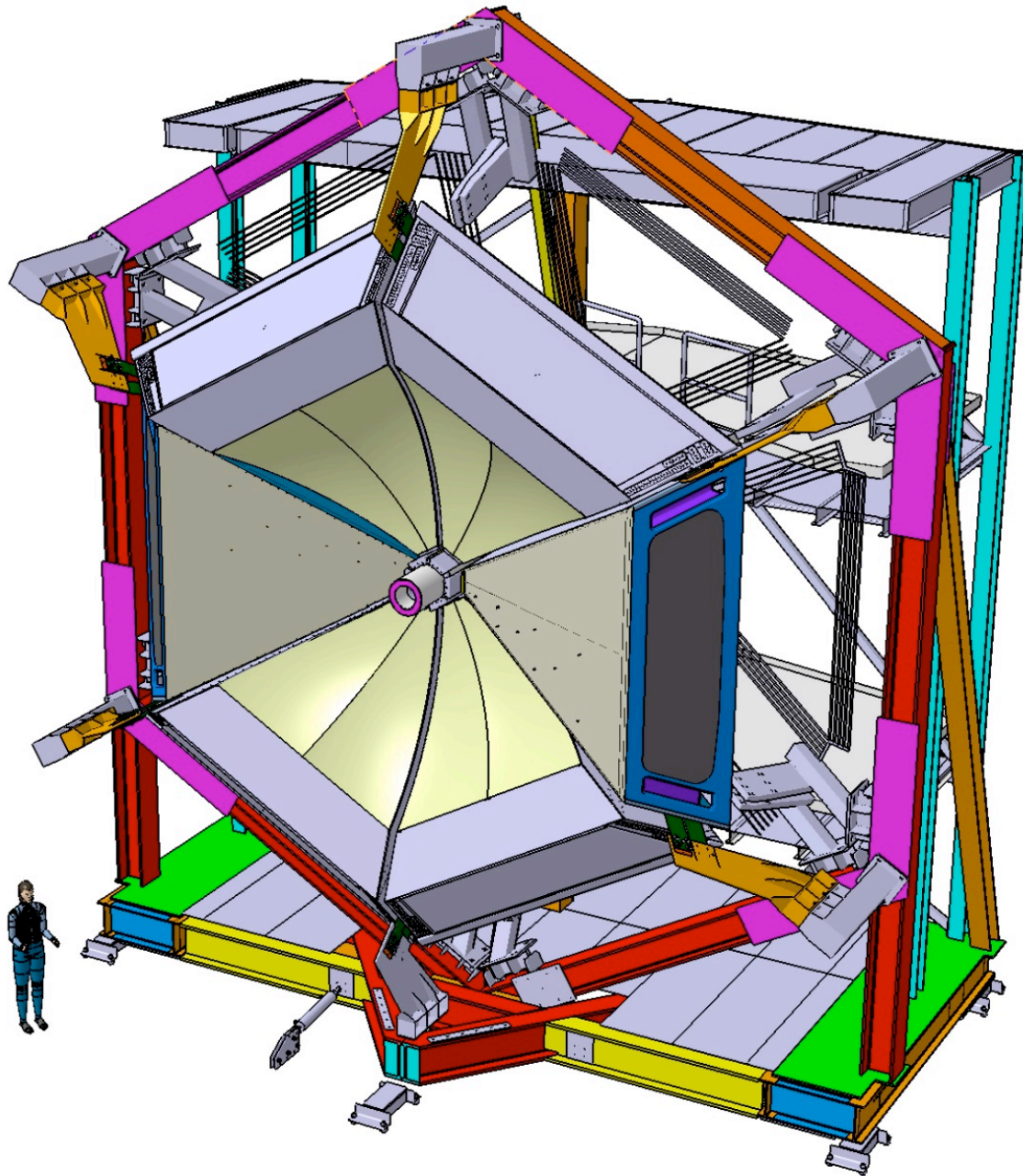
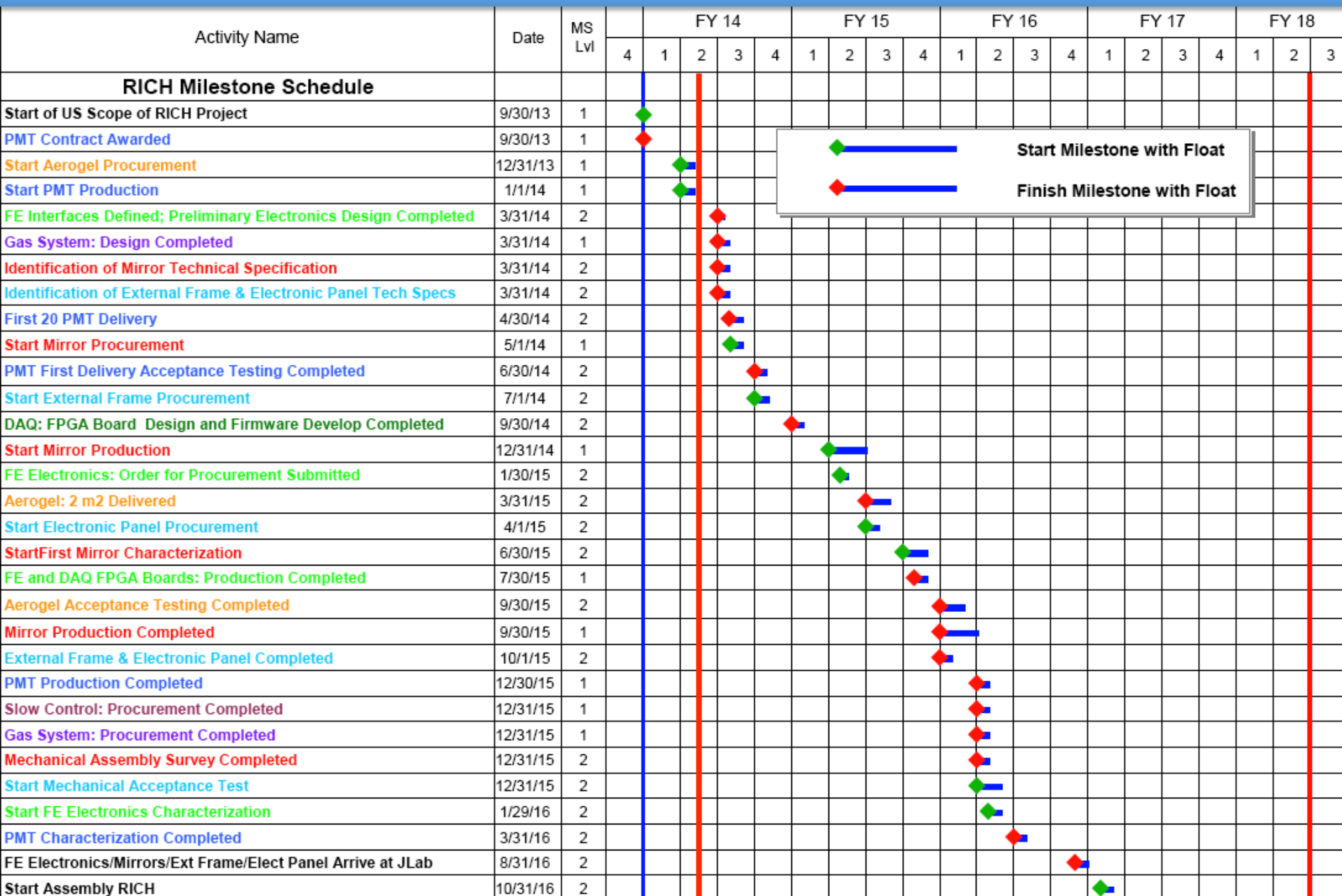


CLAS12-RICH Status-Report

March 5th 2014



RICH Project Milestones

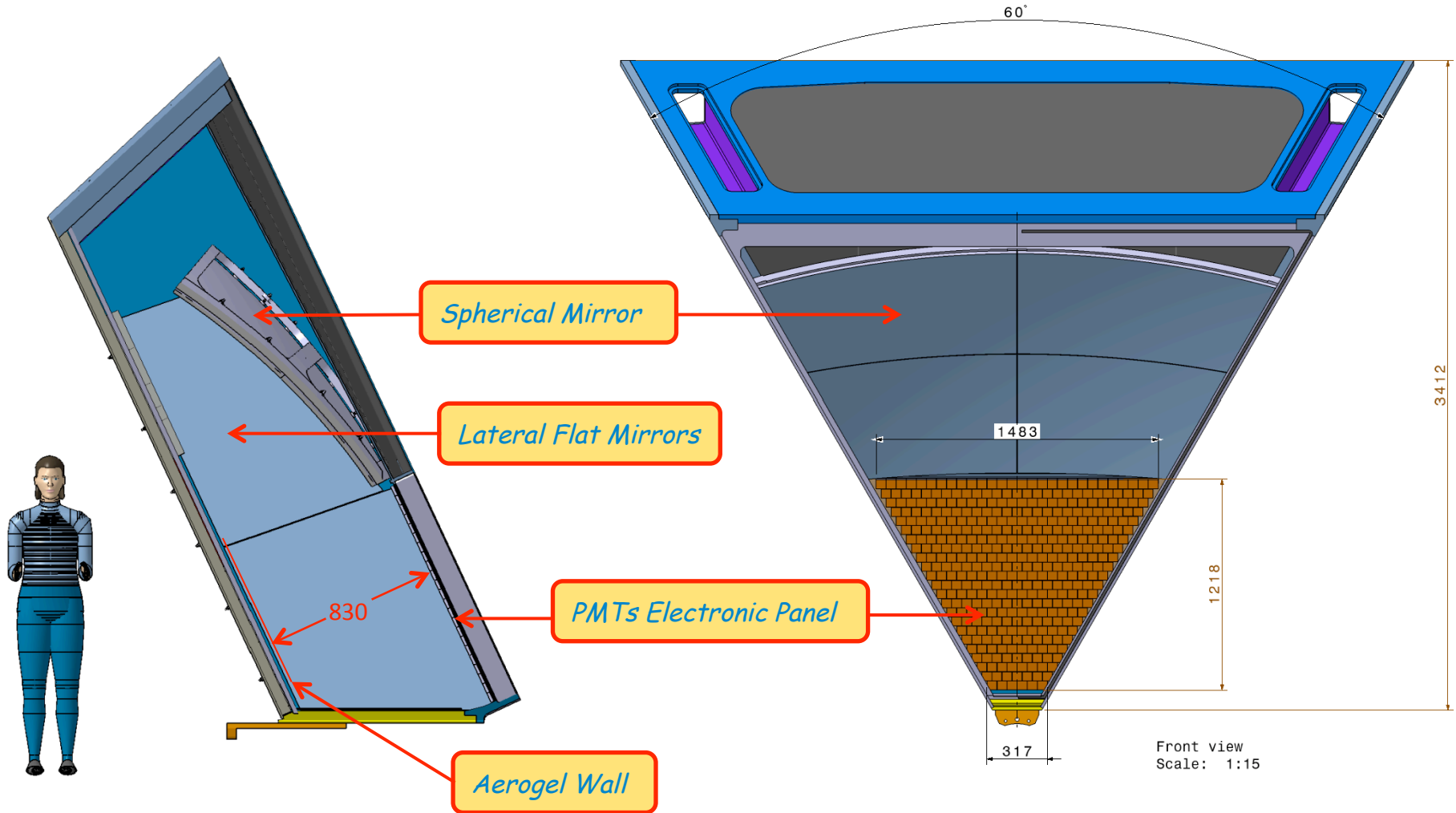


◆ ——— Start Milestone with Float
 ◆ ——— Finish Milestone with Float

External Frame & Electronic Panel

Milestone: Identification of External Frame & Electronic Panel Tech. Specs. (3/31/14)

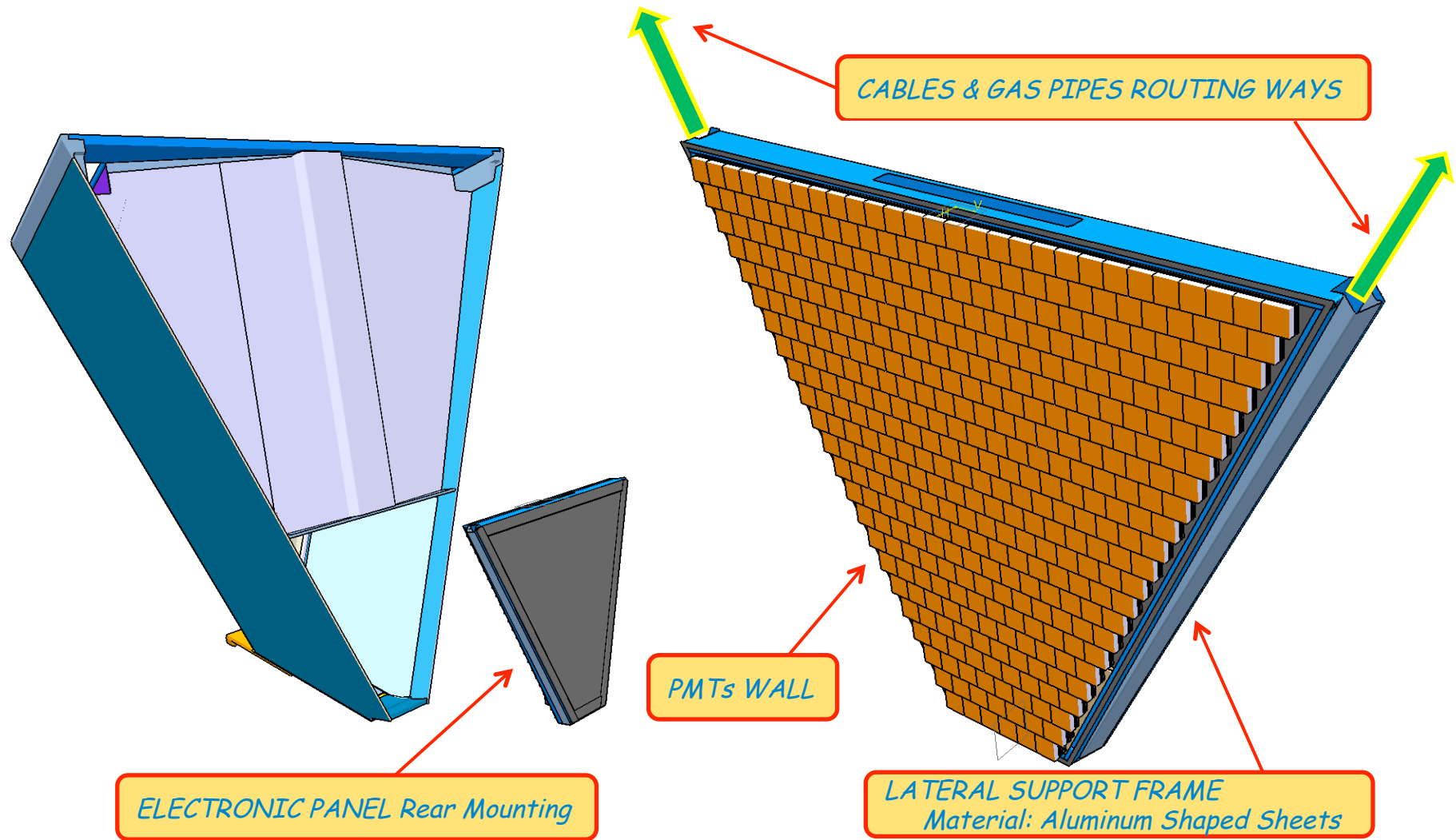
RICH module designed to be as much as possible close to the existing LTCC sector layout



External Frame & Electronic Panel

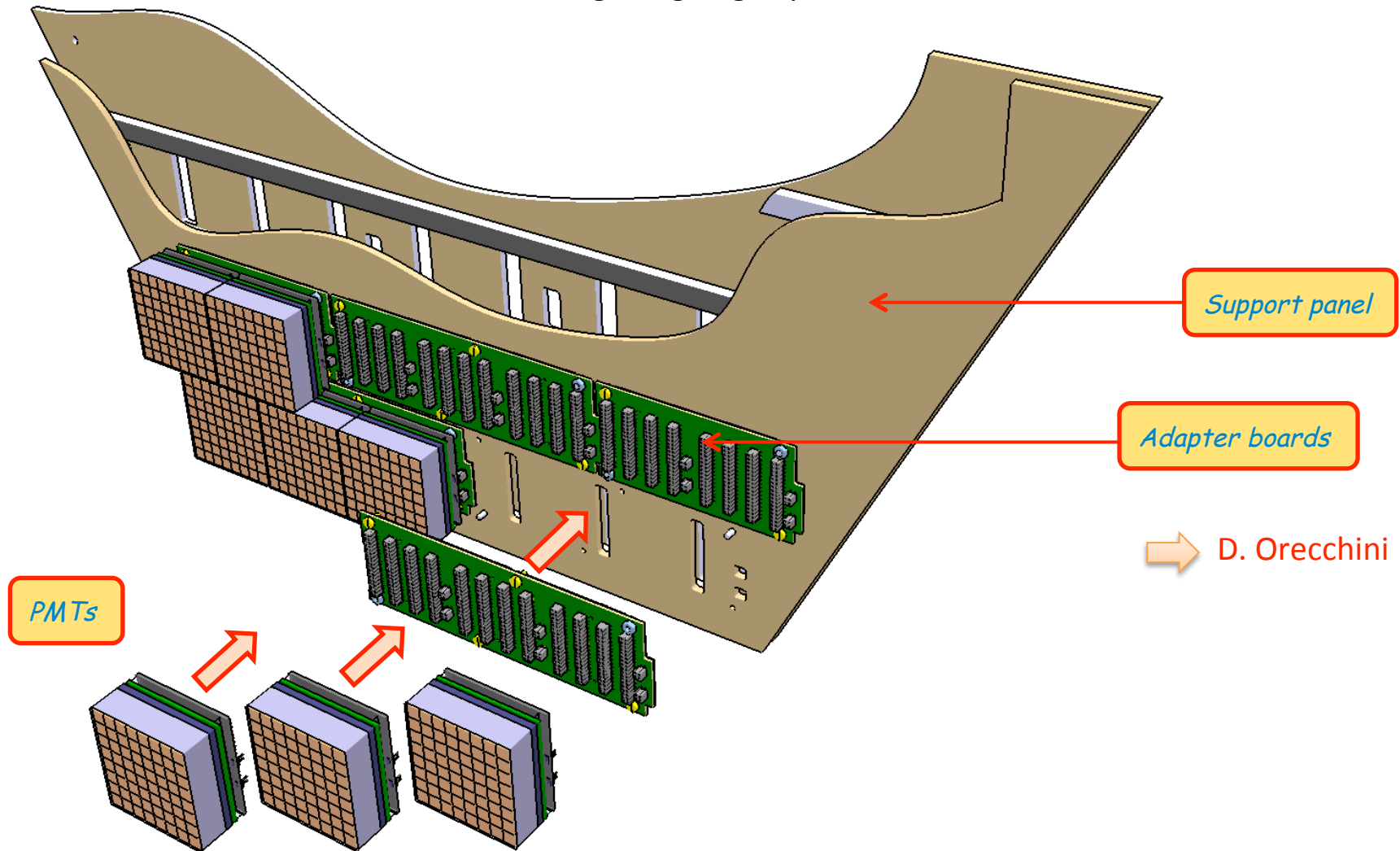
Milestone: Identification of External Frame & Electronic Panel Tech. Specs. (3/31/14)

Electronic panel designed as self supporting element to allow external PMT assembling



Electronic Panel Assembling

The panel should host PMTs and electronics and be light and gas tight to divide the inner dry N_2 volume from the electronics cooled in controlled atmosphere
Mechanic and Electronic design ongoing in parallel

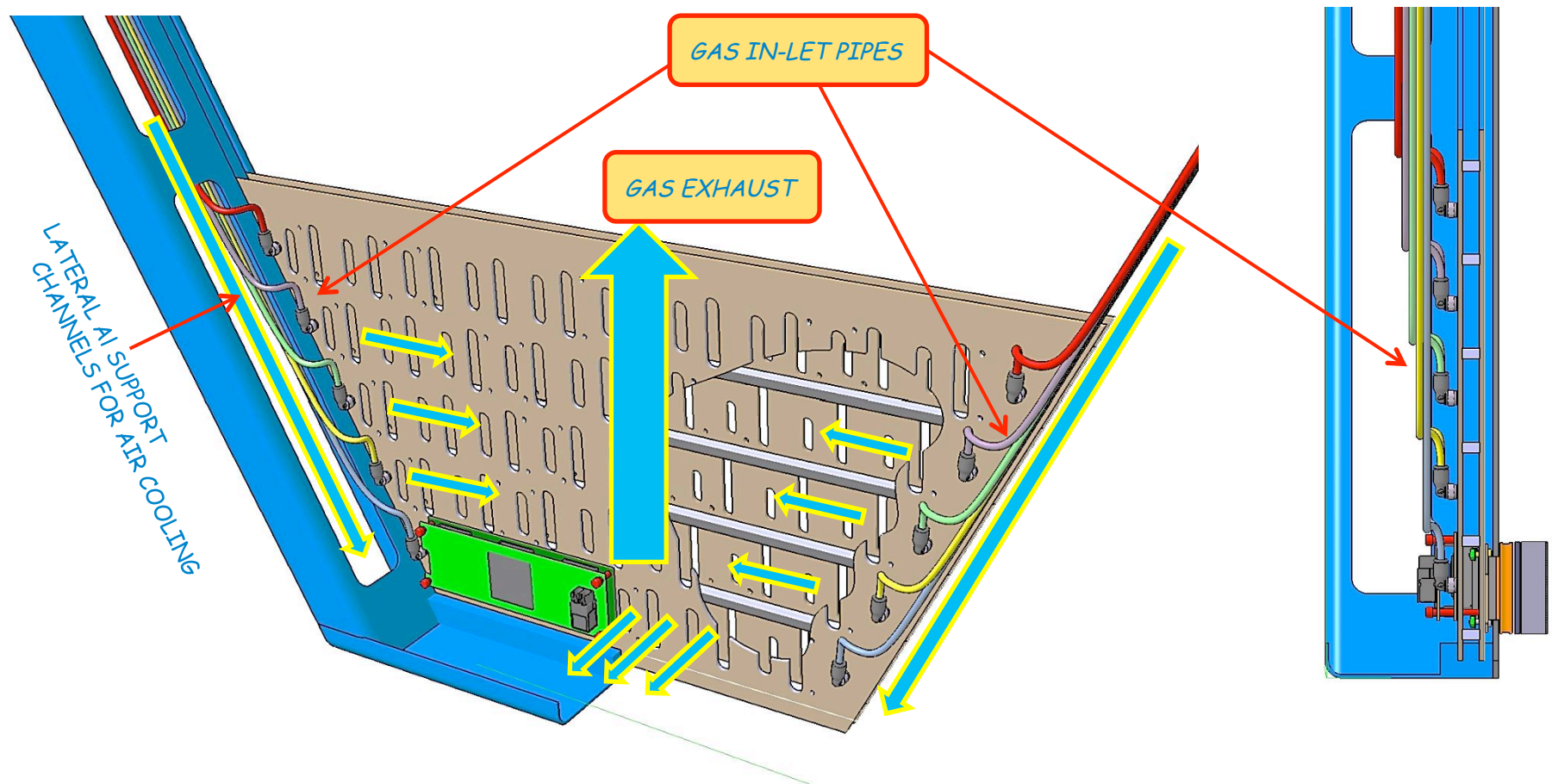


Gas system & Electronics Cooling

Milestone: Gas System: (Preliminary) Design Completed (3/31/14)

Needed to identify requirements for the mechanical structure

Experienced manpower (INFN-Bari) assigned to this task

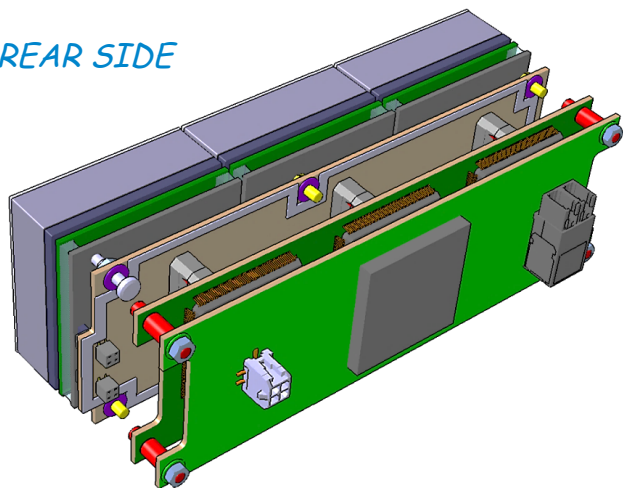


Read-Out Electronics

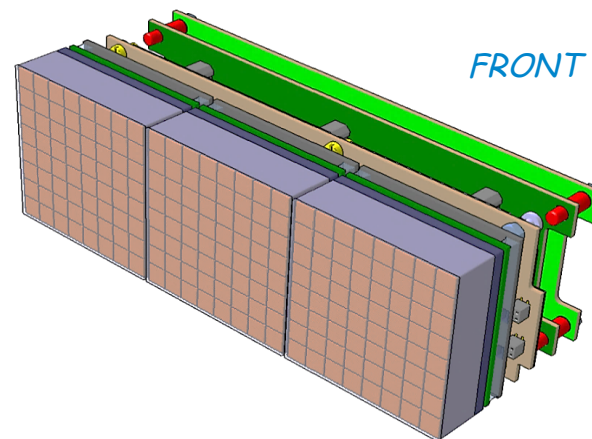
Milestone: FE Interfaces Defined; Preliminary Electronics Design Completed (3/31/14)

Readout boards serve groups of 2 or 3 PMTs

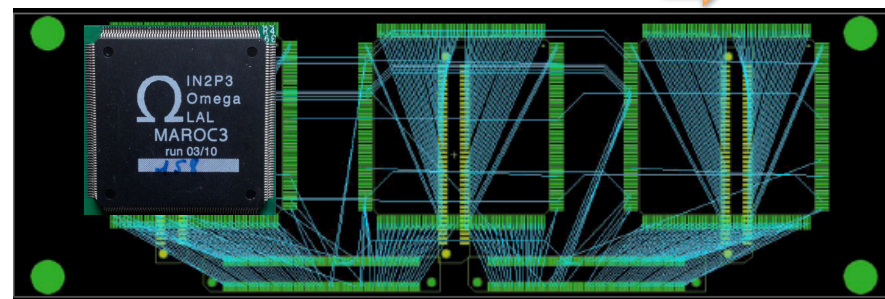
REAR SIDE



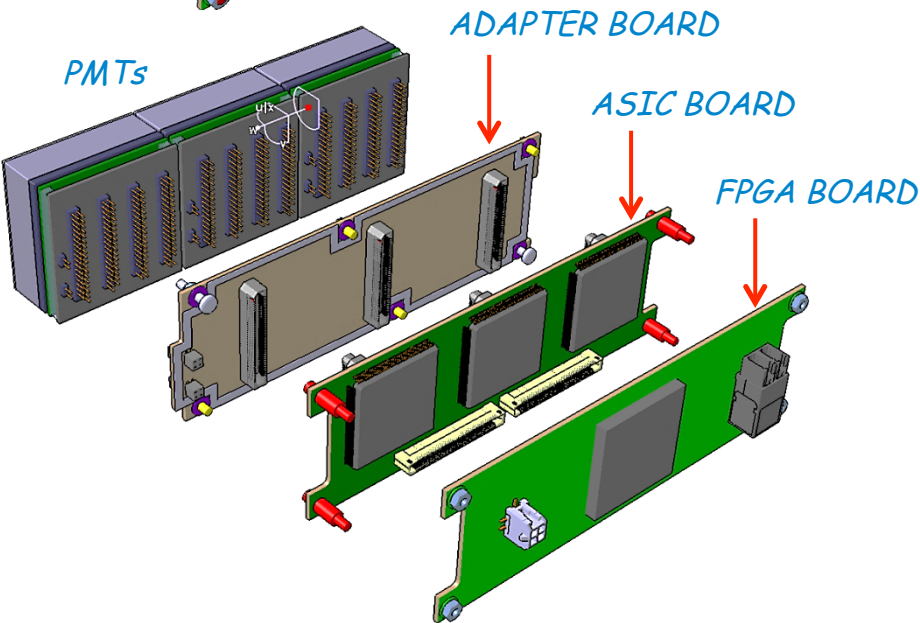
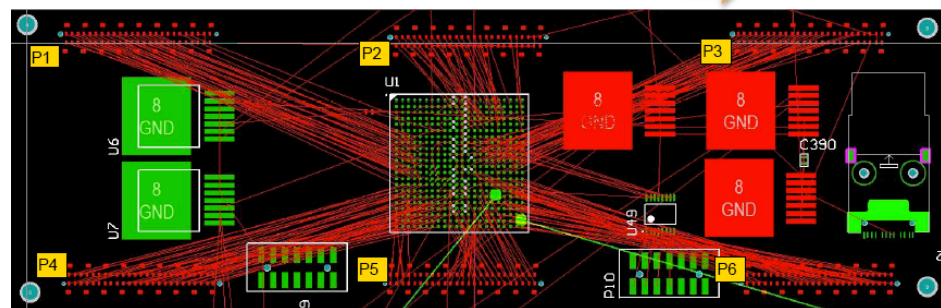
FRONT SIDE



Preliminary ASIC BOARD routing (INFN) → S. Turisini



Preliminary FPGA BOARD 2D layout (JLab) → C. Cuevas



Mirrors

Milestone: Identification of Mirror Technical Specification (3/31/14)

Manufacture Engineering Phase ongoing with companies in Italy and USA

In contact with CERN laboratory for mirror characterization

CFRP SPHERICAL Mirror

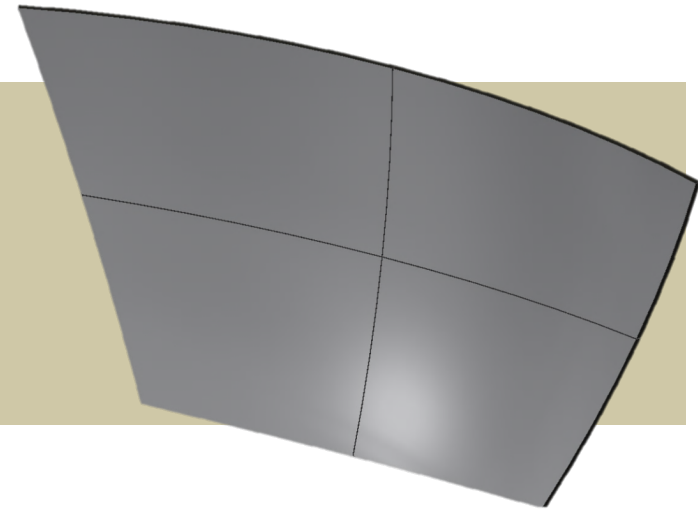
Radius tolerance $\leq 1\%$

Surface accuracy: $5 \mu\text{m RMS}$

Surface Quality: 3 nm RMS

$D0 < 5 \text{ mm}$

Reflectivity $> 90\%$



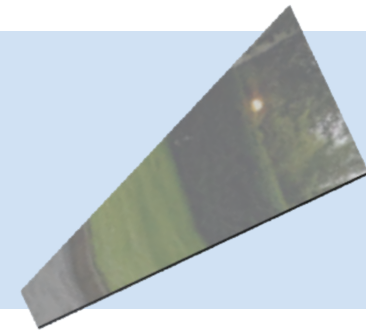
Planar Glass Mirror

Planarity tolerance $\leq 0.1 \text{ mm}$

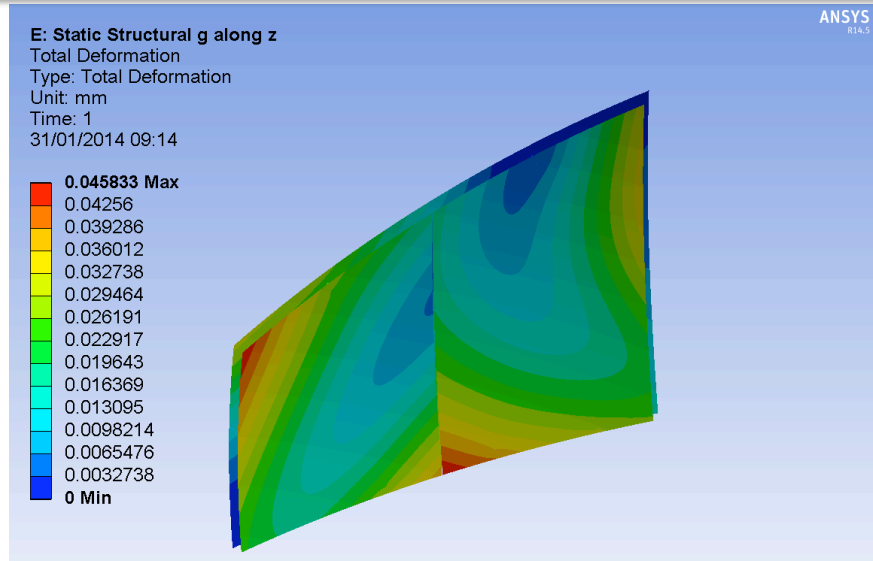
Surface accuracy: $5 \mu\text{m RMS}$

Surface Quality: 3 nm RMS

Reflectivity $> 90\%$

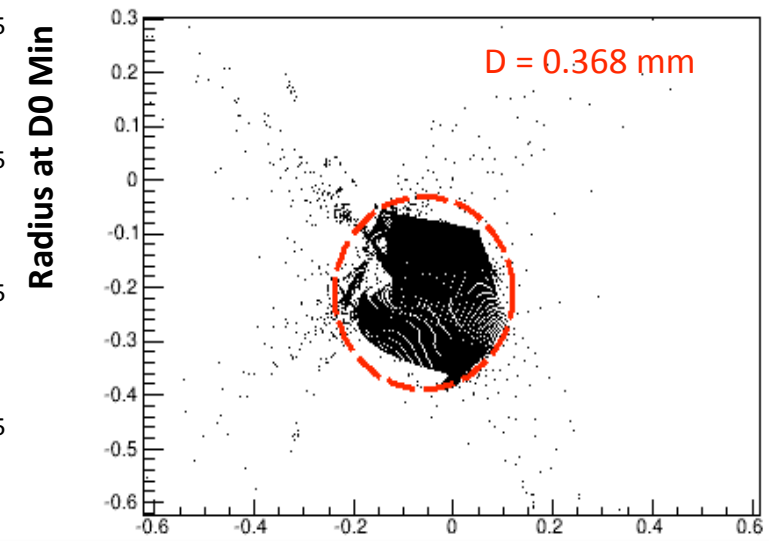
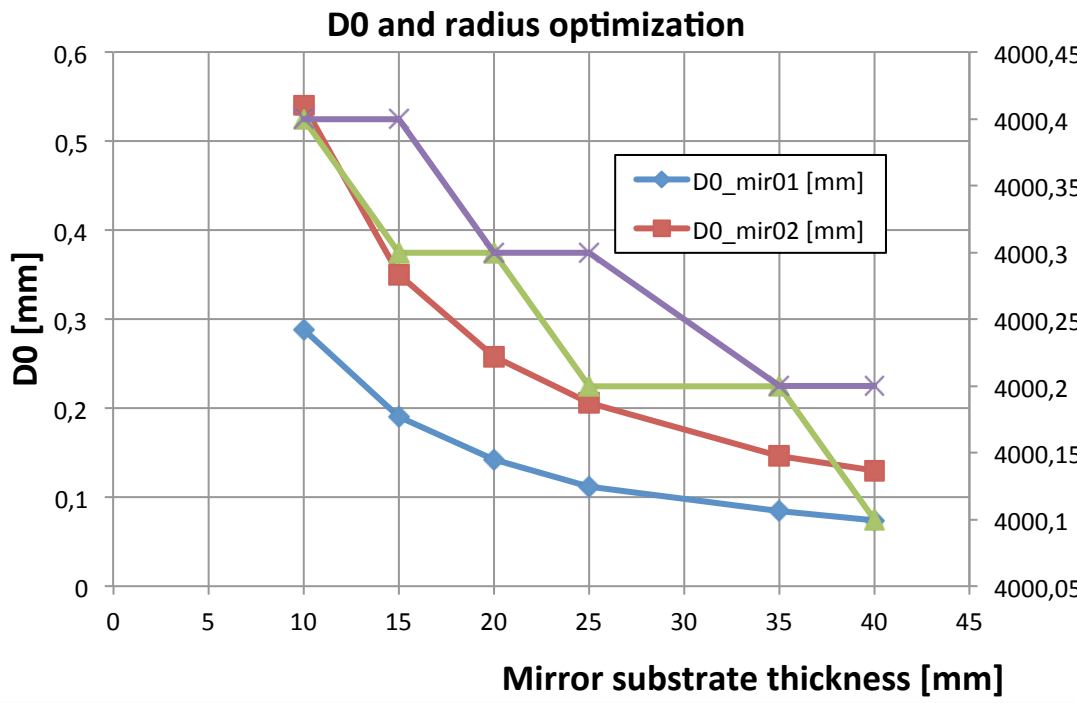
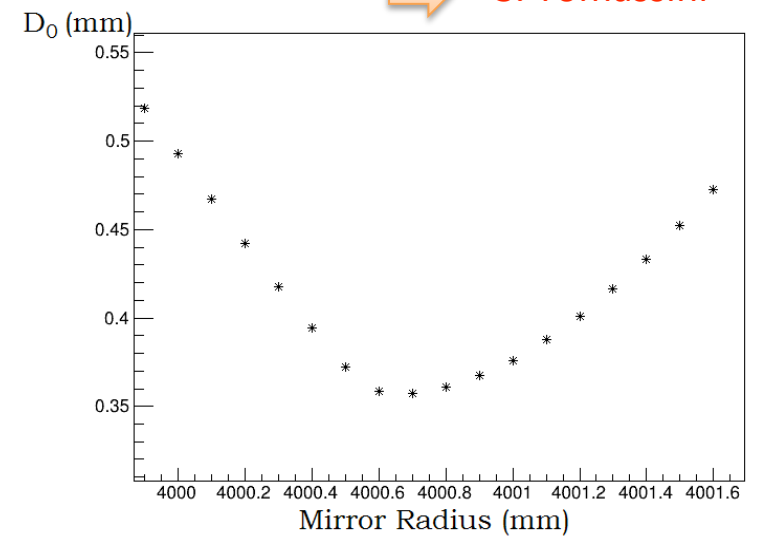


CFRP Spherical Mirror



FEM mechanic analysis is being connected to optical performance evaluation

➔ S. Tomassini



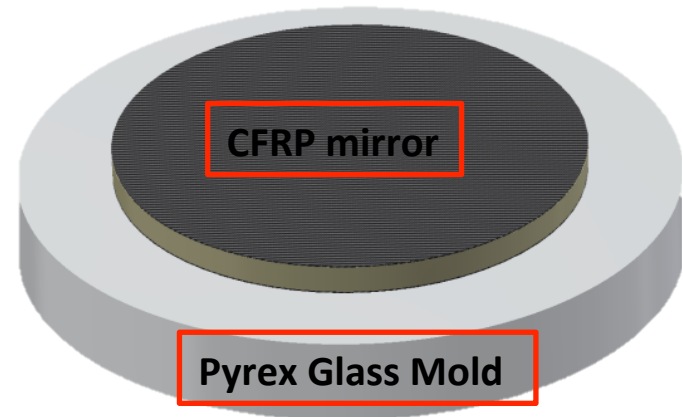
CFRP Spherical Mirror

Two mirrors demo in preparation at CMA (USA) :

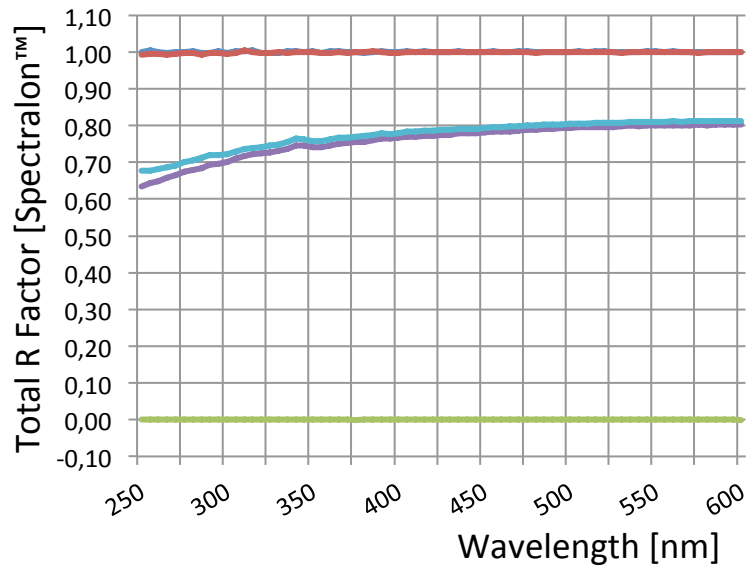
- CFRP skin and rohacell core
- spherical shape, 30 cm diameter
- 1st demo: 3.5 m radius, LHCb finish, from a CMA mandrel

not fulfilling specs. → to be redone by the end of March

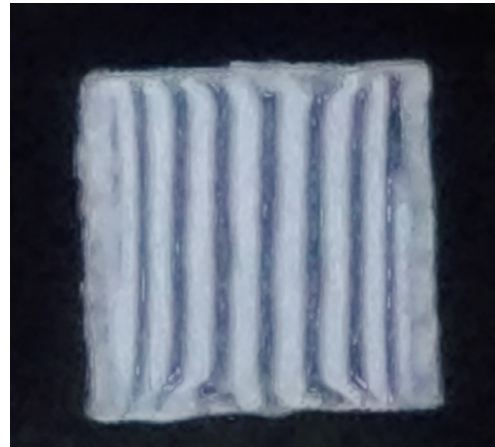
- 2nd demo: 4 m radius, CLAS12 finish, from the Marcon mandrel



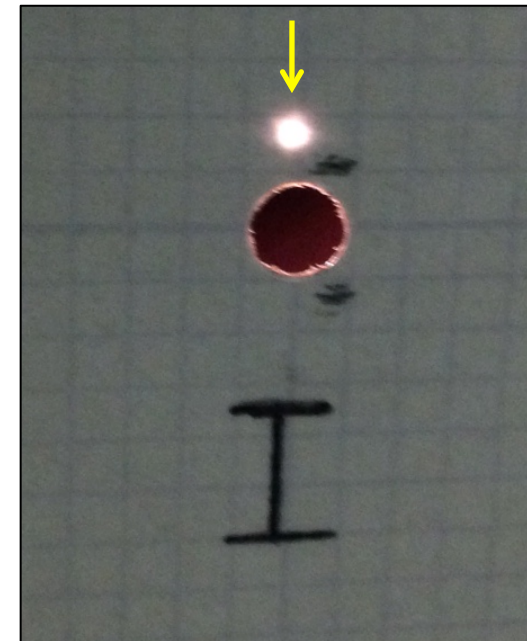
Reflectivity well below 90%



Ronchigram indicates edge effect



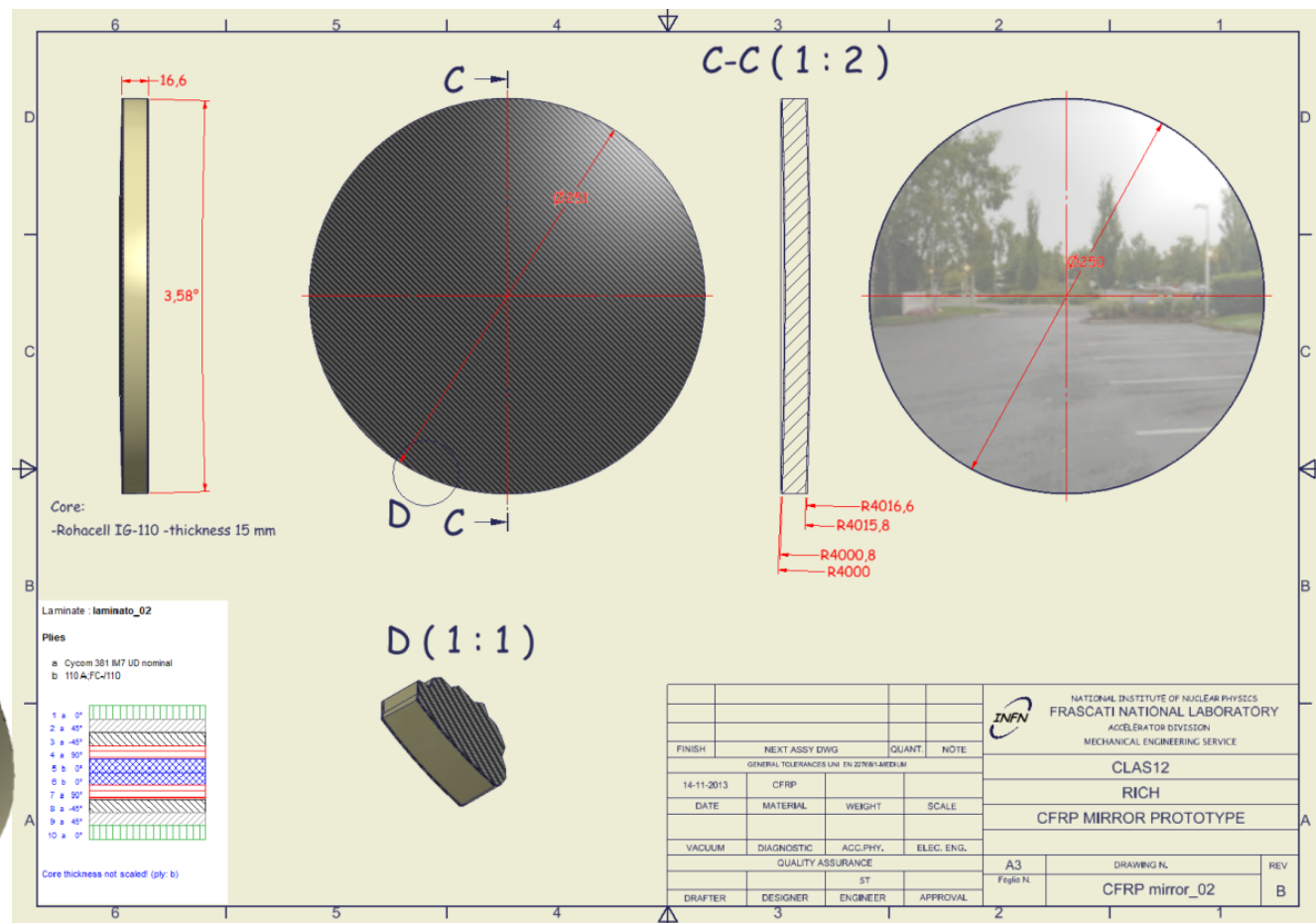
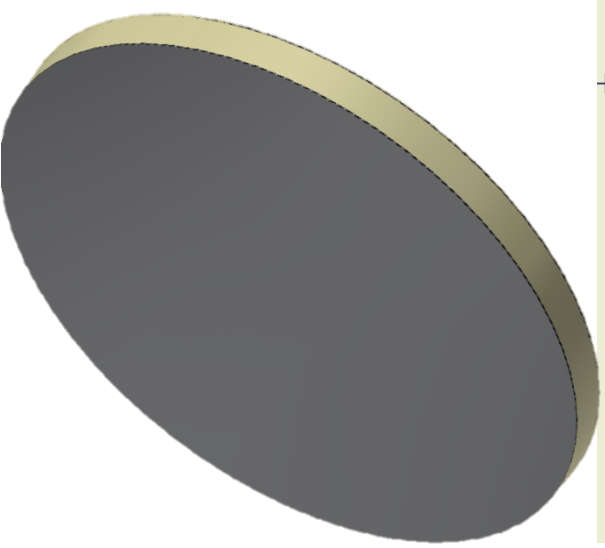
Return spot size = 1.25 mm



CFRP Spherical Mirror: Mandrel Demo

- Mandrel demo in preparation at Marcon (Italy) :
- supremax (borosilicate glass) material
 - spherical shape, 4 m radius, 35 cm diameter

➔ delivery expected middle of March



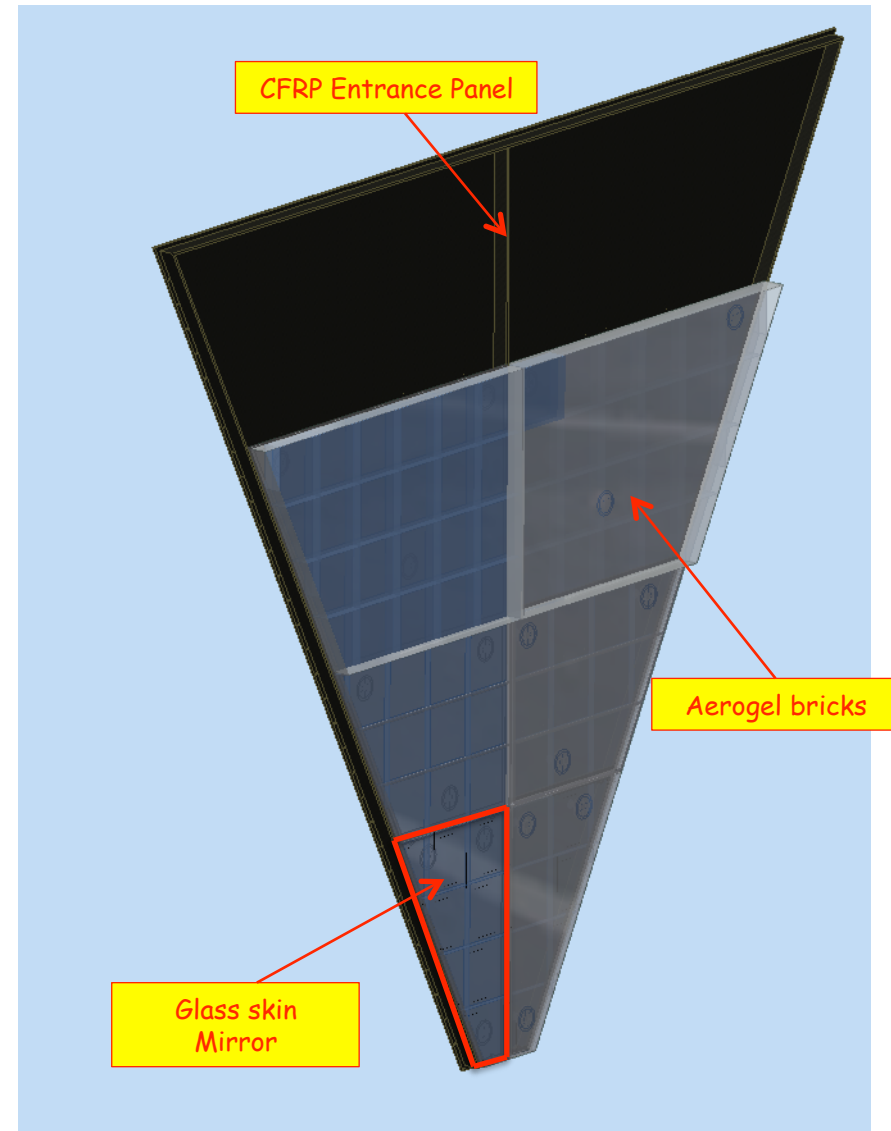
Glass Skin Mirror

Two demos under preparation at Media-Lario (Italy) :

- soda-line mm glass skin and Al honeycomb core
- reinforced frame for aerogel holder
- 1st demo: 1.6 mm (standard) glass skin thicknesses

→ delivery expected middle of April

- 2nd demo: <1 mm (goal) glass skin thicknesses



MA-PMT Photon Detector

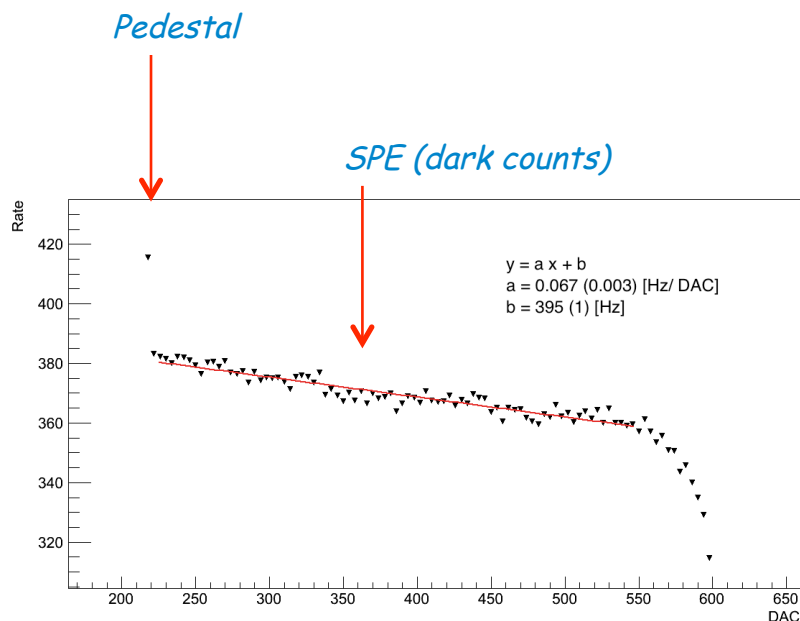
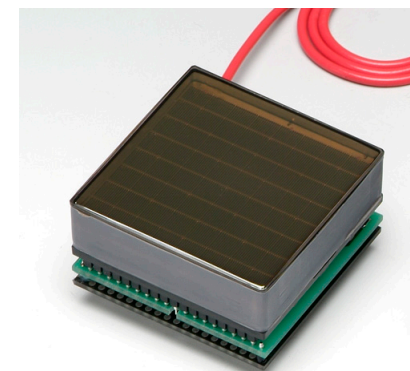
Milestone: Start PMT Production (1/1/14)

- H8500 chosen for the first 80 PMTs (H12700 not ready)

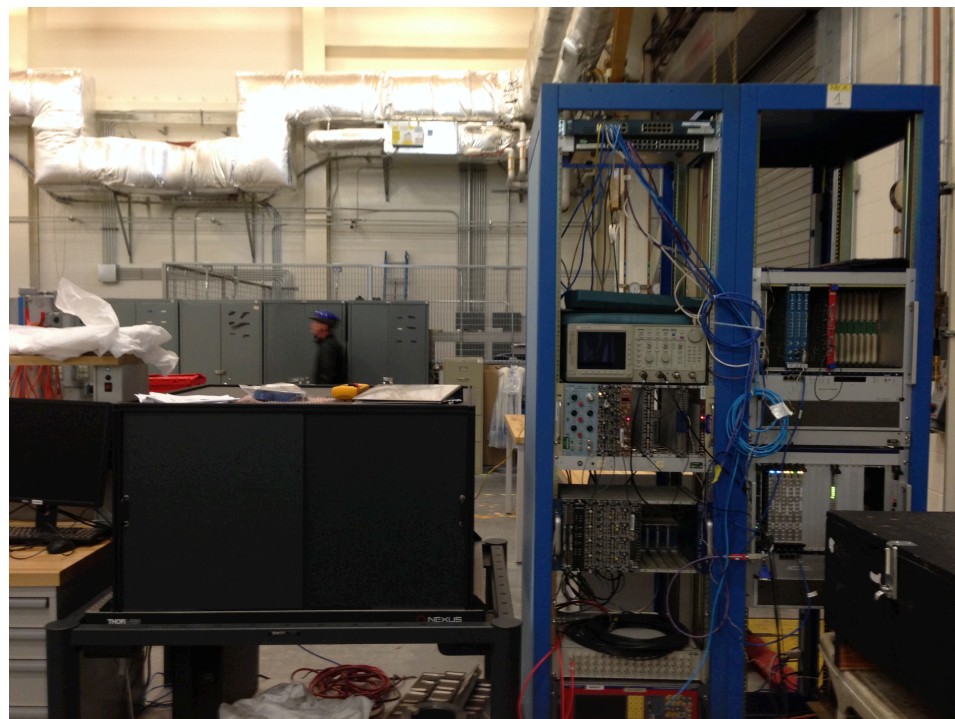
Milestone: First 20 PMT Delivery (4/30/14)

⇒ acceptance test bench ready at JLab (A. Kim)

- characterization with digital readout ongoing
- inter-calibration procedures under development



Threshold scan of dark count digital readout



JLab test bench

Aerogel Production

Aerogel Manufacture Engineering:

- maximize production rate for large scattering lengths (>50 mm)
- minimize edge effects (large area tiles)
- improve bottom surface accuracy

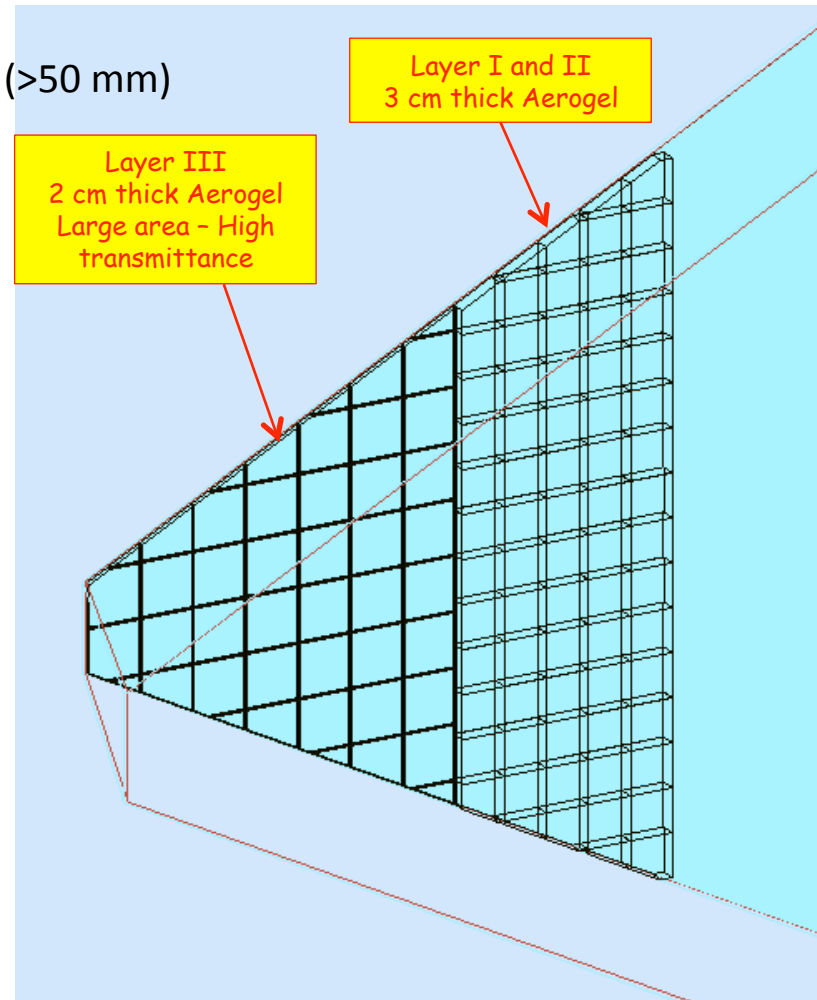
➔ Started in December 2014

Aerogel Production Phases:

- I) First layer of the tick radiator $\sim 2 \text{ m}^2$ by March 2015
 - minimum requirement on optical quality

➔ under negotiation (INFN)

- II) Second layer of the tick radiator
 - medium requirement on optical quality
- III) Thin radiator layer
 - maximum requirement on optical quality



Aerogel Radiator

Manufacture Engineering Phase ongoing with Novosibirsk to improve and stabilize large tiles production yield and transmission length:

- ➡ large tiles (20x20 cm²) yield acceptable for mass production has been achieved
- ➡ new tiles with optical improved surface ready for test

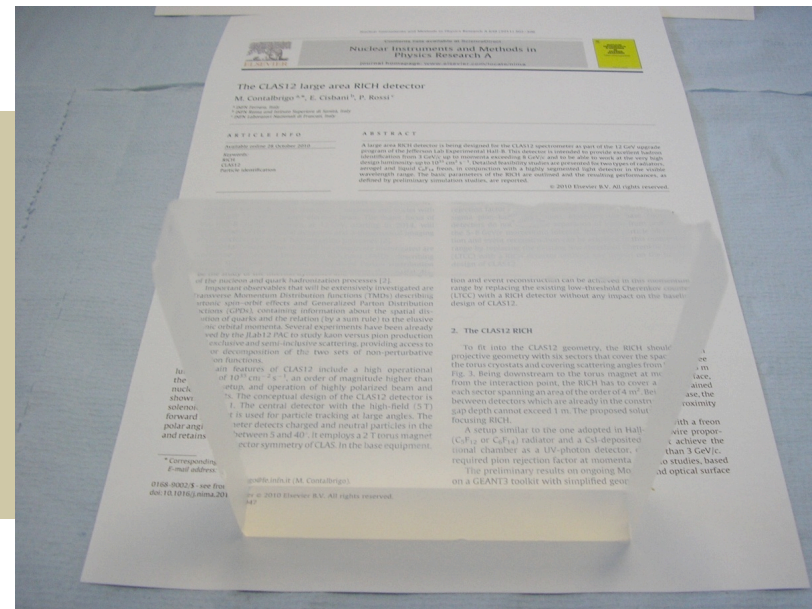
Aerogel Radiator

Refractive index: 1.05

Area: 20x20 cm²

Thickness: 3 cm

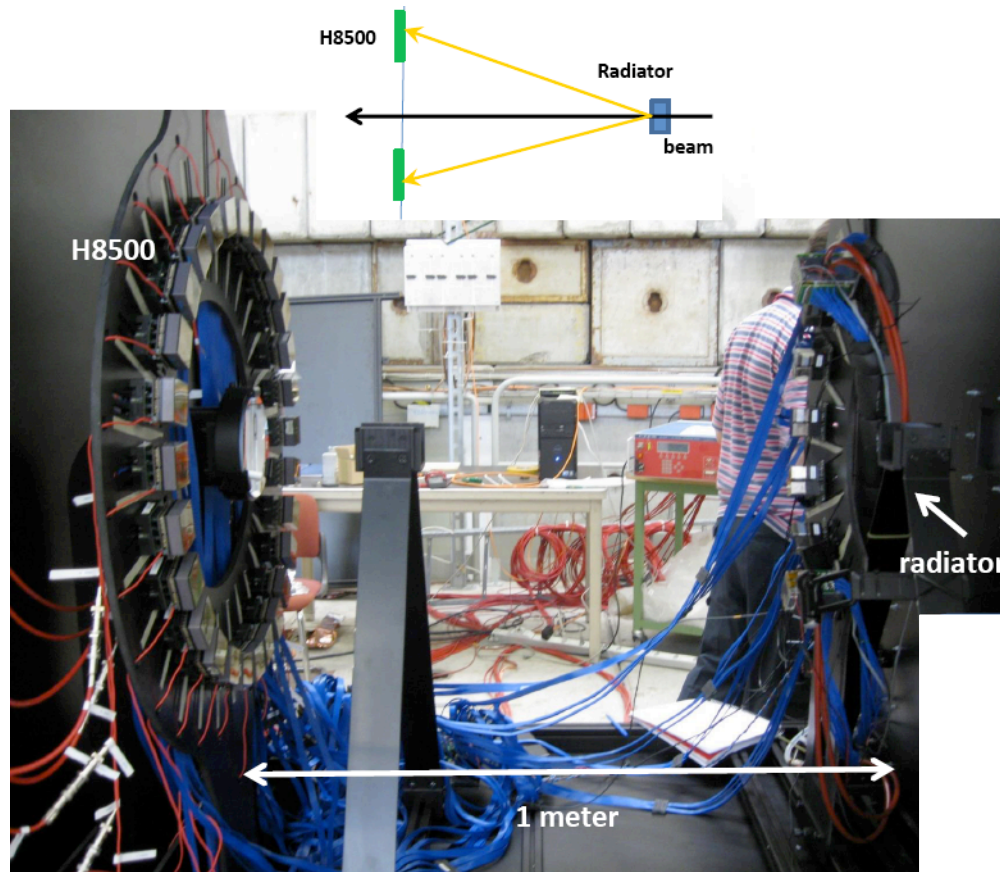
Scattering Length: greater than 50 mm



BTF Test Beam

To verify in real (Cherenkov light) conditions

- ➔ MAROC3 digital readout performance
- ➔ Aerogel refractive index homogeneity, surface and edge effects



➔ S. Mirazita

RICH Project Latest's

- ✓ Ongoing: Mechanic and Readout Electronic design
- ✓ Ongoing: Mirror and Aerogel manufacture engineering
- ✓ Ongoing: H8500 and H12700 characterization
- ✓ April: first 20 PMT delivery
- ✓ April: BTF test-beam
- ✓ Before summer: start aerogel production
- ✓ Before summer: start mirror procurement
- ✓ Fall: prototype of readout electronic ready for tests