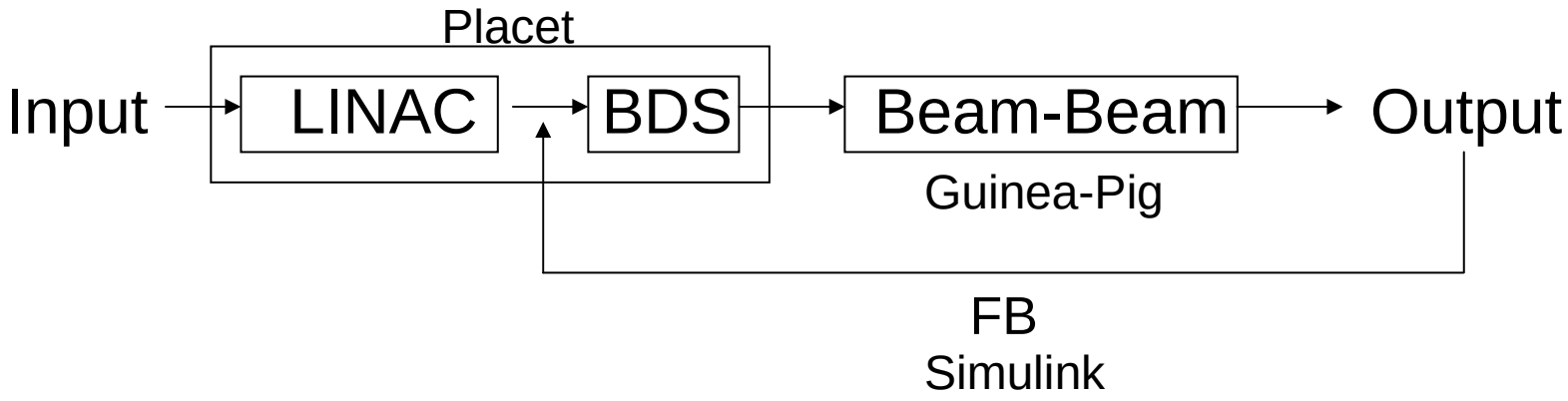
Placet based start-to-end simulations for the ILC with Intra-train FB system

Philip Burrows, Anthony Hartin, Javier Resta Lopez
(JAI, Oxford University)

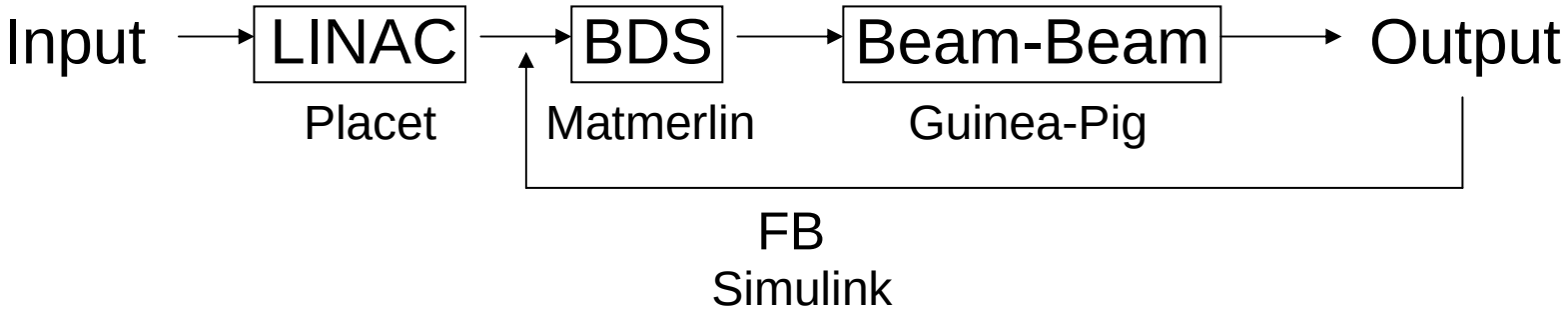
Andrea Latina, Daniel Schulte
(CERN, Geneva)

ILC integrated simulations

Updated simulations:



G. White version (2005):



ILC integrated simulations (Simulation update)

- Placet scripts for tracking along LINAC + BDS, linked with Simulink (Matlab)
- LINAC:
  - Sliced bunches tracked along the LINAC
  - Initial vertical norm. emittance (exit from DR and RTML) = 24 nm
  - Initial injection jitter (from DR and RTML) = 0.1σ
  - Including long- and short-range transverse and longitudinal wakefield functions
  - Structure misalignment. Alignment errors:

	$\sigma_{x,y}$	$\sigma_{rot\text{-}z}$	$\sigma_{rot\text{-}x,y}$
Quad	300 μm	300 μrad	
BPM	200 μm		300 μrad
Cavity	300 μm		

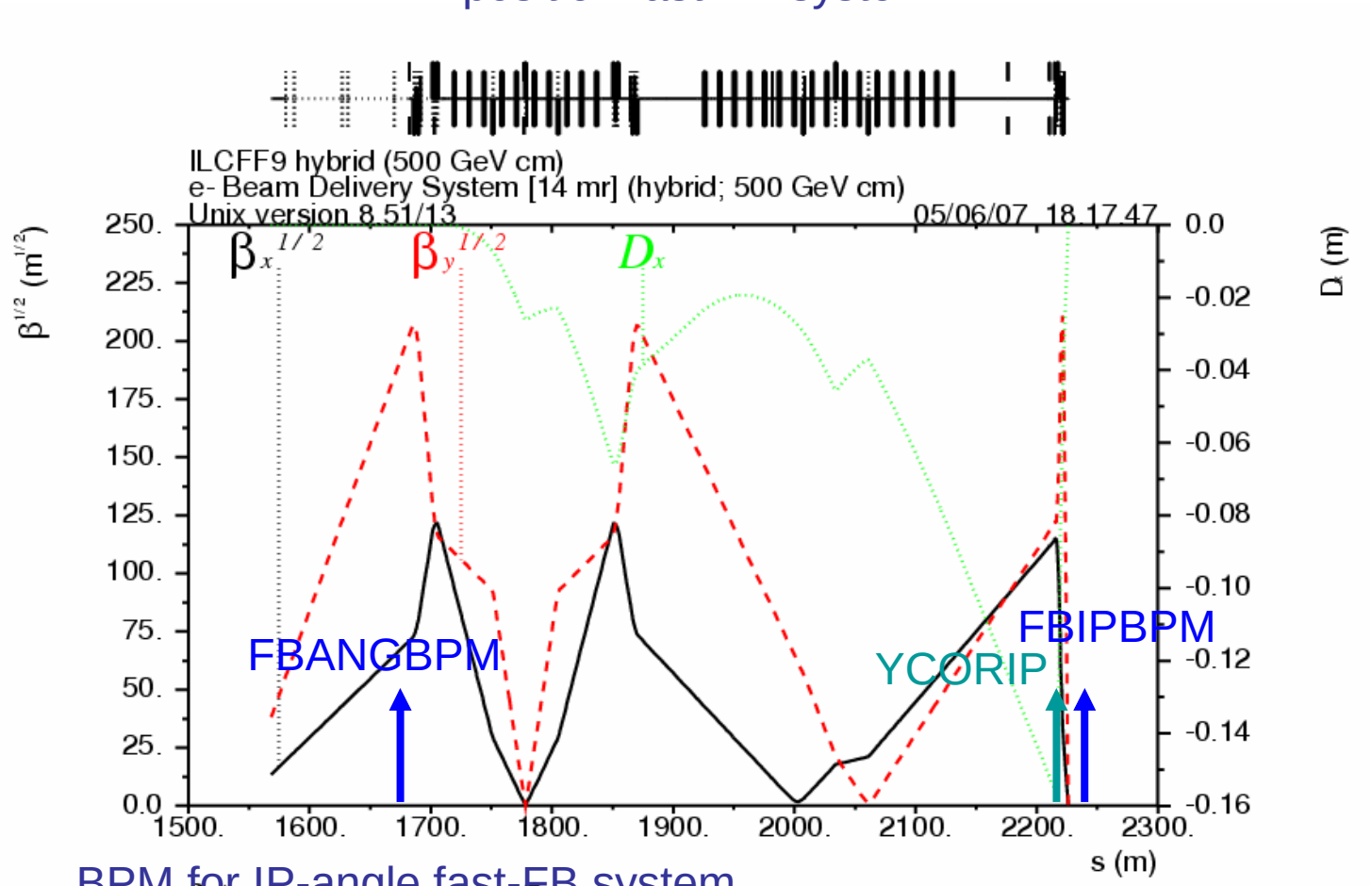
  - Static beam based alignment algorithms: 1to1, DFS
  - Inter-train ground motion model B (A. Seryi)

ILC integrated simulations (Simulation update)

- BDS & IP:
  - BDS optics 14 mrad used (version 2007)
  - Macroparticle tracking (Placet)
  - 0.2 s of GM model B
  - Beam-beam interaction at the IP (Guinea-Pig):
    - Luminosity and beam-beam deflection
    - Output for studies on EM background
  - Fast intra-train FB:
    - Simulink model (G. White)
    - Assuming BPM resolution: 2 μm (IP angular FB), 5 μm (IP position FB)
    - Kicker errors: 0.1 % rms bunch-bunch
    - Kick in the vertical plane ≤ 70 σ_y
    - Kick in the vertical angle ≤ 5 $\sigma_{y'}$

BPM and kicker positions

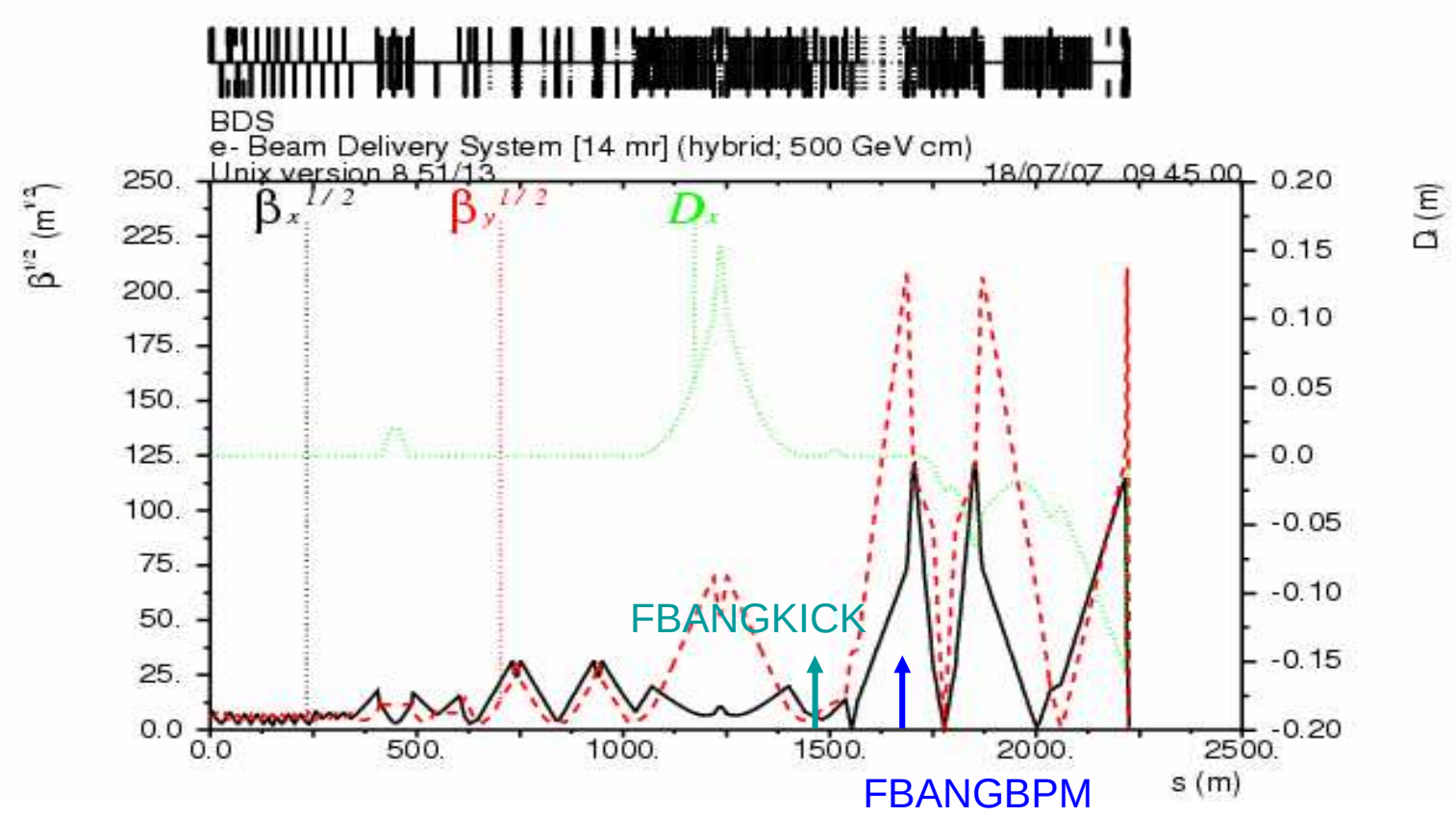
IP-position fast-FB system



BPM for IP-angle fast-FB system

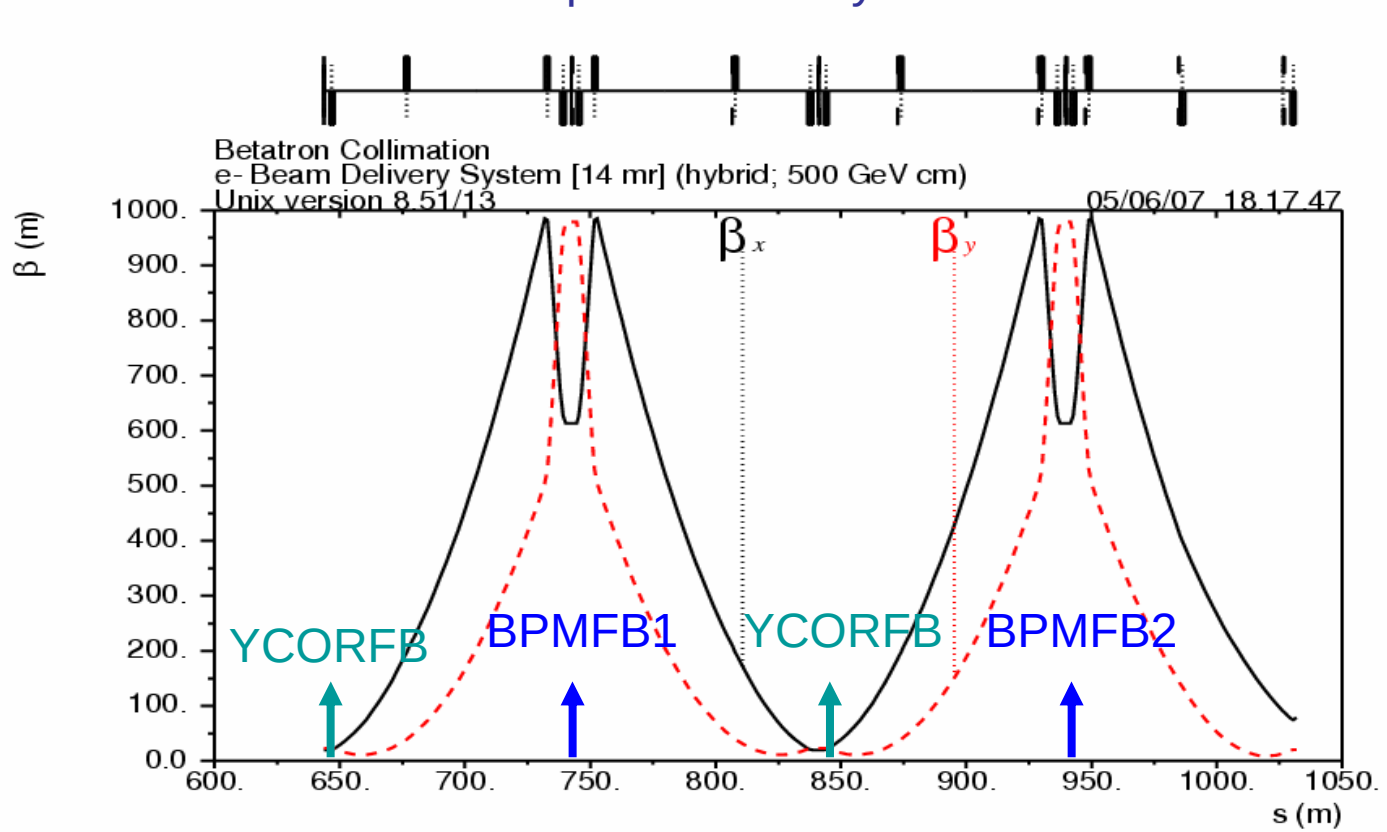
BPM and kicker positions

IP-angle Fast-FB system



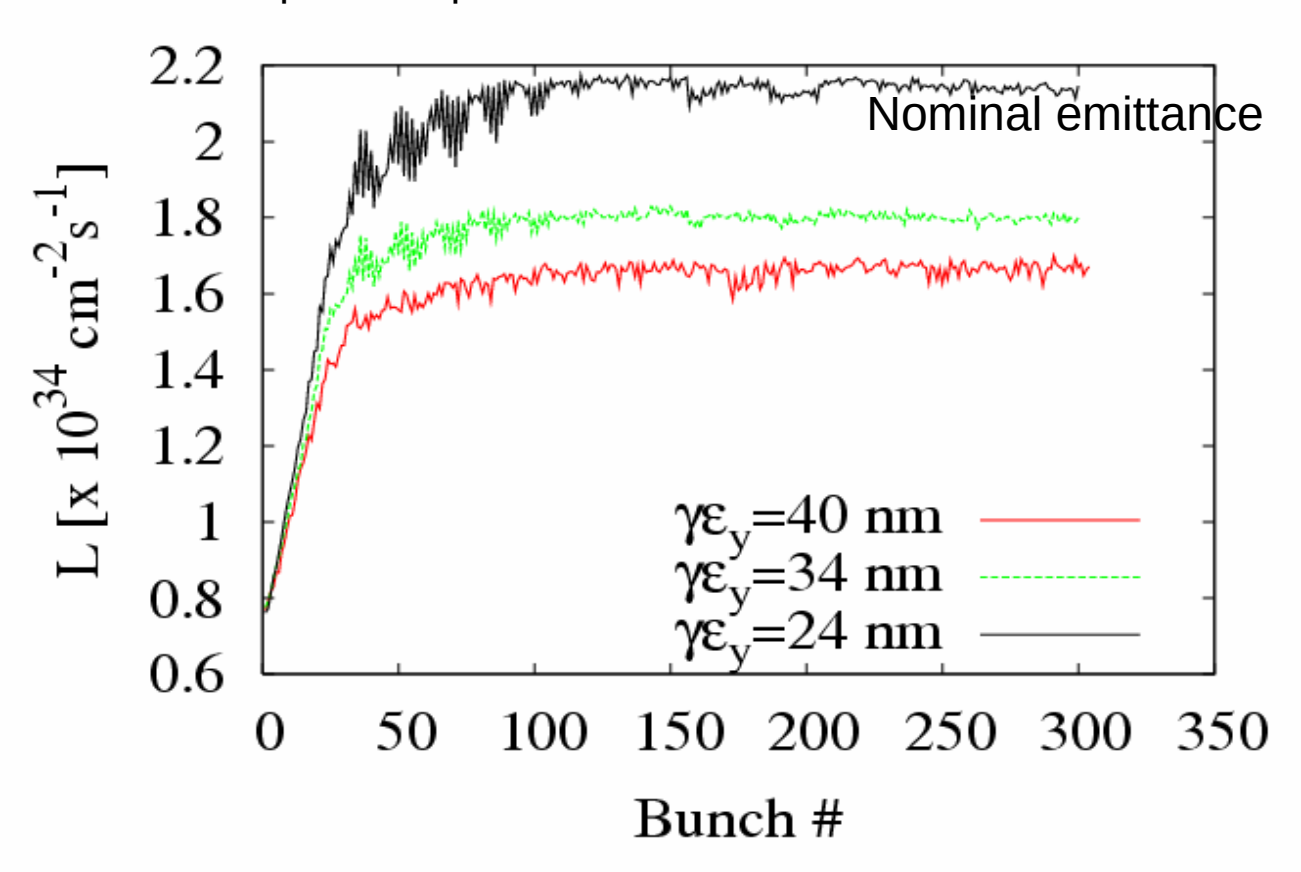
BPM and kicker positions

Upstream FB system



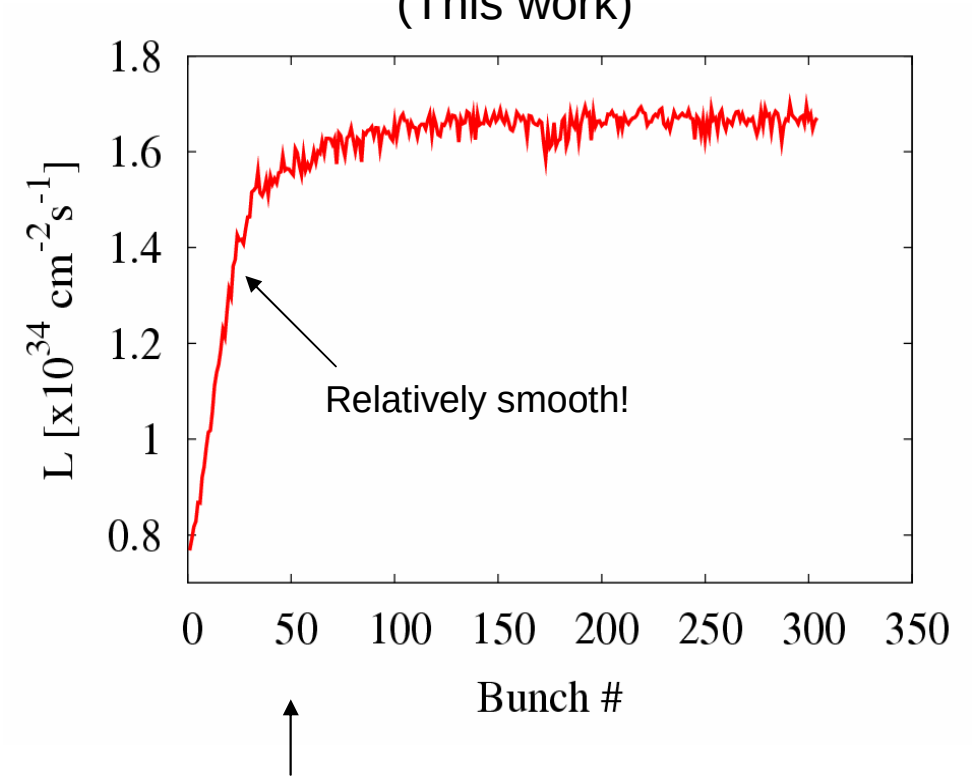
Luminosity

Example for a single seed
300 bunches
50000 macroparticles per bunch

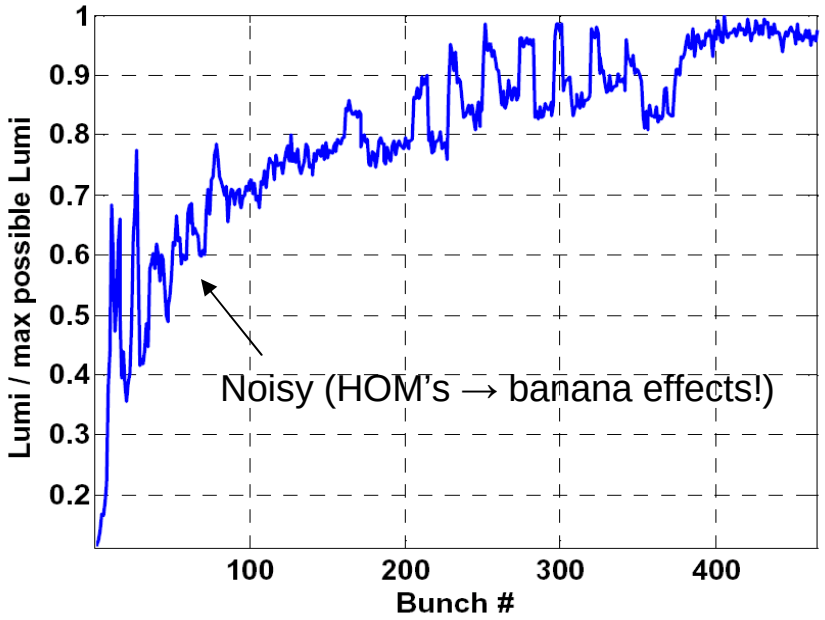


Luminosity

(This work)



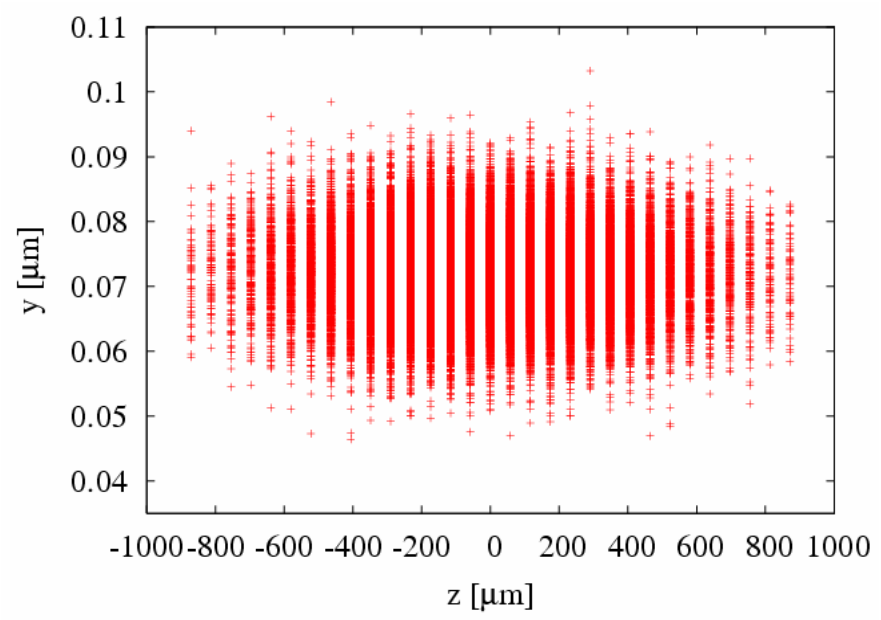
(Glen White et al., EUROTeV-Report-2006-088)



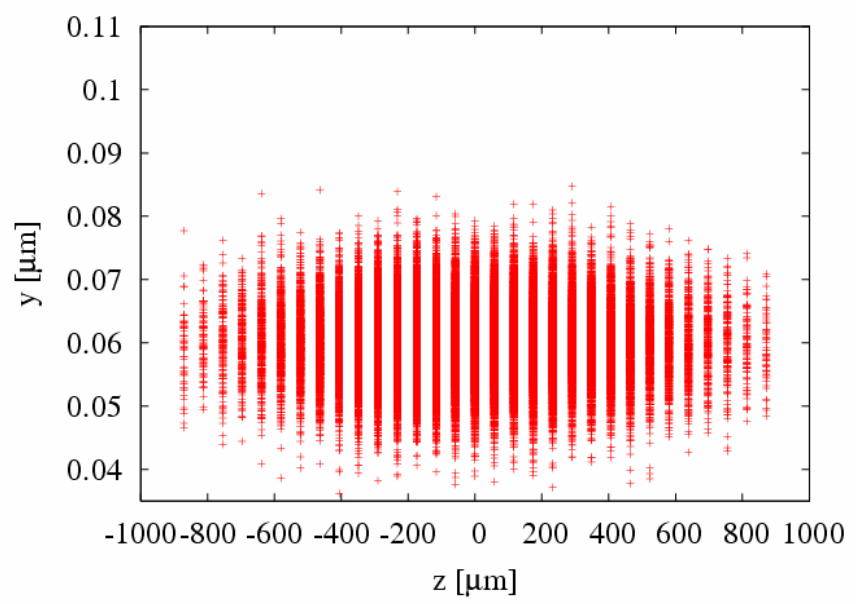
(Assuming a pessimistic case of 60 % emittance growth in the linac)

Longitudinal profile of a sample bunch at the IP

electrons



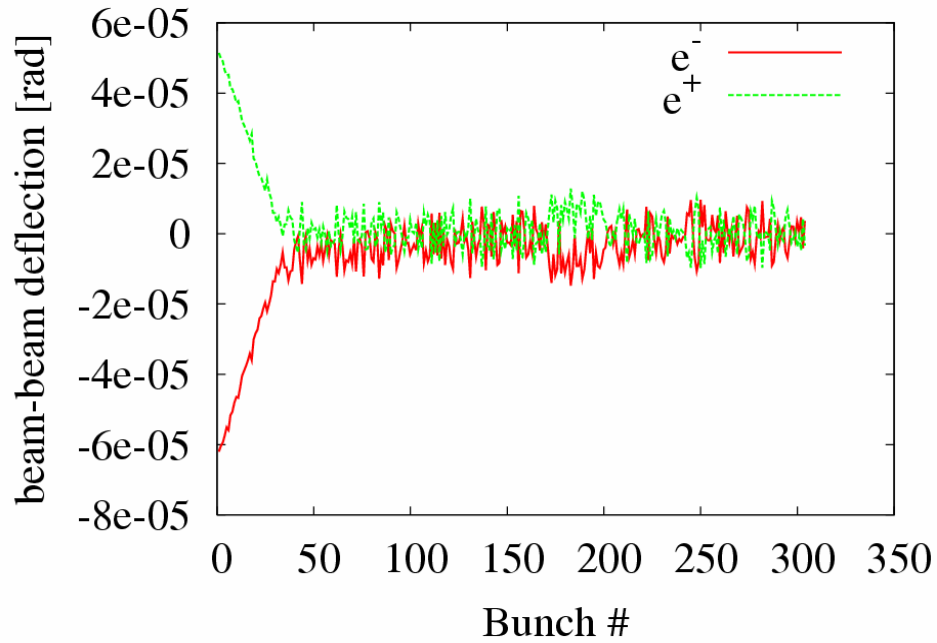
positrons



Almost no banana effect!

For the present ILC linac simulations the short-range wakefield effects are much weaker than for the previous TESLA linac simulations.

IP beam-beam deflection



IP vertical offset