RHIC Performance Update

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Machine Advisory Committee Meeting
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BROOKHAVEN
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Run-5

- **Beam: 11/23/04 to 06/24/05**
- **Cu-Cu**
  - **100 GeV/n** (8 weeks for physics)
  - **31.2 GeV/n** (1 ½ weeks for physics)
  - **11.2 GeV/n** (1 ½ days for physics)
- **p↑-p↑**
  - **100 GeV** (9 ½ weeks for physics)
  - **205 GeV** (2 stores for physics)

Run-5 Cu-Cu Summary

Major accomplishments at 100 GeV:

- 253m of NEG coated beam pipes installed in warm regions
- start-up/ramp-up in 2.5 weeks (1.5 weeks less than planned)
- enough bunch intensity to run at beam-beam limit with 4 IPs
- β^* reduced by 10% to 0.9m at STAR

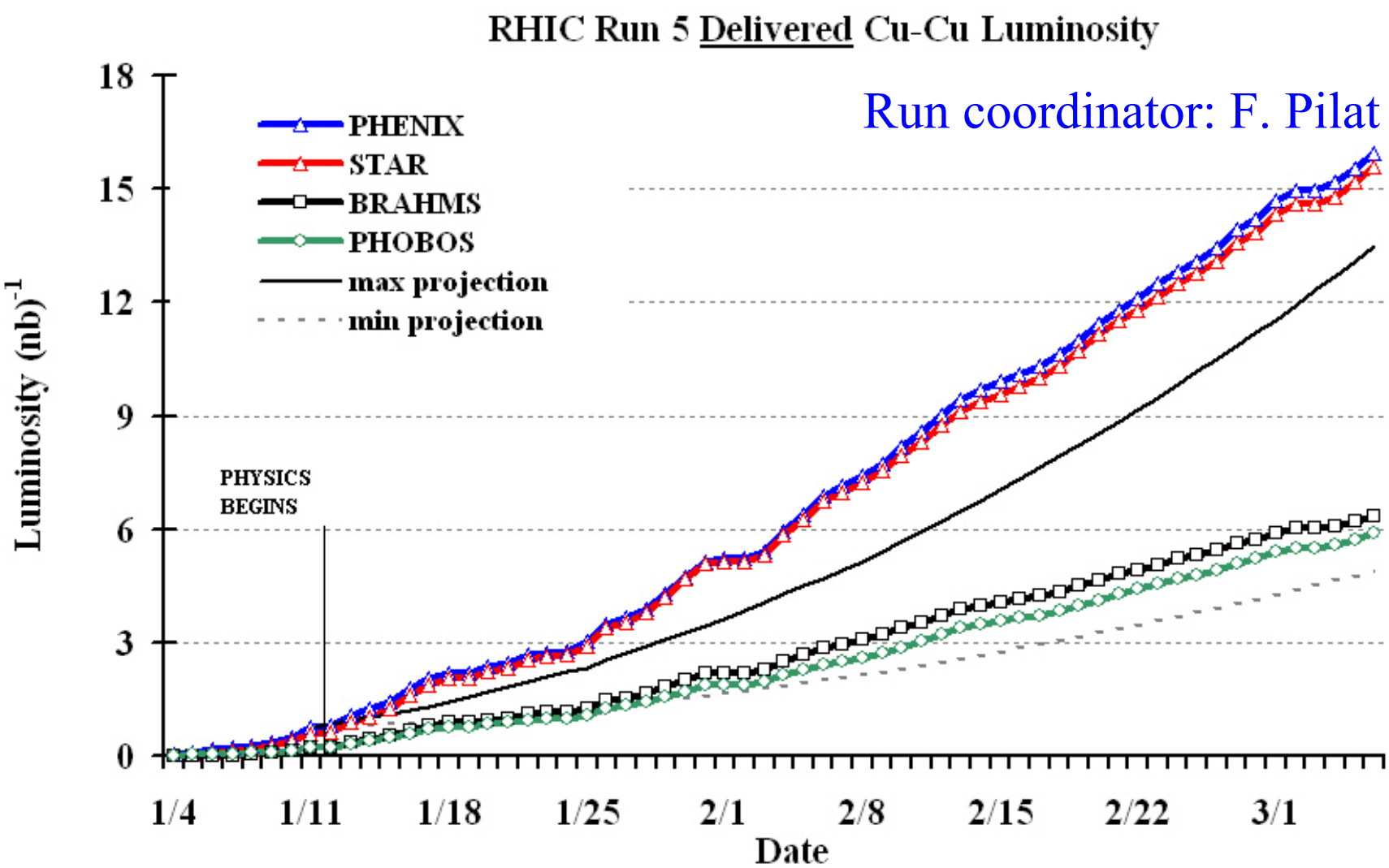
Major accomplishments at 31.2 GeV:

- 74% of calendar time in store

Major accomplishments at 11.2 GeV:

- 82% of calendar time in store

Run-5 Cu-Cu Summary



Run-5 p↑-p↑ summary

Major accomplishments at 100 GeV:

- polarized source upgraded with sc solenoid
- 60% polarization at AGS extraction
- first acceleration of polarized protons in AGS with cold snake (10^{11} protons per bunch, 50% polarization at AGS extraction)
- operation with up to 111 bunches per ring
- increased store polarization by 5%

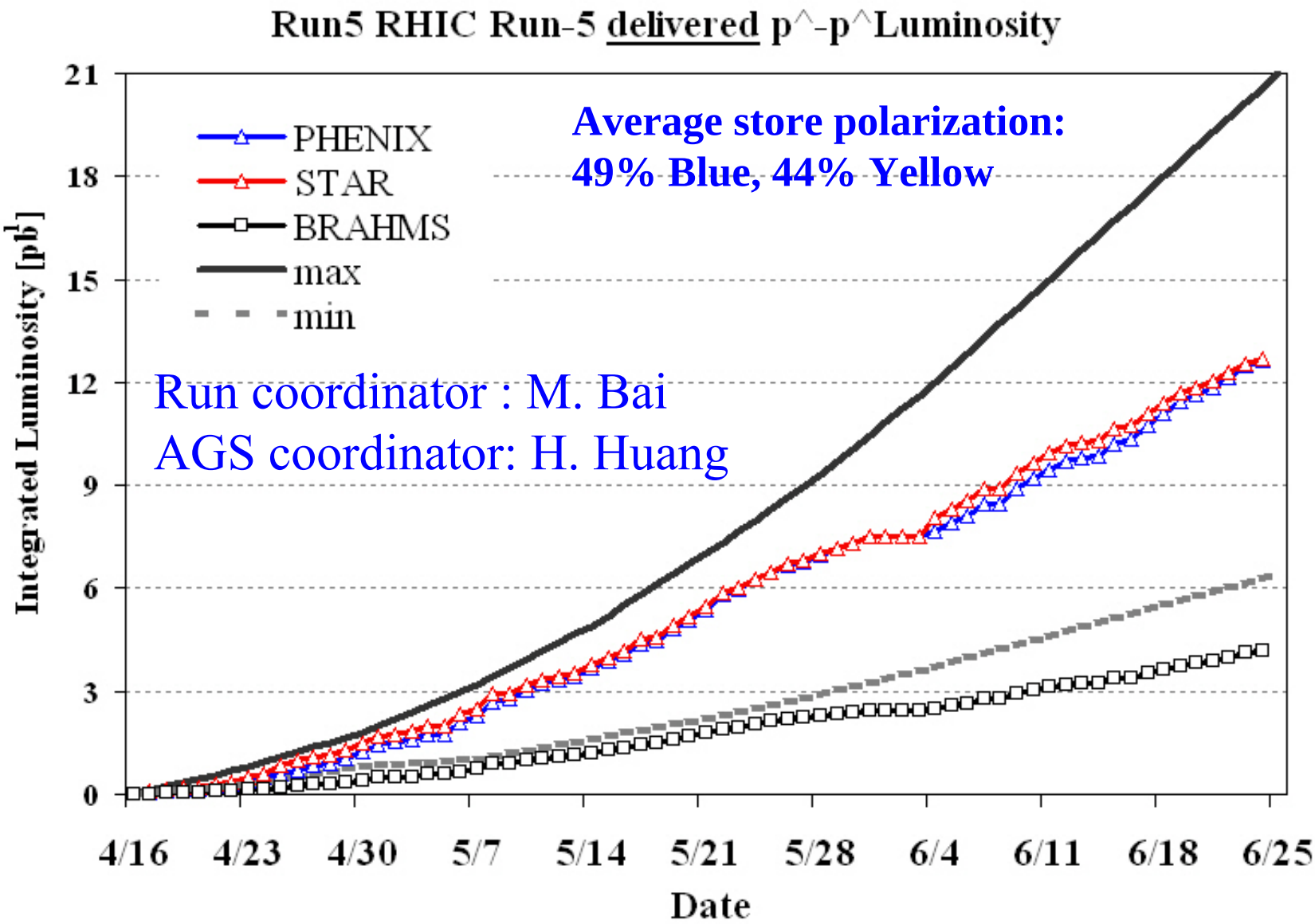
Major accomplishment at 205 GeV:

- ramp setup for higher energy in 3 days
- first acceleration and storage of polarized protons >100 GeV
- 30% polarization at higher energy

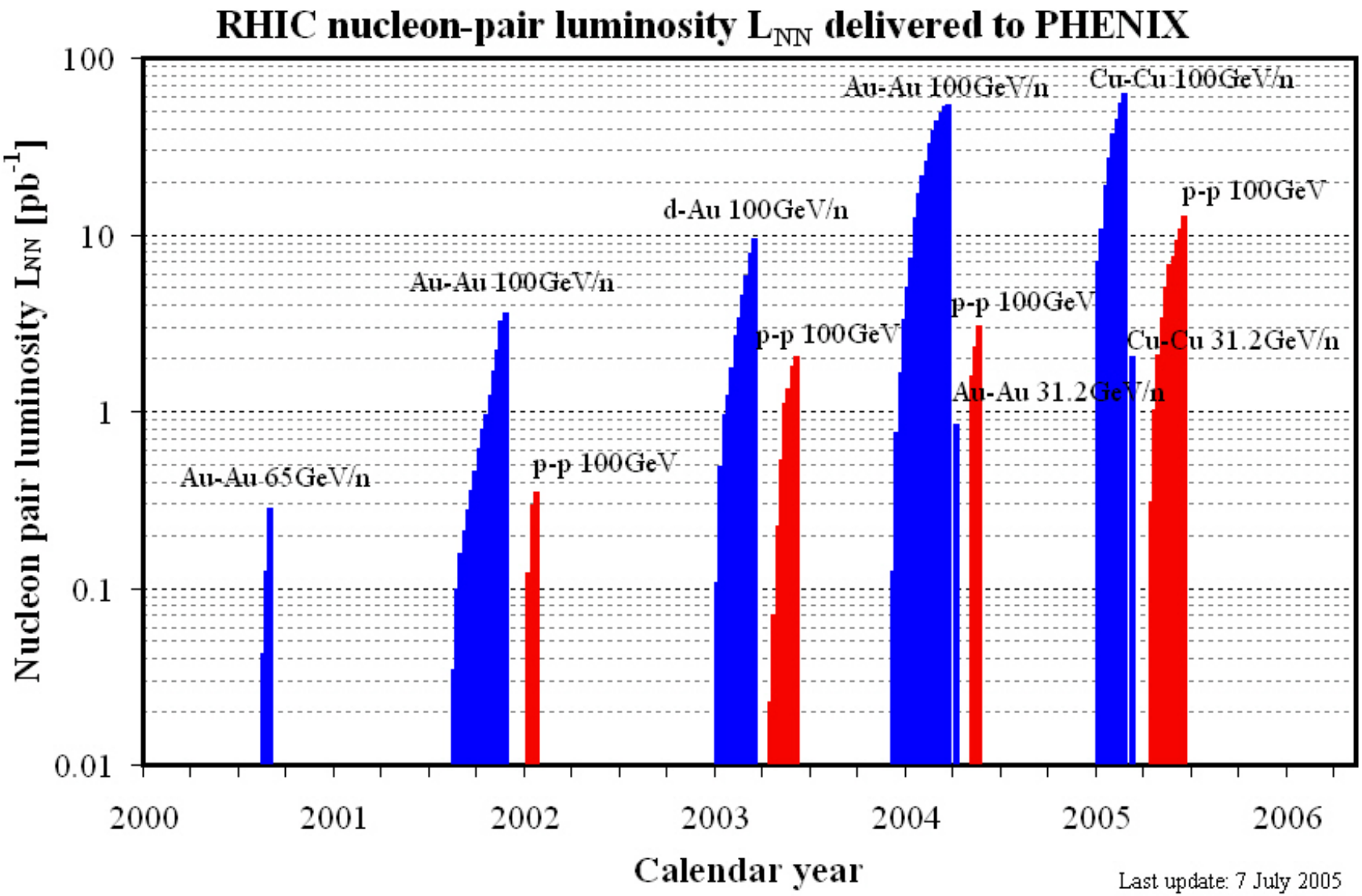
Initial AGS cold snake commissioning

- extraction with 10^{11}protons/bunch and 50% polarization

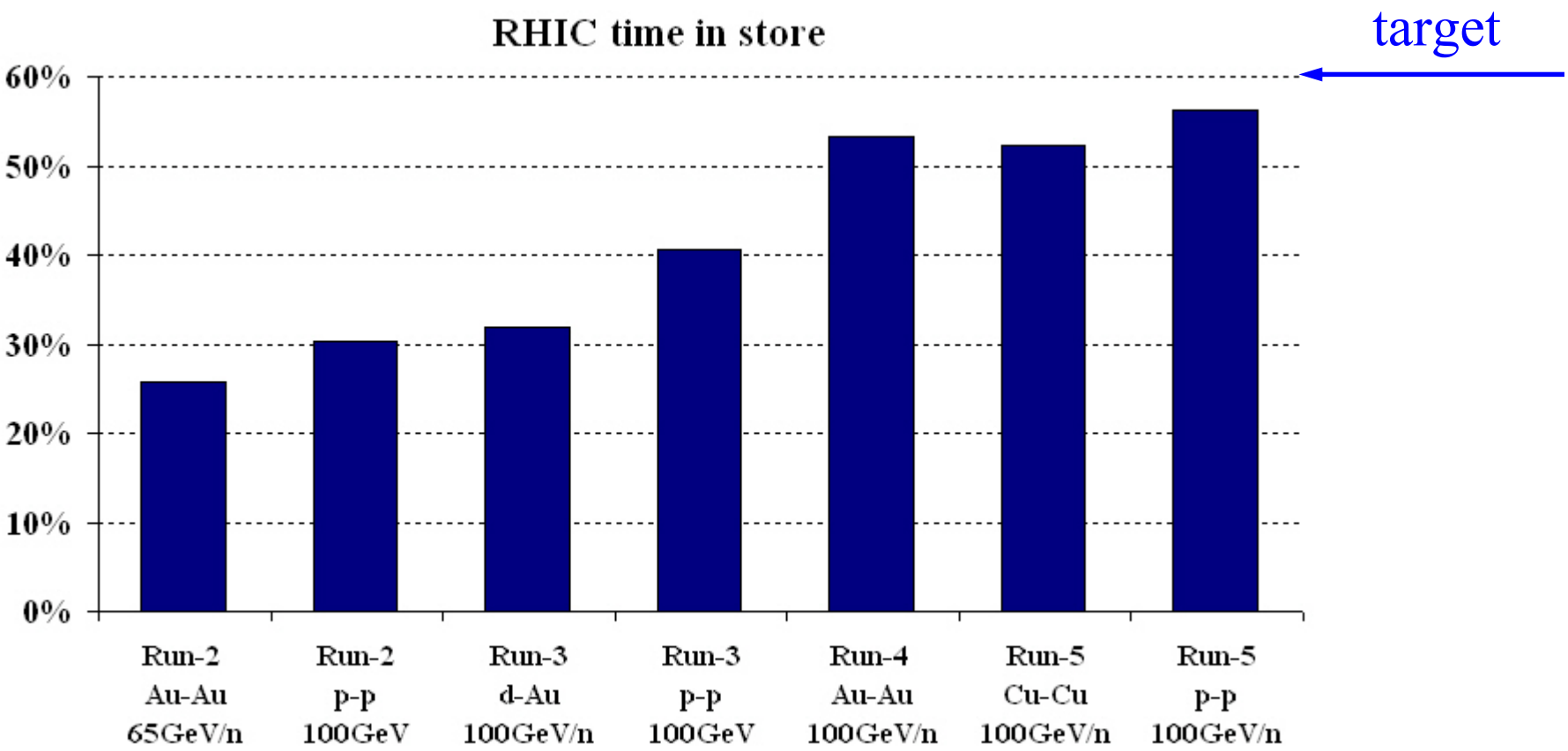
Run-5 p↑-p↑ summary



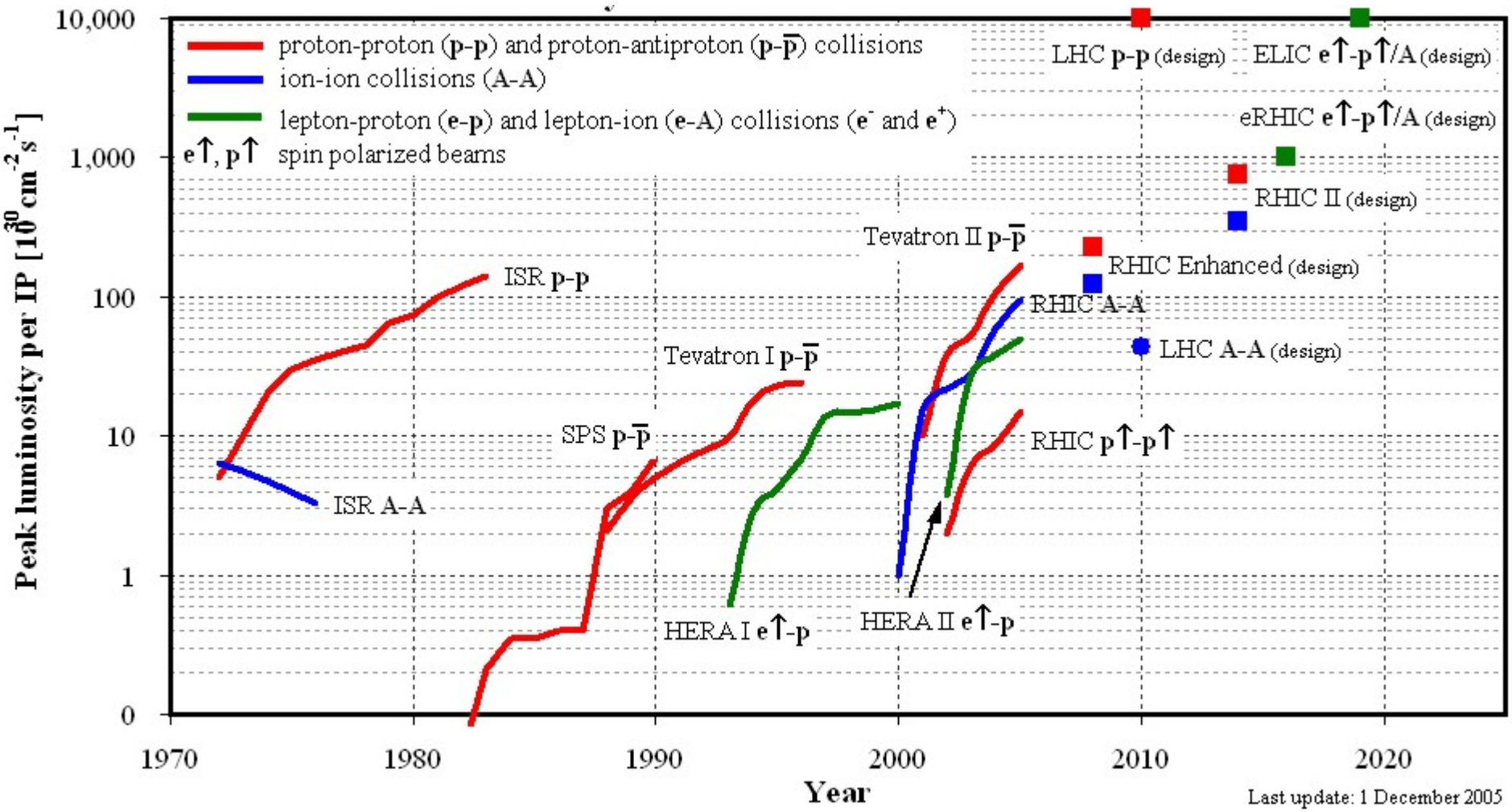
RHIC delivered luminosity



RHIC calendar time in store



Hadron collider luminosity

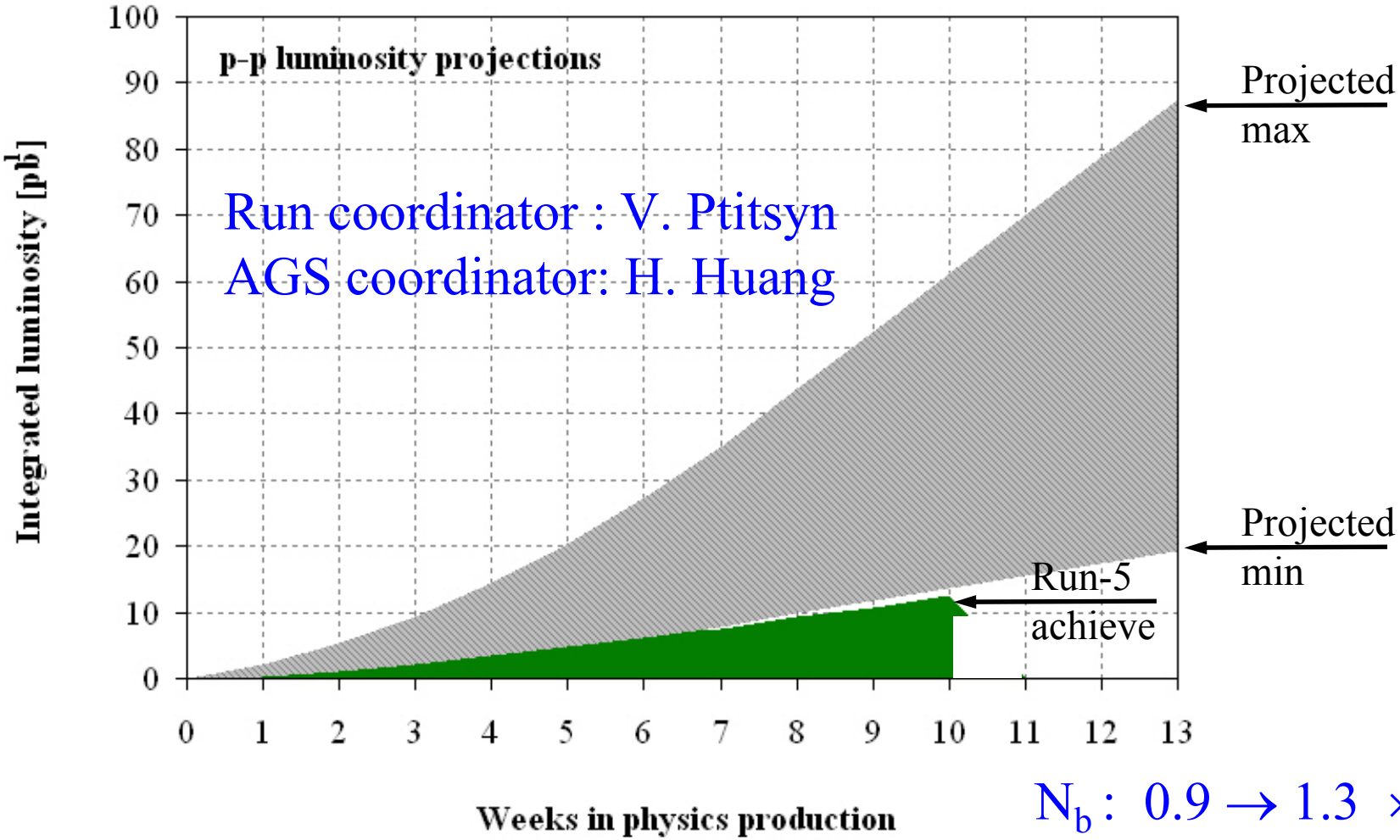


Note 1: For ion collisions the nucleon-pair luminosity is shown. The nucleon-pair luminosity is defined as $L_{NN} = A_1 A_2 L$, where L is the luminosity, and A_1 and A_2 are the number of nucleons of the ions in the two beam respectively.
Note 2: An upward arrow next to a particle symbol denotes polarized beam.

RHIC Run-6 plans

- 20 cryo weeks (14 1/2 weeks for physics)
- p↑-p↑ at 100 GeV, 31.2 GeV, 250 GeV, (11 GeV)
- Major improvements
  - Further AGS cold snake commissioning
    → increase in polarization and bunch intensity
  - Now 430m of NEG coated beam pipes installed
    → reduction of dynamic in warm regions
  - Arc vacuum now 10^{-6}–10^{-7} Torr before cool-down
    → reduction of dynamic in cold regions
  - 10Hz orbit feedback for IP under construction
    → likely to cause diurnal vertical orbit movements
  - IR4 triplets disconnected from ceiling
    → likely to cause diurnal vertical orbit movements

Run-6 plans



N_b : 0.9 → 1.3 ×10^{11}

n : 106 → 111

P : 47 → 60 %

Path to RHIC II

Quantity	Unit	Design 1999	Achieved 2005	Enhanced Design 2008	RHIC II ≥2012
Au^{79+} on Au^{79+}					
Beam energy	GeV/n		— 100 —		
Number of bunches	...	60	45	— 112 —	
Bunch population, initial	10^9	1.0	1.1	— 1.0 —	
β-function at IP	m	2.0	1.0	1.0	0.5
Peak luminosity	$10^{26}cm^{-2}s^{-1}$	12	15	32	90
Average store luminosity	$10^{26}cm^{-2}s^{-1}$	2	5	8	70
polarized p^+ on polarized p^+					
Beam energy	GeV	250	100	— 250 —	
Number of bunches	...	60	106	— 112 —	
Bunch population, initial	10^{11}	1.0	0.9	— 2.0 —	
β-function at IP	m	2.0	1.0	1.0	0.5
Peak luminosity	$10^{30}cm^{-2}s^{-1}$	15	10	220	750
Average store luminosity	$10^{30}cm^{-2}s^{-1}$	10	7	150	500
Average store polarization	%	–	46	70	70

Need e-cooling for these (this MAC)