BB Čerenkov Efficency Analysis for d_2^n

BB Čerenkov Efficency and 4-Pass Energy Calibration

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Outline

Cuts (1)

- Some Cuts used:
- $BB.tr.n == 1$
- $(DBB.evtypebits\&1 << 2) == (1 << 2)$
- $BB.optics.charge == -1$
- As well as...

Cuts (2)

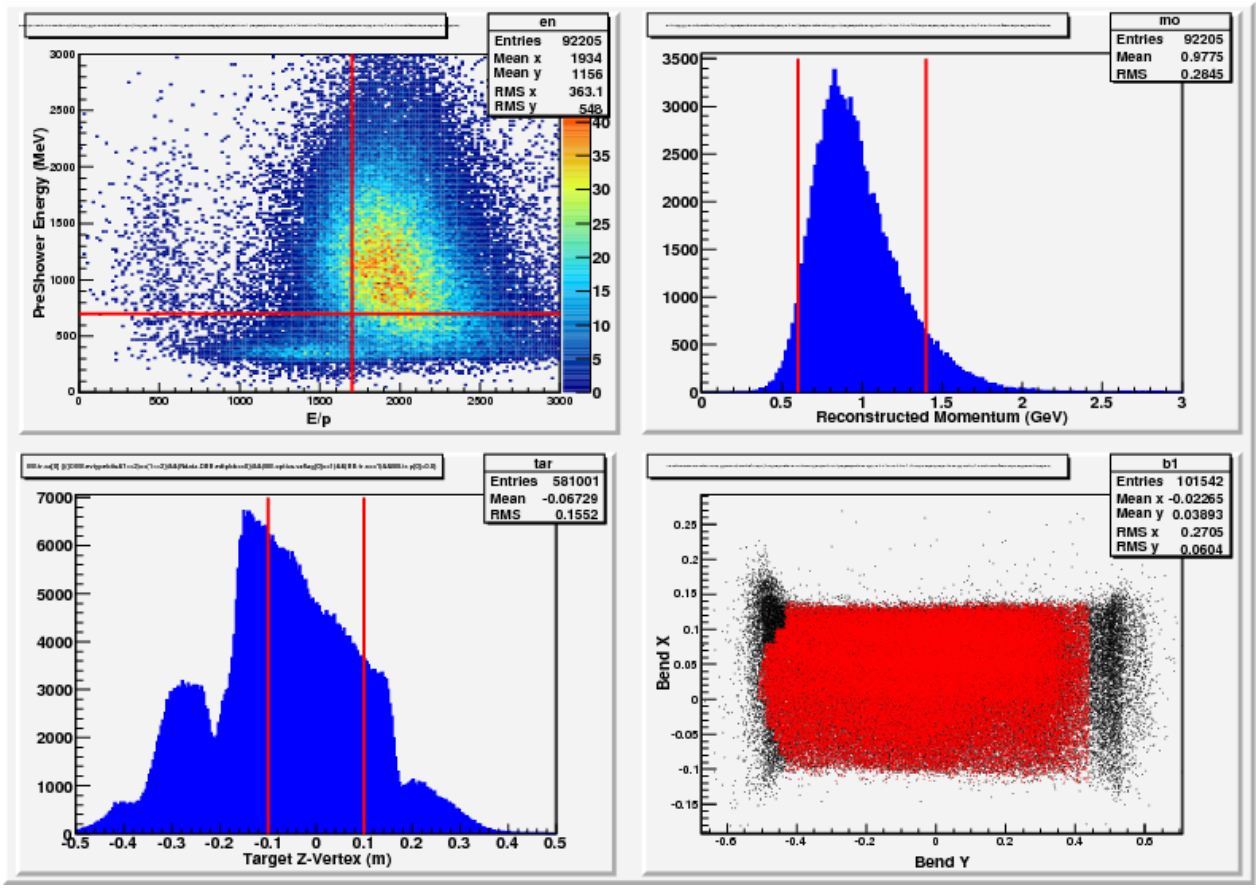


Figure: Cuts used to define a good electron

Cuts (3): Mirror Cuts

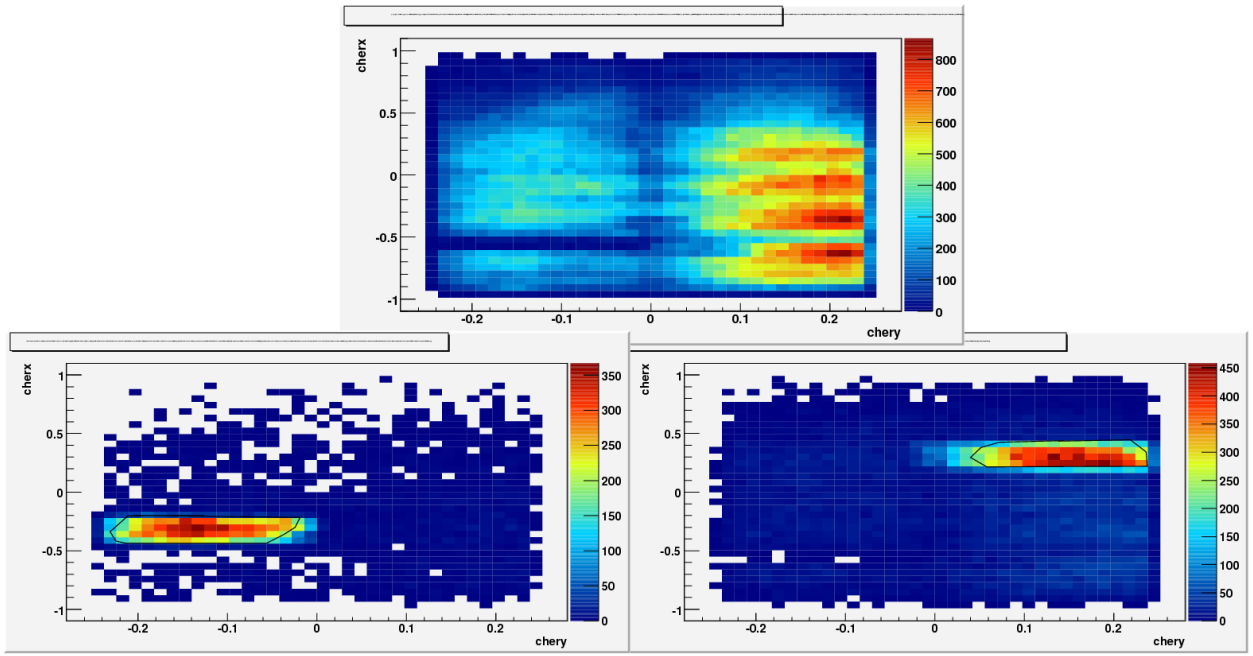


Figure: Čerenkov geometric cuts, all mirrors (top), mirror 14 (bottom left) and mirror 7 (bottom right)

Cuts (4): Shower Geometry Cut

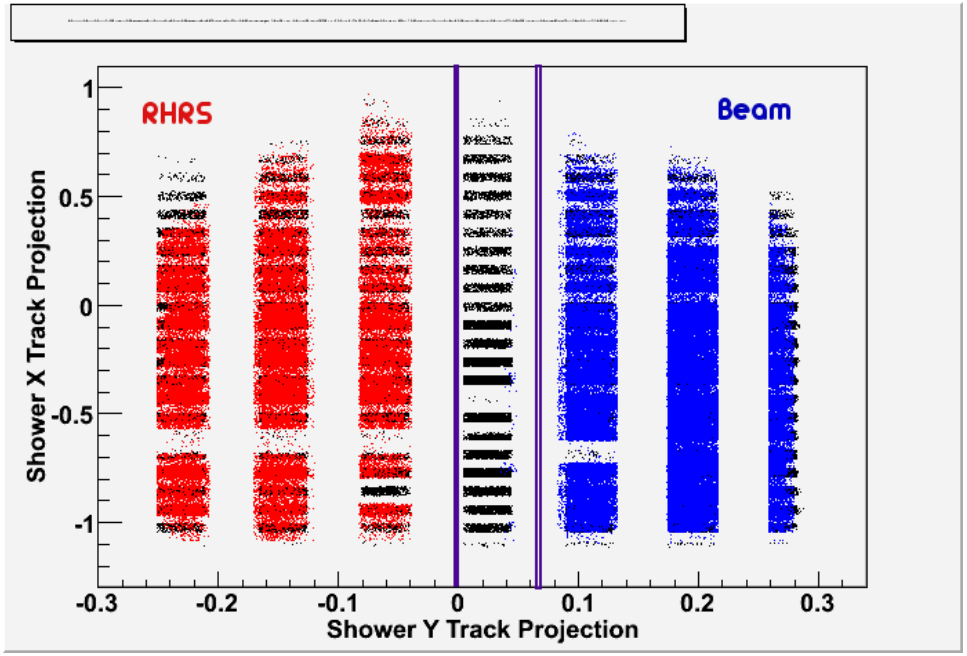


Figure: Geometrical shower cuts. RHRS side (red,left) and beam side (blue,right)

Cuts (5): Track Match Cut

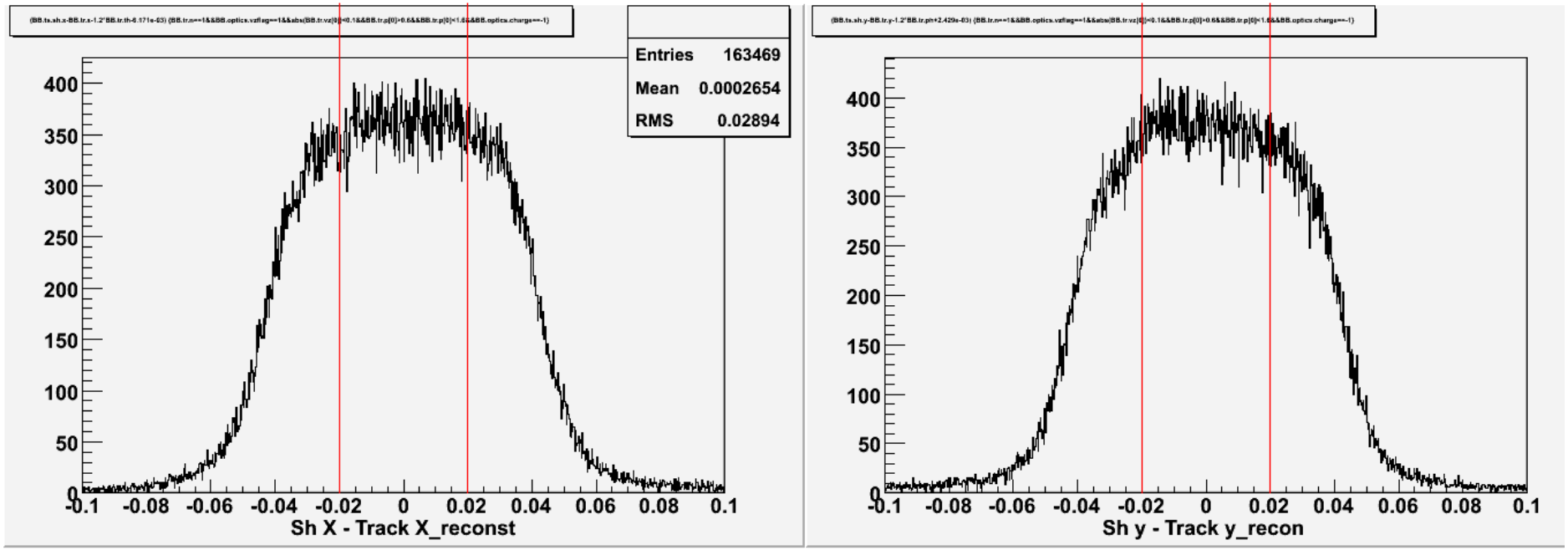


Figure: Shower cluster position - reconstructed shower track

Cuts (6): TDC Cuts

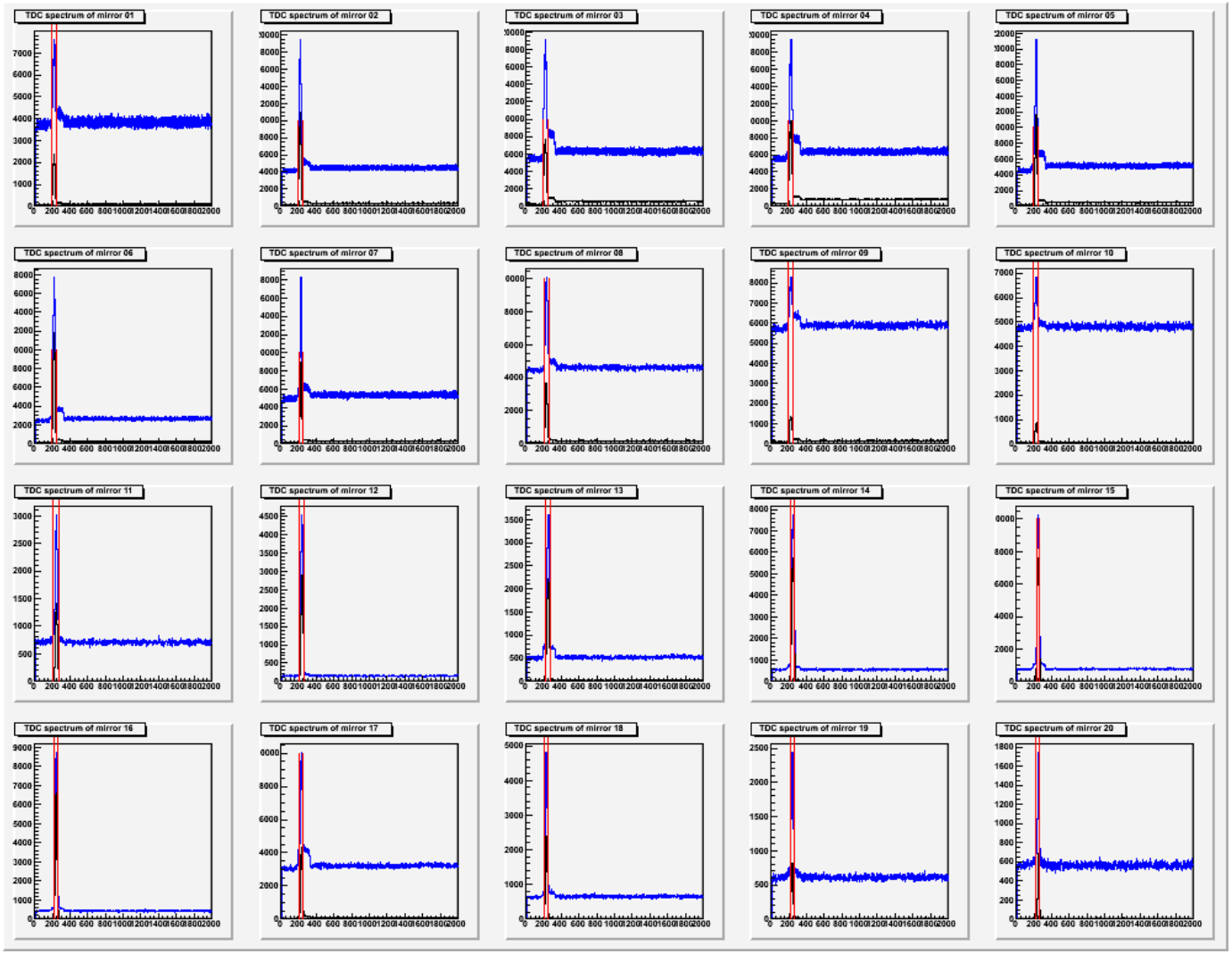
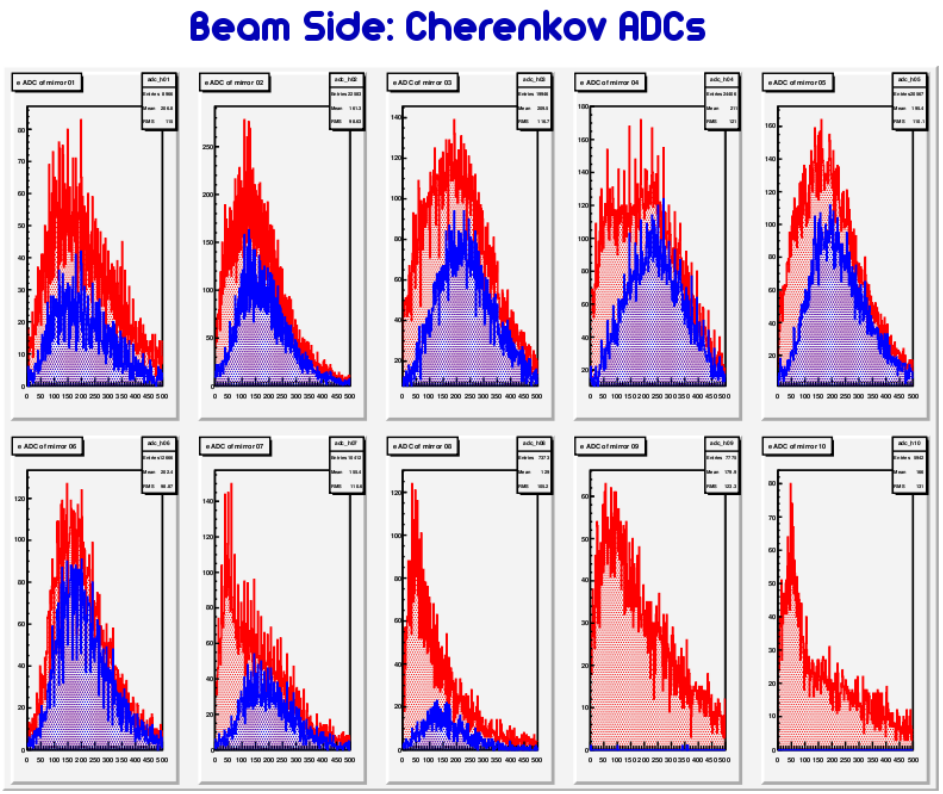


Figure: Čerenkov TDC cuts, (blue w/o mirror cut), (red w/ mirror cut)

Cuts (7): ADC Cuts



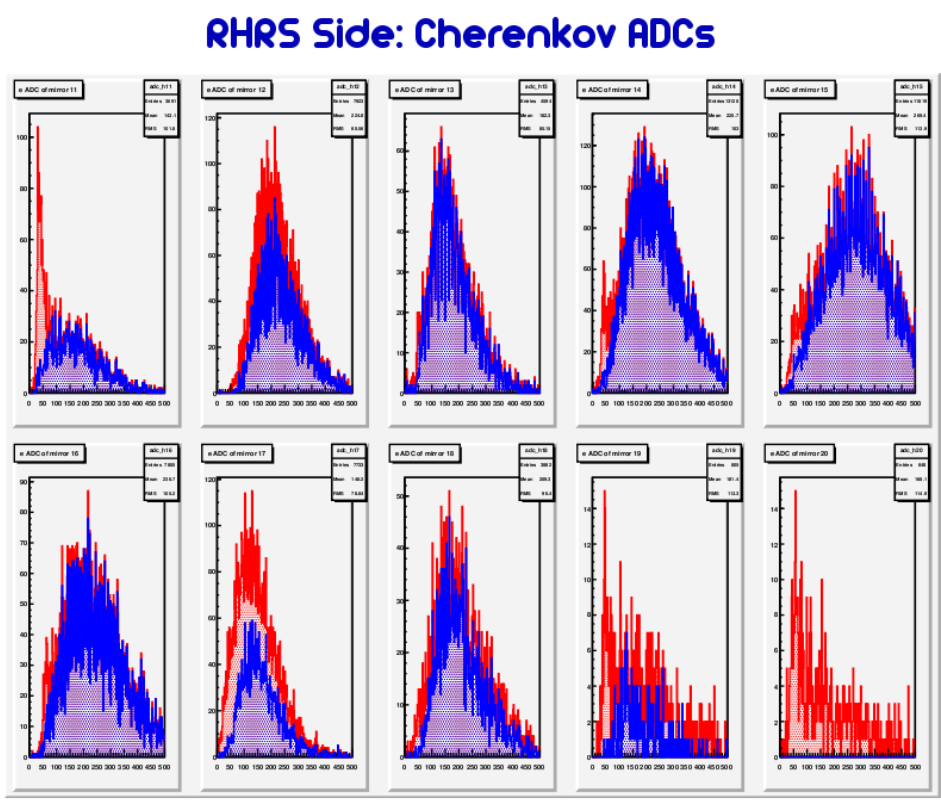


Figure: Čerenkov ADC cuts, (blue w mirror cut), (red w/o mirror cut)

4-pass Efficiencies

By applying the beam/RHRS geometry cuts with no Čerenkov cuts(ADC,TDC) to the good tracks we determine our denominator. By seeing how many of the above tracks survive a Čerenkov cut, we determine our numerator.

- beam side:
  - $\frac{16{,}413}{21{,}823} = 76.25 \pm 0.78\%$ (4-pass)
- RHRS side:
  - $\frac{44{,}582}{49{,}357} = 90.33 \pm 0.59\%$ (4-pass)
- From 1-pass H2 runs, Čerenkov efficiency is $91.15 \pm 3.11\%$ (pmt 14 only)

4-Pass Energy Calibration Coefficients

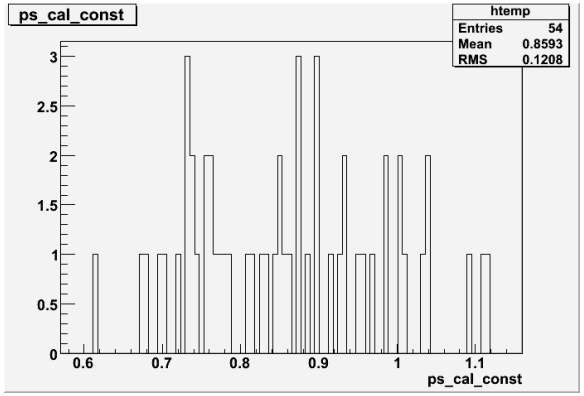


Figure: PreShower energy coefficients

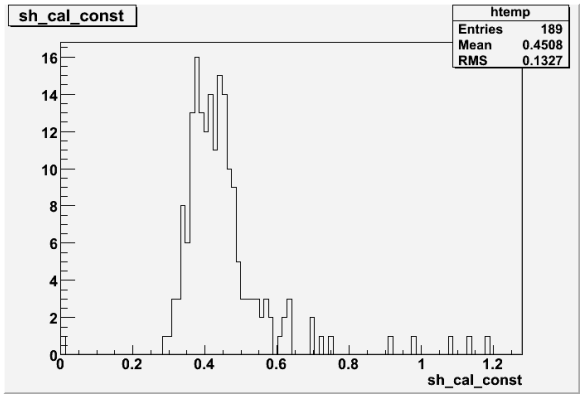


Figure: Shower energy coefficients

4-Pass PID

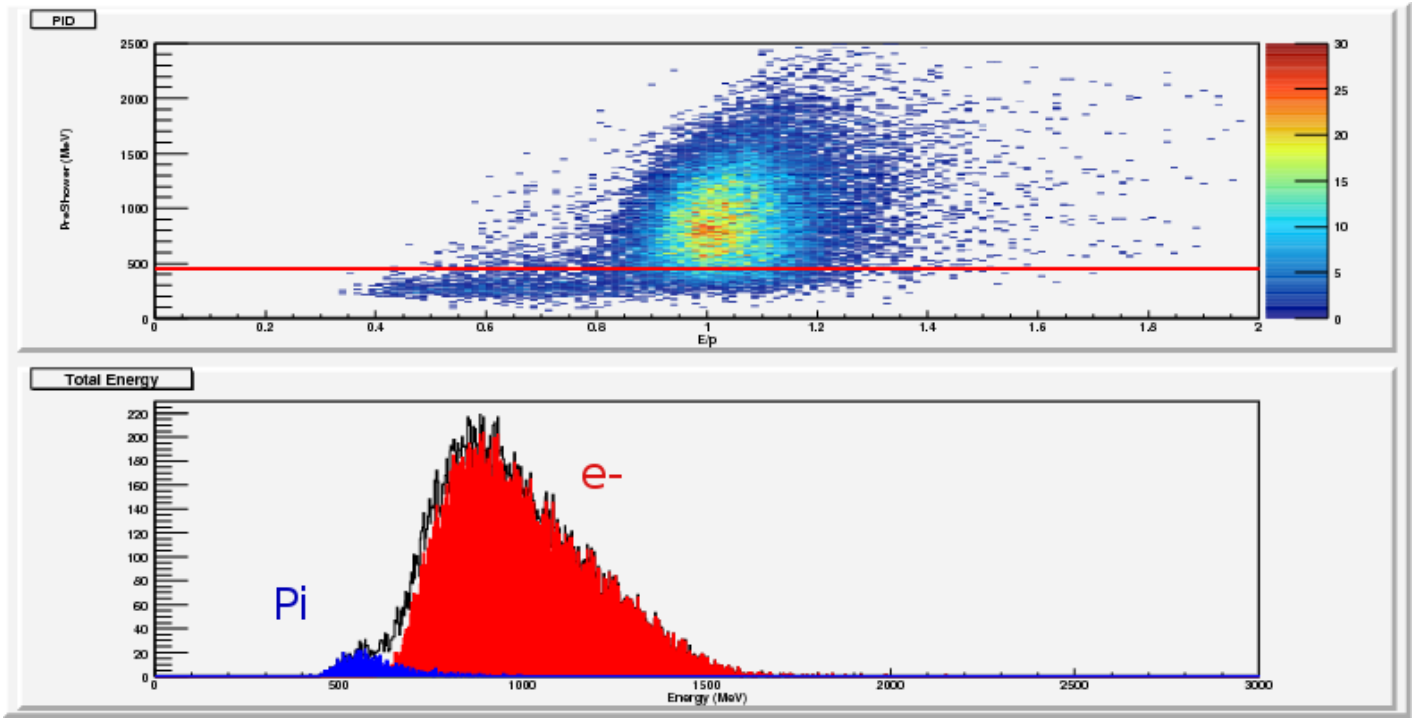


Figure: PreShower vs E/p (top), total energy (bottom)

4-Pass Resolution

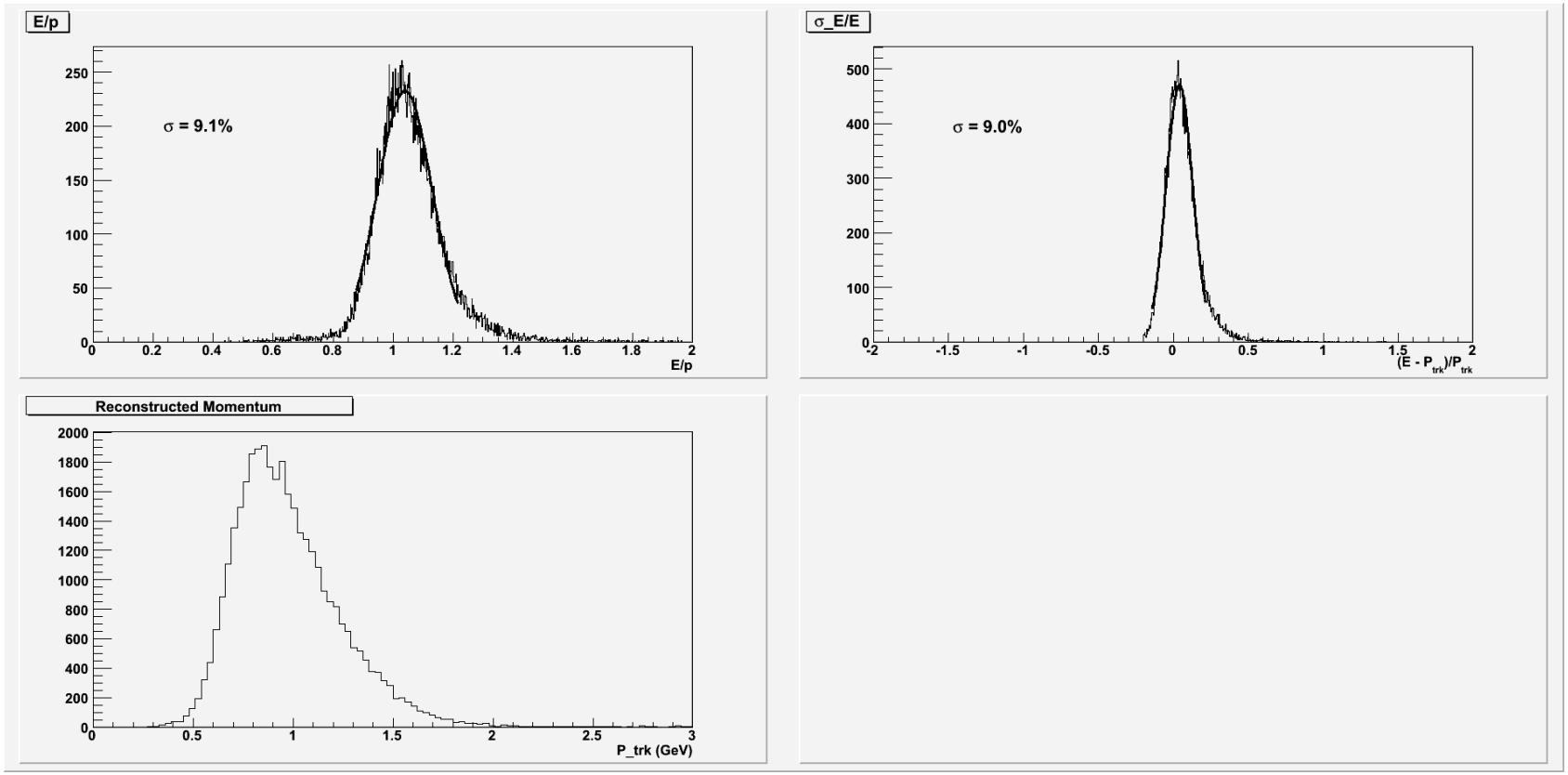


Figure: E/p (top left), dE/E (top right) and momentum (bottom)

Analyzer ROOT Problems

- ROOT troubles:
  - The Analyzer does not allow 2D array types to be defined as global root variables (those that show up in TTree after replay)
  - Also tried to use vector type, also does not allow this definition type
- New approach:
  - Create 20 1D arrays of nhits, one array for each TDC (like DecData class)
  - Use db files to read in TDC offsets and electron TDC channel range
  - Do TDC analysis in THaCherenkov class
- The In Class Analysis:
  - Loop over all hits in each TDC. Since in class can use 2D array TDC[pmt][nhit]

Analyzer ROOT Problems: New Approach (Cont.)

- Read in TDC cut window from db
- Loop over all hits in each TDC and if within cut window set TDC[pmt] flag to TRUE for each event
- Define TDC[pmt] cut flag as global variable (so it appears in TTree after replay). Then can just cut on TDC[pmt] cut flag = 1 (in cut window) or 0 (out of cut window).

Issue

```
Int_t THaCherenkov::Decode( const THaEvData& evdata )
{
  ClearEvent();
  // Loop over all modules defined for Cherenkov detector
  for( Int_t i = 0; i < fDetMap->GetSize(); i++ ) {
    THaDetMap::Module* d = fDetMap->GetModule( i );
    bool adc = (d->model ? fDetMap->IsADC(d) : i < fDetMap->GetSize()/2 );

    // Loop over all channels that have a hit.
    for( Int_t j = 0; j < evdata.GetNumChan( d->crate, d->slot ); j++) {

      Int_t chan = evdata.GetNextChan( d->crate, d->slot, j );
      if( chan < d->lo || chan > d->hi ) continue;      // Not one of my channels

//      // Get the data. Aero mirrors are assumed to have only single hit (hit=0)
      Int_t data = evdata.GetData( d->crate, d->slot, chan, 0 );

      // Get the detector channel number, starting at 0
      Int_t k = d->first + chan - d->lo - 1;

    // Copy the data to the local variables.
      if( (!adc)&&(k==0) )
        for(Int_t ihit = 0; ihit < evdata.GetNumHits(d->crate,d->slot,chan); ihit++)
        {
          if(ihit<MaxHits)
          {
            Int_t rdata = evdata.GetData( d->crate, d->slot, chan, ihit );
            ndata++;
            fTT[ihit] = rdata;
          }
        }
```

What's Next

- Switch to transversity BB TotalShower class?
- Redo 4-pass efficiencies using calibrated energy
- Apply 4-pass energy calibrations to 1-pass?
- Continue Work on Čerenkov Class