



HERD PSD BACKSPLASH UPDATE



· 28 MAY 2021

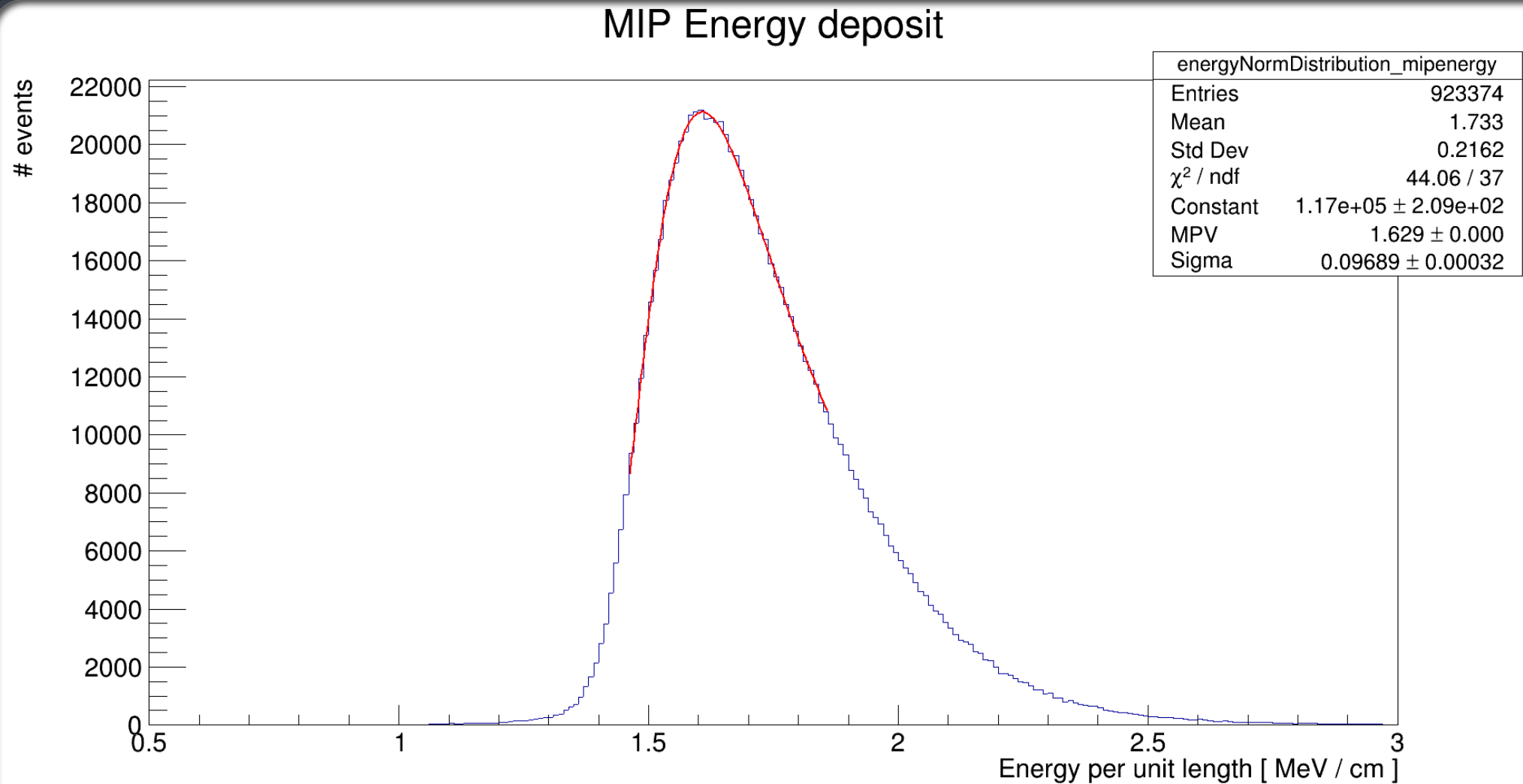
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SIMULATION AND ANALYSIS FOR MIPS STUDY

- 10 CM X 10 CM X 0.5 CM TILES WITH NO GAP
- 10^6 MUONS @ 100 GeV
- CALO UNBIASED TRIGGER SELECTION (ENERGY THRESHOLD @ 50 MeV)

MIP ENERGY DEPOSIT DIVIDED BY TRACK LENGTH

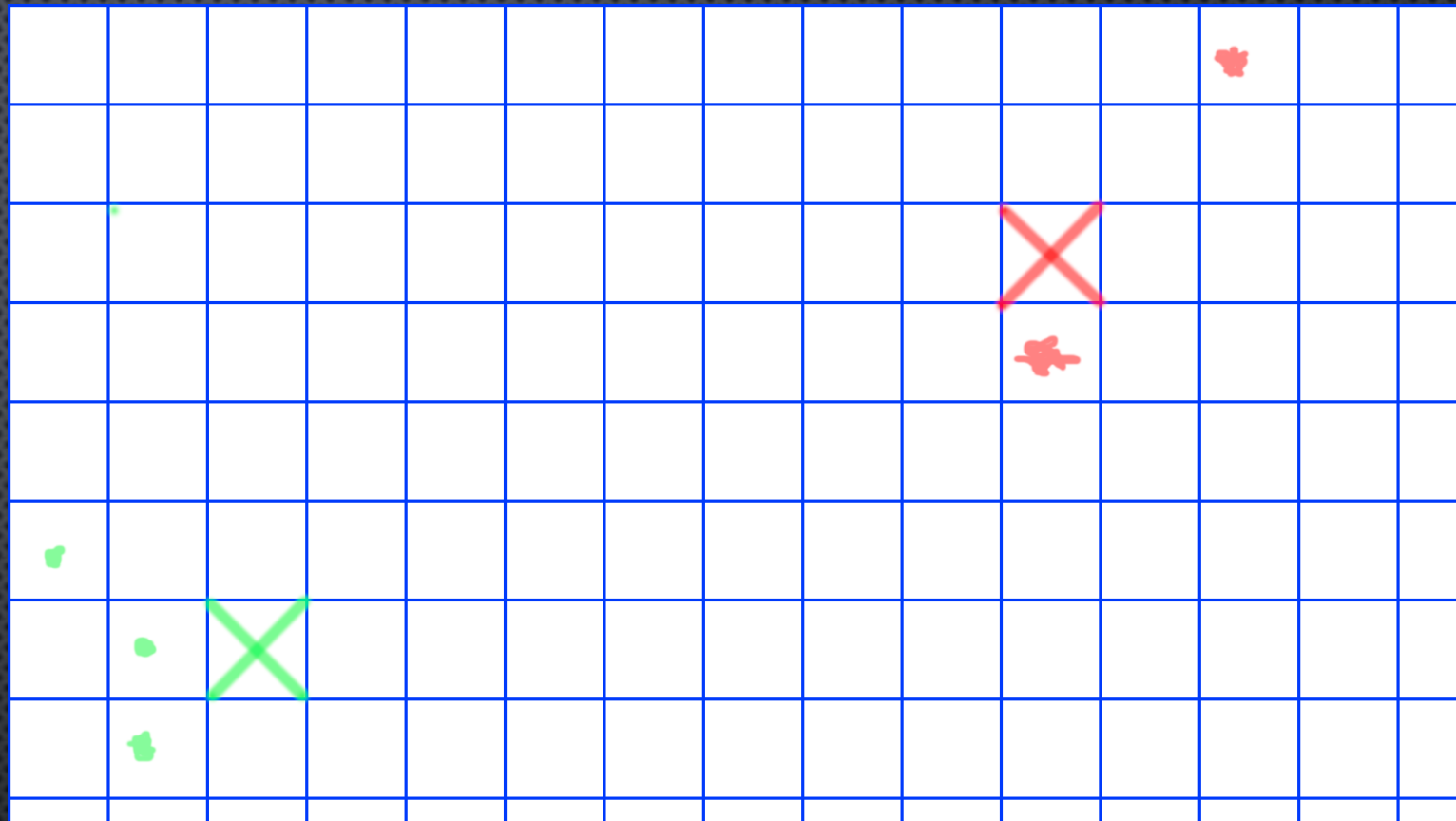


MPV: 1.6 MEV / CM

TEST ON PHOTONS

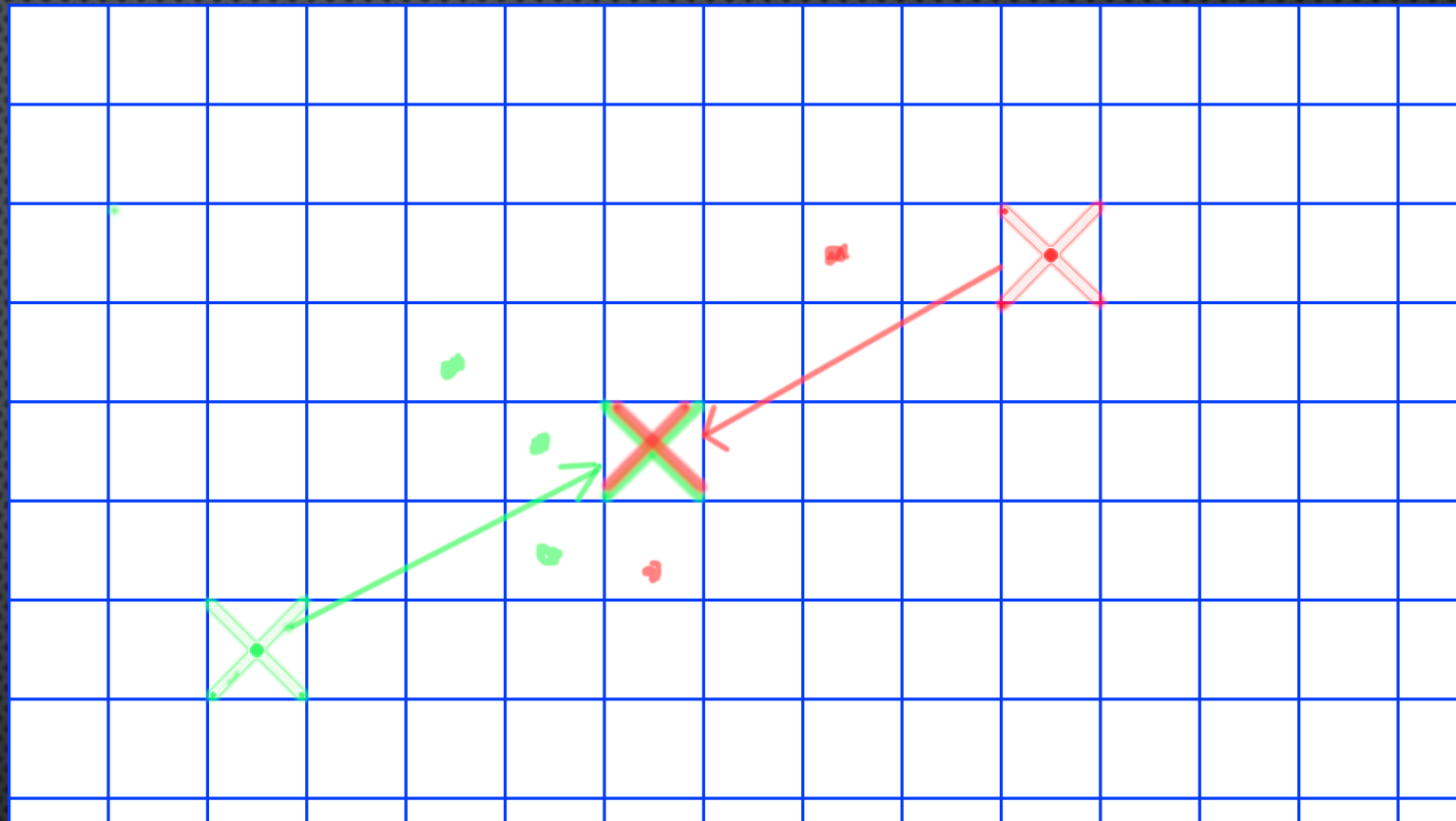
- SIMULATION WITH HERDSOFTWARE 0.1.0
 - COMPACT-V1-GEOMETRY 10 CM X 10 CM X 0.5 CM TILES
 - COMPACT-V1-GEOMETRY MODIFIED TO USE 3 CM WIDTH AND 0.5 CM THICK BARS
- 10^6 PHOTONS GENERATED WITH ISOTROPIC DISTRIBUTION @ 1 GeV
- TILE / BAR "TRIGGERED" WHEN $E > 0.25 \text{ MeV}$ (1 / 3 MIP)

ANALYSIS



- EVENT 1: 1 PHOTON IMPINGING IN THE RED CROSS TILE, BACKSPLASH TRIGGERS DOT MARKED TILES
- EVENT 2: 1 PHOTON IMPINGING IN THE GREEN CROSSED TILE
- BACKSPLASH DISTRIBUTION WILL BE THE SUM OF THE GREEN + RED

ANALYSIS



- WE CAN TAKE THE DISTANCE INSTEAD, SO THE BACKSPASH DISTRIBUTION FOR EACH IMPINGING PHOTON WILL LOOK LIKE AS ENTERING THE SAME TILE
- SIMILAR PROCEDURE IS APPLIED IN THE BARS CASE

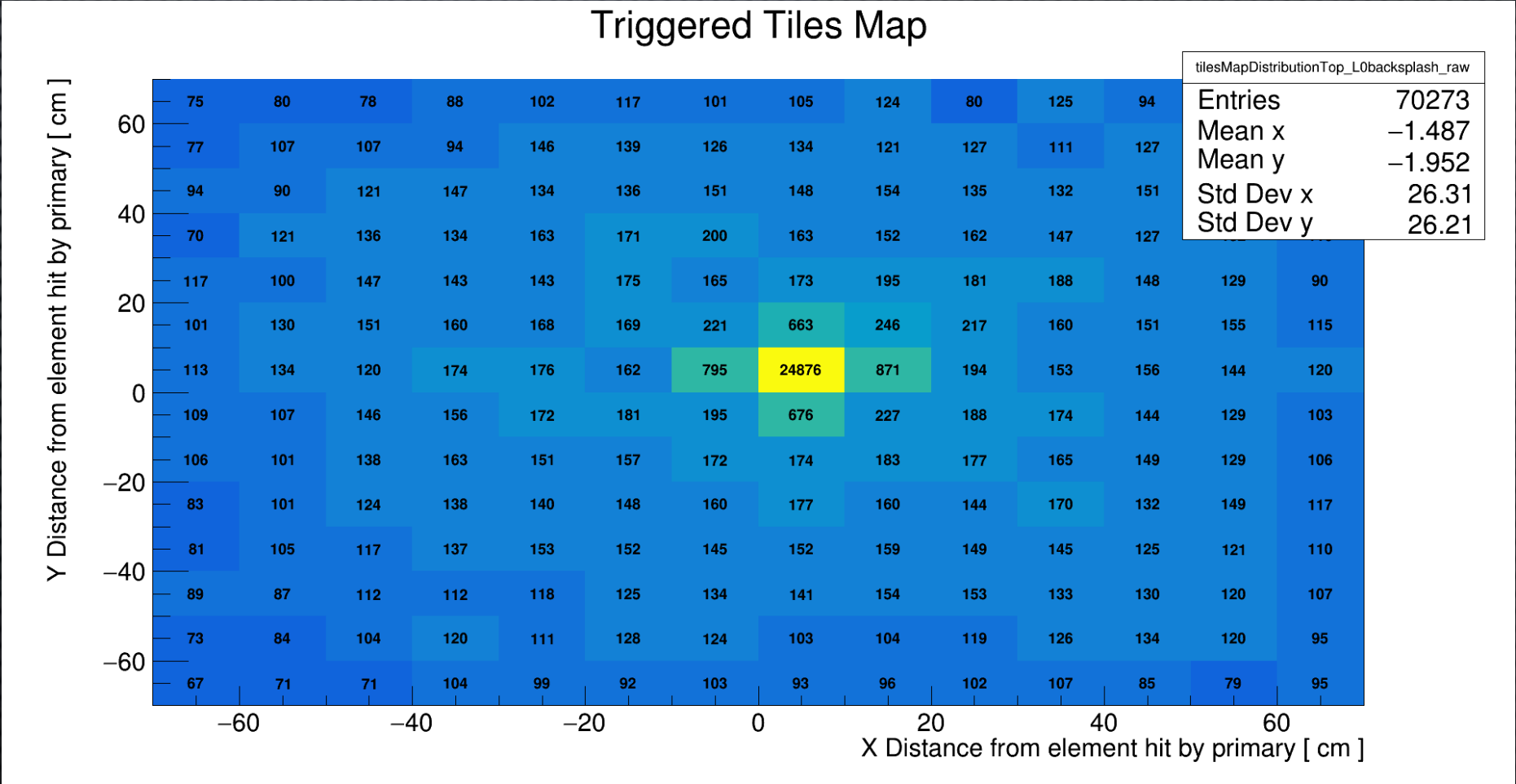
TILES RESULT

- 859830 EVENTS THAT PASSED CALO UNBIASED TRIGGER
- 1 LAYER ANALYSIS
- 741037 EVENTS DIDN'T TRIGGER ANY TILES (86%)
- IN THE REMAINING 118793 EVENTS:
 - 120960 TILES WERE TRIGGERED
 - 53893 TIMES WAS TRIGGERED THE TILE INTERSECTED BY THE PHOTON TRAJECTORY (45%)
 - MOSTLY CAUSED BY $e^- e^+$ PRODUCTION BEFORE OR INSIDE PSD 36674 TIMES (68%)

TRIGGERED TILES - TOP

SPATIAL DISTRIBUTION

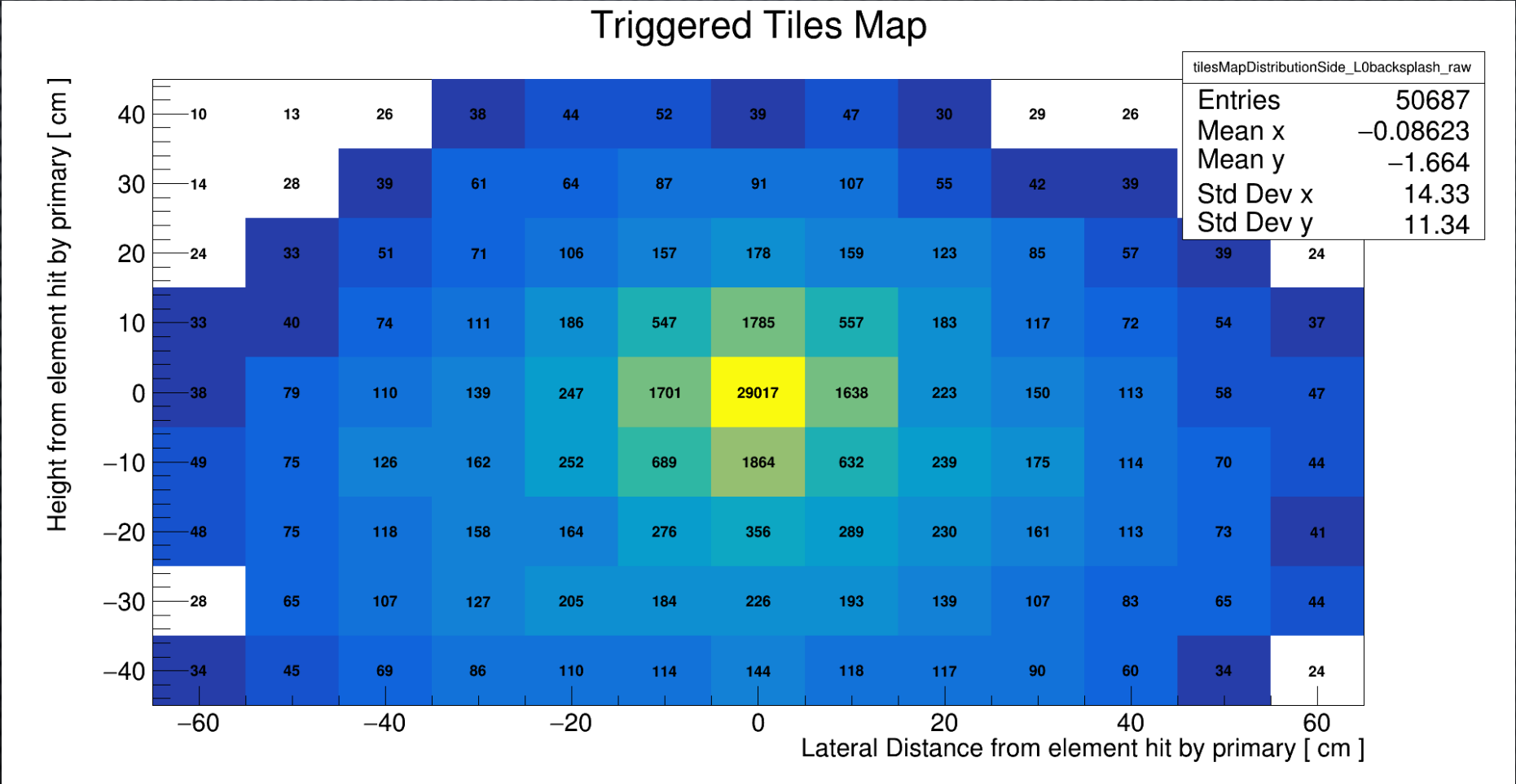
- Central tile is the one hit by photon
- 36% times the central tile was triggered
- 41% times the central and neighbouring tiles were triggered



TRIGGERED TILES – LATERAL SIDE

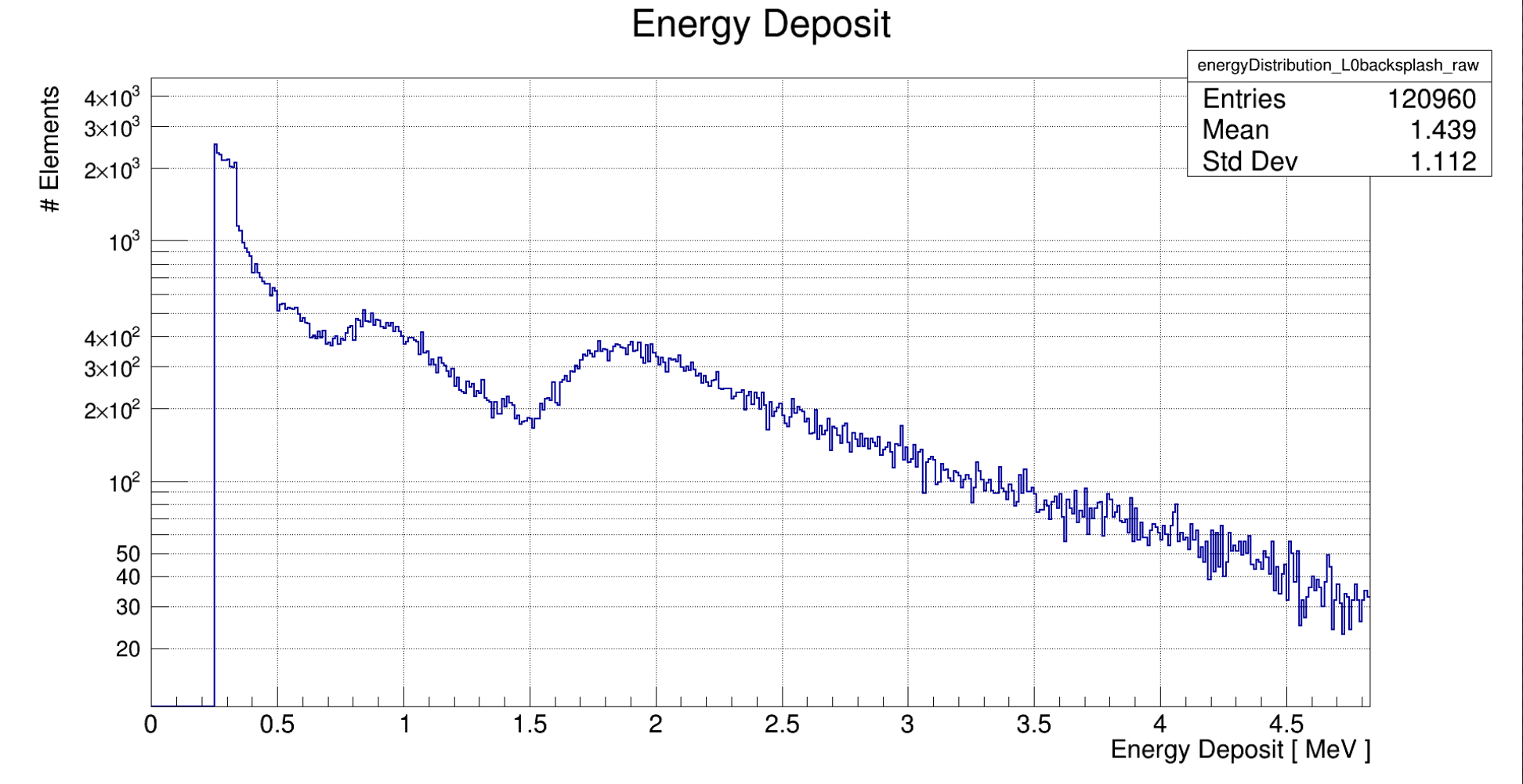
SPATIAL DISTRIBUTION

- Central tile is the one hit by photon
- 57% times the central tile was triggered
- 75% times the central and neighbouring tiles were triggered



TRIGGERED TILES

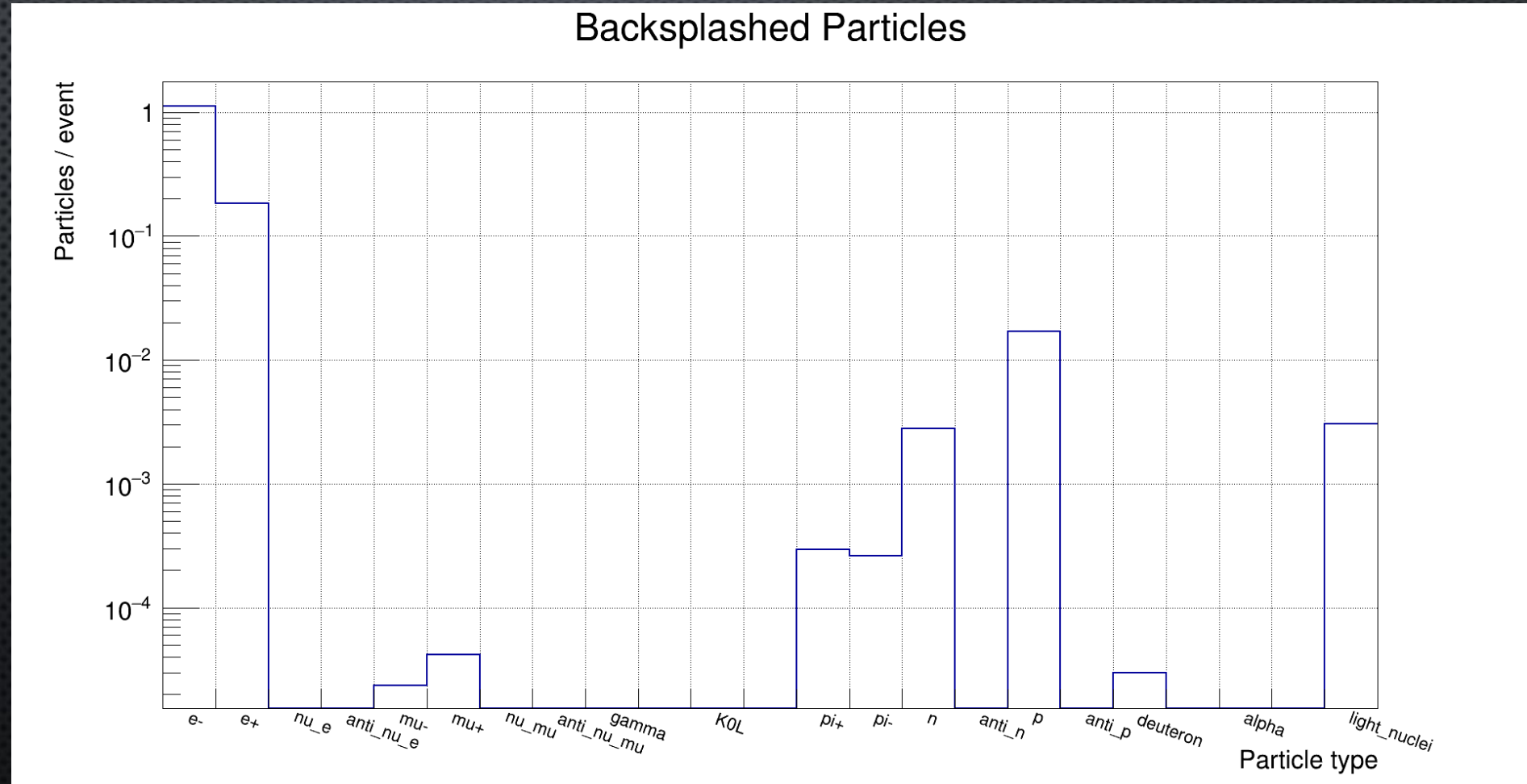
ENERGY DISTRIBUTION



TRIGGERED TILES

PARTICLE COMPOSITION

- Particles releasing at least 25 keV inside triggered tiles, normalized on the number of triggered tiles
- Dominant contribution from e^- and e^+



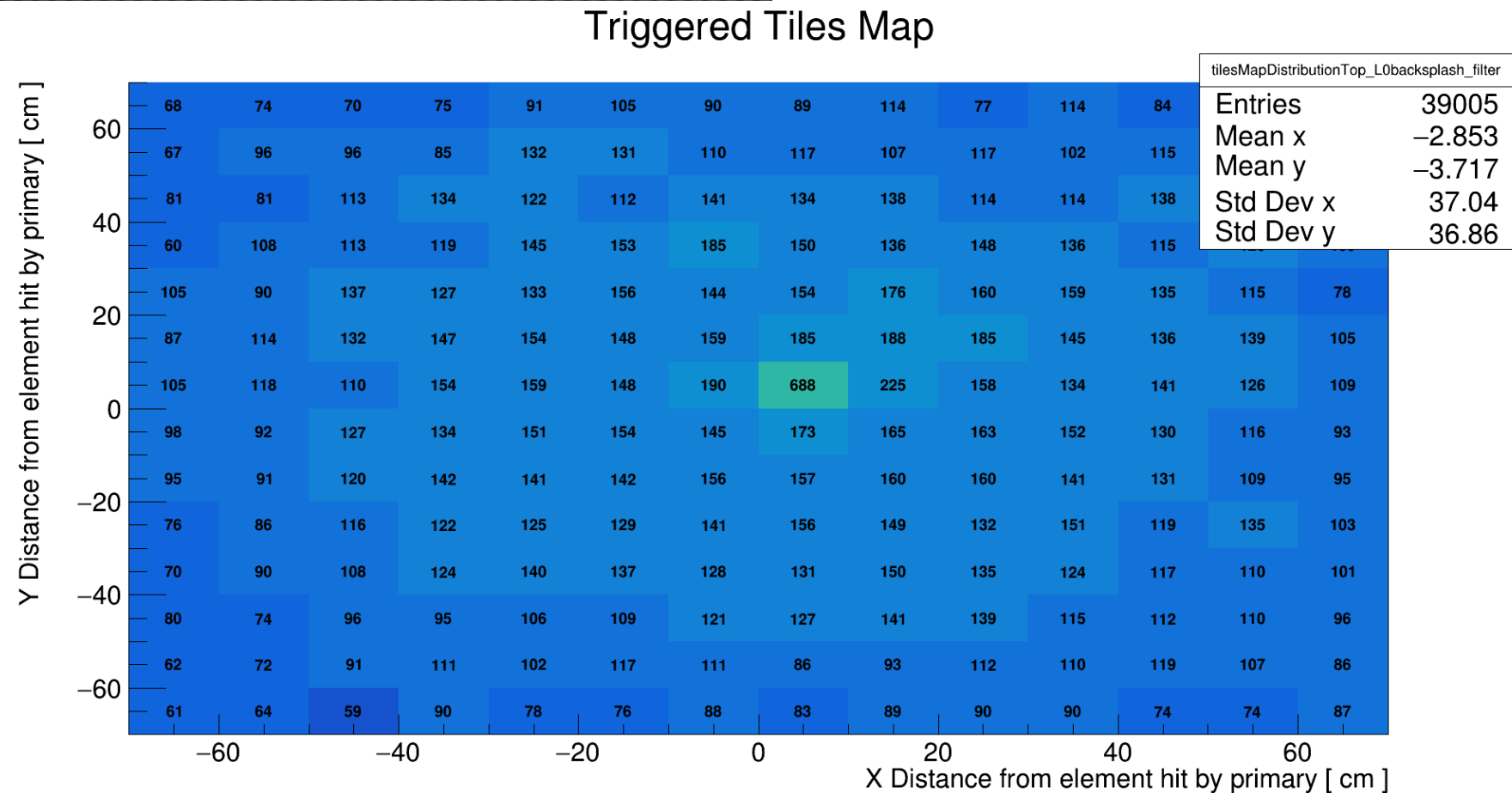
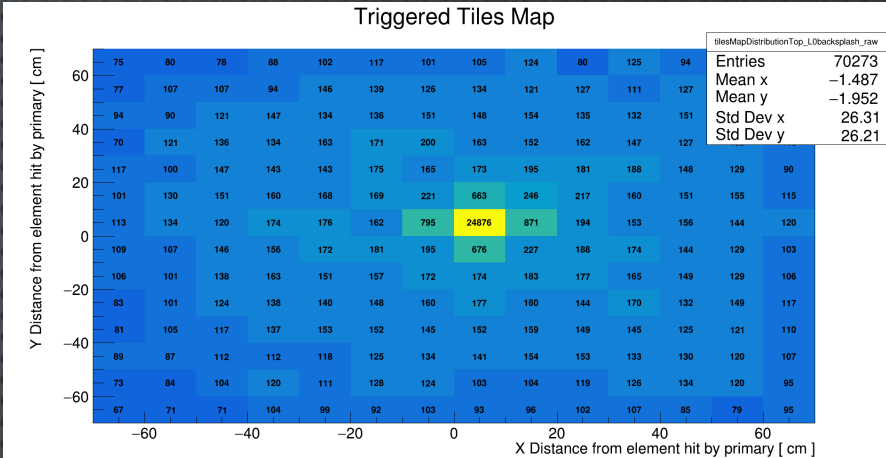
ELECTRON POSITRON PAIR REMOVAL

- THE ANALYSIS IS REPEATED FILTERING OUT ALL THE PHOTONS PRODUCING A PAIR BEFORE OR INSIDE THE PSD

Number	Before Filtering	After Filtering	Change (%)
Unbiased trigger sel.	859830	799246	-7
"Good" events	741037	732139	-1.3
Primary proj. tile hit triggered	53893	3783	-92

TRIGGERED TILES - TOP SPATIAL DISTRIBUTION

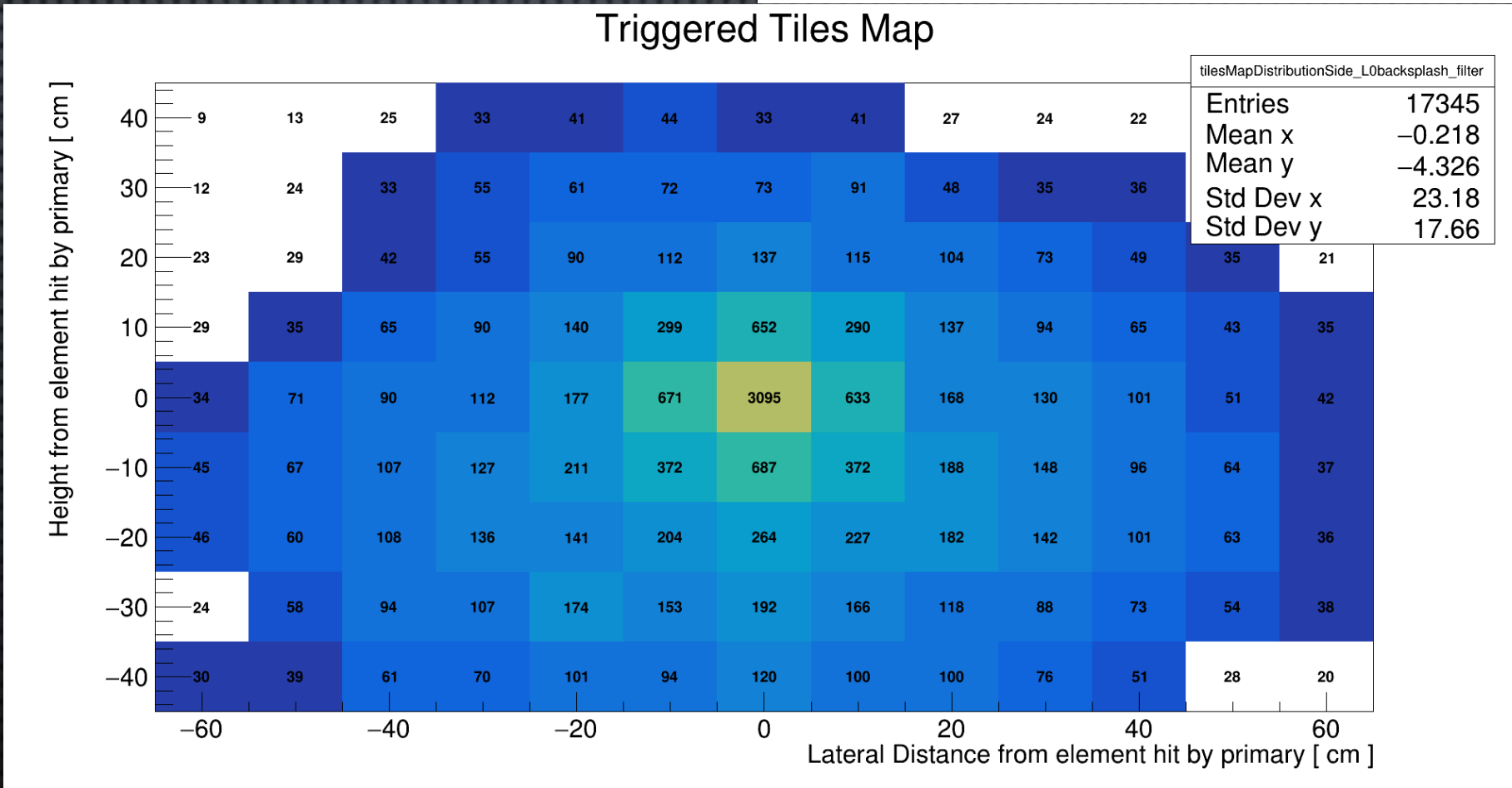
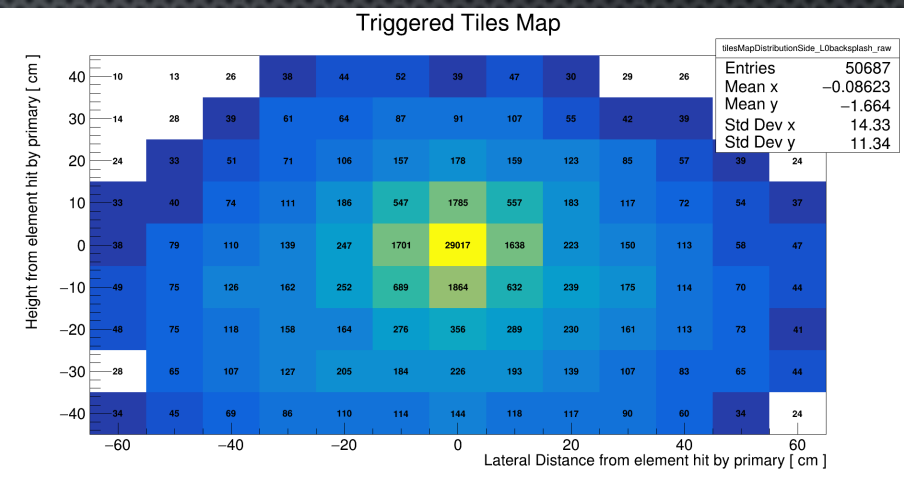
- Central tile is the one hit by photon
- 36% -> 1.7% times the central tile was triggered
- 41% -> 5.5% times the central and neighbouring tiles were triggered



TRIGGERED TILES – LATERAL SIDES

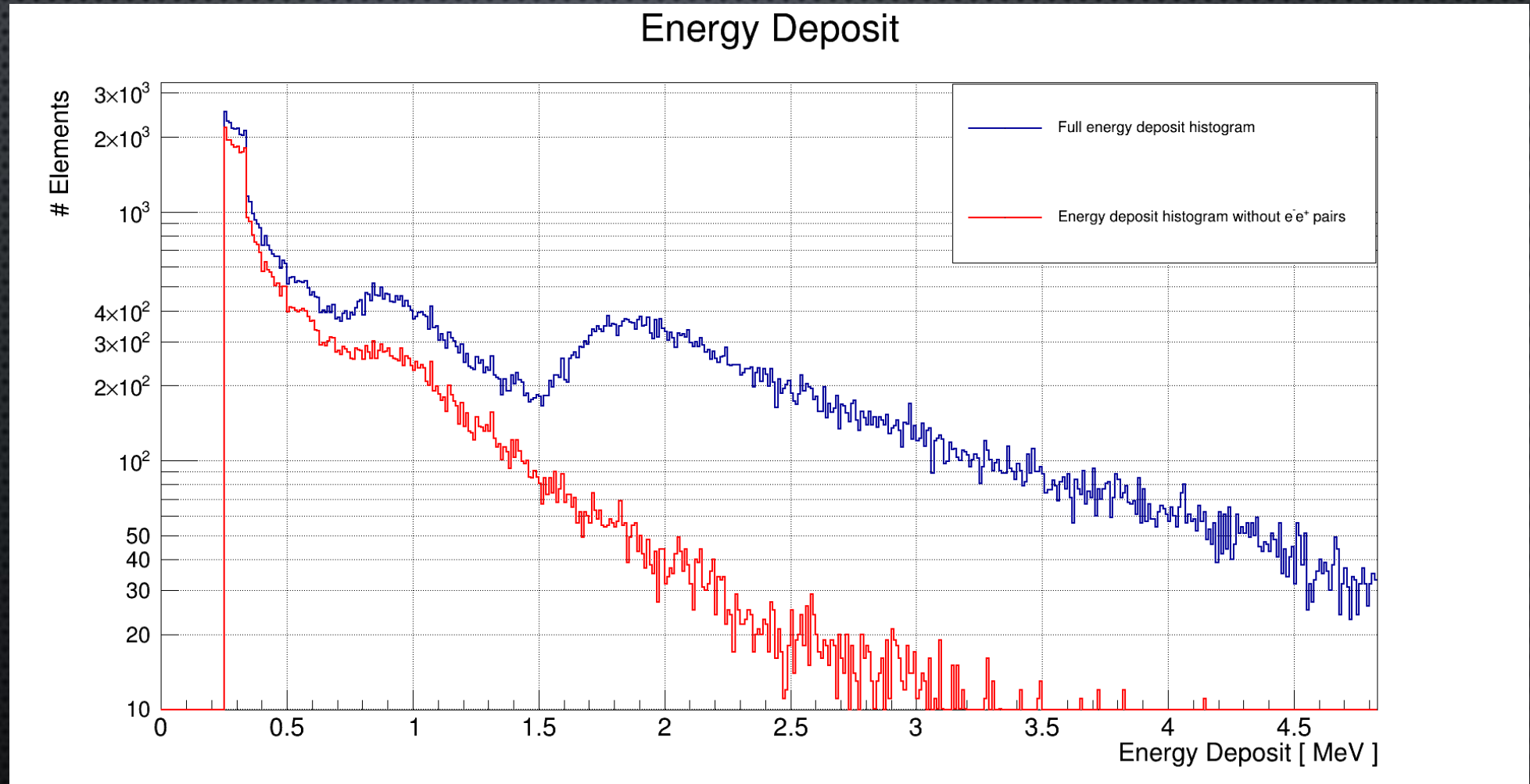
SPATIAL DISTRIBUTION

- Central tile is the one hit by photon
- 57% -> 18% times the central tile was triggered
- 75% -> 40% times the central and neighbouring tiles were triggered



TRIGGERED TILES

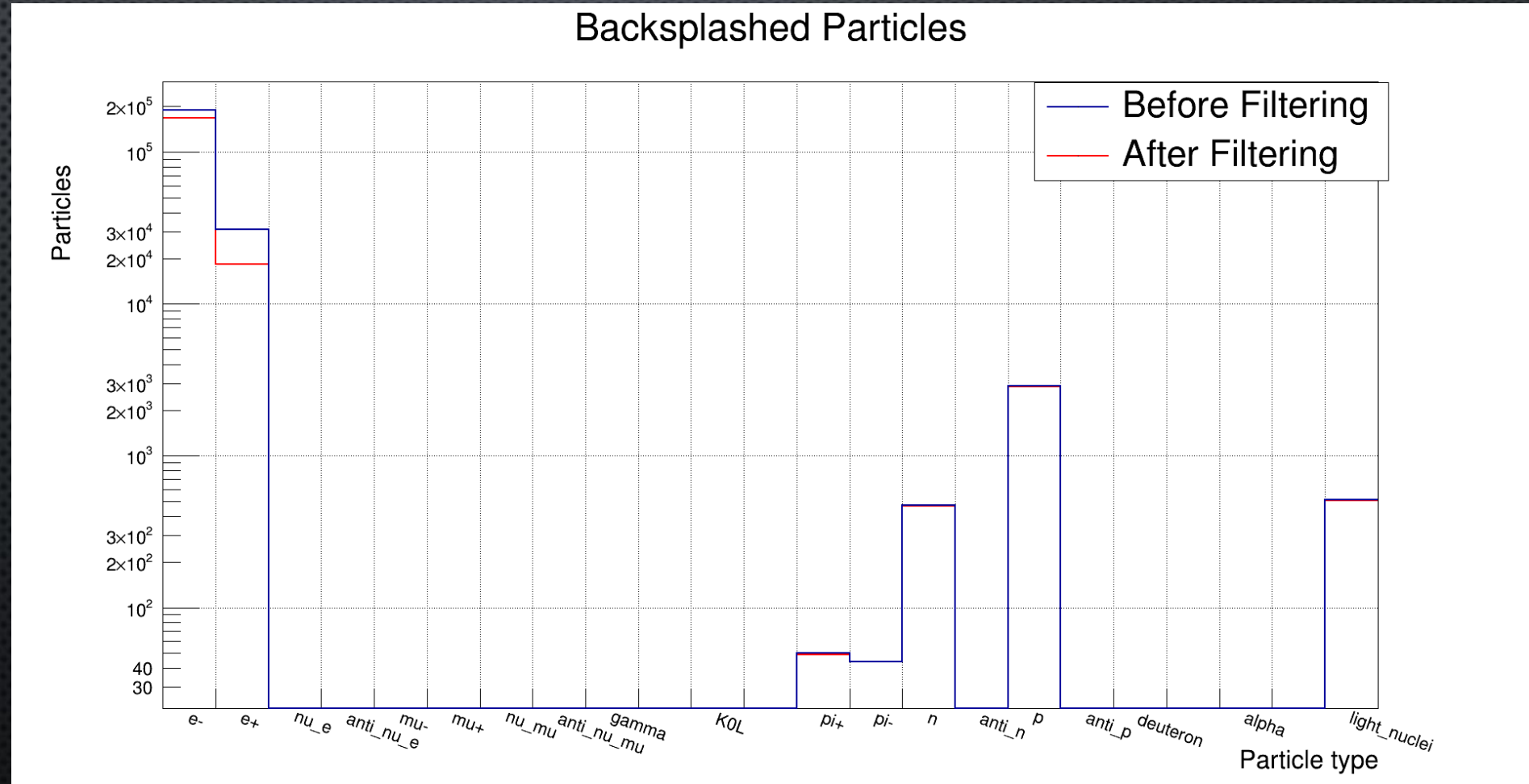
ENERGY DISTRIBUTION

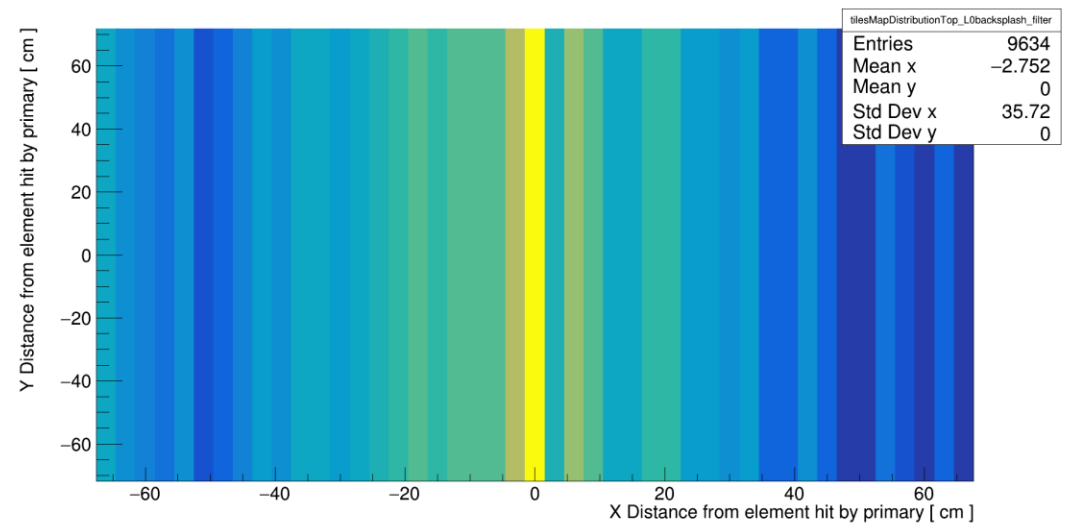
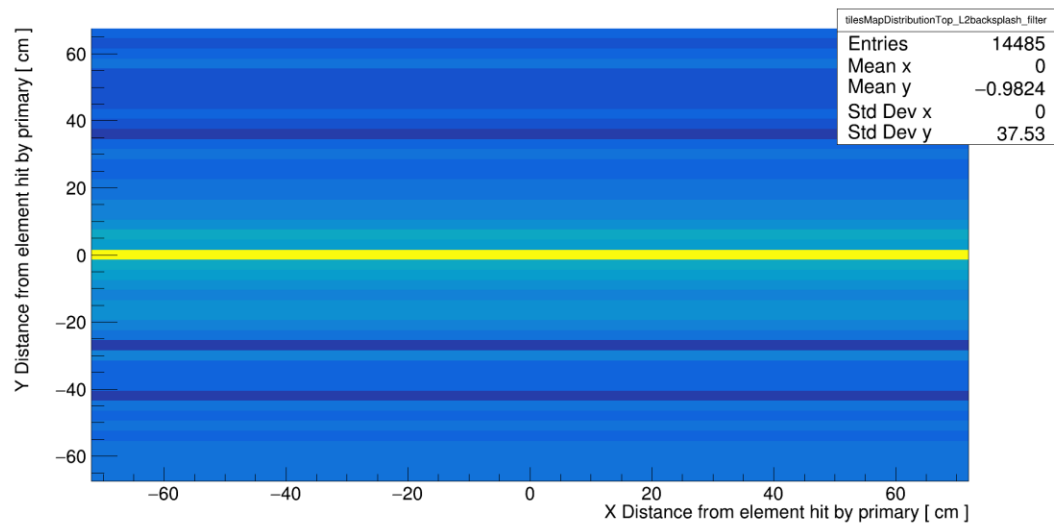


TRIGGERED TILES

PARTICLE COMPOSITION

- Positron drops 41%
- Electron drops 11%
- Still dominant contribution





BARS RESULTS – COMING SOON

WHAT TO DO NEXT?

- MULTIPLE CHECK WHAT IS WORKING WELL
- APPLY THE SAME ANALYSIS TO PHOTONS WITH DIFFERENT ENERGIES (100 MeV – 10 GeV)
- FIND SOME BENCHMARK PARAMETERS
- USE THE FORMAT OF HERD BENCHMARK FOR THE CODE