Fermilab

U.S. DEPARTMENT OF ENERGY | Office of Science

Report on Working Group # 2

The MU2E detector: calorimeter

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MUSE Scientific Board meeting

8-March-2019

Mu2e

Overall EMC status

- Production for crystals and sensors progressing well
- **Test of radiation hardness of FEE, MB, DIRAC done**
  → V3 of FEE and V2 of DIRAC under design
  → new cable FEE-MB selected
  → SEU tests under planning
- **Work on preparation for CRR mechanics**
- **Deliverable status**

CsI production

SICCAS

- 622 crystals received /725 = 86%
- **Rejection factor 3%**

End of SICCAS production: Apr 2019

→ StGb getting stabilized

→ October 2018: 25 crystals received with high rejection factor: 41%

→ Dec 18: 63=25+38 crystals received

- ❑ **5 bad out of 25**
- ❑ **5 bad out of 38**
- ❑ **1 bad for ser # > 15000**

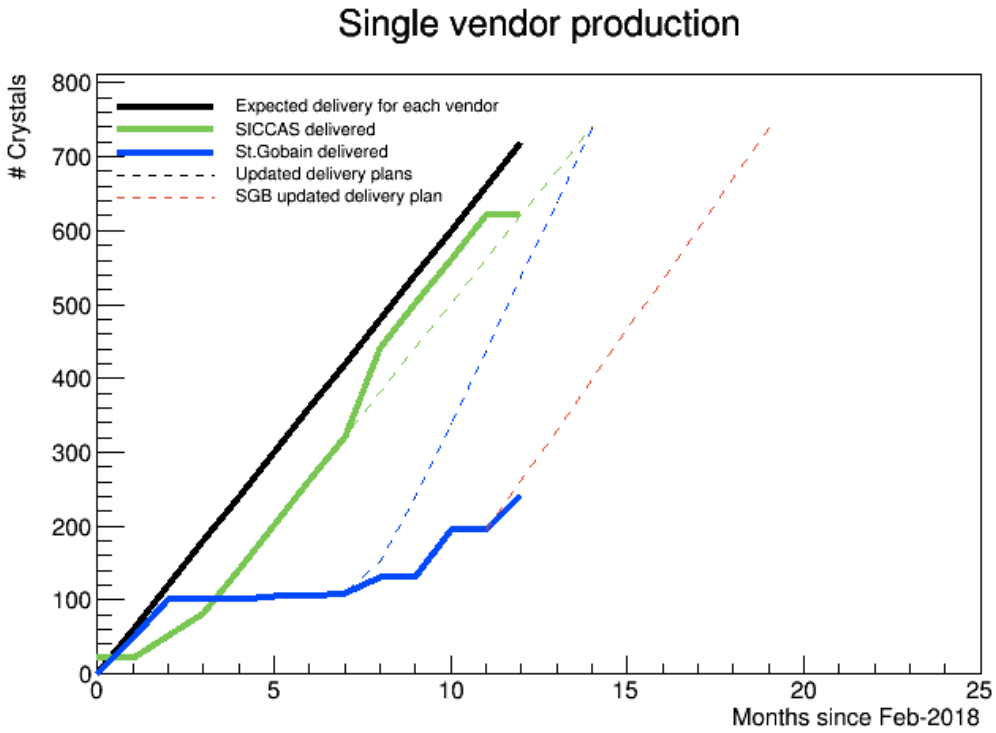
Rejection factor = 10/63 = 16%

⇒ End of January +48 crystals

⇒ good quality + 30 arrive this week

Bi-weekly phone call established

End of SgB production ➔ Oct 2019



	Siccas	St.Gobain	Total
Shipped	**622/725**	**242/725**	**864/1450**
Arrived	622	242	864
CMM + inspection	622	242	864
Sent to Caltech	184	16	210
Back to Vendor	13	44+20	73
Irradiation at Caltech	**8**	**-**	**8**

SiPM production

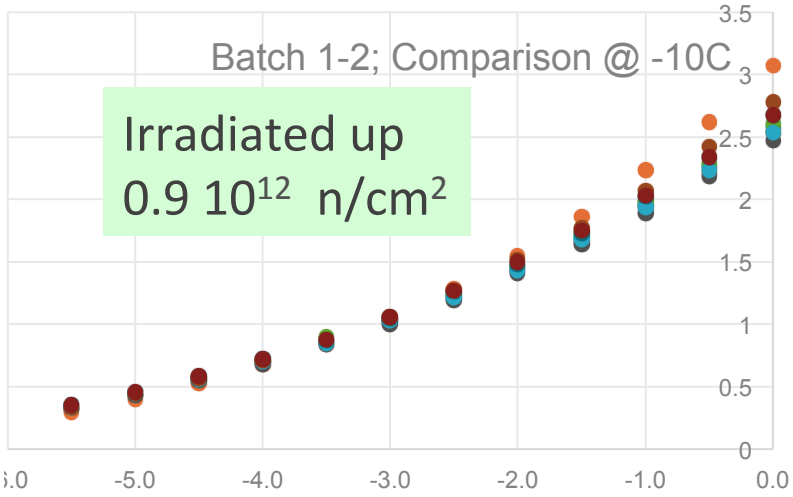
- ❑ All 12 shipments of the standard production (3360) received
- ❑ Schedule is to complete QA production test for end of March.
- ❑ Two additional shipments expected with the schedule of of completing their QA in May 2019 and reach 4000 sensors

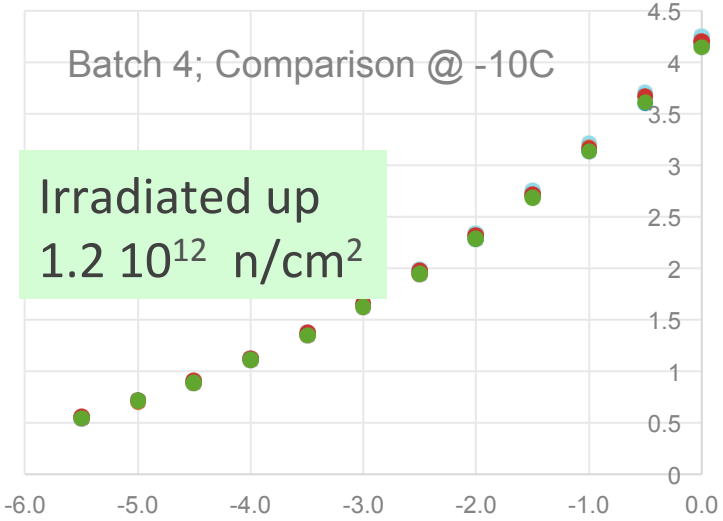
Up to yesterday:

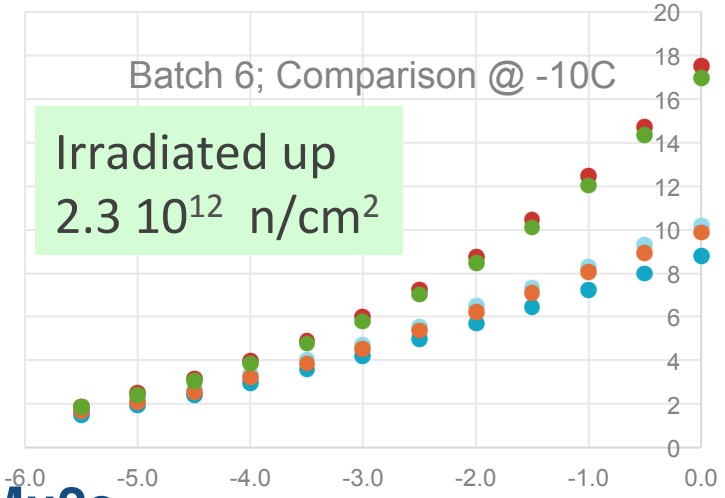
➔Geometry checked: Batch # 12 (3360)
➔QA station (Idark, I-V and Gain) checked: Batch # 10 (2750)
➔Irradiation test up to batch #7 (see next page)
➔MTTF test keep working w.o. deads ..

➔ MTTF > 10 milion hours

Production SiPM irradiation with neutron





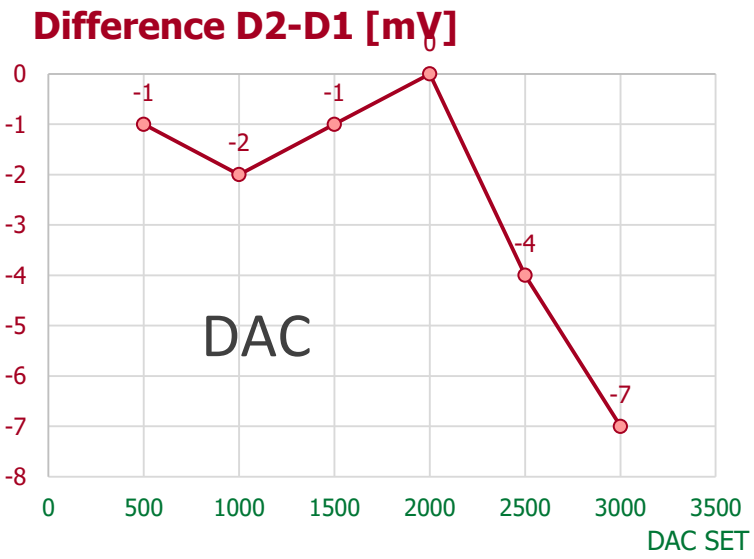


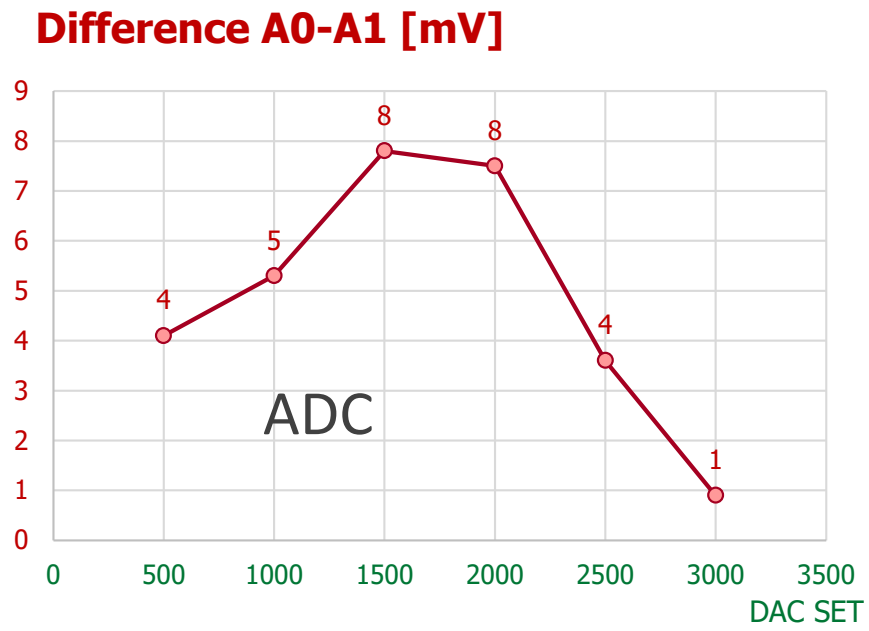
- 5 SiPMs/batch "passively" neutron irradiated @ Dresden
- For Mu2e, the max n-flux in SiPM area is of around (4)x10^10 n/cm^2
- Safety Factor 3(MC)x5(Years)x2(Prod) = 1.2 10^12n/cm^2
- Max Idark current for operation of 2 mA

➔ Requires cooling of -10 C, Lower operation overvoltage to Vop-3V (for the MU2E serie) , 20% of PDE relative loss

FEE ADC/DAC test up to 120 krad

- all analog parts of Amplifier and HV regulator are rad-hard but LT ADC/DAC of digital sector suffering from 10-15 krad up → new rad-hard TI ADC/DAC identified
- PCB with TI ADC/DAC completed
- **1 week of gamma irradiation done @ end of January up to 110 krad**





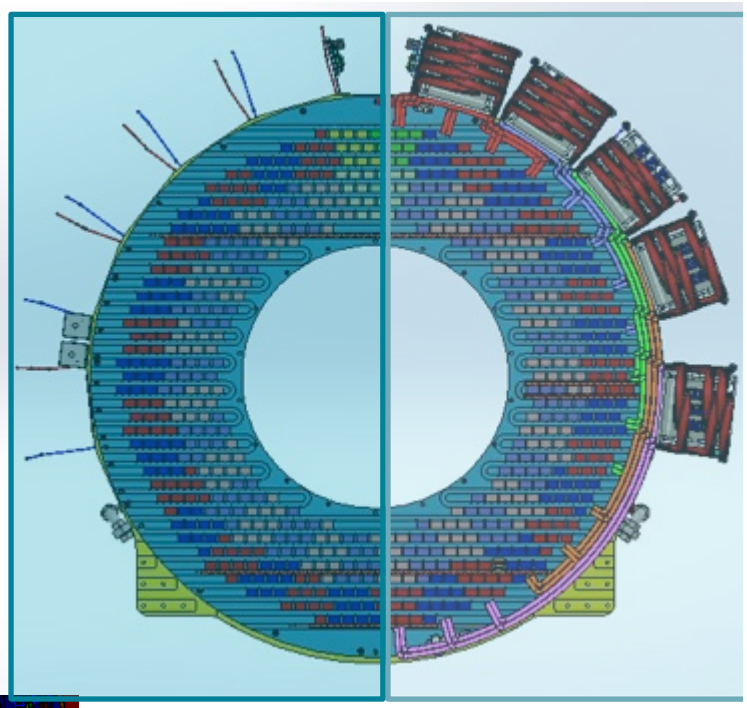
- Maximum deviation of ADC and DAC before and after irradiation
- Consistent with TI specifications

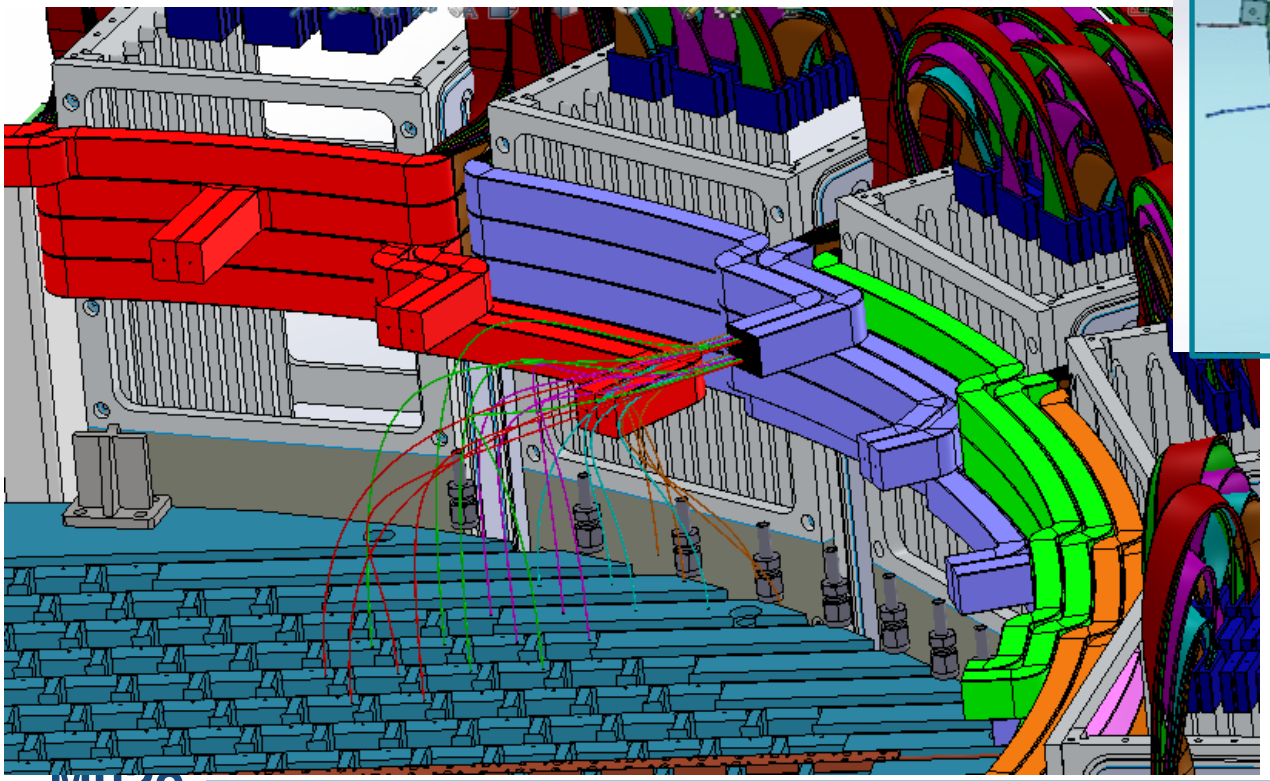
Mechanical integration:FEE+MB cabling

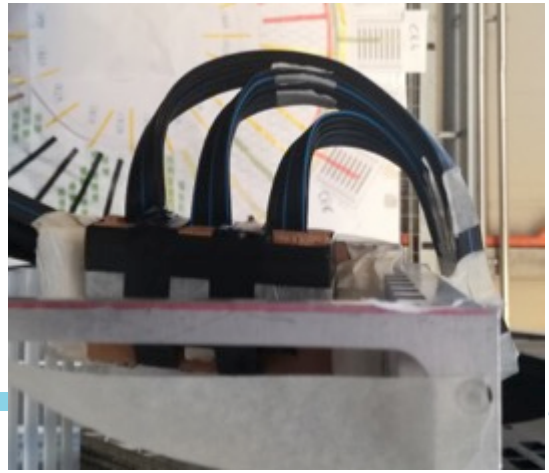
- → FEE rad-hard chip format being frozen
- → New cable selected to handle rad-hard ADC/DAC
- → Routing of FEE-MB cables in CAD model
- → First realistic estimate of cable lengths, weights

4 km cables , 55 kg/disk

- → New mockup in progress







Status of deliverables & Milestones

→**D2.1 (TDR) Month 12**
→**D3.3 (Design Laser system) Month 18**
→**D4.2 (Development of Simulation Code) Month 32**
→**D2.2 (Production DB for Crystals and sensors) Month 36**
→MS2 (Assembly of the first calorimeter disk) Month 42

Calorimeter disk will not be ready for June
➔ CRR of mechanics is slipping
➔ CRR for electronics being discussed
➔ Mechanics expected/needed for October
➔ FEE electronics expected for October
Delay it for the end of the year ..