HERD – SCD meeting

Updates on the SCD design and simulation

05/12/2022

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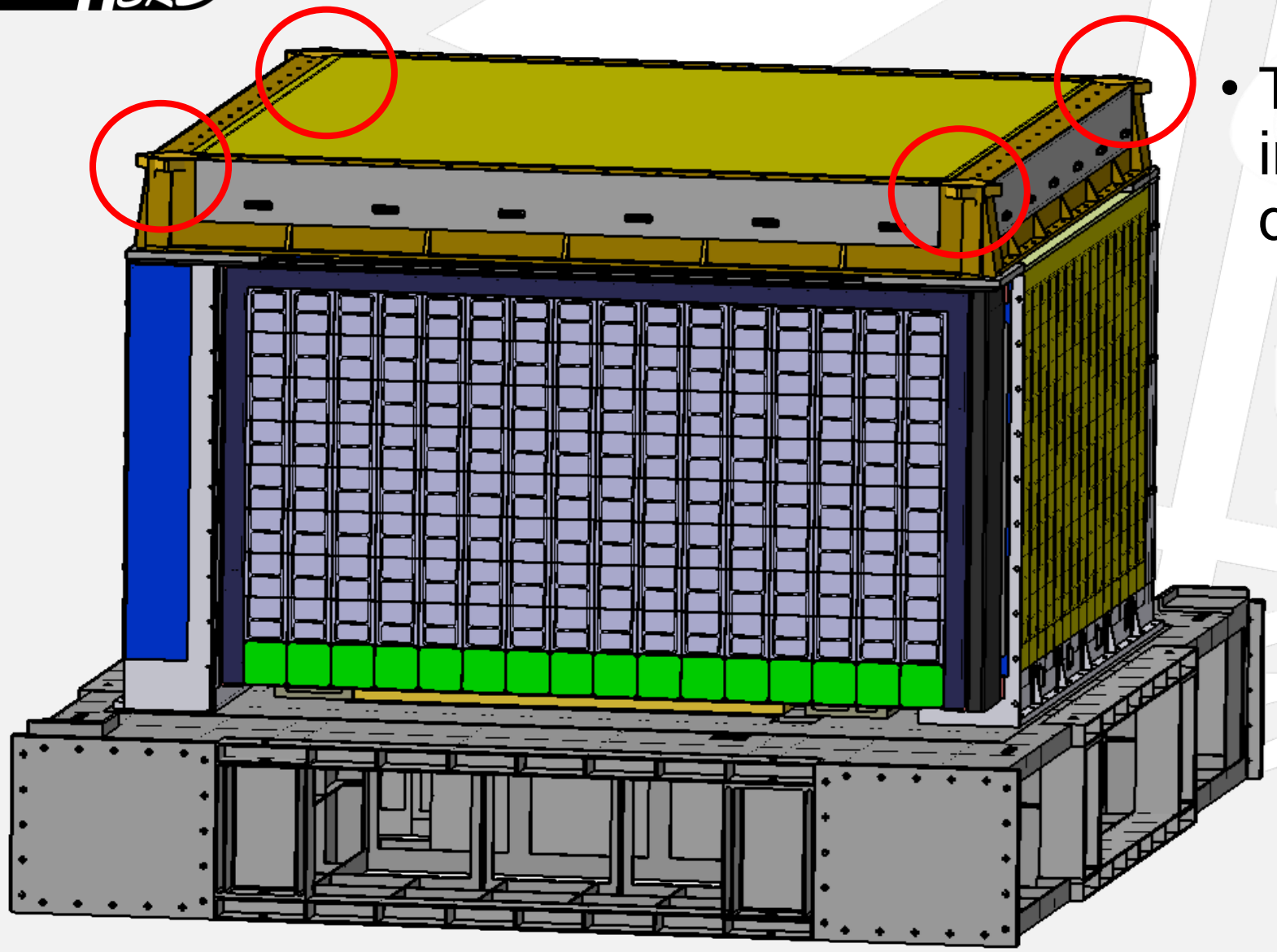
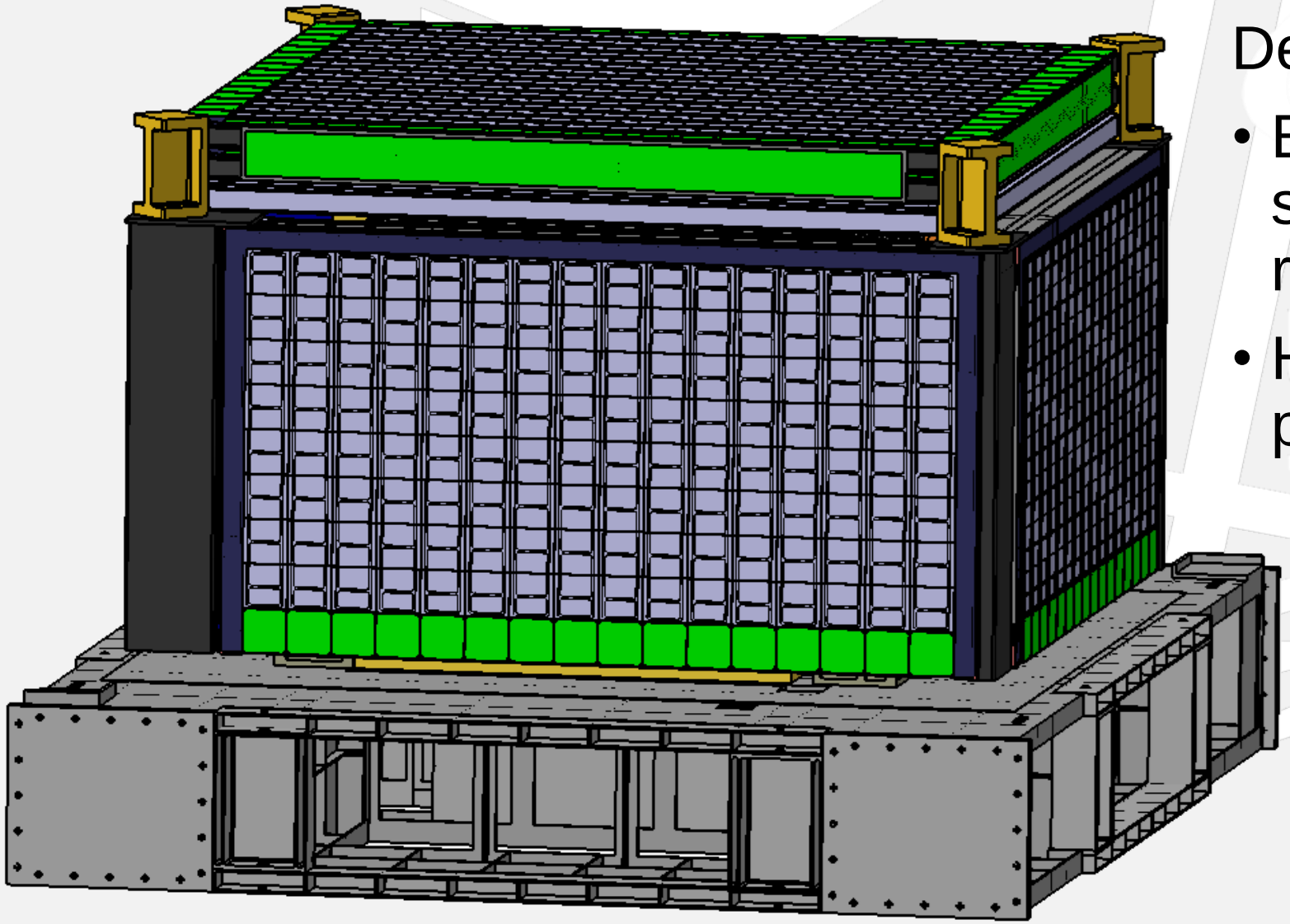
Design updates - overall

Design updates - overall



- The proposed design is included in the previous design's envelope

Design updates - overall



Design assumptions:

- External cover and debris shield are IHEP responsibility
- HERD design team also provides a heat sink

Design updates - overall

Plane	No. of silicon tiles X*	No. of silicon tiles Y*
Top pack, top plane	256 + 256	256 + 256
Top pack, bot plane	256 + 256	256 + 256
Total:	**1024**	**1024**
Side pack 1, int plane	128 + 128	128 + 128
Side pack 1, ext plane	128 + 128	128 + 128
Total:	**512**	**512**
Side pack 2 same as side pack 1	-	-
Side pack 2 same as side pack 1	-	-
Side pack 3 same as side pack 1	-	-
Side pack 4 same as side pack 1	-	-

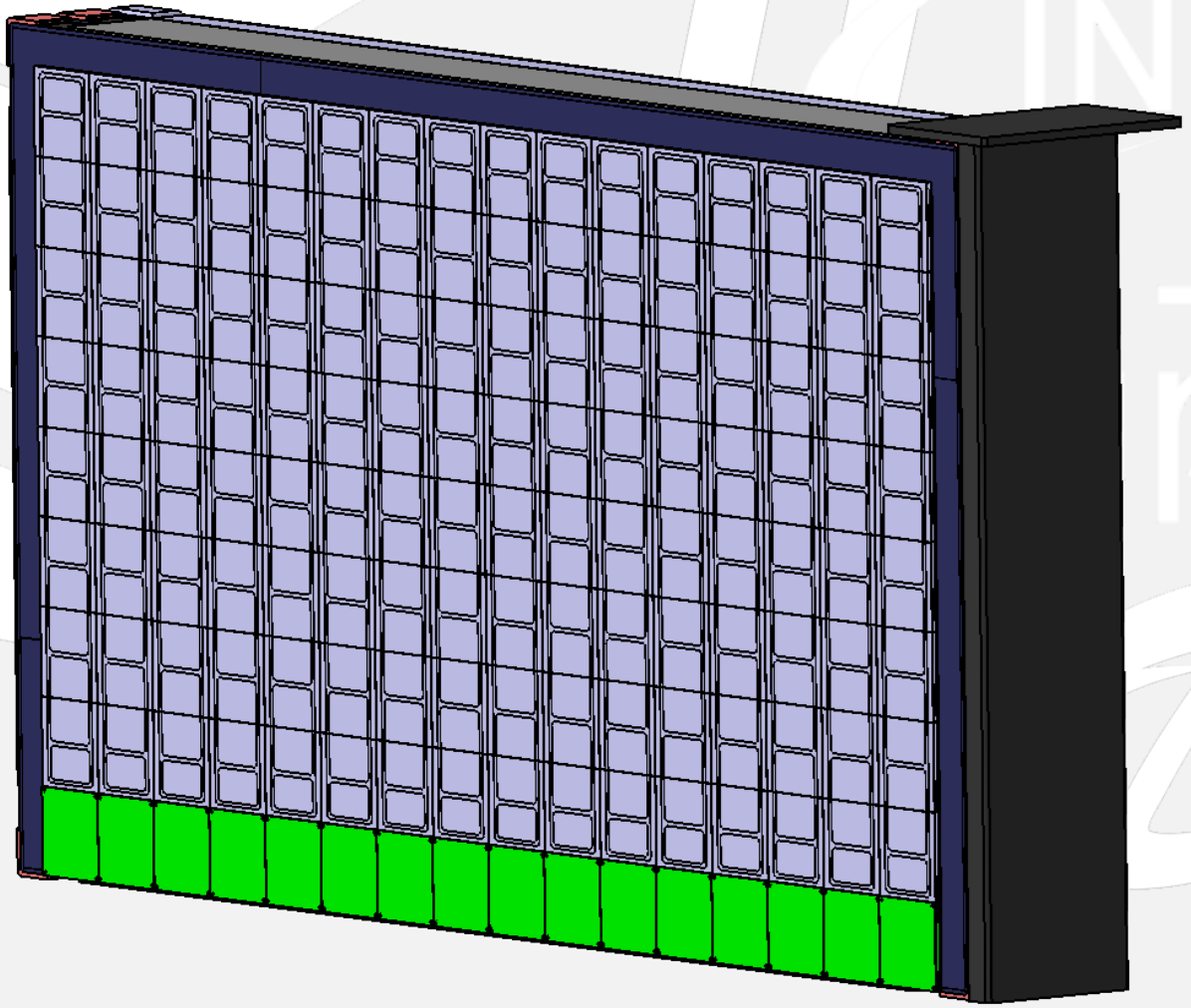
Total number of tiles: 6144

Tile dimensions 100x100 mm^2

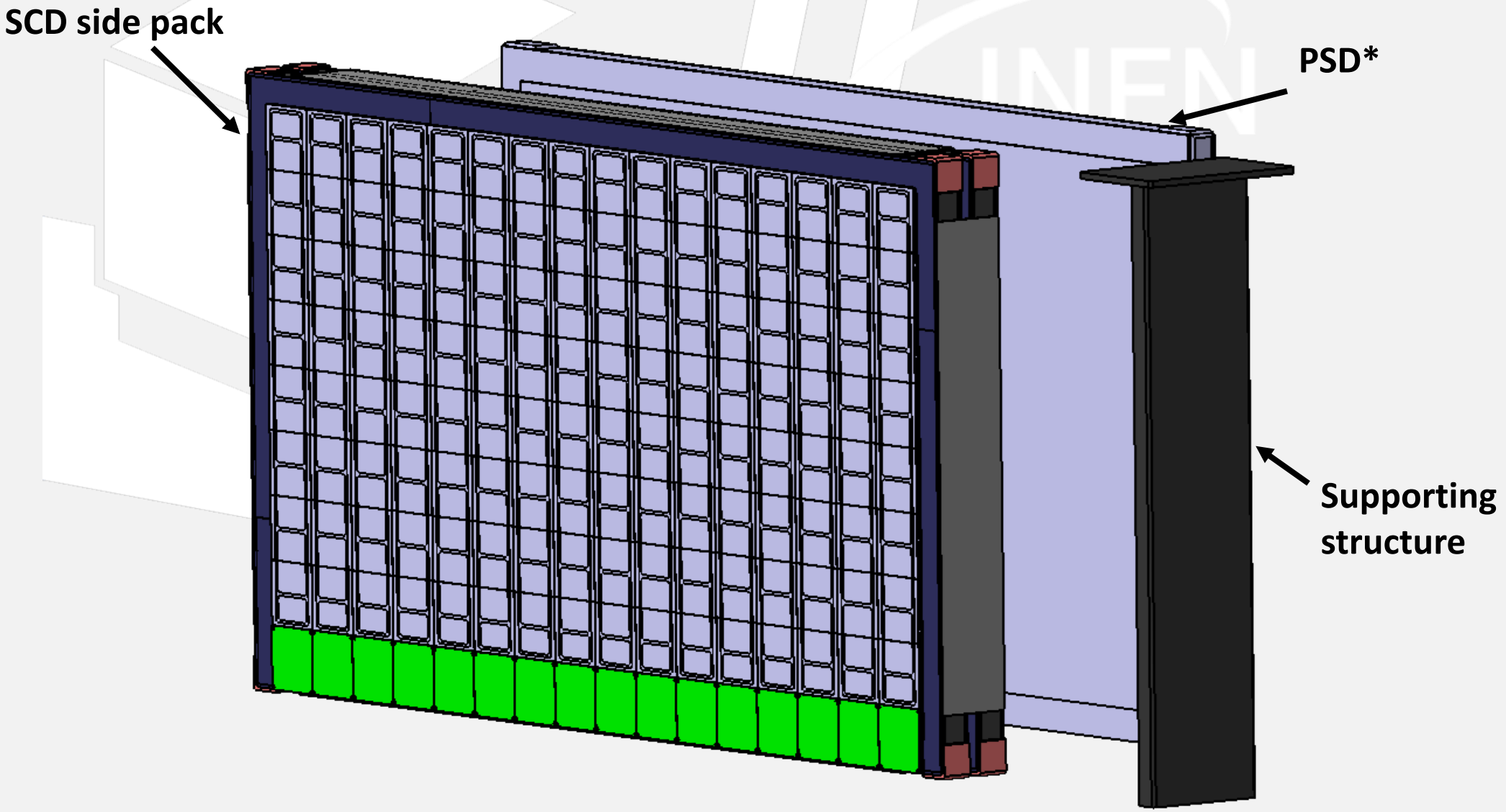
*Z is the normal to the mechanical plane

Design updates - side

Design updates - side

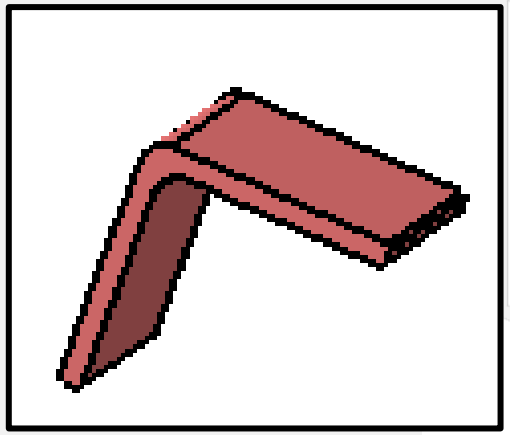


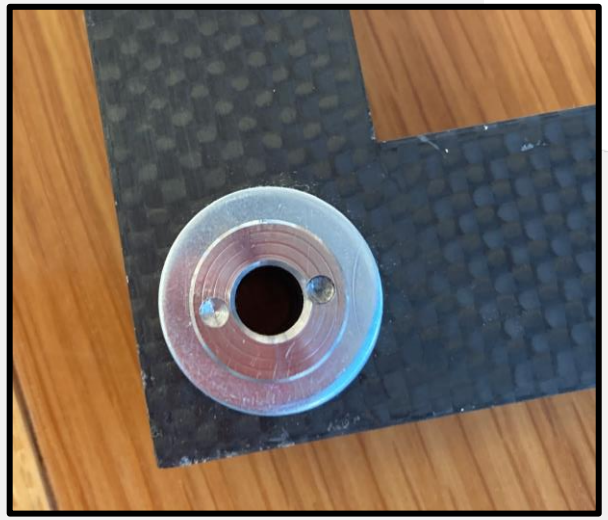
Design updates - side



*to be considered as an envelope. NOT engineered.

Design updates - side





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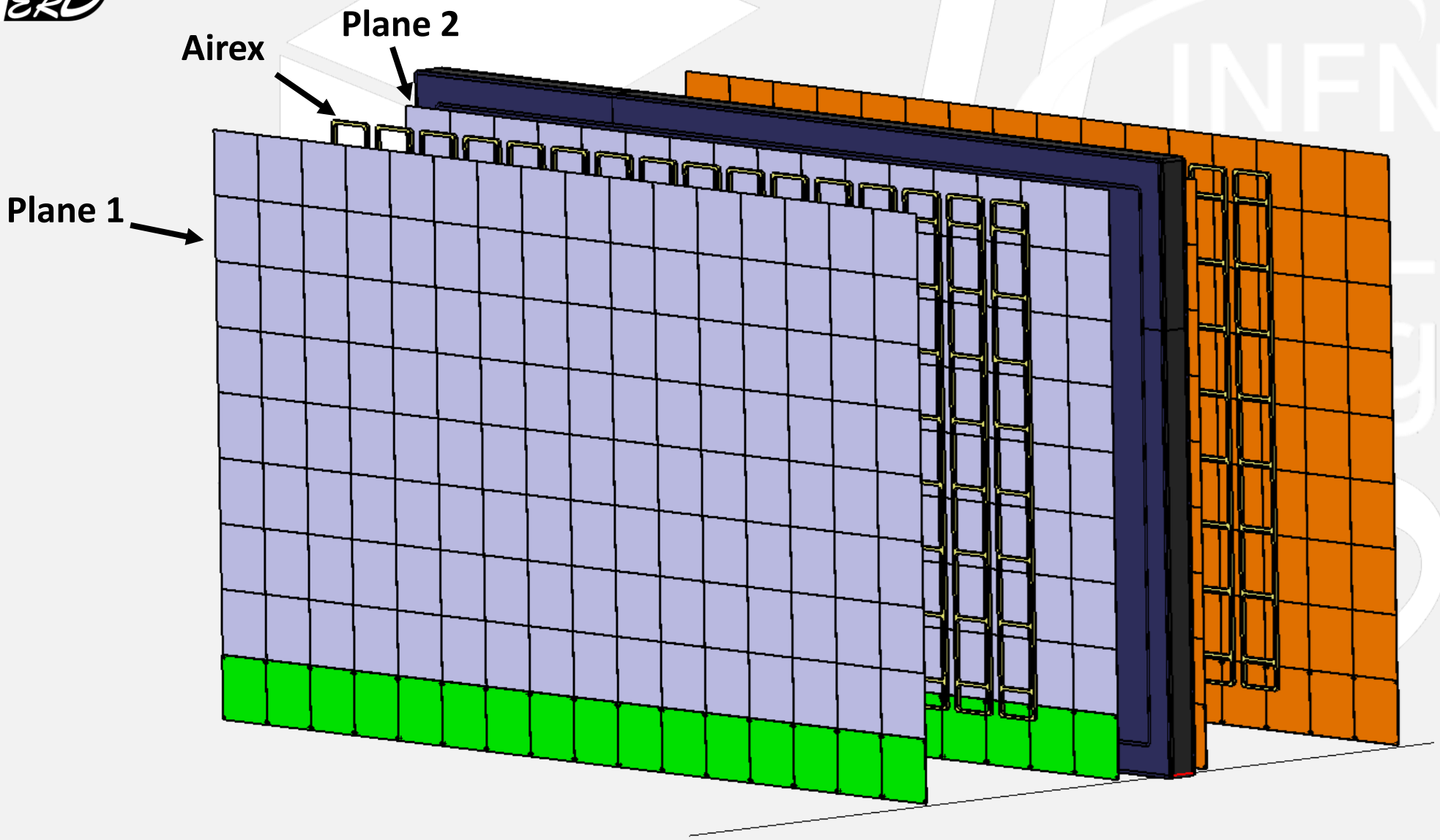
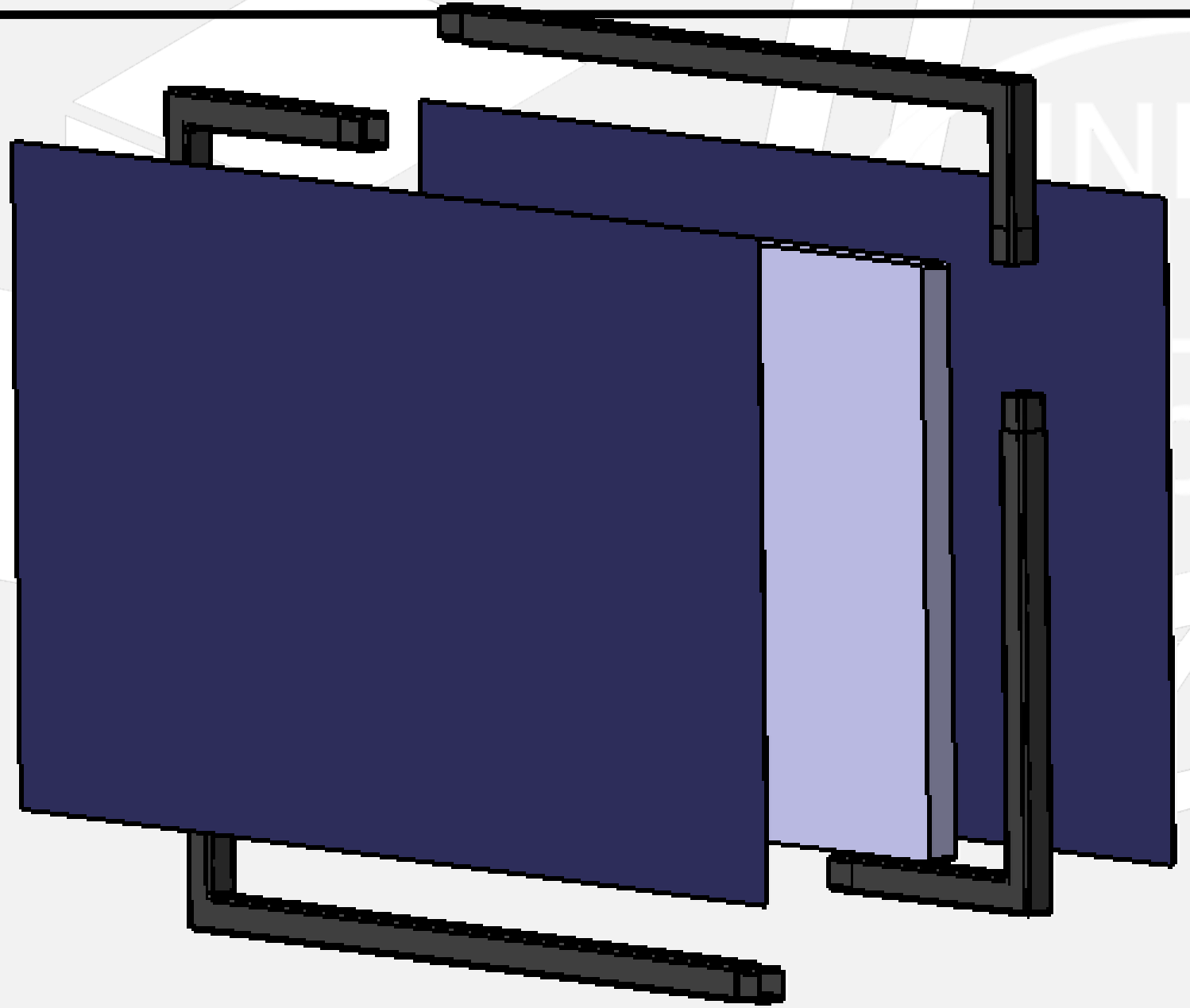
Corner fixations

Conceptual design. Final design to be engineered

Design updates - side



Design updates - side



Design updates - top

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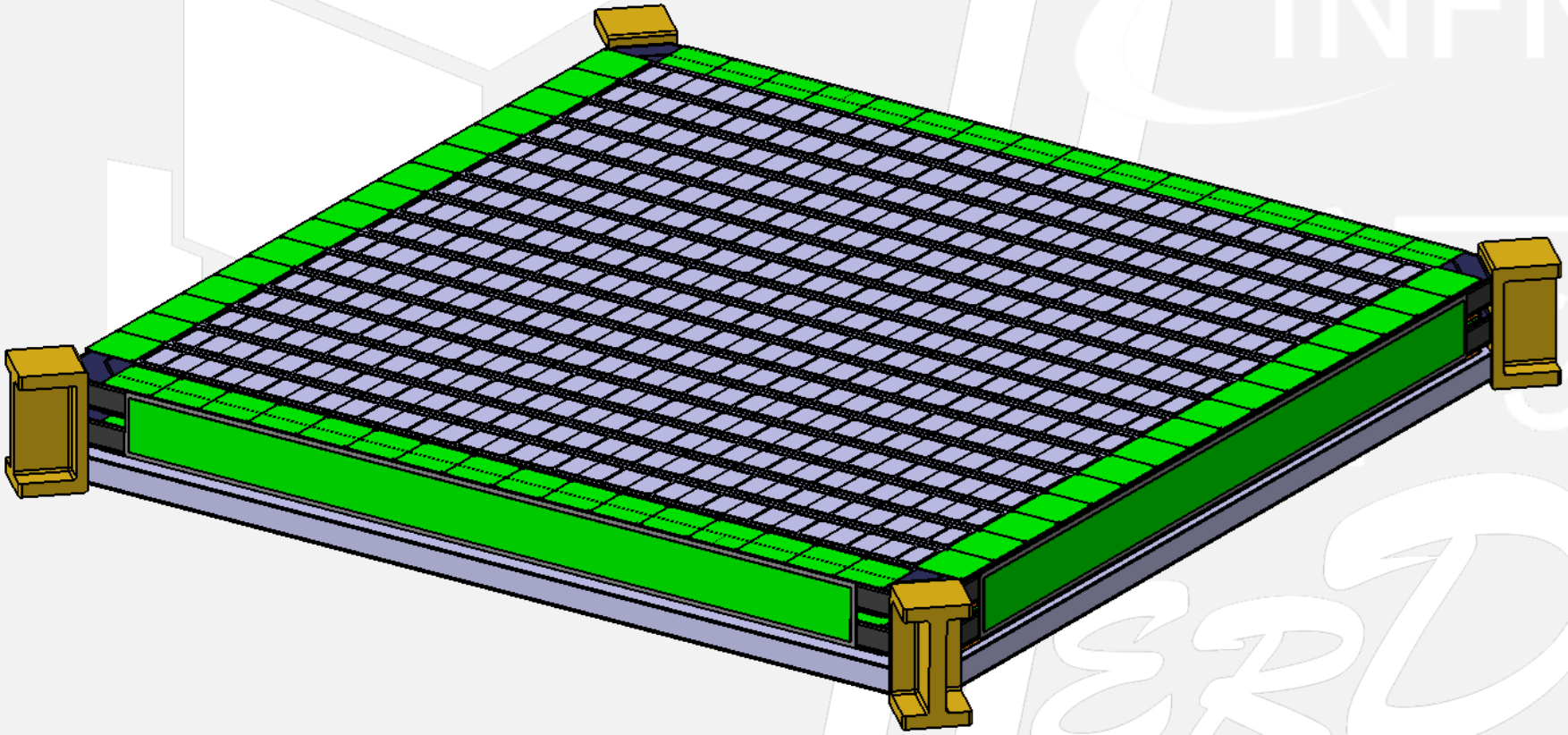
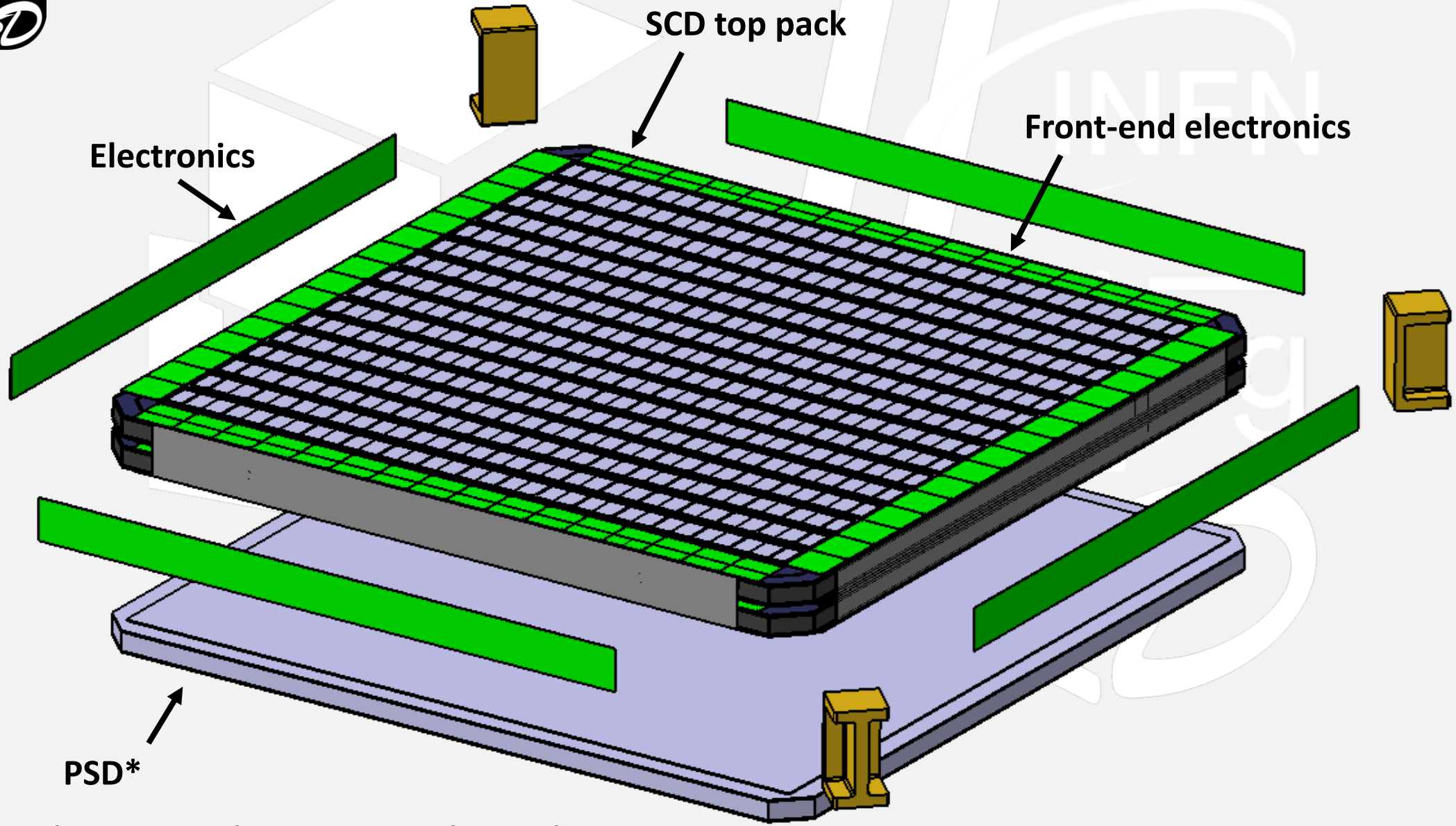


Design updates - top



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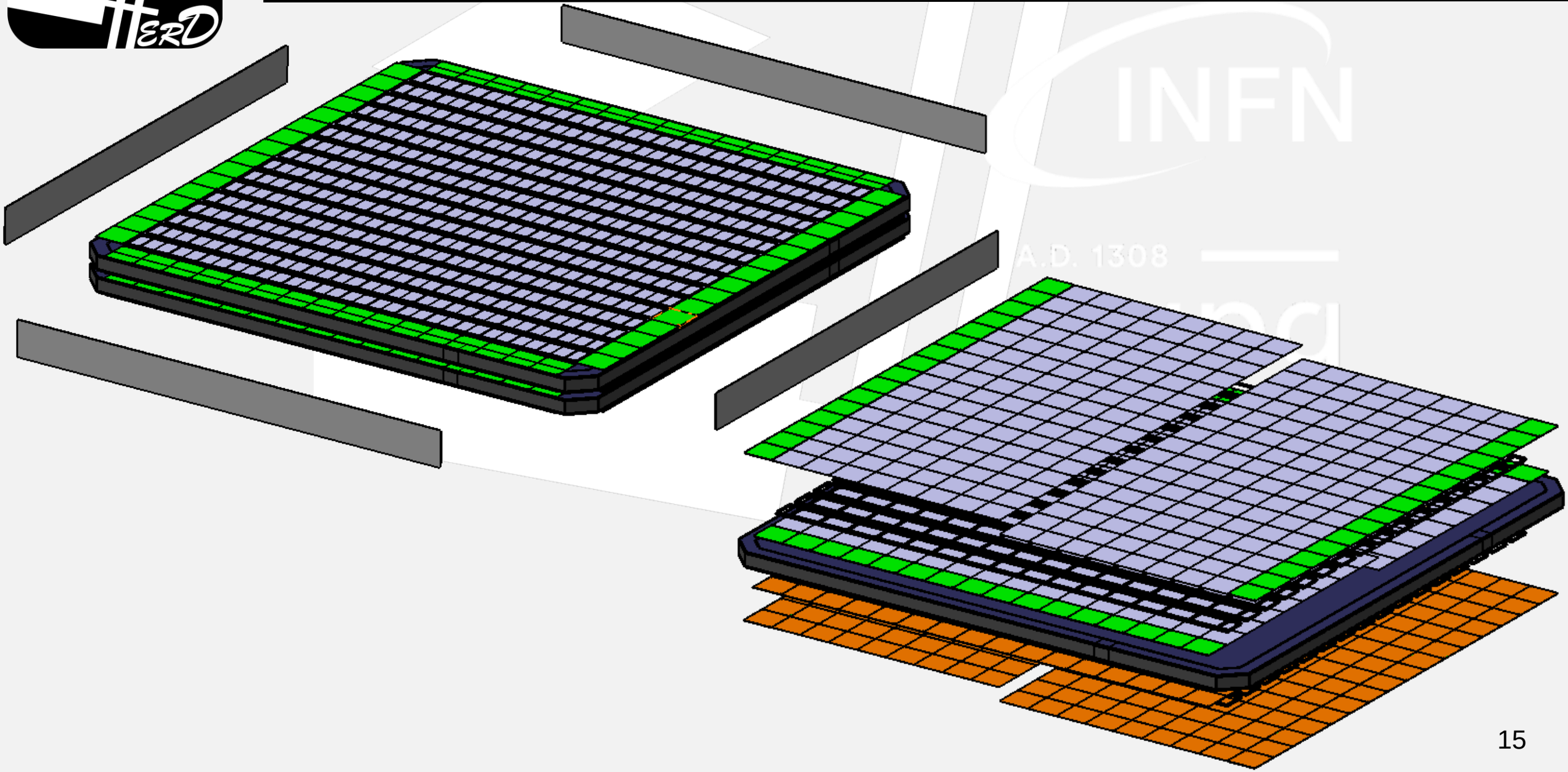
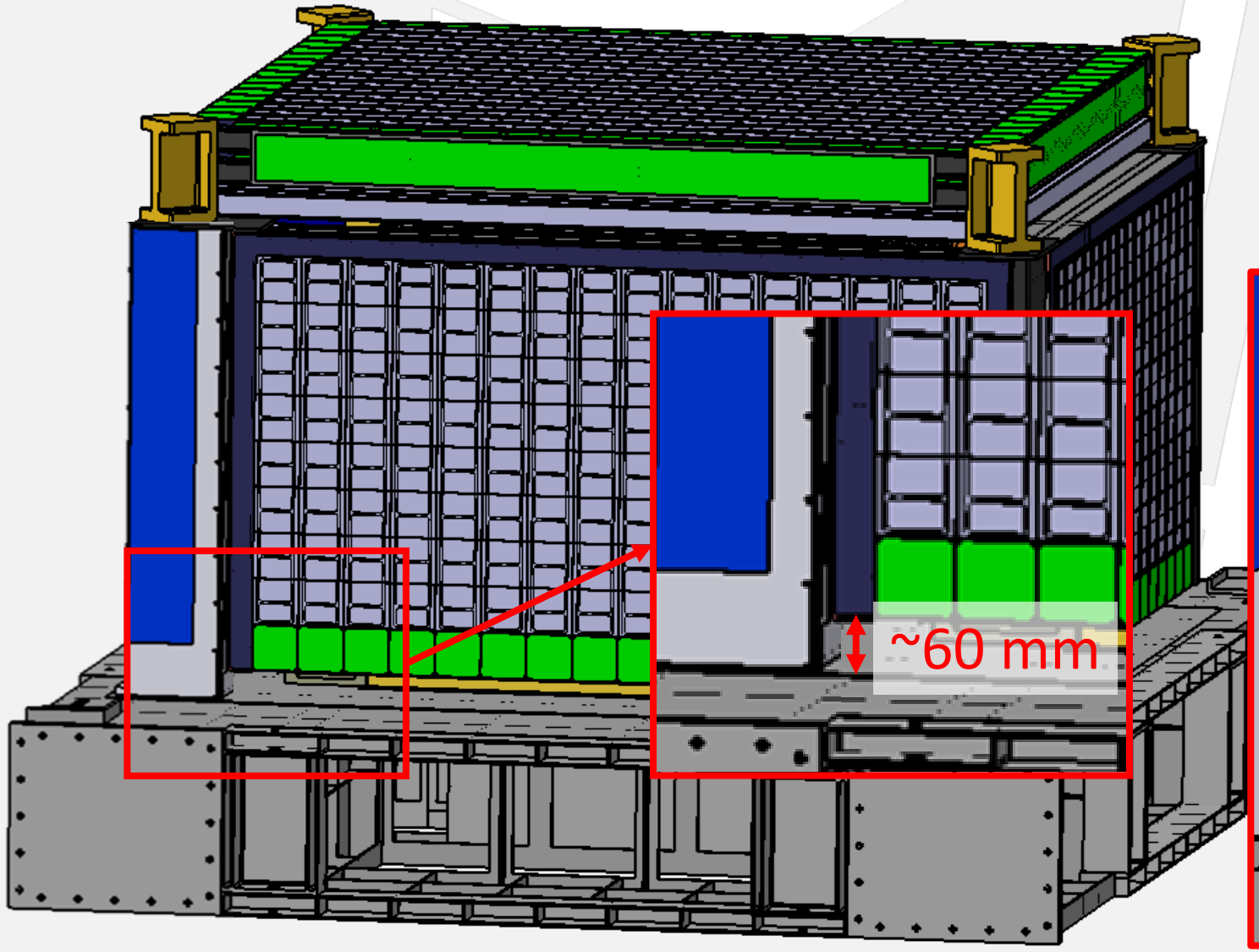
Design updates - top

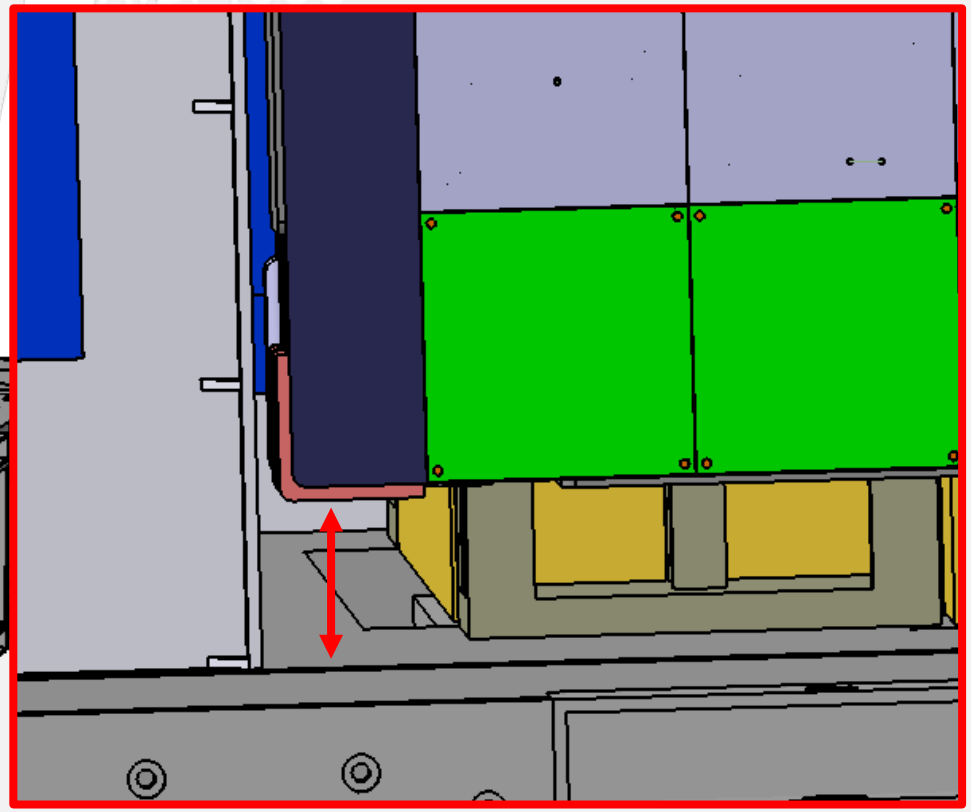


Design updates - question

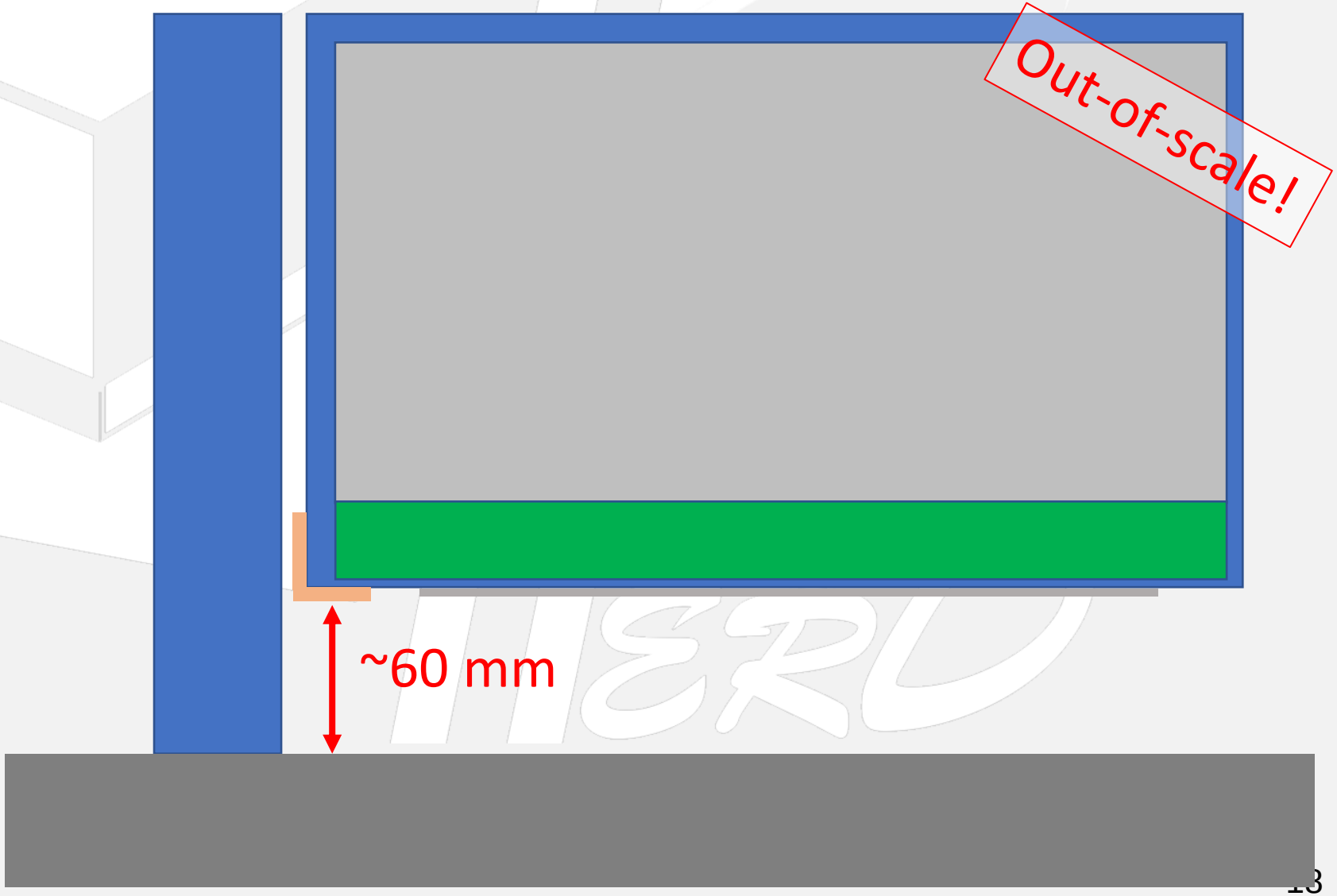
Design question

- About 60 mm gap between the side SCD and the supporting plate

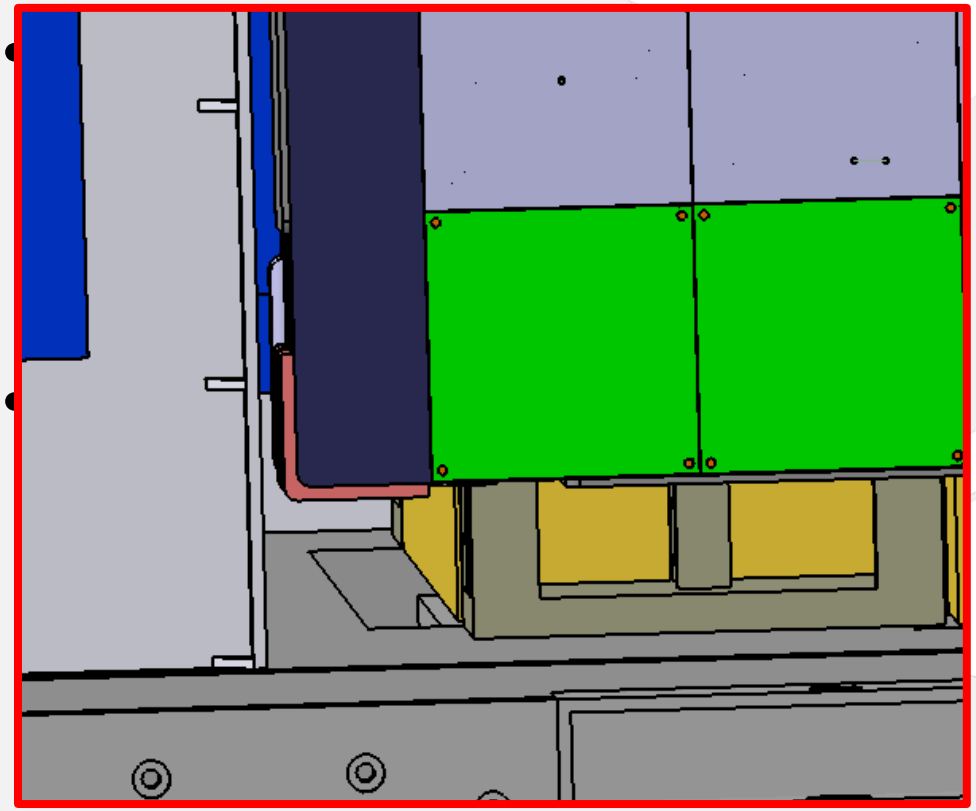


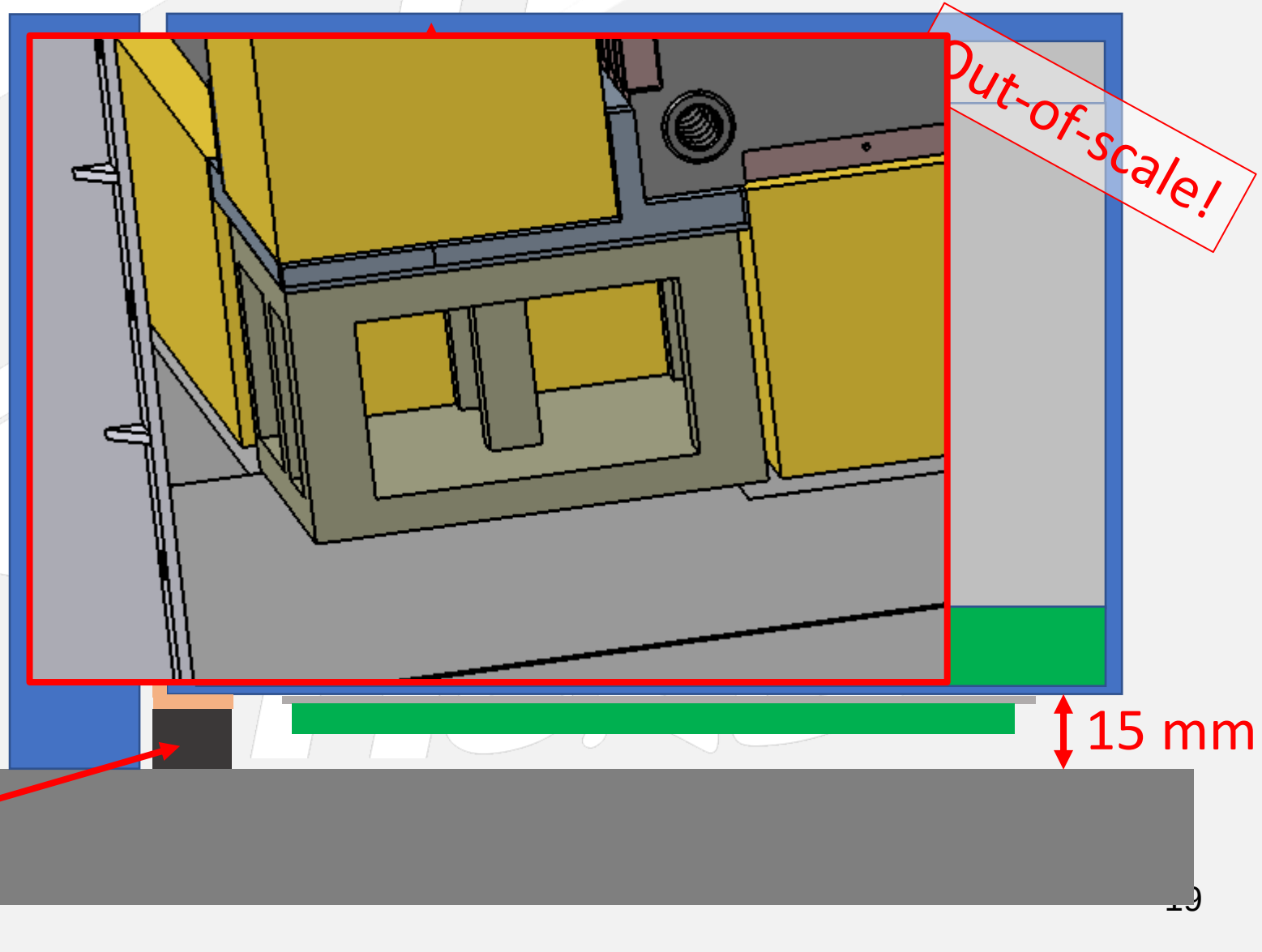


Proposal



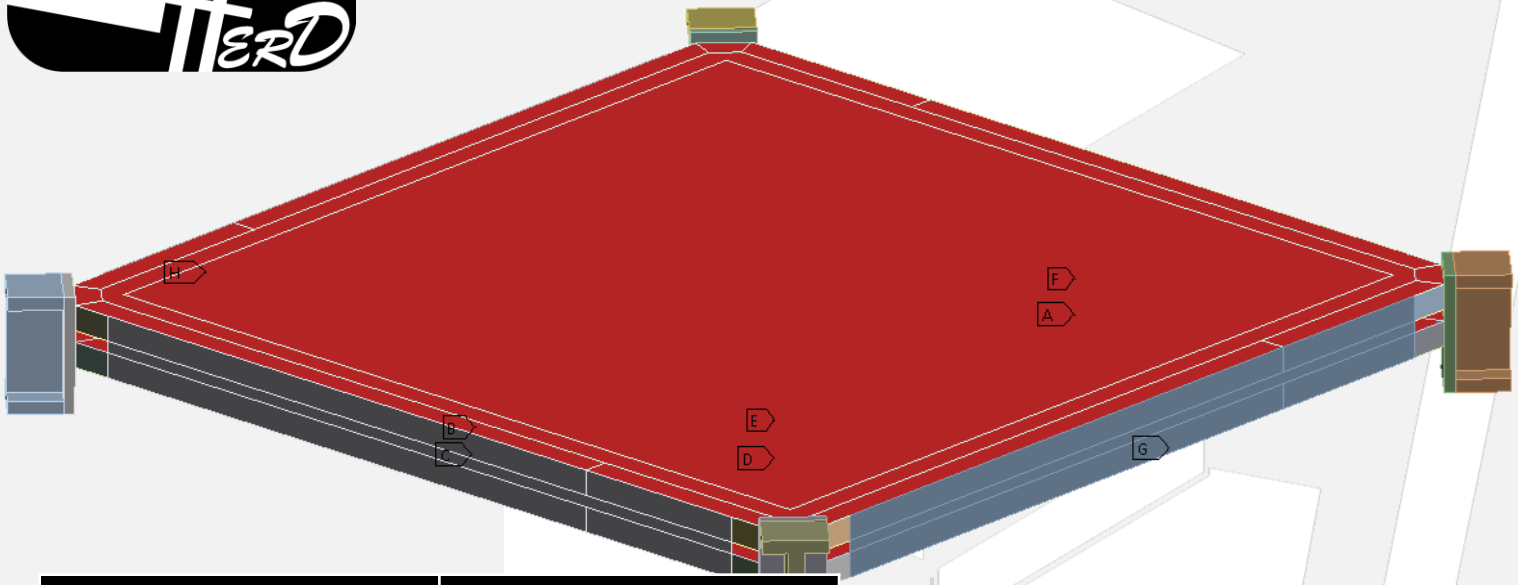
Proposal





FEA analysis

FEA – complex model top



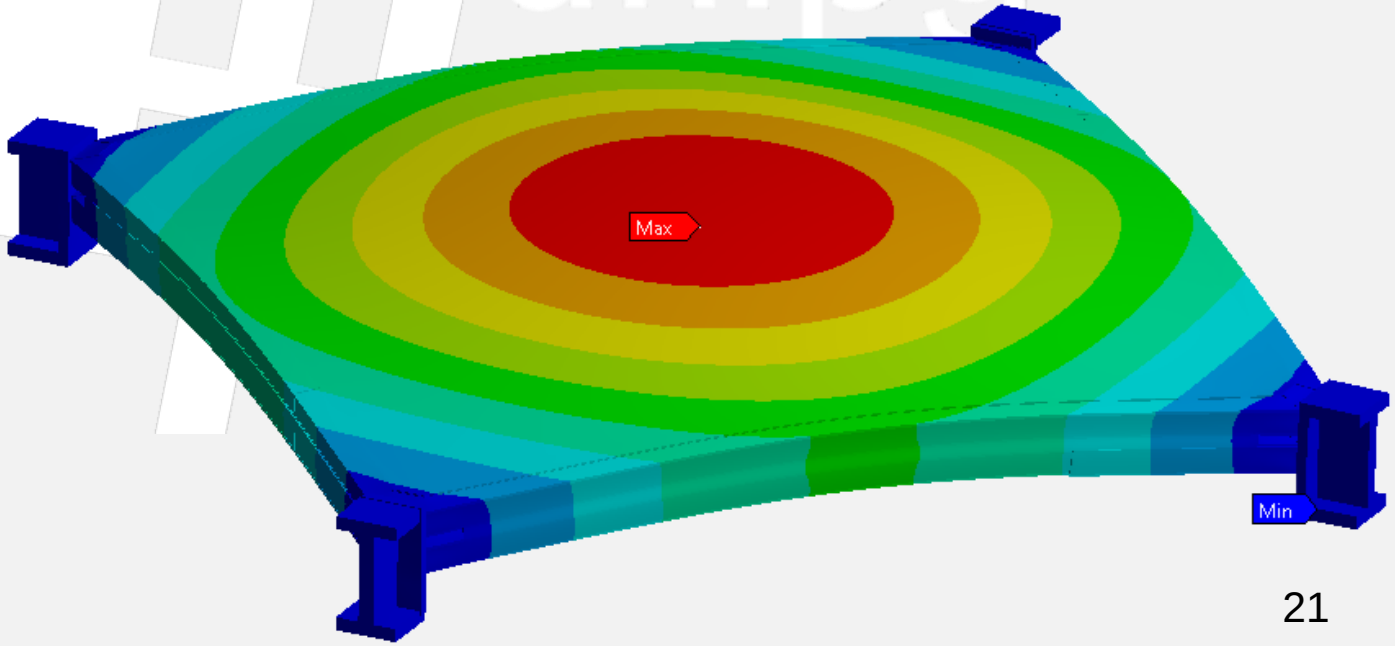
Solid bodies:

- Core
- Supports

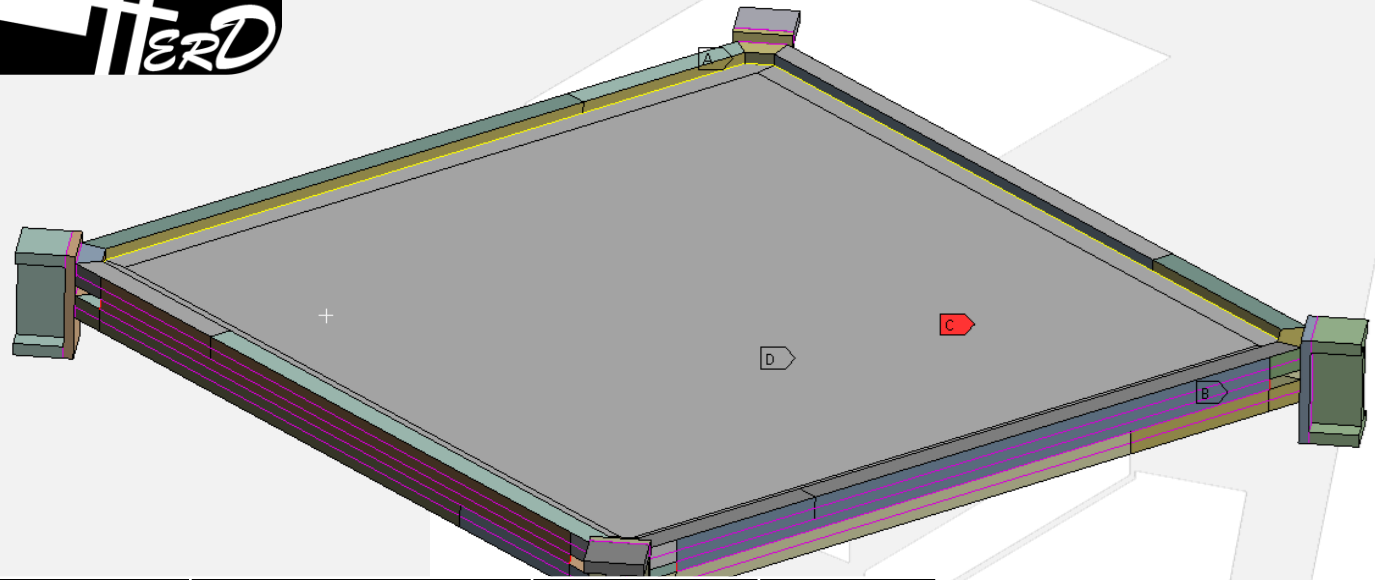
Surface bodies:

- Skins (x4) – CFRP (ACP)
- Frame – CFRP (ACP)
- Lateral panels - aluminum

Mode	Frequency [Hz]
1	92.836
2	121.09
3	152.74
4	152.95
5	182.8
6	267.12
7	273.87
8	277.27
9	310.08
10	348.28



FEA – simplified model top



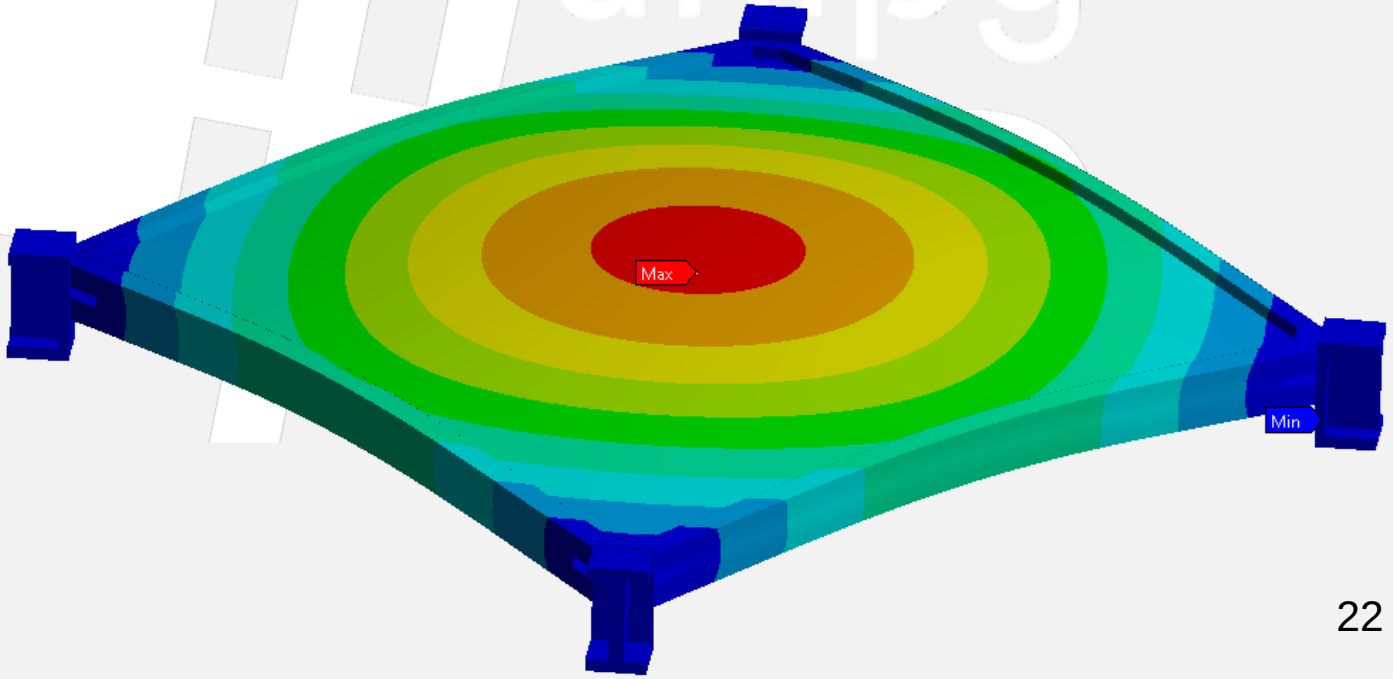
Solid bodies:

- Supports

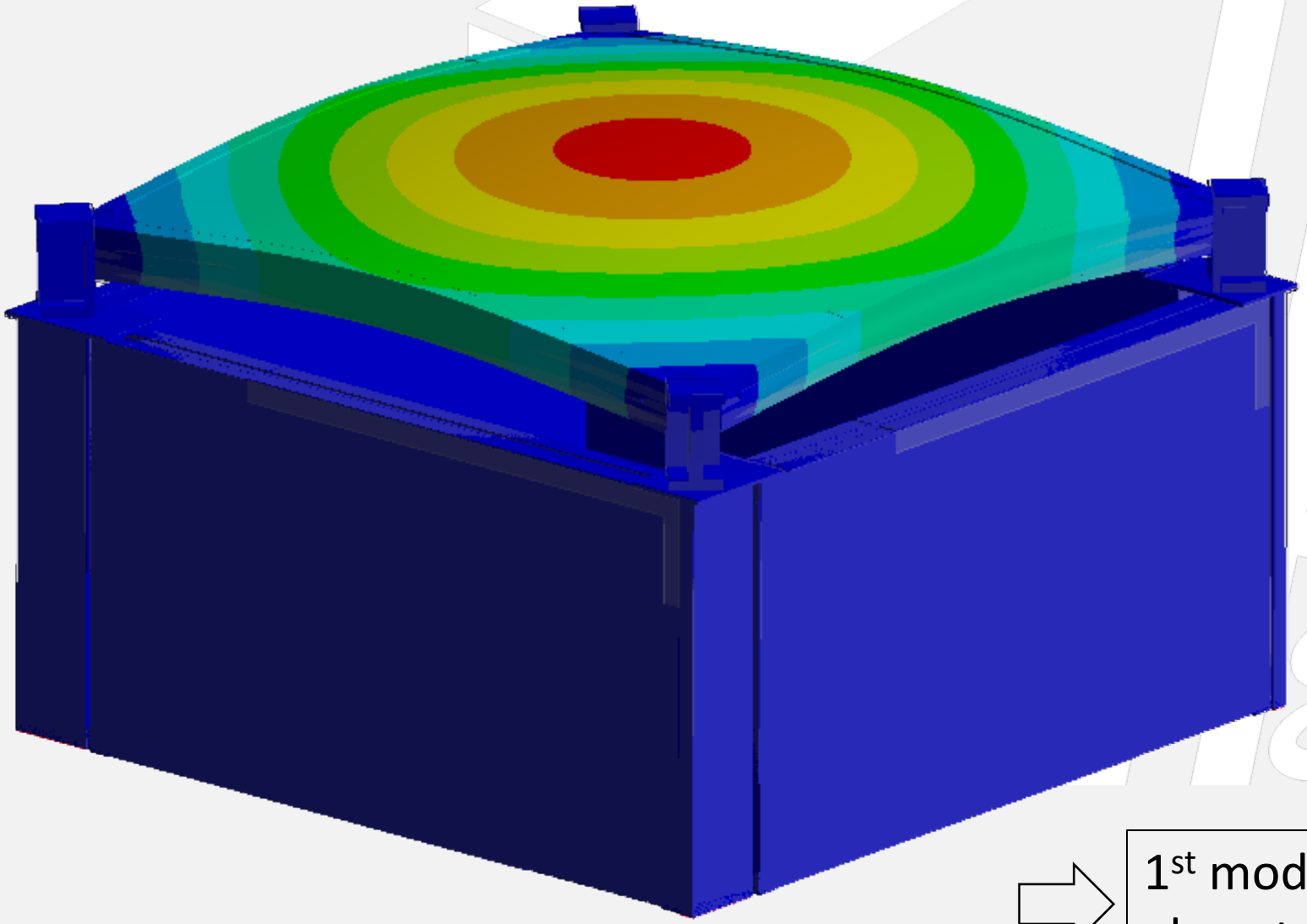
Surface bodies:

- Sandwich (x2, skin-HC-skin) – CFRP (ACP)
- Frame – CFRP equivalent material
- Lateral panels - aluminum

Mode	Frequency [Hz]	Error [Hz]	Error %
1	83.64	1.414	1.7197%
2	121.11	0.89	0.7403%
3	145.84	3.38	2.3726%
4	146.48	3.43	2.3978%
5	170.4	4.84	2.9234%
6	259.85	4.85	1.9020%
7	275.39	1.18	0.4303%
8	288.55	1.07	0.3722%
9	311.21	5.6	1.8324%
10	329.99	5.21	1.6042%



FEA – simplified model full



Mode	Frequency [Hz]
1	80.28
2	110.58
3	116.12
4	117.76
5	121.06
6	130.81
7	137.58
8	138.36
9	163.68
10	166.18
11	167.48
12	185.88
13	196.73
14	201.2
15	202.56
1	80.28

⇨ 1st mode resonance frequency almost identical (wrt to top alone)

Conclusions, questions and prospects

Conclusions&Questions

Concerning the **physics**:

- The actual design foresees 6144 100x100 mm^2 single sided silicon detectors
- **Question: do you need any input from us? Such as the position and dimensions of the detecting surfaces?**

Concerning the **FEA**:

- First mode frequency of the SCD is above 70 Hz as requested
- The 10% error of the simplified model is conservative
- The side planes do not play a relevant role in the first resonance frequency calculation
- **Question: are we allowed to proceed with the current design (no stiffening cross in the core)??**

Concerning the **model**:

- A .stp version is available on the repository (Home/Hardware/SCD/Mechanics/**20221205_SCD_full_CAD_model**.stp)
- **Question: the current design is acceptable?**
- **Question: the proposal about the «spare 60 mm» is acceptable?**

Prospects

Mechanics:

- Manufacture of a reduced size prototype for model validation
- Complex model of the full object and stress analysis
- Silicon tiles characterization campaign
- Airex spacer analysis, design and characterization

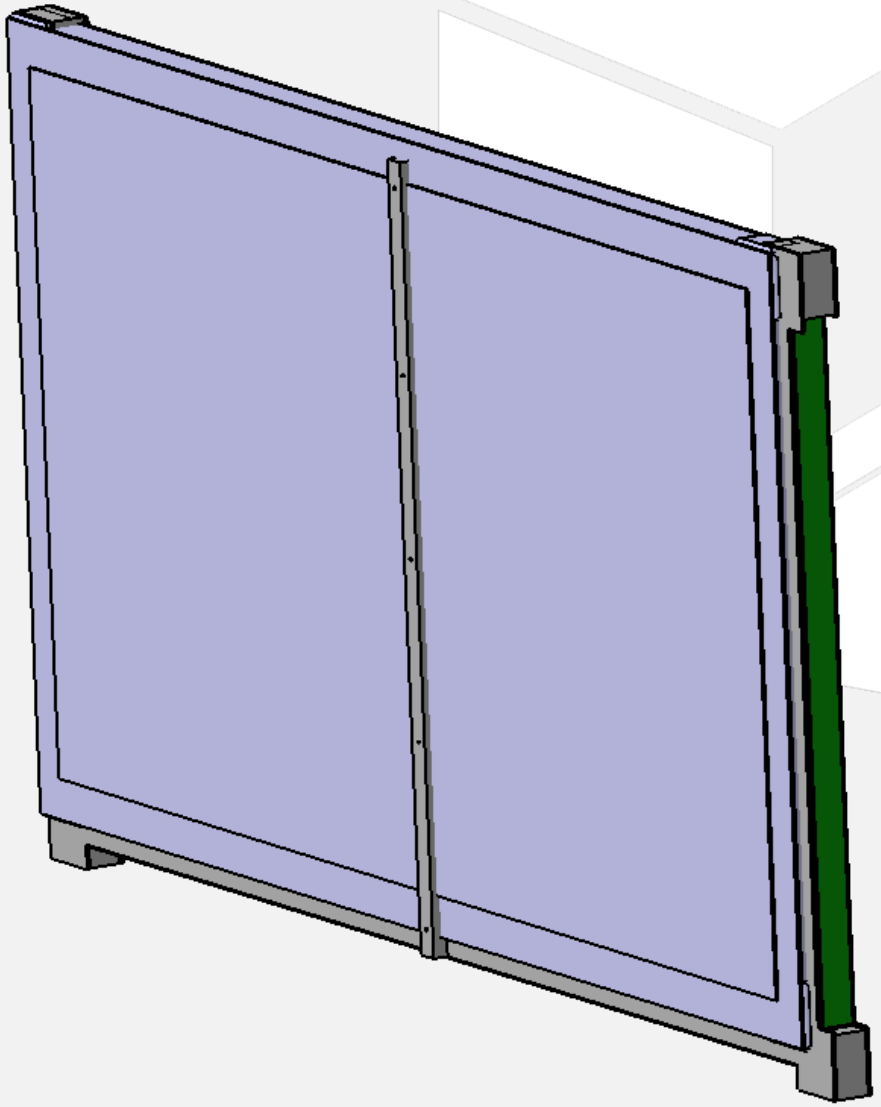
Integration:

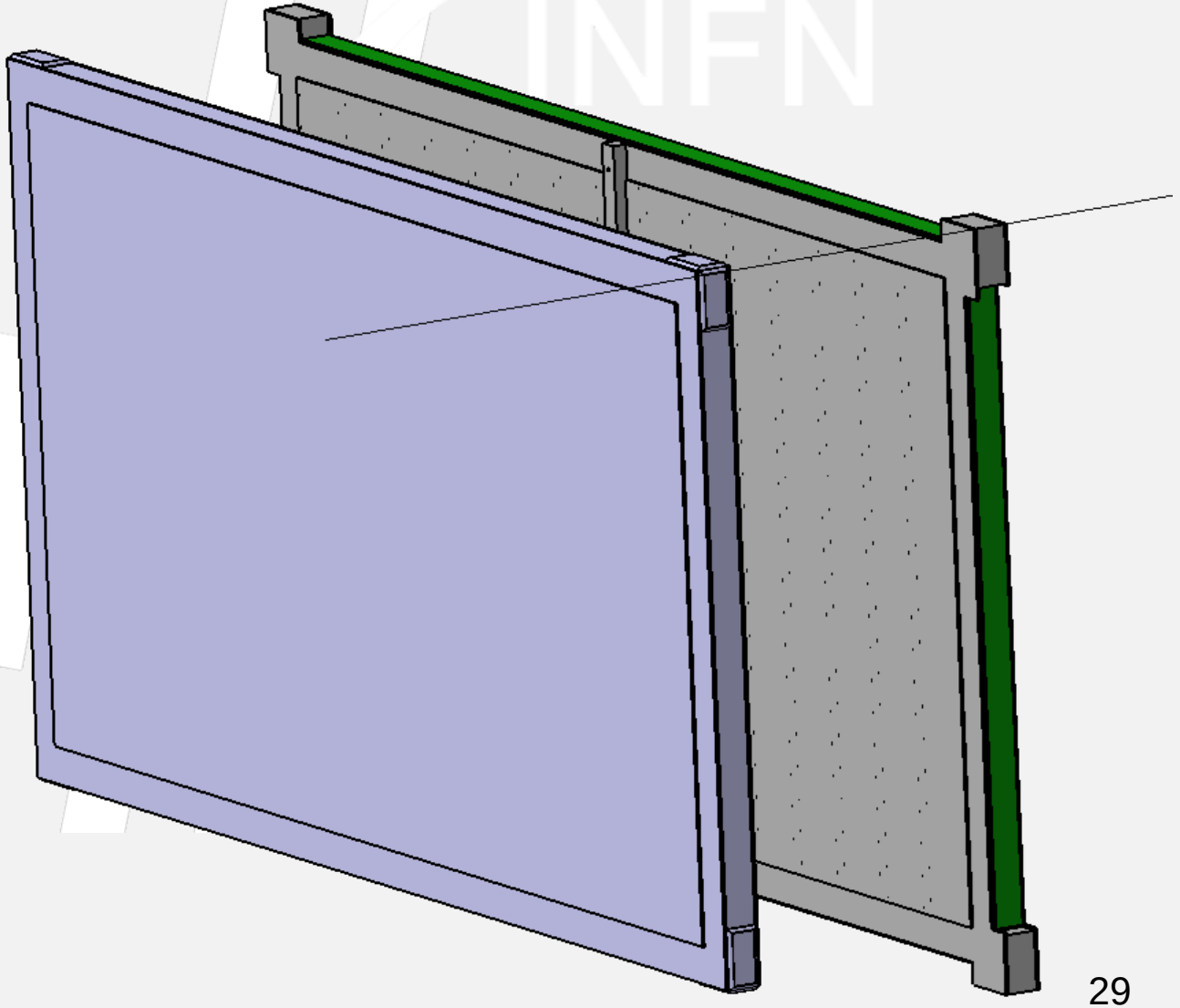
- Start the discussion with the electronics for the positioning of the electronics, the routing of cables and the identification of thermal paths

Thanks for the attention

Back-up slides

Back-up





Back-up