

G4 Validation Tests: RPG, FTF, BERT+Fixes

Status of Work at FNAL

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Geant4 Harmonic Group Meeting

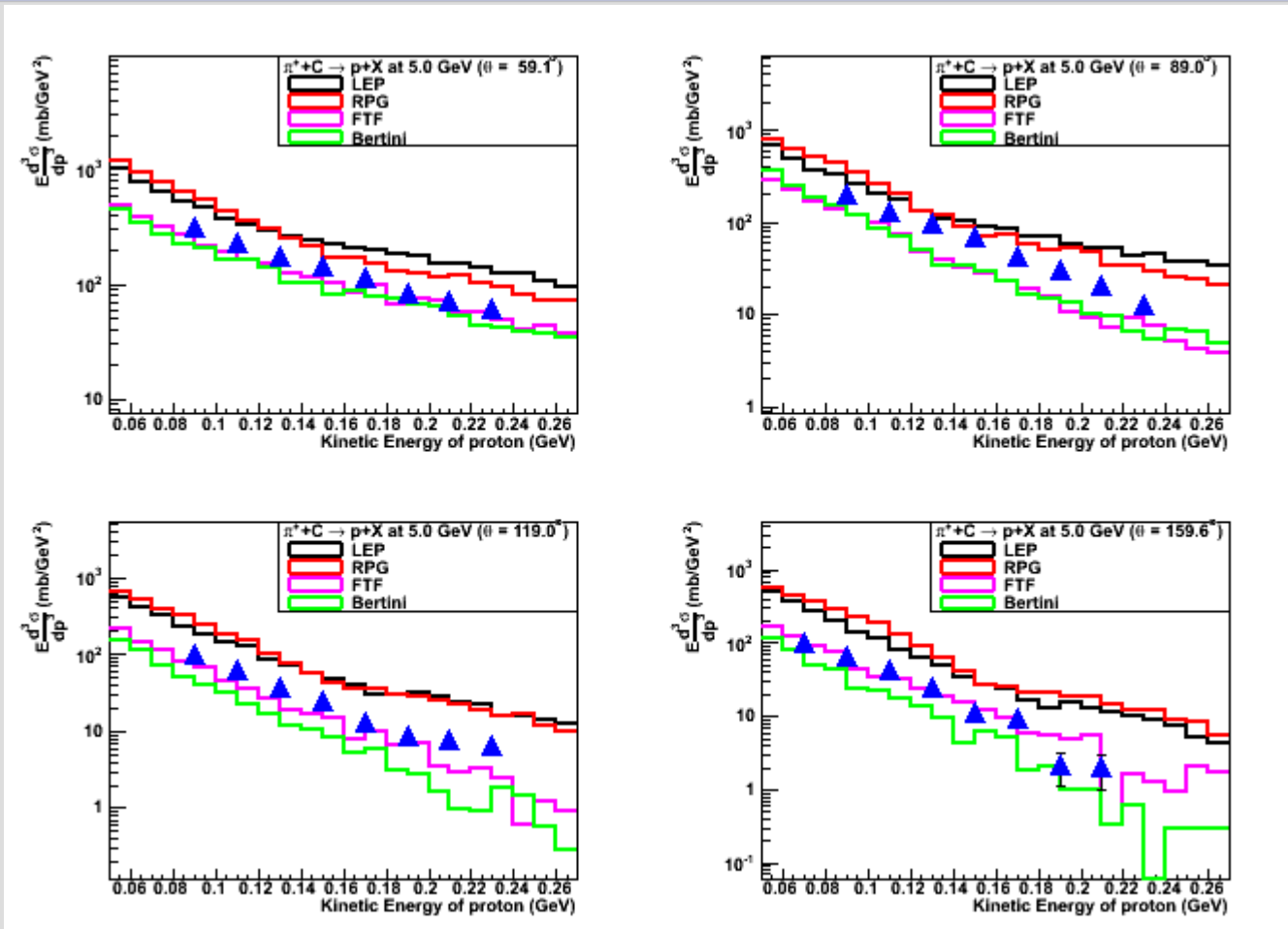
April 24, 2008



General Information

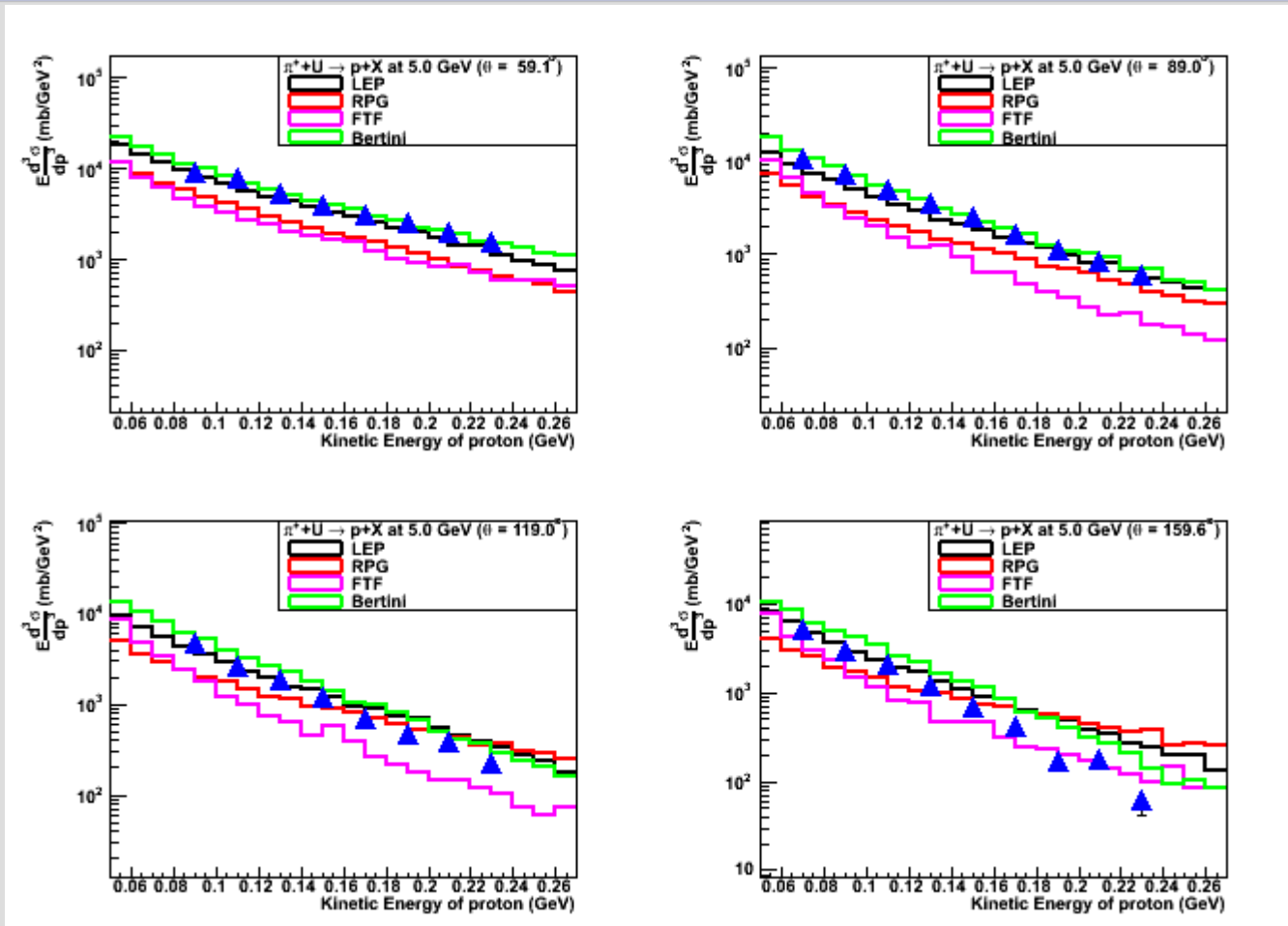
- **Test most recent developments and updates in G4/HAD**
- **Follow-up of earlier efforts: reports by S.Banerjee, J.Yarba in Sept.07, Nov.07, Jan.08, Feb.08**
- **Data Sets: ITEP-148-1983, Phys.Atom.Nucl. v42, p116**
- **Measurements of current interest: inclusive proton or neutron production in $\pi^+/\pi^-/p$ -nucleus interactions; beam energy 5GeV; C, U targets**
- **Data quality: stat.err.1-10%, syst.err.quoted at 5-6%**
- **Ref.tag geant4-09-01-ref-03 + RPG (CVS HEAD) + Coulomb barrier in Bertini model + fixes to Q-elastic**
- **Models: RPG, FTF, Bertini, LEP (for reference)**

$\pi^+ C \rightarrow p X$ at 5.0 GeV



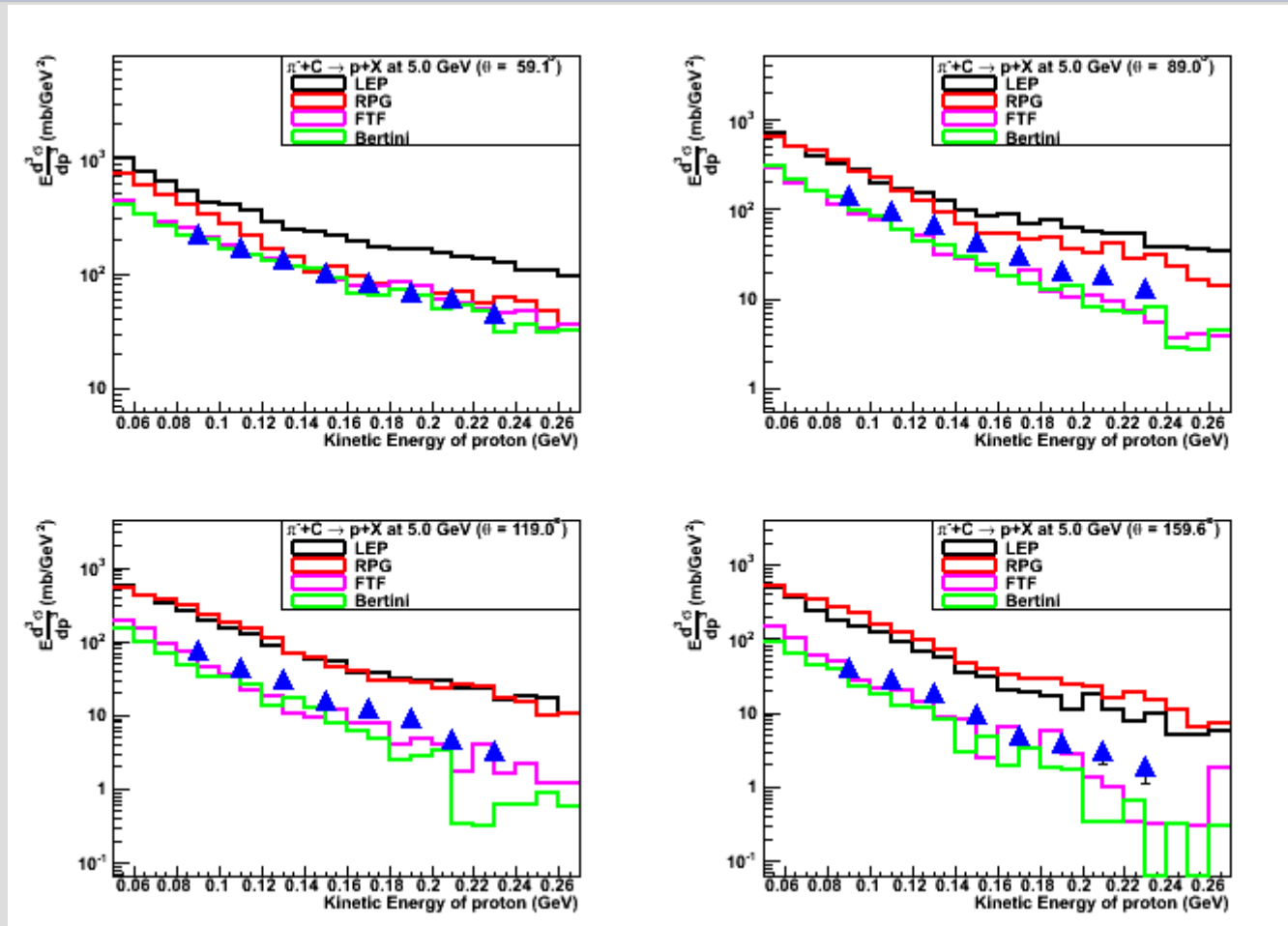
FTF good (except somewhat off at right angle); Bertini reasonable; LEP & RPG off

$\pi^+ U \rightarrow p X$ at 5.0 GeV



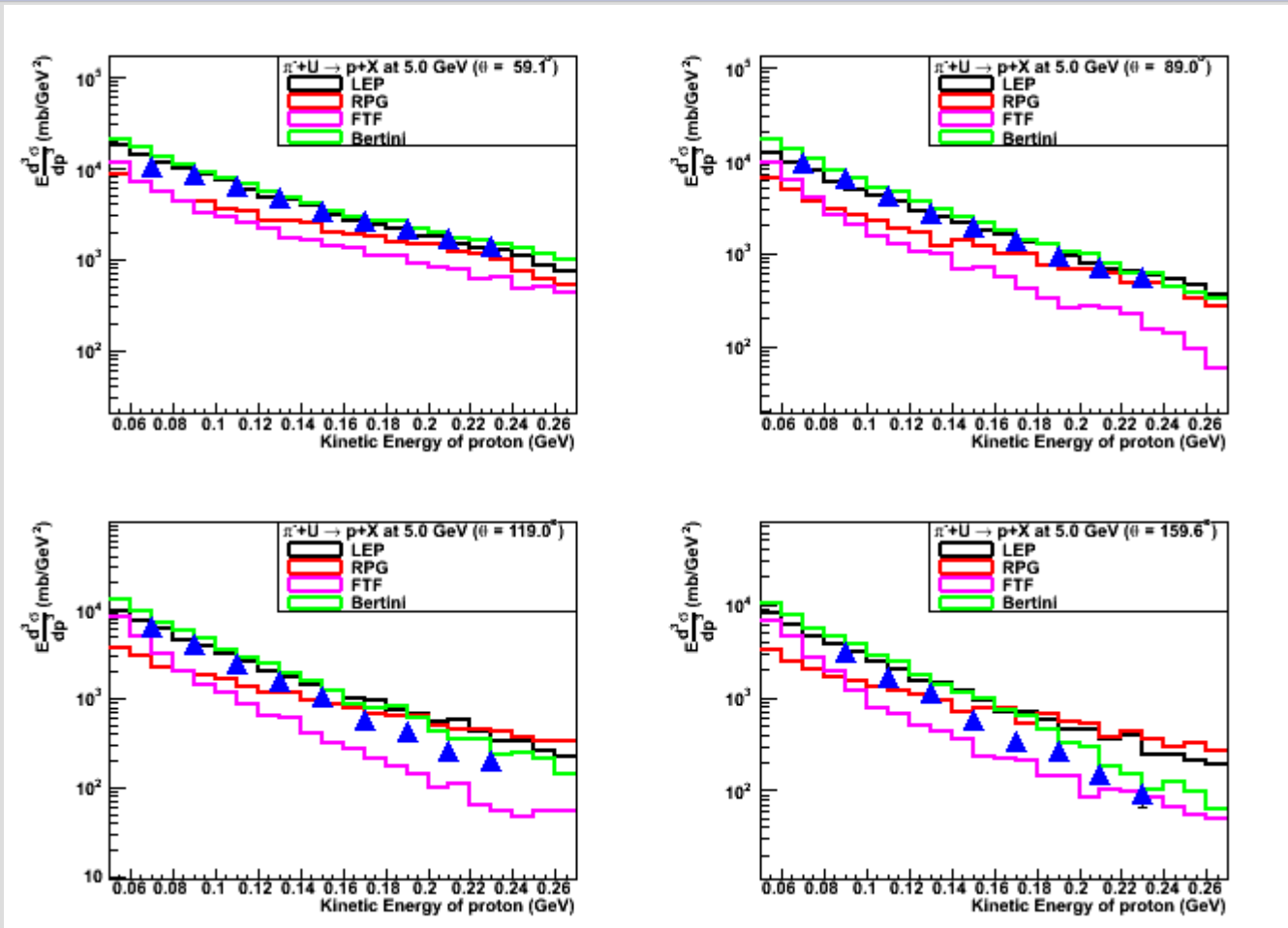
LEP, Bertini OK (somewhat off in very bck); RPG off; FTF mostly off but very bck

$\pi^- C \rightarrow p X$ at 5.0 GeV



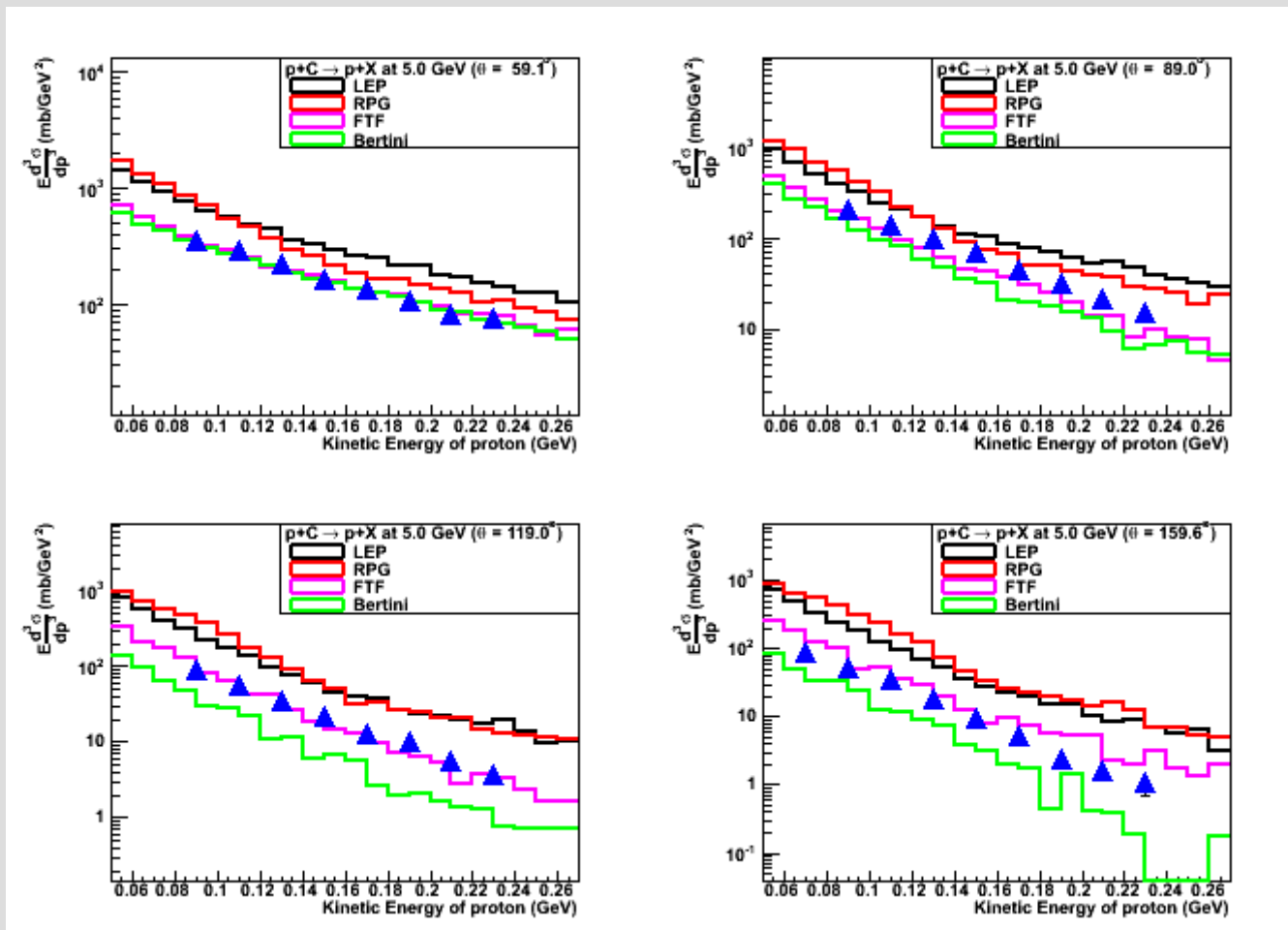
Bertini, FTF good; RPG reasonable only in fwd, off in bck; LEP off everywhere

$\pi^- U \rightarrow p X$ at 5 GeV



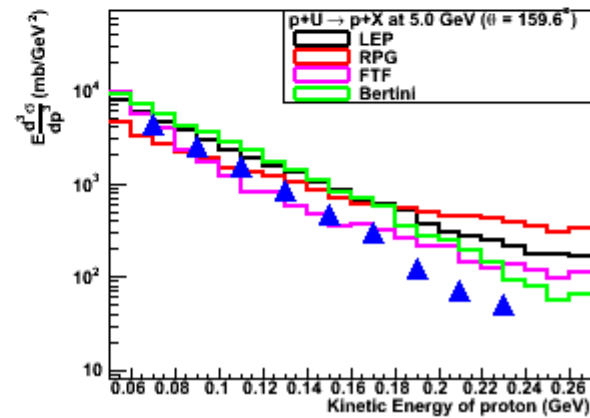
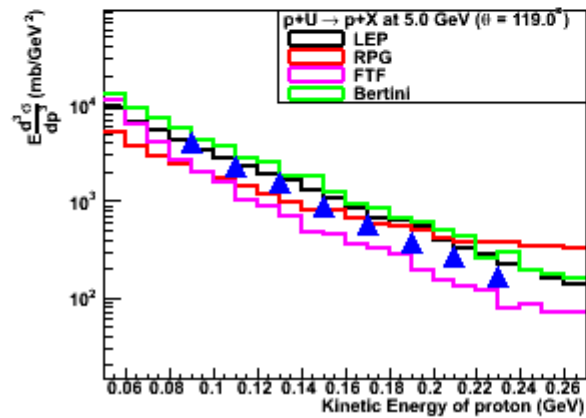
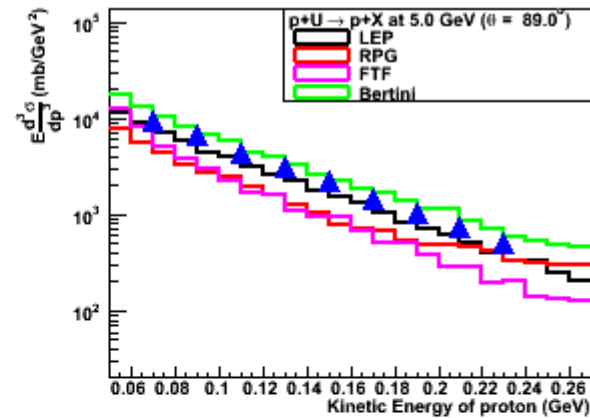
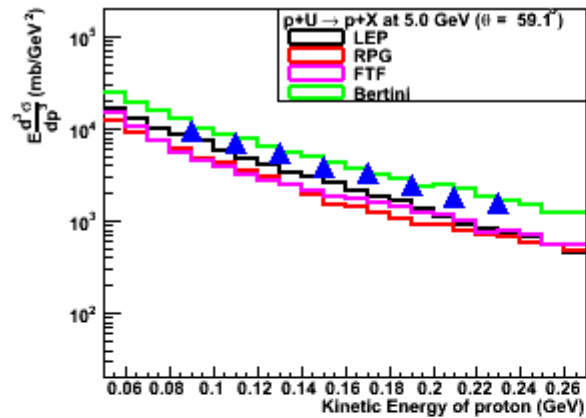
Bertini OK; LEP mostly OK but very bck; RPG reasonable in some areas; FTF off

p C -> p X at 5.0GeV



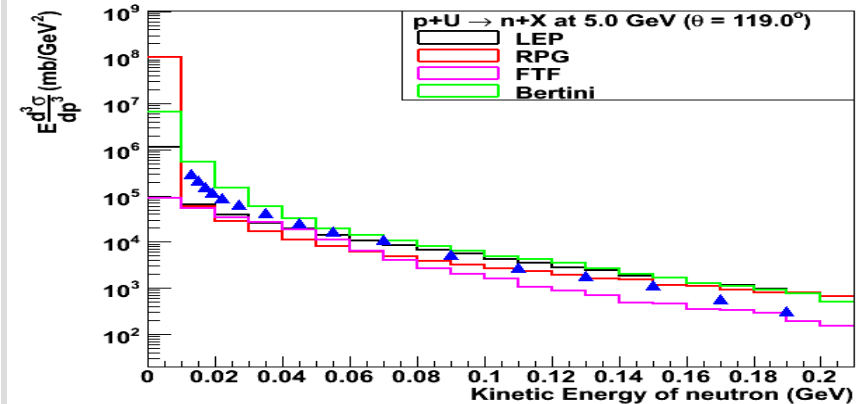
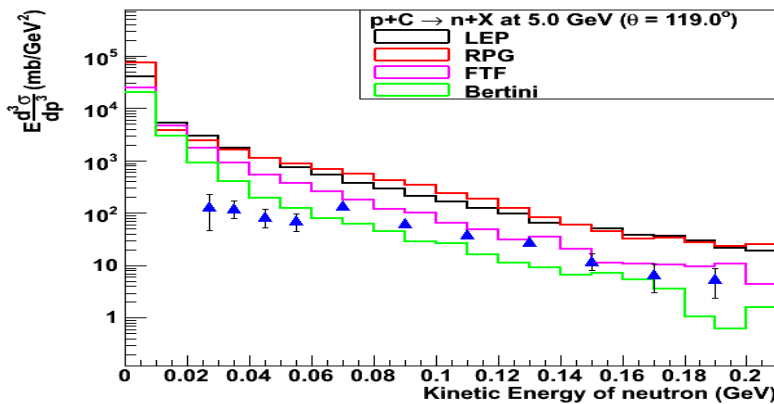
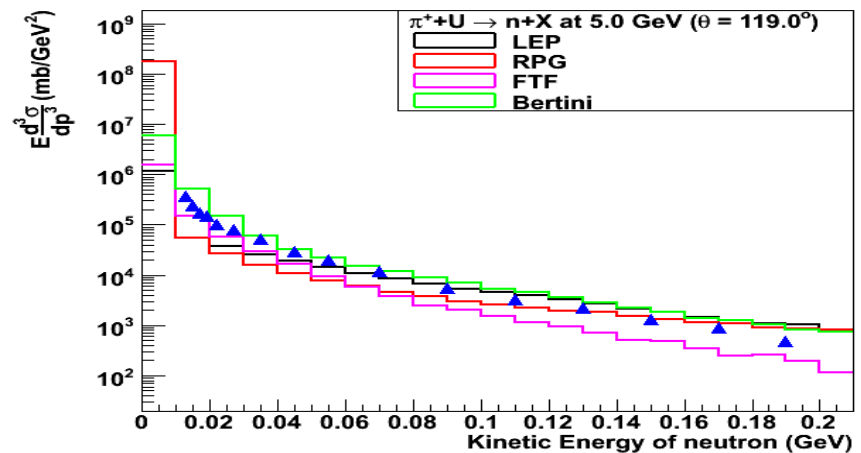
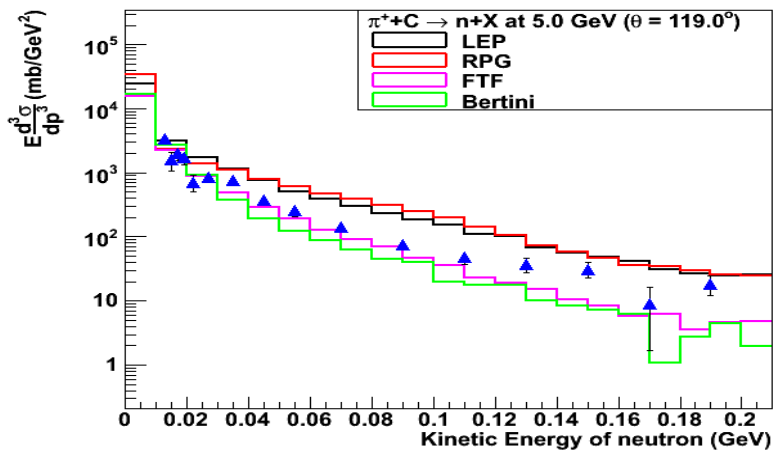
FTF good; Bertini good in fwd, off in bck; LEP, RPG off

p U -> p X at 5.0GeV



LEP OK except very bck; Bertini reasonable except very bck; NO model is good in very bck

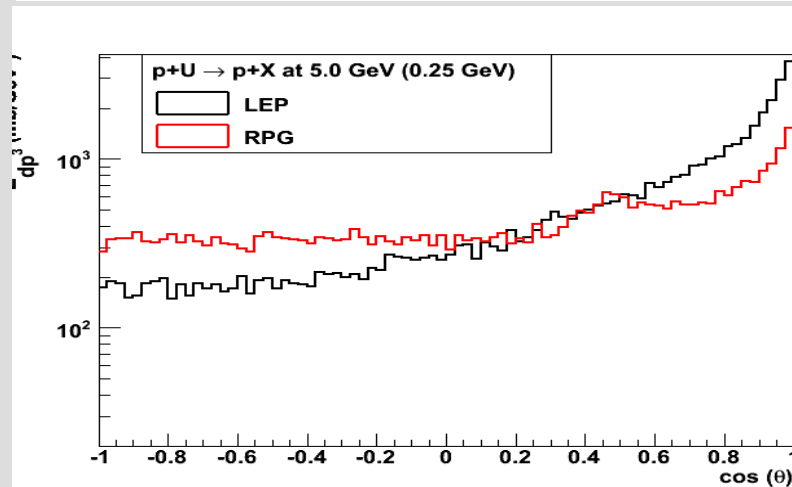
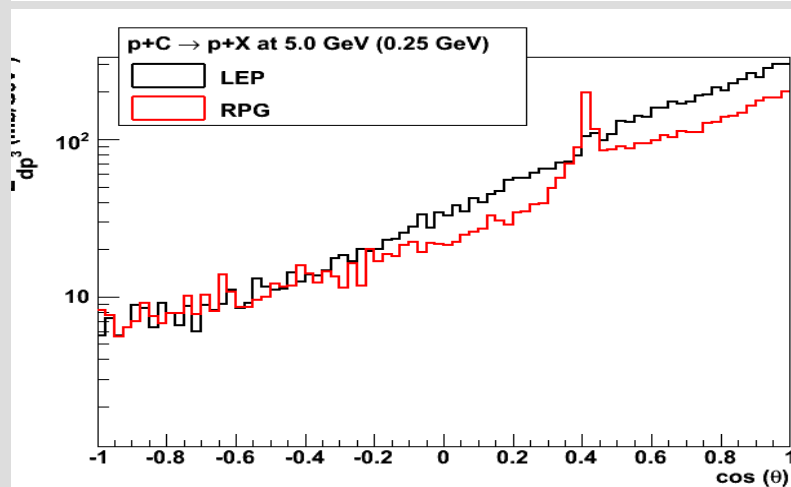
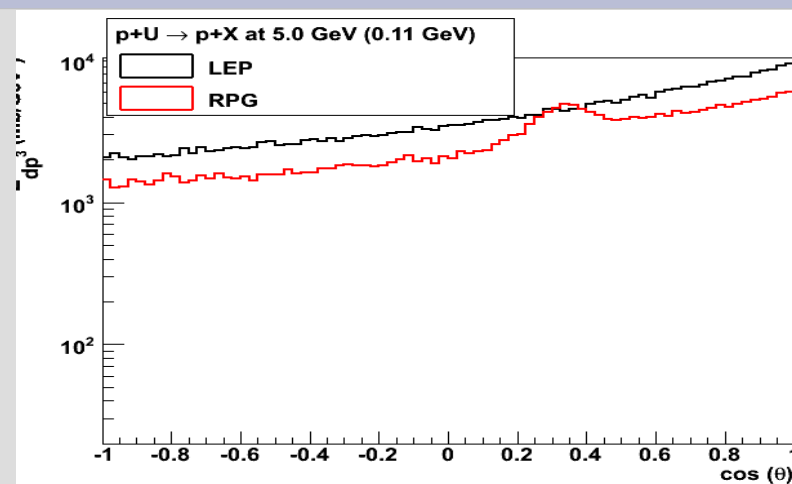
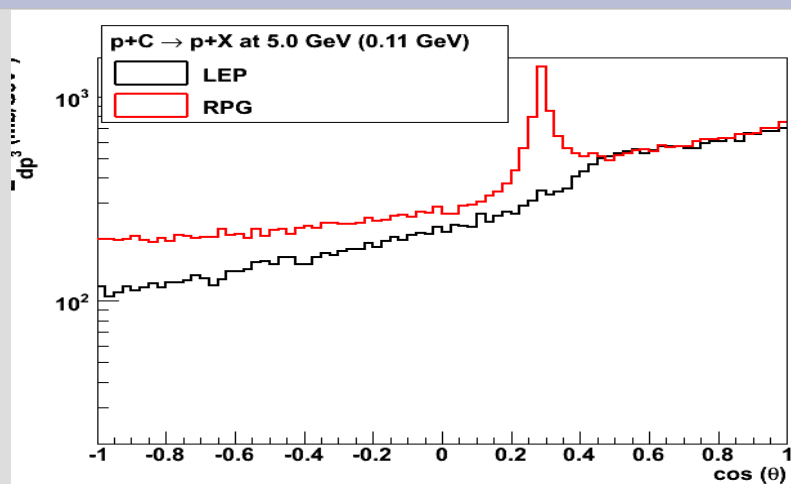
$\pi^+ A, p A \rightarrow n X$ at 5.0 GeV, at 119.0deg



Bertini, FTFP better for light target; all models are comparable for heavy target, FTF somewhat off

RPG: problems in angular distributions

(similar pattern for all beams, final state particles)



Abnormal peak: position depends of the KE of the final state particle, shape depends on target type

Notes on CPU

- **LEP and RGP are of about the same speed and are the fastest of all models**
- **Bertini and FTF are at least 2 times slower than LEP/RPG**
- **Adding Coulomb barrier to the Bertini model does NOT seem to affect the speed**

Summary

- For a light target (C), FTF predictions are closest to the data; Bertini is also pretty reasonable in most areas
- For a heavy target (U), LEP fits exp.data well in most cases; Bertini is also close
- RPG is operational, gives results similar to LEP for light target, but often predicts smaller cross-sections for heavy target; also, abnormal peaks observed in angular distributions of the final state particles
- Over a variety of tests, Bertini still shows as “most universal”; RPG definitely needs work