Calocube collaboration meeting
Firenze, 20/06/2014

Analysis update

by

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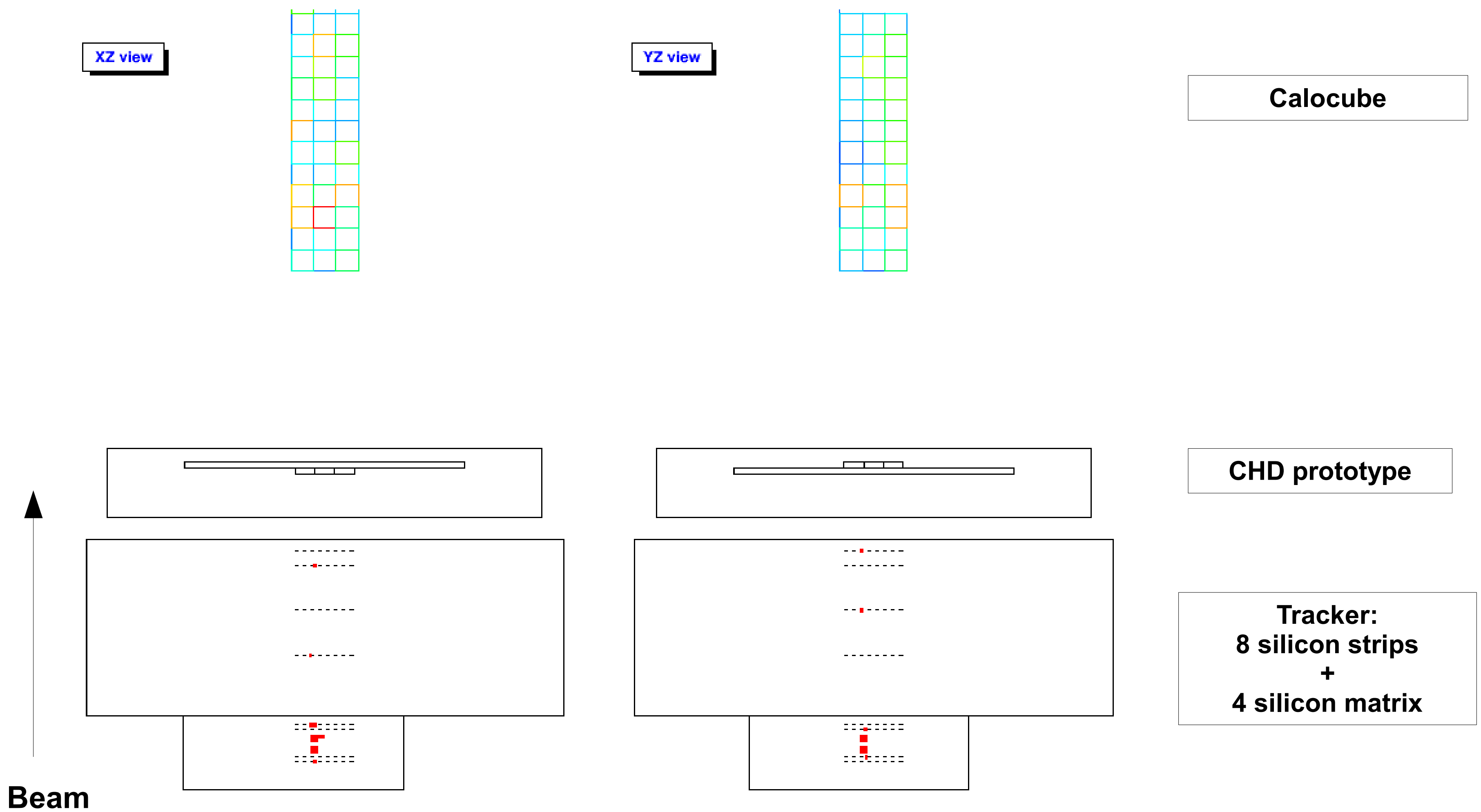
Experimental apparatus



Data Sample

13 GeV/n lead fragments beam

20130205-152105_s1_r2.root 16k

20130205-161701_s1_r2.root 100k

20130205-175320_s1_r2.root 172k

20130205-235059_s1_r2.root 44k

20130206-005803_s1_r2.root 7.5k

20130206-041733_s1_r2.root 12k

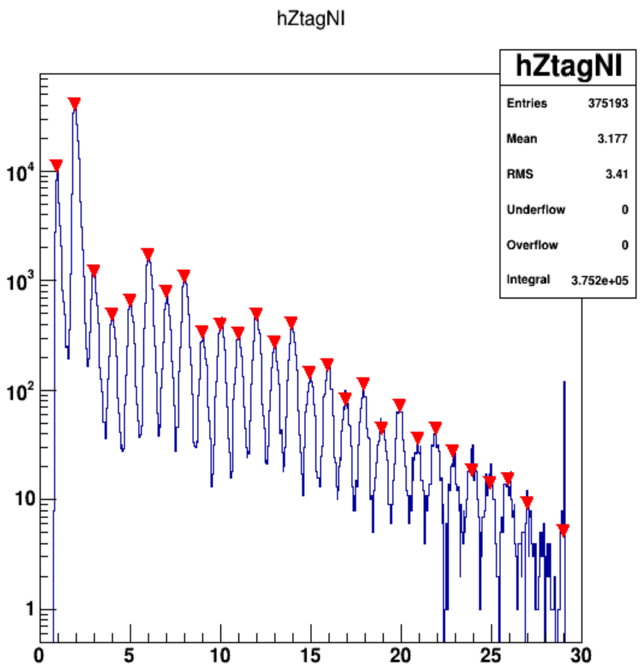
20130206-051503_s1_r2.root 100k

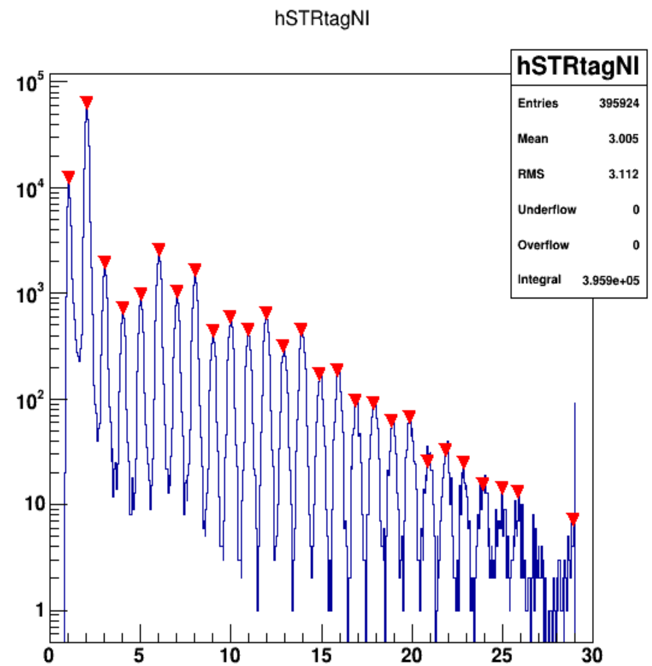
20130206-063921_s1_r2.root 100k

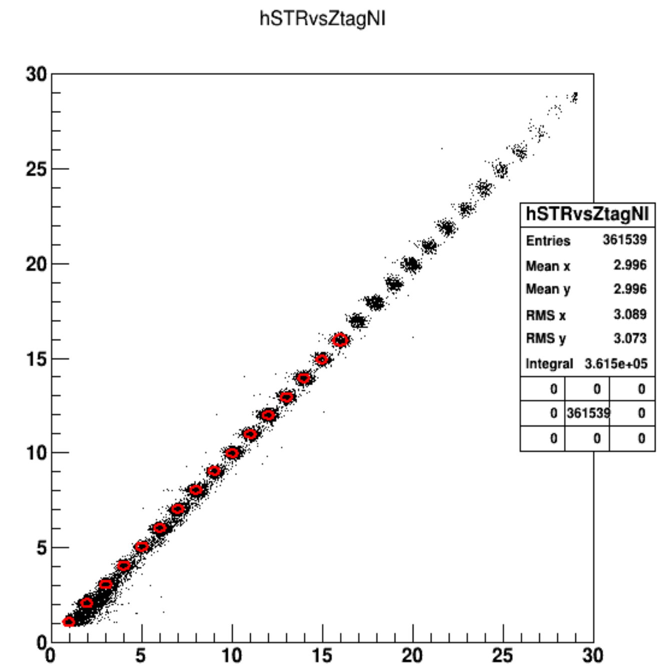
20130206-075811_s1_r2.root 68k

Charge Tagging

with Silicon strips & Matrices







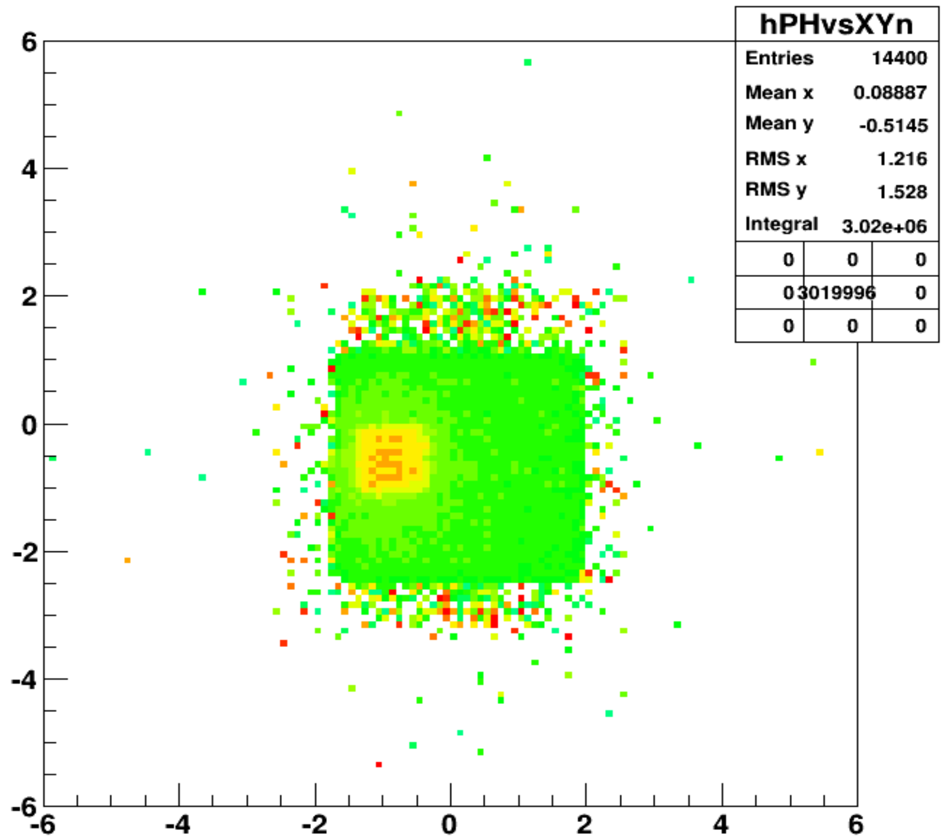
The ion charge has been reconstructed using the signals of 4 silicon matrices (plot on the left) and up to 8 silicon strips (plot at the center);

to select an extremely pure sample of each ion the two measures have been combined in a 2D plot (on the right);

an elliptical cut has been applied

Single Cube response:

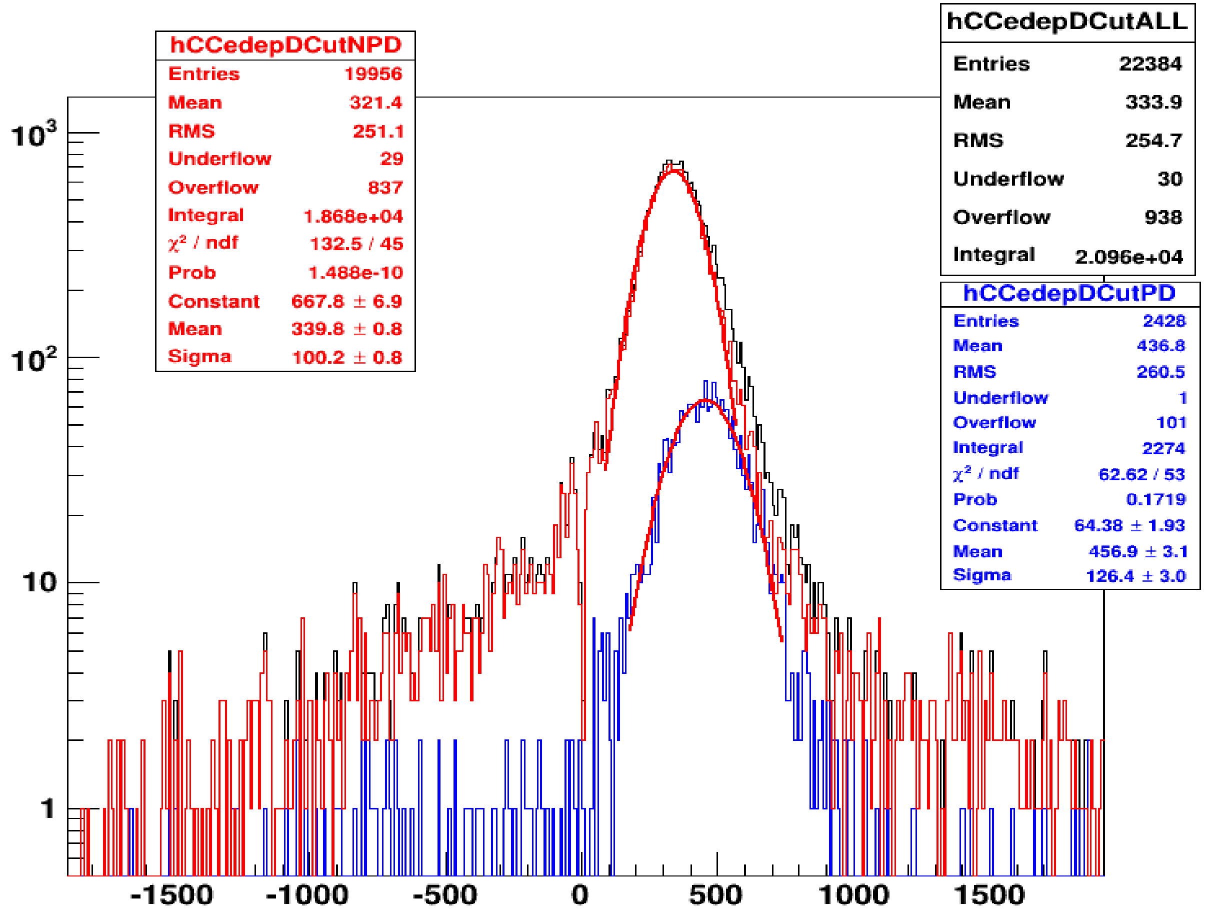
in order to reconstruct the charge with calocube we studied the single cube signal as a function of particle entry point



Mean signal in central cube of first layer vs particle impact point coordinates (reconstructed by Si strip tracker): we can see clearly a signal excess in the photodiode position;

in the following analysis we exclude events in which the beam particle crosses the photodiode

Photo diode effect (1): Deuterium signal distribution

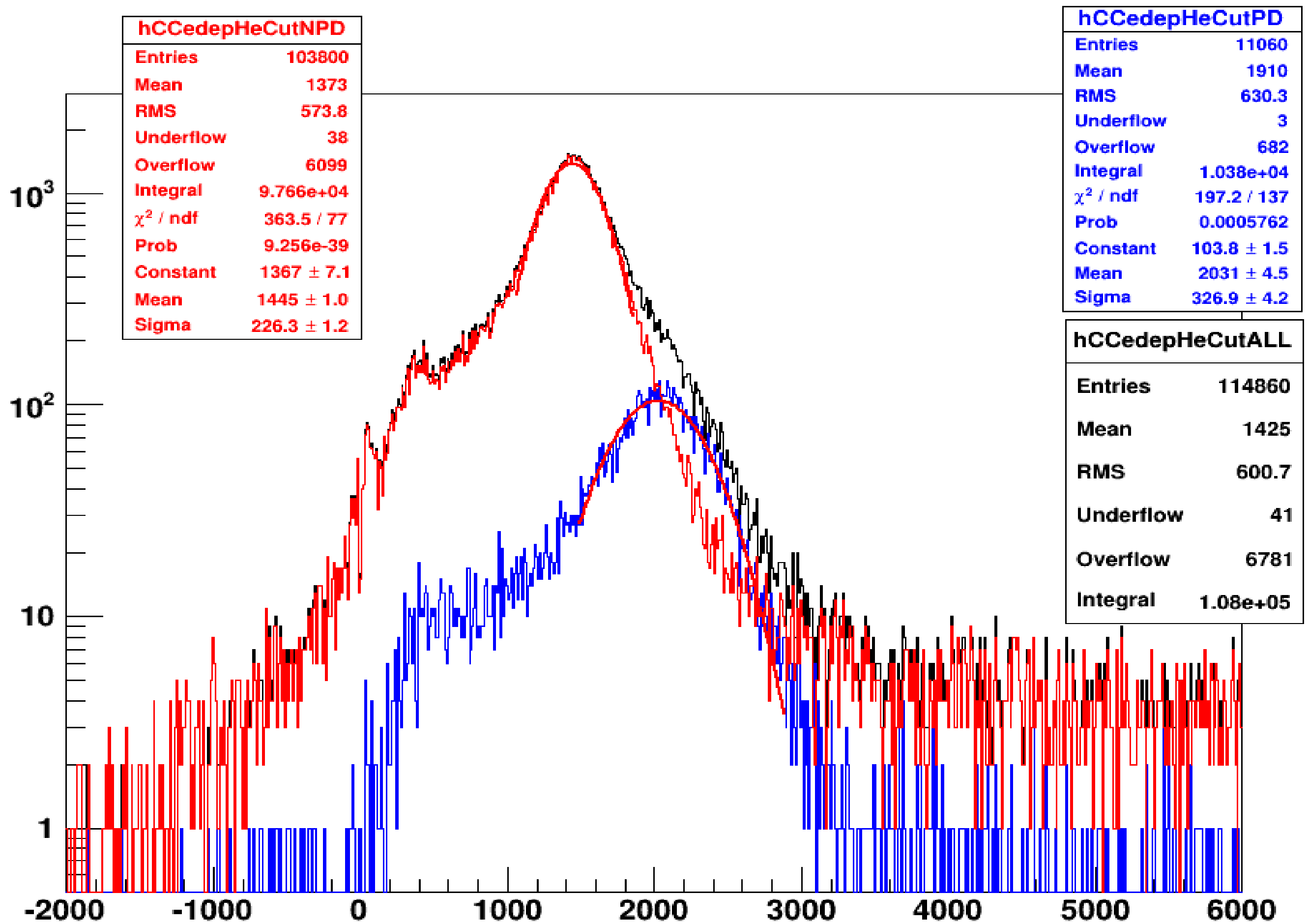


Single cube energy deposit distribution:

- Black line: all signals
- Red line: beam particles not crossing the photodiode
- Blue line: beam particles crossing the photodiode

$$\frac{PH\ \ photo\ diode - PH\ without\ PD}{PH\ without\ PD} \simeq 0.34$$

Photo diode effect (2): Helium signal distribution

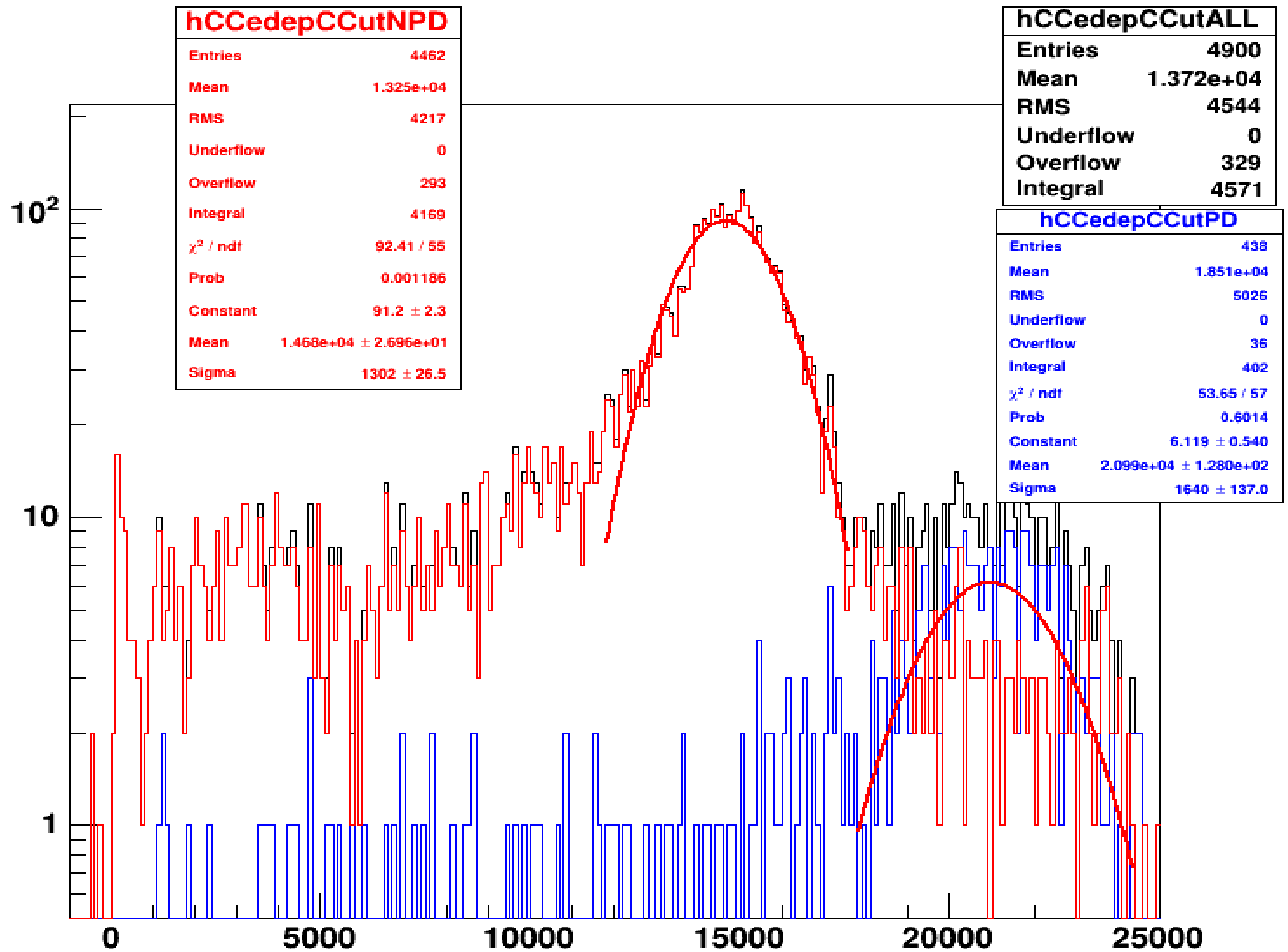


Single cube energy deposit distribution:

- Black line: all signals
- Red line: beam particles not crossing the photodiode
- Blue line: beam particles crossing the photodiode

$$\frac{PH\ \ photo\,diode - PH\ without\ PD}{PH\ without\ PD} \simeq 0.40$$

Photo diode effect (3): Carbon signal distribution

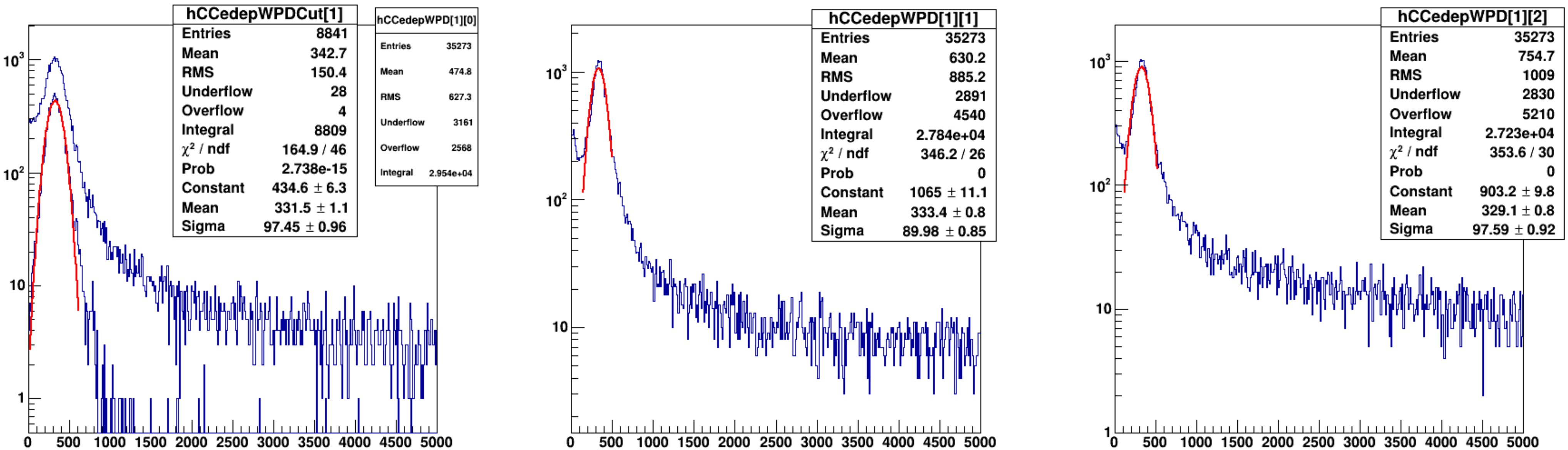


Single cube energy distribution:

- Black line: all signals
- Red line: tracks don't cross the photodiode
- Blue line: tracks cross the photodiode

$$\frac{PH\ \ photo\, diode - PH\ without\ PD}{PH\ without\ PD} \simeq 0.43$$

Not Interacting nuclei selection (1): deuterium

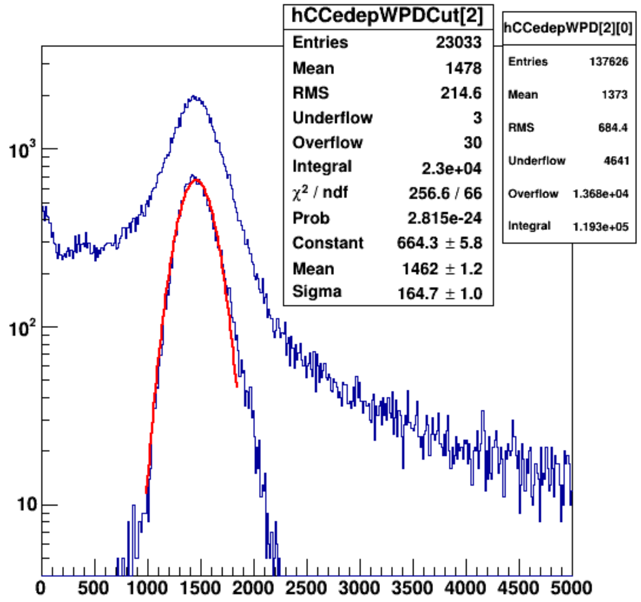


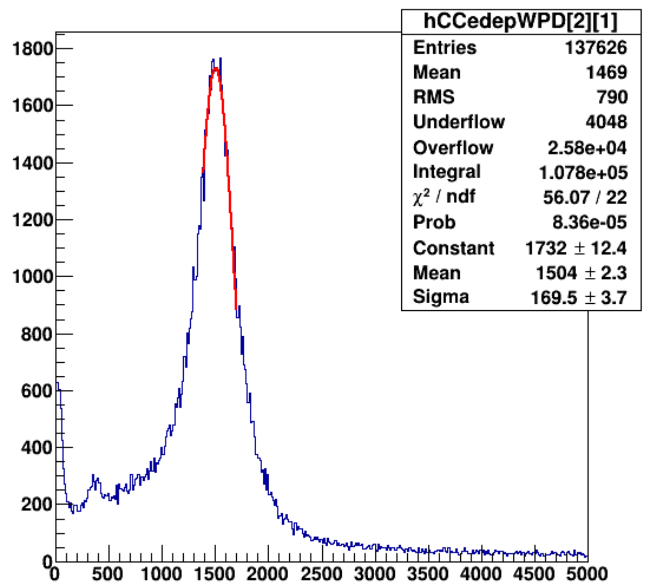
We selected a sample of particles (for each chemical species) impinging the central cube of first layer of the calorimeter (excluding the photo diode region);

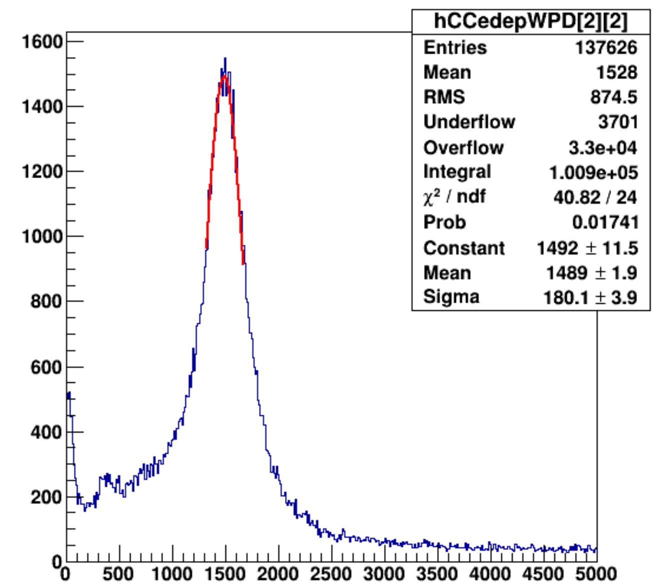
To extract from the energy deposit distribution in the cube (upper line on the plot on the left) the not interacting ion signals, we applied a cut around the MIP peak on the central cube signals of second and third layers (plot on the center and on the right);

The final plot (lower line in the plot on the left) has been fitted by a Gaus function;

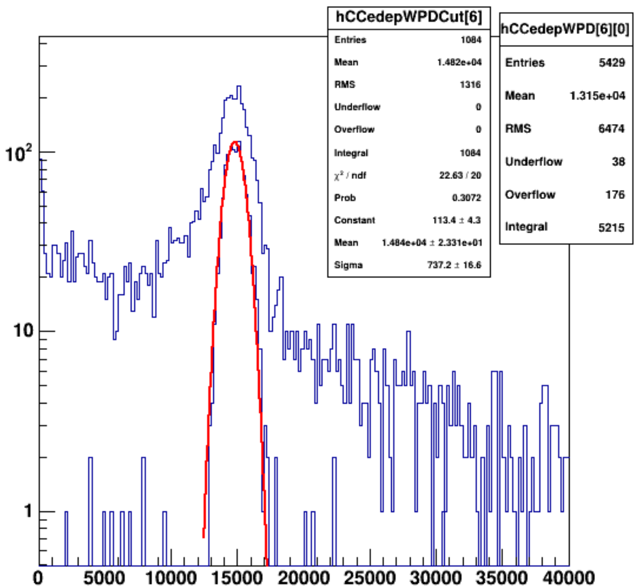
Not Interacting nuclei selection (2): helium

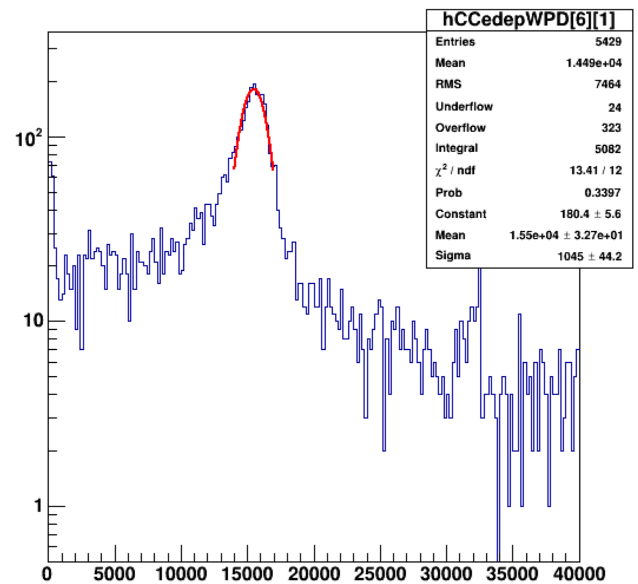


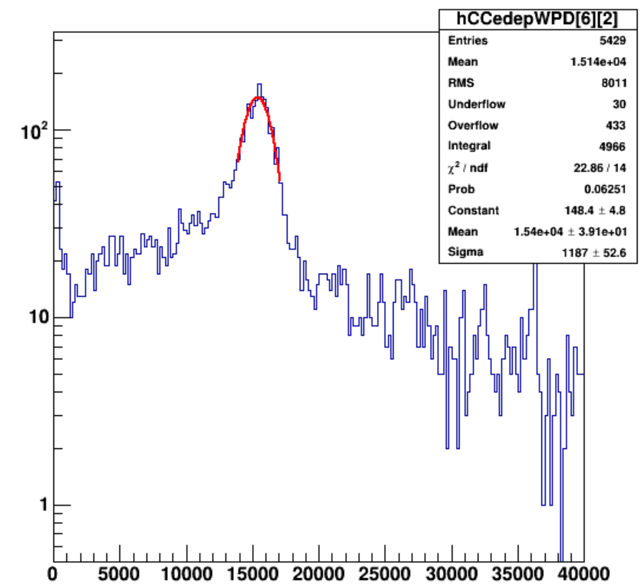




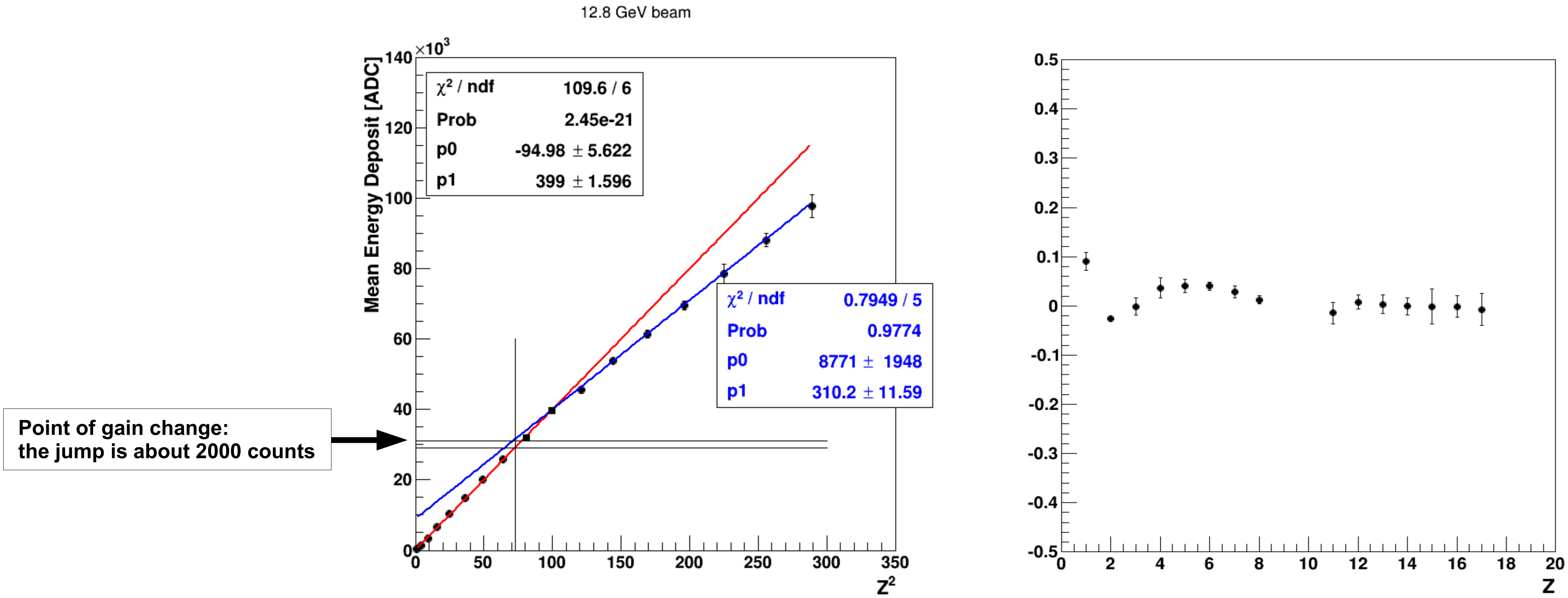
Not Interacting nuclei selection (1): carbon







Mean energy deposit vs Z^2



We calculate the mean MIP signal for each chemical species (from deuterium up to chlorine);

The two electronics gains have been stitched using the formula:

High gain signal scale = (low gain signal)*19.93 – 2000;

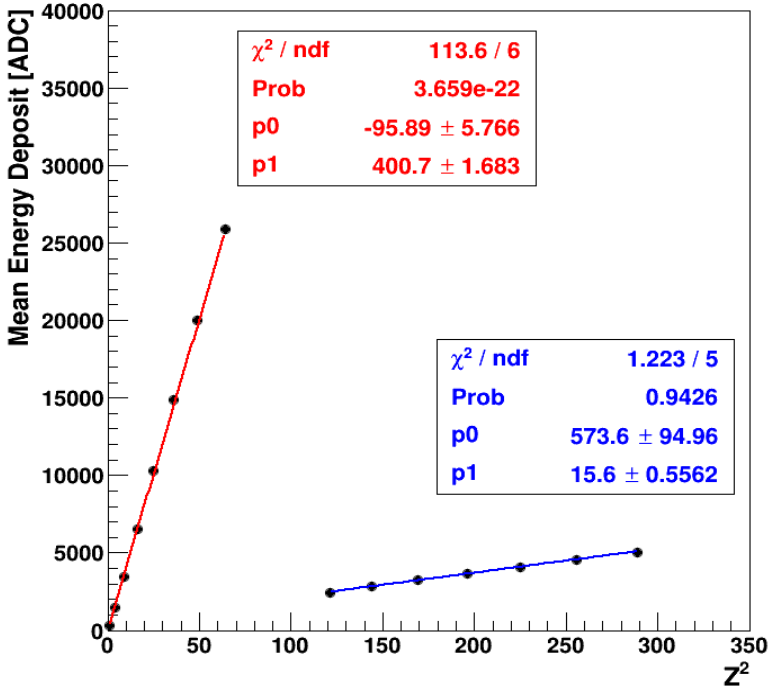
The mean energy deposit has been plotted versus Z^2 (plot on the left):

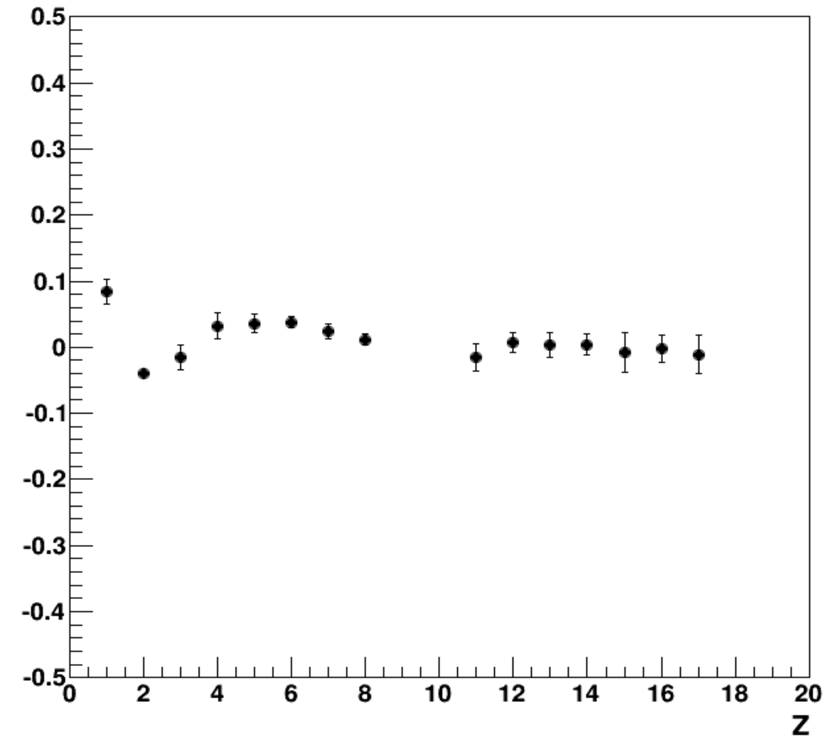
Around charge Z=9/10 we can see clearly a break;

Two linear fits have been performed: from Z=1 up to Z=8 and from Z=11 up to Z=17;

The residuals have been reported in the plot on the right.

Mean energy deposit vs Z^2

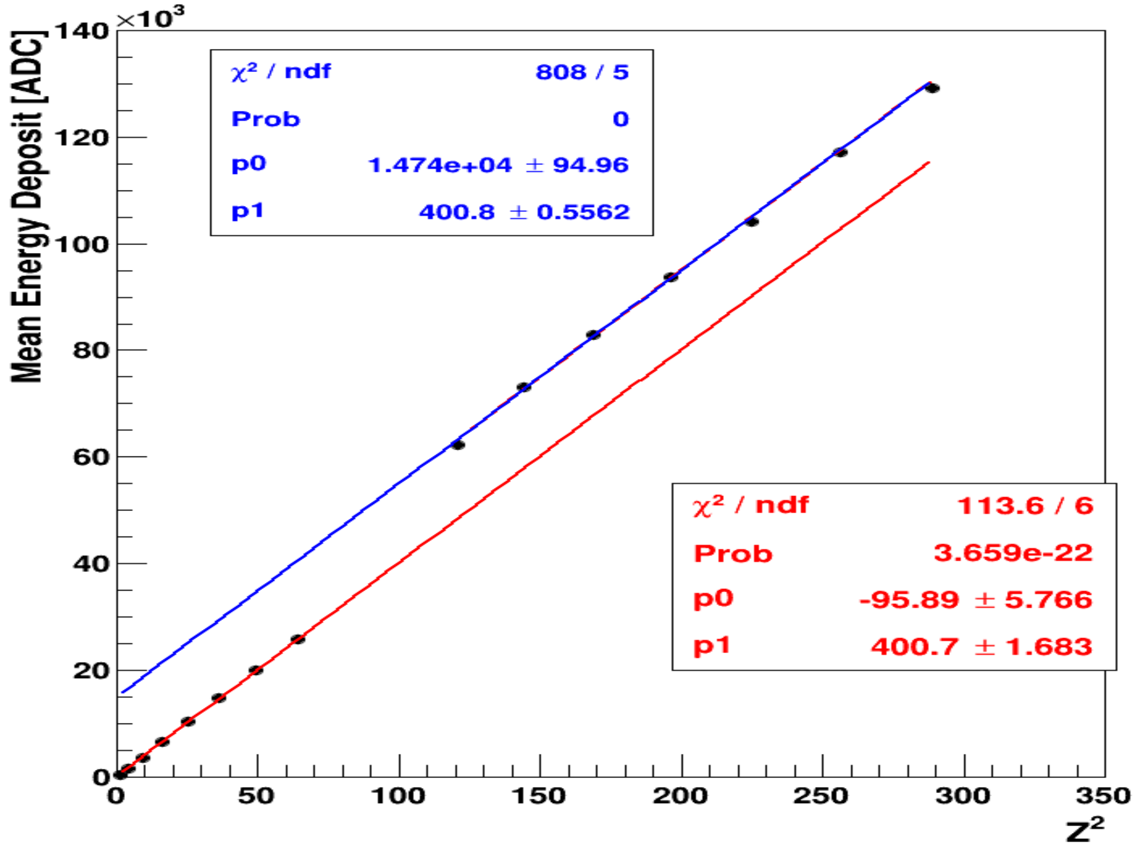




We plot mean ion signal versus Z^2 separately in each electronics gain without stitching;

Two linear fits have been performed (residuals on the right).

Two gains parallelization

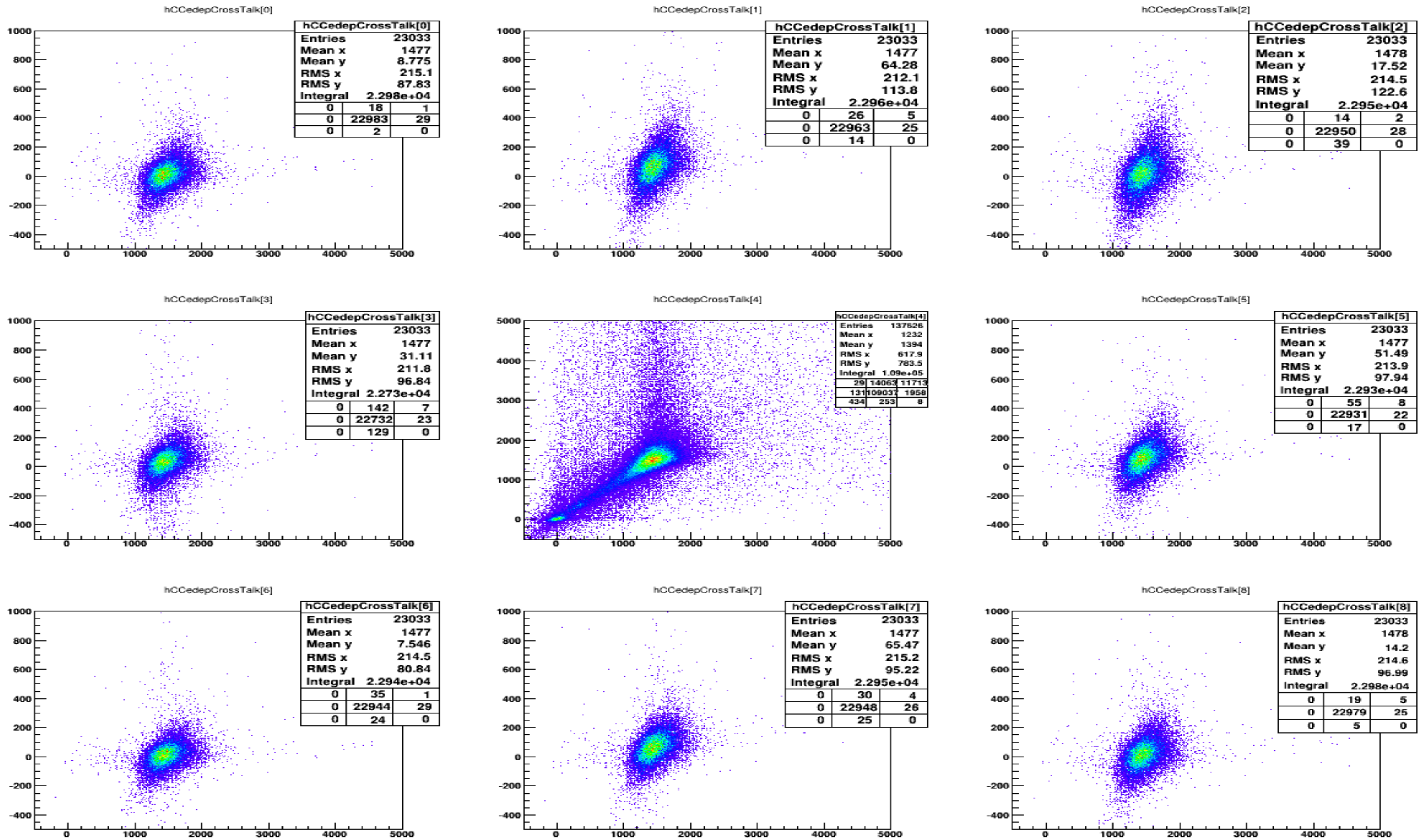


We tried to make parallel the two fitted lines;

To do this it is necessary to multiply the high range curve (blue line) by a factor equal to 25.7;

This value is different from value measured in lab (19.93)

Cubes Cross Talk (1): Helium

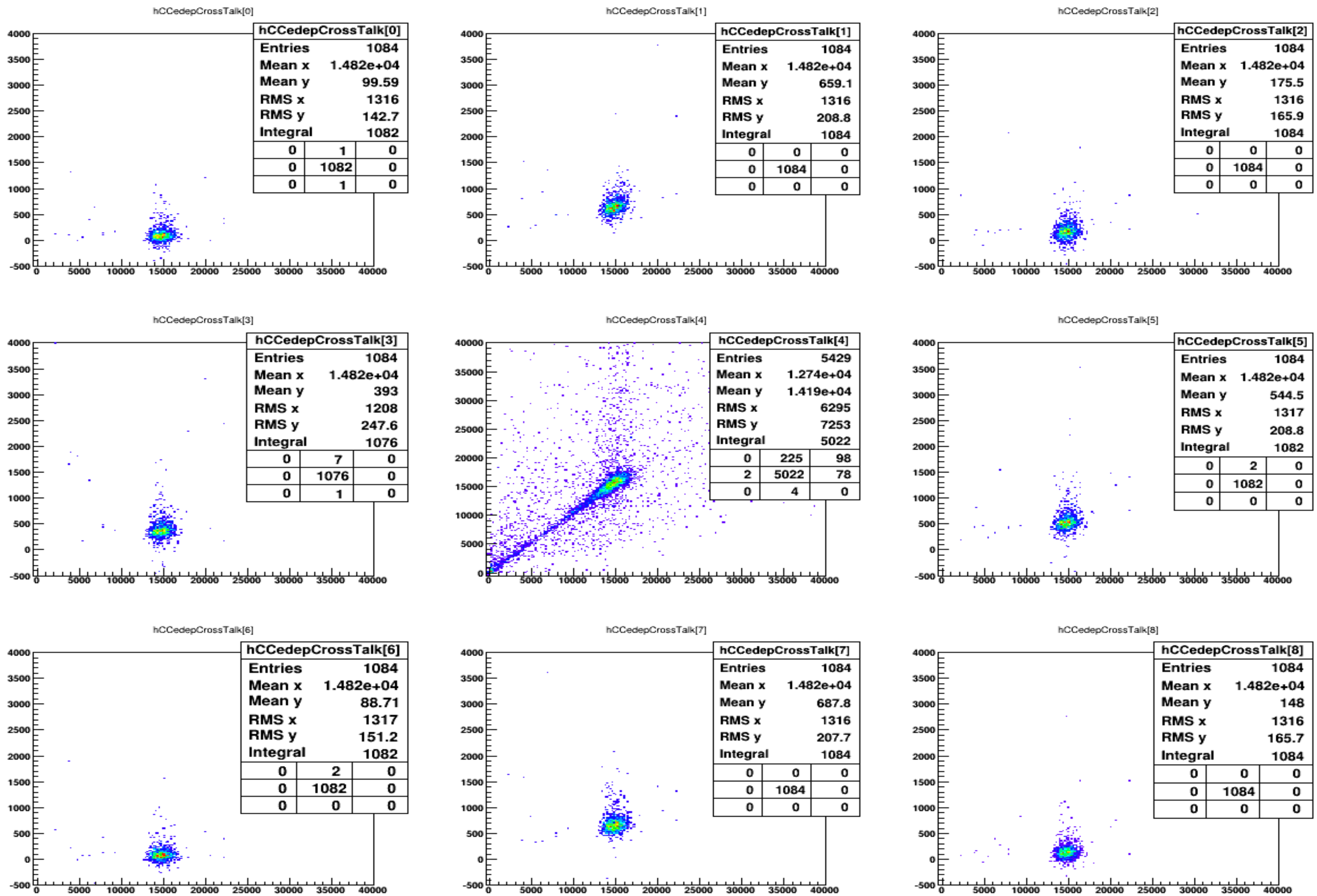


To find a solution for the problem, we studied the cross talk in the first layer;

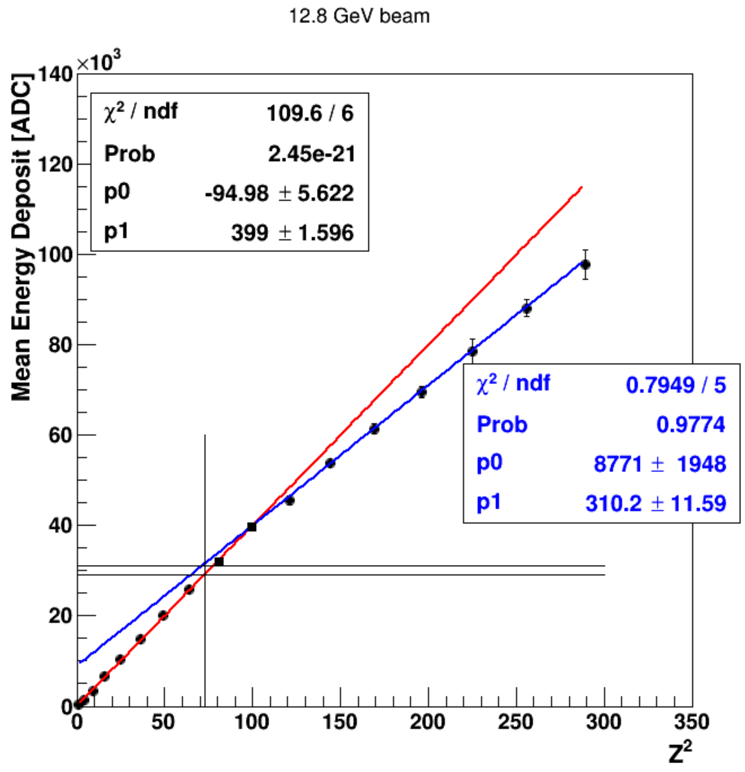
we report the correlation plots between the central cube signal (X) and the signals of the other cubes (Y) in the same layer (the plot in the center shows the correlation between second layer central cube and first layer central cube);

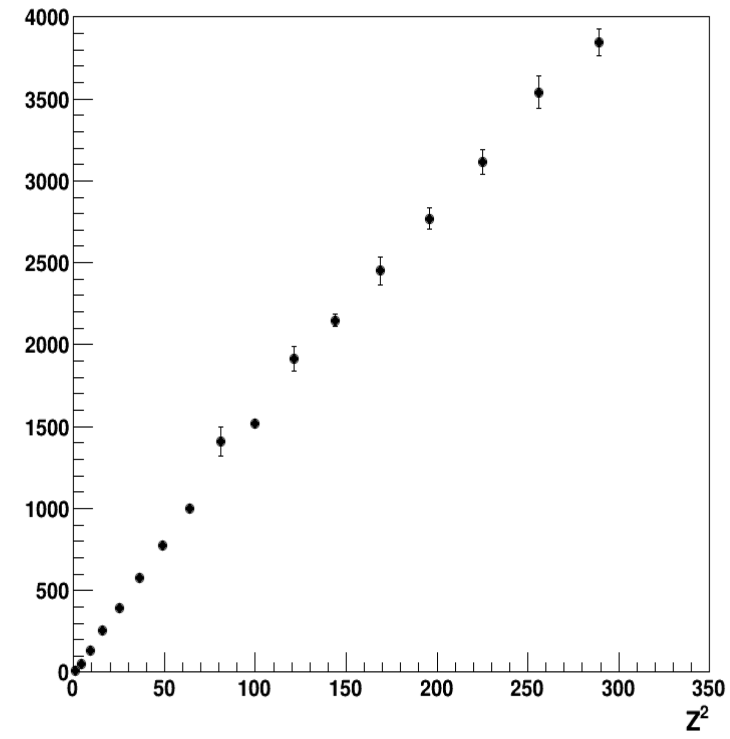
A cross talk signal is evident in the 4 lateral cubes (see also the next slide)

Cubes Cross Talk (2): Carbon



Cross Talk vs Z²





We calculated the mean of the signals of lateral cubes for each chemical species;

We plotted the cross talk signal versus the Z² (on the right);

A break, similar to the previous plot (on the left), is clearly visible in the same region (Z=9/10);

The crosstalk signals are always below the level of electronics gain change (~29000 counts)

Conclusions

The change in the slope of the cube response function seems to be due to a physical effect and not to a chenge in the electronics gain;

Quenching effect in the crystals for High Z nuclei?