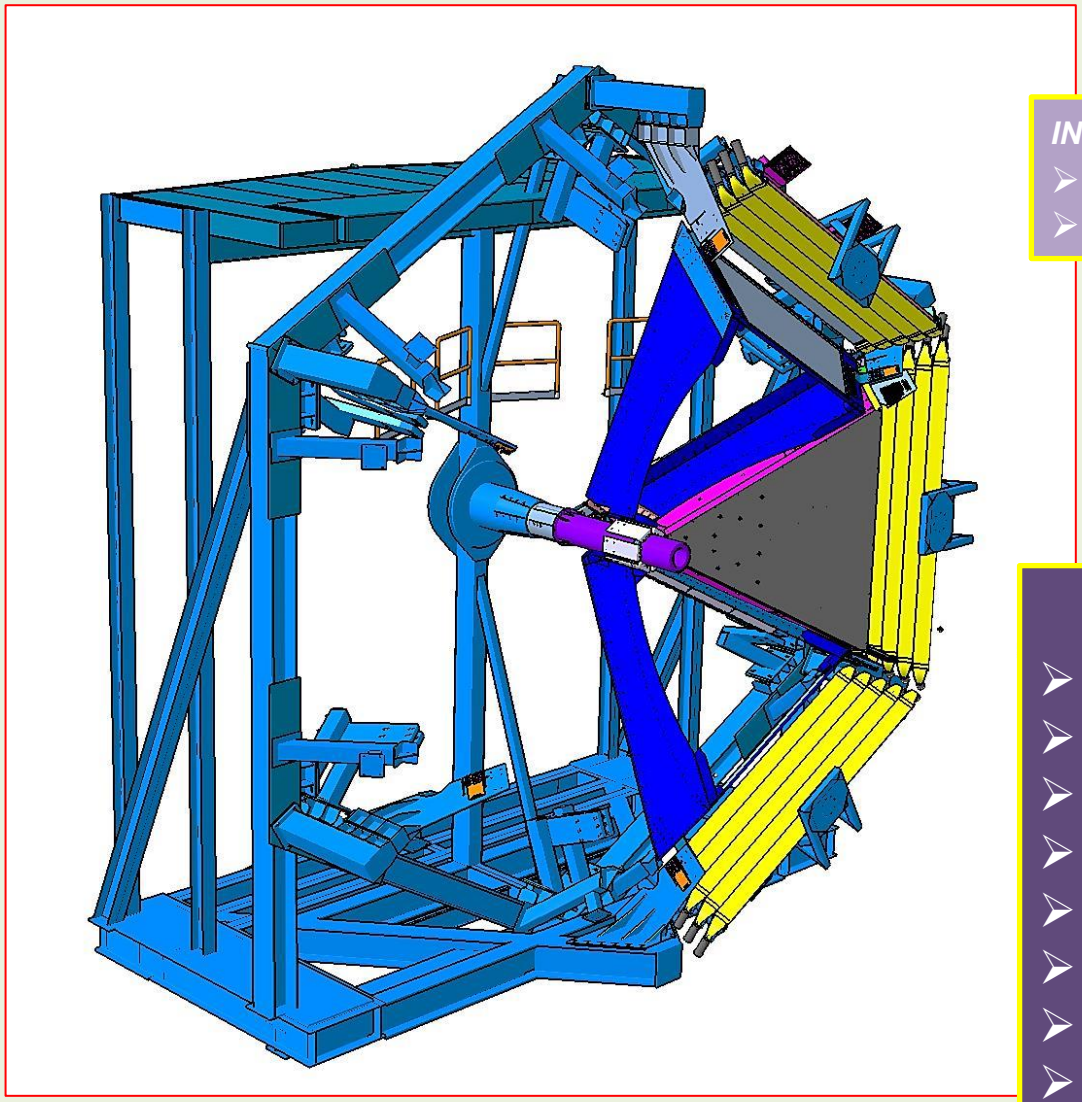


INVOLVED PEOPLE

- INFN LNF – Dario Orecchini / Sandro Tommasini
- ARGONNE NL – Kevin Bailey / Thomas O'Connor

FACED TOPICS

- RICH INTEGRATION IN CLAS 12
- RICH MODULE SUPPORT STRUCTURE
- RICH COMPONENTS & ACCEPTANCE AREA
- PATCH PANELS
- CABLES & PIPELINES PATHWAY
- EXIT SIDE PANEL OVERVIEW
- ENTRANCE SIDE PANEL OVERVIEW
- ELECTRONIC PANEL OVERVIEW
- RICH MATERIAL BUDGET

RICH MECHANICS TIMELINE

- ***June/September 2013 Jlab - DOE Review***
  - First draft of the RICH detector inside the CLAS12 constraints
  - General definition of the components and materials

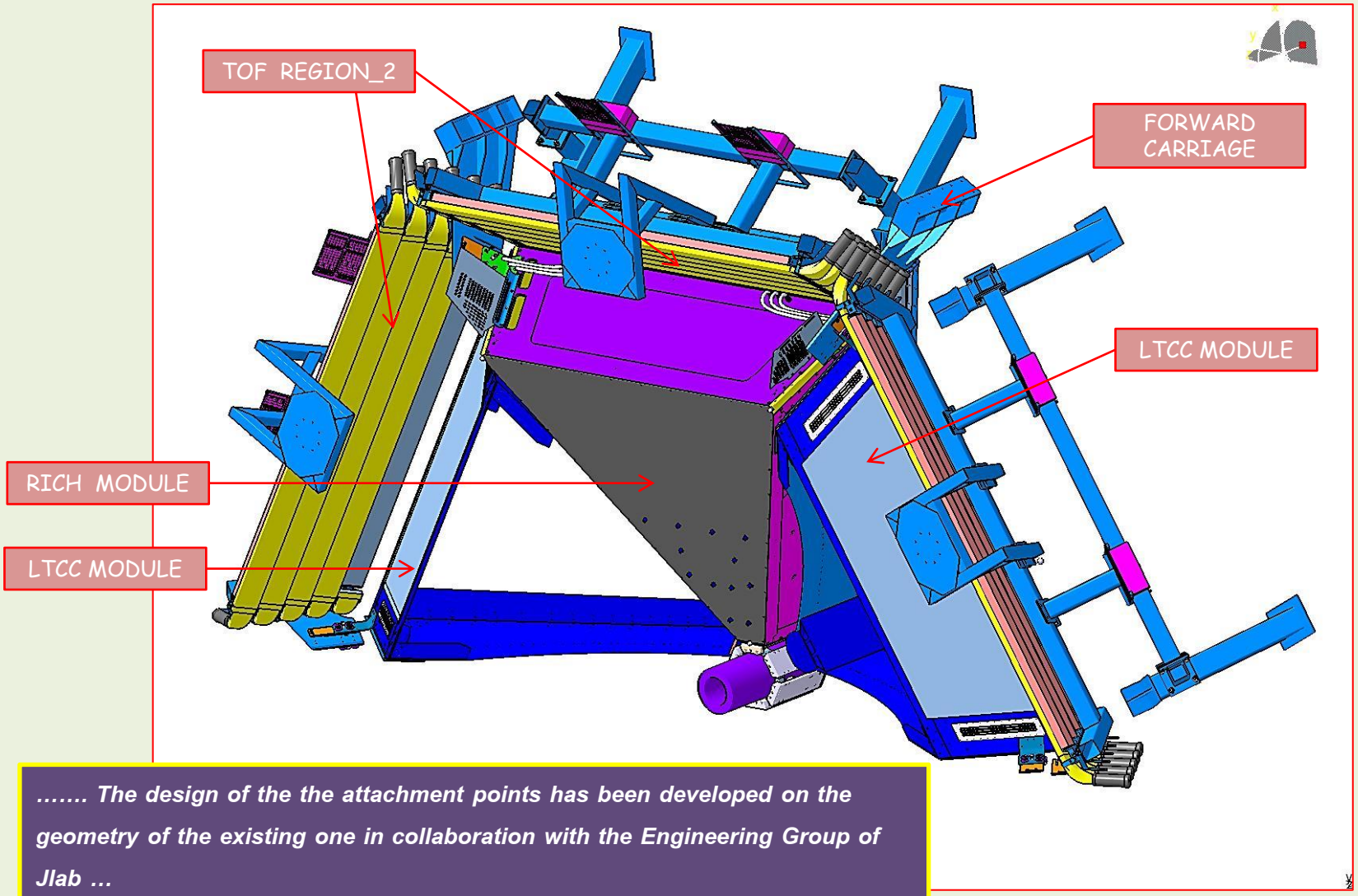
- ***June 2014 JLab Mechanics bReview***
  - Detailed description of the RICH detector
  - Verification of the compatibility with CLAS12

- ***April 2015 Meeting at JLab***
  - Final check of the detector geometry
  - Definition of the assembly and installation procedures

- ***May 2015***
  - Contract for the RICH construction awarded

- ***Summer 2015***
  - Finalization of the construction details

- ***October 2015***
  - Construction started



……. The design of the the attachment points has been developed on the geometry of the existing one in collaboration with the Engineering Group of Jlab …

- ***NO INTERFERENCES HAVE BEEN FOUND WITH OTHERS CLAS12 COMPONENTS***
- ***THE RICH MODULE IS FULLY INSIDE THE ASSIGNED VOLUME***

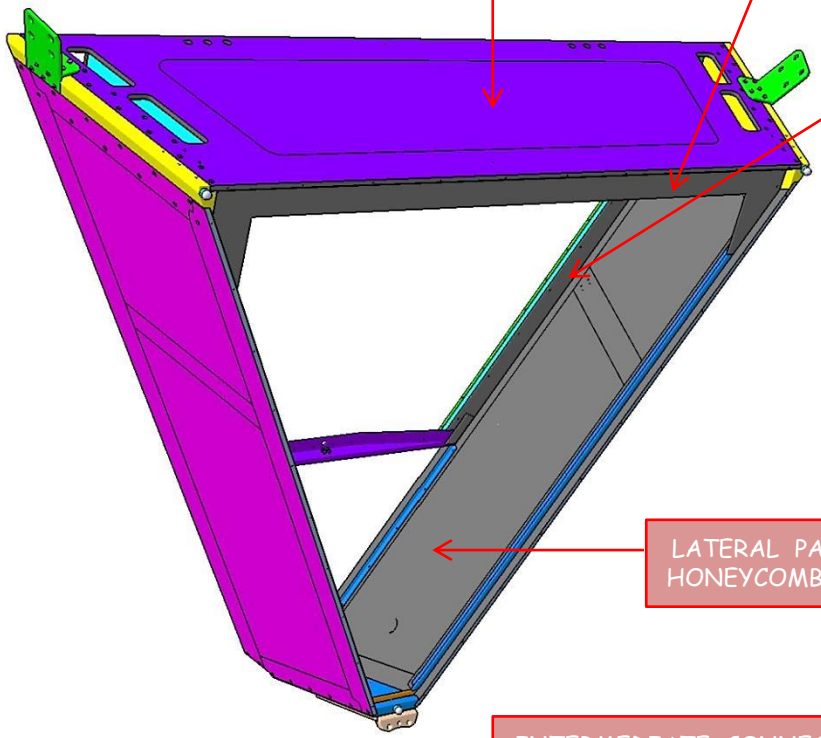
UPPER CLOSING FRAME - CFRP 25mm Thickness
(Boundary frame in monolitic carbon, plus a core of Nomex Honeycomb)

UPPER STIFFENING FRAME
CFRP - 10mm Thickness

OVERVIEW OF LOW XO MATERIAL BUDGET COMPONENTS

LATERAL STIFFENING FRAME
CFRP - 10mm Thickness

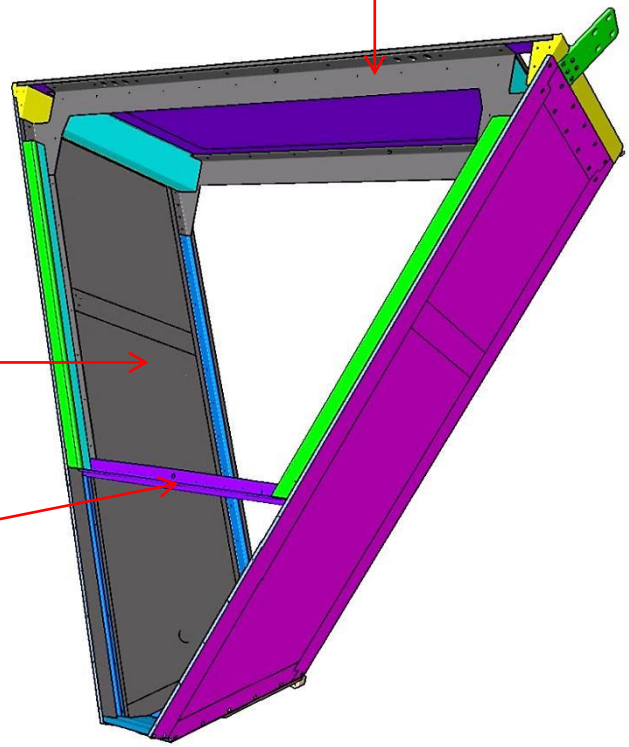
UPPER STIFFENING FRAME
CFRP - 10mm Thickness



LATERAL PANEL ALUMINUM
HONEYCOMB - 25mm Thickness

INTERMEDIATE CONNECTION FRAME
CFRP - 10mm Thickness

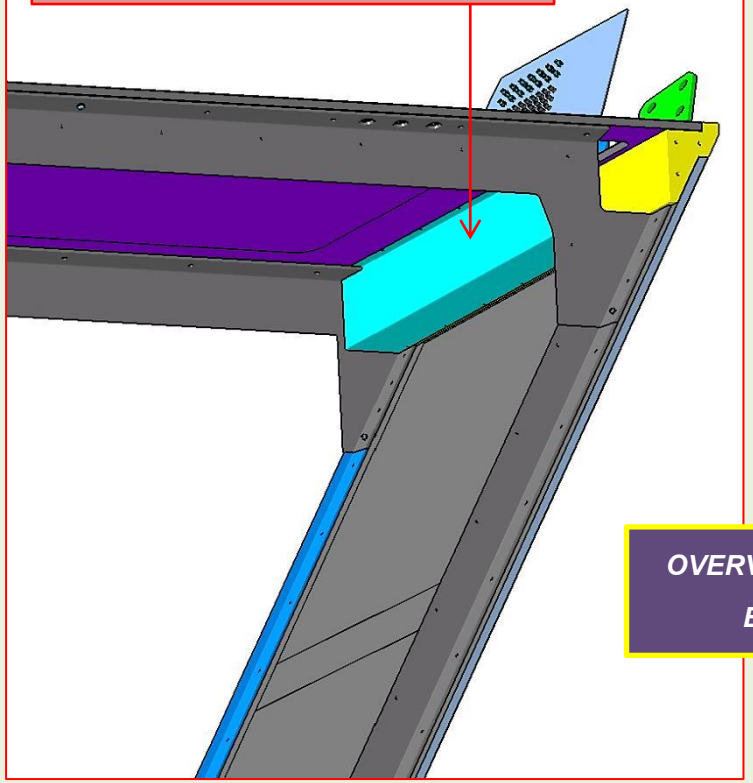
ENTRANCE SIDE VIEW



EXIT SIDE VIEW

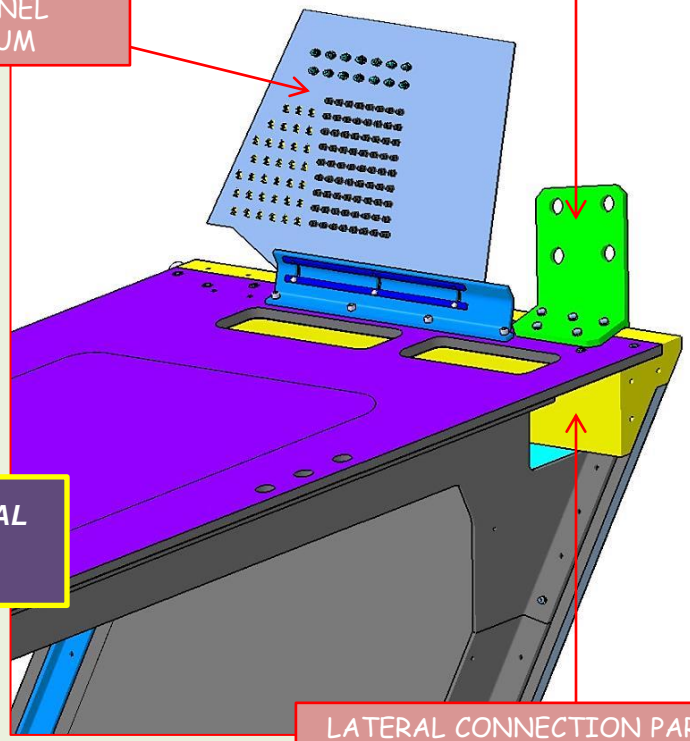
> THE RICH MODULE IS UNDER CONSTRUCTION BY TECNAVAN (Veroli – Italy).
> THE ASSEMBLY TEST WILL BE DONE AT THE END OF 2015
> THE MODULE WILL BE AT JLAB IN MARCH 2016

CABLES & PIPES RACEWAYS
ALUMINUM SHEET - 1mm Thickness



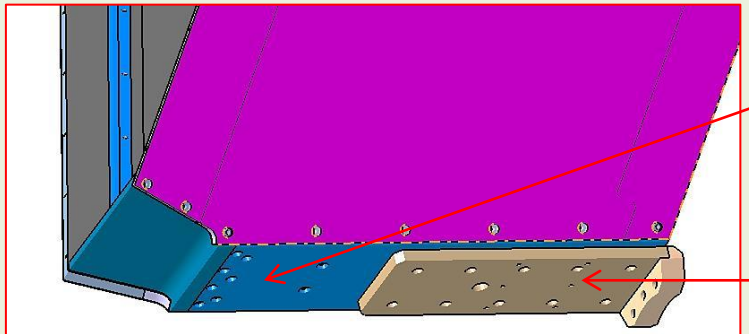
CONNECTION STIRRUP
AISI 316L Amagnetic Steel

PATCH PANEL
ALUMINUM



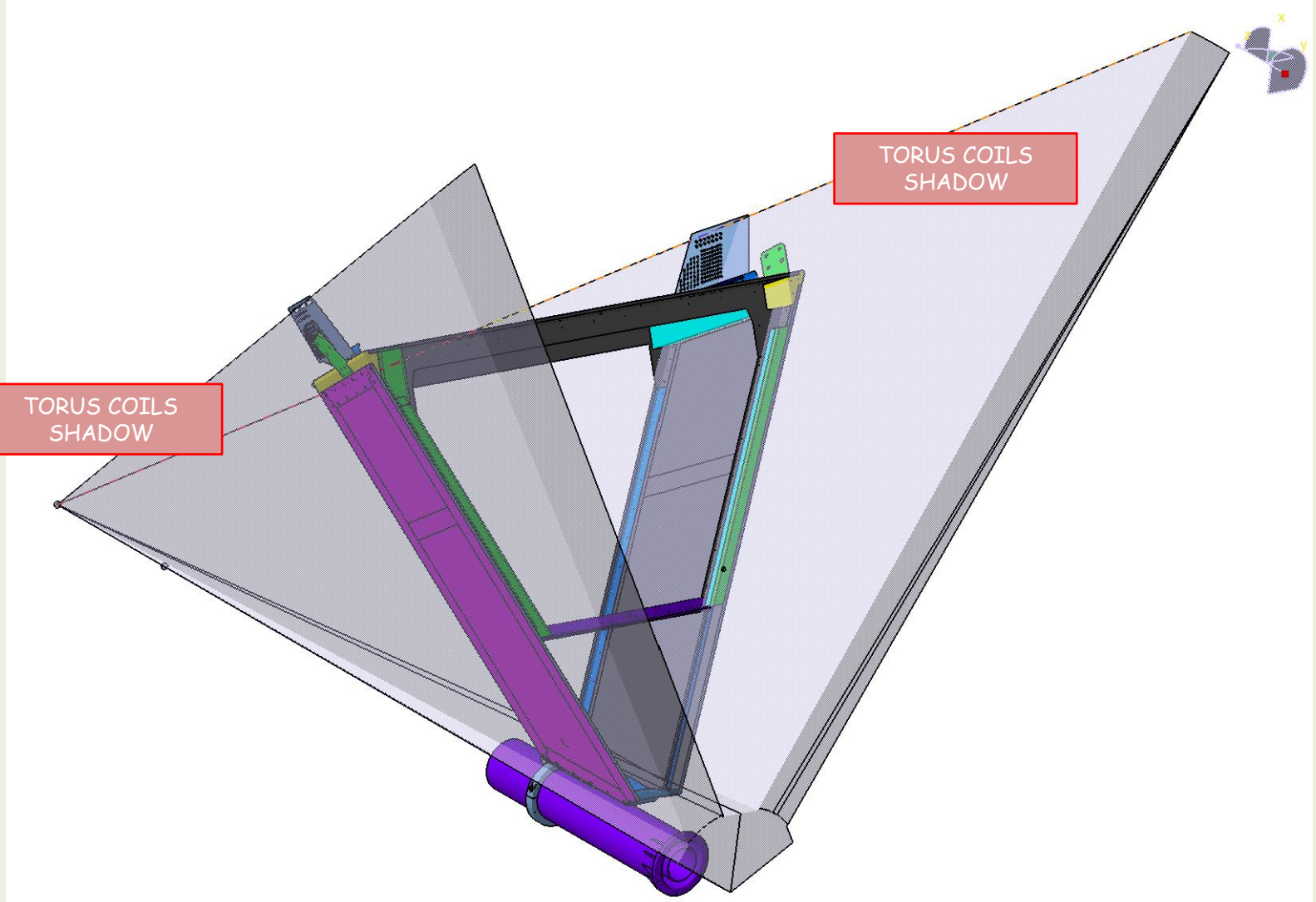
LATERAL CONNECTION PART
MONOLITIC ALUMINUM

OVERVIEW OF HIGH XO MATERIAL BUDGET COMPONENTS

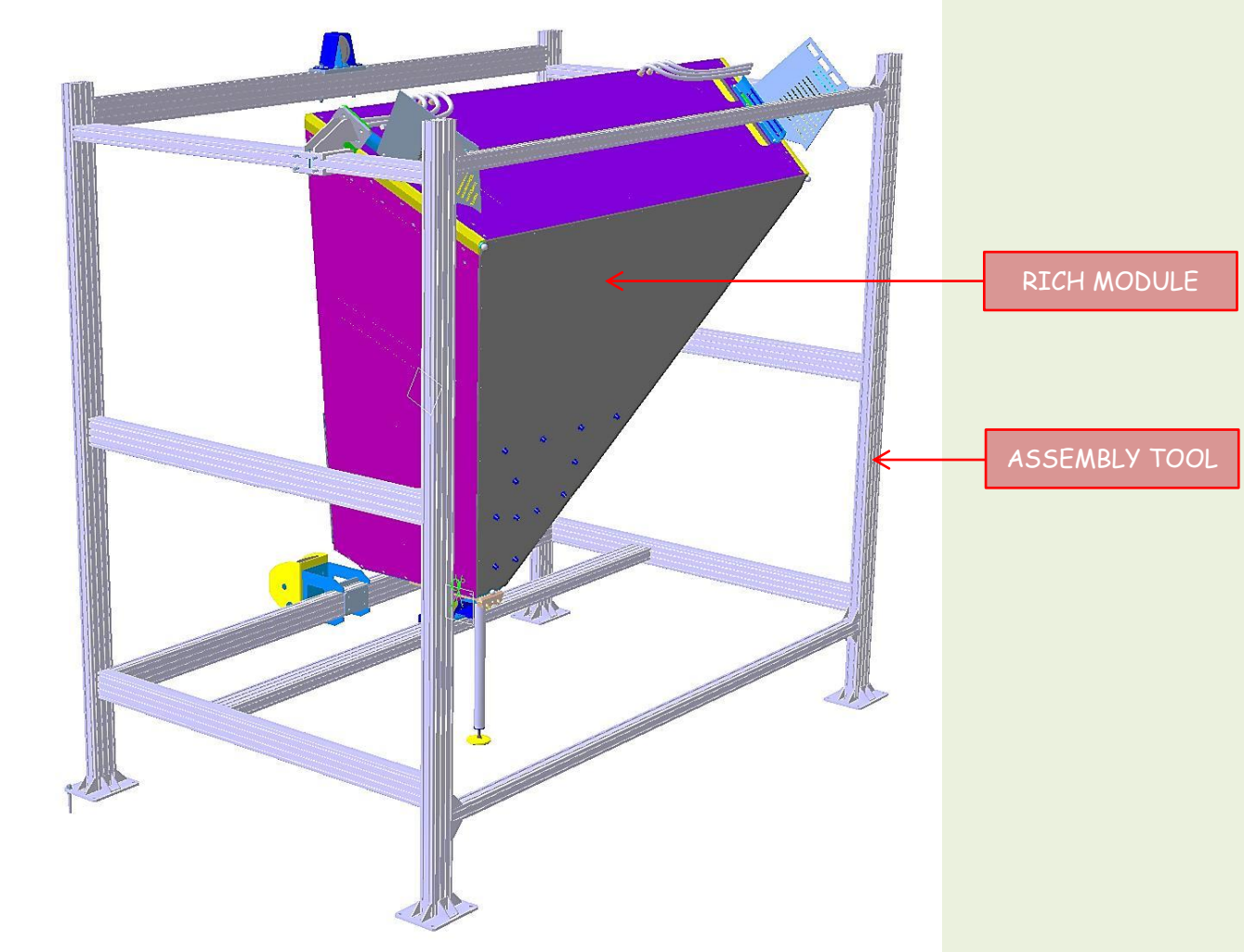


LOWER PLATE
MONOLITIC ALUMINUM

LOWER HOOKING COLLAR
AISI 316L Amagnetic Steel



- ***ONLY LOW MATERIAL BUGET COMPONENTS ARE IN THE ACCEPTANCE AREA***
- ***HIGH MATERIAL BUDGET COMPONENTS ARE IN THE TORUS COILS SHADOW***



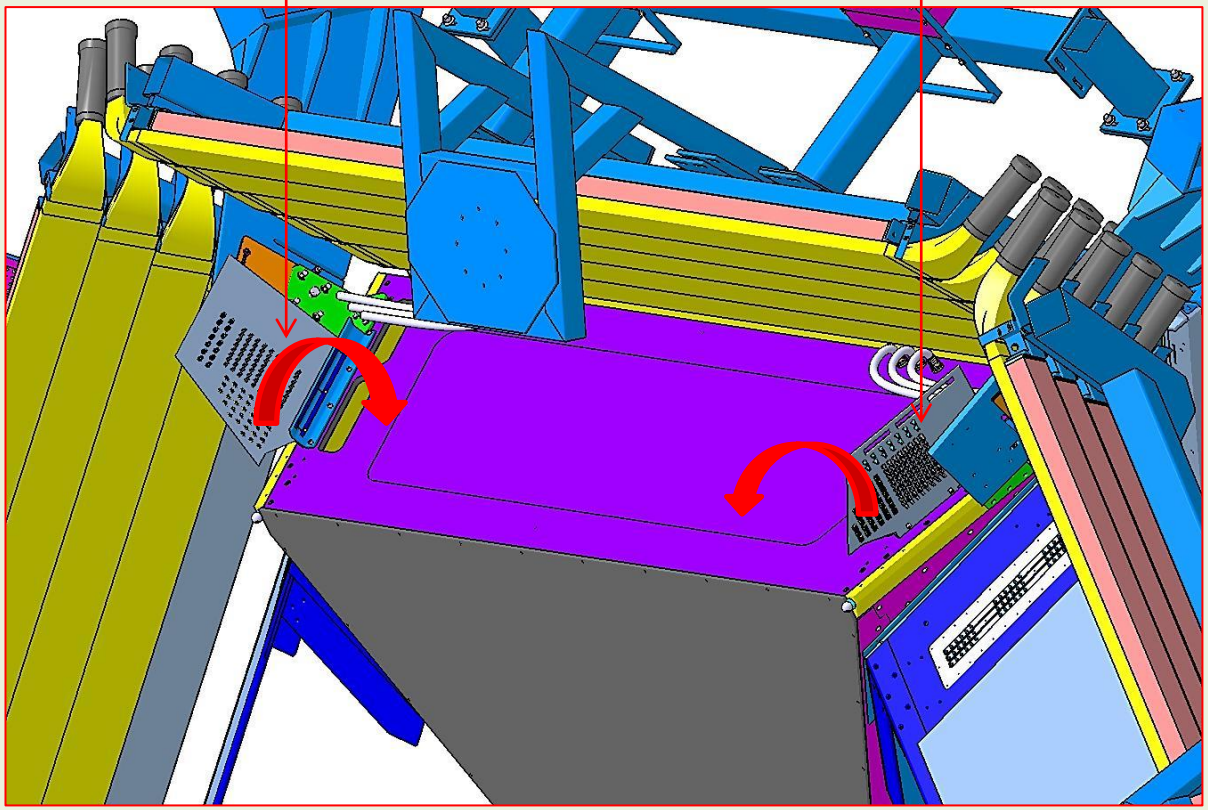
> THE RICH MODULE ASSEMBLY TOOL IS UNDER CONSTRUCTION BY TECNAVAN (Veroli – Italy).

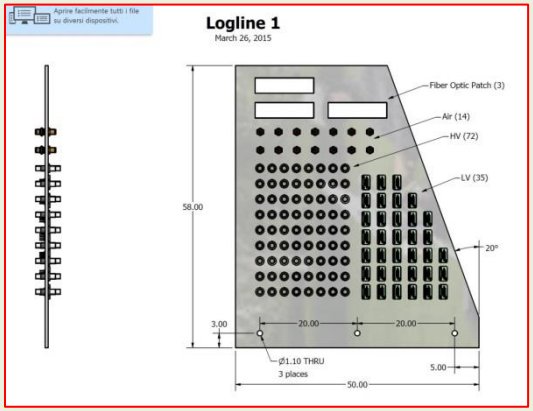
> THE FULL ASSEMBLY TEST WILL BE DONE AT THE END OF 2015

> THE TOOL WILL BE DELIVERED AT JLAB TOGHETER WITH THE MODULE IN MARCH 2016

P_PANEL LEFT

P_PANEL RIGHT





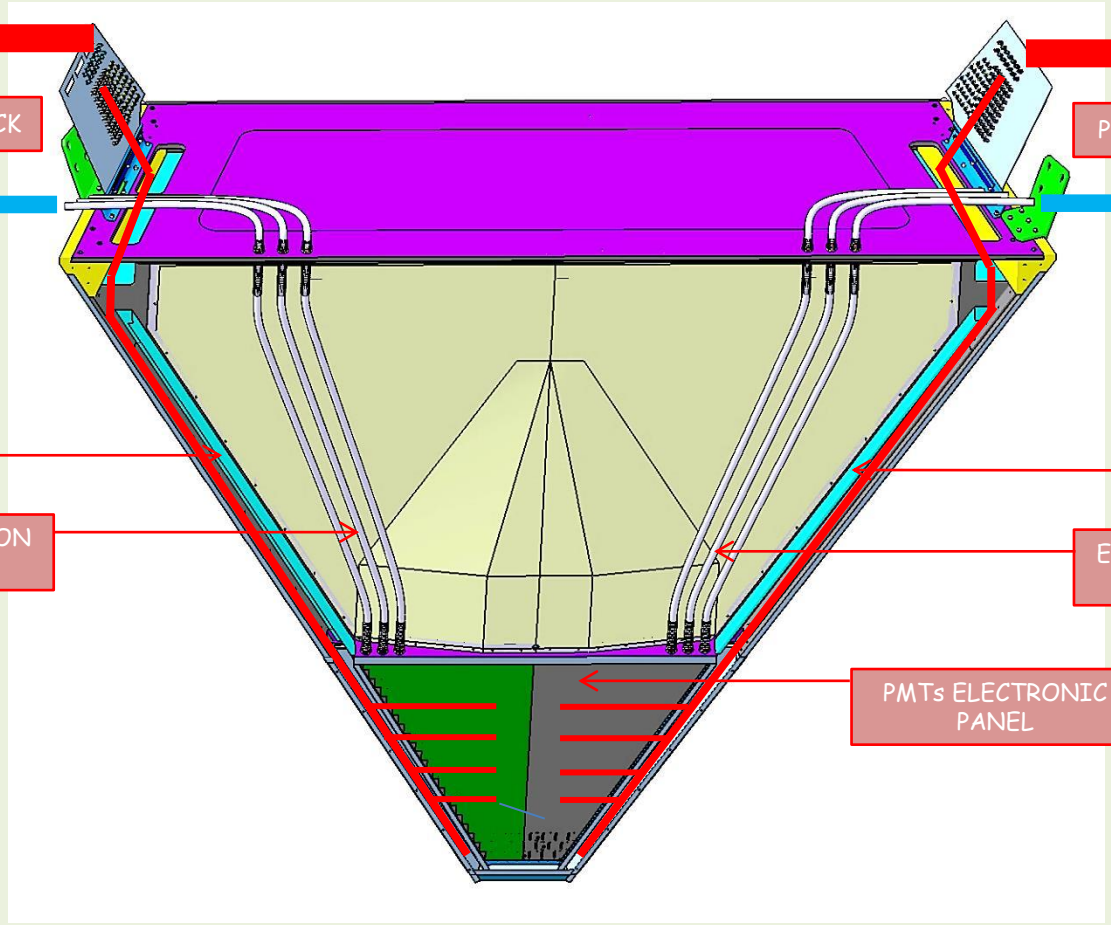
> DESIGNED AND REALIZED BY ARGONNE

> THE LAYOUT HAS BEEN DEVELOPED RESPECT ALL THE PLANNED CONNECTORS

> DESIGNED TO BE OUT OF THE ACCEPTANCE AREA

> DESIGNED TO BE ROTATED TOWARD THE RICH UPPER CLOSING PANEL DURING THE MOVING AND INSTALLATION PHASES

NB. JOBS IN CHARGE OF THOMAS O'CONNOR (ARGONNE NL)

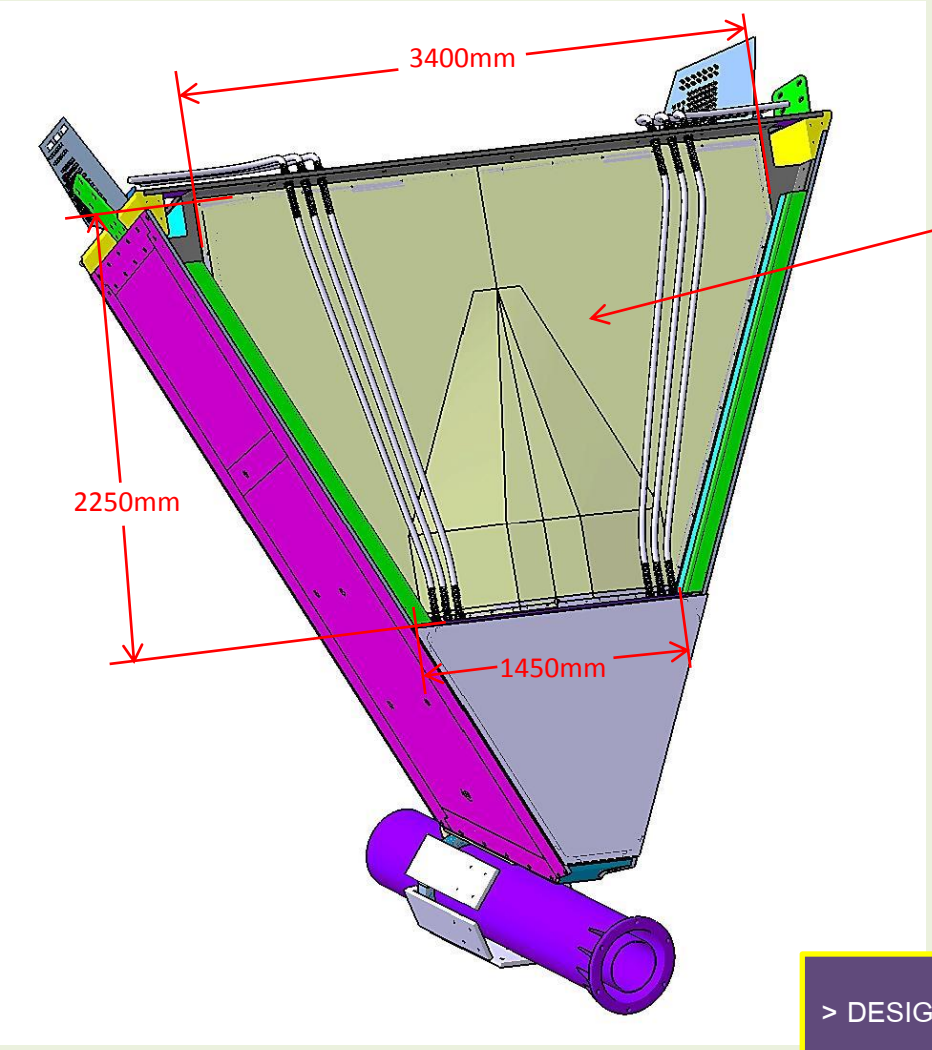


- OPERATION THAT WILL BE DONE IN THE ASSEMBLY AREA

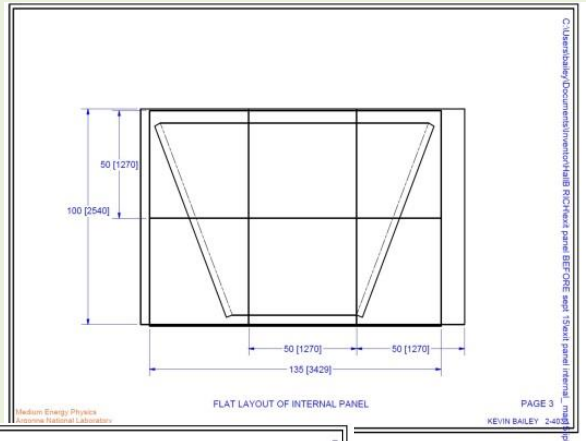
- THE CABLES (HV – LV – DIGITAL) WILL BE ROUTED FROM THE BOARDS IN THE LATERAL RACEWAYS.
- ALL THE CONNECTORS WILL BE CONNECTED ON THE PATCH PANELS HOUSING.

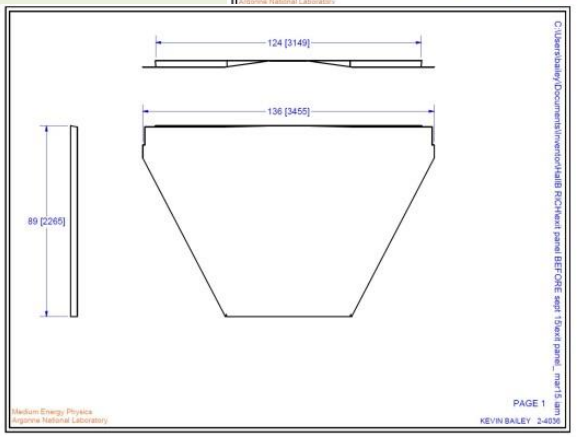
- OPERATION THAT WILL BE DONE AFTER THE INTEGRATION IN CLAS12 APPARATUS

- THE CABLES AND THE AIR PIPELINES WILL BE ROUTED FROM THE PATCH PANELS TO THE RACKS.



EXIT PANEL



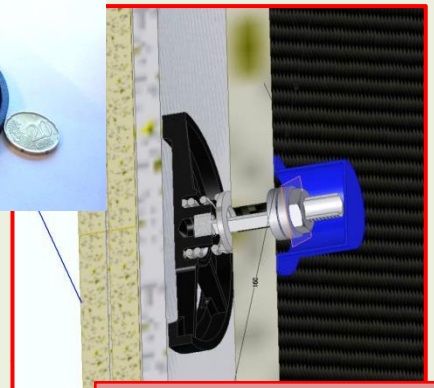


> DESIGNED AND REALIZED BY ARGONNE

> DESIGNED IN ALUMINUM SHEET (0.5 mm in thickness)

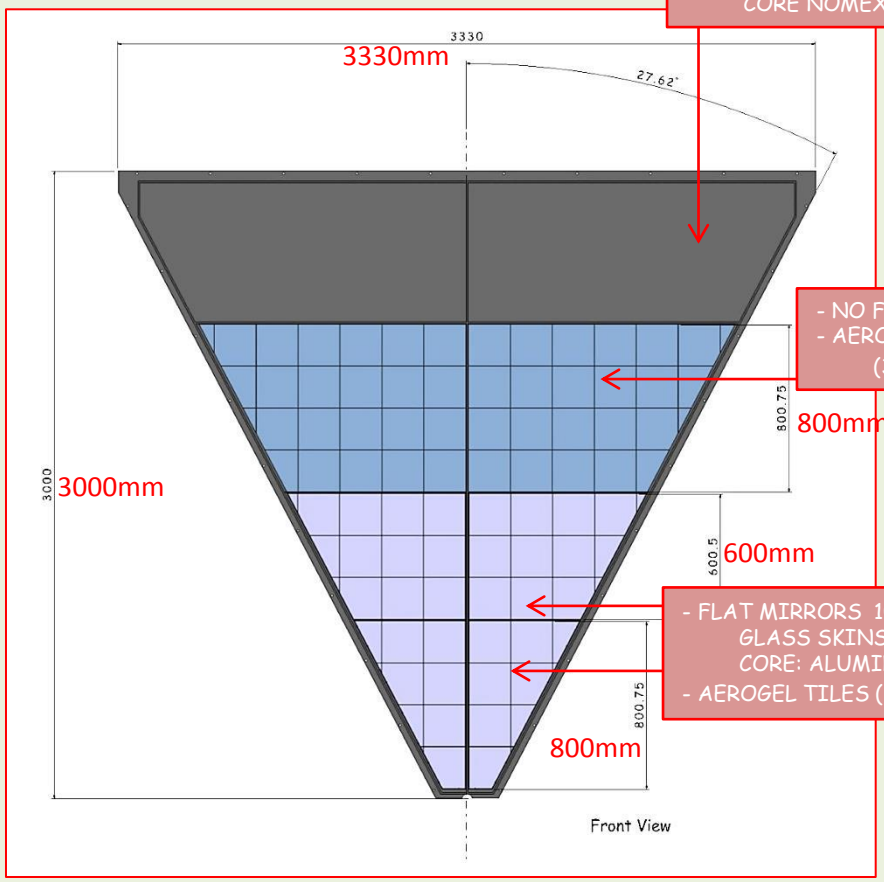
NB. JOBS IN CHARGE OF KEVIN BAILEY (ARGONNE NL)

- THE ROLE OF THE ENTRANCE PANEL IS:
  TO SUPPORT THE MODULES OF FLAT MIRRORS PLUS AEROGEL TILES
  TO REALIZE THE GAS–TIGHT AND THE LIGHTIGHT
- ***THE ORDER IS UNDER PREPARATION***



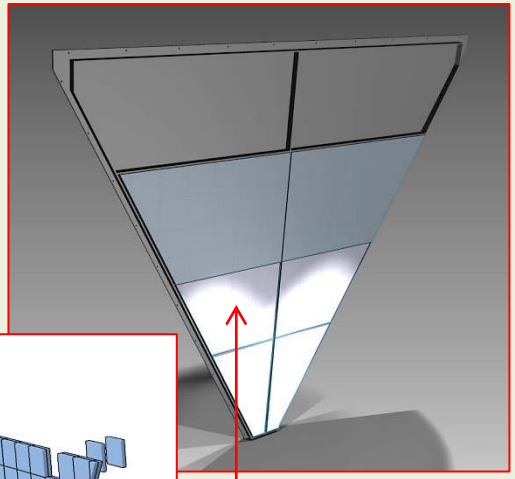
- FLAT MIRRORS SUPPORT AND ADJUSTAMENT BRACKET

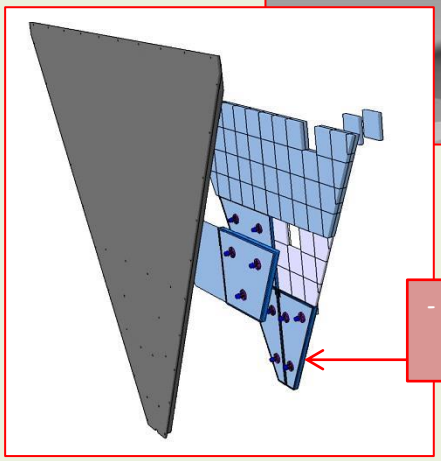
- SUPPORT PANEL (15mm thickness)
  SKINS CFRP (0,5mm thickness)
  CORE NOMEX HONEYCOMB



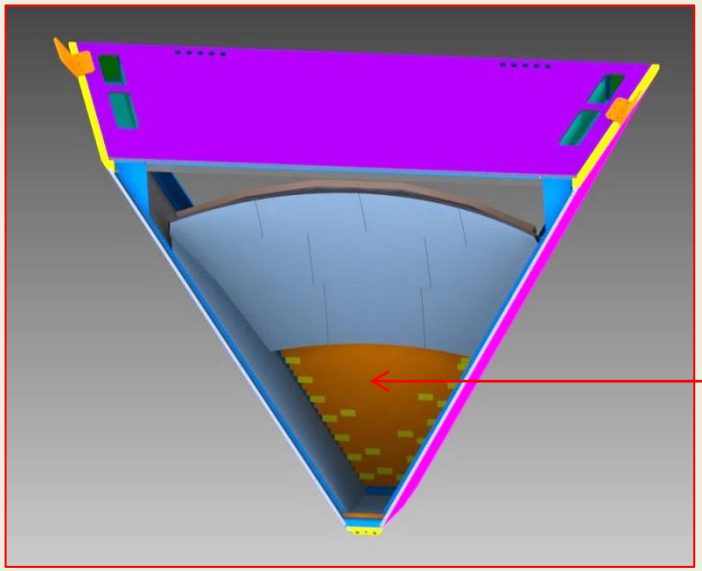
- NO FLAT MIRROR
- AEROGEL TILES
  (30+30mm tickness)

- FLAT MIRRORS 10mm Thickness
  GLASS SKINS 0,7mm
  CORE: ALUMINUM HONEYCOMB
- AEROGEL TILES (20mm tick.)





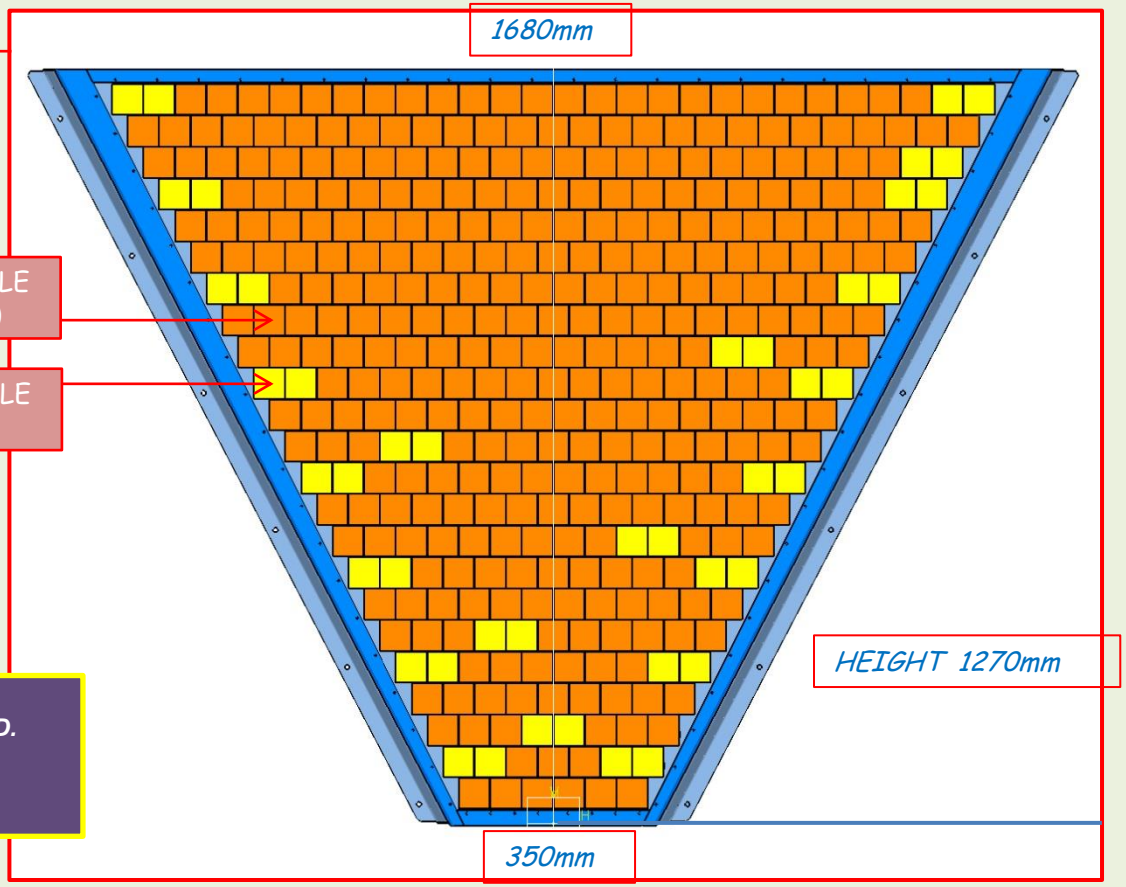
- MODULES OF FLAT MIRRORS PLUS AEROGEL TILES



E_PANEL MAIN NUMBERS:
- **391 PMTs**
- 23 LAYERS
  (1° LAYER > 6 PMTs)
  (23° LAYER > 28 PMTs)

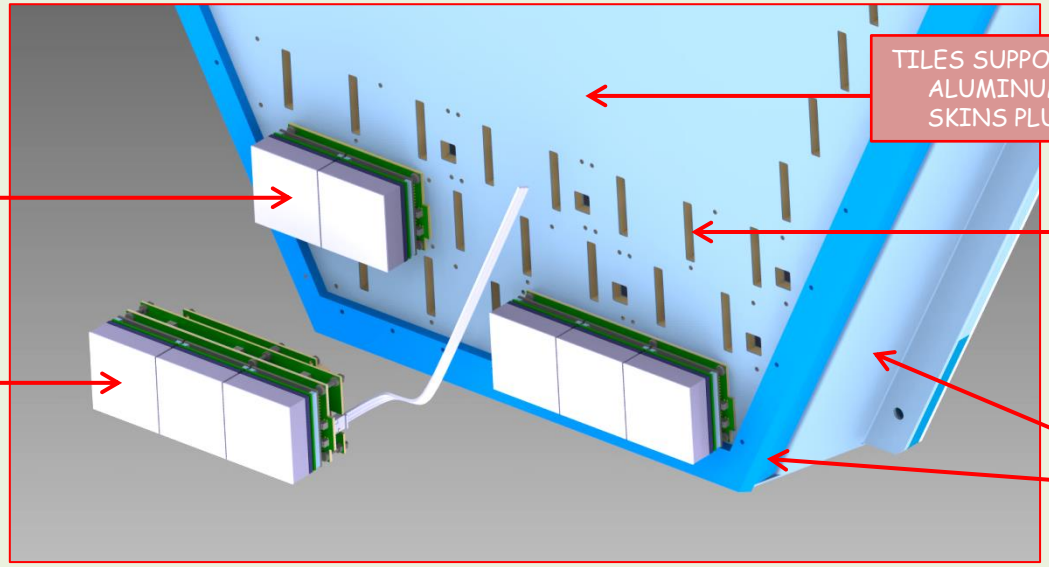
- 2 PMTs TILES: 23 > 23x2= 46 PMTs
- 3 PMTs TILES: 115 > 115x3= 345 PMTs

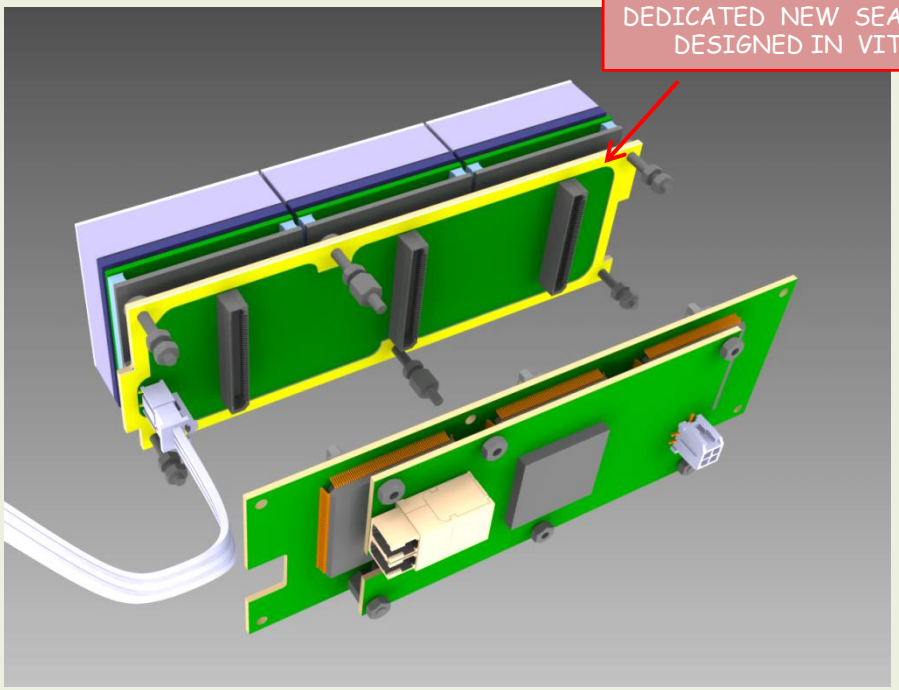
(-3 PMTs TILES HAVE BEEN PREFERRED)

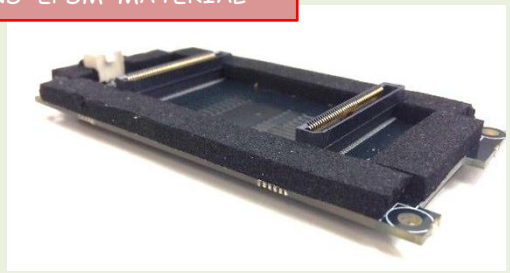


> THE ELECTRONIC PANEL DESIGN HAS BEEN COMPLETED.

> **THE ORDER IS UNDER PREPARATION**

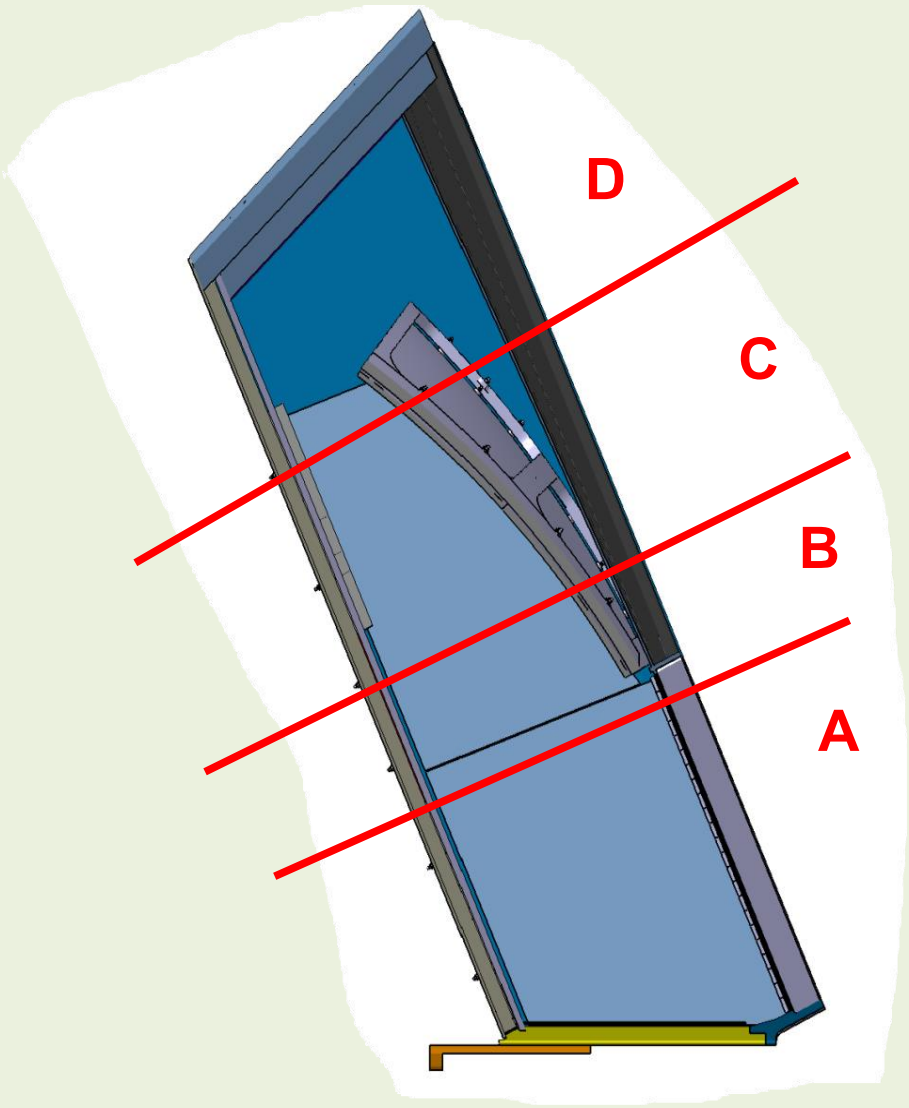






ASSEMBLY PROCEDURE AND LIGHTIGHT
HAVE SUCCESSFULLY TESTED

RICH: Fraction of X0 (%)	
A) Total	**33.8**
- front+back panels	1.6
- planar mirror	1.3
- thin aerogel	1.7
- electronics	29.2
B) Total	**6.3**
- front+back panels	1.6
- planar mirror	1.3
- thin aerogel	1.7
- spherical mirror	1.7
C) Total	**7.7**
- front+back panels	1.6
- thick aerogel	5.1
- spherical mirror	1.7
D) Total	**1.6**
- front+back panels	1.6
For comparison:	
- LTCC	3.2%
- FTOF	12%



CONCLUSIONS

- **RICH INTEGRATION IN CLAS 12**

  THE MODULE IS FULLY INSIDE THE ASSIGNED VOLUME

- **RICH MODULE SUPPORT STRUCTURE**

  THE MODULE IS UNDER CONSTRUCTION BY TECNAVAN (Veroli – Italy)

- **RICH COMPONENTS & ACCEPTANCE AREA**

  ONLY LOW MATERIAL BUGET ARE IN THE ACCEPTANCE AREA

- **PATCH PANELS**

  DESIGN HAS BEEN DONE. DETAILS ARE UNDER DEVELOPMENT

- **CABLES & PIPELINES PATHWAY**

  THE SYSTEM AND THE COMPONENTS HAVE BEEN DESIGNED.

- **EXIT SIDE PANEL OVERVIEW**

  DESIGN HAS BEEN DONE. DETAILS ARE UNDER DEVELOPMENT

- **ENTRANCE SIDE PANEL OVERVIEW**

  THE DESIGN HAS BEEN COMPLETED. THE ORDER IS UNDER PREPARATION

- **ELECTRONIC PANEL OVERVIEW**

  THE DESIGN HAS BEEN COMPLETED. THE ORDER IS UNDER PREPARATION

- **RICH MATERIAL BUDGET**

  THE OPTIMIZATION OF THE MATERIAL BUDGET AND THE POSITION OF THE COMPONENTS RESPECT THE ACCEPTANCE AREA HAS BEEN DONE