

Collectivity observables with high Q^2 probes



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Collective effects in small collisions systems

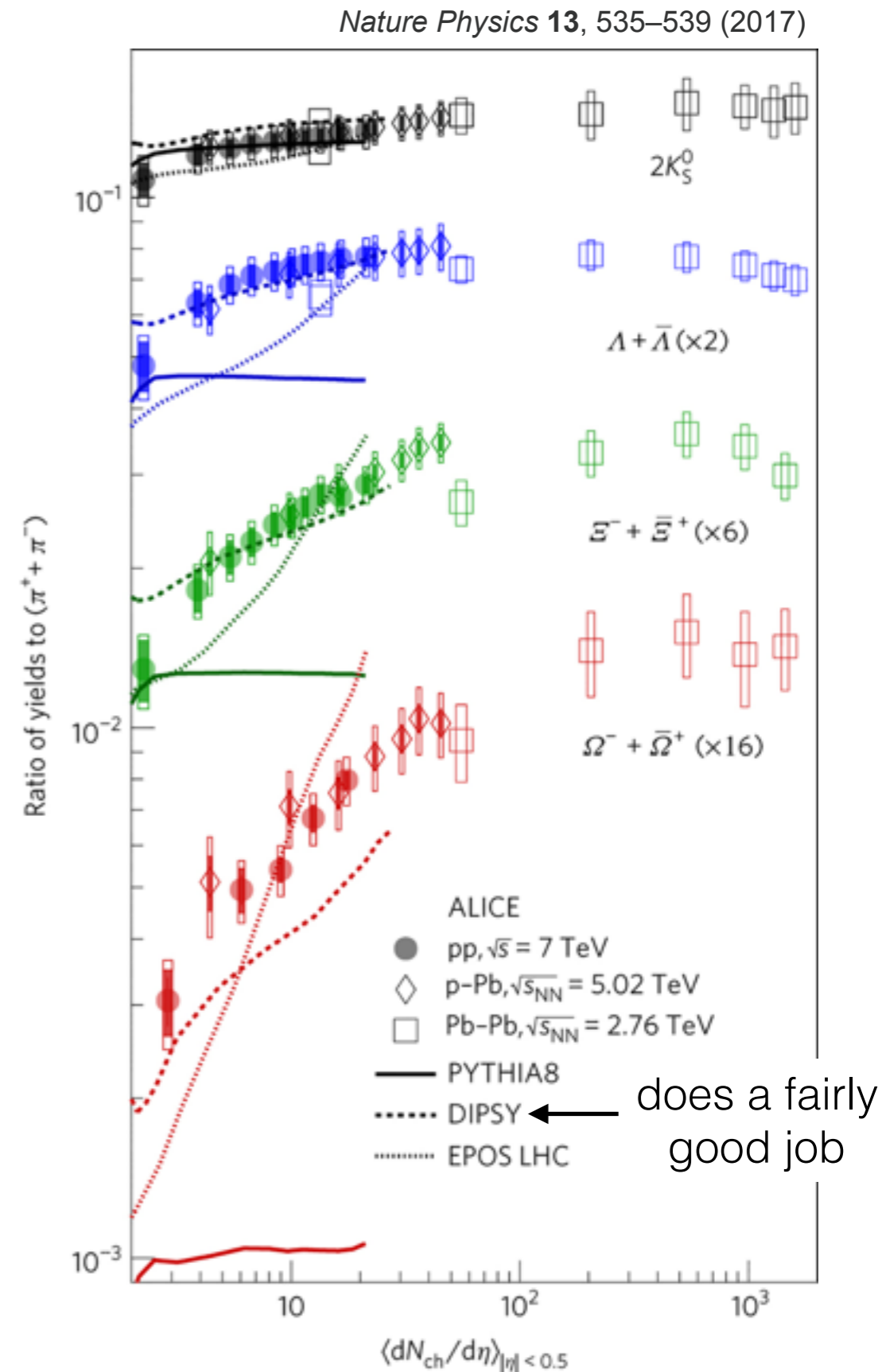
Thursday, June 15, 2017

Collective effects have been observed in pp that resemble the behavior of HI collisions.

Natural question: what about other effects observed in HI that have not yet been probed in pp ?

One of the most striking aspects of HI physics at high Q^2 is the modification of jet energy and structure

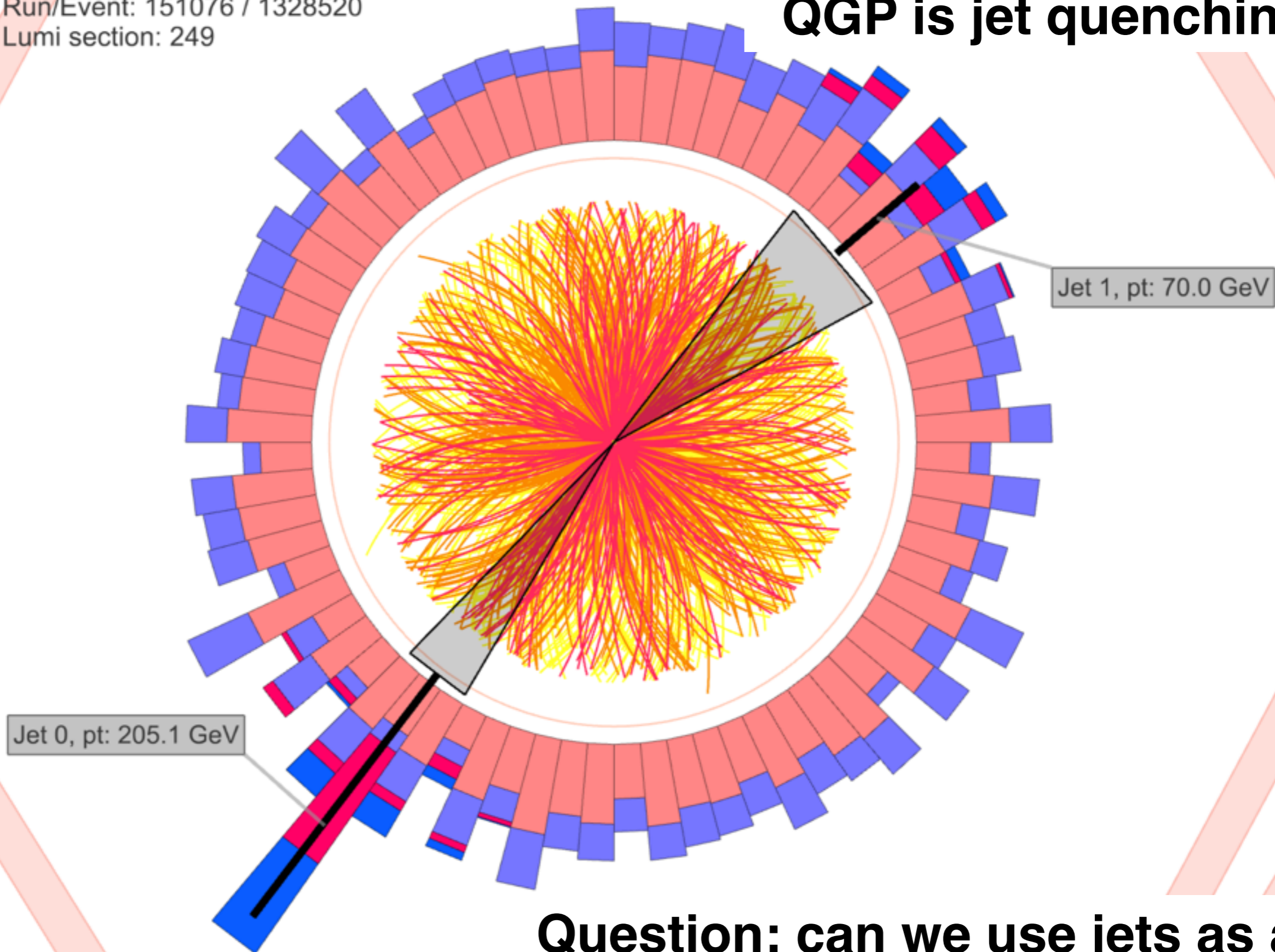
Can we study this to see if a QGP is formed in 'central' pp collisions?





CMS Experiment at LHC, CERN
Data recorded: Sun Nov 14 19:31:39 2010 CEST
Run/Event: 151076 / 1328520
Lumi section: 249

One key feature of the QGP is jet quenching



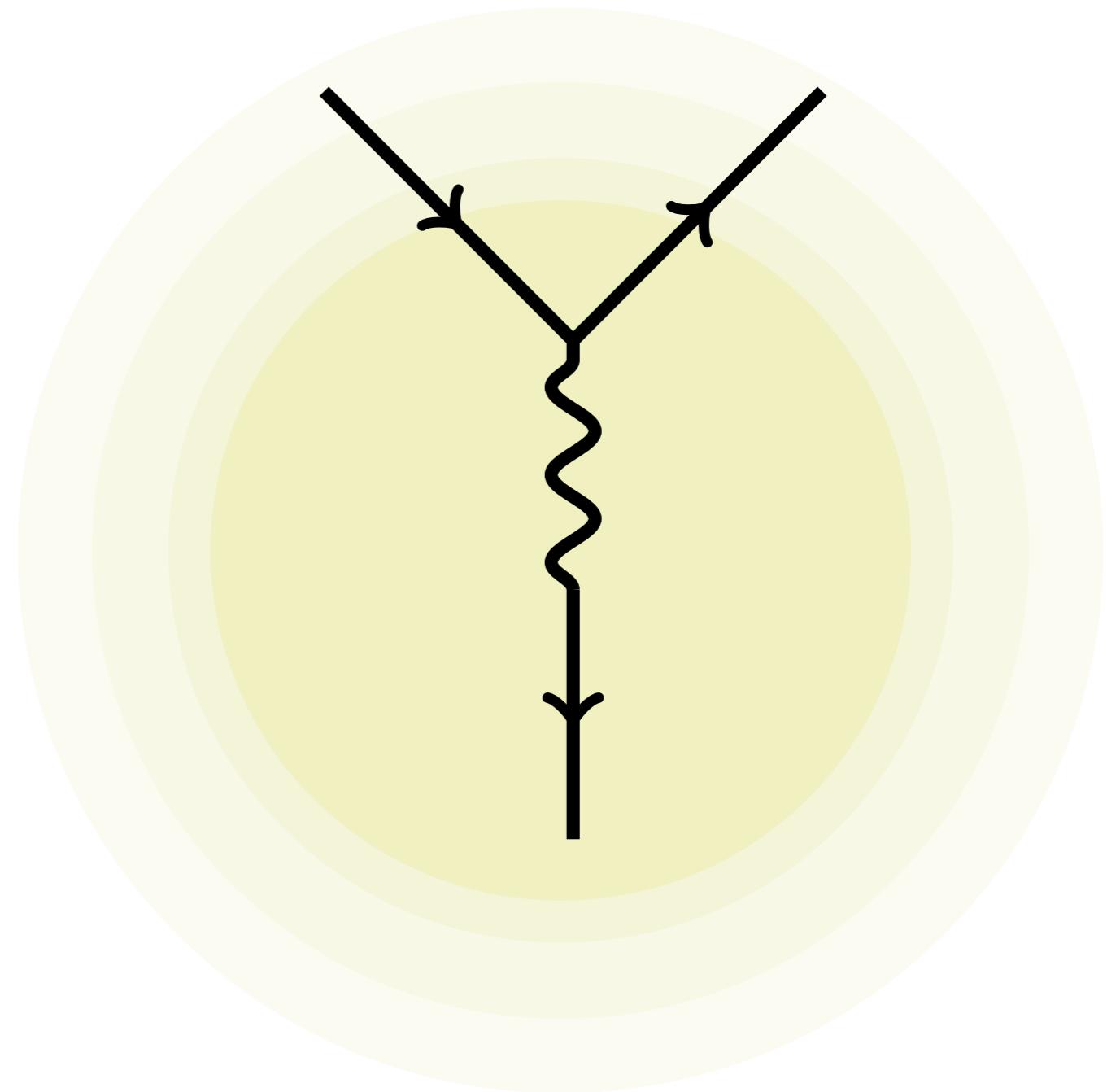
Question: can we use jets as a probe of collective effects in pp ?

In $Z + 1$ jet production, the transverse momentum of the jet and Z should balance.

We have endless
 Z 's at the LHC

Proposal: study jet(s) as a function of event multiplicity

Experimentally, we can measure this extremely well ($<1\%$)



not to scale

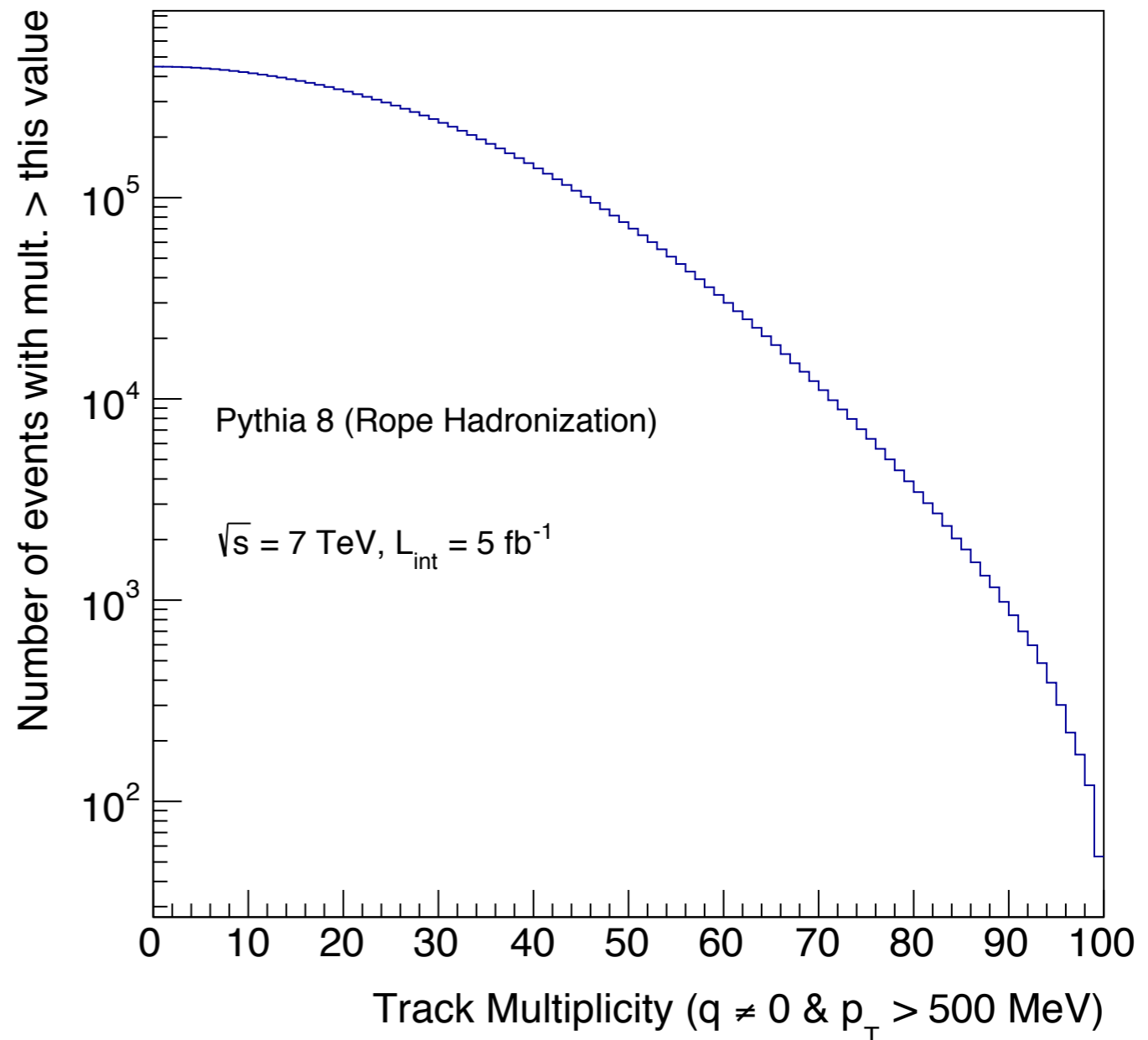
N.B. could also be γ

Pythia 8 with and without rope hadronization
see talk by Leif and <http://home.thep.lu.se/DIPSY/>

Count the number of
charged particle
tracks not in jets.

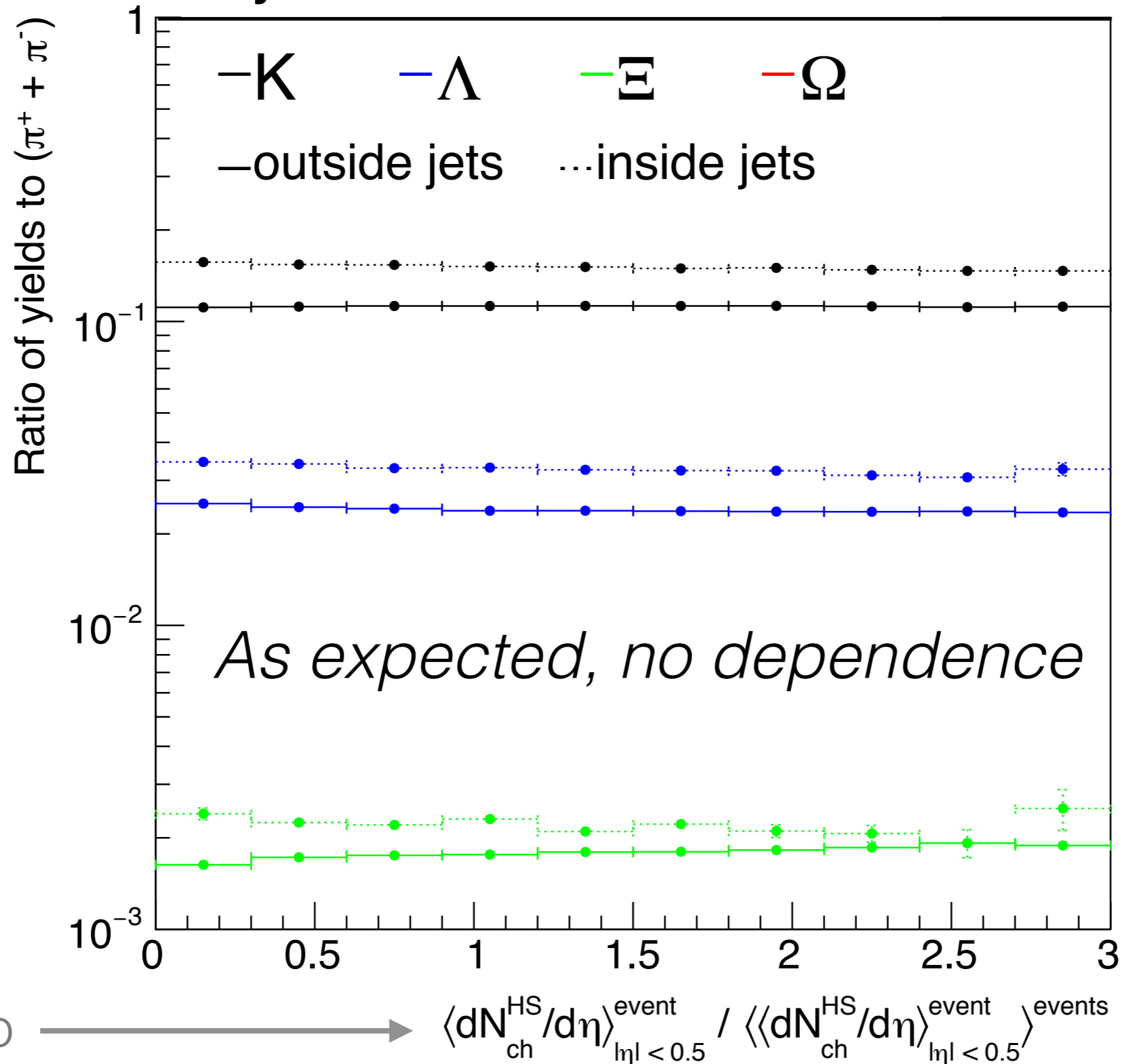
Cluster jets with
anti- k_t with $R = 0.4$

Veto events with more than
one jet above 25 GeV.



Strangeness in(out)side jets

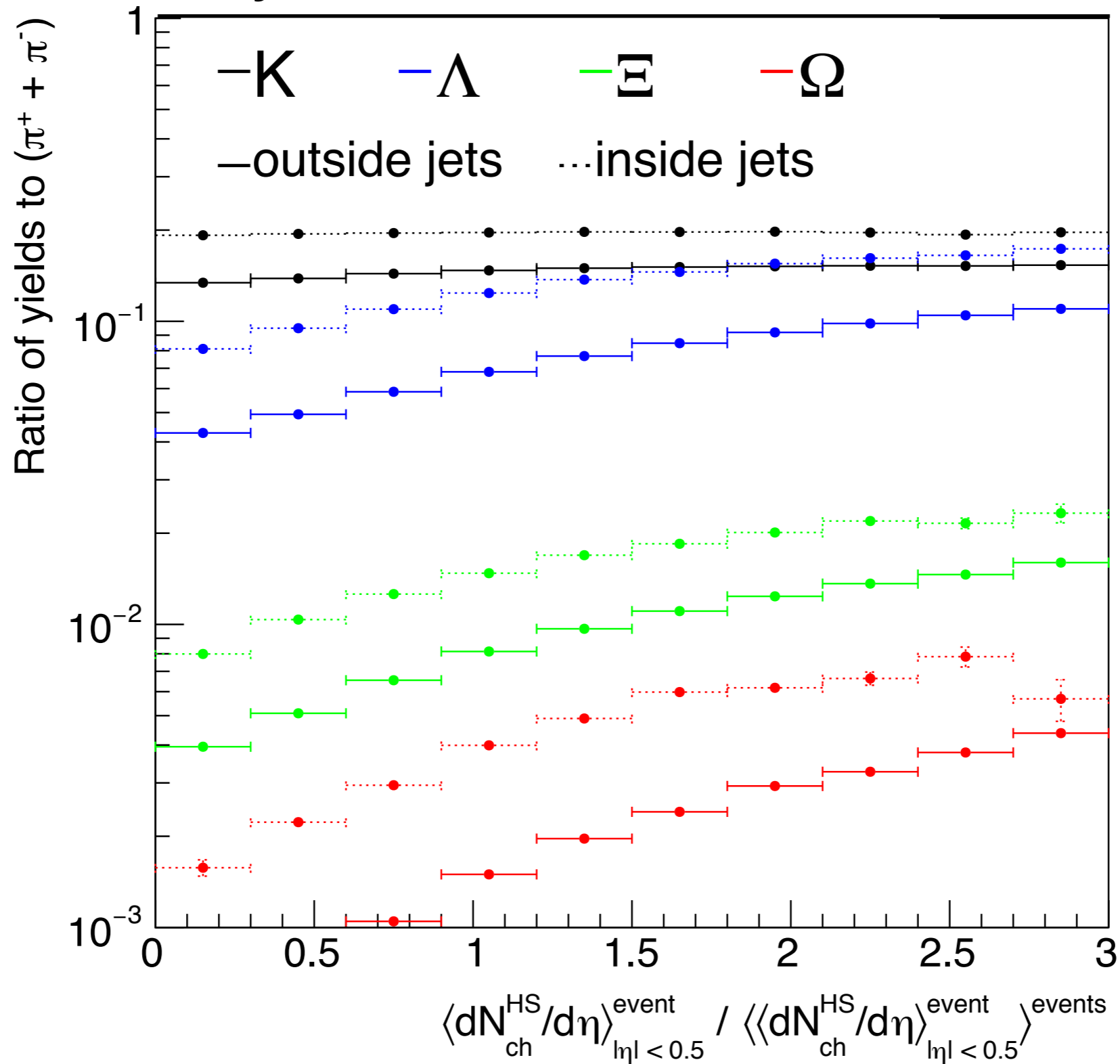
Pythia 8 (no rope)



Average multiplicity, normalized to the average

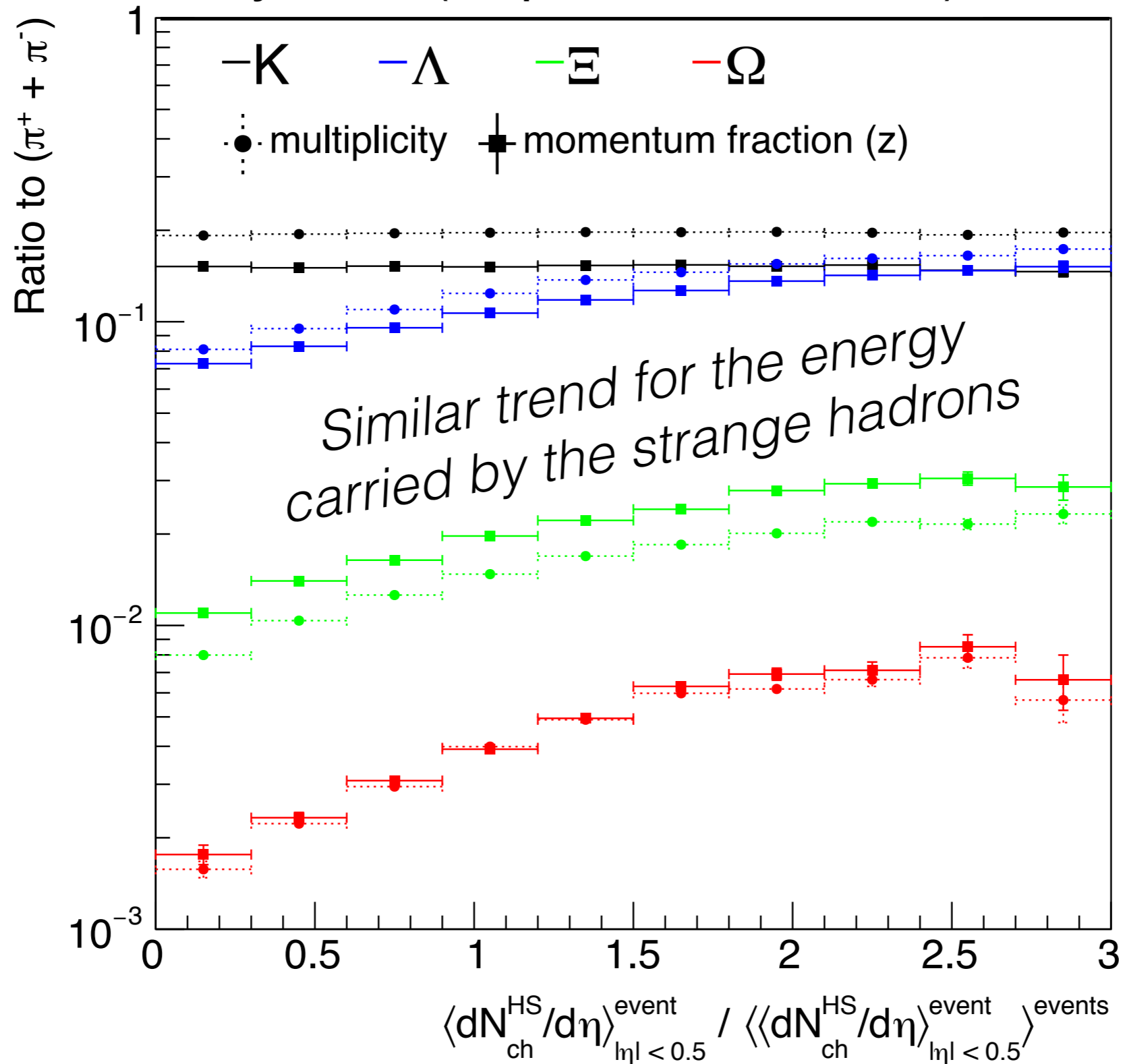
Strangeness in(out)side jets

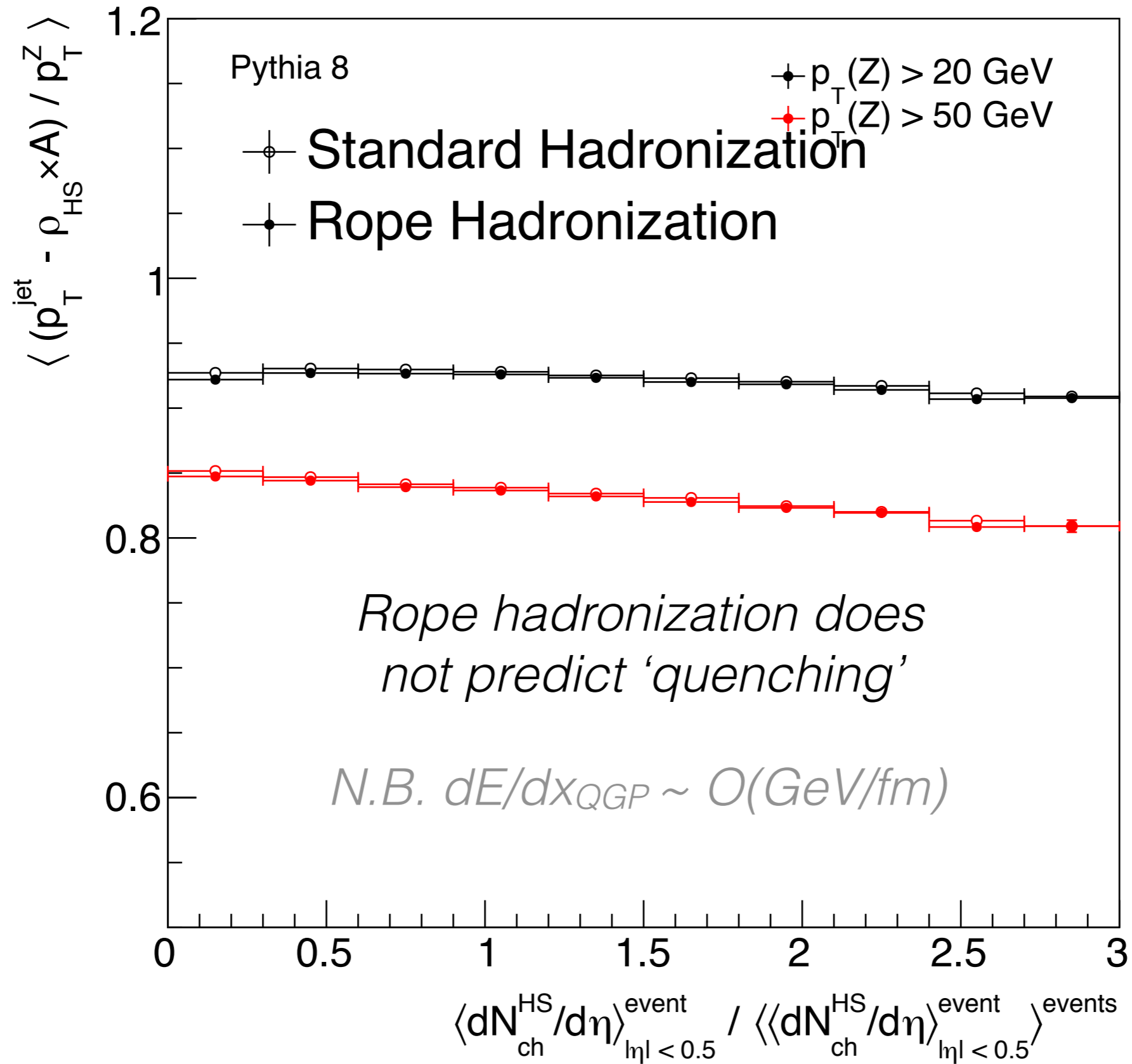
Pythia 8 (rope hadronization)



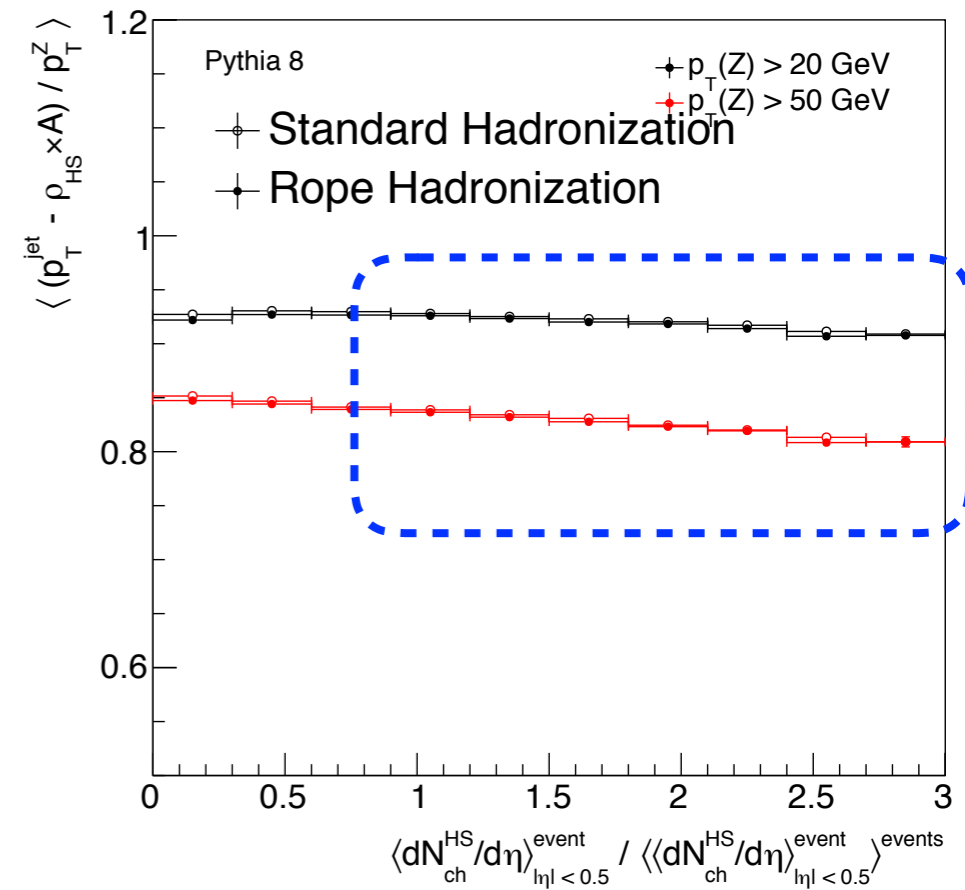
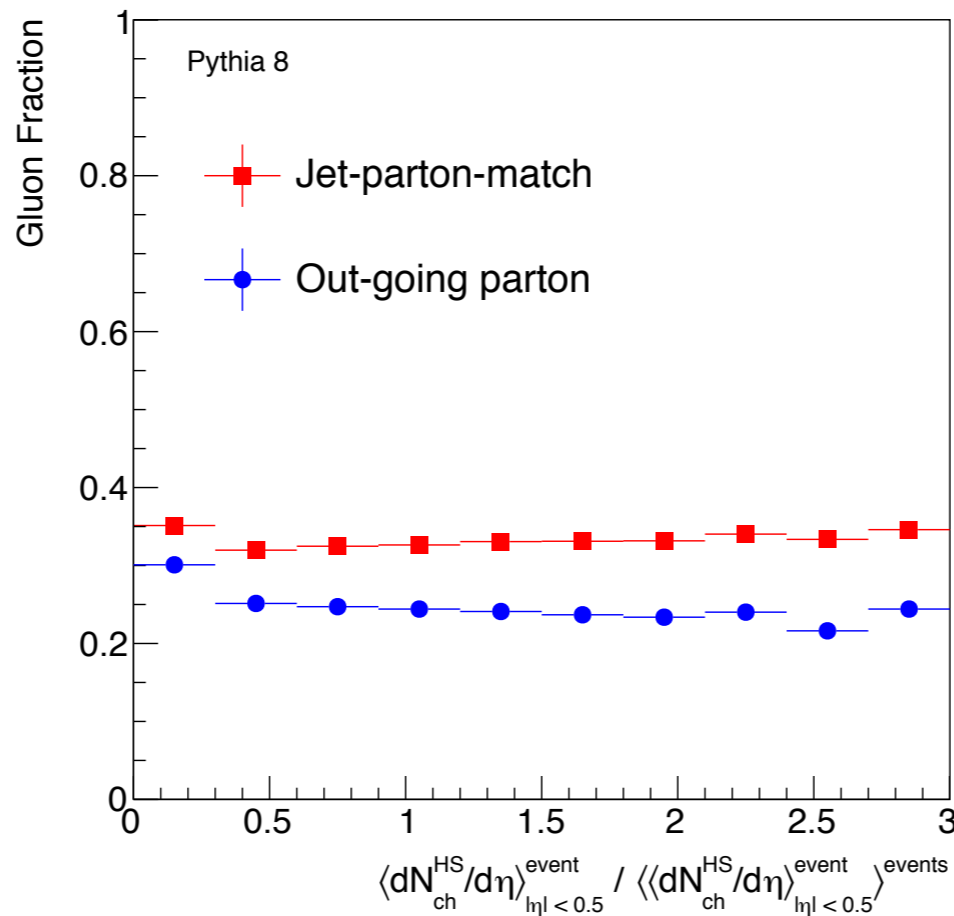
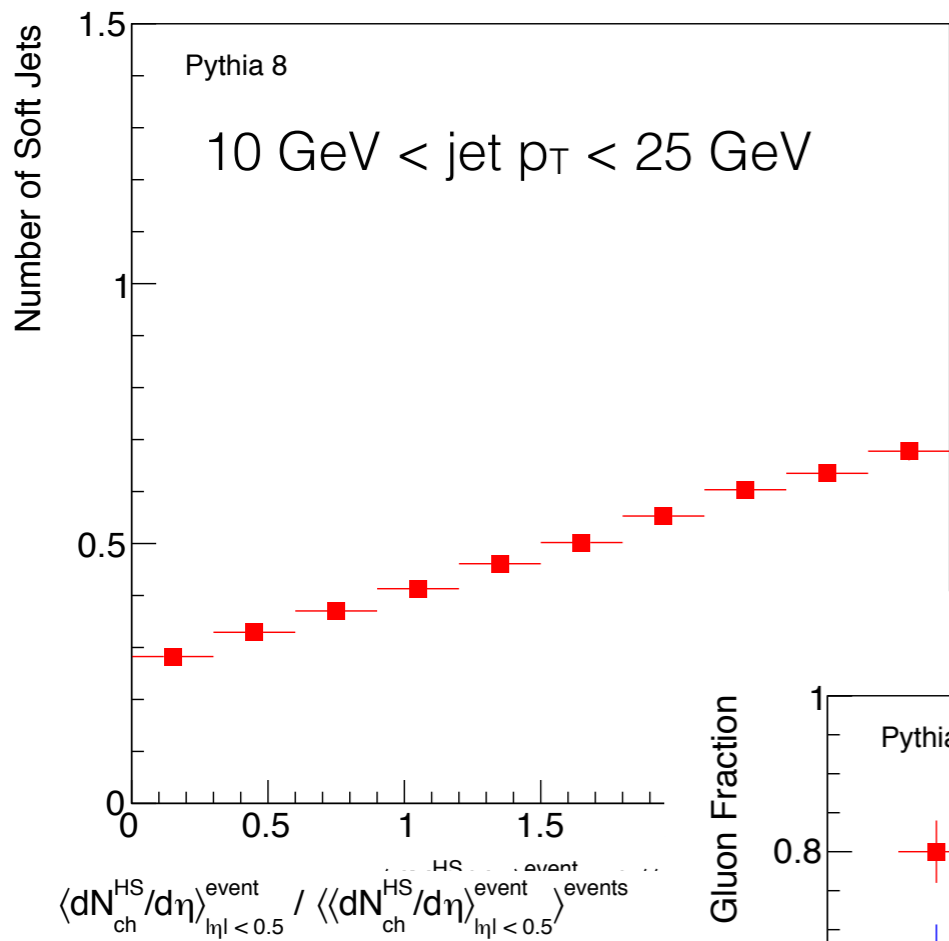
Expected raise; note this is also true inside jets!

Pythia 8 (Rope Hadronization)





Investigating the slope



Partially due to soft jets, angular 'resolution'; does not seem to be affected by q/g composition.

We propose to use jets as high Q^2 probes of collective behavior in pp collisions.

In addition to studying the strangeness inside jets, the idea is to search for quenching.

Key challenge is modeling the ‘natural’ multiplicity dependence of the Z +jet balance.

*maybe can fit templates with and without quenching;
can also try to lower the jet p_T for the veto.*

Quenching effects are not observed in rope hadronization model, but that does not mean they don't exist!

Backup

Preliminary! (N.B. no $Z p_T$ cut)

