Single electron efficiency study with simulation

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Outline

A bug was found in HbdFinalSimulator

1. Simulation setup
2. Before fixing
3. Bug
4. Solution
5. After fixing
6. Conclusion

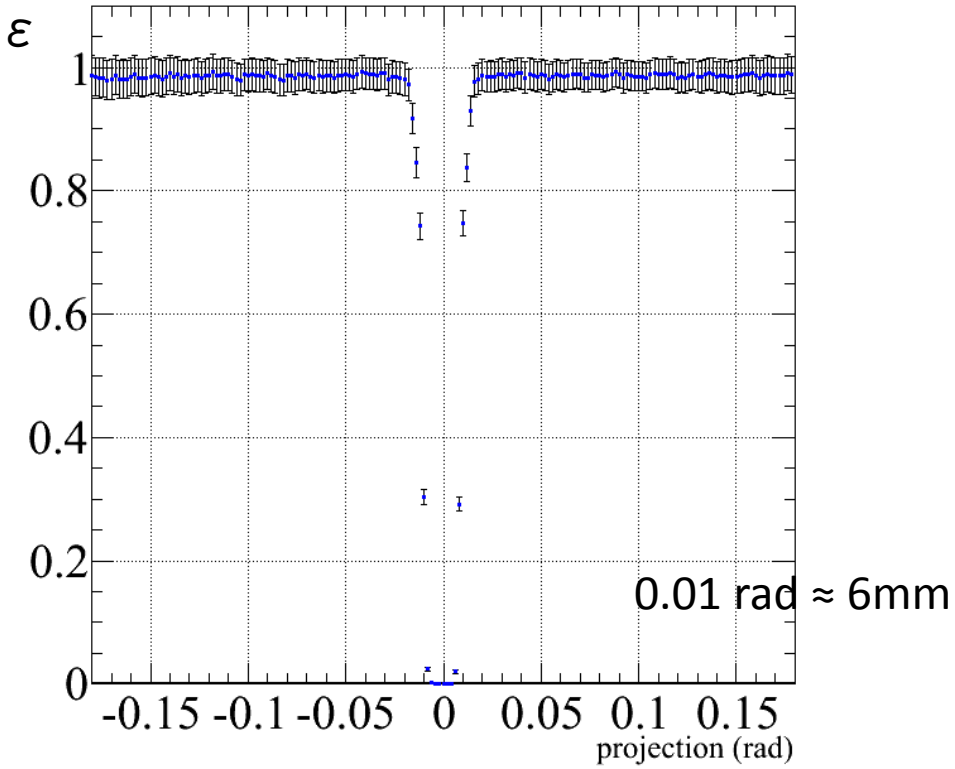
Setup

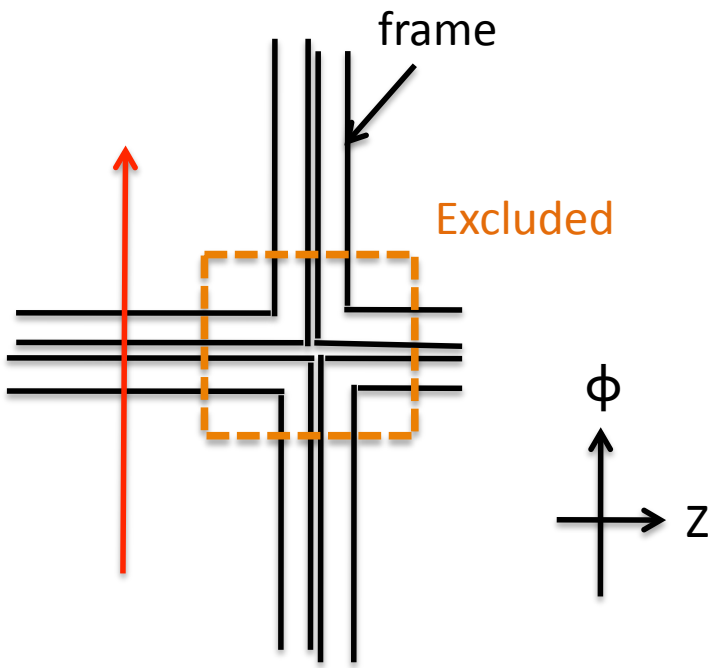
- Electrons from ϕ decay are used
  - abs(vertexz) <20cm
- Central arm cuts
  - Track quality = 31 || 51 || 63
  - n0 ≥ 3
  - ecore/mom > 0.6
  - prob > 0.01

  - abs(emcdz) < 10
  - abs(emcdphi) < 0.03
  - ecore > 0.15
  - disp < 5
  - chi2/npe0 < 10
- HbdWisClusterizer
  - Master pad > 3 p.e, other pads > 1 p.e.
- Tracks with mom> 1GeV/c are used in the following analysis

Before fixing

- Efficiency = (Number of electrons after 3σ matching)/(Number of Central Arm electrons)
- σ is calculated in the area far from frames
- Efficiency drops to 0 around the frames





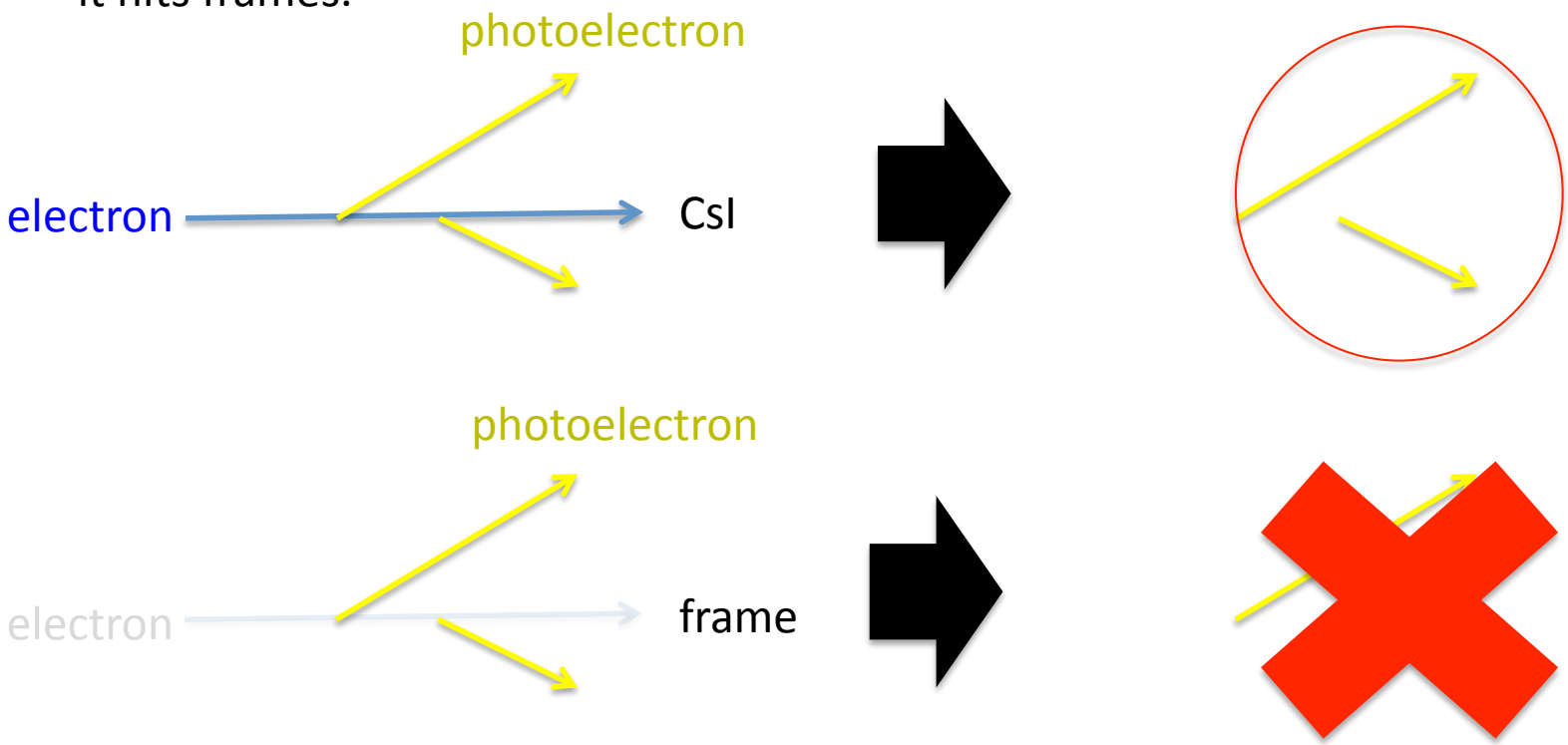
Problem

PISA

PISA stores tracks & associated photoelectrons only when they hit active volumes (CsI in our case).
An electron track is not stored when it hits frames.

Old HBD Slow Simulation

Photoelectrons must be associated with an electron track.



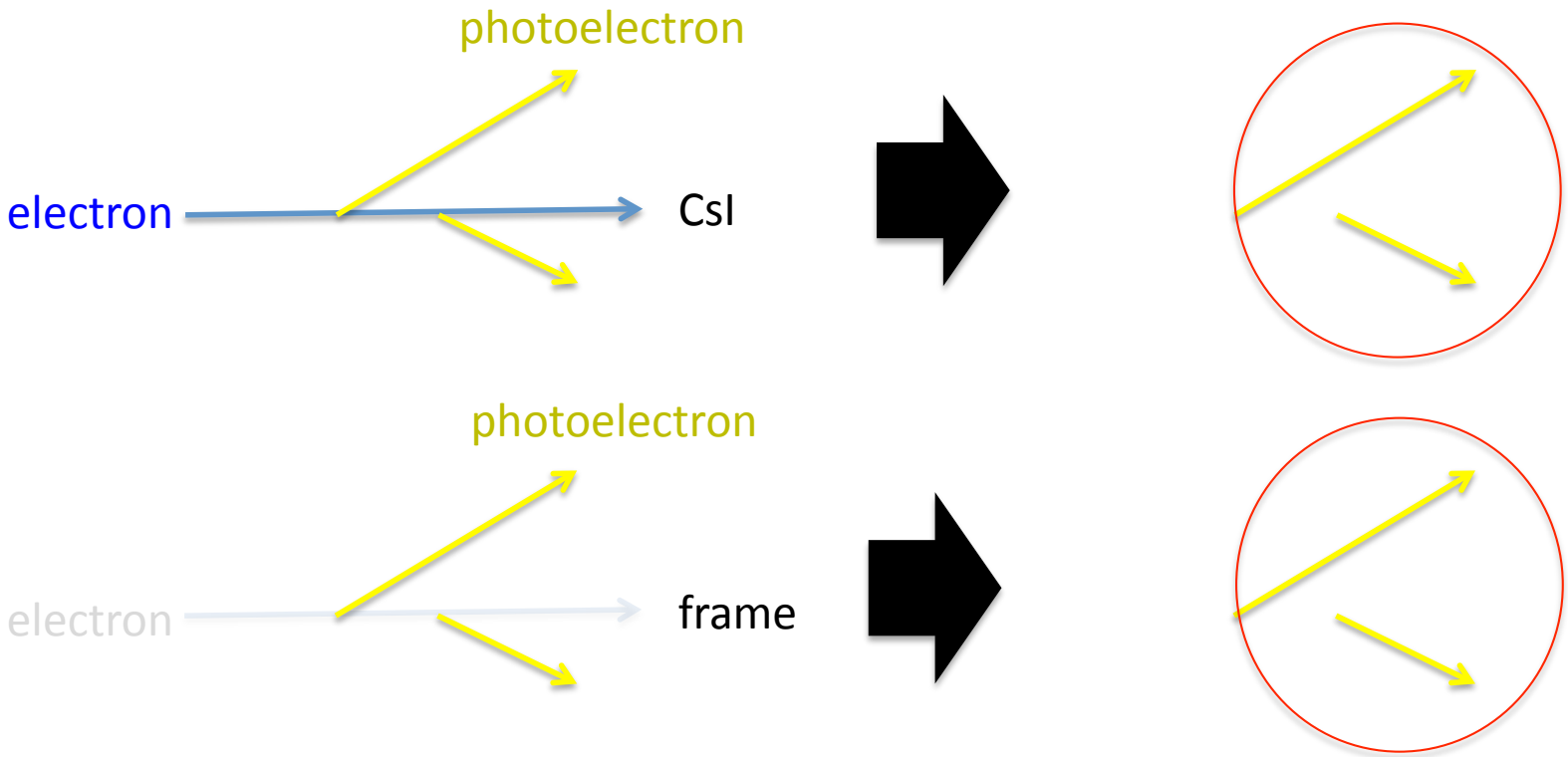
Solution

PISA

An electron track is not stored when it hits frames.

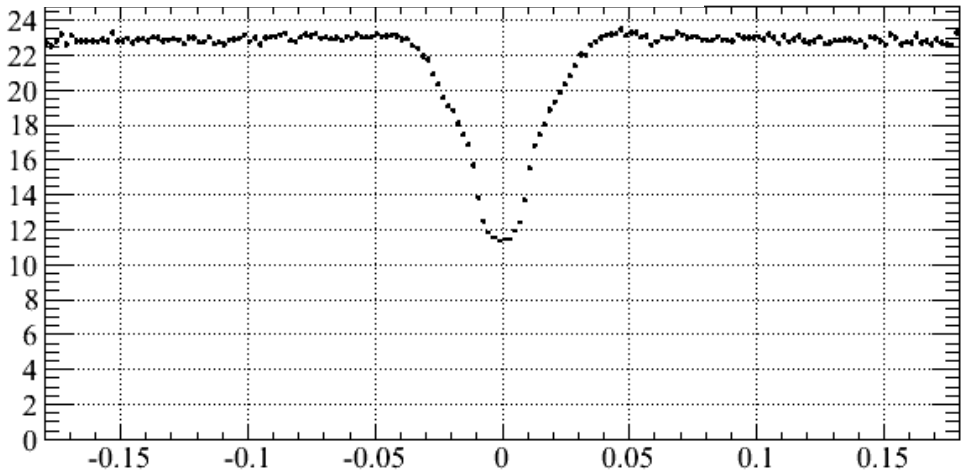
New HBD Slow Simulation

Give up the association.
Use all the photoelectrons

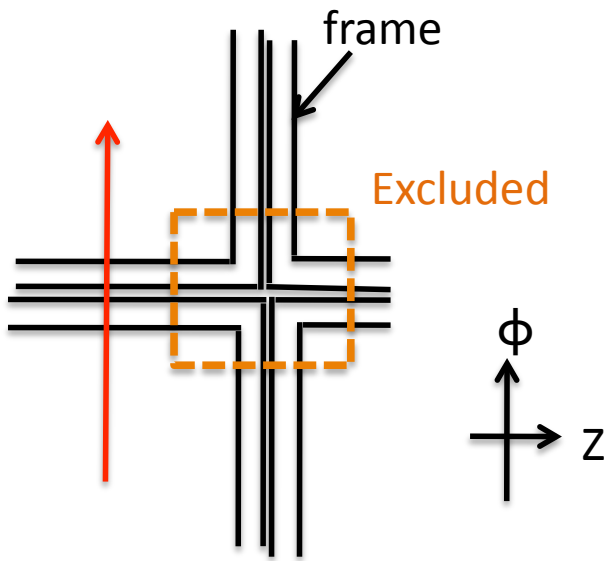


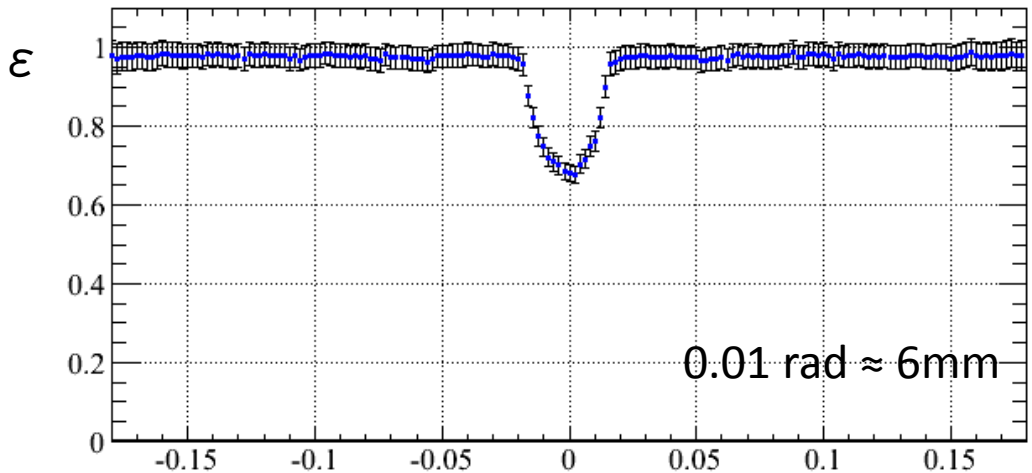
After fixing 1

Average # of p.e after 3σ matching



hbdpphi around frames (rad)



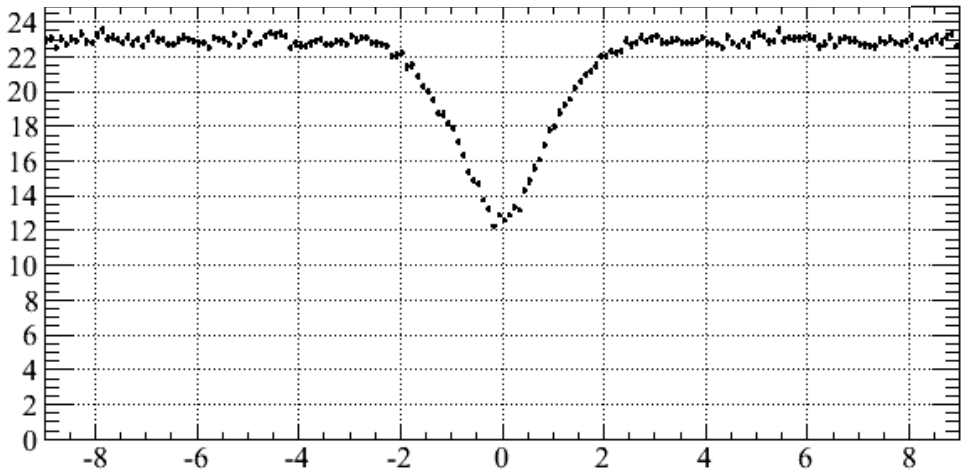


hbdpphi around frames (rad)

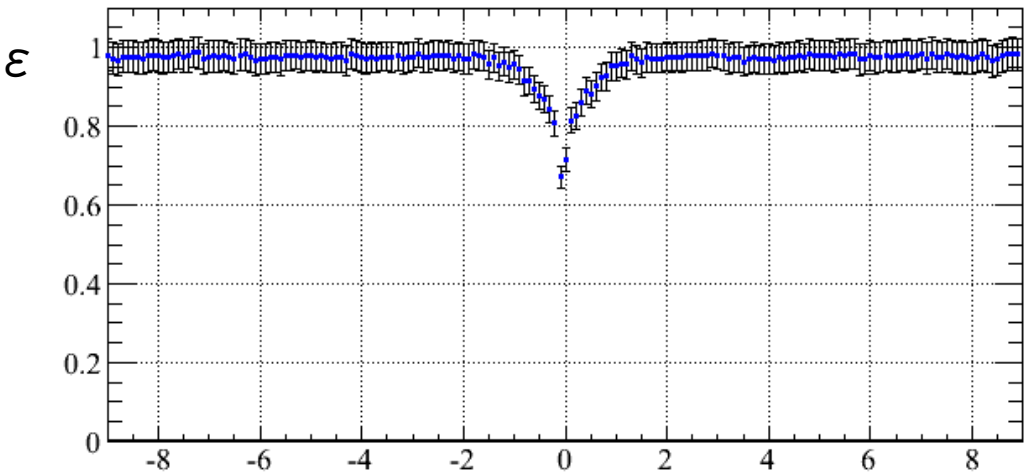
- $3\sigma_z \approx$ 1.6cm,
- $3\sigma_\phi \approx$ 17mrad(~1cm)
- Efficiency is not 0 around frames
- Half of photoelectrons are lost on a frame when the hit is in the middle of the frame.

After fixing 2

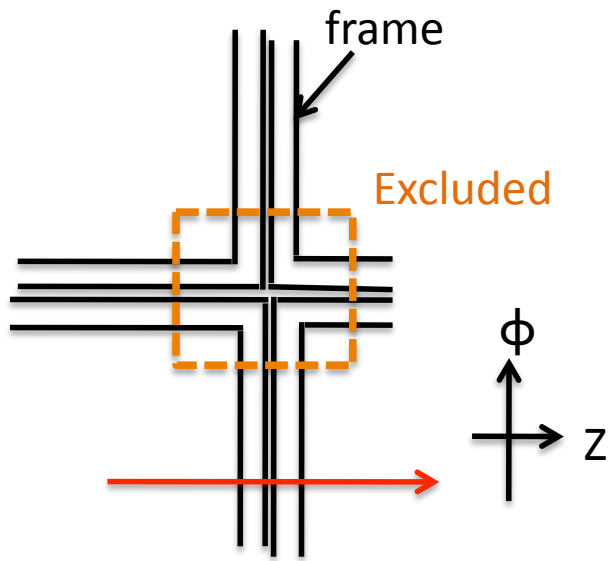
Average # of p.e after 3σ matching



hbdpz around frames (cm)

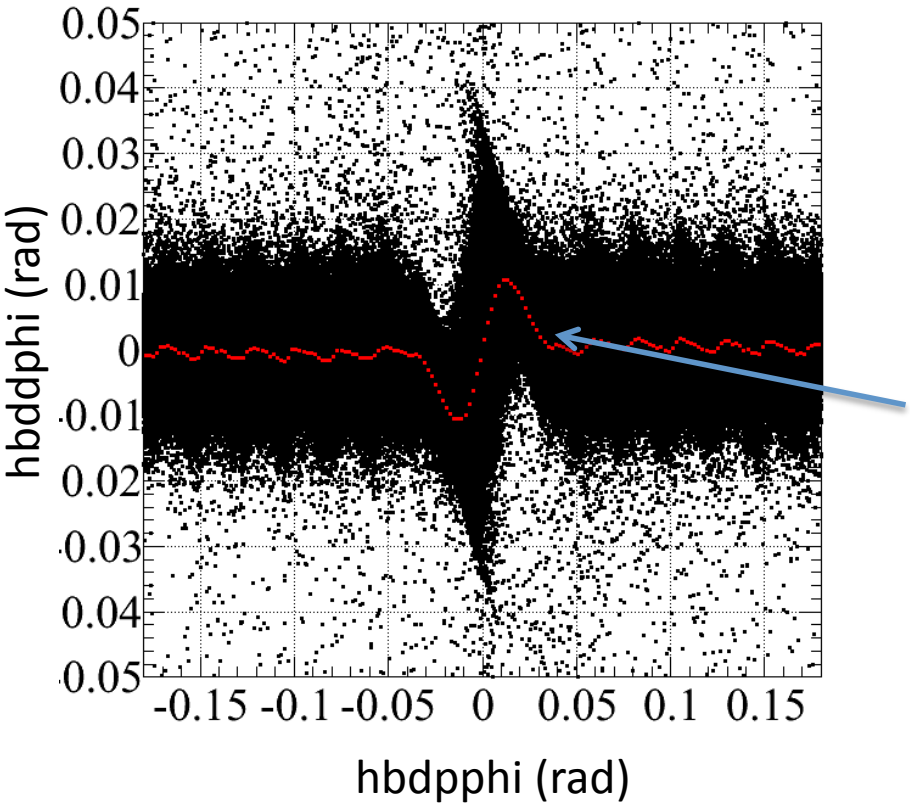


hbdpz around frames (cm)



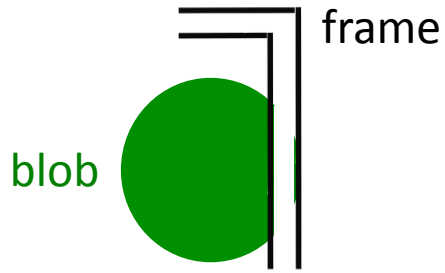
Remaining issue

- We are still investigating how efficiency is lost around frames.

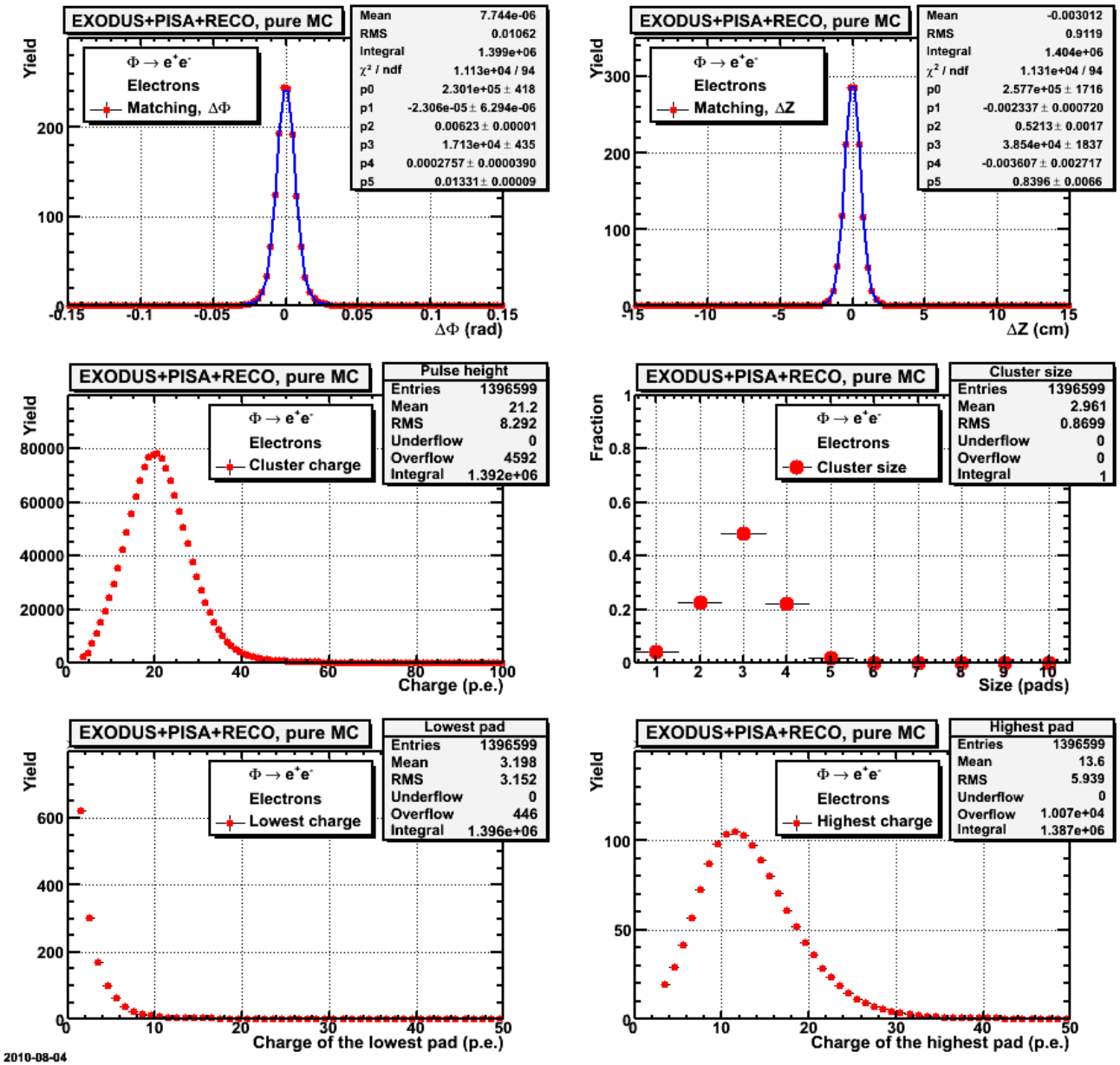


A problem is that we are using constant 3σ matching.

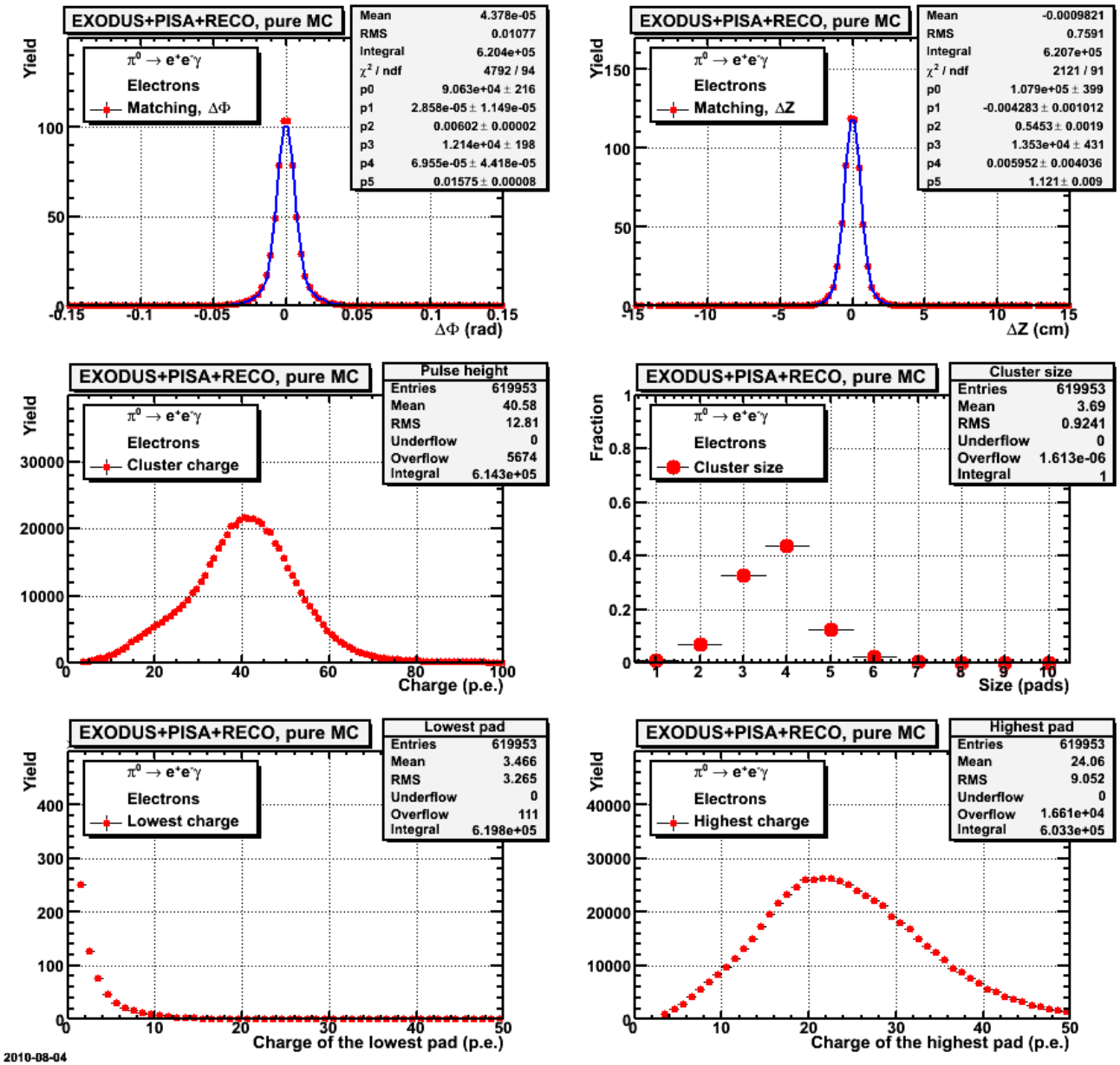
When a part of a blob is on a frame, COG of the blob is shifted.



Single electron cluster properties



Double electron cluster properties



Conclusion

- New HbdFinalSimulator is working fine.