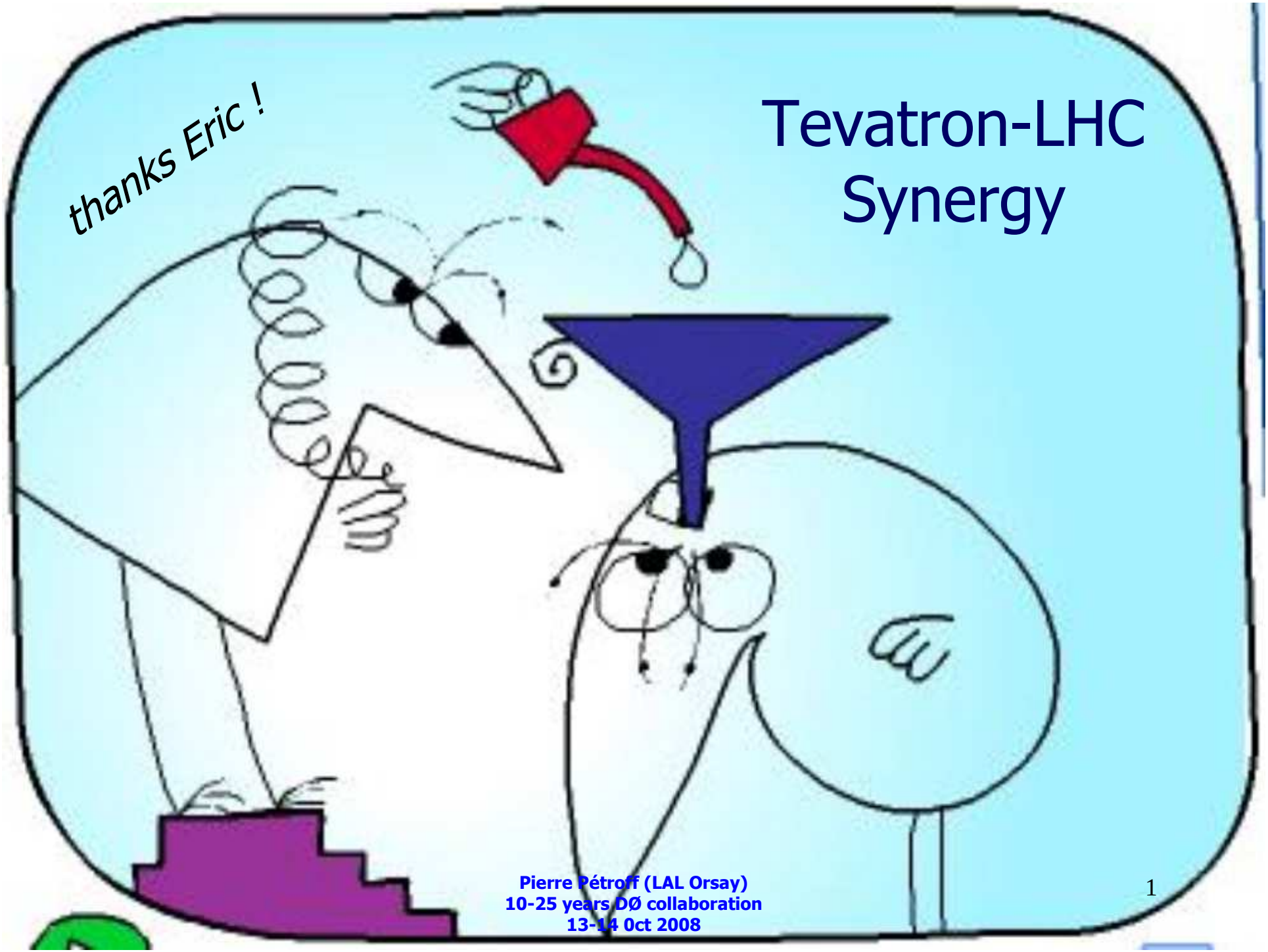
Tevatron-LHC Synergy



Tevatron – LHC "Synergy"

Synergy: joint work and cooperative action

The Tevatron and the LHC physics programs share common goals

TeV4LHC since 2004: facilitate the start-up of the physics exploration at the LHC by using experience built up at the Tevatron

Various experimental issues at the LHC that can be addressed using experience gained at the Tevatron
Many of the tools developed at CDF and DØ to facilitate searches for new particles are beeing used at ATLAS and CMS

- Strong "synergy" in hardware, software, computing, physics and manpower
- But more than that: Tevatron IS a candle for the young LHC

Tevatron – LHC "Synergy"

Tevatron and LHC share people and technical knowledge

- Students, postdocs move toward ATLAS/CMS
- Engineering and technical staff at cutting edge
- Senior physicists in common

Real-life experience on dealing with physics with an imperfect reality !

Tevatron – LHC "Synergy"

IN2P3 scientific committee (1997) ok to join DØ
Saclay already in since (1984 ?)
- physics program
- prepare young physicists at LHC

IN2P3 scientific committee (2006) ok up to 2009
- very rich physics harvest
- very rich potential discovery
- setup synergy with LHC experiments
    - heavy flavors/generators/
    - manpower

Where do we stand ?

DØ France Migration

43 thesis → 63% in LHC experiments
Postdocs → 100% " "
Seniors → 40% at >= 50% in LHC

But this rich synergy should not be broken NOW !

Migration from DØ to ATLAS/CMS must proceed
at the right pace and takes into account (for short term)
- the LHC start-up progress
- the Tevatron performances
  and its potential discovery when ATLAS/CMS are commissioning still

Thesis Overview

43 thesis (since 1987 !) 3 Run I and 40 Run II
8 thesis in preparation for 2010

defended already :
NP: 22 top: 12 Higgs: 5 QCD: 2 exp: 2 (Run I)

Comment: in 2008 NP: 2 top: 3 Higgs:2
in 2010 top: 2 Higgs:6

DØ France thesis on "hot" topics !
good synergy with LHC Higgs searches

5 habilitation thesis

Technology

Tevatron RUN I experience →ATLAS/CMS detectors

Tevatron Run II: electronic calibration of the LAr calorimeter
Same design than in ATLAS and same engineer team

Synergy during the 3 first Minutes of LHC

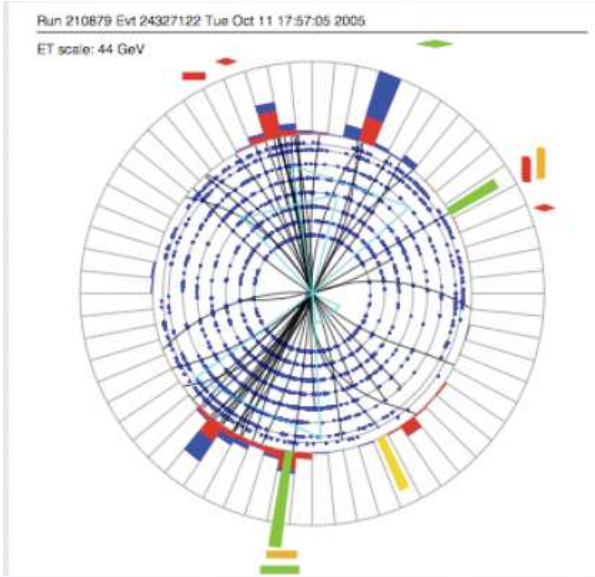
Tevatron data and experience are invaluable for success of searches at LHC .

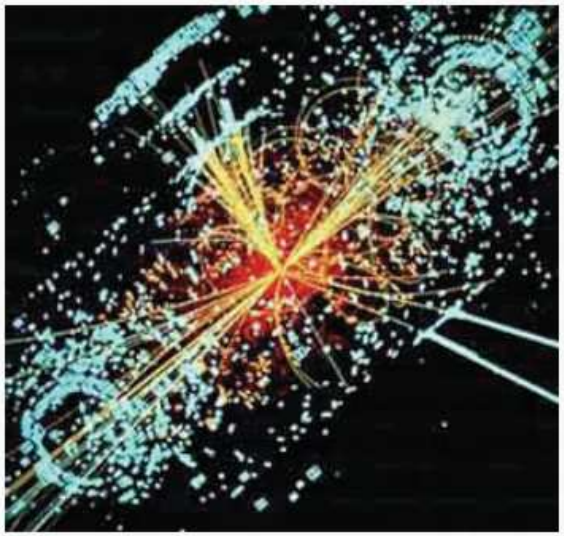
Physics environment at the LHC is very similar to that at the Tevatron

Tuning on Tevatron data:

- Tuning of min-bias and multiple interaction models
- understanding of reliability and limitations of MC generators
- Test of theoretical N..LO calculations
- Experimental methods and techniques for particle ID

Tevatron to LHC





With ~3×10^4/fb Z and ~6×10^5/fb W events on tape, Tevatron dataset is now large enough and adequately understood to vet ME-PS models for many final states involving vector bosons.

A concerted effort by experimentalists and theorists is needed to resolve existing puzzles and improve predictions of ME-PS programs which are critical for Higgs/NP searches at both Tevatron and LHC:

Tuning to Tevatron data is a good opportunity

Sabine Lammers
Physics at LHC 2008

Tevatron: a candle

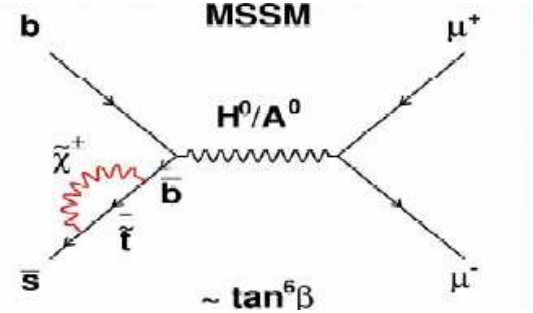
Tevatron results: a guideline for searches at LHC direct searches and indirect searches (precision EW)

A few examples about indirect searches
- new physics
    - limits Bs→ μμ
    - phase in Bs direct CPV
- Higgs indirect limits

Indirect Search: $B_s \rightarrow \mu\mu$

The search for $B_s \rightarrow \mu\mu$ is perhaps the most sensitive to SUSY since sparticles show up in loops

Especially sensitive at high tanß ($\propto$tanß^6)



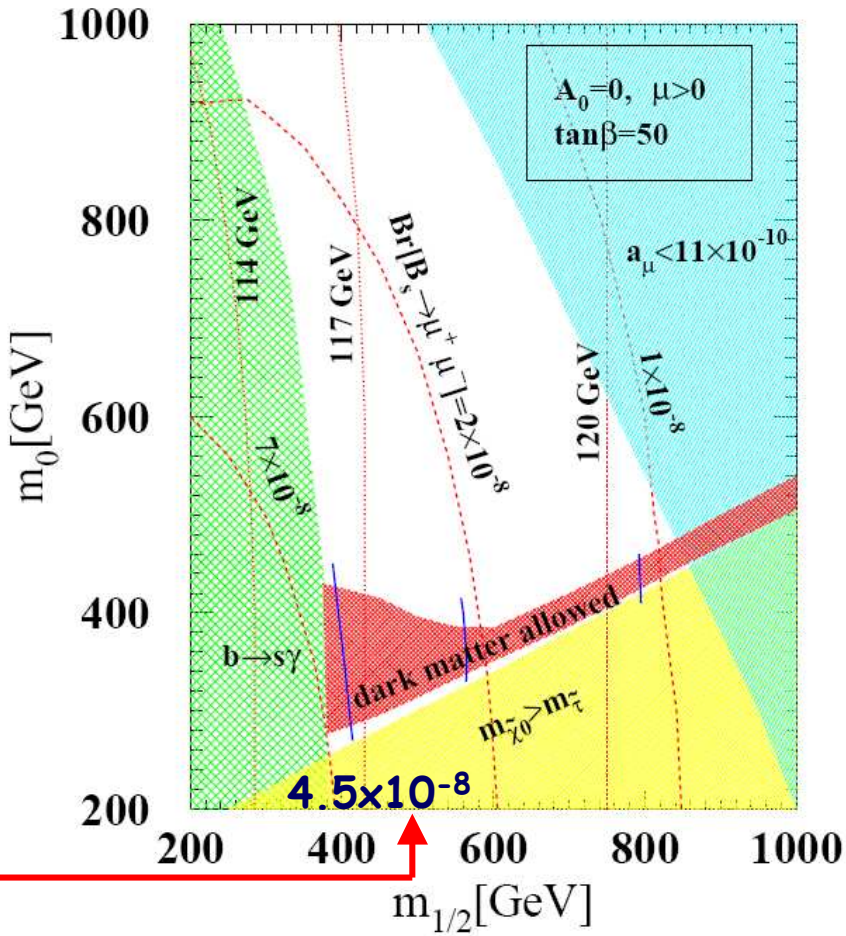
Preliminary Combined CDF/DØ

BR($B_s \rightarrow \mu\mu$)<4.5x10^{-8} @95%

BR$_{SM}$=3.5x10^{-9}

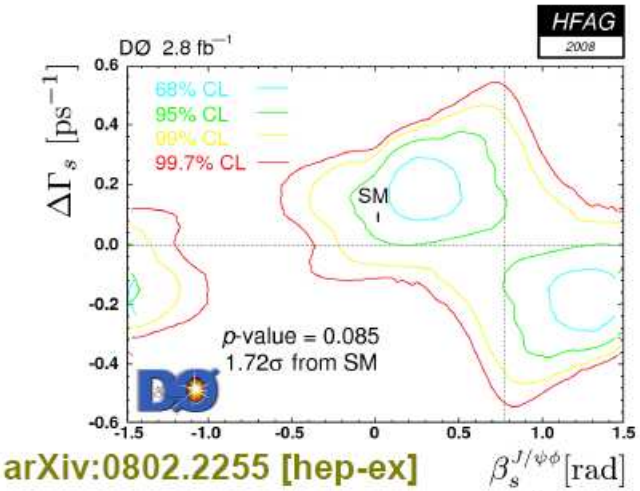
$M_{\tilde{g}} \sim 700$ GeV/c^2

Arnowitt et al PLB 538, 121 (2002)

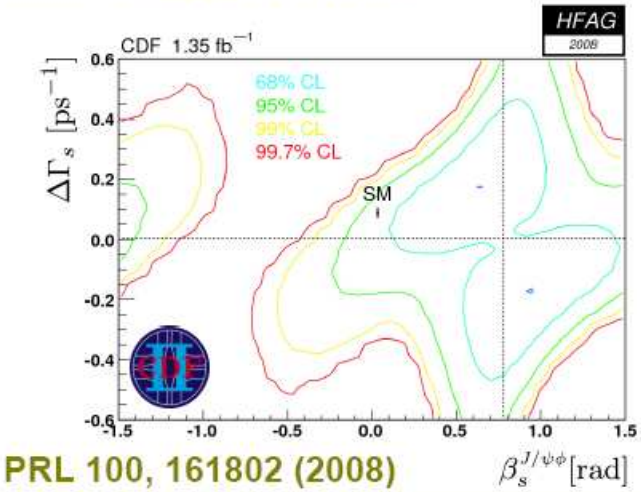


CP Violation in B_s^0 -> $J/\psi\,\phi$

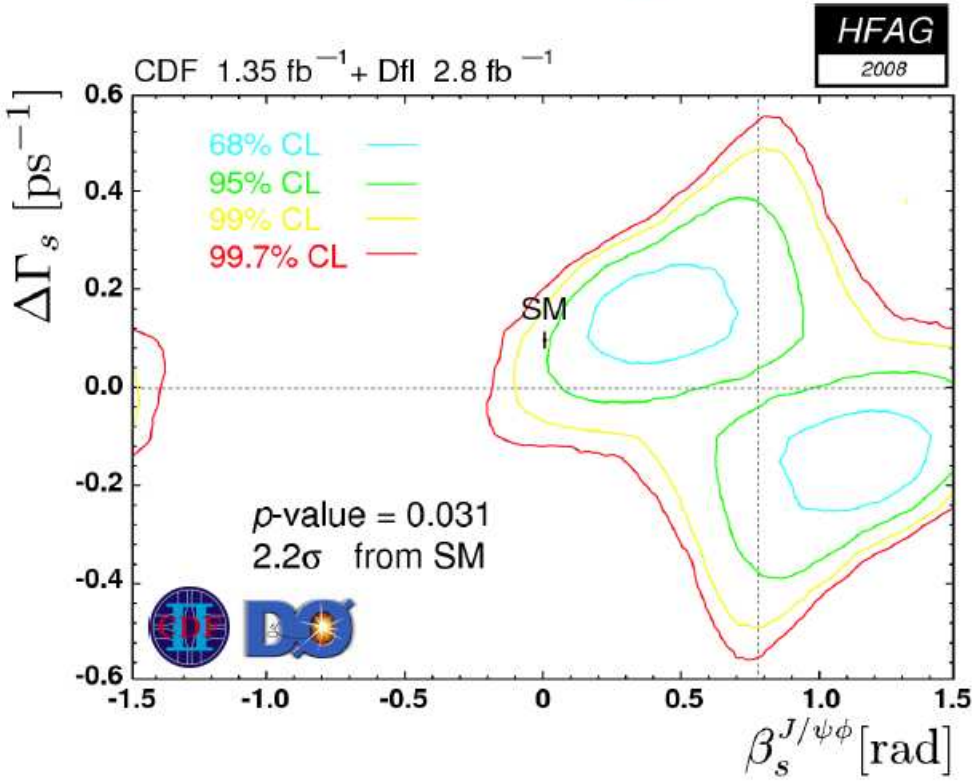
New: D0 released data with no constraint for average with CDF



arXiv:0802.2255 [hep-ex]



PRL 100, 161802 (2008)



β_s in [0.14,0.73] or [0.83,1.42] at 90% CL

Combined p-value(SM): 0.031 (~2.2σ)

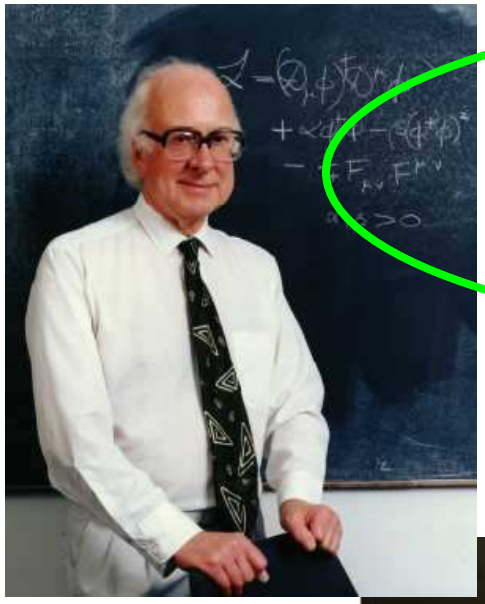
Pete Renton ICHEP 2008

Indirect Higgs limits

today		$m_H = 84^{+34}_{-26}$ GeV < 154 GeV @ 95% cl
A	δM_t $1.2 \rightarrow 1.0$ GeV	$m_H = 84^{+34}_{-26}$ GeV < 153 GeV @ 95% cl
B	δM_W $25 \rightarrow 15$ MeV	$m_H = 71^{+25}_{-20}$ GeV < 119 GeV @ 95% cl
C	for both A and B	$m_H = 71^{+24}_{-19}$ GeV < 117 GeV @ 95% cl

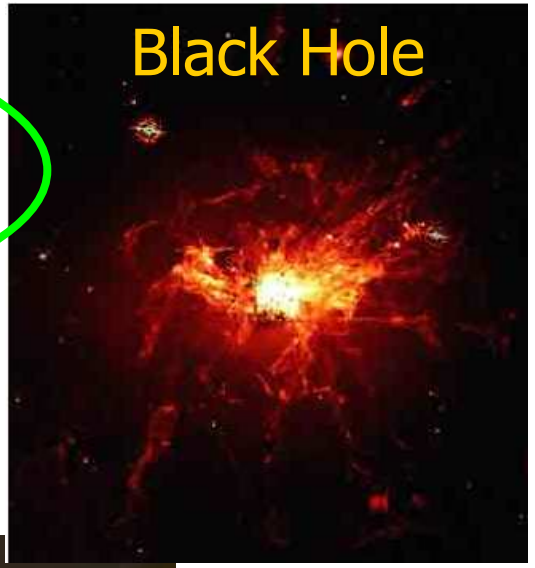
assumes central values unchanged

realistic at Tevatron (4 fb-1 on tape already !)



long and fruitful professional life
if not swallowed by a ..

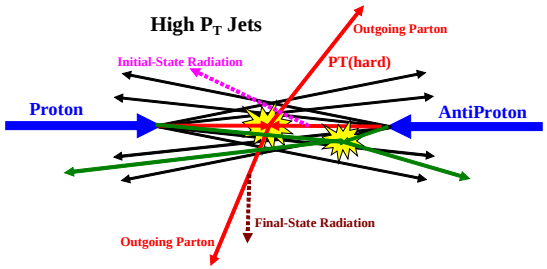
Please do something for my Nobel prize !
I would'nt like to wait up to
I 'm 87 years old !!!

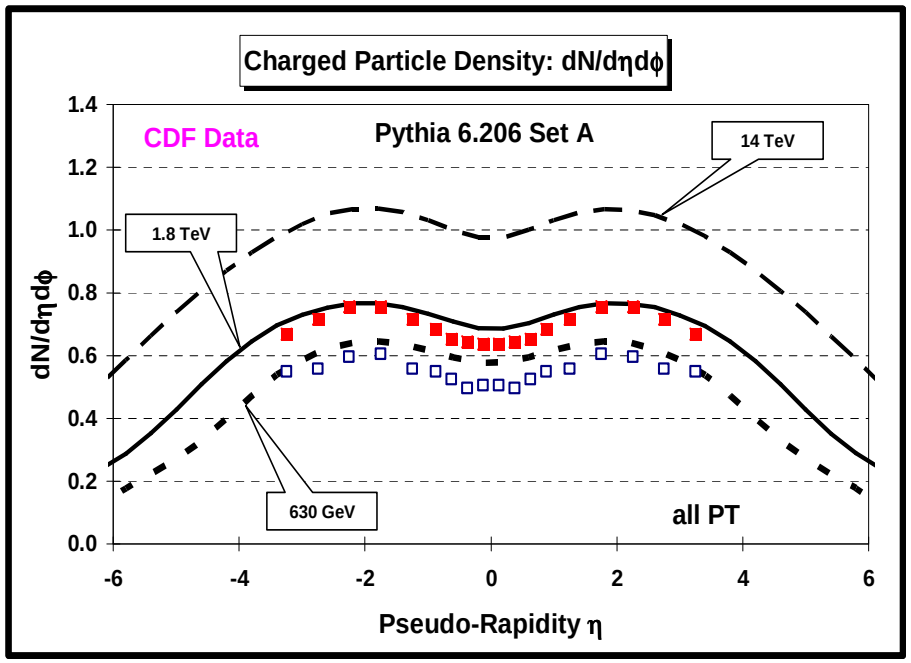


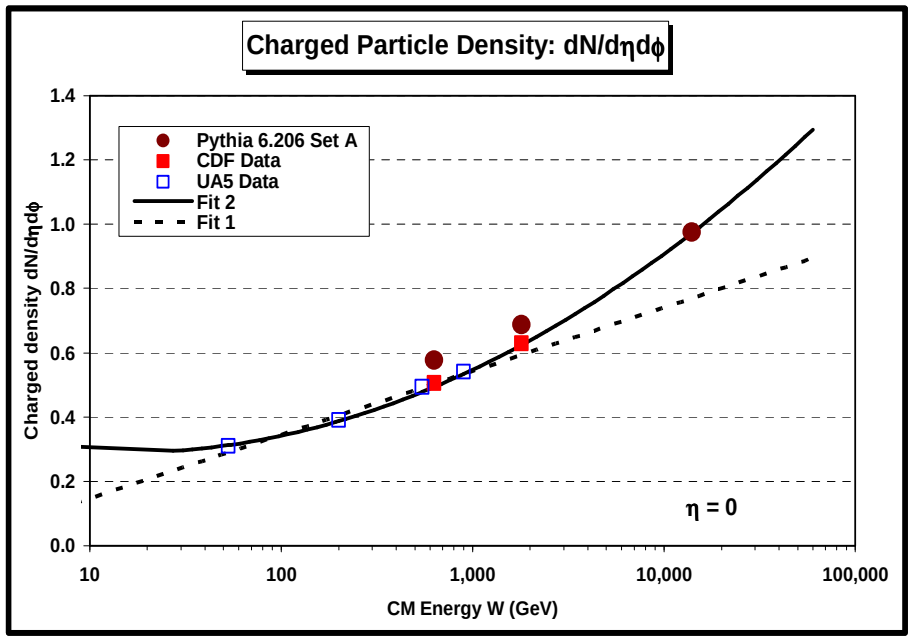
2002

Backup Slides

MC tuning on min-bias and UE data propagate to LHC





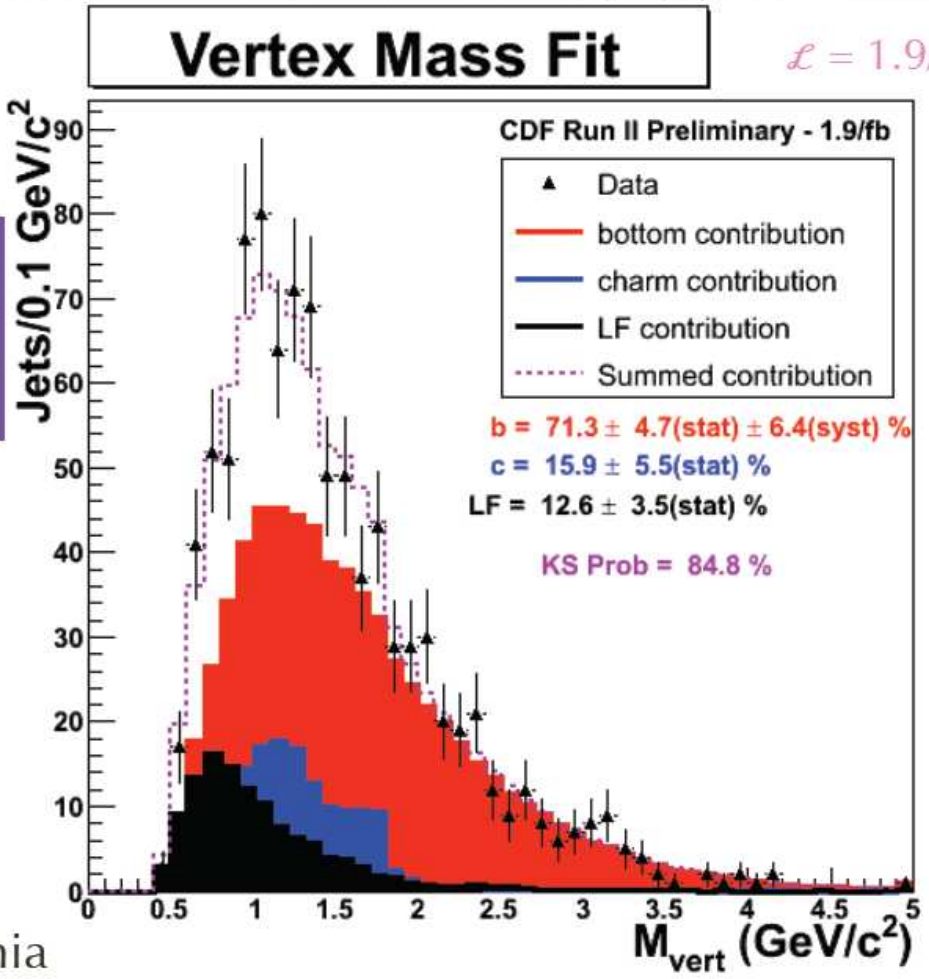


W+heavy flavor jets

Phase space:
- a truth level electron or muon with $p_T > 20$ GeV/c, $|\eta| < 1.1$
- a truth level neutrino with $p_T > 25$ GeV/c
- 1 or 2 total truth level jets with $E_T > 20$ GeV/c^2, $|\eta| < 2.0$

Backgrounds: ttbar (40%), single top (30%), fake W (15%), WZ (5%)

Alpgen prediction: 0.78 pb
Result: measure σ(W+bjets)xBR(W→lν)
σxBR = 2.74 ± 0.27 (stat) ± 0.42 (sys) pb.
→ **3.5x bigger!**

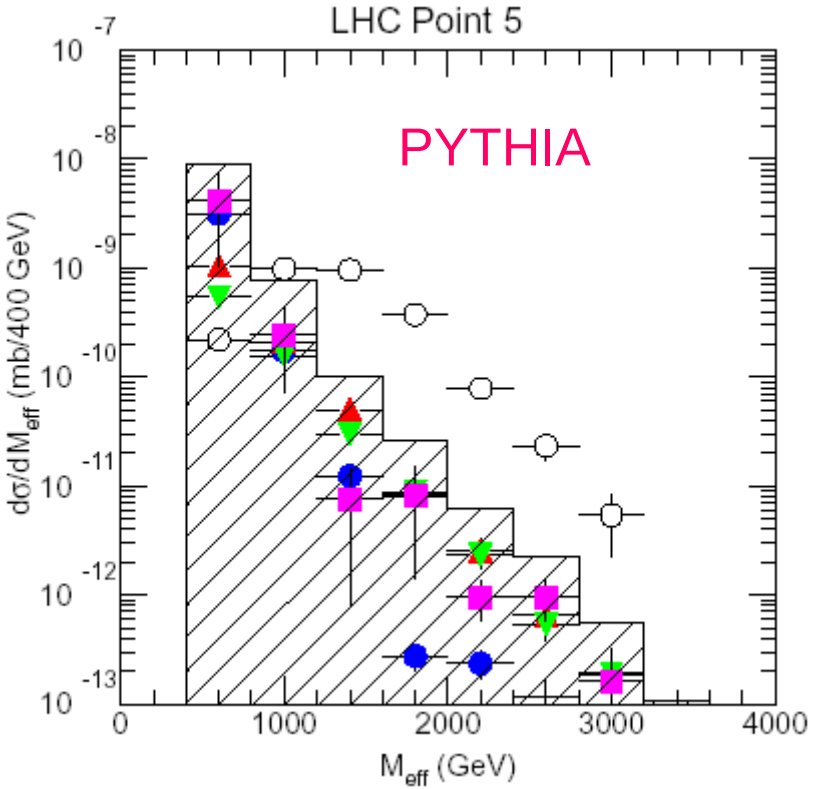


much larger difference than seen in W+c-jets

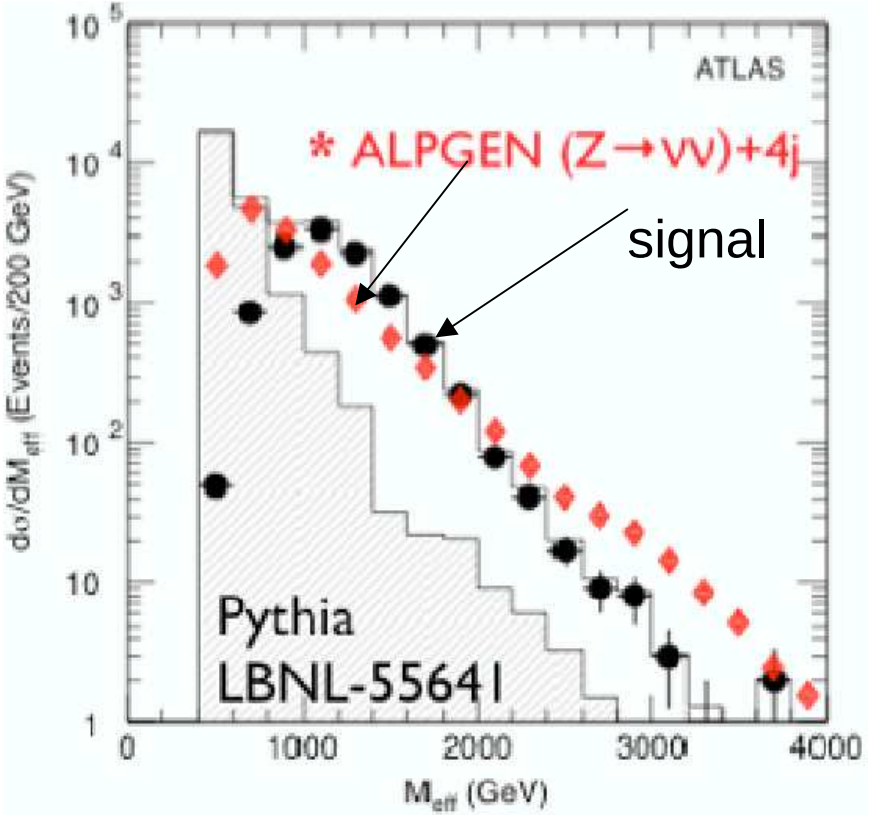
Still to come:
- differential distributions
- comparisons to Sherpa, Pythia

SUSY very easy ! But … !!

BUT …. a MC could mask another one and..
the "discovery" could be flawed by Z→νν+jets background !



background prediction from PS MC (shaded histo)



exact matrix-element calculations of the multiparton emission amplitudes

$$M_{eff} = E_T^{miss} + \sum_{i=1}^{4} p_T(jet_i) \quad (GeV)$$