



Fermilab ACE Science Workshop - Welcome!

Stefania Gori, Nhan Tran,

Karri DiPetrillo, Bertrand Echenard, Jeff Eldred, Roni Harnik, Pedro Machado, Matt Toups

June 14, 2023

Logistics

- If you would like to join us tonight at [Two Brothers Roundhouse](#), please fill the [google form](#) by **1pm today**
 - **The reception is from 6:30-9:00**
 - \$35/person (drinks and appetizers) - collecting via cash, Venmo, Zelle when you fill the google form
- Fill the discussion session interest [form](#) so we can finalize room assignments

Background

TM-2754-AD-APC-PIP2-TD

An Upgrade Path for the Fermilab Accelerator Complex*

R. Ainsworth, J. Dey, J. Eldred, R. Harnik, J. Jarvis, D.E. Johnson, I. Kourbanis,
D. Neuffer, E. Pozdeyev, M.J. Syphers,[†] A. Valishev, V.P. Yakovlev, and R. Zwaska

Fermi National Accelerator Laboratory, Batavia, IL, 60510, USA

(Dated: May 19, 2021)

FERMLAB-FN-1145, LA-UR-22-21987

Physics Opportunities for the Fermilab Booster Replacement

John Arrington,¹ Joshua Barrow,^{2,3} Brian Batell,⁴ Robert Bernstein,⁵ Nikita Blinov,⁶ S. J. Brice,⁵ Ray Culbertson,⁵ Patrick deNiverville,⁷ Vito Di Benedetto,⁵ Jeff Eldred,⁵ Angela Fava,⁵ Laura Fields,⁸ Alex Friedland,⁹ Andrei Gaponenko,⁵ Corrado Gatto,^{10,11} Stefania Gori,¹² Roni Harnik,^{5, *} Richard J. Hill,^{5,13} Daniel M. Kaplan,¹⁴ Kevin J. Kelly,^{5,15} Mandy Kiburg,⁵ Tom Kobilarcik,⁵ Gordan Krnjaic,⁵ Gabriel Lee,^{16,17,18} B. R. Littlejohn,¹⁴ W. C. Louis,⁷ Pedro Machado,⁵ Anna Mazzacane,⁵ Petra Merkel,⁵ William M. Morse,¹⁹ David Neuffer,⁵ Evan Niner,⁵ Zarko Pavlovic,⁵ William Pellico,⁵ Ryan Plestid,^{5,13} Maxim Pospelov,²⁰ Eric Prebys,²¹ Yannis K. Semertzidis,^{22,23} M. H. Shaevitz,²⁴ P. Snopok,¹⁴ M.J. Syphers,²⁵ Rex Tayloe,²⁶ R. T. Thornton,⁷ Oleksandr Tomalak,^{5,7,13} M. Toups,⁵ Nhan Tran,⁵ Yu-Dai Tsai,^{5,27} Richard Van de Water,⁷ Katsuya Yonehara,⁵ Jacob Zettlemoyer,⁵ Yi-Ming Zhong,²⁸ and Robert Zwaska⁵

Report from the Fermilab Proton Intensity Upgrade Central Design Group

Robert Ainsworth, Giorgio Apollinari, Tug T. Arkan, Sergey Belomestnykh, Pushpalatha C. Bhat, S.J. Brice, Brian Chase, Mary E. Convery, Steven J. Dixon, Jeff Eldred, Grigory Ereemeev, Brenna Flaughner, Jonathan D. Jarvis, Sergio Jiindariani, David Johnson, Jonathan Lewis, Richard Marcum, Sergei Nagaitsev, David Neuffer, Donato Passarelli, Frederique Pellemoine, William A. Pellico, Sam Posen, Eduard Pozdeyev, Alexander Romanenko, Arun Saini, Kiyomi Seiya, Vladimir Shiltsev, Nikolay Solyak, James M. Steimel, Diktys Stratakis, Alexander A. Valishev, Mayling L. Wong-Squires, Slava Yakovlev, Katsuya Yonehara, Robert Zwaska

Fermi National Accelerator Laboratory

May 31, 2023

[Posted on ACE Science Workshop agenda](#)

<https://arxiv.org/abs/2106.02133>
<https://arxiv.org/abs/2203.03925>
+ many supplementary white papers

-ph] 8 Mar 2022

Accelerator Complex Evolution evolution

- What has changed along the way?
 - **Muon collider** interest through Snowmass process
 - PIU-CDG study determined faster path to > 2MW to DUNE before Booster Replacement
 - Led to the broader Accelerator Complex Evolution (ACE) plan — **includes the MI fast ramp upgrade + Booster Replacement**
- ACE overview
 - **Part 1, ACE-MIRT: Reduce Main Injector Ramp time + Target R&D** to get to > 2 MW
 - **Part 2, ACE-BR: Booster Replacement**
 - Necessary for long-term facility reliability (Booster is 50 years old)
 - Configurations for Booster Replacement (Linac or RCS)

Status and summary

- In light of PIU-CDG findings and Snowmass community study...
 - Step back and re-evaluate ACE Science program and design
 - Assemble community input and understand **physics thrusts' complementarity**
- Today - ACE Science Workshop next week (June 14-15)
 - <https://indico.fnal.gov/event/59663/>
 - Outcome of these workshop will include a report on findings
 - Material drawn from organizers, discussion leads, speakers with feedback from community
 - First in a series of workshops to co-design physics case and technical design
 - Continue development of ACE towards CD-0 in ~2 year timescale

Cast of characters

- Organizers



S. Gori
(Co-chair)



K. DiPetrillo



B. Echenard



J. Eldred



R. Harnik



P. Machado



M. Touns

- Special thanks to Brenna Flaughner, Traci Langford
- Conference office, campus access, FNAP, et al for support

Cast of characters

- Discussion leads

CLFV - Muon Collider



B. Bernstein



S. Jindariani



D. Stratakis

Dark Sectors - Muon Collider



C. Cesarotti

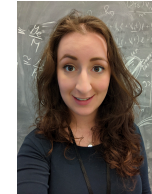


Y. Kahn

CLFV - Neutrinos



A. Thapa



I. Bigaran



R. Plestid

Neutrino - Dark Sectors



J. Zettlemoyer



A. Sousa



B. Dutta

CLFV - Dark Sectors



M. Solt



J. Zupan

Muon Collider - Neutrinos



Z. Tabrizi



C. Herwig

Suggestions for this workshop

- The structure is as follows:
 - ACE overview
 - Physics thrusts
 - Muon Collider; Neutrinos beyond DUNE; Charged Lepton Flavor Violation (CLFV); Dark Sectors
 - Short remarks on additional potential physics programs and R&D
 - Special parallel session discussing accelerator topics
 - Discussion sessions explore the physics thrusts' complementarity
 - Thrusts needs and requirements have largely evolved separately
 - Need to understand how these programs fit together
 - Complementary physics, detectors, and accelerator needs
 - ACE design goal: enable as much physics as possible without closing off possibilities

Suggestions for this workshop

- **Meet new people, ask questions!**
 - The workshop brings together (intentionally) folks from across many areas of expertise and physics
 - Thank you to all the speakers and attendees!
 - If you are wondering something and don't know who to ask, find one of the organizers or discussion leads, we can help point you in the right direction
 - For those of you attending virtually, some of the organizers and discussion leads are attending via Zoom as well - so feel free to reach out to them












Community standards

All members of the Fermilab community are expected to conduct themselves according to the basic principles of:

- (1) building trust and credibility;
- (2) communicating openly and honestly;
- (3) respecting one another.

Link: [Fermilab code of business ethics and conduct](#)

We are one Fermilab

-  Everyone is worthy of respect
-  Encourage discussion
-  Genuinely listen
-  Collaborate
-  Respect the messenger
-  Have courage
-  Own your voice
-  Be kind
-  Fresh perspectives lead to innovation
-  Encourage others to speak
-  Own it, mistakes happen
-  Share the air