Grid testing of Geant4: **10.2.ref09**

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CERN PH/SFT

Main Changes in Hadronics with respect to G4 10.2.ref08

- BERT, Precompound, De-excitations : no changes
  - But updated data set G4PhotonEvaporation4.0
- FTF
  - *parton_string/management/* : added new fatal exception in G4VPartonStringModel when string fragmentation fails (after 100 attempts)
  - *parton_string/hadronization/* : bug-fix in G4LundStringFragmentation
- Radioactive Decay : several improvements

Crashes

- Several crashes, all of the same new type:

```
-------- EEEE ------- G4Exception-START -------- EEEE -------
*** G4Exception : had006
issued by : G4HadronicProcess::PostStepDoIt
In parton_string/management/src/G4VPartonStringModel.cc, line 268:
 ===> G4VPartonStringModel:: fails to fragment strings
Call for QGSP (or FTFP)
…
ApplyYourself failed
*** Fatal Exception *** core dump ***
 -------- EEEE -------- G4Exception-END --------- EEEE -------
```

A fix will be proposed shortly for testing

Warnings

- From the SimplifiedCalo application:
  post-step-energy > pre-step-energy
  - Always due to **elastic** scattering of tens-MeV protons
    (Chips elastic cross section & final-state model is used)
- Several new warnings, all of the same new type:

```
-------- WWWW ------- G4Exception-START -------- WWWW -------
*** G4Exception : had012
issued by : G4HadronicProcess:CheckResult()
Warning: Secondary with off-shell dynamic mass detected:
         proton, PDG mass: 938.272, dynamic mass: 1092.17
re-sample the interaction
Process / Model: neutronInelastic / QGSP
Primary: neutron (2112),  E= 33417.7, target nucleus (13, 27)
*** This is just a warning message. ***
 -------- WWWW -------- G4Exception-END --------- WWWW -------
```

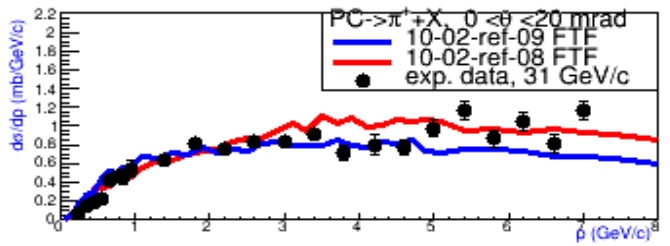
The problem, which started with Ref07, seems not to be due to the string model, but to Precompound/de-excitation...
On-going investigations...

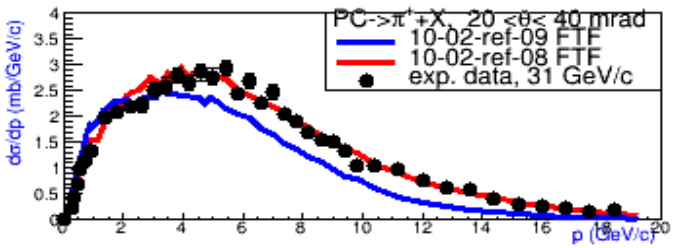
Reproducibility

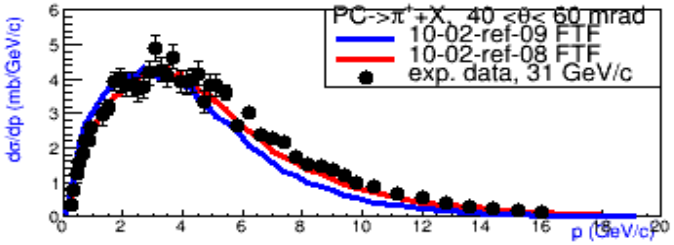
- **Reproducibility OK** , also with Radioactive Decay!

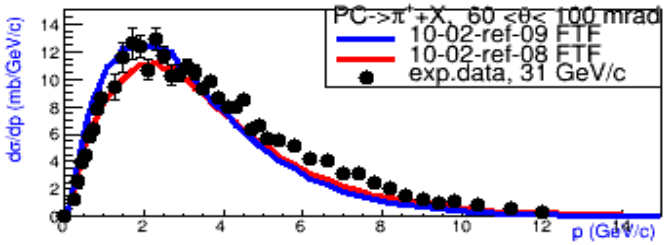
FTFP : test22 , 31 GeV/c **p C → π+** X

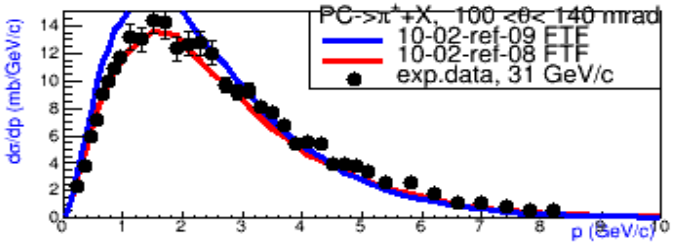
G4 10.2.ref09
G4 10.2.ref08

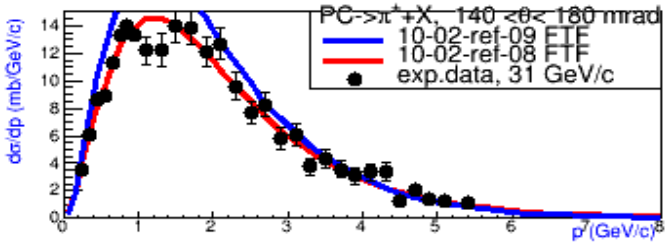


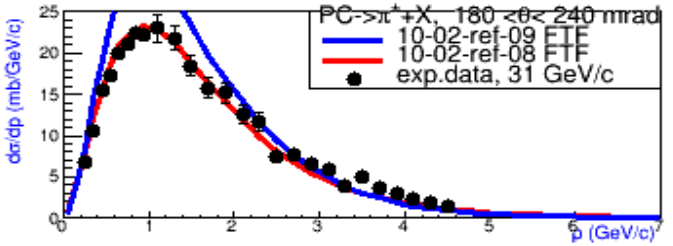


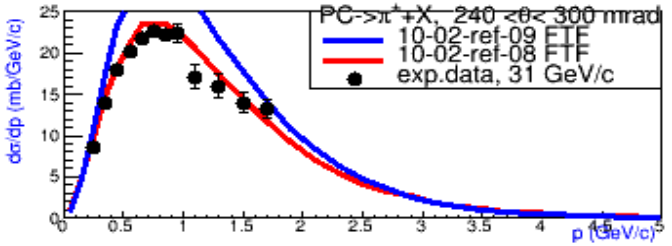


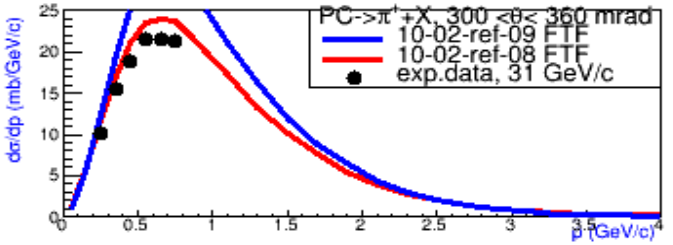


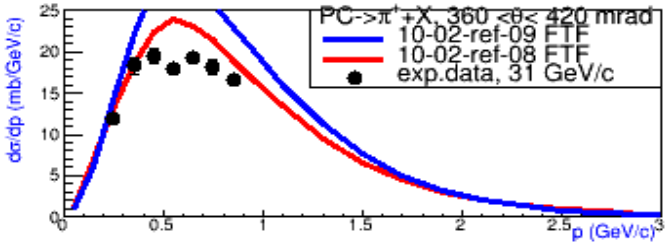






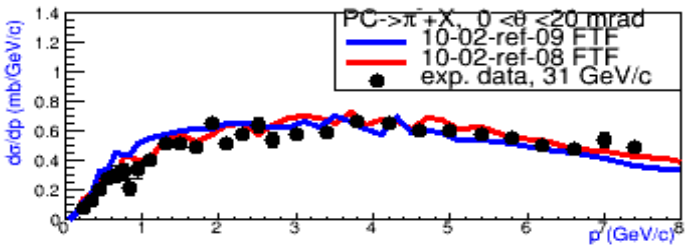


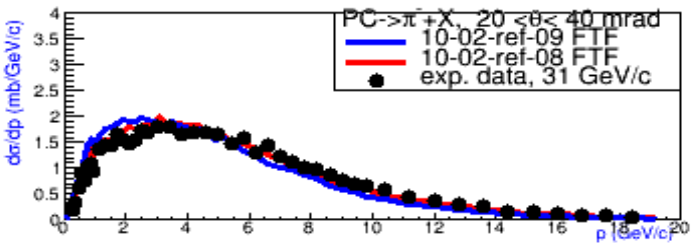


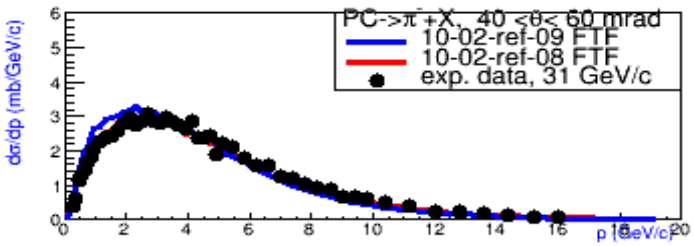


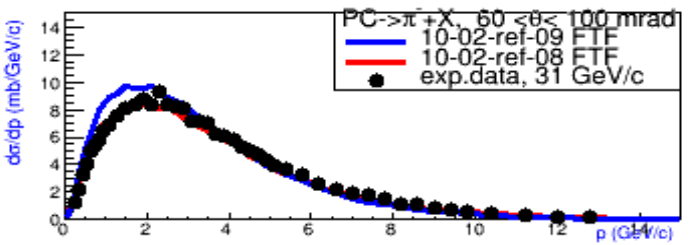
FTFP : test22 , 31 GeV/c **p C → π- X**

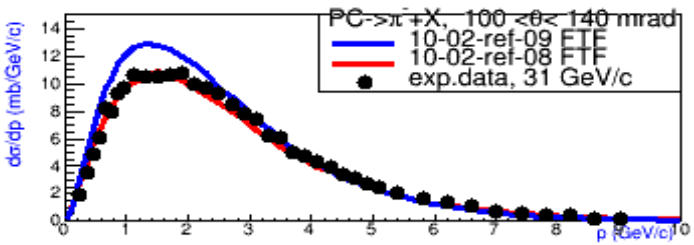
G4 10.2.ref09
G4 10.2.ref08

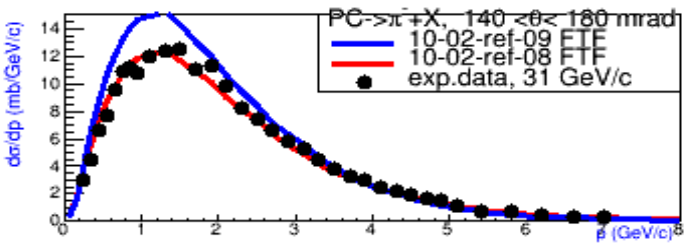


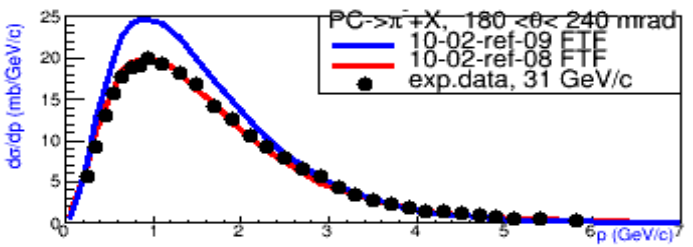


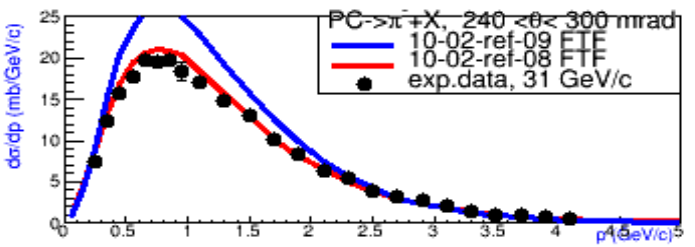


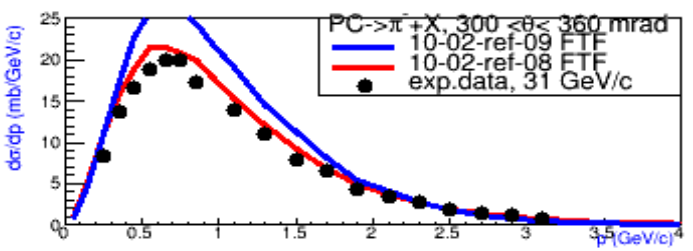


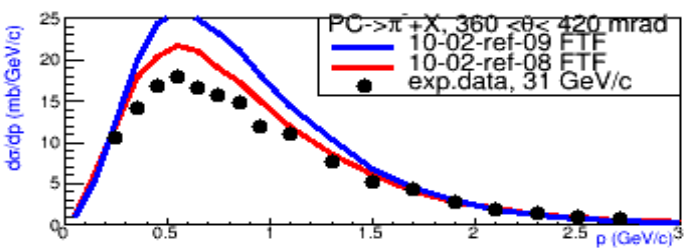






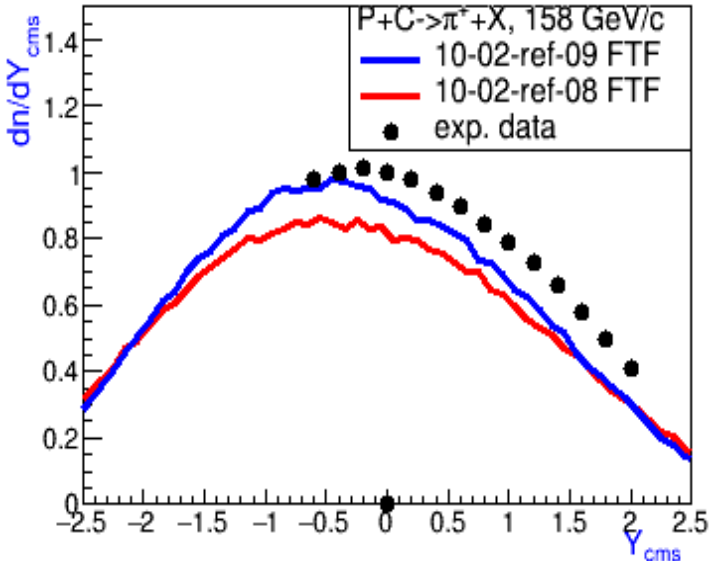


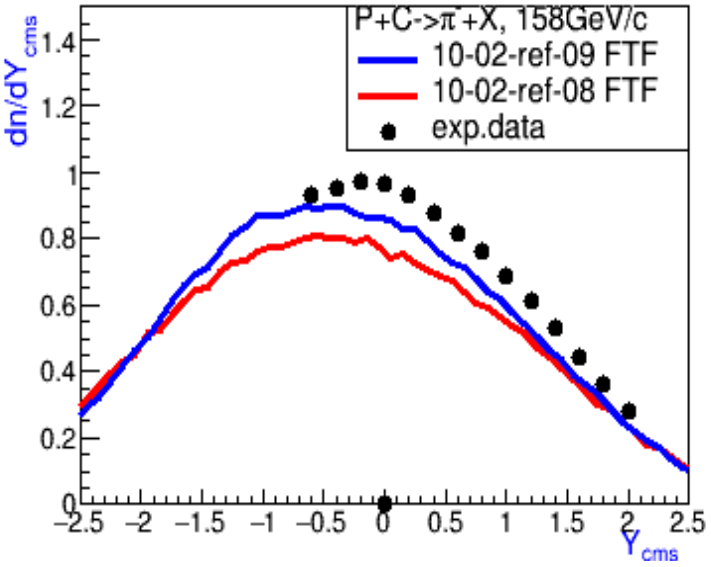


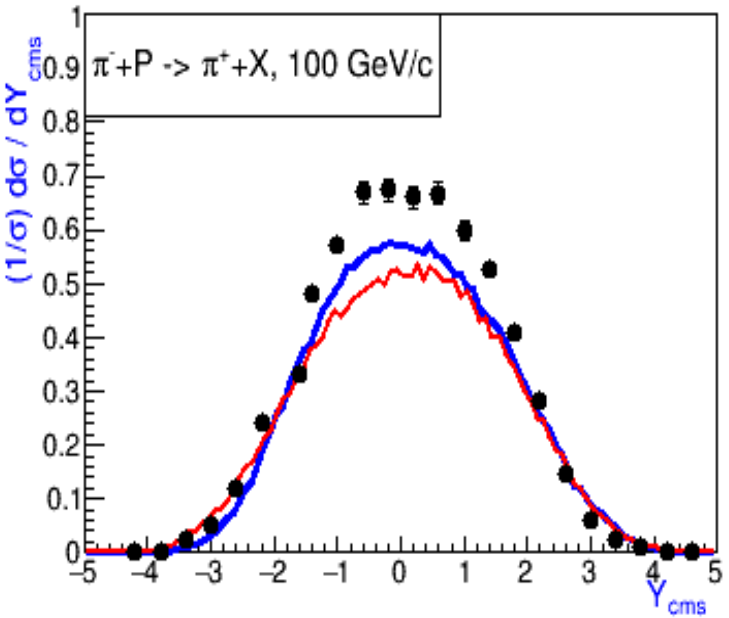


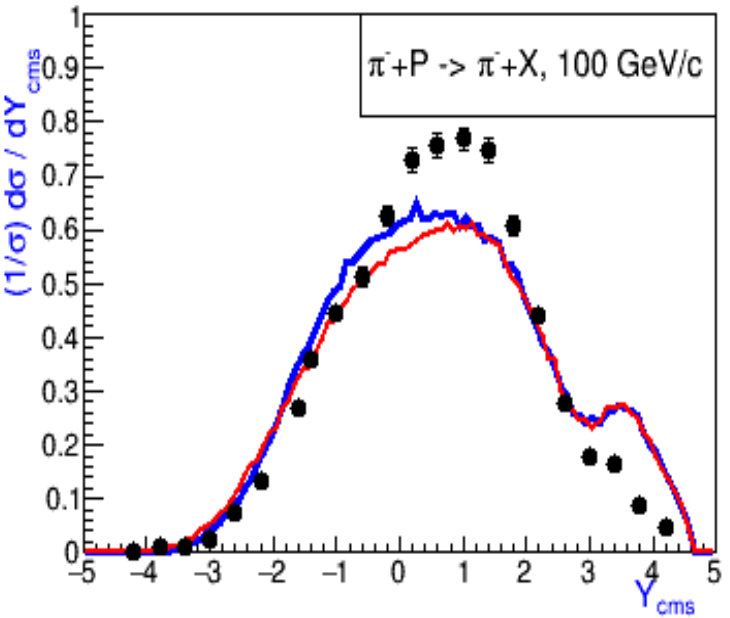
FTFP : test22 , 158 GeV/c p C → **π± X**
100 GeV/c π± p → **π± X**

G4 10.2.ref09
G4 10.2.ref08





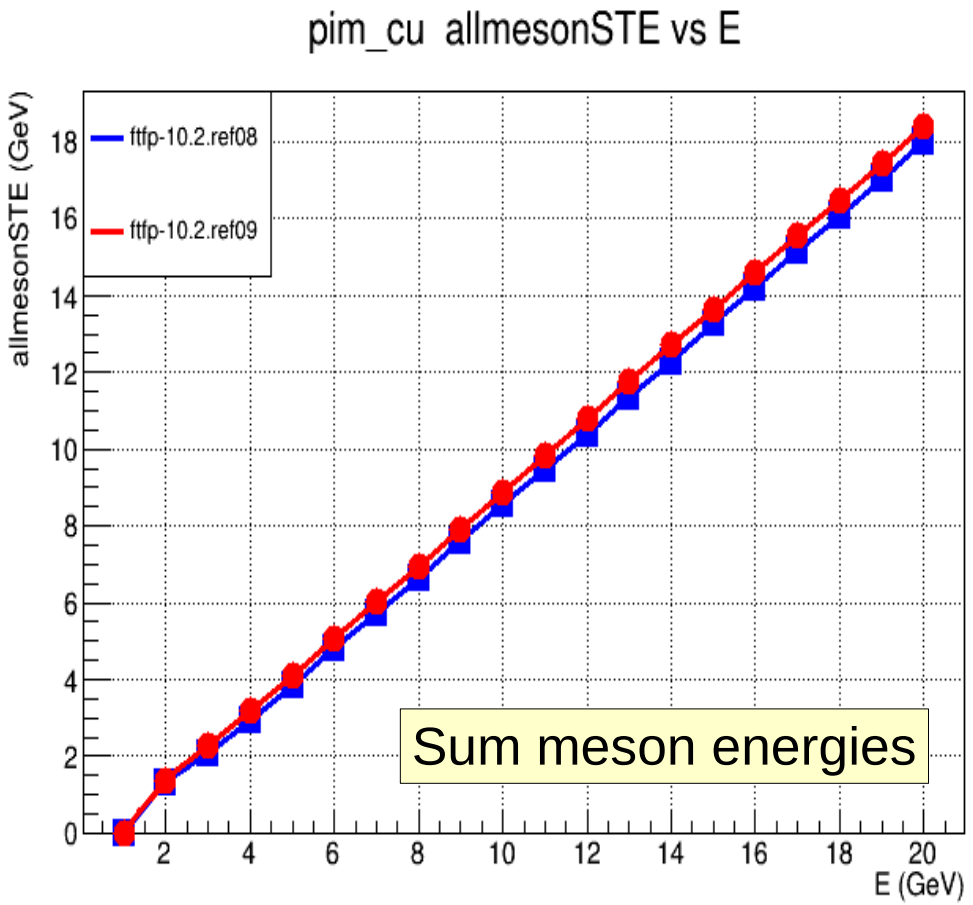


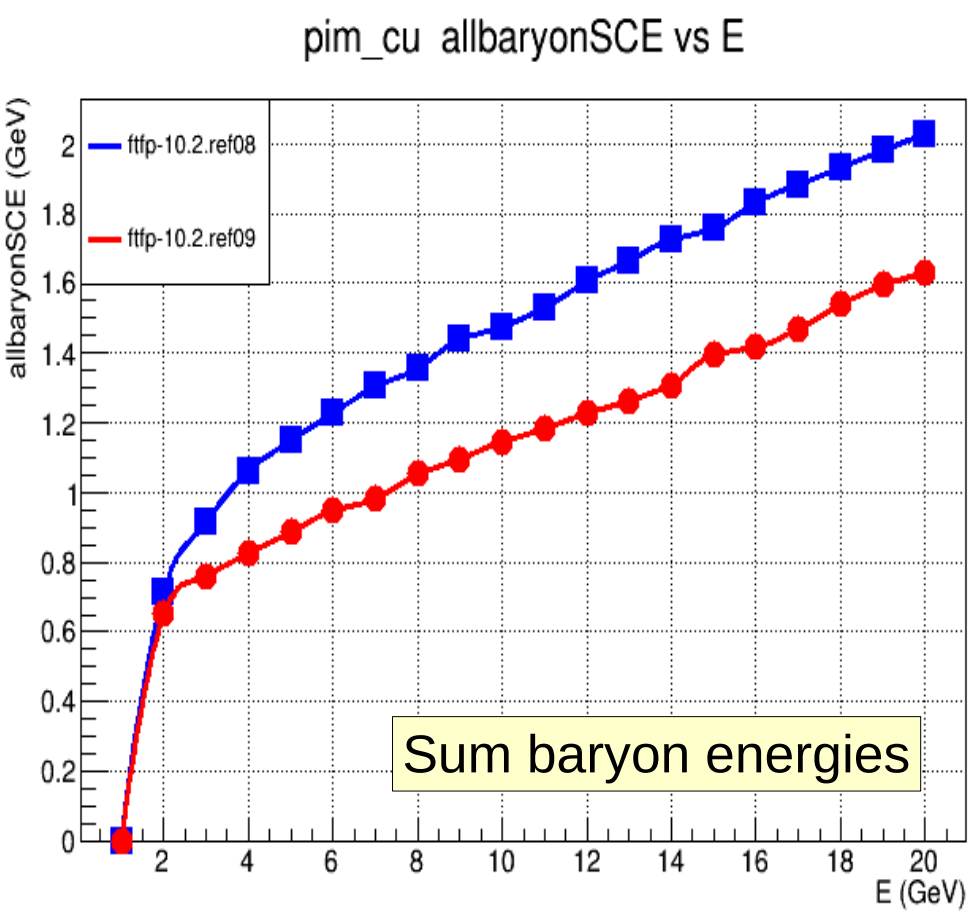


FTFP : energy flow in mesons and baryons

G4 10.2.ref09
G4 10.2.ref08

π^- on Cu

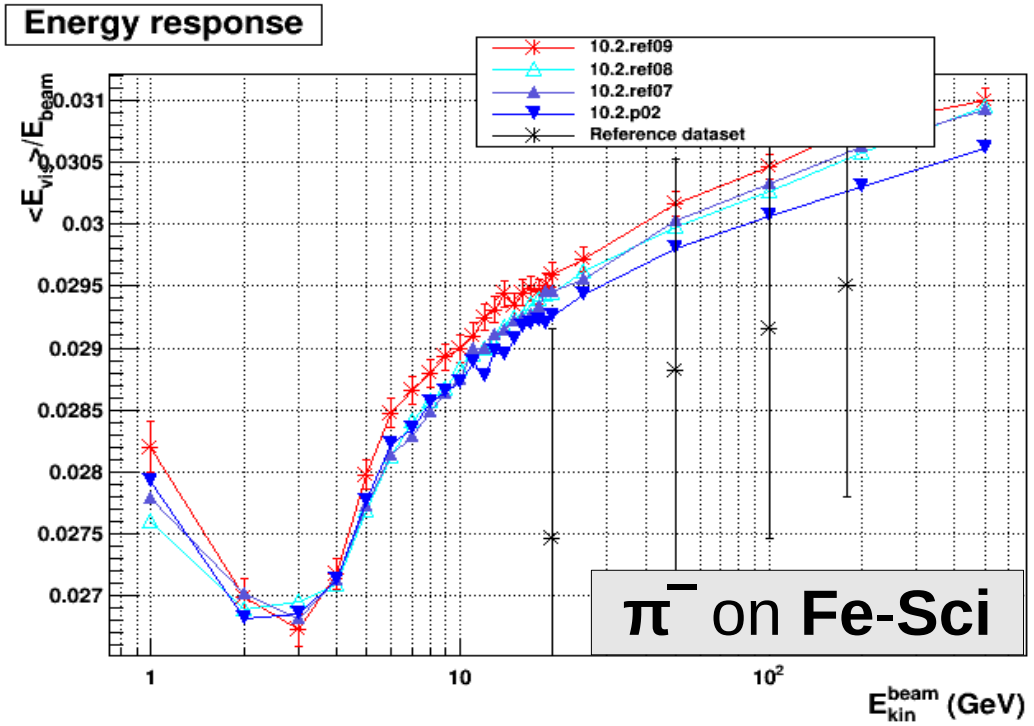


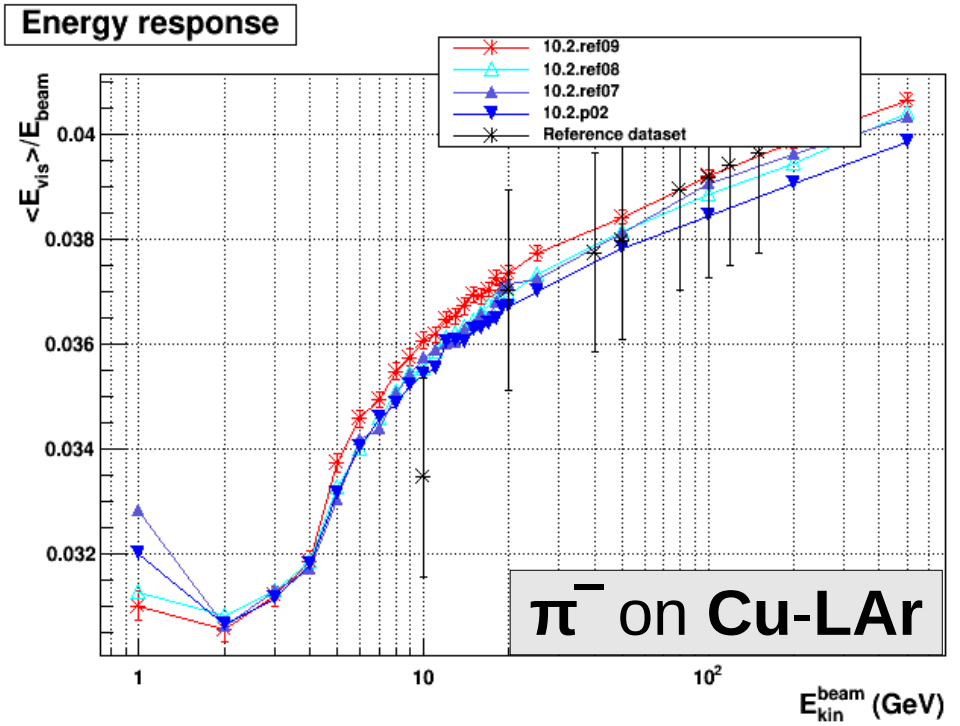


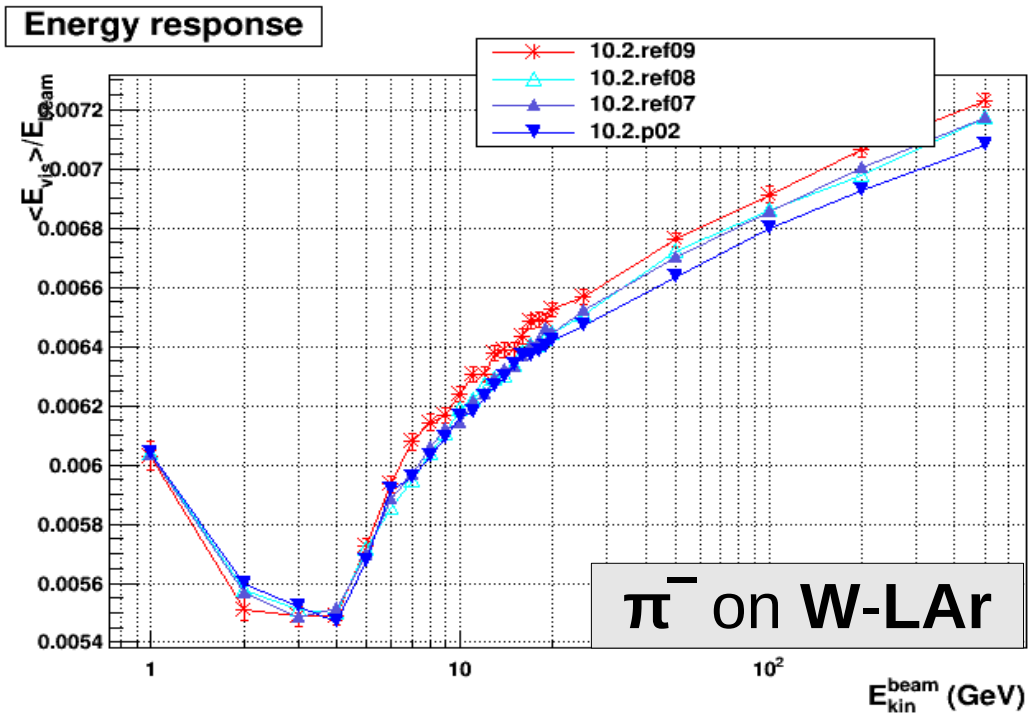
Pion showers: FTFP_BERT

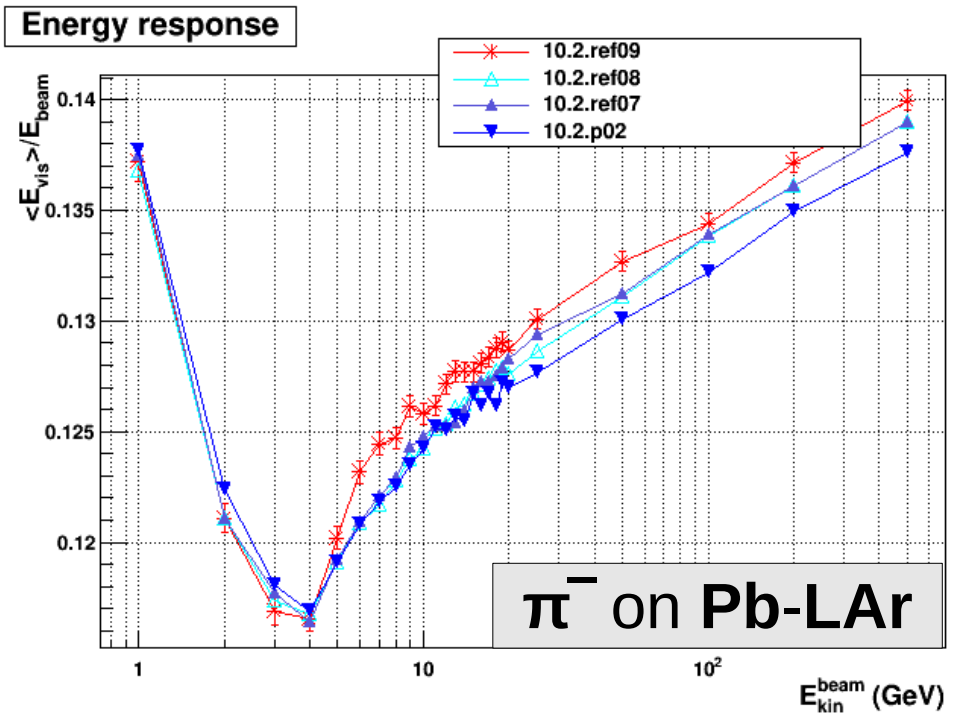
G4 10.2.ref09 ,
10.2.ref08 ,
10.2.ref07 ,
10.2.p02

FTFP_BERT : Energy Response

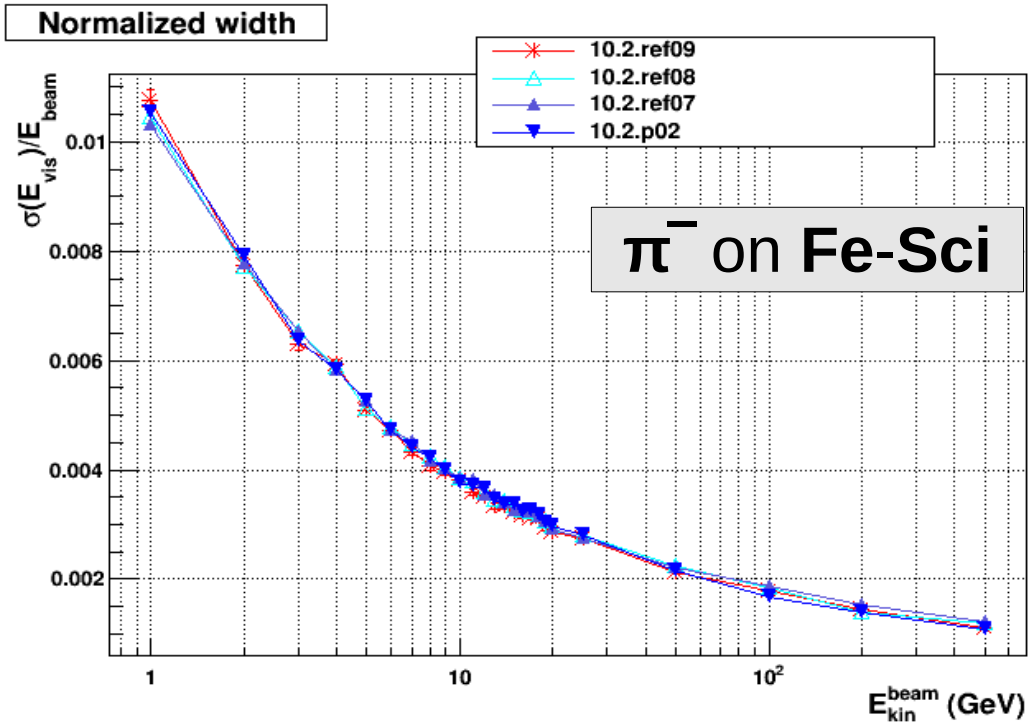


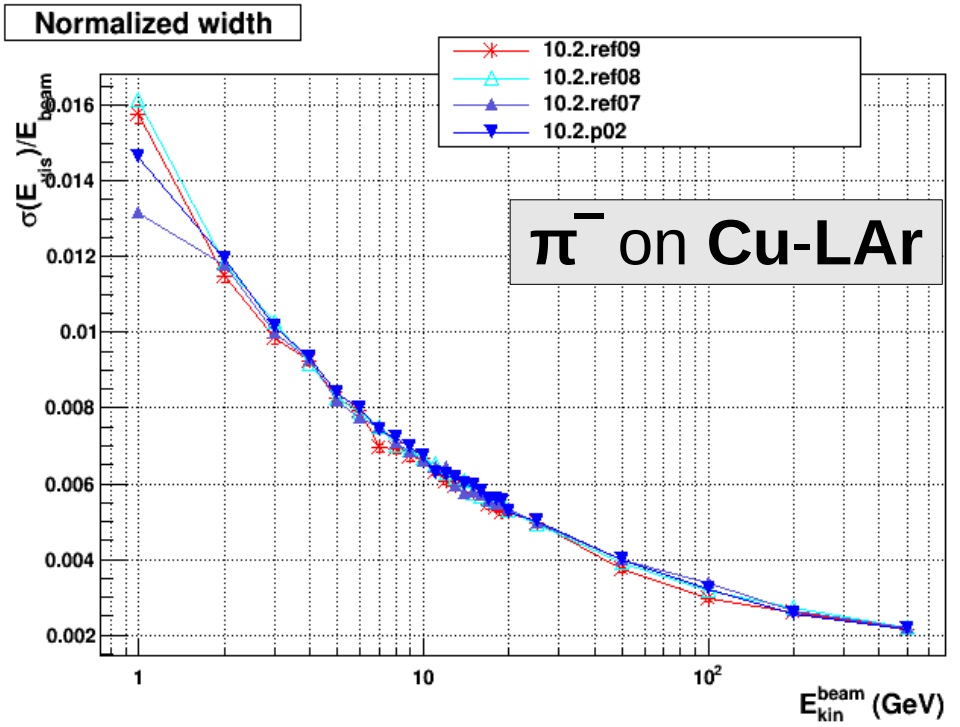


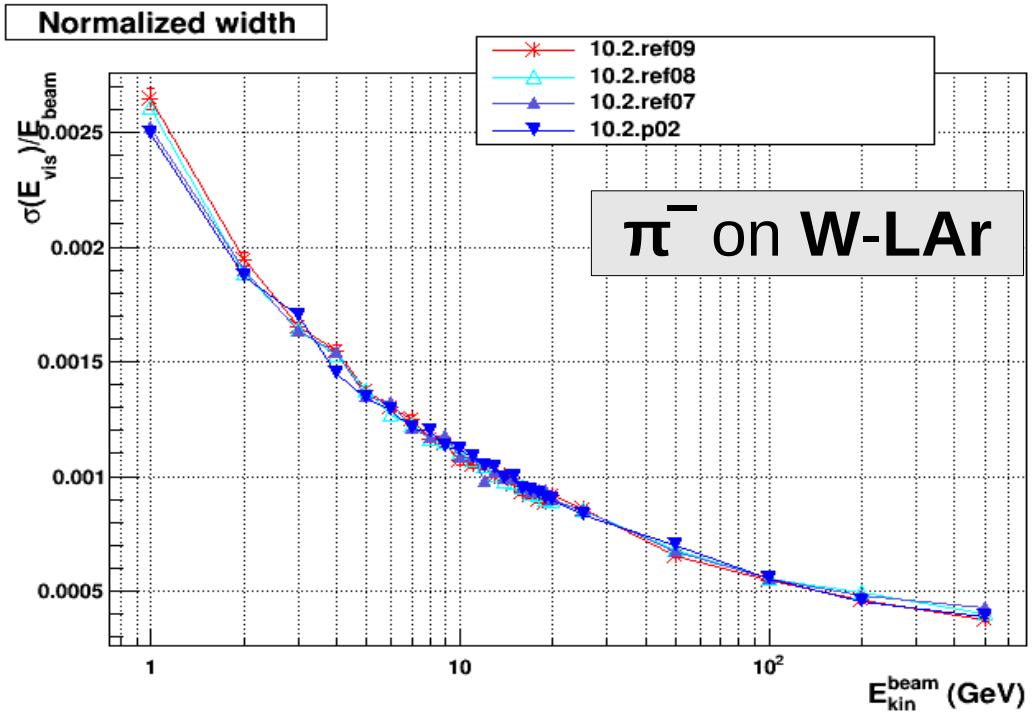


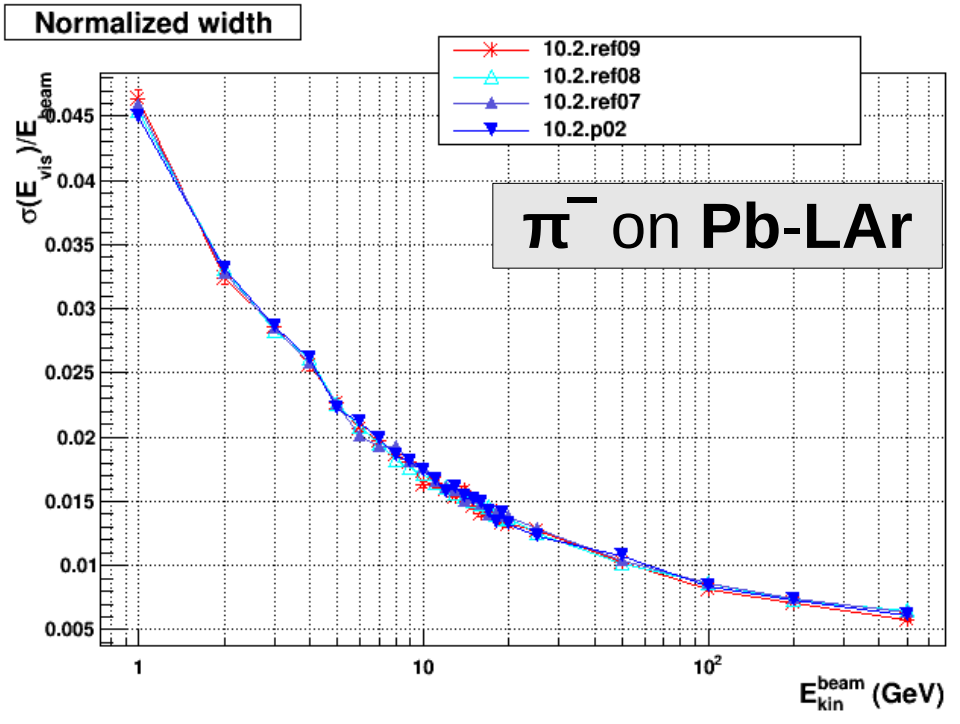


FTFP_BERT : Energy Width

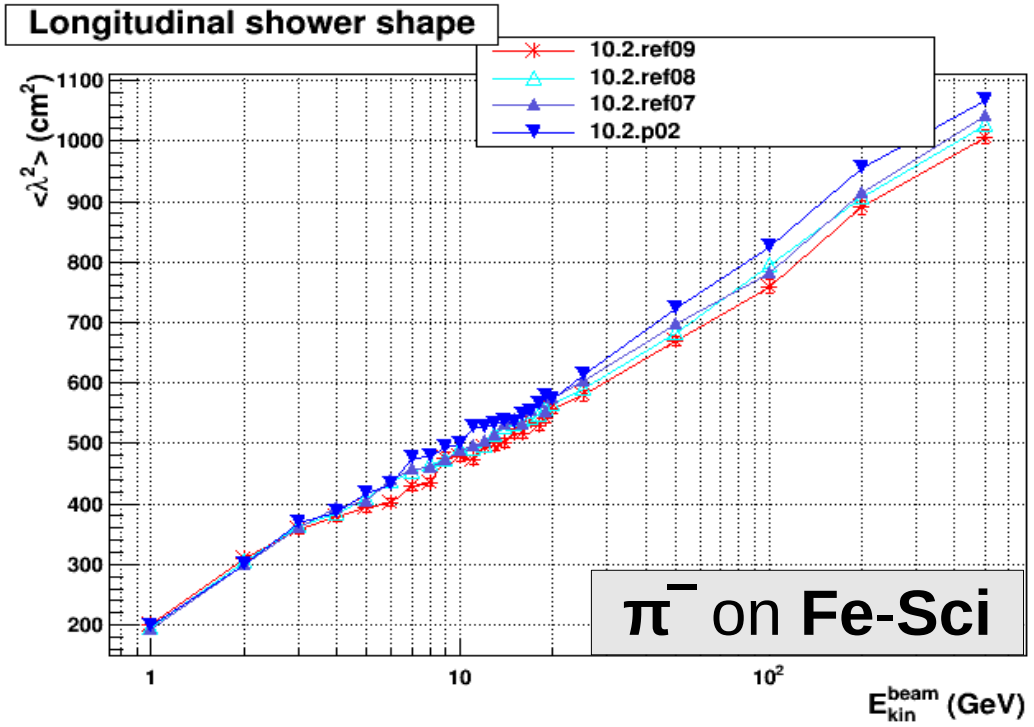


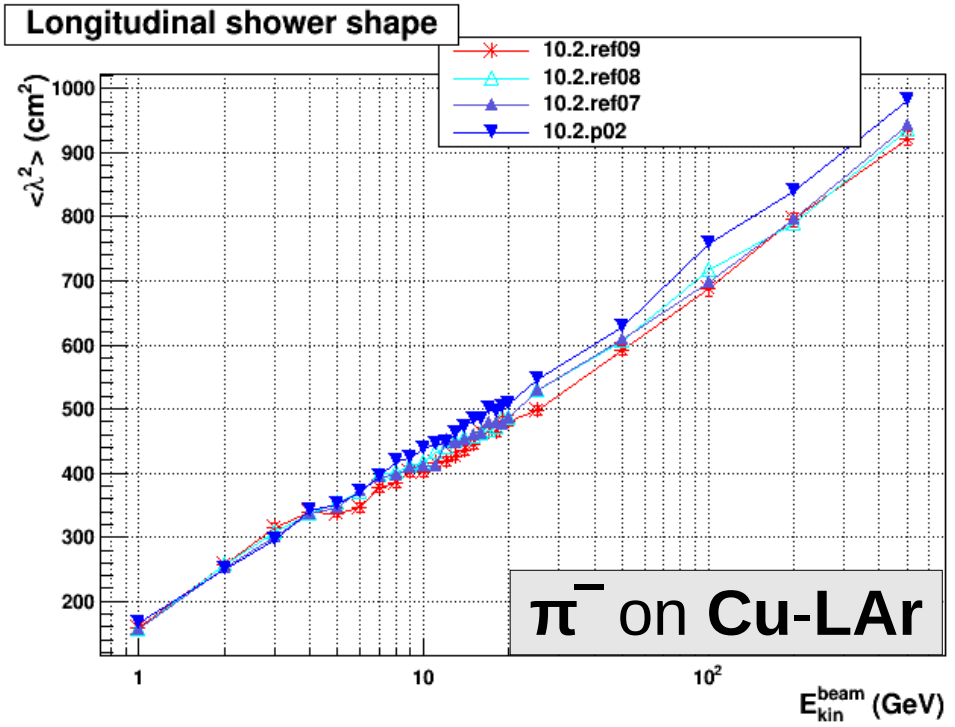


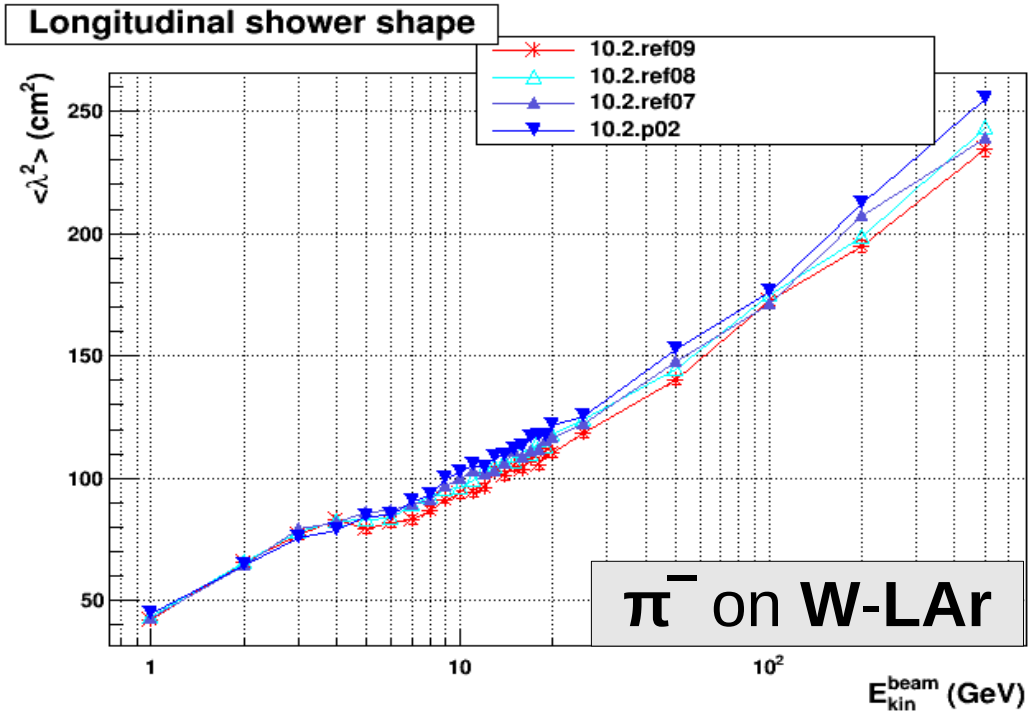


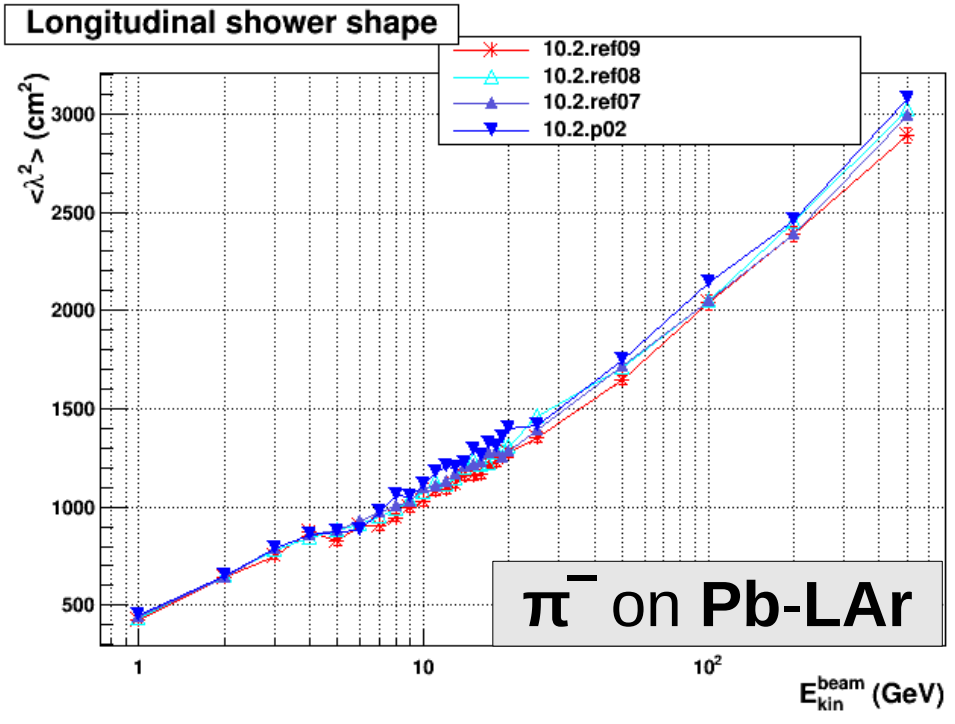


FTFP_BERT : Longitudinal Shape

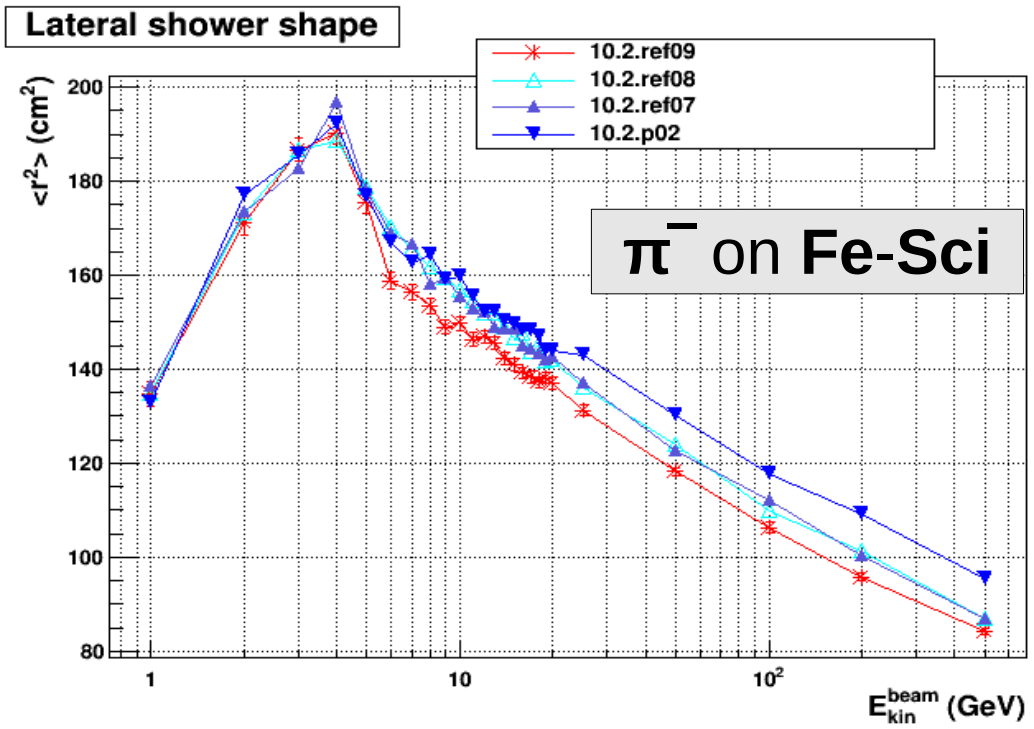


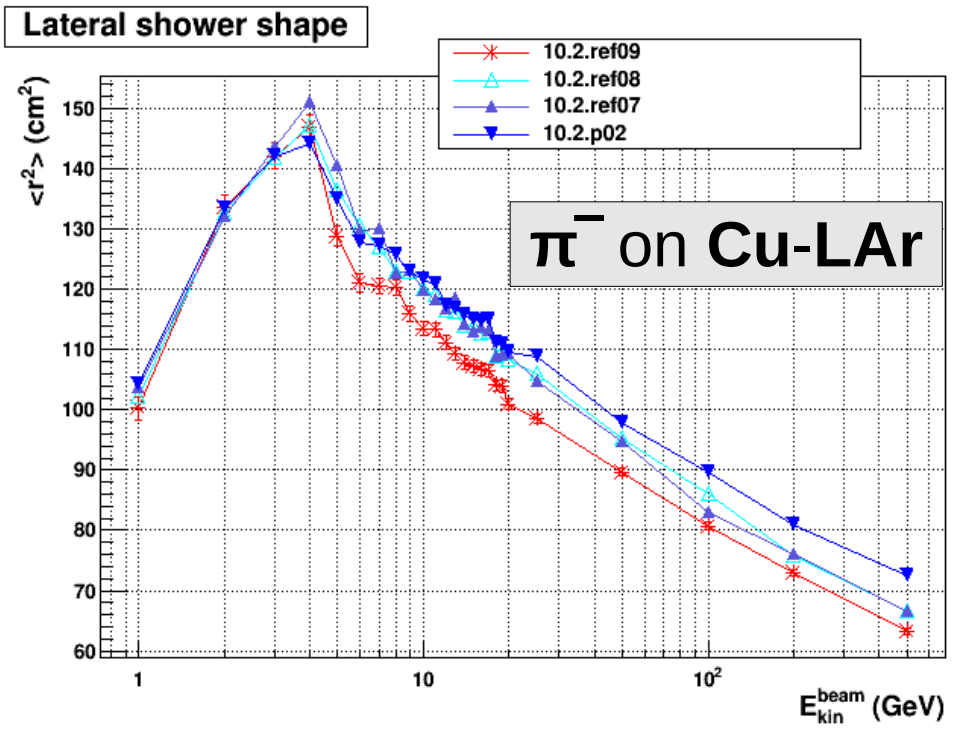


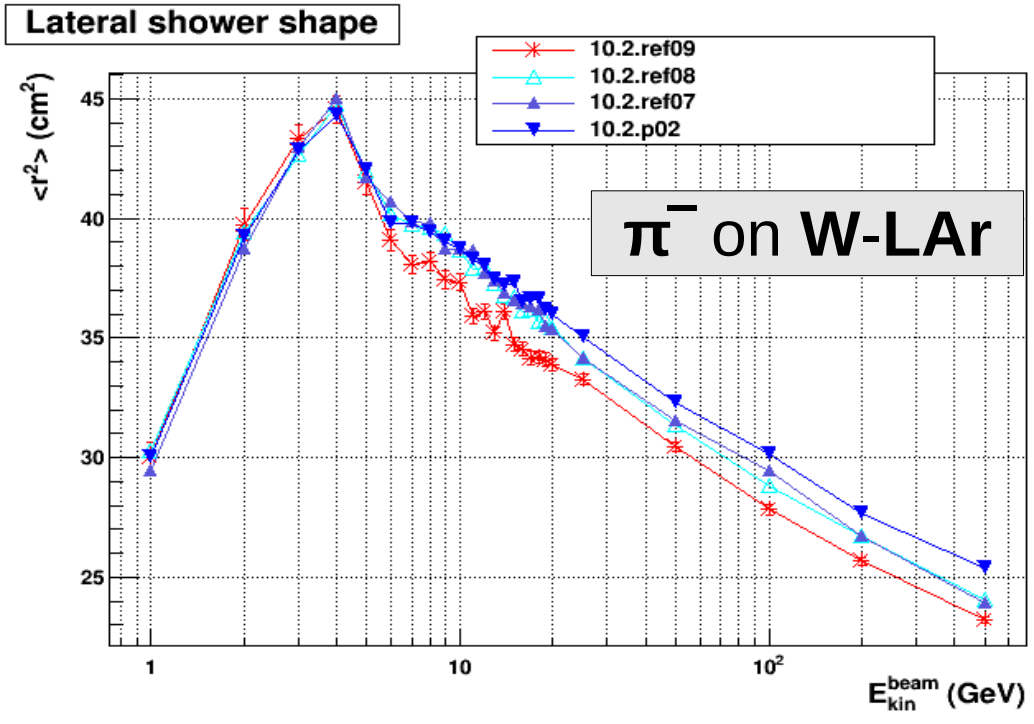


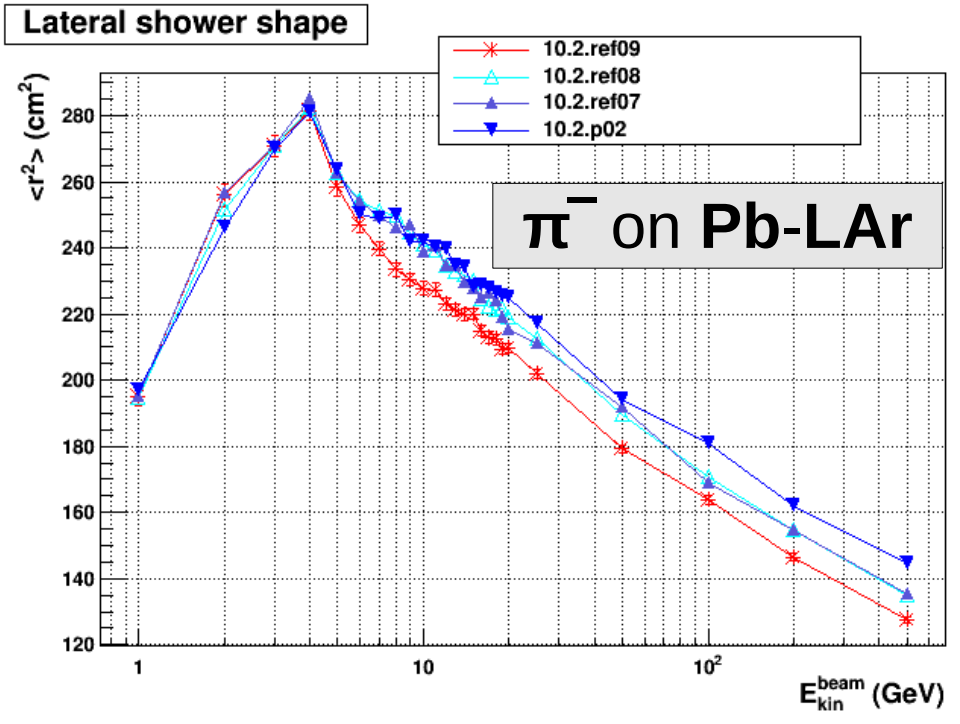


FTFP_BERT : Lateral Shape









Conclusions

- **G4 10.2.ref09**
  - New crashes
    - Understood the source; fix ready shortly
  - Warnings
    - E_postStep > E_preStep due to Chips proton elastic : why?
    - Proton off-shell : on-going investigation in Preco/de-excitation
  - **Reproducibility OK** (also with Radioactive Decay !)
  - Bug-fix in Lund string hadronization makes worse some thin-target comparisons → needs retuning of FTF !
  - FTFP_BERT hadronic showers
    - Higher energy response and narrower showers w.r.t. ref08 : worse showers!
      - The bug fix gives more energy to mesons and less to baryons