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A HEAVY-ION COLLISION EVENT

Pythia8/ANGANTYR
(Default)

Pythia8/ANGANTYR
(New)

Glauber
model

*CR = Colour reconnection

N - CR in every
sub-collision

String Fragmentation
+ Hadronization for
every sub-collision

All *hadrons* from all
sub-collisions are
combined

N- pp like
sub-collisions



A heavy-ion
event is
simulated

All *partons* from all
sub-collisions are
combined

Spatially constrained
CR performed in
whole event

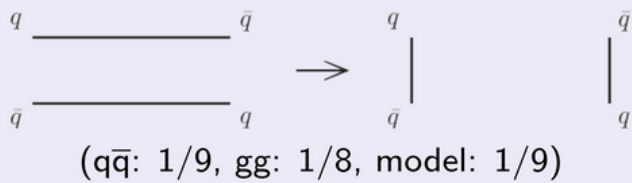
String
Fragmentation +
Hadronization

MPI based Colour reconnection, used in Pythia8/Angantyr (Default)

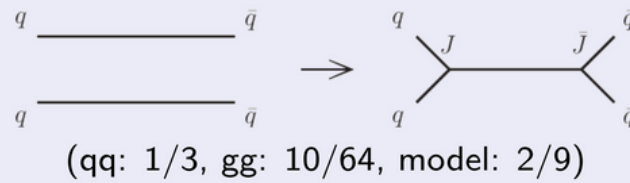


QCD Colour reconnection is extended with spatial constraints, used in Pythia8/Angantyr (New)

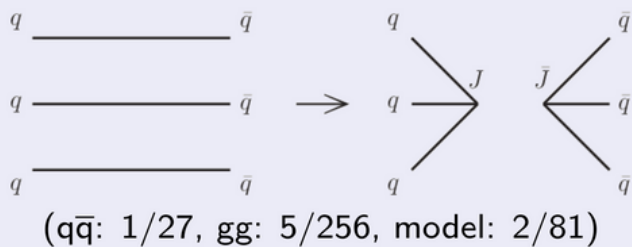
Ordinary string reconnection



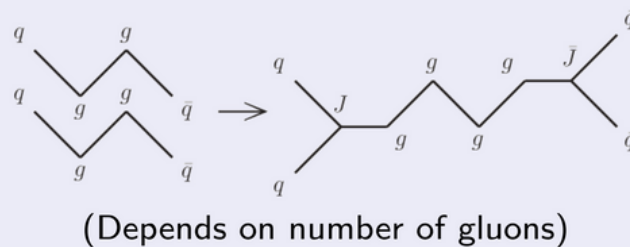
Double junction reconnection



Triple junction reconnection

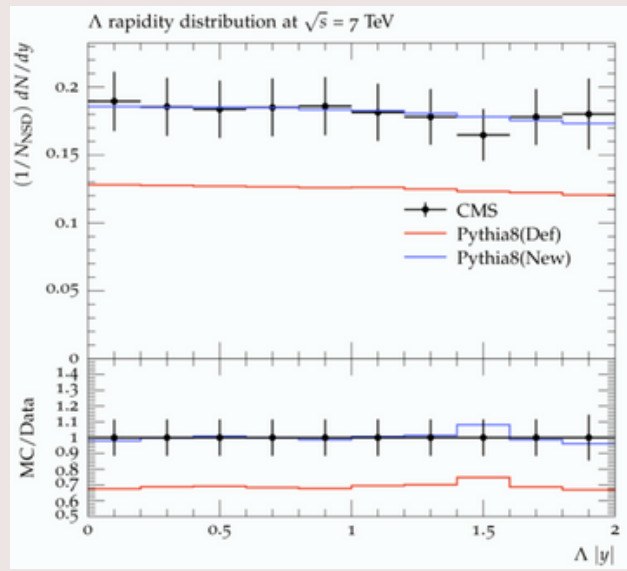
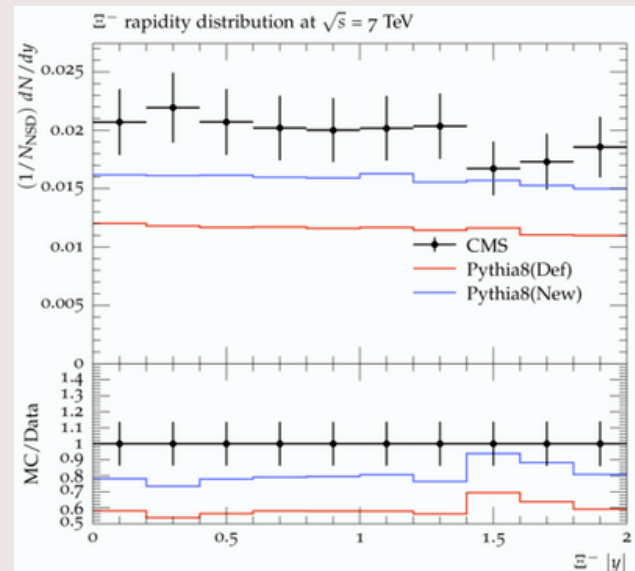
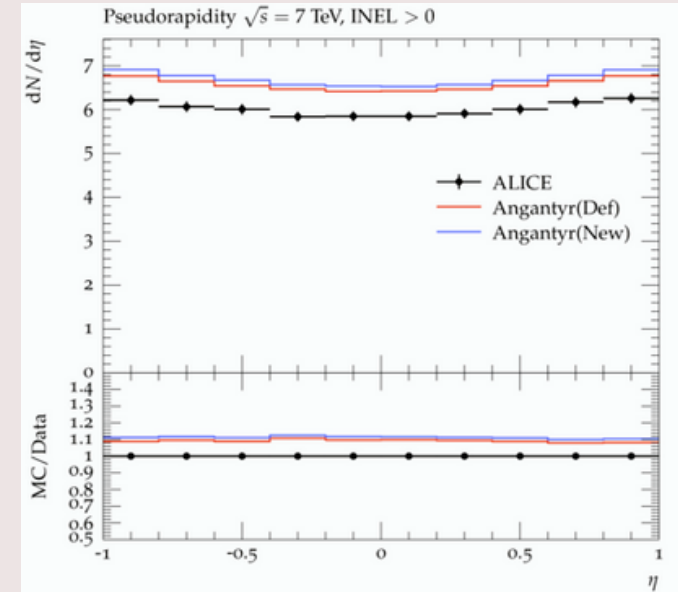
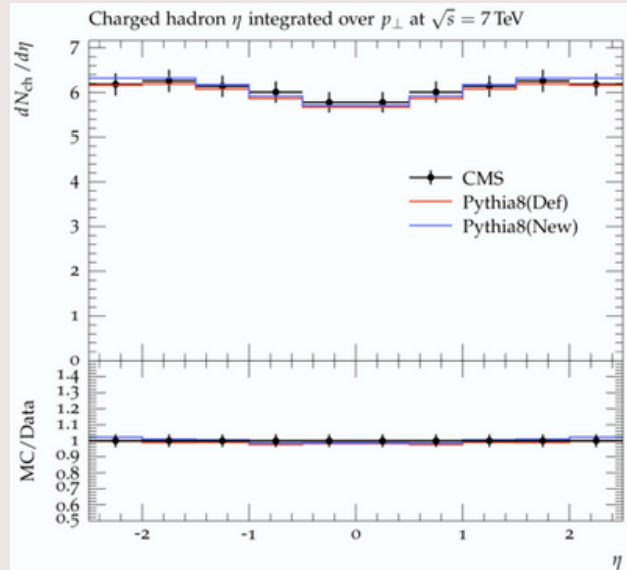
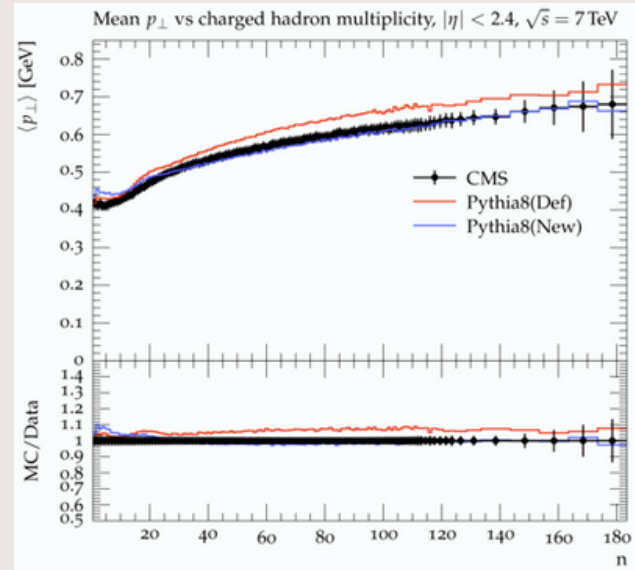


Zippering reconnection



Apart from the existing constraints, the colour dipoles are **spatially constrained**, meaning, dipoles separated farther than the allowed range will not be colour reconnected.

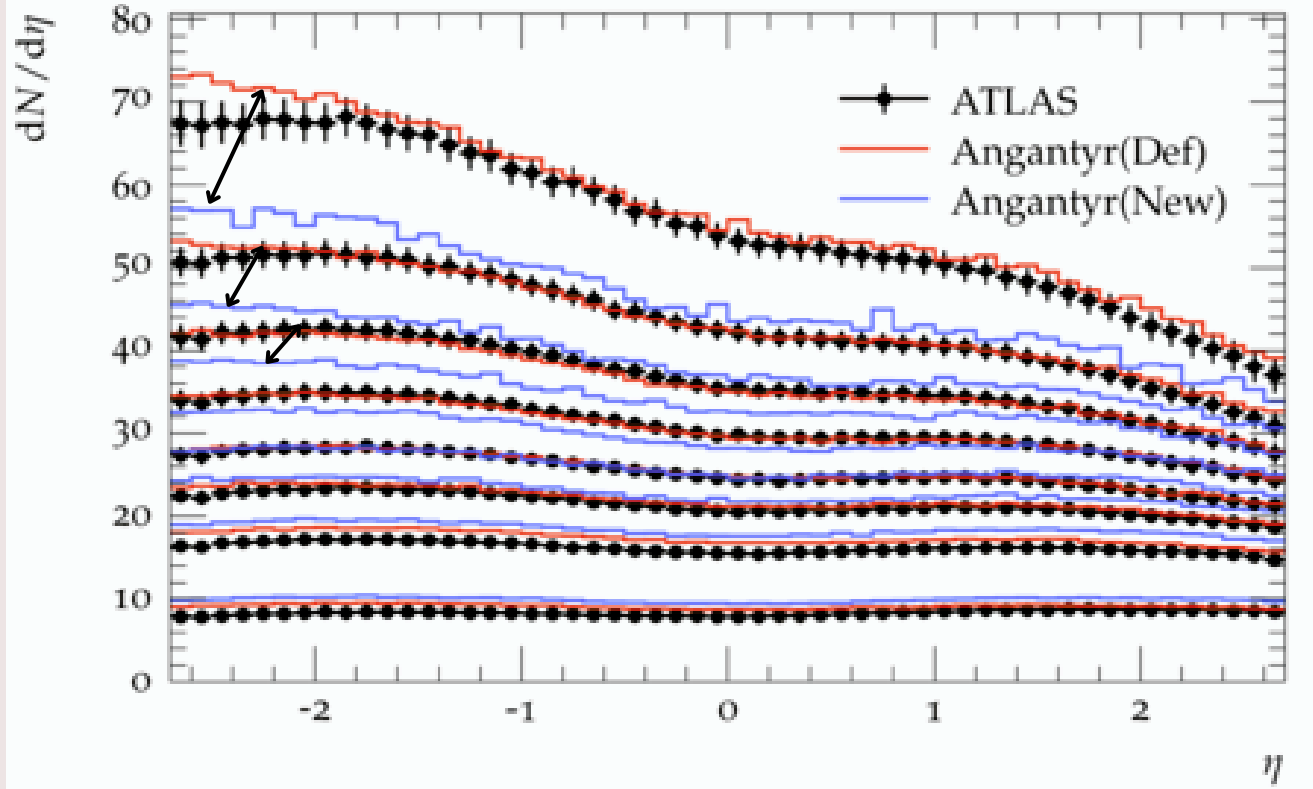
pp collisions



- New changes with re-tuning are able to reproduce Pythia8 (Default) distributions
- New changes **enhance** baryon production due to junction topology in QCD CR

pPb collisions

Centrality dependent η distribution, pPb $\sqrt{s_{NN}} = 5.02$ TeV



- Events are generated using the **same** parameters used as in *pp* collisions
- Approx. 10% suppression in multiplicities in the **0-10%** centralities is observed, because of A) **loss** of high multiplicity events, due to technical reasons in the string fragmentation model, B) **enhanced CR** among the colour dipoles from all the sub-collisions
- In addition to *pp* tunes, secondary non-diffractive events are modified (they are introduced in the Angantyr model at the *pA* level)

From top to bottom: 0-1%, 1-5%, 5-10%, 10-20%, 20-30%, 30-40%, 40-60%, and 60-90% centrality.

*Secondary non-diffractive (Figure 3).



ANGANTYR (NEW)

STRENGTHS

- An MC model challenging the assumption of a QGP formation in HI events, *HI = Heavy-ion
- A HI event is treated inclusively by merging sub-collisions at the parton level, instead of a collection of many pp like collisions as in Angantyr (Default)
- The model is re-tuned in pp collisions, the parameters introduced in pA collisions are re-tuned in pA collisions, **No tuning** at AA collisions

LIMITATIONS

- In pA and AA type collisions, high multiplicity events are more often aborted compared to low multiplicity events, which introduces a bias in simulation
- Angantyr (Default) Pb-Pb @ 2.76 TeV ~ 0.59 s/event
- Angantyr (New) Pb-Pb @ 2.76 TeV ~ 272 s/event
- Angantyr (Default) Xe-Xe @ 5.44 TeV ~ 0.44 s/event
- Angantyr (New) Xe-Xe @ 5.44 TeV ~ 159 s/event

OUTLOOK

Work in progress to reduce the bias in HI events simulation, and the event simulation time

OPPORTUNITY

A model with a new method of sub-collisions handling is ready to be tested against HI collision experiments observables