Report from EPAC'08

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LIS meeting, 28/7/08

I’ll talk about…

- Colliders:
  - Crab cavities at KEKB
  - Last year of PEP II
  - Electron lenses at Tevatron
- Plasma wake-field accelerators

Performance of KEKB with Crab Cavities, Y. Funakoshi

ABSTRACT: 20 years after they were initially proposed, in February 2007 crab cavities are for the first time installed in an operating collider, KEKB. The commissioning of KEKB with crab cavities is presented, and the performance of the collider is compared to the performance without crab cavities. Lessons learned from the operation with such cavities for future projects are discussed.

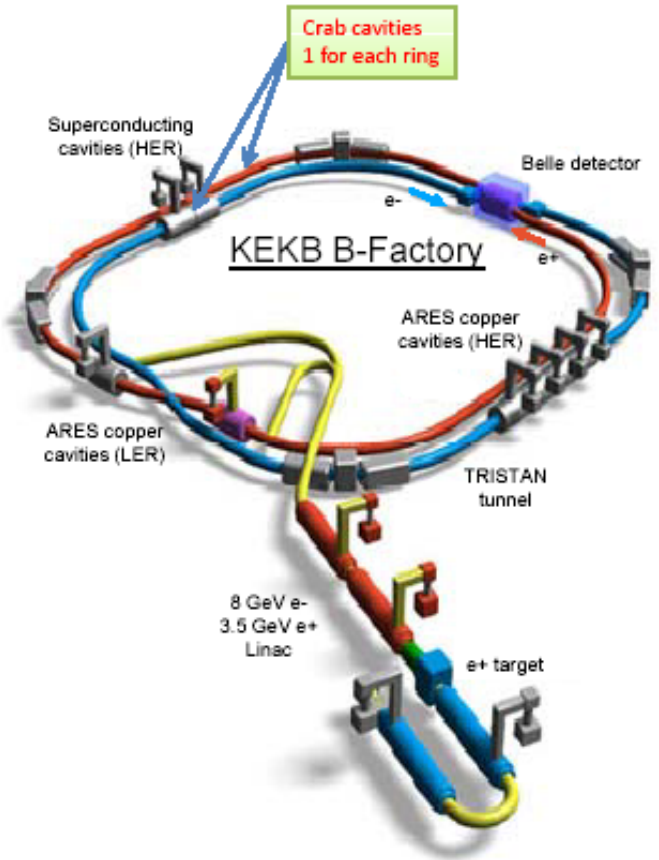
RELATED TALKS:

- Observations of Beam-Beam Tune Spectrum and Measurement of Coherent Tune Shift at KEKB, T.Ieiri
- Crab Waist collisions in Dafne and SuperB design, P. Raimondi
- Development of the KEK-B Superconducting Crab Cavity, K.Hosoyama, KEK

Performance of KEKB with Crab Cavities, Y. Funakoshi

Overview of KEKB

- Circumference:
  - 3016m
- Beam energy
  - 3.5 GeV (e+; LER)
  - 8.0 GeV (e-; HER)
  - E_{cm} = 10.58GeV ($\Upsilon(4S)$)
- Beam Currents*
  - 1.8A [1.62A] (2.6A) (LER)
  - 1.34A [0.95A] (1.1A) (HER)
- Number of Bunches: 1585/ring (~5000)
- Horizontal crossing Angle:
  - 22mrad or crab crossing
- Peak Luminosity
  - $1.0 \times 10^{34} cm^{-2}s^{-1}$ on May 09 2003
  - $1.71 \times 10^{34} cm^{-2}s^{-1}$ (record w/o crab)
  - $1.61 \times 10^{34} cm^{-2}s^{-1}$ (record w/ crab)
- Physics:
  - B physics (Asymmetric) (Belle)
- Integrated Luminosity:
  - Total:>850 fb^{-1}
  - ~ 1fb^{-1}/day (record: 1.23 fb^{-1}/day)



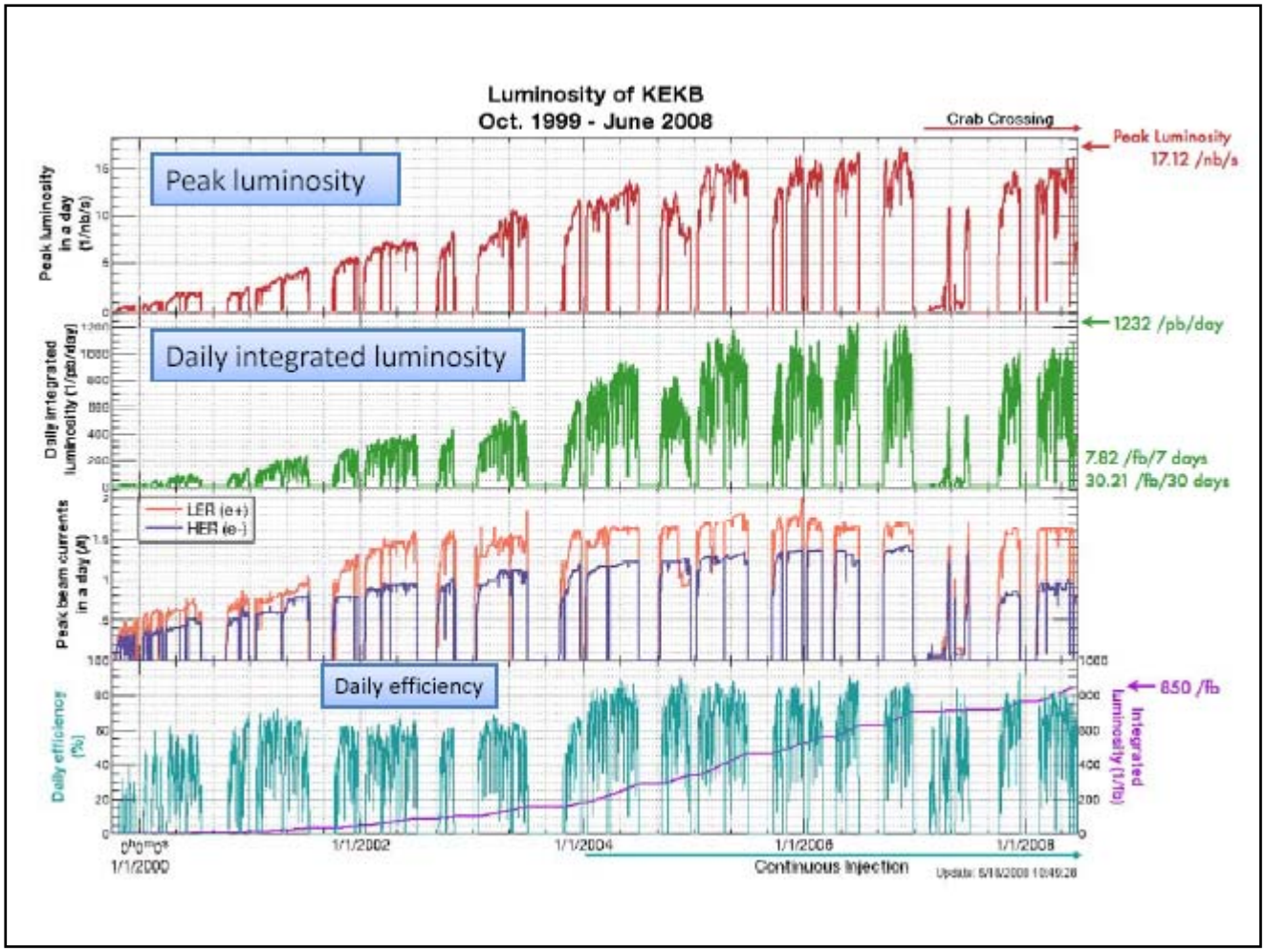
*Beam currents: [ ]: w/ crab, ( ):design

Performance of KEKB with Crab Cavities, Y. Funakoshi

Summary

- 20 years after they were initially proposed, in February 2007 crab cavities are for the first time installed in an operating collider, KEKB.
- The crab cavities at KEKB have been working much more stably than the initial expectation.
  - They are presently being used in usual physics run (high beam current!!).
- The success of the development of the crab cavities is important, since they can be applied to other machines such as SR facilities or an upgrade of LHC.
- With crab crossing, the vertical beam-beam parameter of 0.093 was obtained. This indicates superiority of crab crossing scheme.
- However, the crab cavity at KEKB has not yet fully realized its potential capability in the sense that the specific luminosity is much lower than the beam-beam simulation at the high bunch currents.
- Finding the cause of this problem is very important for KEKB, since the design of SuperKEKB already counts the luminosity gain by the crab cavities.

Performance of KEKB with Crab Cavities, Y. Funakoshi



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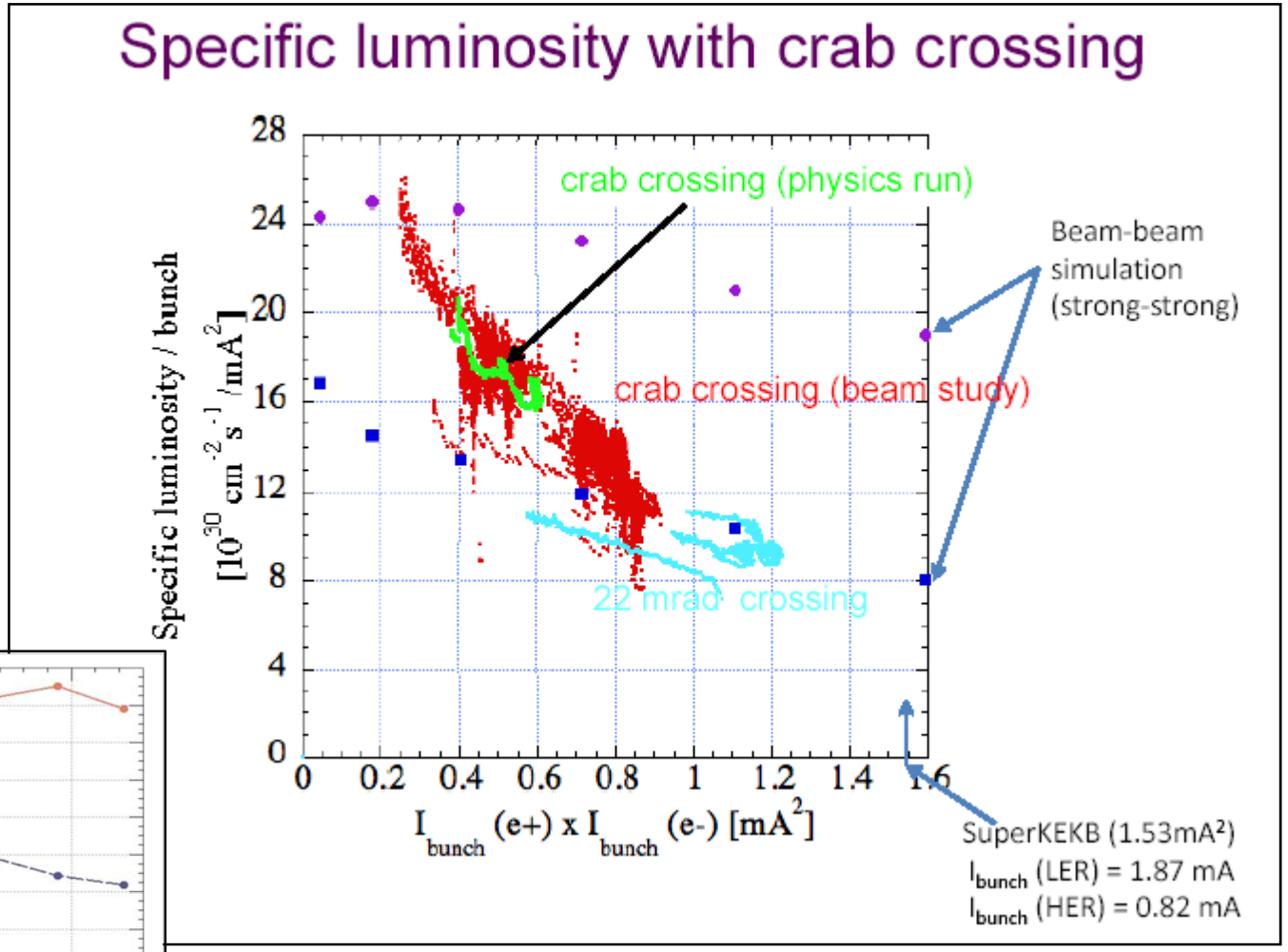
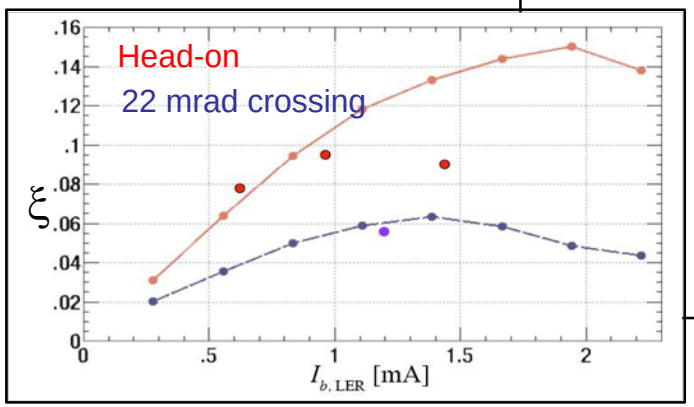




The Last Year of PEP-II B-Factory Operation, J.Seeman

Accelerator Systems Division

PEP-II General Accelerator "Achievements"

- Introduced beta-beats to help chromatic corrections near IR.
- First collider to continuously inject into a ring with the physics detector taking data.
- Installed 2 km of solenoids on the e^+ LER ring to suppress the Electron Cloud Instability ECI.
- Held the overall luminosity record for several years. Now second to KEKB (1.2 vs 1.7 x 10^{34}
- Highest stored electron current (2.1 Amps)
- Highest stored positron current (3.2 Amps)

Accelerator Systems Division

PEP-II 1998-2008: Thanks to all!

High luminosity operation, Beam-beam effects and their compensation in Tevatron, V.Shiltsev

Global View

- FNAL Accelerator Complex works in parallel for :
  - Tevatron Collider Run II (CDF and D0 experiments)
  - Neutrino program (8 GeV and 120 GeV protons on target)
- Collider Run II will definitely run thru FY09 (09/30/09)
  - FY2010 Run is very probable but not approved yet
- After the end of the Tevatron Collider Run II:
  - Tevatron to be decommiss'd and conserved (kept at LN temp)
  - Neutrino experiments will continue (350kW→700kW @120 GeV)
  - New experiments to start (e.g., NoVA, μ2e, etc)
- Fermilab's next big thing - "Project X"
  - High Intensity 1.3 GHz SC RF 8 GeV proton linac
  - The linac, Recycler and Main Injector to be employed for 8 GeV and 120 GeV fixed target experiments (ν's, K's, μ's)
  - Construction to start in ~2012

High luminosity operation, Beam-beam effects and their compensation in Tevatron, V.Shiltsev

Very Good Progress Since 2007

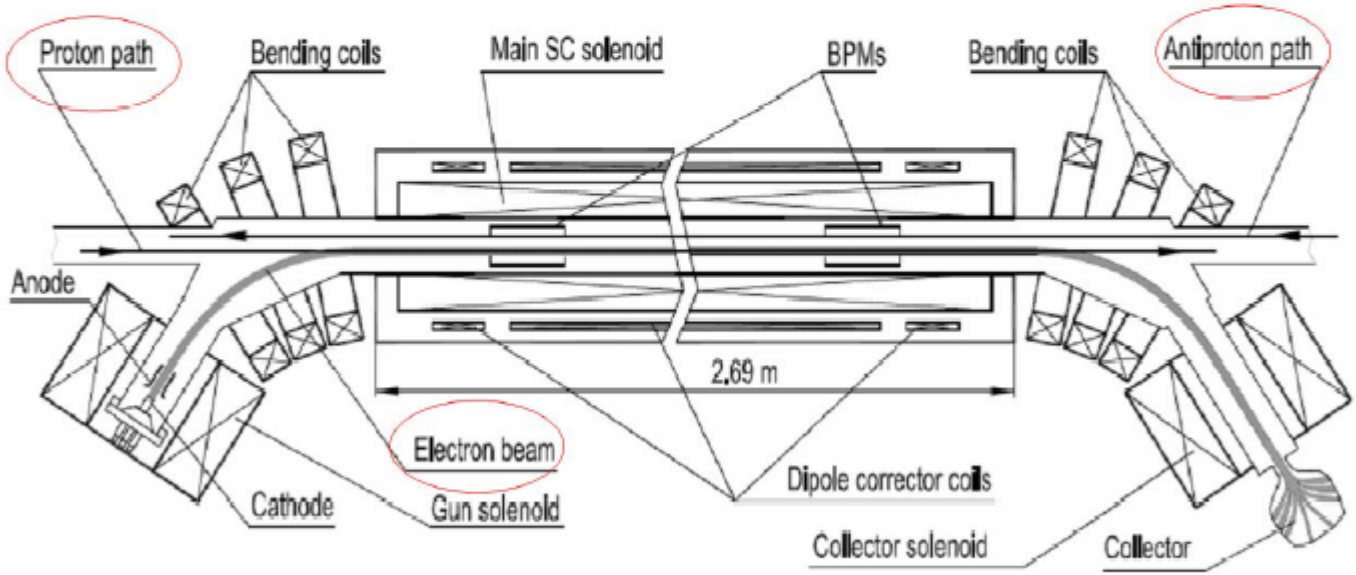
- *No big upgrades, progress is due to operational tune-ups*
- Still, we've got (compared to Summer 2007)
  - + 8% in max peak luminosity (2.92e32 → 3.15e32)
  - +24% in max weekly luminosity (45 pb-1 → 56 pb-1)
  - +25% in avg weekly lumi (32pb-1 → 40 pb-1 in 2008)
  - +17% in peak pbar production rate (23e10/hr → 27e10/hr)
  - +14% in average pbar production (19.3e10/hr → 22.1e10/hr)
- Why:
  - Optimization of pbar stoch.cooling systems in Debuncher & AA
  - Faster pbar transfers from Accum to Recycler (30 → 2 min)
  - New RR WP → lifetime and mining efficiency
  - New MI collimators and faster Booster m-pole correctors
  - Shot set up time 2 hr 45 min → 1 hr 45 min
  - Tevatron optics tune up (β^*, D*) and orbit stabilization
  - A lot of attention to (preventive) maintenance and uptime

High luminosity operation, Beam-beam effects and their compensation in Tevatron, V.Shiltsev

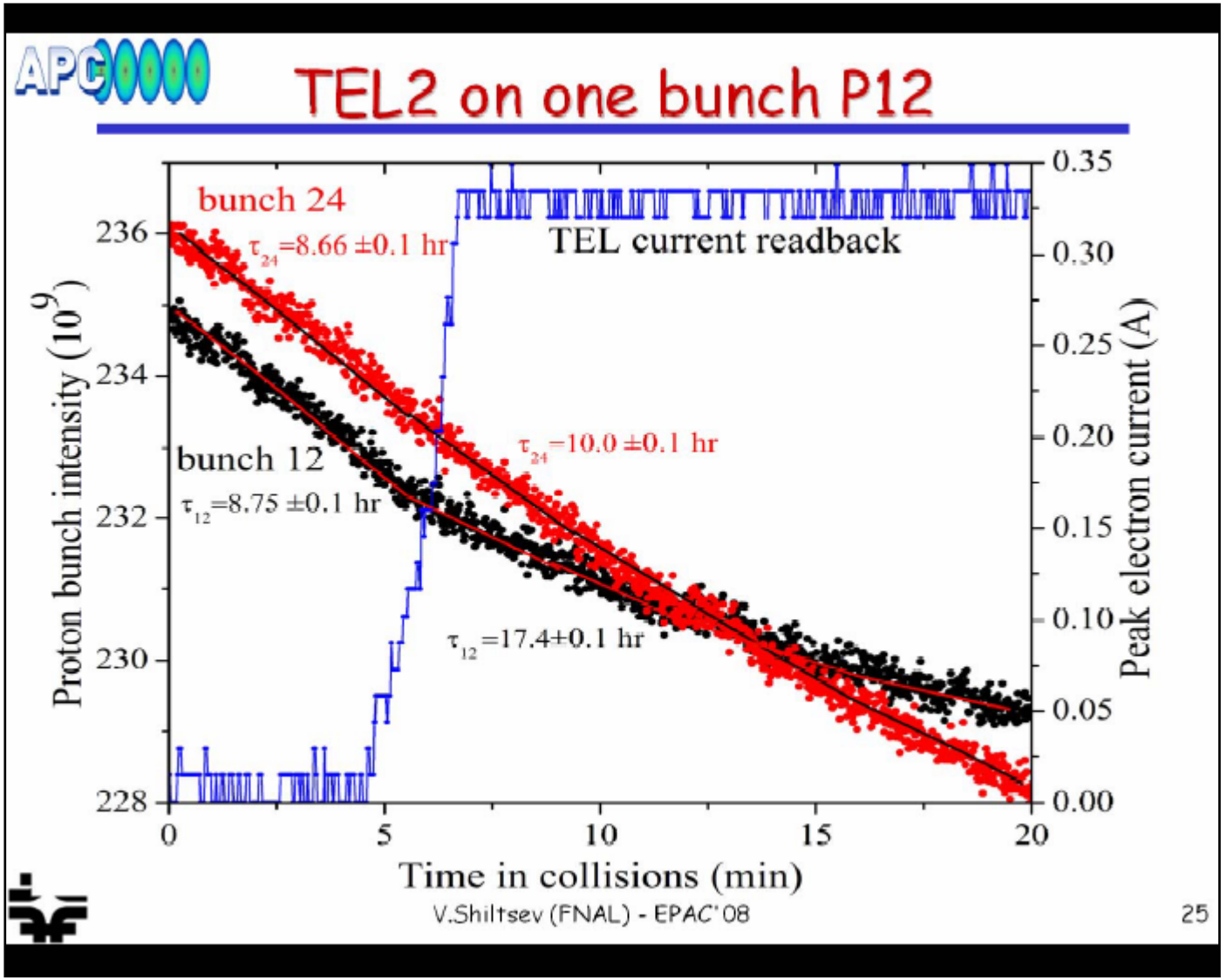
What is Electron Lens?

~4 mm dia 2 m long very straight beam of ~10kV

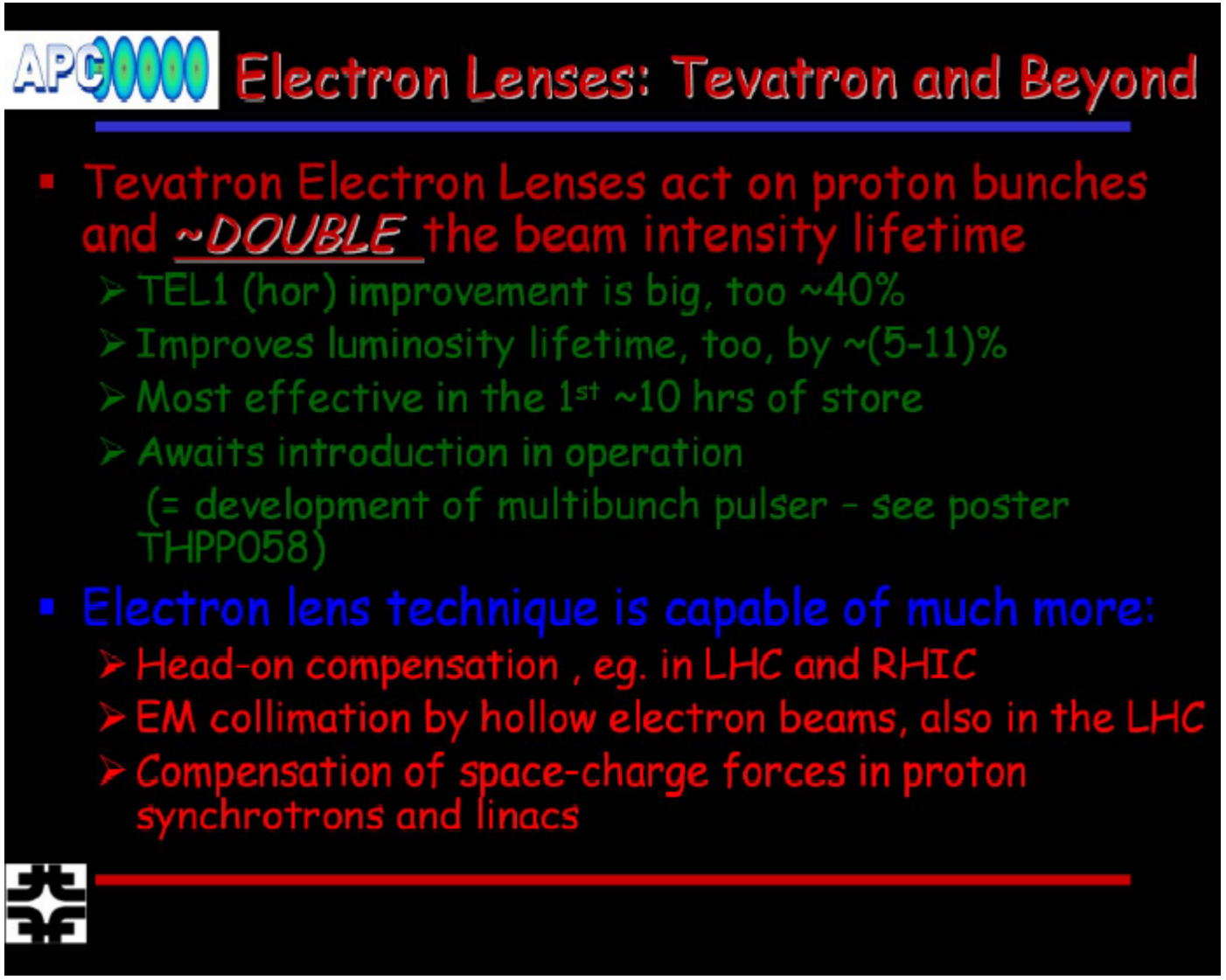
~1A electrons (~10^{12}) immersed in 3T solenoid



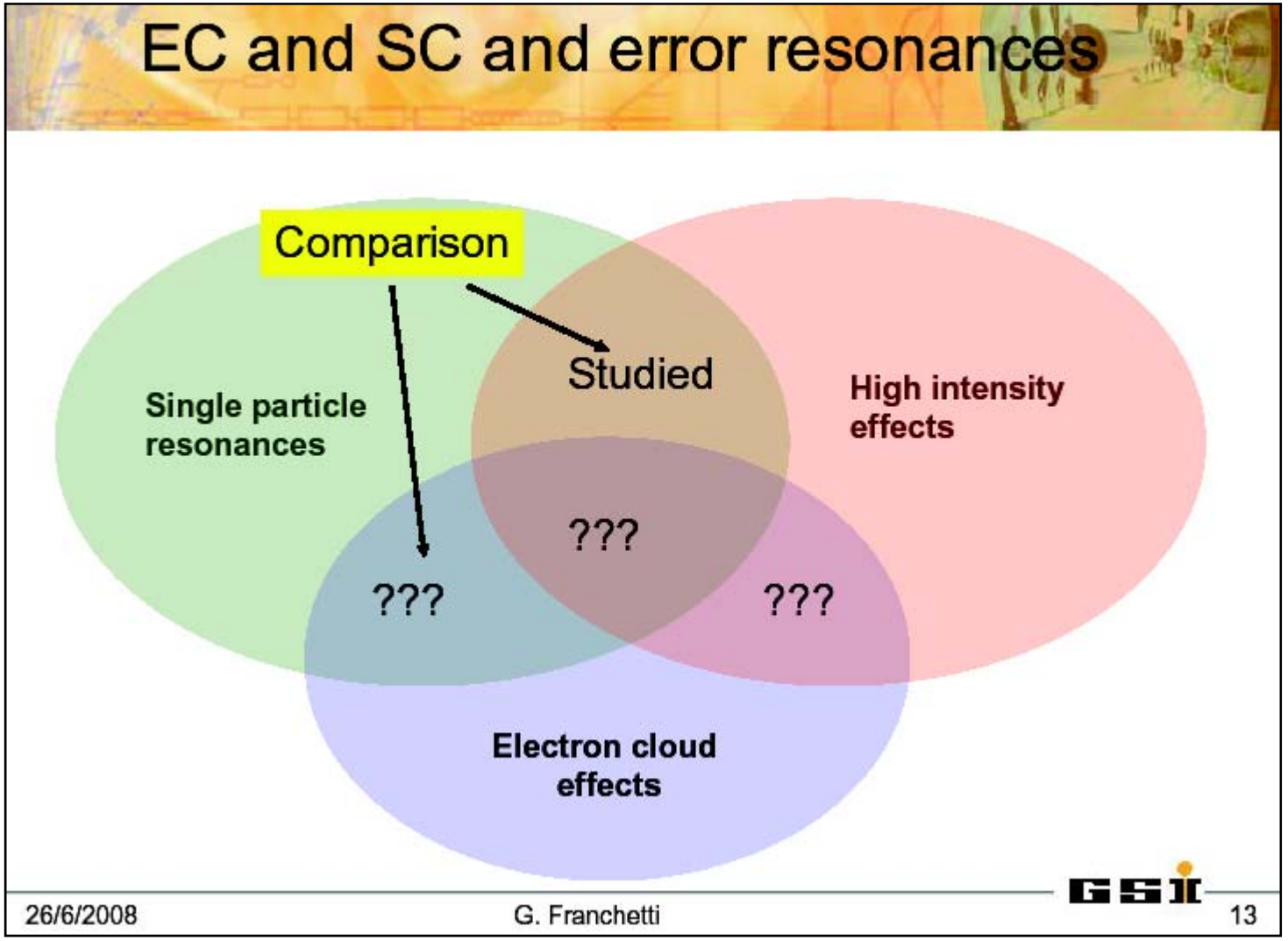
High luminosity operation, Beam-beam effects and their compensation in Tevatron, V.Shiltsev



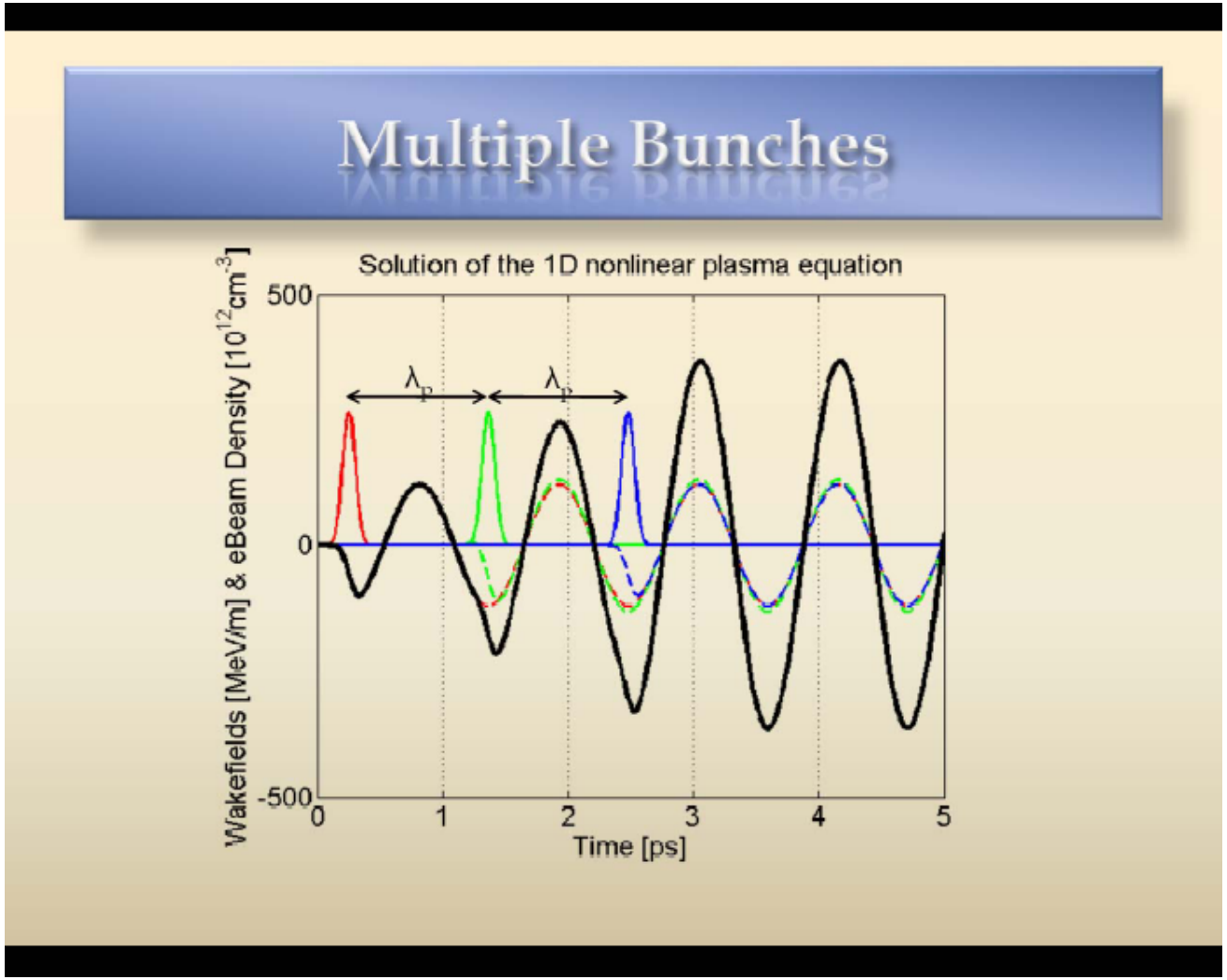
High luminosity operation, Beam-beam effects and their compensation in Tevatron, V.Shiltsev



Incoherent Effects of Space Charge and Electron Cloud, **G. Franchetti**



Experimental Results of a Plasma Wakefield Accelerator Using Multiple Electron Bunches, E.Kallos, USC



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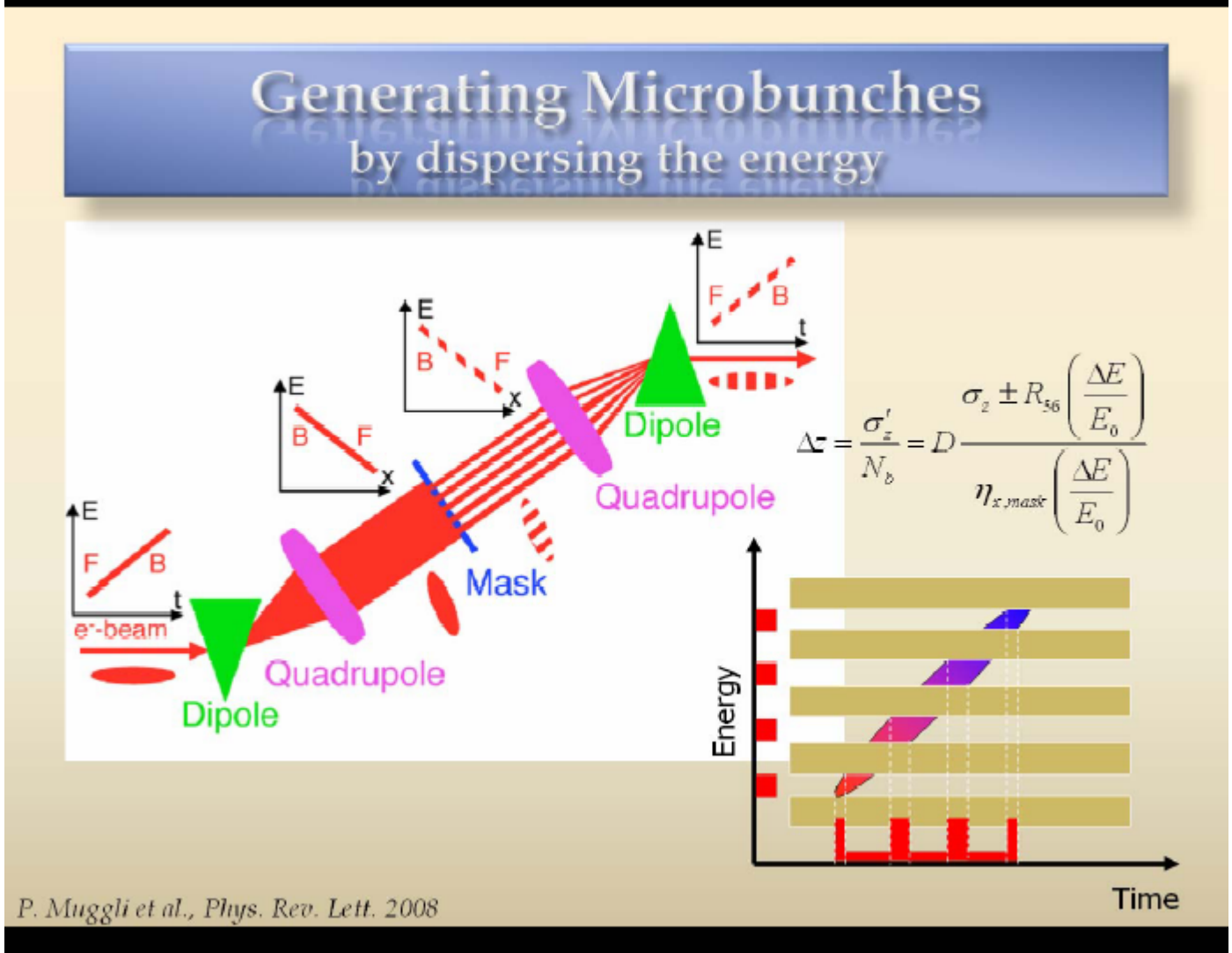

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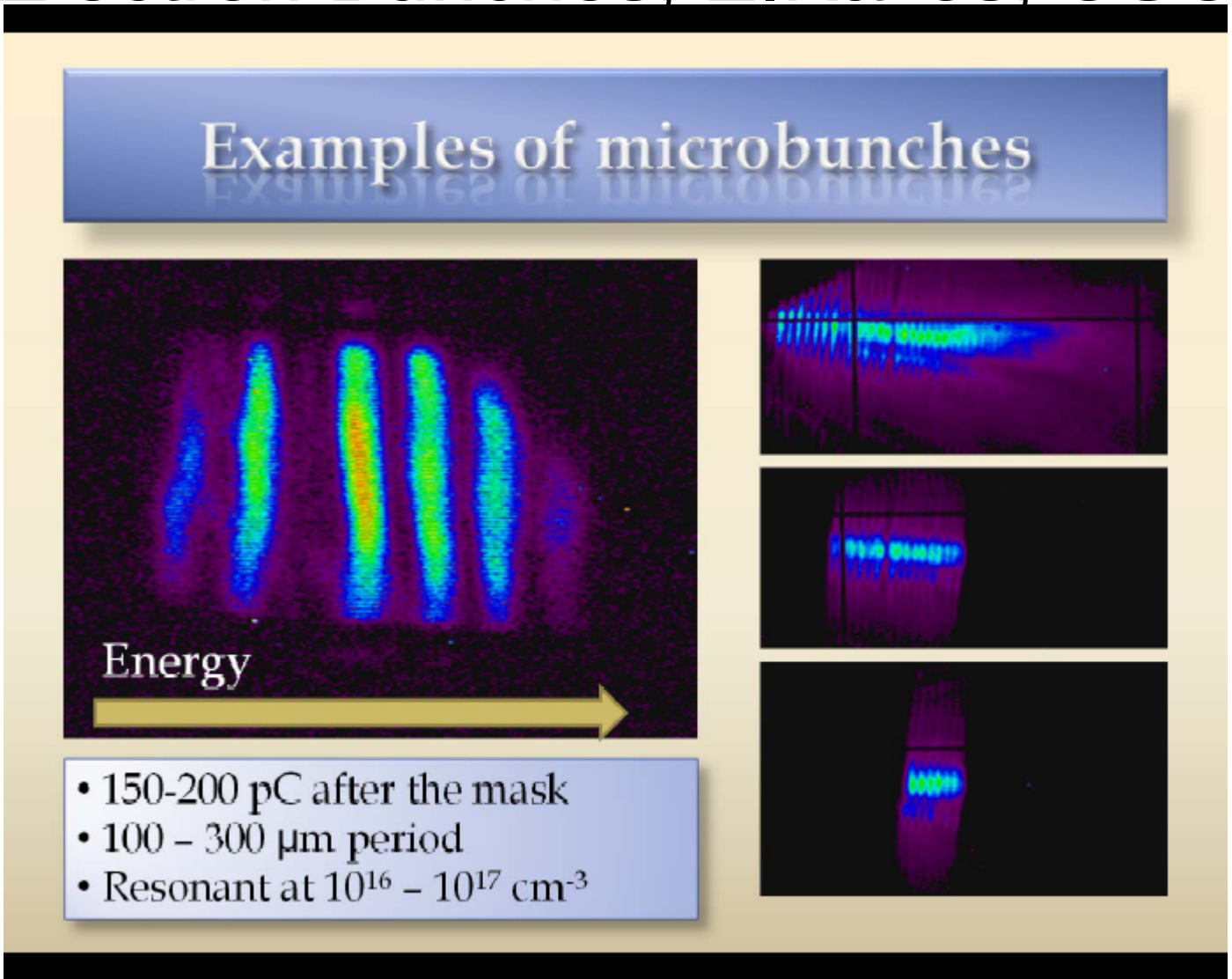

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