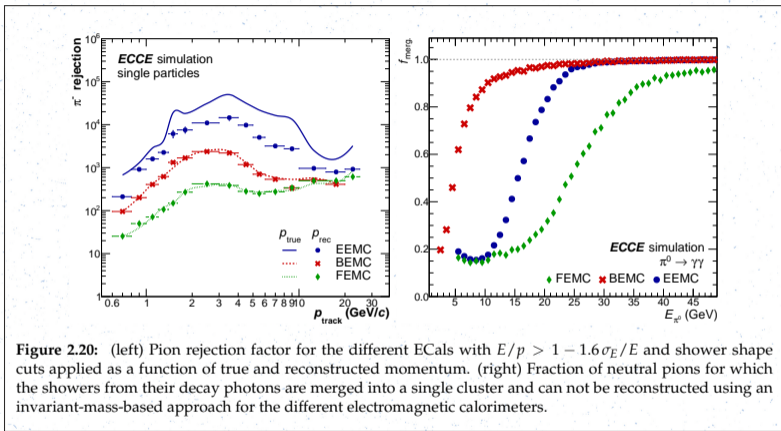# Pion rejection factor in SciGlass ECal

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University of Kentucky

ECCE proposal

Figure 2.20: (left) Pion rejection factor for the different ECals with $E/p > 1 - 1.6\,\sigma_E/E$ and shower shape cuts applied as a function of true and reconstructed momentum. (right) Fraction of neutral pions for which the showers from their decay photons are merged into a single cluster and can not be reconstructed using an invariant-mass-based approach for the different electromagnetic calorimeters.

For a Gaussian peak $(1 + \mathrm{erf}(1.6/\sqrt{2}))/2 = 94.5\%$ efficiency - that's not how they've defined, it's more like $(1 + \mathrm{erf}(0.6/\sqrt{2}))/2 = 72.5\%$
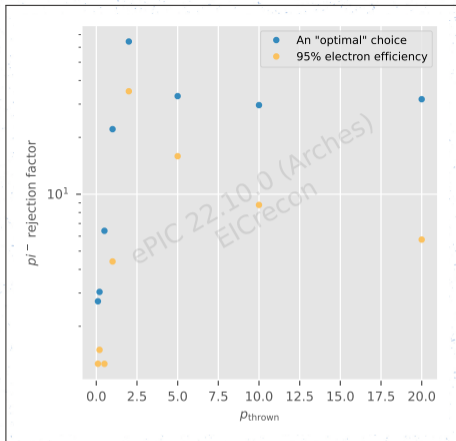
Last week:

`https://indico.bnl.gov/event/`
`17705/contributions/70652/`
`attachments/44399/74929/oct_`
`campaign_benchmarks.pdf`

In backup of `https:`
`//indico.jlab.org/event/546/`
`contributions/9980/attachments/`
`7933/11151/machine_learning_`
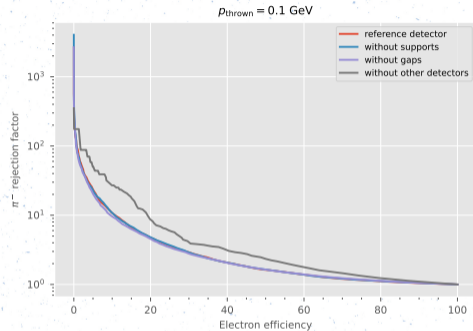`hall_ac_2022_phelps.pdf`
(was shown at 2nd EIC AI/ML
Workshop)

Last week

» Sum of all towers after smearing/digitization in EICrecon (clustering not used)

» 22.10.0 geometry

» Ill-defined polar angles (missing data for certain energies/rapidities)

This week

» Sum of all towers directly after simulation in DD4hep+Geant4 (clustering not used)

» 22.11.1 geometry (full 12 mm sector gap introduced)

» Particles thrown within acceptance of the calorimeter ($29^{\circ} < \Theta < 160^{\circ}$)

Pion rejection (0.10 GeV)
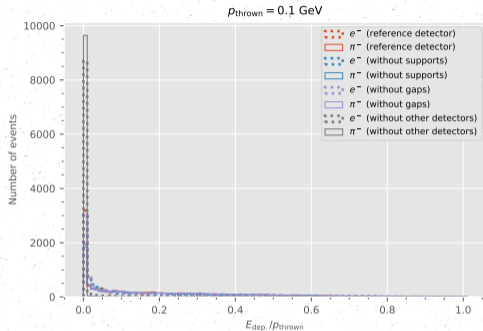
» without supports - carbon fiber and wedge box removed
» no gaps - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)
» without other detectors - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
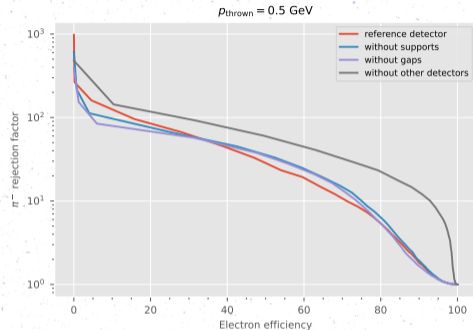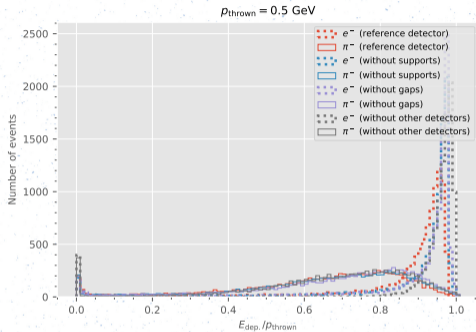
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Pion rejection (0.20 GeV)
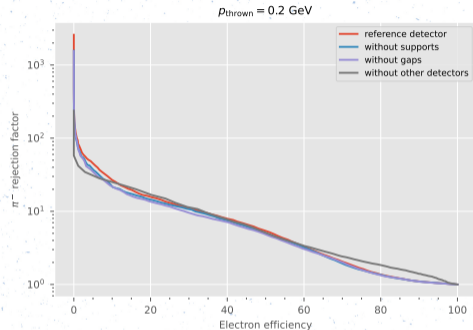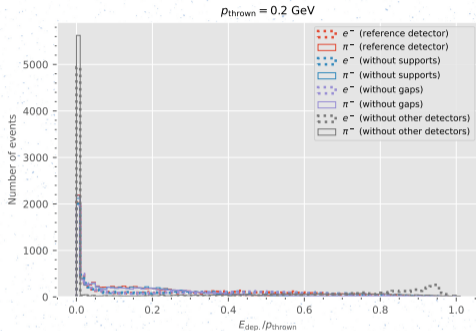
» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)

Pion rejection (0.50 GeV)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
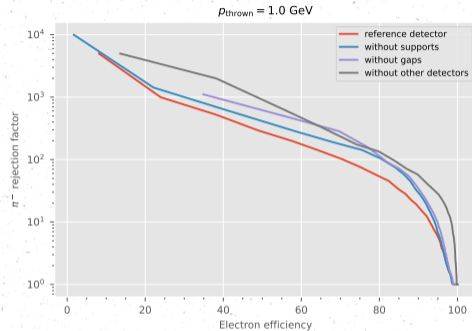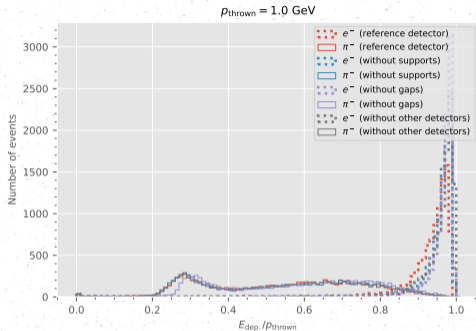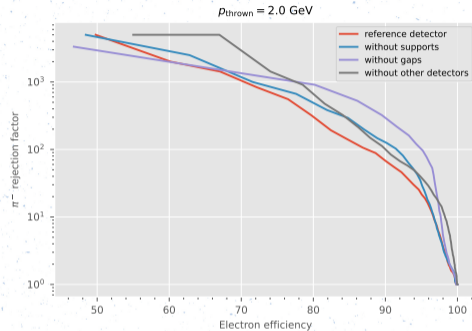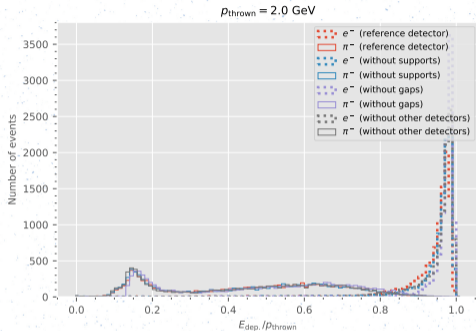
Pion rejection (1.00 GeV)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)

Pion rejection (2.00 GeV)

p_{thrown} = 2.0 GeV

e^- (reference detector)
π^- (reference detector)
e^- (without supports)
π^- (without supports)
e^- (without gaps)
π^- (without gaps)
e^- (without other detectors)
π^- (without other detectors)

p_{thrown} = 2.0 GeV

reference detector
without supports
without gaps
without other detectors

» without supports - carbon fiber and wedge box removed

» no gaps - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» without other detectors - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
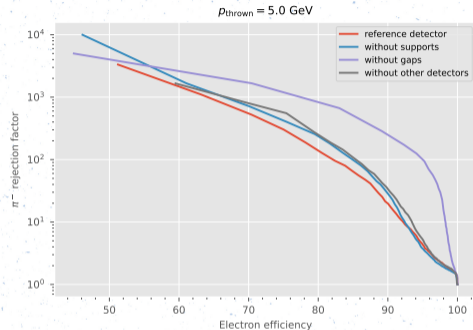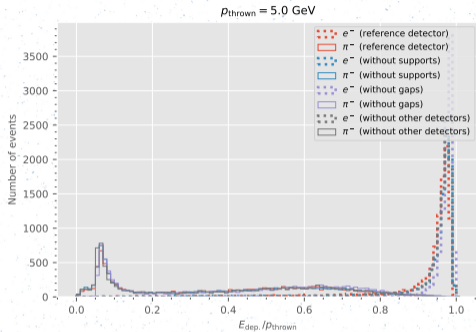
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Pion rejection (5.00 GeV)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
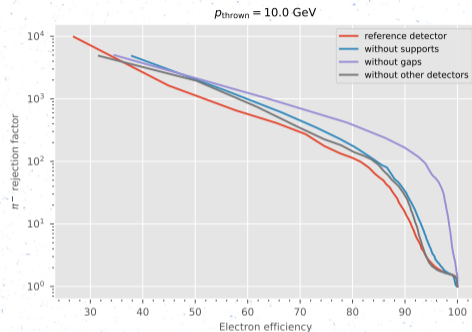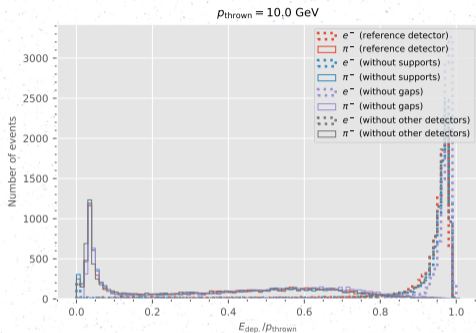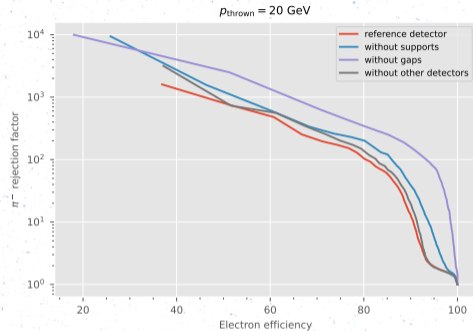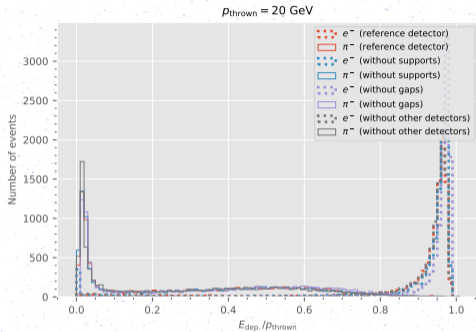
Pion rejection (10.00 GeV)

» without supports - carbon fiber and wedge box removed

» no gaps - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» without other detectors - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
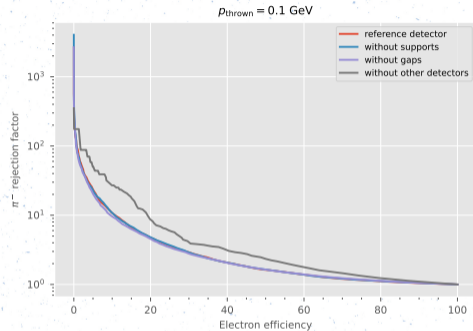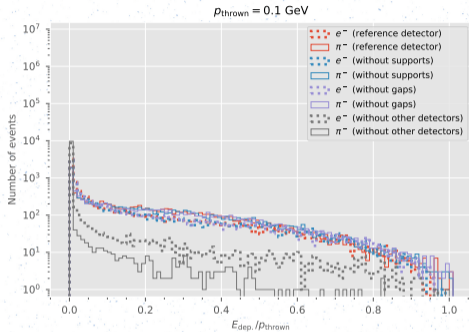
Pion rejection (20.00 GeV)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
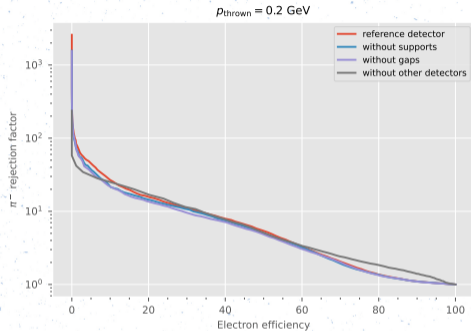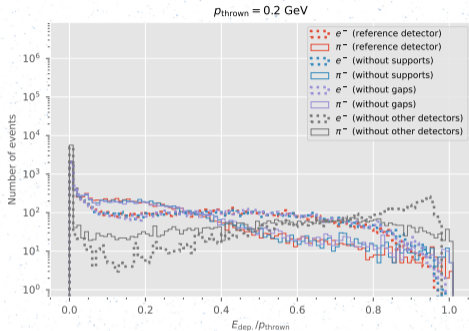
Pion rejection (0.10 GeV, logarithmic scale)

» without supports - carbon fiber and wedge box removed

» no gaps - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» without other detectors - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
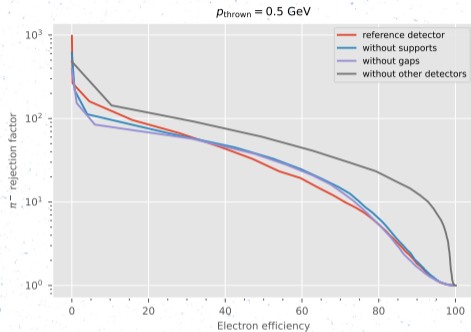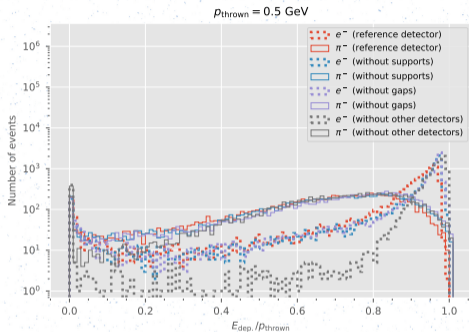
Pion rejection (0.20 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
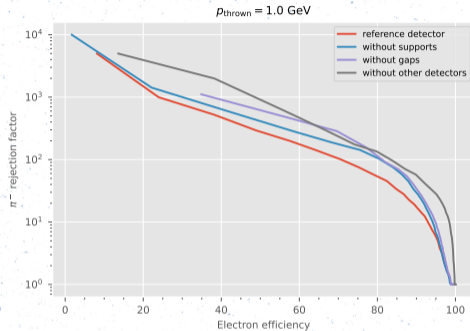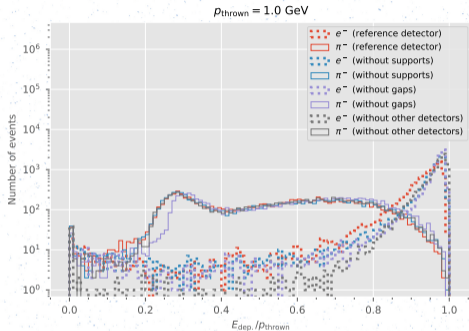
Pion rejection (0.50 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
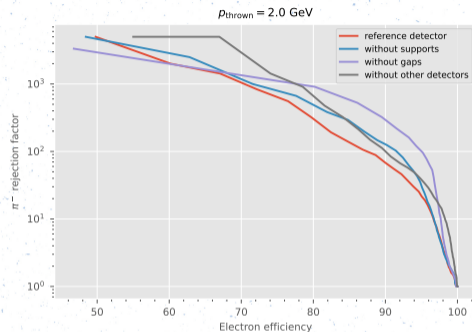
Pion rejection (1.00 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
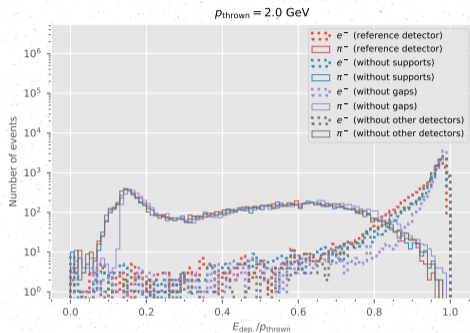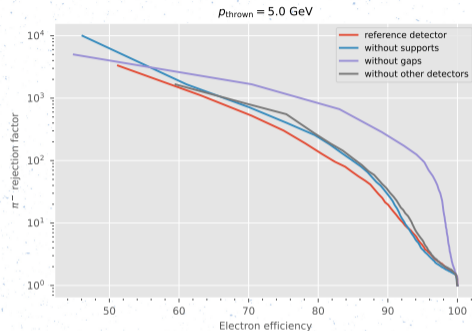
Pion rejection (2.00 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
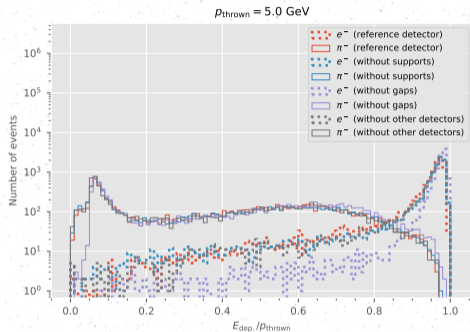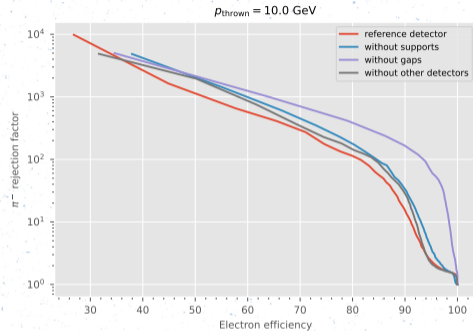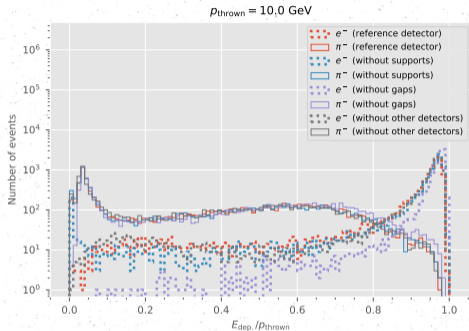
Pion rejection (5.00 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

» **without other detectors** - remove all material not related to EcalBarrel, keep the magnetic field (A bug fixed on 11/29/2022)
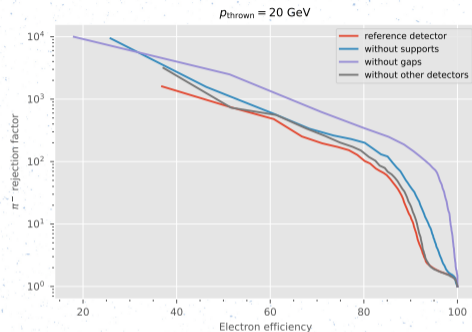
Pion rejection (10.00 GeV, logarithmic scale)

» **without supports** - carbon fiber and wedge box removed

» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

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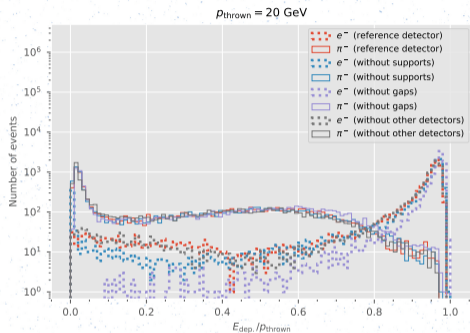
Pion rejection (20.00 GeV, logarithmic scale)

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» **no gaps** - remove longitudinal gap and increase height (1 mm → 0 mm), increase tower width (and ignore volume overlaps)

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Pion rejection: energy dependency