FIRST EVO Meeting 6 2 2014

ToF-Wall Analysis

F. Balestra, F. Iazzi, R. Introzzi

INFN PoliTO

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Overview

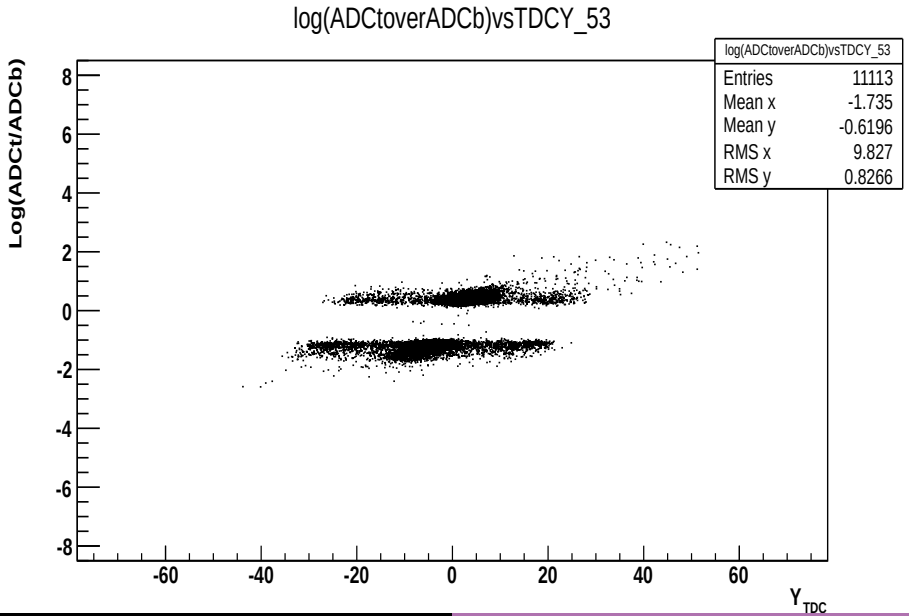
What are we studying? Y_{ADC}

For single channel calibration, the quantity Y_{ADC} has been introduced:

- $Y_{ADC} = \frac{1}{2\alpha}\left(\log\frac{ADC_t}{ADC_b} + \log\frac{\epsilon_b}{\epsilon_t}\right)$
  (where ADC_t and ADC_b are considered after the pedestal subtraction) depending on two parameters:
  - α: the slat attenuation coefficient;
  - gain ratio: $\frac{\epsilon_b}{\epsilon_t}$.

If we look at the slats with the hole, we notice that this variable, compared to Y_{TDC}, has a better resolution.

$$(Y_{TDC} = \frac{v_{light}}{2} * [(TDC_b - TDC_t) + (\Delta_t - \Delta_b)])$$



The idea: Y_{ADC} in HlReco

Is it possible to use Y_{ADC} in HlReco to obtain a better track matching??
To understand it, it is necessary, at first, to calibrate Y_{ADC} independently from Y_{TDC} (at the contrary of what we have done until now).

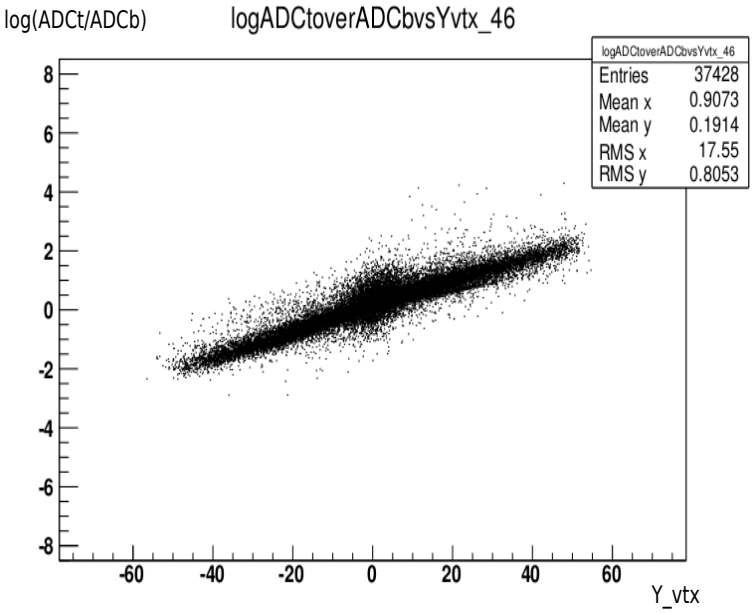
- To do that we have to find, slat by slat, the two calibration parameters:
  - α;
  - gain ratio.

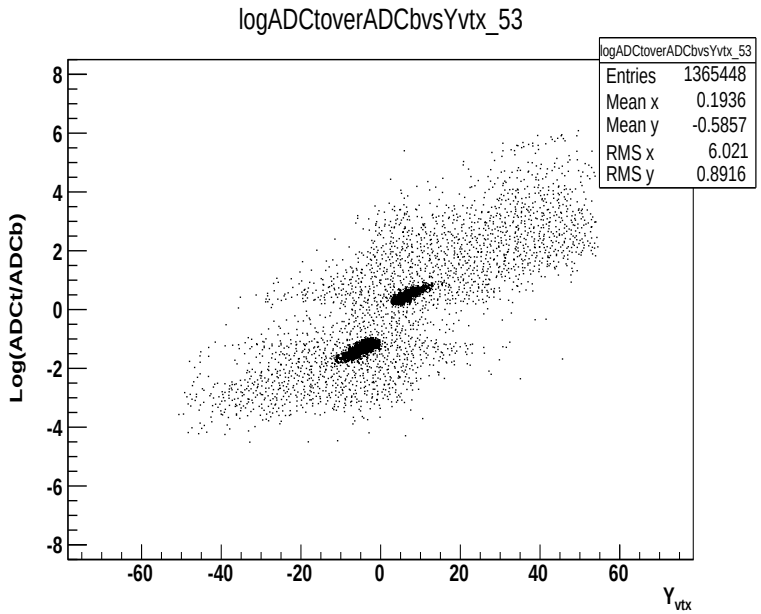
The variable we used to perform this calibration is Y_{vtx} i.e. the Y component of the projection of the VTX track on the ToF-Wall (after matching).

Y_{ADC} calibration

To calibrate Y_{ADC} we started from plots of log(ADCt/ADCb)vsYvtx (in HlRecoTools.cc):

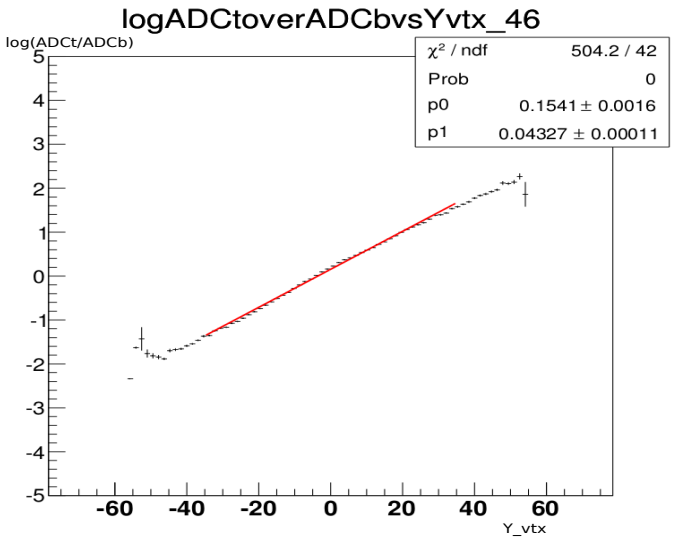
- selecting all the tracks with VTX-BM matching i.e. no pile-up;
- checking if the tracks belong to the same vertex;
- checking if the vertex is good.

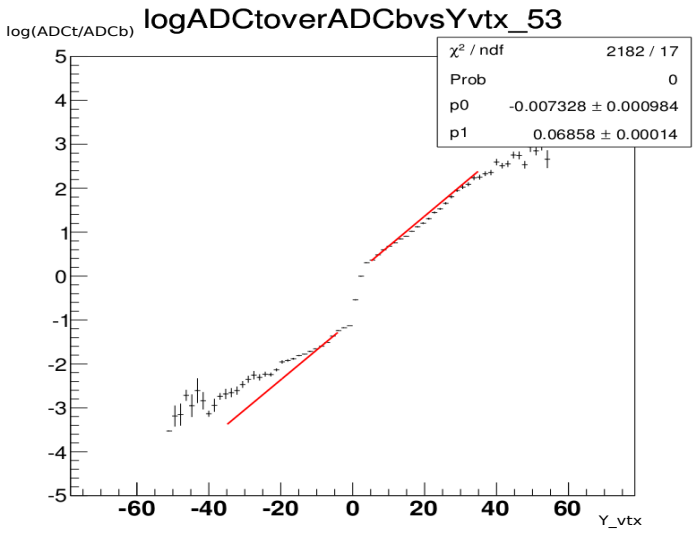




The calibration parameters are retrieved from a ProfileX of the previous plots:

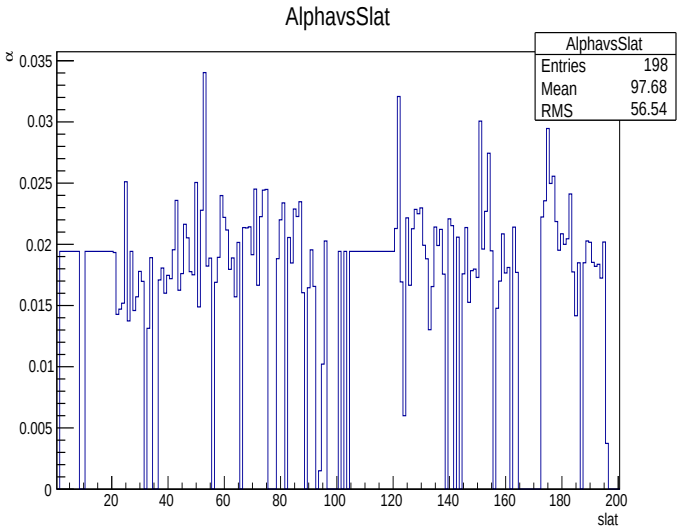
- α is the slope parameter p1 divided by 2: α=p1/2,
- the gain ratio (Gratio) comes from the constant parameter p0: Gratio=exp(p0).

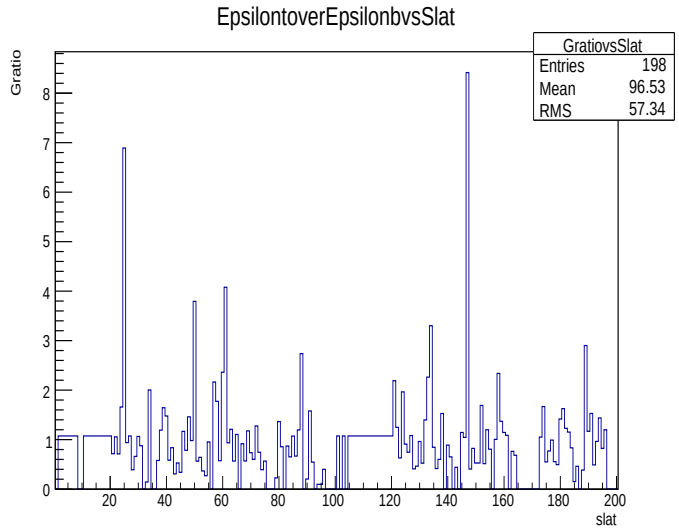




For central slats (52,53,54) with the hole and for other problematic slats (51 and 151) in which a discontinuity seems to be present,
we implemented a discontinuous fit above and below the gap.

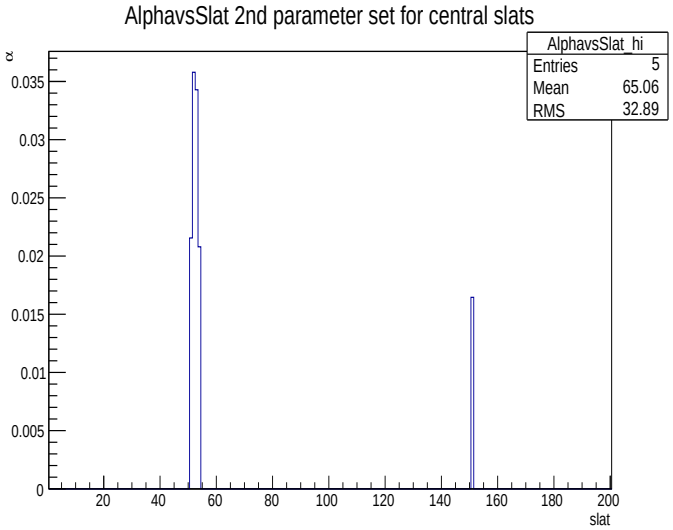
In this way, we obtain the values of α and Gratio for each slat and we insert them in two histograms.
These histograms, for the slats with a double fit, contain the fit values of the part below the discontinuity.

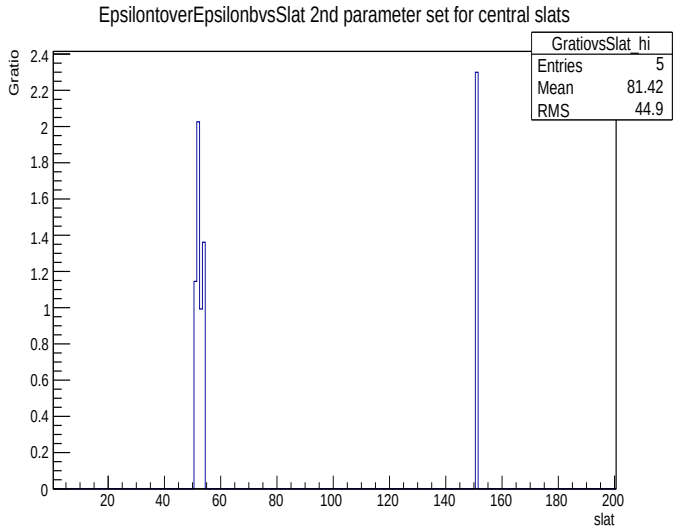




The mean value of the parameters has been used in those slats in which the statistic was not sufficient to perform the fit.

For the slats with a double fit, we produced another set of histograms containing the fit values of the part above the discontinuity.





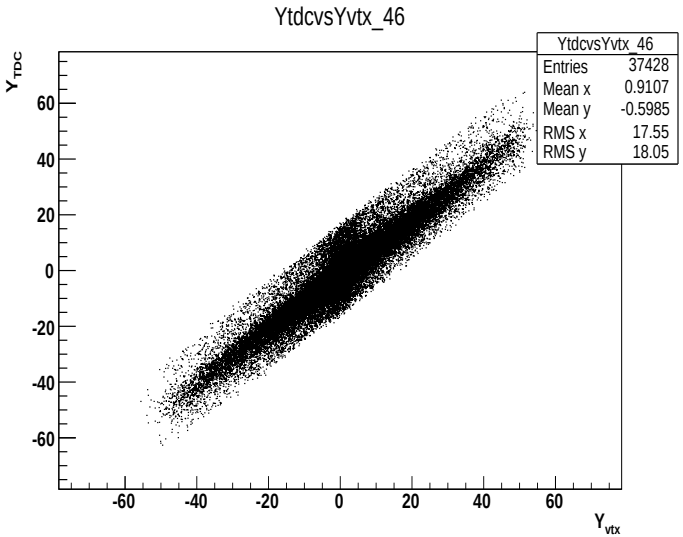
These histograms are used, at present, into TATactNtuRaw.cxx for the Single Channel Calibration (Y_{ADC} and ADC_b, ADC_t).

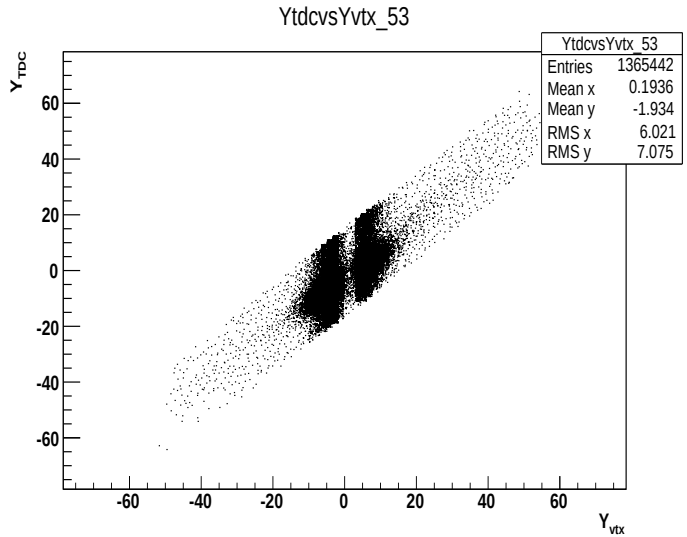
What are we studying? Light speed slat by slat

A procedure completely analogous to the one used to find α and Gratio allows to calculate the light speed v_{light} in each slat.
To find v_{light} we started from plots of Y_{TDC} vs Y_{vtx} (in HlRecoTools.cc):

- selecting all the tracks with VTX-BM matching i.e. no pile-up;
- checking if the tracks belong to the same vertex;
- checking if the vertex is good.

$$Y_{TDC} = \frac{v_{light}}{2} * [(TDC_b - TDC_t) + (\Delta_t - \Delta_b)]$$

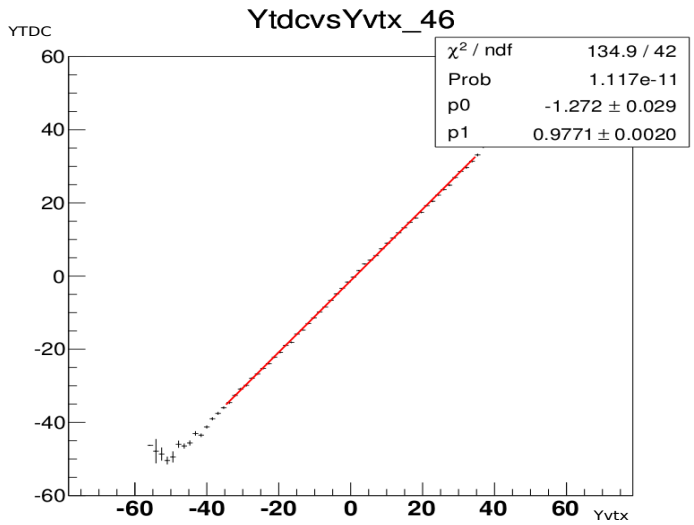


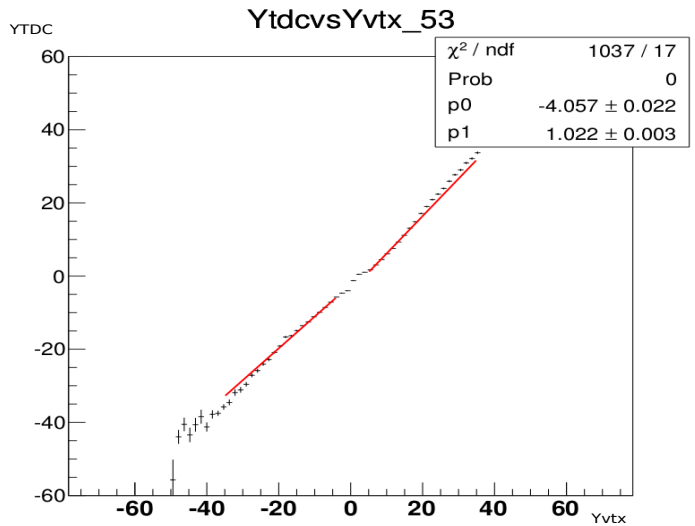


Light speed evaluation

The light speed values are retrieved, for each slat, from a ProfileX of the previous plots:
calling $v_{0;light}$ the value of the light speed measured for some slats (one for each Front-Wall module) at GSI using ^{90}Sr (and performing an average):
$v_{0;light} = 15.7\ cm/ns$

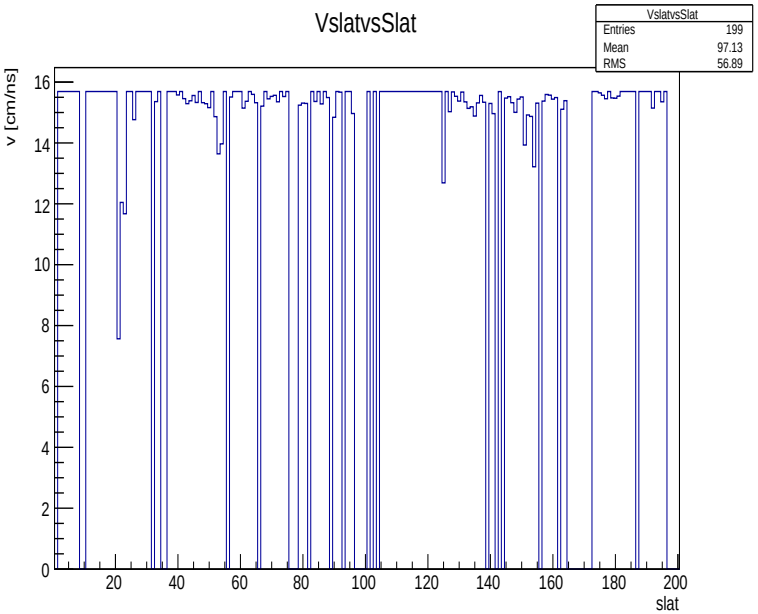
- v_{light} is the slope parameter p1 multiplied by $v_{0;light}$: v_{light}=p1*$v_{0;light}$

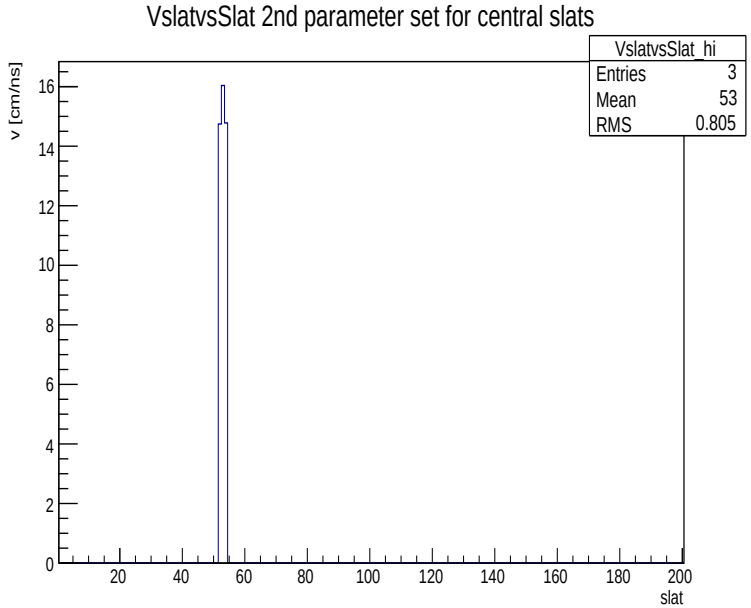




For central slats (52,53,54) with the hole, we implemented a discontinuous fit above and below the gap.

In this way, we obtain the values of light speed for each slat.
As before we produced two sets of histograms:



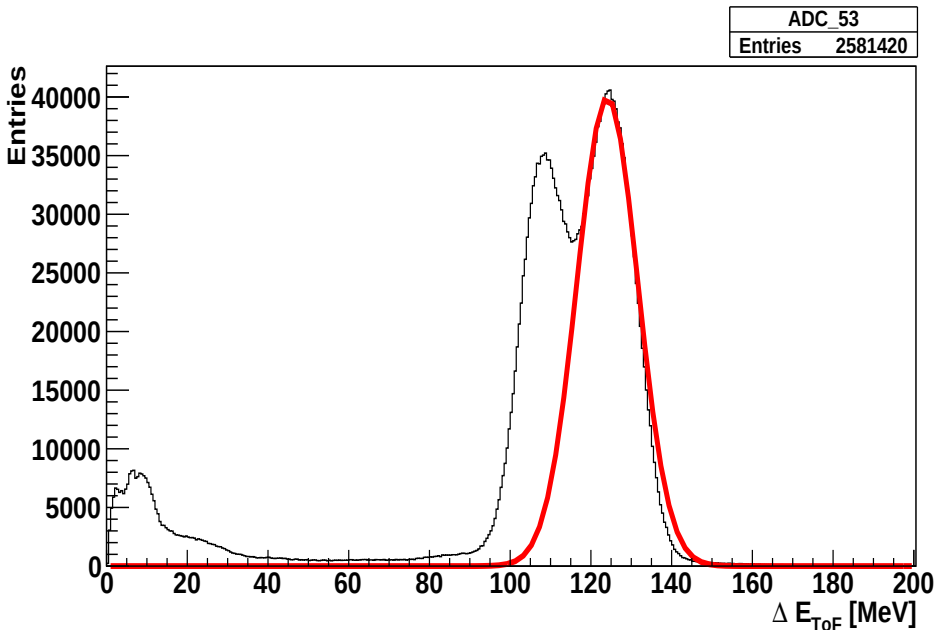


In slats in which the statistic was not sufficient to perform the fit, the value of $v_{0;light}$ has been set.
These histograms are used, at present, into TATactNtuRaw.cxx for a better calculation of Y_{TDC}.

Works in progress

Some evaluation/recalibration have still to be completed:

- evaluation of the Y_{ADC} resolution (using the error propagation from the measured quantities);
- Eloss recalibration for slats with the hole (52, 53, 54), recalculating the Birks' parameters (L0 and kb) using single channel $light_t$ and $light_b$.



THE END

Thanks for your attention