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# Analysis on CERN TB2022-06 Data

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Affiliation:



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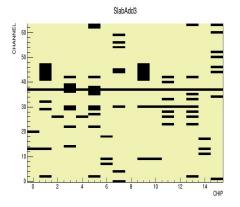
### Masking Effect





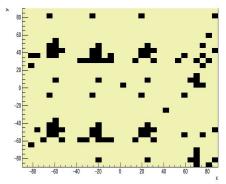
#### • There are 15 x 16 x 64 = 15,360 cells in overall SiWECAL

- 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.



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SlabAdd3



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### Procedure

#### **Masking Simulation**

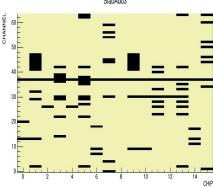
- Masking patch was introduced by Fabricio in SiWECAL-Sim .
- Each hit registered in the simulation is associated with the masking information based off the Run\_Settings files.
- One need to retrieve and match the masking pattern, same as the one in the . reconstruction.

#### **Beam Position**

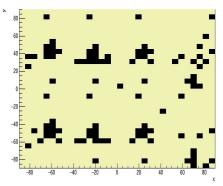
- It is worth highlighting that, generated beam position and size significantly affects the . final energy and hit distributions.
- The input beam position and size for the generator will not necessarily be identical to . the final beam spot shape. One needs to play around with parameters to get them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

#### Selection

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



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## **Masking in Action**

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Hit XY e' 10 GeV slab 3

Hit XY e' 10 GeV slab 7

Hit XY e' 10 GeV slab 11

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#### e-10 GeV simulation Hit XY e' 10 GeV slab 0 Hit XY e' 10 GeV slab 1 Hit XY e' 10 GeV slab 2 Hit XY e' 10 GeV slab 2 Hit XY e' 10 GeV slab 3 Hit XY e' 10 GeV slab 0 Hit XY e' 10 GeV slab 1 Hit XY e' 10 GeV slab 4 Hit XY e' 10 GeV slab 5 Hit XY e' 10 GeV slab 6 Hit XY e' 10 GeV slab 7 Hit XY e' 10 GeV slab 4 Hit XY e' 10 GeV slab 5 Hit XY e' 10 GeV slab 6 Hit XY e' 10 GeV slab 8 Hit XY e' 10 GeV slab 8 Hit XY e' 10 GeV slab 9 Hit XY e' 10 GeV slab 10 Hit XY e' 10 GeV slab 11 Hit XY e' 10 GeV slab 9 Hit XY e' 10 GeV slab 10 Hit XY e' 10 GeV slab 12 Hit XY e' 10 GeV slab 13 Hit XY e'10 GeV slab 14 Hit XY e' 10 GeV slab 12 Hit XY e' 10 GeV slab 13 Hit XY e' 10 GeV slab 14

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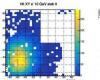


## **Masking in Action**

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## e-10 GeV reconstruction



Hit XY e' 10 GeV slab 4

Hit XY e' 10 GeV slab 8

Hit XY e' 10 GeV slab 12



Hit XY e' 10 GeV slab 5

Hit XY e' 10 GeV slab 9

Hit XY e' 10 GeV slab



Hit XY e' 10 GeV slab 6

Hit XY e' 10 GeV slab 10



Hit XY e' 10 GeV slab 3





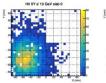
Hit XY e' 10 GeV slab 11



Hit XY e' 10 GeV slab 13



## e-10 GeV simulation



Hit XY e' 10 GeV slab 4



Hit XY e' 10 GeV slab 5





Hit XY e' 10 GeV slab 6





Hit XY e' 10 GeV slab 7

Hit XY e' 10 GeV slab 8

Hit XY e' 10 GeV slab 12



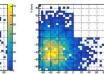
Hit XY e' 10 GeV slab 9 Hit XY e' 10 GeV slab 10





Hit XY e' 10 GeV slab 11

Hit XY e' 10 GeV slab 13







Hit XY e' 10 GeV slab 14

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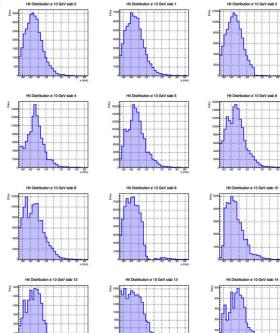
### **XY Hit Projections**

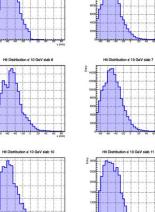
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Sistribution e' 10 GeV slab 2

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## e- 10 GeV Hit Map X Projection

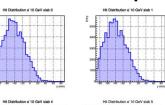


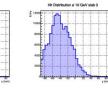


Hit Distribution e' 10 GeV slab 3

## e-10 GeV Hit Map Y Projection

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Hit Distribution e' 10 GeV slab 6 Hit Distribution e' 10 GeV slab 7

Hit Distribution e' 10 GeV slab 9

Hit Distribution e'10 GeV slab 13

Hit Distribution e' 10 GeV slab 8

Hit Distribution e' 10 GeV slab 12





Hit Distribution e 10 GeV slab 14

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

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E 0.14

0.12

0.1

0.08

0.06

0.04

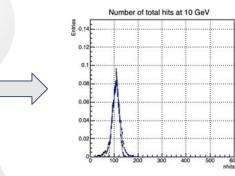
0.05

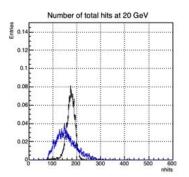
Number of total hits at 10 GeV

## Number of Total Hits

Number of total hits at 20 GeV

## With mask





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• The simulated number of total hits now gets scaled down to more appropriate value

300 400

• Reconstruction now has better agreement with simulation.

No mask

E 0.14

0.12

0.1

0.08

0.06

0.04

0.01

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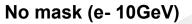
300 400



## **Total Hits per Slab**

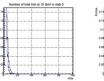


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Number of total hits at 10 GeV in slab 6

Number of total hits at 10 GeV in slab 10



Number of total hits at 10 GeV in slab 4

Number of total hits at 10 GeV in slab 8

Number of total hits at 10 GeV in slab 12

#### Number of total hits at 10 GeV in slah 1 Number of total hits at 10 GeV in slab 2 10.14

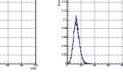
Number of total hits at 10 GeV in slab 5

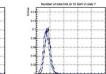
Number of total hits at 10 GeV in slab 9

0.0

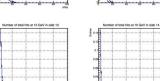
1.02

101





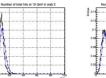
Number of Intal hits at 10 GeV in slab 3



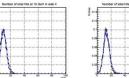
#### With mask Number of total hits at 10 GeV in slah 0

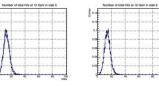


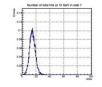


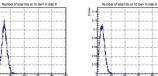






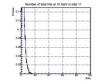




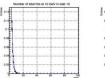




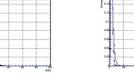




Number of total hits at 10 GeV in slab 12







Number of total hits at 10 GeV in slab 11

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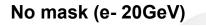


## **Total Hits per Slab**



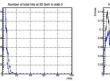
Number of Intal hits at 20 GeV in siah 2

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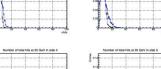


Number of total hits at 20 GeV in slab 2

Number of total hits at 20 GeV in slab 10

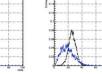


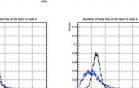
Number of total hits at 20 GeV in slab 8

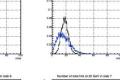


Number of total hits at 20 GeV in slah 1

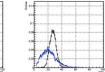
Number of total bits at 20 GeV in slab 9

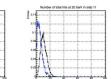


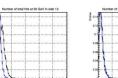


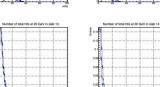


Number of total hits at 20 GeV in slab 3













With mask

Number of total hits at 20 GeV in slah 0





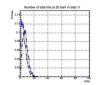
Number of total hits at 20 GeV in slab 1

Number of total hits at 20 GeV in slab 5

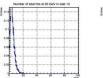
44







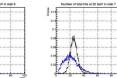












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Number of total hits at 20 GeV in slab 8

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### Summary



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- 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.