

Grid testing of Geant4 : **10.5.cand{00,01}**

G. Folger, D. Konstantinov, G. Latyshev,
W. Pokorski, A. Ribon

CERN PH/SFT

Main Changes in Hadronics vs. Ref09

- Bug fixes, Coverity fixes, better printout, clean-up, etc. in many areas of hadronics
 - Not expecting to have any significant impact on the physics results
- Cross sections
 - Several changes which may affect the physics results – in particular longitudinal showers
 - Starting point was the unexpected changes at level of thin-target (reported by Julia Y. during the hadronic group meeting) between Ref09 and Ref08 on a model (FTF)
 - Cross sections are used in thin-target comparisons for the normalization (when not used physics lists, i.e. model-level “test30”-like tests)
 - It turned out that the differences in FTF were due to undocumented changes in string-fragmentation, but the investigation on cross sections showed bad surprises with respect to G4 10.4.p02 ...
 - Improved deployment of **Hadr00** in **geant-val** , allowing to check easily and quickly a large number of cross section comparisons for each reference tag...
 - New data library : **G4PARTICLEXS1.1**

Crashes & Warnings

- No crashes
- No infinite loops
- No warnings

Reproducibility

- Reproducibility OK
 - Except for **INCLXX** in MT mode
 - Many violations, even at run-level (“weak reproducibility”)
 - Sequential is ok

Hadr00 : hadronic cross_sections

in **geant-val**

hadro0, inelastic cross section

p

π^+

π^-

K^+

K^-

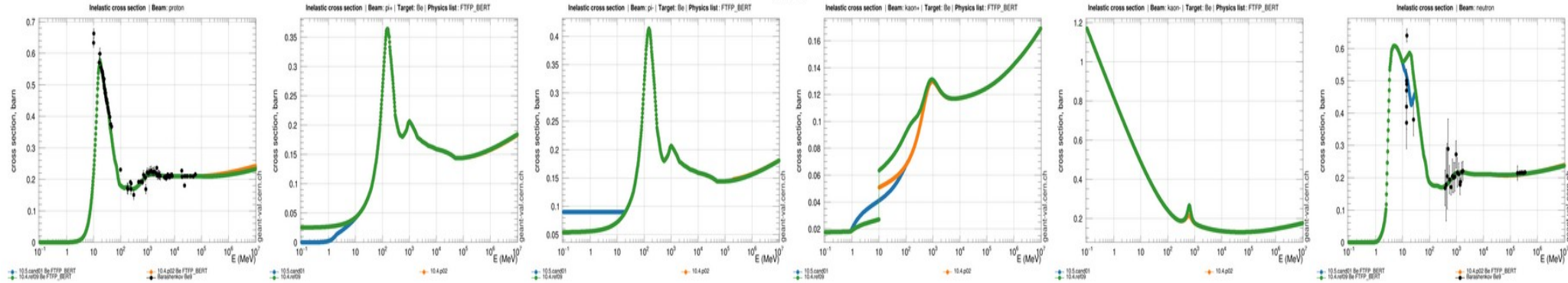
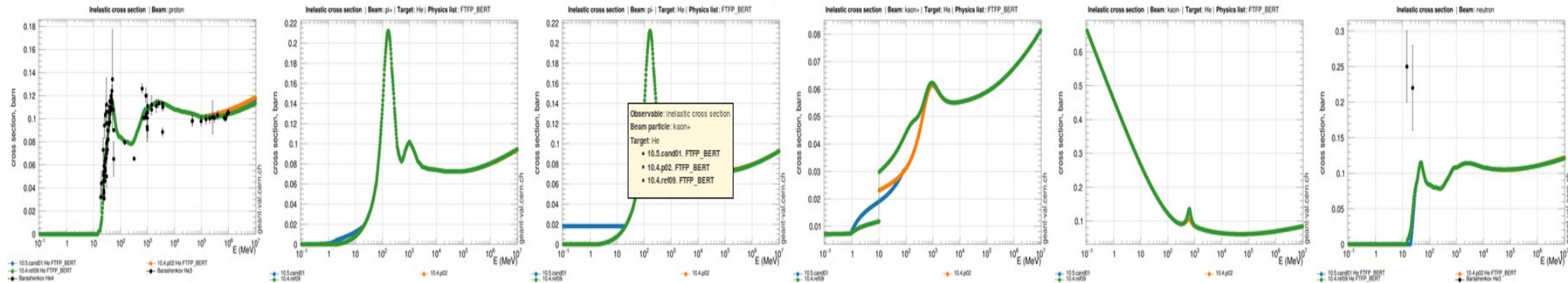
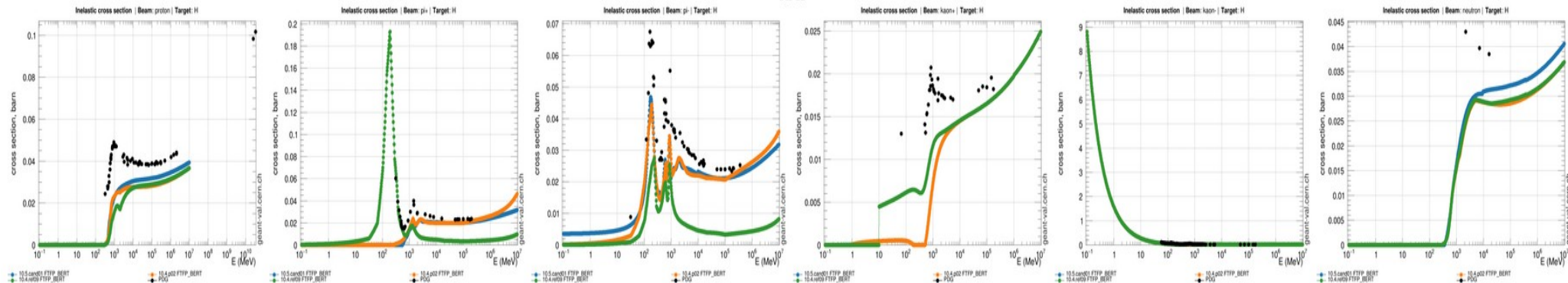
n

on H

on He

on Be

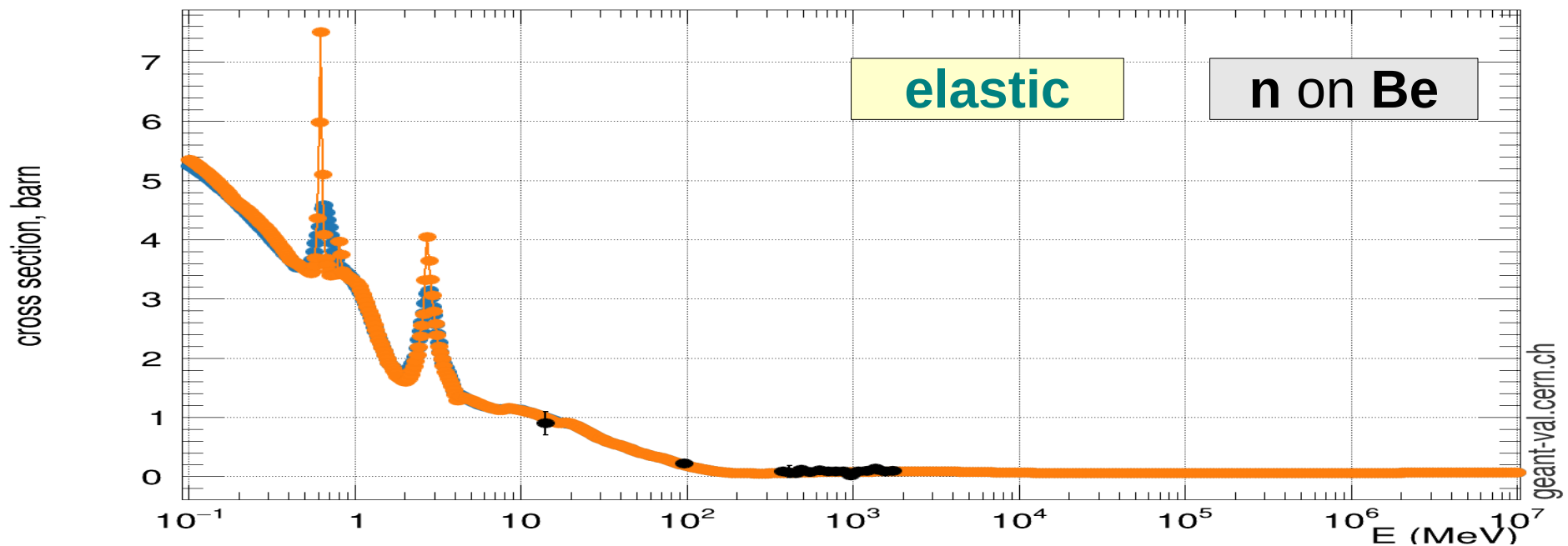
on C



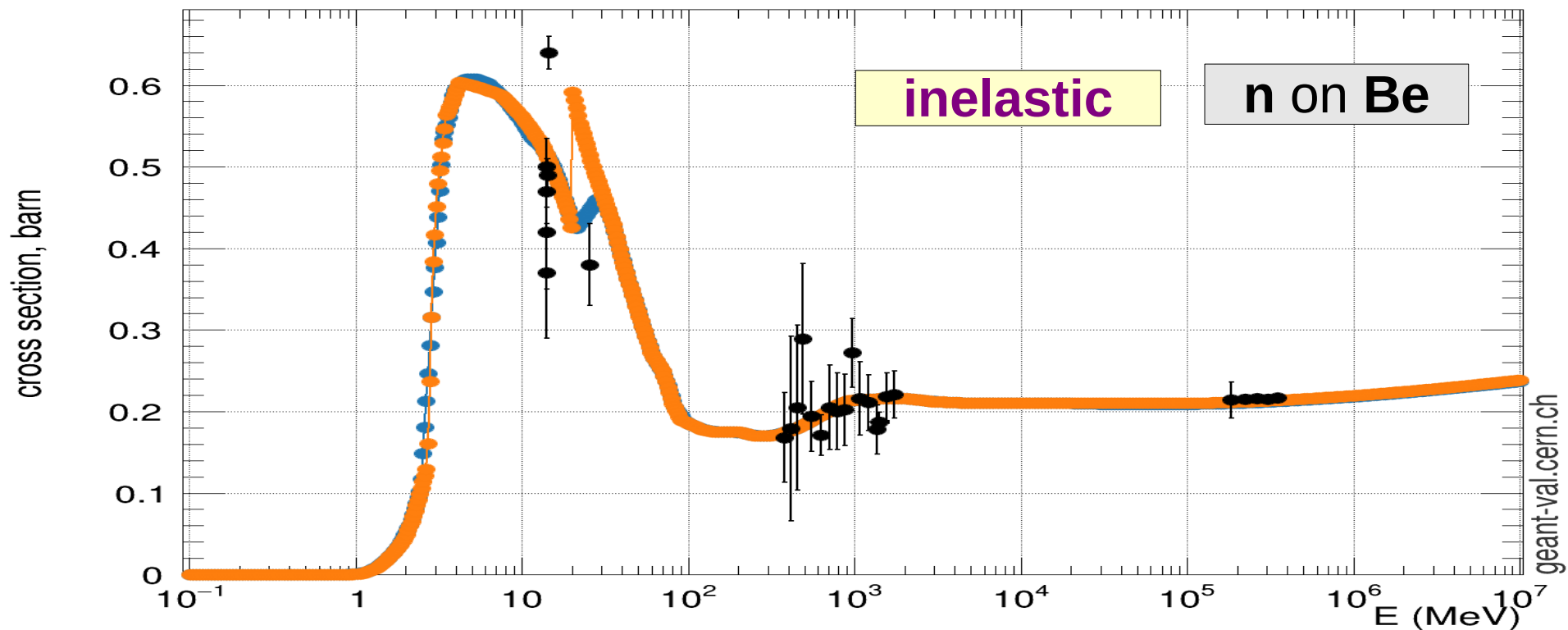
10.5.cand01 Be FTFP_BERT
 10.4.ref09 Be FTFP_BERT

10.4.p02 Be FTFP_BERT
 Barashenkov Be9⁻

Elastic cross section | Beam: neutron



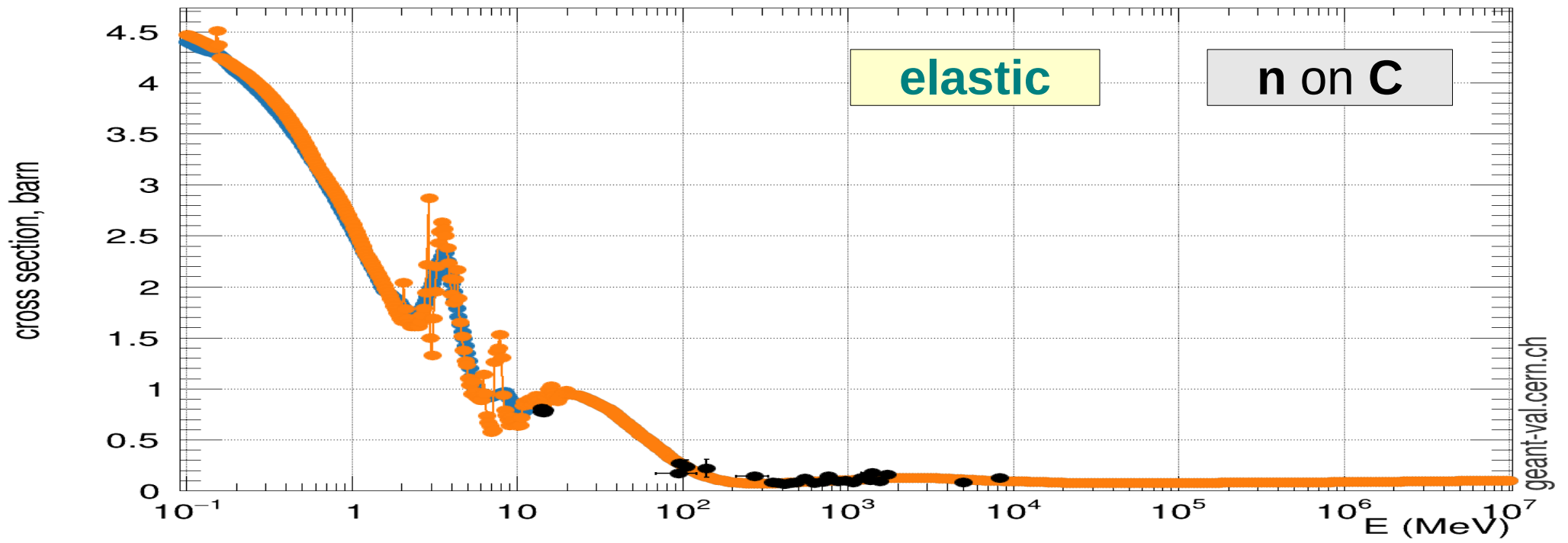
Inelastic cross section | Beam: neutron



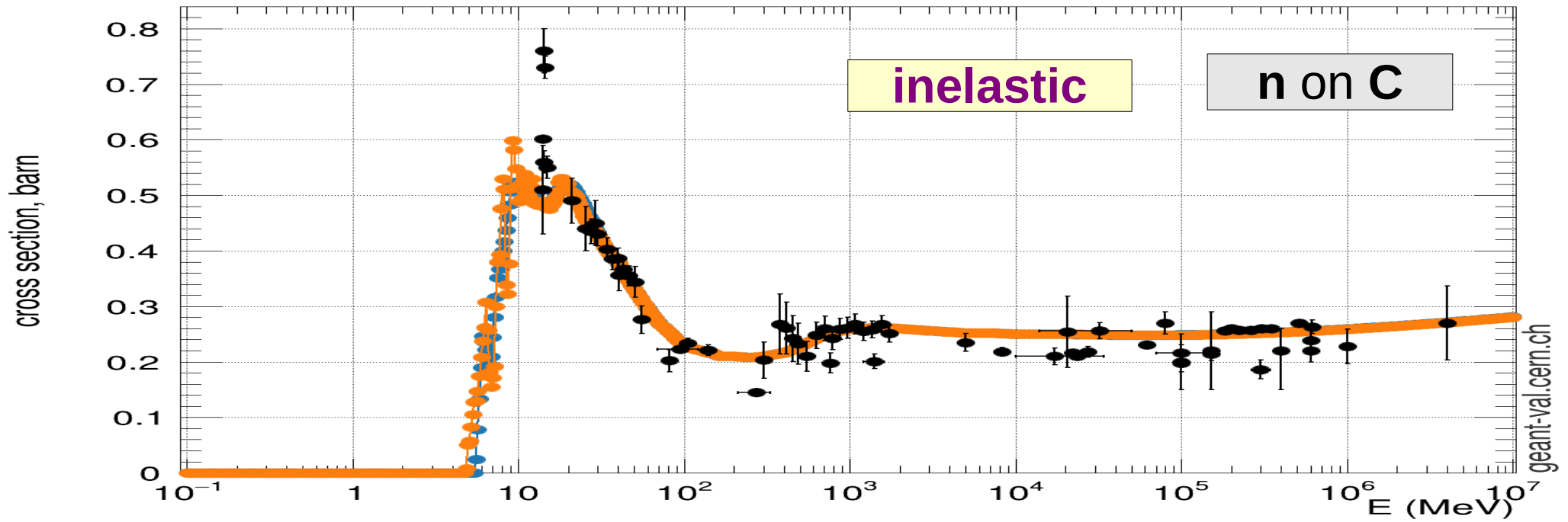
10.5.cand01 Be FTFP_BERT
Barashenkov Be9

10.5.cand01 Be FTFP_BERT_HP

Elastic cross section | Beam: neutron



Inelastic cross section | Beam: neutron



10.5.cand01 C FTFP_BERT
Barashenkov C12

10.5.cand01 C FTFP_BERT_HP

Pion- showers: FTFP_BERT

G4 10.5.cand01

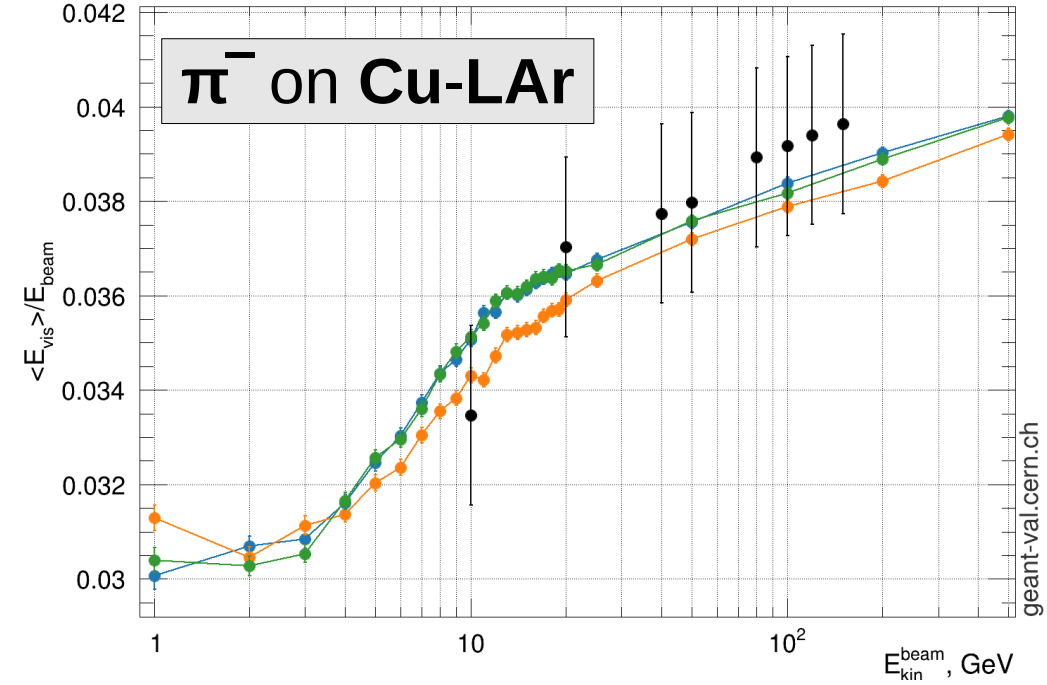
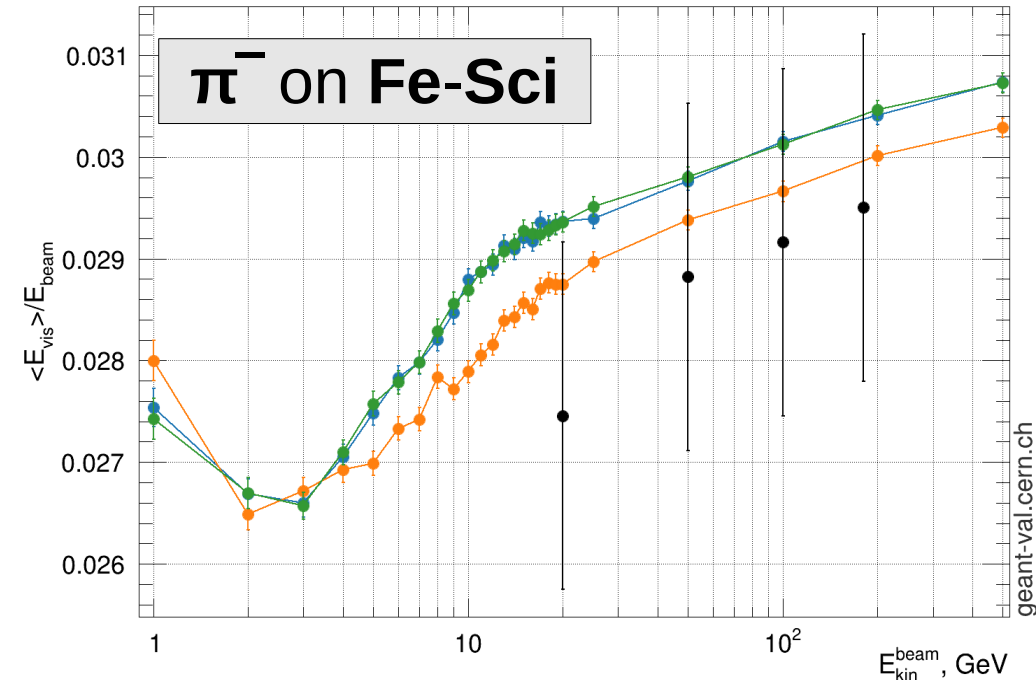
10.4.ref09

10.4.p02

FTFP_BERT : Energy Response

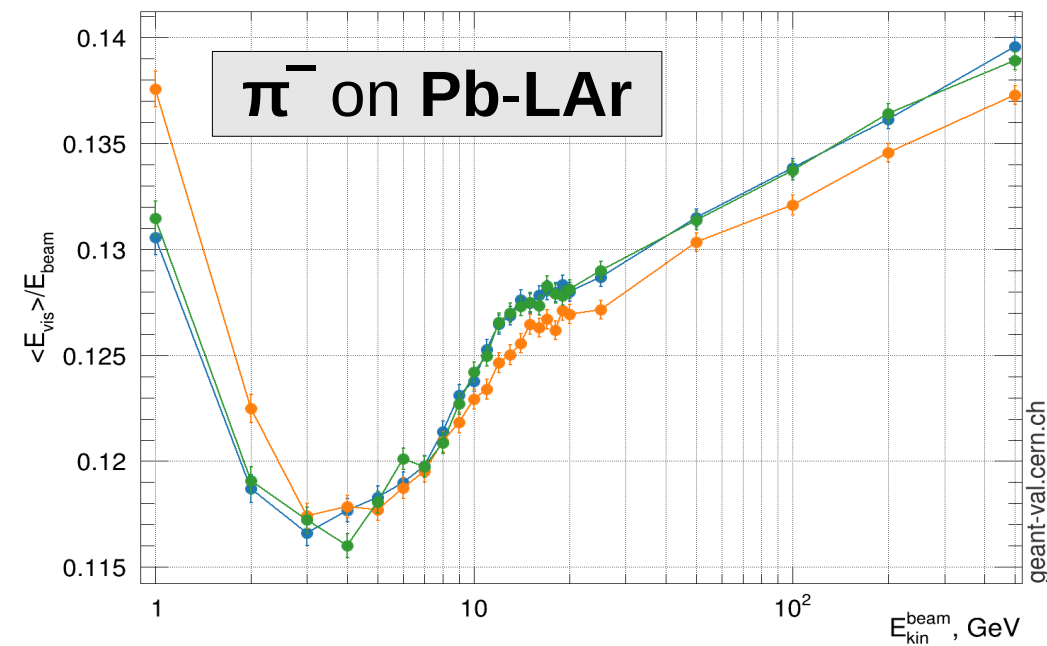
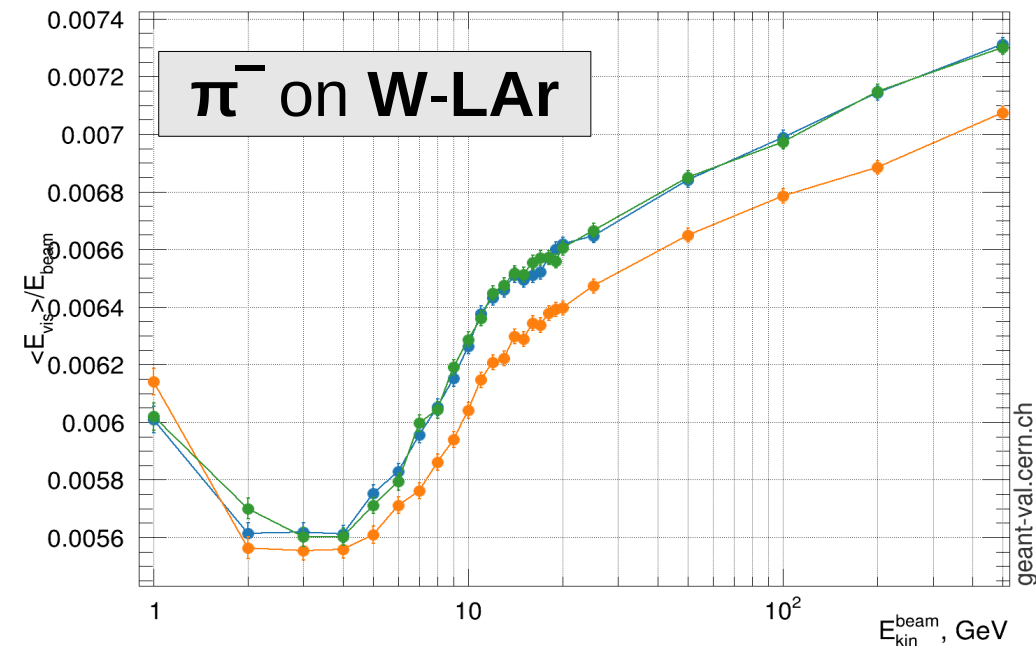
Energy response | Beam: pi- | Target: TileCal

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



10.5.cand01
10.4.ref09

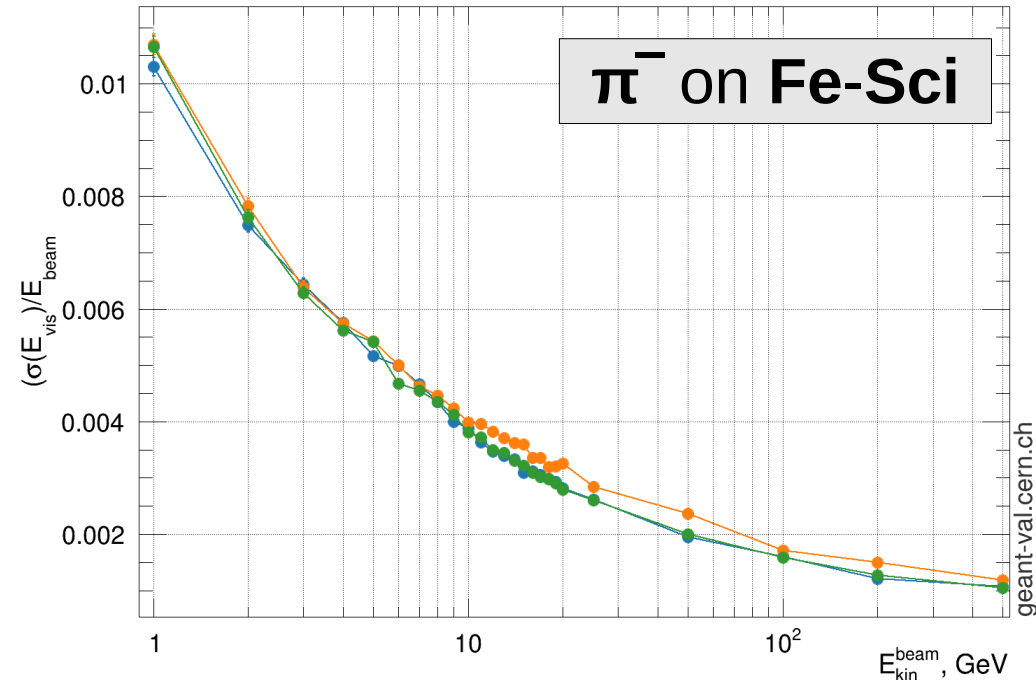
10.4.p02

10.5.cand01
10.4.ref09

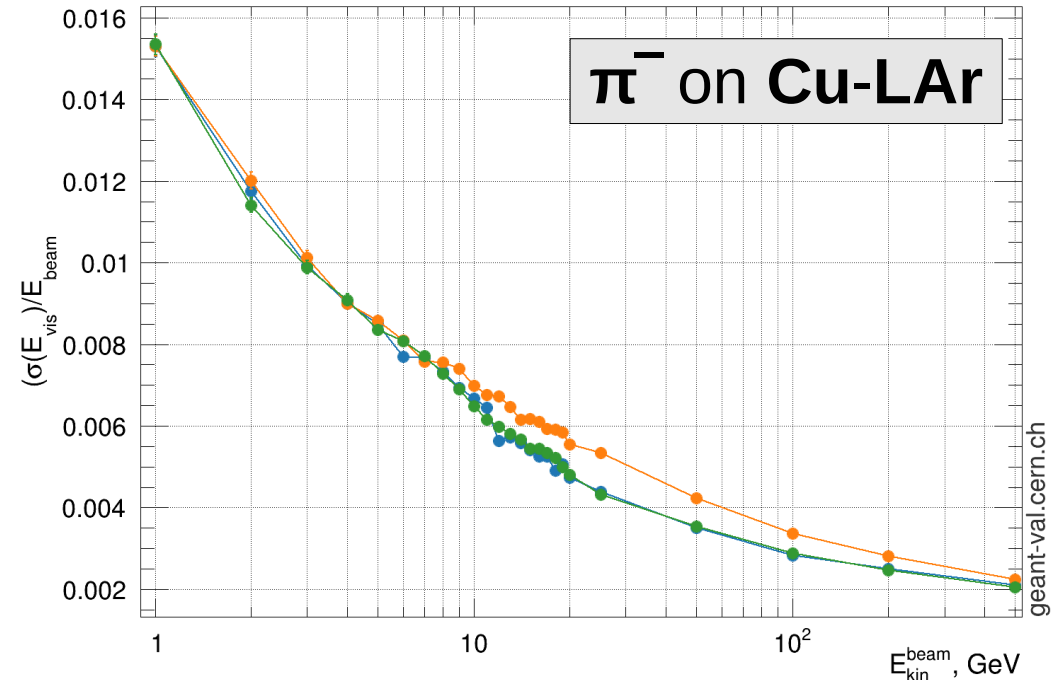
10.4.p02

FTFP_BERT : Energy Width

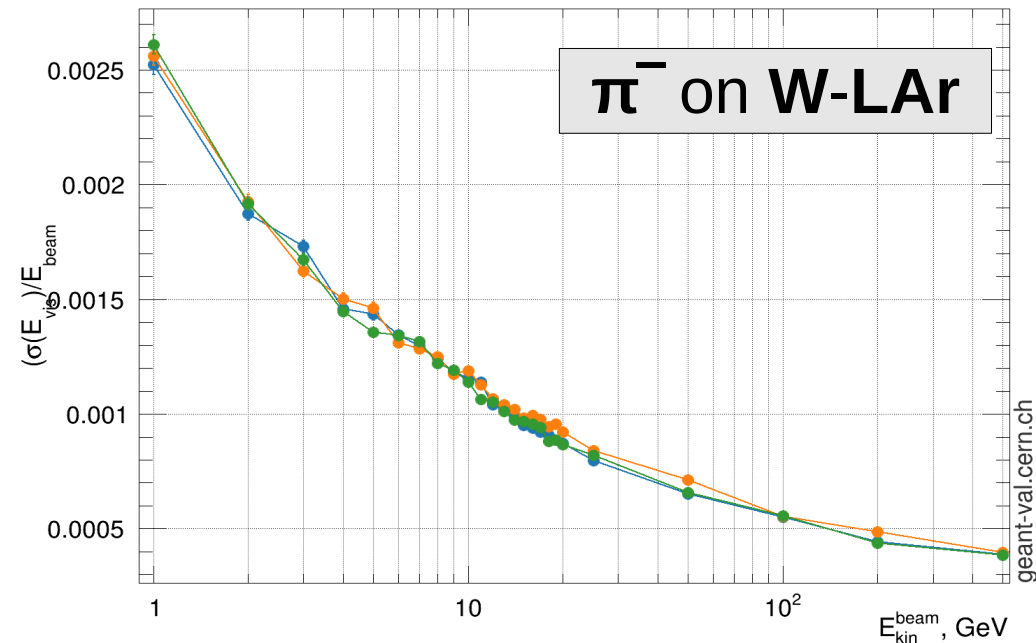
Normalized width | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



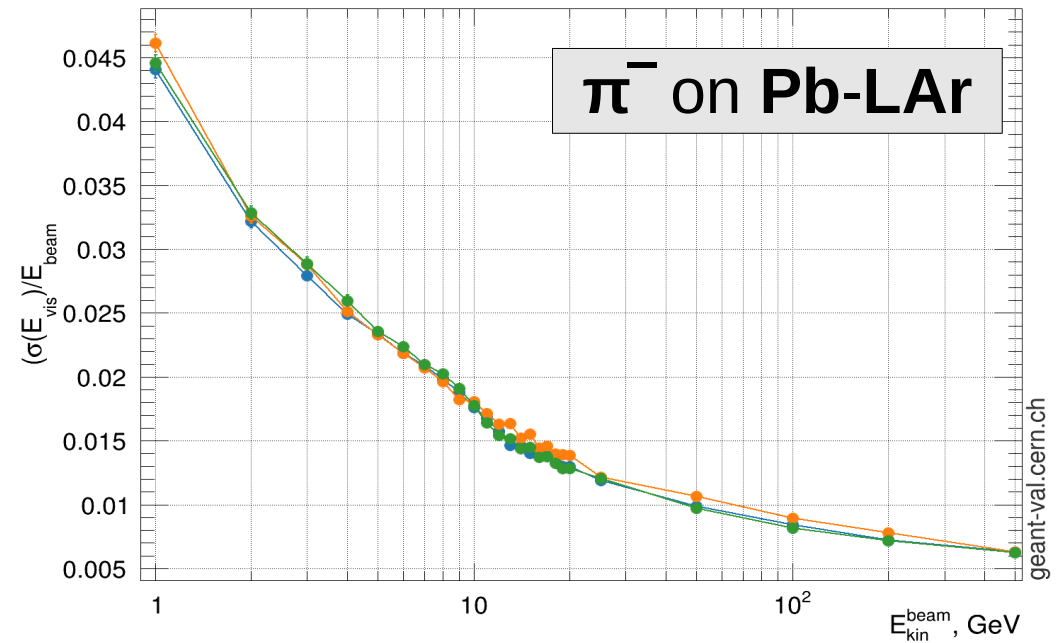
Normalized width | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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



10.5.cand01
10.4.ref09

10.4.p02

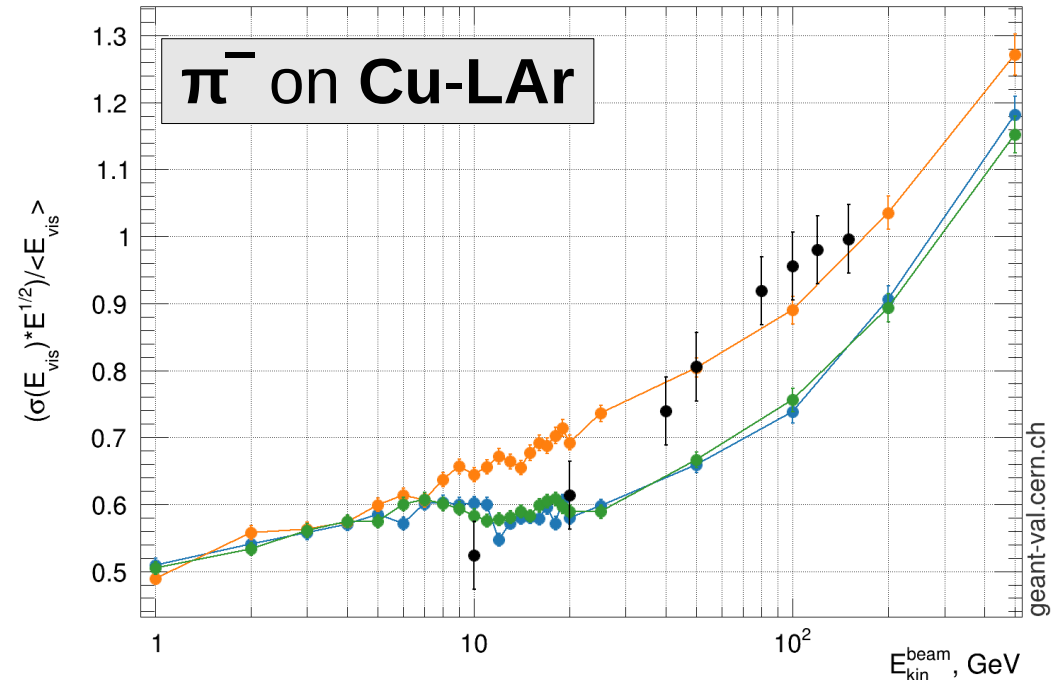
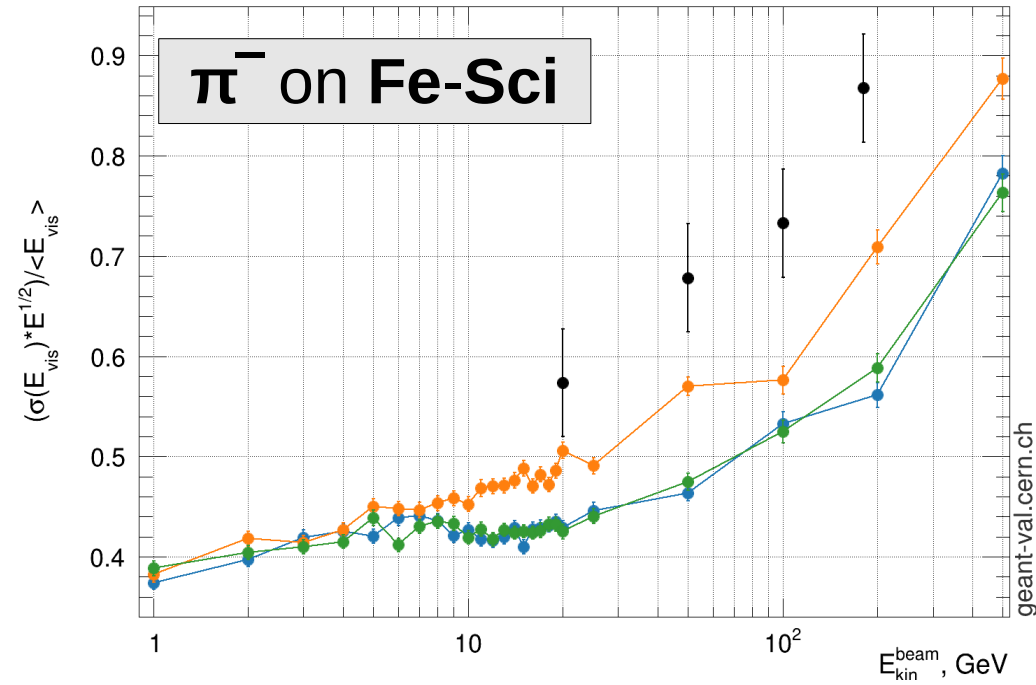
10.5.cand01
10.4.ref09

10.4.p02

FTFP_BERT : Energy Resolution

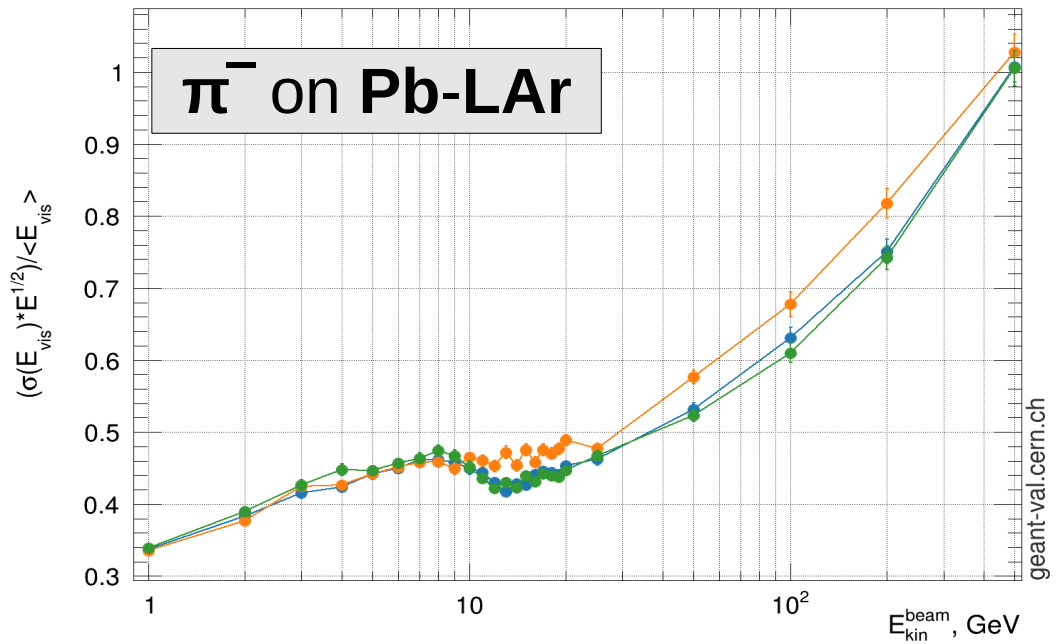
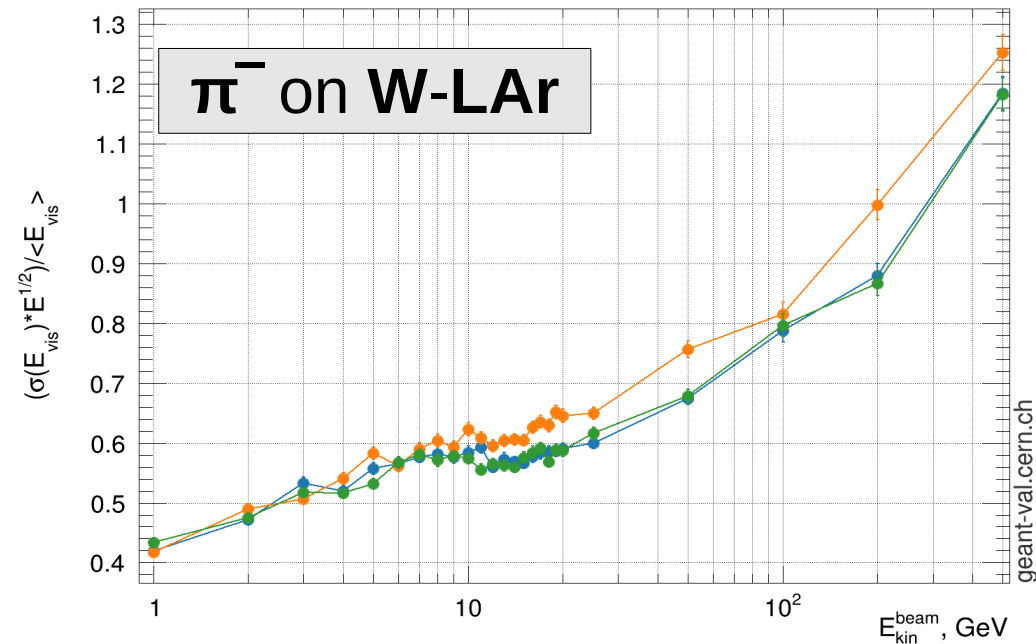
Energy resolution | Beam: pi- | Target: TileCal

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



10.5.cand01
10.4.ref09

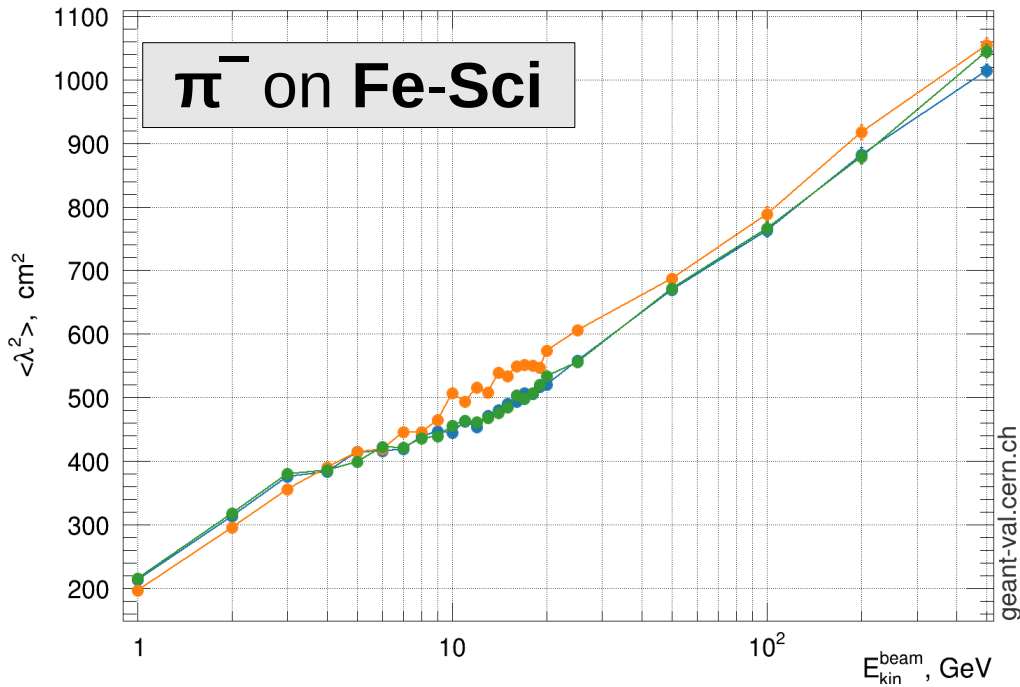
10.4.p02

10.5.cand01
10.4.ref09

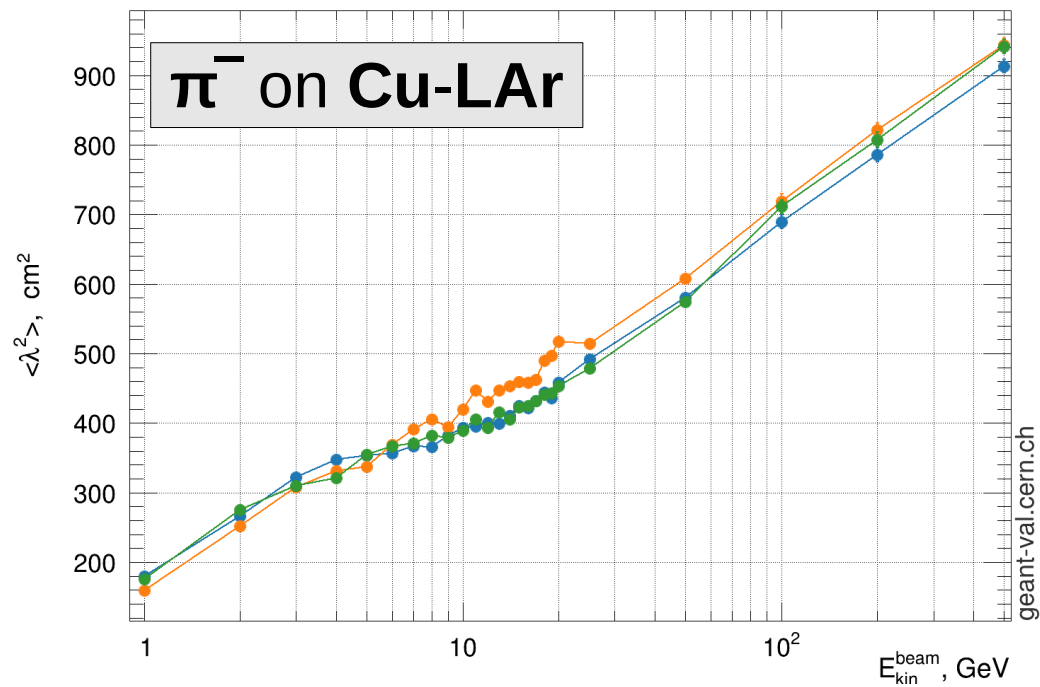
10.4.p02

FTFP_BERT : Longitudinal Shape

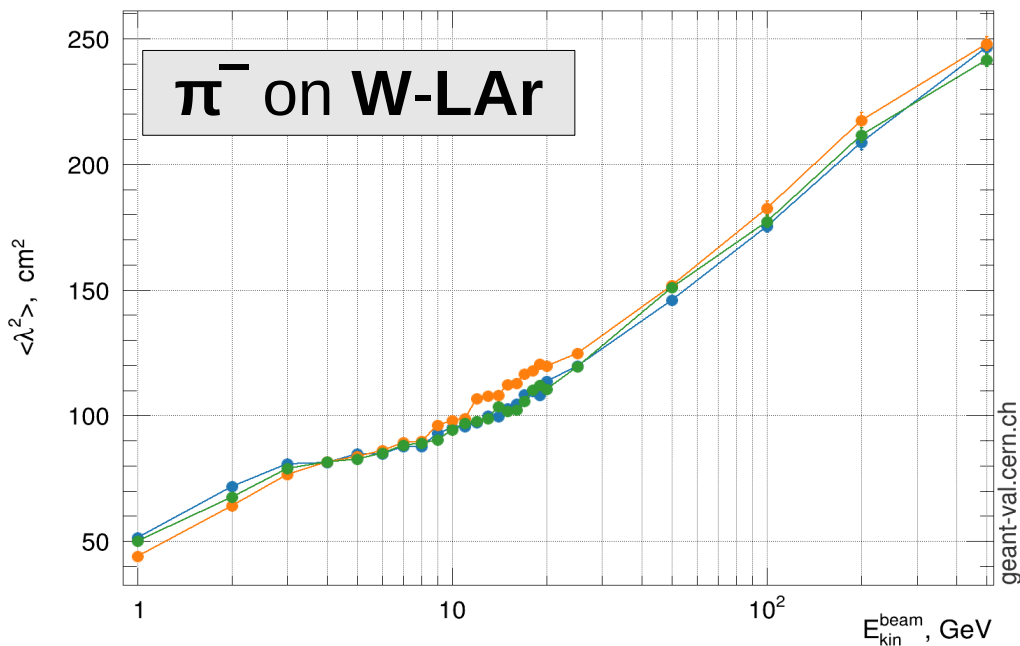
Longitudinal shower shape | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



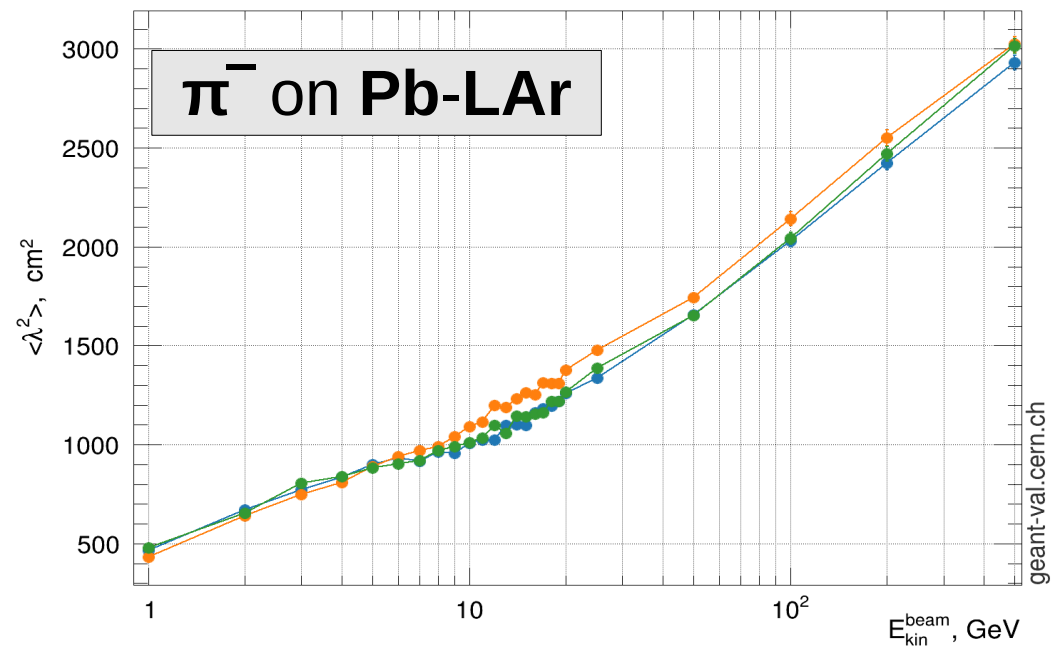
Longitudinal shower shape | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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



10.5.cand01
10.4.ref09

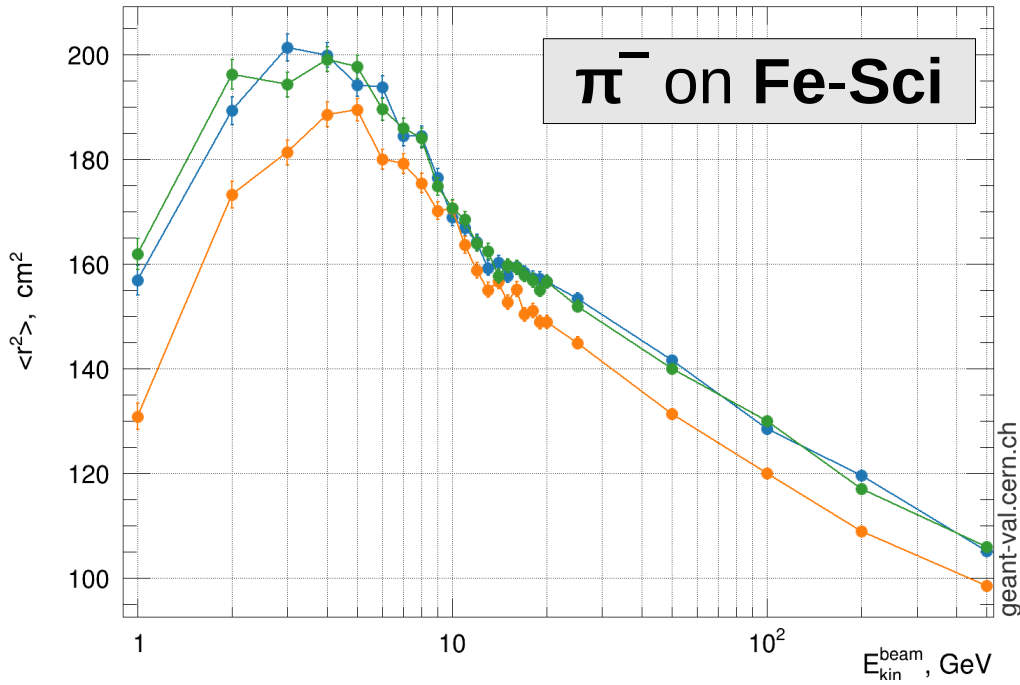
10.4.p02

10.5.cand01
10.4.ref09

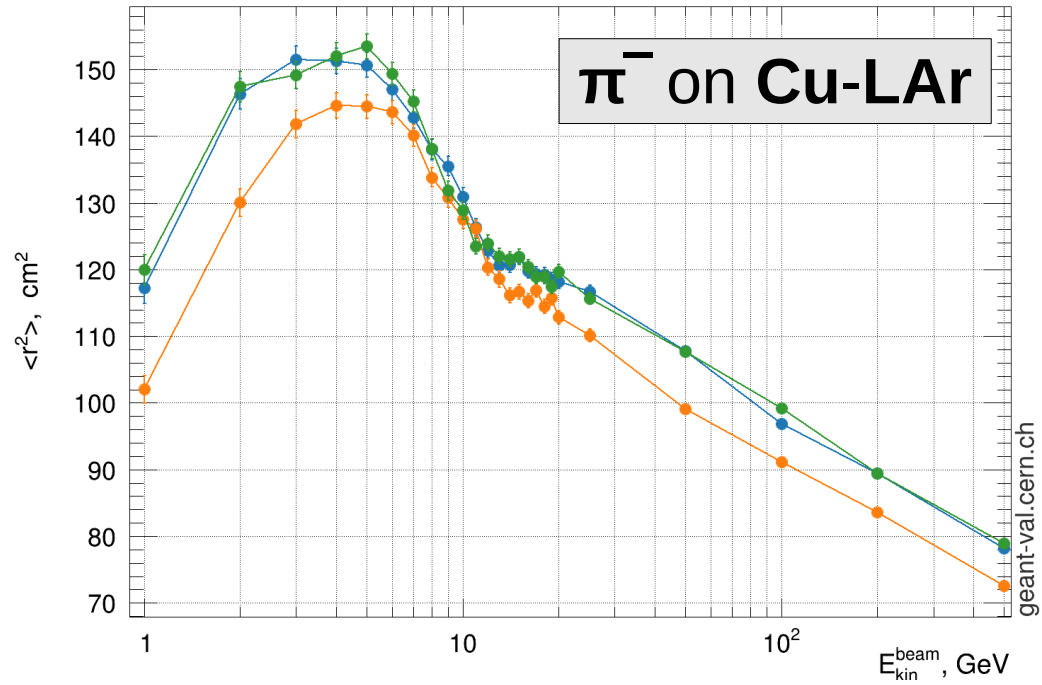
10.4.p02

FTFP_BERT : Lateral Shape

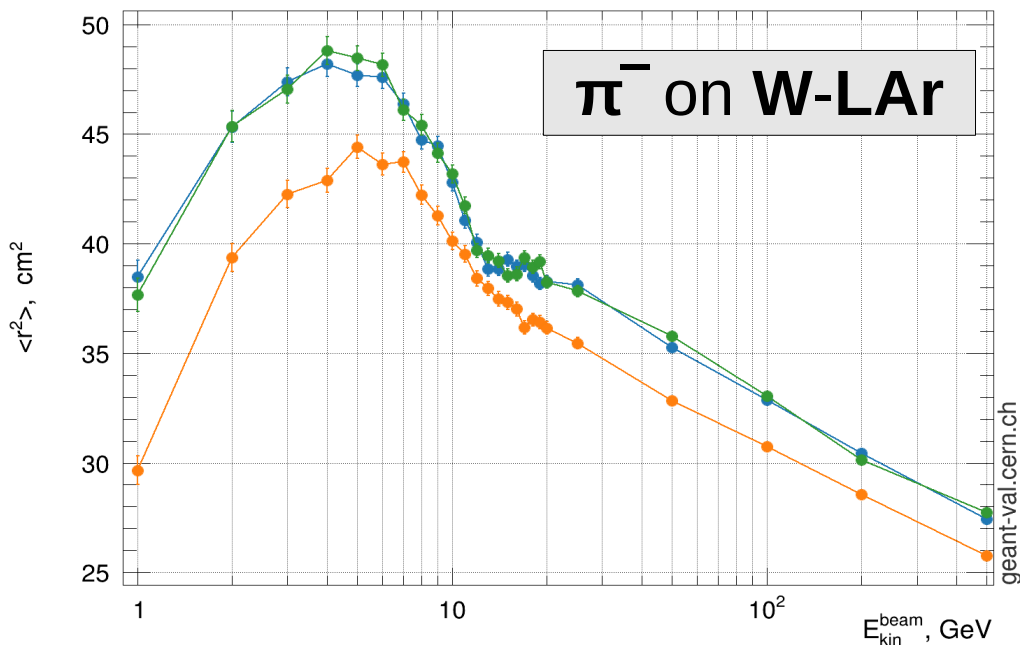
Lateral shower shape | Beam: pi- | Target: TileCal | Physics list: FTFP_BERT



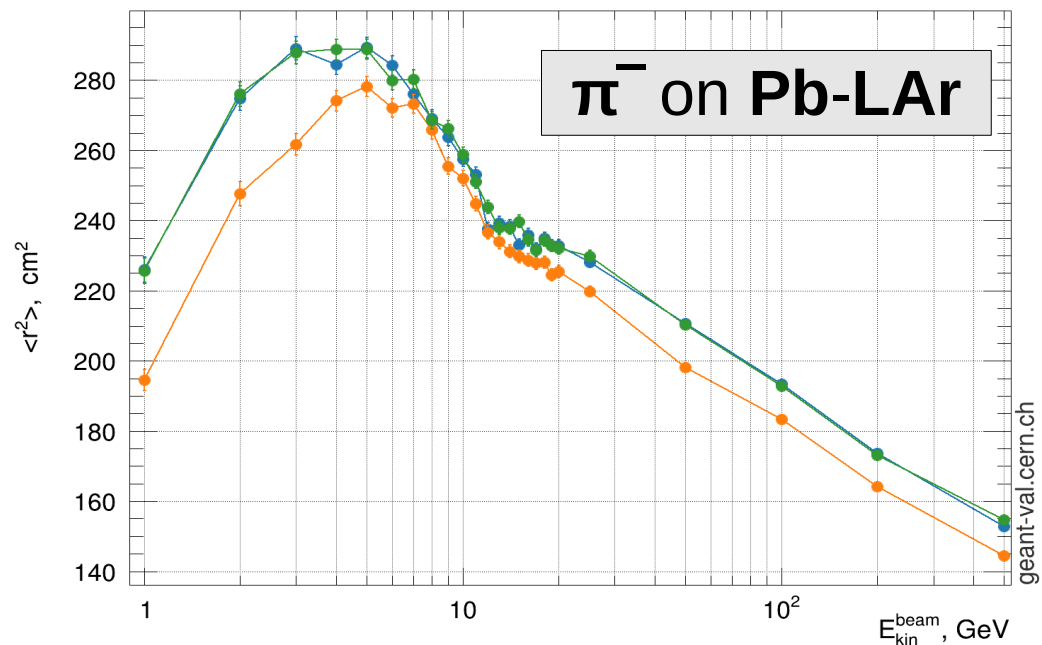
Lateral shower shape | Beam: pi- | Target: AtlasHEC | Physics list: FTFP_BERT



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



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



10.5.cand01
10.4.ref09

10.4.p02

10.5.cand01
10.4.ref09

10.4.p02

Conclusions

- **G4 10.5.cand01**
 - No crashes, warnings, infinite loops
 - Reproducibility OK
 - Except **INCLXX** in **MT** mode
 - Sequential is ok
 - Learnt lesson: run & check regularly Hadr00 !
 - **FTFP_BERT** hadronic showers vs. Ref09
 - Stable

Back up

Pion- showers, G4 10.5.cand01

FTFP_BERT

QGSP_FTFP_BERT

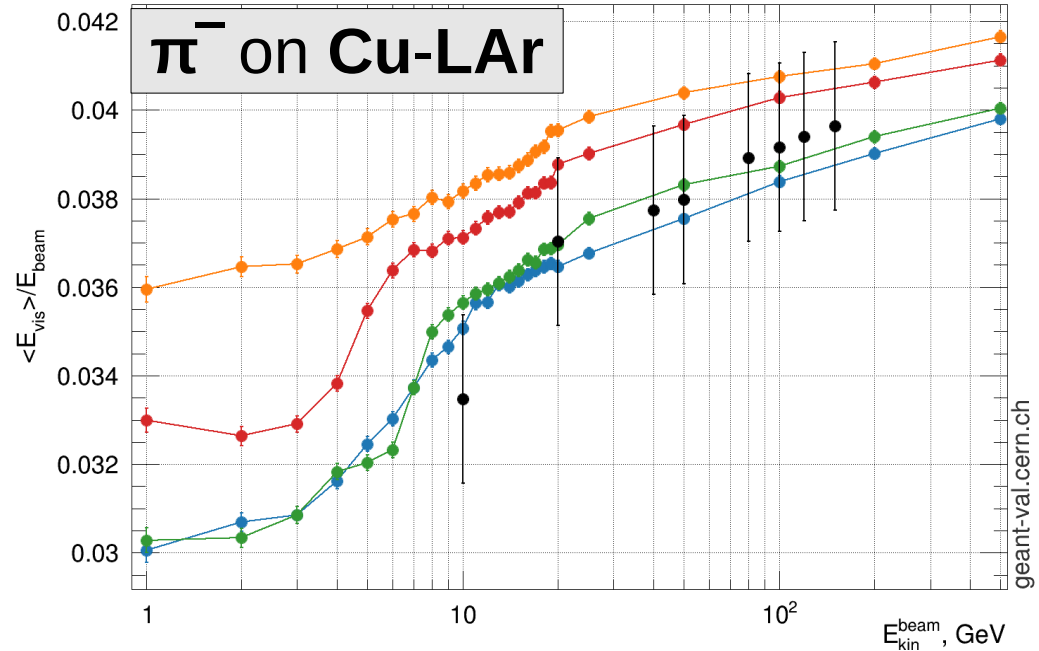
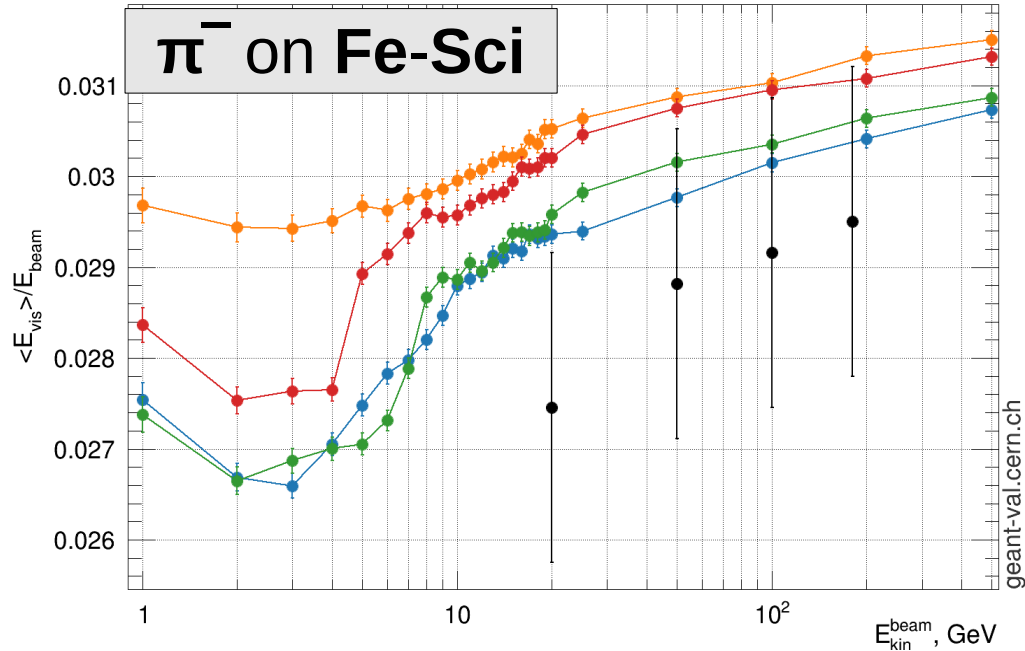
QGSP_INCLXX

QGSP_BIC

Energy Response

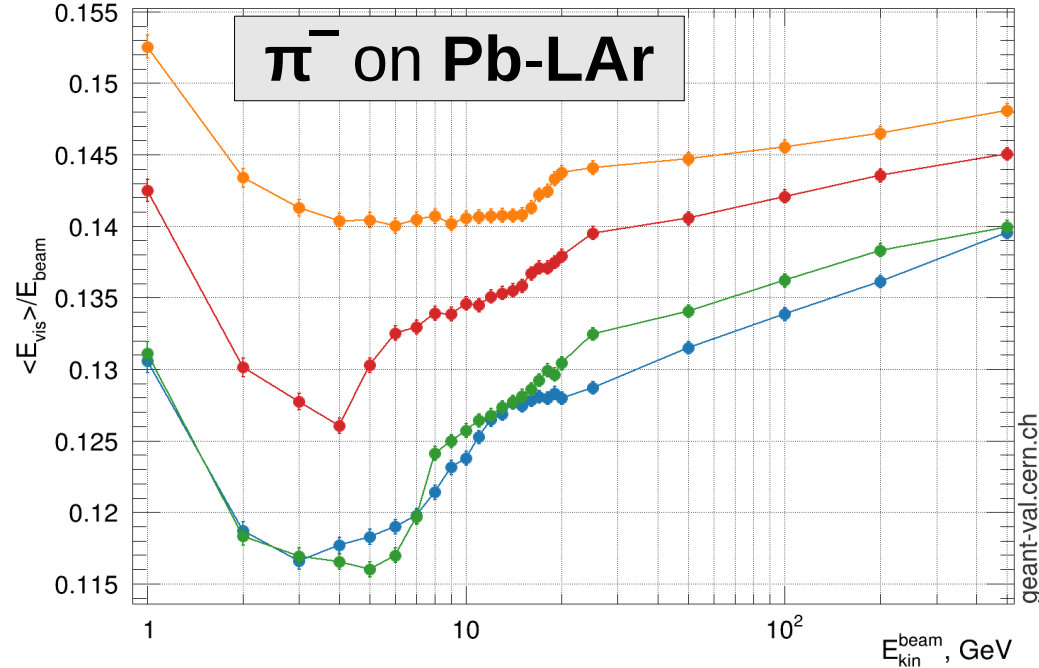
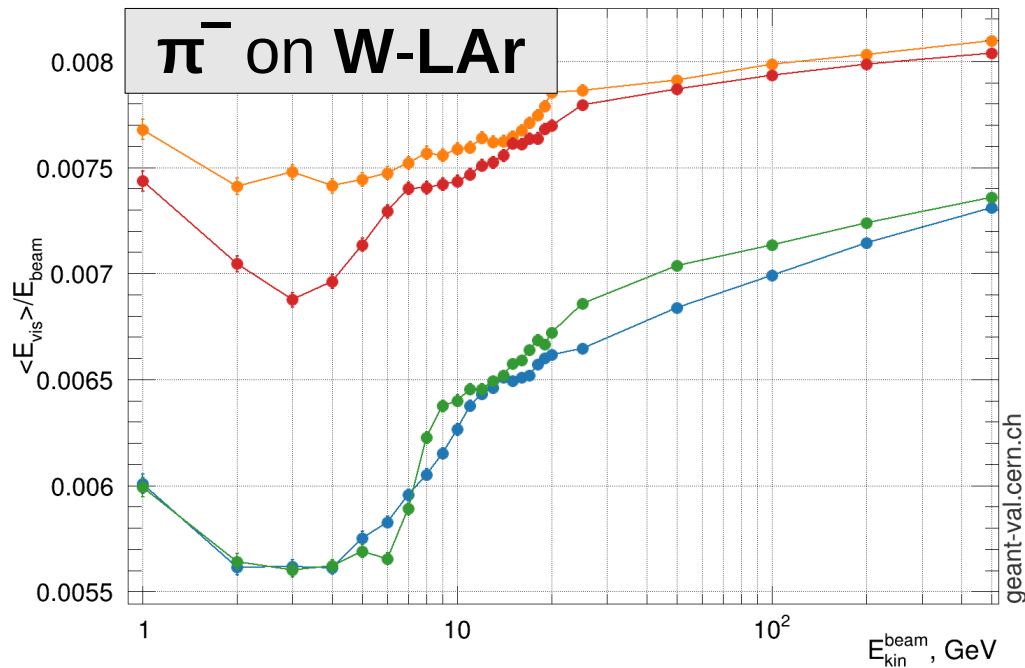
Energy response | Beam: pi- | Target: TileCal

Energy response | Beam: pi- | Target: AtlasHEC



Energy response | Beam: pi- | Target: AtlasFCAL

Energy response | Beam: pi- | Target: AtlasECAL



10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

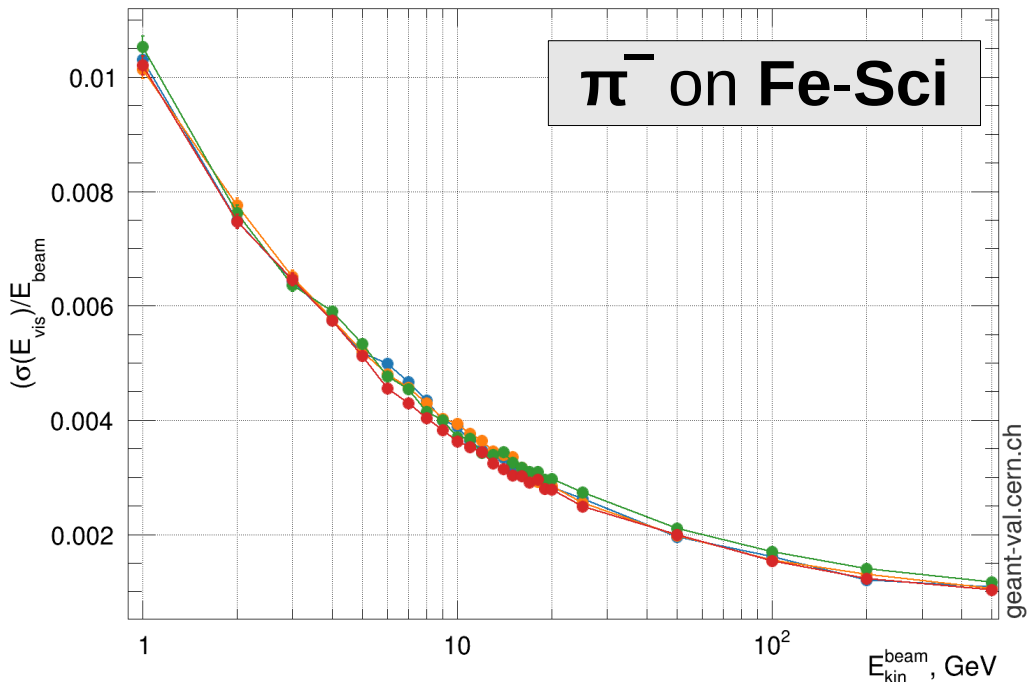
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

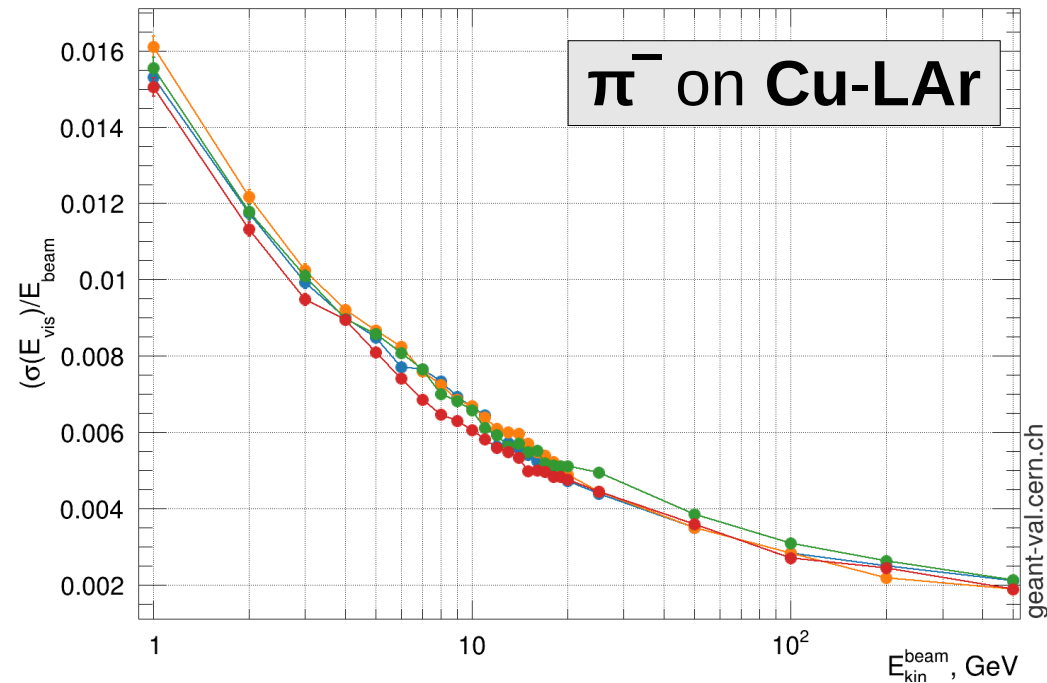
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

Energy Width

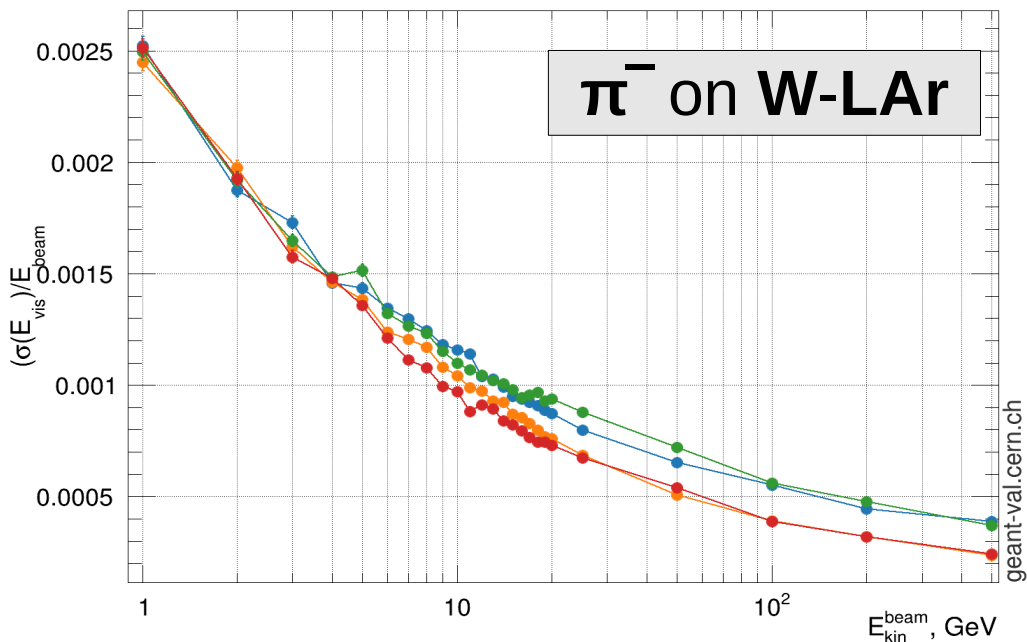
Normalized width | Beam: pi- | Target: TileCal



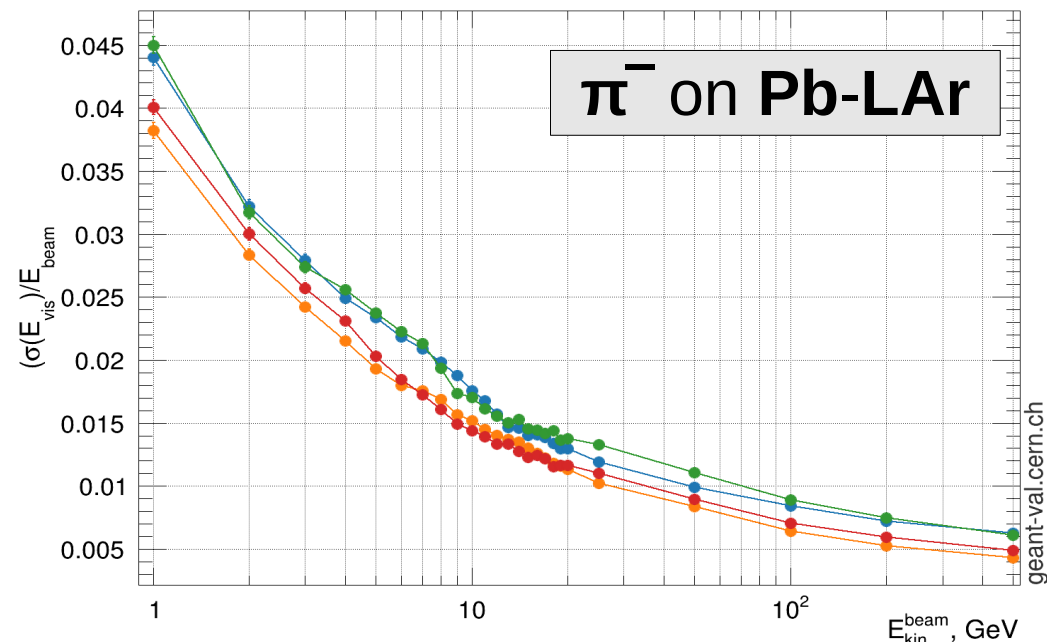
Normalized width | Beam: pi- | Target: AtlasHEC



Normalized width | Beam: pi- | Target: AtlasFCAL



Normalized width | Beam: pi- | Target: AtlasECAL



10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

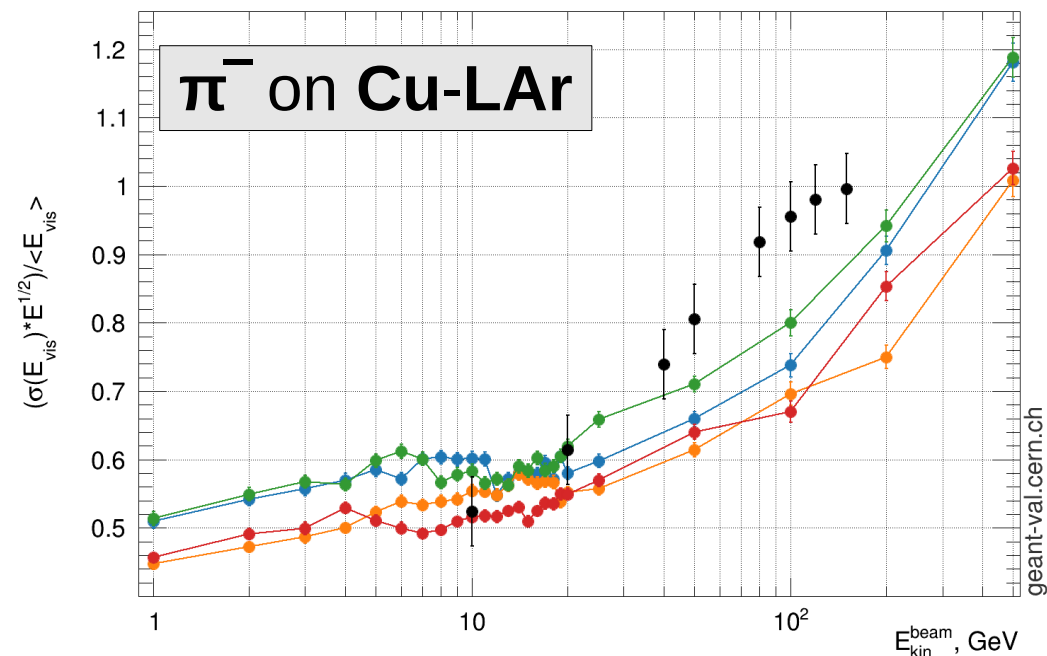
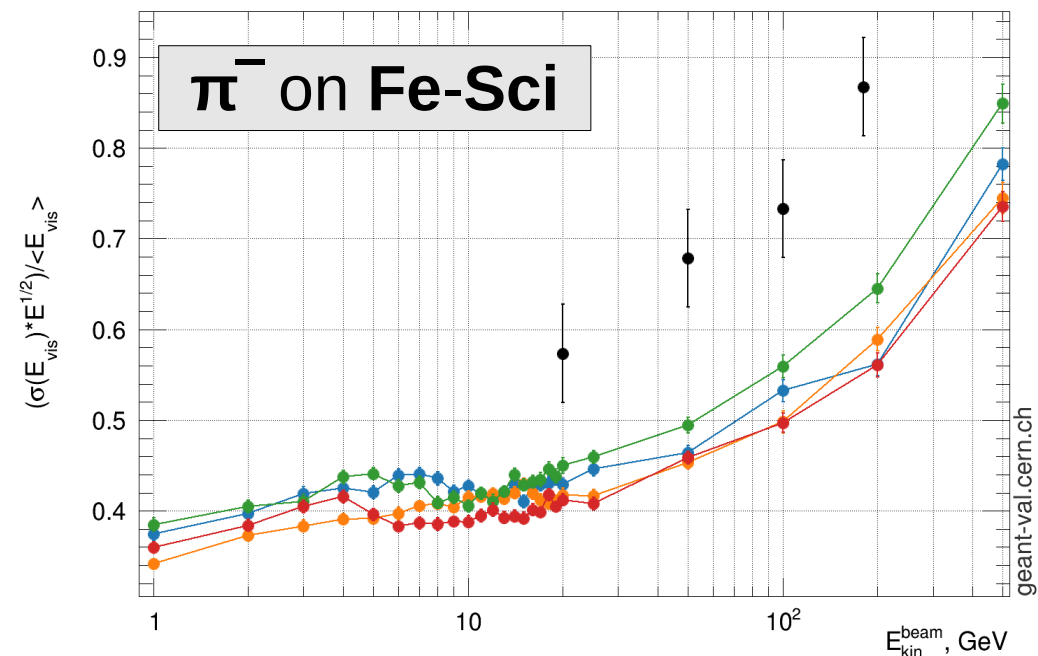
10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

Energy Resolution

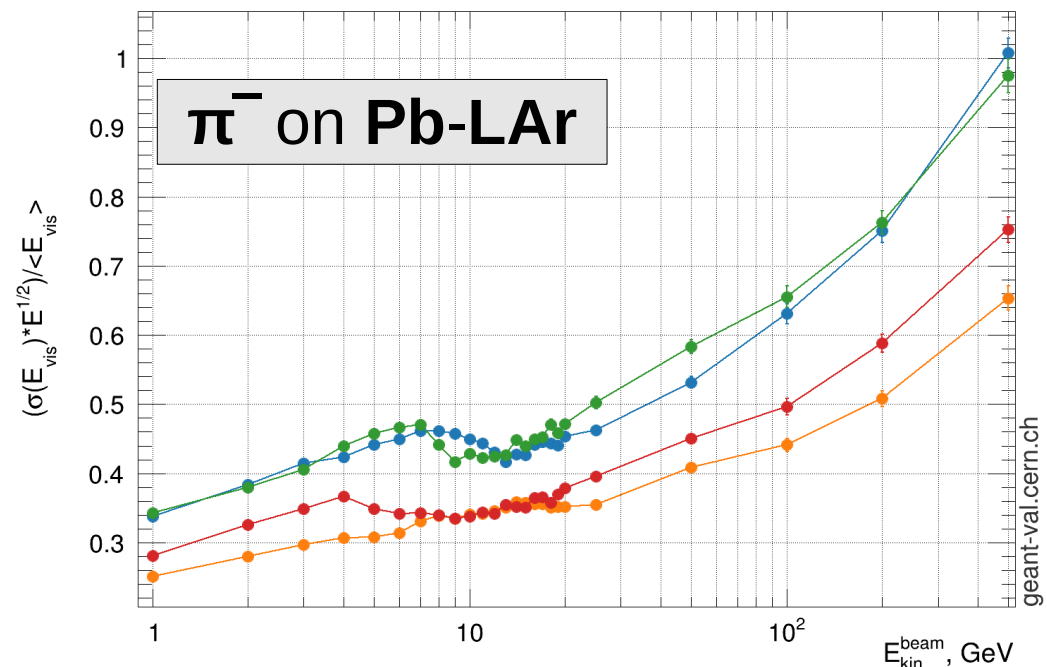
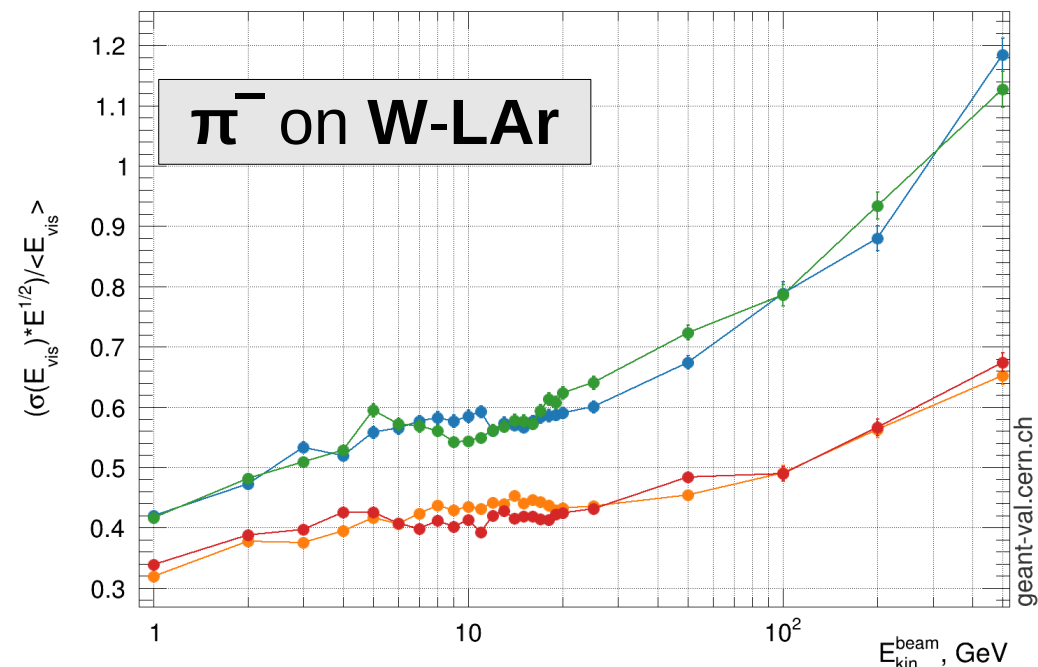
Energy resolution | Beam: pi- | Target: TileCal

Energy resolution | Beam: pi- | Target: AtlasHEC



Energy resolution | Beam: pi- | Target: AtlasFCAL

Energy resolution | Beam: pi- | Target: AtlasECAL



10.5.cand01 FTFTP_BERT
10.5.cand01 QGSP_FTFTP_BERT

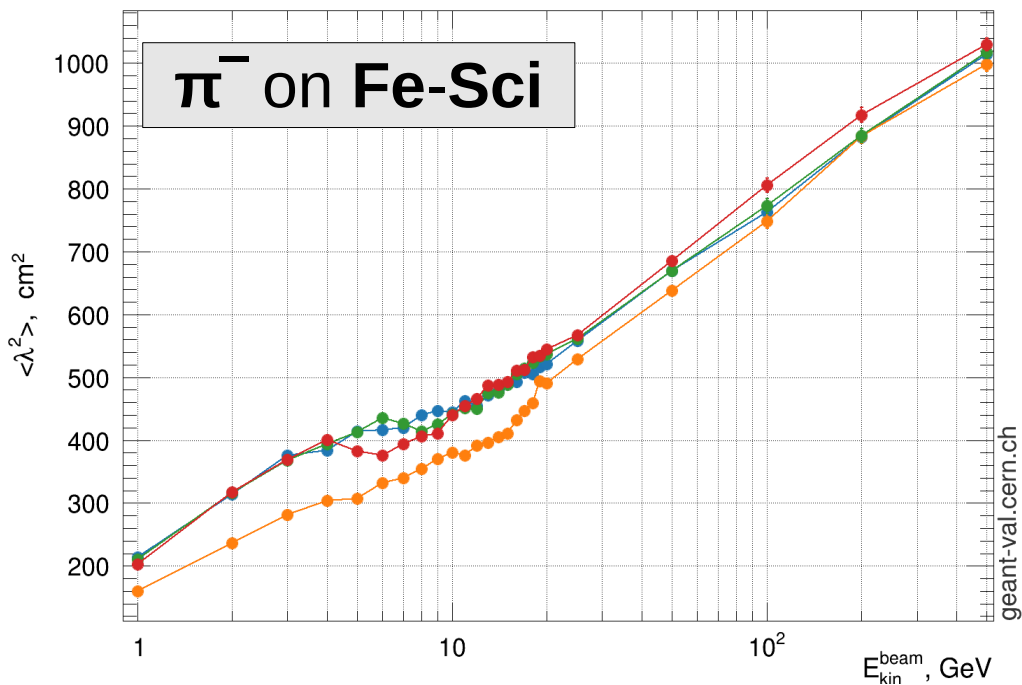
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

10.5.cand01 FTFTP_BERT
10.5.cand01 QGSP_FTFTP_BERT

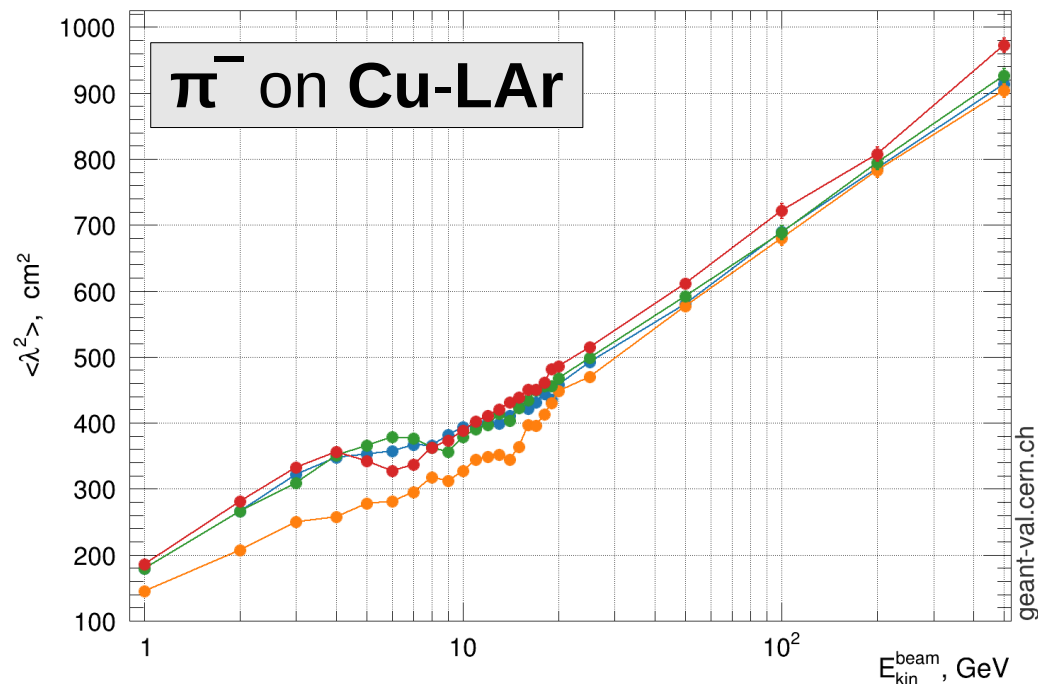
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

Longitudinal Shape

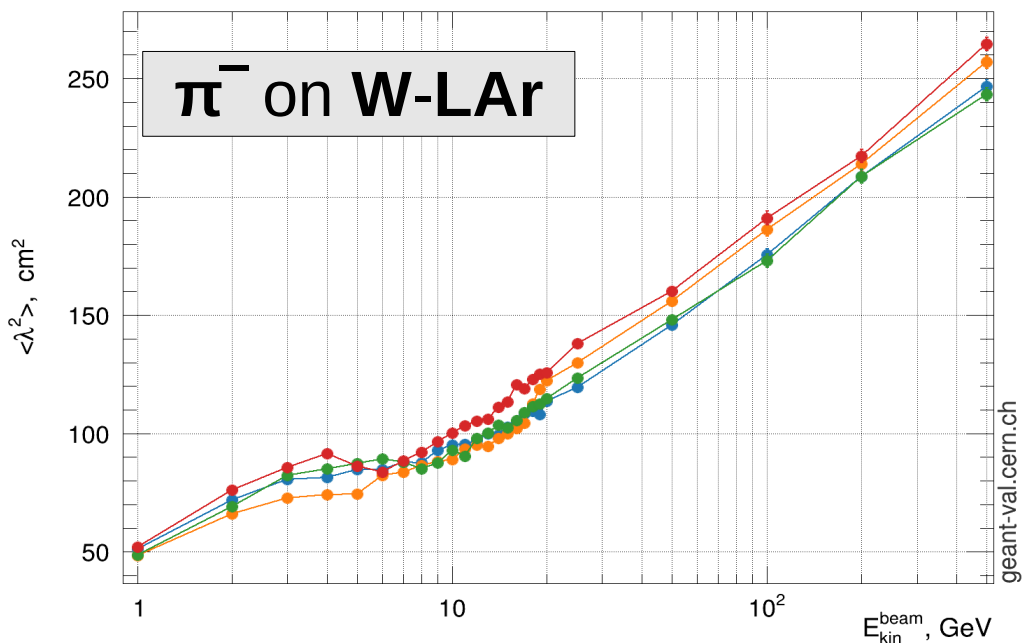
Longitudinal shower shape | Beam: pi- | Target: TileCal



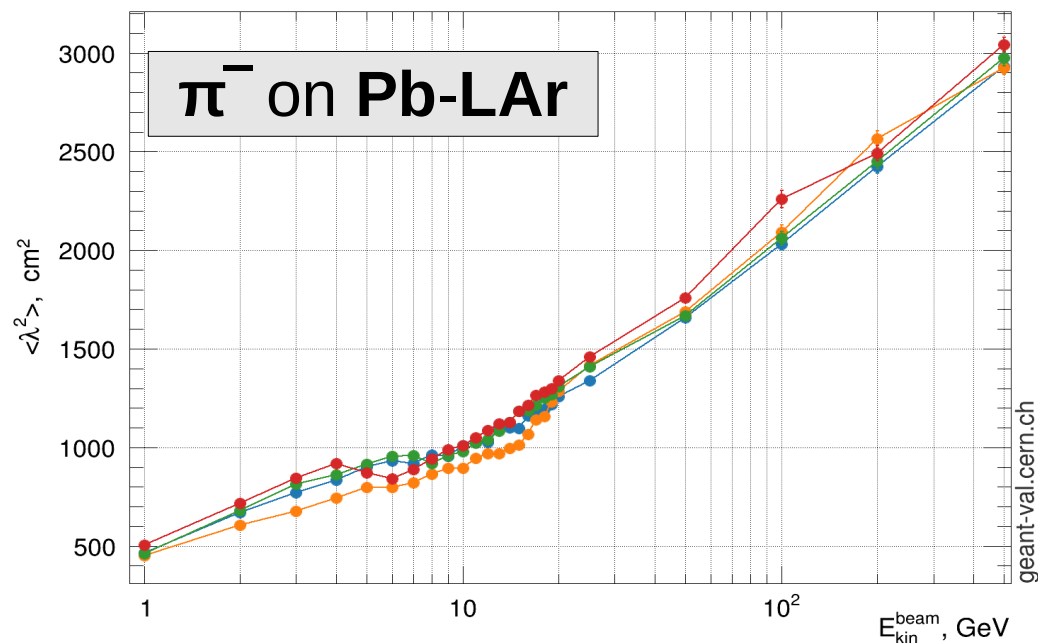
Longitudinal shower shape | Beam: pi- | Target: AtlasHEC



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



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



10.5.cand01 FTFF_BERT
10.5.cand01 QGSP_FTFF_BERT

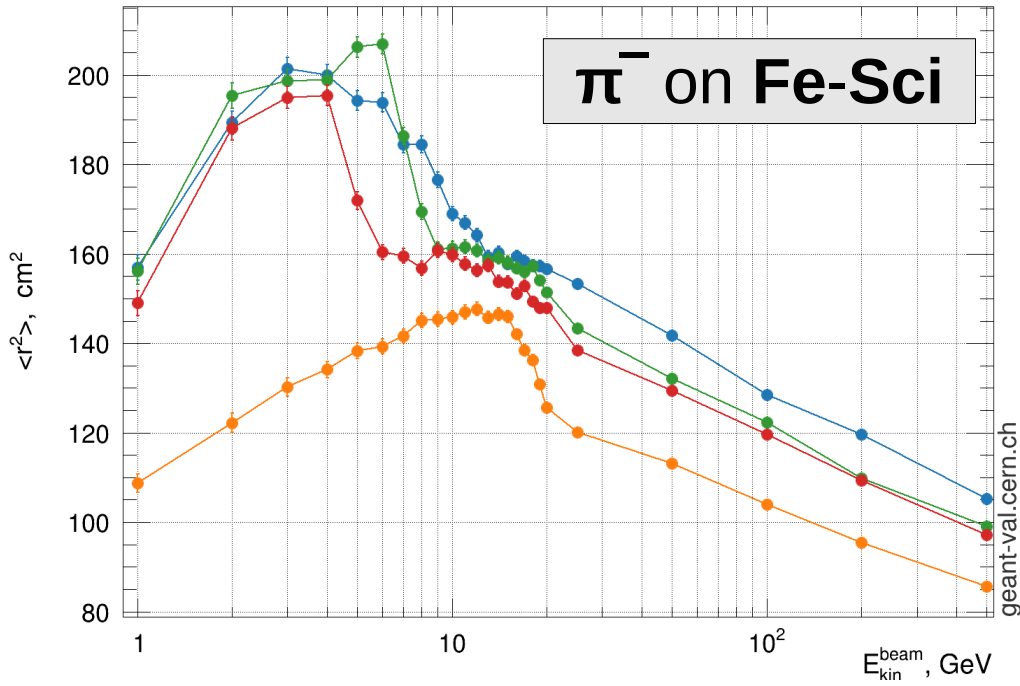
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

10.5.cand01 FTFF_BERT
10.5.cand01 QGSP_FTFF_BERT

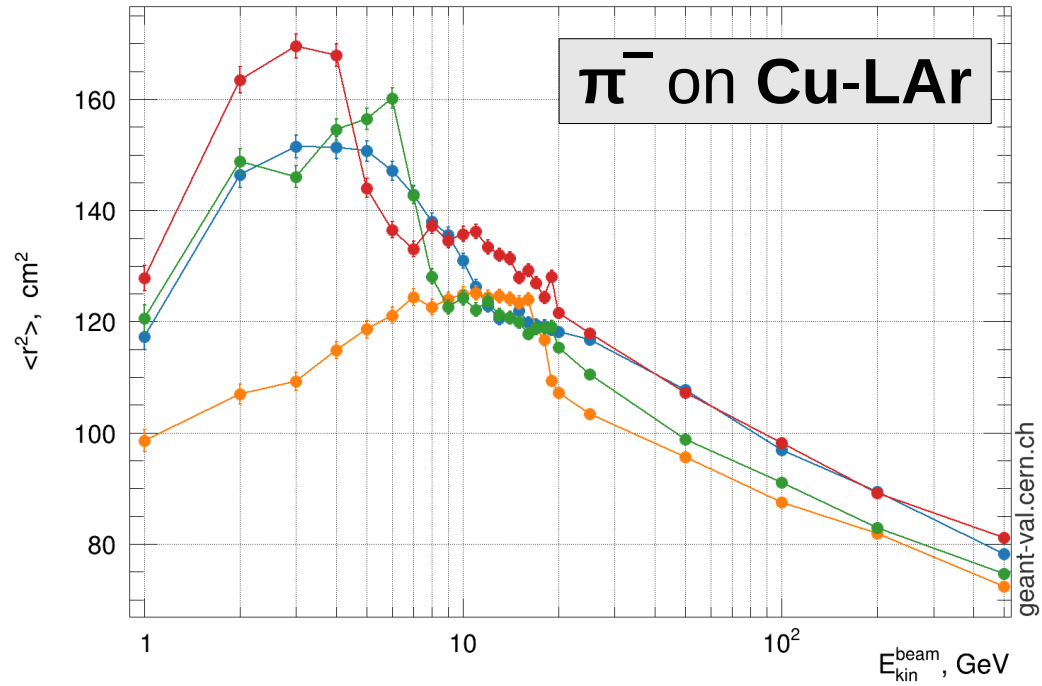
10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

Lateral Shape

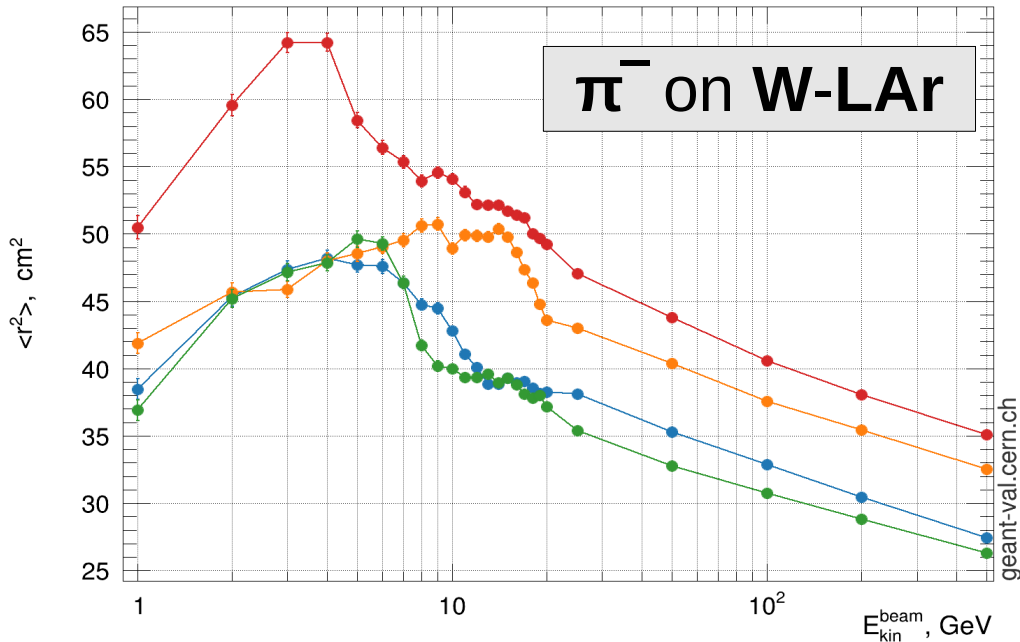
Lateral shower shape | Beam: pi- | Target: TileCal



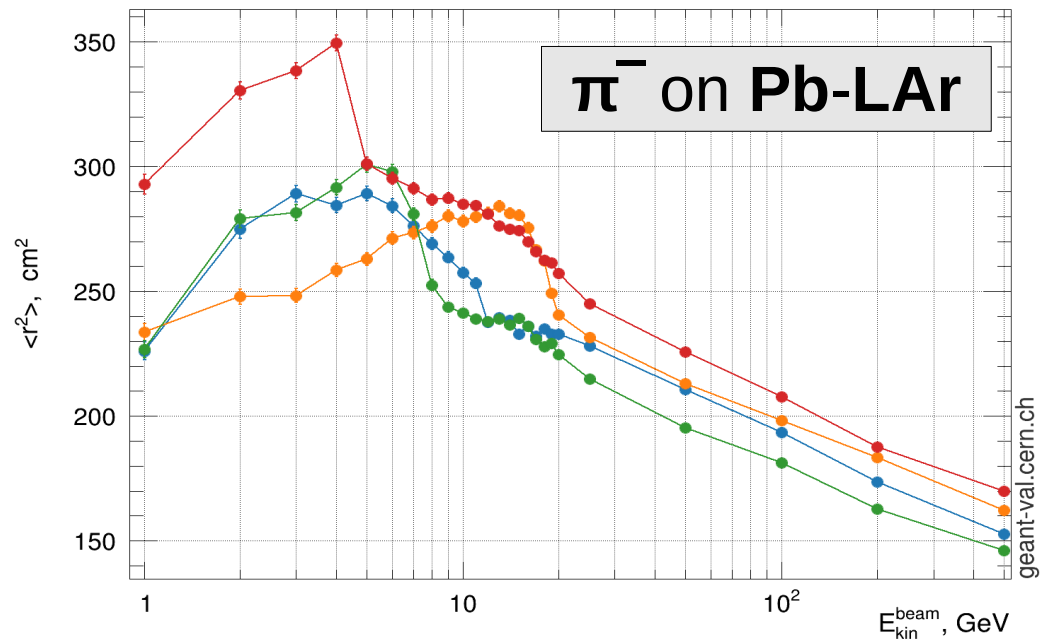
Lateral shower shape | Beam: pi- | Target: AtlasHEC



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



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



10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC

10.5.cand01 FTFP_BERT
10.5.cand01 QGSP_FTFP_BERT

10.5.cand01 QGSP_INCLXX
10.5.cand01 QGSP_BIC