

CLAS12-RICH Status-Report

May 5th 2014

RICH Project Milestones

Activity Name	Date	MS Lvi	Finish Date		F					FY 15				FY 16			FY 17				FY		
				4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
RICH Milestone Schedule																							
Start of US Scope of RICH Project	9/30/13	1	9/30/13																				
PMT Contract Awarded	9/30/13	1	9/30/13					Γ	-							art	Milor	ton	o wit	h El	0.01		
Start Aerogel Procurement	12/31/13	1	1/31/14					Start Milestone with Float															
Start PMT Production	1/1/14	1	1/31/14						Finish Milestone with Float														
FE Interfaces Defined; Preliminary Electronics Design Completed	3/31/14	2	4/30/14				H	1															
Identification of Mirror Technical Specification	3/31/14	2	4/30/14																				
Identification of External Frame & Electronic Panel Tech Specs	3/31/14	2	4/30/14																				
First 20 PMT Delivery	4/30/14	2	5/30/14																				
Start Mirror Procurement	6/2/14	1	7/1/14																				
PMT First Delivery Acceptance Testing Completed	6/30/14	2	7/30/14				Ŀ	<u></u>															
First 1 m2 Aerogel: Order for Procurement Submitted	6/30/14	2	7/30/14				•	<u> </u>															
Start Metallic External Frame Procurement	8/1/14	2	9/3/14					-															
DAQ: FPGA Board Design and Firmware Develop Completed	9/30/14	2	10/30/14						-														
Start Mirror Production	12/31/14	1	3/31/15							Ĭ													
DAQ FPGA: Order for Procurement Submitted	1/30/15	2	2/27/15							٠													
FE Electronics: Order for Procurement Submitted	2/27/15	2	3/31/15							•													
2 m2 Aerogel Production Completed	3/31/15	2	9/30/15																				
Start Electronic Panel Procurement	4/1/15	2	5/1/15								-												
Start First Spherical Mirror Characterization	6/30/15	2	8/31/15																				
FE and DAQ FPGA Boards: Production Completed	7/30/15	1	8/31/15									٠											
2 m2 Aerogel Acceptance Tests Completed	9/30/15	2	11/30/15																				
External Frame & Electronic Panel Completed	10/1/15	2	10/30/15										-										
Mirror Production Completed	12/31/15	1	3/31/16										•										
PMT Production Completed	12/31/15	1	2/1/16										•	-									
Start Mechanical Assembly Test	12/31/15	2	2/29/16										•	-									
Start FE and DAQ Electronics Characterization	1/29/16	2	2/29/16										•	•									
PMT Characterization Completed	3/31/16	2	4/29/16											-	-								
Mechanical Assembly Survey of Spherical Mirrors Completed	3/31/16	2	4/29/16																				
3 cm Thickness Aerogel Production Completed	5/31/16	2	10/31/16												•		-						
Mirrors/Ext Frame/Elect Panel Arrive at JLab	8/31/16	2	9/30/16													٠							
Start RICH Assembly	10/3/16	2	11/2/16														-						
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Contalbrigo M.

External Frame & Electronic Panel

Milestone: Identification of External Frame & Electronic Panel Tech. Specs. (3/31/14) achieved (2/28/14) RICH module designed to be as much as possible close to the existing LTCC sector layout Technical review with JLab engineers 20 June 2014.



Gas System



Velocity_abs

Aerogel

The Manufacture Engineering Phase by the Russian vendors at Novosibirsk to improve and stabilize large tiles production yield has been completed:

- large tiles yield acceptable for mass production has been achieved
- new tiles with optical improved surface delivered for test
- visit of the manufactures from Novosibirsk in Ferrara: March 17-23, 2014



Aerogel Radiator

Rafractive index: 1.05 Area: 20x20 cm² Thickness: 3 cm Scattering Length: greater than 50 mm

MA-PMT Photon Detector

20 MA-PMTs delivered at Jlab on March 27

- 1 month in advance versus plan
- 2 rejected due to anode dark current > 5 nA

30 MA-PMTs delivered at Jlab on April 29











We have started discussion with procurement and Hamamatsu how to integrate H12700 in the Phase II and Phase III of the contract

Contalbrigo M.

Read-Out Electronics

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

Work done in parallel to finalize executive design of

Adapter board (Genova) ASICs boards (Ferrara) DAQ boards (JLab)

Meetings ongoing to fix details interfering with mechanics board holding details LV and readout transceiver orientation and cable routing



ASIC BOARD routing (INFN)



Universal FPGA BOARD 2D layout (JLab)



Mirrors

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

achieved (2/28/14)

Manufacture Engineering Phase ongoing with companies in Italy and USA In contact with CERN laboratory for mirror characterization

CFRP SPHERICAL Mirror

Radius tolerance <= 1% Surface accuracy: 5 µm RMS Surface Quality: 3 nm RMS D0 < 5 mm Reflectivity > 90%



CFRP Spherical Mirror: Mandrel Demo

Mandrel demo in preparation at Marcon (Italy) :

- supremax (borosilicate glass) material
- spherical shape, 4 m radius, 35 cm diameter
 - Delivered at the end of March

Mechanics is fulfilling specs (from preliminary characterization results)





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. i to be redone by the end of March

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



Wavefront Data

The mirror was measured with a Shack-Hartmann wavefront sensor as shown in the image below. The test is a radius of curvature test.



CFRP Coated Mirror





Wavefront Data

Camera signal showing the microlens array for slope measurements.



Camera Image, Raw data of full aperture of the CFRP mirror.

Wavefront Data

Surface map of the CFRP mirror shows errors of 1.86 μ m p-v surface, below the 2.5 μ m p-v surface requirement.



Reflectivity Data

The second measurement indicates just above 60% reflectivity at 450nm



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

mechanics fulfilling specs. but coating process not reliable

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



CMA can do the wanted CFRP substrate but not the coating

CMA has accepted to reproduce demo n.1 without coating by the end of May

For coating we have contacted

- * SESO-Thales (France) made the coating for LHCb, max allowed mirror diameter 1.8 m
- * Zaot (Italy)

coating the planar mirrors for Media-Lario, max allowed mirror diameter 1.8 m, in principle able to reach 92-95% reflectivity in the 300-600 nm wavelength range



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 <= 1% Surface accuracy: 5 µm RMS Surface Quality: 3 nm RMS D0 < 5 mm Reflectivity > 90%

Planar Glass Mirror

Planarity tolerance <= 0.1 mm Surface accuracy: 5 μm RMS Surface Quality: 3 nm RMS Reflectivity > 90%



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

Technical review @ Media-Lario
Delivered

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





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

Surface quality: 40 μm p-v, 8-9 μm rms

- not perfect Al mold (20 μm p-v)
- not optimized vacuum process
- gravity (to be studied by FEM simulation)





Glass Skin Mirror

Suitable coating with room for improvement

