WG3
MPI@LHC ‘23

High multiplicities, small systems

Selected theory snacks

Bierlich, Colamaria

1

Javira Altmann: Updates on junction formation and charm production in PYTHIA

Albi Kerbizi: Quark spin in string hadronization

2

3

Alexandru Manea: Investigating collective effects in small collision systems using PYTHIA8 and EPOS4 simulations

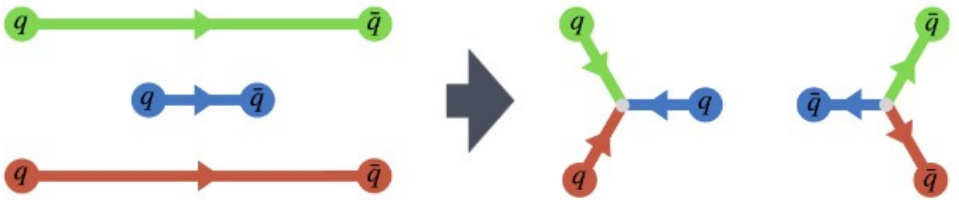
Andrzej K. Siodmok: Fitting a deep generative hadronization model

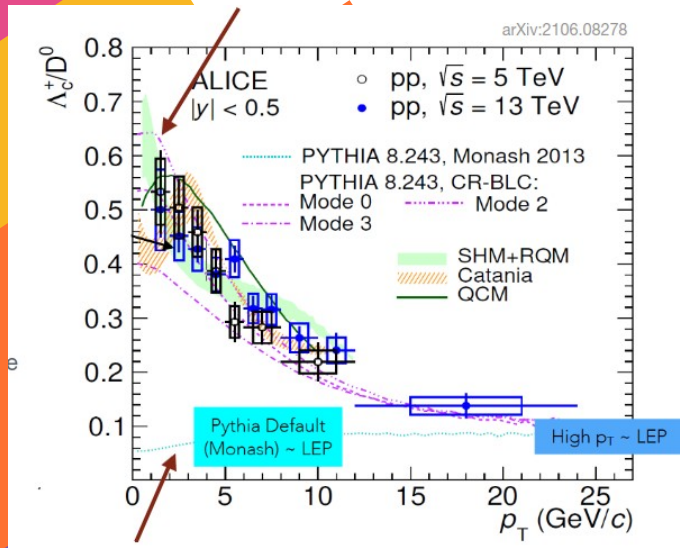
4

Junction updates

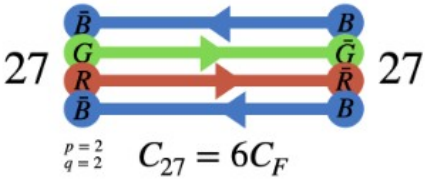
J. Altmann

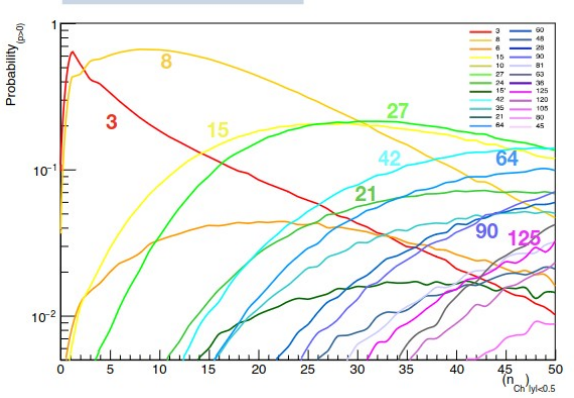
* 40 % of baryons from junctions
* 70 % of HF baryons!





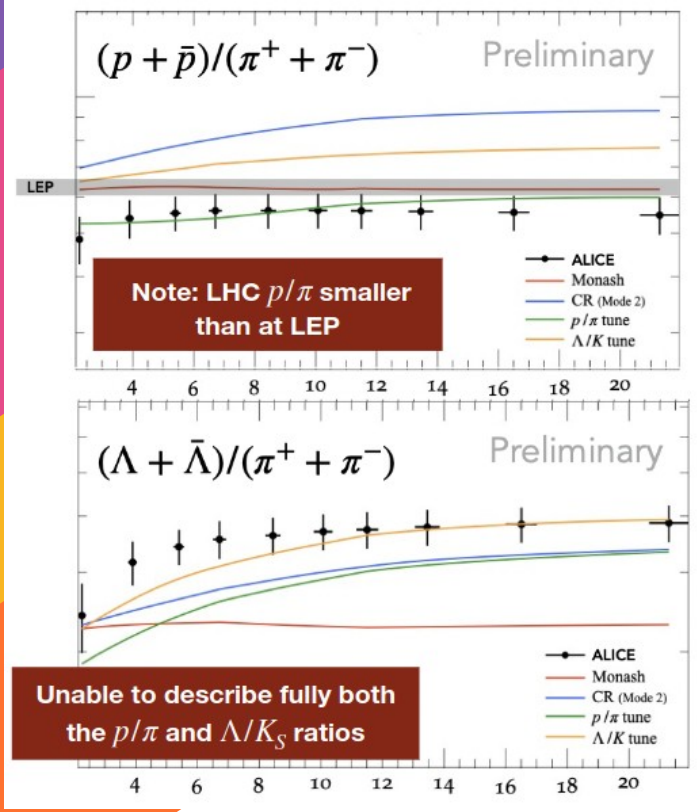
* Support for heavy quarks questionable!
* Improvements for HQ and strangeness enhancement presented (pearl-on-string + close packing)





Results and questions

J. Altmann

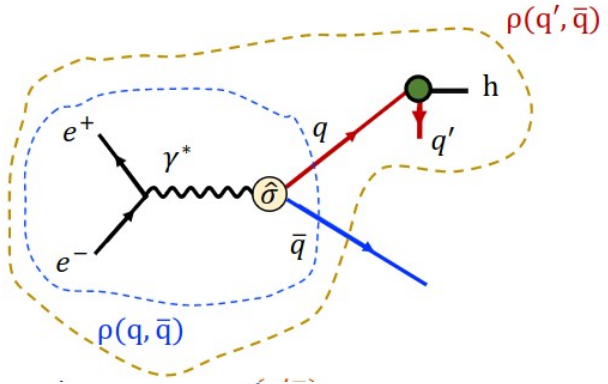


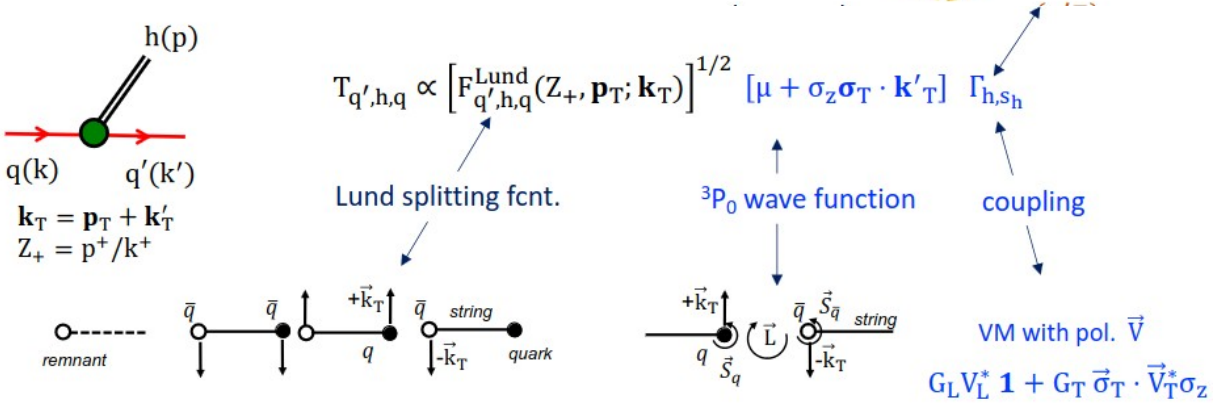
* Implication of new results on HF (no Lambda/D enhancement wrt Nch)?
* Protons remains weird – is the baseline wrong?
* Observable consequences for baryon production model (popcorn/destructive interference…)

Quark spin hadronization

A. Kerbizi

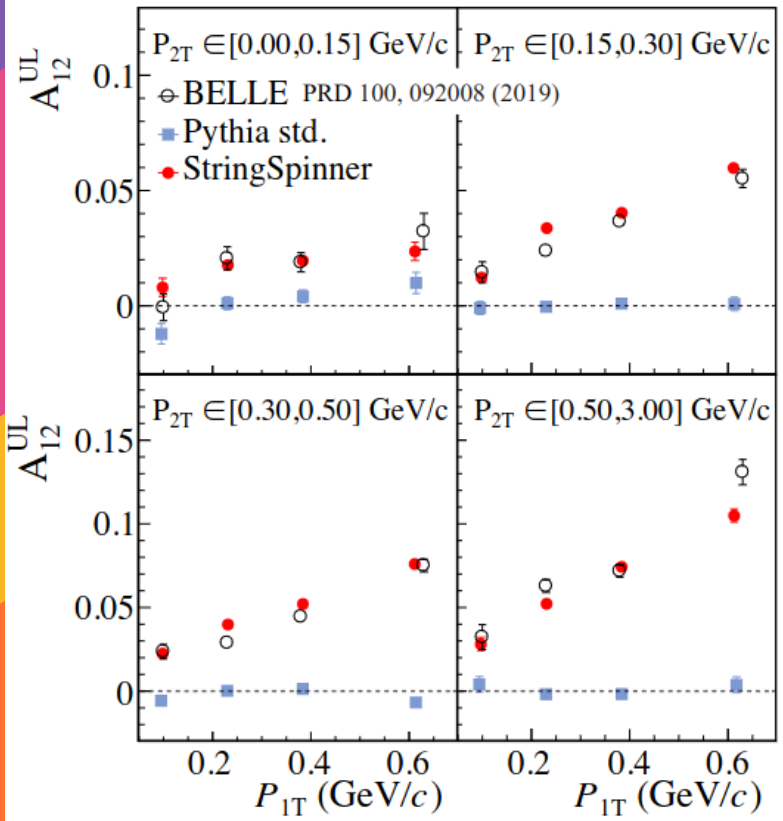
* Extending Lund string with quark spin
* DIS and LEP, pp is coming
* Spin density matrix evaluation
* Veto produced hadrons accordingly





Results and questions

A. Kerbizi



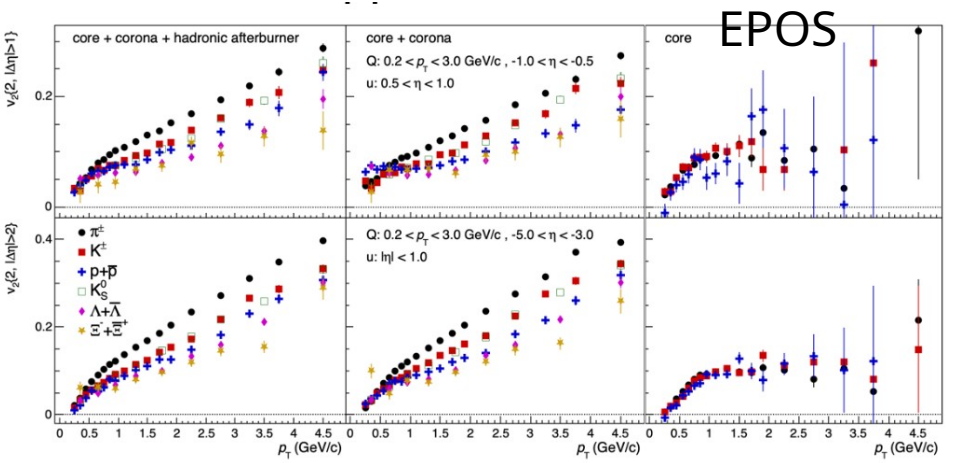
pi-pi asymmetry wrt T

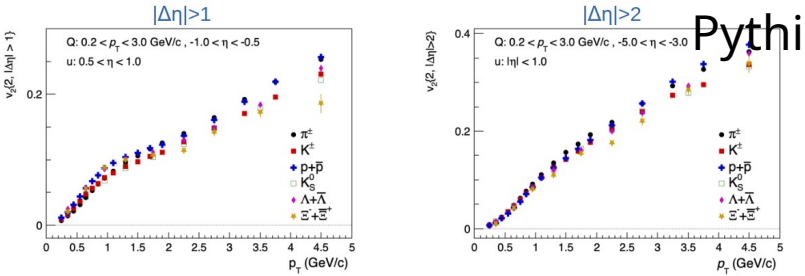
* Satisfactory description of existing data – new model extending strings.
* Baryon production most relevant for HI, not in yet.
* Interesting questions also for coherence effects, more entanglement effects (?), what about junctions…

Sources of collectivity

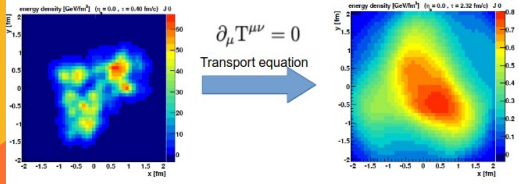
A. Manea

* Comparison study, Pythia vs. EPOS
* Qualitative features of models in small systems
* Teach us what a collectivity signal is?



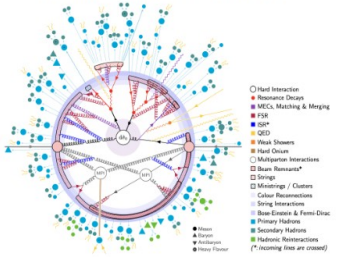


K. Werner, arXiv: 2306.10277



- Macroscopic model: EPOS4
  - Core–corona model with statistical hadronization
  - Collective effects from hydrodynamical evolution of the medium

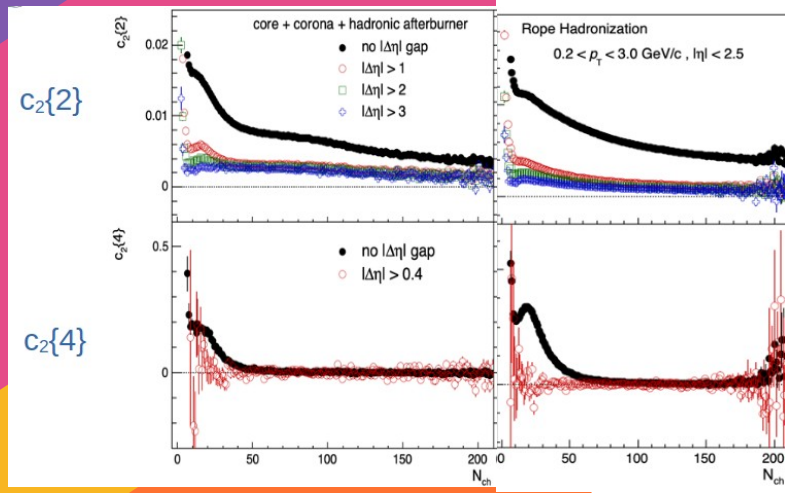
C. Bierlich et al., arXiv: 2203.11601



- Microscopic model: PYTHIA 8
  - QCD strings with LUND fragmentation
  - Collective effects from new processes
    - Color reconnection, rope hadronization, ...

Results and questions

A. Manea



EPOS

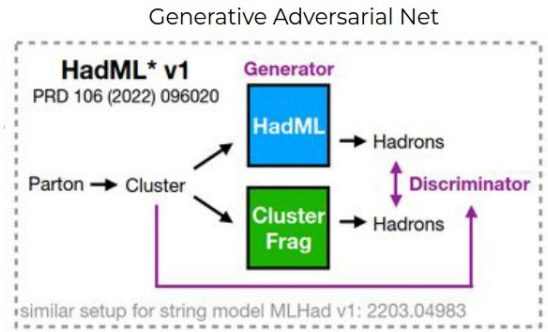
Pythia

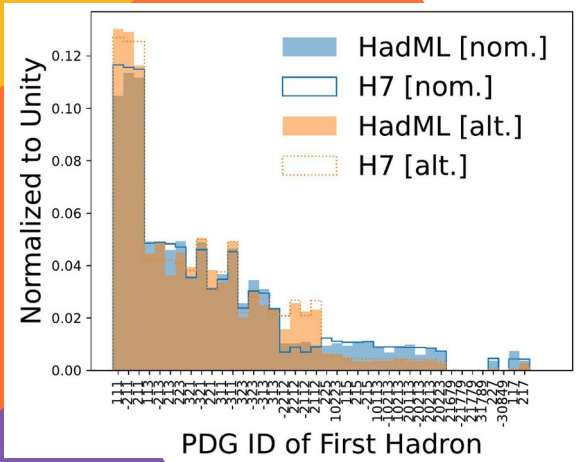
* Cannot easily extend qualitative interpretation of HI observables in pp.
* Case in point: mass ordering v2, negative c2(4).
* How can we be sure that collectivity in pp is “the same” as in AA?

GAN Hadronization

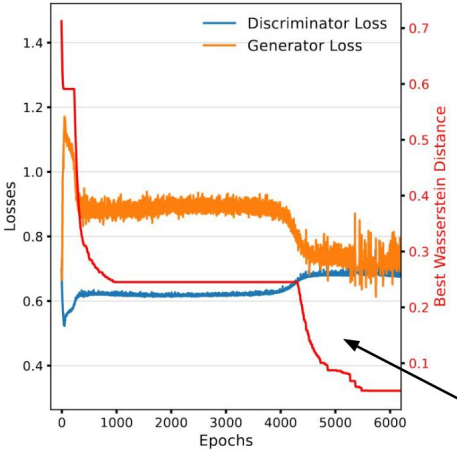
A. Siódmok

* A GAN to reproduce cluster hadronization.
* Fitting is difficult, problem in a nutshell:
    * can fit with full information (ex 1: “local”)
    * exp only provides partial information
* Solved by full model implementation (ex 2: “global discriminator”)





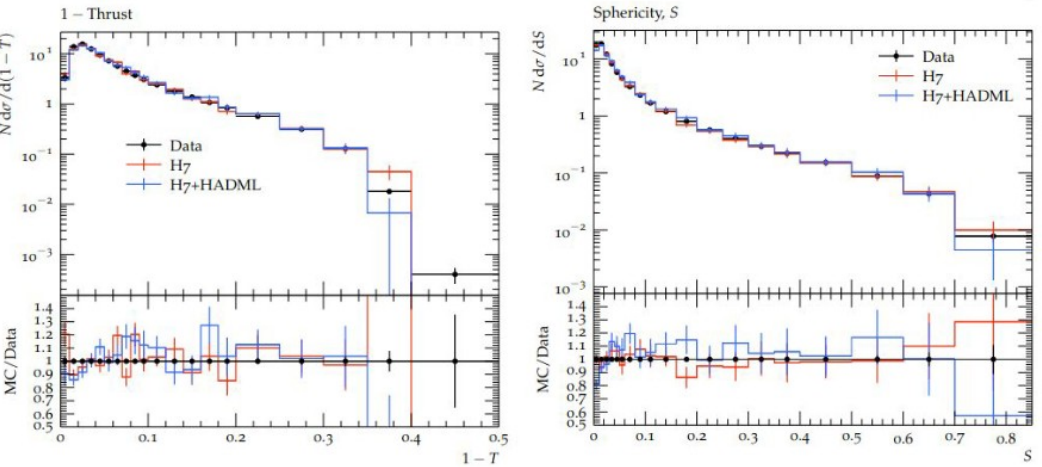
← PID is coming!



Results and questions

A. Siódmok

LEP DELPHI Data



N.B. we have trained on H7, so we don't expect to be any better than it at modeling the data.

OBS: Results from Herwig (not data) training

* NN version of hadronization models are maturing, MPI24: full hadronization models.
* Solving technical problems: what about the physics?
* What are experimental needs?
* What can we learn? Can NN be used to understand/tune existing (physics) models?