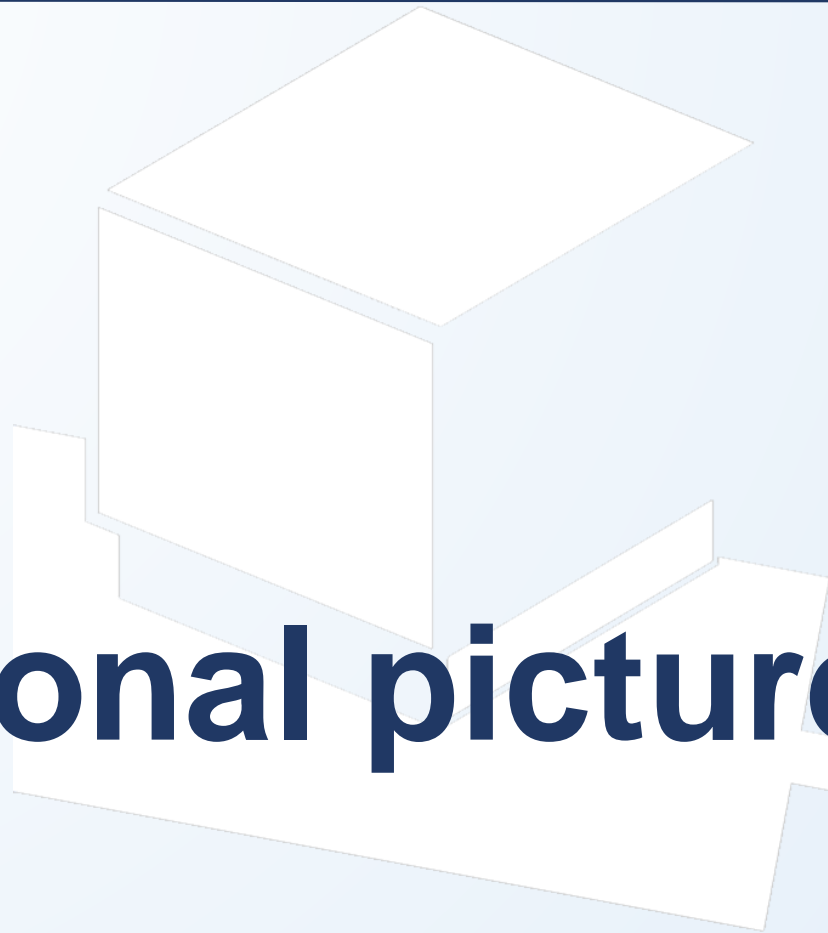
- Iteration with PSD to proceed
- Silicon mechanical characterization
- Full simplified simulation
- Airex mechanical analysis and tests

## Low priority

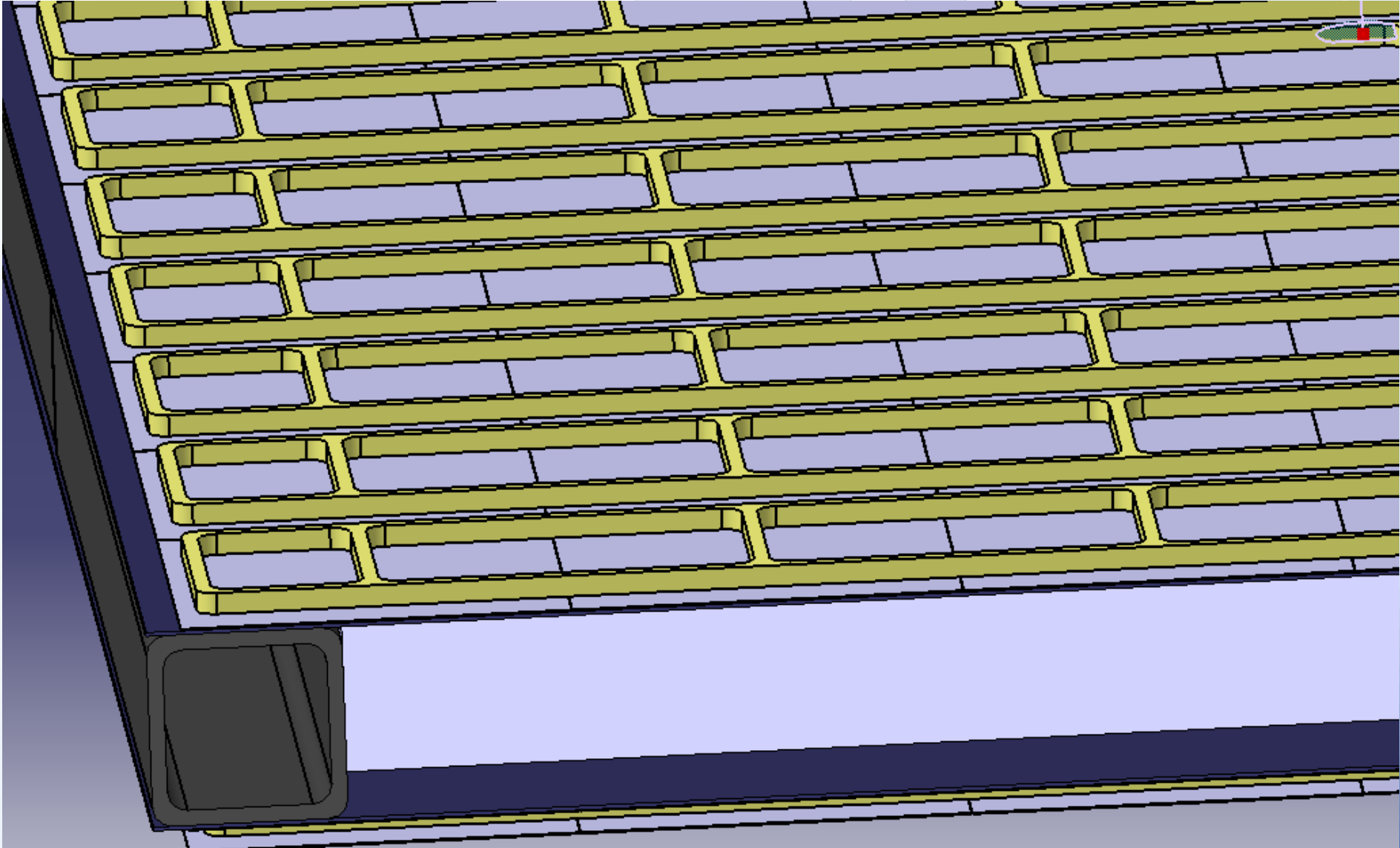
- Thermal distortion

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# Additional pictures

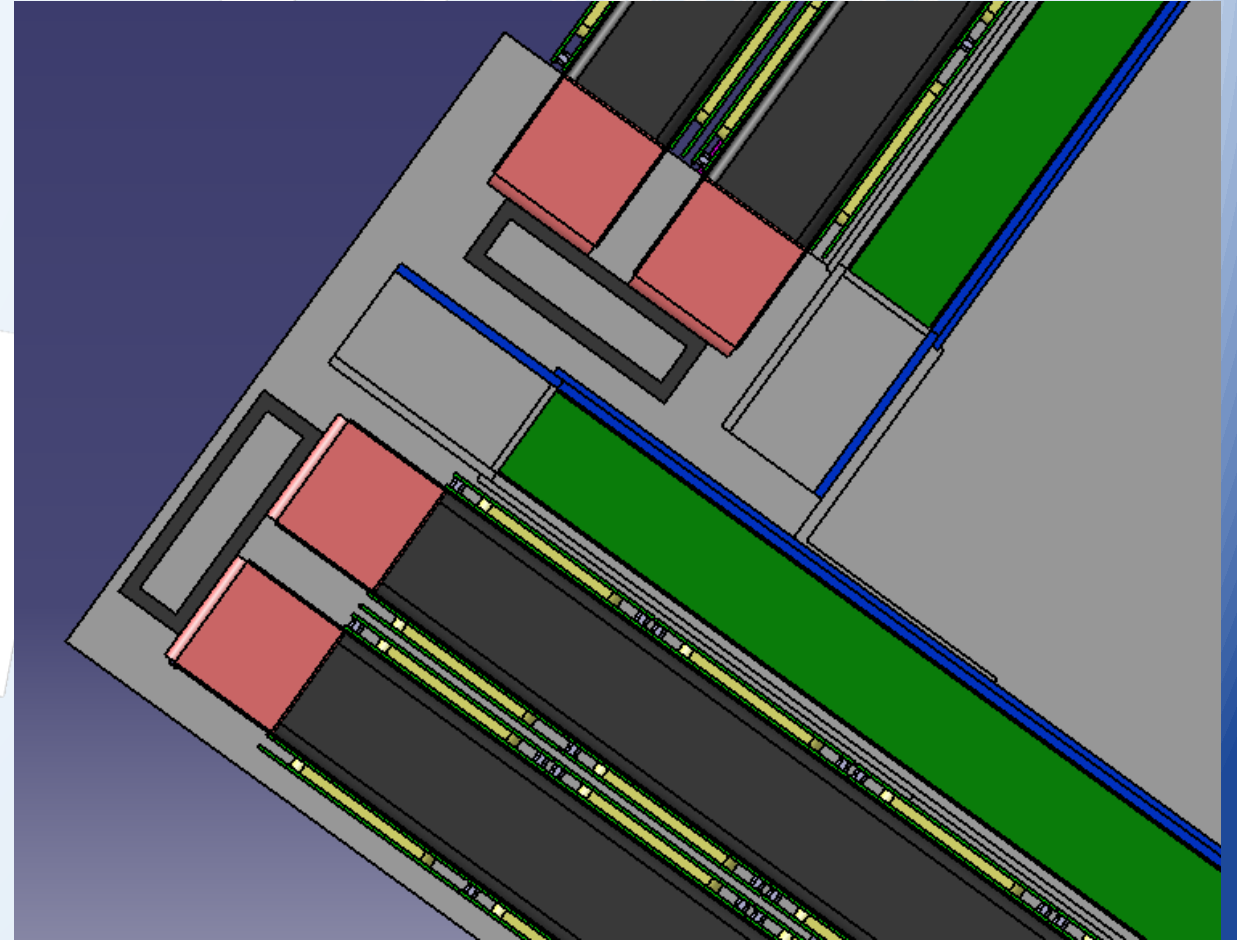
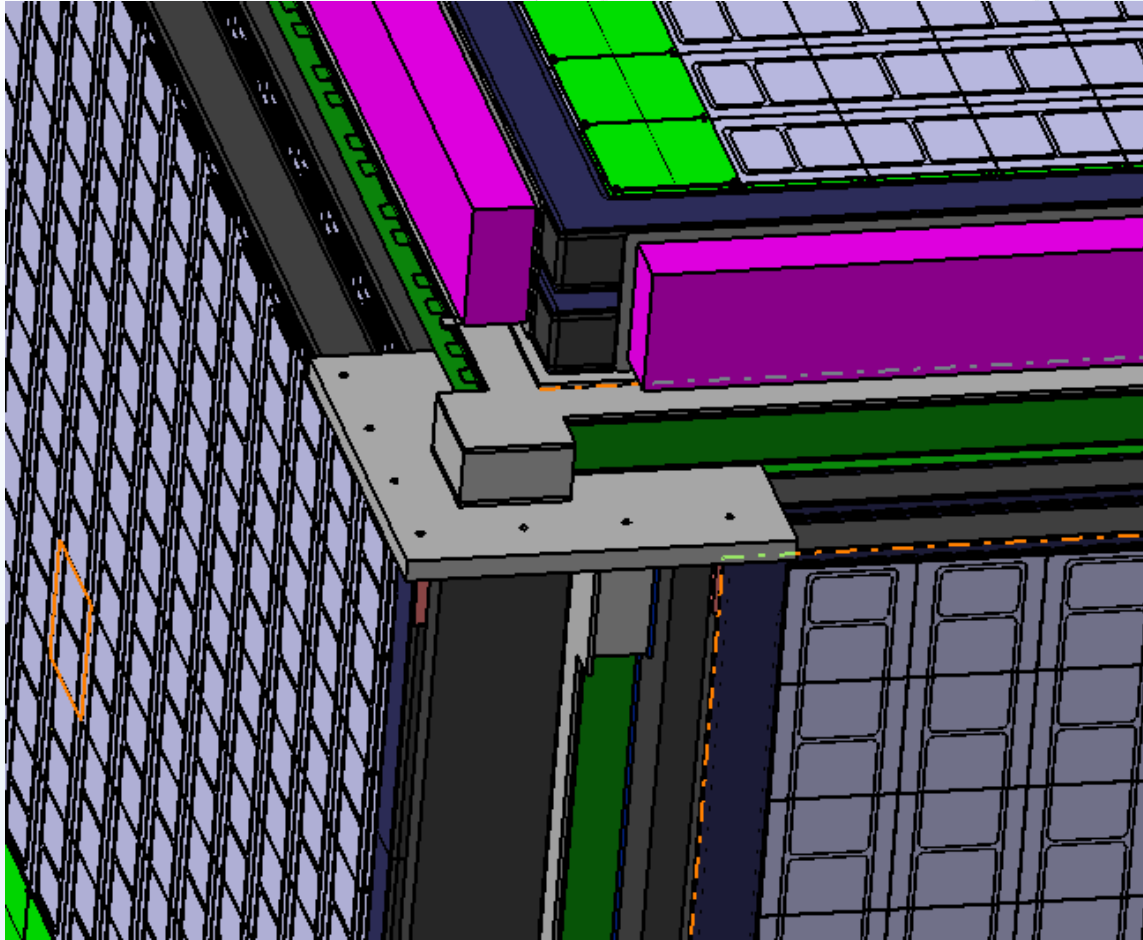


# Discussion on the mechanics 2





# Discussion on the mechanics 3



**Thanks for the attention!**

