calorimeter calibration

First use of DST data for calorimeter calibration

data: pass 3

momentum: 58$\pm$5 GeV/c for q$>$0 and 56$\pm$5 GeV/c for q$<$0

target: thin, LH2, empty

Event/track selection cuts:

- nTotalTrks $\leq$ 20
- vertices are within the target sizes (X and Y)
- 20$<$NTPCPoints$<$95
- -10$<$TrkTime$<$50 ns
- tracks with the DC4, PWC5 and PWC6 hits
- track projections at EMCAL area within 5 cm radius, center of beam spot is 4 cm away from the beam line
- only single track per event at HCAL aperture
- EMCAL-track matching, EMCAL and HCAL sum ADC's derived from functions implemented for the DST analysis.

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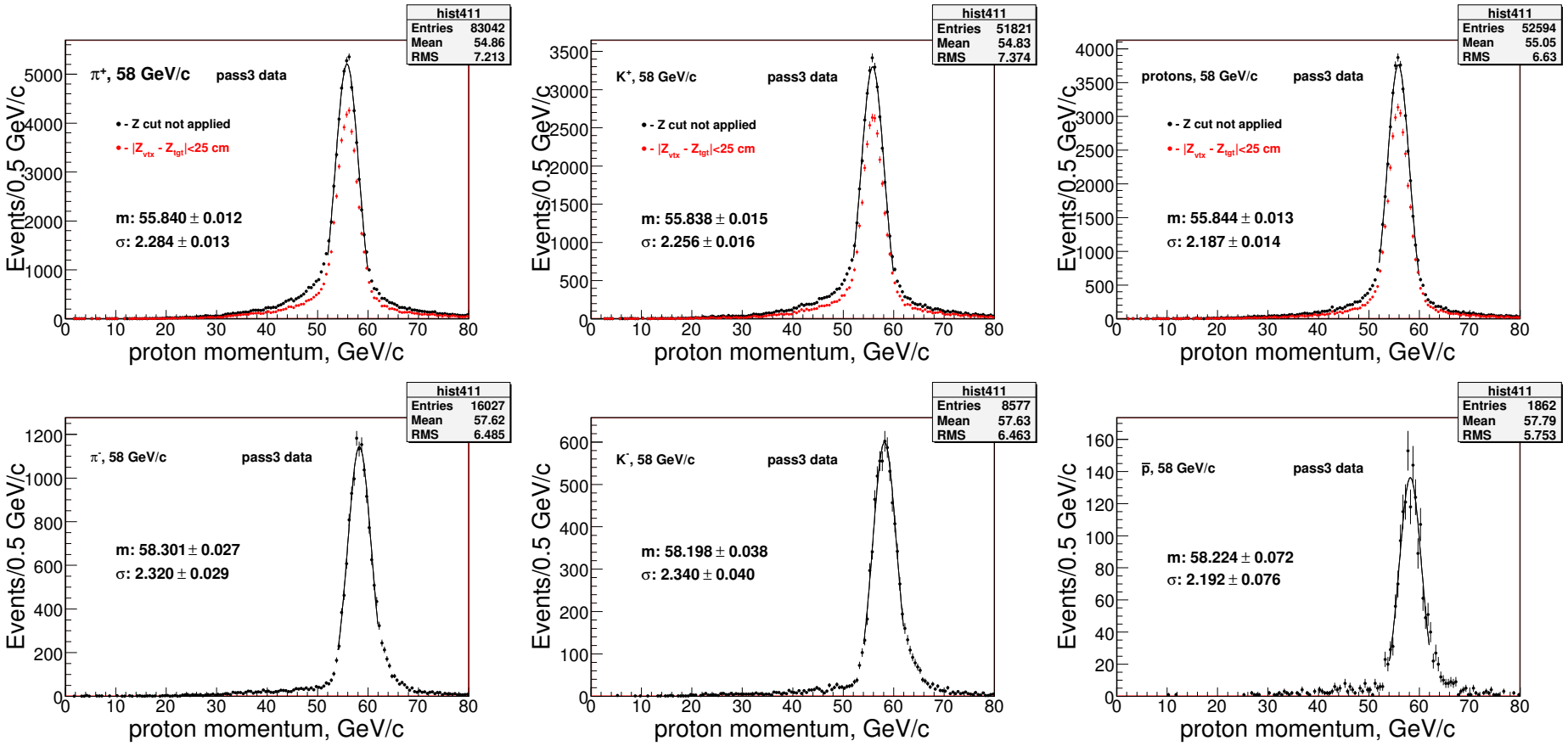
momentum



The momentum distributions for $\pi^{\pm}$ (left plots), $K^{\pm}$ (on middle) and p/$\bar{p}$ (right plots). Selection of particle's species based on the trigger bits. It can be cleaned up by using RICH info (later on). The mean value of momentum for the negatively charged tracks appeared to be 55.8 GeV/c (top plots), while for the positively charged tracks 58.2 GeV/c (bottom plots).

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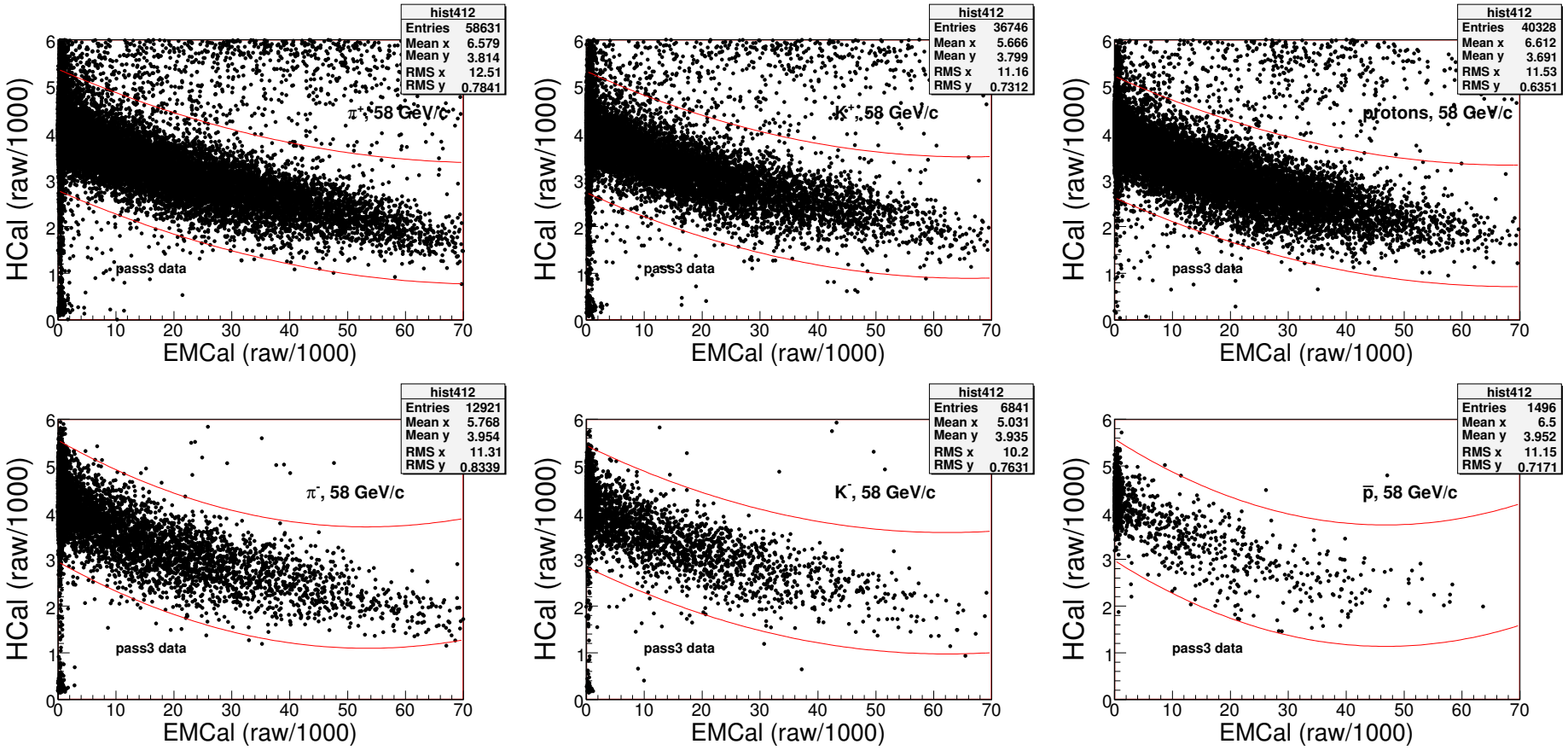
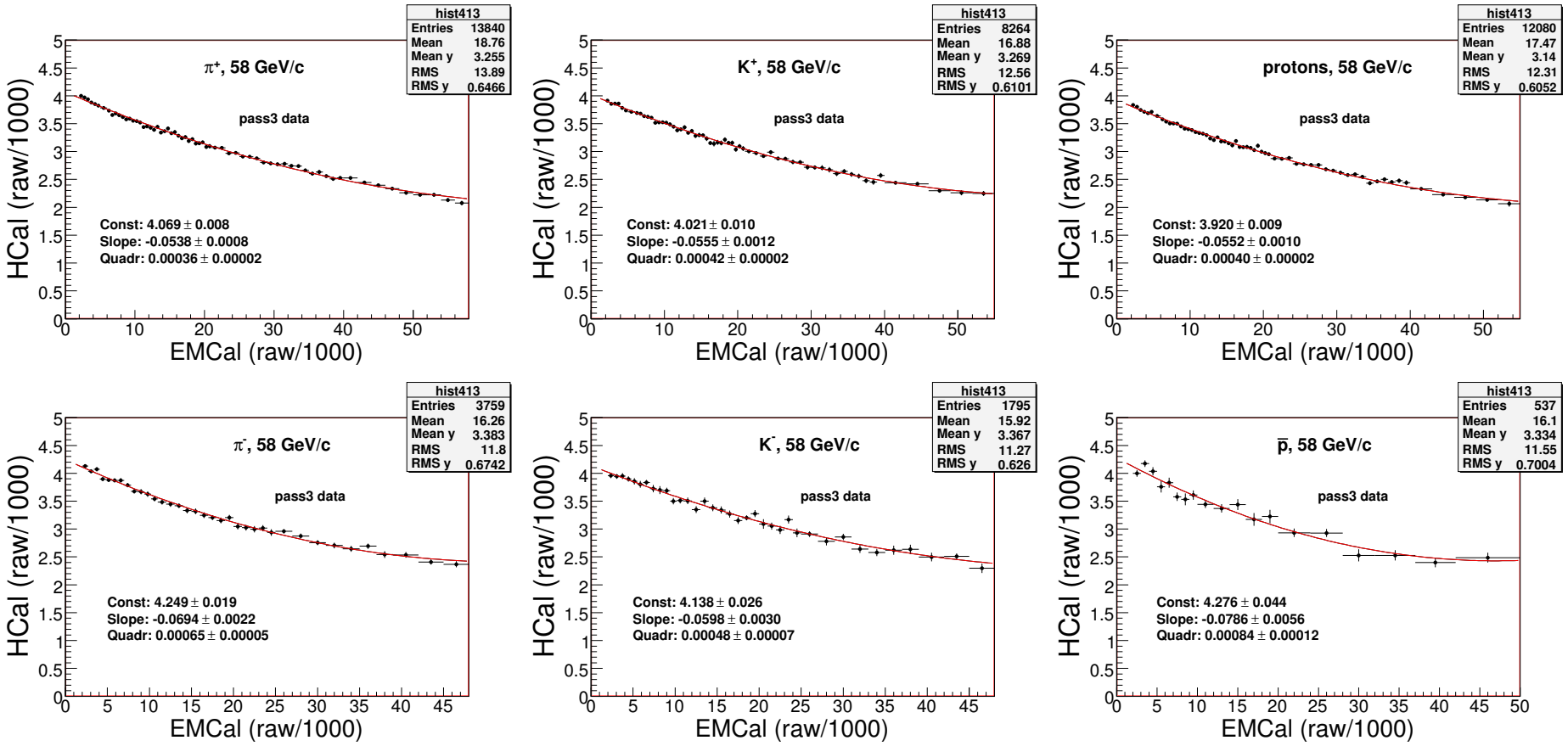
HCAL vs EMCAL: raw ADC sum



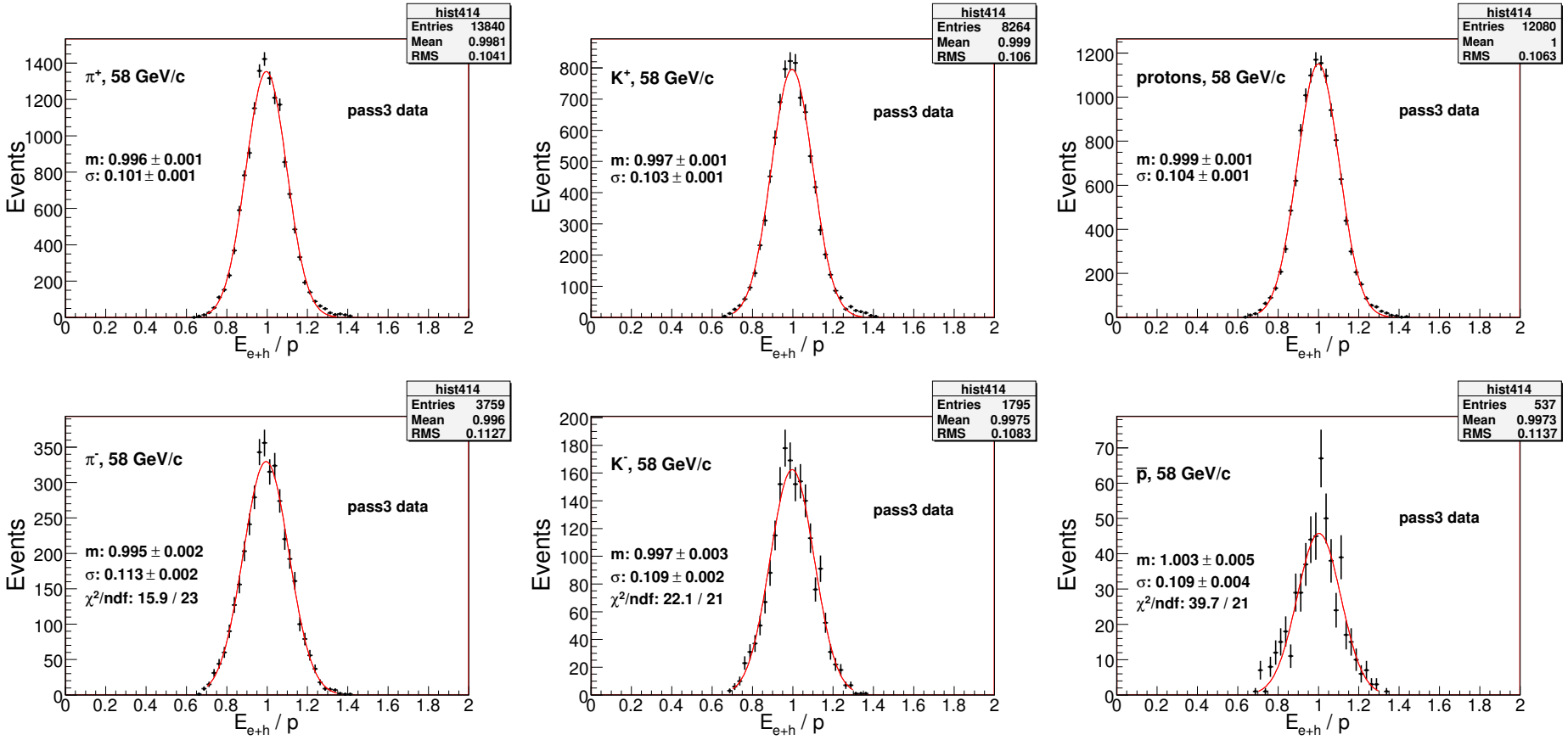
The HCAL vs EMCAL scatter plots for $\pi^{\pm}$ (left plots), $K^{\pm}$ (on middle) and p/$\bar{p}$ (right plots). The red curves show the region within which events were used for the calibration purpose. The low statistics for $\bar{p}$ plot is due to the rare yield in interactions.

HCAL vs EMCAL: fit profiles



The fit results of HCAL vs EMCAL profiles: $\pi^{\pm}$ (left plots), $K^{\pm}$ (on middle) and p/$\bar{p}$ (right plots). The red curves are 2nd order polynomial functions. The data illustrates the presence of some non-linearity. The non-linearity is higher for the negative tracks (bottom) than for the positive (top).

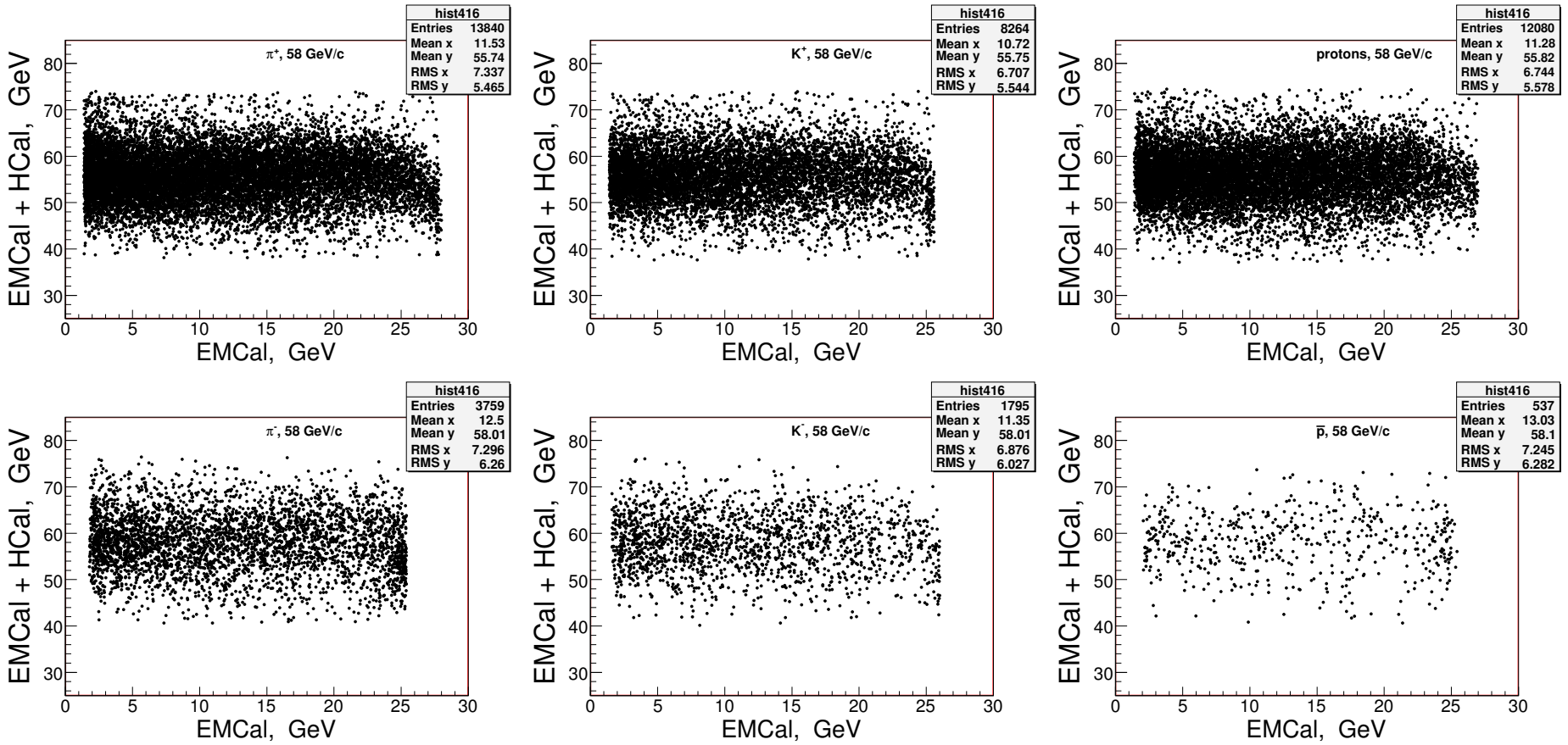
E_{e+h} / p ratio



The E_{e+h}/p ratio's for $\pi^{\pm}$ (left plots), $K^{\pm}$ (on middle) and p/$\bar{p}$ (right plots). The E_{e+h} value was calculated as:

E_{e+h} = HCAL$\cdot f_1$ + EMCAL$\cdot f_2$ + EMCAL$^2\cdot f_3$, where f_1 is a coefficient for HCAL, f_2 and f_3 are linear and quadratic coefficients for EMCAL.

(EMCAL+HCAL) vs EMCAL



The (EMCAL+HCAL) vs EMCAL scatter plots for $\pi^{\pm}$ (left plots), $K^{\pm}$ (on middle) and p/$\bar{p}$ (right plots). If calibration is done correctly, then the (EMCAL+HCAL) should not be dependent on EMCAL. The data demonstrate the linearity/independence for EMCAL values up to about 22 GeV. Beyond this point the data drop down. Possible explanation: EMCAL's ADC overflows (saturation) at high energy depositions.

energy coefficients and $\sigma_{E/p}$

	$f_1, (MeV)$	$f_2, (MeV)$	f_3, (MeV)	$\sigma_{E/p}$
π^-	13.72 $\pm$ 0.06	0.95 $\pm$ 0.03	-0.0090 $\pm$ 0.0007	0.113 $\pm$ 0.002
π^+	13.72 $\pm$ 0.03	0.74 $\pm$ 0.01	-0.0049 $\pm$ 0.0003	0.101 $\pm$ 0.001
K^-	14.06 $\pm$ 0.09	0.84 $\pm$ 0.04	-0.0068 $\pm$ 0.0010	0.109 $\pm$ 0.002
K^+	13.89 $\pm$ 0.03	0.77 $\pm$ 0.02	-0.0058 $\pm$ 0.0003	0.103 $\pm$ 0.001
$\bar{p}$	13.62 $\pm$ 0.14	0.70 $\pm$ 0.05	-0.0114 $\pm$ 0.0016	0.109 $\pm$ 0.004
proton	14.25 $\pm$ 0.03	0.79 $\pm$ 0.01	-0.0058 $\pm$ 0.0003	0.104 $\pm$ 0.001

Table 1: Summary of the energy coefficients: 1st column - for HCAL, 2nd - EMCAL's linear term and 3rd column - EMCAL's quadratic term. 4th column is $\sigma_{E/p}$.

summary

This is first energy calibration update using DST (pass 3) software. Previous calculation made with tracking based on the wire chambers info.

HCAL vs EMCAL scatter plots demonstrate some non-linearity, so data were fitted with 2nd order polynomial function. Fit parameters allow to calculate the energy coefficients. The energy coefficients appeared to be different for each particle's species.

The overall energy resolution of system found to be within (10 - 11)% at 58 GeV/c using the individual coefficients.

Data indicates that the energy deposition into EMCAL above 22 GeV can cause some limitation/drop (ADC overflows?).