

Diffractive VM production at the EIC

Kong Tu

BNL

03.14.2020

The issue from DPAP report

- One major conclusion from the DPAP committee is that the physics performance was found to have no difference between ATHENA and ECCE.
- Diffractive VM was considered one of the processes to benefit from a 3T field.
- ECCE claimed that the ECAL helped and dominated at backward region for scattered electron reco resolution.
- ATHENA didn't consider ECAL in full simulations.

Tracker + ECAL @ ATHENA

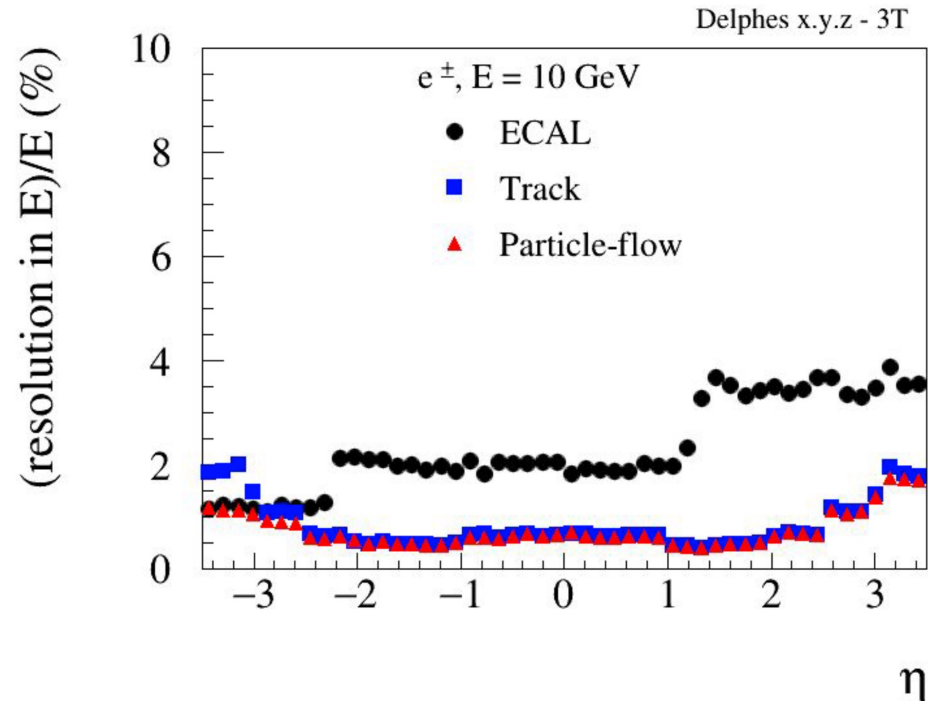
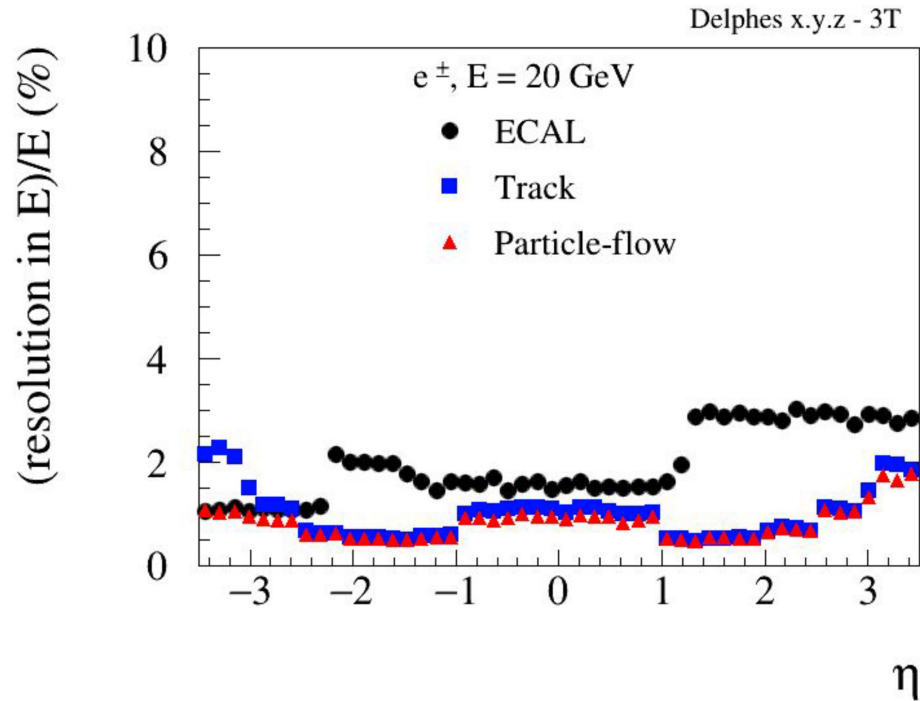
- Used the Delphes fast simulations with parameters “ATHENA.tcl” – card, https://github.com/eic/delphes_EIC/blob/master/ATHENA.tcl

- Backward ECAL $-3.5 < \eta < -3$: $\frac{2\%}{\sqrt{E}} \oplus 1\%$

(This is a little better than what we put in the proposal, although the text seemed to say 1% , probably rounded it up?)

- The algorithm is implemented here, <https://github.com/delphes/delphes/blob/3cfe61d819de7a83aee1ea6a1e0c3b1e0a8e28e8/modules/Calorimeter.cc>

Energy resolution by Miguel Arratia



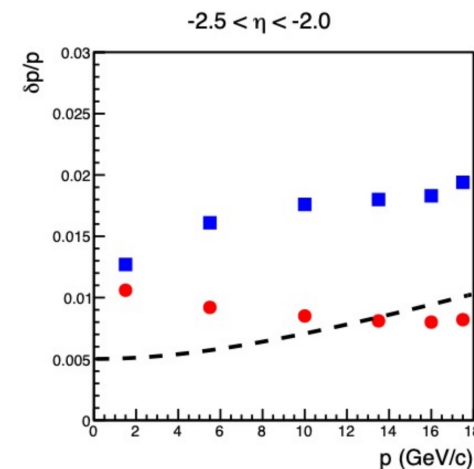
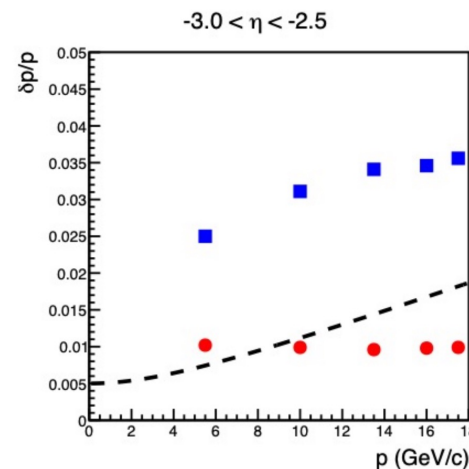
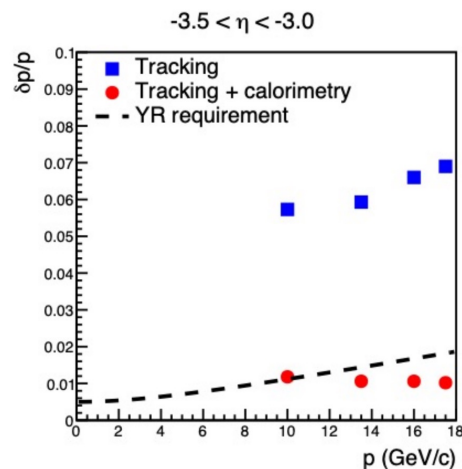
The improvement is at very backward $\eta < -3$, and larger improvement for higher energy

ECCE's G-1 response

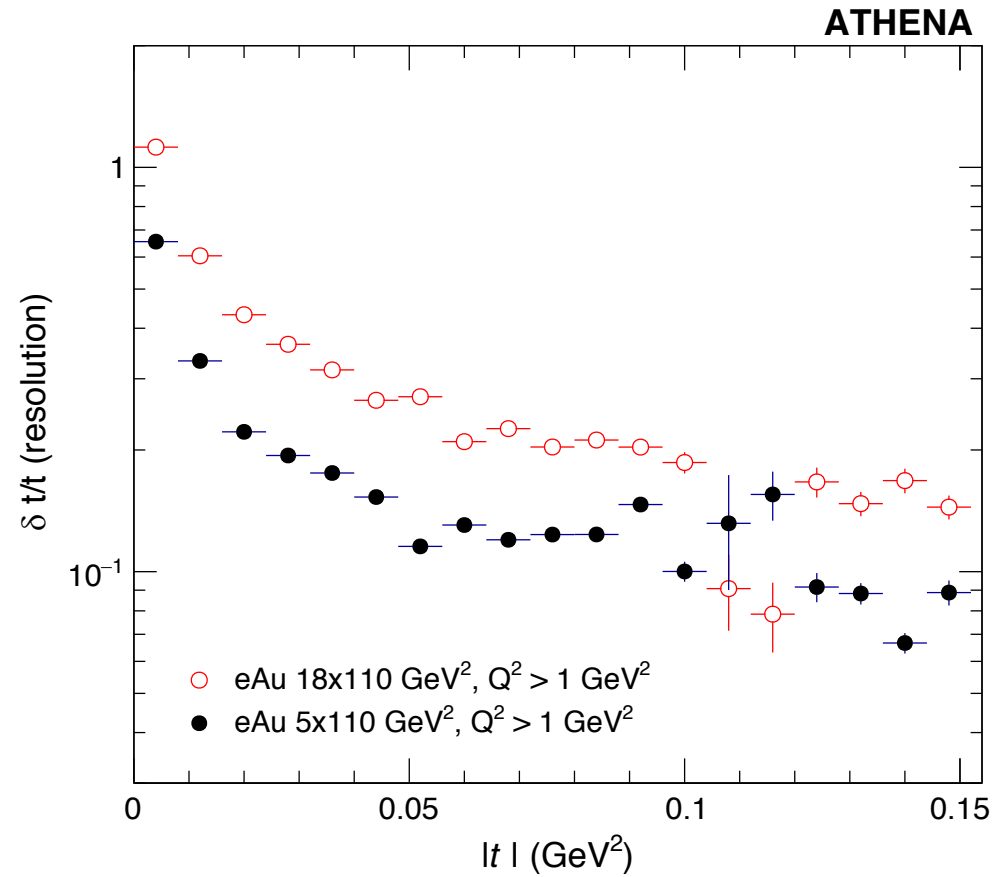
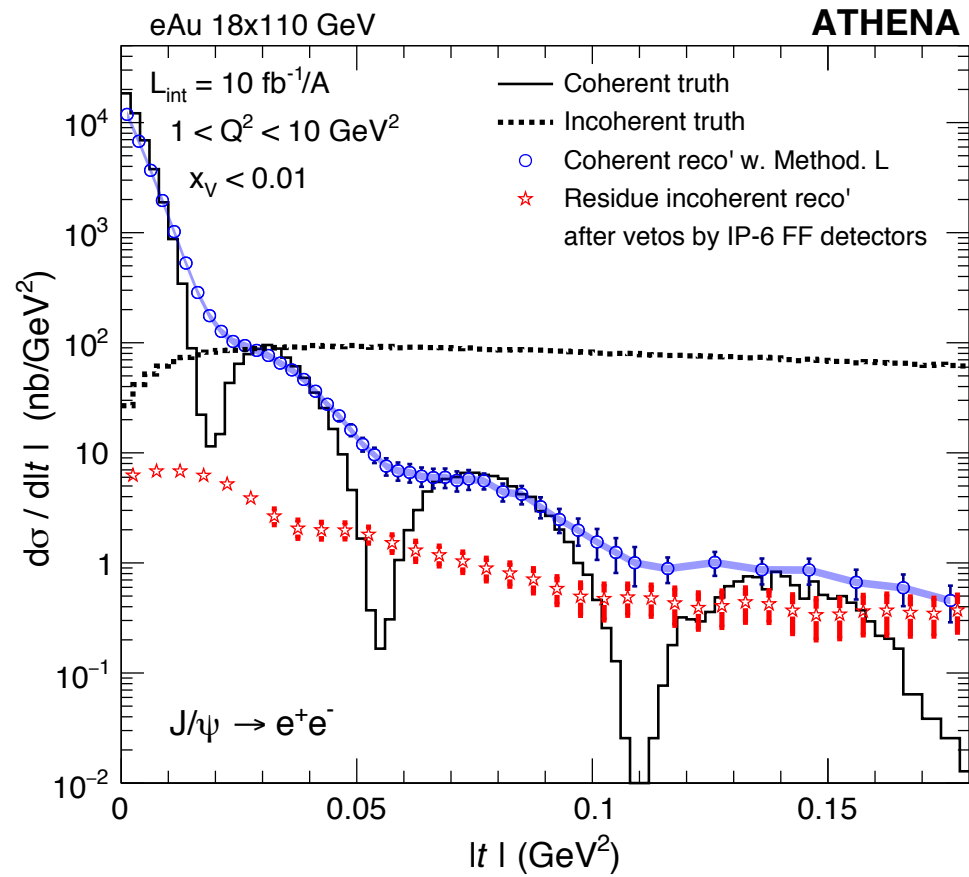
G-1: Momentum resolution



- EM calorimetry significantly improves lepton momentum reconstruction resolution where tracking resolution is poorest
- As shown in the ECCE physics studies, we are fully capable of addressing EIC science. Especially for physics reactions that drive the backward reconstruction resolution (e.g. coherent meson production), increasing the magnetic field (i.e. improving tracking resolution) does not help much as momentum resolution is dominated by calorimetry.

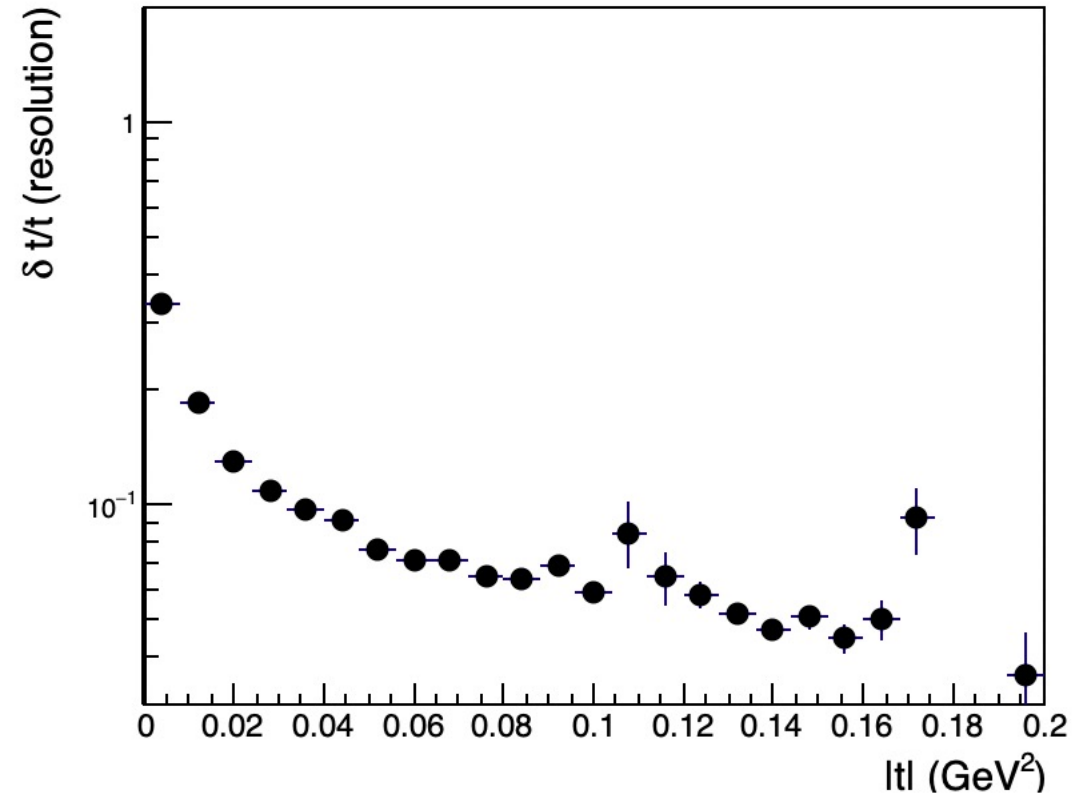
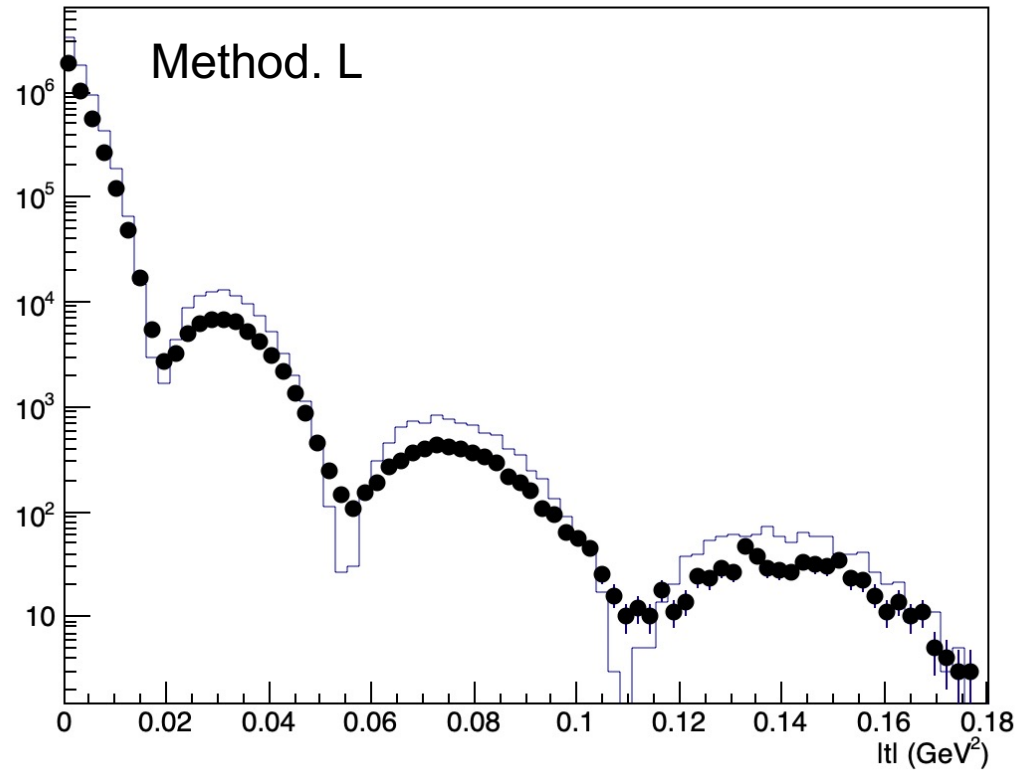


What we had in the DPAP report



Tracker+ECAL from Delphes

18x110 eAu : $\phi \rightarrow K^+K^-$

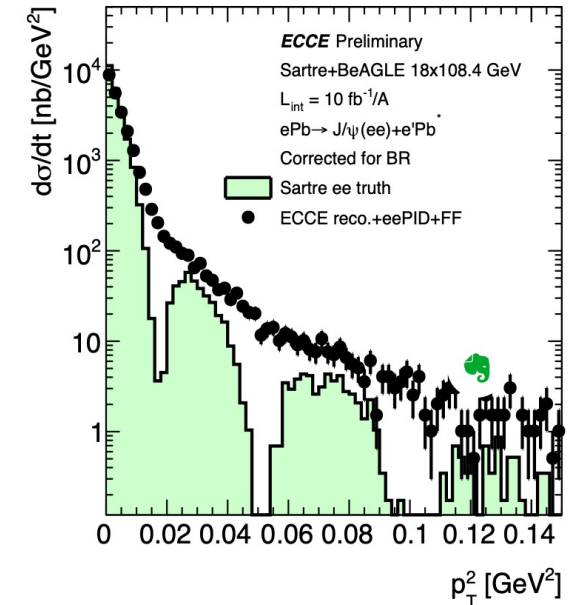
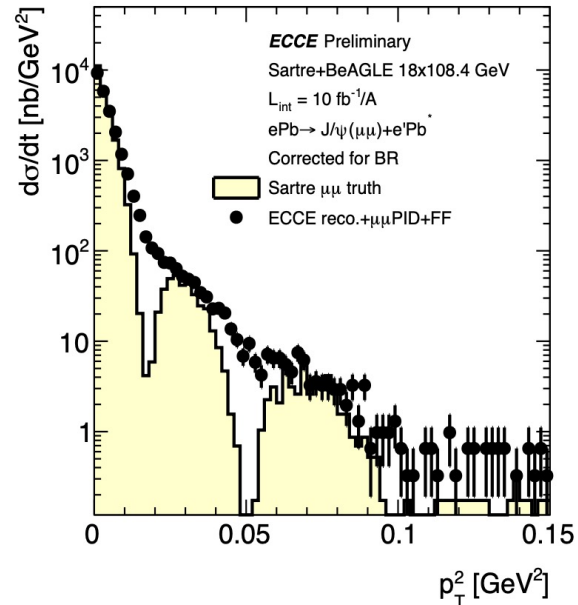


This shows the measurement can be done with a very good ECAL.

Puzzle

P-1: Coherent cross-section (no incoherent BG)

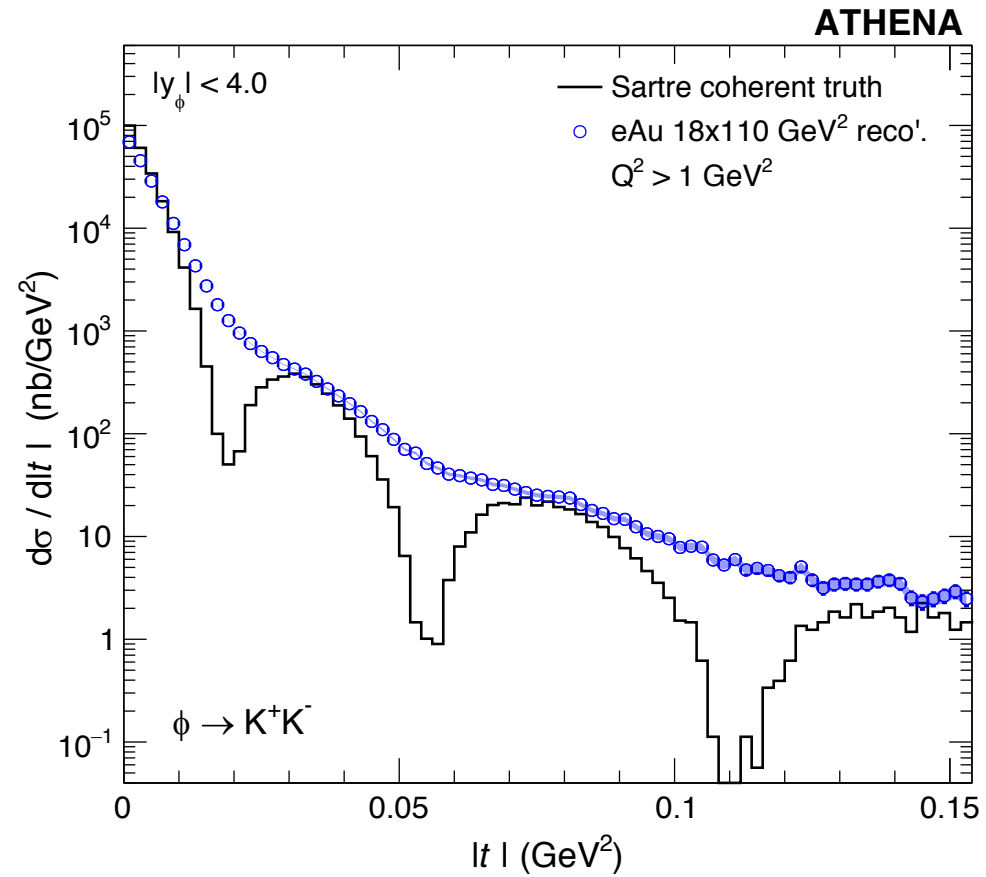
- Resolution sufficient for observation of “kinks” in the $\mu\mu$ channel (weaker for ee)
- Estimate 10% systematics or better (see next slides), as many efficiencies should be measurable in data using tag & probe.
- Aggregate efficiency is $\sim 50\%$.



Summary

- ECAL dominates the resolution in the backward region. Tracking is not helping.
- The puzzle is why ECCE did not manage to produce the diffractive minima. They claimed to use the same t reco method. However, their plot looks exactly like the one we have without ECAL.

Backup



Backup

