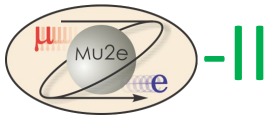

Mu2e-II Snowmass22 White Paper Preparation

Frank Porter

December 9, 2021

DocDB-nnnnn

Mu2e-II

The goal of Mu2e-II is improved sensitivity to muon-to-electron conversion

- If no signal in Mu2e, Mu2e-II increases discovery potential
- If signal in Mu2e, Mu2e-II verifies and studies properties of new physics
- Enabled by PIP-II beam
- At least an order of magnitude increased sensitivity over Mu2e to $R_{\mu e}$
- Make use of existing Mu2e infrastructure
- Challenges are in increased beam intensity

$$R_{\mu e} \equiv \frac{\Gamma(\mu^- N(A,Z) \to e^- N(A,Z)}{\Gamma(\mu^- N(A,Z) \to \nu_\mu N(A,Z-1)^*)}$$

Mu2e-II Snowmass22 Committee

Name	Institution	Email
Dan Ambrose	U Minn	ambrose0028@gmail.com
Rebecca Chislett	UC London	rebecca.chislett@ucl.ac.uk
Lisa Goodenough	FNAL	goodenou@fnal.gov
Julian Heeck	U Virginia	julian.heeck@gmail.com
David Neuffer	FNAL	neuffer@fnal.gov
Yuri Oksuzian	ANL	yoksuzian@anl.gov
Frank Porter (chair)	Caltech	fcp@caltech.edu
Giovanni Tassielli	INFN-Lecce	giovani.tassielli@le.infn.it
Robert Bernstein (ex officio)	FNAL	rhbob@fnal.gov
Jim Miller (ex officio)	Boston U	miller@bu.edu

Mu2e-II Snowmass Schedule

March 15, 2022 deadline for submission of Mu2e-II contribution to arXiv

- Mu2e-II aim for a “good first draft”: by February 1, 2022
- That is, we should be writing in December and January

Outline and framework on Overleaf (read link):
https://www.overleaf.com/read/mrbgttkmfgvq

Organized into working groups

Mu2e-II Working Groups

Mu2e-II working groups	Convenors
Theory mu2eii-theory@fnal.gov	Lorenzo Calibbi Julian Heeck
Accelerator (including PS, production target, extinction) mu2e-ii-accelerator@fnal.gov	Karie Badgley David Neuffer Eric Prebys
Radiation mitigation (includes radiation simulation) mu2eii-radiation@fnal.gov	Michael MacKenzie Stefan Mueller Vitaly Pronskikh
Tracker mu2eii-tracker@fnal.gov	Daniel Ambrose Giovanni Tassielli
Calorimeter (and STM?) mu2eii-calorimeter@listserv.fnal.gov	David Hitlin Luca Morescalchi Ivano Sarra
CRV mu2eii-crv@listserv.fnal.gov	Craig Dukes Yuri Oksuzian
Sensitivity estimate (includes simulation, stopping target) mu2e-ii-sensitivity@listserv.fnal.gov	Lisa Goodenough Sophie Middleton Yuri Oksuzian
Trigger and DAQ mu2eii-tdaq@listserv.fnal.gov	Antonio Gioiosa Giani Pezzullo

Contributed Paper – Detailed outline

CONTENTS

Mu2e-II workshops

Recent past workshops

For earlier workshops, see the Mu2e-II calendar at:
https://mu2eii-internal-wiki.fnal.gov/wiki/Main_Page#Calendar

Workshop dates	Links to recordings
Wednesday, March 3, 2021 https://indico.fnal.gov/event/47787/	https://caltech.zoom.us/rec/share/po6RL9ZZL27yeF8sjUZ9Wk9xcBwwqm-TYgRmSNjn6yUYBE5mvb5Myza-ez2k3tFV.deUj8dQcDWOVSqAU
Wednesday, April 28, 2021 https://indico.fnal.gov/event/48516/	https://caltech.zoom.us/rec/share/NM_b0LyWSJopNa__YAu9LXmfjJ05XrCmjXkmfwCoqj9VtBqVFKeA0N4pouLDKGMz.1f96W6EOVkyUsnT4
Wednesday, July 21, 2021 https://indico.fnal.gov/event/49360/	https://caltech.zoom.us/rec/share/Lm8mhRjuLVcAVvyvWYmlWUNaLu-WlwRSB-uGvxncaQBz0TAHTUWKHiipsi7LMwUt.F8VaPWZ49mhfLB9w
Wednesday, September 15, 2021 https://indico.fnal.gov/event/50719/	https://caltech.zoom.us/rec/share/-bUabAznMOAloD7qg9e7ae_Zp1NDGdm7nmoe3XjVxEy3bXHYJD-kR4bSIEu2Fp4I.UPHlnKPp90ZMyMjg
Next workshop deferred to focus on preparing white paper	

Additional Material

Accelerator

mu2e-ii-accelerator@fnal.gov

Karie Badgley, Convenor, FNAL

David Neuffer, Convenor, FNAL

Eric Prebys, Convenor, UCD

Mary Anne Cummings, Muons, Inc.

Keegan Harrig, UCD

Andrei Gaponenko, FNAL

Vadim Kashikhin, FNAL

Kevin Lynch, CUNY

James Popp, CUNY

Diktys Stratakis, FNAL

- Accelerator meetings every other Thursday, 1PM CT.
- Sep 23, 2021: AF2/AF5/AF7/RP/NP target workshop https://indico.fnal.gov/event/46752/
- Eric talk at Snowmass Muon Collider Forum, Oct 12, 2021 https://indico.fnal.gov/event/51315/

Radiation simulation and mitigation

mu2eii-radiation@fnal.gov

Michael MacKenzie, Convenor, Northwestern
Stefan Mueller, Convenor, HZDR
Vitaly Pronskikh, Convenor, FNAL
Anna Ferrari, Reuven Rachamin, HZDR
Vadim Kashikhin, FNAL
James Popp, CUNY
David Pushka, FNAL
Yuri Oksuzian – CRV
Sophie Middleton – Sensitivity
Giani Pezzullo - TDAQ

Theory

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Lorenzo Calibbi, Convenor, Nankai U

Julian Heeck, Convenor, UVa

Robert Szafron, BNL

Yuichi Uesaka, Kyushu Sangyo University

Tracker

mu2eii-tracker@fnal.gov

Daniel Ambrose, Convenor, UMinn

Giovanni Tassielli, Convenor, INFN Lecce

David Brown, LBNL

Brendan Casey, FNAL

Manolis Kargiantoulakis, FNAL

James Popp, CUNY

Mete Yucel, FNAL

Tracker meetings every two weeks on Tuesdays 12AM CT
Next meeting November 30, 2021

Calorimeter

mu2eii-calorimeter@listserv.fnal.gov

David Hitlin, Convenor, Caltech

Luca Morescalchi, Convenor, INFN Pisa

Ivano Sarra, Convenor, LNF

Leo Borrell, Bertrand Echenard, Dexu Lin, Sophie Middleton, James Oyang, Frank Porter, Liyuan Zhang, Renyuan Zhu, Caltech

Eleonora Diociaiuti, Raffaella Donghia, Simona Giovannella, Fabio Happacher, Stefano Miscetti, LNF

Stefano Di Falco, Simone Donati, Antonio Gioiosa, Elena Pedreschi, Franco Spinella, INFN Pisa

Cosmic Ray Veto

mu2eii-crv@listserv.fnal.gov

Craig Dukes, Convenor, Uva

Yuri Oksuzian, Convenor, ANL

Karen Byrum, Simon Corrodi, Peter Winter, Lei Xia, ANL

Raymond Culbertson, Gary Drake, Anna Pla-Dalmau, Greg Rakness, FNAL

Akram Artikov, Yuri Davydov, JINR, Dubna

Timothy Bolton, Glenn Horton-Smith, Yurii Maravin, Kres Neely, KSU

Gerald Blazey, Kurt Francis, Sergey Uzunyan, Vishnu Zutshi, NIU

Merrill Jenkins, U South Alabama

Steven Boi, Ralf Ehrlich, Stephen Goadhouse, Craig Group, UVa

Trigger/DAQ

mu2eii-tdaq@listserv.fnal.gov

Antonio Gioiosa, Convenor, INFN Pisa
Gianantonio Pezzullo, Convenor, Yale
Richard Bonventre, LBNL
Rebecca Chislett, UCL, Tracker
Raffaella Donghia, LNF
Bertrand Echenard, Caltech
Ryan Rivera, FNAL
Roberto Soleti, LBNL
Franco Spinella, INFN Pisa – Calorimeter
Craig Dukes, UVa – CRV
Jinyuan Wu, FNAL

Sensitivity estimates

mu2e-ii-sensitivity@listserv.fnal.gov

Lisa Goodenough, Convenor, FNAL

Sophie Middleton, Convenor, Caltech

Yuri Oksuzian, Convenor, ANL

Rebecca Chislett, UCL

Michael Hedges, Purdue

Cole Kampa, Northwestern

Manolis Kargiantoulakis, FNAL

Michael MacKenzie, Northwestern

Mu2e-II Communication

- Public wiki page: https://mu2eiiwiki.fnal.gov

- Private wiki page:
  https://mu2eii-internal-wiki.fnal.gov/wiki/Main_Page
  - SSO log-on
  - This page has the Mu2e-II calendar with links to zoom, indico, etc.

- Mu2e-II mailing list: mu2eii@listserv.fnal.gov

- Mu2e-II Slack channel link:
  - https://Caltech-tka1525.slack.com

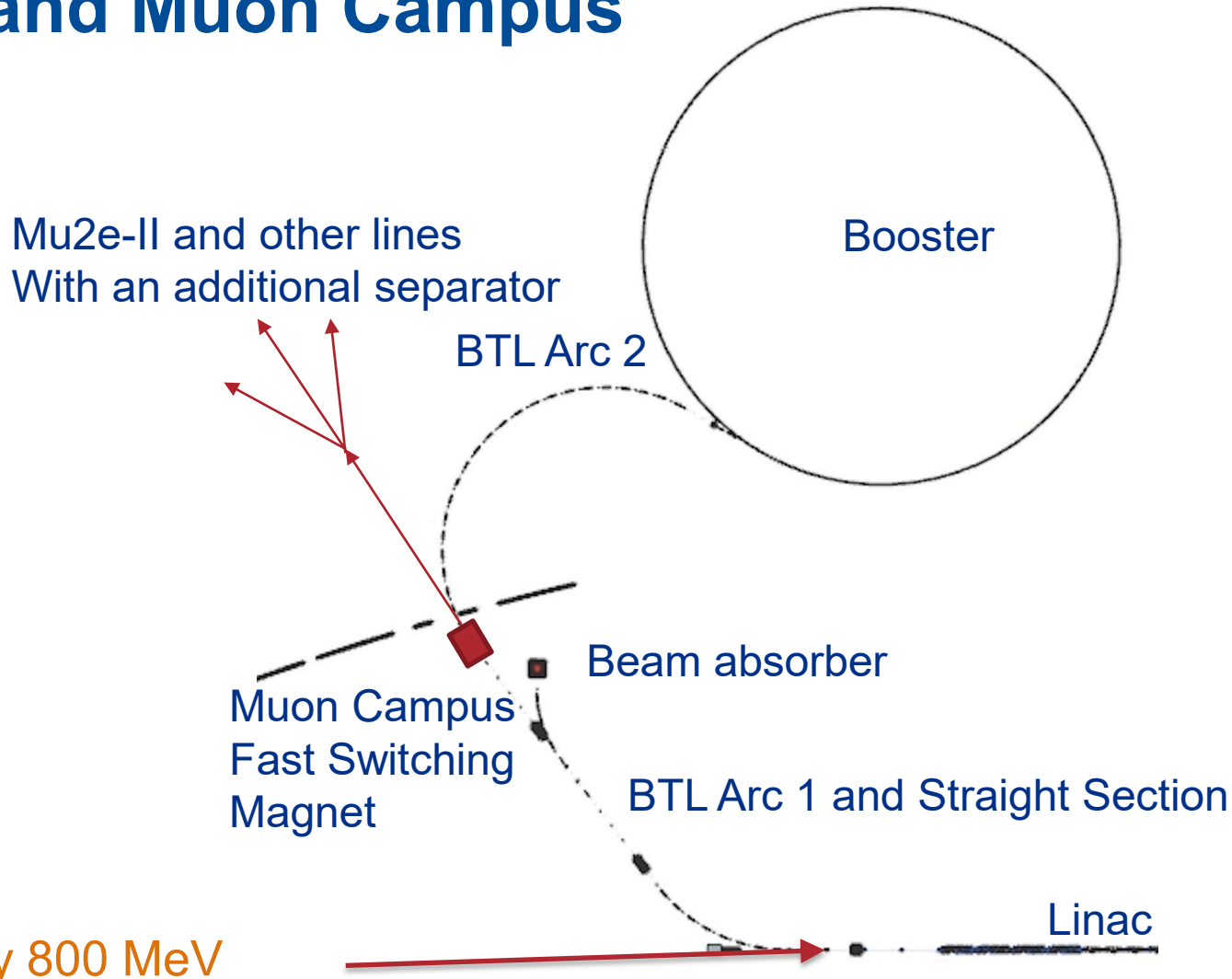
Layout for DUNE and Mu2e-II and Muon Campus

Possible PIP-II upgrade 800 MeV → 1 GeV

- Add two cryomodules
- Estimate < 20 M$ total
- Time scale might be commensurate with Mu2e-II

How much does 1 GeV help over 800 MeV?

- $r \propto \gamma v \Rightarrow r(1\ \text{GeV}) \cong 1.16 \times r(800\ \text{MeV})$
- Is 16% straighter enough to make a useful difference?



- Beam energy 800 MeV
  - Beam energy up to 1GeV after adding two more cryomodules

Eduard Pozdeyev 210812