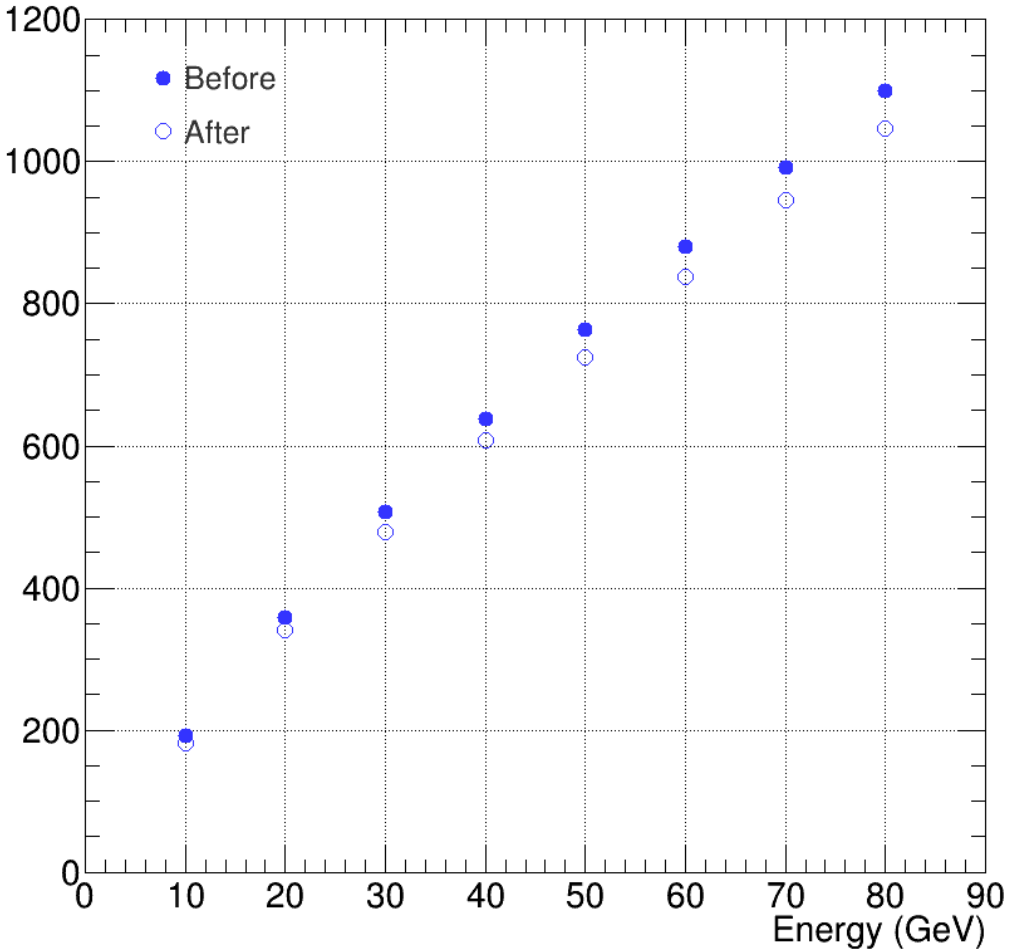
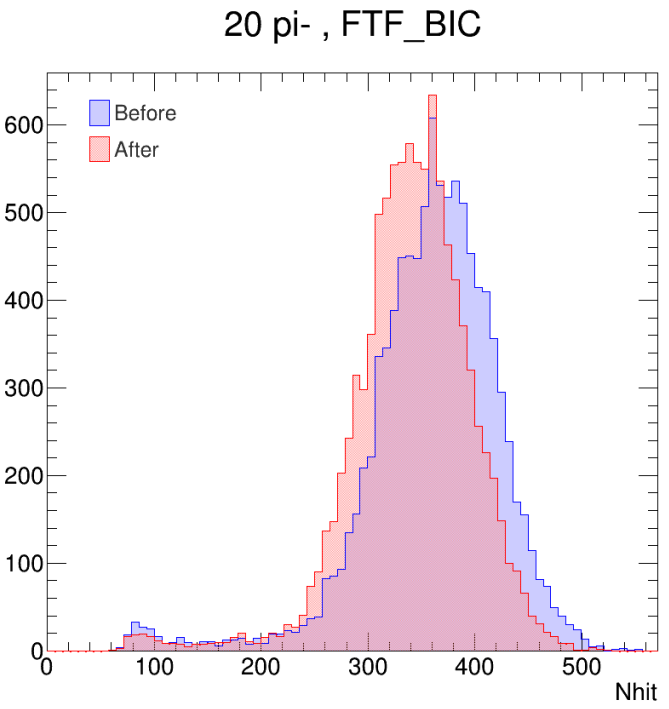
SDHCAL Simulation Status

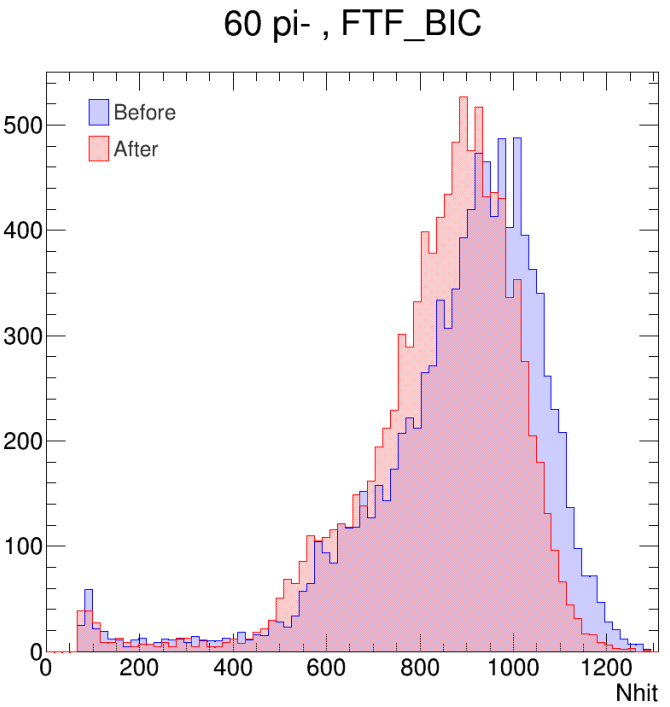
Simulation

- Changes in simulation :
  - PCB : changed from vacuum to g10
  - Electronics mask : changed from vacuum to epoxy
  - Absorber : changed from 7.85 g/cm³ steel to 8 g/cm³ steel to match 304L / 316L steel specifications
  - A 1mm air layer has been added between the structure 15mm steel layers and the cassette 2.5 mm steel layers (that was previously single 20mm steel layers)

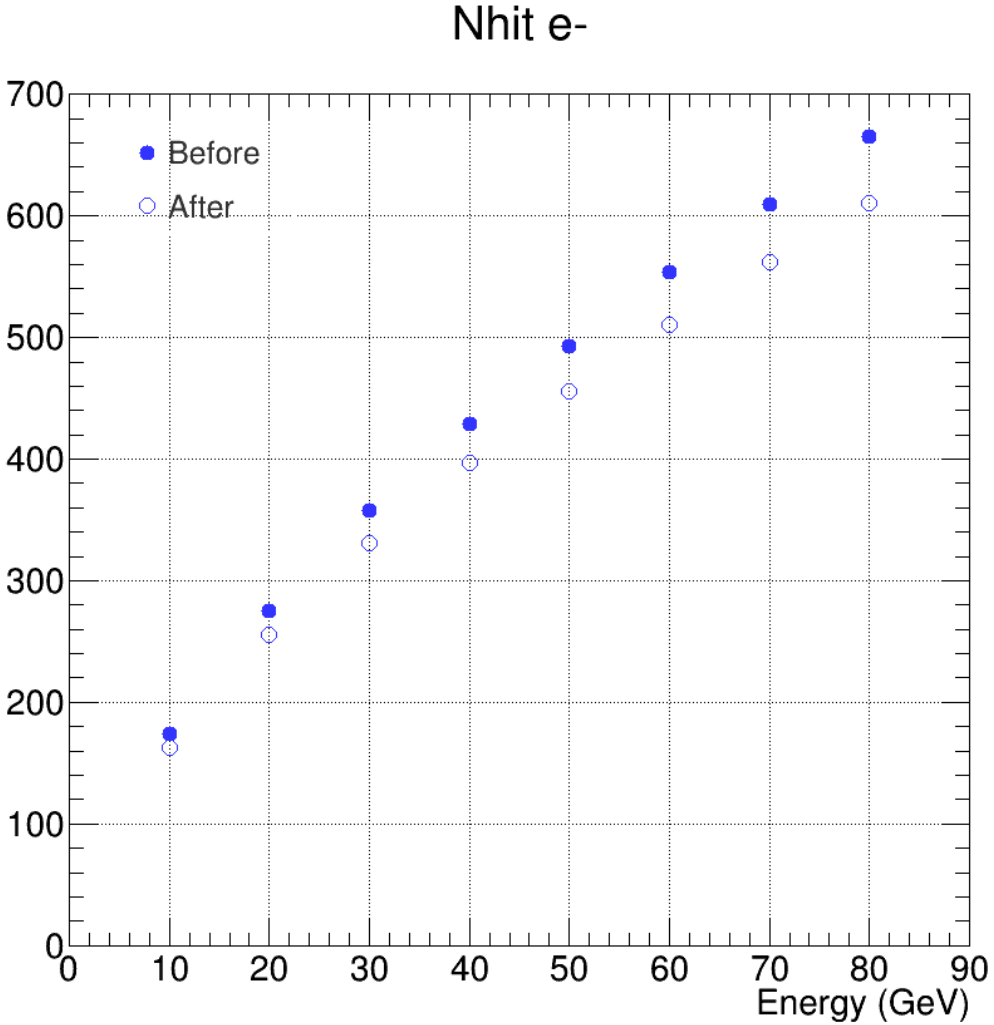
Simulation

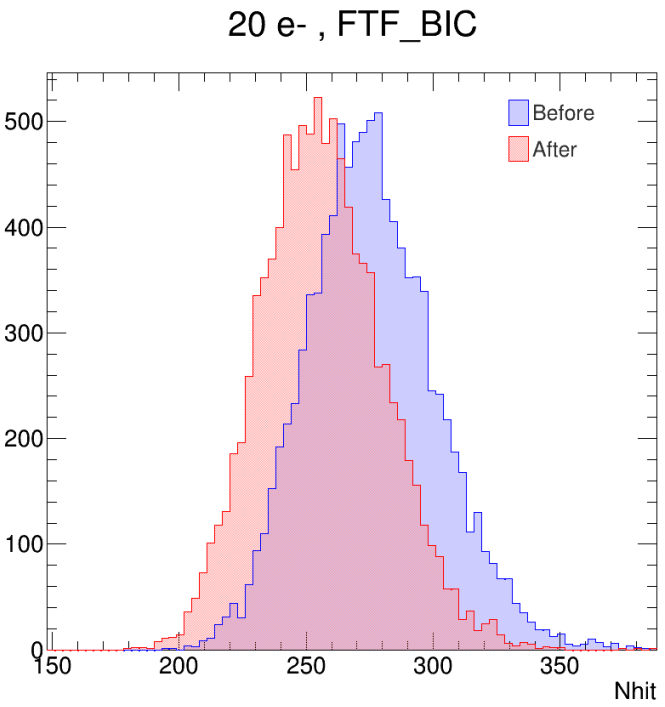

Nhit pi-
Before
After
1200
1000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
Energy (GeV)

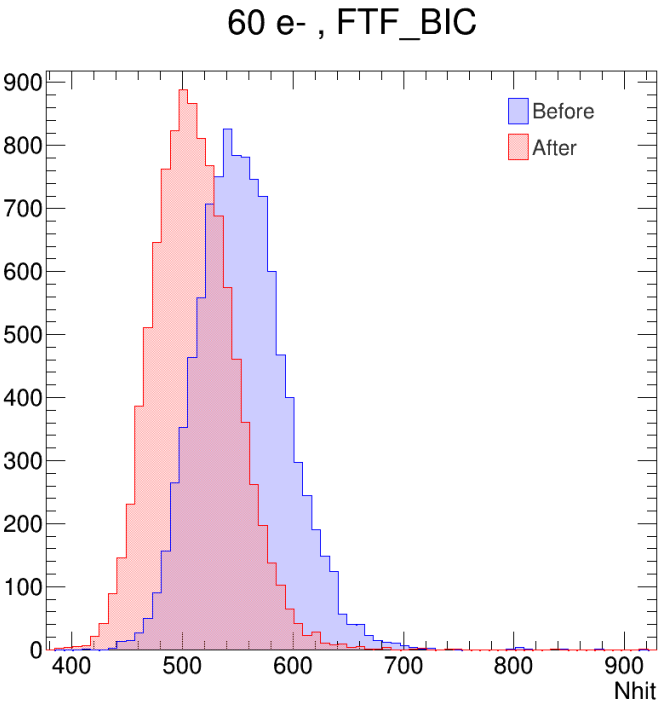

20 pi- , FTF_BIC
Before
After
600
500
400
300
200
100
0
0
100
200
300
400
500
Nhit


60 pi- , FTF_BIC
Before
After
500
400
300
200
100
0
0
200
400
600
800
1000
1200
Nhit

Simulation

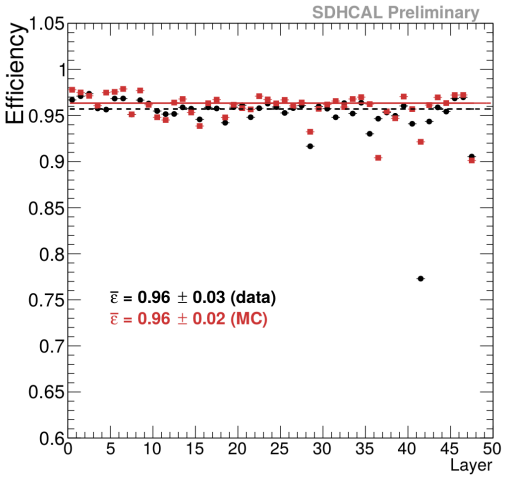

Nhit e-
Before
After
0
100
200
300
400
500
600
700
0
10
20
30
40
50
60
70
80
90
Energy (GeV)

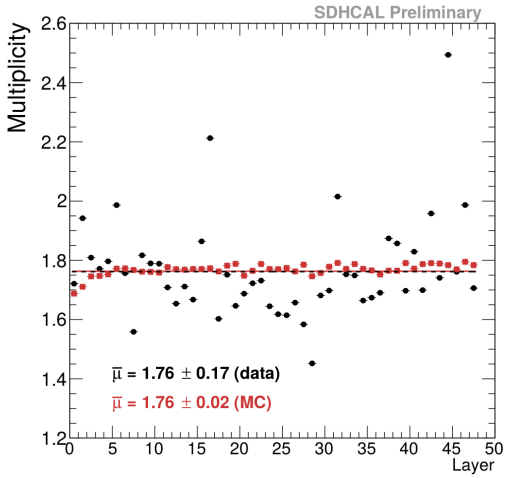

20 e- , FTF_BIC
Before
After
0
100
200
300
400
500
150
200
250
300
350
Nhit

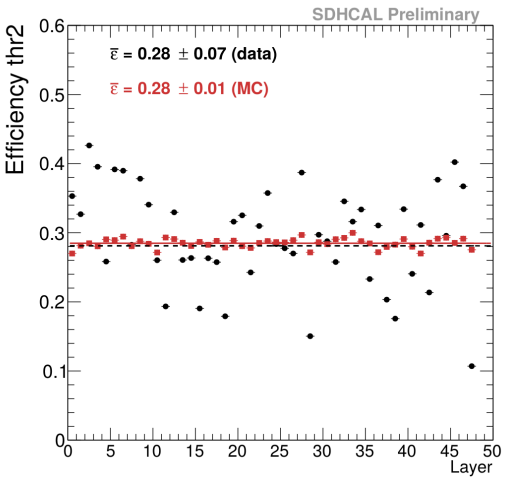

60 e- , FTF_BIC
Before
After
0
100
200
300
400
500
600
700
800
900
400
500
600
700
800
900
Nhit

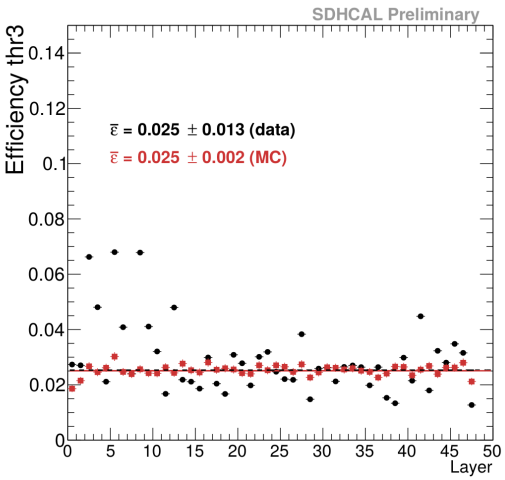
Digitizer

- New parametrization of the digitizer is needed due to simulation changes
  - Current digitizer
    - Induced charge : $\frac{1}{\Gamma(\frac{\overline{q}}{\delta})\delta^{\frac{\overline{q}}{\delta}}} \times q^{\frac{\overline{q}}{\delta}-1} e^{-\frac{q}{\delta}}$
    - Charge spreading : $A_1 \times e^{-\frac{1}{2}\left(\frac{r}{\sigma_1}\right)^2} + A_2 \times e^{-\frac{1}{2}\left(\frac{r}{\sigma_2}\right)^2}$





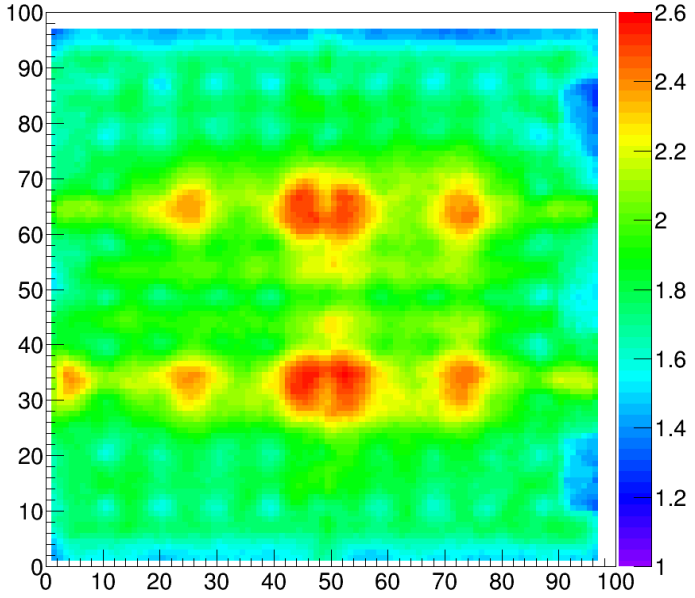


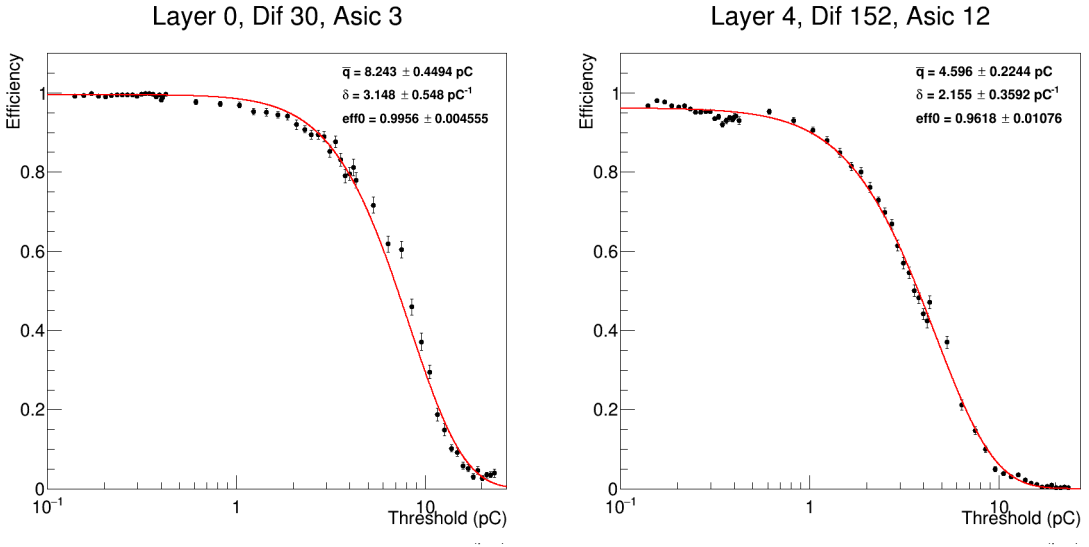


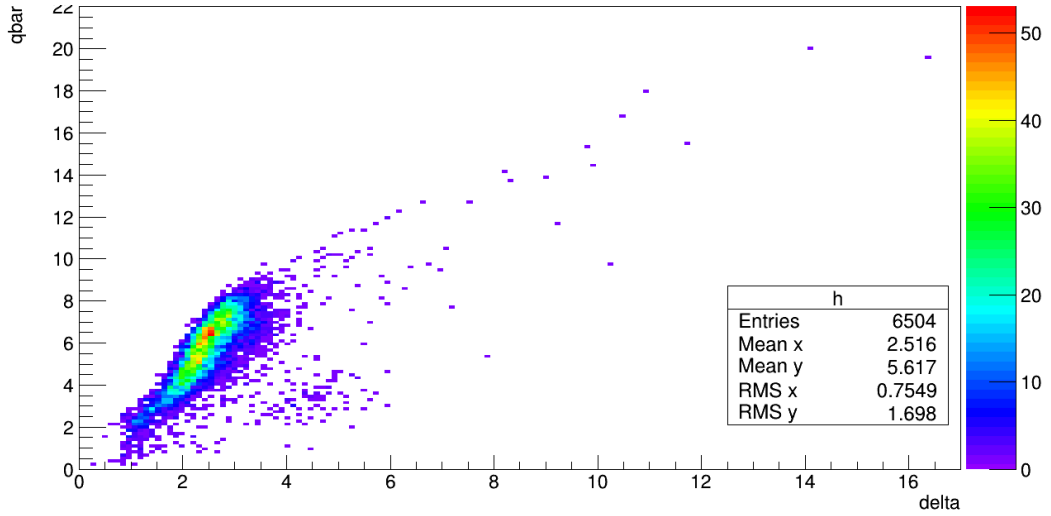
  - Average multiplicity and efficiencies are well reproduced, but not the fluctuations

Digitizer

- October 2015 beam test
  - Threshold scan for all layers (except 1 and 34 which were off during the scan)
  - Enough statistics to study efficiencies and multiplicity **per ASIC**



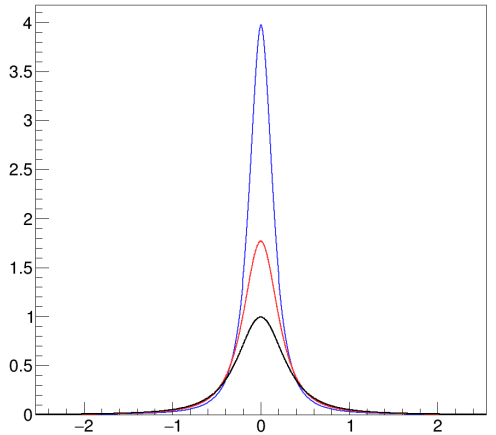




Digitizer

- New charge spreading distribution
  - 1 parameter instead of 4 : easier to tune

$$A \times \frac{d}{\left(r^2 + d^2\right)^{3/2}}$$



- 1 different set of parameters ($\overline{q}$, δ , d) per ASIC