



Performance of BM@N scintillation wall in Xe+CsI@3.8 AGeV run

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Outline

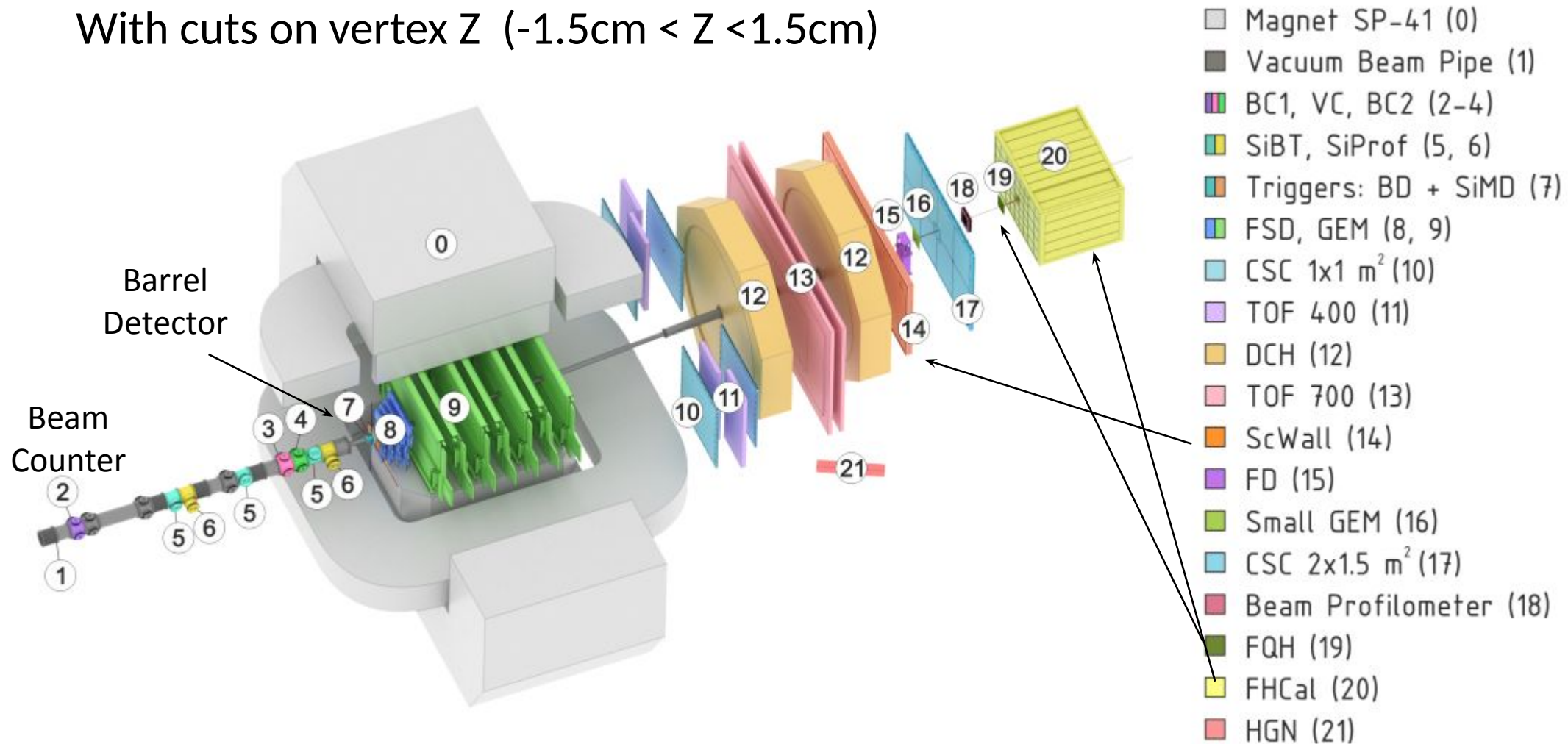
- The general structure and tasks of the scintillation wall
- The ScWall performance examples at different energies
- ScWall calibration
- The charges range detected in the last BMN runs
- The sensitivity of the ScWall to centrality according to multiplicity
- Multiplicity distributions as a function of the charge deposited on the ScWall
- Correlations of ScWall multiplicity with the calorimeter deposited energy and barrel detector multiplicity

Event selection

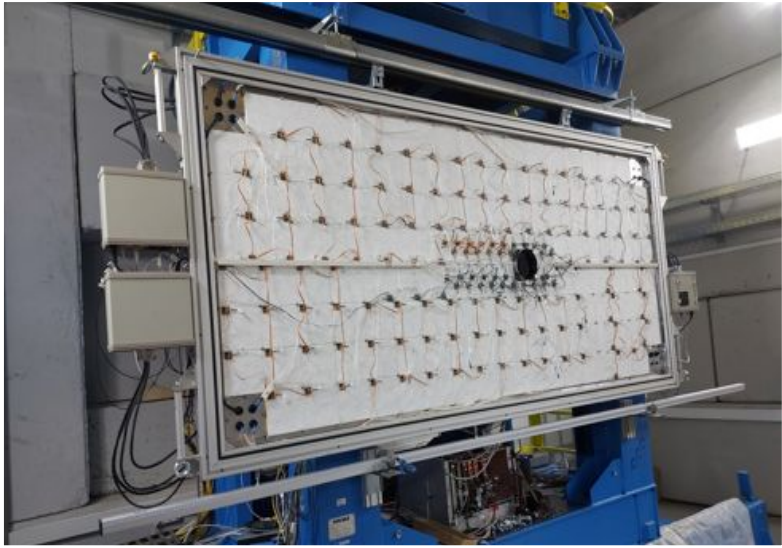
≥ 2 tracks in vertex reconstruction

Single Xe ion selected with Beam Counter BC1S

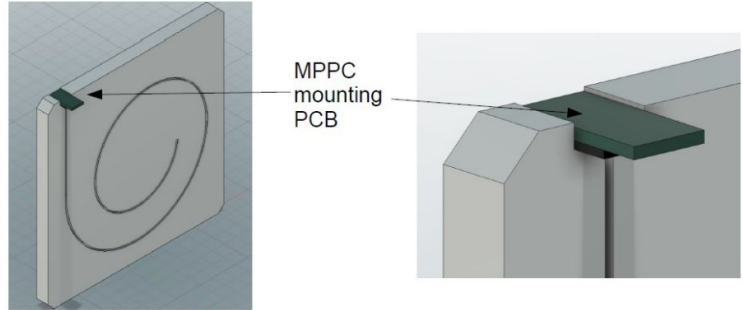
With cuts on vertex Z ($-1.5\text{cm} < Z < 1.5\text{cm}$)



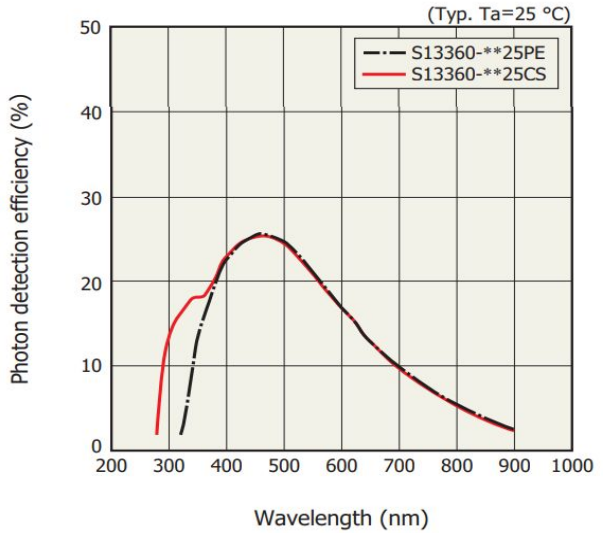
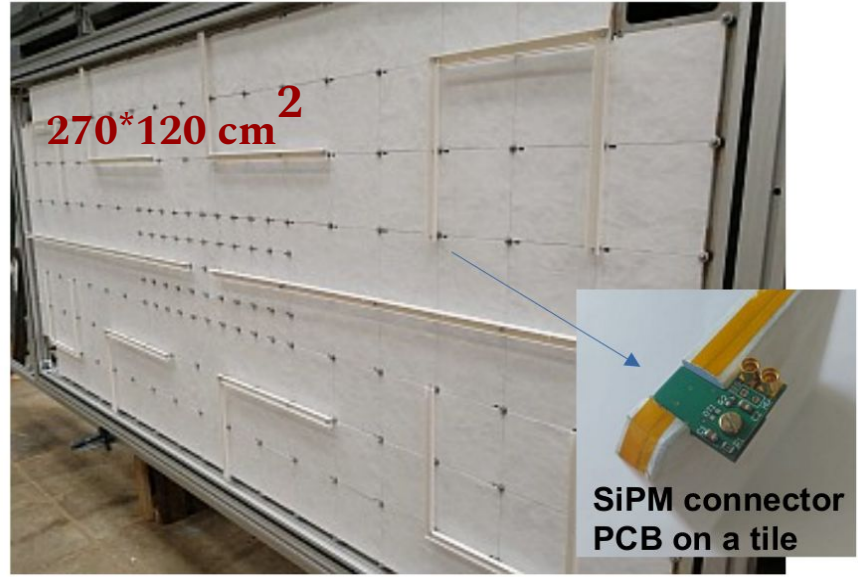
Scintillation Wall (ScWall) for fragments charge measurements and reaction plane estimation



- 36 small inner cells $7.5 \times 7.5 \times 1 \text{ cm}^3$ + 138 big outer cells $15 \times 15 \times 1 \text{ cm}^3$
- light yield for MIP signal – small cells $55 \text{ p.e.} \pm 2.4\%$; big cells $32 \text{ p.e.} \pm 6\%$.
- optional beam hole (covered with 4 small cells for the SRC run)
- covered with a light-shielding aluminum plate
- light collection by WLS fibers
- light readout with SiPM mounted on the PCB at each scint. cell



light collection from tiles



- Hamamatsu MPPC
S13360-1325CS $1.3 \times 1.3 \text{ mm}^2$
- Number of pixels: 2668
- Gain: 7×10^5
- PDE: 25%

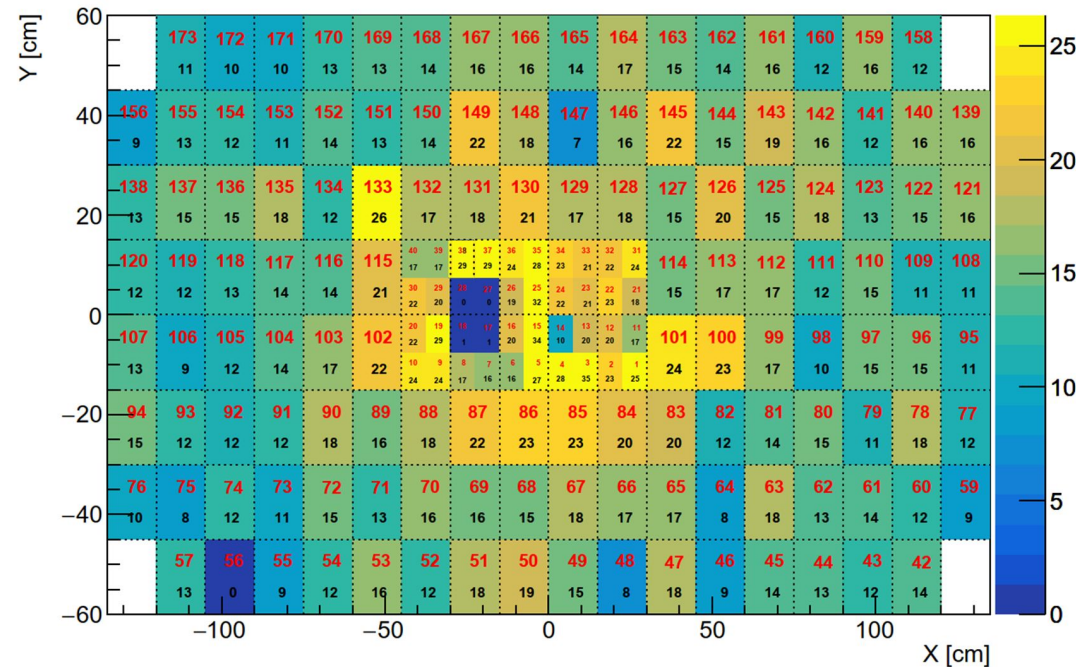


ScWall: design

41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
95	96	97	98	99	100	101	102	103	104	105	106	107					
108	109	110	111	112	113	114	115	116	117	118	119	120					
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174

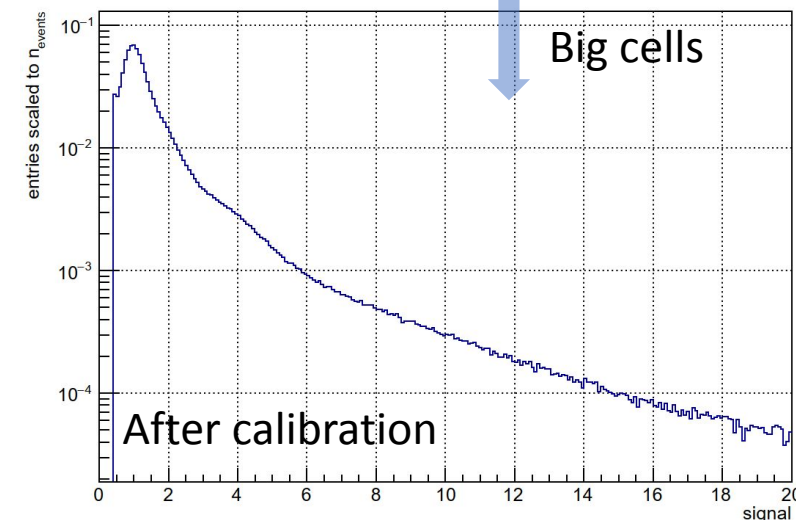
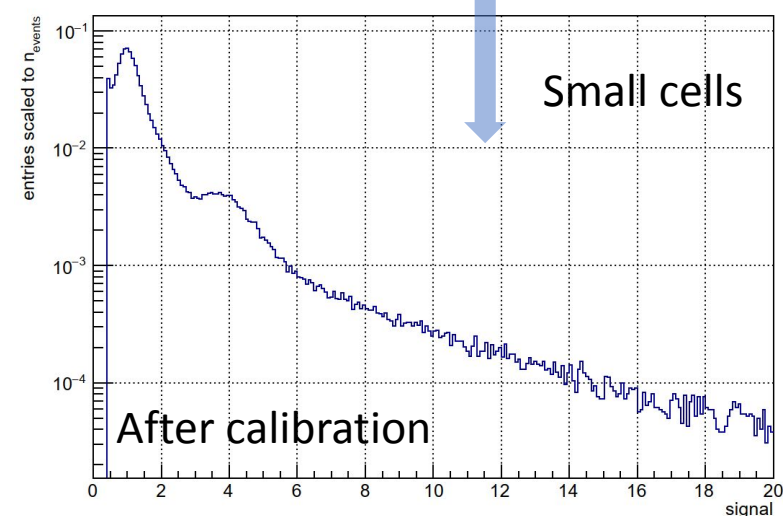
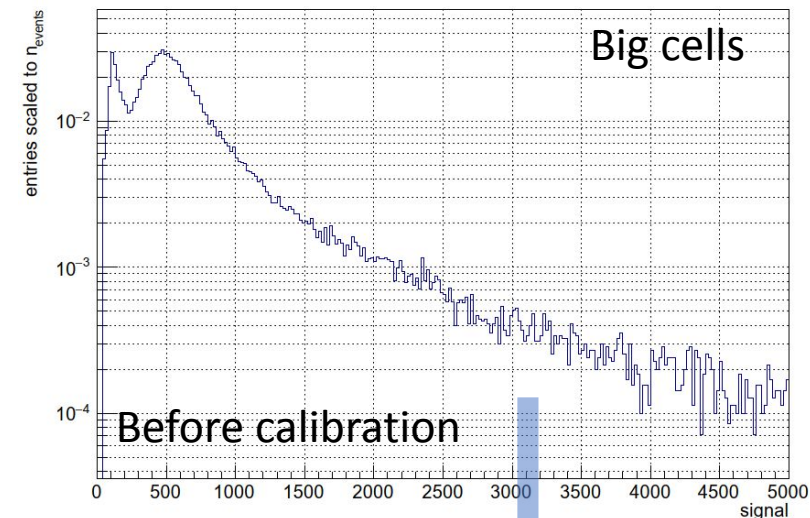
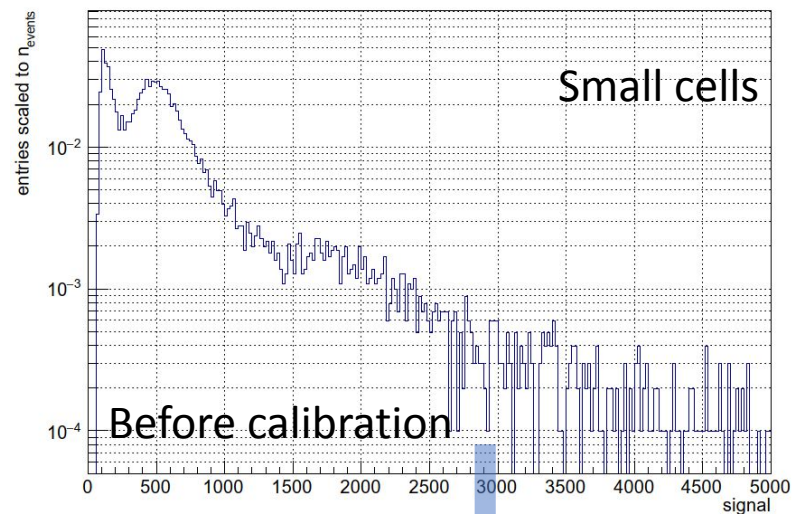
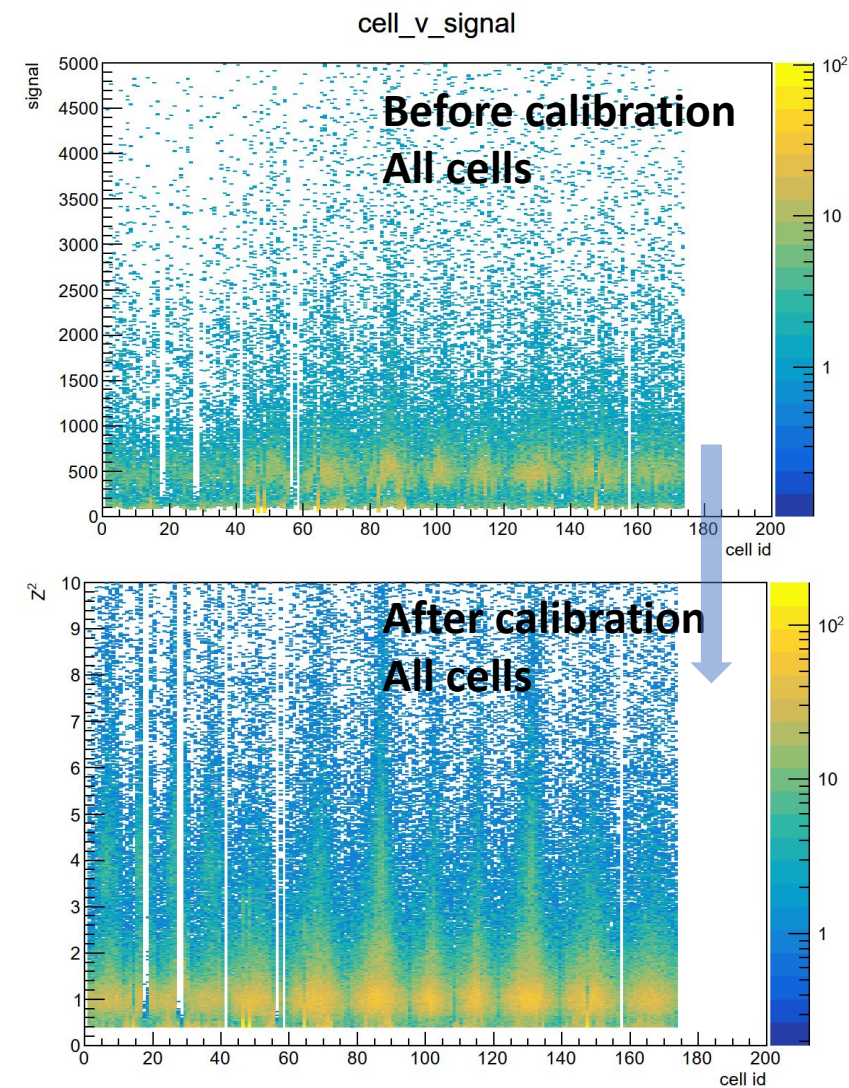
- readout divided into 12 sectors each one equipped with single temperature sensor
- each 4 sectors are read by combined electronics unit:
 - One ADC64s2 board
 - Four 16-channels FEE boards
 - Voltage control unit

ScWall average Z^2 distribution with CsI (2%) target, Xe, CCT2



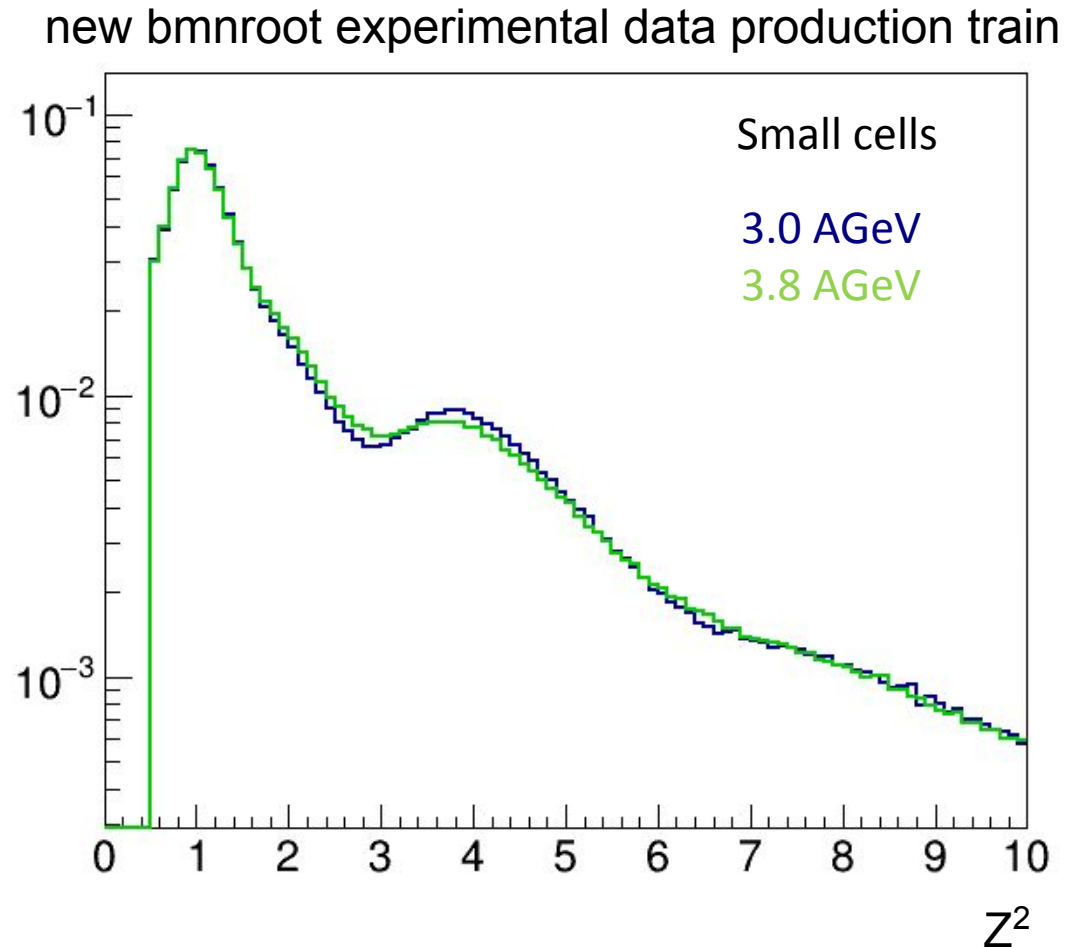
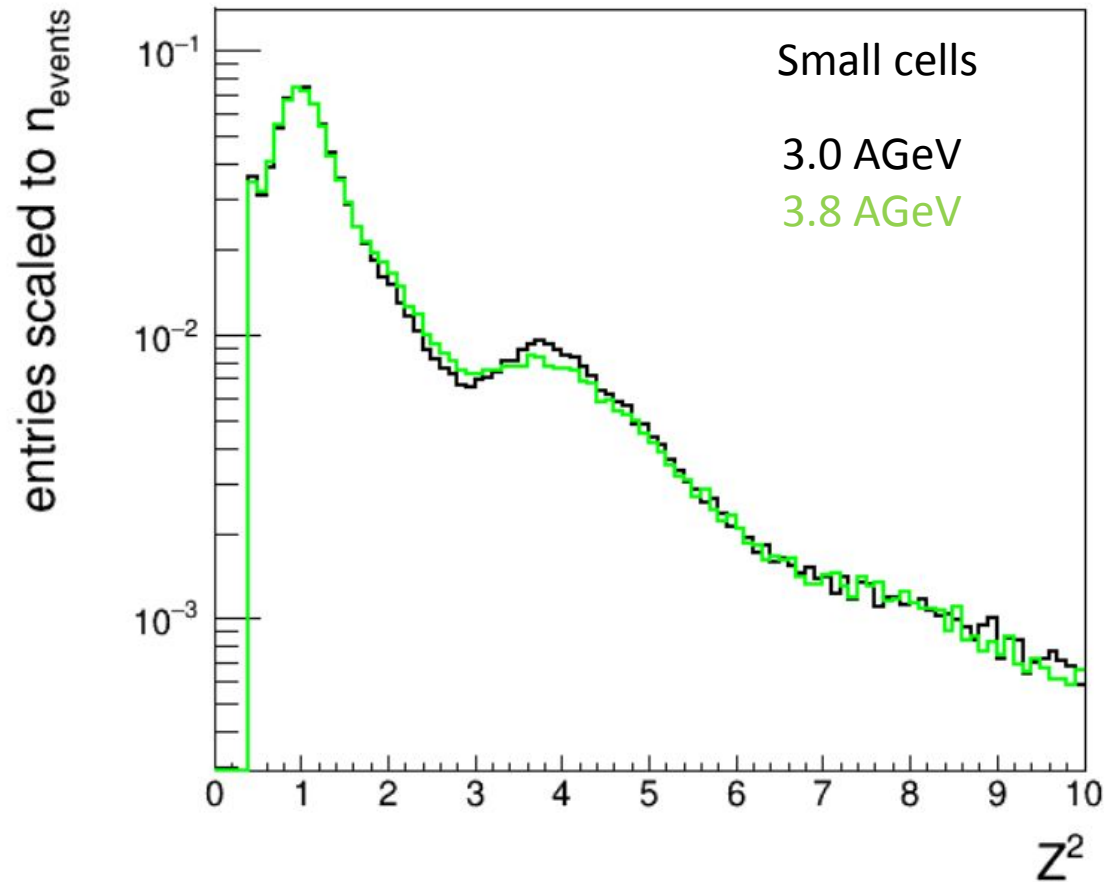
3.8 GeV

Charge distribution in ScWall cells (CCT2)



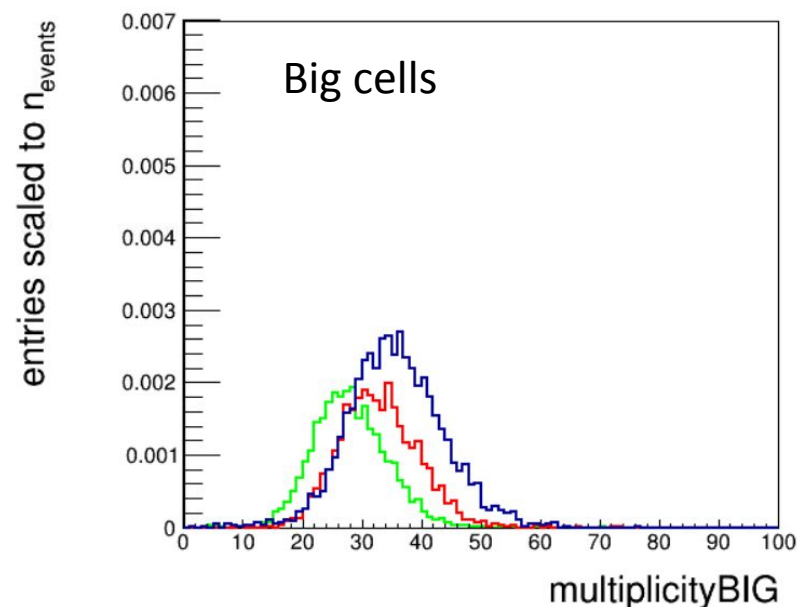
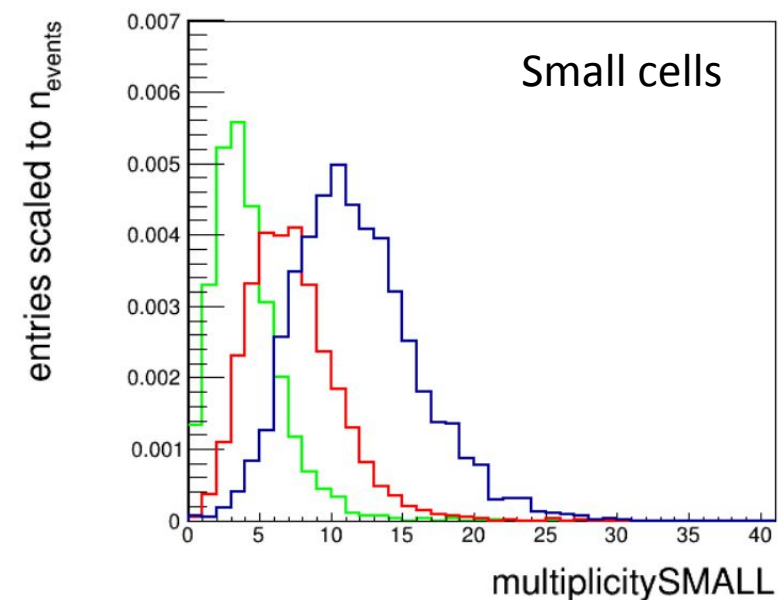
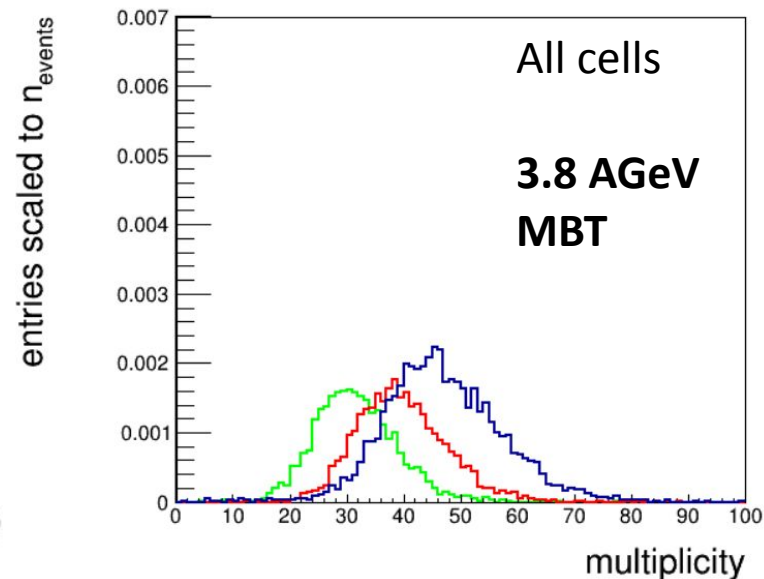
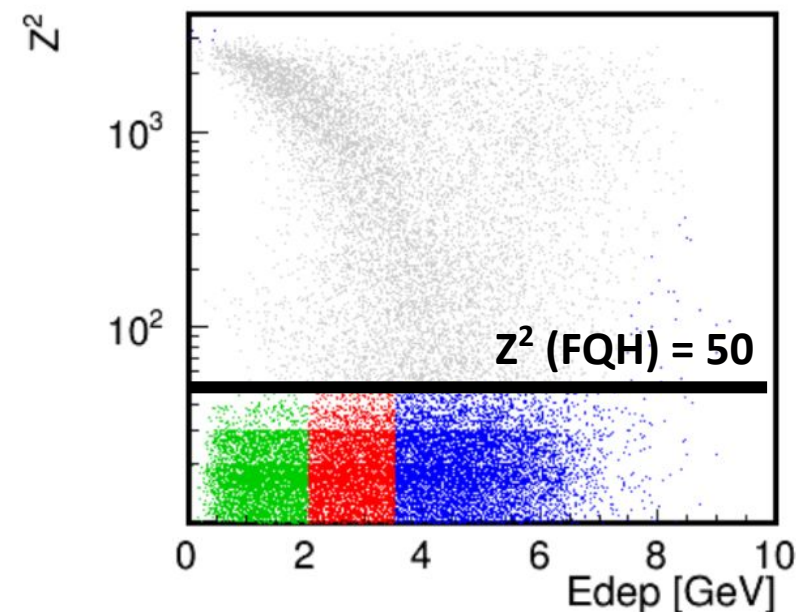
Charge distribution over the scintillation wall. A peaks corresponding to charges $Z = 1, 2$ can be clearly seen.

Charge distribution in ScWall cells



- Comparison of the charge distributions over the scintillation wall for the two energies at 3.0 and 3.8 GeV for the CCT2 trigger.
- The two cell types (small and big) are presented separately.
- It can be seen that the distributions are very similar, with a slight difference in the second peak.

ScWall multiplicity distributions of charged particles for different centrality classes



ScWall multiplicity refers to the number of fired cells in the wall.

Multiplicity is sensitive to centrality -> can be used as estimator. Green, red and blue reflect the most central, semi-central and semi-peripheral arbitrary classes of events.

~50% of minbias events, need to be checked with sim ($b < 10$ fm).

Cuts:

BC1S (1 Xe)

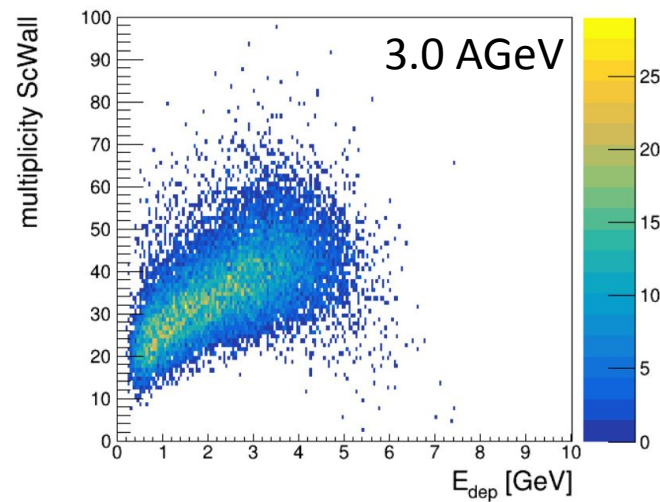
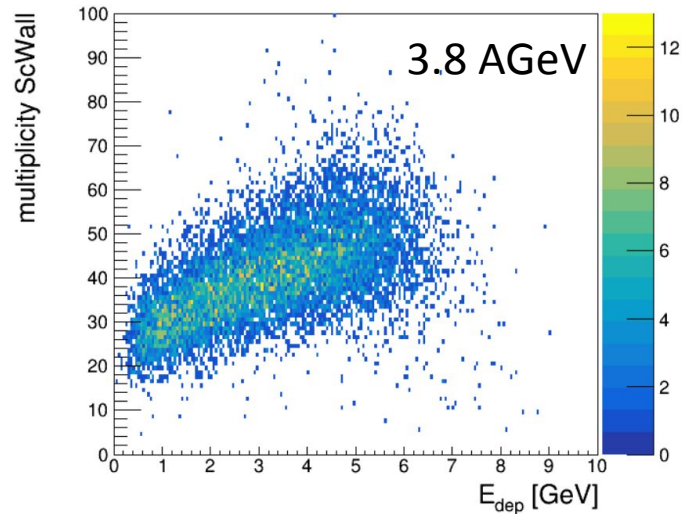
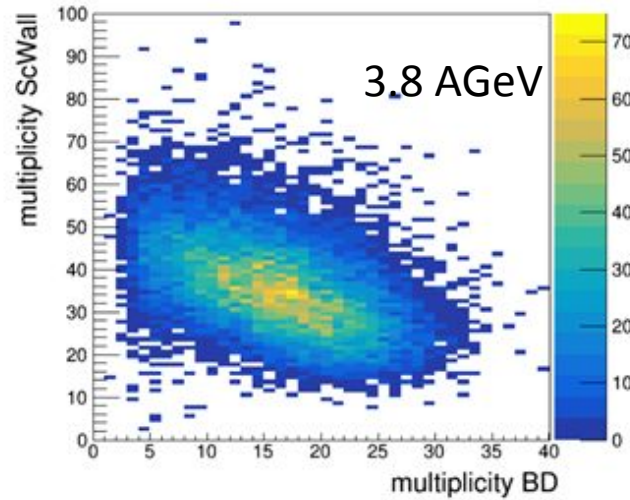
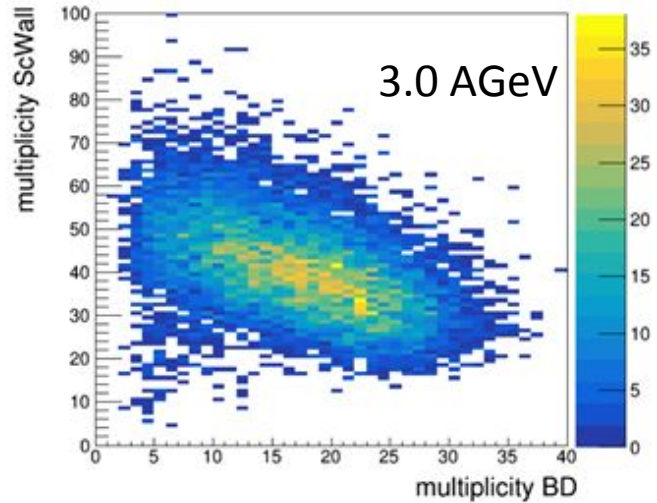
Z^2 (ScWall) > 0.4

vertex Z (-1.5 < Z < 1.5)

Z^2 (FQH) < 50

MBT

Multiplicity in ScWall / multiplicity in BD



Multiplicity correlates with energy deposition in the calorimeter, and anticorrelates with multiplicity in BD.

Cuts:

BC1S

Z^2 (ScWall) > 0.4

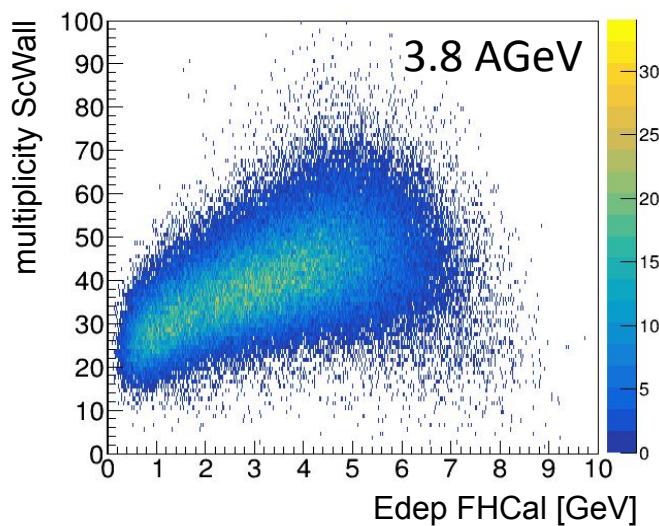
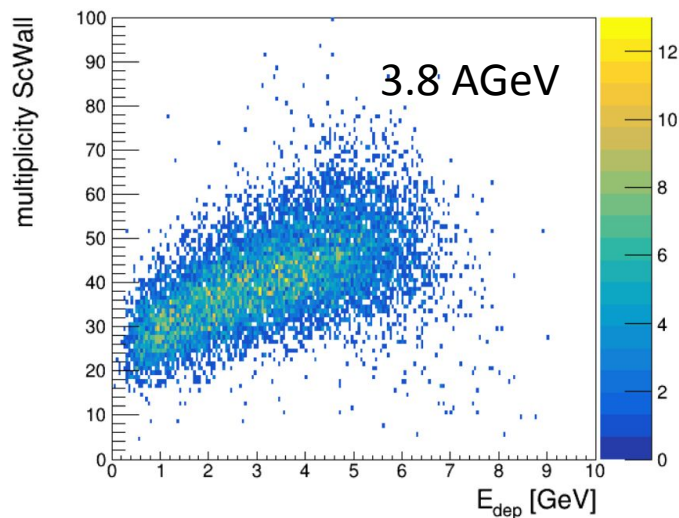
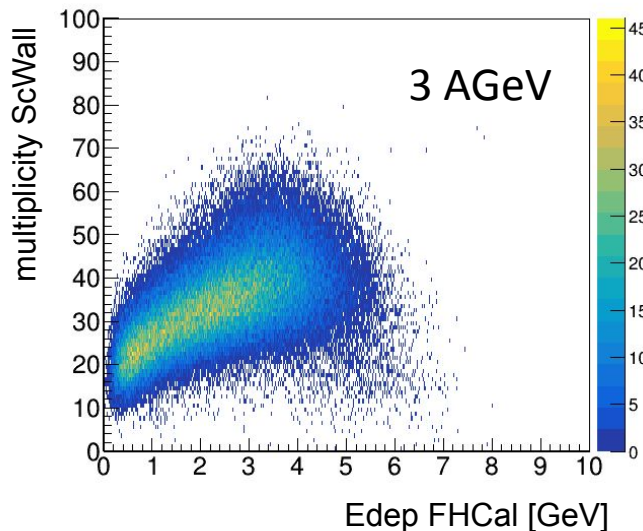
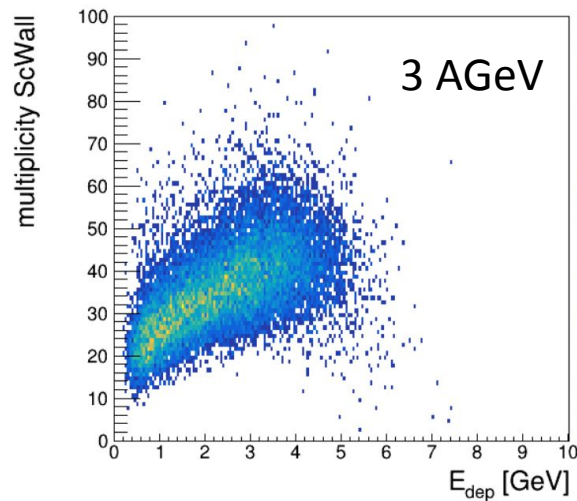
vertex Z (-1.5 < Z < 1.5)

Z^2 (FQH) < 100

CCT2

Multiplicity in ScWall / E_{dep} in FHCAL

new bmnroot experimental data
production train



Cuts:

BC1S

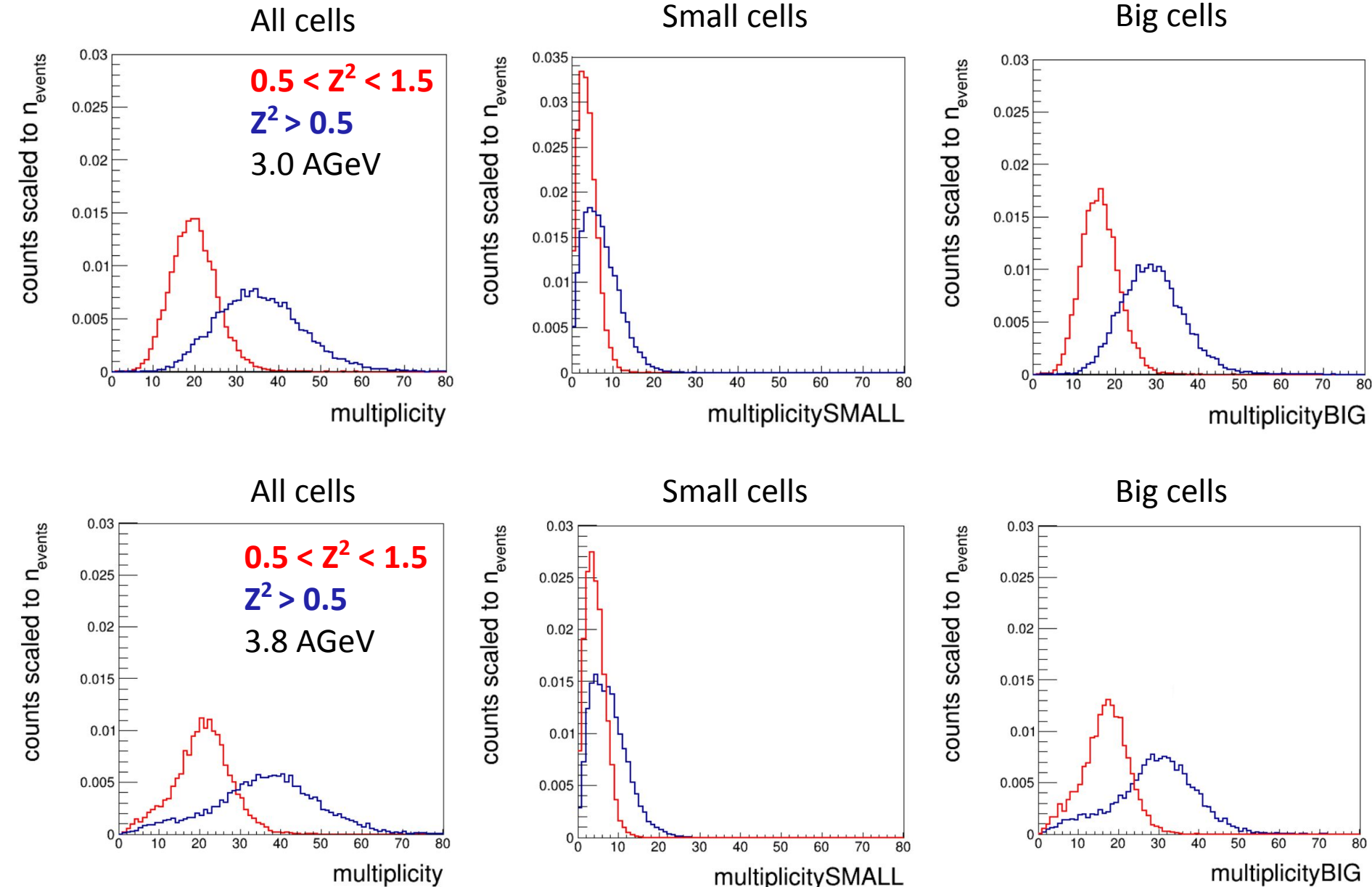
Z^2 (ScWall) > 0.4

vertex Z (-1.5 < Z < 1.5)

Z^2 (FQH) < 100

CCT2

Multiplicity distribution of charged particles in ScWall



Multiplicity is sensitive to charges on the wall for both energies. The peak corresponding to the single charge is clearly prominent.

This dependency can be used for comparison with Monte Carlo models (DCM-QGSM-SMM etc.)

Comparison with models, to do: adjust sim to data.

Conclusion

- The general structure and tasks of the scintillation wall have been presented.
- The ScWall performance examples at different energies were demonstrated.
- ScWall calibration results were shown.
- The charges range detected in the BMN run 8 are shown.
- The sensitivity of the ScWall to centrality according to hit multiplicity is shown.
- Correlations of ScWall multiplicity with the calorimeter deposited energy and barrel detector multiplicity are presented.
- ScWall hit multiplicity distributions for different spectator charges are shown.
- *To do: MC simulations (DCM-SMM, PHQMD, etc.) and comparison with the run data.*

Thank you for your attention!

Backup

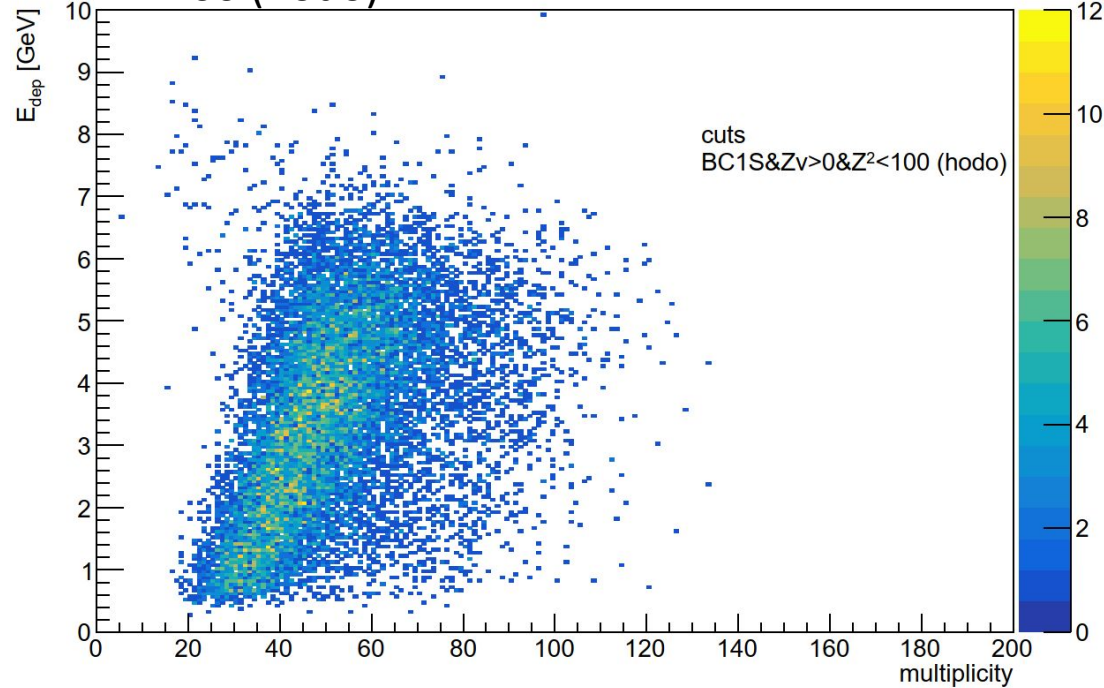
Edep vs multiplicity (scwall) CCT2 (MBT is equal)

Cut (BC1S)

Cut (vertex & BC1S)

Cut (vertex ($|z| > 0$) & BC1S)

$Z^2 < 100$ (hodo)

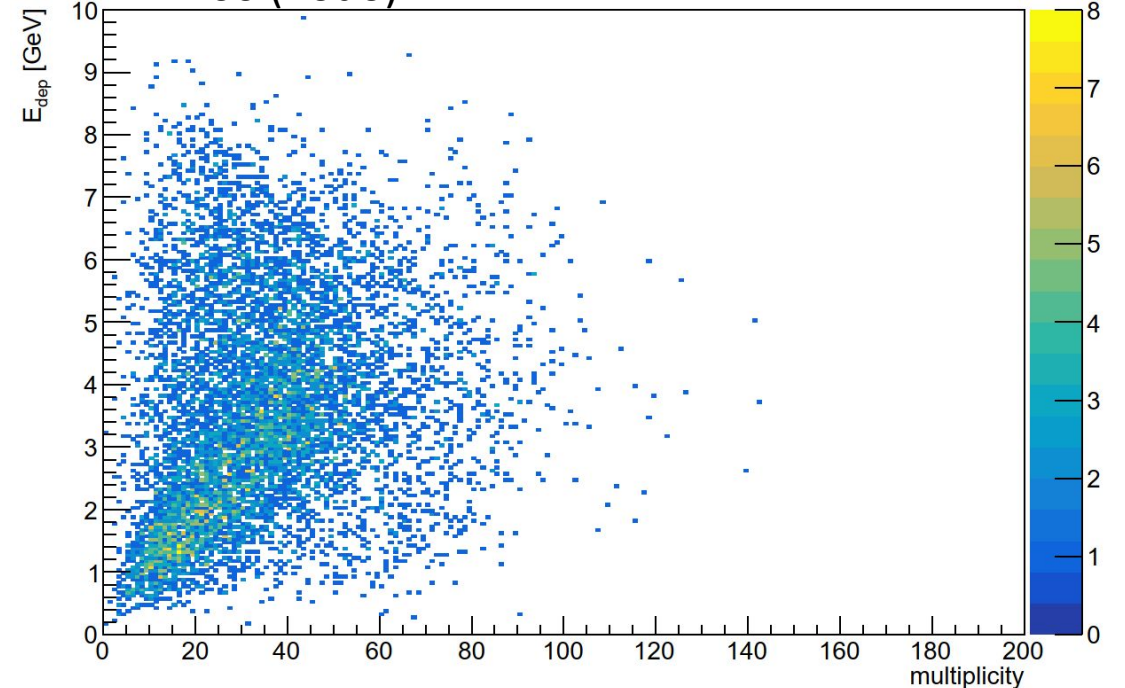


Cut (BC1S)

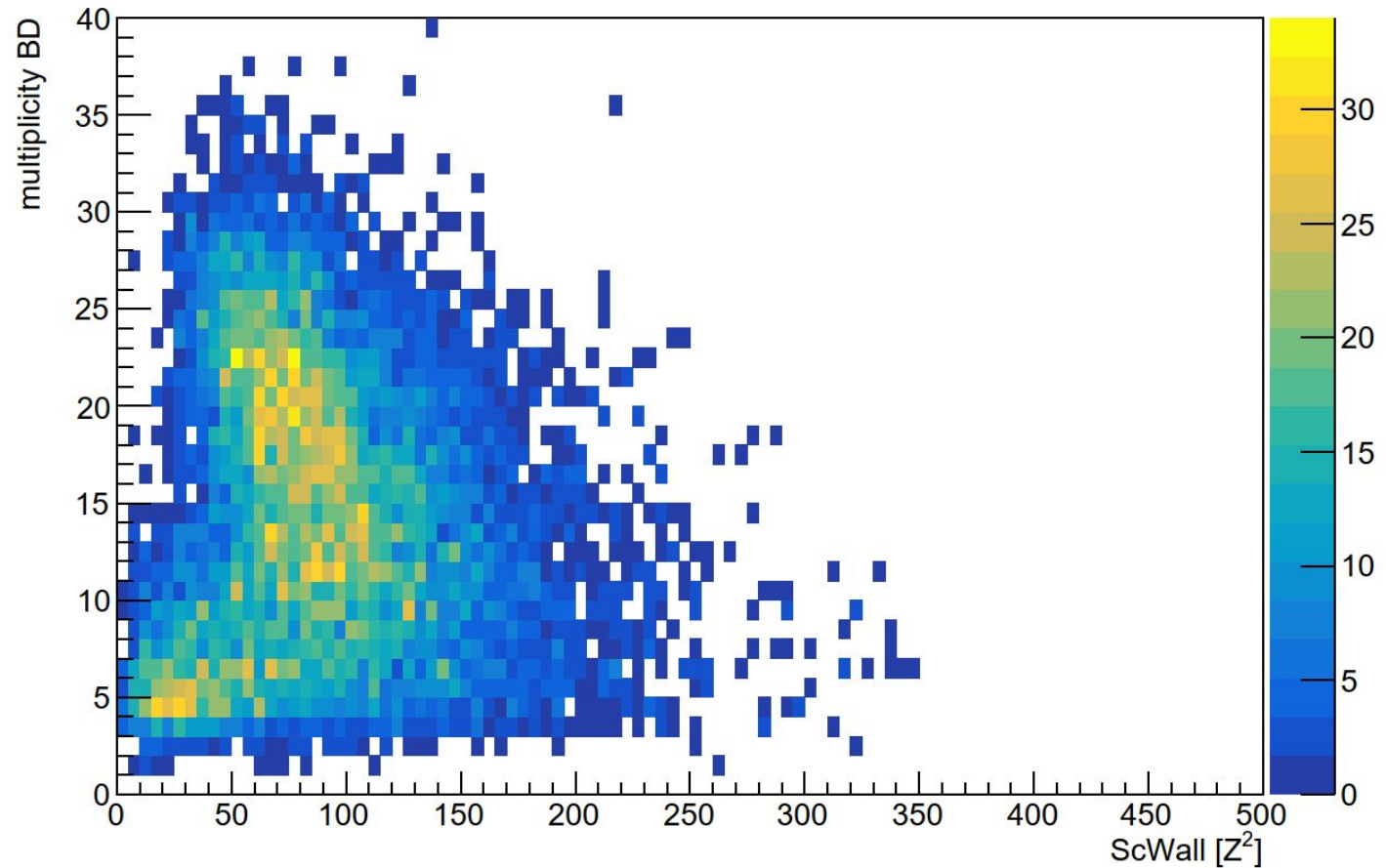
Cut (vertex & BC1S)

Cut (vertex ($|z| > 0$) & BC1S)

$Z^2 > 100$ (hodo)



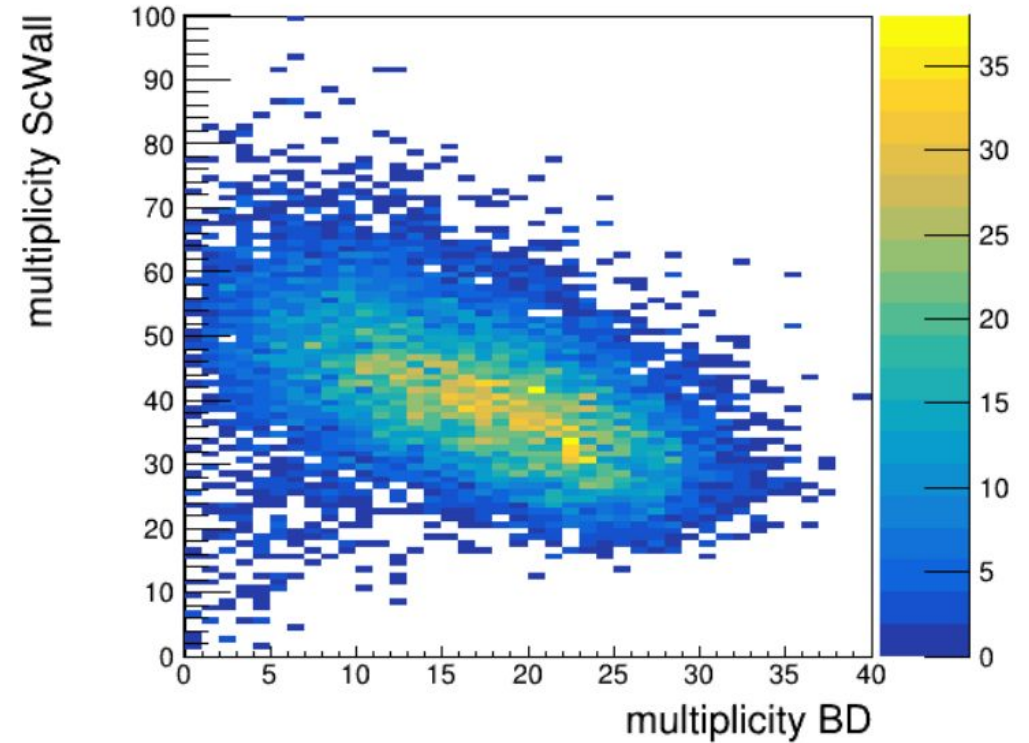
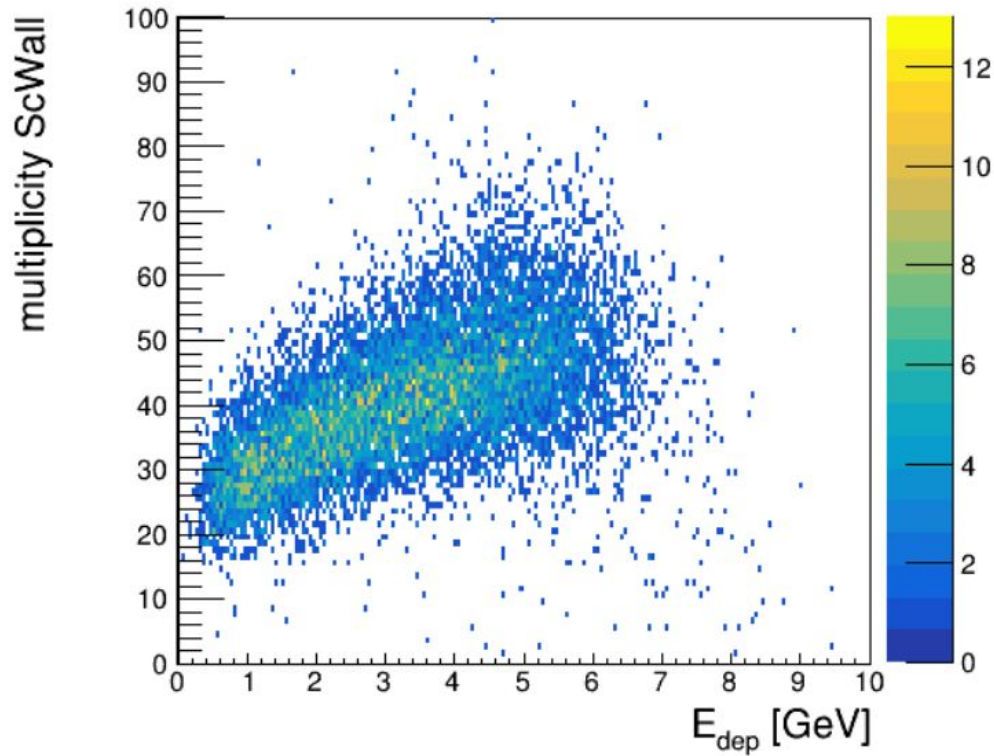
BD mult vs ScWall charge



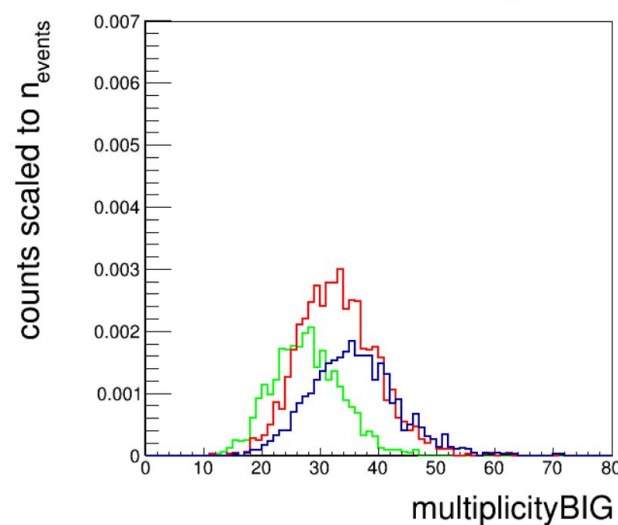
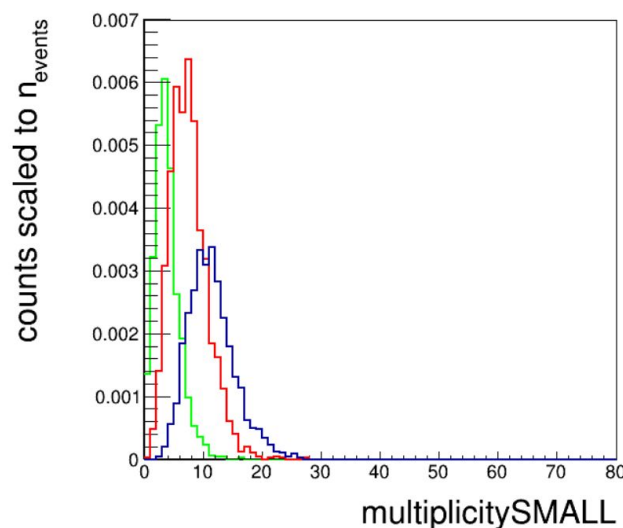
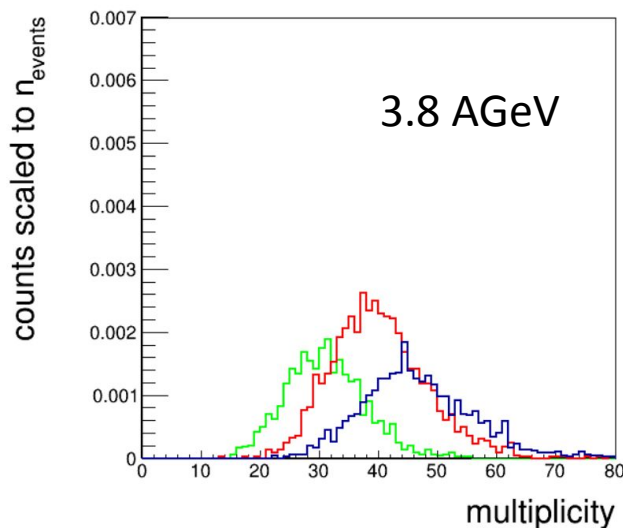
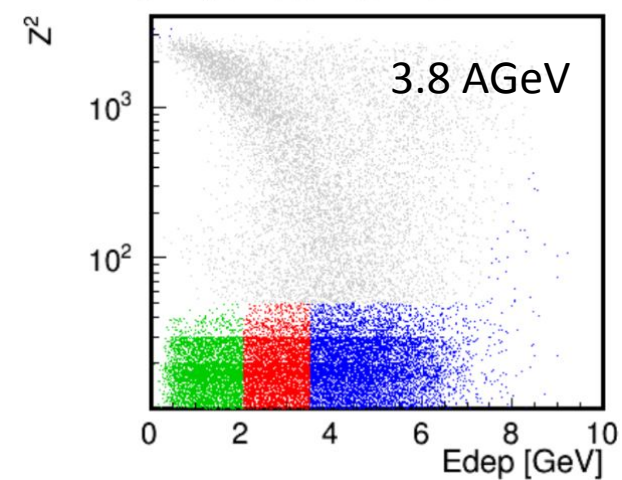
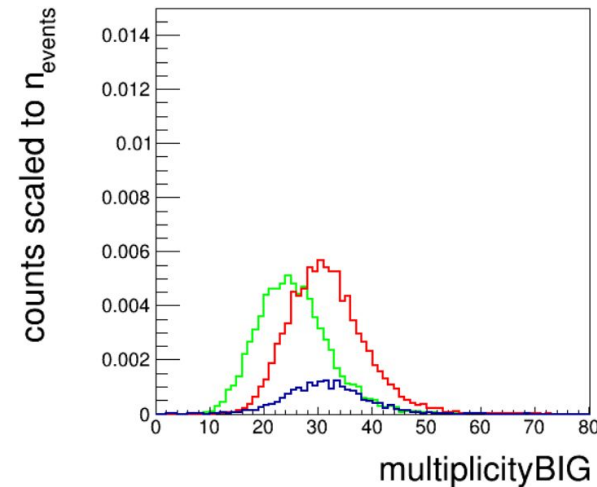
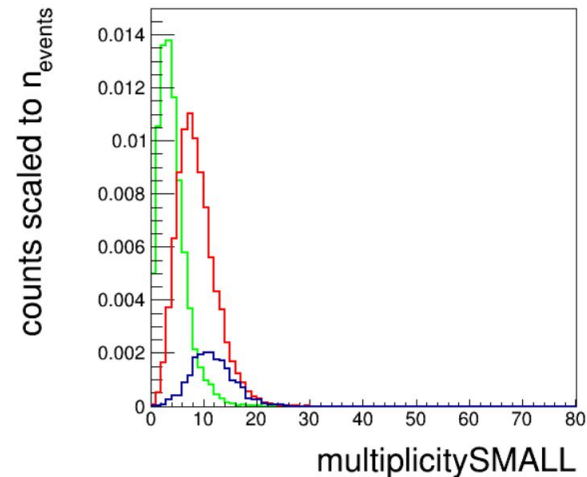
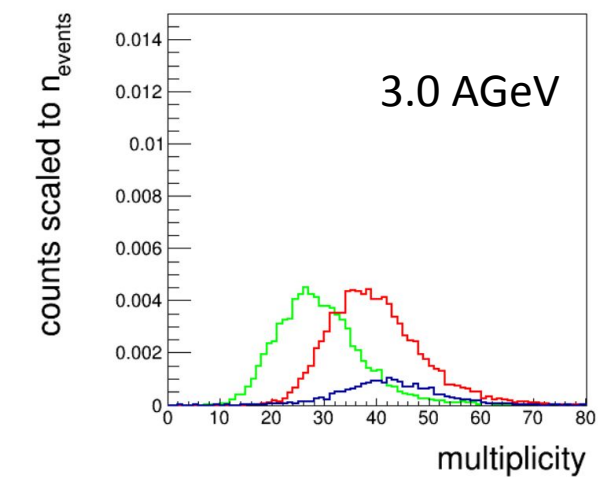
MBT 3.8

Cuts:
BC1S
 Z^2 (ScWall) > 0.4
vertex Z (-1.5 < Z < 1.5)
 Z^2 (FQH) < 50

MBT



ScWall multiplicity distributions of charged particles for different centrality classes



Multiplicity is sensitive to centrality. Green, red and blue reflect the most central, semi-peripheral and peripheral classes of events.

Background subtr. Before / after

