

# **Current status of QGS and FTF**

**V. Uzhinsky, November 2018**

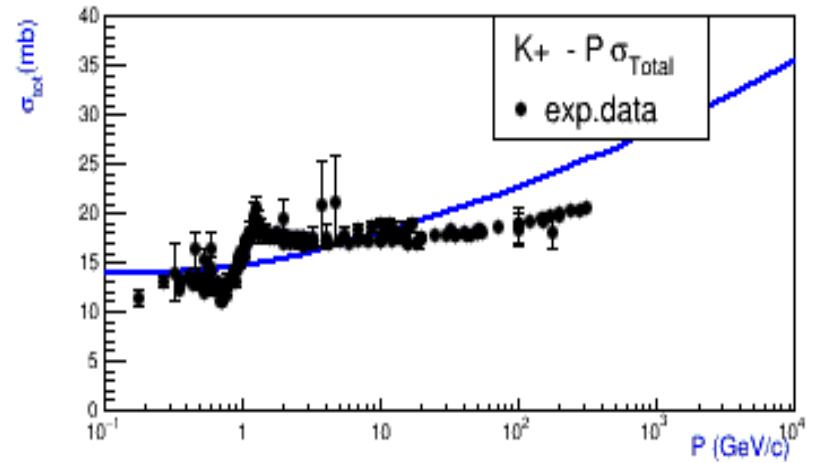
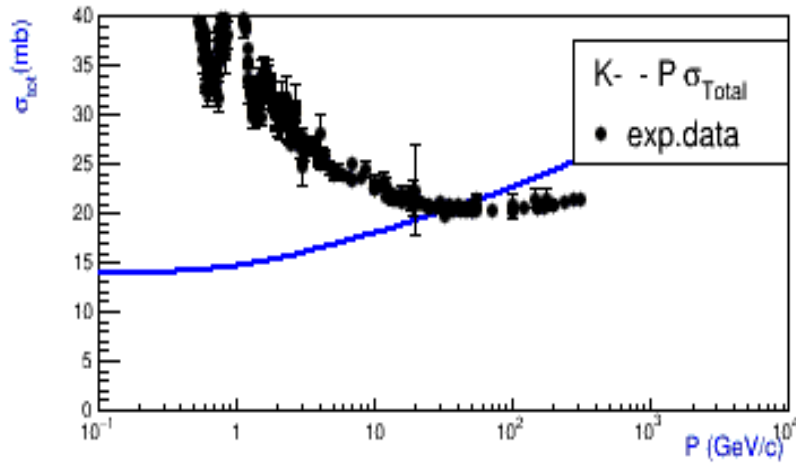
**1. Improving K+P cross sections in QGS**

**2. QGSM fragmentation**

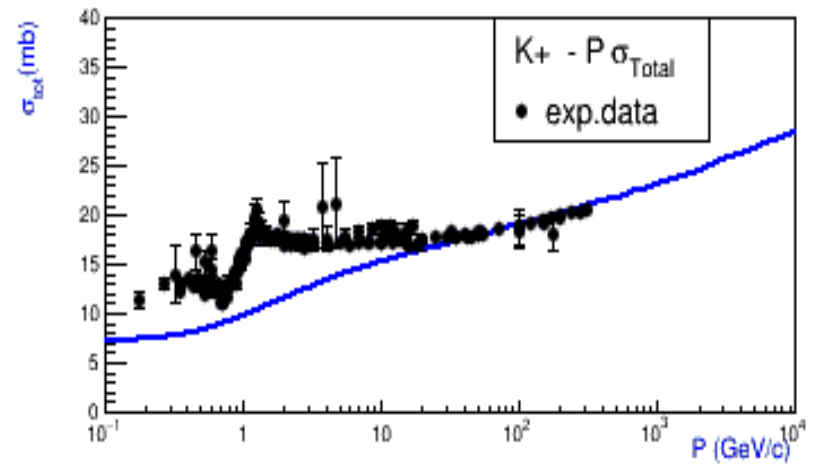
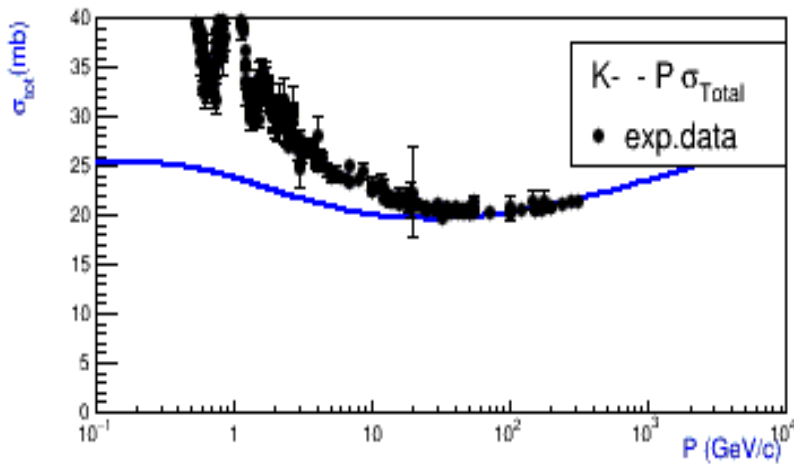
**3. FTF, EPOS 1.99, Pythia**

# 1. K+N cross sections, Total X

Old, ref-07

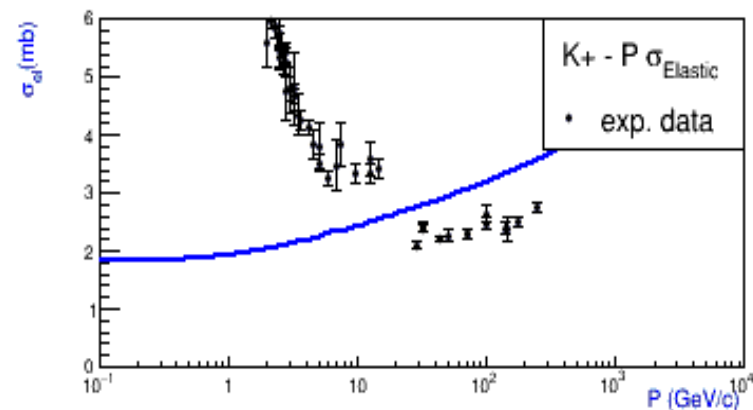
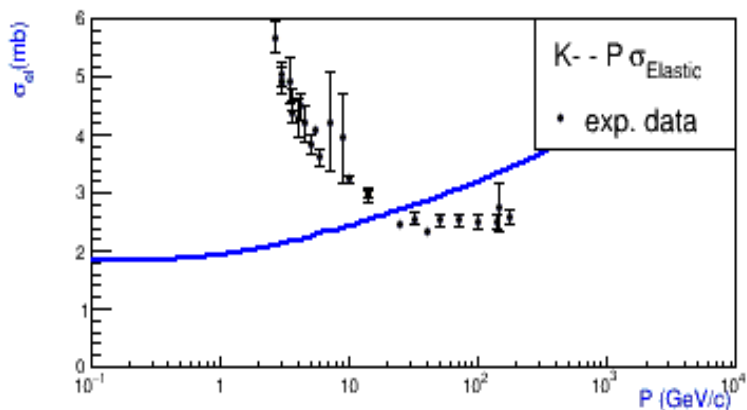


New, ref-08

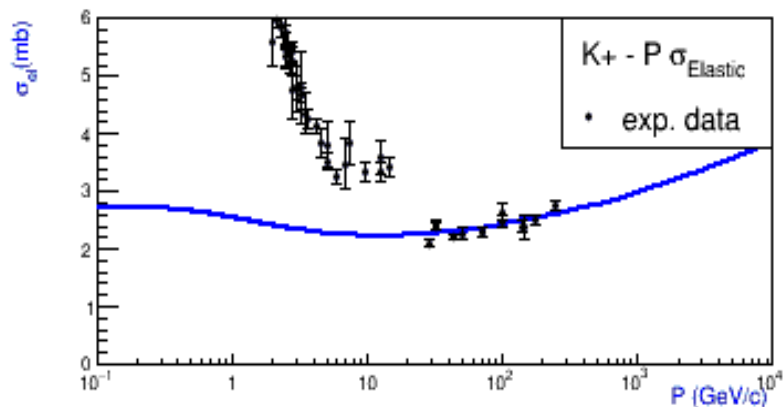
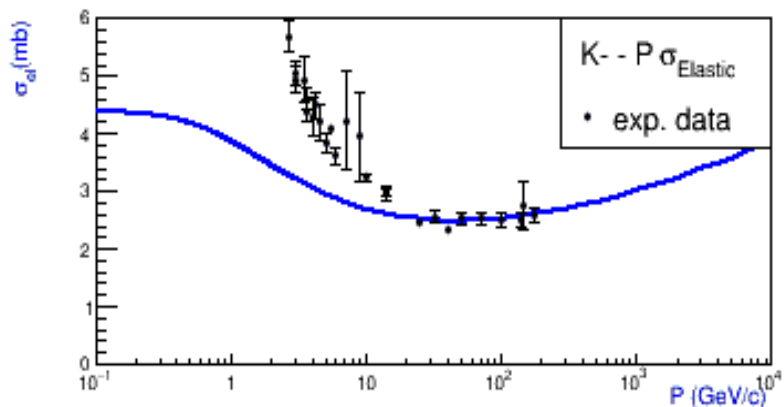


# 1. K+N cross sections, Elastic X

Old, ref-07

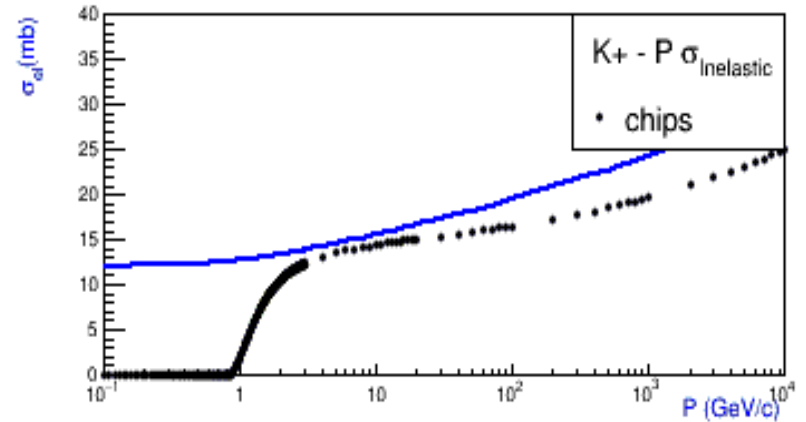
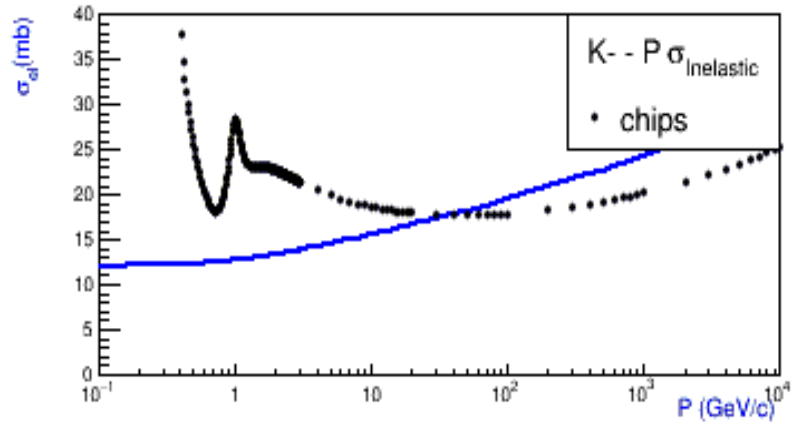


New, ref-08

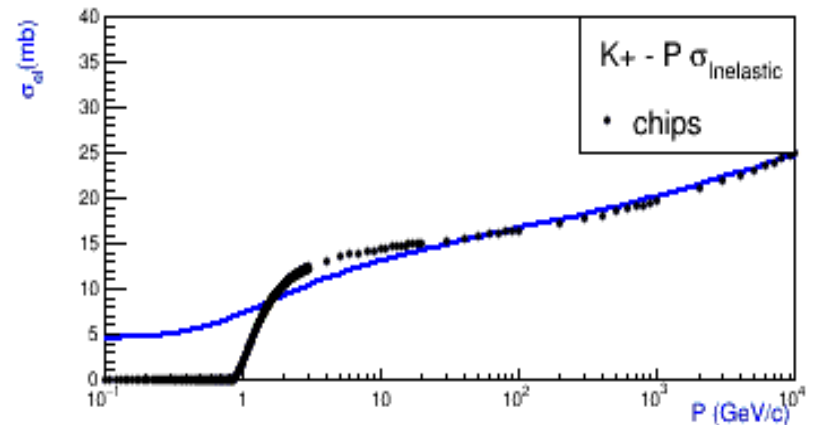
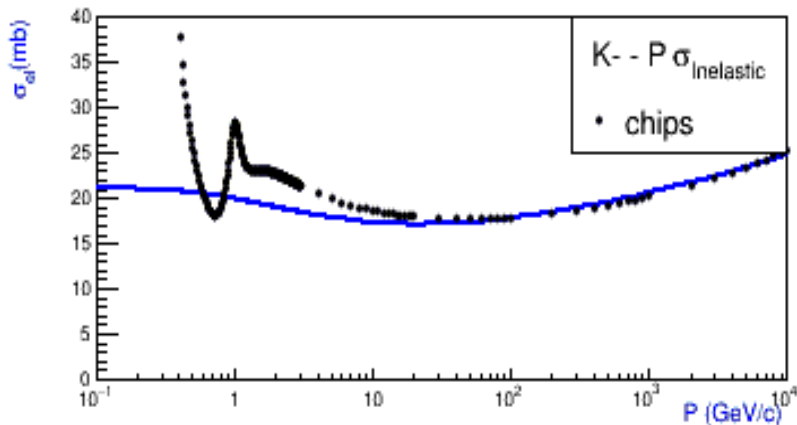


# 1. K+N cross sections, Inelastic X

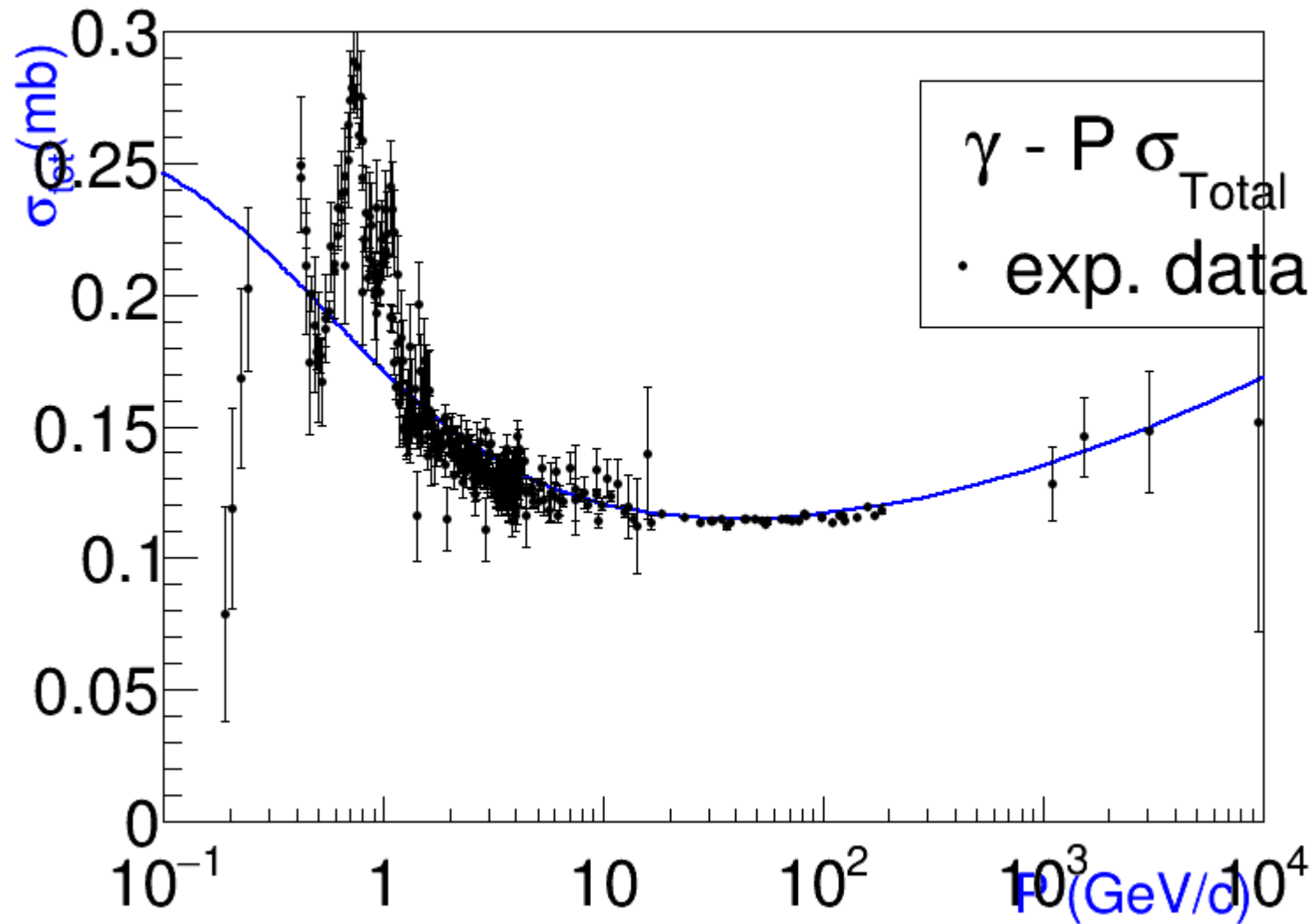
Old, ref-07



New, ref-08



# 1. Gamma+N cross sections, Inelastic X



# 1. K, Gamma+N cross sections

## G4Reggeons.cc

```
G4Reggeons::G4Reggeons(const G4ParticleDefinition * particle)
```

```
//Projectile is Kaon
```

```
Cpr_pomeron = 1.522;
```

```
Ctr_pomeron = C_pomeron_N;
```

```
C_pomeron = Cpr_pomeron*Ctr_pomeron;
```

```
Gamma_pomeron_Pr = 0.90/GeV;
```

```
Gamma_pomeron_Tr = Gamma_pomeron_N;
```

```
Gamma_pomeron = Gamma_pomeron_Pr * Gamma_pomeron_Tr;
```

```
Rsquare_pomeron_Pr = 0.31/GeV/GeV;
```

```
Rsquare_pomeron_Tr = Rsquare_pomeron_N;
```

```
Rsquare_pomeron = Rsquare_pomeron_Pr + Rsquare_pomeron_Tr;
```

```
Freggeon_Alpha = 0.7;
```

```
Freggeon_Alphaprime = 0.8/GeV/GeV;
```

```
Freggeon_Gamma = 1.32/GeV/GeV;
```

```
Freggeon_Rsquare = 0.5/GeV/GeV;
```

```
Freggeon_C = 1.0;
```

```
FParity = +1;
```

```
Wreggeon_Alpha = 0.4;
```

```
Wreggeon_Alphaprime = 0.9 /GeV/GeV;
```

```
Wreggeon_Gamma = 1.68/GeV/GeV;
```

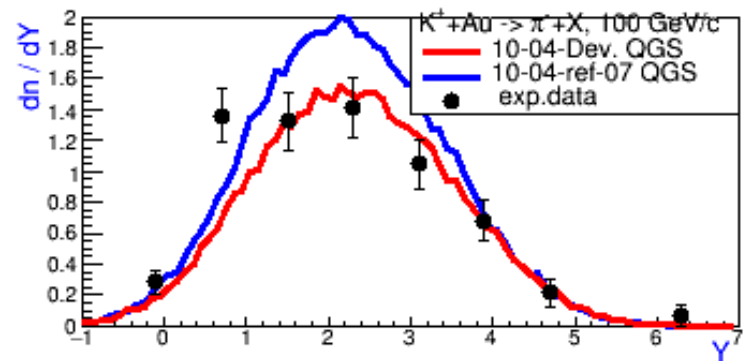
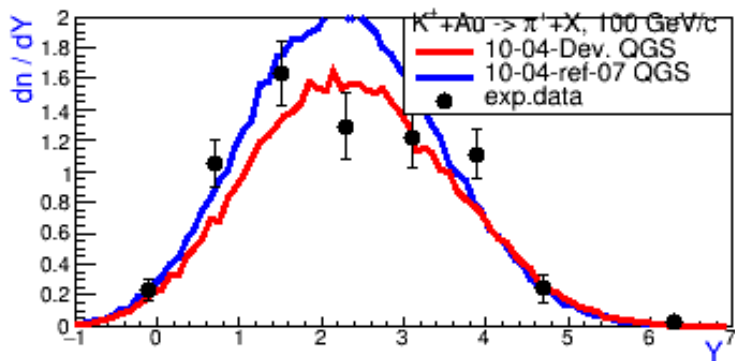
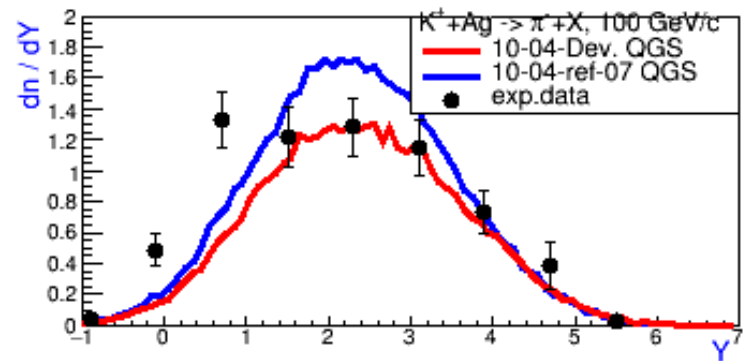
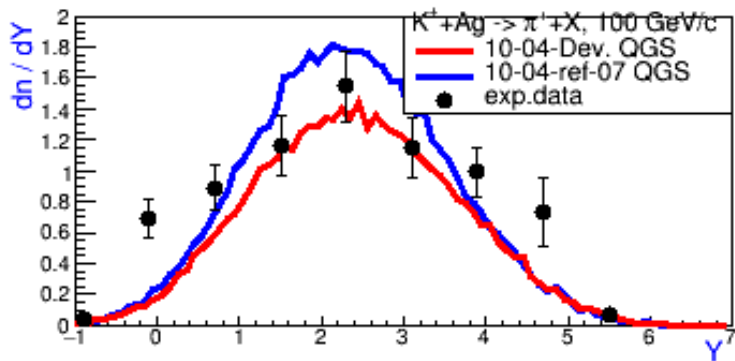
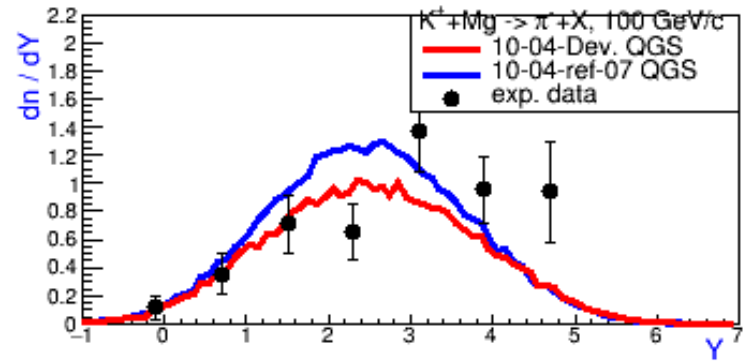
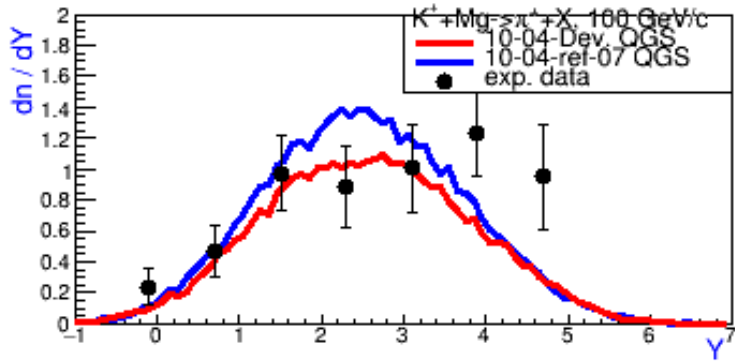
```
Wreggeon_Rsquare = 9.19/GeV/GeV;
```

```
Wreggeon_C = 1.0;
```

```
if(PDGcode > 0) WParity = -1;
```

```
if(PDGcode < 0) WParity = +1;
```

# 1. K+N cross sections, results

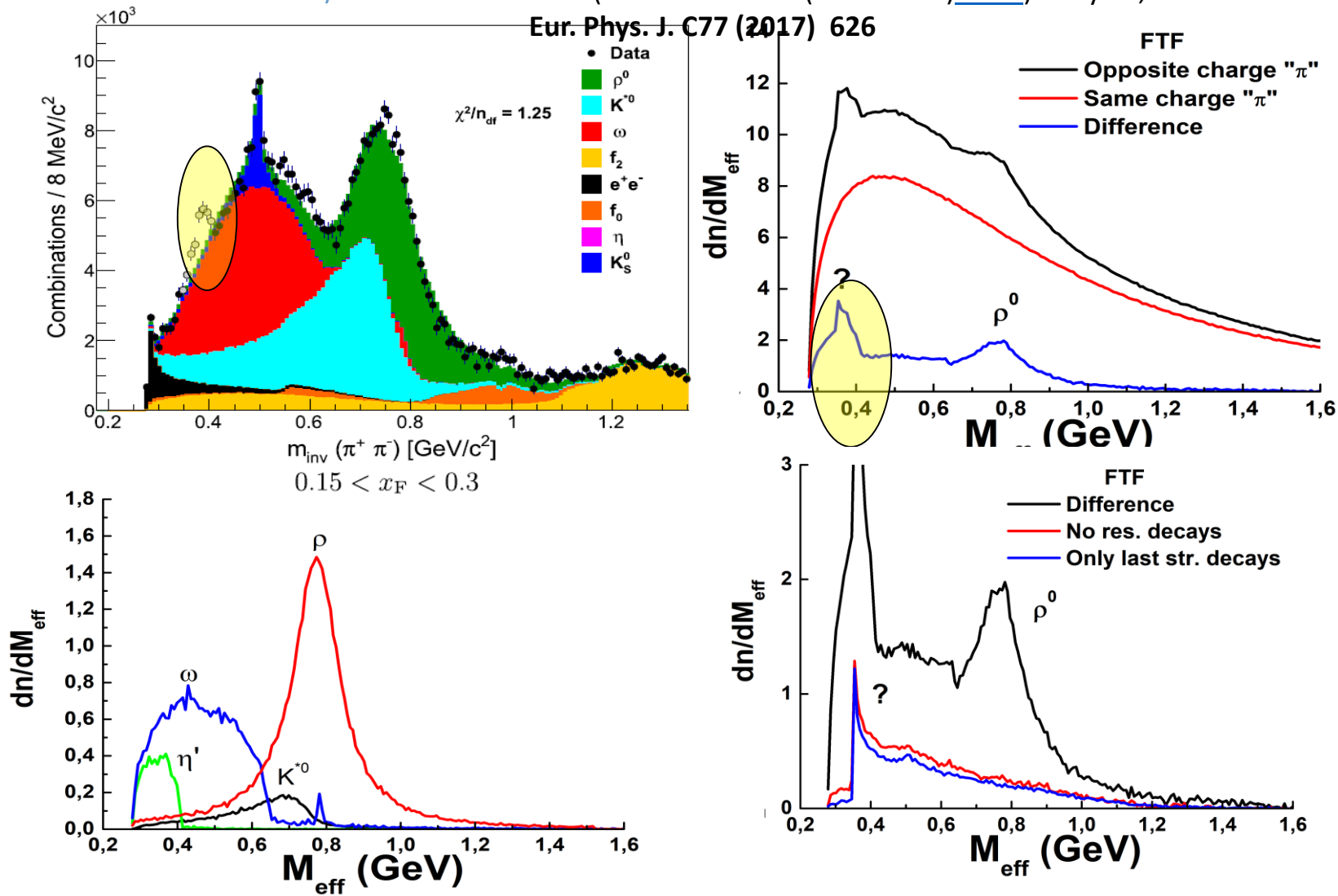


## 2. QGSM fragmentation

Measurement of meson resonance production in  $\pi^- + C$  interactions at SPS energies

NA61/SHINE Collaboration (A. Aduszkiewicz (Warsaw U.) *et al.*). May 23, 2017.

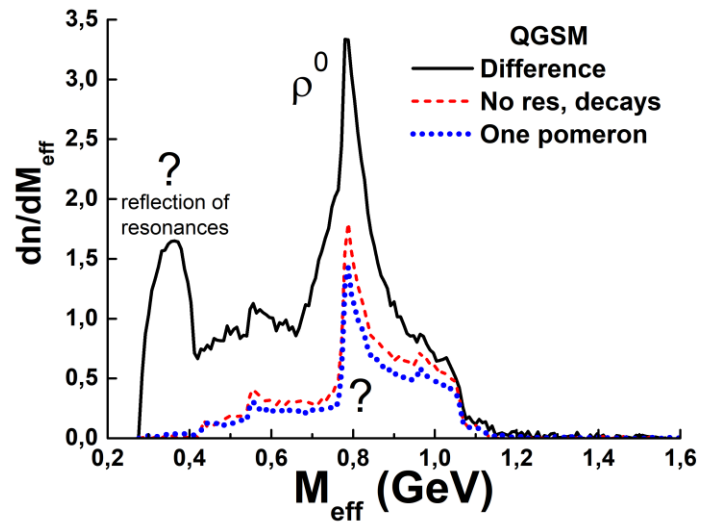
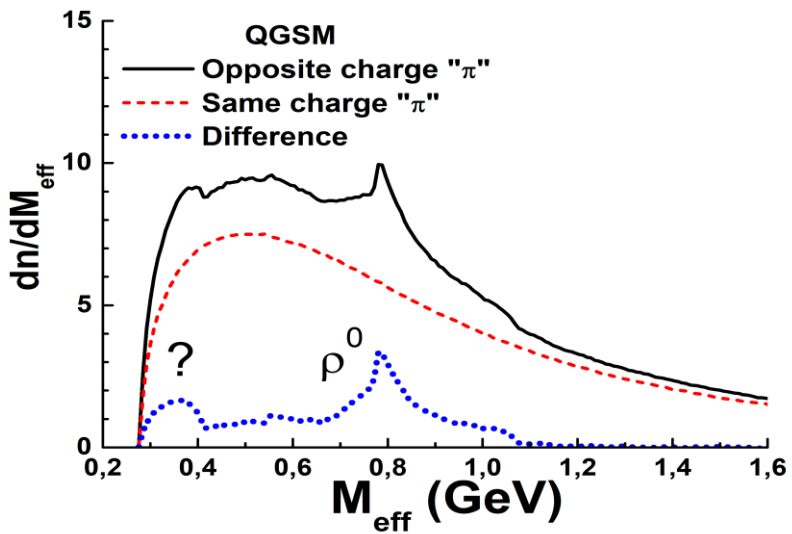
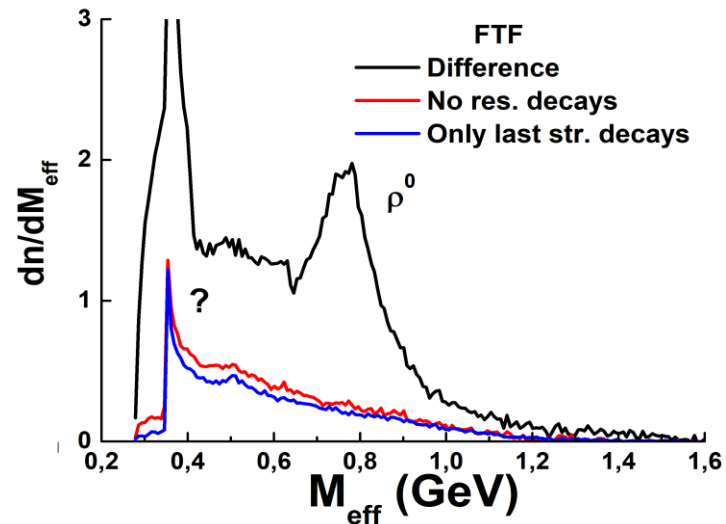
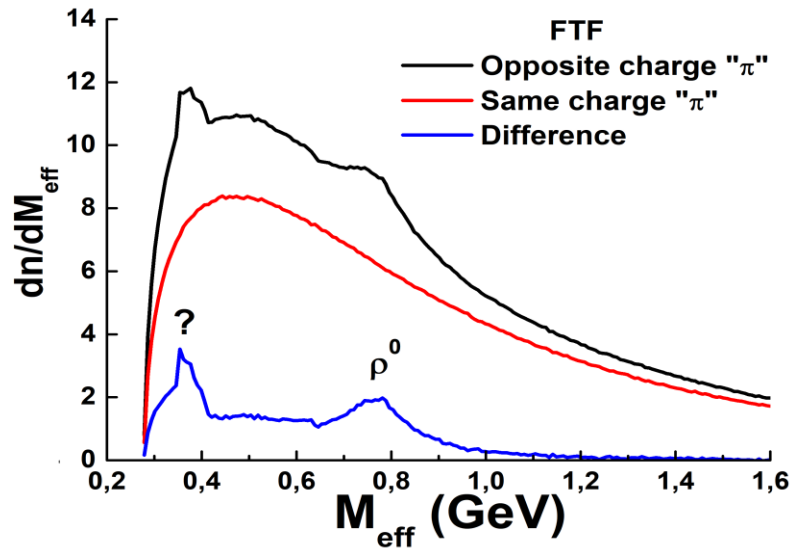
Eur. Phys. J. C77 (2017) 626



Peak at 375 MeV – fragmentation of small mass strings!



## 2. QGSM fragmentation

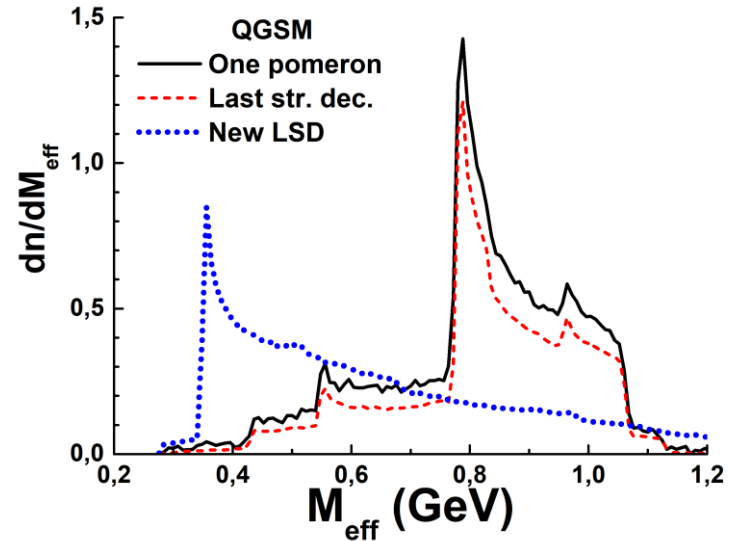
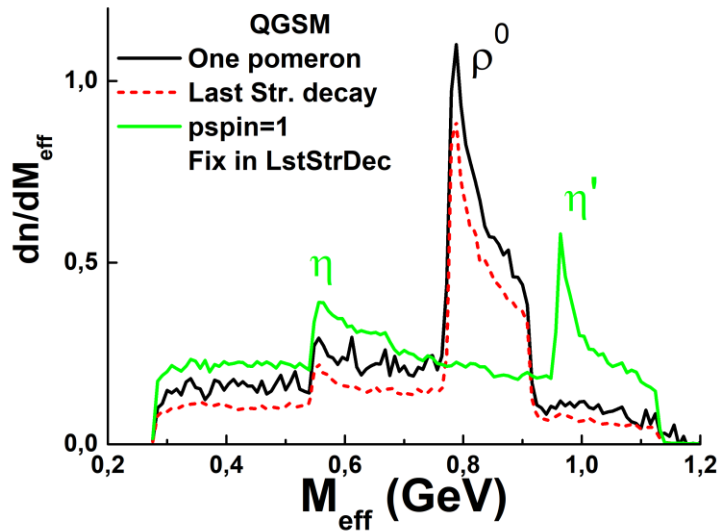


**It is unrealistic!**

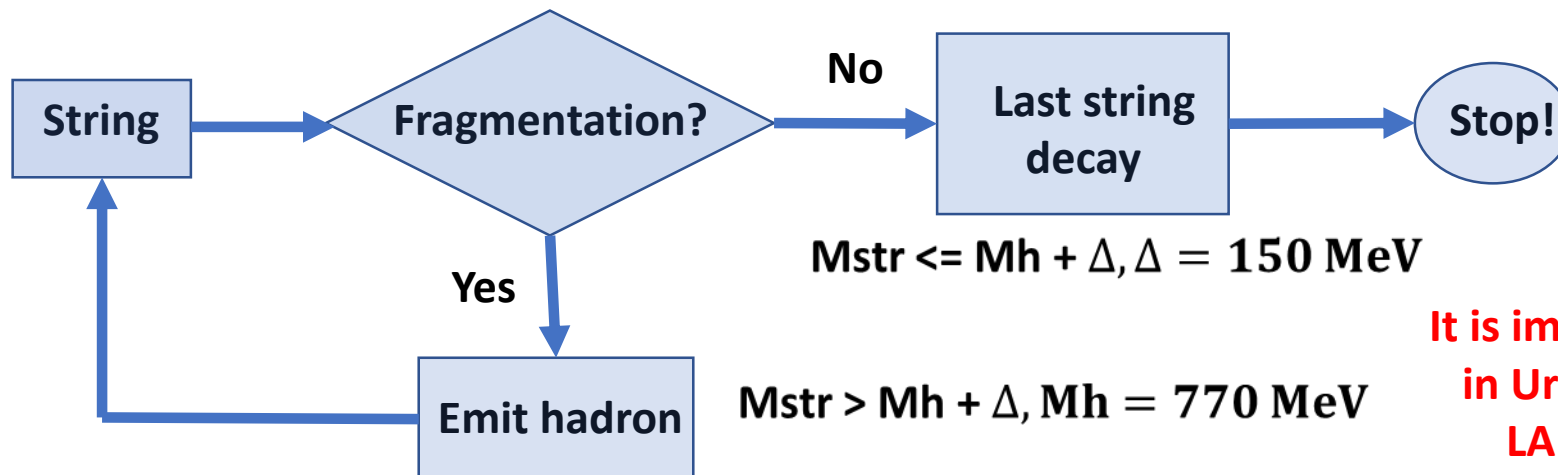
**It is unrealistic!**

## 2. QGSM fragmentation

**New last string decay!**

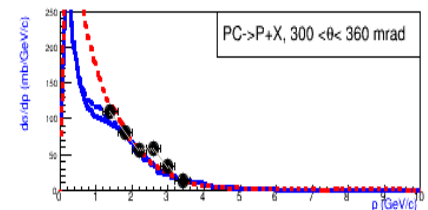
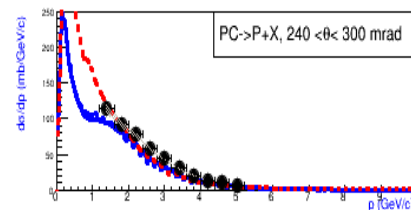
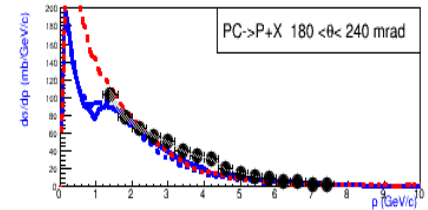
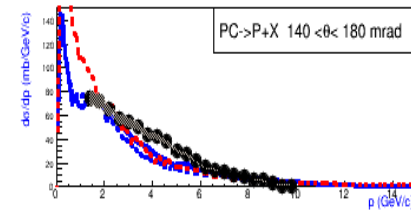
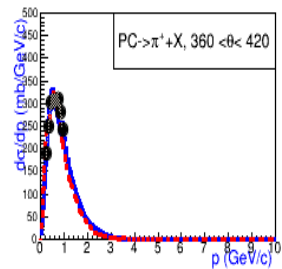
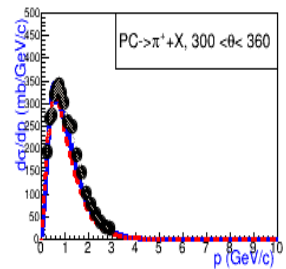
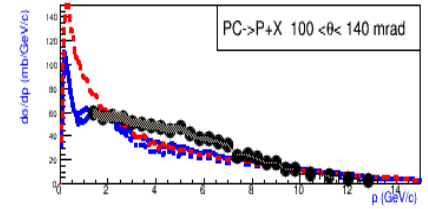
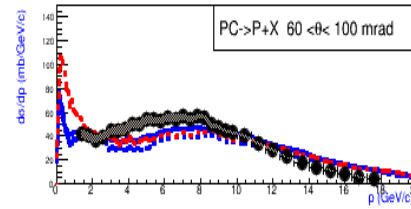
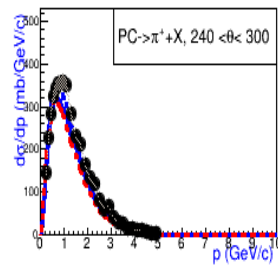
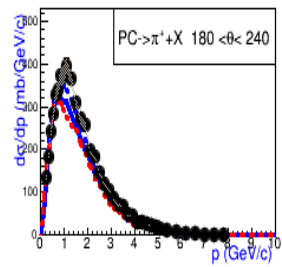
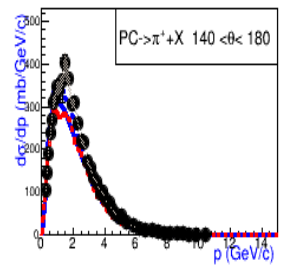
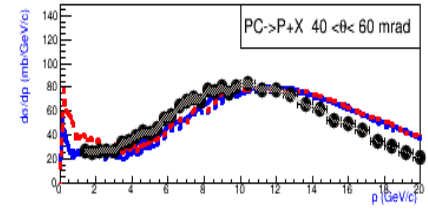
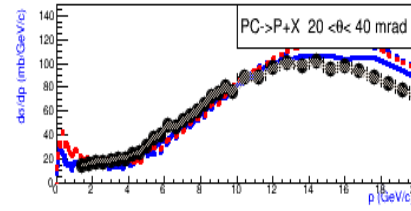
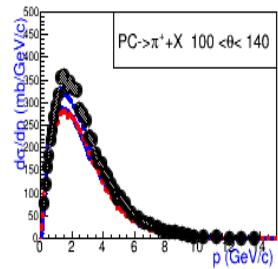
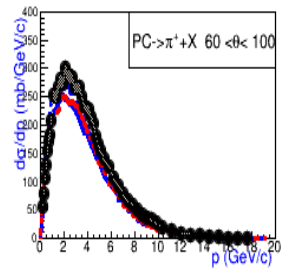
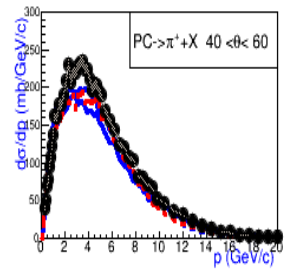
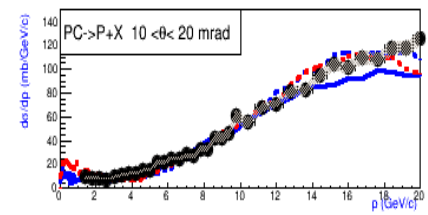
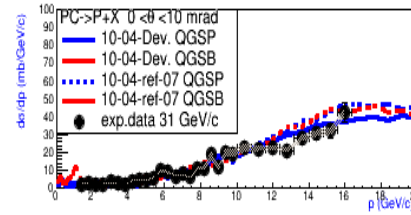
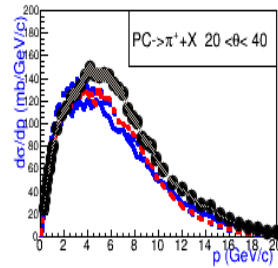
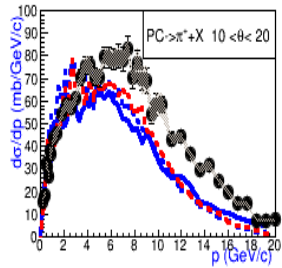
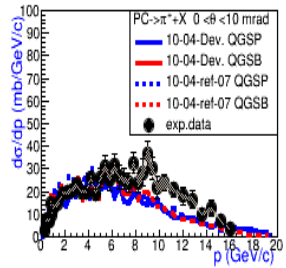


### Algorithm of QGSM fragmentation

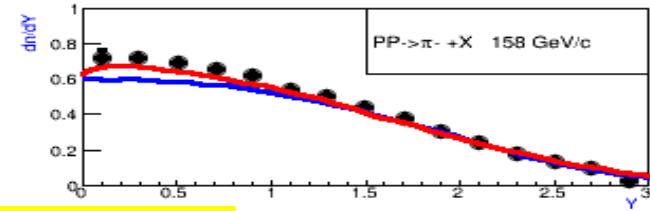
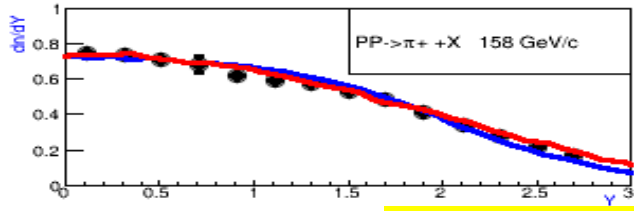
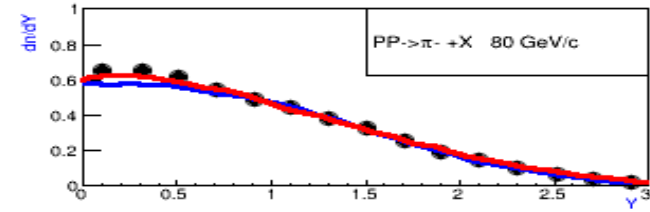
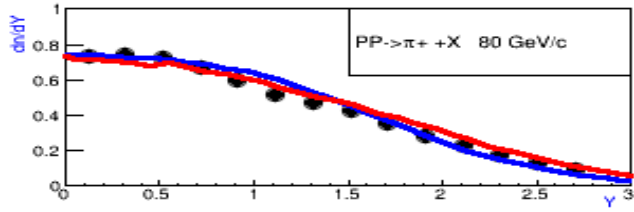
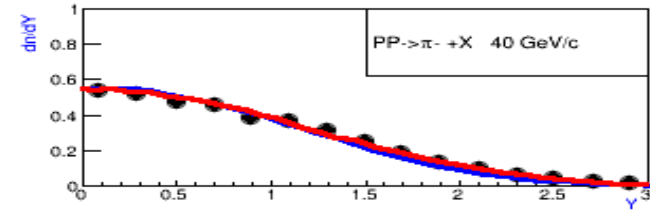
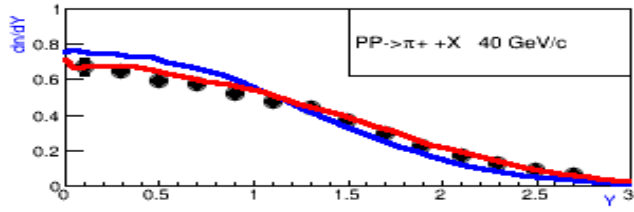
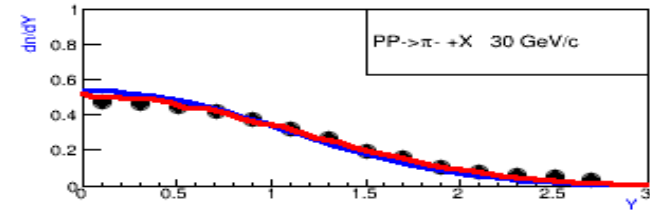
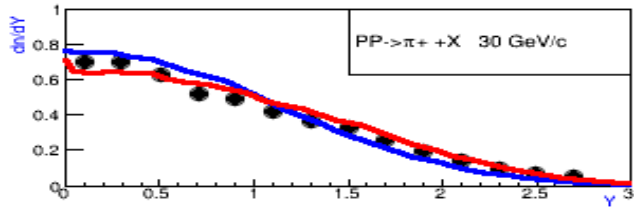
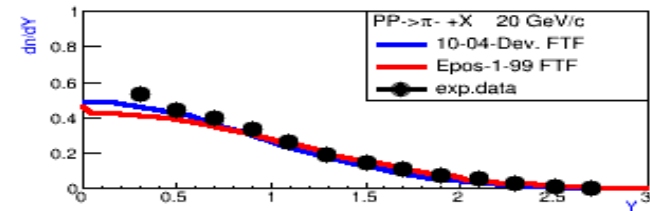
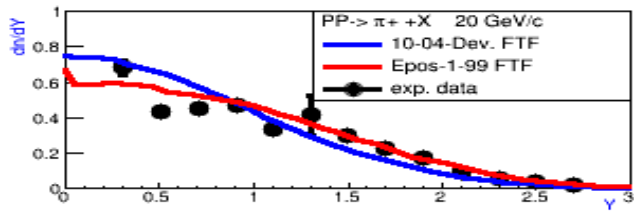


**It is implemented  
in UrQMD and  
LA QGSM**

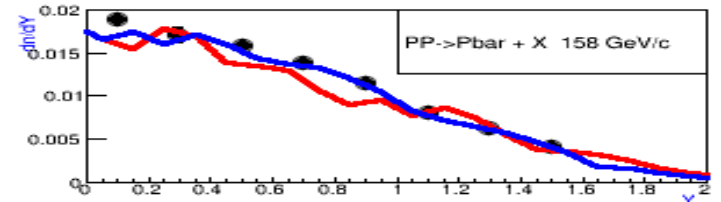
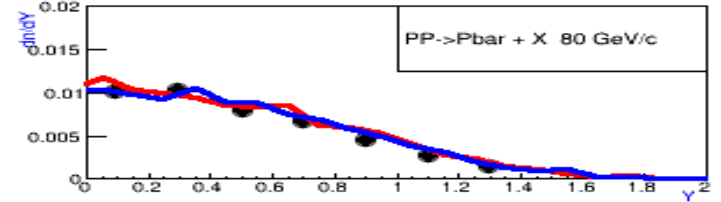
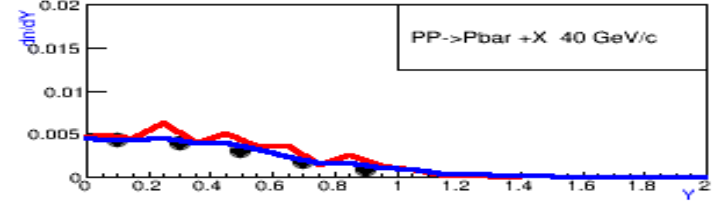
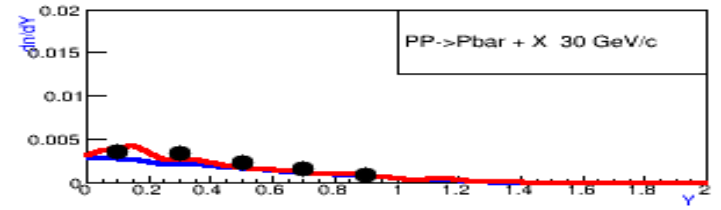
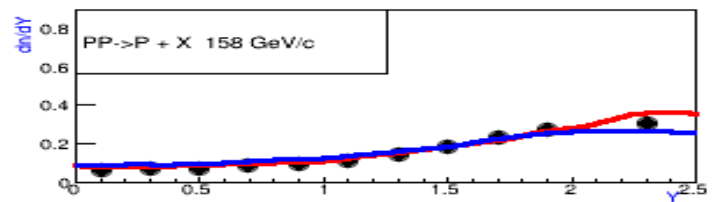
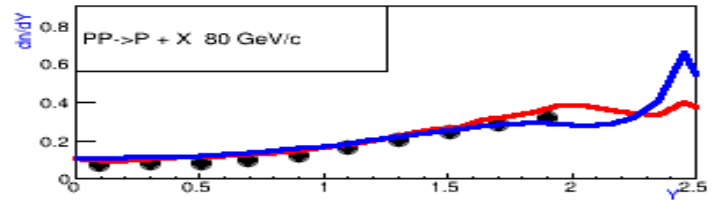
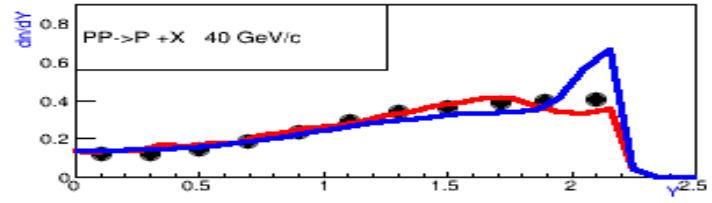
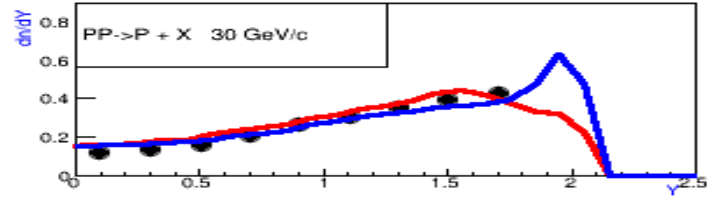
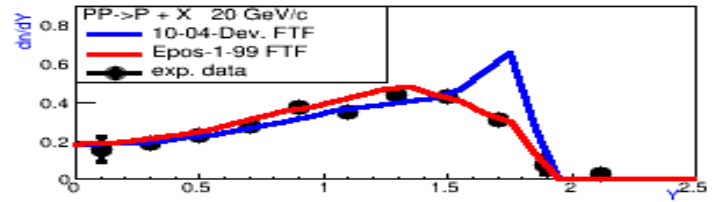




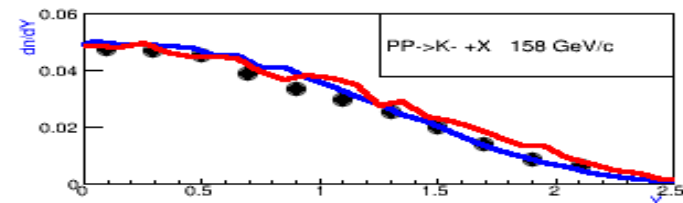
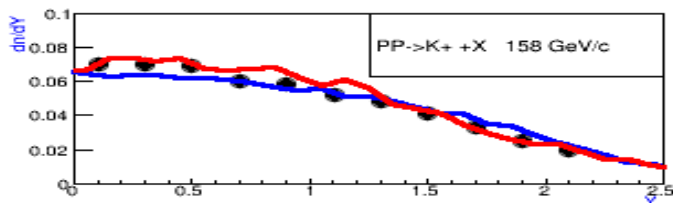
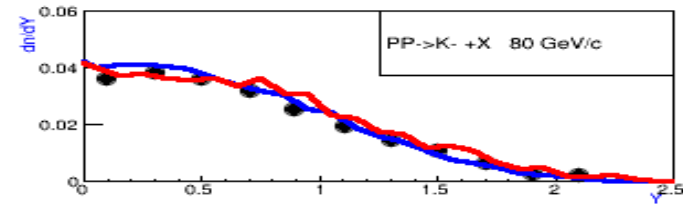
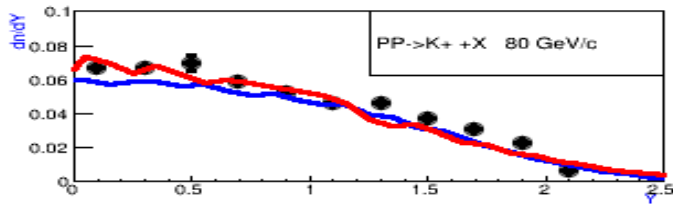
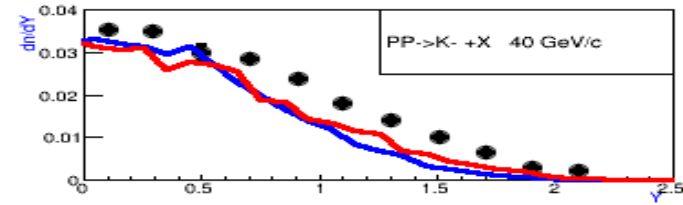
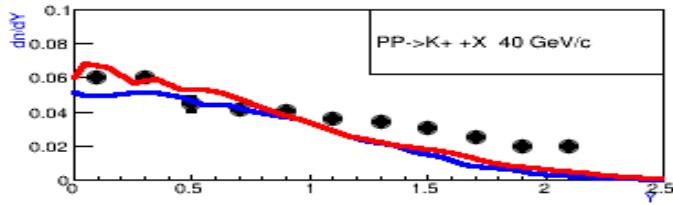
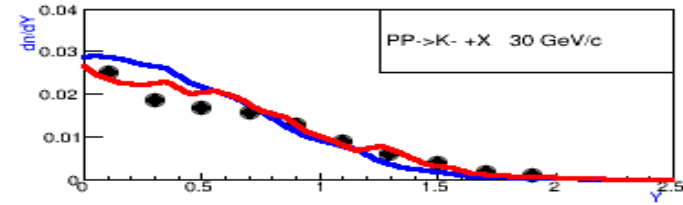
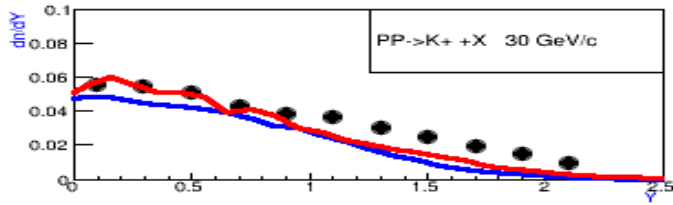
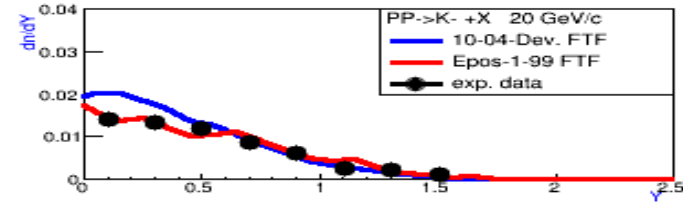
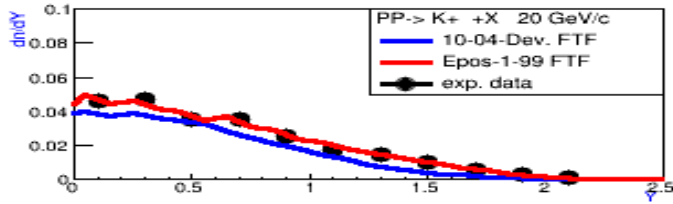
### 3. FTF and EPOS 1.99



**FTF = EPOS 1.99**



FTF = EPOS 1.99

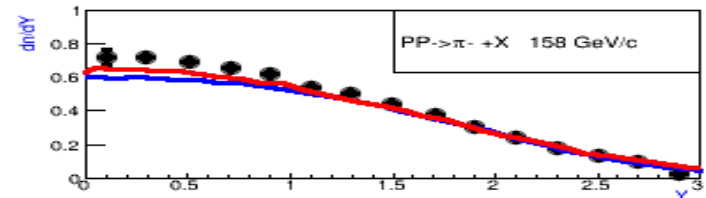
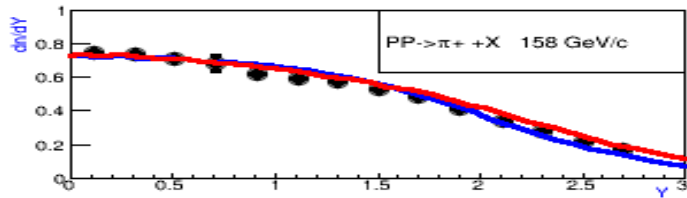
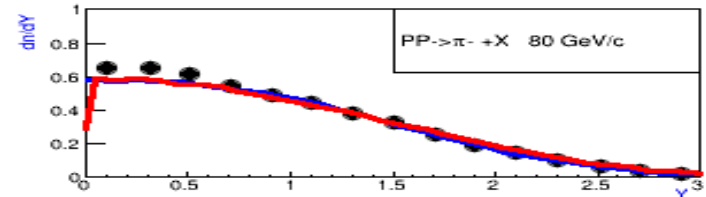
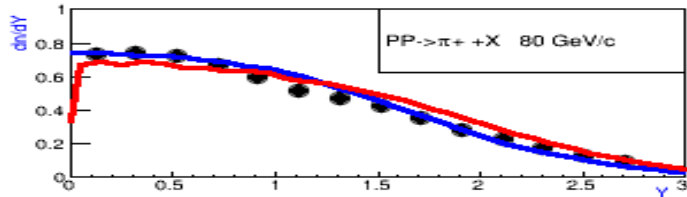
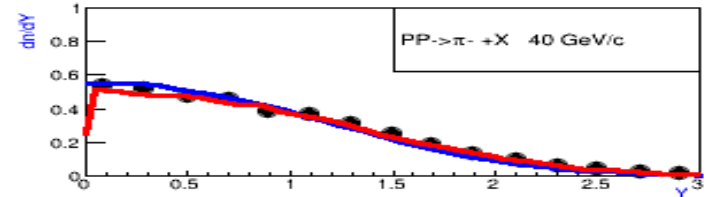
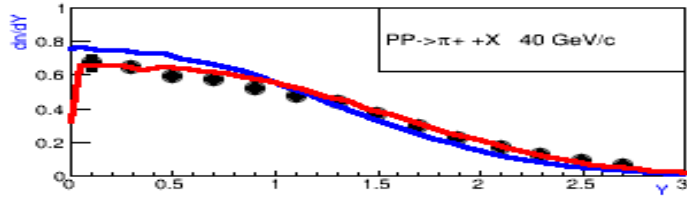
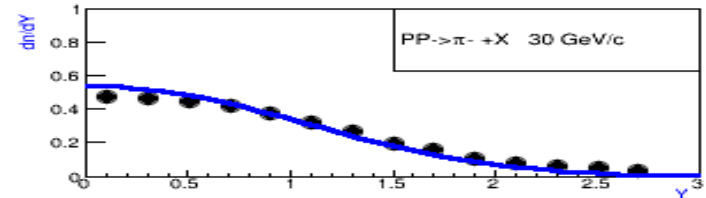
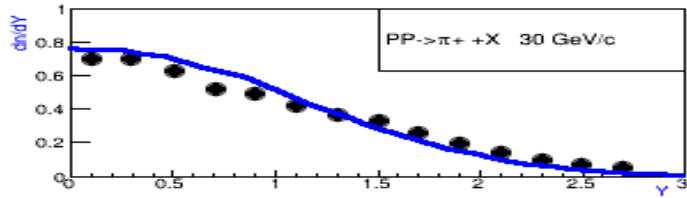
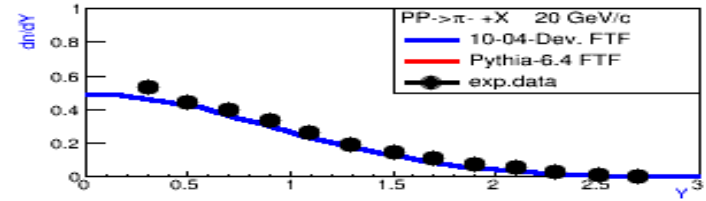
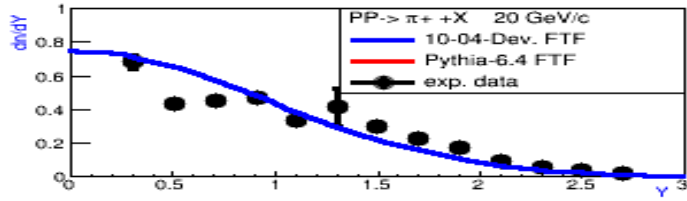


FTF = EPOS 1.99

Pi+

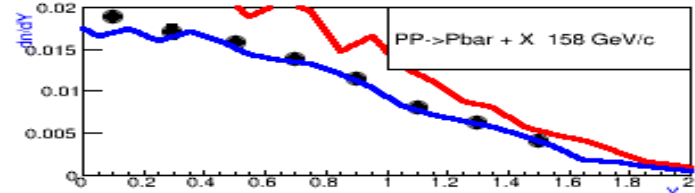
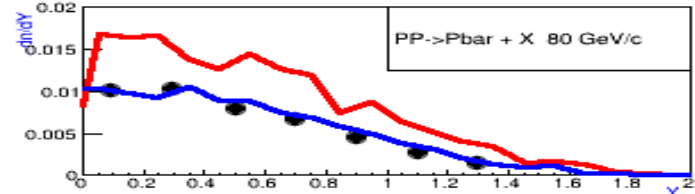
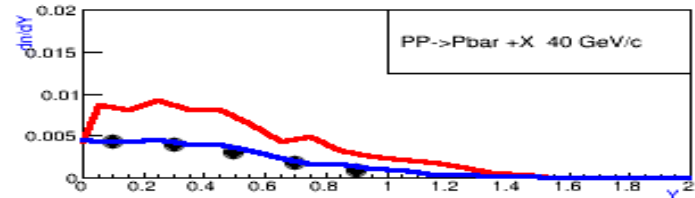
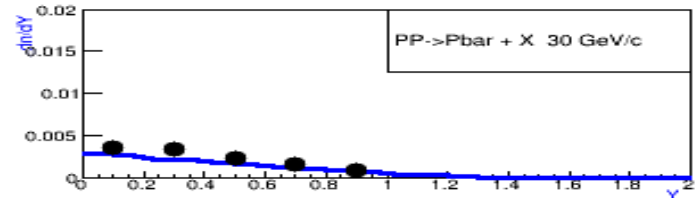
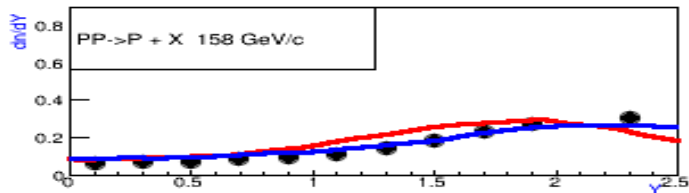
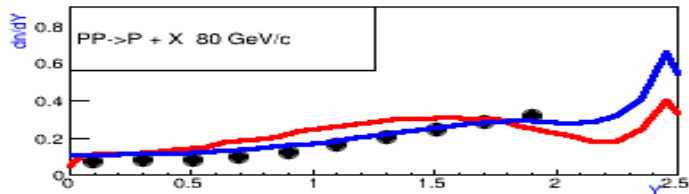
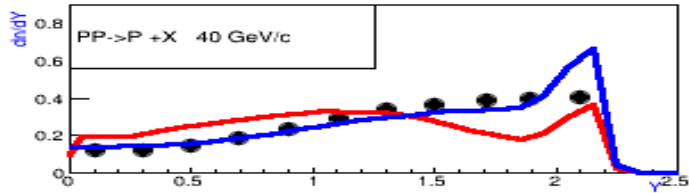
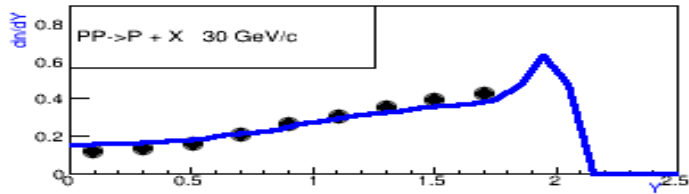
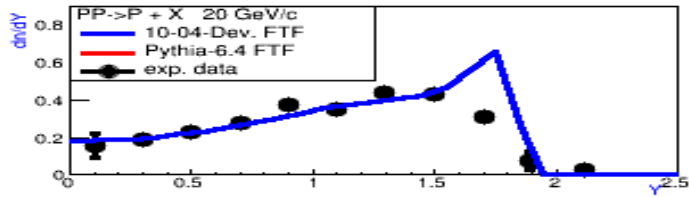
### 3. FTF and Pythia

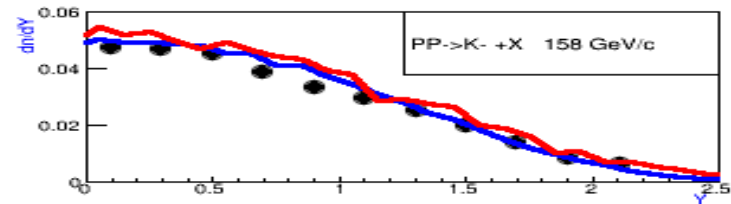
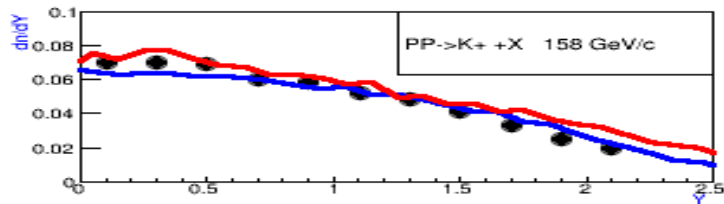
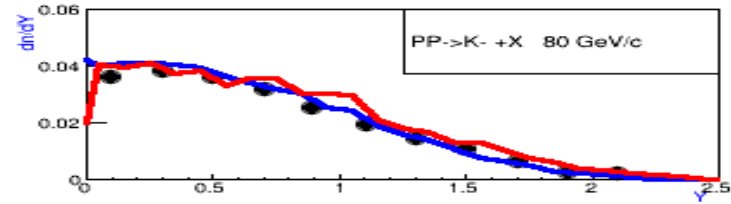
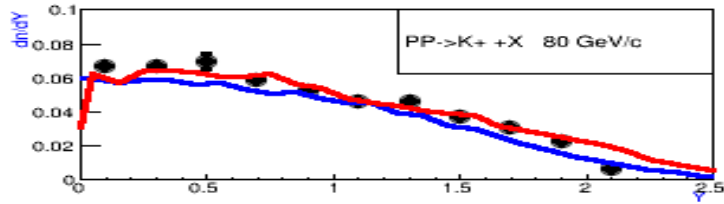
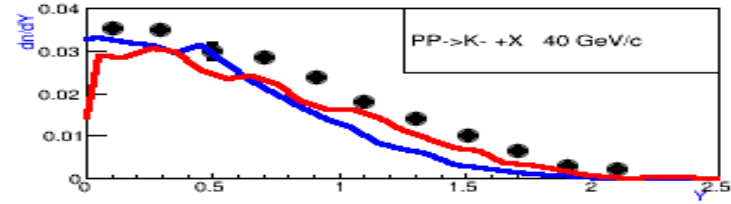
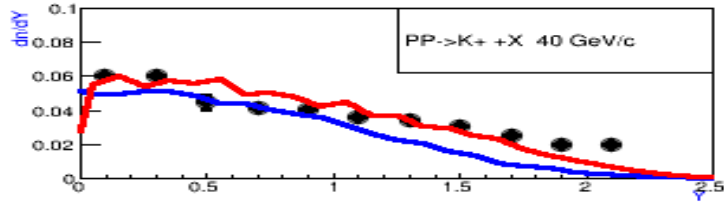
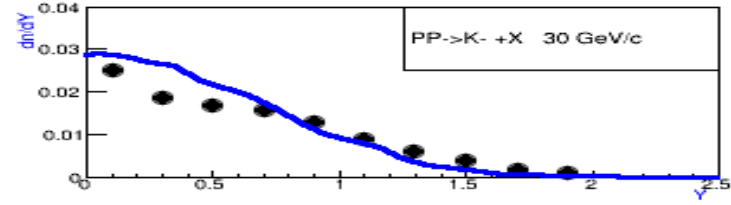
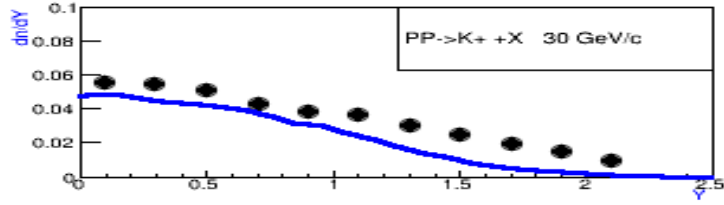
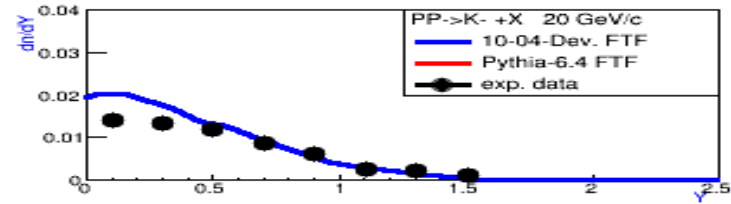
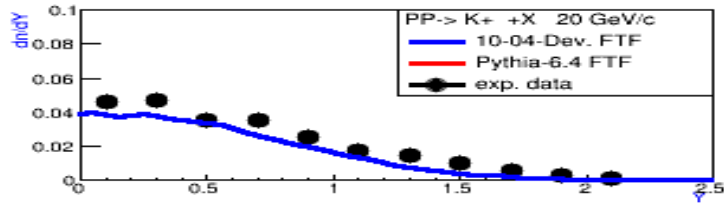
Pi-



FTF = Pythia

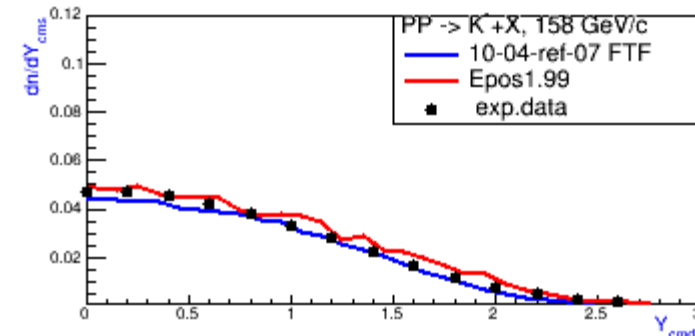
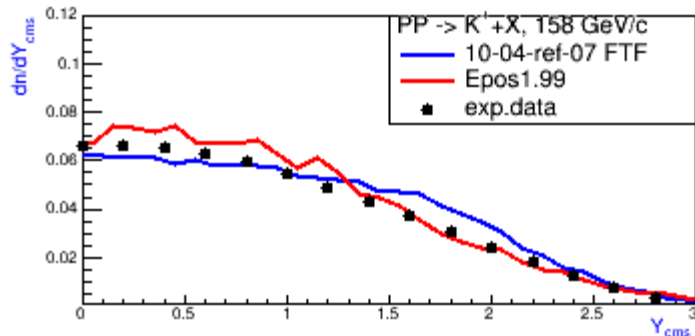
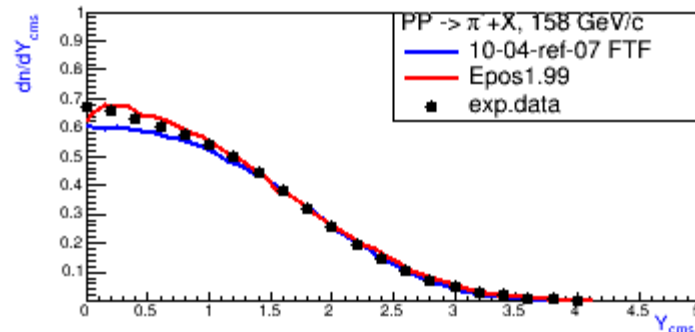
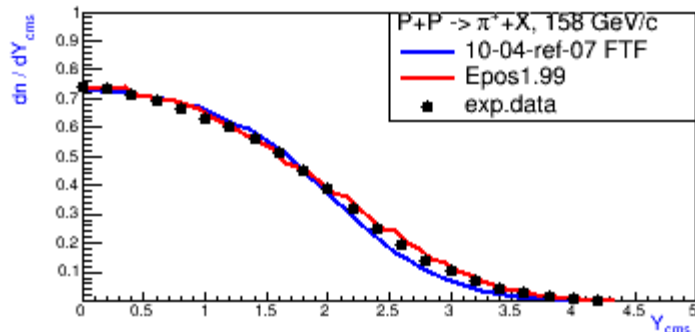
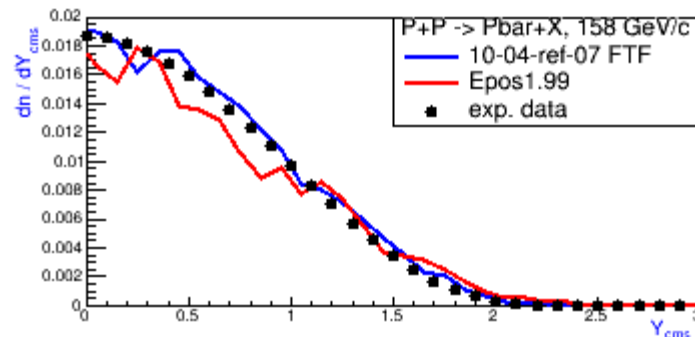
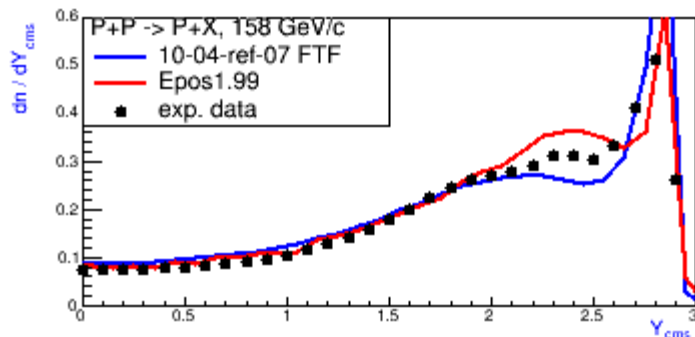






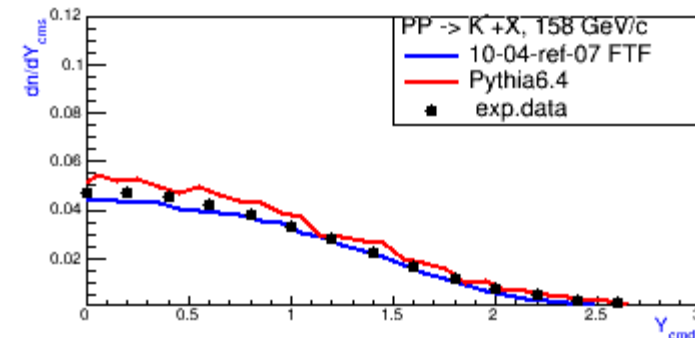
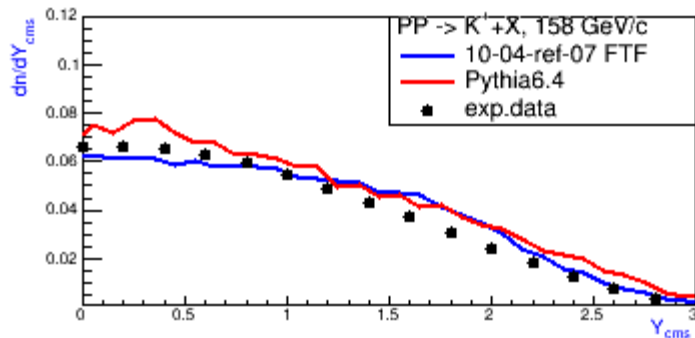
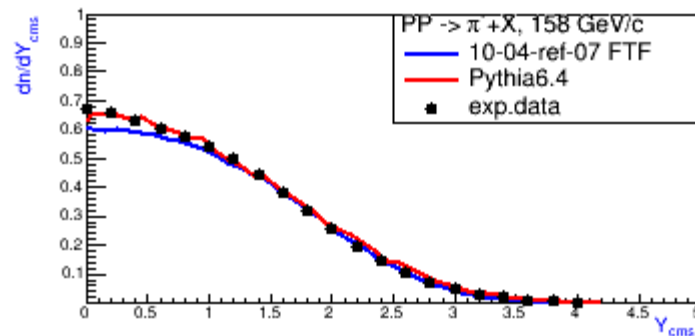
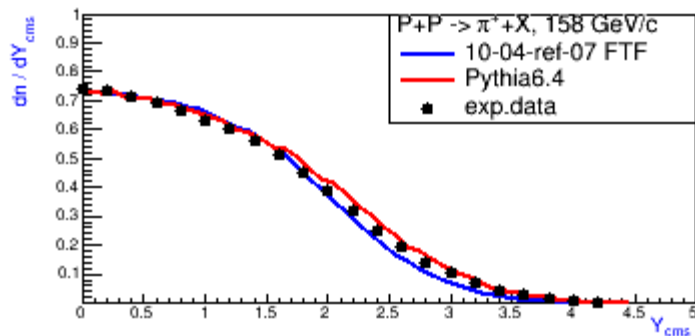
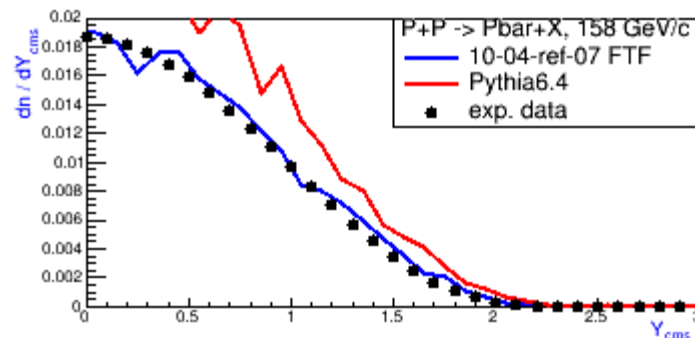
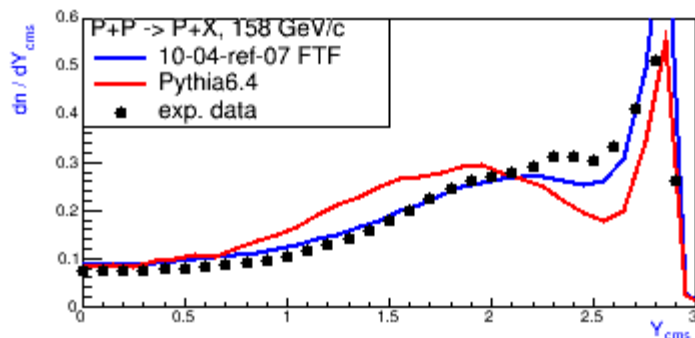
FTF = Pythia

### 3. FTF and EPOS 1.99



FTF = EPOS

### 3. FTF and Pythia



FTF # Pythia

## Summary

1. K + P cross sections are improved in QGSM.
2. QGSM fragmentation is improved, new low mass string fragmentation algorithm is implemented. **More physics is needed!**
3. FTF works as well as EPOS 1.99 for PP interactions.
4. Pythia works as FTF at the energy  $> 30$  GeV for PP interactions. Pythia has problems with baryon spectra. Pythia cannot work for nucleus-nucleus interactions.
5. QGS and FTF models of Geant4 are working well. We can be proud of our models.