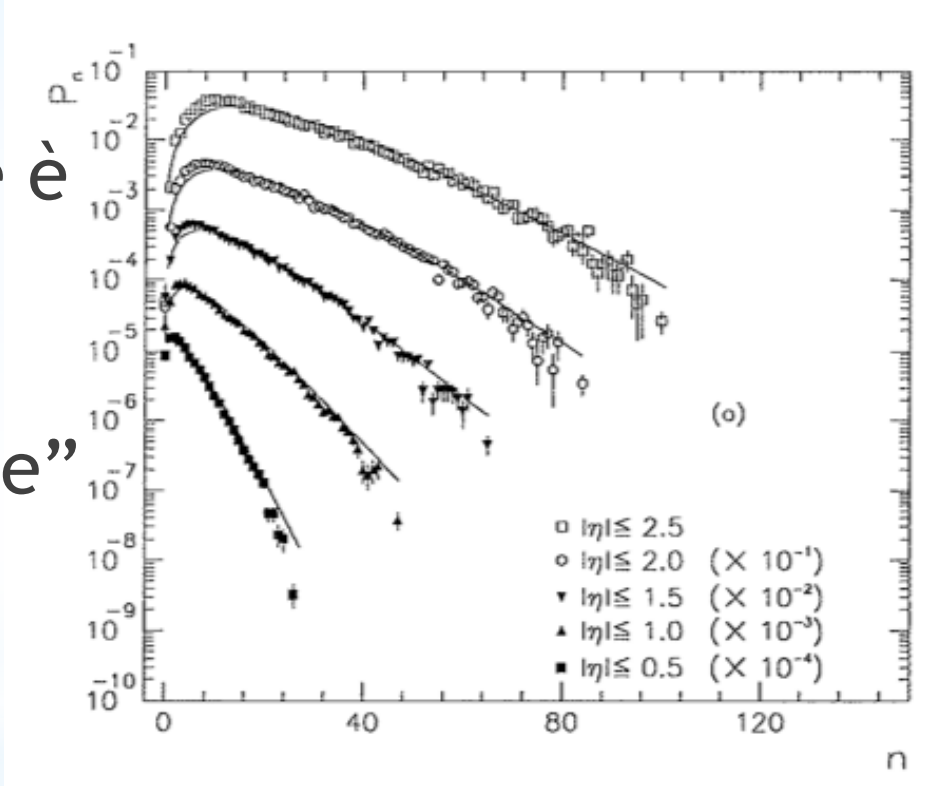
1995-2012 : CDF

Niccolò Moggi

I miei primi anni a CDF

* La scelta di CDF
* Soft QCD = guardare dove è più buio
* Primi passi nel buio = "misurare tutto il possibile"
* MB nel Run-1: misure inclusive e correlazioni di stato finale



Poi ho capito perchè…

La ricerca di “fenomeni collettivi”

* Lo studio della “struttura” dell’evento:
  * Esiste una categoria di eventi prodotta con meccanismi “diversi” ? (eg: QGP)

CDF/ANAL/MIN_BIAS/CDFR/4763

What Can We Learn from Minimum Bias? Part I

N.Moggi, F.Rimondi

October 5, 1998

not indeed, since it is clear that we are in the non linear QCD region: more than two, perhaps many, partons interact at a time. Collective effects may play a role. From the experimental point of view questions are: do soft hadron interactions exhibit any peculiar behaviour that can characterize them with respect to other types of hadron interactions, for istance high p_t interactions? Where and how should experiments

Dove guardare ?

in the two directions addressed by the two questions above. On one side we are looking for any specific behaviour which, somewhat characterizing soft interactions, can help understanding the transition from soft multiparticle production to the rare high p_t jet production (see CDF notes 4294, 3866 on this subject). On the other side we

Si cercano segnali di discontinuità in funzione delle variabili di evento (N_{ch})

* $\langle p_T(N_{ch})\rangle$: cambia la slope in $dN_{ch}/d\eta \approx 5$
  * vedi ora Prof. Campanini, CMS
* Correlazioni di stato finale Vs N_{ch}
* Densità di K^0s/Λ^0 Vs N_{ch}

* Tutte analisi pubblicate e/o presentate

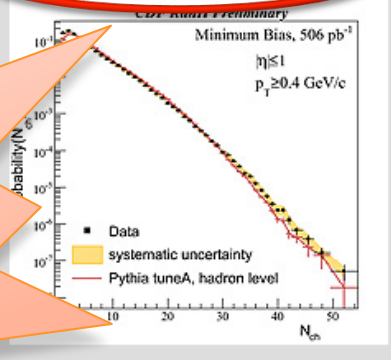
Fermilab Today

Thursday, Oct. 22, 2009

"sorting out the soft mess"

Fermilab Result of the Week

Sorting out the soft mess



The multiplicity distribution in minimally biased data compared to the prediction of simulation.

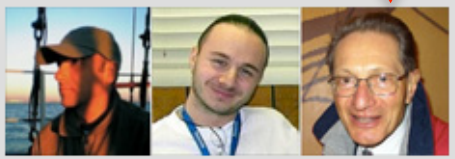
In a proton-antiproton collider, like the Tevatron, the properties of hard head-on collisions of two partons - quarks and gluons that make up the protons - can be calculated using the theory of Quantum Chromo Dynamics (QCD). But the majority of the collisions at the Tevatron are softer and produce less energetic particles. In these cases, scientists cannot perform QCD calculations because they are too complex.

A model of these soft events requires a complex cocktail of many different physical effects that cannot be described independently. In the most recent models, the best results come from a single proton-antiproton collision that contains multiple parton-parton interactions and includes correlations between the final state particles that originate from these different collisions. In other words, data seems to confirm that there are multiple interactions and that a connection exists between the different partonic collisions because the partons come from the same proton and antiproton.

To study these softer processes and understand how they relate to the harder ones, scientists at CDF collect an unbiased sample of events that contain all types of interactions sampled according to their natural production rate. The goal is to make a set of measurements that experimentally describe this sample. One such measurement is the distribution of the multiplicity of charged particles that are produced by the collisions. It represents the probability that an event ends up producing a certain number of final state particles.

The recent measurement from CDF has the highest precision over the largest multiplicity range ever studied. Together with previous measurements, it will contribute to phenomenological models and be useful for extrapolations to LHC energies. Additionally, the measurement will help scientists make more precise estimates of the soft backgrounds in many higher energy physics studies that they can't calculate directly using QCD.

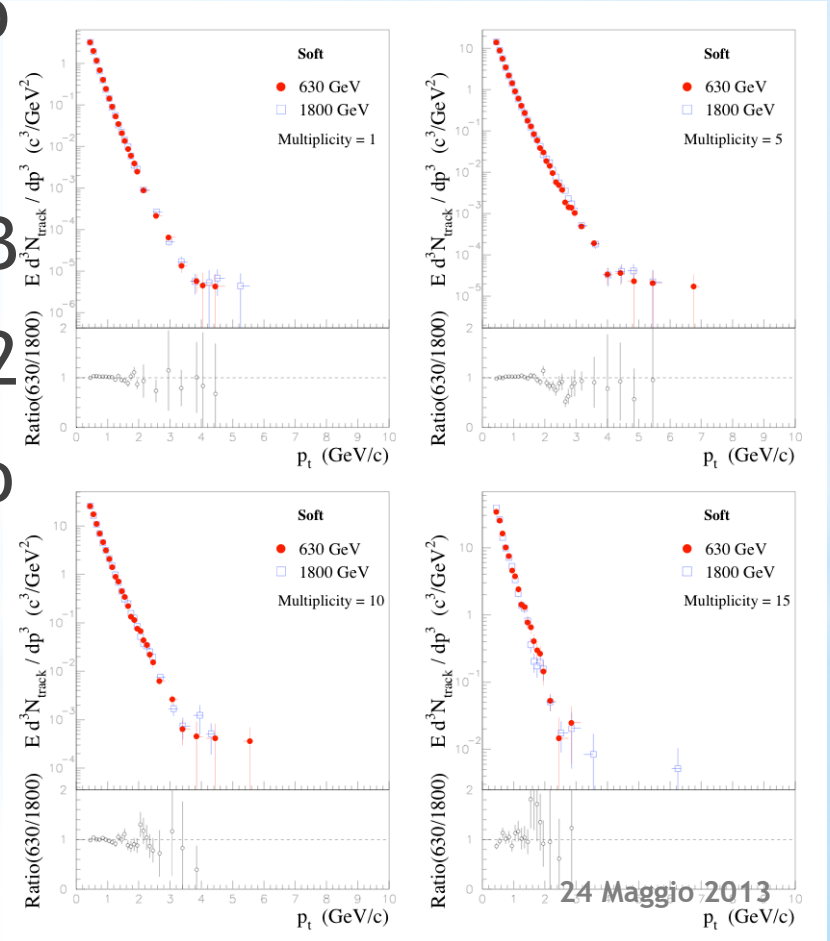
— *Edited by Craig Group*



The CDF scientists who made this measurement, from the left: Niccolo Moggi, Manuel Mussini, Franco Rimondi, all from the University and INFN, Bologna.

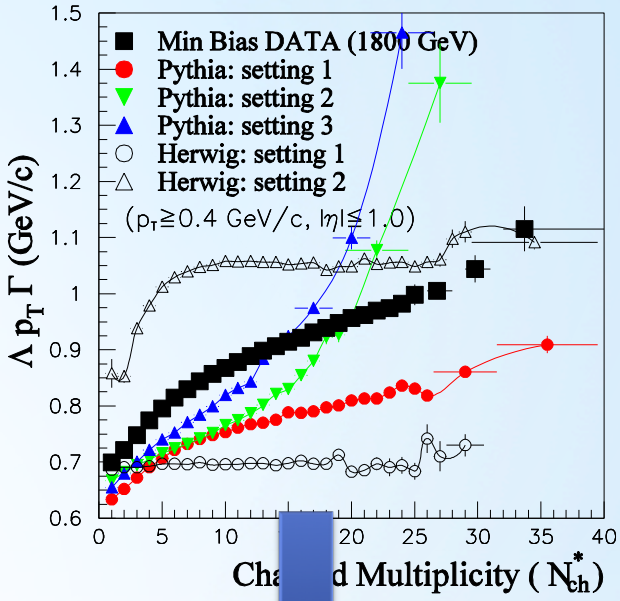
Interessanti incidenti di percorso

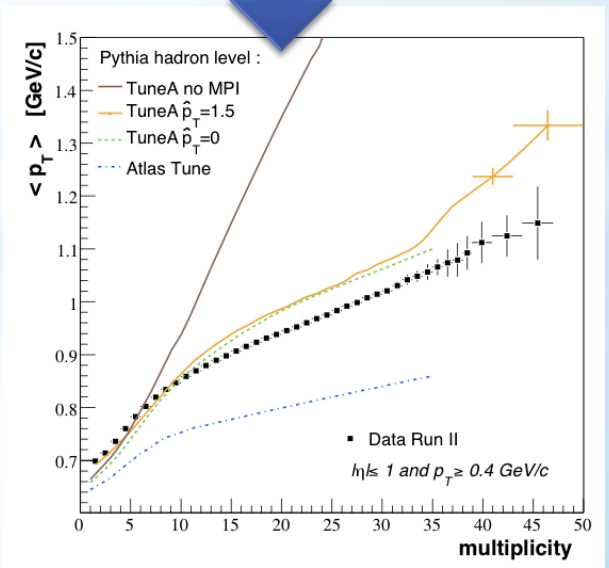
* Dal $\langle p_T(N_{ch}) \rangle$ il primo segnale della invarianza di $Xs(p_T)$ con $\sqrt{s}$ per N_{ch} fissato
* funziona solo per la componente “soffice” del MB
* possibile nuova analisi Run2 1960/900/300 GeV in corso



Gli studi per LHC

* studi per il background a LHC
* tuning dei MC (vedi anche R.Field e l'analisi dell' "underlying event")
  * Pythia "tuneA"
  * solo nel MB si trova il giusto cocktail di soft + jet per tunare i MC





10 anni di MB

- Un insieme di misure sistematiche
- Alcune osservazioni notevoli ma non chiarite (invarianza componente soft)...
- Per quanto riguarda il MB è cambiato il nostro "pregiudizio" o background teorico
- Nella comunità scientifica maggiore consapevolezza del significato ed utilità del MB
  - chiarito il significato di alcune espressioni (UE, MB, PileUp...)
  - ci avviciniamo ad una comprensione "globale" delle interazioni pp (?)
- ..ed un progetto (troppo?) ambizioso...

Le idee per il futuro

Rimane il problema della descrizione “globale” di tutta la sezione d’urto inelastica

Studio del flavor nel MB:

* ricostruzione Xs totale dalla somma dei flavor ?
  * soft = u,d mentre hard = heavy flavors ?
  * a $\sqrt{s}$<TeV il soft raggiungerebbe una saturazione (invarianza con $\sqrt{s}$) mentre hard accenderebbe via via i suoi contributi HF

✓ π carichi

✓ K^0s

✓ D^0, D^+

✓ …