effect of beam parameters on Higgs-strahlung (and others) at 250 GeV

very prelim.

Daniel Jeans 3 Mar 2017

now considering energy staging of ILC project

250 GeV → lumi and/or energy upgrades → 500 GeV → ??

current ILC optimised for 500 GeV running

250 GeV will have greater weight,

particularly in the stages of project proposal and first 10 years' running

revisit parameters for 250 GeV ILC machine

can we get more physics output from first ILC stage?

can we get higher luminosity at 250 GeV

c.f. circular Higgs factories

we have heard from Yokoya-san the best ways to increase luminosity

start from TDR parameters “Set 2”

horizontal beam emittance → reduce by 2 “Set 4”

horizontal beta function → reduce by sqrt(2) “Set 15”

[beam size ~ sqrt (emittance * beta)

vertical beta function → increase by sqrt(2) “Set 16”

[mitigate disruption parameter growth]

in this talk, we'll look at the effect on physics

beams are smaller

→ interact more strongly with each others

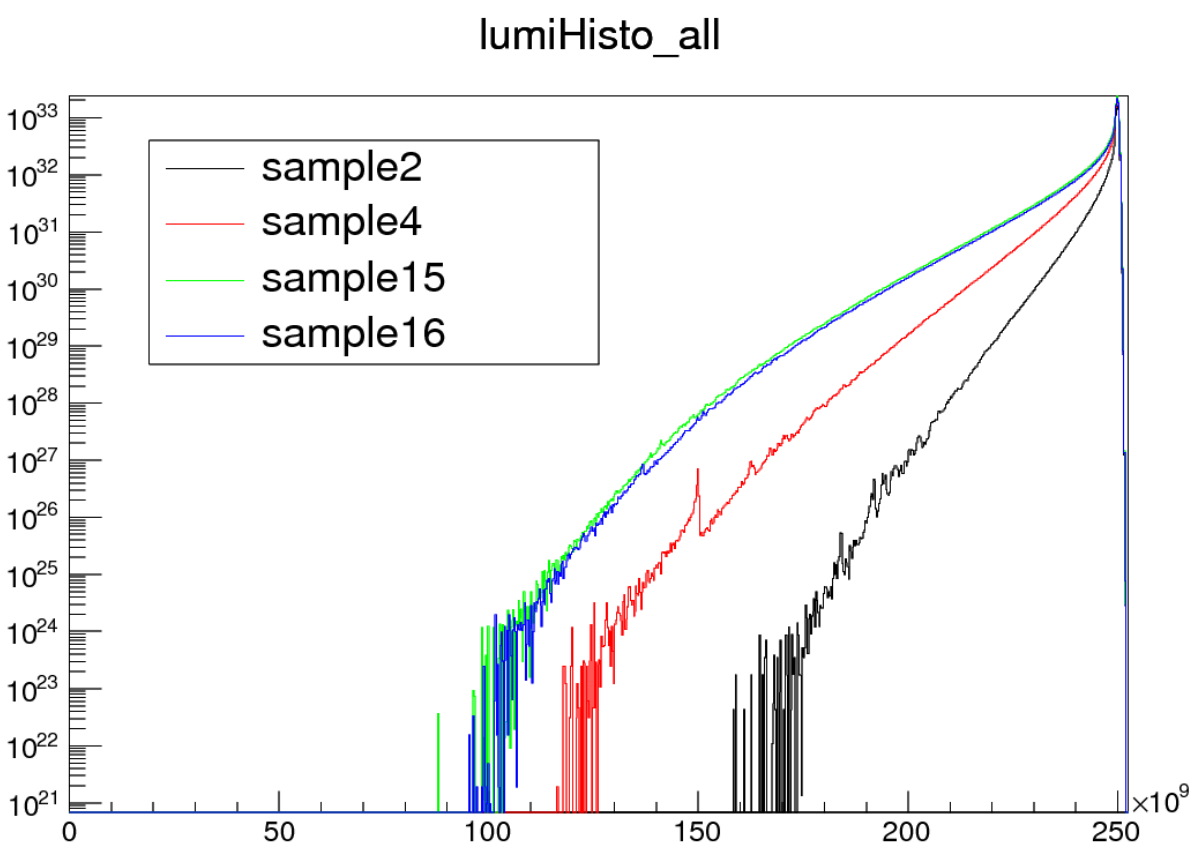
→ more beamstrahlung

→ more energy spread of collisions

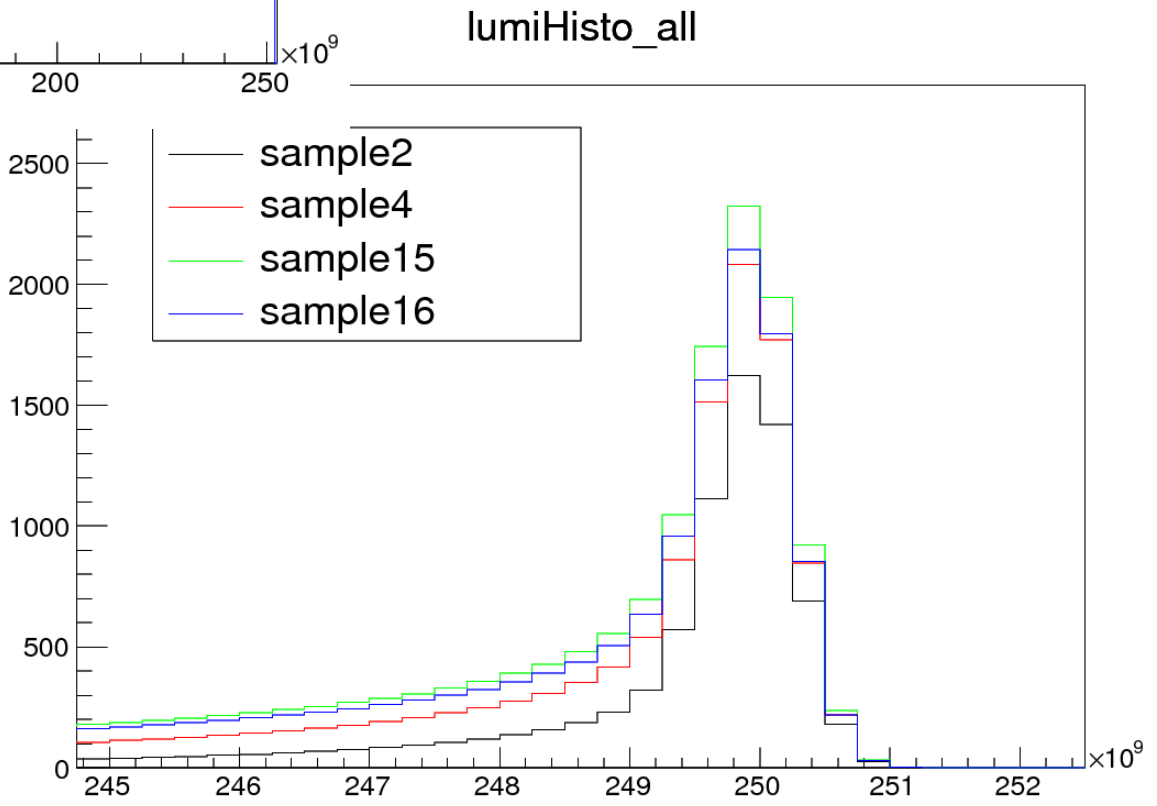
these effects can be simulated by the CAIN program

luminosities for different beam parameters at 250 GeV

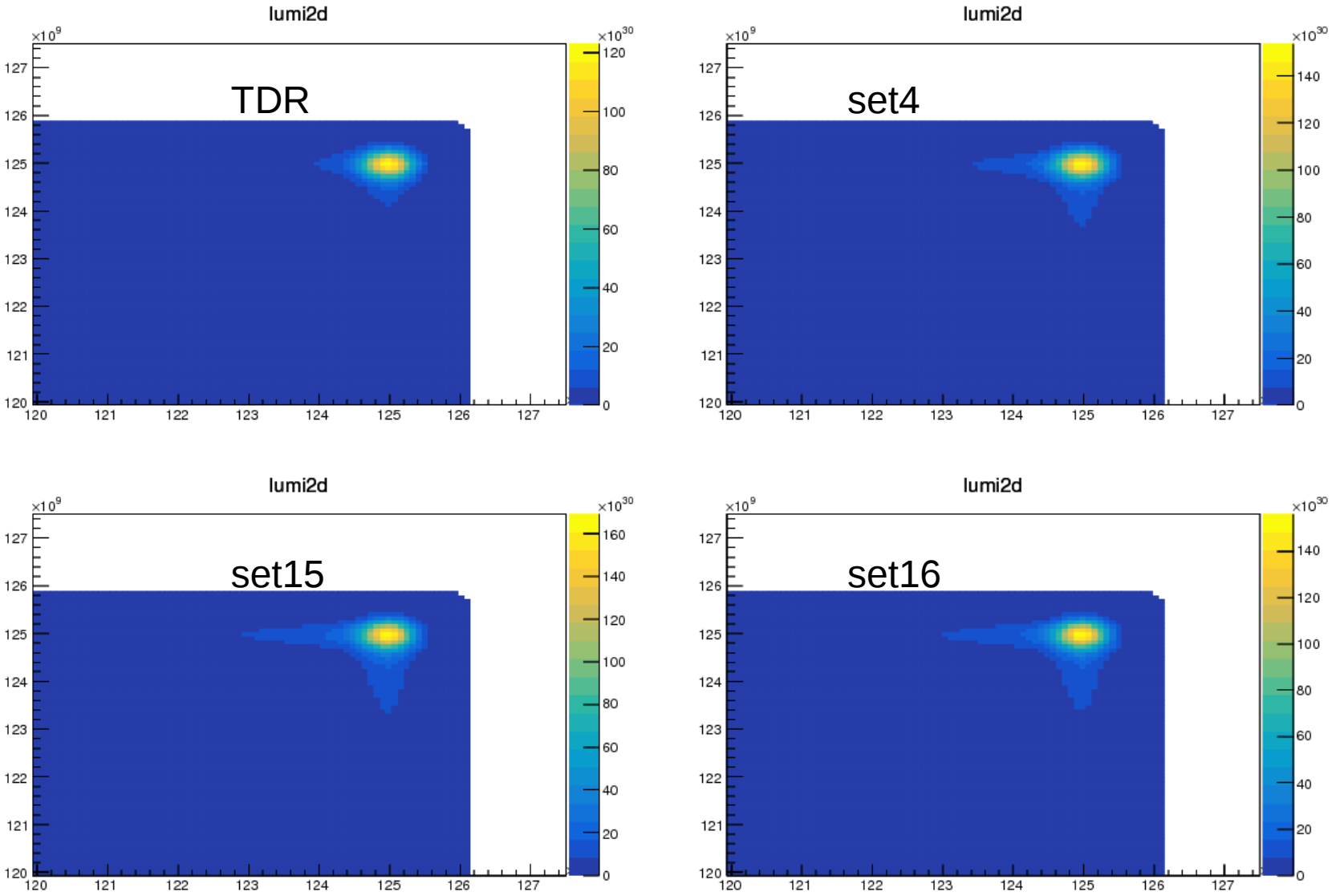
	all energies	>90%	>95%	>99% of nominal
TDR	8.08e+33	8.08e+33	7.99e+33	6.97e+33
Set4	1.37e+34 x1.69	1.35e+34 x1.68	1.29e+34 x1.62	9.90e+33 x1.41
Set15	1.97e+34 x2.44	1.90e+34 x2.35	1.72e+34 x2.15	1.18e+34 x1.69
Set16	1.80e+34 x2.23	1.73e+34 x2.15	1.57e+34 x1.97	1.08e+34 x1.55



luminosity spectrum



2-d luminosity spectrum



use WHIZARD2 to simulate

e+ e- → mu+ mu- H

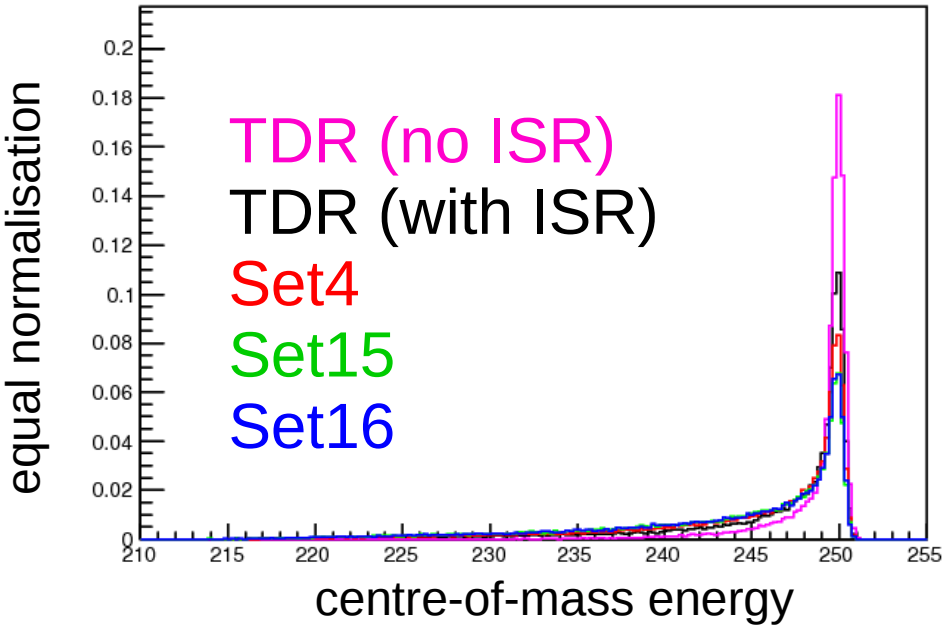
H → 4 nu

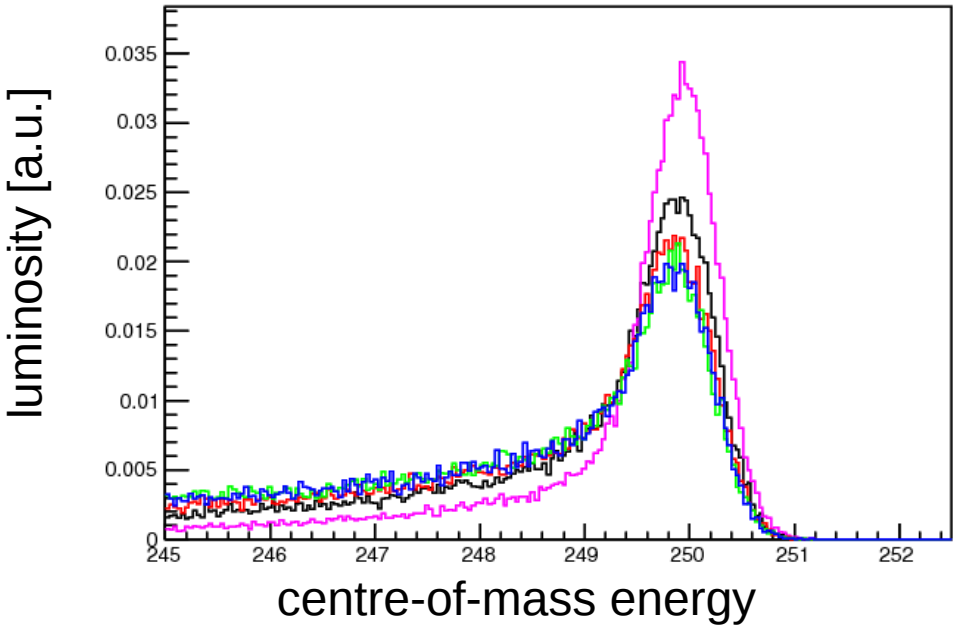
different beam energy spectra

analysis most sensitive to the collision energy

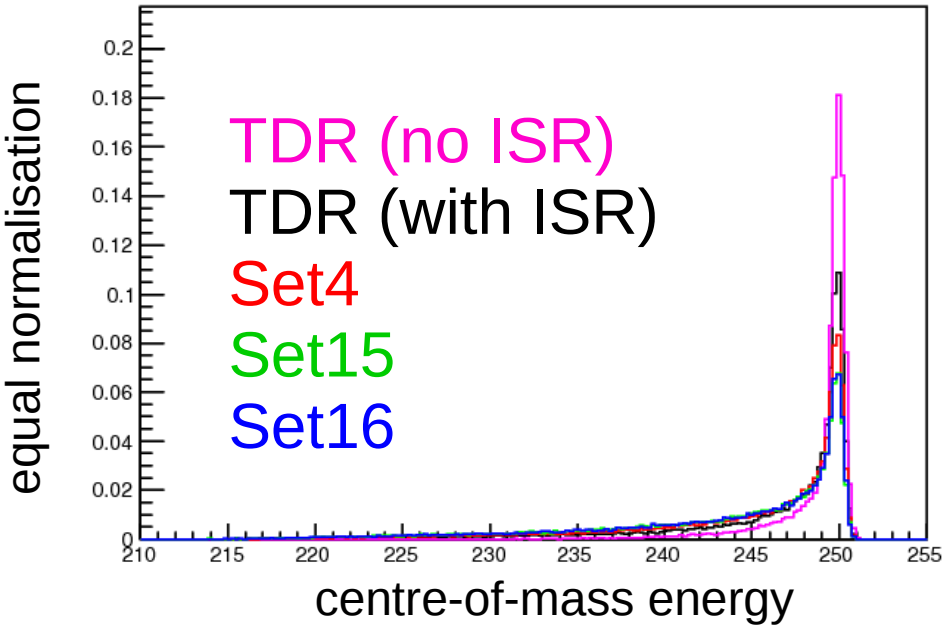
recoil technique assumes centre-of-mass frame and energy

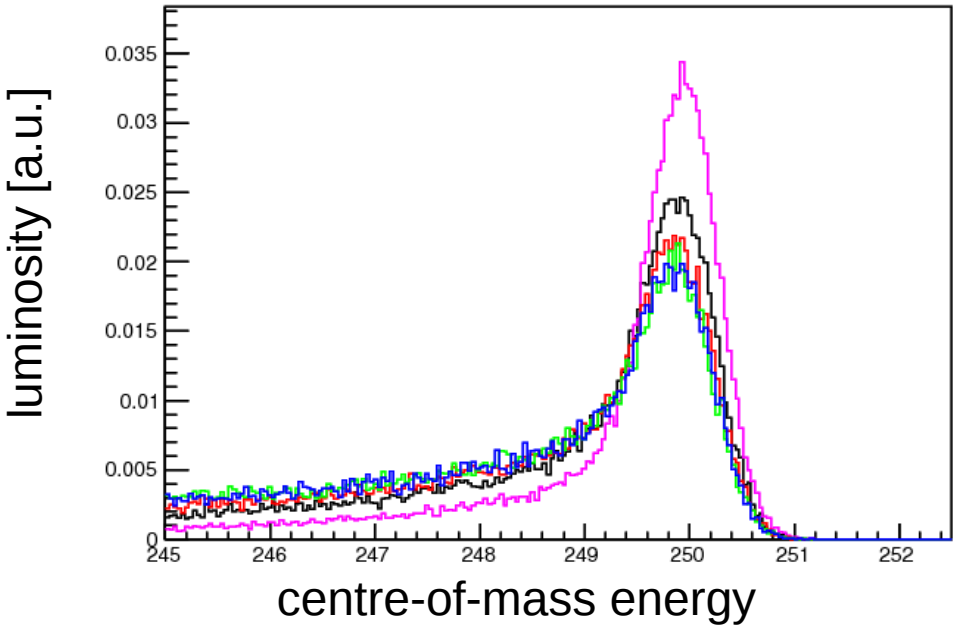
at generator level



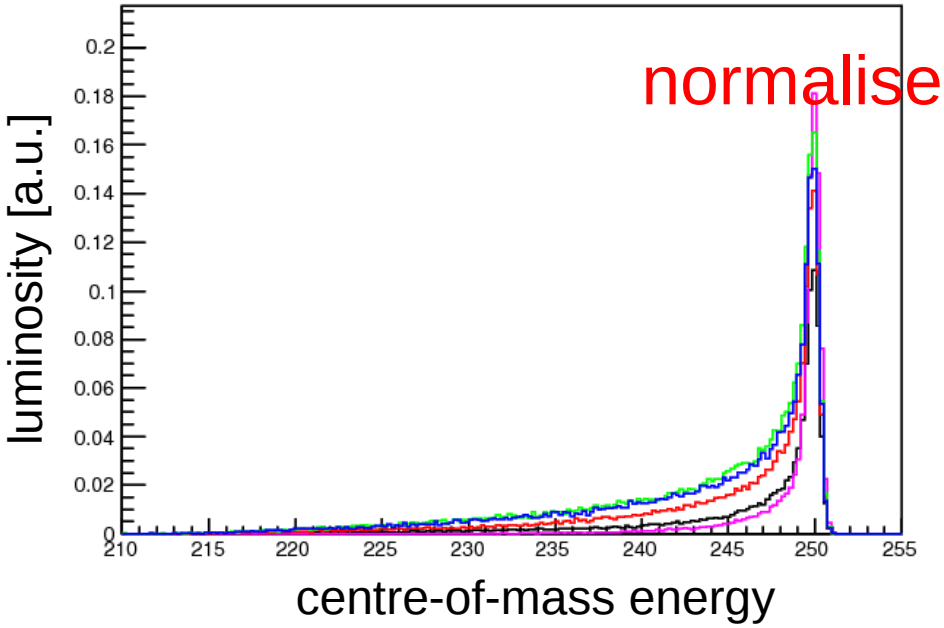


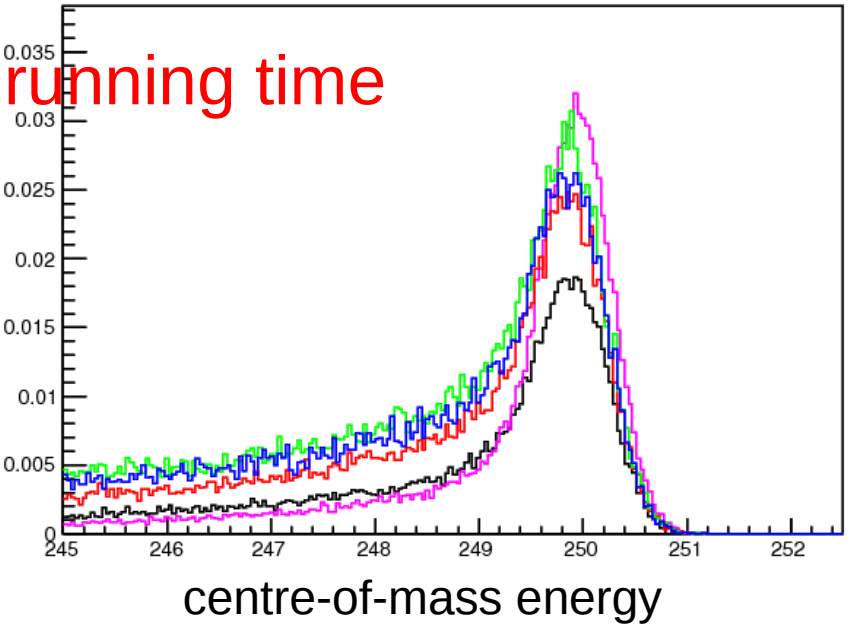
at generator level



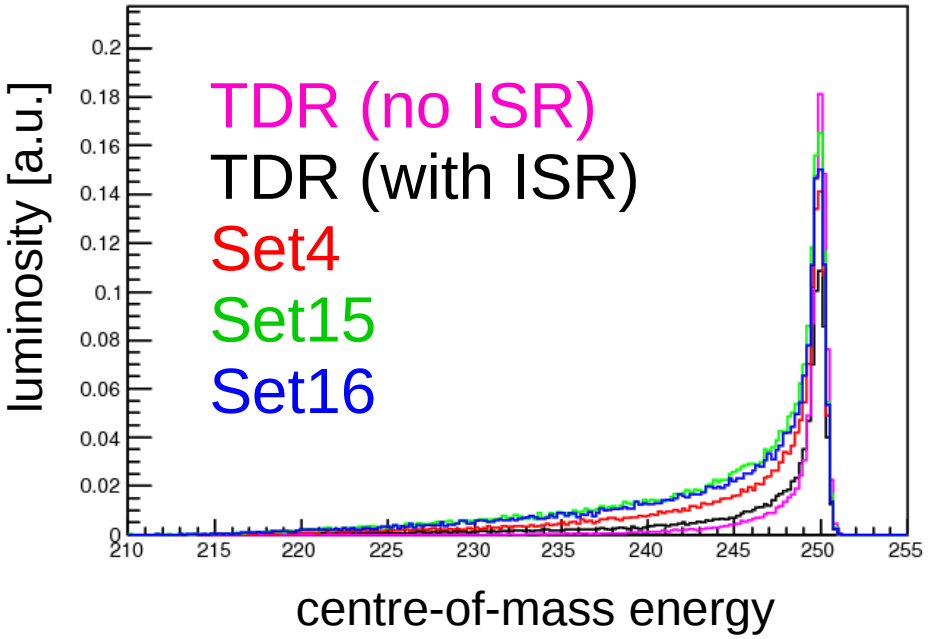


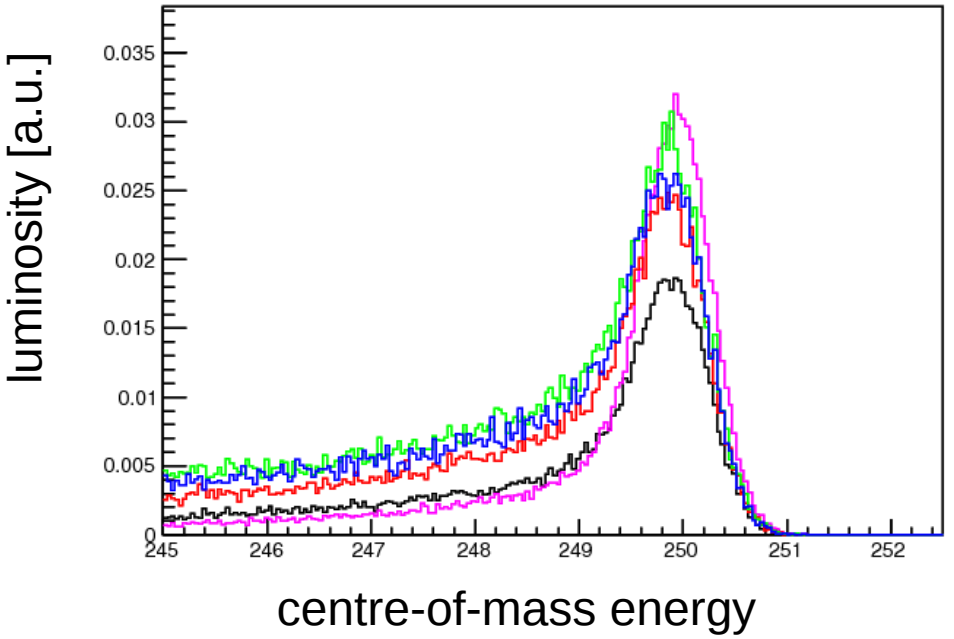
normalised to running time

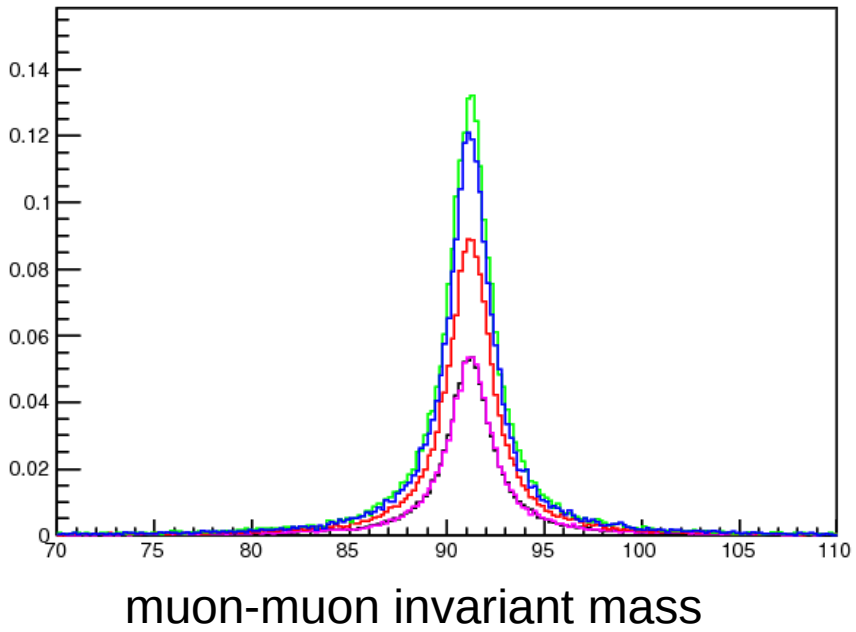


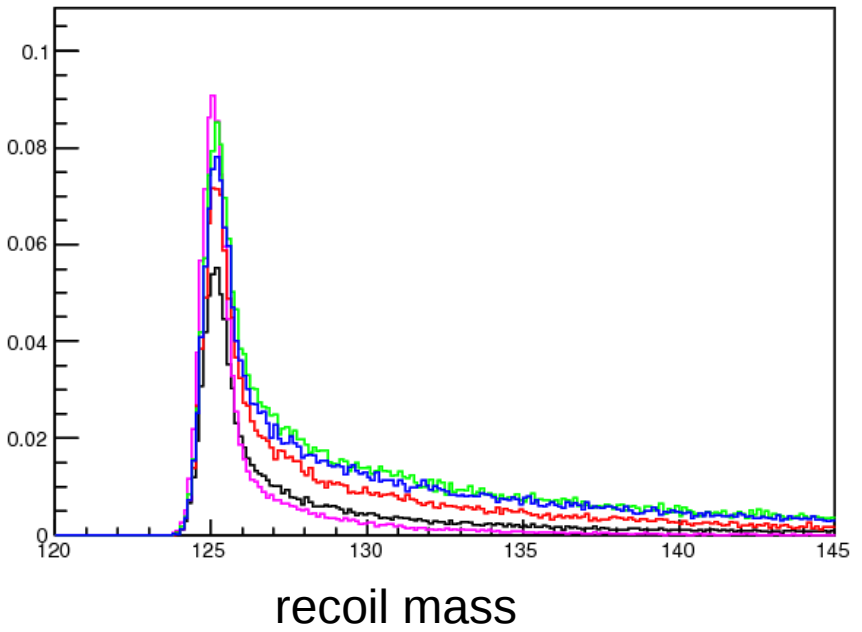


at generator level



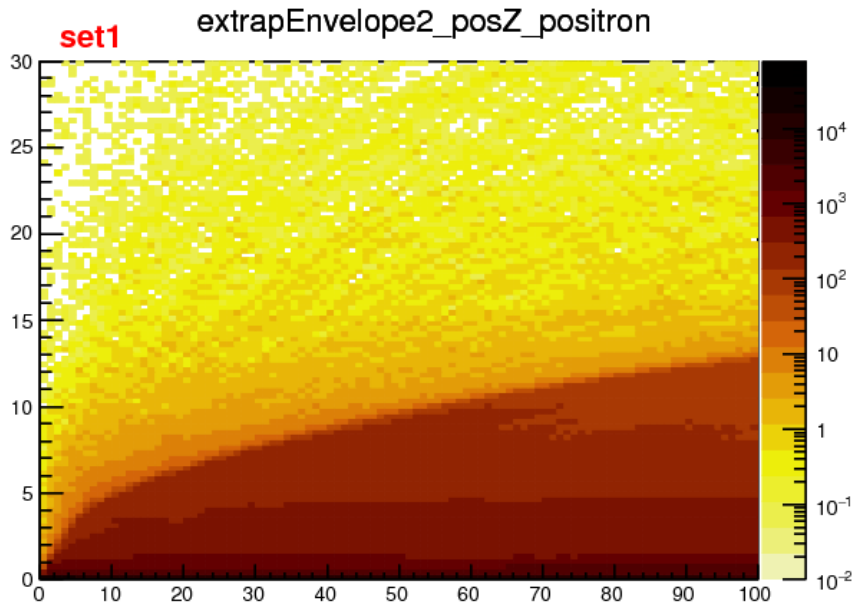






detector backgrounds

tighter beams = more incoherent pair production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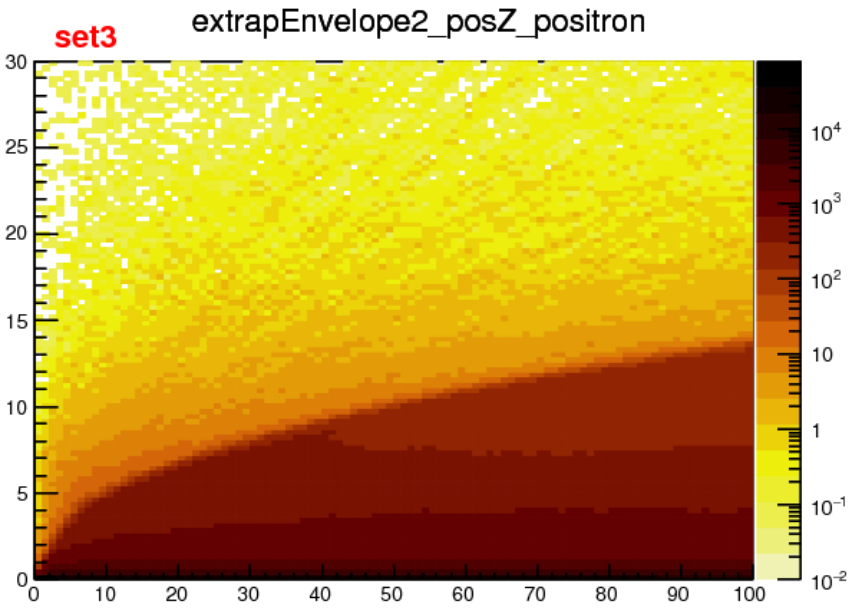
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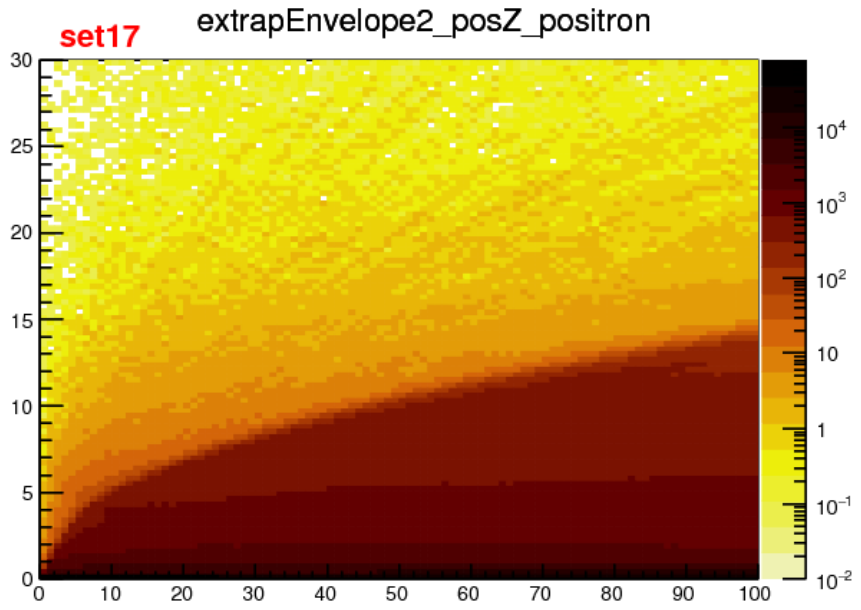
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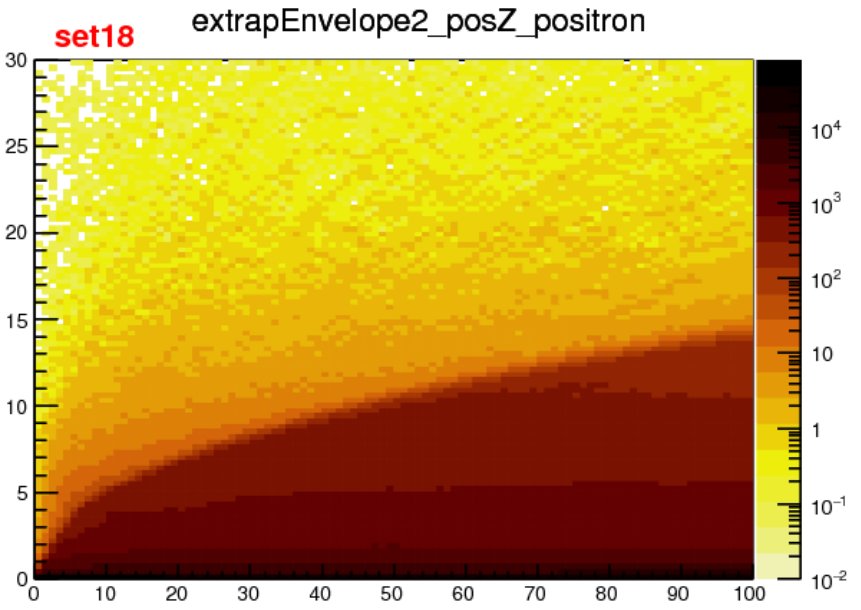
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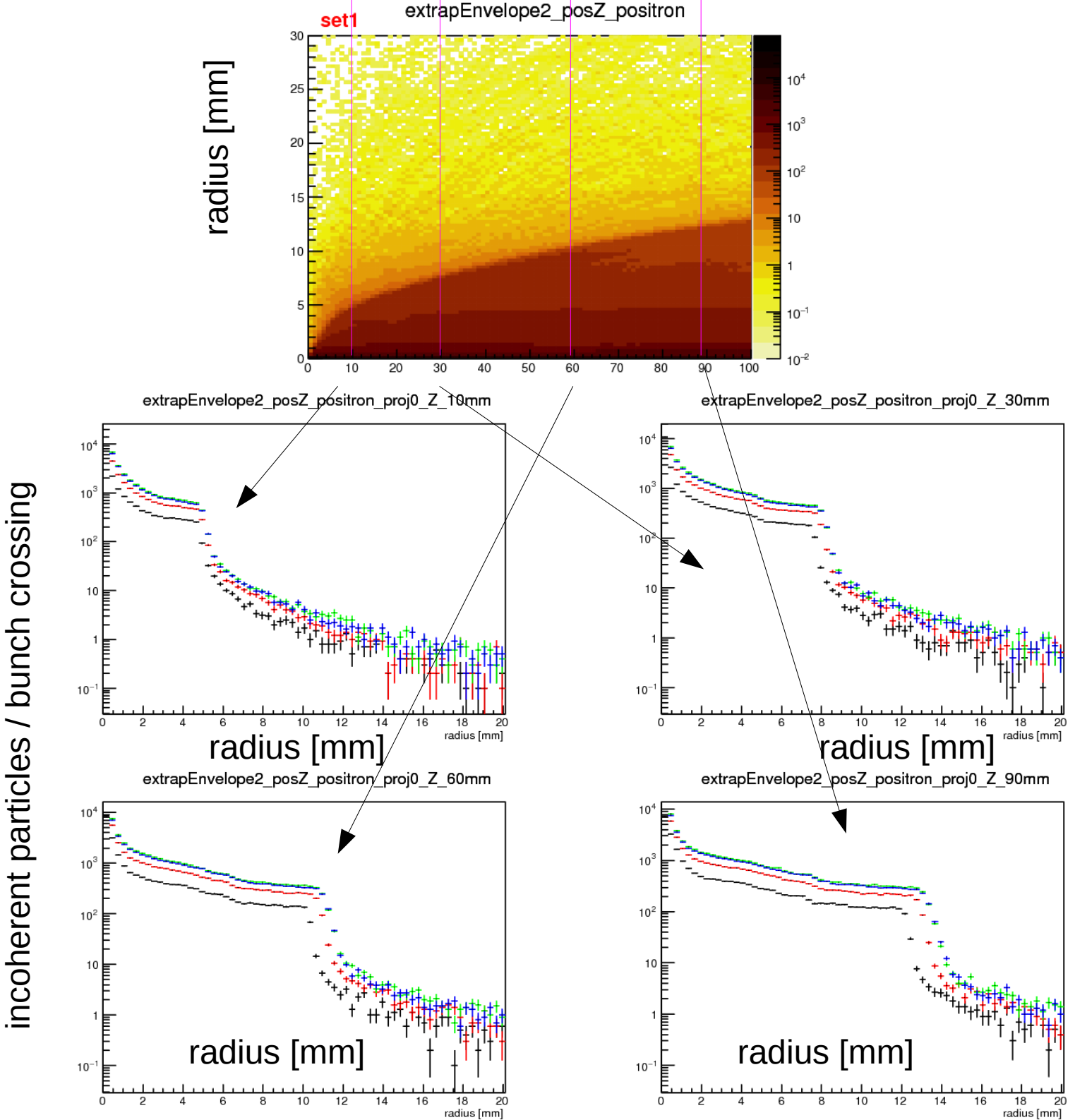
set1
extrapEnvelope2_posZ_positron
radius [mm]
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extrapEnvelope2_posZ_positron_proj0_Z_30mm
extrapEnvelope2_posZ_positron_proj0_Z_60mm
extrapEnvelope2_posZ_positron_proj0_Z_90mm
radius [mm]
incoherent particles / bunch crossing

looking at effects of new 250 GeV beam params

looks promising