Calibration of the MIPP EM calorimeter

Rajendran Raja

MIPP Collaboration meeting

April 8,2006

- Method
- Preliminary results with 19 GeV/c electrons
- Thanks to Turgun for providing ped subtracted data in ascii format for use in lsq package.
- Work remaining

Method

- Outlined in MIPP Note 61

Energy deposited in Layer E_j is given by

$$E_j = \sum_{k=1}^{k=N} \lambda_{jk} L_k$$

where L_k is the live energy observed in layer.

Total energy in calorimeter is given by

$$E_{tot} = \sum_{j=1}^{j=N} \sum_{k=1}^{k=N} \lambda_{jk} L_k = \sum_{k=1}^{k=N} w_k L_k$$

where the weights $w_k = \sum_{j=1}^{j=N} \lambda_{jk}$

Minimizing the sum of squares

$S^2 = \sum_{l=1}^{l=M} (E_{tot}^l - \sum_k w_k L_k^1)^2$ over M events wrt w_k leads to

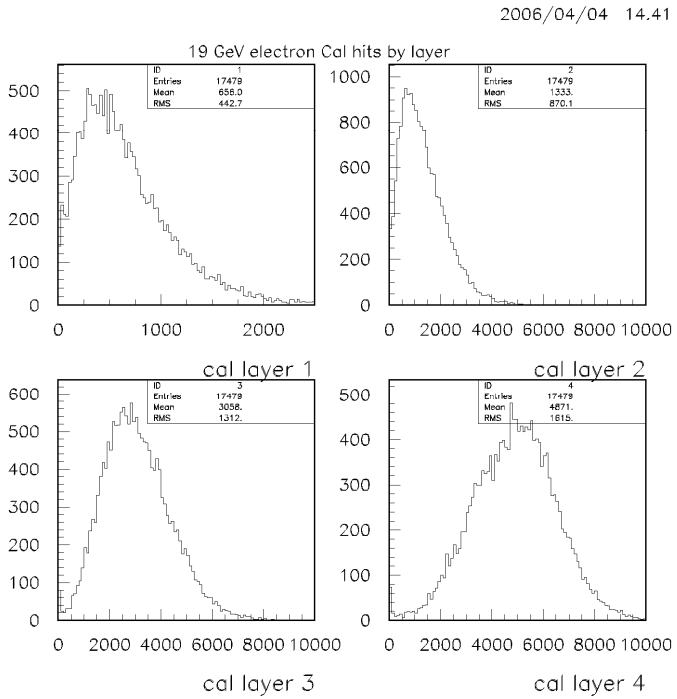
$\sum_{k=1}^{k=N} < L_j L_k > w_k =< E_{tot} L_j >$ where <> implies average over events

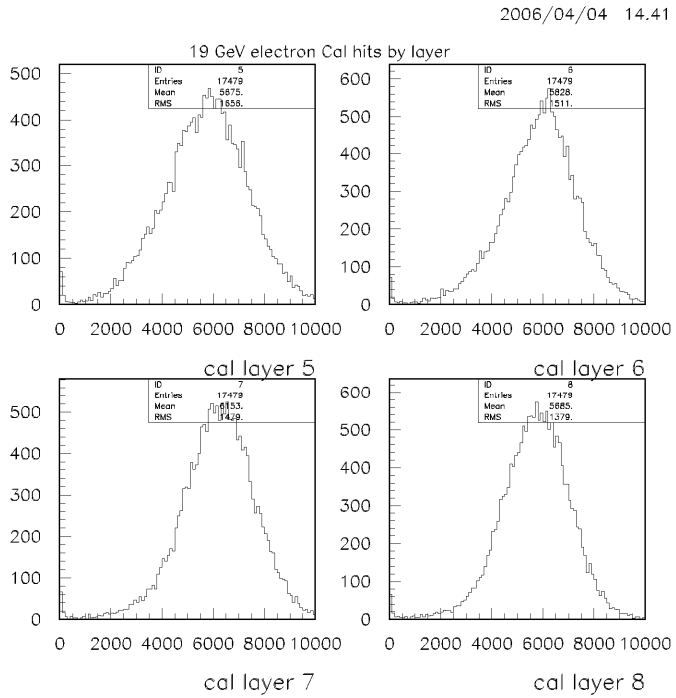
This leads to the matrix inversion solution

$w_k = \sum_{j=1}^{j=N} M_{kj} d_j$ where M is the inverse of the matrix $< L_j L_k >$

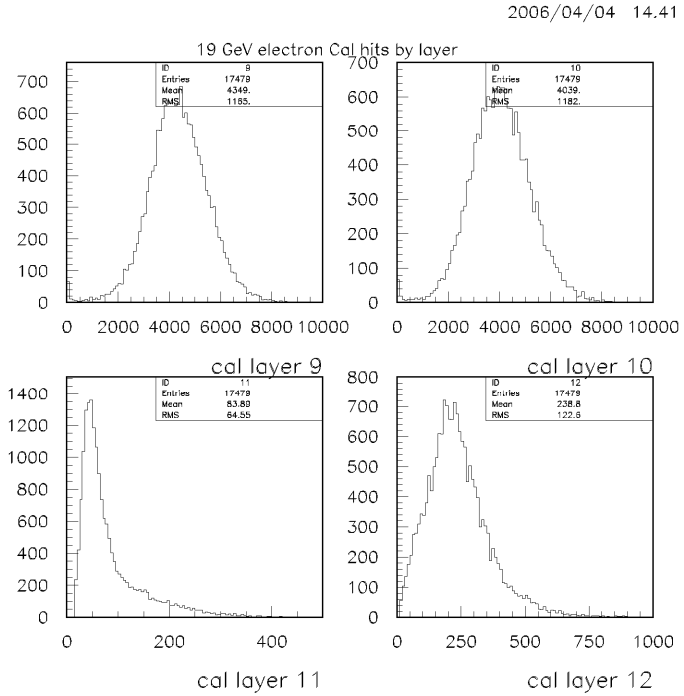
and d is the vector $< E_{tot} L_j >$

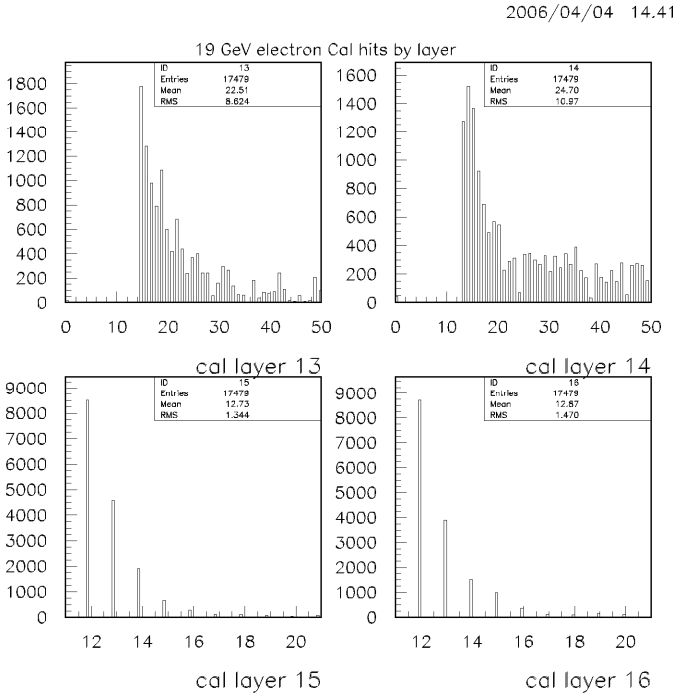
17479 electron events at -19GeV
Cal hits by layer pedestals subtracted
EM Cal layers 1-10 Hcal laters 11-18



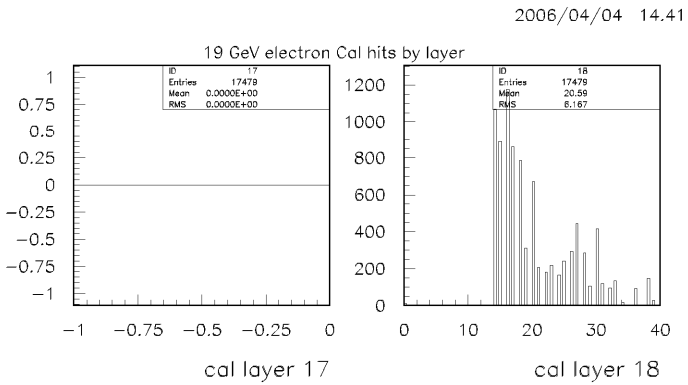


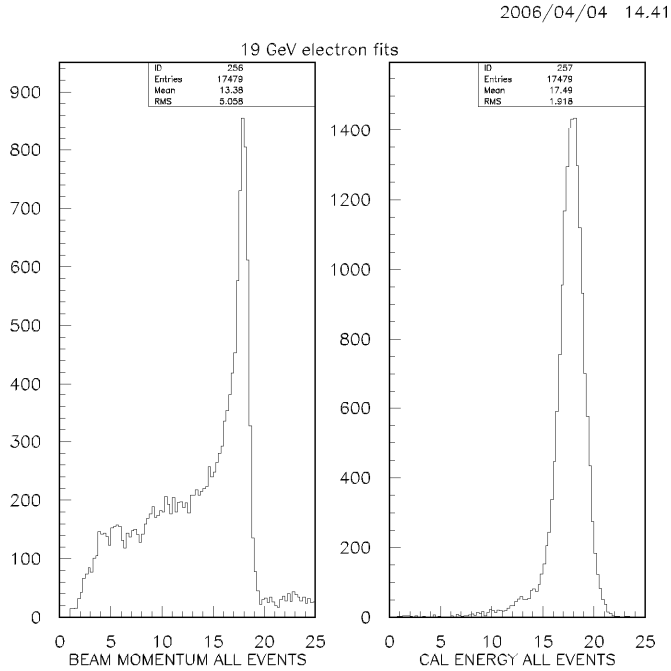
Layers 9-16


2006/04/04 14.41
19 GeV electron Cal hits by layer
cal layer 9
cal layer 10
cal layer 11
cal layer 12

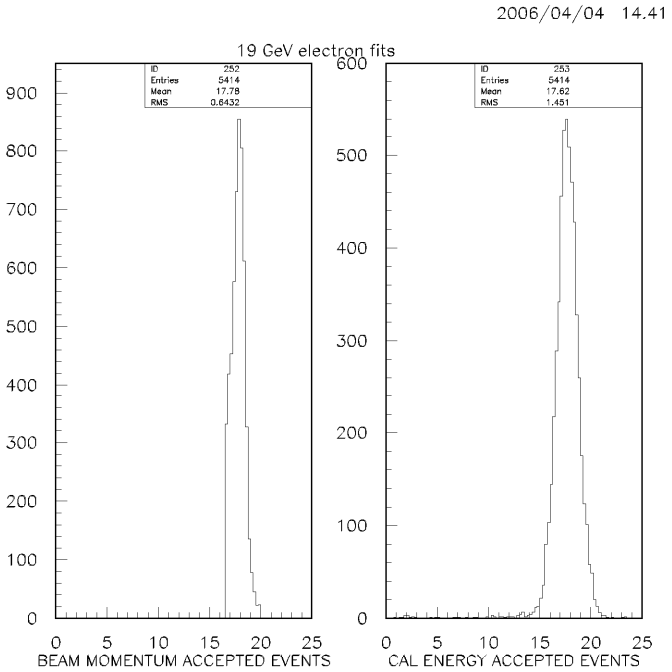

2006/04/04 14.41
19 GeV electron Cal hits by layer
cal layer 13
cal layer 14
cal layer 15
cal layer 16

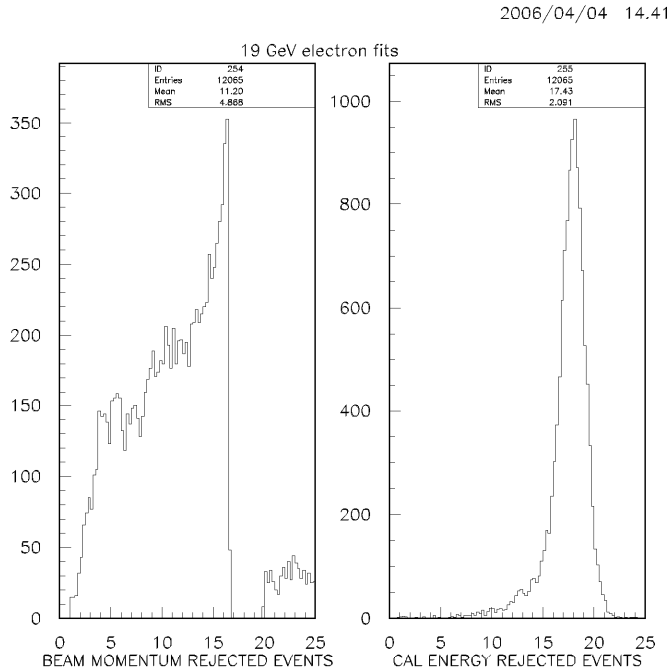
Layers 17-18


2006/04/04 14.41
19 GeV electron Cal hits by layer
ID 17
Entries 17479
Mean 0.0000E+00
RMS 0.0000E+00
ID 18
Entries 17479
Mean 20.59
RMS 6.167
cal layer 17
cal layer 18

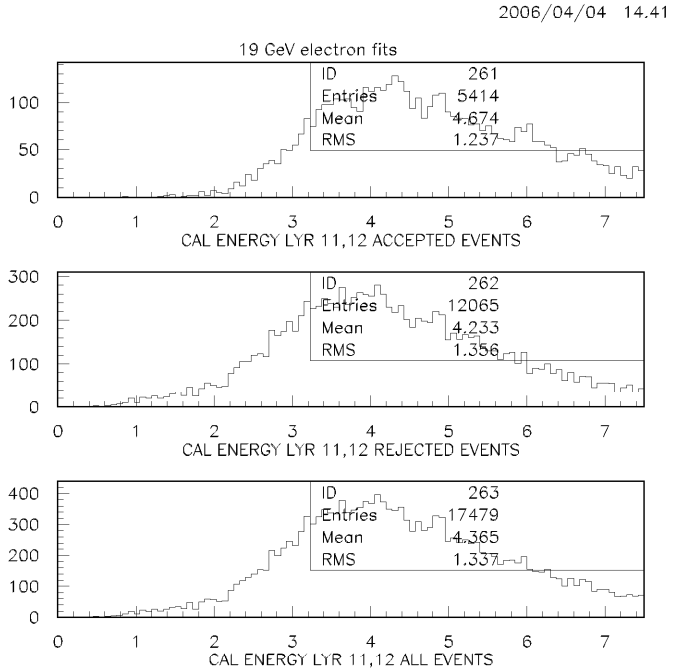

2006/04/04 14.41
19 GeV electron fits
ID 256
Entries 17479
Mean 13.38
RMS 5.058
ID 257
Entries 17479
Mean 17.49
RMS 1.918
BEAM MOMENTUM ALL EVENTS
CAL ENERGY ALL EVENTS

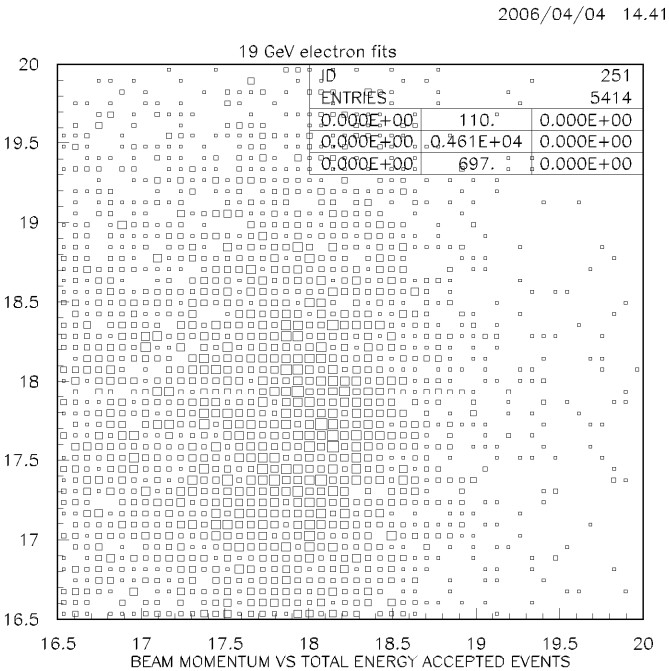
Cut on momenta





Leakage into Hcal





Calorimeter Layer Weights-Results

Layer 1 0.37153D-03
Layer 2 0.12228D-03
Layer 3 0.27651D-03
Layer 4 0.27904D-03
Layer 5 0.31329D-03
Layer 6 0.36237D-03
Layer 7 0.34957D-03
Layer 8 0.28364D-03
Layer 9 0.28773D-03
Layer 10 0.30249D-03

Layer 11 0.14269D-01
Layer 12 0.14796D-01

Work to do –

- Repeat for other momenta
- Verify momentum and time independence
- Match tracks and shower centroids
- Populate database with run dependent constants
- PID photons, electrons in calorimeter

Calibration of the MIPP Hadron calorimeter

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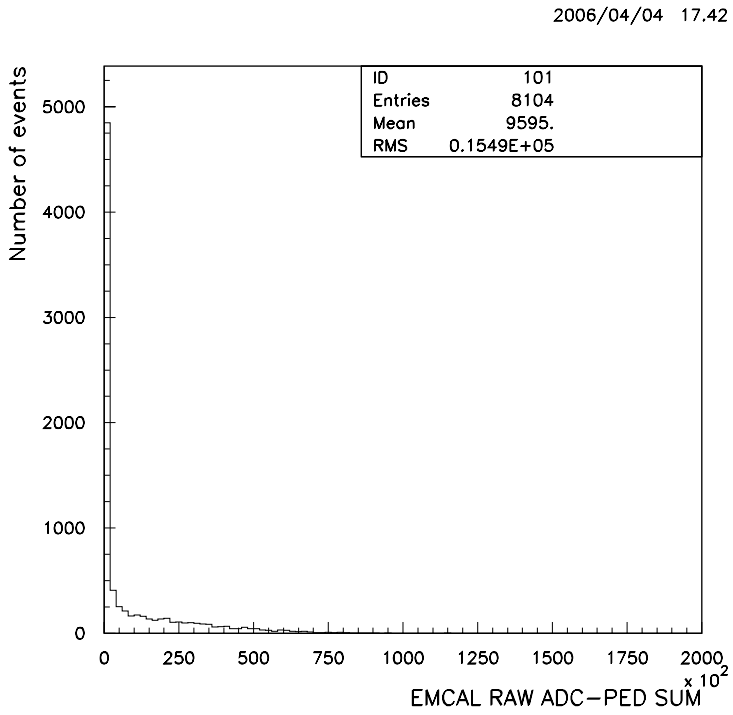
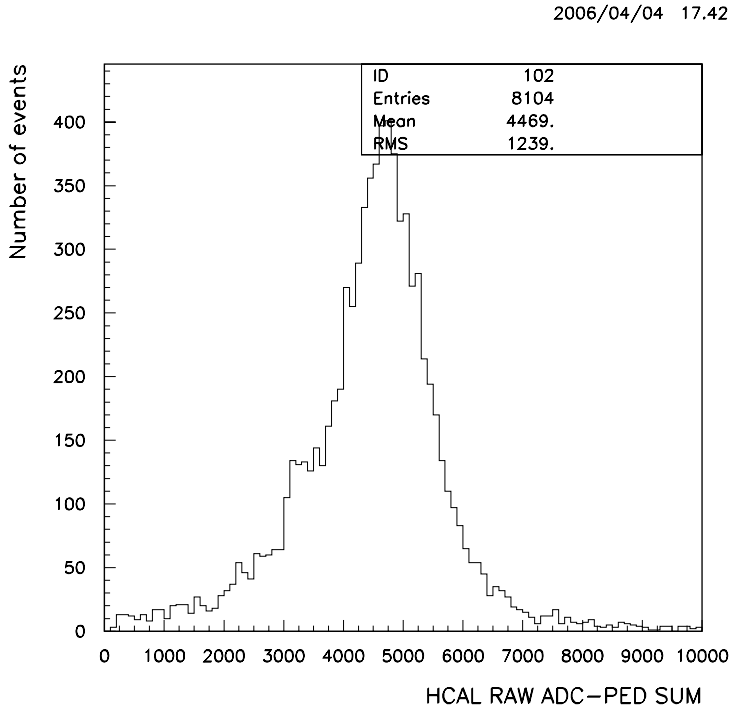
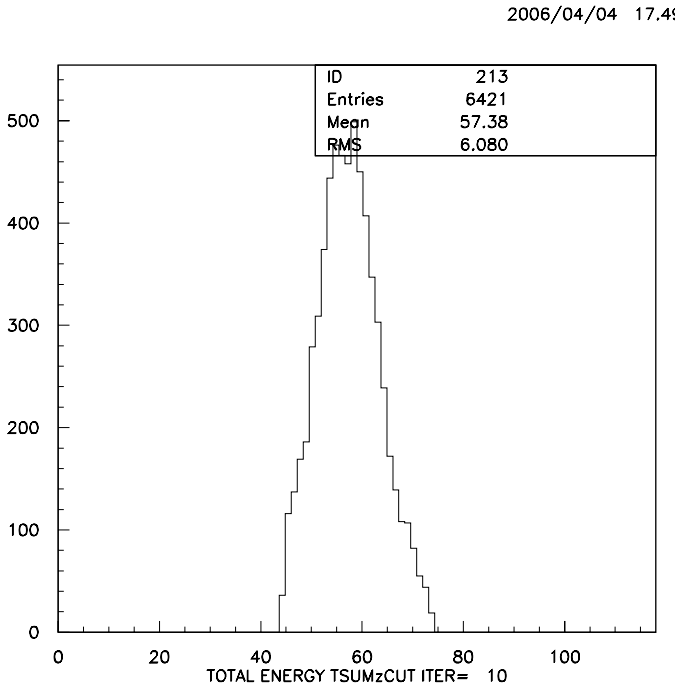
Work out Total energy after initial raw cuts to get rid of muons etc. Cut better on total energy and iterate till converge.

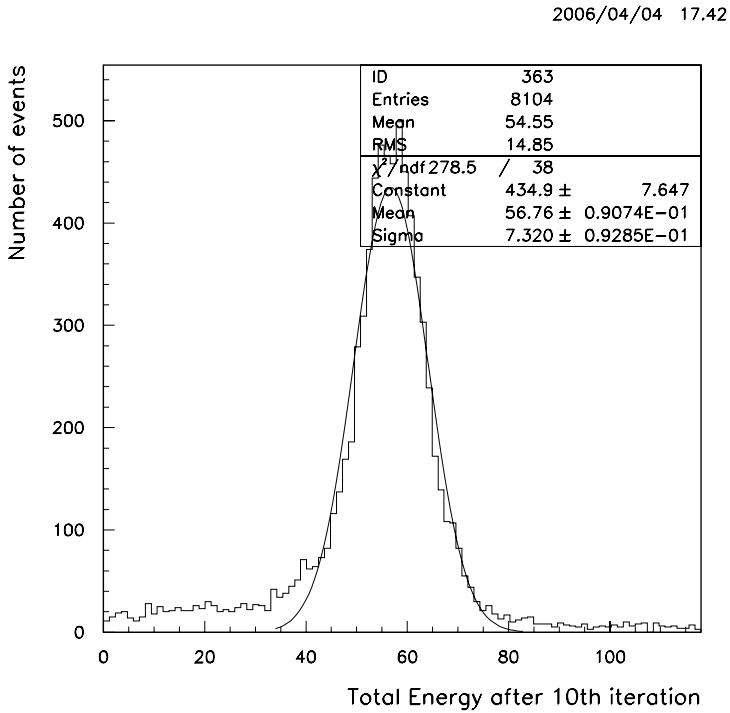
Hadrons Raw calorimeter data





Fit after 10 iterations





Results

- (1,1) 0.35273D-02
- (2,1)-0.20197D-01
- (3,1) 0.10556D-03
- (4,1) 0.39961D-03
- (5,1)-0.18923D-03
- (6,1) 0.24910D-03
- (7,1) 0.14596D-02
- (8,1)-0.49662D-03
- (9,1) 0.83451D-03
- (10,1) 0.65886D-03
- (11,1) 0.12906D-01
- (12,1) 0.13199D-01
- (13,1) 0.85489D-02
- (14,1) 0.17503D-01
- (15,1) 0.17960D-01
- (16,1) 0.20388D-01
- (17,1) 0.28842D-02
- (18,1) 0.54821D-02

More statistics needed.

Do the same to hadrons as for electrons. Populate database. Not enough statistics to cut on em fraction and calibrate EM only.