Preparation for the PIP-II RDR

Valeri Lebedev

PIP-II weekly meeting
April - 1, 2014
Fermilab

U.S. DEPARTMENT OF ENERGY

Fermilab

Objectives

- Future events
  - P5 report, May 2014
  - PIP-II RDR, Fall 2014
    - Active phase of writing after P5 report
  - PIP-II CD-0, ?
- Recent documents to be used/referred
  - Project X RDR
    - Accelerator Reference Design, Physics Opportunities and Broader Impacts; June 2013 (214 pages)
  - PIP-II White paper
    - Proton Improvement Plan-II; December 2013 (48 pages)
  - XMAC-14 presentations and Report
  - ACD with RCS can be helpful source of information for Booster injection

- Legend for Table of Contents
  - green – almost ready to go
  - Blue – can be borrowed/modified from existing documents
  - Red – needs to be written

Suggested Table of Contents for PIP-II RDR

1. **INTRODUCTION** (Lebedev)
   1.1. Evolution of the Reference Design
   1.2. Assumptions
   1.3. Facility Scope and Staging (relationship to PIP and NoVA)
2. **PERFORMANCE GOALS** (Lebedev)
   2.1. Technical Goals
   2.2. Operational Scenarios

3. ACCELERATOR FACILITY DESIGN

3.1. 800 MeV Linac (Lebedev)

- 3.1.1. Warm Front End (ion source, LEBT, RFQ & MEBT)
- 3.1.2. CW Linac physics design (Choice of break-points, Acc. grad., cryomod. param.)
- 3.1.3. CW Linac – Beam Dynamics (add beam loss)
- 3.1.4. CW Linac – Pulsed operation (LFD compensation, Requirements to RF power and cryogenics)

3.2. Beam Transport to Booster and Beam Dump (Johnson) (beam line design, permanent dipoles?, beam loss (additional to 3.1.3), beam dump requirements, beam switch to mu-to-e upgrade, future RF separation and beam transport to the next stage)

3.3. Booster Modifications (Zwaska)

- 3.3.1. Injection
- 3.3.2. Transition crossing
- 3.3.3. Beam instabilities (Burov)

3.4. Recycler/Main Injector (Kourbanis)

- 3.4.1. Recycler Modifications (+slip stacking and beam stability)
- 3.4.2. Main Injector Modifications
- 3.4.3. Beam instabilities (Burov)
- 3.4.4. Electron Cloud Mitigation

4. DESIGN CONCEPTS OF MAJOR SUBSYSTEMS

4.1. CW Linac (Yakovlev)

- 4.1.1. Ion source, LEBT, RFQ and MEBT
- 4.1.2. CW Accelerating Structures Requirements
- 4.1.3. Low-beta section (2.1-10 MeV, 162.5 MHz)
- 4.1.4. Low-beta section (10-160 MeV, 325 MHz)
- 4.1.5. Medium-beta section (160 – 800 MeV, 650 MHz)
- 4.1.6. RF Splitter
- 4.1.7. RF power
- 4.1.8. LLRF (Chase)

4.2. Booster (Zwaska)

- 4.2.1. Injection girder
- 4.2.2. RF cavities and High power RF

4.3. MI/RR (Kourbanis)

- 4.3.1. Hardware for Main Injector transition crossing
- 4.3.2. RF Systems (beam loading compensation)

4.4. Cryogenics (Klebaner)

4.5. Instrumentation (Scarpine)

4.6. Controls (J. Patrick)

4.7. Safety and radiation shielding (Leveling)

4.7.1. Radiation Limits
4.7.2. Radiological Design Requirements and Consequences of Project X Radiation Limits (TLM use in Booster)
4.8. Machine Protection System (J. Steimel & A. Warner)
4.8.1. MPS Configuration
4.8.2. Protection System R&D
5. SITING AND CONVENTIONAL FACILITIES (?)
5.1. Siting Options
5.2. Conventional Facilities
5.3. Site Power Requirements
APPENDIX I: LBNE Neutrino Beam (?)
1. Technical Requirements/Scope
2. Accelerator Physics Design
3. R&D Required
APPENDIX II: Mu-to-e upgrade (?)
REFERENCES

Before we write

- Beam stability in Recycler, Burov
- Alternative transition crossing, Lebedev
- Optics for Linac-to-Booster transport