Hadronic Showers in Geant4
11.2.cand{00,01}

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CERN EP-SFT

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Main Changes in Hadronics in G4 11.3.cand00 *vs.* 11.2.ref09

- *hadronic/cross_sections*
  - *G4ChargeExchangeXS* : several improvements
    - Switched computations from level of isotopes to level of elements : code becomes several times faster, without loss of accuracy
    - Added protections against negative components of cross section and potential division by zero, which might happen only at extreme high energies
    - Fixed problem in pion cross sections according to the prescription of the original paper

Note : currently, this class is used only in the physics constructor ***G4ChargeExchangePhysics*** , which is used only in **QBBC** reference physics list

Main Changes in Hadronics in Cand01 *vs.* Cand00

- Updated hadronic datasets *PhotonEvaporation6**.1*** , *RadioactiveDecay6**.1***
  - For PhotonEvaporation6.1 : corrections of the files: z72.a154, z81.a193, z92.a239
  - For RadioactiveDecay6.1 : several files have been corrected

Main Changes in Hadronics after Cand01

- Updated hadronic dataset *RadioactiveDecay6.1.**1***
  - Minor fixes of 3 files : z7.a13, z77.a164, z77.a171
- Updated hadronic dataset *RadioactiveDecay6.1.**2***
  - README_RDM : updated to clarify that the mean life is taken from ENSDFSTATE (the value in RadioactiveDecay is ignored)
- *examples/extended/hadronic/FlukaCern*
  - Skip rotation of the final-state particles from the assumed projectile direction, (0, 0, 1), to the original direction of the projectile – this rotation is already done in *G4HadronicProcess::PostStepDoIt*
    - This is expected to fix the discrepancy between Geant4 and Fluka-Cern regarding the leakage in the ATLAS test-beam set-ups, reported by Lorenzo Pezzotti

Crashes & Warnings

- No crashes
- No infinite loops
- No new warnings

Reproducibility

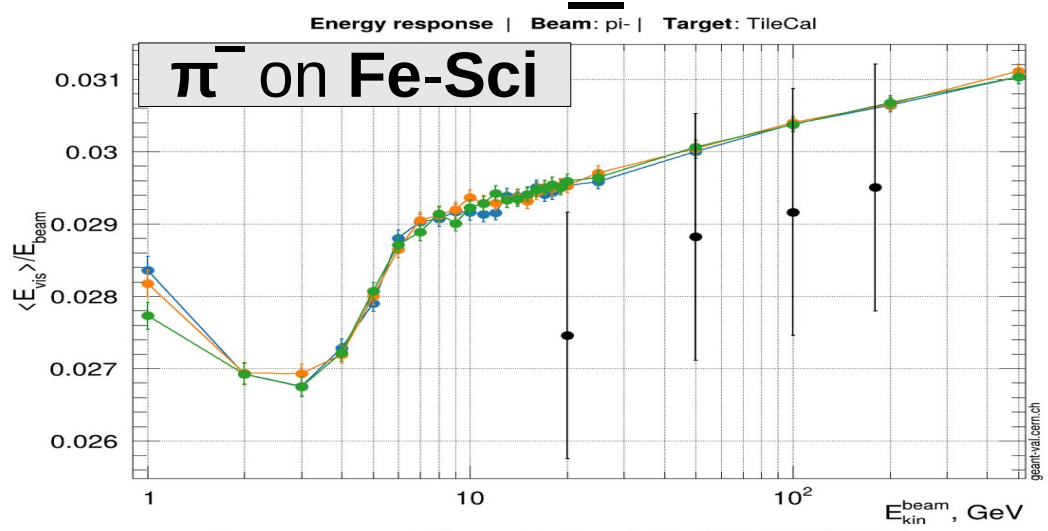
- OK in all cases
  - One violation seen only once in QGSP_BIC_HP_EMZ in Cand01
    - Under study, but difficult to isolate and investigate…
    - It is likely a rare violation, not seen before because of limited statistics

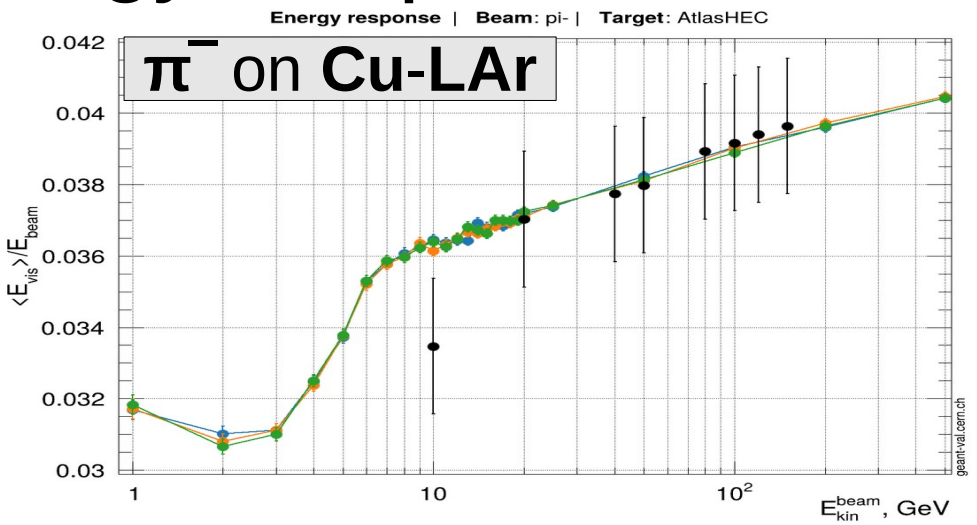
Pion- showers: FTFP_BERT

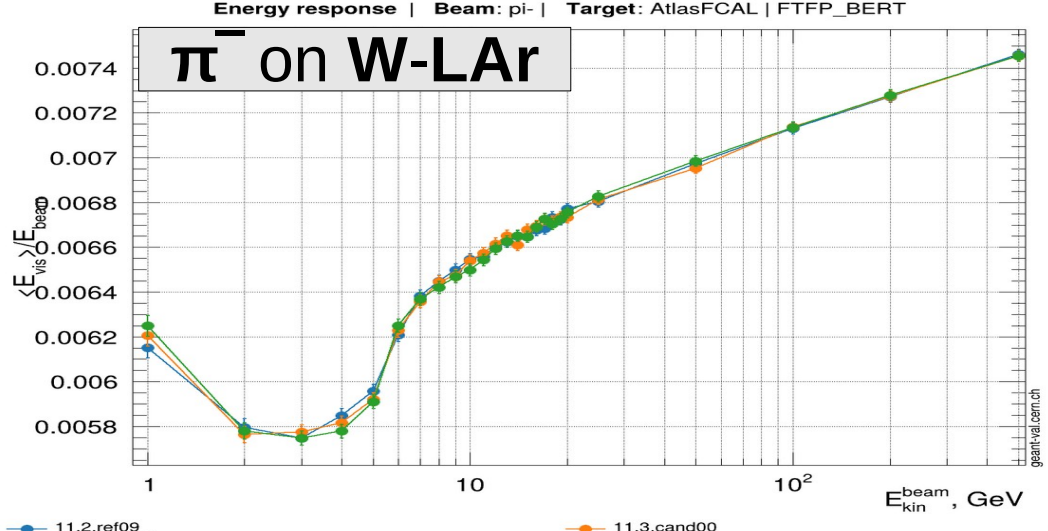
G4 11.2.ref09
G4 11.3.cand00
G4 11.3.cand01

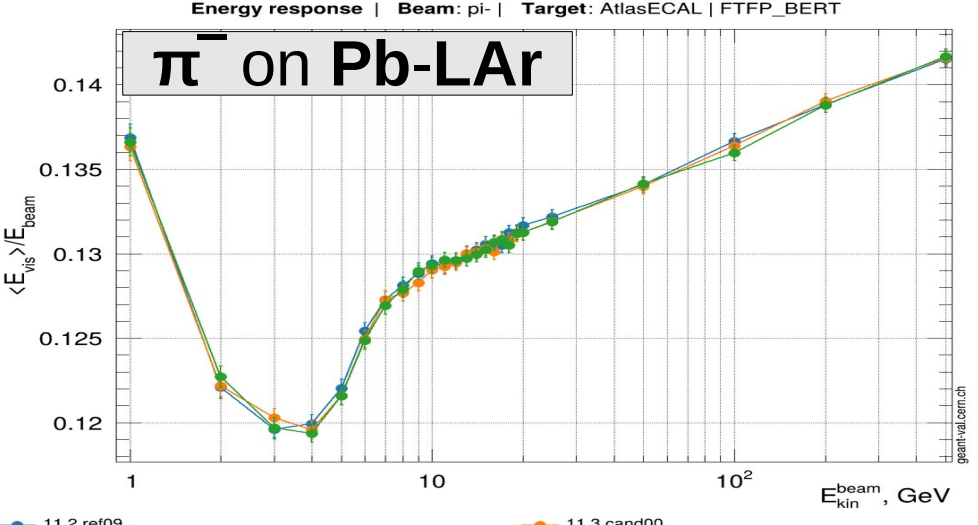
Note : conventional Birks treatment
(easier and no experimental h/e to fit !)

FTFP_BERT : Energy Response

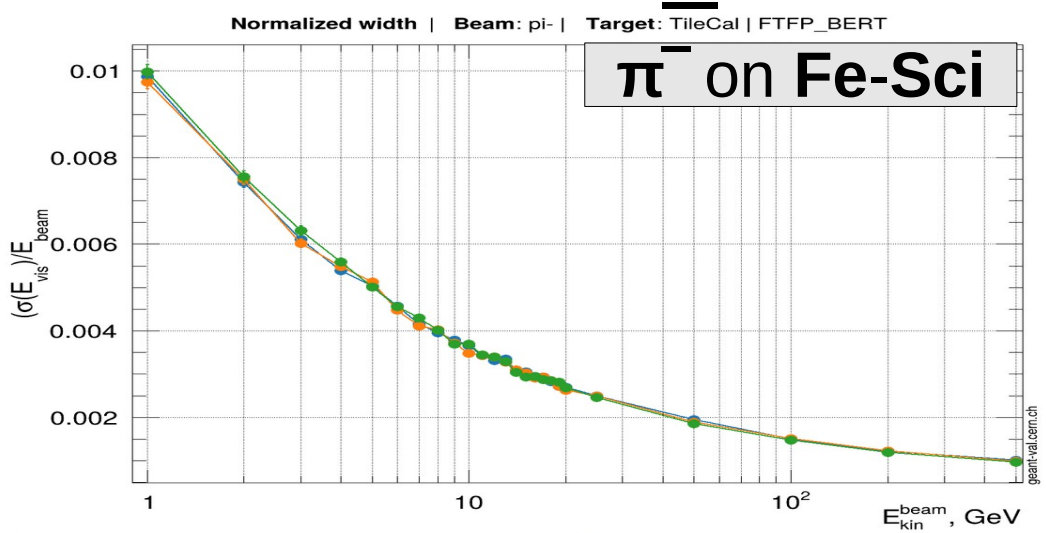


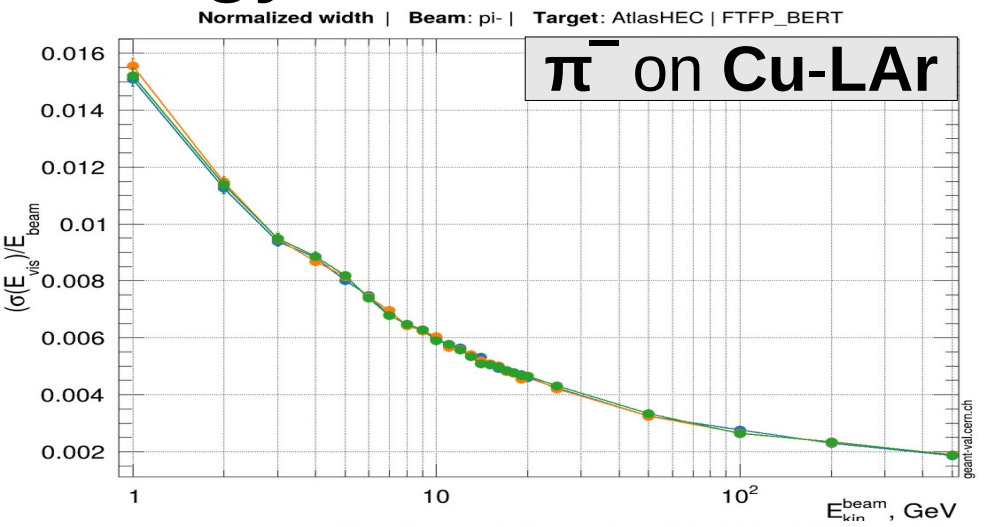


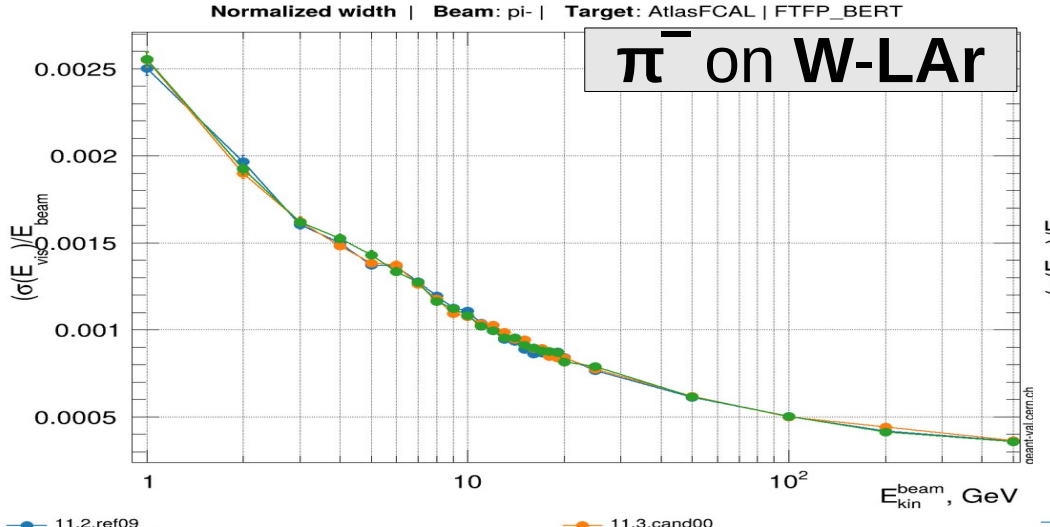


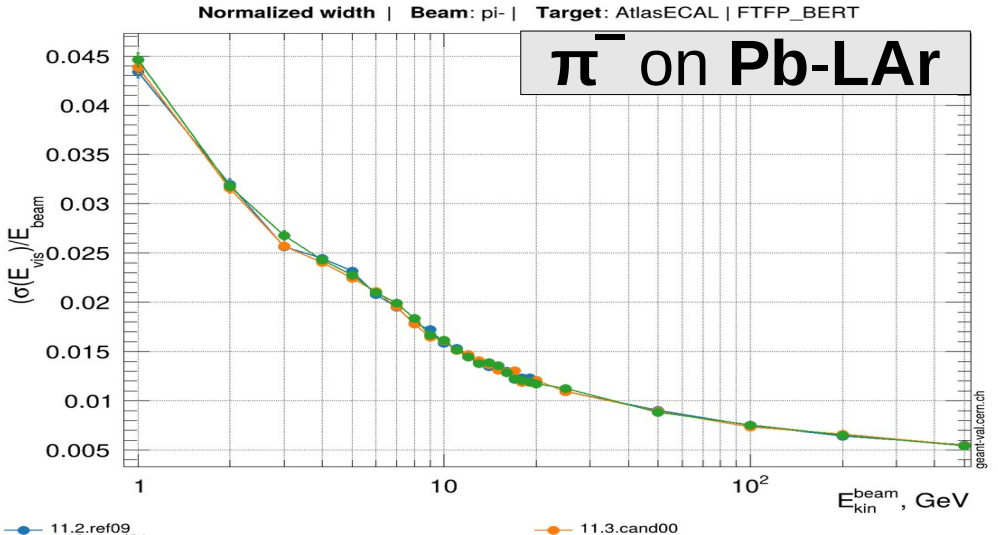


FTFP_BERT : Energy Width

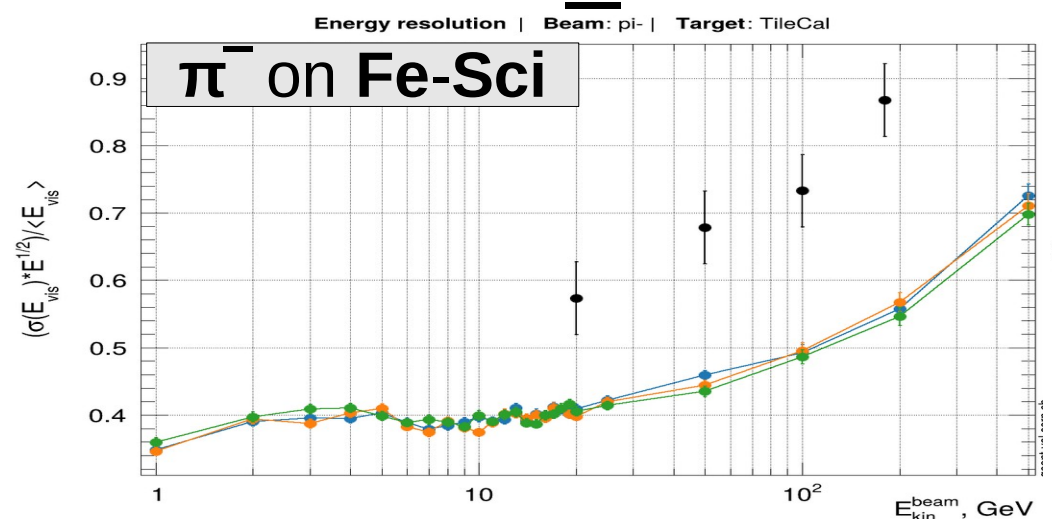


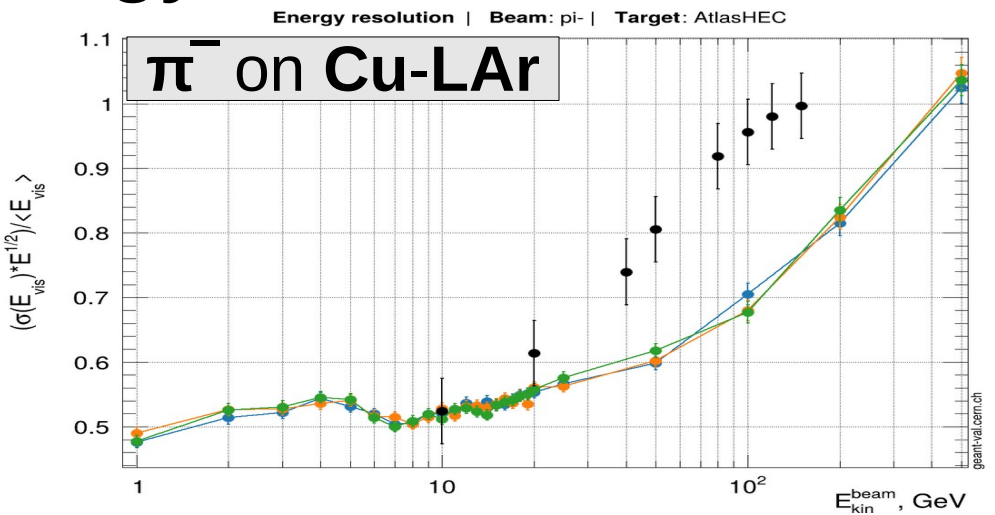


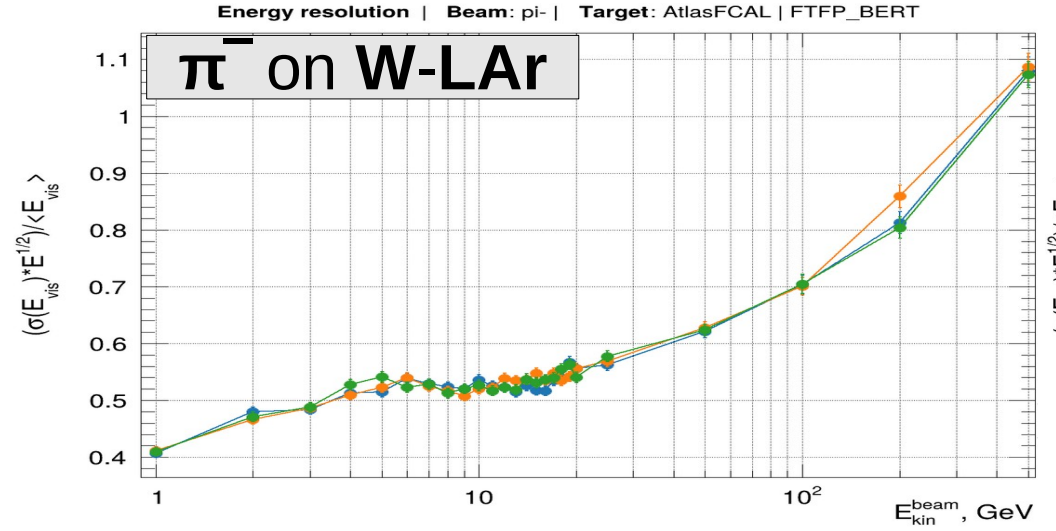


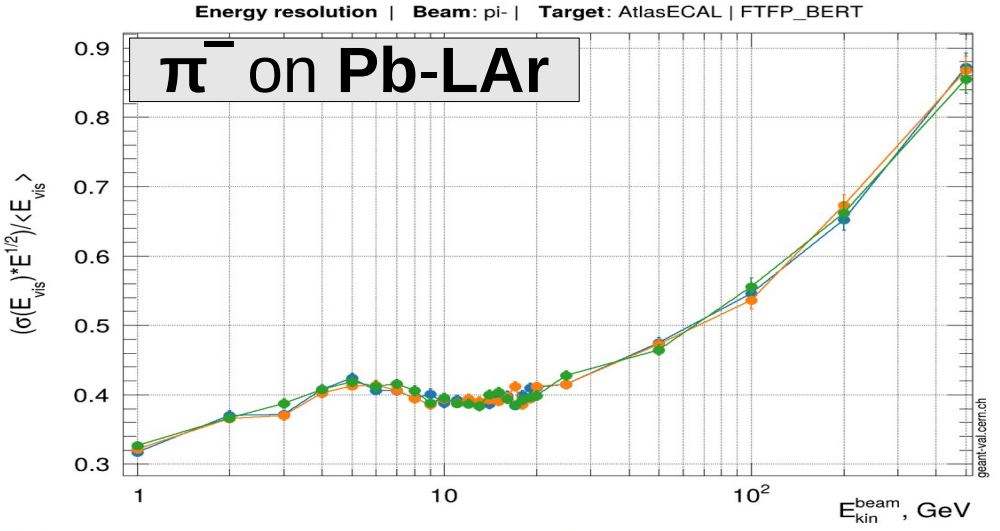


FTFP_BERT : Energy Resolution

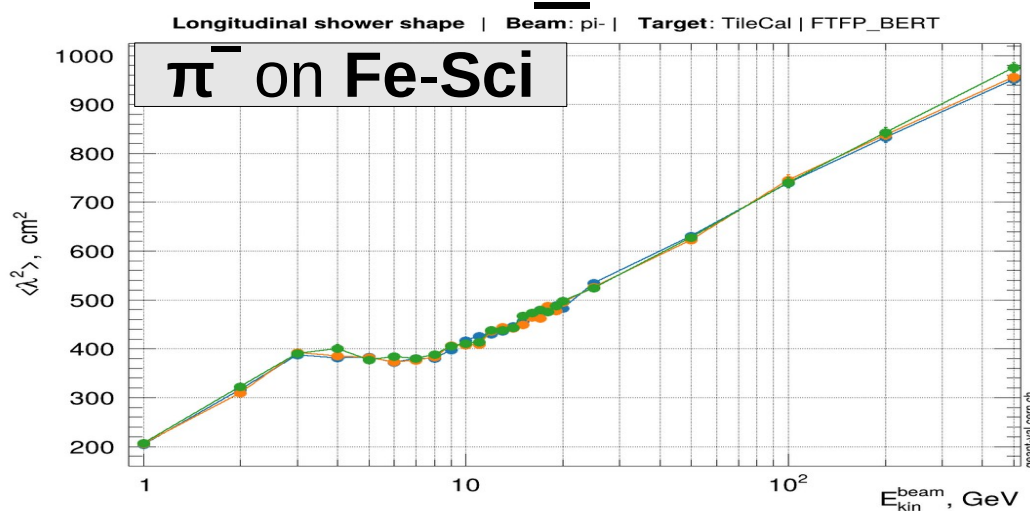


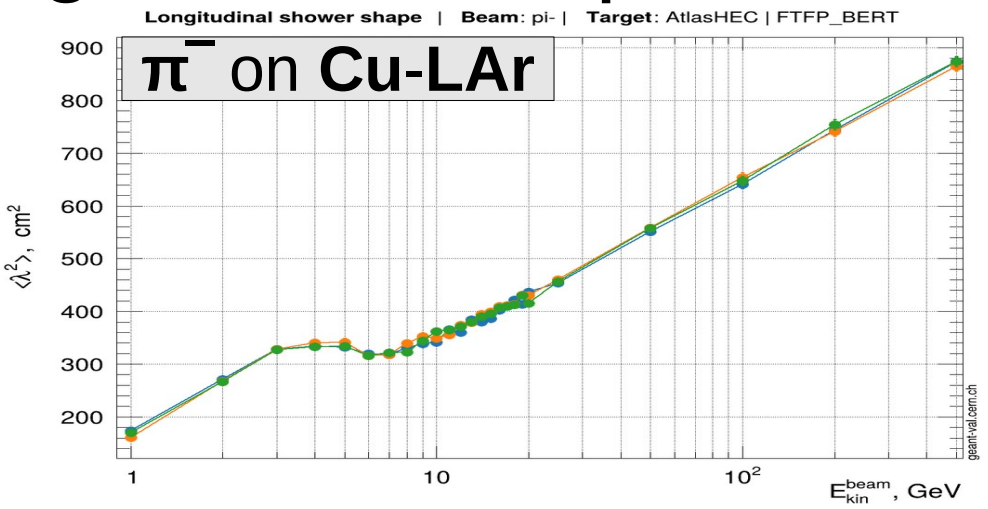


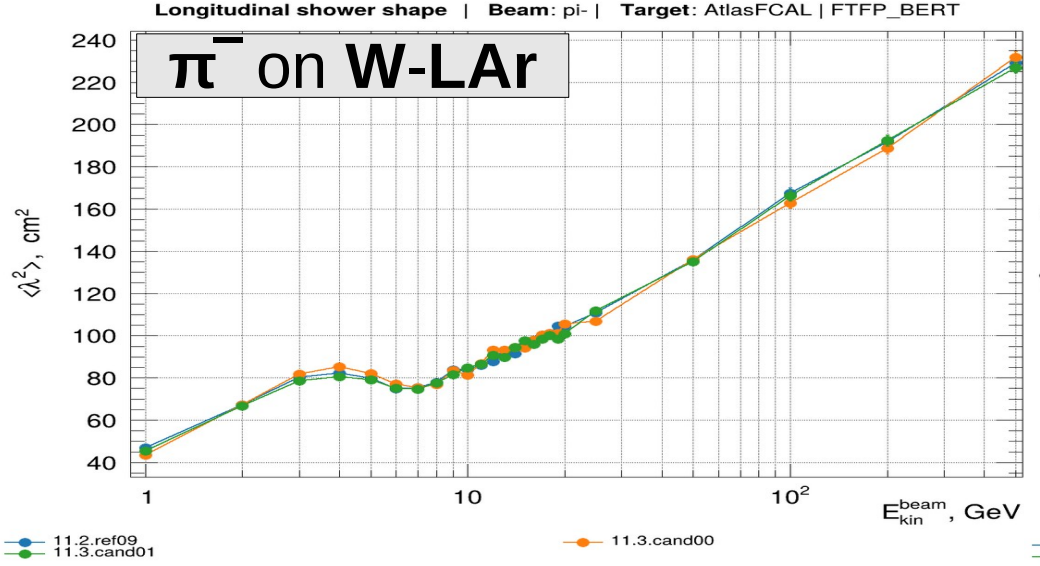


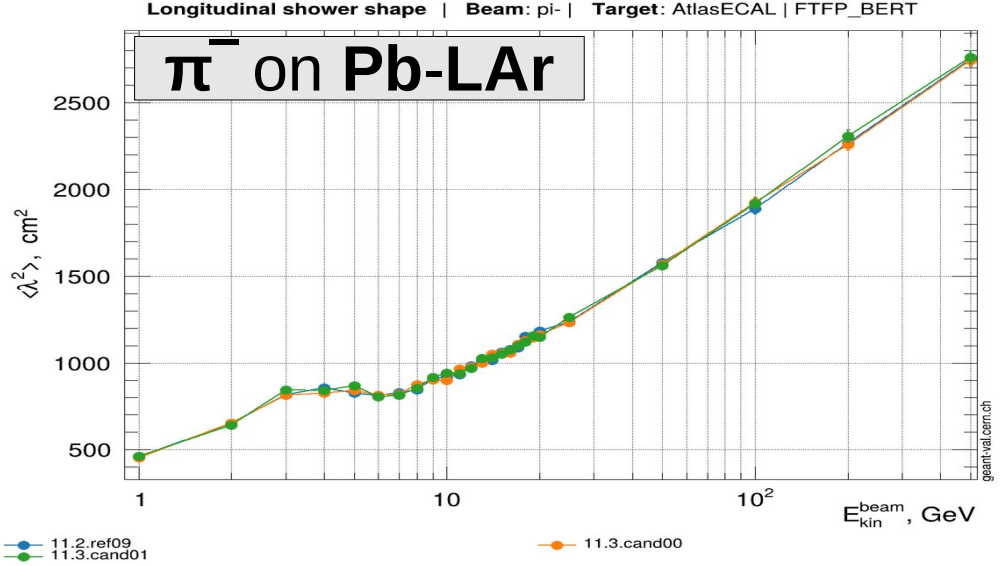


FTFP_BERT : Longitudinal Shape

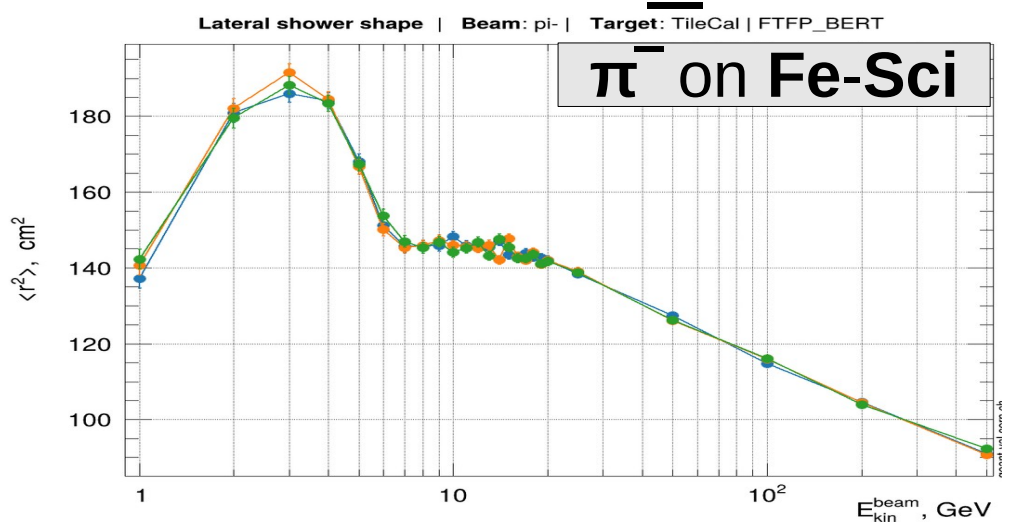


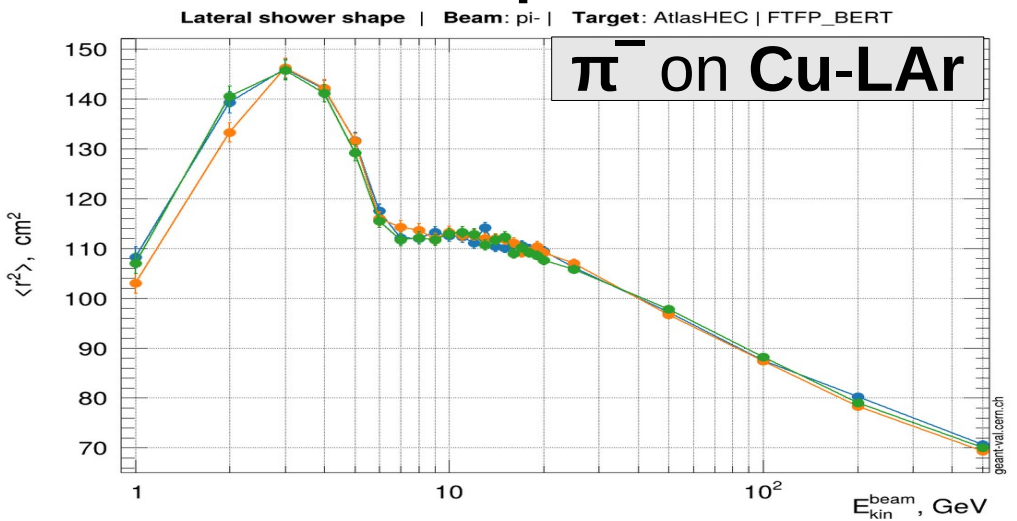


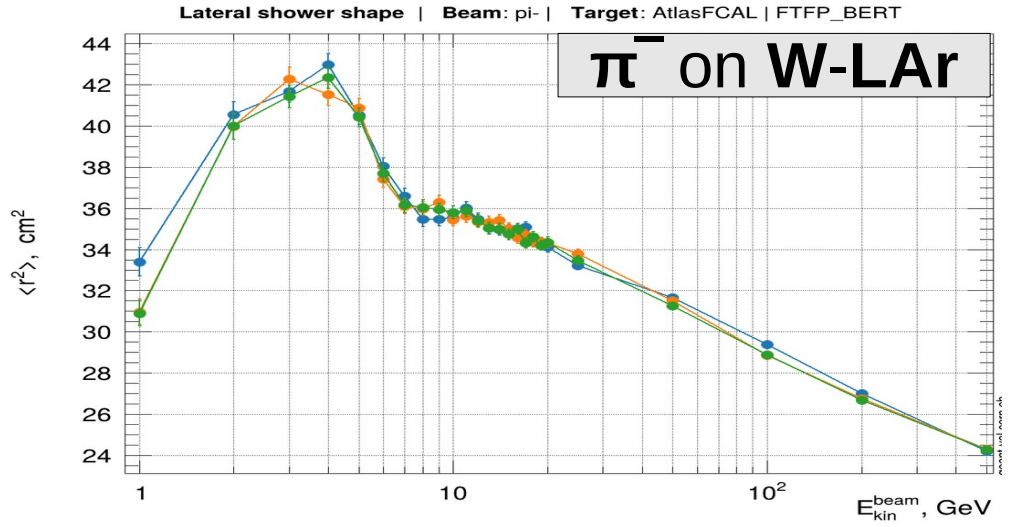


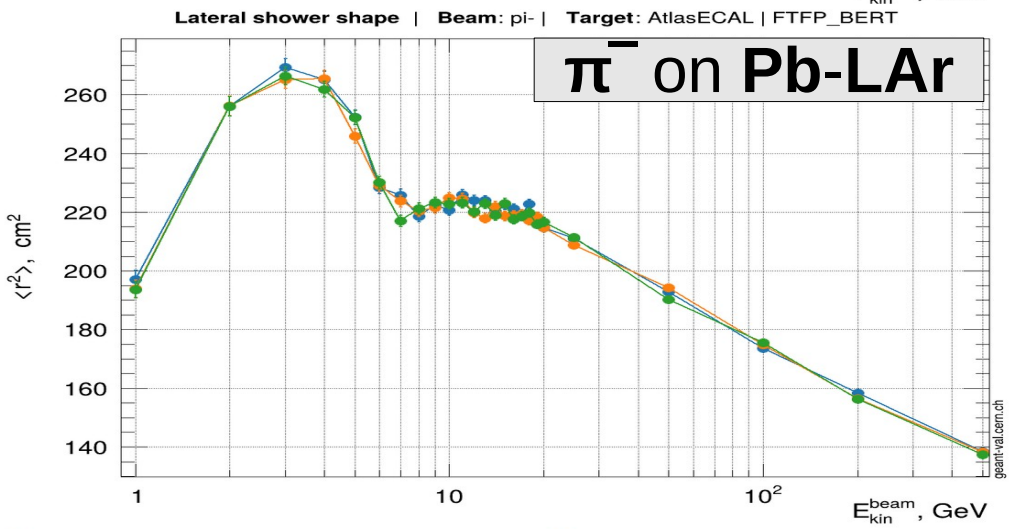


FTFP_BERT : Lateral Shape









Conclusions

- **G4 11.3.cand{00, 01}**
  - No crashes, no infinite loops, no new warnings
  - Reproducibility is fine in all cases
    - Except for one, single rare violation seen with QGSP_BIC_HP_EMZ
  - Hadron showers:
    - For all reference physics lists, the hadronic showers of 11.3.cand{00, 01} are similar to those of Ref09