

RHIC Retreat 2002 Performance Session Summary

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- Linear lattice, optics matching
- Coupling, working point
- Chromaticity, snapback, transverse emittance
- Beta squeeze, triplet correction/performance
- 110 bunches, beam-beam/ramping, e- cloud
- Au transition crossing, triplet vibration
- Impedances and instabilities, single-bunch I_{max}
- Electron Cloud and related instabilities
- Backgrounds, collimation, gap cleaning
- Abort performance and issues
- AGS polarization efficiency/plans
- RHIC polarization transmission, issues
- d/Au performance issues

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✓ *All talks are on the web, and “experts” are listed above*

Optics, Coupling, Chromaticity

- **Linear Optics**

- *High- β optics good ($\approx 10\%$), low- β objects considerably worse ($> 50\%$)*
- ✗ *Little time was spent in systematic, careful optics evaluation*
- **To Do:** *Develop/improve tools for online optics analysis/correction*
- **To Do:** *Carefully study IP optics to match beam sizes during collisions*

- **Coupling and Working Point**

- *Typically decoupling ΔQ_{\min} achieved was 0.01 (crude) to 0.003 (fine)*
- *Local decoupling performed in several IRs*
- **To Do:** *Routine operations decoupling, develop new decoupling methods*
- **To Do:** *Canned flattop coupling compensation of experiment magnets*
- **To Do:** *Scan working point, investigate pp tunes below 0.2 tune box*

- **Chromaticity**

- ✗ *Chromaticity measured often, but not systematically or reproducibly*
- *Initial ramp results with PLL/radial modulation*
- **To Do:** *Produce routine reproducible chromaticity measurements*

Au Transition, Triplets

- **Transition**

- *After octupoles and instabilities, commissioning never completed*
- *Typical losses of a few percent of beam, but always losses*
- **To Do:** *Complete system commissioning: timing, RF, control*
- **To Do:** *Develop tomography, tools to evaluate/fix quad instability*
- **To Do:** *Develop chromaticity jump along with transition jump*

- **Triplet Vibration and Nonlinearities**

- *Horizontal vibration in both rings is 9-13 Hz, 0.05-0.1 σ_{beam}*
- *IP8/2 triplets required large amounts of local coupling correction*
- *Yellow lifetime degraded substantially in $\beta^* = 1\text{m}$ optics*
- **To Do:** *IR8/2 triplet coupling/nonlinear compensations required*

- **112 Bunches, Beam-Beam**

- *All-ferrite injection kicker performance good, no failures*
- *Kicker rise time marginal for 112 bunch operation*
- *Pressure rise is limiting effect for Au operation*
- **To Do:** *Synchronize RF up ramp, avoid modulated beam-beam*

Instabilities and Impedances

- **Pressure Rise / Electron Cloud**

- *Worse with shorter bunch spacing, very sensitive to total intensity*
- *Always in warm field-free regions, exacerbated by beam losses*
- *Some limited data on bunch train tune shift: $\Delta Q = 2.5 \times 10^{-3}$*
- *Induced incoherent tune spread may offset others, limit damping*
- **To Do:** *Install e^- detector, solenoids in some baked warm straights*
- **To Do:** *Collect high-precision tune shift/vac data for 112 bunches*

- **Impedances**

- *Longitudinal impedance measured at Au injection within factor of 2*
- *Possible explanations for soliton-like proton bunch behavior*
- *Wakefields and space charge are important to consider*
- *Measured impedances are larger than expected; too low for instability*
- **To Do:** *Fast instability: BPM sum/diff mountain range at transition*

Backgrounds, Gap Cleaning, Abort

- **Background**

- *Scrapers neither good nor bad for background, but helped cleaning*
- *Incidents of high backgrounds in STAR/PHENIX*
- *STAR very sensitive to scraper/crystal positioning in pp run*
- **To Do:** *More experiment signals to MCR for background cleaning*
- **To Do:** *Start collimation early and use often; 2nd set of collimators?*

- **Gap Cleaning**

- *Gap cleaning sometimes worked well, sometimes did not (experts)*
- *Scans of frequencies in gap cleaning were nonreproducible*
- **To Do:** *Gap cleaning application, automated freq/timing sweeps*

- **Abort**

- *Some single-module pretriggers were very significant (PHOBOS)*
- *Timing shifted by 2 bunches 4 months after original setup*
- *Concern about health of absorber; loss monitors good diagnostic*
- **To Do:** *Develop backup trigger system in ring, cleaner pretrigger trips*
- **To Do:** *Run/test system for 2 months before run*

Deuteron-Gold, Polarization

- **Deuteron-Gold Issues**

- *Require efficient switchovers from Tandem MP6 to MP7, injectors*
- *Inject at same $B\rho$; store at same RF frequency for cogging*
- *Switching rings (d/Au vs Au/d) is nontrivial*
- *Orbit angled through RF cavities, IP; DX/D0 aperture issues*
- *Experiments: crossing not parallel with detector midplane*
- **To Do:** *Too much to list, e.g. RampEditor for 2 species*

- **AGS/Injector Polarization (more from Leif)**

- *Source polarization 70%, AGS extraction 20-30%*
- *Causes: slower ramp rate, weak partial snake, J10 jitter*
- *Polarization measurements very slow (30 min) \Rightarrow slow improvement*
- **To Do:** *CNI polarimeter, user-switchable AC dipole/snake*