

Half-Integer Tevatron Working Point

A. Valishev FNAL

January 14 2010 Tevatron Accelerator Studies Workshop, FNAL



Outline

- Motivation and prior developments
- Possible studies
- Summary



Present Working Point



At the present w.p. the available tune space is 3/5-7/12=0.017Beam-beam tune shifts are $\xi a=0.025 \ \xi p=0.02$



Working Point Near 2/3





Stage 1: Change WP

• First, perform studies to evaluate new WP:

 determine stopband width of 2/3 resonance wrt 3/5 at 150 GeV, may be at LB (1-2 shifts)

• compare emittance growth rates at 150 GeV at <3/5 and <2/3 (1 shift)

• check stability of highest possible bunch intensity at 150 and 980 (1x0, 36x0) - to confirm that either octupoles or dampers can handle what MI can provide now (320-330e9 at 150 GeV) (1-2 shifts)

Commission new feeddown tune correction schemes (0.5-1 shift)

Then, change the tunes all the way from 150 to LB

- on C.O and helices
- tune and coupling and chromaticity adjustments
- parsing the squeeze
- altogether ~4-6 shifts
- operation @ new WP with present N_p, adjust knobs (1-2 mos)
- at the end may gain 5-10% in Integrated luminosity
- When? Sep'04-Jan'05; no hit on luminosity integral



July 2005 Studies of 2/3 w.p. at 150 GeV



Stopband width 0.019, 0.011

Stopband width 0.013, 0.016



Investigation of the 2/3 Resonance

Y. Alexahin et al., WEPCH096, EPAC'06



Conclusion: resonance mainly driven by S6 feeddown sextupoles. Using S6A0 it is possible to reduce the RDT

1/14/2010



Motivation for Half-Integer w.p.



- 1. Tune space increase (50%)
- 2. Reduction of beam-beam tune shift for the same ξ (20%)



Beam-Beam Simulations



1/14/2010





Correction of Chromatic β -function







Effect of Chromatic β -function on Lumi Integral



- Commissioning of the new sextupole scheme was complicated and lengthy
- It was decided that potential gain in luminosity integral from increased initial luminosity over the remaining time in Run II can not substantiate a lengthy commissioning of the half-integer w.p.



Proposed End-of-Run II Study

- Attempt several high proton intensity stores at a w.p. near ½, aiming at record-high pbar beam-beam parameter above 0.03 (requires 3.5-4 10¹¹/bunch from MI) OR
- Increase proton beam-beam parameter beyond 0.03 by increasing antiproton intensity and/or disabling the transverse blowup system
- Work list
 - Develop beta-beating correction scheme for Injection, Squeeze and Collision lattices (reconnect Q39 ???)
 - Develop helix modifications (if necessary)
 - Develop feeddown configurations for all sequences
 - Tune-up injection, ramp and squeeze near $\frac{1}{2}$ estimate 2 weeks
 - Attempt 3-4 stores estimate 1 week
- Total of ~ 1 month, during which time the antiproton source must be operational
- No hardware modifications are foreseen (?Q39), much of preparatory work has been done