



Presentation to P5 Panel - Energy Frontier (Preliminary)

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The Energy Frontier - The LHC and HL-LHC Program

- Fermilab is committed to maintaining its leadership role in the LHC and HL-LHC programs
 - Continue to operate CMS through Run 3 and fully exploit the Run 2 and 3 datasets to their analysis potential
 - Play a critical role in CMS operations and continue to maintain the CMS detector and computing infrastructure
 - Complete the HL-LHC upgrades and transition to operations for CMS
 - Maintain high-efficiency operations of the upgraded CMS detector and computing infrastructure
 - Make the next set of groundbreaking discoveries and high-precision measurements with the newly upgraded CMS ~~detector~~ experiment
 - Provide project support for LHC beam adjacent (high η) and long lifetime experiments
- The program above will require a sustained research budget

The Energy Frontier – Critical Accelerator and Detector Development

- Future accelerator research program should be focused on a Higgs factory and 10+ TeV partonic center-of-mass energy collider
- We envision significant investments in synergistic accelerator R&D ([arXiv:2207.06213](https://arxiv.org/abs/2207.06213)) that would enable Fermilab and the US High-Energy physics program to tackle technical major challenges common to various future collider concepts
 - This R&D will enable Fermilab to make critical contributions to various accelerator research programs and play a significant role in the in the international programs
 - To develop feasible, sustainable, and cost-effective collider concepts and corresponding demonstrators to be hosted at Fermilab
- Fermilab is uniquely positioned to lead such an Integrated Collider R&D program thanks to its
 - Critical mass of accelerator personnel and an extensive research infrastructure
 - Past experience utilizing a wide array of accelerator technologies
- Fermilab will pursue novel detector designs that have the potential to achieve:
 - High spatial resolution with channel sizes approaching a single micron
 - High-speed detector capabilities that approach a time resolution of a single picosecond
 - Dual channel or 5D calorimetry capability
 - Sustained operations after 10 to 30 times more radiation than the HL-LHC end-of-life scenario