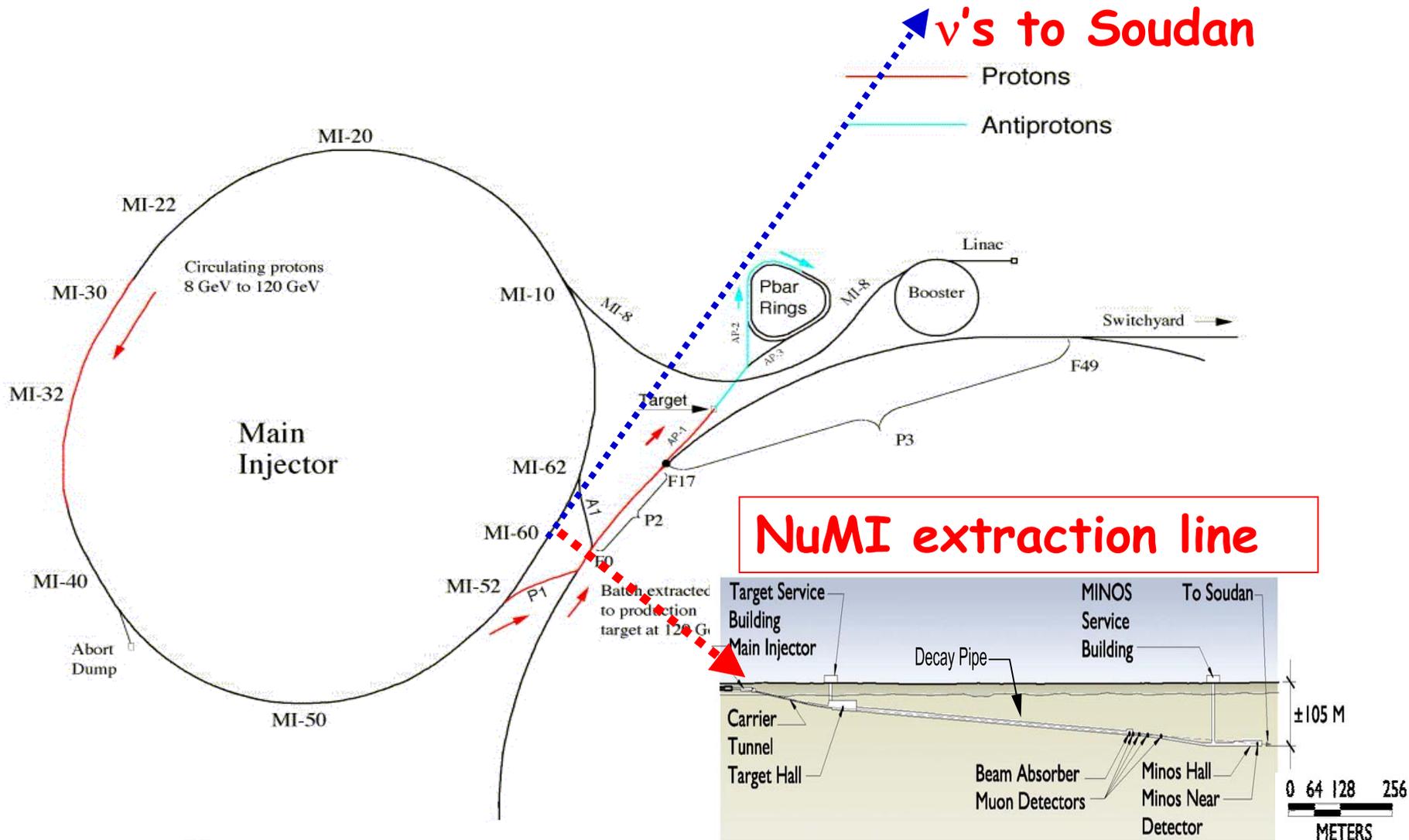


# **Main Injector Operations in the** **Future**

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**July 25, 2005**

# MI in 2005



# Introduction

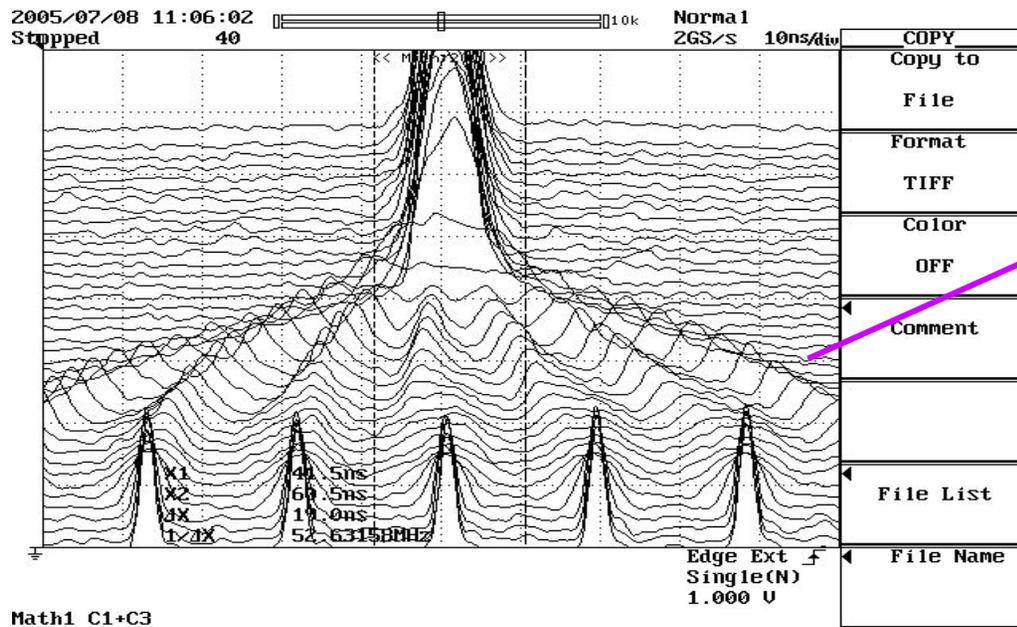
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- **Main Injector is currently delivering protons and pbars to the TeV, protons to the pbar target, NuMI target and SY120.**
- **After the commissioning of NuMI we have been running beam to NuMI along with slip stacked beam to the pbar target in a mixed mode with 0.5Hz rep rate.**
- **The total MI beam intensity can be as high as  $3.5E13p/cycle$  and is expected to increase to about  $4.5-5.5E13p/cycle$  with the implementation of beam stacking for NuMI.**

# Protons for Collider

- One group of protons consisting from 7-9 53 MHz bunches is injected at a time, accelerated to 150 GeV and coalesced into one 53MHz bunch.
- A total of 36 injections are required to fill the TeV.
- In the future we might try to coalesce 4 groups of protons at a time.

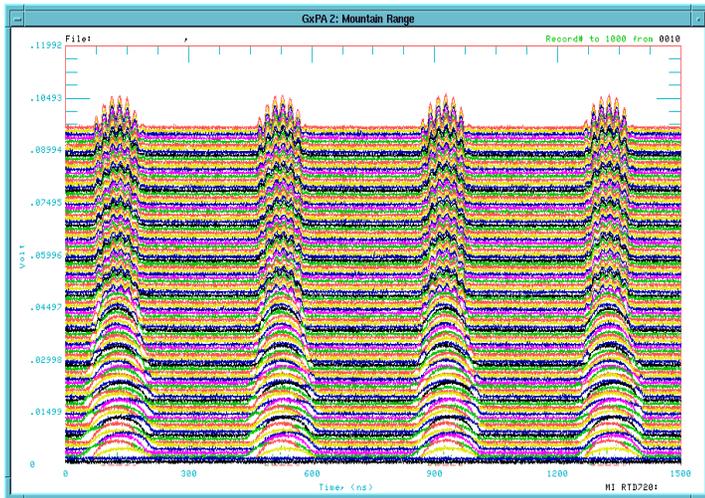


Proton Coalescing

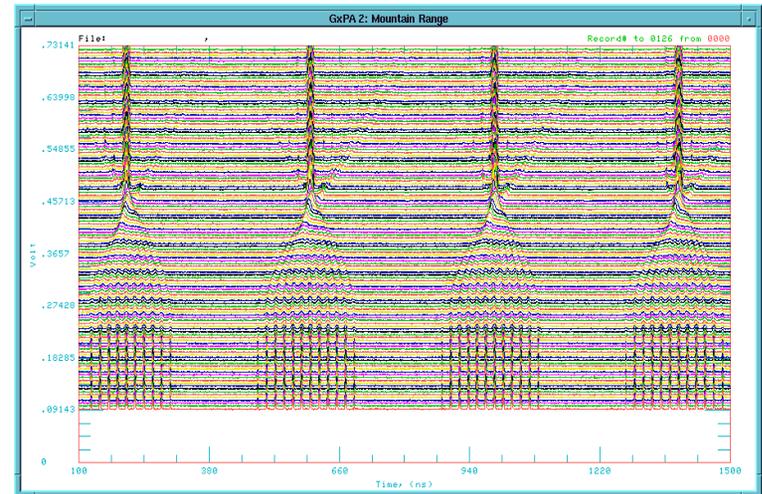


# Pbars for Collider

- All pbar transfers happen in 2.5MHz. Acceleration to 150 GeV happens in 53 MHz. In the future we plan to accelerate with 2.5 MHz to 27 GeV.
- Four groups of pbars are injected and accelerated in MI at a time. Nine injections total are required.



Pbar Injection

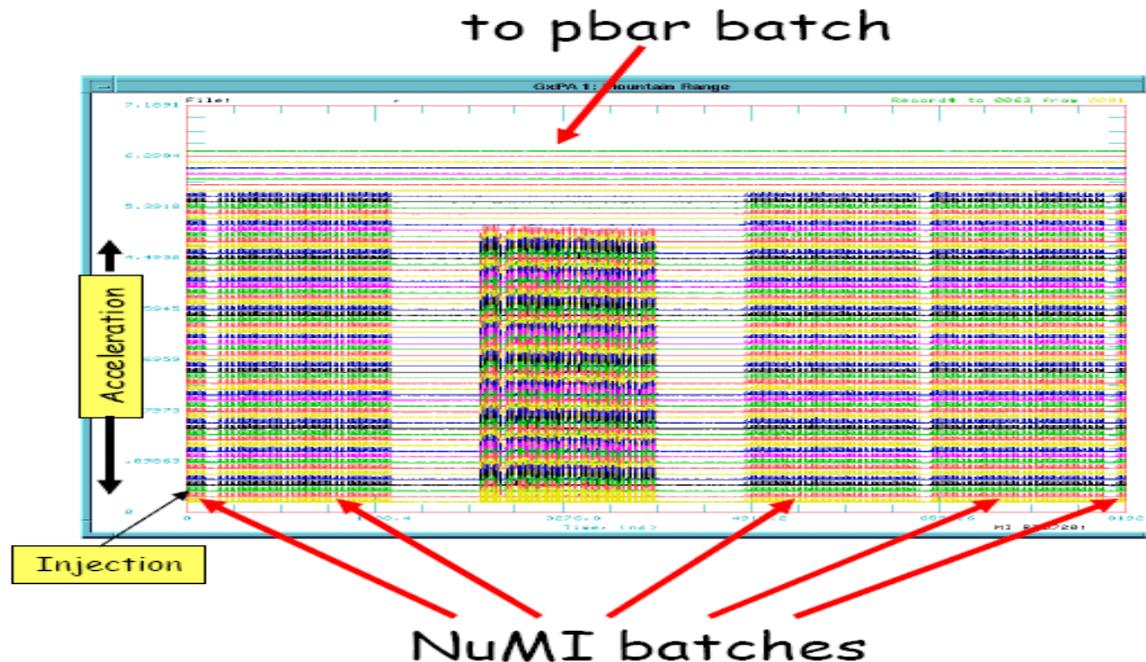


Pbar Coalescing

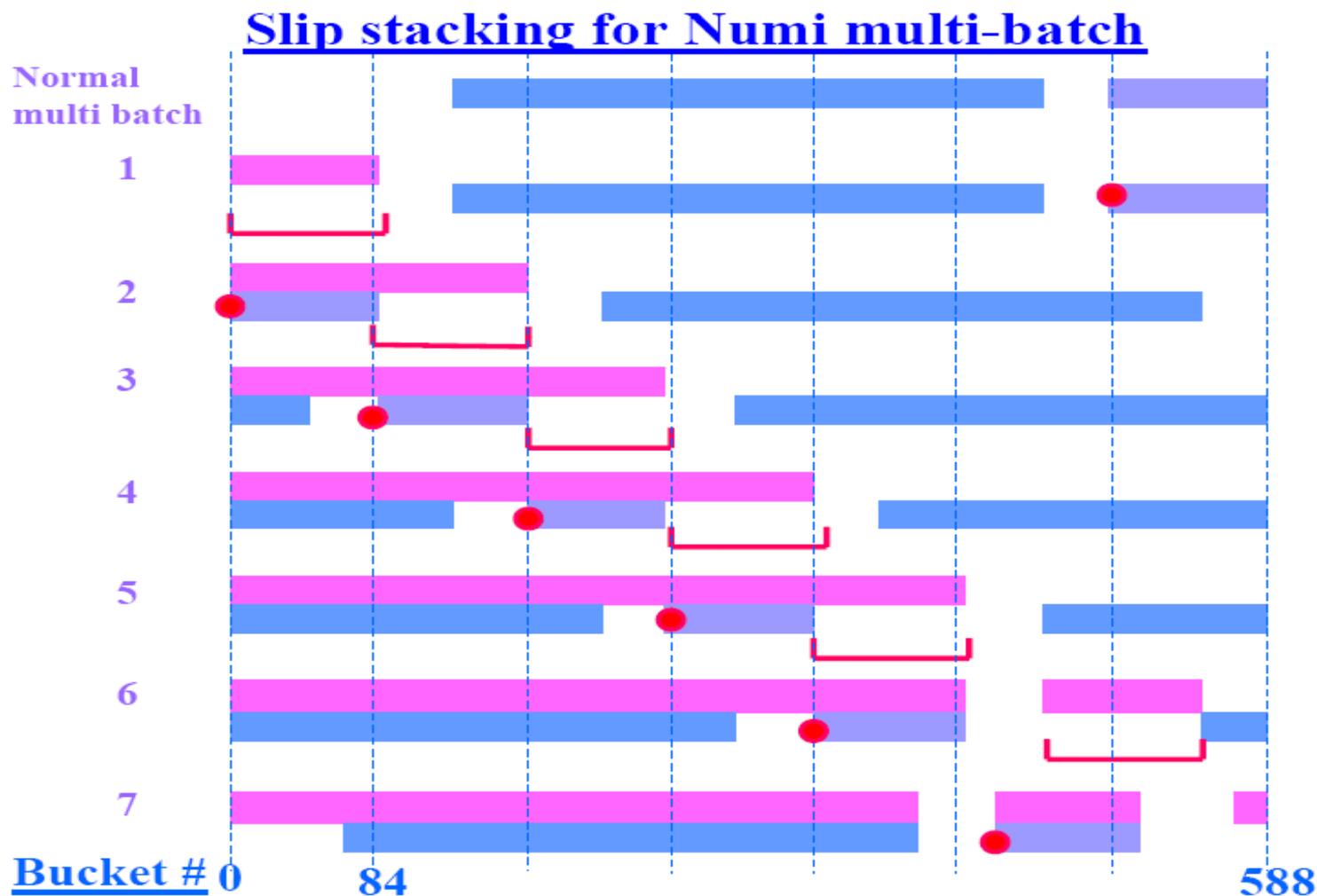


# NuMI and Stacking

- Two Booster batches are slip stacked into one double intensity batch for  $p\bar{p}$  production and five additional batches are injected for NuMI.
- In the future we plan to try slip stacking for NuMI increasing the number of batches to the NuMI target from 5 to 9.



# Cartoon of multi-batch Slip Stacking



# CONCLUSIONS

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- **Main Injector will continue to play a crucial role to Fermilab's program.**
- **Different beam species with different bunch intensities and rf structures need to be reliably accelerated.**
- **Providing beam for NuMI requires higher beam intensity and power.**
- **The BPM upgrade is essential to the current and future MI operation.**