Guinea-Pig with Merlin beams

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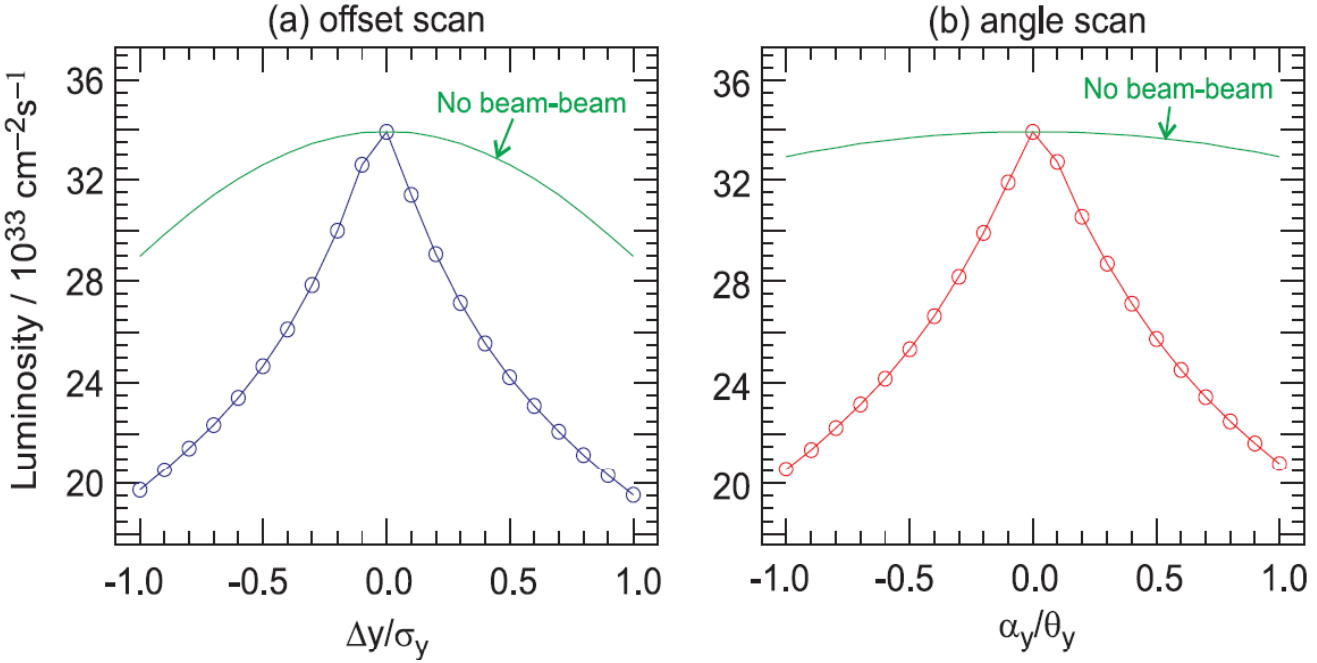
ILC tech meeting

September 6th, 2007

Offset and angle scan from TESLA TDR

Luminosity drops fast with small change of offset and/or angle



Results from beam-beam simulation with GUINEA-PIG from TESLA TDR

TESLA parameters: σ_y = 5nm , θ_y = 12 μrad

How is the luminosity change for the ILC parameters?
Now check with **beams generated with MERLIN**

MERLIN beam parameters

Merlin beam:

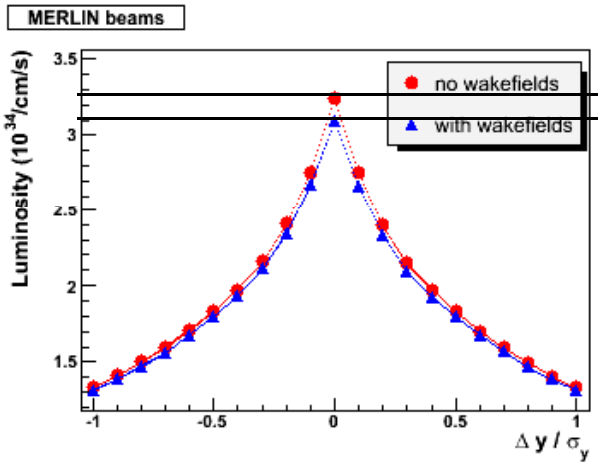
10^6 particles -> 500k per beam:

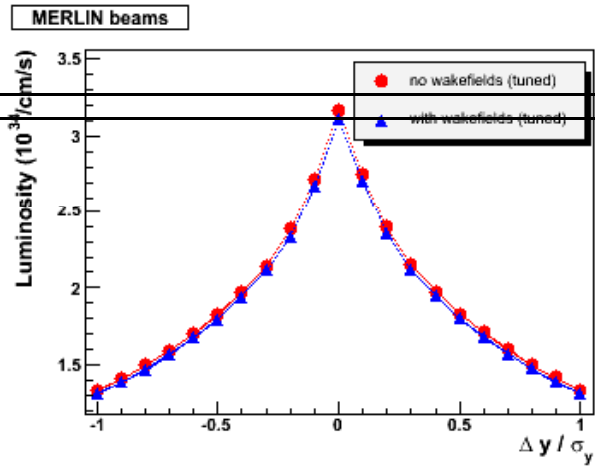
- generated with ILC2006e lattice file:
  - $\sigma_x \approx 600$ nm
  - σ_x =4.1 nm (nom RDR: 5.7nm)
  - $\gamma\varepsilon_x$ = 8 mm•mrad (nom RDR: 10 mm•mrad)
  - $\gamma\varepsilon_y$ = 0.02 mm•mrad (nom RDR: 0.04 mm•mrad)

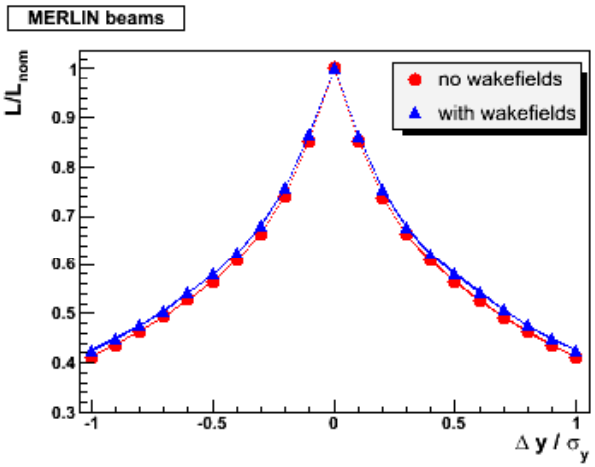
  4 samples:
  - wakefields switched on and off
  - tuning of the interaction point position (see Dirks talk) on and off
- generated with the modified ILC2006c lattice file from Dirk:
  - $\sigma_x \approx 650$ nm
  - σ_x = 5.7 nm (= nom RDR value)
  - $\gamma\varepsilon_x$ = 10 mm•mrad (= nom RDR value)
  - $\gamma\varepsilon_y$ = 0.04 mm•mrad (= nom RDR value)

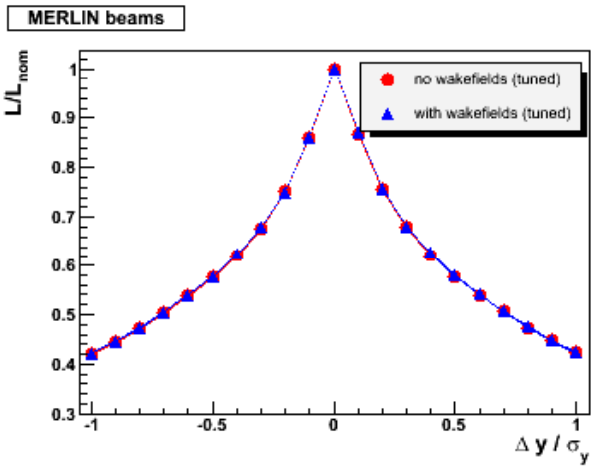
Offset scan with MERLIN beam (ILC2006e)

Lumi lower (~5%) with wakefields switched on





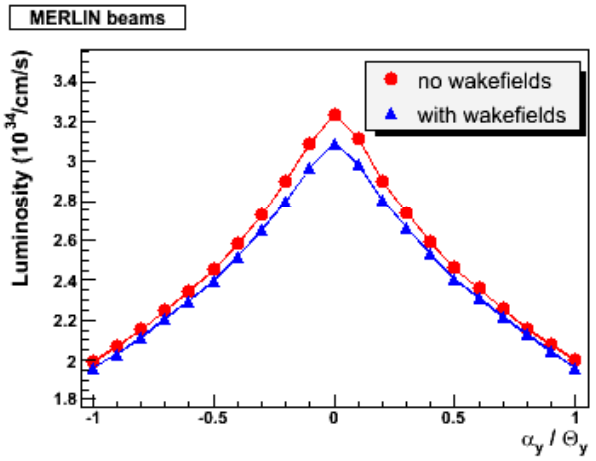


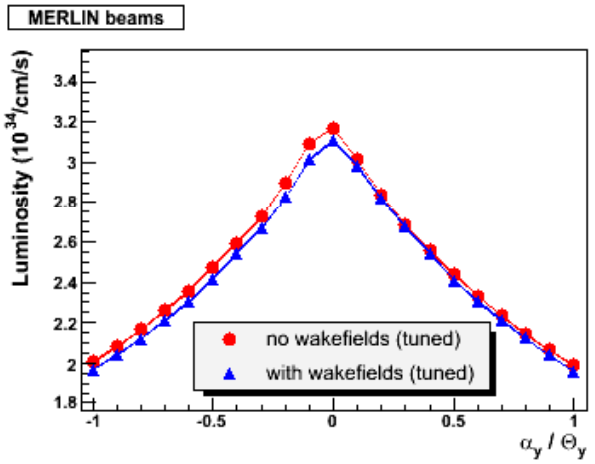


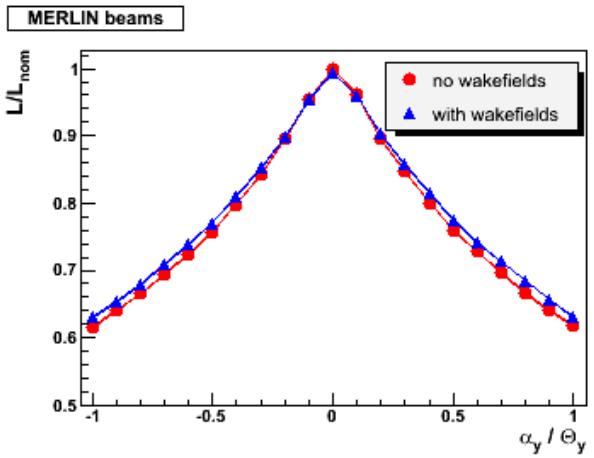
Tuning has only small positive effect on wakefield sample, even negative for sample w/o wakefields

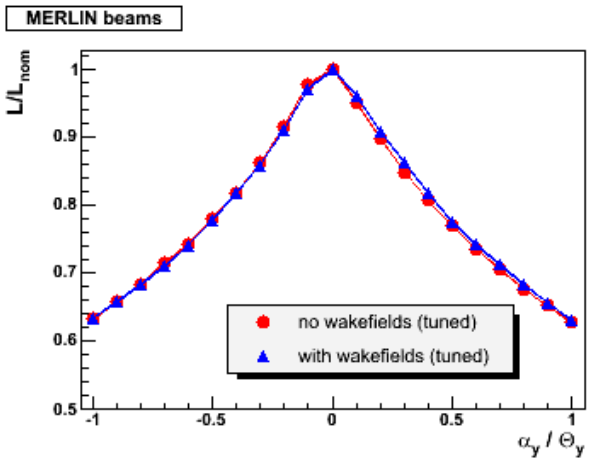
Angle scan with MERLIN beam (ILC2006e)

Slight shift of central value for all samples, but no possibility to regain lumi



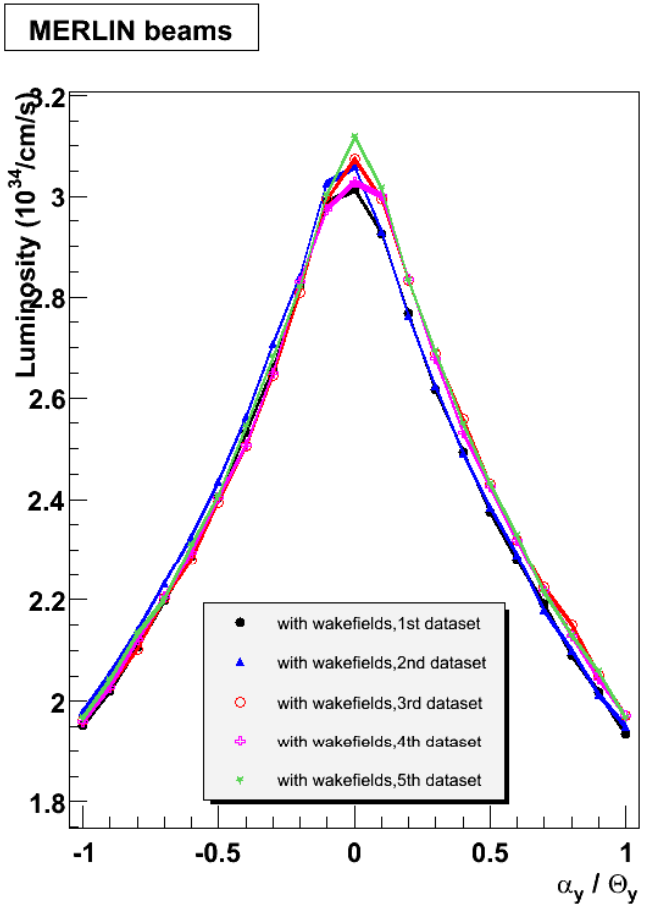




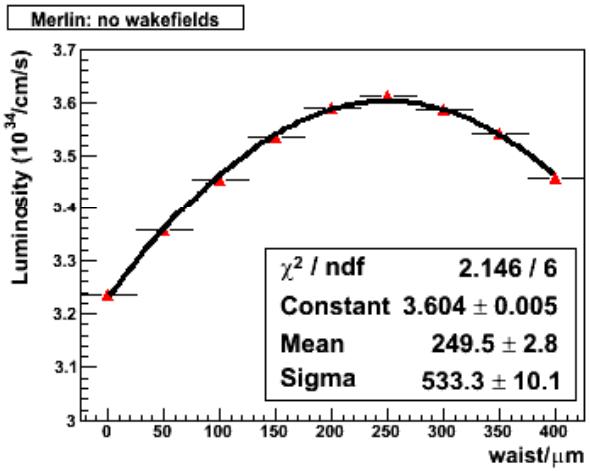


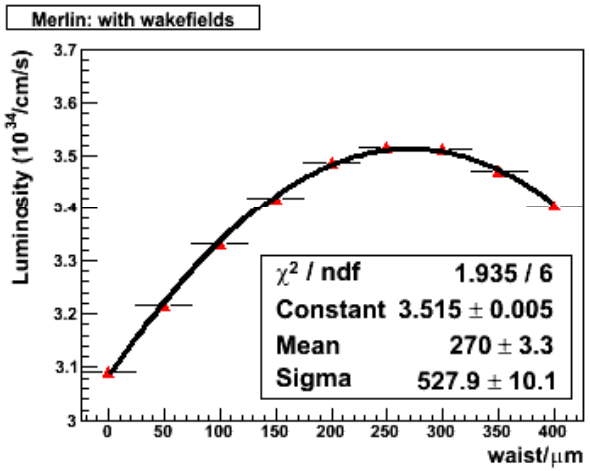
Angle scan with MERLIN beam (ILC2006e)

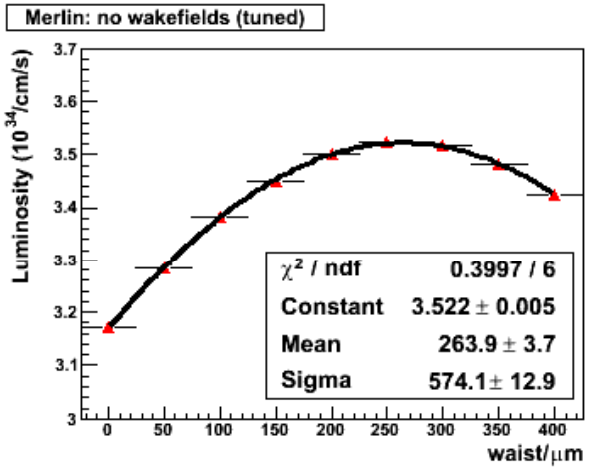
Here the 10^6 particles are split into 5 samples (with 100k p. per beam) to check for statistical uncertainties.

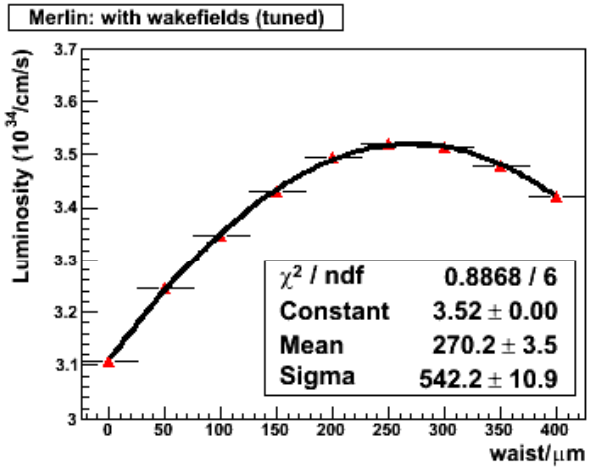


Waist scan with MERLIN beam (ILC2006e)









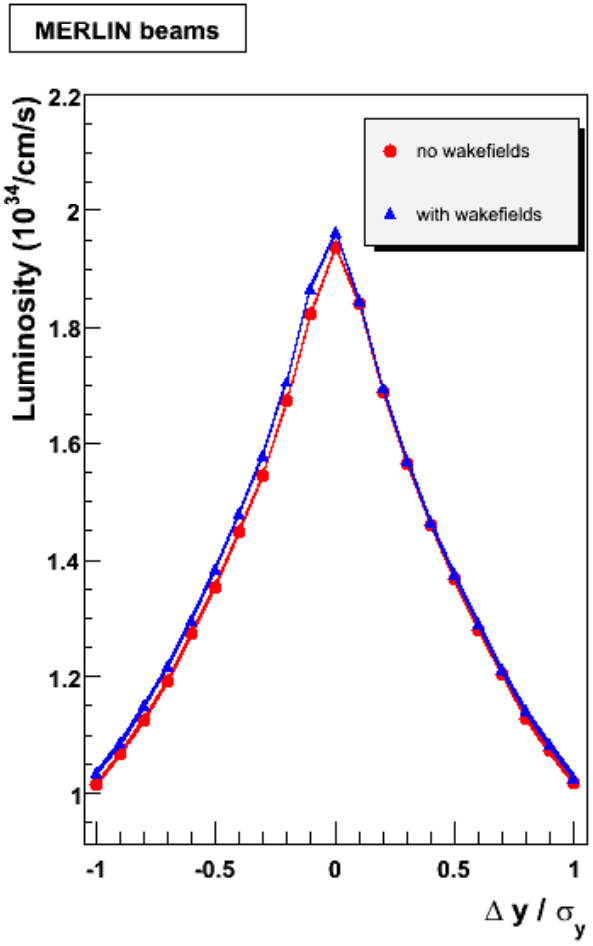
Waist:
focus of beam with respect to interaction point

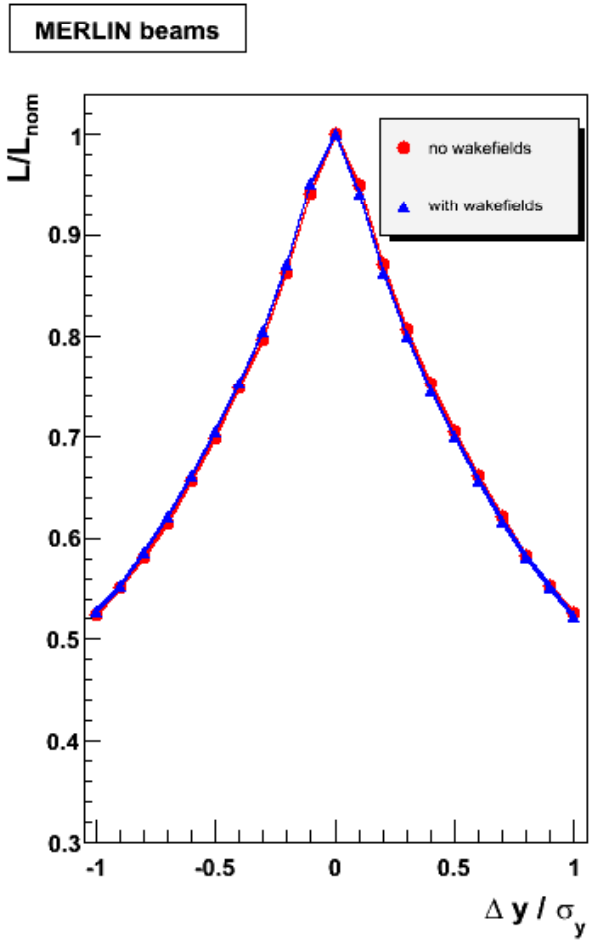
Tuning to best waist reduces lumi loss due to wakefields from ~4.7% to ~2.7%

Offset scan with MERLIN beam (ILC2006c_mod)

Lumi including wakefields is higher!

???

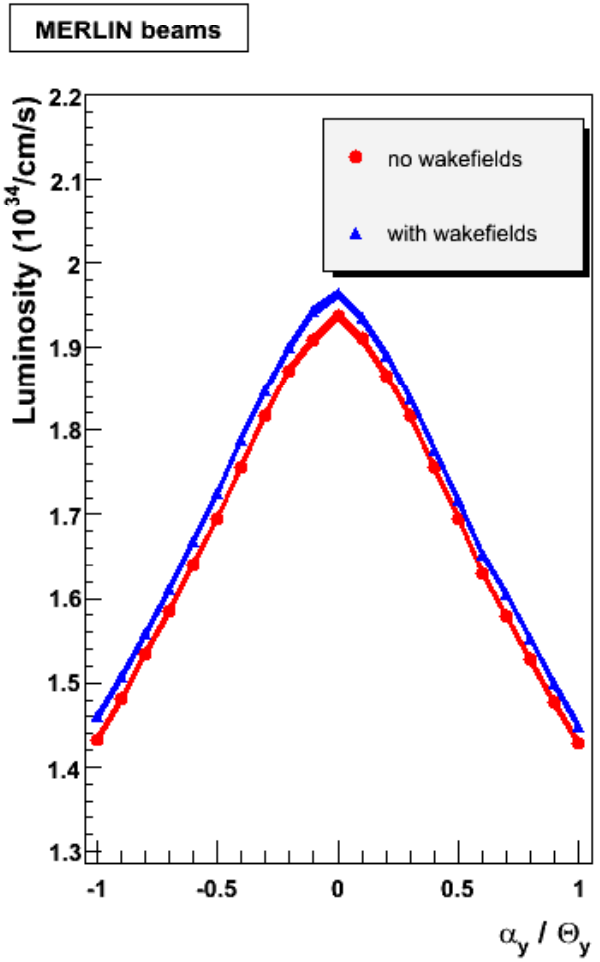


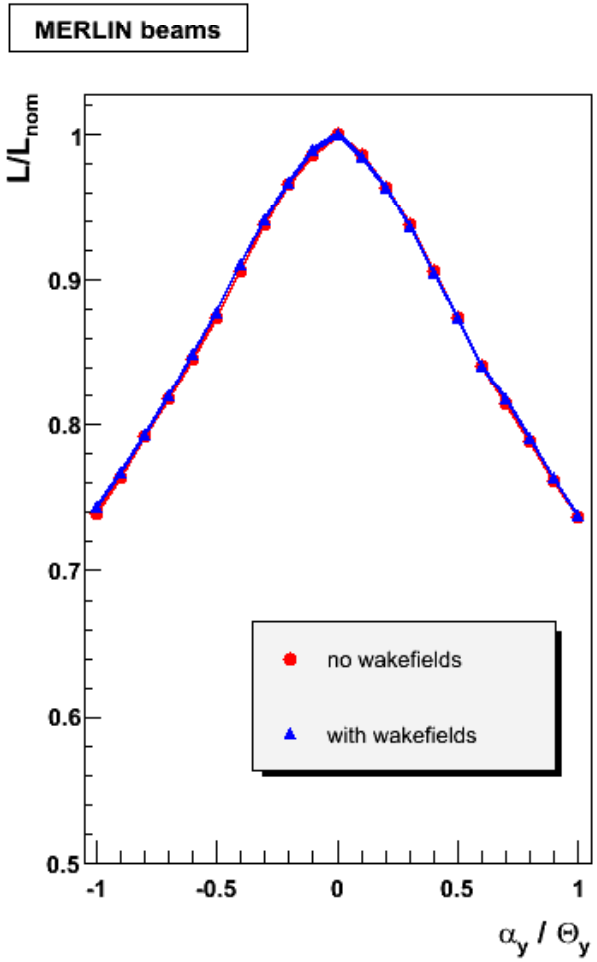


Angle scan with MERLIN beam (ILC2006c_mod)

Lumi including wakefields is higher!

???





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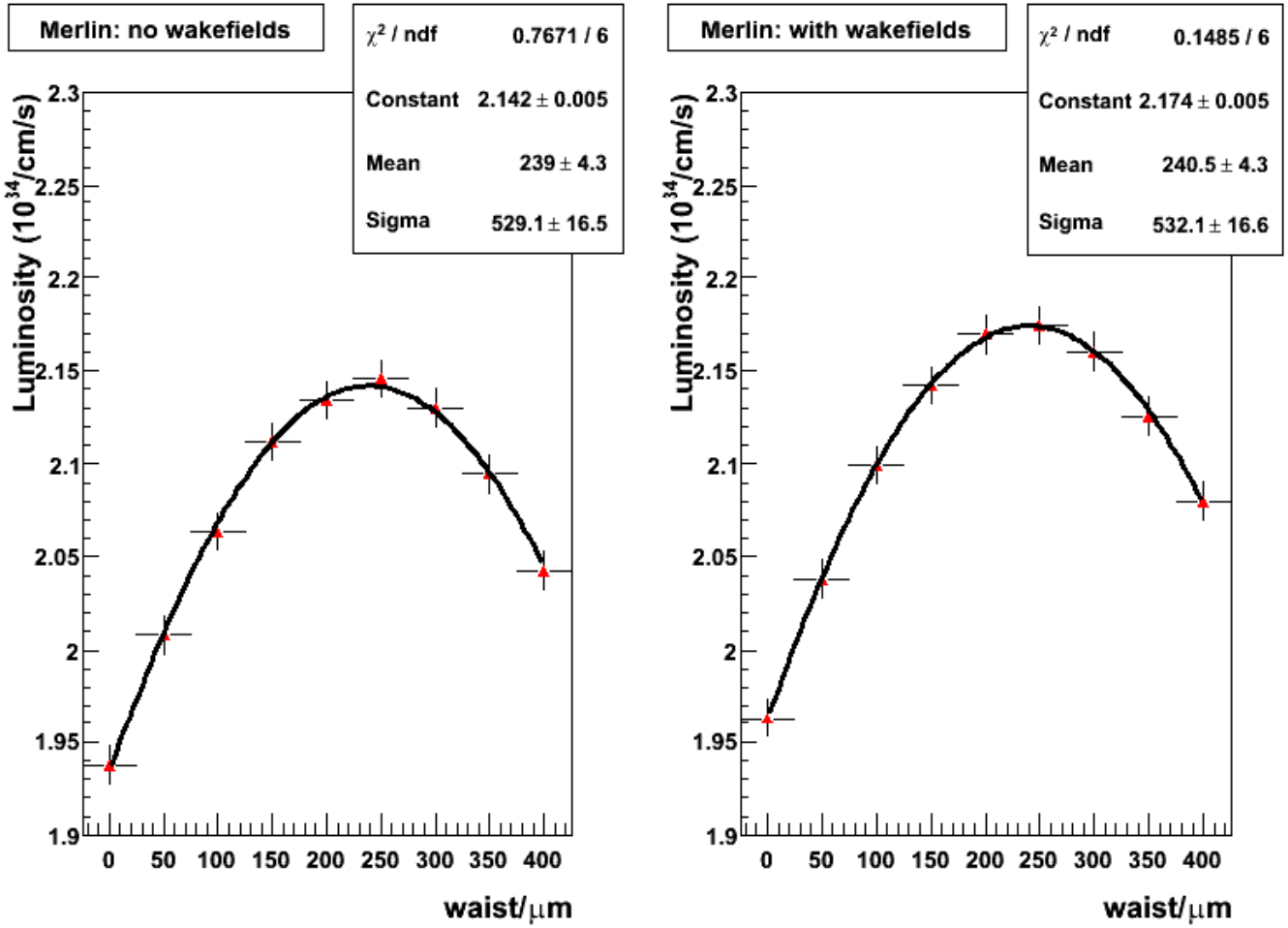

Conclusions

- No possibility to regain lumi by doing offset or angle scans
- Luminosity slightly lower for sample with wakefields switched on in ILC2006e, vice versa for modified ILC2006c (need to check further)
- Highest lumi for waist ~270 μm (ILC2006e) and ~240 μm (ILC2006c) before interaction point
- Tuning?