

Introduction!

Patrick Meade

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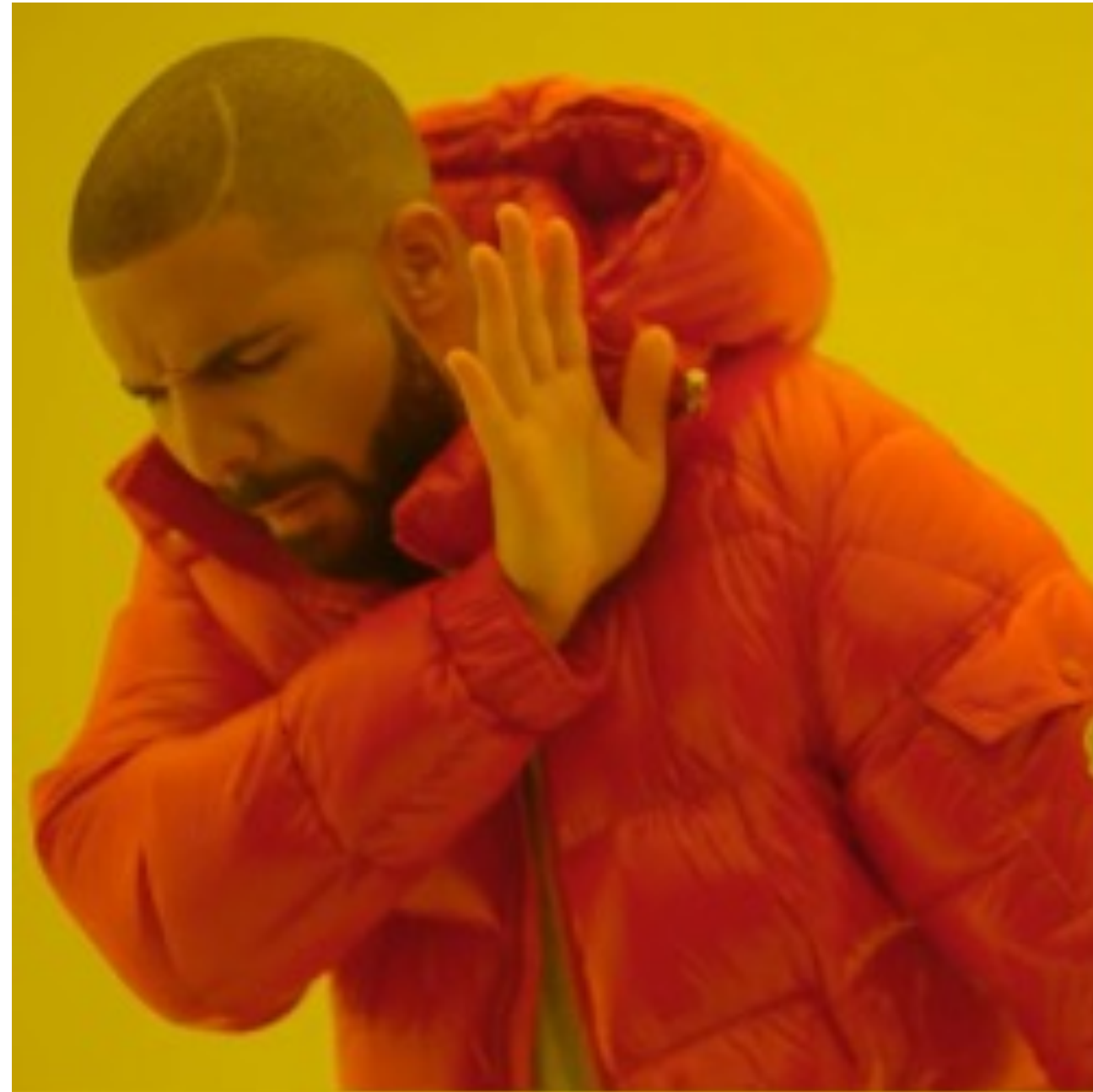
Remarkable how far we've come



“Who ordered that?” -
1930s

Conferences devoted to
exploiting muons 2020s





electrons



muons

There are multiple aspects as to why we care about muons so much

- Using muons as a tool because they have practical properties that other particles in the SM don't have
- Studying muons directly because they give us a window into flavor and testing the second generation
- Provide a natural portal to other sectors of the SM and potentially beyond

What this workshop is about is learning from each other and finding both synergies and ways to help other parts of the growing muon community!

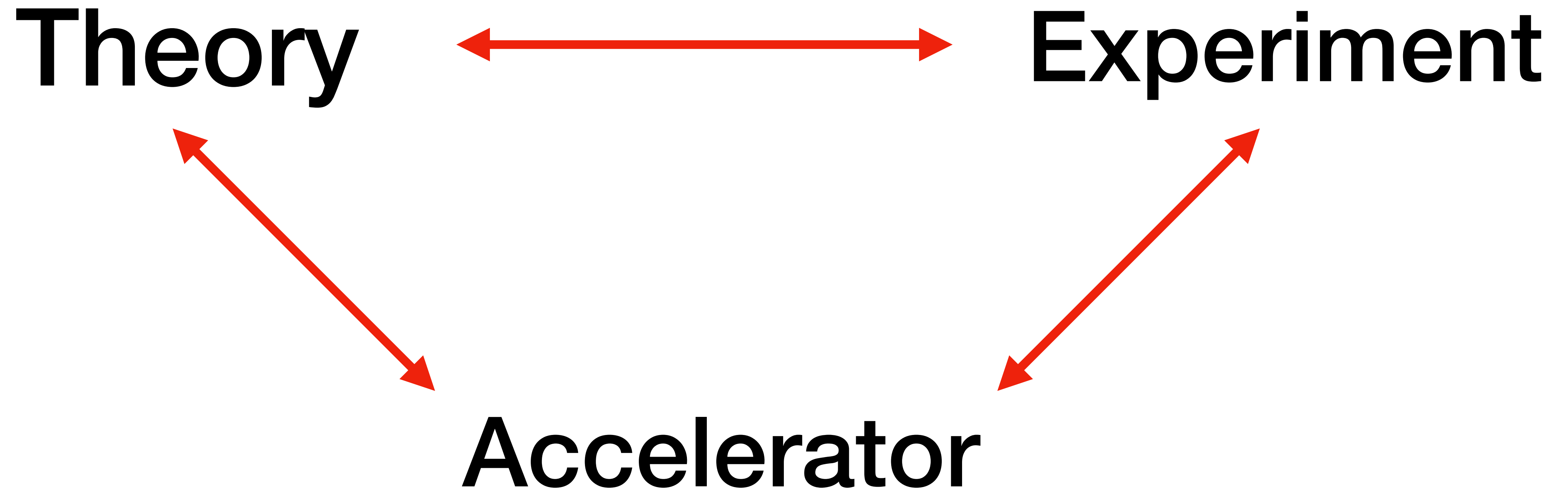
I come at this from a high energy theorist side, so I think a muon collider is the *most powerful* and quickest way to get to the 10+ TeV energy scale

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But I also have written 100 TeV pp papers and circular and linear e^+e^- papers, so how did I get here or is this just the flaky theorist stereotype who is only concerned about energy coming through?

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“What did I find most surprising in Snowmass? That theorists wanted to talk to us”

Vladimir Shiltsev (Fermilab Accelerator Physicist)



Accelerator

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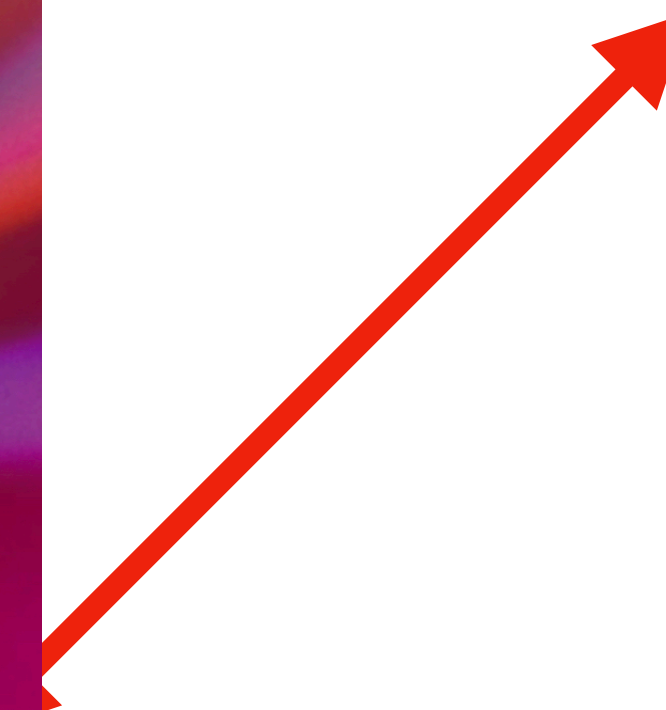
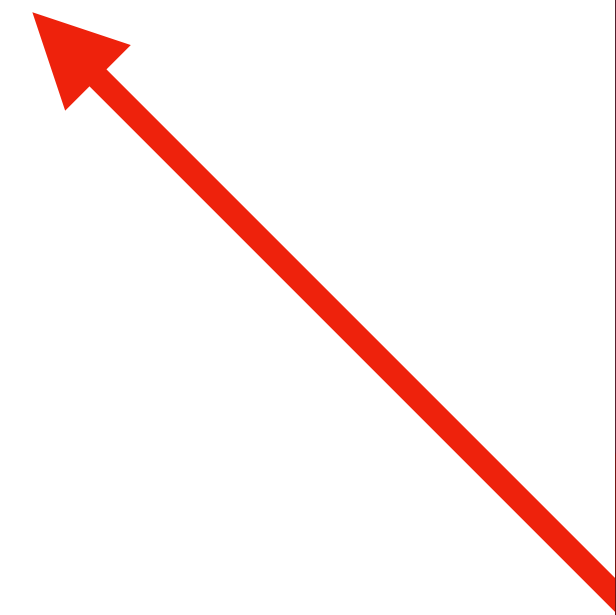
Theory

Helmut Wiedemann

**Particle
Accelerator
Physics**

Fourth Edition

Experiment



Goes much further as this was my airplane reading - Daniel, Chris, others I'm happy for more reading suggestions this week!

Need to push this even further for/during a demo program and a lead up to a muon collider

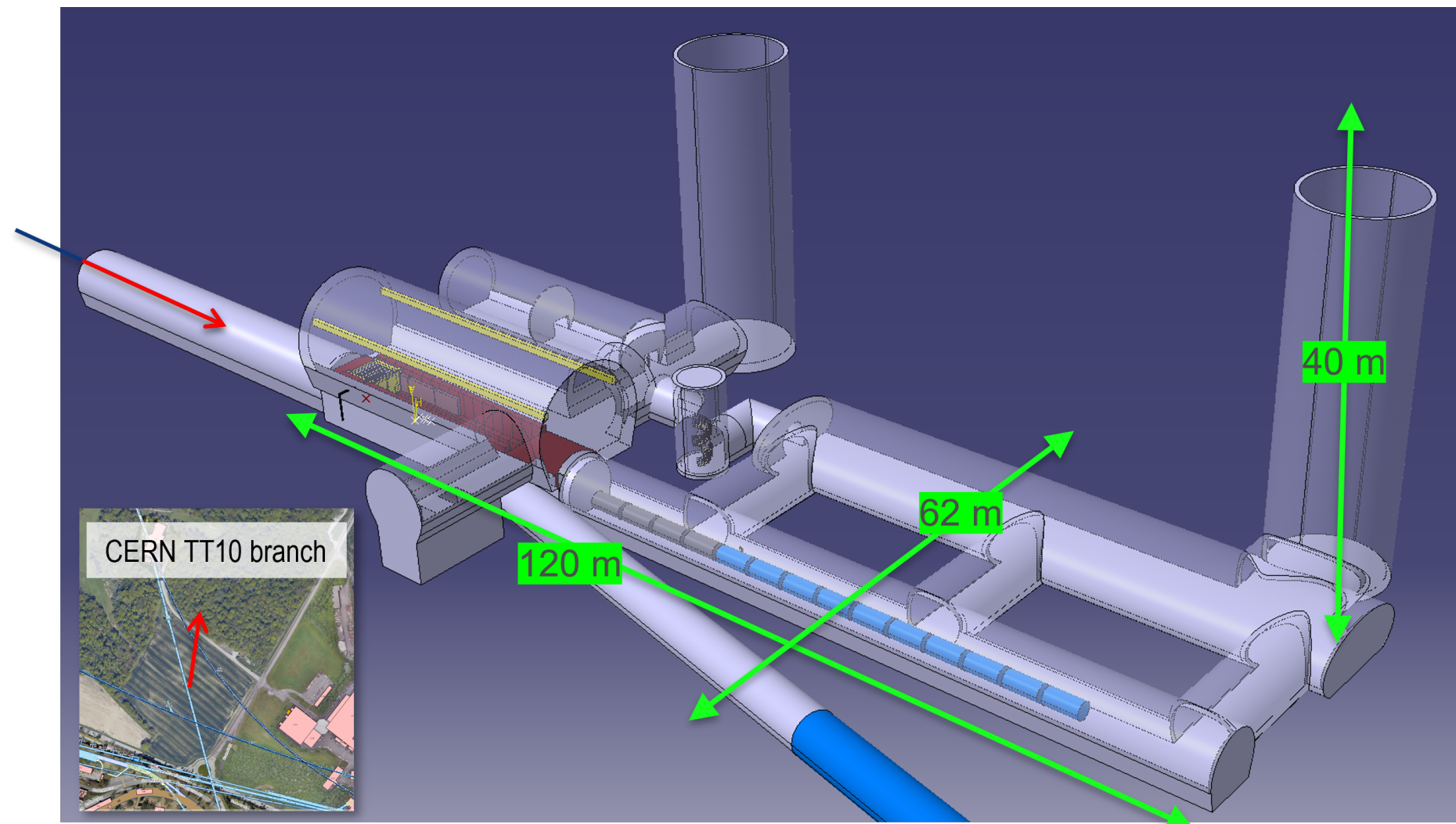


Figure 6: TT10 Muon Collider demonstrator concept at CERN.

Esteban et al. IPAC conference proceedings
<https://inspirehep.net/literature/2137202>

Fermilab ACE Science Workshop

Jun 14 – 15, 2023
America/Chicago timezone

Enter your search term



Overview

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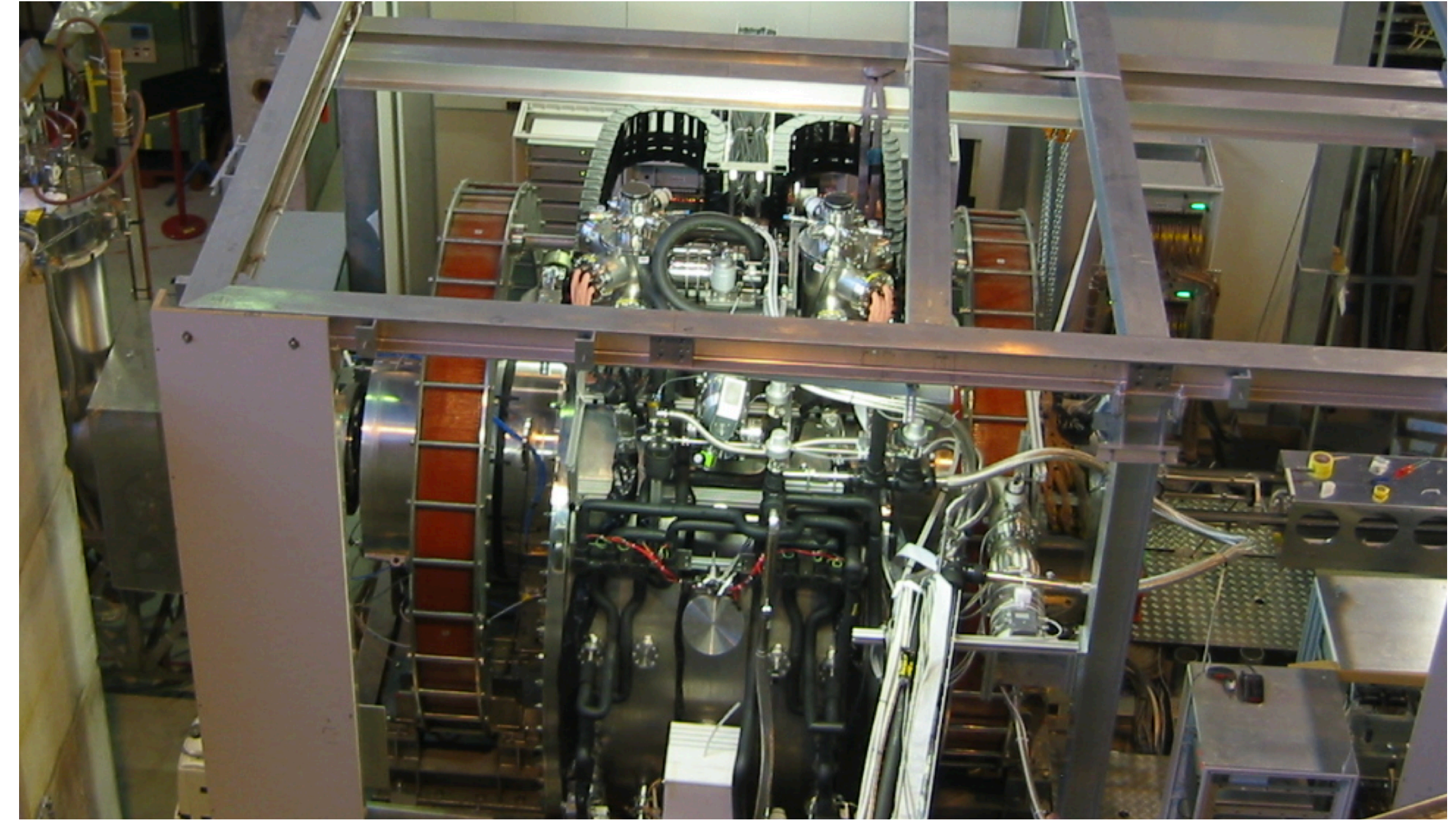
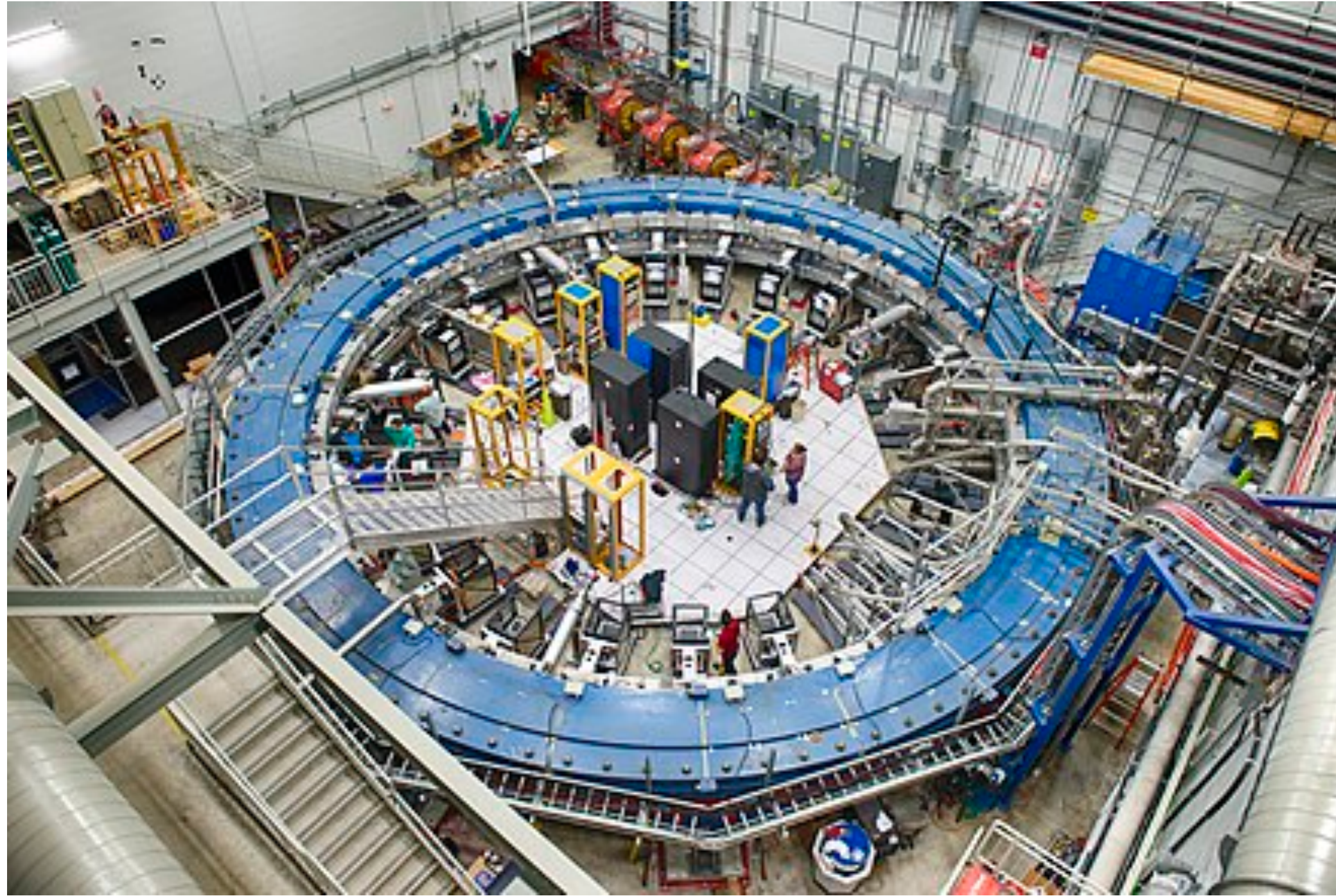
[Participant List](#)

[Local Accommodations](#)

Over the past year Fermilab has developed the Accelerator Complex Evolution (ACE) plan to ensure quality, high intensity beam delivery for a diverse set of experiments, including the flagship DUNE experiment, and for upgrades necessary for a potential future multi-TeV collider. The ACE plan begins with modifications to the Main Injector and the DUNE Target that will improve reliability and provide up to 2.1 MW of beam for DUNE through the mid-late 2030s. The second phase of ACE involves replacement of the booster to expand the scientific capabilities of the complex beyond LBNF/DUNE, improve overall complex capacity and reliability while providing a platform for detector development and serving as a front end for future colliders.

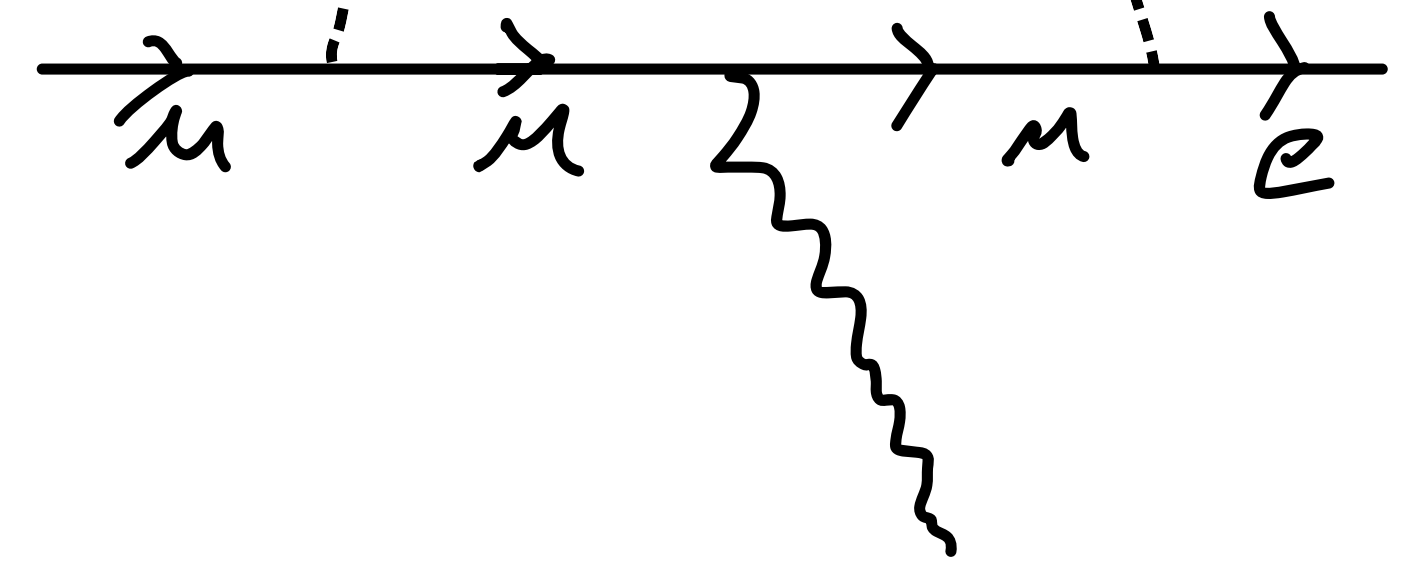
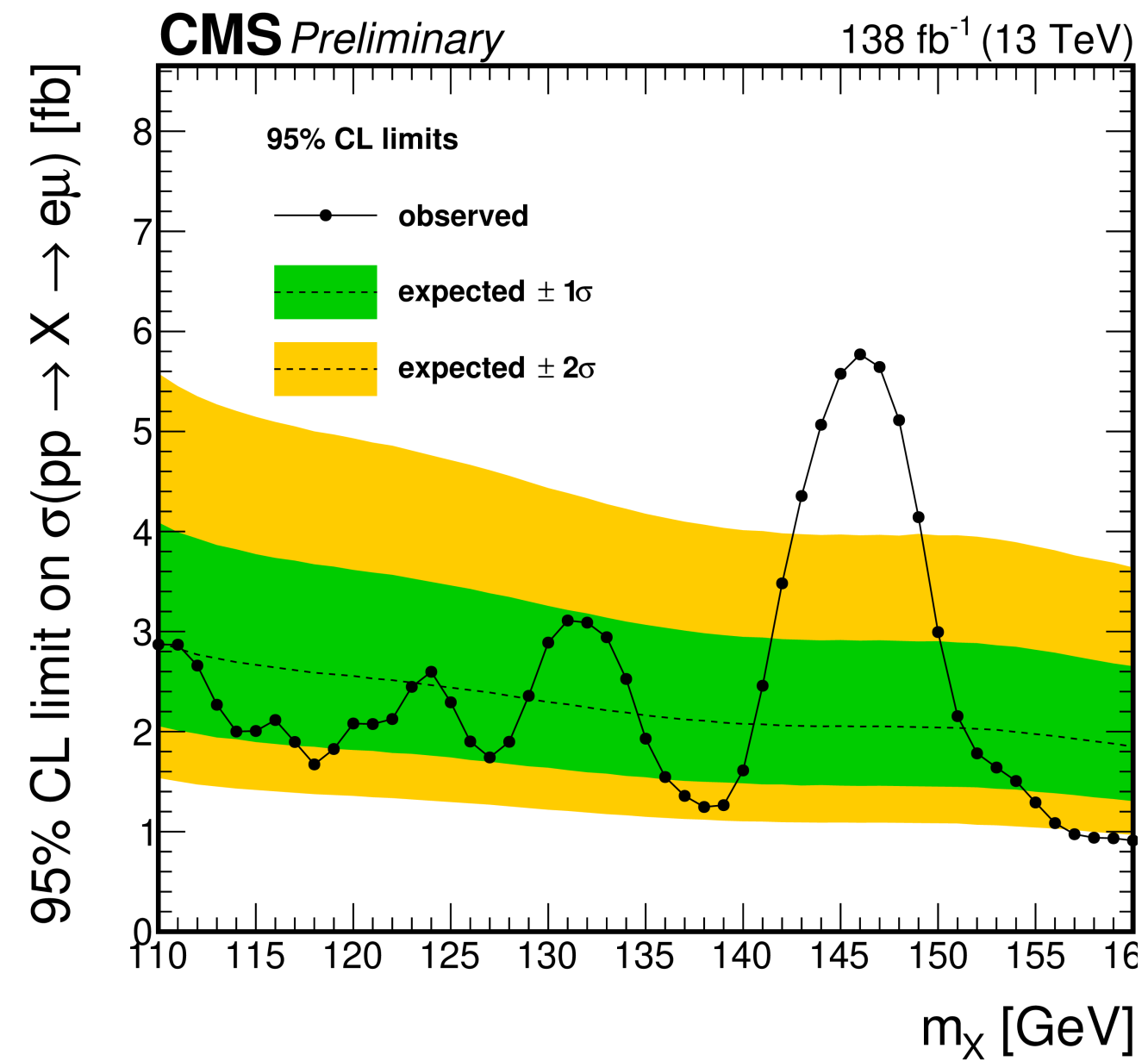
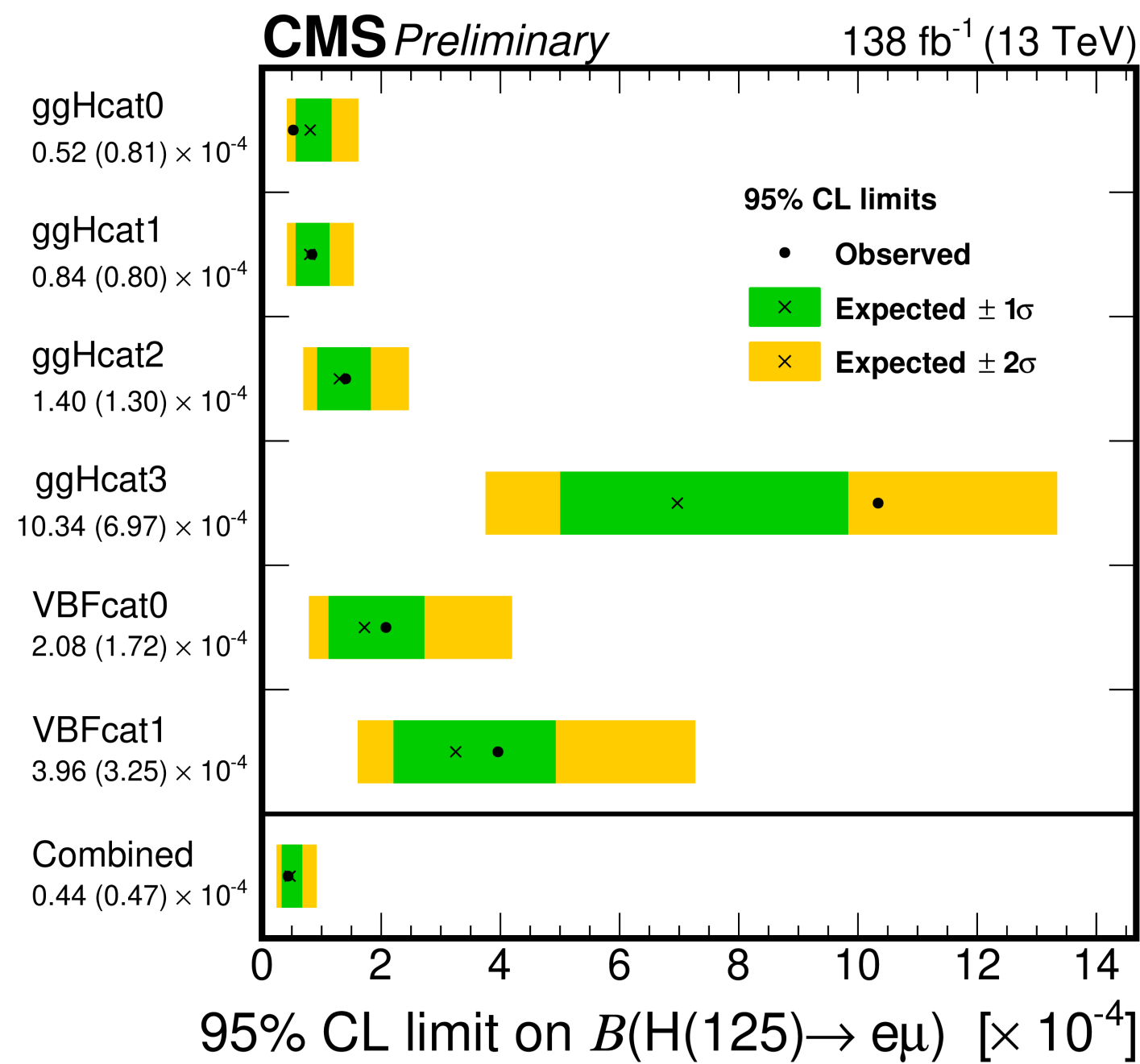
How do we get the most science out of any demo program? Beam dumps? Neutrinos? What else?

Synergies and interests of course go beyond a muon collider which is why many of you are here



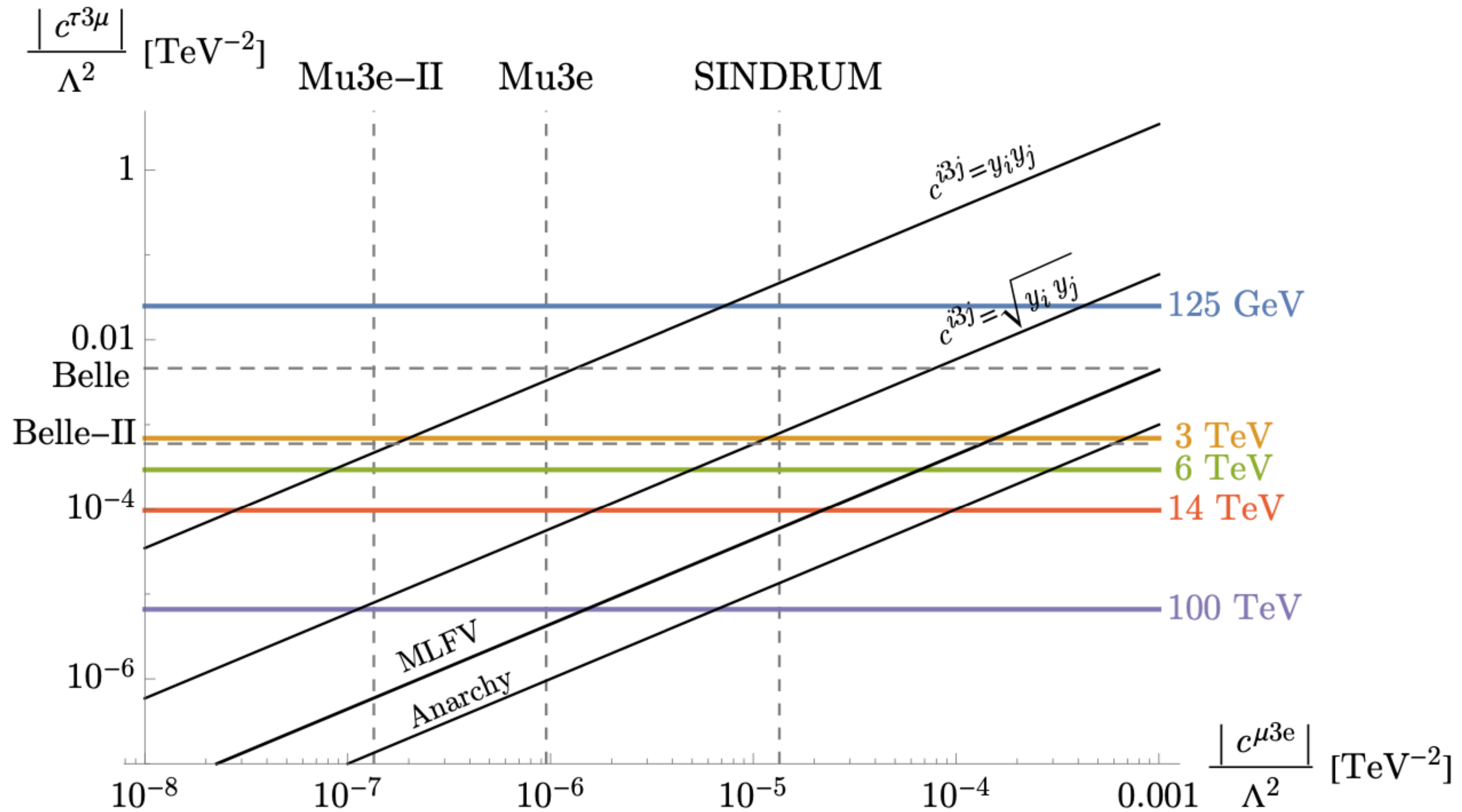
Muons offer exquisite probes of the SM that are being conducted worldwide

Cross fertilization and feedback is important in many directions



SM Higgs BF is bounded by $\lesssim 10^{-8}$ based on current $\mu \rightarrow e\gamma$ constraints

Precision can give targets for colliders



The uses for muons extend far beyond just HEP but also benefit from HEP techniques/detectors

CERN COURIER

CULTURE AND HISTORY | FEATURE

Cosmic rays for cultural heritage

24 April 2023

Taking advantage of detectors used for particle physics, cosmogenic muons are becoming powerful tools for non-destructive imaging of large structures such as pyramids. Physicist and muographer Andrea Giammanco explains.



Structural secrets Muon tomography is helping researchers to solve some of the enduring mysteries surrounding the pyramids of Giza. Credit: iStock/Kateryna Kolesnyk

The uses for muons extend *really* far beyond just HEP



HR001122S0049

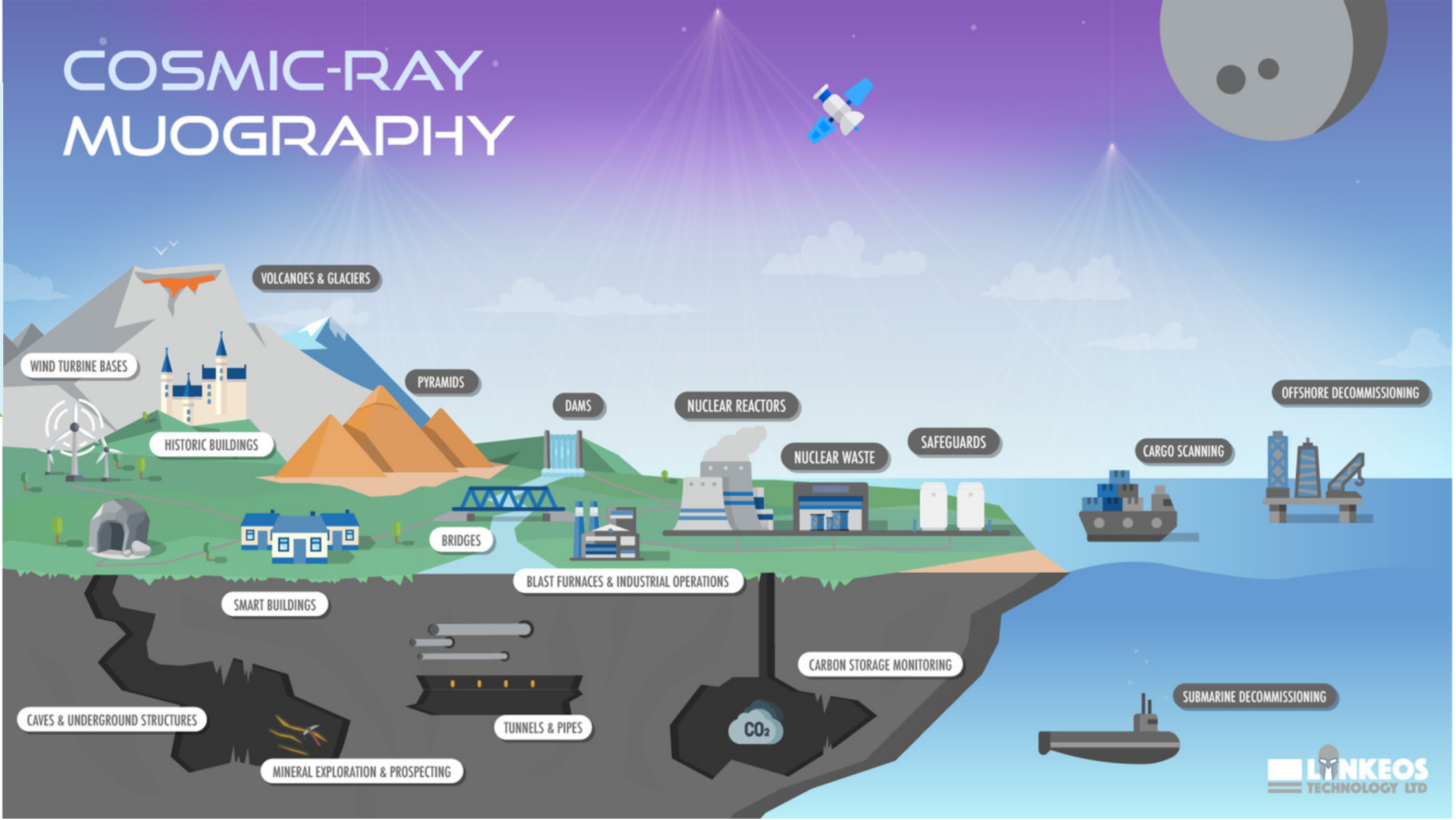
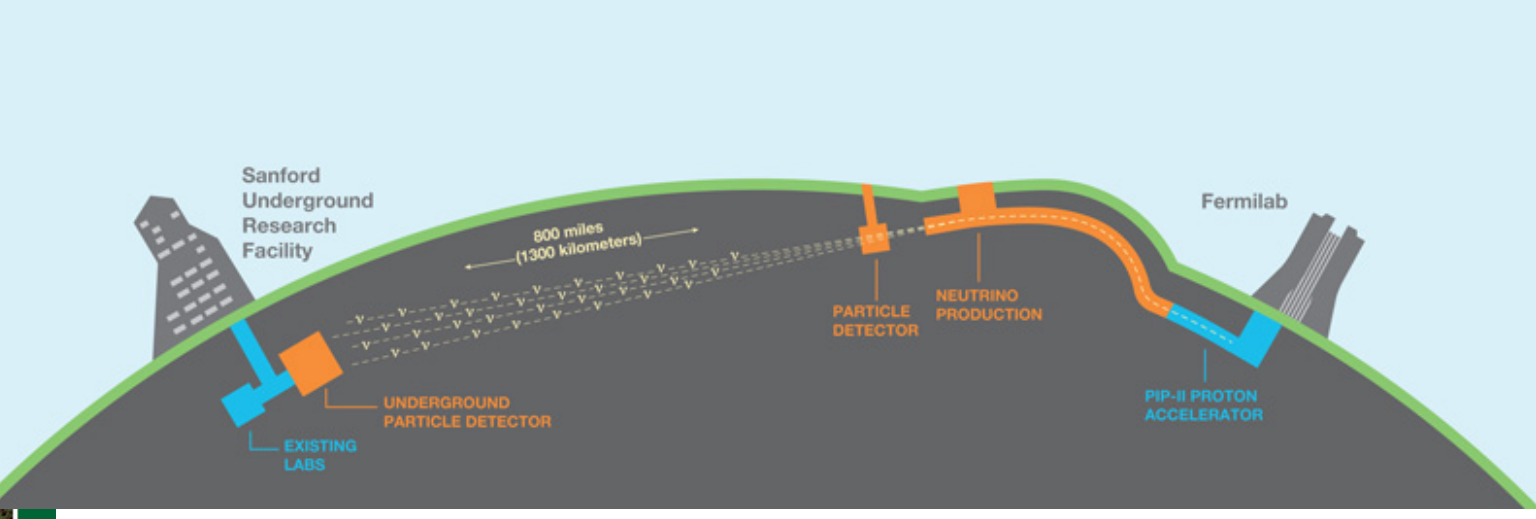
Muons for Science and Security (MuS2)

Department of Defense

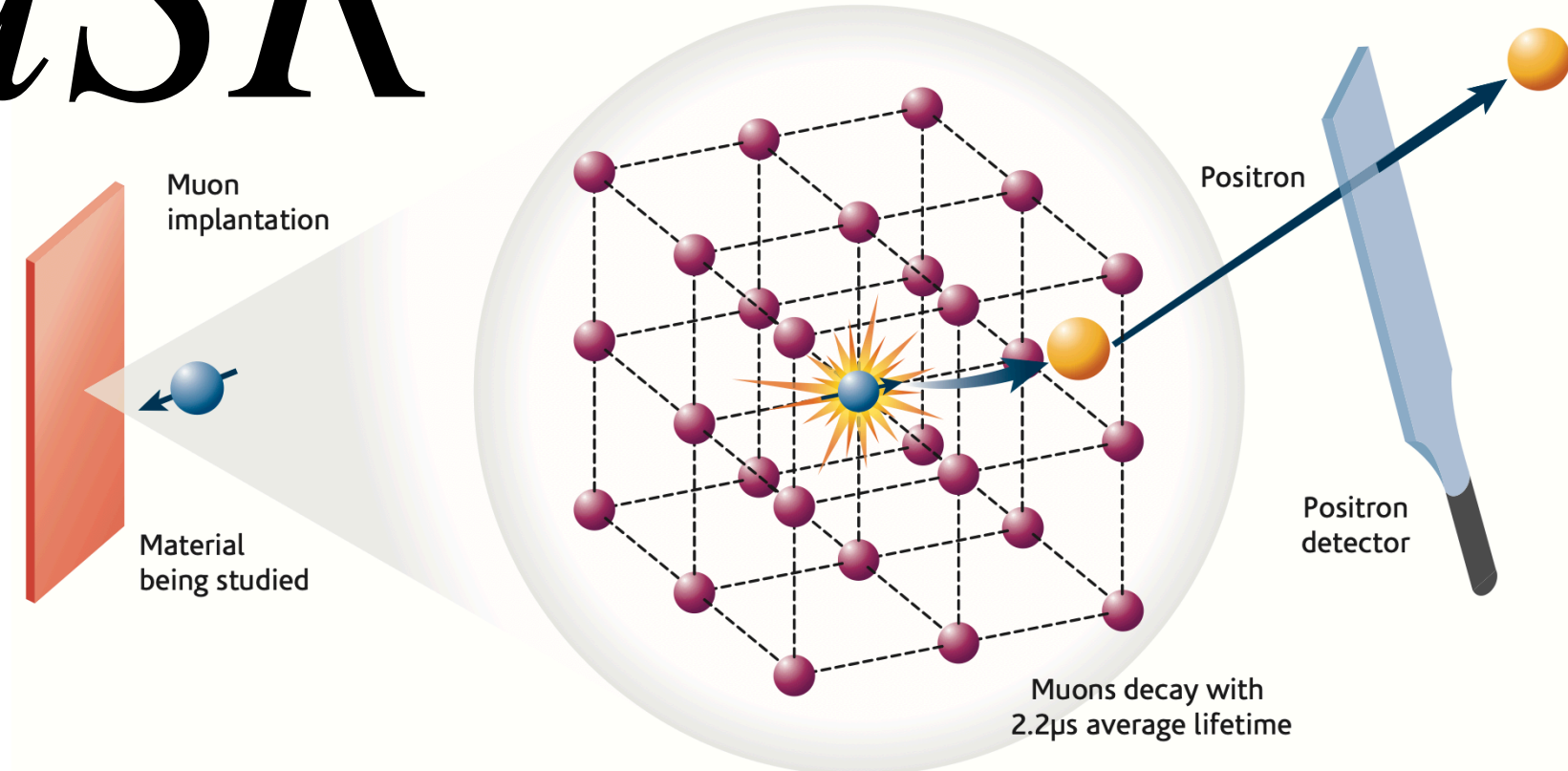
DARPA - Defense Sciences Office

The Defense Sciences Office (DSO) at the Defense Advanced Research Projects Agency (DARPA) is soliciting innovative research proposals for a directional source of muons produced at relevant energies and in sufficient quantities to support demonstrations of national security and scientific applications. Proposed research shall investigate the generation of directional muon beams with 10 GeV to 100 GeV energies and produce 10^6 to 10^8 muons, while showing a clear path to a practical design for a transportable system. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

My standard slide I use in muon collider talks...



μSR



HR001122S0049
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**We have plenty of time for discussion especially
on the last day**



**So let's come together and see how much we can learn and
accomplish these next few days in this bellissimo ambiente!**