

Report on Working Group # 2 The MU2E detector

S.Miscetti LNF INFN Frascati

MUSE Scientific Board meeting 18-Dec-2017

Calorimeter: status and plans

2017 achievements:

- → PRE-Prod CsI and SiPMs completed & Module-0 tested
- \rightarrow BID for CsI and SiPMs done \rightarrow Comments on delivery in few slides
- → PRE-Prod of MB Design completed, in production x 5, @ LNF for Xmas
- \rightarrow PRE-Prod and test of FEE chips \rightarrow see next slides
- → PRE-Prod of WD. First board in Pisa, x3 in progress, V2 under planning
- → Pre-production of FEE cables in progress, @ LNF for Xmas
- **Data analysis of Module-0 in advanced status**
- Plans on new "Module-0" slice tests
 - → update up to Ring-2 (19 New SiPM Holders, preamps, cables, MB+WD readout) ..
- □ Vacuum chamber for Module-0 ready ...
- □ Preparation of QA room in SIDET OK, QA stations underway
- **Details for production underway:**
 - → Wrapping, Labeling CsI and SiPMs, DB Handling
- □ Successful test of SiPM cooling and SiPM-Csl thermal gradient
- Mockup in progress



Calorimeter: pre-reviews ····

 In November we had two dedicated internal reviews for : PRE-electronics review (21-22 Nov 2017) to discuss:

- status of calorimeter electronics;
- services and cabling;
- a PCB review (layout of FEE chips, Mezzanine Board and Digitizer board)
- discussion of rad-hard components (VTRX, FPGA, DC-DC converter)
- PRE-Mechanical system review (28-29 Nov 2017) to discuss:
 - status of outgassing
 - status of cabling layout (FEE and services)
 - operations of assembly, installation and maintenance
 - interferences with tracker (cabling, access ...)
 - status of cooling system

Positive outcome of these discussions with some recommendations and some progress in the overall design ...

- ... small corrections or board layouts and suggestions
- ... new drawings of feet for the calorimeter disk
- ... better organization of patch panels for distribution of services
- ... preliminary ideas for access

5 Fermilab

Electronics pre-Review

Two days of presentation and PCB review. Very nice outcome. PCB review held by G.Drake, R.Rivera, J.Olson.

Nov. 22 for the review of your PCBs. You have done a lot of work to this point, and your designs look fairly mature. Thanks for putting together the presentations. This was a lot of work, but really helped the committee understand how the boards work, and what the important performance parameters are.

This was an informal review, and the comments that follow are meant to be helpful. The preamp and mezzanine boards appear to be nearly final, and is mostly ready to go, with the suggestions below. the DIRAC board was aid to have another major iteration, to incorporate the PolarFire FPGA and possibly DDR4 memory. We suggest having a final design review of this board after the final design is complete prior to fabrication.

Then a list of technical comments follow.



Test of FEE-gain

After Module-0 test beam, we have worked to tune FEE gain to avoid saturation

- At BTF we had FEE gains : GX1 = 15 and GX2=30. A clear saturation observed @ 100 MeV.
- We had fixed with two steps operation: reduced SiPM bias, modified preamp.
- We run with Vbias = Vop-3V (for the series) and Gx1 = 7.5.
- Since the CAEN digitizer had 0-1 V dynamic range we had also modified the output of the Mezzanine Board.

The product of Npe X Gsipm= Qsipm reduction due to Vbias is ≈ 2

This means our Gx1 effective was 3.8

Proposal is to have the new set of Preamps running with Gx1=4 in order to get a pulse height of 1.1 V at 100 MeV

Dynamic range 0-2 V



S. Miscetti I MUSE SB meeting

Details on outgassing measurement

□ Outgassing of module-0.

- ❑ The Al-disk with 51 wrapped crystals and packed as in the final configuration reached in a vacuum vessel 0.6 x 10⁻⁵ Torr (after 5 days of pumping) in agreement with the outgassing specifications of the measured components.
- \rightarrow Virtual leaks reduced to a small effect.
- \rightarrow Next step is to test the SiPM and FEE disk.





Cooling: comparison ANSI vs test



6 S. Miscetti I MUSE SB meeting 18 Dec 2017

QA stations /QA room: CsI+ SiPM

- □ QA area cleaned. AC units OK. Floor with low outgassing resin done. Installation of glass windows and doors done. ODH requirements for N₂ flow being controlled by our mech. Integration team.
- Discussion for usage of sources underway:
- OK for Na²² calibration source
- OK for CsI¹³⁷ for RIN but shielding still underway

The QA area is now ready to be used:

- First tables installed, storage cabinets being procured:
- Missing materials being procured (PMTs, Digitizer, RIN readout, Power supplies, PREP-material)
- QA stations being completed in Italy for:
 - Optical test of crystals;
 - Radiation Induced Noise test on crystals;
 - SiPM MTTF determination;
 - SiPM gain/IV curve.

ed:

18 Dec 2017

🛟 Fermilab

- D.Pasciuto (Pisa → NIU) will oversee the logistic for the production and organize the adjacent area for disk assembly and installation. He will be at FNAL for 1 years starting from 8th of January 2018.
- We will start organizing shifts and training from beginning of February

CsI+ SiPM pre-series delivery

□ First 50 SiPMs (pre-series) will be at LNF next week to test QA station.

□ SiPM production will start in the middle of February.

→ They will be shipped directly to Fermilab.

 □ Pre-series of 12 Siccas CsI crystals sent from China on first week of December. They arrived at FNAL on Friday 15 and have been surveyed for mechanical tolerances. Pre-series from St.Gobain has been delayed → we will receive it end of January.

Crystal production will start in the middle of February.

□ Mechanical precision of the crystal OK

Bad quality on some crystals corners to be understood



18 Dec 2017