ZDC status report

- ZDC setup 2018
- Module design: 64 layers Sc(5mm)+Pb(10mm)
- Cosmic tests was performed before 2017
- Test with carbon beam: X-Y scan performed in Marth 2017
- Cosmic test 2018 was done take in account very high energy for Krypton beam
- Beam test results in March-April 2018 with nuclear beams: ^{6}C, ^{18}Ar, ^{36}Kr

Hadron calorimeter calibration in carbon beam with kinetic energy T= 4.5 GeV per nucleon

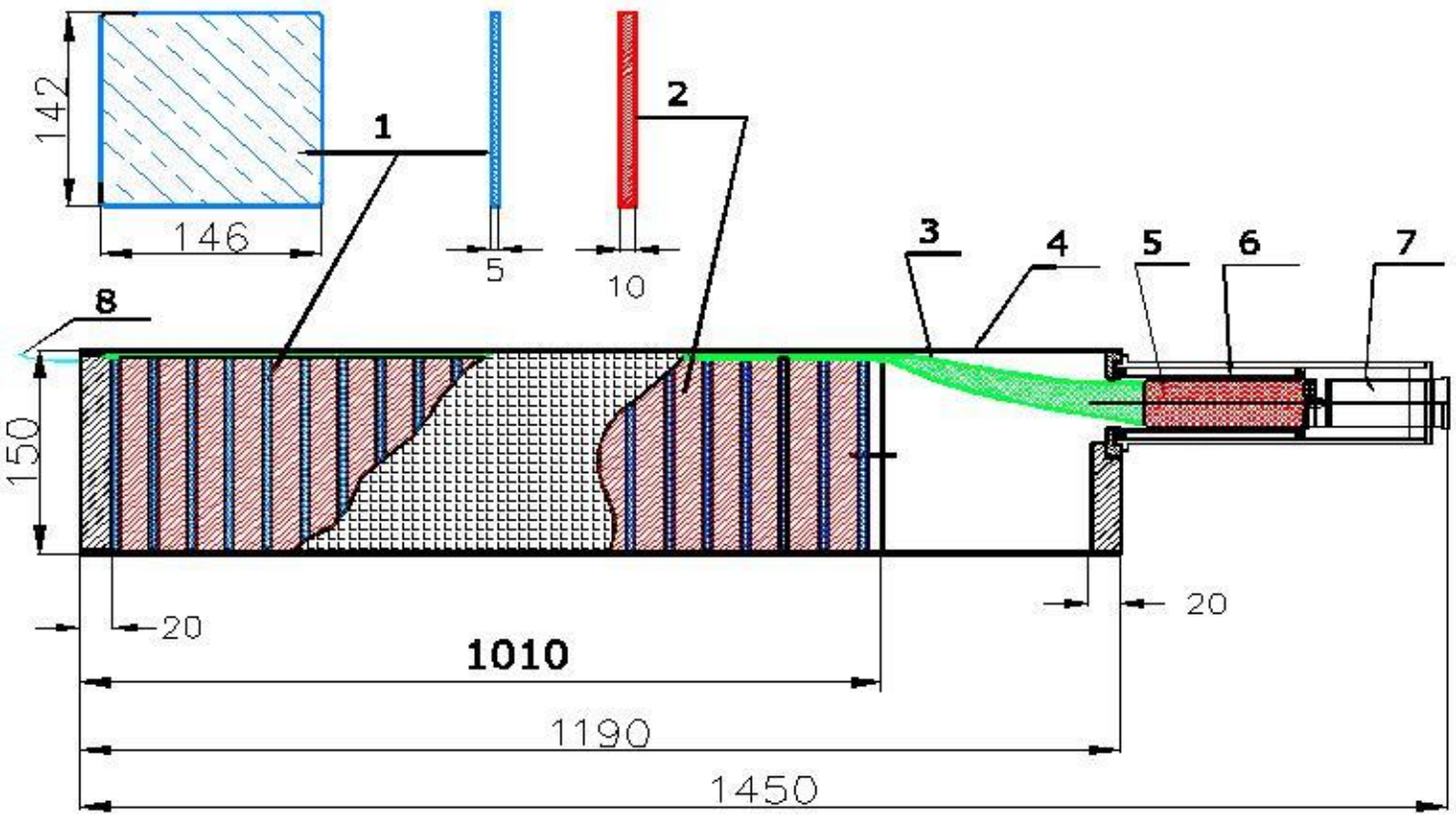
Калибровка адронного калориметра в пучке ядер углерода с энергией 4.5 ГэВ на нуклон

Oleg Gavrishchuk , LVHE JINR

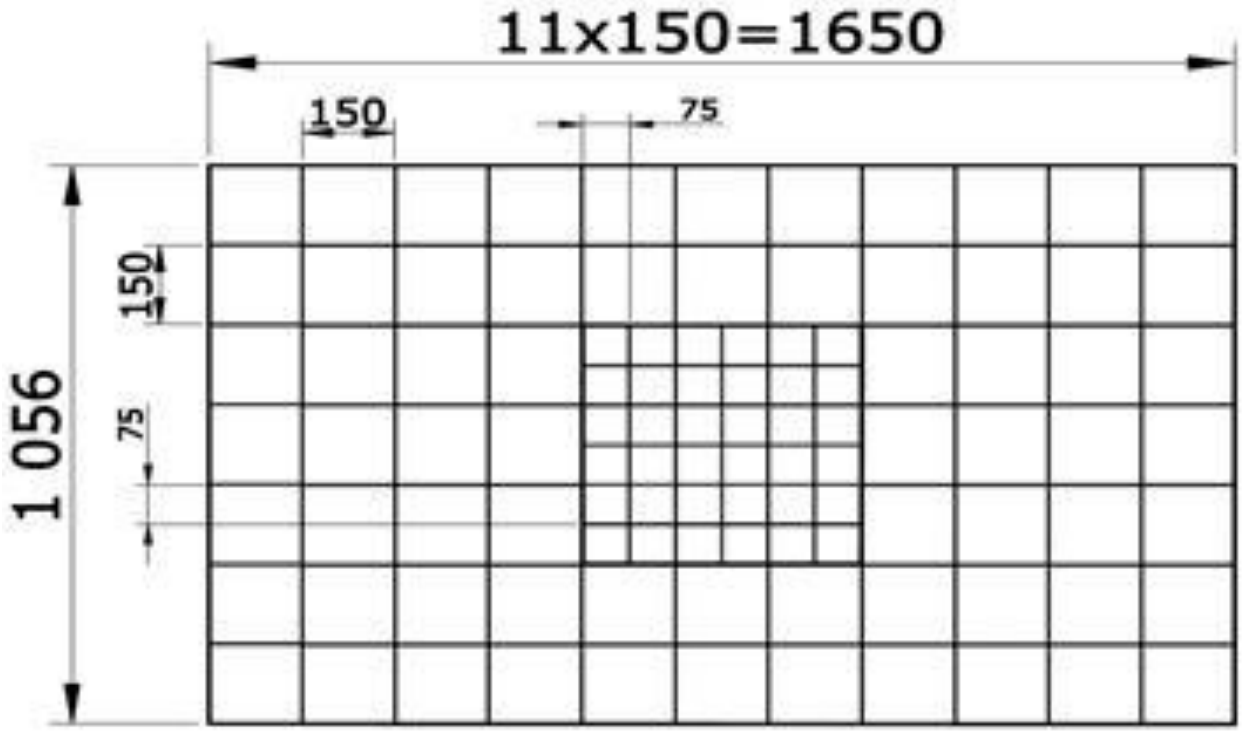
- ZDC Setup 2017
- Calibration in transvers cosmic
- Beam calibration in Carbon beam T=4.5 GeV/N in Marth 2017

ZDC setup 2015

ZDC module design:
64 layers (Sc-5mm+Pb10mm)



ZDC dimension and cell sizes



ZDC layout: central part consist of 36 modules with sizes 7.5×7.5 cm^2,
peripheral part contains 68 modules of 15×15 cm^2

ZDC modules mapping

68	61	54	47	40	36	32	28	21	14	7
67	60	53	46	39	35	31	27	20	13	6
66	59	52	45	104 98 92 86 80 74 103 97 91 85 79 73			26	19	12	5
65	58	51	44	102 96 90 84 78 72 101 95 89 83 77 71			25	18	11	4
64	57	50	43	100 94 88 82 76 70 99 93 87 81 75 69			24	17	10	3
63	56	49	42	38	34	30	23	16	9	2
62	55	48	41	37	33	29	22	15	8	1

ZDC layout: central part consist of 36 modules with sizes 7.5×7.5 cm^2, peripheral part contains 68 modules of 15×15 cm^2

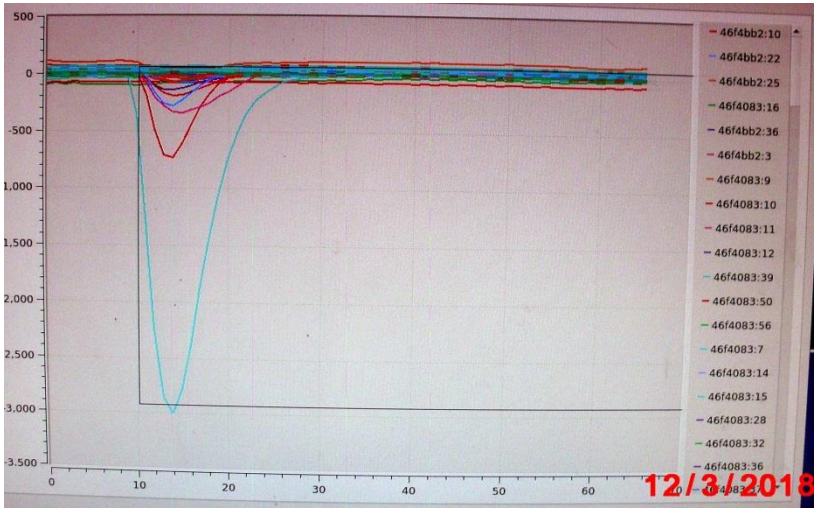
ZDC setup 2017_2018
for cosmic and beam tests

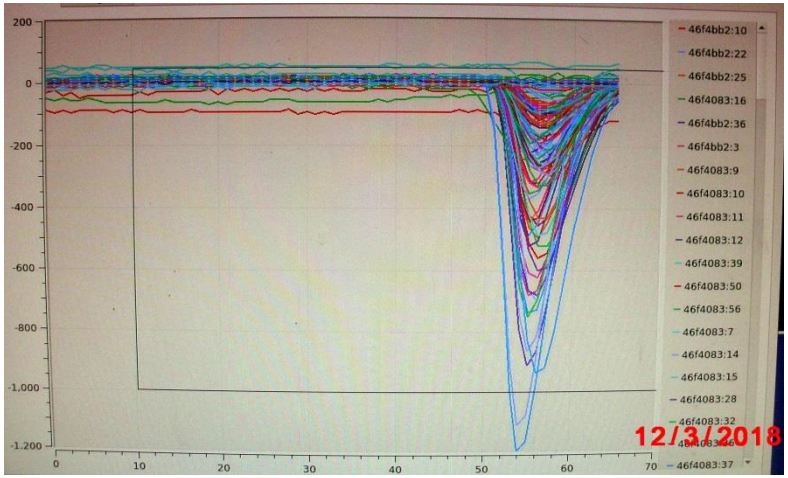
Trigger
Counters
for cosmic

dE/dX counter
for Z selection

ZDC front view:

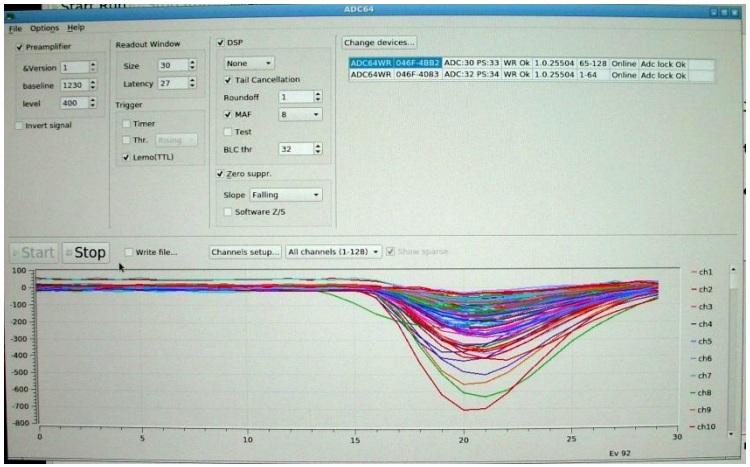
1. LED fiber are distributed for 104 cells using sigle Led flashed
2. Scintillation counter of 10x10cm^2 in front ZDC



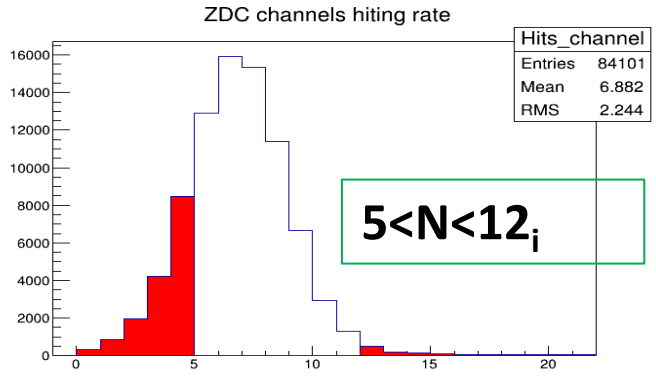


SCR : Gate=64 samples (1000 ns):
the tim,e =3.5 μs

BM&N: Gete=28 smples (432 ns):
the time of=0.8 μs

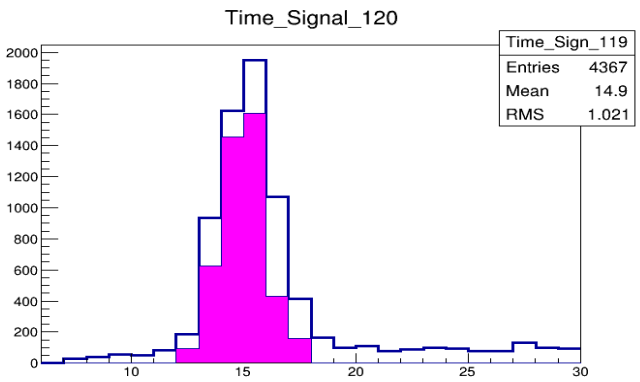


Criteria for events selection in cosmic rays



$5<N<12_i$

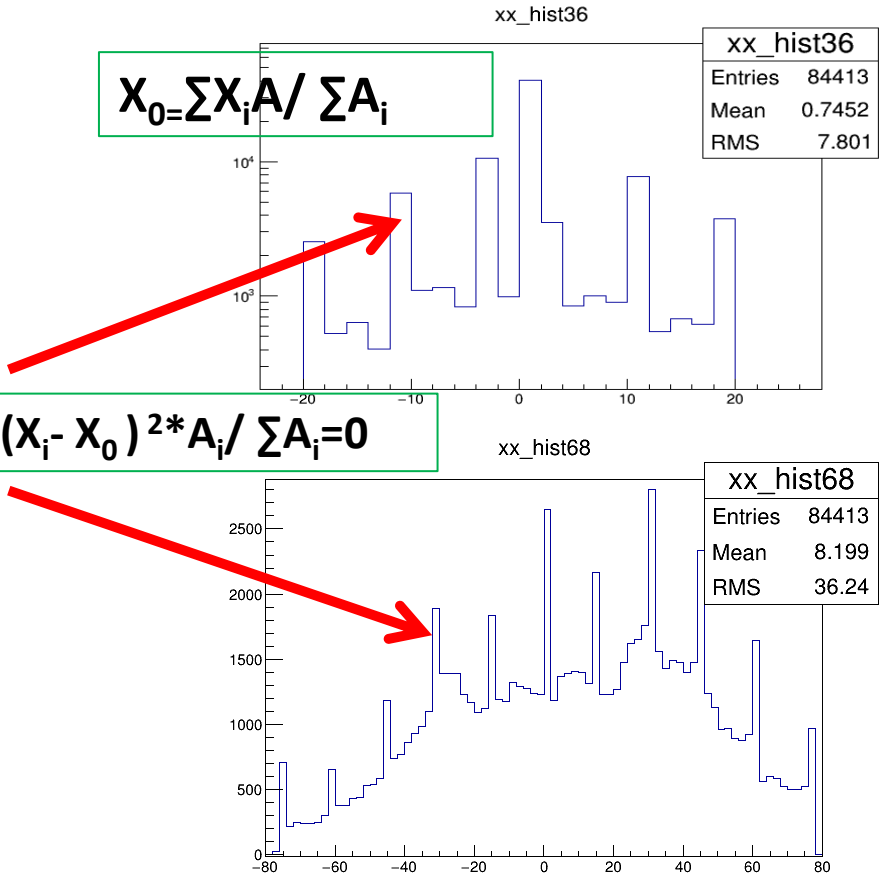
Hits distribution



Time selection

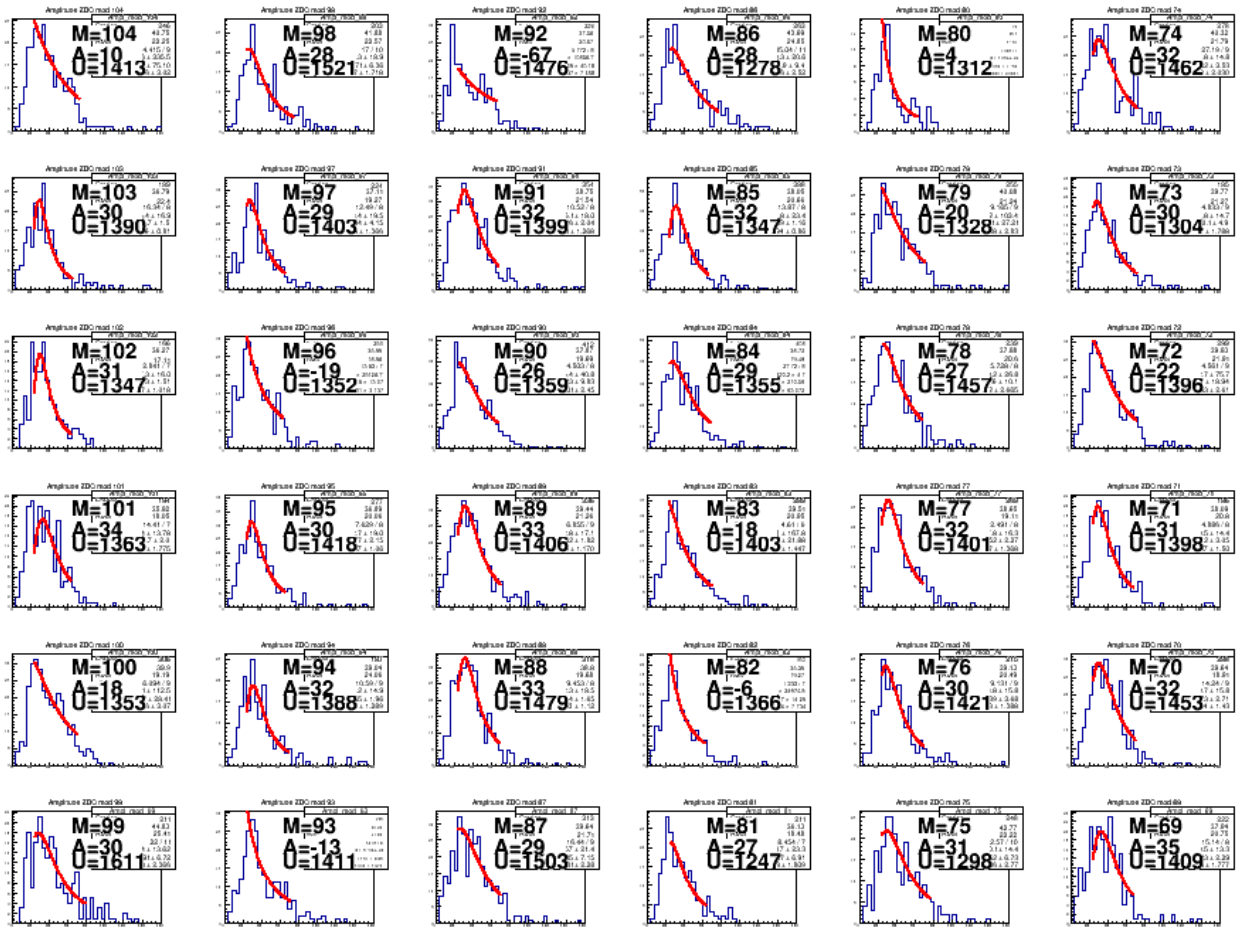
$X_0=\sum X_i A / \sum A_i$

$D_x=\sum (X_i - X_0)^2 * A_i / \sum A_i = 0$

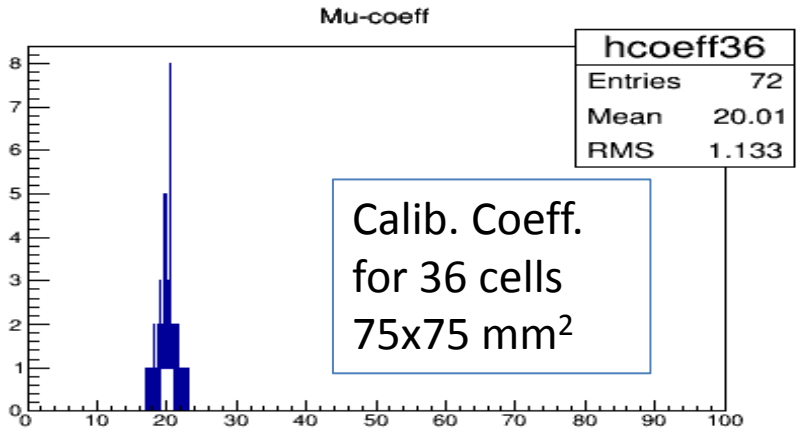


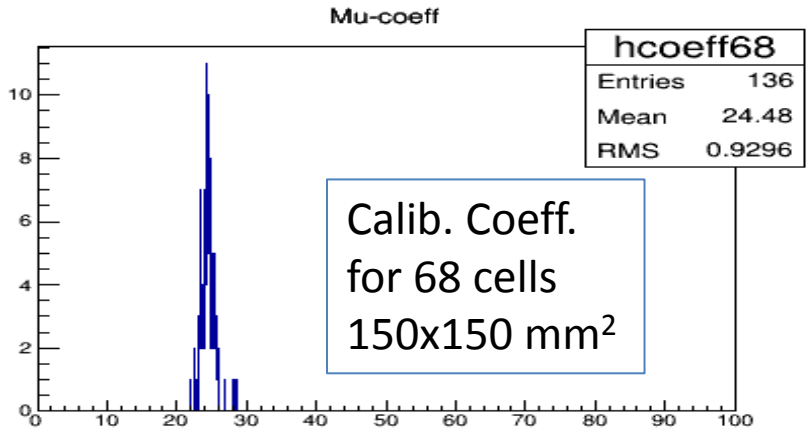
Cosmic spectra for 68 outer cells

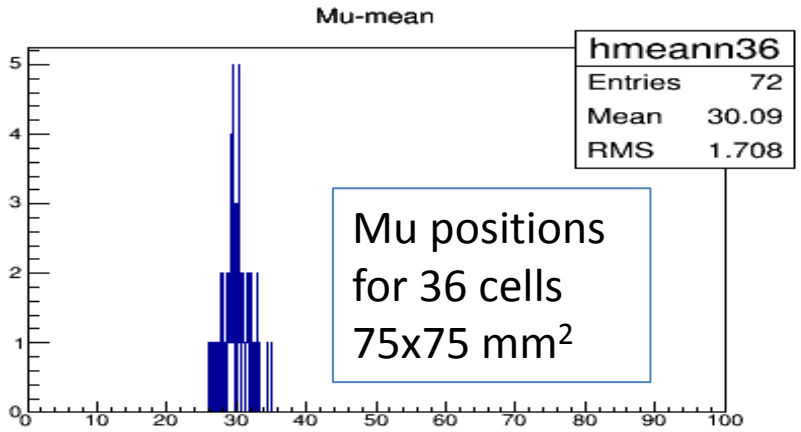
Cosmic spectra for 36 inner cells

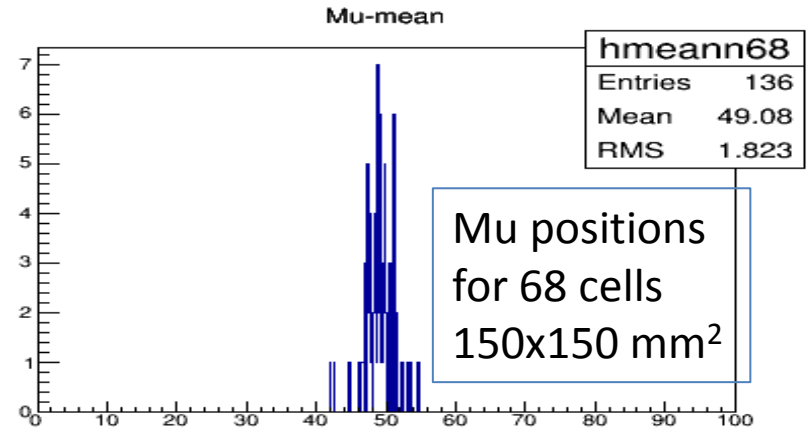


Calibration coefficients: k=Const[MeV]/<Mu[Ch]>

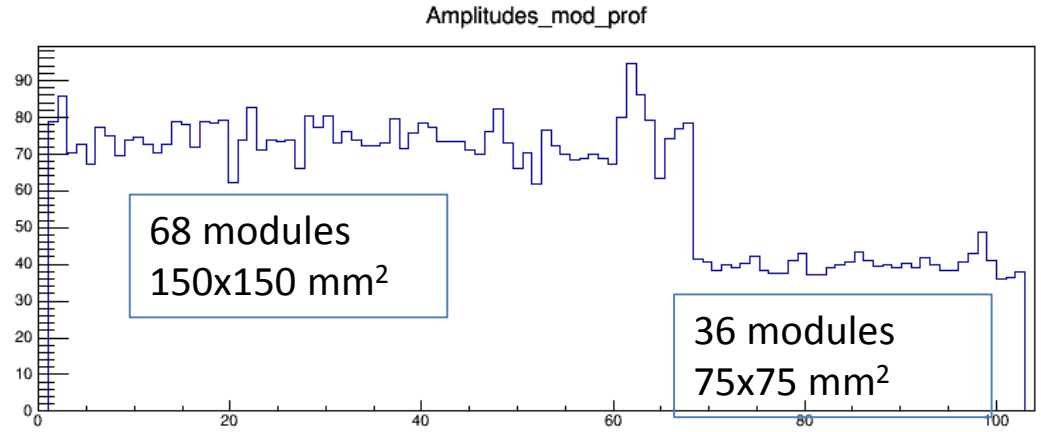


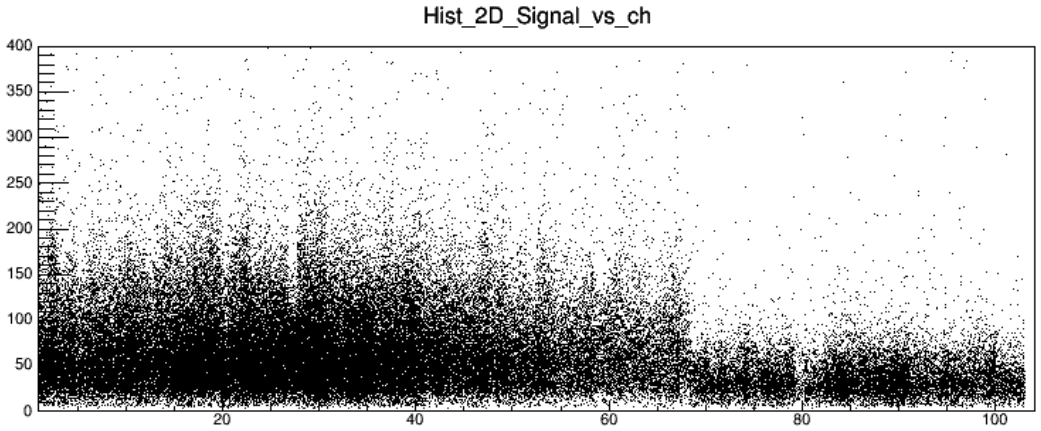




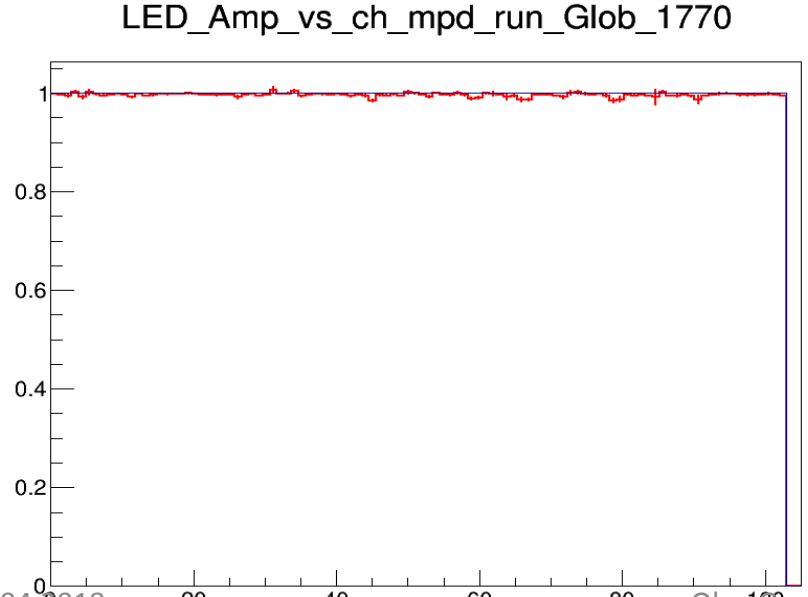


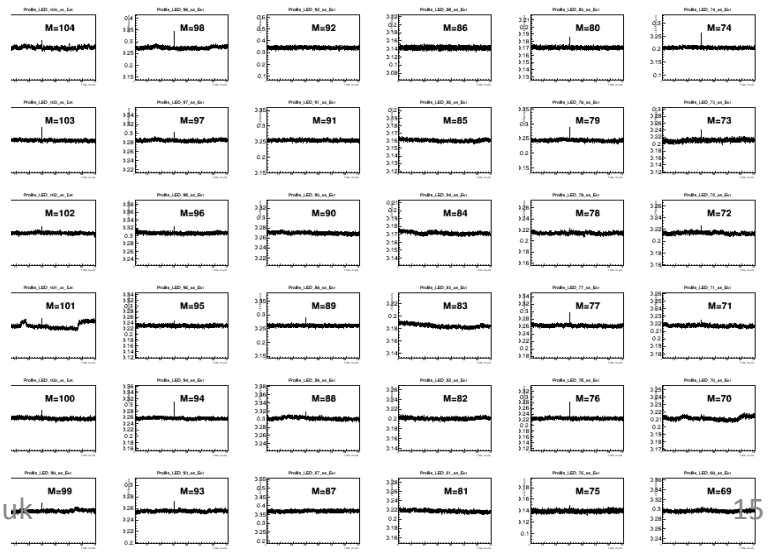
Mu position for all ZDC cells





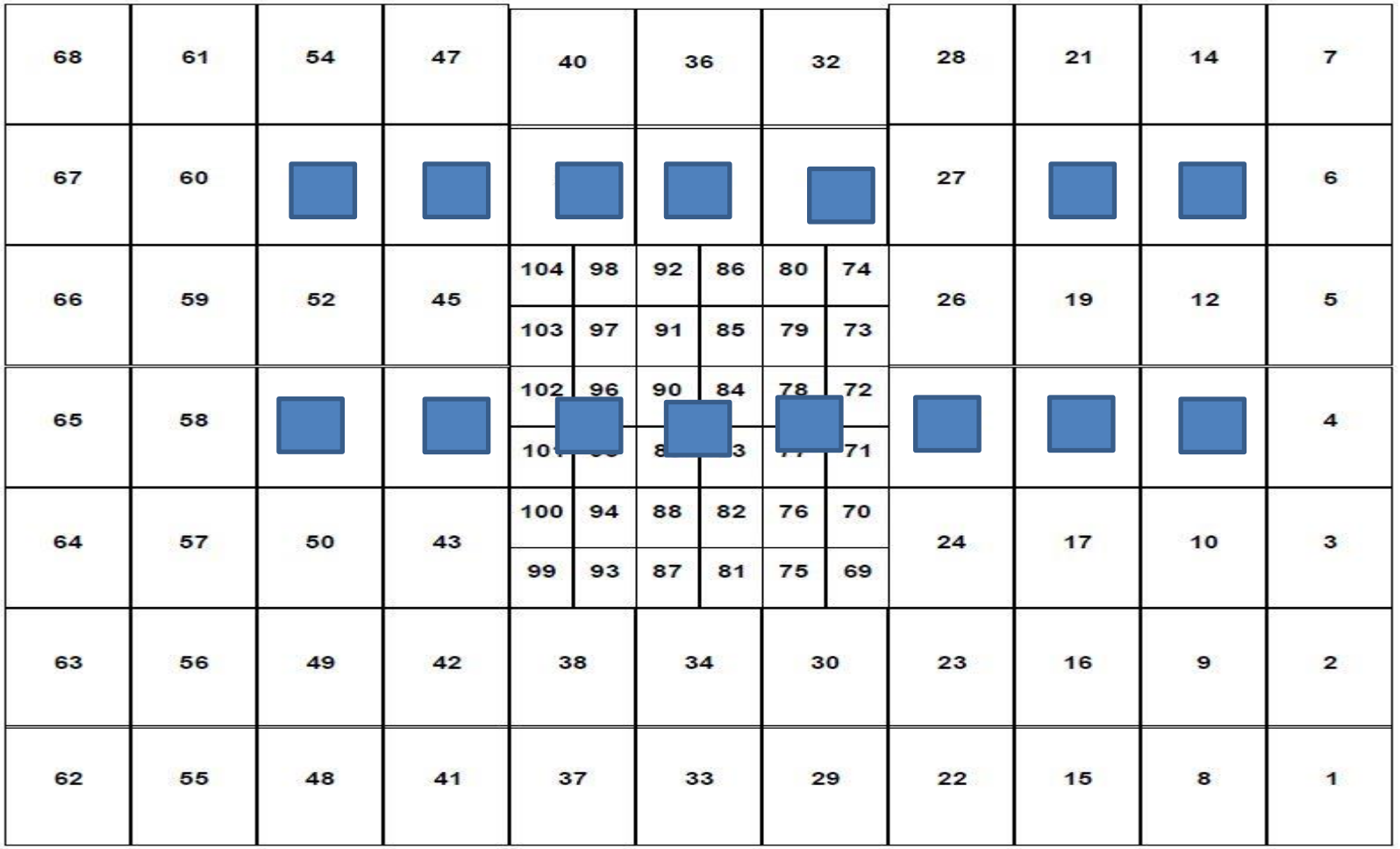
LED monitoring: current/reference for all 104 ZDC cells during 1 week





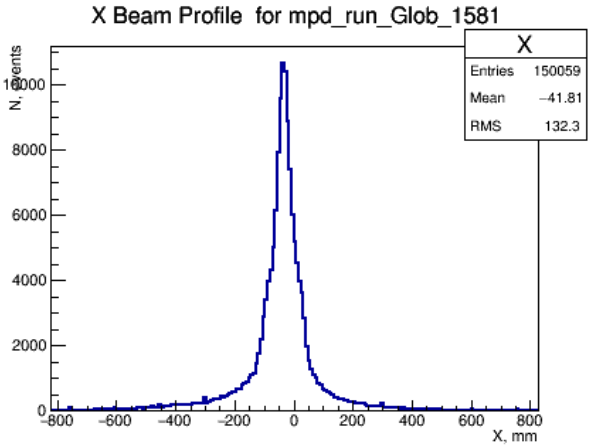
36 central(inner) cells 75x75 mm^2

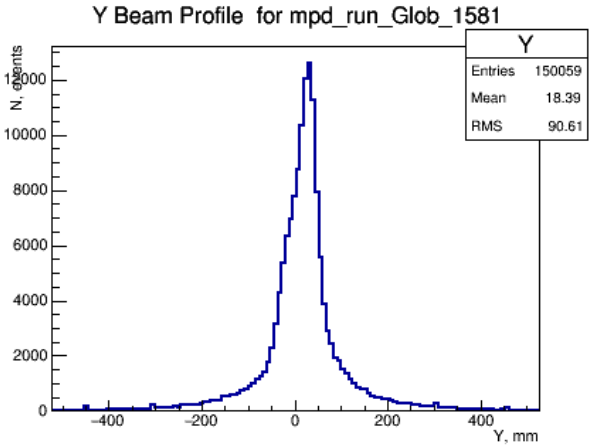
ZDC modules numbering and scan's positions in carbon beam of 4.5 GeV/ N (2017)

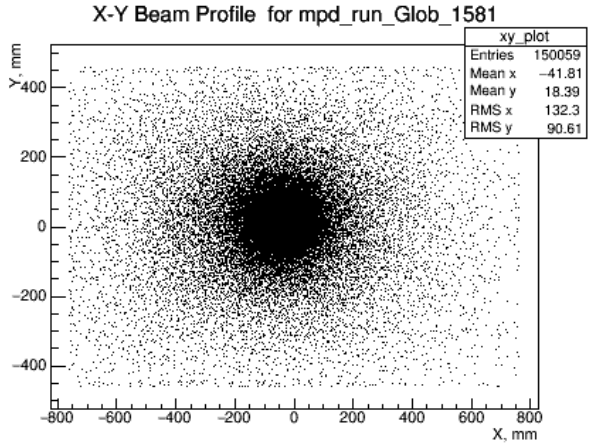


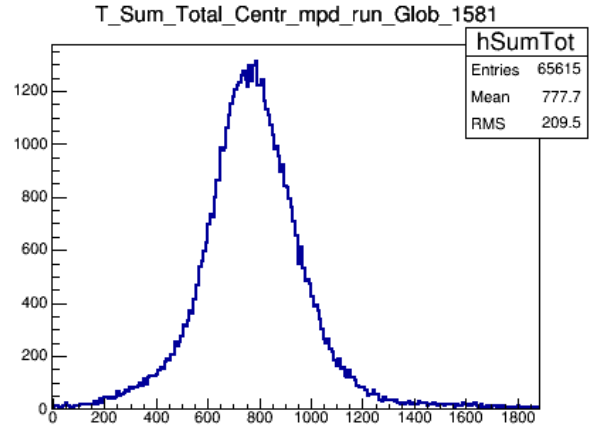
ZDC layout: central part consist of 36 modules with sizes 7.5×7.5 cm^2, peripheral part contains of 68 modules of 15×15 cm^2

X , Y Profiles, 2D profile , Carbon energy spectrum in certain ZDC position

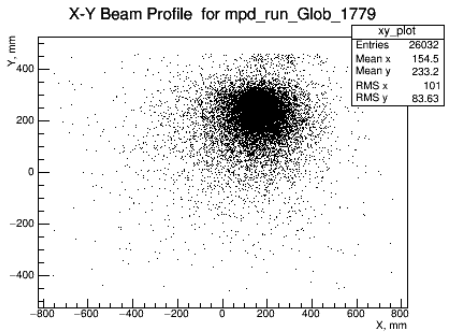


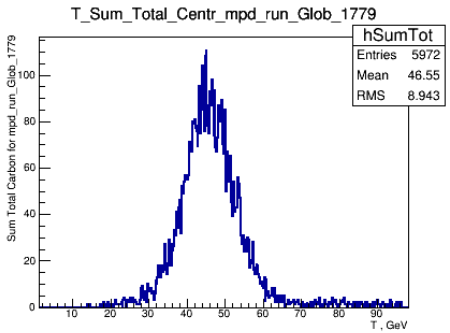


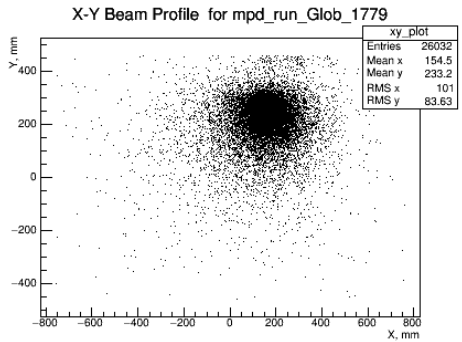


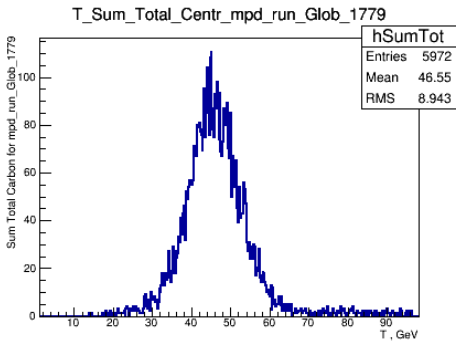


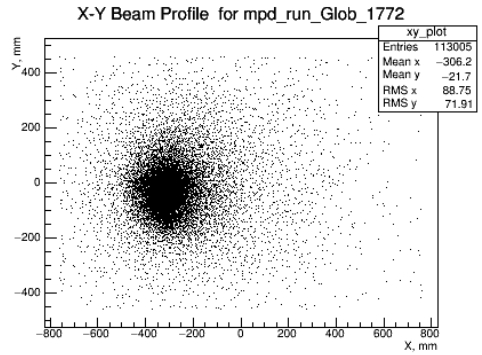
ZDC scan over X & Y (4 points from 20): 2D profiles and energy carbon spectra of 4.5 GeV/N in different X/Y beam positions

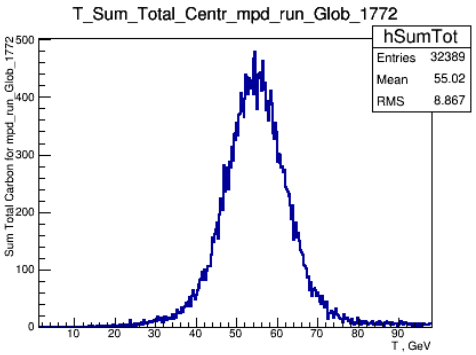


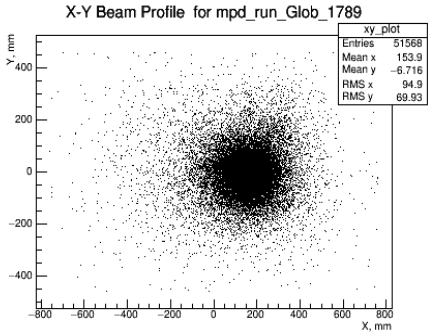


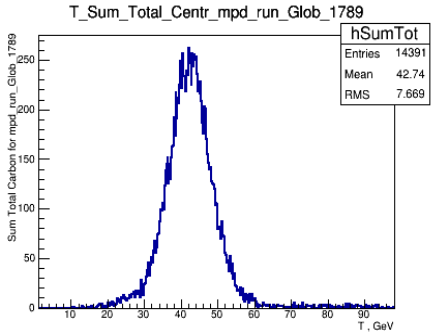




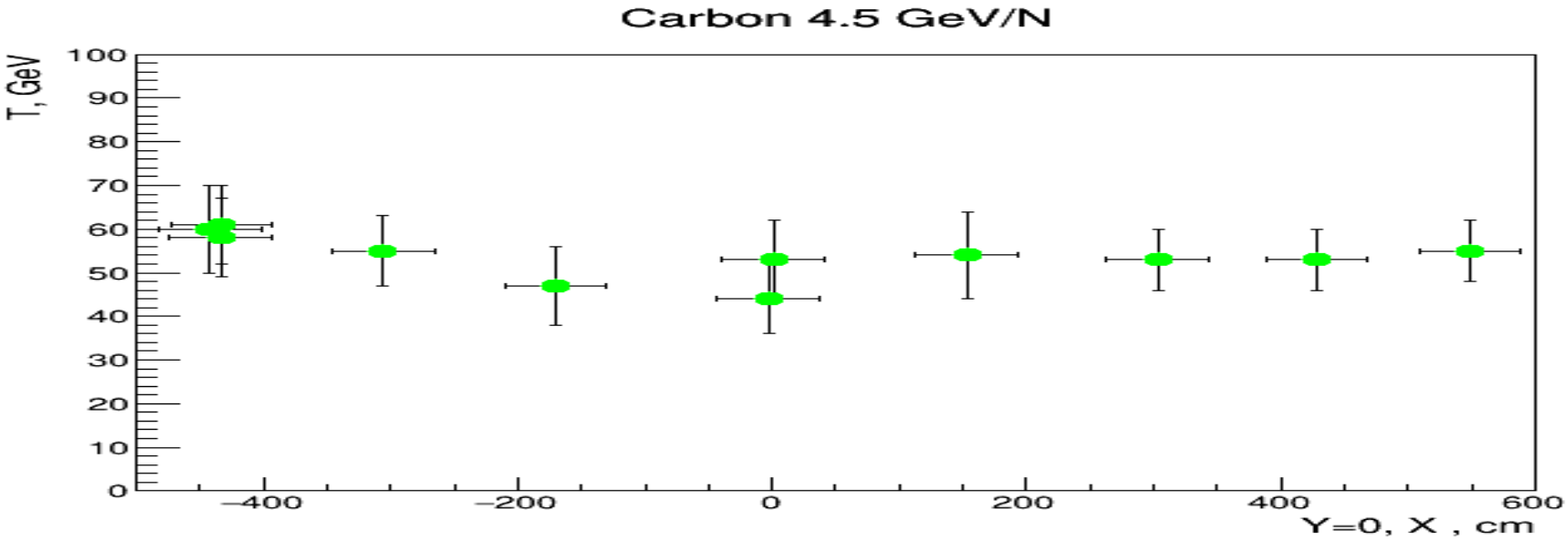


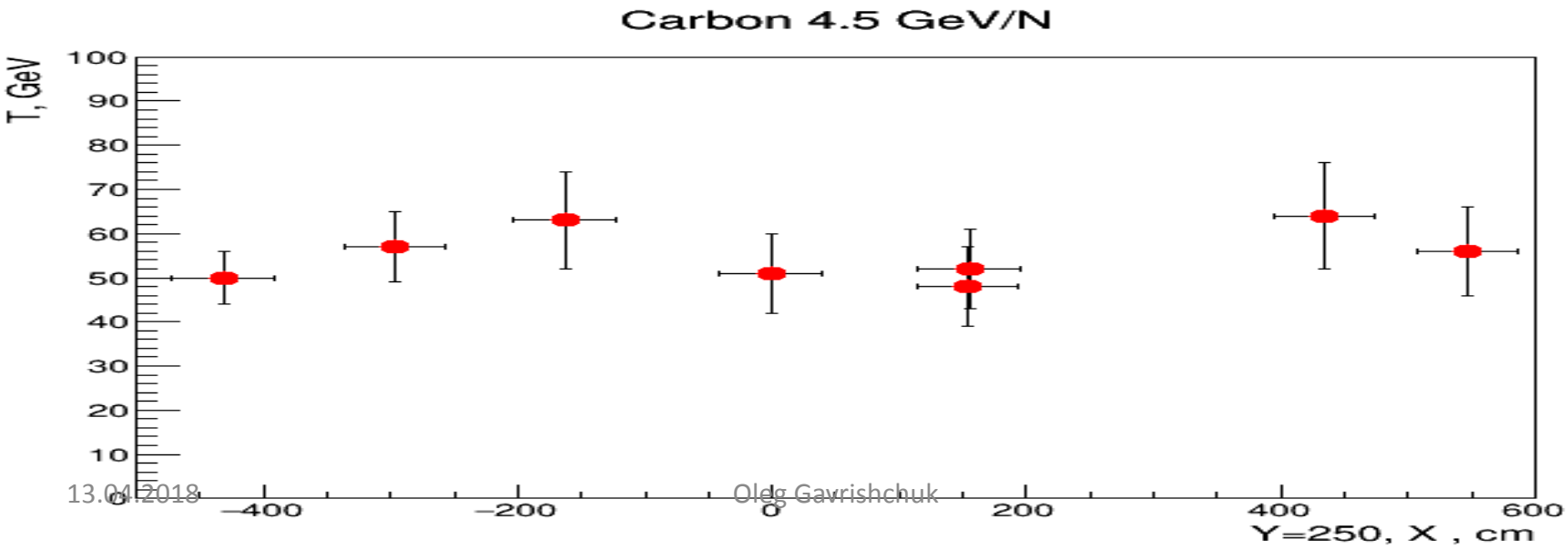




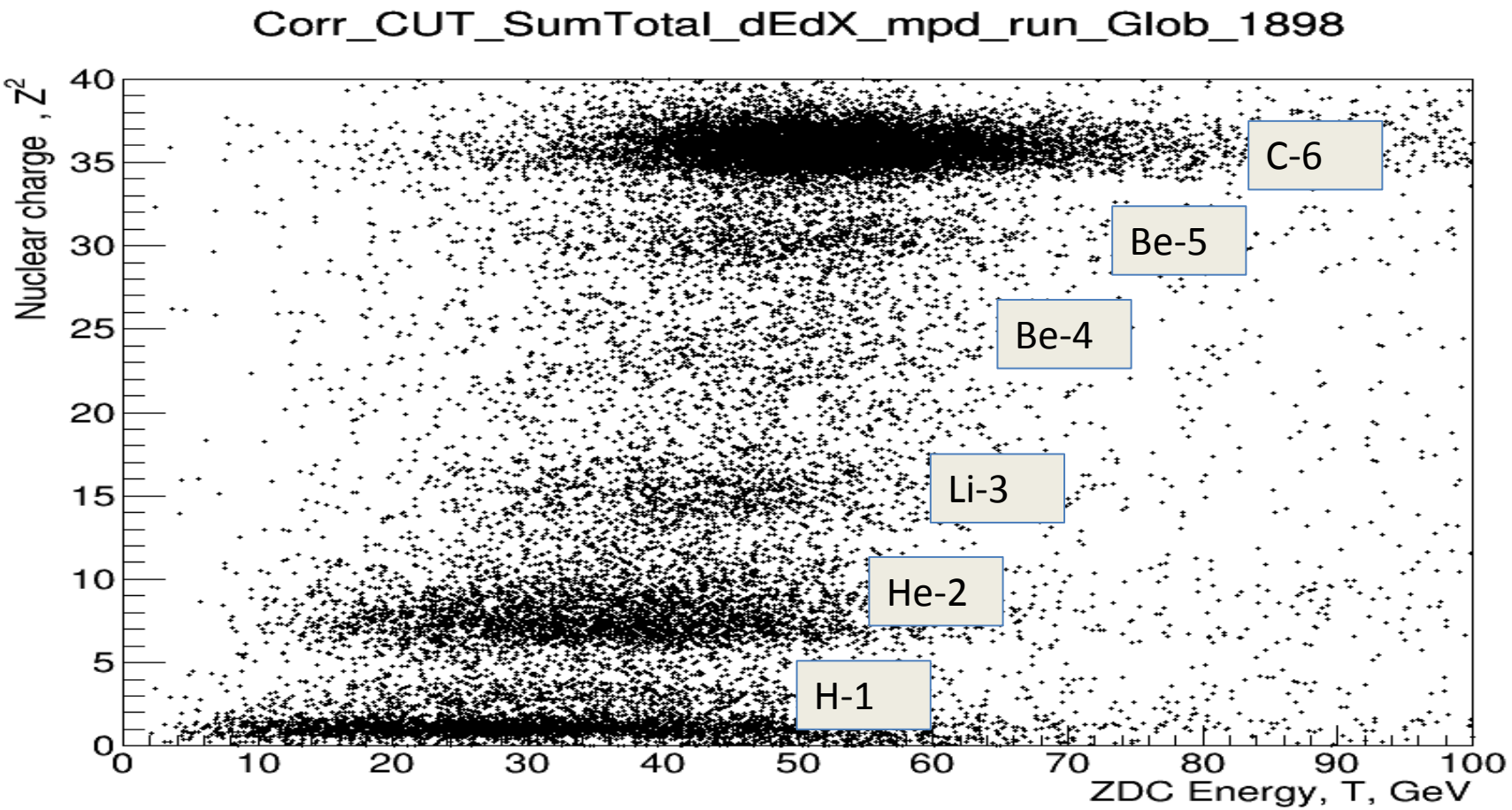


Scan results with Carbon beam at T=4.5 GeV/N

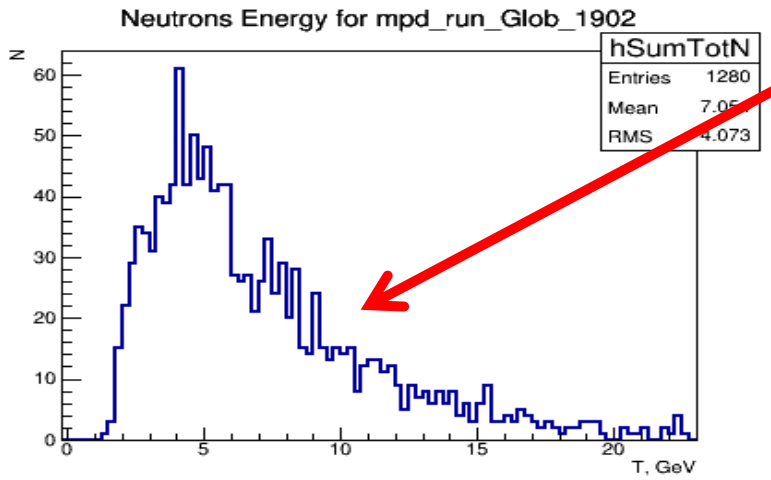


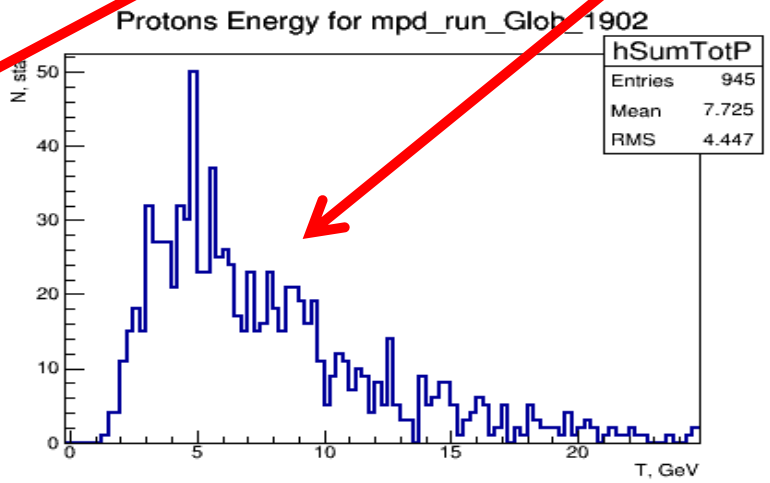


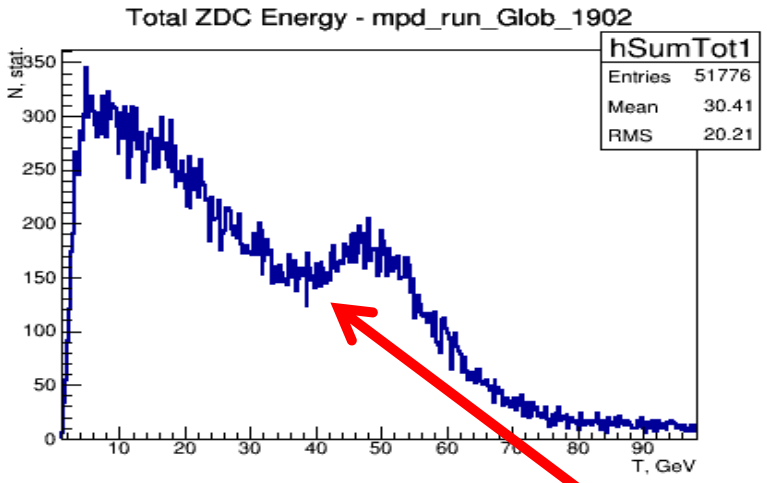
2D plots: ZDC Energy vs Z^2

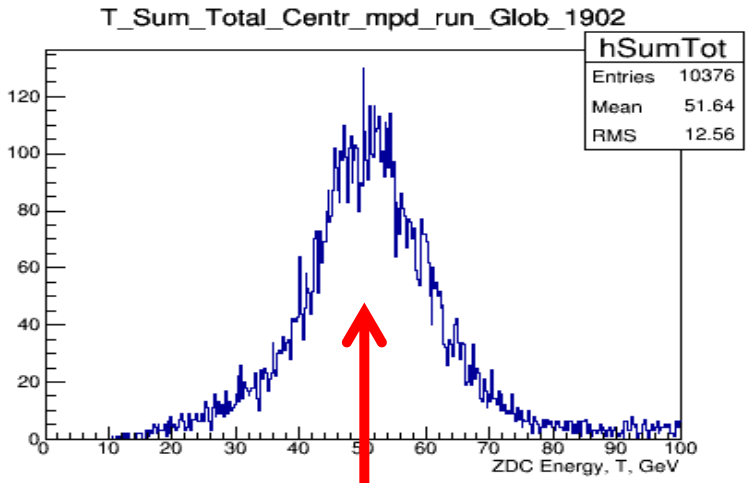


Energy response in ZDC: Neutrons, Protons









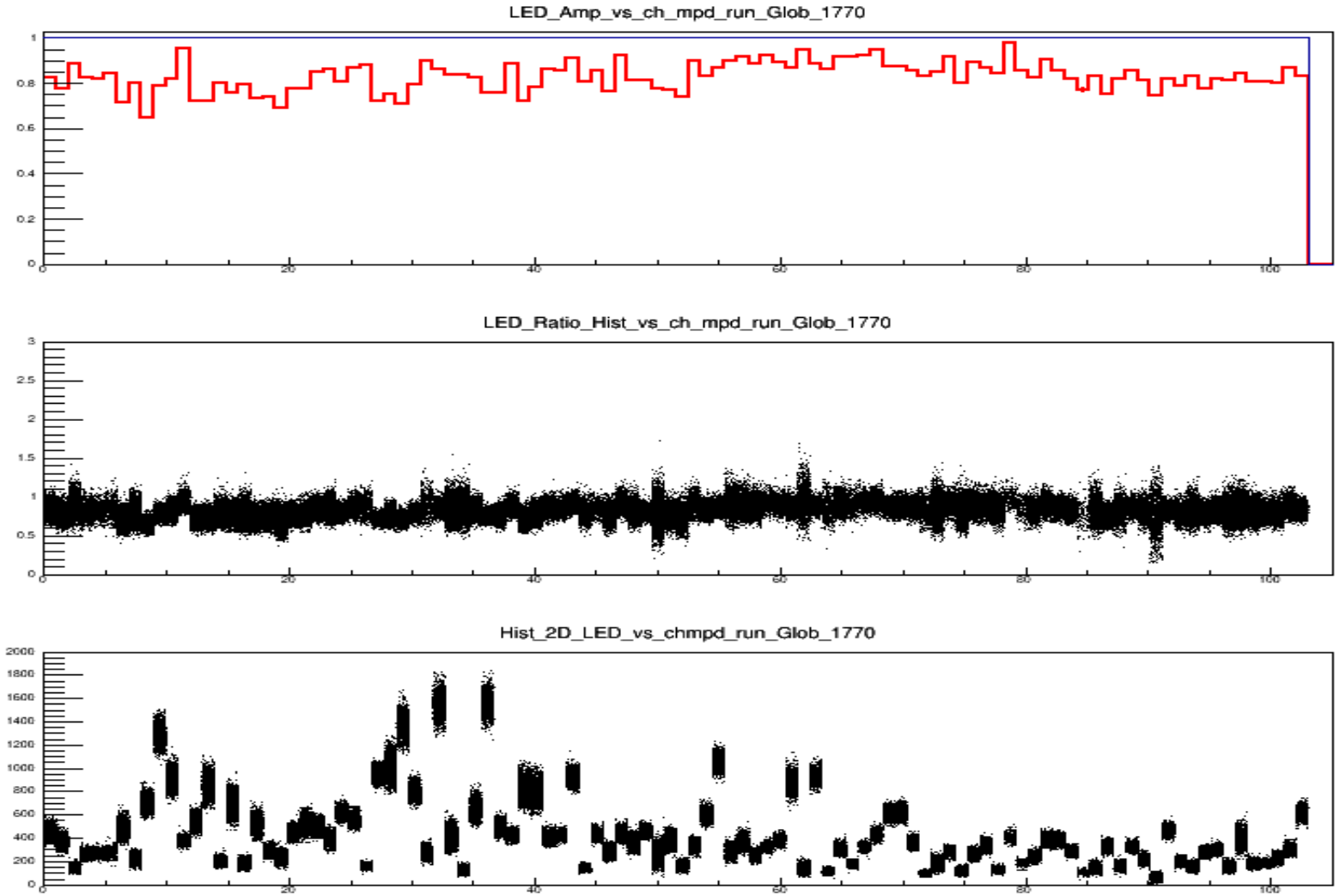
Total energy

^{12}C

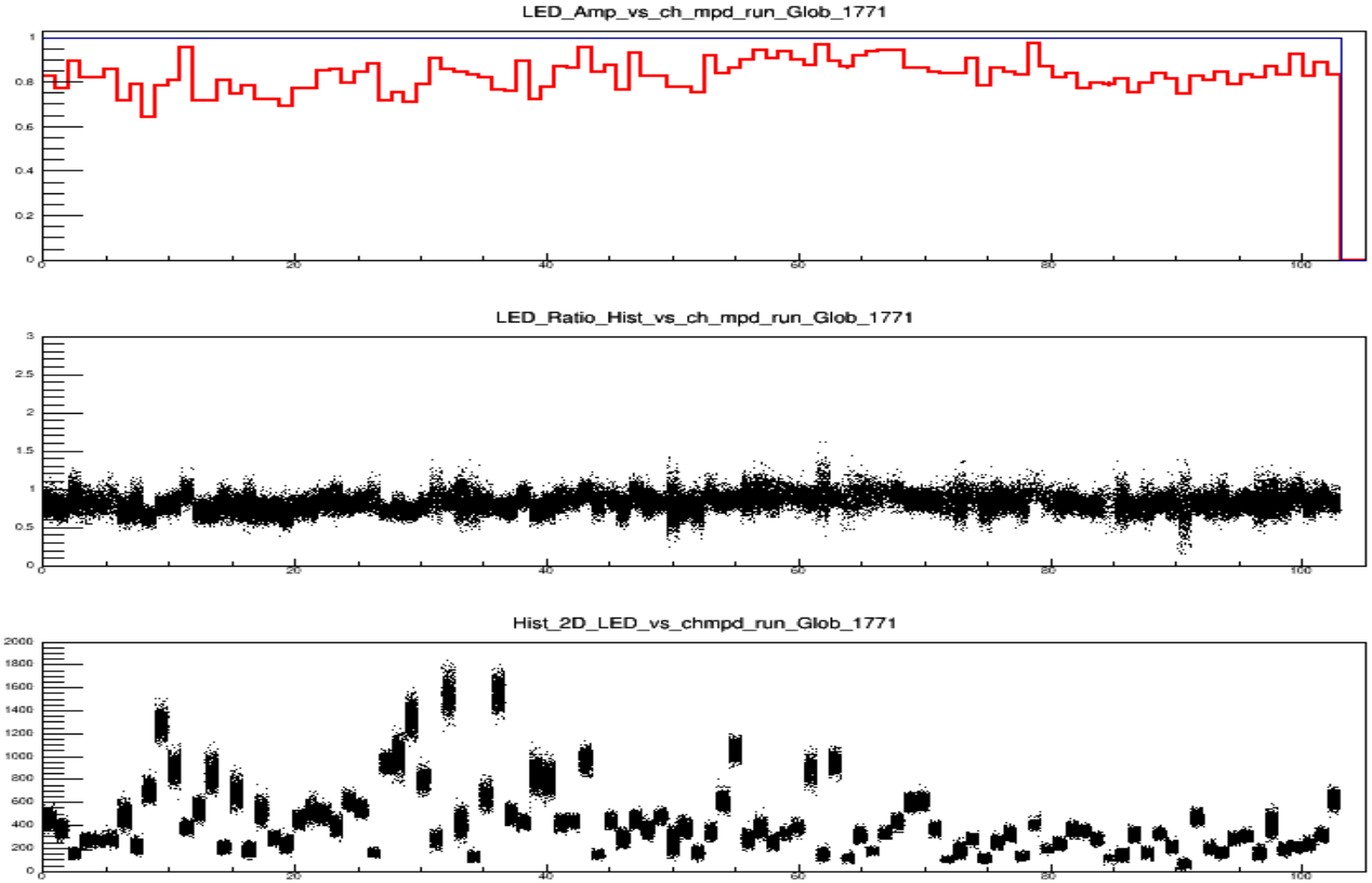
LED monitoring

- LED monitoring system permanently used for ZDC stability control.
- LED pulsed out of spill (100 pulses) every RUN.
- Normalization of all LED amplitudes was done stating from beginning of beam tests.

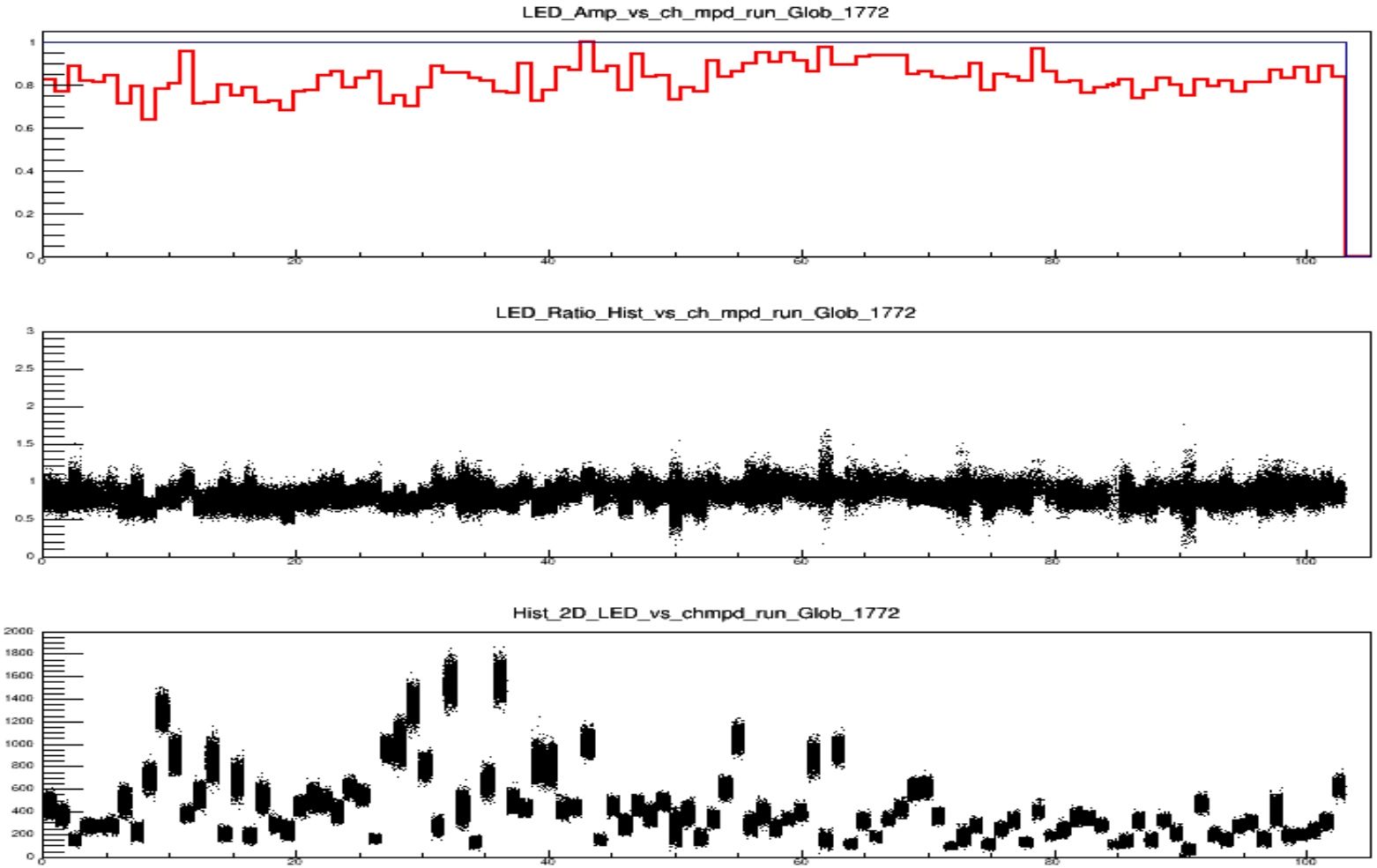
LED monitoring



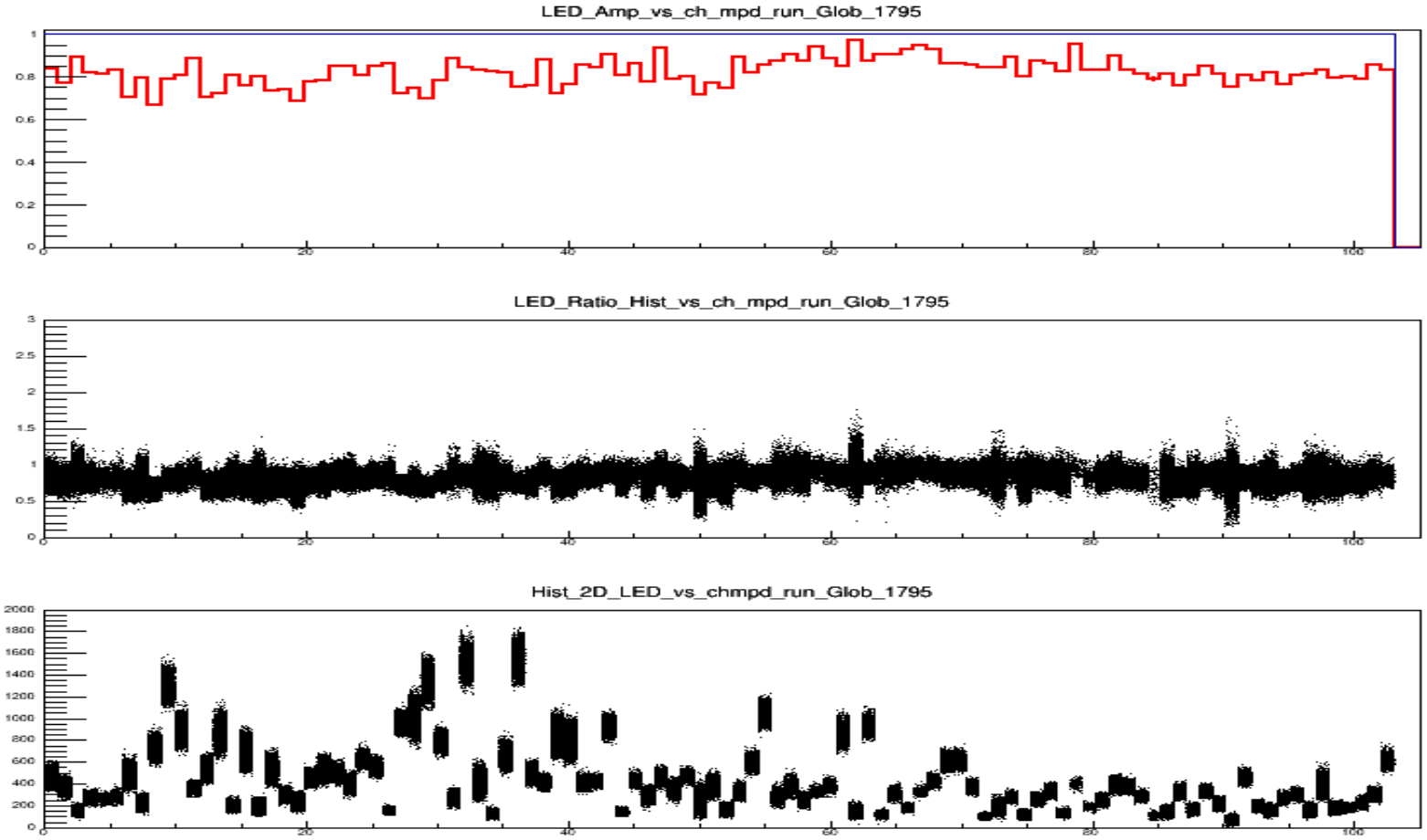
LED monitoring



LED monitoring



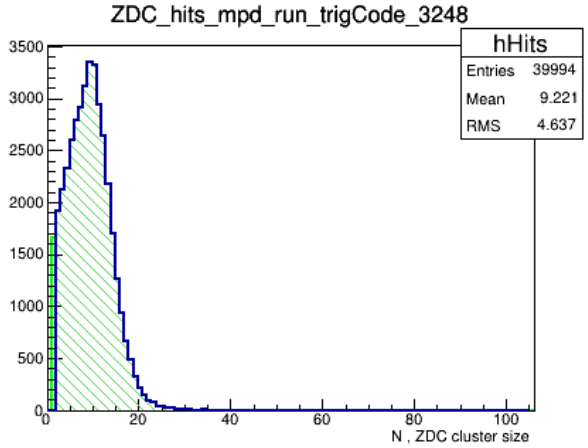
LED monitoring

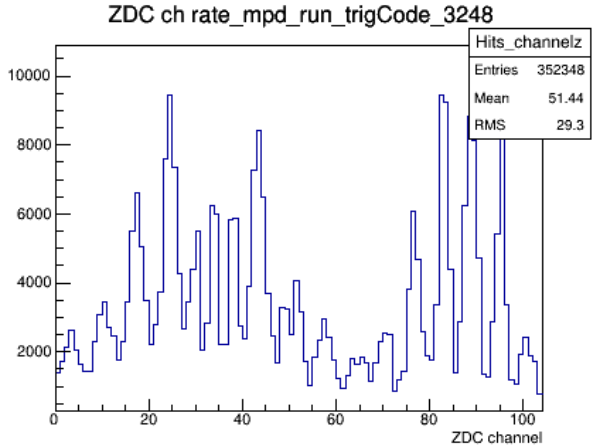


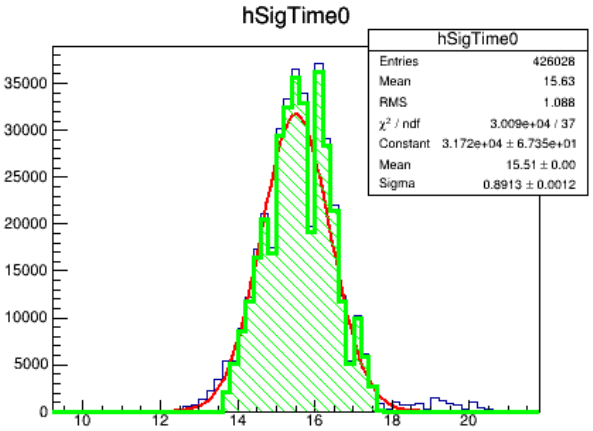
2018 beam tests results

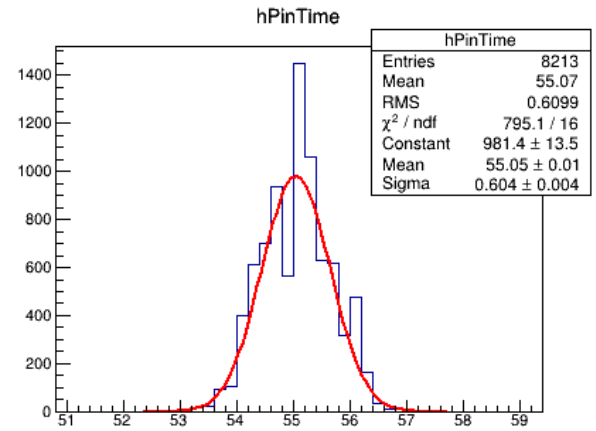
- Carbon beam 3.17 GeV/N – SRC setup
- Argon beam 3.2 GeV/N – BM&N Setup
- Krypton beam 2.6 GeV/N – BM&N Setup

Carbon beam 3.17 GeV/N-Targ H2

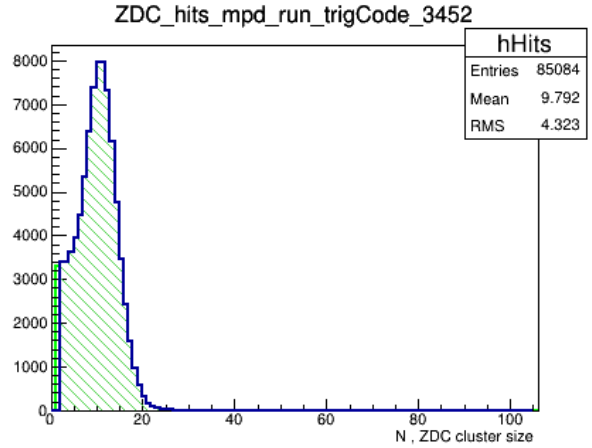


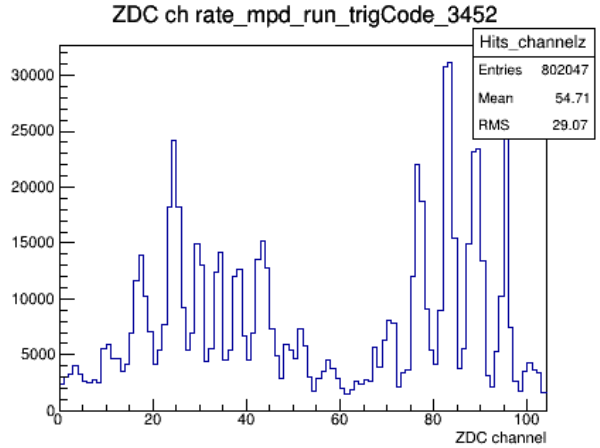


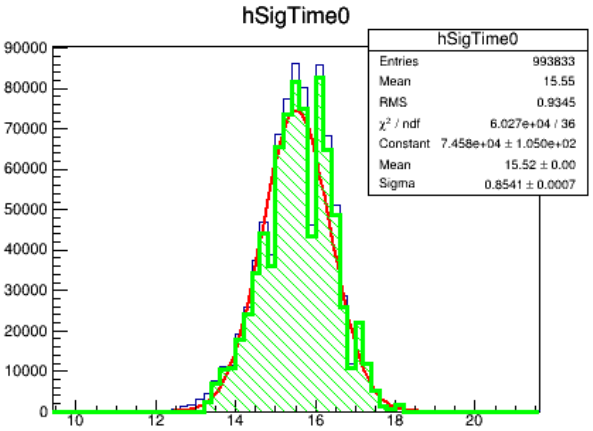


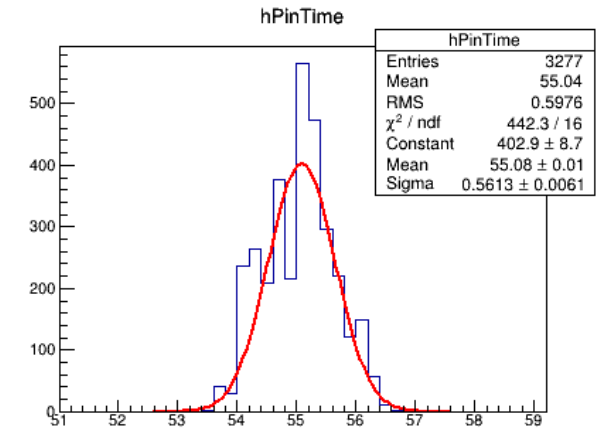


Carbon beam 3.17 GeV/N – Targ Pb

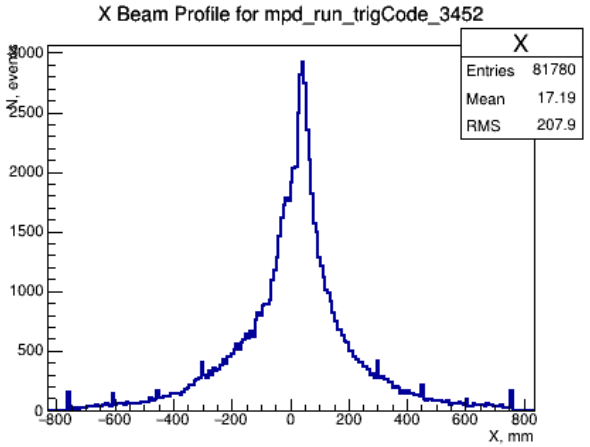


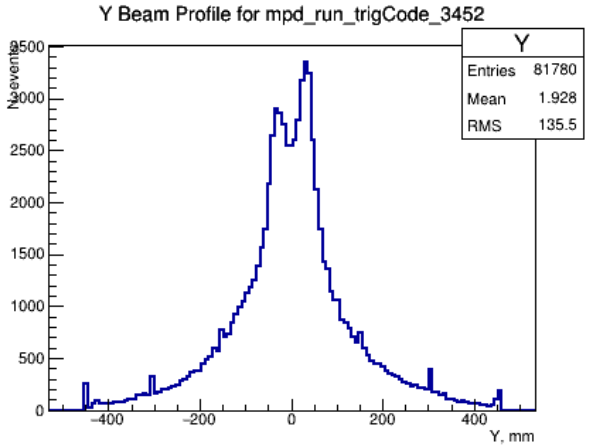


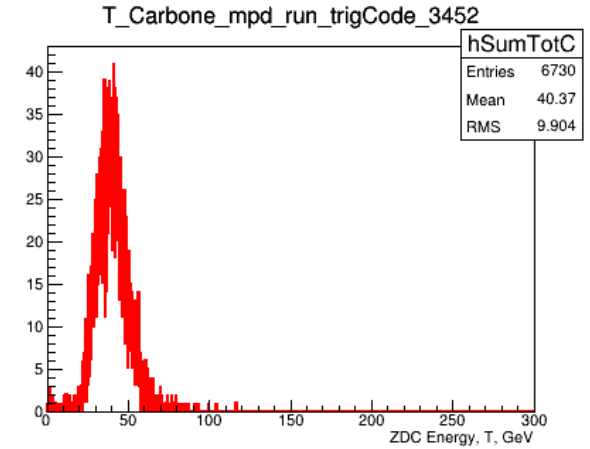


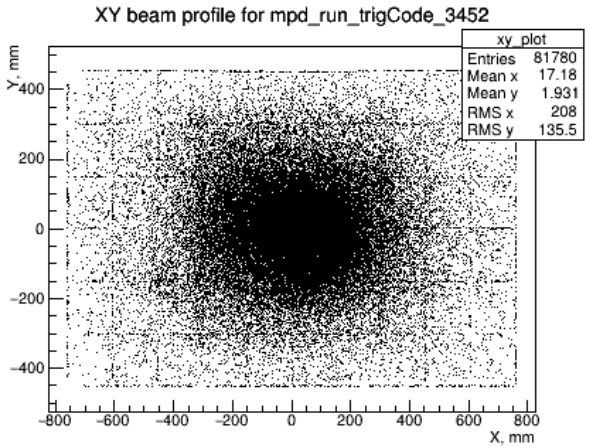


Carbon beam 3.17 GeV/N

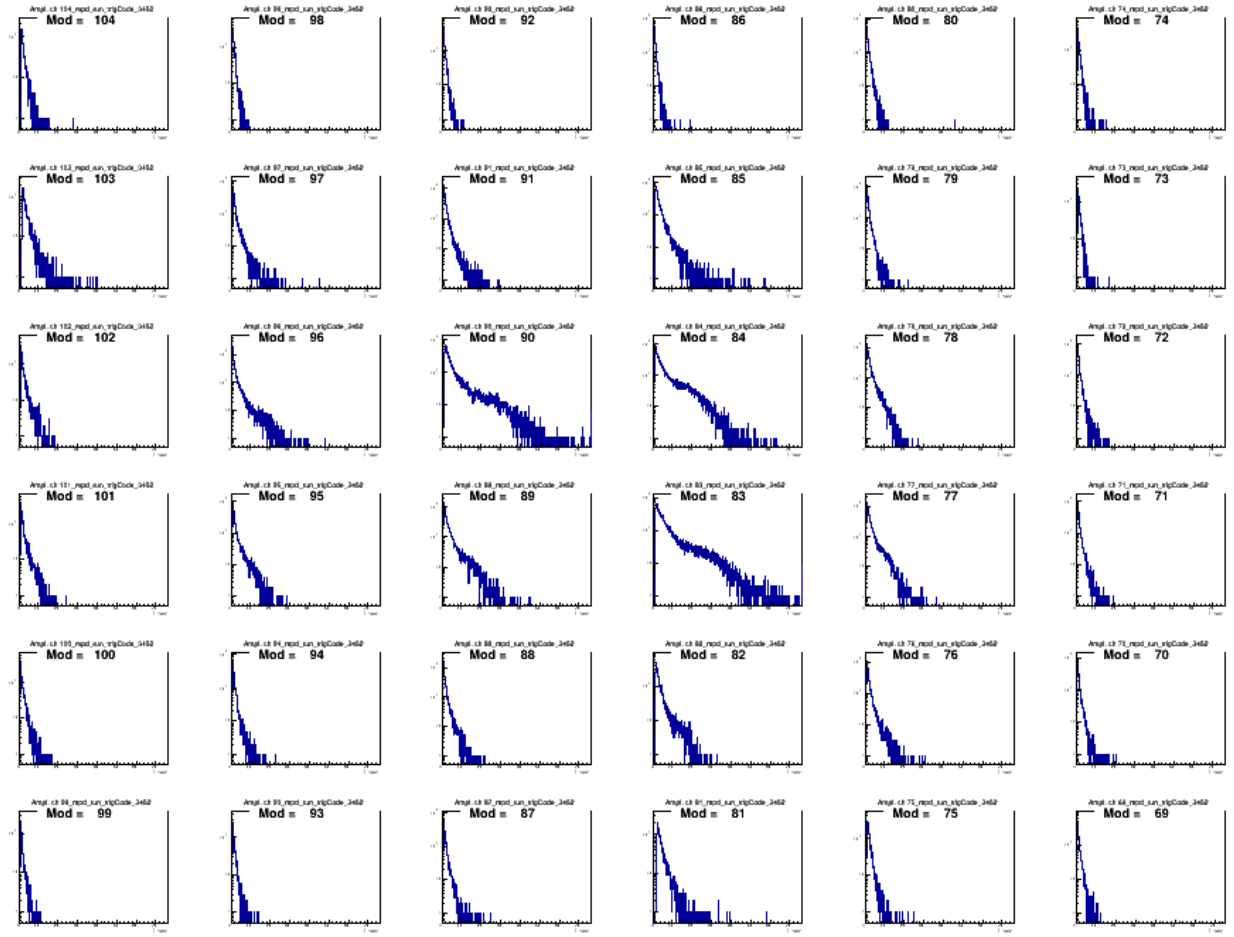




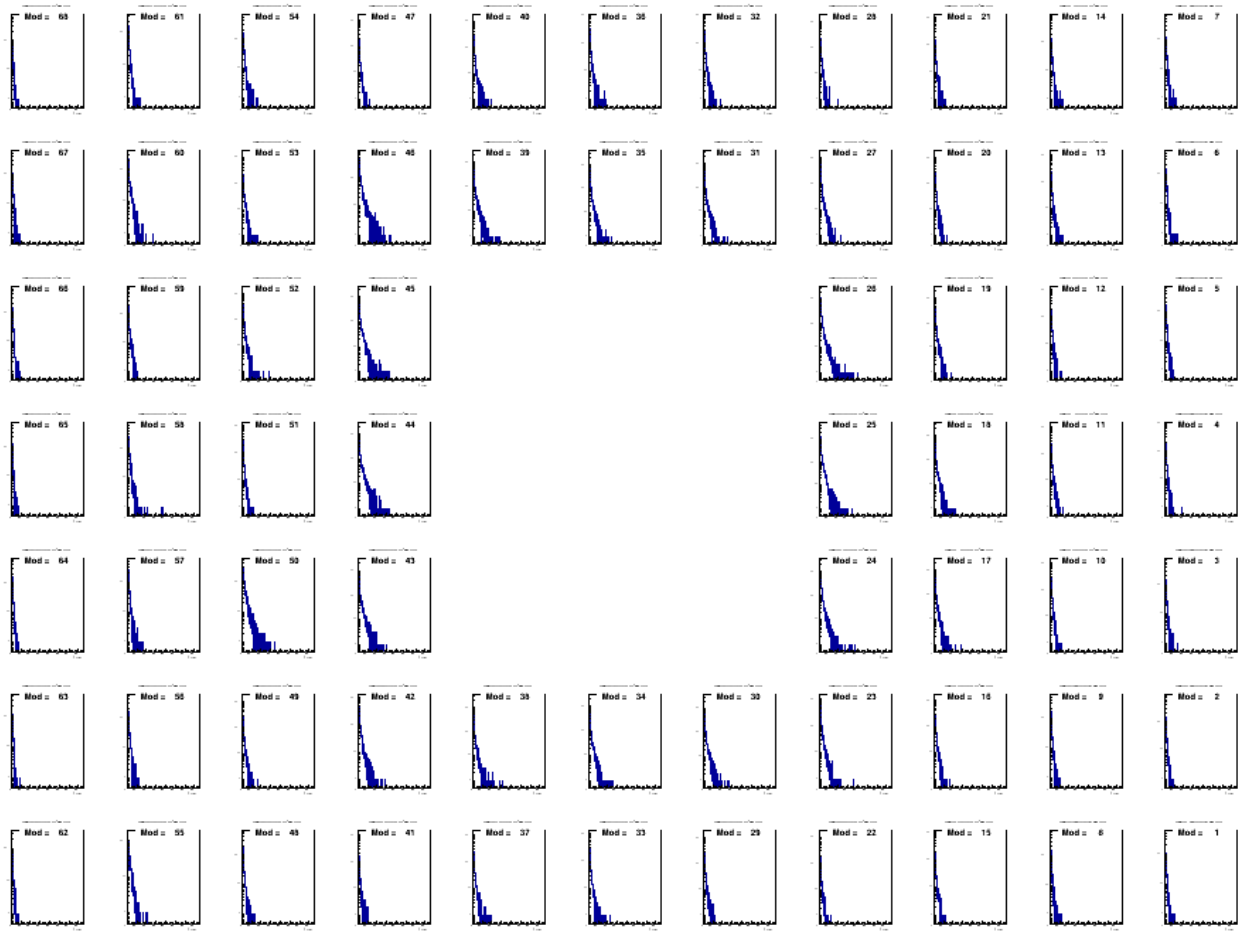




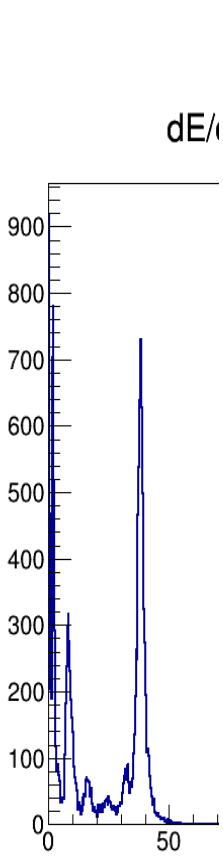
Carbon beam 3.17 GeV/N

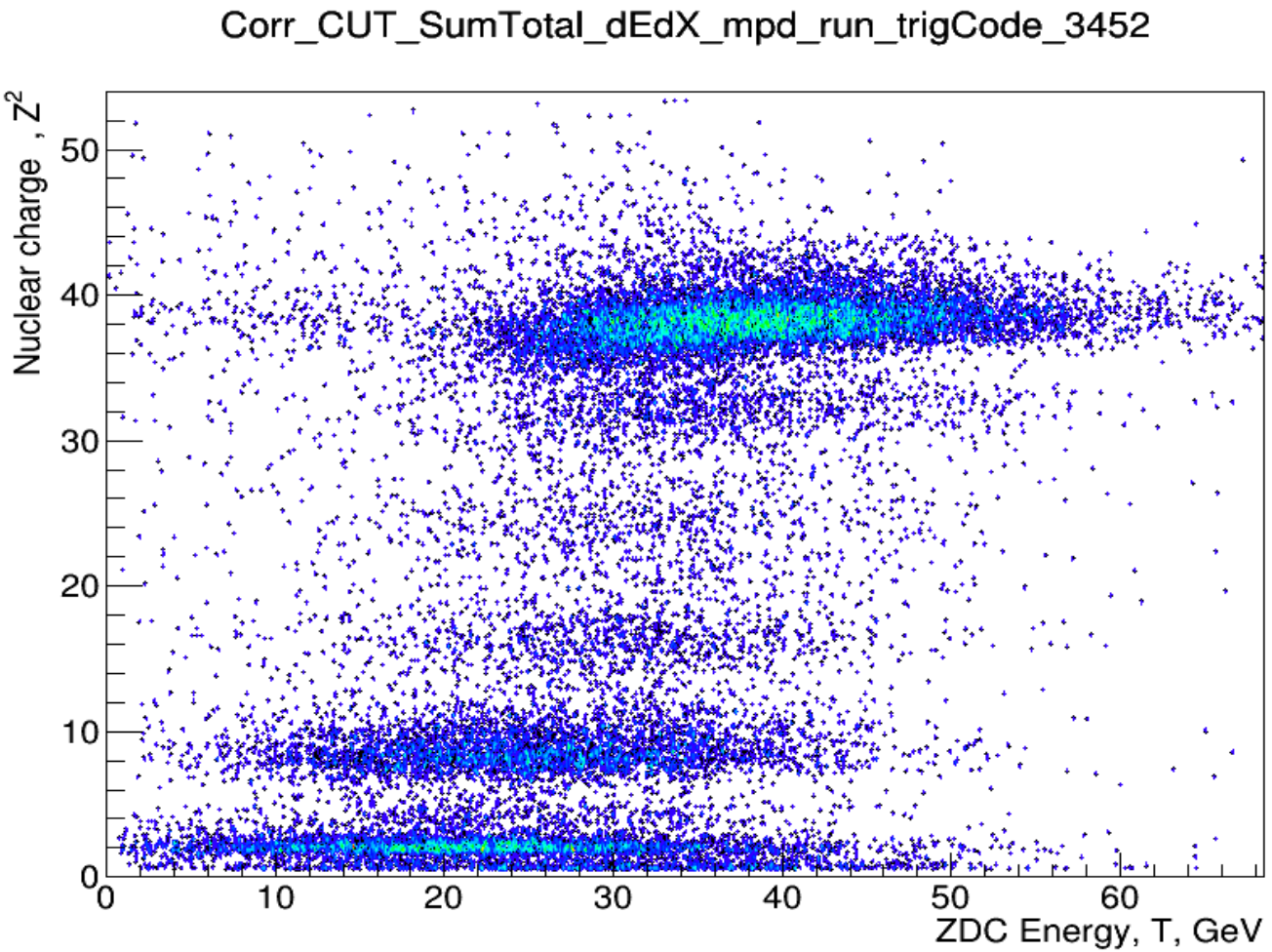


Carbon beam 3.17 GeV/N

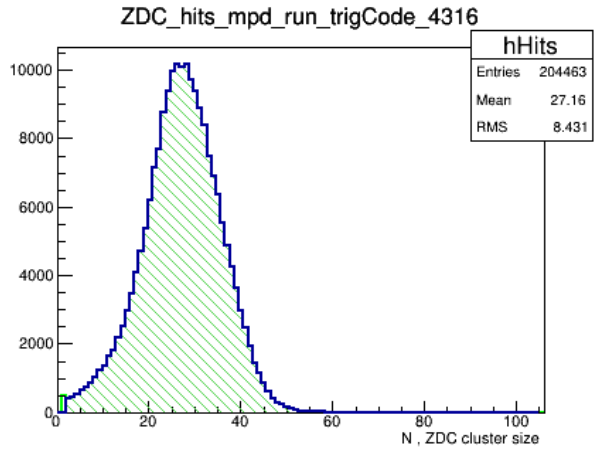


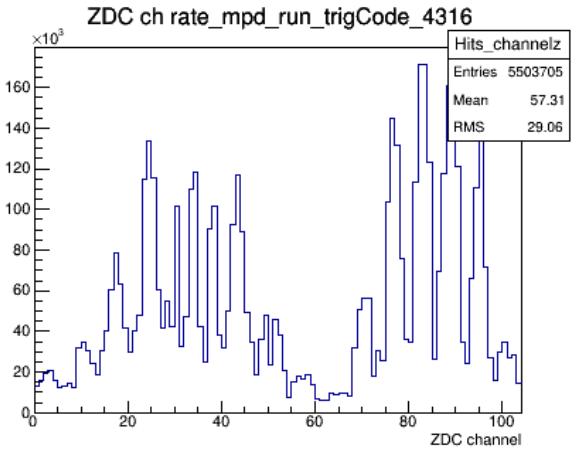
Carbon beam 3.17 GeV/N

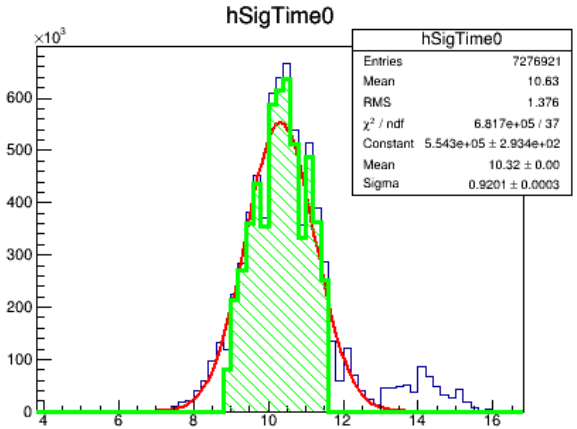


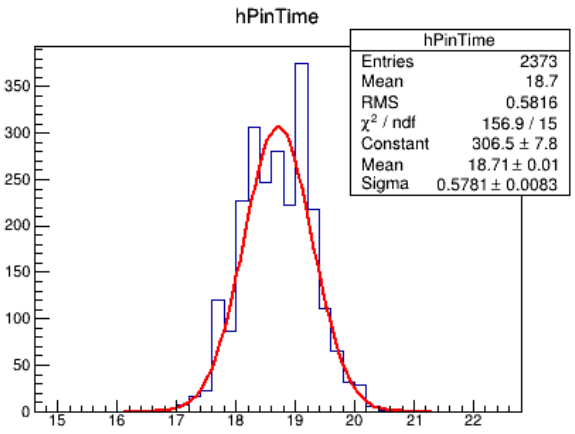


Argon beam, 3.3 GeV/N-C-Targ

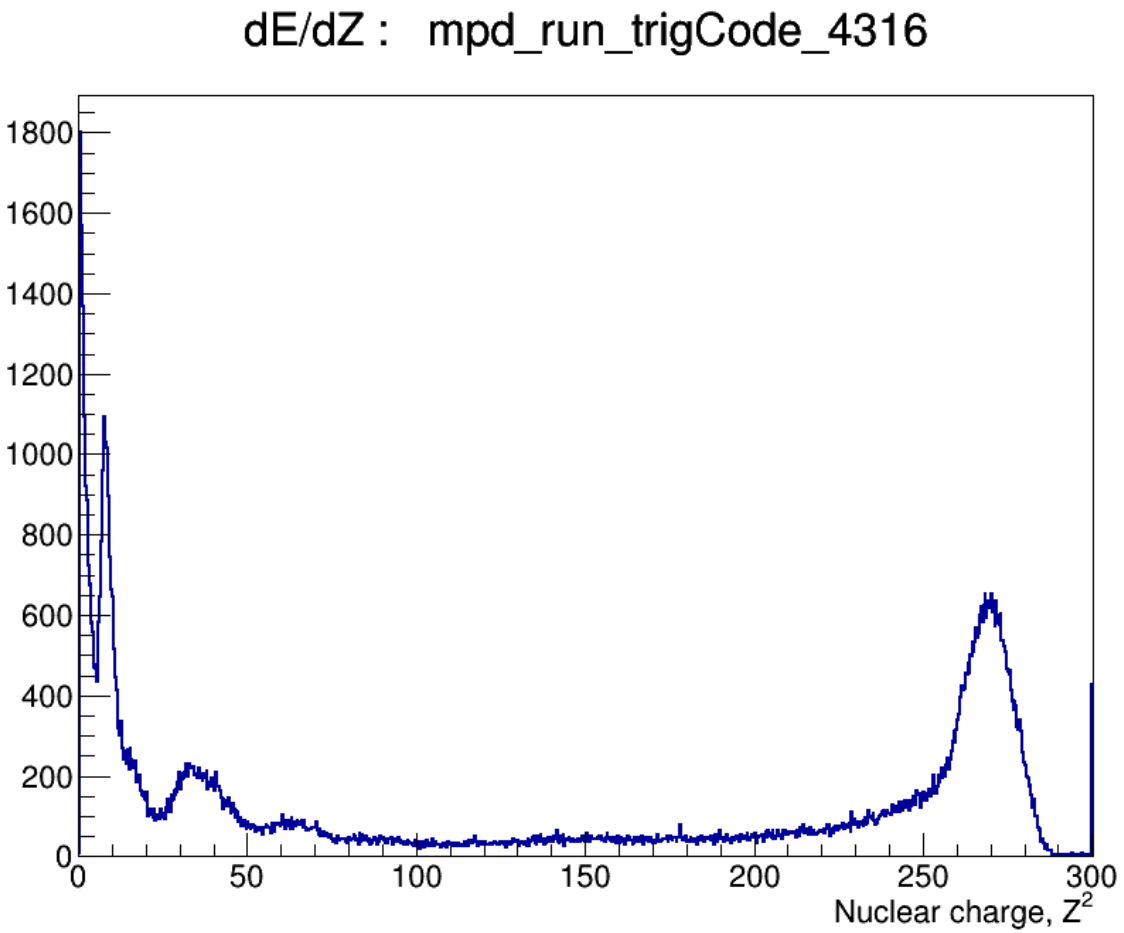




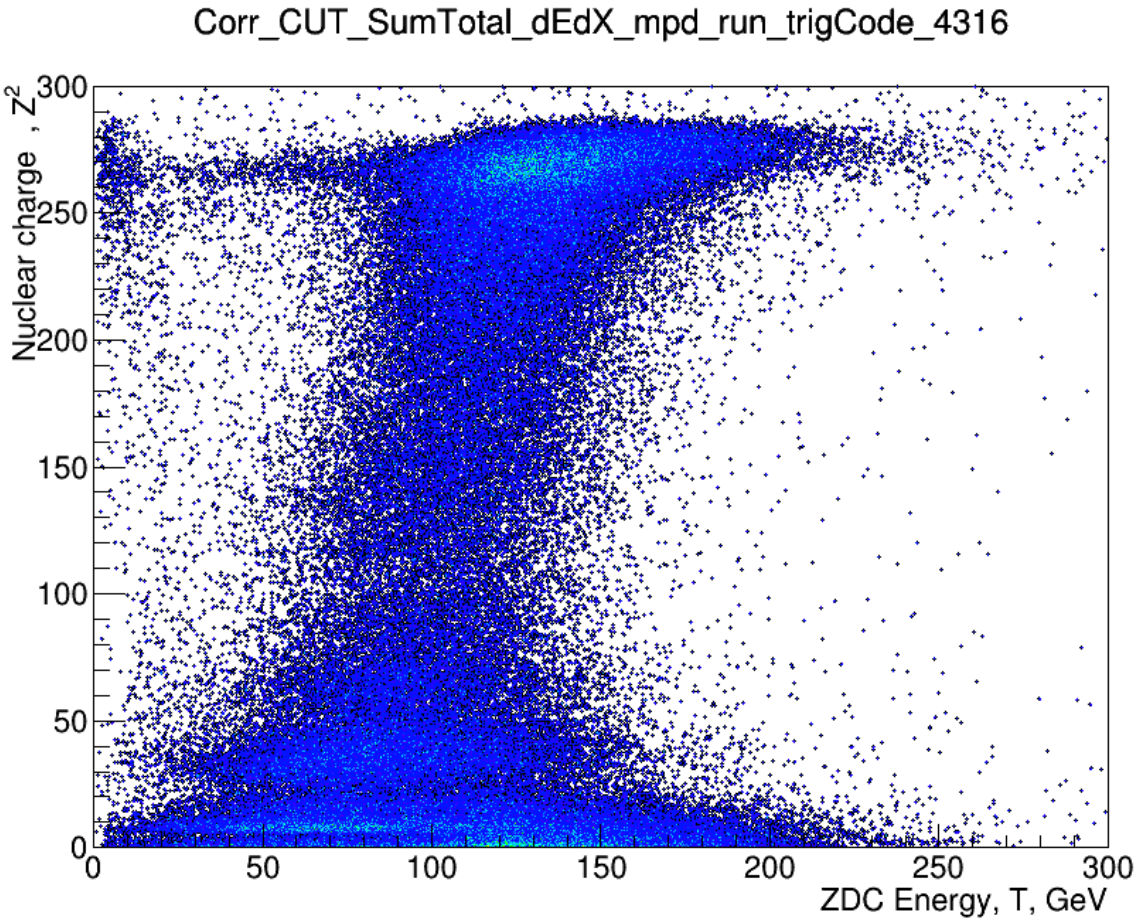




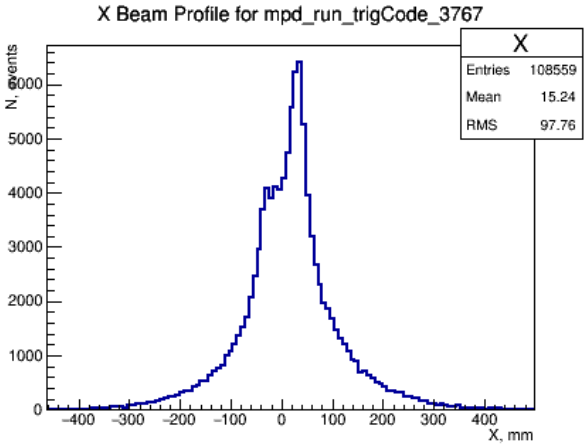
Argon beam, 3.3 GeV/N-C-Targ

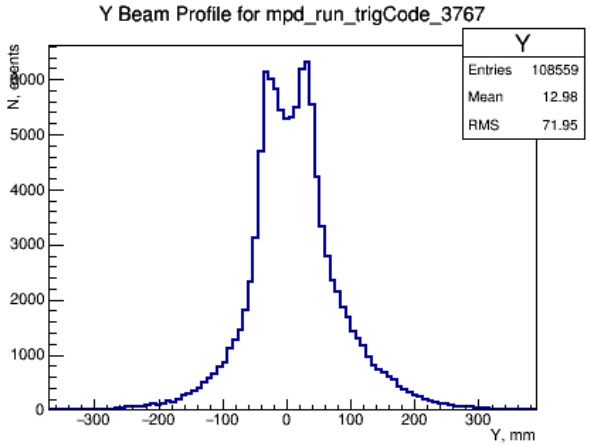


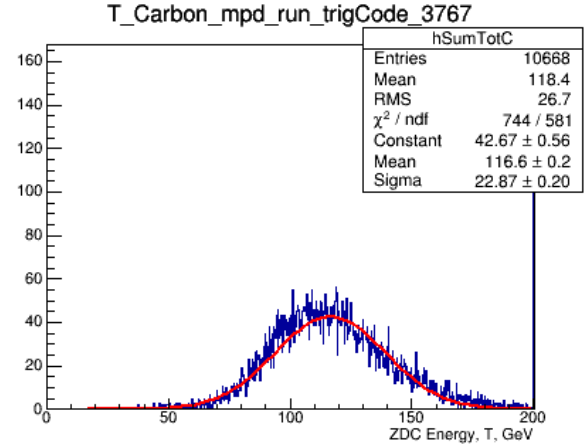
Argon beam, 3.3 GeV/N-C-Targ

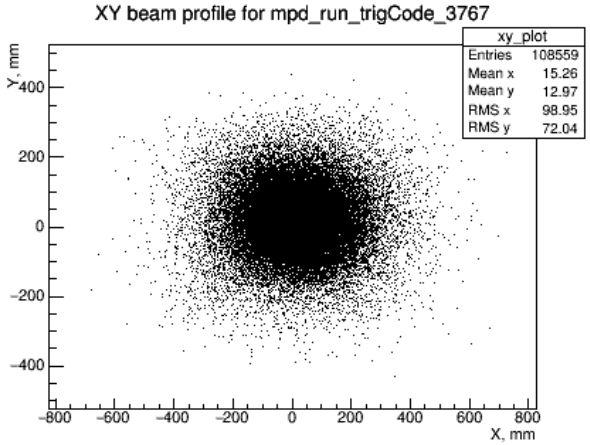


Argon beam, 3.3 GeV/N

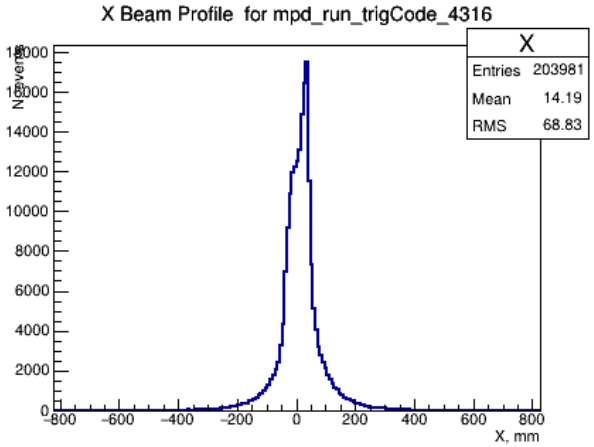


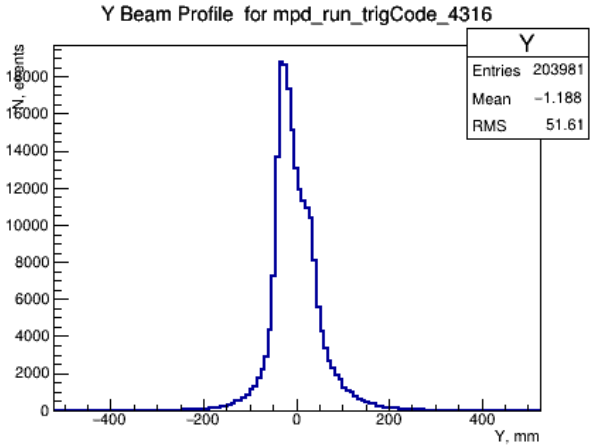


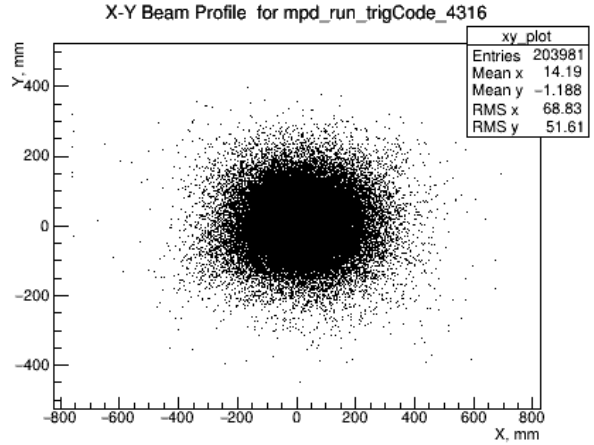


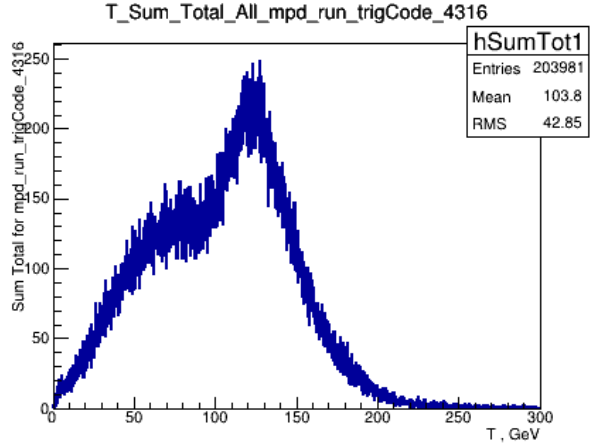


Argon beam, 3.3 GeV/N

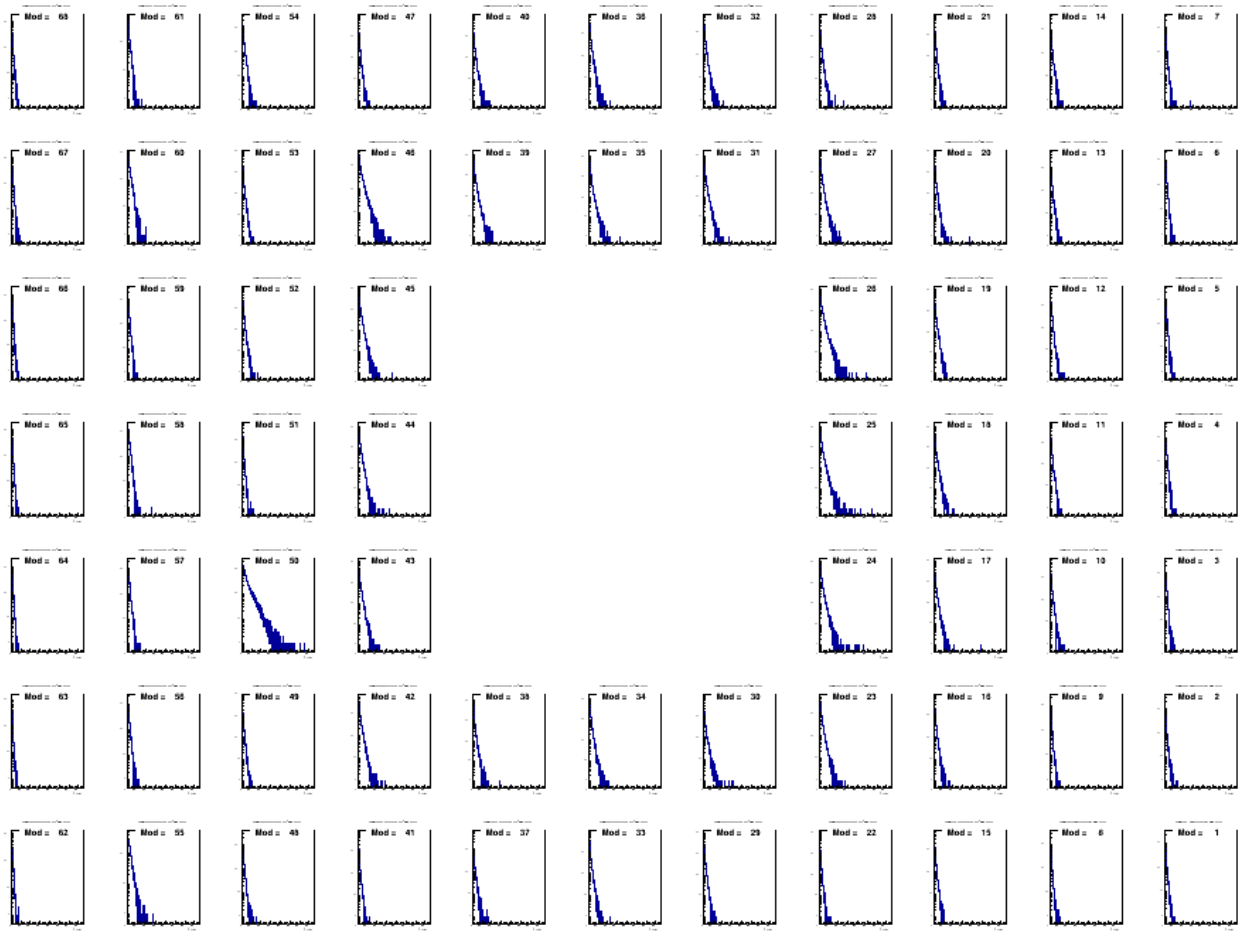




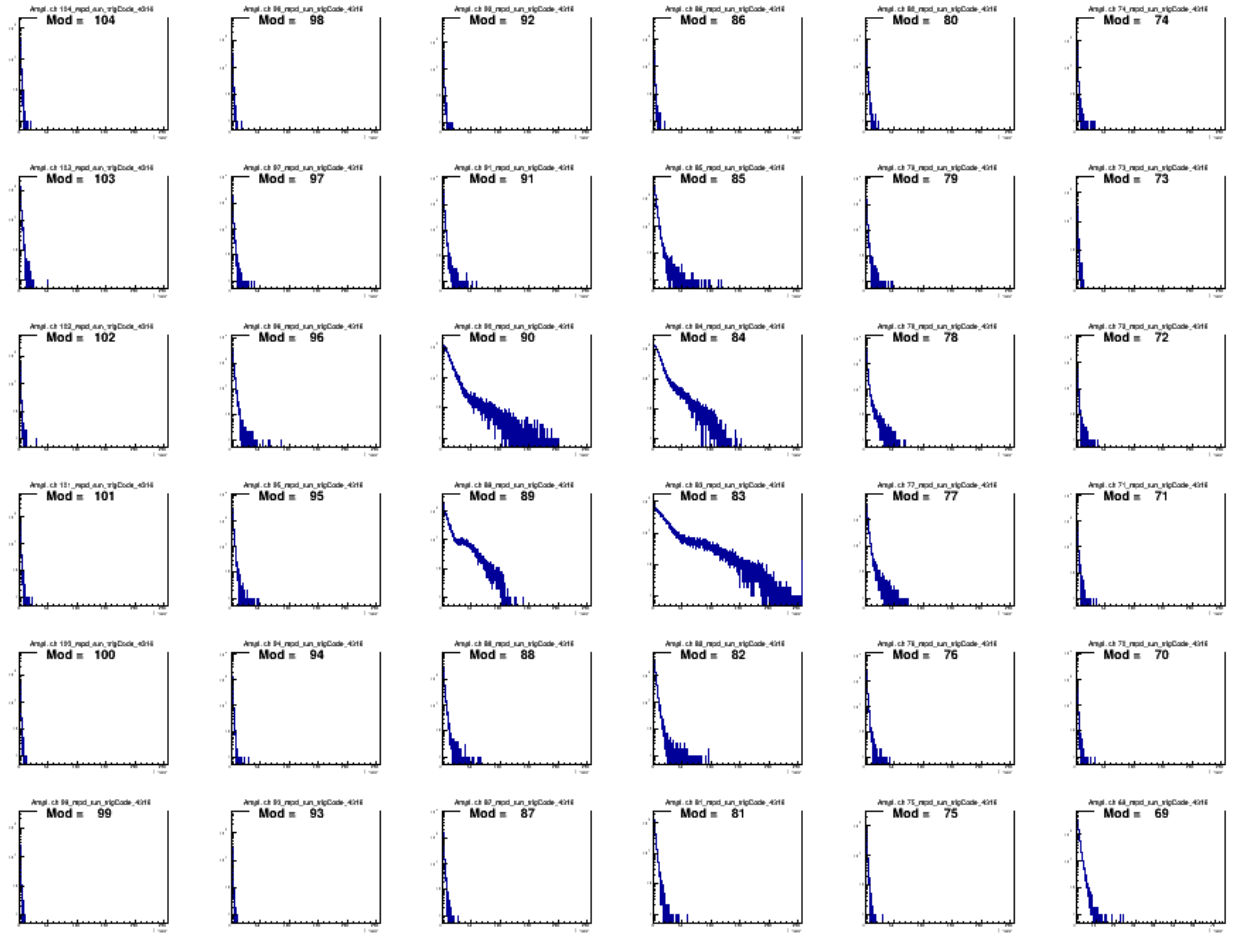




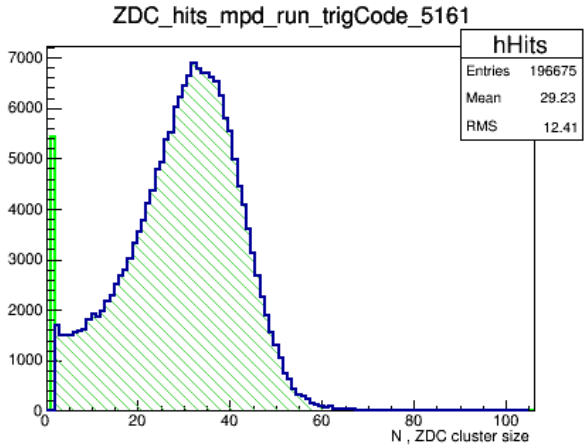
Argon beam, 3.3 GeV/N

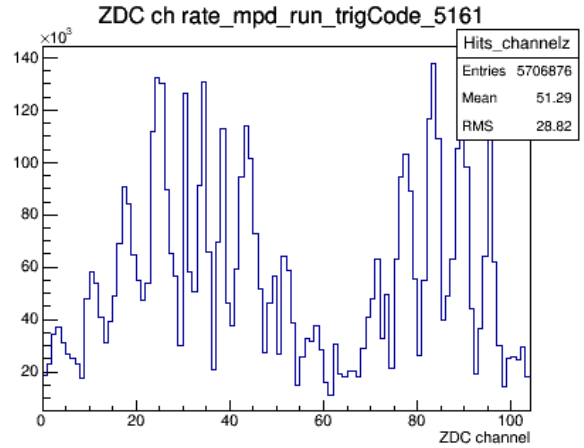


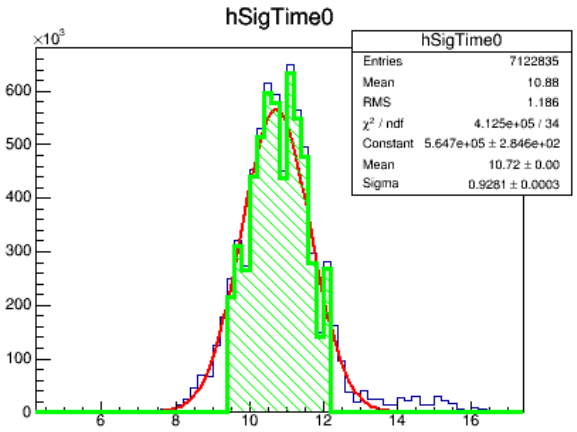
Argon beam, 3.3 GeV/N

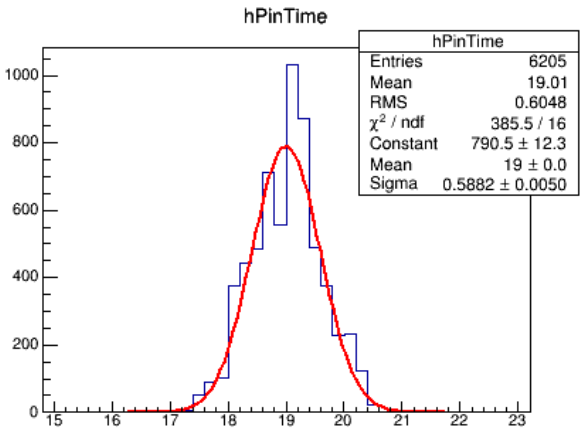


Krypton beam, 2.6 GeV/N-Cu_targ

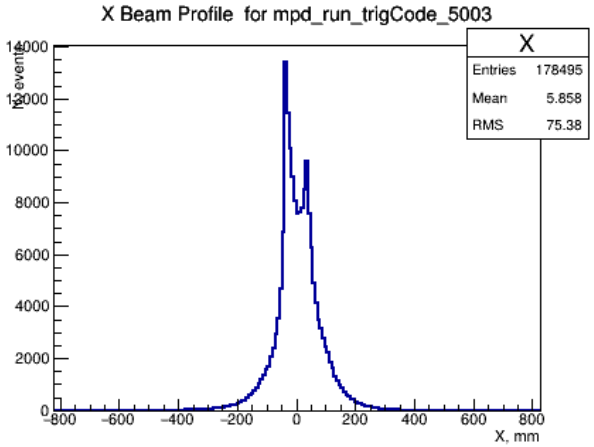


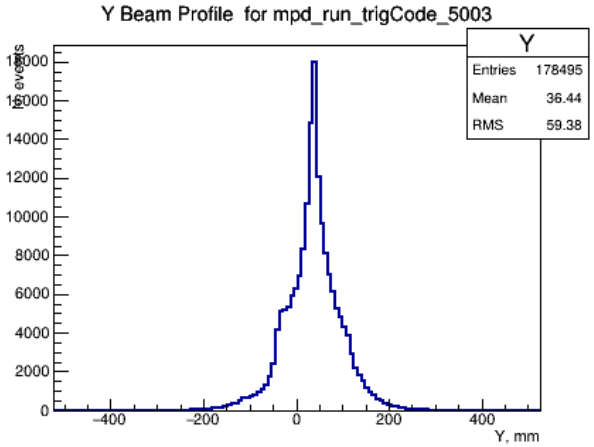


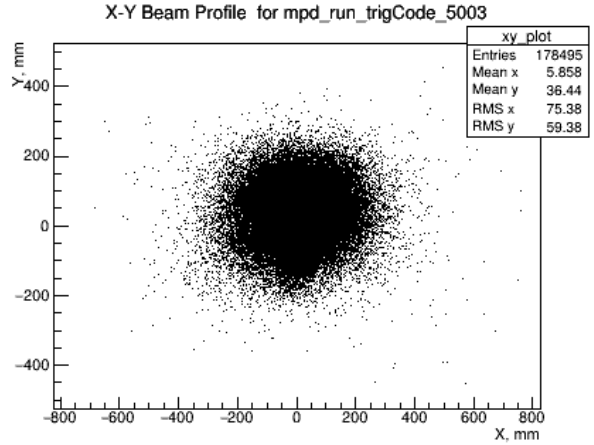


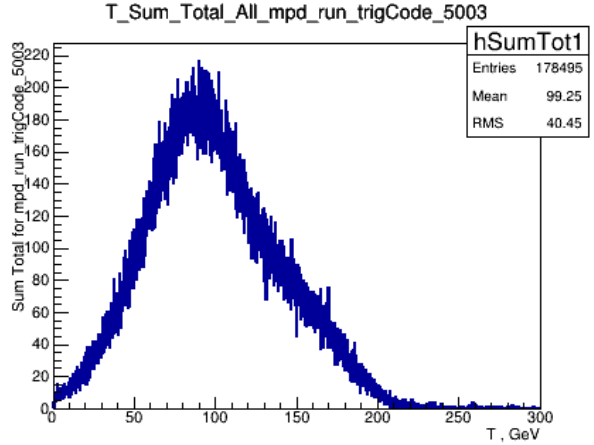


Krypton beam, 2.6 GeV/N-Al_targ

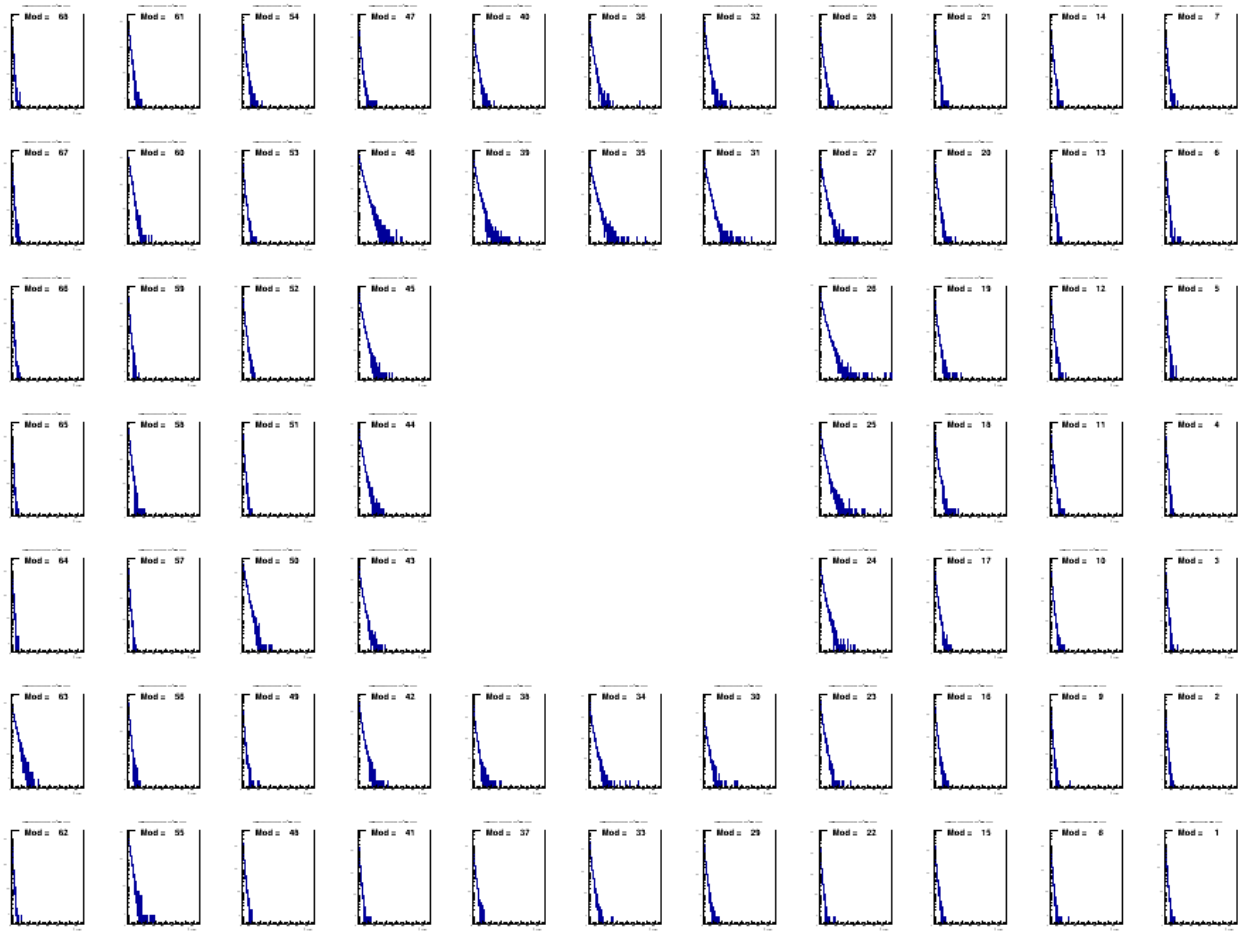




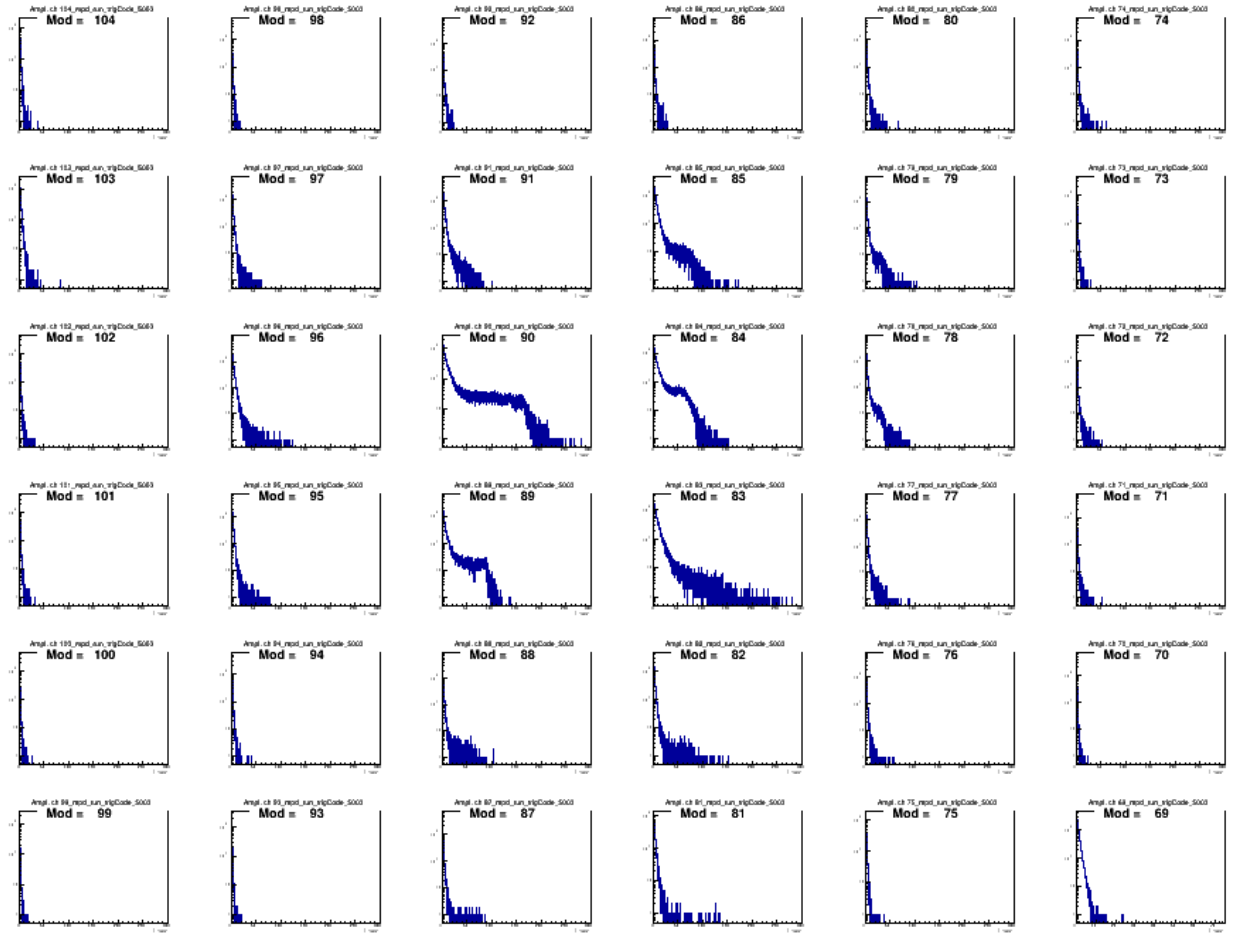




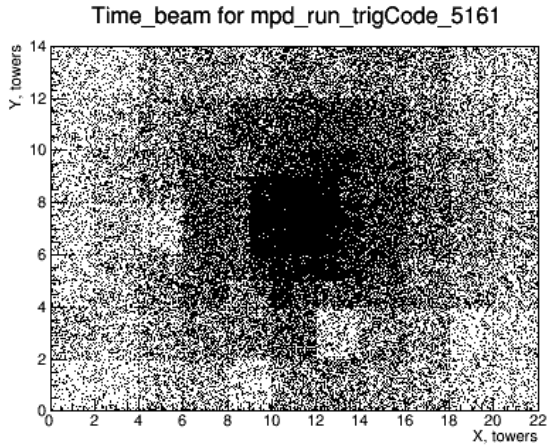
Krypton beam, 2.6 GeV/N

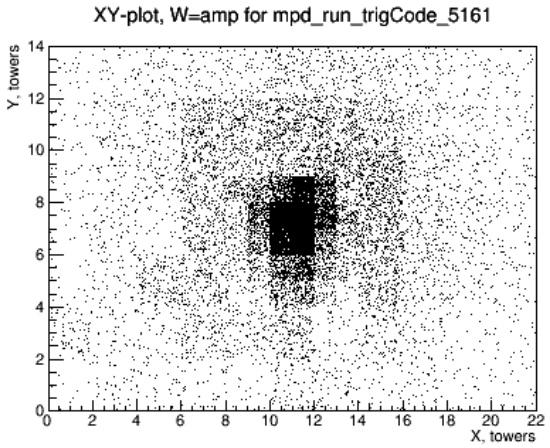


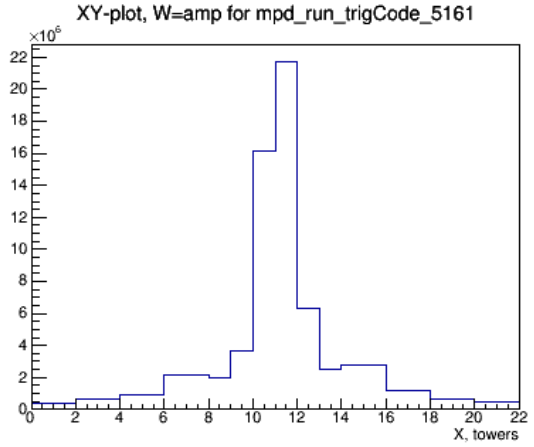
Krypton beam, 2.6 GeV/N

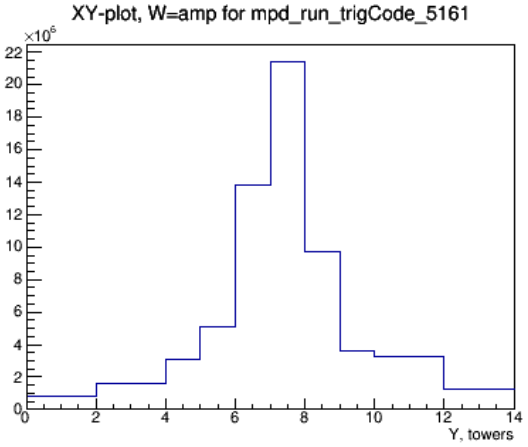


Krypton beam, 2.6 GeV/N-Cu-Targ

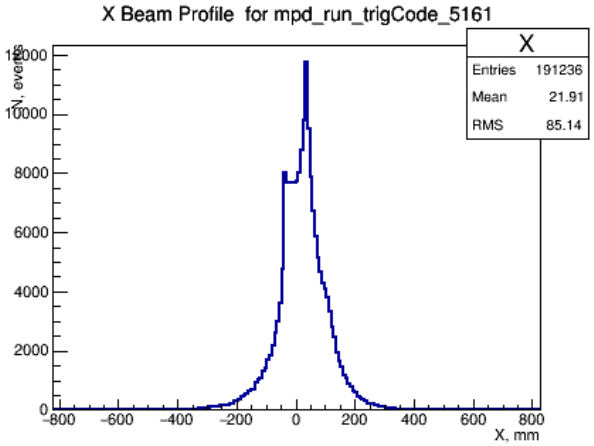


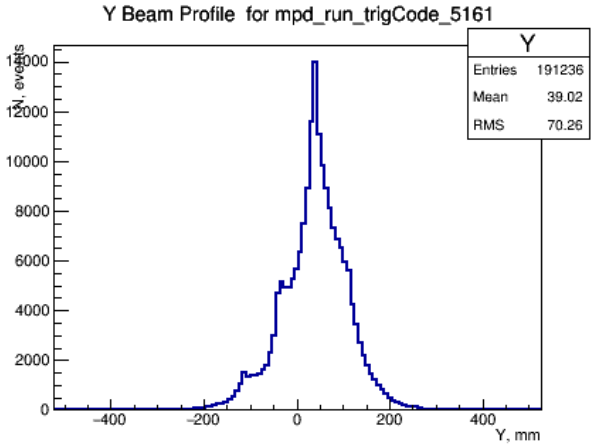


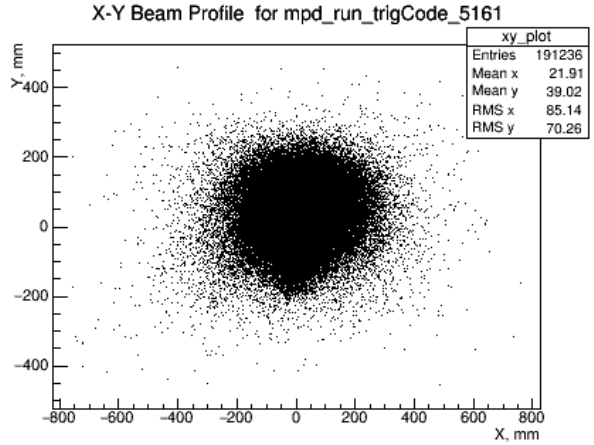


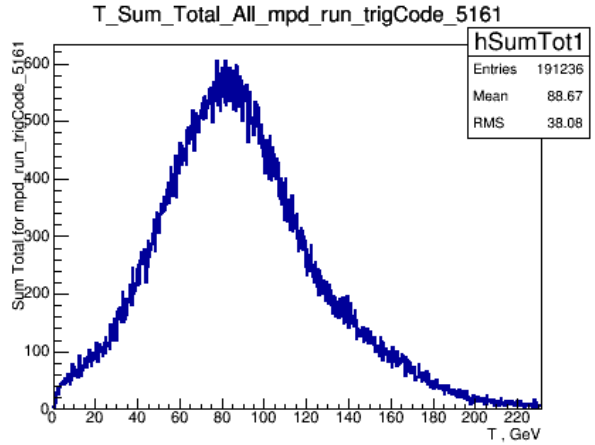


Krypton beam, 2.6 GeV/N

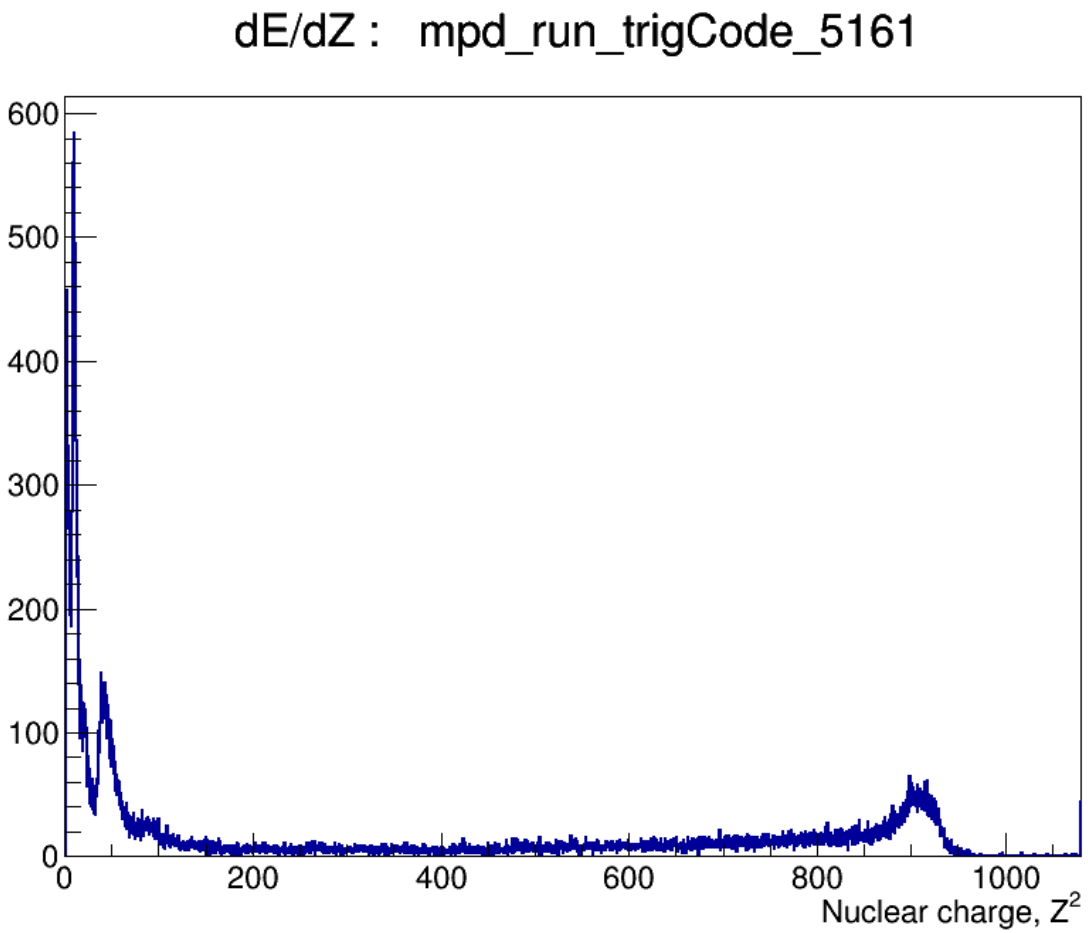




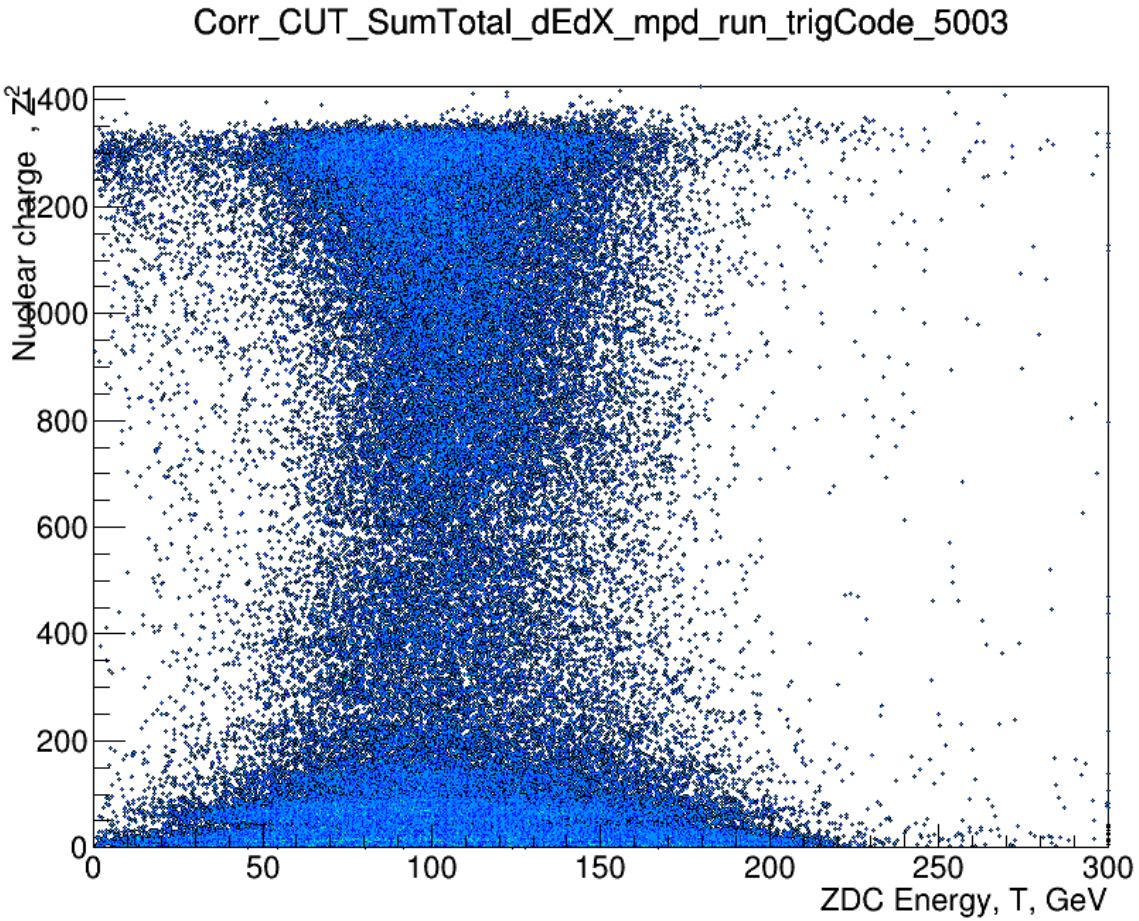




Krypton beam, 2.6 GeV/N



Krypton beam, 2.6 GeV/N-Al_targ



End of report

Thanks for everybody!