Before & After CDFSIM Run 2

Corrections are small and independent of the leading jet E_T!

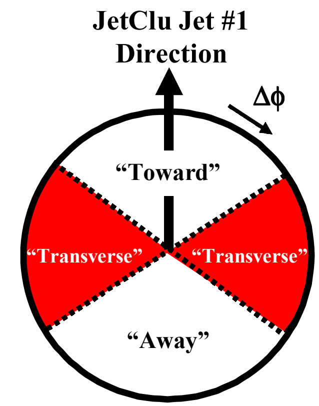
Outline of Talk

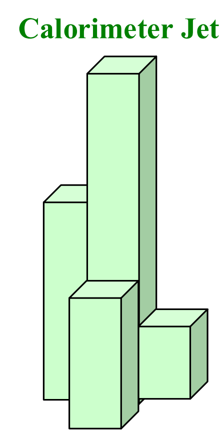
- The **"transverse"** region as defined by the leading **"calorimeter jet"**.

Corrections are large and depend on the leading jet E_T!

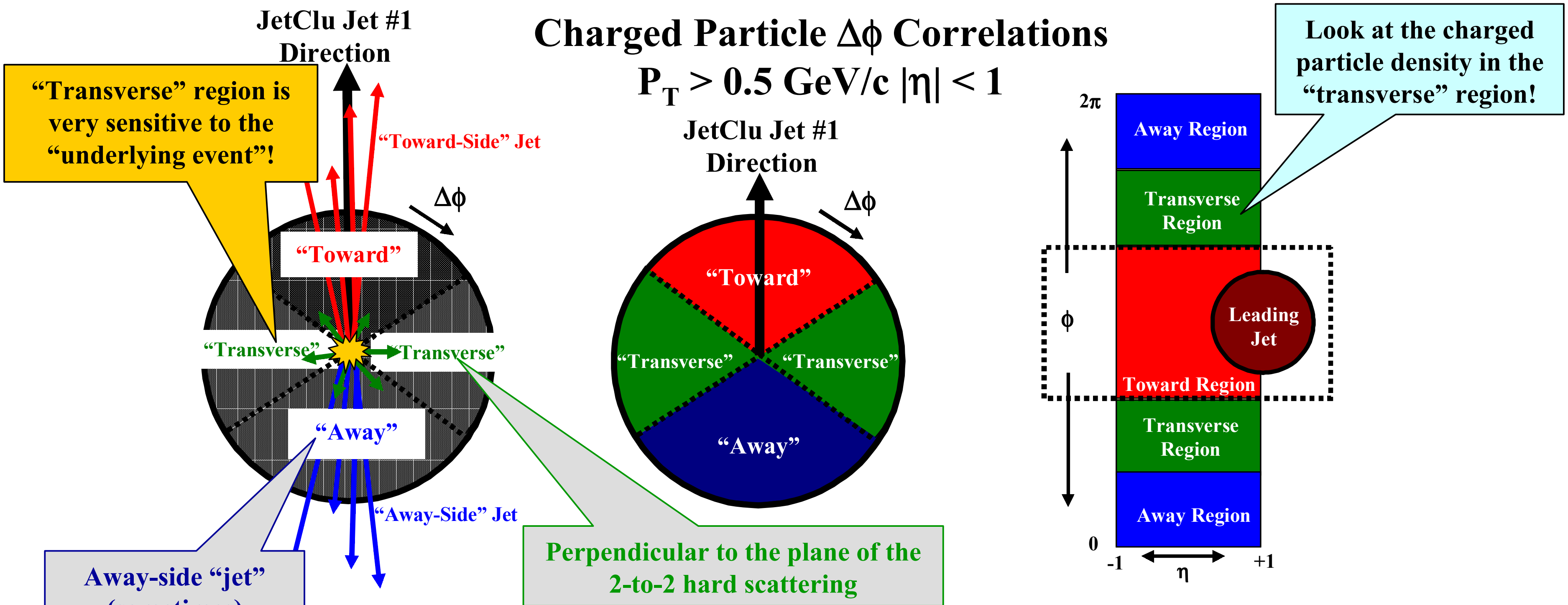
- Some of the characteristics of the leading **"calorimeter jet"**.

Have to "unfold" the detector efficiencies and produce "corrected" plots!





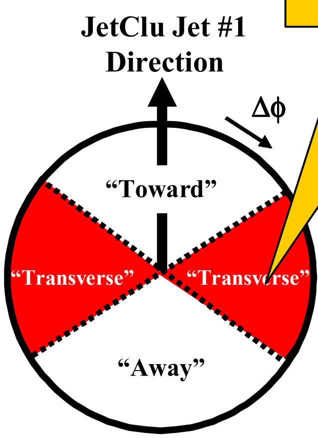
Evolution of JetClu Jets "Underlying Event"

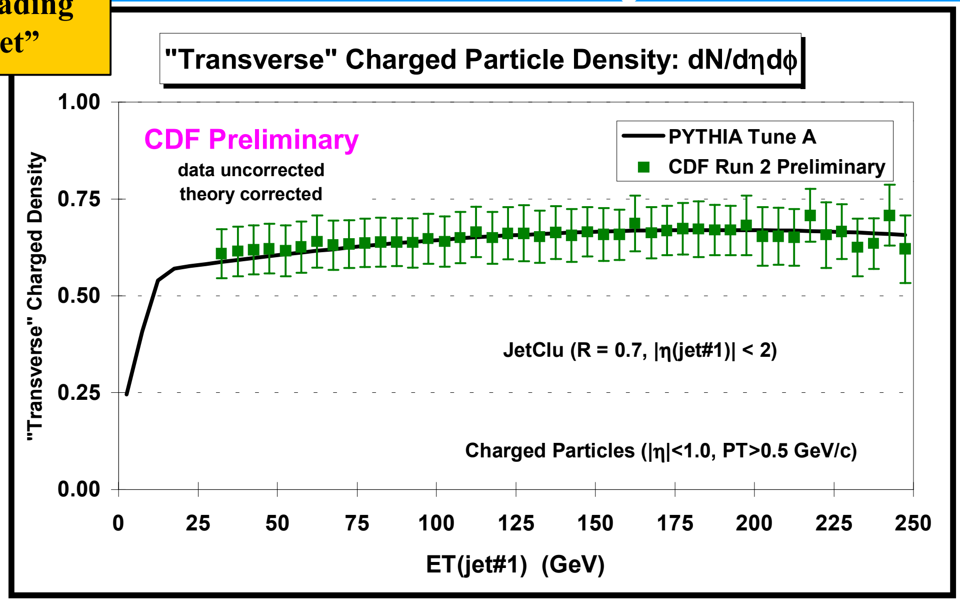


- Look at charged particle correlations in the azimuthal angle Δφ relative to the leading JetClu jet.
- Define $|\Delta\phi| < 60^{o}$ as "Toward", $60^{o} < |\Delta\phi| < 120^{o}$ as "Transverse", and $|\Delta\phi| > 120^{o}$ as "Away".
- All three regions have the same size in η-φ space, $\Delta\eta x \Delta\phi = 2x120^{o} = 4\pi/3$.

JetClu “Transverse” Charged Particle Density

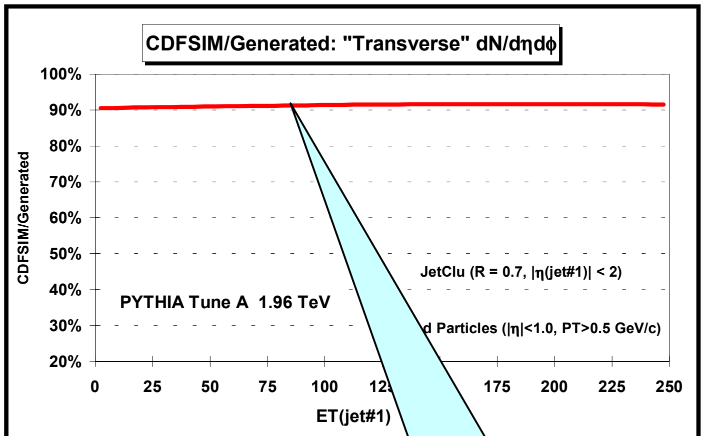
“Transverse” region as defined by the leading “calorimeter jet”

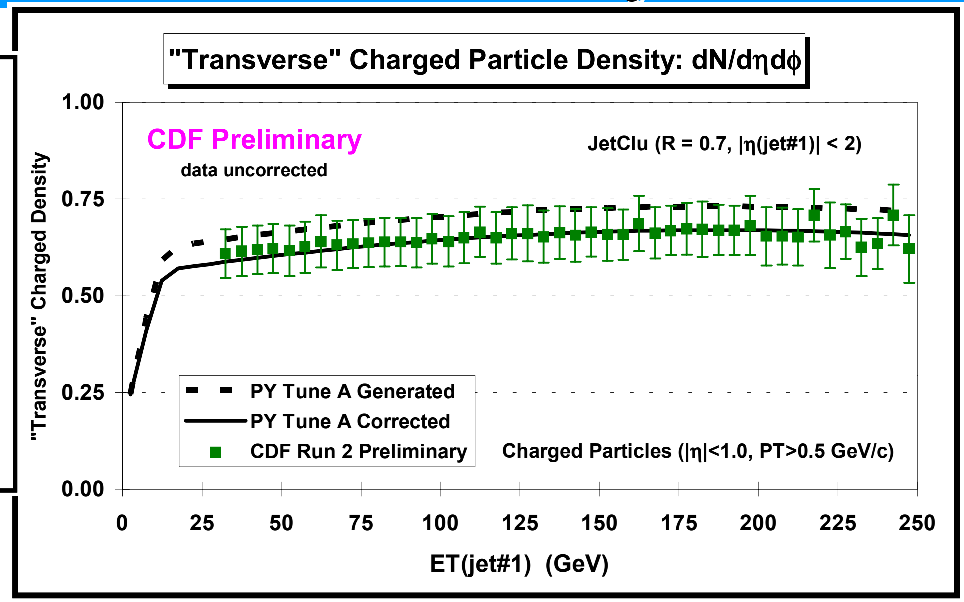




- Shows the data on the average “transverse” charge particle density ($|\eta|<1$, PT>0.5 GeV) as a function of the transverse energy of the leading JetClu jet ($R = 0.7$, $|\eta(jet)| < 2$) from Run 2, compared with **PYTHIA Tune A after CDFSIM**.

JetClu “Transverse” Charged Particle Density



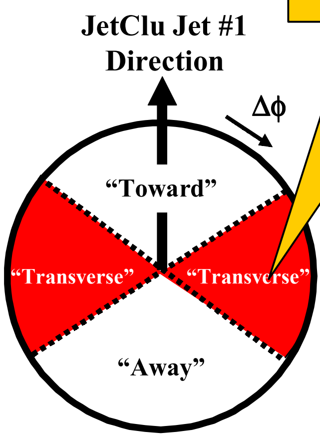


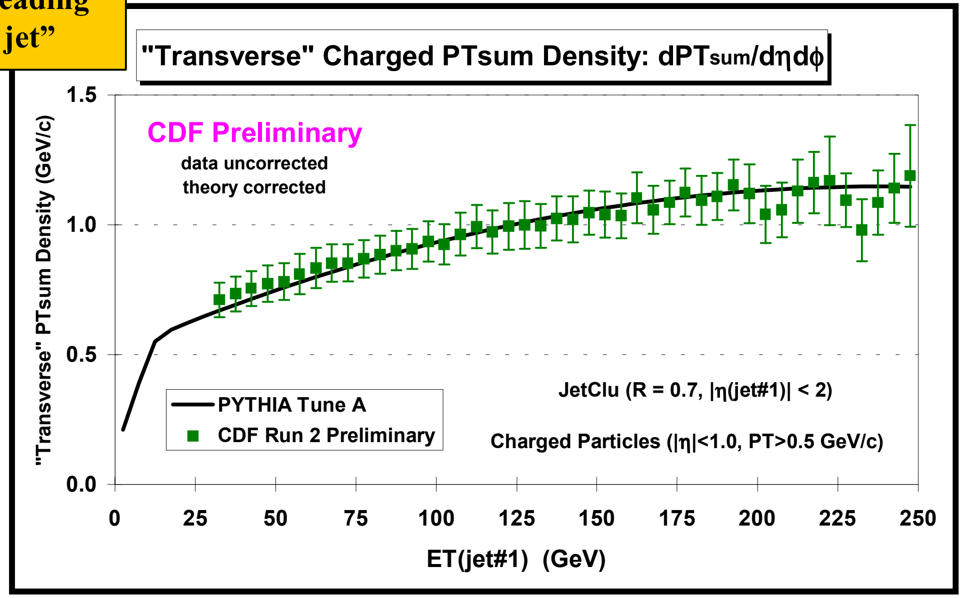
Small correction (about 90%) independent of E_T(jet#1)!

- **Shows the data on the ... ge “transverse” charge particle density (|η|<1, PT>0.5 GeV) as a function of t... leading JetClu jet (R = 0.7, |η(jet)| < 2) from Run 2, com... A after CDFSIM.**
- **Shows the generated prediction of PYTHIA Tune A before CDFSIM.**
- **Shows the ratio CDFSIM/Generated for PYTHIA Tune A.**

JetClu "Transverse" Charged PTsum Density

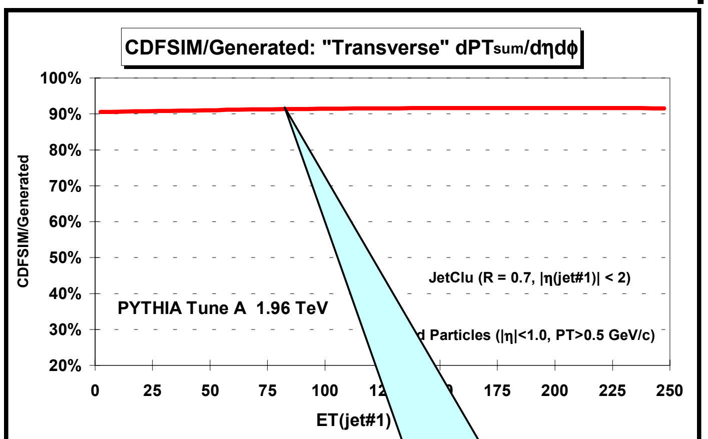
"Transverse" region as defined by the leading "calorimeter jet"

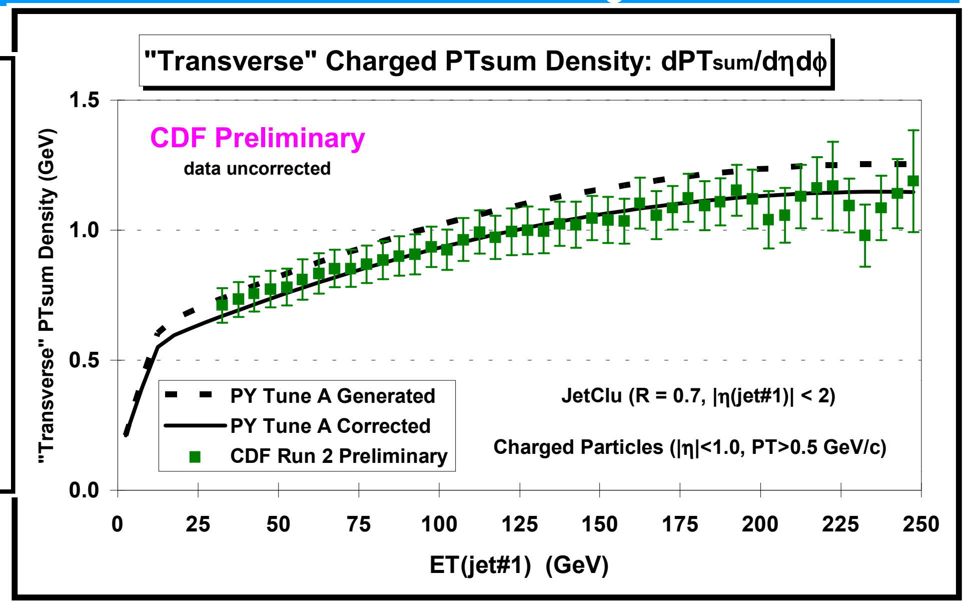




- Shows the data on the average "transverse" charged PTsum density (|η|<1, PT>0.5 GeV) as a function of the transverse energy of the leading JetClu jet (R = 0.7, |η(jet)| < 2) from Run 2, compared with **PYTHIA Tune A after CDFSIM**.

JetClu “Transverse” Charged PTsum Density

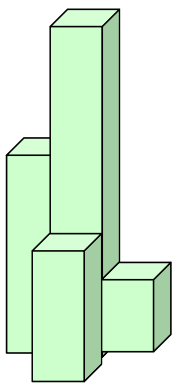


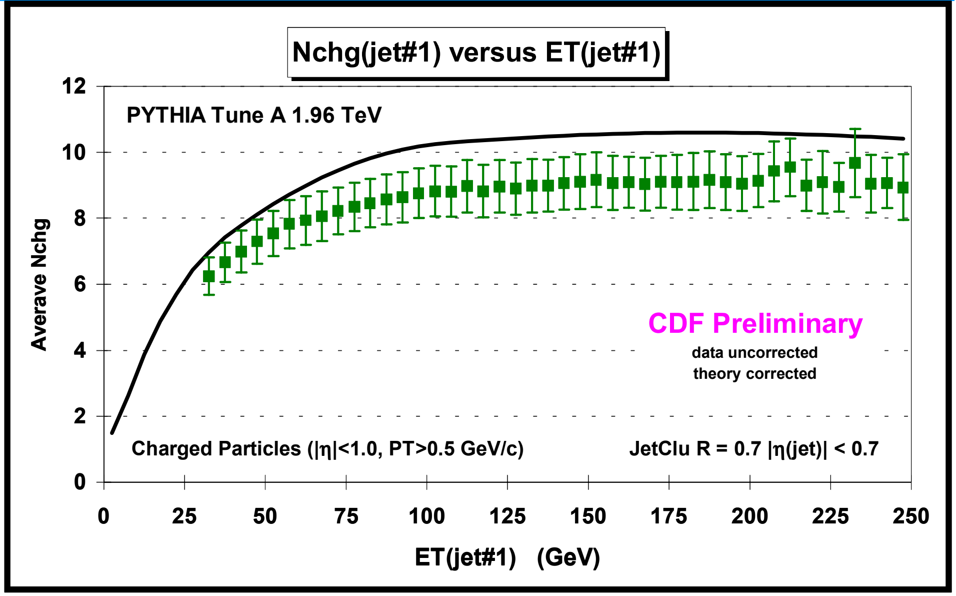


Small correction (about 90%) independent of E_T(jet#1)!

- Shows the data on the ... ge “transverse” charged PTsum density (|η|<1, PT>0.5 GeV) as a functio ... of the leading JetClu jet (R = 0.7, |η(jet)| < 2) from Run 2, c ... ne A after CDFSIM.
- Shows the generated prediction of **PYTHIA Tune A before CDFSIM**.
- Shows the ratio **CDFSIM/Generated** for PYTHIA Tune A.

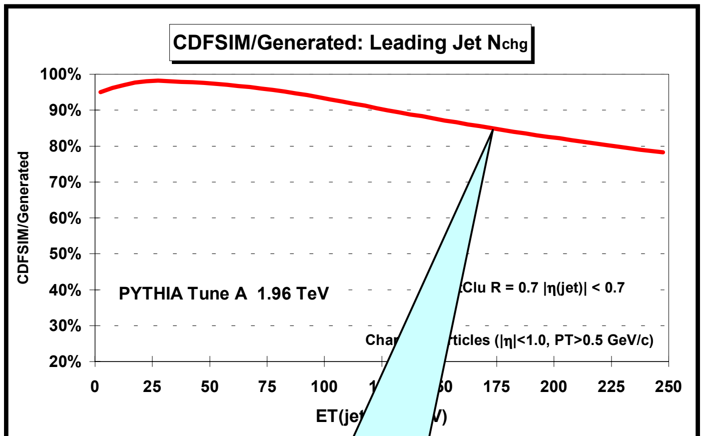
The Leading "Calorimeter" Jet Charged Particle Multiplicity

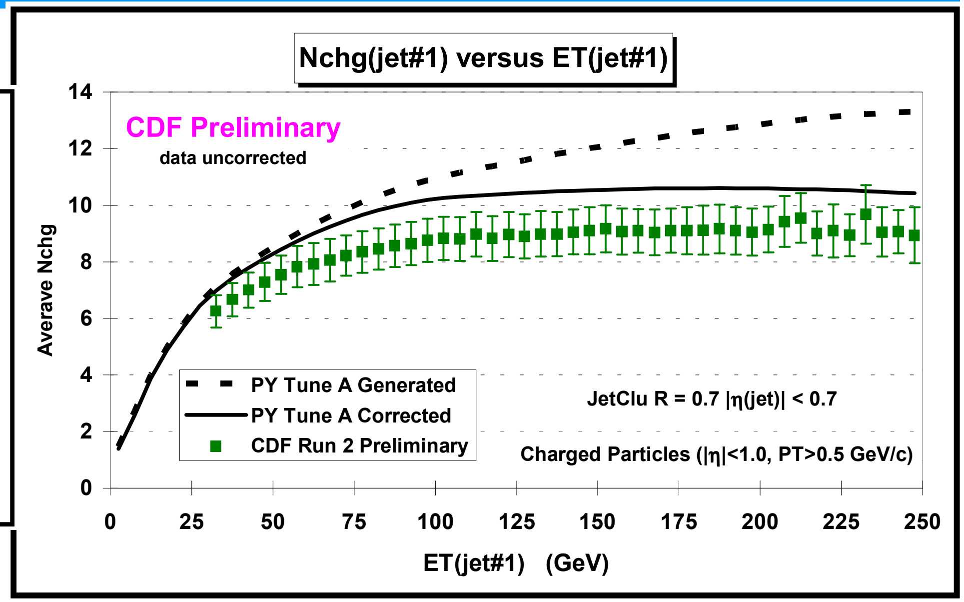




- Shows the Run 2 data on the average number of charged particles ($|\eta|<1$, $P_T>0.5$ GeV, R = 0.7) within the leading **"calorimeter jet"** (JetClu R = 0.7, $|\eta(jet)| < 0.7$) as a function of E_T(jet#1), compared with **PYTHIA Tune A after CDFSIM**.

The Leading "Calorimeter" Jet Charged Particle Multiplicity





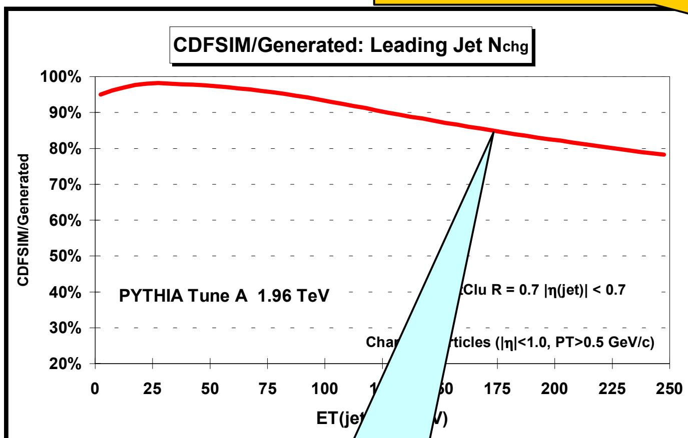
- Shows the ... data on the average number of charged particles ($|\eta|<1$, $P_T>0.5$ GeV, R = 0.7) w... he leading **"calorimeter jet"** (JetClu R = 0.7, $|\eta(jet)|< 0.7$) as a function ... ed with **PYTHIA Tune A after CDFSIM**.
  ... prediction of **PYTHIA Tune A before CDFSIM**.

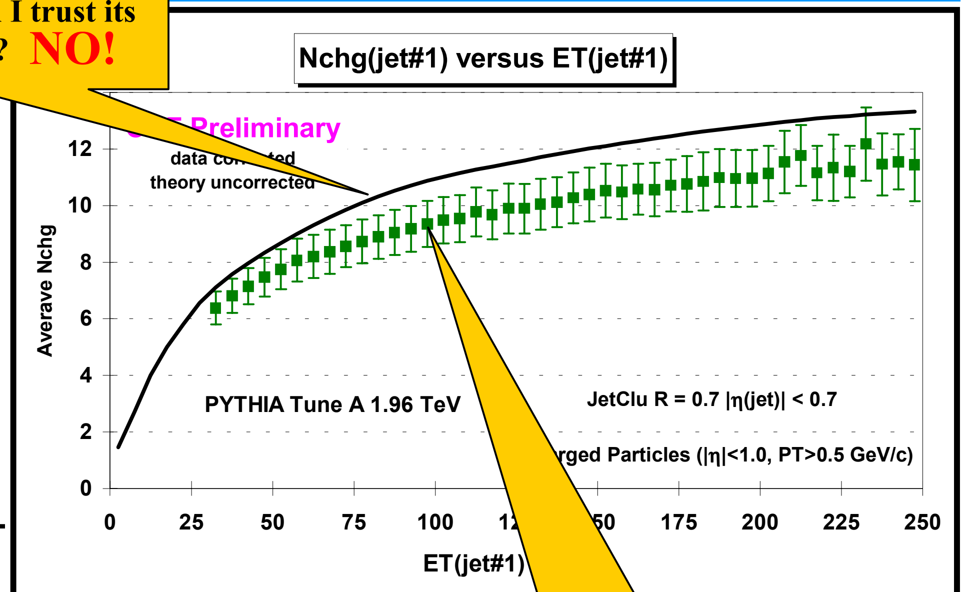
> Correction becomes large for E_T(jet#1) > 100 GeV and depends on E_T(jet#1)!

- Shows the ratio **CDFSIM/Generated** for PYTHIA Tune A.

The Leading "Calorimeter" Jet Charged Particle Multiplicity

BUT… PYTHIA Tune A does not fit the data so can I trust its "unfolding" function? **NO!**





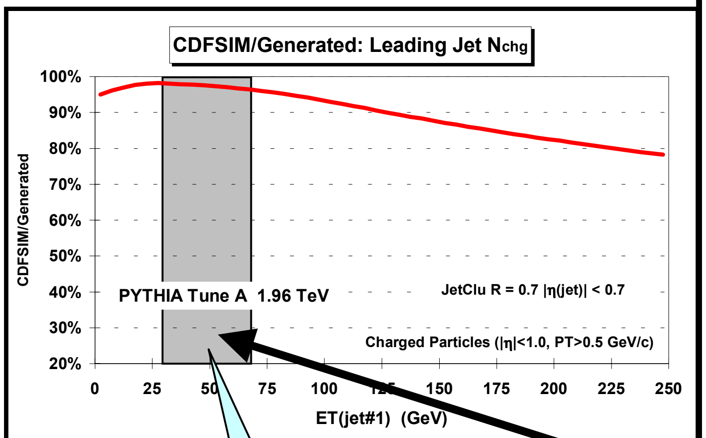
- Shows the … data on the average number of charged parti… |<1, P_T>0.5 GeV, R = 0.7) w… he leading **"calorimeter jet"** (JetClu R = 0.7, |η… 0.7) as a function … ed with **PYTHIA Tune A after CDFSIM**.
- … prediction of **PYTHIA Tune A before**

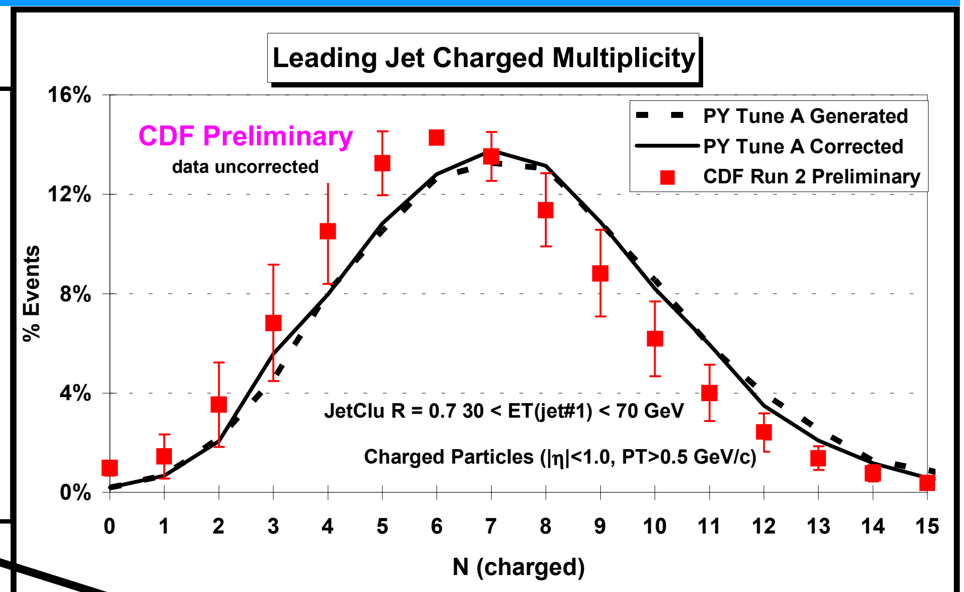
Correction becomes large for E_T(jet#1) > 100 GeV and depends on E_T(jet#1)!

Multiply data by the "unfolding function" determined from PYTHIA Tune A to get "corrected" data.

- Shows the ratio **CDFSIM/Generated** for PYTHIA Tune A.
- Shows **"corrected" Run 2 data** compared with PYTHIA Tune A (uncorrected).

The Leading "Calorimeter" Jet Charged Particle Multiplicity

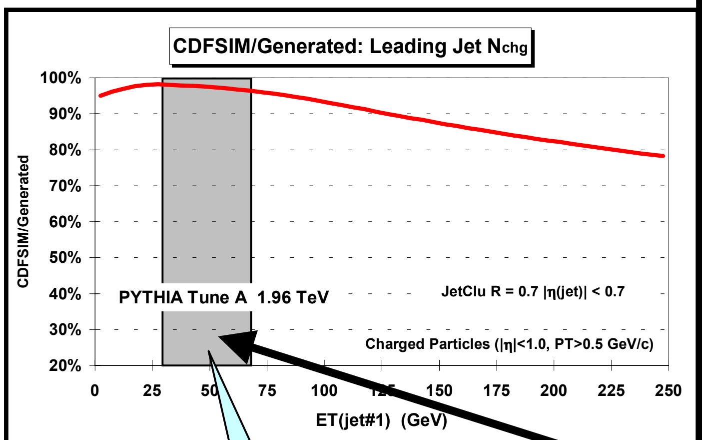


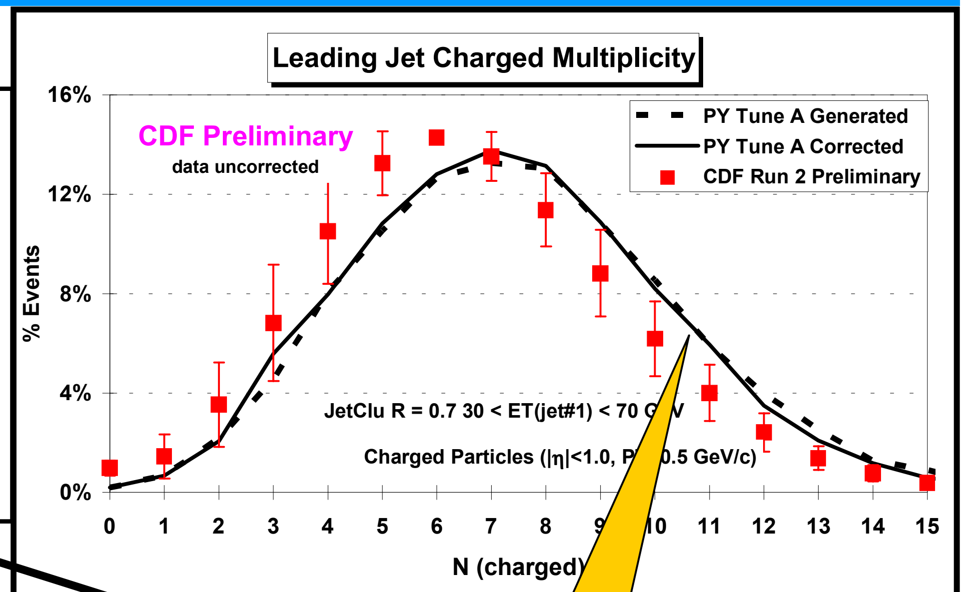


- **Shows charged particle multiplicity distribution ($|\eta|<1$, $P_T>0.5$ GeV/c) within the leading "calorimeter jet" (JetClu, R = 0.7, $|\eta(jet)| < 0.7$) for the range $30 < E_T(jet\#1) < 70$ GeV compared with PYTHIA Tune A before and after CDFSIM.**

Small correction for
$30 < E_T(jet\#1) < 70$ GeV !

The Leading "Calorimeter" Jet Charged Particle Multiplicity



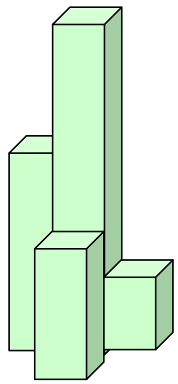


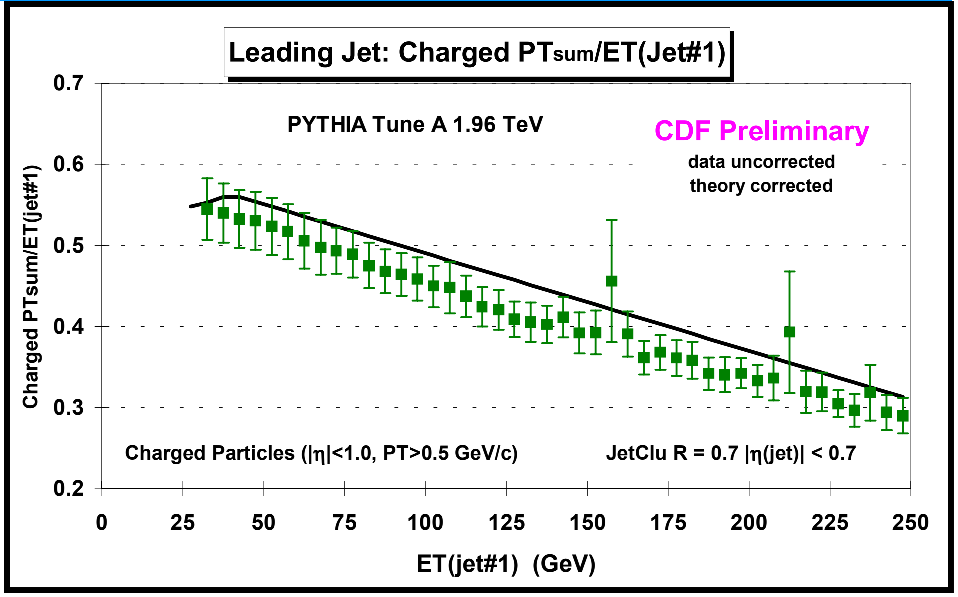
- Shows charged particle multiplicity distribution ($|\eta|<1$, $P_T>0.5$ GeV/c) within the leading **"calorimeter jet"** (JetClu, R = 0.7, $|\eta(jet)| < 0.7$) for the range **30 < E_T(jet#1) < 70 GeV** compared with **PYTHIA Tune A before and after CDFSIM.**

Small correction for
30 < E_T(jet#1) < 70 GeV !

PYTHIA produces too many charged particles within the leading "jet"!

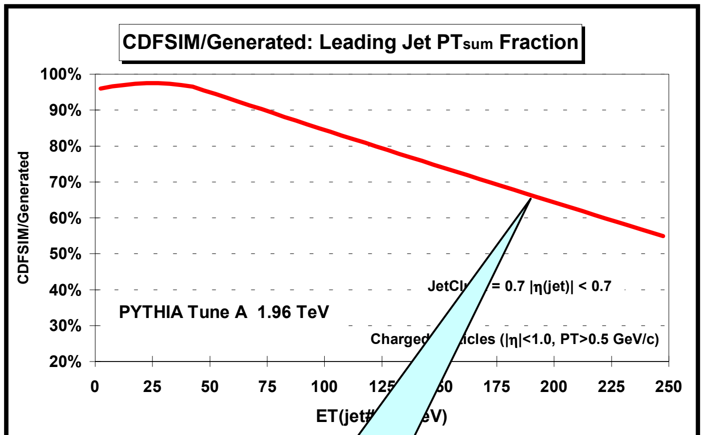
The Leading "Calorimeter" Jet Charged PTsum Fraction

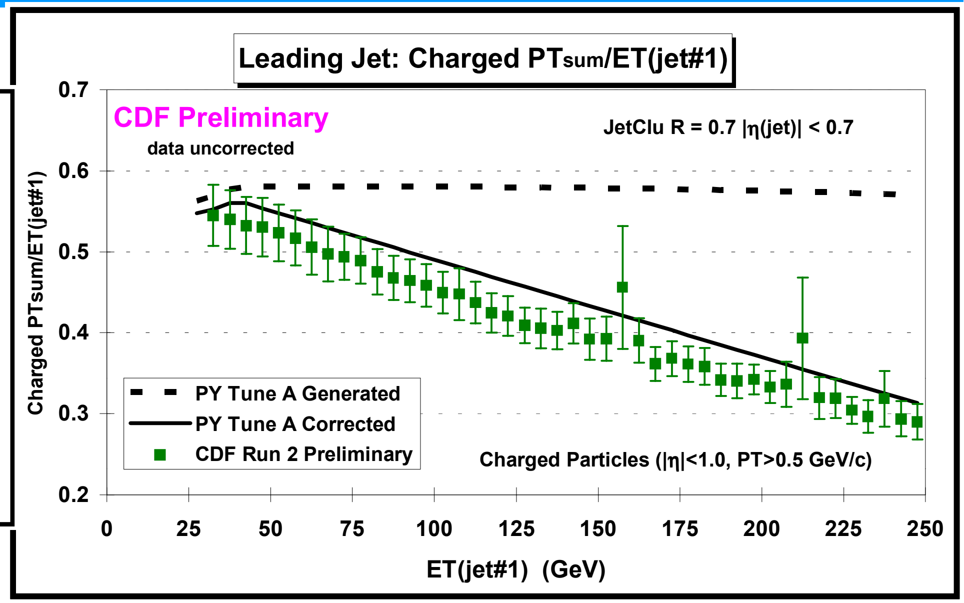




- Shows average charged PTsum fraction, PTsum/E_T(jet#1), within the leading **"calorimeter jet"** (JetClu, R = 0.7, |η(jet)| < 0.7) compared with **PYTHIA Tune A after CDFSIM**.

The Leading "Calorimeter" Jet Charged PTsum Fraction



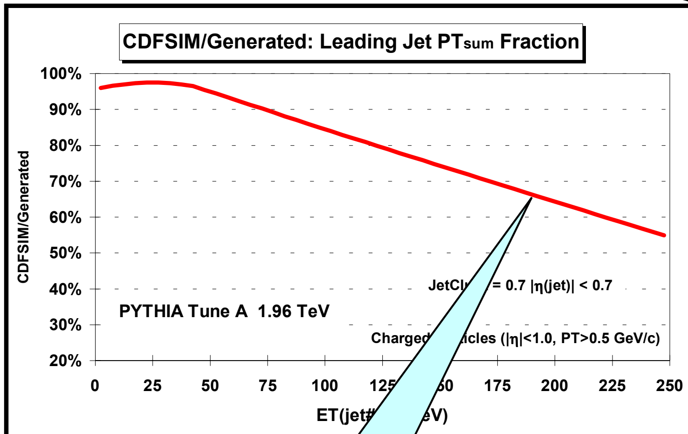


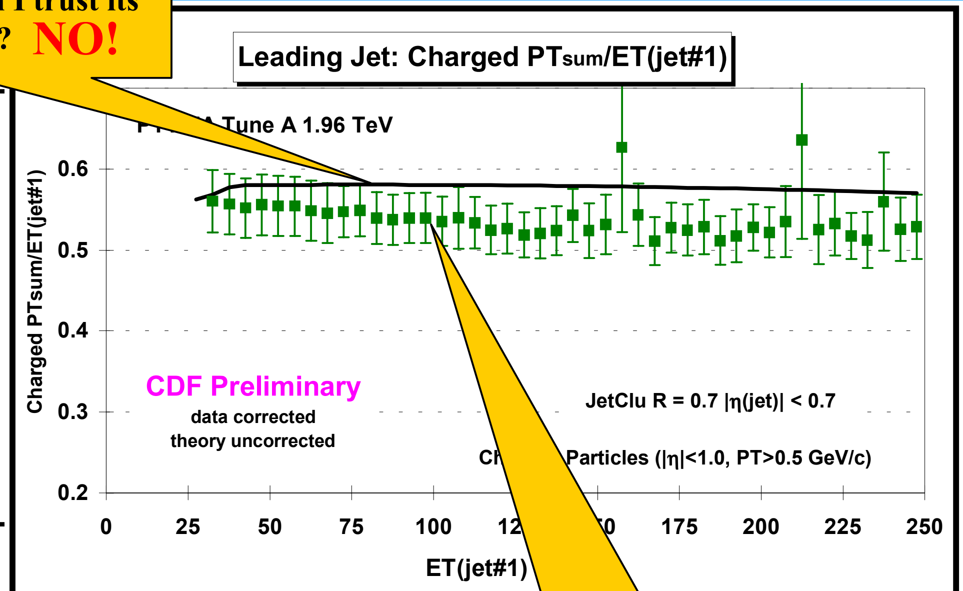
- Shows average charged PTsum fraction, $PTsum/E_T$(jet#1), within the leading "calorimeter jet" (JetClu, R = 0.7, |η(jet)| < 0.7) compared with **PYTHIA Tune A after CDFSIM**.
- Shows the generated prediction of **PYTHIA Tune A before CDFSIM**.
- Shows the ratio **CDFSIM/Generated** for PYTHIA Tune A.

Very large correction that depends on E_T(jet#1)!

The Leading “Calorimeter” Jet … um Fraction

BUT… PYTHIA Tune A does not fit the data so can I trust its “unfolding” function? **NO!**



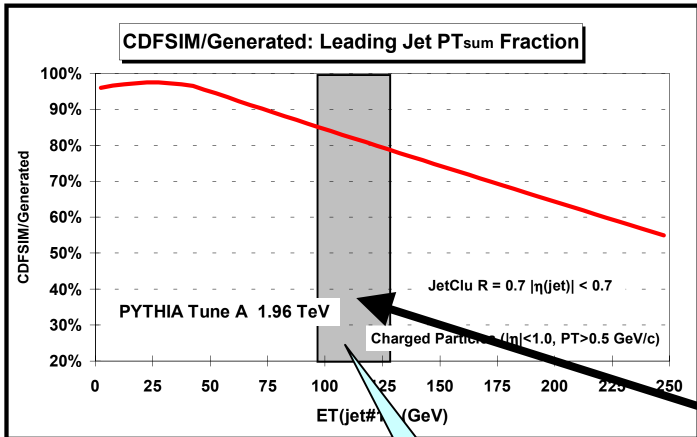


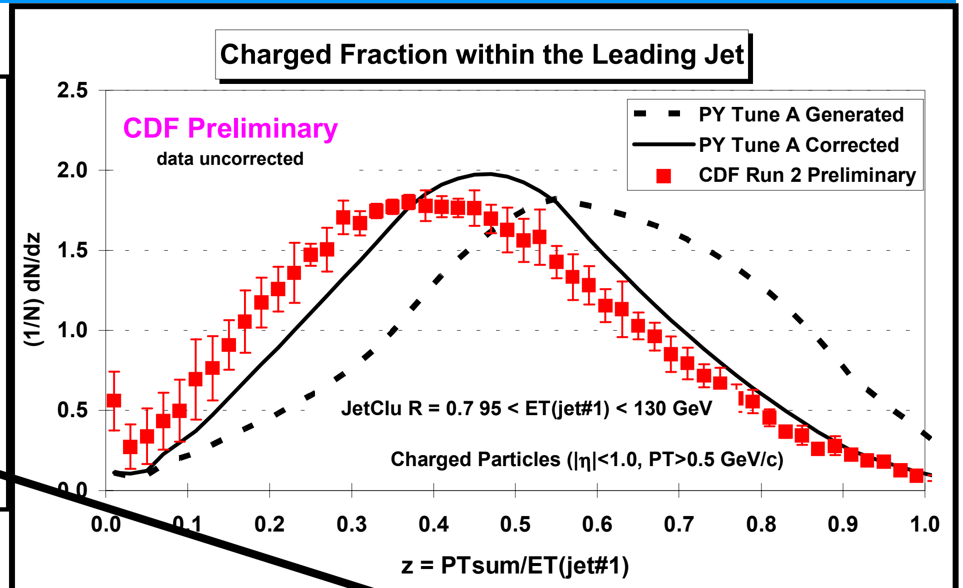
Very large correction that depends on E_T(jet#1)!

Multiply data by the “unfolding function” determined from PYTHIA Tune A to get “corrected” data.

- Shows av… e charged PTsum fraction, PTsum/E_T(jet#1), with … leading “calori… jet” (JetClu, R = 0.7, |η(jet)| < 0.7) compared with … IA Tune A after …
- … ated prediction of PYTHIA Tune A before …
- Shows the ratio CDFSIM/Generated for PYTHIA Tune A.
- Shows “corrected” Run 2 data compared with PYTHIA Tune A (uncorrected).

The Leading "Calorimeter" Jet Charged PTsum Fraction

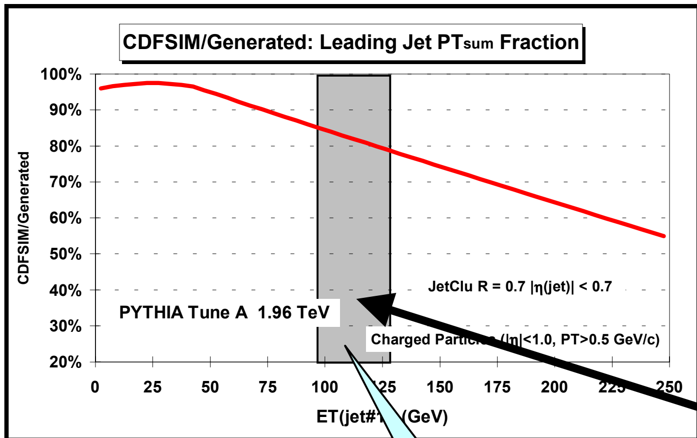


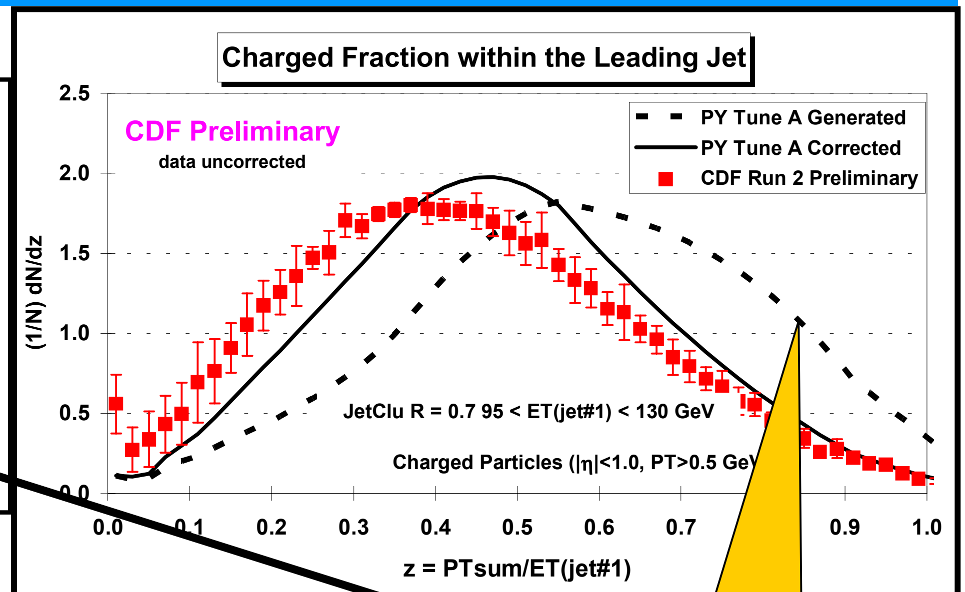


- Shows distribution of the charged PTsum fraction, z = PTsum/E_T(jet#1), within the leading **"calorimeter jet"** (JetClu R = 0.7, |η(jet)| < 0.7) for the range **95 < E_T(jet#1) < 130 GeV** compared with **PYTHIA Tune A before and after CDFSIM**.

Large correction for
95 < E_T(jet#1) < 130 GeV !

The Leading "Calorimeter" Jet Charged PTsum Fraction





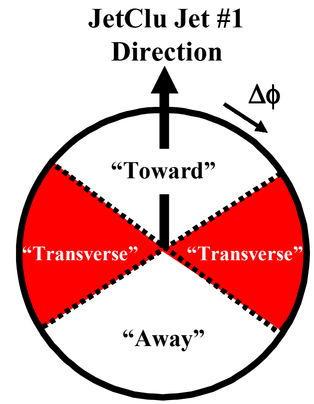
- Shows distribution of [the] charged PTsum fraction, $z = PTsum/E_T(jet\#1)$, [within] the leading **"calorimeter jet"** (JetC[lu] R = 0.7, $|\eta(jet)| < 0.7$) for the range **$95 < E_T(jet\#1) < 130$ GeV** compared with **PYTHIA [Tun]e A before and after CDFSIM.**

Large correction for $95 < E_T(jet\#1) < 130$ GeV !

I could multiply data by the "unfolding function" determined from PYTHIA Tune A?... BUT could I trust the result? **NO!**

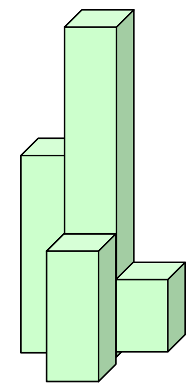
My Plans

- All the blessed plots for the the "transverse" region are fine for now: "uncorrected data" versus "corrected theory"… But for publication I will correct the data (easy to do!) and produce plots with "corrected data" versus "uncorrected theory".



- For the characteristics of the leading "calorimeter jet" I will have to "unfold" the detector efficiencies (not so easy!) and produce "corrected data" and plot "corrected data" versus "uncorrected theory".

Calorimeter Jet



- I will have to determine "unfolding" functions from both PYTHIA and HERWIG and use the differences to estimate the systematic uncertainties.

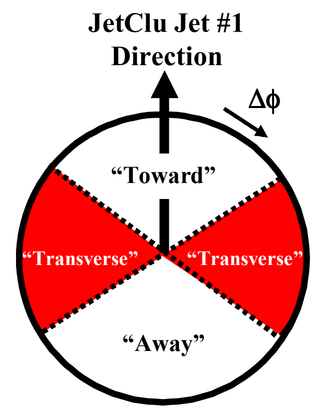
My Plans

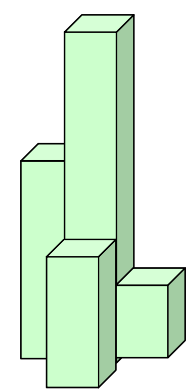
- All the blessed plots for the the "transverse" region are fine for now: "uncorrected data" versus "corrected theory"… B he data (easy to do!) ed data" versus "unco

PYTHIA Tune A does not fit the "characteristics of the leading jet" so I cannot trust its "unfolding" function!

- For the charac cs of the leading "calorimeter jet" I will have to " d" the detector efficiencies (not so easy!) and pr ce "corrected data" and plot "corrected data" versu uncorrected theory".

- I will ha e to determine "unfolding" functions from both PYTHIA and HERWIG and use the differences to estimate the systematic uncertainties.





My Plans

- All the blessed plots for the the "transver... " region are fine for now: "uncorrected d... " versu... orrected theory"… B... HA Tune ... not ... he da... (easy to do!) ... a" versus "uncorrec...
- For the chara... et" I will have to "... easy!) and p... data" versu... orrec...
- I will have to determine "un... ng" ... tions fro... both PYTHIA and HERWIG and ... e the di... rences to estimate the systematic unce... inties.

"cha... es o... cannot ...

I hope to have some new plots of the "characteristics of the leading jet" ready for preblessing in about a month!