Jet quenching: the interface between theory and experiment
CERN, February 11th-15th 2013

Introductory remarks to Session II - *Characterizing jet quenching: experimental issues*, *12.02.2013*

Néstor Armesto
Departamento de Física de Partículas and IGFAE
Universidade de Santiago de Compostela
nestor.armesto@usc.es

Contents:

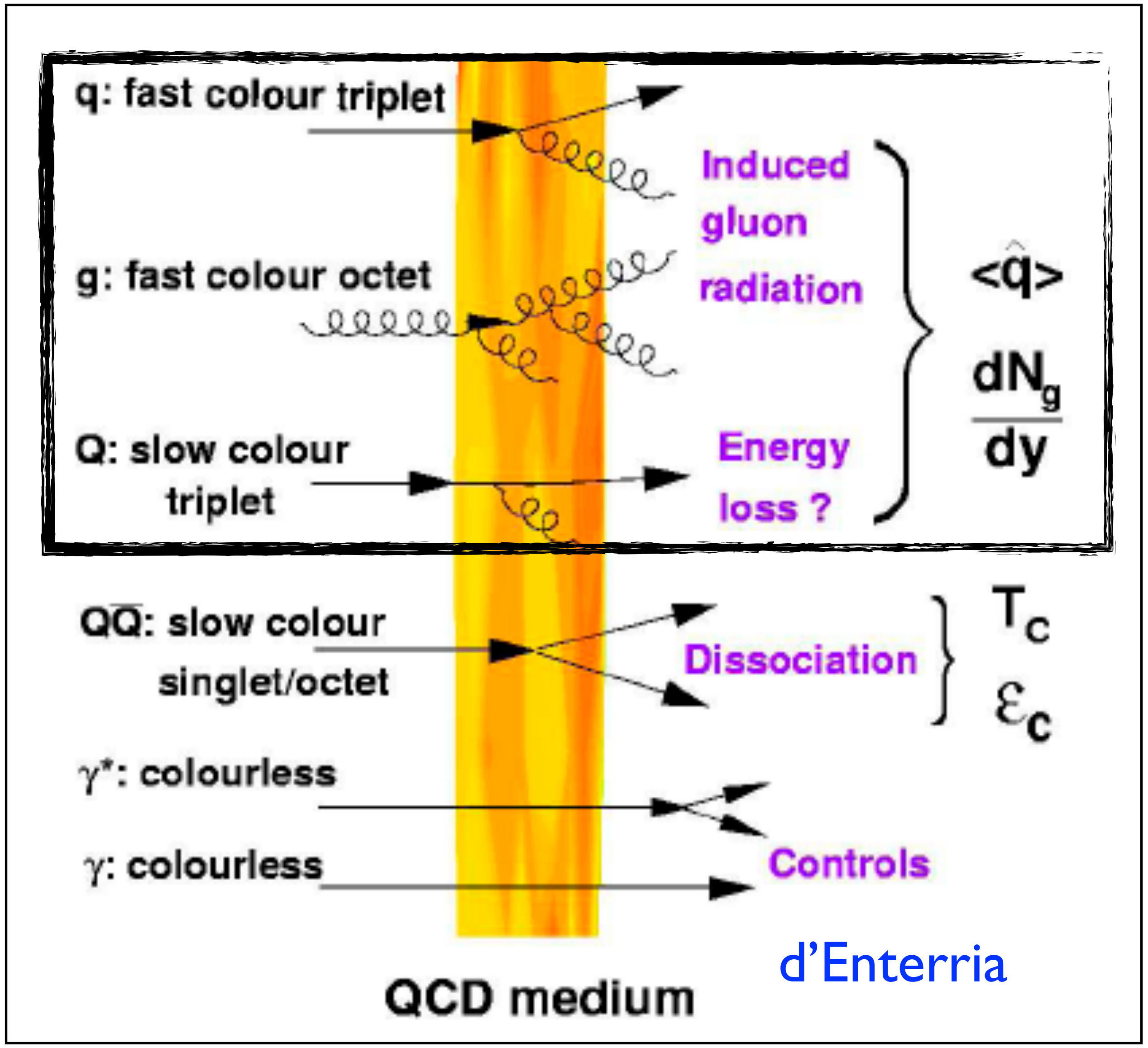
15:00 ***Introductory remarks***, Nestor Armesto.

15:20 ***Jet reconstruction and corrections in ALICE***, Marta Verweij.

15:40 ***TBA for ATLAS***, ATLAS speaker.

16:00 ***Jet Reconstruction and Underlying Event treatment in CMS***, Yetkin Yilmaz.

16:20-18:00 ***Discussion***.



Theoretician point-of-view: I hope it matches the wishes of the organizers ;-))).

The problem from phenomenology:

➜ Observables at particle level are 'easily' treated in phenomenology:

compute pp events with quenching in your model

$$R_{AA}(\eta, p_T) = \frac{dN_{AA}/d\eta dp_T}{\langle N_{coll}\rangle dN_{pp}/d\eta dp_T}$$

assume control on geometry/dynamics

compute pp events without quenching

➜ In this way, we have gone far. BUT we do not know the energy of the radiating parton:

→ We may select hadrons with particular radiation/hadronization: trigger bias.

→ We need control on the partonic spectra: benchmark.

→ We have only information on the leading (+subleading) particle.

→ We may select specific geometries: surface bias.

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⇒ JETS

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Jets: contributions and problems

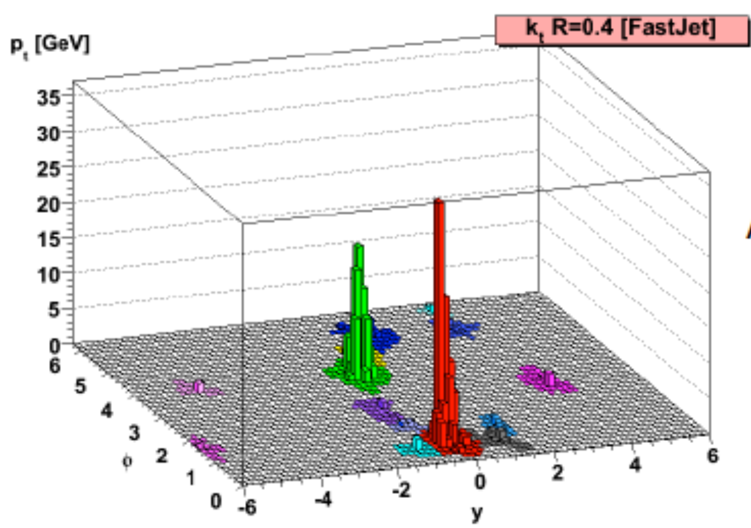
➜ Take a jet of radius R:

$$\langle p_{Tjet} - p_{Tparton} \rangle = \langle \delta p_T \rangle = a p_T \alpha_s \ln R - b \frac{1}{R} + c R^2$$

perturbative radiation, affected by medium

non-perturbative contribution, affected by medium?

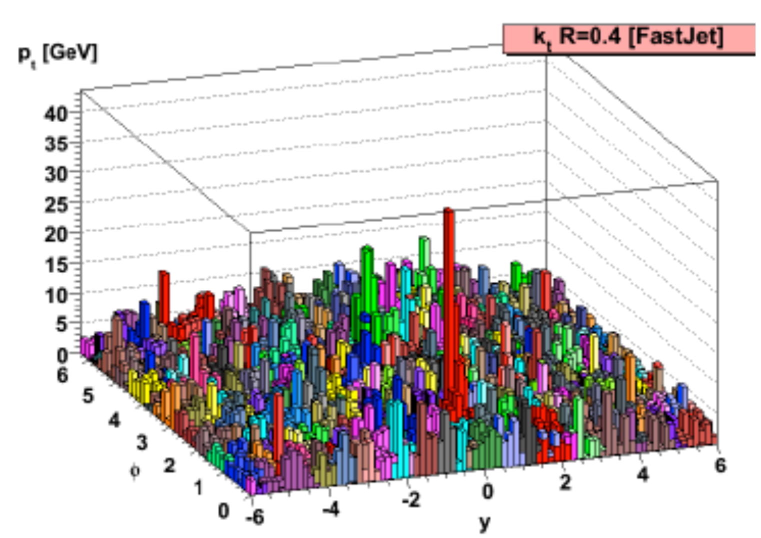
underlying event, pileup⇒subtraction, affected by medium?

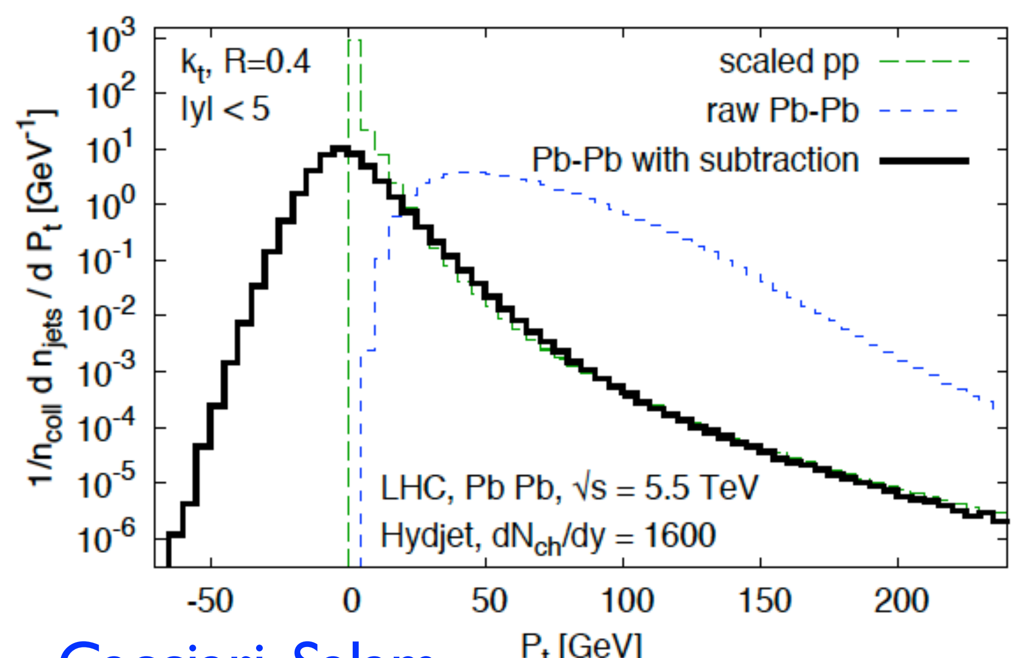


An example hard event

$p_t \sim 100$ GeV
Generated with Pythia

Mixed into LHC HI environment
HydJet, $dN_{ch}/dy \simeq 1600$





Cacciari, Salam

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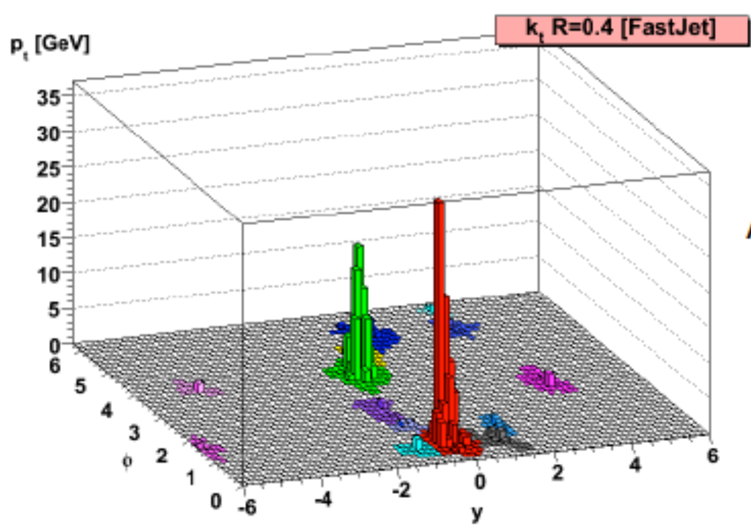
We aim to do this, at least for for scales much larger than T.



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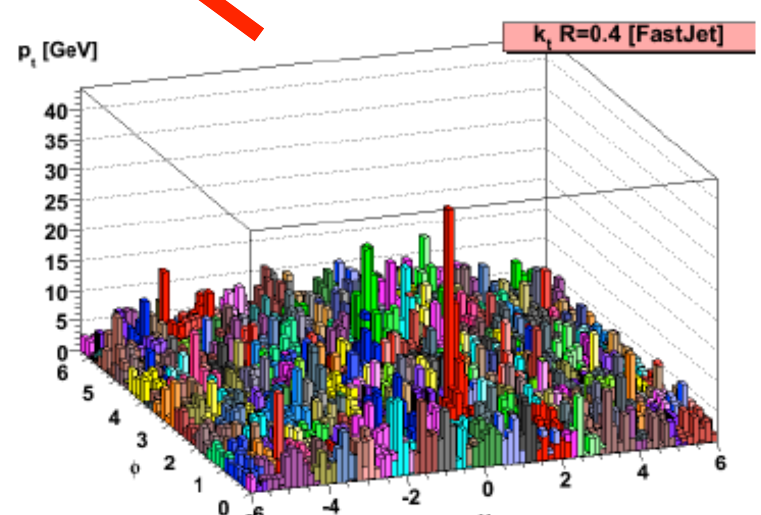

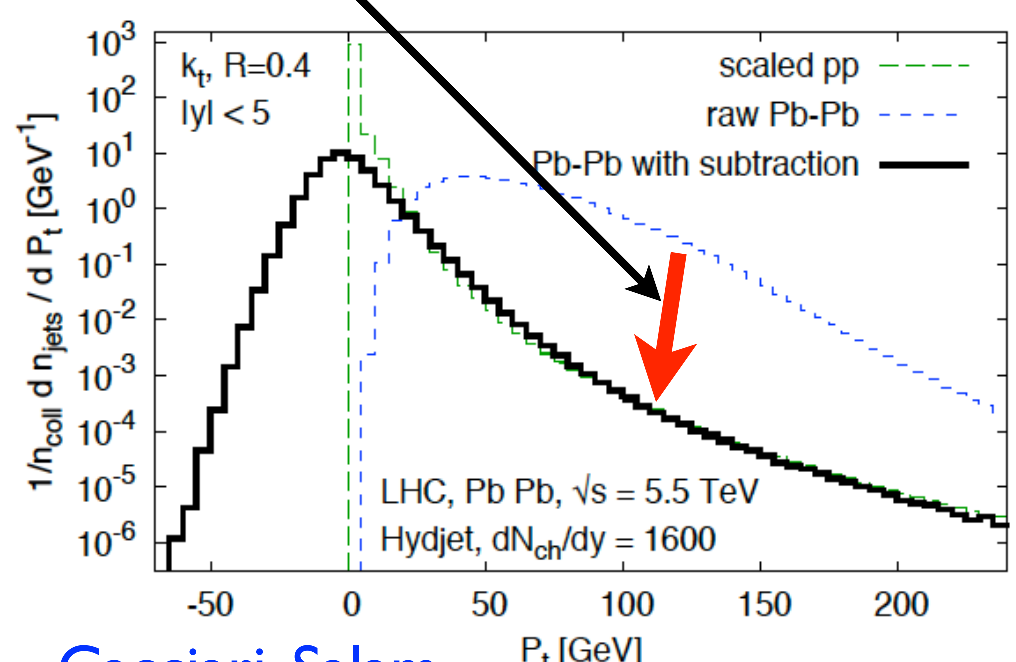

Cacciari, Salam

Jets and background subtraction:

➜ Ideally, one wants to use the same strategy employed for particles: compare quenched and non-quenched pp events.

➜ This **assumes** that background subtraction has removed all effects of the background on the jet (at least, for large enough scales) - leaving, at most, a flat pedestal.

➜ Several studies (Cacciari-Salam-Soyez, see Liliana's talk tomorrow) challenge this assumption: fluctuations may affect different observables, mimicking/disturbing true medium effects.

➜ Each collaboration has a different detector and uses a different method - which is GOOD.

➜ We need to understand how they do in order to achieve a meaningful comparison between model and experimental results, so we can achieve a trustable, precise medium characterization.

Jets and background subtraction:

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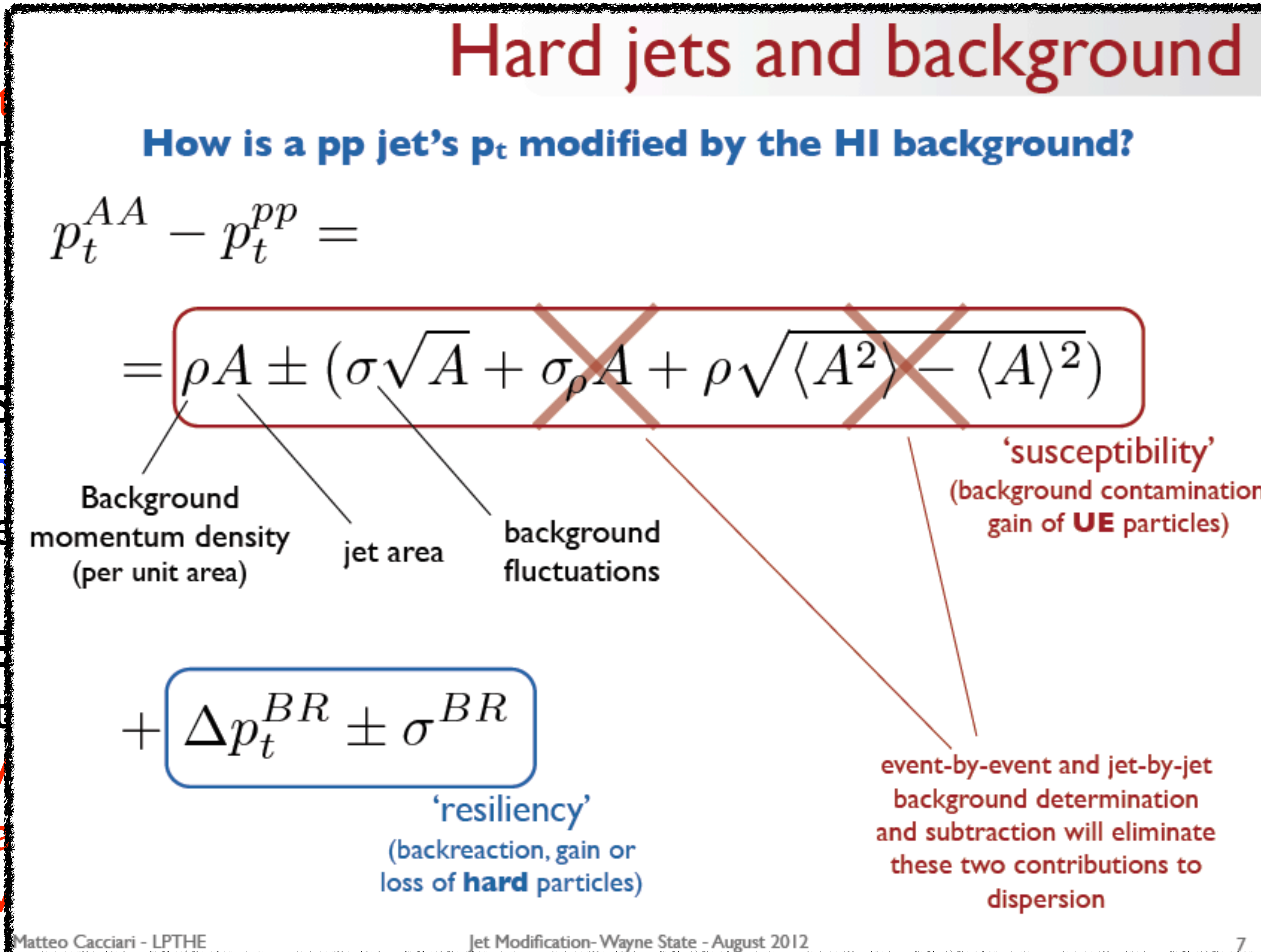

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To discuss (I):

➜ **Jet definition**: can we agree in a common jet definition in terms of algorithm (with radius and merging scheme) and particle content à la Les Houches accords? That could be the same in pp, pPb and PbPb? This would be most useful for comparison and would simplify life for theoreticians.

➜ **Options for model/data comparison:**

(a) Should we theoreticians simply provide the quenching code to the experiments and they extract the medium parameters running it?;

(b) can we do it ourselves with some model background?;

(c) both?

To discuss (I):

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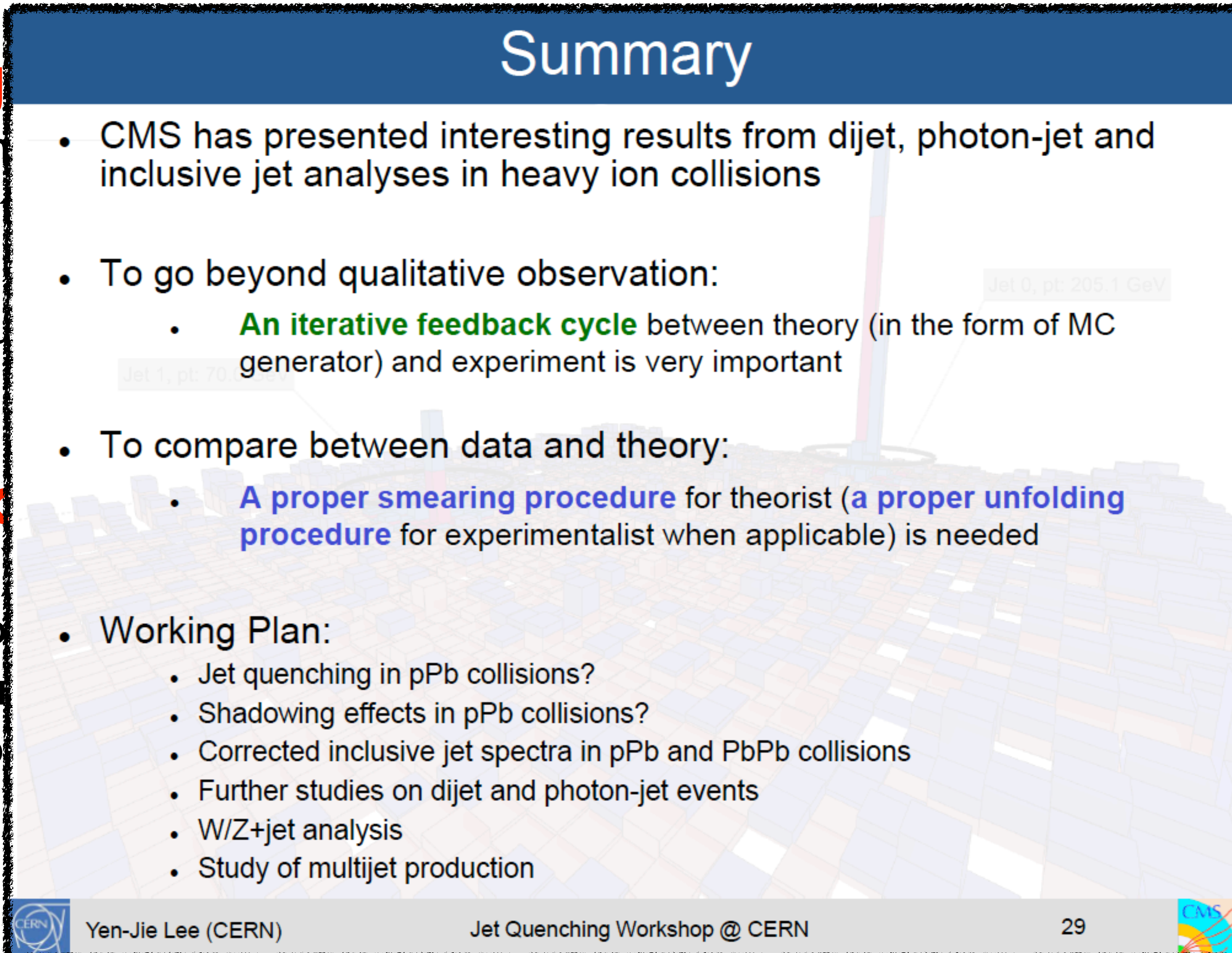

To discuss (II):

➜ **If (b), (c)**: how can we validate our background? Would it be possible that all collaborations, irrespective of how they finally do the subtraction/reconstruction, provide some numbers (for example, ρ, σ_{jets} as provided by some fixed version of FastJet) that we can use to validate our model for the background? Can we agree in some common cuts e.g. max{p_{Tmin}} for charged, so we can compare?

➜ Could response matrices for detector (+background?) smearing, be provided?

➜ **Which observables look more promising for extracting medium parameters i.e. which ones are those for which background effect seems smaller? How should be proceed to propose new ones?**

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Jet reconstruction

HYDJET **simulations**		ρ (GeV) (y=0, 0-10%)	σ (GeV)	σ_ρ (GeV)	σ_{jet} (GeV) (anti-kt, R=0.4)
LHC 2.76 TeV	all	250	**18**	36	**16**
	charged only	147	**12.5**	22	**11.3**

Data LHC 2.76 TeV	ρ (GeV) (y=0, 0-10%)	σ (GeV)	σ_ρ (GeV)	σ_{jet} (GeV) (anti-kt, R=0.4)
ALICE, charged only 1201.2423	138		18.5	**11.2**
CMS 1205.0206				**5.2** (R=0.3 + NR)
ATLAS 1208.1967				**12.5**

Only background-induced component, no calorimeter effects

While σ_{jet} is of course ultimately the only relevant number, it would be nice to have all the others too from the experiments, for comparison and cross-checks

I'd be most happy if I could fill in the blanks at this workshop

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