

Low energy validation of hadron string model (preliminary)

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Abstract

A low energy validation of hadron string models (FTF and Qq-hadron) based on GEANT4 FTF implementation is discussed. The Qq-model parameters were modified in accordance with the Barashenkov-Glauber-Gribov cross-section set. The quasi-elastic ratio is calculated based on the Glauber-Gribov cross-sections. The string mass excitation spectrum mass is sampled in accordance with the low mass diffraction model.

1 Hadron string parameters

The FTF model utilizes the CHIPS cross-sections and simplified quasi-elastic ratio. The Qq-model, based on FTF, was modified:

1. Hadron-nucleon cross-sections for nucleons, pions and kaons were modified in accordance with the G4HadronNucleonXsc.
2. The quasi-elastic ratio was modified in accordance with the Glauber-Gribov cross-sections.
3. The string mass excitation spectrum mass is sampled in accordance with the low mass diffraction model.

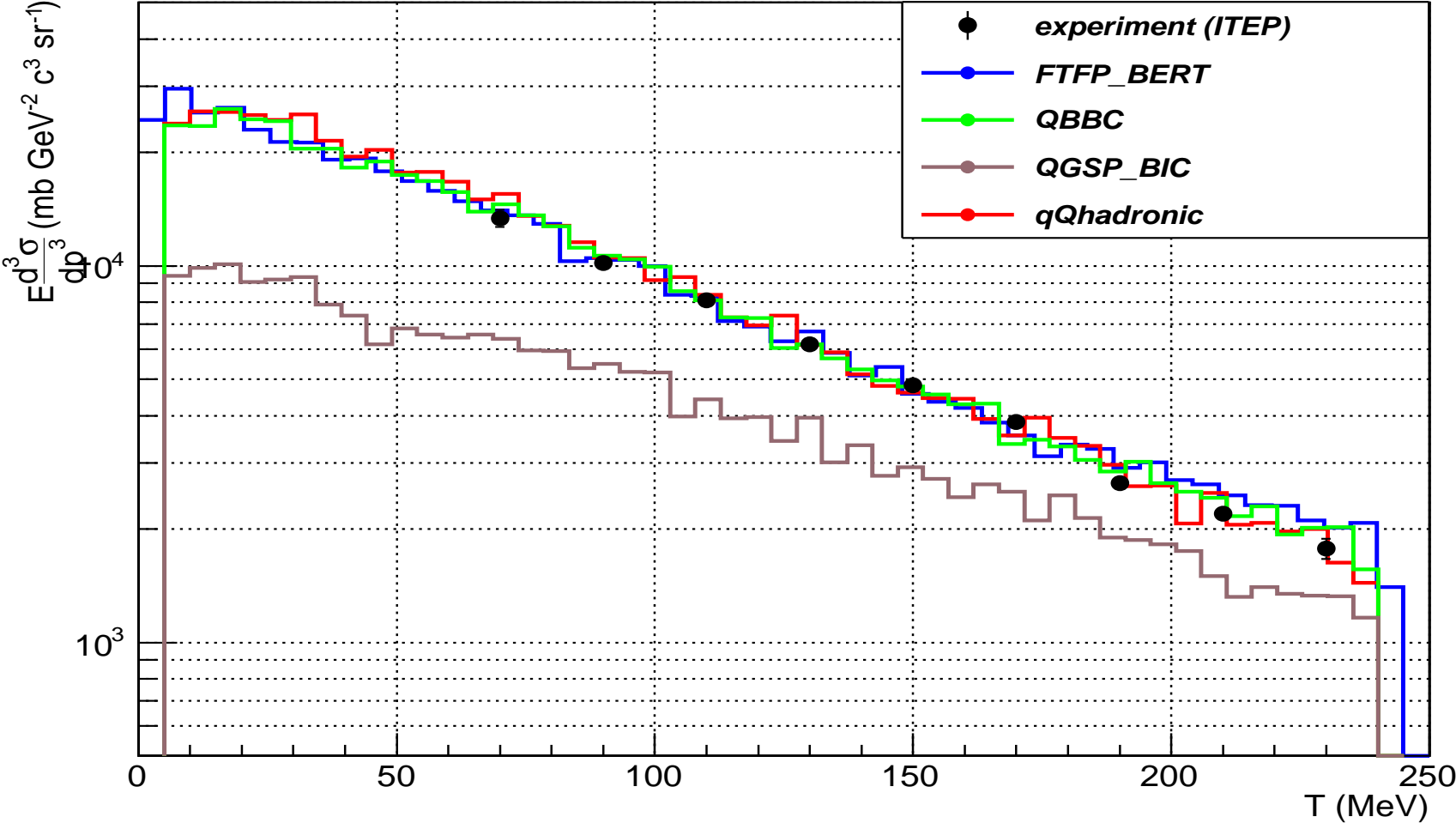
2 Physics lists

Few standard (QBBC, QGSP_BIC, FTF_BIC) and two modified (FTFP-low, qQ-model) physics lists with string extension to low energy region were used (models involved at $P=1.4$ GeV/c):

1. QBBC: for π^\pm FTF: 3 GeV - 100 TeV, BERT: 0-4 GeV.
2. FTF_BIC: FTF: 4 GeV - 100 TeV, BIC: 0-5 GeV.
3. QGSP_BIC: FTF: 9.5 GeV - 25 GeV, QGSP: 12 GeV - 100 TeV, BIC: 4-9.9 GeV, BERT: 0-5 GeV.
4. FTFP-low: FTF: 1 GeV - 100 TeV, BERT: 0-1.1 GeV.
5. qQ-model: Qq: 0.5 GeV - 100 TeV, BERT: 0-1 GeV.

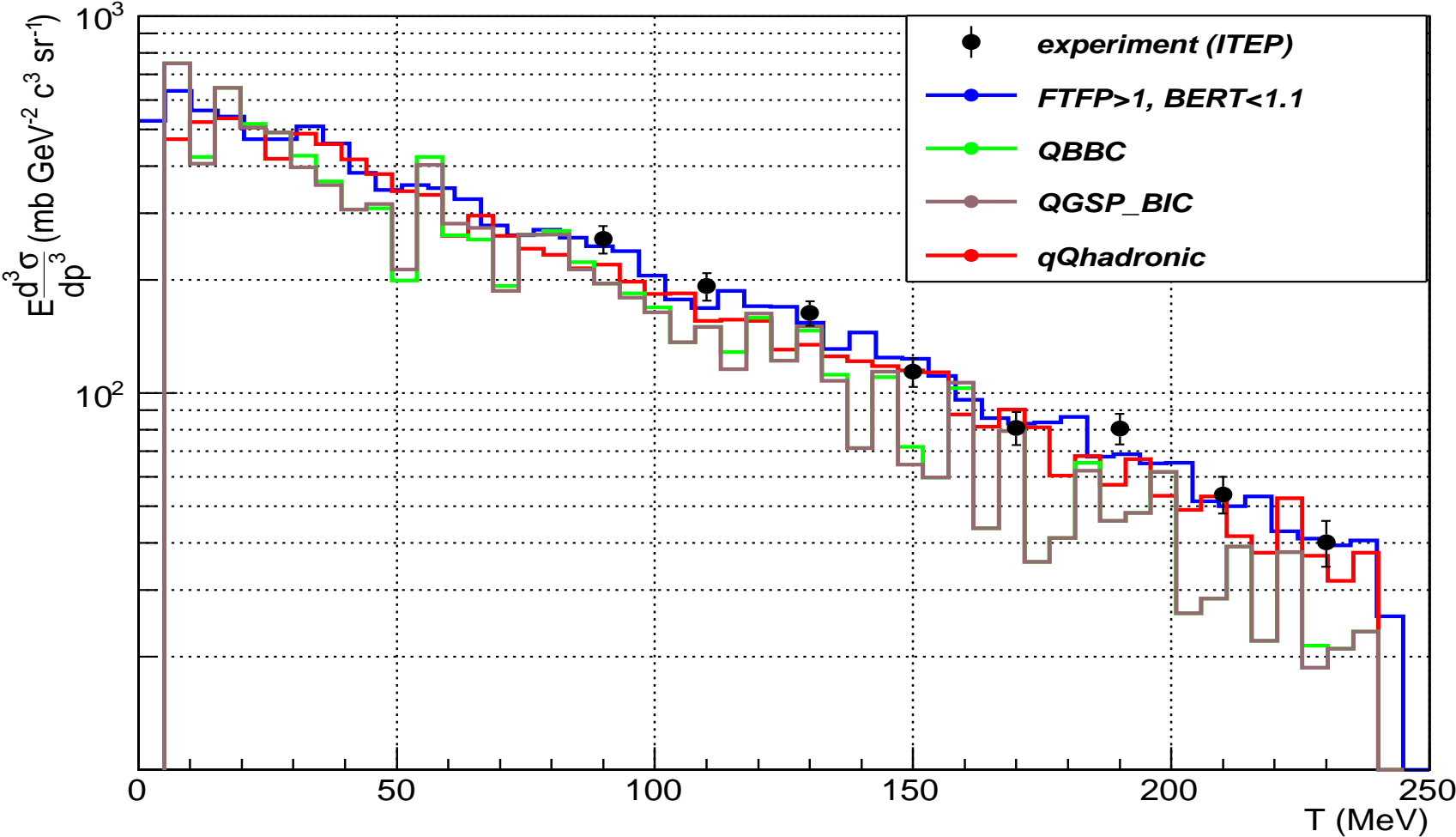
GEANT4 version geant4-10-01-ref-06 was used. The hadron models were compared with ITEP experimental data (test47) for thin target 26x26x18 mm³.

pU->pX at proton momentum 7.5 GeV/c and scattering angle 59 degree



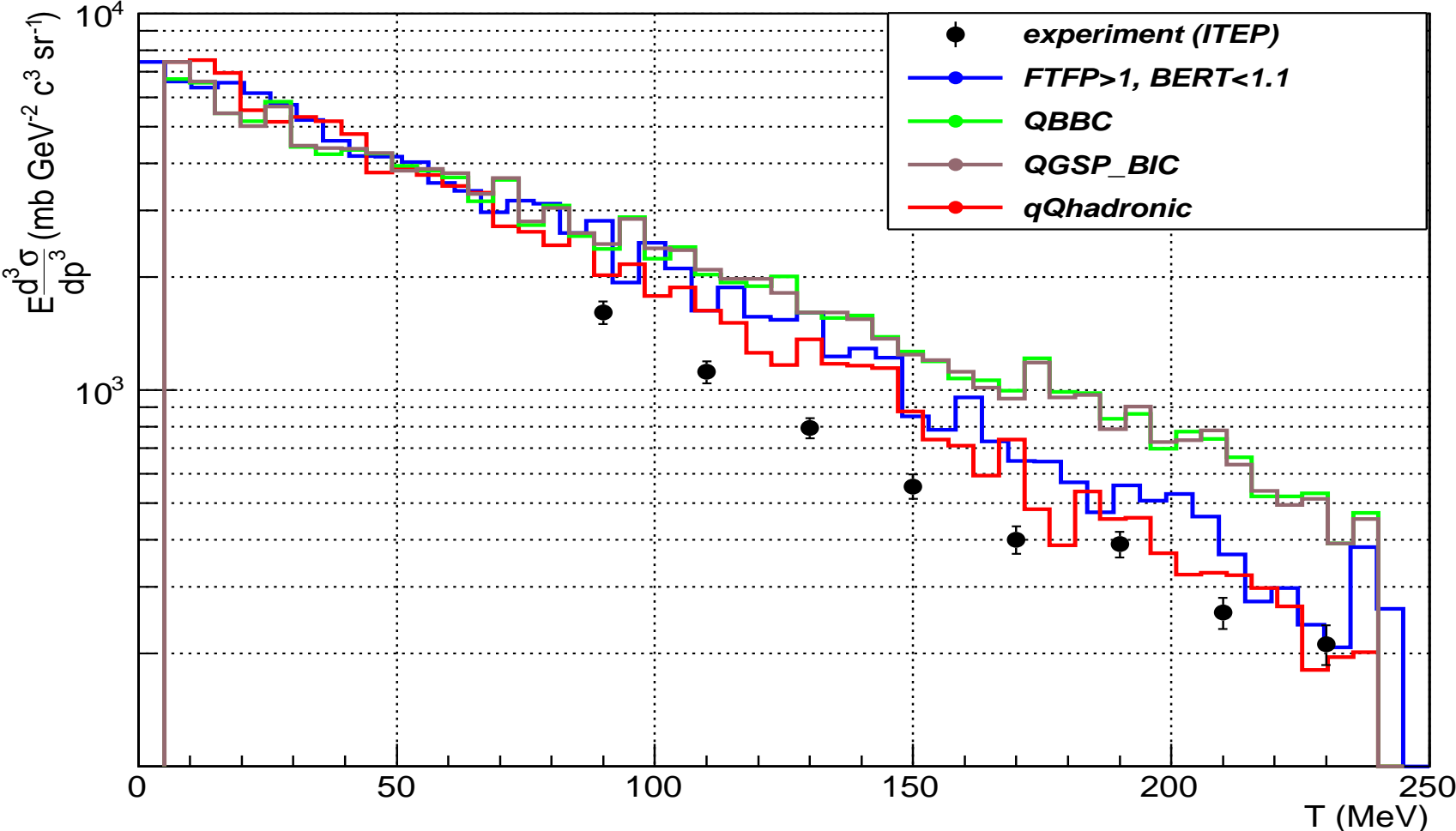
Energy spectrum of invariant differential cross-section for $pU \rightarrow pX$. Initial proton momentum is 7.5 GeV/c, the proton scattering angle is 59° .

$\pi^- C \rightarrow pX$ at π^- momentum 1.4 GeV/c and p scattering angle 59 degree



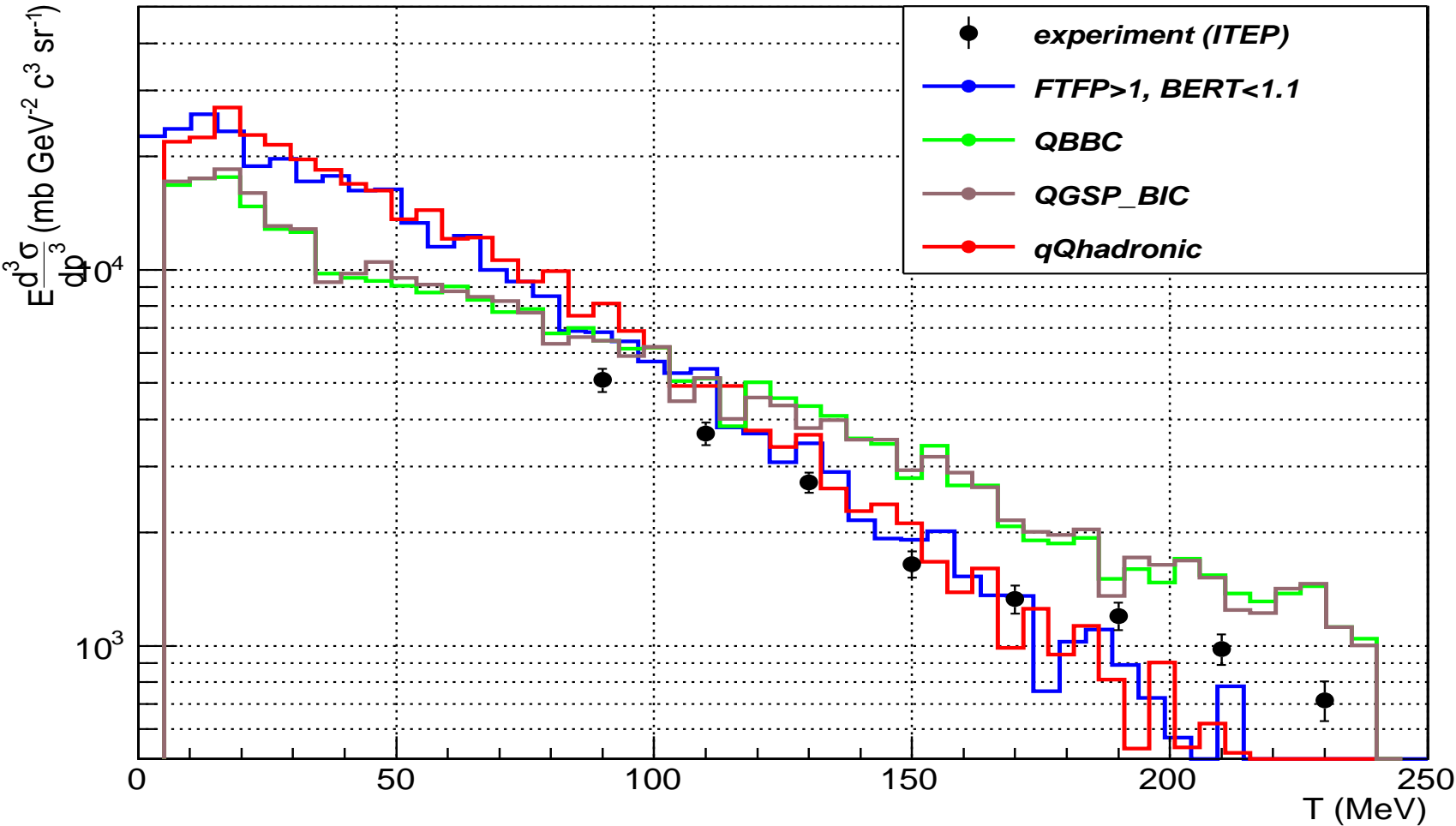
Energy spectrum of invariant differential cross-section for $\pi^- C \rightarrow pX$. Initial pion momentum is 1.4 GeV/c, the proton scattering angle is 59° .

$\pi^-Cu \rightarrow pX$ at π^- momentum 1.4 GeV/c and p scattering angle 59 degree



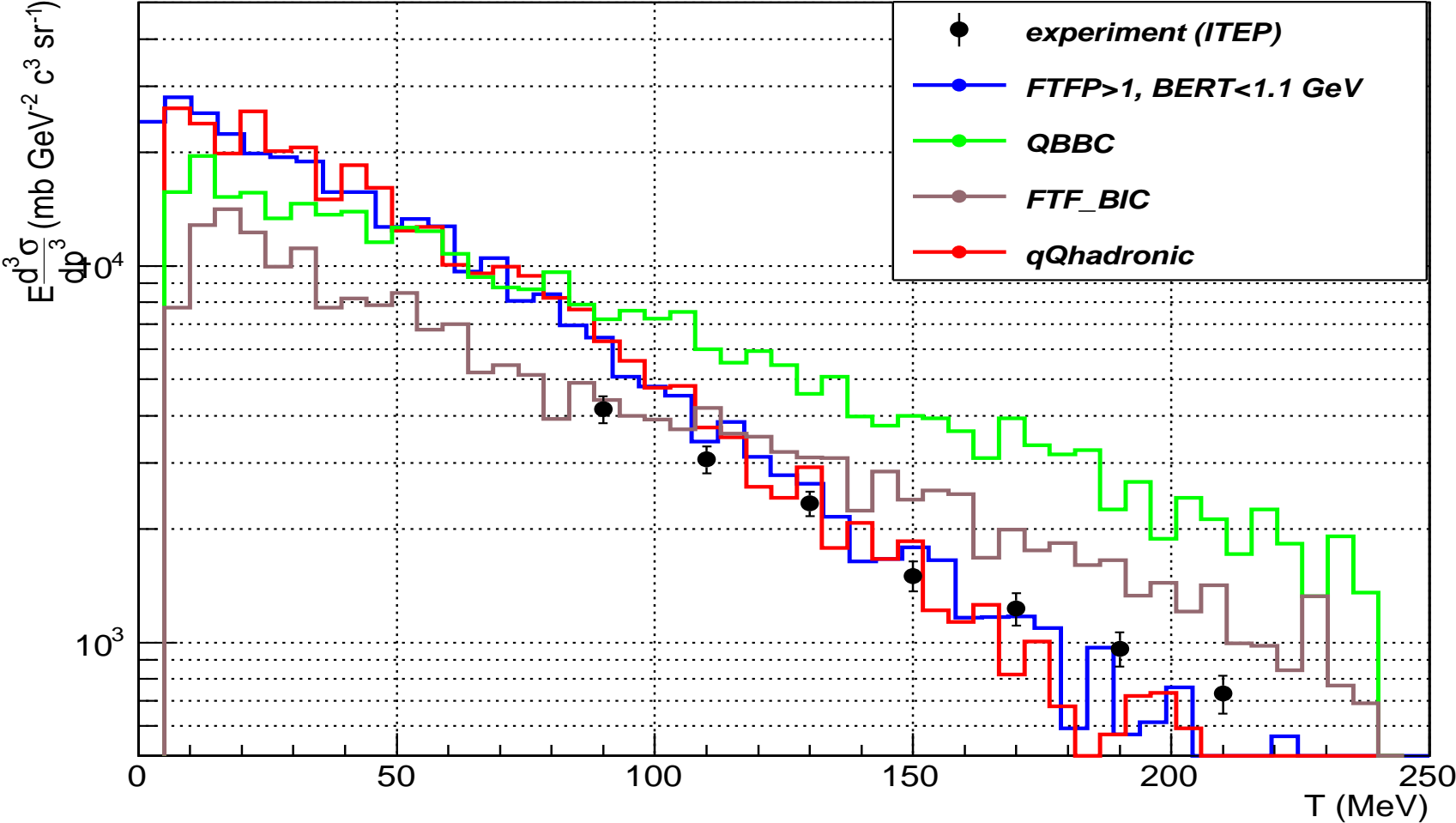
Energy spectrum of invariant differential cross-section for $\pi^- Cu \rightarrow pX$. Initial pion momentum is 1.4 GeV/c, the proton scattering angle is 59° .

$\pi^+Pb \rightarrow pX$ at π^+ momentum 1.4 GeV/c and p scattering angle 59 degree



Energy spectrum of invariant differential cross-section for $\pi^+ Pb \rightarrow pX$. Initial pion momentum is 1.4 GeV/c, the proton scattering angle is 59° .

$\pi^-U \rightarrow pX$ at π^- momentum 1.4 GeV/c and p scattering angle 59 degree



Energy spectrum of invariant differential cross-section for $\pi^-U \rightarrow pX$. Initial pion momentum is 1.4 GeV/c, the proton scattering angle is 59°.

3 Summary

1. GEANT4 string models based on the FTF implementation show better agreement with the ITEP data at $P_{\pi\pm}=1.4$ GeV/c compared to the GEANT4 cascade models.
2. Optimization of other string parameters for the qQ-model, comparison with more experimental data are current plans.