Analysis on CERN TB2022-06 Data

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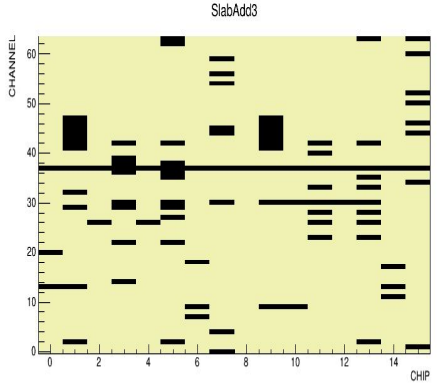
CEPC EU Workshop 2023
July 3-6, 2023

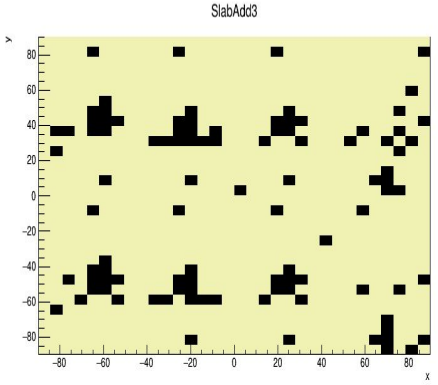
Affiliation:

In collaboration with:

Masking Effect

- There are 15 x 16 x 64 = 15,360 cells in overall SiWECAL
- Some of which were required to be **masked** due to:
  - Electrical cross talk
  - Wafer delamination
  - Connector to the SL board
- Notably, cell 37 has consistently been masked in each chip, representing a recurring anomaly.
- The cumulative effect of such masked cells is substantial and should not be underestimated.
- For an extended period, simulations did not incorporate the consideration of this masking effect.





Procedure

Masking Simulation

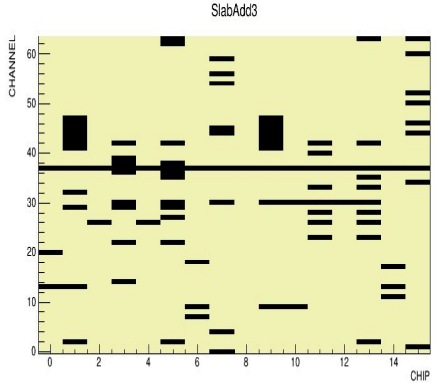
- Masking patch was introduced by Fabricio in SiWECAL-Sim
- Each hit registered in the simulation is associated with the masking information based off the Run_Settings files.
- One need to retrieve and match the masking pattern, same as the one in the reconstruction.

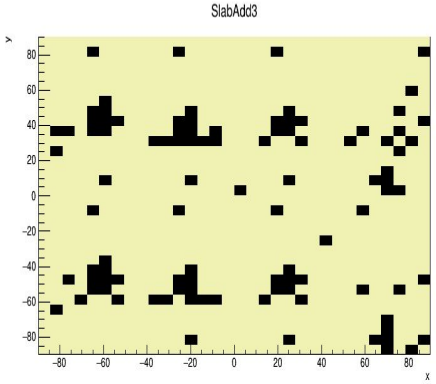
Beam Position

- It is worth highlighting that, generated beam position and size significantly affects the final energy and hit distributions.
- The input beam position and size for the generator will not necessarily be identical to the final beam spot shape. One needs to play around with parameters to get them right.

Selection

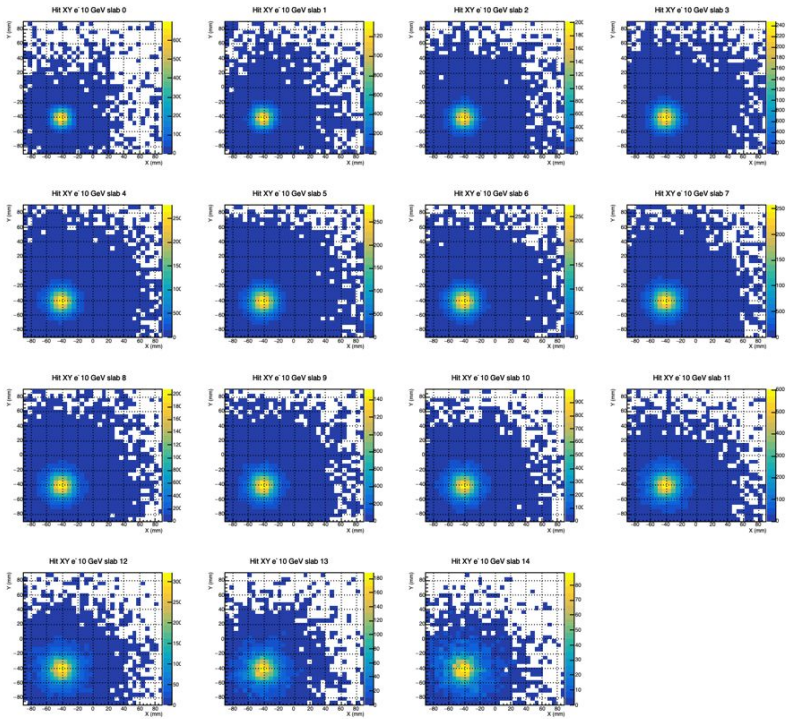
- More than 13 coincidences
- Hit Energy > 1
- Hit SCA > 2

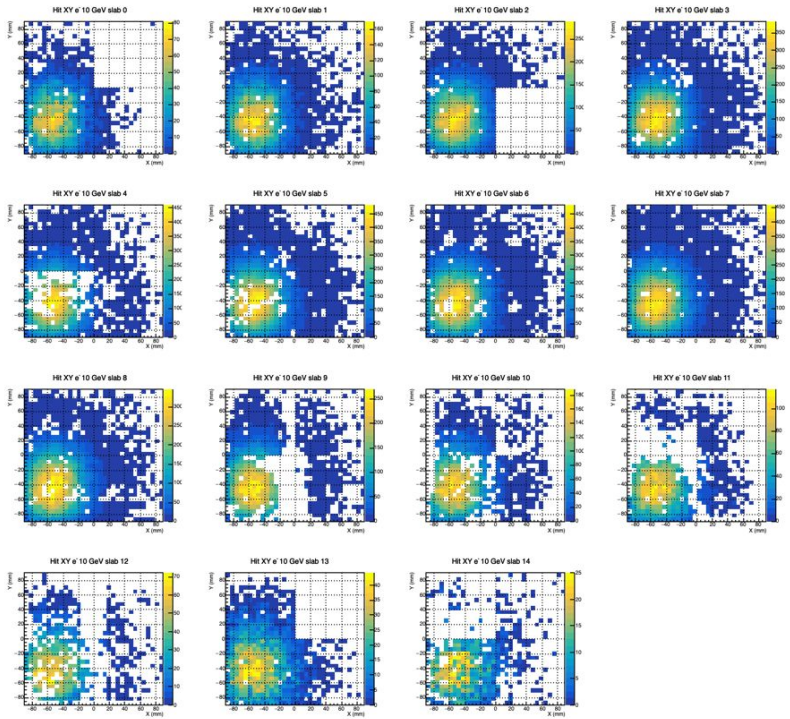




Masking in Action

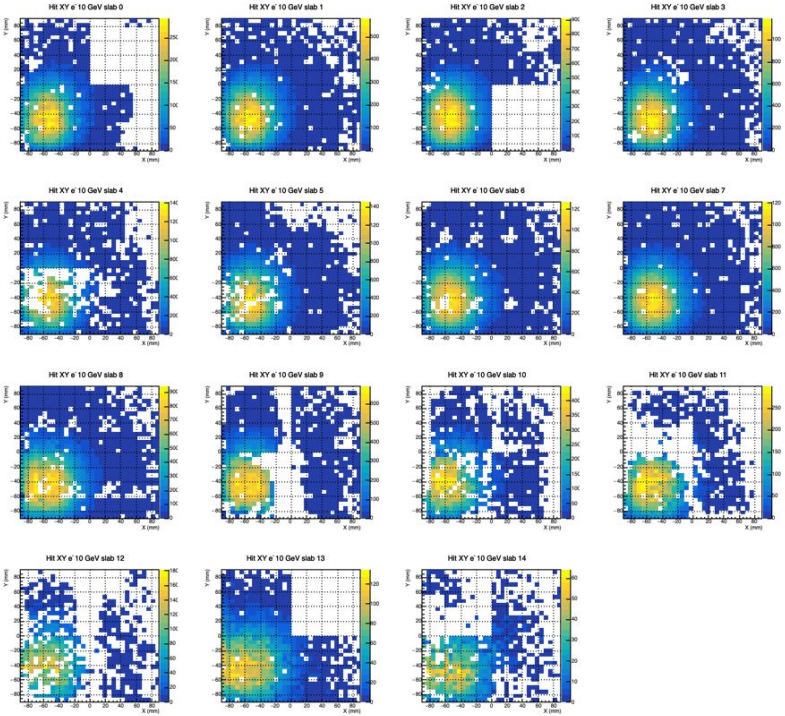
e- 10 GeV simulation



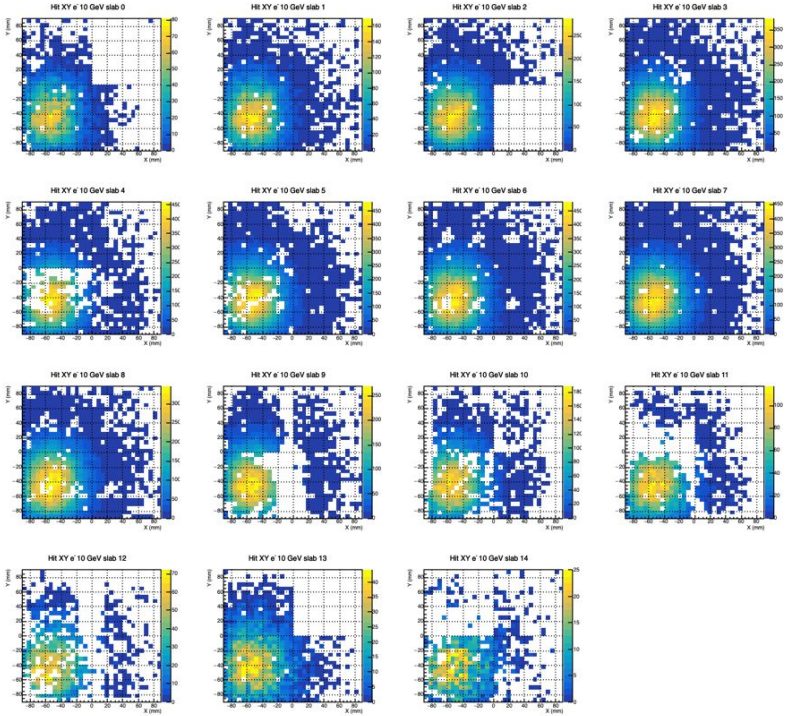


Masking in Action

e- 10 GeV reconstruction

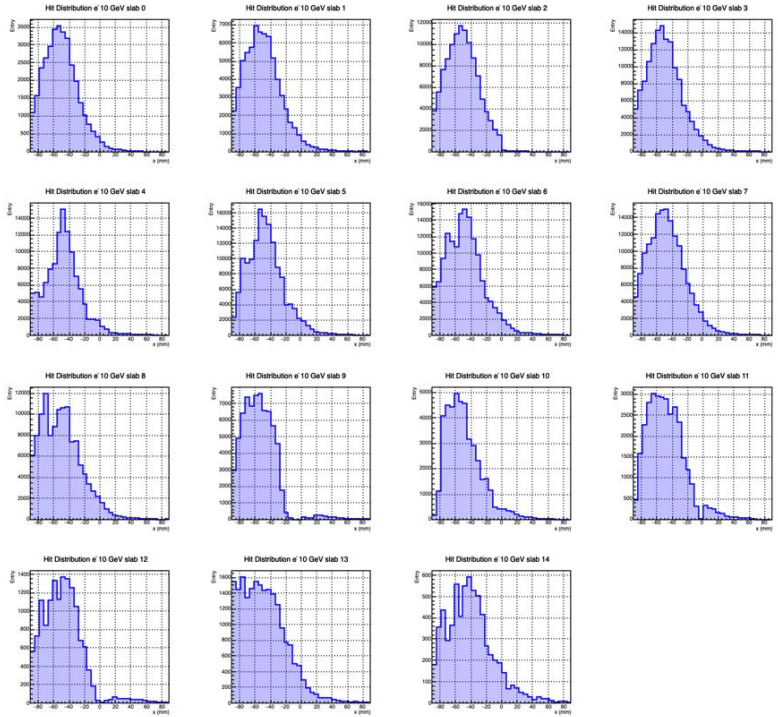


e- 10 GeV simulation

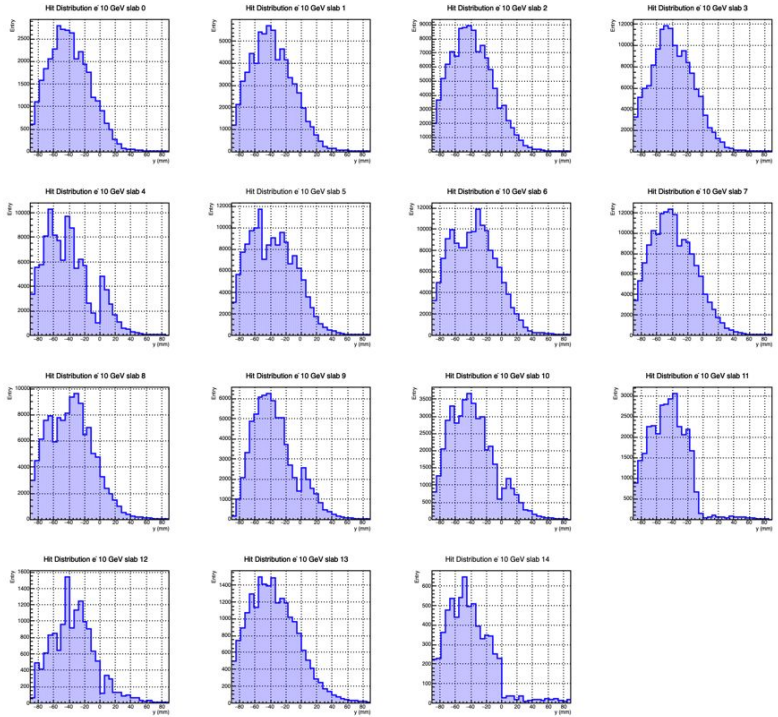


XY Hit Projections

e- 10 GeV Hit Map X Projection



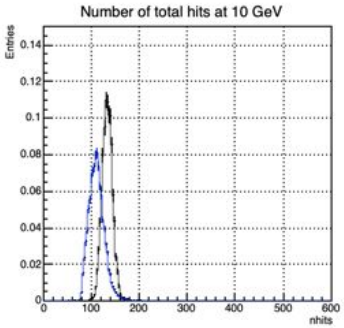
e- 10 GeV Hit Map Y Projection

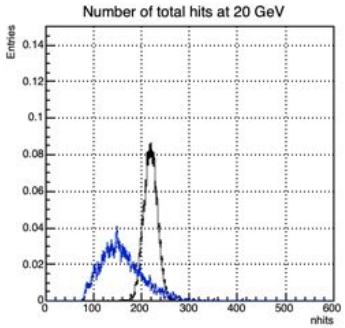


Gaussian fit was performed for each projection distribution to nurture the input parameter for the simulation

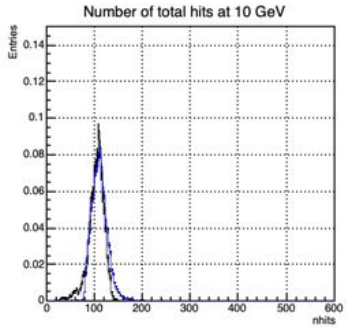
Number of Total Hits

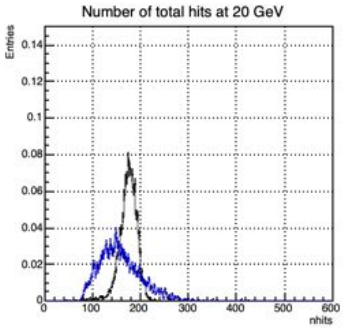
No mask





With mask

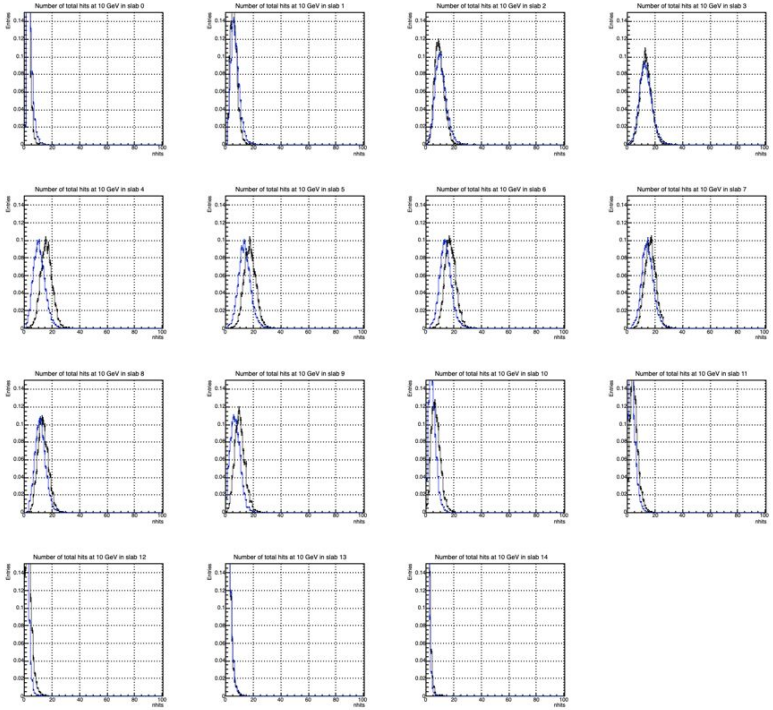




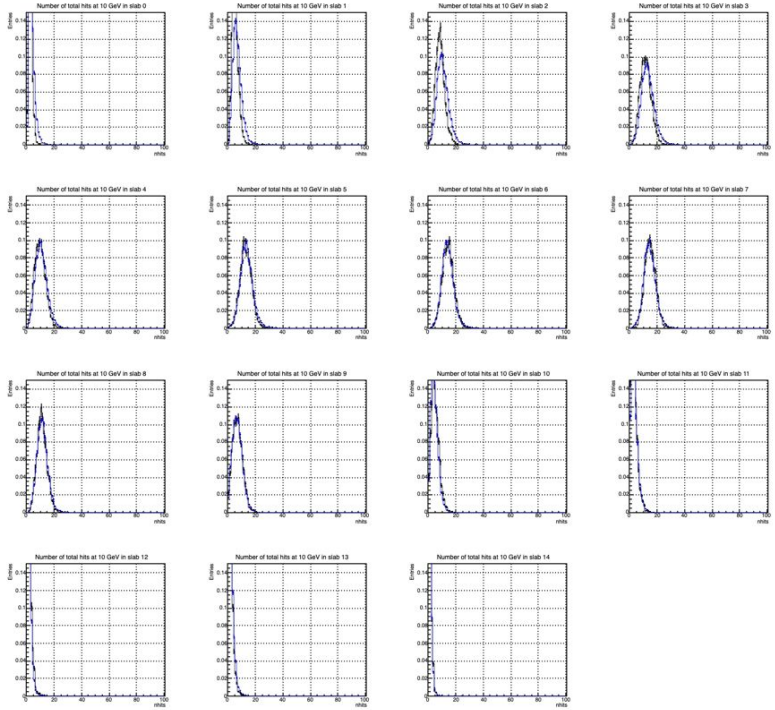
- The simulated number of total hits now gets scaled down to more appropriate value
- Reconstruction now has better agreement with simulation.

Total Hits per Slab

No mask (e- 10GeV)

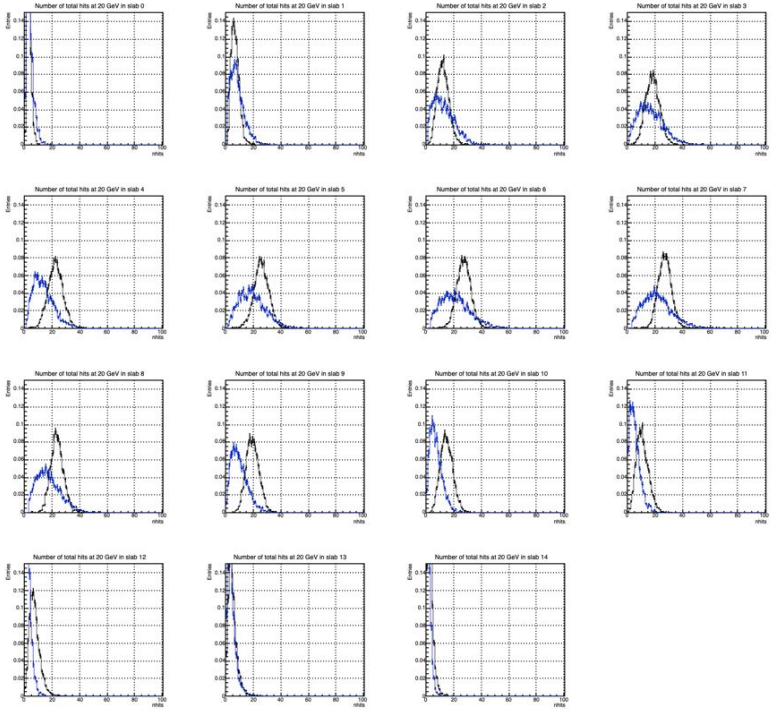


With mask

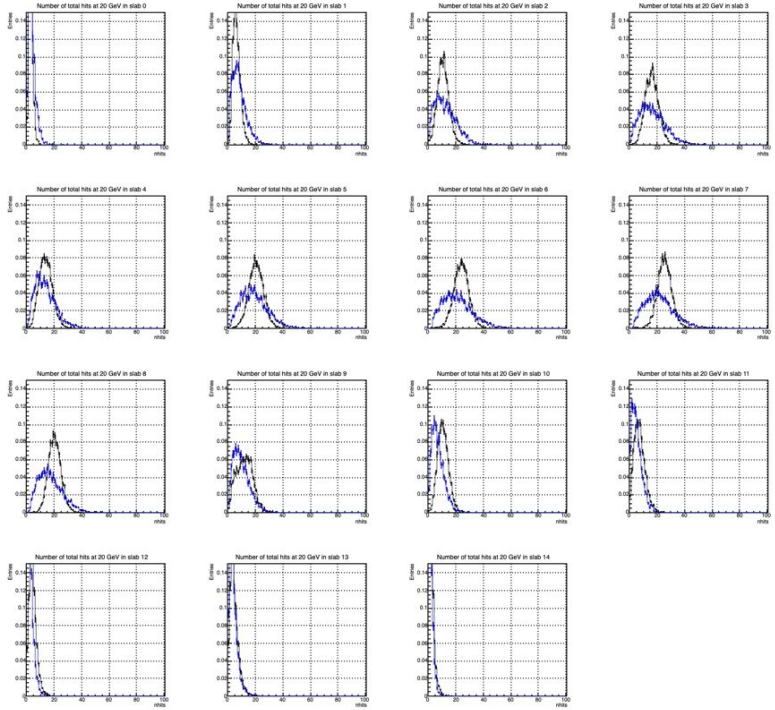


Total Hits per Slab

No mask (e- 20GeV)



With mask



Summary

- **Masking Studies**
  - New features are now taken into account in simulation
    - Masking
    - Beam axis position
    - Beam axis width
  - They all significantly contribute to the final hit counts.
- **Comparison**
  - The total number of hits for both 10 and 20 GeV do get closer to the generation, as the simulated distribution shift down.
  - It is also clear that some slabs still lack in number hits.