Slip stacking Operation and Future Plan

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Effect of slip stacking on proton on target
Effect of slip stacking on stack rate

With slip stacking

With normal stacking
Outline

• Status of slip stacking operation

• Issues
  – Emittance from Booster
  – Balancer circuit for bunch rotation

• Future plans
Slip stacking process in phase space
Mountain range plot at injection
Our goal for pbar stacking

- Intensity: $8 \times 10^{12}$ [ppp] (particle per pulse)
- Bunch length at extraction: < 1.5 nsec
- Time of slip stacking process: 200msec (<3 Booster cycles)
Intensity on stacking cycle

- Intensity @ ext.: 7.5E12

~6% beam loss

Beam intensity

Momentum

8.0E12 @ inj.
7.5E12 @ ext.
WCM signal and bunch length at extraction

- Bunch length @ ext.: ~1.8 nsec
Intensity on Pbar target

- Intensity on Pbar target: 7.0E12

Beam on target

Beam in MI

7.0E12 on target

7.5E12 @ MI ext.
Operation condition on stacking cycle

Beam at MI ext. 7.0E12

Beam on target

Beam to abort

One week
Status

• Intensity: 7.5E12 ( @ MI ext.)
  – Intensity @ inj.: 8.0E12
  – Intensity on Pbar target: 7.0E12
  – Intensity to abort line: 0.5E12

• Bunch length @ ext.: 1.8 nsec

• Time of slip stacking process: 184 msec
Wall current monitor at extraction

300mV/div

10mV/div

82 bunches to target
WCM signal After extraction kicker fired

• Beam to MI abort line
WCM signal at injection

- Beam starts leaking at injection
WCM signal at injection with and w/o bunch rotation

- Tuned up balancer in Booster for bunch rotation

**before tuning balancer**

**after tuning balancer**
Bunch rotation at Booster extraction

- Vrf @ Booster ext. : 400kV ↔ Vrf @ MI inj. : 90kV

Δp/p: 0.0015 → 0.00082
Bunch rotation study with low intensity
Beam emittance vs Intensity from Booster

- w/o bunch rotation
- two times bigger since shutdown
Beam emittance on MI rf bucket

MI rf bucket (90kV)

Beam emittance (Intensity @ 4E12)
Future plan

• To fix un-captured beam at injection
  – Emittance from Booster
  – Balancer circuit for bunch rotation

• Increase intensity to 8E12 on TARGET