**8 GeV Beam Requirements in 2030**

**Assumptions**

PIP-II complete with following performance:

800 MeV, 2 mA, 100% duty factor

Booster has reached end of service with following performance:

6.4E12 ppp x 20 Hz = 164 kW

LBNE is running at 1.2 MW @ 120 GeV

A suite of short baseline neutrino experiments is in place and operating at 80 kW @ 8 GeV

Mu2e has been reconfigured for 800 MeV and is operating at 100 kW

**Goals for the Next Decade**

Increase LBNE beam power beyond 2 MW

Support short baseline experimental program at several x 100 kW

Support next generation muon experimental program at several x 100 kW

(Provide protons at 3 GeV or above for a kaon program at few x MW)

(Provide protons at 7 GeV or above for muon-facility at few x MW)

**Constraints**

Neutrino experiments require low duty factor

Muon experiments require high duty factor

Slip-stacking is not an option at these intensities

Space-charge at injection into circular accelerators should be limited to <0.15

**Beam Requirements at 8 GeV**

MI Neutrino Program

2 MW @ 60 GeV requires 1.5E14 protons/0.7 seconds

Tune shift of 0.12 requires injection energy of 7.3 GeV

8 GeV Program

400 kW @ 8 GeV requires 3.2E14 protons/sec

Beam Requirements at 8 GeV

5.3E14 protons/sec (=680 kW)

2.7E13 ppp @ 20 Hz

Transverse emittance <20 mm-mr (normalized, 6×rms) – to be accepted into MI

Tune shift of 0.15 requires injection energy of 3 GeV for 6 pulse injection into MI

(Injection at 2 GeV gives a tune shift of 0.28)

**Implications**

The way to decrease the tune shift in the RCS is to decrease the circumference of the ring and up the cycle time. The alternative is to replace the RCS with an 8 GeV linac.