LEP jet studies and its implications to future EIC measurements

Yi Chen (MIT)

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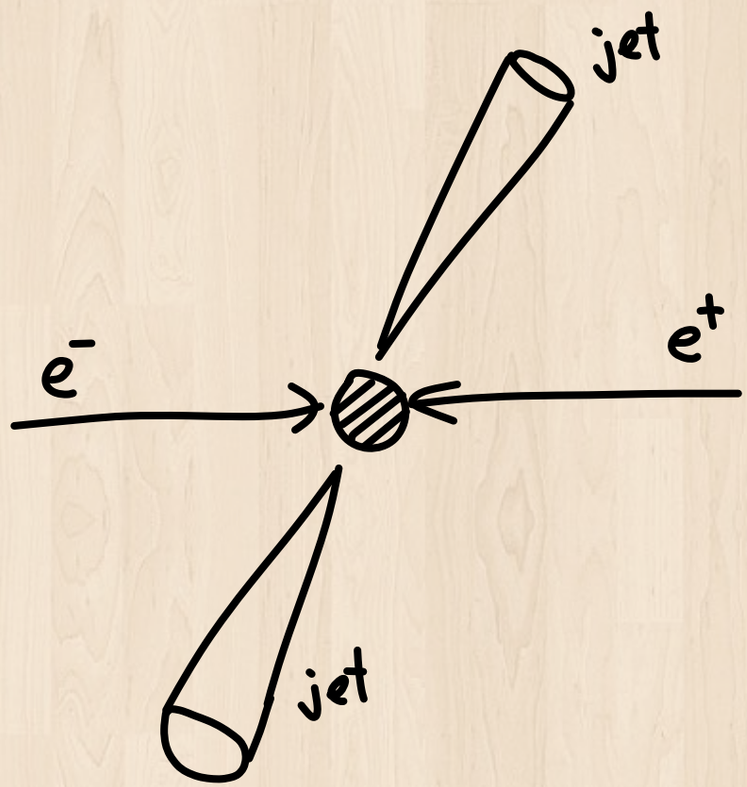
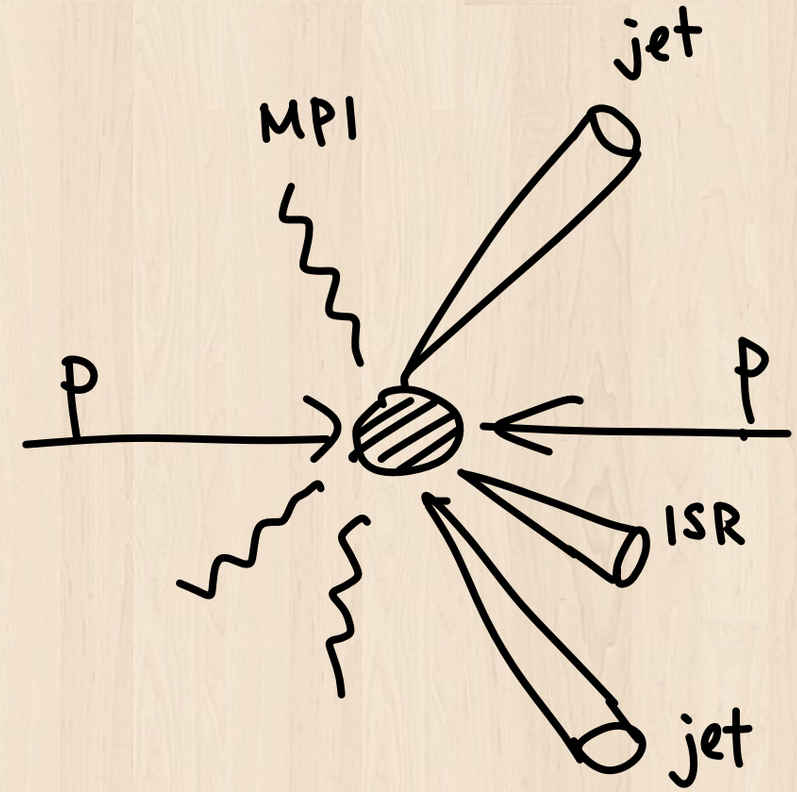
The MIT HIG's work is supported by DOE NP

e^+e^-: clean

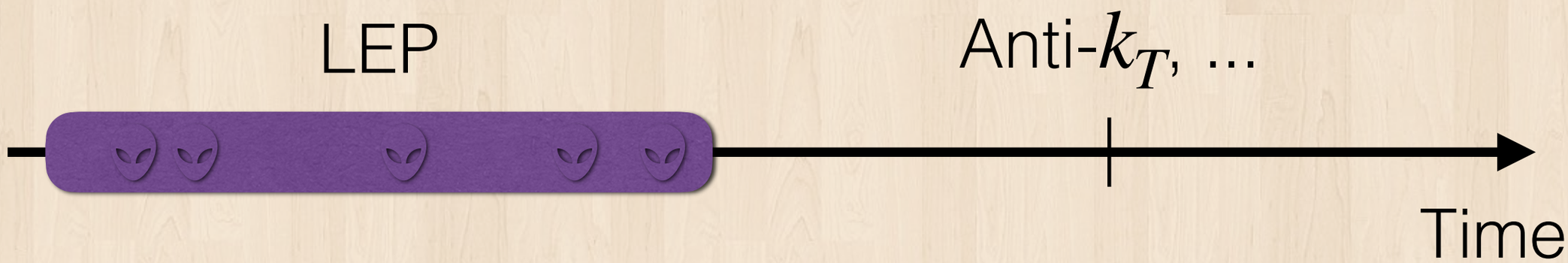


Better control of
event kinematics



PDF convolution
No longitudinal control
More ISR
MPI

LEP jet measurements



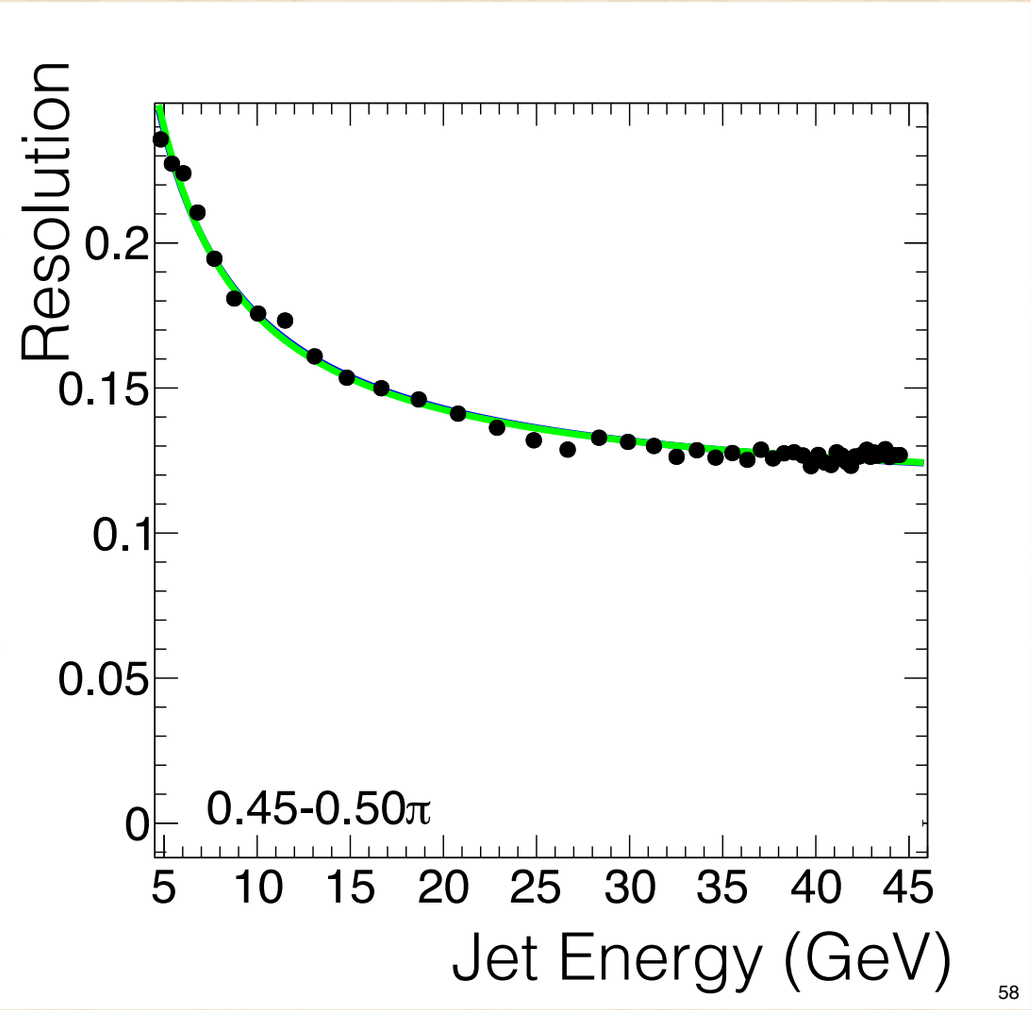
Most jet measurements are done with
previous generation of jet algorithms
=> Not ideal for LHC/RHIC/EIC comparisons

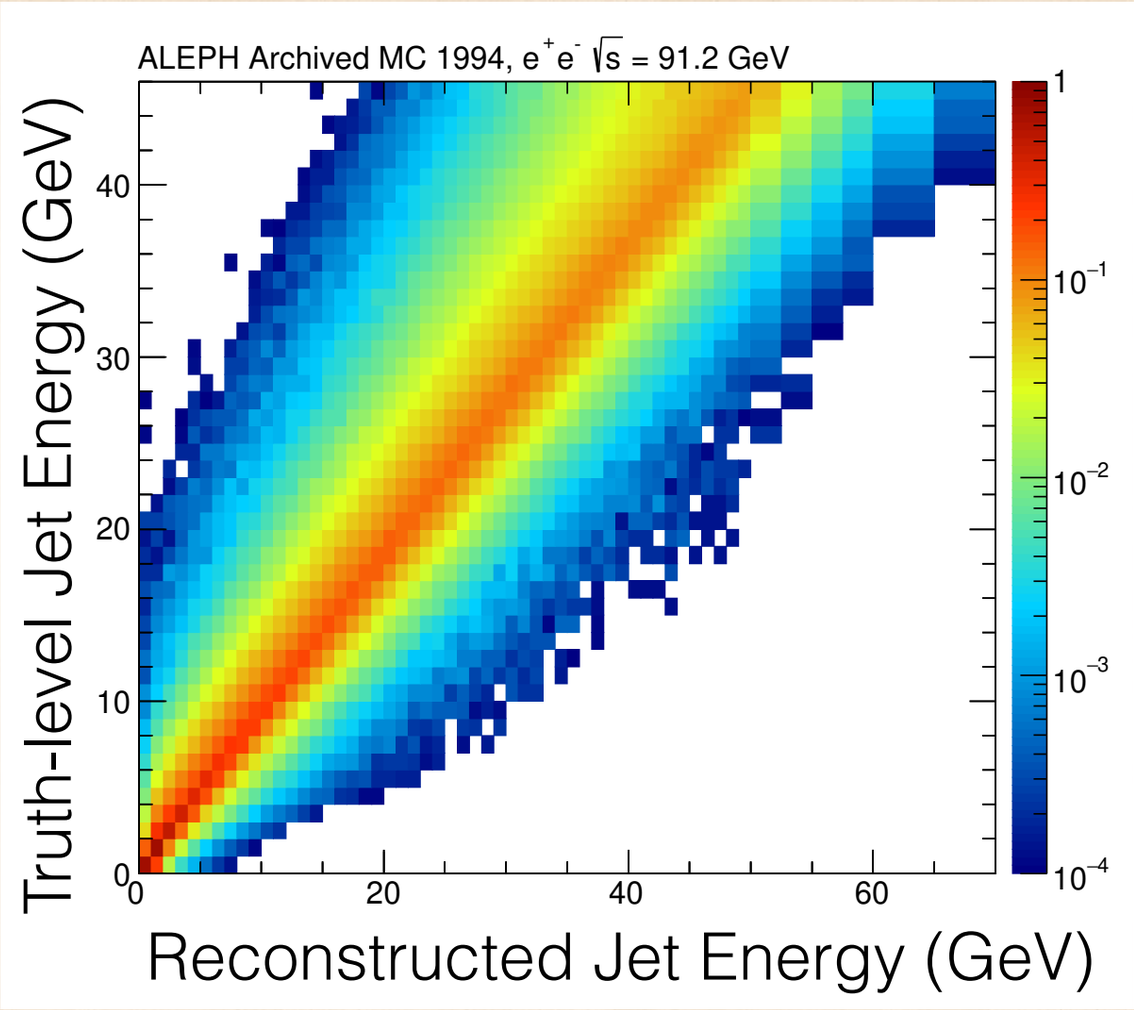
Excellent opportunity for re-analysis with new algorithms

Example: recent re-analysis of archived ALEPH data

Jet performance

ALEPH data, 91.2 GeV, e^+e^-. Anti-k_T jet R = 0.4





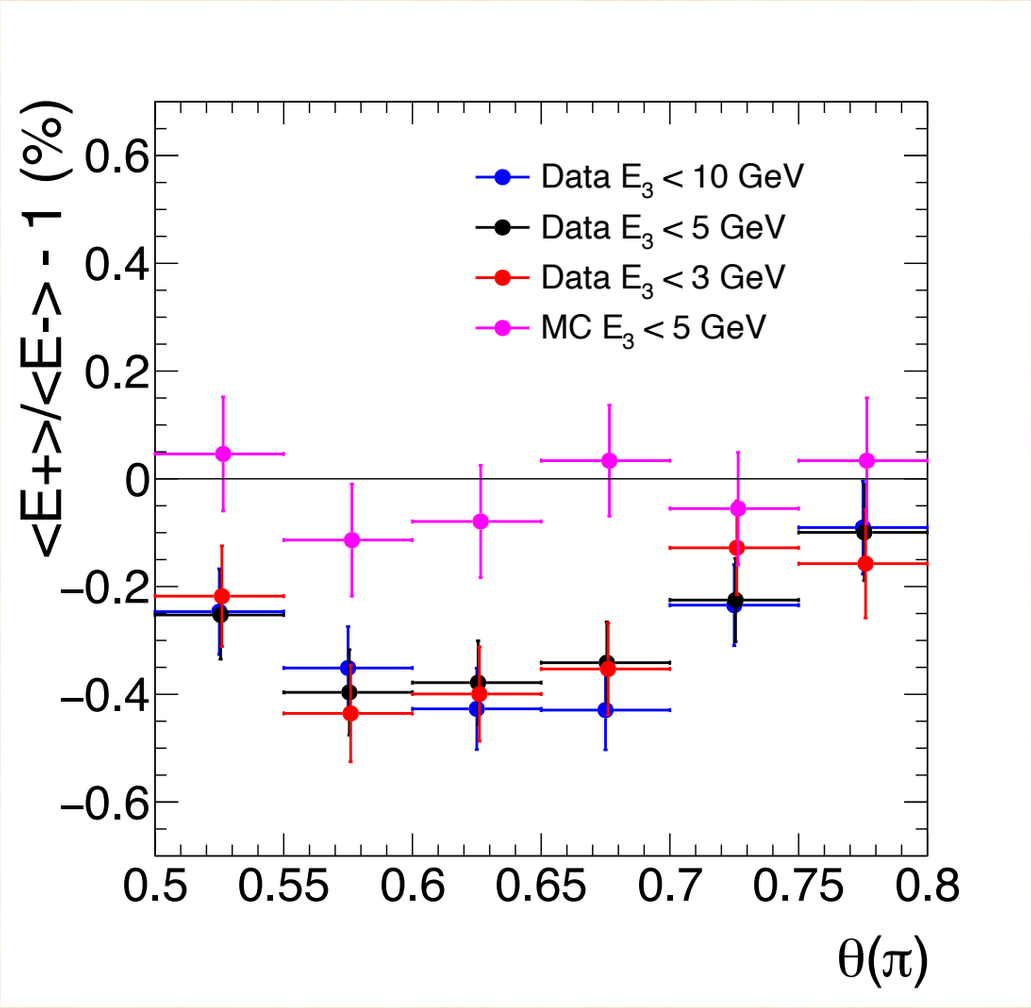
Energy resolution: 12-25%

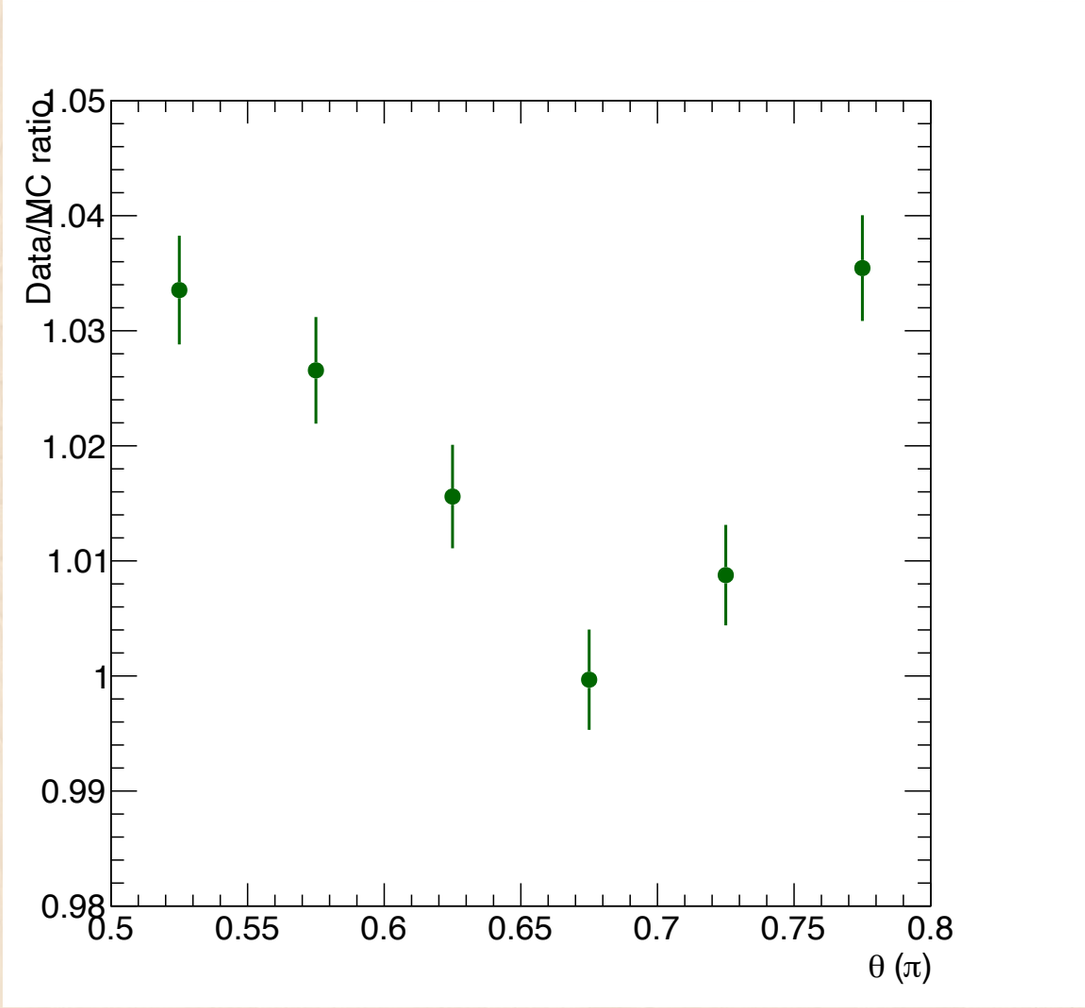
Well-behaved detector effects

arXiv 2108.04877

Jet performance: data/MC

Simulation generally captures jet performance well





Residual scale up to 0.5%

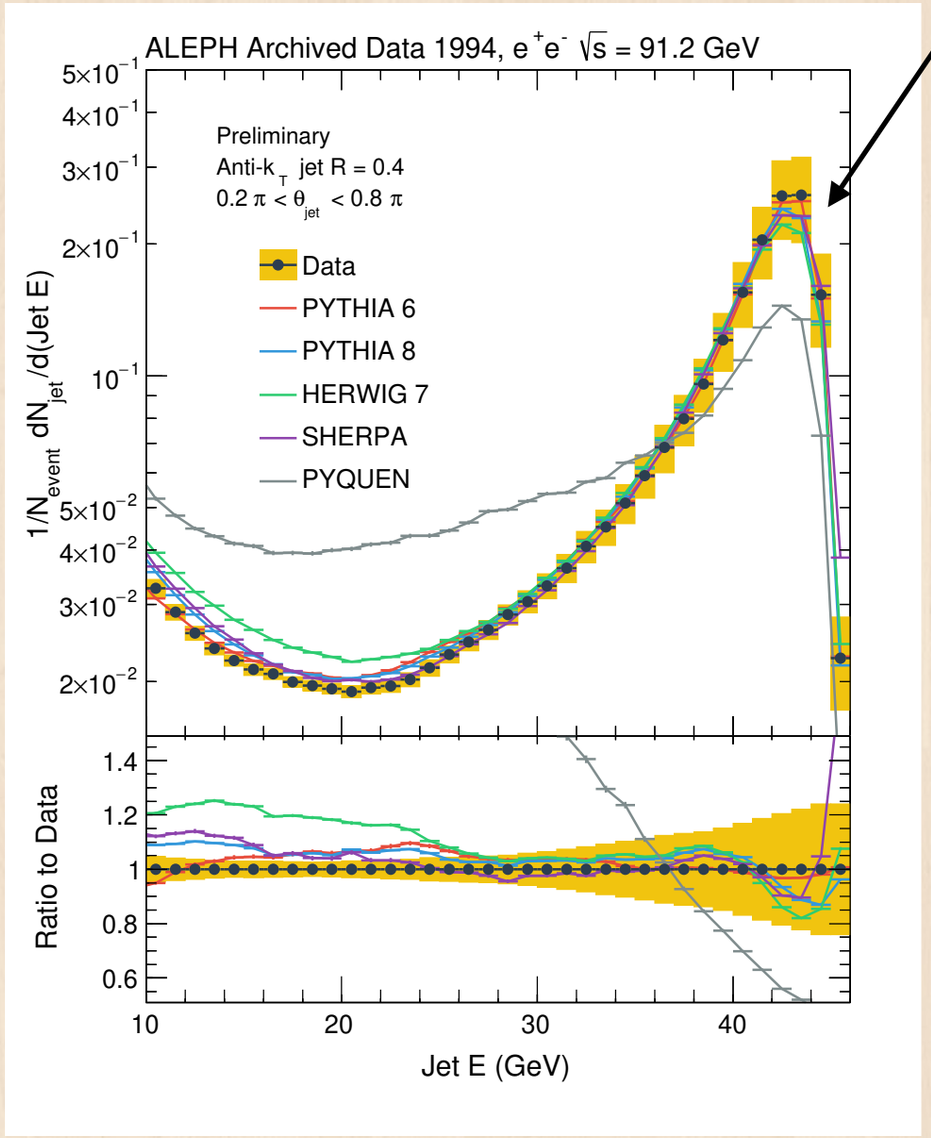
Up to 5% difference in jet energy resolution

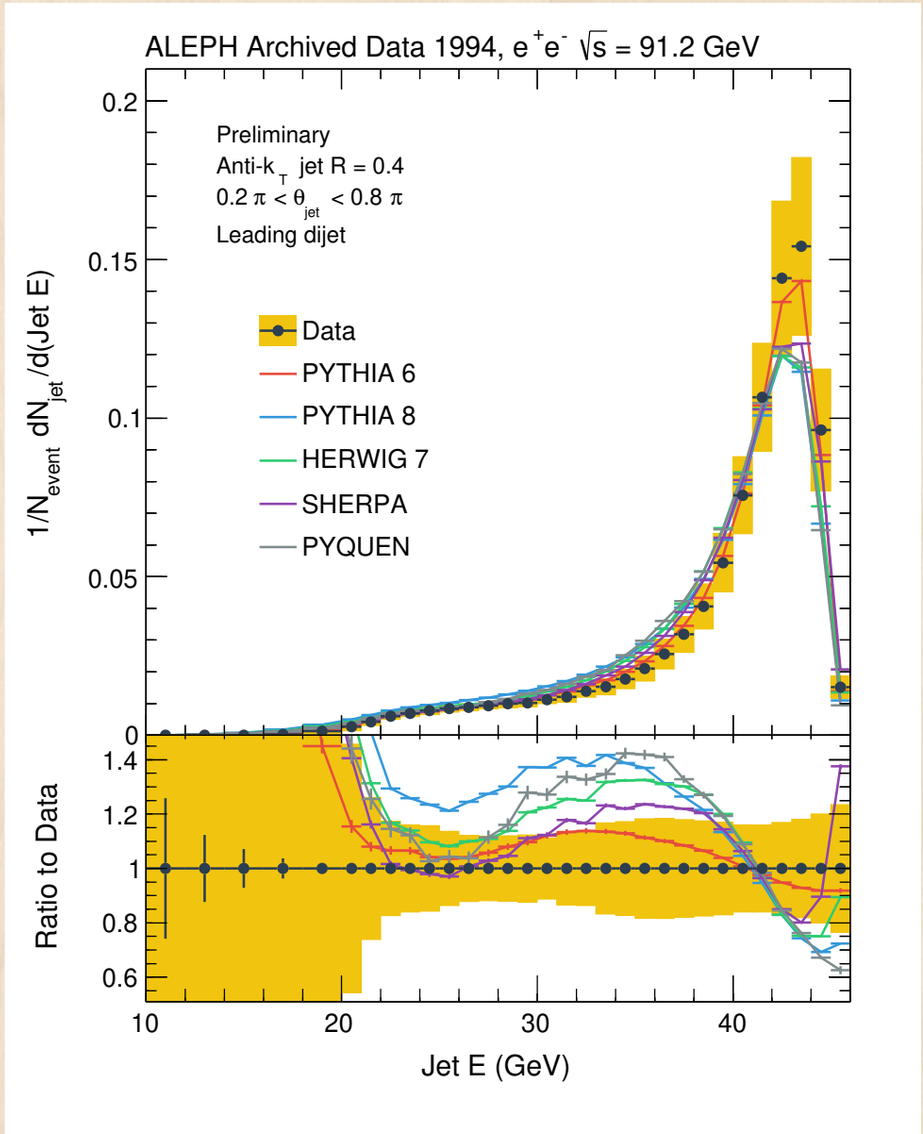
arXiv 2108.04877

Example result: jet spectrum

$Z \to jj$ peak

Inclusive jets





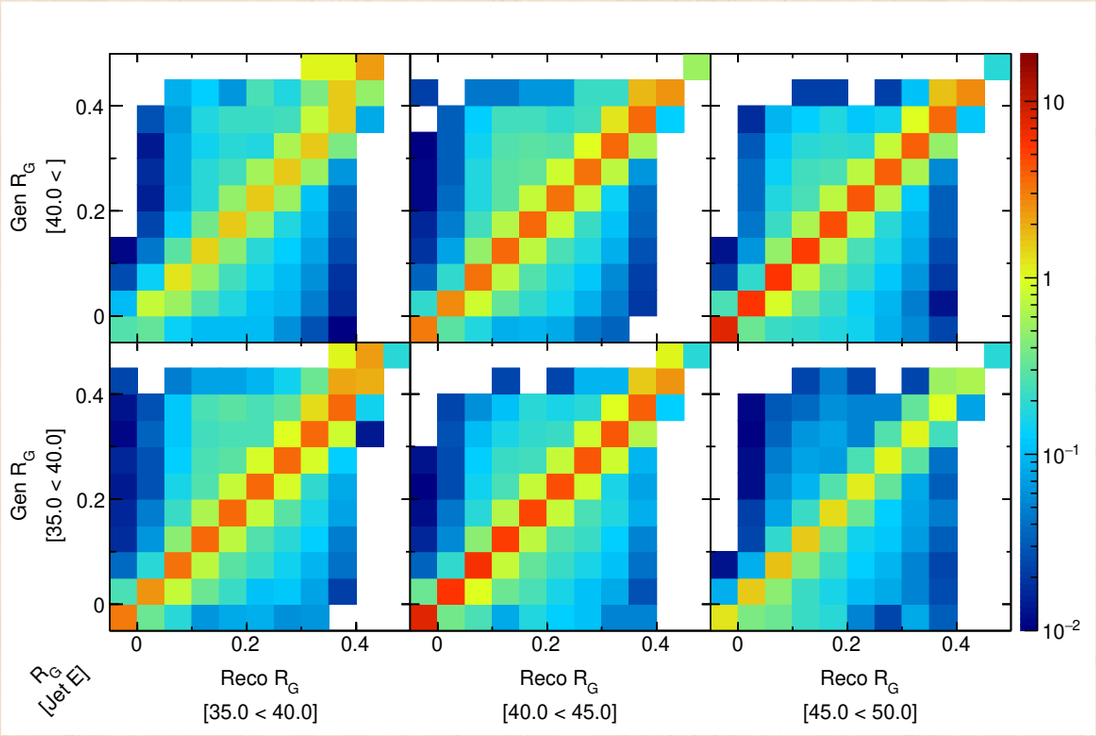
Leading dijet only

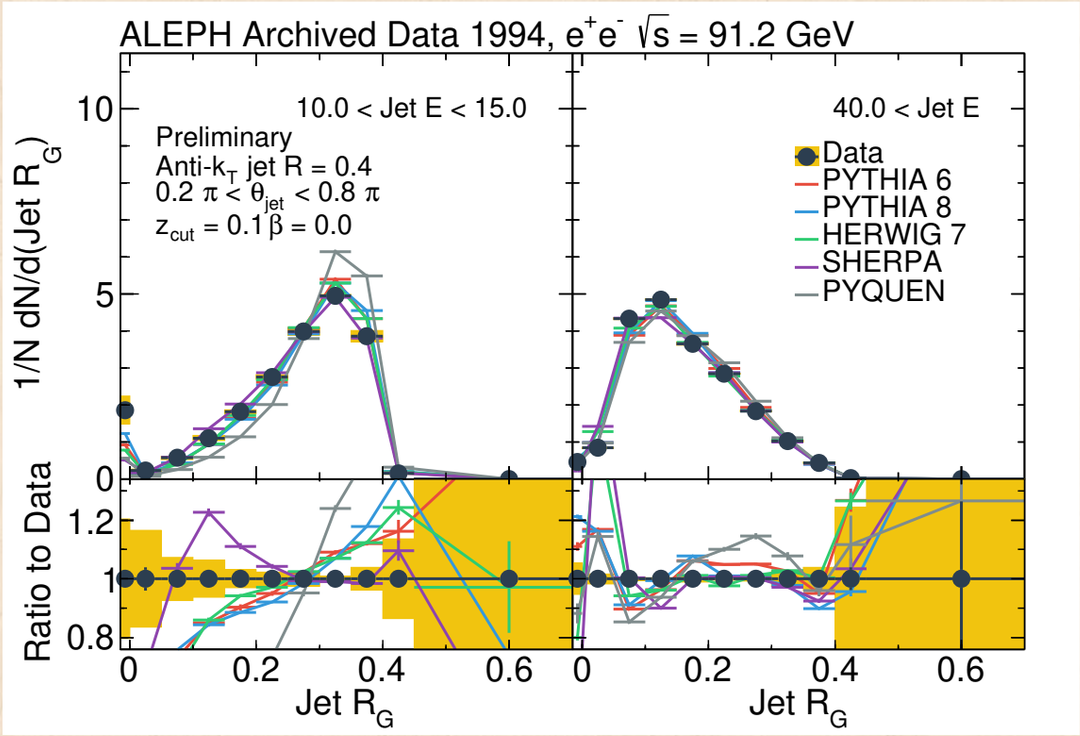
Agreement of simulation 10-20% level (up to 40%)

(Simulation normalized to same area as data)

Example: groomed width

Soft drop grooming with $z_{\text{cut}} = 0.1, \beta = 0.0$





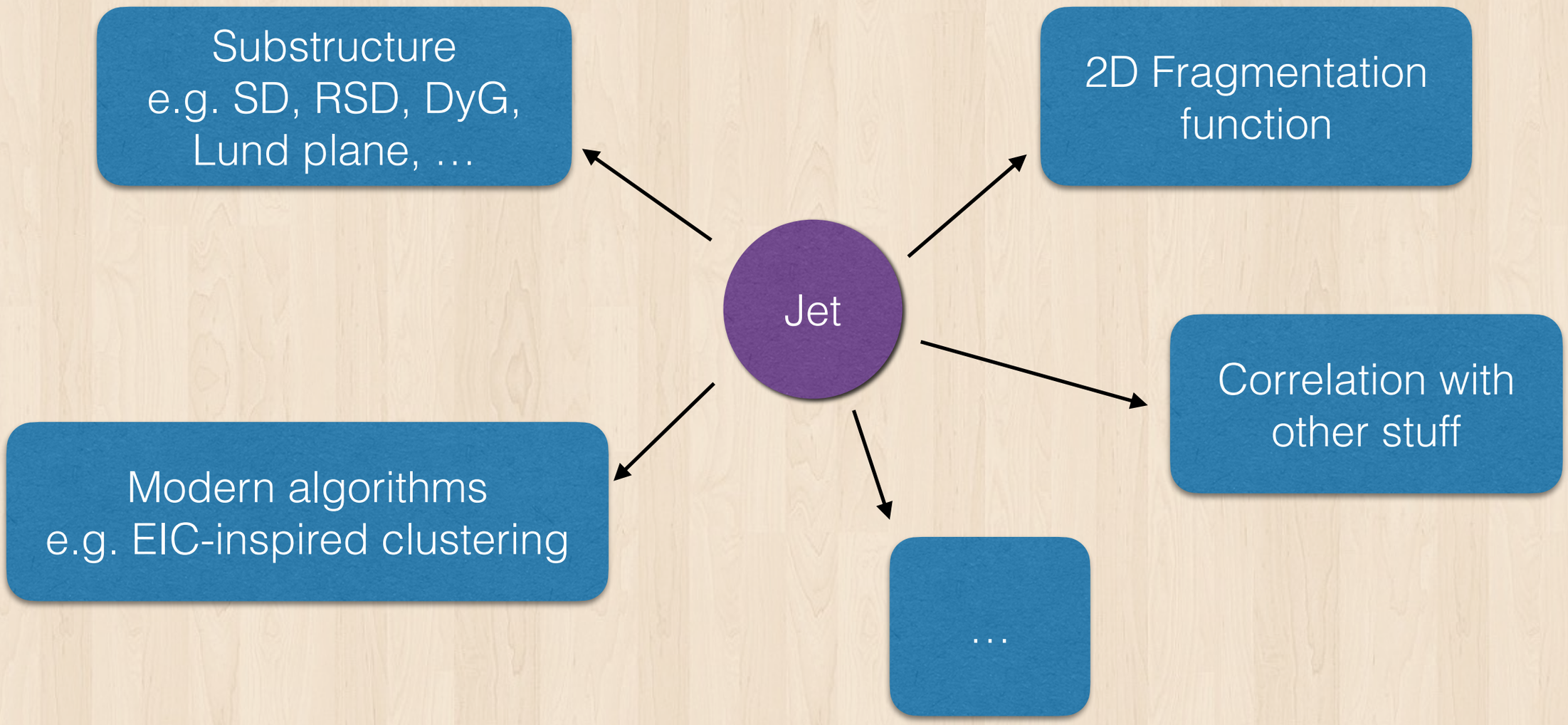
2D unfolding: jet E + R_g

(partial matrix shown)

Different jet energy ranges

Very distinct behaviors

Many possibilities



Testing ground for new algorithm developments

Provide reference measurements

Summary

- e^+e^- is a clean system for jet studies
- LEP jet studies provide complementary information to other collision systems (pp, ep, ...)
  - Decent jet performance
  - Reference measurement, no hadronic initial state
- Excellent testing ground for new developments

Backup Slides Ahead