Validation of Geant4.10.1.p03, 10.2.p01, and 10.2.ref03 Brief Summary based on test19, 47, 48, 75, and 23

Julia Yarba,Fermilab

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
  - Tests of FTFP_BERT, QGSP_BERT, NuBeam, Shielding, ShieldingM physics lists on light and heavy (simplistic) targets – test23
- Releases:
  - Geant4.10.1.p01, 10.2.p01, 10.2.ref03
- Mainly a verbal report
- Selected plots in backup slides

Geant4.10.1.p03

- Everything went smoothly with 10.1.p03.
- Results are fairly stable as far as tests 19, 23, 47, 48, and 75 go
  - NO appreciable differences have been detected between 10.1.p02 and 10.1.p03

Geant4.10.2.p01 (I)

- Good news first:
  - From test23/Shielding(M), I reported suspected infinite loops for 10.2 and crashes for 10.2.ref01
  - The crashes were tracked down to G4RadioactiveDecay, and now seem to be fixed
  - No problems from test23 (phys.lists test including NuBeam and Shielding/ShieldingM)
- Wherever results comparison was possible, there're no appreciable differences from 10.2
- There're some differences from 10.1.p03 (i.e. 10.1-series), e.g. in QGSP or FTFP, but those are known, and we've already discussed those at earlier meeting

Geant4.10.2.p01 (II)

- Now the bad news:
  - In 10.2.p01 some problems were detected via test47, and they all seem to boil down to PreCompound
    - Here the term "PreCompound" is kind of collective here, based on how it shows in the crash diagnostics
    - To be more precise, the issues does go through PreCompound::DeExcite
  - Model-level p+U or pion+U jobs crashing with Binary or INCLXX, with similar diagnostics
  - Discussed the issue with Vladimir I. (back in March)
- The crashes are likely to be rare; they happen far into long jobs
- However, it raises some concerns about release geant4 10.2.p01

Geant4.10.2.ref03

- All tests went smoothly
- Changes are detected in QGS(P)
  - Actually, since 10.2.ref01
  - Resumed upgrade work on QGS
  - Plots in backup
  - Large deviations from the data and reference Geant4 results
    - Understandable – work in progress
- No crashes in PreCompound were detected
  - Either they've been fixed or we "got lucky"…
- New addition: starting 10.2.ref03, test19 includes pion+Ta or proton+Ta runs and "specific" (theta spectra) comparison vs selected HARP datasets, per request from FNAL/Mu2e

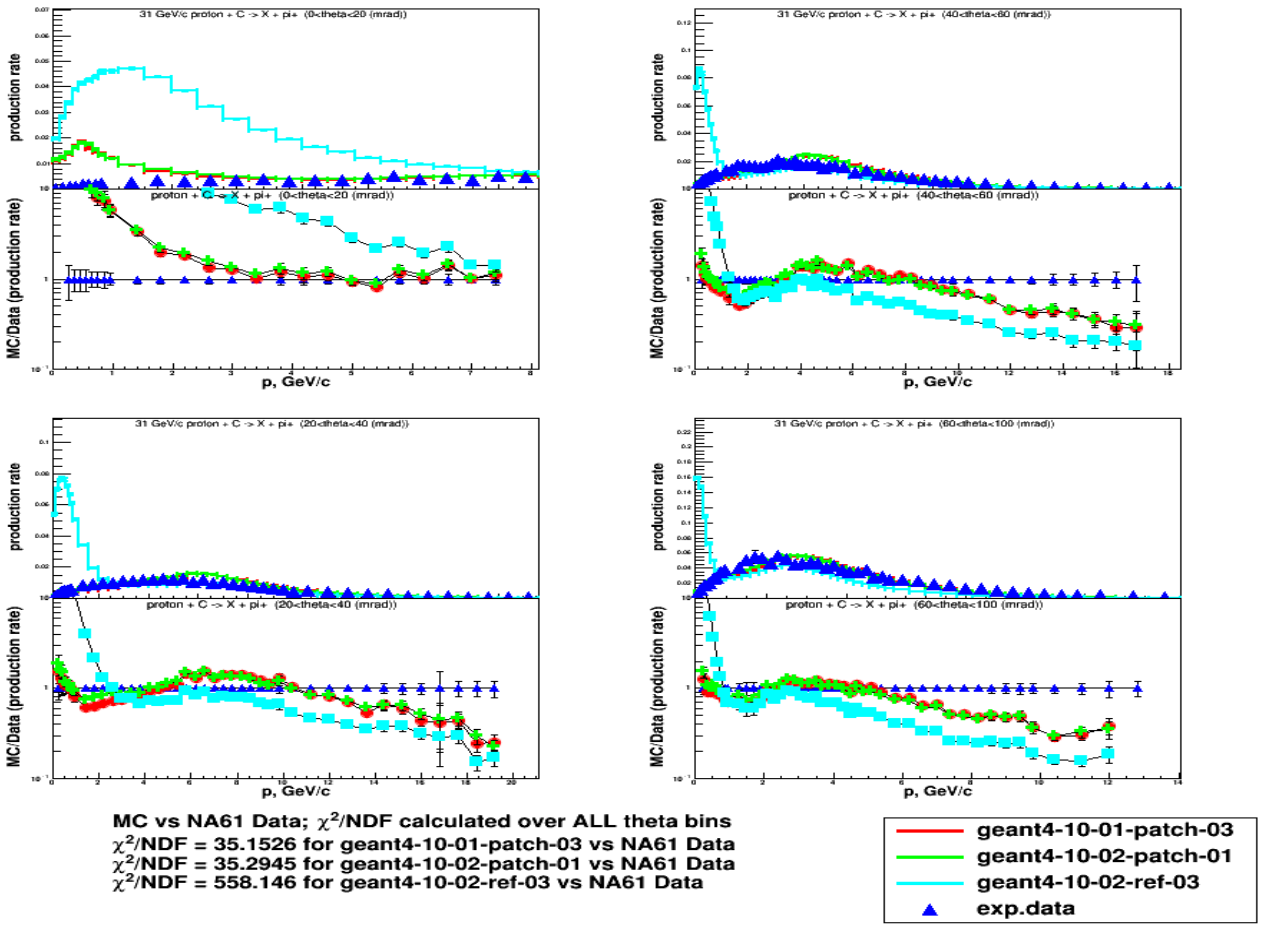
Validation Tools, Archiving, etc.

- VDB is undergoing upgrade, including underlying DB schema
- Latest validation results have not been uploaded yet, but will be uploaded shortly
- There is an effort to upgrade test19 and make it pickup experimental datasets for validation directly from the DB (as opposed to ASCII files saved in SVN)
  - A proof-of-principle was shown at our VDB meeting last week
    - Thanks to Dima K. !!!
  - I was really hoping to declare such migration this time but… we need a few more days to finalize the involved software tools
- Tests in question already involve some statistical analysis (chi2); however, we plan to expand the effort, including consolidation of available software tools

BACKUP SLIDES (PLOTS)

QGSP: 31GeV/c p+C -> π^++X (I)

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



QGSP: 31GeV/c p+C -> π^++X (II)

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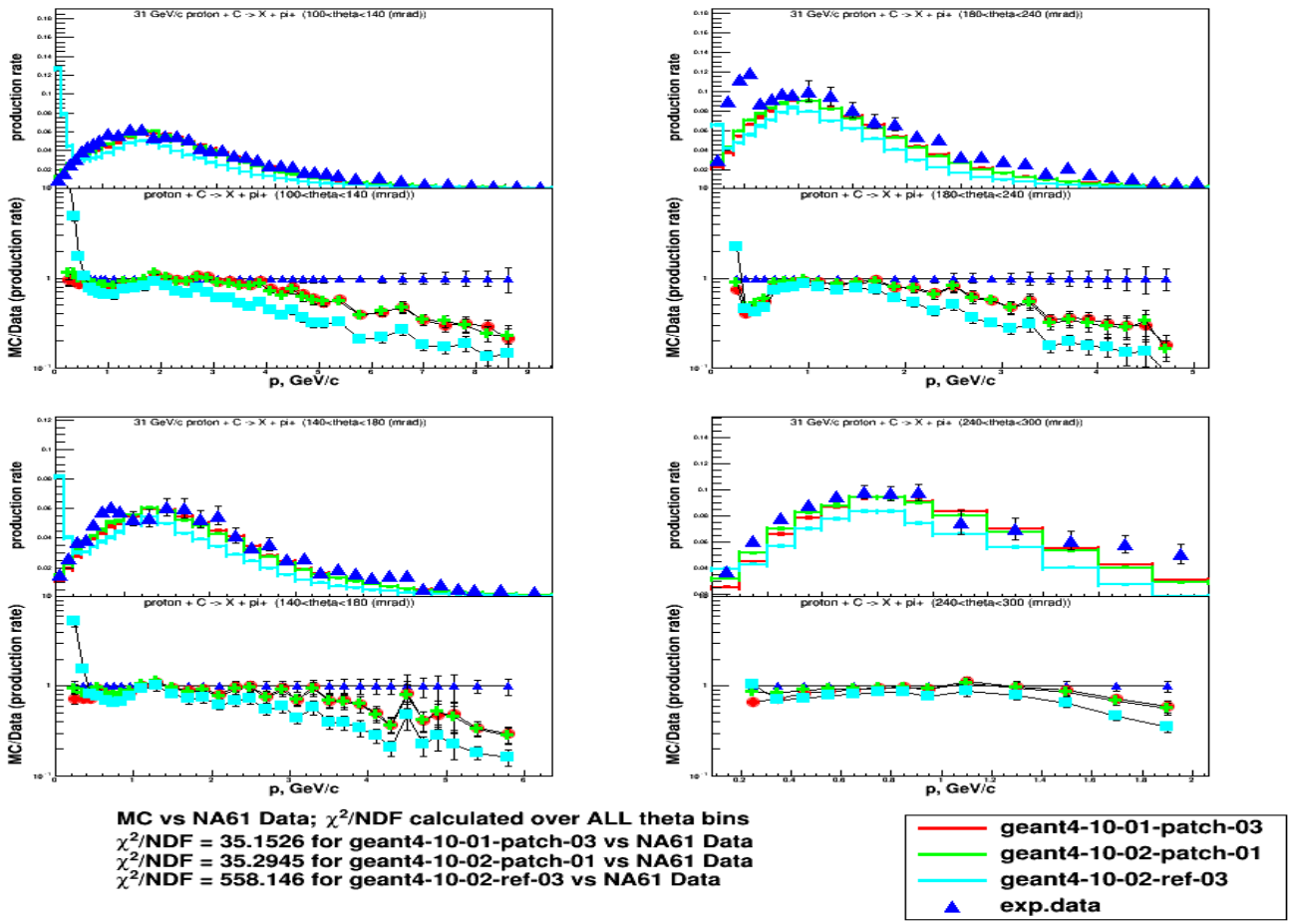

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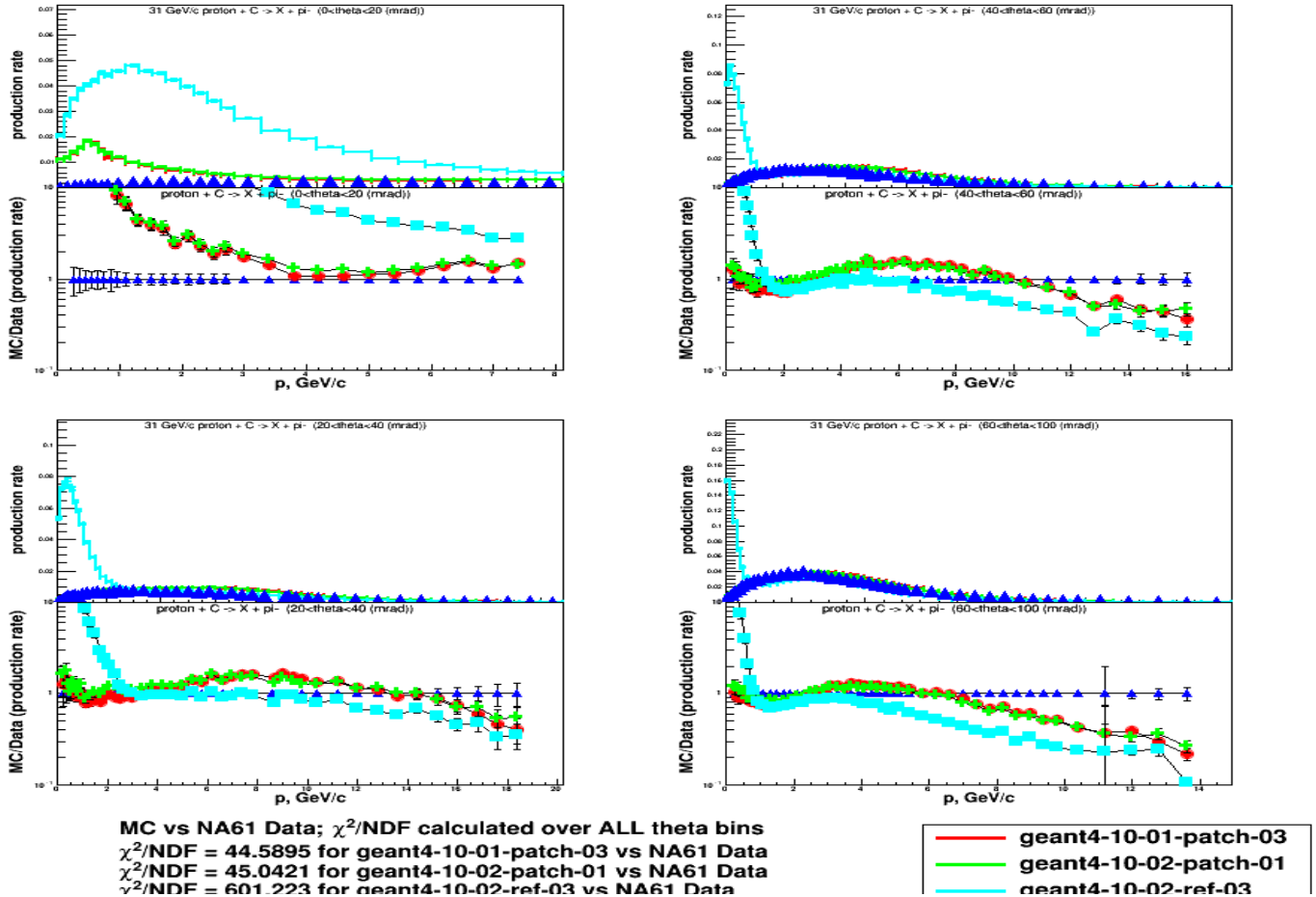

QGSP: 31GeV/c p+C -> π^-+X (II)

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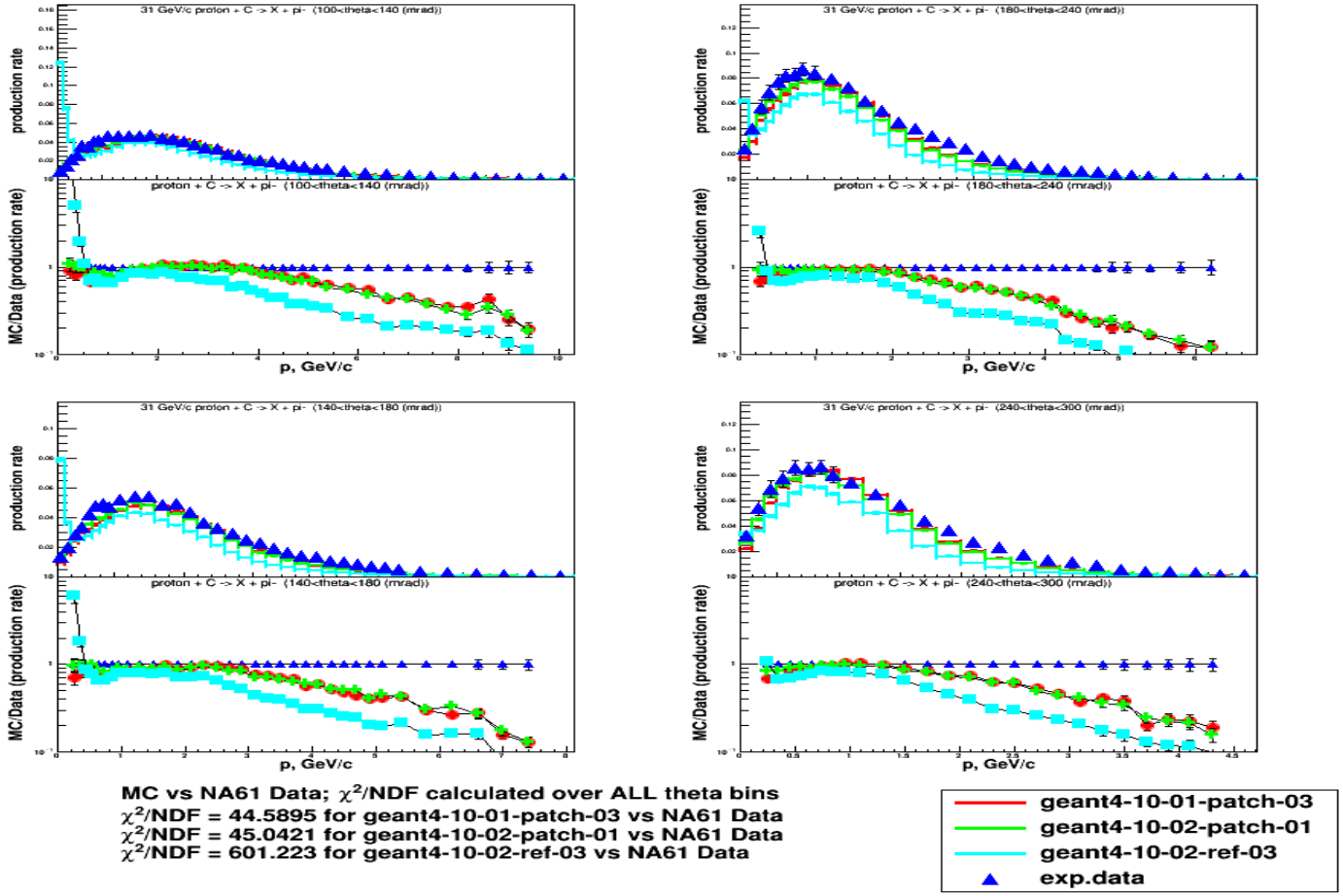

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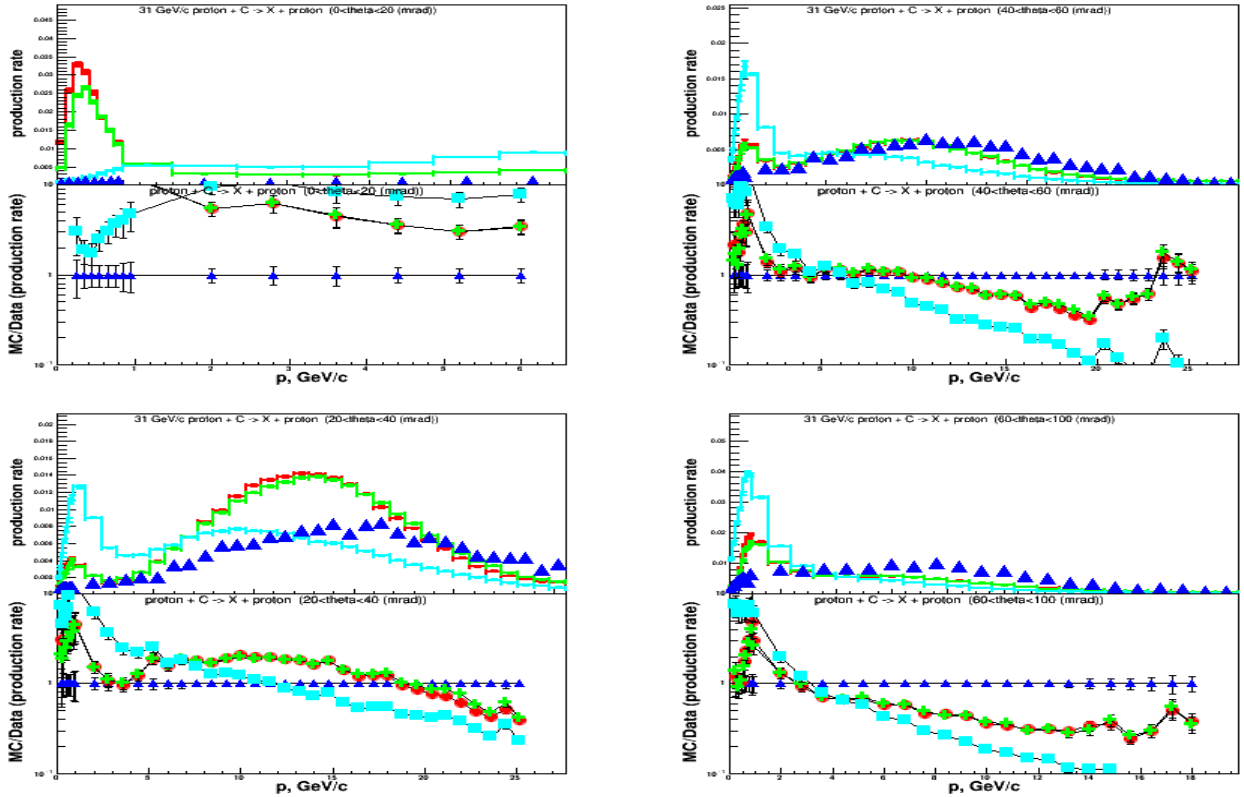
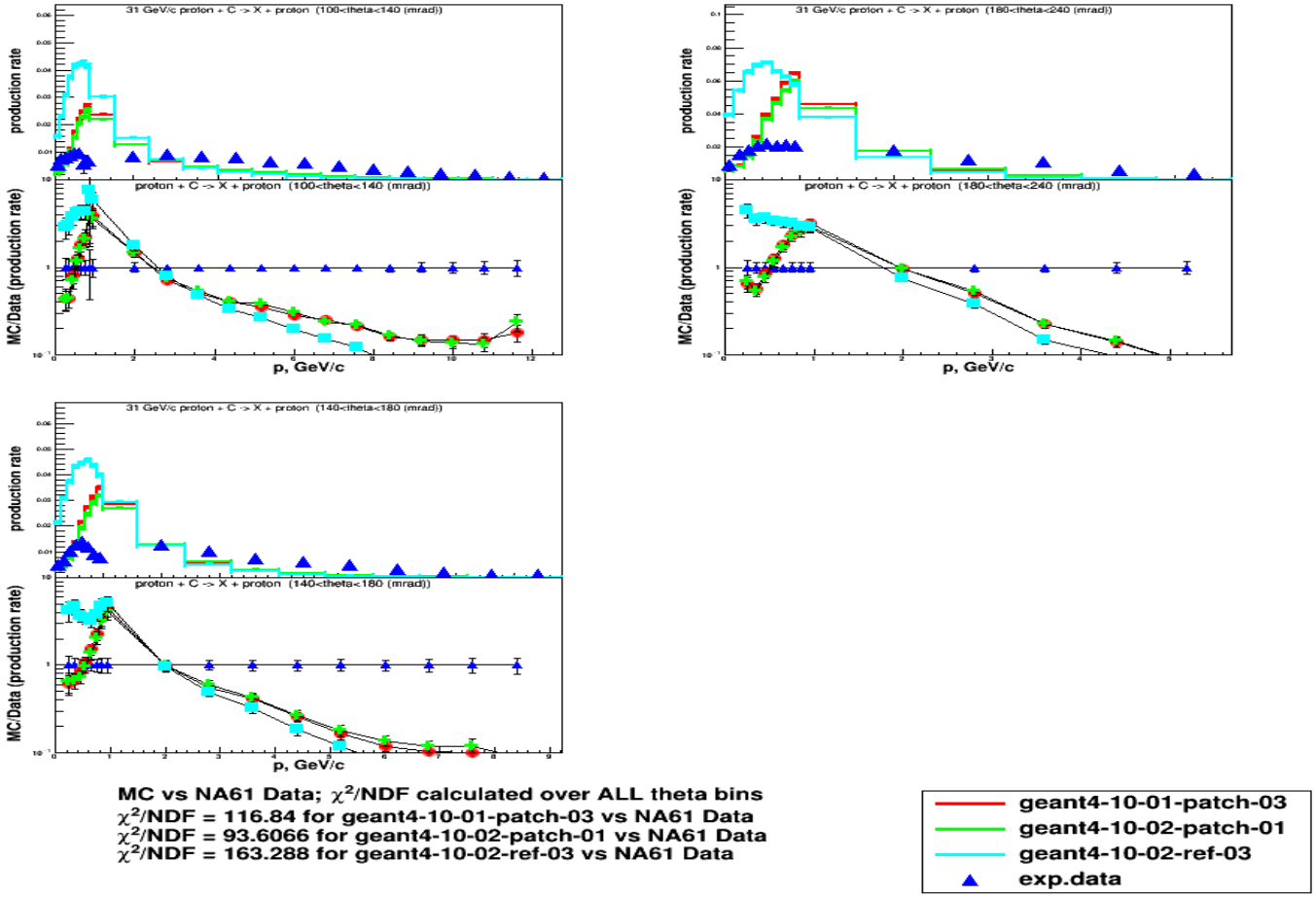


MC vs NA61 Data; χ^2/NDF calculated over ALL theta bins
χ^2/NDF = 116.84 for geant4-10-01-patch-03 vs NA61 Data
χ^2/NDF = 93.6066 for geant4-10-02-patch-01 vs NA61 Data
χ^2/NDF = 163.288 for geant4-10-02-ref-03 vs NA61 Data

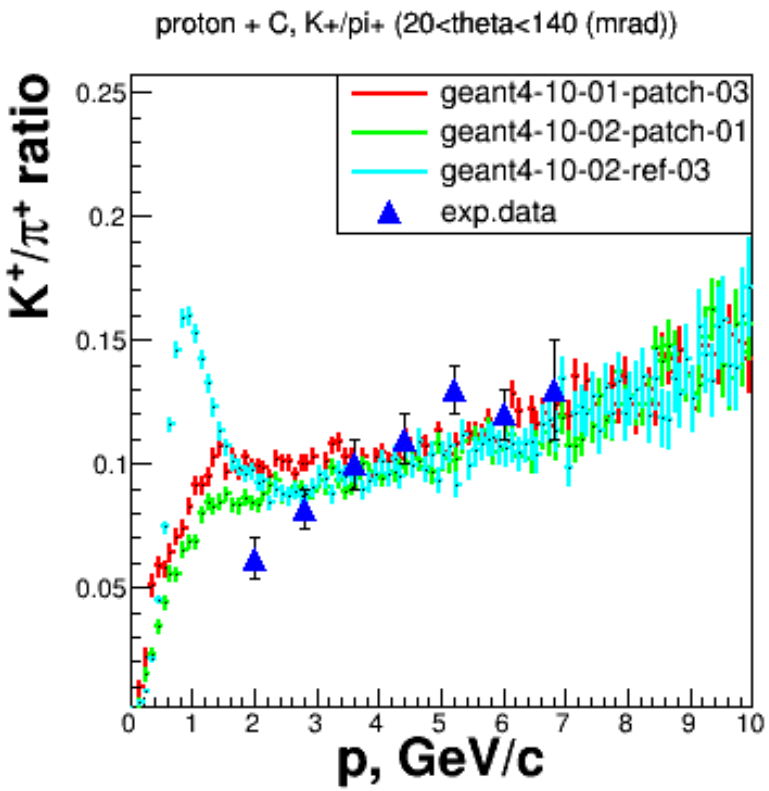
QGSP: 31GeV/c p+C -> p+X (II)

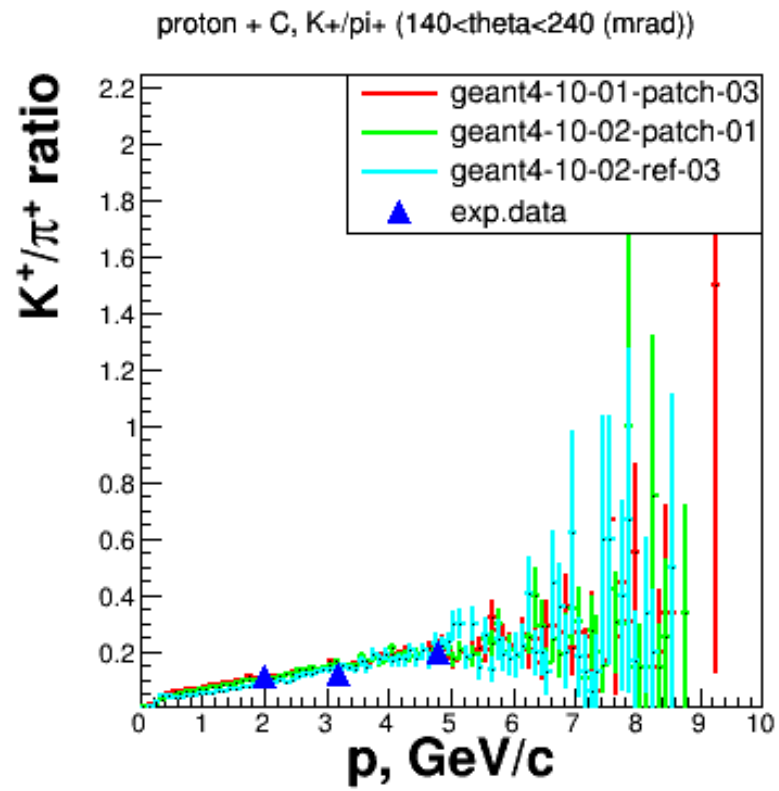
NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)



QGSP: K+/π^+ in 31GeV/c p+C

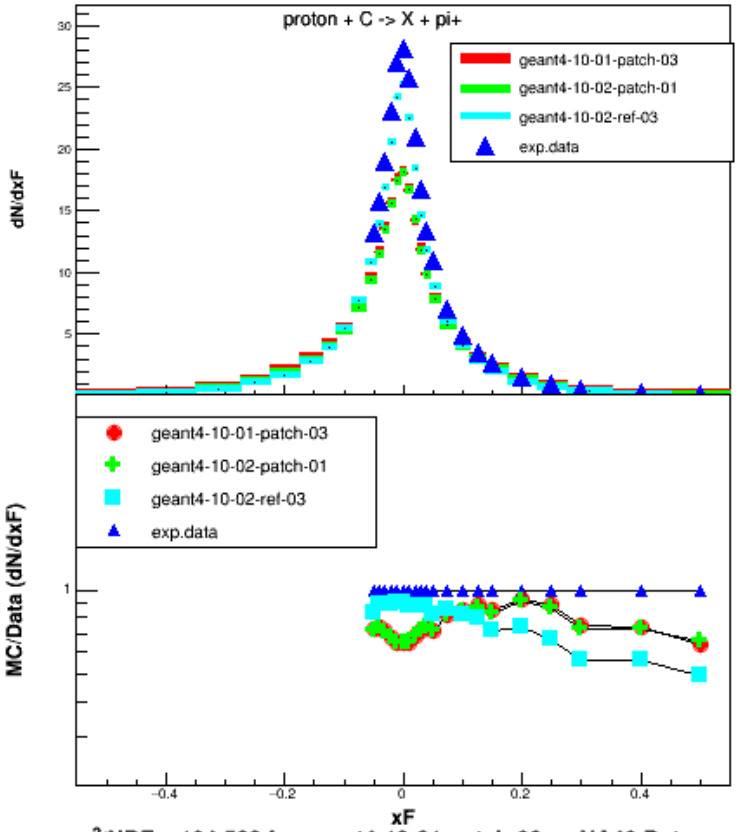
NA61 Data: N.Abgrall et al., Phys.Rev. C84, 034604 (2011)



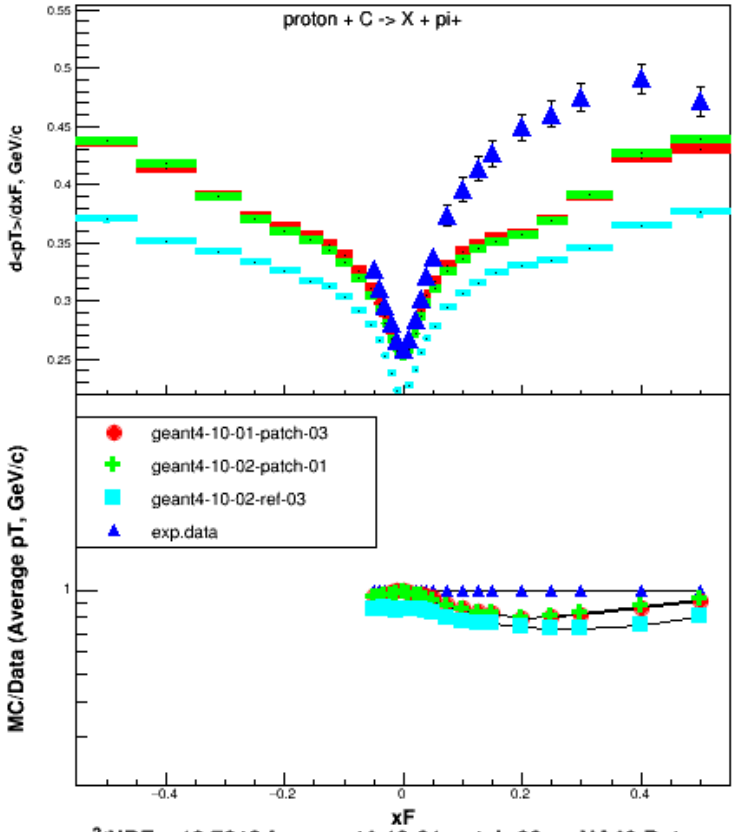


QGSP: 158GeV/c p+C -> π^++X

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



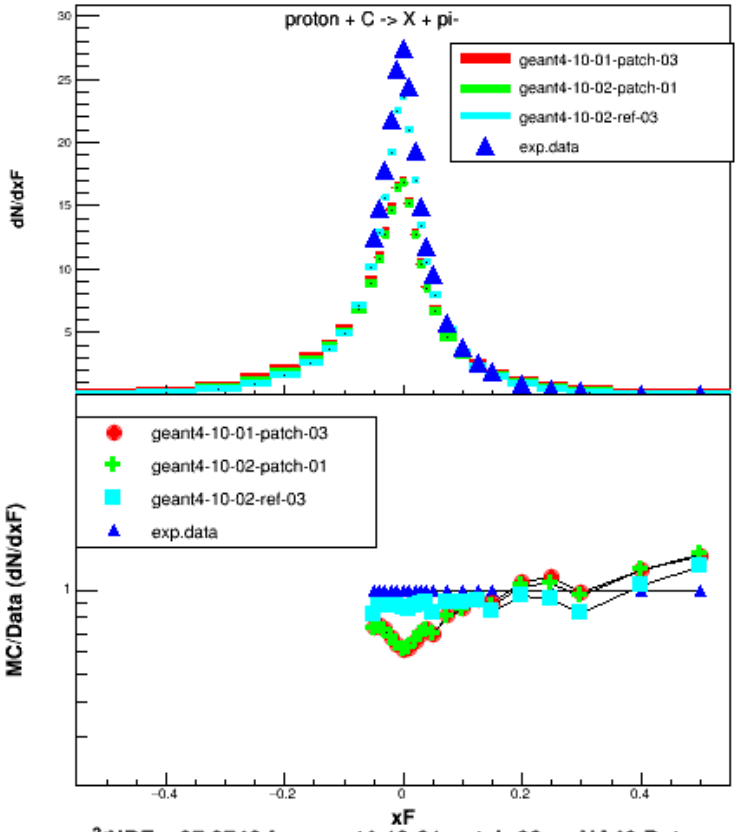
χ^2/NDF = 104.566 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 107.85 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 81.1524 for geant4-10-02-ref-03 vs NA49 Data



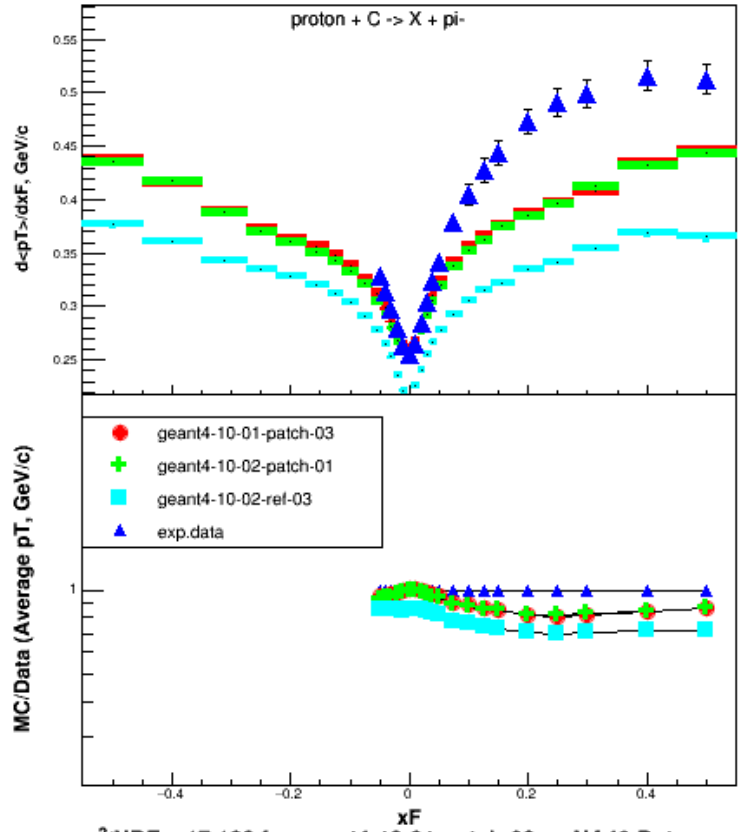
χ^2/NDF = 18.7212 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 20.3901 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 61.8418 for geant4-10-02-ref-03 vs NA49 Data

QGSP: 158GeV/c p+C -> π^-+X

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



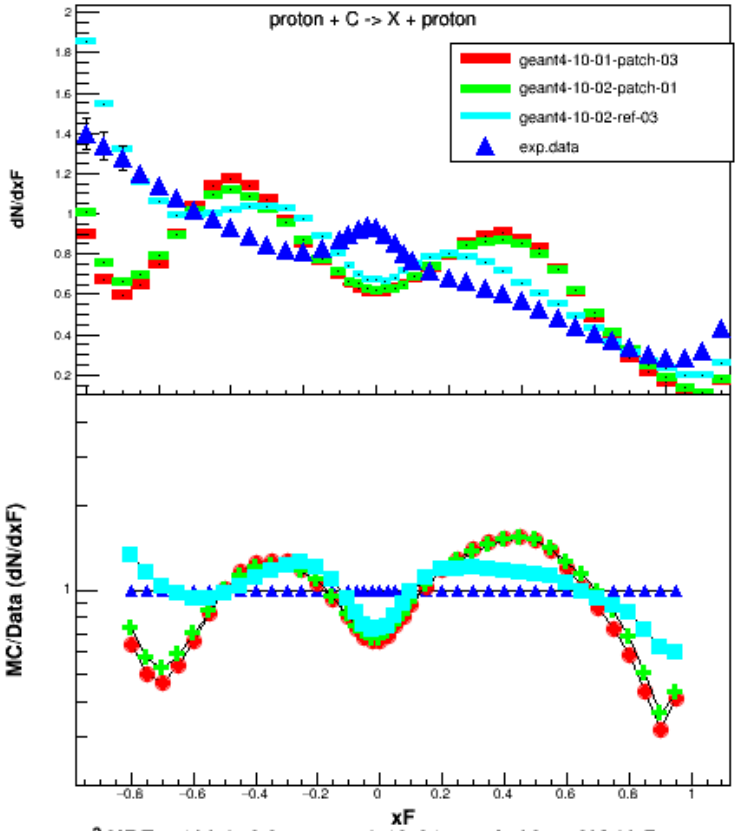
χ^2/NDF = 97.9746 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 100.671 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 24.1535 for geant4-10-02-ref-03 vs NA49 Data



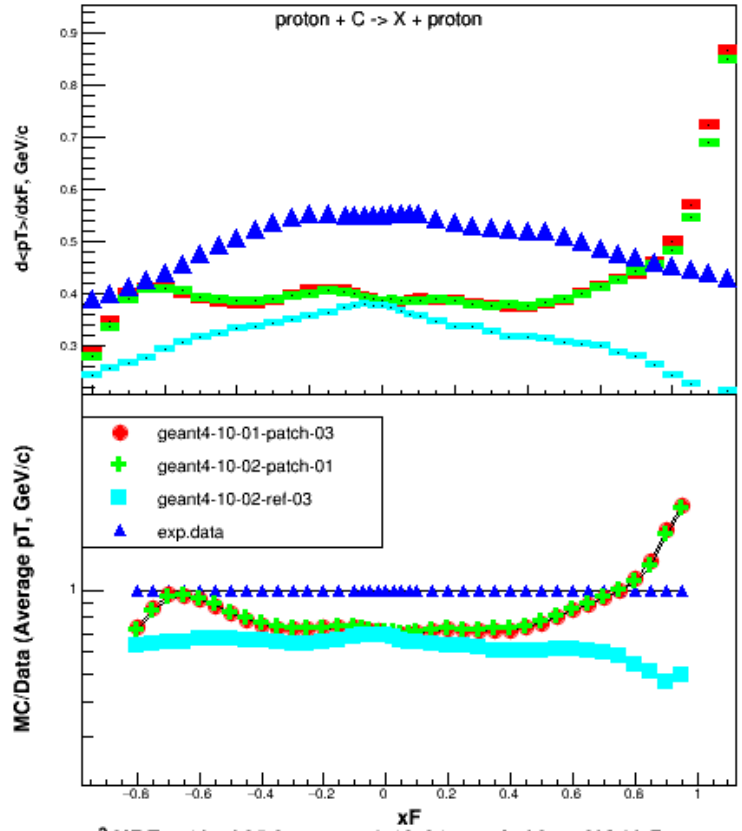
χ^2/NDF = 17.128 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 18.5 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 72.9948 for geant4-10-02-ref-03 vs NA49 Data

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

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



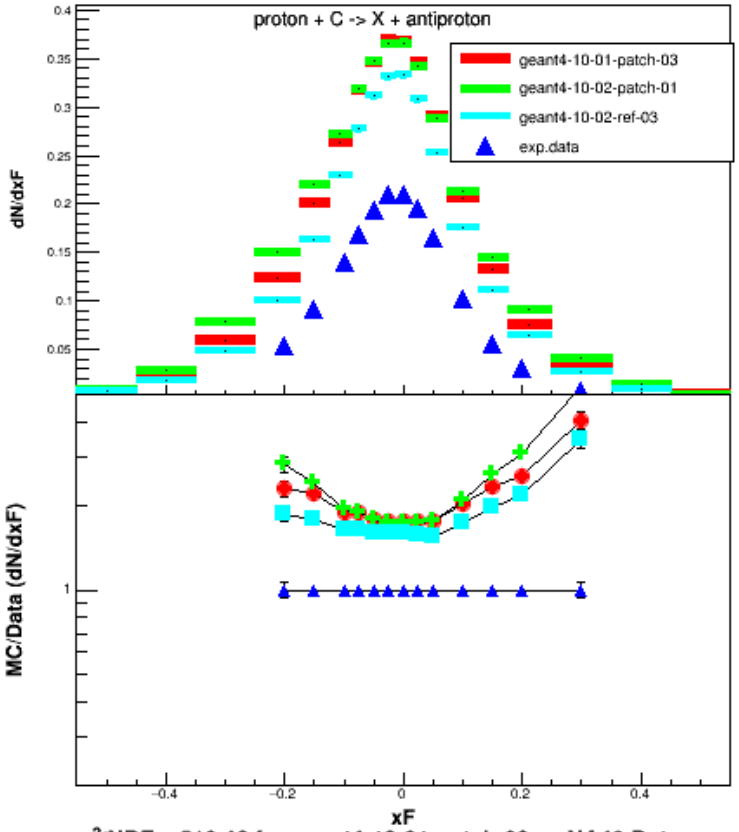
χ^2/NDF = 103.019 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 88.8157 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 30.3175 for geant4-10-02-ref-03 vs NA49 Data



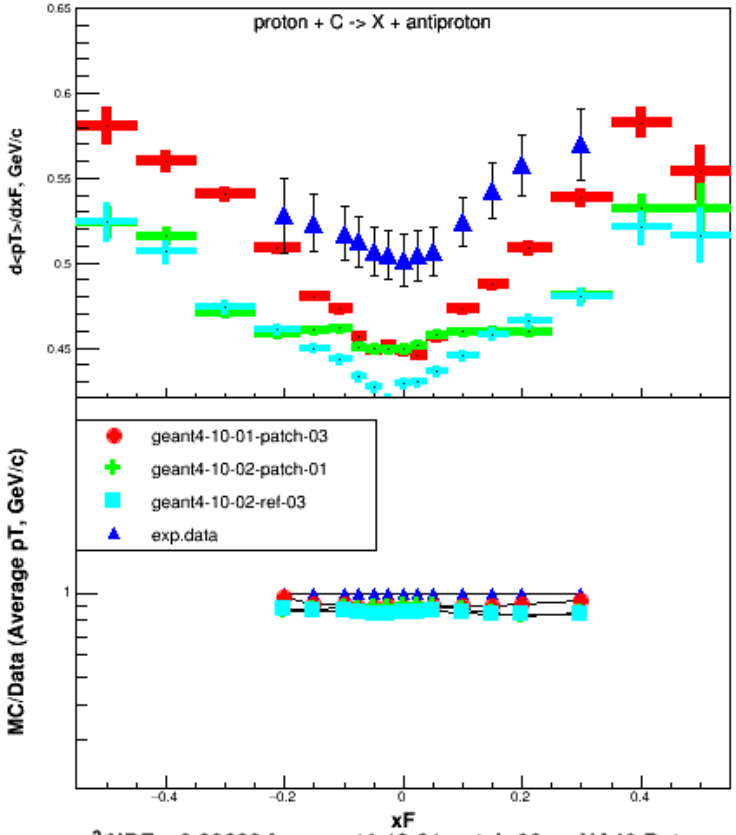
χ^2/NDF = 121.335 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 114.622 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 195.47 for geant4-10-02-ref-03 vs NA49 Data

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

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



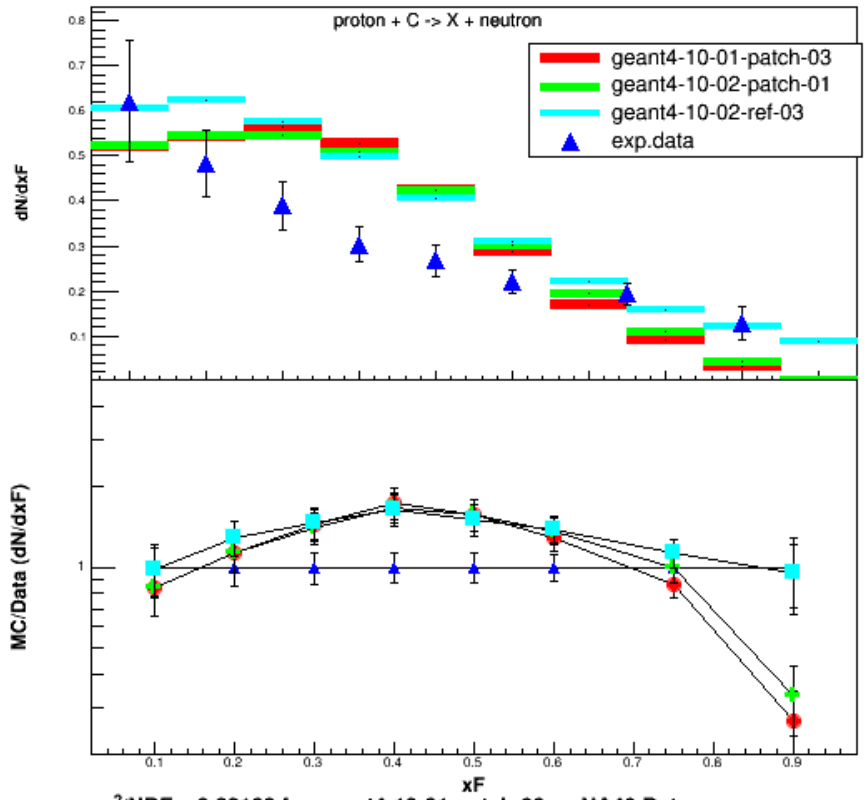
χ^2/NDF = 510.46 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 672.136 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 294.046 for geant4-10-02-ref-03 vs NA49 Data



χ^2/NDF = 9.90636 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 15.8816 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 23.3583 for geant4-10-02-ref-03 vs NA49 Data

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

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



χ^2/NDF = 9.82183 for geant4-10-01-patch-03 vs NA49 Data
χ^2/NDF = 9.1265 for geant4-10-02-patch-01 vs NA49 Data
χ^2/NDF = 8.58541 for geant4-10-02-ref-03 vs NA49 Data