On HCAL needs beyond 3.0

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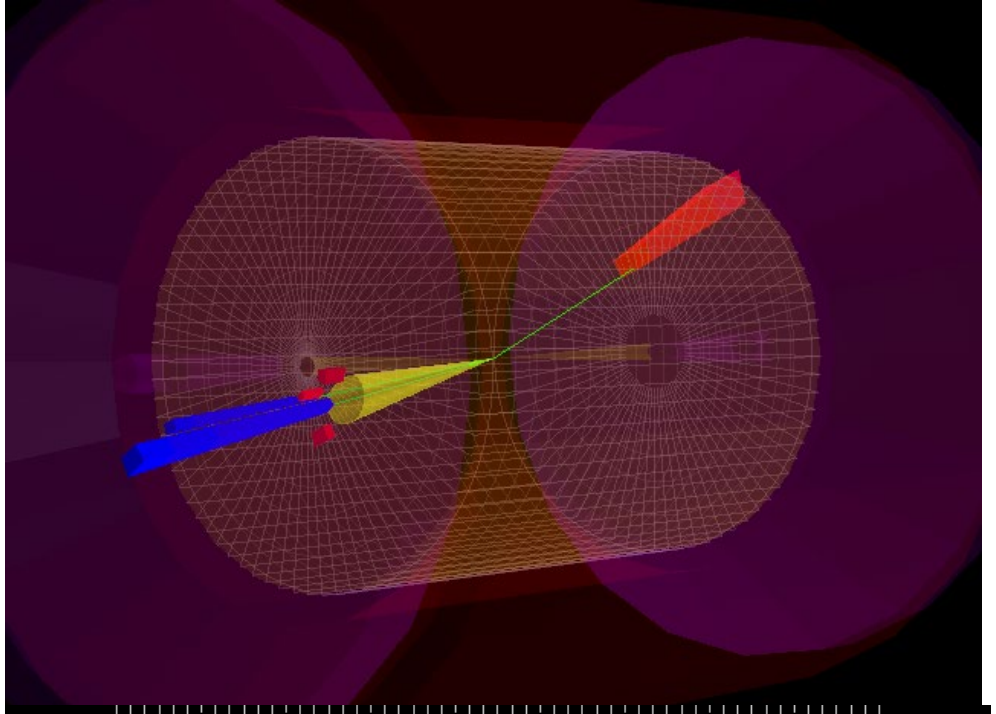
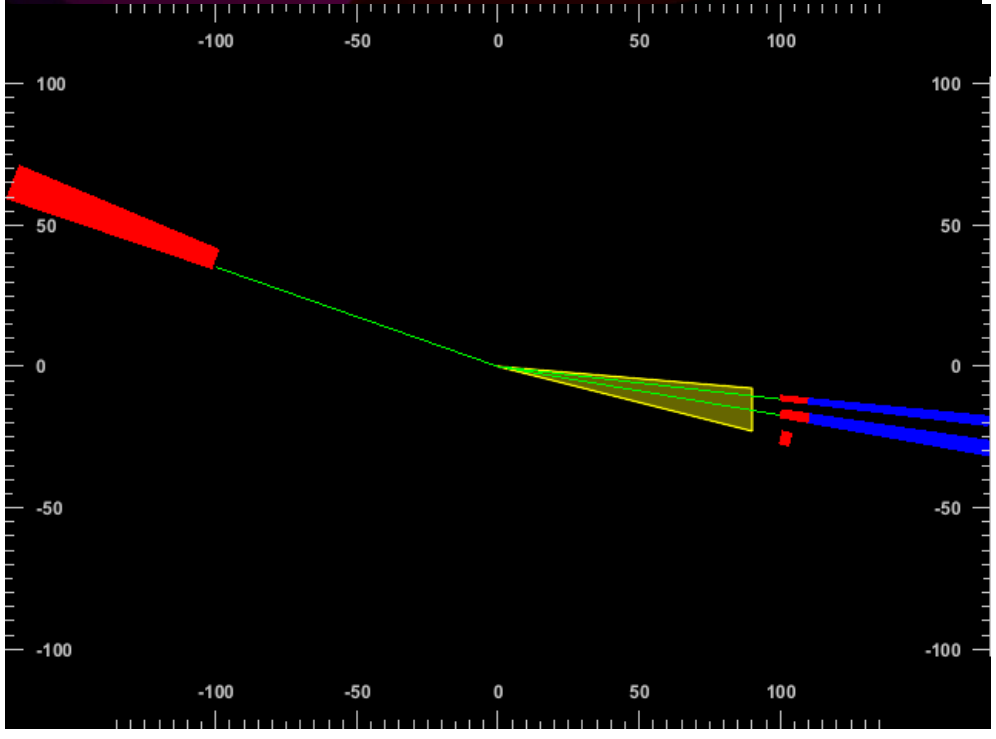
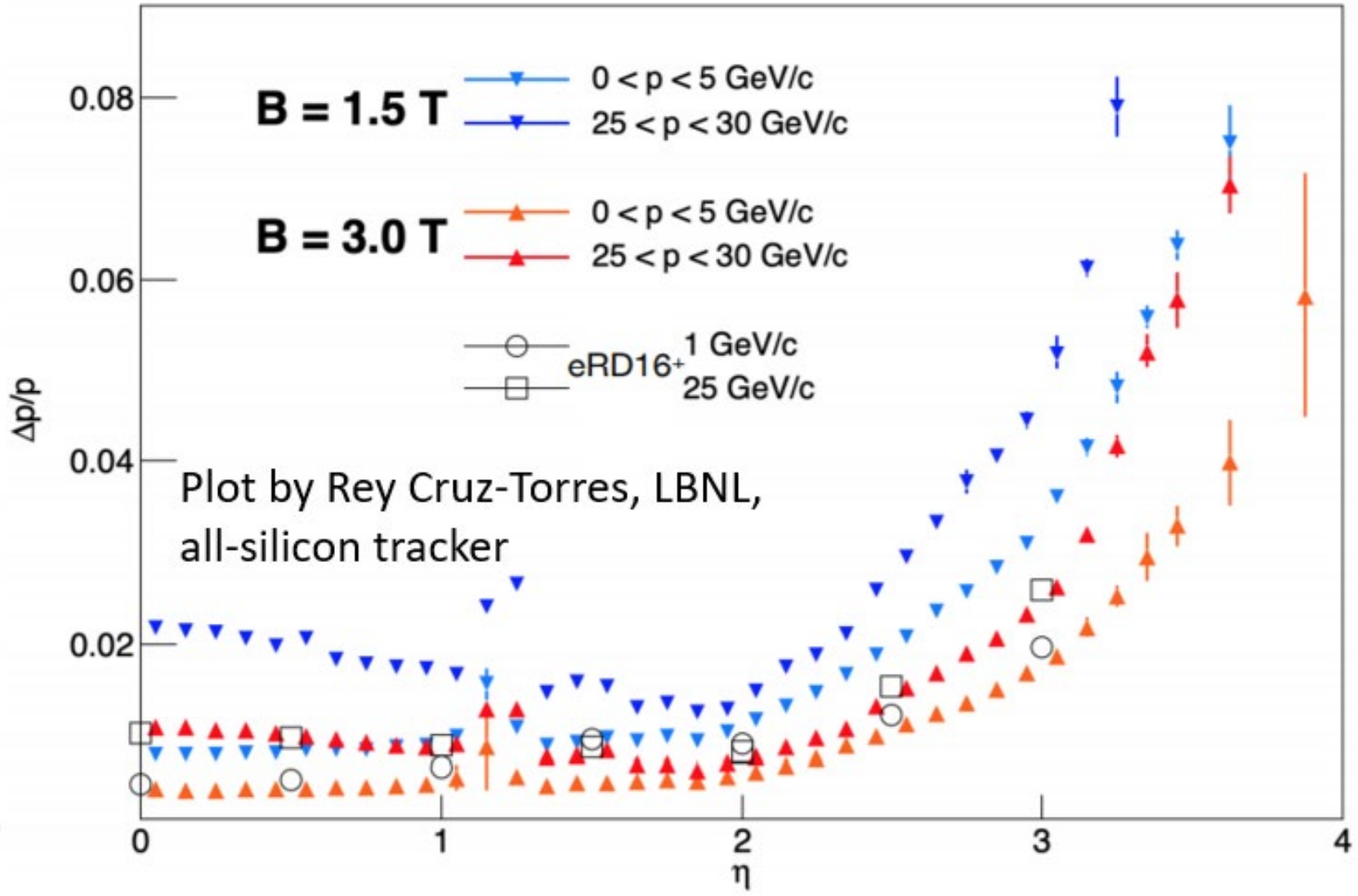




Intro

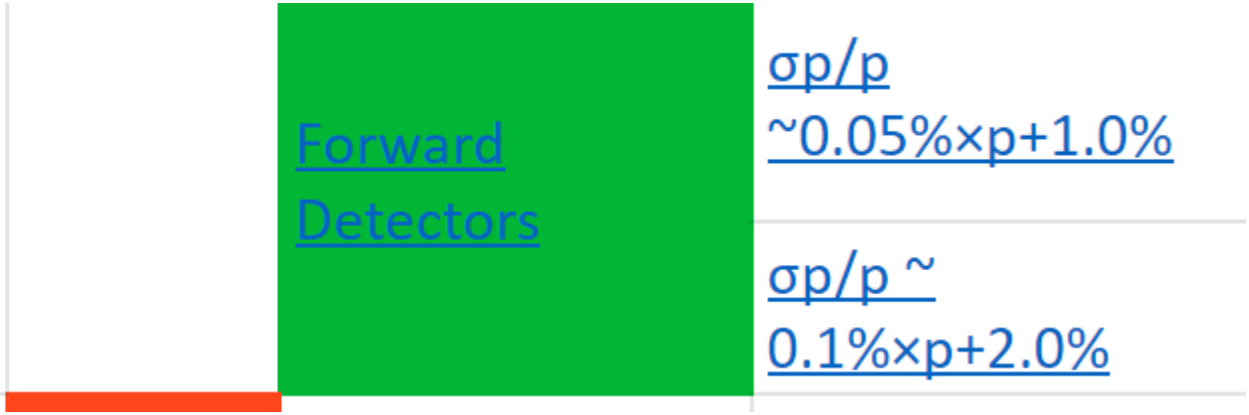
- I will discuss issues with tracking beyond 3.0 and the motivation for a HCAL with low constant term and high resolution.
- I will show what constant term we likely need.
- I will briefly discuss the physics potential of such an option

Realistic simulations show tracking performance deteriorates fast beyond eta = 3.0



Realistic simulations show tracking performance deteriorates fast beyond eta = 3.0, but currently the detector matrix states:

16	1.0 to 1.5
17	1.5 to 2.0
18	2.0 to 2.5
19	2.5 to 3.0
20	3.0 to 3.5

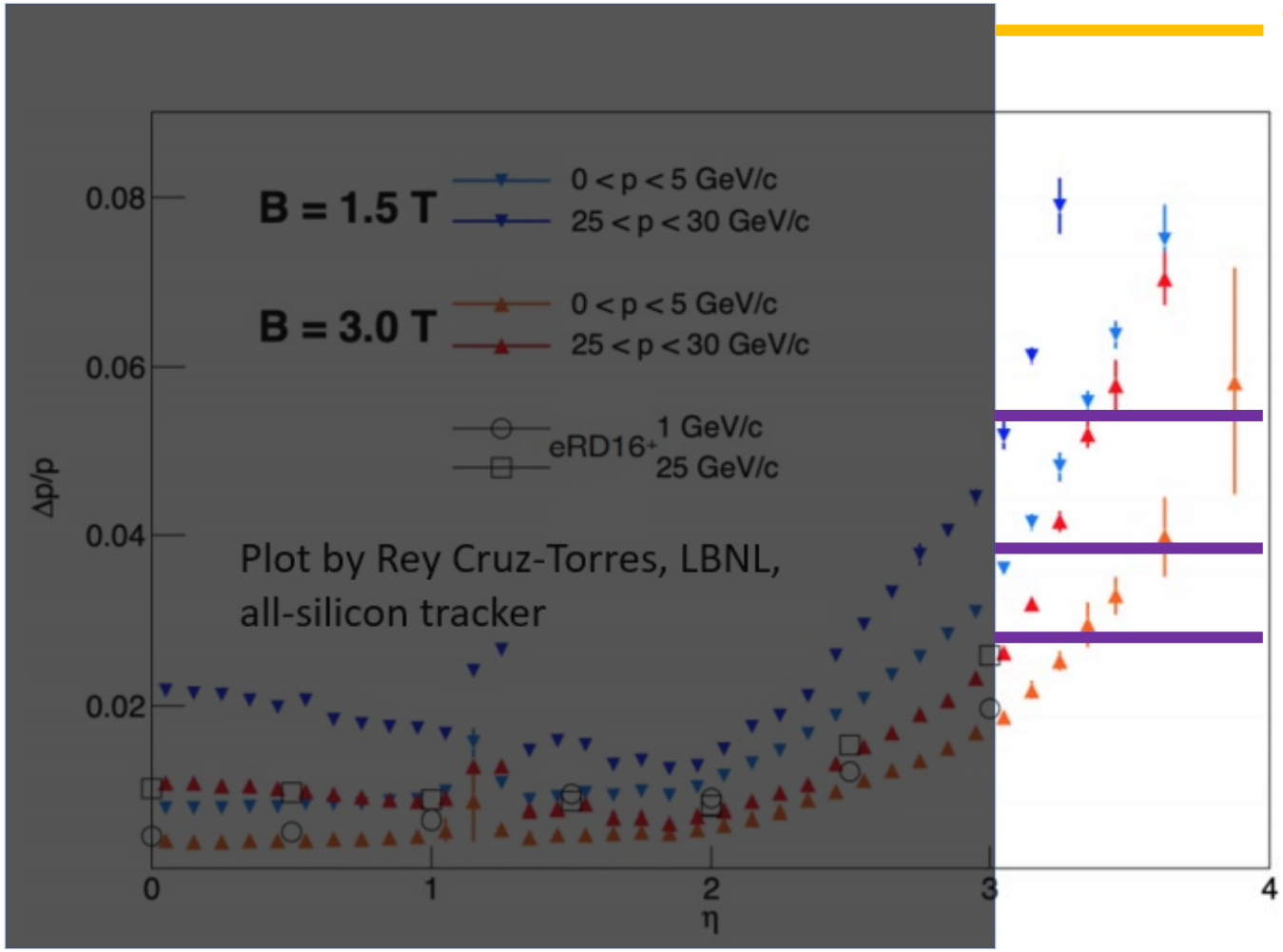


Totally unrealistic requirements in detector matrix?

- Are we misleading ourselves to wrongly conclude HCAL has little impact on jet and missing-energy measurements beyond eta=3.0?
- Given realistic performance, can PID even work beyond 3.0 up to 50 GeV, as currently stated in matrix?.

HCAL with 50%/sqrt(E) + 10%
at E=30 GeV

at E>50 GeV



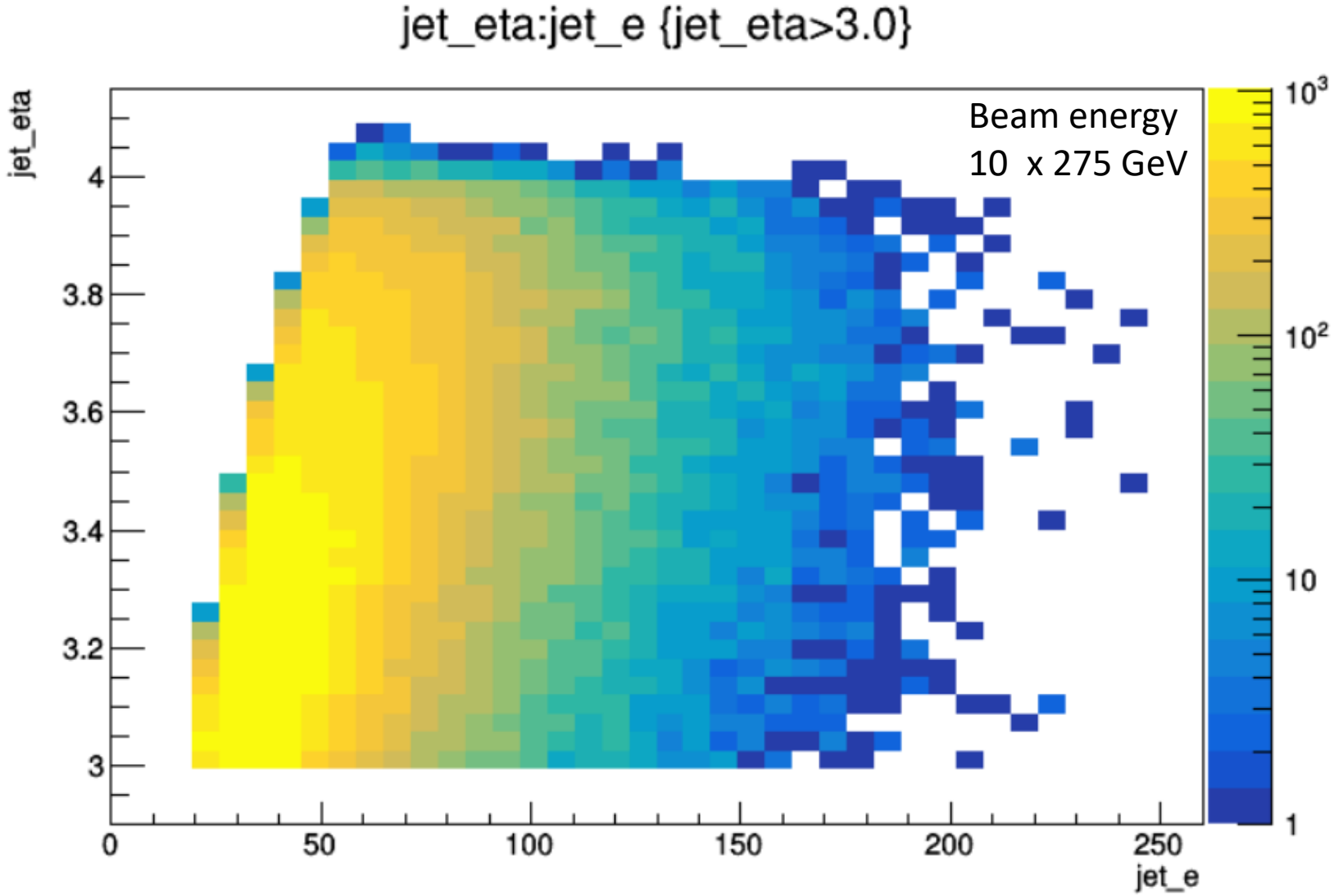
HCAL with 40%/sqrt(E)

at E = 50 GeV

at E = 100 GeV

at E = 200 GeV

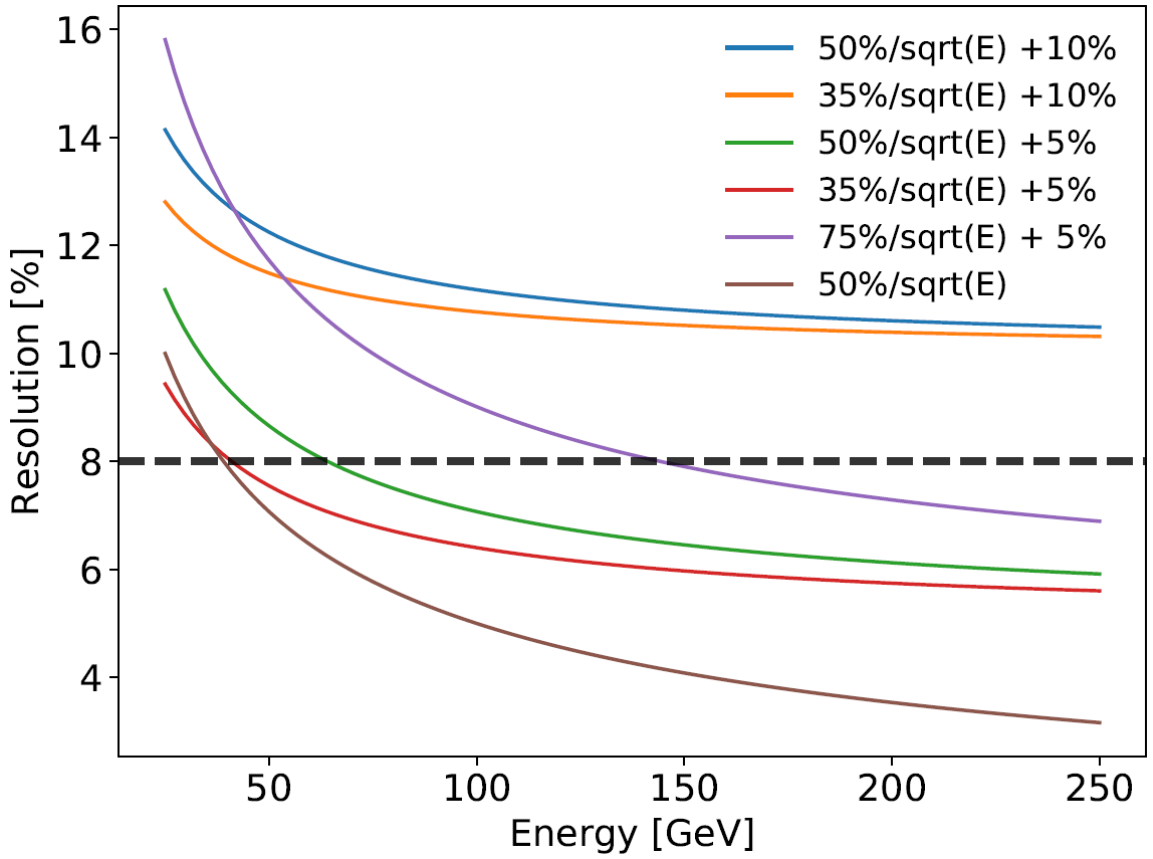
There is plenty of phase space for jets beyond 3.0 For DIS (not including diffractive stuff here yet)



Simulation statistics does not reflect projected rates, jets surely reach 200 GeV and more

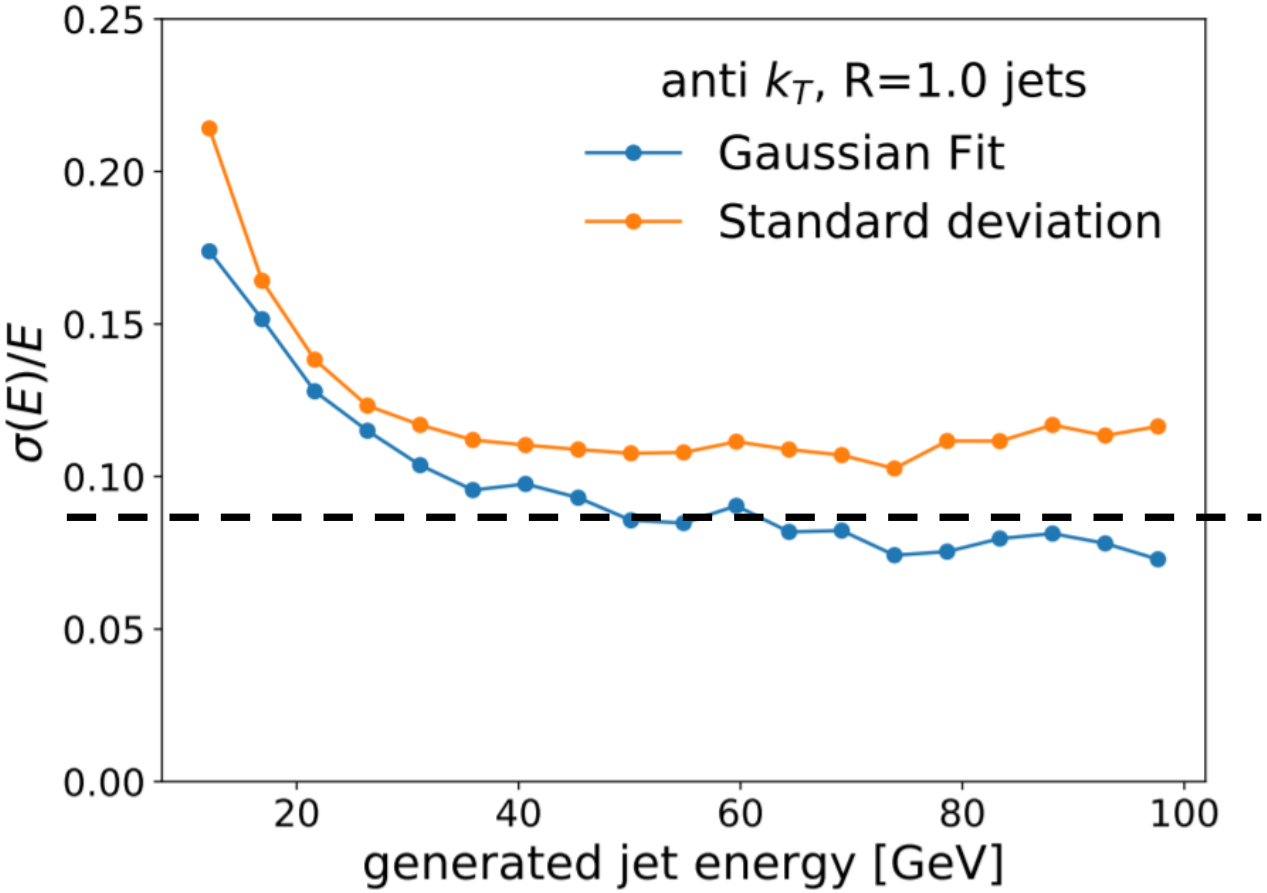
Jet energy resolution (~ Bjorken x resolution)

with calorimeter



Current 50% + 10% specs IS NOT ENOUGH

with energy flow (uses tracks, so not available beyond 3.0)



What if we connect the dots…

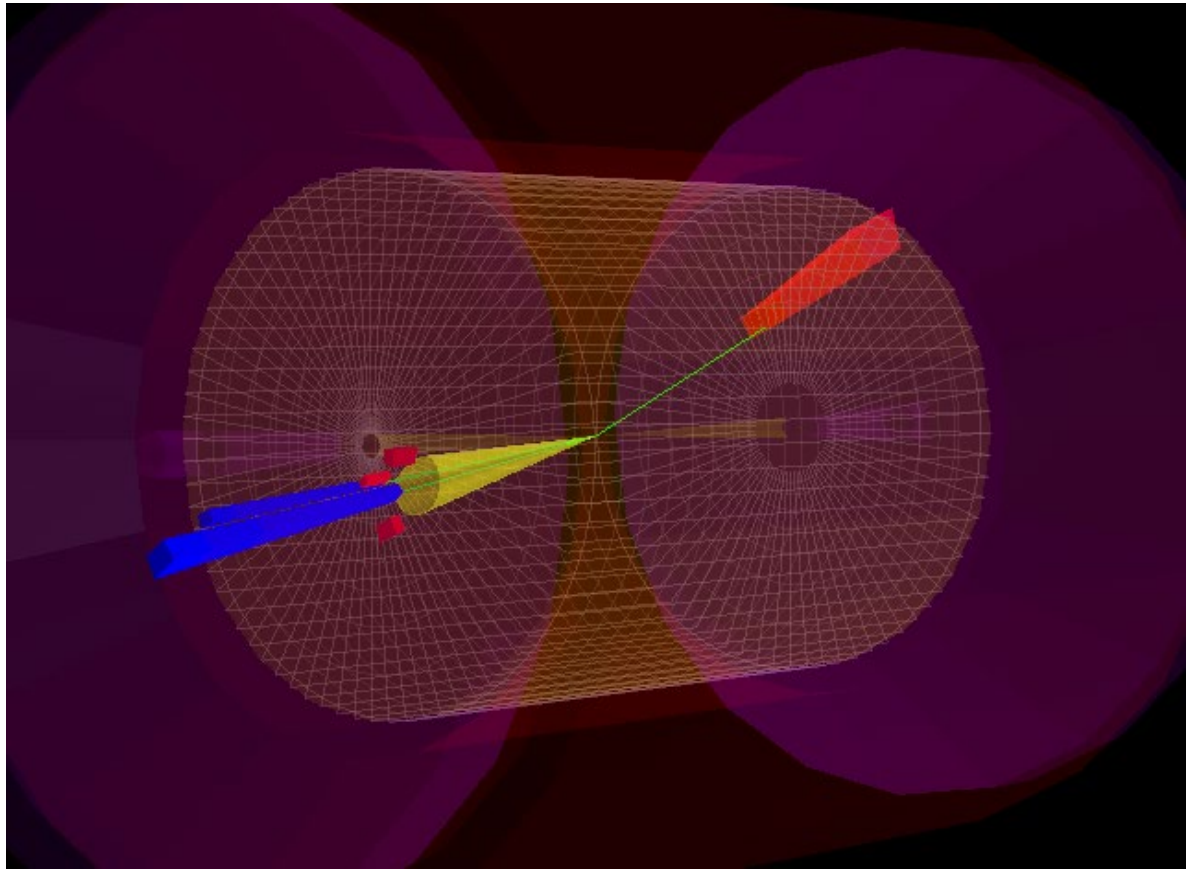
- Tracking performance deteriorates fast beyond eta = 3.0 for the momentum range relevant in that region.
- Material in front of endcap calorimeters and limited space compromises resolution and leads to large (~10%) constant terms.
- PID beyond eta=+3.0 is not needed for high Q2 (>100 GeV2) jet measurements. Might not be even possible given that tracking crashes

-> Give up PID beyond eta=+3.0 and use space for a forward-calorimeter system (ECAL&HCAL) ??
Constant term should be <5% and stochastic term ~40%

Space issues and leakage through beam pipe need to be studied.

What would you gain optimizing forward calorimetry beyond 3.0?

High-x physics
(inclusive DIS, electron-jet Sivers and others TMDs)
Low-x physics
(forward jets sensitive to BFKL dynamics)
Diffractive jets
(quark and gluon GPDs, saturation)
High-x pi0/eta SIDIS
…
…



Summary

- Realistic tracking performance suggest role of HCAL beyond 3.0 will be critical for jet, diffractive and high-x measurements.
- The unrealistic tracking performance assumed in the detector now at 3.0 and beyond can be misleading.
- Constant term needs to be ~5% and not 10% to enable a very rich physics program.
- The potential for a high-resolution forward HCAL is great!!!
  We can make a strong case for a forward physics program, which covers the EIC core science from end to end.
- I suggest you check projections on Jacquet Blondel performance, see what happen without unrealistic tracking, and see impact of HCAL.