Tracking Requirements

Christoph Montag

RHIC Retreat, July 30 - August 2, 2010

Heavy ions

- Changed integer tunes by 3 units ("IBS suppression lattice") without tracking
- Implemented split-transition lattices with large β- and dispersion beats without tracking
- $\beta^* = 60\,\mathrm{cm}$ caused rebucketing problems in Run-10.
- Never even attempted tracking for low-energy running, though sextupole component in dipoles is huge
- Changed the polarity of half the SDs during low-energy running (no time for tracking anyway)

Protons

- Tracking led to working point change from .22 to .68
- Extensive tracking for near-integer working point showed improved dynamic aperture, but did not reveal 10 Hz background problems
- Tracking for $\beta^* = 70$ cm showed DA reduction from 4.5σ at $\beta^* = 90$ cm to 3.5σ at $\beta^* = 70$ cm
- Poor luminosity lifetime at $\beta^* = 70$ cm provided some sort of "calibration" - 4.5σ is sufficient, 3.5σ is not
- Beam-beam plus triplet errors causes trouble at small β^*

Spin

- 4-D orbit tracking only, plus spin
- Some tracking with fixed dp/p (no synchrotron oscillations)
- No orbit distortions, BPM errors, etc. - at least not in recent years
- Large width of 7/10 resonance beyond 100 GeV was totally unexpected in Run-9

Our strategy in the past

- Performed extensive DA tracking for every change to the proton lattice.
- Never tracked for heavy ions - "they're not at the beam-beam limit".
- Not much spin tracking at all.
- Tracking requests driven by the Run Coordinator (plus Wolfram and Thomas).

What can be done better?

- Dynamic aperture is only a relative measure. Need better tools.
- Lifetime tracking instead of DA (Yun). Extremely challenging, but TEVATRON was successful.
- 6-D tracking for spin, including scans of closed orbit distortions, chromaticity, emittance, etc.
- Tracking needs to be integral part of lattice development.
- We need better guidelines as to when tracking is required.