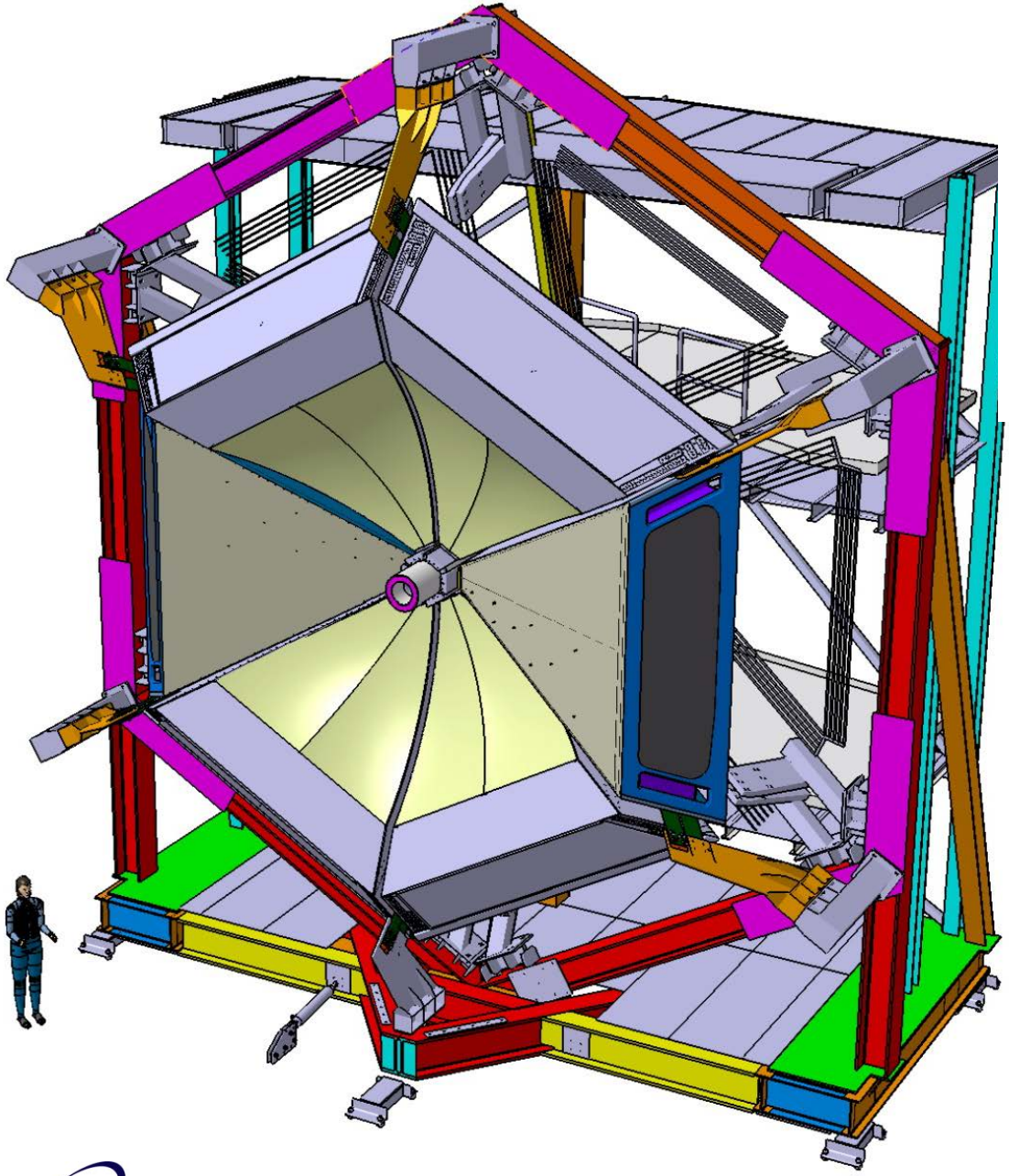


CLAS12 RICH – Mid-Term Review

RICH Installation and integration in CLAS12

October 13th 2015

D. Orecchini, S. Tomassini

INFN Istituto Nazionale di Fisica Nucleare

Outline

1. **Assembly of the detector in the clean room at JLab.**
2. **RICH transportation to the Hall B**
3. **RICH Installation in the CLAS12 apparatus.**
4. **Utilities**
5. **Conclusions.**

RICH assembly operation plan

- The delivery of the components will start after summer:
  - aerogel (October 2015)
  - 1st CFRP mirror (March 2016)
  - RICH mechanical Case (March 2016)

- The CFRP Mirror test will start in March 2016 in the dark room.

- The assembly of the RICH module will start in October 2016 (according to the management plan) and will last till the transportation in Hall B (August 2017).

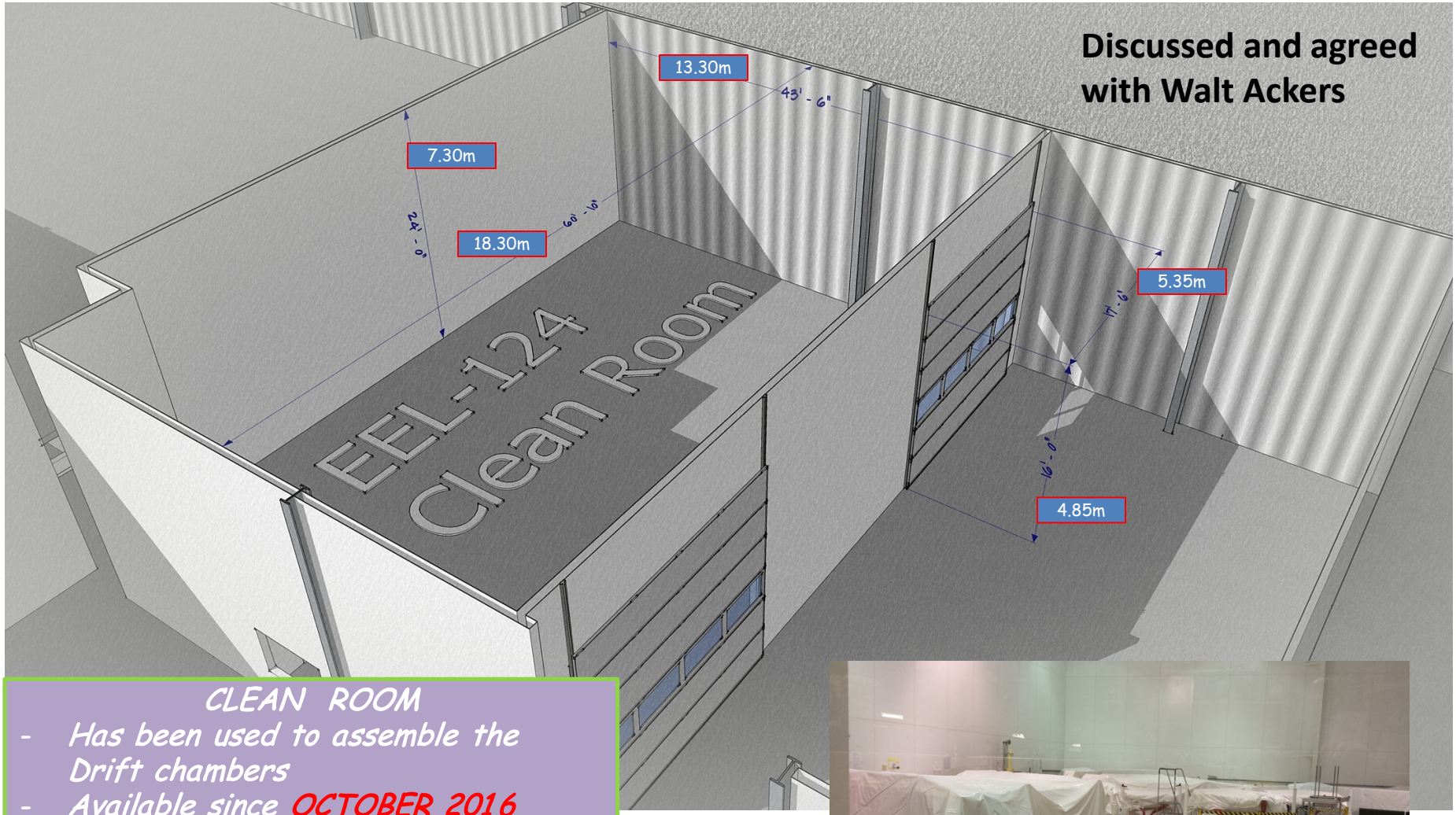
The mechanical assembly requires:

Clean room:
  - storage of aerogel
  - storage and test (dark room) of the mirrors
  - assembly and alignment of the mirrors
  - installation of the aerogel in the front panel

Normal room:
  - storage of the RICH module before the beginning of the assembly operations
  - assembly and tests of the electronic panel

See the RICH installation document:
https://clasweb.jlab.org/wiki/index.php/2015_October_13_RICH_Project_Mid-term_Review

Clean Room EEL-124

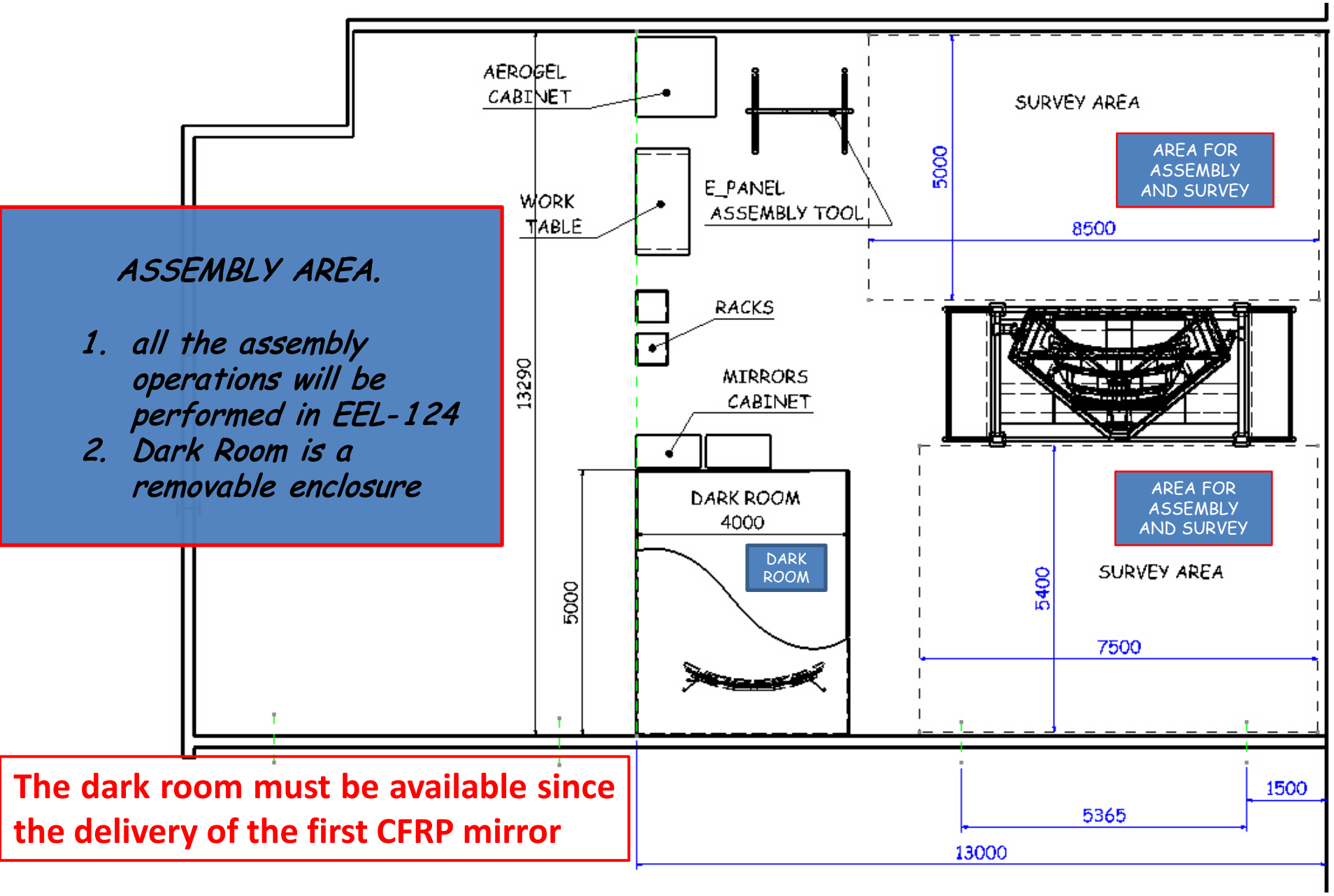


Discussed and agreed with Walt Ackers

CLEAN ROOM

- *Has been used to assemble the Drift chambers*
- *Available since **OCTOBER 2016** after the installation of the Drift chambers*
- *Small areas inside the room will be available **since first delivery of materials***

RICH ASSEMBLY AREA LAYOUT IN EEL-124



ASSEMBLY AREA.

1. *all the assembly operations will be performed in EEL-124*
2. *Dark Room is a removable enclosure*

The dark room must be available since the delivery of the first CFRP mirror

CLEAN ROOM EEL-124
Is equipped with a Gantry Crane Capacity 3 TON

A Gantry Crane will be used for mechanical assembly of the RICH case. The rotation of the RICH, once the assembly will be completed, will be performed by means of a winch.

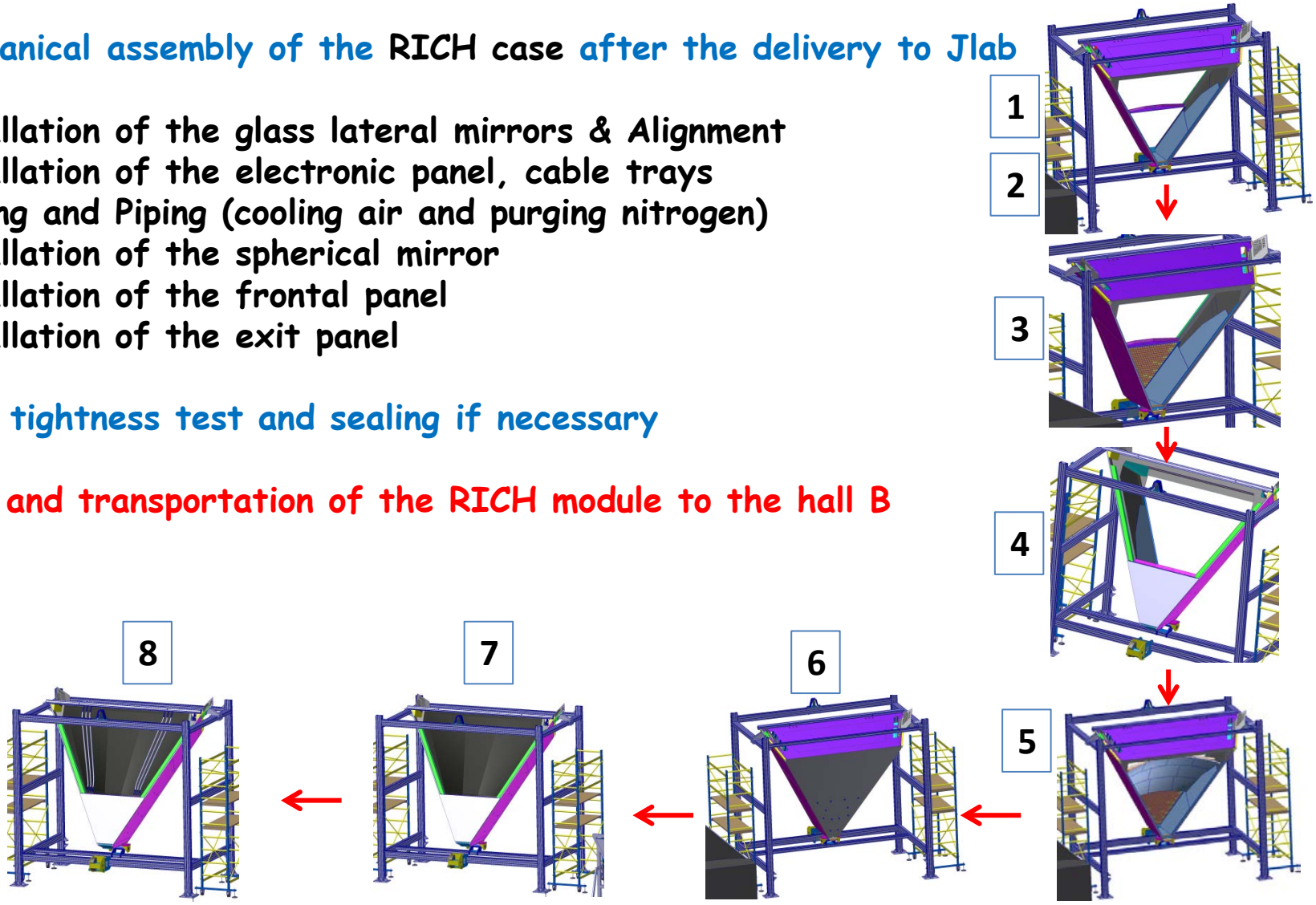
List of operations before the RICH module rotation and transportation to Hall B

1. Mechanical assembly of the RICH case after the delivery to Jlab

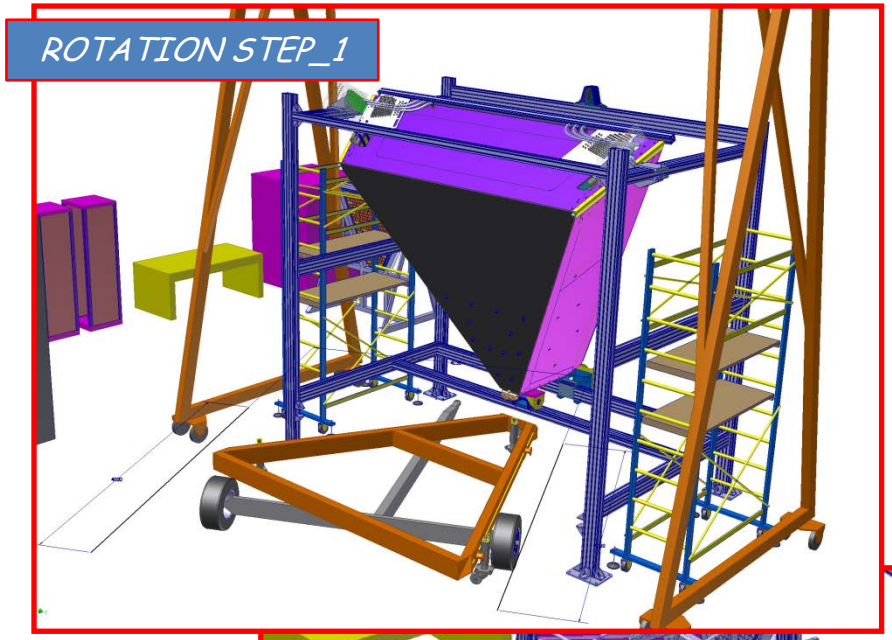
2. Installation of the glass lateral mirrors & Alignment
3. Installation of the electronic panel, cable trays
4. Cabling and Piping (cooling air and purging nitrogen)
5. Installation of the spherical mirror
6. Installation of the frontal panel
7. Installation of the exit panel

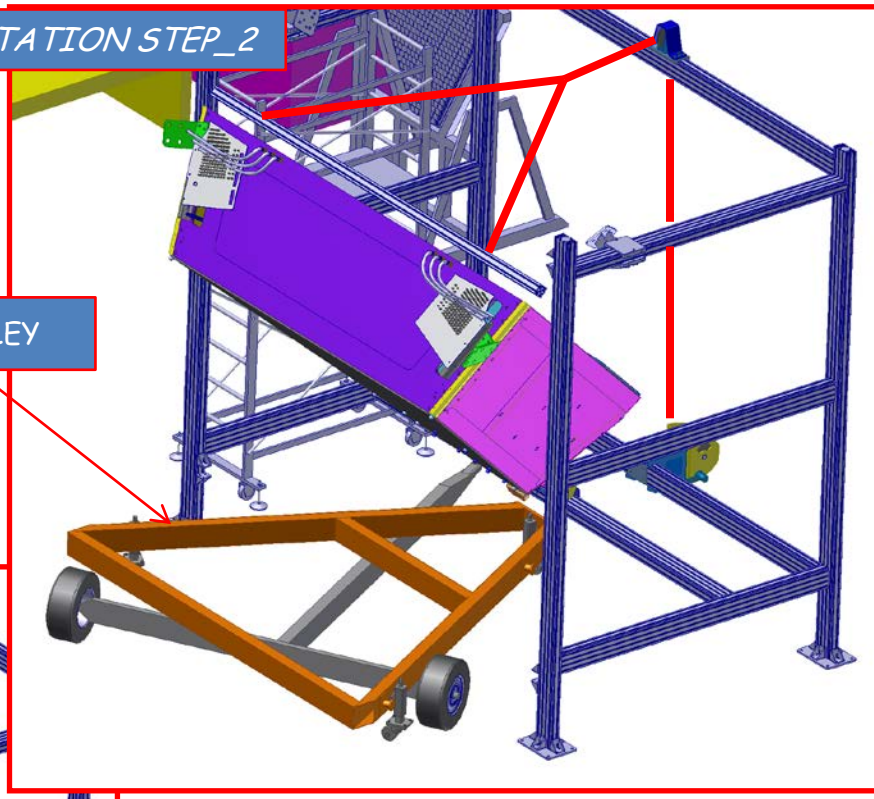
8. Light tightness test and sealing if necessary

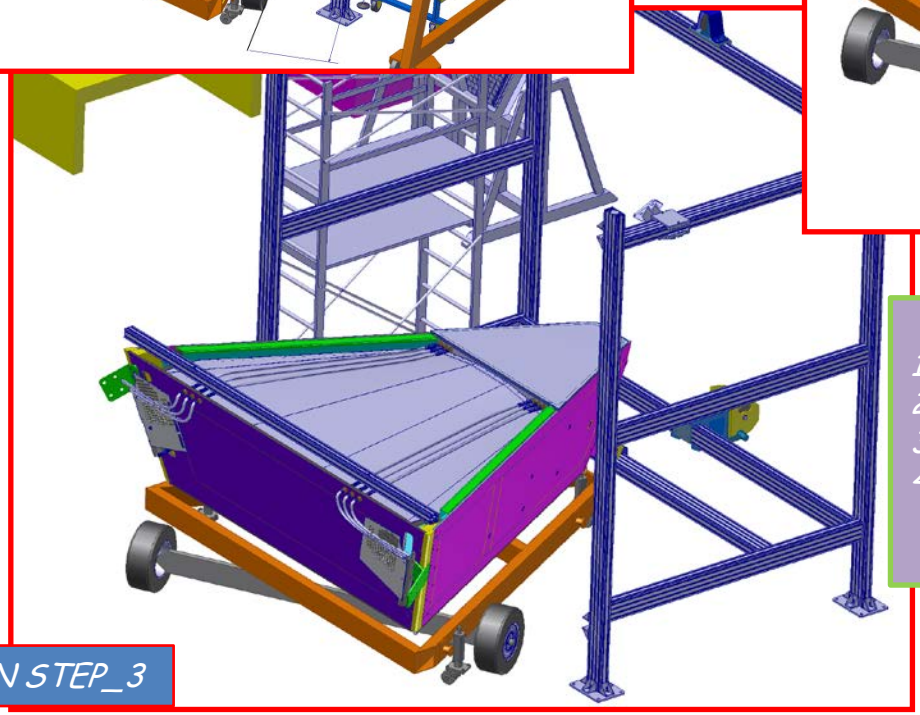
Rotation and transportation of the RICH module to the hall B



Rotation of the RICH module





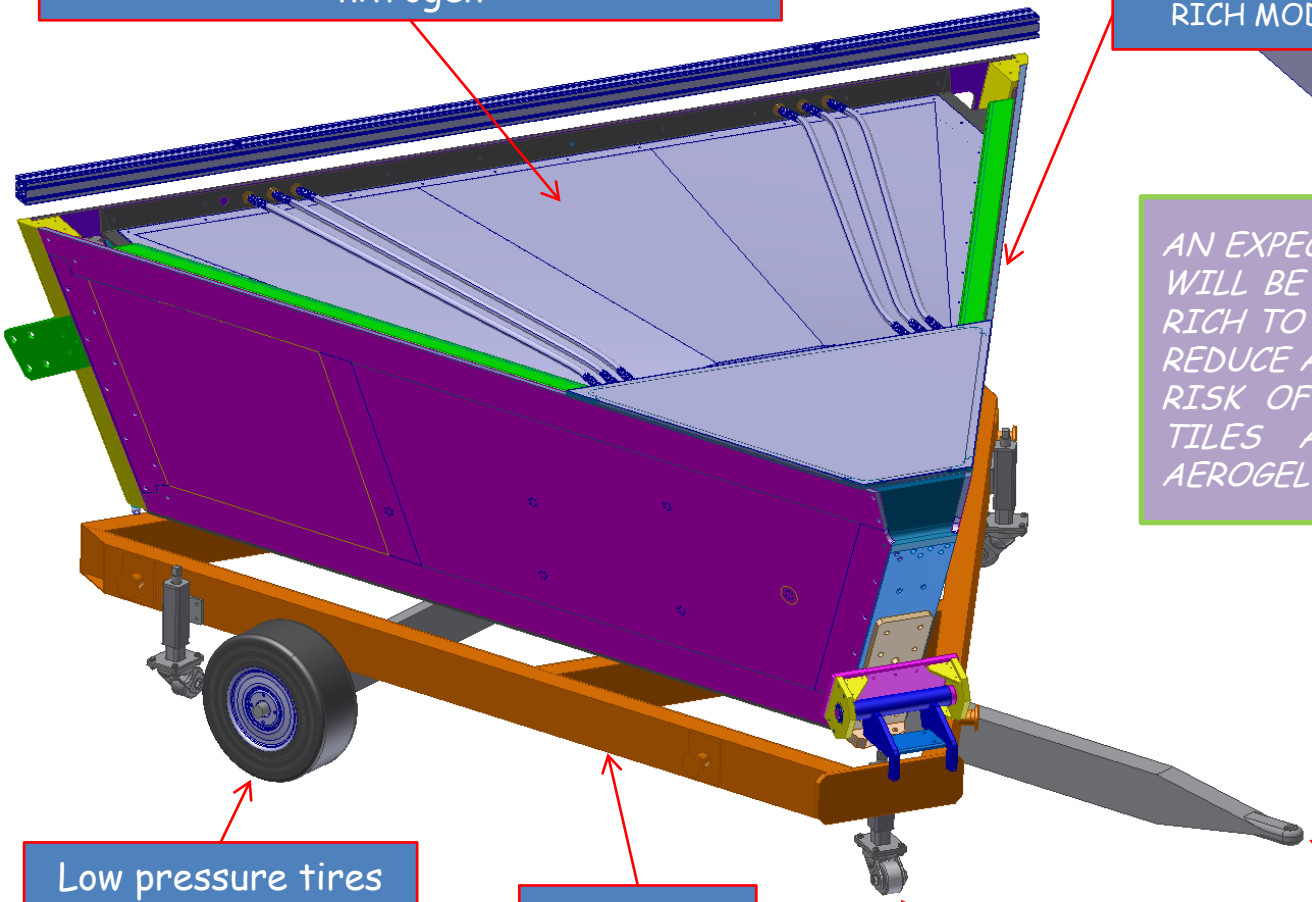


1) THE RICH HAS BEEN ASSEMBLED
2) THE RICH IS ROTATED BY THE WINCH
3) THE RICH IS SECURED ON THE TROLLEY
4) THE TROLLEY IS ROLLED OUT THE CLEAN ROOM

TROLLEY FOR THE TRANSPORTATION

The volume will be closed and sealed in its final assembly and the inner volume will be temporarily fluxed by dry nitrogen

RICH MODULE



AN EXPECIALLY DESIGNED TROLLEY WILL BE USED TO TRANSPORT THE RICH TO THE HALL B IN ORDER TO REDUCE AS MUCH AS POSSIBLE THE RISK OF BREAKING THE AEROGEL TILES AND TO NOT STRESS THE AEROGEL SUSPENTION SYSTEM

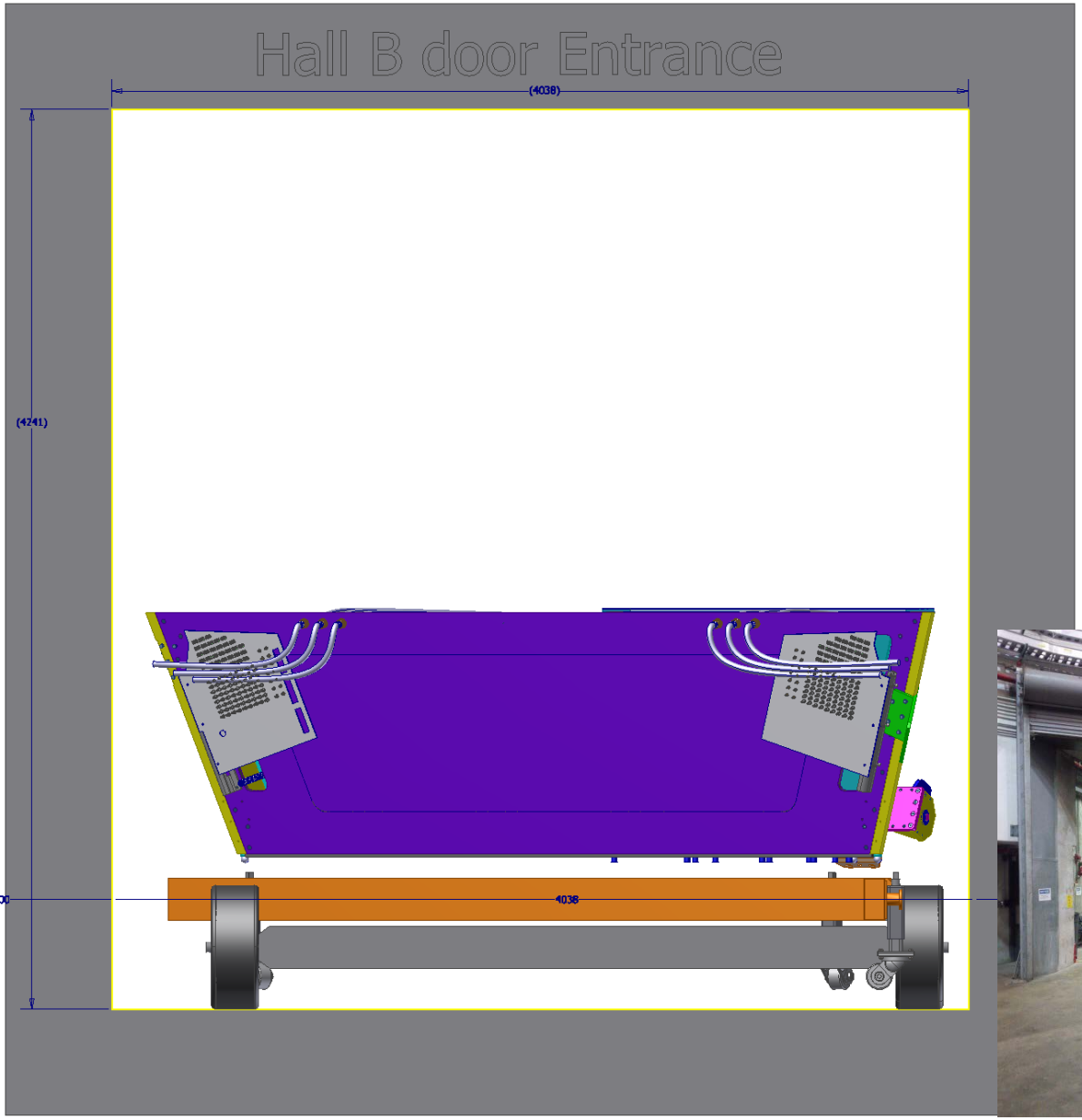
Low pressure tires to damp vibrations

TROLLEY

Jackable wheels for fine adjustment

The system can be safely pulled by a Forklift or electric tractor …

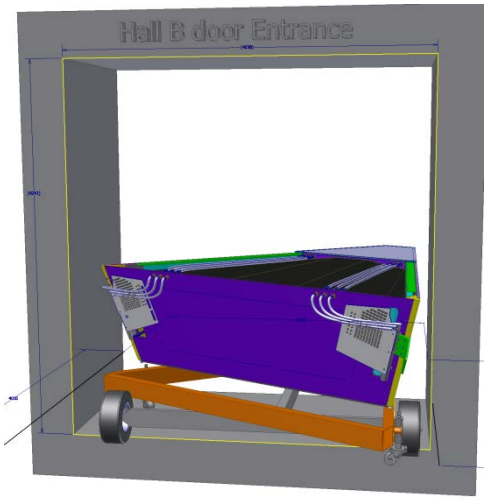
Hall B ENTRANCE



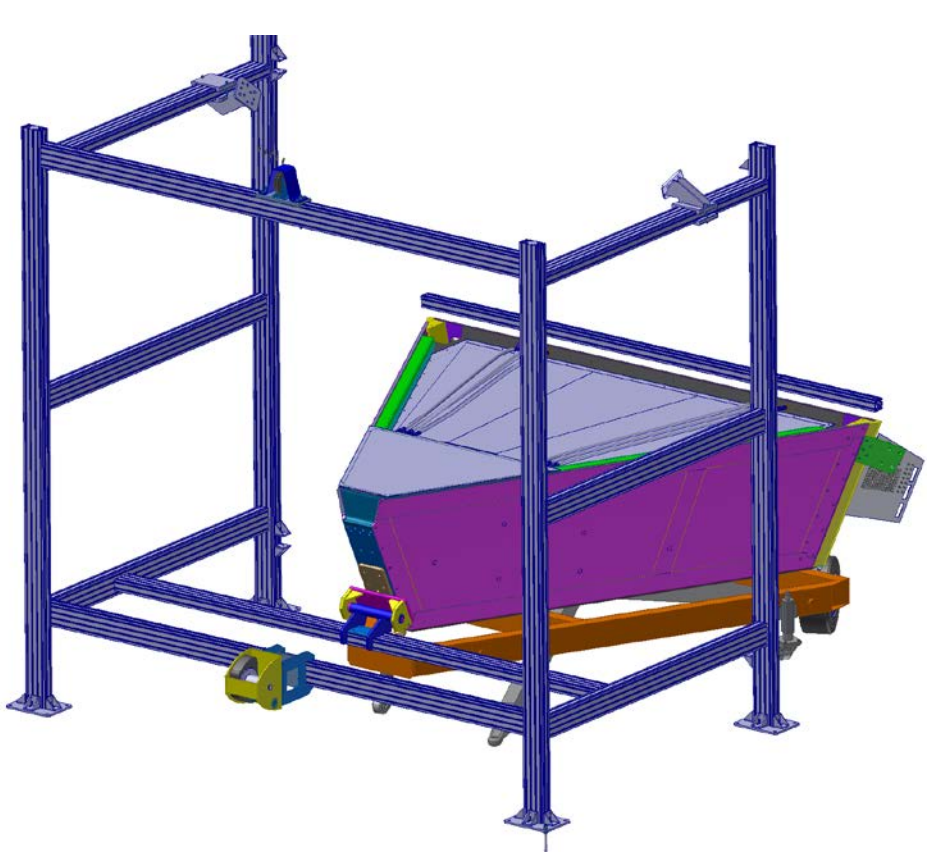
To easily enter the hall B door, the trolley has an asymmetric shape

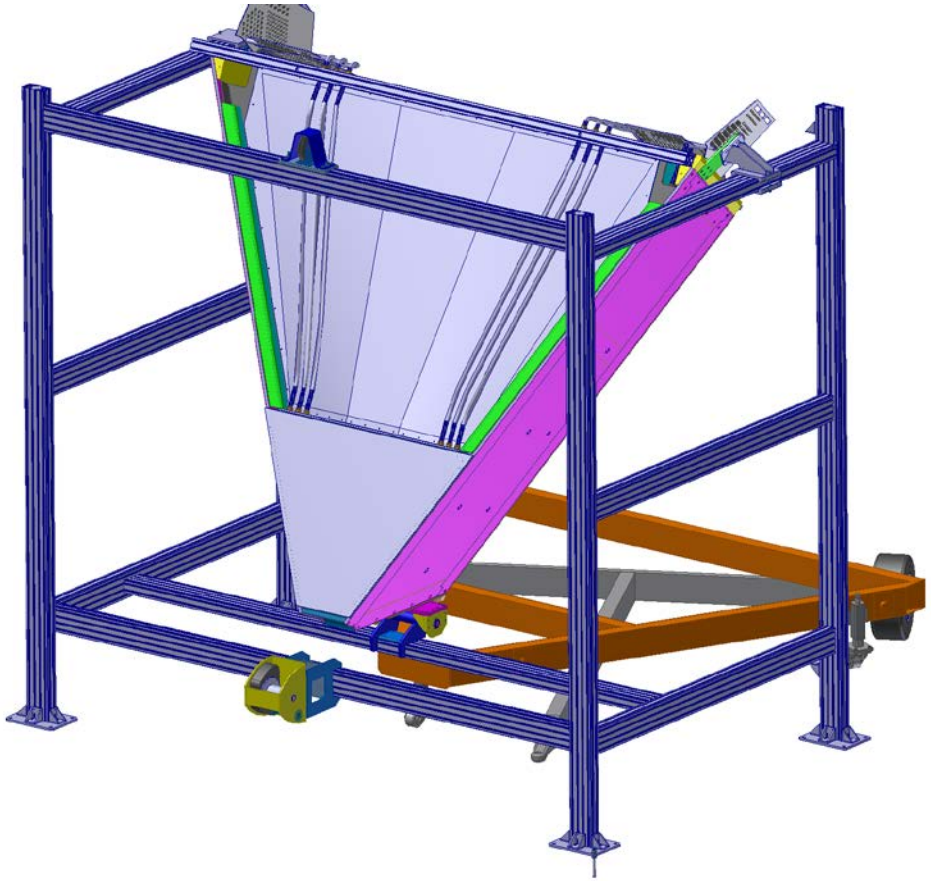
There are 10 cm of clearance on each side of the door

One stirrup must be dismounted and the two patch panels must be folded



Back Rotation once in hall B

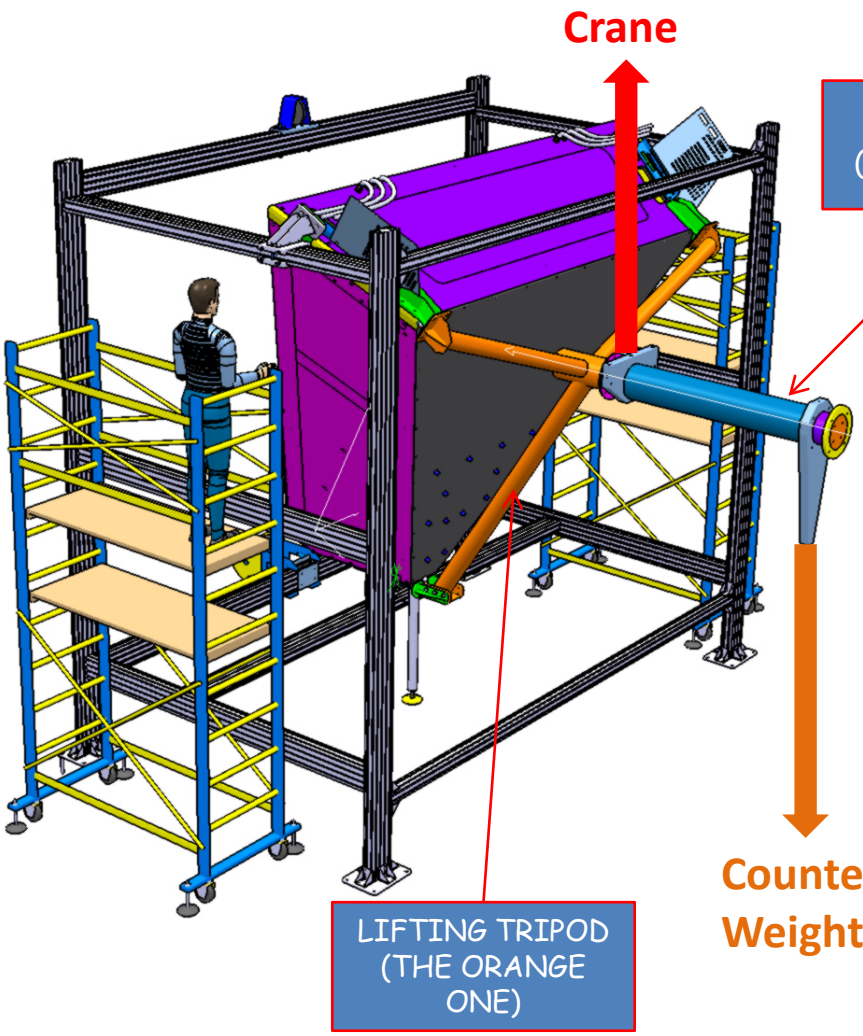


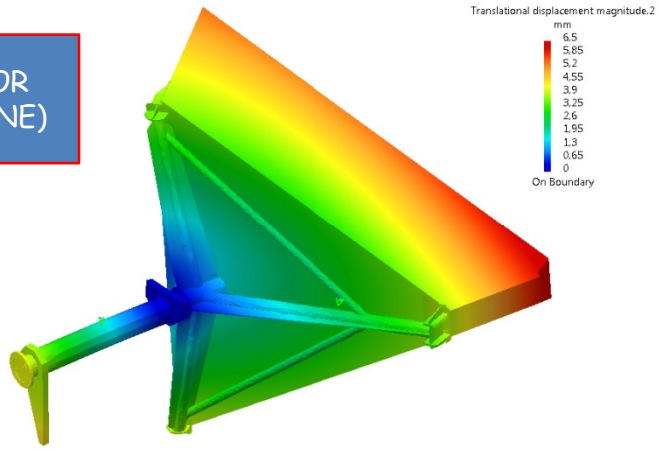


The assembly structure will be dismounted and remounted in Hall B

The RICH will be back rotated to the position ready to attach the lifting Tripod

LIFTING TRIPOD

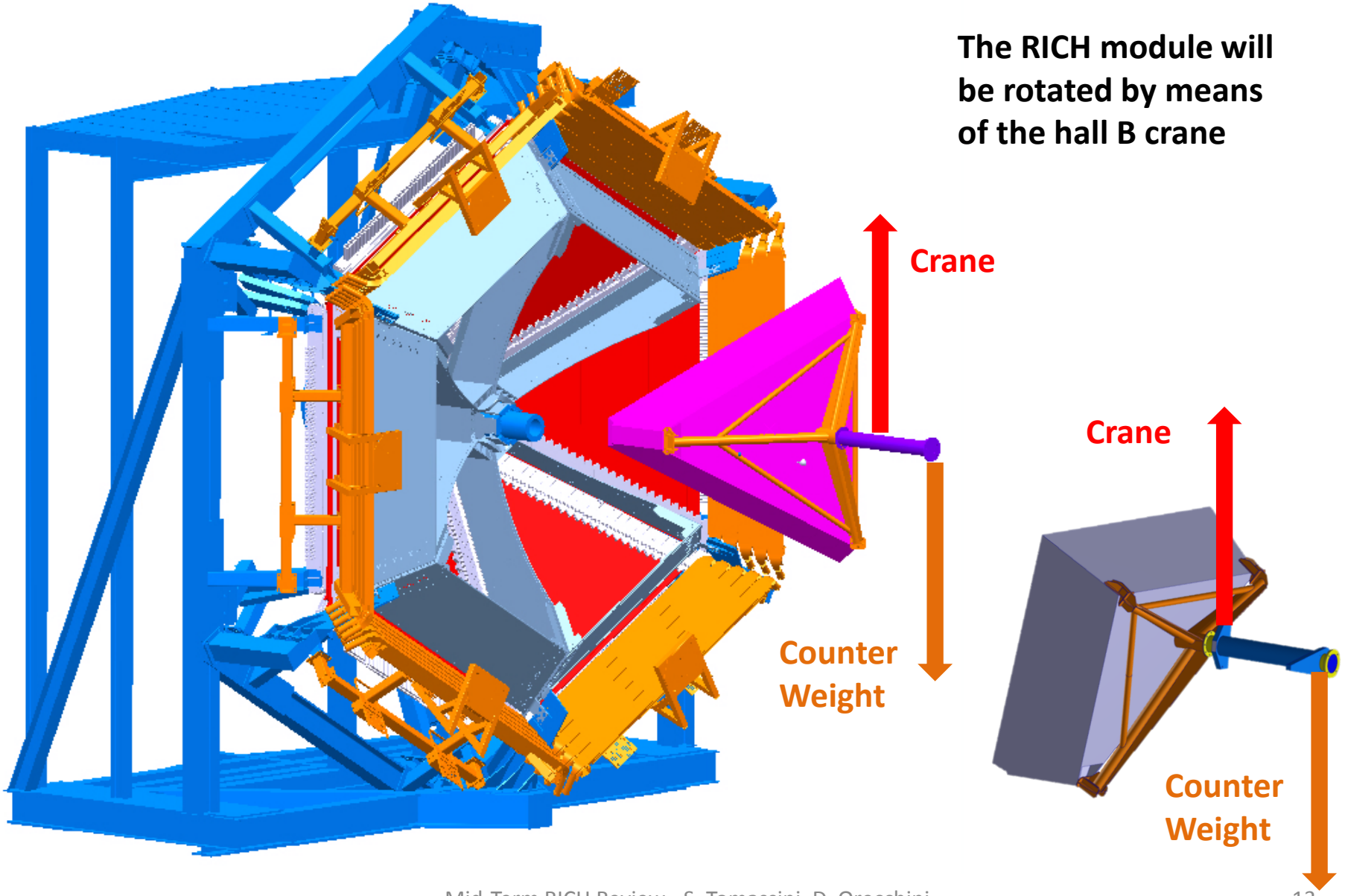




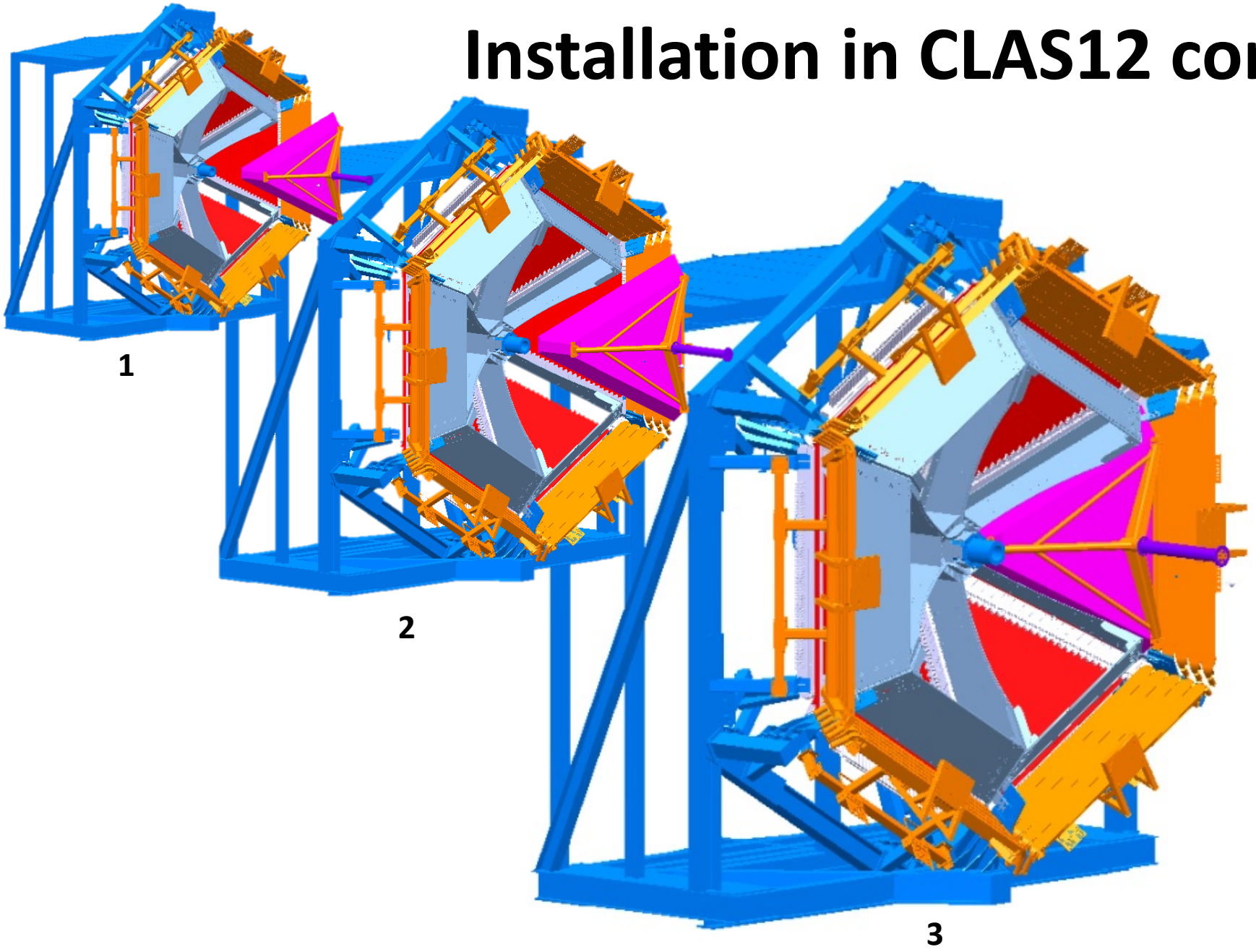
A LIFTING TRIPOD FOR RIGGING THE RICH MODULE ON THE FORWARD CARRIAGE HAS BEEN DESIGNED

Installation in CLAS12

The RICH module will be rotated by means of the hall B crane



Installation in CLAS12 cont’



UTILITIES

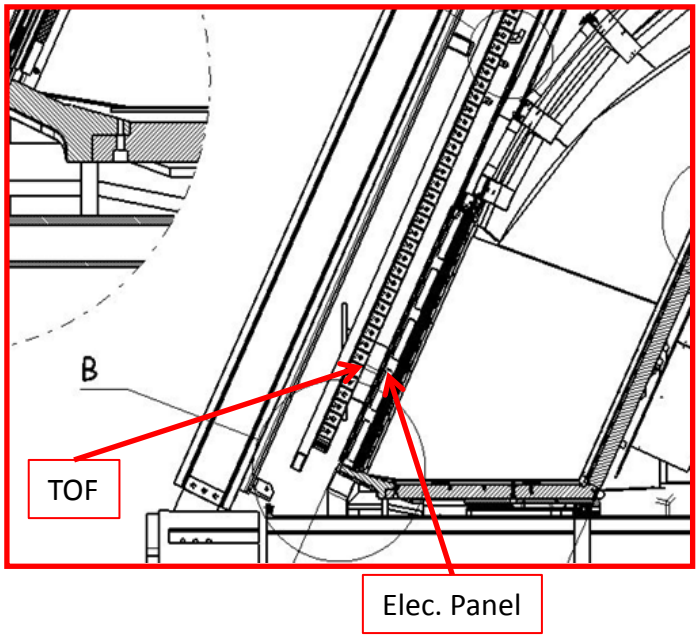
- **Compressed air** to cool down the electronic panel to keep safe the FTOF

  Limit temperature is 100F on the FTOF panel

- **Purging Nitrogen** to reduce the relative humidity inside the RICH as required to maintain the aerogel performances

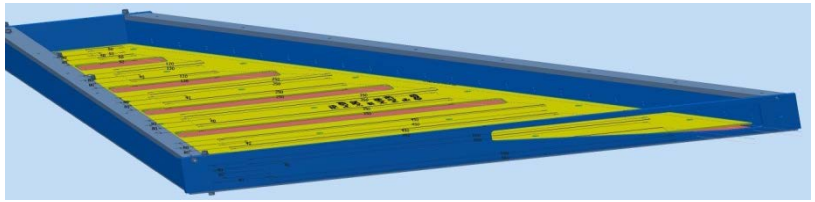
  Total volume is **5 m^3**

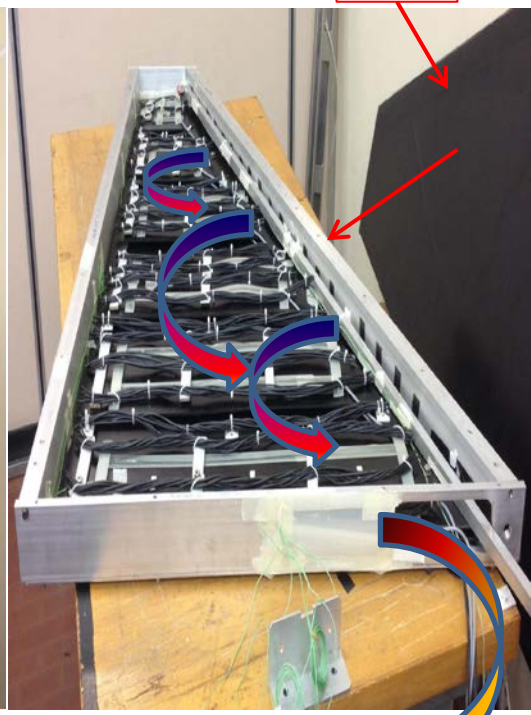
Electronic Box: Test Cooling Setup



Prototype of half of the electronic panel made of Aluminum and PVC and resistive wires to simulate the heating.
The box is sealed and has an air inlet and outlet
~ 50W on the ASIC plane
~ 200W on the FPGA plane
Fresh air fluxed inside the box from a compressor
Temperatures measured in few points inside and outside the box

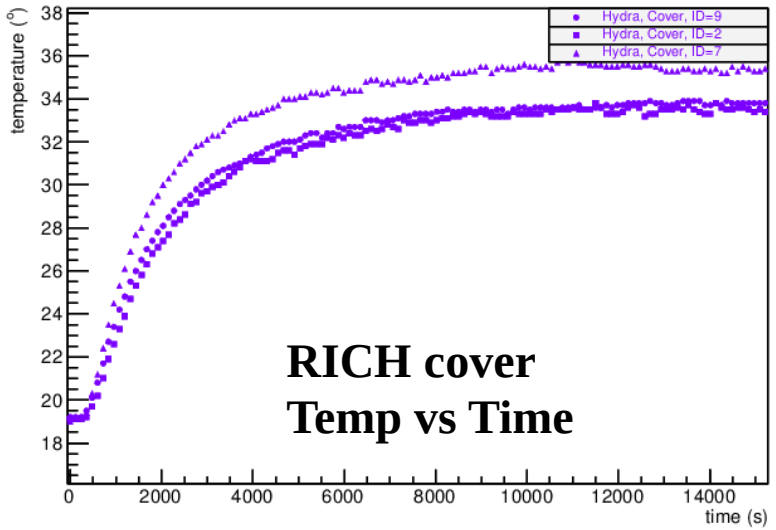
Temperature limit for TOF operation is 100 °F /38 °C



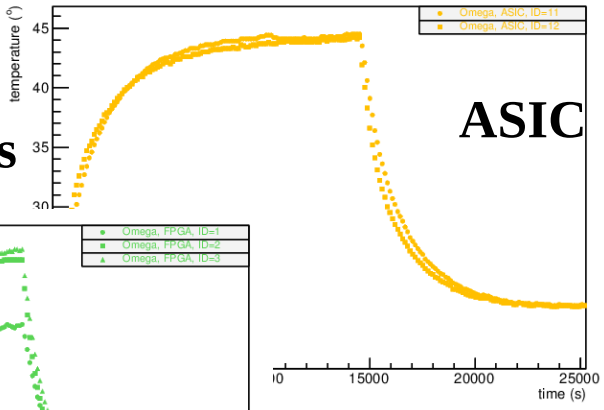


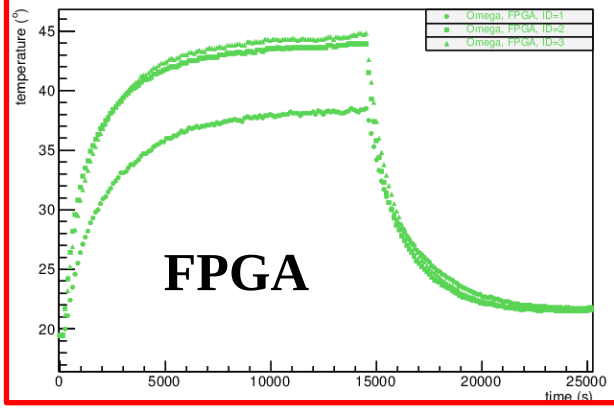
Measured Temperatures

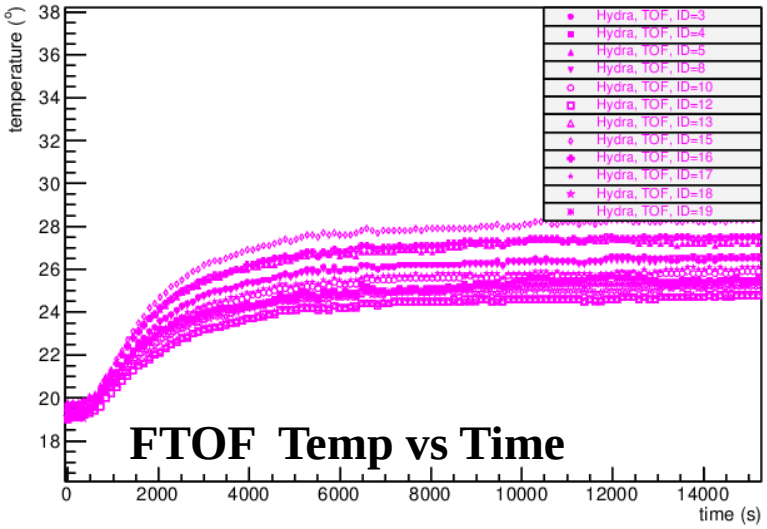
Air flow is 100 l/min, inlet temperature scaled to 20 °C

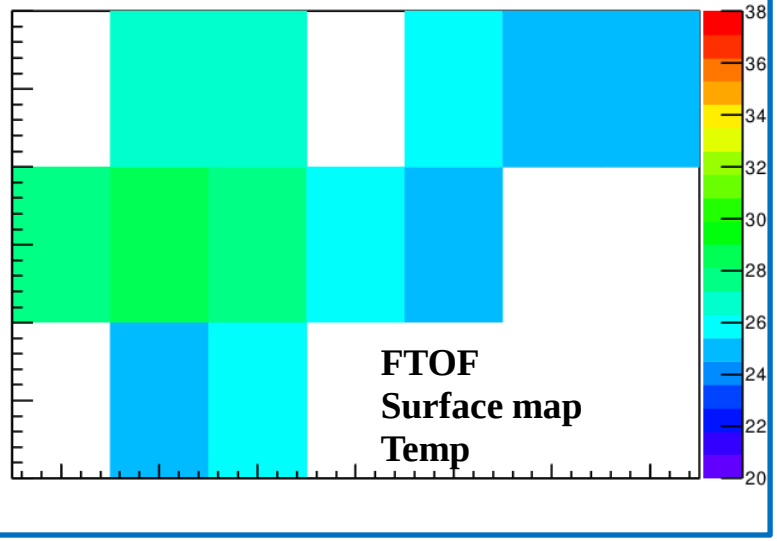


Inner temperatures









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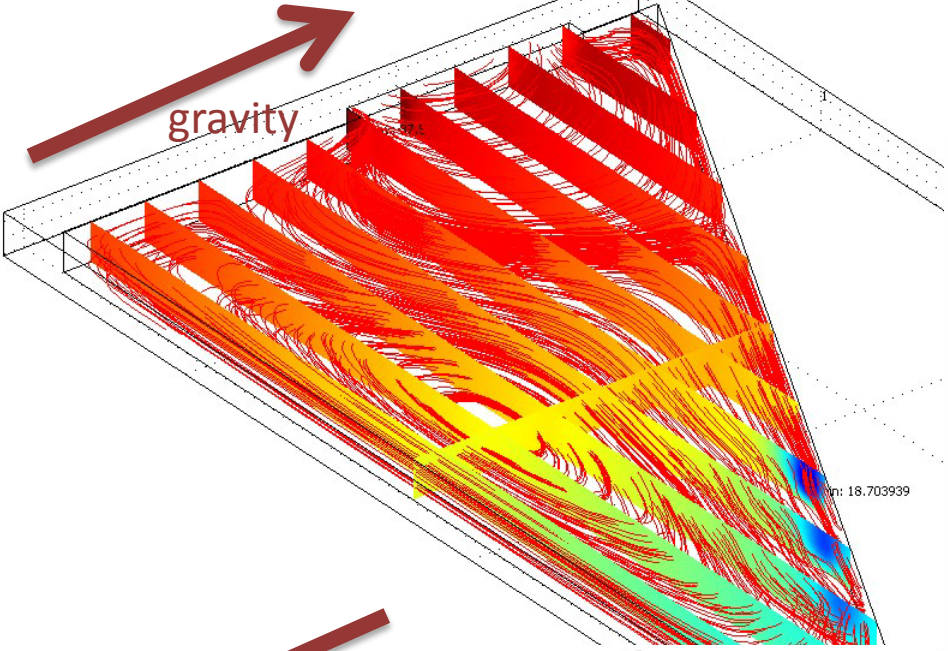
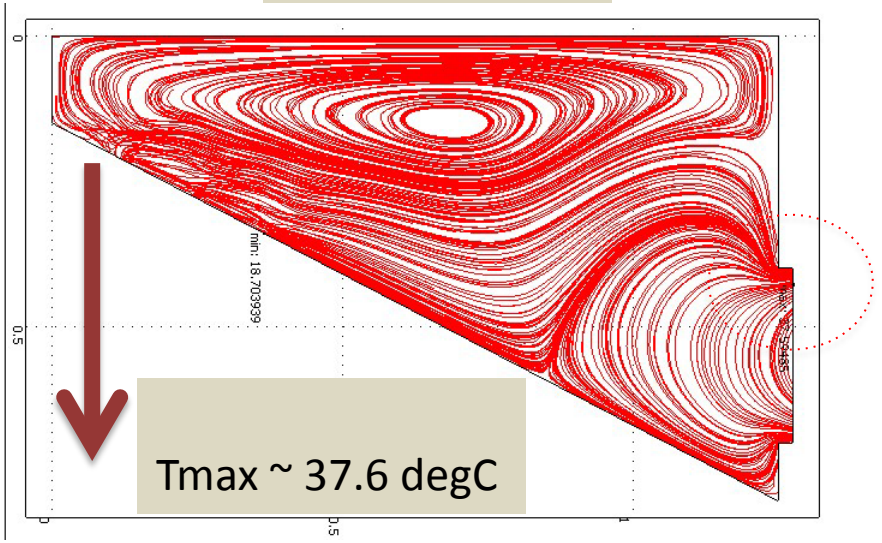
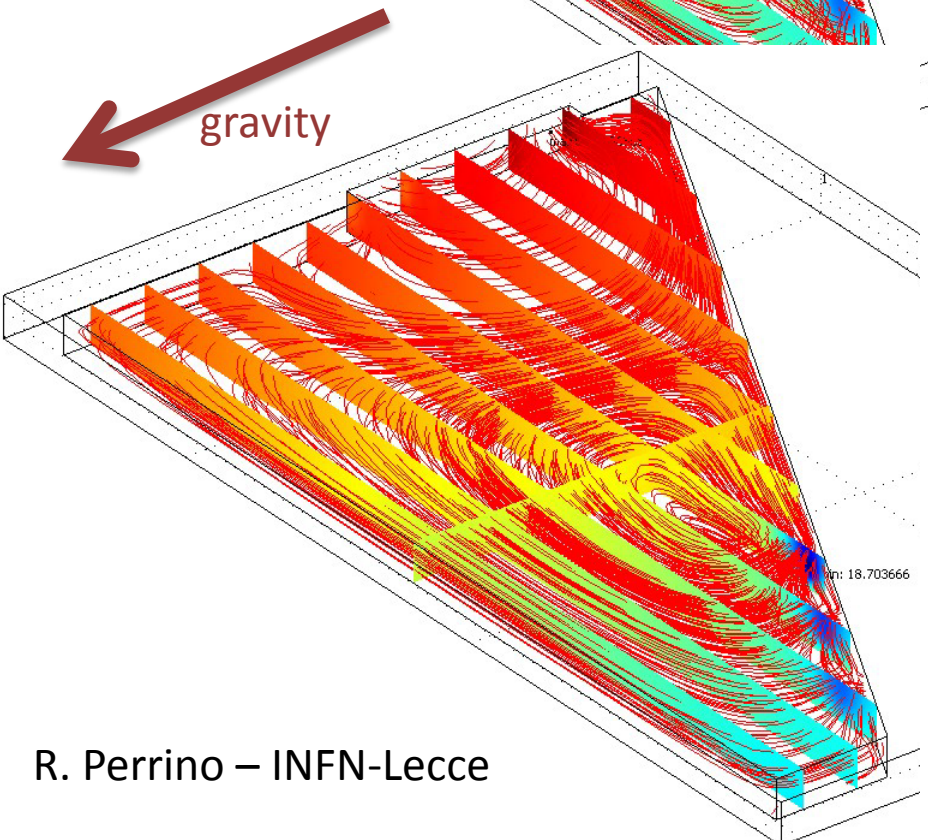
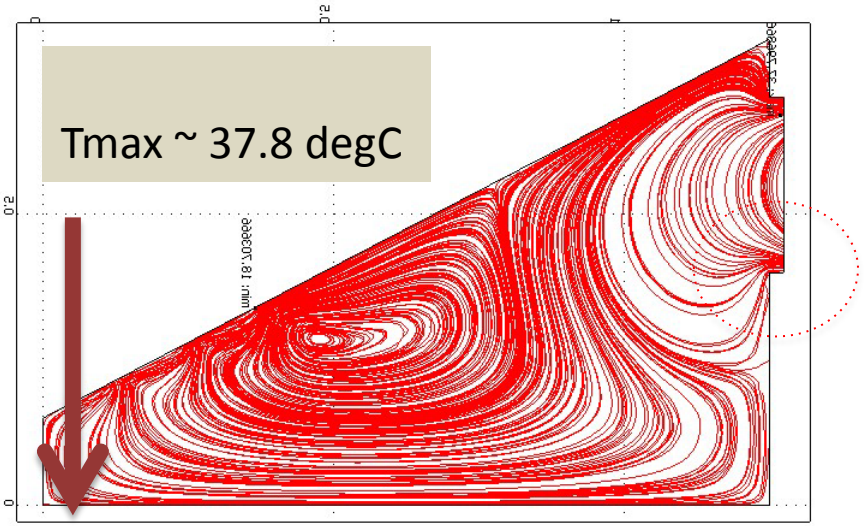
Tmax~28C **well below the requirements**

Effect of gravity







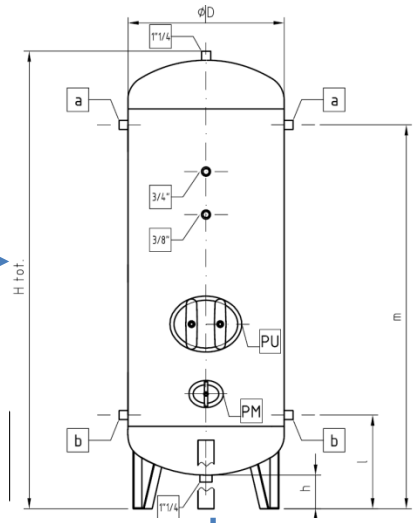


The Effect of natural convection can be neglected

Utilities: Compressor Layout

SF11-8 MC FF

SF11-8 MC FF



Flow rate	20,2 l/s
Elec. Power	10,4 kW
Dew Point T	3 °C
Dimensions	1,4x0,7x1,8m
Weight	515 kg
Noise Press	60 dB(A)

Installation area: 10 m^2
Cost: ~30k€

To the Electronic Box

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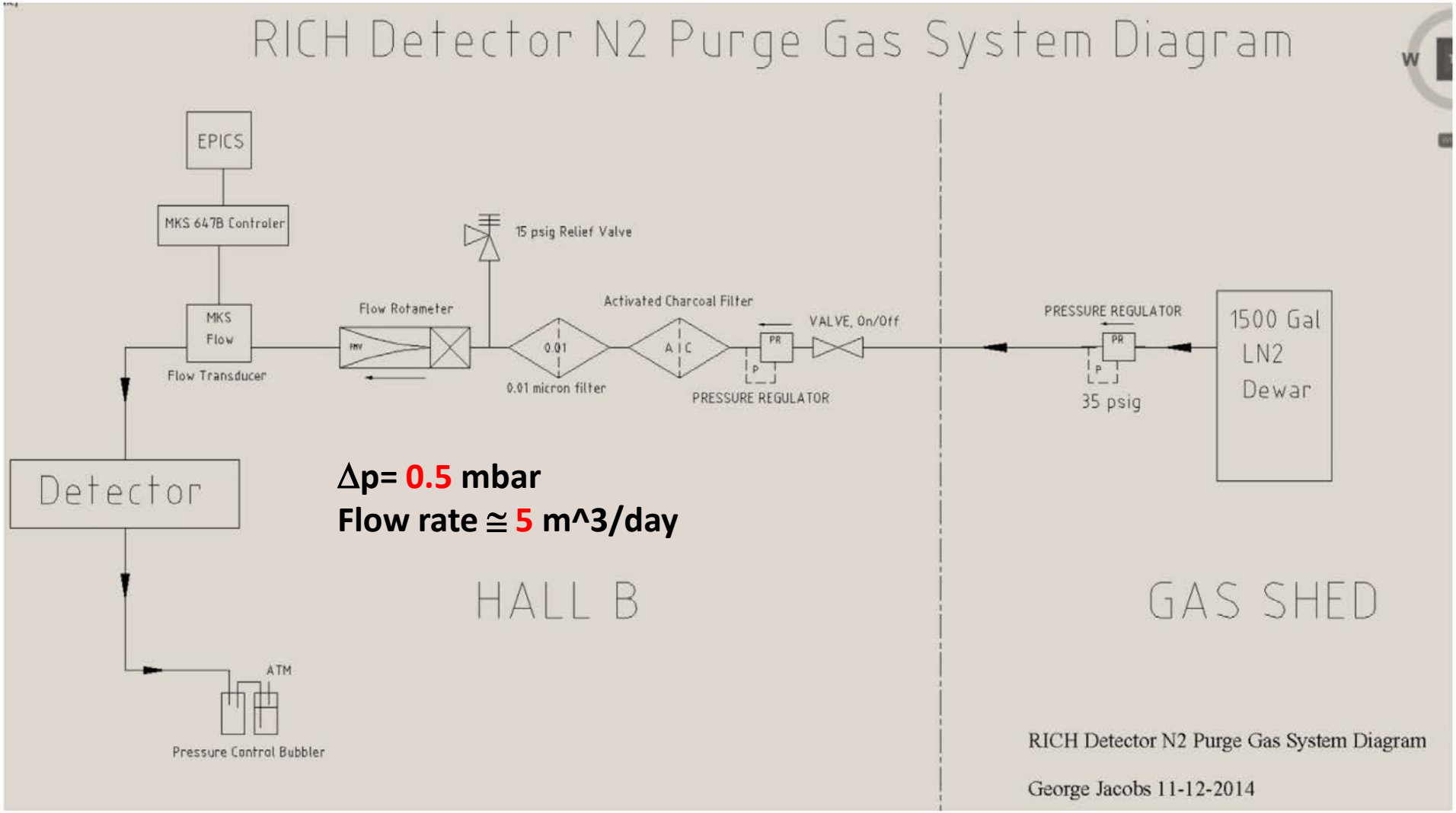
UTILITIES: Purging Nitrogen



Slow control

ELEMENTS TO BE CONTROLLED

In charge of Glasgow group

- **Electronics and MAPMT**
  - **High Voltage**
  - **Low Voltage**
- **Services**
  - **Nitrogen gas system**
    - humidity, pressure, flow rate
  - **Electronic cooling system**
    - inner temperature
    - air temperature, humidity, flow rate
  - **Air Compressors**
    - Functioning status

Only instrumentation compatible with Jlab equipments will be used (e.g. CAEN HV power supply)

CONCLUSIONS

- **The assembly procedures in the clean room have been defined and spaces have been allocated**
- **The RICH will be transported to the Hall B fully assembled, sealed and in safe condition for the aerogel**
- **Installation in CLAS12 must be done by minimizing the potentially risky movements**
- **Preliminary design of the services have been done, finalization in collaboration with JLab**
- **Slow control will be required to manage standard equipment for JLab**

Spare Slides

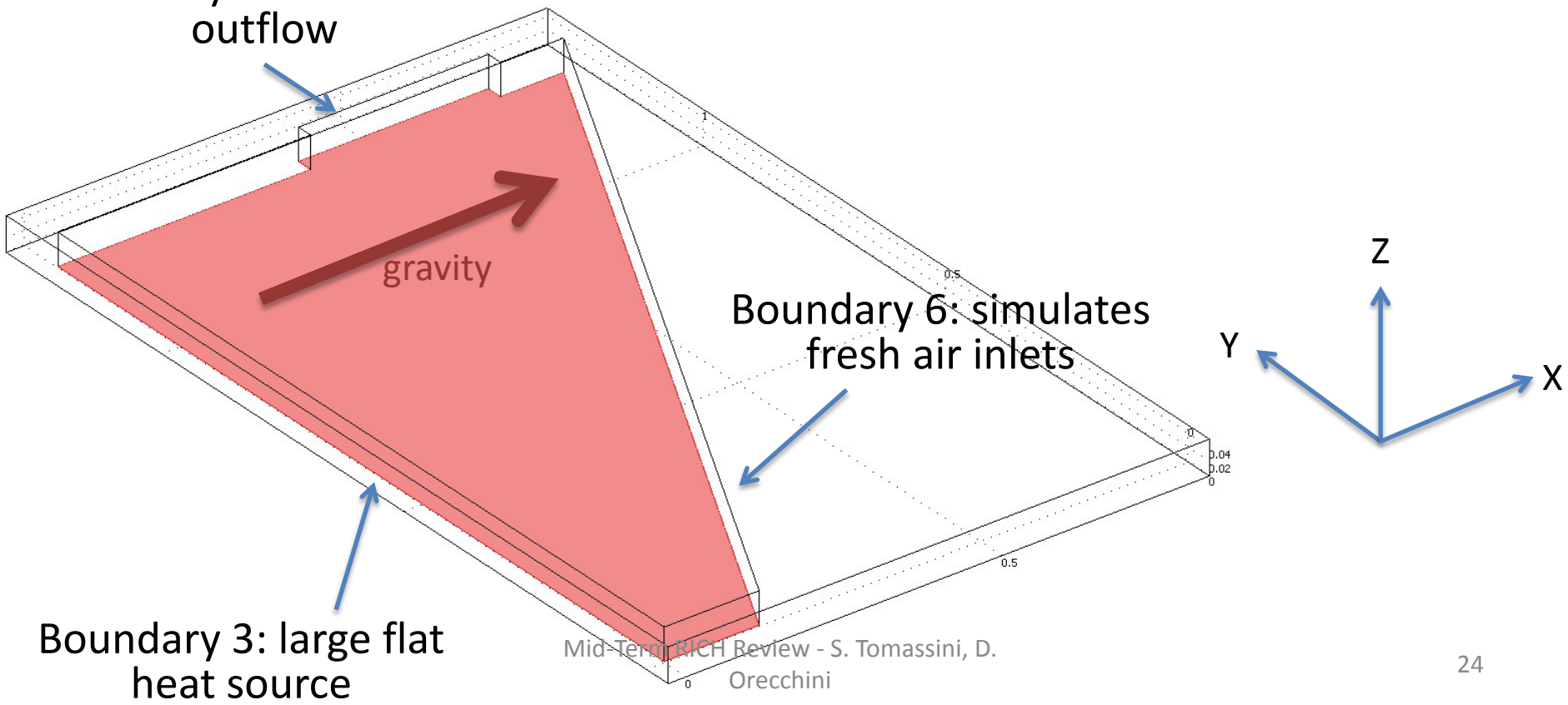
(Code: Comsol Multiphysics 3.2)

Geometry

- Inner air volume only
- 3 holes for fresh air inlet

Physics

- Power source on boundary 3: 200 W/m²
- Fresh air inlets on boundary 6: defined through inlet velocity and temperature
- All other boundaries are adiabatic
- ON/OFF Gravity volume force along coordinate of choice (e.g. X)



CLAS12 RICH Assembly area in EEL124