

# Hadronic Validation – Geant4.9.6-ref03

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Geant4 Hadronic Meeting

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## General Remarks

- Reference release: *Geant4.9.6.p01*
- Included tests:  
test48, test47 (part), test19 (previous talk), test75
- All materials will be uploaded in the *G4 Validation Repository* shortly



## Test48: Capture/Annihilation

- Only Bertini(PreCo) and FTF
- Negligible variation for  $\pi^-$  on C (Bertini)
- No other changes observed for  $\pi^-$
- Also stable for  $K^-$ ,  $\Sigma^-$ ,  $p\bar{p}$
- Muon capture is NOT tested - will be a separate report soon

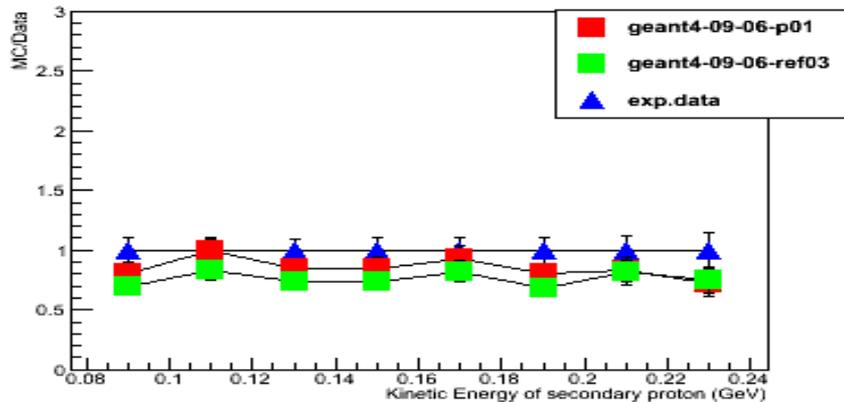


## Test47: Intermediate Energy (up to 7.5GeV)

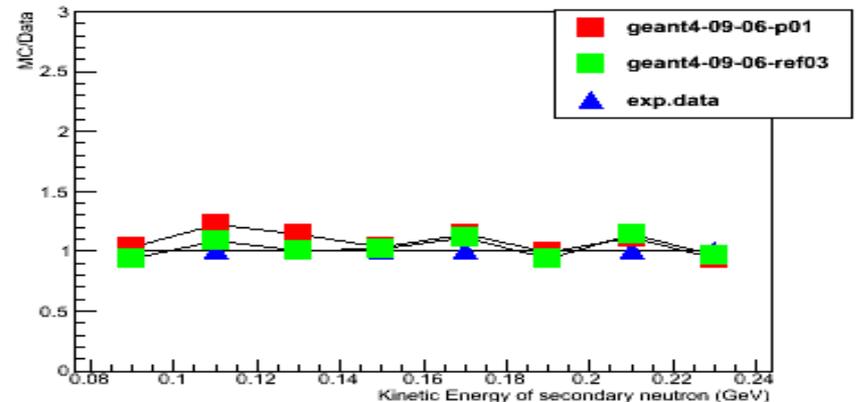
- Models: Bertini, Binary, FTF; INCL++ in the plans
- General observation:  
Bertini is best overall across the board
- FTF - minor variations between 9.6-ref03 and 9.6.p01 (i.e. deviation from data vs 9.6.b01 are still there)
- Variations in Binary between 9.6.-ref03 and 9.6.p01 for pion on light target, no significant changes for proton - more details next time
- Variations in Bertini 9.6-ref03/9.6.p01 for pions - sometimes good, sometimes no; see following slides/plots variations for protons within errors

## Test47 (cont.): 1.4 GeV pi- on C -> p, n + X

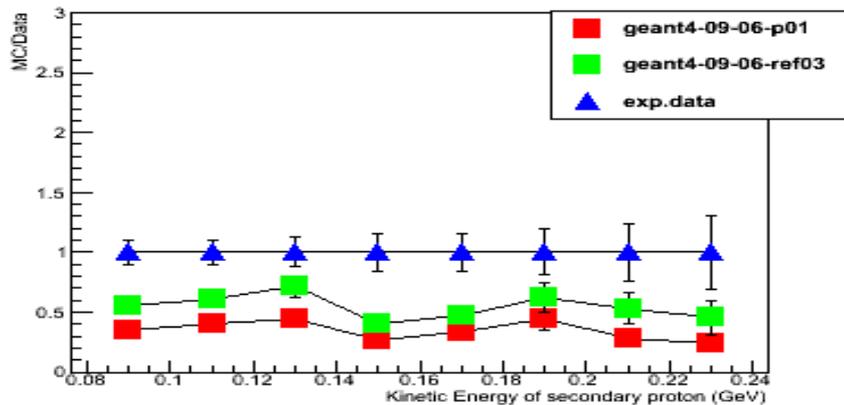
piminus+C to p at 1.40 GeV (bertini) ( $\theta = 59.10$ )



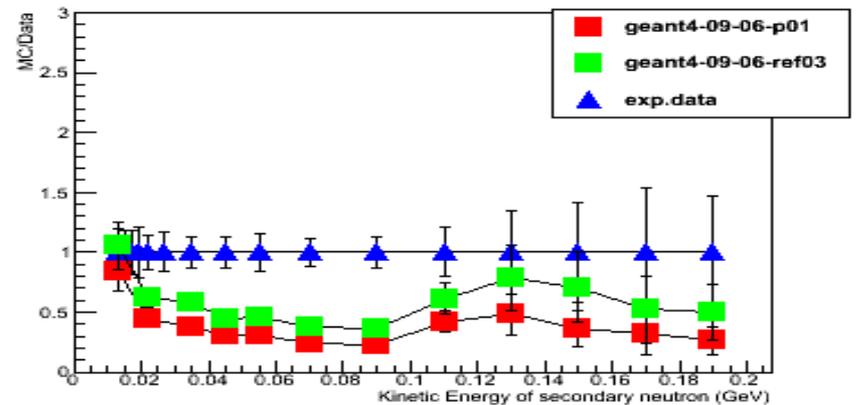
piminus+C to n at 1.40 GeV (bertini) ( $\theta = 59.10$ )



piminus+C to p at 1.40 GeV (bertini) ( $\theta = 119.00$ )

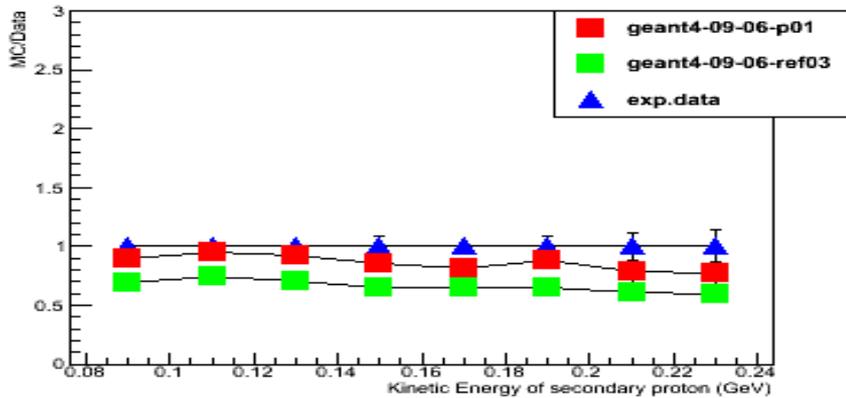


piminus+C to n at 1.40 GeV (bertini) ( $\theta = 119.00$ )

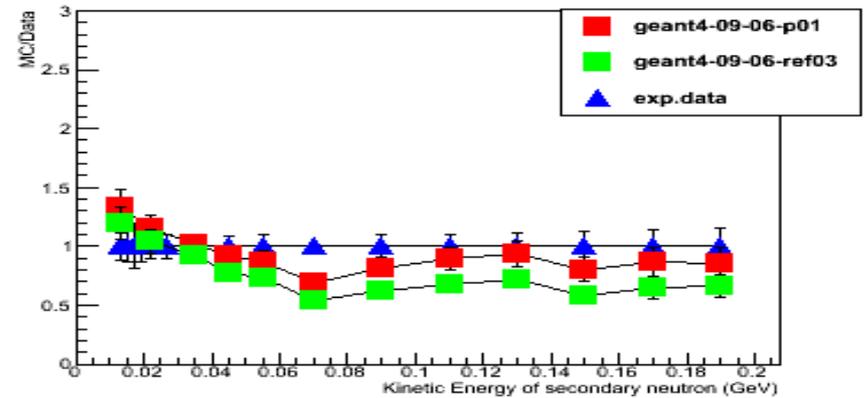


## Test47 (cont.): 5.0 GeV pi- on C -> p, n + X

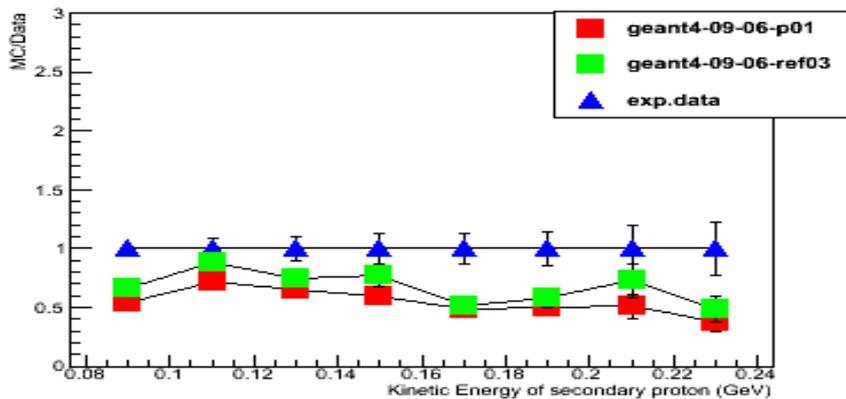
piminus+C to p at 5.00 GeV (bertini) ( $\theta = 59.10$ )



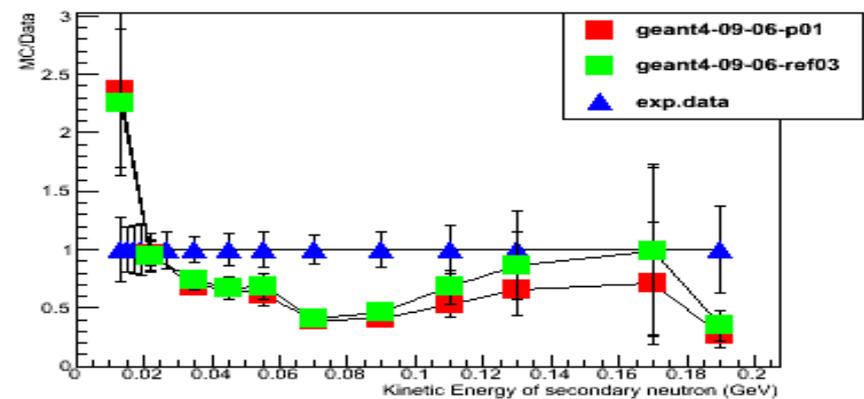
piminus+C to n at 5.00 GeV (bertini) ( $\theta = 59.10$ )



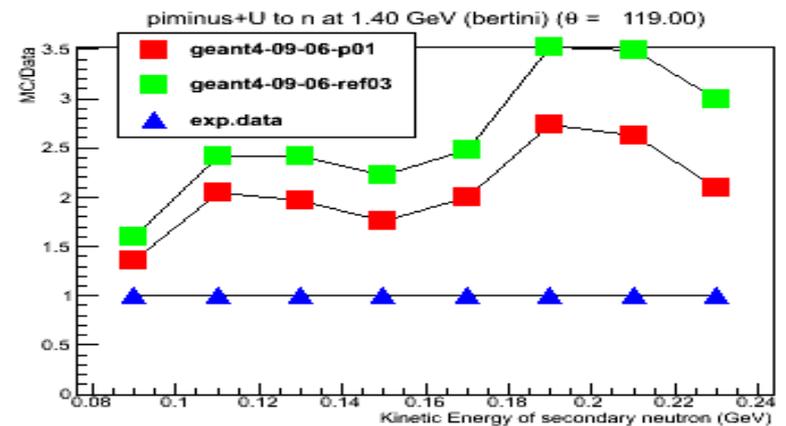
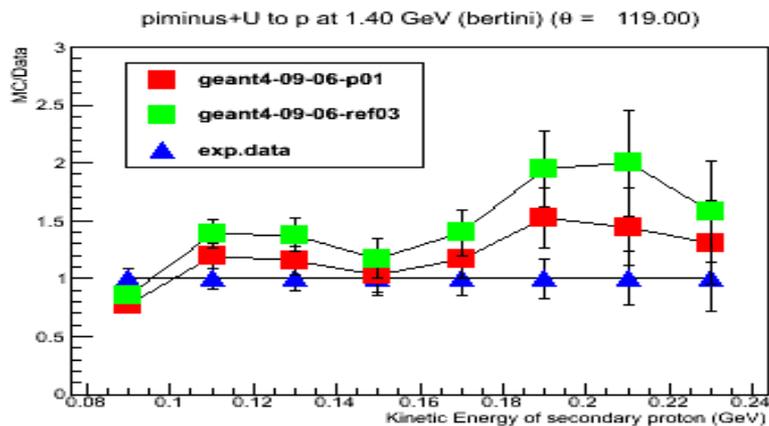
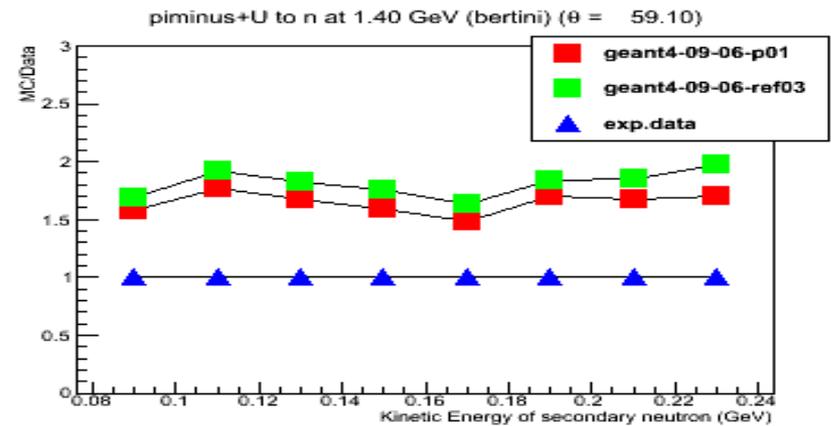
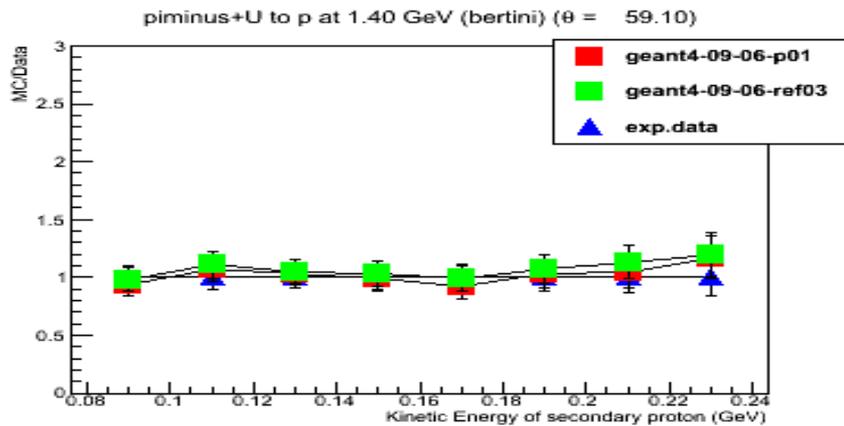
piminus+C to p at 5.00 GeV (bertini) ( $\theta = 119.00$ )



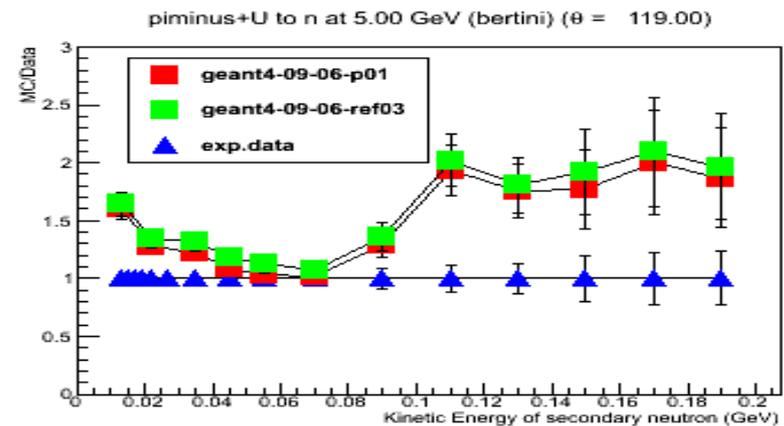
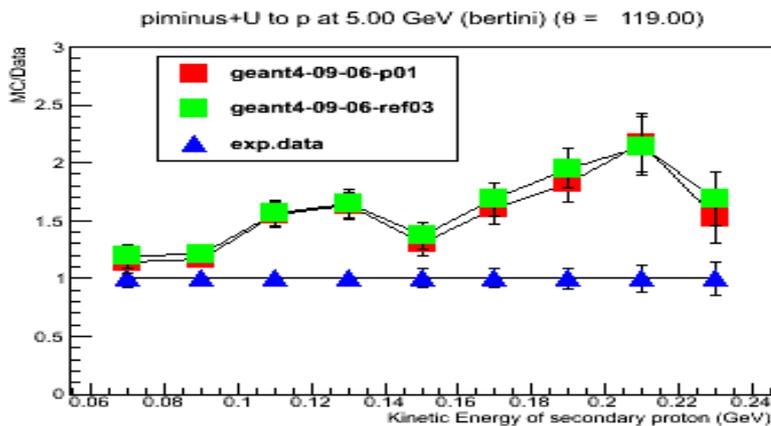
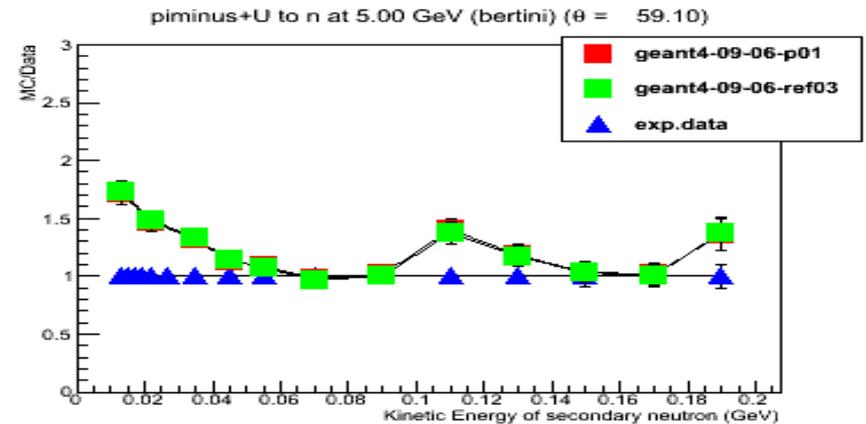
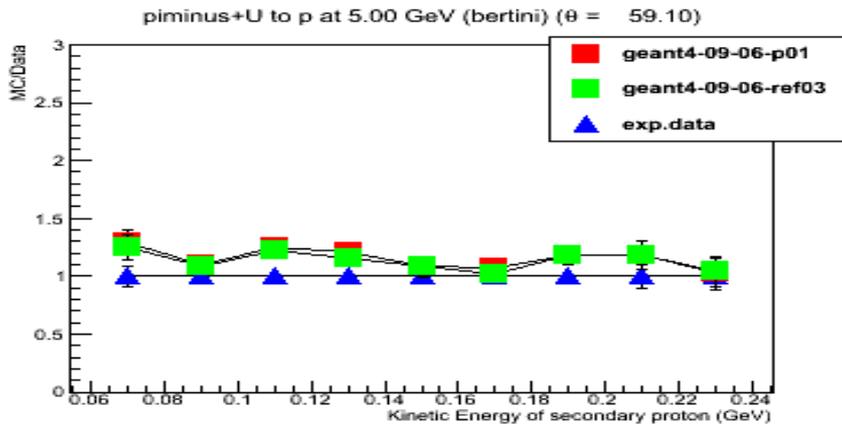
piminus+C to n at 5.00 GeV (bertini) ( $\theta = 119.00$ )



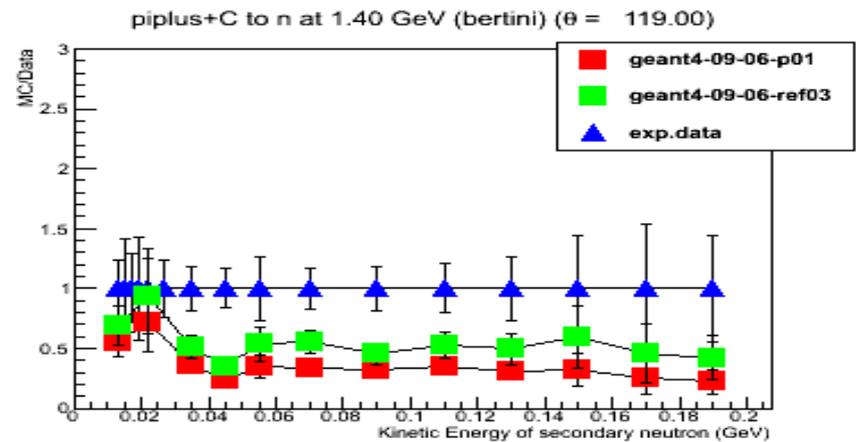
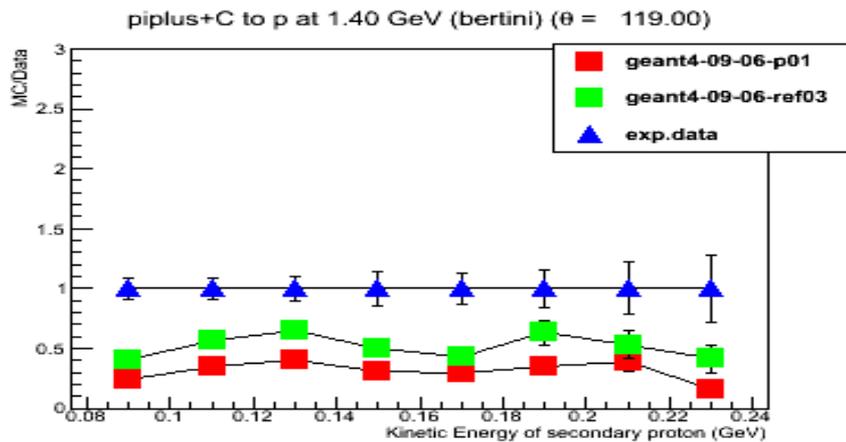
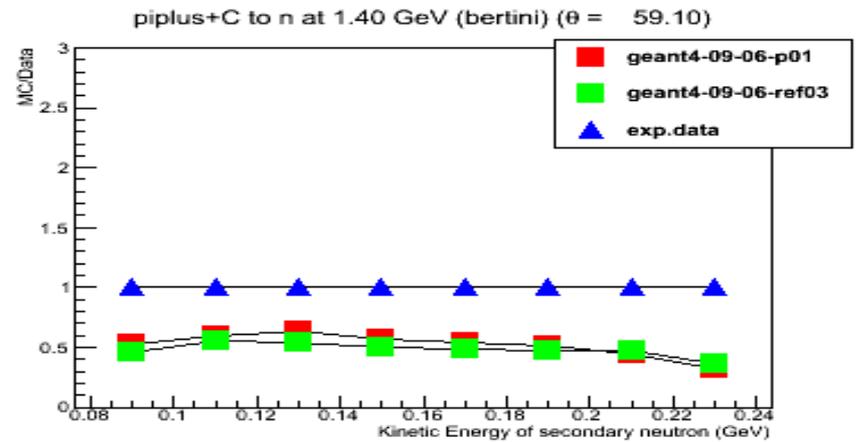
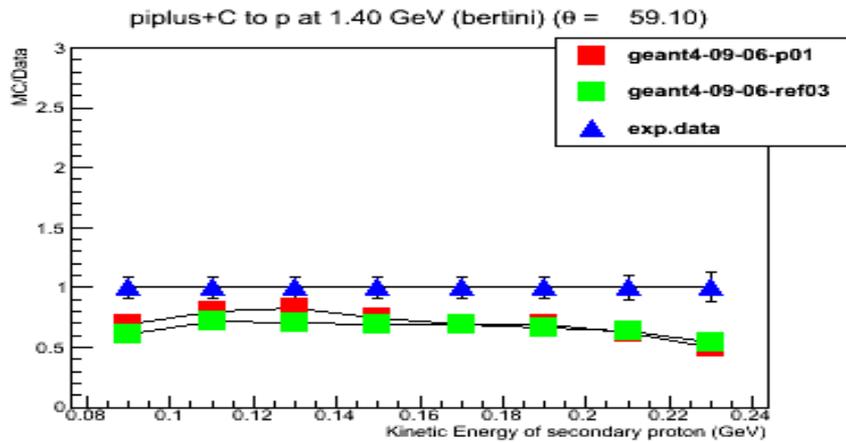
## Test47 (cont.): 1.4 GeV pi- on U -> p, n + X



## Test47 (cont.): 5.0 GeV pi- on U -> p, n + X

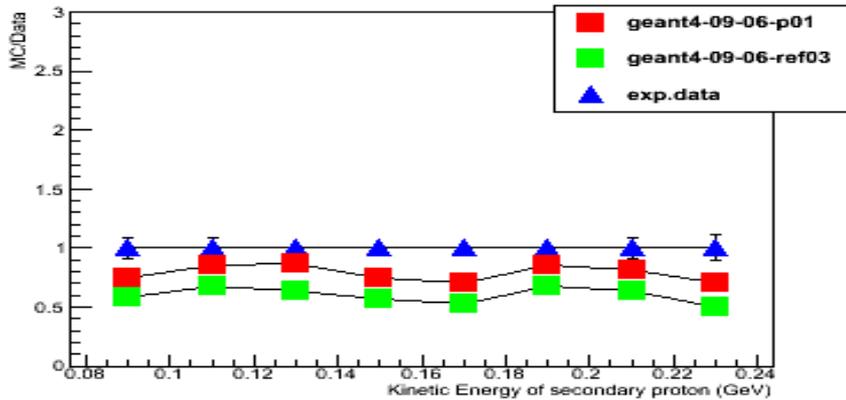


## Test47 (cont.): 1.4 GeV pi+ on C -> p, n + X

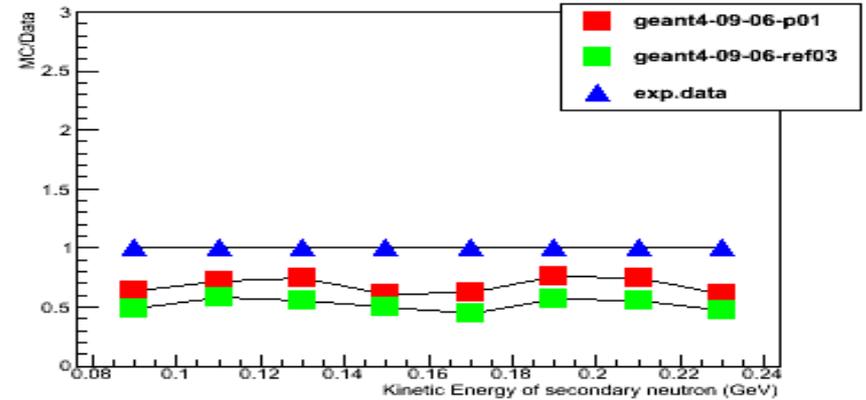


## Test47 (cont.): 5.0 GeV pi+ on C -> p, n + X

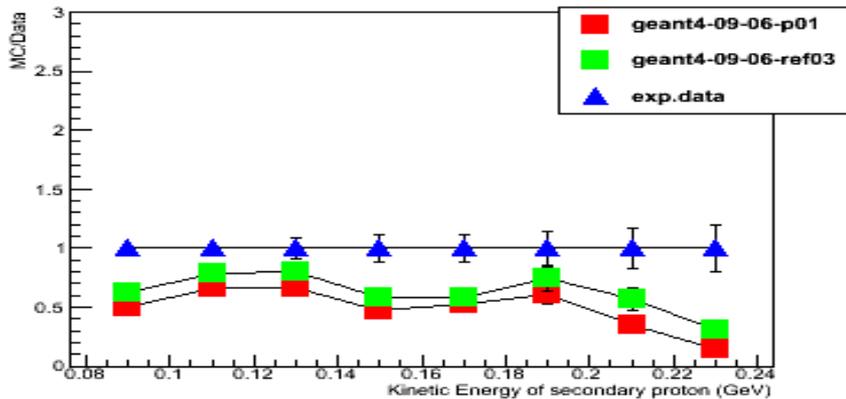
piplus+C to p at 5.00 GeV (bertini) ( $\theta = 59.10$ )



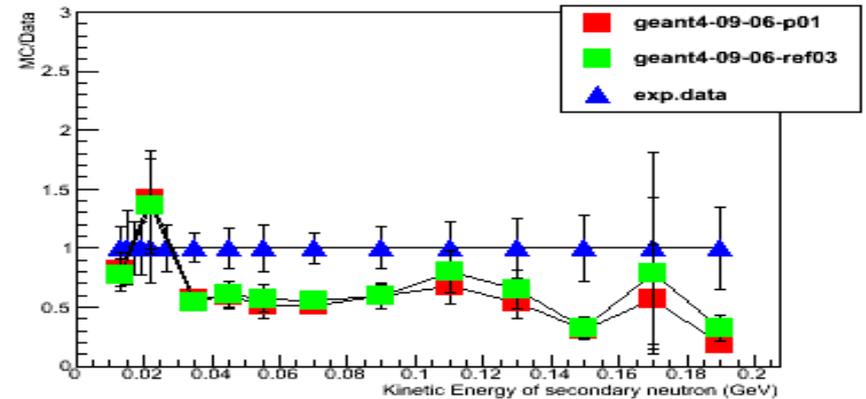
piplus+C to n at 5.00 GeV (bertini) ( $\theta = 59.10$ )



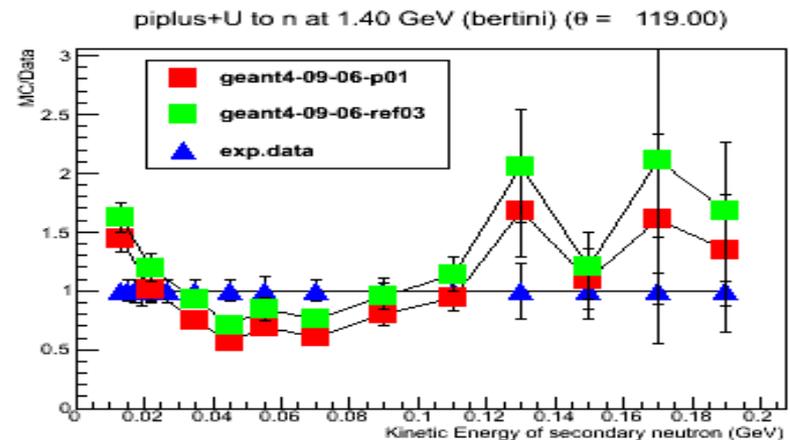
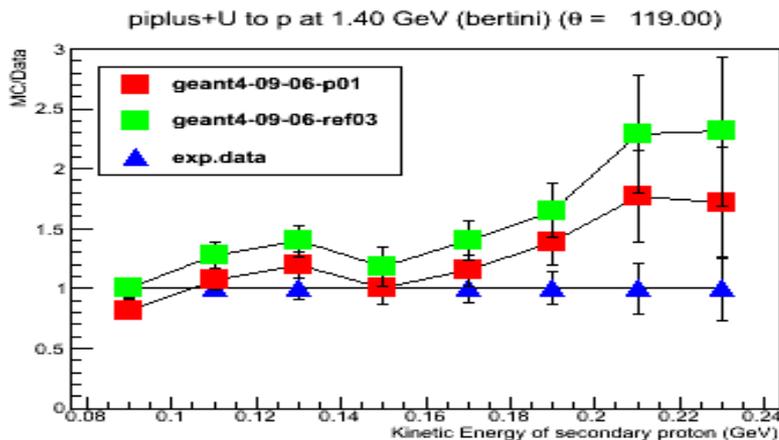
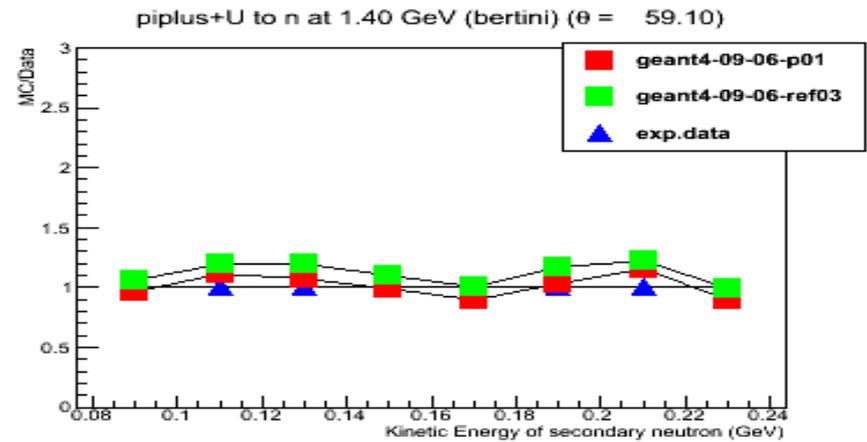
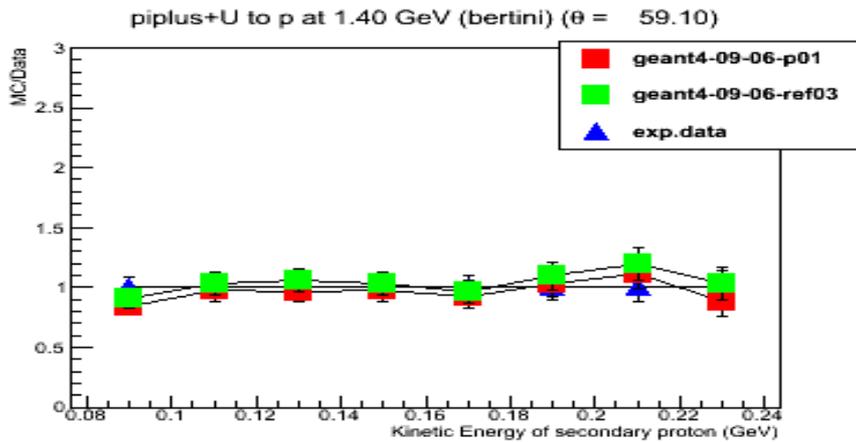
piplus+C to p at 5.00 GeV (bertini) ( $\theta = 119.00$ )



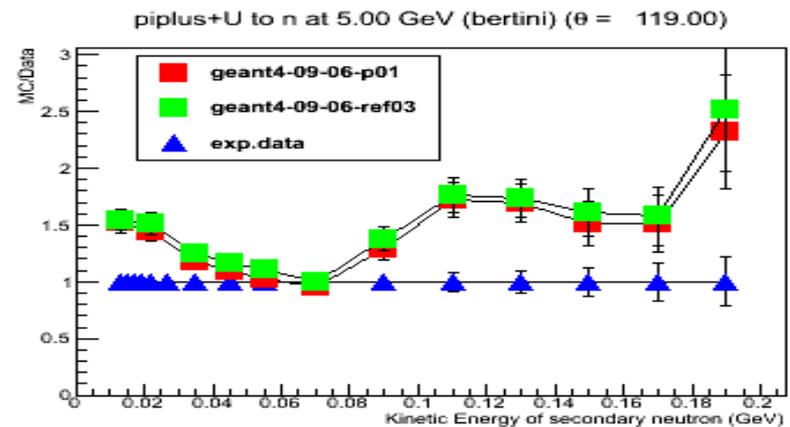
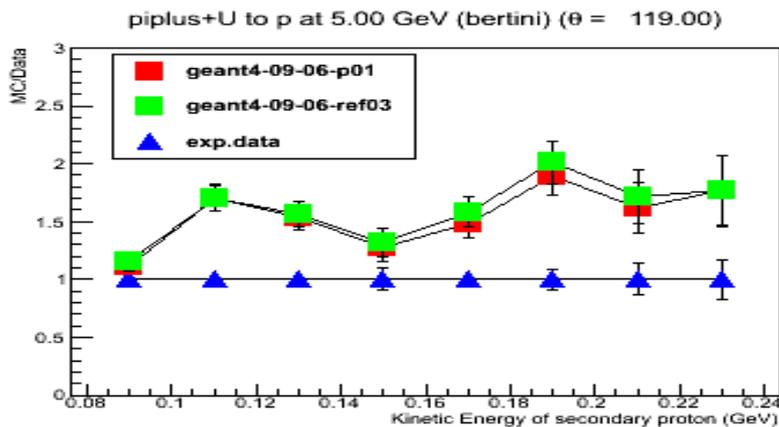
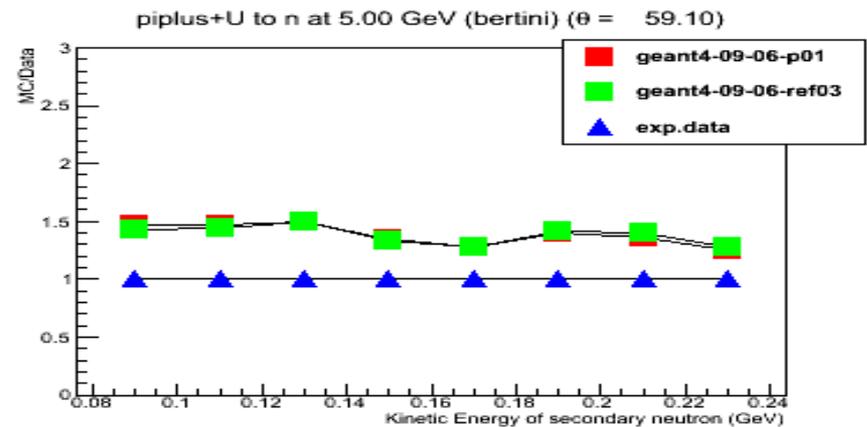
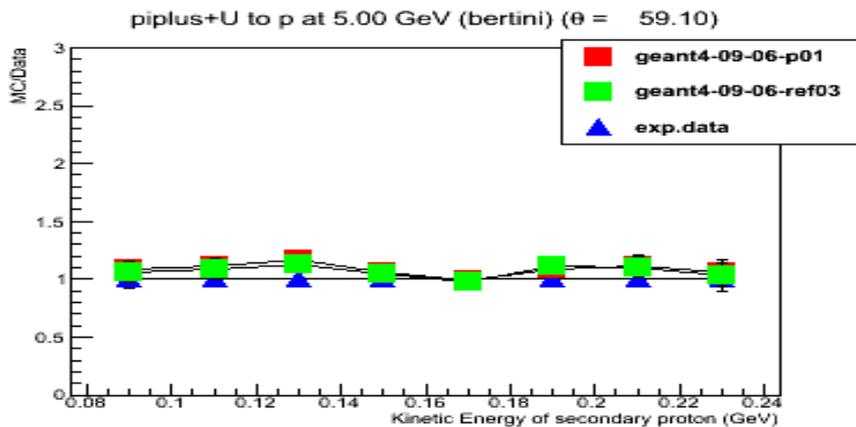
piplus+C to n at 5.00 GeV (bertini) ( $\theta = 119.00$ )



## Test47 (cont.): 1.4 GeV pi+ on U -> p, n + X



## Test47 (cont.): 5.0 GeV pi+ on U -> p, n + X





## Test19: High Energy

- Details in my other talk today
- Datasets: NA61, NA49
- Export of MIPP in the plans
  - More data also available from PhD Theses
- Although there's disagreement NA49/MIPP in measurement of secondary neutrons:  
T.Nigmanov et al., Phys.Rev.D83:012002, 2011
- Regression tests will be added soon

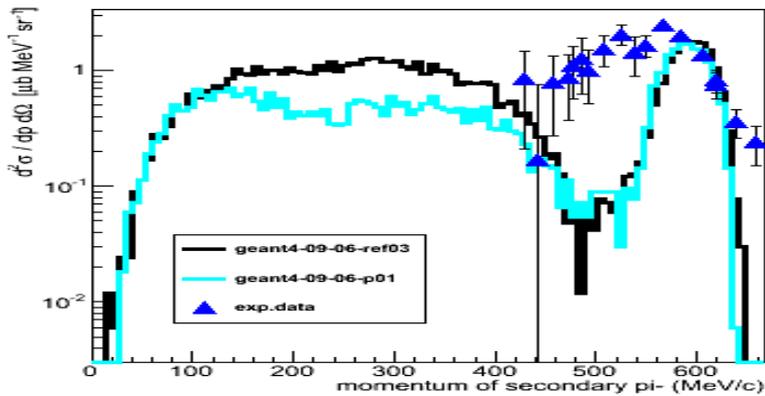


## Test75: Gamma/Lepto-Nuclear

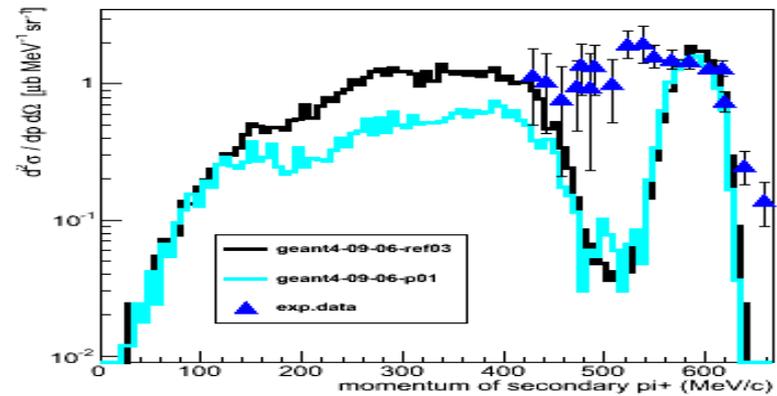
- Mike K. found a bug in the validation code (incorrect filling of 1 histogram)
- Core work ongoing in Bertini
- Variations in 300MeV gamma-Cu proton spectra but not significant in the range where we have data
- Variations in pions spectra from 668MeV gamma on Cu or Pb - see following slides/plots
- Considering to add lepto-N (code is there) but uncertain what to test against ???

## Test75: 668MeV gamma on Cu $\rightarrow$ $\pi^{\pm} + X$

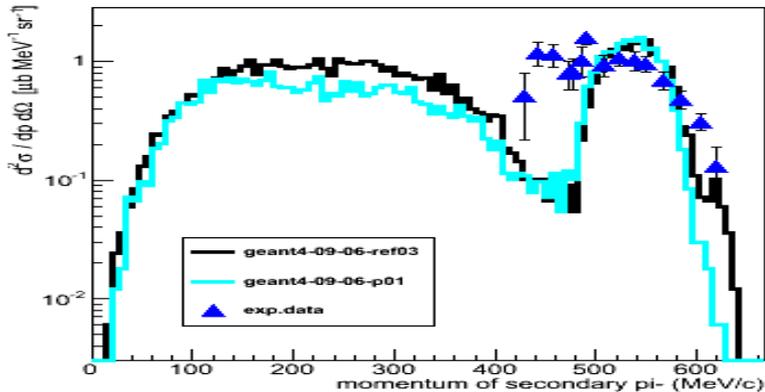
gamma + Cu  $\rightarrow$  X +  $\pi^-$  (28deg)



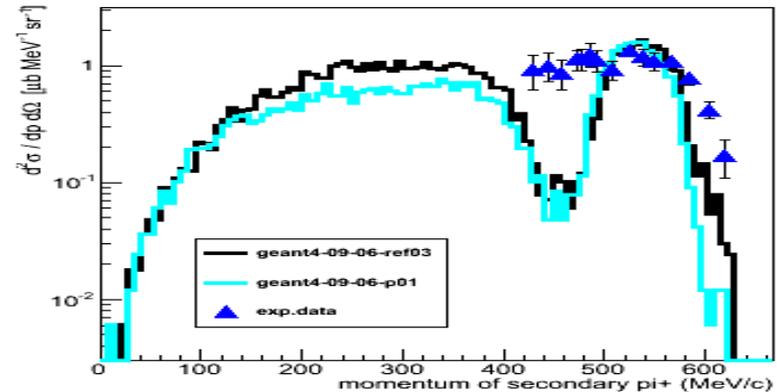
gamma + Cu  $\rightarrow$  X +  $\pi^+$  (28deg)



gamma + Cu  $\rightarrow$  X +  $\pi^-$  (44deg)

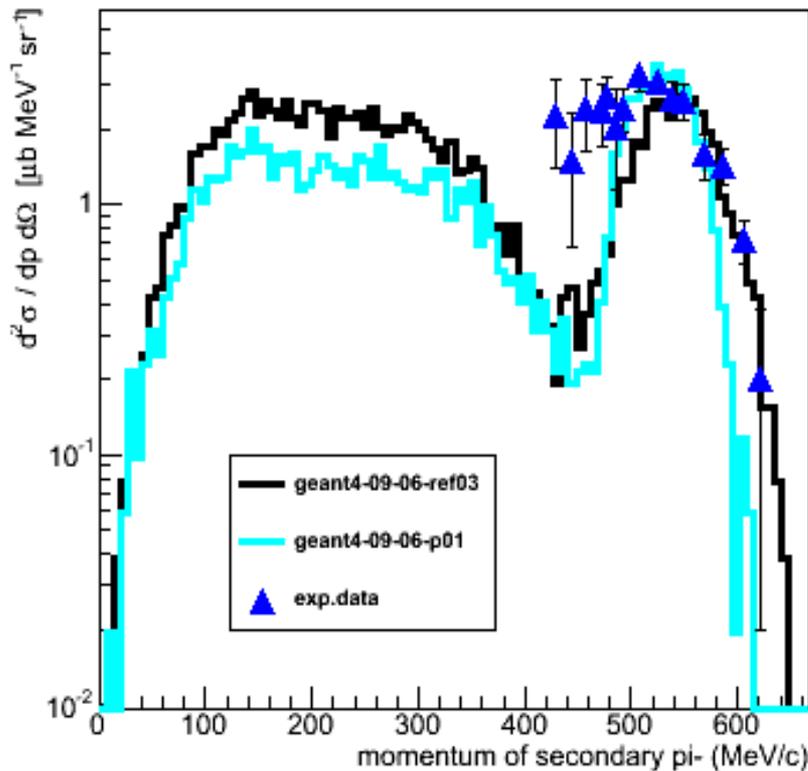


gamma + Cu  $\rightarrow$  X +  $\pi^+$  (44deg)

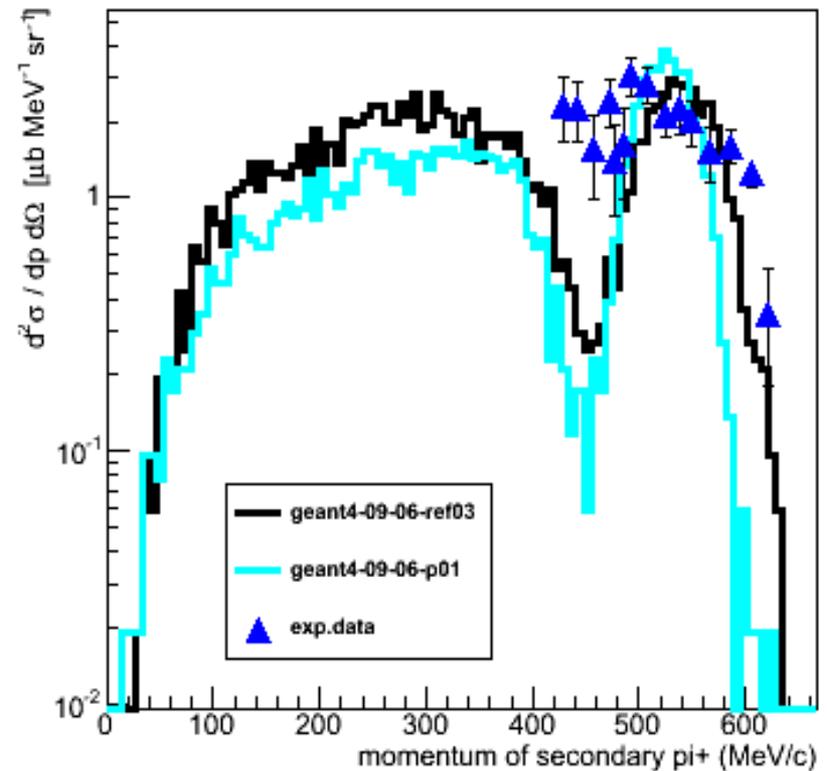


## Test75: 668MeV gamma on Pb -> pi+/- + X

gamma + Pb → X + pi- (44deg)



gamma + Pb → X + pi+ (44deg)





## Geant4 Validation Repository

- Categorization into “public” and “internal” now applies to all materials
- Now only a subset of most recent results is labeled “public” and displayed via public pages
- The whole collection is available to “Experts” (login same as for uploading results)
- Plans to improve login procedure
- New version available on “development” server:  
<http://g4devel.fnal.gov:8080/G4ValidationWebApp/>
- “Production” server needs upgrade - shortly