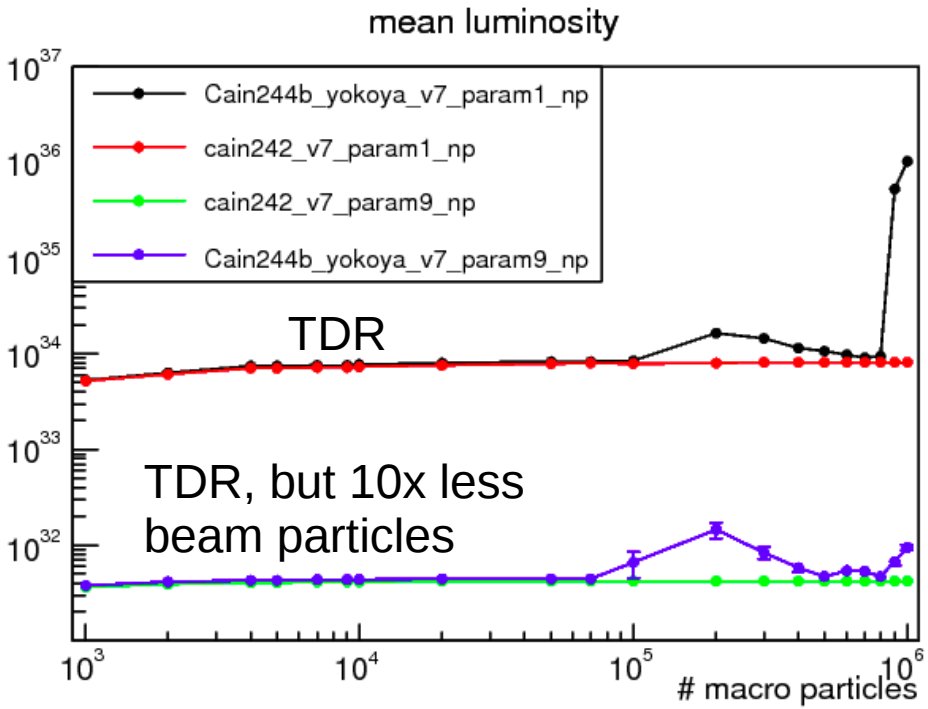
Update

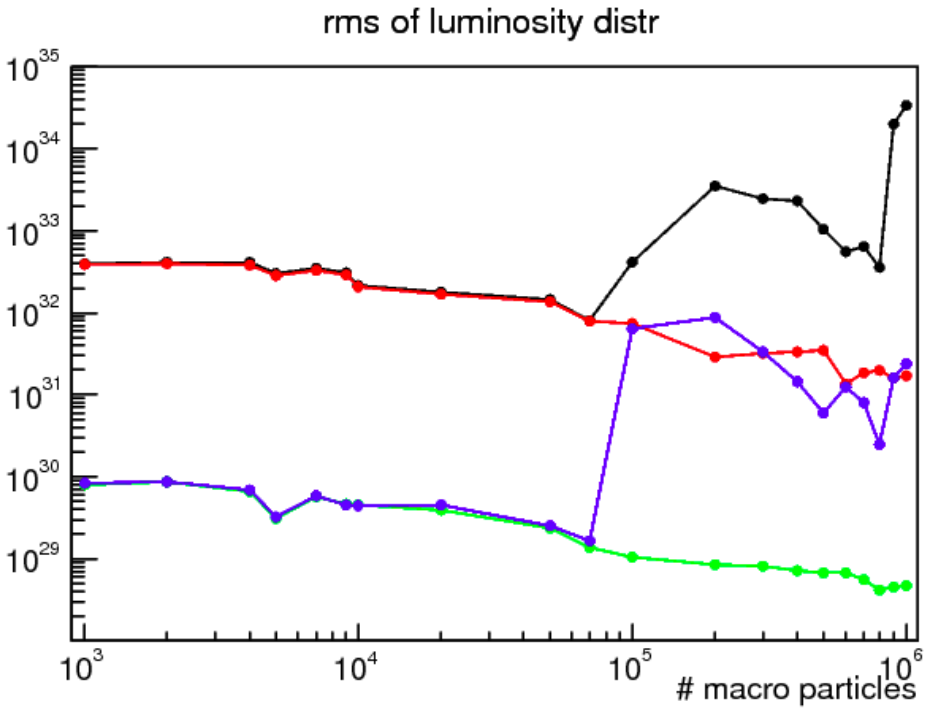
- CAIN #particles dependency
- effect on physics of different luminosity spectra @ 250 GeV
- beam kick for large y offsets

Daniel Jeans, 11 April 2017

last meeting: observed weird dependence on CAIN results
as function of # macro particles

mean and rms of luminosities calculated in 10 CAIN runs/point:





only present in most recent beta version of the code (244b)

previous version (I checked 242, 243) look as expected
→ stay with older versions for the time being

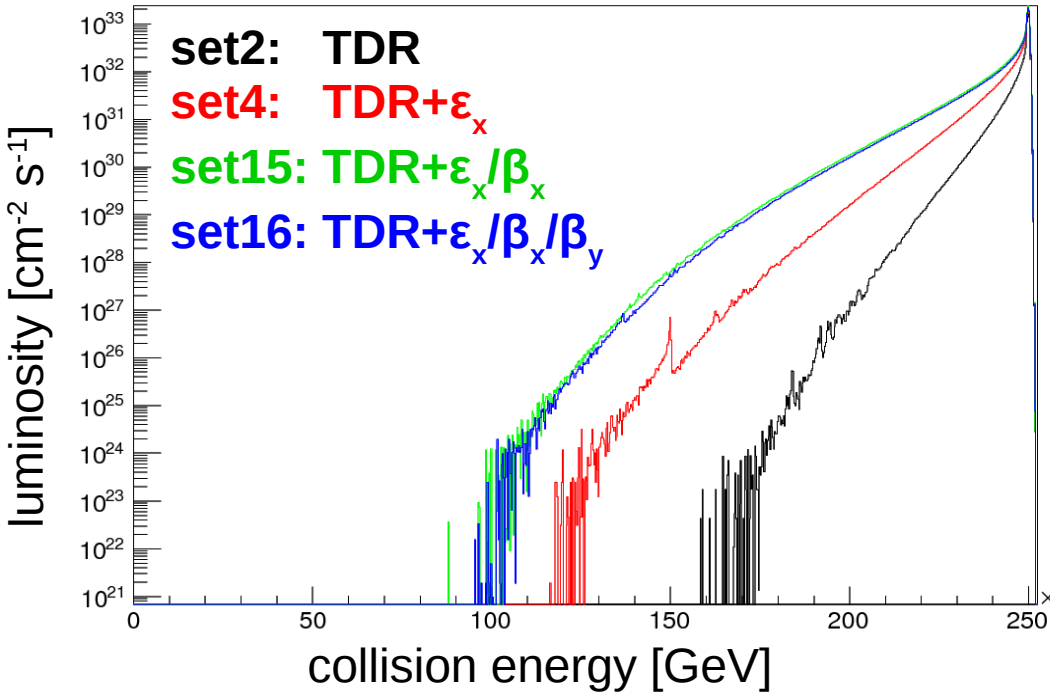
effect of 250 GeV luminosity spectra on physics

Higgs mass extraction in
Higgs-strahlung process e+ e- → HZ , Z → mu mu
is, I think, most sensitive to knowledge of collision energy

do simple full-sim pseudo-analysis to
estimate effect of different luminosity spectra

recoil mass distribution affected by:
beamstrahlung ←larger for new parameter sets
detector resolution ←smallest for Z → mu mu

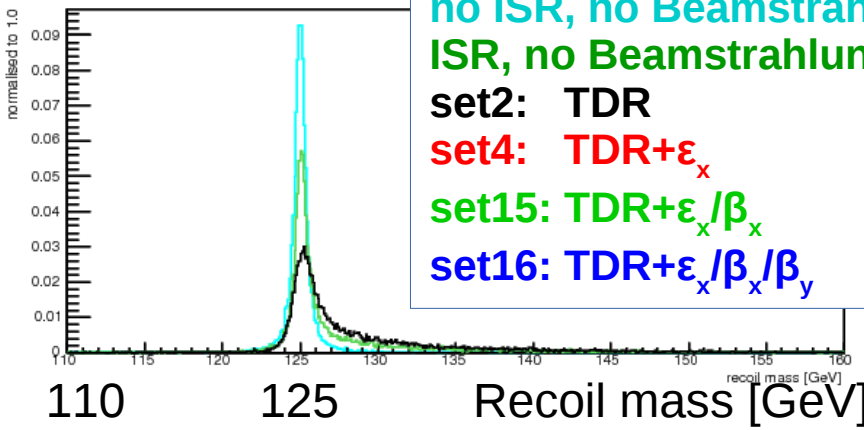
is increased beamstrahlung compensated by increase luminosity?



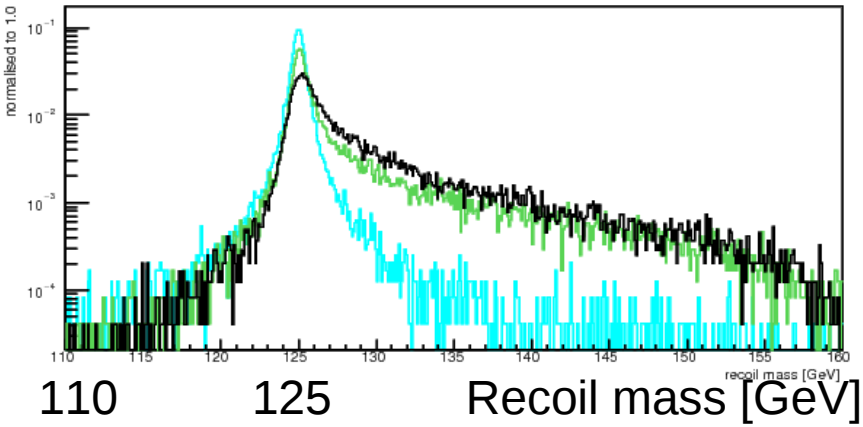
recoil mass distributions: after full simulation and reconstruction

no ISR, no Beamstrahlung
ISR, no Beamstrahlung
set2: TDR
set4: TDR+ε_x
set15: TDR+ε_x/β_x
set16: TDR+$\varepsilon_x/\beta_x/\beta_y$

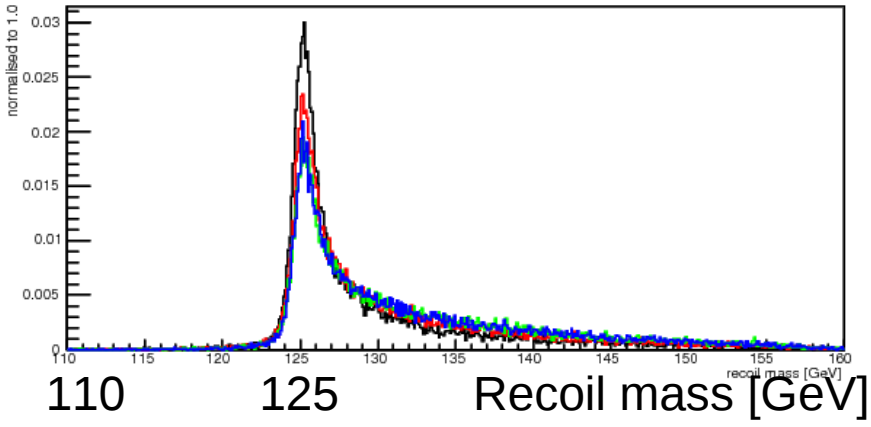
equal normalisation



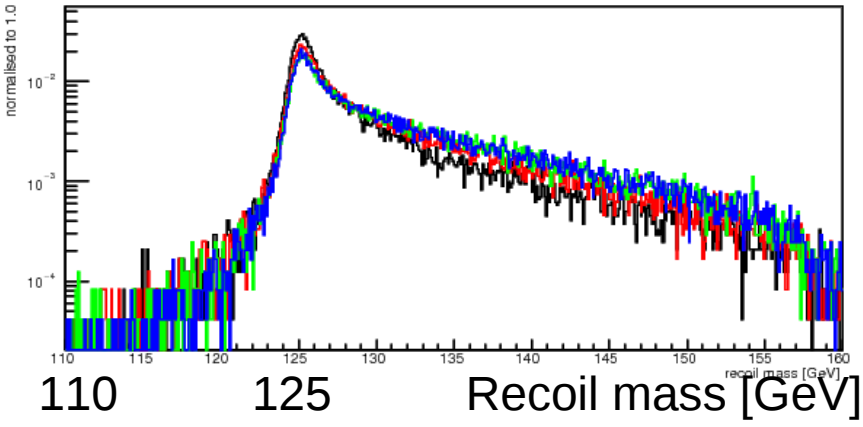
110 125 Recoil mass [GeV]



110 125 Recoil mass [GeV]

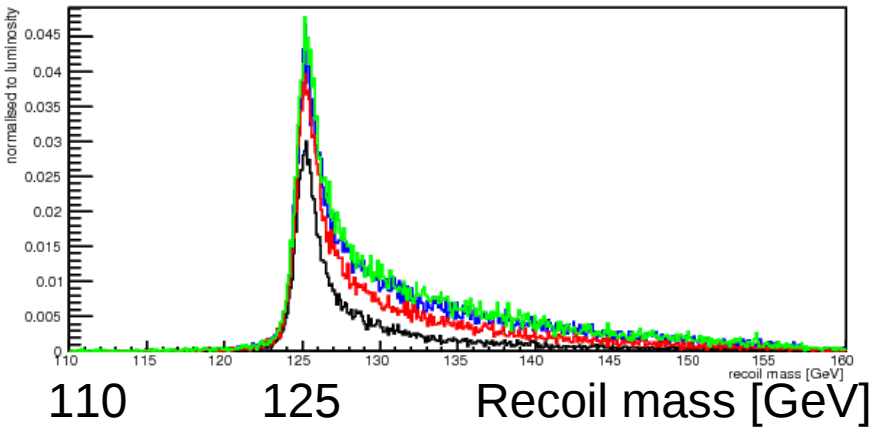


110 125 Recoil mass [GeV]

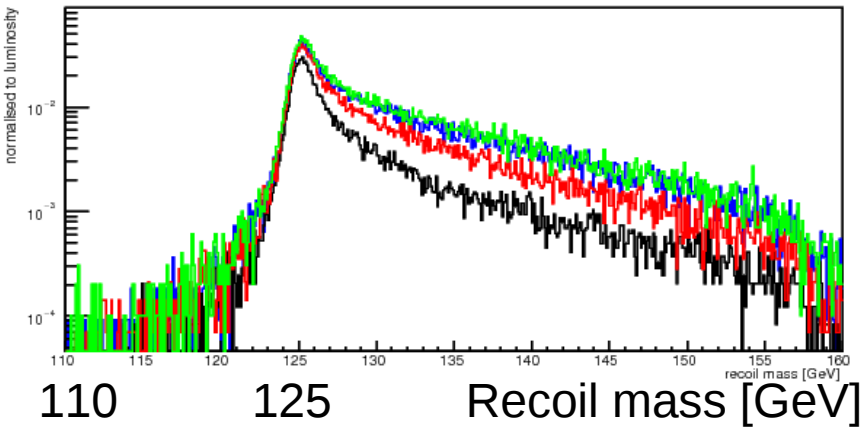


110 125 Recoil mass [GeV]

scaled to luminosity



110 125 Recoil mass [GeV]

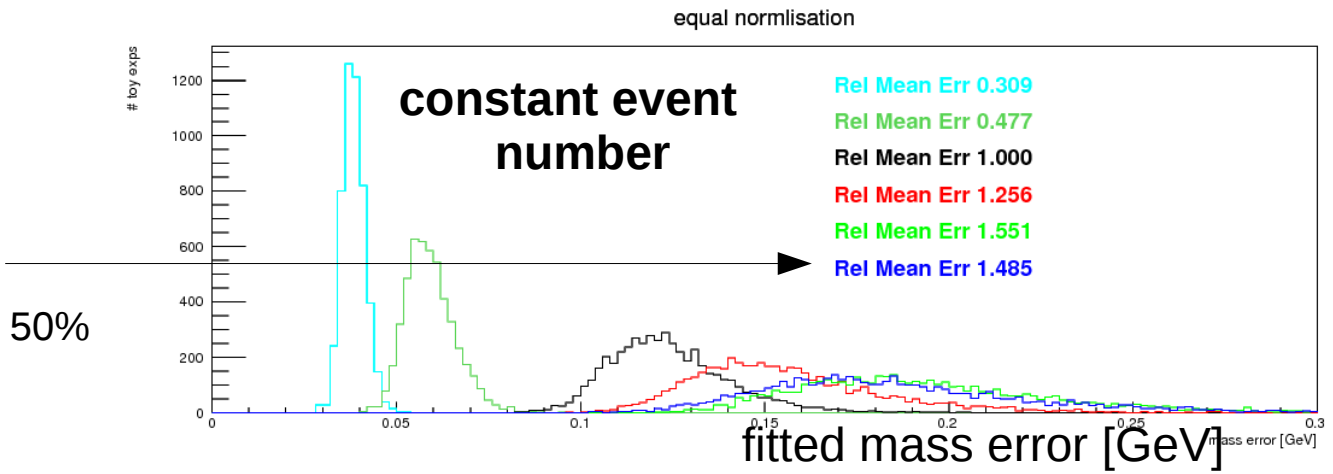


110 125 Recoil mass [GeV]

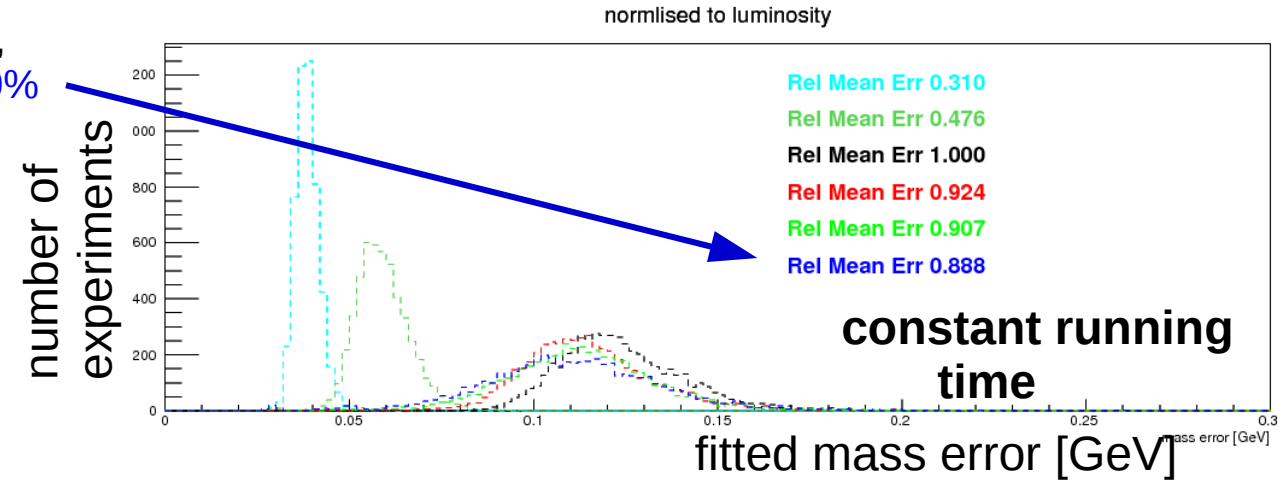
Toy MC experiments, assuming flat background expected mass measurement errors using different beam spectra

no ISR, no Beamstrahlung
ISR, no Beamstrahlung
set2: TDR
set4: TDR+ε_x L0.01 ↑ 41%
set15: TDR+ε_x/β_x L0.01 ↑ 69%
set16: TDR+$\varepsilon_x/\beta_x/\beta_y$ L0.01 ↑ 55%

with same **number of events**:
new spectra are less powerful,
expected mass error degrades by 50%
compared to TDR



with same **running time**:
higher lumi more than compensates,
expected mass error improves by 10%
compared to TDR

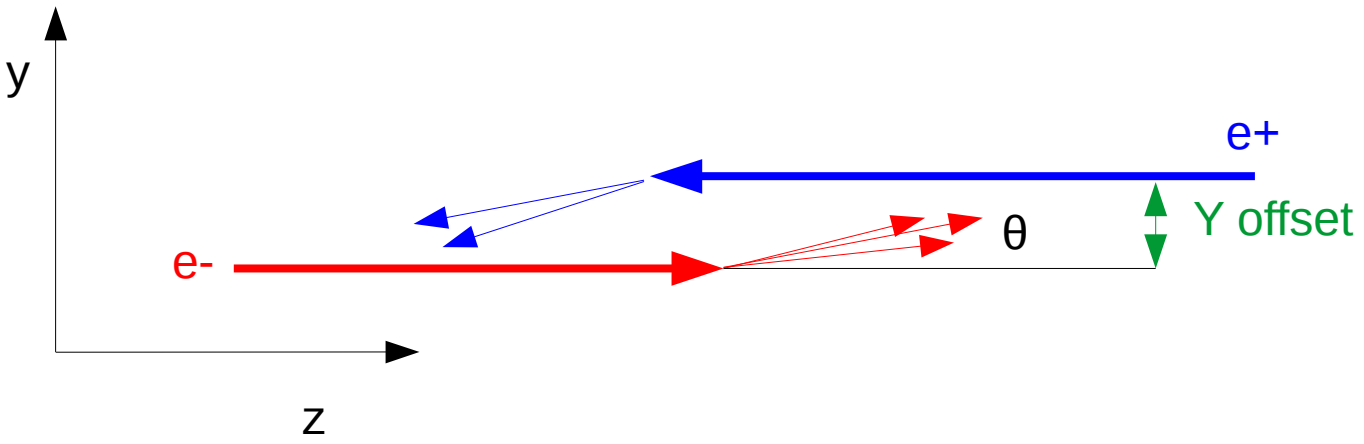


even for this analysis, which is rather sensitive to the luminosity spectrum,
new parameters are better than the TDR
→ expect larger improvement in other analyses

beam kick vs. vertical displacement
for different 250 GeV parameter sets

(request from Okugi-san :
if I understand correctly related to tolerance to vibrations)

look at distribution of beam particles' θ = atan(py/pz) after the collision
using CAIN
comparing TDR and **TDR+$\varepsilon_x/\beta_x/\beta_y$** parameters

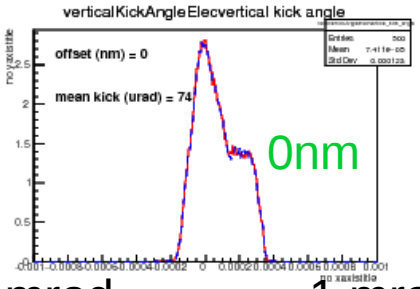


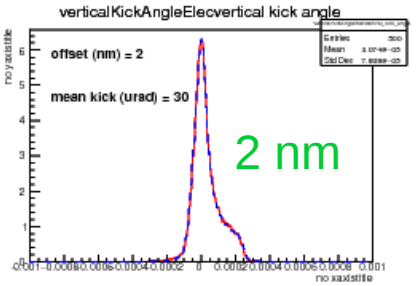
TDR parameters, vertical offsets: 0, 2, 5, 10, 20, 50, 100, …, 1000, …., 10000 nm
plot distribution of atan(Py/Pz) after CAIN simulation

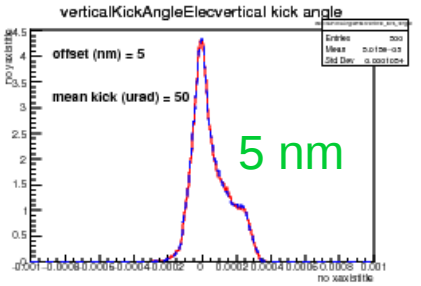
electrons / positrons

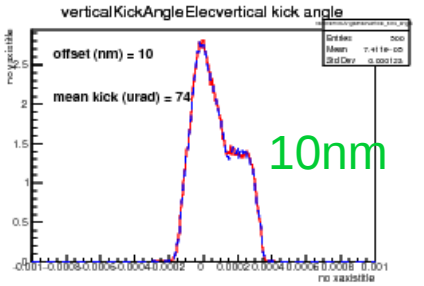
particles

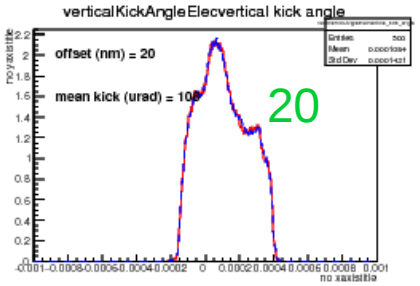
-1 mrad → 1 mrad

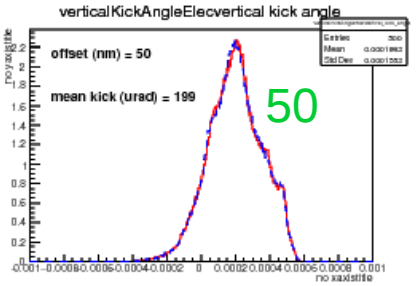


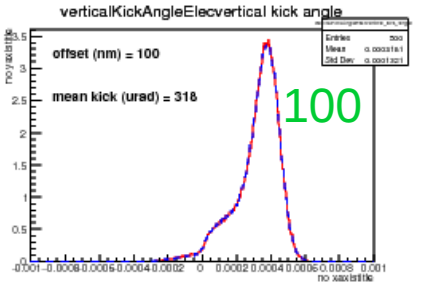


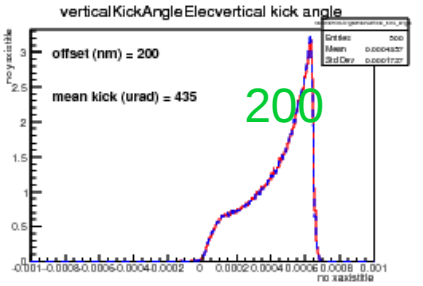


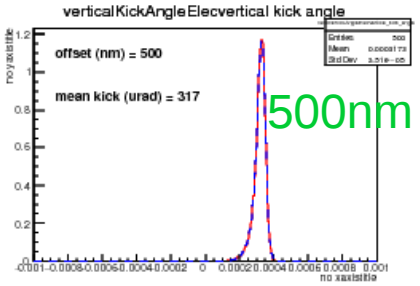


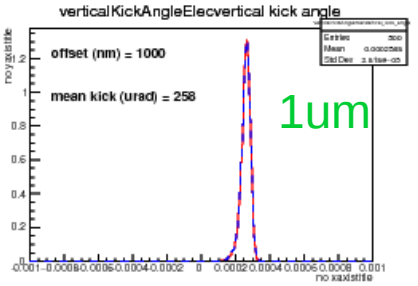


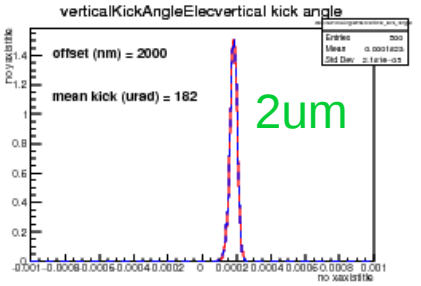


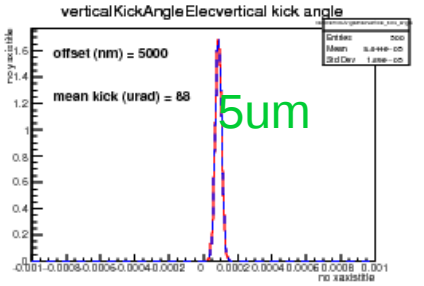


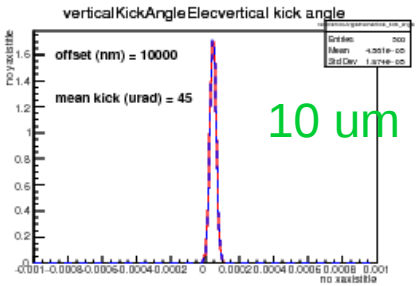


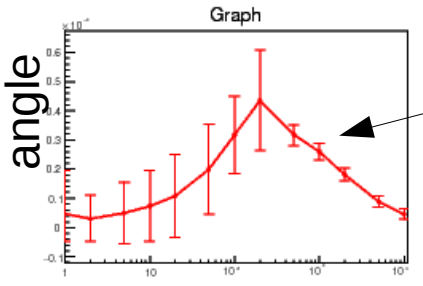












mean and RMS

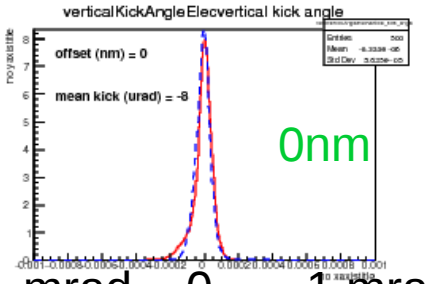
why are some of these so lumpy?

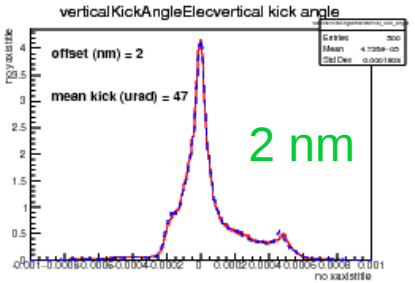
same for new parameters **TDR+$\varepsilon_x/\beta_x/\beta_y$**

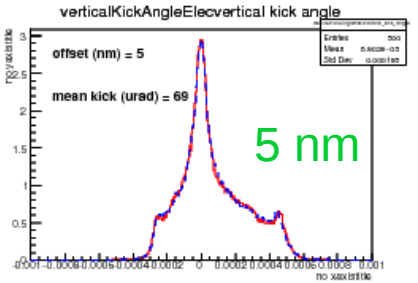
electrons / positrons

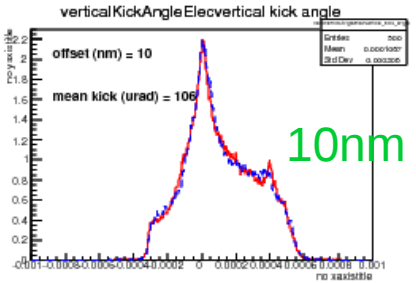
particles

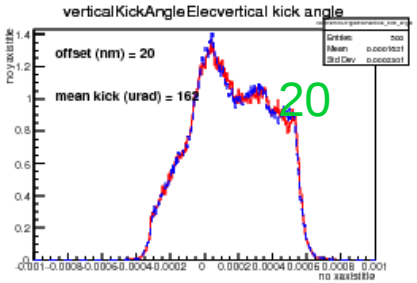
-1 mrad 0 1 mrad

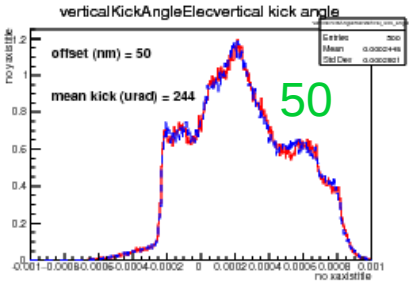


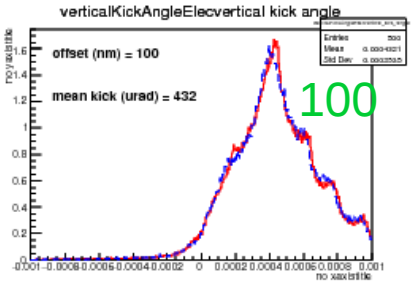


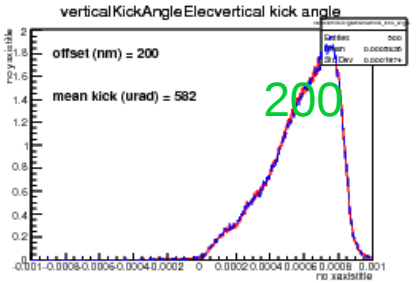


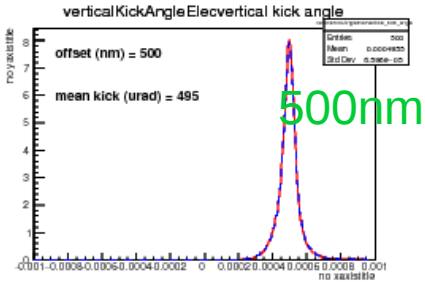


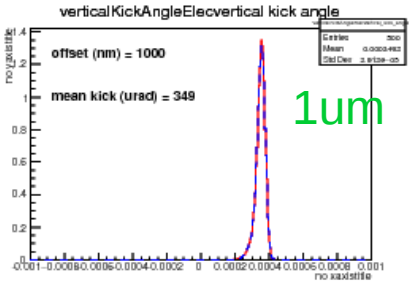


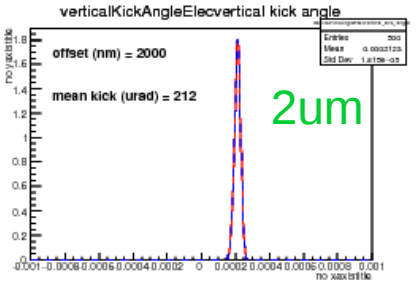


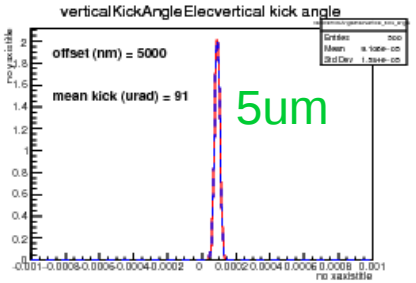


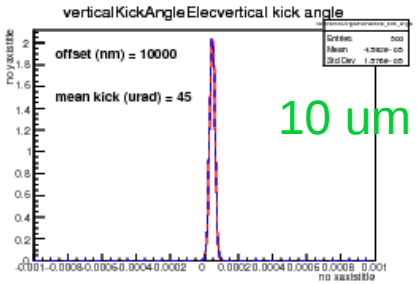


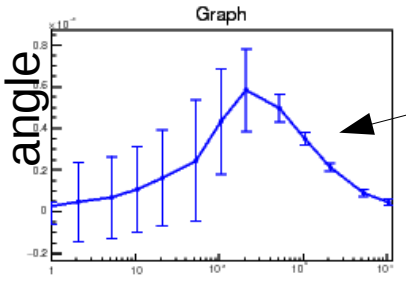








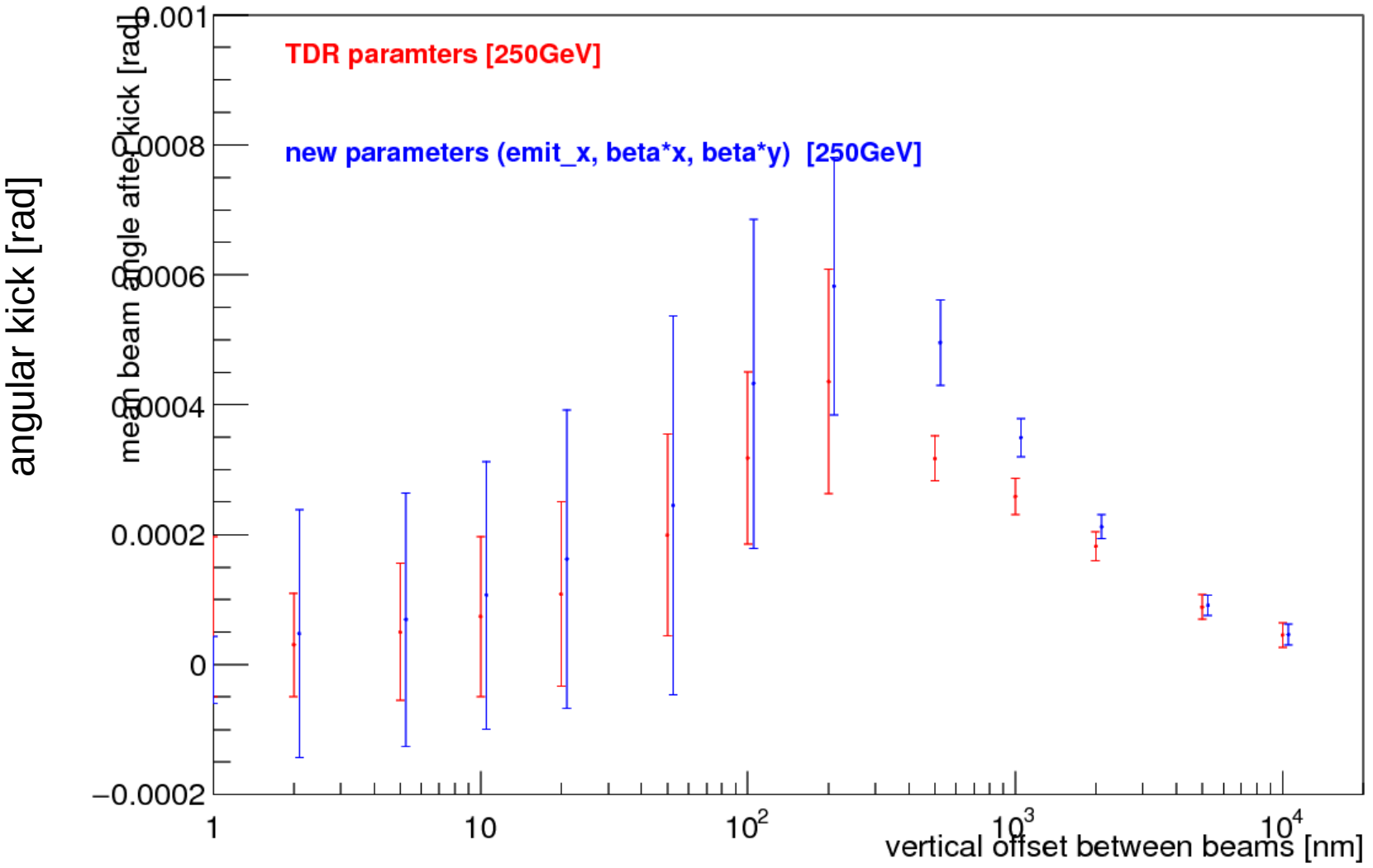




mean and RMS

why are some of these so lumpy?

compare the two parameter sets



movie of simulated bunch crossings (CAIN)
comparing different parameters