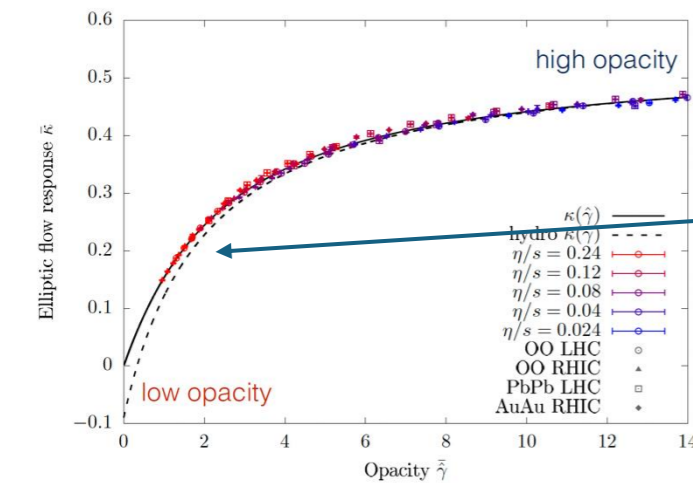


# Discussion

## Question often asked: Is “QGP” formed in small systems?

Before answering this question, how do we define the “QGP” here?

- Collectivity: experimentally, continuous to low  $N_{ch}$  (not only for  $v_n$  but also radial flow, HBT etc. ) and clear evidence of connection to initial geometry.



Single scattering

S. Schlichting

Ideal Hydro

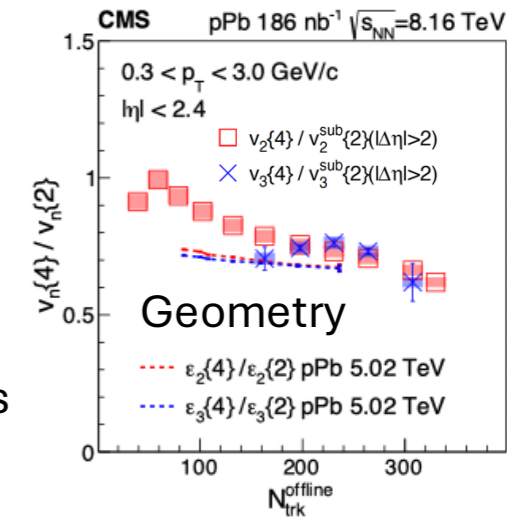
Theoretically, it is **opacity** instead of **size** that matters

Does “QGP” mean a valid description by hydro?

Is there a line between QGP and no QGP?

Isn't the physics essentially the same all the way down to very low opacity?

Hydro. works quite well, except for (small?) off-equilibrium corrections.?



- Equilibration/thermalization: is it a requirement to define a QGP? What is the evidence (even in AA)?
- Deconfinement: NCQ scaling? Hadronic alone models are insufficient
- Jet quenching: no positive evidence observed yet but isn't it expected due to much smaller opacity for hard probes?

What is qualitatively “new” physics in QGP? – **Partonic rescatterings**

Wei Li, Rice (wl33@rice.edu)

# Effective kinetic theory description

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Event-by-event initial conditions from TrENTo model for OO, AuAu, PbPb  
as in Trajectum [Nijs, vdSchee, PRC 106, 054905 \(2022\)](#)

- OO configurations from QMC with N<sup>2</sup>LO chiral EFT interactions

[Lim, Carlson, Loizides, Lonardonì, Lynn, Nagle, Orjuela Koop, Ouellete PRC 99, 044904 \(2019\)](#)

Will consider cumulants of energy  $\mathbf{e}_p$  flow to quantify anisotropic flow

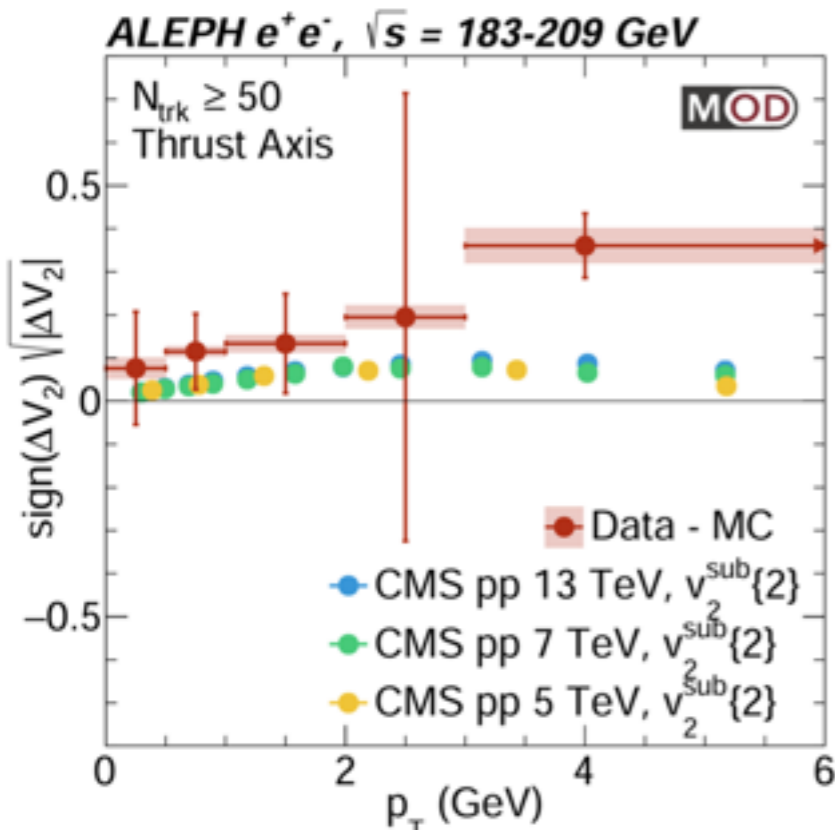
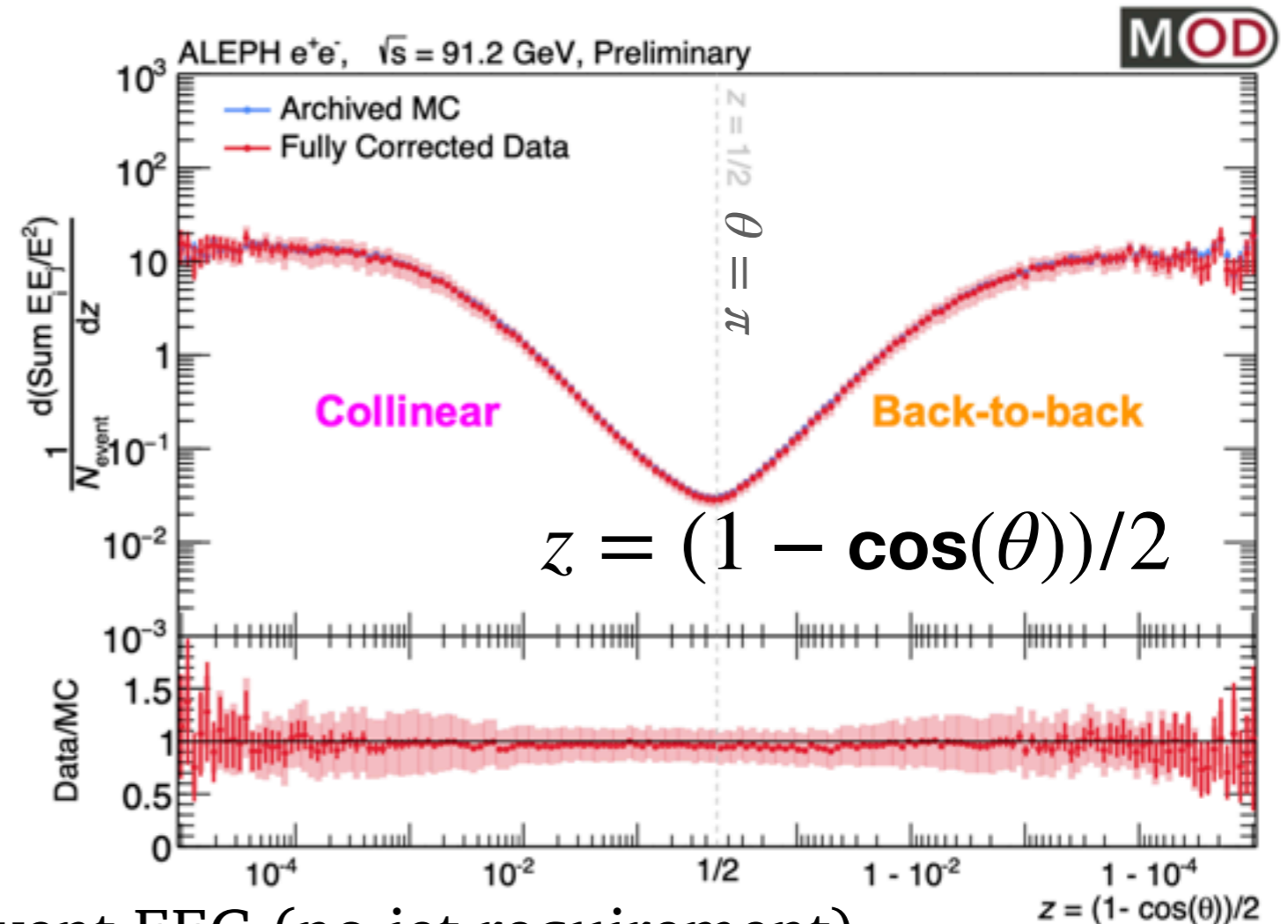
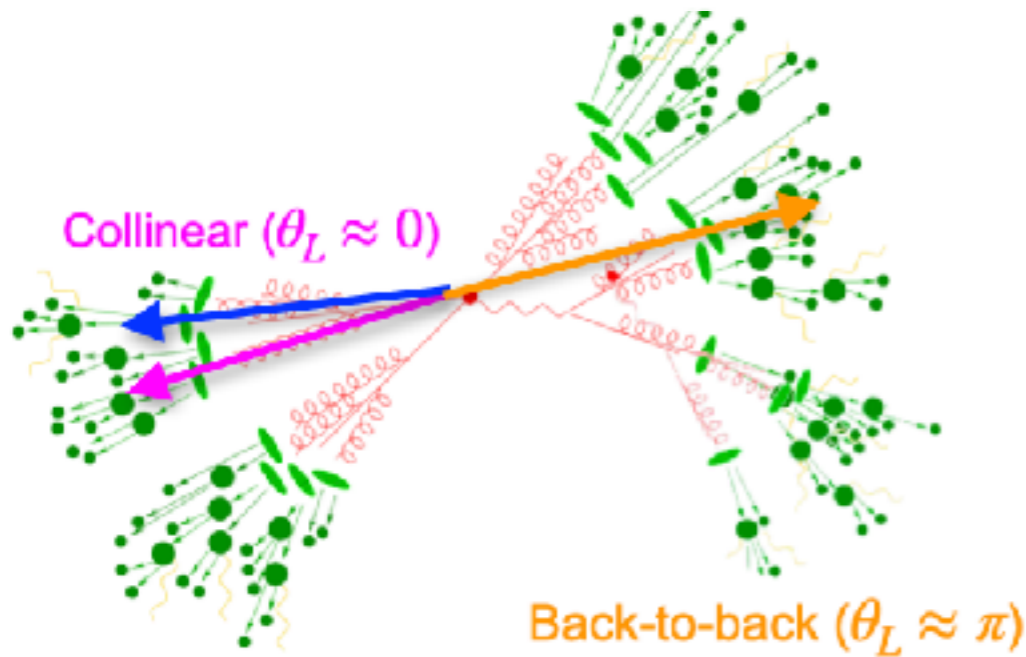
$$\epsilon_p = \frac{\int d^2x_{\perp} T^{xx} - T^{yy} + 2iT^{xy}}{\int d^2x_{\perp} T^{xx} + T^{yy}} \quad c_2 = \langle \epsilon_p \epsilon_p^* \rangle \quad \dots$$

which can be directly computed in Kinetic Theory and Hydrodynamics without ambiguities due to freeze-out procedure

# Energy correlators in $e^+e^-$

Hannah Bossi, Yi Chen, Janice Chen, Yen-Jie Lee

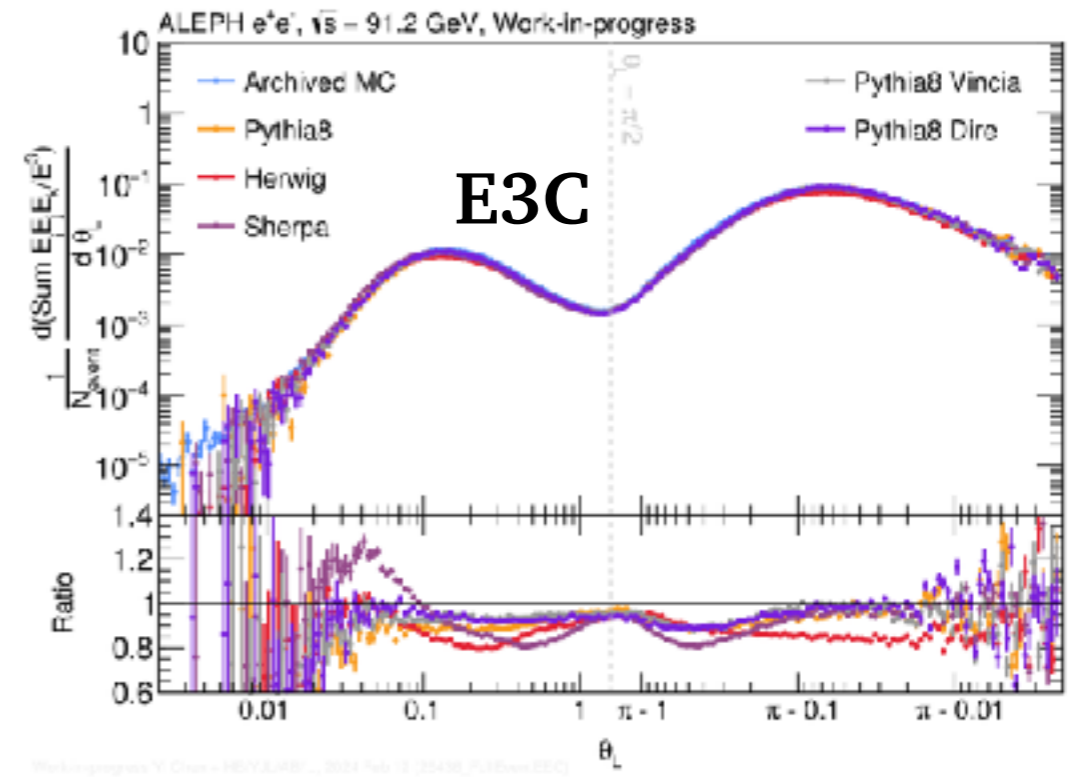
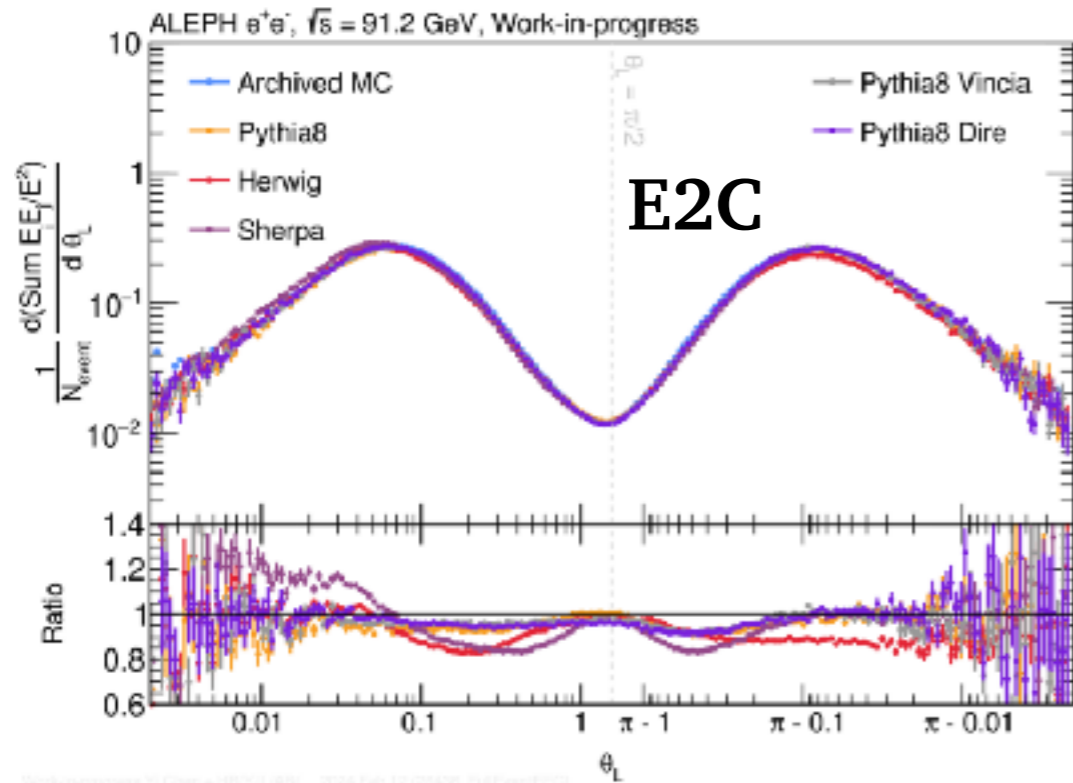
$$E2C(z) = \frac{1}{N_{\text{event}}} \frac{d(\sum E_i E_j / E^2)}{dz}$$



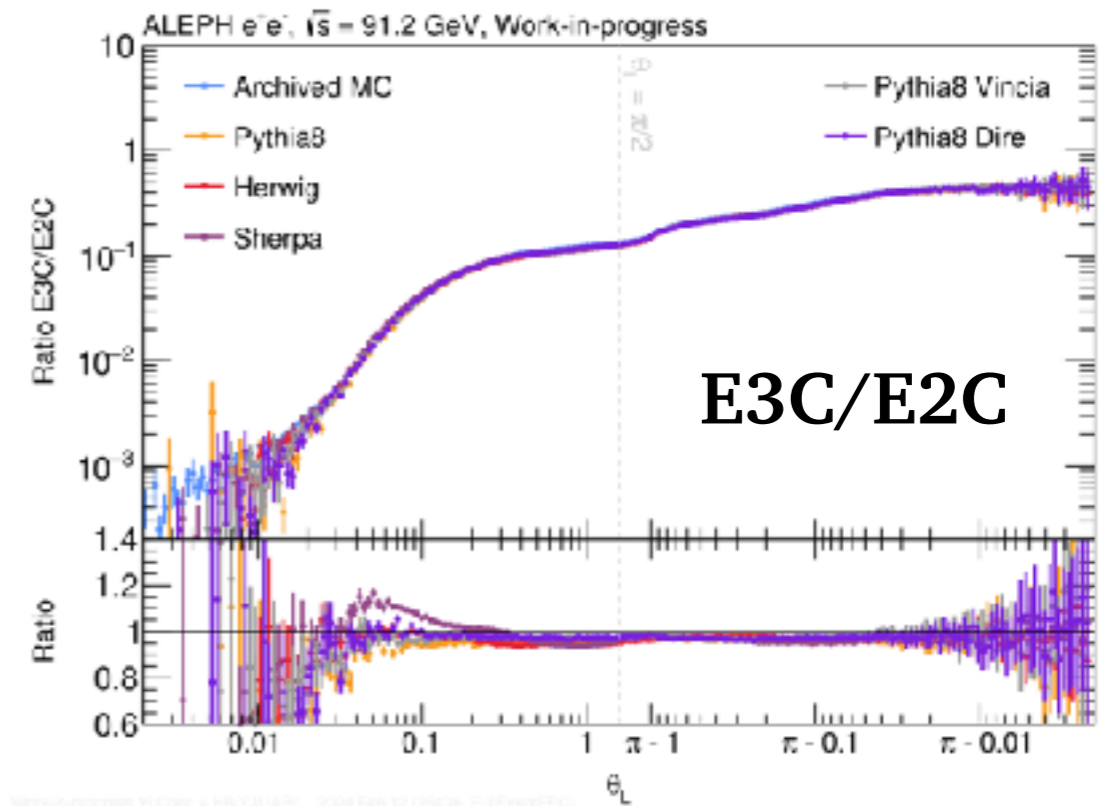
- Full event EEC (no jet requirement)
- Fully-corrected result shows good agreement with Archived MC (PYTHIA 6)
- May be interesting to study EEC in different multiplicity intervals to investigate long-range near side excess seen in high multiplicity  $e^+e^-$  not seen in Archived MC. [[arXiv: 2312.05084](https://arxiv.org/abs/2312.05084)]

# Energy correlators in $e^+e^-$

Hannah Bossi, Yi Chen, Janice Chen, Yen-Jie Lee



- Large differences seen between MC generators (similar hierarchy to pp case)
  - SHERPA > HERWIG > PYTHIA
- Archived MC (PYTHIA 6) agrees well with data.
- E3C/E2C behavior similar between models



- can experiments measure energy flow  $e_p$ ?
- Would this be more robust than traditional methods for extracting  $v_2$ ?

# Non-flow baselines and Parton Cascades

Robin Törnkvist

“Negative”  $v_2$  in small systems:

