FCAL Clustering WG.
Meeting Minutes.
August 5, 2015.

Veta presented Update on TB shower development analysis at ISS:

- improved maximum method was used for signal analysis;
- electrons and muons discrimination made by cut on deposited energy;
- Signal from the low gain cahannels was corrected using the coefficient equals to 2.0;
- Plots and table with numbers of shower development for different configuration were presented.

During the discussion Marek pointed out that:

- it is important to use convolution Landau-Gaus fit for the calibration as it was described by Sergej;
- gain correction coefficient must be 2.27 (could be 2.17), and not 2.0;
- Maximum method used to extract the signal does not allow to get the correct amplitude of the original analog signal and it could introduce some bias to the analysis. It is important to use ether deconvolution or extract amplitude from the pseudo-gaussian (CR-RC) fit to the digitized pulse signal. The fit could be interesting approach to compare with the deconvolution method;
- It is essential to subtract the common mode noise.

Titi gave a talk on a method for muon-electron discrimination in the LumiCal test-beam

- It was shown that center of gravity of LumiCal hits provides an excellent discrimination between electrons and muons.

After the general discussion on BT analysis Marek agreed to distribute some recipe which are crucial for correct signal extraction and produce comparable results. I was sen in two e-mails after the meeting and the text is also attached hereafter.

Oron presented an Update on LimiCal Alignment and MIP Position Reconstruction.

- η variable, which is the charge fraction collected by one of two LimiCal sensor pads, as a function of particle position with respect to those two pads was reconstructed using the track position information from the telescope;
- The transition area of η-function ranges from 300 μm to 500 μm for different planes;
- It was shown that transition region of η-function can be used for LumiCal sensors alignment.

During the discussion it was suggested to check for comparison similar plots received previously during the beam tests with single LumiCal sensor.

Next meeting was scheduled to take place on August 26, at 4pm (CEST).

TB data analysis essentials from Marek are on the next pages.

Dear All,

I was asked to write/remind what should be a minimal set of
steps/procedures for the shower analysis of our last TB.
First of all: everybody can and should put all her/his best ideas in the
analyses, so this email is absolutely not to constrain your ideas!!!
The points which I'm giving below are aimed mainly in obtaining the
results (done by different persons) which can be comparable.
I'm not saying that this is the only correct way and that we will not
change it - BUT NOW WE WOULD LIKE TO MAKE COMPARISON BETWEEN
THE DATA/MC ANALYSES DONE BY DIFFERENT PERSONS, and for this some common
assumptions are needed.
Most of the steps/procedures were already agreed during the last HWG
meeting so it is partially a reminder.

1. Regarding data cleaning steps:
- pedestal subtraction. Everybody is free to do her/his own procedure.
But please do this step, and even better please let us know how you did
it. As an example: Jakub does it event-by-event using first 15 (noise)
samples to get pedestal for each channel. I have not asked Veta today,
but I had an impression that Veta was calculated a constant value of
pedestal-per-channel per-run(s) (am I right Veta ?)
- mean common mode subtraction. From Jakub's analyses I saw that it is
very big effect in our data so we should really do it.

2. Regarding front-end parameters:
- the ratio between the gains of high/low gain channels is:
  -- 2.17 if we take it from the front-end design parameters
  -- 2.27 was obtained by Jakub from the muon data analysis.
So please, either find yourself the right one analyzing the muon data,
or use one of the two mentioned above.

3. Pulse amplitude:
- each procedure is good assuming that it does not introduce systematic
error
- so deconvolution seems to be good
- fitting the ADC samples (Tsample=20ns) to analog pseudo-gaussian
(CR-RC) pulse shape seems to be good. Our pulse is described as:
   A * (t/tau) * exp (-t/tau), for our front-end: tau~70ns
- taking the maximum ADC sample is less good because the ADC sampling
clock is not synchronized with experimental trigger
and so the samples are not taken in the same phase of the front-end pulse

4. Regarding shower development:
- to obtain the gain of the electronics (number of ADC counts per MIP or
number of ADC counts per 4fC) for muon data, please use the Landau&Gauss
fit and extract the MPV (MIP) from the Landau part.
Since it was discussed between Strahinja and Sergej that this Landau MPV

from CERNLIB is systematically shifted, for the Landau part of the fit please use the "corrected" procedure as explained by Sergej. I'll add Sergej's email at the end of this email.
Again, Titi - I'm not saying that this is the best way (in the future we can decide to change it) - but since we know that
changing type of the fit systematically changes the results, we need the same fit to be able to compare the results.
- in electron shower analysis to be fit-independent, our reference plot should use the average energy deposited per plane on the "Y" axis

Let me know if something is not clear or whether I have forgotten something...

Thanks and Regards,
marek

ps. below the copy of the relevant part of Sergej email:

Concerning CERNLIB "Landau" function. In fact it is some parametrisation function of one variable. People introduced "MPV_Landau" and "sigma_Landau" the following way:
y = (x-MPV_Landau)/sigma_Landau - 0.22278298 and calculate library "Landau" function substituting y value
as an argument. This way 2 parameters appear. In addition the third parameter, normalisation, is usually used for the fit.
When "corrected" y value is used, the function has maximum at MPV_Landau (see attached plot where par(1) = MPV_Landau = 3 and par(2) = sigma_Landau = 1).
So indeed as you mentioned, library function was left as it is, with systematic shift, but standard fit programs use above mentioned correction to account for this effect. I will try to find references to some examples. As a result, there is no difference between "true" MPV of the distribution and the "MPV Landau" parameter. The advantage is that you do not need to use extra maximum finders or some other routines, you have already an estimate of the MPV and, if fit program works properly, correct estimate of the MPV error