HMS Calorimeter Calibration

- DIS Runs 3196-3199 (Mid Momentum) and 3408, 3411, 3418 and 3419 (High Momentum). Runs with the same kinematics were chained together.
- Time Window Cuts: (/PARAM/HMS/CAL/hcal_cuts.param)
 - hcal_pos = hcal_neg = (-100,0)

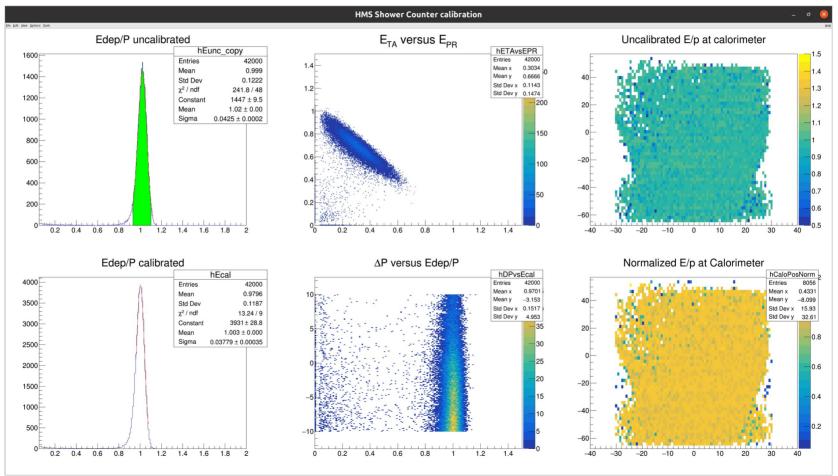
Input File

CALIBRATION/hms_cal_calib/input.dat

ΓŦ	cameron@cameron-Inspiron-7391: ~				
GNU nano 2.3.1	File: input.dat				
-10 10 Delta range, % 0.5 1.5 Beta range 1.5 Gas Cherenkov, threshold on signals in p.e. 10 Minimum number of hits per channel required to be calibrated 0.05 2. Range of uncalibrated energy deposition histogram 500 Binning of uncalibrated energy deposition histogram -0.1 0.1 Gaussian fit range around mean e- peak in the uncalibrated Edep histogram 2. Sigma width to select events to use in calibration (green fill) ; Calibration constants for file hms_ecal.root (HMS 2489-2494), 164827 events processed					
1 2 3	2.99, 7.13, 9.22, 10.26, 10.82, 12.49, 11.93, 12.39, 10.28, 15.14, 14.59, 12.85, 6.40, 0.87, 12.23, 9.46, 13.51, 8.71, 6.30, 7.73, 7.41, 8.94, 11.40, 11.51, 12.40, 14.86, 4.29, 14.78, 18.17, 21.53, 16.96, 18.97, 23.00, 19.51, 21.92, 25.86, 18.37, 22.29, 19.84, 2.17, 16.75, 20.16, 18.54, 17.89, 19.25, 22.14, 17.51, 19.67, 20.51, 18.37, 18.86, 26.46, 5.11, 14.11, 14.42, 10.92, 11.88, 13.32, 14.58, 18.16, 12.63, 11.47, 10.60, 11.41, 19.57,				
	4.71, 13.20, 14.22, 14.34, 16.11, 16.93, 19.64, 17.34, 18.06, 11.49, 14.83, 13.72, 8.86, 0.00,				

DIS Mid Momentum Runs 180°, Ep=-2.9 GeV, 30°

1st Iteration Using Input File From Last Slide



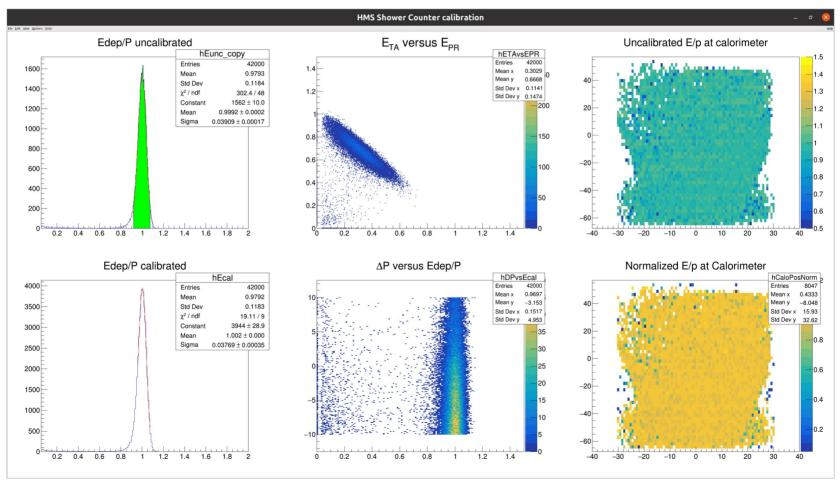
DIS Mid Momentum Runs 180°, Ep=-2.9 GeV, 30°

2nd Iteration Using Output From Previous Calibration

HMS Shower Counter calibration Edep/P uncalibrated E_{TA} versus E_{DD} Uncalibrated E/p at calorimeter hEunc copy hETAvsEPR 1.5 Entries 42000 42000 1600 Entries 0.303 Mean Mean 0.9796 1.4 Mean y 0.6668 Std Dev 0.1187 1400 Std Dev x 0.1142 1.3 χ^2 / ndf 311.3 / 48 Std Dev y 0.1474 1558 ± 10.0 Constan 200 1200 1.2 0.9996 ± 0.0002 Mean 0.03922 ± 0.00017 Sigma 1000 1.1 150 800 0.9 600 100 0.8 400 0.7 0 200 0.6 X. I. . . . I. . . . I. . . . I. 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 0.2 0.4 0.8 1.2 1.4 -40 -30 -20 -10 0 10 20 30 40 0.6 Edep/P calibrated ∆P versus Edep/P Normalized E/p at Calorimeter hEcal hDPvsEcal hCaloPosNorm 4000 42000 8050 Entries 42000 Entrios 0.9697 0.4333 Mean > Aean x Mean 0.9793 Mean v -3.153 Mean v -8.059 3500 Std Dev 0.1184 Std Dev x 0.1517 Std Dev x 15.93 χ^2 / ndf 14.82/9 Std Dev y 4.953 Std Dev y 32.62 3946 ± 28.9 3000 Constan Mean 1.003 ± 0.000 0.8 Sigma 0.03758 ± 0.00034 2500 25 2000 0.6 20 1500 0.4 1000 0.2 500 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 0.6 0.8 1.2 1.4 -30 -20 -1010 20 30 40 02 04 1 -40 0

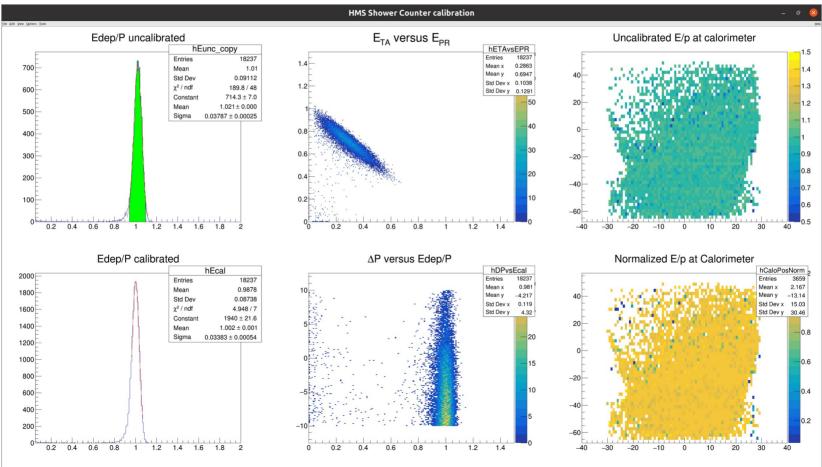
DIS Mid Momentum Runs 180°, Ep=-2.9 GeV, 30°

3rd Iteration Using Output From Previous Calibration



DIS High Momentum Runs 90°/180°, Ep=-3.5 GeV, 30°

1st Iteration Using Input File From 2nd Slide



DIS High Momentum Runs 90°/180°, Ep=-3.5 GeV, 30°

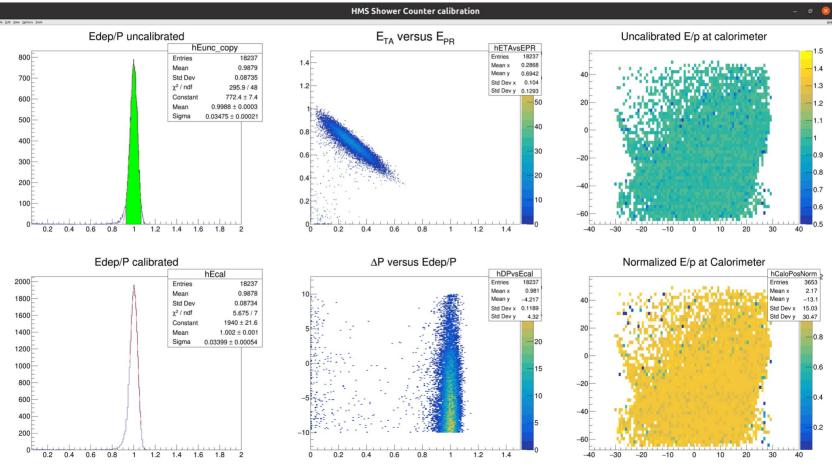
2nd Iteration Using Output From Previous Calibration

Resolution = σ/μ = 0.0341

HMS Shower Counter calibration Edep/P uncalibrated E_{TA} versus E_{DD} Uncalibrated E/p at calorimeter hEunc copy hETAvsEPR 15 18237 800 Entrios Entries 18237 1.4 0.2866 Mean x 0.9879 Mean 1.4 Mean v 0.6944 700 Std Dev 0.08739 Std Dev x 0.104 1.3 γ^2 / ndf 257.7/48 12 Std Dev y 0,1292 765.6 ± 7.4 Constan 600 1.2 Mean 0.9988 ± 0.0003 0.03521±0.00022 Sigma 500 1.1 400 0.9 300 0.8 200 0.7 100 Salardan barbar Λ 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 1.2 1.4 -30 -20 -10 10 20 30 40 0.2 0.8 _40 0 Edep/P calibrated ΔP versus Edep/P Normalized E/p at Calorimeter hEcal hDPvsEcal hCaloPosNorm 2000 18237 3654 Entries 18237 Entries Entries 0.9811 Mean x Mean y 2.169 Mean 0.9879 1800 Mean v -4.217 Mean v -13.11 Std Dev 0.08735 Std Dev x 0.119 Std Dev x 15.03 χ^2 / ndf 5.549/7 1600 Std Dev y 4.32 Std Dev y 30,47 Constan 1937 ± 21.6 1400 Mean 1.002 ± 0.001 0.8 0.0341 ± 0.0005 Sigma 1200 1000 0.6 15 800 0.4 600 400 02 200 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 0.4 0.6 0.8 1.2 1.4 _30 -20 -10 0 10 20 30 40 02 1 -40

DIS High Momentum Runs 90°/180°, Ep=-3.5 GeV, 30°

3rd Iteration Using Output From Previous Calibration



Resolution Summary Table

	Iteration 1	Iteration 2	Iteration 3
Mid Momentum	3.78%	3.76%	3.77%
High Momentum	3.38%	3.41%	3.40%

HM = High Momentum MM = Mid Momentum

In conclusion, it appears that doing more iterations does not improve the resolution. Also, the resolution appears to increase with increasing momentum.