

Improvement of FTF (FRITIOF) Model in GEANT-4

Physics Reference Manual

June 14, 2006

Parton string model.

22.3.2 The diffractive string excitation

In the diffractive string excitation (the Fritiof approach [9]) only momentum can be transferred:

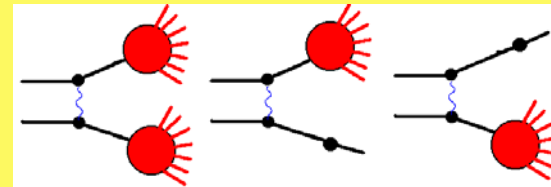
$$\begin{aligned} P_1' &= P_1 + q \\ P_2' &= P_2 - q, \end{aligned} \quad (22.18)$$

where

$$q = \left\{ -q_t^2 / (x^- E_2^-), q_t^2 / (x^+ E_1^+), \mathbf{q}_t \right\} \quad (22.19)$$

is parton momentum transferred and \mathbf{q}_t is its transverse component. We use the Fritiof approach to simulate the diffractive excitation of particles.

Original FRITIOF model

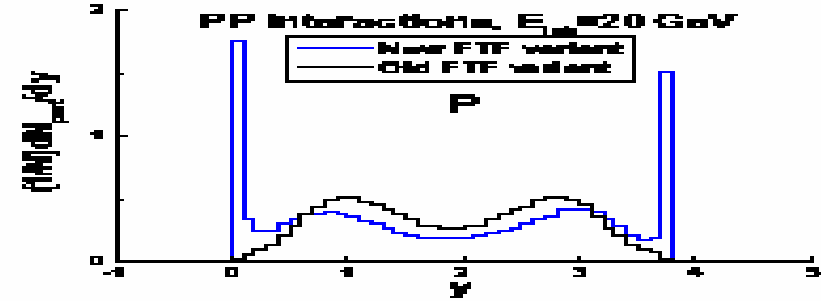
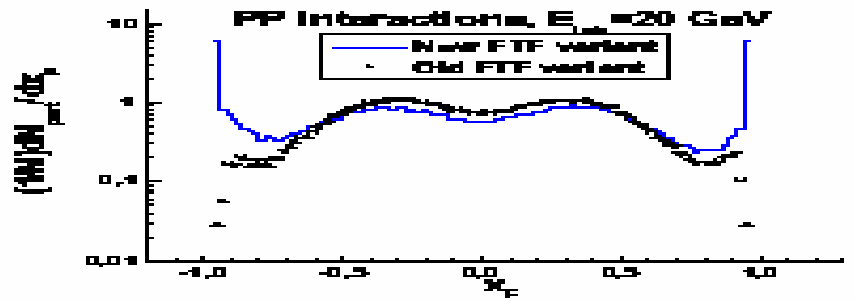
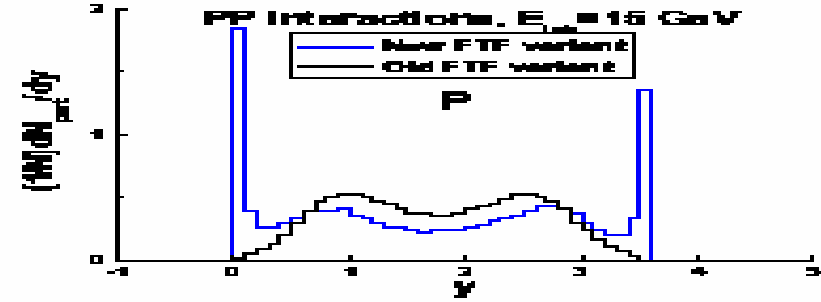
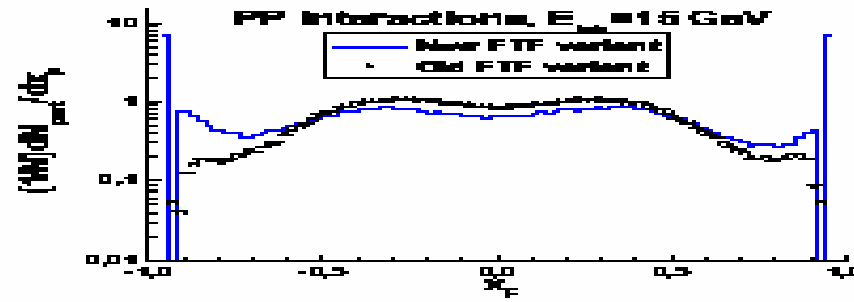
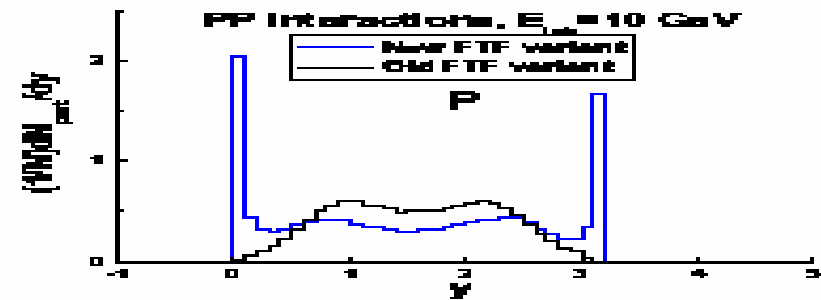
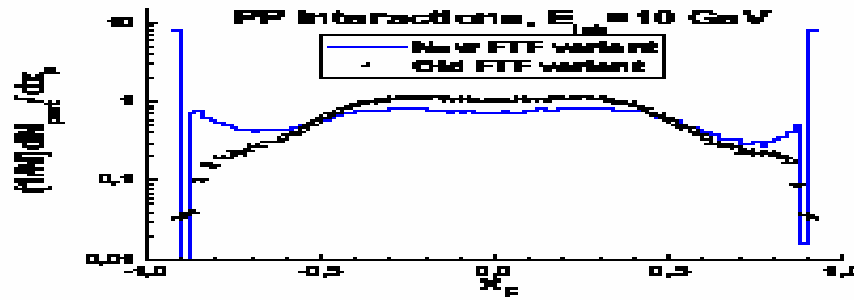
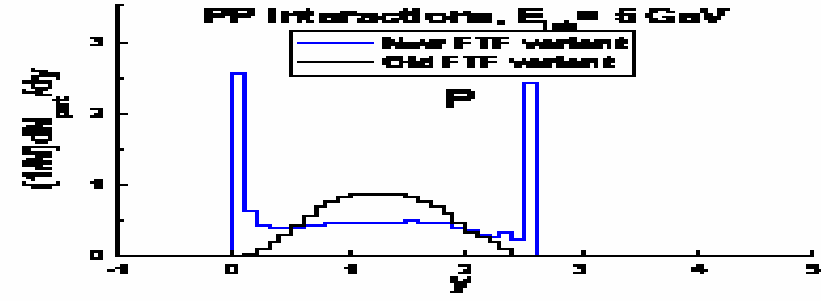
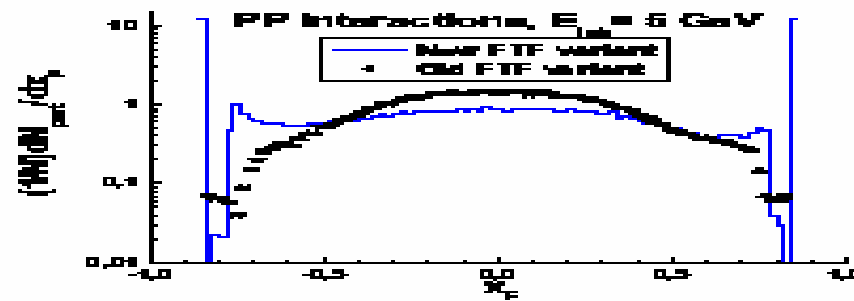


$$dW \propto dP_{proj}^- / P_{proj}^-$$

$$dW \propto dP_{tar}^+ / P_{tar}^+$$

PP->P+X

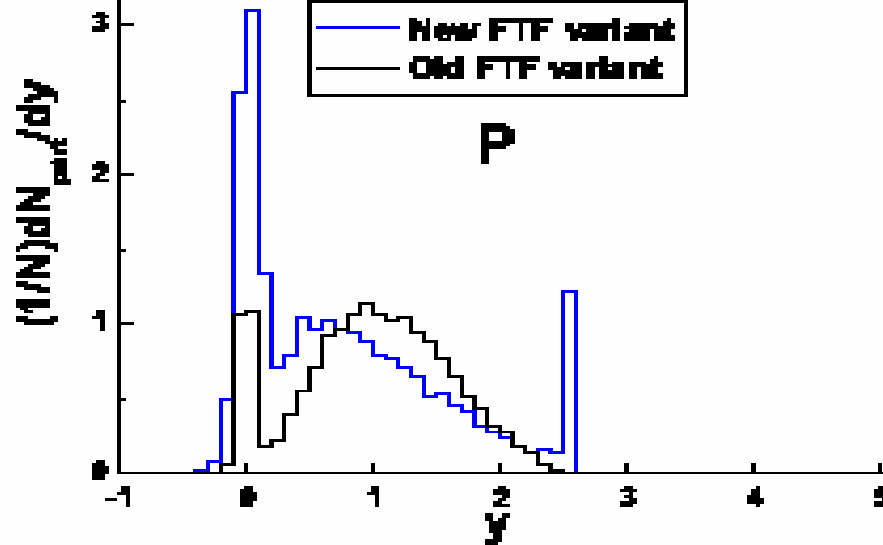
First results



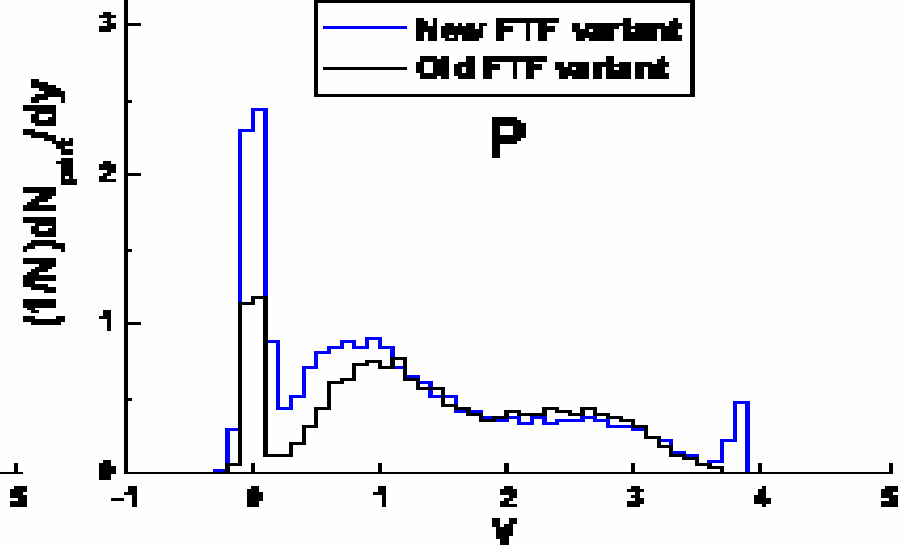
pA->p+X

First results

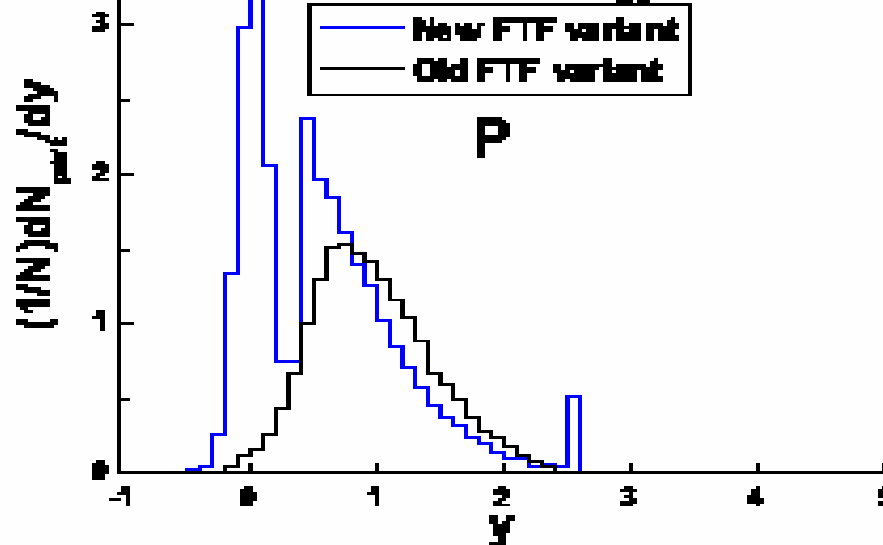
pC Interactions, $E_{\text{lab}} = 5 \text{ GeV}$



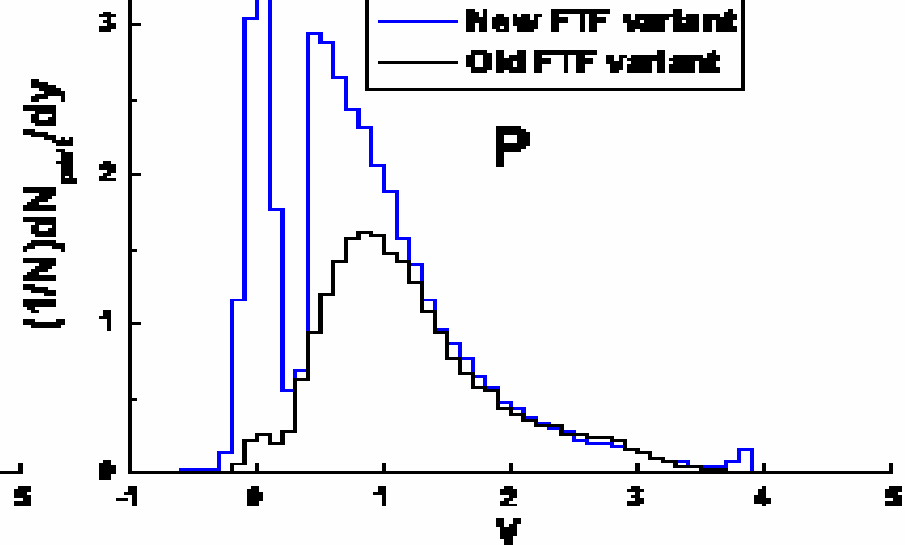
pC Interactions, $E_{\text{lab}} = 20 \text{ GeV}$



pAu Interactions, $E_{\text{lab}} = 5 \text{ GeV}$



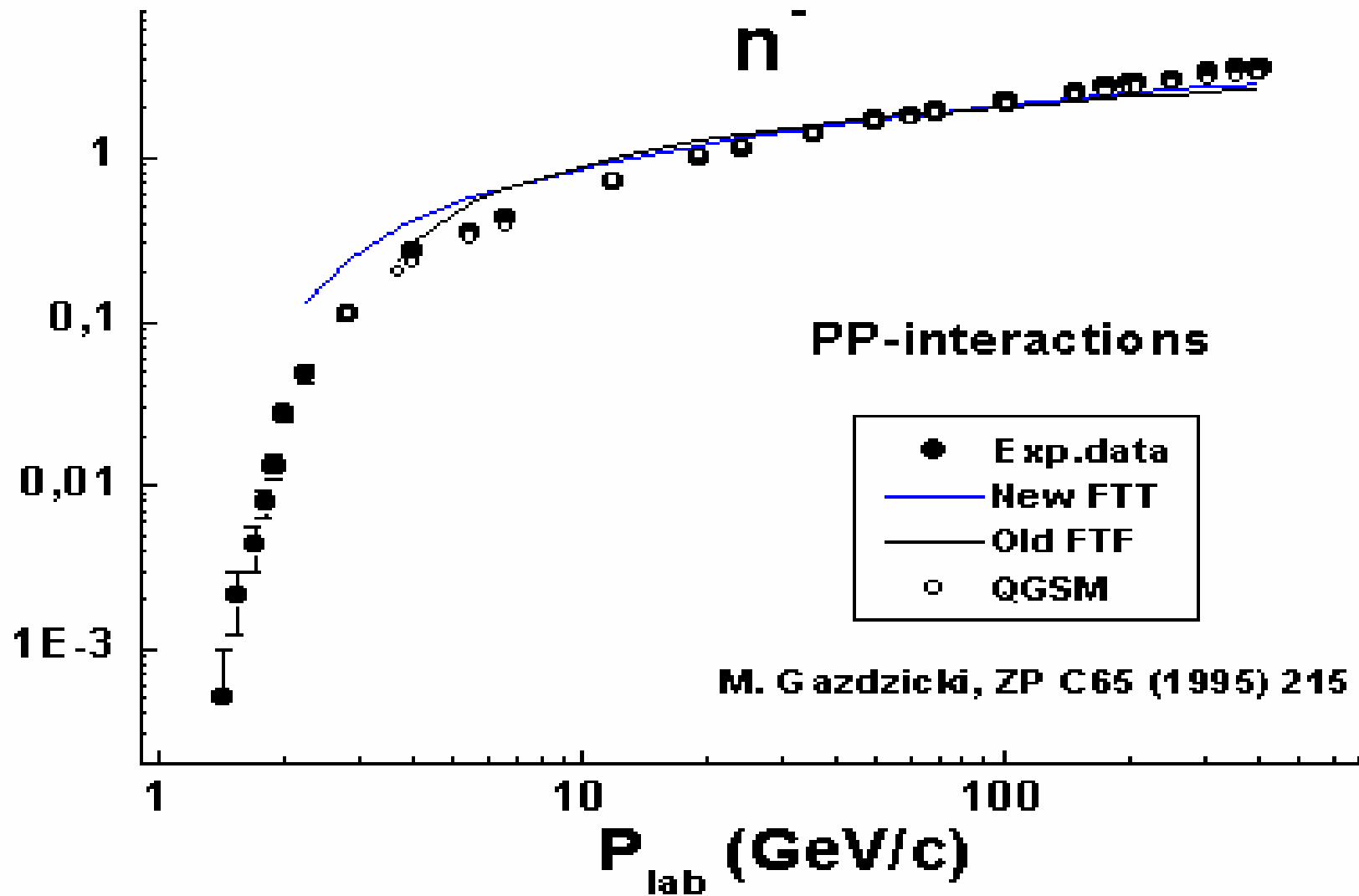
pAu Interactions, $E_{\text{lab}} = 20 \text{ GeV}$



Particle multiplicities in pp-interactions

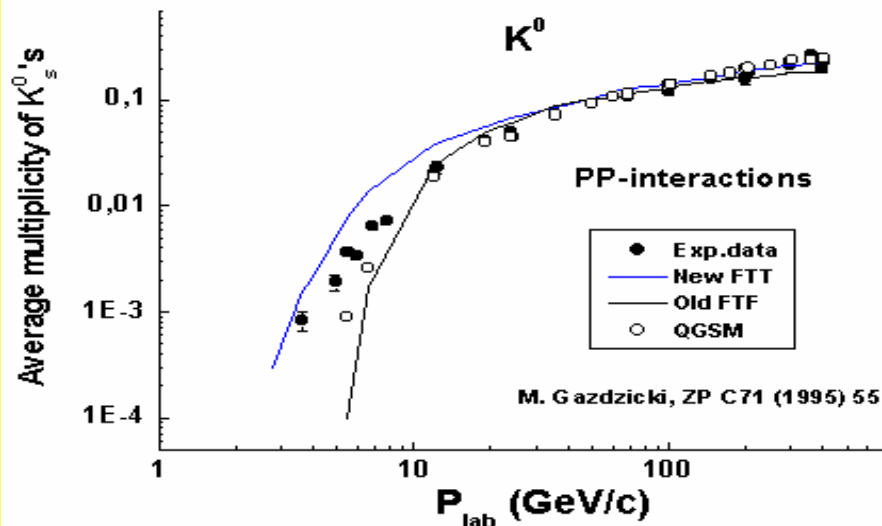
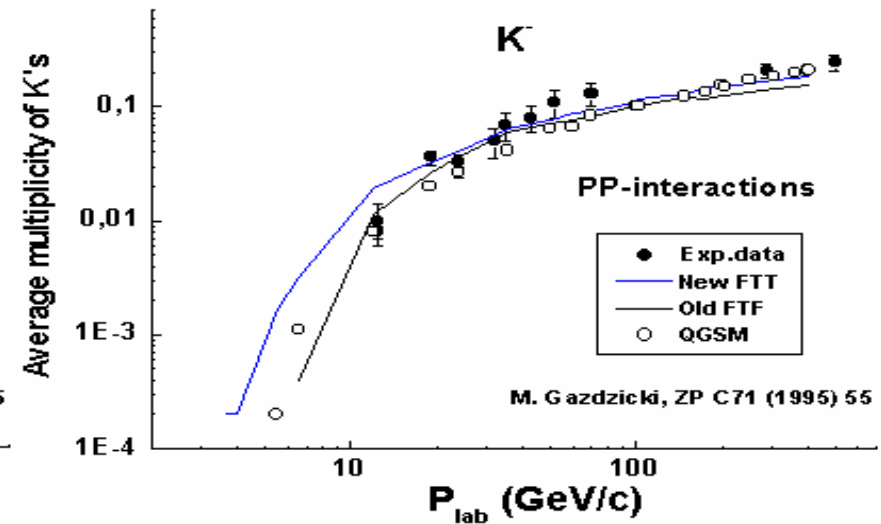
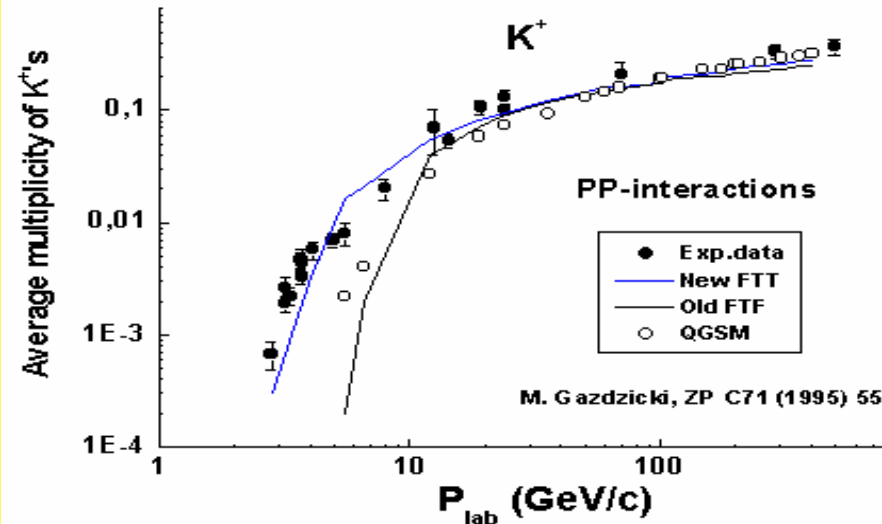
Comparison with exp. data

Average multiplicity of negative particles



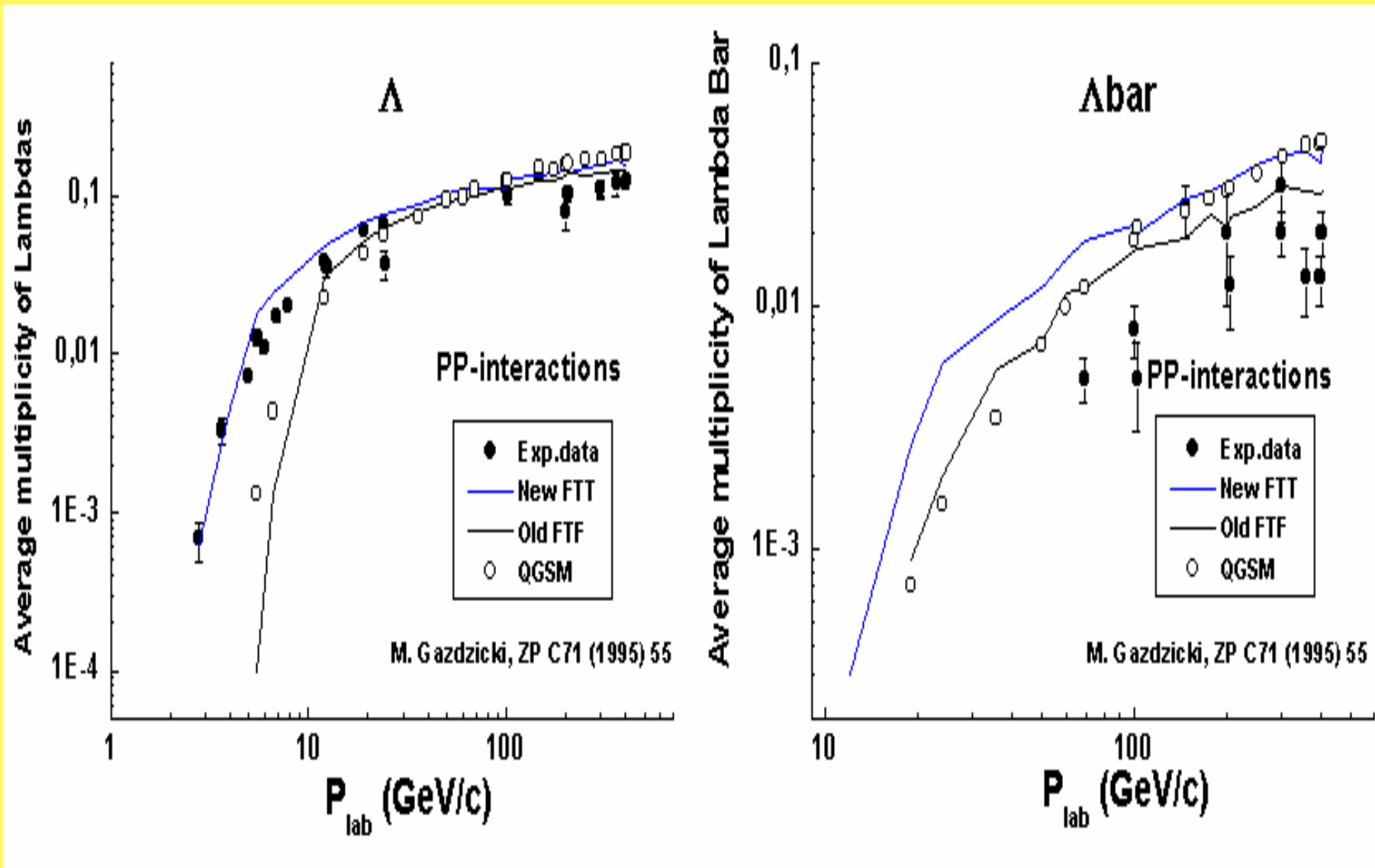
Particle multiplicities in pp-interactions

Comparison with exp. data



Particle multiplicities in pp-interactions

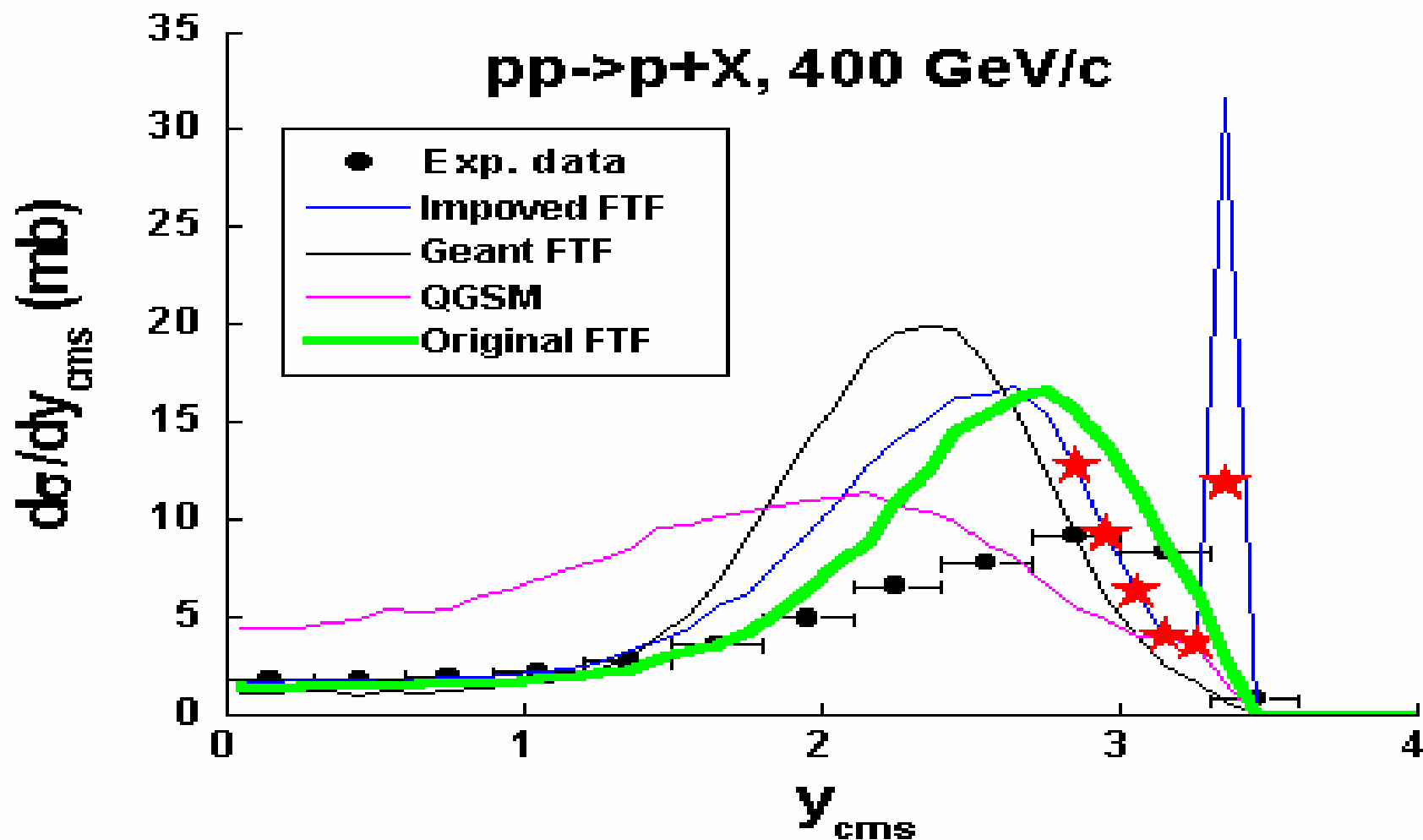
Comparison with exp. data



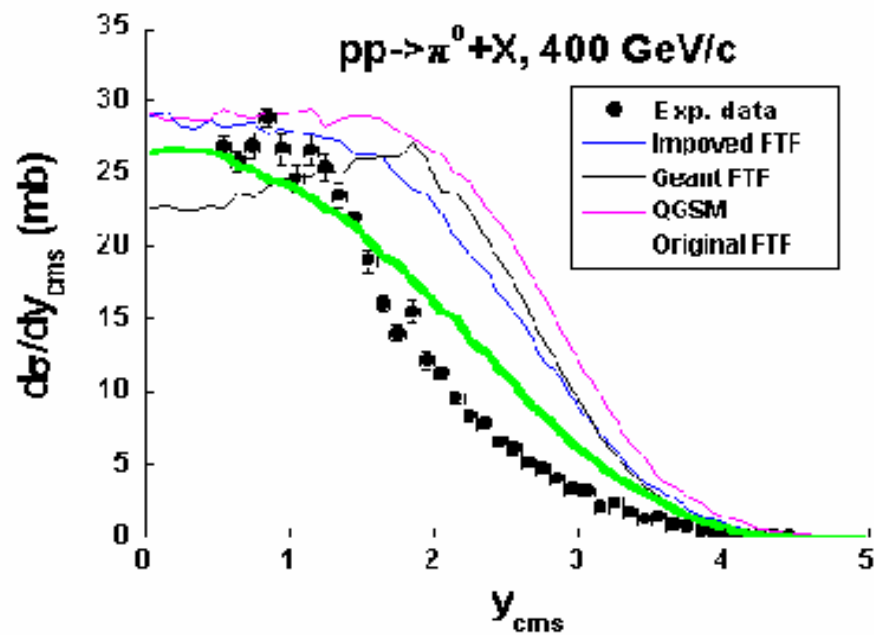
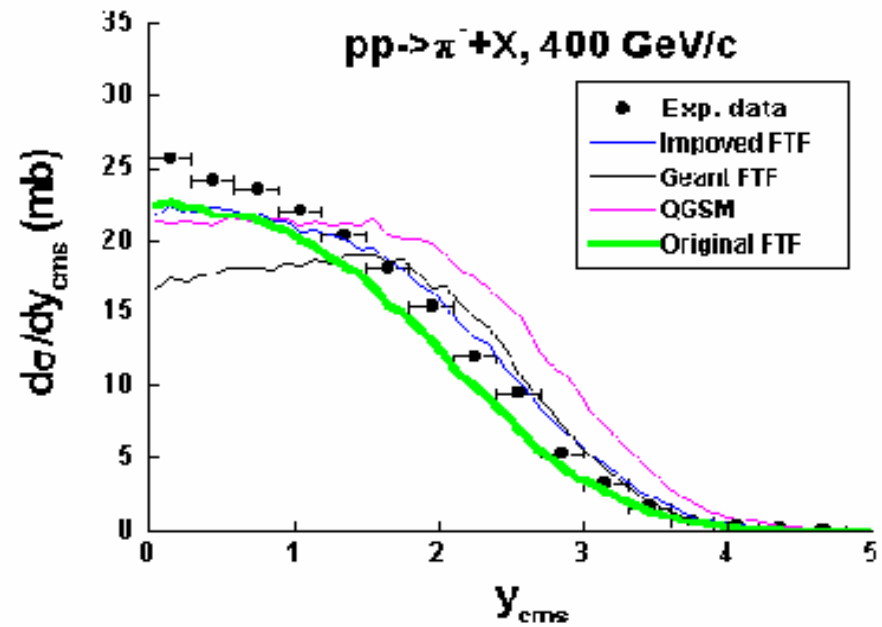
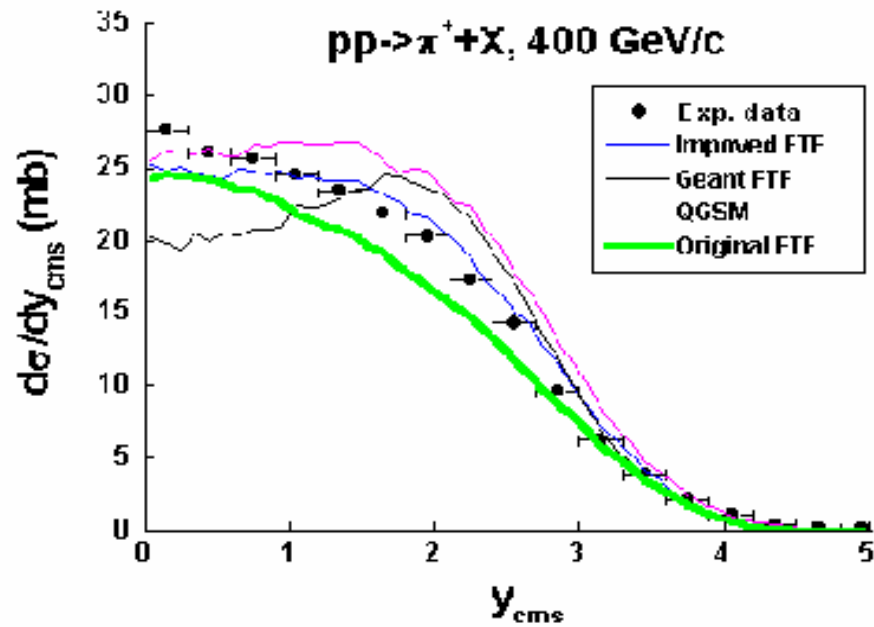
New variant of FTF model

PP-interactions at 400 GeV/c,
M. Aguilar-Benitez et al., (NA-27 Collab.)
Zeit. fur Phys., C50 (1991) 405.

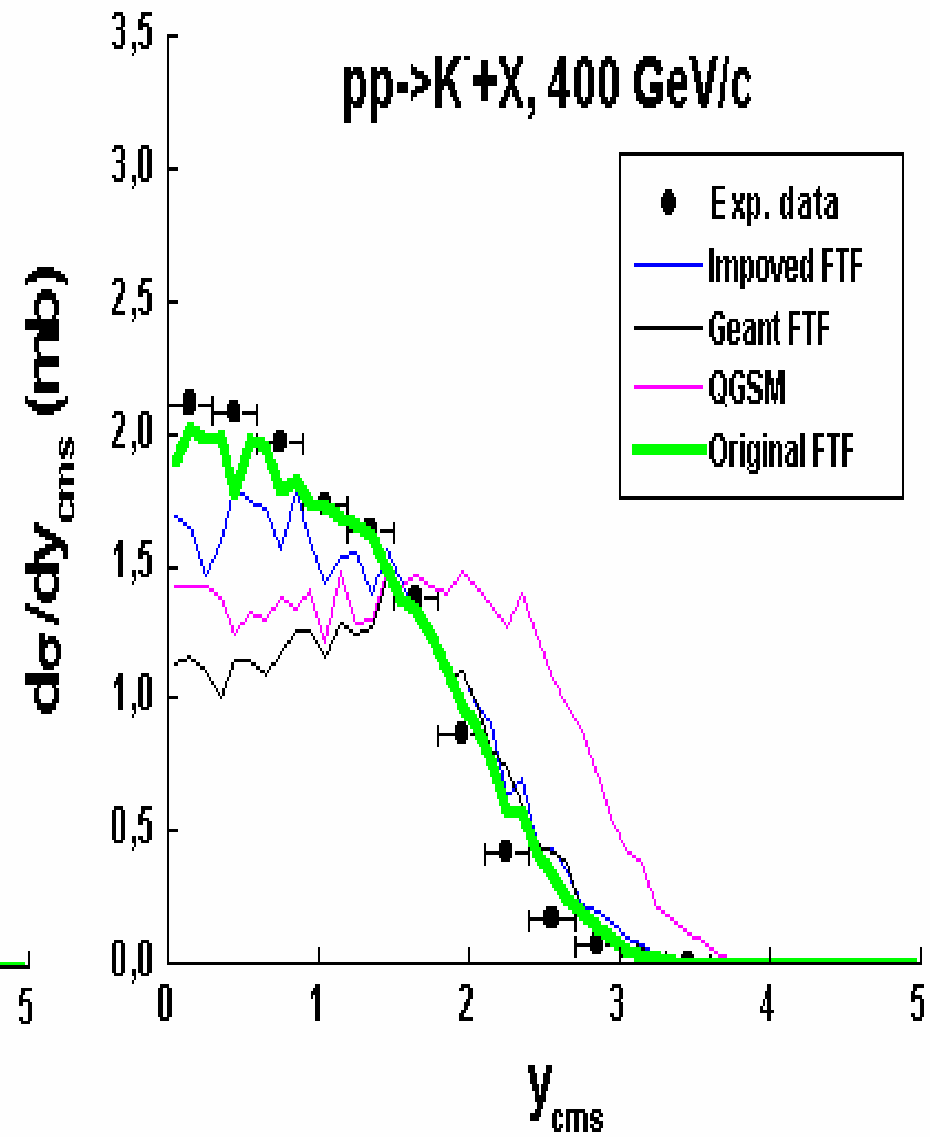
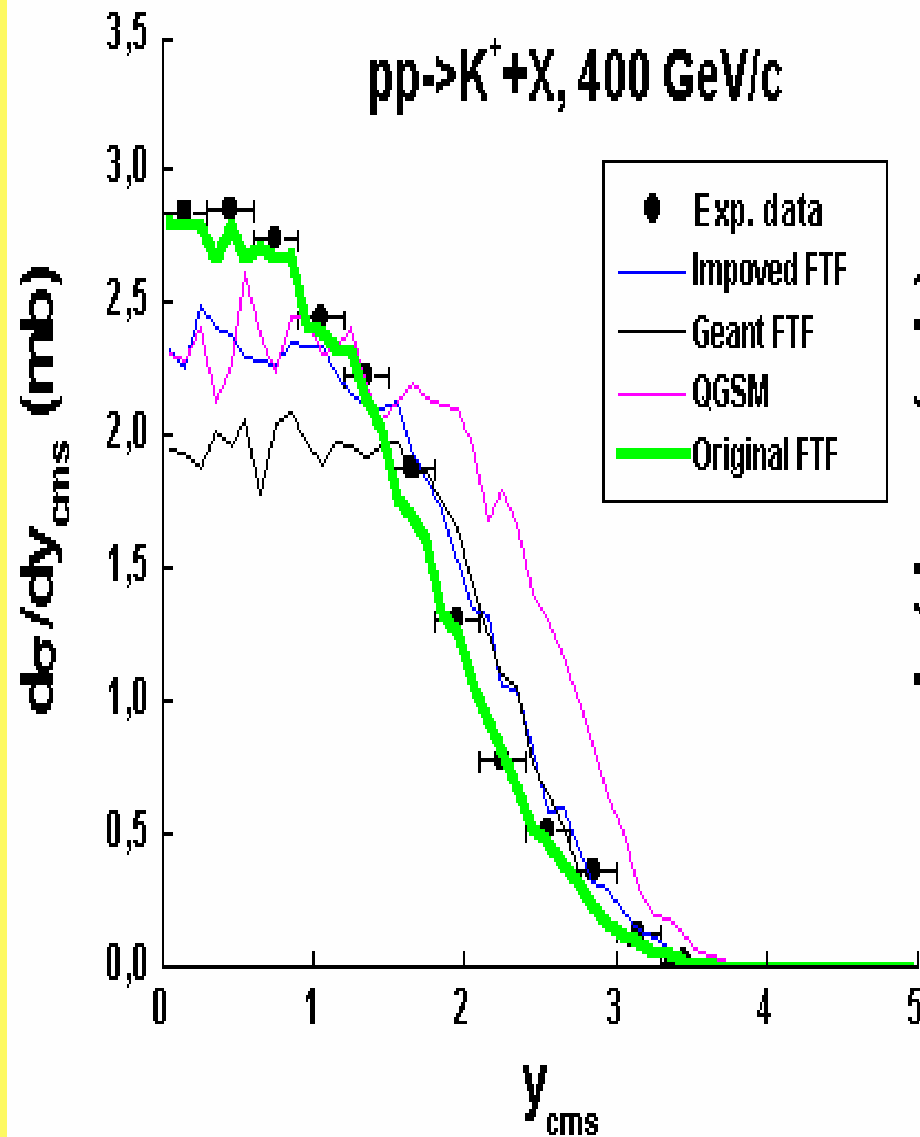
Comparison
with exp. data



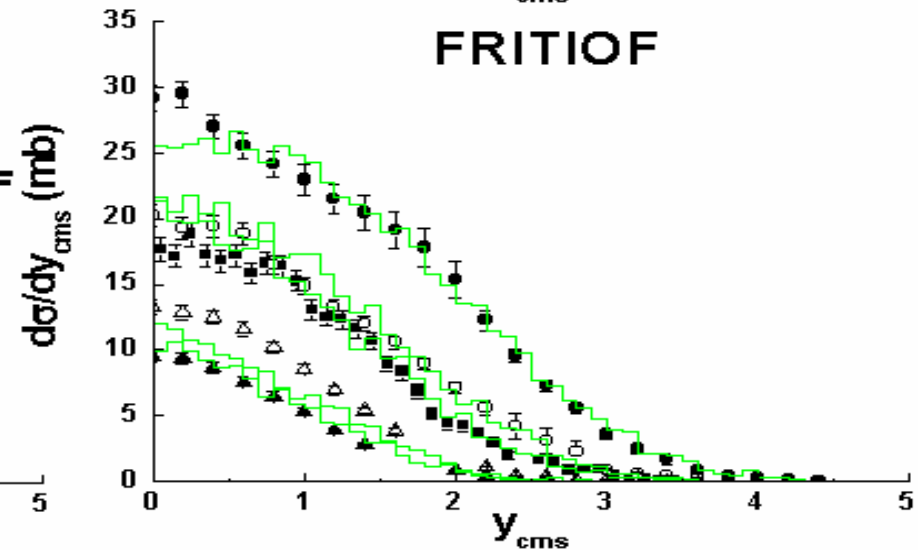
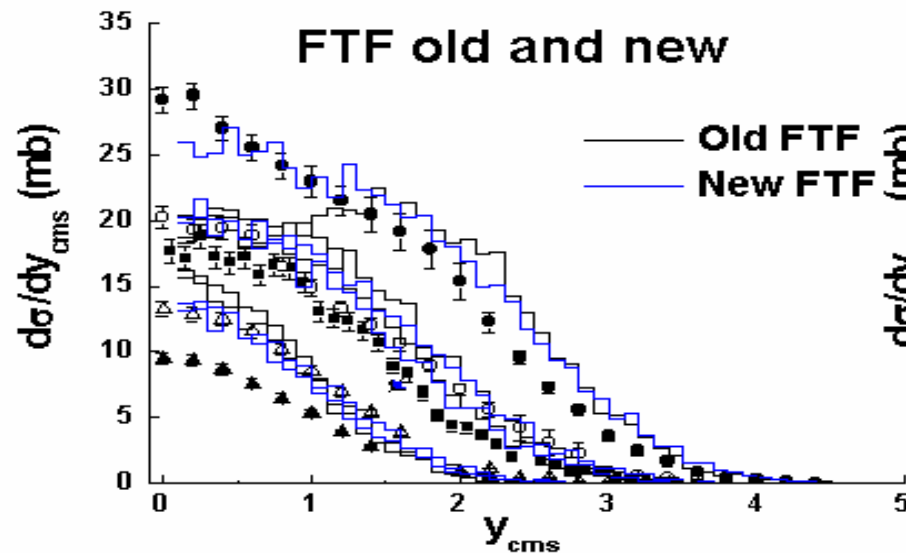
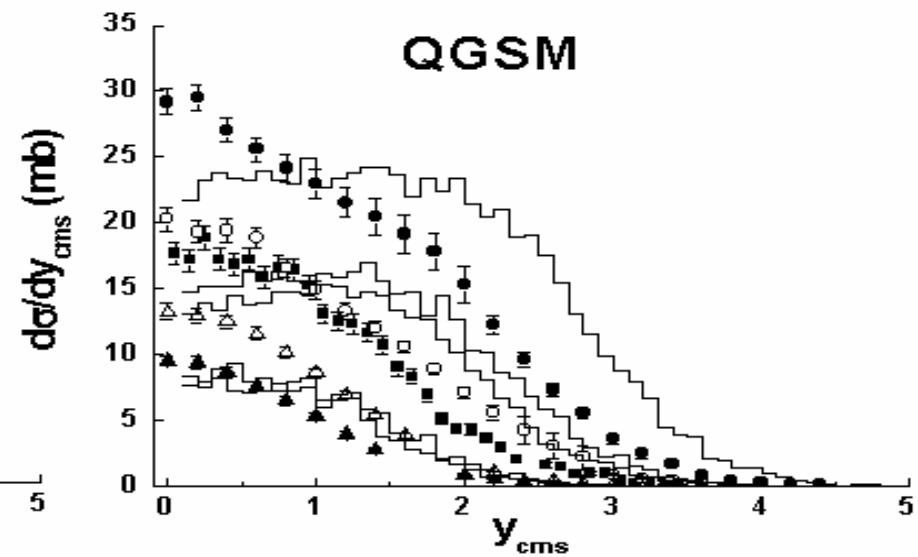
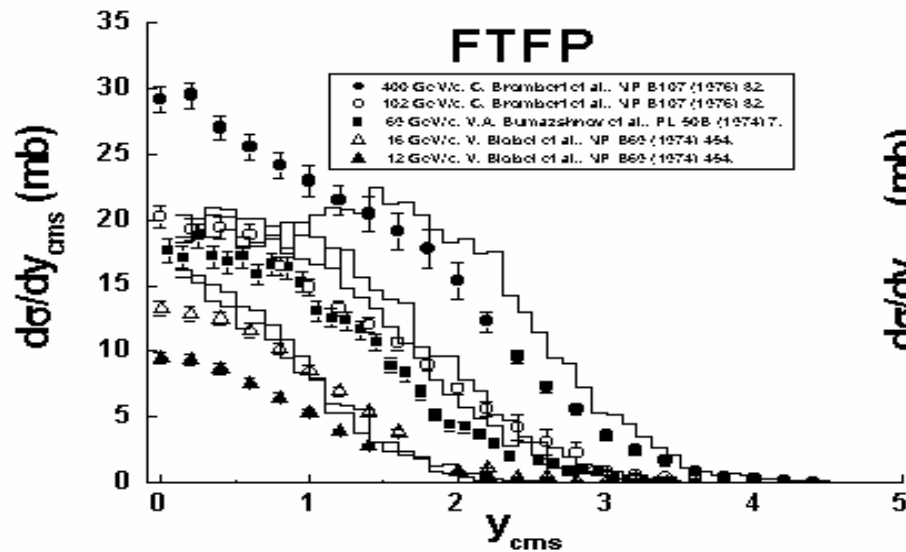
Comparison with exp. data



Comparison with exp. data



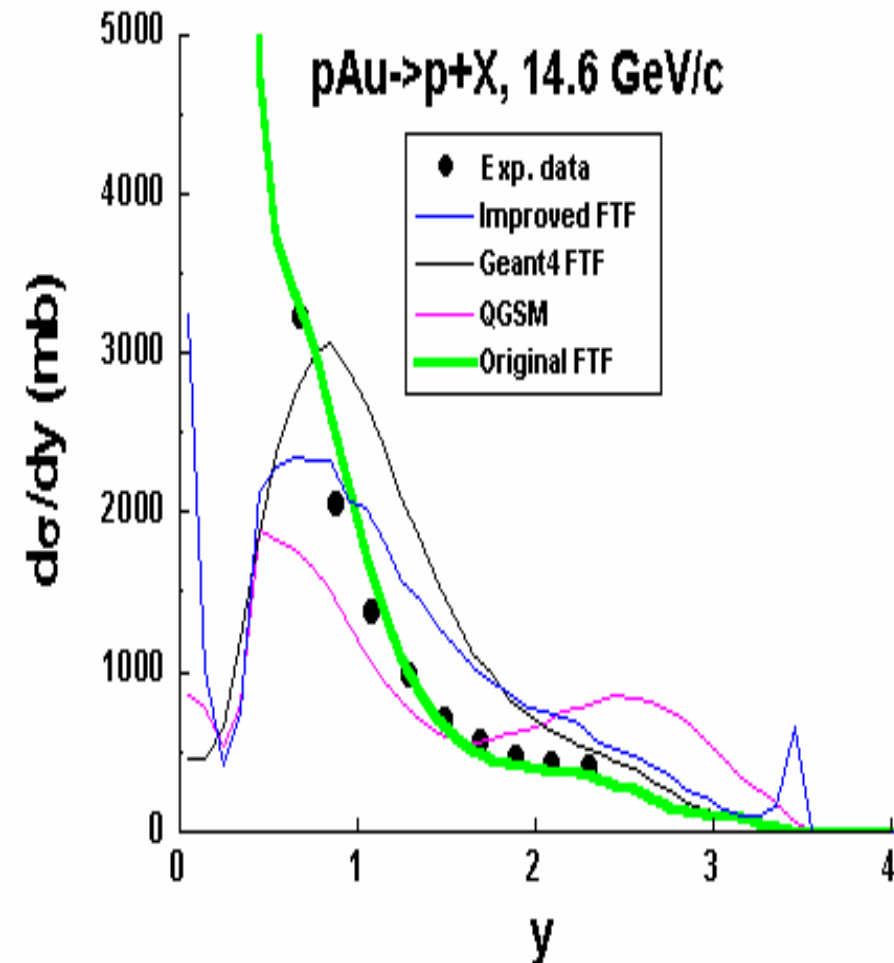
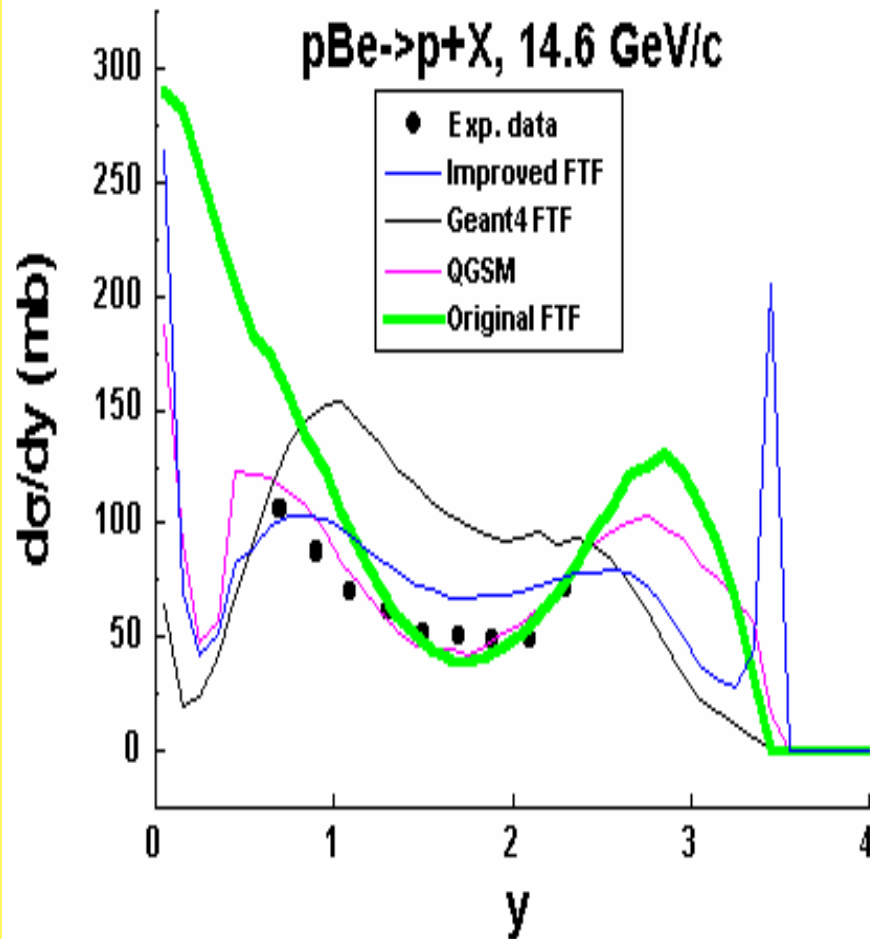
Comparison with exp. data



pp-interactions are described quite well!

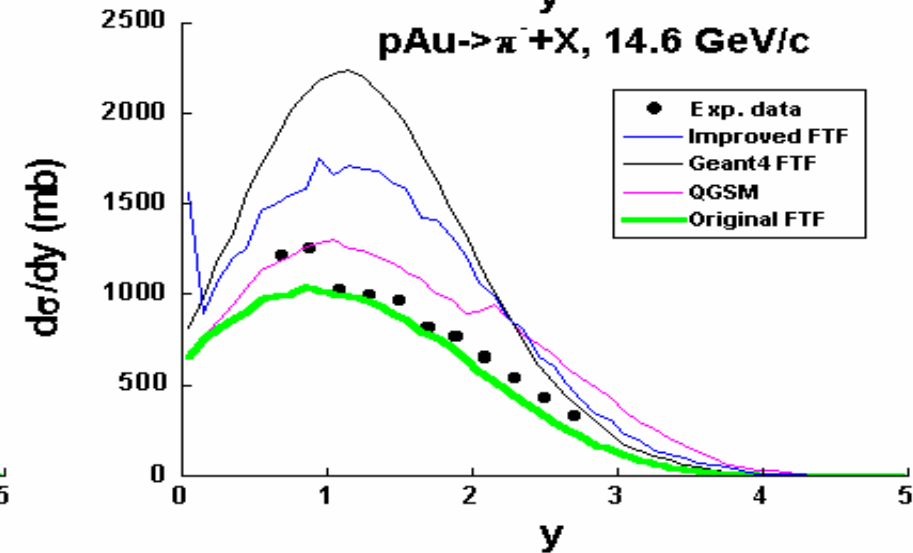
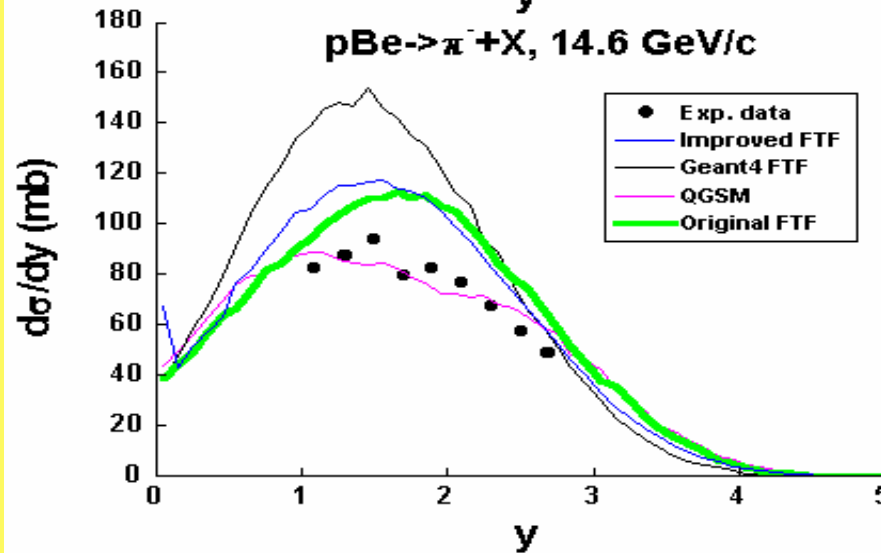
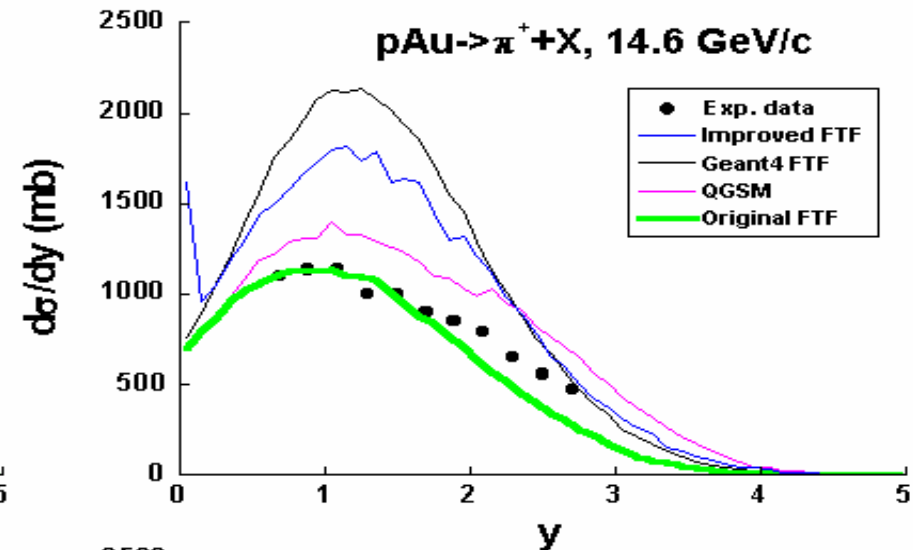
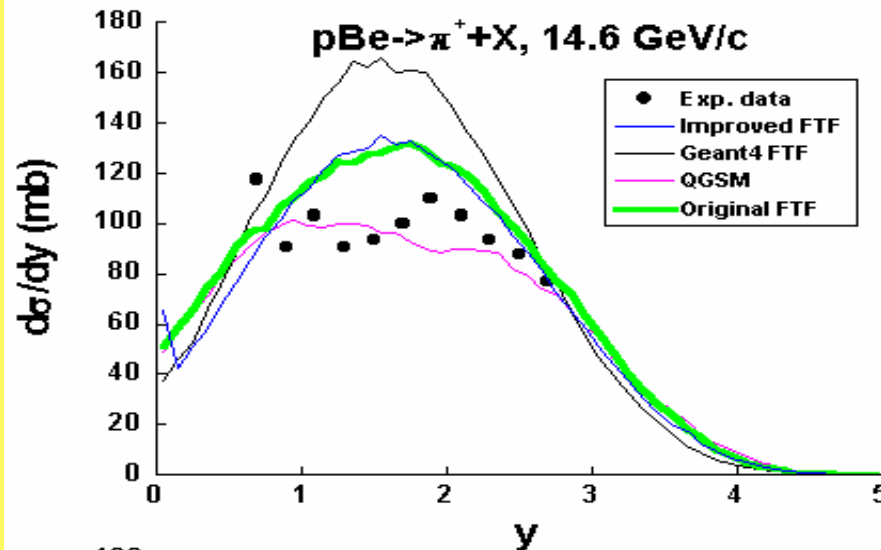
p+Be, p+Au interactions at 14.6 GeV/c
T. Abbott et al. (E-802 Callab.),
Phys. Rev. D45 (1992) 3906

**Comparison with
exp. data**



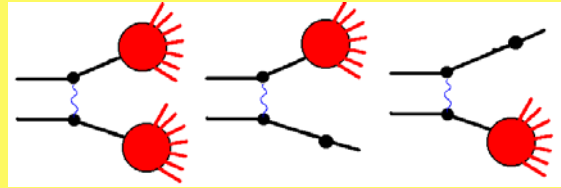
**In FTF model probabilities of intra-nuclear collisions were taken from QGSM.
In the original FRITIOF model - from Glauber approximation**

Comparison with exp. data



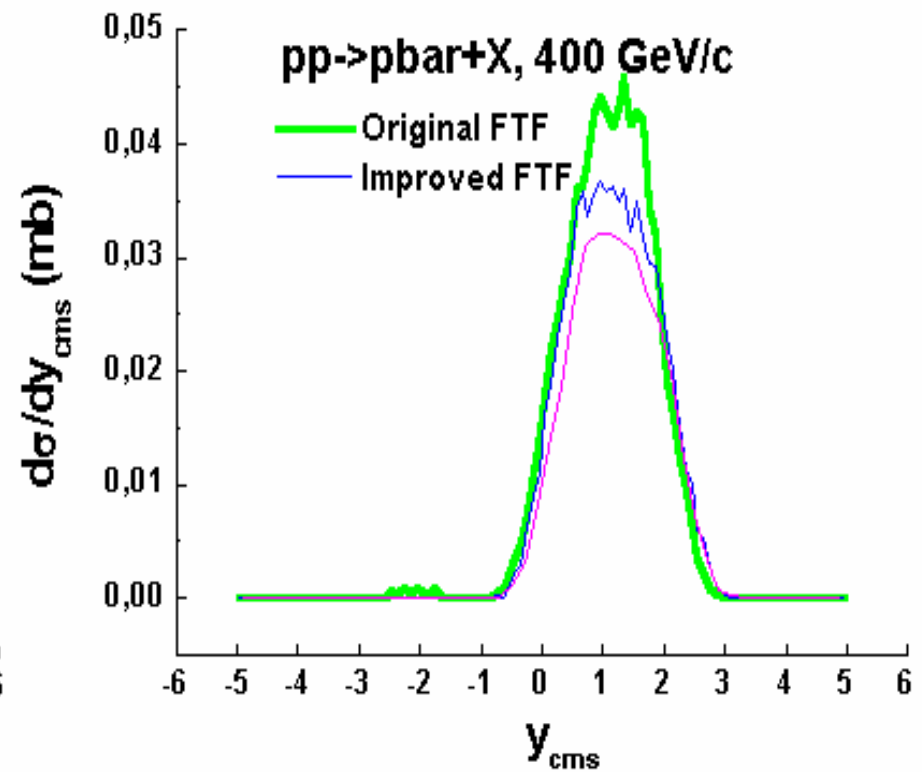
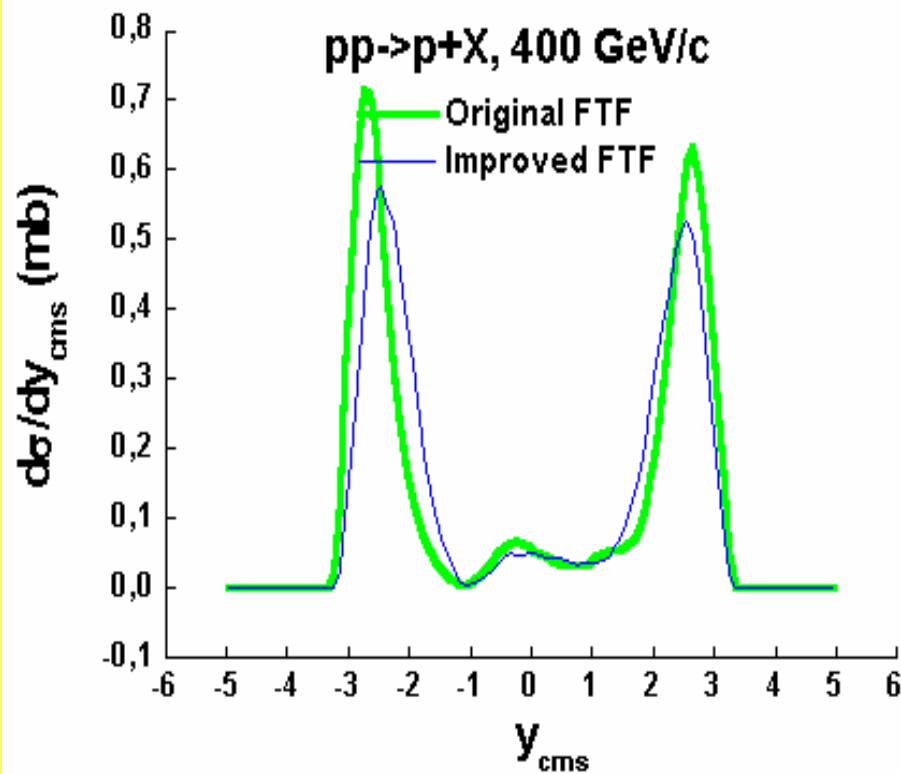
There is a problem with description of rapidity distributions

9 GeV

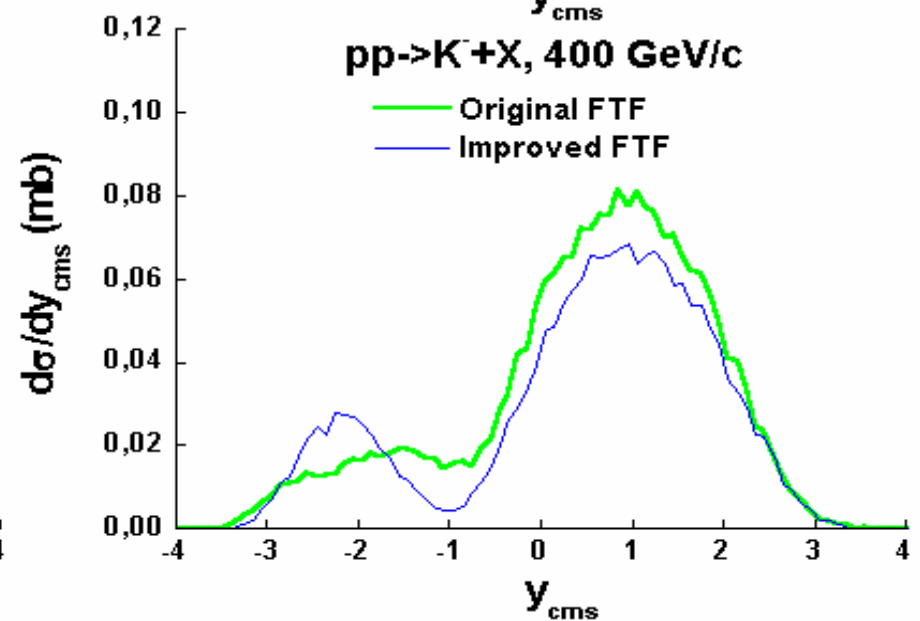
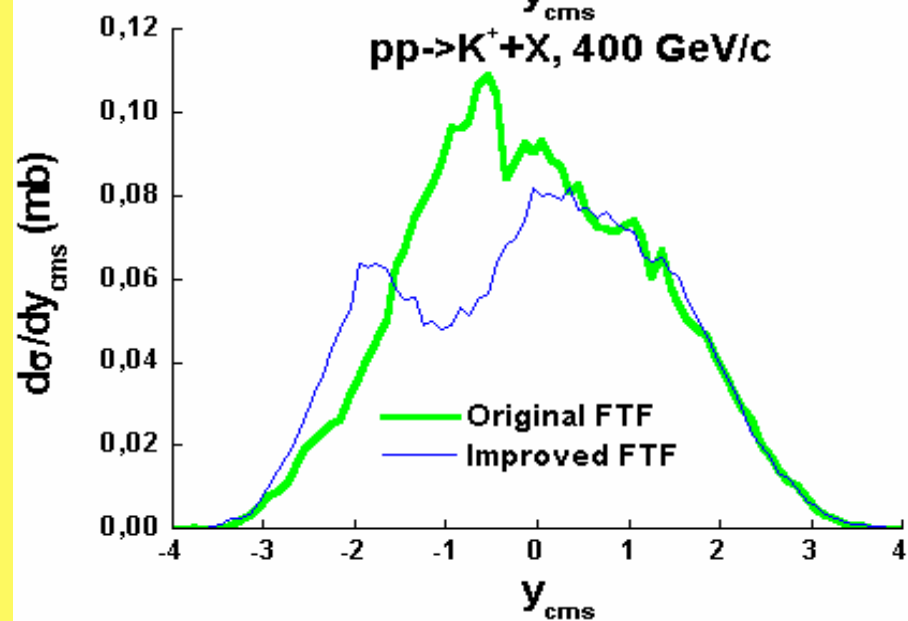
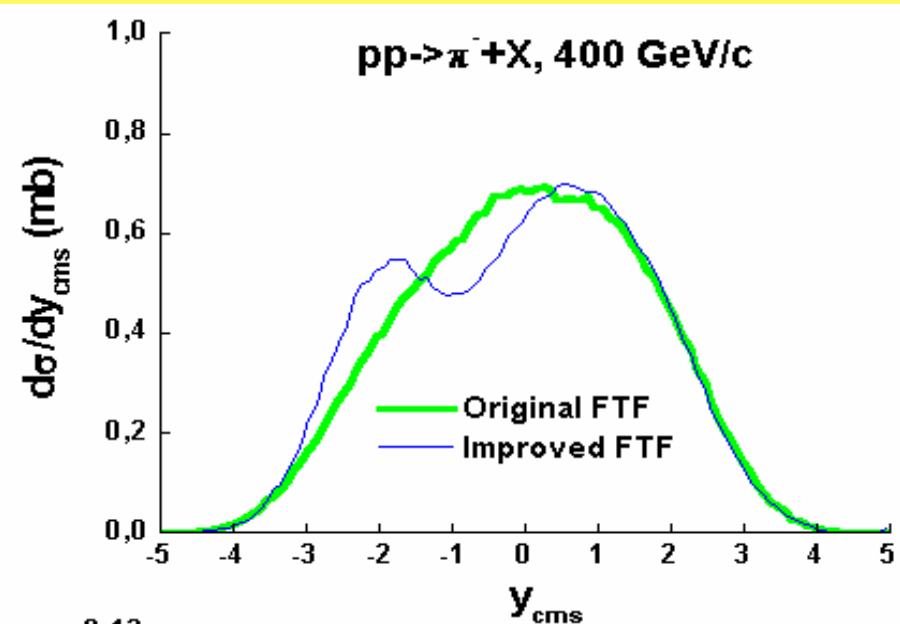
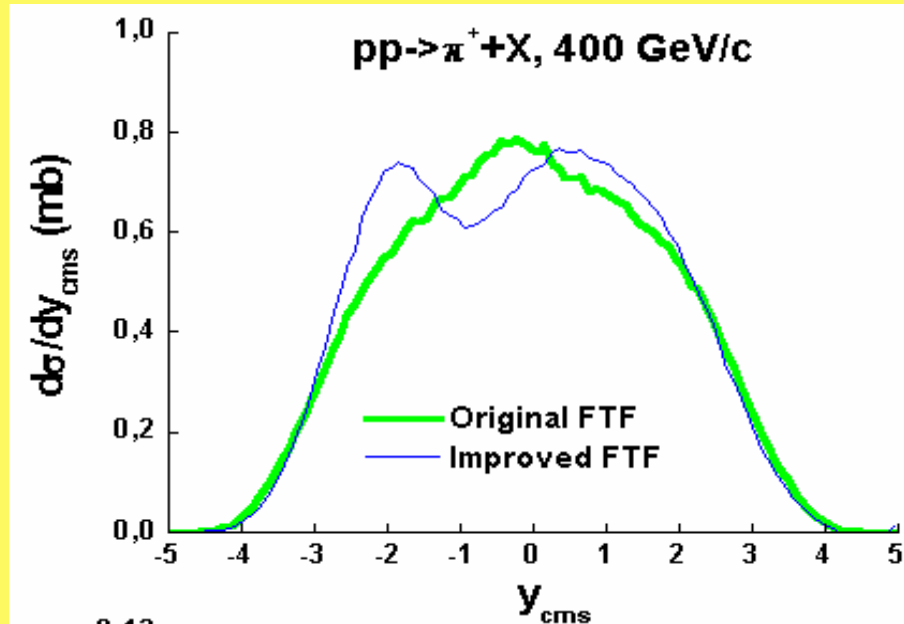


**Check of string
fragmentation**

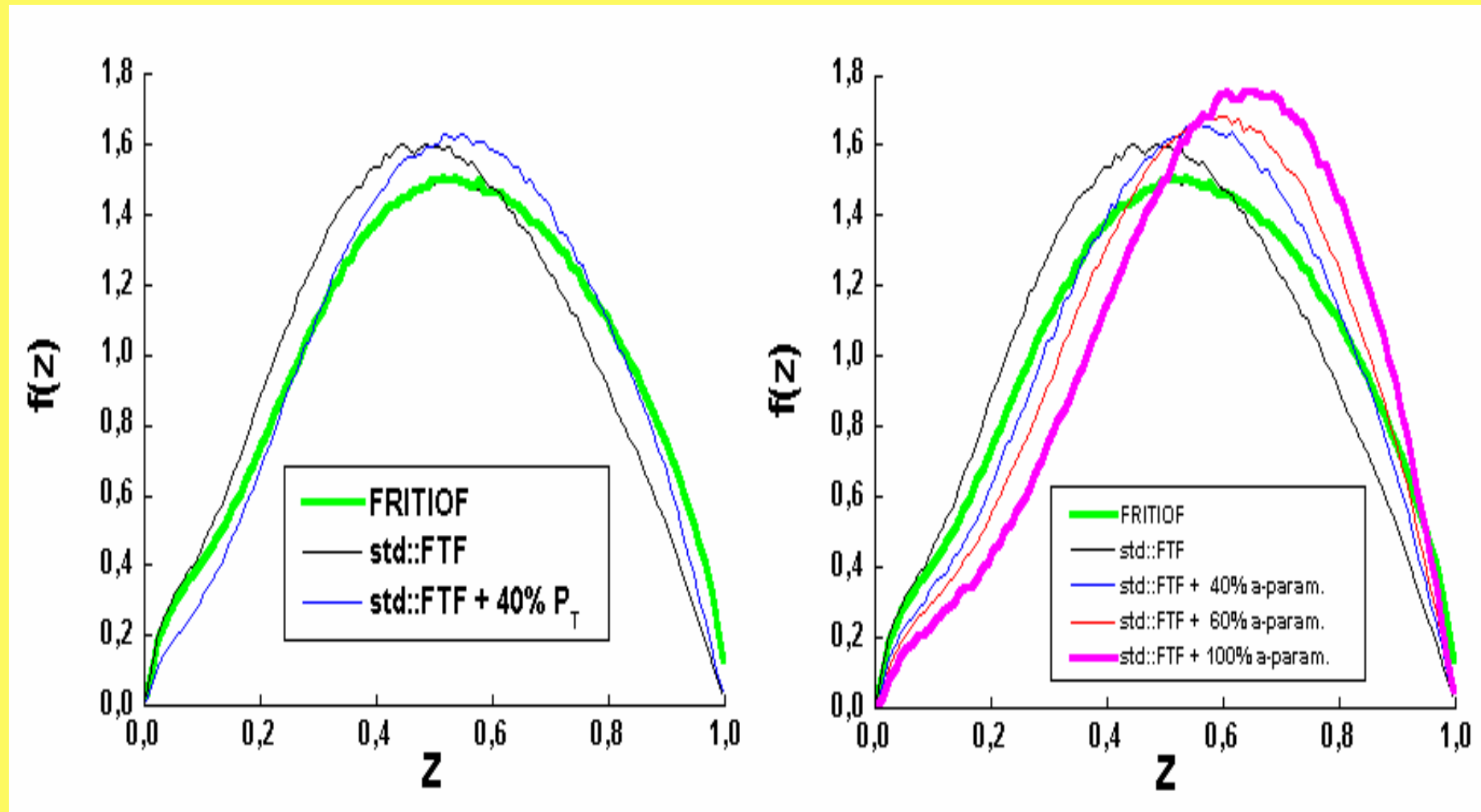
3 GeV



Check of string fragmentation



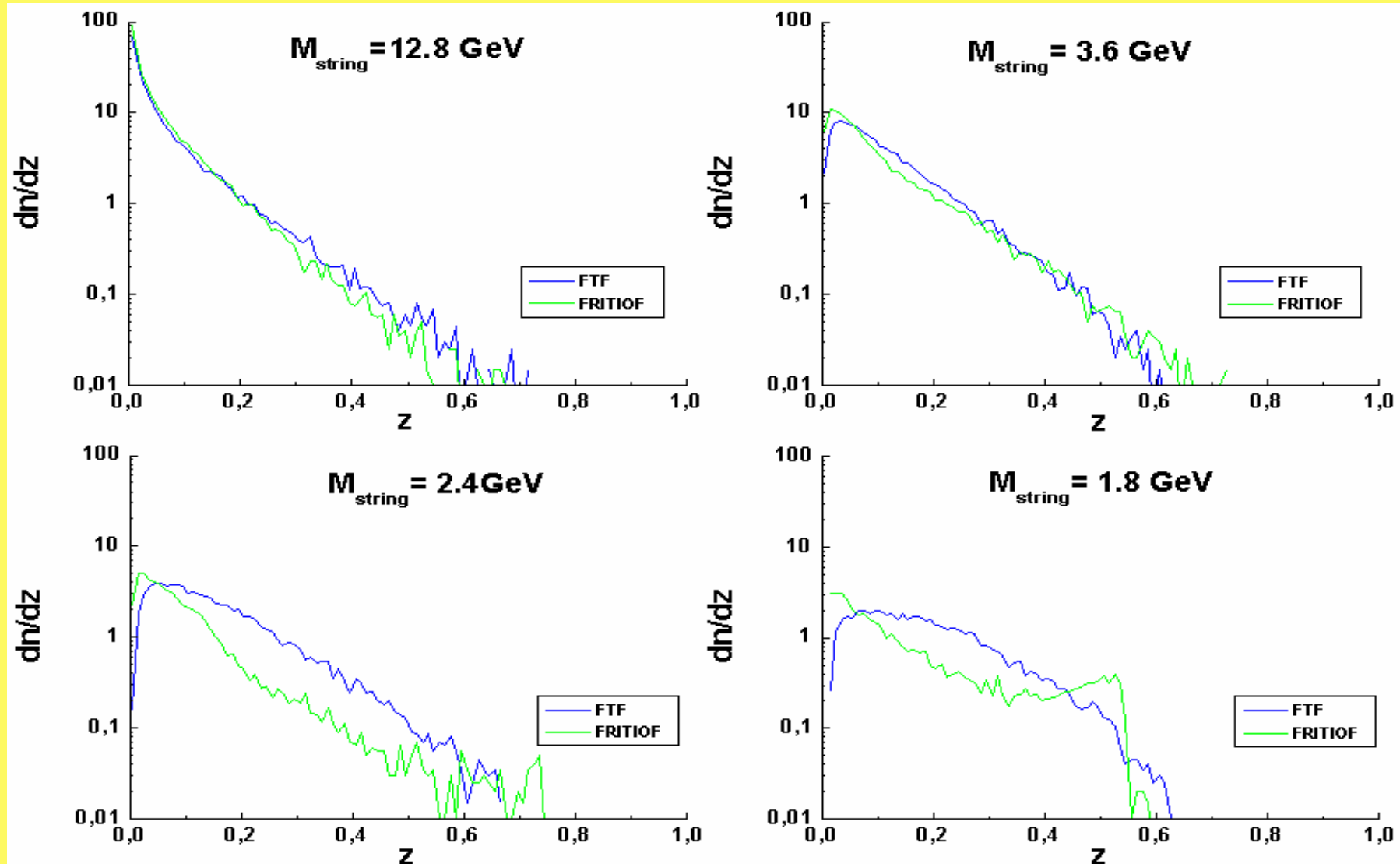
Check of fragmentation function – $f(z)$



$$F(z) \sim (1/z)(1-z) \exp(-a \cdot mt^2)$$

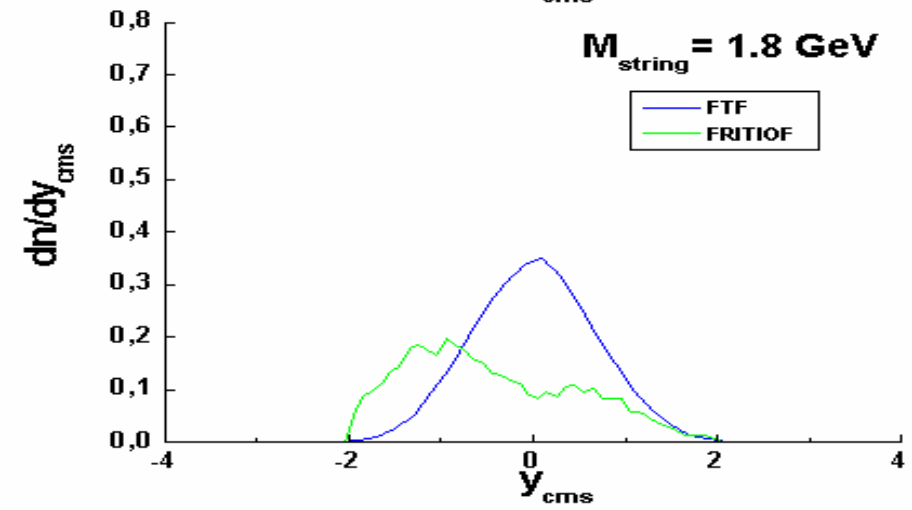
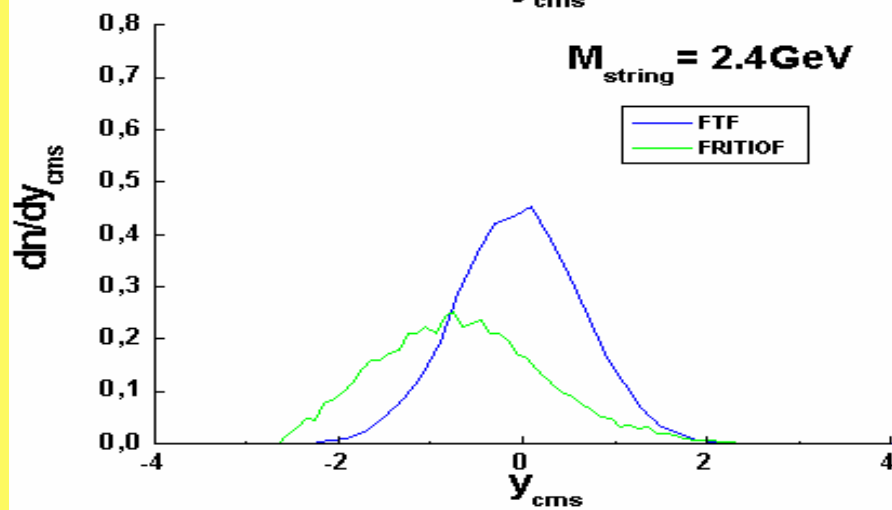
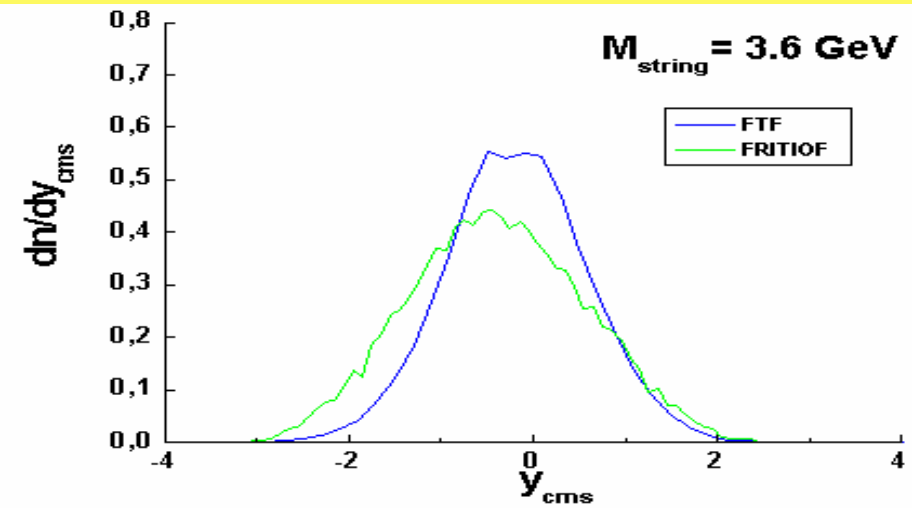
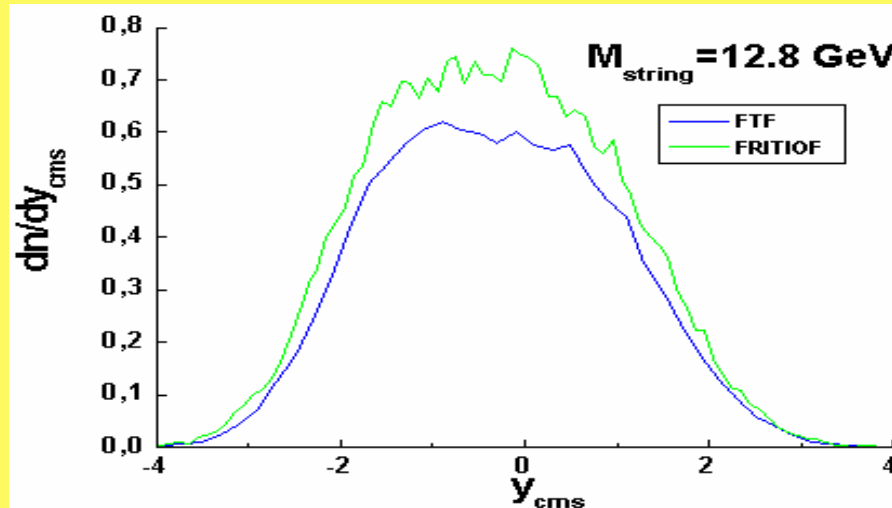
Check of string fragmentation. Single string fragmentation.

π -mesons



Check of string fragmentation. Single string fragmentation.

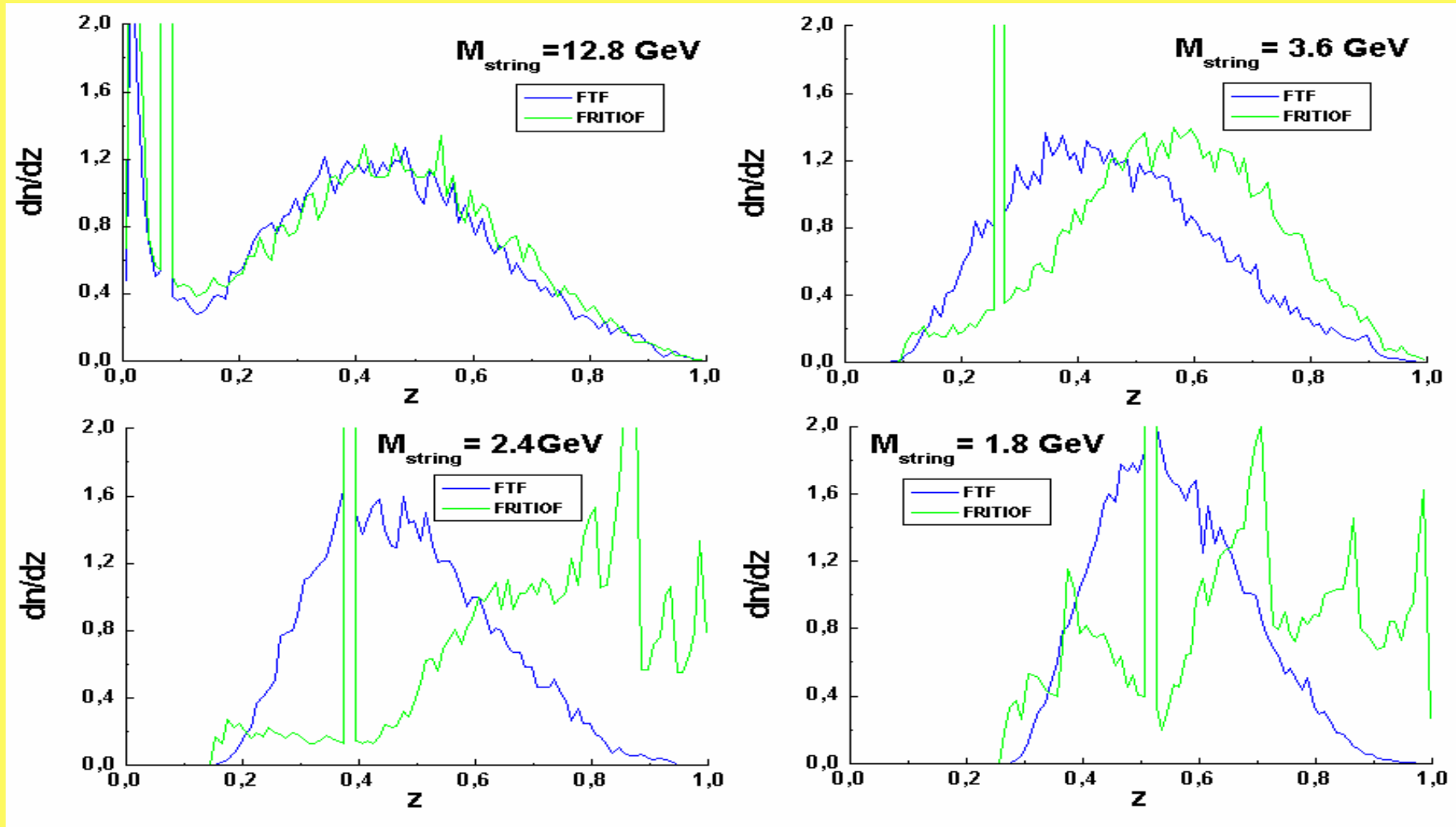
π -mesons



There is a clear forward-backward asymmetry in the FRITIOF model

Check of string fragmentation. Single string fragmentation.

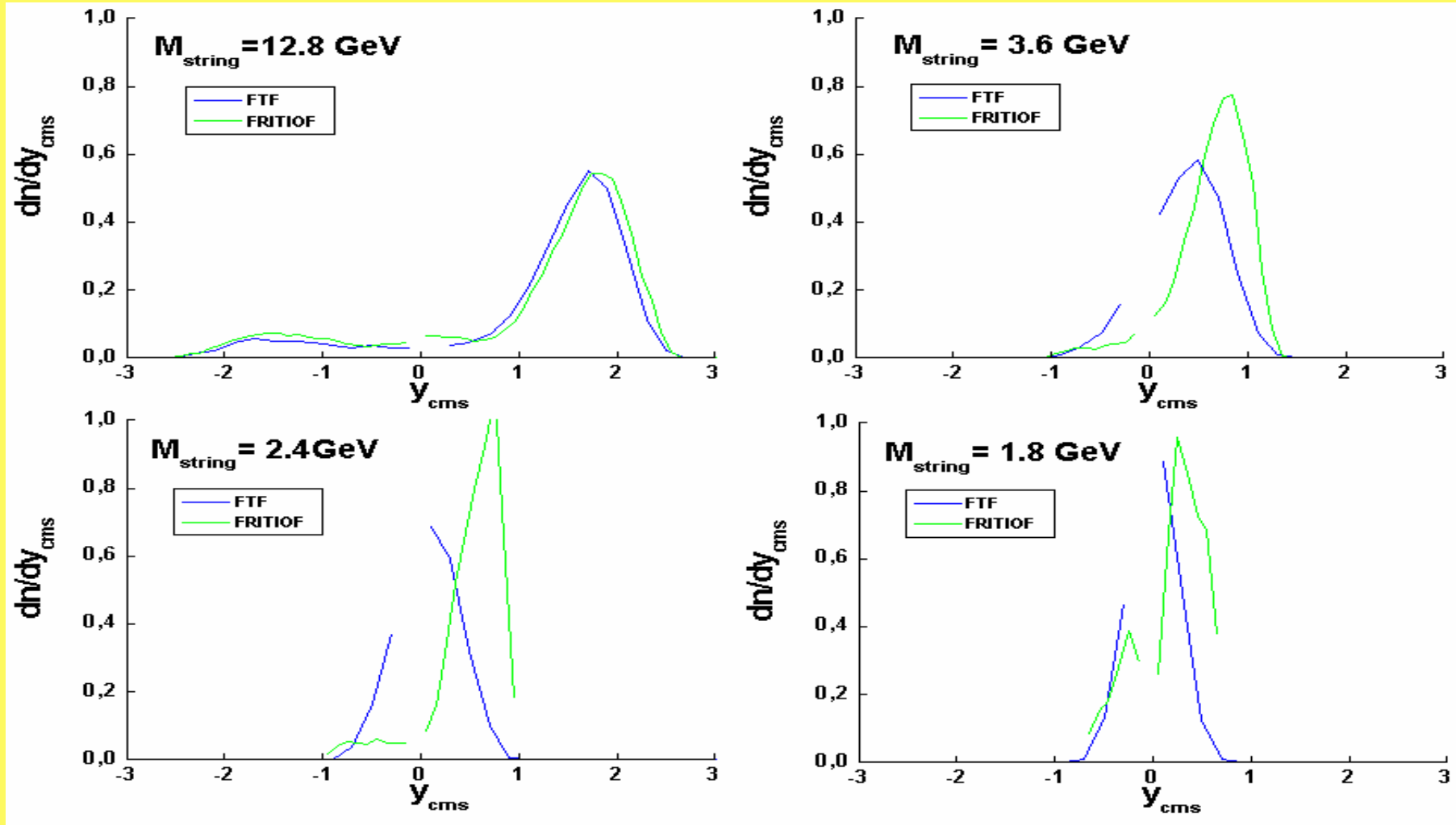
protons



Very strange results from the FRITIOF model!

Check of string fragmentation. Single string fragmentation.

protons



There is a weak leading particles effect in FTF

Conclusion

We have some improvement of FTF

1 $dW \propto dP_{proj}^- / P_{proj}^-$ Implemented

2 Glauber calculations are implemented

3 Inclusion of the leading particles effect
Is in progress

We hope on the better results