Nantes contribution to Follow up meeting

Model by

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2. Bulk

EPOS 2:

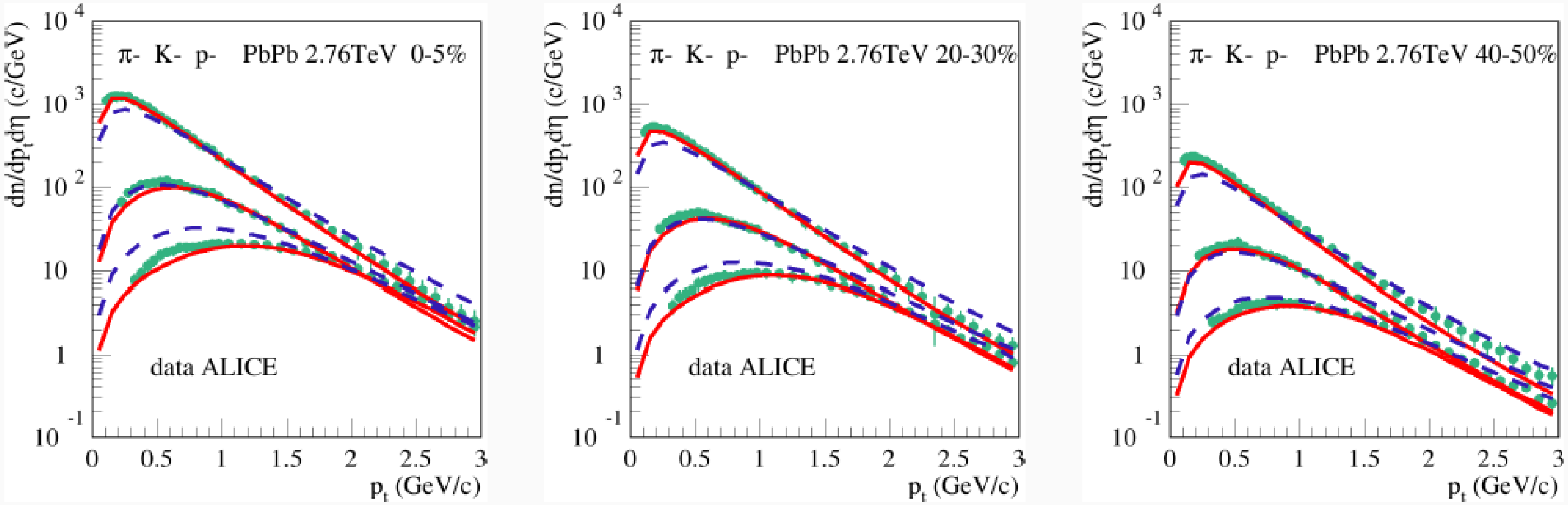
- EPOS initial conditions (fluctuating)
- smoothen flux tubes (mimick viscosity)
- 3D non viscous hydro with lattice EOS
- Hadron production according to string fragmentation

↑

Important ingredient for bulk inter comparison

EPOS model - freeze-out and hadronic afterburner

transverse momentum distributions (π, K, p) for different centralities (EPOS2)



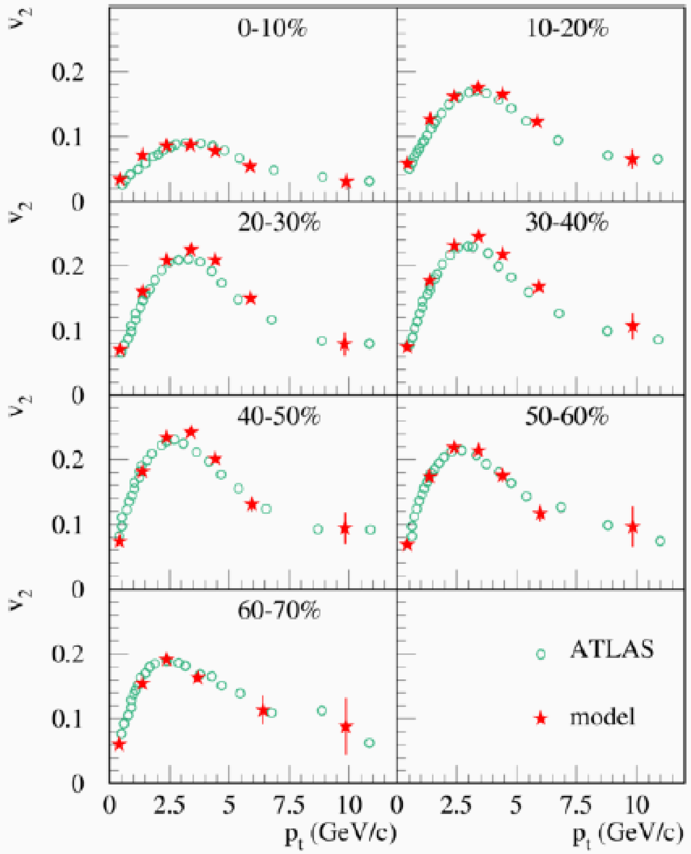
green: ALICE data blue: without hadronic cascade red: full calculations

- particlization on hypersurface of constant energy density/temperature $T_H = 166$ MeV, Cooper-Fry procedure.

  (but space-time evolution of fluid dynamical fields is available until $T \sim 130$ MeV)

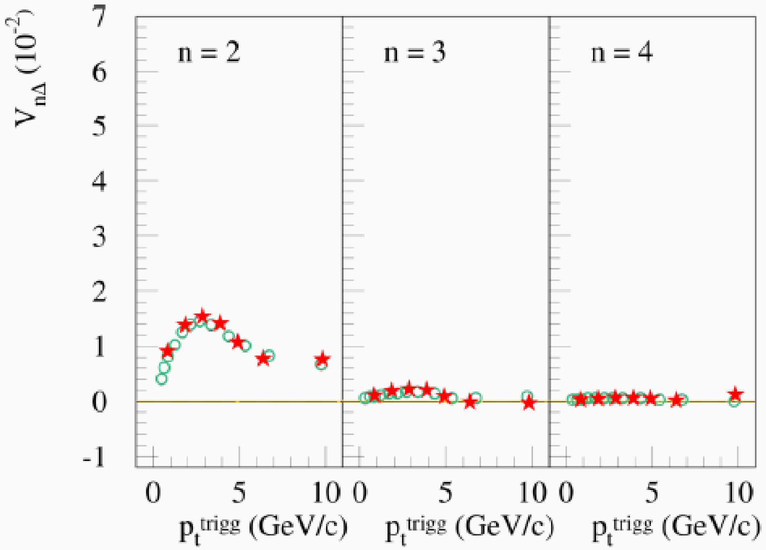
- subsequent hadronic final state interactions via UrQMD.

Flow in PbPb collisions



(EPOS2)

left: v_2 with respect to opposite hemisphere sub-event plane
below: v_n from di-hadron correlations, semi-peripheral collisions, data from ALICE, $p_{T,\text{assoc}} = 0.25 - 0.5$ GeV/c

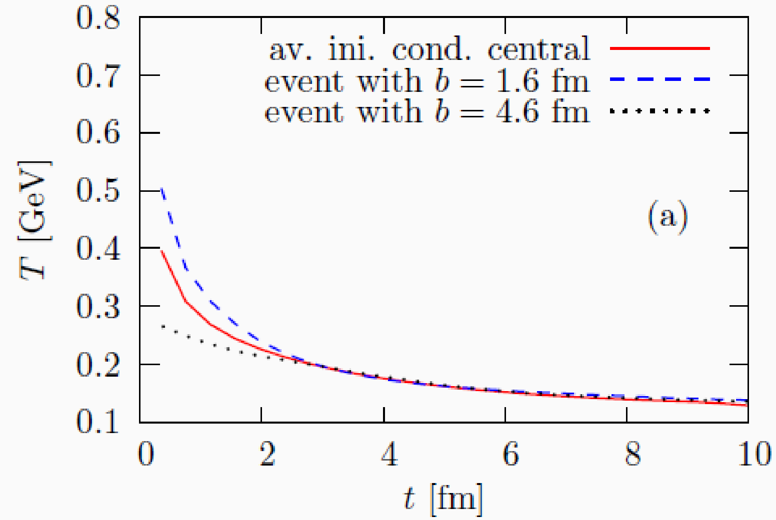


TO DO: Need to provide the values for the model at Tc

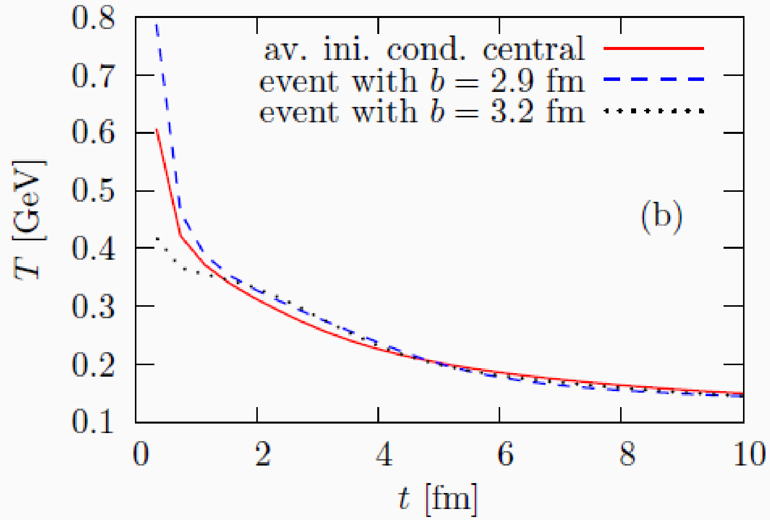
Temperature profiles

A comparison of the temperature evolution in the middle of the fireball ($x = y = \eta = 0$):

RHIC, $\sqrt{s} = 200$ GeV



LHC, $\sqrt{s} = 2.76$ TeV

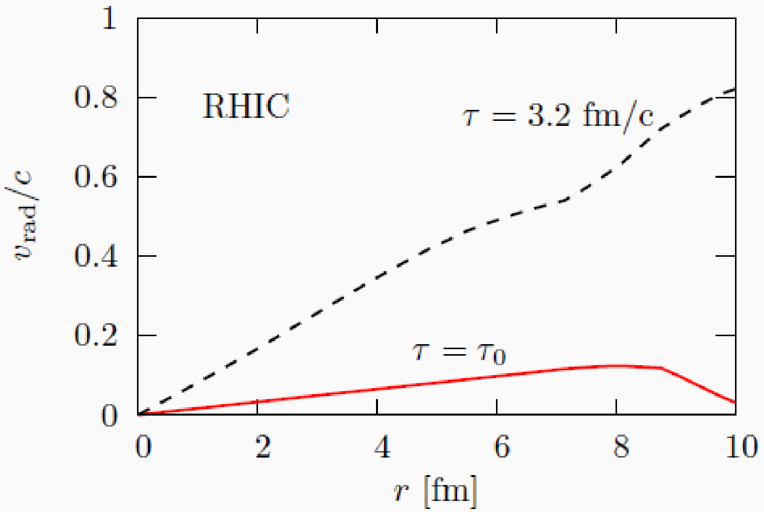


(EPOS2)

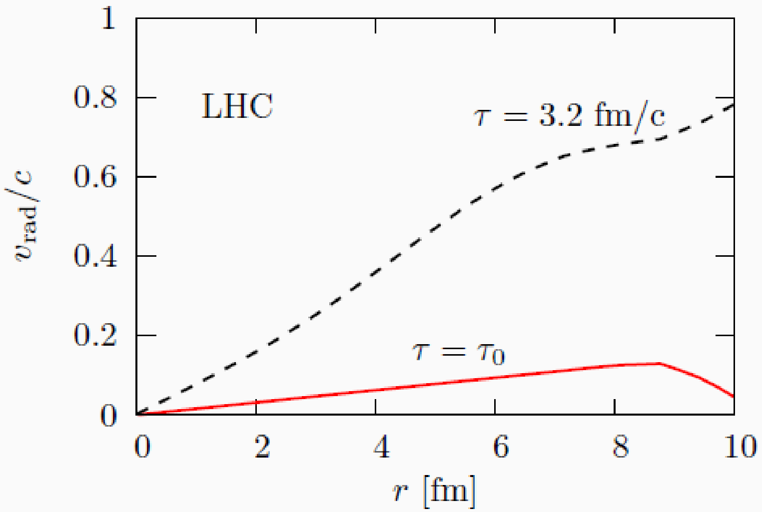
Velocity profiles

A comparison of the radial velocities as a function of the radius in central collisions:

RHIC, $\sqrt{s} = 200$ GeV

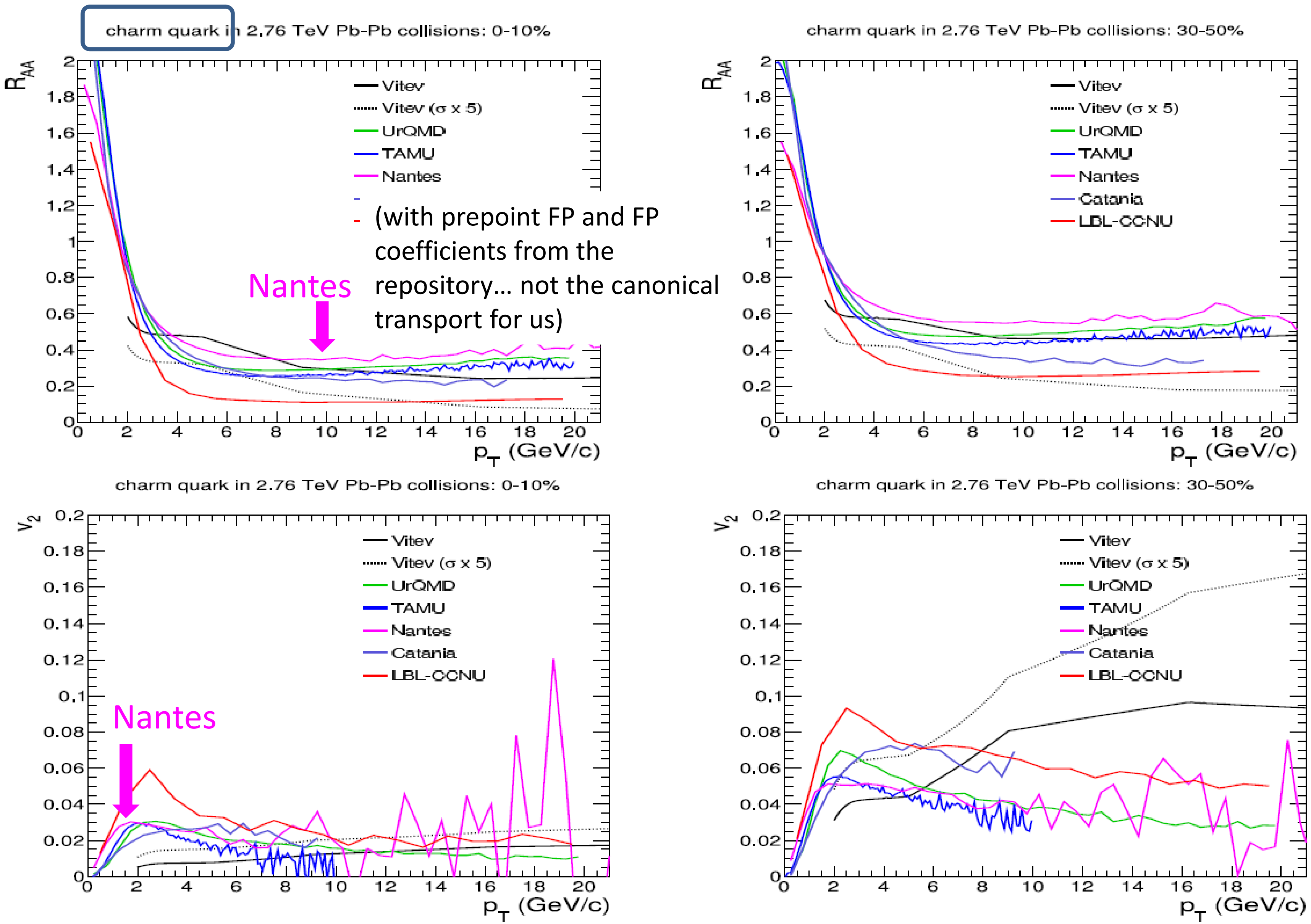


LHC, $\sqrt{s} = 2.76$ TeV



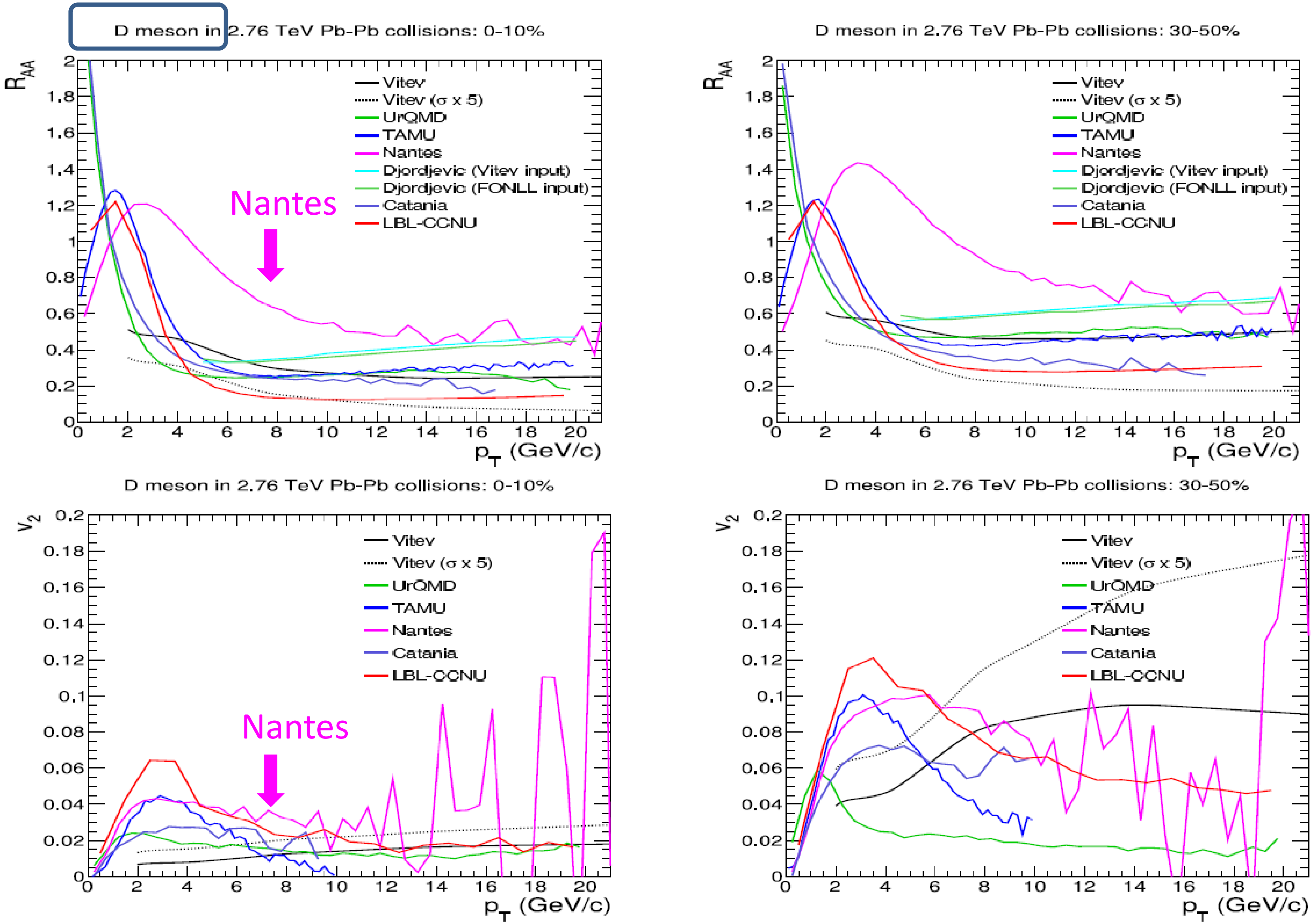
(EPOS2 - includes preequilibrium flow)

2. Bulk

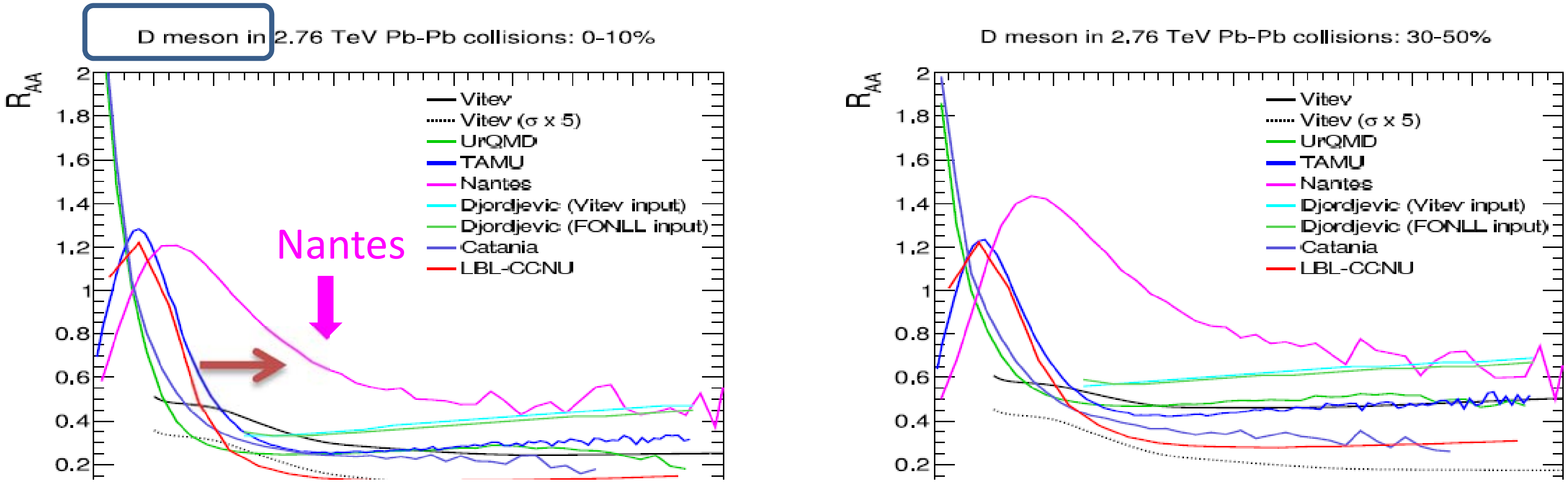


In the bulk part of the various bulk models for v2; medium leading to the minimal quenching, which could explain why we can cope with large drag coefficient

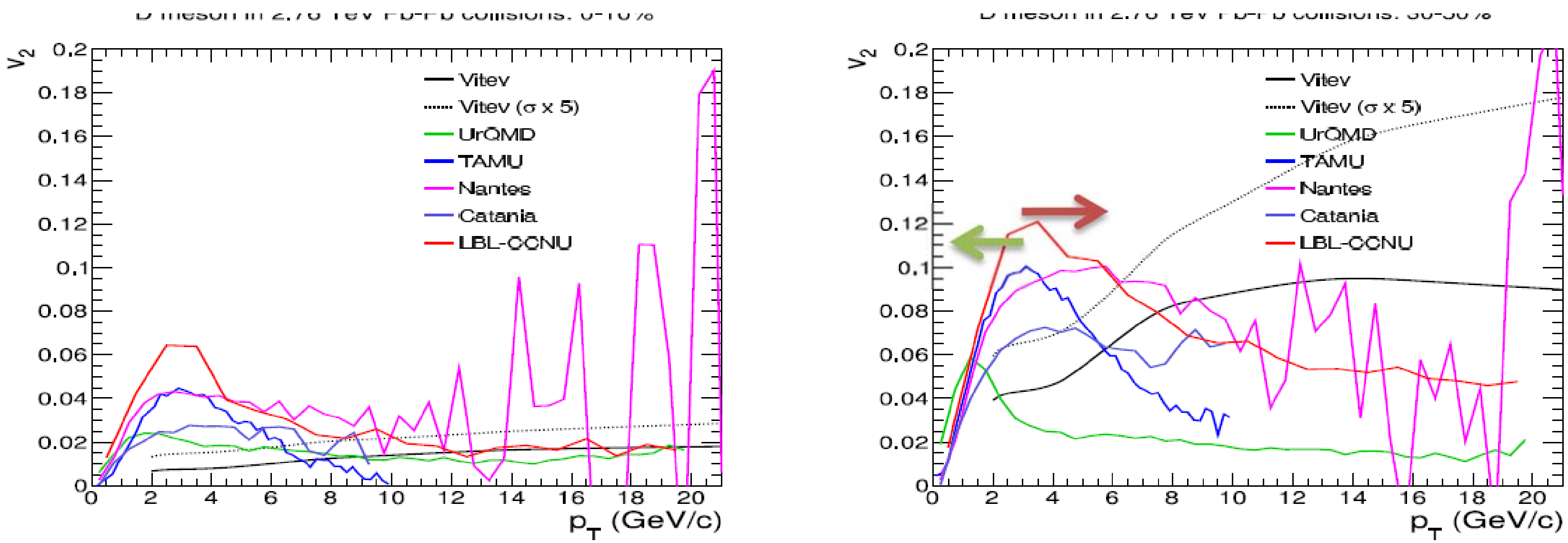
2. Bulk


D meson in 2.76 TeV Pb-Pb collisions: 0-10%
D meson in 2.76 TeV Pb-Pb collisions: 30-50%
R_AA
v_2
p_T (GeV/c)
Vitev
Vitev (σ x 5)
UrQMD
TAMU
Nantes
Djordjevic (Vitev input)
Djordjevic (FONLL input)
Catania
LBL-CCNU
Nantes
Nantes

2. Bulk



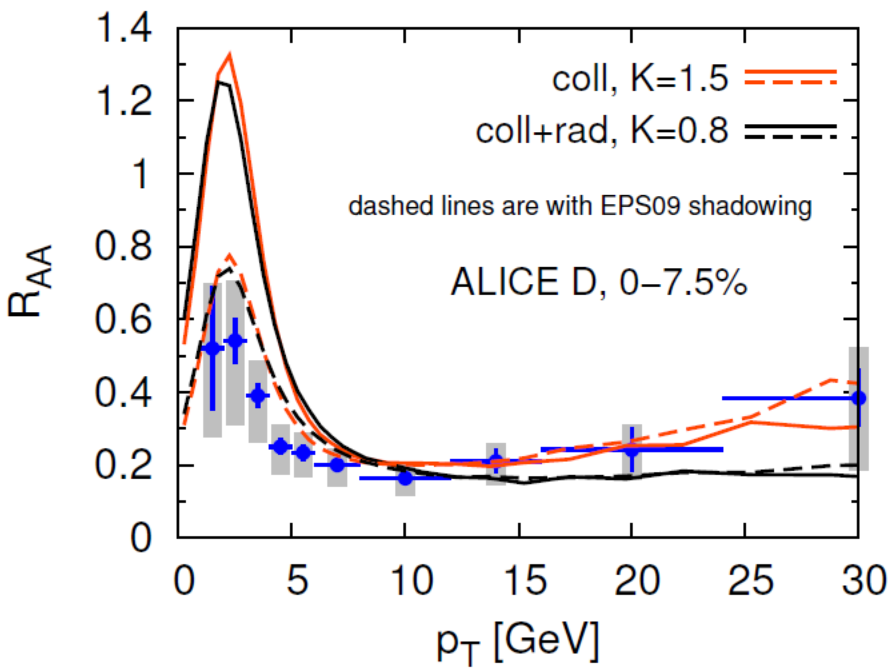
STRONG extra flow from recombination, for both centralities + some relative increase of the RAA even at intermediate pT

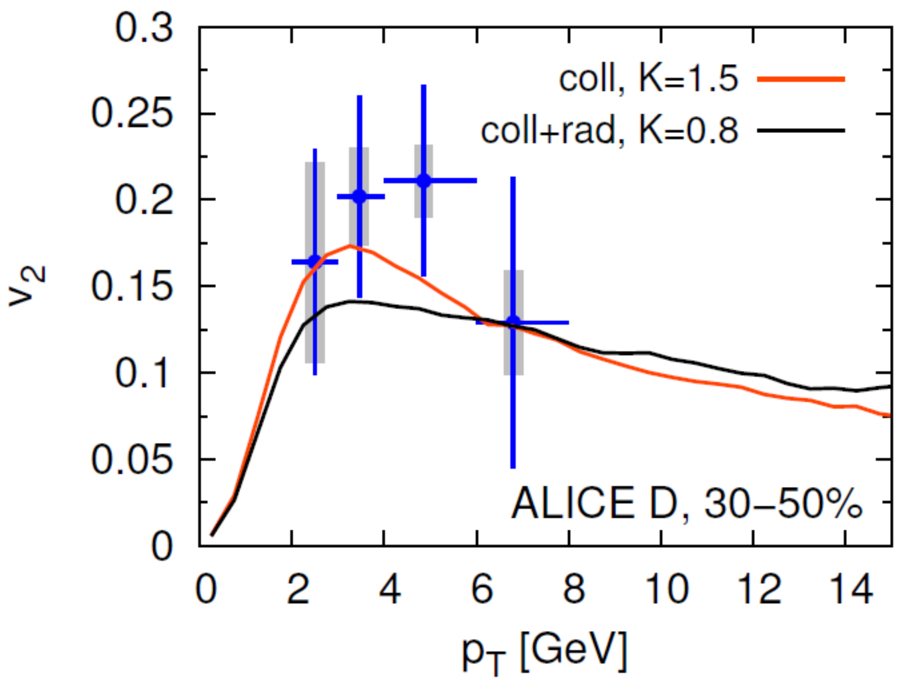


Also seen in the v2 peak in the 30-50 centrality class (spread in the peaks)

2. Bulk

In real life (with our own HQ energy loss model):





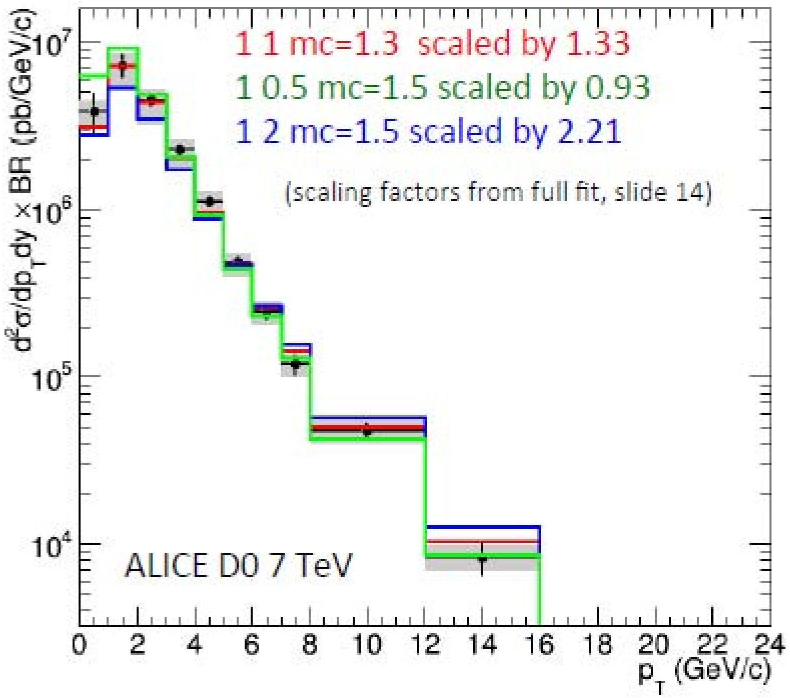
Too large radial flow of D meson as compared to data, even with shadowing included…

2 possible explanations:

- **Bulk brings too much extra flow… not seen at the level of c-quark (EPOS3 under study)**
- **Coalescence is responsible for this => need systematic investigation**

6. Initial heavy flavor spectra

Summary and proposal

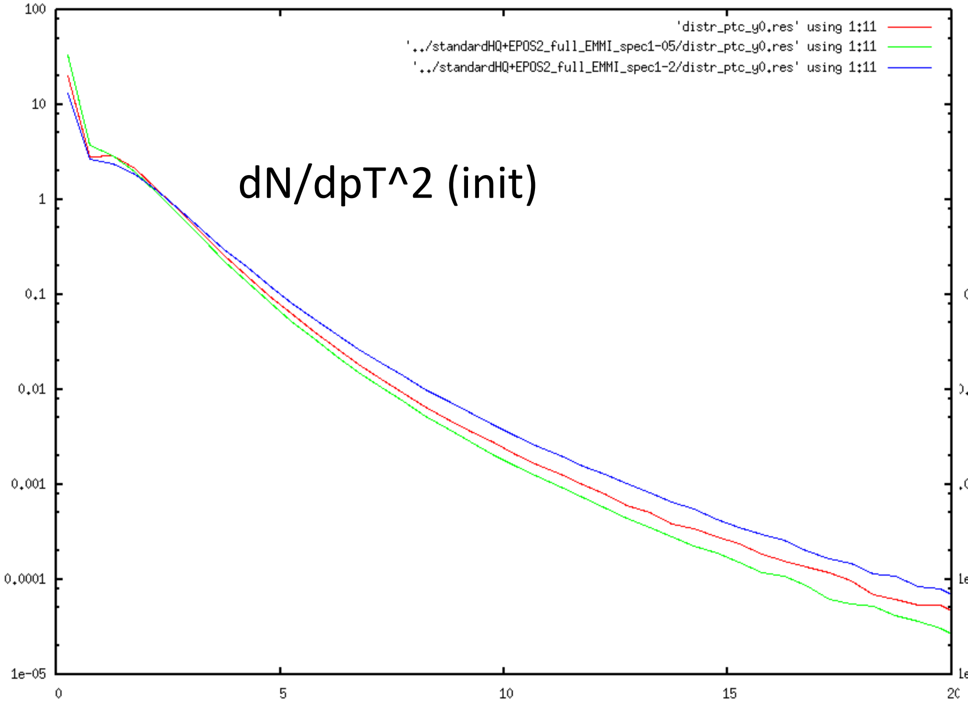


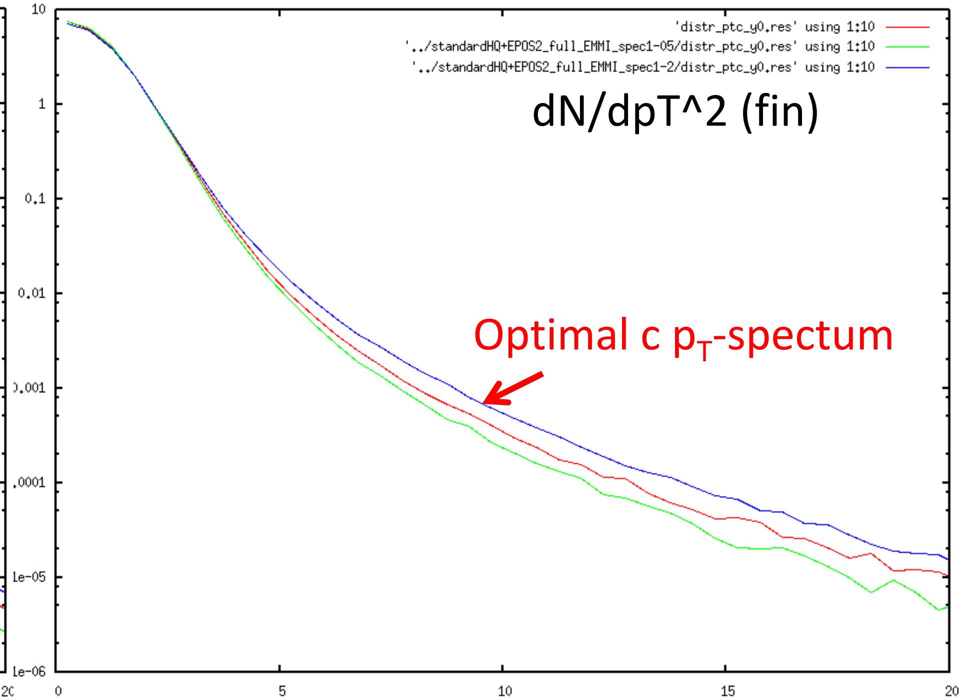
→ Propose to use these three with the same parameters and scaling factors at 2.76 and 5 TeV

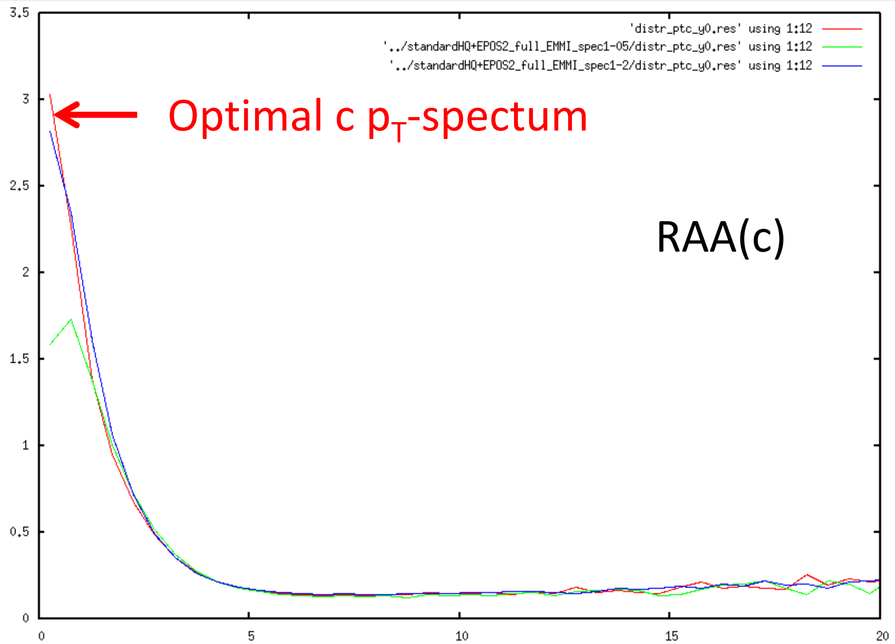
→ Scaling factors do not matter for RAA and v2, only for absolute dN/dpT

No shadowing

c-quarks (sqrt(s)=2.76 TeV)

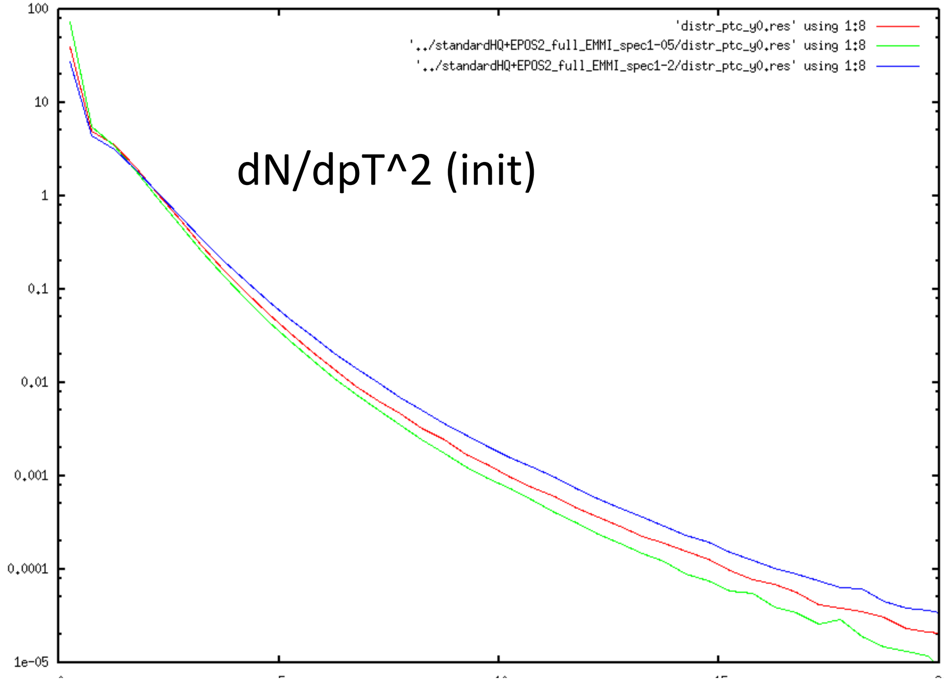


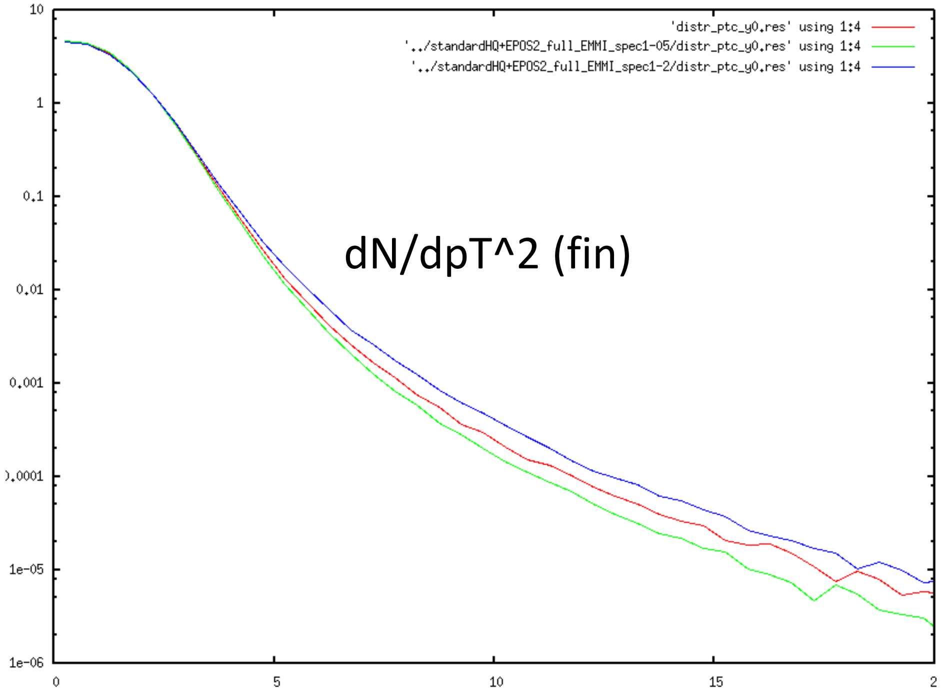


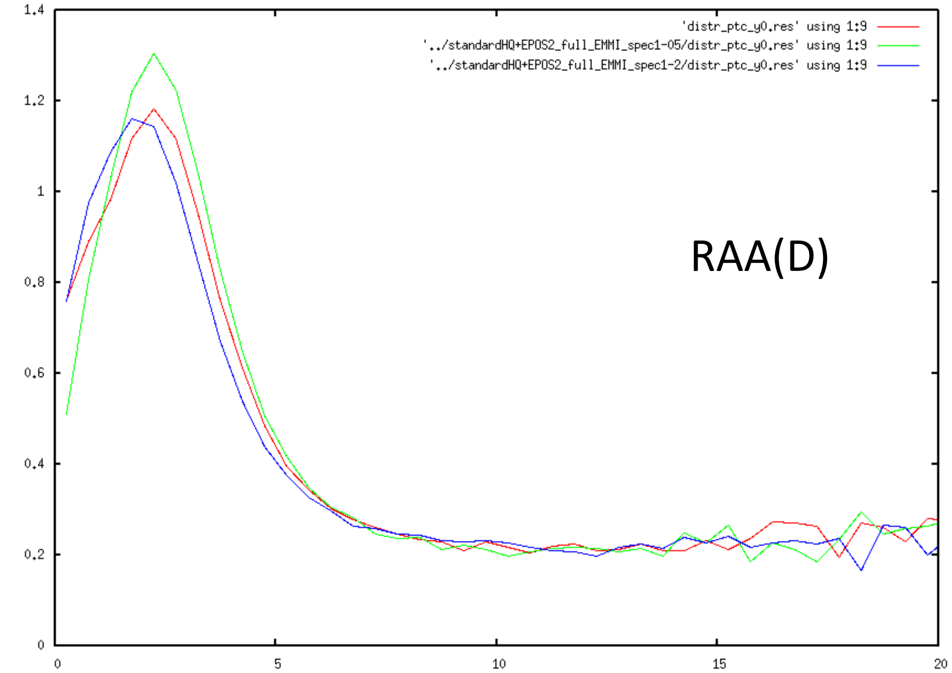


- No effect on the RAA for $p_T > 3$ GeV/c
- Strong effects for $p_T < 2$ GeV/c…
- … But due to initial spectrum only (similar final)
- Larger effects for small renormalization scale

D-mesons (sqrt(s)=2.76 TeV)





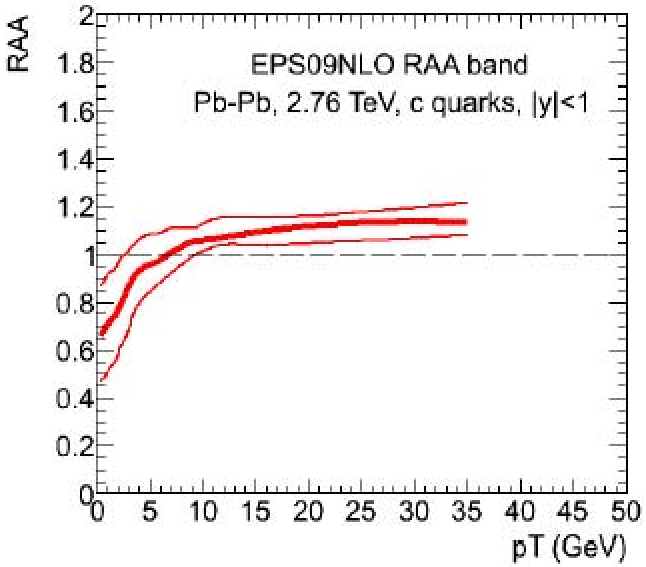


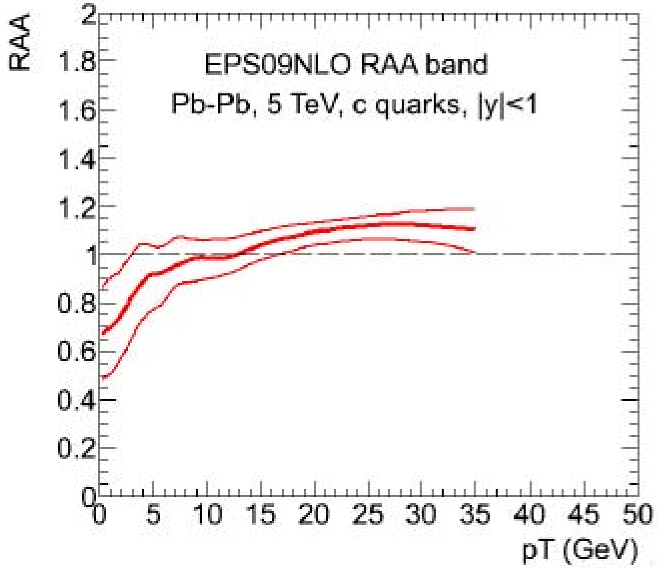
- Position of the bump not too much affected
- Stronger peak for μ_R=0.5

Same with EPSO9 shadowing

Shadowing

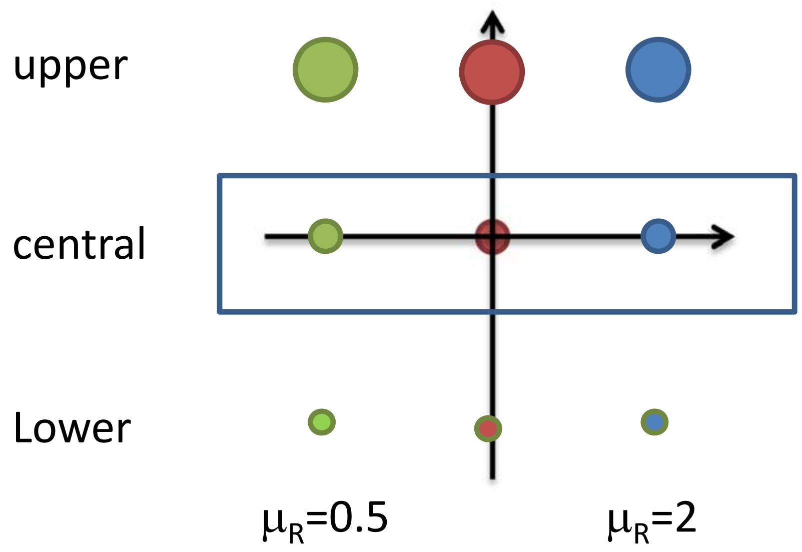
- RAA for c quarks with MNR+EPS09NLO
- Proposal: multiply the input c-quark pT spectrum from FONLL by this RAA and use the band to define a band on final RAA and v2
- Result very similar for 2.76 and 5 TeV (EPS09 flat at low x)





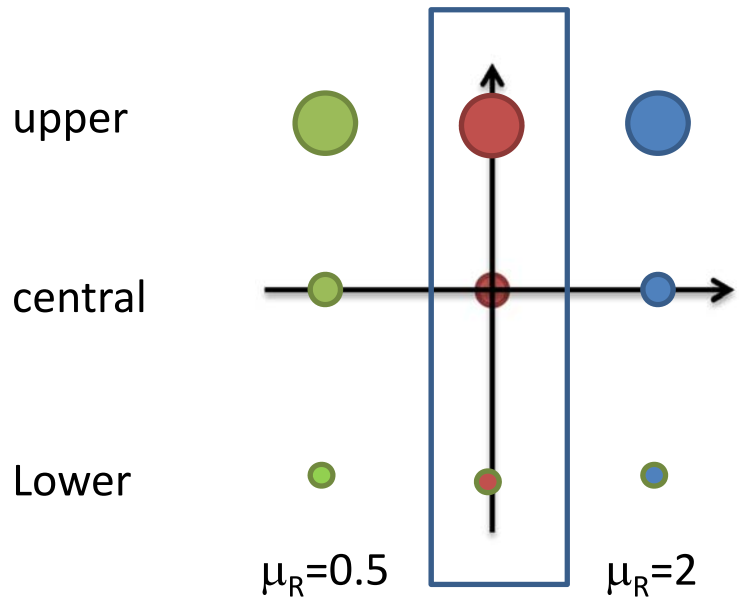
Min bias ? Central ?

Same with EPS09 shadowing (central value)

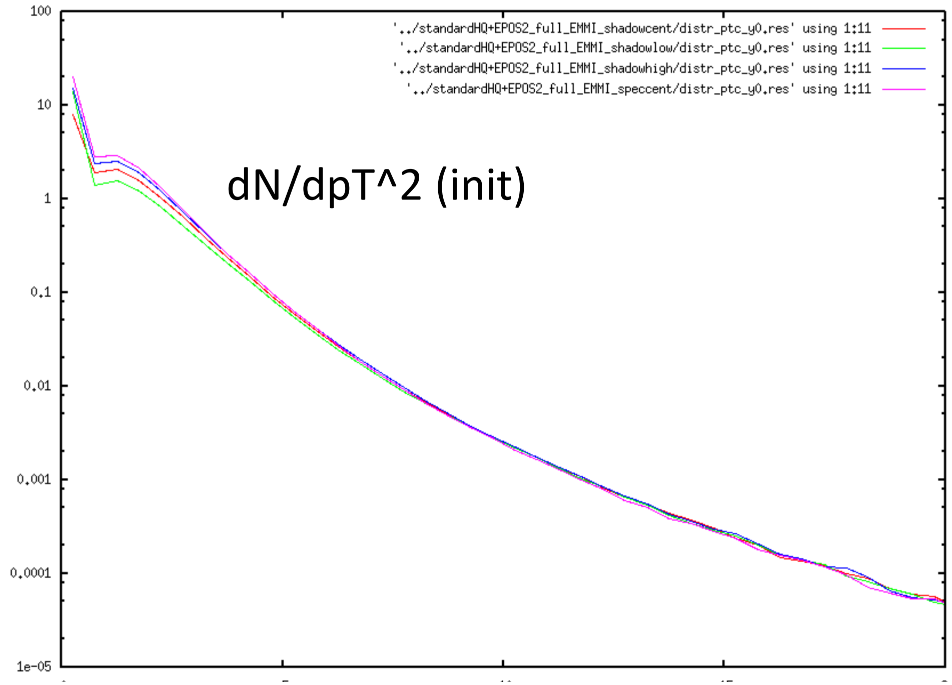


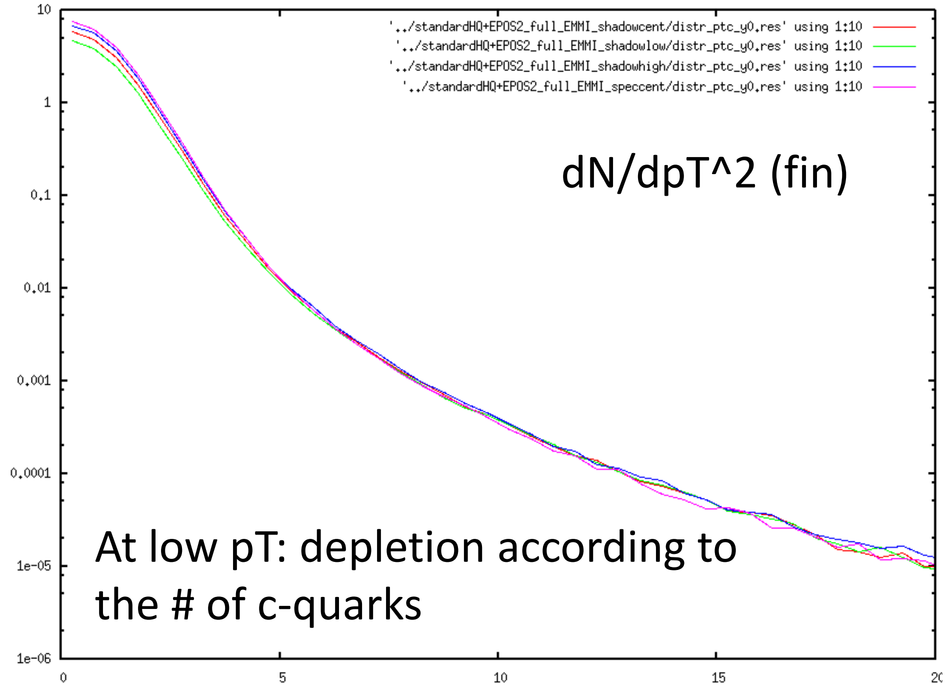
UNDER CONSTRUCTION…

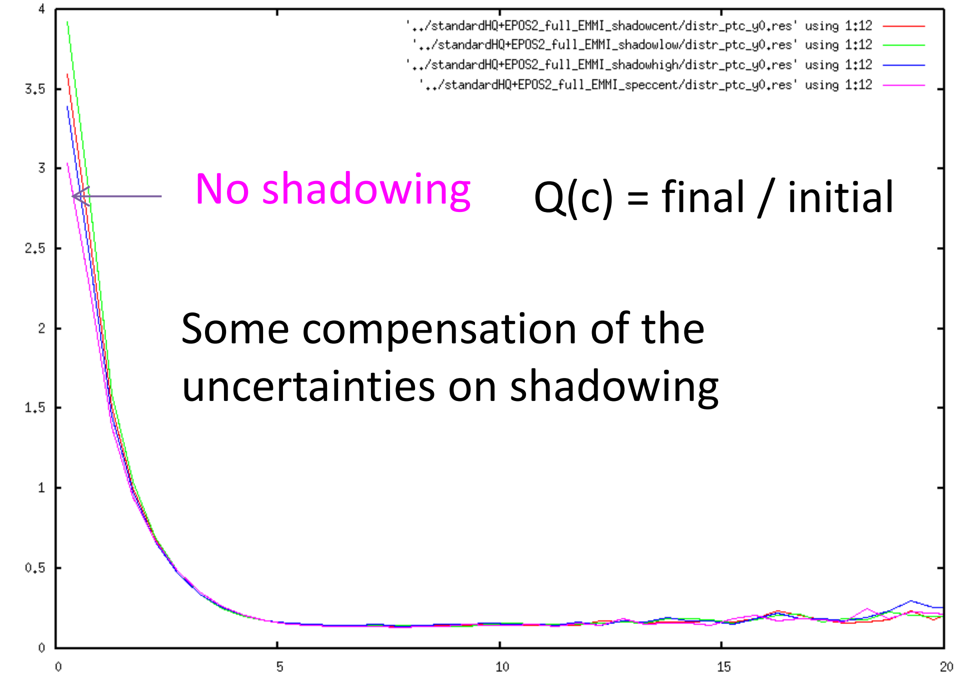
Influence of Shadowing (Optimal FONLL spectrum)

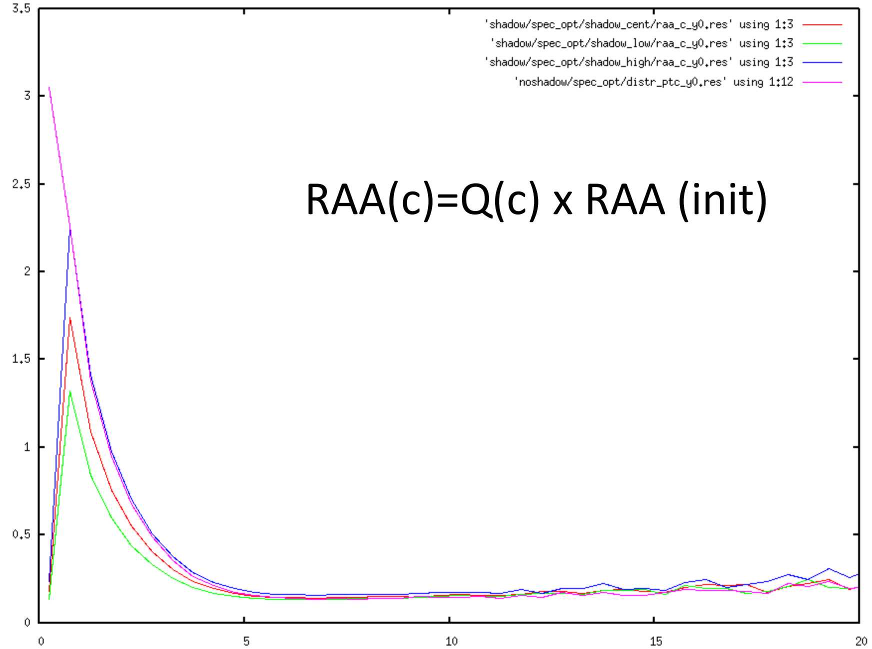


c (sqrt(s)=2.76 TeV)

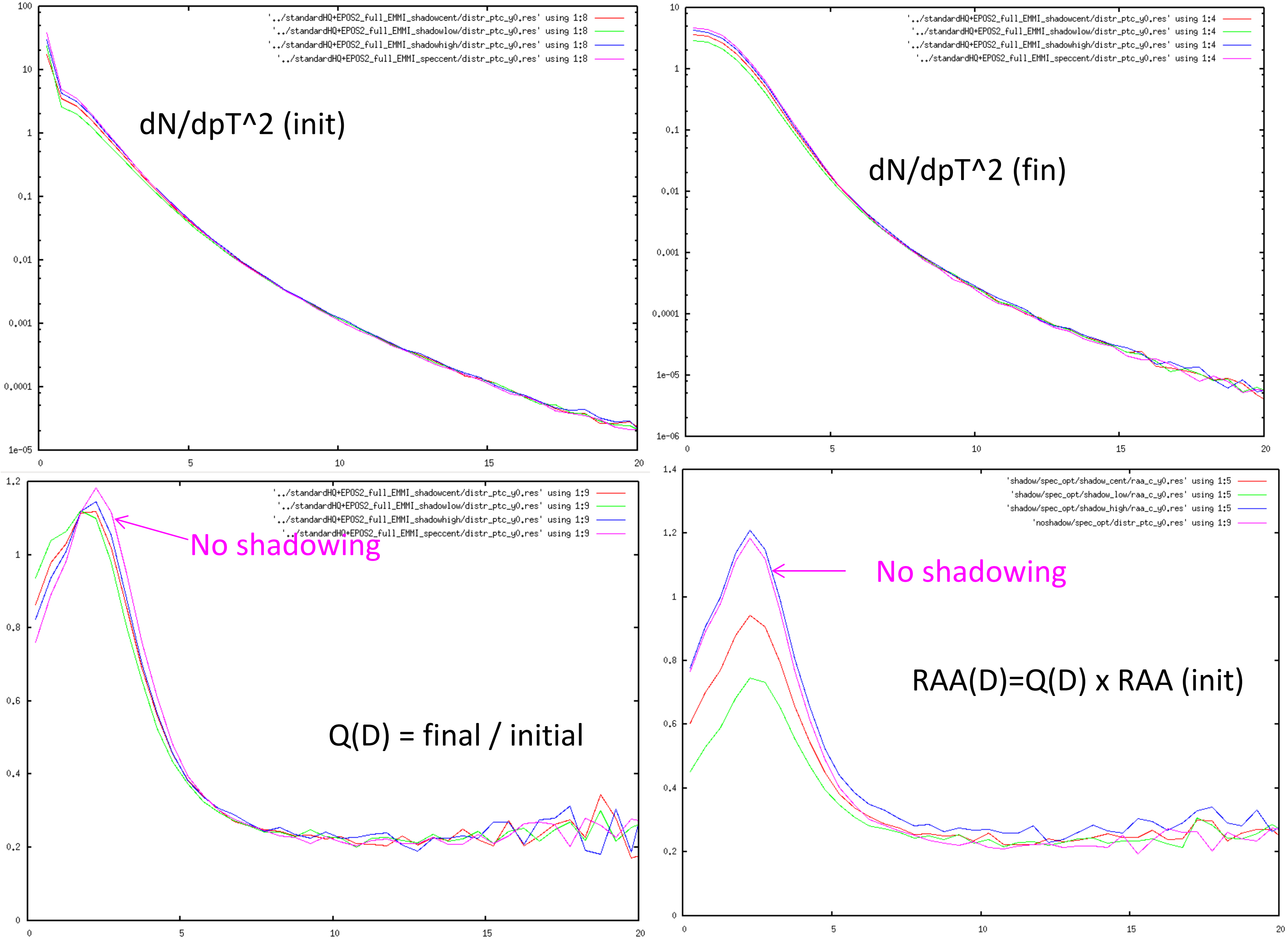








D-mesons (sqrt(s)=2.76 TeV)

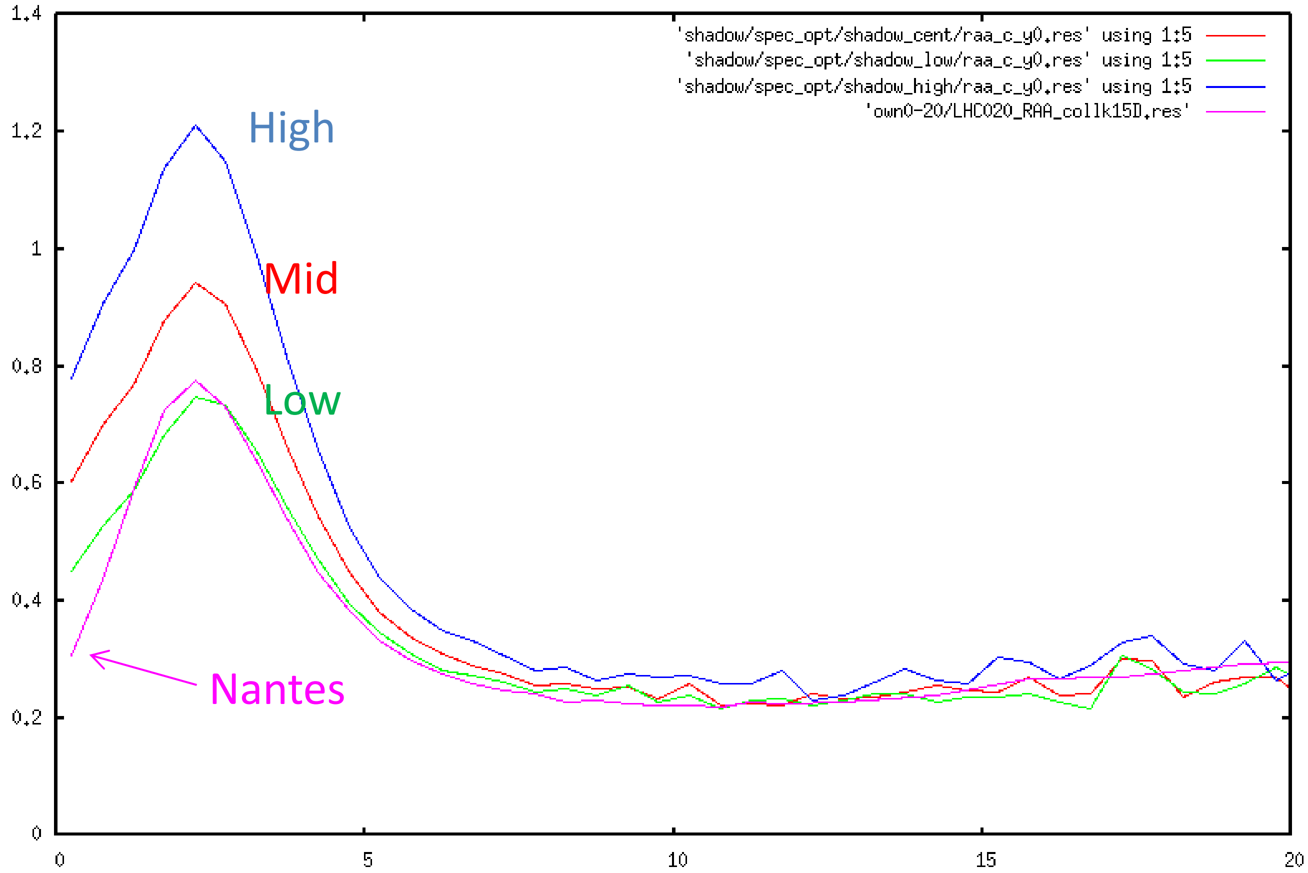


Common tool

- Package to generate pT according to the FONLL + shadowing, available to all the practitionners

Comparison with own spectra

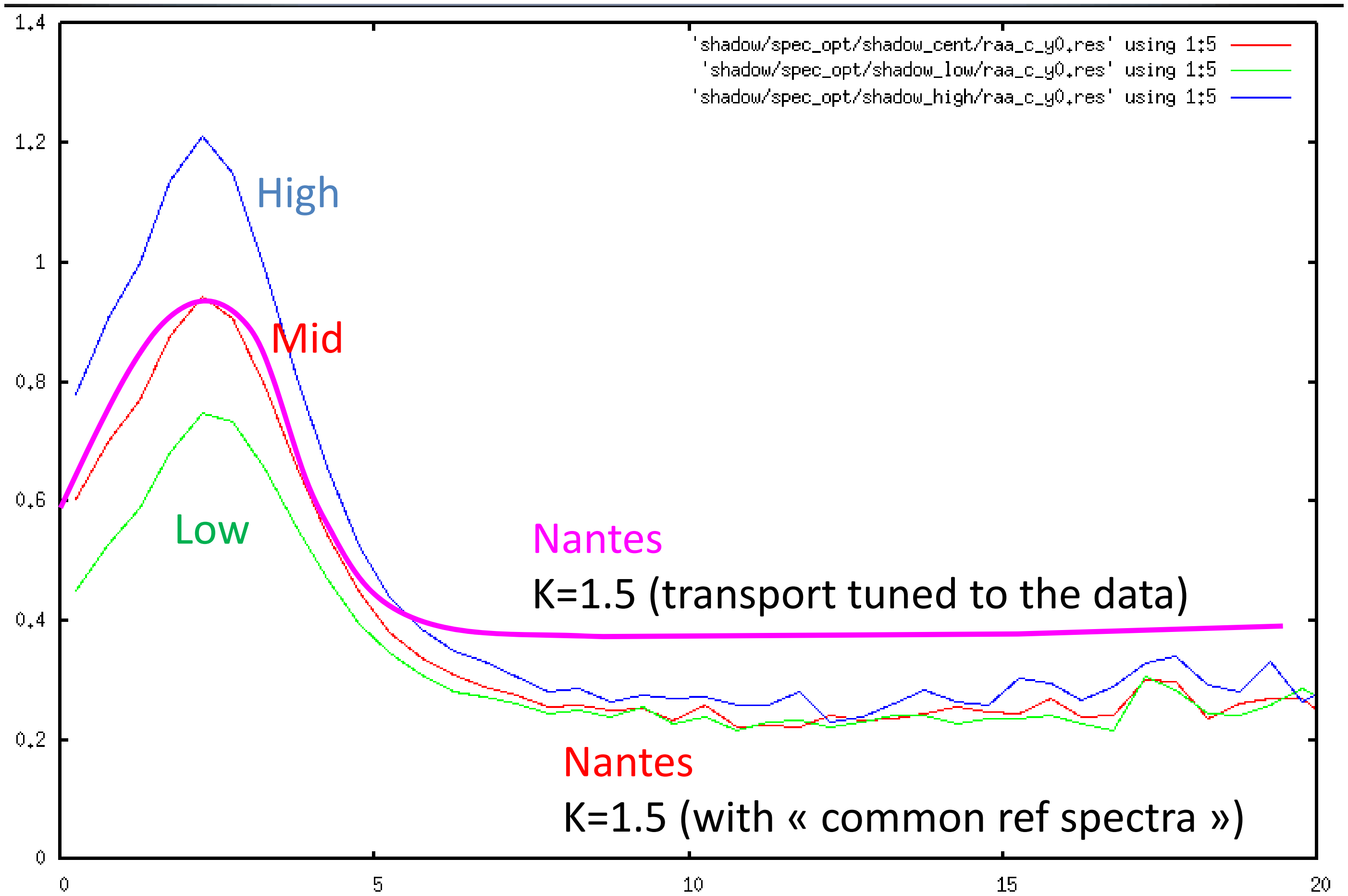
In the July meeting, the Nantes spectrum was found a bit « off » wrt the spectra used in the various models…



… however: good agrement for pT>5 GeV/c and within error bars for pT<5 GeV/c (need to check which precise shadowing was used for Nantes)

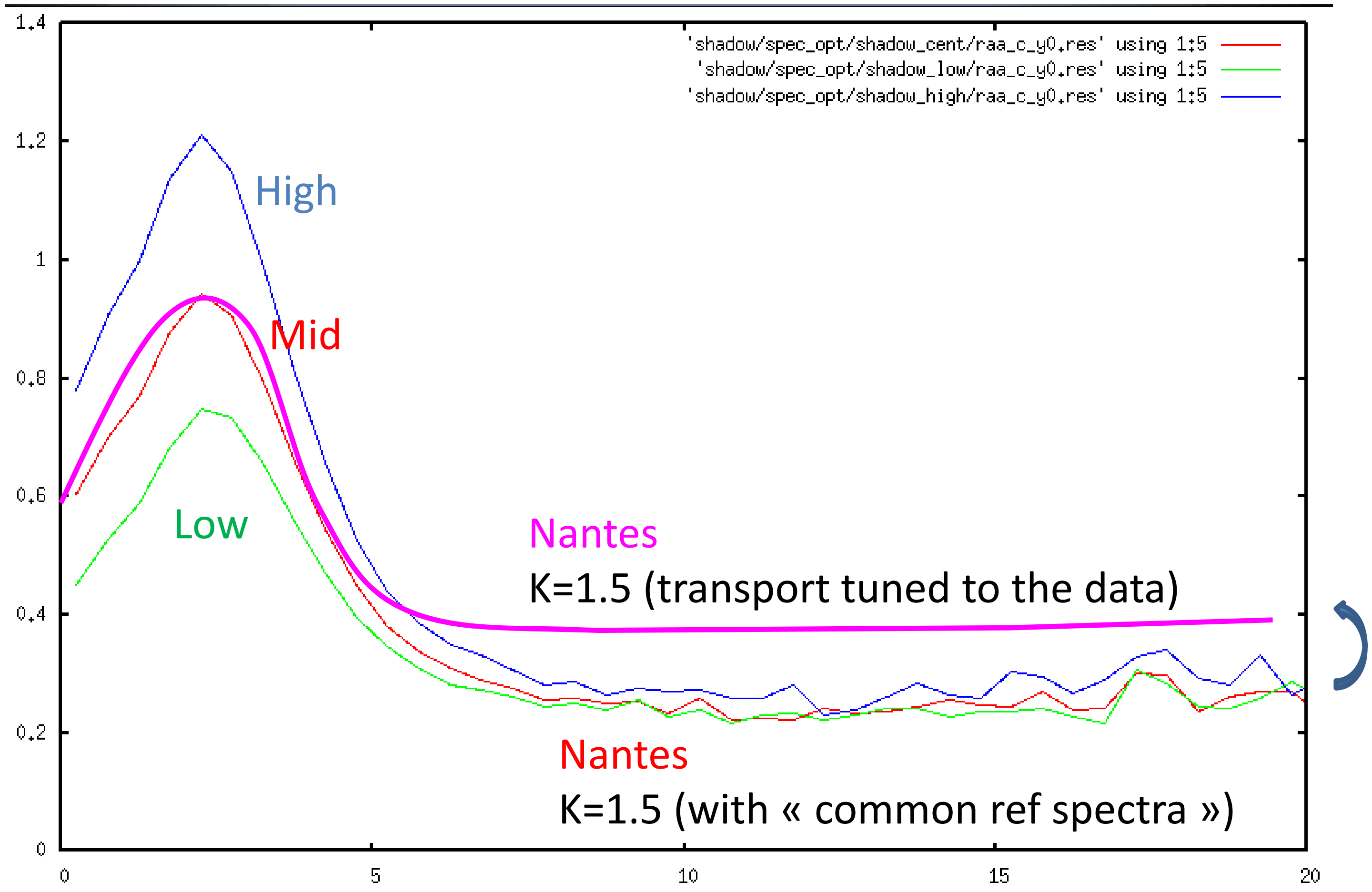
Some words on methodology (appendix A)

… but assume:



Some words on methodology (appendix A)

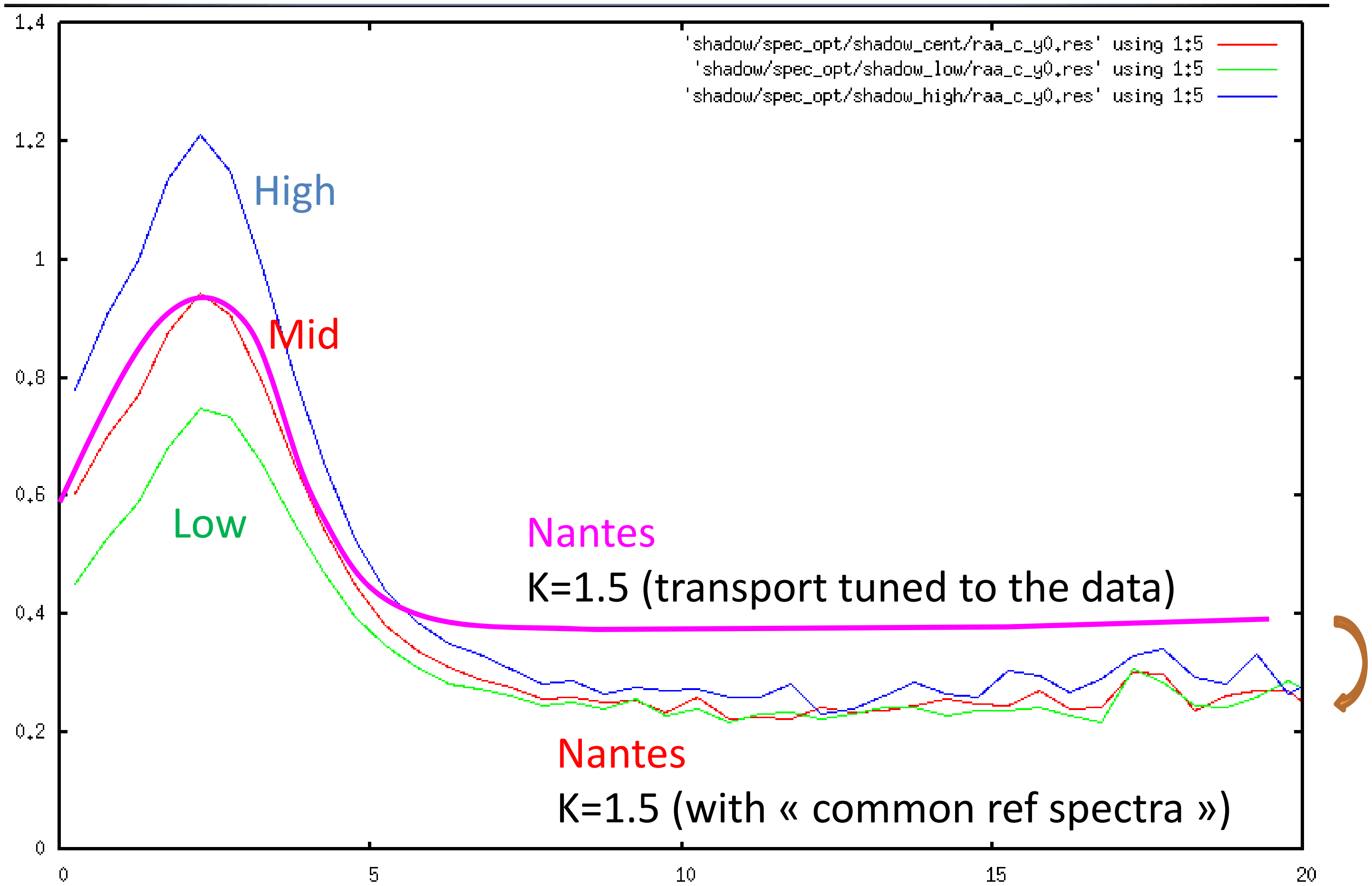
… but assume:



… we then either diminish the K factor (the quenching) in the « common spectra » version to match our previous results => f.i. K =1

Some words on methodology (appendix A)

… but assume:

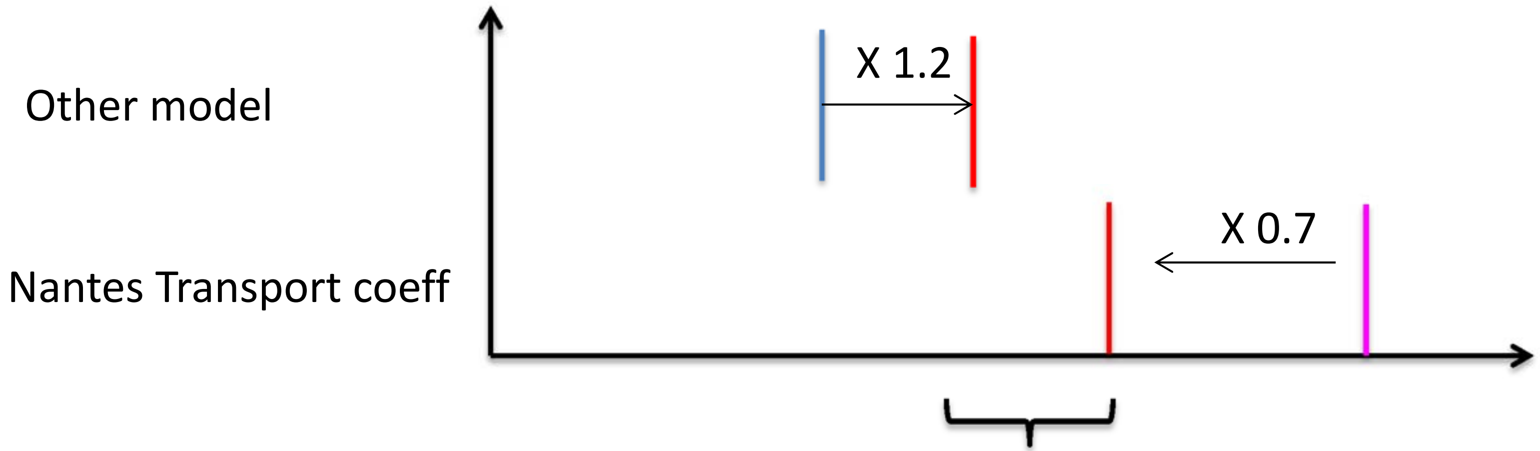


… or increase the K factor (the quenching) in the « nantes spectra » version to match the ones found in the « common spectra » version => f.i. K =2

Some words on methodology (appendix A)

In both case, we find K_{common} ≈1/1.5 ≈ 1.5/2 $K_{spec\ Nantes}$

=> Transport $coeff_{common}$ ≈1/1.5 ≈ 1.5/2 Transport $coeff_{spec\ Nantes}$



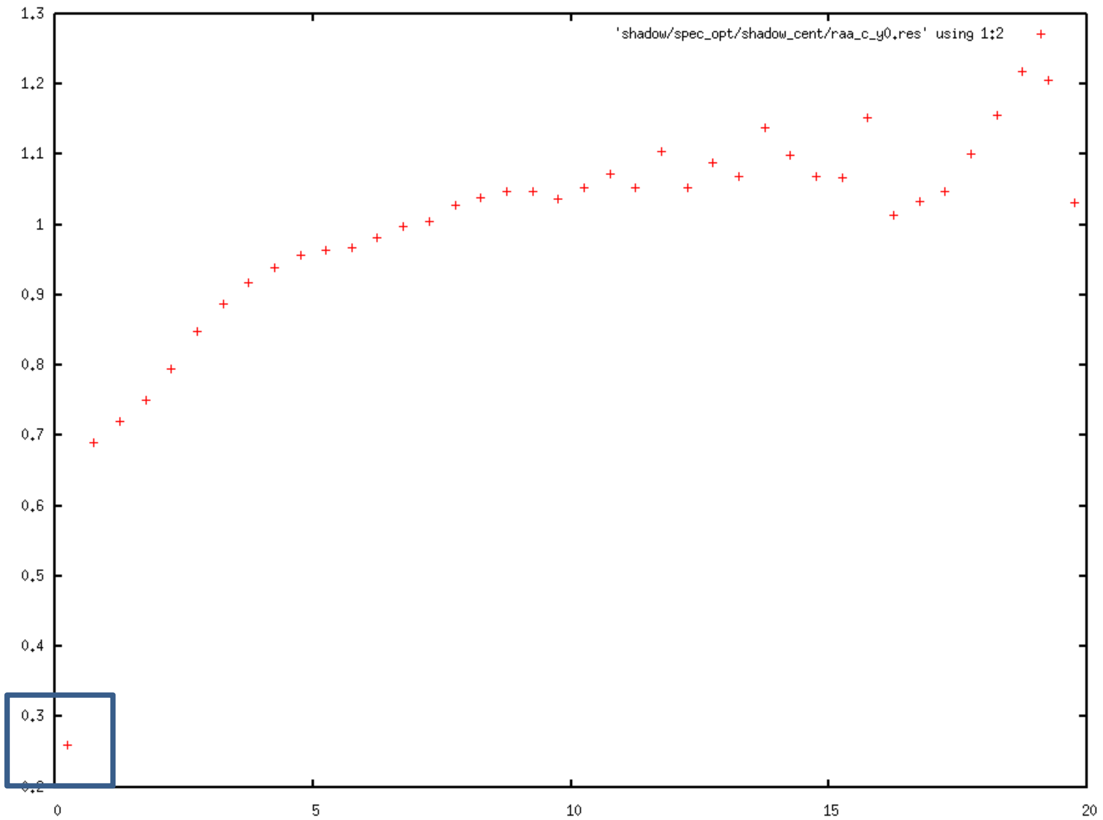
Reduction of systematic errors for this specific ingredient… but does not mean that the values with the common ingredient are the « correct » ones (it all depends how well you have this ingredient under control)

TO DO for 6.

- Quantify the effects ?
- Check spectrum is dN/dpT
- Check centrality dependence of shadowing
- Check latest hadronisation (possible caviat: fragmentation function are not the ones used by the experimentalist to tune the spectra)

Back up

- RAA c init:



Spurious, due to
Discretization in the sampling