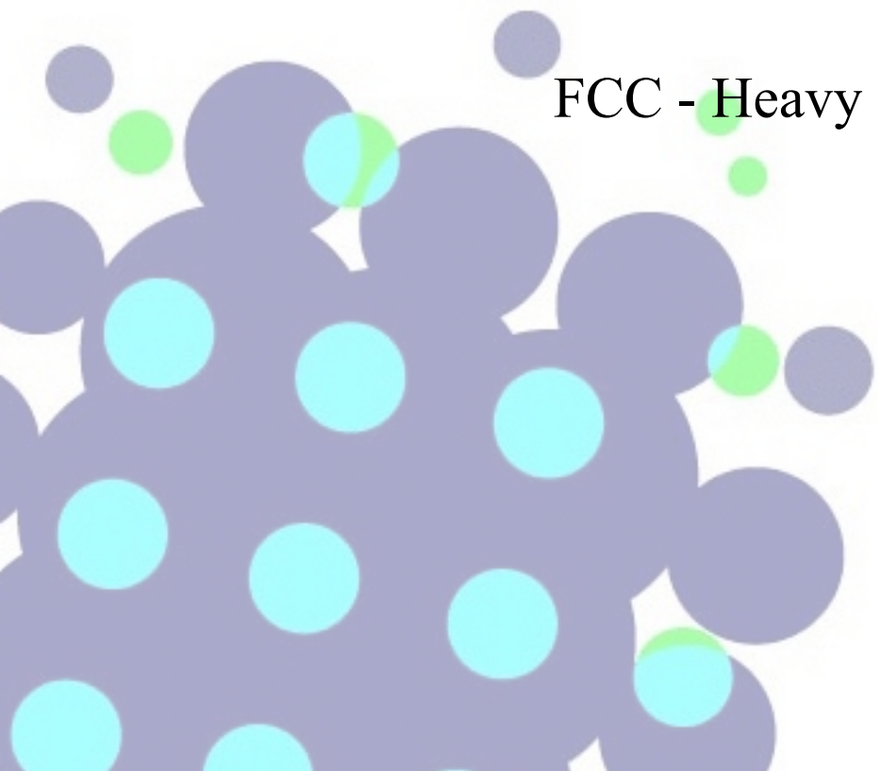
Jet quenching at FCC

Carlos A. Salgado
Universidade de Santiago de Compostela

FCC - Heavy Ions - Informal meeting November 2015 - CERN



@CASSalgado @HotLHC

European Research Council
Established by the European Commission

Outlook

Past workshops

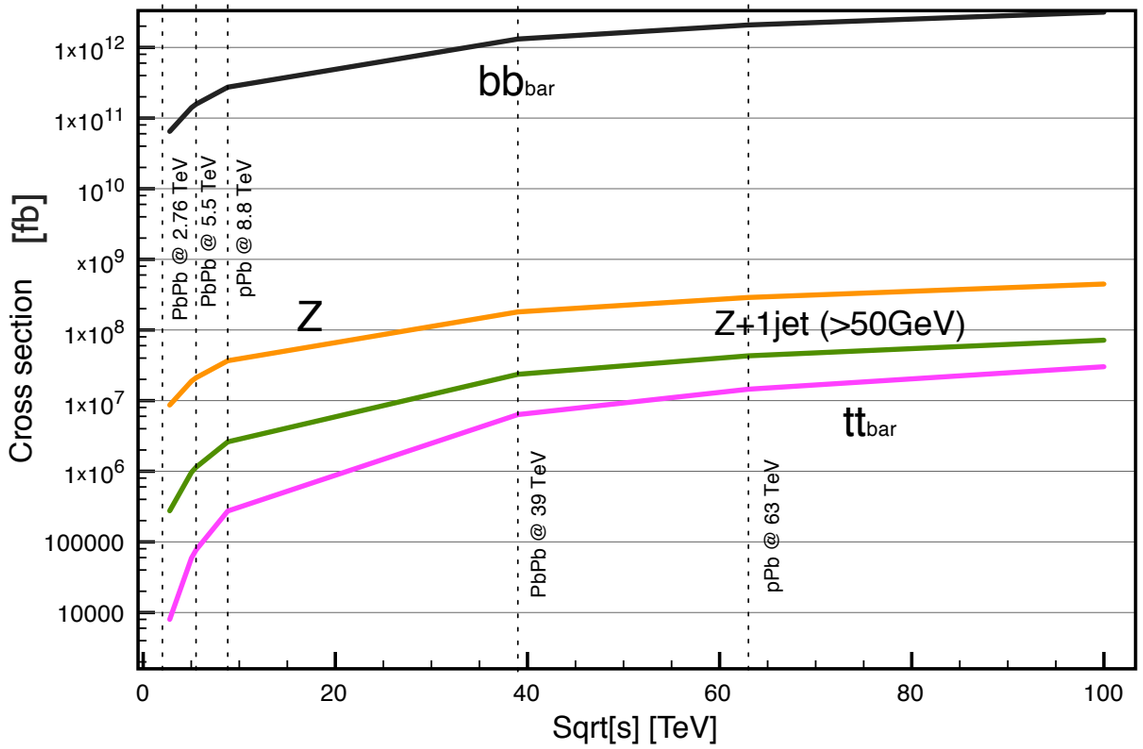
- Discussion on jet quenching (high-pT) limited
- Boosted tops
- Heavy-flavor (mostly soft/semisoft region)
- Cross sections computed for some hard processes

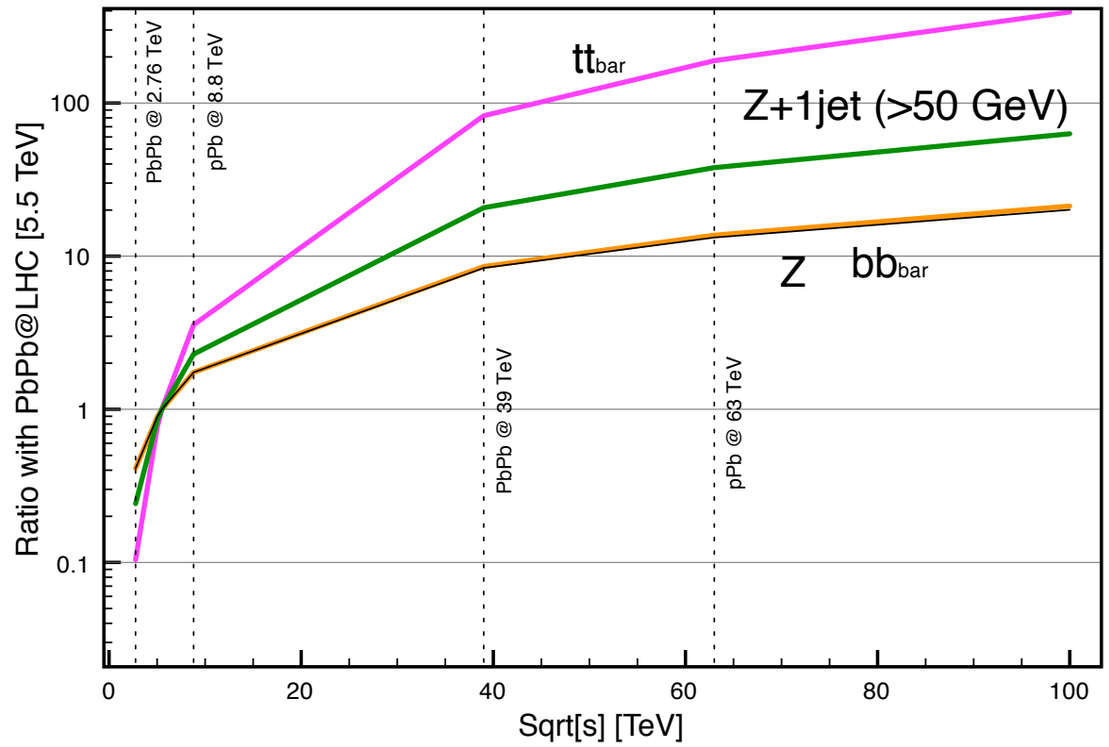
Outline of the chapter (probably sub-section) possibilities

- Present expected yields of some processes (mostly done)
- Present description of the present data — Does not look very interesting
- Description of present understanding of the phenomena
- Main competitive advantages of the FCC
  - **Tops**
  - **Systematics of the jet quenching parameter(s)**
  - **More?**

Cross Sections & Ratios to 5.5TeV

CAS - FCC meeting January 2014





All calculations for pp collisions, computed with MCFM

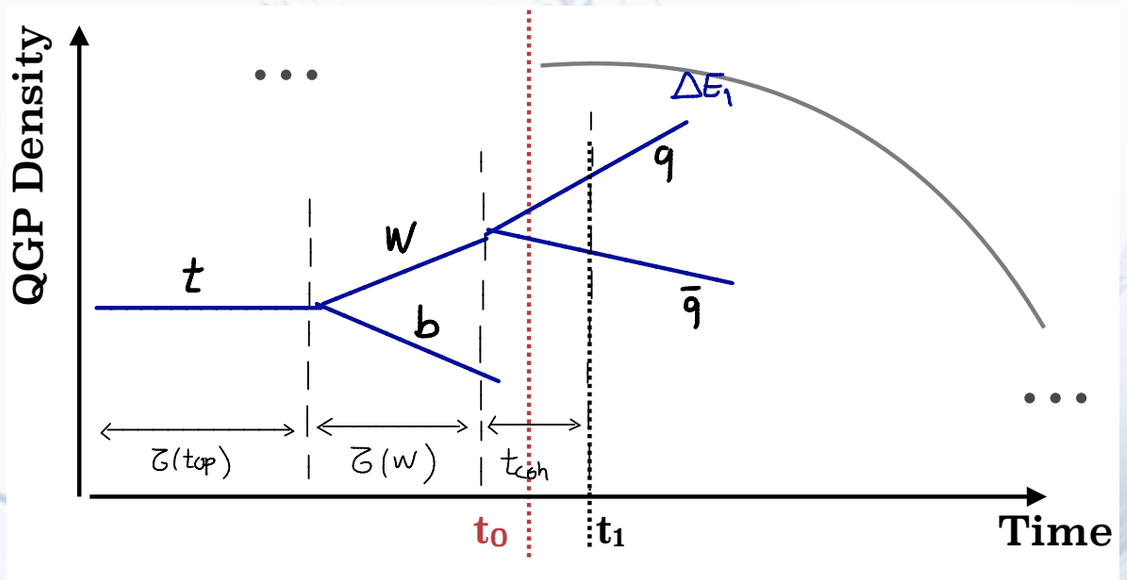
- *Large enhancements for larger masses*
- *80x for ttbar; 40x for Z+1jet (pt>50 GeV); 20x for bbar or Z*

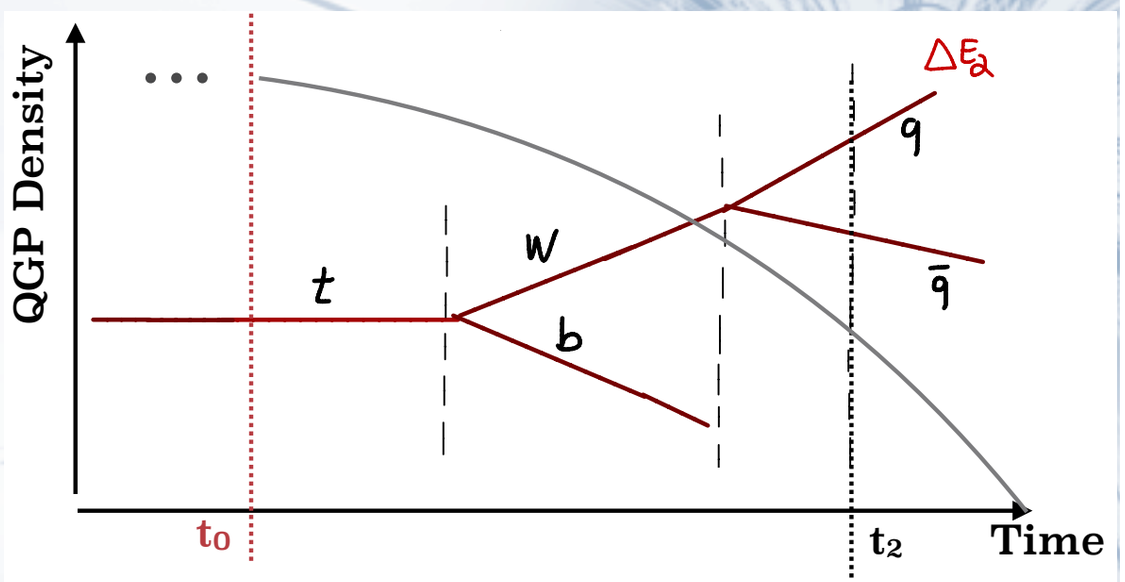
Boosted tops

[Liliana Apolinario]

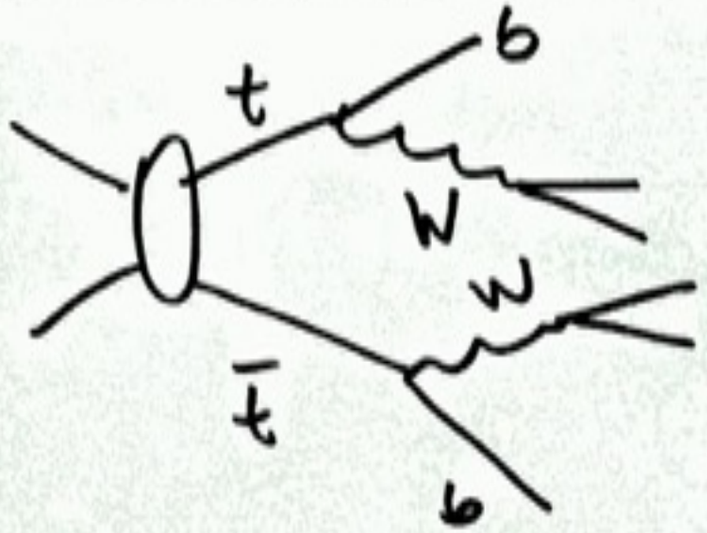
Introduction

- **Boosted tops may be used for a two-fold purpose:**
  - Study the time structure of the medium;
  - Investigate coherence/ decoherence jet quenching phenomena.
- **How?**
  - Using source of QCD particles that is delayed in time (top & W decay times)
  - Exploiting the fact that the onset of radiation is also delayed in time (coherence time)





The tops & the W's



BOOST: $\frac{P_T}{M}$

Andrea's estimate $L \sim 1\,\text{fm}\cdot P_T[\text{TeV}]$

Take: $P_T \simeq 0.5$ TeV $\Rightarrow \frac{P_T}{M} \sim \frac{1}{3}$

0 fm/c $t\bar{t}$ produced

~ 0.5 fm/c each $t \to Wb$

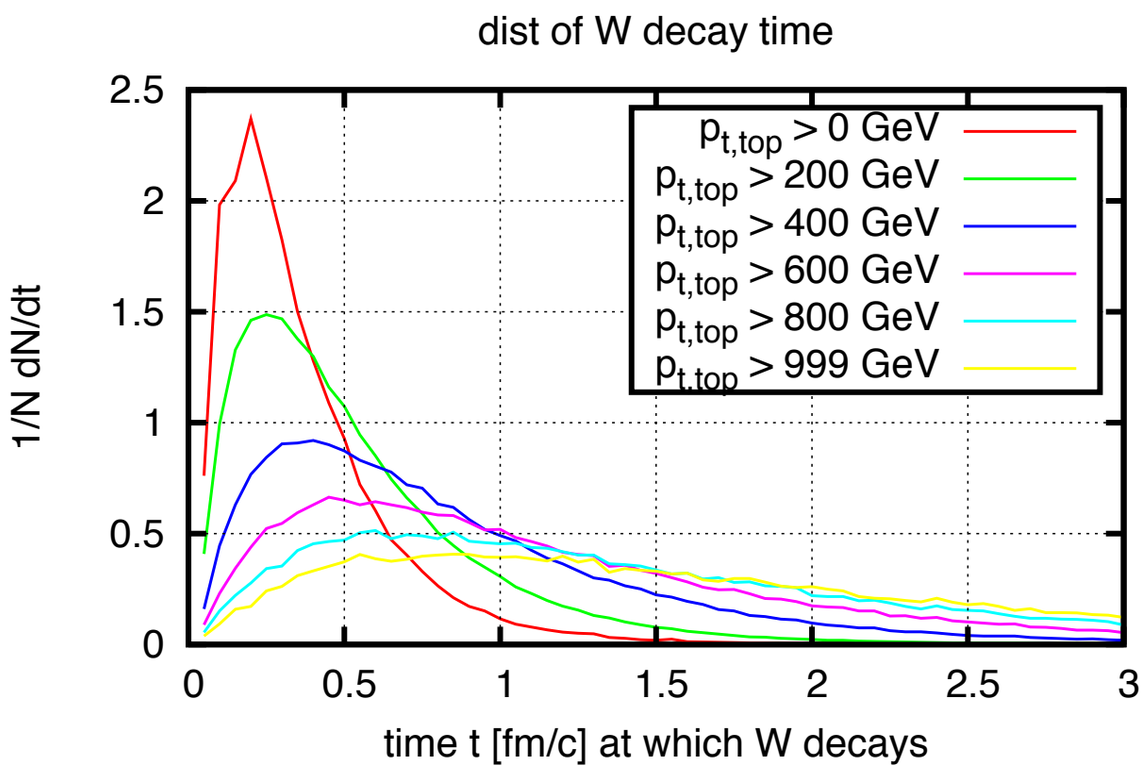
~ 0.8 fm/c W decay

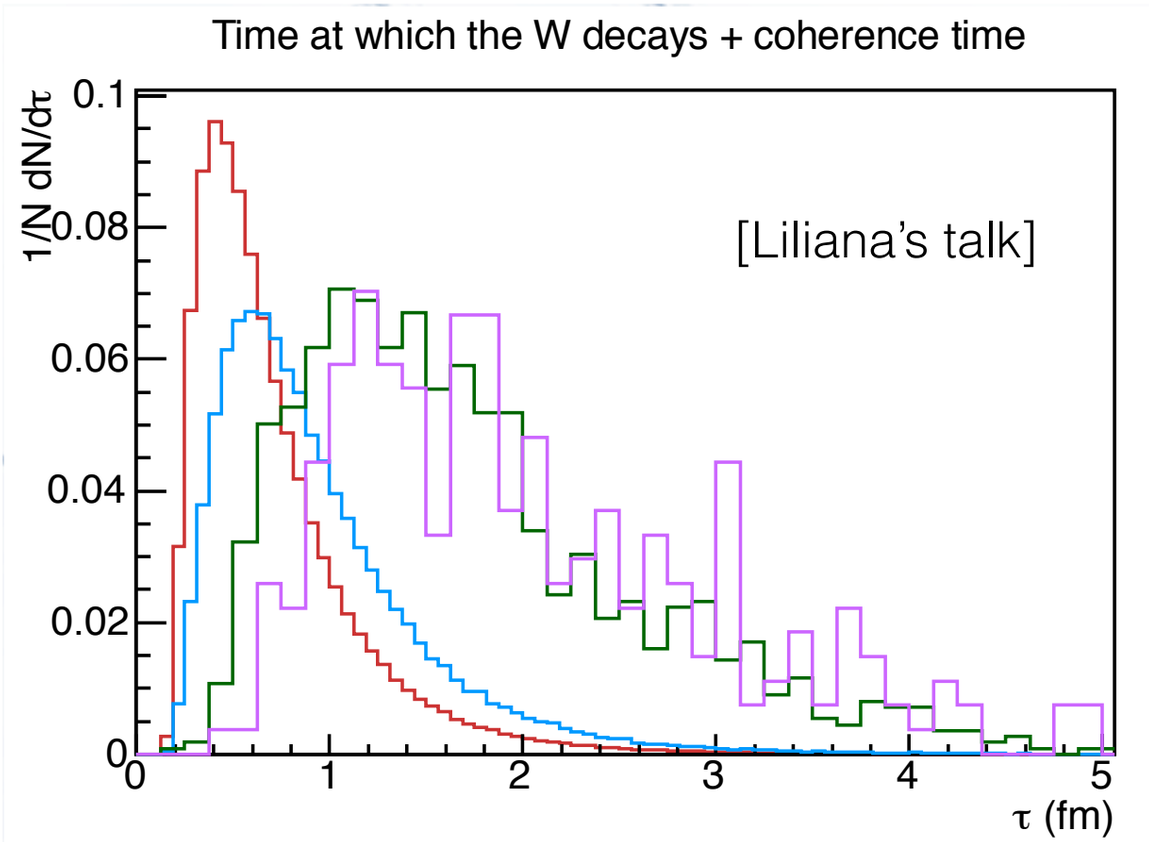
$\longrightarrow$ Take hadronic decay for one of them

$$t_{min} \sim \left[\frac{12}{\hat{q}\,\theta^2_{q\bar{q}}}\right]^{1/3} \simeq 0.5\,\text{fm} \Rightarrow$$

1.8 fm $W \to q\bar{q}$ rest

Effects of the boost



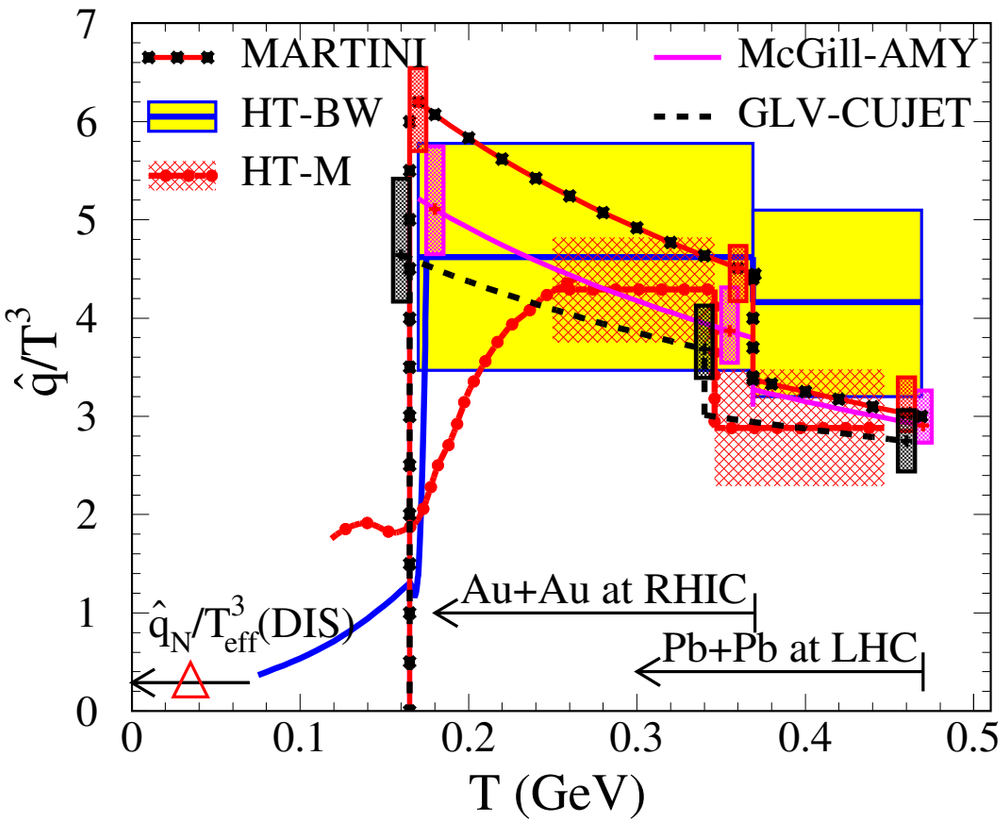


Extraction of the value of qhat

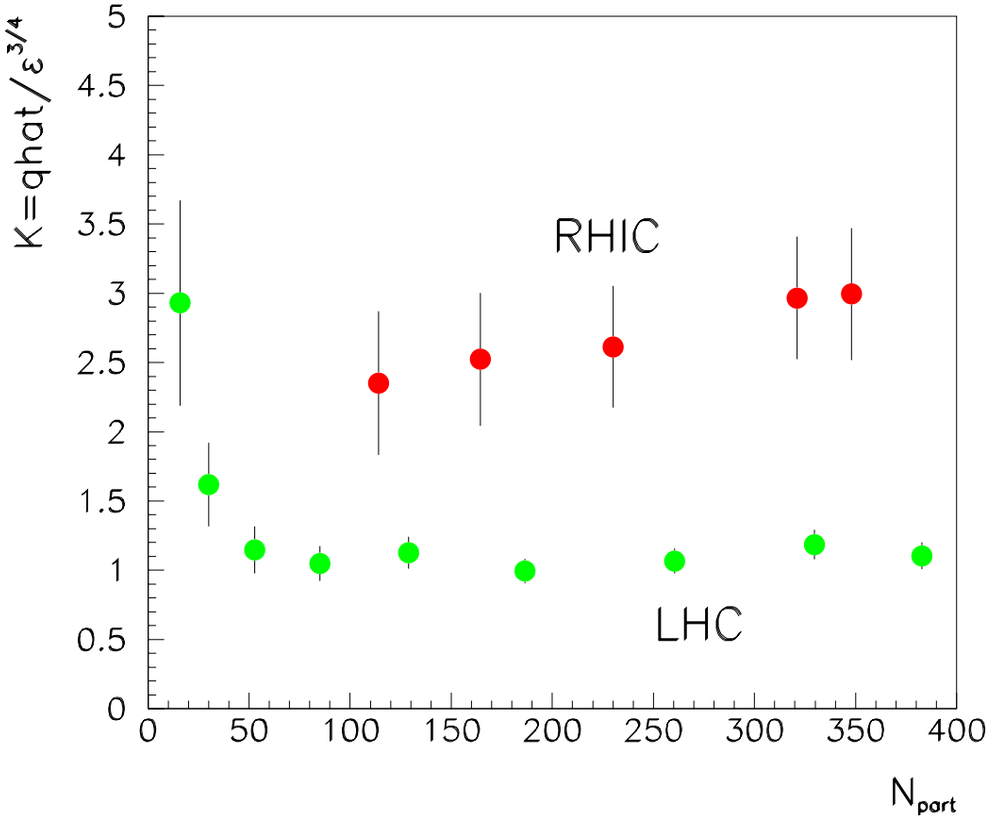
Do we understand the dependences of the qhat parameter?

- In terms of temperature, etc

$$\hat{q}_{\rm ideal} \simeq 2\epsilon^{3/4}$$



Jet Collaboration



[Andres, Armesto, Luzum, Salgado, Zhu, in preparation]

Taken at face value: why K depends only on collision center of mass energy?

- Needs clarification - FCC lever arm in temperature helpful

Outlook

Past workshops

- Discussion on jet quenching (high-pT) limited
- Boosted tops
- Heavy-flavor (mostly soft/semisoft region)
- Cross sections computed for some hard processes

Outline of the chapter (probably sub-section) possibilities

- Present expected yields of some processes (mostly done)
- Present description of the data — Does not look very interesting
- Description of present understanding of the phenomena
- Main competitive advantages of the FCC
  - **Tops**
  - **Systematics of the jet quenching parameter(s)**
  - **More?**