Validation of Geant4.10.1.ref10
Brief Summary
based on test19, 47, 48, and 75

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Geant4 Hadronic Group Meeting

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General Information

- Included:
  - AtRest processes – test48
  - Gamma-N interactions – test75
  - Baryon production by Bertini, Binary, FTF at intermediate energies – test47
  - FTFP, QGSP(+G4LundStringFragm.) at 31GeV/c or 158GeV/c – test19
- Releases:
  - Geant4.10.1.p02, 10.2.b01, 10.1.ref09
  - Geant4.10.1.ref10
- Only signature plots shown (interesting/non-negligible changes)
- Otherwise, a verbal overview
- All results/plots uploaded to G4 Validation Repository:

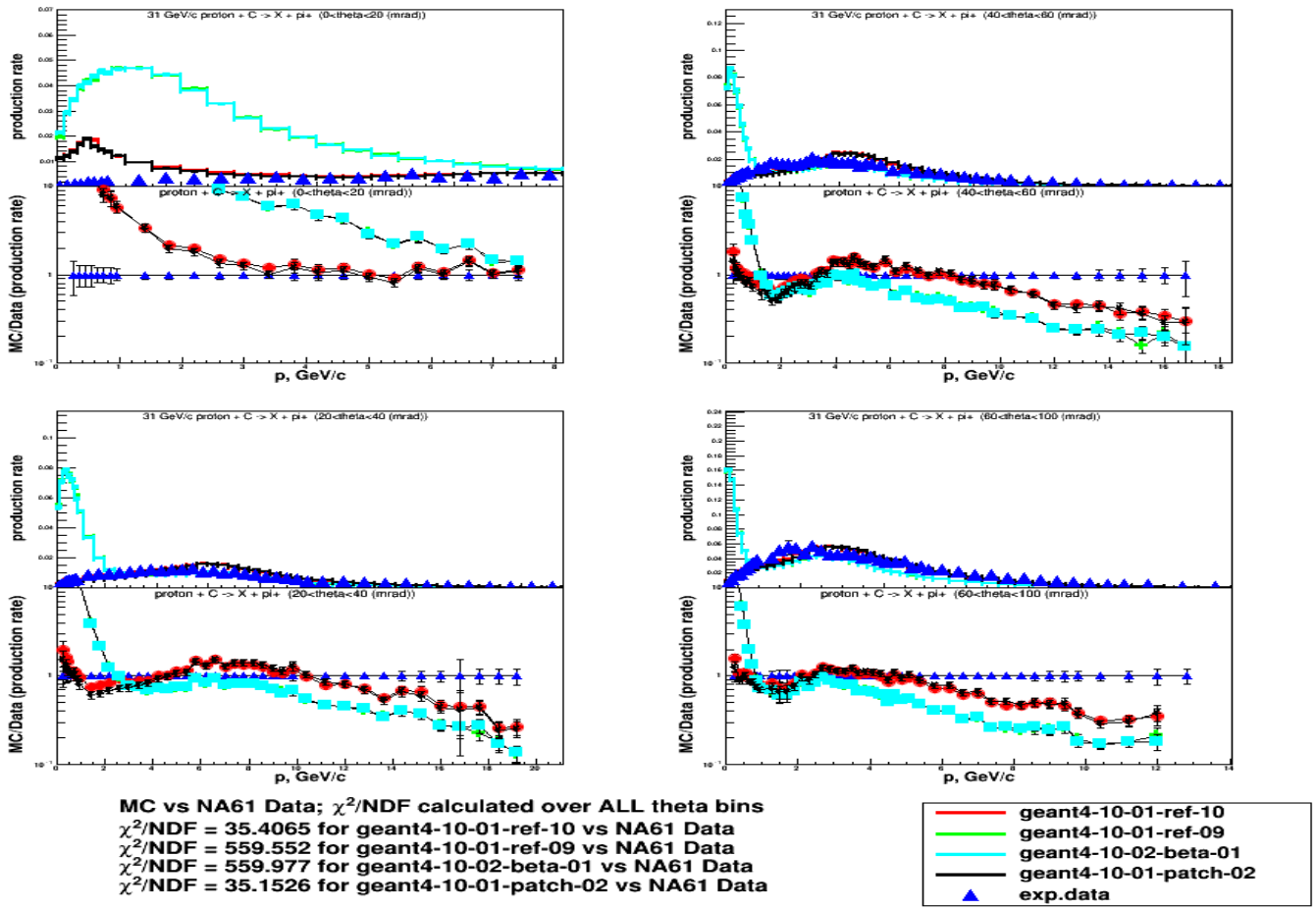
http://g4devel.fnal.gov:8080/G4WebAppNG

G4.10.1.ref10 Summary

- NO changes found in Bertini, Binary, INCLXX
- QSG is back (within "dribbles") to where it was in 10.1.p02
  - **Per discussion/decision at the Geant4 collaboration workshop, latest changes/ developments in QGS has been postponed until further tuning**
  - Plots in the following slides
- Changes in FTF(P) observed in G4.10.2.b01
  - Largely discussed at previous meeting (7/15/15,6/17/15, 5/20/15)
  - No major changes at higher energy (31GeV,158GeV), as compared to 10.1.p02
  - Recent efforts towards p/n production by a several-GeV proton or pion beam
    - Fairly stable through b01, ref09, and ref10
    - Results are different from 10.1.p02 - statistically speaking they're somewhat closer to the data (although the best agreement was in ref04 !).
    - Modeling of pion production in p/pion+A interactions in the several-GeV range is also affected (based on limited observations from p/pion+C, p/pion +Be, or p+Ta results):
      - Slight improvement for proton projectile
      - Slight degradation for pion projectile
  - Plots in the following slides

QGSP: 31GeV/c p+C -> π^++X (I)

NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)



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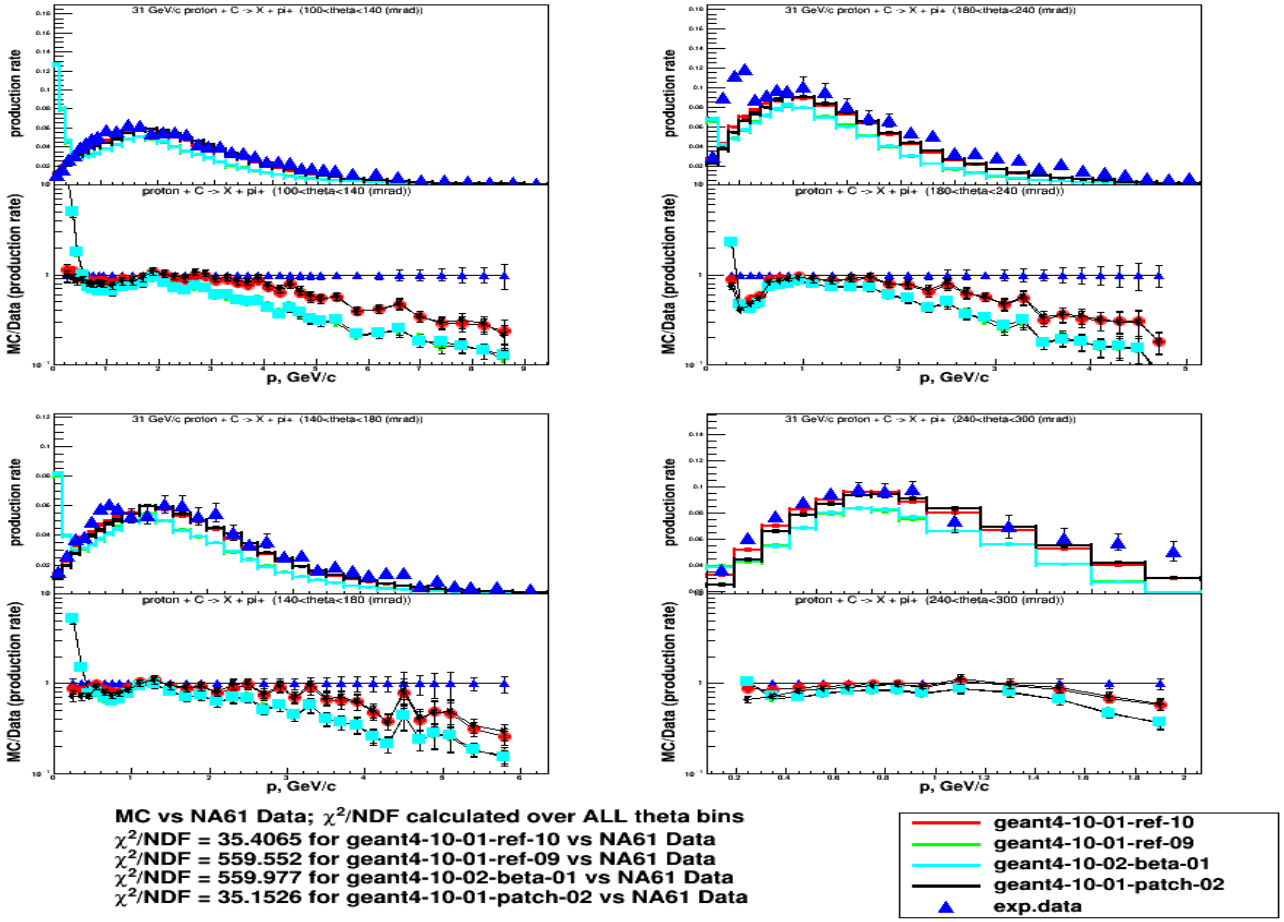

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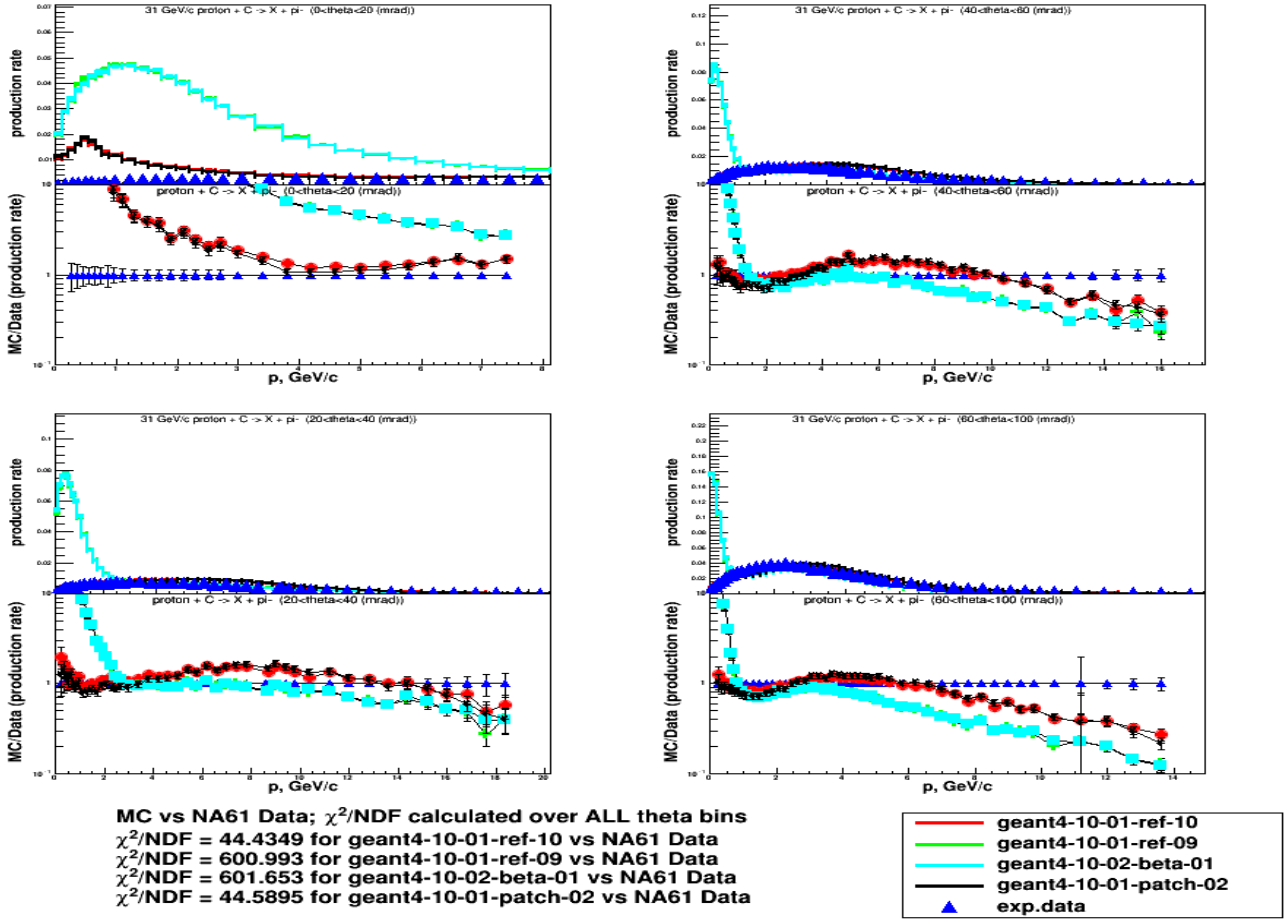

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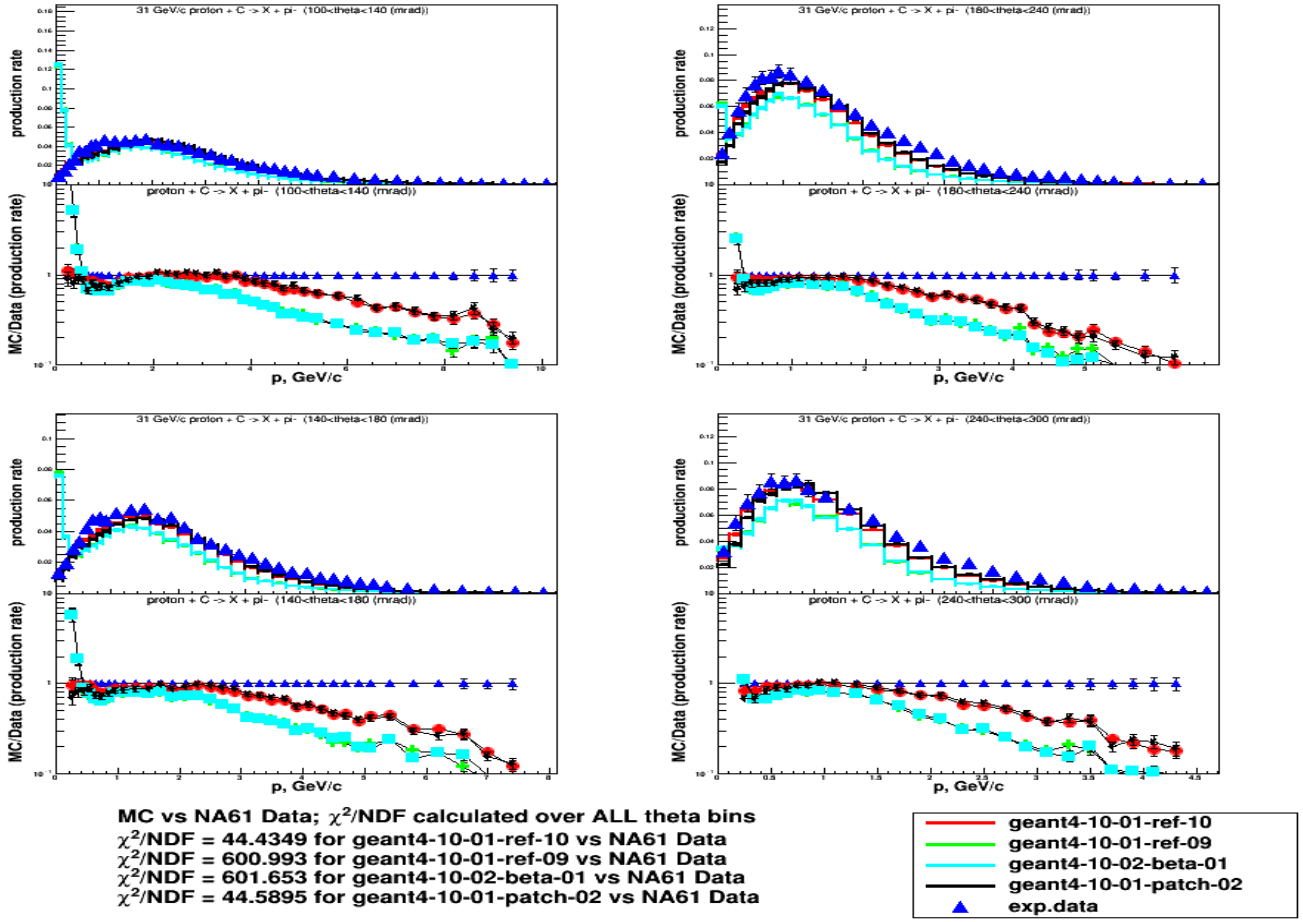
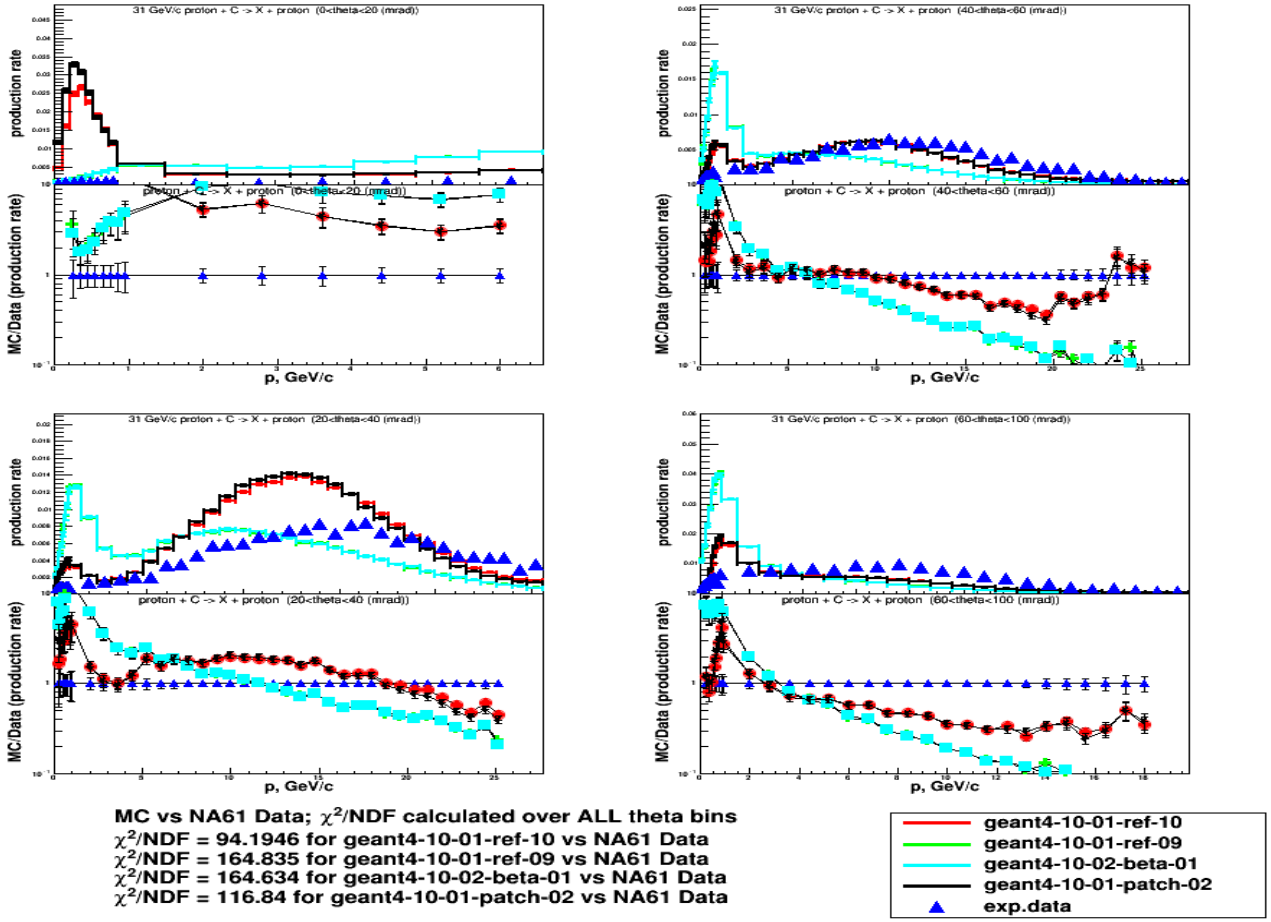


QGSP: 31GeV/c p+C -> p+X (I)

NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)



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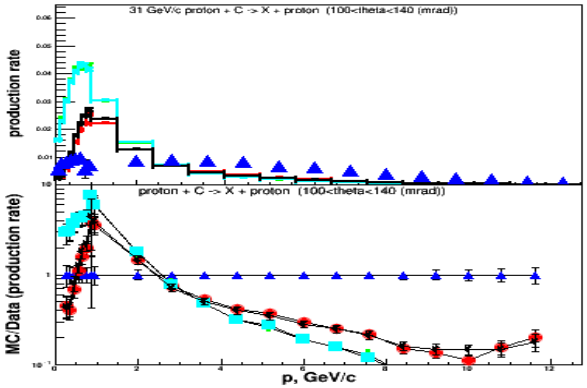
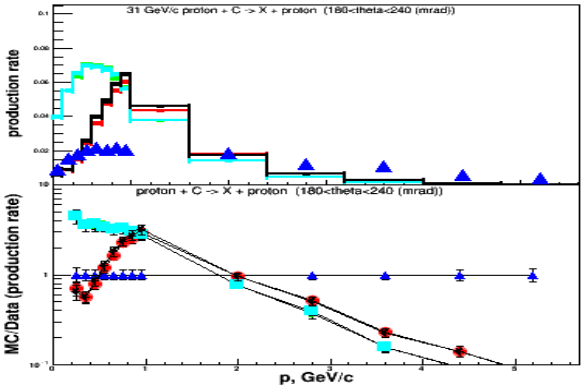
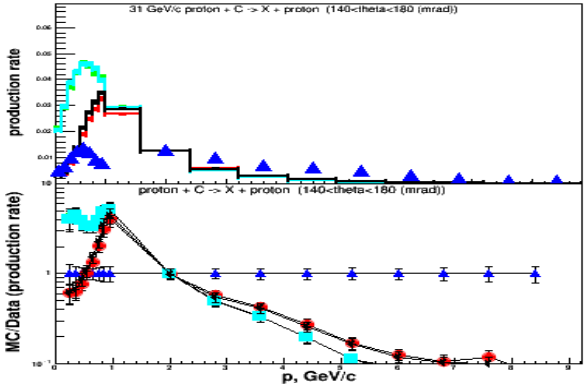
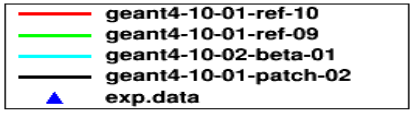
NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)





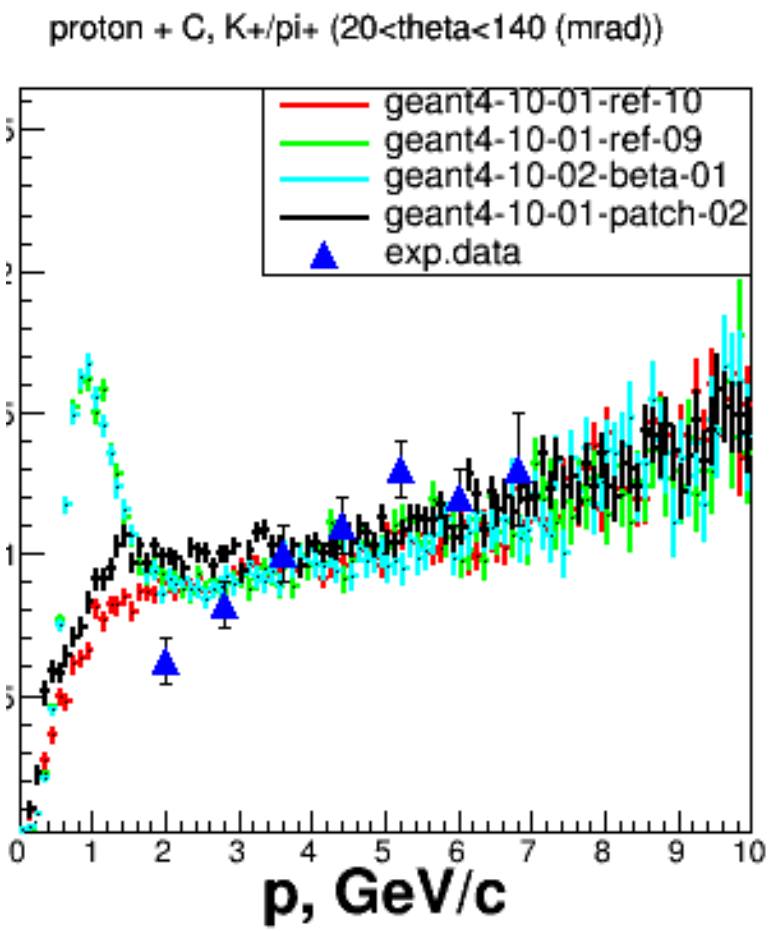


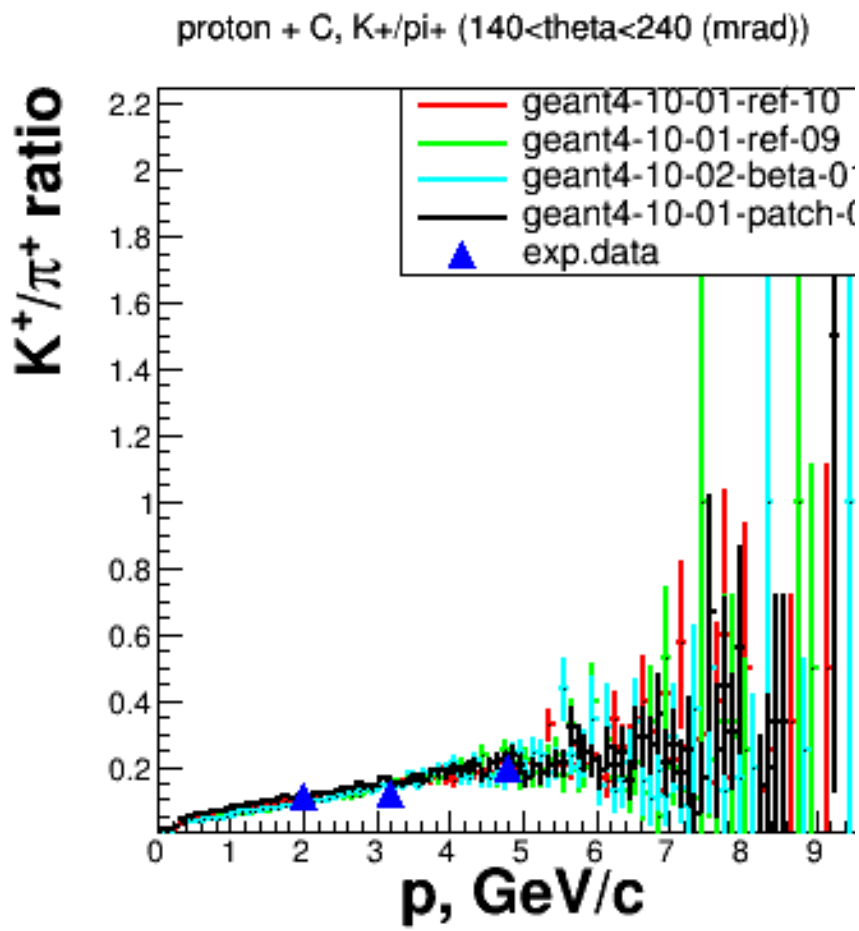
MC vs NA61 Data; χ^2/NDF calculated over ALL theta bins
χ^2/NDF = 94.1946 for geant4-10-01-ref-10 vs NA61 Data
χ^2/NDF = 164.835 for geant4-10-01-ref-09 vs NA61 Data
χ^2/NDF = 164.634 for geant4-10-02-beta-01 vs NA61 Data
χ^2/NDF = 116.84 for geant4-10-01-patch-02 vs NA61 Data



QGSP: K+/π^+ in 31GeV/c p+C

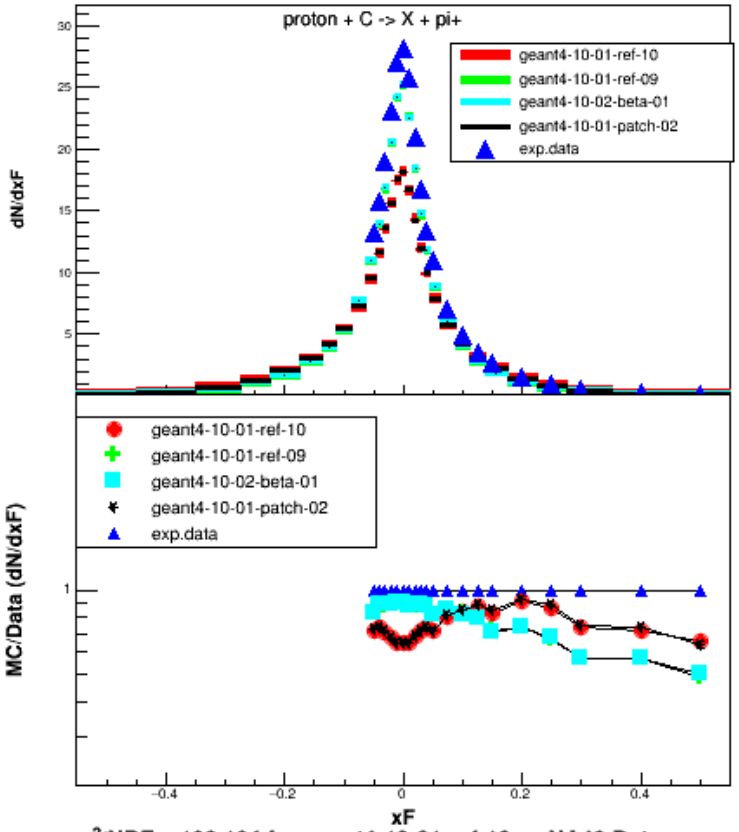
NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)



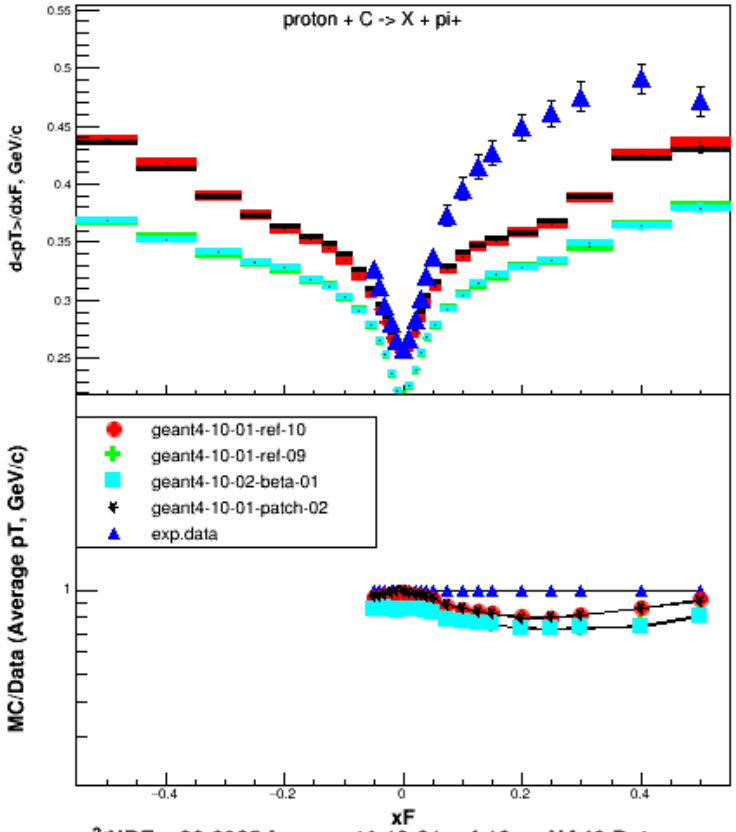


QGSP: 158GeV/c p+C -> π^++X

NA49 Data: http://spshadrons.web.cern.ch/spshadrons



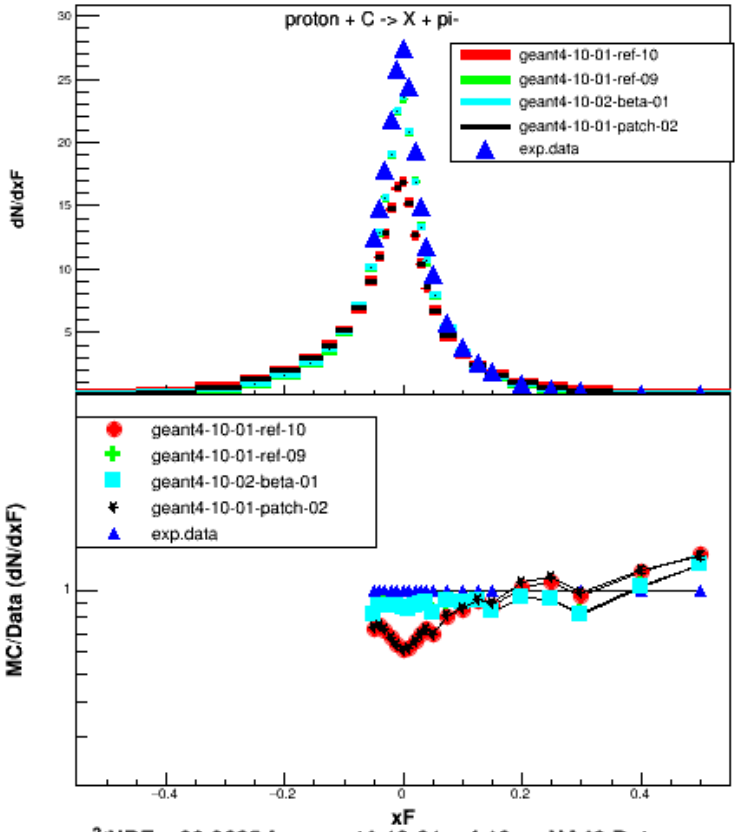
χ^2/NDF = 108.194 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 80.2835 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 80.1344 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 104.566 for geant4-10-01-patch-02 vs NA49 Data



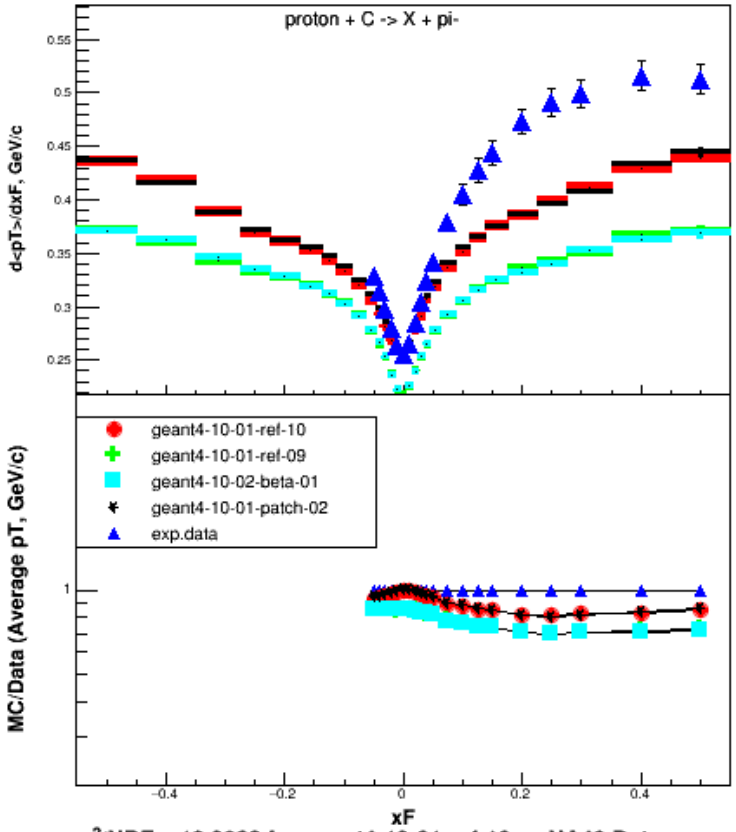
χ^2/NDF = 20.6925 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 62.1664 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 62.2574 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 18.7212 for geant4-10-01-patch-02 vs NA49 Data

QGSP: 158GeV/c p+C -> π^-+X

NA49 Data: http://spshadrons.web.cern.ch/spshadrons



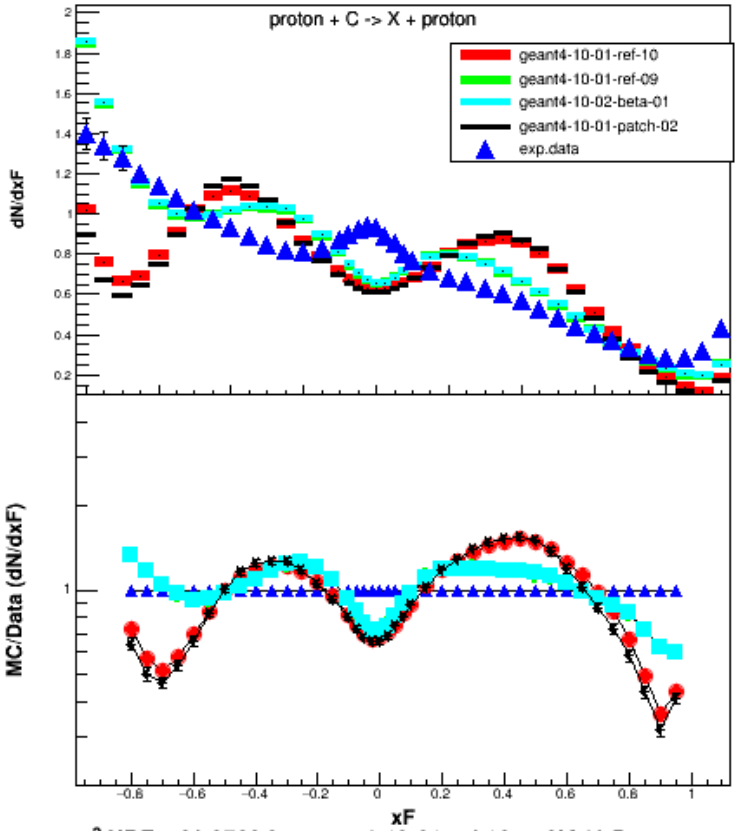
χ^2/NDF = 99.9635 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 24.318 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 24.1156 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 97.9746 for geant4-10-01-patch-02 vs NA49 Data



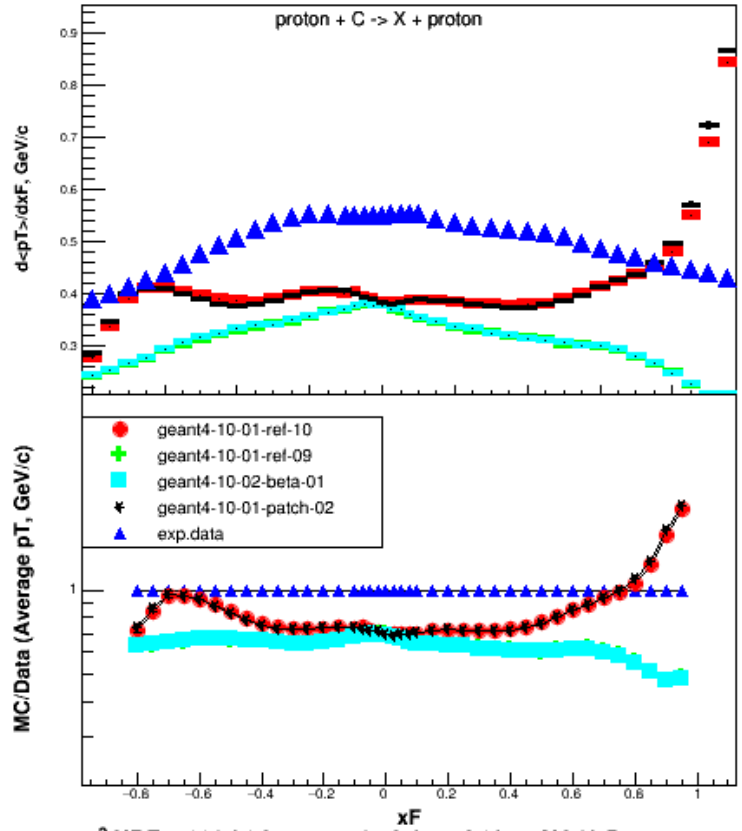
χ^2/NDF = 18.8032 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 72.2767 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 73.4602 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 17.128 for geant4-10-01-patch-02 vs NA49 Data

QGSP: 158GeV/c p+C -> p+X

NA49 Data: http://spshadrons.web.cern.ch/spshadrons



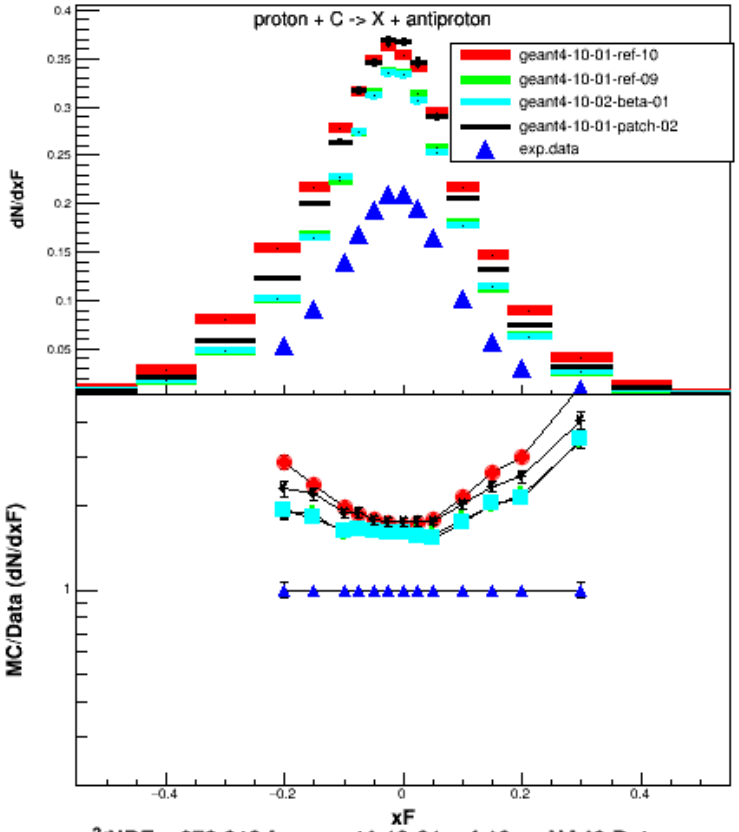
χ^2/NDF = 88.2762 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 30.5416 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 30.8385 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 103.019 for geant4-10-01-patch-02 vs NA49 Data



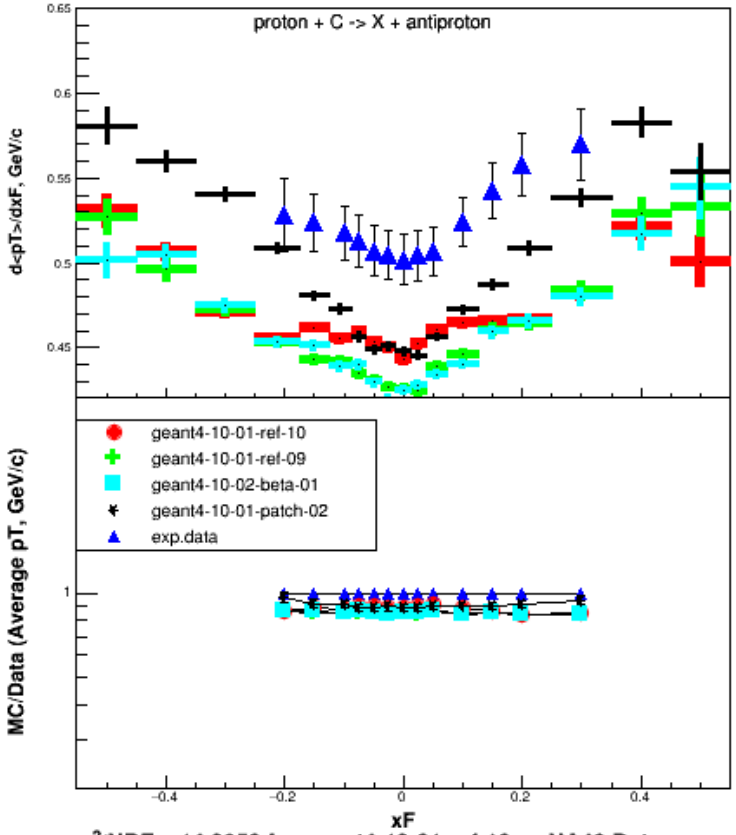
χ^2/NDF = 114.34 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 194.597 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 195.116 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 121.335 for geant4-10-01-patch-02 vs NA49 Data

QGSP: 158GeV/c p+C -> pbar+X

NA49 Data: http://spshadrons.web.cern.ch/spshadrons



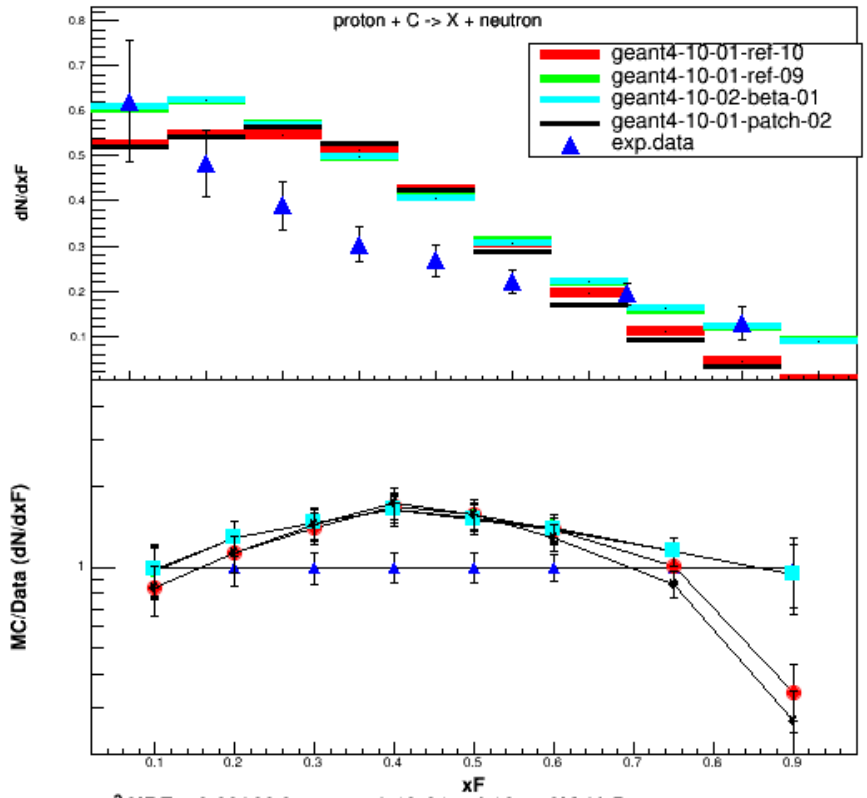
χ^2/NDF = 673.818 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 303.365 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 293.146 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 510.46 for geant4-10-01-patch-02 vs NA49 Data



χ^2/NDF = 14.8959 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 23.1634 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 23.8635 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 9.90636 for geant4-10-01-patch-02 vs NA49 Data

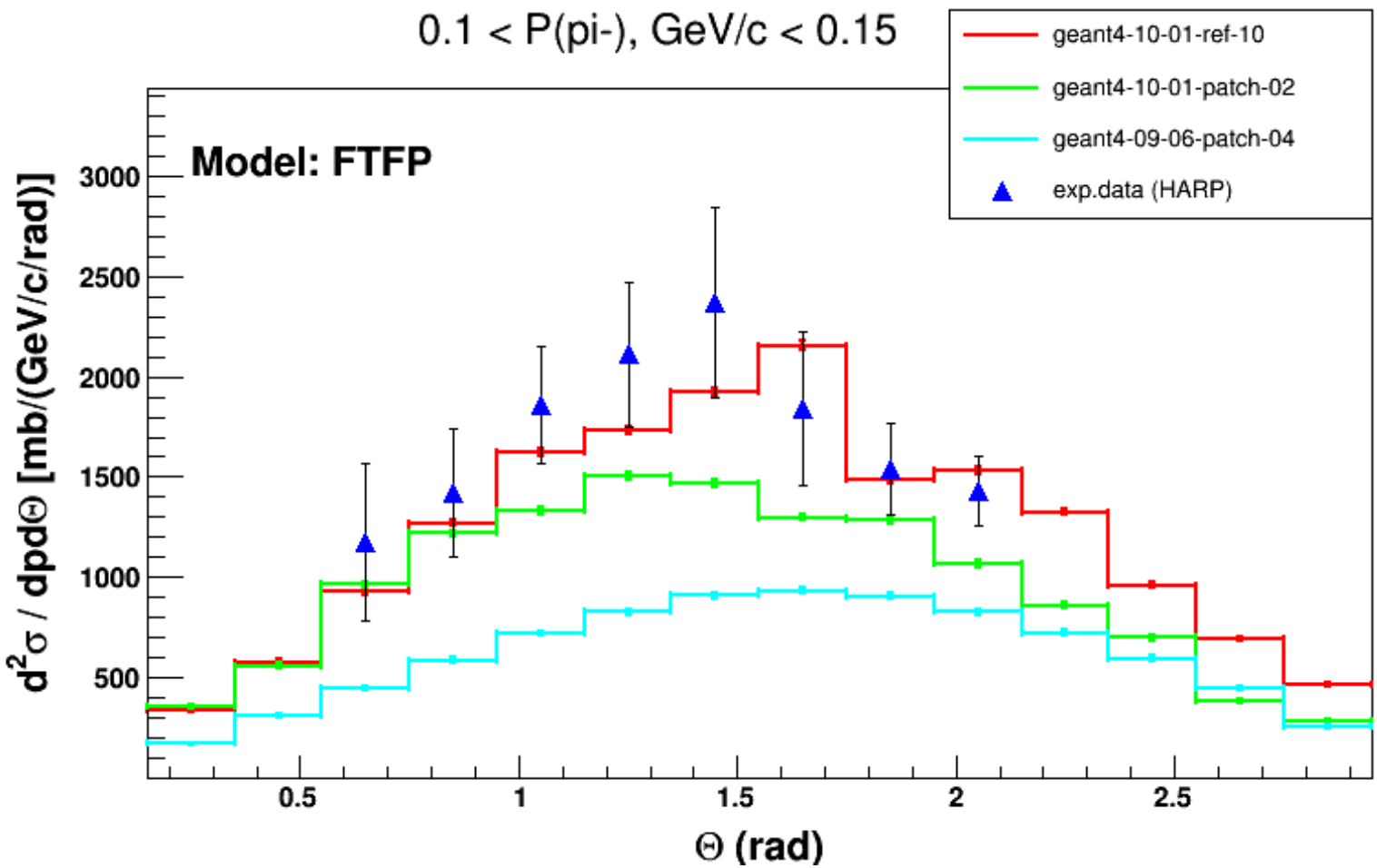
QGSP: 158GeV/c p+C -> n+X

NA49 Data: http://spshadrons.web.cern.ch/spshadrons



χ^2/NDF = 9.23902 for geant4-10-01-ref-10 vs NA49 Data
χ^2/NDF = 8.82233 for geant4-10-01-ref-09 vs NA49 Data
χ^2/NDF = 8.54639 for geant4-10-02-beta-01 vs NA49 Data
χ^2/NDF = 9.82183 for geant4-10-01-patch-02 vs NA49 Data

FTFP: 8GeV/c p+Ta -> π^-+X

HARP Data:M. Apollonio et al., Phys.Rev.C80 065207, 2009

NOTE: Data presented in a “non-traditional” way, i.e. as a theta-spectrum in a particular momentum-bin of the outcoming pi- (per Mu2e @ FNAL)