

# Elastic Scattering Gen4 vs Gen3

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# Elastics Selection

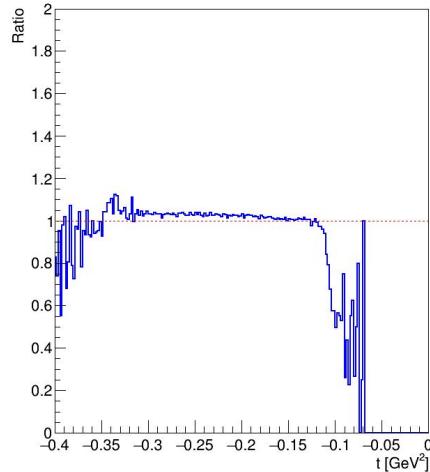
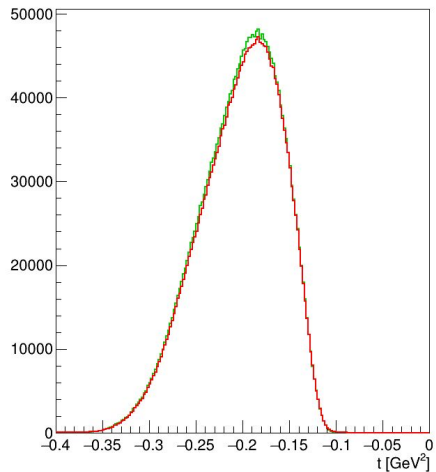
- Analysis conditions:
  - **Exp:** Day 45 | **Sim:** 1/10 of PLUTO Elastic Scattering statistics
  - PT2 trigger (from TBit; in Gen3 Sim - trigger emulator)
  - `kIsUsed() && !isAtAnyMdcEdge()`
  - In HADES: `(cand.charge > 0 && cand.m > 500.0)` | In FwDet: proton assumption
  - HADES Sector 4 (240° - 300°) excluded!
  - **Magnetic Field correction + Energy Loss correction**
  - Number of protons  $\geq 2$  (searching for pairs):
    - 1 hit in HADES - 1 hit in FwDet (**HF**)
    - 2 hits in HADES (**HH**)
- Selection of elastic scattering (~equivalent to Gabriela's):
  - $\Delta\varphi = |\varphi_1 - \varphi_2| \approx 180^\circ \pm 10^\circ$
  - $\text{Tan}(\theta_1) \cdot \text{Tan}(\theta_2) \approx 1/(\gamma_{\text{cm}})^2 = 0.292682 \pm 0.125$
  - $\Delta p \approx 0 \pm 500 \text{ MeV (HH)} \mid \pm 100 \text{ MeV (HF)}$
  - $\text{Vertex}_z \in (-150 \text{ mm}; -100 \text{ mm})$

Gen4 & Gen3

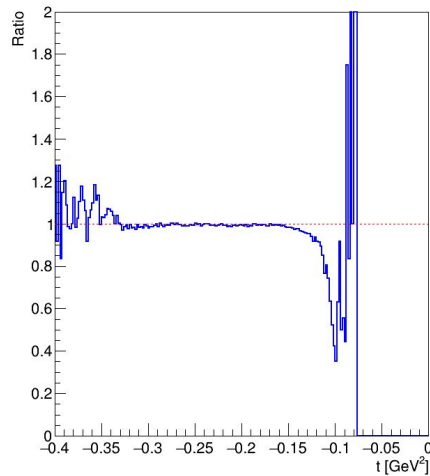
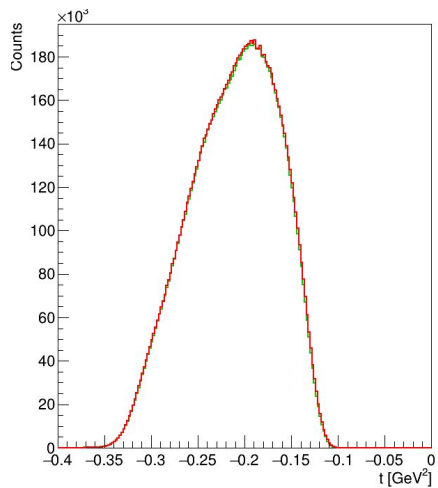
Gen4 / Gen3

# HF - t (4mom transfer)

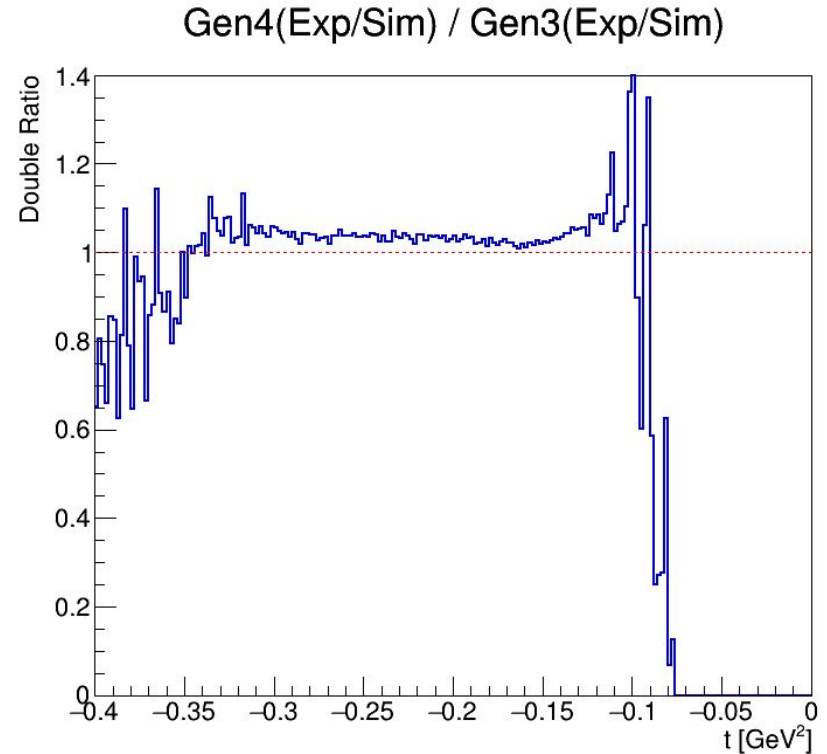
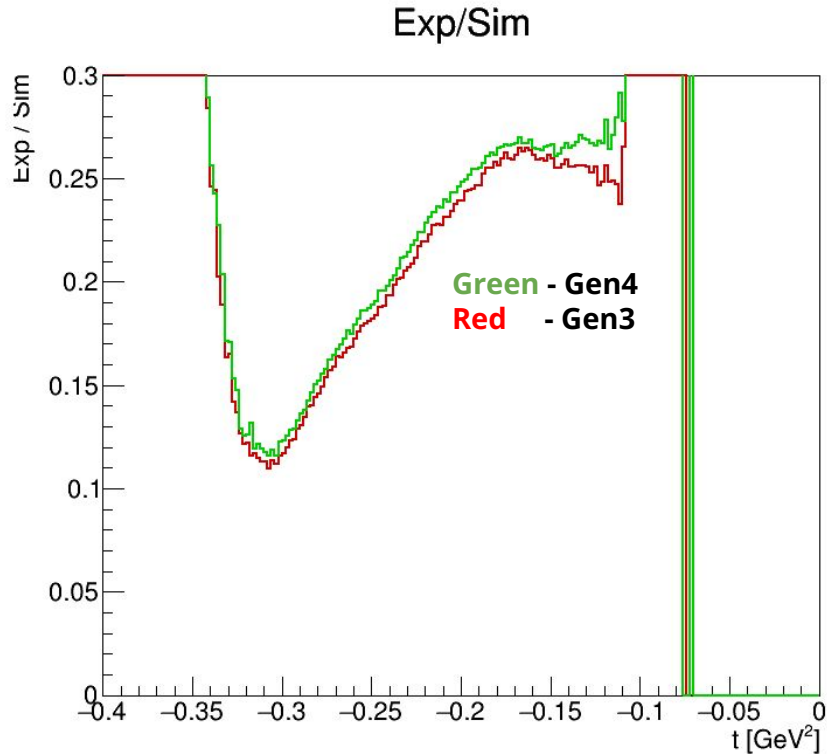
Experimental data



Simulation data

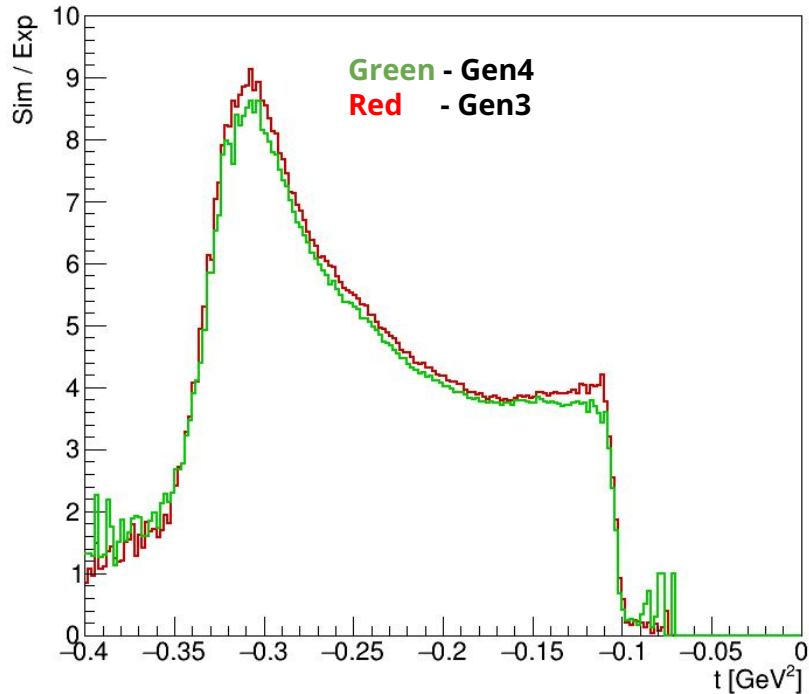


# HF - t - 4mom transfer Exp/Sim

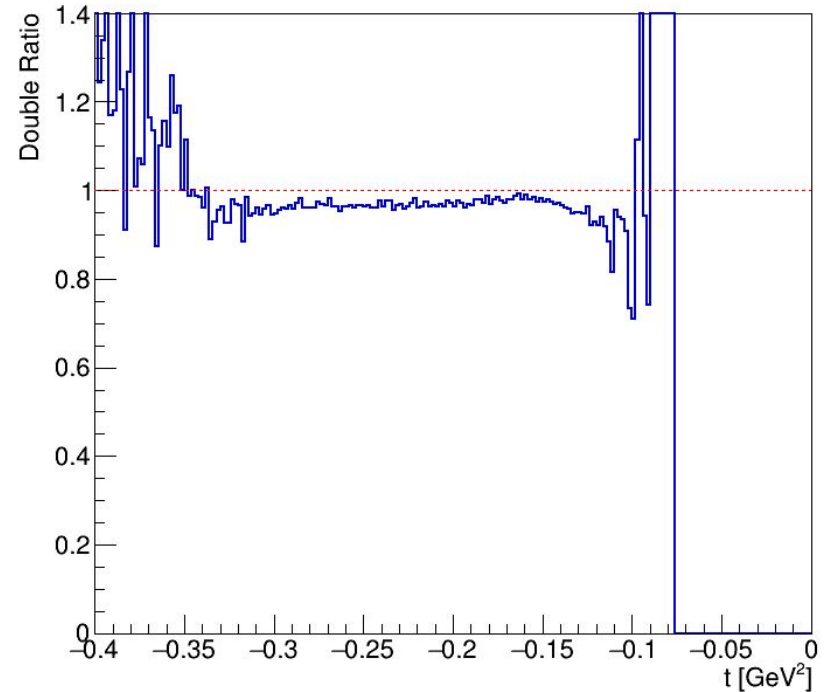


# HF - t - 4mom transfer Sim/Exp

Sim/Exp



Gen4(Sim/Exp) / Gen3(Sim/Exp)



# HF - Efficiency & Luminosity

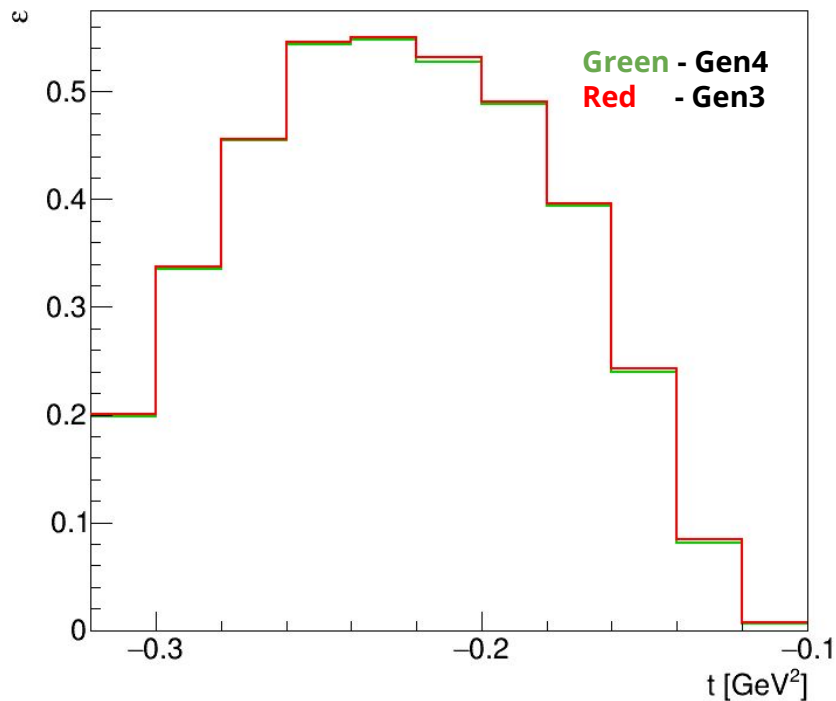
**Integrated Luminosity (-0.29;-0.11):**

-> Gen4: 31.6546 nb<sup>-1</sup>

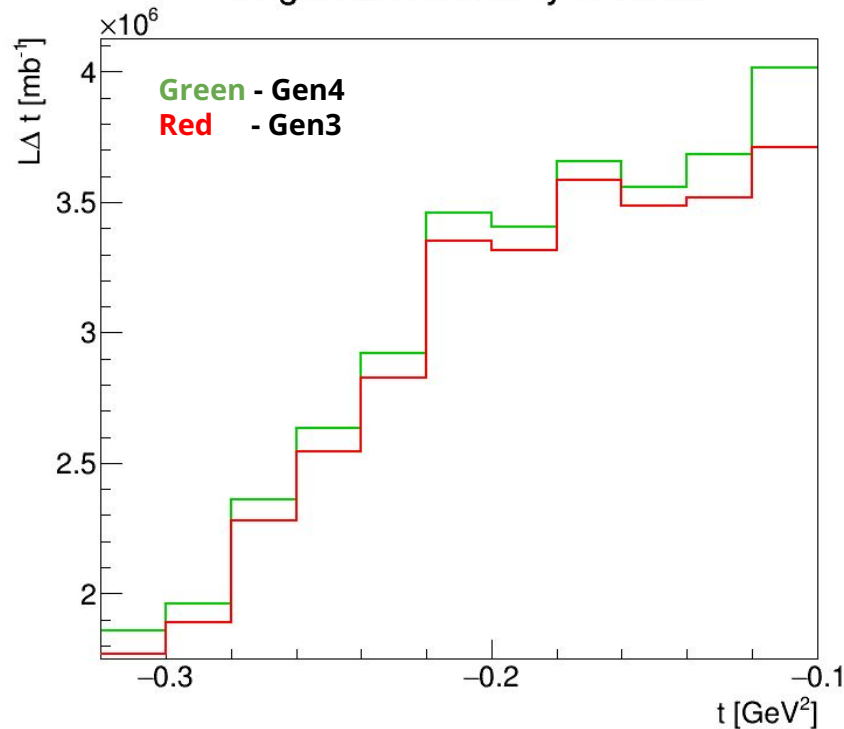
-> Gen3: 30.5025 nb<sup>-1</sup>

Does not include correction  
for Sim-Exp discrepancy yet

Efficiency



Integrated Luminosity in  $t$  bins



# HF - Efficiency & Luminosity

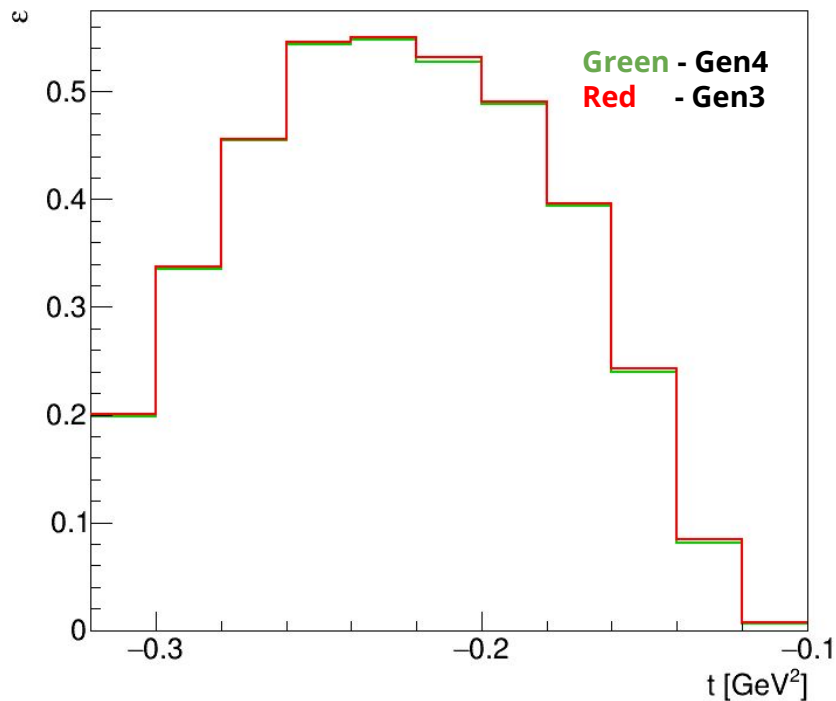
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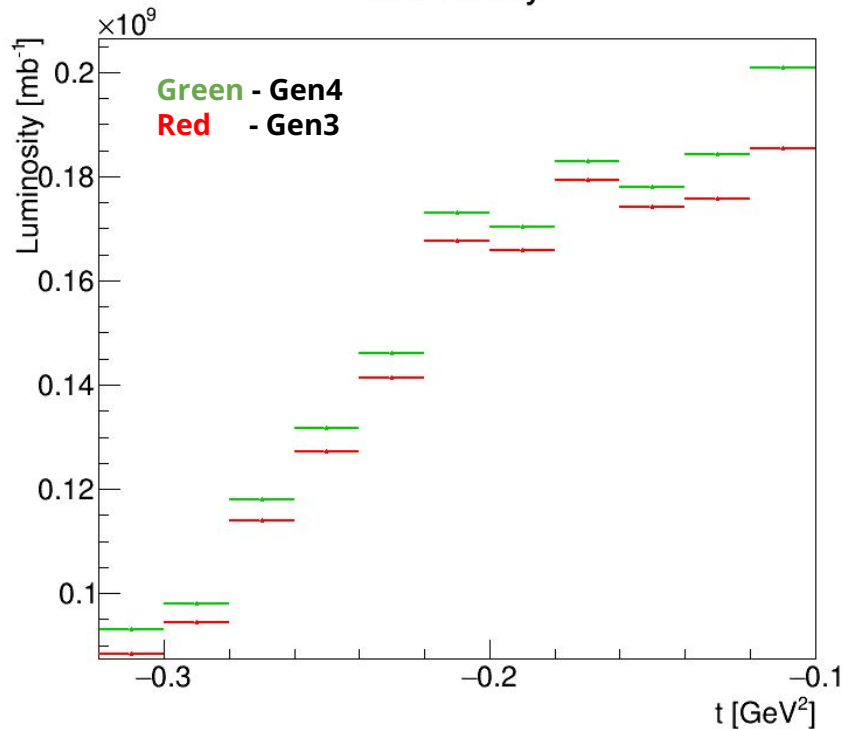
-> Gen3: 30.5025 nb<sup>-1</sup>

Does not include correction  
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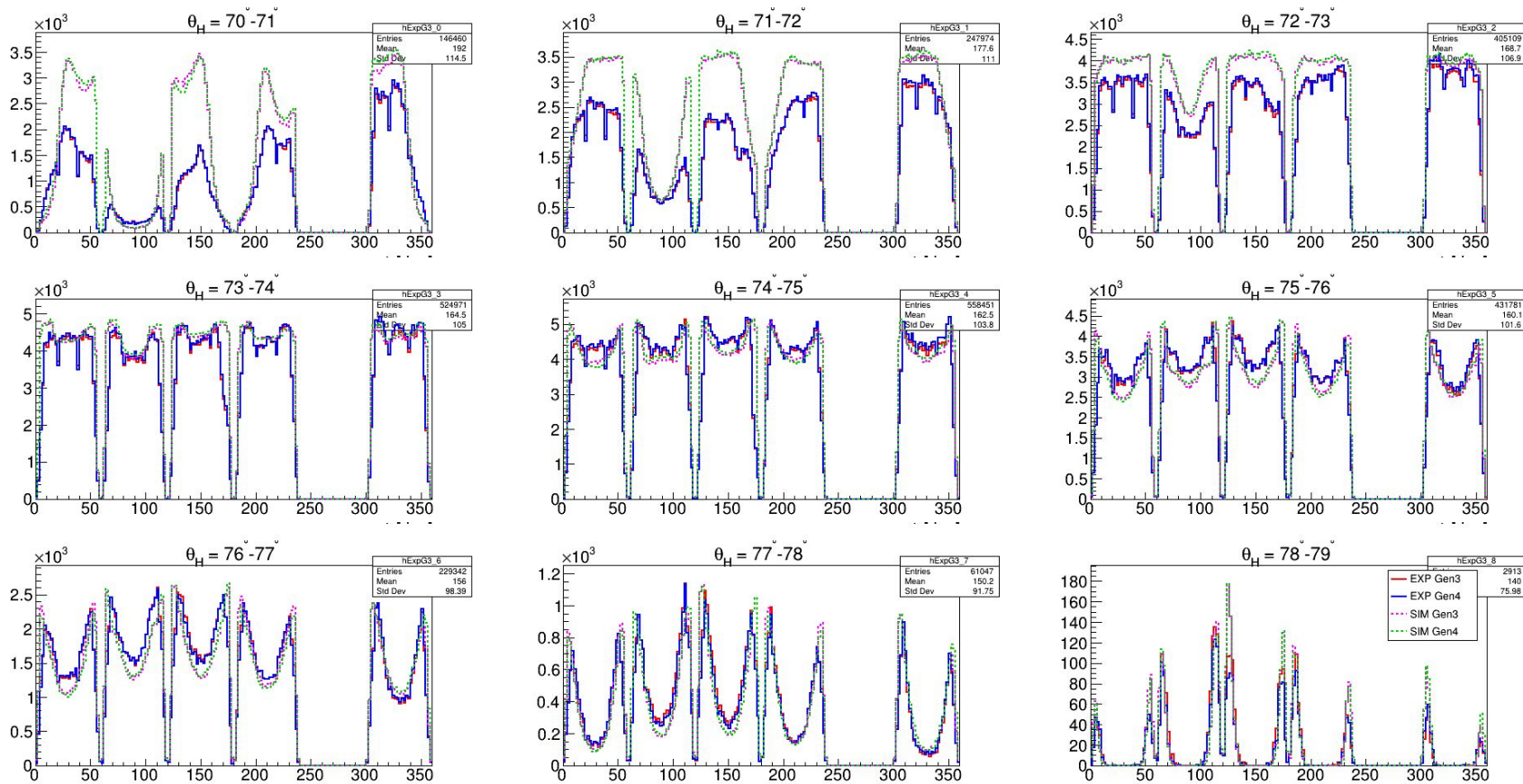
Efficiency



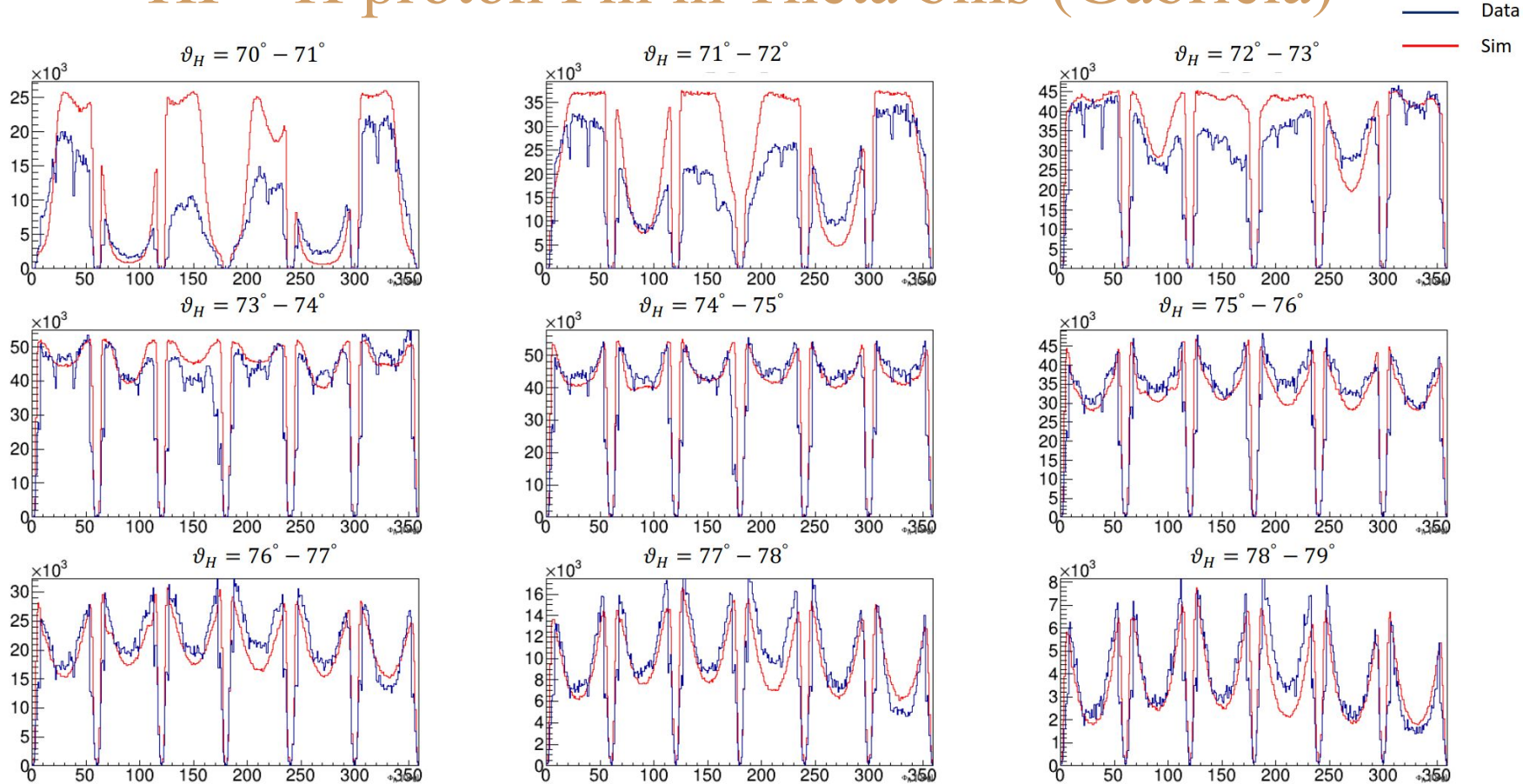
Luminosity



# HF - H proton Phi in Theta bins (Mine)



# HF - H proton Phi in Theta bins (Gabriela)



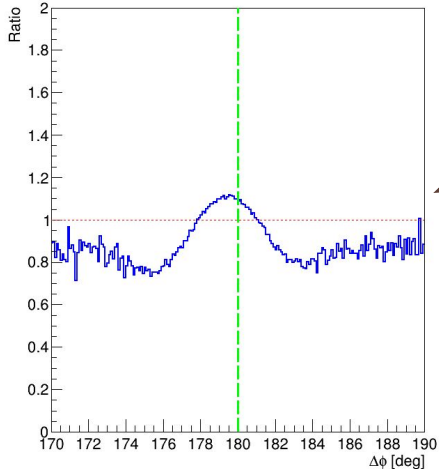
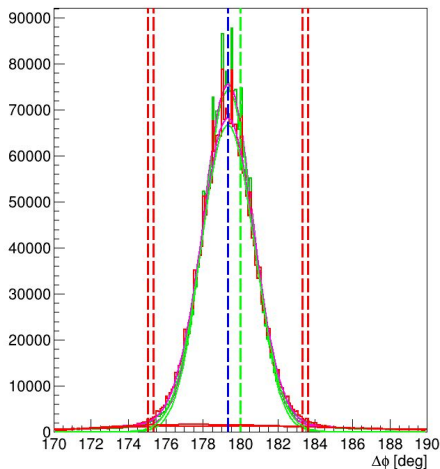
# HF Case

Gen4 & Gen3

Gen4 / Gen3

# HF - $\Delta\Phi$

Experimental data



Experimental data:

**Gen4 Fit results -> Delta Phi:**

Mean:  $179.339 \pm 0.000887422$

Sigma:  $1.32601 \pm 0.000750962$

Signal:  $2.48578e+06 \pm 1618.41$

**Gen3 Fit results -> Delta Phi:**

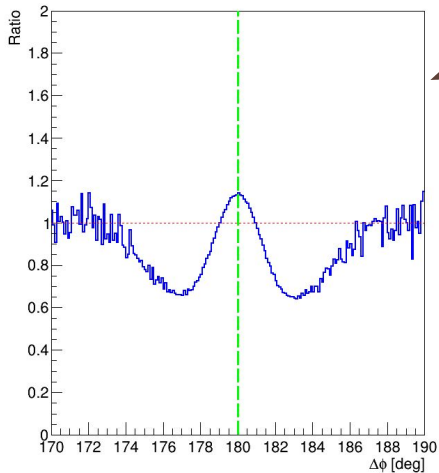
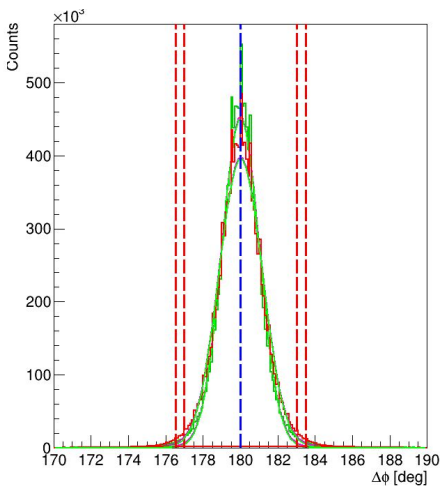
Mean:  $179.323 \pm 0.000985221$

Sigma:  $1.42568 \pm 0.000837125$

Signal:  $2.3993e+06 \pm 1588.67$

**Yield Gen4/Gen3: 1.03604**

Simulation data



Simulation data:

**Gen4 Fit results -> Delta Phi:**

Mean:  $180.005 \pm 0.000302417$

Sigma:  $1.00505 \pm 0.000271873$

Signal:  $1.14815e+07 \pm 3410.44$

**Gen3 Fit results -> Delta Phi:**

Mean:  $180.011 \pm 0.000347739$

Sigma:  $1.16007 \pm 0.000310059$

Signal:  $1.16028e+07 \pm 3431.83$

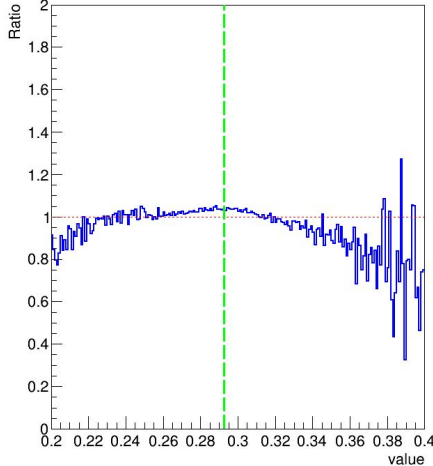
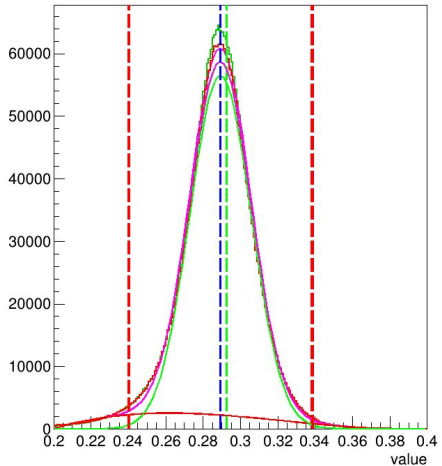
**Yield Gen4/Gen3: 0.989544**

Gen4 & Gen3

Gen4 / Gen3

# HF - TanTheta

Experimental data



Experimental data:

**Gen4 Fit results -> TanTheta:**

Mean:  $0.289204 \pm 1.1468e-05$

Sigma:  $0.0162514 \pm 1.004e-05$

Signal:  $2.39992e+06 \pm 1630.91$

**Gen3 Fit results -> TanTheta:**

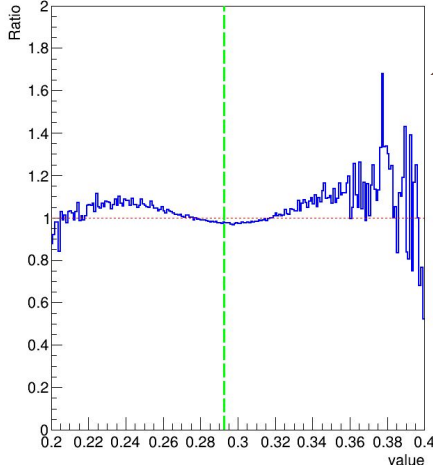
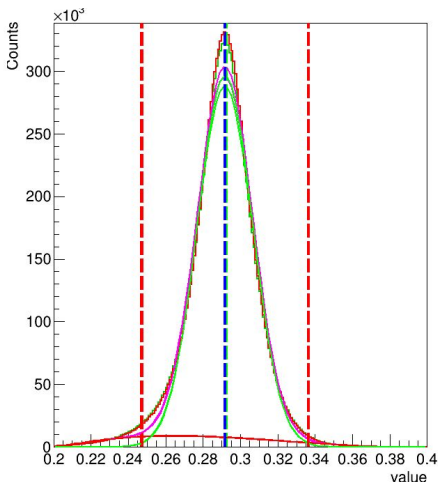
Mean:  $0.289264 \pm 1.17933e-05$

Sigma:  $0.0164385 \pm 1.03504e-05$

Signal:  $2.33854e+06 \pm 1617.81$

**Yield Gen4/Gen3: 1.02625**

Simulation data



Simulation data:

**Gen4 Fit results -> TanTheta:**

Mean:  $0.291588 \pm 4.87355e-06$

Sigma:  $0.0149542 \pm 4.44759e-06$

Signal:  $1.08912e+07 \pm 3412.5$

**Gen3 Fit results -> TanTheta:**

Mean:  $0.291721 \pm 4.75224e-06$

Sigma:  $0.0147455 \pm 4.31151e-06$

Signal:  $1.1037e+07 \pm 3427.86$

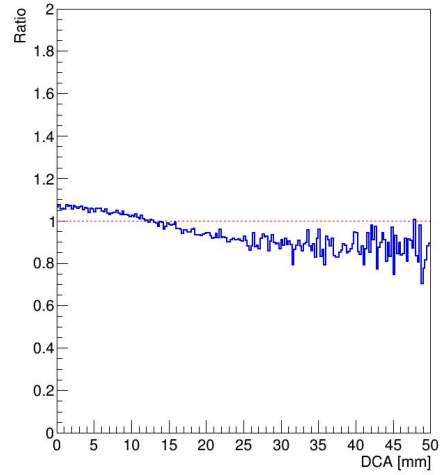
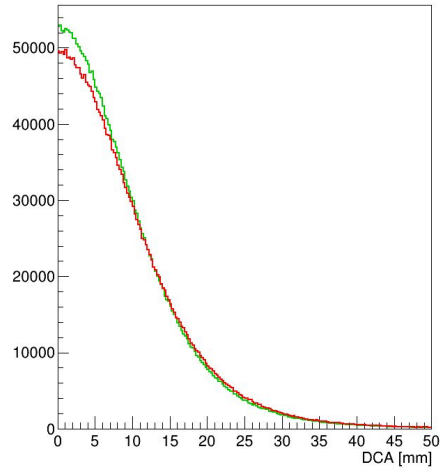
**Yield Gen4/Gen3: 0.986796**

Gen4 & Gen3

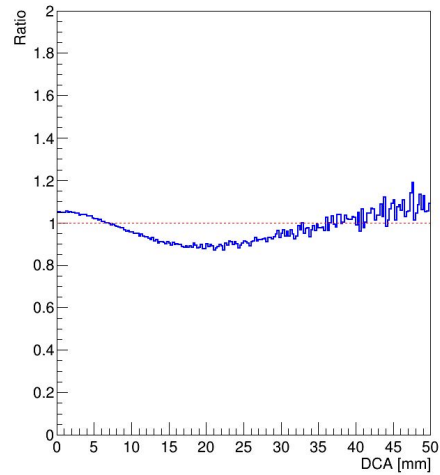
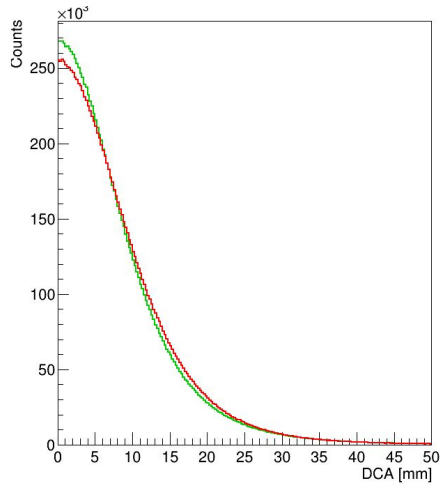
Gen4 / Gen3

# HF - DCA

Experimental data



Simulation data

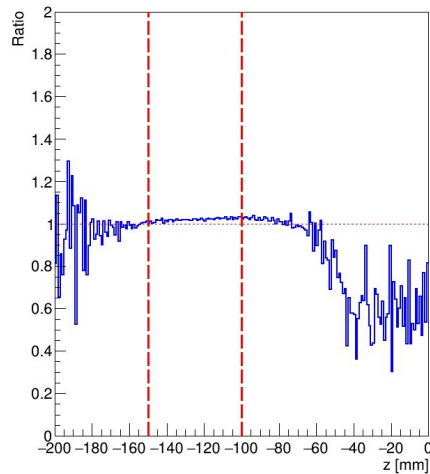
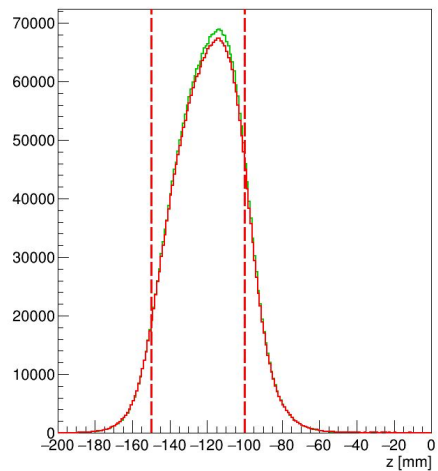


Gen4 & Gen3

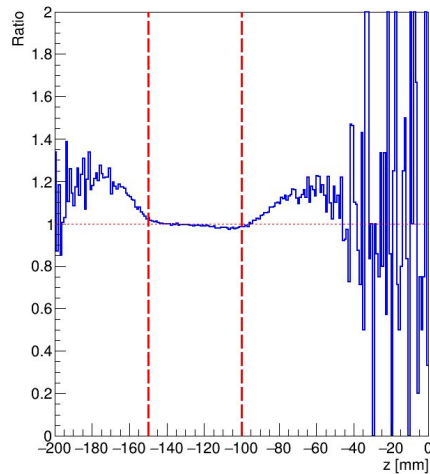
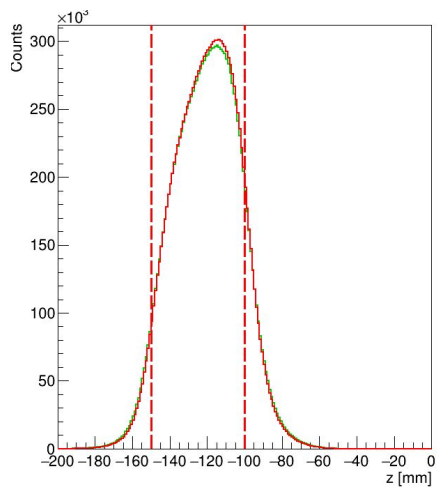
Gen4 / Gen3

HF - VertexZ

Experimental data



Simulation data

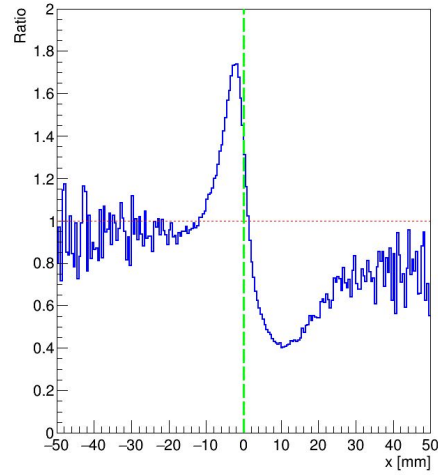
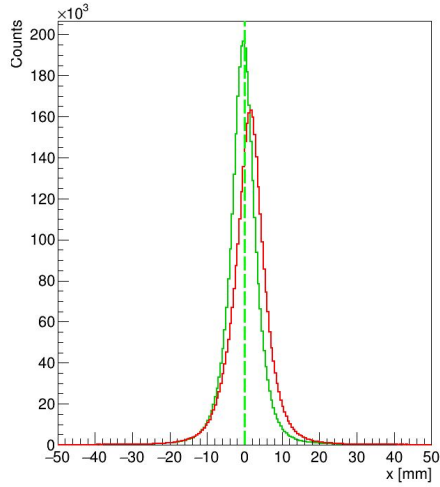


# HF - VertexX

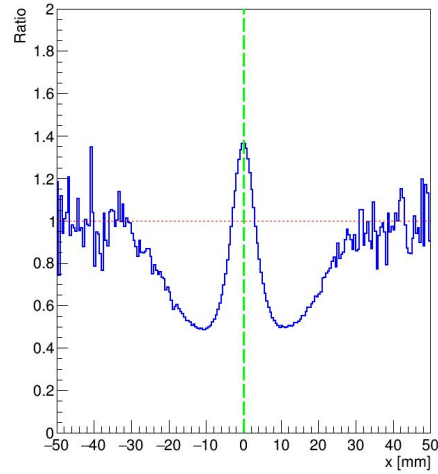
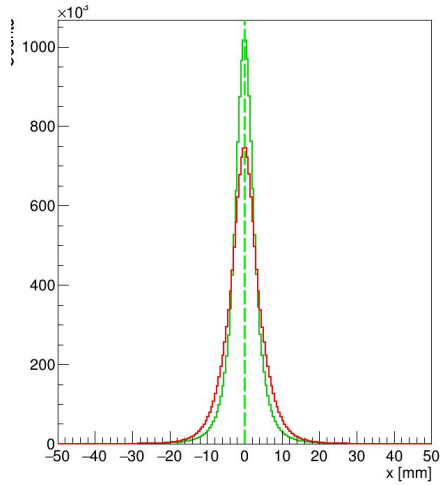
Gen4 & Gen3

Gen4 / Gen3

Experimental data



Simulation data

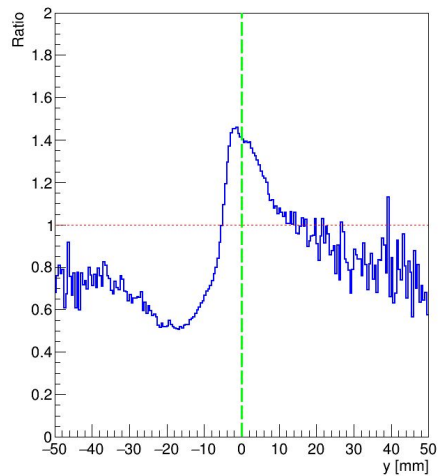
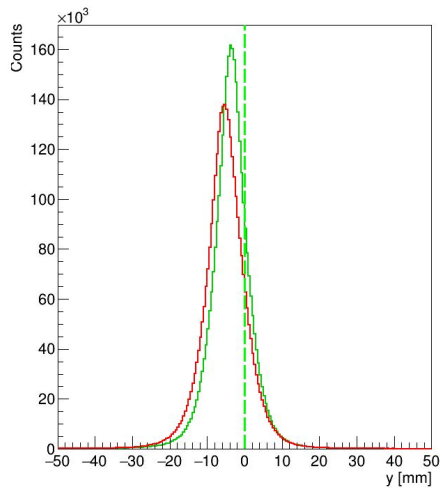


Gen4 & Gen3

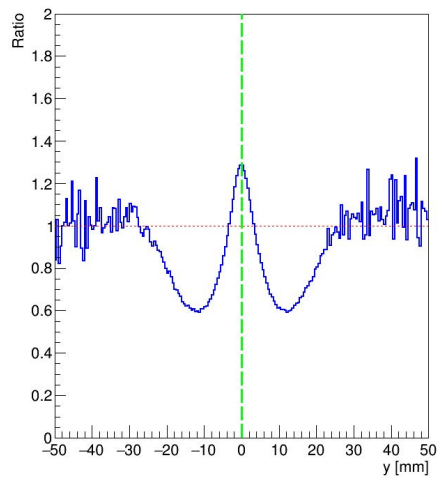
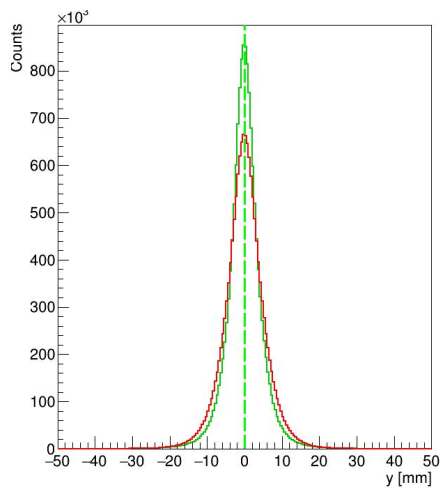
Gen4 / Gen3

HF - Vertex Y

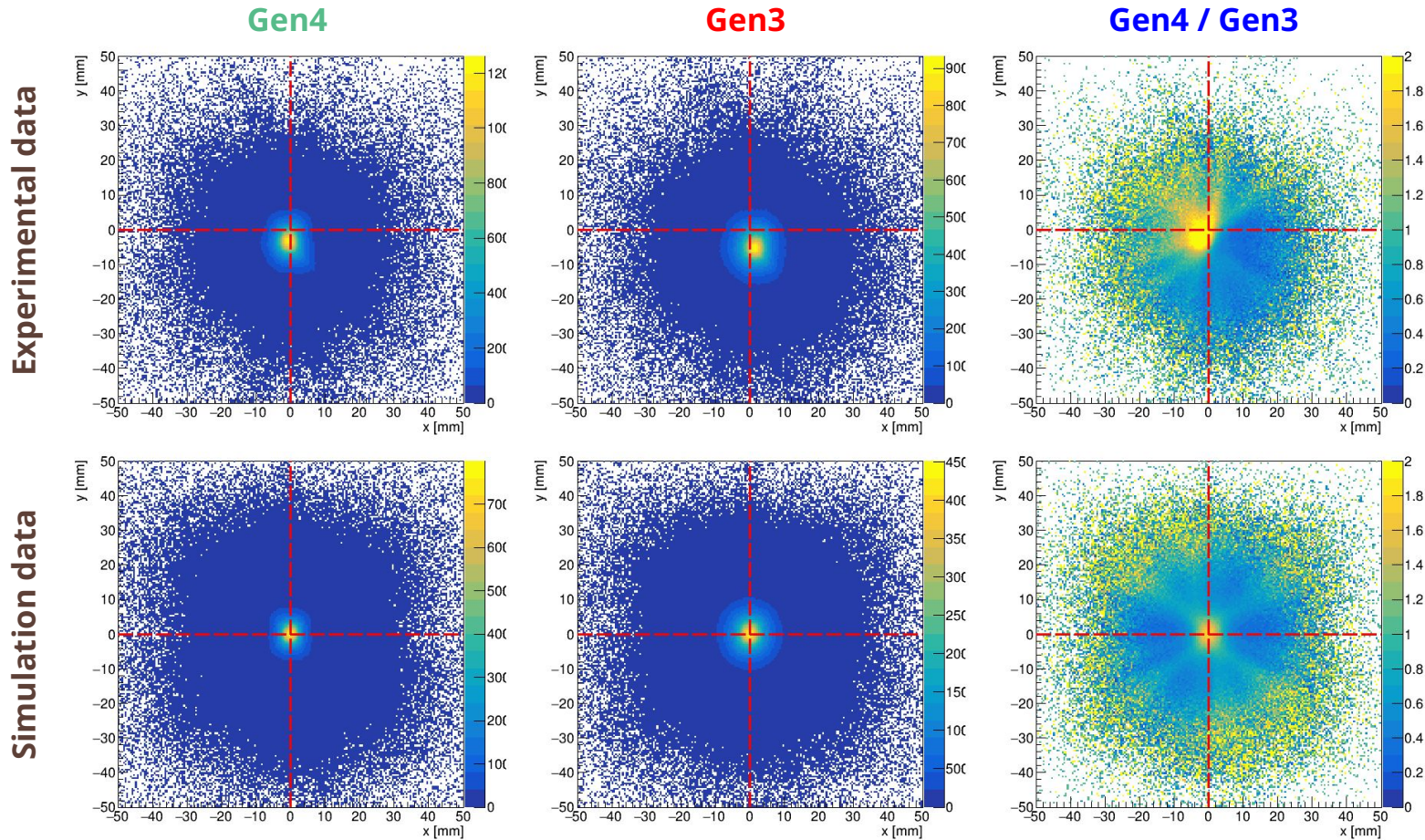
Experimental data



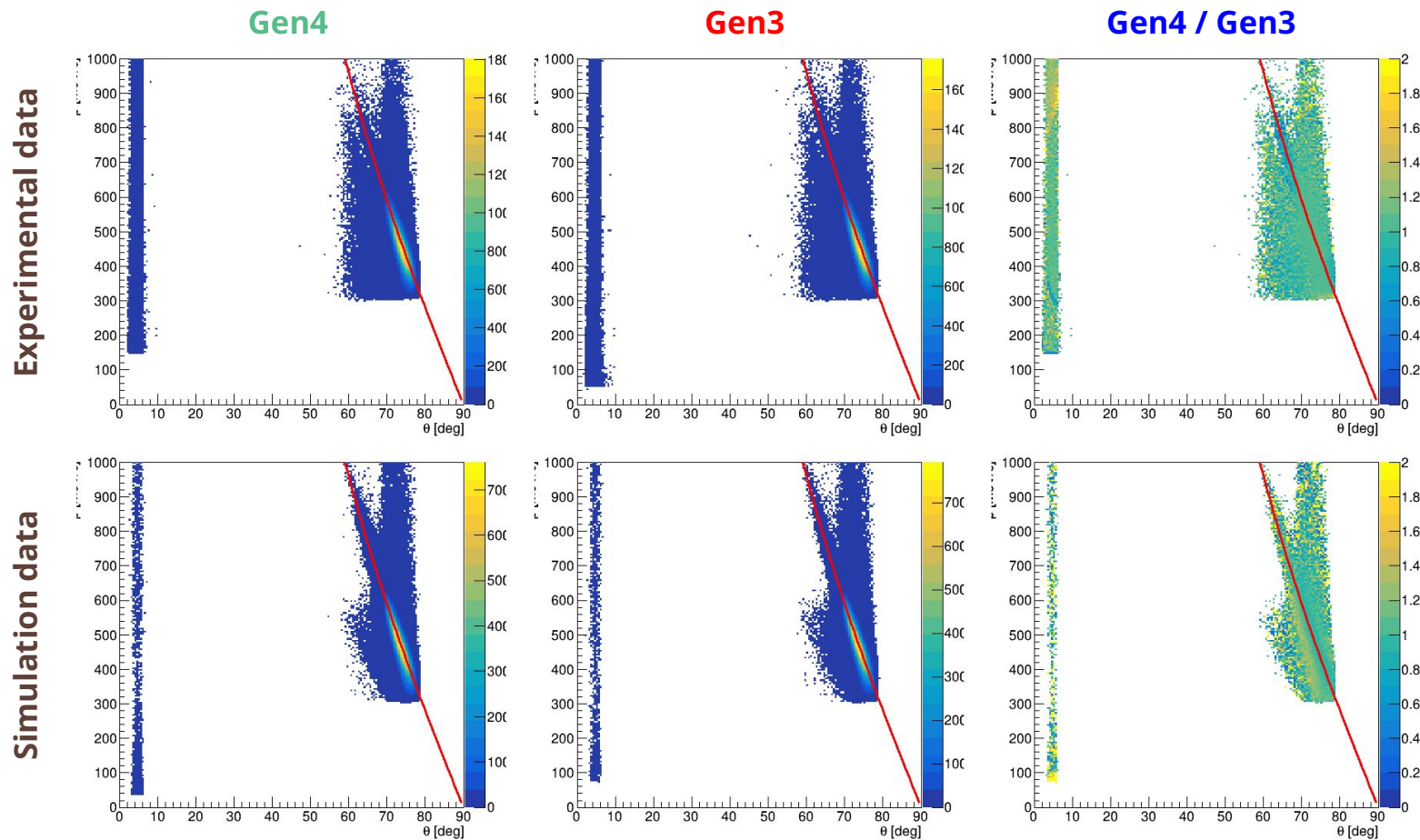
Simulation data



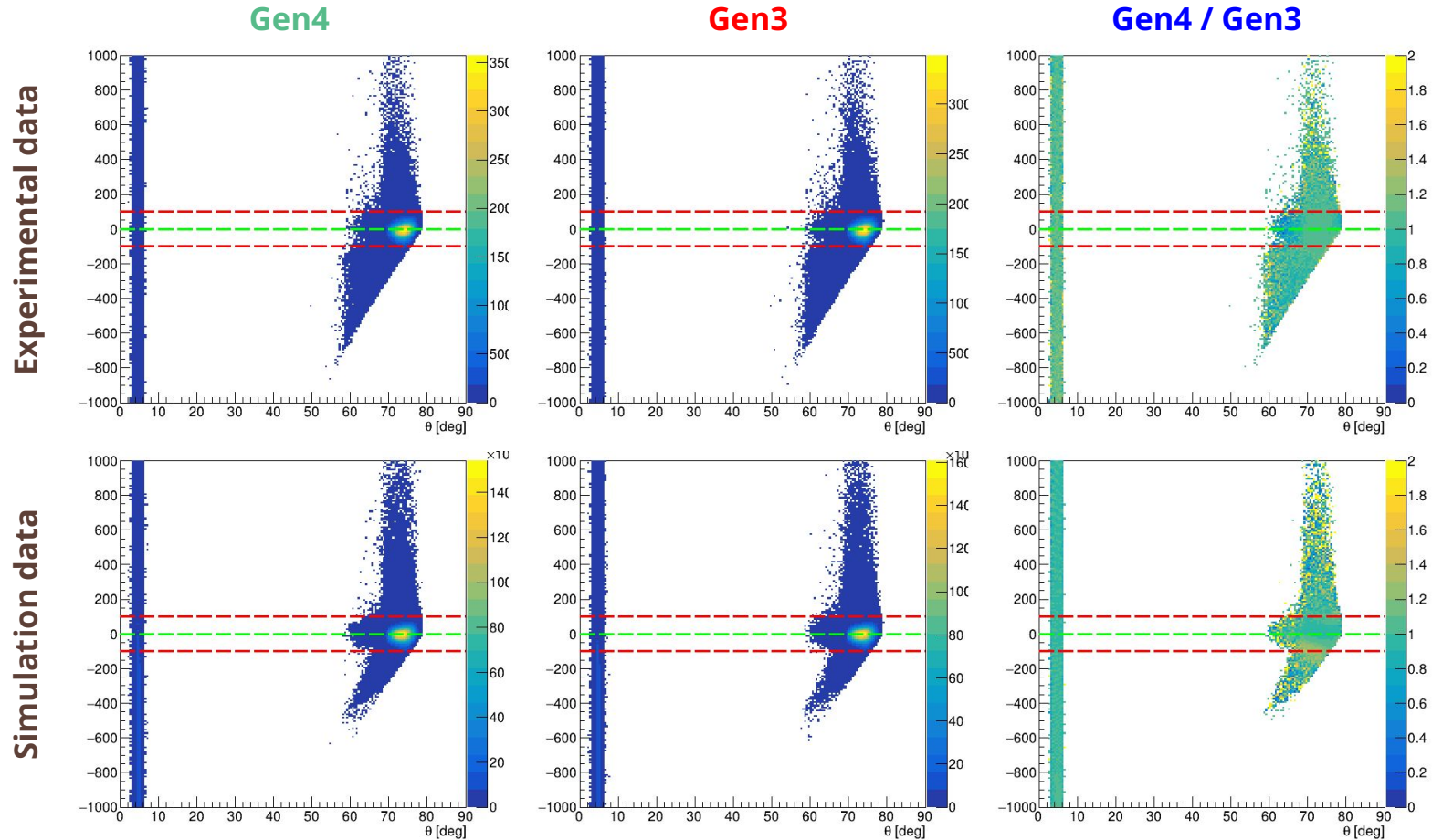
# HF - VertexXY



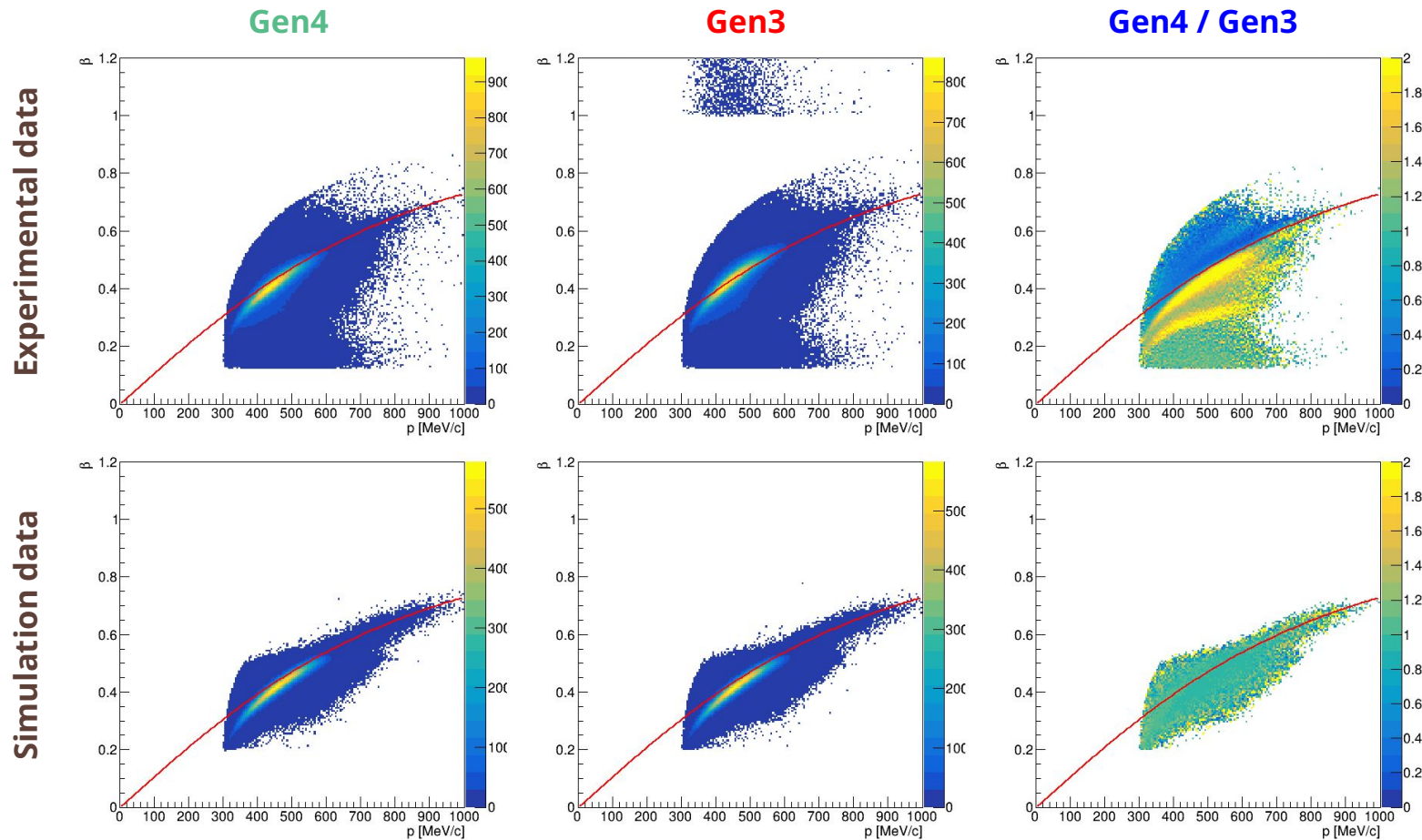
# HF - Mom vs Theta



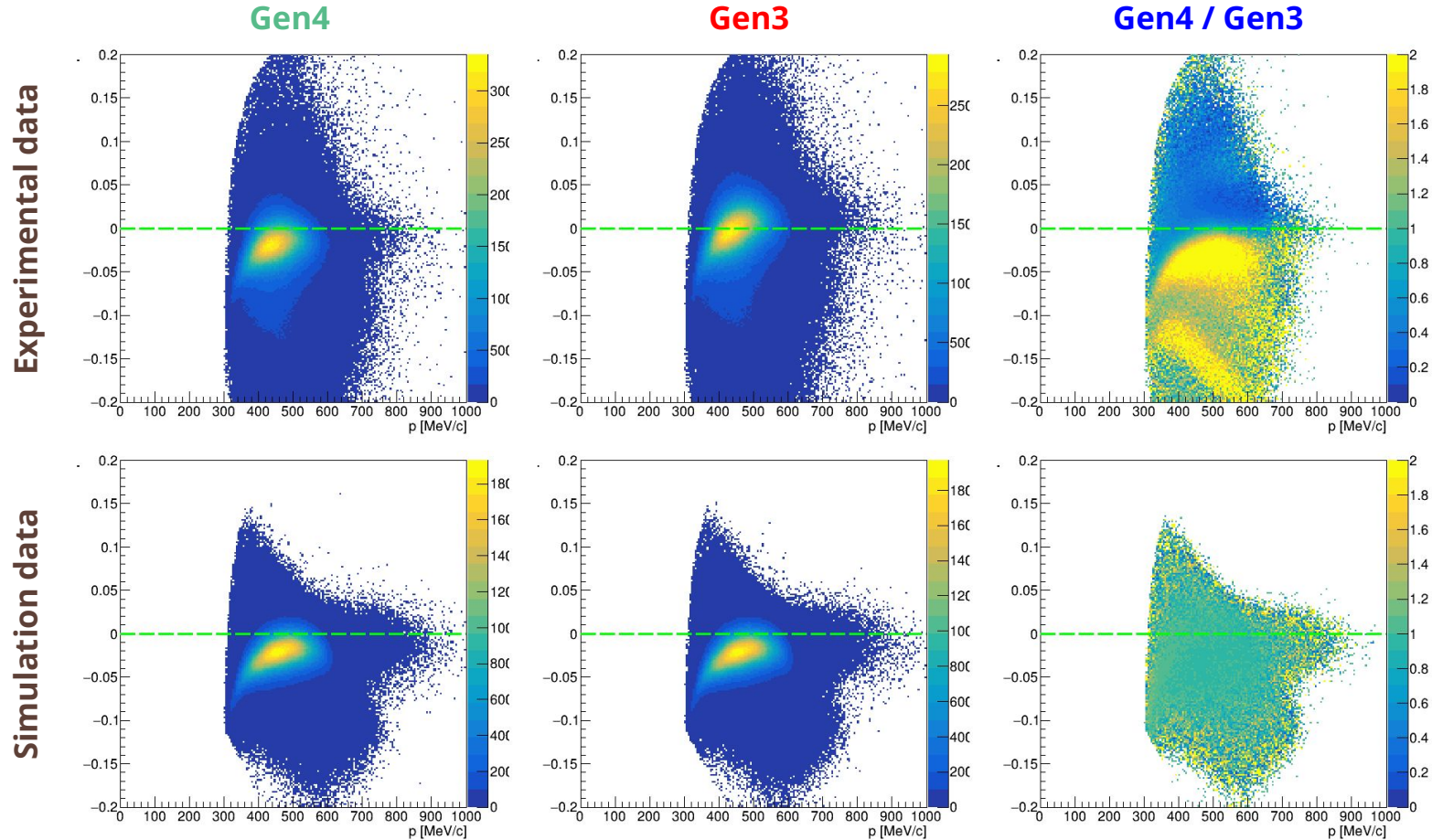
# HF - $\Delta$ Mom vs Theta



# HF - Beta vs Mom (PID)



# HF - $\Delta\text{Beta}$ vs Mom (PID)



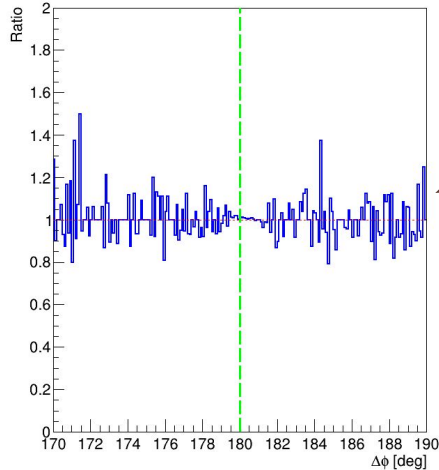
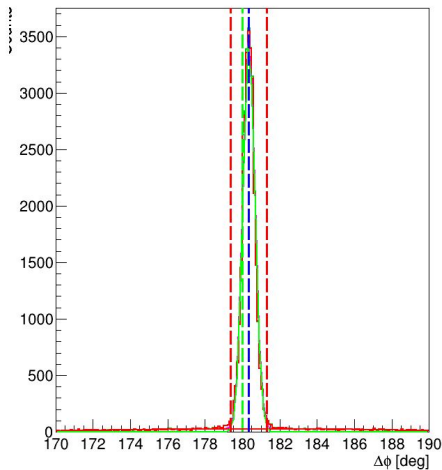
# HH Case

Gen4 & Gen3

Gen4 / Gen3

# HH - $\Delta\Phi$

Experimental data



Experimental data:

**Gen4 Fit results -> Delta Phi:**

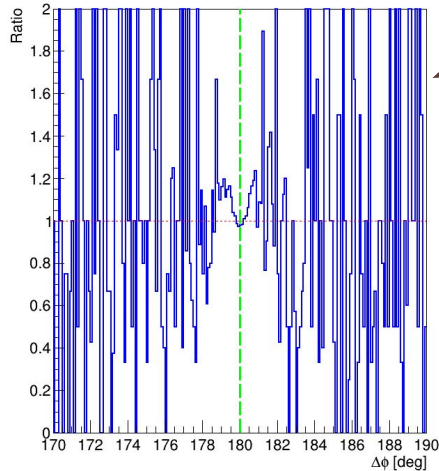
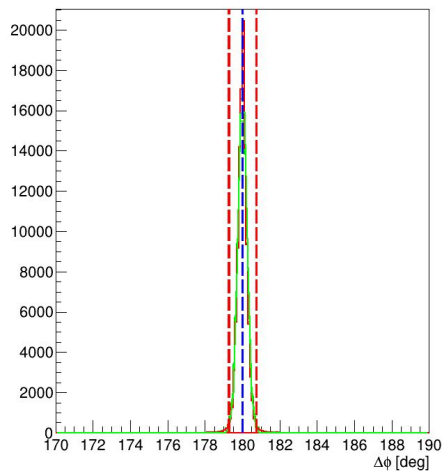
Mean:  $180.344 \pm 0.00197317$   
 Sigma:  $0.322515 \pm 0.00167122$   
 Signal:  $28381.2 \pm 170.09$

**Gen3 Fit results -> Delta Phi:**

Mean:  $180.346 \pm 0.00198113$   
 Sigma:  $0.322623 \pm 0.00167864$   
 Signal:  $28190.5 \pm 169.533$

**Yield Gen4/Gen3: 1.00676**

Simulation data



Simulation data:

**Gen4 Fit results -> Delta Phi:**

Mean:  $180 \pm 0.000772554$   
 Sigma:  $0.250838 \pm 0.0006924$   
 Signal:  $106418 \pm 326.326$

**Gen3 Fit results -> Delta Phi:**

Mean:  $180.001 \pm 0.000745535$   
 Sigma:  $0.241424 \pm 0.000663354$   
 Signal:  $105921 \pm 325.555$

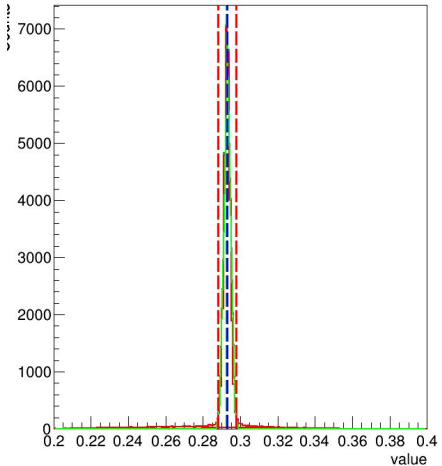
**Yield Gen4/Gen3: 1.0047**

Gen4 & Gen3

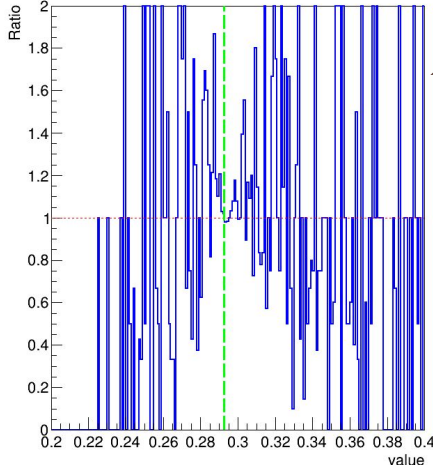
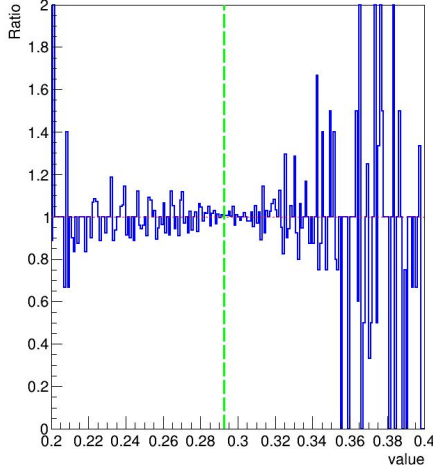
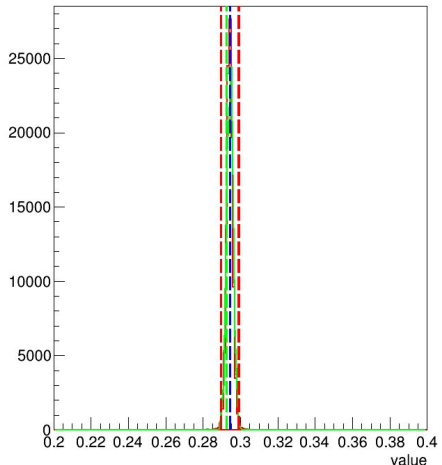
Gen4 / Gen3

# HH - TanTheta

Experimental data



Simulation data



Experimental data:

**Gen4 Fit results -> TanTheta:**

Mean:  $0.292937 \pm 1.0024e-05$

Sigma:  $0.00165698 \pm 8.68814e-06$

Signal:  $28573.2 \pm 169.833$

**Gen3 Fit results -> TanTheta:**

Mean:  $0.29293 \pm 1.00405e-05$

Sigma:  $0.00165497 \pm 8.72761e-06$

Signal:  $28376.8 \pm 169.254$

**Yield Gen4/Gen3: 1.00692**

Simulation data:

**Gen4 Fit results -> TanTheta:**

Mean:  $0.294318 \pm 4.9757e-06$

Sigma:  $0.00162514 \pm 4.08425e-06$

Signal:  $107262 \pm 327.586$

**Gen3 Fit results -> TanTheta:**

Mean:  $0.294312 \pm 4.84956e-06$

Sigma:  $0.00157911 \pm 3.94327e-06$

Signal:  $106695 \pm 326.706$

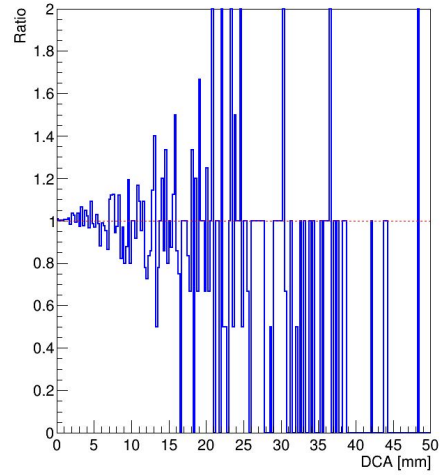
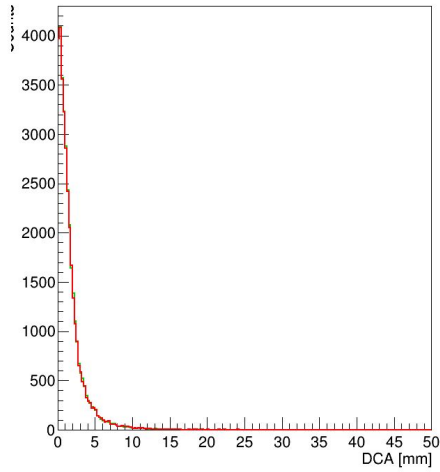
**Yield Gen4/Gen3: 1.00532**

Gen4 & Gen3

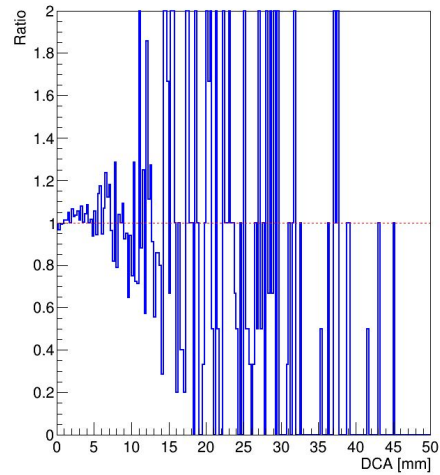
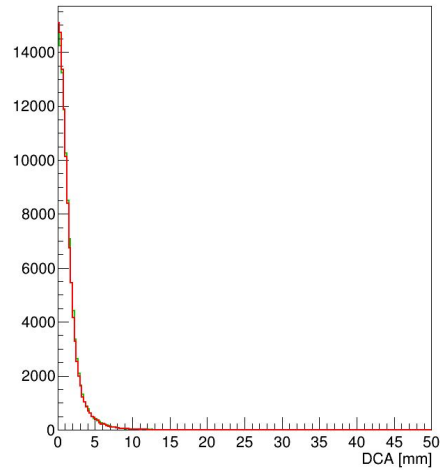
Gen4 / Gen3

HF - DCA

Experimental data



Simulation data

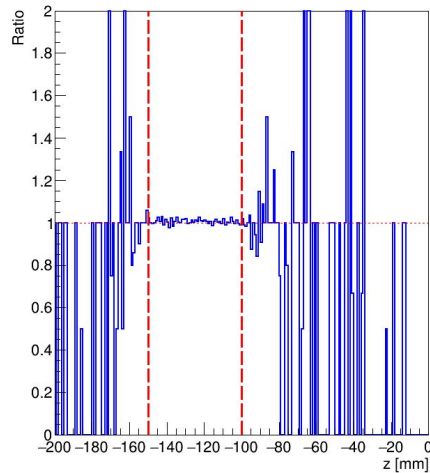
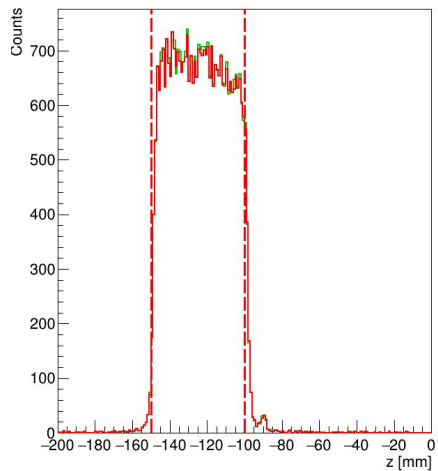


Gen4 & Gen3

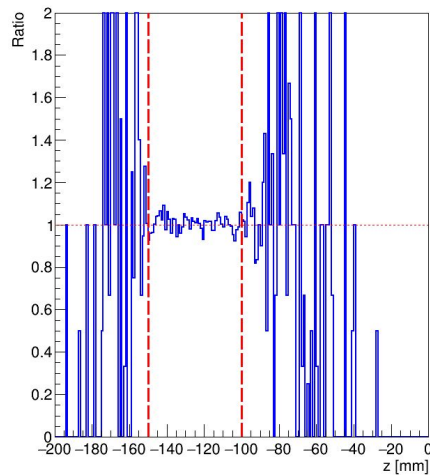
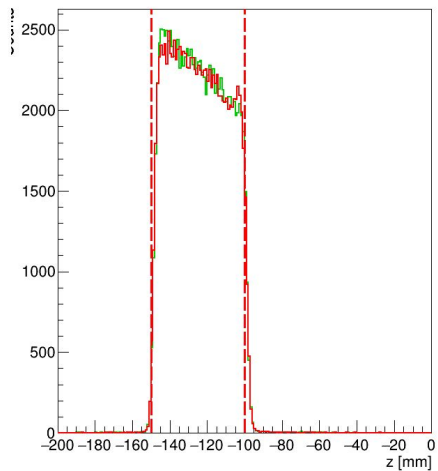
Gen4 / Gen3

HF - VertexZ

Experimental data



Simulation data

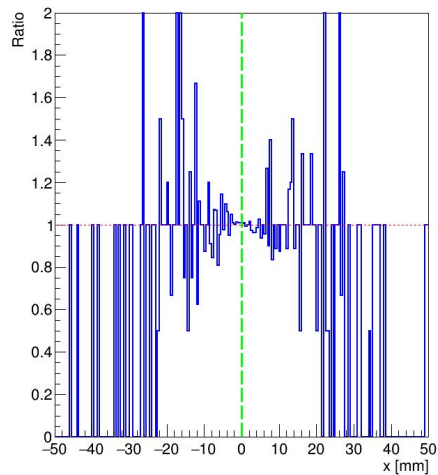
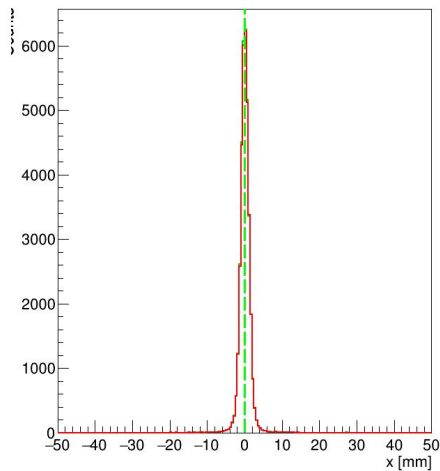


Gen4 & Gen3

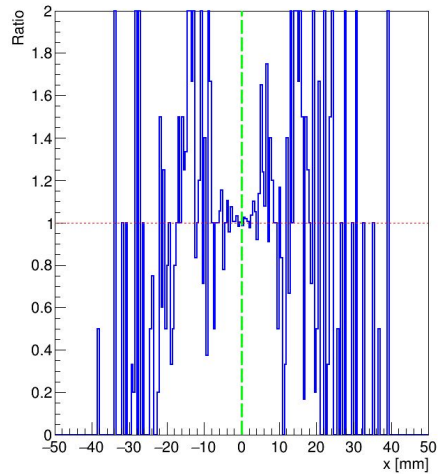
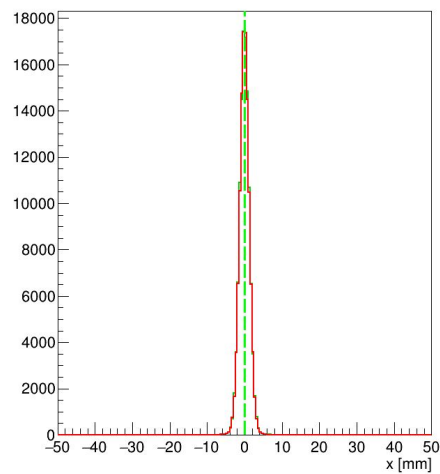
Gen4 / Gen3

HF - VertexX

Experimental data



Simulation data

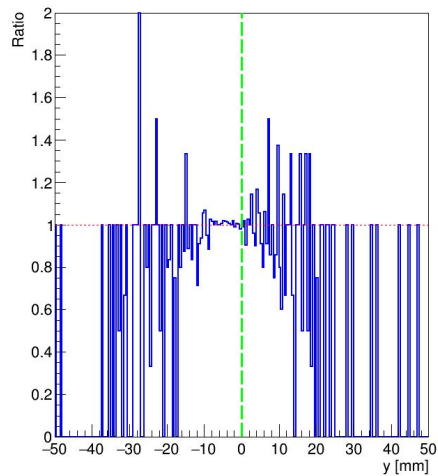
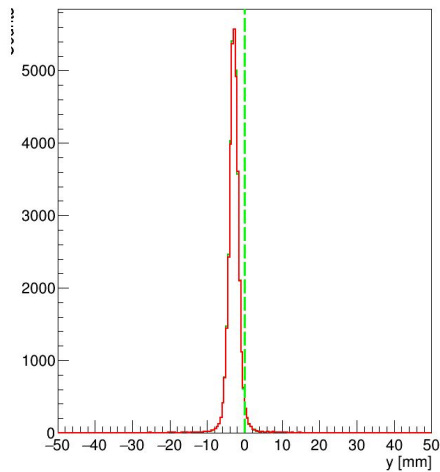


Gen4 & Gen3

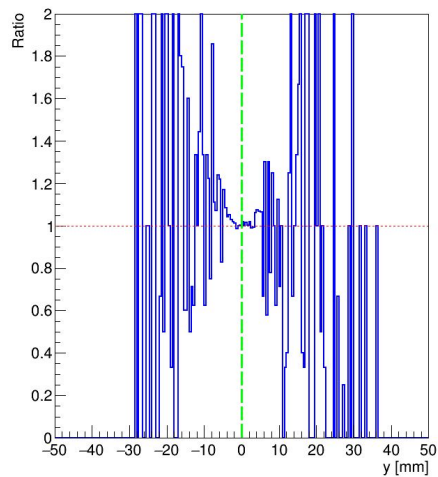
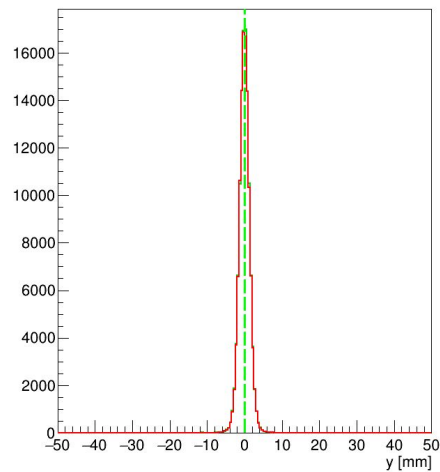
Gen4 / Gen3

HF - Vertex Y

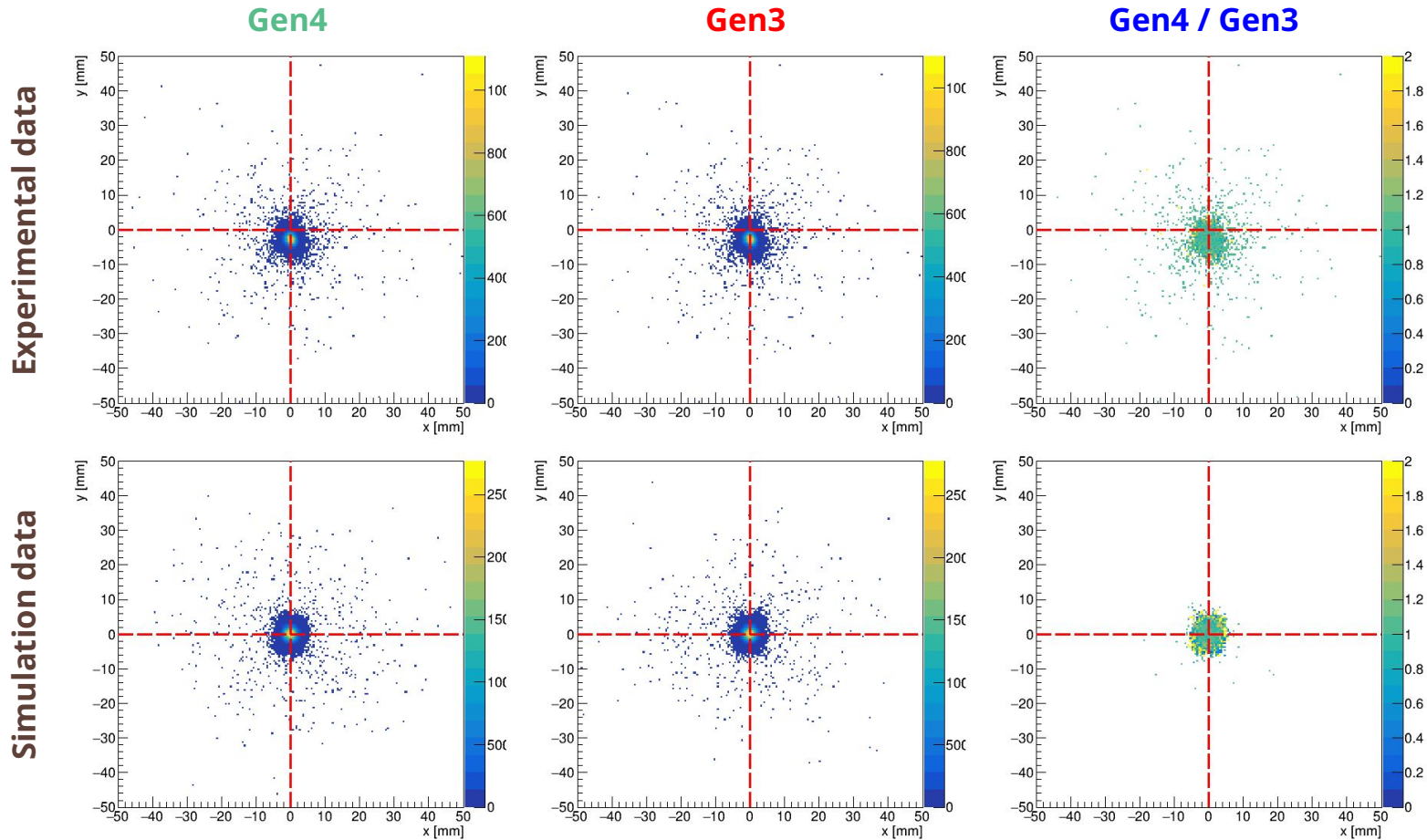
Experimental data



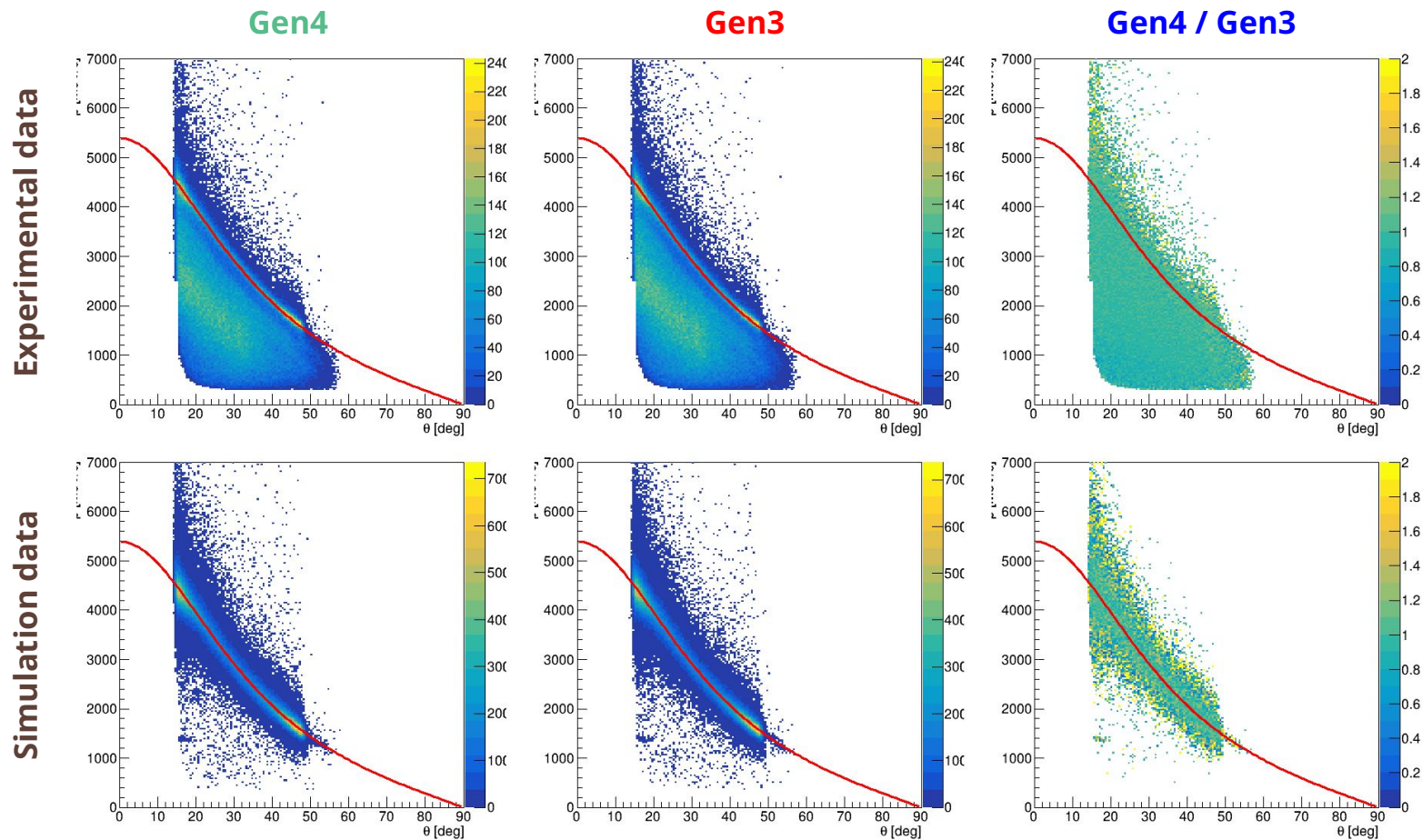
Simulation data



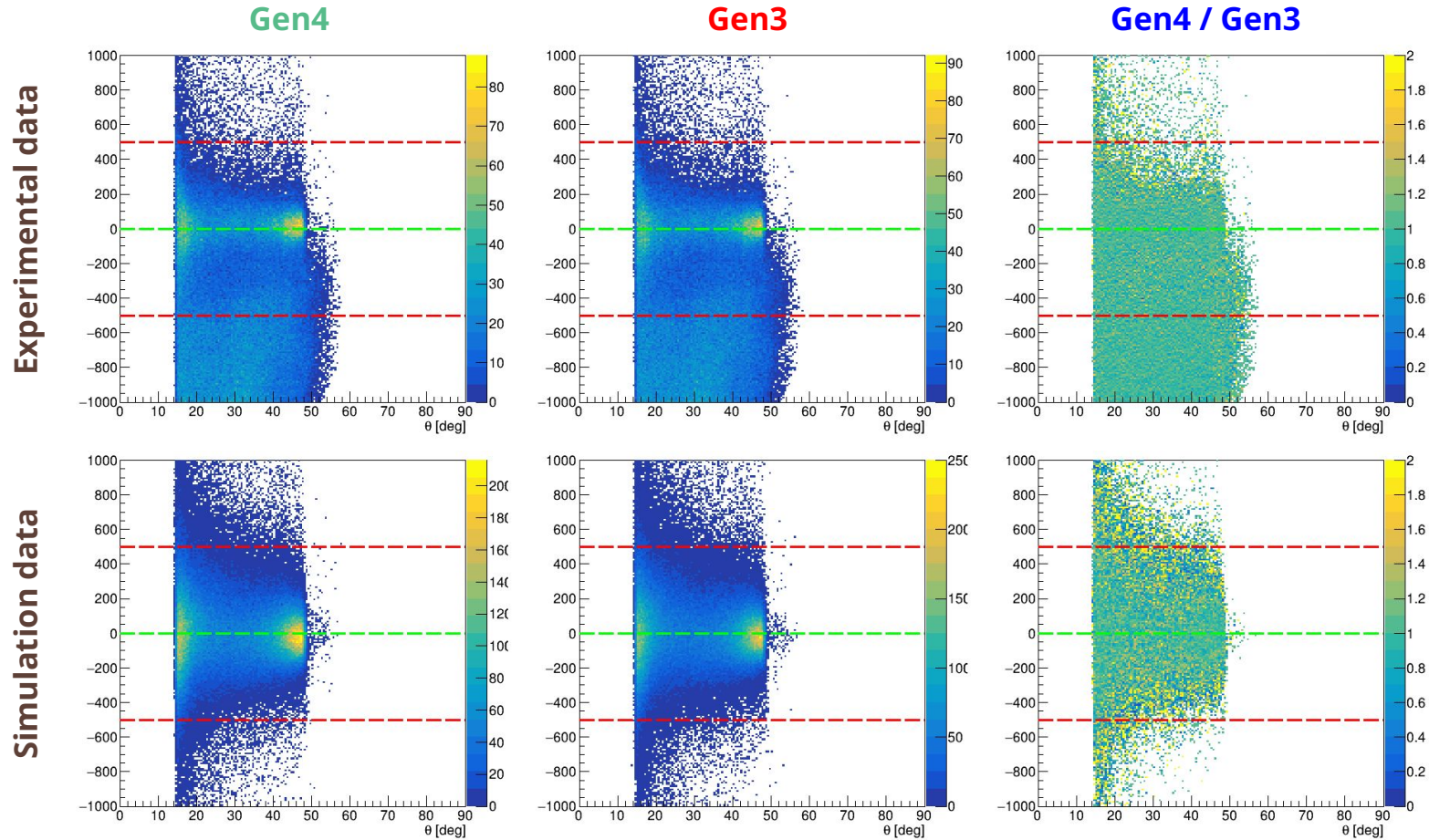
# HF - VertexXY



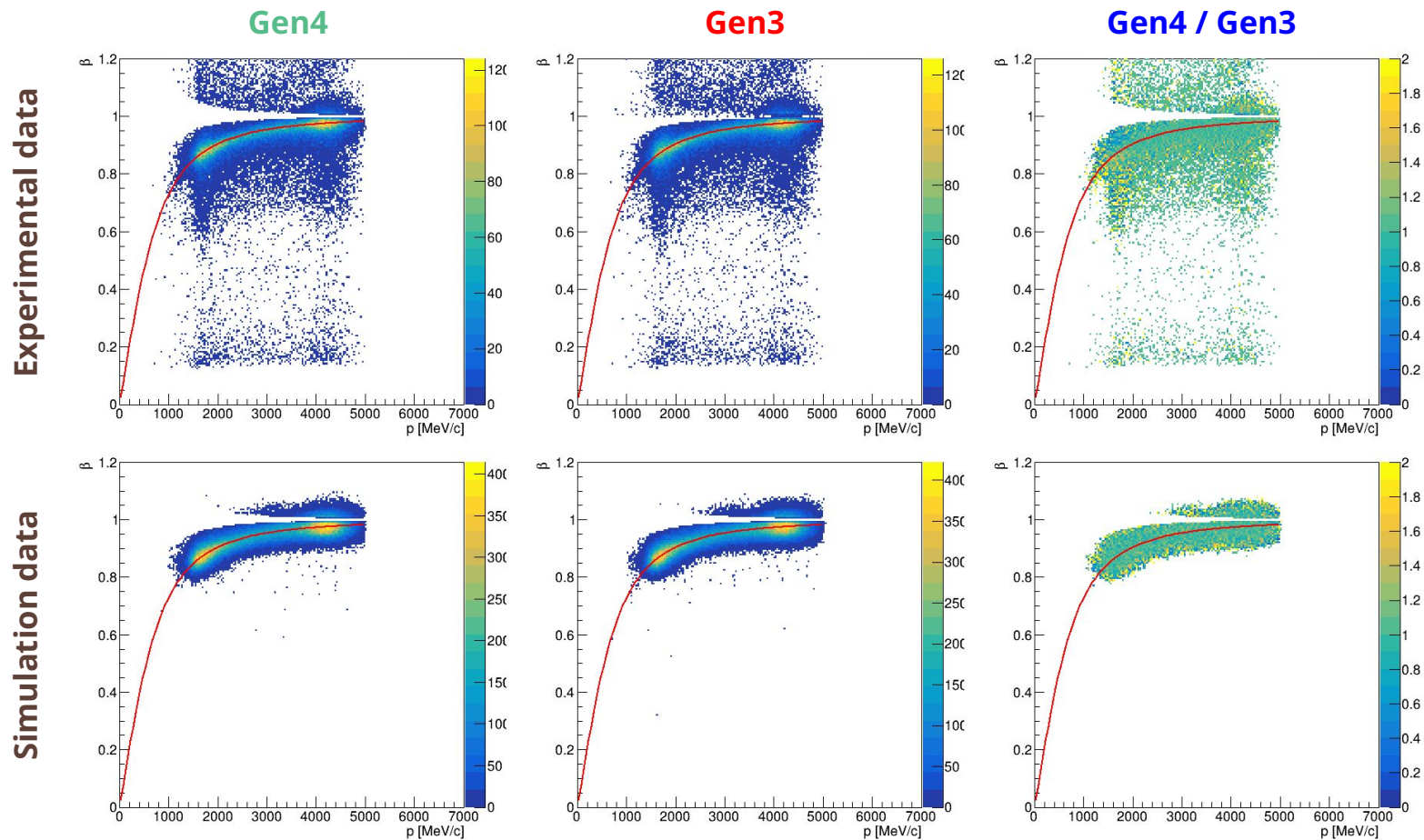
# HF - Mom vs Theta



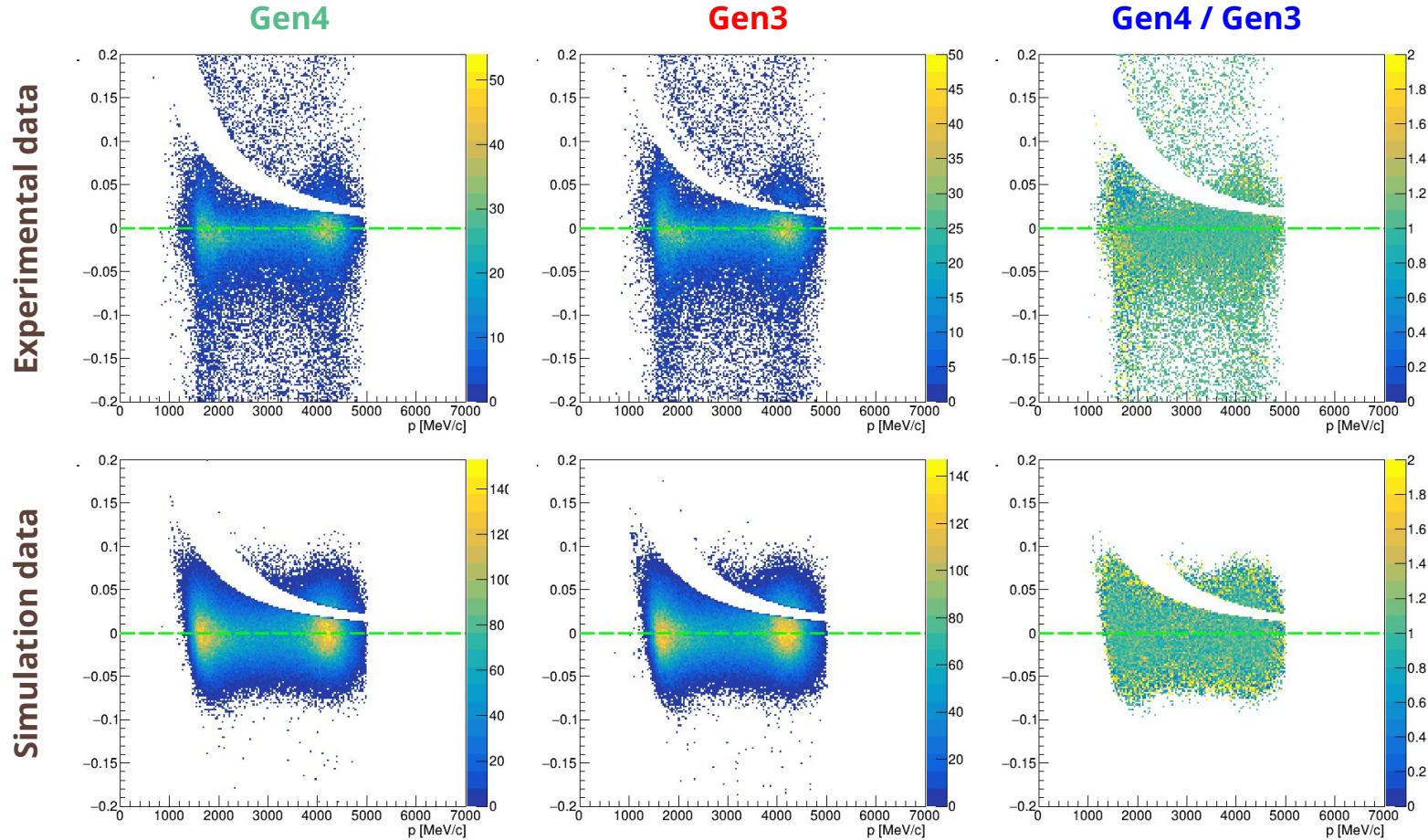
# HF - $\Delta$ Mom vs Theta



# HF - Beta vs Mom (PID)



# HF - $\Delta\text{Beta}$ vs Mom (PID)





# BACKUP

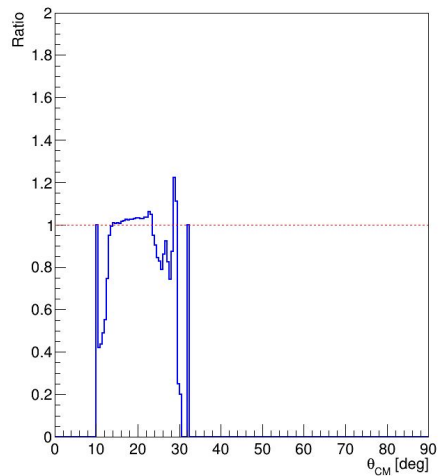
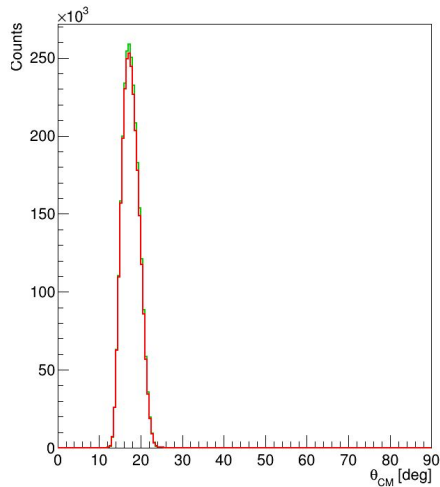


Gen4 & Gen3

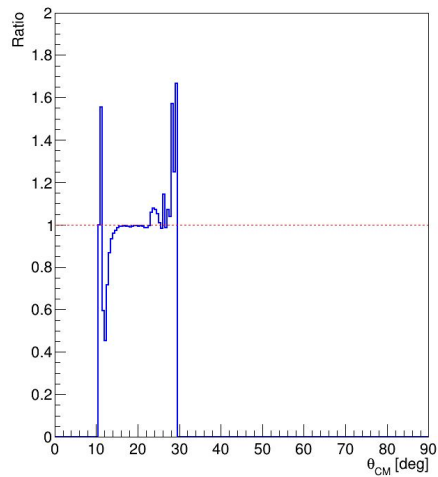
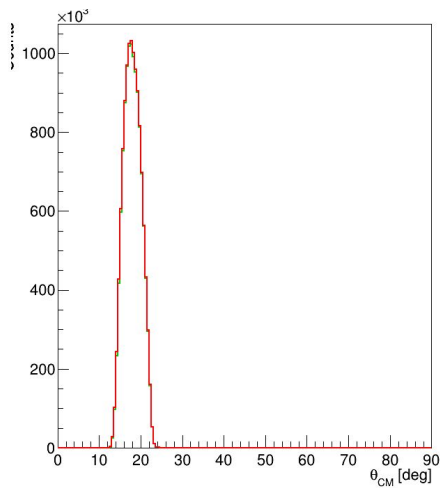
Gen4 / Gen3

# HF - Theta CM

Experimental data



Simulation data

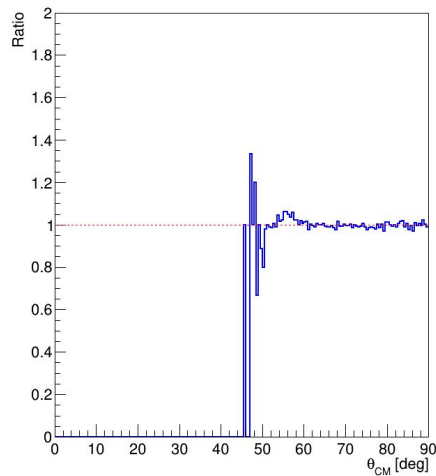
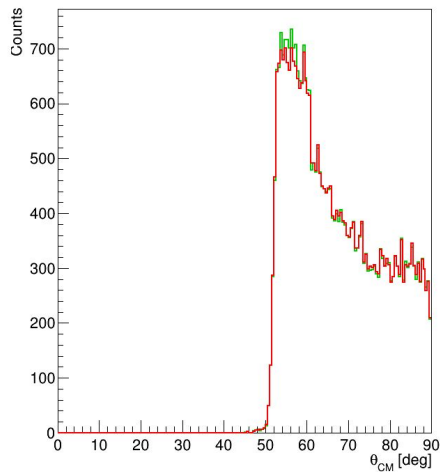


Gen4 & Gen3

Gen4 / Gen3

# HF - Theta CM

Experimental data



Simulation data

