PIP-II
Project Director Report

April 2021

Project Highlights

- Successful 6-yr PIP-II Injector Test Facility test beam program concludes on April 16
- STFC UKRI - DOE Project Planning Documents receive DOE approval
- Final design of linac complex is complete
- Final Design Report was released to P2MAC for review

Major Upcoming Events

6-7 May PIP2IT Retreat

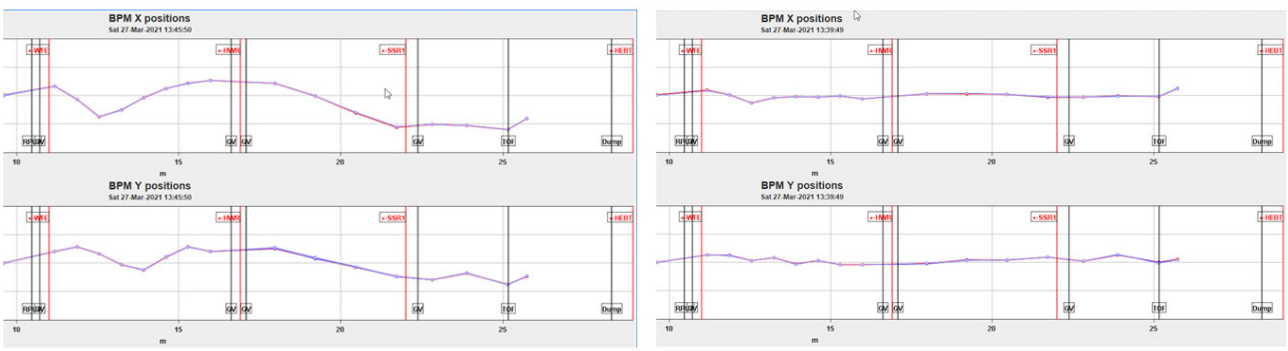
1-3 June PIP-II Machine Advisory Committee meeting

14 June PIP-II Project Executive Board (P2PEB#8)

Beam test program sucessfully completed at PIP-II Injector Test Facility

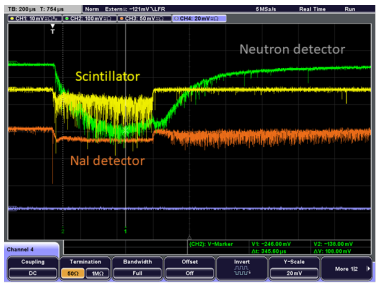
PIP2IT beam studies focused on beam characterization, repeated demonstration of LBNF Booster parameters.

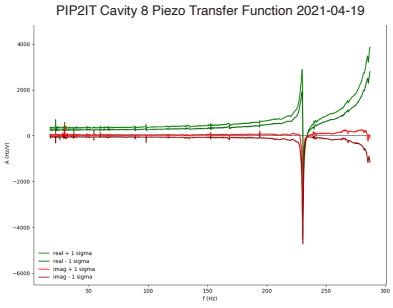
- The beam suitable for injection into the Booster has been accelerated repeatedly, reproducibly, and stably.
- Beam characterization: transeverse and longitudinal beam profiles and emittances were measured and found to be in reasonable agreement with expected values.
- Automatic tuning of beam orbit utilizing Bayesian Optimization with Gaussian processes was successfully tested at PIP2IT. The perturbed orbit was aligned after software application (bottom graphs).
- MEBT beam line and the beam absorber were tested with long pulses providing valuable engineering data.
- **PIP2IT beam operations ended on April 16, concluding a 6-year highly productive program.**

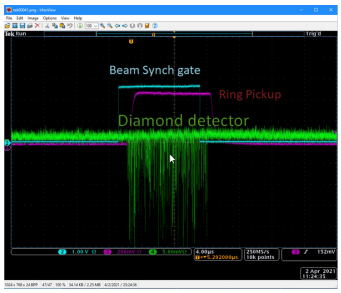


Accelerator Systems successfully validated at PIP2IT

- A suite of loss monitors of different technologies detected beam loss at full 550 μsec beam pulse width. Detectors included neutron (on loan from FRIB), sodium iodide, and scintillator-based monitor (left screen shot).
- A key Machine Protection System demonstration was the detection of short (10 μsec) pulse, 2.1 MeV beam losses by a diamond detector (right screen shot). This achievement goes a long way in MPS being able to protect the HWR and SSR cryomodules from beam-induced quenches at PIP-II.
- LBNL LLRF system successfully demonstrated at SSR1 (middle plot displays SSR1 Cavity 8 Piezo Transfer Function).

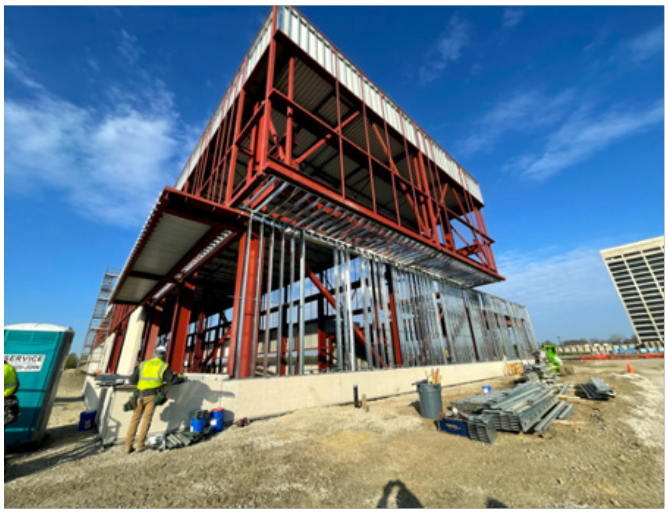


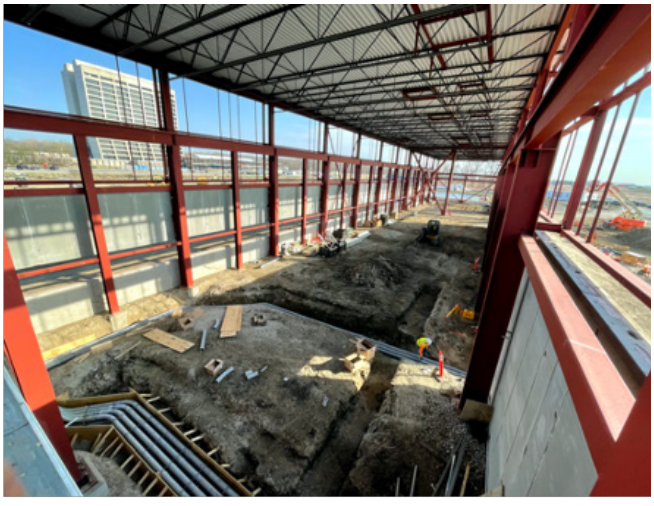




Conventional Facilities

- Cryogenic plant building construction is ongoing (top right picture).
  - Roof decking and parapet wall construction has begun.
  - Underslab utilities installation is underway (bottom right picture).
- Linac complex final design has been completed.
- Booster connection design kicked off April 28.



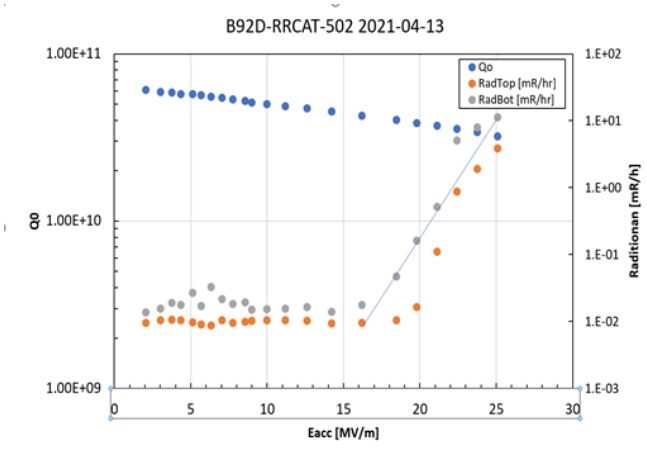


Project Planning Documents with STFC UKRI

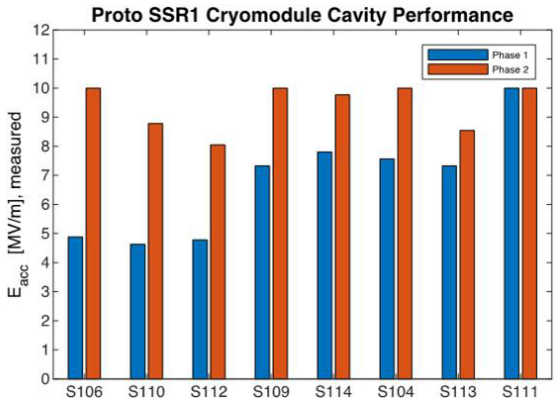
- On April 15, the Project Planning Documents (PPDs) Part 1 and Part 2 for the UK contribution to PIP-II were approved by DOE, and they are now ready to be signed by both parties.
- The purpose of the PPDs is to describe mutual understandings between Fermilab and STFC UKRI regarding the detailed scope of work, deliverables, and conditions of acceptance of the planned in-kind contribution to the PIP-II project.
- This is an important milestone for the PIP-II project, since PPDs developed in partnership with STFC UKRI colleagues are the first PPDs officially approved by DOE.

SRF and Cryogenics

- The prototype SSR1 reached the performance requirements for PIP-II slot II.
- RRCAT cavity #502 met requirements for bare cavity VTS performance and is ready to be jacketed.
- Fermilab cavity AES-009 jacketing is complete; preparing for pressure testing (right picture).



RRCAT-502 bare cavity VTS results



Summary of gradients of all SSR1 prototype cavities for Phase I and II