

Report on KOTO EMCal Study

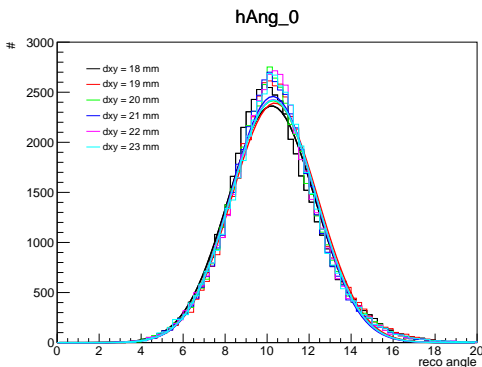
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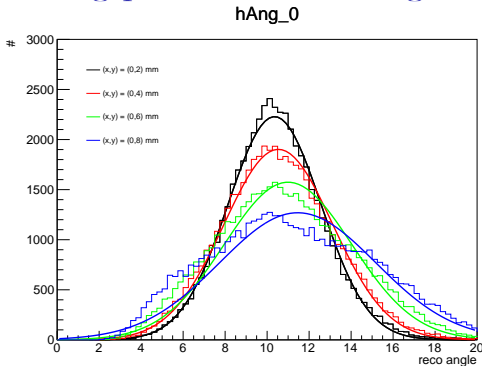
- ▶ Reconstruction as a function of the detector width
- ▶ Effect on starting point of incident gamma
- ▶ Machine learning optimization study

dependence on the detector width



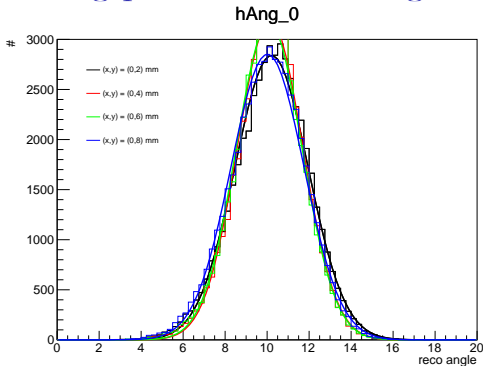
- ▶ Training sample: random generation for polar(0–50 deg) and azimuthal angle(0–360 deg) with 100k events
- ▶ Test samples: 50k fixed $\theta = 10^\circ$ events.
 - ▶ dxy is set in geant4 simulation.
- ▶ Not effective

Effect on starting point of incident gamma



- ▶ Training sample: random generation for polar(0–50 deg) and azimuthal angle(0–360 deg) with 100k events with fixed incident position
- ▶ Test samples: 50k fixed $\theta = 10^\circ$ events with various incident positions
 - ▶ +2,4, 6, and 8 mm
- ▶ Biased training results in worse reconstruction.

Effect on starting point of incident gamma

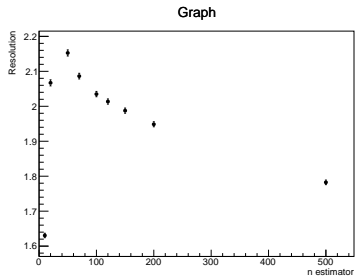
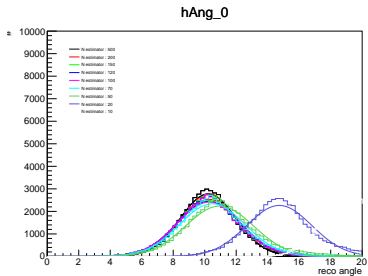


- ▶ Training sample: random generation for polar(0–20 deg) and azimuthal angle(0–360 deg) with 100k events with random incident position
- ▶ Test samples: 50k fixed $\theta = 10^\circ$ events with various incident positions
 - ▶ +2,4, 6, and 8 mm
- ▶ Unbiased training results in better reconstruction.

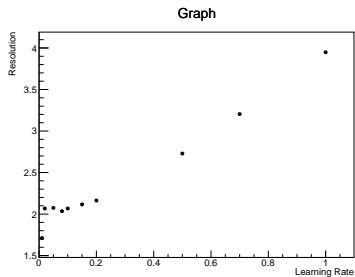
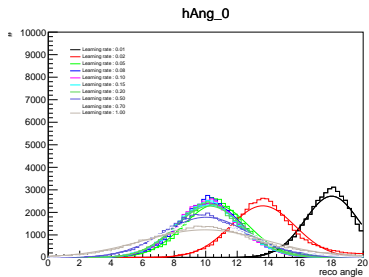
Machine learning optimization study

- ▶ Input parameters for setting up the training is following
 - ▶ `n_estimators=100`, `learning_rate=0.08`, `gamma=0`, `subsample=1`, `max_depth=7`
 - ▶ Each parameter has been scanned to optimize the training.
 - ▶ Need to understand the functionality of each parameter.
- ▶ Training sample: random generation for polar(0–50 deg) and azimuthal angle(0–360 deg) with 100k events with fixed incident position
- ▶ Test samples: 50k fixed $\theta = 10^\circ$ events

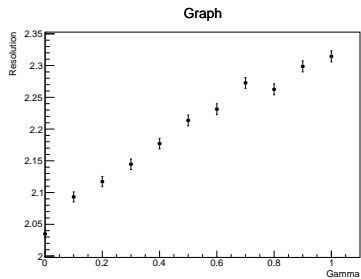
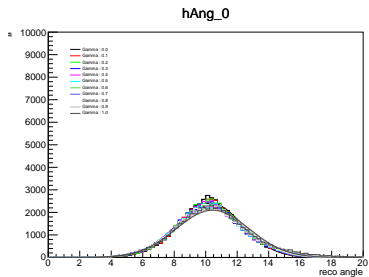
n_estimators



learning_rate

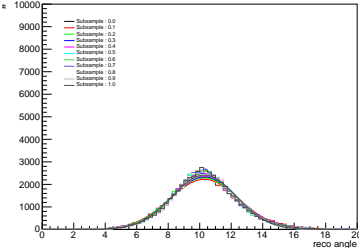


gamma

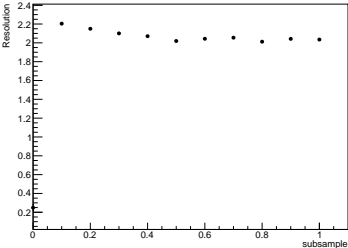


subsample

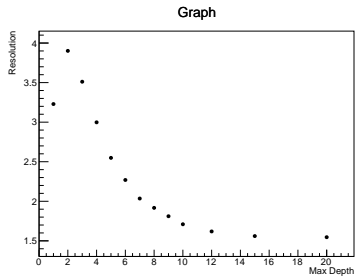
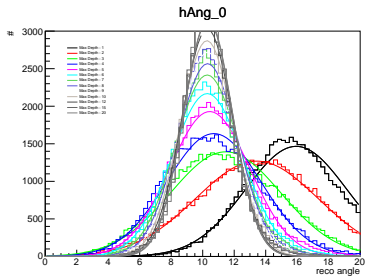
hAng_0



Graph



max_depth



Status

- ▶ Further scan of dxy effect?
- ▶ Bias from fixed incident position
- ▶ Optimization of training setup.