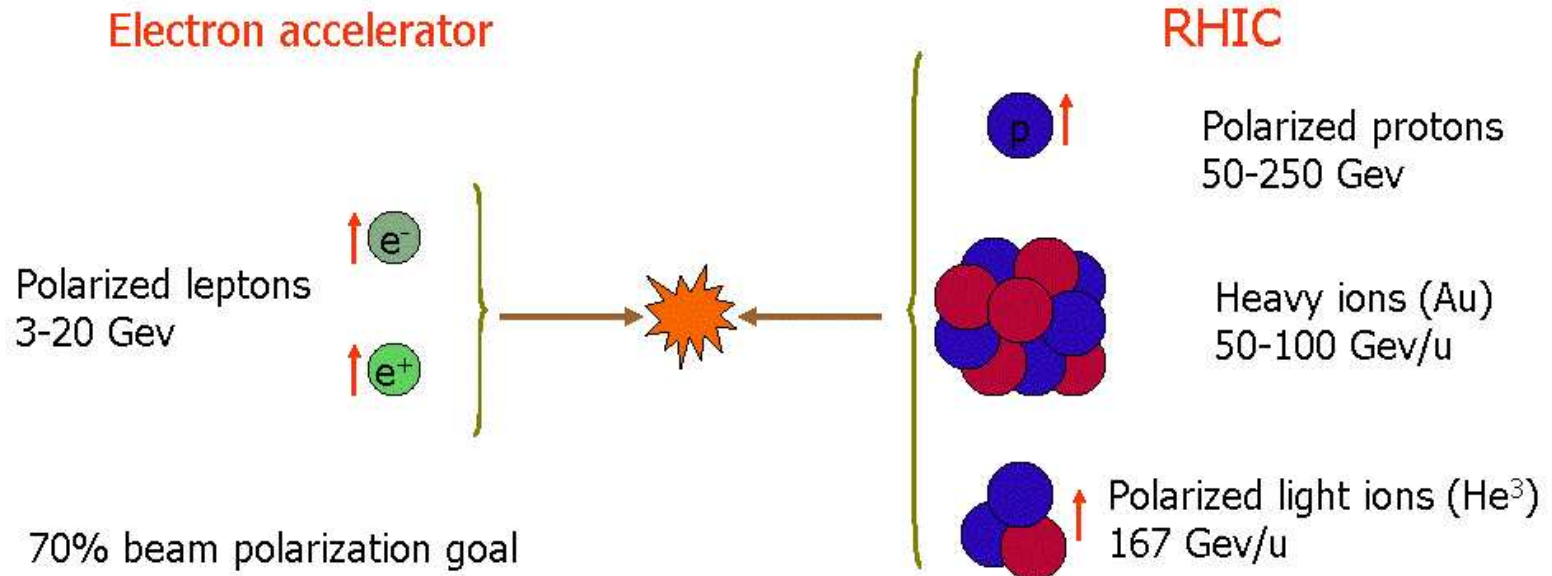


Status and design of eRHIC

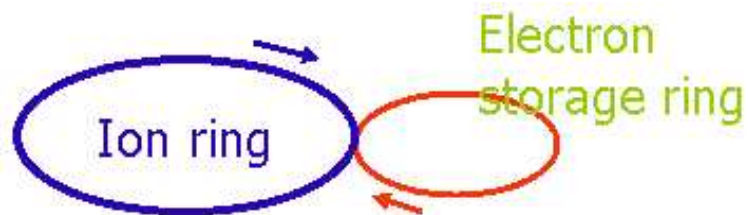
Christoph Montag, BNL

Workshop on Precision Electron Beam Polarimetry for the EIC
August 22-23, 2007

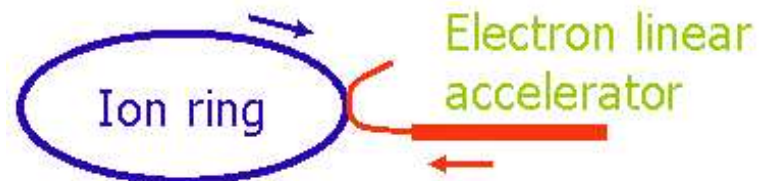
eRHIC scope



Basic design choice: ring-ring vs. linac-ring



- Advantages:
 1. e^+ as well as e^-
 2. e-ring can be self-polarizing
- Issues:
 1. beam-beam tunes shift
 2. limited ion energy range

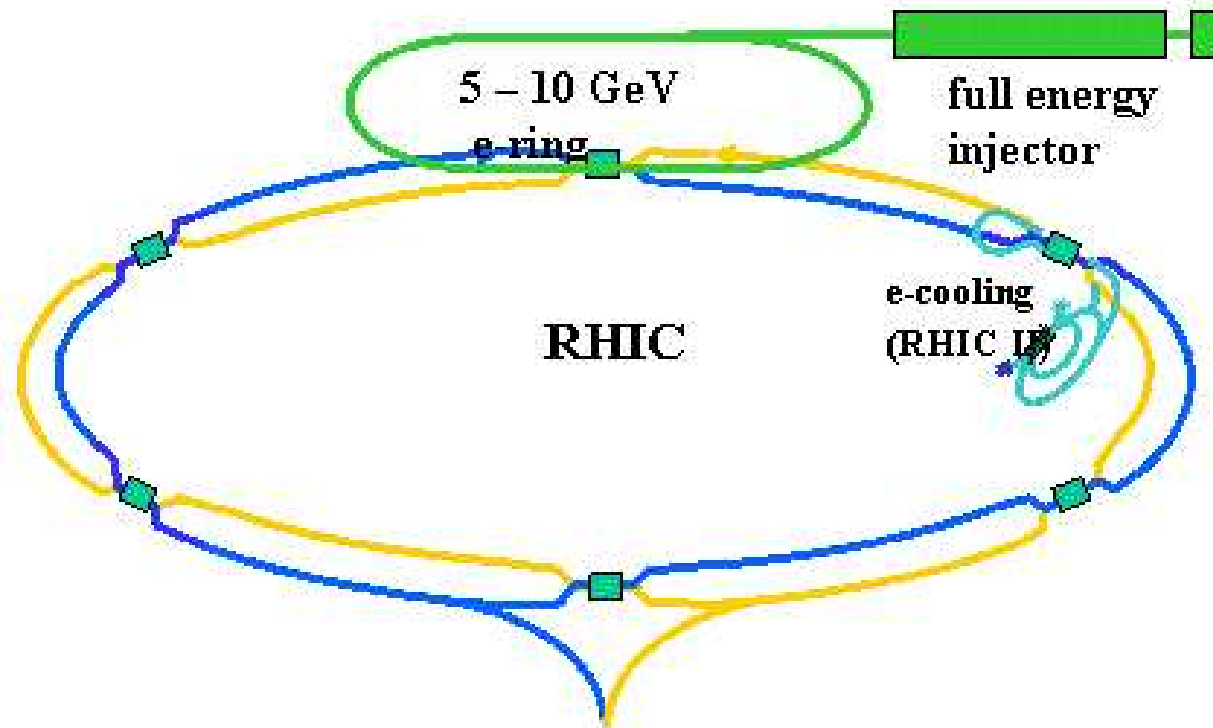


- Advantages:
 1. "no" tunes shift limit
 2. spin transparent (no rotators)
- Issues:
 1. no positrons
 2. e-beam stability

Parameter lists for eRHIC design concepts

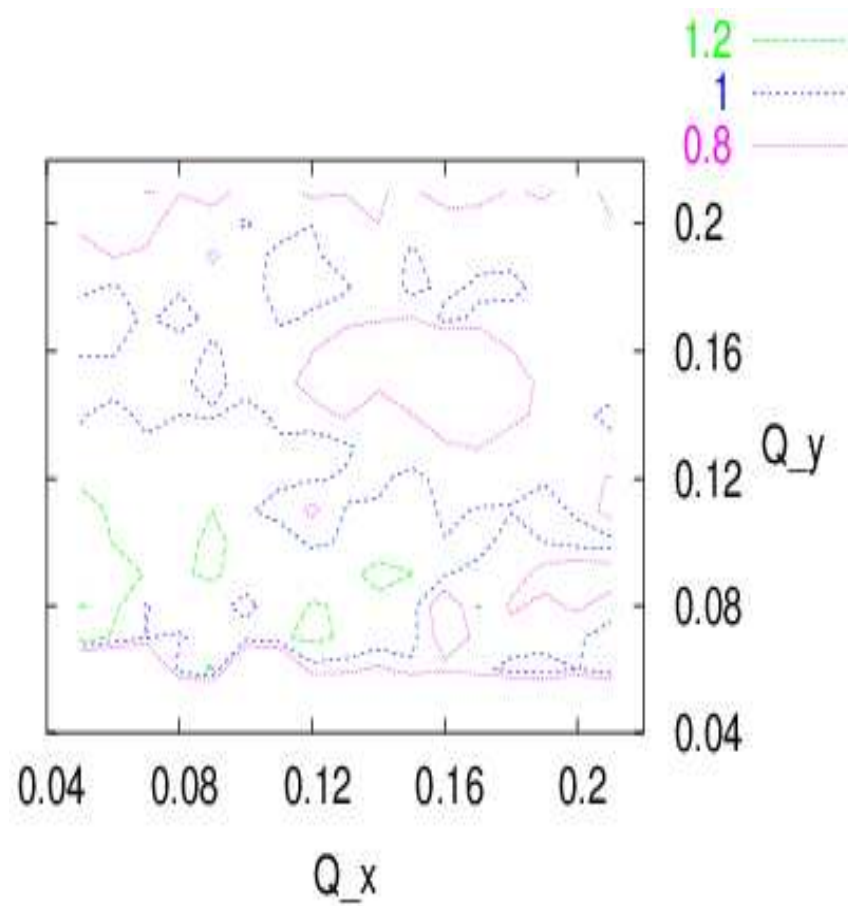
	eRHIC ring-ring		eRHIC linac-ring	
	p	e	p	e
energy [GeV]	250	10	250	10
bunch freq. [MHz]	14.1		14.1	
bunch int. [10^{11}]	1.0	2.3	2.0	1.2
beam current [A]	0.21	0.48	0.42	0.26
emittance [nm]	9.5	53/9.5	3.8	5.0
β^* [cm]	108/27	19/27	26	20
max. beam-beam parameter per IP	0.015	0.08	0.015	2.3
bunch length [cm]	20	1.2	20	1.0
peak luminosity [$10^{33} \text{ cm}^{-2} \text{ sec}^{-1}$]	0.47		2.6	

eRHIC ring-ring design



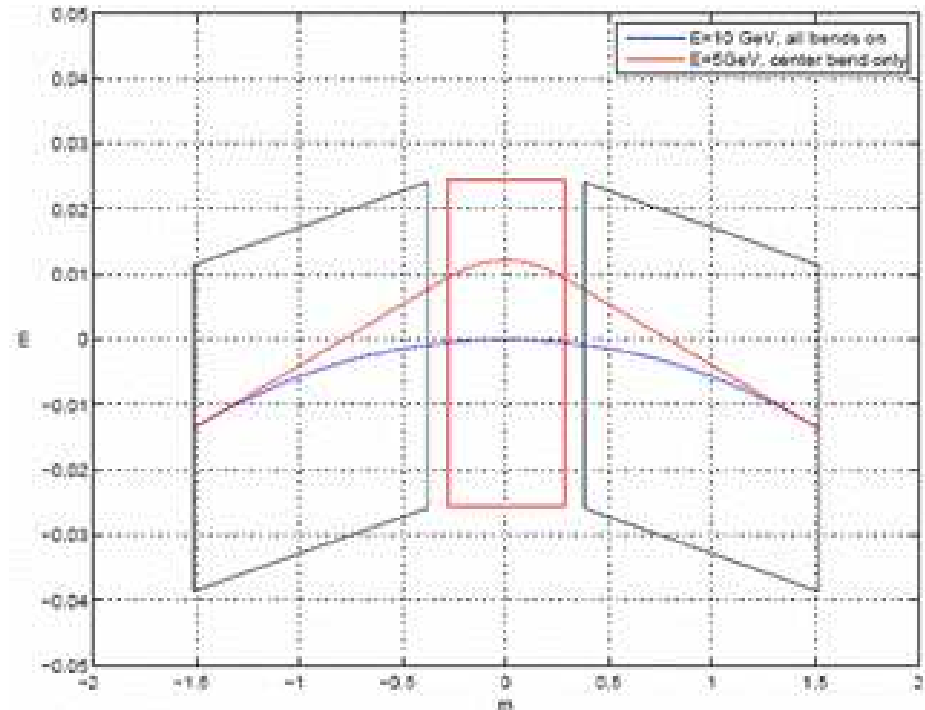
10 GeV self-polarizing electron storage ring, circumference
1/3 of RHIC

Beam-beam tunescan



Electron beam-beam tuneshift of $\xi_y = 0.08$ is feasible

Superbend dipole



Enhanced synchrotron radiation to shorten polarization built-up time at low energy

R&D for ring-ring eRHIC

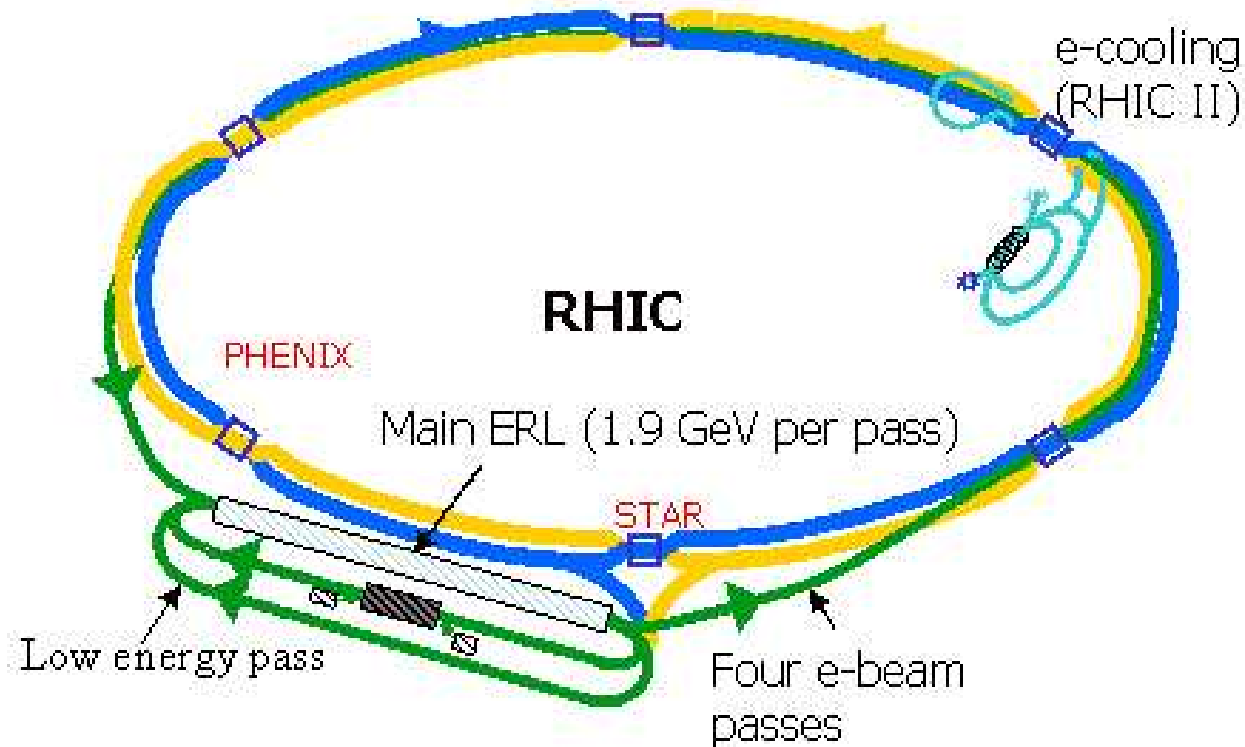
Revolution frequencies in both rings have to be matched

Due to “low” ion beam γ , ion velocity changes considerably with energy

→ electron ring circumference has to change accordingly (up to 20 cm)

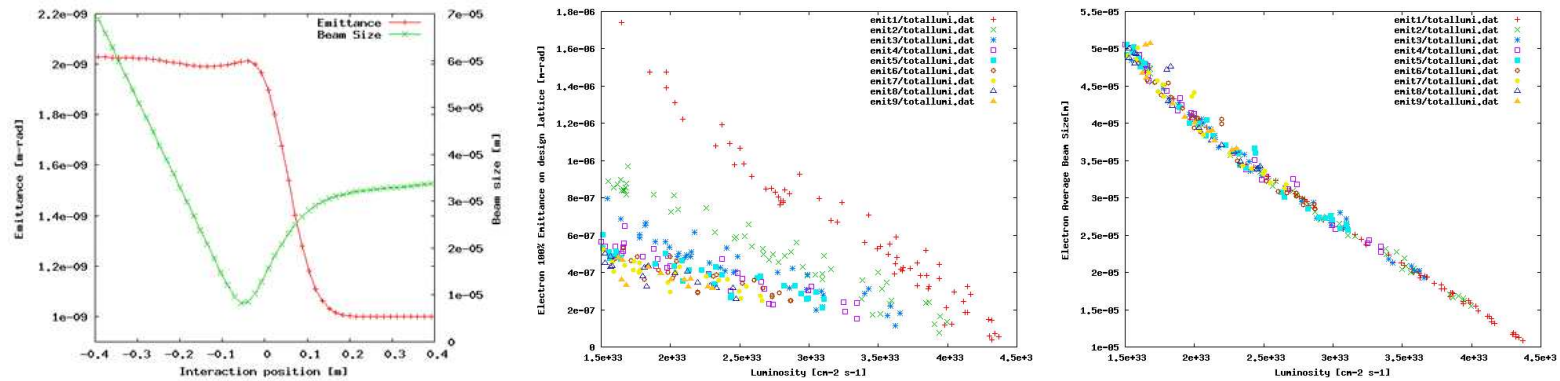
→ “trombone”

eRHIC linac-ring design



10 GeV superconducting energy-recovery linac (ERL) in RHIC tunnel

Beam-beam simulations



Parameter optimization for large disruption

→ Reduction of electron- β^* from 1.0 m to 0.2 m, and corresponding emittance increase

R&D items for eRHIC ERL

- energy-recovery technology for high energy (10 GeV), high current (250 mA) beam
- instability issues
- beam loss tolerances, cavity protection
- beam-beam effects, including kink instability
- high-intensity polarized electron gun

Summary

- Two basic design concepts for eRHIC are being studied, ring-ring and linac-ring
- Designs are based on experience with HERA
- New ideas and technologies are applied to maximize luminosity
- The final design decision will be based on physics needs and technological feasibility