E/Pi Ratio in Tungsten
Quick & Dirty Study

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DISCLAIMER:

Data taken from online histograms: No reliable calibration, no cleanup, no nothing

Simulations performed standalone, with a geometry close to that of the WHCAL - No digitization, no noise, ...

NO WARRANTY, USE AT YOUR OWN RISK

Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

CALICE Calorimeter for ILC

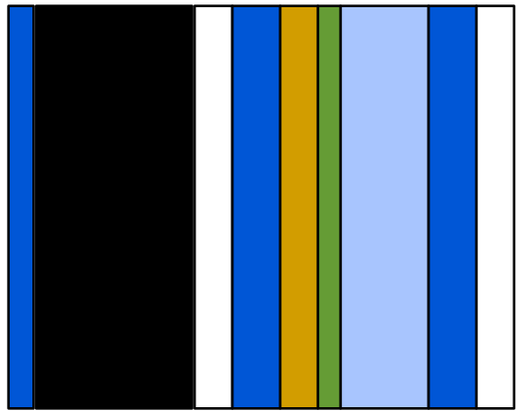
TUM LMU Excellence Cluster Universe

The Motivation - Compensation?

- Katja observed that while Software Compensation works quite well in Pandora with ILD, no improvement is achieved in CLIC_ILD
  - The difference:
    ILD is 20 mm stainless steel, 5 mm scintillator, 1.5 mm air
    CLIC_ILD is 10 mm tungsten alloy, 5 mm scintillator, 1.5 mm air
  - The explanation: in the CLIC HCAL, the e/pi ratio is 1, in ILD it is around 1.2 - 1.3
    (for further detail, see Katjas presentation at the ILD opt. meeting on 11/17)

- The obvious question: Is the WHCAL we have in the beam compensating?
  Does MC describe the e/pi ratio?

Standalone Simulations



Layers modeled after CALICE Geometry description, omitting 3M foil layer (2 x 115 µm Polystyrole, same atomic composition as Scintillator)
Tungsten: 94% W, 4% Ni, 2% Cu, density 17.6 g/cm^3
Total layer thickness: 25.5 mm

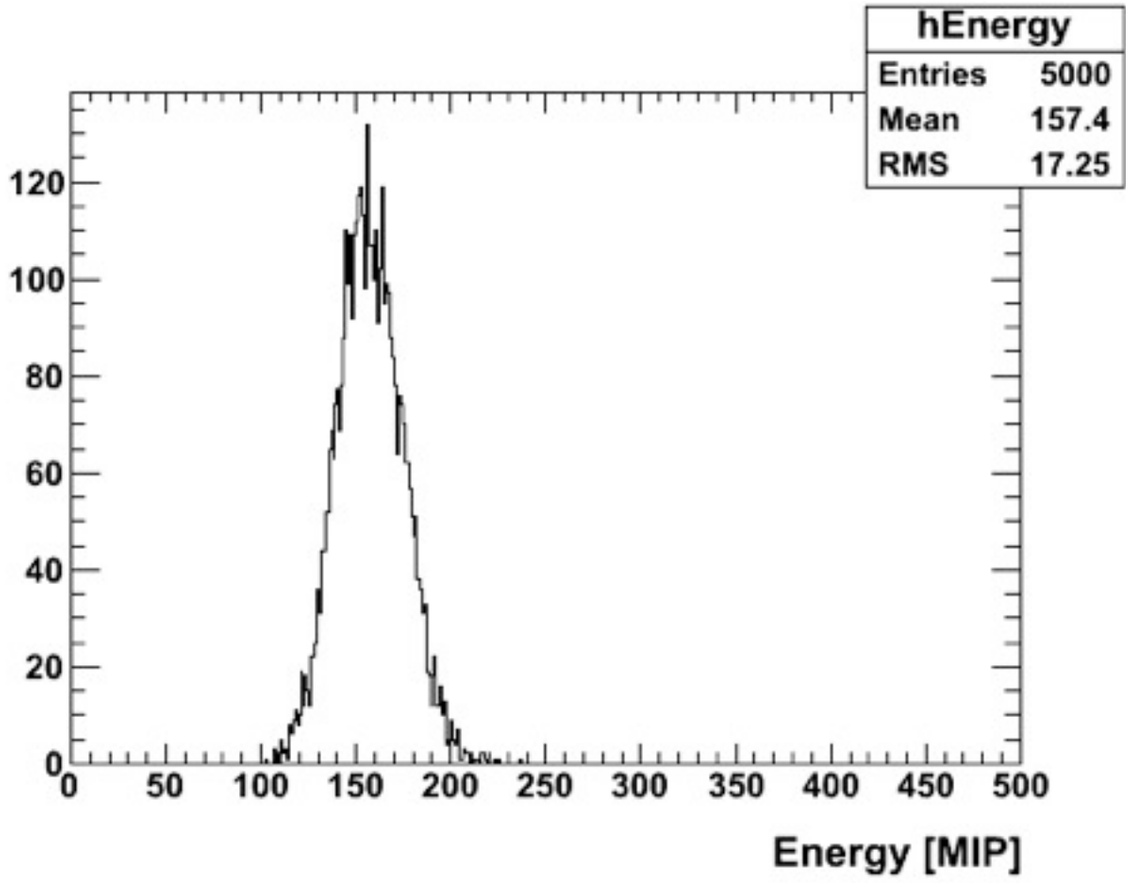
10 mm Tungsten
1.5 mm Air
1 mm Steel
2 mm Steel
1.5 mm Cable/Fiber
1 mm PCB
5 mm Scintillator
2 mm Steel
1.5 mm Air

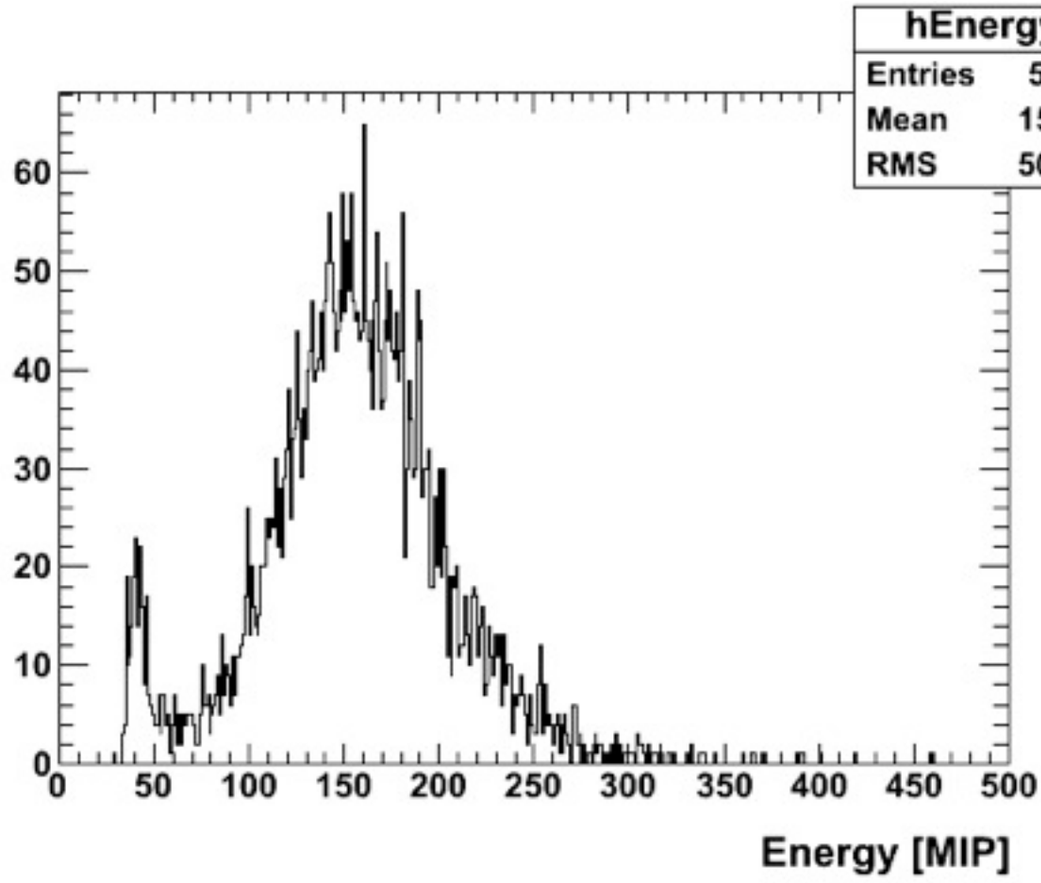
total: 30 layers

- Simulations using GEANT4.9.3 p01, QGSP_BERT, 100 ns time cut (I know, it should be 150 ns, will correct that in the future...), Birk's law,
  range cut 0.05 mm
  But: No digitization, raw energy per cell (with a 0.5 MIP cut on each cell)

Simulation Results: 6 GeV

- Simulations performed for 6 and 4 GeV negative (e^-, π^-), 5 k events each





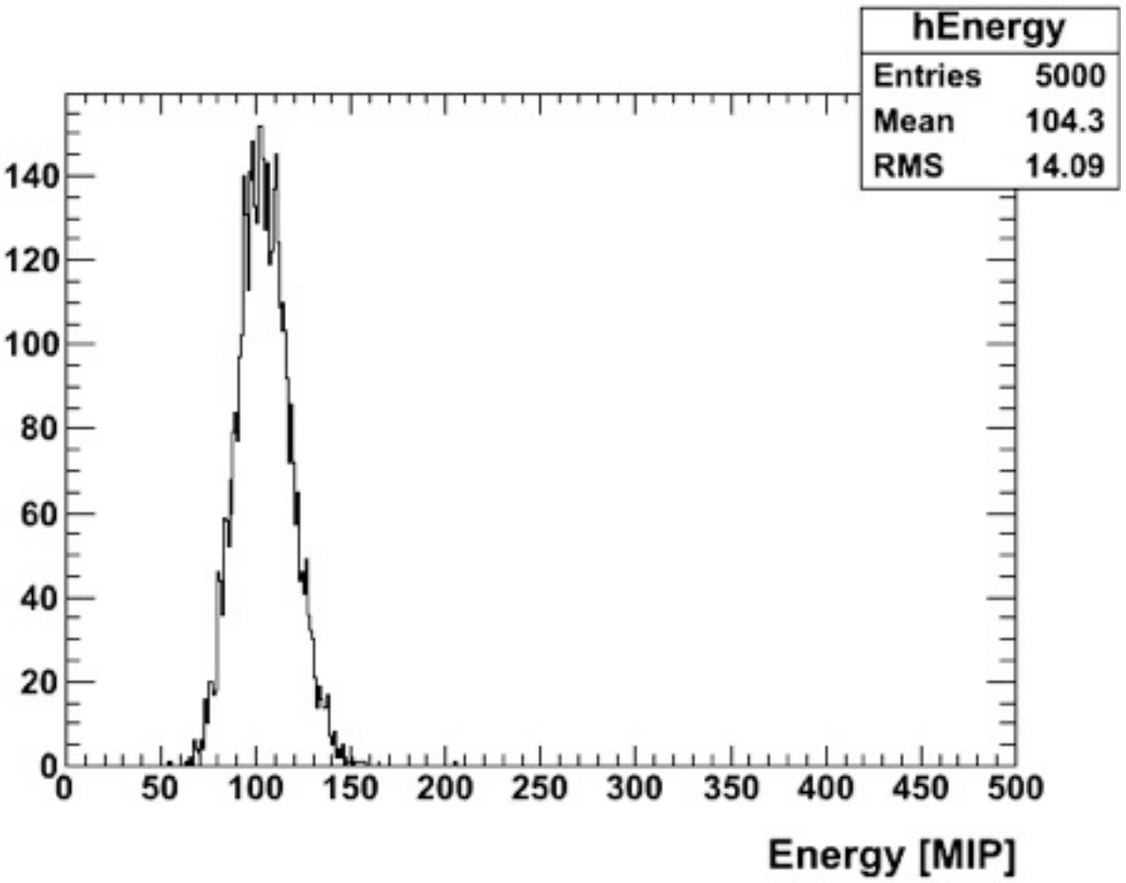
QGSP_BERT: e^-: 157 (<90>) π^-: 157 (<90>)

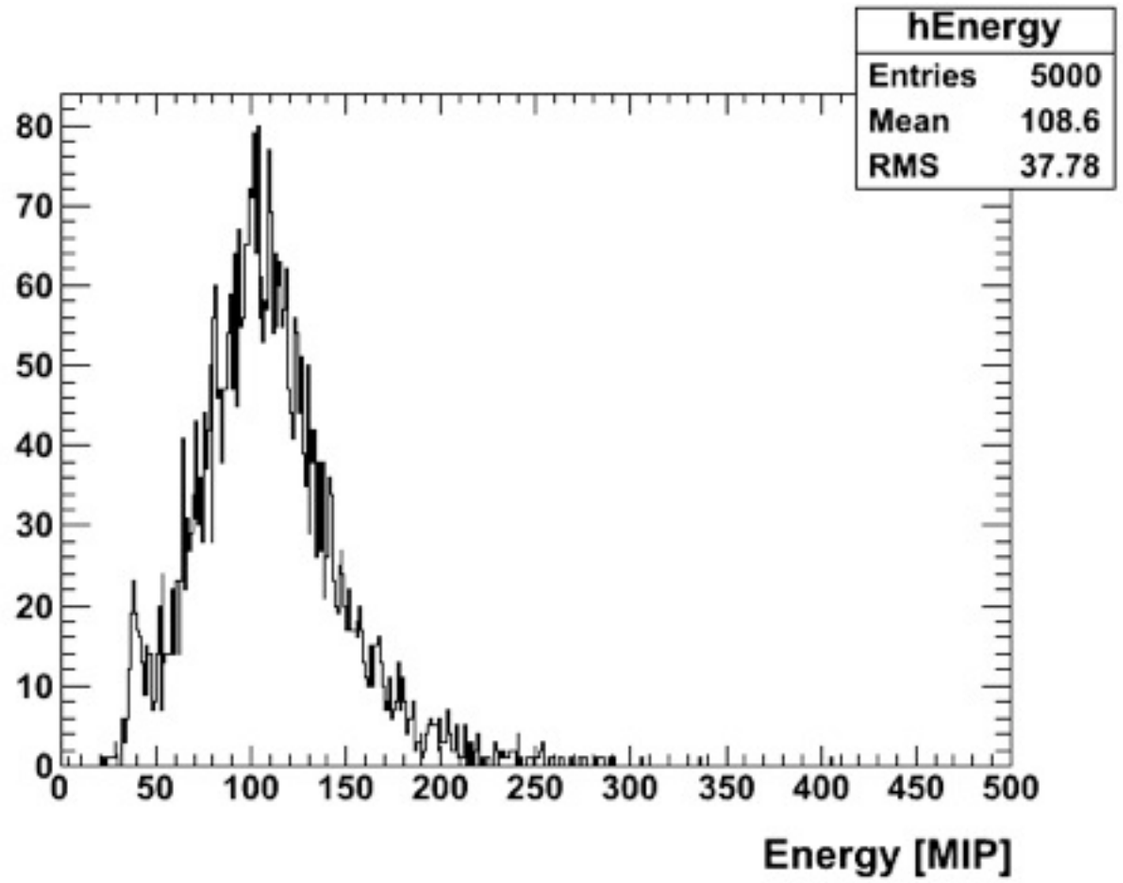
(with QGSP_BERT_HP: 152)

⇨ e/pi = 1.0 (1.03 HP)

Simulation Results: 4 GeV

- Simulations performed for 6 and 4 GeV negative (e^-, π^-), 5 k events each





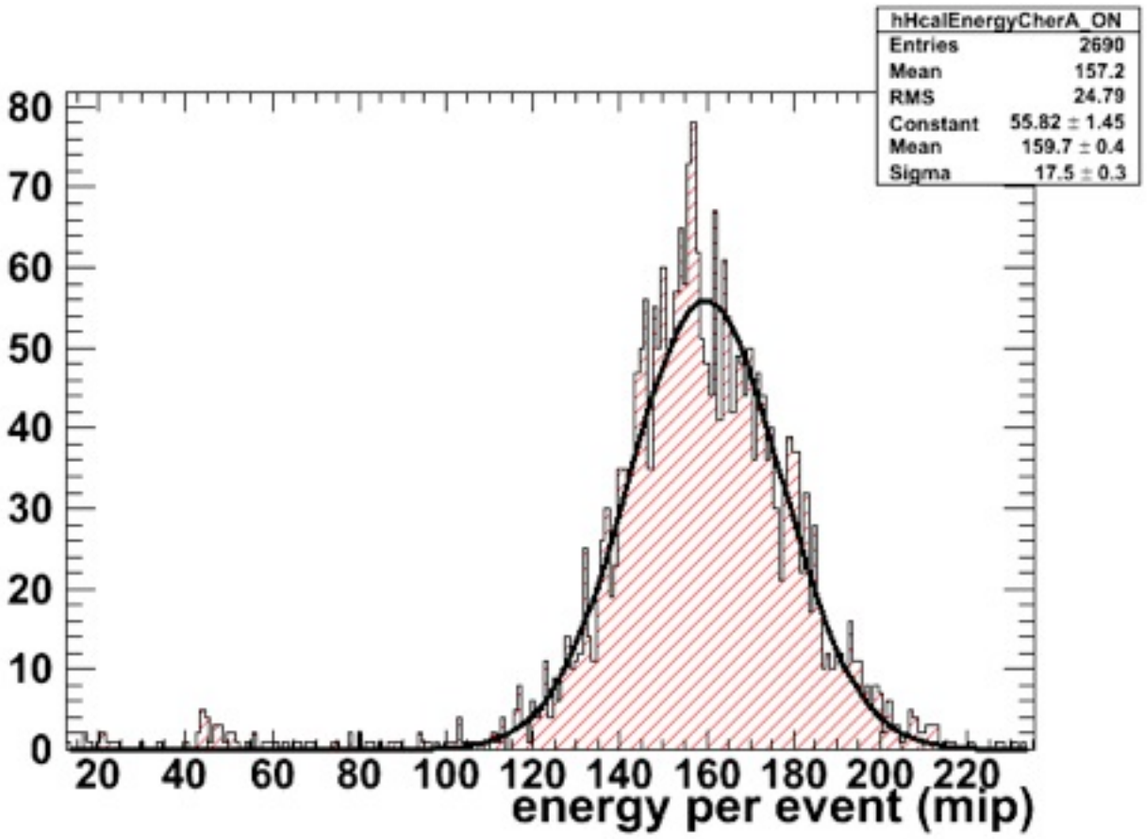
QGSP_BERT: e^-: 103 (<90>) π^-: 105 (<90>)

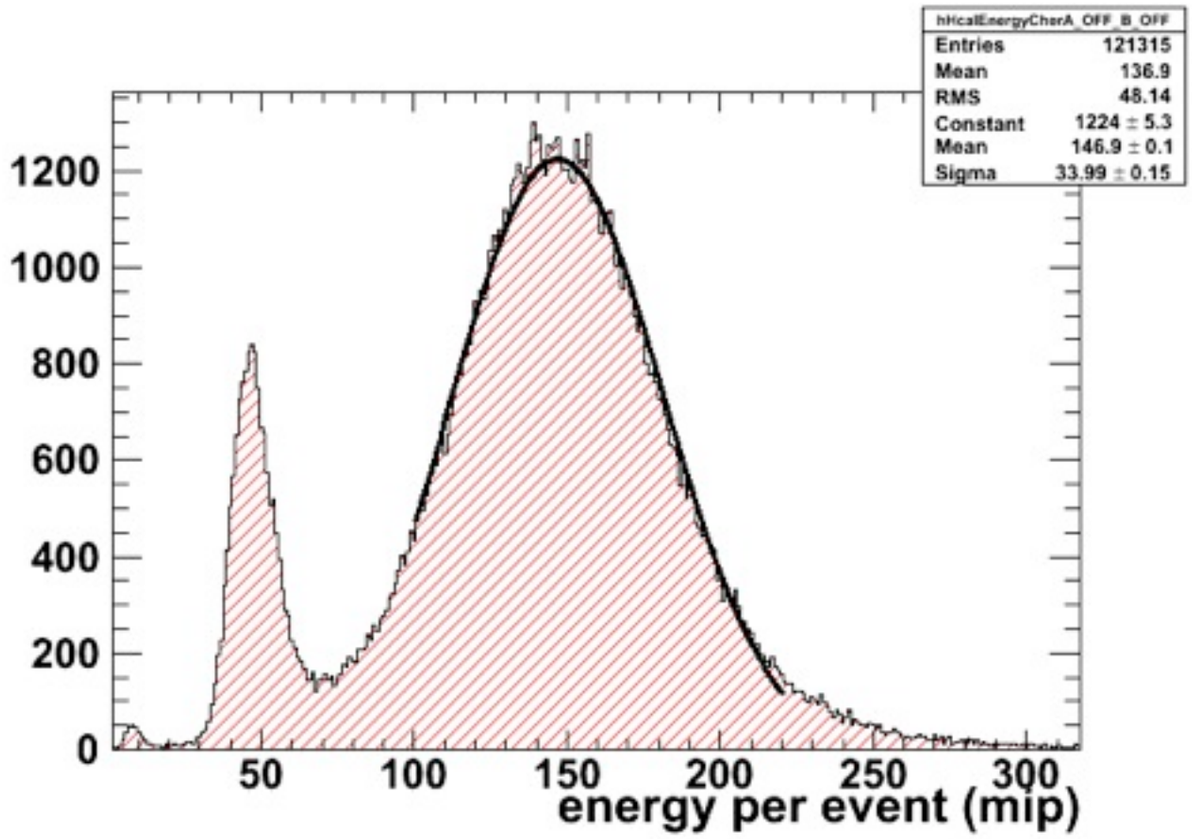
(with QGSP_BERT_HP: 99)

⇨ e/pi = 0.98 (1.04 HP)

Data: Online Histograms: 6 GeV

- Electron / Pion&Muon sample selected using Cherenkov





e^-: 159 (Gaussian mean)

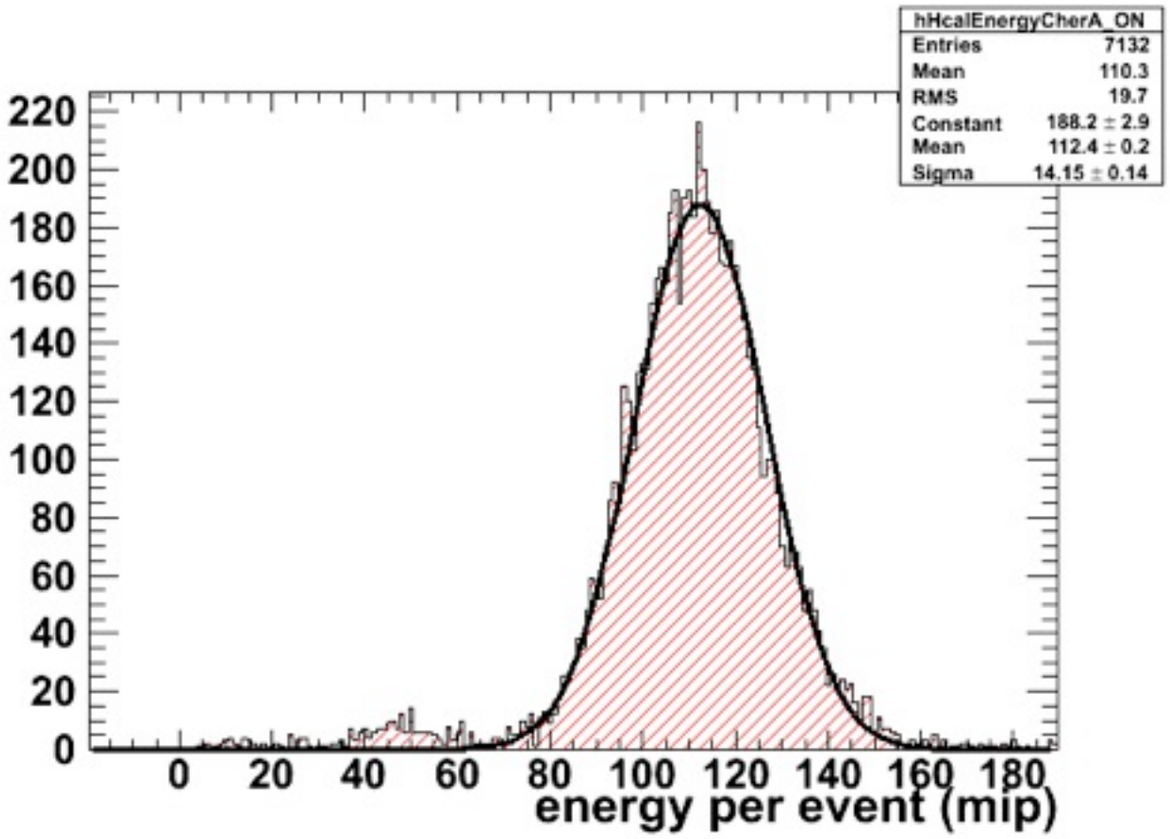
π^-: 147 (Gaussian mean)

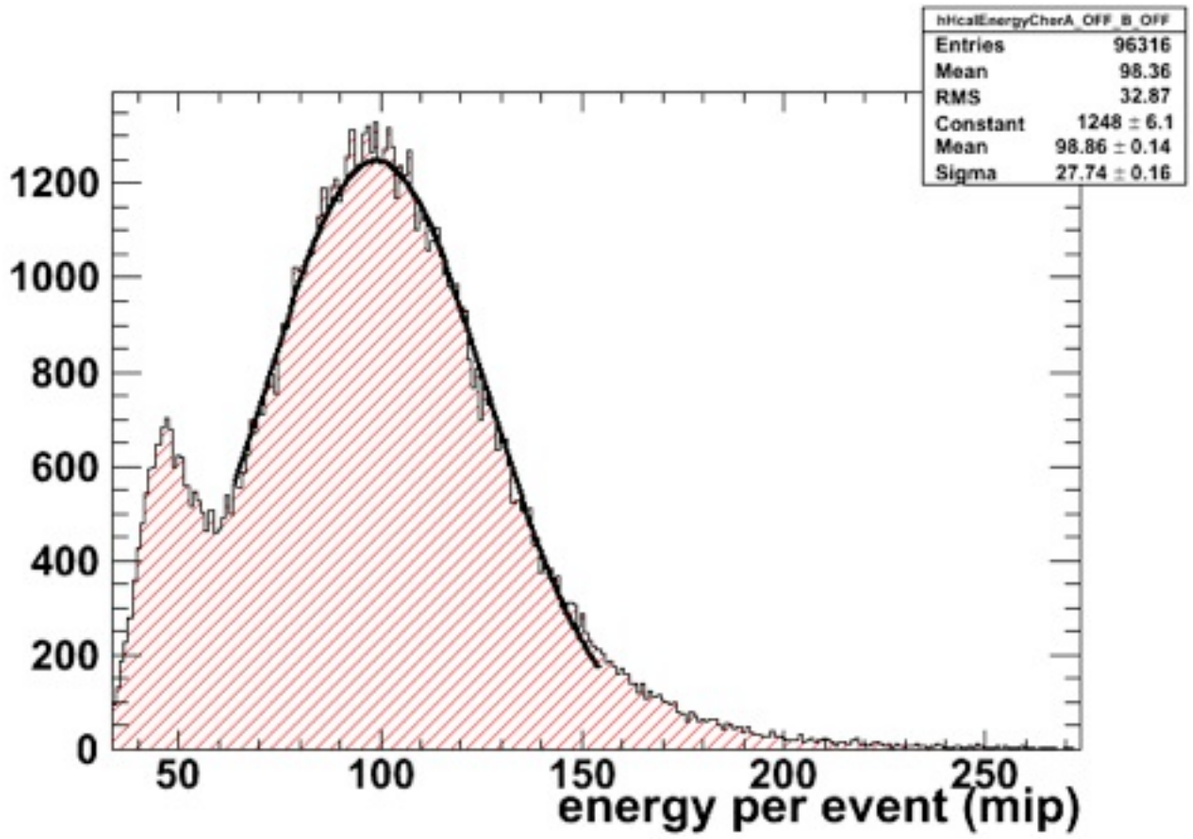
⇨ e/pi = 1.08

WARNING: Very preliminary, no calibration, no subtraction of noise, Muon ID...

Data: Online Histograms: 4 GeV

- Electron / Pion&Muon sample selected using Cherenkov





e^-: 112 (Gaussian mean)

π^-: 99 (Gaussian mean)

⇨ e/pi = 1.13

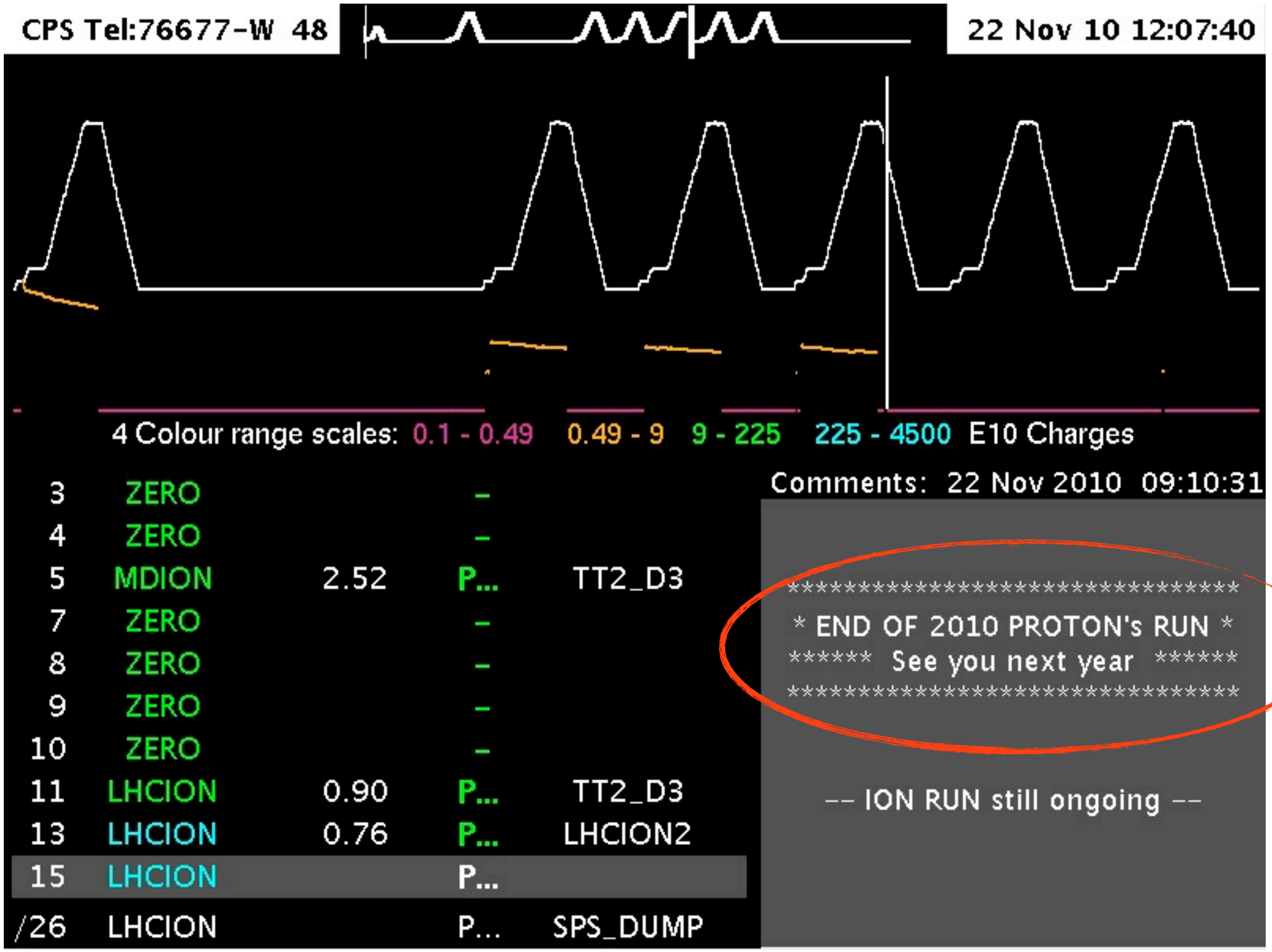
WARNING: Very preliminary, no calibration, no subtraction of noise, Muon ID...

Conclusion

- No Conclusion yet: A discussion starter!

- Electron & Pion energy reconstruction very interesting in the W HCAL!
  - Potentially a compensating calorimeter
  - A real challenge for the detector simulations!

More to come...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4 ZERO –
5 MDION 2.52 P... TT2_D3
7 ZERO –
8 ZERO –
9 ZERO –
10 ZERO –
11 LHCION 0.90 P... TT2_D3
13 LHCION 0.76 P... LHCION2
15 LHCION P...
/26 LHCION P... SPS_DUMP
Comments: 22 Nov 2010 09:10:31
* END OF 2010 PROTON's RUN *
****** See you next year ******
-- ION RUN still ongoing --