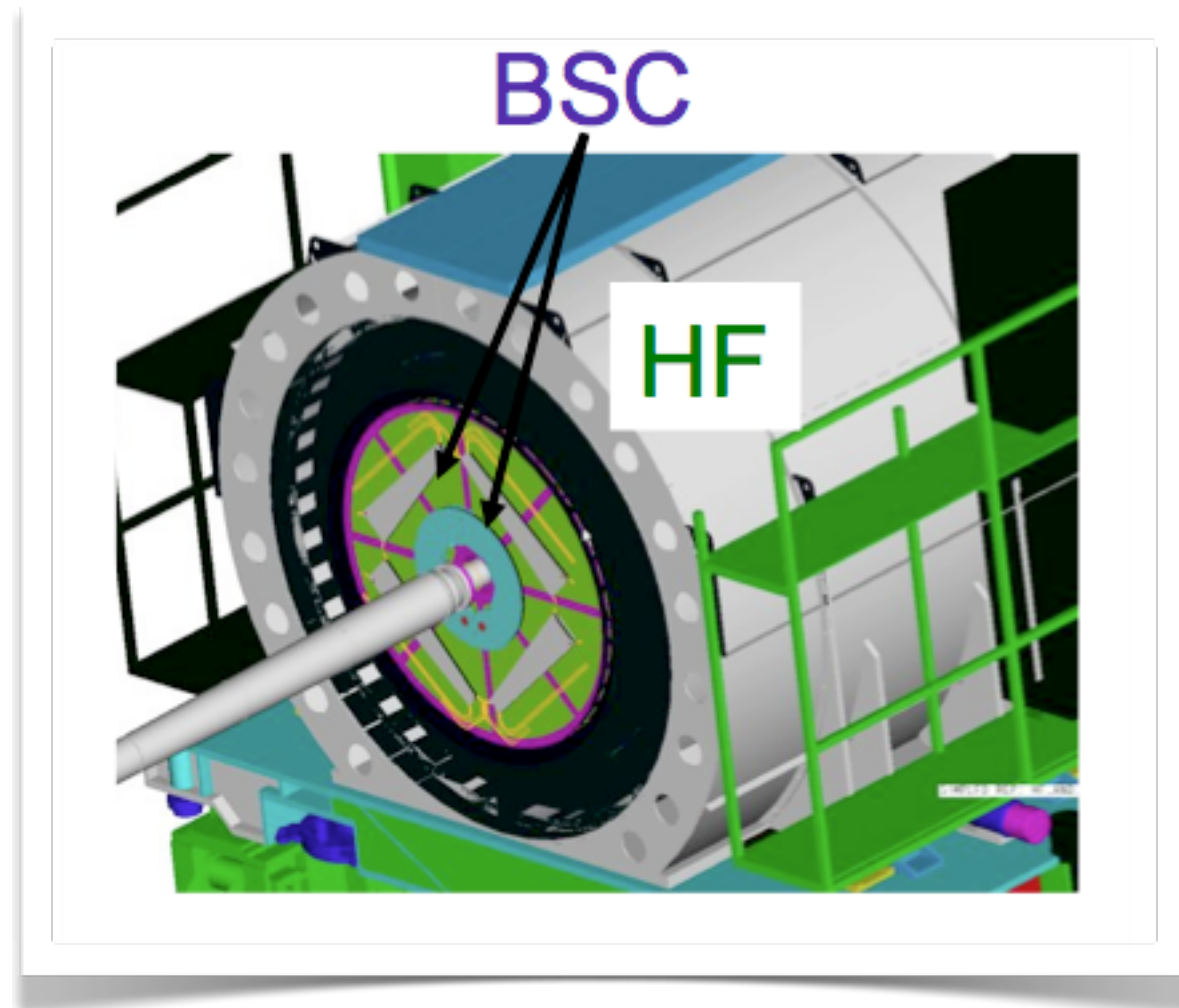# Results on minimum bias from CMS

- generals …

- charged particle spectra

- forward energy flow

- Underlying event studies

Montag, 17. Mai 2010

Triggers

Trigger

- Single hit in Beam Scintillator Counter
- in time with both beams crossing interaction point: Beam Pickups (BPTX)

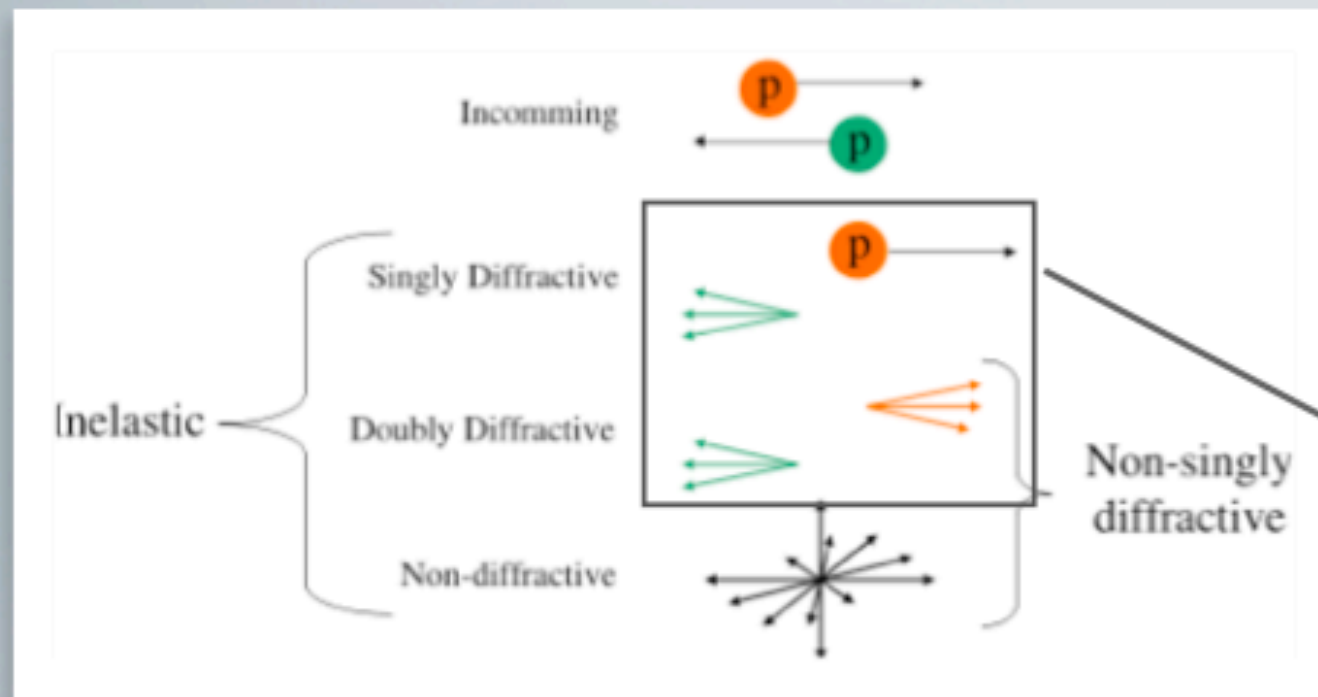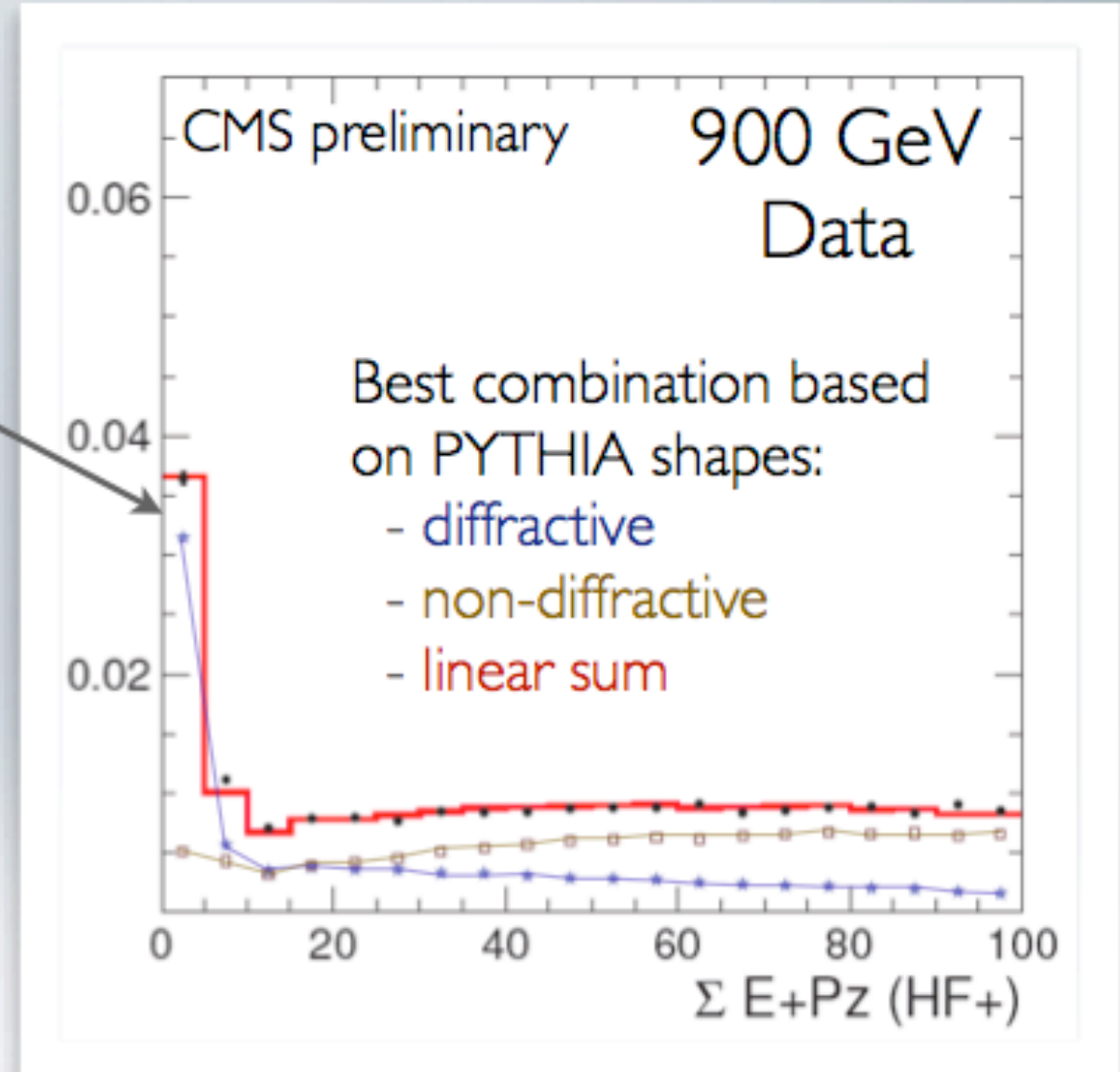$$\text{BSC:} \quad 3.23 < |\eta| < 4.65$$
$$\text{HF:} \quad 2.9 < |\eta| < 5.2$$

Diffractive Component

E. Wenger, MB&UE WG, March 1, 2010

HF calorimeter energy distribution in data used to constrain SD+DD fraction using PYTHIA (PHOJET) event shapes.

Selection Efficiency:
NSD: ~86%
SD: ~19%
DD: ~34%

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Charged Hadrons

A. De Roeck, LHCC Open Session, May 5, 2010

p_T and η distributions of charged hadrons at √s = 7 TeV

- Similar analysis as in the CMS paper JHEP 02 (2010) 041
- Minimum bias selection using BSC trigger.
- Three methods used: tracks, tracklets and pixel clusters
- Results corrected to Non–Single Diffractive cross section.
- Diffraction controlled via forward activity measurements in CMS
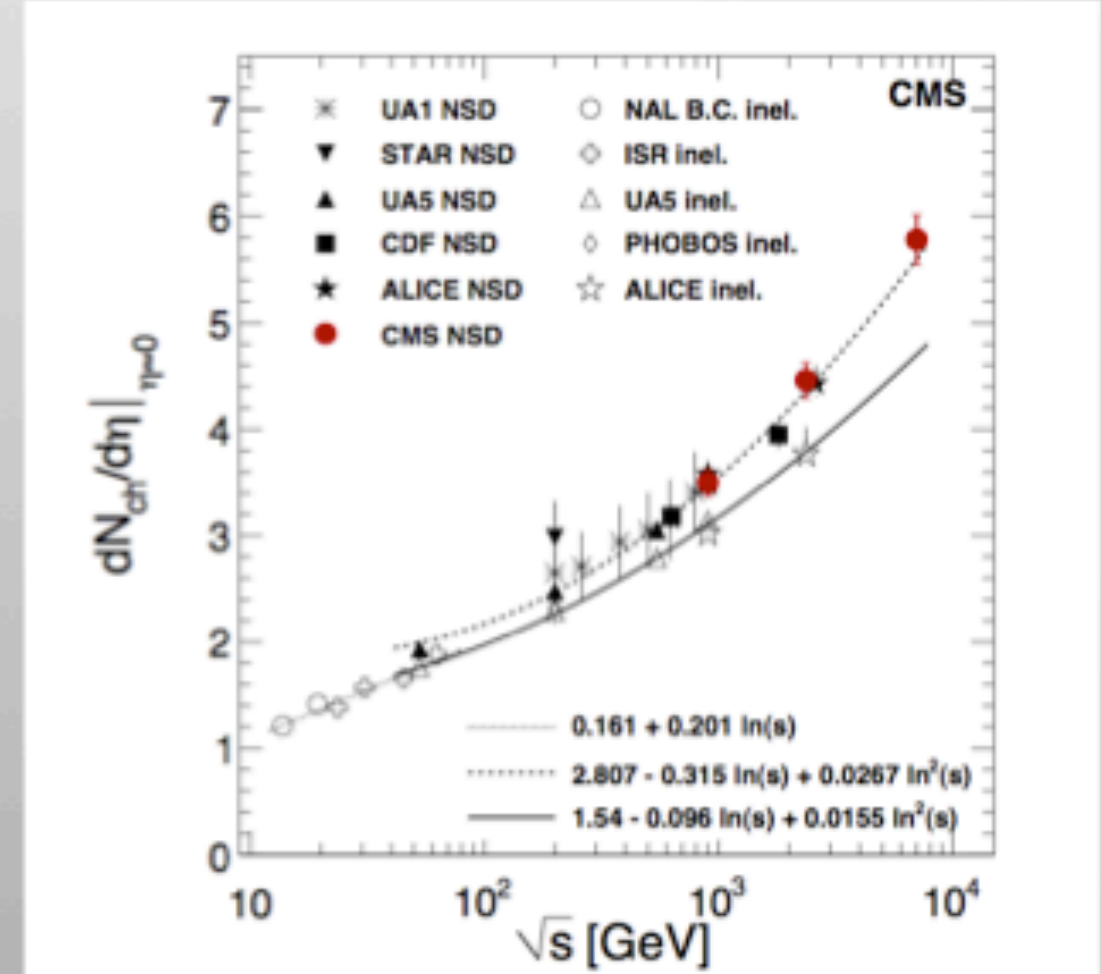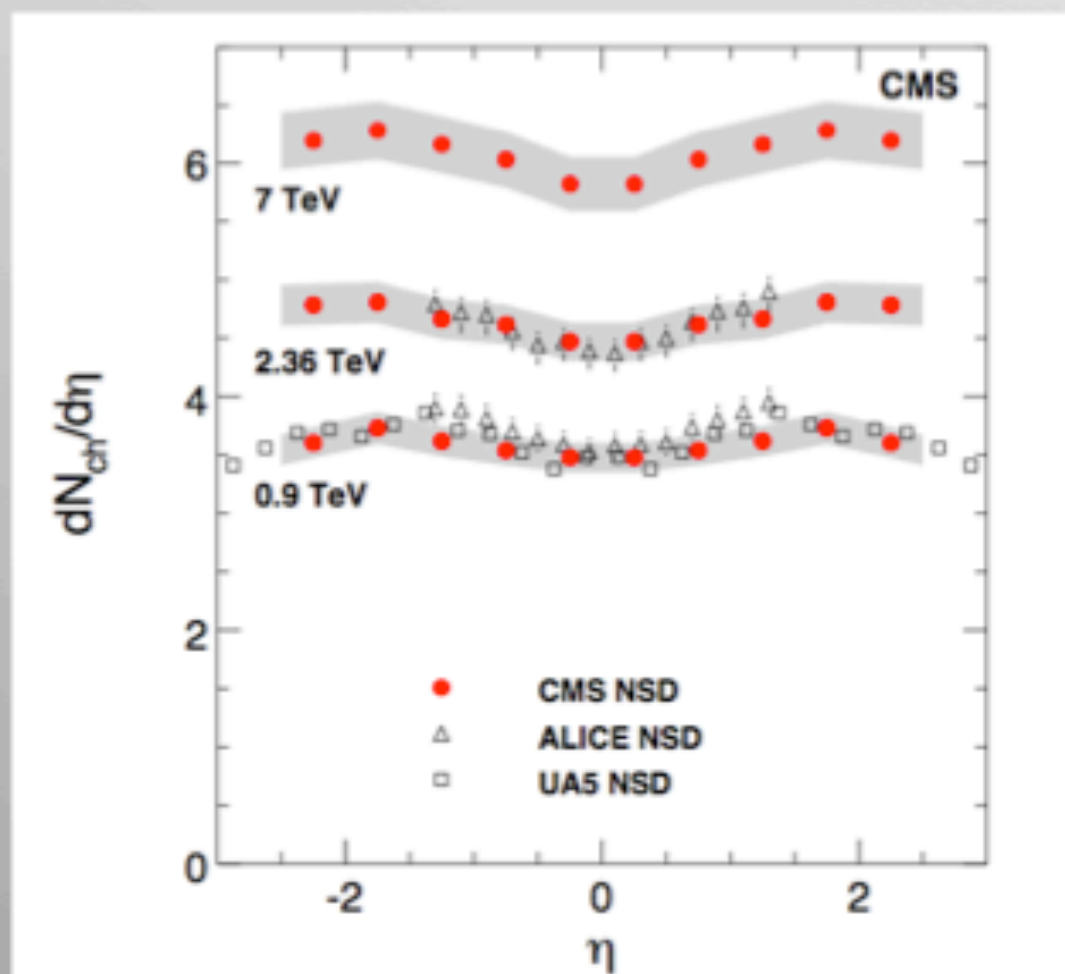
Strong rise of the particle density at 7 TeV

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details of selection

- Primary charged hadrons are defined as all charged hadrons produced in the interactions, including the products of strong and electromagnetic decays, but excluding products of weak decays and hadrons originating from secondary interactions.
- Tracks with $|\eta| < 2.4$ and $pT > 0.1$ GeV/c were used for the measurement of dNch/dpT.
- multiplicity densities are measured for inelastic non-single-diffractive (NSD) interactions to minimize the model dependence of the necessary corrections for the event selection, and to enable a comparison with earlier experiments. The event selection was therefore designed to retain a large fraction of inelastic double-diffractive (DD) and non-diffractive (ND) events, while rejecting all elastic and most single-diffractive dissociation (SD) events.
- To select NSD events, a coincidence of at least one HF calorimeter tower with more than 3 GeV total energy on each of the positive and negative sides of the HF was required.
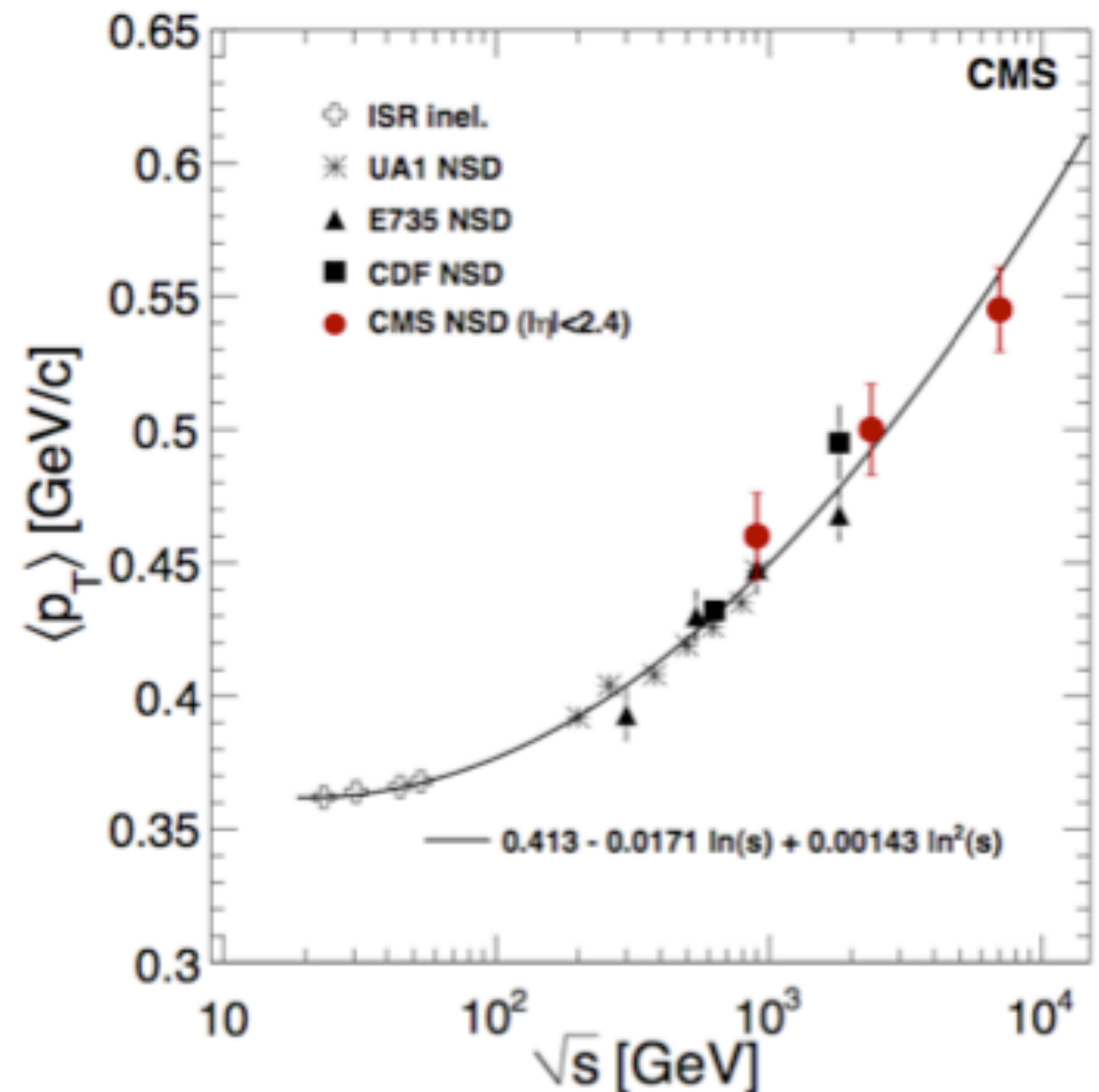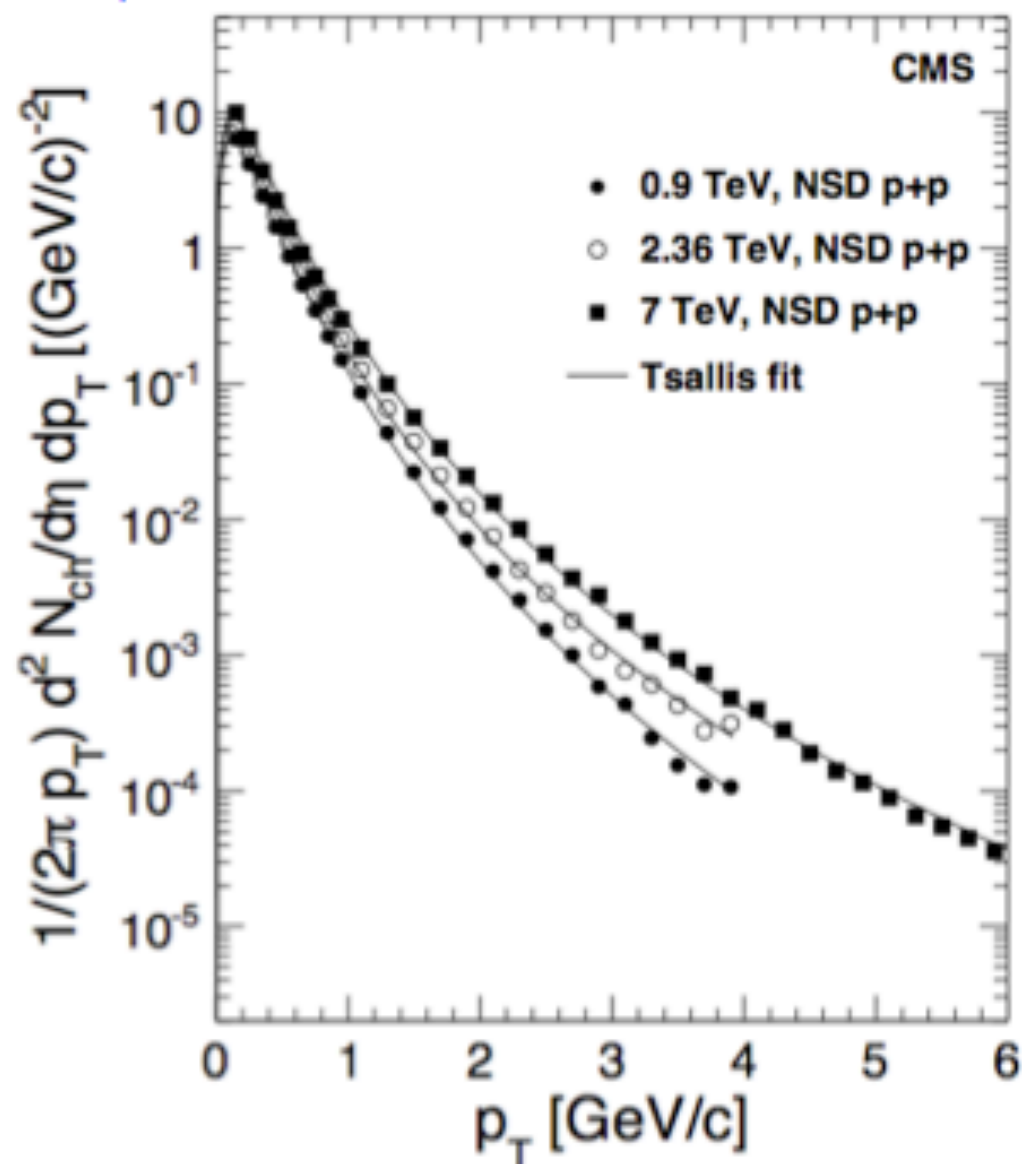
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Charged Hadrons

p_T and $<p_T>$ distributions of charged hadrons at $\sqrt{s}$ = 7 TeV

P_T measurements down to 100 MeV/c
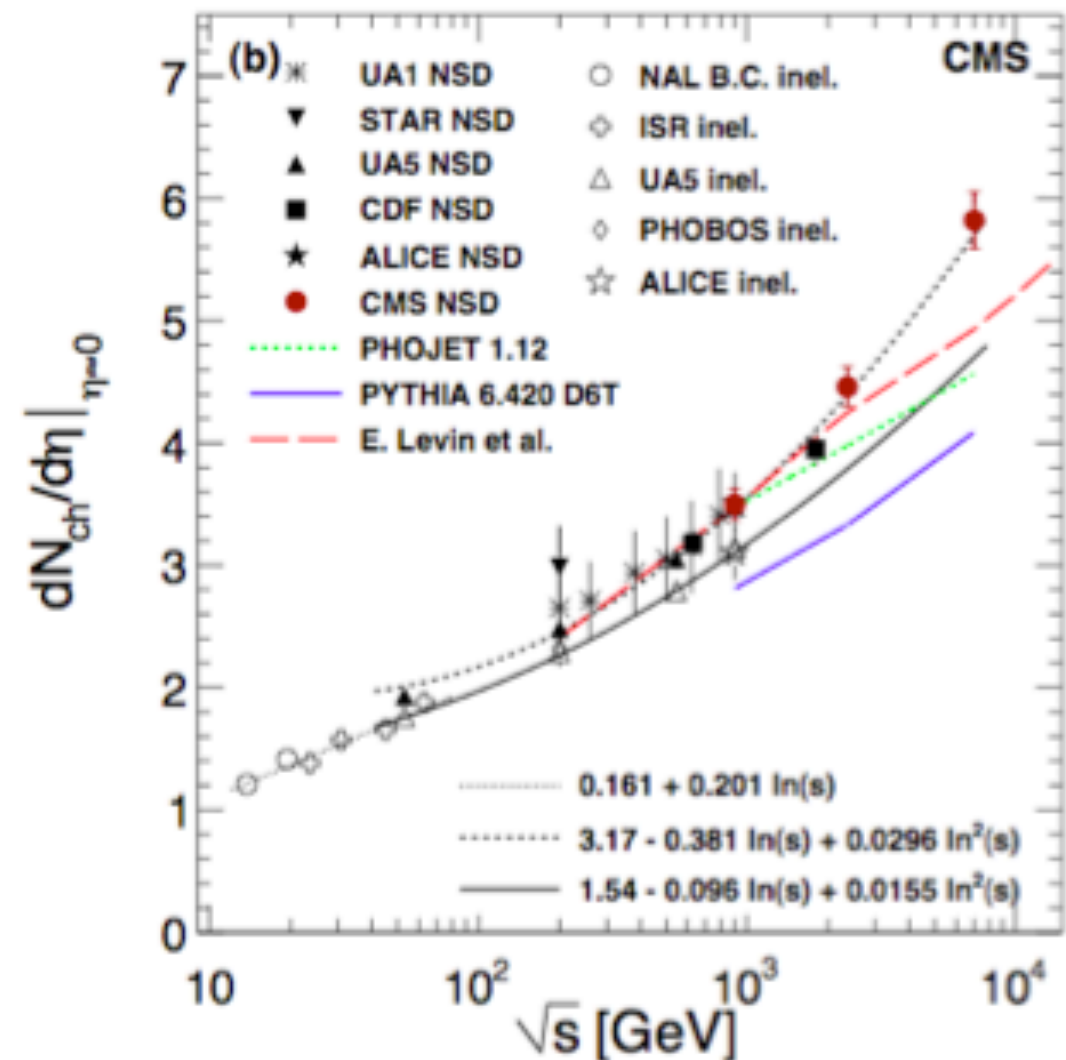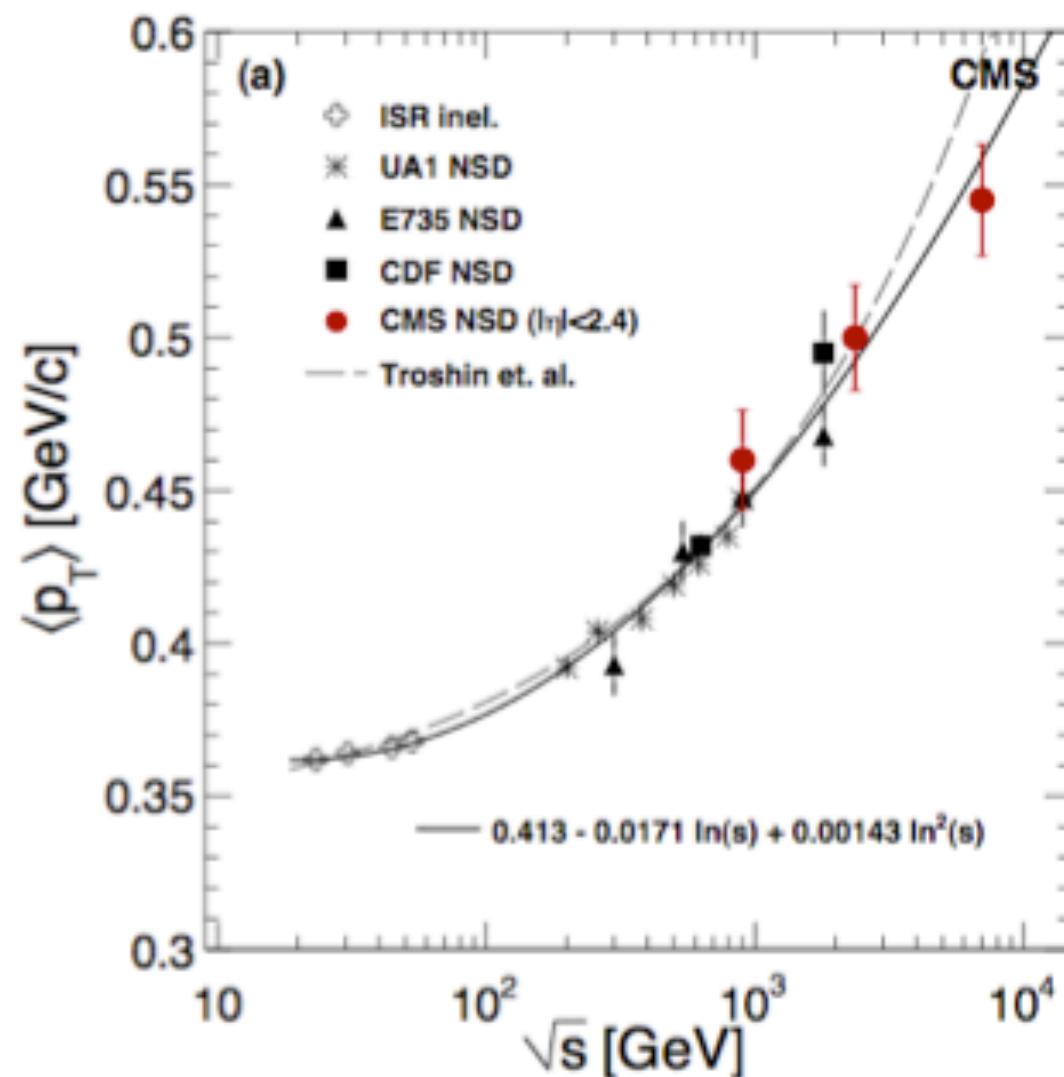

Paper now in final stage of the approval process

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Charged Hadrons

<p_T> distribution and η density of charged hadrons at √s = 7 TeV

Comparison with recent model predictions

Rise of dN/dη in data stronger than currently used models

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Forward Energy Flow

- MinBias event selection

- Ratio of the energy flow at different energies

$$R_{Eflow}^{\sqrt{s}_1, \sqrt{s}_2} = \frac{\frac{1}{N_{\sqrt{s}_1}} \frac{\Delta E_{\sqrt{s}_1}}{\Delta \eta}}{\frac{1}{N_{\sqrt{s}_2}} \frac{\Delta E_{\sqrt{s}_2}}{\Delta \eta}}$$
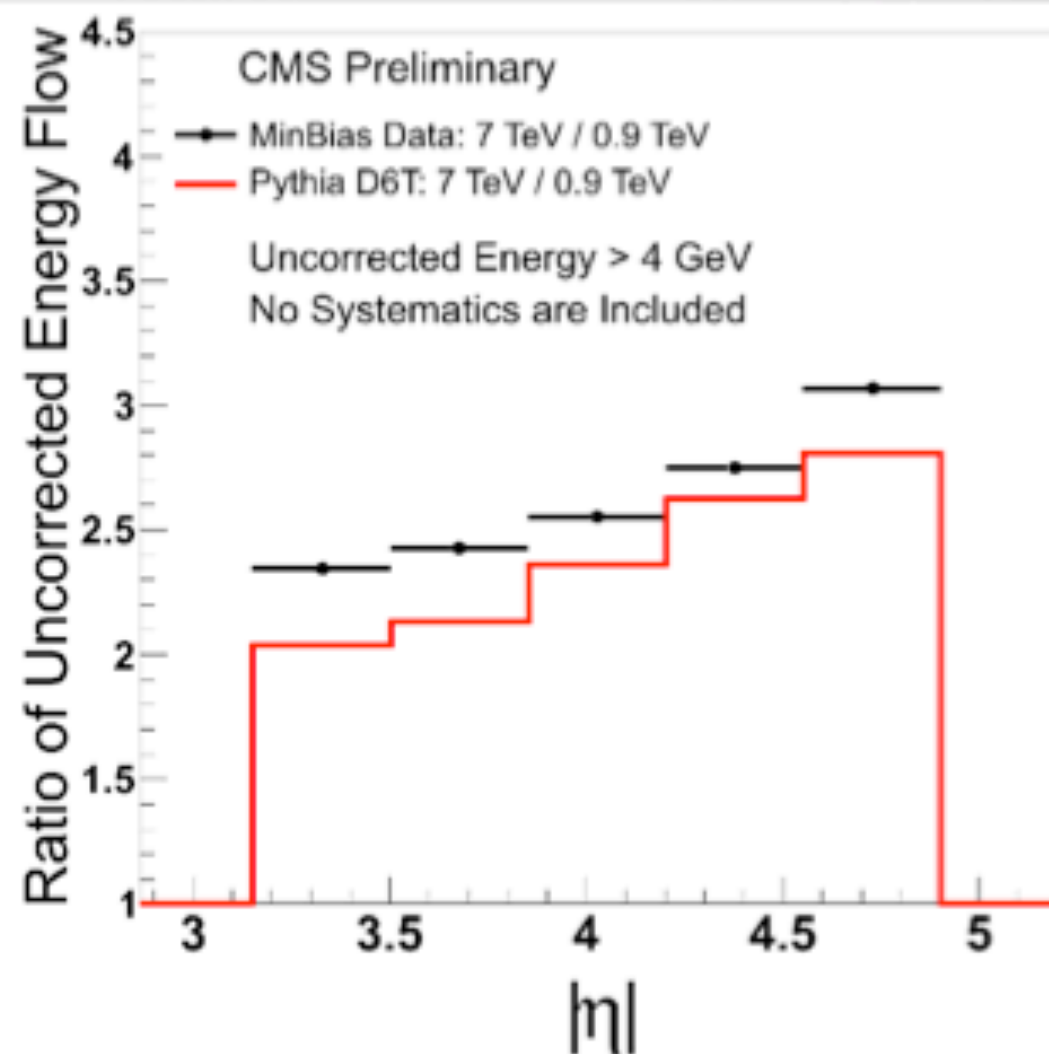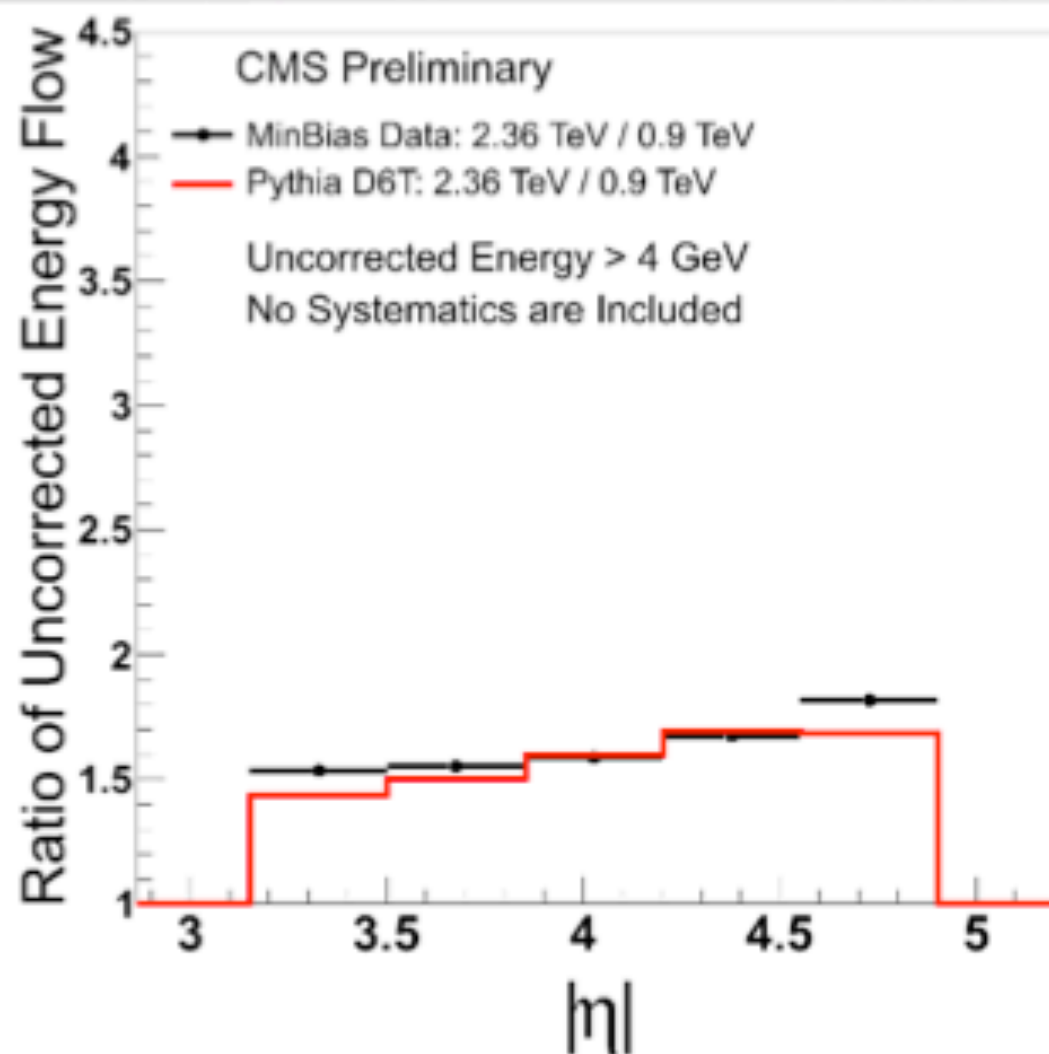
**Similar rise with collision energy as seen in dN/dη analysis**

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A. De Roeck, LHCC Open Session, May 5, 2010

Underlying event activity at √s = 0.9

- MinBias event selection, with additional requirement of a 'hard' scattering via a track jet with p_T > 3 GeV
- Study the particle density and scalar p_T sum in the transverse region, for particles with $|\eta|$ < 2 and p_T > 0.5 GeV (uncorrected data)
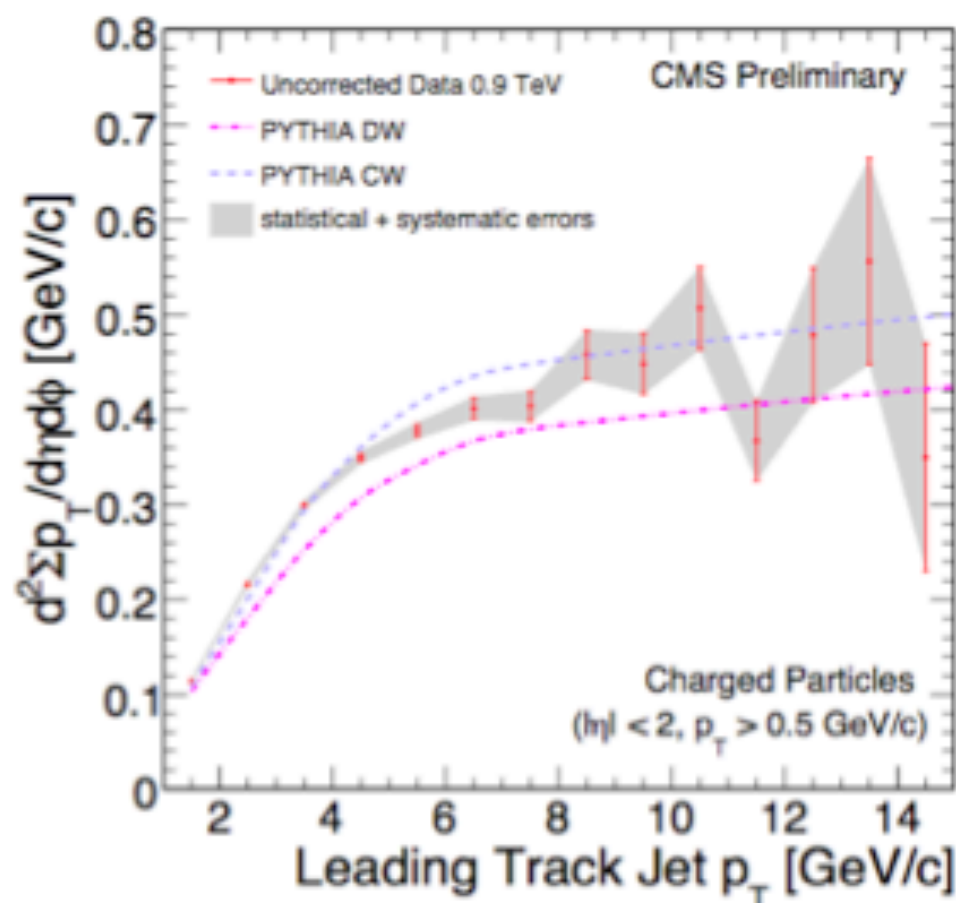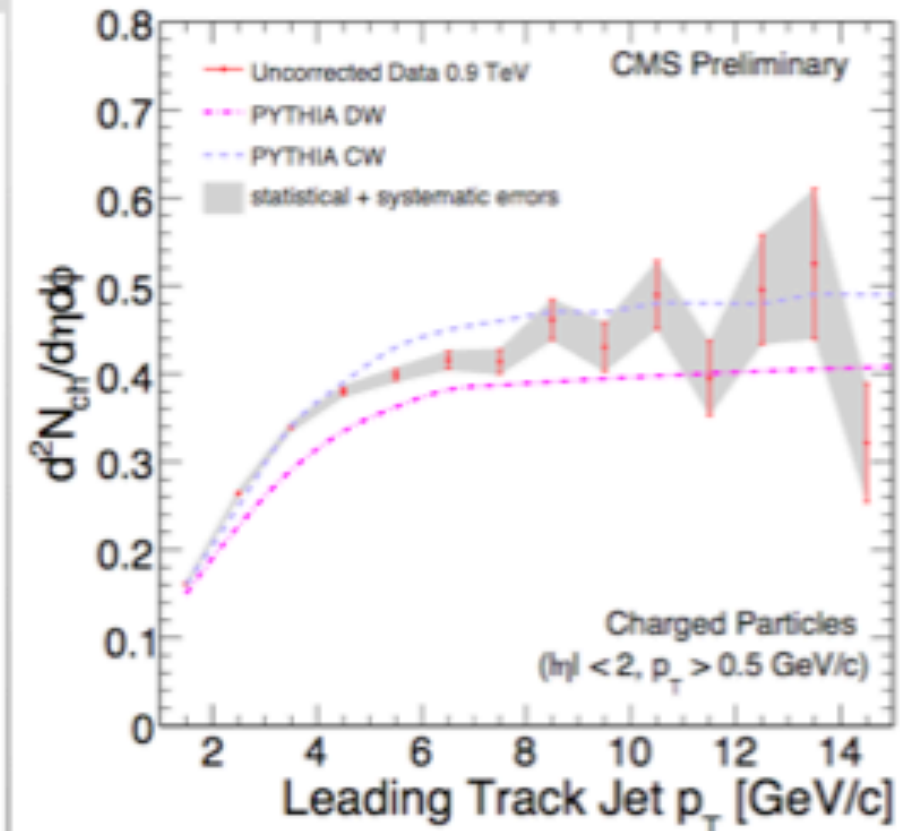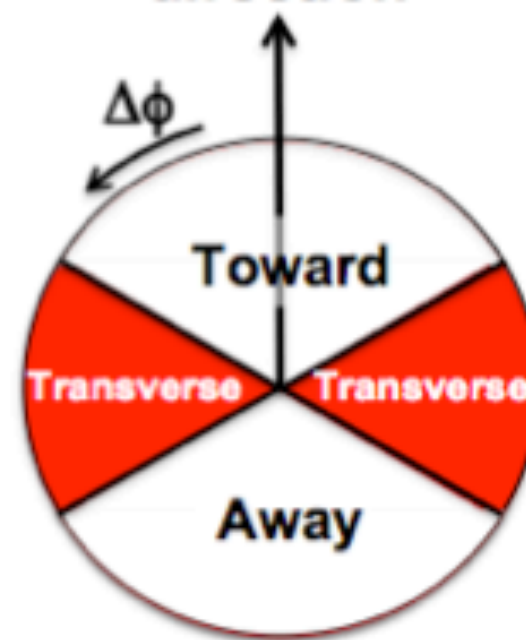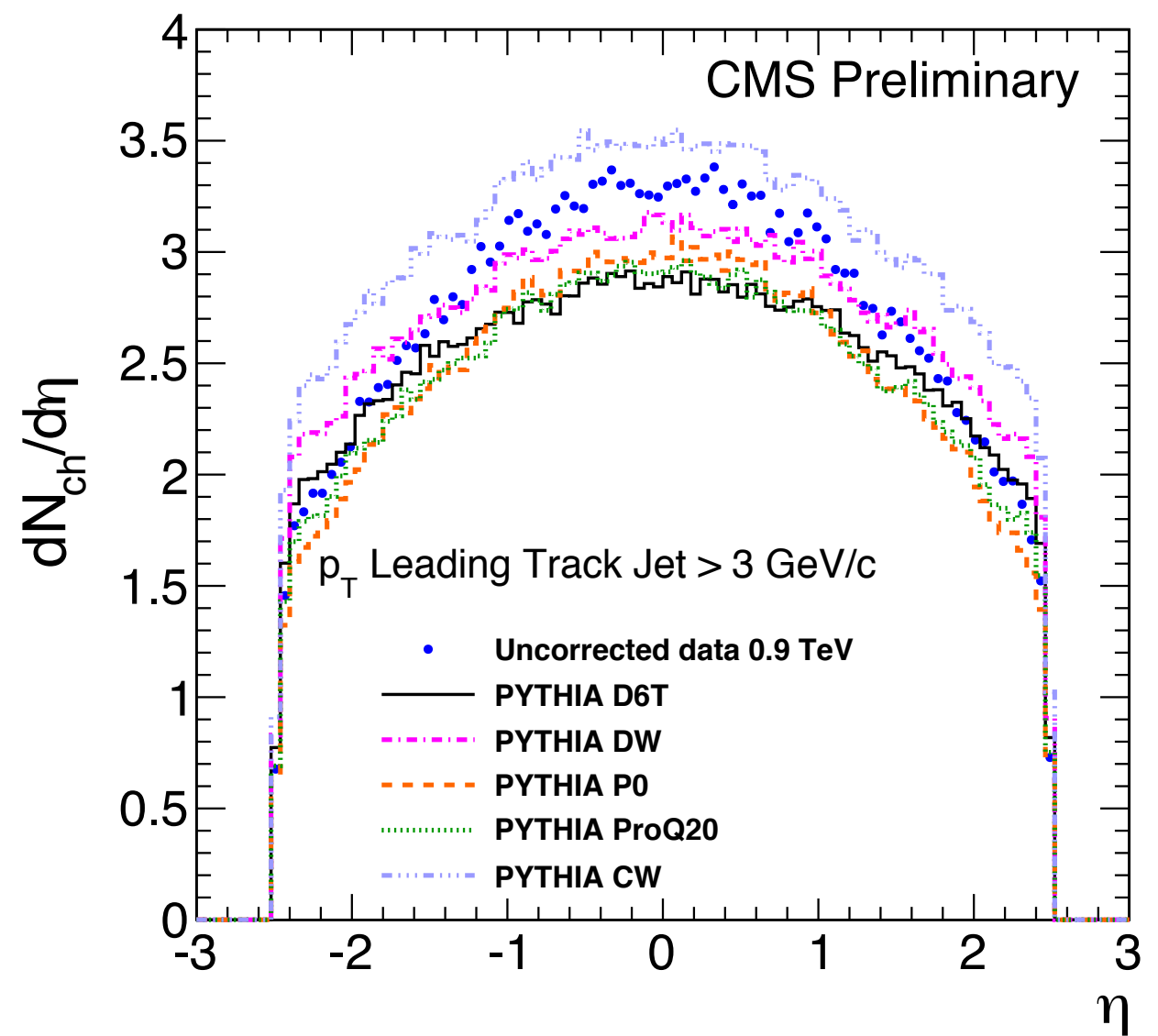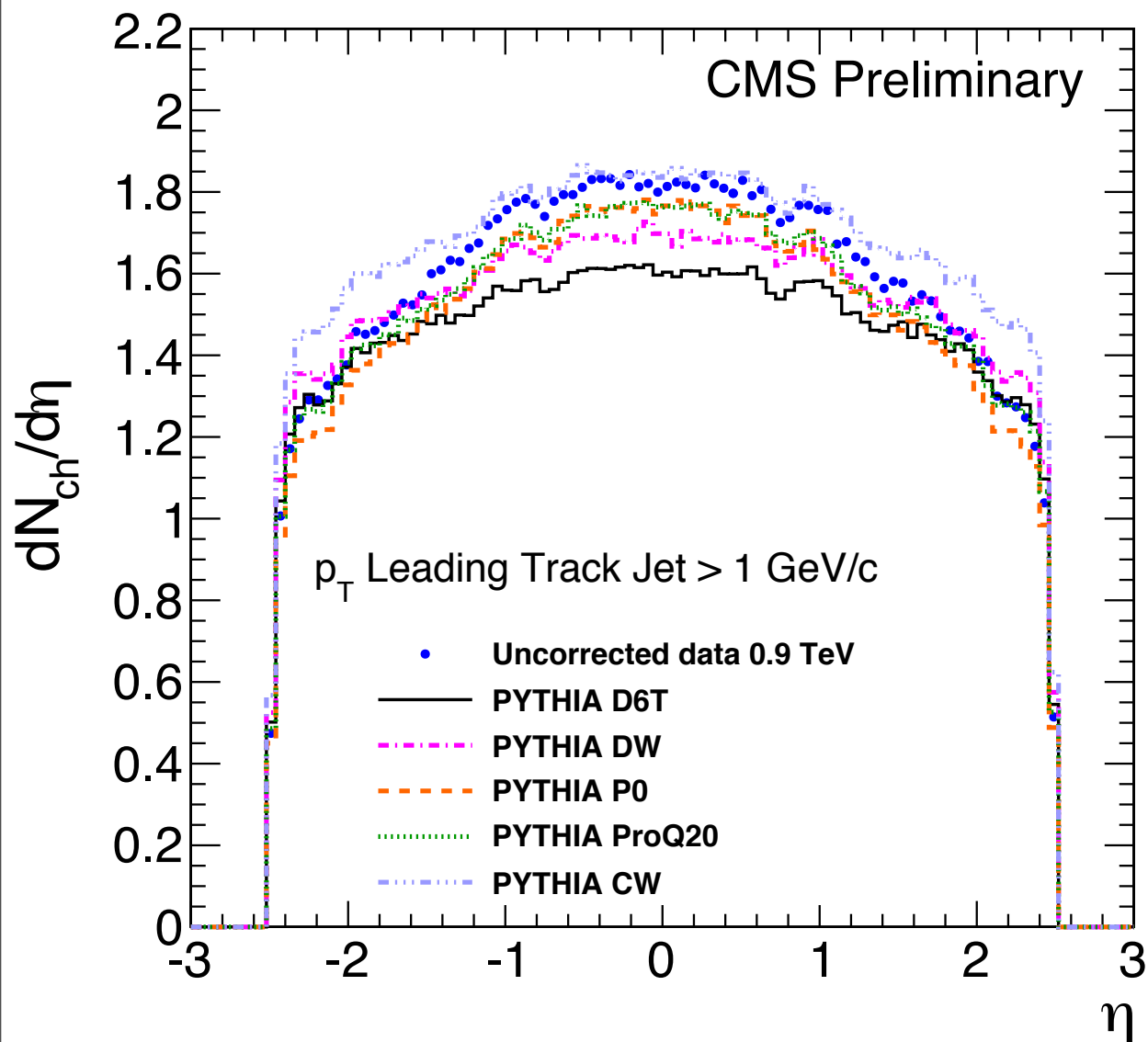

Model Comparison: DW = Standard Tune   CW = New Tune (p_{T0}= 1.8 GeV, ε= 0.3)
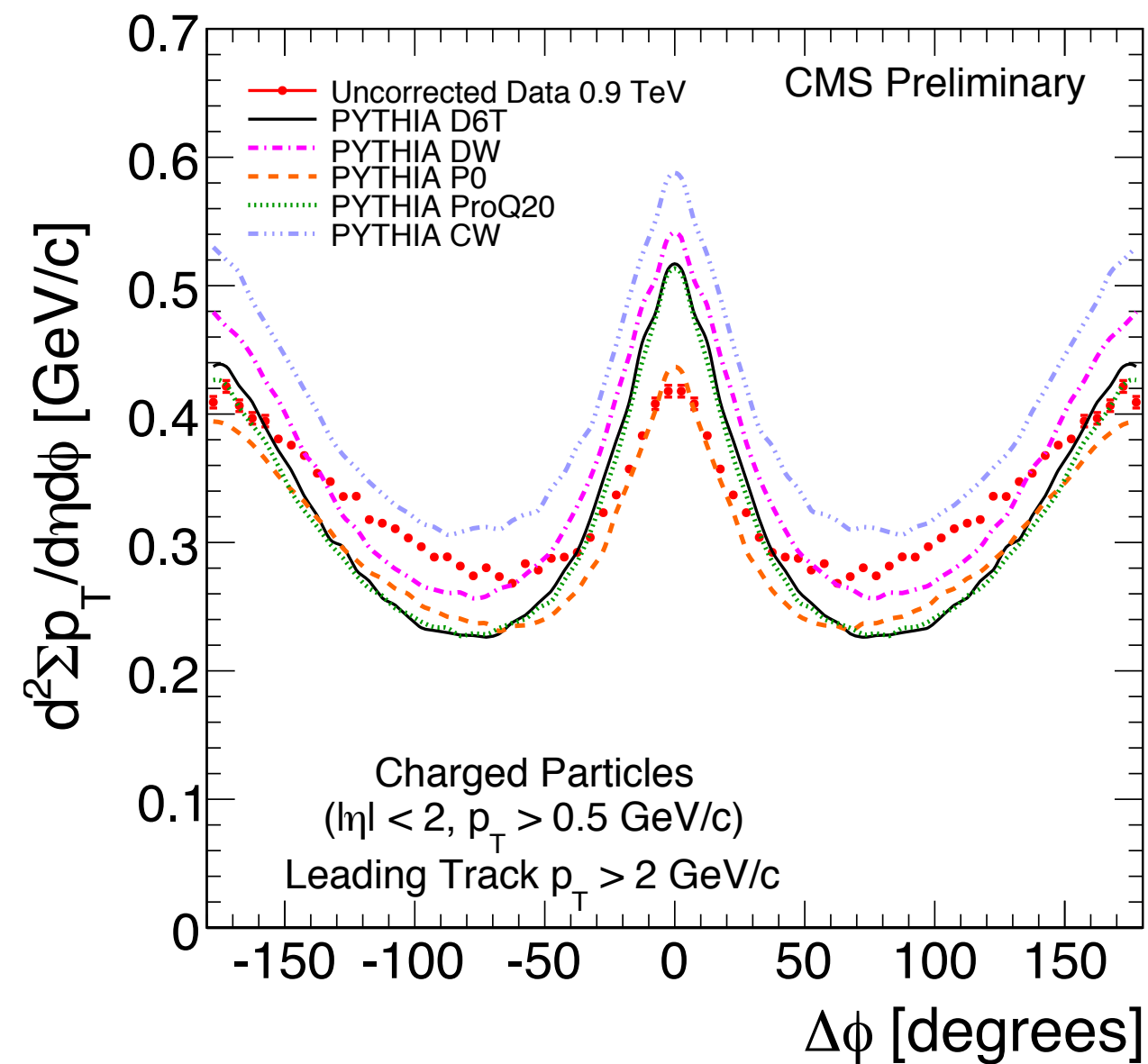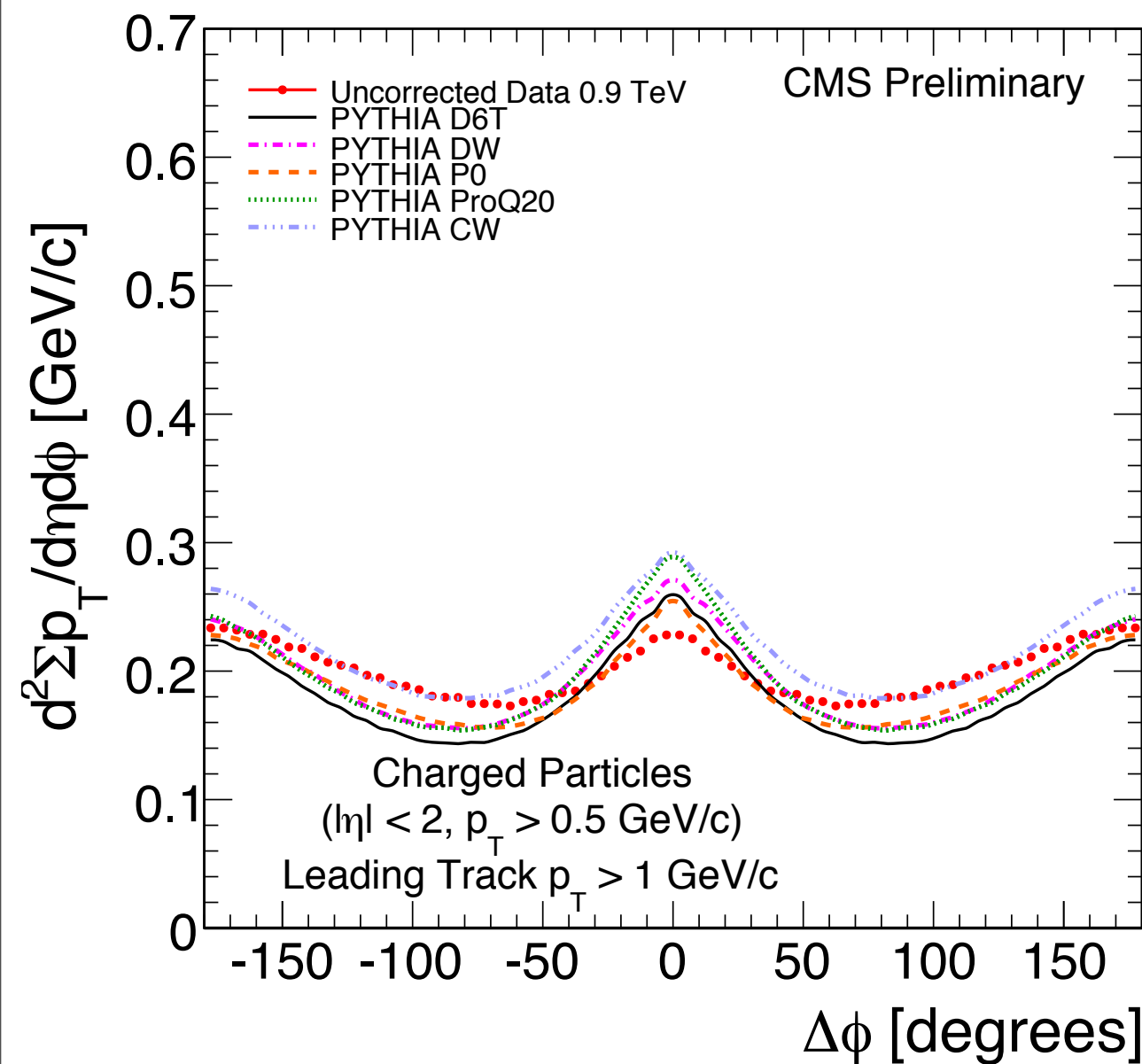
More food for MC model tuning...

Underlying event studies

- **not really a very good description of the measurement !!!**

Underlying event studies

- **not really a very good description of the measurement !!!**

Conclusions

☐ **first measurements on minimum bias and underlying events performed**

    ☐ charged hadron spectra

    ☐ forward energy flow

    ☐ underlying events in transverse region

☐ **first measurements at 7 TeV became available**

☐ **MC models are is rough agreement with measurements**

    ☐ large sensitivity to MB&UE tunes

    ☐ can we obtain a consistent description of different observables

    ☐ can we obtain a consistent description over the full energy range

MPI and UE measurements are still challenging !!!

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