

Grid testing of Geant4 10.5.ref09

G. Folger, D. Konstantinov, G. Latyshev,
I. Razumov, A. Ribon

CERN EP/SFT

Main Changes in Hadronics vs. 10.5.ref08

No changes in QGS, BERT, BIC, INCLXX, Elastic, Pre-equilibrium, Radioactive Decay, ParticleHP, *etc.*

- **Cross sections** : changes at low-energies (< 20 MeV)
- **FTF** : Improvements suggested by the ion-ion validation
 - With small effects on hadron-nucleus at thin-target level
- **De-excitation** : Improvements in the code and in FermiBreakUp

Crashes & Warnings

- No crashes, no infinite loops
- As in Ref08, very frequent warnings on high excitation energy for nuclear fragments

Reproducibility

- As in Ref08, few MT violations observed
 - Due to the Starkov's elastic class G4ElasticHadrNucleusHE

Pion- showers: FTFP_BERT

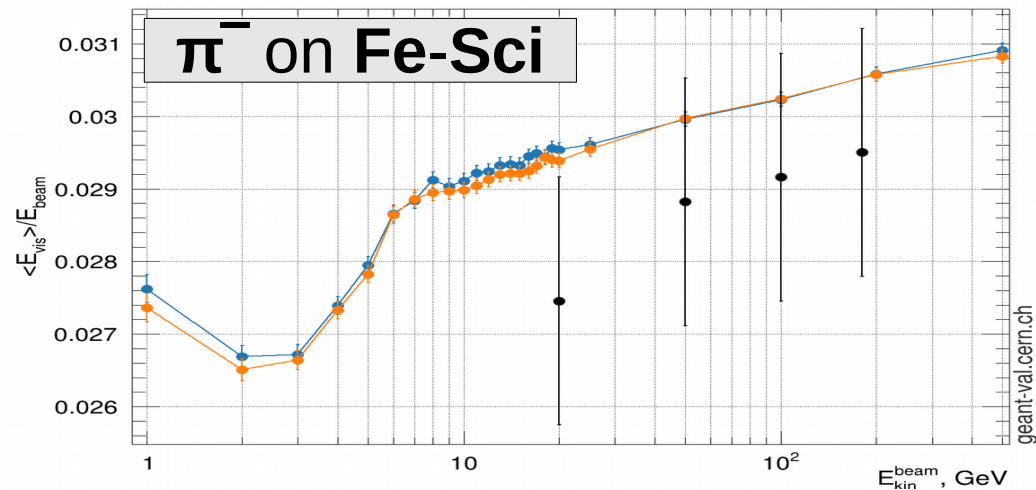
G4 10.5.ref09a (*Urban msc as in Ref07*)

G4 10.5.ref07.tr3_6gev

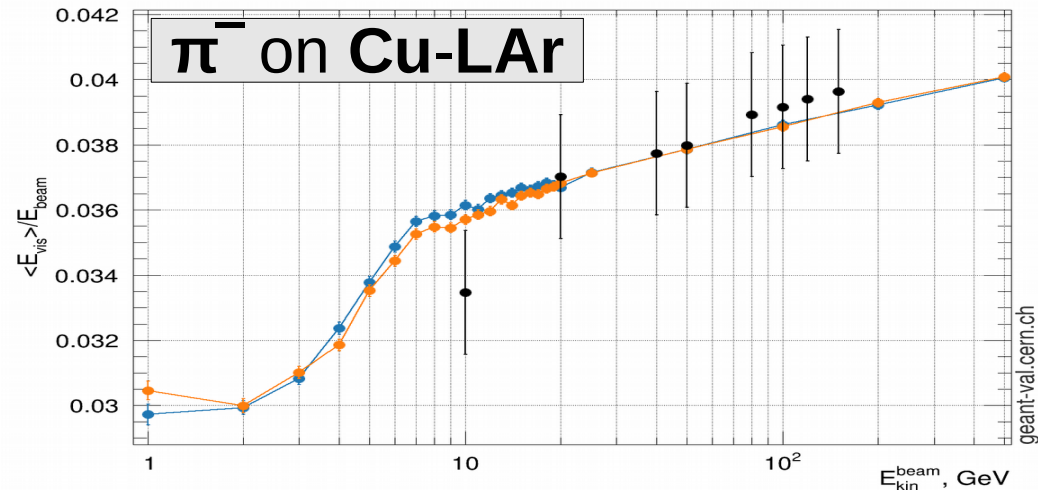
*Note : conventional Birks treatment
(easier and no experimental h/e to fit !)*

FTFP_BERT : Energy Response

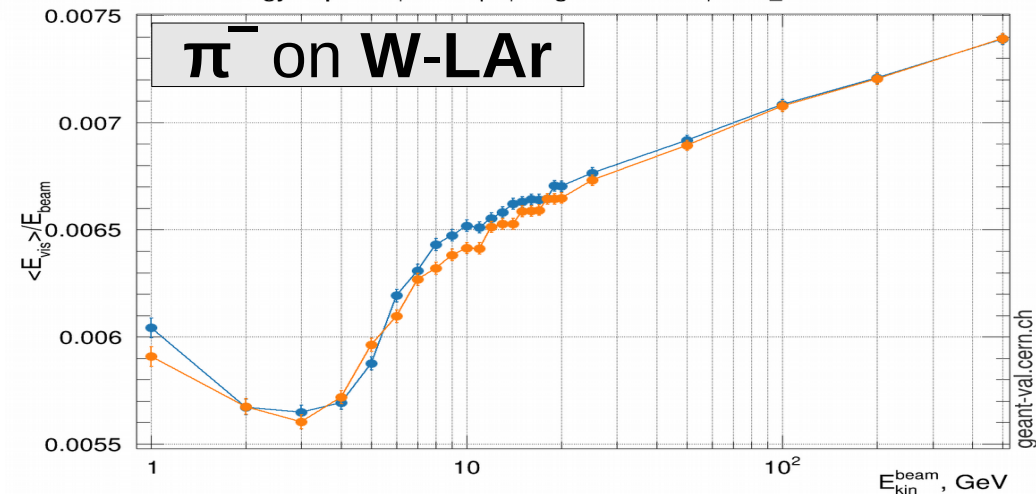
Energy response | Beam: pi- | Target: TileCal



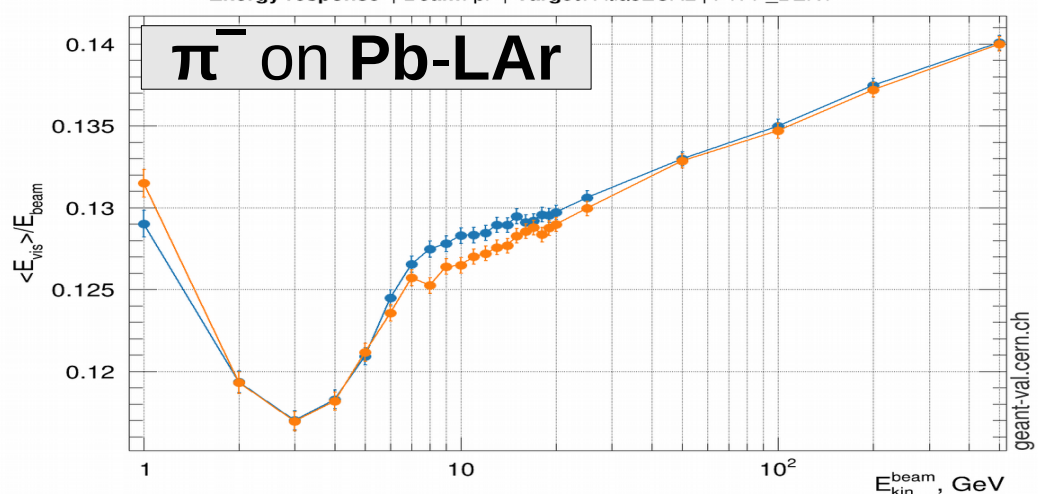
Energy response | Beam: pi- | Target: AtlasHEC



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

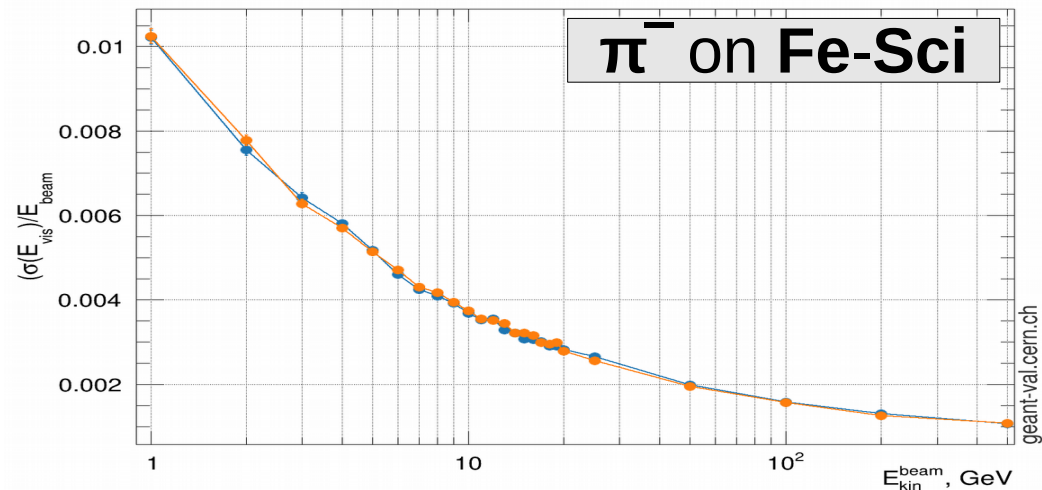


Energy response | Beam: pi- | Target: AtlasECAL | FTFP_BERT

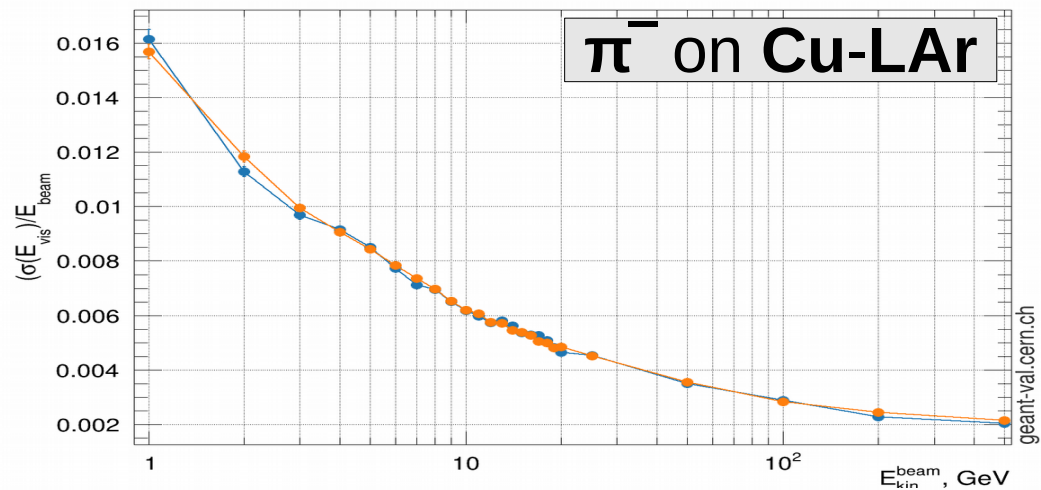


FTFP_BERT : Energy Width

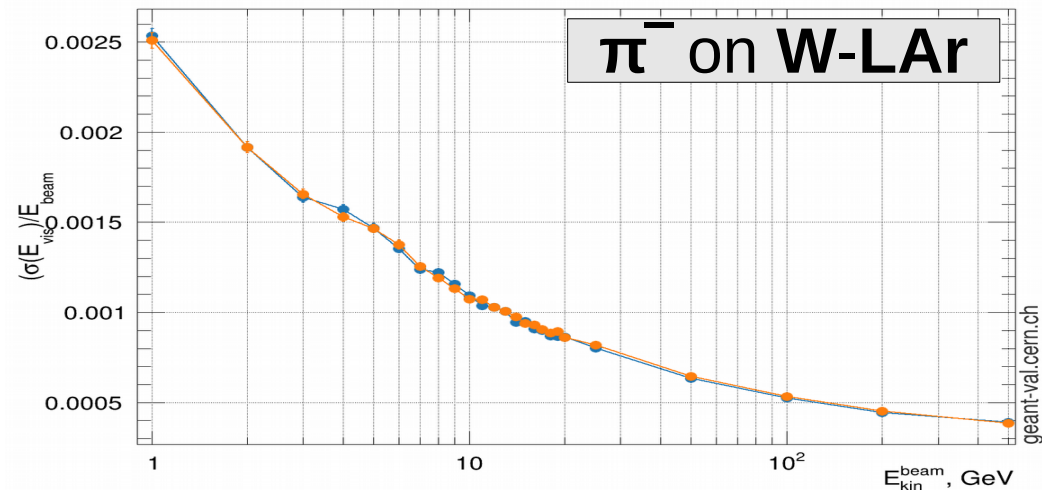
Normalized width | Beam: pi- | Target: TileCal | FTFP_BERT



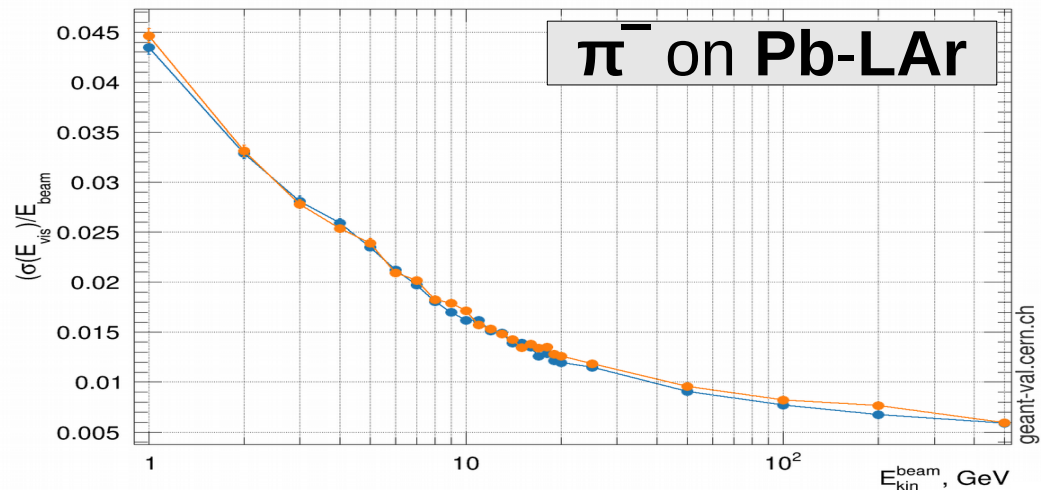
Normalized width | Beam: pi- | Target: AtlasHEC | FTFP_BERT



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

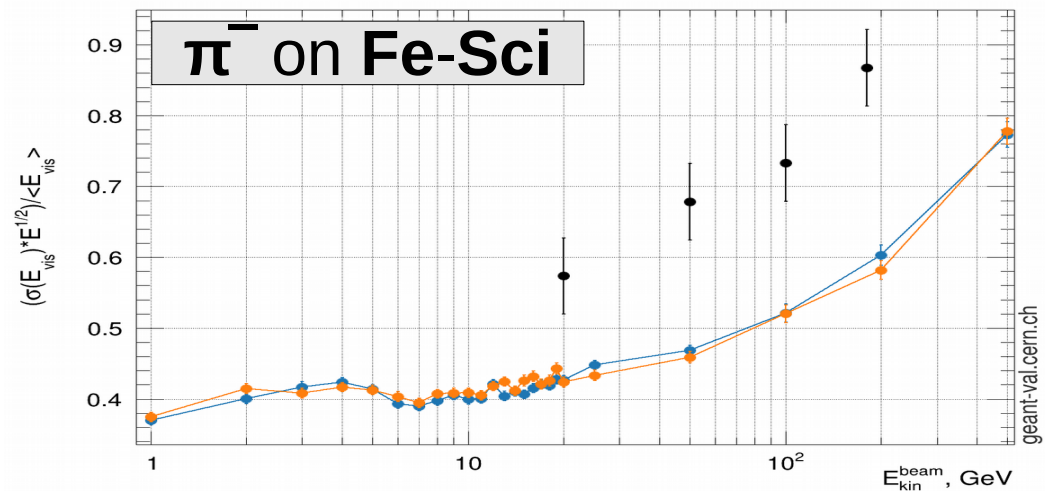


Normalized width | Beam: pi- | Target: AtlasECAL | FTFP_BERT

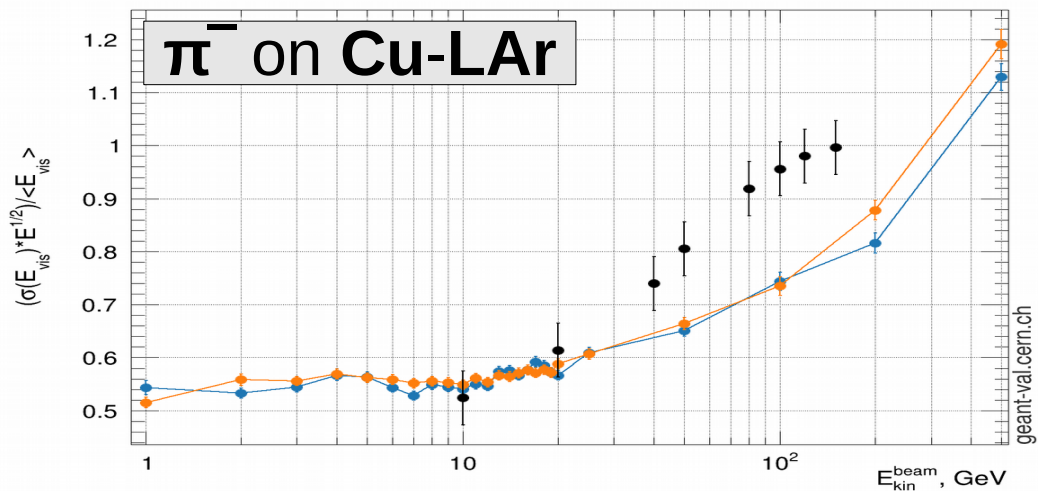


FTFP_BERT : Energy Resolution

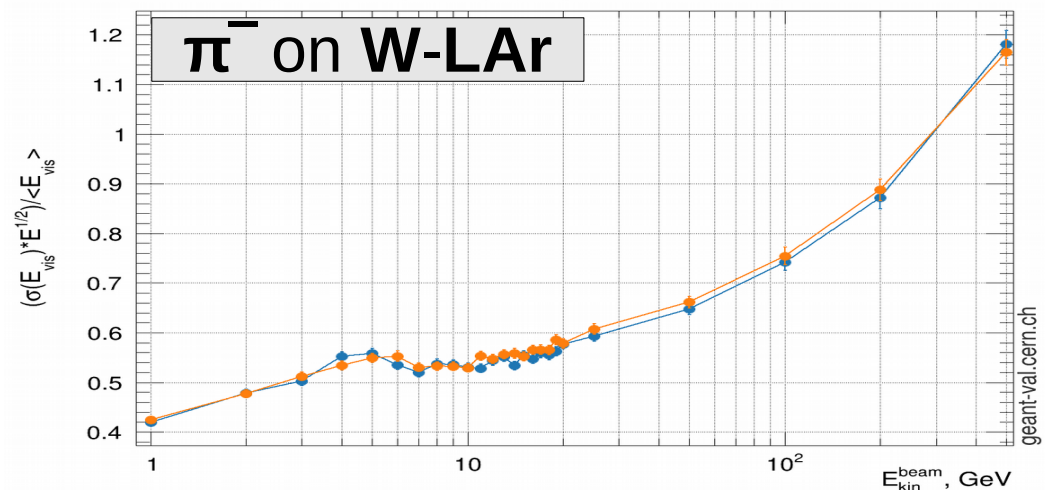
Energy resolution | Beam: pi- | Target: TileCal



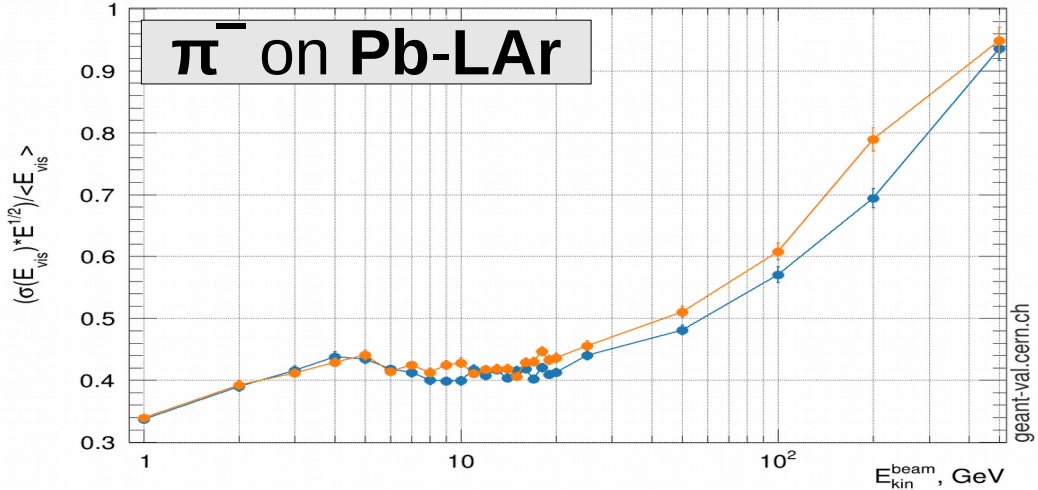
Energy resolution | Beam: pi- | Target: AtlasHEC



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

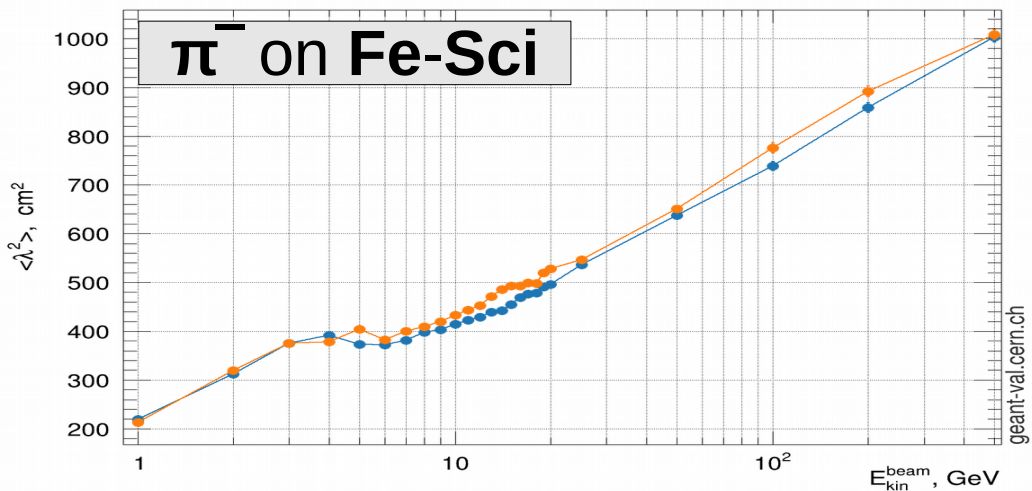


Energy resolution | Beam: pi- | Target: AtlasECAL | FTFP_BERT

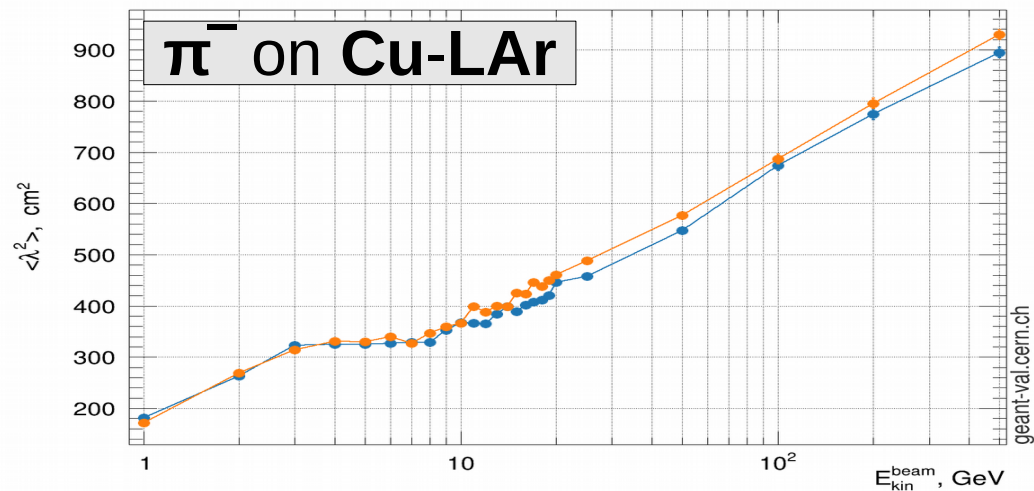


FTFP_BERT : Longitudinal Shape

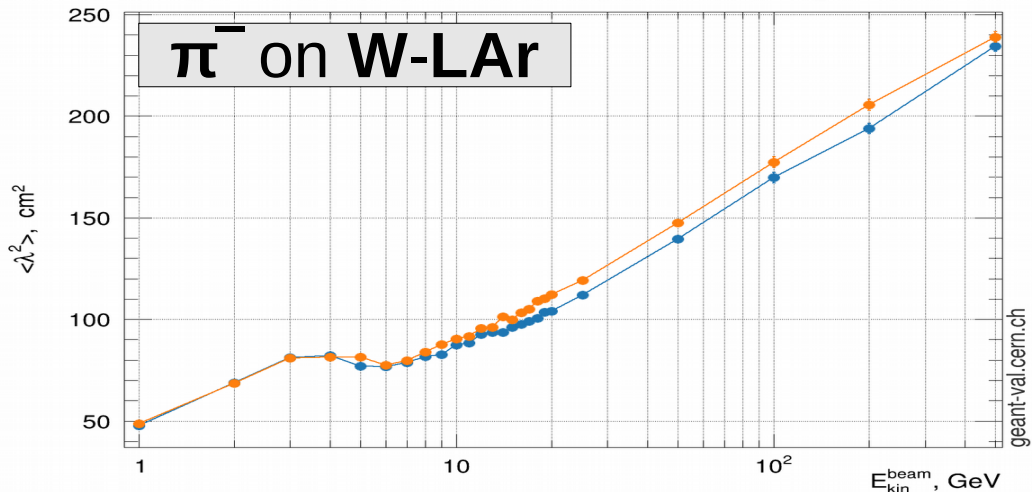
Longitudinal shower shape | Beam: pi- | Target: TileCal | FTFP_BERT



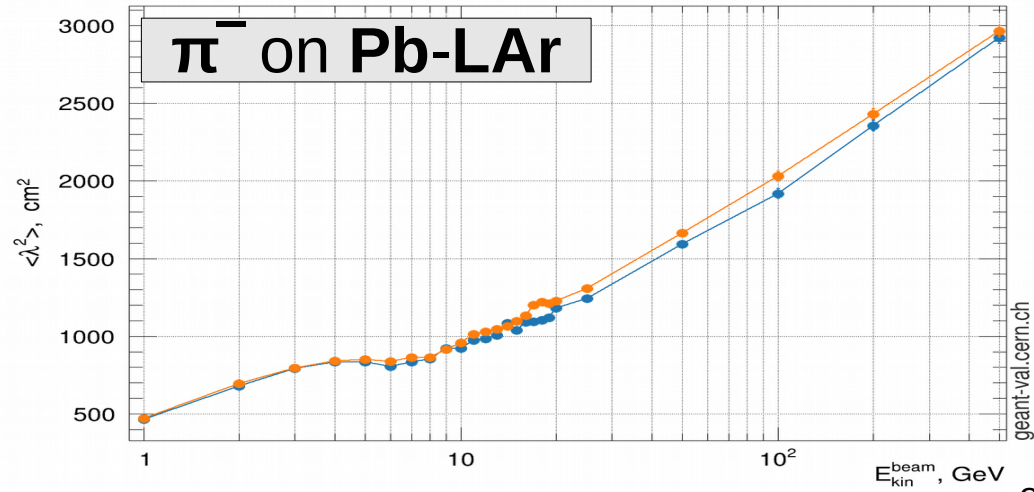
Longitudinal shower shape | Beam: pi- | Target: AtlasHEC | FTFP_BERT



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



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



10.5.ref09a

10.5.ref07.tr3_6gev

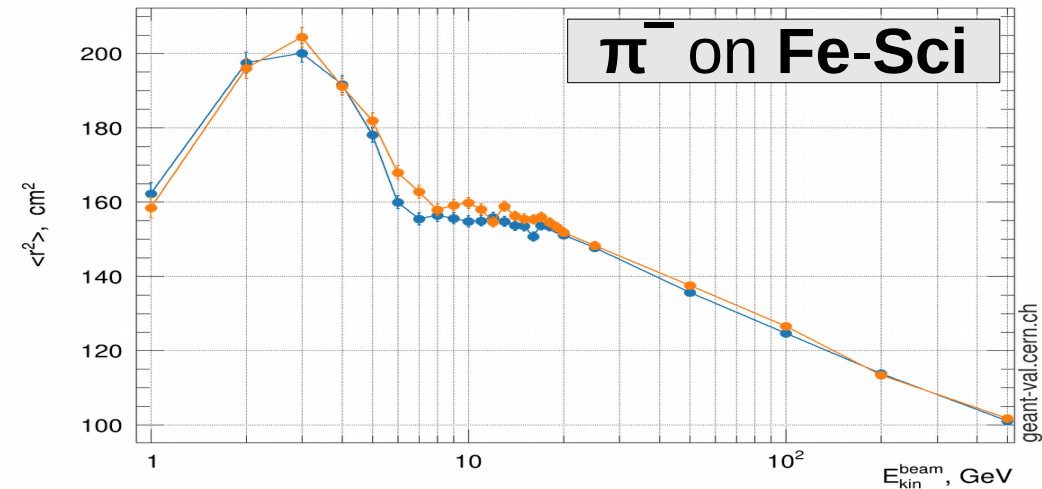
10.5.ref09a

10.5.ref07.tr3_6gev

FTFP_BERT : Lateral Shape

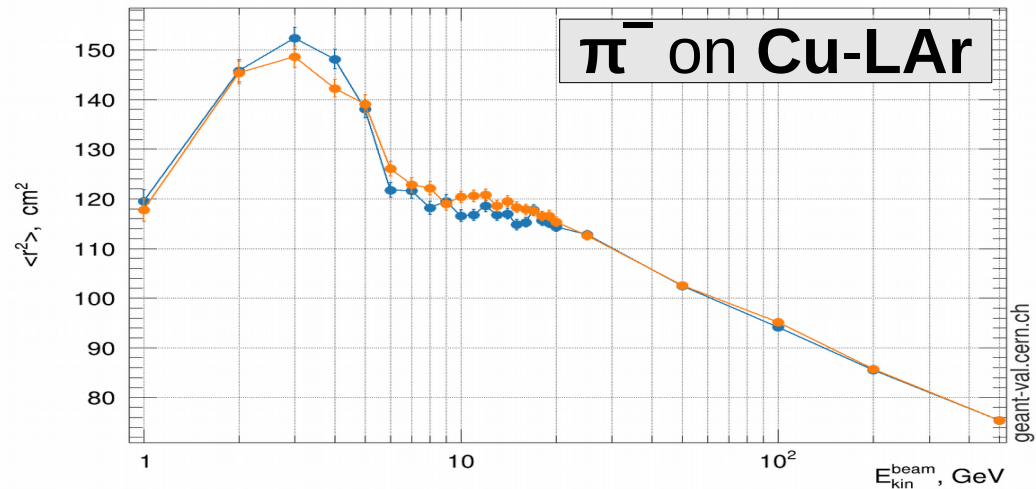
Lateral shower shape | Beam: pi- | Target: TileCal | FTFP_BERT

π^- on Fe-Sci



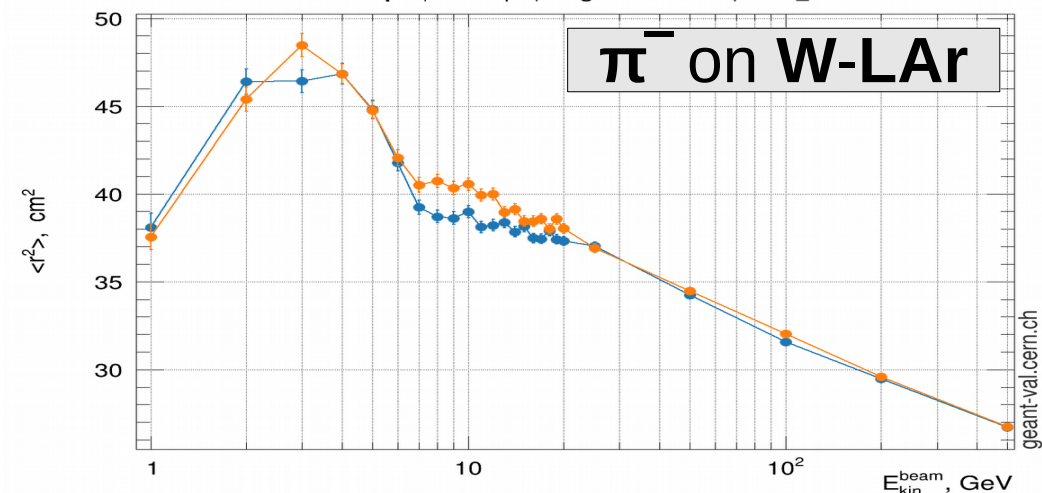
Lateral shower shape | Beam: pi- | Target: AtlasHEC | FTFP_BERT

π^- on Cu-LAr



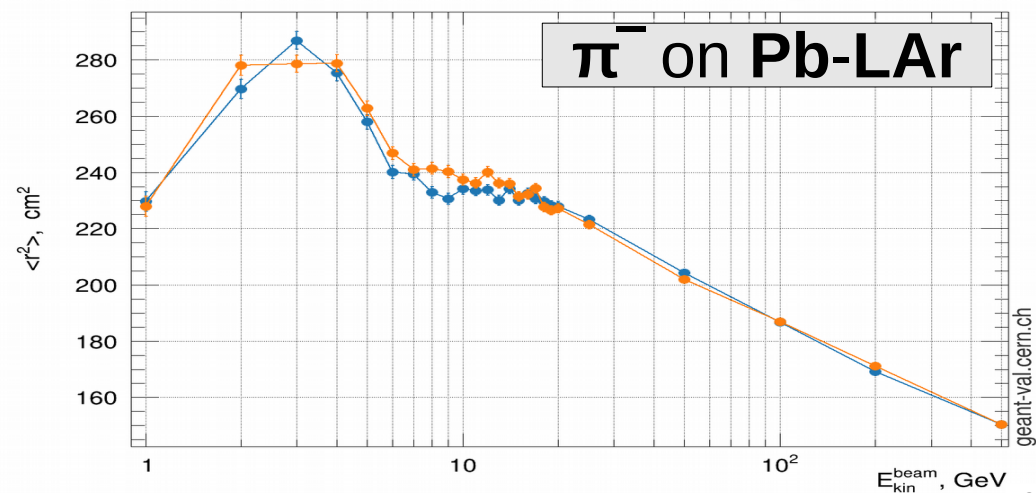
Lateral shower shape | Beam: pi- | Target: AtlasFCAL | FTFP_BERT

π^- on W-LAr



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

π^- on Pb-LAr



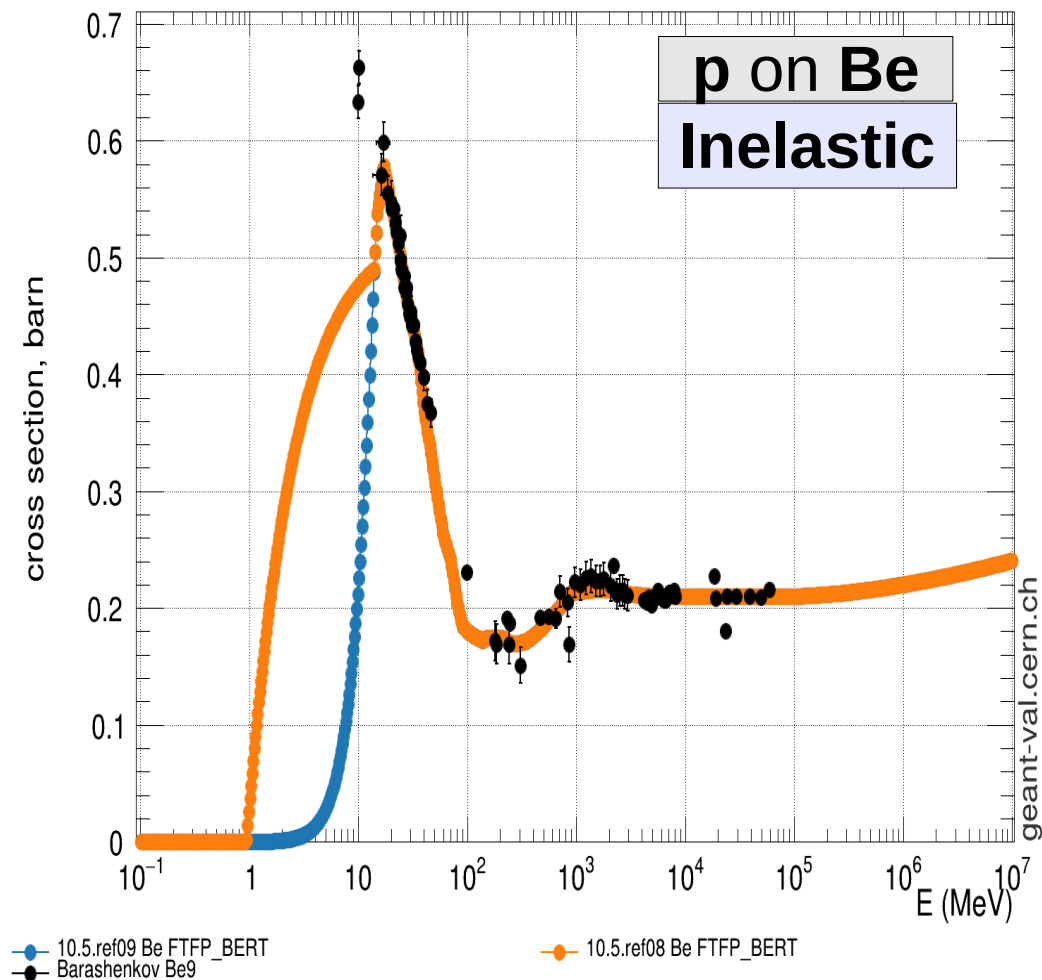
FTFP_BERT cross sections

G4 10.5.ref09
10.5.ref08

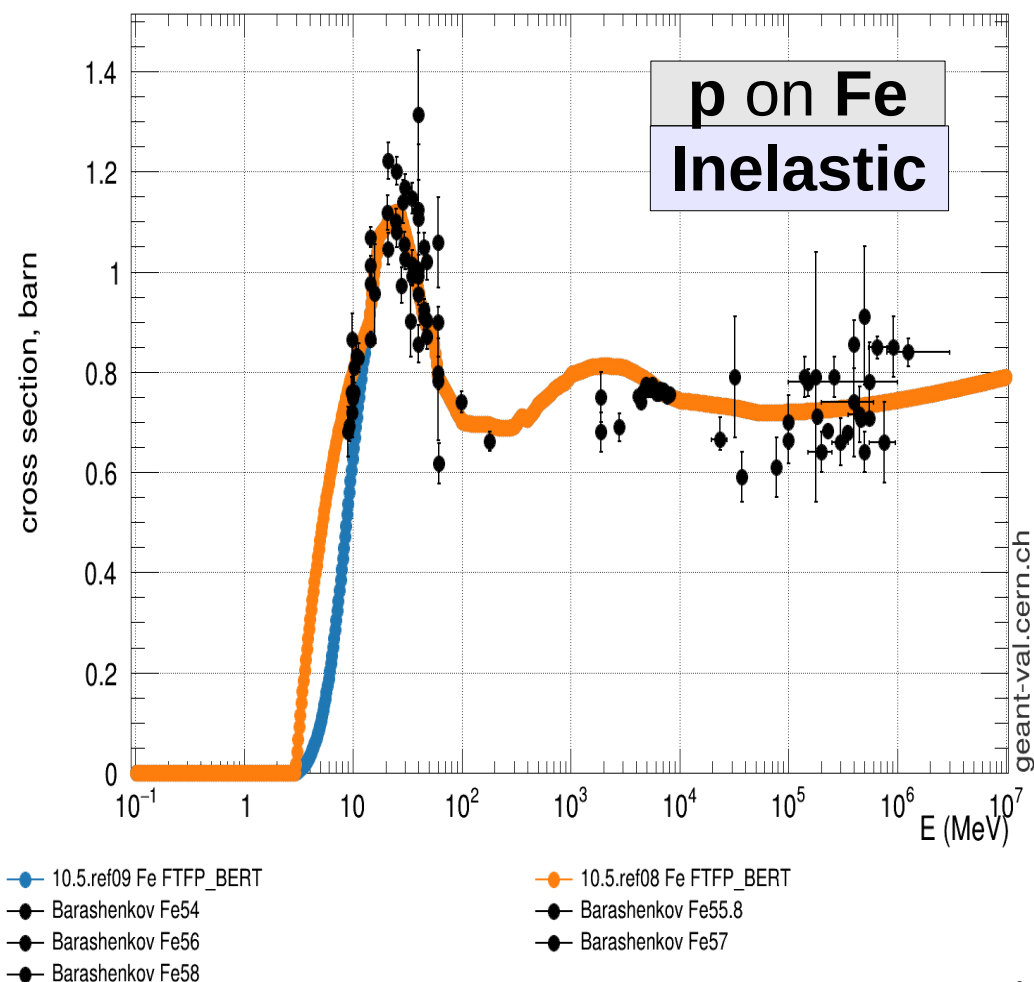
- Changes with respect to Ref08 for p (inelastic only) and π^+ (both elastic & inelastic)

Proton inelastic cross sections

Inelastic cross section | Beam: proton

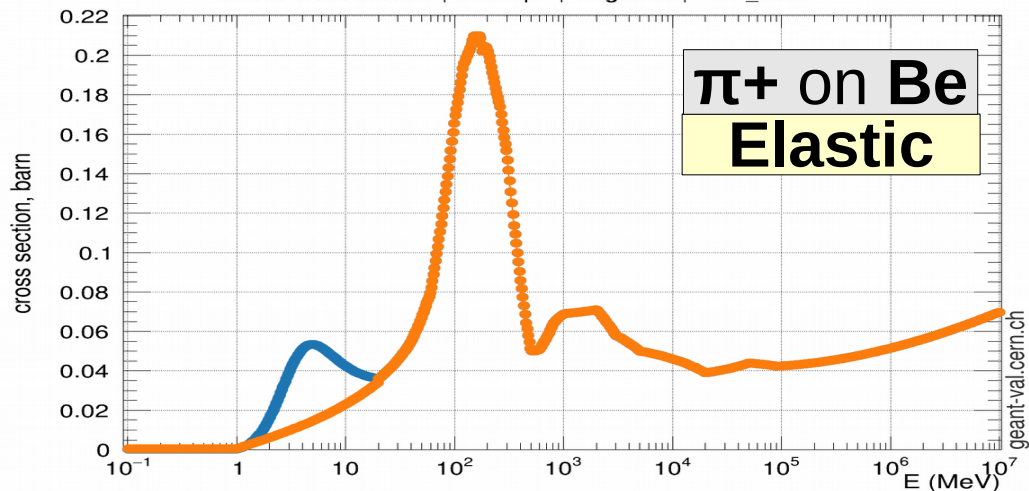


Inelastic cross section | Beam: proton

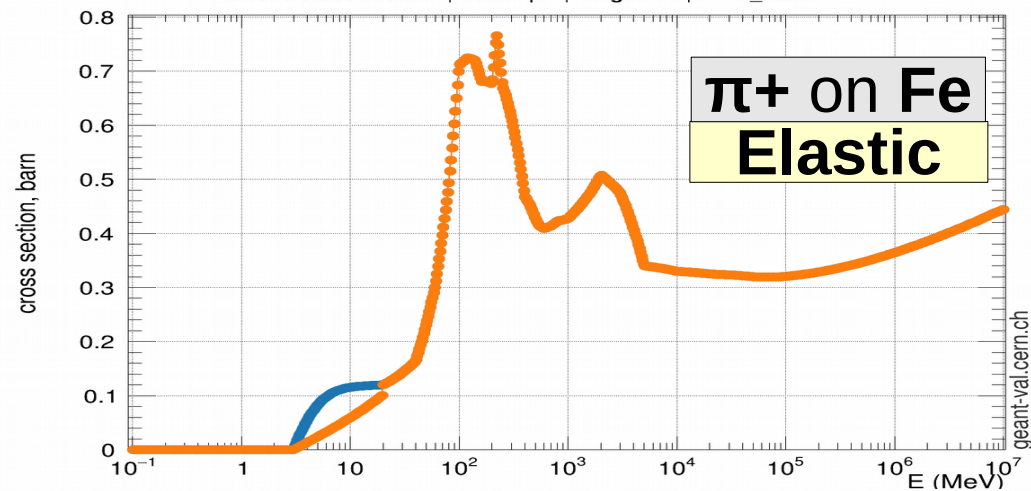


π^+ elastic & inelastic cross sections

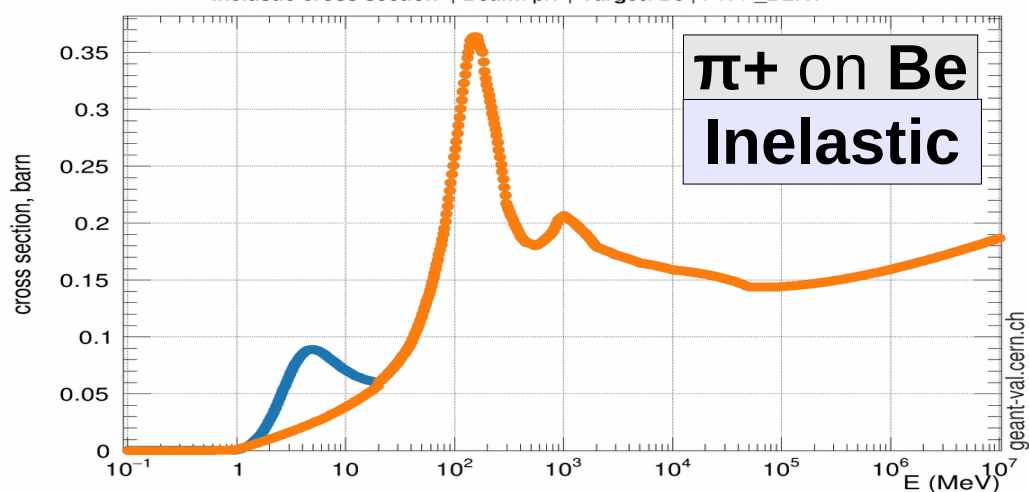
Elastic cross section | Beam: π^+ | Target: Be | FTFP_BERT



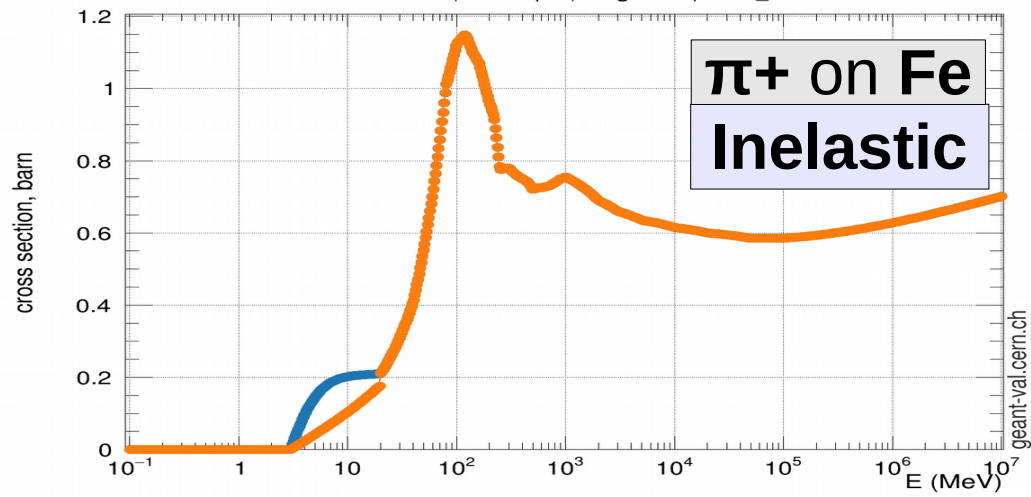
Elastic cross section | Beam: π^+ | Target: Fe | FTFP_BERT



Inelastic cross section | Beam: π^+ | Target: Be | FTFP_BERT



Inelastic cross section | Beam: π^+ | Target: Fe | FTFP_BERT



Conclusions

- **G4 10.5.ref09**
 - No crashes, no infinite loops
 - Same frequent type of warning as in Ref08
 - Same, few MT reproducibility violations as in Ref08
 - For the cross sections in Ref08, p inelastic looks good, whereas for π^+ elastic & inelastic there is a new, strange peak around 10 MeV...
 - A bit higher energy response and narrower shower at intermediate energies, and shorter showers at all energies
 - Likely due to FTF, whereas the shorter showers are likely due to the increased low-energy π^+ inelastic cross sections...