

# 15 GeV Low Energy Run

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## Beam Energy

- With  $\gamma_t = 8.5$  in the AGS, 7.5 GeV gold beams would have to be extracted very close to transition - at  $\gamma = 8.05$
- Short bunch length and large  $\Delta p/p$  near transition make longitudinal matching into RHIC very difficult
- Slightly lowering the beam energy to 7.3 GeV ( $\gamma = 7.84$ ) allows longitudinal matching with 93 kV in the AGS and 400 kV in RHIC (M. Blaskiewicz).
- This is the lowest energy that can be reached without changing the harmonic number in RHIC

## Space Charge

Space charge tune shift:

$$\Delta Q_{\text{sc}} = -\frac{Z^2 r_p}{A} \frac{N}{4\pi\beta\gamma^2\epsilon_N} \frac{C}{\sqrt{2\pi}\sigma_s}$$

Assuming RMS emittance  $\epsilon_N = 2.5 \text{ mm mrad}$  and  $\sigma_s = 2 \text{ m}$ , the tune shift limit of  $\Delta Q_{\text{sc}} = -0.05$  corresponds to

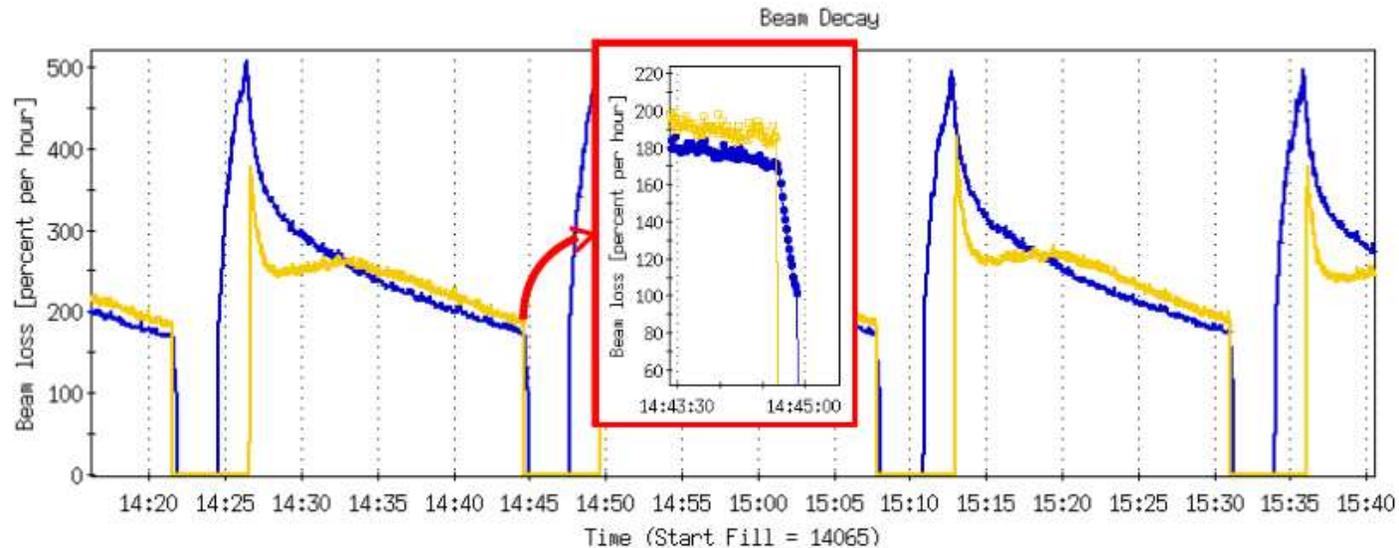
$$N = 2.6 \cdot 10^9$$

Space charge itself is not an issue

With  $N = 1 \cdot 10^9$  Au/bunch and  $\beta^* = 3.5 \text{ m}$  we can expect a peak luminosity of

$$L = 8 \cdot 10^{24} \text{ cm}^{-2} \text{ sec}^{-1}$$

## Beam-beam



In previous low energy runs, beam-beam had a strong effect on beam lifetime though  $\xi_{\text{beam-beam}} \ll \Delta Q_{\text{sc}}$

This beam-beam effect is reduced at near-integer working point, as demonstrated in APEX experiment

## Parameters

beam energy	7.3 GeV
harmonic number	360
$U_{\text{AGS}}$	93 kV
$U_{28\text{ MHz}}$	400 kV
normalized emittance	2.5 mm mrad
rms bunch length	2 m
Space charge tune shift	-0.02
Bunch intensity	$1 \cdot 10^9$
Beam-beam tune shift	-0.003
IBS rates (transv./long.)	3570 sec/1670 sec
$\beta^*$	3.5 m
Peak luminosity	$8 \cdot 10^{24} \text{ cm}^{-2} \text{ sec}^{-1}$

## The Start-Up

- Successful Dry Run two weeks ago, only few items remaining
- Start-up will be coordinated by Machine Specialists (Operations)
- 40 GeV test ramp during start-up to ensure ramping machinery (feedbacks, transition crossing,...) works

## Schedule

- 2/3 to 2/7: Cooldown
- 2/7 to 2/9: Setup at nominal injection energy in Blue
- 2/10: Yellow cold
- 2/10 to 2/12: Setup nominal injection in Yellow
- 2/12 to 2/13: Ramping 6 bunches to 40 GeV
- 2/14 to 2/15: Low energy setup (7.3 GeV)
- 2/16: Start of low energy physics run (3 weeks)

More detailed schedule in OpsWiki,

[http://cadops.bnl.gov/AGS/Operations/OpsWiki/index.php/RHIC\\_Setup:\\_Heavy\\_Ions](http://cadops.bnl.gov/AGS/Operations/OpsWiki/index.php/RHIC_Setup:_Heavy_Ions)

## Summary

- Had to lower beam energy from 7.5 to 7.3 GeV to allow proper longitudinal matching
- Space charge itself should not be an issue at this energy. However, beam-beam plus space charge may be
- Near-integer tunes may reduce beam-beam effect. On-line model has to allow us to get there
- Expect to be running for **Physics around February 16**

**Daily meetings at 8:30 in the LCR, starting February 3**