

Hadronic Showers in Geant4 10.7.cand{00,01}

G. Folger, D. Konstantinov, G. Latyshev,
I. Razumov, A. Ribon
CERN EP/SFT

Main Changes in Hadronics vs. 10.6.ref10

- No changes that can affect the physics, except one:
 - Enabled charm and bottom physics in most physics lists (*cand00*)
- Other changes in:
 - (theo_high_energy/) : new class G4CRCoalescence (*cand00*)
 - Model developed by Diego Mauricio Gomez Coral for the GAPS Collaboration to apply coalescence to the secondaries produced by string models to form deuterons and antideuterons from pairs of proton-neutron, antiproton-antineutron, close in momenta. By default switched off; to switch it on, new UI command:
/process/had/enableCRCoalescence true
 - (management/) G4HadronicProcessStore : Coverity fix (*cand00*)
 - LEND : fixed typos (*cand01*)
 - ParticleHP : improved error message (*cand00*)
 - Cross sections : fixed typos in print-out (*cand01*)
 - Gamma-lepton-nuclear constructor : added flag (*cand00*)

Crashes & Warnings

- No crashes
- No infinite loops
- Neither new warnings nor more frequent known (rare) ones

Reproducibility

- OK all “traditional” tests
- OK all new reproducibility tests for the Tasking mechanism

Pion- showers: FTFP_BERT

G4 10.7.cand01

G4 10.7.cand01a as Cand01 but rolled back UrbanMSC

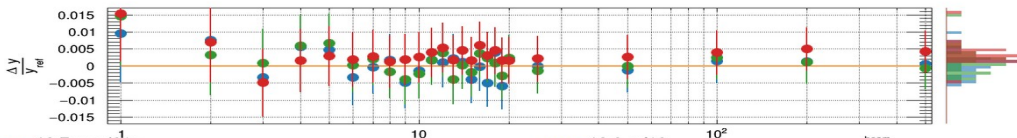
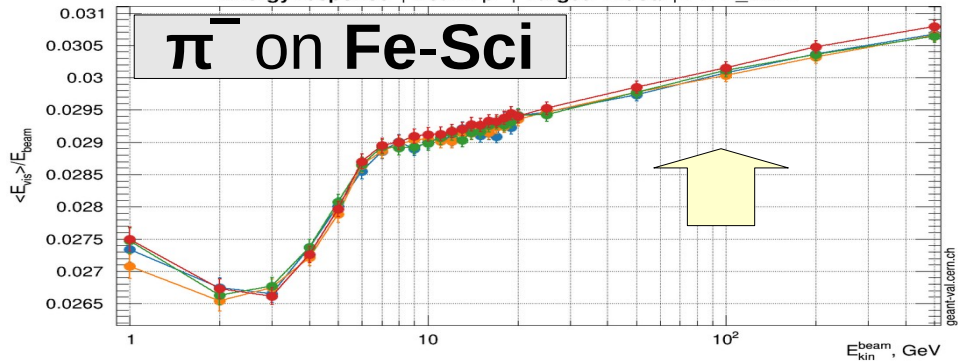
G4 10.7.cand00

G4 10.6.ref10

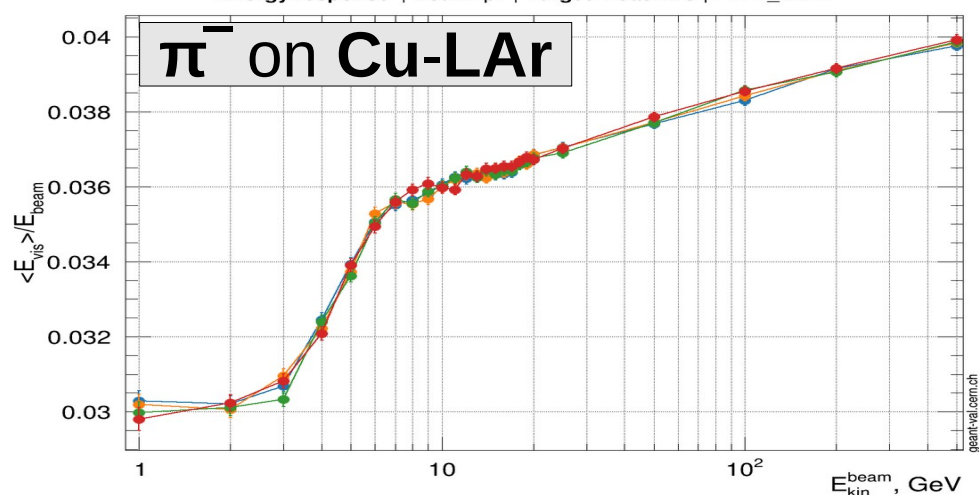
*Note : conventional Birks treatment
(easier and no experimental h/e to fit !)*⁴

FTFP_BERT : Energy Response

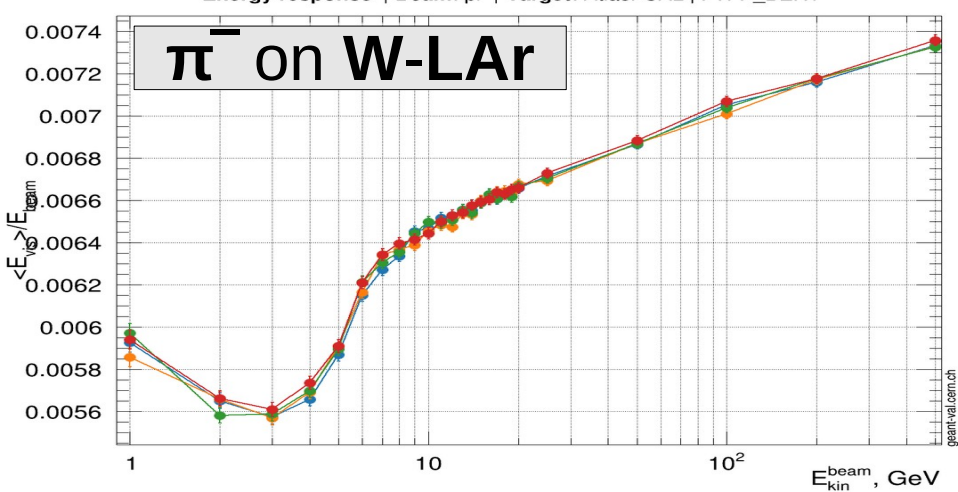
Energy response | Beam: pi- | Target: TileCal | FTFP_BERT



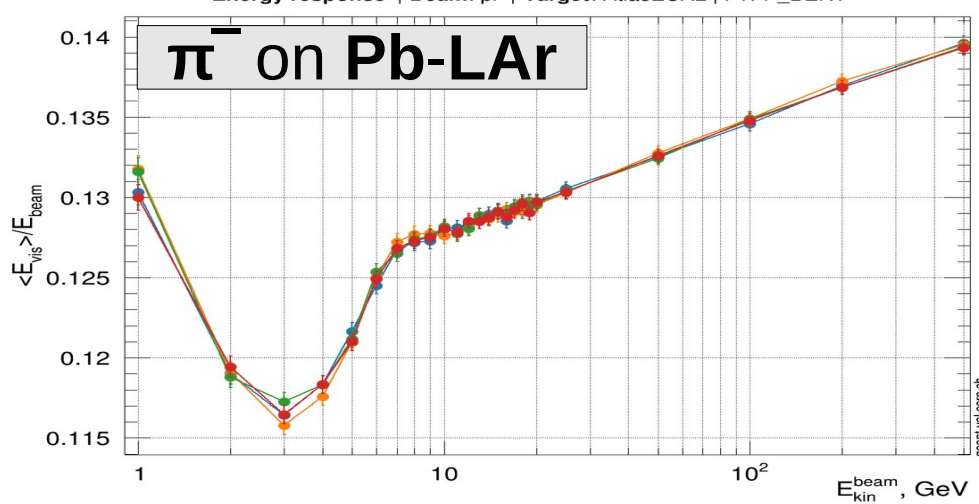
Energy response | Beam: pi- | Target: AtlasHEC | FTFP_BERT



Energy response | Beam: pi- | Target: AtlasFCAL | FTFP_BERT



Energy response | Beam: pi- | Target: AtlasECAL | FTFP_BERT



10.7.cand01a
10.7.cand00

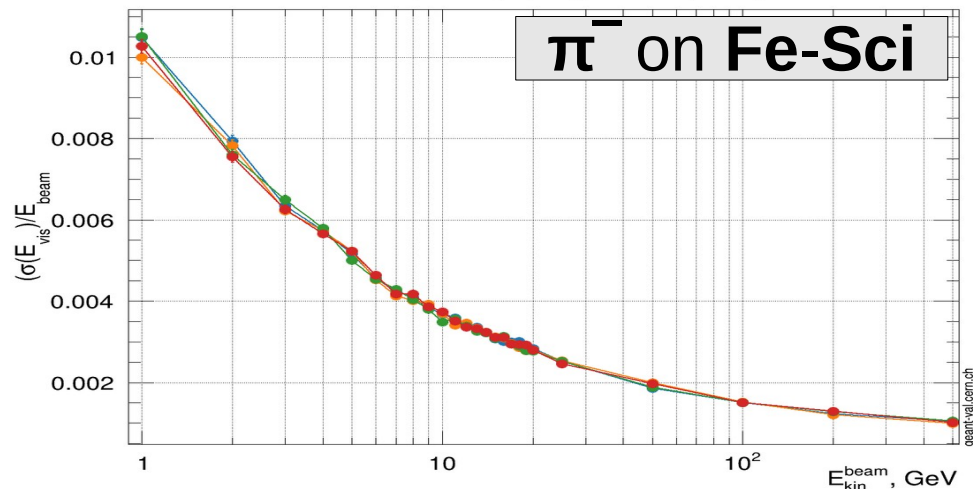
10.6.ref10
10.7.cand01

10.7.cand01a
10.7.cand00

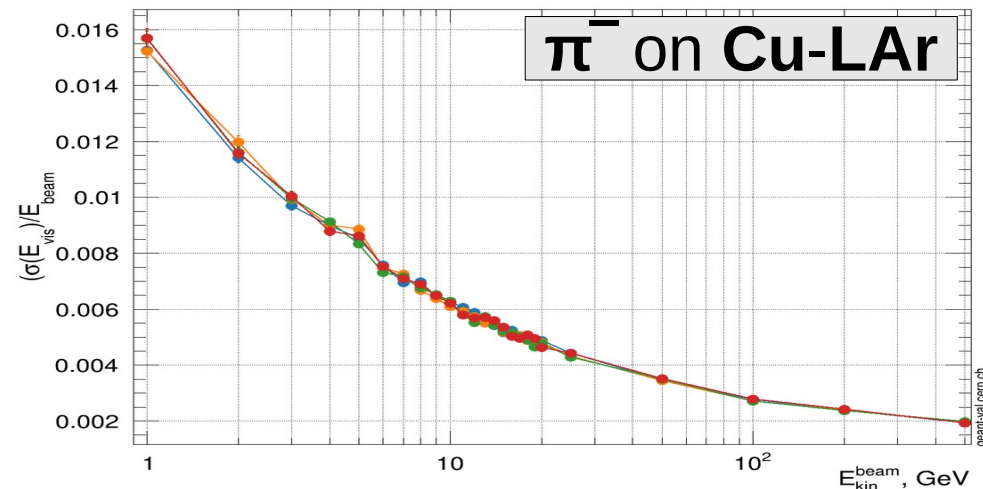
10.6.ref10
10.7.cand01

FTFP_BERT : Energy Width

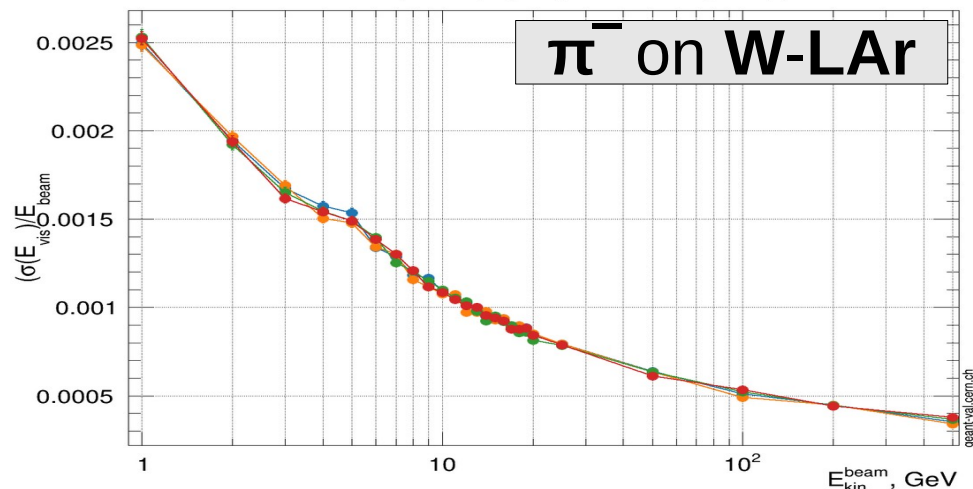
Normalized width | Beam: pi- | Target: TileCal | FTFP_BERT



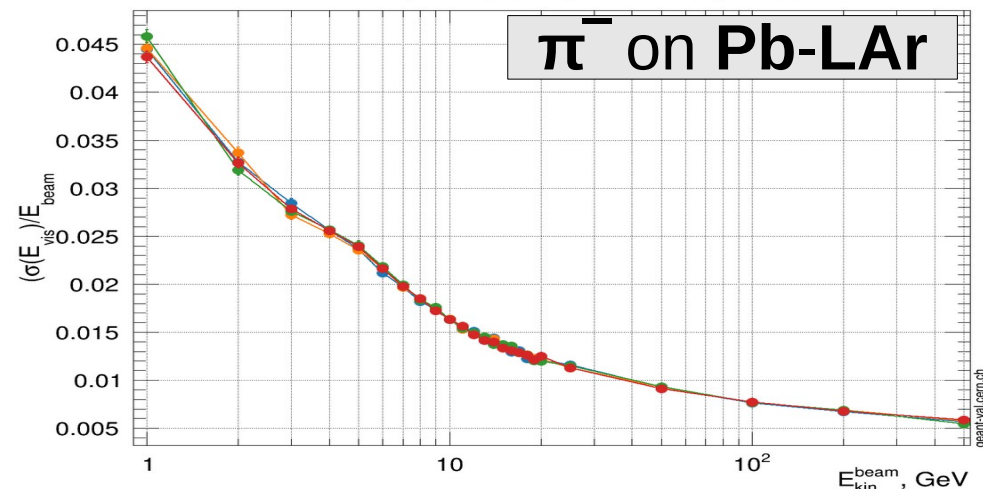
Normalized width | Beam: pi- | Target: AtlasHEC | FTFP_BERT



Normalized width | Beam: pi- | Target: AtlasFCAL | FTFP_BERT



Normalized width | Beam: pi- | Target: AtlasECAL | FTFP_BERT



10.7.cand01a
10.7.cand00

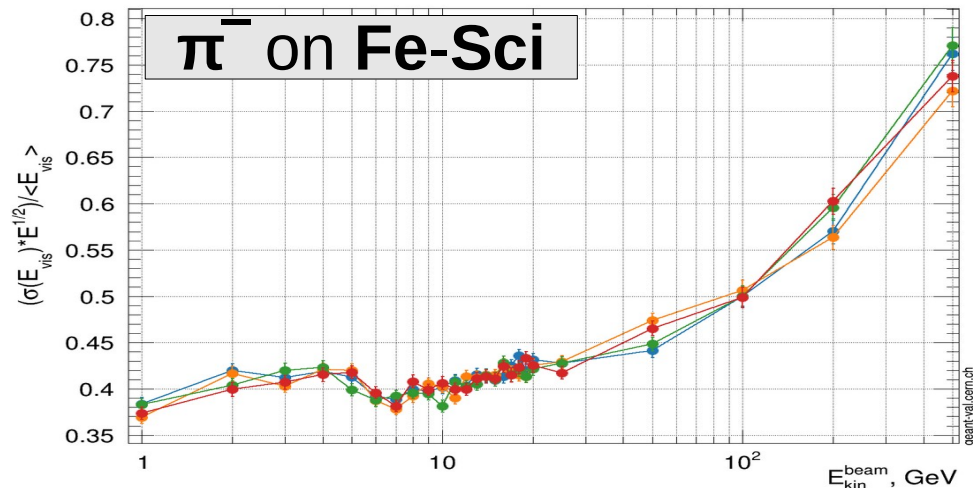
10.6.ref10
10.7.cand01

10.7.cand01a
10.7.cand00

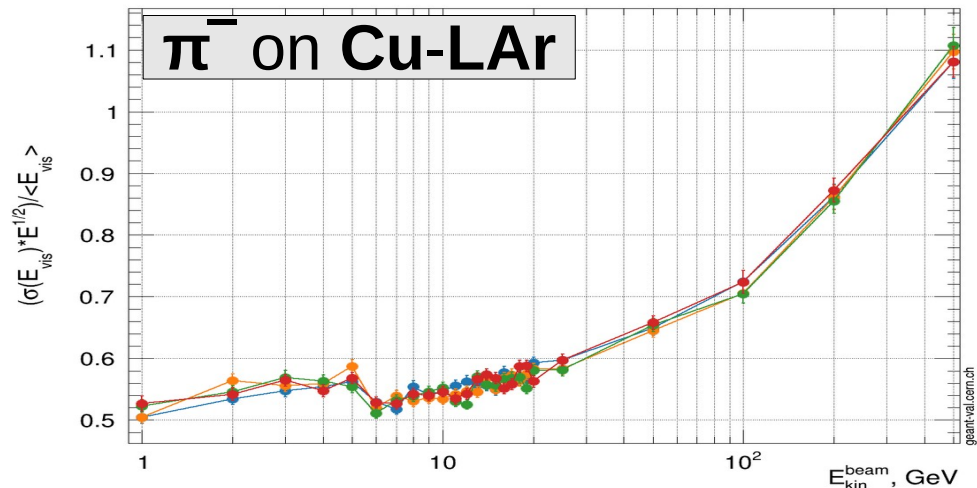
10.6.ref10
10.7.cand01

FTFP_BERT : Energy Resolution

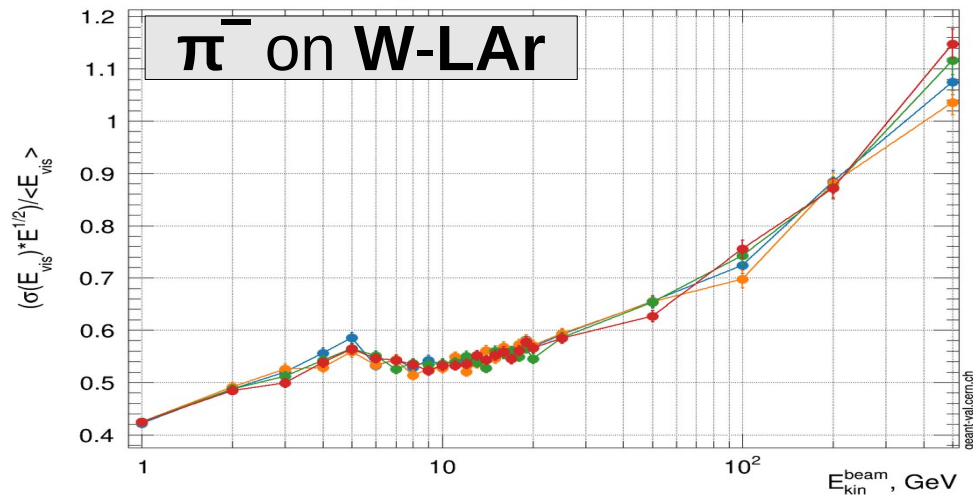
Energy resolution | Beam: pi- | Target: TileCal | FTFP_BERT



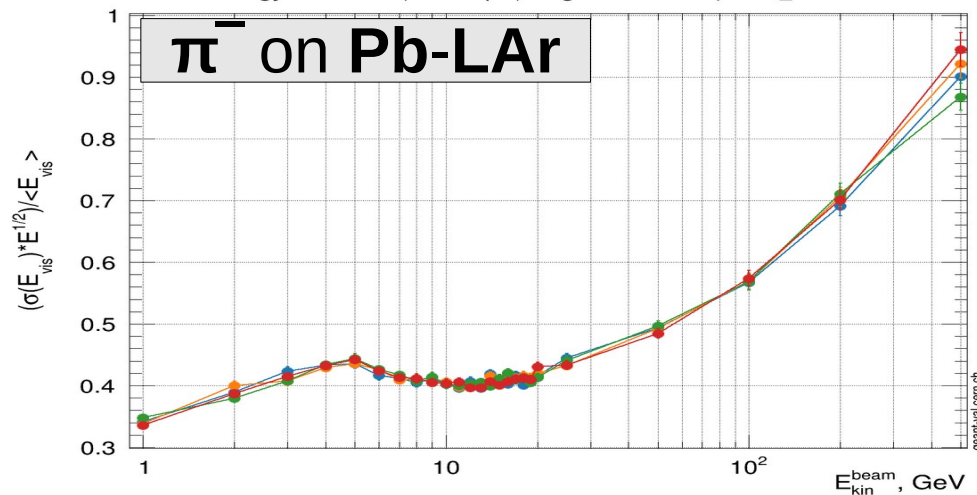
Energy resolution | Beam: pi- | Target: AtlasHEC | FTFP_BERT



Energy resolution | Beam: pi- | Target: AtlasFCAL | FTFP_BERT



Energy resolution | Beam: pi- | Target: AtlasECAL | FTFP_BERT



10.7.cand01a
10.7.cand00

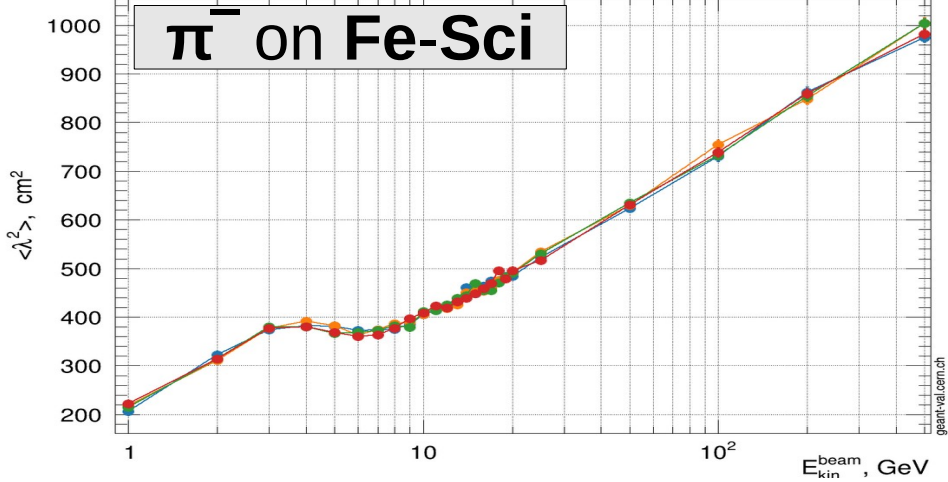
10.6.ref10
10.7.cand01

10.7.cand01a
10.7.cand00

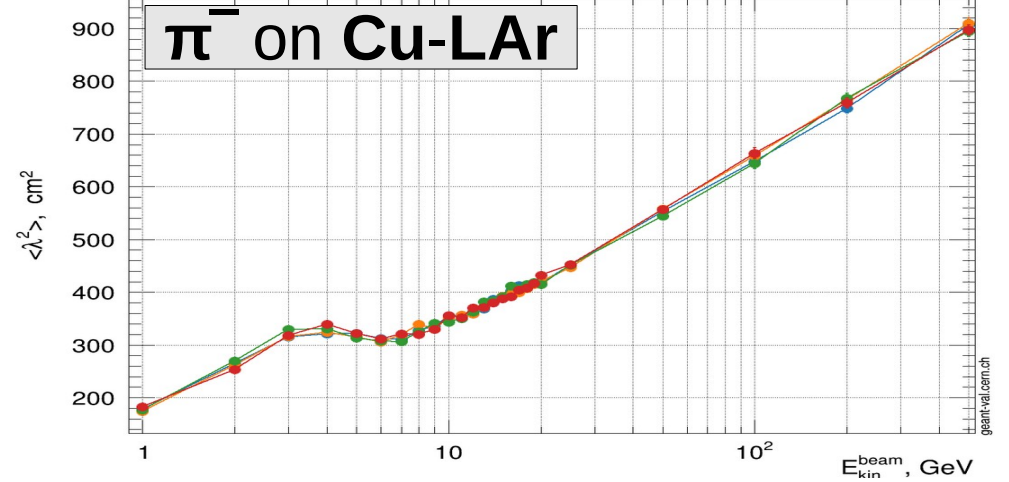
10.6.ref10
10.7.cand01

FTFP_BERT : Longitudinal Shape

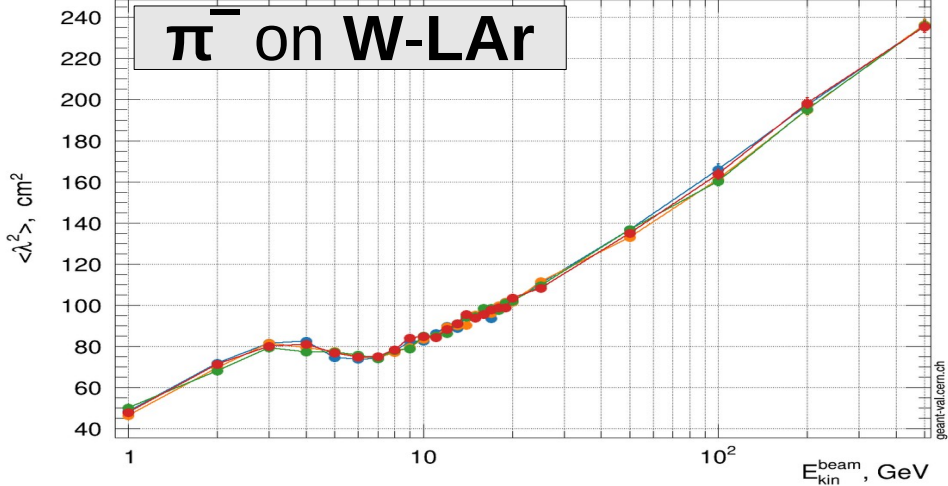
Longitudinal shower shape | Beam: pi- | Target: TileCal | FTFP_BERT



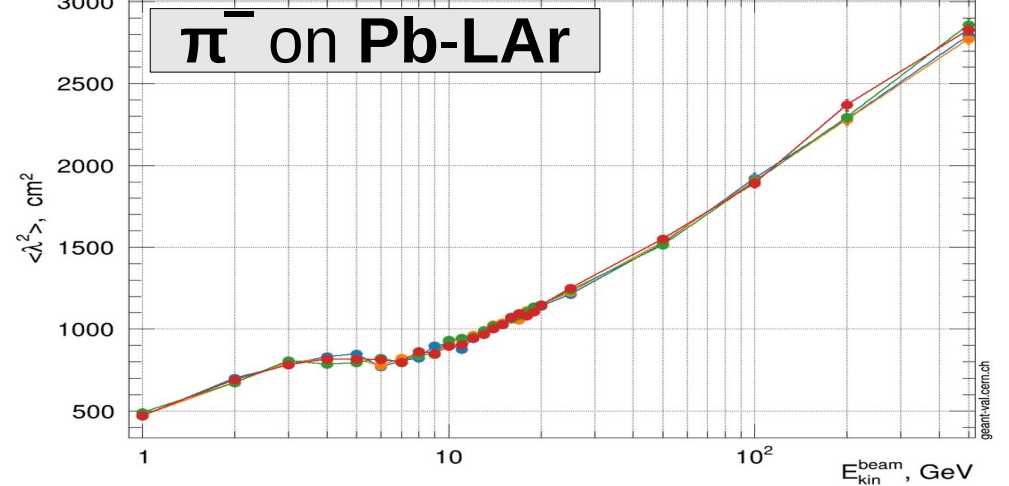
Longitudinal shower shape | Beam: pi- | Target: AtlasHEC | FTFP_BERT



Longitudinal shower shape | Beam: pi- | Target: AtlasFCAL | FTFP_BERT



Longitudinal shower shape | Beam: pi- | Target: AtlasECAL | FTFP_BERT



10.7.cand01a

10.6.ref10

10.7.cand01

10.7.cand01a

10.7.cand00

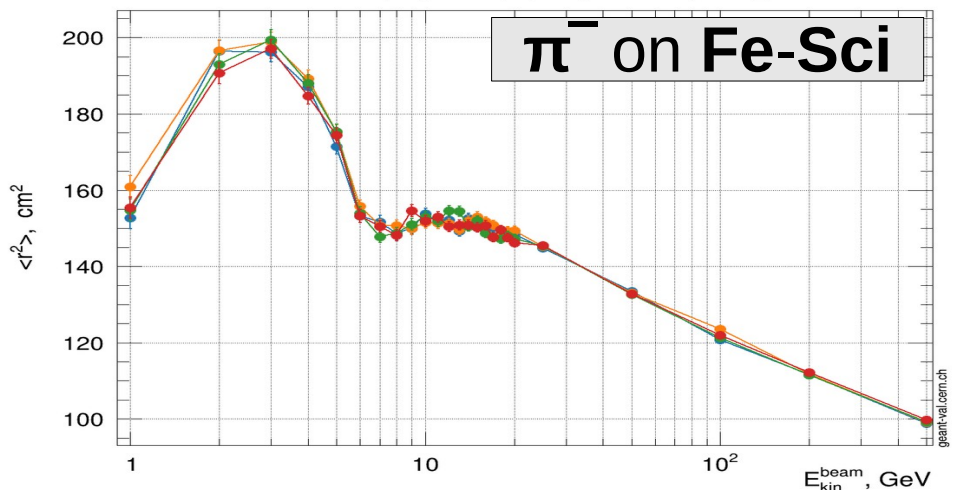
10.6.ref10

10.7.cand01

FTFP_BERT : Lateral Shape

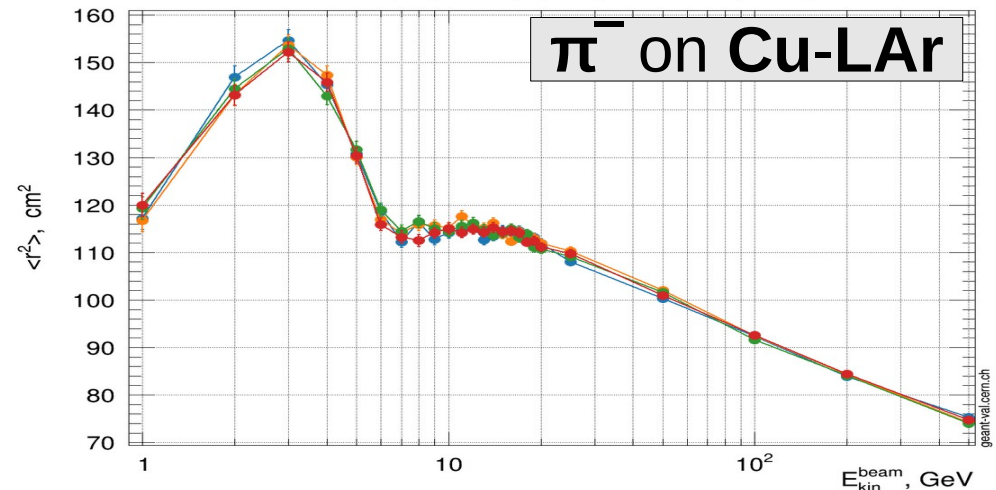
Lateral shower shape | Beam: pi- | Target: TileCal | FTFP_BERT

π^- on Fe-Sci



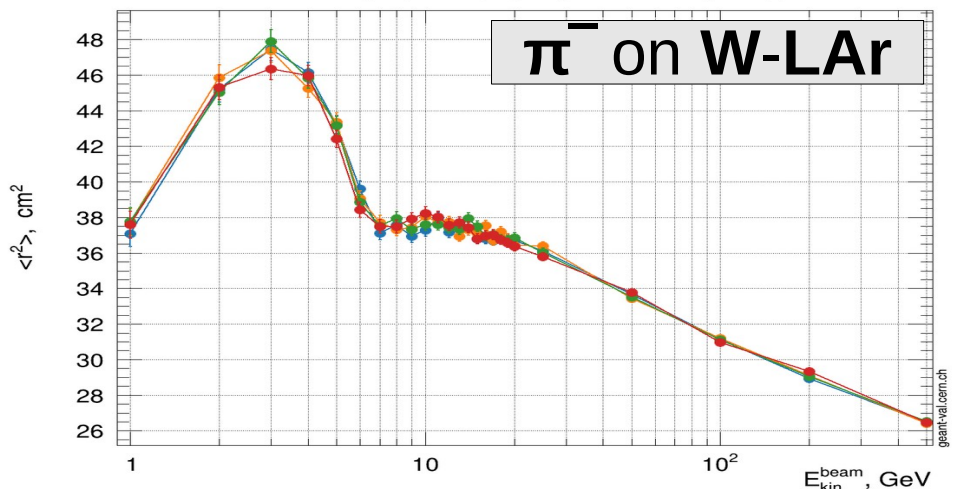
Lateral shower shape | Beam: pi- | Target: AtlasHEC | FTFP_BERT

π^- on Cu-LAr



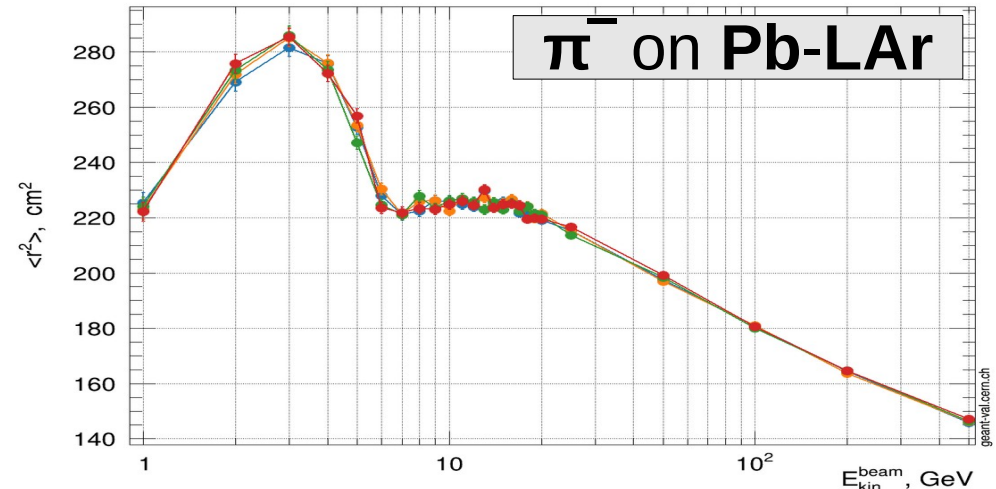
Lateral shower shape | Beam: pi- | Target: AtlasFCAL | FTFP_BERT

π^- on W-LAr



Lateral shower shape | Beam: pi- | Target: AtlasECAL | FTFP_BERT

π^- on Pb-LAr



Conclusions

- **G4 10.7.cand**
 - No crashes, no infinite loops, no new warnings
 - Reproducibility is OK, also with the new Tasking
 - Hadron showers
 - Stable showers for all physics lists, except a $\sim 0.5\%$ increase in visible energy in one simplified calorimeter (Fe-Sci)
 - Due to the roll back of the step limit in Urban multiple scattering as it was in G4 10.6.ref07.
This changed was agreed at the previous SFT/G4 meeting, 2 weeks ago, on November 10th. No further actions are needed.