5th June 2018

FOOT collaboration

Global Reconstruction

Alberto Mengarelli & Matteo Franchini

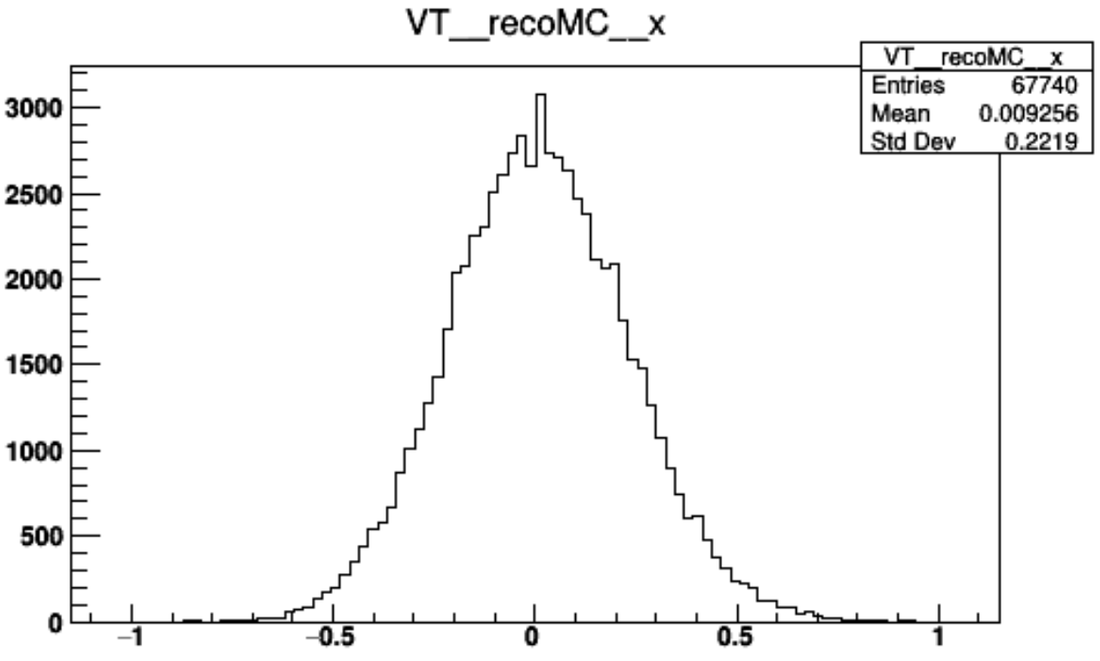
Index

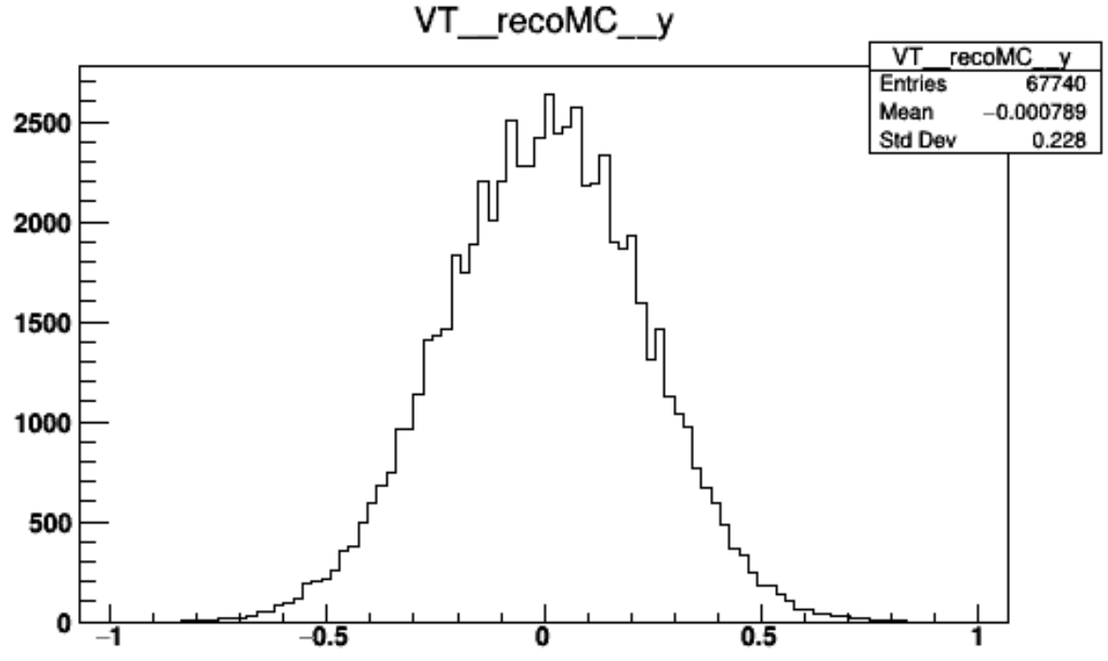
- Control plots Monitoring
- Tracking preselection (multi-tracking)
- Stability test on magnetic field uncertainties
- Stability under positioning uncertainties
- VT & IT clustering & scintillator ready for tracking!
- Tracking & momentum resolution
- Software bulletin

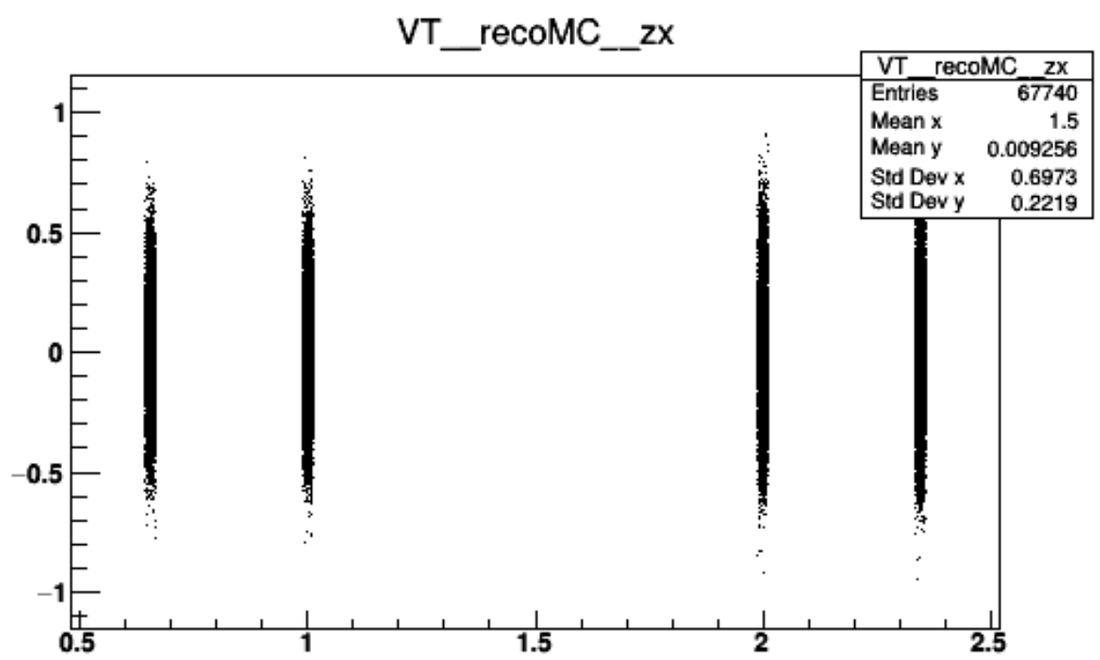

Finalising
Monitoring
Implementation

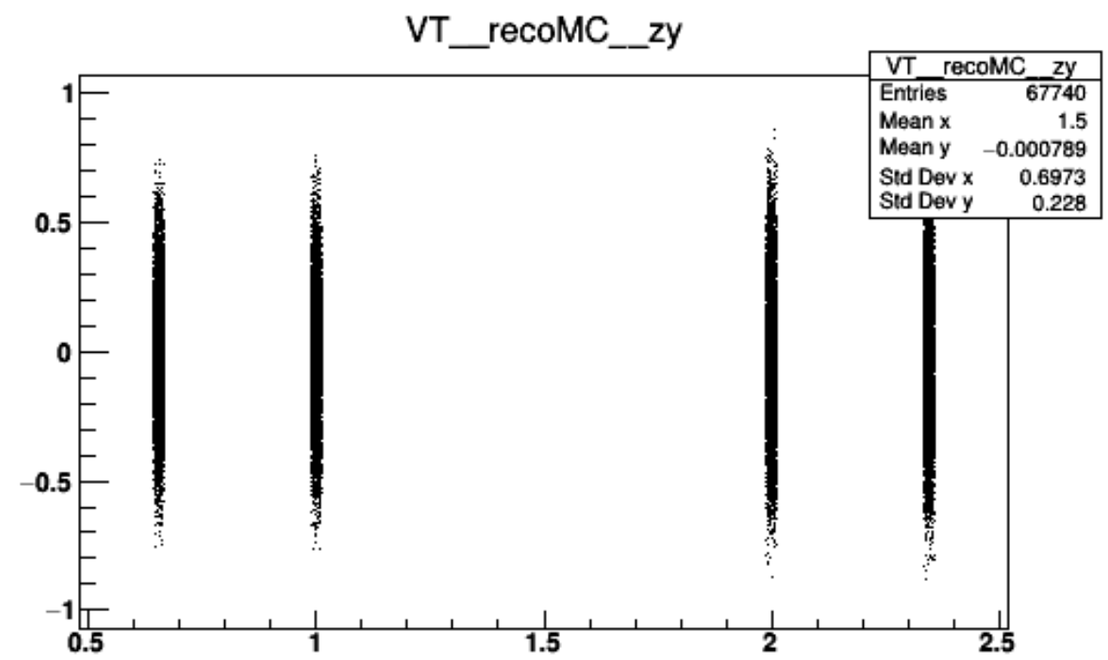
Control Plots for tracking inside SHOE

Geometry Monitoring



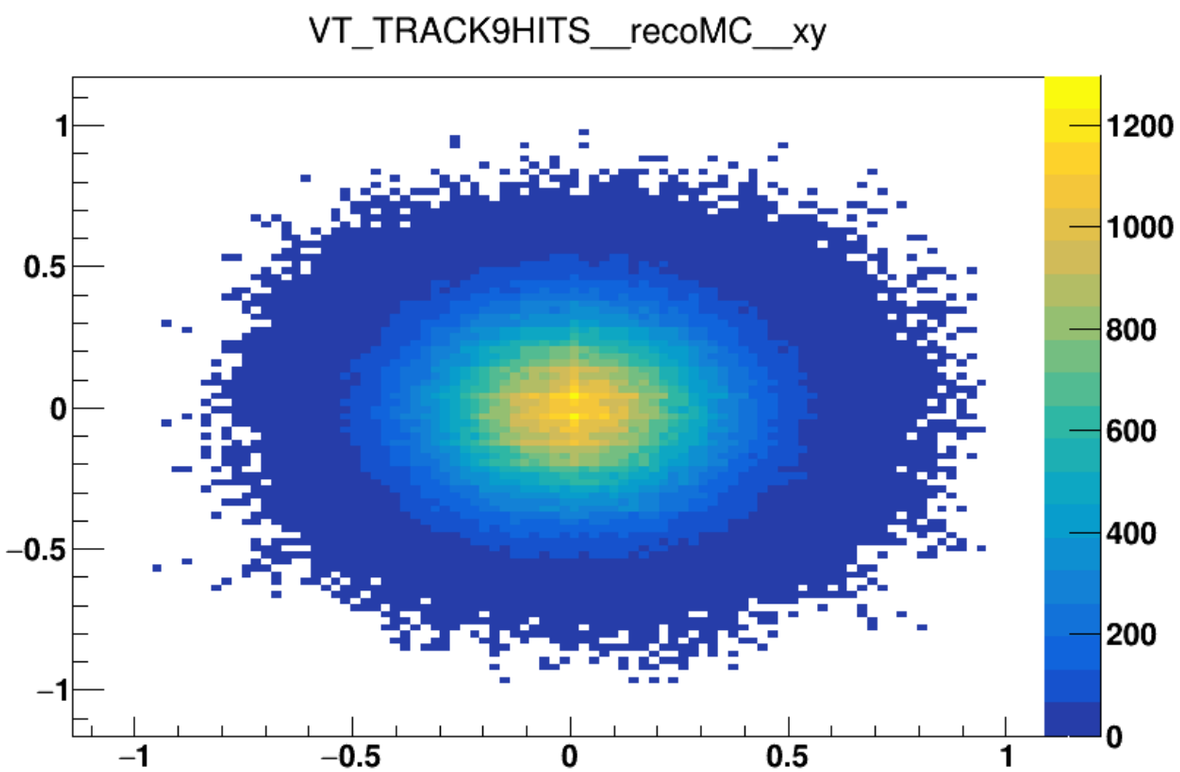


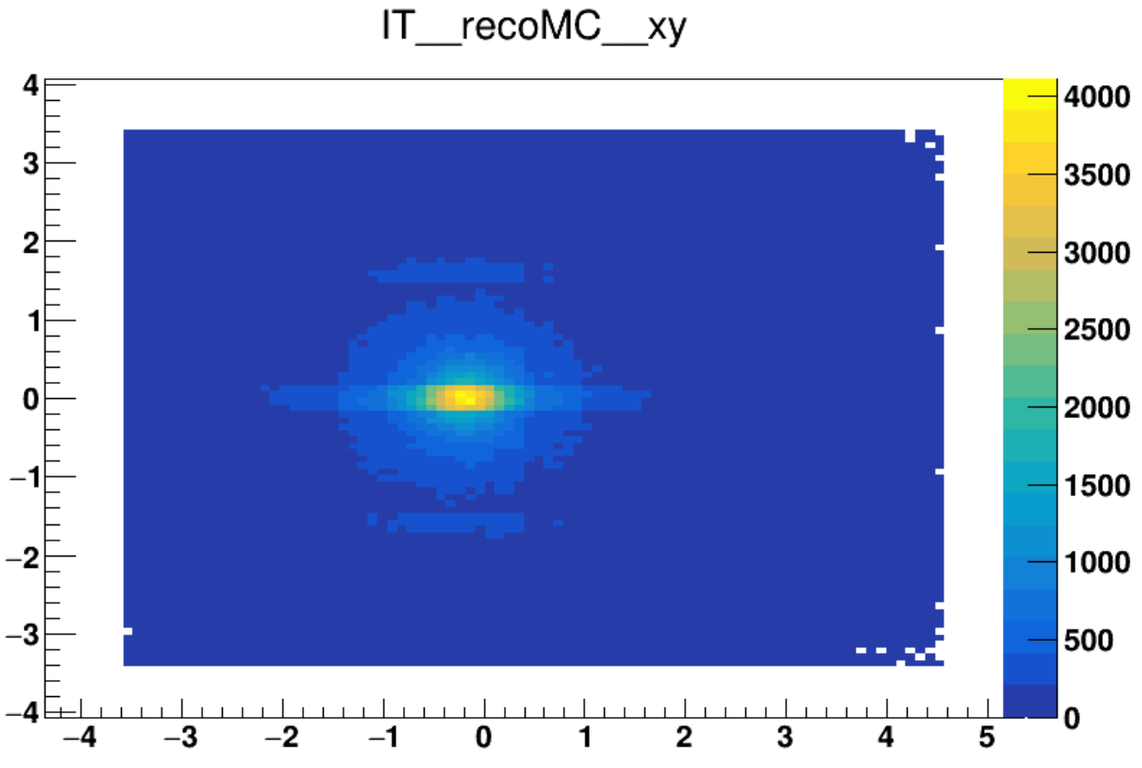


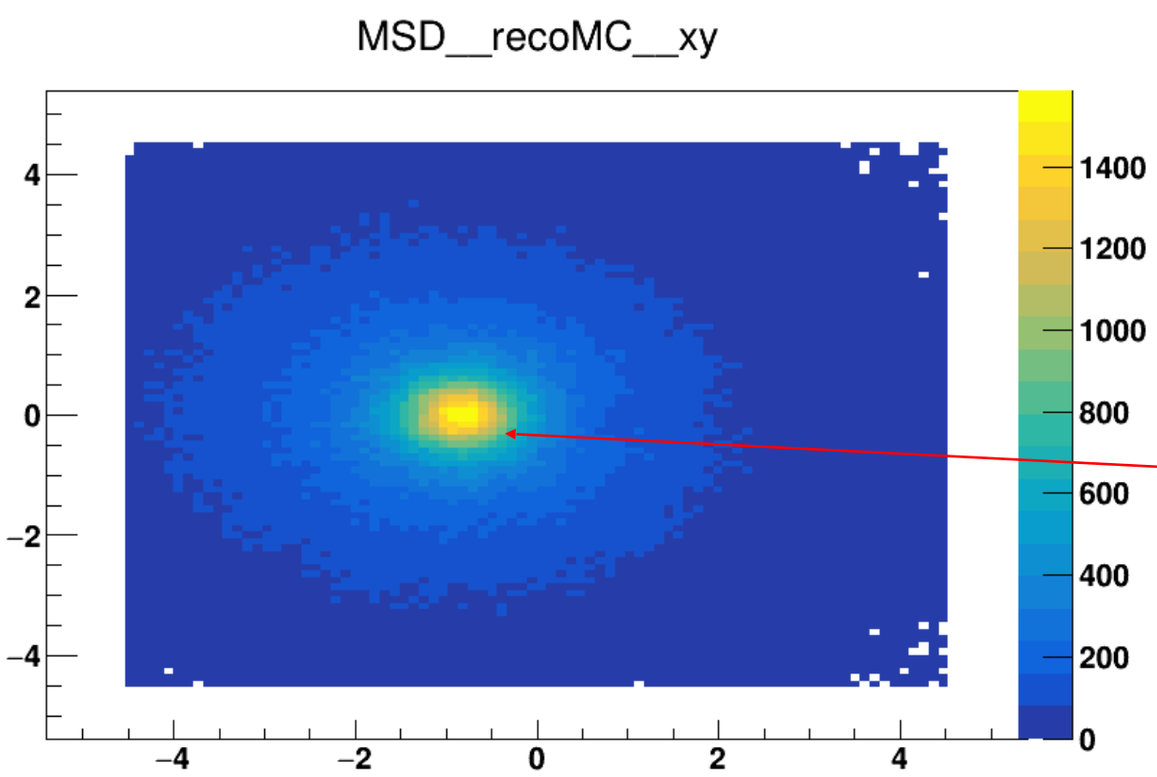


Geometry Monitoring

Running on V14.0.1







- Shift in x visible already not negligible for MSD

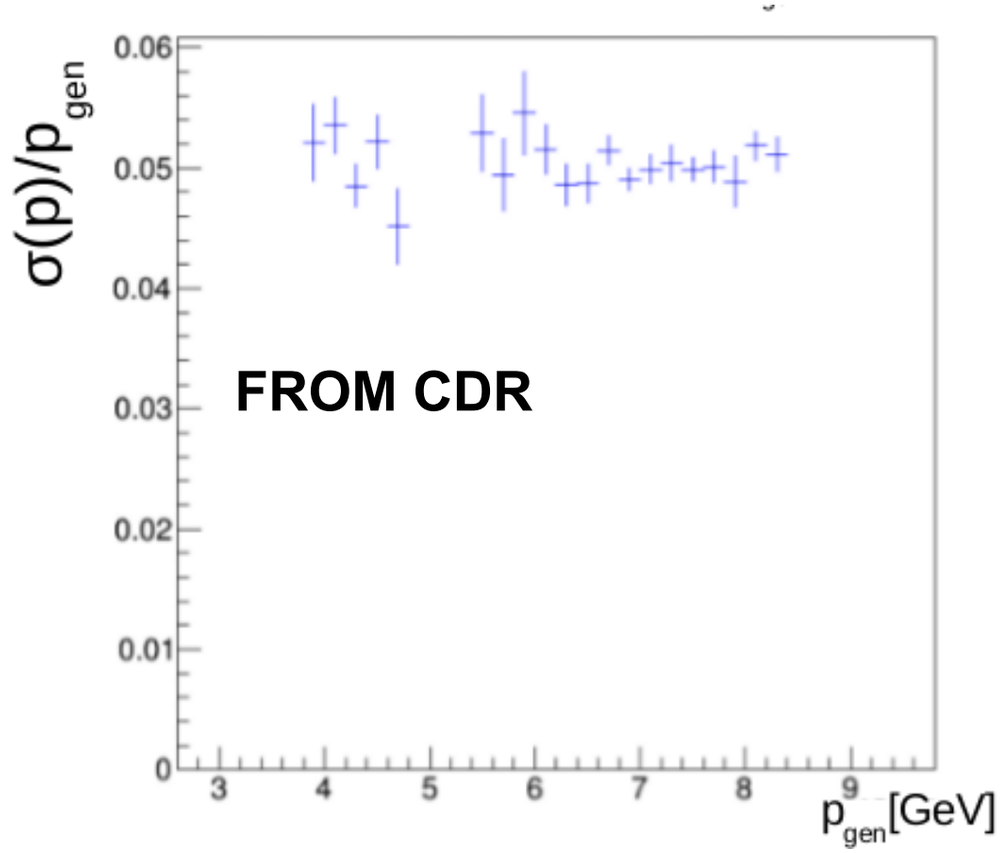
Tracking preselection (multi-tracking)

Preliminary study on multitracking

- **Present results:**
  - **Given using true infos on Hit list**
  - **Fragment type given in input**

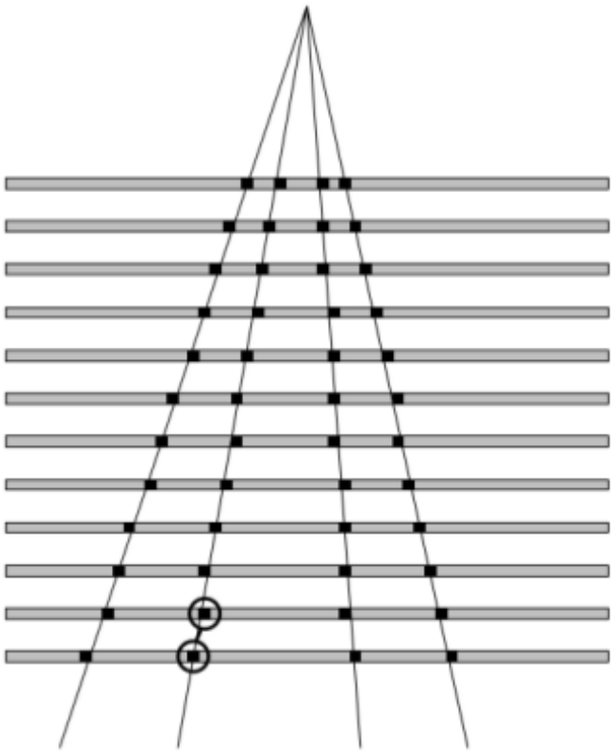
- **Optimal condition for Kalman to fit and Reco the fragment momentum**

- **Efficiency of reconstruction is ~ 1 for each fragment**

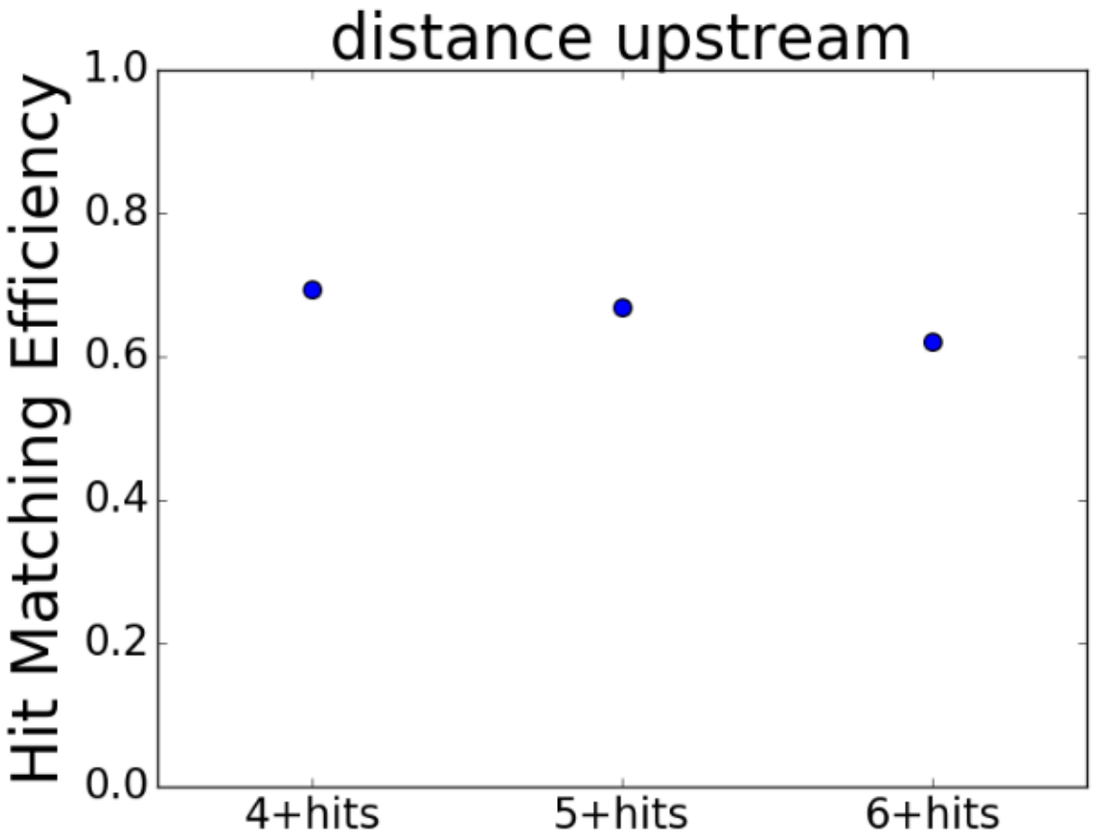


- **This is not realistic and could be done only with MC, while an efficient way to deal with multytracking and assignment of "true" hit list for each fragment track has to be developed**

Minimum distance method:



Riccardo Ridolfi master thesis



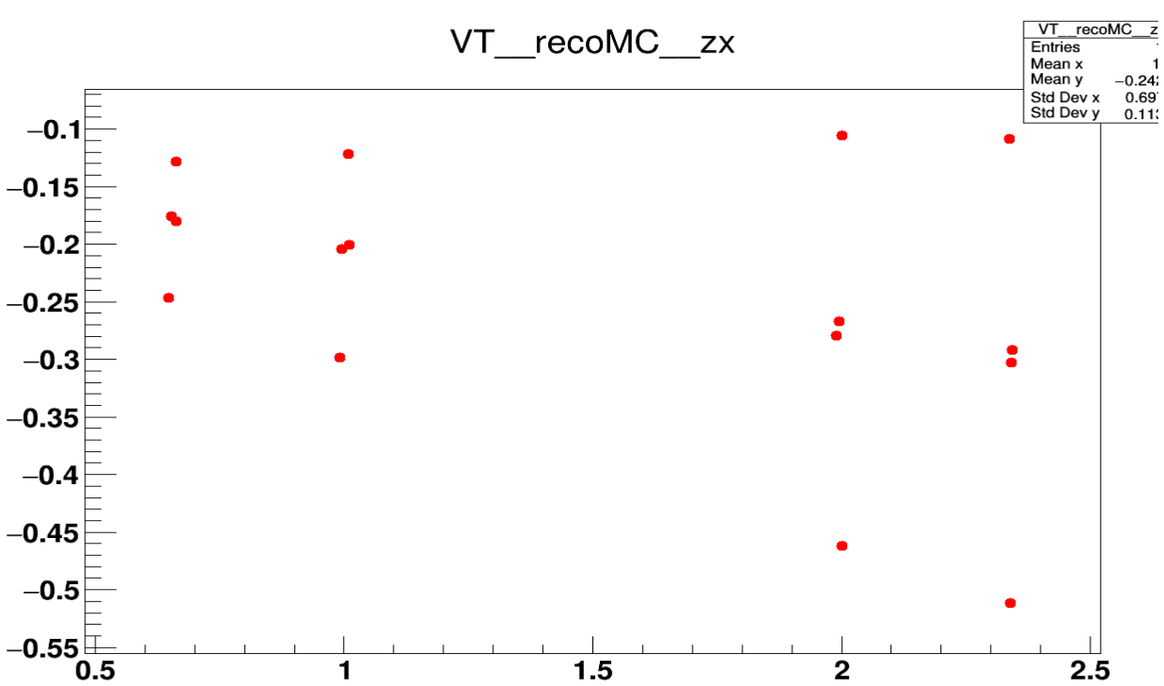
- **Efficiency of match the true track list of hits using minimum distance method is already ~70 % using 4 hits**

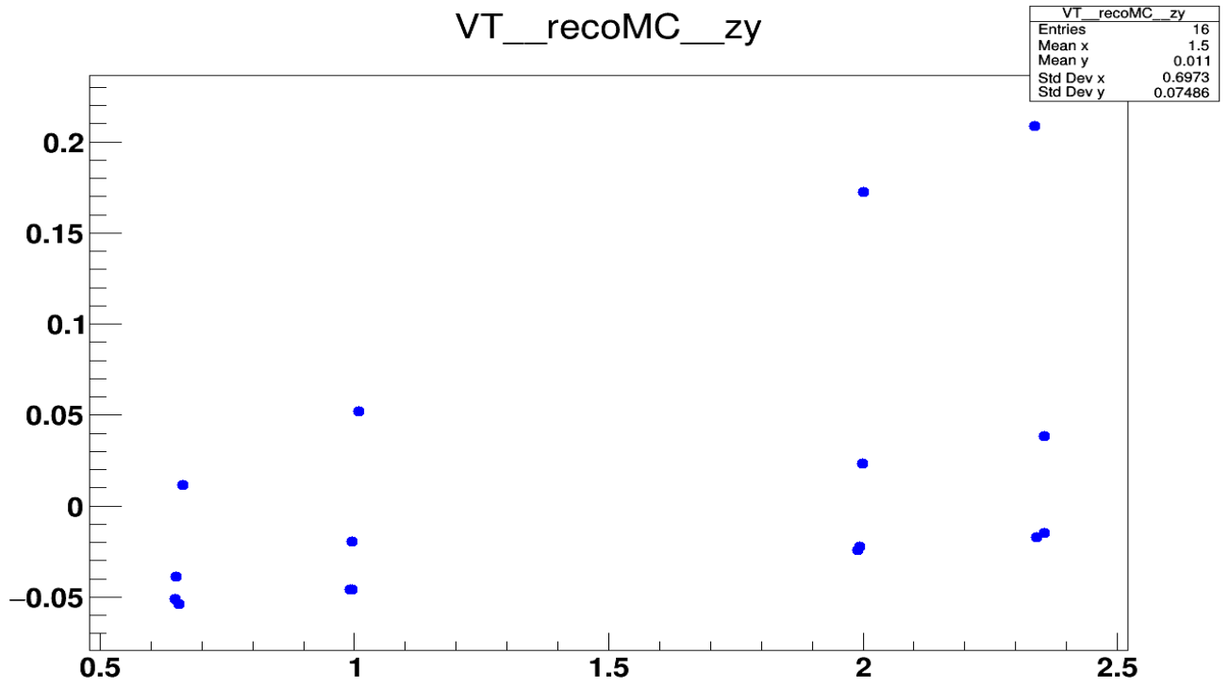
Chi_2 method:

USING ONLY VT RECO HIT (V14.0.1)

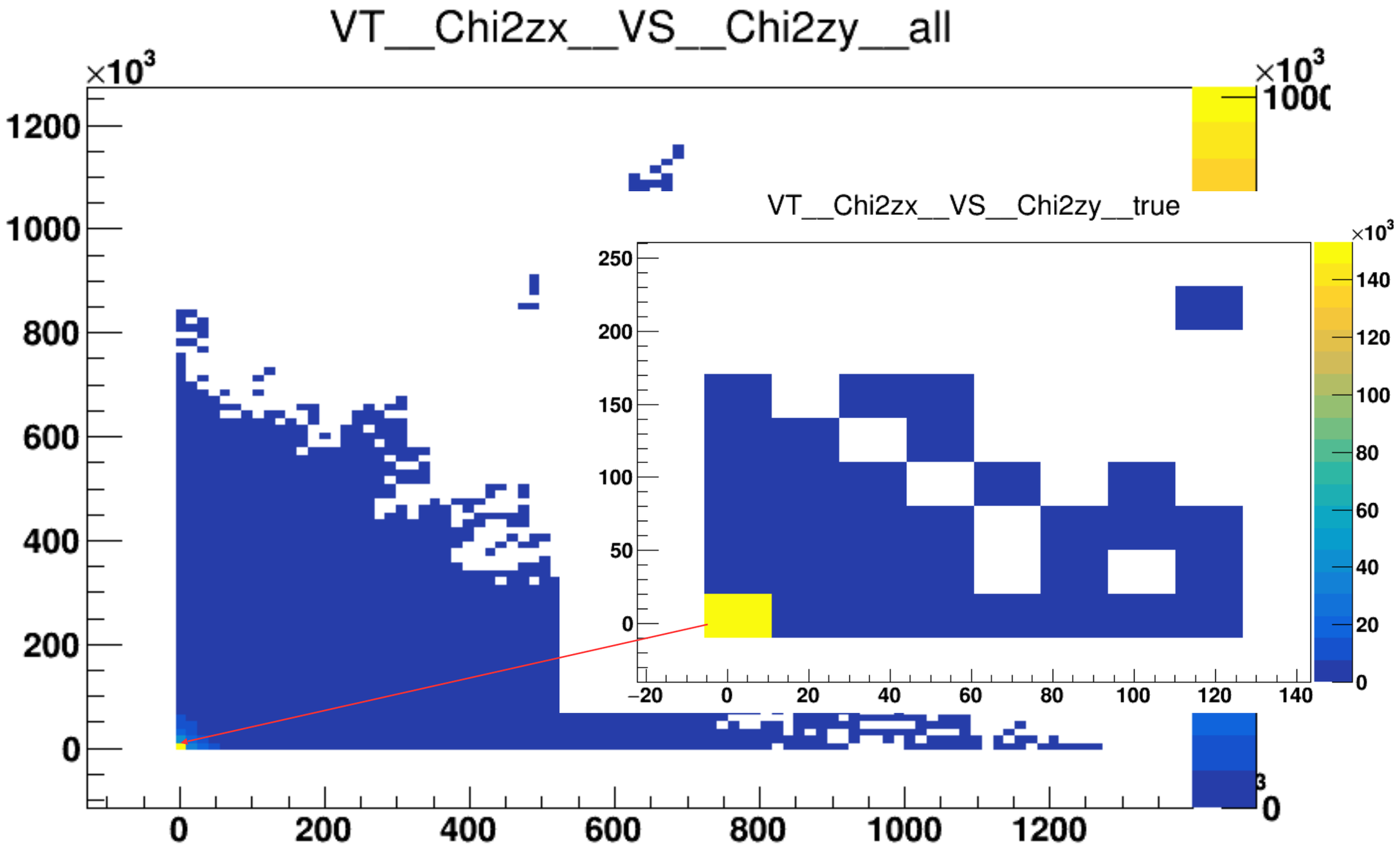
- **BASIC IDEA: Magnetic field in the VT region will not deflect the trajectory so much from a straight line → Fit the combination of the hits in each event to disentangle the true ones by mean of CrHI2 result**

Event with 4 tracks ZX and ZY planes:





- **Selecting tracks with 9 hits, take th 4 hits in the VT, make all combination and look at the CHI2 of the fit with a line for the ZX and ZY planes**



- Apart few cases Values of the TRUE combination CHI2 is confined in the good CHI2 region
- Cutting on CHI2_ZX < 5 and CHI2_ZY < 10 or viceversa the efficiency of selecting the true combination is ~99 % compared to ~75% of the minimum distance method

Stability test on magnetic field uncertainties (I)

Magnetic Field Rotation tests

- **Aim of the tests: Understand possibile degradation of momentum resolution due to misalignment of magnetic field.**

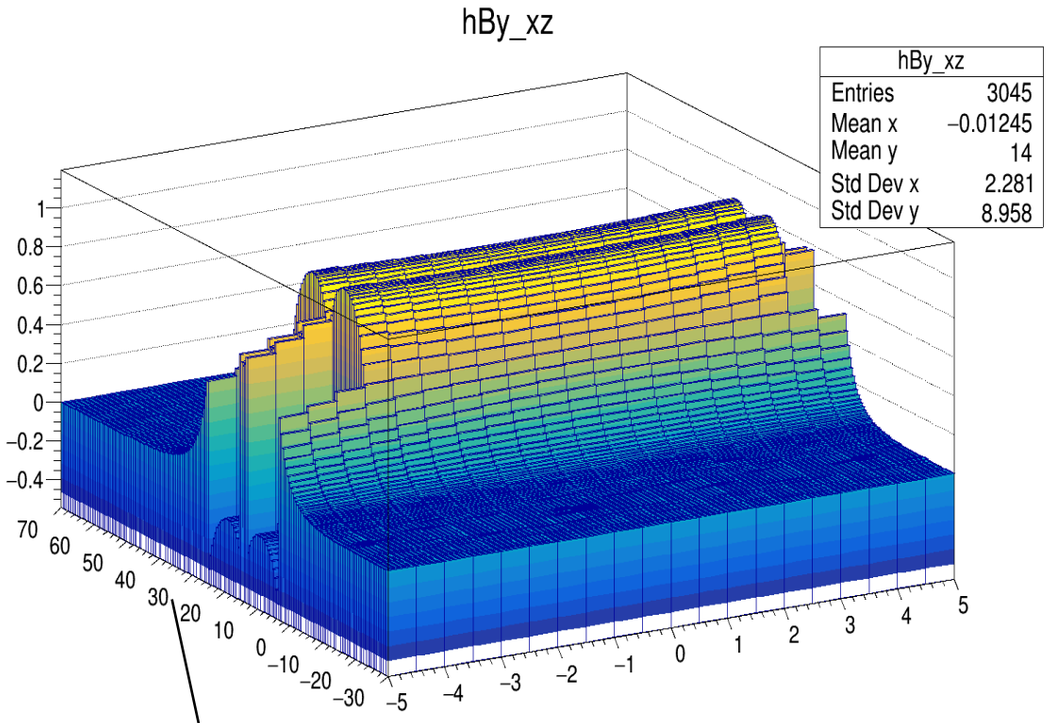
Rotation of the magnetic field cases:

1) Both magnet maps tilted → total field rotation of 1 deg. (only in RECO)

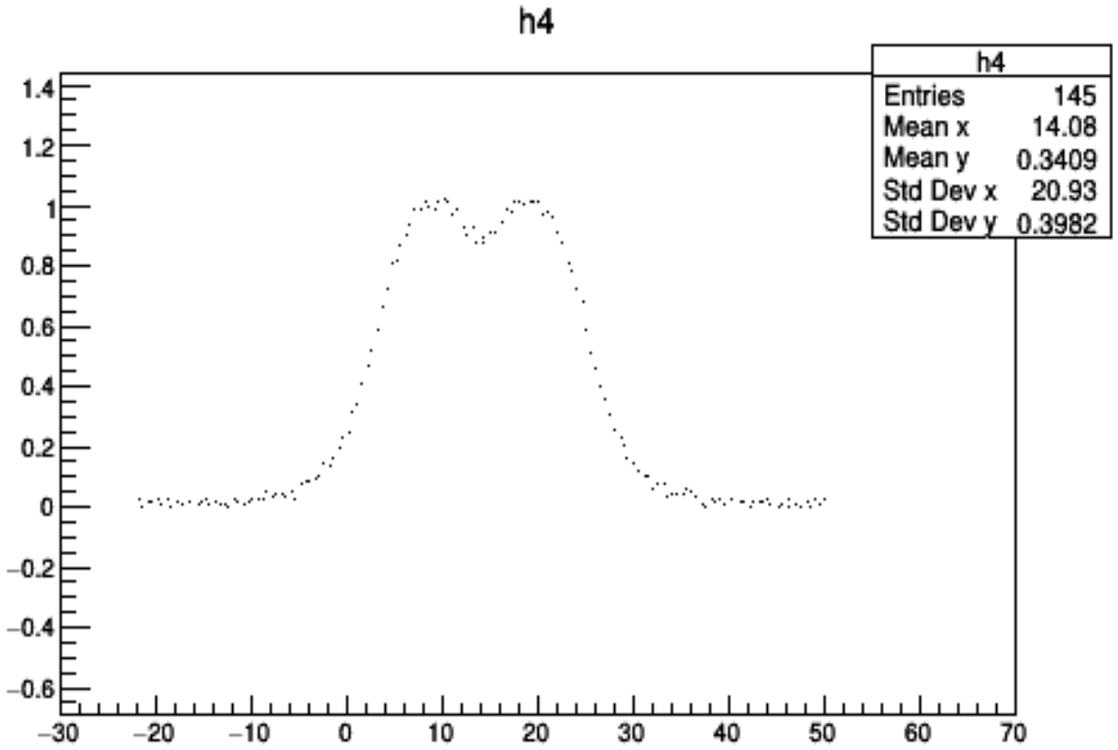
2) Second magnet map rotation of 1 deg wrt the first one. (Only in RECO)

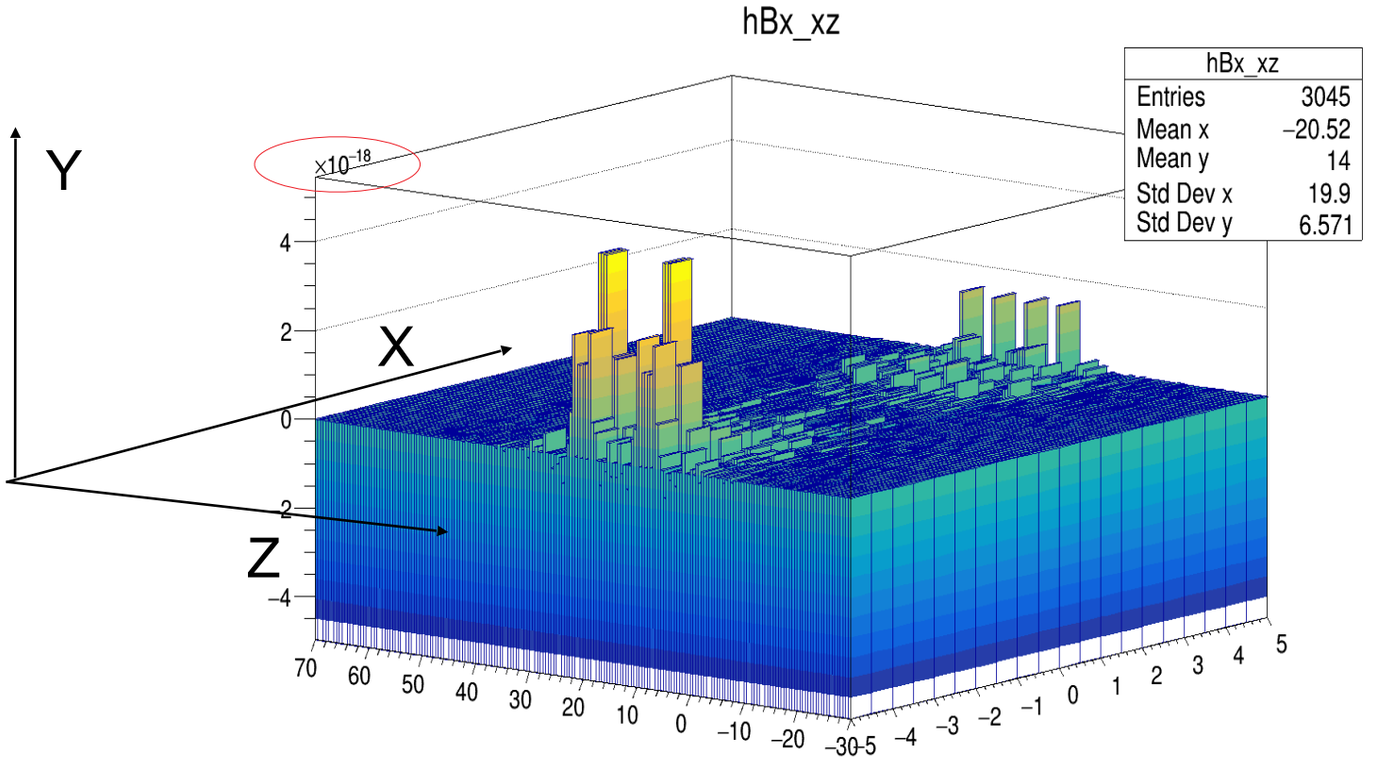
3) Same as 2) but the magnetic field maps are used both in generation (FLUKA) and reconstruction (SHOE) to evaluate momentum resolution

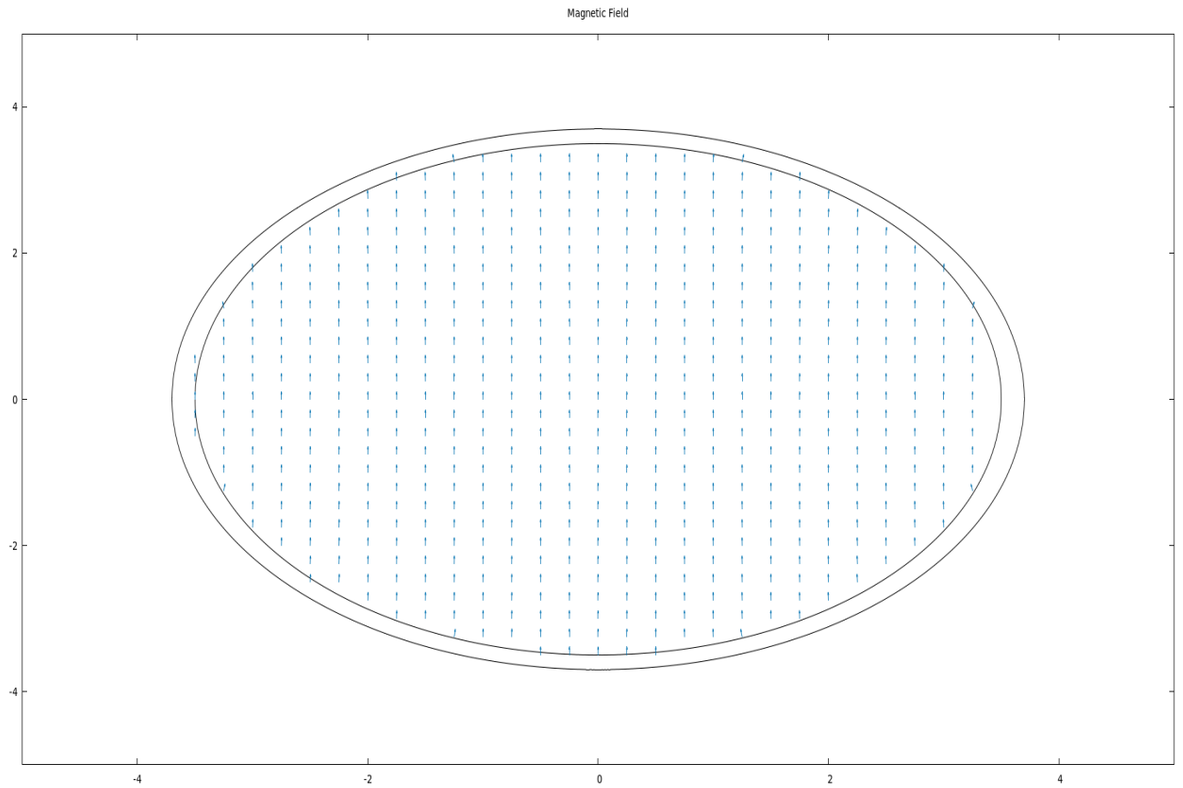
ROTATION CHECK: NO ROTATION



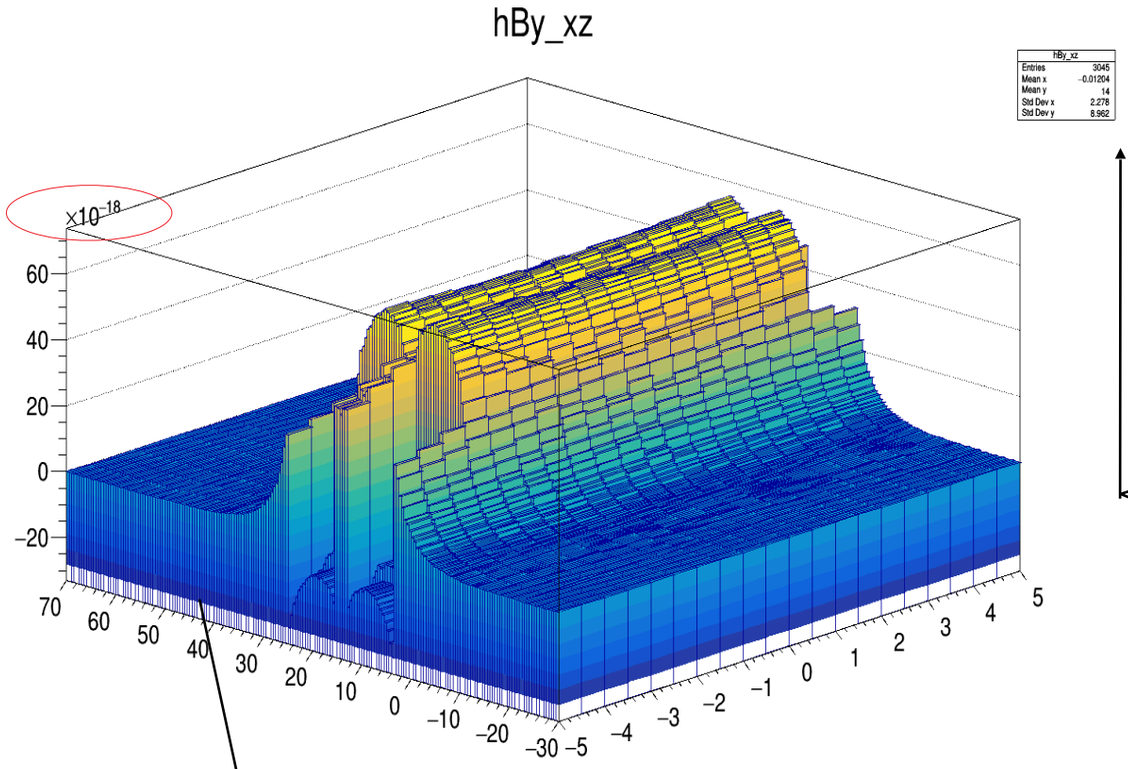
Projection on ZY Plane

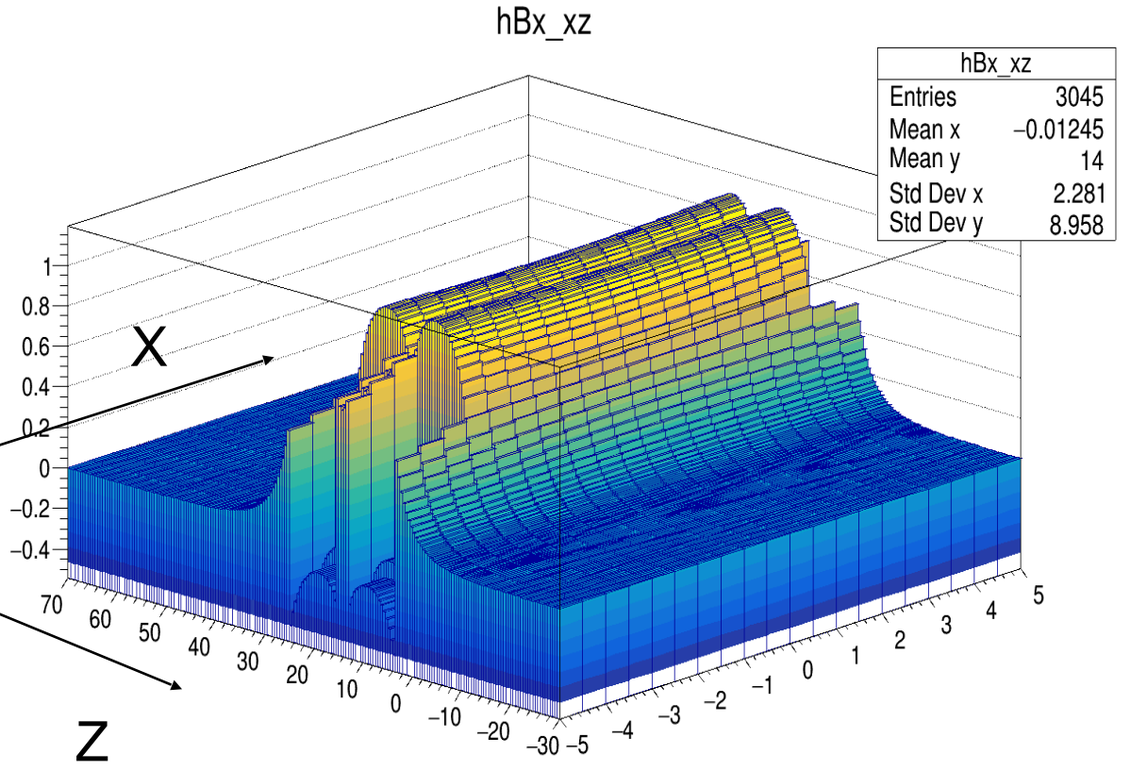




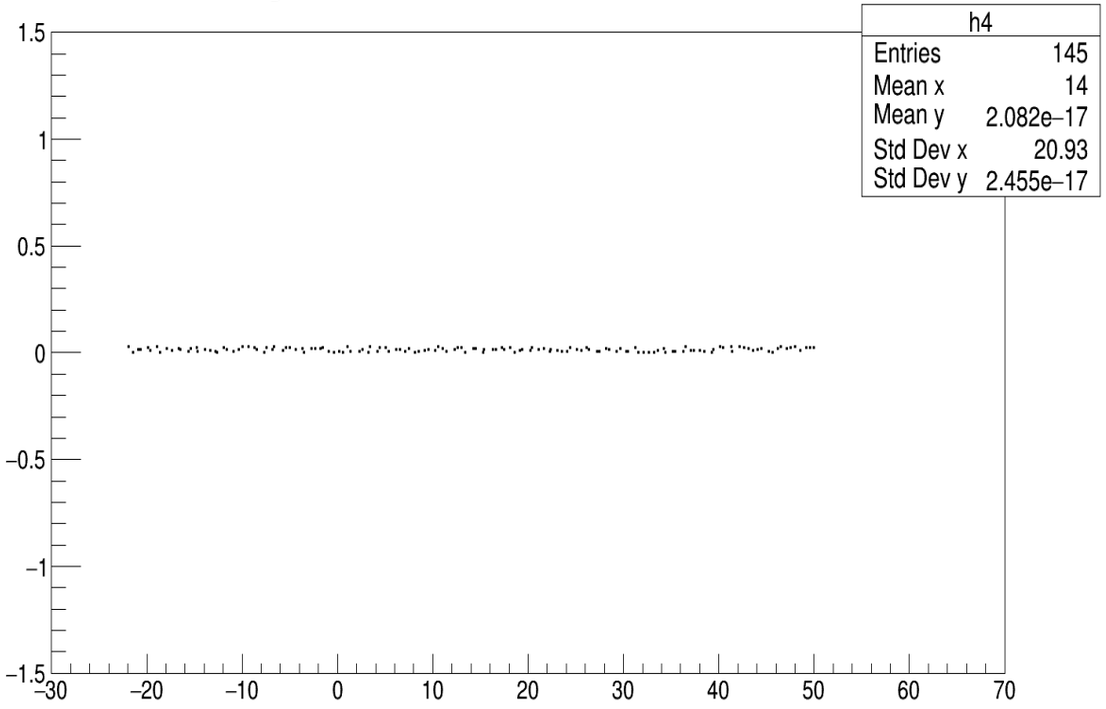


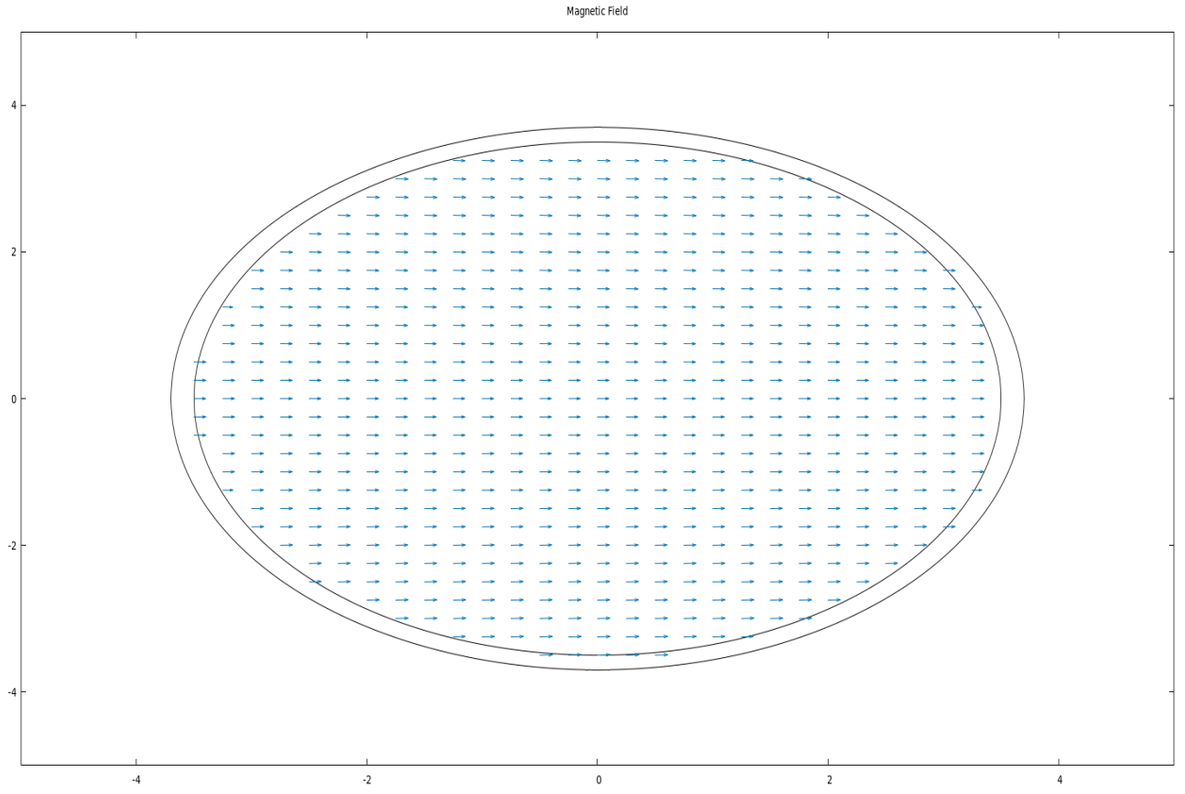
ROTATION CHECK: ROTATION 90 deg





Projection on ZY Plane

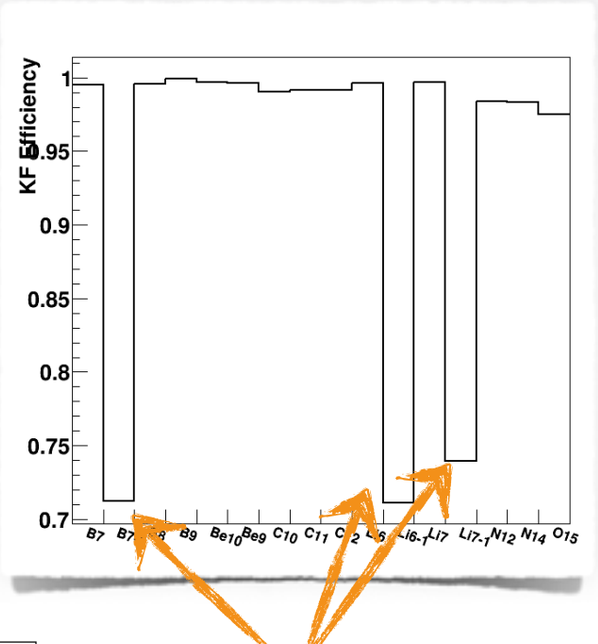




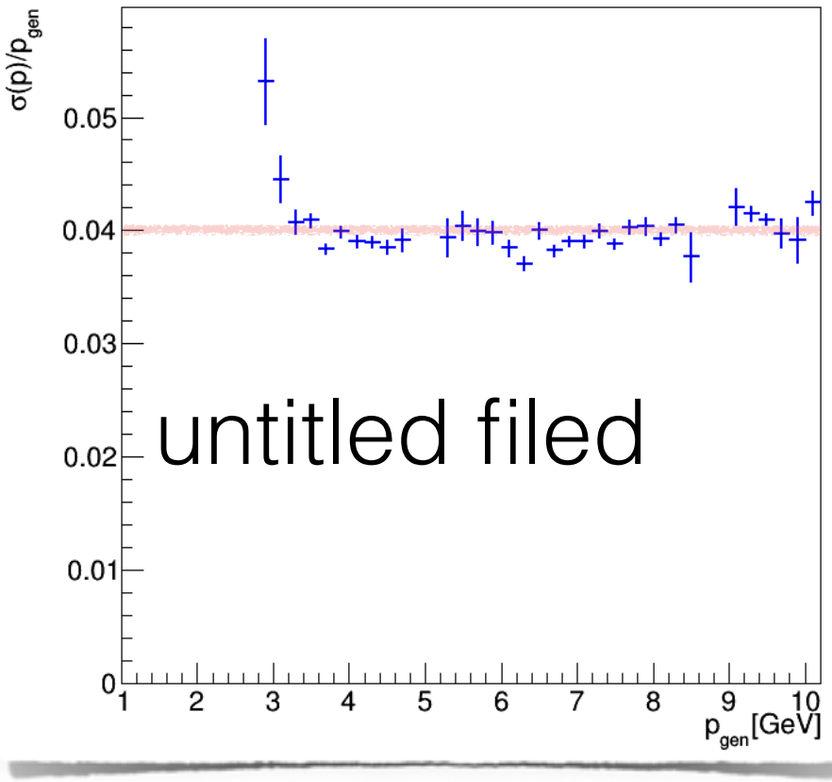
Tilted B filed I

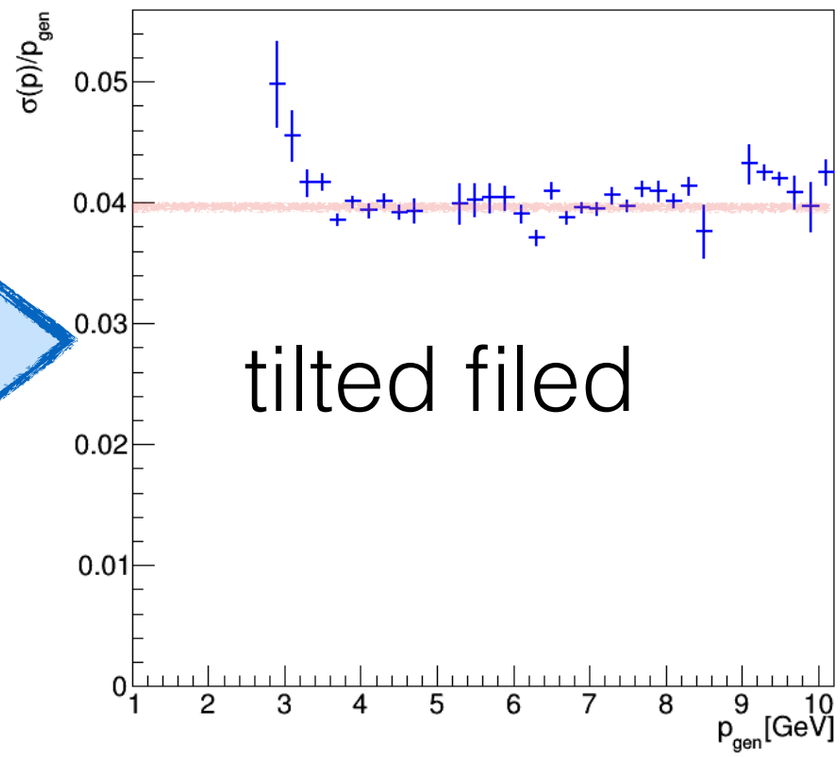
- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.005cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

- The total B-field map is tilted by 1°
- Changing only the map in SHOE
- using a MC sample with untitled B-filed
- Including 2 source of error:
  - from unaligned filed;
  - from wrong B-field between MC and SHOE



Efficiency drop in case of a second fragment of the same type is found in the event. **Low stat.**



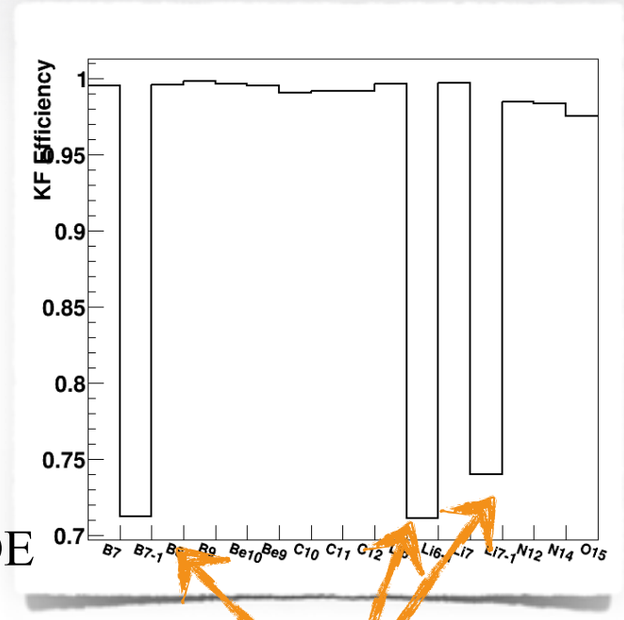


super-small difference

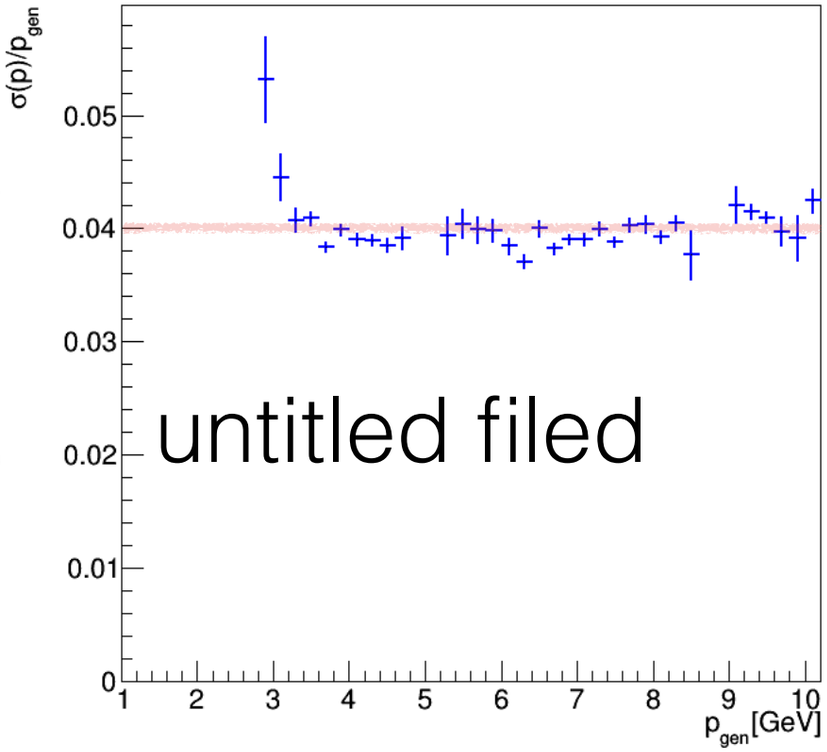
Tilted B filed II

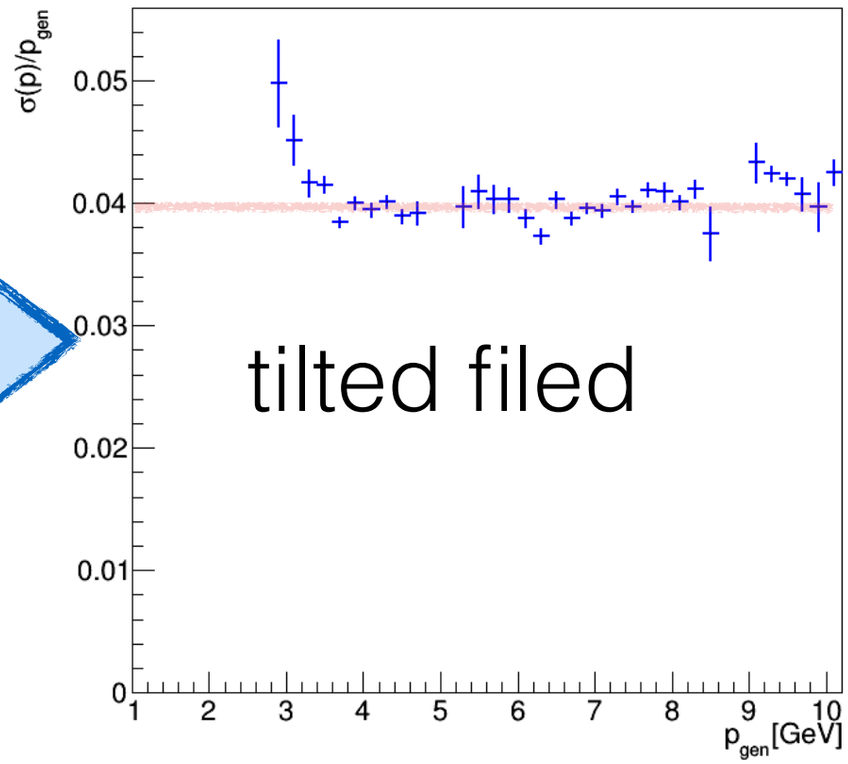
- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.005cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

- **Only second magnet is rotated** by 1°
- Changing only the map in SHOE
- using a MC sample with untitled B-filed
- Including 2 source of error:
  - from unaligned filed;
  - from wrong B-field between MC and SHOE



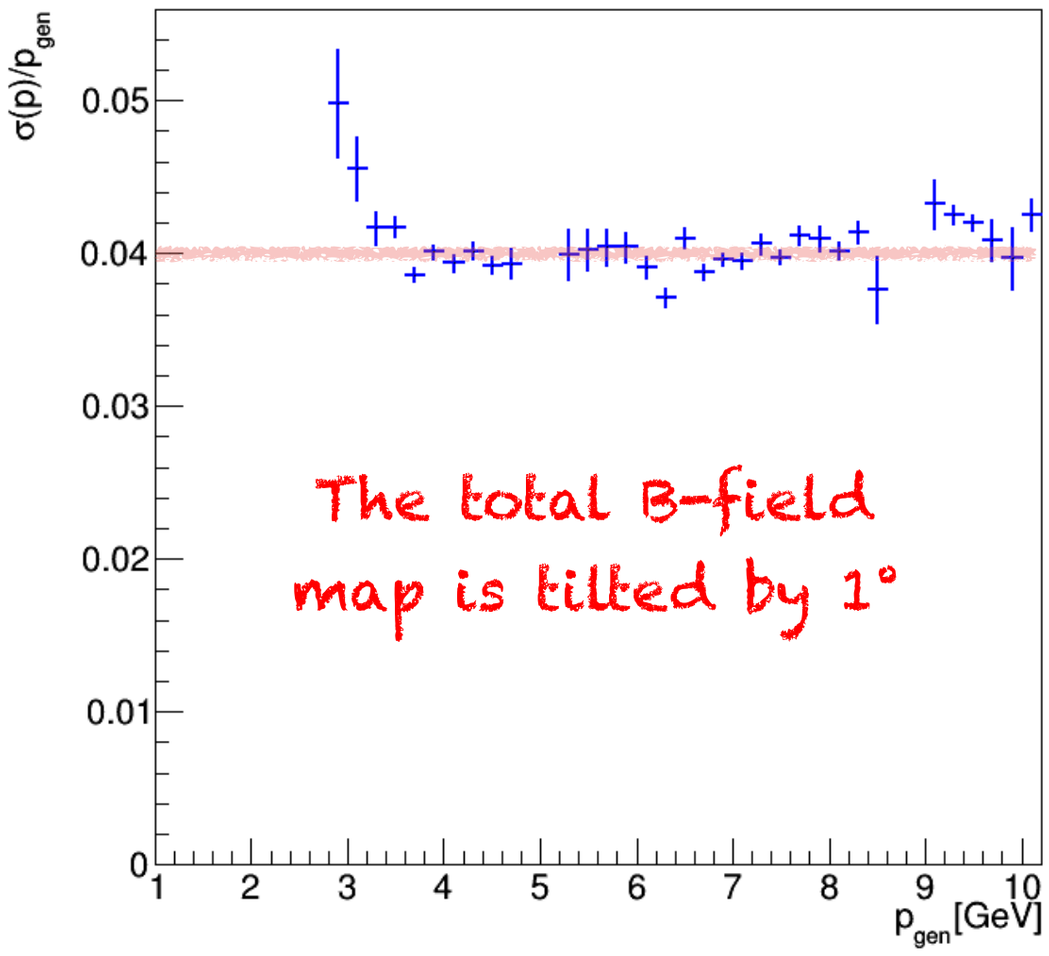
Efficiency drop in case of a second fragment of the same type is found in the event. **Low stat.**

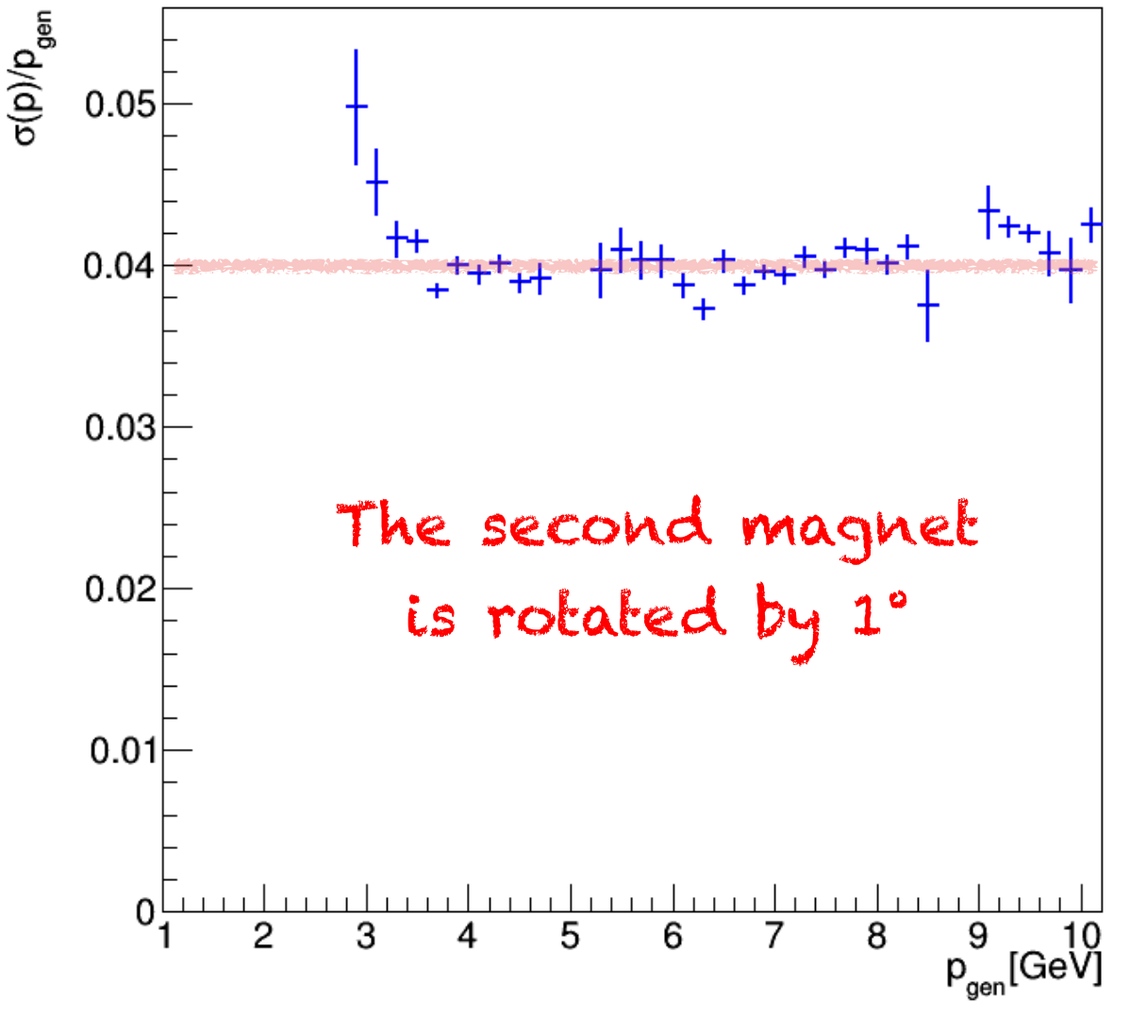




super-small difference

B-field rotation comparison



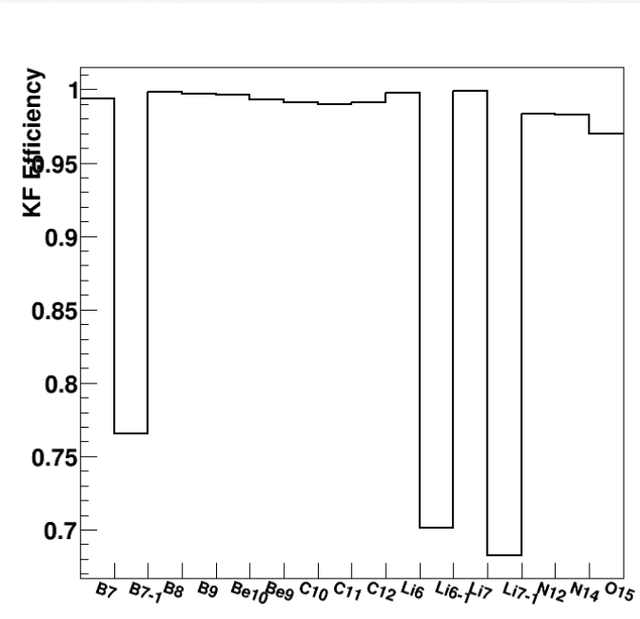


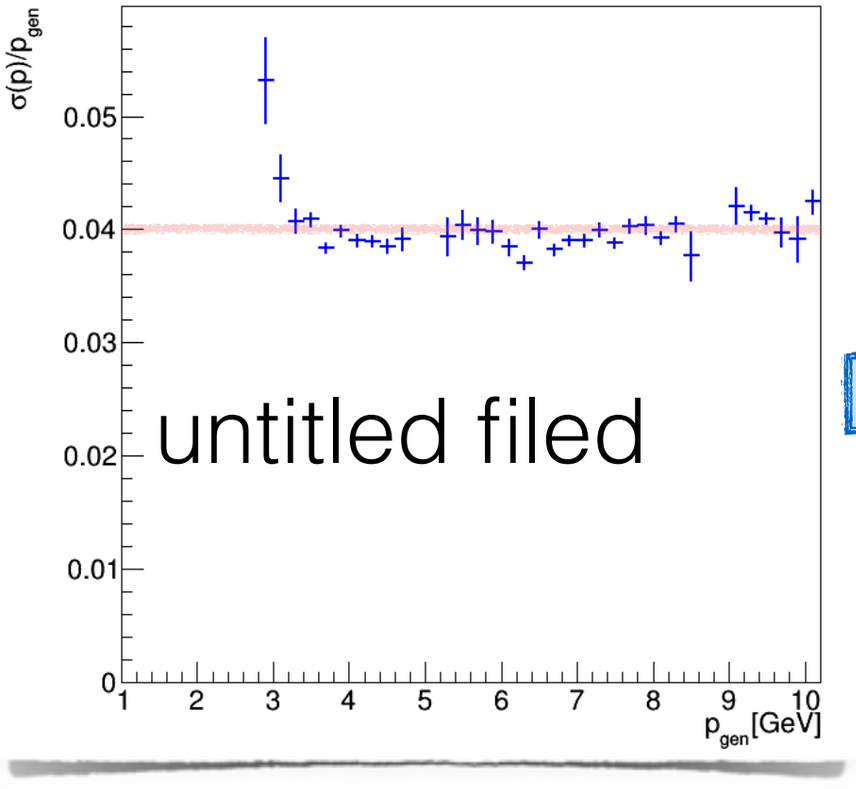
super-small difference

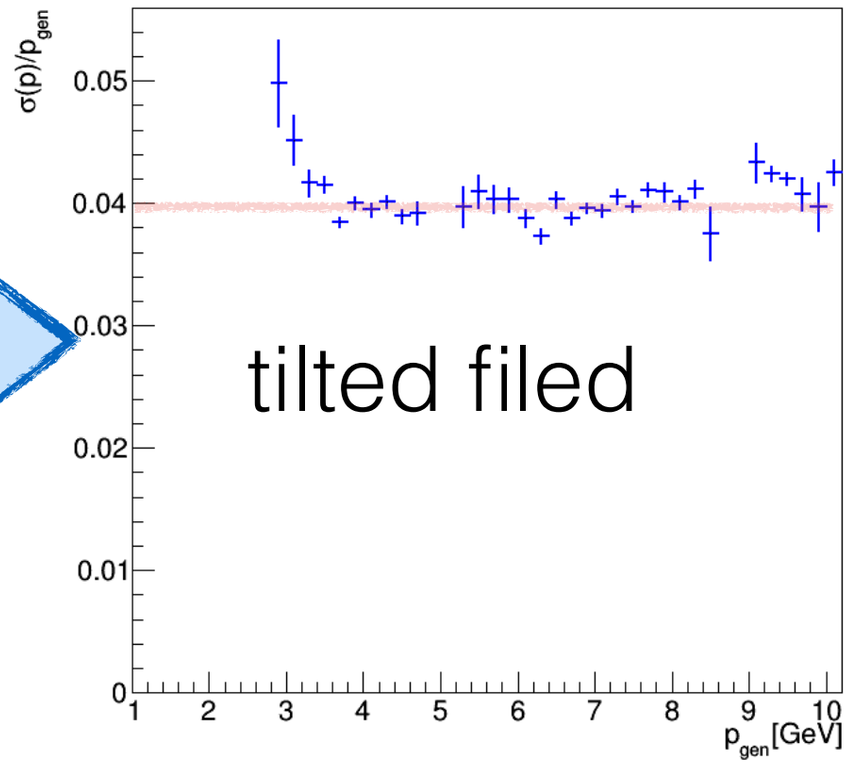
Tilted B filed III

- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.005cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

- **Only second magnet is rotated** by 1°
- Changing **both the map in SHOE and in FLUKA**
- using a MC sample with untitled B-filed
- Including **1** source of error:
  - from unaligned filed;







super-small difference (again)

Summary

- **Control plots for reco and geometry monitoring in SHOE**

- **Several tests with magnetic field rotations has been performed**
  - **No significant momentum resolution change observed in the different configurations.**

- **Preliminary multitracking study**
  - **CHI_2 method seems to be promising for VT (eff ~99%)**
    - **To be checked using reclusterd hit.**

Stability test on magnetic field uncertainties (II)

Impact of Magnet uncertainty

v14.0.1

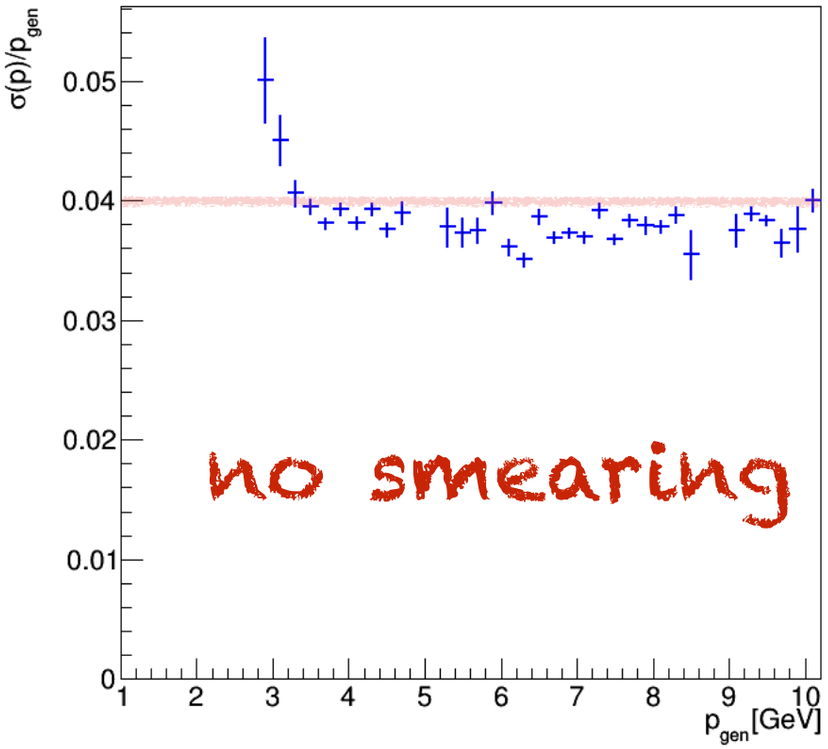
Magnets: 10 cm

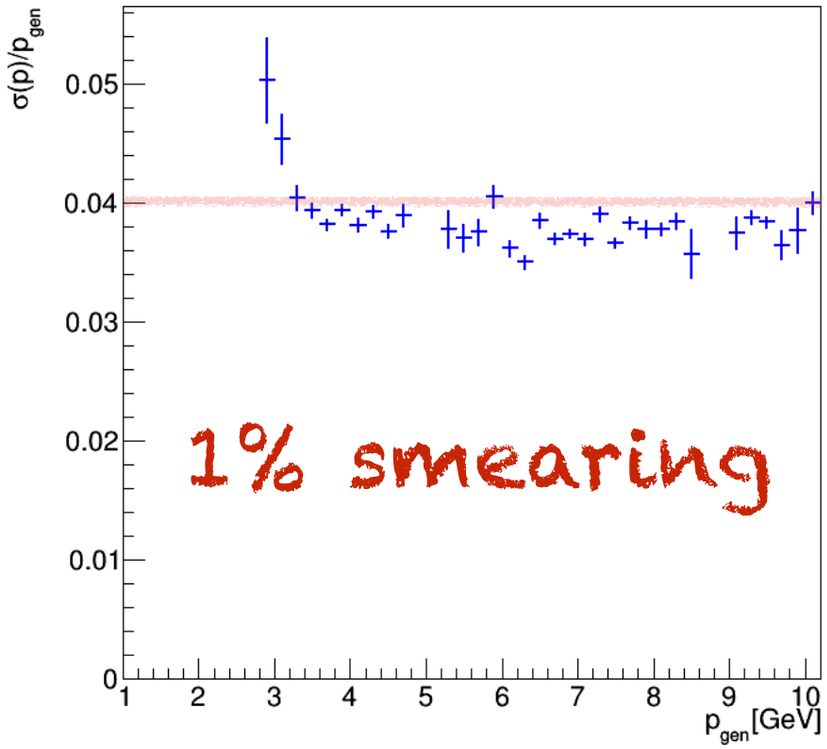
Interspace: 2cm

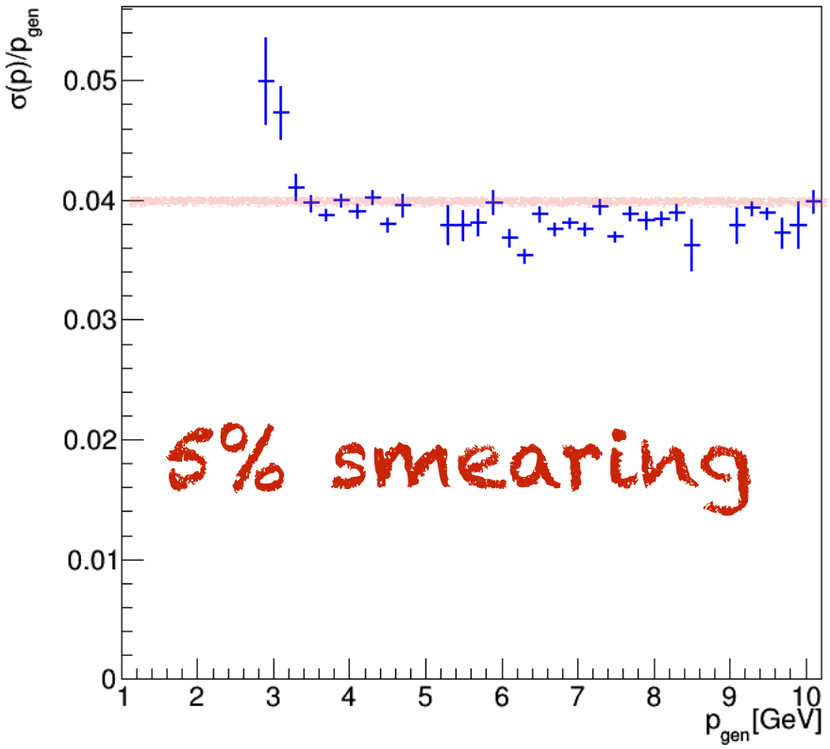
- Test the impact of the **uncertainties in the B <u>measurement</u>** by smearing the magnetic field.

- **Gaussian smearing** of in Bx, By, Bz components of the magnetic field map **independently** (map granularity every 5mm);

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm







Impact of Magnet uncertainty

v14.0.1

Magnets: 10 cm

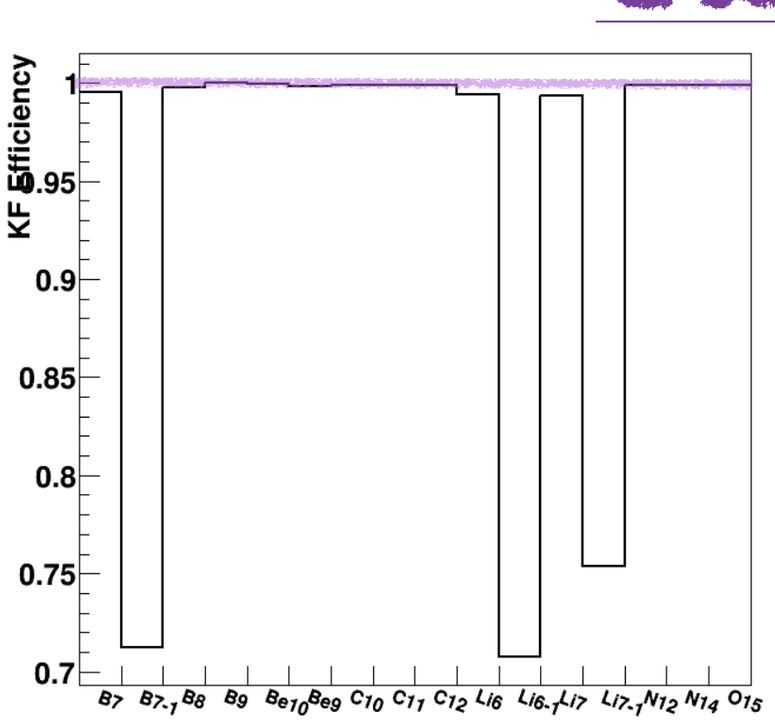
Interspace: 2cm

- Test the impact of the **uncertainties in the B <u>measurement</u>** by smearing the magnetic field.

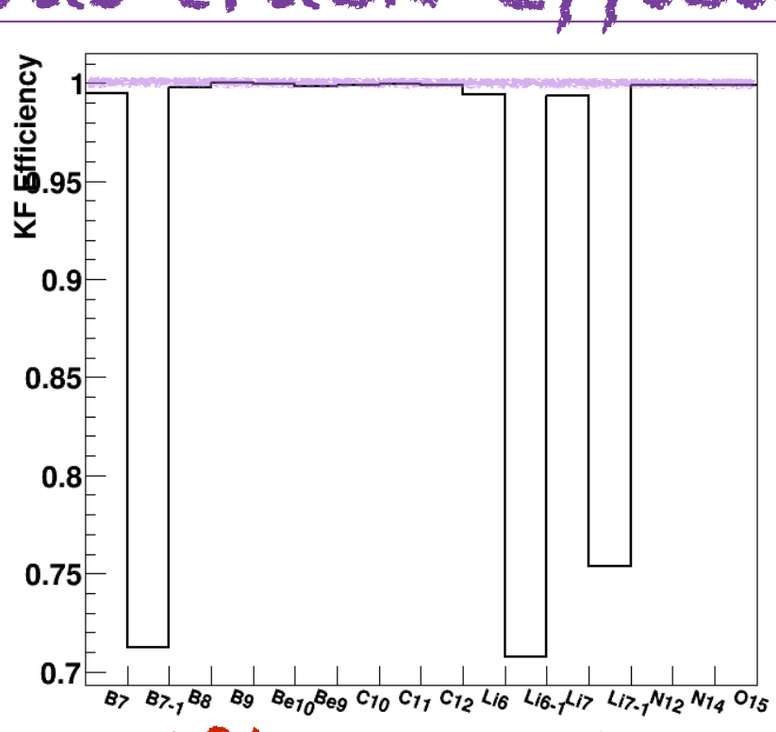
- **Gaussian smearing** of in Bx, By, Bz components of the magnetic field map **independently** (map granularity every 5mm);

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

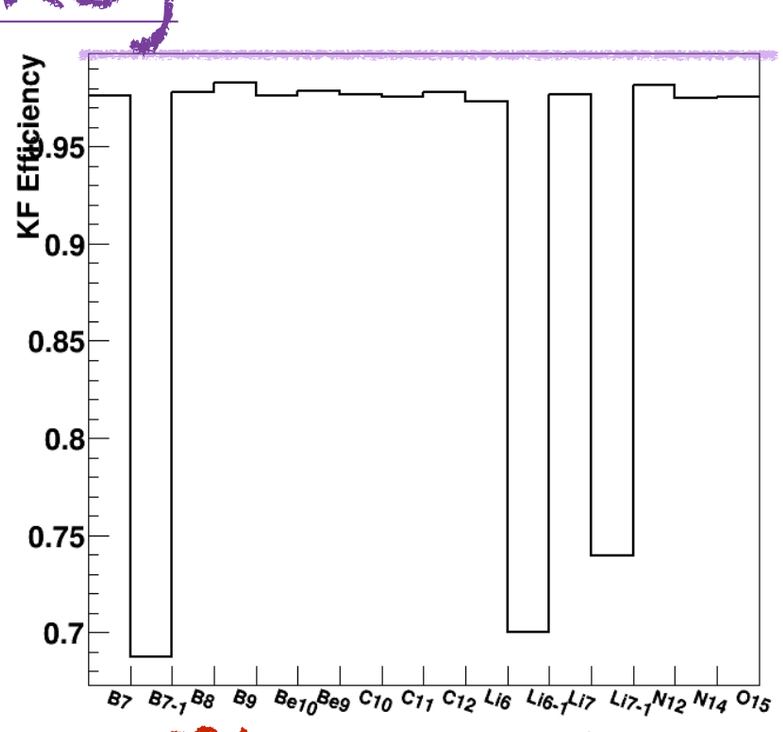
Global track efficiency



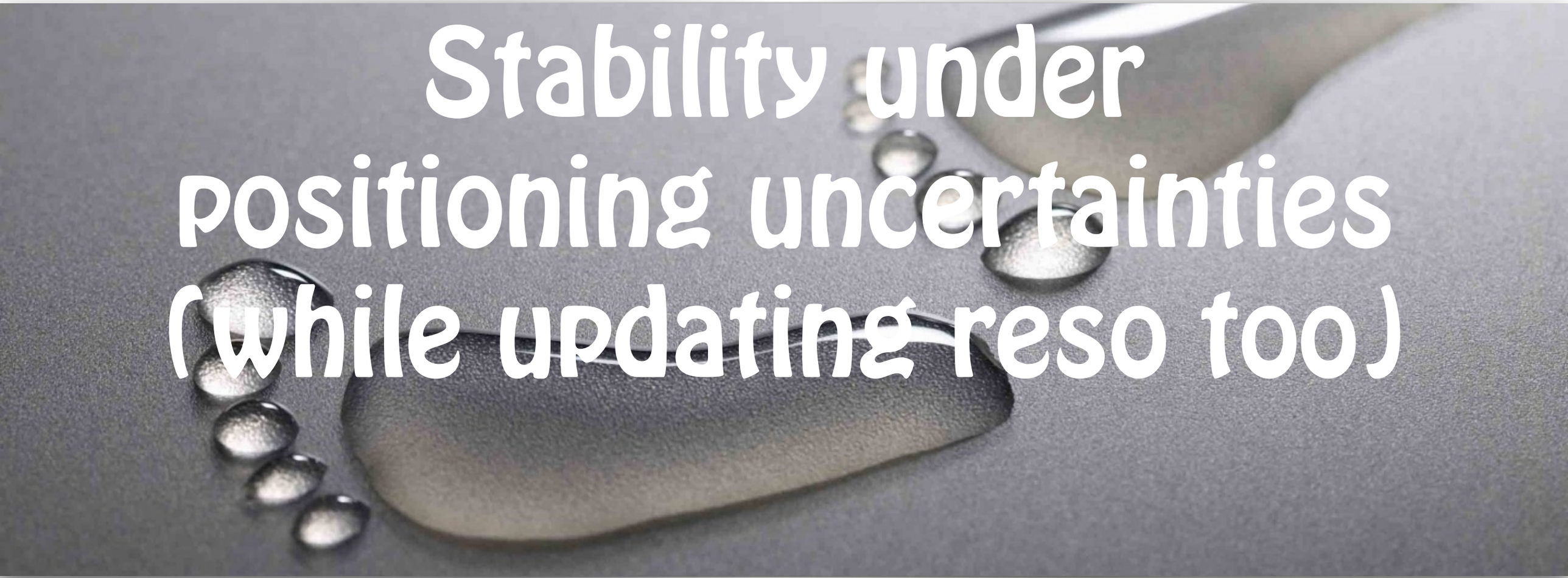
no smearing



1% smearing



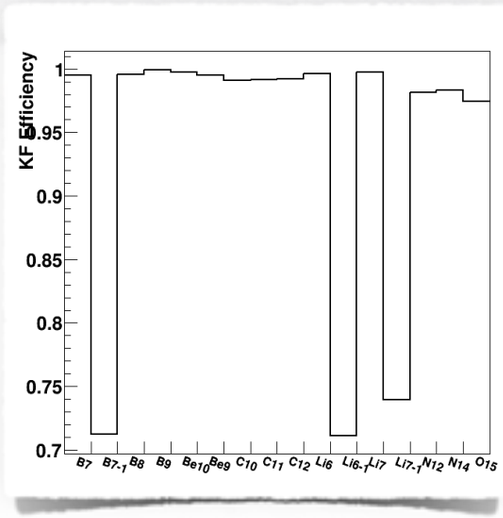
5% smearing

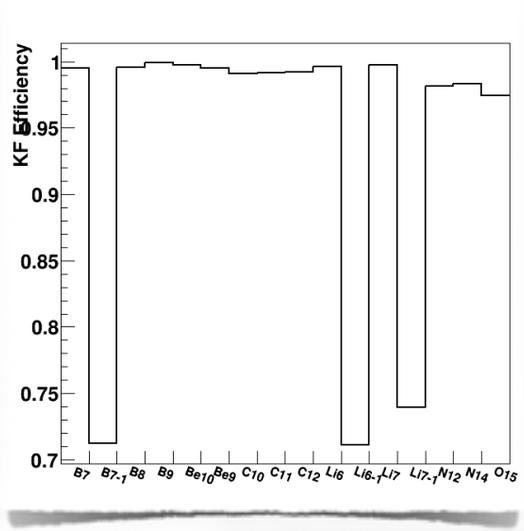


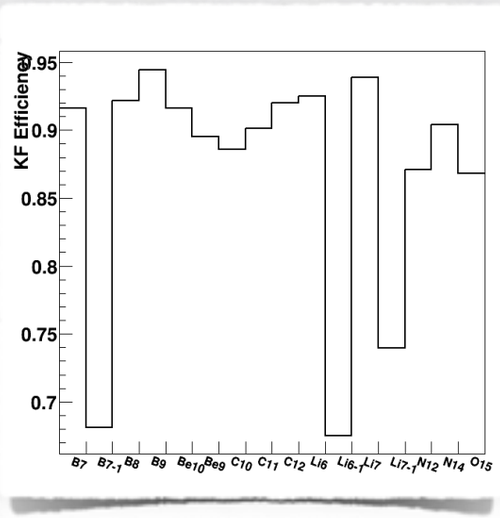
Stability under positioning uncertainties (while updating reso too)

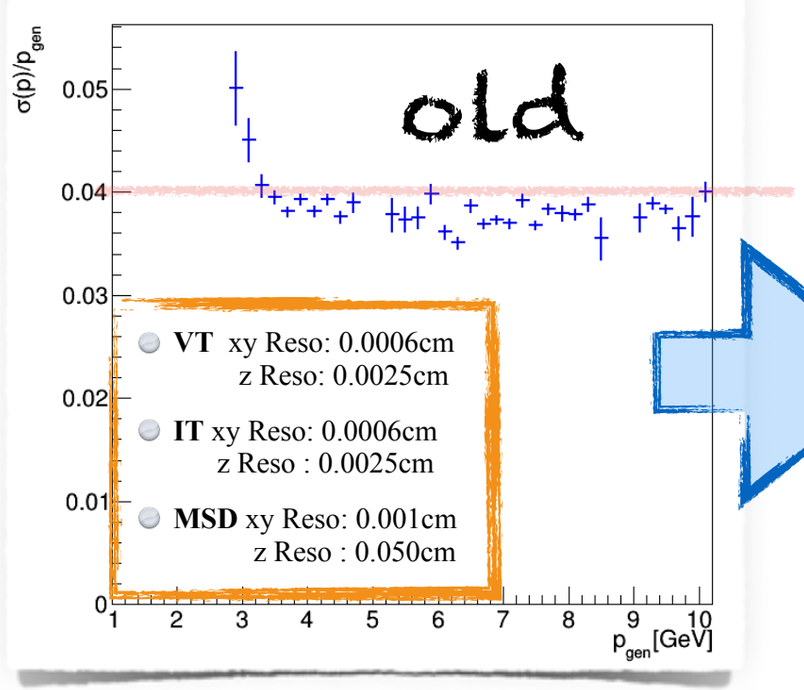
Updated Resolutions I

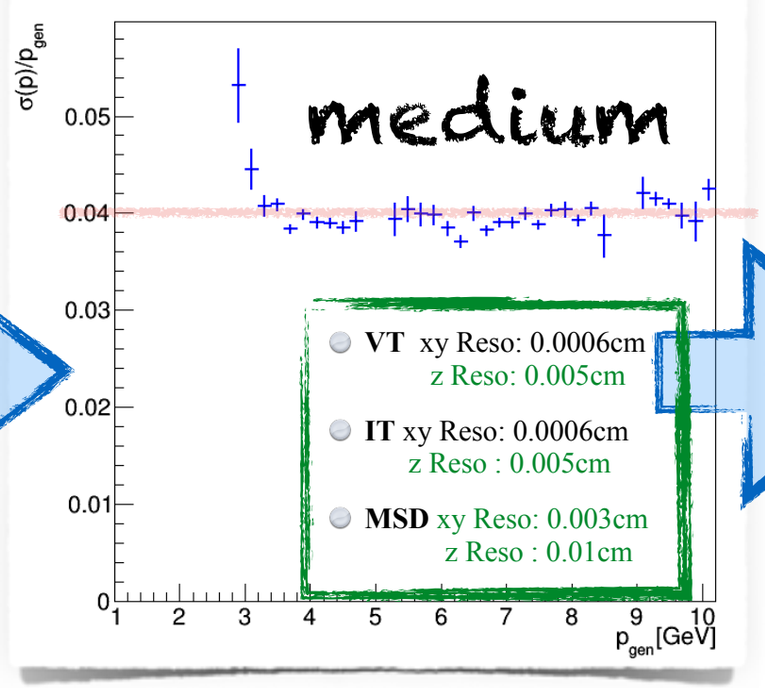
- Updating with **more realistic** spatial resolutions, in 2 steps;
- **Instructive** to look at the **momentum resolution** and **tracking efficiency**.
- Gives information on **hardware constraints**.

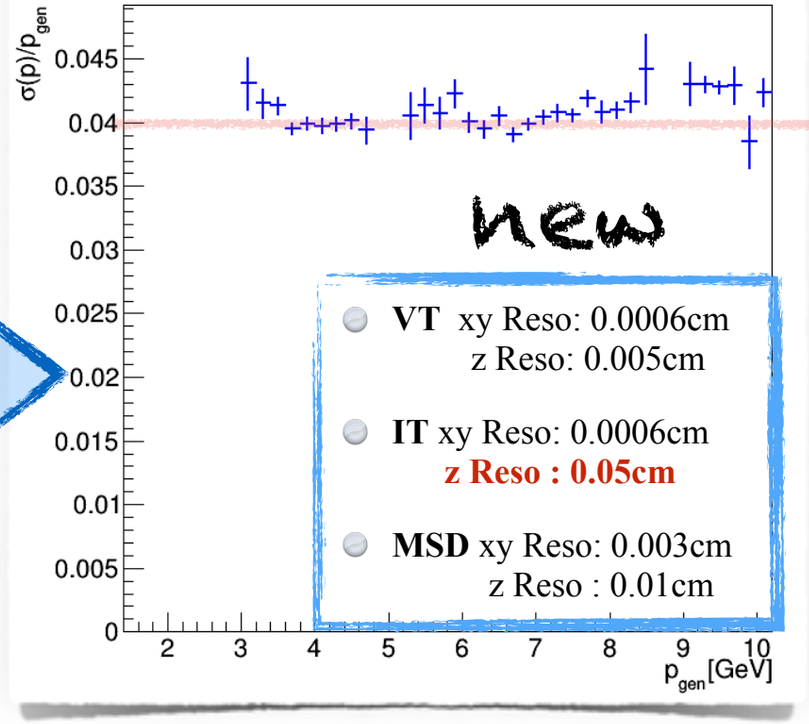








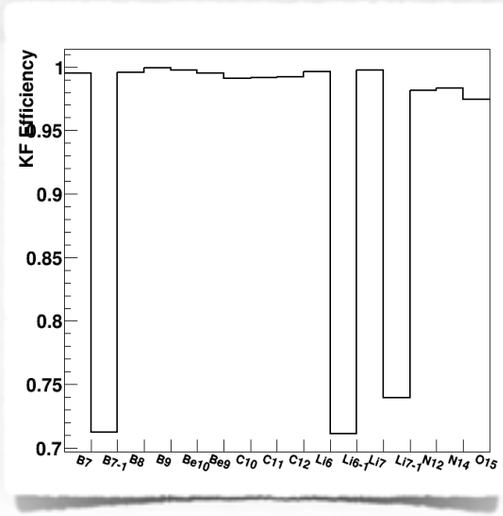


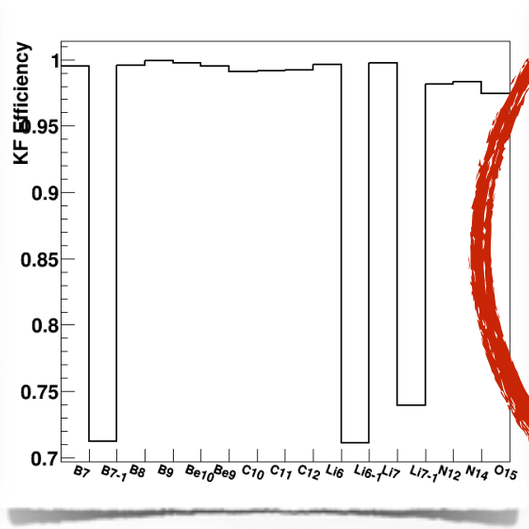


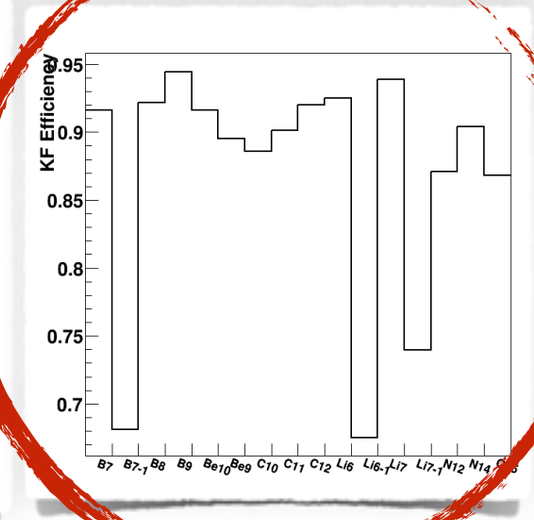
Resolution do not worsen much, Kalman efficiency does, some under 80%
(almost 99% before!!!)

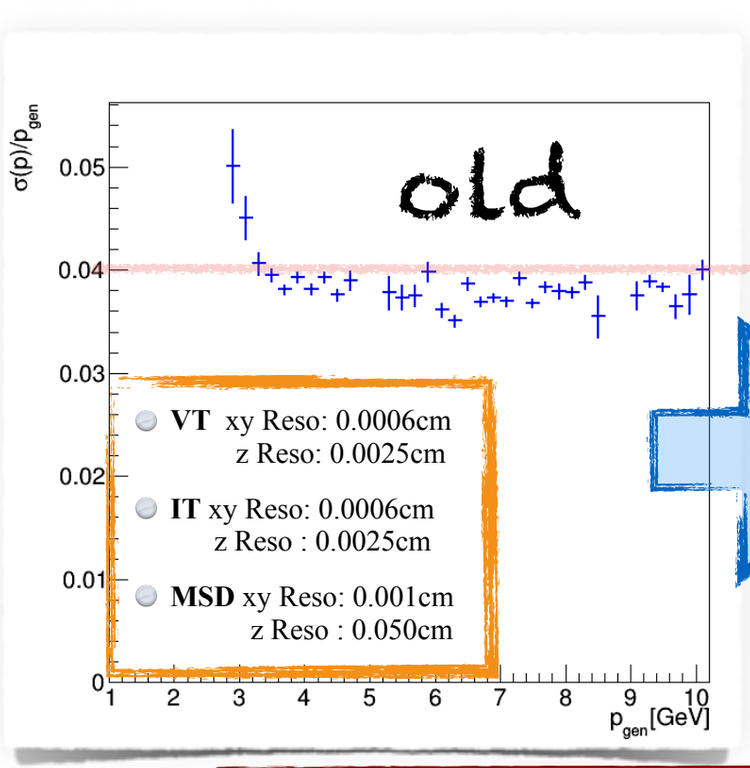
Updated Resolutions I

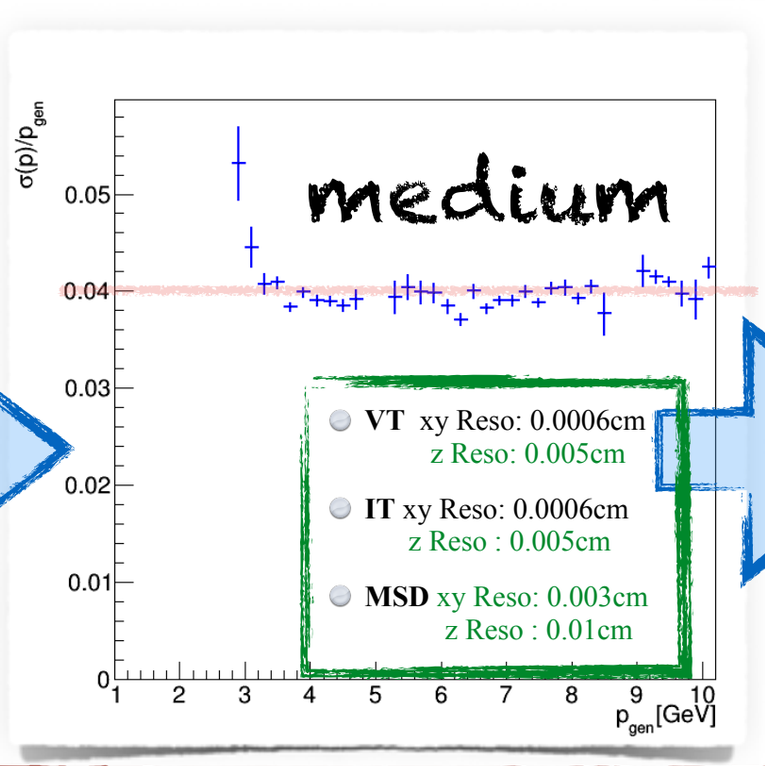
- Updating with **more realistic** spatial resolutions, in 2 steps;
- **Instructive** to look at the **momentum resolution** and **tracking efficiency**.
- Gives information on **hardware constraints**.

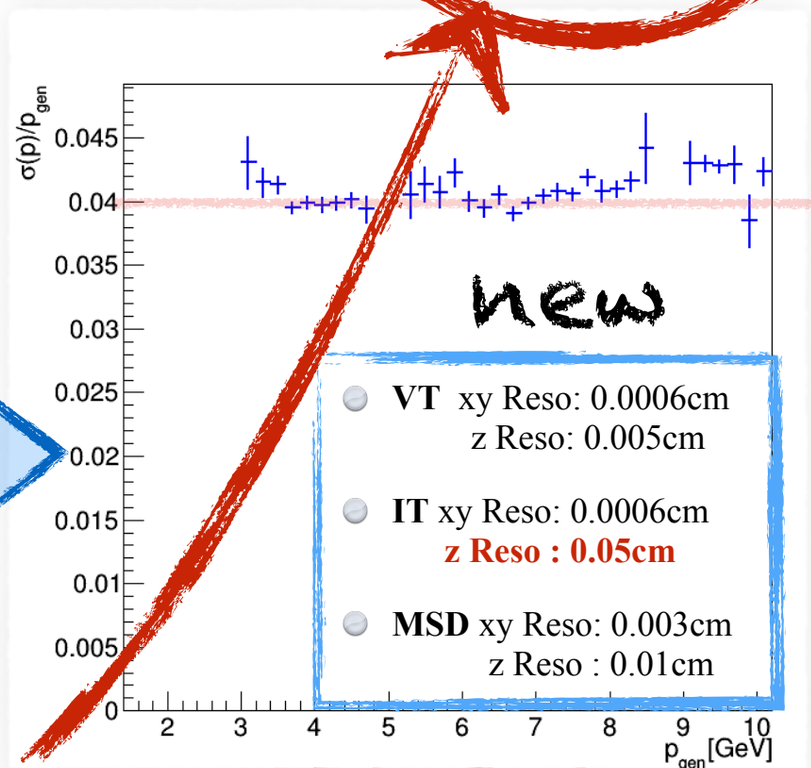












Resolution do not worsen much, Kalman efficiency does, some under 80%
(almost 99% before!!!)

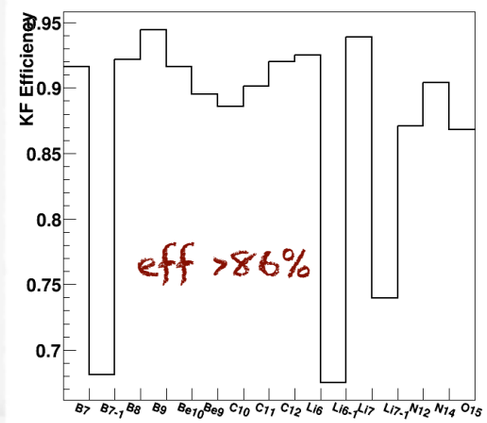
Updated Resolutions II

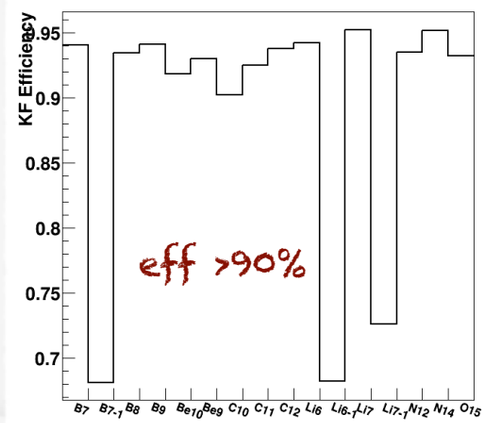
Change of the IT z resolution ONLY

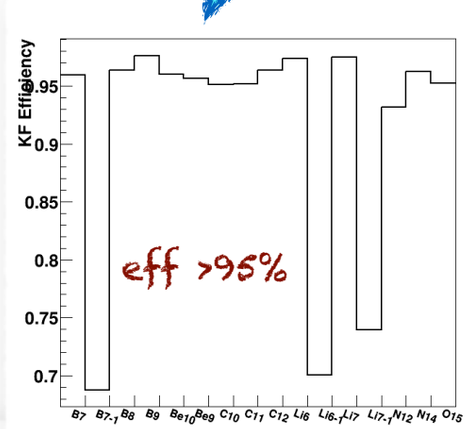
- Focusing on the **IT z-resolution** only since have a non-negligible impact;
- Important to set **acceptable threshold** for hardware constrains;
- Similar effect for **VT** z-resolution;

- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : ?????cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

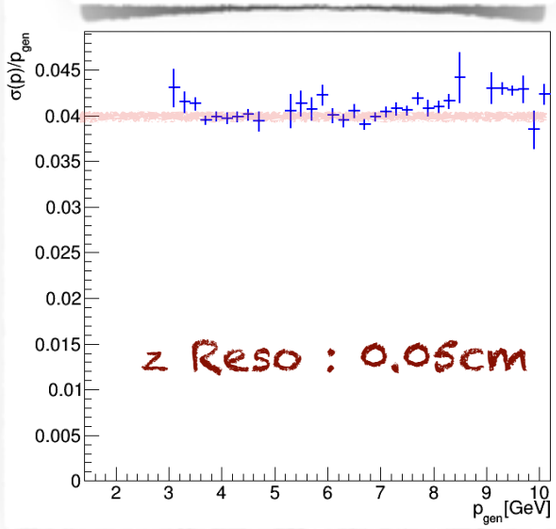
Decreasing err.

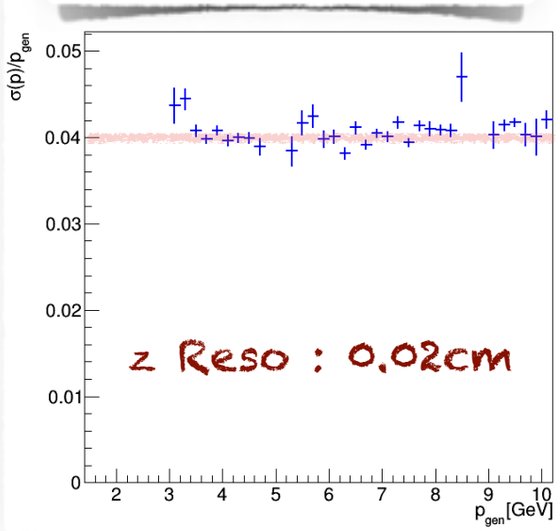


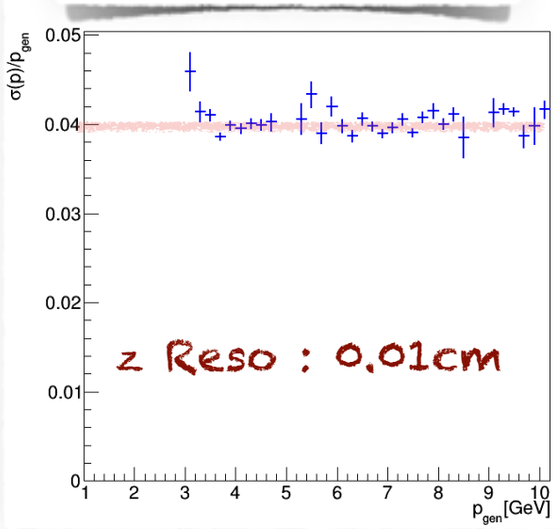




before (50 micron)
eff ~ 99%







<u>Conclusion</u>:
IT (and VT) z-resolution is important for a **good tracking efficiency**! (more then reso)

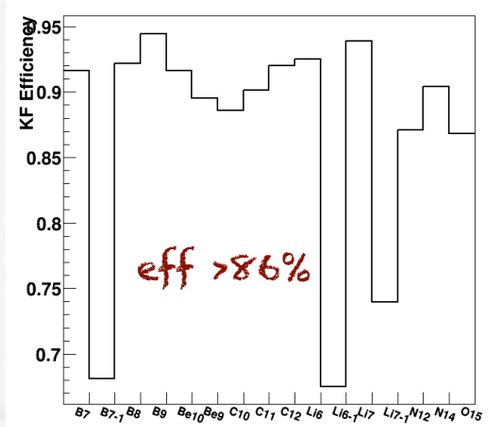
Updated Resolutions II

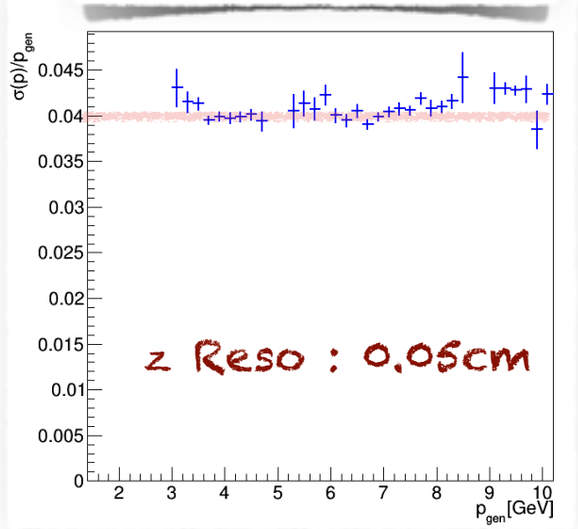
Change of the IT z resolution ONLY

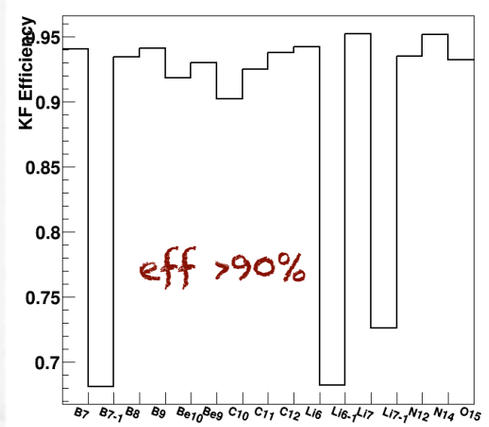
- Focusing on the **IT z-resolution** only since have a non-negligible impact;
- Important to set **acceptable threshold** for hardware constrains;
- Similar effect for **VT** z-resolution;

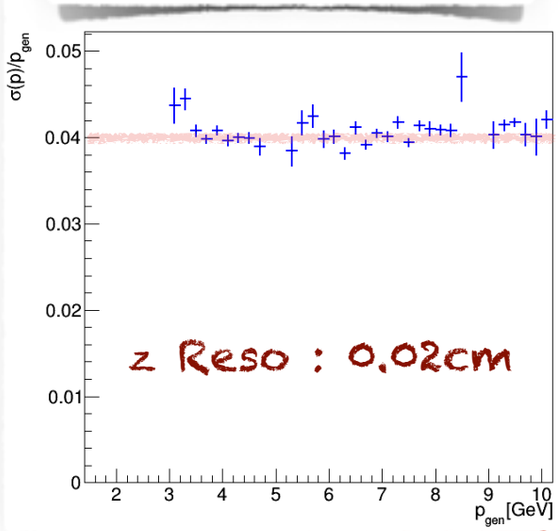
- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : ?????cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

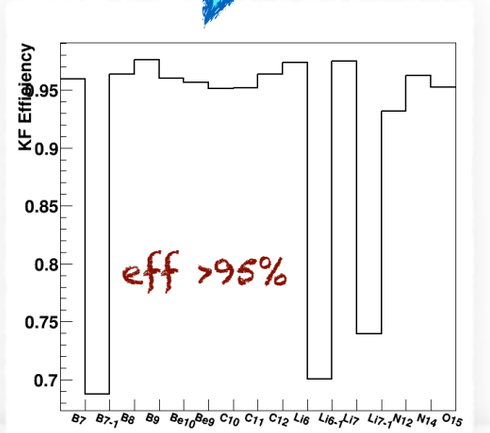
Decreasing z-res

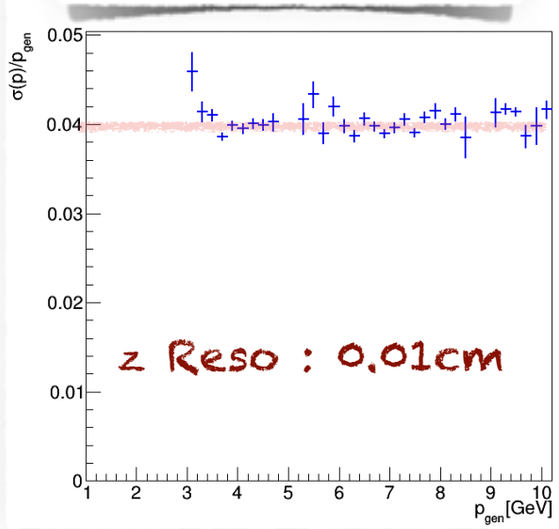












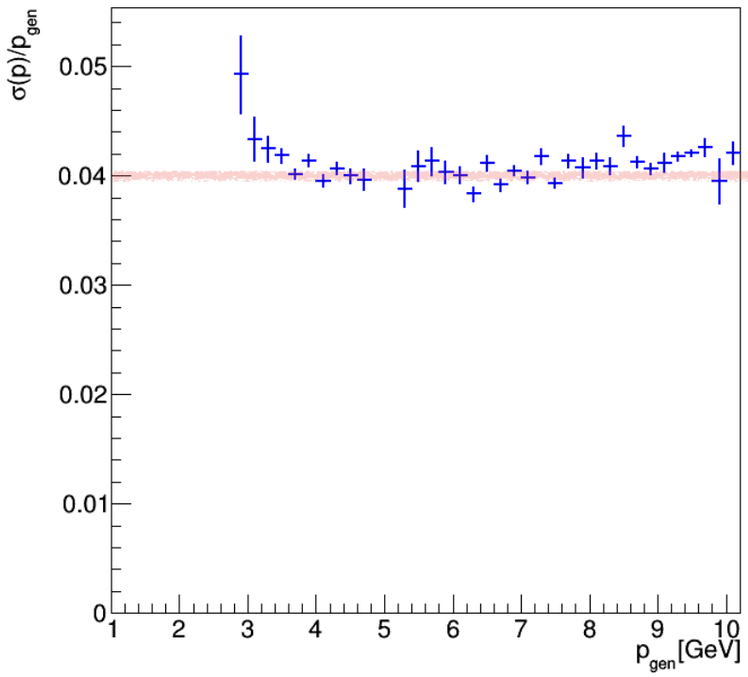
before (50 micron)
eff ~ 99%

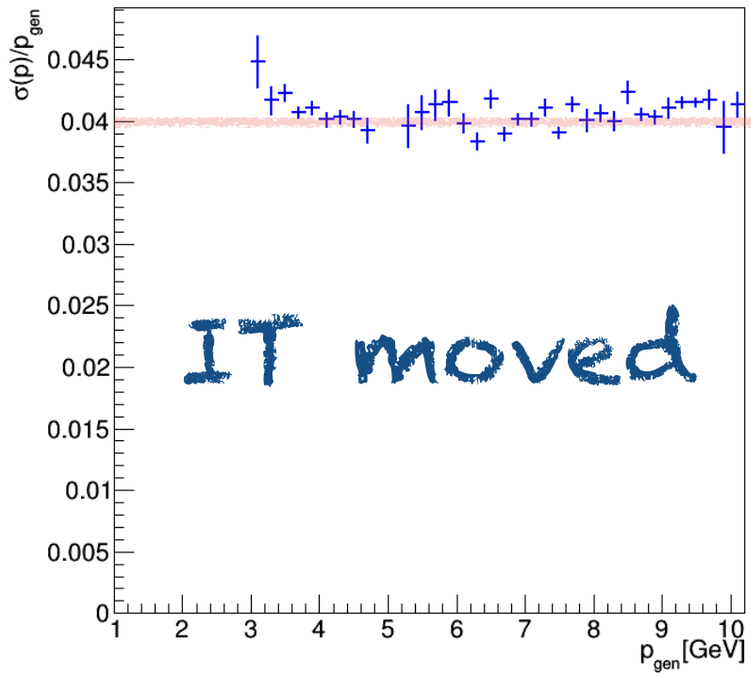
Conclusion:
IT (and VT) z-resolution is important for a **good tracking efficiency**! (more then reso)

IT shift test

- Disentangle **layer distance** and **module positioning**;
- IT detector **center shifted** by +0,05cm only in reconstruction;

suggestion by Giuseppe





- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.02cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

Conclusion

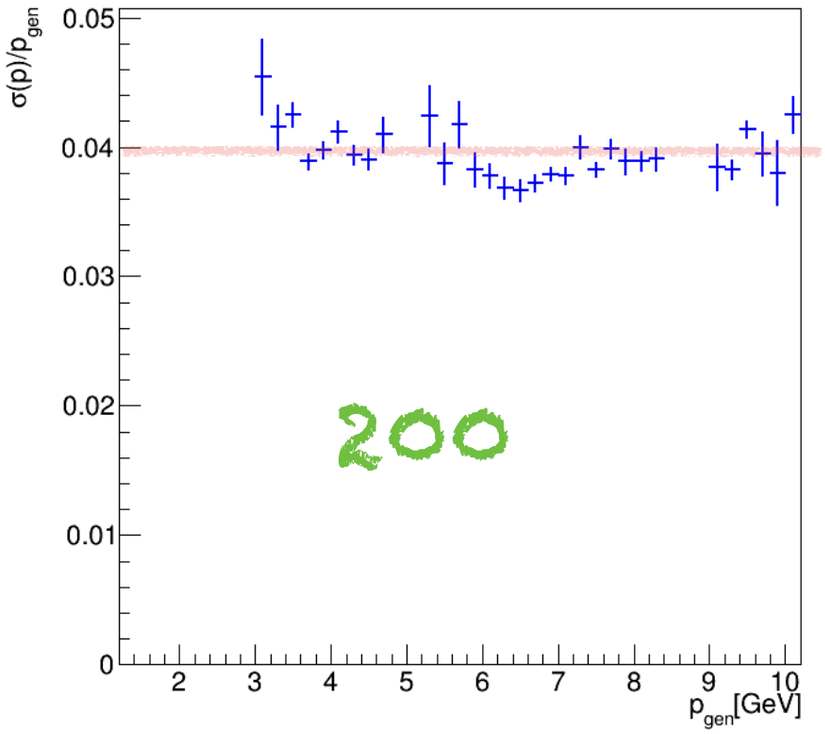
- **Good reso stability, negligible eff. loss**: smaller effect than increasing the uncertainty uncorrelated on both ITR planes to 500.
- Distance between plans much more precise them plume position.

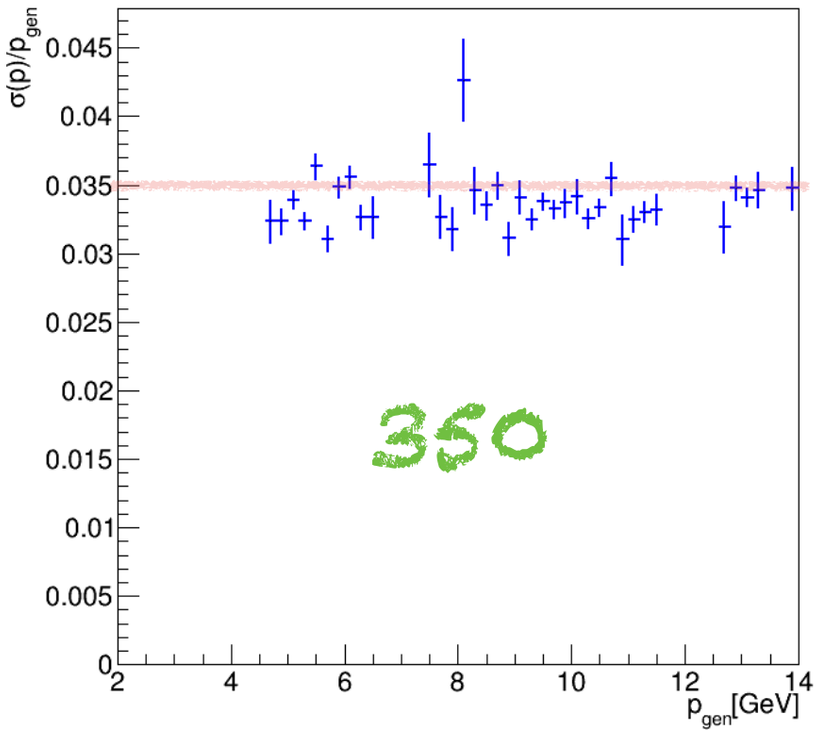

Tracking &
momentum resolution
v14

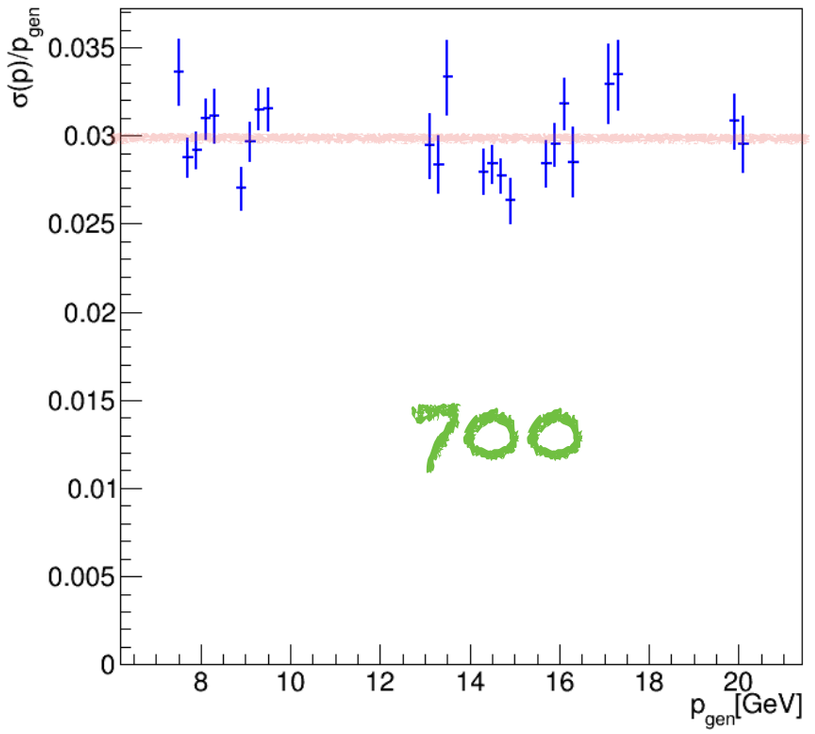
More energy!!

- **Here** more the momentum, more the resolution;
- Seems we're **dominated by MS** that decrease with increasing momentum.
- Then Kalman seems **good** at fitting also **"poorly" bended** tracks.

- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.005cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

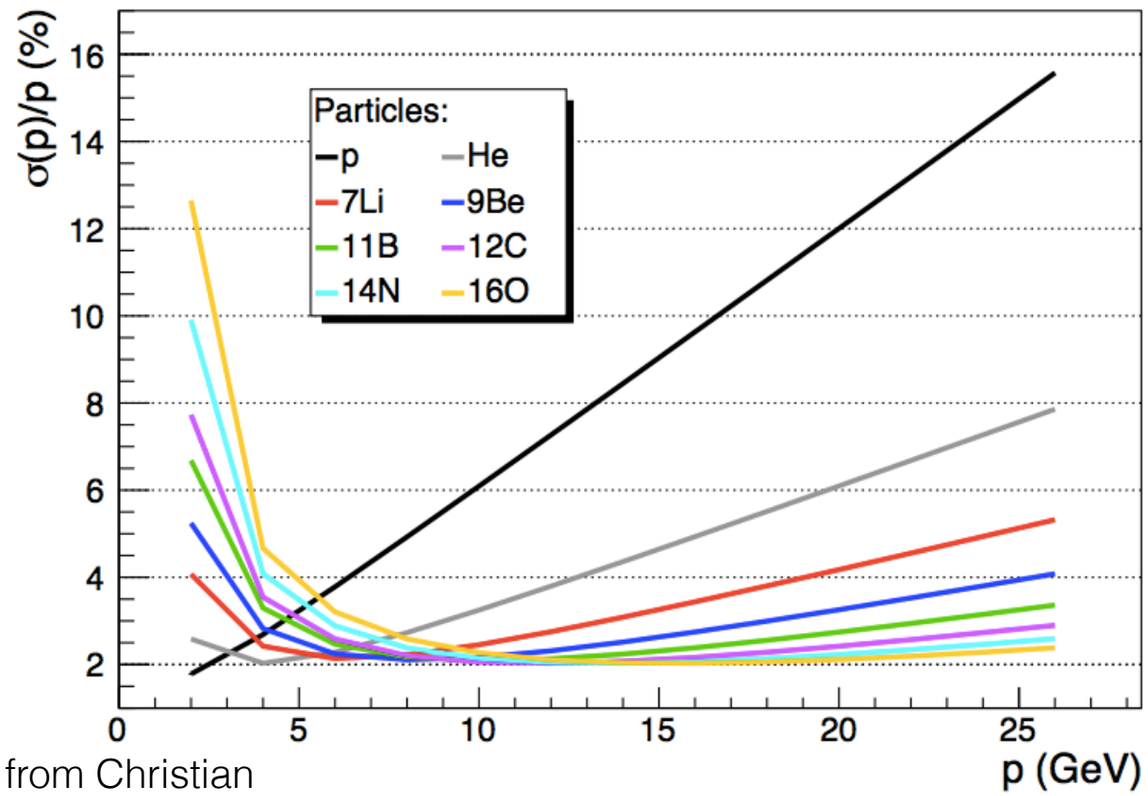






Resolution falls

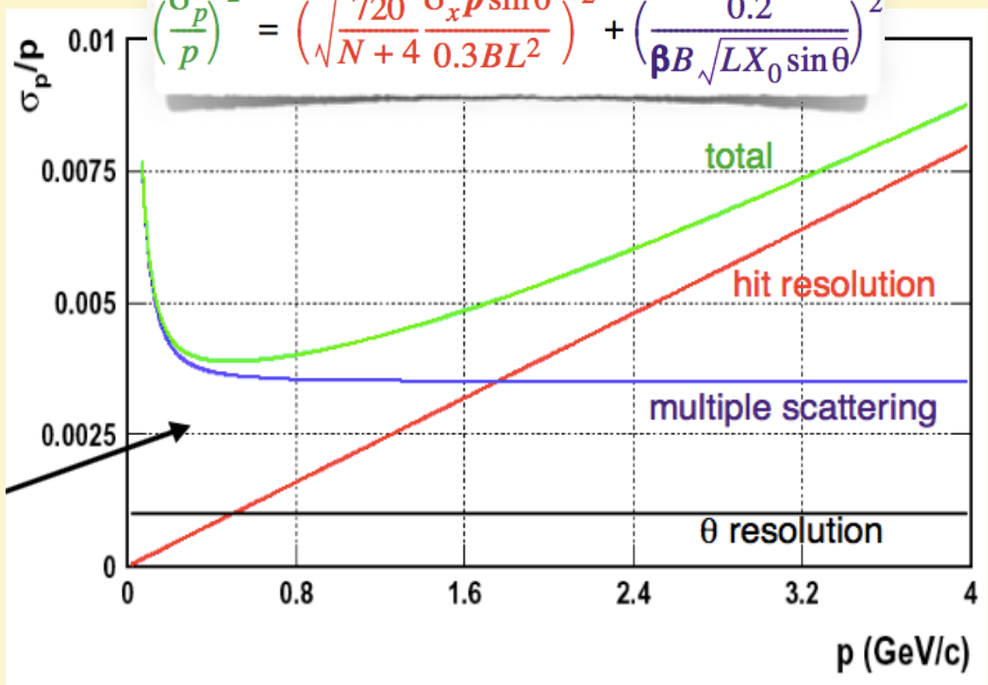
- Momentum resolution plot **given by different elements** contribution
- Moreover, elements has different **momentum spectrum**
  - because in fragmentation different elements are produced at different momentum, down from Li, up to O;
- At equal momentum :
  - **light elements:** lower σ_{MS}, higher $\sigma_{spatialReso}$
  - **heavy elements:** higher σ_{MS}, lower $\sigma_{spatialReso}$



from Christian

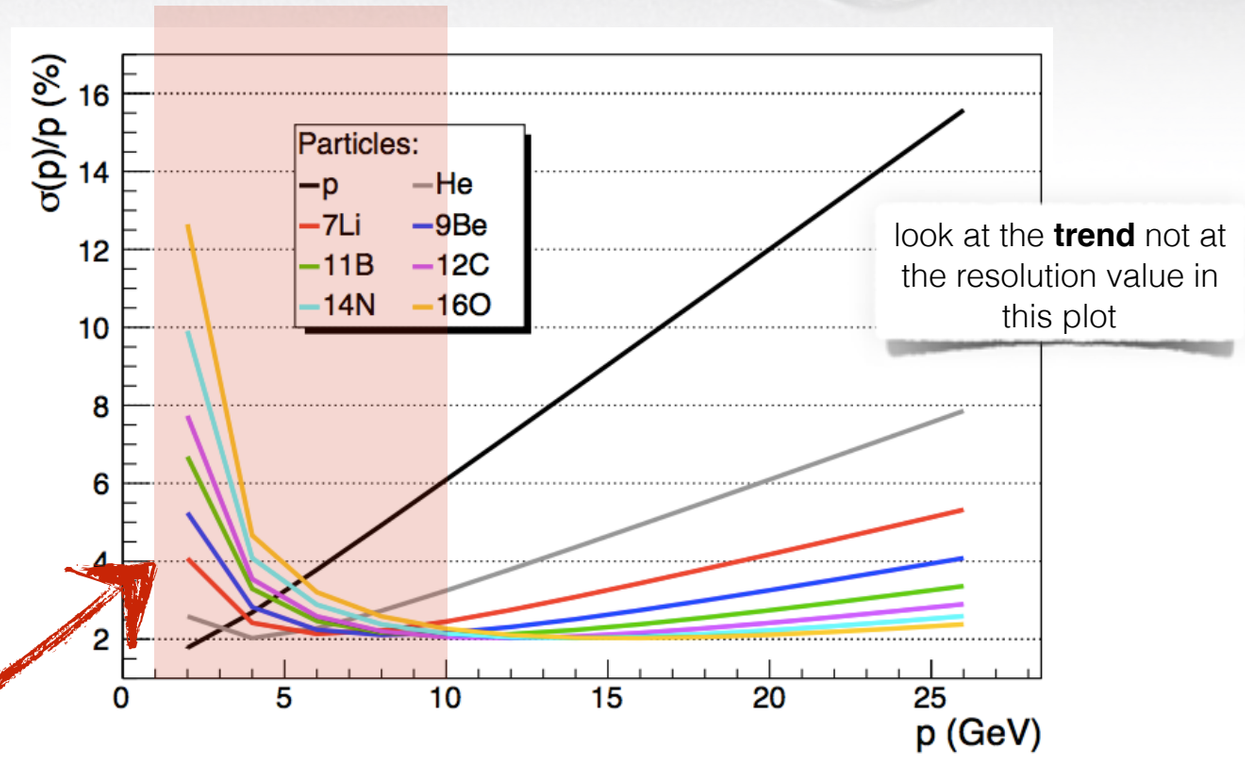
Brief review

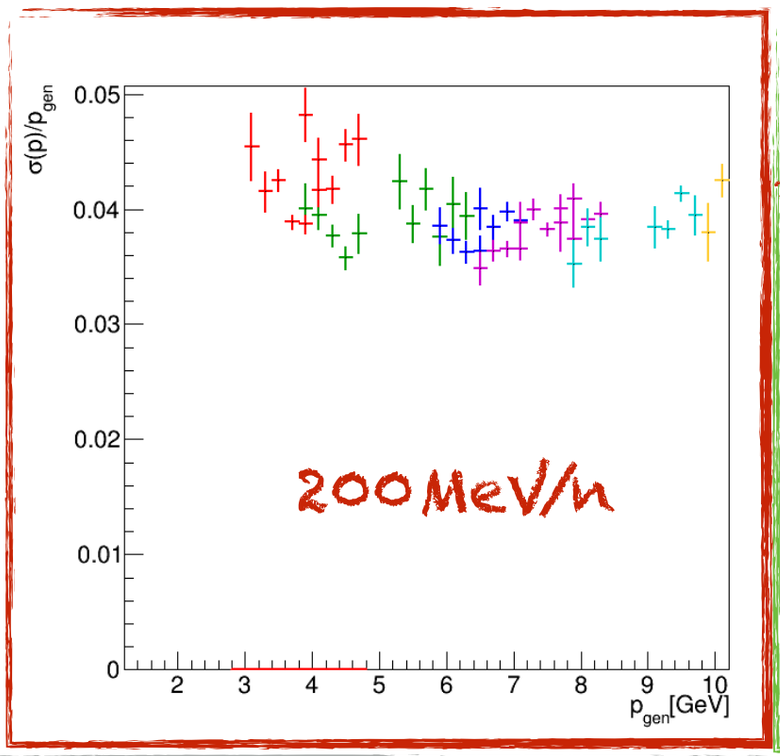
$$\left(\frac{\sigma_p}{p}\right)^2 = \left(\sqrt{\frac{720}{N+4}}\frac{\sigma_x p \sin\theta}{0.3BL^2}\right)^2 + \left(\frac{0.2}{\beta B\sqrt{LX_0\sin\theta}}\right)^2$$

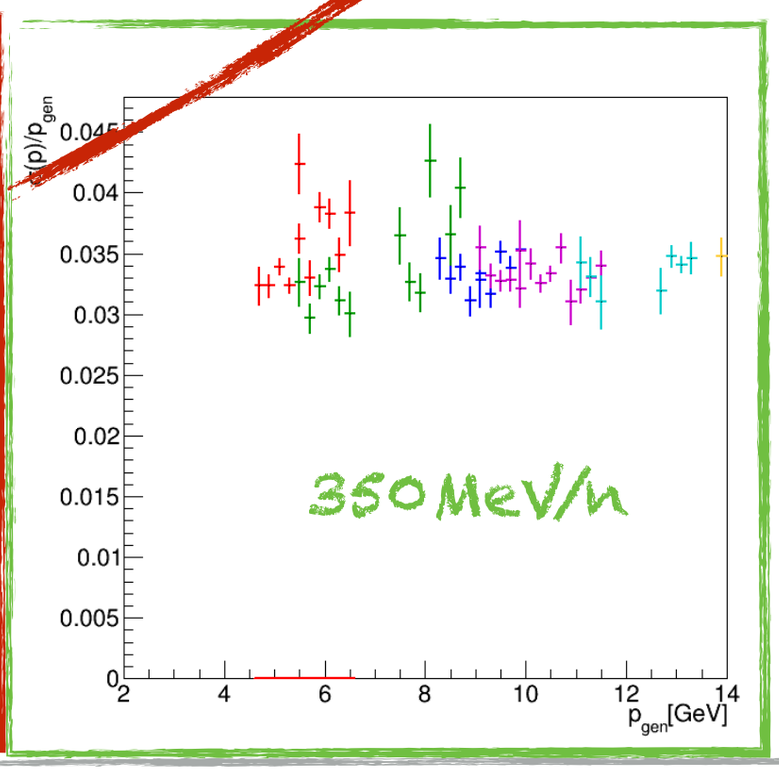


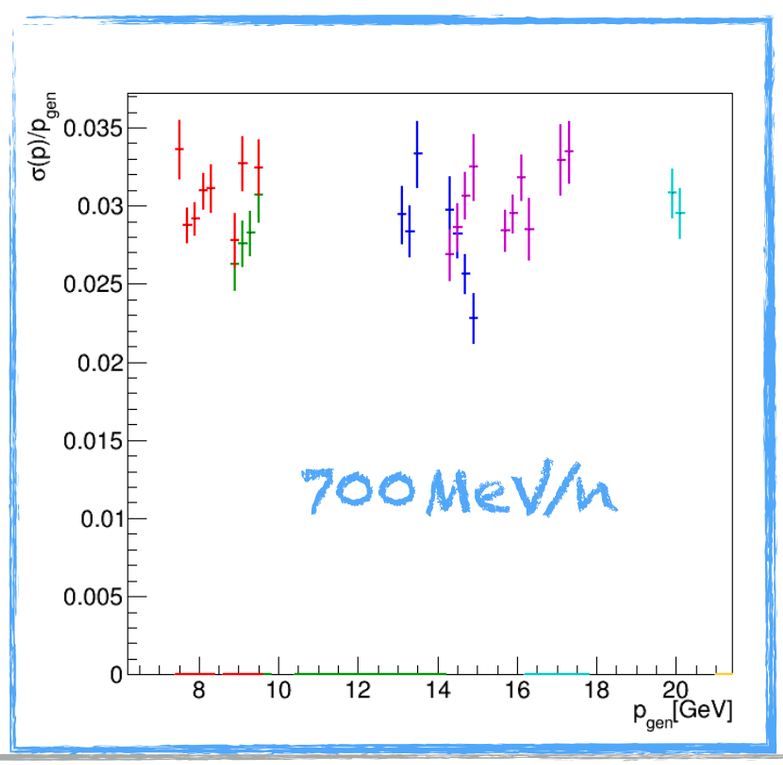
Resolution falls

- **At 200MeV/n**, all elements are in the "decreasing" part, dominated by ***MS contribution***;
  - **light elements** have *lower p*: MS contribution fall earlier;
  - **heavy-elements** have *higher p*: approaching minimum, MS not so high anymore;
- **At 700MeV/n**, all in region dominated by ***spatial resolution***;
  - **light elements** (steeper growth, lower-p minimum) have low p; still close to the minimum
  - **heavy elements** (grows slower, higher-p minimum) have higher p but still close to the minimum



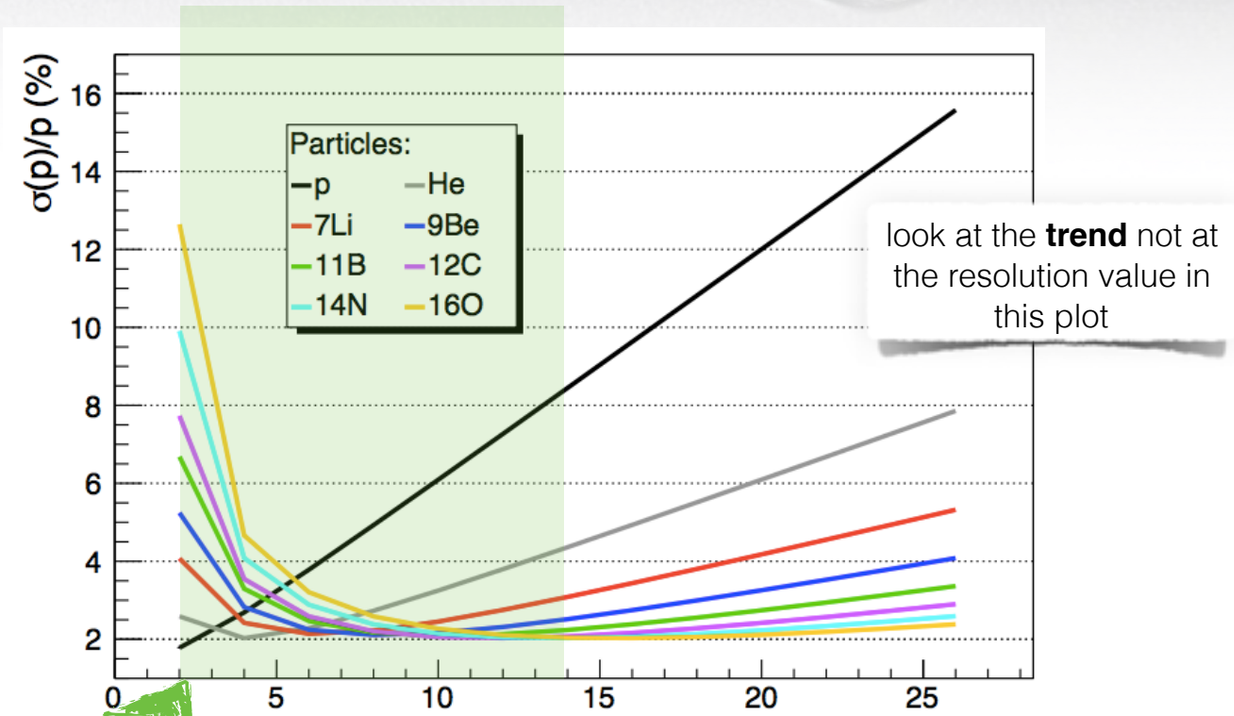


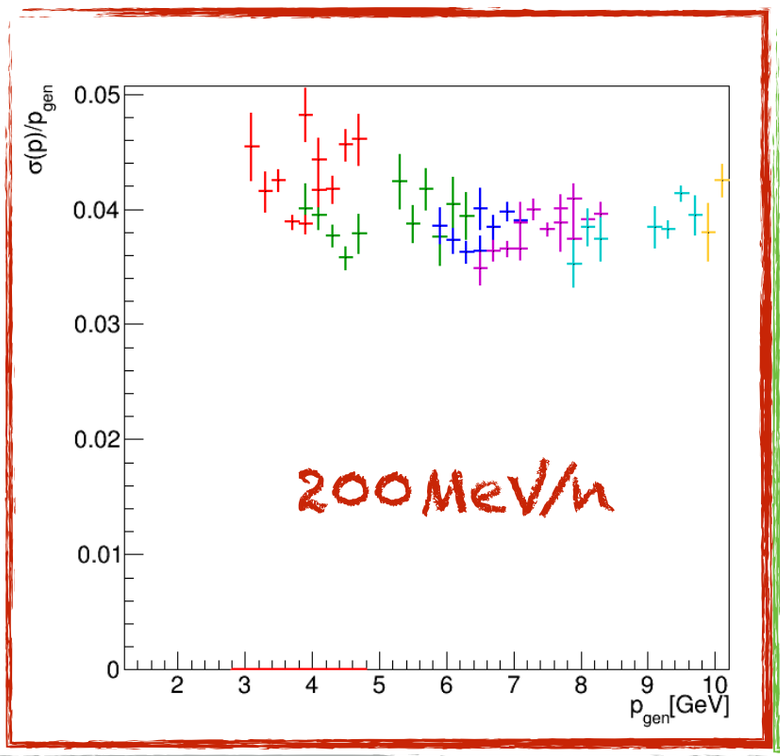


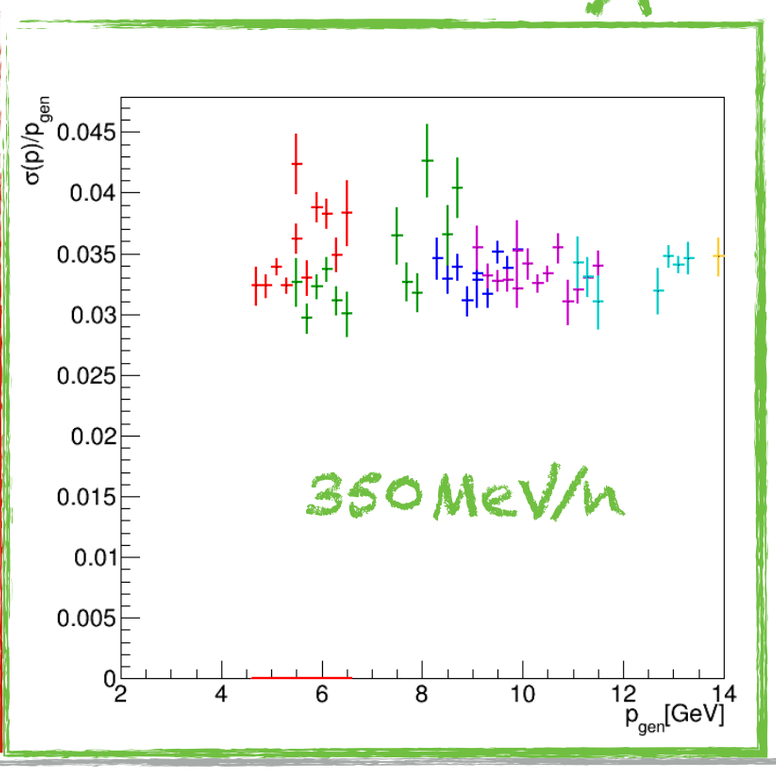


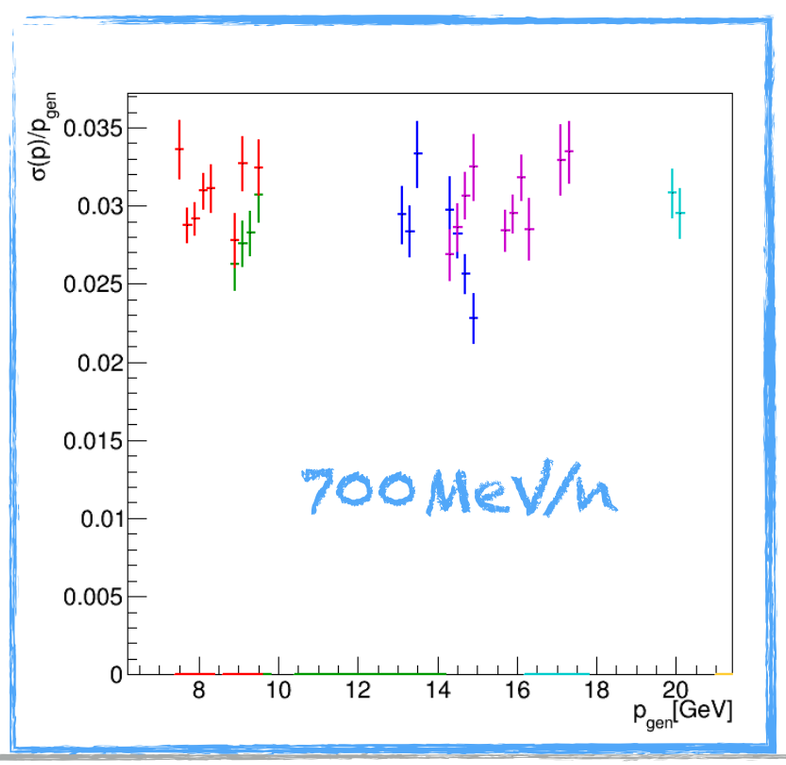
Resolution falls

- **At 200MeV/n**, all elements are in the "decreasing" part, dominated by ***MS contribution***;
  - **light elements** have *lower p*: MS contribution fall earlier;
  - **heavy-elements** have *higher p*: approaching minimum, MS not so high anymore;
- **At 700MeV/n**, all in region dominated by ***spatial resolution***;
  - **light elements** (steeper growth, lower-p minimum) have low p; still close to the minimum
  - **heavy elements** (grows slower, higher-p minimum) have higher p but still close to the minimum



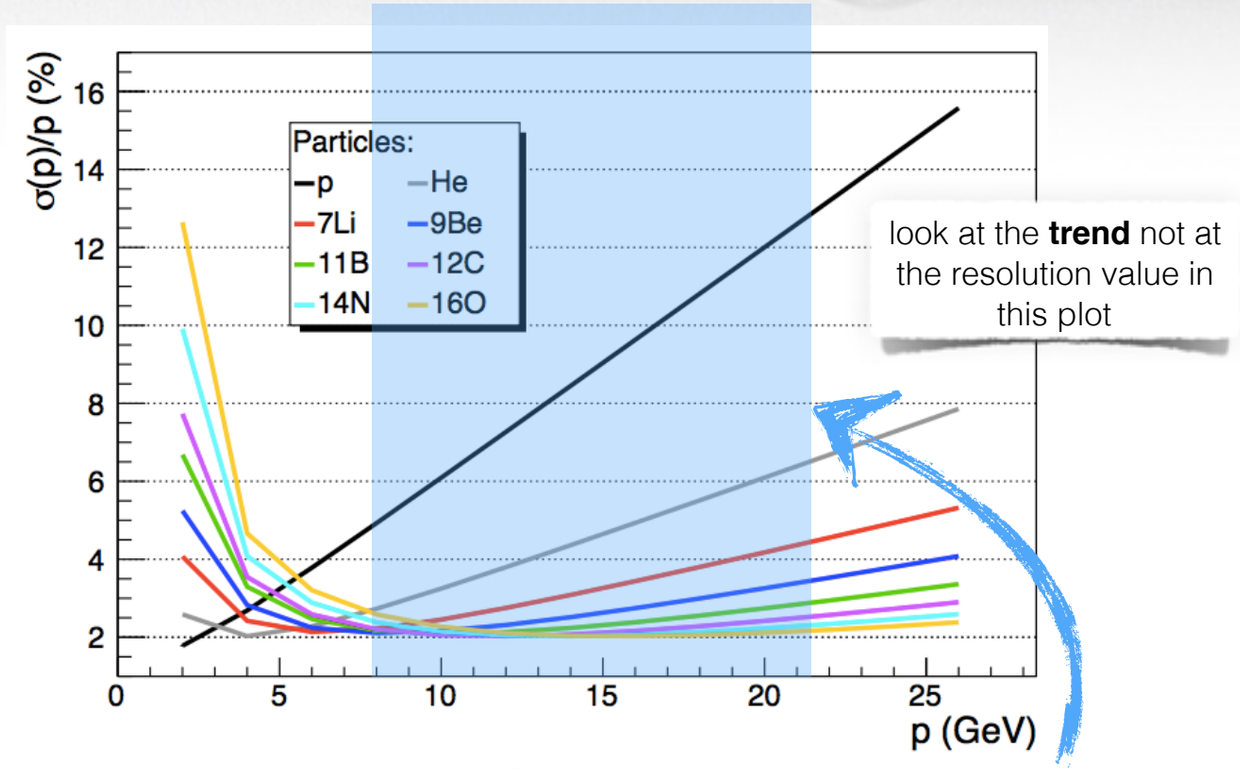


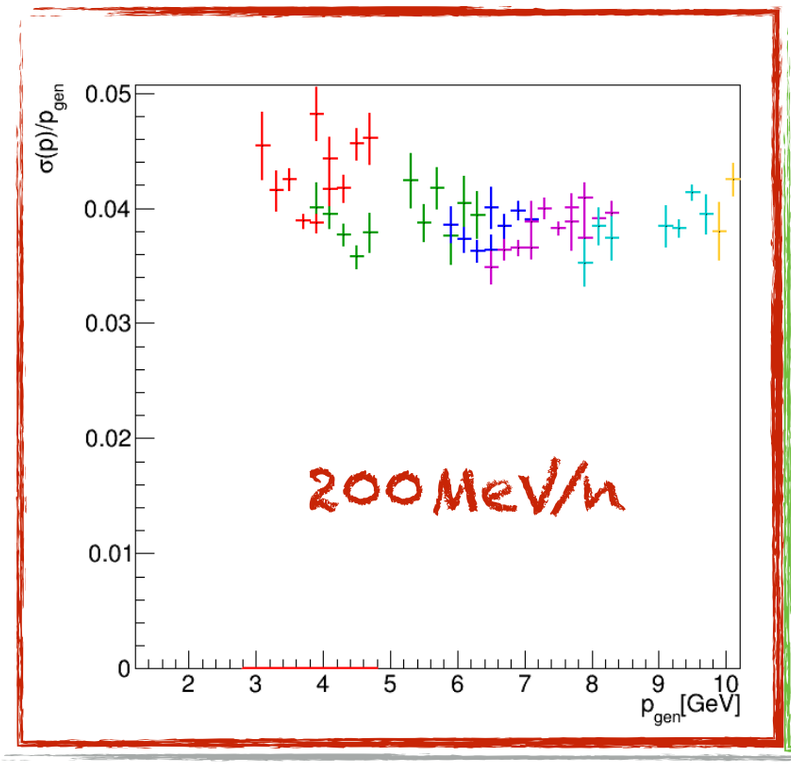


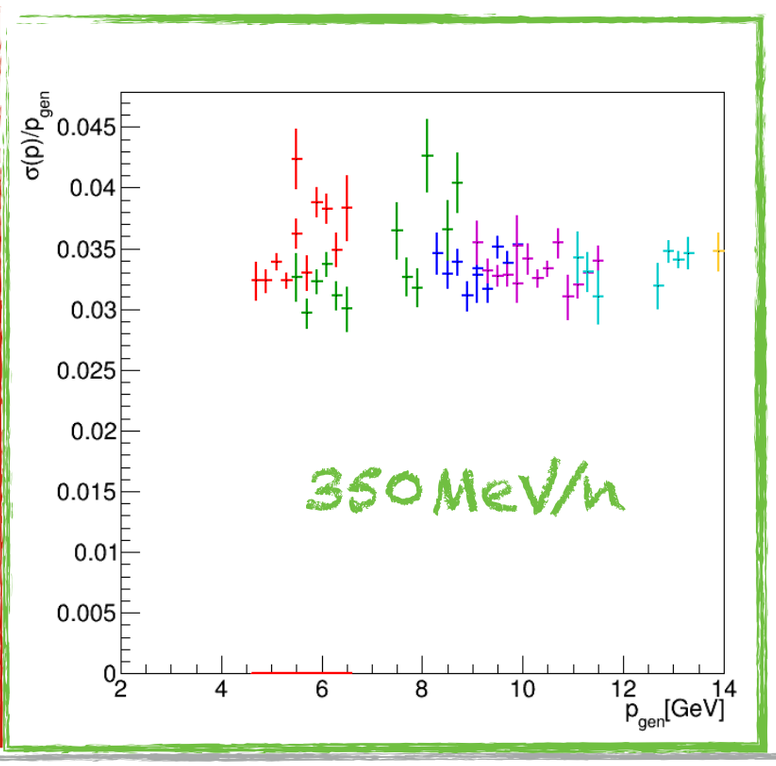


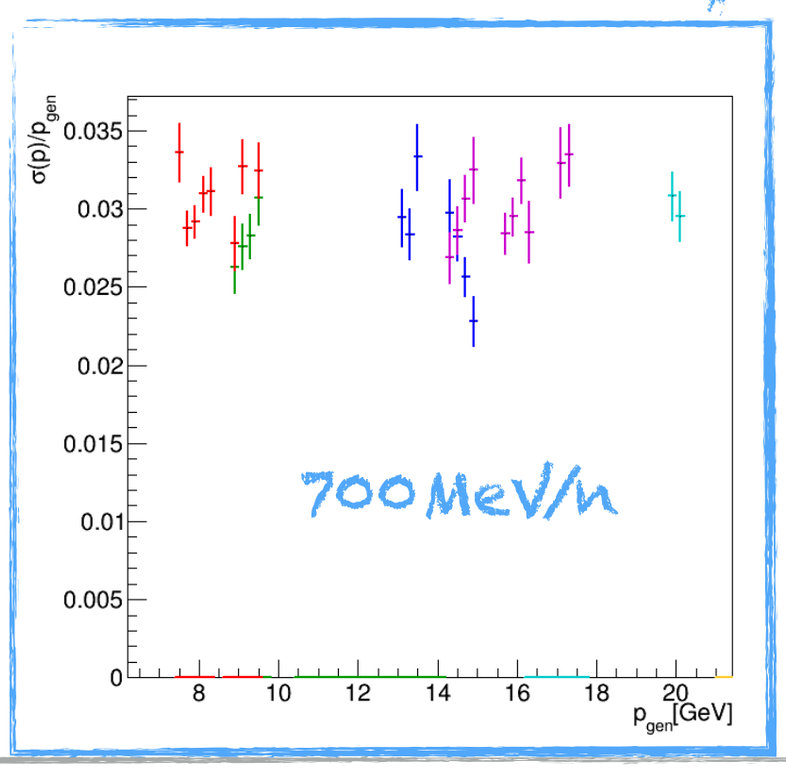
Resolution falls

- **At 200MeV/n**, all elements are in the "decreasing" part, dominated by ***MS contribution***;
  - **light elements** have *lower p*: MS contribution fall earlier;
  - **heavy-elements** have *higher p*: approaching minimum, MS not so high anymore;
- **At 700MeV/n**, all in region dominated by ***spatial resolution***;
  - **light elements** (steeper growth, lower-p minimum) have low p; still close to the minimum
  - **heavy elements** (grows slower, higher-p minimum) have higher p but still close to the minimum



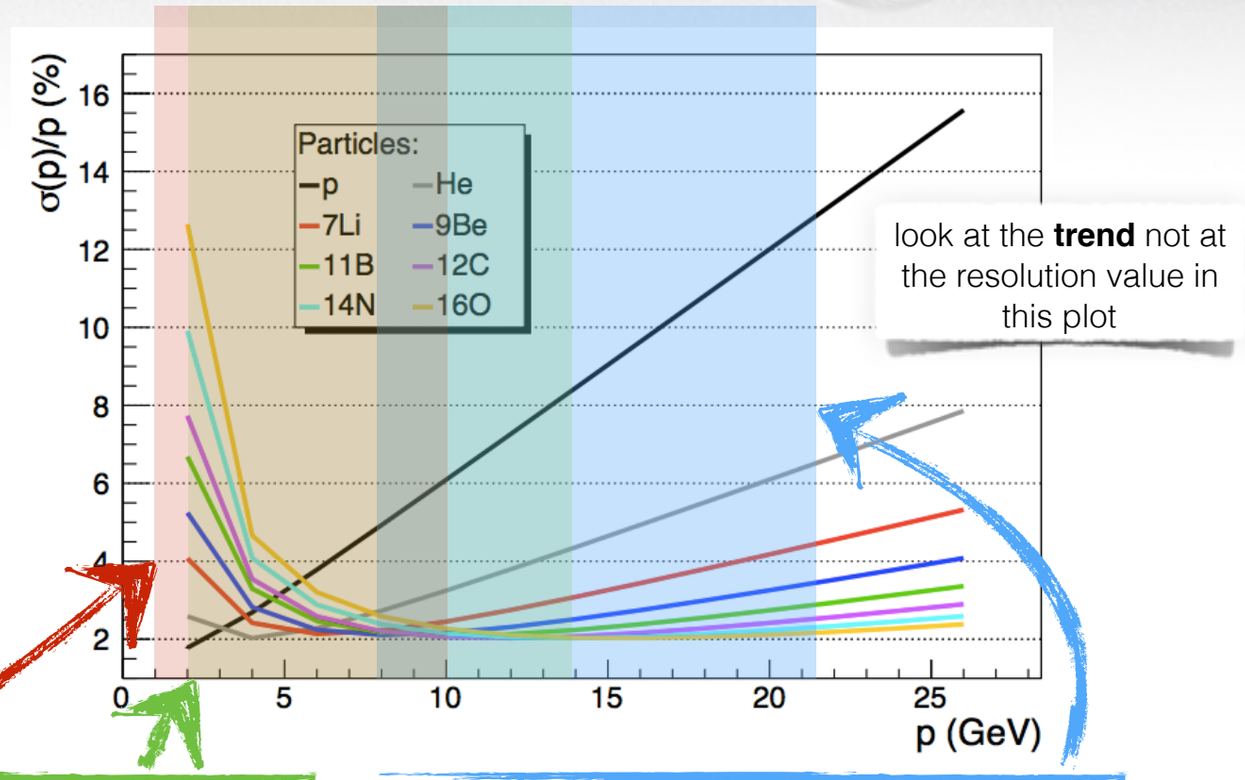


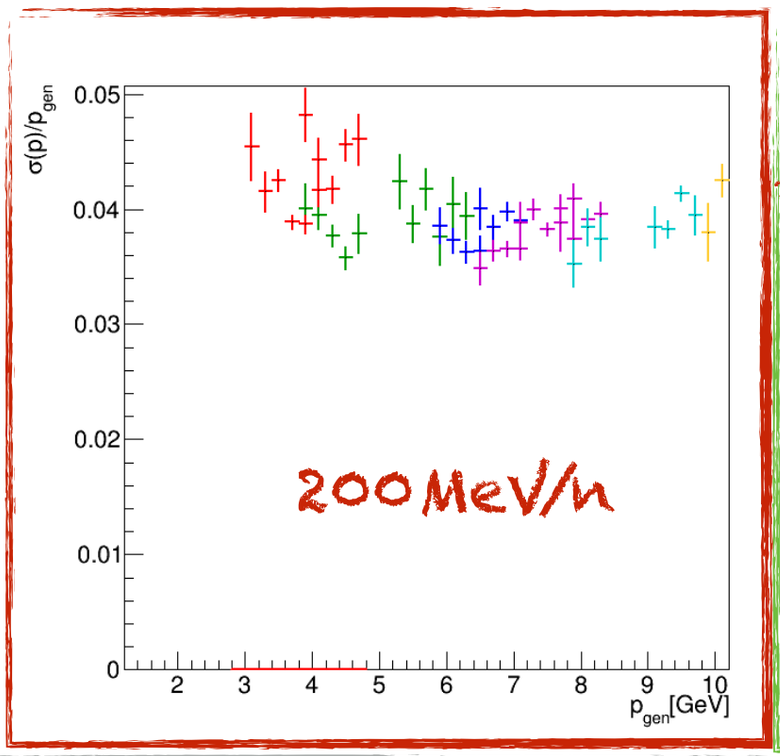


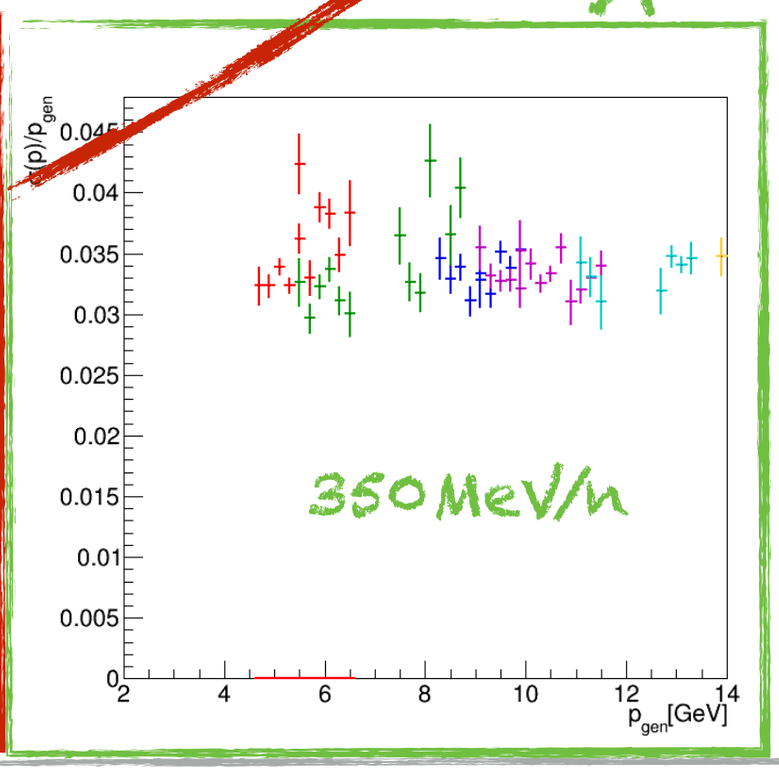


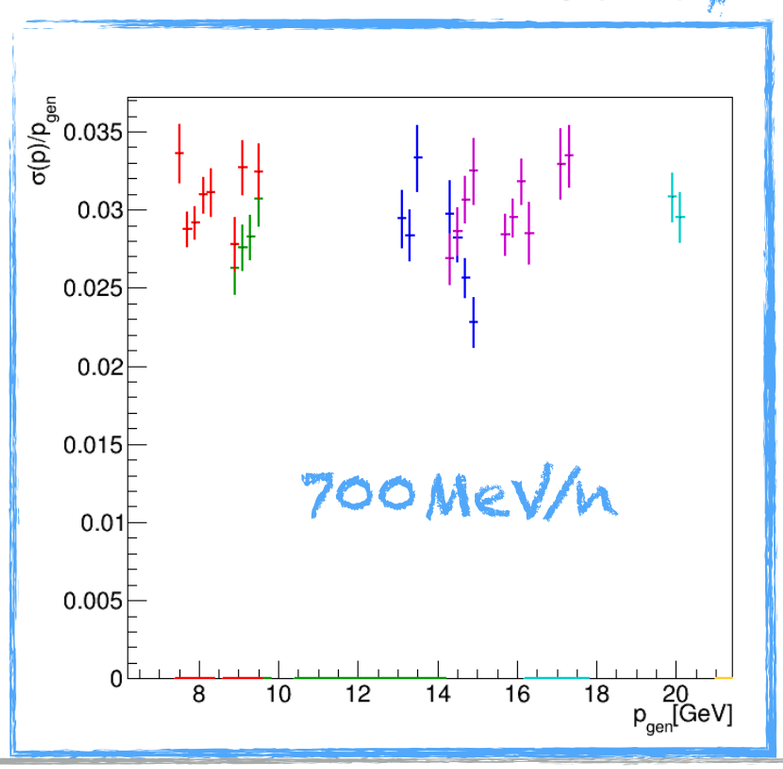
Resolution falls

- **At 200MeV/n**, all elements are in the "decreasing" part, dominated by ***MS contribution***;
  - **light elements** have *lower p*: MS contribution fall earlier;
  - **heavy-elements** have *higher p*: approaching minimum, MS not so high anymore;
- **At 700MeV/n**, all in region dominated by ***spatial resolution***;
  - **light elements** (steeper growth, lower-p minimum) have low p; still close to the minimum
  - **heavy elements** (grows slower, higher-p minimum) have higher p but still close to the minimum



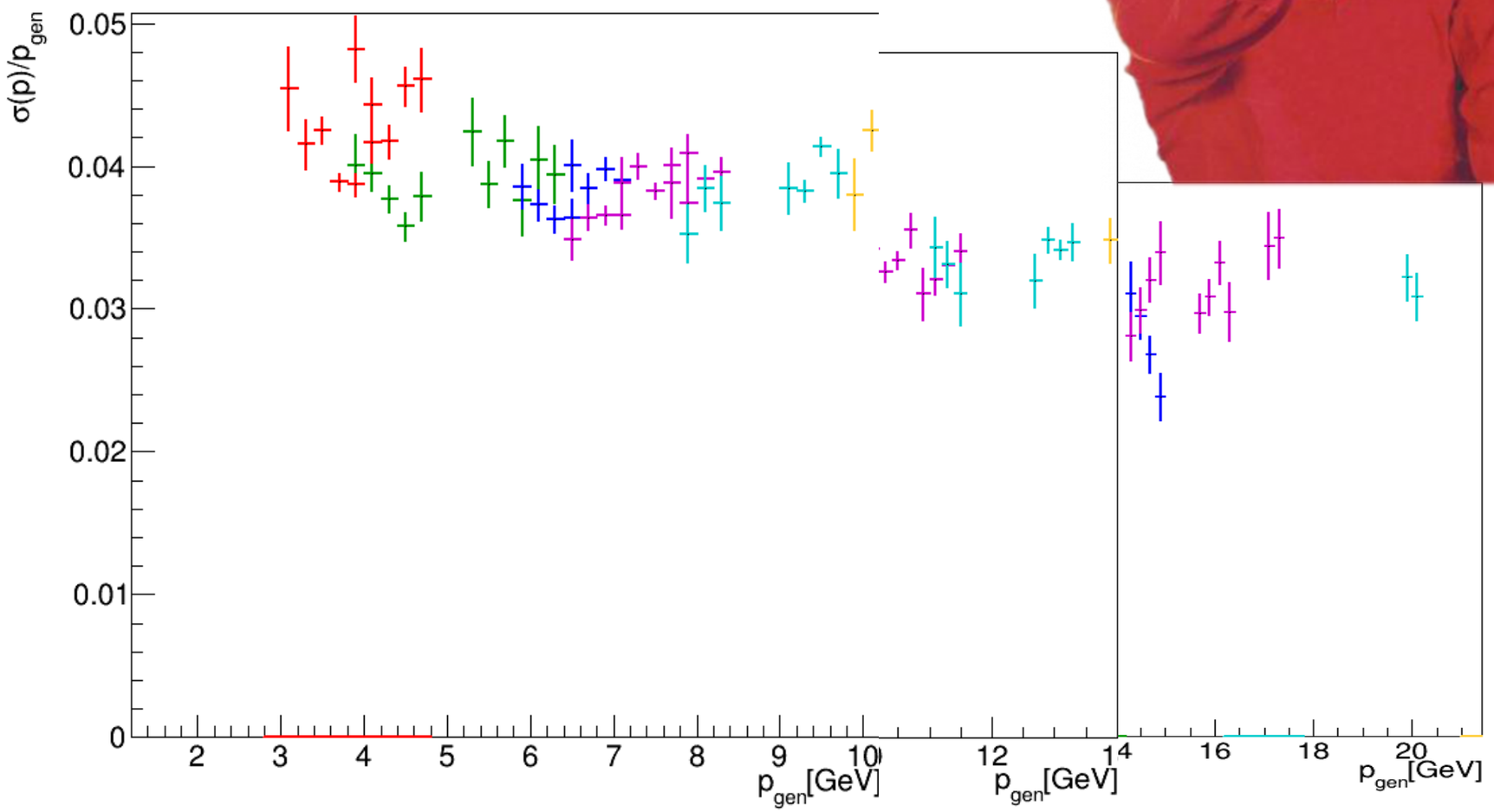






Resolution falls

- Contribution in the full spectrum



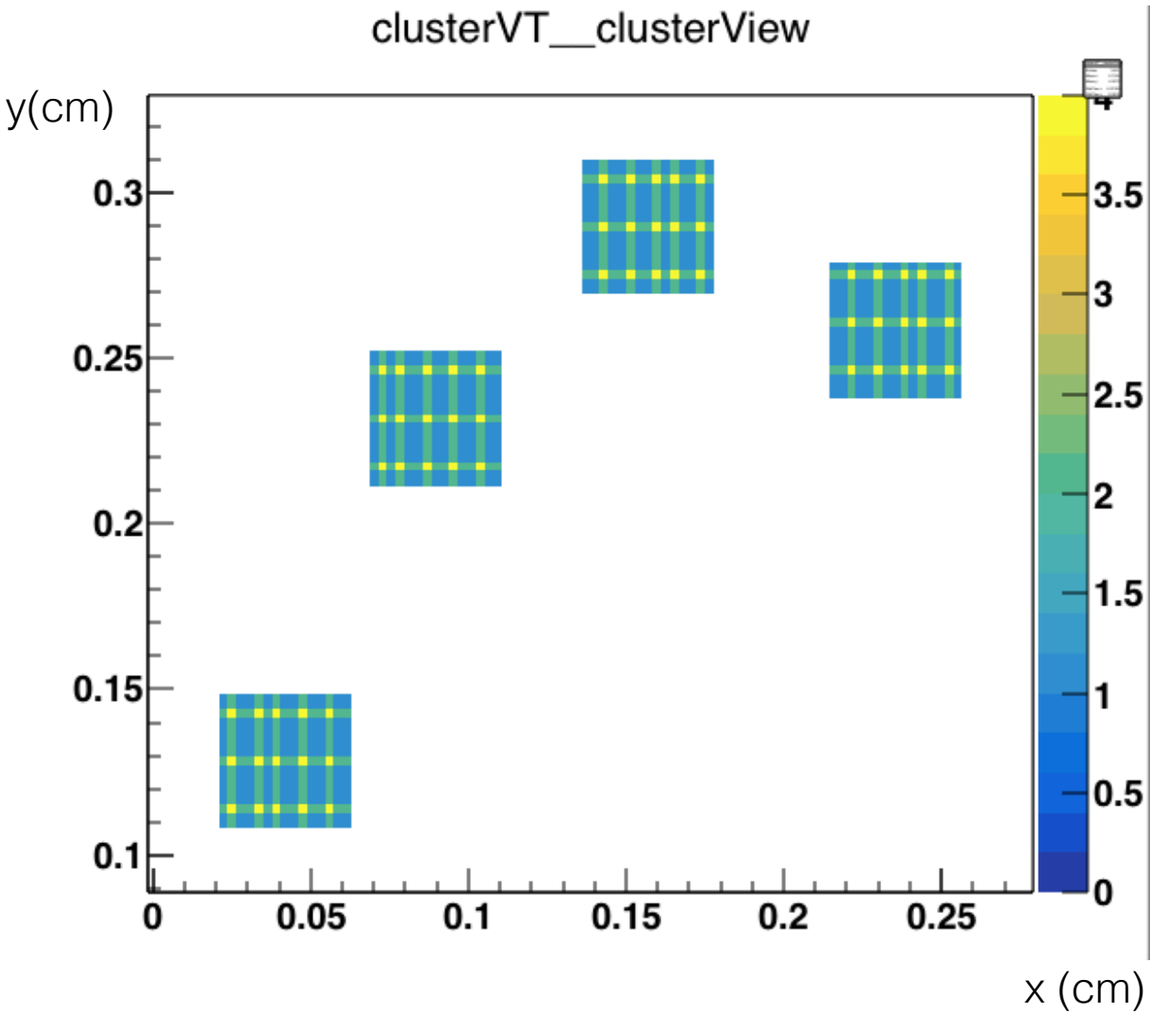
VT & IT clustering

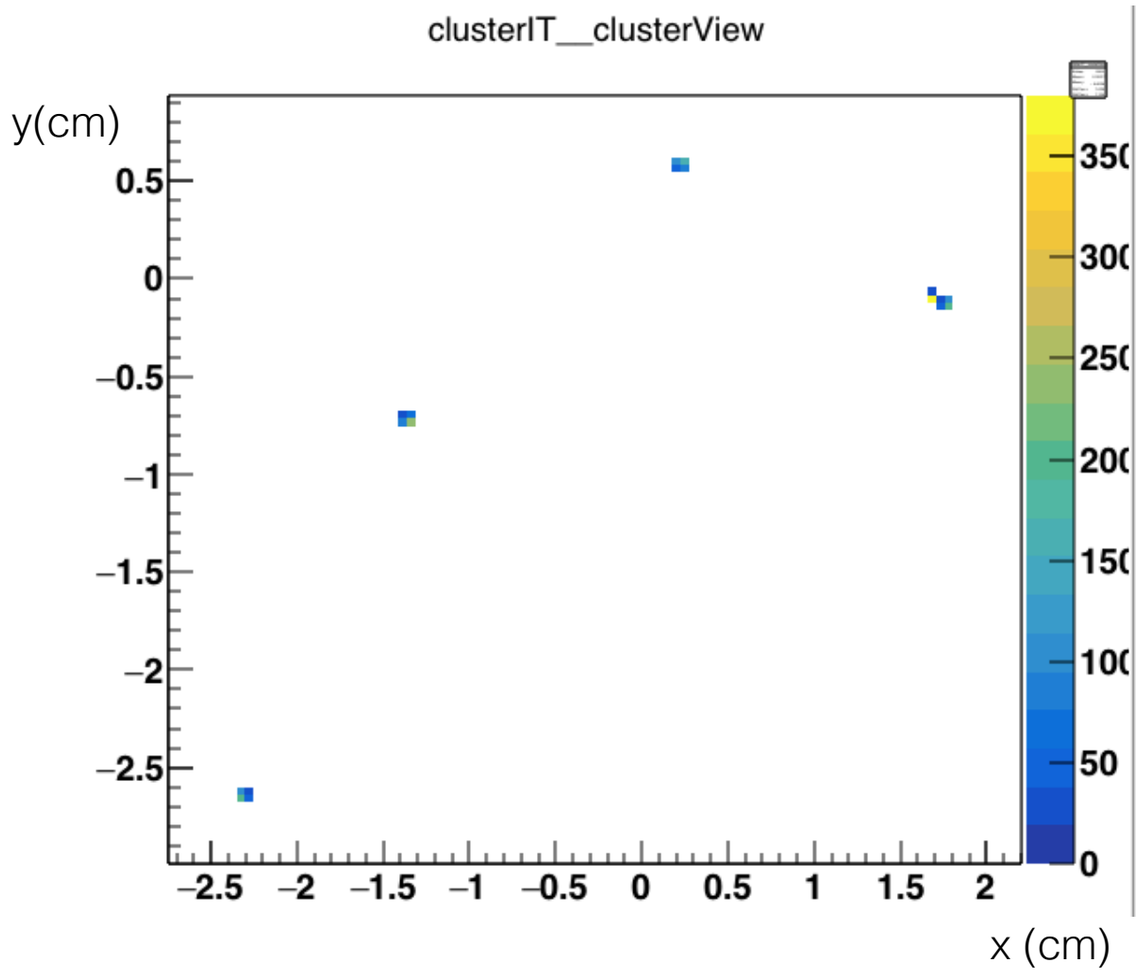
Clustering

- **Re-designed** the clustering classes for both VT and IT…**it works!**
- Now pixels hits are categorised in different group depending on their origin (MC, cluster, noise, pileup, …)
- Possible to **cluster separately** pixels from different groups;
- **“Simple clustering”**: group together neighbours pixels;
- Do not consider possible contact-clusters: improbable, but to be checked;
- **Ready for the digitisation**, working on code harmonisation with Chris. Close to finalisation.

Clustering

(20px square around MC hits for testing)

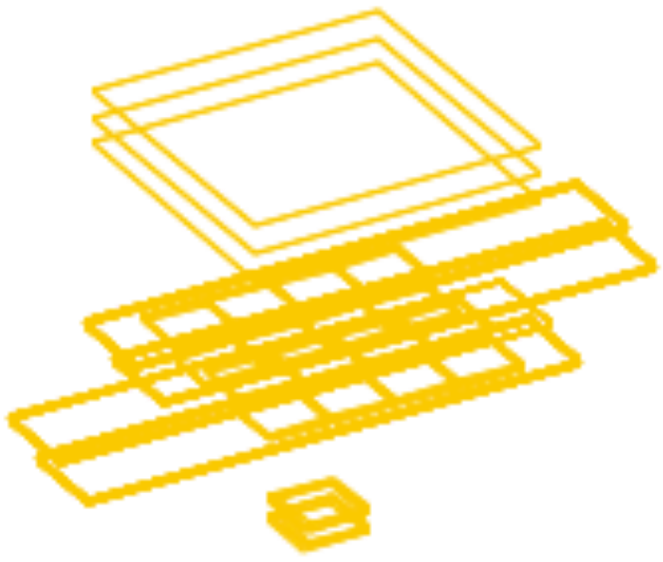


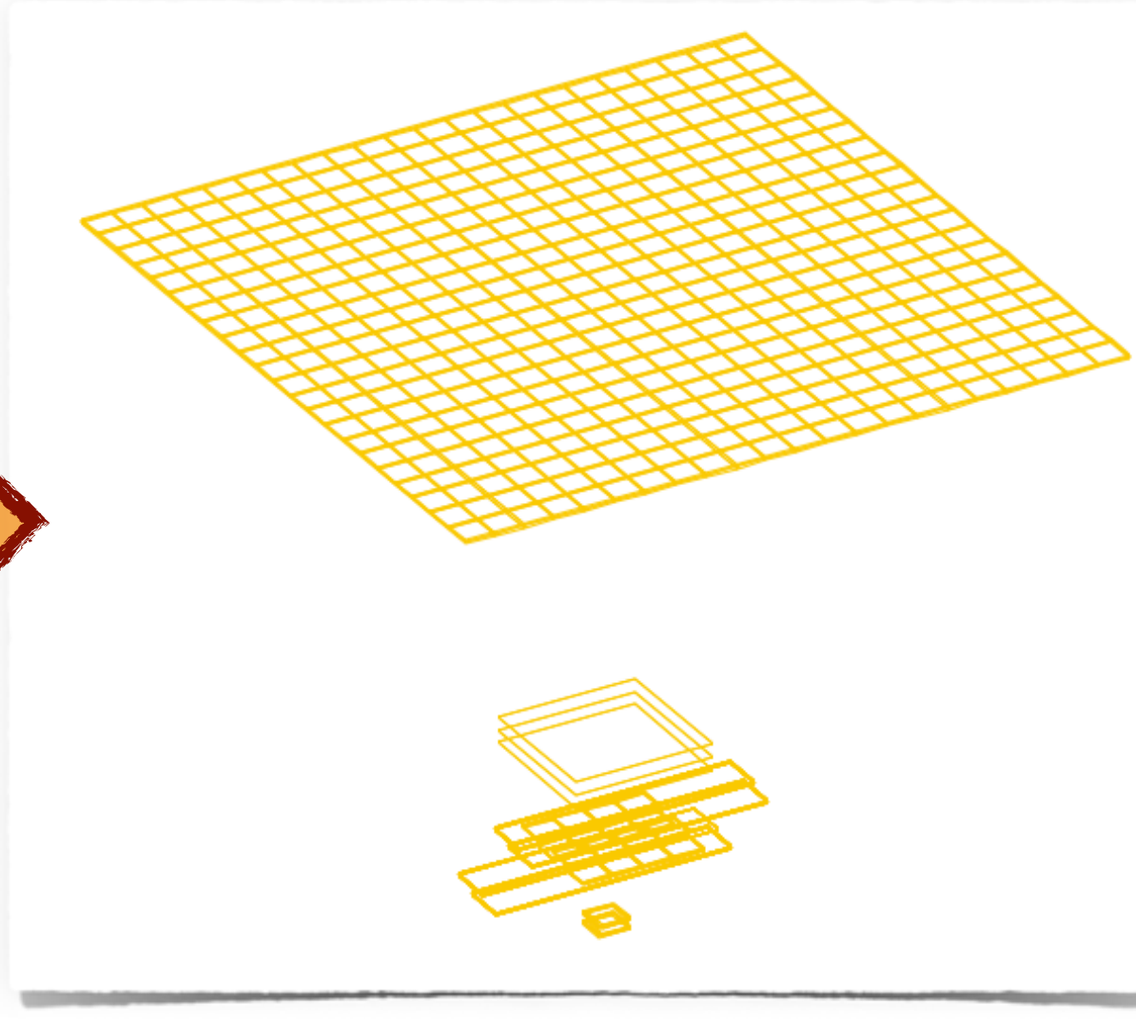



Scintillator ready for
tracking!

Scintillator in tracking

Serena's contribution

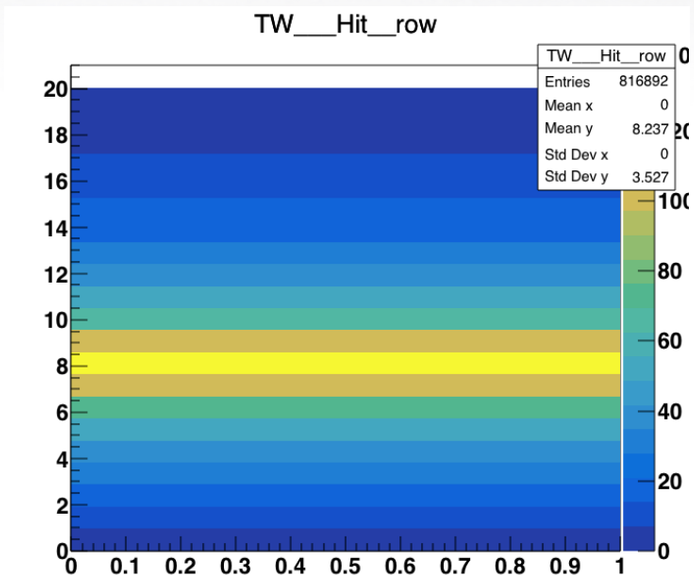


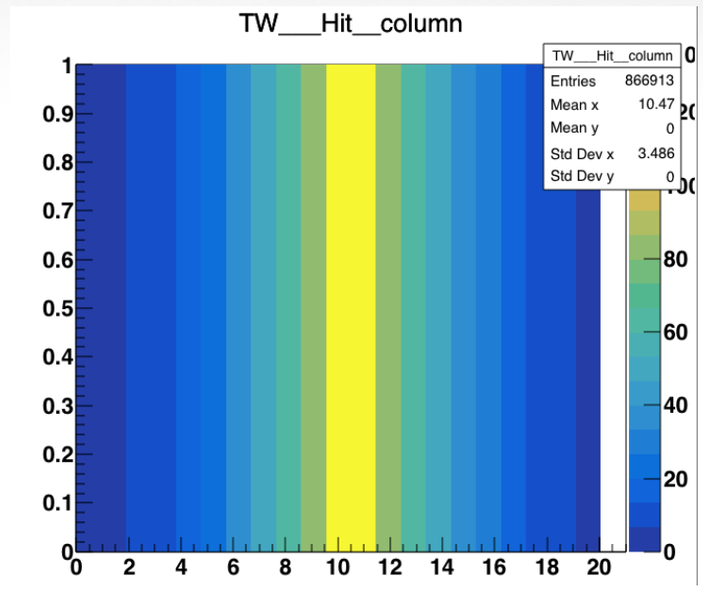


Scintillator in tracking

- **Included** the Scintillator in the Global Reconstruction;

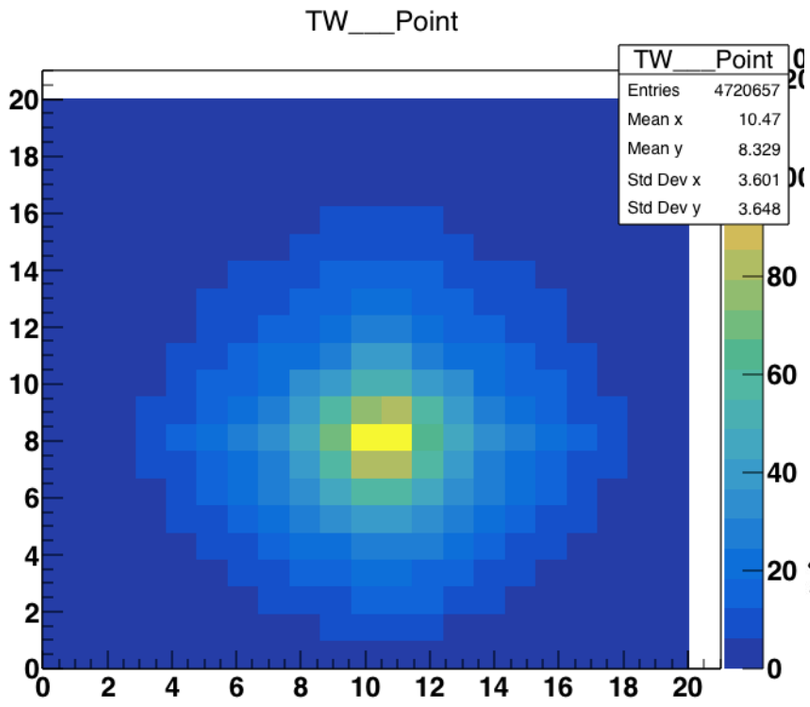
- **Spatial position (x, y)** given by the hit bar, spatial resolution given by
  - **√12*lenght = 0,57cm**.





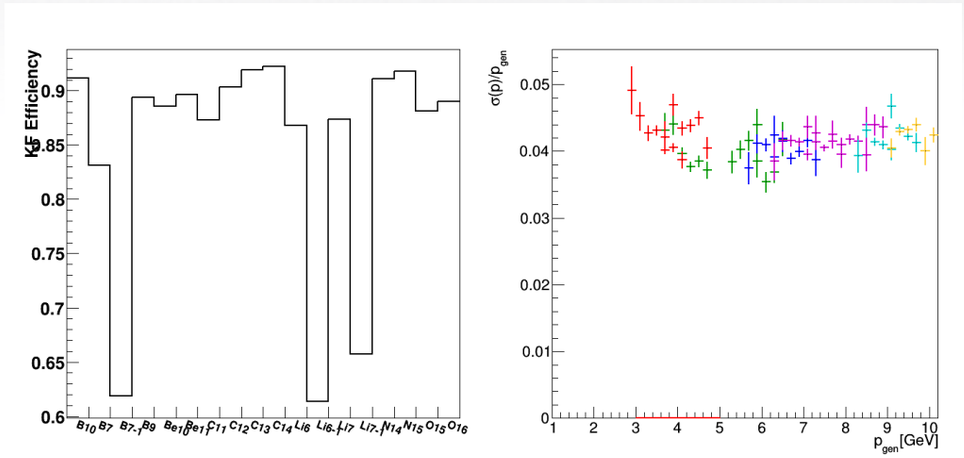
- Founding all the **intersections** between bars with at least one hit;

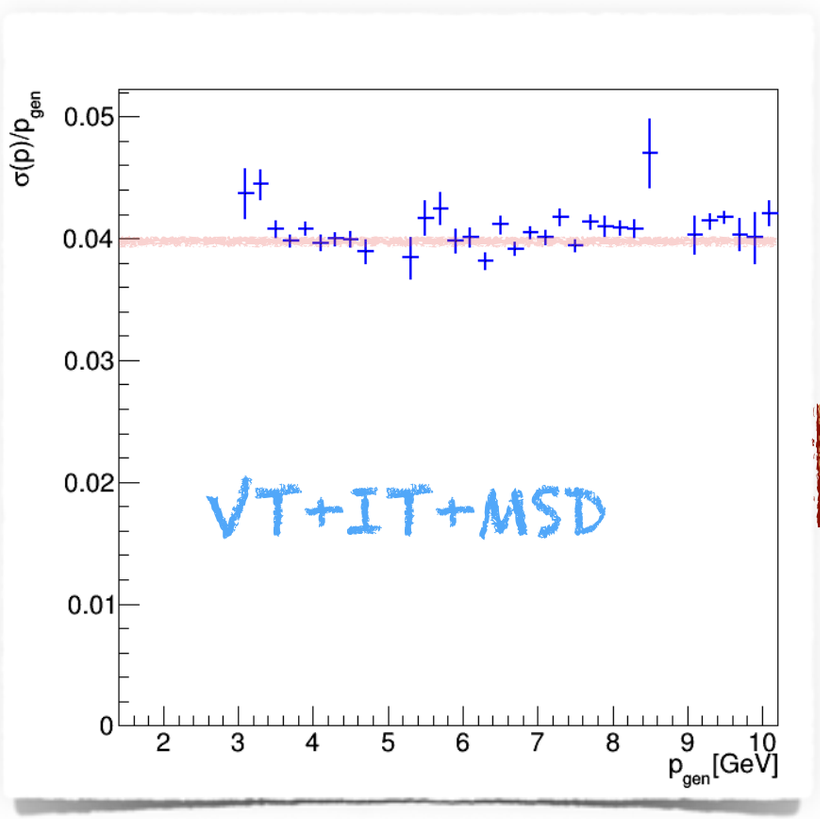
- Using only **non-ghost** intersections for tracking

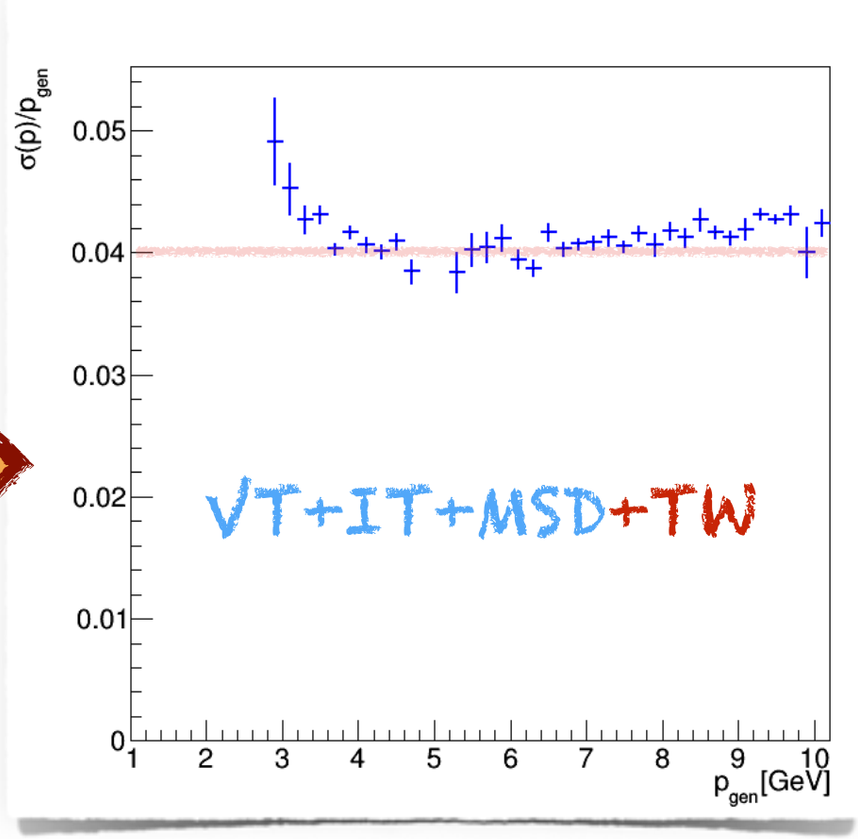


Scintillator in tracking

- Longer lever-arm, worse resolution;
- **Very preliminary result:** cannot improve momentum resolution much…
- … **but** probably useful for **track founding** in the tracking process







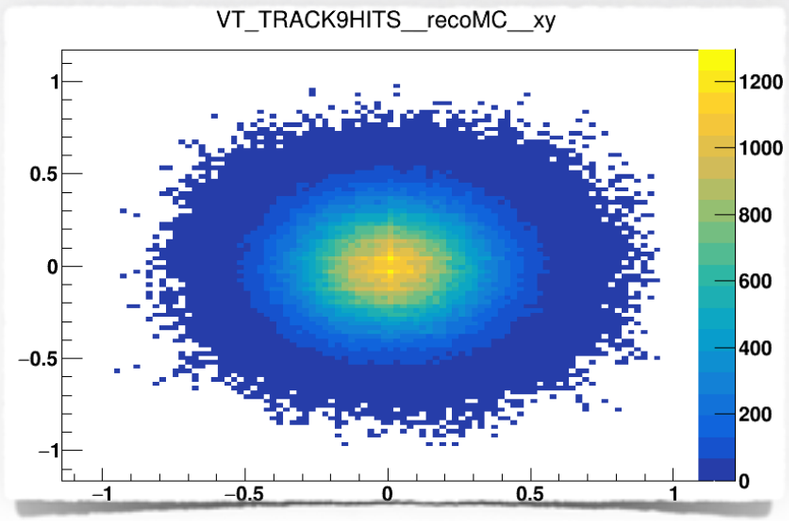

Software bulletin

Software bulletin

- New **developer mailing list** foot-software-develop@lists.infn.it, please add if you're thinking to **contribute** to code developing. In the future, a **user mailing list** will be created;
- Developer contribute is always welcome;
- Useful link: http://arpg-serv.ing2.uniroma1.it/twiki/bin/view/Main/FOOTReconstruction#The_reconstruction_of_data_event
- Code will be soon moved to a FOOT common code git repository;
- One **Branch** for each simulation version, helps to keep order!
- Updates:
  - Association between reco hits and true particles;
  - Hit categorisation and VT&IT clustering;
  - TW fully functioning;
  - …

Conclusion

- **Control plots for reco and geometry monitoring in SHOE**
- **Several tests with magnetic field rotations has been performed**
  - **No significant momentum resolution change observed in the different configurations.**
- **Preliminary multitracking study**
  - **CHI_2 method seems to be promising for VT (eff ~99%)**
    - **To be checked using reclusterd hit.**



- Tested **magnetic map stability** to different stress and uncertainties;
- Found some **desiderata on hardware design** for good tracking performances
- Resolution decrease with momentum explained, **great for high energy beams!**
- **Clustering** in place
- **Scintillator** fully integrated!

- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.02cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm
- Tolerate 500micron z-uncertainty on IT module positioning

THANKS


Back-up

- v14.0.1 -> mag 10cm, interspace 2cm:
  - Total mag field on the FOOT axis (from VT to MDS cm) = **239.389 kG*cm**
  - **integration step:** ~100 micron

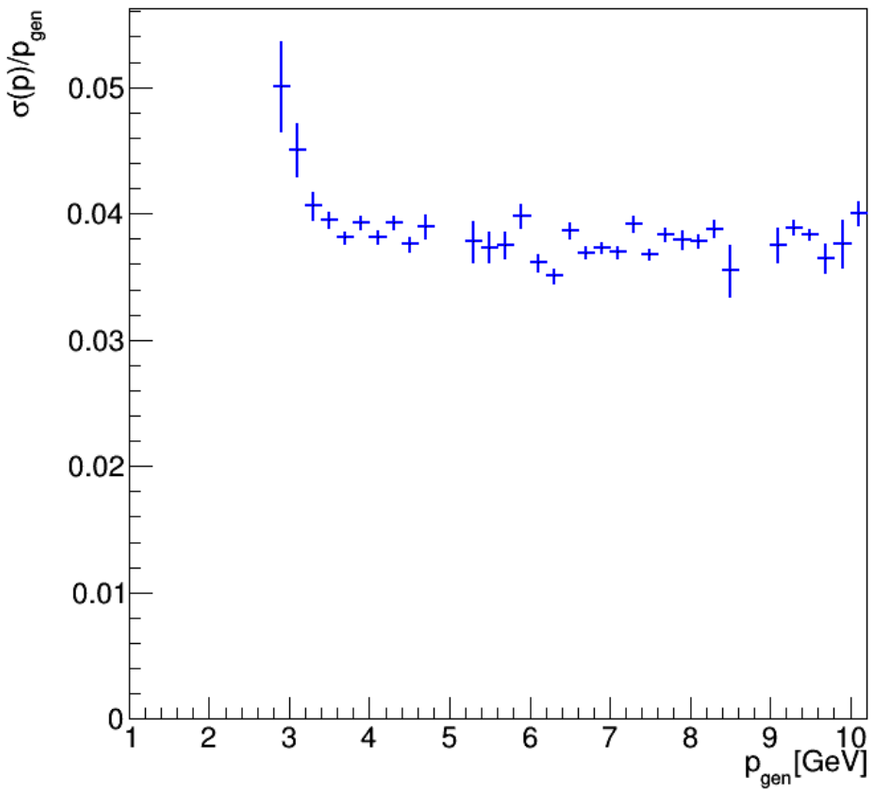
Software bulletin

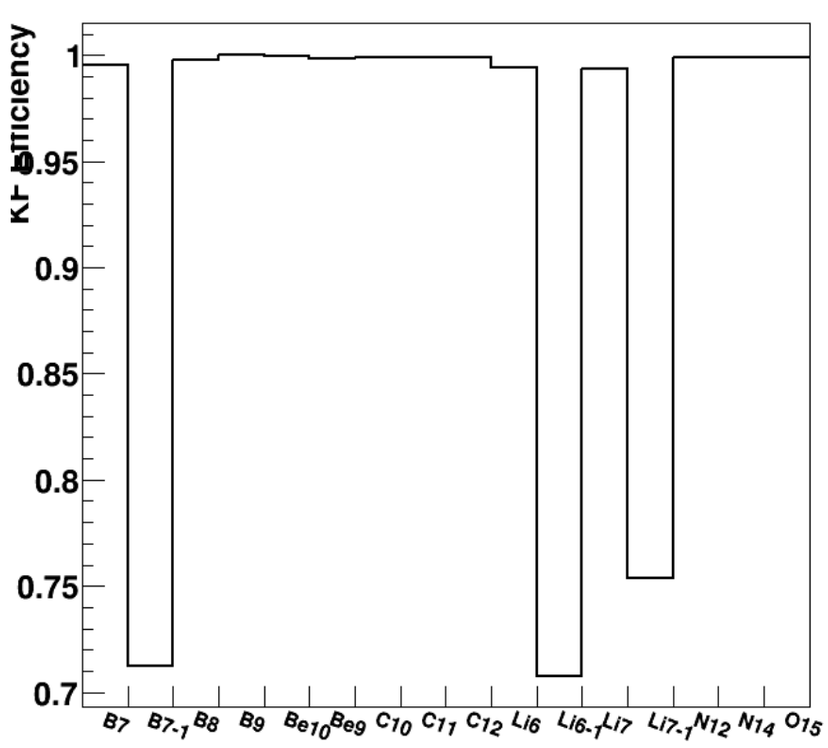
- New developer mailing list, please add if you're thinking to contribute to code developing;
- In the future, a user mailing list will be created;
- One Branch for each simulation version
- Association between reco hits and true particles
- TW fully functioning
- Next:
  - Digitisation VT, IT
  - Digitisation MSD
  - Geometry of truncated pyramids for Calorimeter
  - Hit managing for Calorimeter
  - real-data reading, starting with test-beam
  - vertexing
  - Mutitracking

Momentum Resolution

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

V14.0.1
Magnets: 10 cm
no smearing





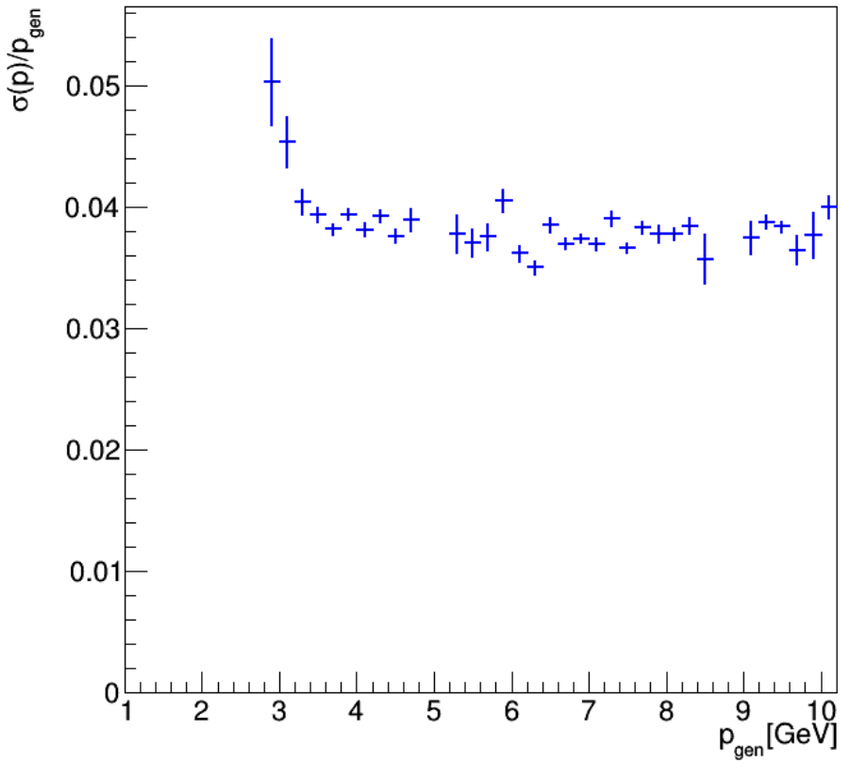
no change%
Efficiency B7 = 0.99514 4914 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998433 3824 3830
Efficiency C10 = 0.998694 6116 6124
Efficiency C11 = 0.999053 8440 8448
Efficiency C12 = 0.999111 4496 4500
Efficiency Li6 = 0.99441 9784 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.993751 4612 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.999137 6945 6951
Efficiency O15 = 0.999085 1092 1093

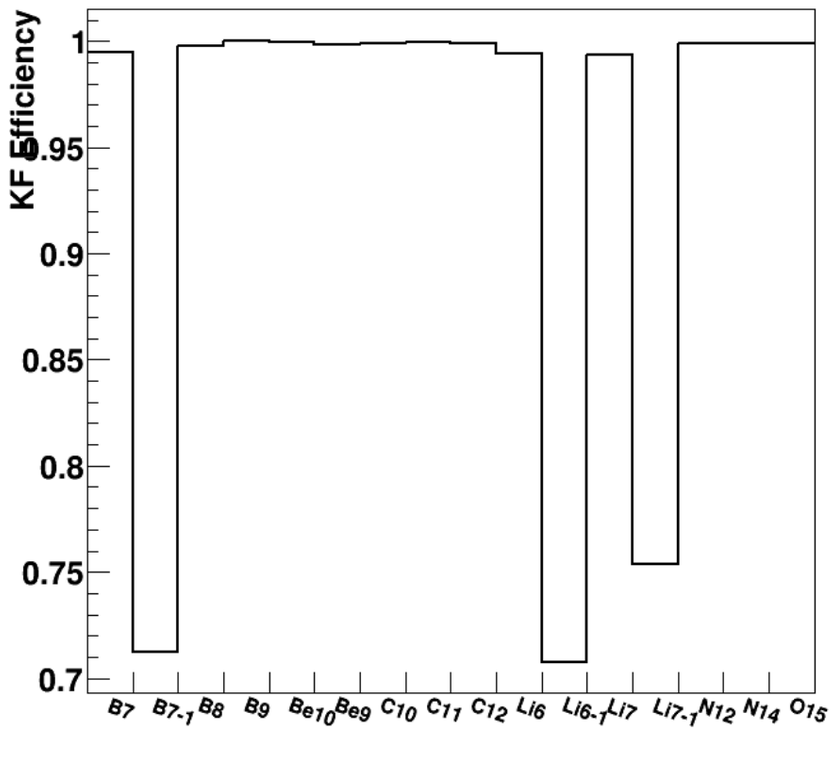
Momentum Resolution

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

V14.0.1
Magnets: 10 cm
1% smearing

0,1%
Efficiency B7 = 0.994735 4912 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998172 3823 3830
Efficiency C10 = 0.99902 6118 6124
Efficiency C11 = 0.99929 8442 8448
Efficiency C12 = 0.999111 4496 4500
Efficiency Li6 = 0.994105 9781 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.99332 4610 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.998993 6944 6951
Efficiency O15 = 0.999085 1092 1093



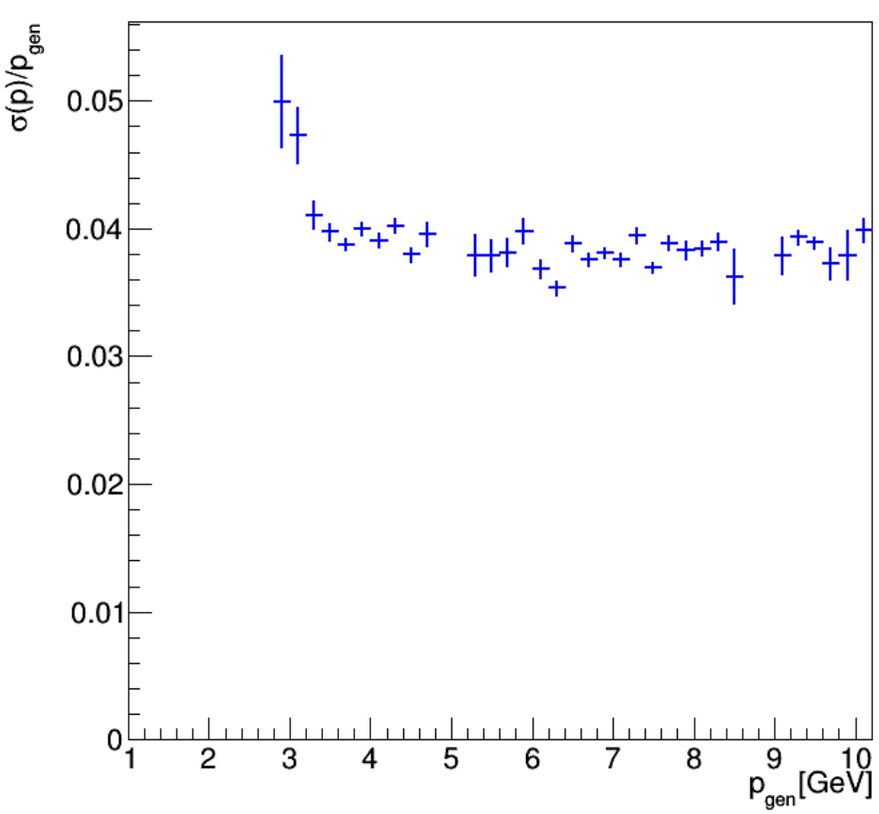


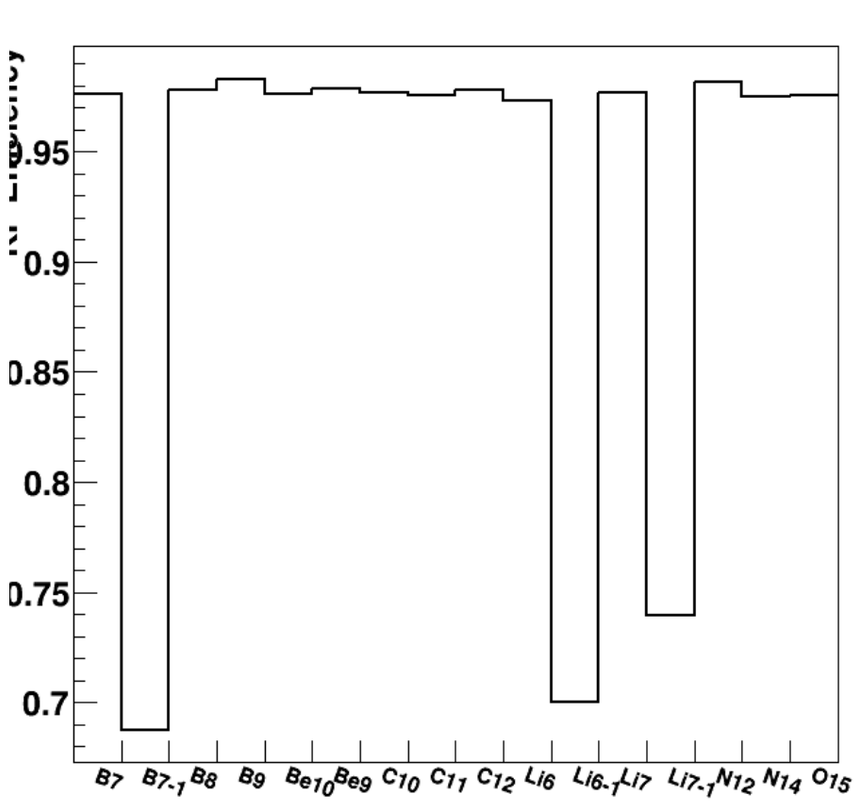
Momentum Resolution

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

V14.0.1
Magnets: 10 cm
5% smearing

5%
Efficiency B7 = 0.975901 4819 4938
Efficiency B7-1 = 0.6875 110 160
Efficiency B8 = 0.97786 1590 1626
Efficiency B9 = 0.982659 1020 1038
Efficiency Be10 = 0.976389 4673 4786
Efficiency Be9 = 0.978329 3747 3830
Efficiency C10 = 0.976486 5980 6124
Efficiency C11 = 0.975852 8244 8448
Efficiency C12 = 0.978 4401 4500
Efficiency Li6 = 0.973066 9574 9839
Efficiency Li6-1 = 0.700361 194 277
Efficiency Li7 = 0.976514 4532 4641
Efficiency Li7-1 = 0.739726 54 73
Efficiency N12 = 0.981424 1268 1292
Efficiency N14 = 0.974968 6777 6951
Efficiency O15 = 0.975297 1066 1093





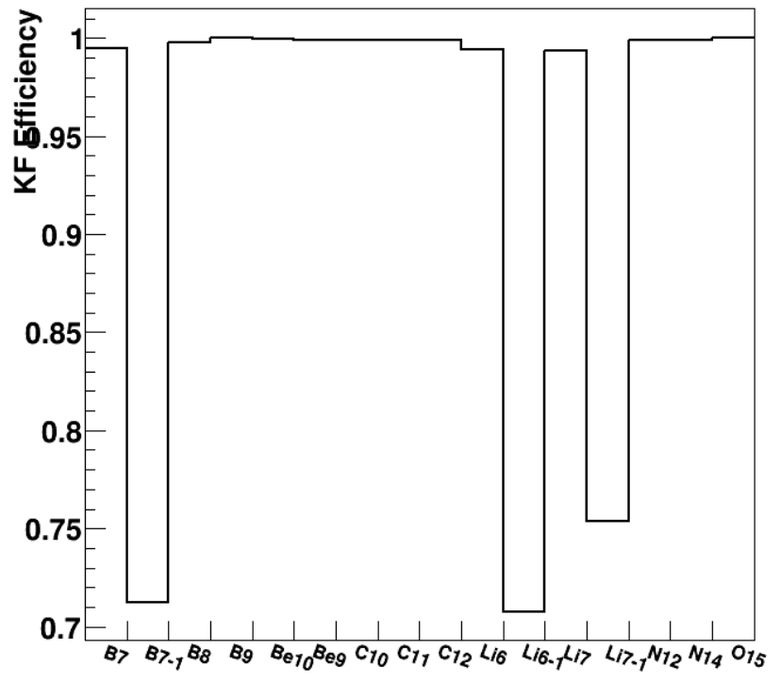
Momentum Resolution

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

V14.0.1
Magnets: 10 cm
0,5% smearing

0,5%
Efficiency B7 = 0.994937 4913 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998695 3825 3830
Efficiency C10 = 0.998694 6116 6124
Efficiency C11 = 0.999053 8440 8448
Efficiency C12 = 0.998889 4495 4500
Efficiency Li6 = 0.994308 9783 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.993751 4612 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.999137 6945 6951
Efficiency O15 = 1 1093 1093

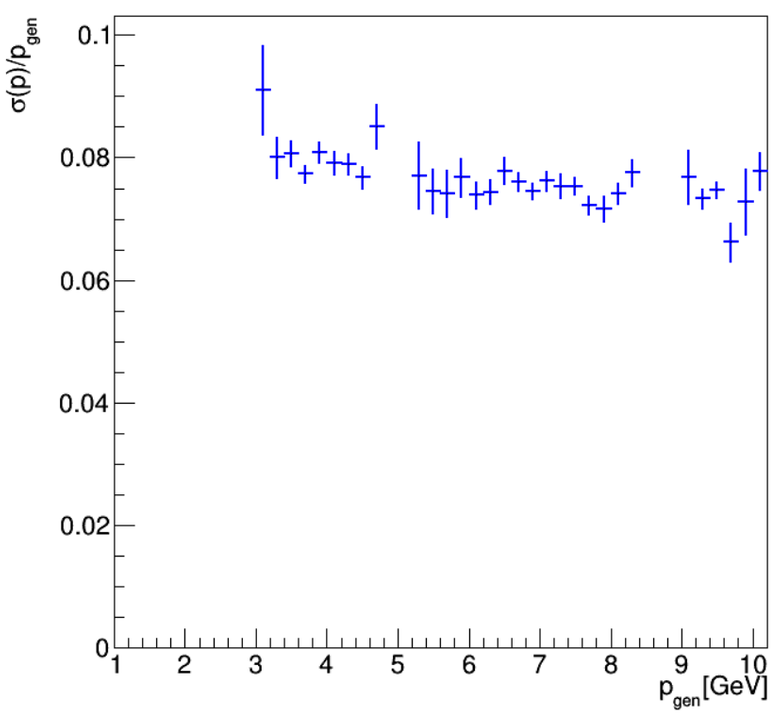
plot no needed looking at the others…

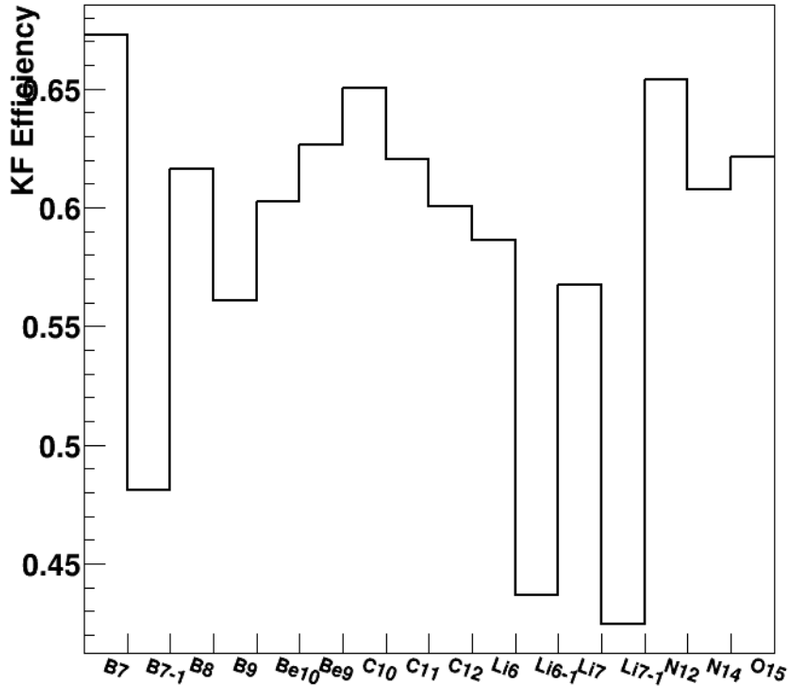


Momentum Resolution

- **VT** xy Reso: 0.0006cm
  z Reso: 0.0025cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.0025cm
- **MSD** xy Reso: 0.001cm
  z Reso : 0.050cm

V14.0.1
Magnets: 10 cm
50% smearing





50%
Efficiency B7 = 0.672539 3321 4938
Efficiency B7-1 = 0.48125 77 160
Efficiency B8 = 0.616236 1002 1626
Efficiency B9 = 0.560694 582 1038
Efficiency Be10 = 0.602382 2883 4786
Efficiency Be9 = 0.626371 2399 3830
Efficiency C10 = 0.650229 3982 6124
Efficiency C11 = 0.620265 5240 8448
Efficiency C12 = 0.600667 2703 4500
Efficiency Li6 = 0.586035 5766 9839
Efficiency Li6-1 = 0.436823 121 277
Efficiency Li7 = 0.56755 2634 4641
Efficiency Li7-1 = 0.424658 31 73
Efficiency N12 = 0.654025 845 1292
Efficiency N14 = 0.607826 4225 6951
Efficiency O15 = 0.621226 679 1093

no change%
Efficiency B7 = 0.99514 4914 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998433 3824 3830
Efficiency C10 = 0.998694 6116 6124
Efficiency C11 = 0.999053 8440 8448
Efficiency C12 = 0.999111 4496 4500
Efficiency Li6 = 0.99441 9784 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.993751 4612 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.999137 6945 6951
Efficiency O15 = 0.999085 1092 1093

1%
Efficiency B7 = 0.994735 4912 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998172 3823 3830
Efficiency C10 = 0.99902 6118 6124
Efficiency C11 = 0.99929 8442 8448
Efficiency C12 = 0.999111 4496 4500
Efficiency Li6 = 0.994105 9781 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.99332 4610 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.998993 6944 6951
Efficiency O15 = 0.999085 1092 1093

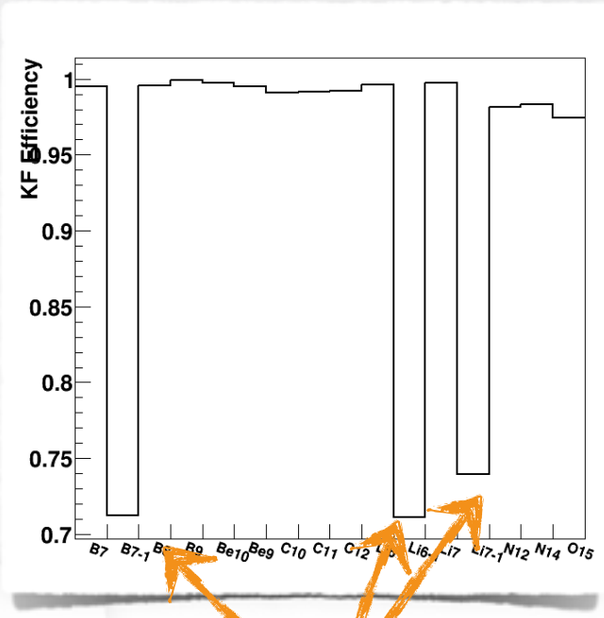
5%
Efficiency B7 = 0.975901 4819 4938
Efficiency B7-1 = 0.6875 110 160
Efficiency B8 = 0.97786 1590 1626
Efficiency B9 = 0.982659 1020 1038
Efficiency Be10 = 0.976389 4673 4786
Efficiency Be9 = 0.978329 3747 3830
Efficiency C10 = 0.976486 5980 6124
Efficiency C11 = 0.975852 8244 8448
Efficiency C12 = 0.978 4401 4500
Efficiency Li6 = 0.973066 9574 9839
Efficiency Li6-1 = 0.700361 194 277
Efficiency Li7 = 0.976514 4532 4641
Efficiency Li7-1 = 0.739726 54 73
Efficiency N12 = 0.981424 1268 1292
Efficiency N14 = 0.974968 6777 6951
Efficiency O15 = 0.975297 1066 1093

0,5%
Efficiency B7 = 0.994937 4913 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.99754 1622 1626
Efficiency B9 = 1 1038 1038
Efficiency Be10 = 0.999582 4784 4786
Efficiency Be9 = 0.998695 3825 3830
Efficiency C10 = 0.998694 6116 6124
Efficiency C11 = 0.999053 8440 8448
Efficiency C12 = 0.998889 4495 4500
Efficiency Li6 = 0.994308 9783 9839
Efficiency Li6-1 = 0.707581 196 277
Efficiency Li7 = 0.993751 4612 4641
Efficiency Li7-1 = 0.753425 55 73
Efficiency N12 = 0.999226 1291 1292
Efficiency N14 = 0.999137 6945 6951
Efficiency O15 = 1 1093 1093

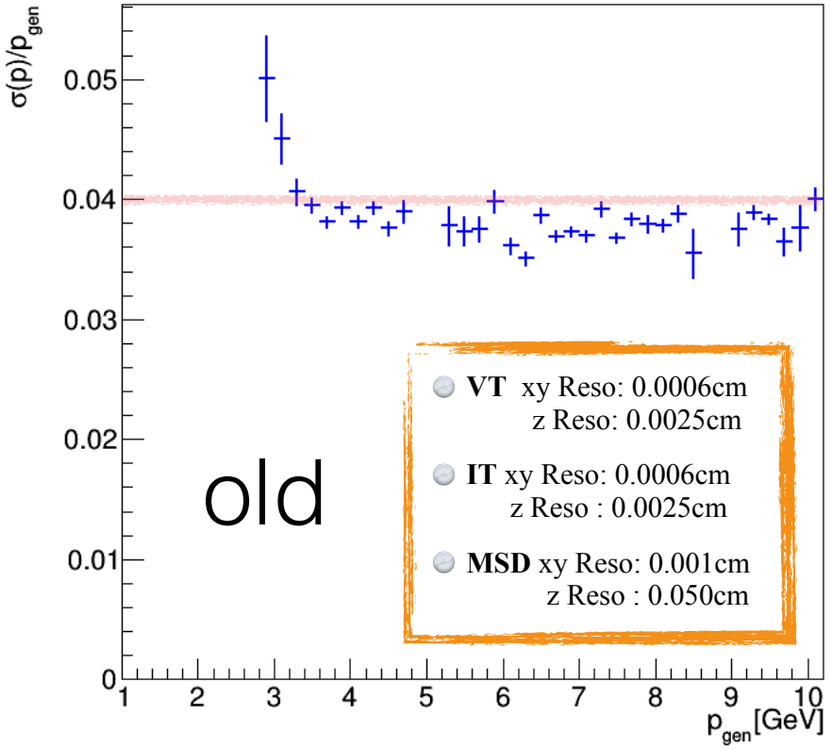
Updated Resolutions

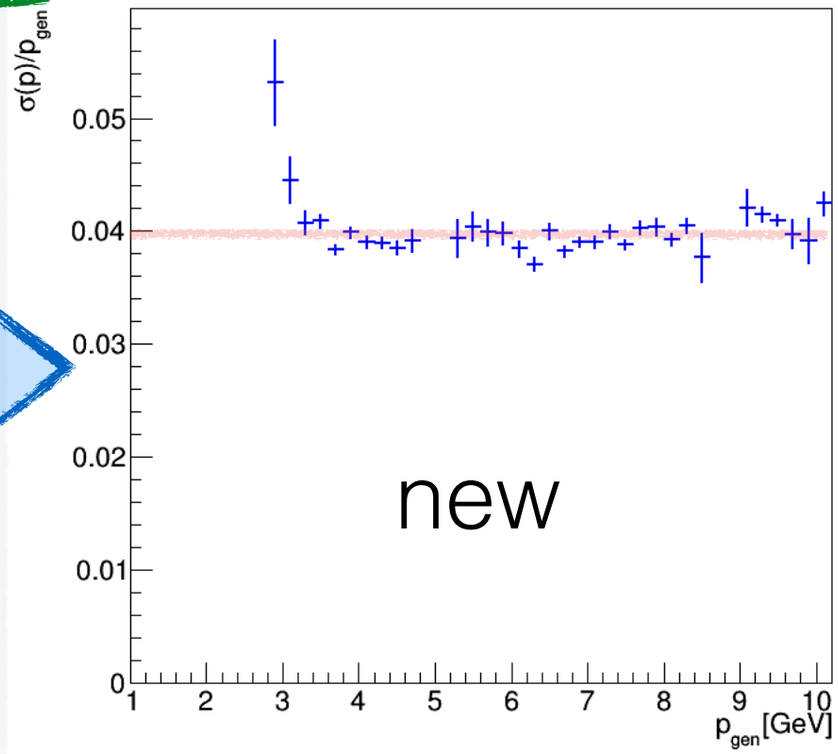
- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.005cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

Efficiency B7 = 0.994937 4913 4938
Efficiency B7-1 = 0.7125 114 160
Efficiency B8 = 0.995695 1619 1626
Efficiency B9 = 0.999037 1037 1038
Efficiency Be10 = 0.997493 4774 4786
Efficiency Be9 = 0.9953 3812 3830
Efficiency C10 = 0.991019 6069 6124
Efficiency C11 = 0.991477 8376 8448
Efficiency C12 = 0.992 4464 4500
Efficiency Li6 = 0.996341 9803 9839
Efficiency Li6-1 = 0.711191 197 277
Efficiency Li7 = 0.997199 4628 4641
Efficiency Li7-1 = 0.739726 54 73
Efficiency N12 = 0.981424 1268 1292
Efficiency N14 = 0.983168 6834 6951
Efficiency O15 = 0.974382 1065 1093



Efficiency drop in case of a second fragment of the same type is found in the event. **Low stat.**

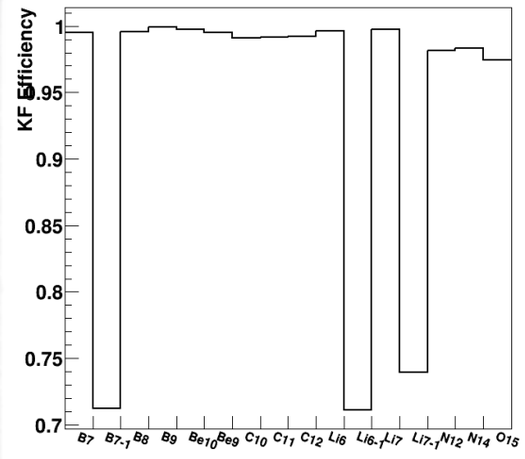




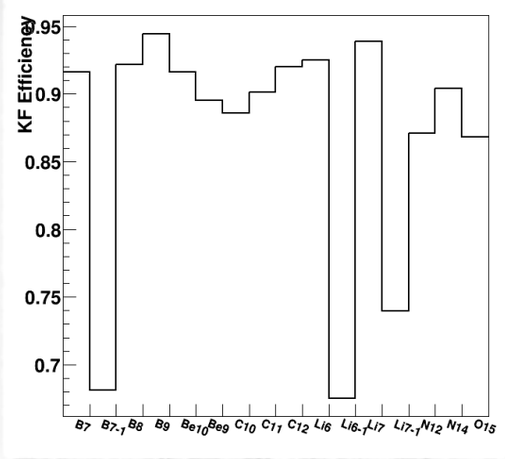
Updated Resolutions II

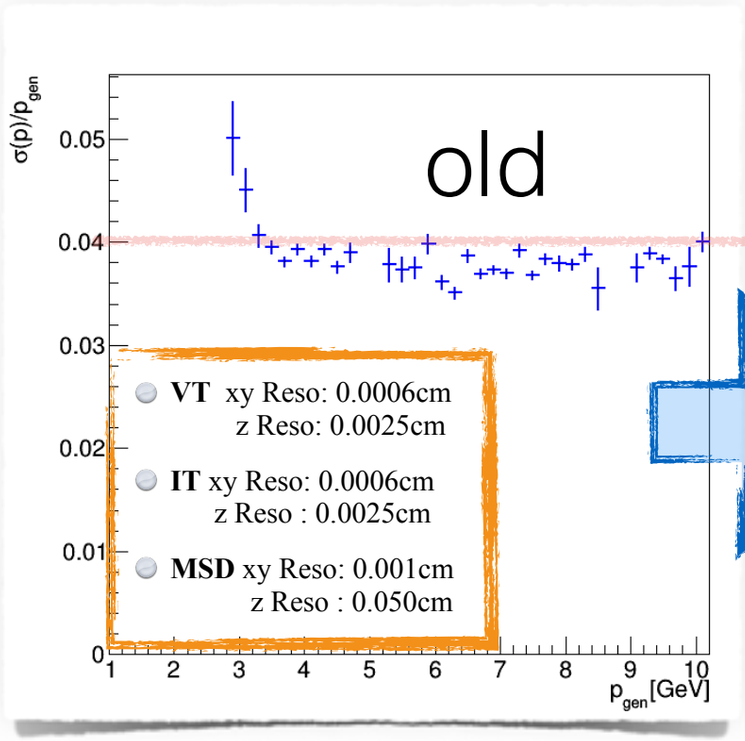
- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.05cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

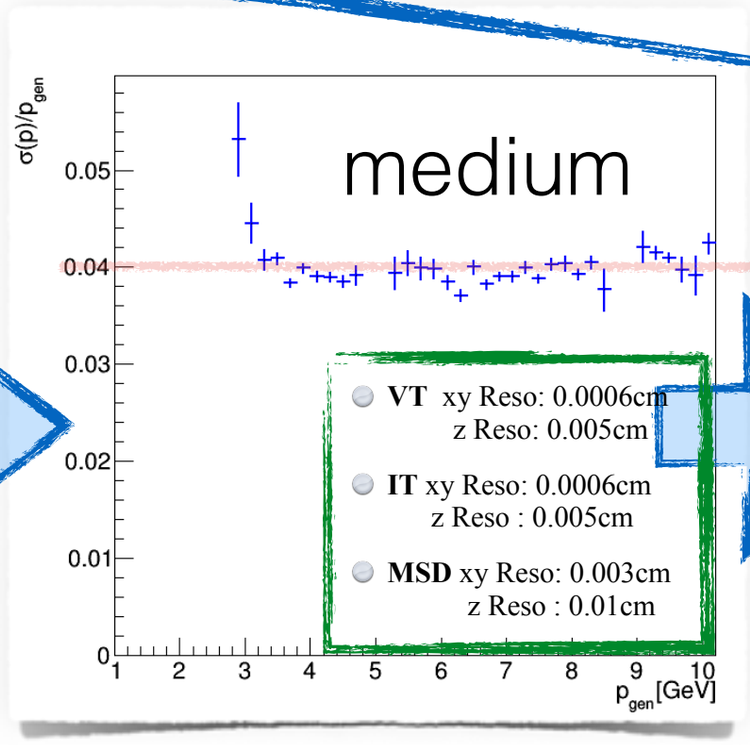
medium

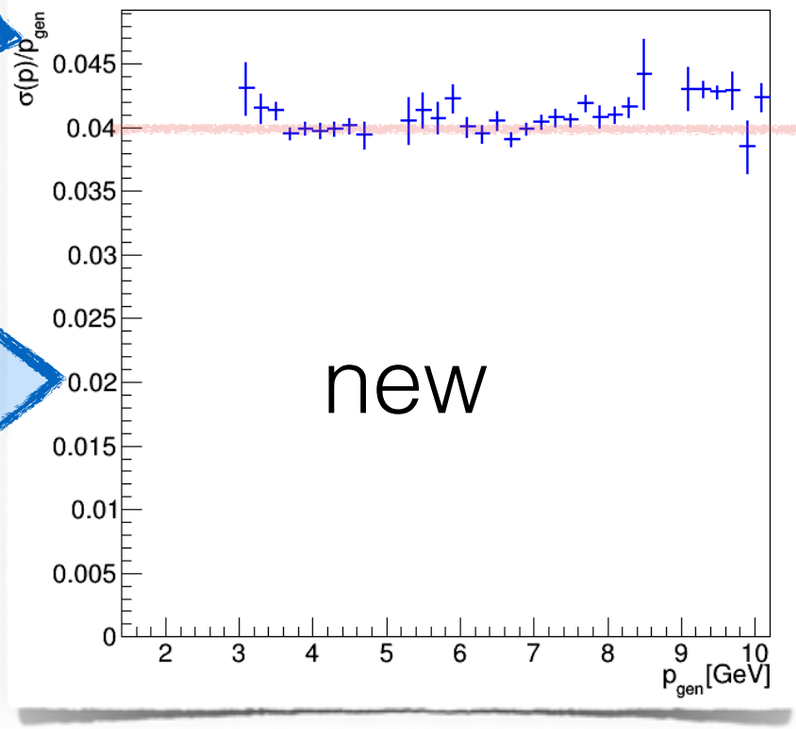


new



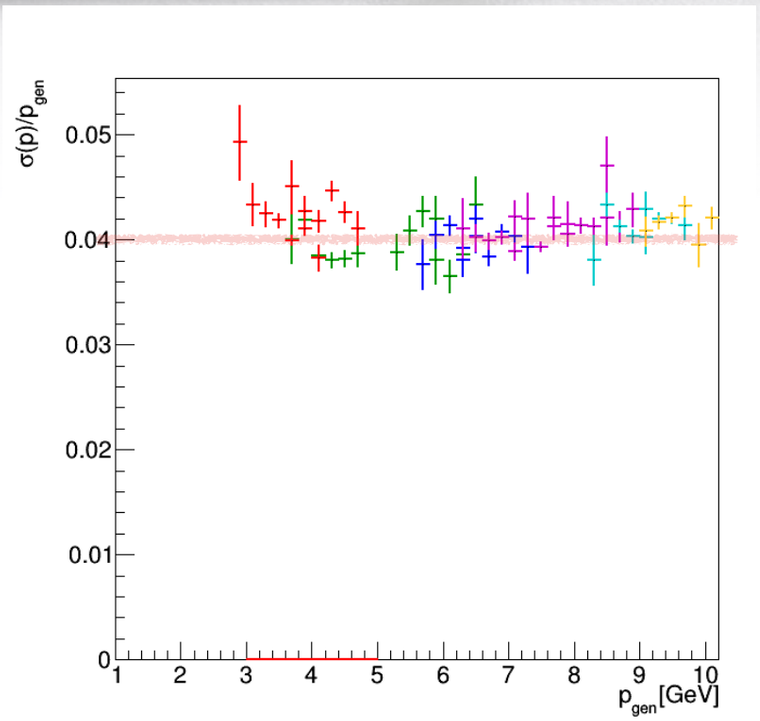


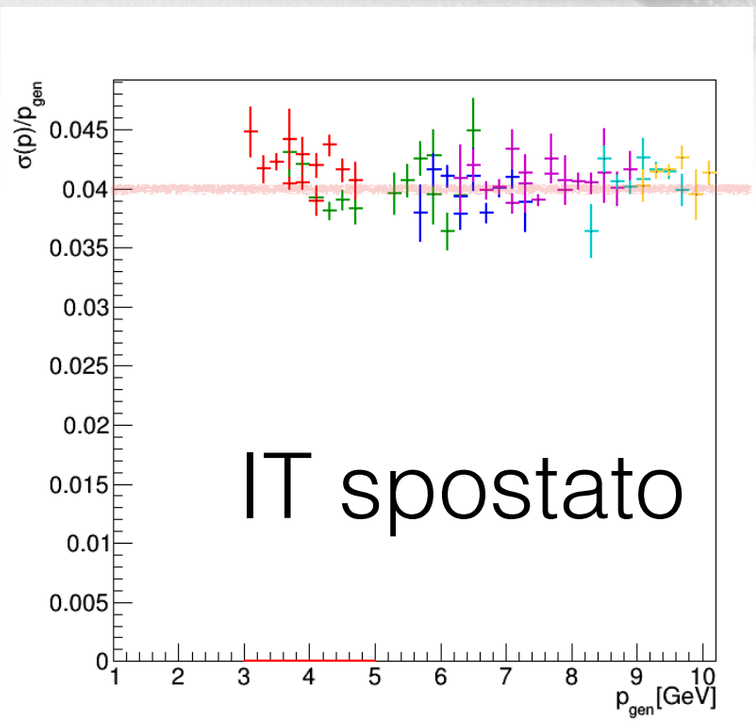


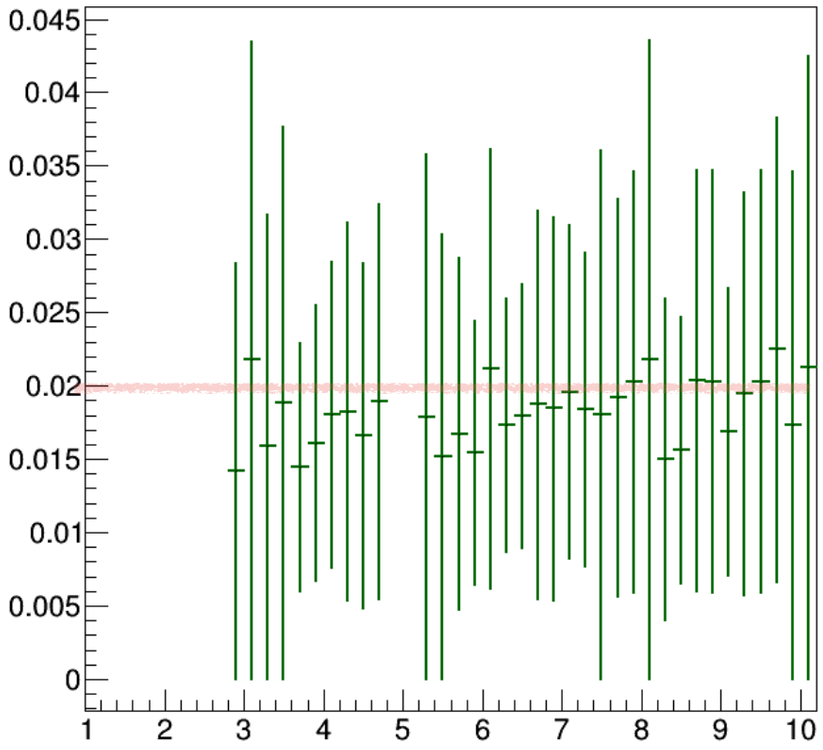


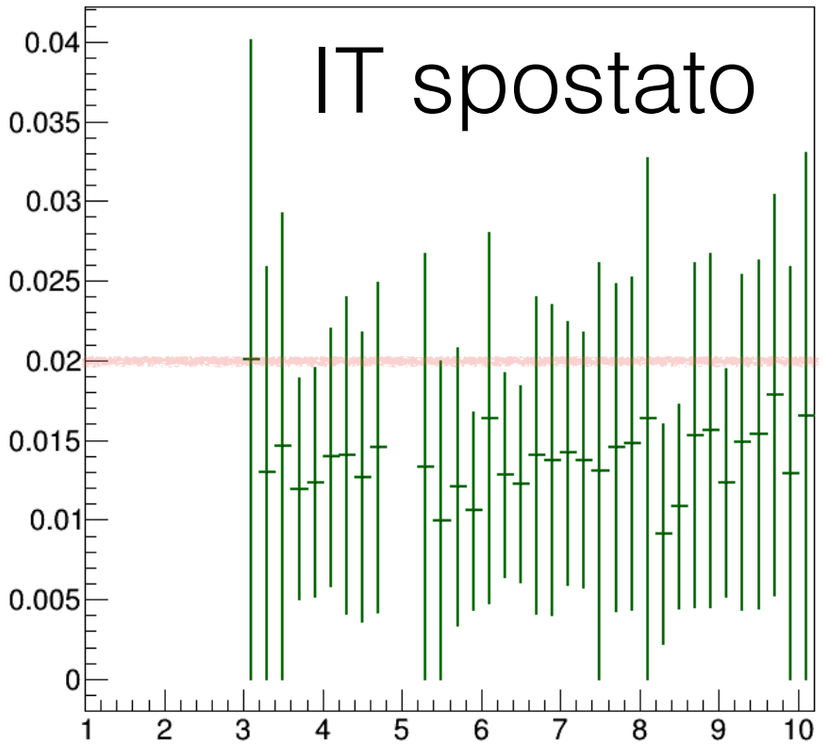
Resolution do not worsen much, Kalman efficiency does, some under 80%
(almost 99% before!!!)

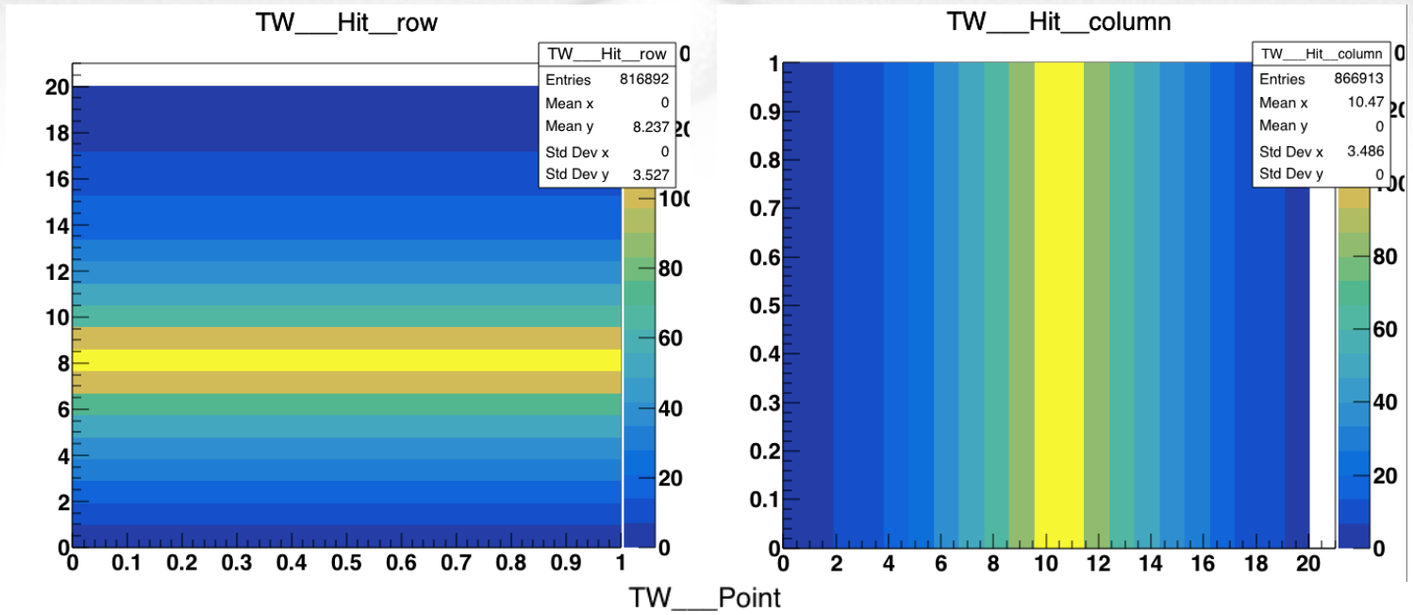
ITR shift test II



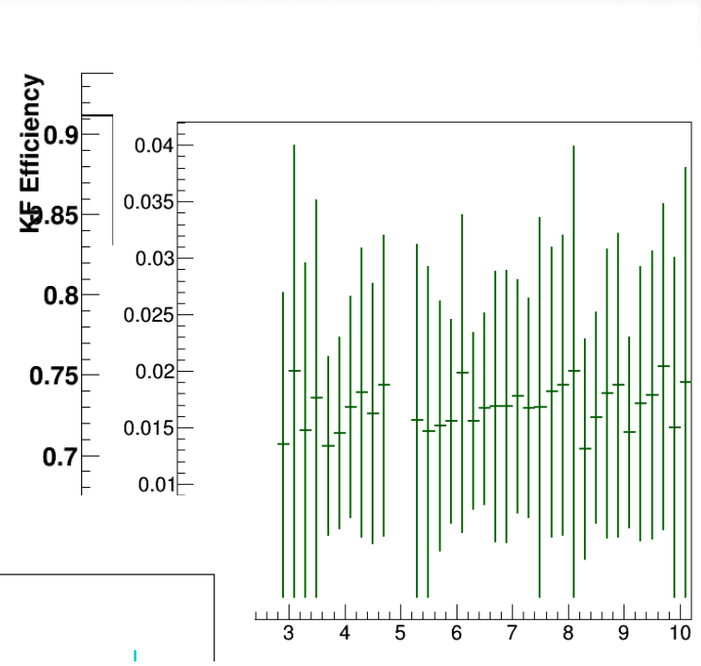




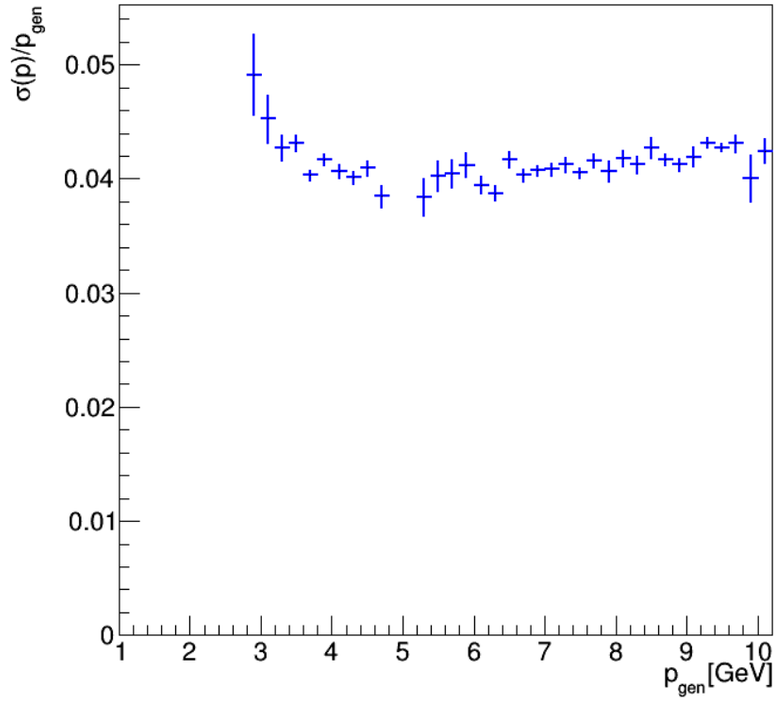


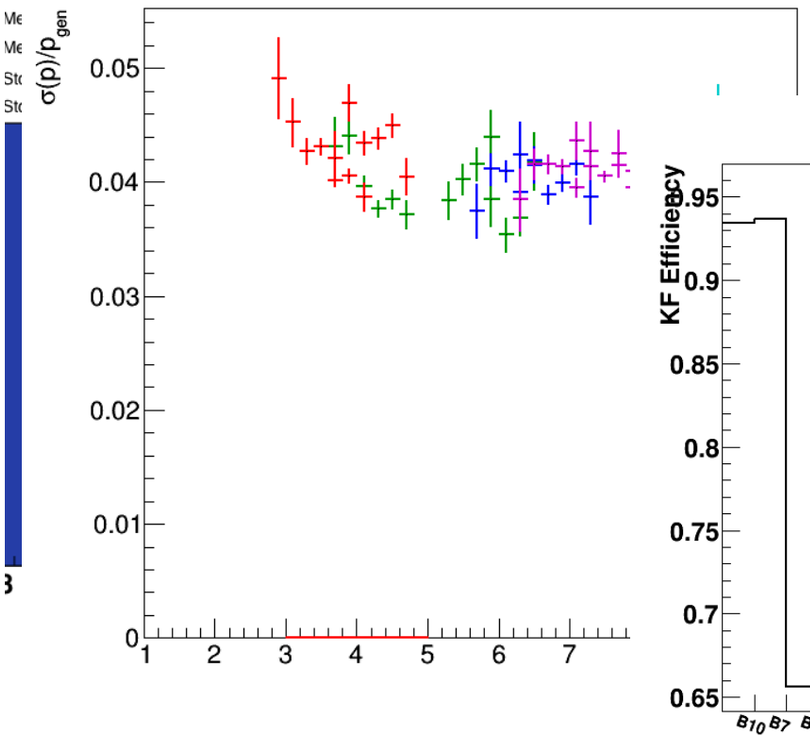

TW___Hit__row
TW___Hit__row
Entries 816892
Mean x 0
Mean y 8.237
Std Dev x 0
Std Dev y 3.527

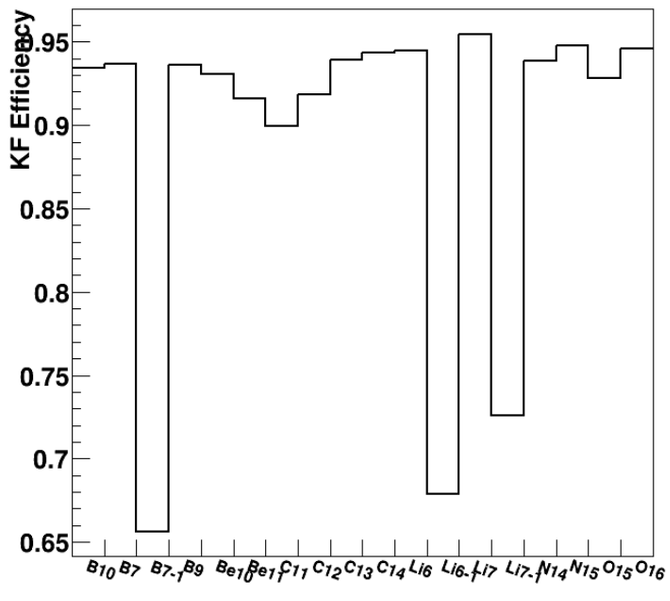
TW___Hit__column
TW___Hit__column
Entries 866913
Mean x 10.47
Mean y 0
Std Dev x 3.486
Std Dev y 0


KF Efficiency

TW___Point


σ(p)/p_gen
p_gen [GeV]

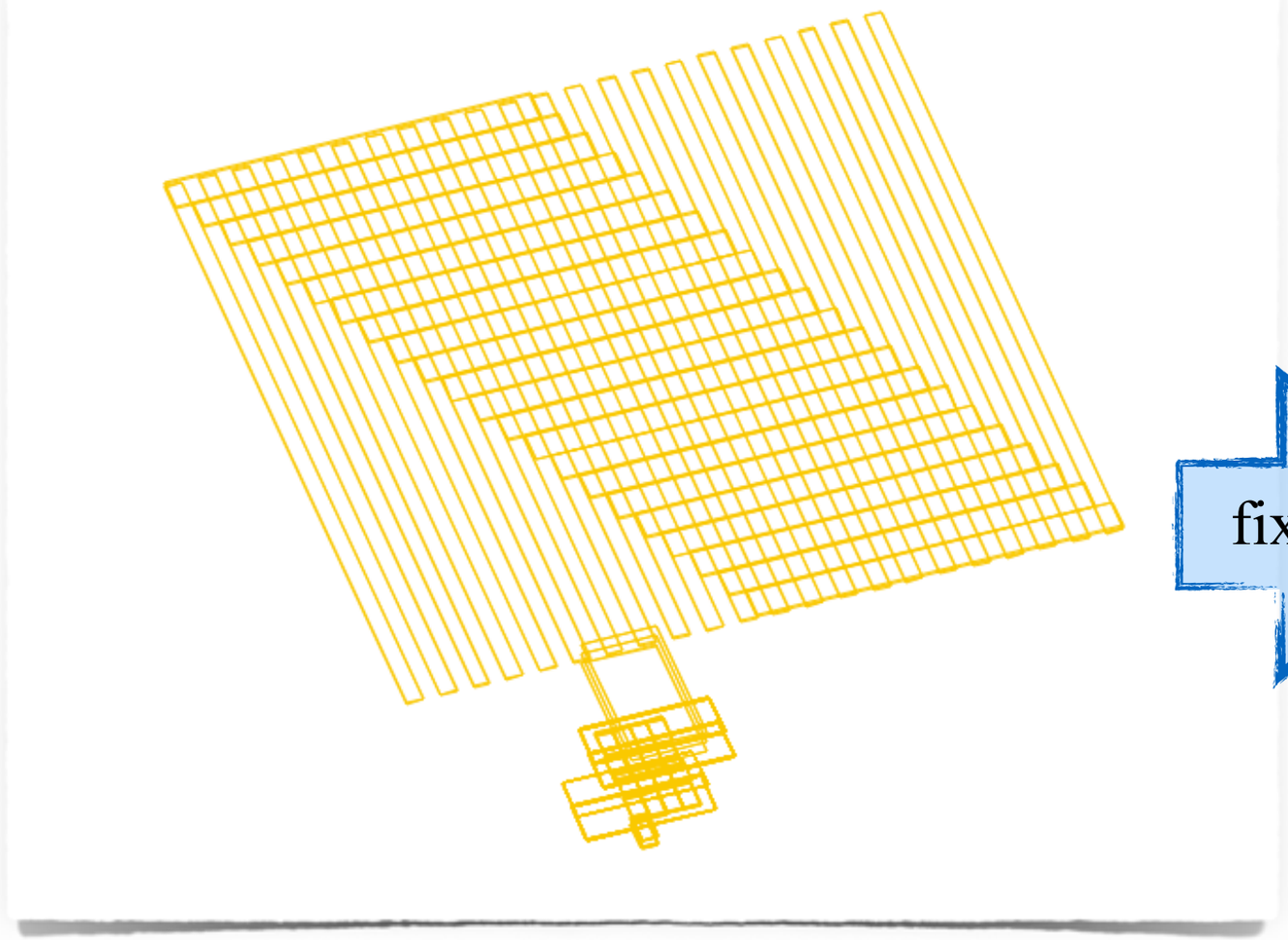

σ(p)/p_gen

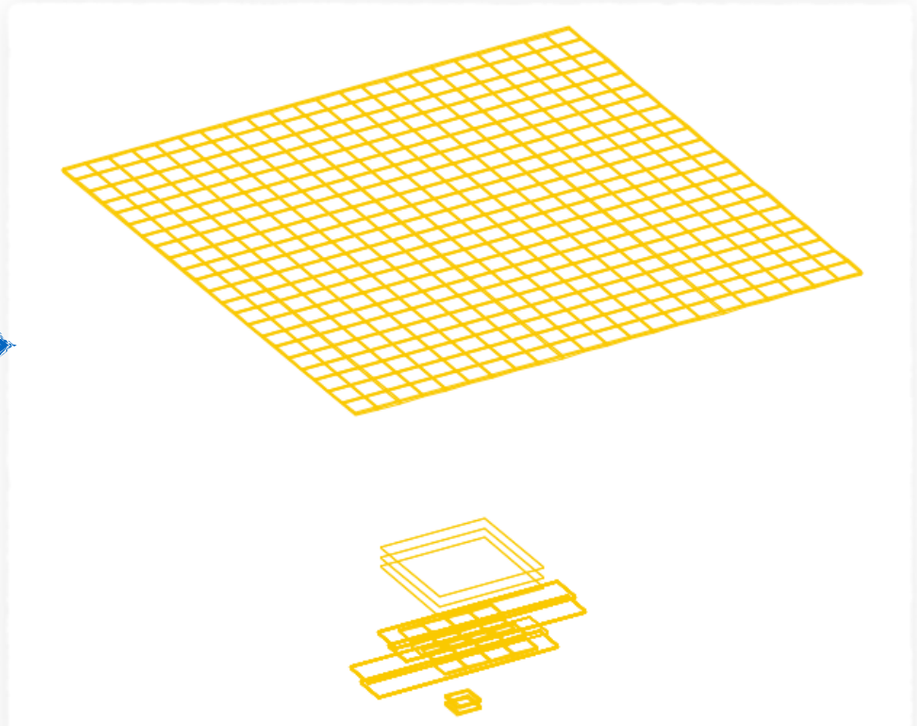

KF Efficiency
B10 B7 B7_1 B9 Be10 Be11 C11 C12 C13 C14 Li6 Li6_1 Li7 Li7_1 N14 N15 O15 O16


GeoTest

- const Double_t SCN_BAR_WIDTH =2.0;//strip dimension in x (I lay) or y (II lay)
- const Double_t SCN_BAR_HEIGHT =44.0;//strip dimension in y (I lay) or x (II lay)
- const Double_t SCN_BAR_THICK =0.3;//strip (layer) thickness

20/5/2018





TGeo

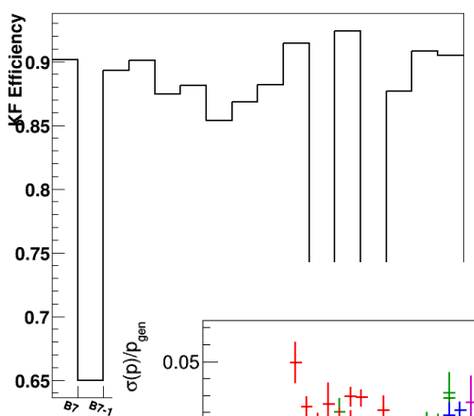
- **VT** xy Reso: 0.0006cm
  z Reso: 0.02cm (bug)
- **IT** xy Reso: 0.0006cm
  z Reso : 0.02cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm

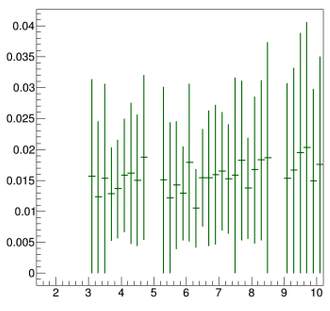
- Comparison between different rootGeometry add node
- Metodo 2 + corretto ma peggior efficienza (reso stabile)…capire. Resto con metodo1

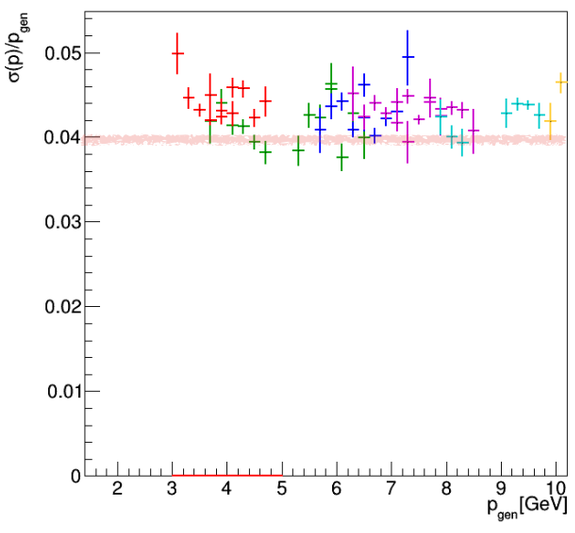
globalTransf of Tvolumes inside ParGeo class. No transf in GetVolumes

Should be a problem: detector Air in 0,0,0 + detector volume out of the detector_universe

Efficiency B7 = 0.90158 4452 4938
Efficiency B7-1 = 0.65 104 160
Efficiency B8 = 0.892989 1452 1626
Efficiency B9 = 0.900771 935 1038
Efficiency Be10 = 0.874634 4186 4786
Efficiency Be9 = 0.881462 3376 3830
Efficiency C10 = 0.853854 5229 6124
Efficiency C11 = 0.86849 7337 8448
Efficiency C12 = 0.881556 3967 4500
Efficiency Li6 = 0.914321 8996 9839
Efficiency Li6-1 = 0.649819 180 277
Efficiency Li7 = 0.923723 4287 4641
Efficiency Li7-1 = 0.684932 50 73
Efficiency N12 = 0.876935 1133 1292
Efficiency N14 = 0.907927 6311 6951
Efficiency O15 = 0.904849 989 1093



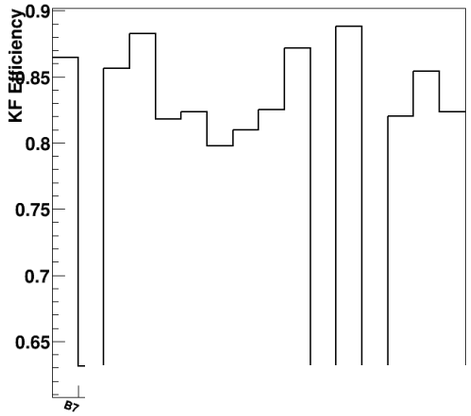


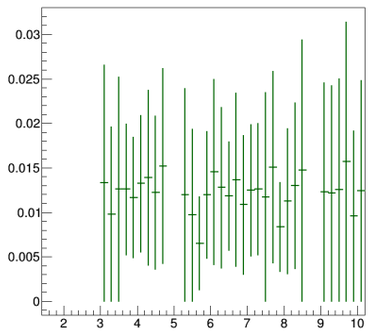


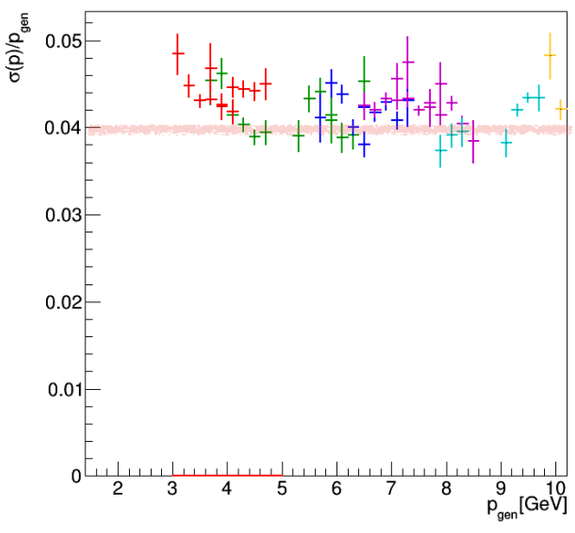
results_afterTW_globalTVolumes_v14.0.1

single detector TVolumes inside ParGeo class are local. Global transf in Booter calling each GetVolumes

Efficiency B7 = 0.86452 4269 4938
Efficiency B7-1 = 0.63125 101 160
Efficiency B8 = 0.856089 1392 1626
Efficiency B9 = 0.882466 916 1038
Efficiency Be10 = 0.818011 3915 4786
Efficiency Be9 = 0.823499 3154 3830
Efficiency C10 = 0.797681 4885 6124
Efficiency C11 = 0.809896 6842 8448
Efficiency C12 = 0.824889 3712 4500
Efficiency Li6 = 0.871532 8575 9839
Efficiency Li6-1 = 0.620939 172 277
Efficiency Li7 = 0.887955 4121 4641
Efficiency Li7-1 = 0.630137 46 73
Efficiency N12 = 0.820433 1060 1292
Efficiency N14 = 0.853978 5936 6951
Efficiency O15 = 0.823422 900 1093



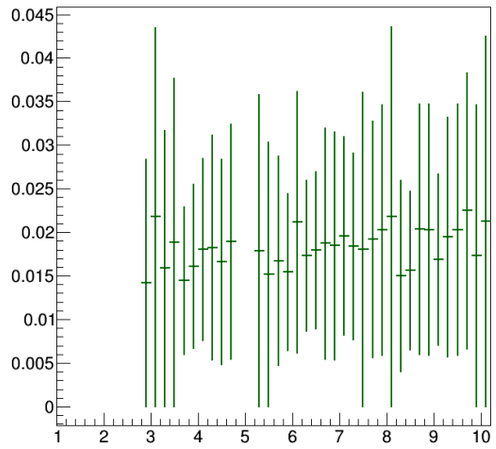




results_afterTW_localTVolumes_v14.0.1

- 20/5/2018 - master update.
- inserting correct reso, all clustering and scintillator, correct mass in PDG.
- v14.0.1
- Status

- **VT** xy Reso: 0.0006cm
  z Reso: 0.005cm
- **IT** xy Reso: 0.0006cm
  z Reso : 0.02cm
- **MSD** xy Reso: 0.003cm
  z Reso : 0.01cm



Efficiency B10 = 0.941233 977 1038
Efficiency B7 = 0.940867 4646 4938
Efficiency B7-1 = 0.675 108 160
Efficiency B9 = 0.930504 1513 1626
Efficiency Be10 = 0.927937 3554 3830
Efficiency Be11 = 0.918721 4397 4786
Efficiency C11 = 0.902025 5524 6124
Efficiency C12 = 0.924598 7811 8448
Efficiency C13 = 0.938 4221 4500
Efficiency C14 = 0.943324 982 1041
Efficiency Li6 = 0.946438 9312 9839
Efficiency Li6-1 = 0.6787 188 277
Efficiency Li7 = 0.958199 4447 4641
Efficiency Li7-1 = 0.739726 54 73
Efficiency N14 = 0.941641 6438 6837
Efficiency N15 = 0.951805 6616 6951
Efficiency O15 = 0.927495 8187 8827
Efficiency O16 = 0.929552 1016 1093