



APEX Status and Plan

Phil's Meeting, Feb 28, 2012

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Current APEX Status

APEX

- One 16-hour session on Feb 22
 - High Intensity beam study: 8 hours
 - Beam-beam: 2 hours
 - IP transfer matrix: 1 hour

- One 16-hour session on March 7
 - High intensity beam study: 11 hours
 - Beam-beam: 2 hours
 - IP trans matrix + spin flipper: 2hours

Polarized proton limits and upgrades

APEX

- New source with 10x intensity and higher polarization
- Electron lenses to partially compensate head-on beam-beam effect
- Use both to increase bunch intensity N_b from 1.65 up to 3.0×10^{11}
- Reduce β^* to 0.5 m (from 0.6 m)
- Possibly new working point(s)
- Develop polarized ^3He capabilities

From W. Fischer's presentation at APEX workshop 2011:

<https://indico.bnl.gov/contributionDisplay.py?sessionId=0&contribId=1&confId=446>

Current PP Challenges

APEX

- Polarization lifetime at store
 - 100 GeV polarization lifetime: ~ 1%/hour
 - 250 GeV polarization lifetime:
 - 255 GeV may mitigate the problem
 - Poor polarization lifetime in Yellow when its working point was placed at (0.74, 0.73)

02-24	16462	0.0443 +- 0.0028	0.5481 +- 0.0647	0.0369 +- 0.0031	0.6777 +- 0.0714
02-24	16463	0.0432 +- 0.0014	0.4545 +- 0.0324	0.0457 +- 0.0014	0.5683 +- 0.0324
02-25	16464	0.0476 +- 0.0031	0.3231 +- 0.0730	0.0413 +- 0.0026	0.7406 +- 0.0599
02-25	16465	0.0467 +- 0.0015	0.4605 +- 0.0359	0.0406 +- 0.0016	0.6030 +- 0.0379

- This confirmed the observation from RUN2004, which indicates
 - It could be due to the coupling since Q_x is closer to 0.75, snk resonance
 - Q_y of core particles too low, ~0.715 with beam-beam in consideration
 - This can be found out if we have a store with local coupling corrected and Q_x and Q_y swapped
 - Needs 8 hours to measure the average polarization over store with Jet

Current PP Challenges

APEX

- Polarization loss from 100 GeV to 250 GeV
 - Current proposed APEX studies
 - Impact of orbital harmonics:
 - 6 hours requested beam time
 - Polarization Loss Crossing 411-NU resonance in RHIC:
 - 2 sessions of 8 hours beam time
 - Polarimeter performance with special targets
 - 2 hours beam time
 - Measure polarization profile at $G_{\text{gamma}}=462.5$
 - 2 sessions of 4 hours beam time

Propose

APEX

- During pp 250 GeV run
 - Restore 12-hour weekly APEX studies to focus on
 - Polarization
 - some polarization studies can be parasitic to physics data taking.
 - Beam-beam
 - Benefit the current run
 - Elens commissioning in RUN13
 - Shorten APEX during heavy ion run
 - ~3 heavy ion related beam studies among a total of 17 current APEX proposals

Challenges for Future Performance

APEX

- Polarization, polarization, polarization
 - 100% polarization transmission efficiency of ramp to 250 GeV
 - Deep understanding of depolarizing mechanism
 - Is it due to the snake resonances driving by expected strong intrinsic resonances? If so, what's the tolerance on various beam/machine parameters?
 - » Orbit, beam emittance, local coupling
 - Is it due to high order resonances?
 - > 100 hours polarization lifetime at store
 - better monitoring/controlling of the local orbit at spin rotators
 - Is the store energy optimized?
 - contribution of spin tune spread
 - Can we reduce difference between D' at the two snakes?
 - Polarimetry, polarimetry!
 - Reliable, fast (hopefully one day, dream can come true 😊)

Challenges for Future Performance

APEX

- Luminosity, luminosity, luminosity!
 - Peak luminosity
 - For pp, this is limited by beam-beam
 - smaller emittance through the whole chain
 - Further beta* squeeze: can we use ATS technique?
 - Elens
 - For Au,
 - available momentum aperture
 - Further beta* squeeze
 - Emittance growth during the ramp
 - Average luminosity
 - Machine reliability
 - Dynamic beta* squeeze for ions