P_T extrapolations at LHC energies

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First ReteQuarkonii worksop
Nantes, 25-28/10/2010

Outline

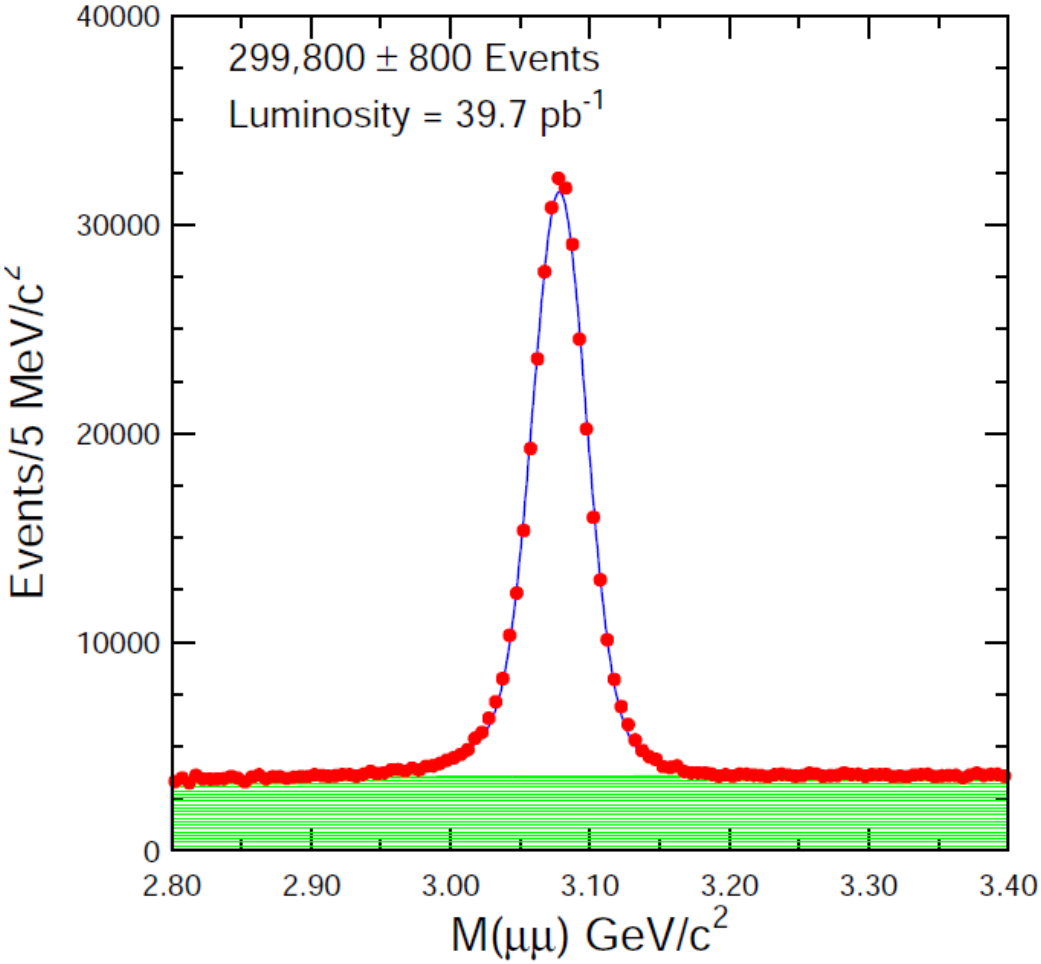
- CDF measurement of quarkonia p_T distributions
- Parametrization of the p_T distributions for the quarkonia
- Energy scaling according to CEM
- Comparison with last measurements at the LHC
- Scaling from pp to Pb-Pb collisions according to CEM
- Expected yields at top LHC energy in Pb-Pb collisions
- From 5.5 A TeV to 2.76 A TeV

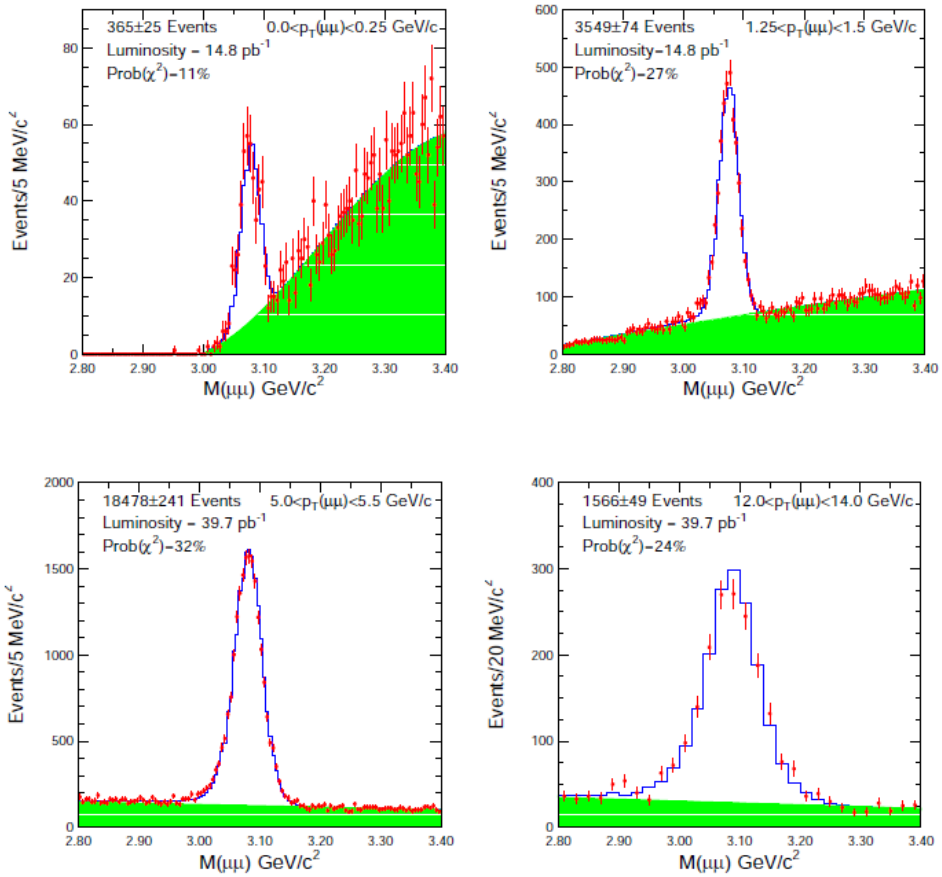
Most of the arguments based on
ALICE-INT 2008-016 (S. Grigoryan, adf)

Inputs: J/ψ mass spectrum at CDF

- Measurement of the J/ψ cross section at sqrt(s)=1960 GeV through its decay into muon pairs
  About 300k events with 20 MeV mass resolution

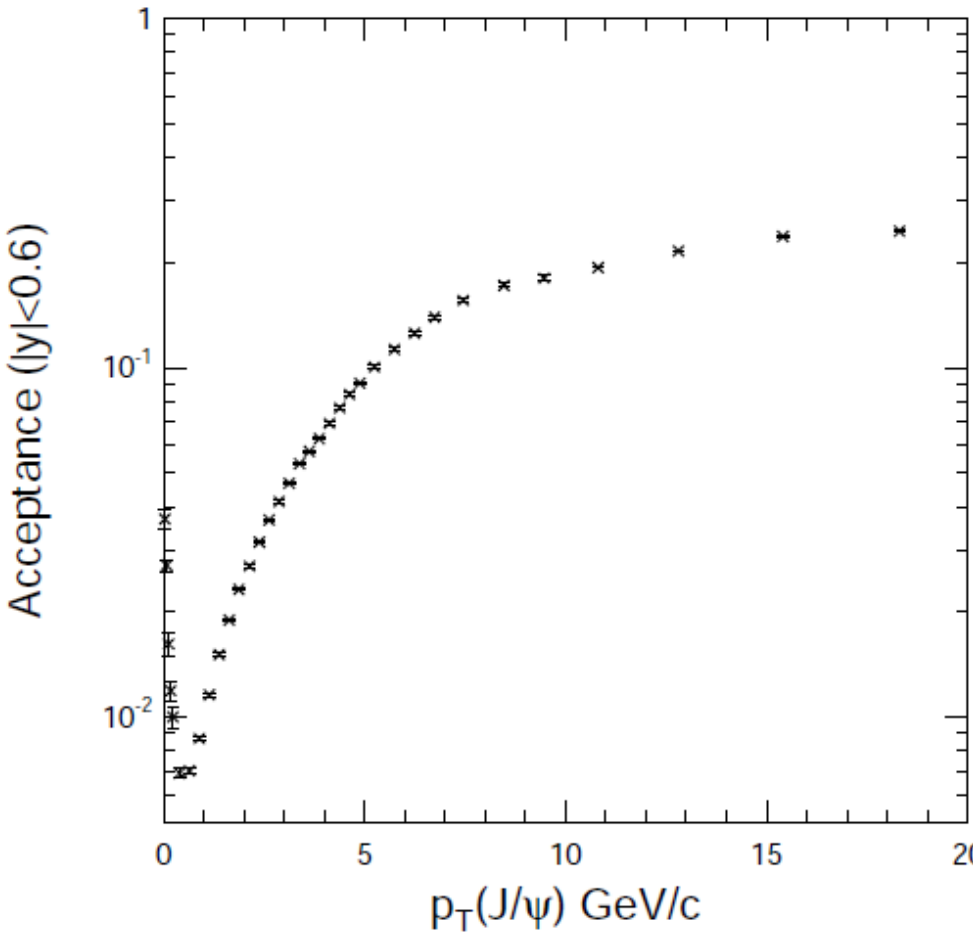
Phys. Rev. D71, 032001 (2005)

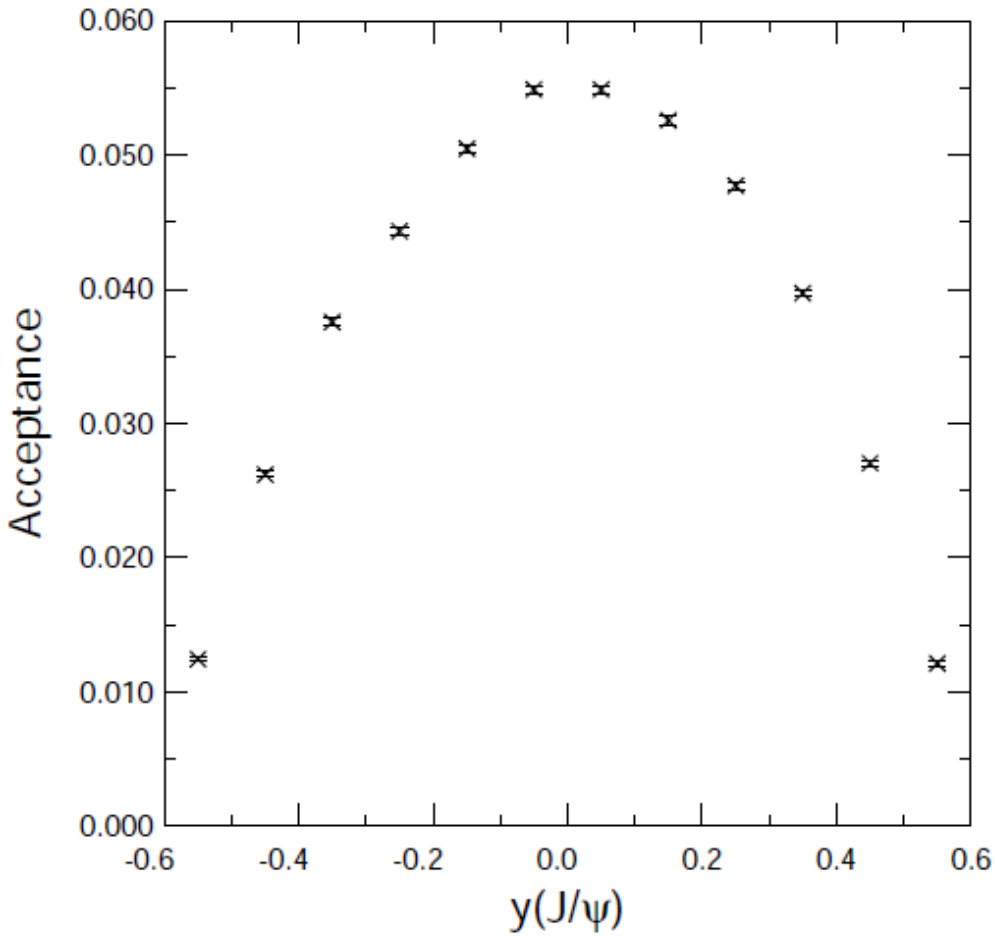




CDF coverage in p_T and rapidity

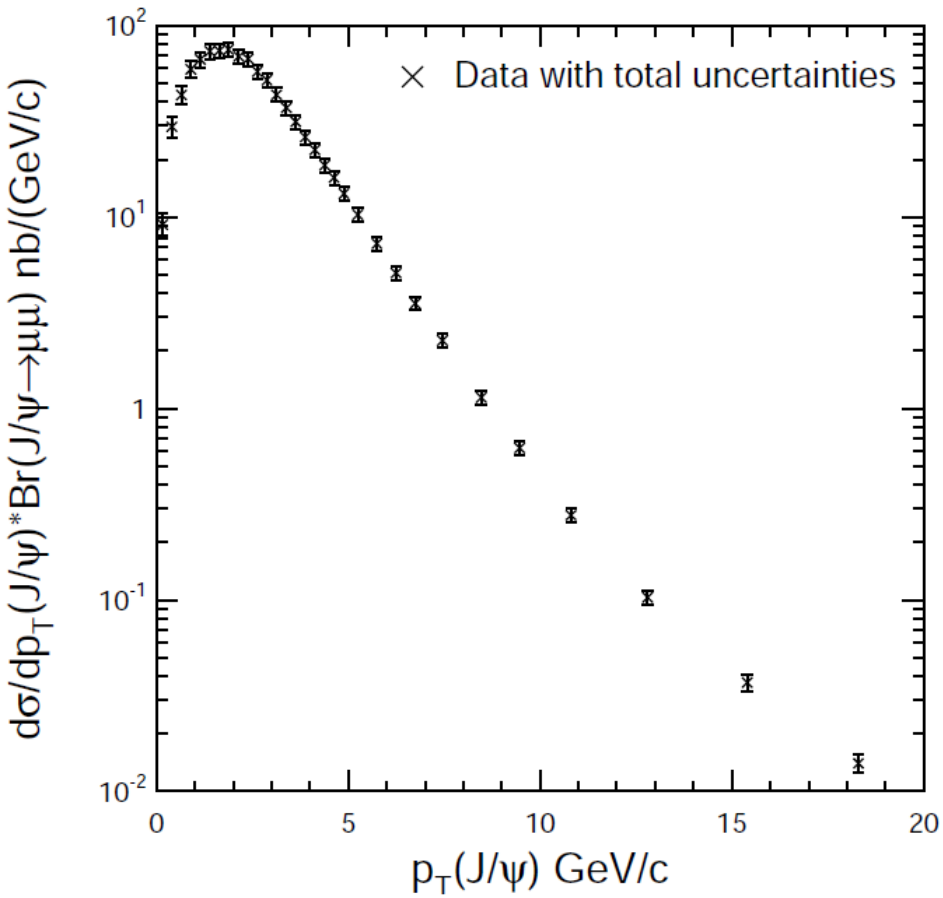
- Measurement at midrapidity, acceptance extends down to p_T=0

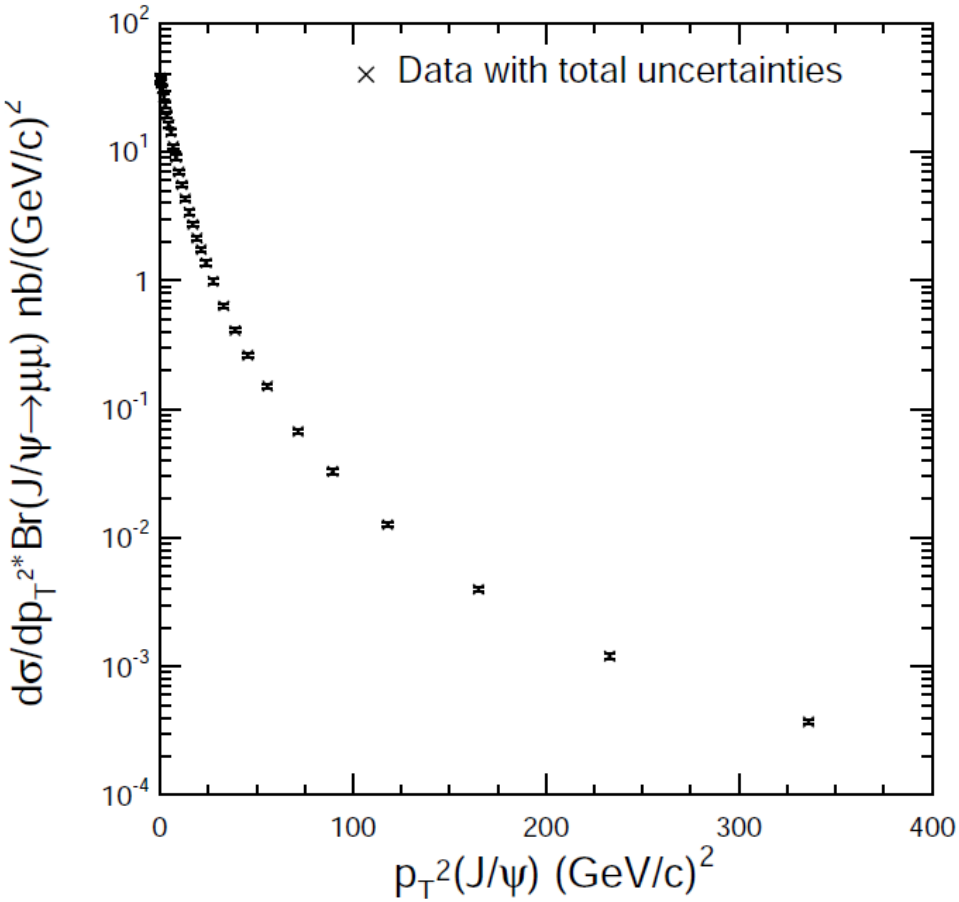




J/y p_T distribution from CDF at 1.96 TeV

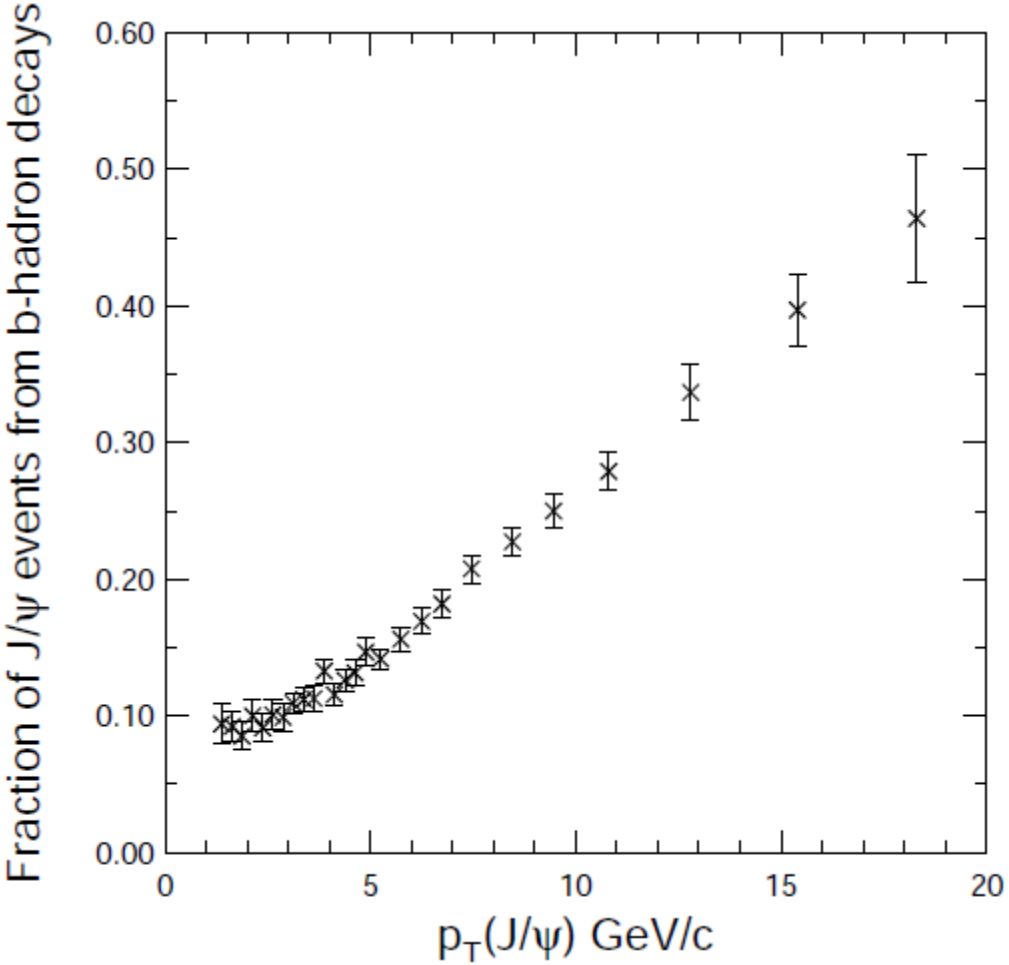
P_T distribution extends up to 20 GeV

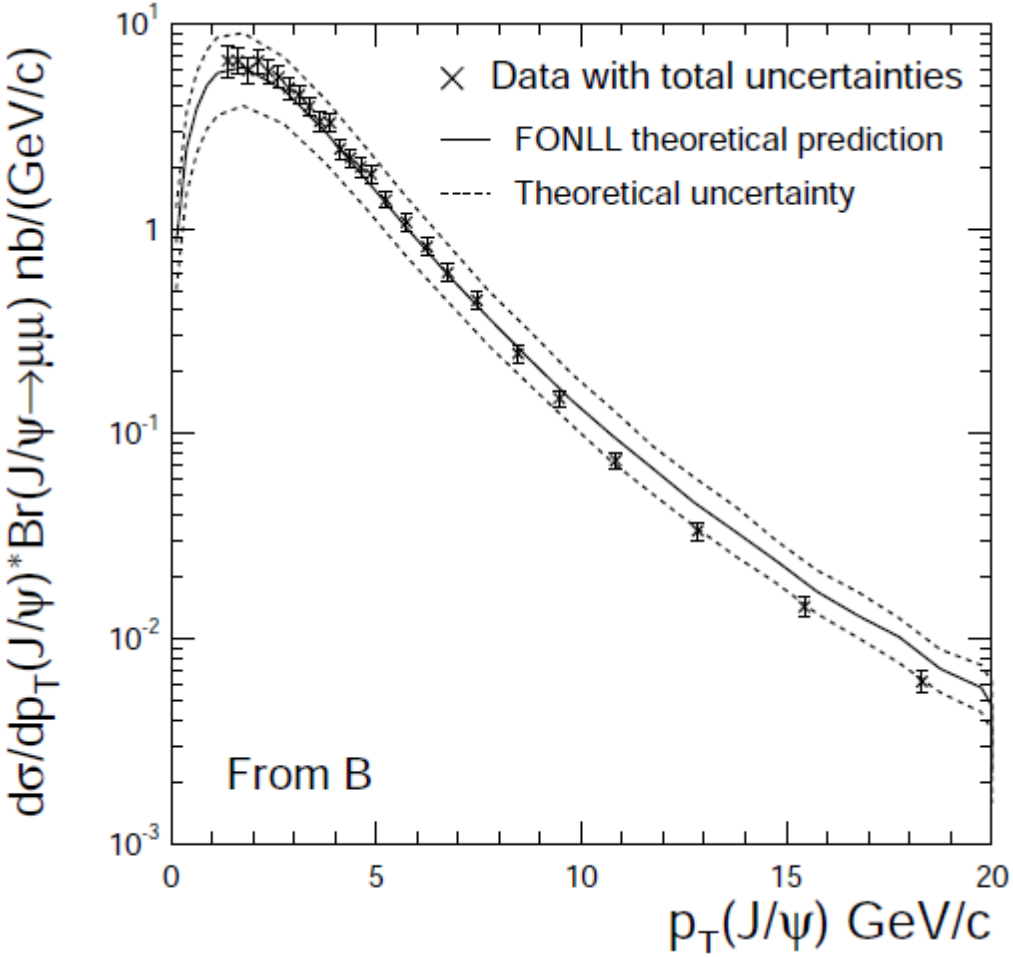




Fraction of J/y from b-hadron decays

- The fraction of J/ψ from B mesons ranges from 10% at low p_T to ~40% at p_T~15 GeV
- Harder p_T distribution than the direct J/ψ

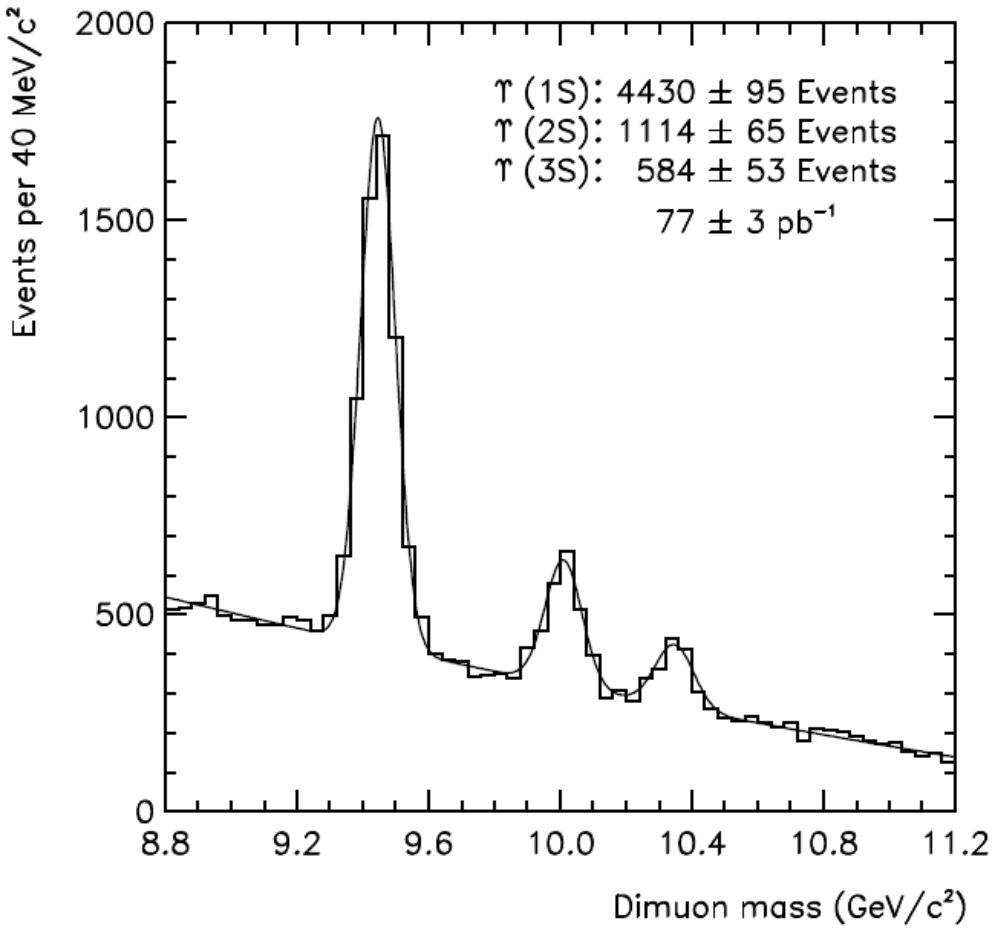


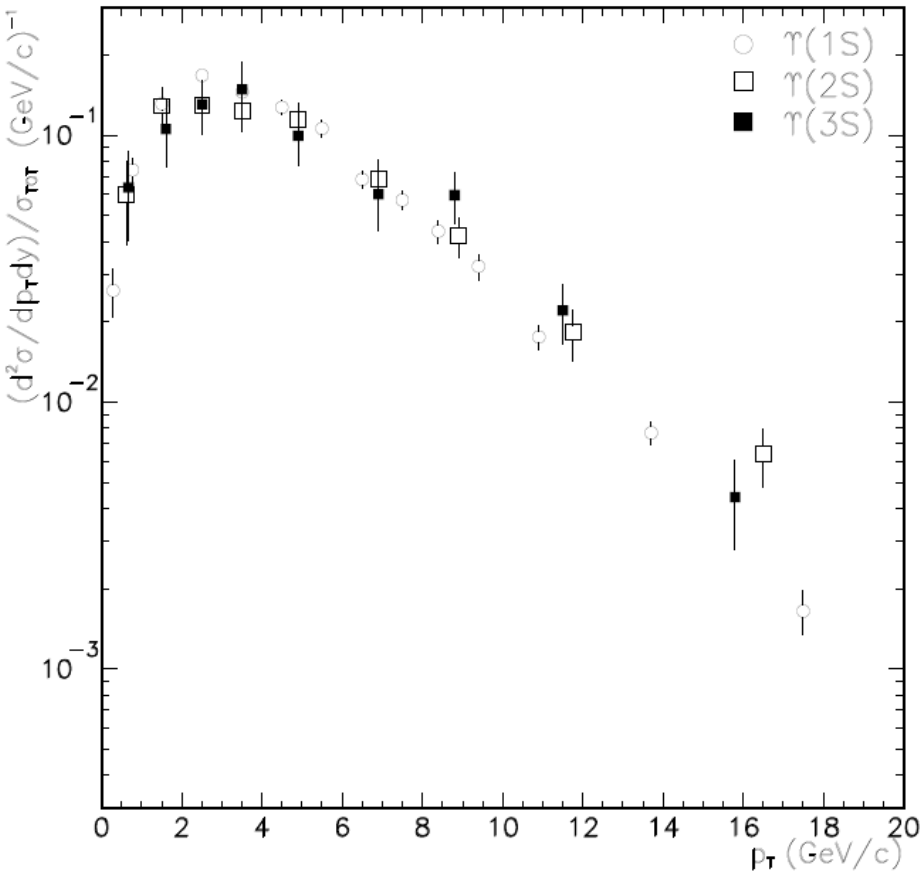


Upsilon p_T distribution measured by CDF at 1.8 TeV

- The resonances of the Y family are well resolved. About 4k events in the Y mass peak.

Phys. Rev. Lett. 88, 161802 (2002)

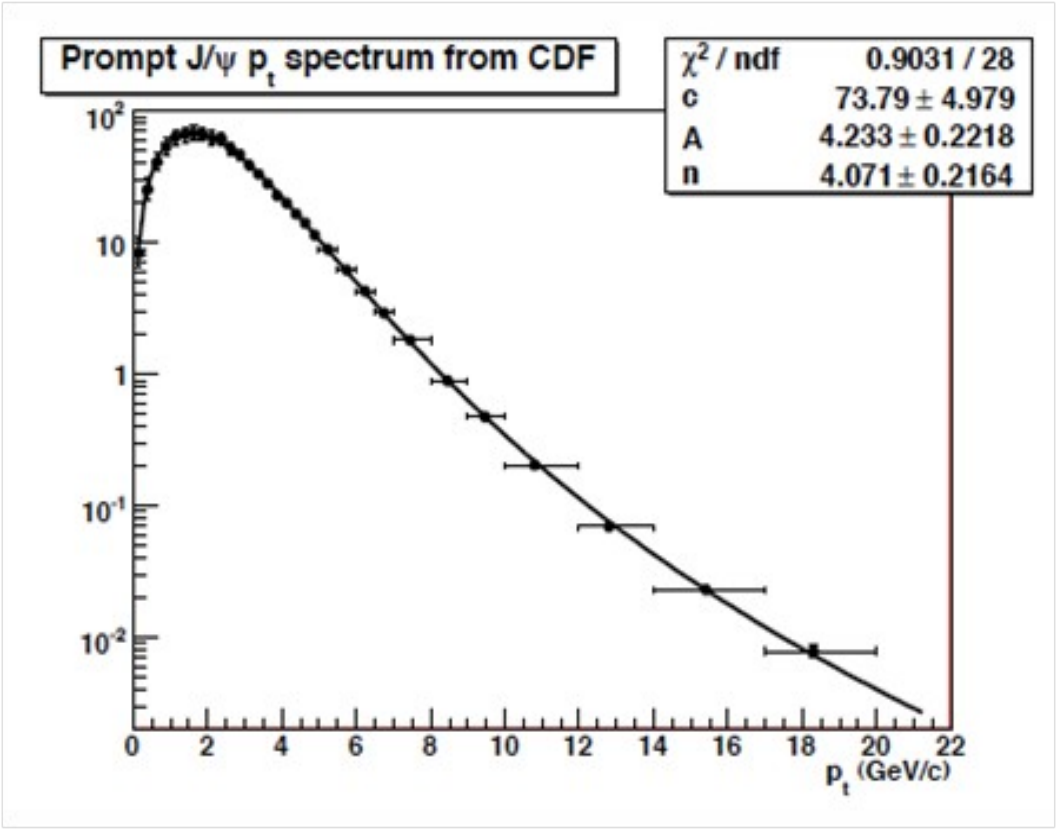


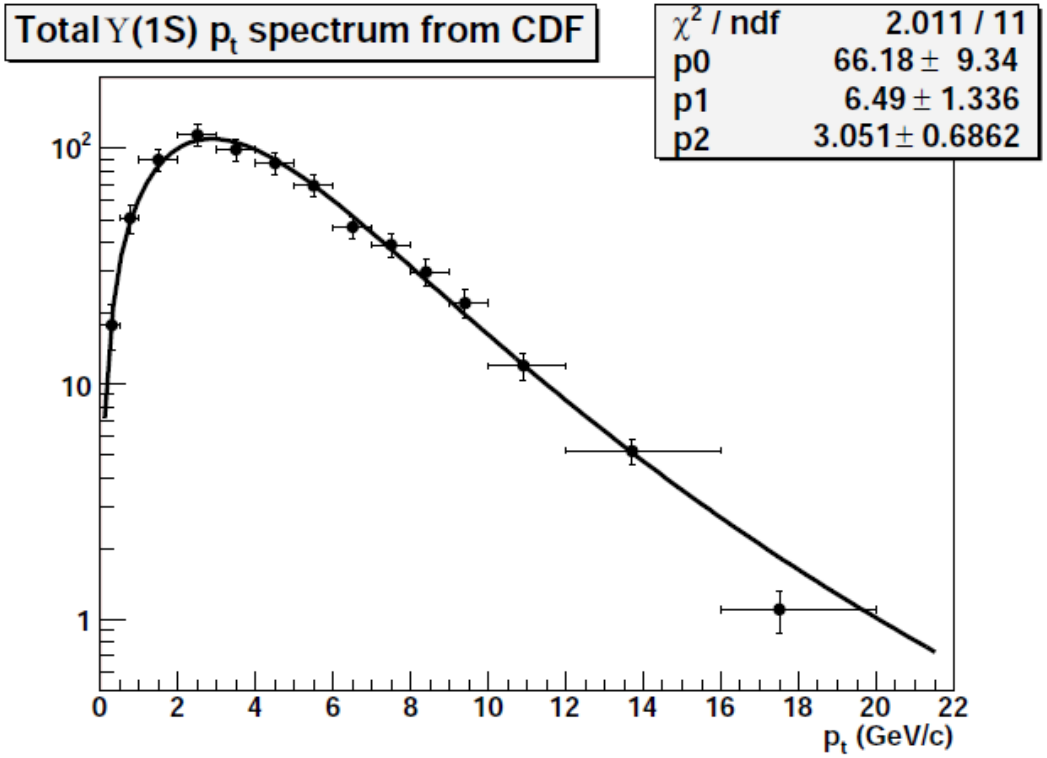


Parameterization of the p_T distribution

- The CDF cross sections (after the subtraction of the J/ψ from B decays) are fitted in the range $0 < p_T < 20$ GeV/c using the function:

$$\frac{dN}{dp_T} = c\,\frac{p_T}{[1+(p_T/A)^2]^n}$$





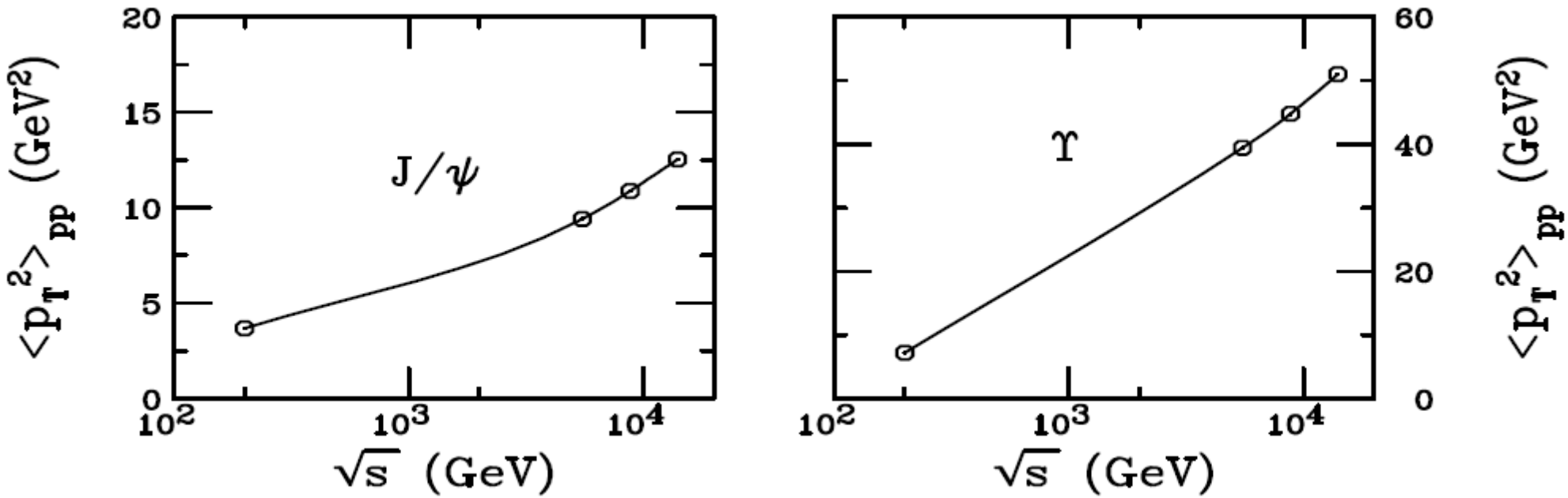
Extrapolation to the LHC energy

- Correction from Tevatron energies to 5.5 TeV according to energy dependence of $<p_T^2>$ given by CEM and NLO pQCD calculations

$$\langle p_T^2 \rangle \propto A^2$$

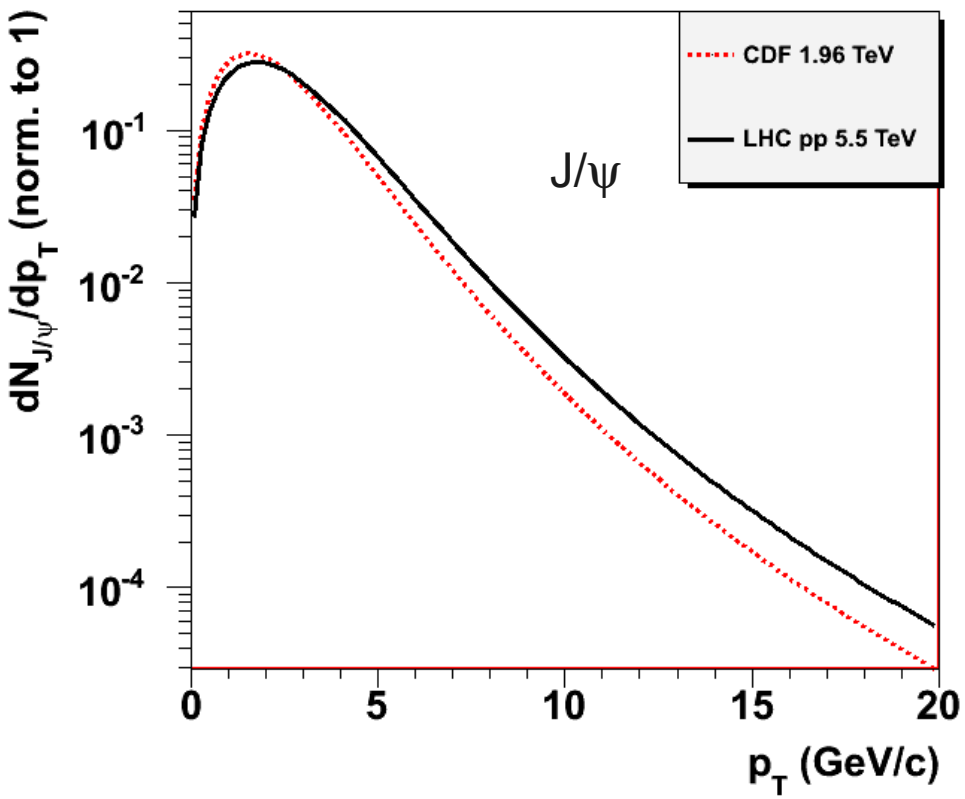
$<p_T^2>$ increases by ~25% from 1.96 to 5.5 TeV for J/ψ and by ~32% for ϒ
increase of A by 12% (15%) for the J/ψ (ϒ)

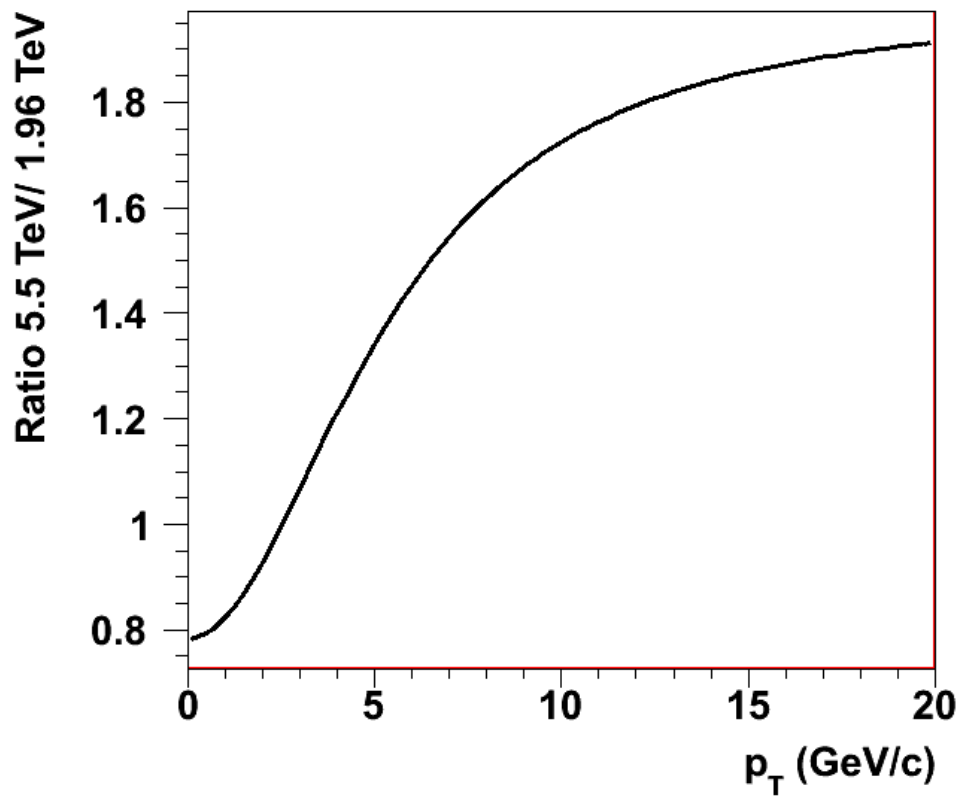
A. Accardi et al, hep/ph 030824 (2003)



From Tevatron energies to sqrt(s)=5.5 TeV

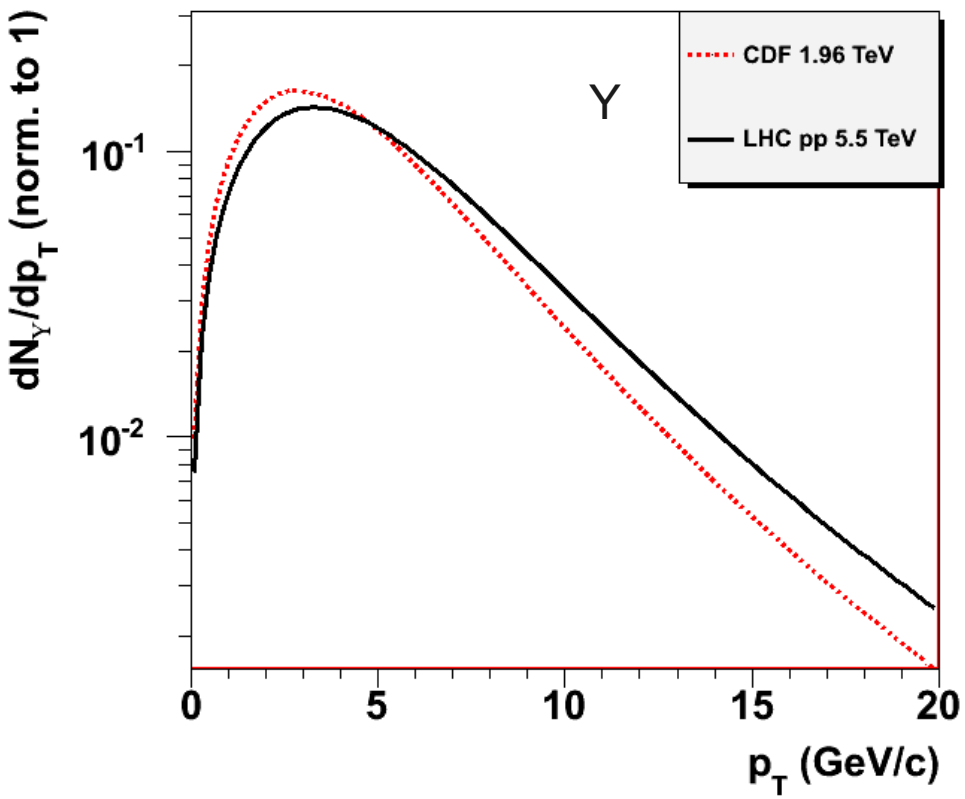
- Comparison between the shapes: both distributions are normalized to 1

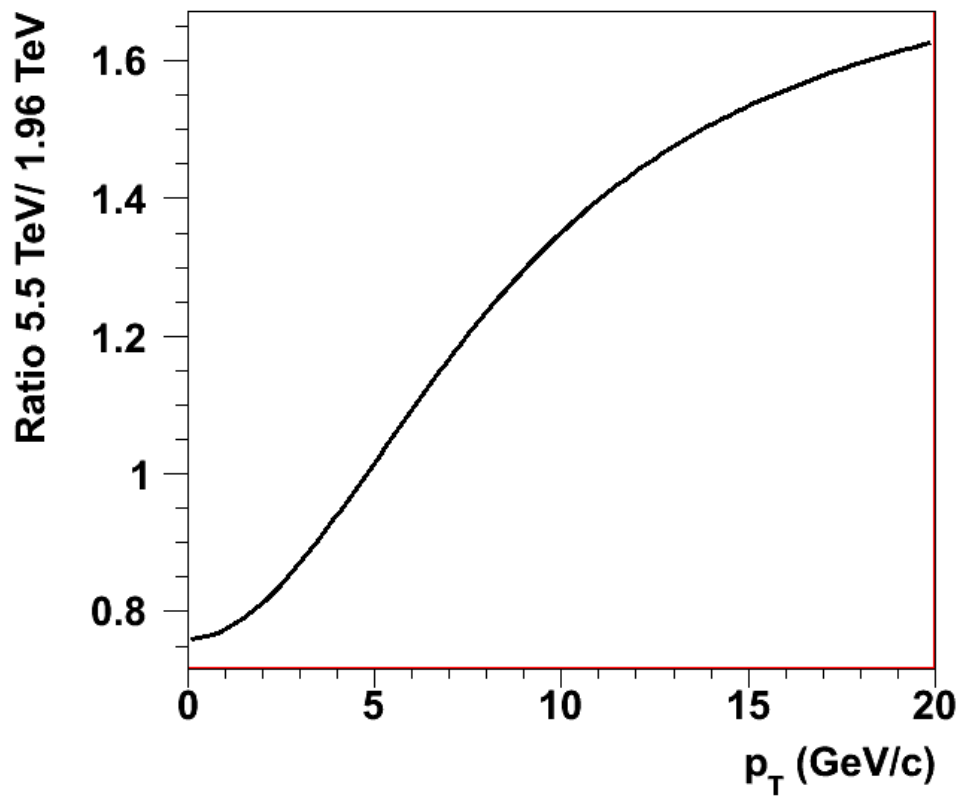




From Tevatron energies to sqrt(s)=5.5 TeV

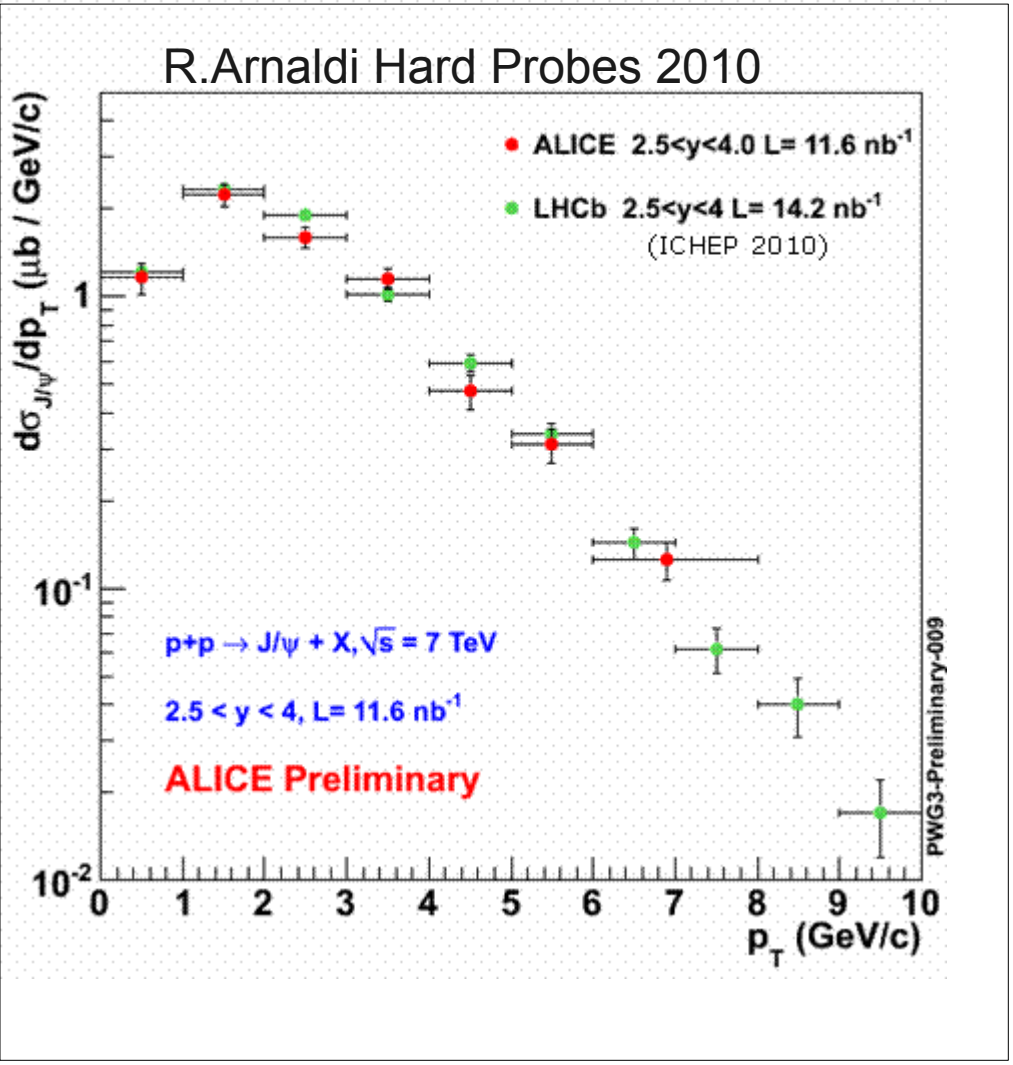
- Similar trend for the Y

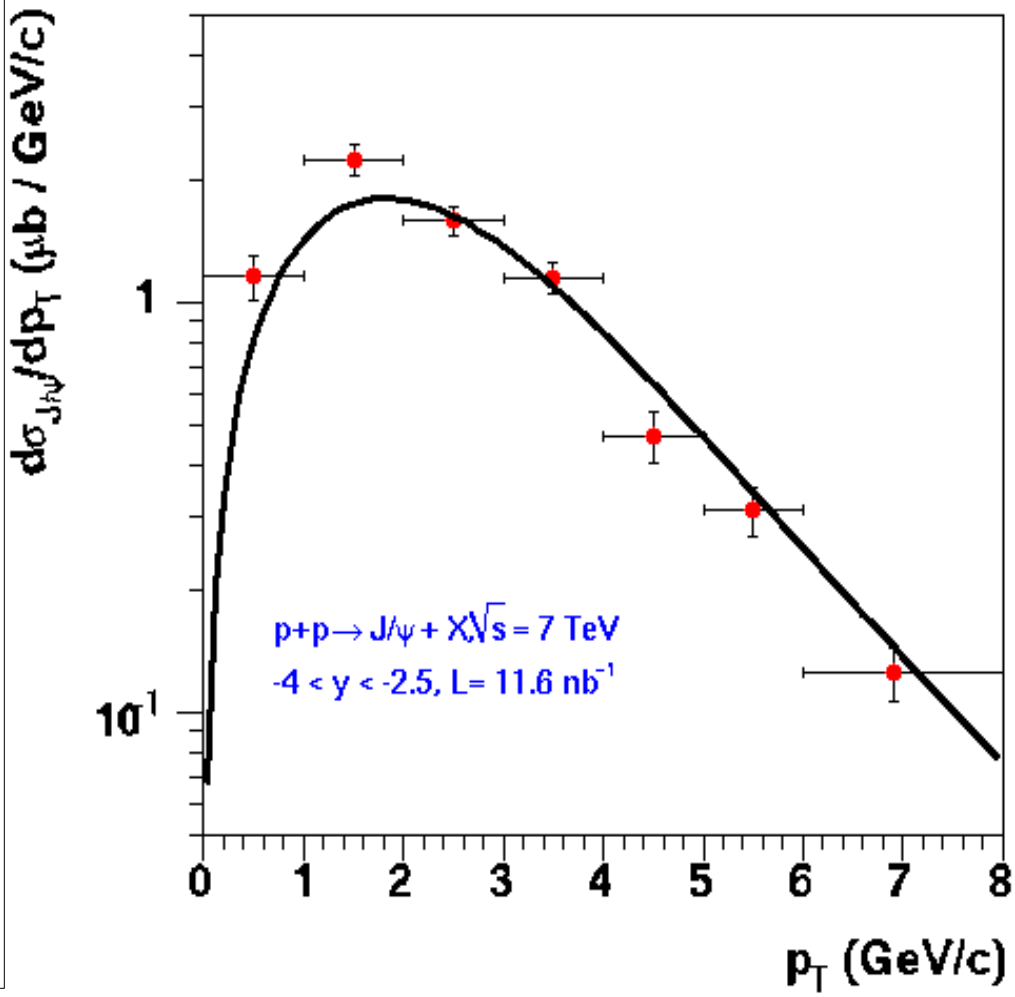




Test of the fit function on the ALICE J/ψ → μμ data

- The scaling according to the sqrt(s) dependence of $<p_T^2>$ in CEM gives a reasonable description of the J/ψ p_T distribution measured by ALICE at 7 TeV

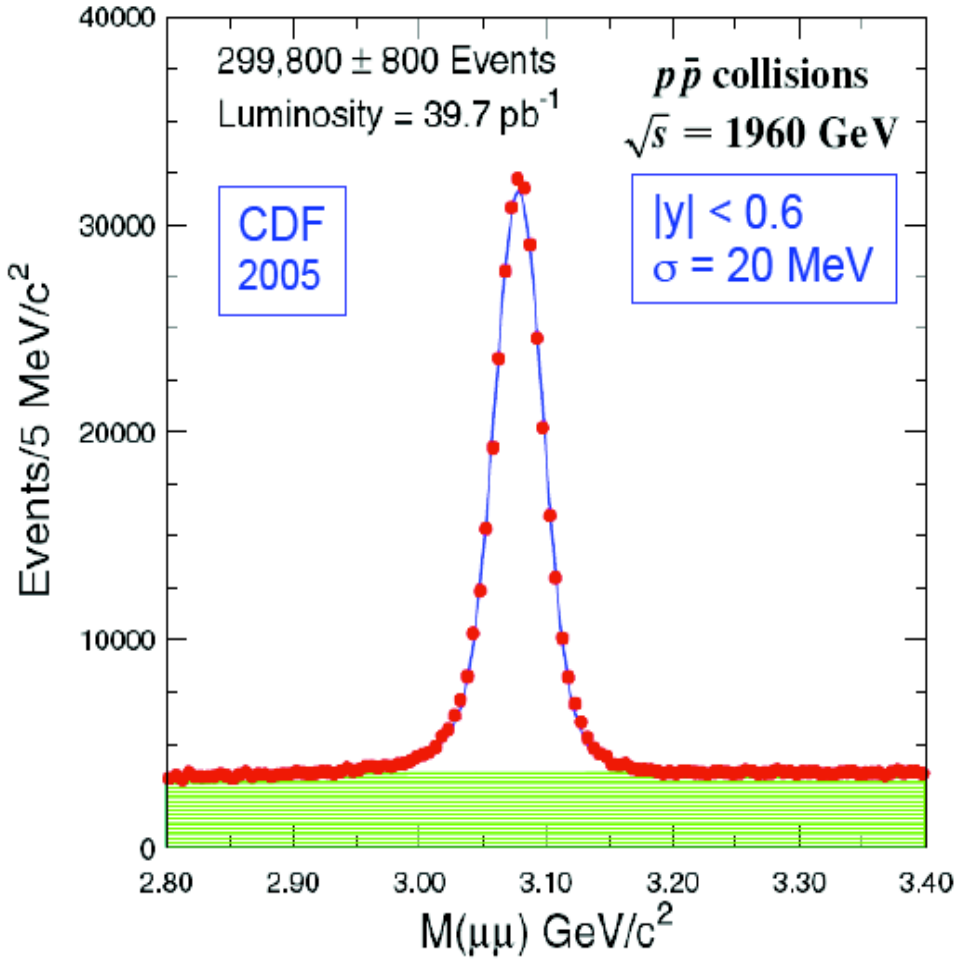


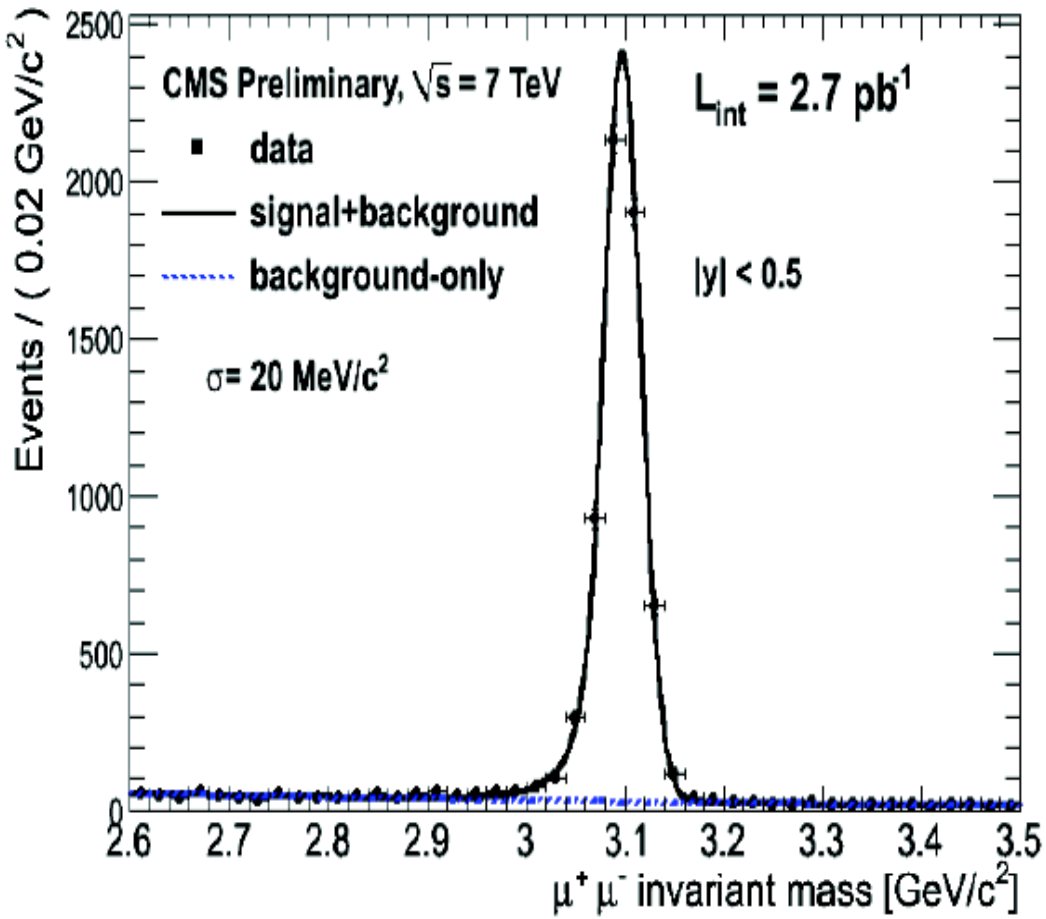


Other measurements at the LHC: CMS

- High statistics, high resolution data taken by CMS in the 7 TeV run

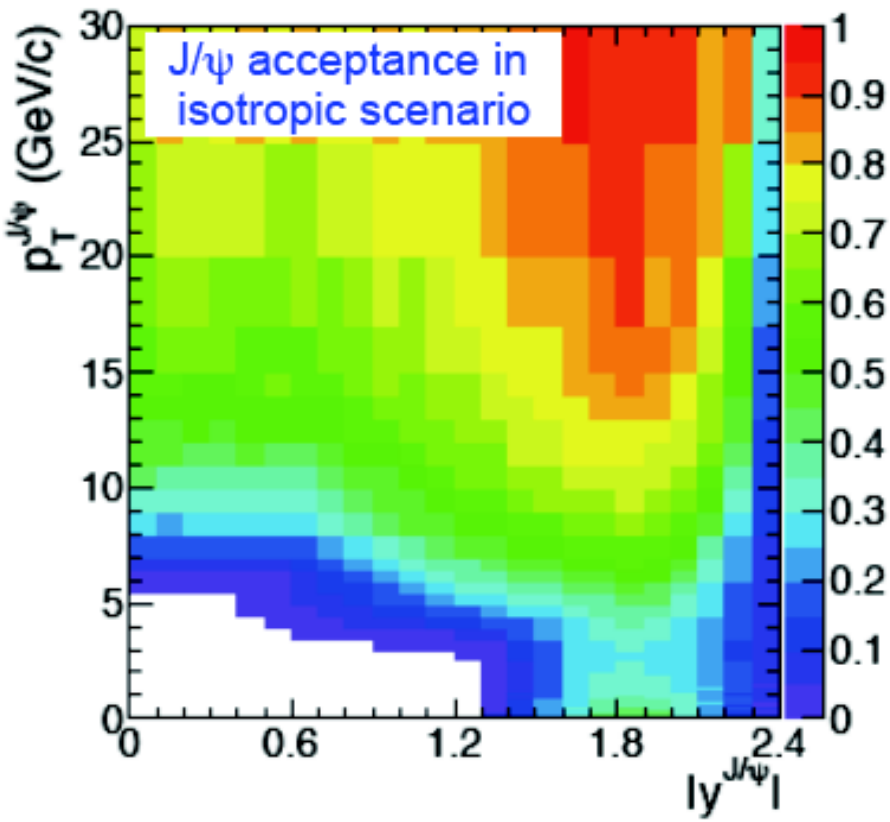
C. Lourenco Hard Probes 2010

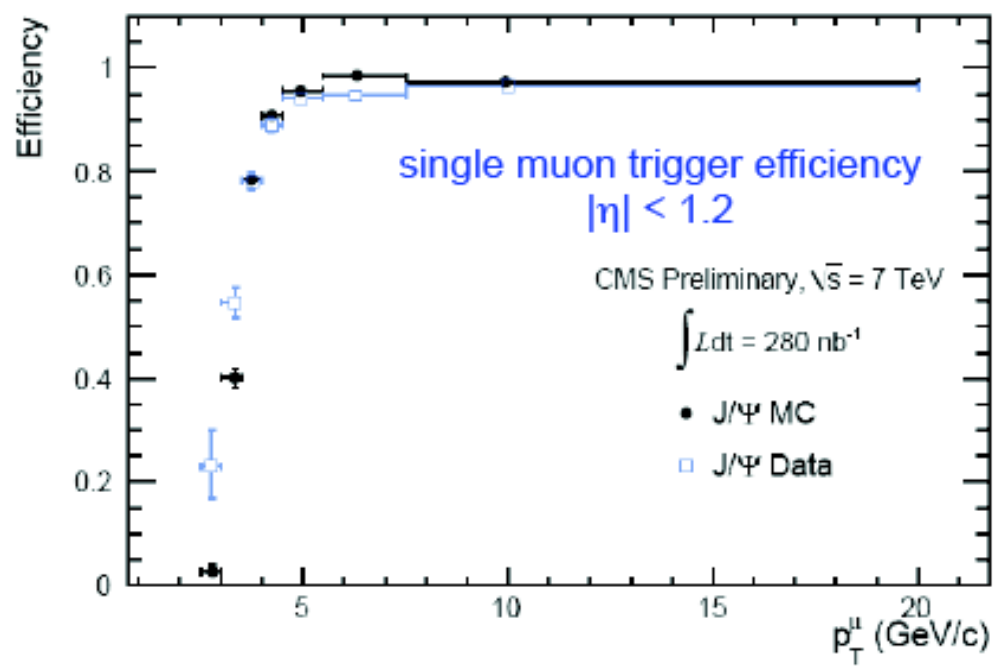




CMS acceptance for the J/ψ

No acceptance at midrapidity for low p_T J/ψ





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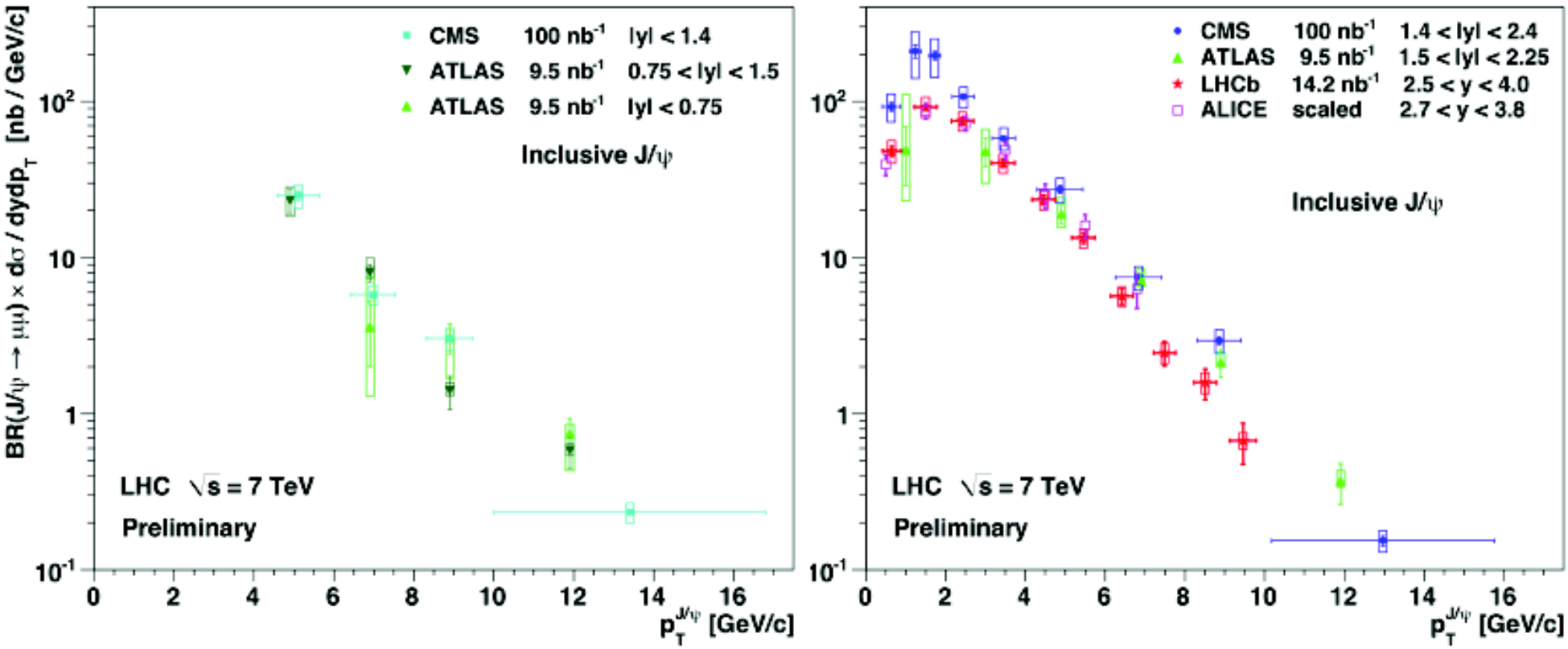
J/y p_T distribution at LHC



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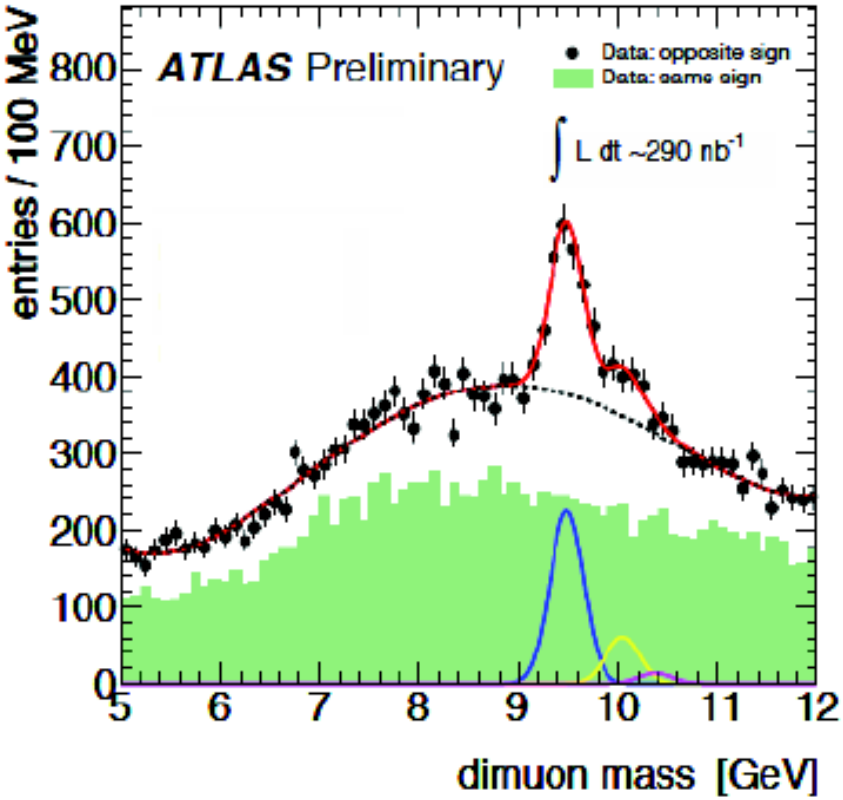
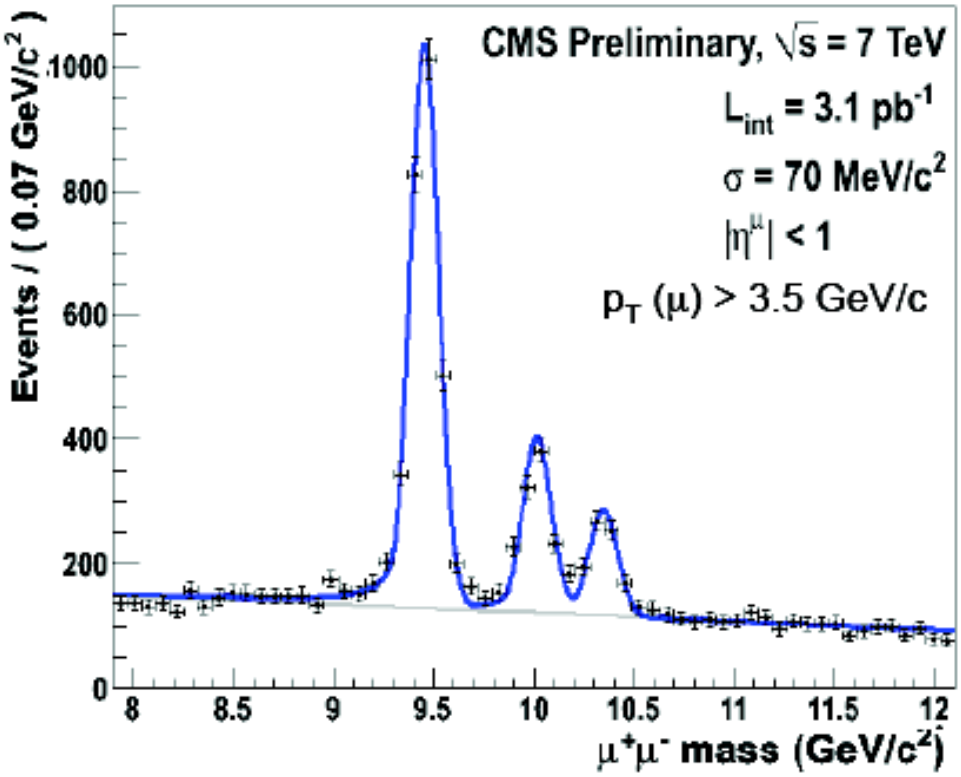
Mass spectra in the Upsilon region

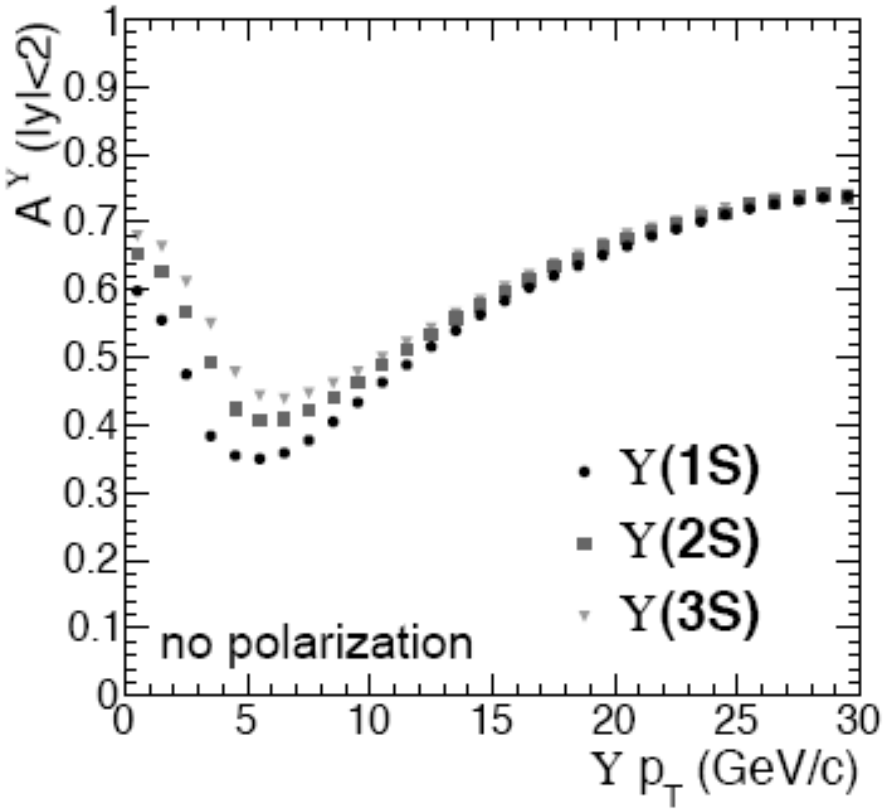




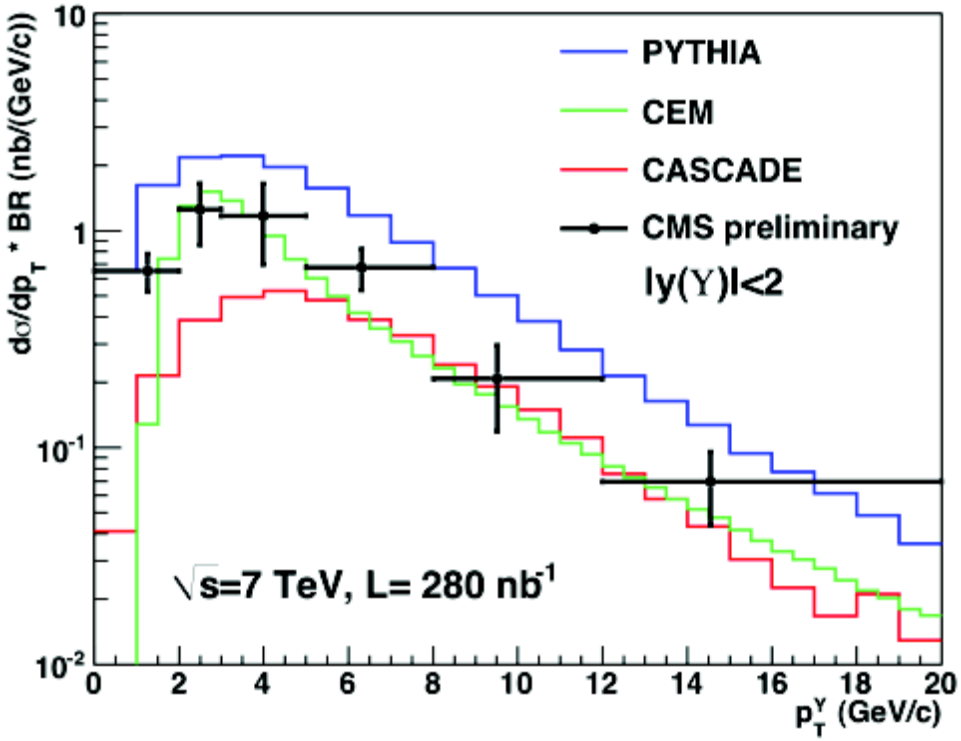
C. Lourenco Hard Probes 2010

Y Pt distribution measured at LHC

- CMS has a very good acceptance for Upsilon dimuons, even at very low p_T



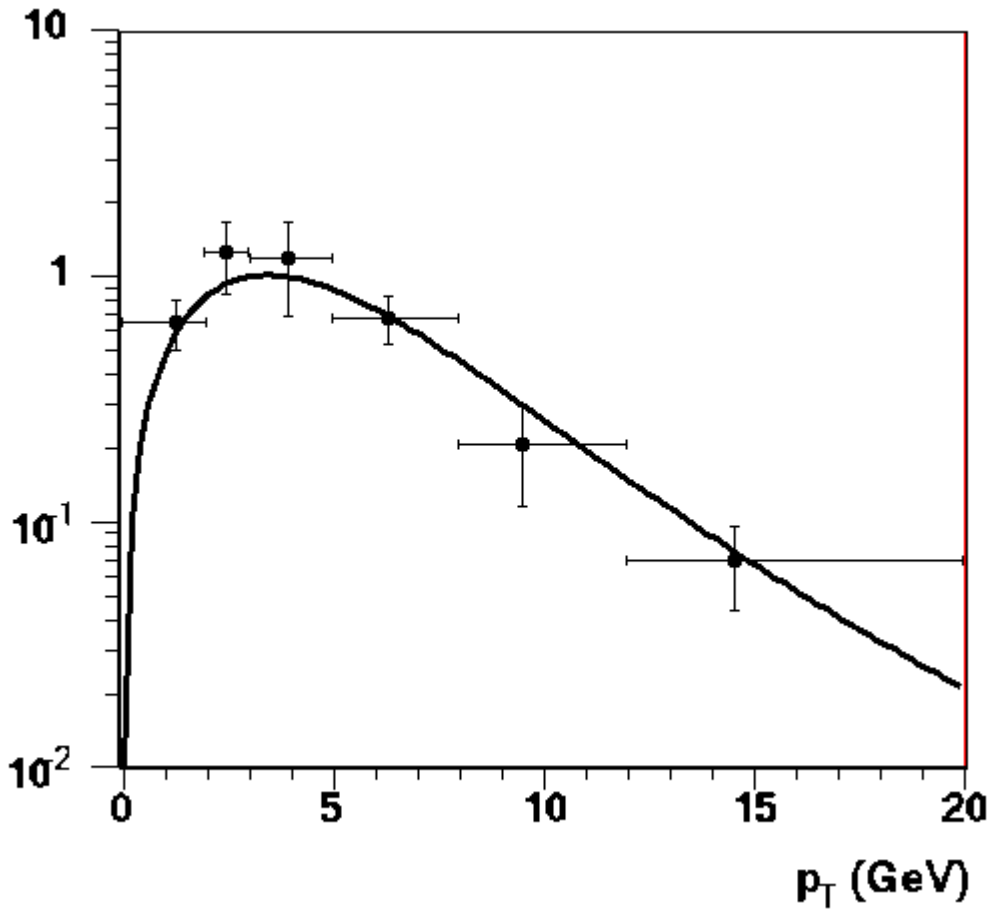
Υ p_T distribution (CMS)



C. Lourenco Hard Probes 2010

Υ measured p_T distribution compared to scaled curve

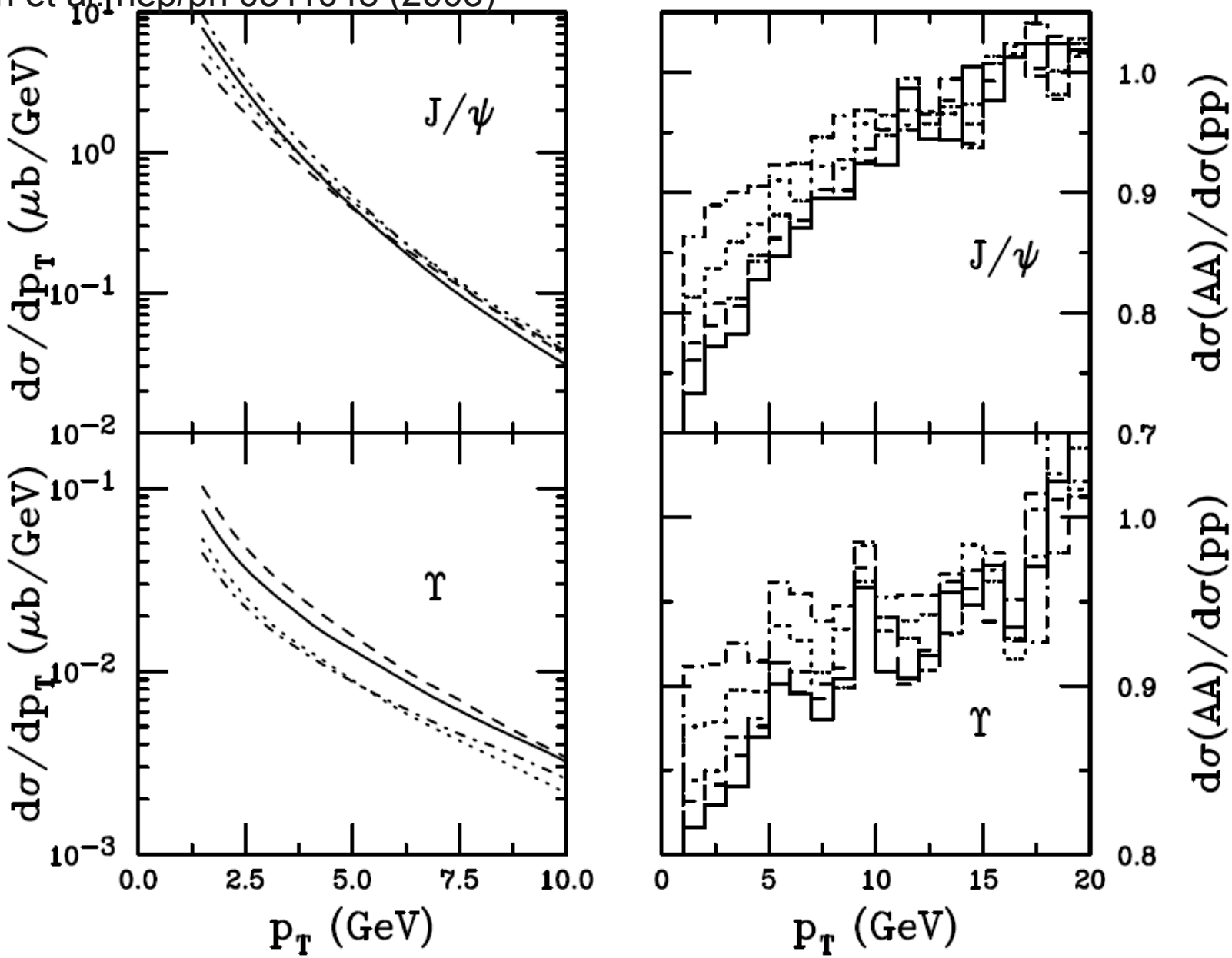
- The scaling at 7 TeV reproduces the Υ p_T distribution



From p-p to Pb-Pb

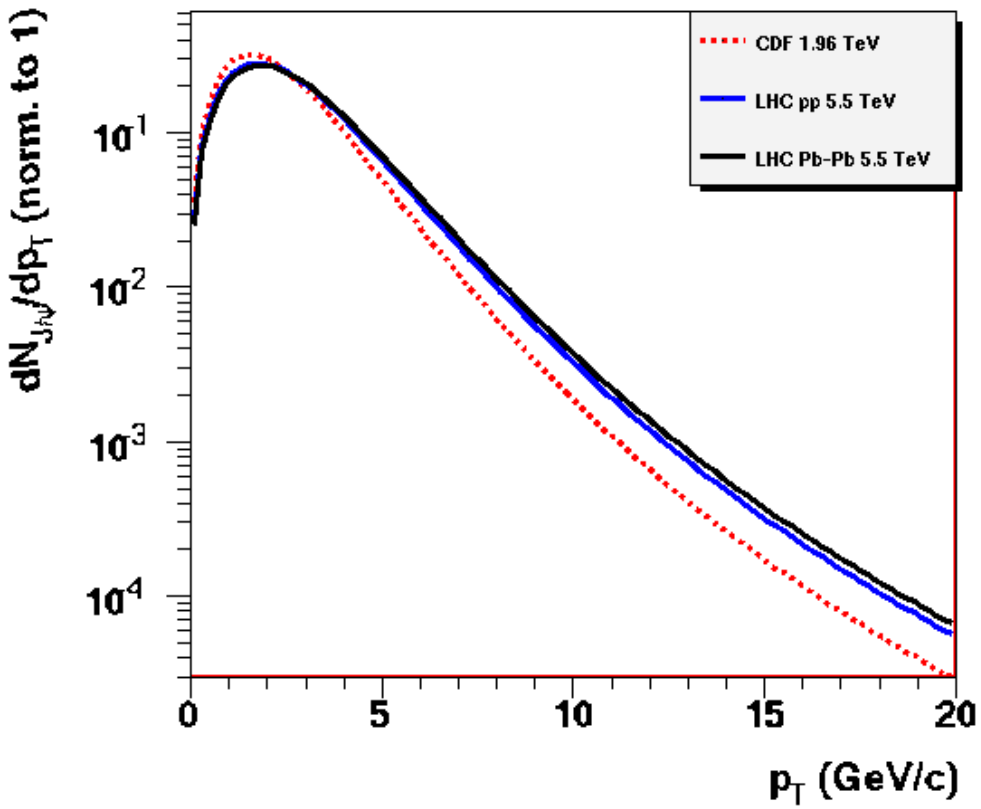
- Correction from p-p to Pb-Pb using (PbPb/pp) vs p_T given by CEM

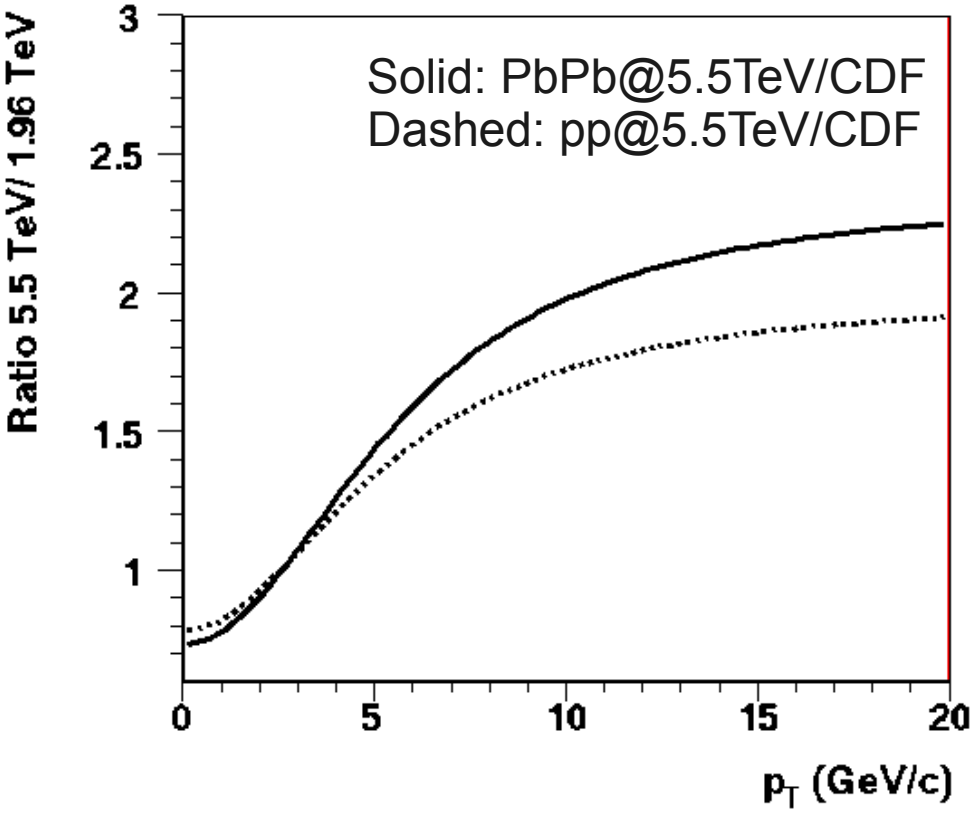
M. Bedjidian et al. hep/ph 0311048 (2003)



Resulting distributions in Pb-Pb at 5.5 TeV

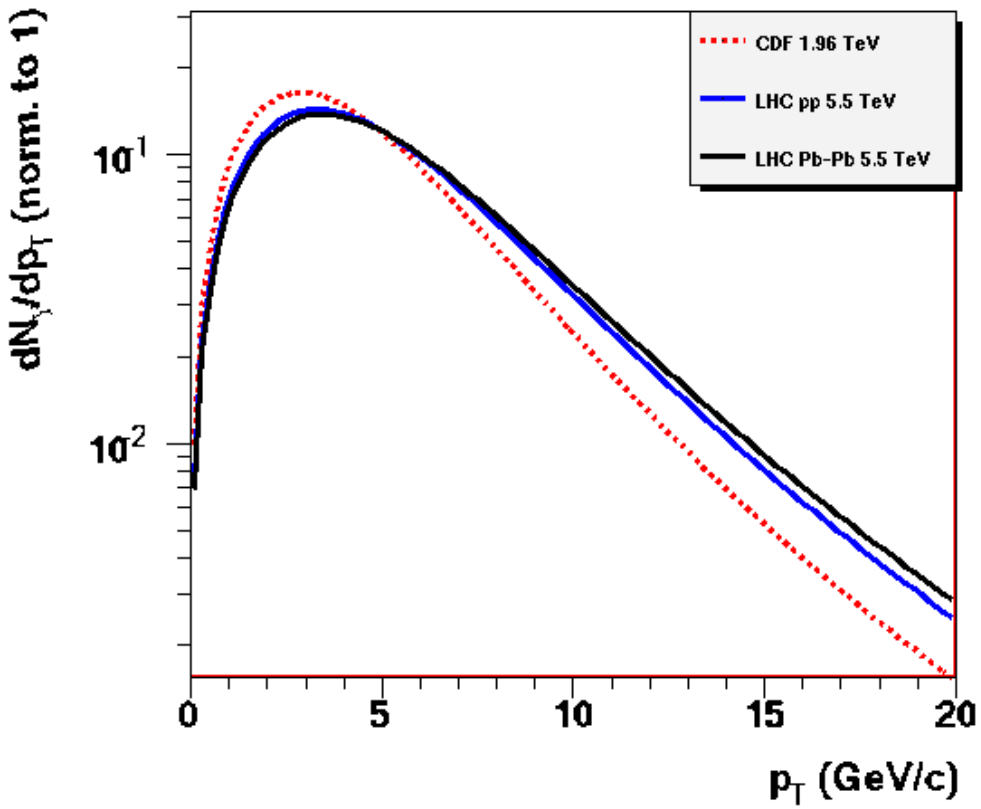
J/ψ p_T distributions

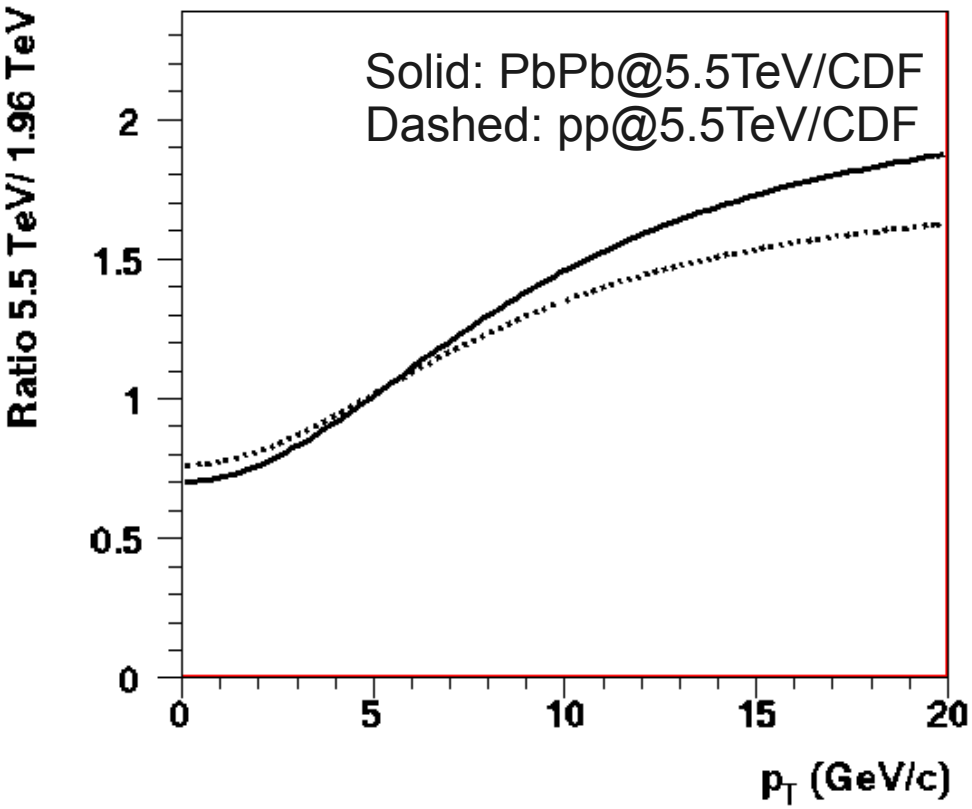




Resulting distributions in Pb-Pb at 5.5 TeV

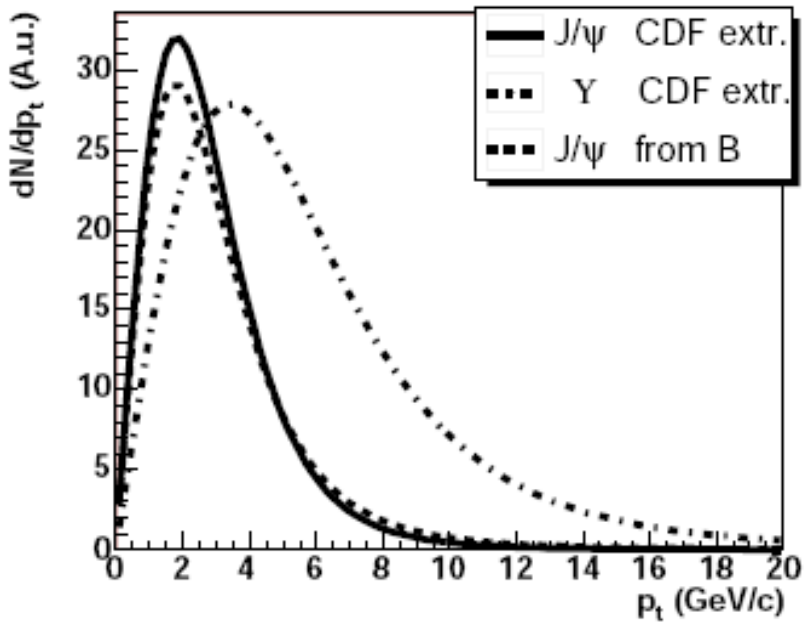
Υ p_T distributions

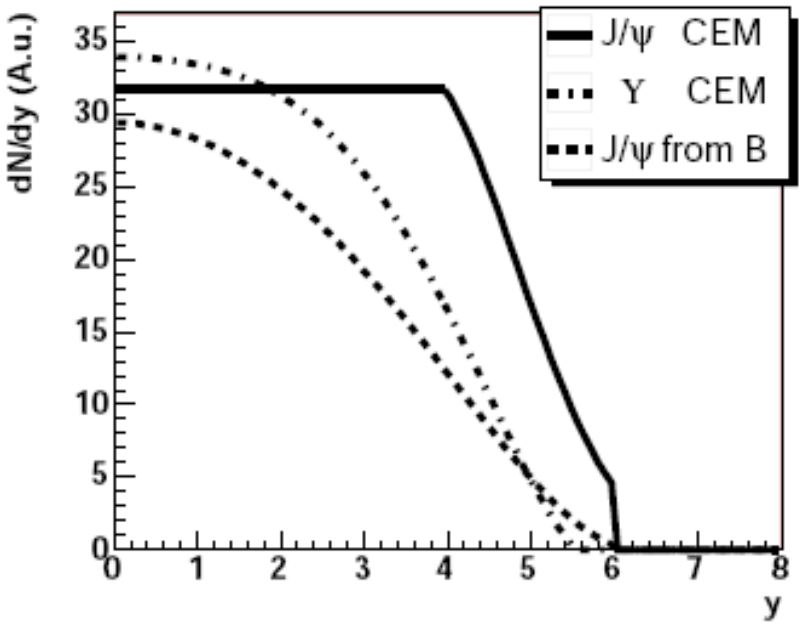




P_T and rapidity distributions of J/ψ and Υ

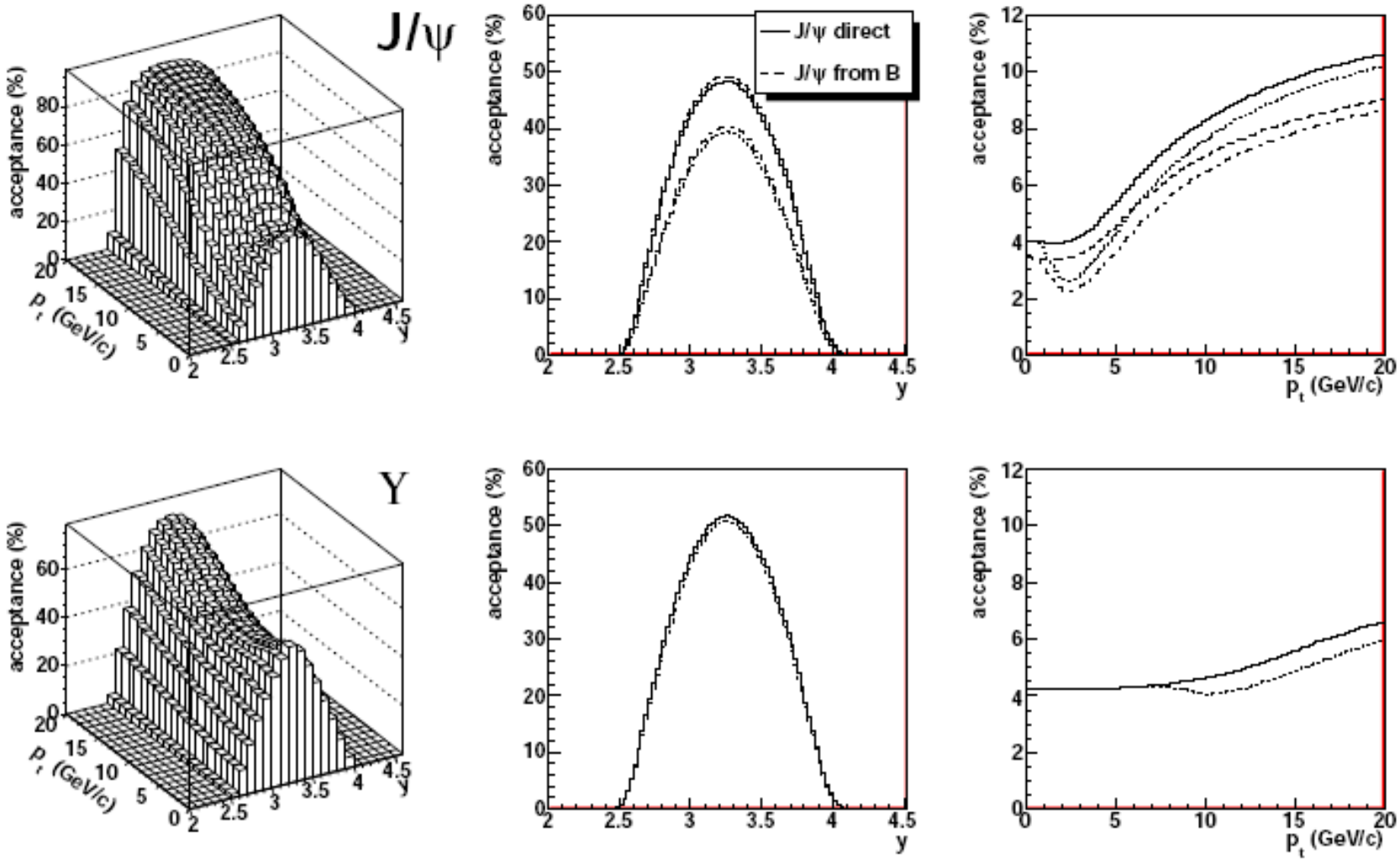
- Rapidity distributions from CEM





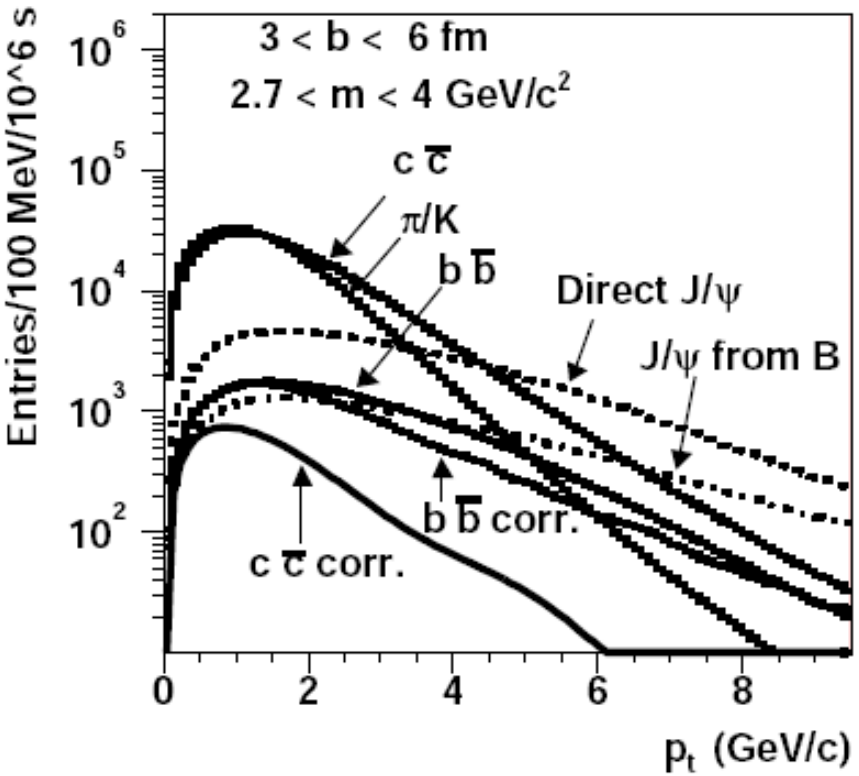
ALICE muon arm acceptance

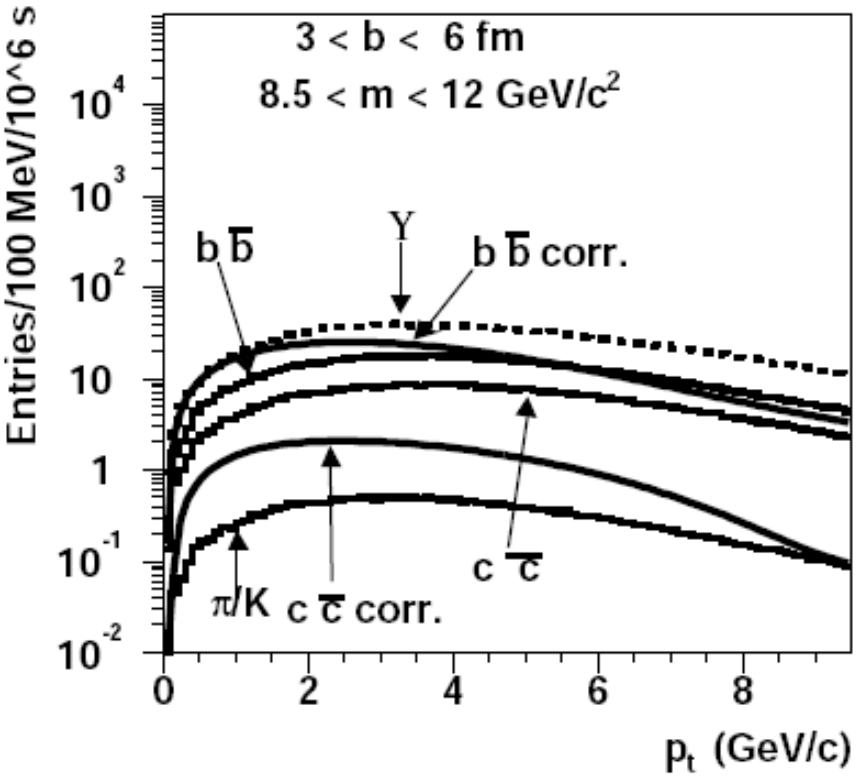
- Acceptance down to p_T=0



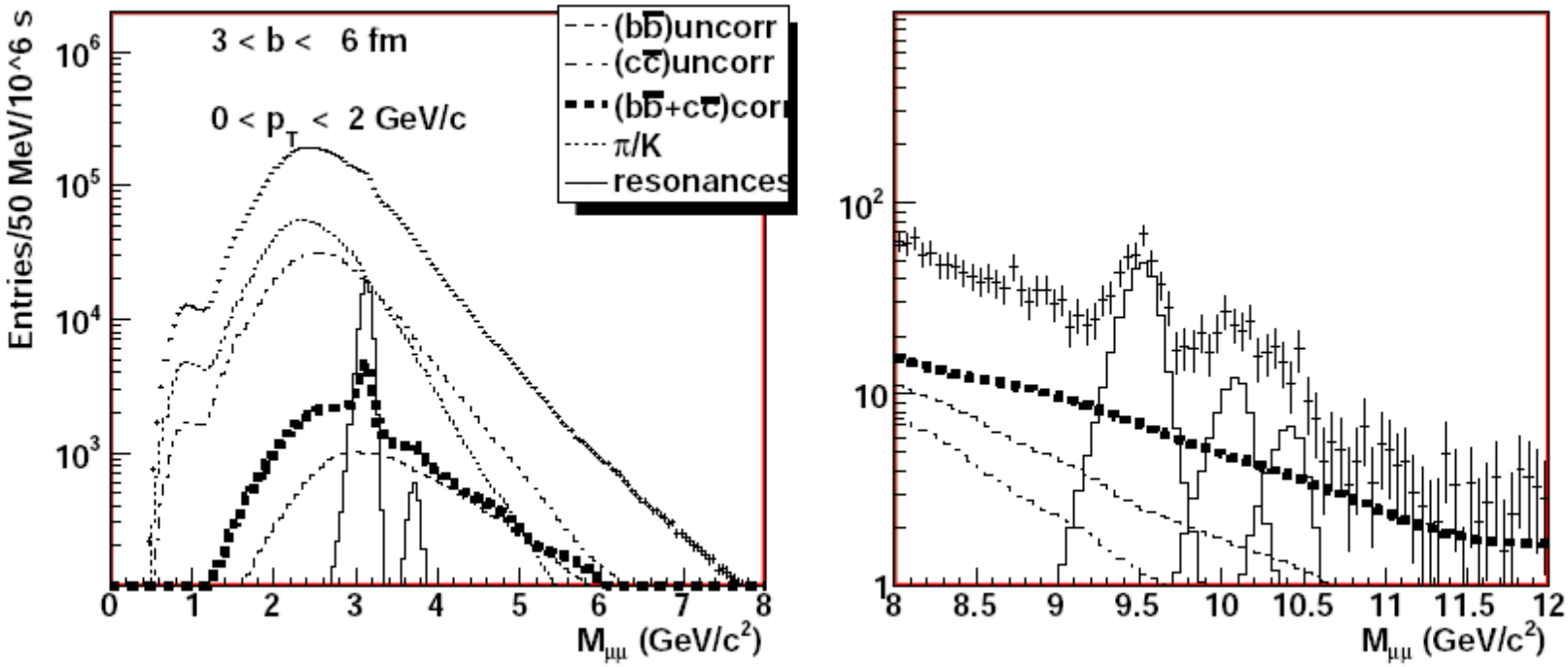
Expected sources vs p_T in central PbPb @ 5.5 TeV

- No QGP scenario
- Ideal conditions of data taking (10^6 s running time, L= 5 10^{26} cm^{-2} s^{-1})

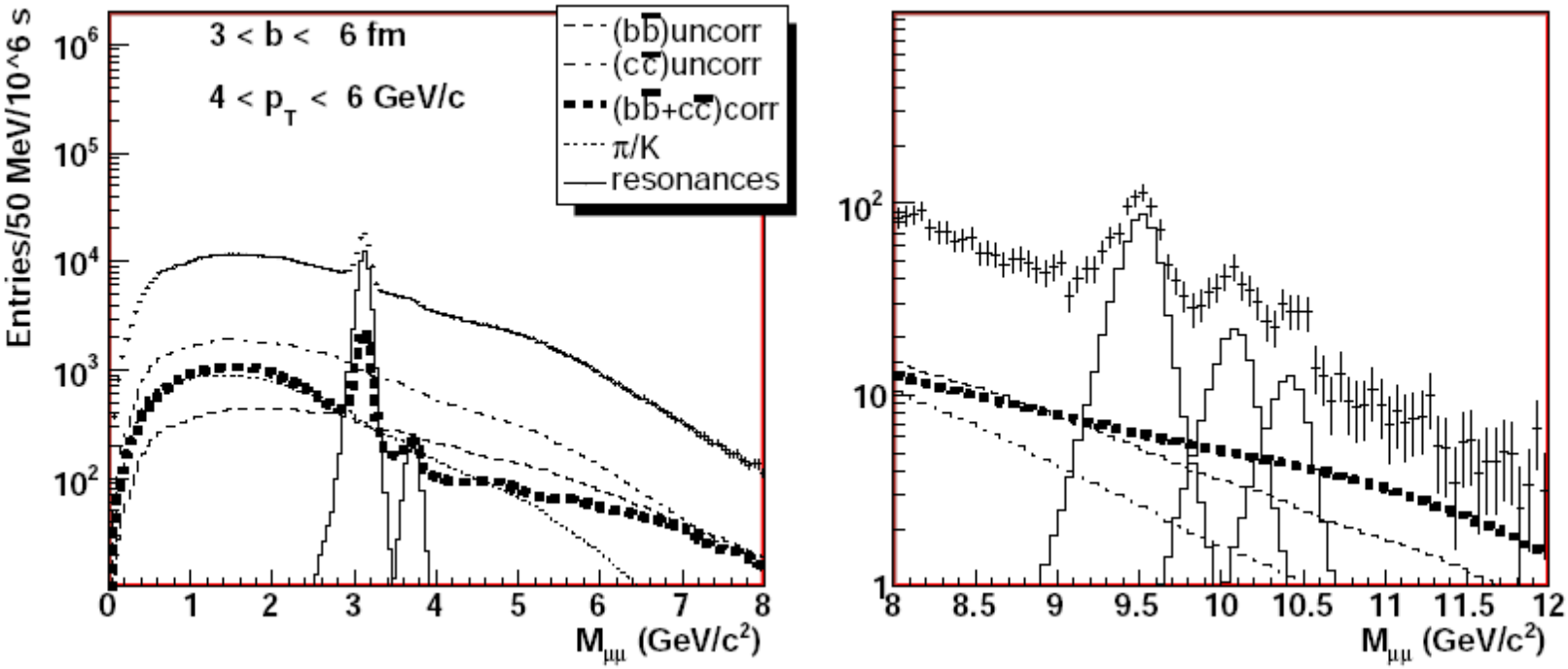




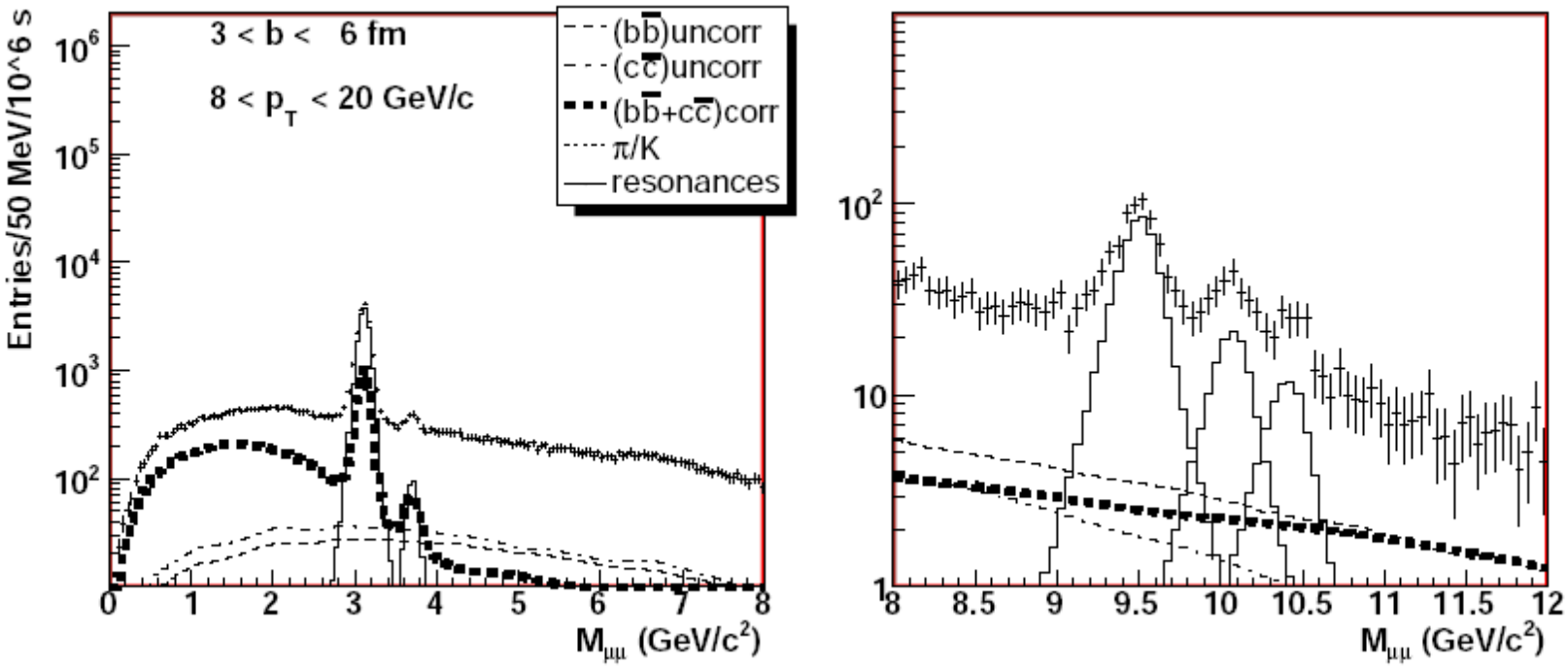
Mass distributions at low p_T



Mass distributions at mid p_T

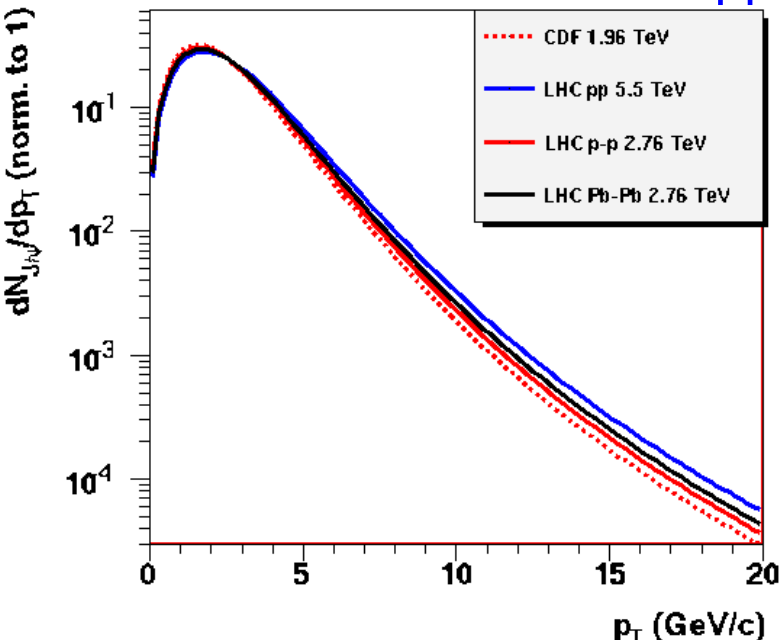


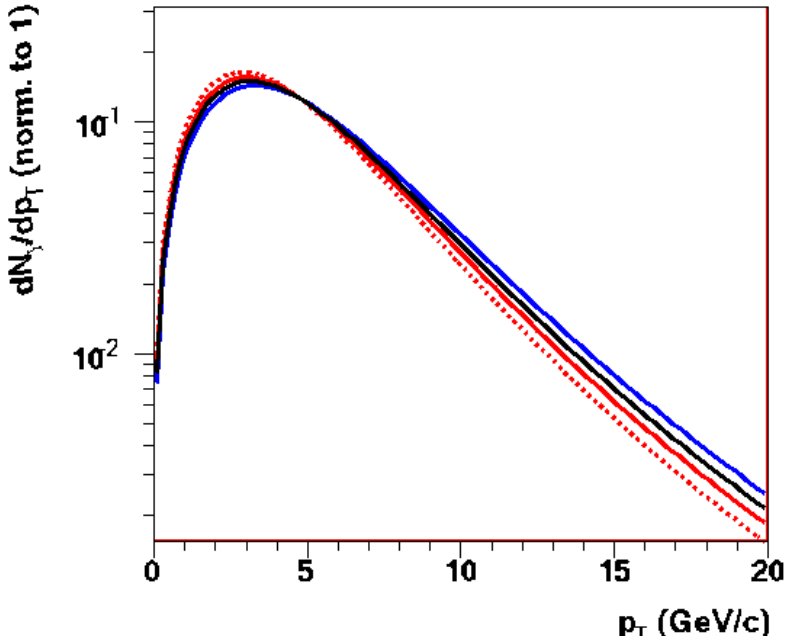
Mass distributions at high p_T

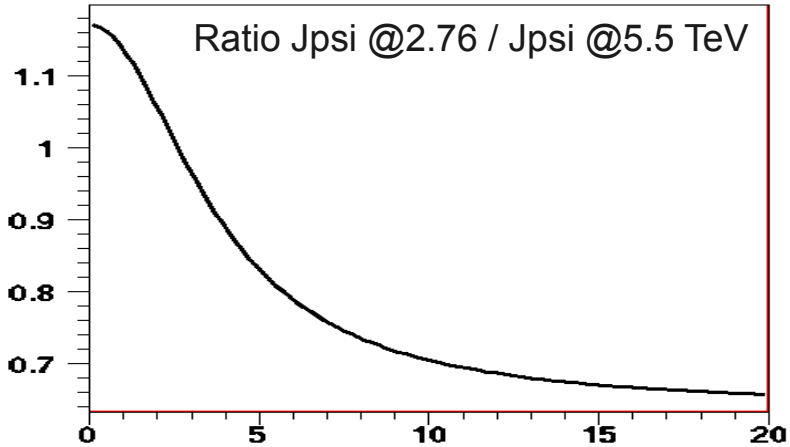


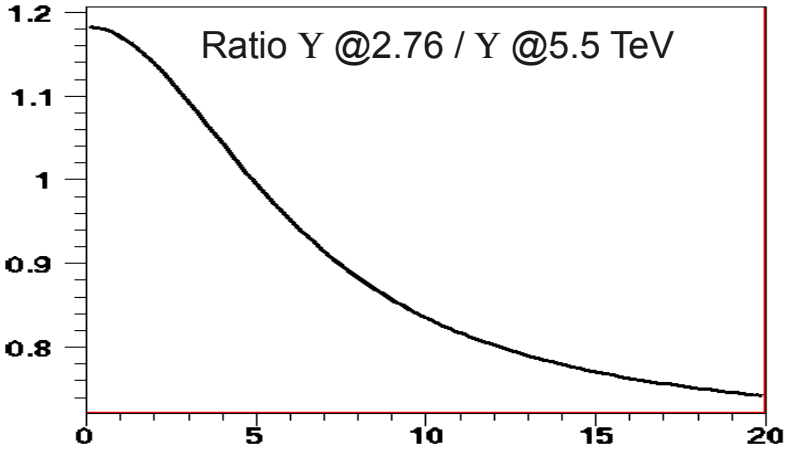
From 5.5 TeV to 2.76 TeV

- According to the previously used scaling, the expected increase in $<p_T^2>$ from 1.96 TeV to 2.76 TeV (pp) is ~ 9% for the J/ψ and ~11% for the Υ, corresponding to an increase in the A parameter of 4.5% and 5.5% respectively
- Assume the same ratio PbPb/pp as at 5.5 TeV









Summary

- A parameterization of the CDF data is adopted for the p_T distributions
- The functions are scaled according to CEM to account for the sqrt(s) dependence
- The scaling seems to work reasonably when compared to data at 7 TeV
- From p-p to Pb-Pb → CEM
- Data taking in Pb-Pb is going to start: stay tuned!