

Radiofrequency superconducting cavities and high power proton Linacs



PIP-II Proton Improvement Plan II

Producing the world's most intense neutrino beam for the Deep Underground Neutrino Experiment (DUNE)

Scientific leader: David Longuevergne (IJCLab) *

Laboratories involved: IJCLab (Orsay)

Nature: research infrastructure

Status: International project under construction, mainly supported by the United States (DOE), India (DAE), Italy (INFN), France (CNRS and CEA), England (UKRI-STFC) and Poland (WUST, WUT and TUL)

Website: <https://pip2.fnal.gov/>

Scientific objectives

The PIP-II project is part of an ambitious programme to study neutrinos. Its objective is to upgrade the Fermilab accelerator complex in the United States to provide a neutrino beam of unprecedented intensity for the DUNE (Deep Underground Neutrino Experiment) project (see DUNE fact sheet). The core of the project is the construction of a new superconducting linear proton accelerator capable of delivering a beam power of 1.2MW on target from the existing rings.

Resources deployed

The new superconducting linear accelerator will provide a continuous 2mA H- ion beam up to an energy of 800MeV. It will consist of a short hot section equipped with a radio frequency quadrupole (pre-acceleration to 2.1MeV and beam bundling). The final beam is converted into H+ protons, accelerated to 8GeV in the first ring (booster) for the production of low-energy neutrinos, then raised to an energy of between 60 and 120GeV in two rings (Recycler ring/Main injector) for the production of high-energy protons, high-energy neutrinos and muons.

800MeV proton energy	1.2MW of protons on target
15 international institutes	2027 first beam in the accelerator
215m total length of the linear accelerator	

IN2P3 CONTRIBUTIONS

- Participation in the development, construction and validation of 33 Spoke type superconducting accelerator cavities (SSR2).
- Construction of prototype components (power coupler and tuning system) in view of their qualification for series production.

Other french laboratories involved
Irfu (CEA Saclay)

2015 Start of the PIP-II project at Fermilab (CD-0)	2018 Start of the collaboration and signature of the SOI (Statement Of Interest)	2019 Start of civil engineering works (Ground-breaking)	2022 Reception and qualification of the SSR2 prototype cavities at the IJCLab.	2025 Expected start of the installation of the cryo-accelerators in the tunnel	2027 Planned start of operation of the superconducting linear accelerator
					2028 Beam injection into the booster

* Since 2018