

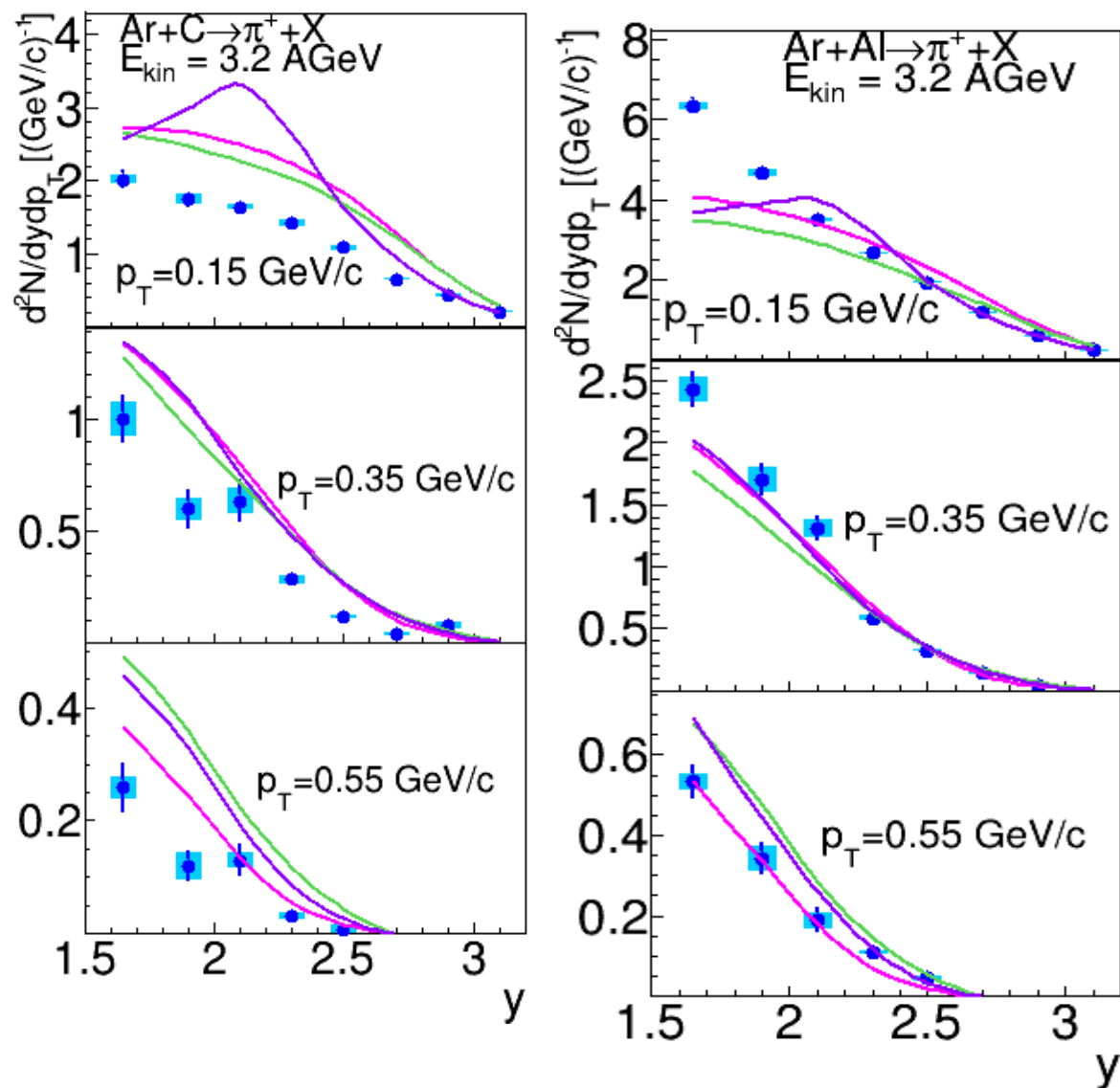
# Is there diffraction dissociation of nuclear nucleons in nucleus-nucleus interactions

LXXIV International conference Nucleus-2024: Fundamental problems and applications

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V. Plotnikov on behalf of the BM@N Collaboration

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**Production of  $\pi^+$  and  $K^+$  mesons  
in argon-nucleus interactions at  
3.2 AGeV**

**JHEP 07 (2023) 174**

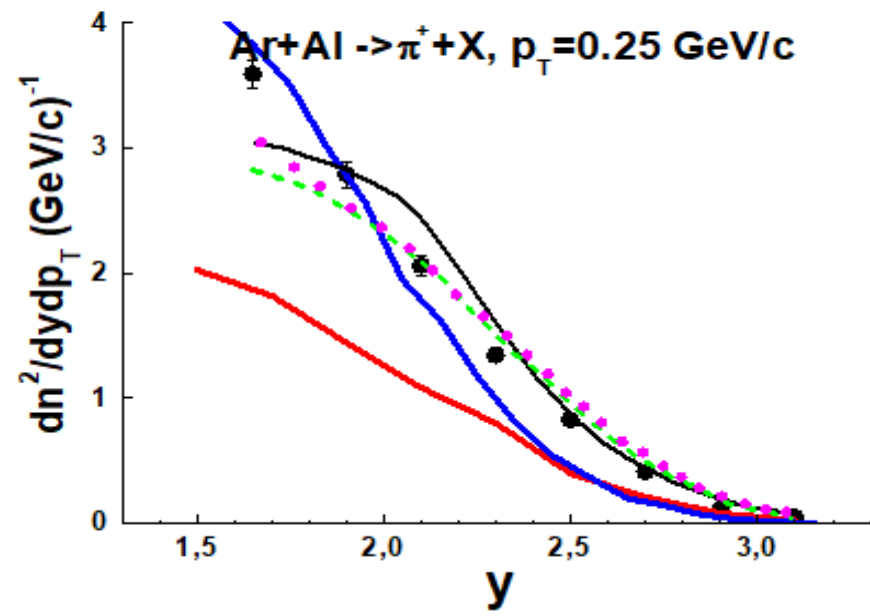
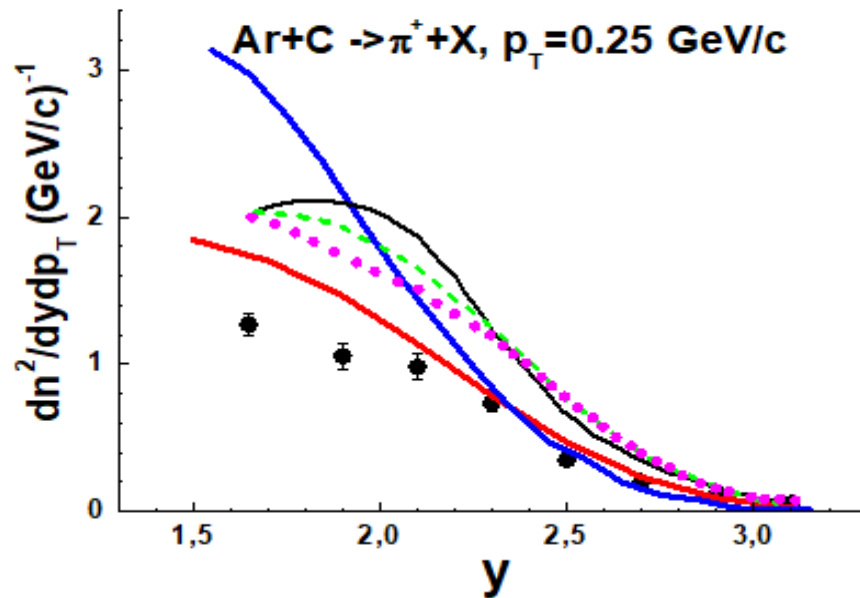
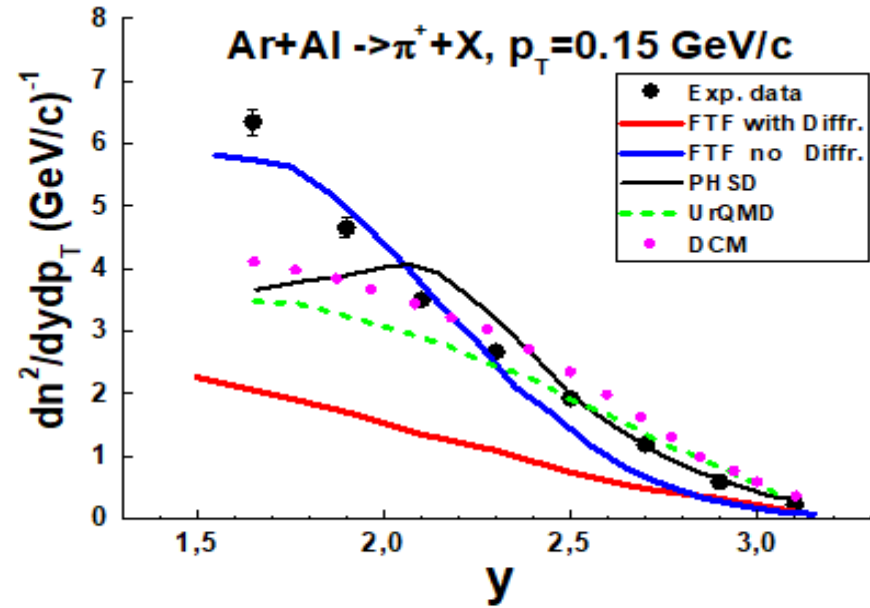
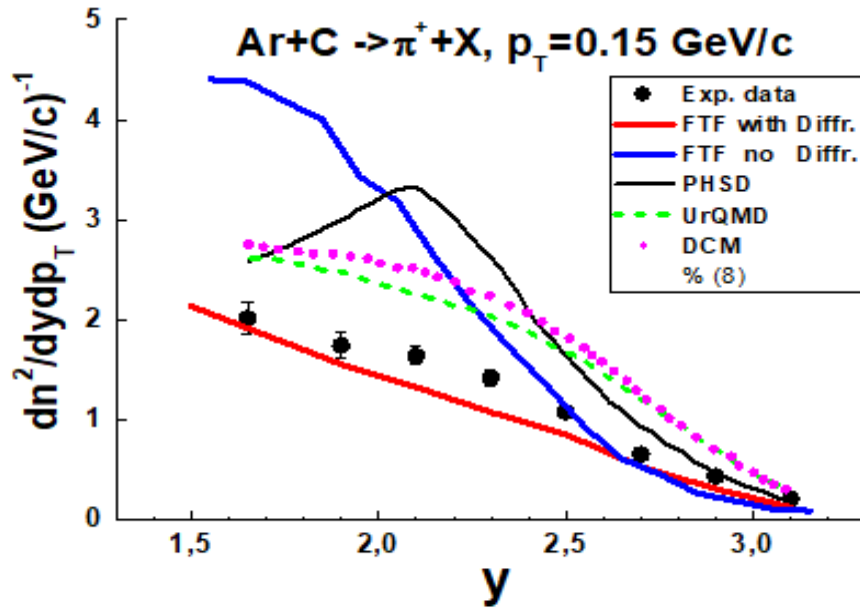
**Ongoing BMN publication**

Production of protons, deuterons,  
tritons in  
argon-nucleus interactions at 3.2  
AGeV

BM@N Collaboration

**It was interesting for us, how  
does Geant4 FTF model  
describe the data?**

## Red lines – default FTF model



C – target, OK, Al – not OK. What is the matter?

# FTF model : basic assumptions

B.Andersson et al. Nucl. Phys. B281 289 (1987)

B.Nilsson-Almqvist, E.Stenlund, Comp. Phys. Comm. 43 387 (1987).

Fig. 1: Processes of string's creations considered in the FTF model.

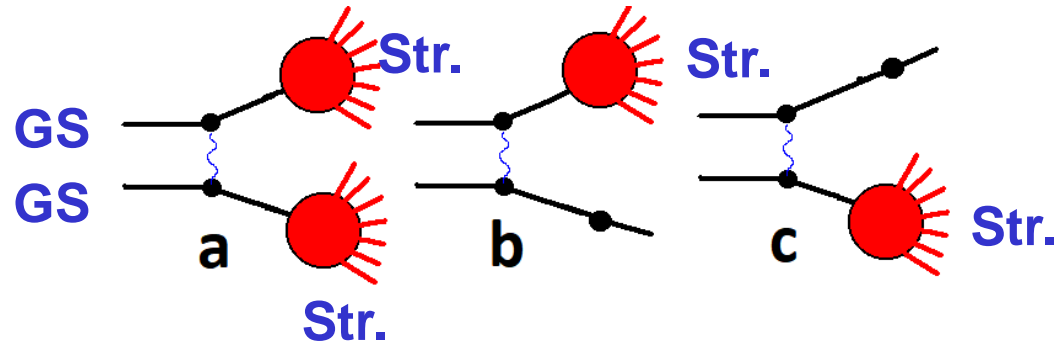
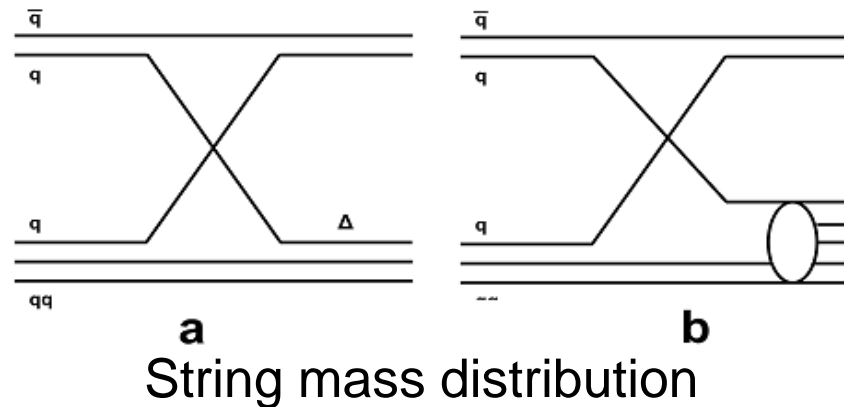


Fig. 2 Additional quark exchange processes in the FTF model.

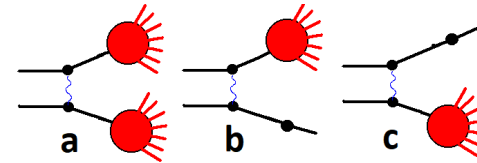


$$dW/dP^- = (1 - f) \frac{1}{\ln(P_{max}^-/P_{min}^-)} \frac{1}{P^-} + f \frac{1}{P_{max}^- - P_{min}^-},$$

$$P^- = \sqrt{M^2 + P_T^2 + P_z^2} - P_z \simeq (M^2 + P_T^2)/2 P_z \quad (P_z \rightarrow \infty) \quad f = 0.55$$

# What has to be done in nucleus-nucleus interactions?

## States of hadrons in FTF

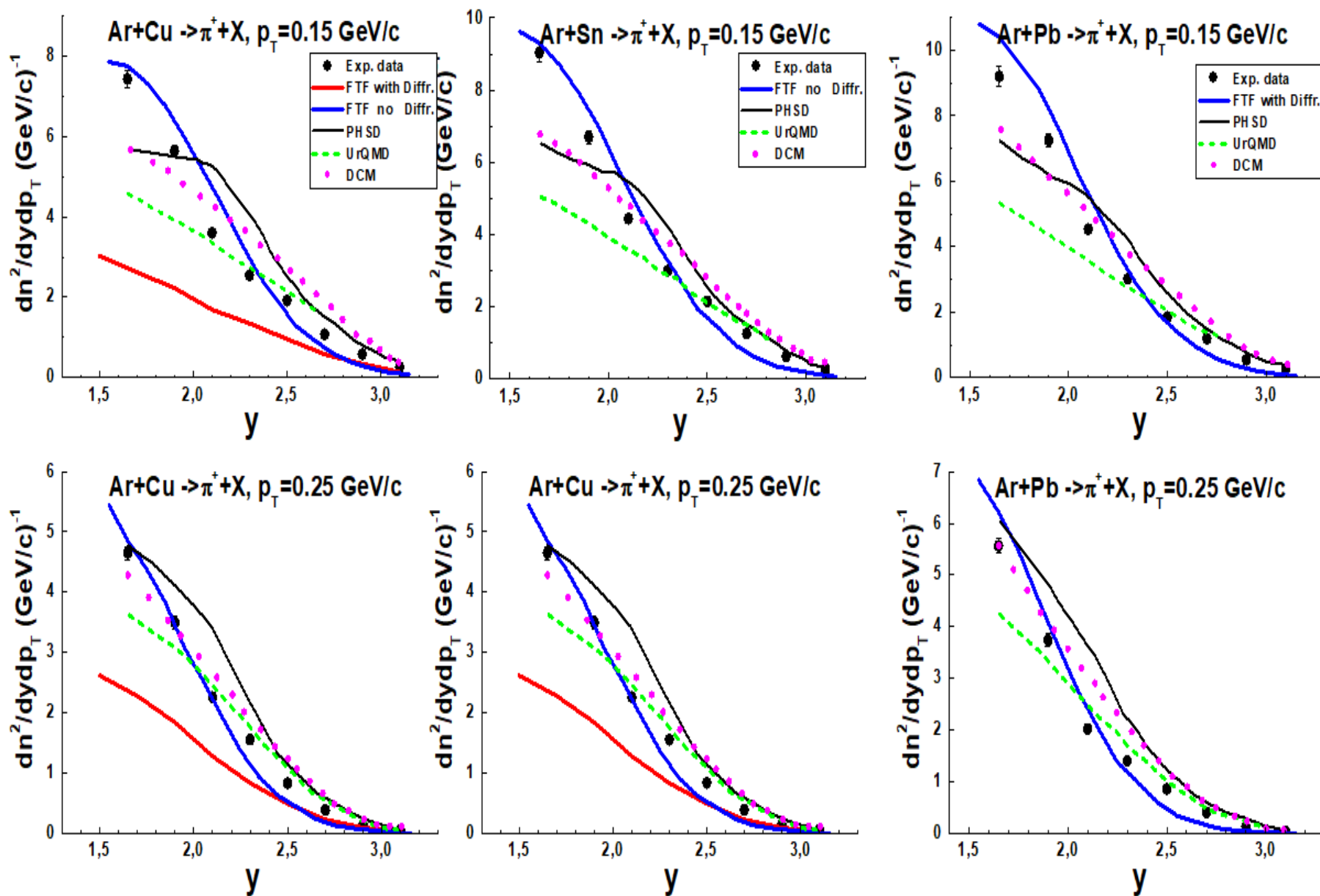


1. Quark exchange (GS + GS, QE)
2. Quark exchange with excitation (GS + TrD or PrD + GS, QE)
3. Projectile diffraction (PrD)
4. Target diffraction (TrD)
5. Non-diffractive interactions (Str. + Std., ND)

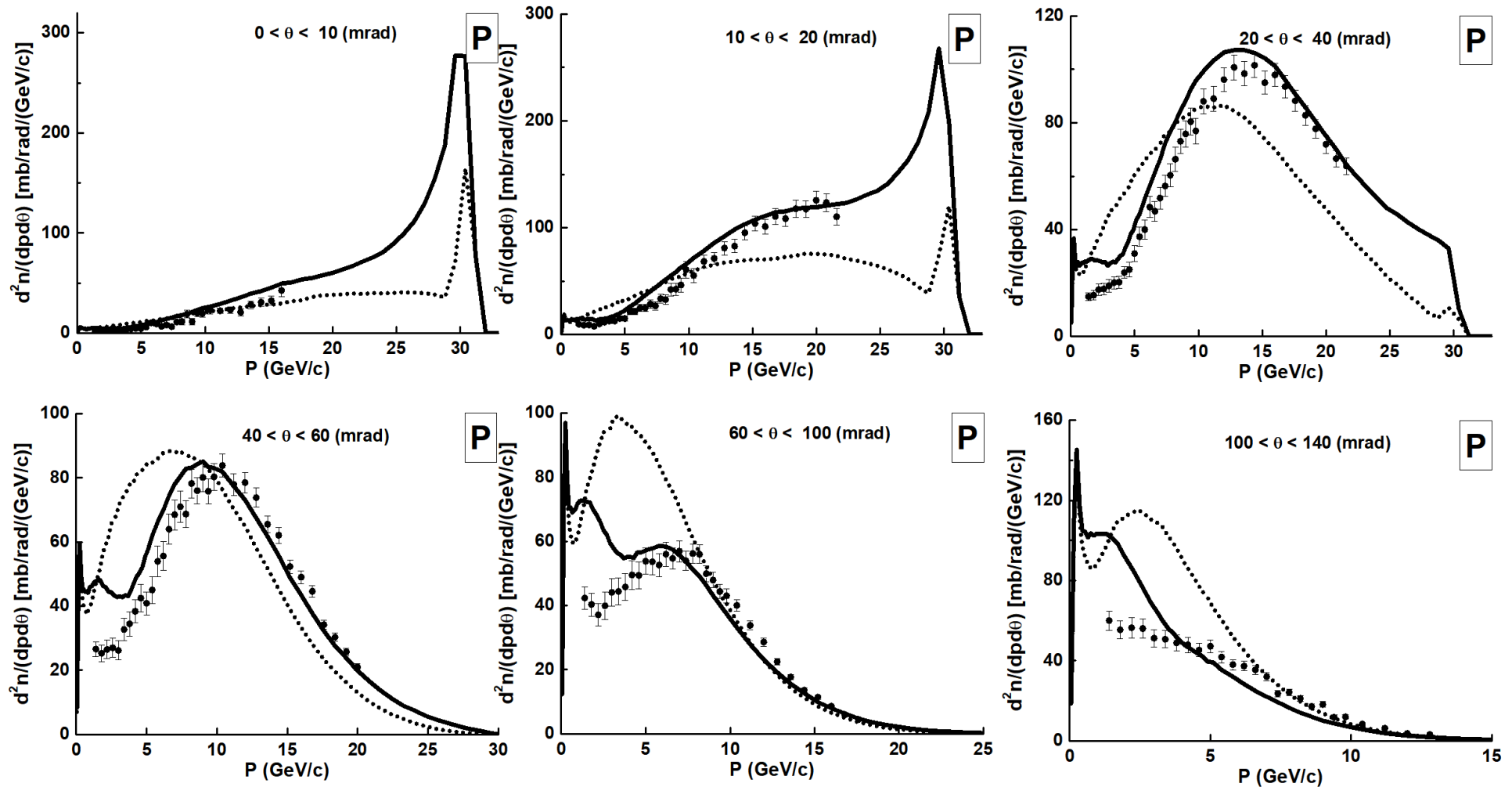
	GS	PrD	TrD	Str.
GS	Qe PrD TrD ND	PrD TrD ND	PrD TrD ND	ND
PrD	PrD Trd ND	PrD TrD ND	PrD TrD ND	ND
TrD	PrD TrD ND	PrD TrD ND	PrD TrD ND	ND
Str..	ND	ND	ND	ND

**New algorithm of DD accounting**

# New algorithm of DD accounting



# Results for p+C at 31 GeV/c, protons

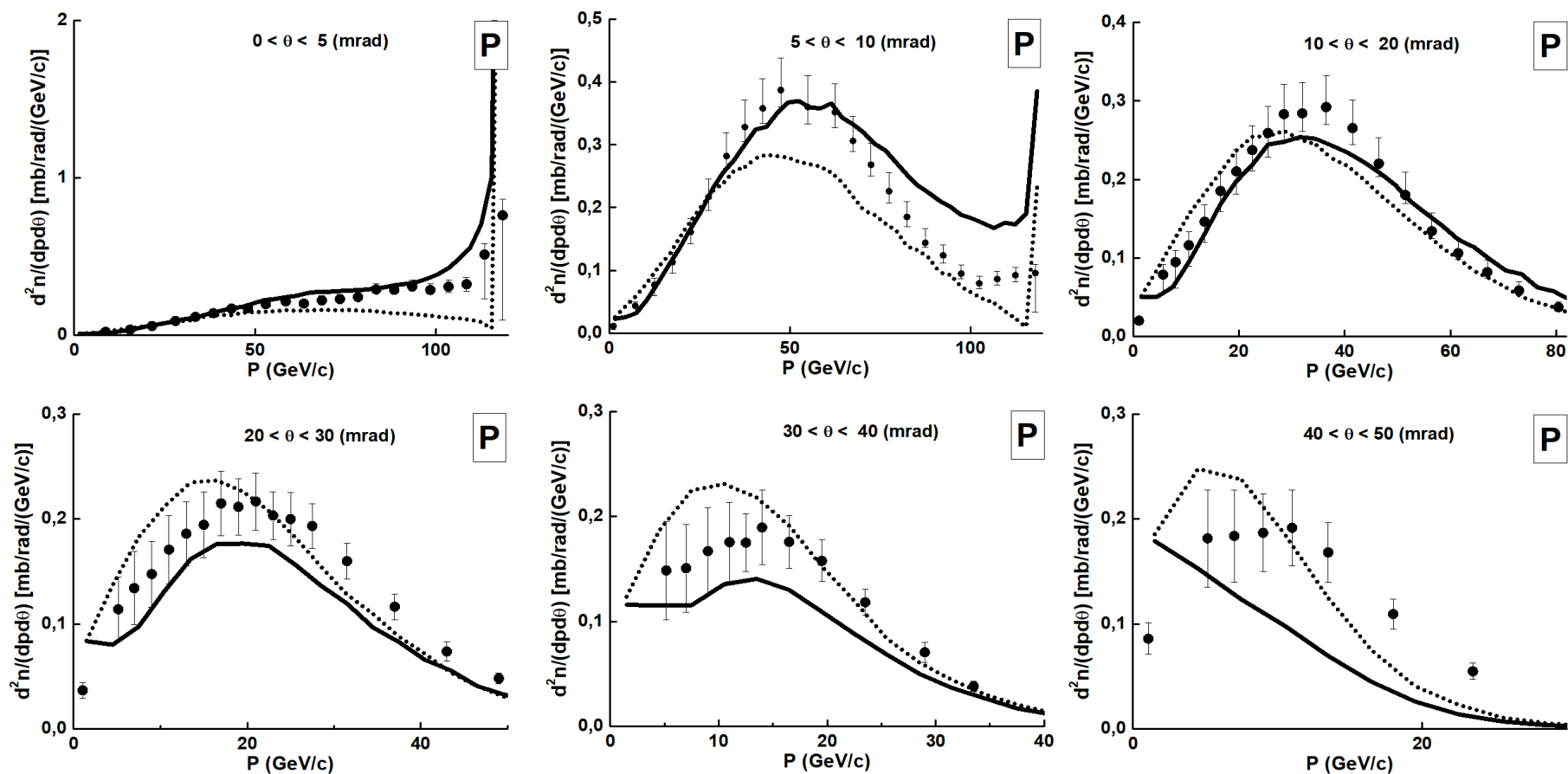


**Solid lines – new algorithm, dotted lines – old FTF**

**Proton spectra are improved!**

# Results for p+C at 120 GeV/c, protons

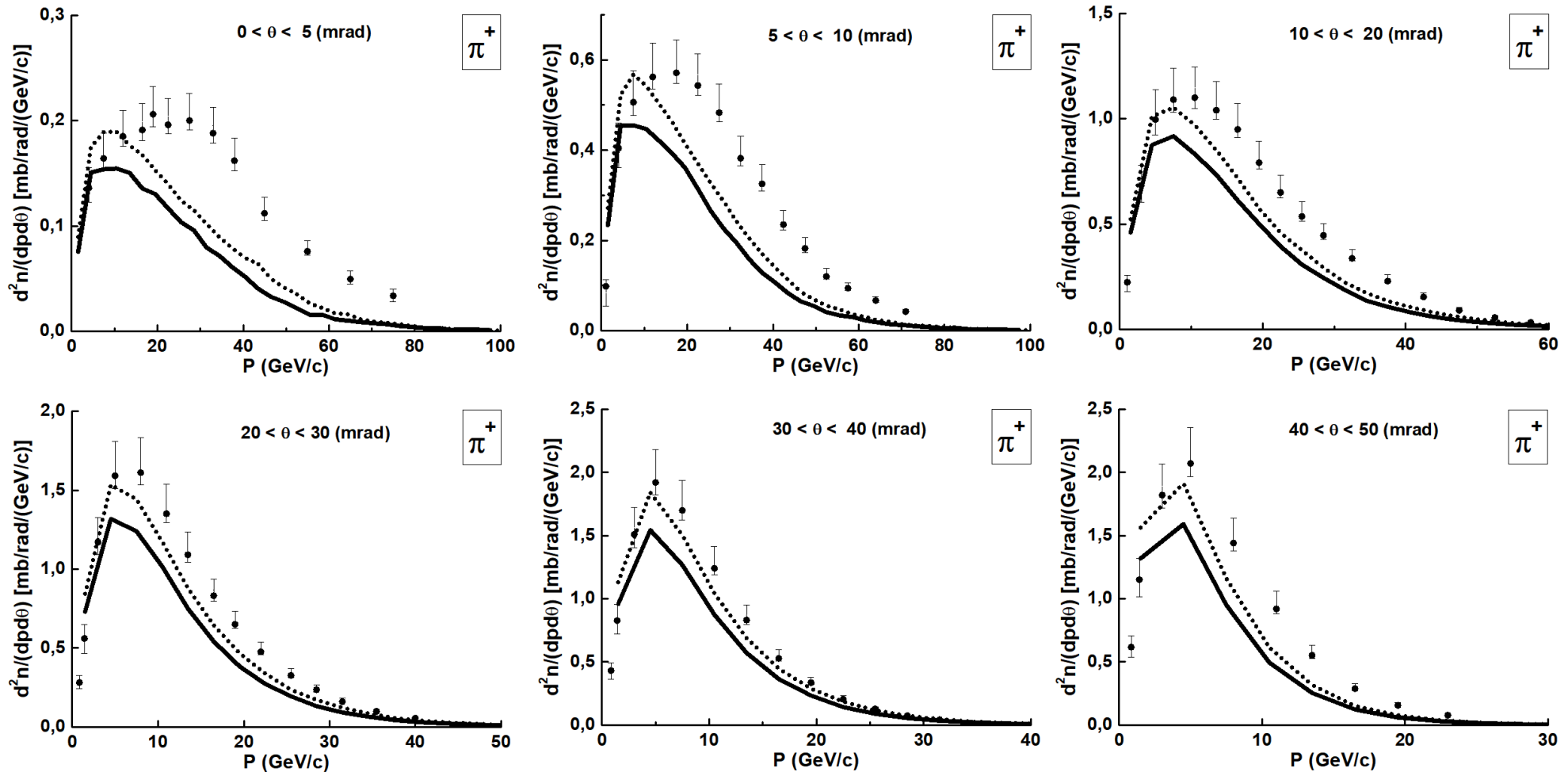
Measurements of  $\pi^+$ ,  $\pi^-$ ,  $p$ ,  $p^-$ ,  $K^+$  and  $K^-$  production in 120 GeV/c p + C interactions, [NA61/SHINE Collaboration](#)  
[H.Adhikary et al. \(Jun 5, 2023\), Phys.Rev.D 108 \(2023\) 072013](#)



**Solid lines – new algorithm, dotted lines – old FTF**

**Proton spectra are improved!**

# Results for p+C at 120 GeV/c, $\pi^+$ mesons

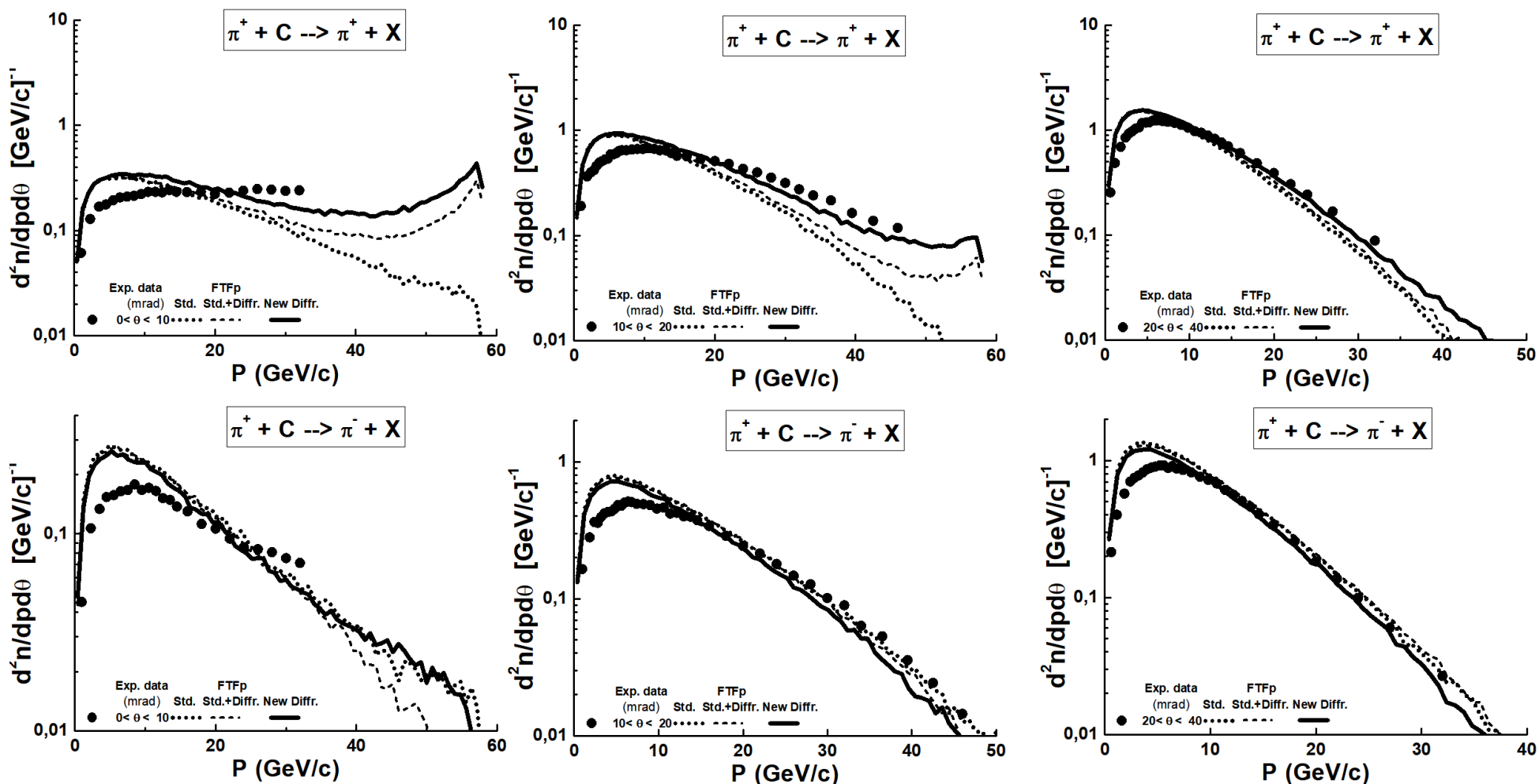


**Solid lines – new algorithm, dotted lines – old FTF**

**Problem – insufficient production of pions!**



# Results for $\pi^+ + C$ at 60 GeV/c, $\pi^+$ and $\pi^-$ mesons



**Solid lines – new algorithm, dotted lines – old FTF**

**New Diffr. O.K.! Problem – enhanced pion production at small  $P$ lab!**

# Conclusion

1. The new treatment of the diffraction dissociation in hadronic interactions allows to improve FTF results for leading particles.
2. The enhanced production of particles with small  $p_{\text{lab}}$  can be suppressed changing the Lund string fragmentation. **It will change too many results!**

