

Grid testing of Geant4 : 10.4.ref04

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CERN PH/SFT

Main Changes in Hadronics vs. Ref03

- No changes in: FTF, QGS, BERT, BIC, Precompound, De-excitation
- Cross sections
 - Introduced switch to allow transuranic elements
- Quasi-elastic
 - Removed unnecessary protection against transuranic elements
- Others
 - ParticleHP
 - Protection against very rare cases of division by zero
 - Radioactive Decay
 - Technical fix relevant for biasing: switch from `std::exp` to `std::expm1` where small exp arguments are expected

Crashes & Warnings

- No crashes
- No infinite loops
- **1 warning** (found in 12 GeV π^- on TileCal (Fe-Sci) with FTFP_BERT_HP)

**** G4Exception : HAD_FANCY3DNUCLEUS_001
issued by : G4Fancy3DNucleus::ChooseFermiMomenta():
difficulty finding proton momentum, set it to (0,0,0)
Nucleus Z A 6 12 , proton with eMax=938.109
*** This is just a warning message. ****

- Warning introduced in G4 10.4.ref01 which can happen from time to time, nothing to worry about if it happens rarely

Reproducibility

- Reproducibility OK

Pion showers: FTFP_BERT

G4 10.4.ref04

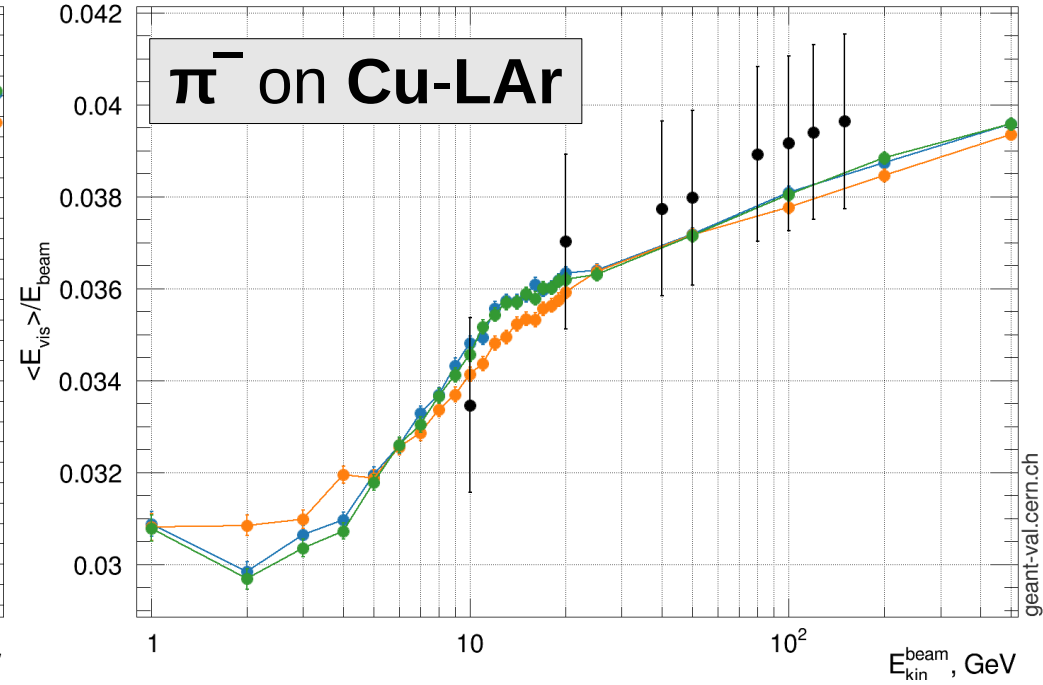
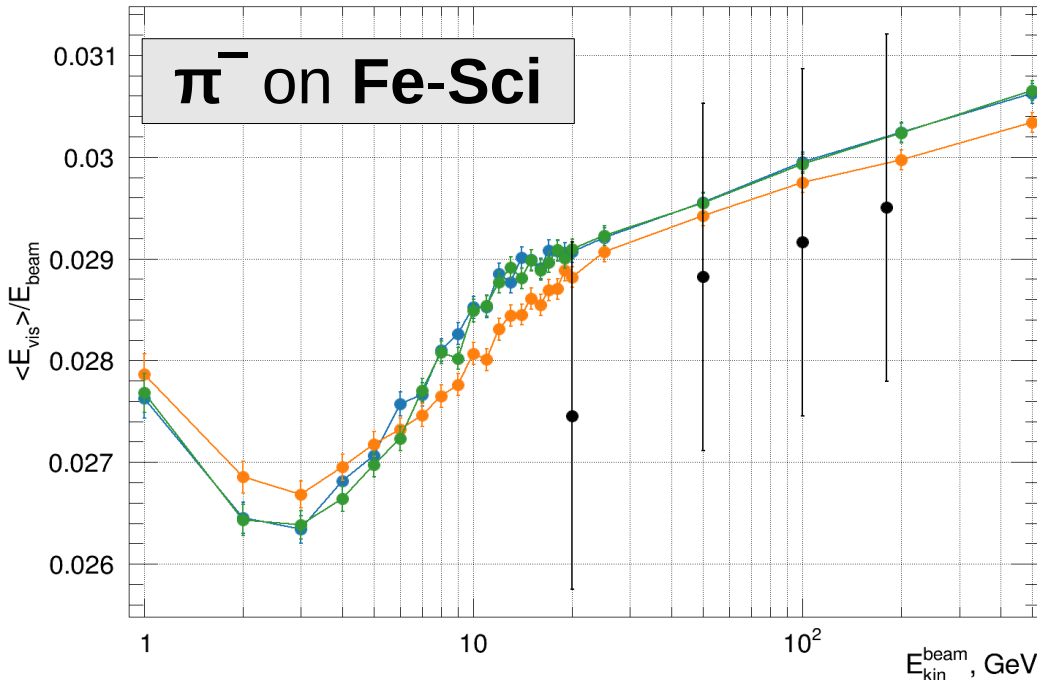
10.4.ref03

10.4.p01

FTFP_BERT : Energy Response

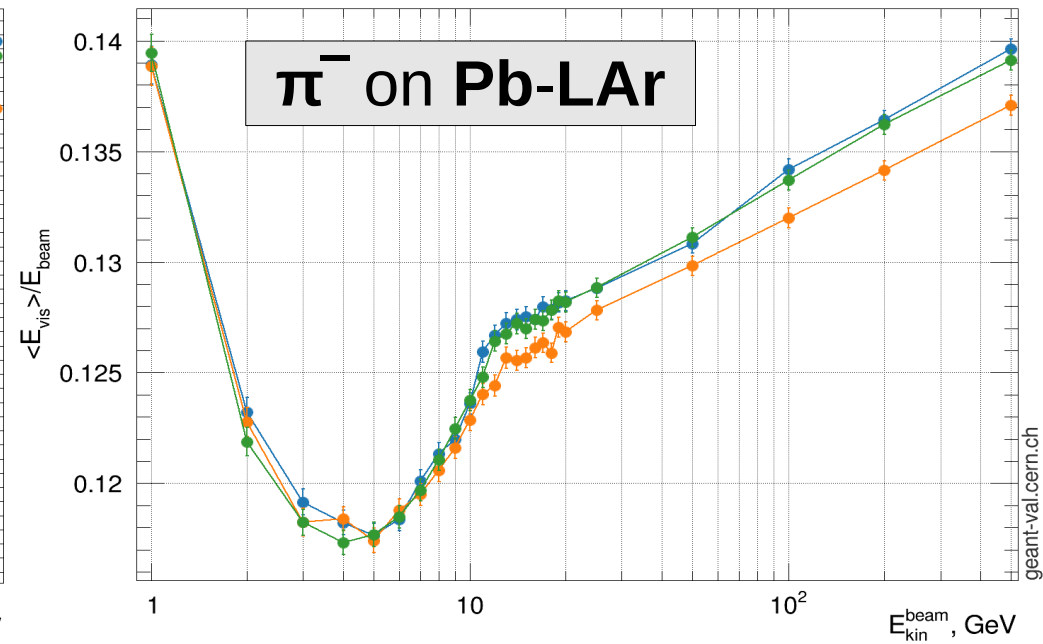
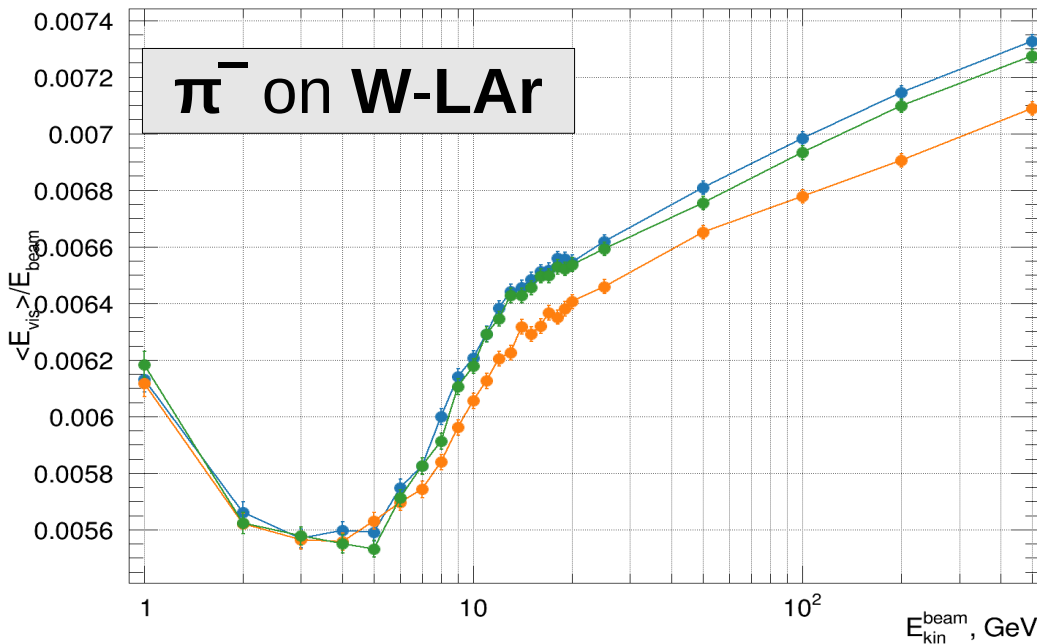
Energy response | Beam: pi- | Target: TileCal

Energy response | Beam: pi- | Target: AtlasHEC



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

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

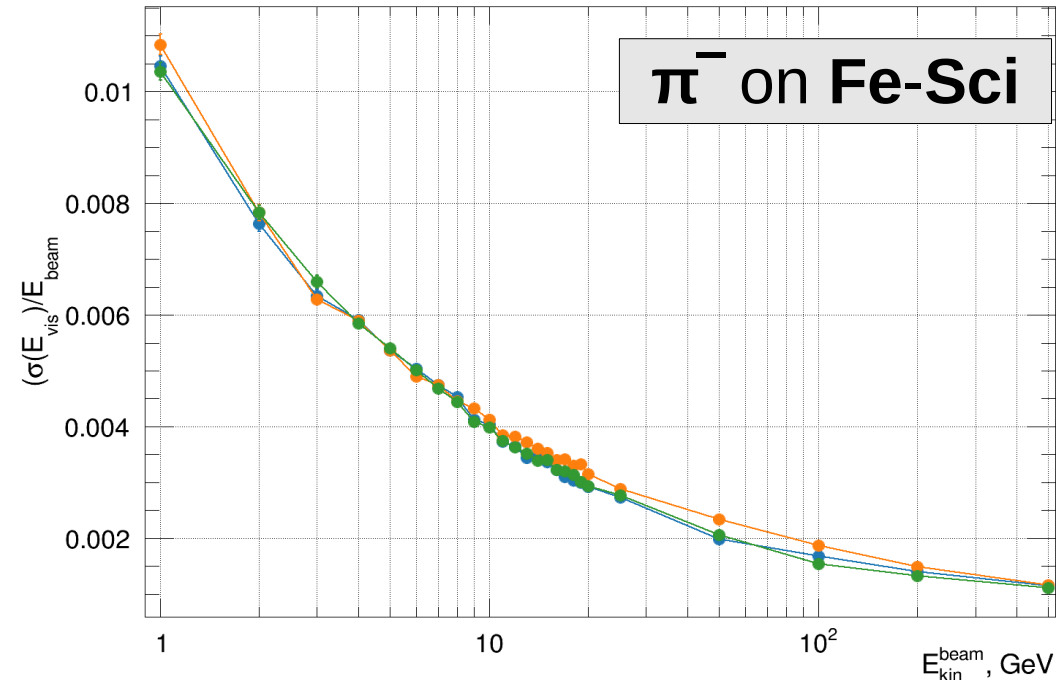


10.4.ref04 (blue circle) 10.4.ref03 (green circle) 10.4.p01_cand01 (orange circle)

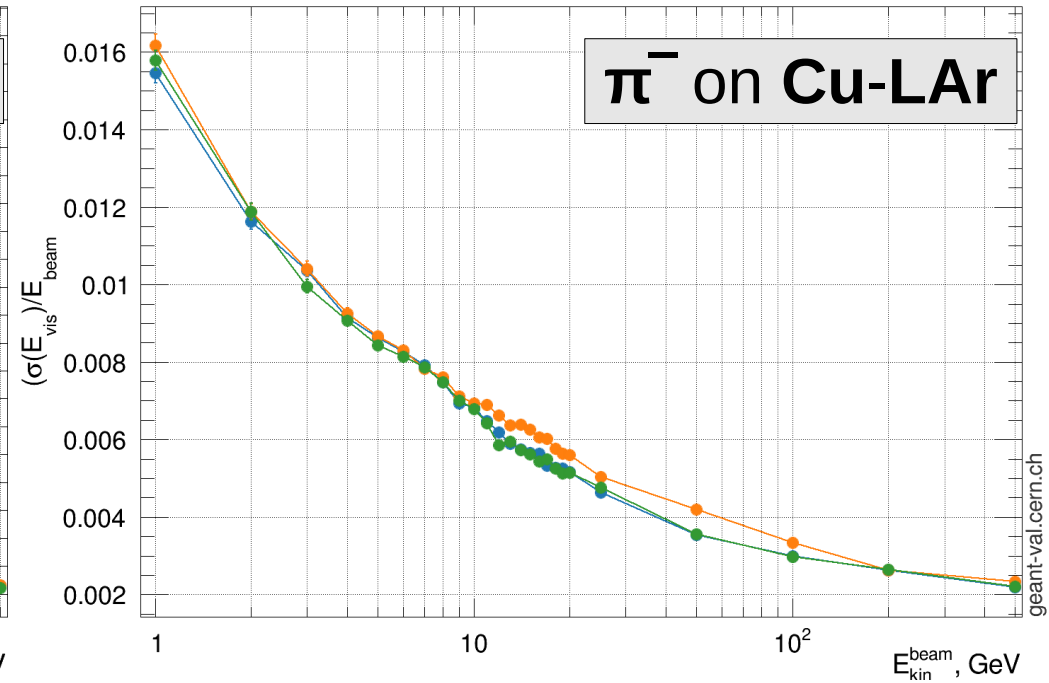
10.4.ref04 (blue circle) 10.4.ref03 (green circle) 10.4.p01_cand01 (orange circle)

FTFP_BERT : Energy Width

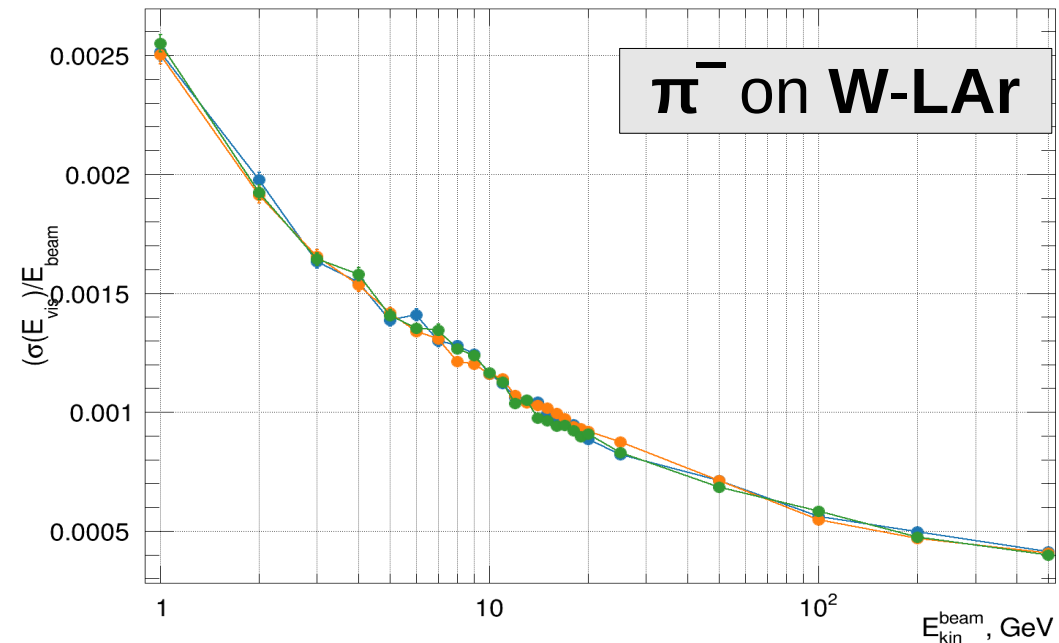
Normalized width | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



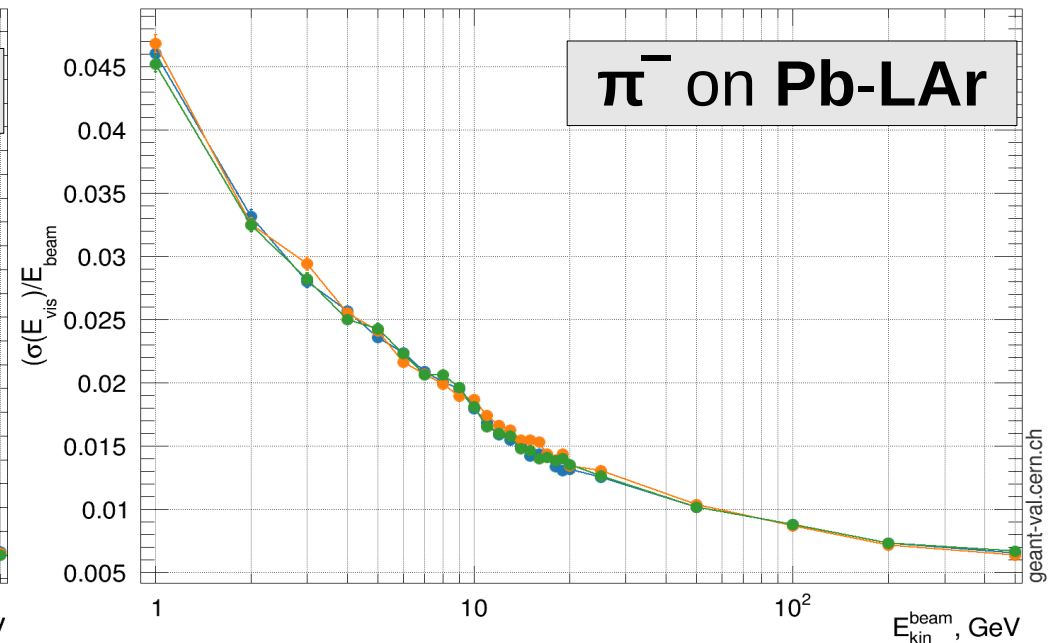
Normalized width | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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



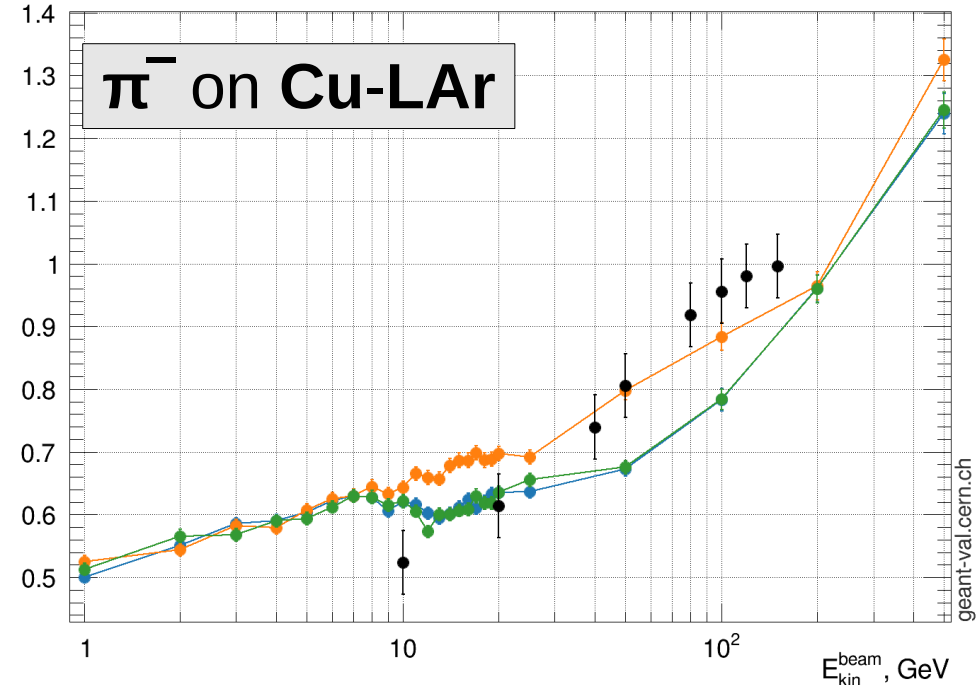
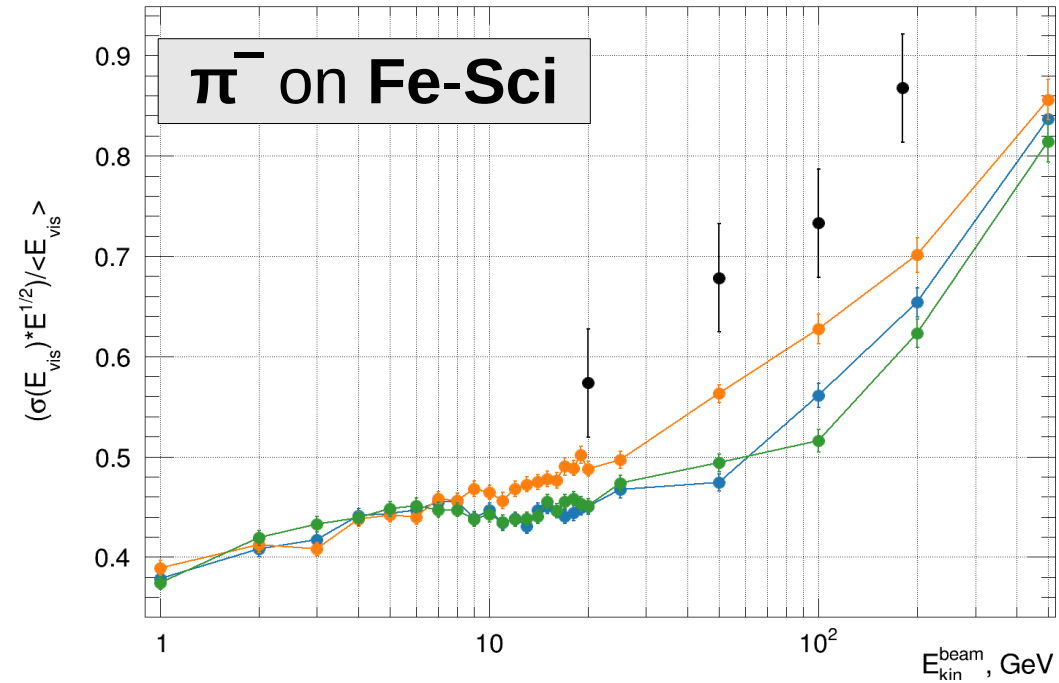
10.4.ref04 (blue circle) 10.4.ref03 (green circle) 10.4.p01_cand01 (orange circle)

10.4.ref04 (blue circle) 10.4.ref03 (green circle) 10.4.p01_cand01 (orange circle)

FTFP_BERT : Energy Resolution

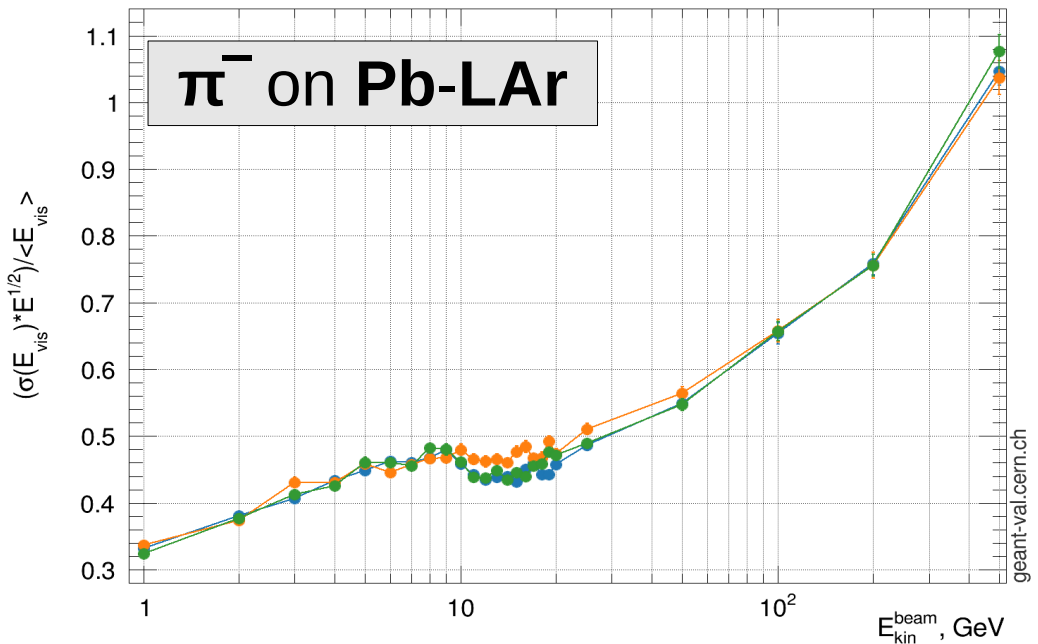
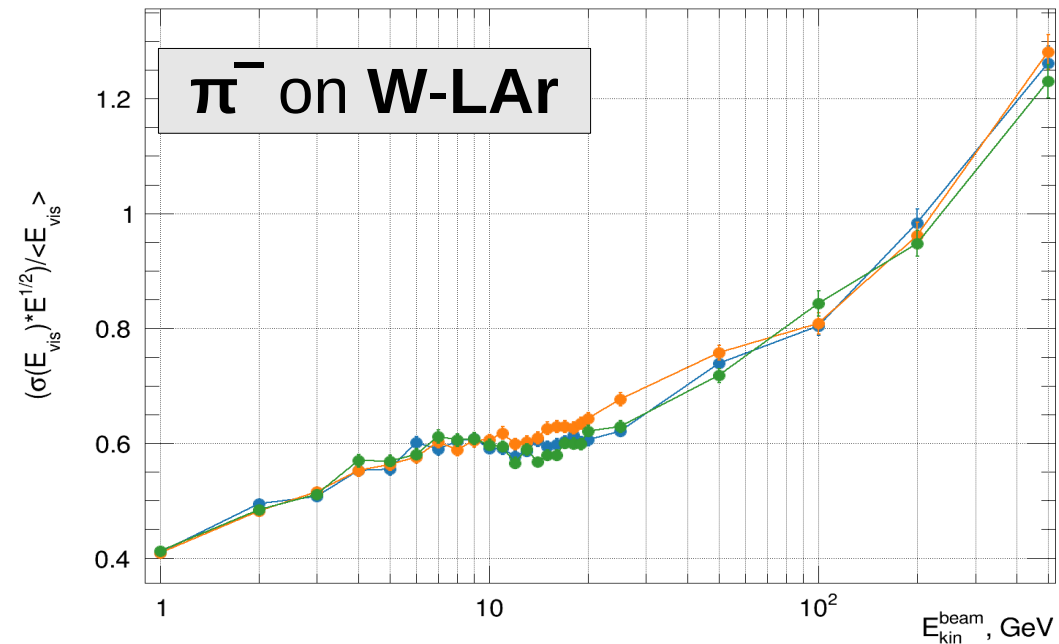
Energy resolution | Beam: pi- | Target: TileCal

Energy resolution | Beam: pi- | Target: AtlasHEC



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

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

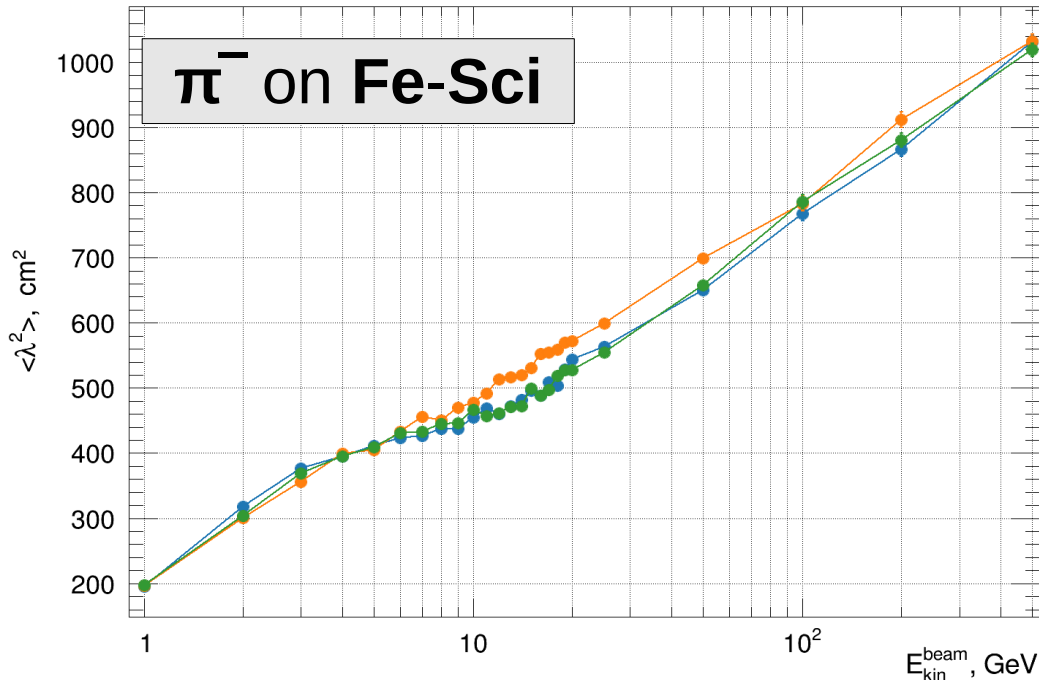


10.4.ref04 (blue line)
10.4.ref03 (green line)
10.4.p01_cand01 (orange line)

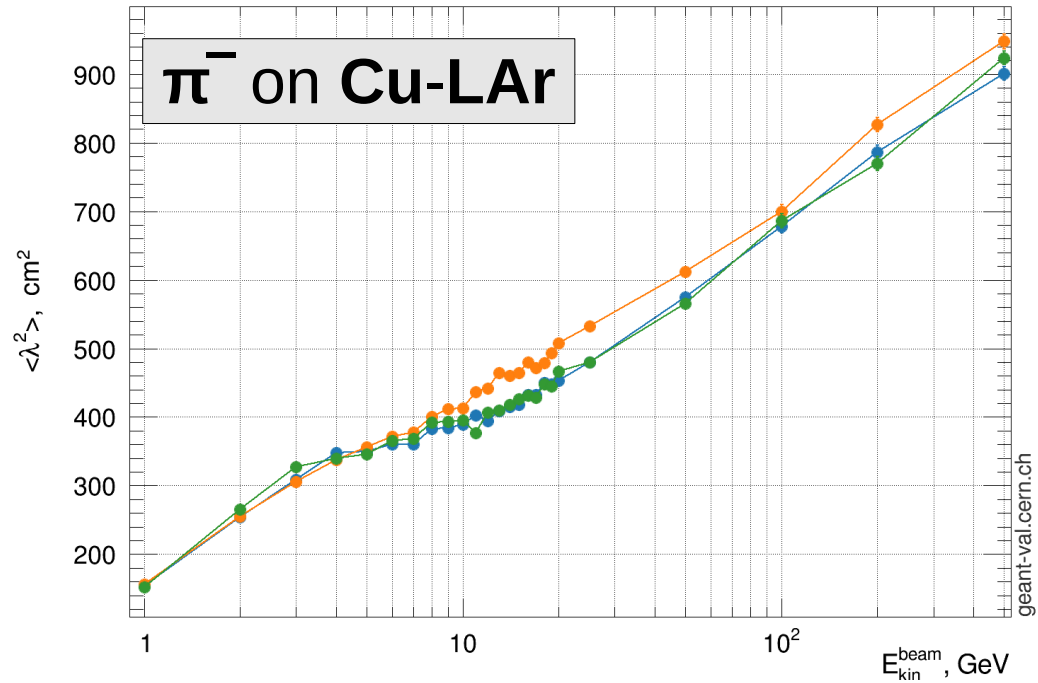
10.4.ref04 (blue line)
10.4.ref03 (green line)
10.4.p01_cand01 (orange line)

FTFP_BERT : Longitudinal Shape

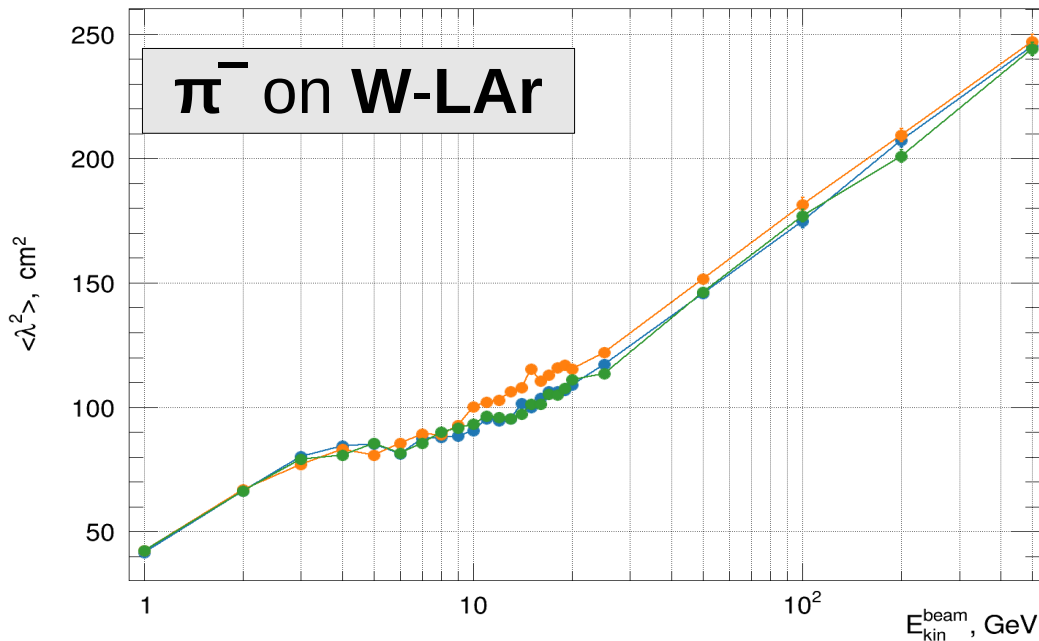
Longitudinal shower shape | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



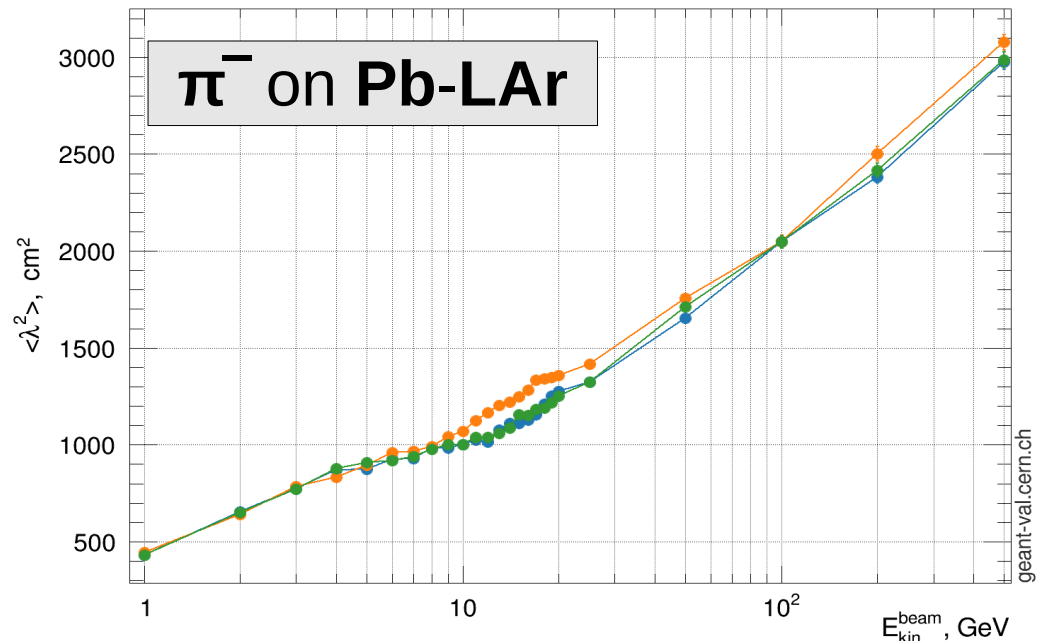
Longitudinal shower shape | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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

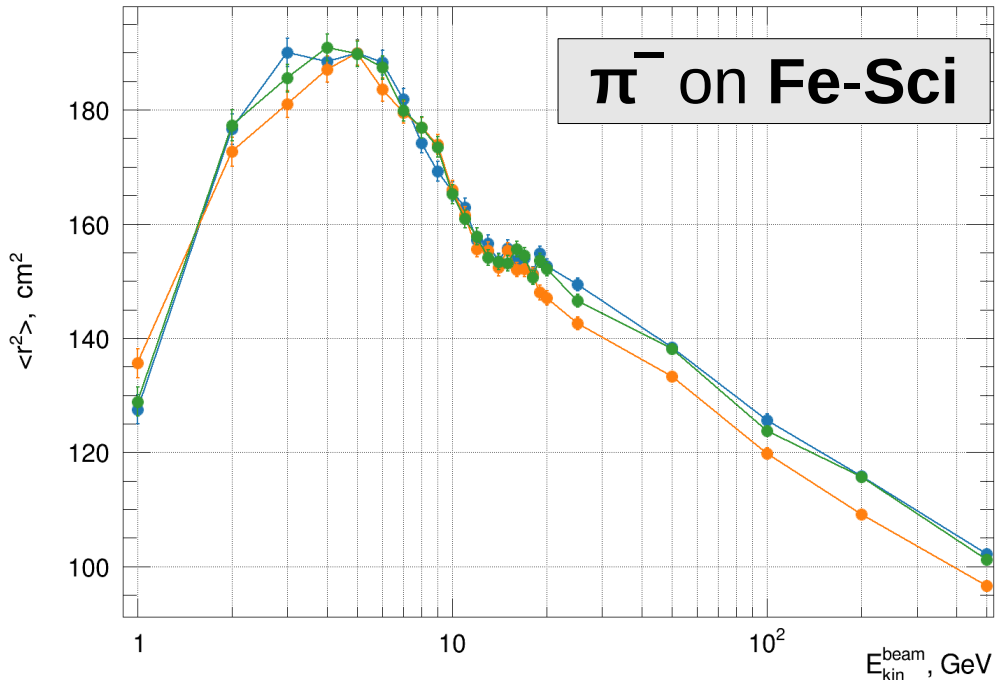


10.4.ref04 (blue line with dots) 10.4.ref03 (green line with dots) 10.4.p01_cand01 (orange line with dots)

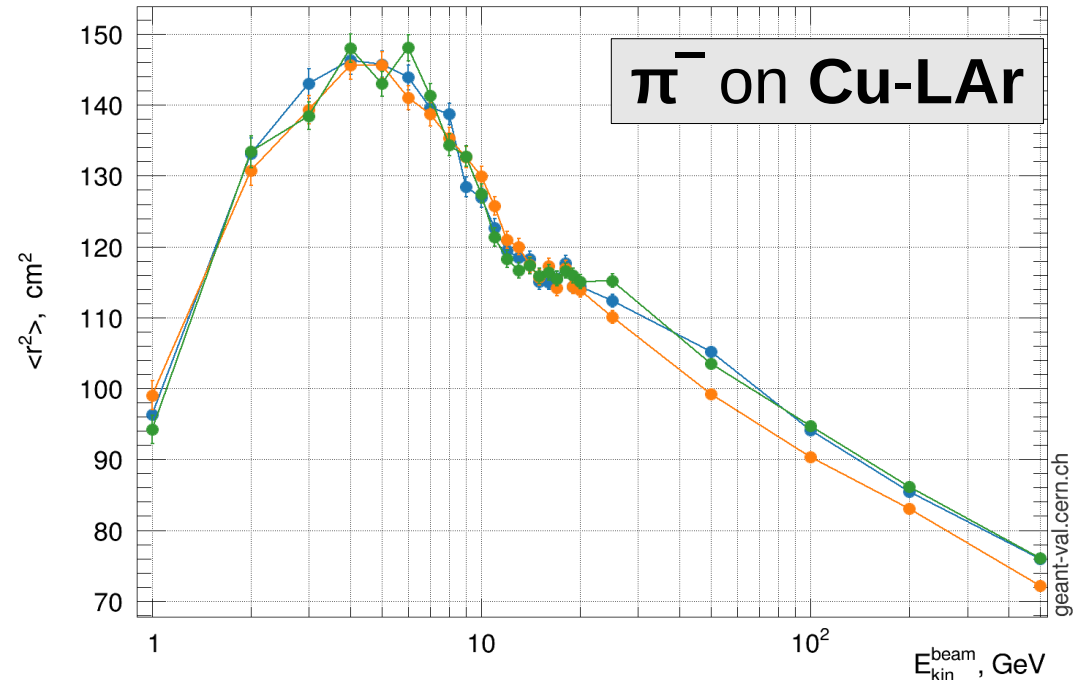
10.4.ref04 (blue line with dots) 10.4.ref03 (green line with dots) 10.4.p01_cand01 (orange line with dots)

FTFP_BERT : Lateral Shape

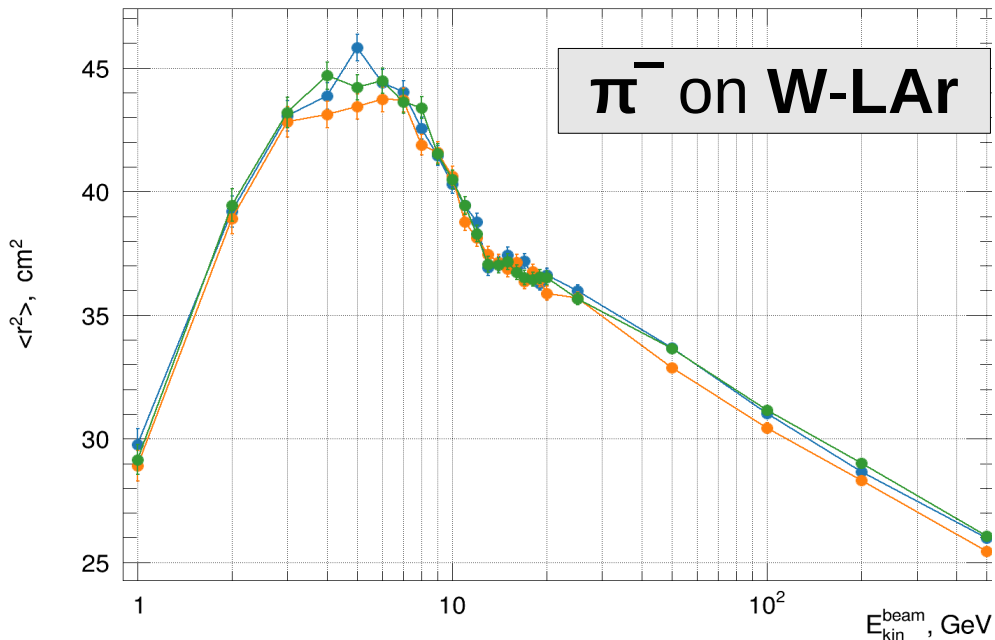
Lateral shower shape | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



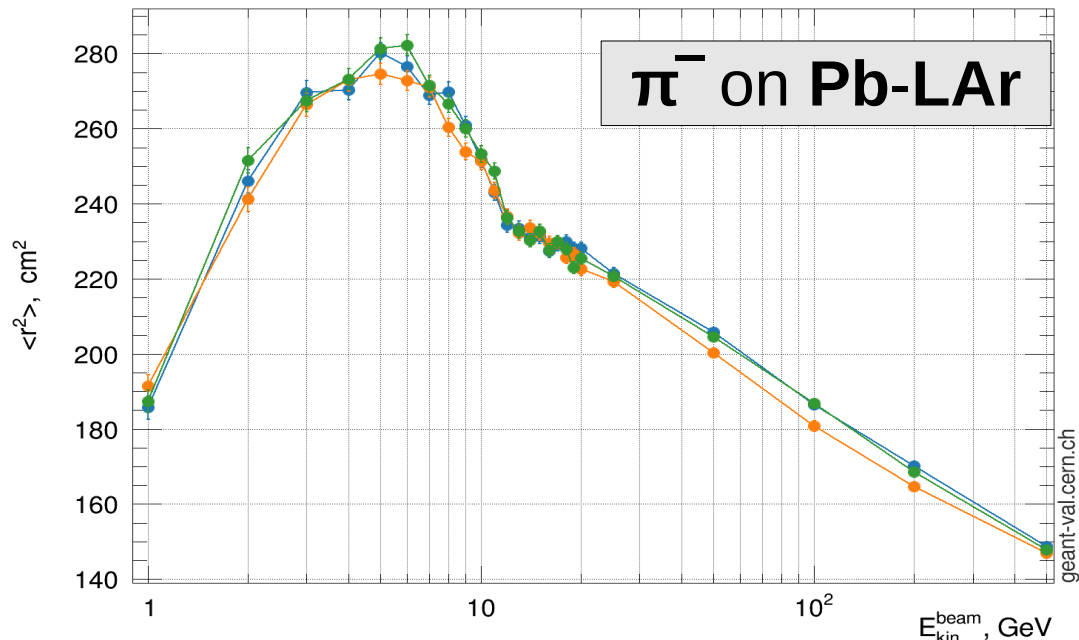
Lateral shower shape | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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



10.4.ref04 (blue circle)
10.4.ref03 (green circle)
10.4.p01_cand01 (orange circle)

10.4.ref04 (blue circle)
10.4.ref03 (green circle)
10.4.p01_cand01 (orange circle)

Conclusions

- **G4 10.4.ref04**
 - No crash or infinite loop
 - One warning
 - In *G4Fancy3DNucleus::ChooseFermiMomenta*
 - Understood and harmless
 - Reproducibility OK
 - FTF hadronic showers
 - G4 10.4.ref04 is equivalent to 10.4.ref03