

SiECAL performance with guard ring, PCB thickness & dead channels

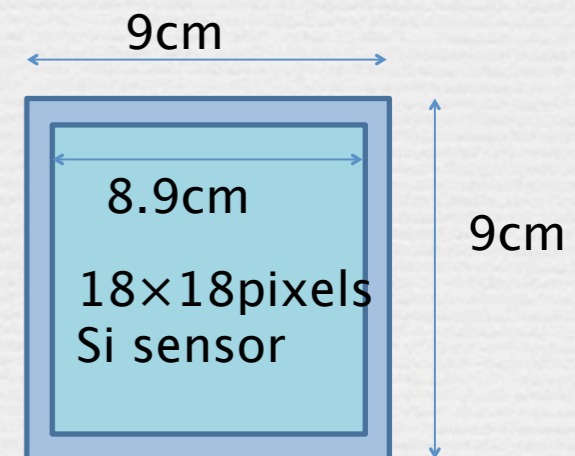
Shion Chen, Chihiro Kozakai, & Daniel Jeans, Sachio Komamiya (U-Tokyo)

- * a few % dead cells -> increase yield for si sensors, reduce cost: what is influence on performance?
- * making thin guard ring can be challenging: how much do we need to push?
- * thin and flat PCB is posing some problems for companies: can we live with thicker one?

simulation study

- simulation with ILD01_o1_v05 (DBD version)
- / MOKKA/MARLIN
- 5mmx5mm segmentation
- dead channel: implemented at digitization
- randomly in each event
- reconstructed by PANDORA
- guard ring 9cmx9cm

Main chip for ILD
guard ring
attached to ground.
width: 0.5mm(default
value)



guard ring & PCB thickness

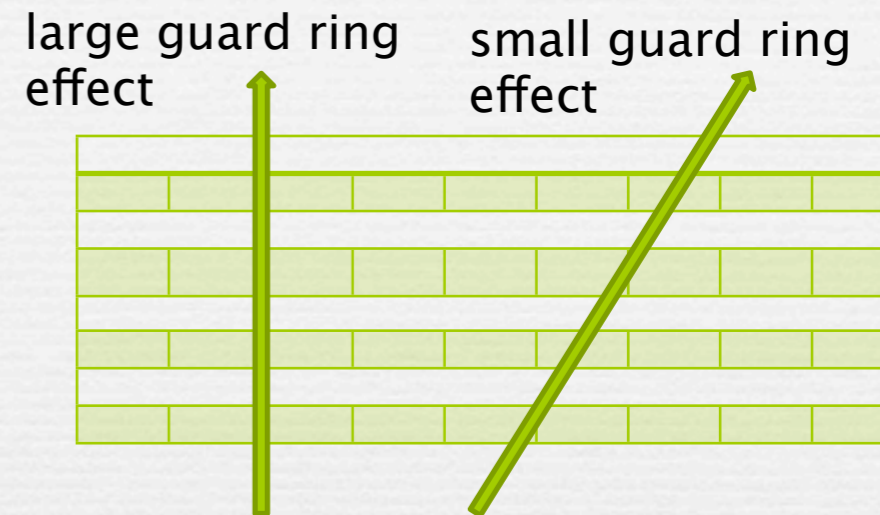
GR

• might be bigger at small $\cos \theta$

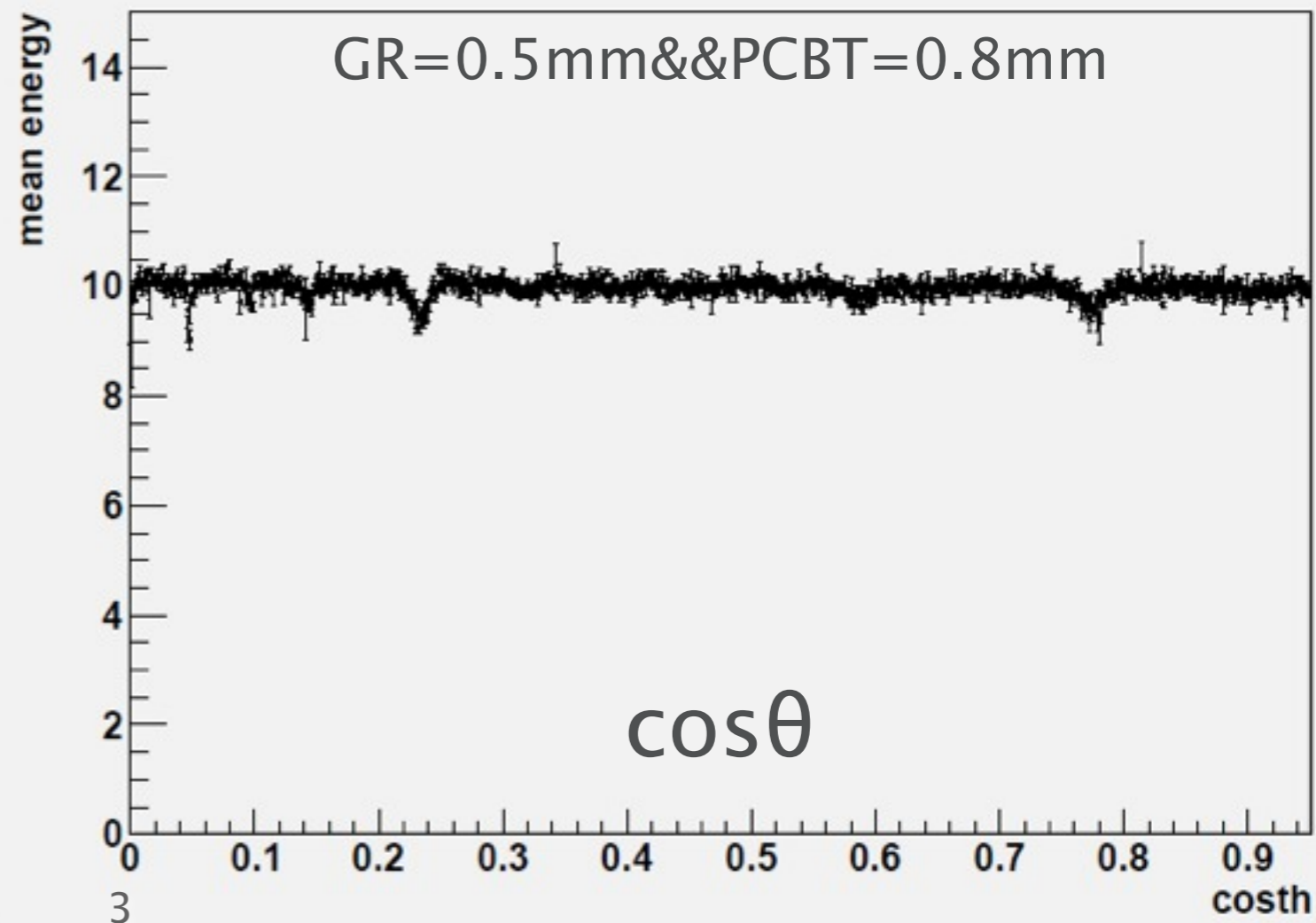
• 10GeV γ

• Direction resolution for θ is 3.3×10^{-4} rad.

• this is good enough to correct with θ



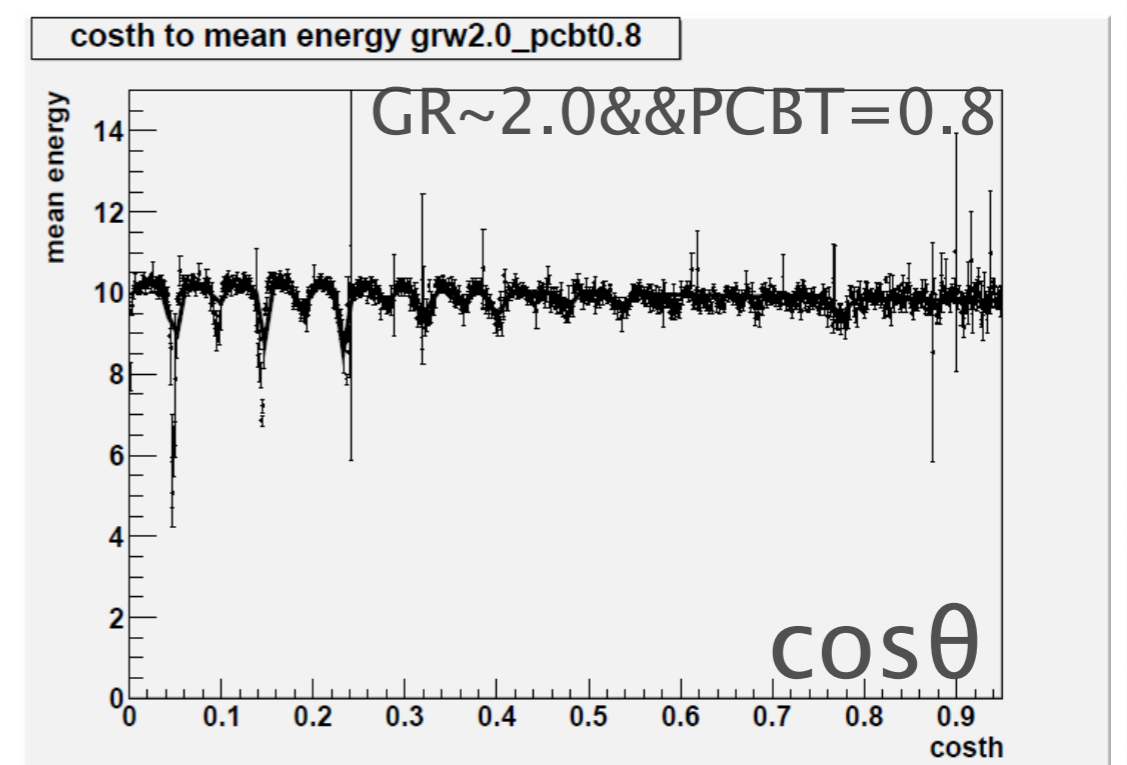
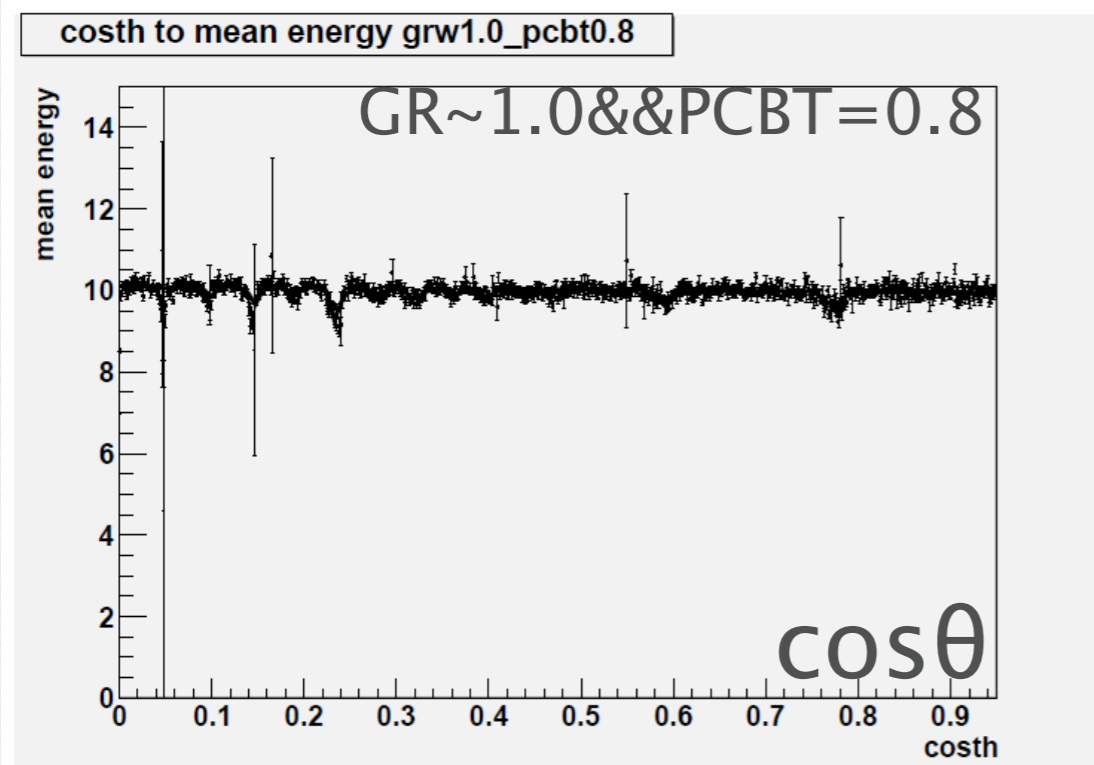
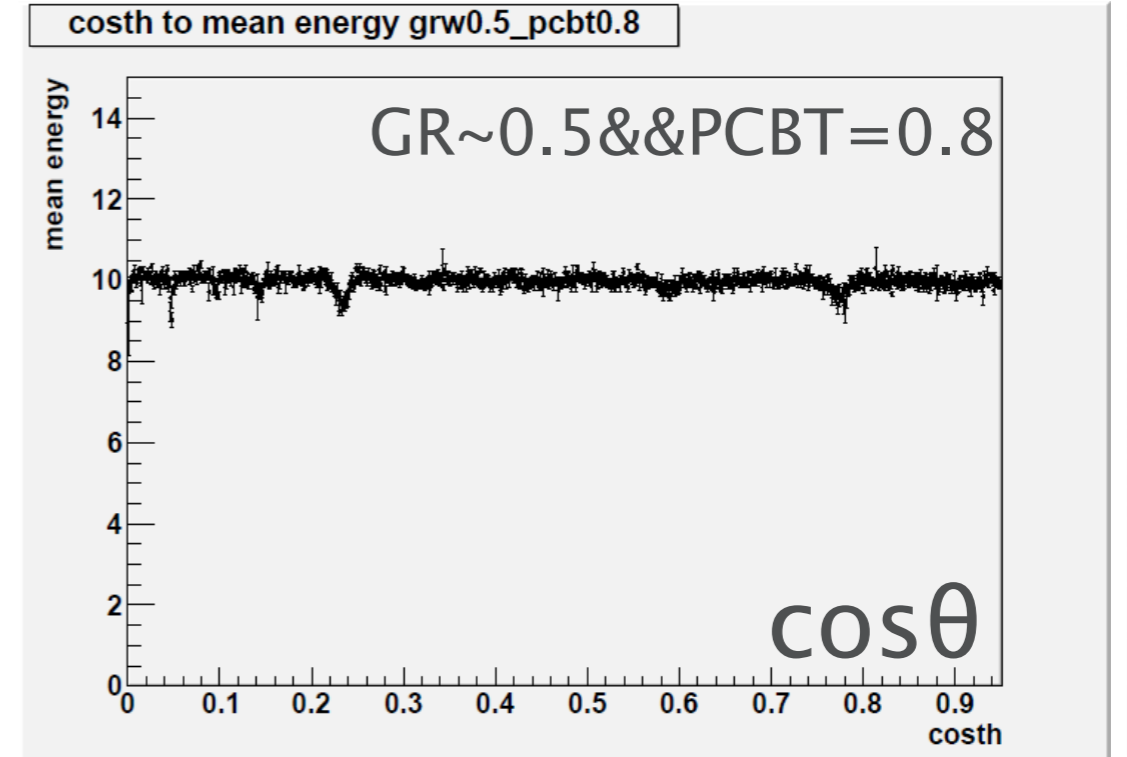
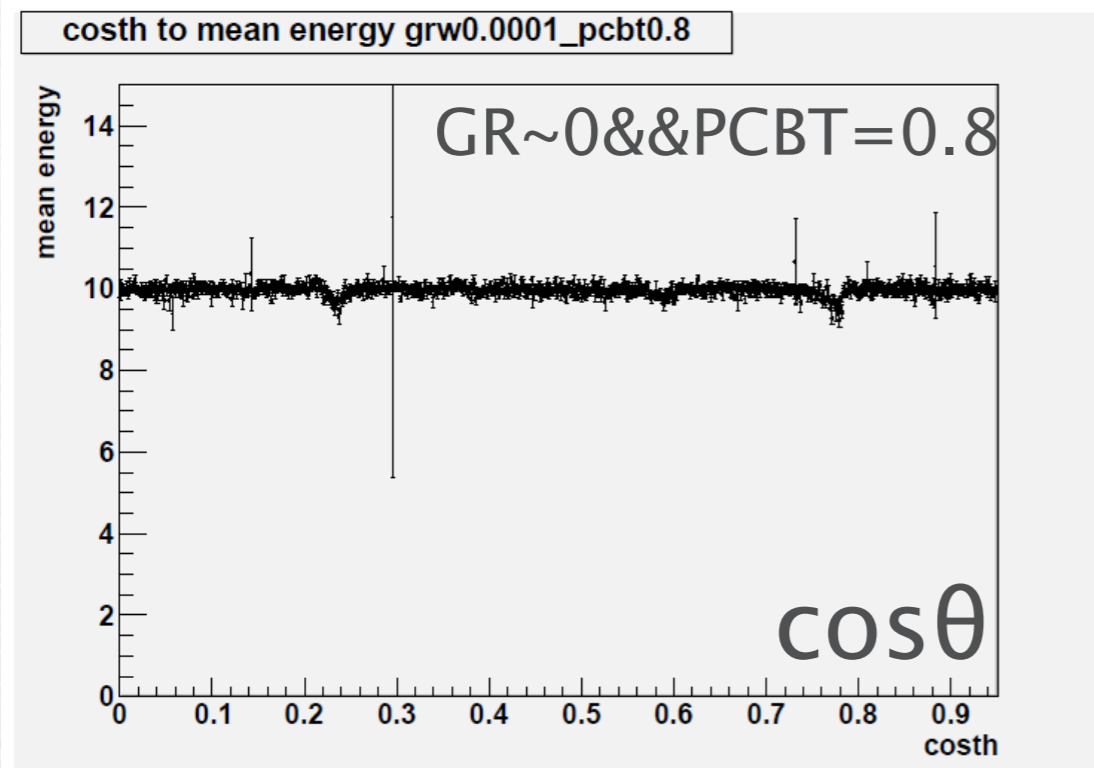
costh to mean energy grw0.5_pcbt0.8



guard ring effect

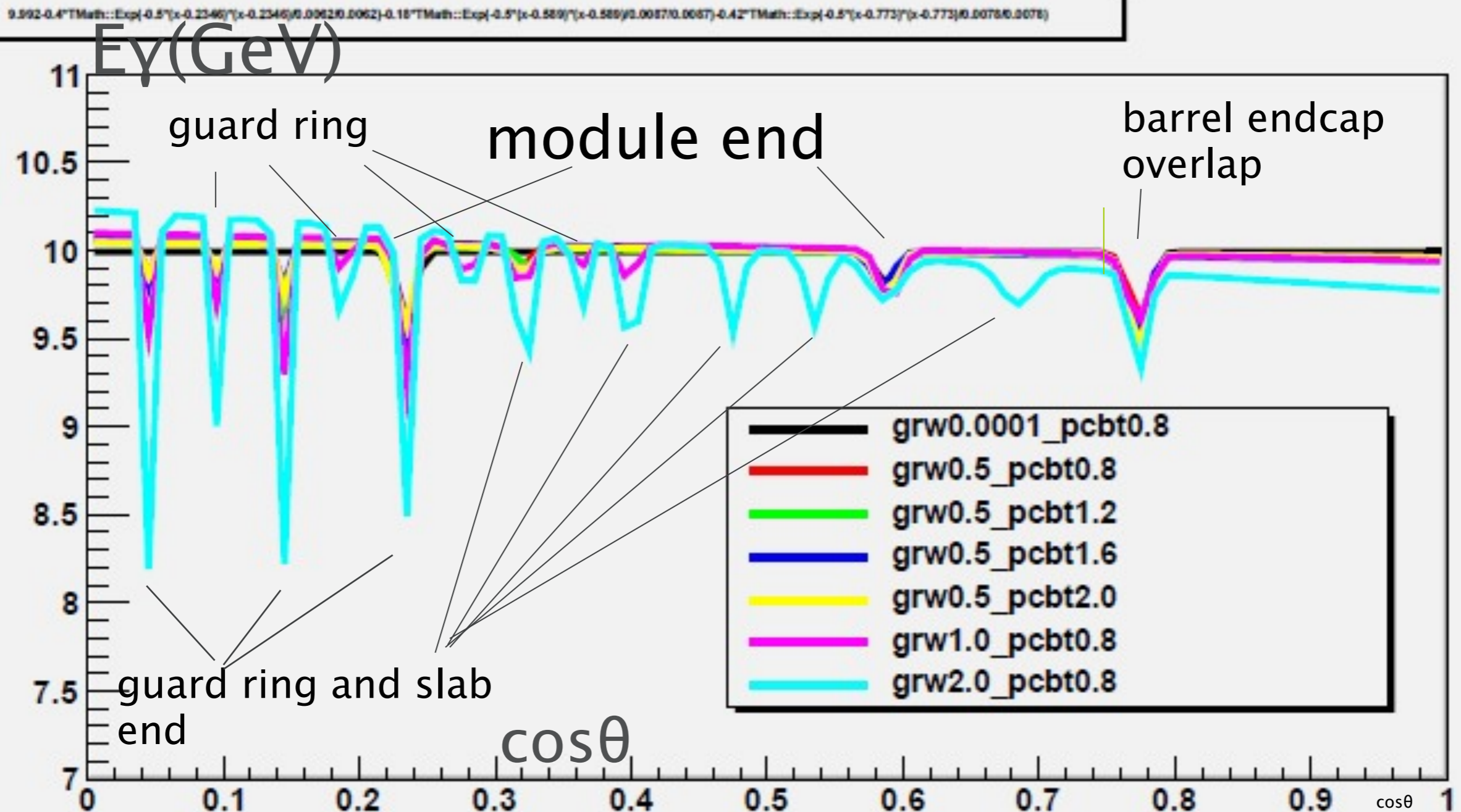
$E_\gamma(\text{GeV})$

10GeV photon



guard ring & PCB thickness

photon energy correction functions
10GeV photon

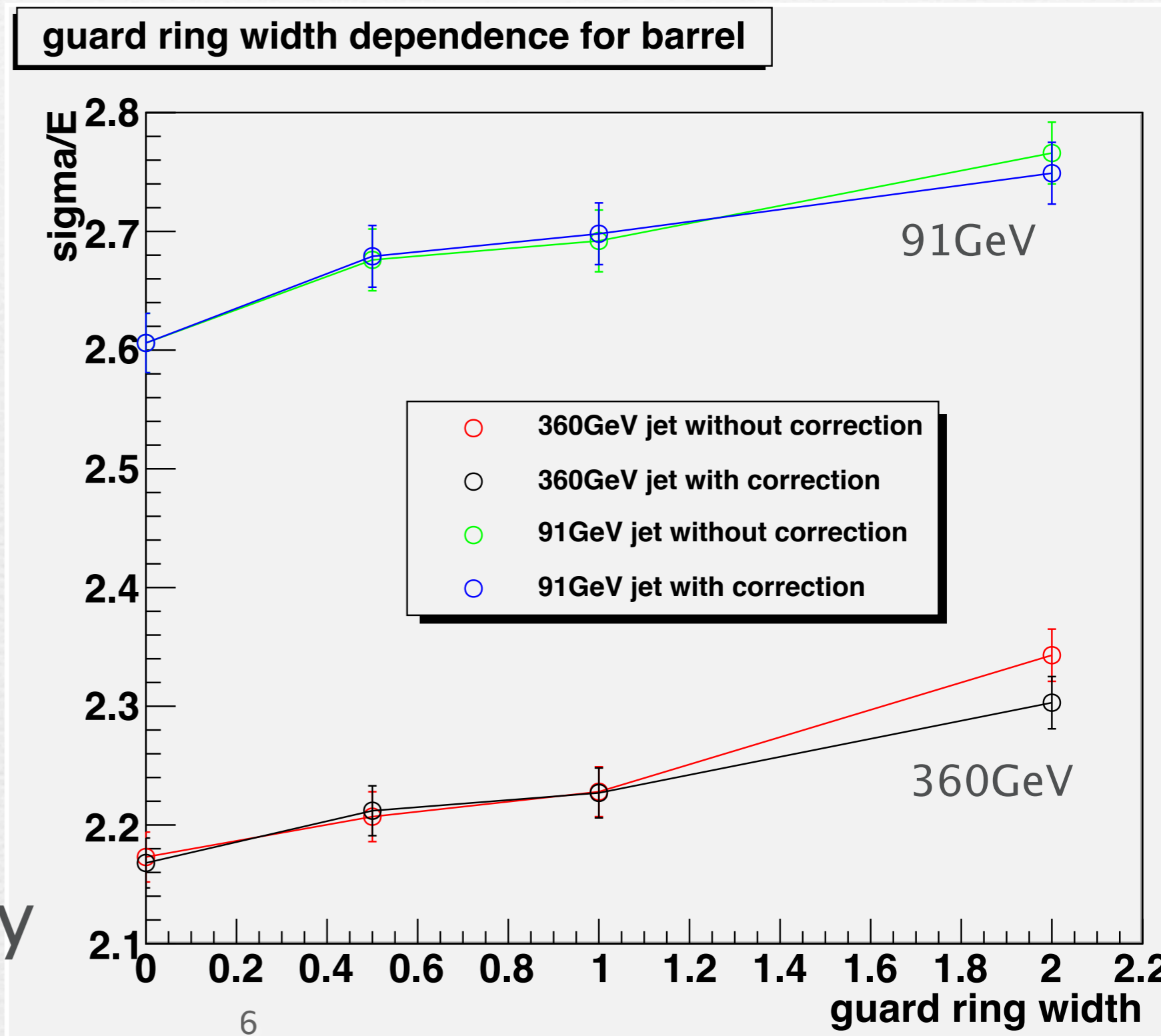


guard ring to JER

☞ effect on Jet energy resolution

worsen
according to the
guard ring
width

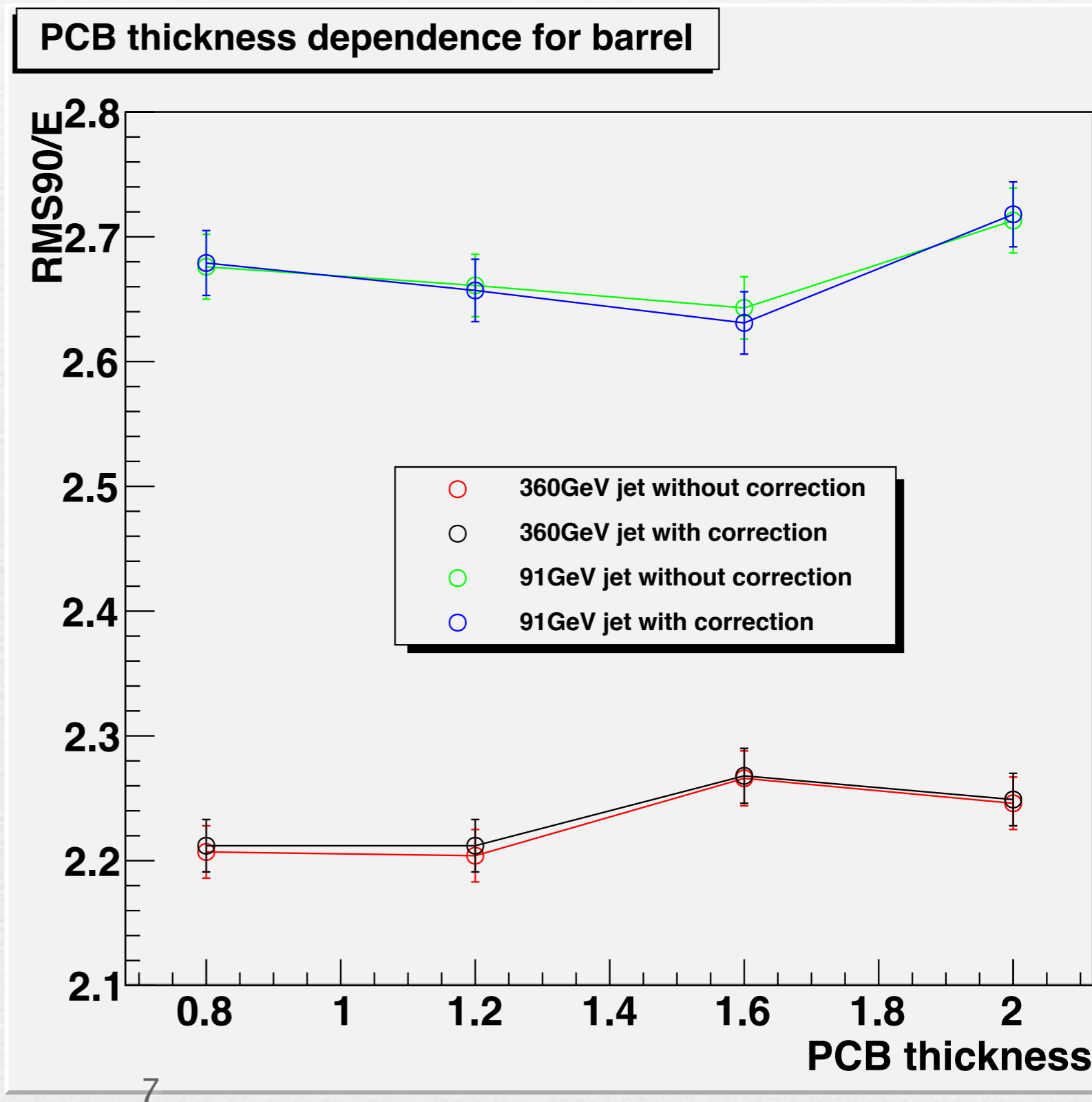
barrel only



PCB thickness to JER

- PCB thickness 0.8 to 2.0mm (thicker ECAL)
- to the lateral direction
- almost no effect on the JER

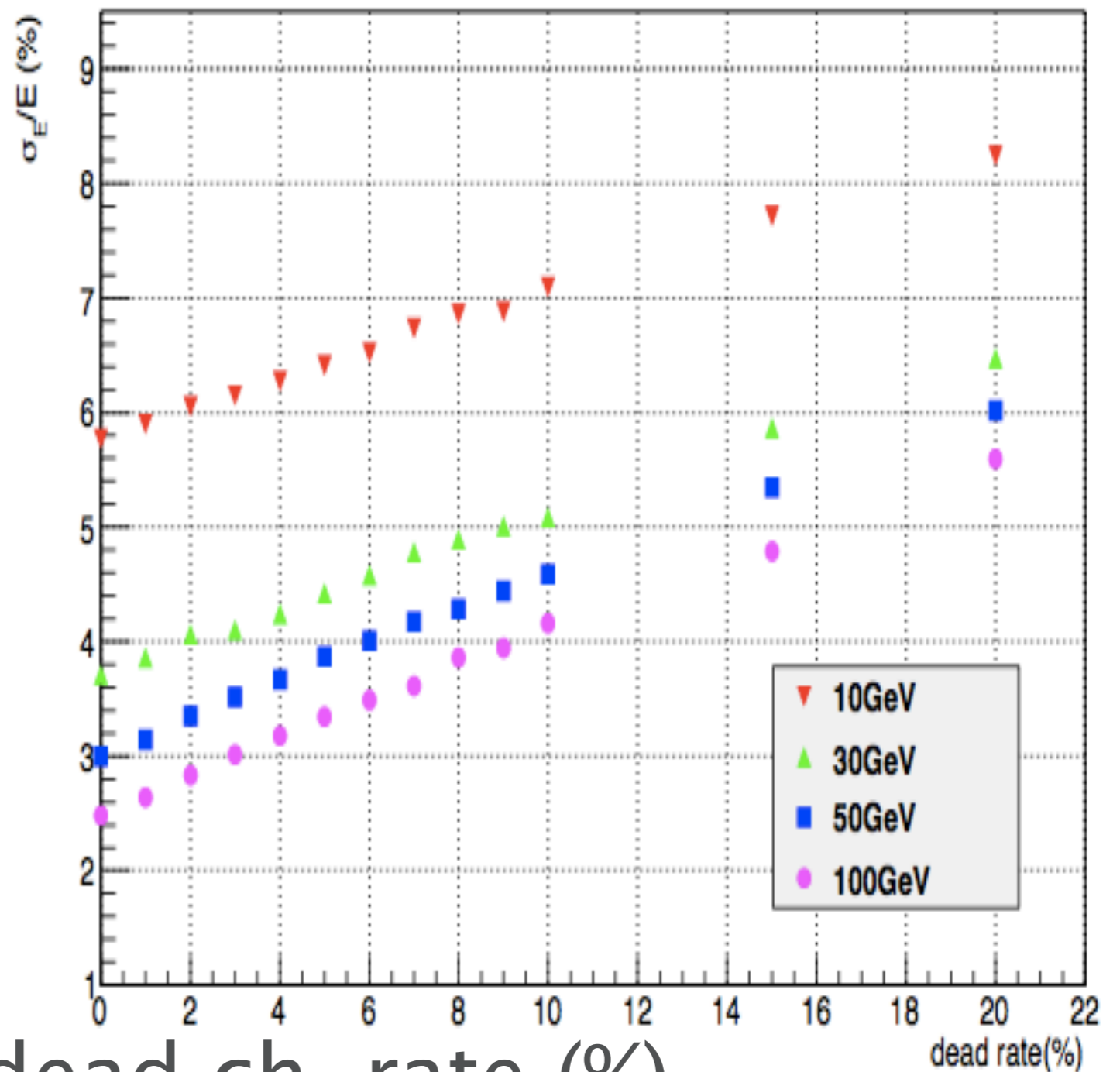
barrel only



dead channels

ER

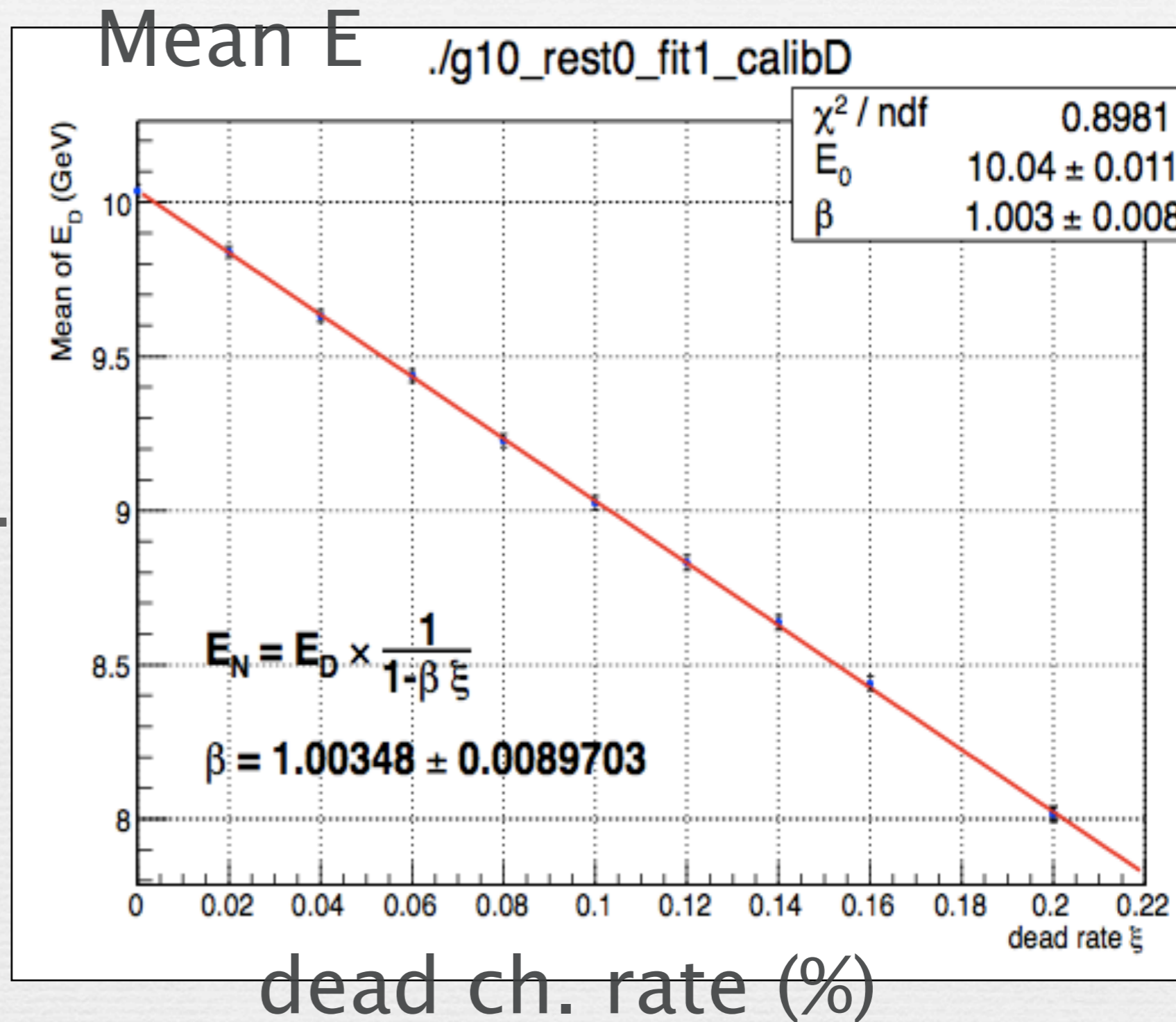
Dead rate dependency of energy resolution of Photon events



- with photons
- 10,30,50,100GeV
- resolution \sim linear dep. on dead ch. rate

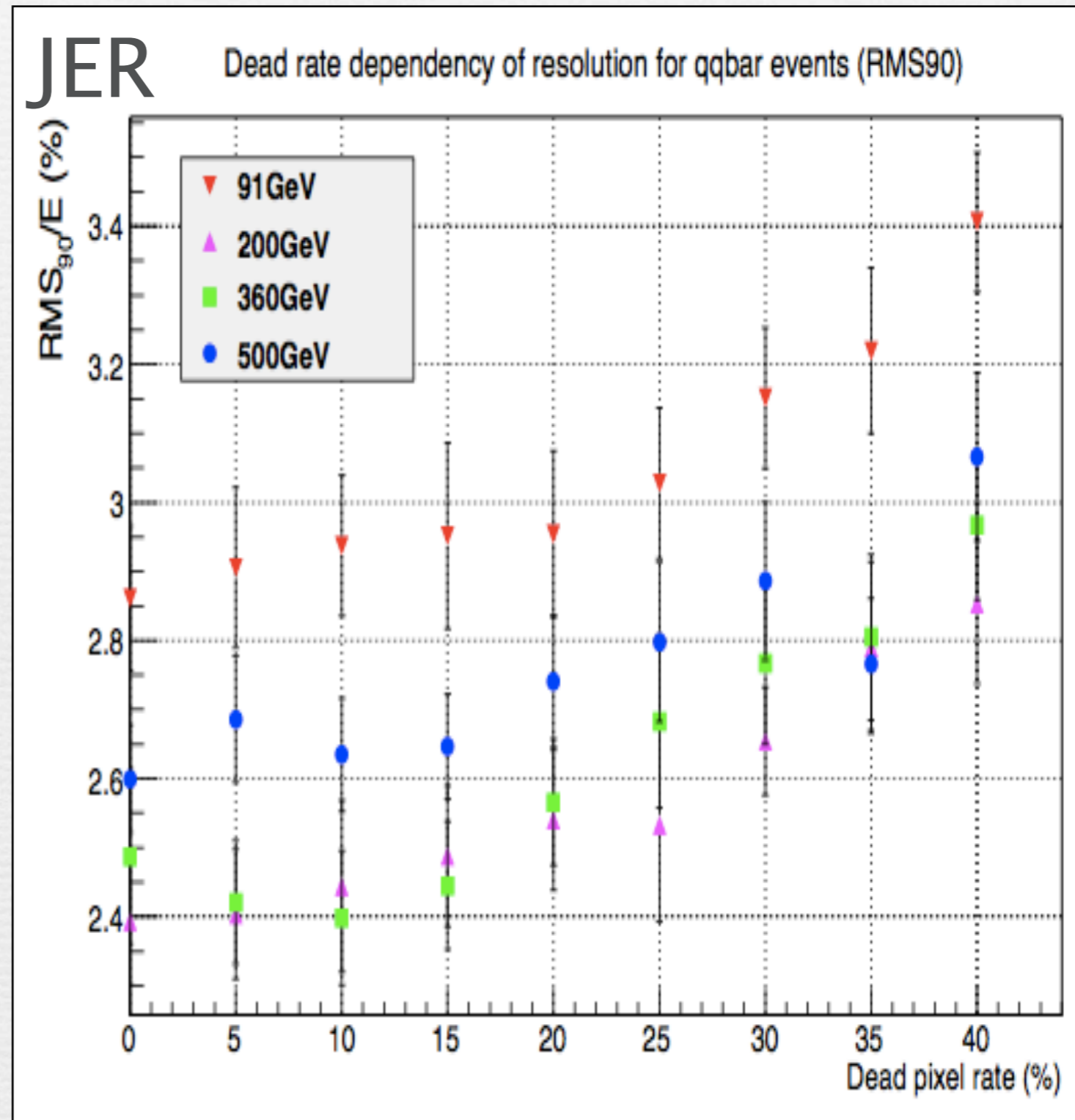
dead ch. cont.

- ☛ 10GeV photons
- ☛ missing energy
- ☛ linear to dead ch. rate ξ



dead ch. cont.

- ☞ Jet energy resolution
- ☞ with PFA
- ☞ up 20% dead: const.
- ☞ more than 20% of dead ch., linearly worse JE resolution



summary

- ILD simulation
- guard ring width & PCB thickness
 - effect by wide guard ring
 - one can correct missing photon E
 - pcb thickness not critical for PFA performance
 - a bit worse JER according to guard R width
- effect of dead channel looks not big
 - photon energy loss is linear to dead ch. rate
how about dead skiroc's ?