



UNIVERSITÀ DEGLI STUDI
DI NAPOLI FEDERICO II



PSD CONCEPT DESIGN

UNINA TEAM

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MEETING ON THE HERD PROJECT, 29/07/2021



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DI NAPOLI FEDERICO II



RICCARDO GUIDA
UNIVERSITY OF NAPLES FEDERICO II



BAR PROTOTYPE

- Development of previous CAD models
- Evaluation of the common mechanical interface to be shared with SCD
- Estimation of detector hermeticity



- Updated dimensions for the PSD Bar Plane (Side)
- Review of the design considering new constraints



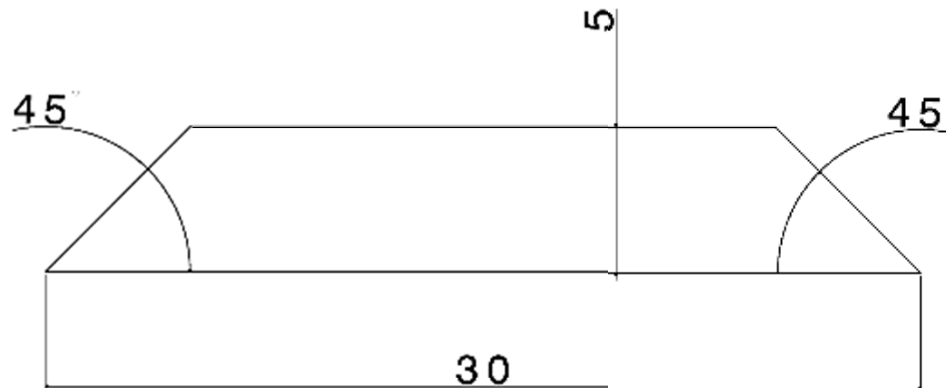
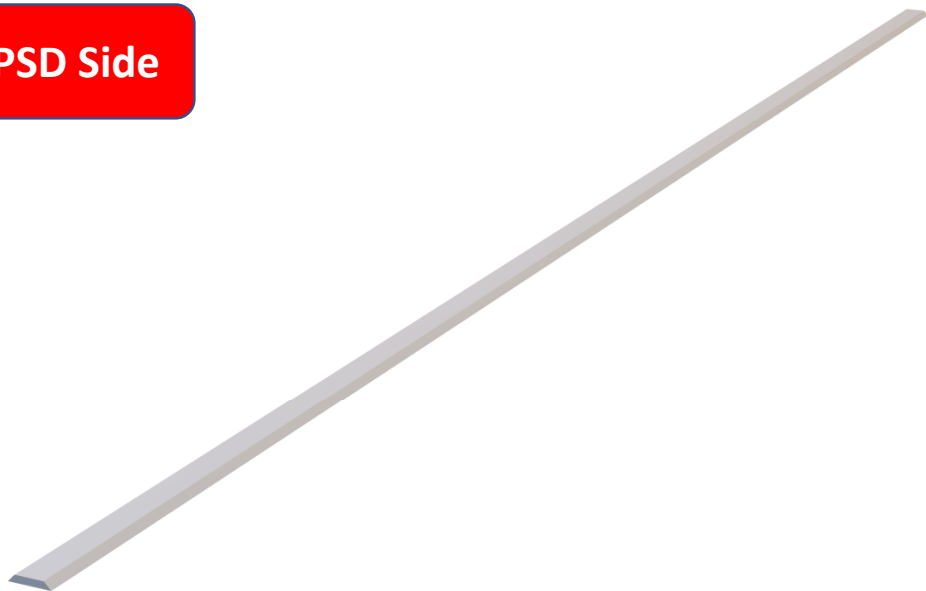
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BAR PROTOTYPE



**PSD Trapezoidal
Bar**

PSD Side



Bar Length: 1590 mm



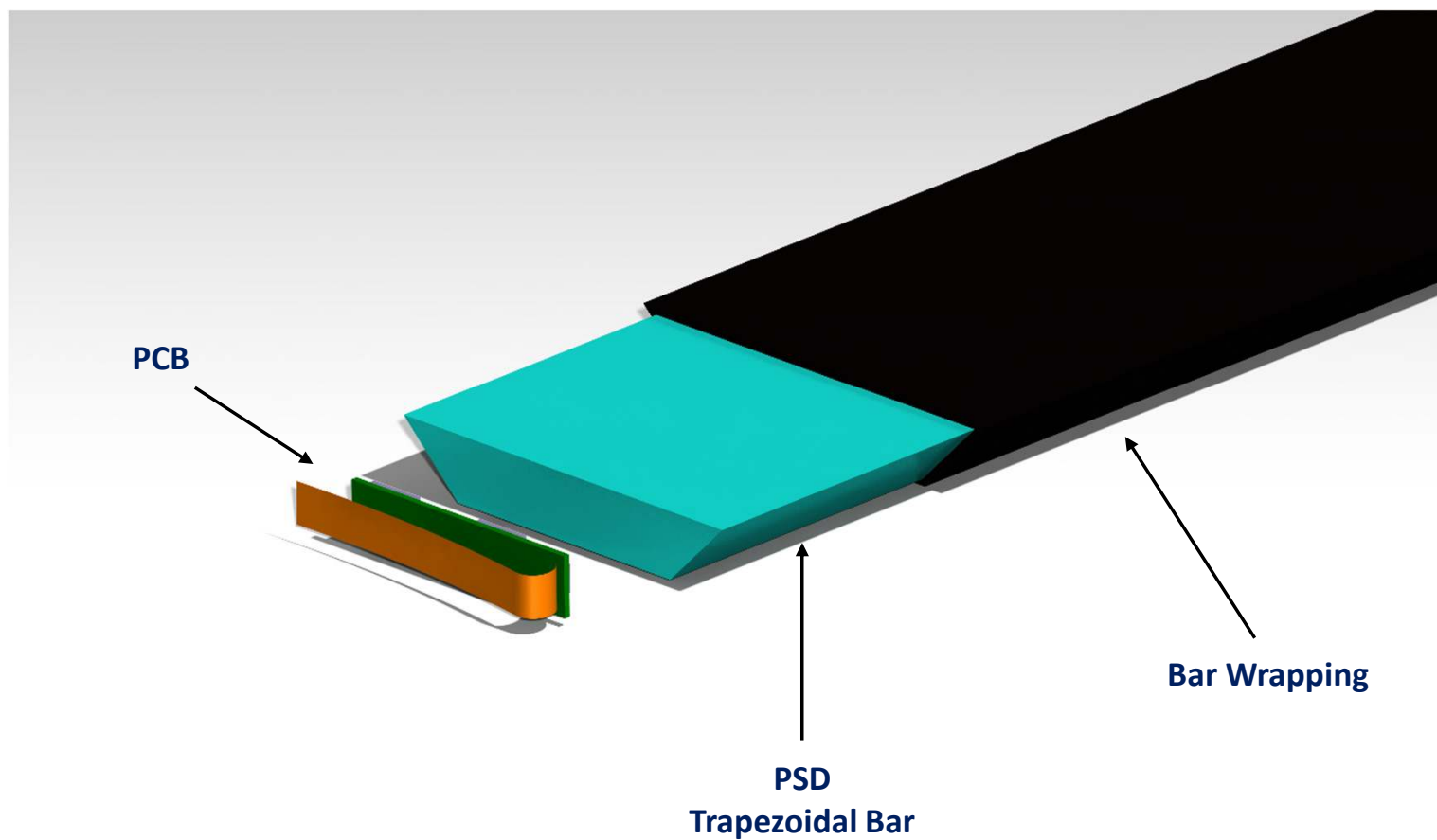
BAR PROTOTYPE

**PSD Trapezoidal
Bar**

PSD Side

Wrapping: 0,5 mm

**Front-end electronics to be
defined**

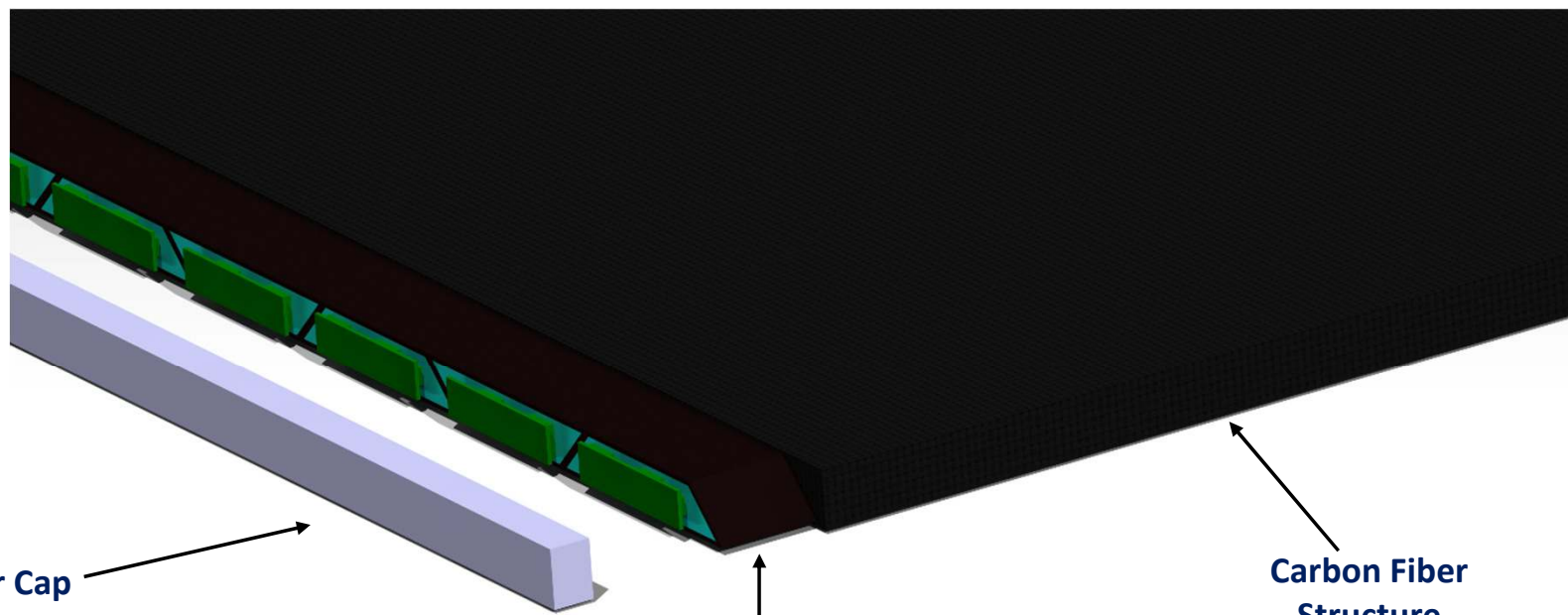




BAR PROTOTYPE

**PSD Bar
Prototype**

PSD Side



Cover Cap

Temporary Front-end
electronics

PSD Trapezoidal
Bar with Wrapping

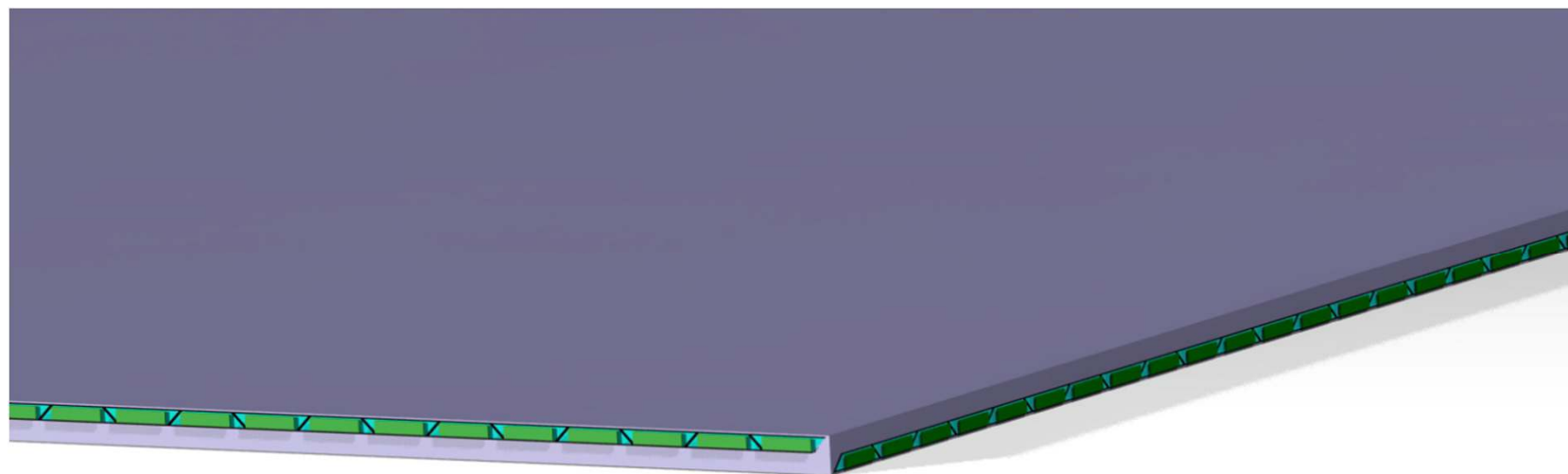
Carbon Fiber
Structure
 $\rho = 1725 \text{ kg/m}^3$



BAR PROTOTYPE

*PSD Bar
Prototype*

PSD Side





BAR PROTOTYPE

**PSD Bar
Prototype**

PSD Side

Dimensions: 1645 x 943 x 14 mm³

Active Area: 1590 x 933 mm²

Detection Area: 1,48 m²

Distance between the two Bar Layers: 2 mm

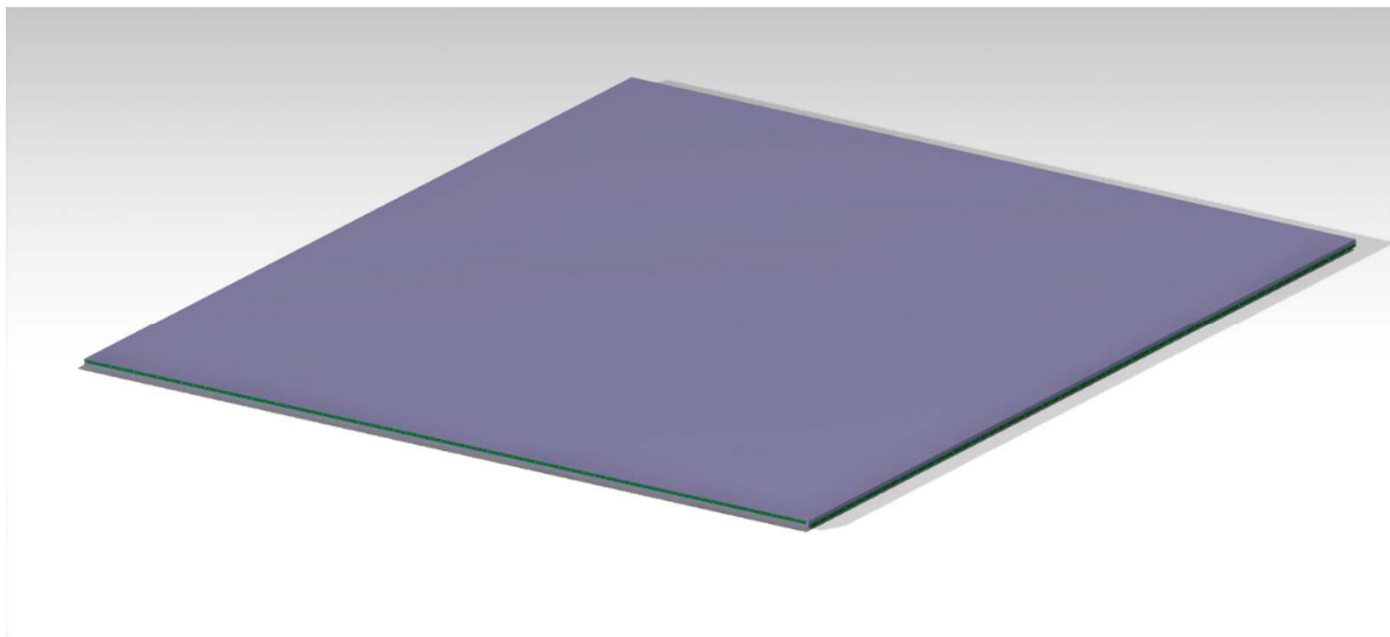
Bars in External layer: 54

Bars in Internal layer: 32

Wrapped PSD Mass: 22,96 kg

Structure Mass: 8,33 kg

Total Mass: 31,29 kg





BAR PROTOTYPE

NEXT STEPS

- Assessment of Dimensions of the Top PSD Bar Prototype
- Evaluation of PSD dynamic properties
- Structural strengthening and estimation of the characteristics of the materials to be used in the following phases
- Development of the common mechanical structure in collaboration with the SCD working group
- Design update based on simulation and experimental test results



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GAETANO PERROTTA
UNIVERSITY OF NAPLES FEDERICO II



TILE PROTOTYPES

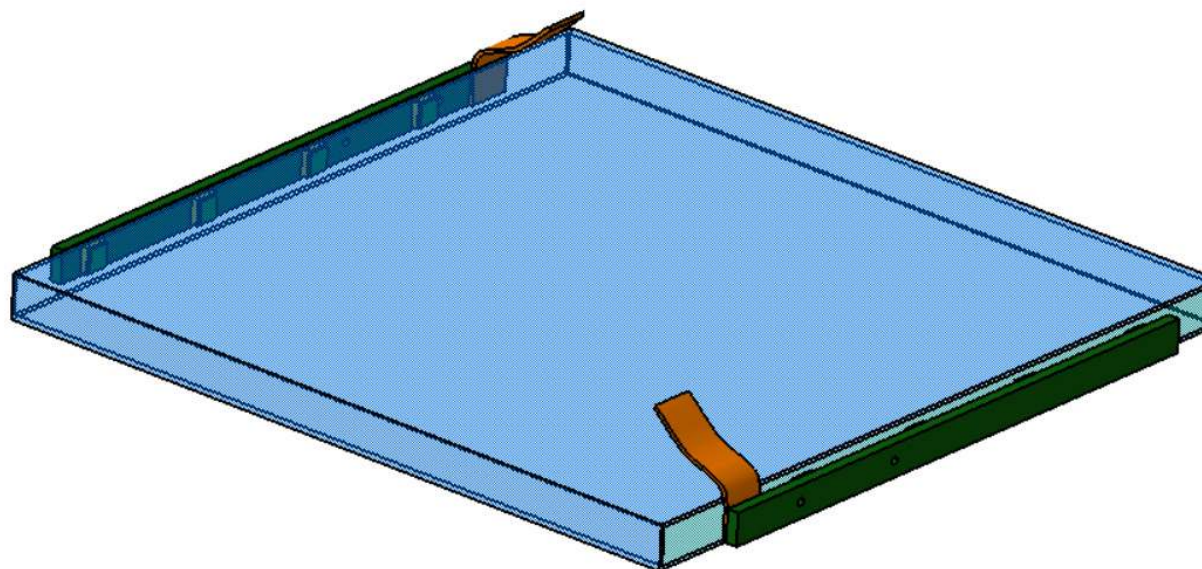
TILE SOLUTION

Dimensions of the Tiles: **100 x 100 x 5 mm³**

Tyvek Offset: **+ 0,5 mm**

PCB Offset: **+ 3 mm**

Total Dimensions: **106 x 101 x 6 mm³**

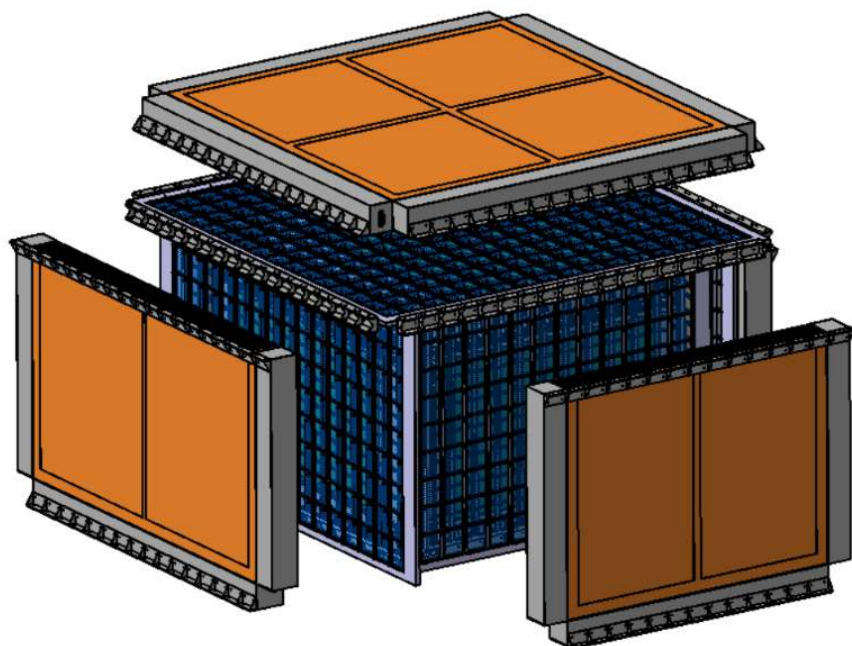


- Temporary Front-End Electronics
- Flexible electronic output in Kapton
- 4 SiPM per PCB

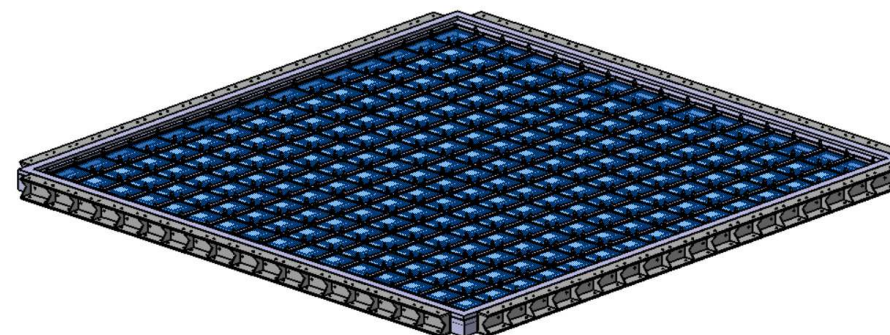


TILE PROTOTYPES

TILE 2 LAYER – 3 FRAME
(T2L-3F)



TILE 2 LAYER – 3 FRAME
T2L-3F-TOP



Dimensions: **1700 x 1700 x 50 mm³**

Active Area: **1616 x 1590 m²**

Distance between the two Tile Layers: **2 mm**

Total number of Tiles: **450**

MASS

Frame: **12,1 kg**

Tiles + PCB: **24,8 kg**



TILE PROTOTYPES

TILE 2 LAYER – 3 FRAME T2L-3F-SIDE-L

Dimensions: **1674 x 1014 x 50 mm³**

Active Area: **1515 x 954 m²**

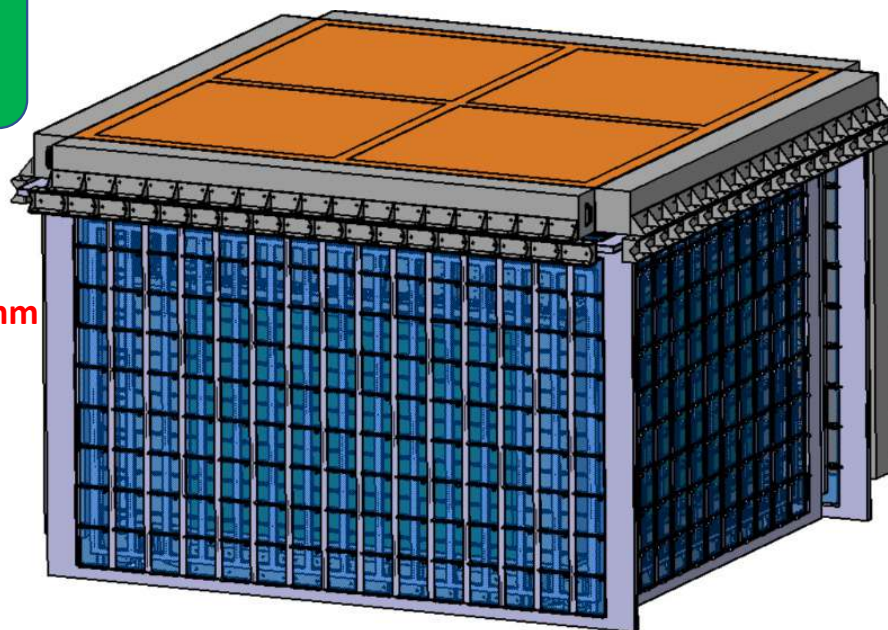
Distance between the two Tile Layers: **2 mm**

Total number of Tiles: **247**

MASS

Frame: **8,1 kg**

Tiles + PCB: **13,6 kg**



TILE 2 LAYER – 3 FRAME T2L-3F-SIDE-S

Dimensions: **1354 x 1014 x 50 mm³**

Active Area: **1212 x 954 m²**

Distance between the two Tile Layers: **2 mm**

Total number of Tiles: **196**

MASS

Frame: **6,7 kg**

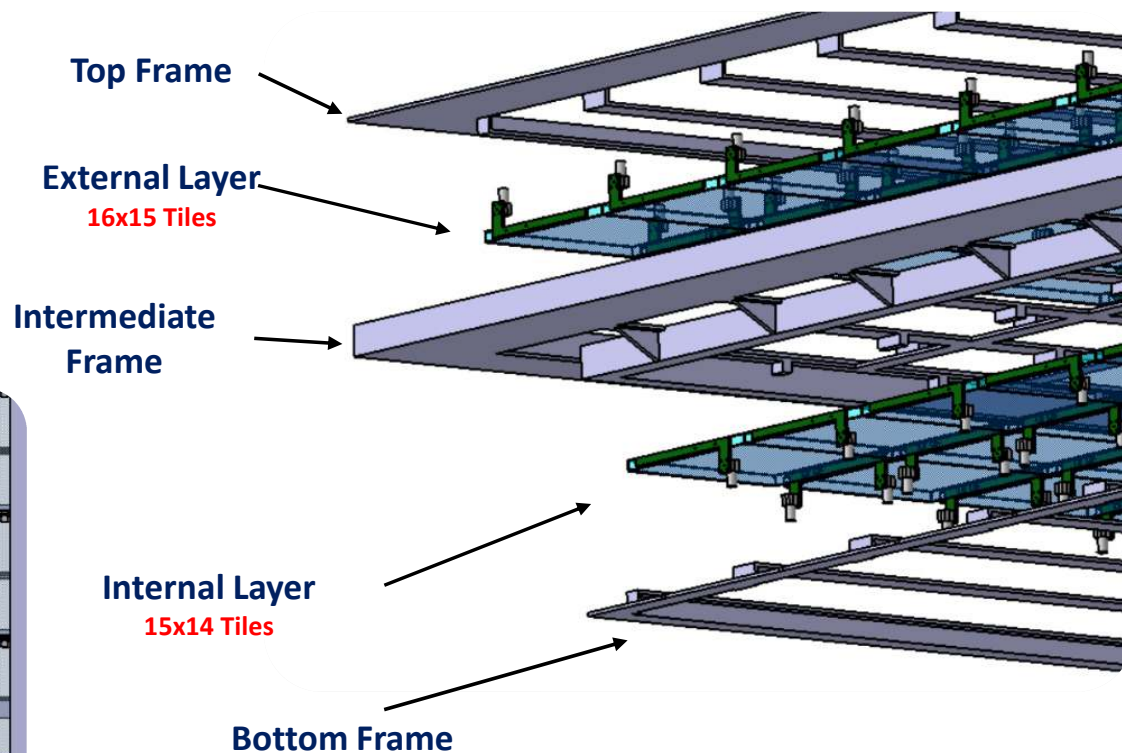
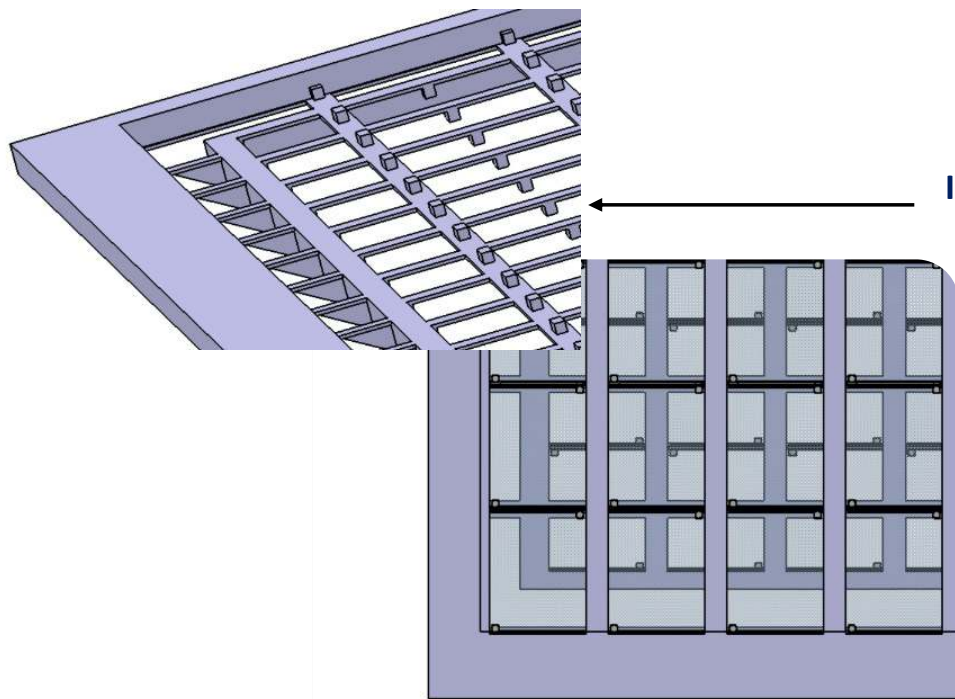
Tiles + PCB: **10,9 kg**

NUMBER OF TILES: 1336
NUMBER OF PCB CONNECTIONS: 2672
FRAME MASS: 41,5 kg
DETECTOR MASS: 73,8 kg



TILE PROTOTYPES

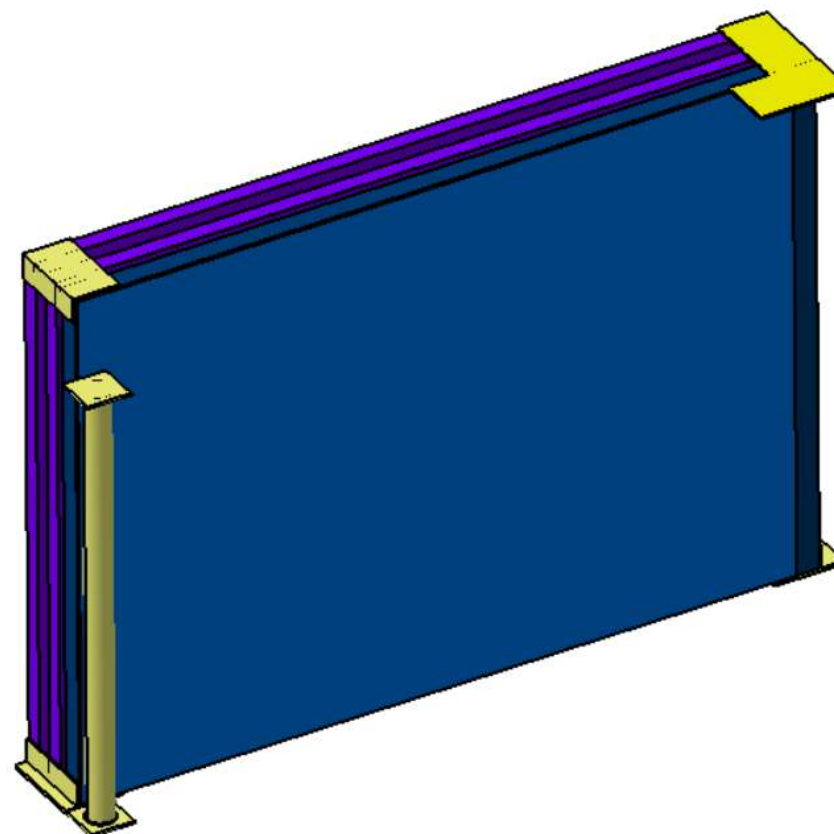
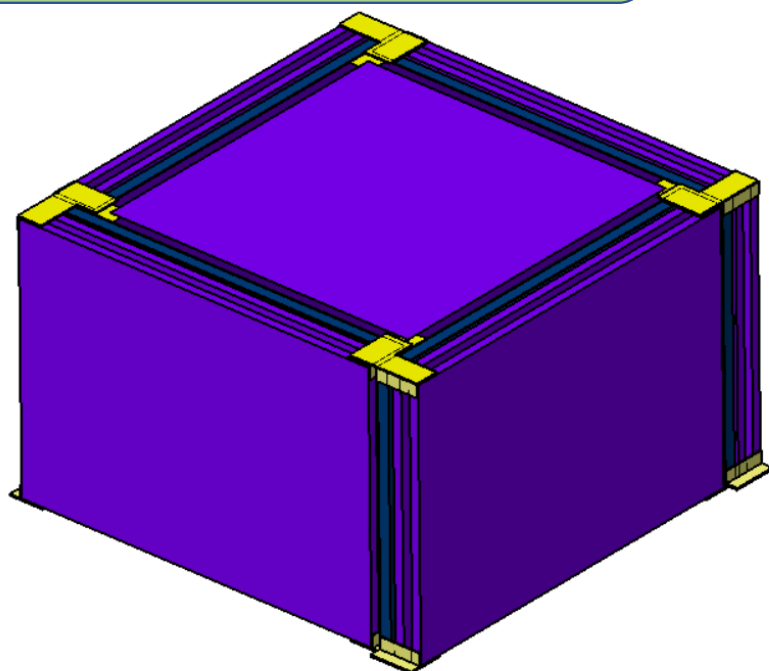
**TILE 2 LAYER – 3 FRAME
T2L-3F-TOP**





TILE PROTOTYPES

*HERD European Configuration
for PSD & SCD*





TILE PROTOTYPES

*HERD European Configuration
for PSD & SCD*

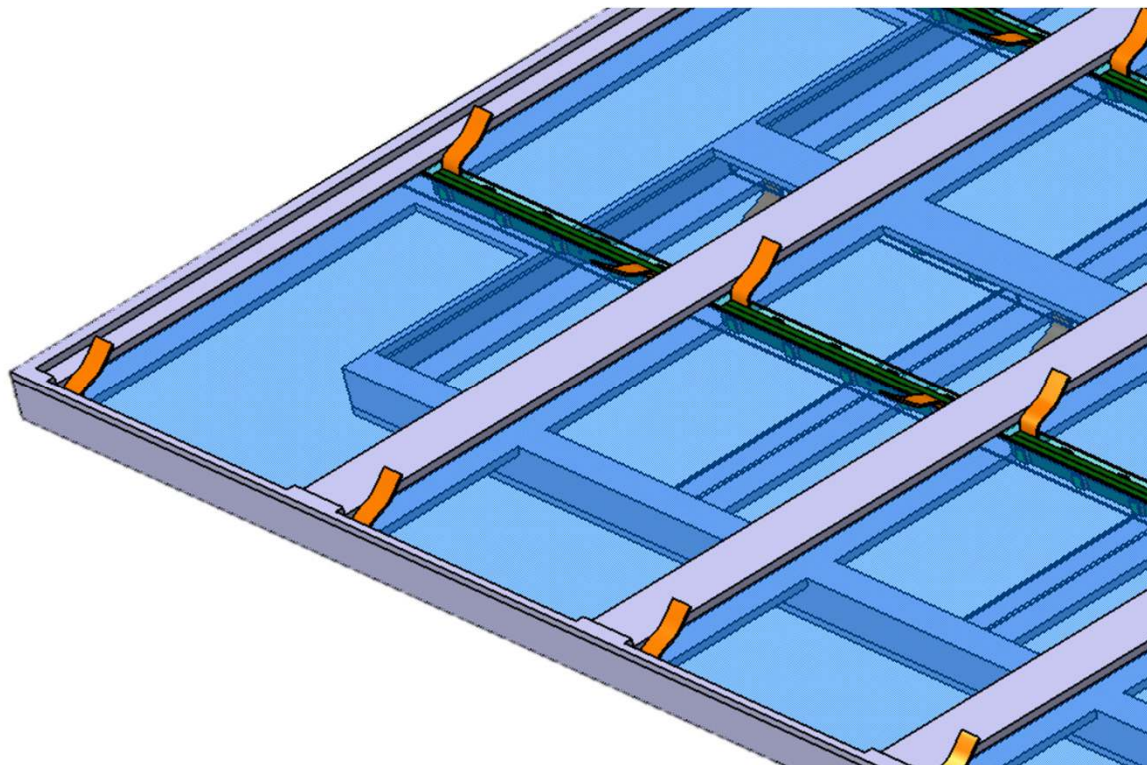


*New dimensional constraints
defined by hermeticity
simulations*

**TILE 2 LAYER – 3 FRAME
T2L-3F-SIDE-L
THIN SOLUTION**

**A 2 mm frame has been realized for a
better hermeticity of the entire PSD**

**Also the electronic part, PCB, has been
improved, changing the previous MCX
connector with flexible Kapton cables**



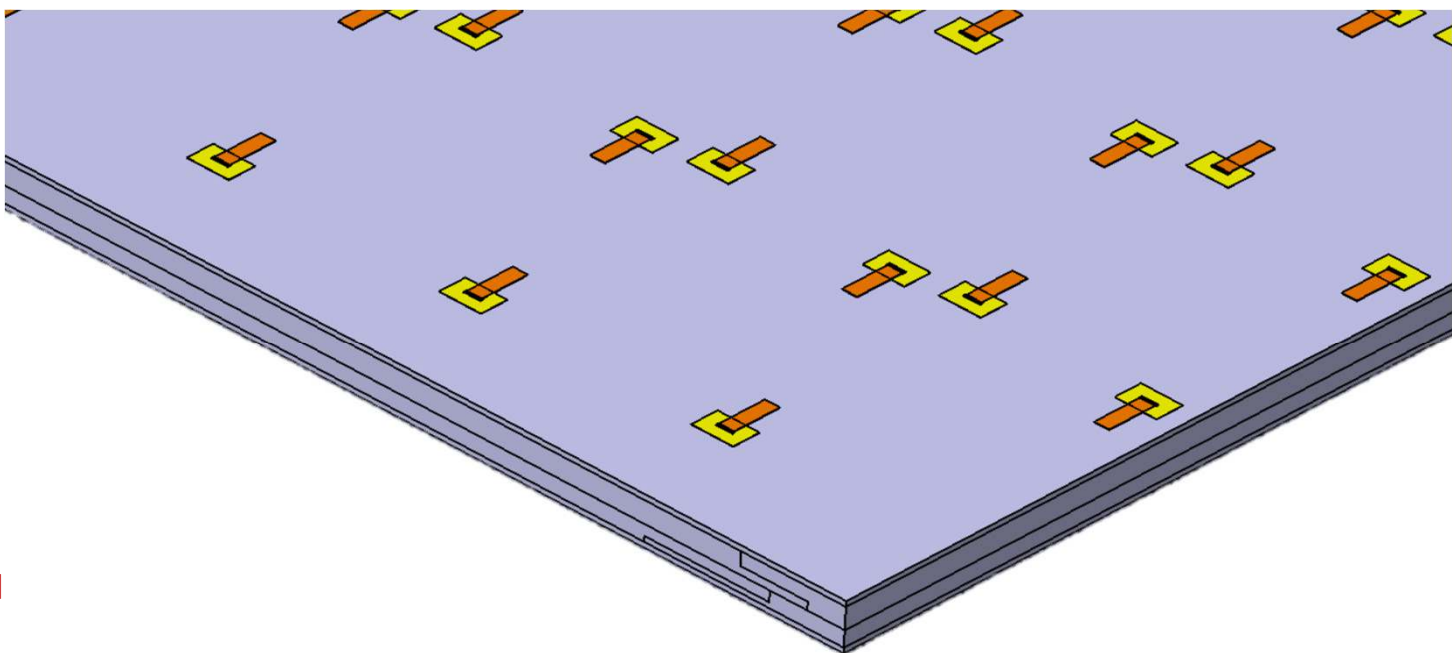


TILE PROTOTYPES

Type-C
CFRP layer - TOP

The use of Carbon fiber plane is here defined,
like DAMPE Honeycomb sandwich
-> to be evaluated with simulations

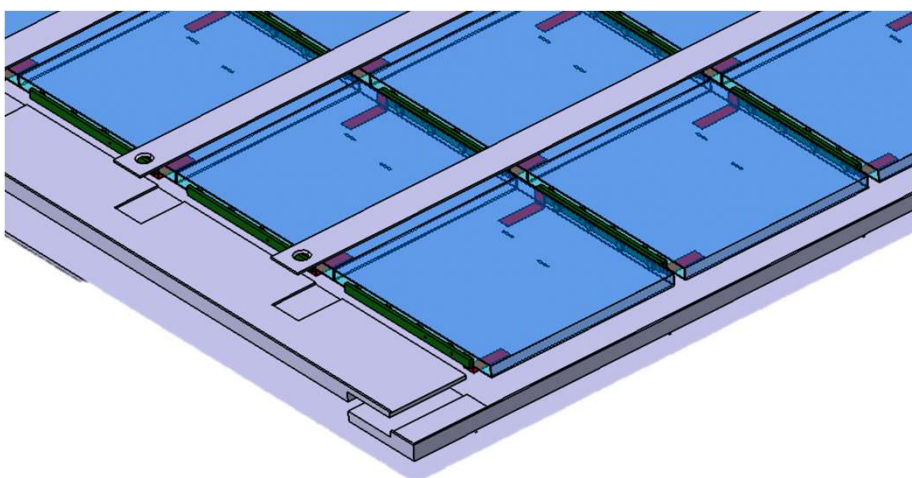
The Kapton cables keep off through same
pocket defined on the same plate, highlighted
by some yellow stickers for better location





TILE PROTOTYPES

Type-C
CFRP layer - TOP

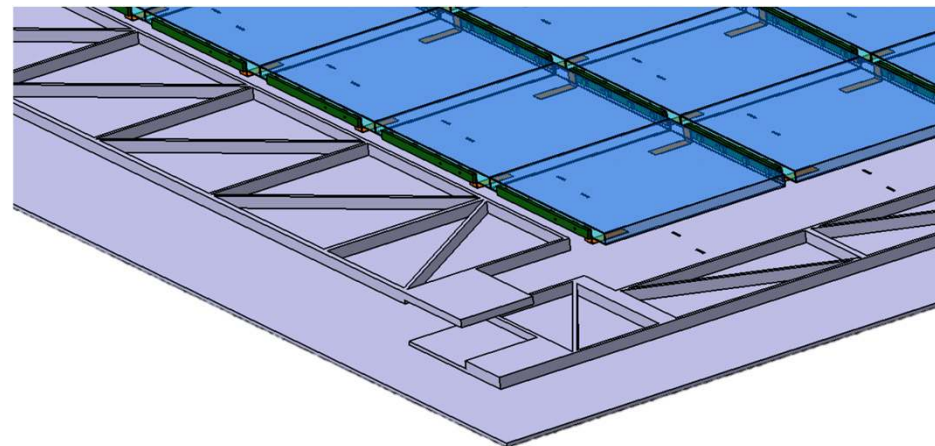


The External Layer is the biggest

We have first a carbon fiber plate, then two elements used to keep all together the parts

A hole could be easily defined to allow the passage of pins or rods to define a link with the other detector

Some stiffness will keep tiles in place



The internal layer here is defined in the same way

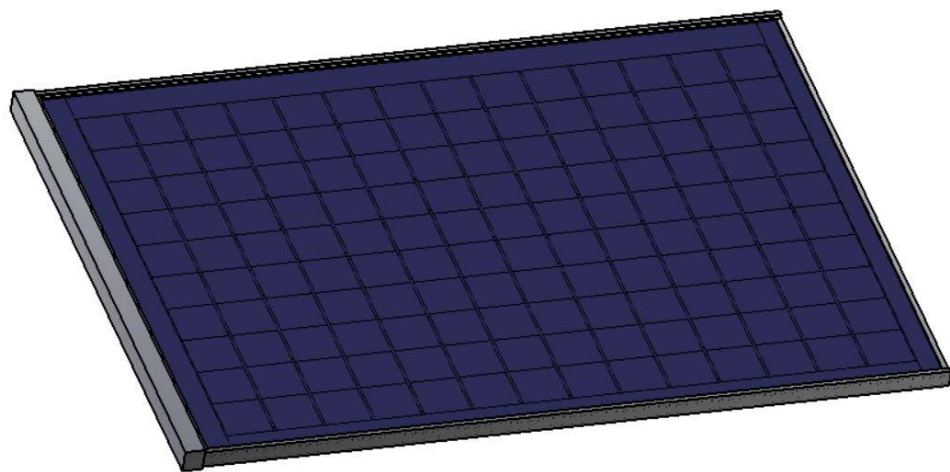
Larger corners have been designed to compensate the empty zones

No stiffness to keep tiles in place are needed since the external layer will close all the Frame



TILE PROTOTYPES

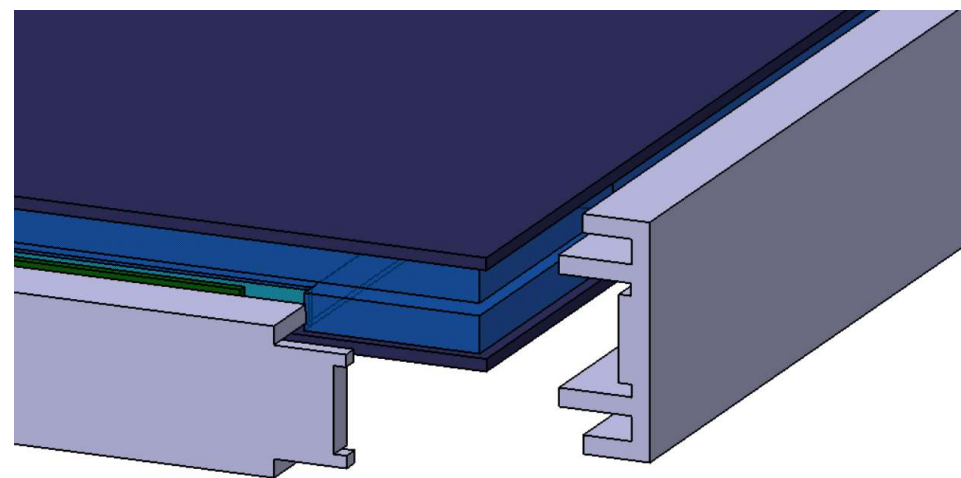
Type-C
CFRP layer - SIDE



Frame: **1150 x 1645 x 50 mm³**
Active area: **1140 x 1600 x 12 mm³**
Tiles: **165 + 140 = 305 and more**

General dimension bars have been used to close the smallest tile layer

No way to use a unified tile dimension due to the crossing configuration



Due to the only 5 mm available for the lateral frame we thought about some Aluminium profiles that could close and keep both layers together

At the corners some external hinges should be adopted to use bolts or screws and allow the link between each Side and Top PSD



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ANTONELLA SUMA
UNIVERSITY OF NAPLES FEDERICO II

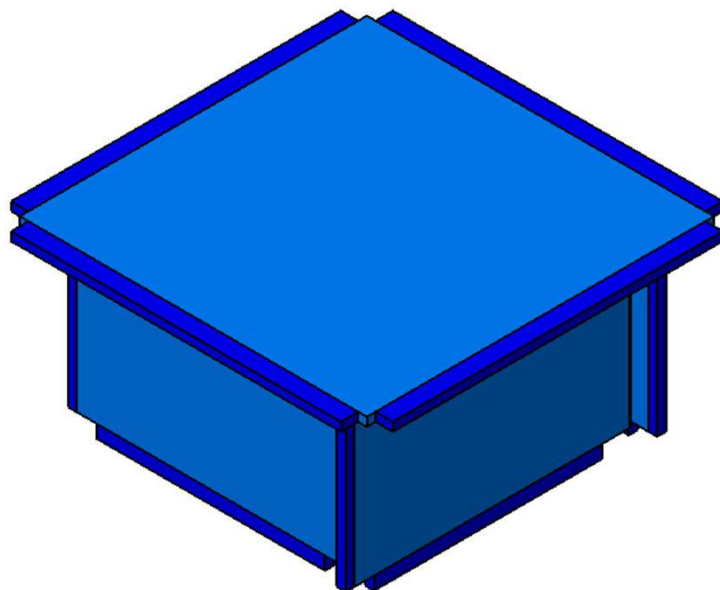
with the cooperation of
F. ALEMANNI, A. PARENTI (GSSI and INFN-LNGS) and
C. ALTOMARE (UNIVERSITY OF BARI)



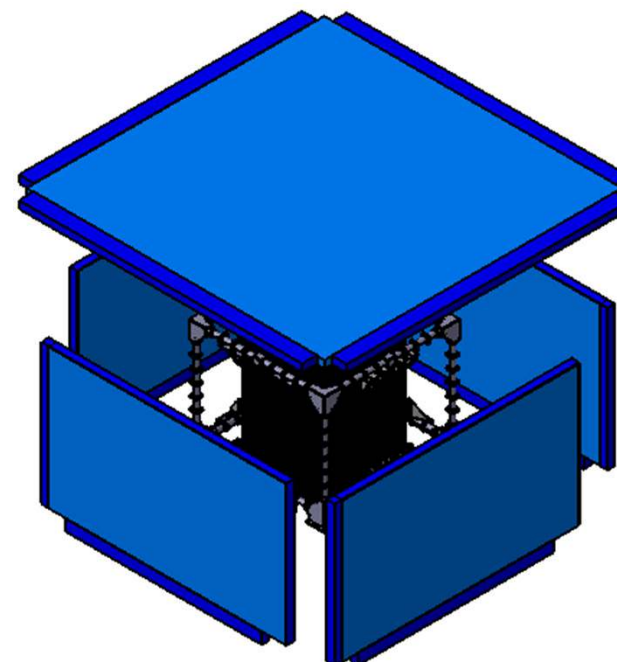
FINAL PROTOTYPE

FINAL PROTOTYPE

GRID



Block modeled in cooperation with:
Edoardo Mancini and Lorenzo Mussolin

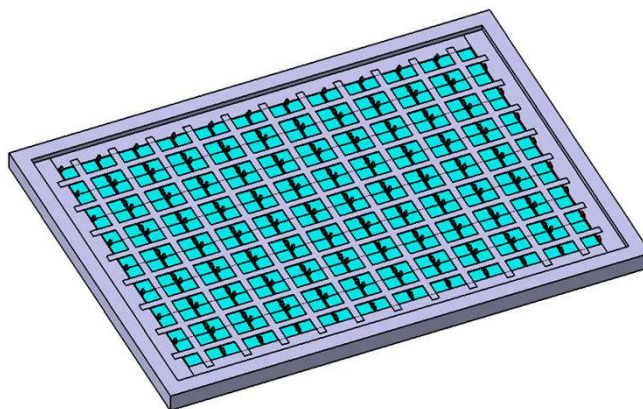
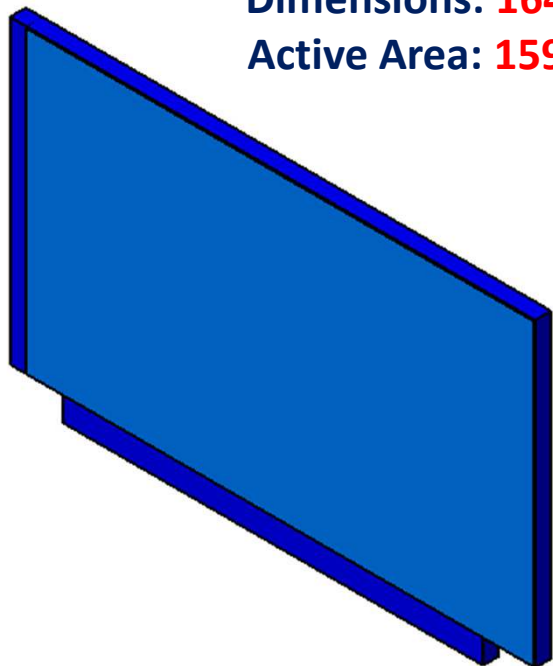


Hermeticity in cooperation with:
**Francesca Alemanno and Andrea Parenti
and Corrado Altomare**

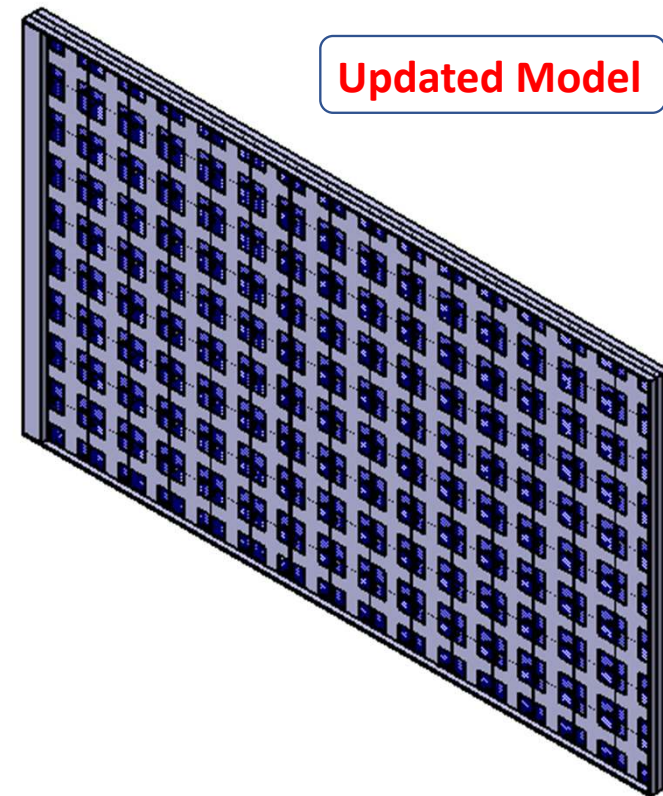


FINAL PROTOTYPE

Dimensions: **1645 x 943 x 50 mm³**
Active Area: **1590 x 933 x 12 mm³**



Previous Model

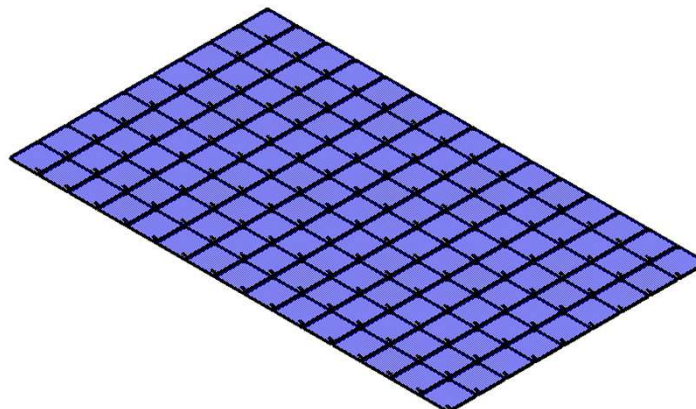


Updated Model

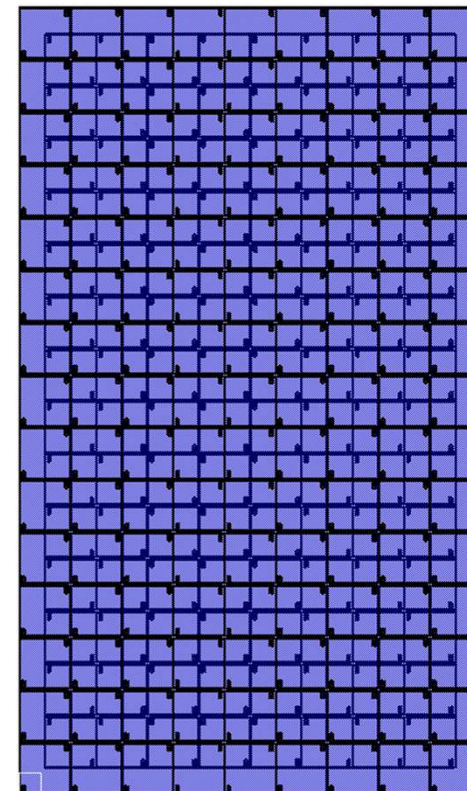
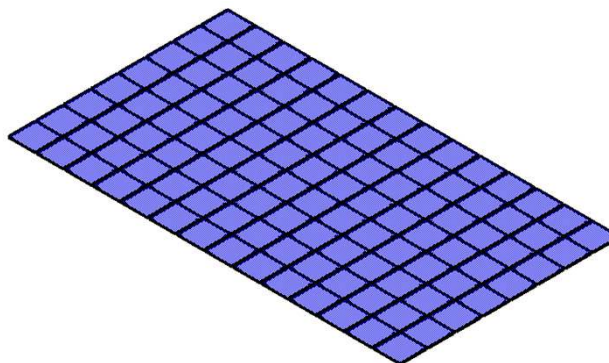


FINAL PROTOTYPE

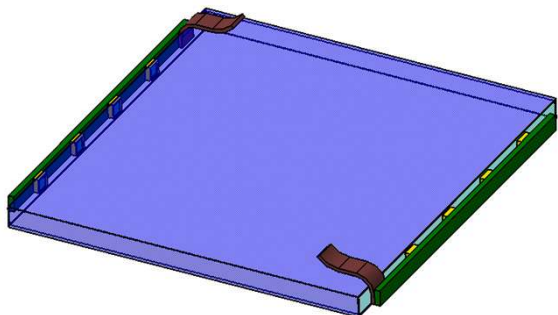
External Layer: 9 x 15 tiles
Dimensions: 1590 x 933 x 6 mm



Internal Layer: 8 x 14 tiles
Dimensions: 1484 x 829 x 6 mm



Temporary front-end electronics



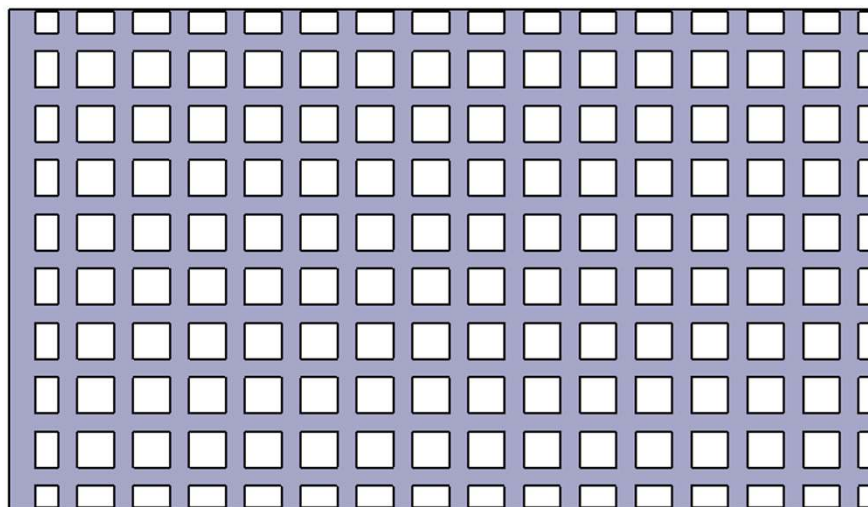
Tile: 103 x 100 x 5mm
Wrapping: + 0.5 mm
PCB thickness: + 3.1 mm



FINAL PROTOTYPE



Dimensions: **1645 x 943 x 50 mm³**



Dimensions: **1643 x 941 x 2 mm³**



Dimensions: **933 x 50 x 50 mm³**



FINAL PROTOTYPE

Dimensions: **1645 x 943 x 50 mm³**

Common Detect Area: **1,48 m²**

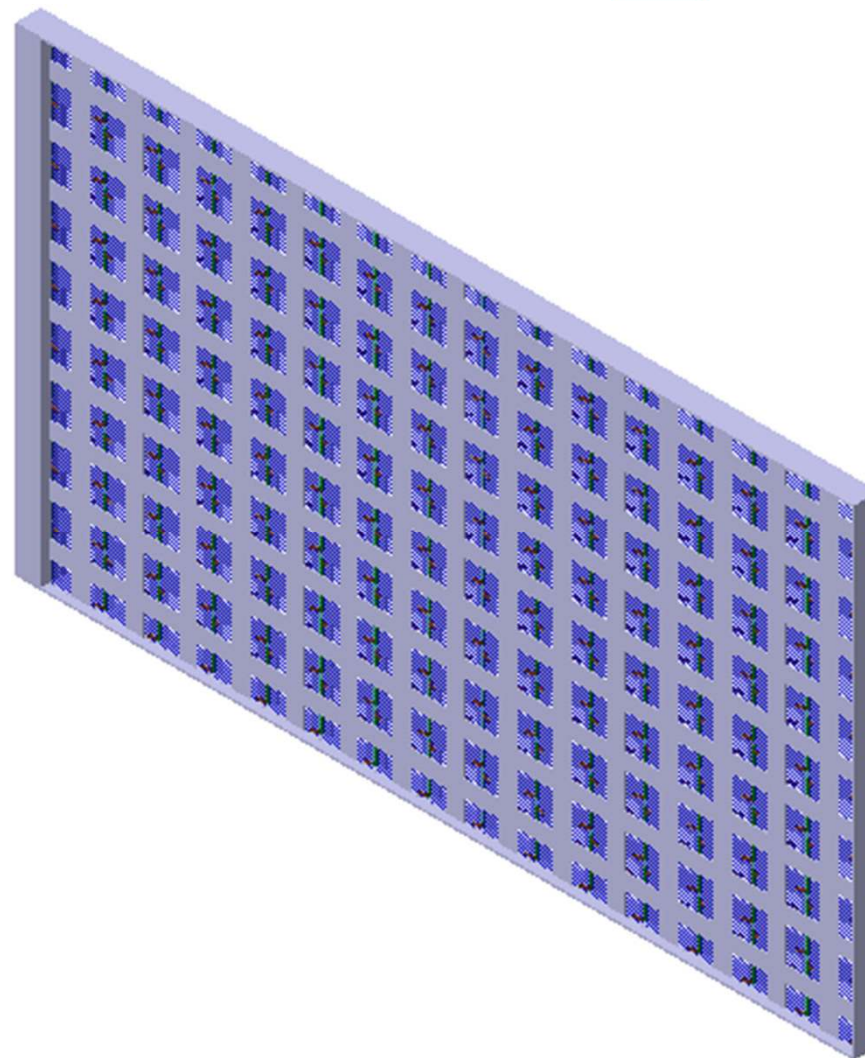
Distance between the two Tile Layers: **Wrapping**

Tiles in External layer: **135**

Tiles in Internal layer: **112 + 48**

Mass (Carbon Fiber 1725 kg/mm³):

17.3 kg (tiles) + 11.7 kg (frame)





FINAL PROTOTYPE

NEXT STEPS

- Final definition of the dimensions of the PSD after the further simulations on the hermeticity
- Dynamic tests on the structure
- Positioning and fixing of the PSD in the common final structure

