MI Operation at Lower Injection Energies

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Project X Collaboration Meeting
April 12-14, 2011

General Comments

- Operating the MI at lower energies for Project X is considered as a cost saving option.

- Operating the MI at lower Injection energies with 3 times the beam intensity represents a challenge since the amount of acceptable loss is very small.

- How low of an Injection energy is realistic to consider depends on many factors (not just the space charge tune shift).
  - Need to have an rf system with the required voltage and frequency swing.
  - Need to have good field quality of MI magnets
  - Need to maintain a reasonable beam admittance

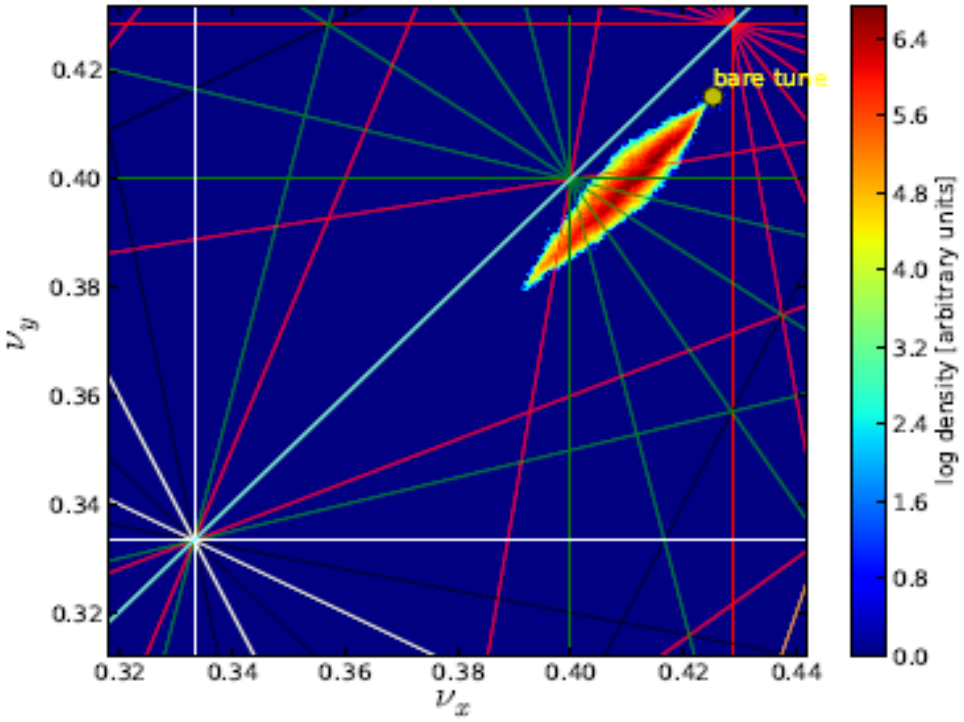
Lower Injection Energies and R&D Plan

- We have no specific effort in the MI/RR R&D plan addressing lower MI energies.
- Have modified the new MI rf system to accommodate Injection Energies down to 6 GeV (Kinetic).
  - The new design requires more cooling for the ferrite tuners.
- We have an extensive plan to study achievable tune shifts in MI that can be used to study the effects of SC at lower energies.
- There are field measurements of the MI magnets at low energies.
  - The field quality of the MI magnets at low energies appears to be good.

Plan for Space Charge

- Start MI space charge simulations using two different codes Synergia (FNAL) and IMPACT(LBNL).
  - Bench mark each code against each other w/w.o SC using the MI lattice.
  - Include the MI aperture and compare simulations predictions of losses with current operations.
  - Predict the sc tune shifts (spreads) and losses with and without second harmonic and bunch intensities of 3E11.
- Produce intense bunches at 8 GeV in MI for space charge measurements.
  - We plan to produce single bunches with 2.5E11 protons at 8 GeV by using a modified bunch coalescing scheme.

Tune footprint with space charge at nominal MI intensities (E. Stern et al.)



Other MI Lower Energy Studies

- We should be able to decelerate the MI beam down to 6 GeV by using the 2.5 MHz coalescing cavities.
  - The 2.5 MHz cavities have enough bandwidth (Q=125).
- Our BPMs work at 2.5 MHz so we should be able to measure lattice at 6 MHz assuming we have enough intensity.
- Measure beam lifetime as a function of tunes and chromaticities.

Conclusions

- Lowering the MI Injection Energy for Project X is a challenge.
- We should be able to operate the MI down to 6 GeV (Kinetic).
  - The new MI RF system will work down to 6 GeV.
  - The fields of the MI magnets appear to be good.
- We will formulate a study plan to study MI beam at 6 GeV.
  - We can decelerate beam down to 6 GeV by using the 2.5 MHz cavities.
  - We have an extensive plan for studying space charge.