

Non-perturbative QCD Effects and the Top Mass

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Based on work with D. Wicke
Eur.Phys.J.C52:133-140,2007,
& arXiv:0807.3248

at the Tevatron. A first attempt at isolating the genuine non-perturbative effects gave an estimate of order ± 0.5 GeV from non-perturbative uncertainties. The re-

Color Reconnections

PS, D. Wicke, arXiv:hep-ph/0703081

...Non-perturbative aspects, on the other hand, still suffer from being hard to quantify, hard to test, and hard to calculate. In this study, we focus on one particular such source of uncertainty: colour reconnection effects in the final state.

We present a new, universally applicable toy model of colour reconnections in hadronic final states.

Color Annealing (in PY6):

- At hadronisation strings pieces may reconnect

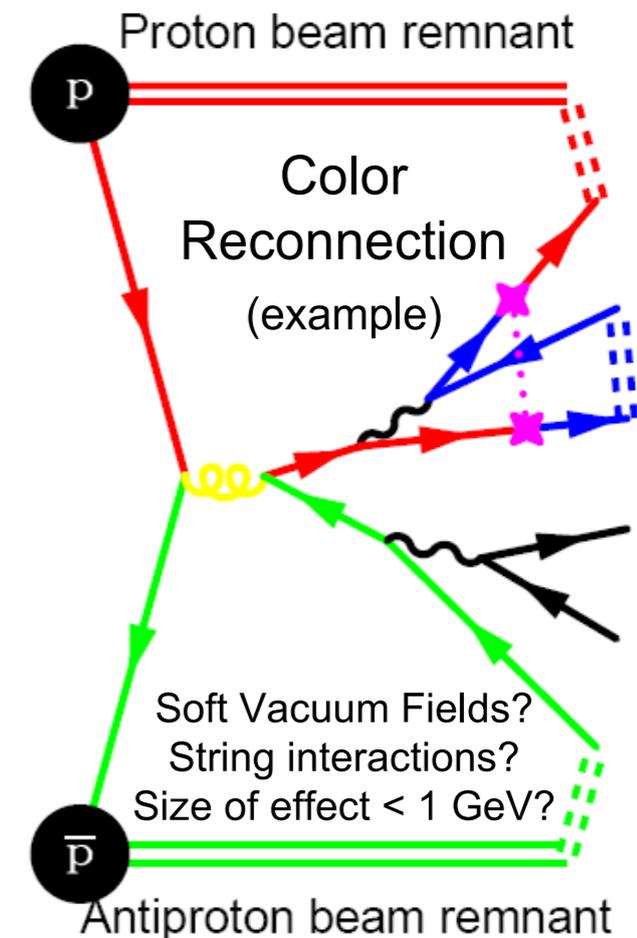
$$P_{\text{reconnect}} = 1 - (1 - \chi)^n$$

χ — strength parameter

n — number of interactions (MPI)

(counts number of possible interactions)

- New connection chosen to minimise string length, i.e. minimise potential energy in strings



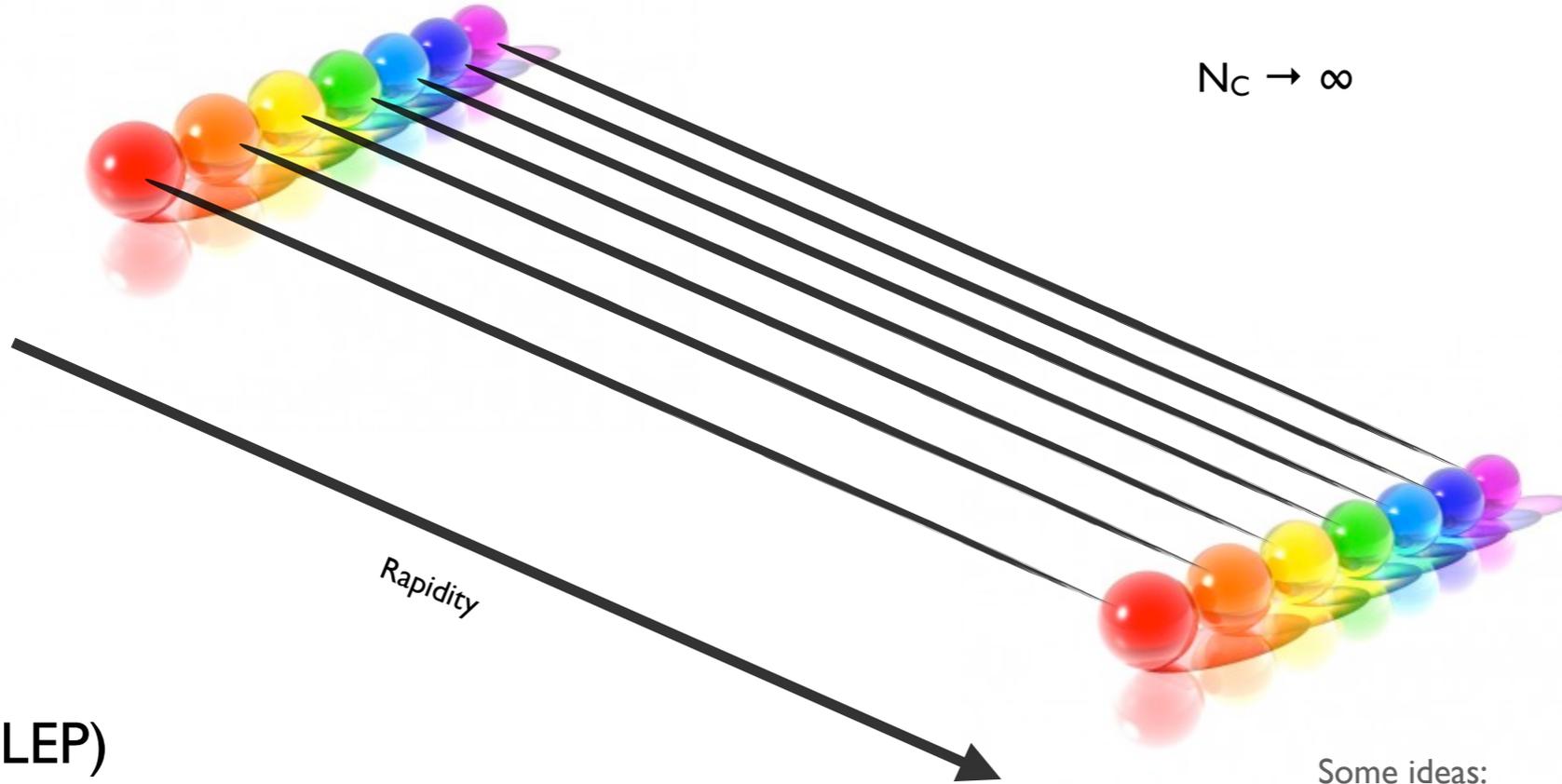
Note: lifetimes are ignored
in current models
→ overestimate
(good for conservative)

Why? (theory)

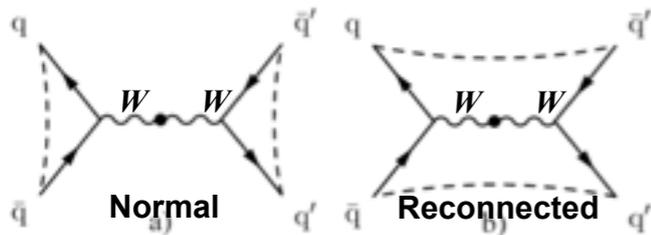
LHC

multiple parton interactions

$N_c \rightarrow \infty$



(LEP)



Multiplicity $\propto N_{MPI}$

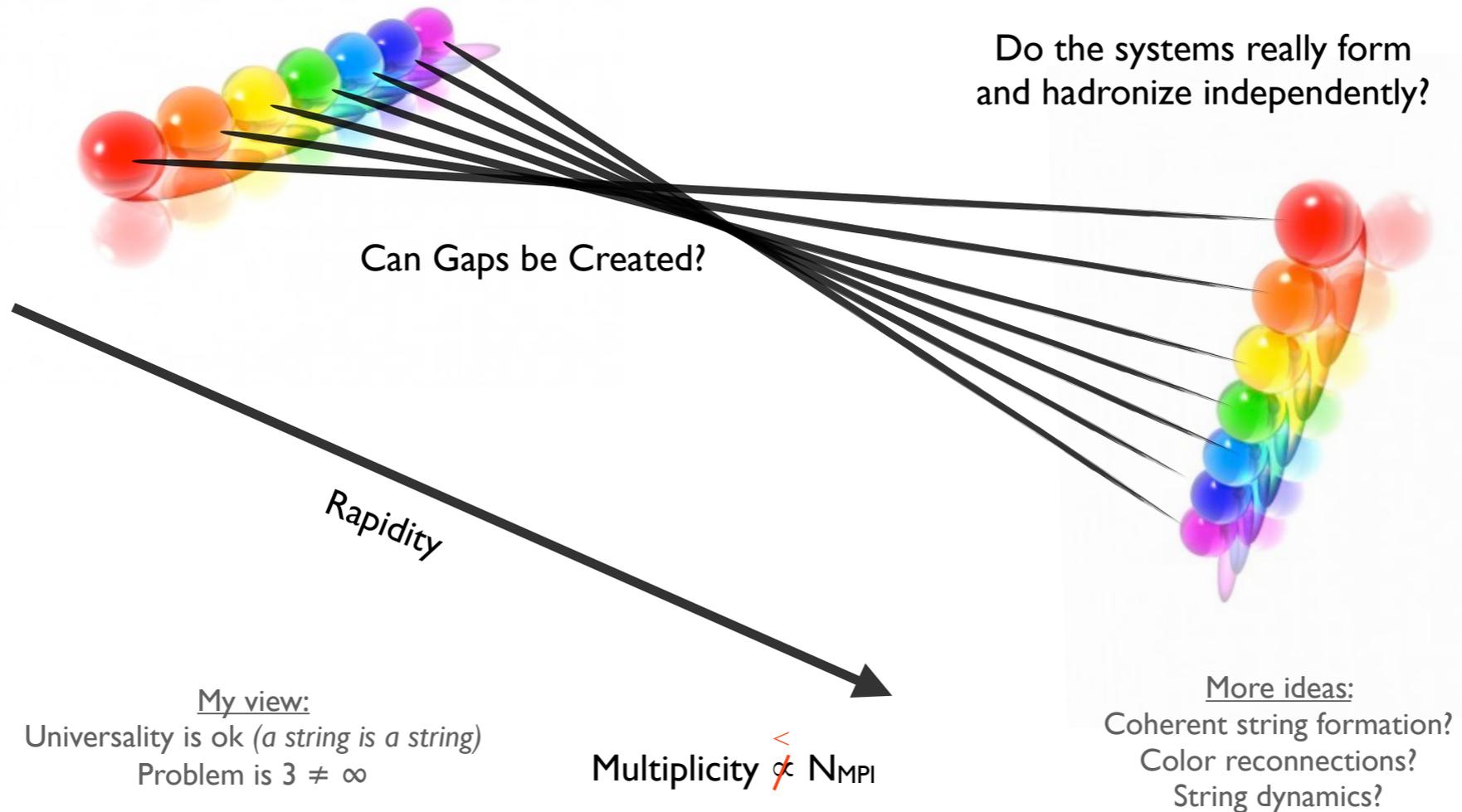
Some ideas:
Hydro? (EPOS)
E-dependent string parameters? (DPMJET)
"Color Ropes"?

Excluded effects $\chi \sim 1$

Why? (theory)

LHC ...

multiple parton interactions

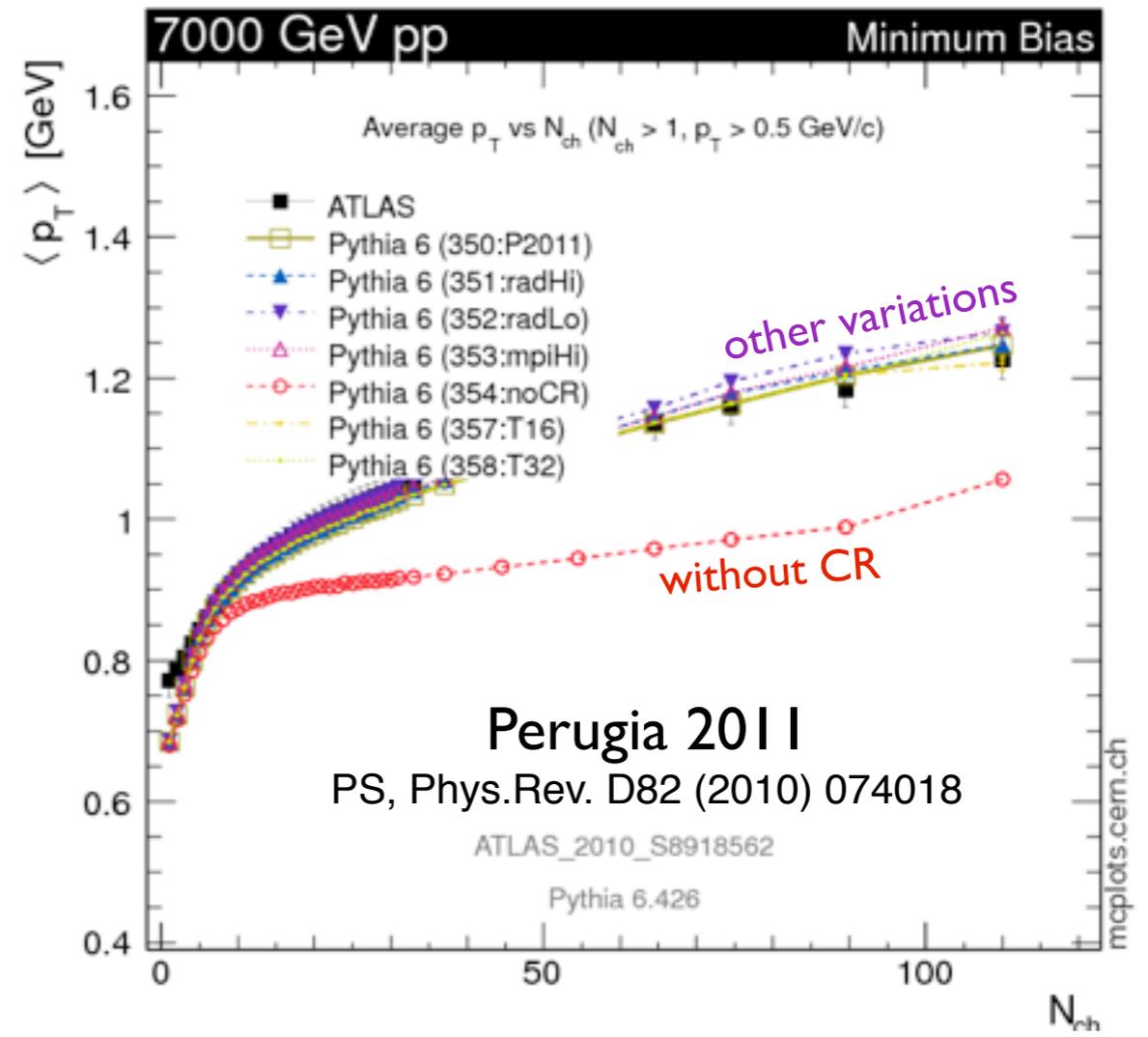
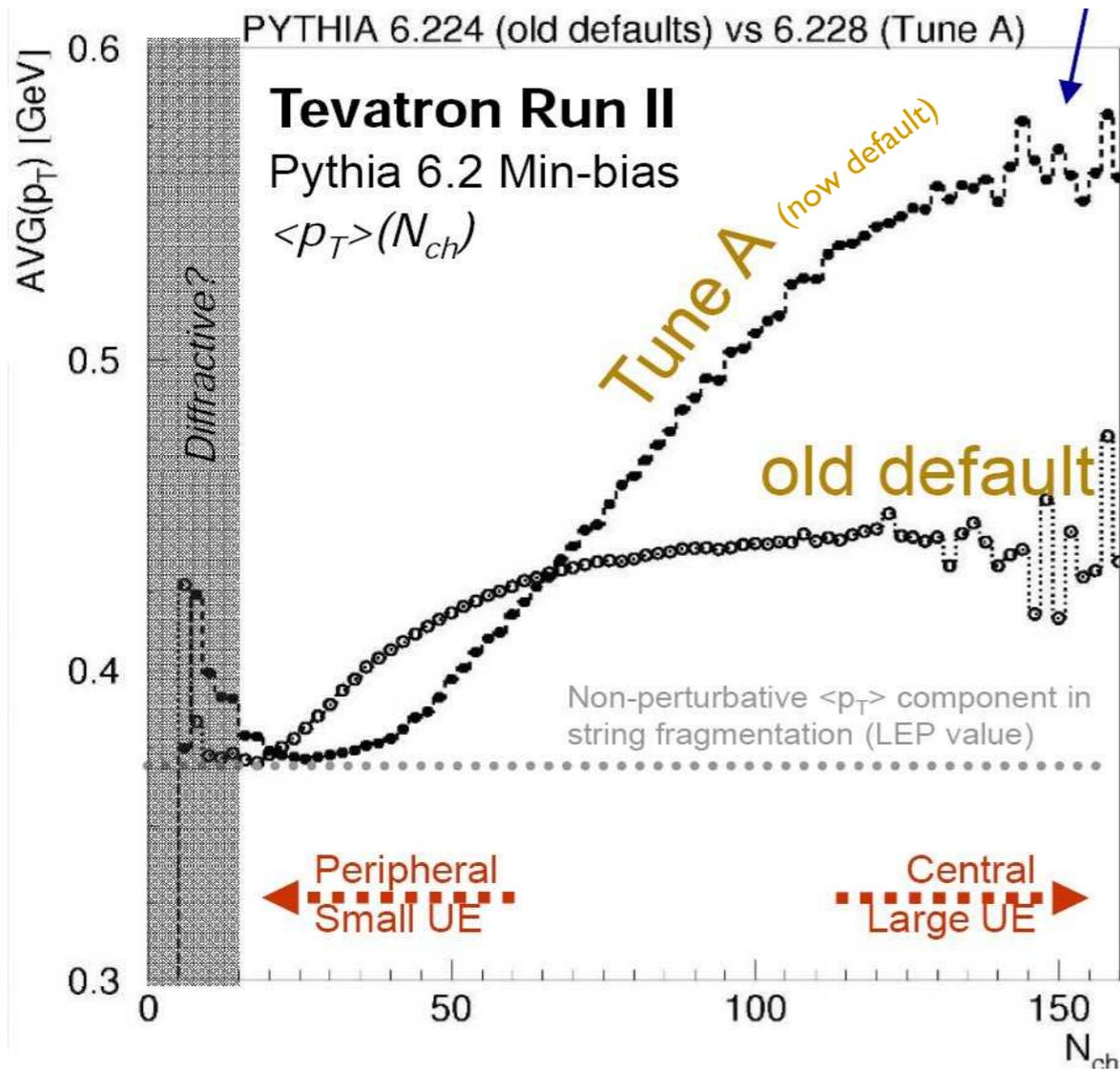


So far (in my opinion) no fully realistic model
Don't trust toy models too much (be conservative)

Why? (exp)

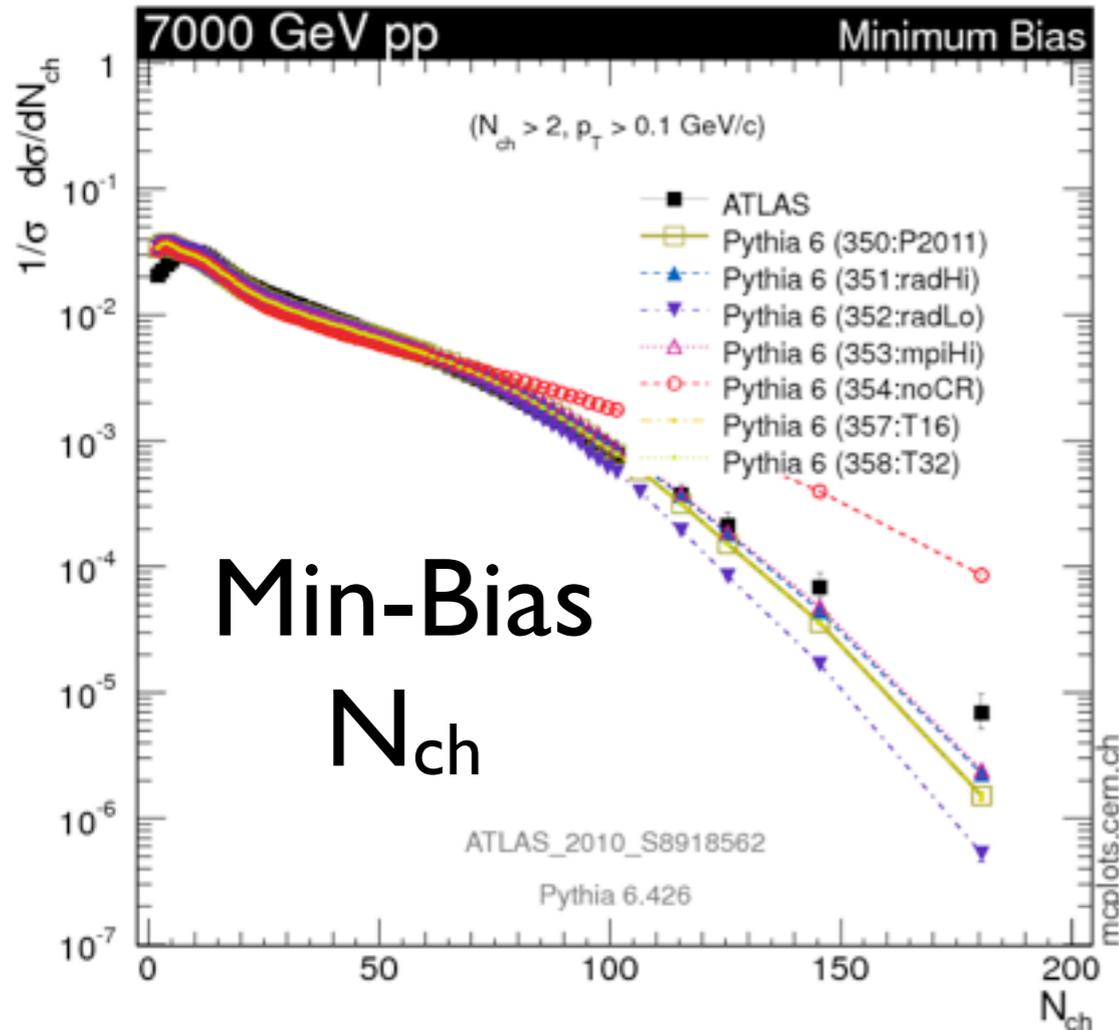
PS, D. Wicke, arXiv:0807.3248

mcplots.cern.ch, this morning

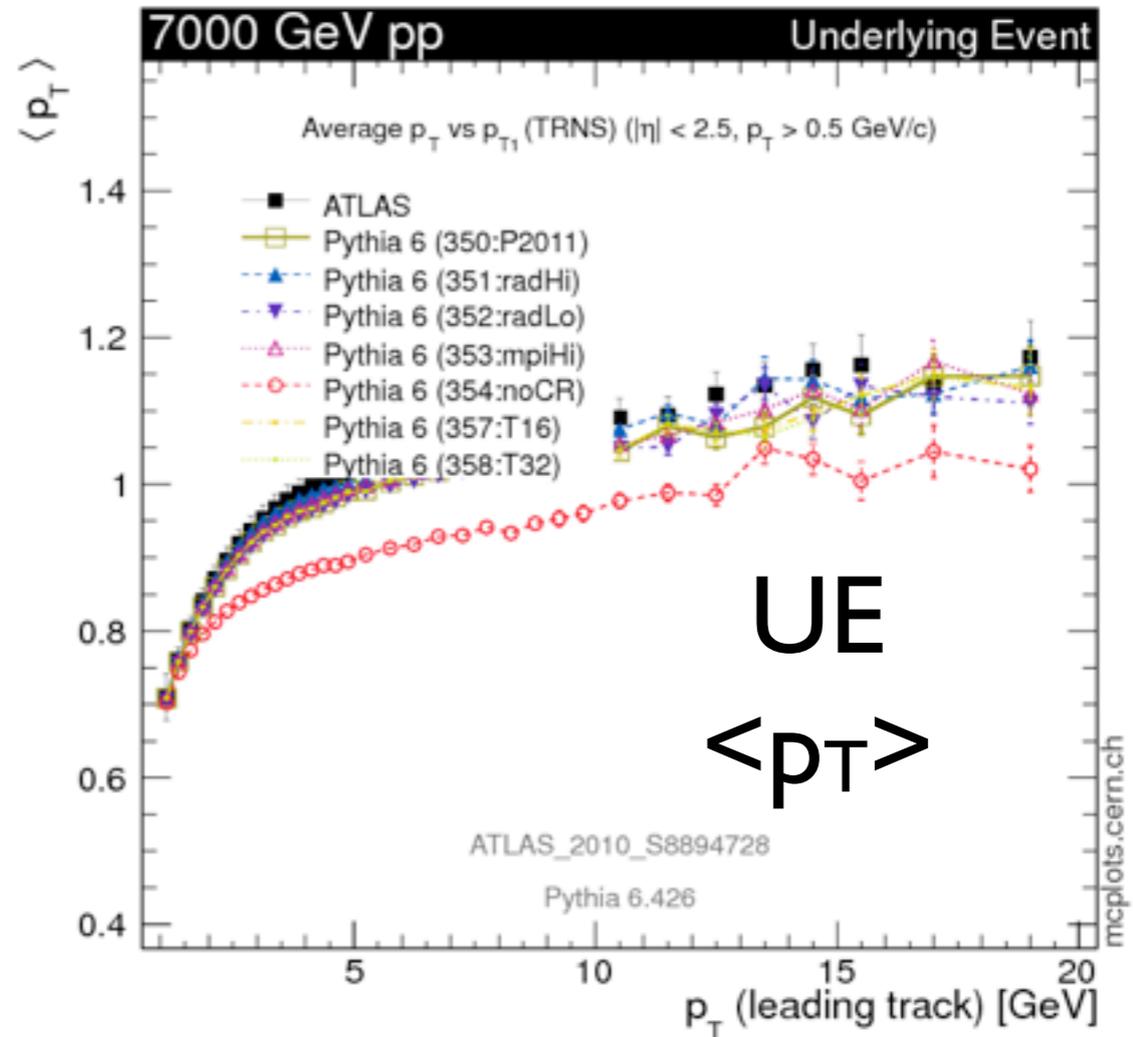


Minimum-Bias : $\langle p_T \rangle(N_{ch})$

Why? (exp)



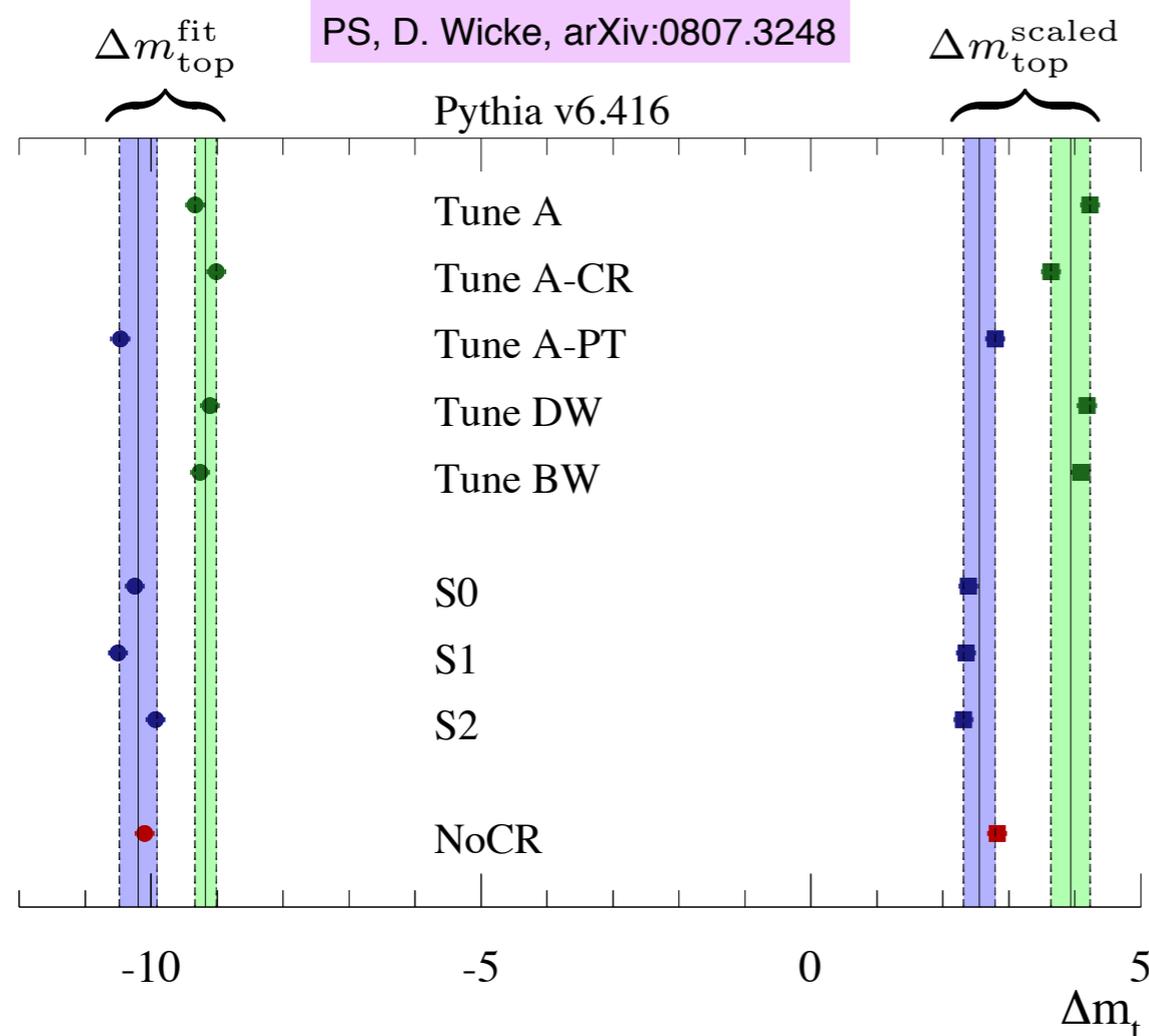
Without CR,
multiplicity grows too fast
with $n_{MPI} \rightarrow$ (too) large tail



UE
 \rightarrow same behavior as in
minimum-bias

Consequences

Naive (pheno-level) top mass study



Differences between **Q**- and **p_T**-ordered shower models ~ 1 GeV

Differences between different CR models within each shower model ~ 0.5 GeV

Repeated by CDF (compared a central tune with a NOCR variant) for full-fledged top mass study \rightarrow similar conclusions $\rightarrow 0.5$ GeV from CR

Warning : is central vs NOCR conservative enough (see plot above)?

On the other hand, expect CR models to overestimate effect in $t\bar{t}$ (no lifetime suppression) and NOCR also somewhat extreme (since it does not agree well with data), so \sim OK?