Updated RHIC Beam-beam compensation

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1. Simulation code
2. Results and the PHYSICS
3. Simulating current RHIC operation

Location of e-lenses

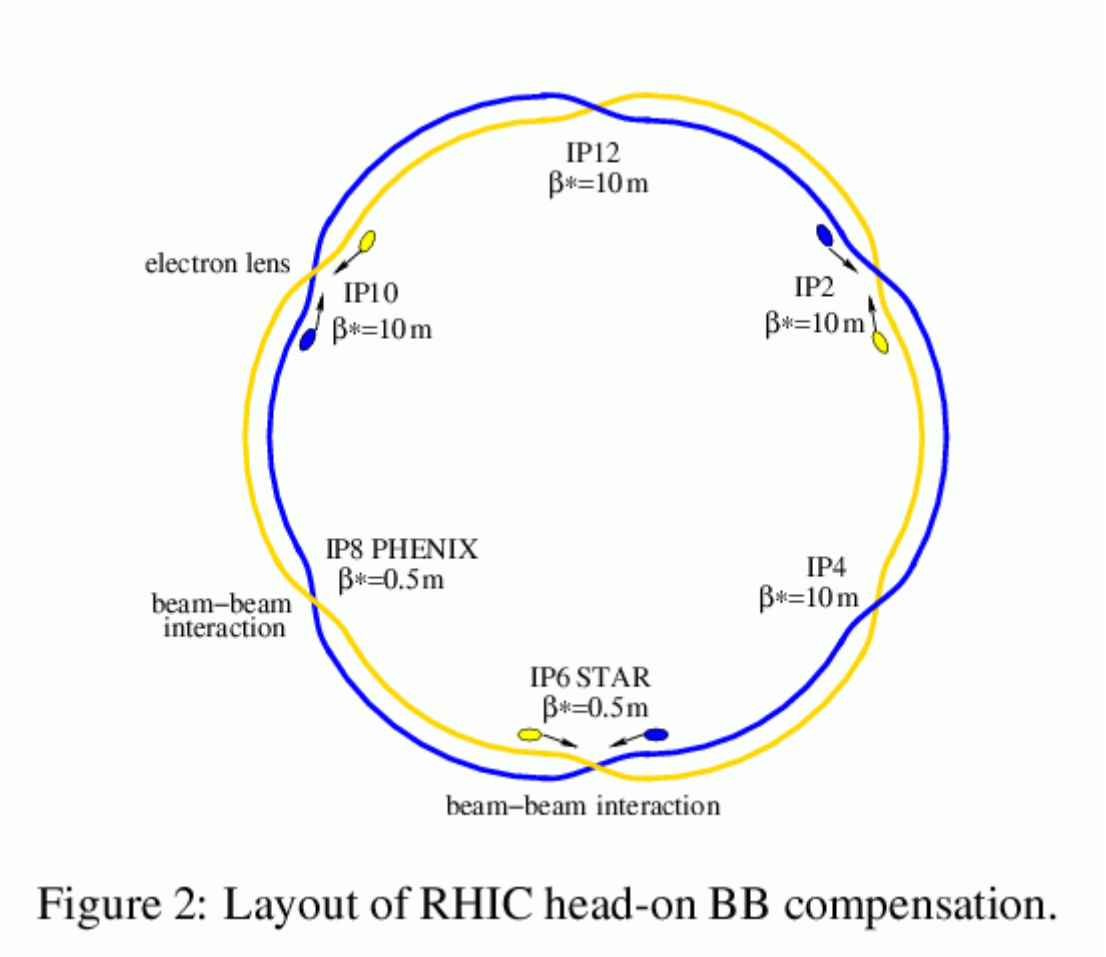


Figure 2: Layout of RHIC head-on BB compensation.

Phase advances: (IP6->IP8: 10.6pi, 8.6pi), (IP8->IP10:8.4pi, 10.9pi)

Simulation code

- modified SixTrack

- stability of single particle motion
  ->tune footprint
  ->frequency map analysis
  ->Lyaponuv exponent
  ->action diffusion
  ->dynamic aperture

- tracking a bunch of protons
  ->beam decay
  ->emittance change

The simulation code works very well for our purpose. It can include all known errors and noises. We are short of computing time.

Simulation Results

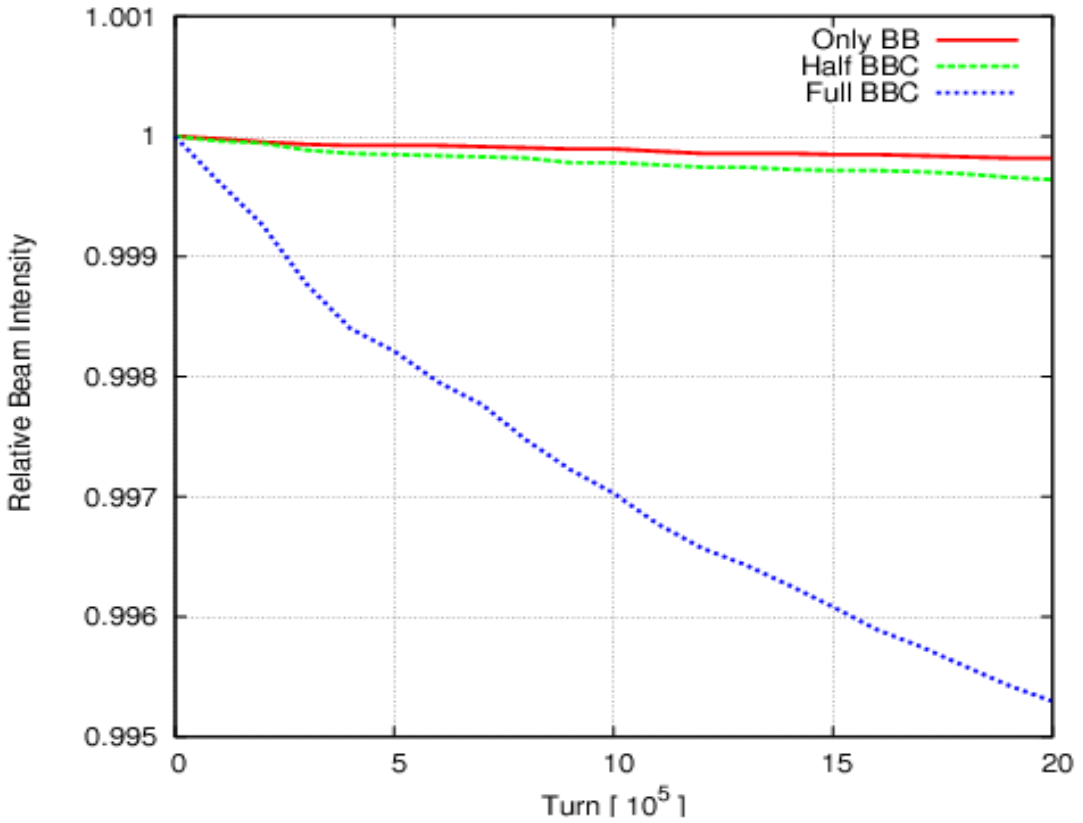


Figure 3: Simulated beam decay with BB compensation.

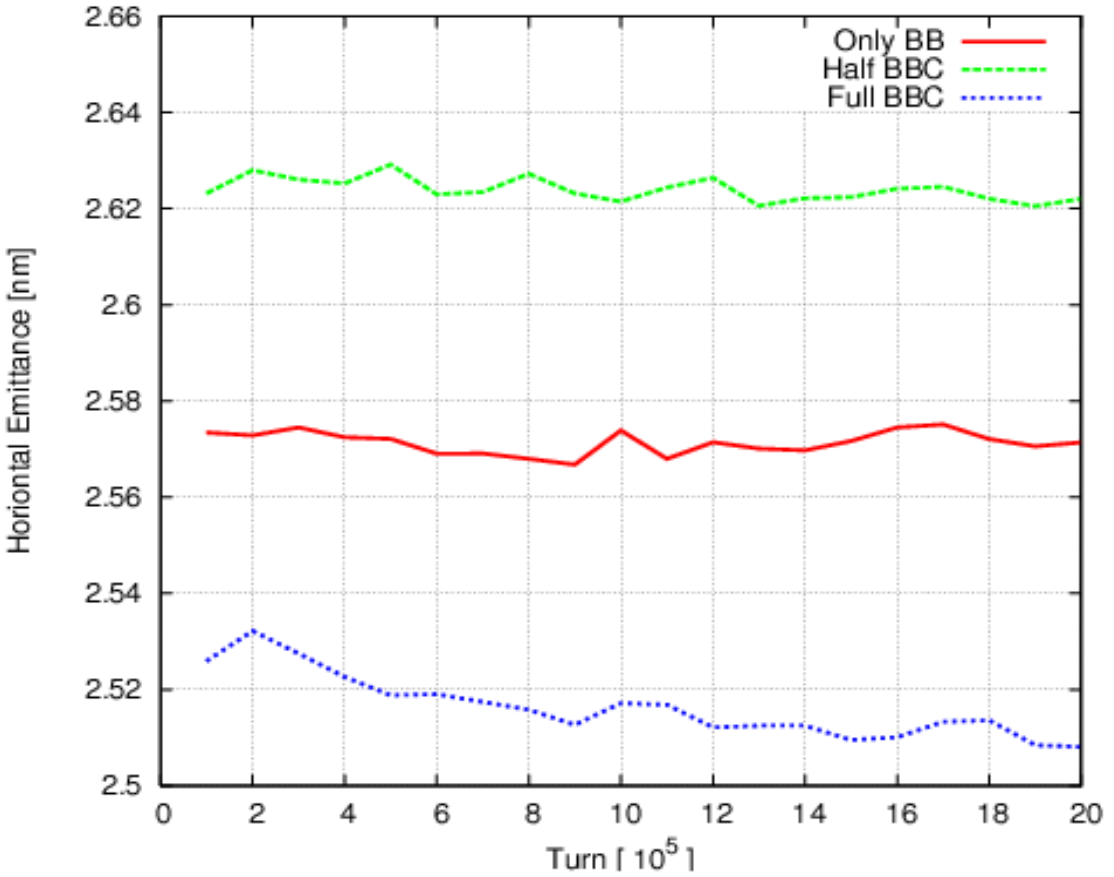
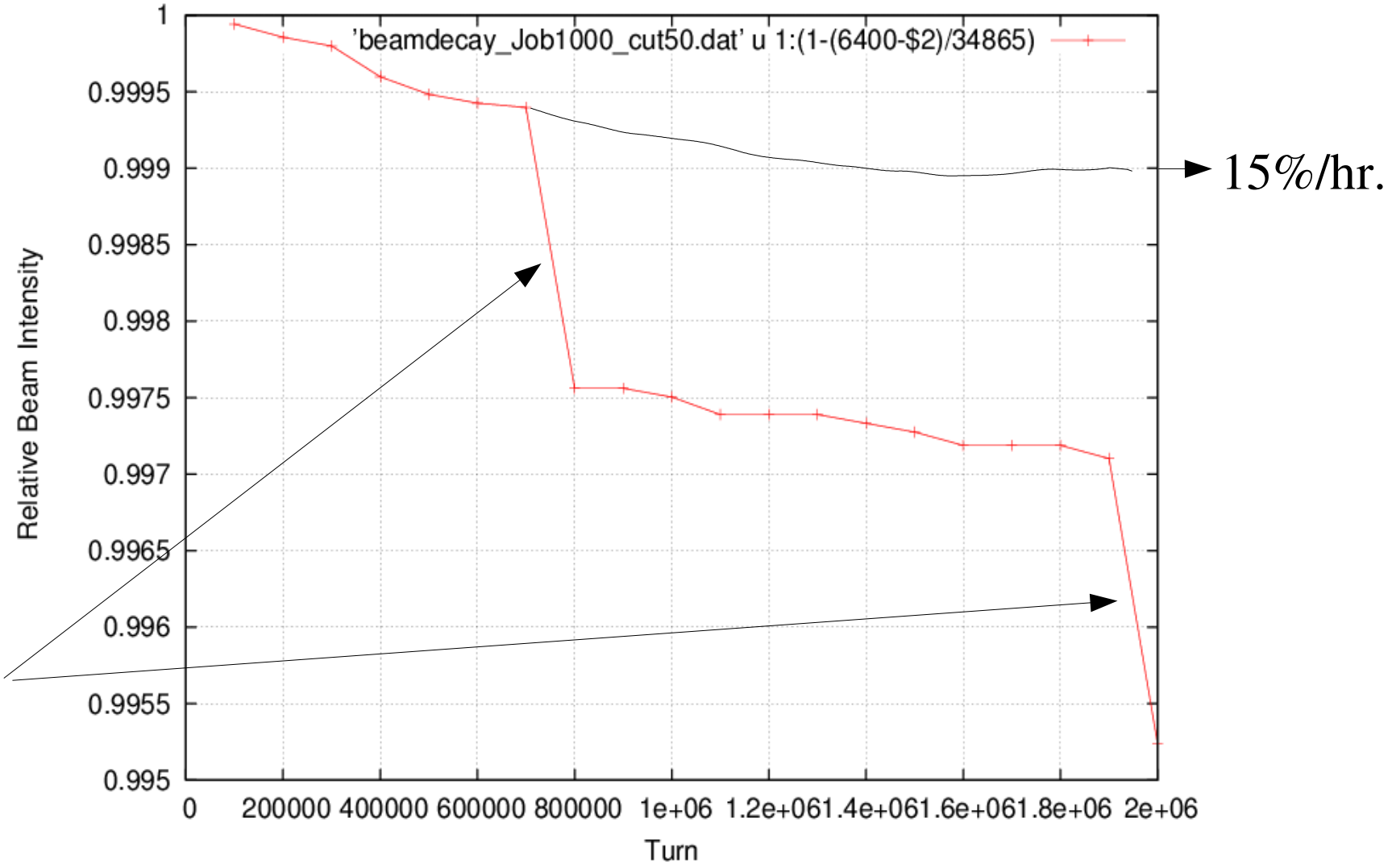


Figure 4: Simulated emittances with BB compensation.



tracking output data lost

artificial phase advances added between IP8->IP10: (9pi, 11pi)

Current Study (focus on PHYSICS)

Effect of phase advance between IPs

->does it help ?
->how much it help ?
->how sensitive it is ?

If phase advance adjustment doesn't help,

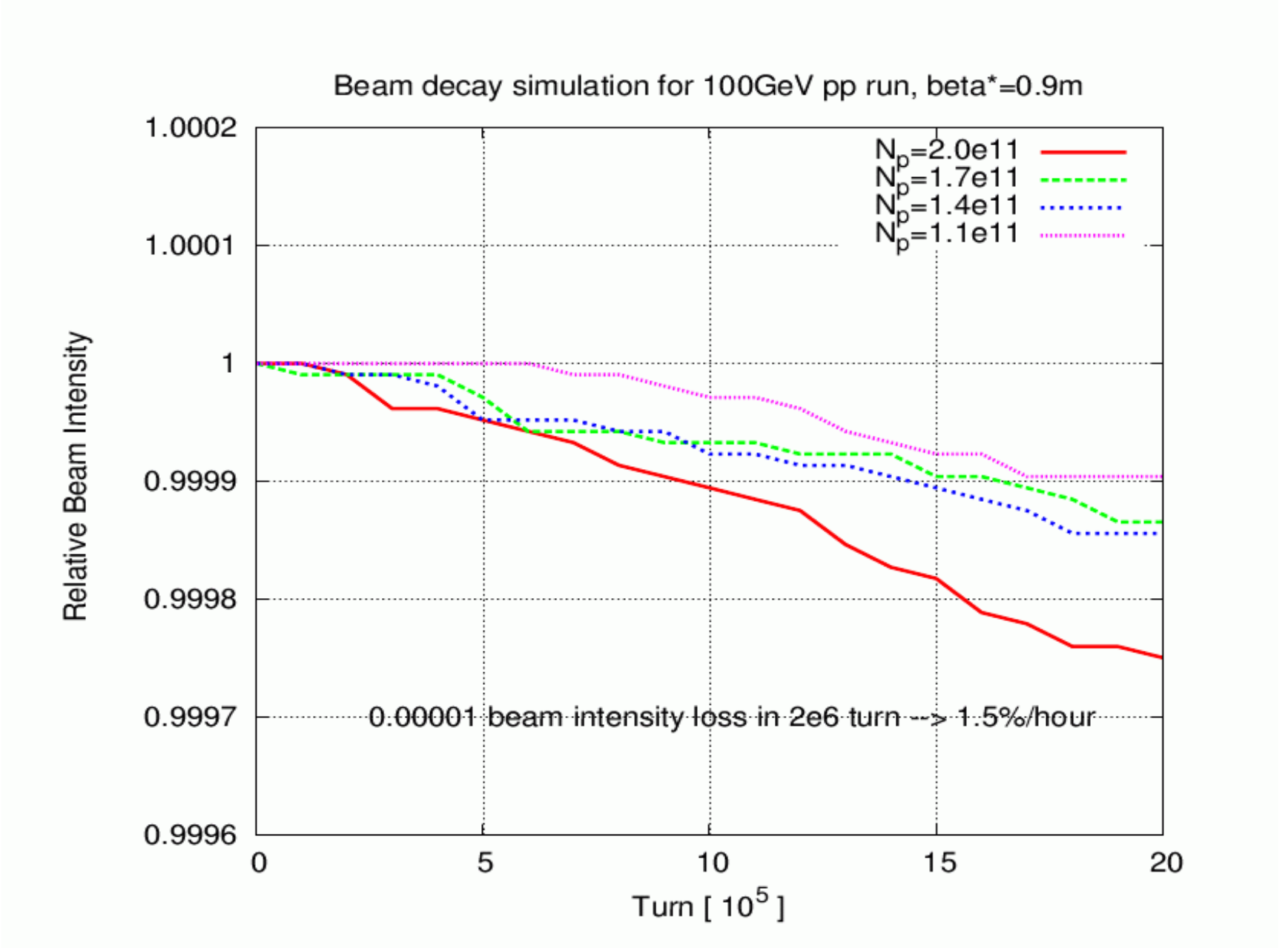
->what's the reason ?
->can overcome or not ?

Analytically, we are working on
beam-beam reason driving term calculation.

Summary

Electron lenses have been proposed for the head-on beam-beam compensation in the polarized proton run in the RHIC. Detailed simulation studies are being carried out to check its effects on the proton beam lifetime and emittance growth. Simulation shows that head-on beam-beam compensation is very efficient to reduce the beam-beam tune shift and tune spread. It will stabilize core particles in the proton bunch and destabilize the particles in the bunch tail in the current design. How to minimize the nonlinear effects from the head-on beam-beam compensation is being studied.

Simulate RHIC operation



can be extended to 1e7 turns, 2mins. of real time.