

## PIP-III: Exploiting PIP-II and delivering Multi-MW on the LBNF Target -

### PIP-III Definition Committee and Working Groups kick-off

#### Preamble

- P5 recommendation is for 2.4MW to DUNE
- 2.4 MW requires  $1.5 \times 10^{14}$  particles from MI @ 120 GeV
- Booster is not capable of accelerating  $2.5 \times 10^{13}$  no matter what the injection energy, or how it is upgraded: many issues
- *Achieving 2+ MW will require replacement of the Booster and possible upgrades of the MI.*
- **PIP-III Mission:**
  - Deliver 2.4 MW @ 60-120 GeV from the Main Injector to the LBNF beamline in support of the DUNE experiment
  - Deliver up to 80 kW @ 8 GeV to support g-2, Mu2e, and short-baseline neutrinos
  - Deliver ~100 kW CW @ 800 MeV to support a second generation Mu2e
  - Exploit the capabilities of CW SRF PIP-II linac to enable other physics opportunities

#### Committee Formation:

- There are several technology options to realize the PIP-III mission, including an extended SRF linac and Rapid Cycling Synchrotron (RCS). The exact energies are a major design choice.
- Fermilab to launch five internal Working Groups (WGs) as input to the PIP-III Definition Committee: science, linac+RCS, Main Injector (MI), conventional facilities (CF), and targets.
- The PIP-III Definition Committee particle physicists (as opposed to accelerator members) will be asked to help convene a planned late spring (April – May) science workshop on the physics potential of the PIP-II/PIP-III complex. This is to get community input into the PIP-III Committee and help inform the optimum PIP-III configuration.
- The PIP-III Workshop will bring together representatives from other DOE labs, international partners, the university community, and Fermilab to consider science potential and technology aspects
- An International committee (TBD later) will review the output of this committee and make recommendations.
- Goal is to have a plan and white paper by the time of P5/Snowmass ~2021.
- Timeline:
  - August 2019 – membership complete and charged
  - December 2019 – Kick-off meeting

- April - May 2020 – Science Workshop and preliminary report
- August 2020 – final report
- Fall 2020-International review

**PIP-III Definition Committee Charge (4 elements):**

- 1. Identify physics opportunities that exploit current P5 investments in the PIP-II CW linac + PIP-III (-> science WG):**
  - Dark sector experiments
  - Is CW capability of linac useful?
  - Electrons in the linac, other particles, is this useful?
  - With 2 MW at 1 GeV, potential beam dump experiments
  - Technology demonstrator
  
- 2. Examine possible accelerator configurations that enable a broad range of scientific opportunities (-> Linac+RCS + MI + Targetry WGs)**
  - Explore broad parameter space, e.g.
    - i. Explore injection energy into RCS and MI
    - ii. Pulsed operation?
  - Identify R&D required
    - i. IOTA, SRF, beam dynamics, beam loss simulations, targets and horns for 2.4 MW
  - Identify upgrades required in the rest of Fermilab Accelerator Complex, e.g. space charge, electron cloud issues in MI with emphasis on R&D
  
- 3. Document the pros and cons. Specifically address benefits to accelerator Science & Technology R&D (-> Chairs lead all WGs)**
  - Scientific capability and reach; cost; technology development (SRF and IOTA).
  
- 4. Document the committee's assessment in a written report due in August 2020, with a preliminary draft report due in May 2020 (-> Chairs)**

**Possible PIP-III timeline:**

- CD-0: Q2FY21 (in line with P5 deliberations)
- CD-1: Q1FY22
- CD-2 (baseline): Q1FY23
- CD-3: Q1FY24

**Participants:**

- Co-Chairs: Bob Tribble (BNL) and Gianluigi Arduini (CERN)

- Steve Peggs, accelerator BNL
- Roni Harnik, particle theory Fermilab
- Nan Tran, collider experimentalist Fermilab
- Alex Friedland, particle theory SLAC
- Richard Van de Water, neutrino experimentalist LANL
- Alex Romanenko, SRF Fermilab
- Gordan Krnjaic, particle theory Fermilab
- Maxim Pospelov, particle theory, University of Minnesota
- Sasha Valishev, accelerator/IOTA Fermilab
- Rich Stanek Senior Team lead, LCLS-II Fermilab
- Tadashi Koseki KEK

### **Fermilab Working Group Leaders:**

Science: Roni Harnik

Linac+RCS: Sasha Valishev, Alex Romanenko, Eduard Pozdeyev

MI: Ioanis Kourbanis

CF: Steve Dixon

Targets: Bob Zwaska

### **Kick-off Meeting Agenda**

- Mission – P5 report – Nigel Lockyer
- PIP-II plans – Lia Merminga
- PIP-III Starting point – Sasha Valishev
- Path forward – Review of Charge – Nigel Lockyer
- Committee structure and next steps – Bob Tribble & Gianluigi Arduini