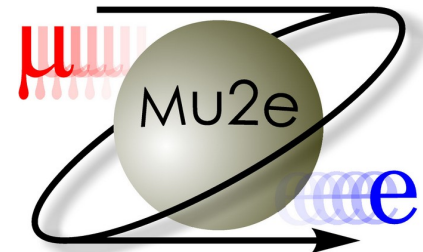
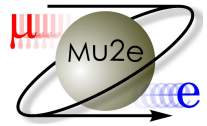


# Mu2e Status

All Experimenter's Meeting  
8/28/2017

Manolis Kargiantoulakis,  
for the Mu2e Collaboration





# Outline

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- Successfully completed DOE Annual Review
- Ramping up construction across the project
- Highlights of progress

# DOE Annual Review

## DOE Independent Project Review took place July 25-27

Response to charge questions was positive, sometimes with qualifications.

- Adequate technical progress
- Schedule and estimates credible
- Major procurements managed successfully
- ES&H handled appropriately
- Risk analysis realistic and contingencies acceptable
- Satisfactory responses to recommendations
- No other significant issues



**2.1 Accelerator Physics**  
G. Pile, ANL, P. Ostroumov, MSU &  
A. Sy, JLab / Subcommittee 1

**OFFICE OF  
SCIENCE**

1. Is the project making adequate technical progress to ensure that the completed project will perform as planned and the key performance parameters will be met? **Yes – very impressive**



Department of Energy  
Office of Science  
Washington, DC 20585

FEB 22 2017

MEMORANDUM FOR STEPHEN MEADOR  
DIRECTOR  
OFFICE OF PROJECT ASSESSMENT

FROM MICHAEL PROCARIO   
DIRECTOR OF FACILITIES  
OFFICE OF HIGH ENERGY PHYSICS

SUBJECT Request OPA to conduct an Independent Project Review  
of the Mu2e PROJECT

I am writing to request that your office conduct an Independent Project Review of the Mu2e Project on July 25–27, 2017 at Fermilab. The purpose of the review is to assess the project's status, progress since the previous DOE review, held June 14–16, 2016, and the identification of any potential issues that could negatively affect the project, as well as addressing the following specific questions:

1. Is the project making adequate technical progress to ensure that the completed project will perform as planned and the key performance parameters will be met?
2. Are the resource-loaded schedule and the estimate-to-complete up-to-date, accurate, and credible?
3. Are the major procurements being managed successfully?
4. Is ES&H being handled appropriately?
5. Has the risk analysis been updated to reflect the real risks for completing the project and are the contingencies acceptable?
6. Has the project satisfactorily responded to the recommendations from previous reviews?
7. Are there any other significant issues that require management attention?

As Program Manager for the Mu2e Project, Dr. Theodore Lavine will serve as the contact person for the Office of High Energy Physics for this review.

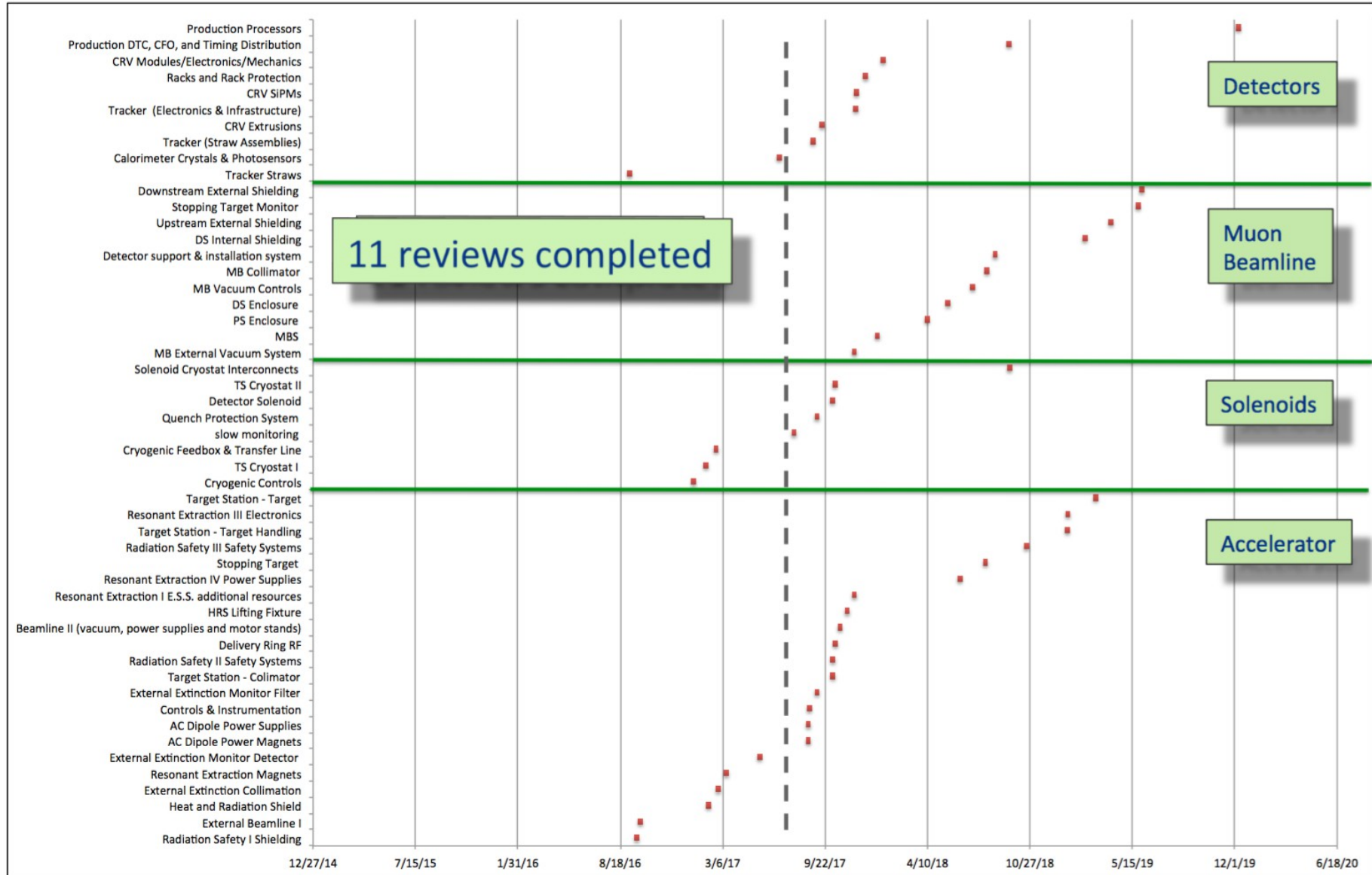
We appreciate your assistance in this matter. As you know, these reviews play an important role in our program. I look forward to receiving your Committee's report.

cc: J. Stephen Binkley, SC-2  
James Siegrist, SC-25  
Theodore Lavine, SC-25  
Kurt Fisher, SC-28  
Paul Philp, FSO  
Nigel Lockyer, Fermilab  
Ronald Ray, Fermilab  
Michael Lindgren, Fermilab



Printed with soy ink on recycled paper

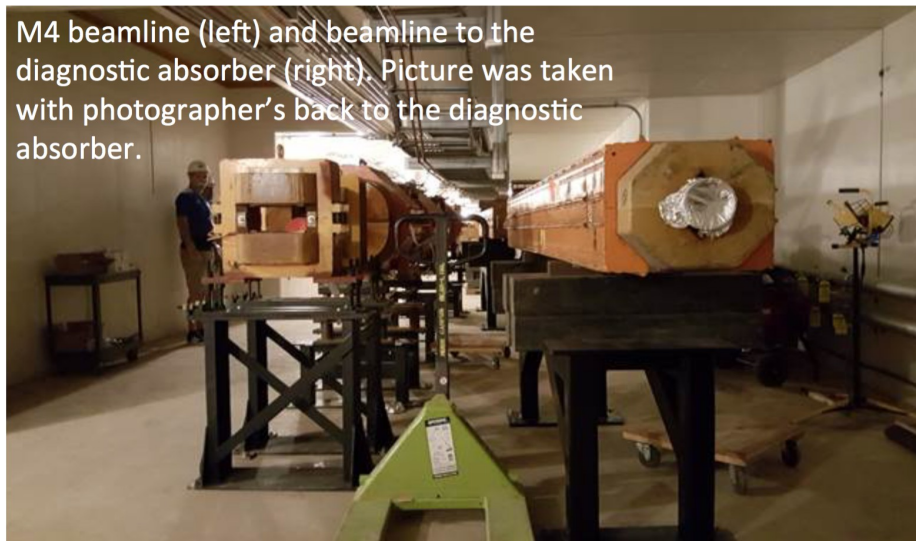
# Schedule for Construction Readiness Reviews



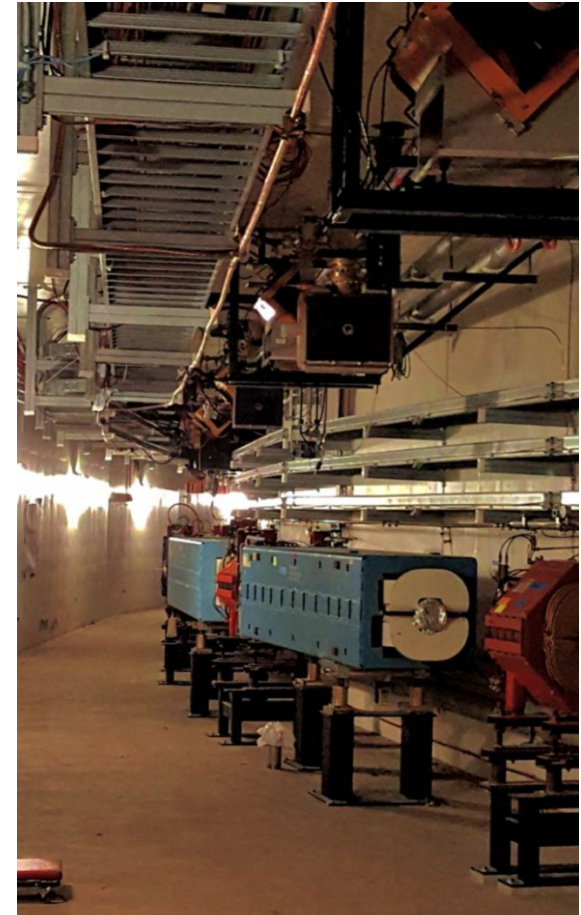


# Accelerator and Beamline

- Recent Muon Campus commissioning (Apr-Jun 2017) exercised many of the new facilities required for Mu2e
- M4 installation progress
  - Almost all magnets up to the focus section have been mounted on their stands
- Major procurements RFPs:
  - Sextupole magnets, Heat and Radiation Shield

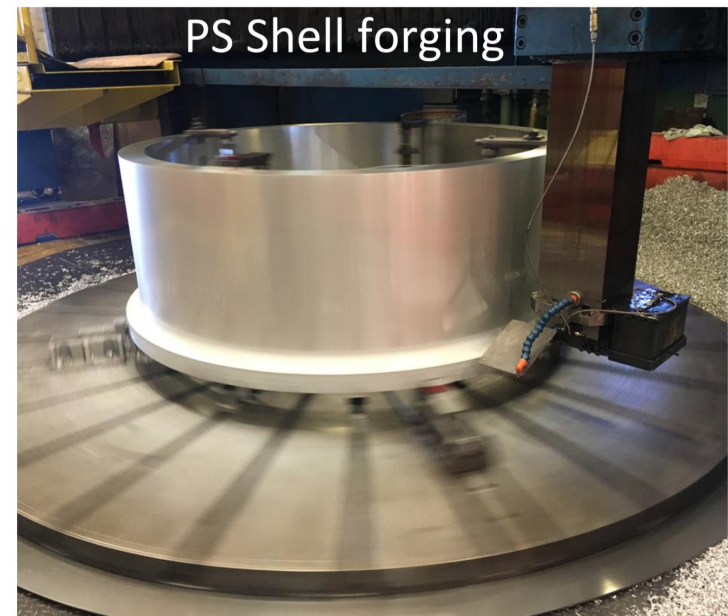


M4 beamline (left) and beamline to the diagnostic absorber (right). Picture was taken with photographer's back to the diagnostic absorber.



# Solenoids

- Procurement of conductor nearly complete
  - Transport Solenoid (TS) and Detector Solenoid (DS) successfully completed and shipped to magnet vendors
  - Completed enough good conductor to build Production Solenoid (PS), additional lengths (spares) in fabrication
- PS/DS being built in industry (General Atomics)
  - Progress on tooling for coil winding, cold mass fabrication, splice tooling, vacuum impregnation
  - Completed fabrication of PS/DS inner bores





# Solenoids – TS at ASG

- TS coil module assemblies being built by ASG.
- Final assembly and tests at Fermilab HAB facility.

31/52 coils  
wound, 29 potted.  
To be machined.



Coil modules at ASG

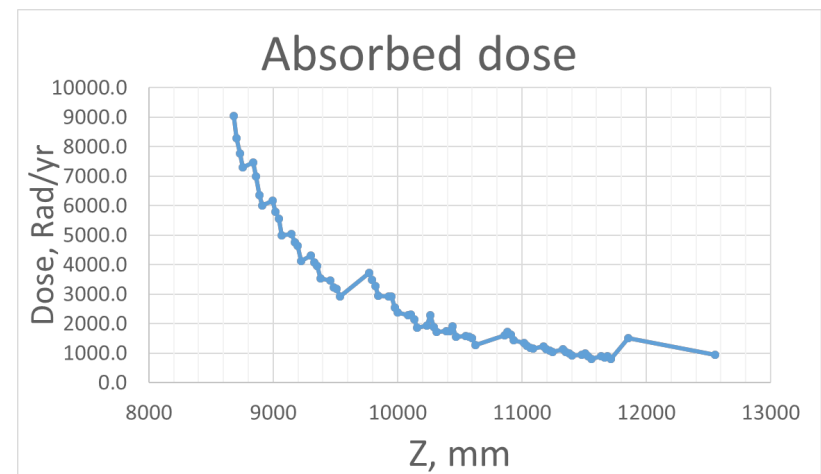
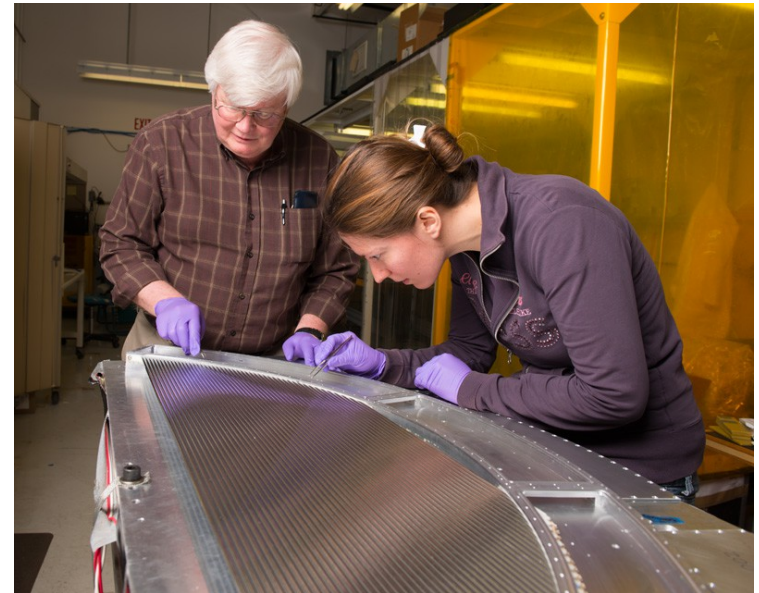
Shell for first  
production unit,  
awaiting coil  
machining



Fermilab HAB facility

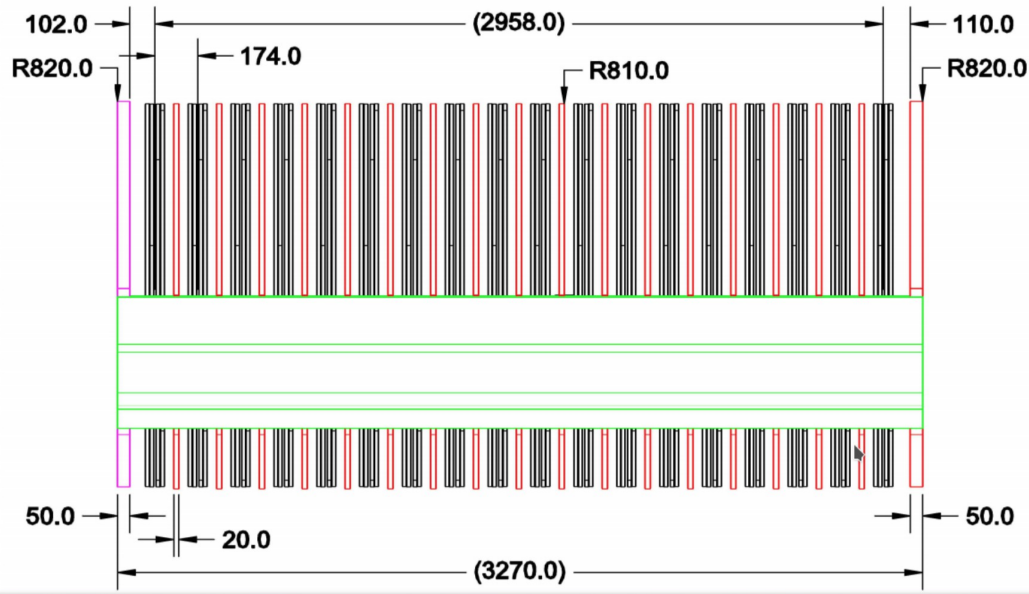
# Straw Tracker

- Completed fabrication of prototype panel “v2.5”
  - Intended to be final
  - Successfully leak tested – meets reqs
- Two panel production lines at Fermilab and UMN
  - Expect two more panels by end of September
  - All construction then moved to UMN
- Concern for radiation damage on FEE
  - After upward revision on estimated TID
  - Max TID on front planes, 9 krad/yr
  - Over 5 years of operation including safety factors x12, FEE must withstand 540 krad

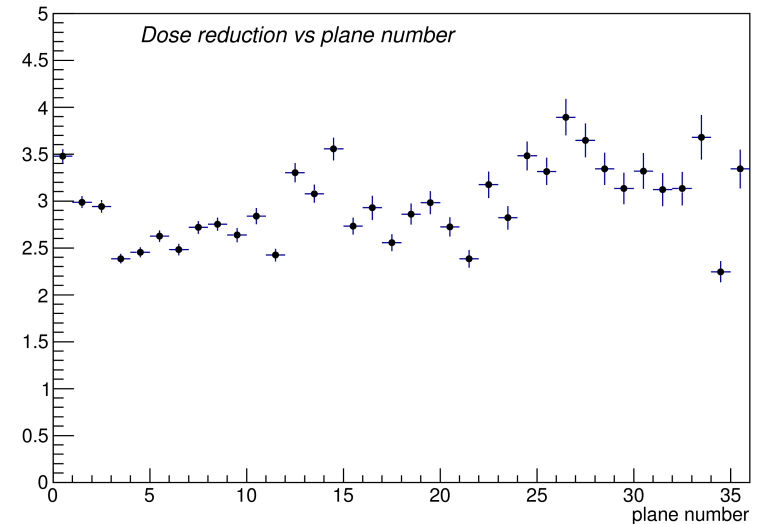




# Tracker: New Geometry



Dose reduction for new geometry + beam flash mitigation

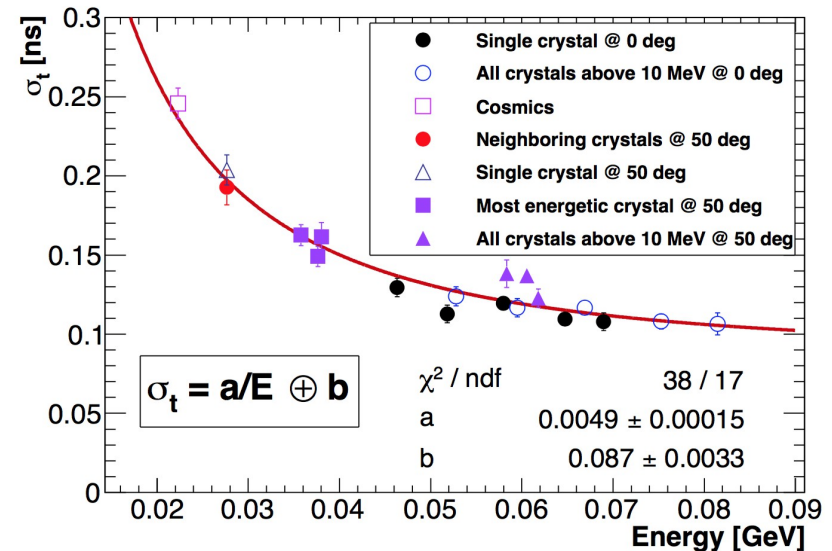


- Simulation campaign led to reoptimization of Tracker shielding and geometry to reduce TID at FEE
  - 18 stations uniformly distributed – gaps removed
  - Thin 2 cm solid brass C360 **rings in-between stations**
  - Upstream stiffener ring** 5 cm solid bronze C943
  - Max TID reduced by x2.5 after shielding in new geometry.
- Possible to reduce beam flash electrons through a hole in stopping target
  - ~30% reduction in beam flash effects without loss in experiment's sensitivity
  - Max TID reduction by x3.5. Radiation testing requirement of 155 krad can be met.

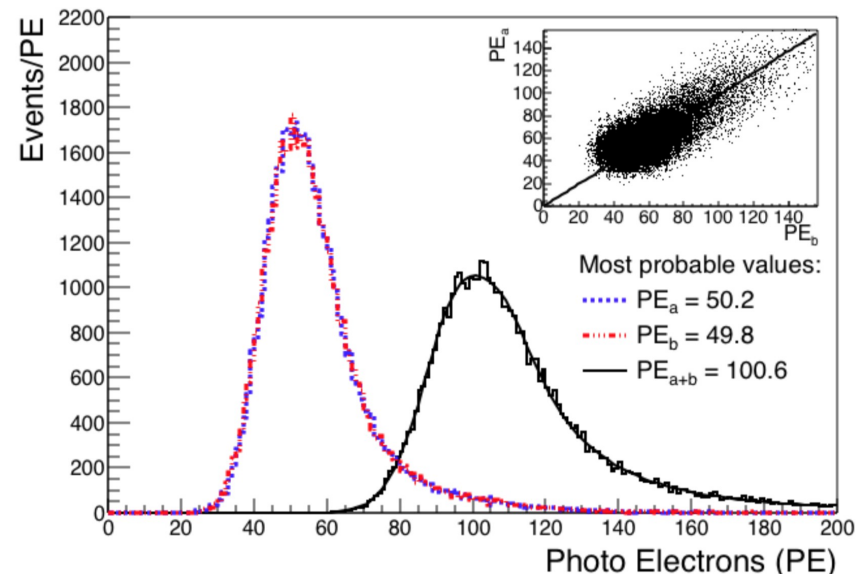
# Calorimeter/CRV Test Beam data publications

- Energy and time response and resolution of 3x3 CsI crystals array
  - Beam Test Facility in Frascati
  - $\sigma_E < 7\%$  (leakage-dominated),  
 $\sigma_t \sim 110\text{ps}$
  - Meets requirements

DOI: [10.1088/1748-0221/12/05/P05007](https://doi.org/10.1088/1748-0221/12/05/P05007)



- PE yields of CRV scintillation counters read out by SiPMs
  - Fermilab Test Beam Facility
  - Avg 50 PE per SiPM channel
  - Meets PE yield requirement for CRV inefficiency  $< 1e-4$

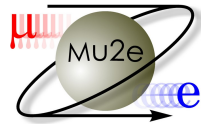


# Summary

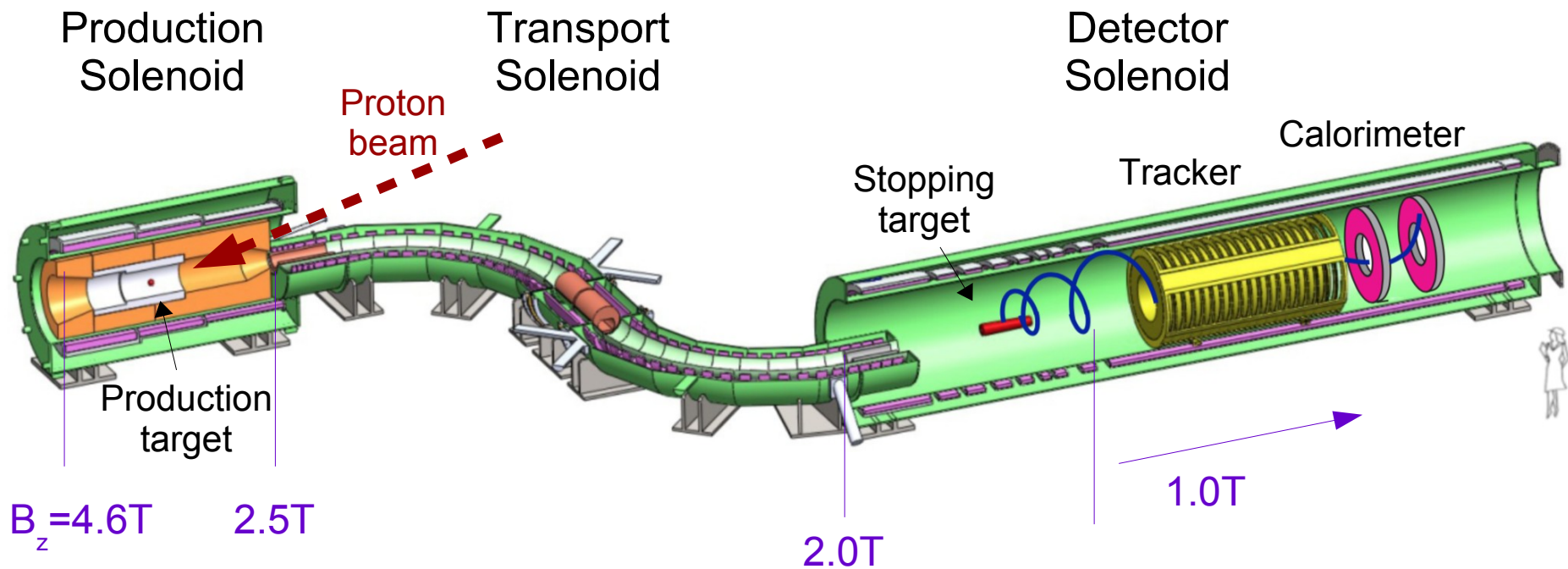
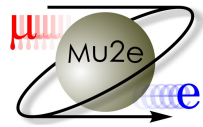
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- Successfully completed DOE Annual Review
- Construction ramping up across entire project
- Pre-production detector prototypes being built and tested, meeting requirements





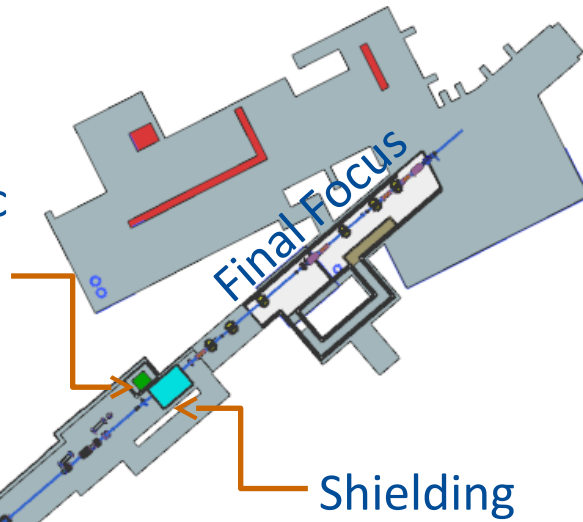
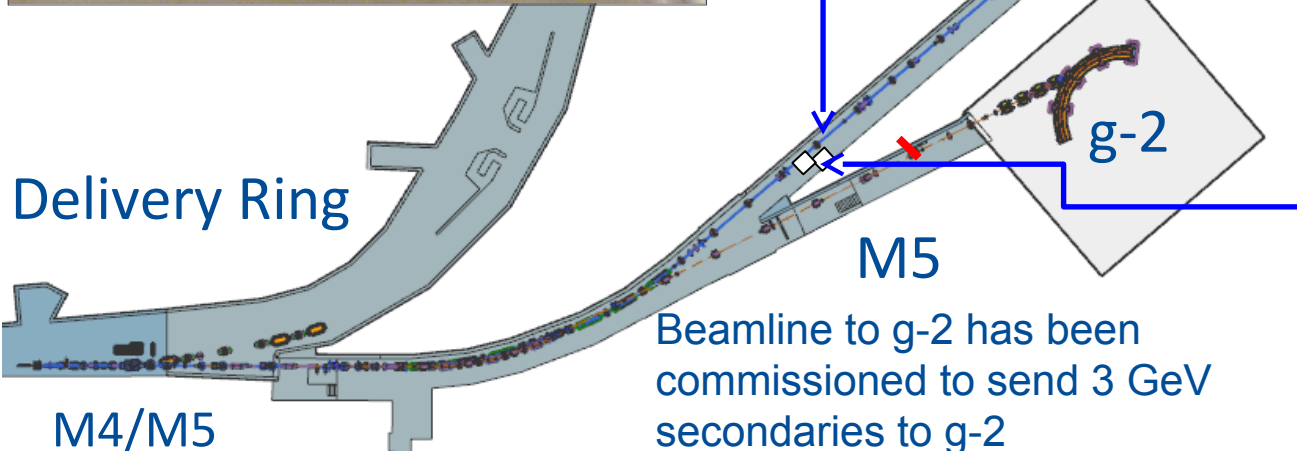
## Backup slides



# Beamline Installation



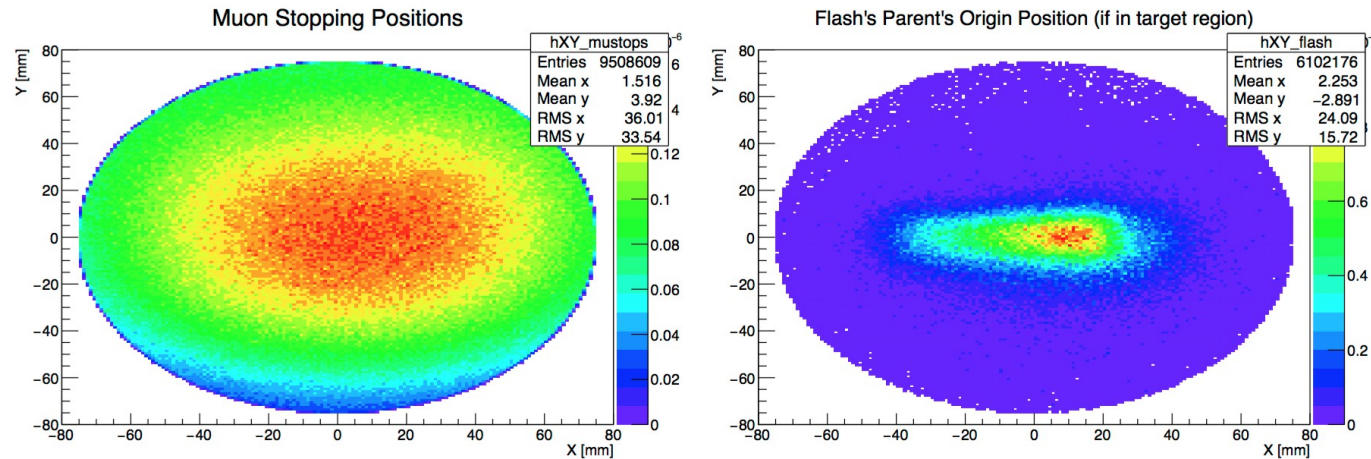
Interlocked Gate



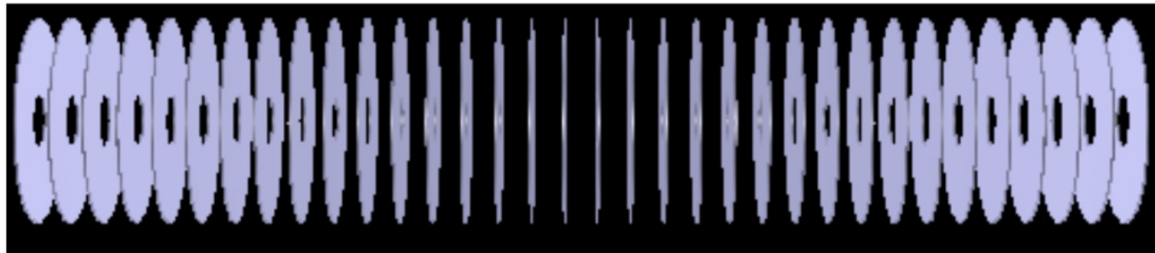
Concrete Labyrinth



# Target with a hole



D.Brown &  
A.Edmonds,  
DocDB-10898



Visualisation of the target with an  $R = 20$  mm hole

- Electrons that produce straw hits are much less broad in XY plane than muons.
- A **target hole** will limit beam interactions in the target, reduce dose on electronics
- Expected to limit beam flash effects by  $\sim 30\%$  without loss in SES
- Might make experiment more sensitive to beam position and target misalignments