

CRV-Mu2ell Welcome

CalTech Workshop

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March 27, 2023

Logistics

- Welcome to the Mu2e-II session on the cosmic ray veto (CRV)!
- This is a hybrid workshop, so let's do our best to make the Zoom attendees contribute:
 - I will do my best to watch for chat messages, but if you have an important comment on Zoom, please feel free to **speak up** to get our attention.
 - We want you involved in discussions!
- We have built some time into the schedule for discussion - please use it!
- Speakers please post your slides on Indico:

<https://indico.fnal.gov/event/57834/timetable/#20230327>

Cosmic Rays - a dangerous background!

SINDRUM II at PSI

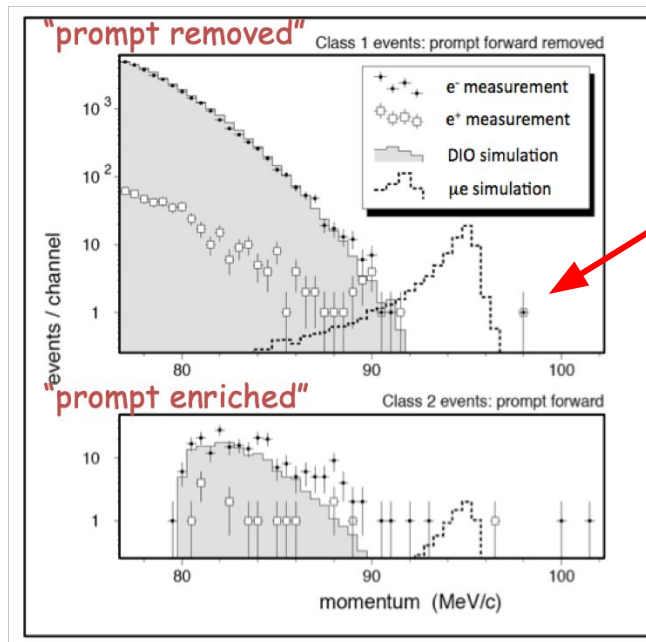
Final results on Au:

$$R_{me} < 7 \times 10^{-13} \text{ @ 90\% CL}$$

One candidate event past the end of the spectrum. Pion capture, cosmic ray?

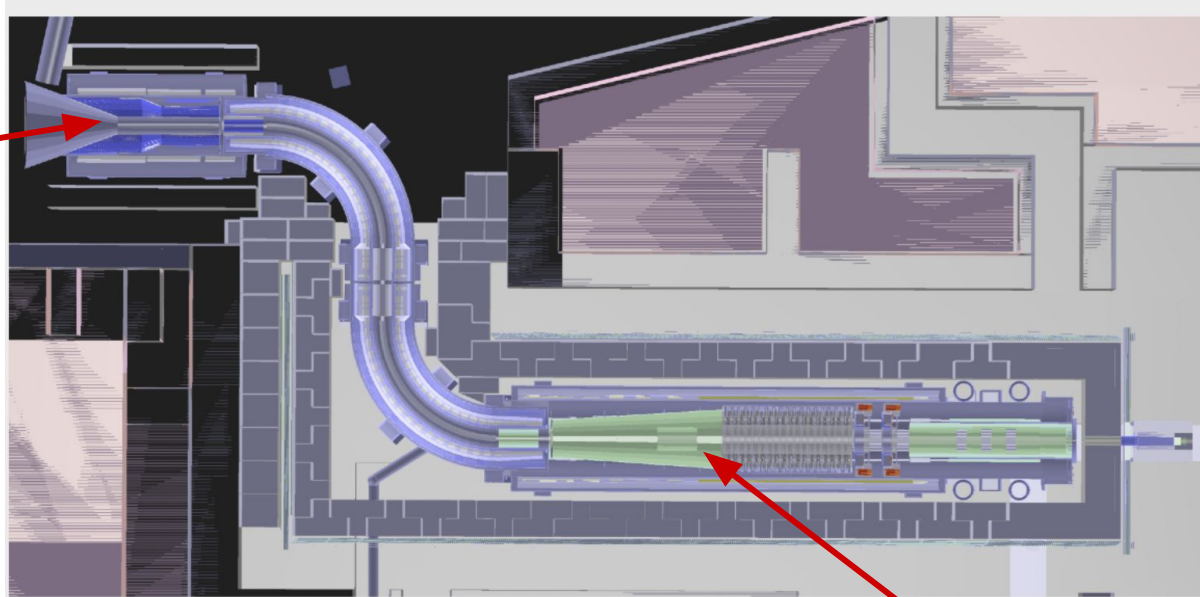
Timing cut shows the contribution of prompt background (0.3 ns muon pulse separated by 20 ns)

W. Bertl et al., Eur. Phys. J. C 47, 337–346 (2006)



Little time separation between signal and prompt background,
this becomes problematic at higher rate.

The challenge of the Mu2e CRV

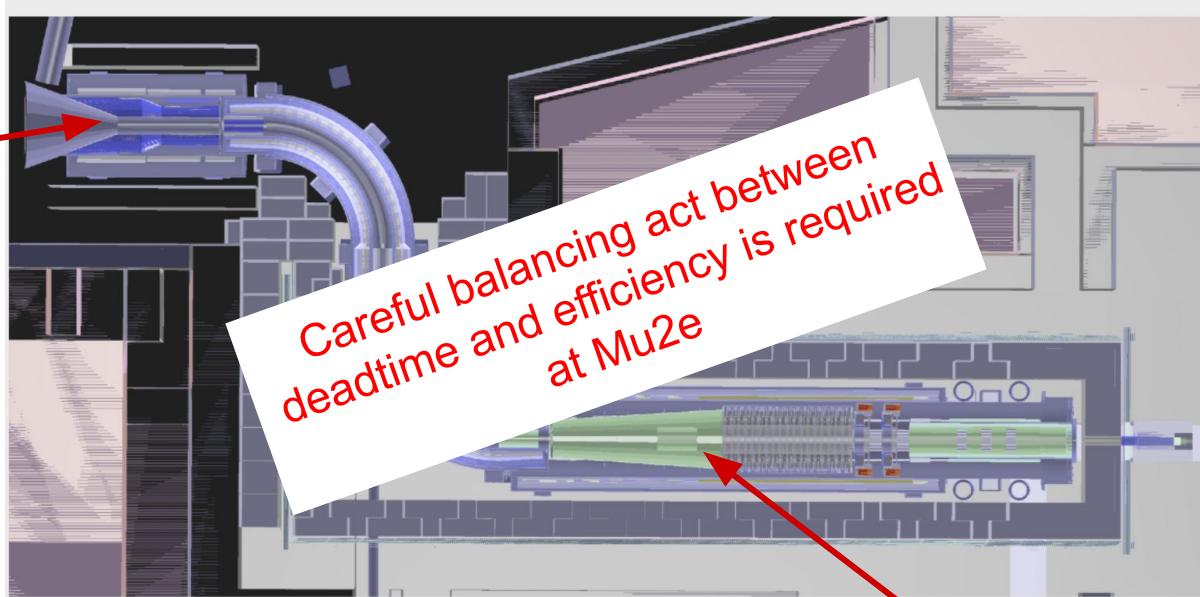


Mu2e will hit target with $\sim 10^{21}$ protons here. Just a few meters away from the CRV!

Both are sources of neutrons and other particles that can leave signals in the CRV and cause downtime!

Mu2e will stop $\sim 10^{18}$ protons here. Just a few meters away from the CRV!

The challenge of the Mu2e CRV



Mu2e will hit target with $\sim 10^{21}$ protons here. Just a few meters away from the CRV!

Careful balancing act between
deadtime and efficiency is required
at Mu2e

Both are sources of neutrons and other particles that can leave signals in the CRV and cause **deadtime**!

Mu2e will stop $\sim 10^{18}$ protons here. Just a few meters away from the CRV!

Running Mu2e will help plan for Mu2e-II

- Not only are the background radiation rates high, but at this point they are highly uncertain.
- For example, we trust our current simulation to only about a **factor of 2** uncertainty on the rates in the CRV from the PS. (caveat - we don't have data to support this! It could even be farther off...)
- When we turn on Mu2e, we can measure these rates and significantly reduce that uncertainty.
- This will help refine the design for the Mu2e-II CRV.

Mu2e-II CRV Goals

Long Term Goals:

- Conceptual Design Report for Mu2e-II
 - Before 1st Mu2e physics publication?
 - ~5 years

Workshop Goals:

- Provide overview of the concept, work done, and challenges remaining to reach a conceptual design. Snowmass report is a good start!
- Discuss needed R&D and a budget request for this work.
- Discuss when construction could begin.
- Match people to the critical tasks.

Agenda: Mu2eII CRV Session

11:00

Welcome and goals

Craig Group

257, Lauritsen

11:00 - 11:05

CRV at Mu2e II Overview

Simon Corrodi

257, Lauritsen

11:05 - 11:45

Studies of Triangular Counters for Mu2eII

Ralf Ehrlich

257, Lauritsen

11:45 - 12:10

12:00

Discussion and plans

Craig Group

257, Lauritsen

12:10 - 12:30

Unique and Exciting Opportunity and Challenge

- Will there be a Mu2e-II?
 - Definitely not, if we don't do the work now!
- Unique Opportunity:
 - Get in early in the process and help make Mu2e-II a reality
 - Young scientists on Mu2e maybe setting themselves up for a future in the field.
- The challenge: Neutron and Gamme fluence will be very high in some regions of the Mu2e-II CRV.

References

During the workshop, you may find the following references useful:

1. Mu2e-II Snowmass Contributed Paper (2022): <https://arxiv.org/abs/2203.07569>
1. [Mu2e-II CRV LOI](#)
2. SINDRUM II: W. Bertl et al., Eur. Phys. J. C 47, 337–346 (2006)
3. Snowmass Summary Report: <https://arxiv.org/abs/2301.06581>
4. Snowmass Report of the Frontier For Rare Processes and Precision Measurements: <https://arxiv.org/abs/2210.04765>

Enjoy the Workshop!

- **We challenge you** to figure out where you can contribute to the effort.
- There is lots of interesting (and challenging) work to do!
- Let's ask the tough questions and make a plan to answer them!

Thanks to all of the speakers who agreed to share their insight and expertise!

Thanks to Yuri Oksuzian for helping me plan the session!