The World of Open Data
ALEPH at LEP

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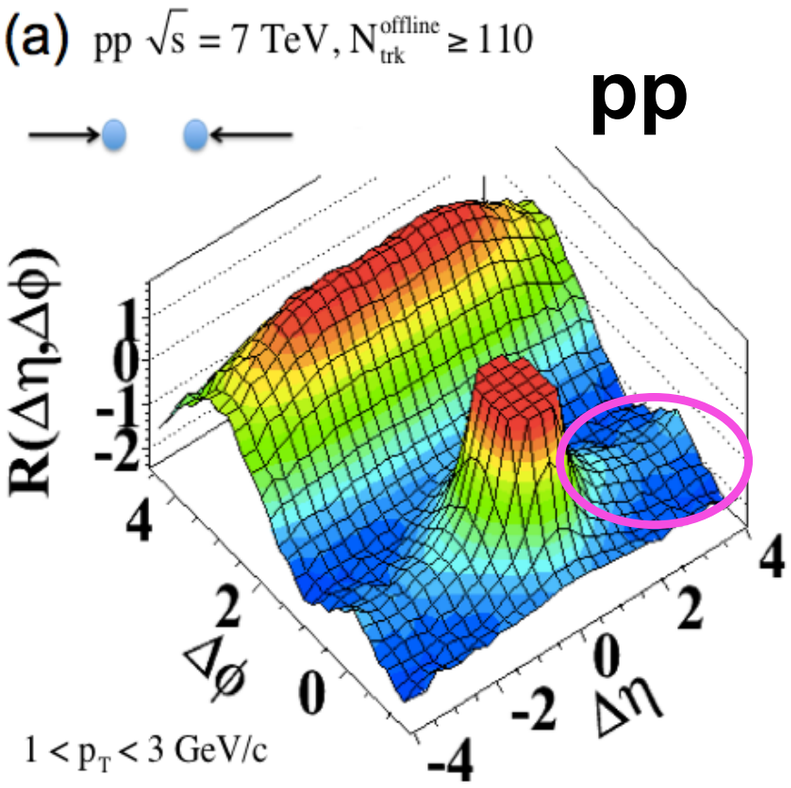
Snowmass Computational Frontier Workshop
August 11, 2020

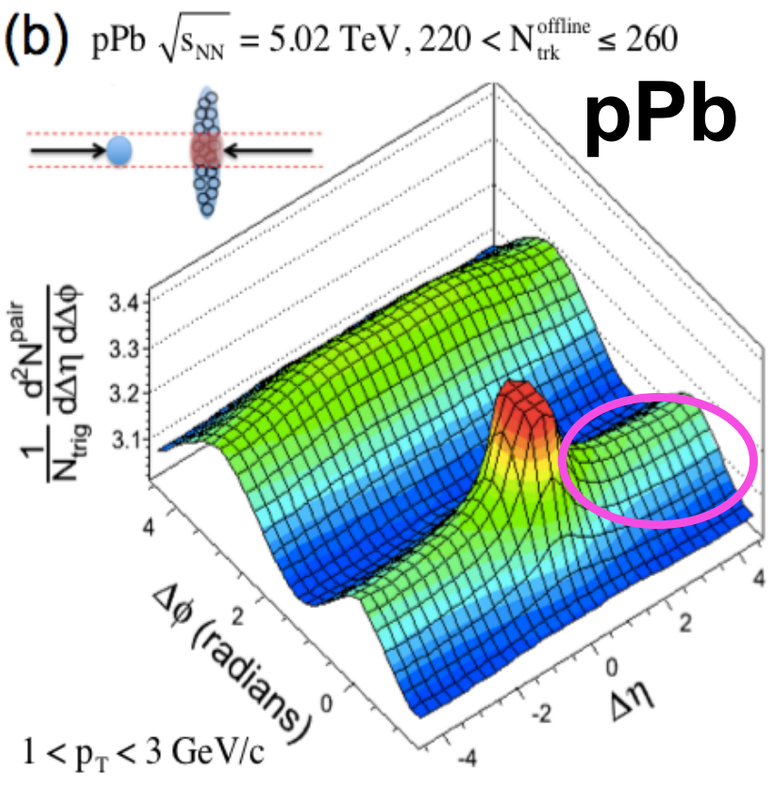
The Punchline

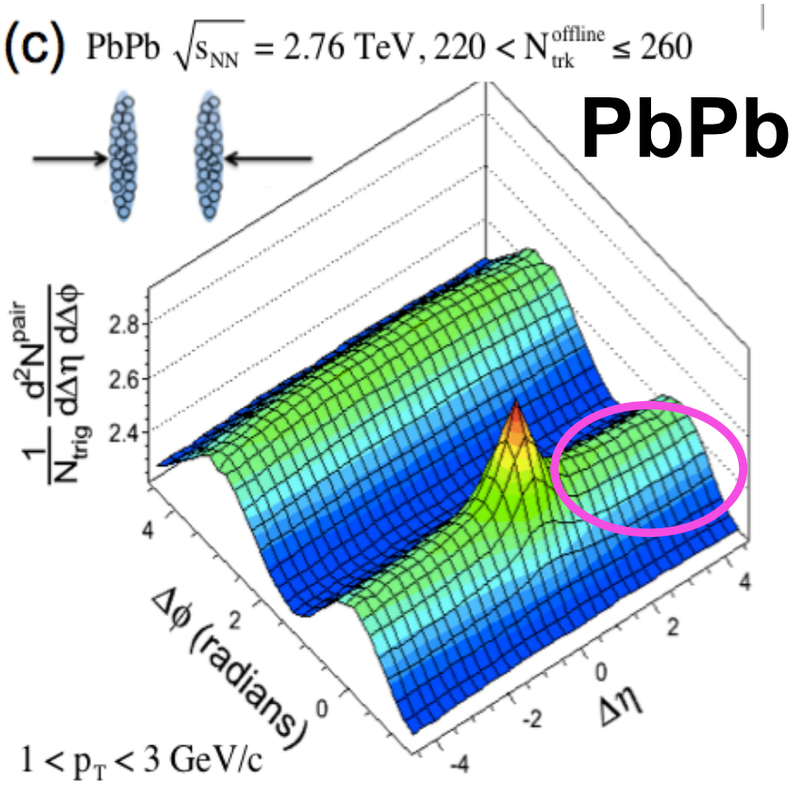
As an early career scientist participating in my first Snowmass process this is my opinion:

Open data gets us better science and therefore it should be done.

QCD Frontier: Heavy Ion Physics in Small Systems

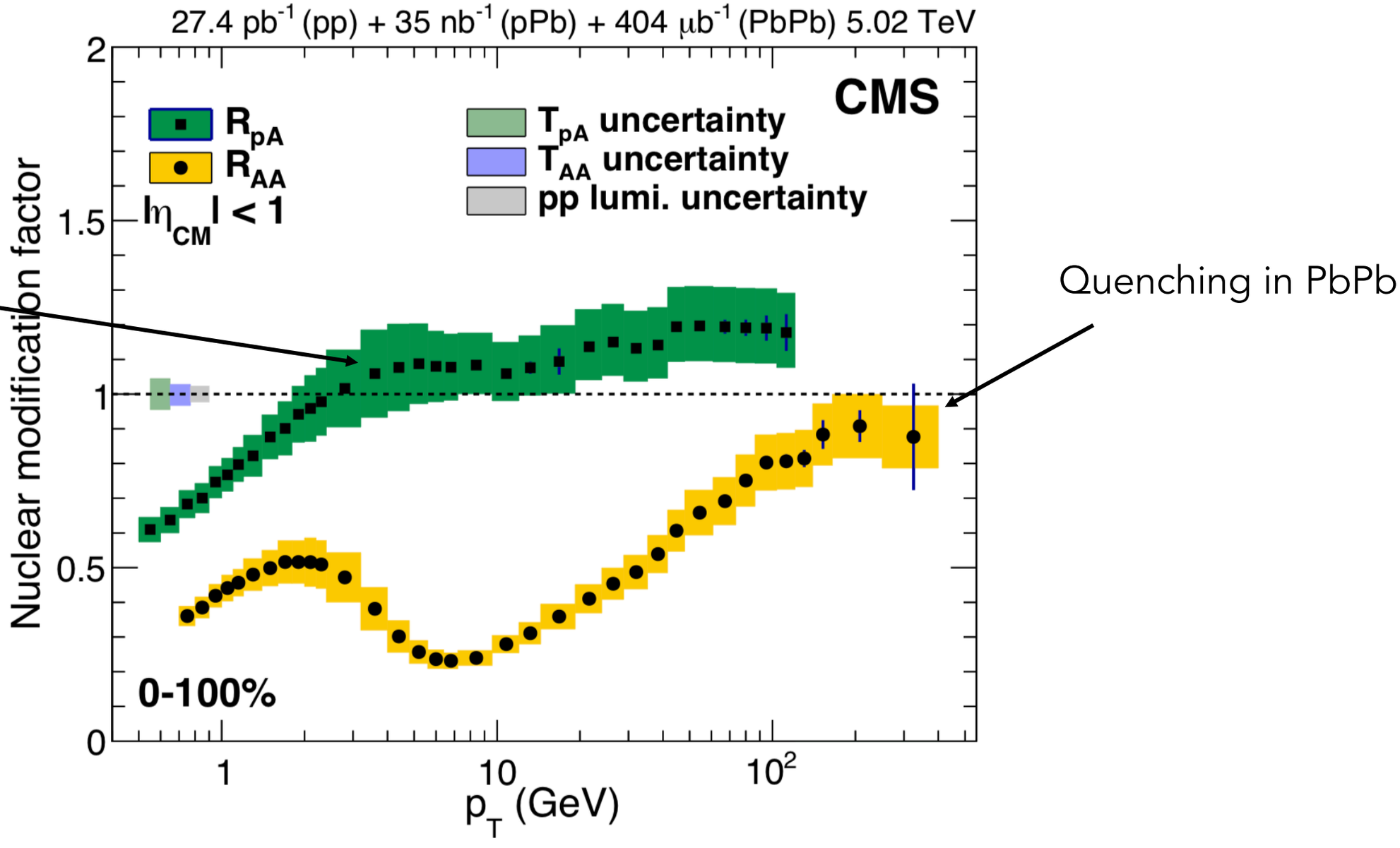






QCD Frontier: Heavy Ion Physics in Small Systems

No quenching in pPb



Quenching in PbPb

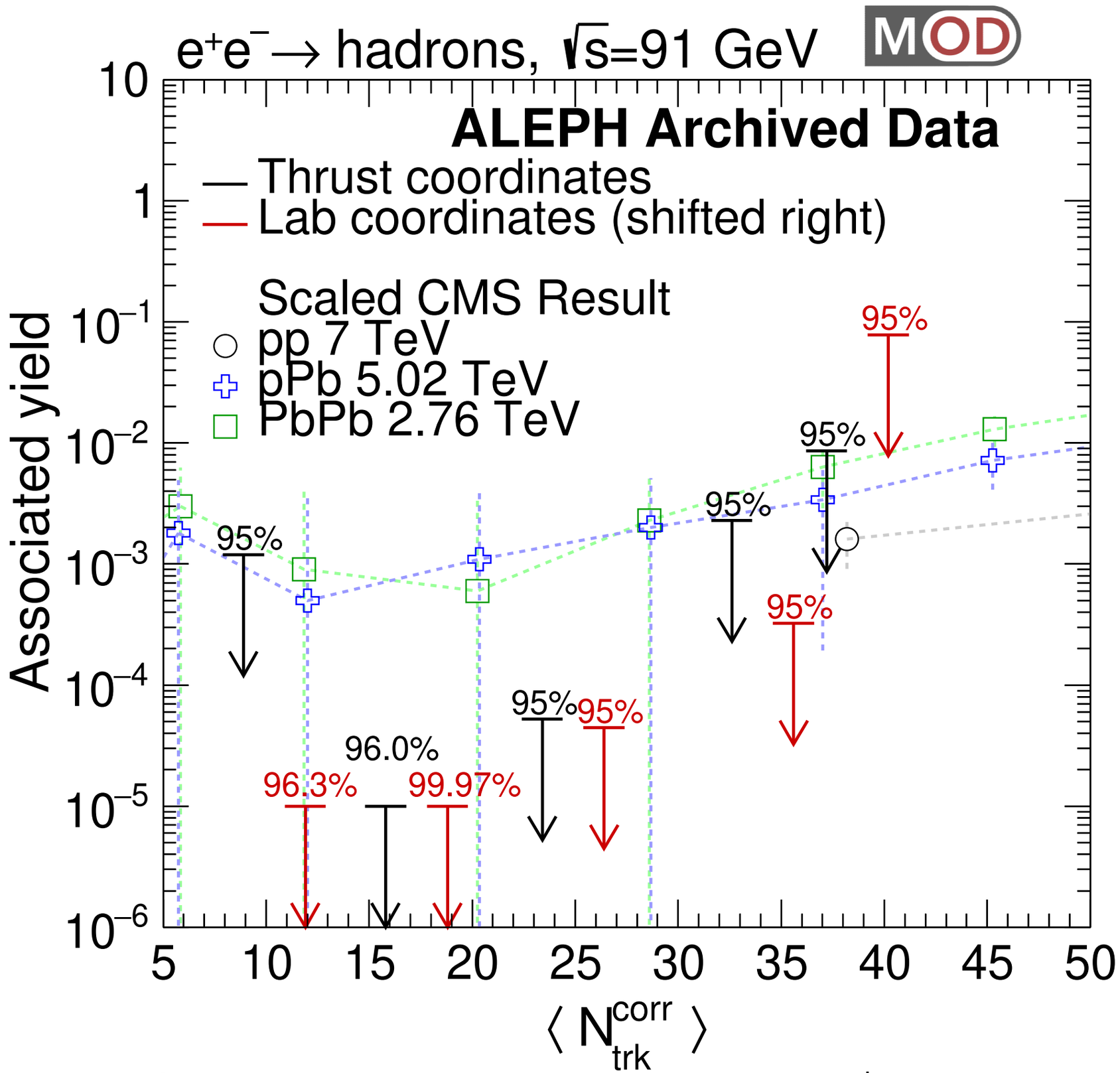
QCD Frontier: Heavy Ion Physics in Small Systems

Three questions:

1. Is quark gluon plasma (QGP) produced in pPb and pp collisions?
2. What conditions are necessary for QGP production?
3. Is heavy ion physics unique to heavy ion collisions?

What happens in e^+e^-?

QCD Frontier: Heavy Ion Physics in Small Systems



Phys. Rev. Lett. 123, 212002

Experimental Techniques: Omnifold

Multi-differential and unbinned machine learning based generalization of Iterative Bayesian Unfolding (IBU)

Andreassen, Komiske,
Metodiev, Nachman, Thaler
Phys. Rev. Lett. 124, 182001

More details in backup

QCD Frontier: τ and $\log(\tau)$

$$T \equiv \max_{\vec{n}} \left(\frac{\sum_{i \in E} | \vec{n} \cdot \vec{p}_i |}{\sum_{i \in E} | \vec{p}_i |} \right)$$

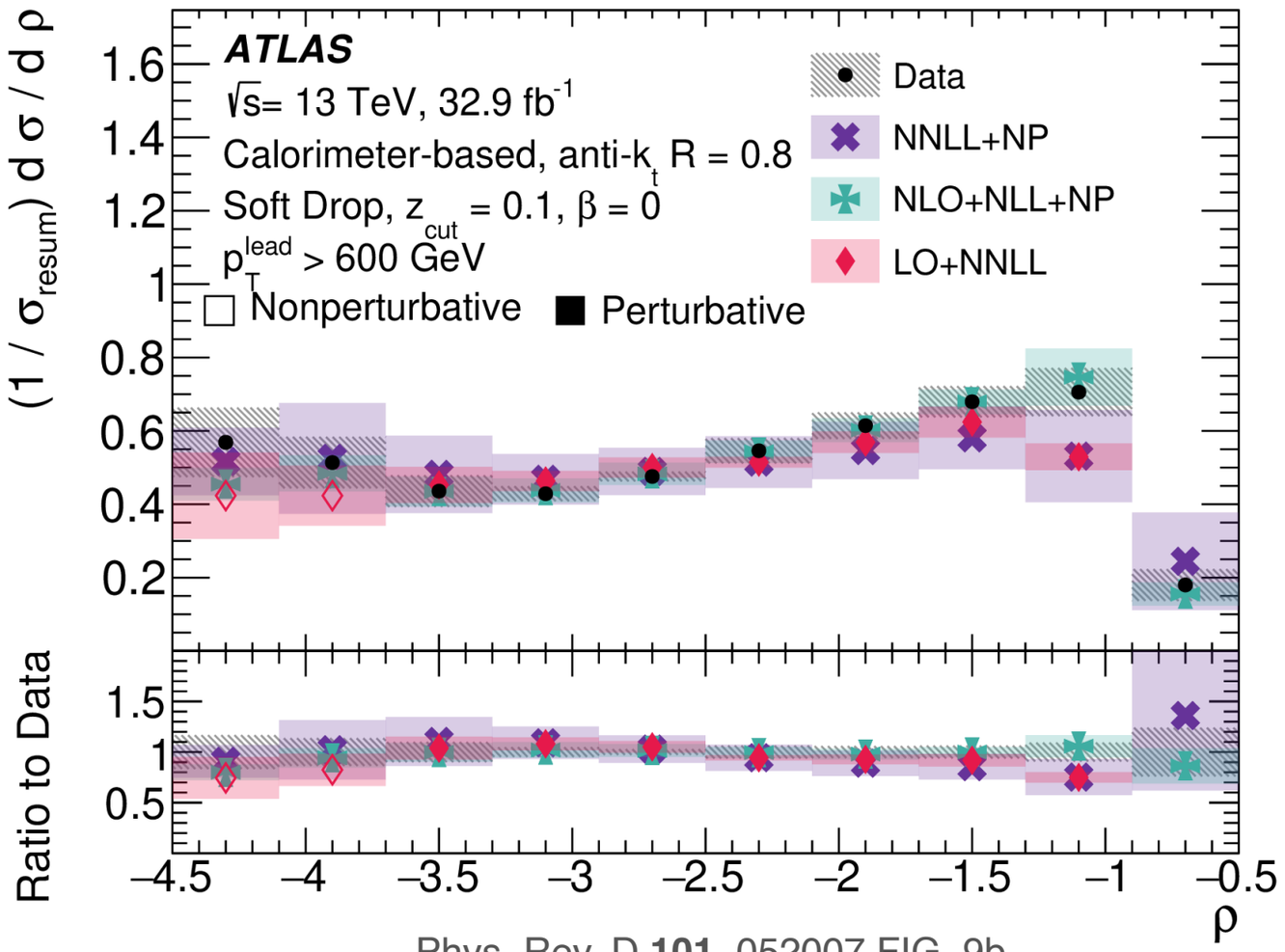
Why τ = 1 - Thrust?

Discrepancy with theory predominantly in the highly perturbative regions = low T or high τ. Theoretical calculations often work with τ.

Why linear and log space?

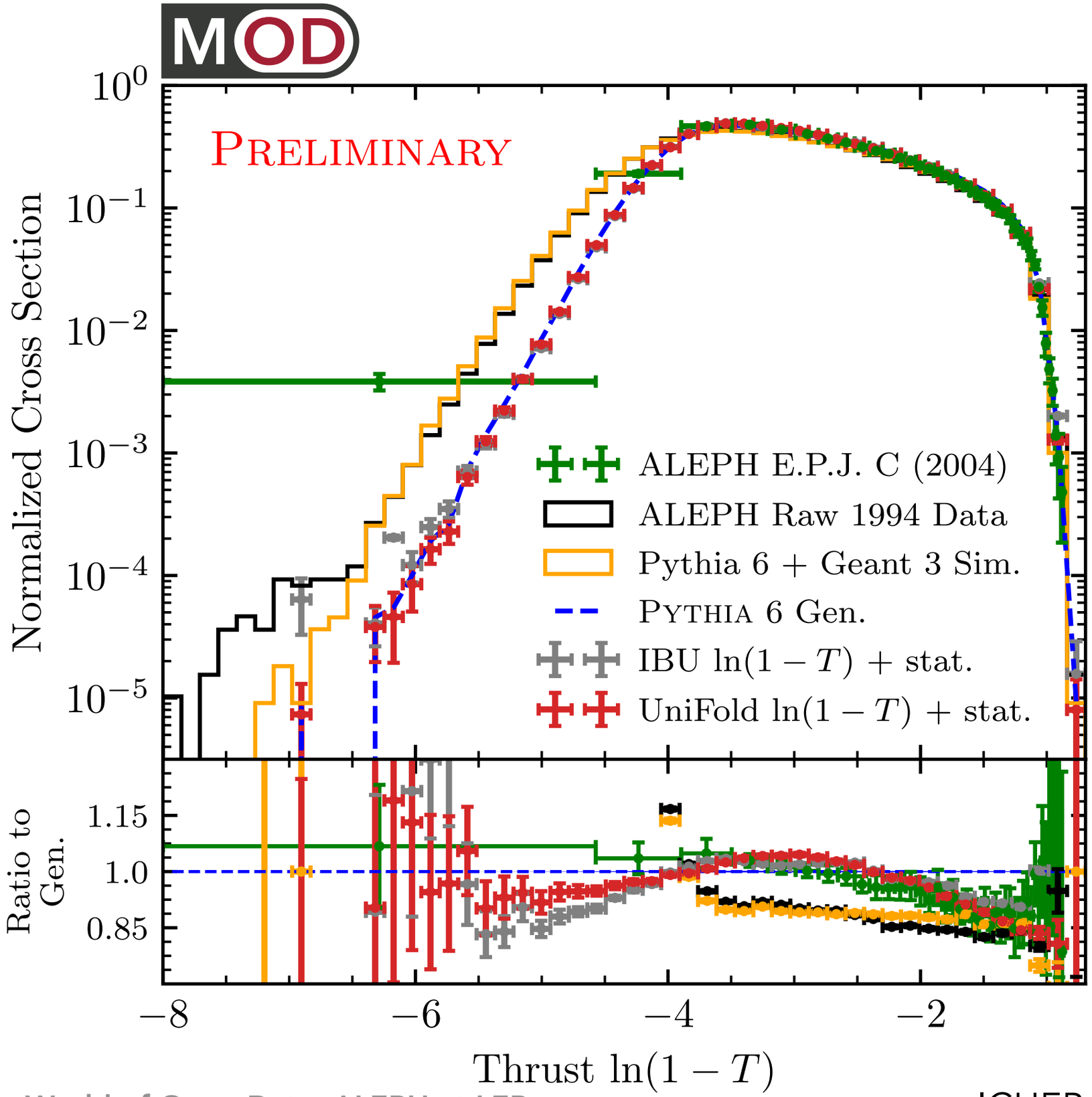
Linear and log space highlight different physics. Insights into perturbative vs. nonperturbative regimes.

Nonperturbative vs. Perturbative

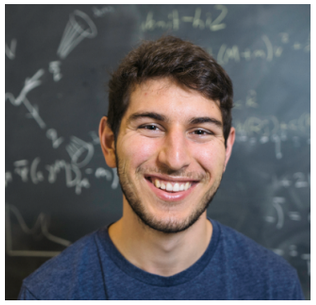


Phys. Rev. D **101**, 052007 FIG. 9b

Experimental Techniques + QCD Frontier: Omnifold + $\log(\tau)$



Thank you from the growing team



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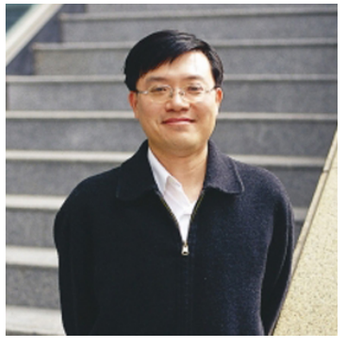

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Marcello Maggi
(INFN, CMS)

Günther Dissertori
(ETH Zürich, CMS)

The World of Open Data is Expanding

CMS Data:
Adversarially Learned Anomaly Detection on CMS Open Data: rediscovering the top quark https://arxiv.org/pdf/2005.01598
End-to-end particle and event identification at the Large Hadron Collider with CMS Open Data: https://arxiv.org/pdf/1910.07029
Exploring the Space of Jets with CMS Open Data: https://arxiv.org/pdf/1908.08542
Explicit Jet Veto as a Tool to Purify the Underlying Event in the Drell-Yan Process Using CMS Open Data: https://arxiv.org/pdf/1907.08842
Opportunities and Challenges of Standard Model Production Cross Section Measurements at 8 TeV using CMS Open Data: https://arxiv.org/pdf/1907.08197
Search for Non-Standard Sources of Parity Violation in Jets at 8 TeV with CMS Open Data: https://arxiv.org/pdf/1904.11195
End-to-End Jet Classification of Quarks and Gluons with CMS Open data: https://arxiv.org/pdf/1902.08276
Searching in CMS Open Data for Dimuon Resonances with Substantial Transverse Momentum: https://arxiv.org/pdf/1902.04222
End-to-End Physics Event Classification with CMS Open Data: https://arxiv.org/pdf/1807.11916
Jet Substructure Studies with CMS Open Data: https://arxiv.org/pdf/1704.05842
Exposing the QCD Splitting Function with CMS Open Data: https://arxiv.org/pdf/1704.05066

ALEPH Data:
Measurements of two-particle correlations in e+e- collisions at 91 GeV with ALEPH Archived Data https://arxiv.org/pdf/1906.00489

BELLE Data:
Measurement of two-particle correlations in hadronic e+e- collisions at Belle https://arxiv.org/pdf/2008.04187

ATLAS, ALICE, LHCb, ?: …

Articles: Open in not enough: https://www.nature.com/articles/s41567-018-0342-2