

# Grid testing of Geant4: **10.3.p01.cand{01, 02}**

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# Main Changes in Hadronics with respect to G4 10.3

- No changes in FTF, QGS, BERT and Precompound
- de-excitations
  - Several changes, physics and technical
- im\_r\_matrix/G4VScatteringCollision (used by Binary Cascade) :
  - fixed memory leak in MT
- Radioactive Decay : only some technical changes
- Data sets:
  - **G4PhotonEvaporation4.3.1**
  - **G4RadioactiveDecay5.1.1**

# Crashes & Warnings

- Full statistics not yet available

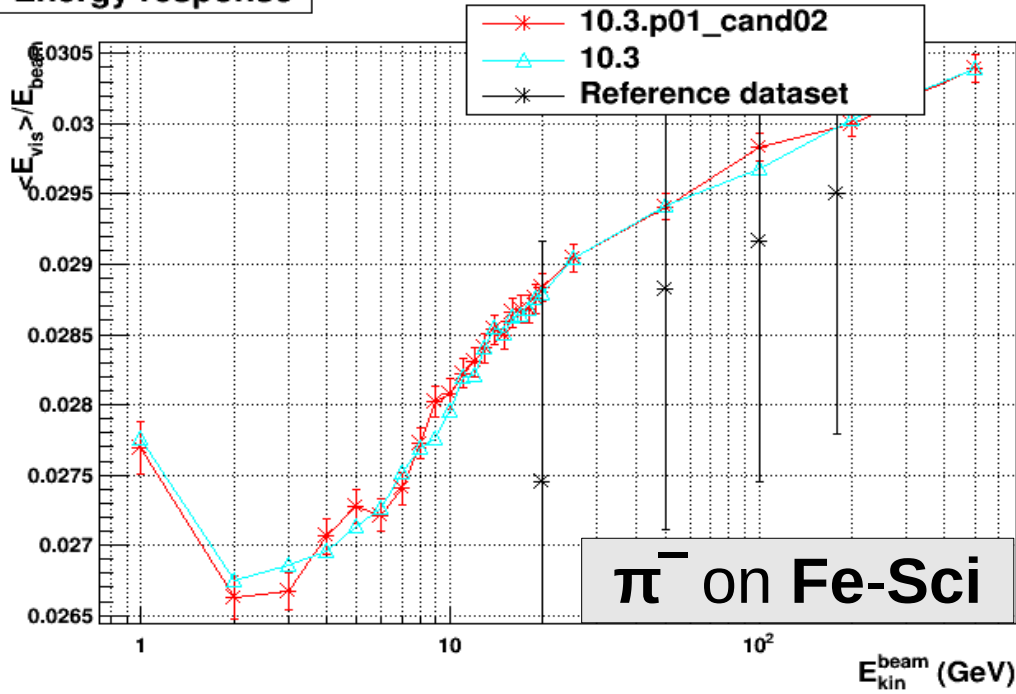
# Reproducibility

- **Reproducibility**
  - 2 violations, out of 5'000 tests, seen in **FTFP\_BERT** in cand01
  - Seen also on pure sequential mode with high statistics (x 10)
    - 20 GeV proton on a simplified calorimeter W-LAr
  - The problem is present also in: **G4 10.3.ref00** , **10.3.ref01**
    - **whereas it is ok in G4 10.2.ref10**
  - The problem appears in inelastic interactions of a ~200 MeV deuteron on W, but the actual culprit is **de-excitation**
    - Isomer, not known in G4NuclideTable, is created, with a mass value which is computed on-the-fly from the 4-momentum
    - Due to numerical instabilities, the mass of the isomer can be slightly (< 1 eV) different according to the history of the event
    - **Fixed by the following tags, included in G4 10.3.p01.cand02 :**
      - **hadr-mod-util-V10-03-02**
      - **hadr-deex-V10-03-14**
      - **radioactive\_decay-V10-03-04**

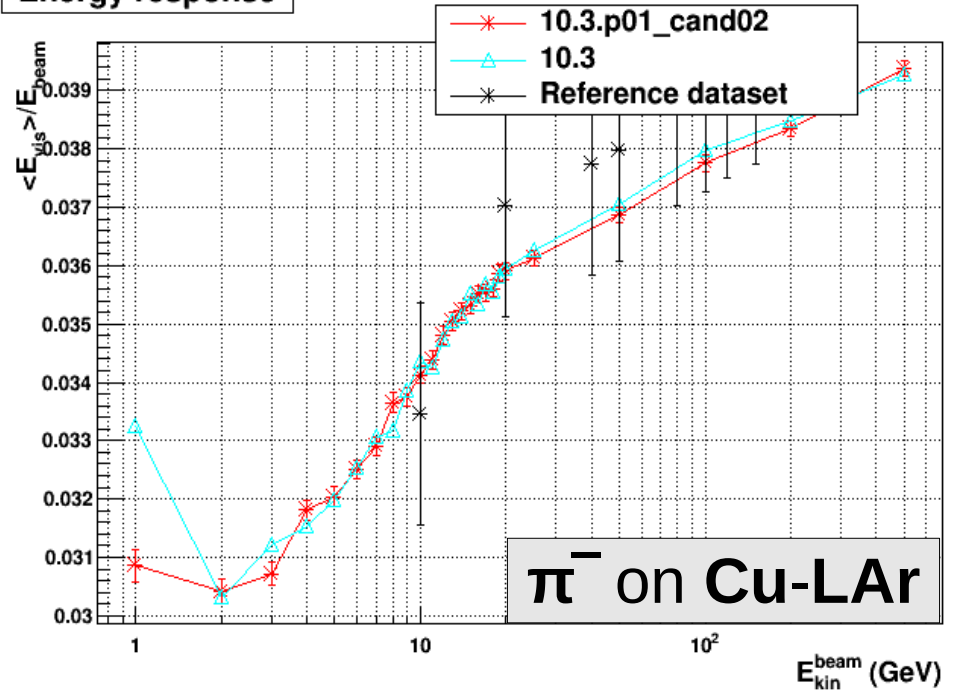
Pion showers: FTFP\_BERT  
G4 10.3.p01.cand02 vs. 10.3

# FTFP\_BERT : Energy Response

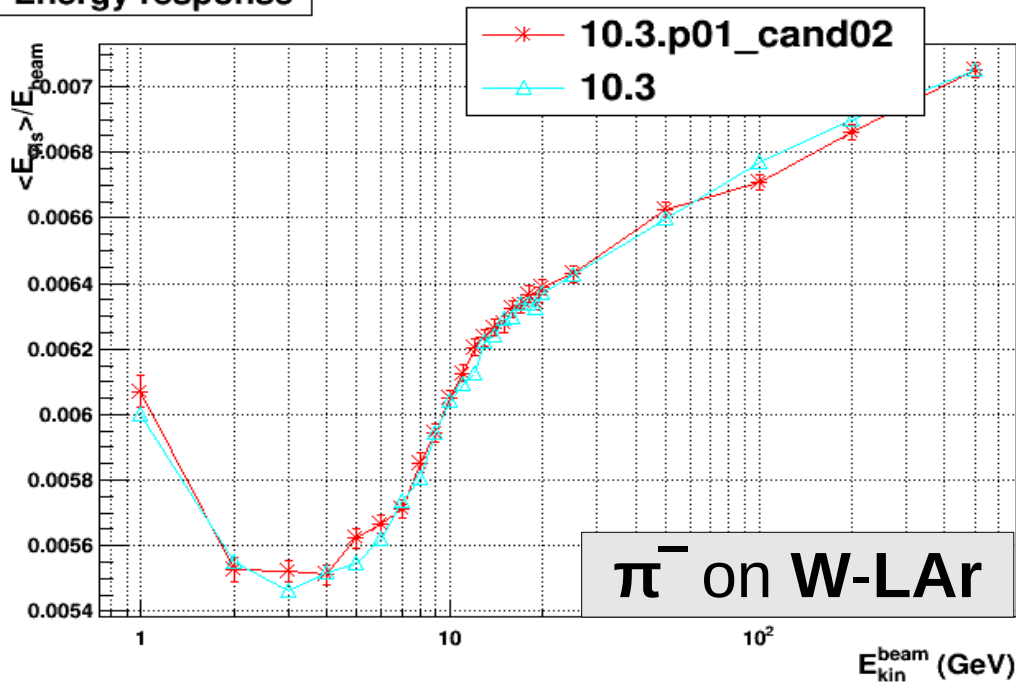
Energy response



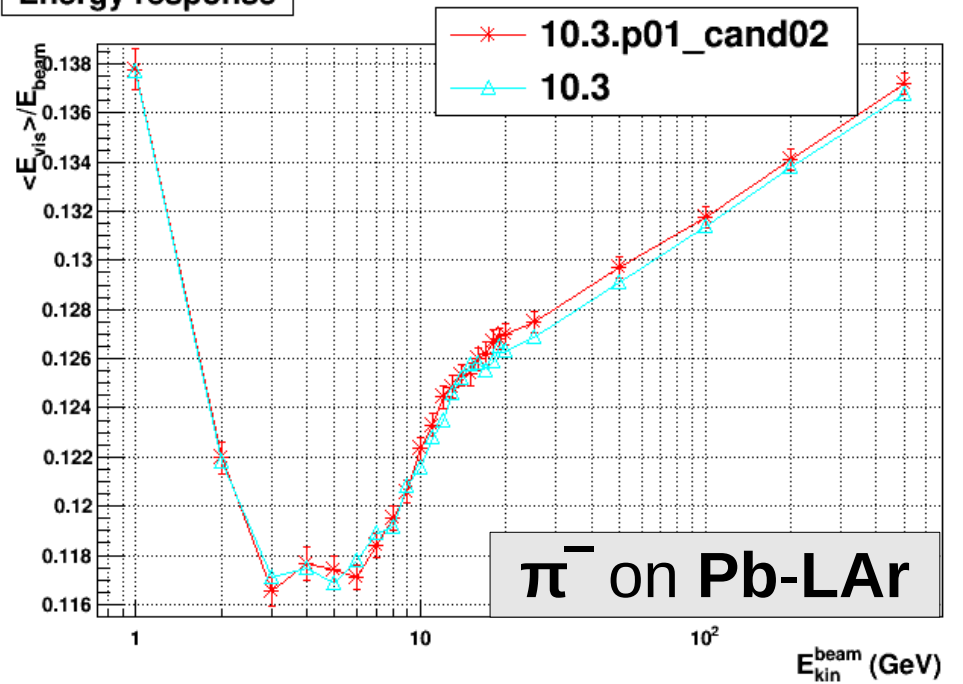
Energy response



Energy response

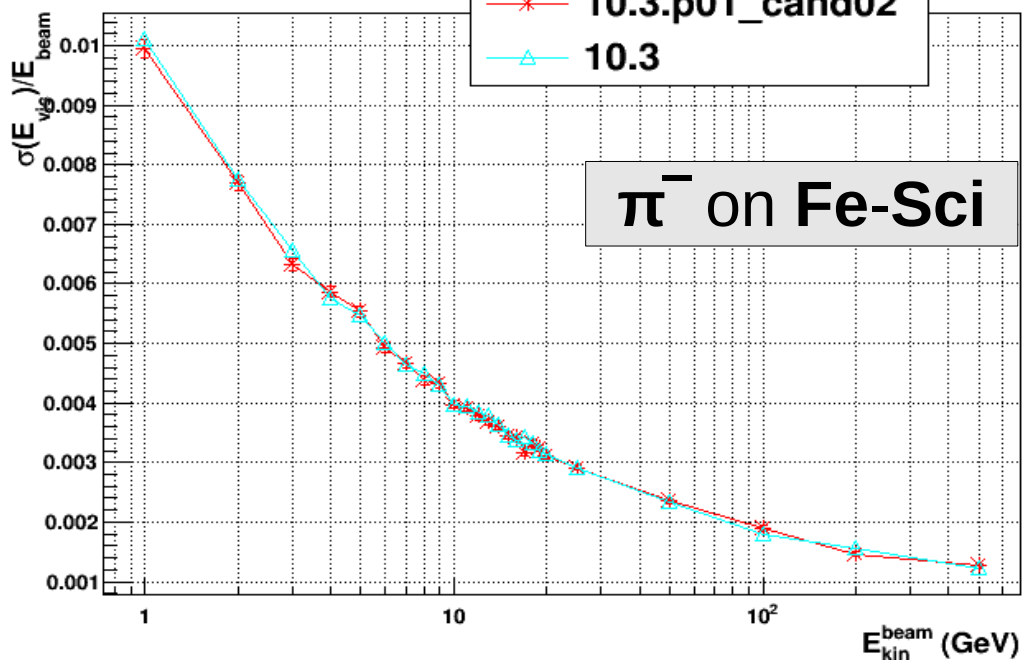


Energy response

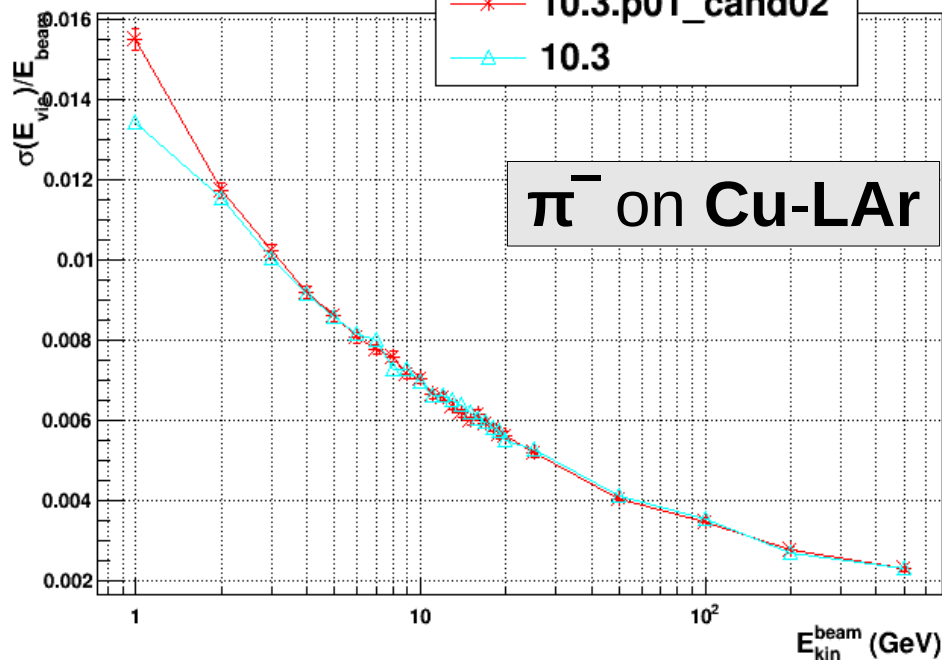


# FTFP\_BERT : Energy Width

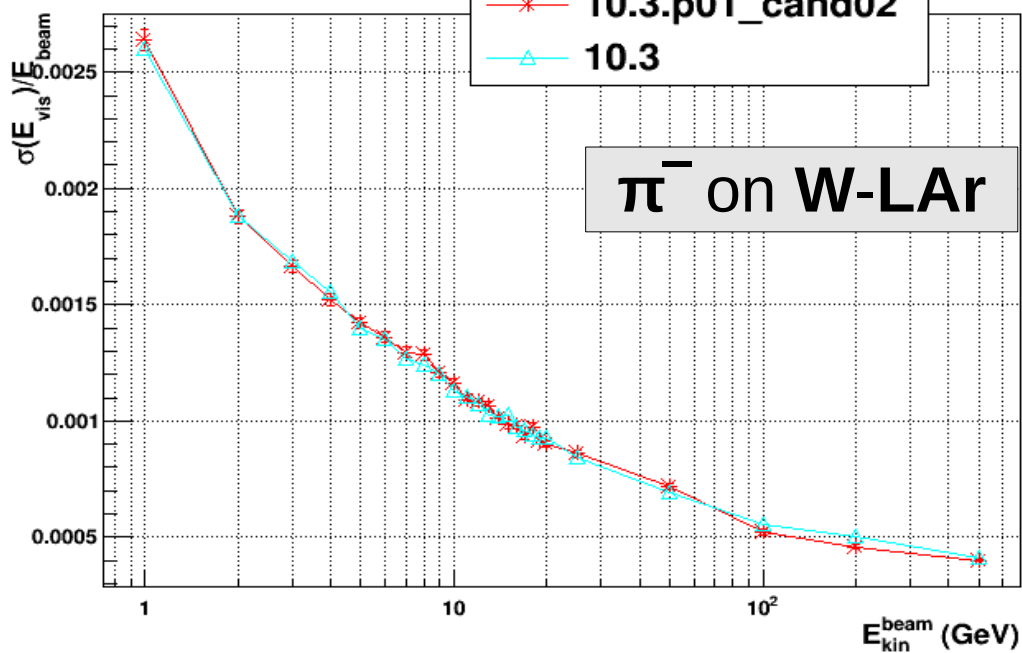
Normalized width



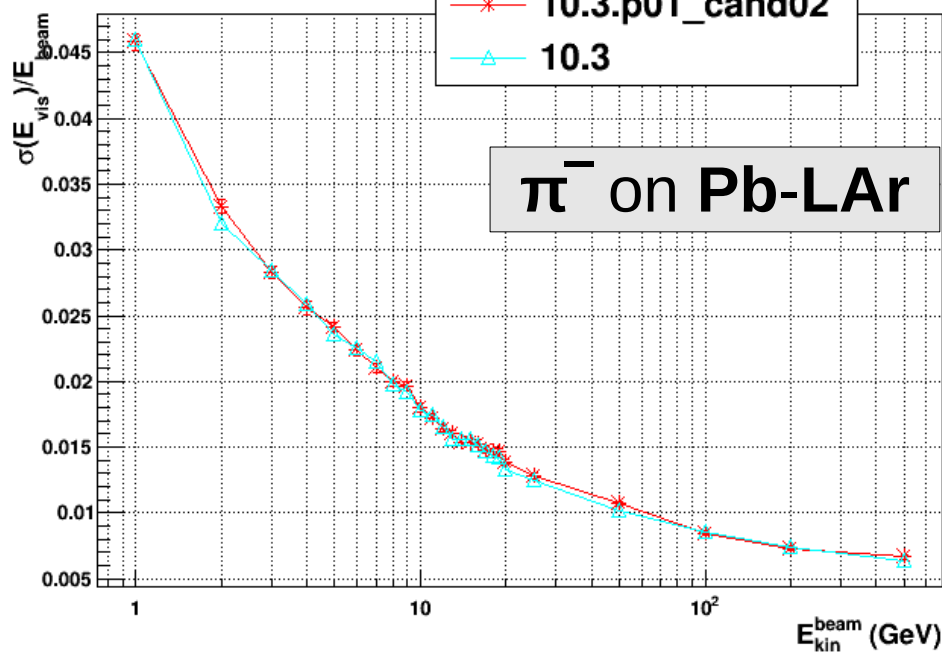
Normalized width



Normalized width

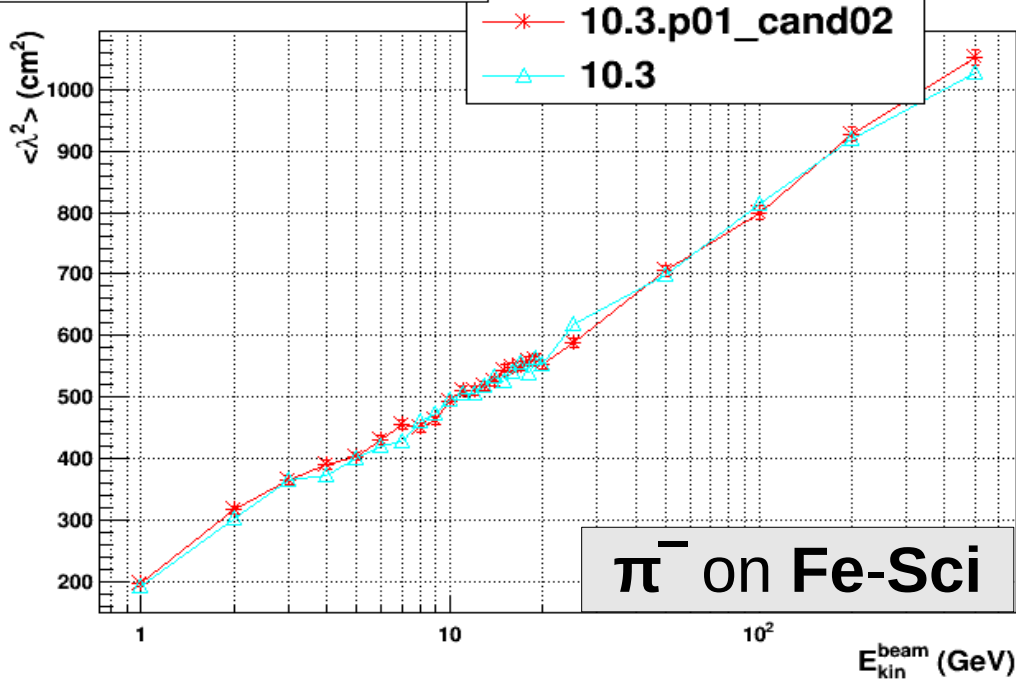


Normalized width



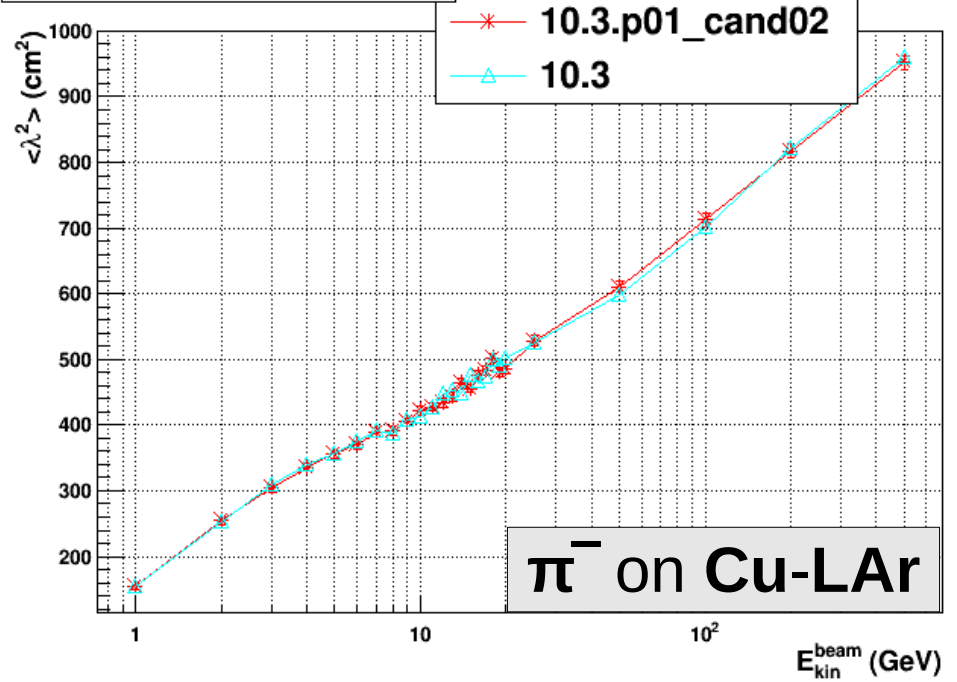
# FTFP\_BERT : Longitudinal Shape

Longitudinal shower shape



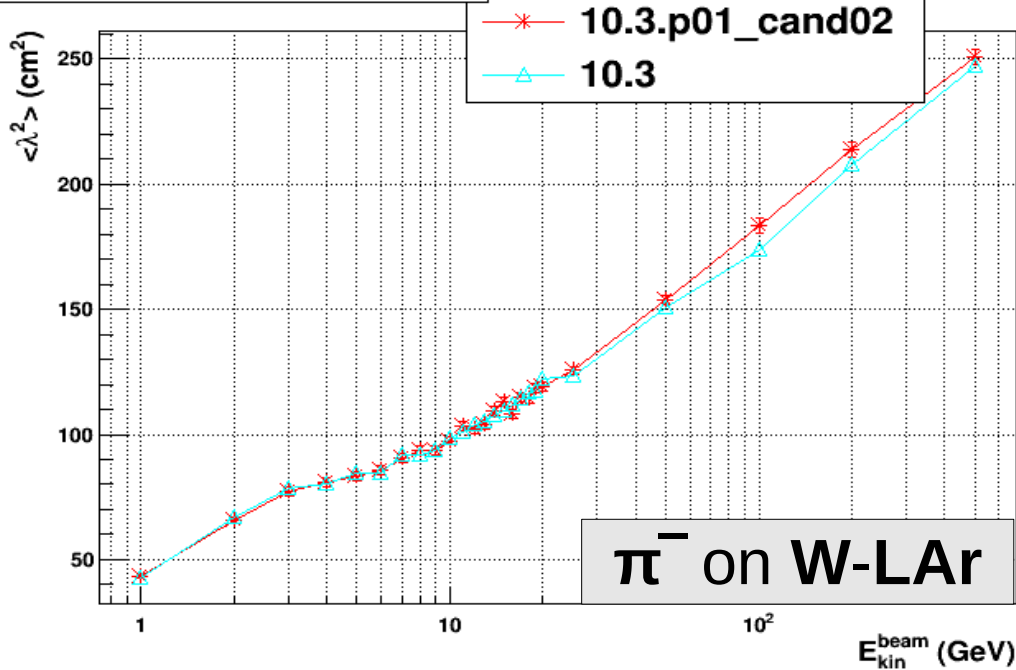
$\pi^-$  on Fe-Sci

Longitudinal shower shape



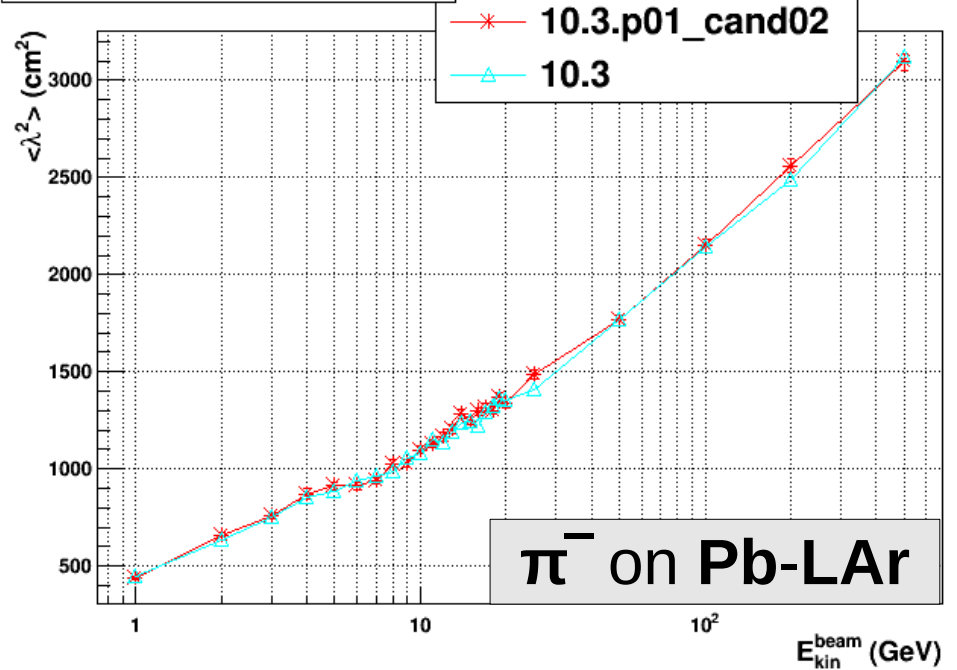
$\pi^-$  on Cu-LAr

Longitudinal shower shape



$\pi^-$  on W-LAr

Longitudinal shower shape

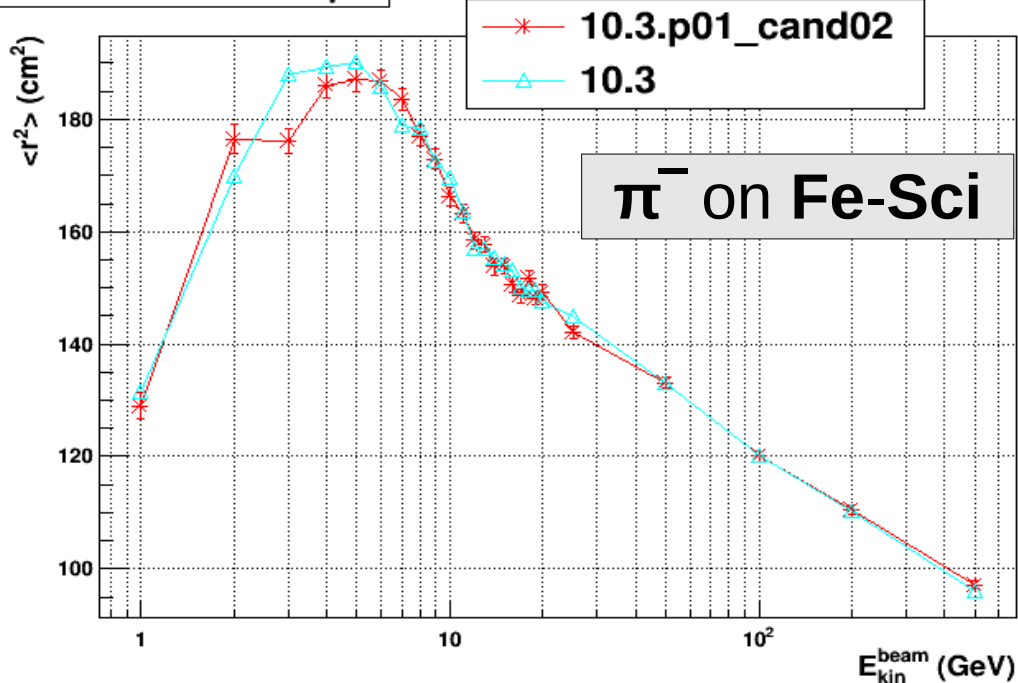


$\pi^-$  on Pb-LAr



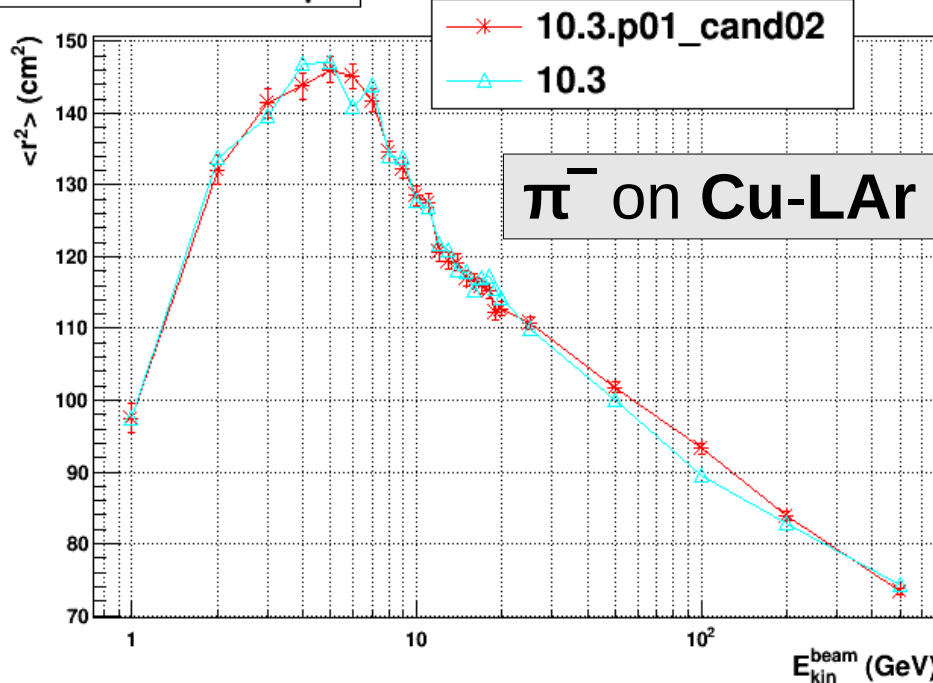
# FTFP\_BERT : Lateral Shape

Lateral shower shape



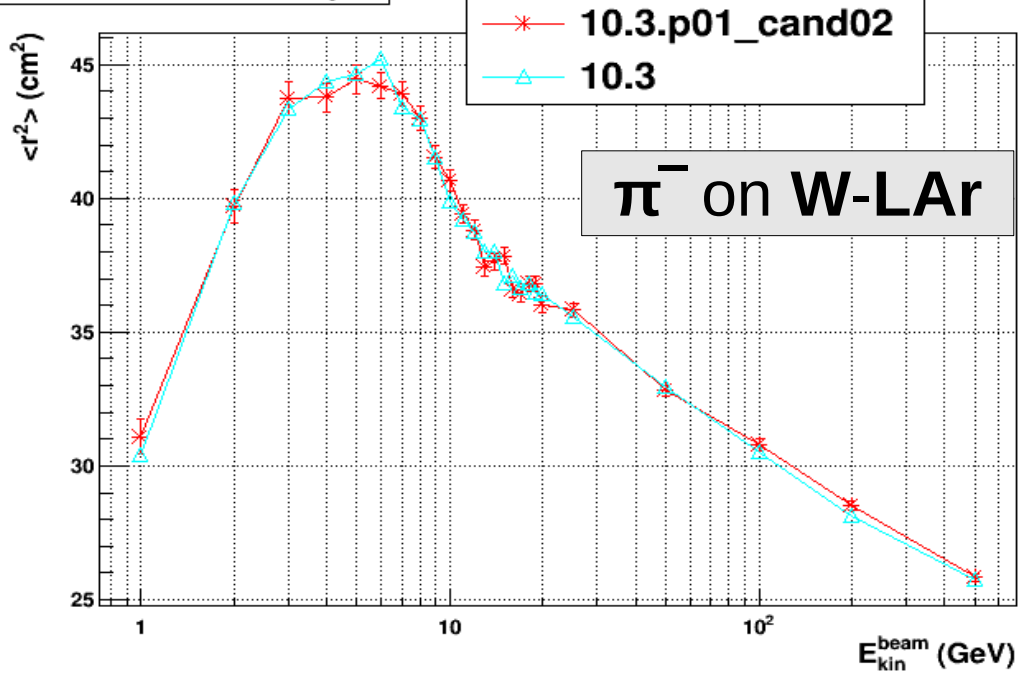
$\pi^-$  on Fe-Sci

Lateral shower shape



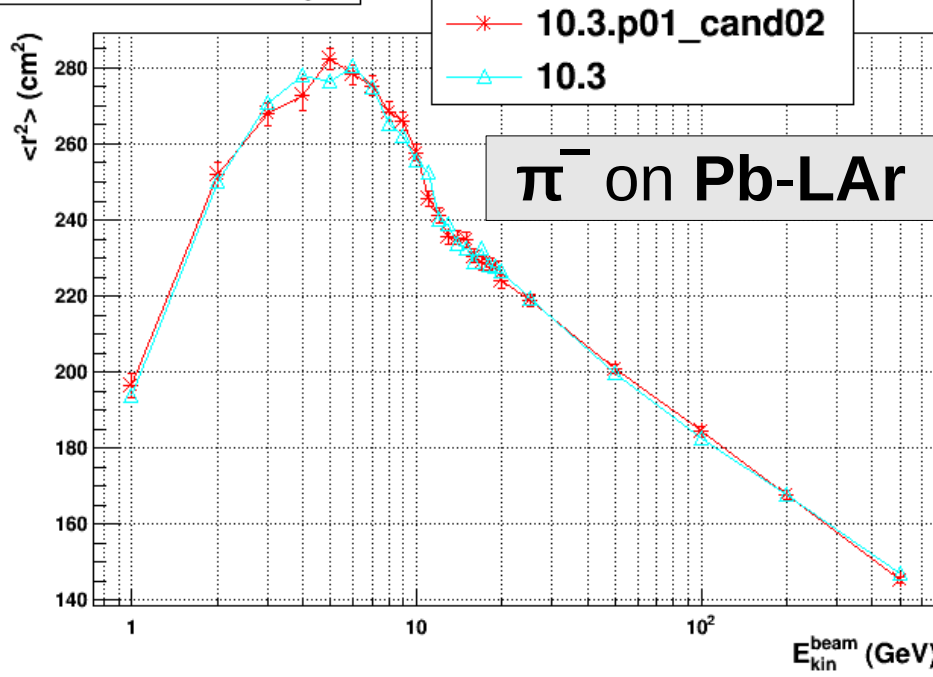
$\pi^-$  on Cu-LAr

Lateral shower shape



$\pi^-$  on W-LAr

Lateral shower shape



$\pi^-$  on Pb-LAr

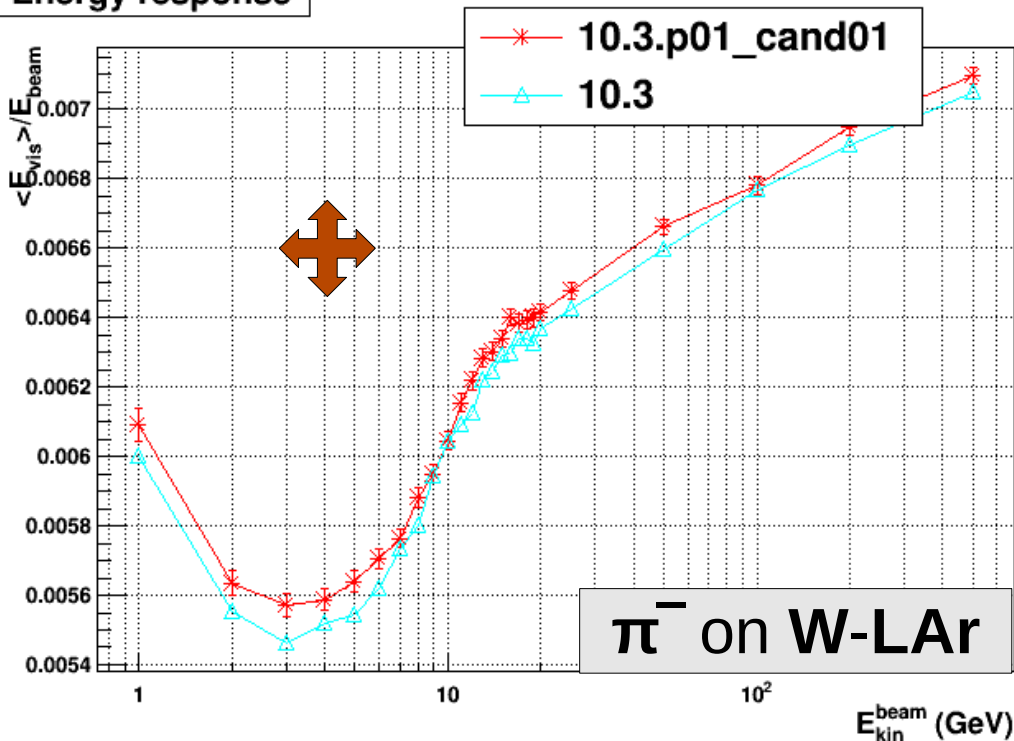
# Conclusions

- **G4 10.3.p01.cand{01, 02}**
  - **Reproducibility** : 2 violations in FTFP\_BERT in cand01, fixed in cand02
    - Rare problem, introduced in G4 10.3, seen also in 10.3.ref01
    - See in BinaryLightIon d-W, but due to de-excitation
      - Numerical instabilities ( $< 1$  eV) of the mass of unknown isomers
      - Fixed by the following tags, included in G4 10.3.p01.cand02 :
        - **hadr-mod-util-V10-03-02**
        - **hadr-deex-V10-03-14**
        - radioactive\_decay-V10-03-04
  - **FTFP\_BERT hadronic showers** : similar to 10.3
    - Note: found in cand01 that wrongly setting G4LEVELGAMMADATA produces silently wrong results! (See backup slide)  
Similar problem for G4RADIOACTIVEDATA  
See also in G4 10.1.p03  
Open a new bug report: #1942

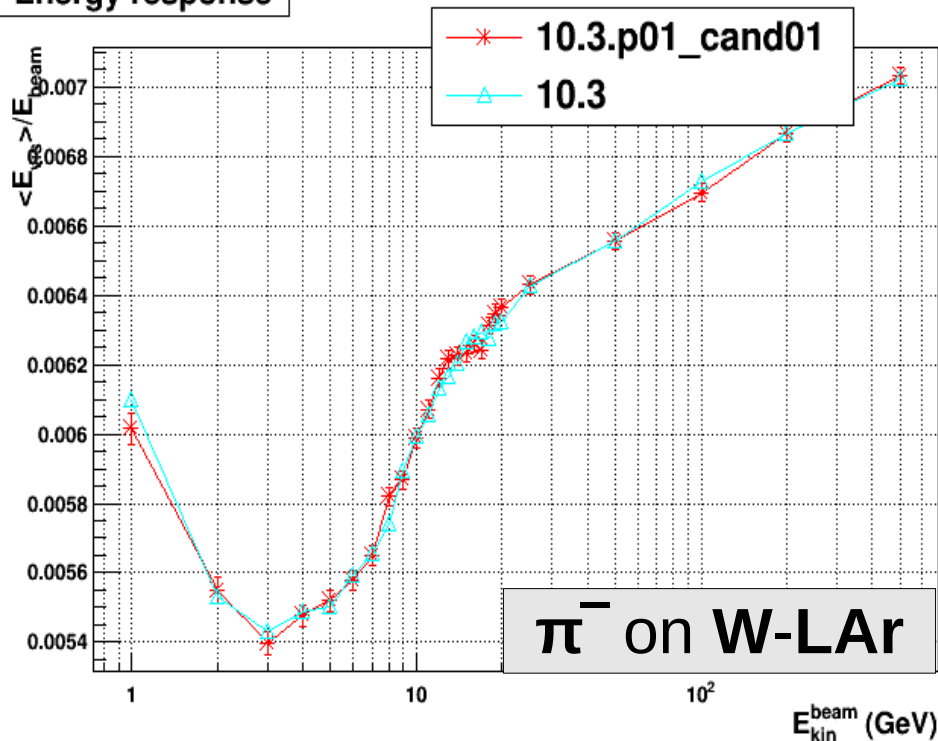
# FTFP\_BERT (left)

# FTFP\_BERT\_HP (right)

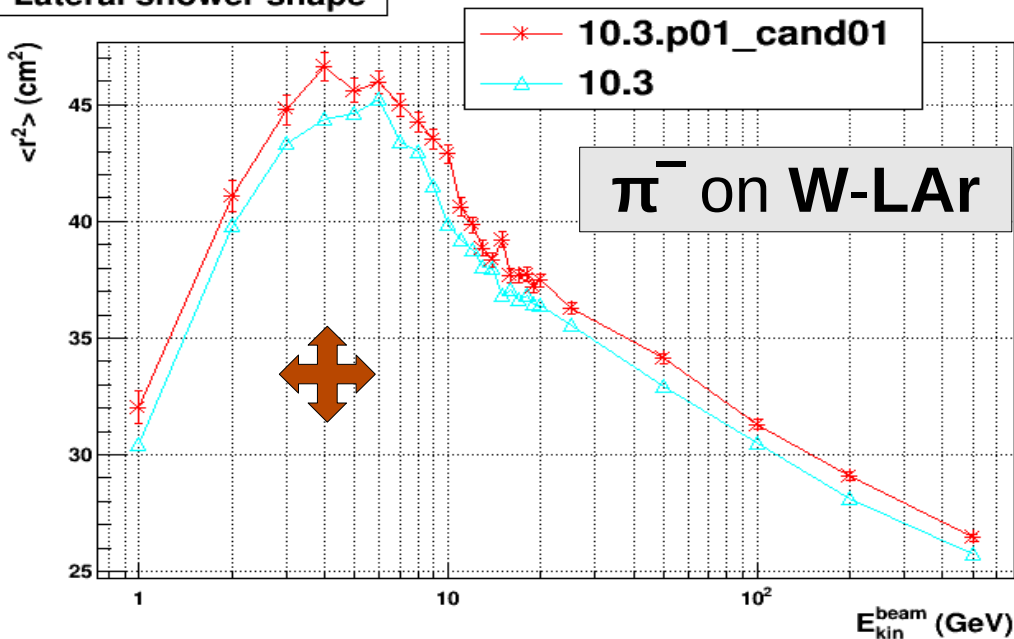
Energy response



Energy response



Lateral shower shape



Lateral shower shape

