

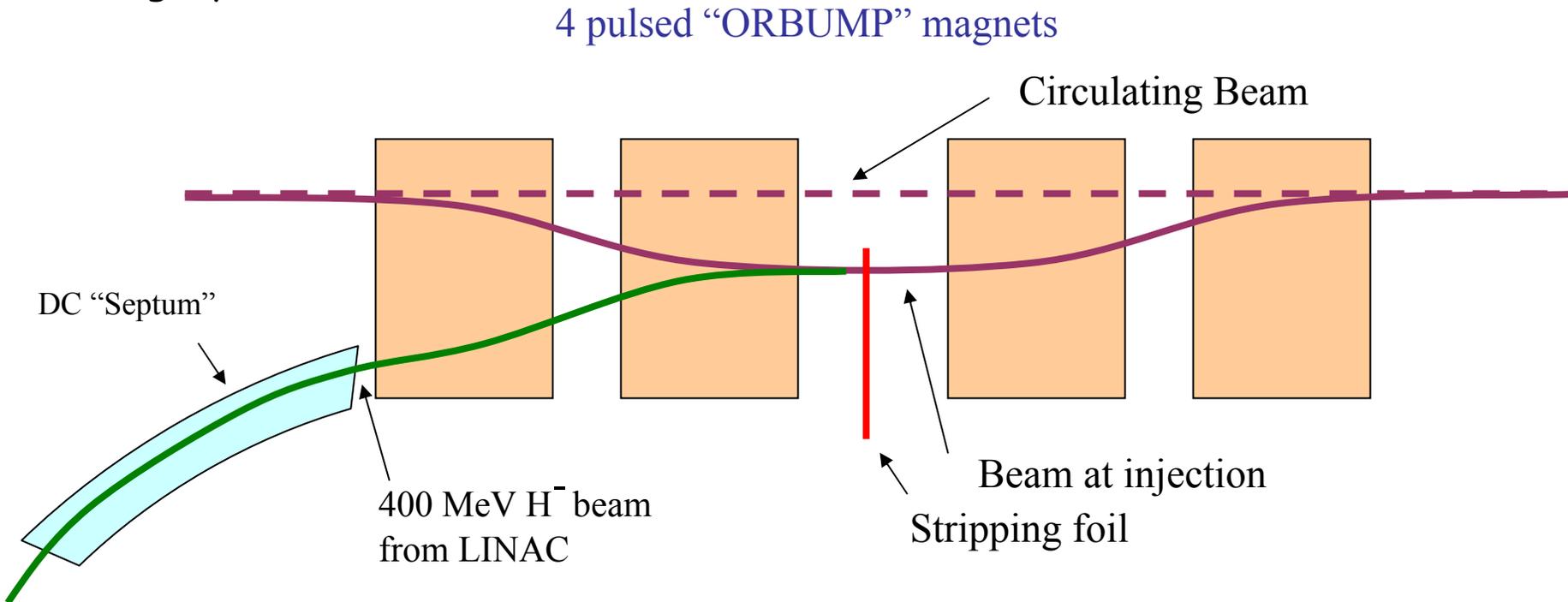
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# New Booster Injection Scheme

Eric Prebys  
(for Milorad Popovic)

# Multi-turn Ion Injection

Existing System:



- At injection, the 40 mA Linac  $H^-$  beam is injected into the Booster over several "turns" (1 turn  $\sim 5E11$ ).
- The orbit is "bumped" out, so that both the injected beam and the circulating beam pass through a stripping foil, after which they circulate together.

# ORBUMP Problems

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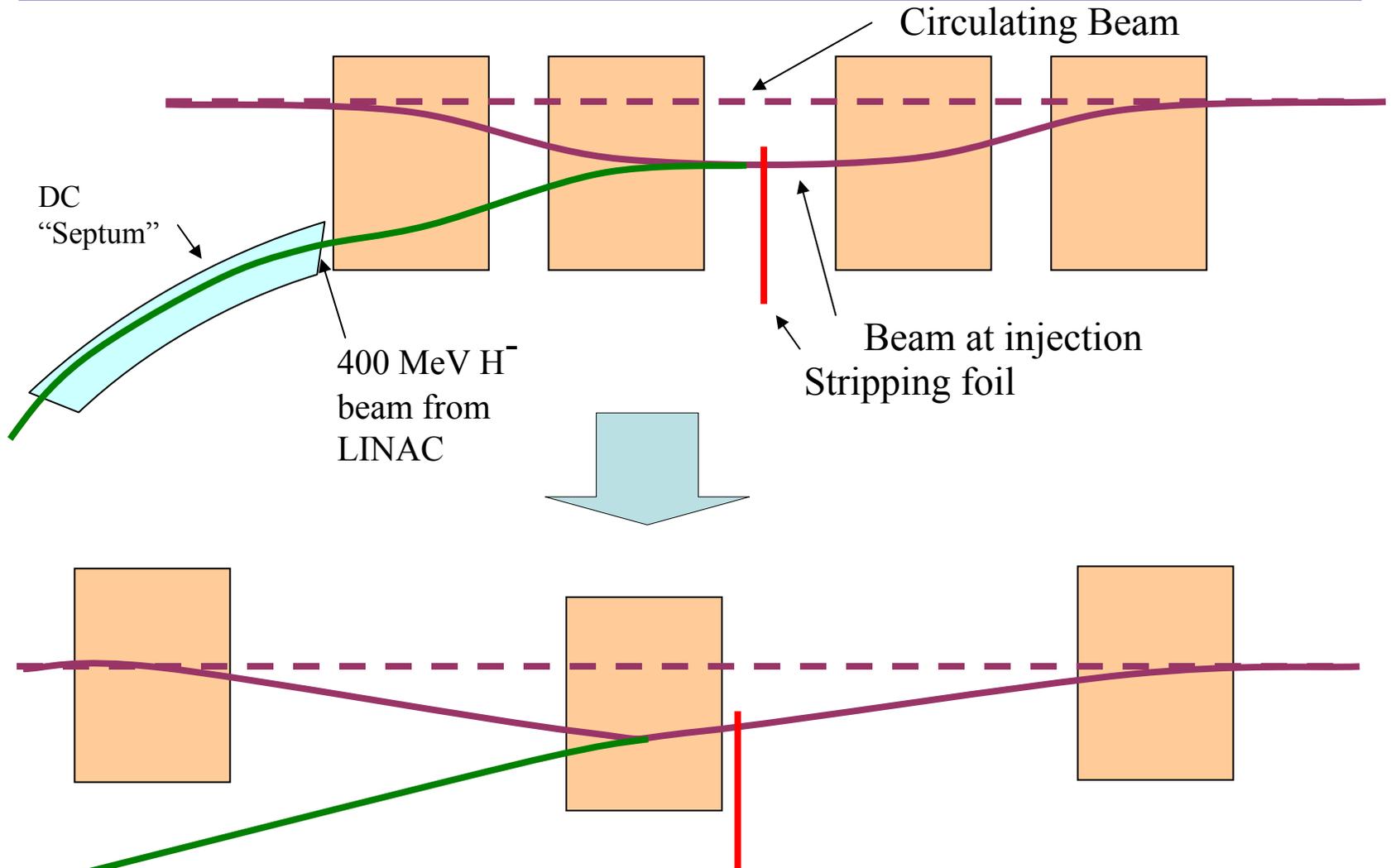
- High rep. rate heating problems
  - Operates instantaneously at 15 Hz, but...
  - Magnets not cooled
    - Will overheat after sustained high rate running
  - Power supply not designed for high rate running
    - Partially improved by water flow improvements and new capacitors
  - Currently limit average rep. rate to ~7.5 Hz, including conditioning prepulses.
- Not powerful enough
  - Not able to bump circulating beam out far enough to properly match injected beam
  - -> ~1 cm of beam motion at injection
  - -> significant losses
- Edge focus effects
  - Strong horizontal bend results in vertical focusing
  - -> vertical lattice distortion.
- Current path not optimum
  - Existing stripline configuration very sensitive to impedance mismatches.

## Baseline solution (Proton Plan 1.2.2)

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- New magnets:
  - Replace laminated magnets with drop-in replacements based on ferrite
  - Cooled stripline and conductor
  - Capable of sustained operation at 15 Hz w/o overheating
- New power supply:
  - Properly spec'ed capacitors and switch network
  - Modern charging supply
  - Also capable of 15Hz operation.
- Combination powerful enough for proper injection matching.
- On track for installation in 2005 shutdown.
  - Build new girder, test and install as a unit (existing girder too hot to work on).

# New Injection Scheme (Milorad Popovic)

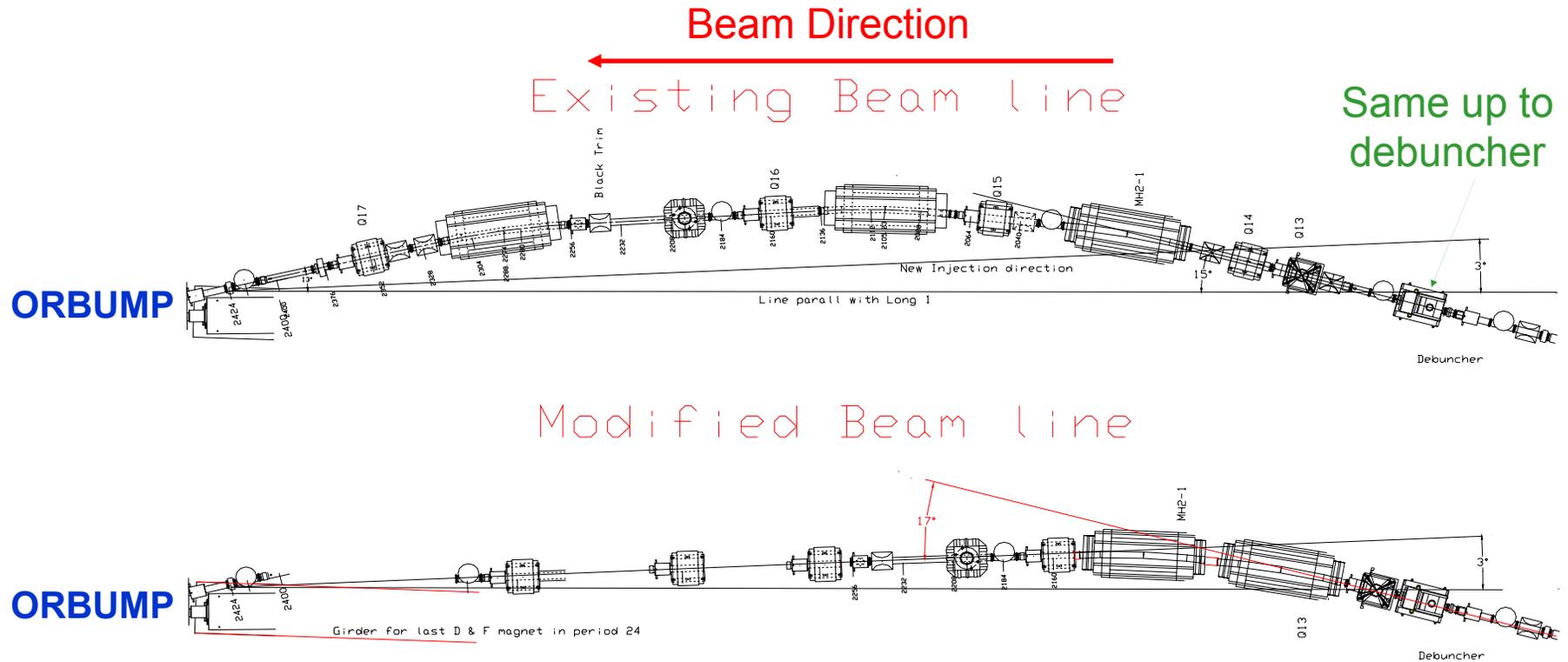


# Advantages

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- Eliminates DCSEP:
  - Historical aperture restriction
  - Hysteresis problems
  - VERY hot
- Less magnets:
  - Now have a full complement of spares (making six).
- Lower power
  - 50% lower current
  - 25% lower voltage
- Reduced edge focusing:
  - ~35% of original effect

# Consequences for 400 MeV line



- No new beamline elements
  - DCSEP and one HBEND removed
  - Remaining elements rearranged
- Minimal stand fabrication

# Implications for Plan

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- ORBUMP project not significantly effected
  - Only need three magnets -> now we'll have three spares
  - Girder and stripline were not yet designed anyway
    - New design simpler
  - Trivial mods to PFN in power supply
- 400 MeV line project new
  - Optical model looks OK
    - Working on beam sheet (F. Garcia)
  - Working with mechanical support for details of line rearrangement (Rob Reilly)
    - One new stand
    - Misc. vacuum parts
    - Had to remove many elements anyway to install new ORBUMP girder