

Task List: Fabrication of PbWO₄ modules for the FCAL2 upgrade (JEF experiment in Hall D)

Timeline: 1600 modules of the FCAL2 insert have to be fabricated by the end of 2022

Status: All parts exist to start mass production

Pre-production: about 20 modules have been fabricated and tested using PS beam test setup. Compton Calorimeter (CCAL) based on 140 modules (with a relatively similar design) was built and successfully used during the PrimEx experiment.

Safety documents and (most) fabrication procedures exist

Part 1. Help Needed

Wrapping PbWO₄ crystals

Procedure	Number	Tools	Comments	Name
1. Cut reflective foil (ESR)	1500	Exist		
2. Cut Tedlar		Exist		
3. Preshape ESR using oven - load ESR to the fixture - preshape ESR in the oven (oven exists)		2 fixtures exist	Can cooperate with the NPS, they have 10 fixtures Large oven can be used	
4. Clean crystal				
5. Wrapp crystal with ESR and Tedlar		Exist		

Estimated time (per module): 20 min wrapping + 20 min preshaping using 2 fixtures
(preshaping time scales with the number of fixtures used)

Light Guide (LG) preparation

1. Glue LG to the PMT using UV glue	1600	Exist		
2. Cut reflective foil (ESR)		Exist		
3. Wrapp LG with ESR				

Estimated time (per module): 15 min

Module fabrication

1. Insert mu-metal shield (cylinder and 50 um foil) into the PMT housing	1600			
2. Insert PMT with silicon cookies				
3. Attach PMT housing to crystal, set tension screws				

Estimated time (per module): 30 min

Preparation of silicon cookies

1. Mix RTV 615, remove bubbles	1650	Exist		
2. Pour RTV to the fixture Set time: 1 day full cure time: 4 - 5 days		Exist	36 cookies in one fixture 3 - 4 hours to load the fixture	

Estimated time scales with the number of fixtures used

Part 2. Help may be needed

Brazing straps

1. Stretch brass strap between two flanges	1600	Exist		Chris Alan Hall D
2. Braze the strap to each flange				

Estimated time (per module): 20 min

QA Check of PbWO_4 crystals

1. Visual inspection	420 checked	All facilities for checking crystals exist		Hall D
2. Dimension measurement				
3. Transmission check				
4. Measure light yield - use radioactive source - use PS test setup				

Estimated time (per crystal): Depends on the number of checks performed

PMT checking

Check PMT diameter	about 900			Hall D, GWU
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Estimated time (per PMT): 5 min

Check PMT dividers

Check divider using LED	1650	Setup exists in JLab		Hall D, Regina, GWU, UNCW
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Estimated time (per divider): 10 min

Check fabricated modules

1. Check light yield and resolution using PS test setup	TBD	Exist		Hall D
2. Check performance using cosmic rays	TBD			

