



# Report on Working Group # 2

## The MU2E detector

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MUSE Scientific Board meeting

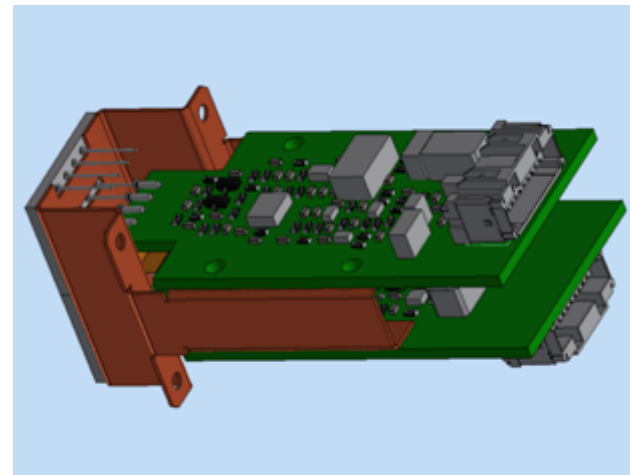
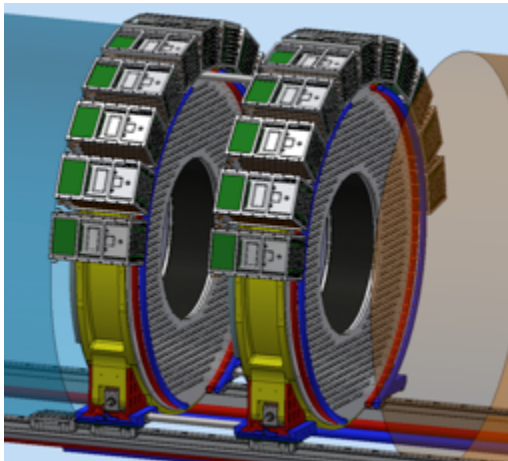
23-June-2016

- **The MUSE contribution to the MU2E detector is focused on two specific detector components:**
  - The EM calorimeter for energy, time and position measurement of the CE candidates;
  - The HPGE detector for the normalization, i.e. for the counting of the muon stopping rate on target.
- **2016 is a crucial turn-around point for MU2E since:**
  - Director reviews and CD-3c has been held;
  - International contributions are increasing. This is also due to our network: HZDR is now part of the experiment (first irradiation on SiPM done) and UK is joining.
- **Our first deliverable will be the Updated TDR for the EMC at the end of the year.**

# Calorimeter: review status and scope



- ❑ **The EMC design has been frozen:**
  - Technology choice (Jul-2015)
  - Final Design (Feb-2016)
  - Director Review for CD3c (Apr-2016) done.
  - **CD-3c (June 2016) done → Proceed to construction!!!**
- ❑ **The calorimeter now consists of two disks with 674 un-doped CsI square crystals, readout by 2 large area, UV extended “CUSTOM” SiPM arrays.**
- ❑ **FEE is on the back of SiPMs and Digital electronics is on “home-made” crates**
- ❑ Calibration is described in Working group 3
- ❑ **INFN has large commitments on all sub-systems.**



# Calorimeter: Design Status



Calorimeter Subsystem	Design Completion	Remaining Work/Risks
Crystals	100%	CsI slow component specified.
Photosensors	85%	SiPM packaging. Have one packaged SiPM from Hamamatsu but want to qualify other vendors
Mechanical Infrastructure	70%	Finalize cooling design. Optimizing tradeoffs between noise, radiation damage and operating temperature. x2 headroom
Front End Electronics And Digitizer (WFD)	70%	<ul style="list-style-type: none"><li>• New pre-amp design for CsI/SiPM</li><li>• WFD board design with 20 channels. Moderate risk that we may have to back off to 18 channel boards. Adds a small amount of complexity.</li></ul>
Calibration	90%	Integration of source pipes. Finalize laser optics.
<b>Overall Design</b>	<b>83%</b>	

# Outcome of CD-3c, charges



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1. Have the project and the laboratory responded satisfactorily to the recommendations of the previous DOE review? **Yes**
2. Is the detailed design sufficiently mature and appropriately reviewed so that the project can continue, as planned, with the procurement and fabrication work? **Yes**
6. Is the documentation required by DOE Order 413.3B for CD-3 complete? **Yes**
7. Are there any outstanding issues that need to be addressed? **No**

# Outcome of CD-3c, recommendations



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### ▪ Recommendations

- Conduct a full system test for each subsystem prior to the respective procurement readiness review.
- Complete a comprehensive system test of the first plane to provide input for the straw assembly CRR, currently scheduled in August, 2017 (WBS 475.6, Tracker).
- Develop plans to monitor and control gas temperature and pressure in the tracker (WBS 475.6, Tracker).
- Ensure that the documents for detailed assembly and installation procedures are complete by the final mechanical design review. (WBS 475.7, Calorimeter).
- Proceed to CD-3.

# Calorimeter: next steps



- **Statement of Work between DOE and INFN in preparation.**  
This document will list the work we will commit to do
- **Engineering should continue in view of 3 reviews at end of 2016 and in 2017:**
  - Mechanical review
  - Construction Readiness Reviews (Crystal and sensors + all the rest)
- Pre-production + QA + Rad Hard test for crystals → **BID from FNAL in progress**
- Pre-production + QA + Rad Hard test + MTTF for SiPMs → **European BID ready to go on Monday (from INFN)**
- Pre-production FEE+WFD in progress
- Mockup of Mechanics for FULL SIZE support, CF structure and rear cooling disk .. In progress
- **Module-0 construction + tests of Rad-Hard and under vacuum (2017)**
- **Construction Readiness Reviews : SPRING/SUMMER 2017**
- Larger bids in 2017 for 2017-2018 procurement crystals, SiPMs, mechanics
- 2018 construction of FEE+ electronics + installation toolings
- **2019 calorimeter assembly + 2020 installation/commissioning**

# Calorimeter: network contribution



Two relevant MUSE network contributions during this first six months:

## ❑ 1) Irradiation of Large Area UV extended Hamamatsu SiPM at HZDR

- preparation of facility
- successful test of 1 SiPM
- planning under discussion for next steps

## ❑ 2) Improvement of QA for crystals interacting with PRISMA people seconded at LNF

- More “Industrial” standard proposed for QA.  
Dedicated document in writing
- Mysql DB + WEB interface for a first version of  
CRYSTAL TRAVELER