Rapid Accumulator to Recycler Transfers Update

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AD/Pbar source
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Frequent Antiproton Transfers

- Introduction
- Progress report
  - Facets
  - Speed
  - Efficiency
- Summary
Frequent Antiproton Transfers - Introduction

- Run II Upgrade project
- Motivation for speeding process
  - Increased stacking rates only possible by not building a core - empty the Accumulator when it 'fills up'
  - Maintain as high an average stacking rate as possible - minimal impact on stacking
- Expected set-up time - ultimate goal
  - move from shot set up to transfer when full
  - actually, automated transfers as they occur on event now
  - Unstack/transfer time now ~30 seconds, driven by time to adiabatically bunch, accelerate, and extract pbars from the Accumulator
Frequent Antiproton Transfers - Introduction

- Requirements
  - **Time**
    - Empty stack every 30 minutes
    - Transfers of order one minute
  - **Stack size**
    - 40 X 10^{10} or less
  - **Emittances**
    - Transverse: 10\pi mm-mrad (95% normalized)
    - Longitudinal: 10 eV-s
    - Up to 50% dilution allowable
Intermediate Goals (since early April)
- 15-minute transfers
- High & Consistent Efficiency
- No reverse proton tune up

Tradeoffs
- Speed
- Efficiency
- Emittances
- Stack size
Frequent Antiproton Transfers - Current State

43:22 ‘normal’ amount of time vs. 57:55 in early April

20:36 to load pbars (3 minutes/transfer 7 transfers/episode)
Ready to transfer after 17:40 from stacking stop
Frequent Antiproton Transfers - Current State

Rapid Transfer Efficiency

- Accum to MI
- Accum to RR

Shot #

Rapid Transfer Update - AEM
Frequent Antiproton Transfers - Current State

Rapid Transfer Efficiency vs. Stack Size

- Accum to MI
- Accum to RR

Rapid Transfer Update - AEM
**Frequent Antiproton Transfers - Current State**

- **Changes to date**
  - MI orbit smoothing/tuneup (SY120 off) before stacking is stopped
  - MI to Accumulator tuneup only when efficiency drops
    - Sample and save Beamline orbit on every set up
    - ~ 1 tuneup/week
  - Sequencer optimization
    - See above
    - Remove unnecessary or redundant steps
    - Fewer checks
    - Stack sooner
    - More work to do
  - NuMI running during set up
Frequent Antiproton Transfers - Current State

Ongoing work

- **Current Focus on efficiency rather than speed**
  - Collect MI extraction position data for reverse protons
    - Looks okay
  - P1 - AP3 orbit data
  - SEM grids
    - Difference between reverse protons and pbars?
Frequent Antiproton Transfers - Current State

- Identical beam line settings restored
- Set-ups 1 week apart
- Consistent cusps?
Frequent Antiproton Transfers - Current State

- **Ongoing work**
  - **Next steps/tools**
    - Beam line BPM upgrade
    - MI injection damper
    - Ramp AP1 power supplies
Frequent Antiproton Transfers - Diagnostics

- Beam line BPM upgrade status
  - Assembly and procurement largely complete
  - Front end software complete
  - Application software in progress
  - First system installed at F23 for AP1
    - Timing and system shakedown in progress
    - Test data with beam being gathered at 53 MHz and 2.5 MHz
    - 3 BPM's/plane instrumented
  - Complete later this summer
Frequent Antiproton Transfers - Summary

- Greater focus on faster and more efficient Accumulator to Recycler transfers
- Transfers are faster, but not yet 15 minutes
  - Stack size/# of transfers
  - No Reverse Proton tuning
- Working to understand source(s) of drift in efficiency
- More tools under development