Plans for RHIC

RHIC performance

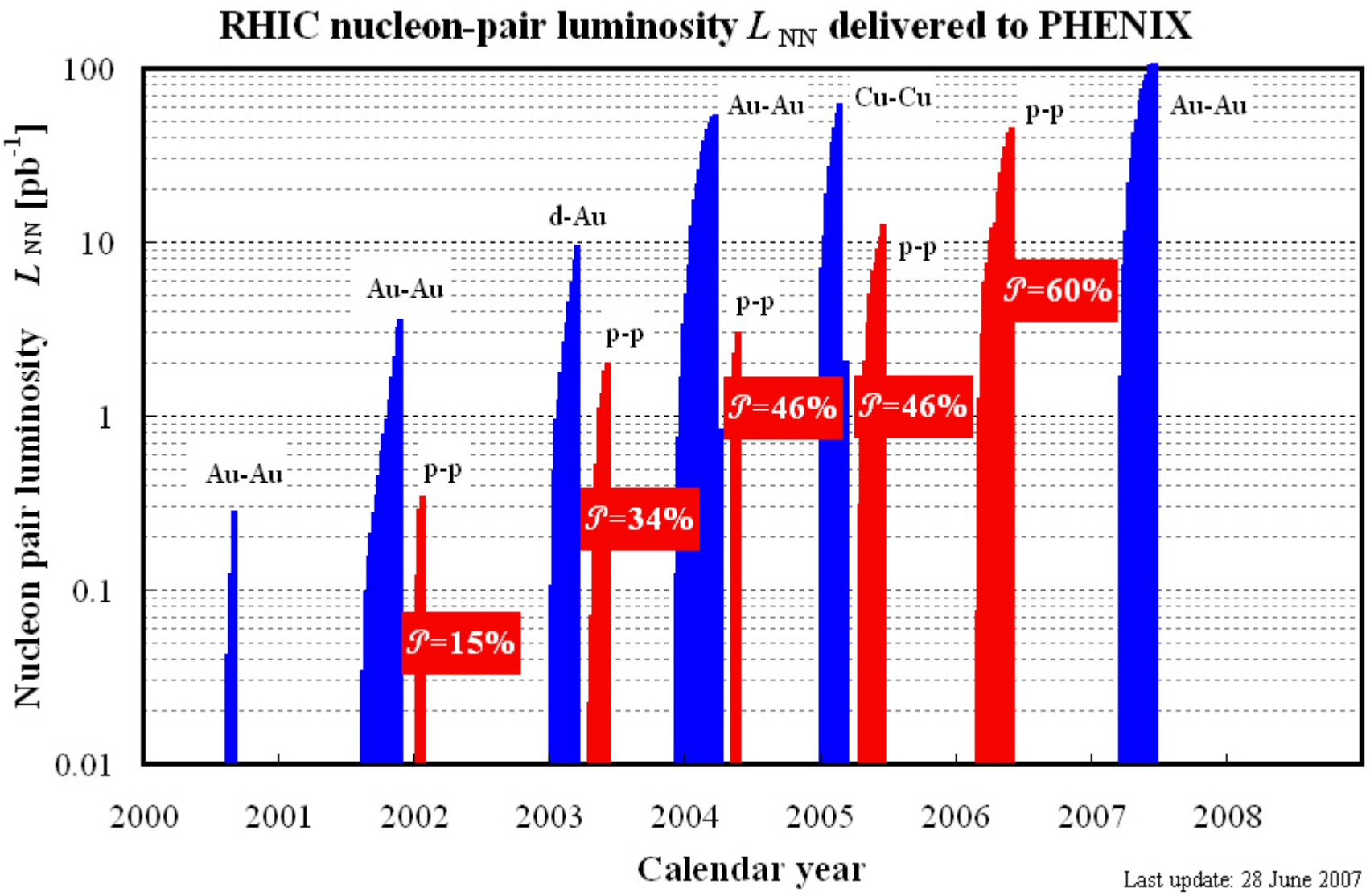
Short term and long term upgrade plans

(Luminosity, Luminosity, Luminosity)

BROOKHAVEN NATIONAL LABORATORY

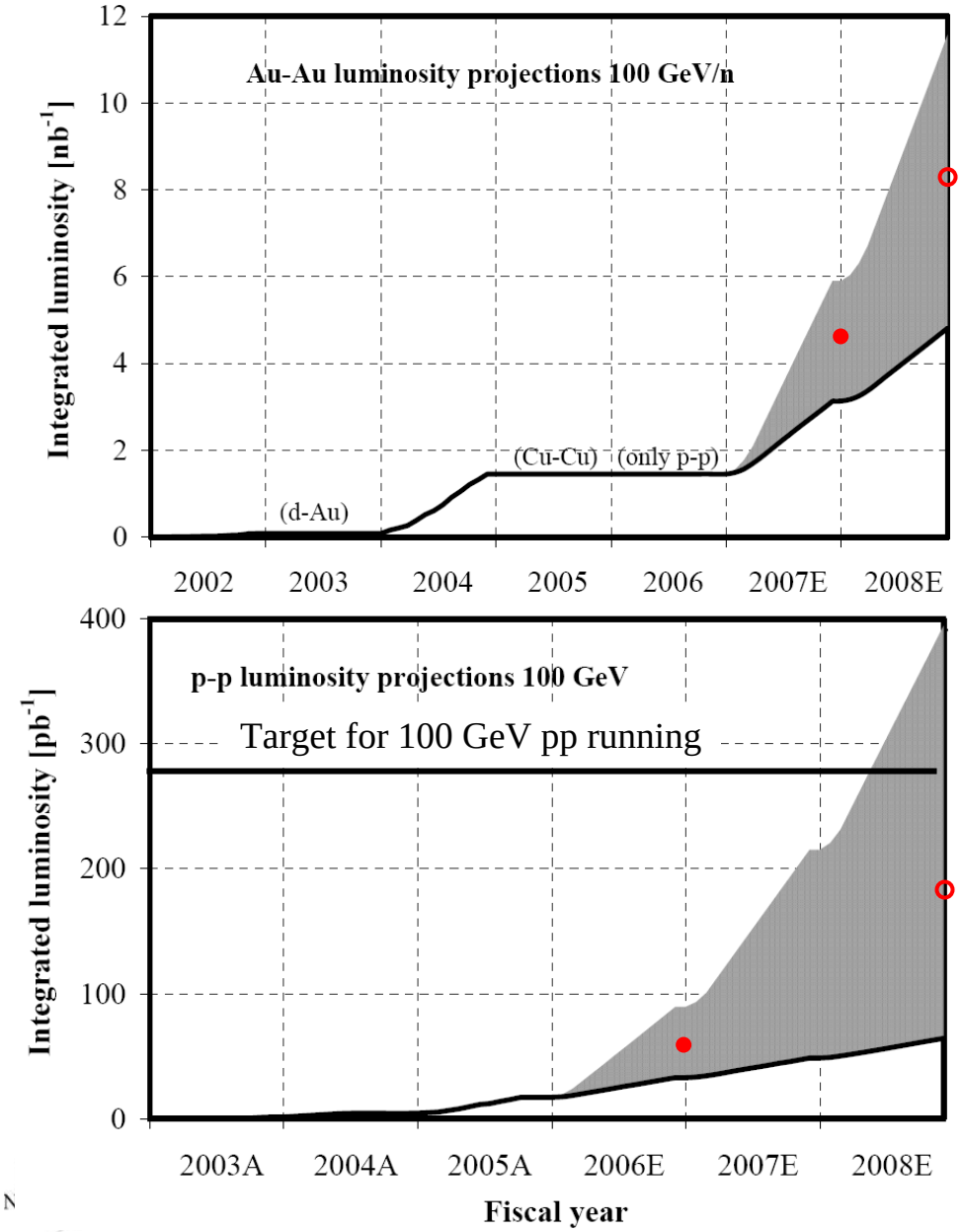
Thomas Roser
APEX Workshop
November 1, 2007

Delivered Luminosity and Polarization



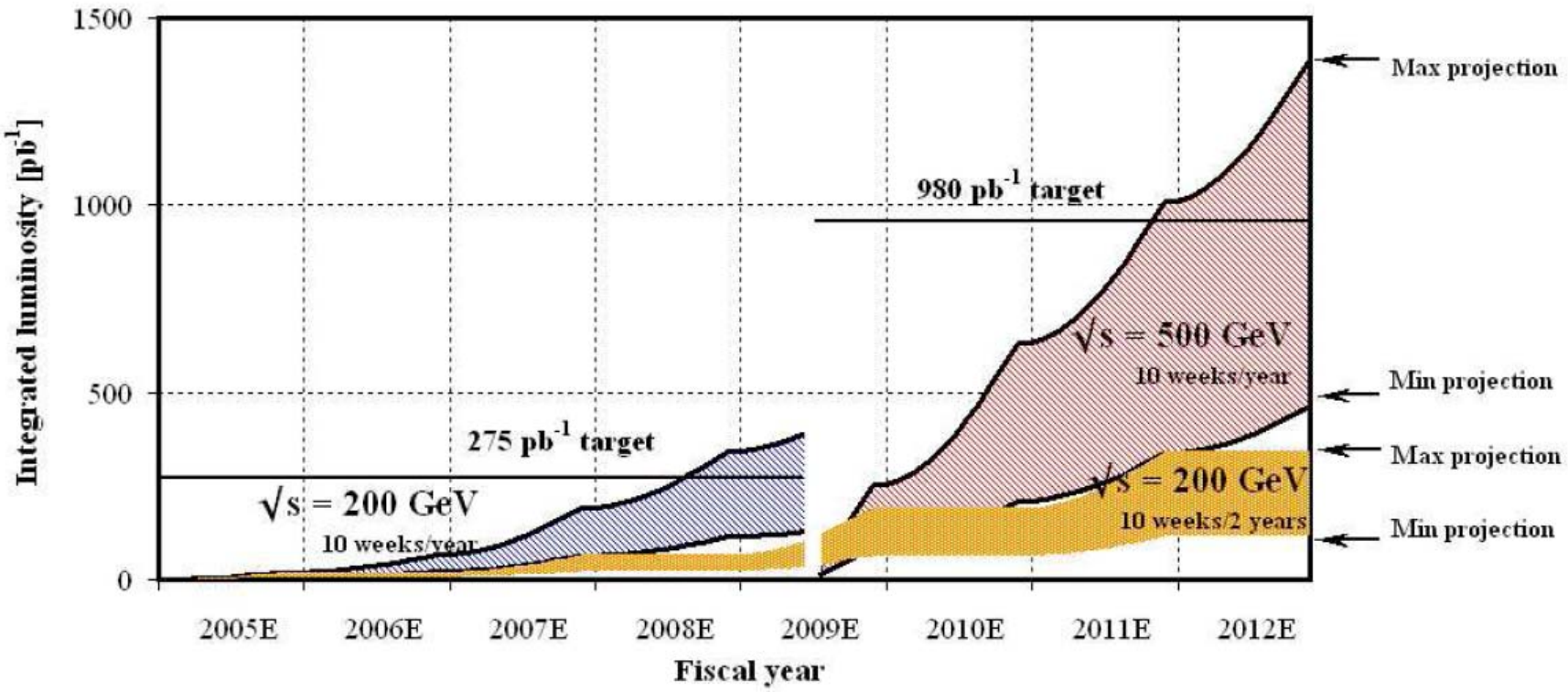
BROOKHAVEN NATIONAL LABORATORY

RHIC Luminosity Evolution



- Achieved luminosities (•) match the prediction
- Next runs (o) need to double the luminosity again!

RHIC Spin Luminosity Goals



RHIC physics operation, detector upgrades, machine evolution

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012

Au-Au, d-Au, Ion scans, critical pt. search
Spin: pp at 200 GeV; 500 GeV development

Ion runs: Hard Probes
500 GeV Spin Runs

Near-term upgrades:
HBD, TOF, DAQ, FMS, Muon Trigger

Mid-Term Upgrades:
Vertex detectors, NCC, forward tracking

EBIS Construction

RHIC II Construction

Machine and detector R&D; continued luminosity improvements; eRHIC development

Near Term Run Plan

Run 8

- **10 weeks d-Au at 200 GeV [150 nb^{-1}]**
- **12-13 weeks polarized pp at 200 GeV [130 pb^{-1}; 65%pol.]**

Run 9

- **10 weeks Au-Au at 200 GeV [3.5 nb^{-1}]**
- **12 weeks polarized pp at 200 GeV and/or 500 GeV**

Run 10

- **14 weeks Au-Au low-energy scan in search of QCD critical point**
- **8 weeks polarized pp at 500 GeV**

Run 11

- **12 weeks U-U at 200 GeV ??**

RHIC upgrades plans

Next 3 – 4 years:

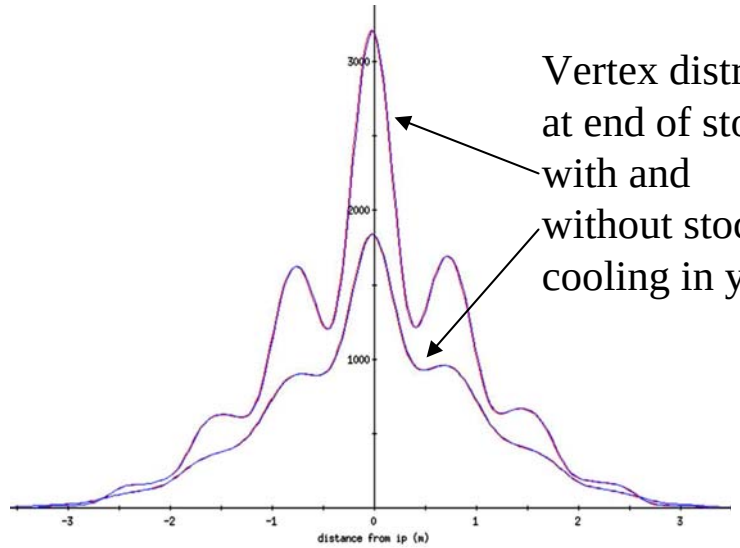
- 0.5 m betastar for Au – Au and p – p operation
- Stochastic cooling in RHIC of Au beams
- New storage rf system in RHIC (56 MHz s.c. cavity)
- Commissioning of the EBIS pre-injector (U beams)
- Electron lens in RHIC for beam-beam compensation (?)

Possible upgrades in the future:

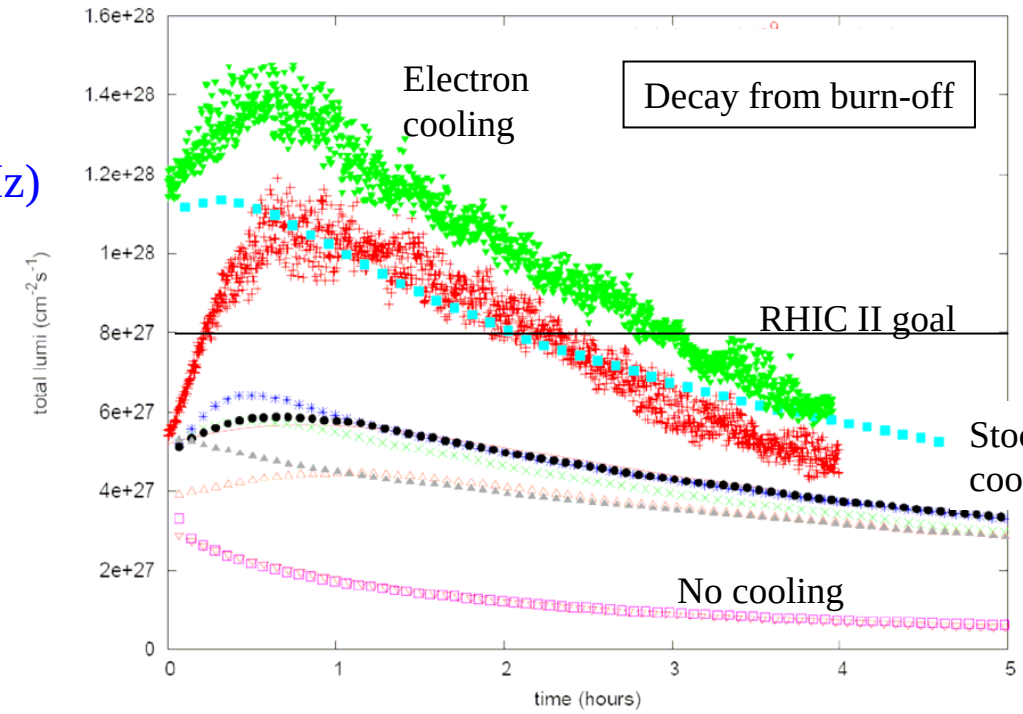
- Electron cooling in RHIC (if stochastic cooling is insufficient)
- Electron cooling in RHIC for low energy operation (2-5 GeV/n per beam)
- ~ 3 GeV high intensity electron beam colliding with RHIC beams ?
- “coherent electron cooling” of proton beams
- 10 – 20 GeV high intensity electron beam colliding with RHIC beams (eRHIC)

Stochastic Cooling at RHIC

- Longitudinal bunched beam stochastic cooling demonstrated at 100 GeV/n in RHIC counteracting longitudinal IBS.
- Longitudinal stochastic cooling in Blue ring under construction
- Transverse stochastic cooling in RHIC at 100 GeV/n might be possible using the same approach.
- Requires four planes of transverse stochastic cooling and new (56MHz) rf system
- With coupling may need only two planes
- First transverse stochastic cooling plane for Run 9



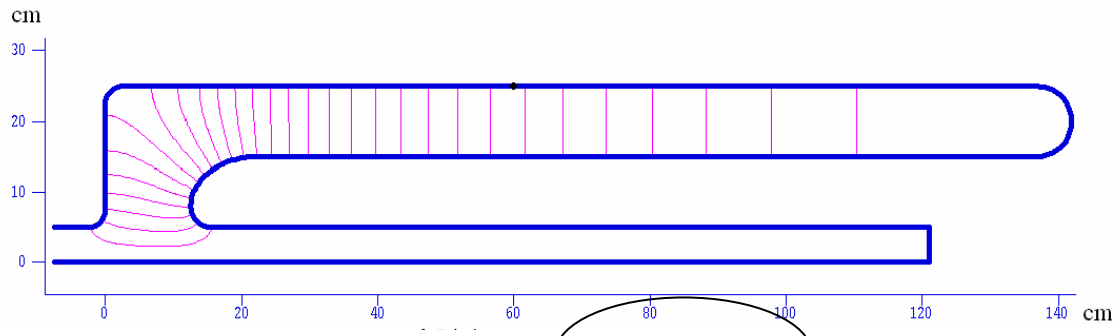
Vertex distribution at end of store with and without stochastic cooling in yellow



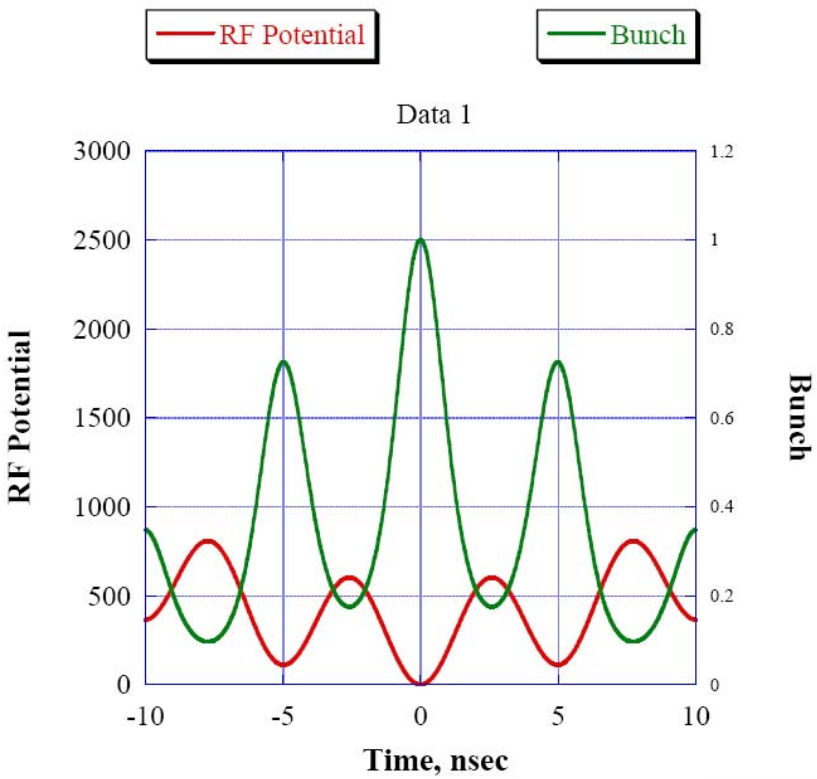
BROOKHAVEN NATIONAL LABORATORY

56 MHz SRF cavity in RHIC

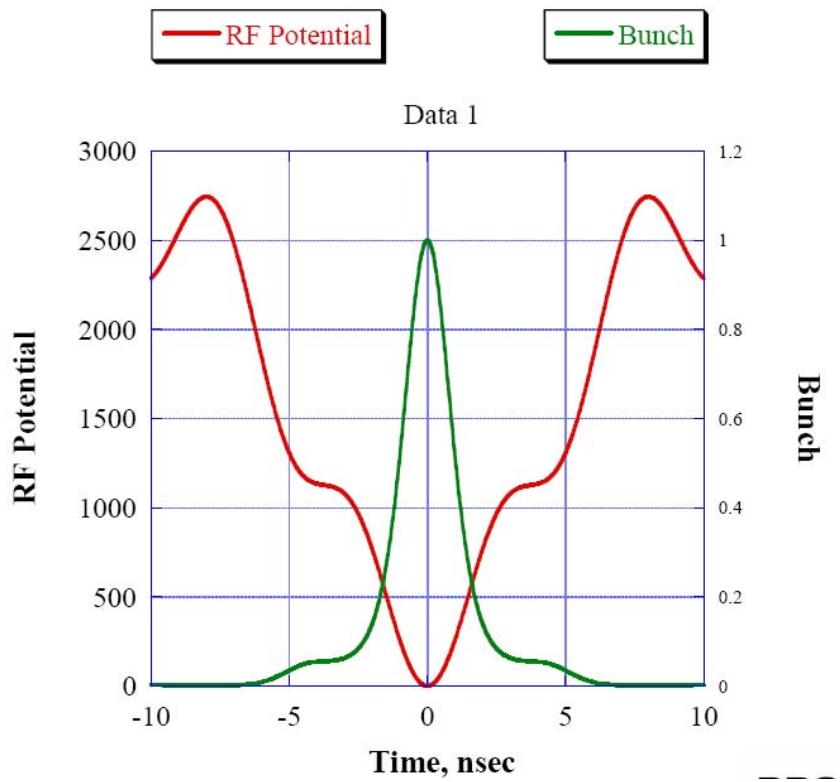
- Avoid rebucketing operation.
- Greatly reduces satellite bunches
- Quarter wave resonator



V_{28MHz}= 0.3MV; V_{SRF}= OFF; V_{197MHz}= 2 MV



V_{28MHz}= 0.3MV; V_{SRF}= 2 MV; V_{197MHz}= 2 MV



Ilan Ben-Zvi et al

Accelerator Improvement Projects plans (in k$)

($000)	phase	FY2008E	FY2009E	FY2010E
Accelerator Improvement Projects (AIP)				
FY2008				
First plane of transverse stochastic cooling (R&D)		1,500		
Main Control Room consolidation and upgrade	II of IV	400		
RHIC SRF (56 MHz)	I of III	1,300		
RHIC cryo control system upgrade	II of II	400		
FY2009				
RHIC SRF (56 MHz)	II of III		1,000	
RHIC transverse stochastic cooling, 2nd plane			1,500	
RHIC electron lenses	I of II		400	
RHIC abort kicker upgrade	I of II		-	
Main Control Room consolidation and upgrade	II of IV		800	
FY2010				
RHIC transverse stochastic cooling, 3rd plane				-
RHIC transverse stochastic cooling, 4th plane				-
RHIC SRF (56 MHz)	III of III			1,700
RHIC electron lenses	II of II			1,700
Main Control Room consolidation and upgrade	III of III			400
RHIC abort kicker upgrade	II of II			-
Total		3,600	3,700	3,800