



Physics Opportunities at a Beam Dump Facility at PIP-II and Beyond

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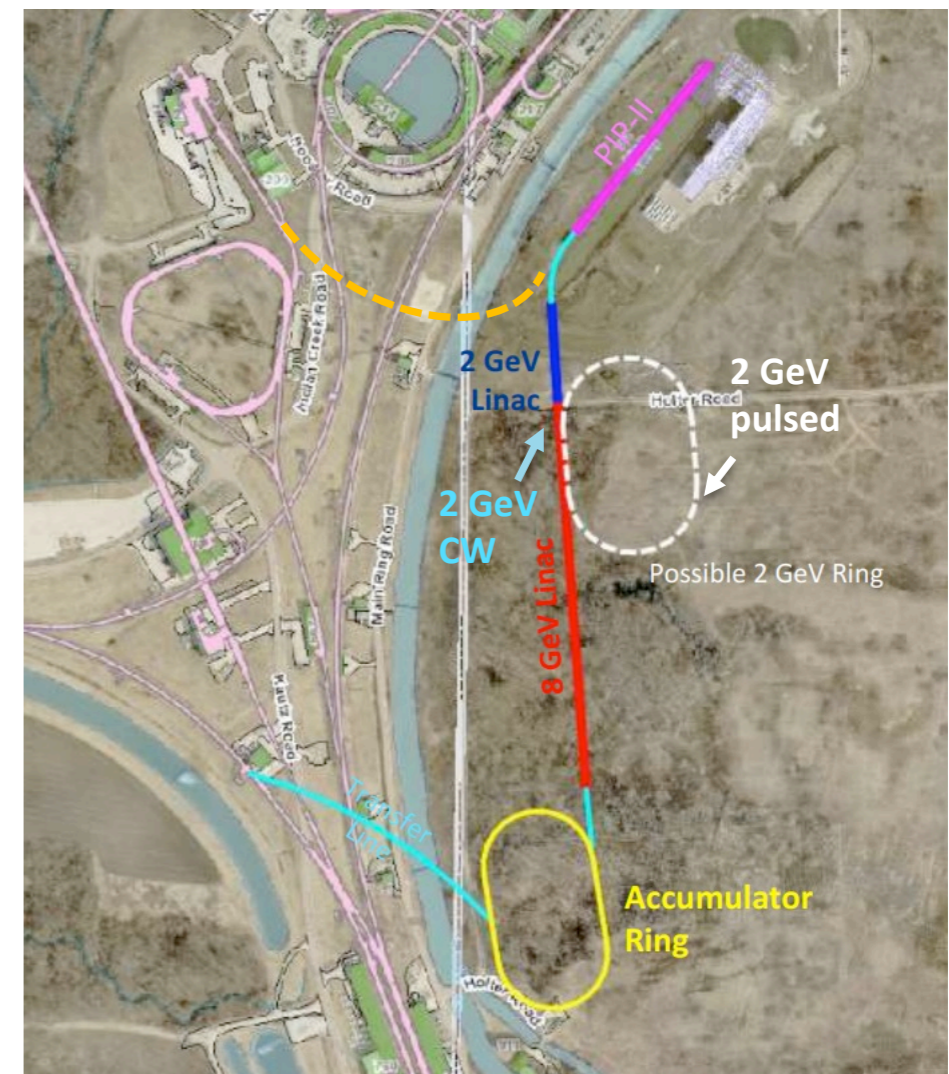
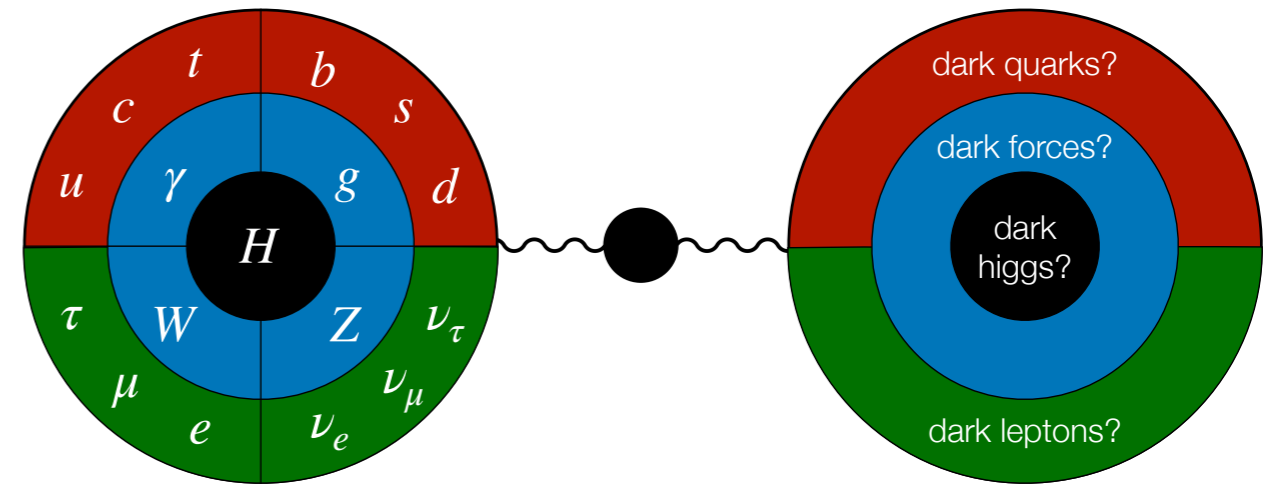
PIP-II and the Fermilab Accelerator Complex Evolution (ACE)

- PIP-II Linac upgrade to the Fermilab accelerator complex enables among the highest power \sim GeV proton beams in the world
 - Capable of 1.6 MW at 800 MeV proton energy continuous wave
 - Small percentage of protons (1.1%) needed to support DUNE
- ACE has two components
 - Upgrades to Main Injector and target station allowing DUNE to achieve results on an accelerated schedule
 - A Booster replacement, which will
 - Provide a robust and reliable platform for the future of the Fermilab accelerator complex
 - Enable the capability of the complex to serve precision experiments and searches for new physics with beams from 1-120 GeV
 - Create the capacity to adapt to new discoveries



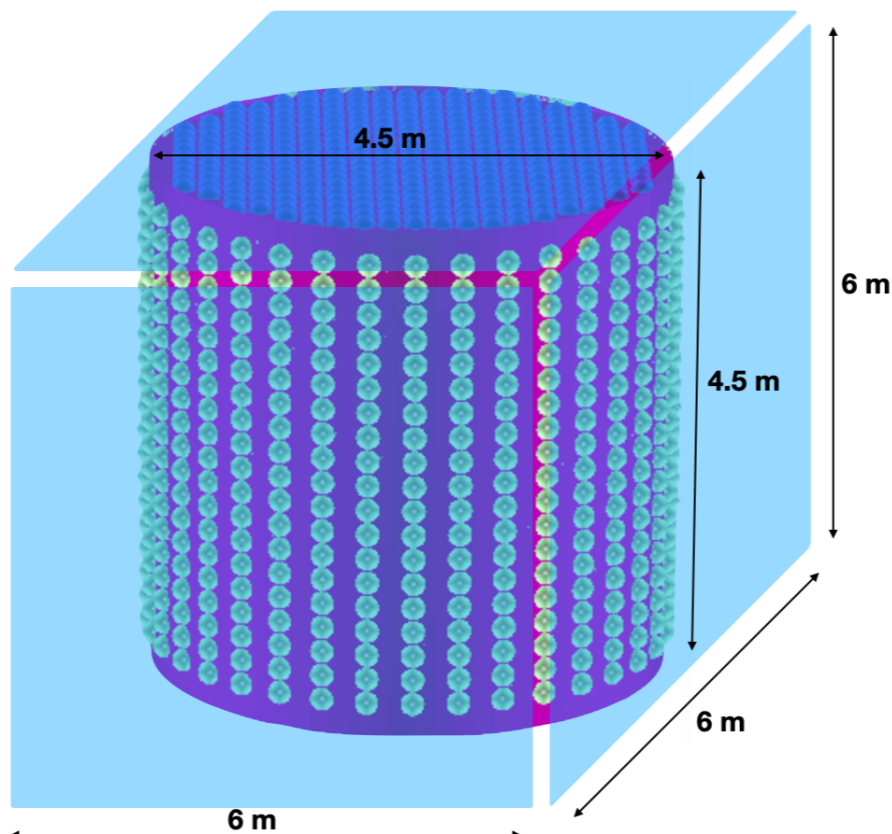
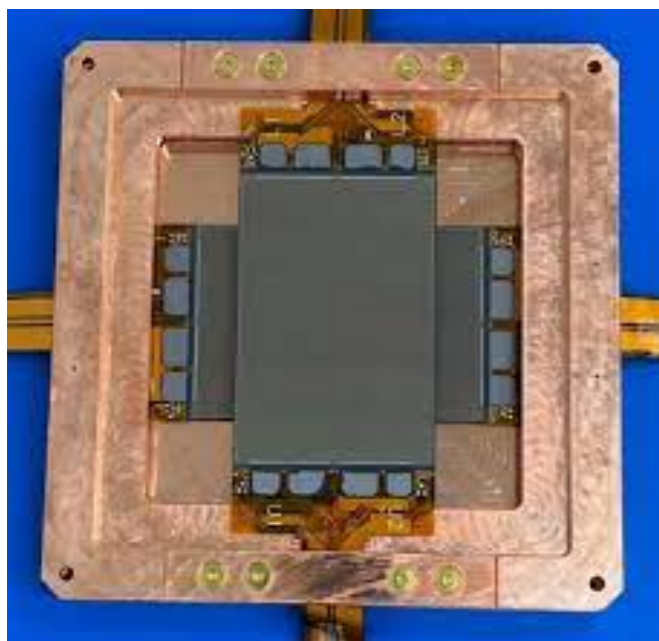
Opportunity for GeV PIP-II Beam Dump Facility

- Accelerator-based dark sector searches were identified as an HEP priority during the most recent Snowmass process
 - Proton beam dump-based dark sector searches highlighted as part of Fermilab's future program
- Beam dump target facility and experimental hall can be optimized for HEP-based physics searches
 - Low-Z target such as carbon, improve pion/proton ratio
 - Optimize for neutron background suppression
 - Multiple detectors at flexible locations
- Possibilities for different configurations from 0.8-2.0 GeV proton energy
 - PIP-II Linac or an proton accumulator ring coupled to PIP-II
- Physics opportunities studied at a recent [PIP-II Beam Dump Workshop](#) and the [ACE Science Workshop](#) held at Fermilab



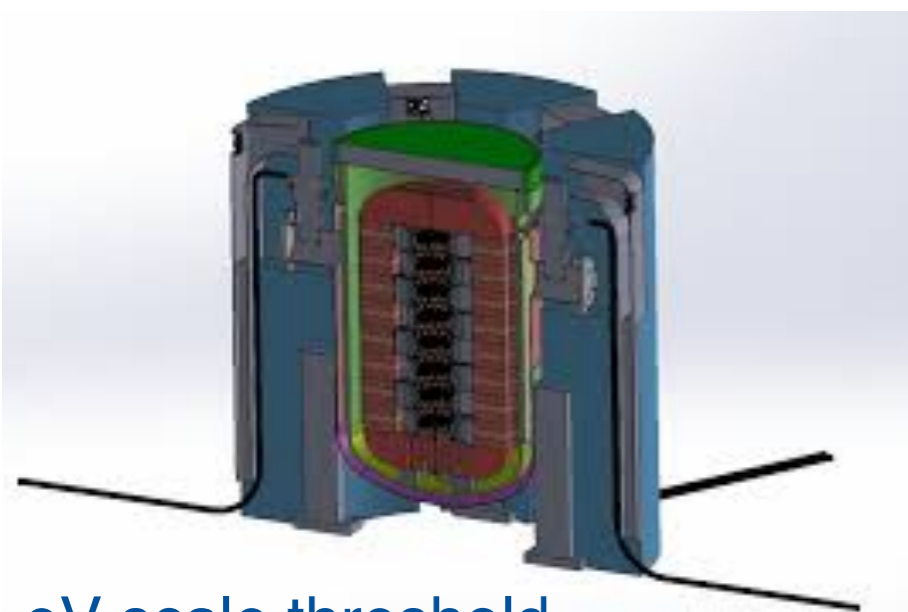
This diagram highlights a lot of the possibilities!

Proposed Small- and Mid-scale Experiments at a PIP-II Beam Dump Facility



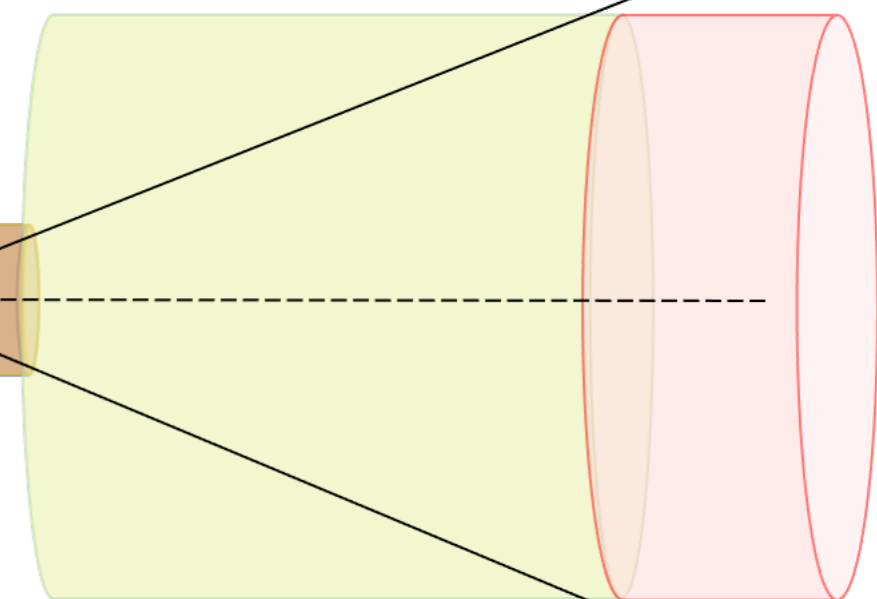
keV-scale threshold
e.g. [PIP2-BD](#): Large-scale
LAr scintillation detector
Light dark sector searches

MeV-scale threshold
e.g. [DAMSA](#): EM
Calorimeter
Axion-like particle
(ALP) searches



eV-scale threshold
e.g. [SENSEI@MINOS](#) and [Oscura](#):
kg-scale skipper-CCD detectors
Millicharged particle searches

Proton beam



Summary

- The PIP-II project at Fermilab and the further improvement under the ACE plan will produce among the most powerful GeV proton beams in the world
- There is a possibility to create an HEP-focused facility for dark sector searches by coupling PIP-II to a beam dump with or without an accumulator ring
- This facility could host a suite of small- to mid-scale with different detector thresholds to target a broad range of dark sector models
- The physics opportunities were explored at a recent PIP-II beam dump workshop and the ACE Science Workshop at Fermilab

Thank you!

Questions?