

Project X Accelerator

An aerial photograph of the Project X Accelerator site. The foreground is dominated by a large field of tall, golden-brown grasses. A dirt path or road winds through the field, leading towards a large, white, rectangular building in the distance. To the right of the path, a blue canal or river flows through the landscape. In the background, there are more buildings and a line of trees under a clear blue sky.

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On behalf of the PX Collaboration
HEPAP Facilities Subpanel
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-
- Mission and capabilities
 - Staging Strategy
 - Readiness to Construct

Links:

[Project X Website](#)

[Project X Reference Design Report](#)



- An opportunity to create the foremost Intensity Frontier facility in the world...

6 MW of beam power, supporting multiple experiments, with flexible/independent beam formats, at energies ranging from 1 – 120 GeV

- Capitalizing on significant investment in, and rapid development of, superconducting rf technologies over the last twenty years



- Providing a flexible platform for future development of the Fermilab complex
- Undertaken by an international collaboration



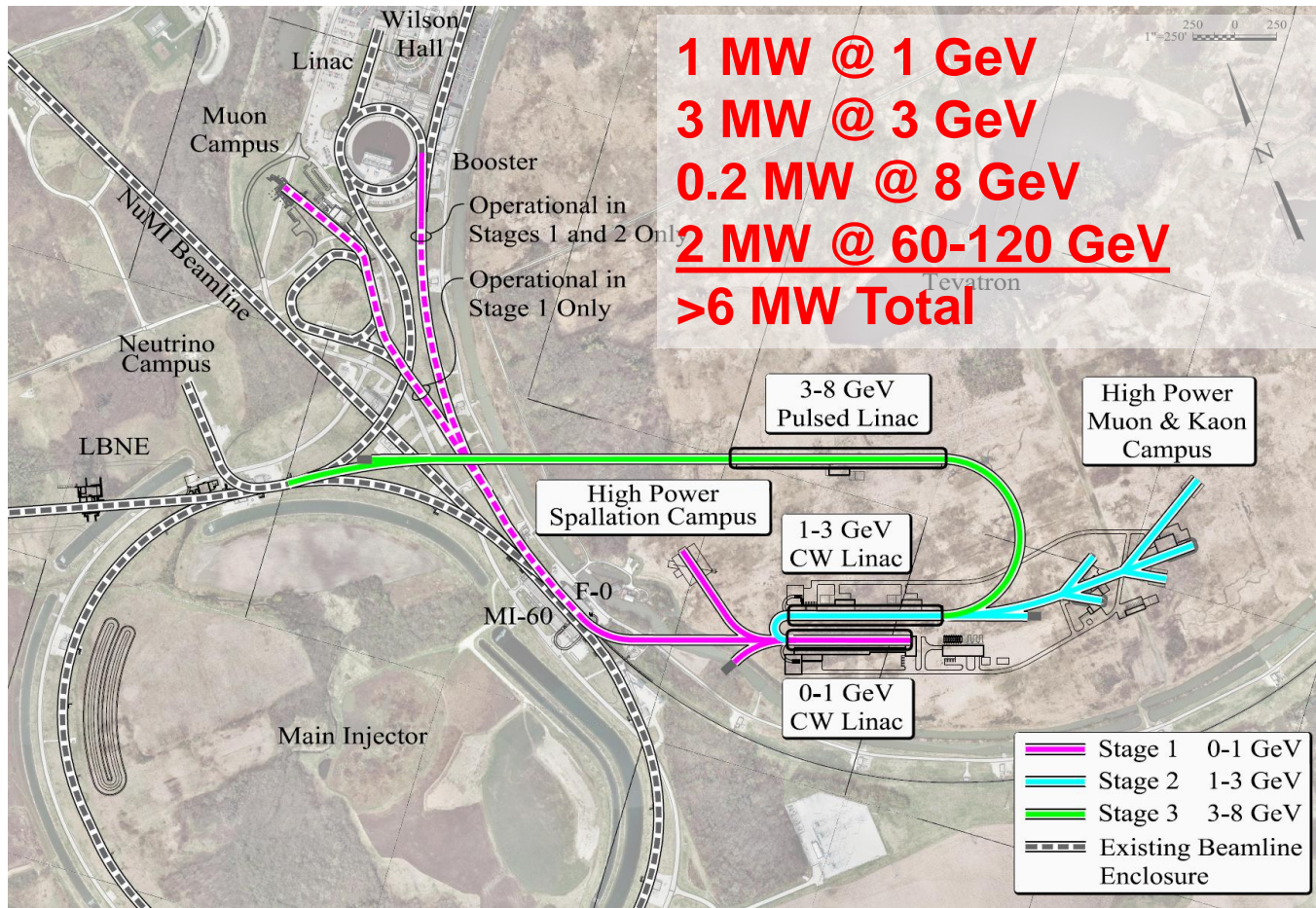
- A neutrino beam for long baseline neutrino oscillation experiments
 - 2 MW proton source at 60-120 GeV
- MW-class low energy proton beams for kaon, muon, neutrino, and nuclear/nucleon based precision experiments
 - Operations simultaneous with the neutrino program
- A path toward a muon source for possible future Neutrino Factory and/or a Muon Collider
 - Requires ~4 MW at ~5-15 GeV
- Possible missions beyond particle physics
 - Energy and materials applications





- 3 GeV CW superconducting H- linac with 1 mA average beam current.
 - Enhanced performance of the existing proton complex (Stages 1, 2)
 - Spallation based program (nucleons and energy applications) program at 1 GeV (1 MW)
 - Rare processes programs at 3 GeV (3 MW)
 - Flexible provision for variable beam structures to multiple users
 - 3-8 GeV pulsed linac capable of delivering 350 kW at 8 GeV
 - Enhanced performance for short and long-baseline neutrino programs
 - Establishes a path toward a muon-based facility
 - Upgrades to the Recycler and Main Injector to provide ≥ 2 MW to the neutrino production target at 60-120 GeV.
- ⇒ ***Utilization of a CW linac creates a facility that is unique in the world, with performance that cannot be matched in a circular accelerator based facility.***

Reference Design Staging

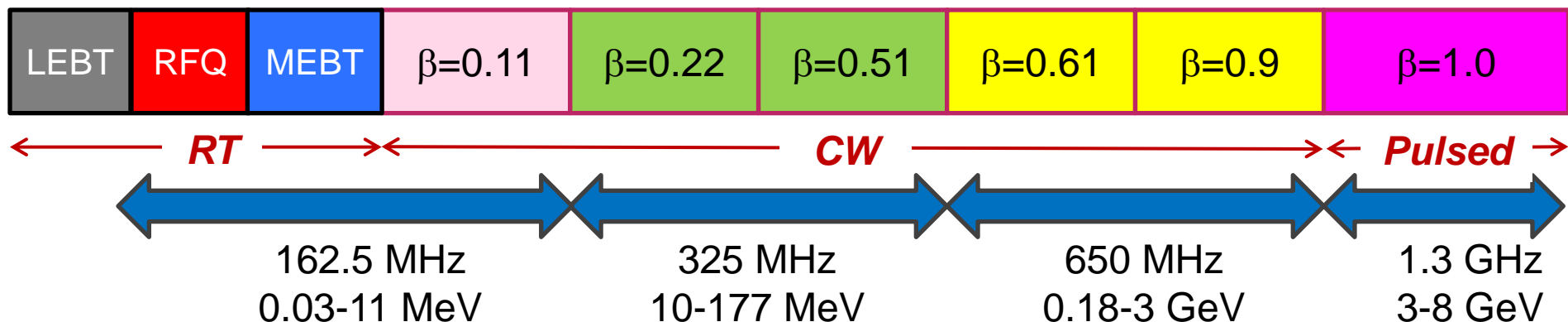


Staged Physics Program



← Project X Campaign →

Program:	NOvA + Proton Improvement Plan	Stage-1: 1 GeV CW Linac driving Booster & Muon, n/edm programs	Stage-2: Upgrade to 3 GeV CW Linac	Stage-3: Project X RDR	Stage-4: Beyond RDR: 8 GeV power upgrade to 4MW
MI neutrinos	470-700 kW**	515-1200 kW**	1200 kW	2450 kW	2450-4000 kW
8 GeV Neutrinos	15 kW + 0-50 kW**	0-42 kW* + 0-90 kW**	0-84 kW*	0-172 kW*	3000 kW
8 GeV Muon program e.g. (g-2), Mu2e-1	20 kW	0-20 kW*	0-20 kW*	0-172 kW*	1000 kW
1-3 GeV Muon program, e.g. Mu2e-2	-----	80 kW	1000 kW	1000 kW	1000 kW
Kaon Program	0-30 kW** (<30% df from MI)	0-75 kW** (<45% df from MI)	1100 kW	1870 kW	1870 kW
Nuclear edm ISOL program	none	0-900 kW	0-900 kW	0-1000 kW	0-1000 kW
Ultra-cold neutron program	none	0-900 kW	0-900 kW	0-1000 kW	0-1000 kW
Nuclear technology applications	none	0-900 kW	0-900 kW	0-1000 kW	0-1000 kW
MuSR	none	0-900 kW	0-900 kW	0-1000 kW	0-1000 kW
# Programs:	4	9	9	9	9
Total max power:	735 kW	2222 kW	4284 kW	6492 kW	11870kW



- Reference Design Report documents a complete integrated concept
 - Builds on experience from SNS (1 MW) operations
 - Complete set of electromagnetic and beam dynamics modeling/simulation
 - Provides context for R&D Program
- Development programs aimed at minimizing technical and cost risk
 - Front End
 - SRF
 - Main Injector/Recycler High Intensity Operations
 - High Power Targets
- Technology required for Project X is largely in-hand,
 - Will be demonstrated/fully developed for a 2017 construction start.
- Potential for significant Indian in-kind contribution (Stages 1 and 2)



- Project X represents a unique opportunity for the U.S. to establish a world leading Intensity Frontier program that will persist for decades.
 - Broadband attack on central questions of particle physics utilizing neutrino, kaon, muon, nucleon, and atomic probes
 - Platform for future development of a Neutrino Factory, Muon Collider, or next generation Hadron Collider
- The capabilities of the Project X Reference Design – *multi-MW beam power, with flexible beam formats, at energies between 1-120 GeV* – are unmatched by any other facility, either in existence or in the planning stages, within the world today.
- A multi-MW high energy proton accelerator is a national resource, with a potentially broad user base.
 - Engaging potential user communities beyond particle physics who would benefit from access to high power proton beams: energy applications, muSR
- Staging strategy developed with compelling physics opportunities at each stage
 - Leveraging significant prior investment in the Fermilab complex.
- Complete Reference Design concept; aligned R&D program
- The technologies required to construct Project X are largely in hand today
 - Stages 1 and 2 could be completed by 2025 with Indian contribution

⇒ **Project X is ready to initiate construction**