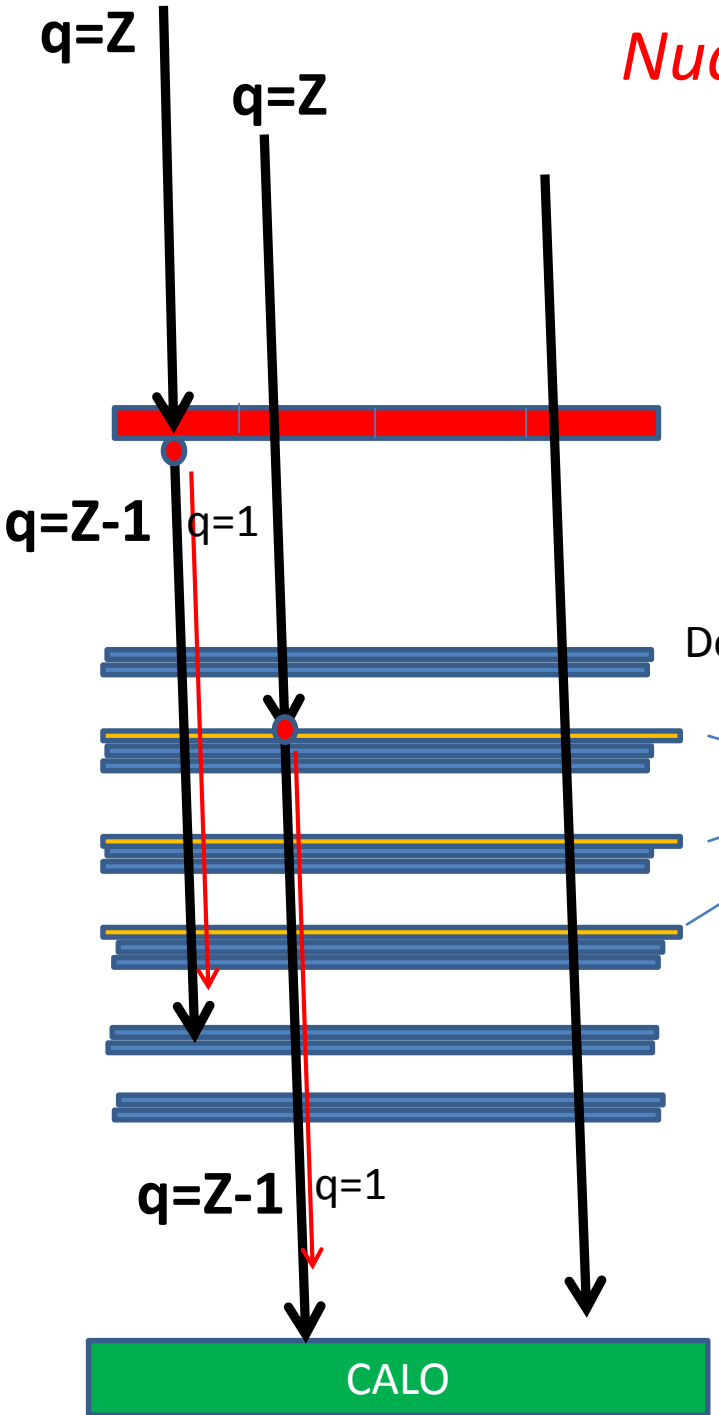


Nucleus-Nucleus interactions

Z nucleus transform to **Z-n + ...**

Psd -1 cm plastic csintillator. 30x30 cm^2

$dE/dX \propto q^2$ **CHARGE MEASUREMENT**

Double layer Silicon Planes

3 planes W (1mm each)

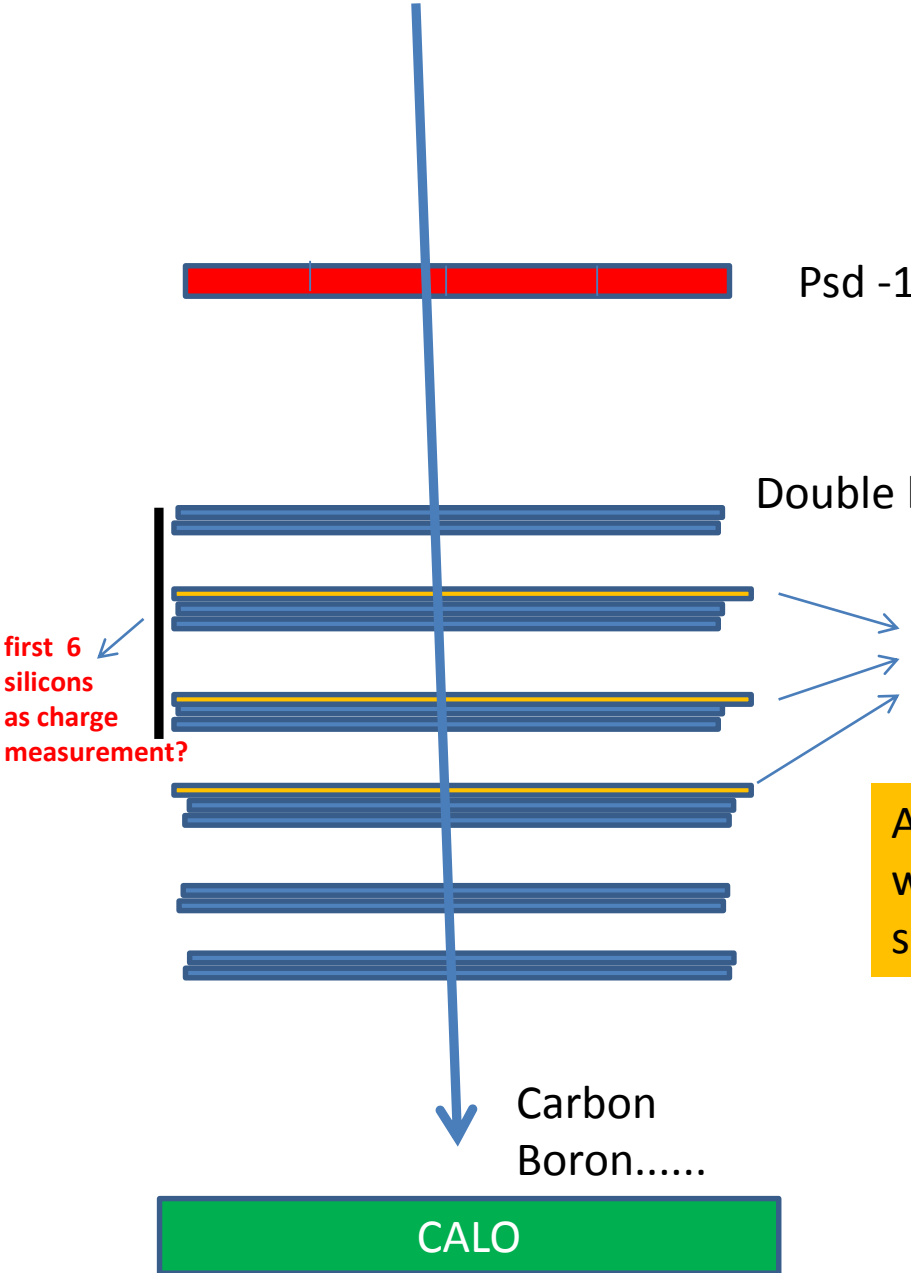
2 important syst. errors

1. Correction for inefficiency
2. Correction for contamination

Contamination can not be corrected reliably due to uncertainty and model dependent predictions

BORON/CARBON ratio is a very important HERD goal, since BORON flux is ~1/10 CARBON, contamination is important

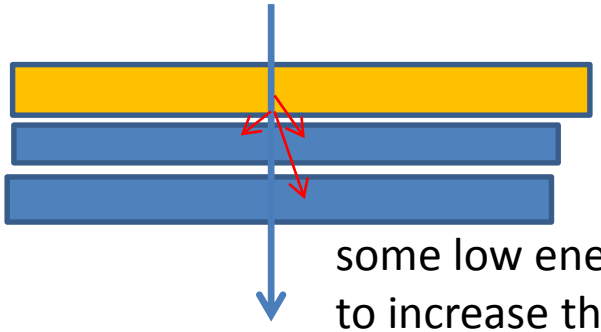
HERD - FLUKA SIMULATION



After the simulation is possible to select events which have first nuclear interaction point in a selected material and decide if take it or not.

SIMULATION RESULTS

1) the presence of W plane above the silicon plane cause a "disturbance" on the dE/dX measure of that plane. Nothing to do with nuclear interactions

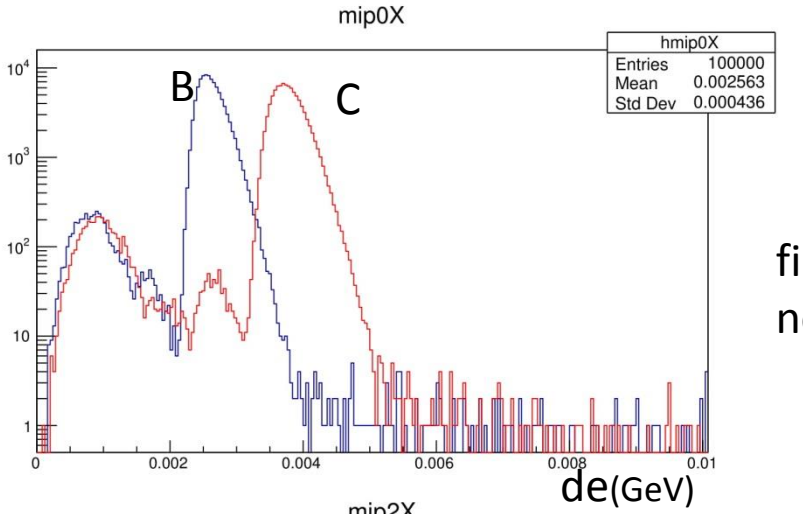


some low energy electrons are created in W and contribute to increase the dE/dX in the silicons

2) Nuclear spallation cause infficiency and contamination on charge identification

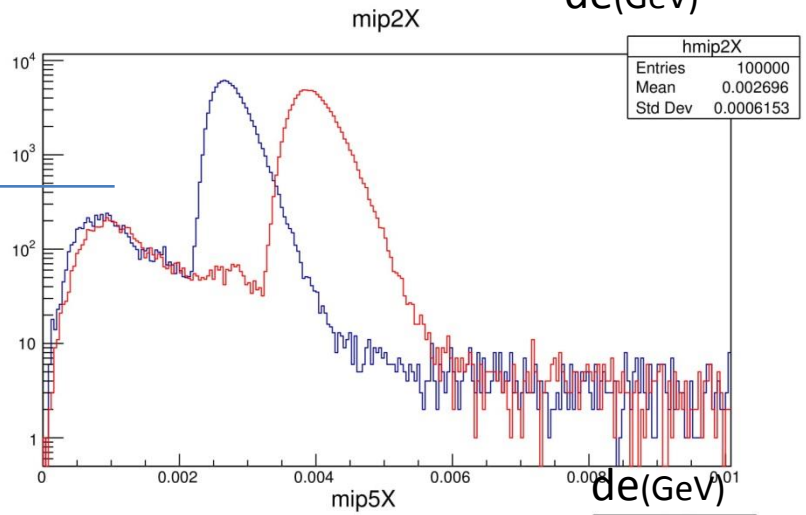
Ionization dE in single Si planes

100GeV/n

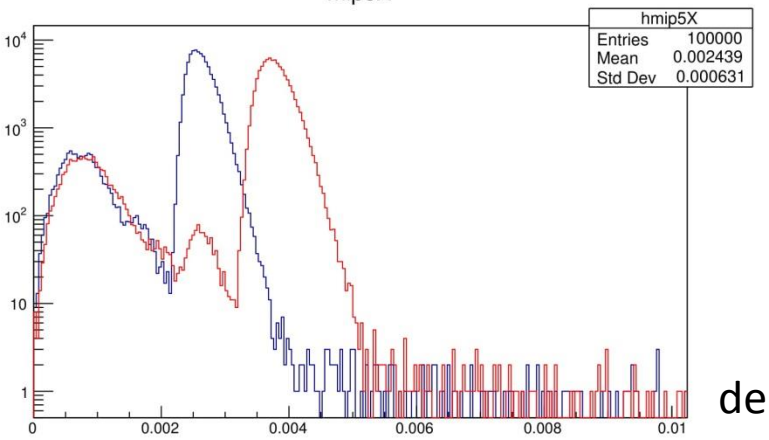


first Si layer
no W above

typical figure for
Si planes having
Tungsten on its top



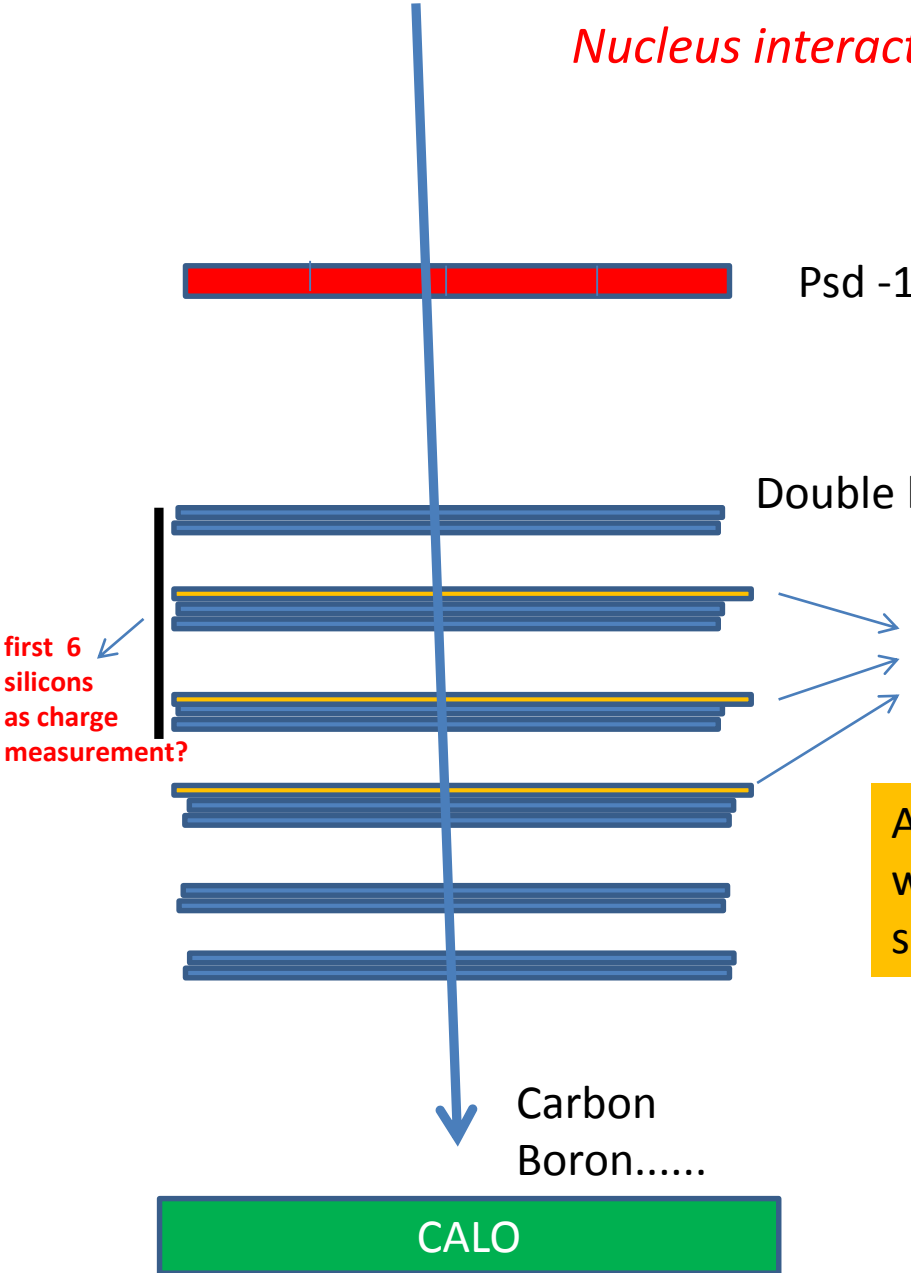
Silicon layer on third
double plane



Silicon layer on last
double plane

HERD FLUKA SIMULATION

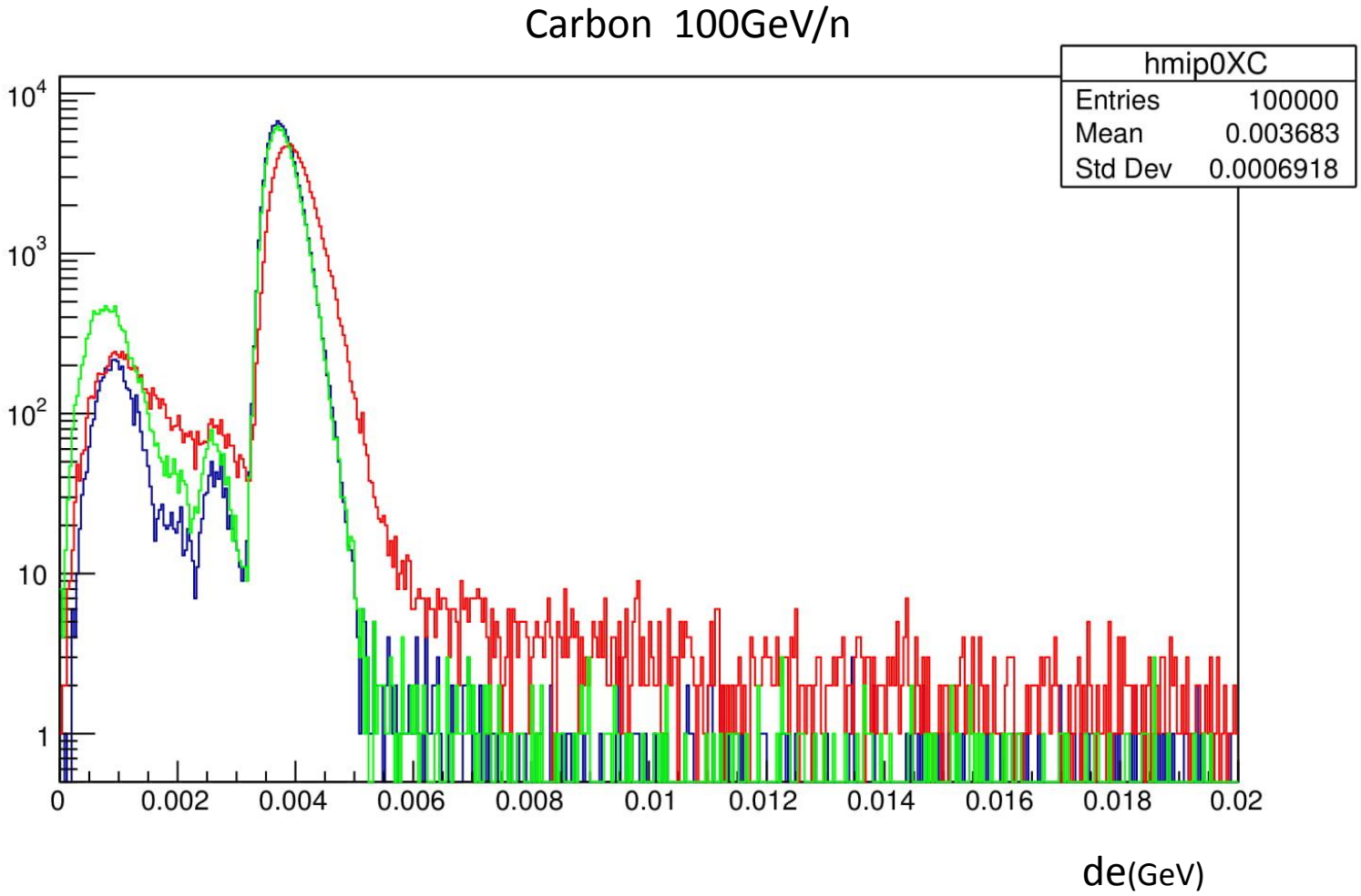
Nucleus interactions and contaminations



After the simulation is possible to select events which have first nuclear interaction point in a selected material and decide if take it or not.

0X
2X
5X

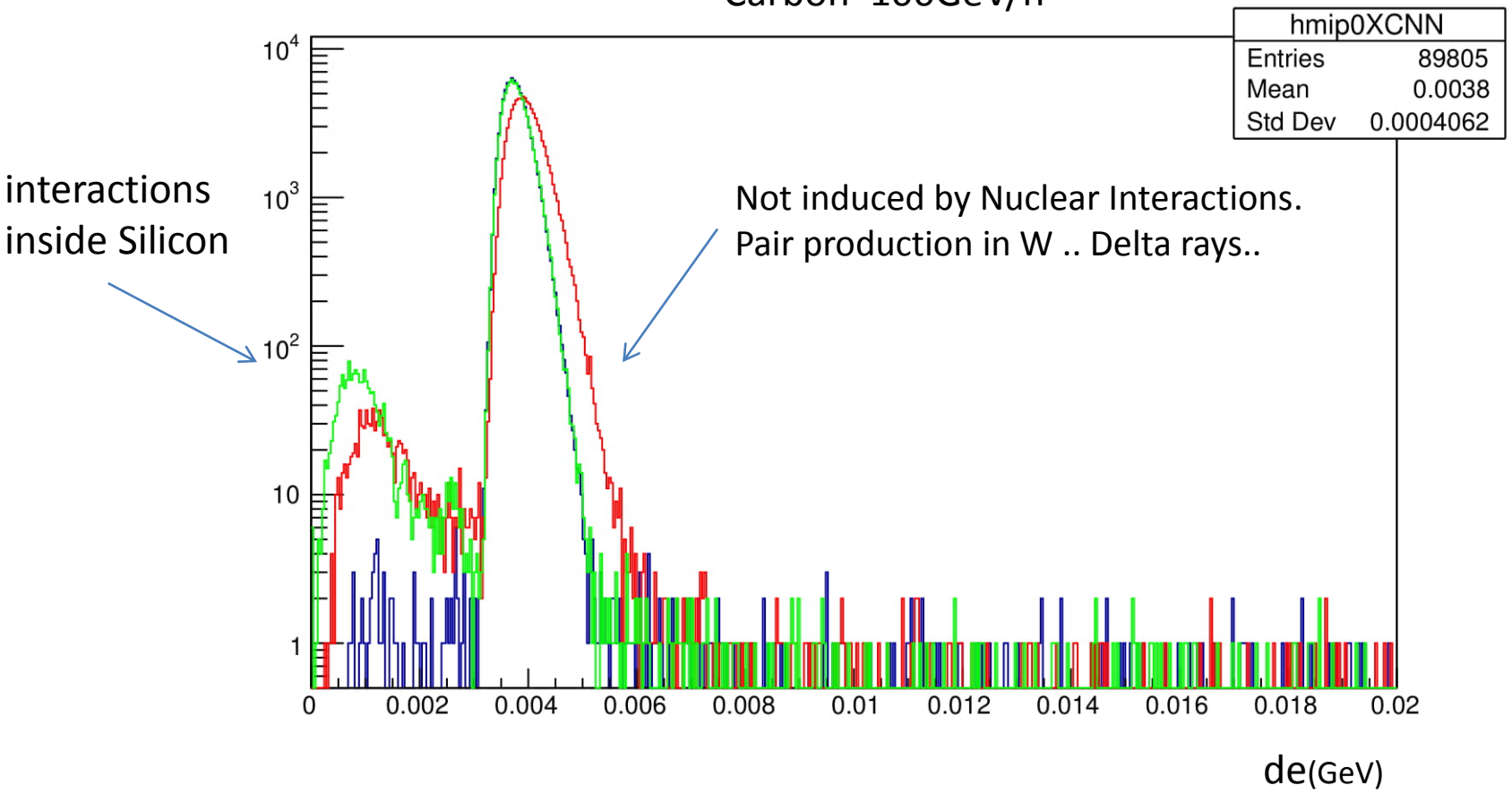
→ W on top of the Si layer



W on top of the Si layer

without nuclear interactions on W and PSD

Carbon 100GeV/n



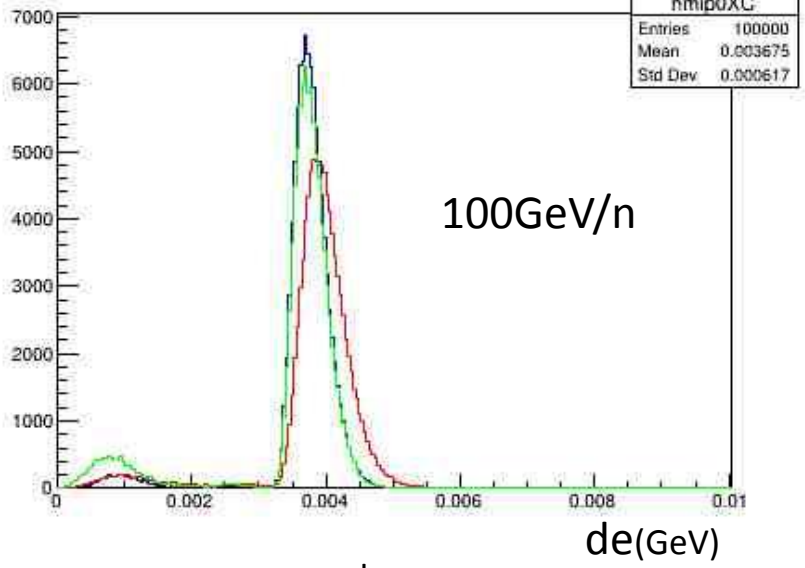
interactions inside Silicon

Not induced by Nuclear Interactions.
Pair production in W .. Delta rays..

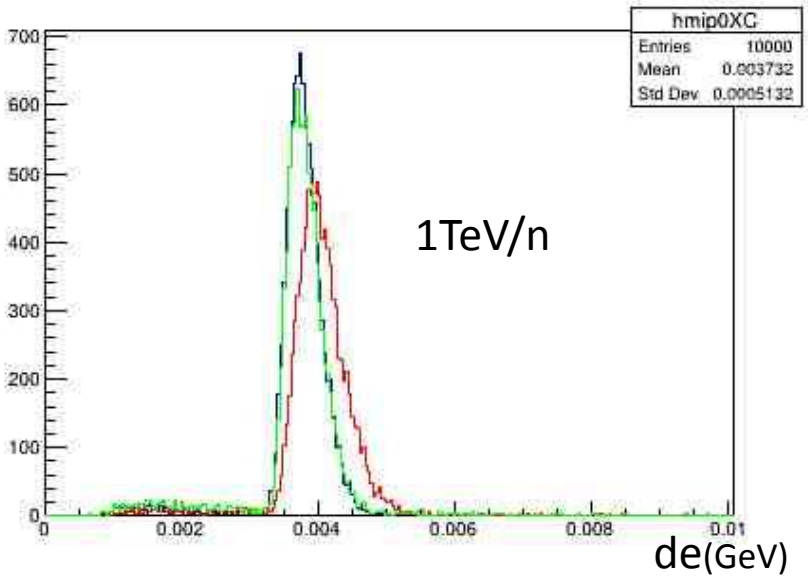
0X
2X
5X

→ W on top of the Si layer

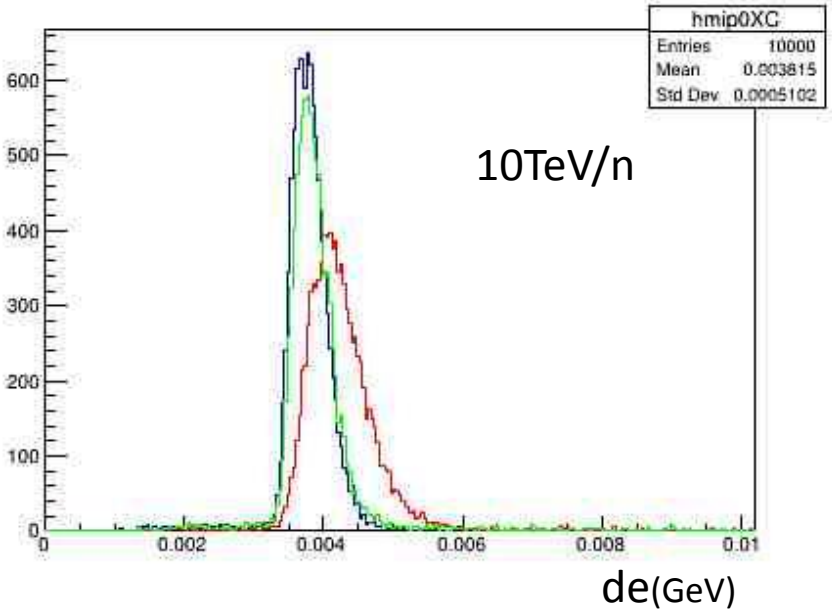
carbon



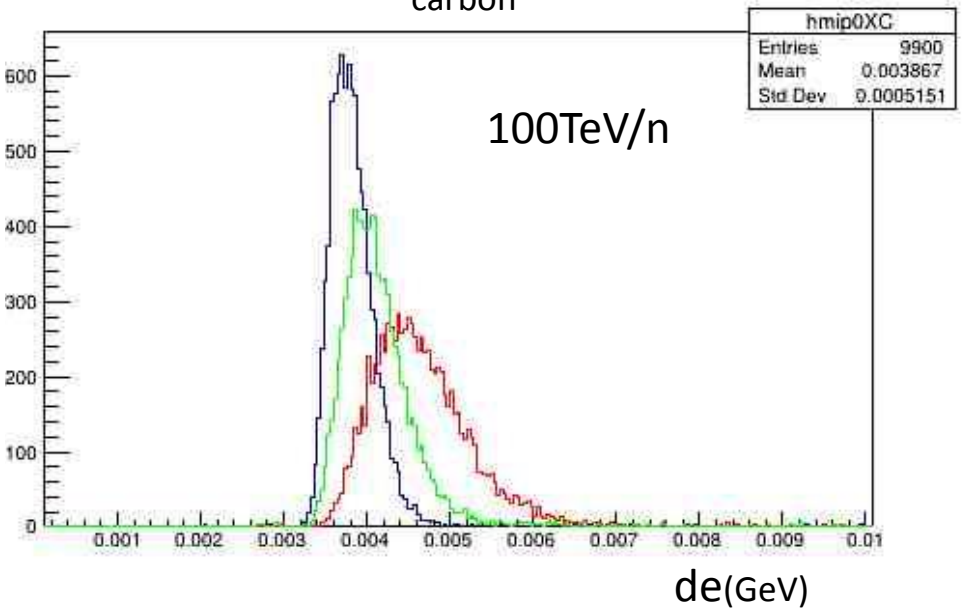
carbon



carbon

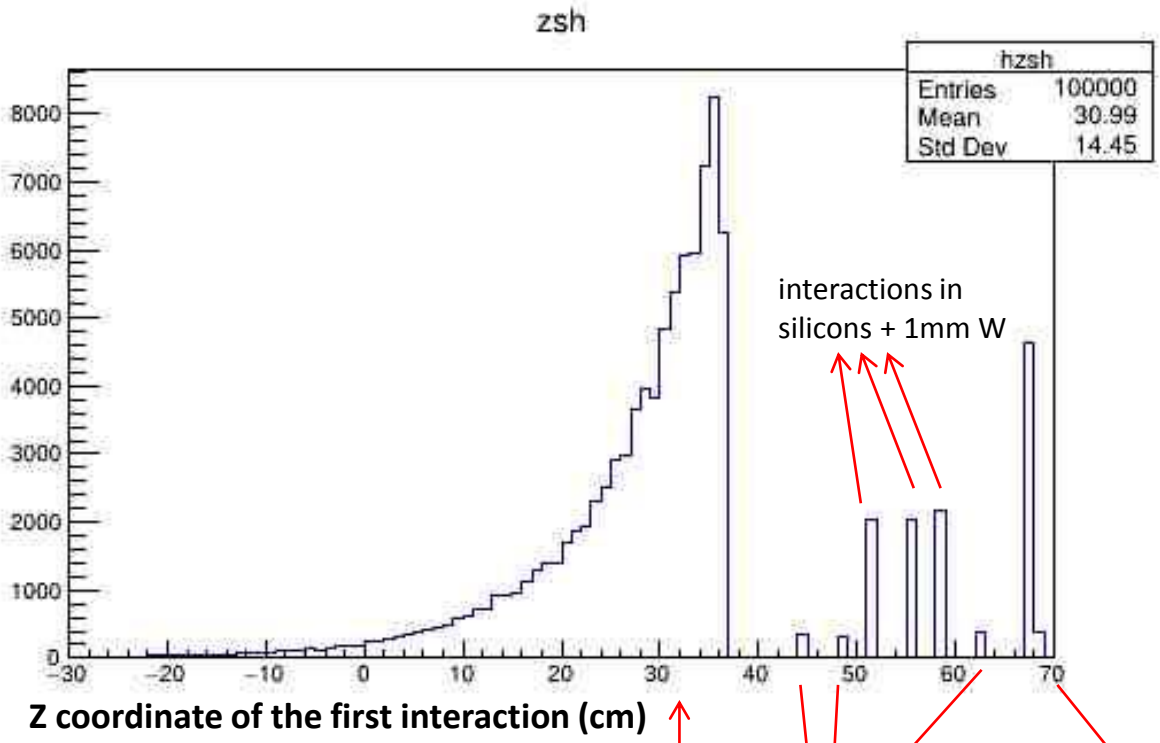


carbon



NUCLEAR INTERACTIONS

fluka simulation **100 GeV/n** carbon **0 deg inclination**



interactions in silicons + 1mm W

total interactions in 3 x 1 mm W

5 %

Interactions in 1 cm scint plast

5 % !!

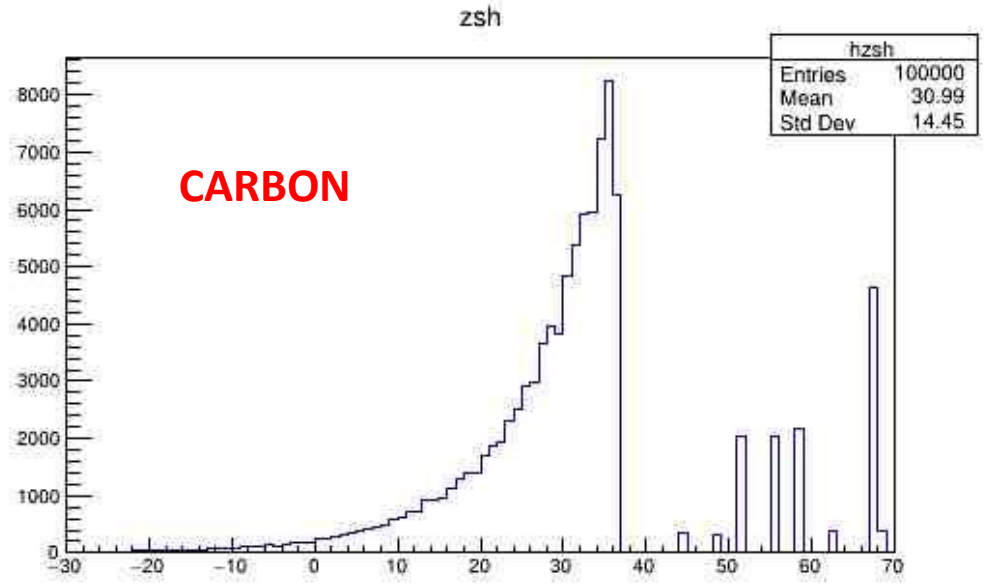
calo

interactions inside silicons

interactions in PSD. 1cm scint plast.

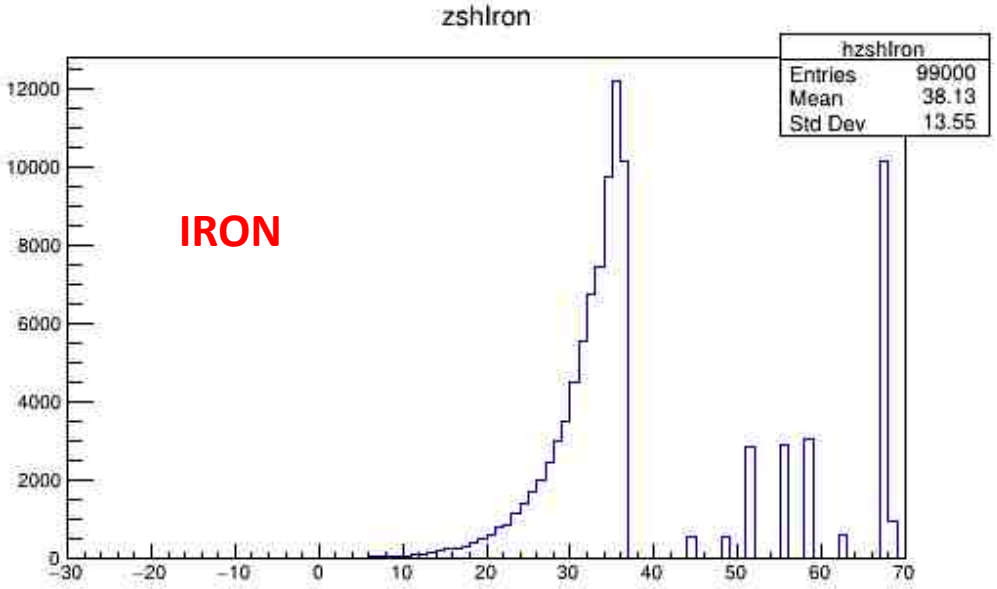
Interaction
Nucleus c on target b

$1/L_{int}(cm) \propto (A_c^{1/3} + Ab^{1/3})^2 \quad \frac{1}{A_b} \rho_b$



Z coordinate of the first interaction (cm)

interactions :
~5% PSD
~5% W

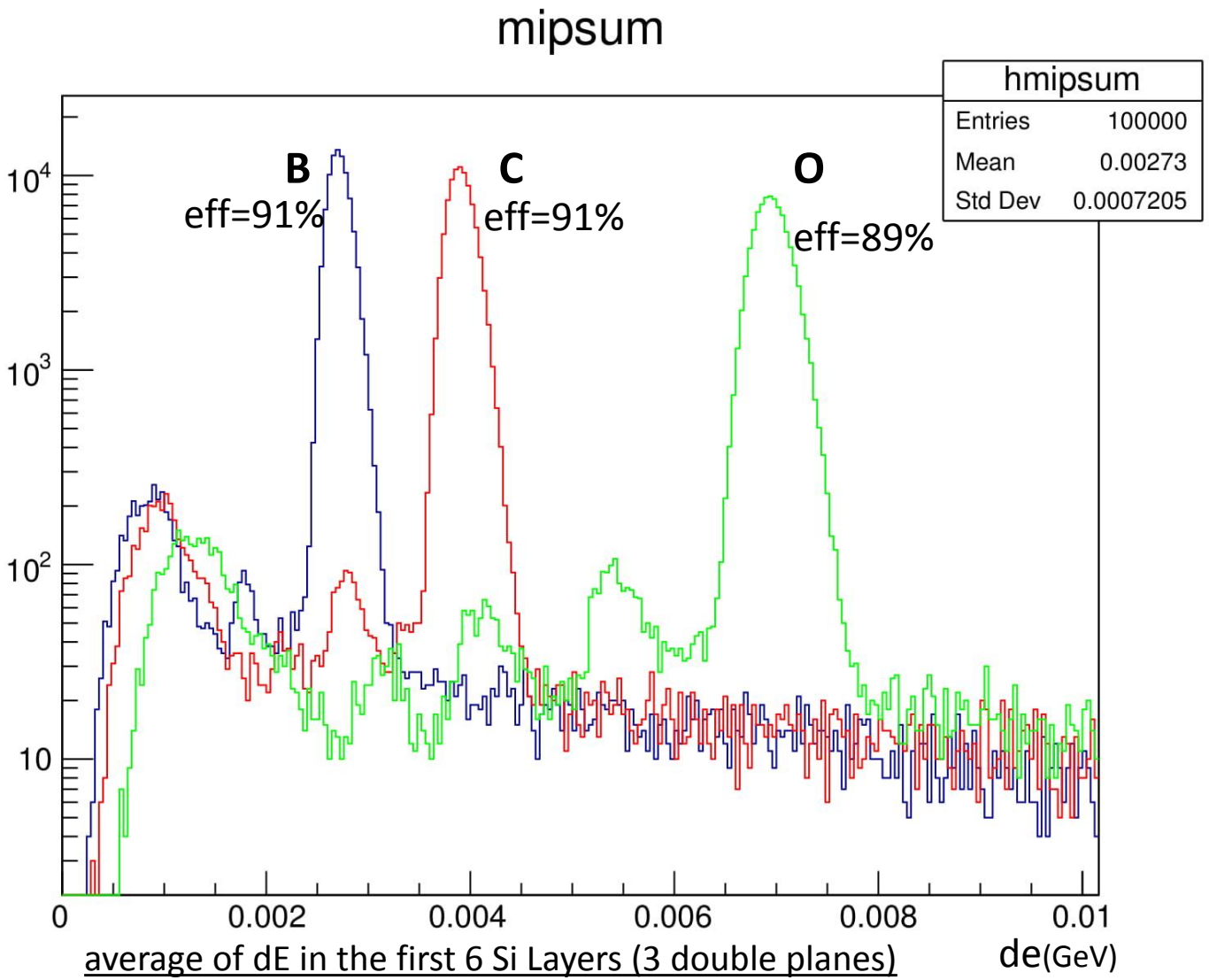


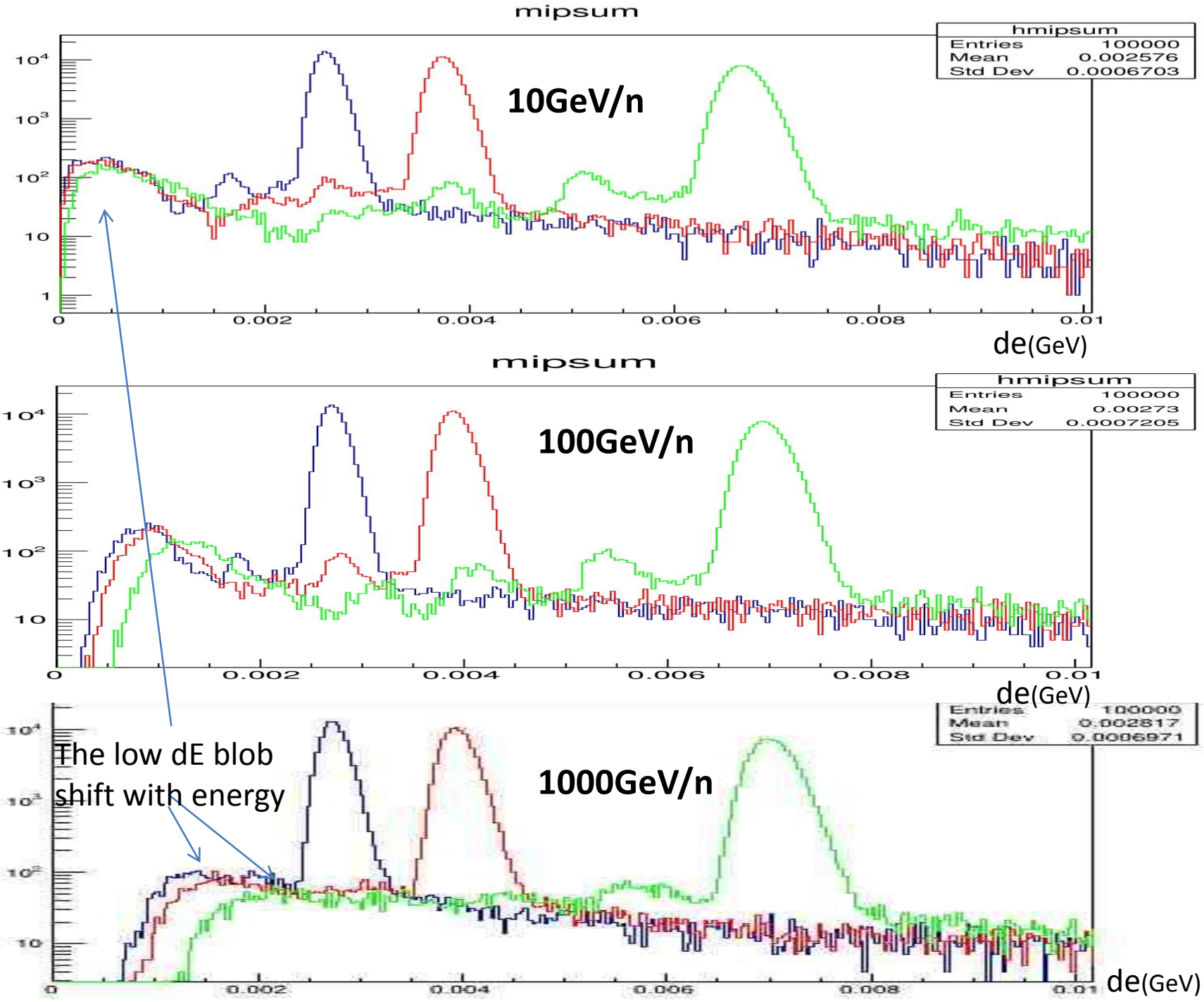
Z coordinate of the first interaction (cm)

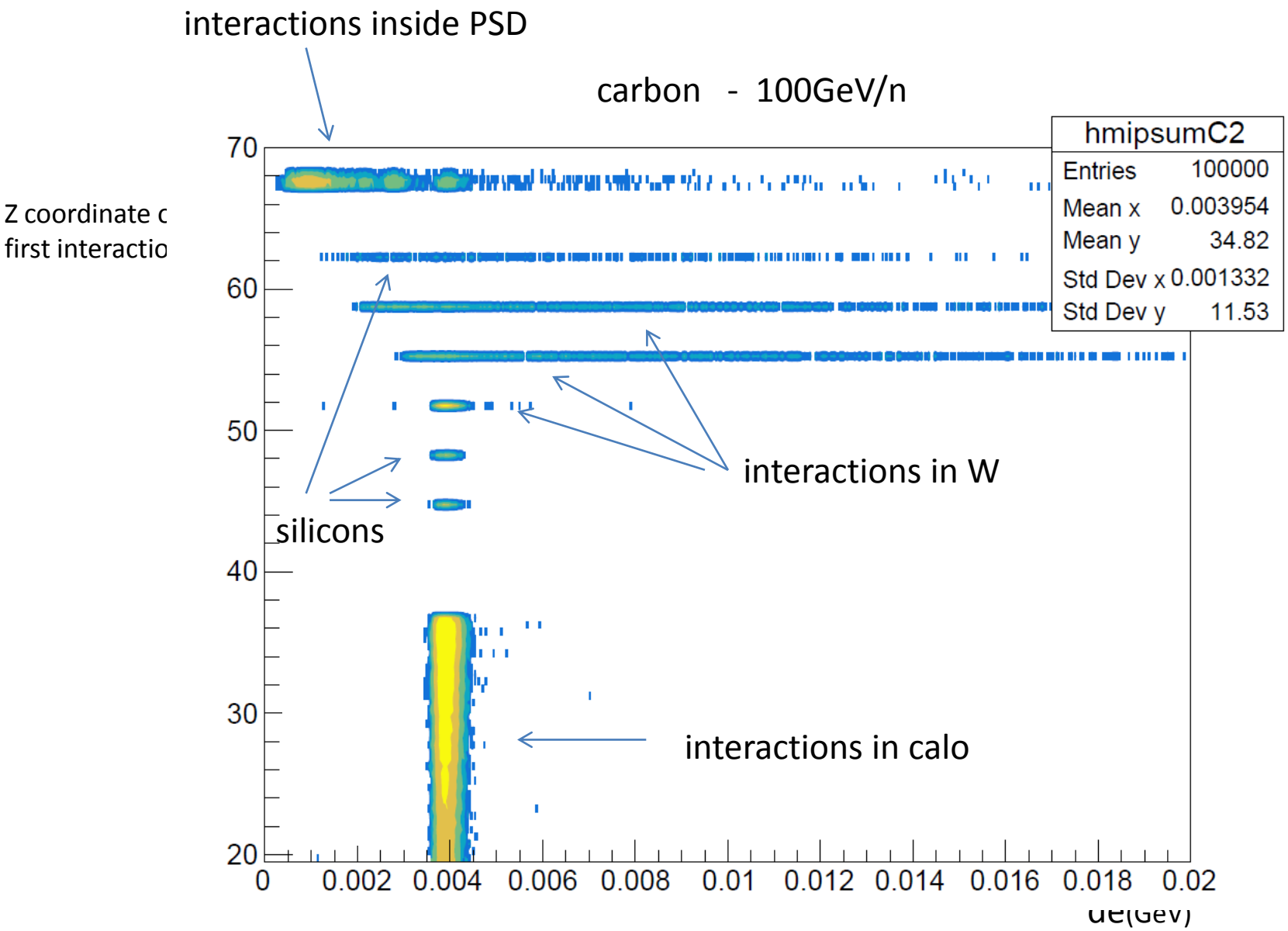
interactions :
~11% PSD
~7,5% W

average of dE in the first 6 Si Layers (3 double planes)

100GeV/n




mipsum
hmipsum
Entries 100000
Mean 0.002576
Std Dev 0.0006703
10GeV/n
de(GeV)
mipsum
hmipsum
Entries 100000
Mean 0.00273
Std Dev 0.0007205
100GeV/n
de(GeV)
Entries 100000
Mean 0.002817
Std Dev 0.0006971
1000GeV/n
The low dE blob
shift with energy
de(GeV)



average of dE in the first 6 Si Layers (3 double planes)

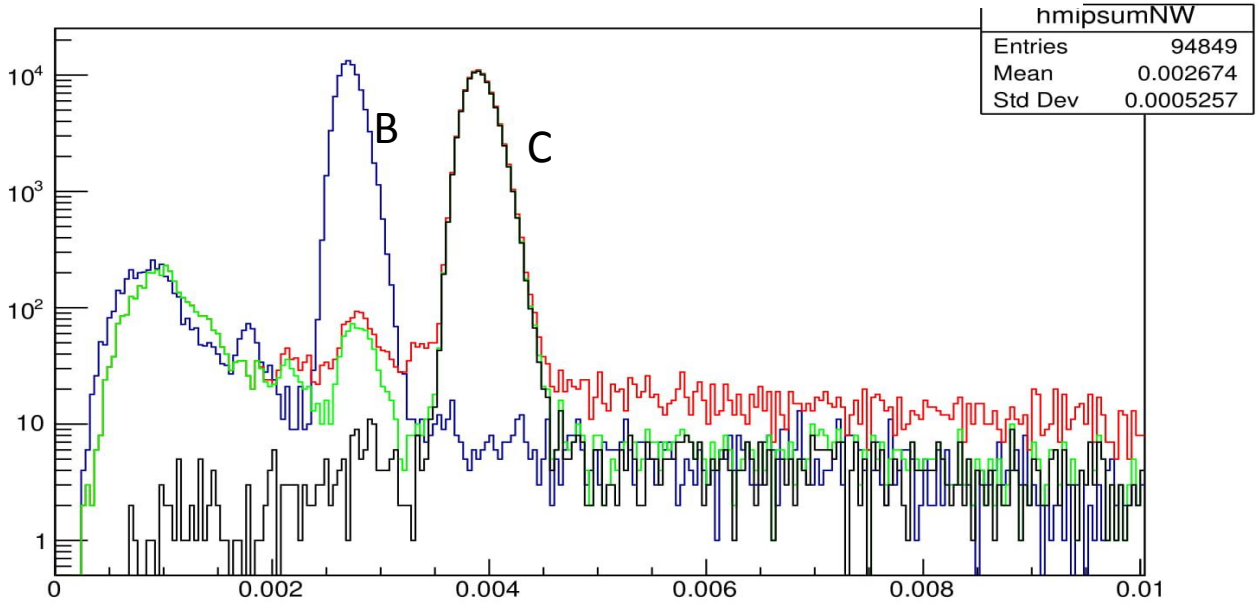
Without W and PSD Interactions

100GeV/n

Interactions in all materials eff=91%

no interactions in W eff=94%

no interactions in W and no in PSD eff=99%

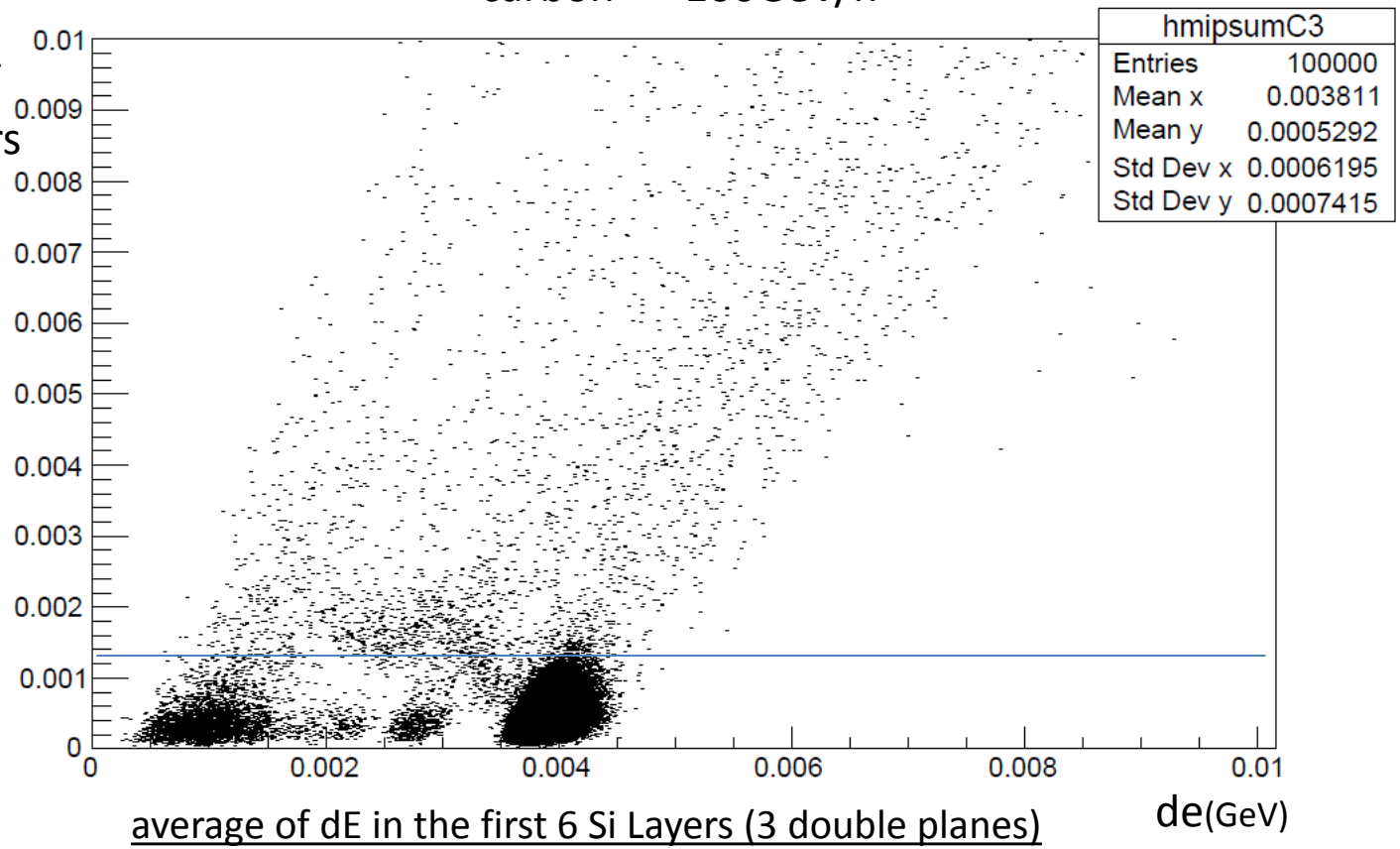


average of dE in the first 6 Si Layers (3 double planes)

de(GeV)

quality cut ?

max variation from the average of the 6 layers

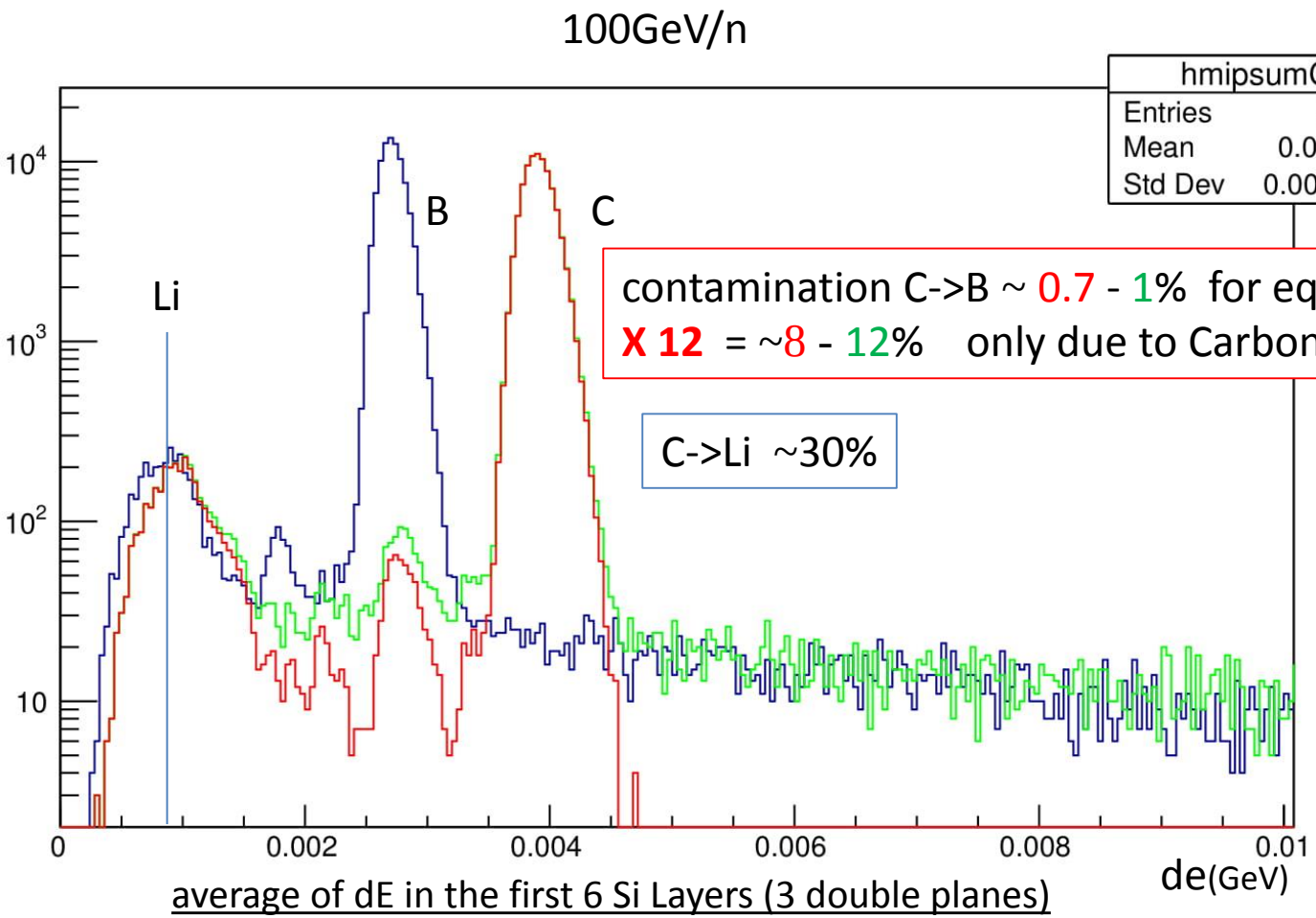


average of dE in the first 6 Si Layers (3 double planes)

without CUT

with CUT

Carbon is ~ 12 times more abundant than boron for the same PARTICLE energy around 100GeV/n



contamination C->B ~ 0.7 - 1% for equal abundance

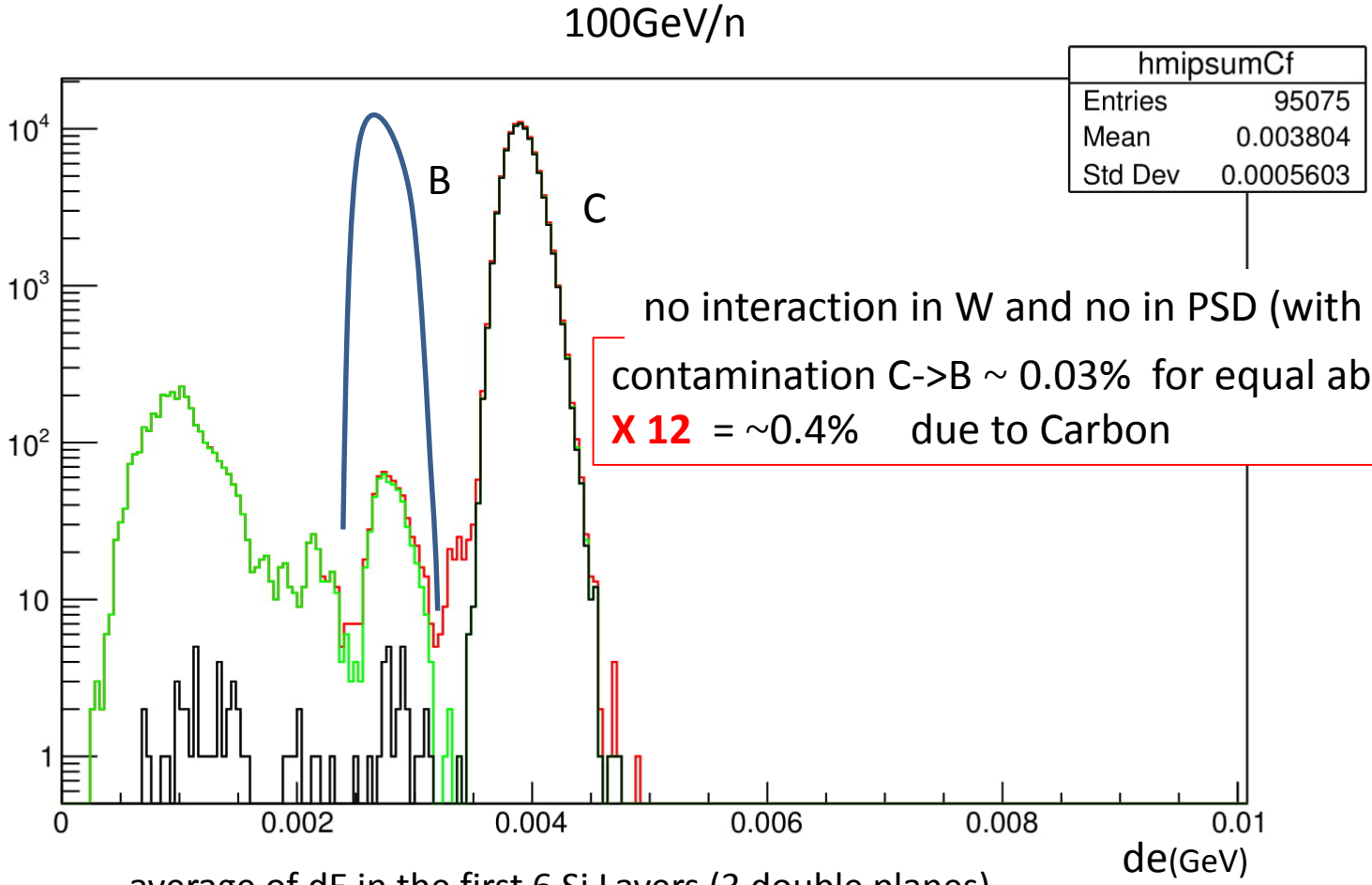
X 12 = ~8 - 12% only due to Carbon

C->Li ~30%

Interactions in all materials (with CUT)

no interactions in W (with CUT)

no interaction in W and no in PSD (with CUT)



no interaction in W and no in PSD (with CUT)

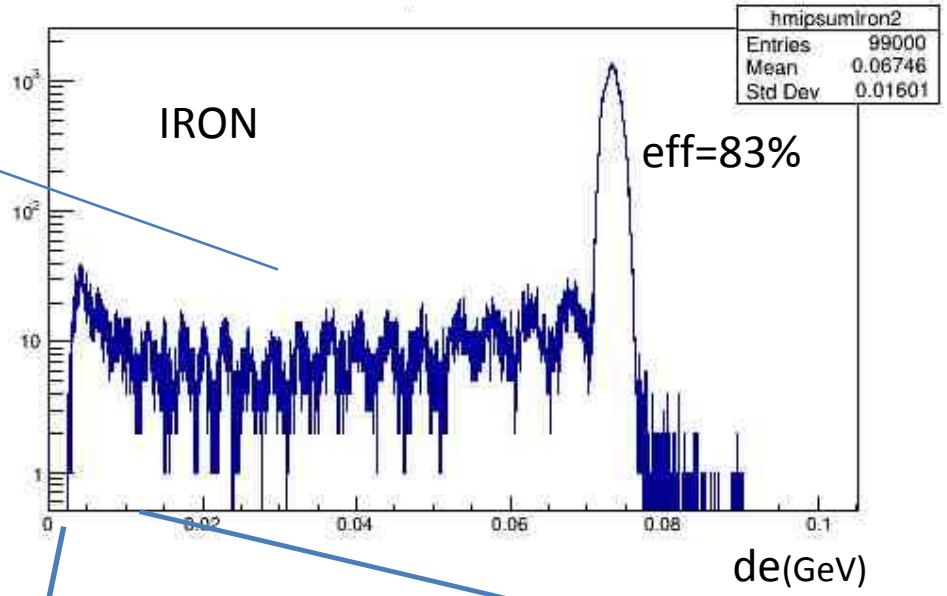
contamination C->B ~ 0.03% for equal abundance

X 12 = ~0.4% due to Carbon

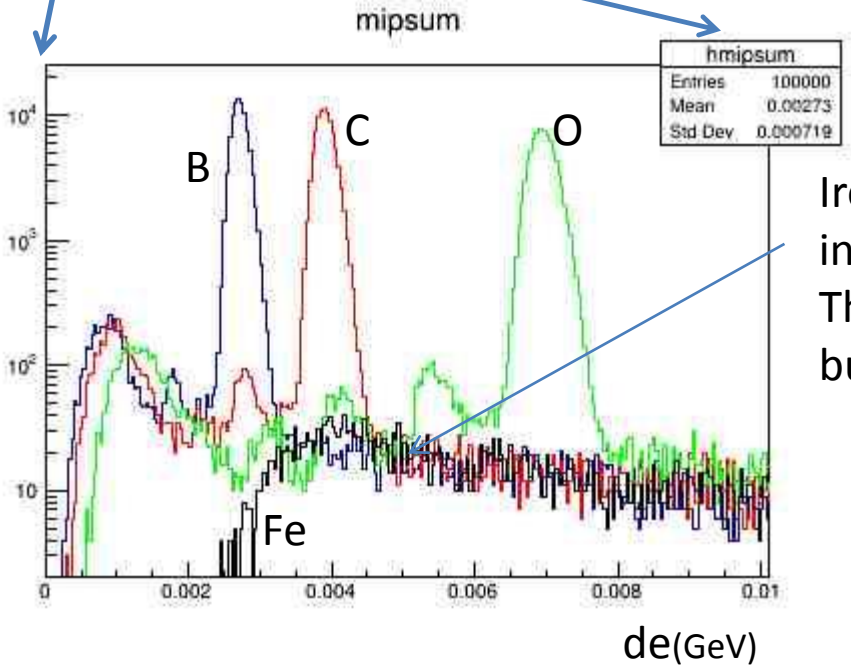
average of dE in the first 6 Si Layers (3 double planes)

typical contamination on NUCLEI with similar flux 1-2%

Iron - 100GeV/n



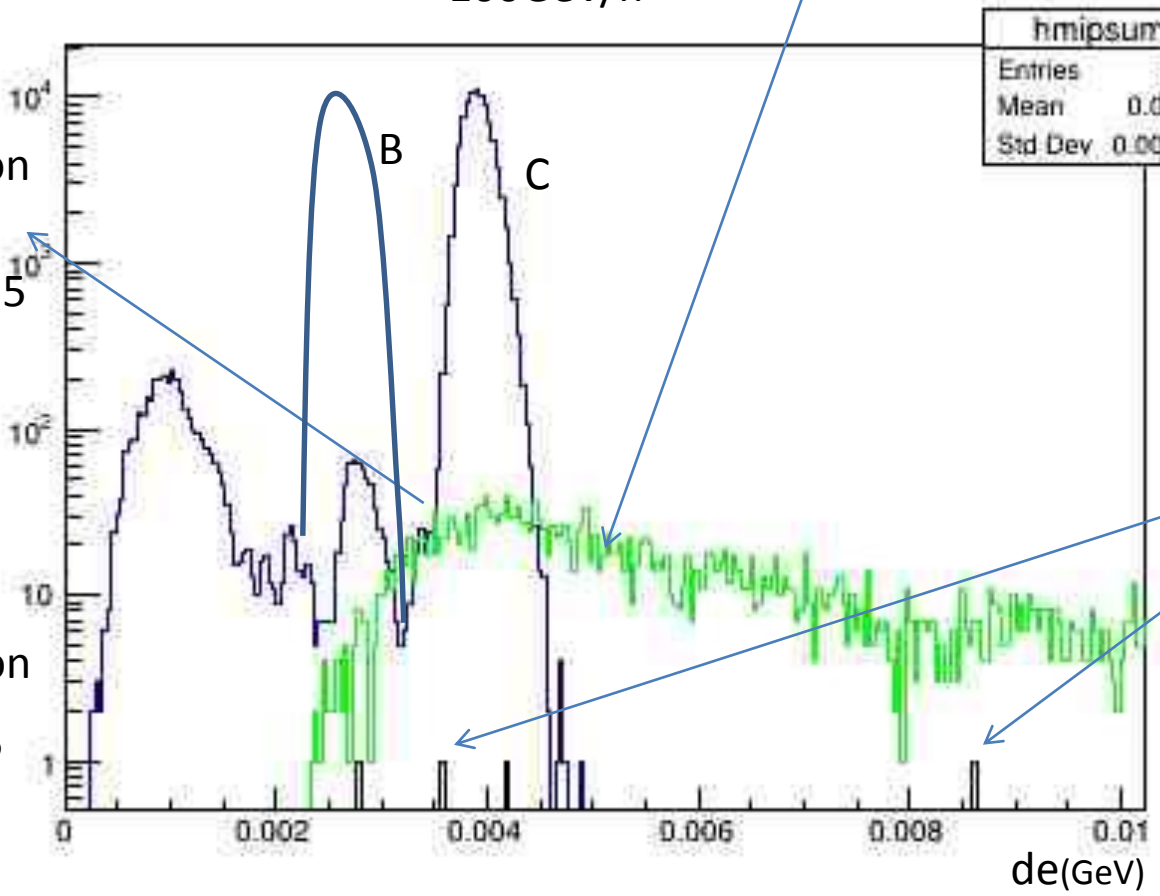
with W and PSD



Iron contamination in B-C region.
The position of the bump depends on energy

Iron without interactions in W

100GeV/n



Iron contamination for Carbon ~1%

Flux ratio Fe/C=1.5

If the energy dependent Iron bump goes below Boron can give 10% contamination

Flux ratio Fe/B=15

Iron without interactions in W and PSD

CONCLUSIONS

W between silicon layers disturb the de/dx measurement

1cm PSD above dE/dx measure is more critical than W concerning Nuclear interations effects