Tracking reconstruction, edge effects and cross-talk

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Track reconstruction methodology

1. Tracking:

- DigXs and DigYs have been took for all telescope planes
- Hits number/plane = 1
- Reconstruction of the track – has bee done so that the residual to the measured points (x1,y1,z1), (x2,y2,z2) and (x3,y3,z3) is minimum (track reconstruction method is an approximate one). Sigma from fits are smaller than about 30μm
- The Si chamber alignment was make with a maximum 100microns shift

2. Signal:

- Condition for signal (already used in precedent analysis):

MAXC(pad_nr)>Eped (pad_nr) + coef*RMS(pad_nr), we used coef = 3

I. Merging data from FCAL data acquisition and TelAna output

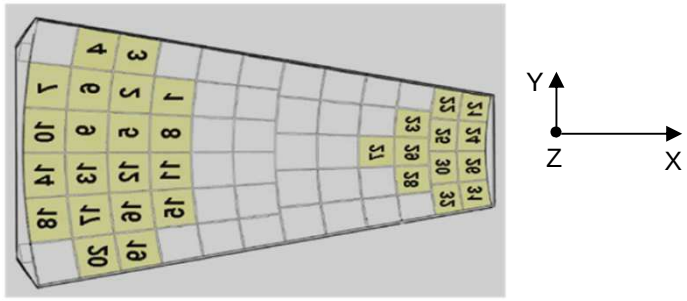
I.1. Methodology:

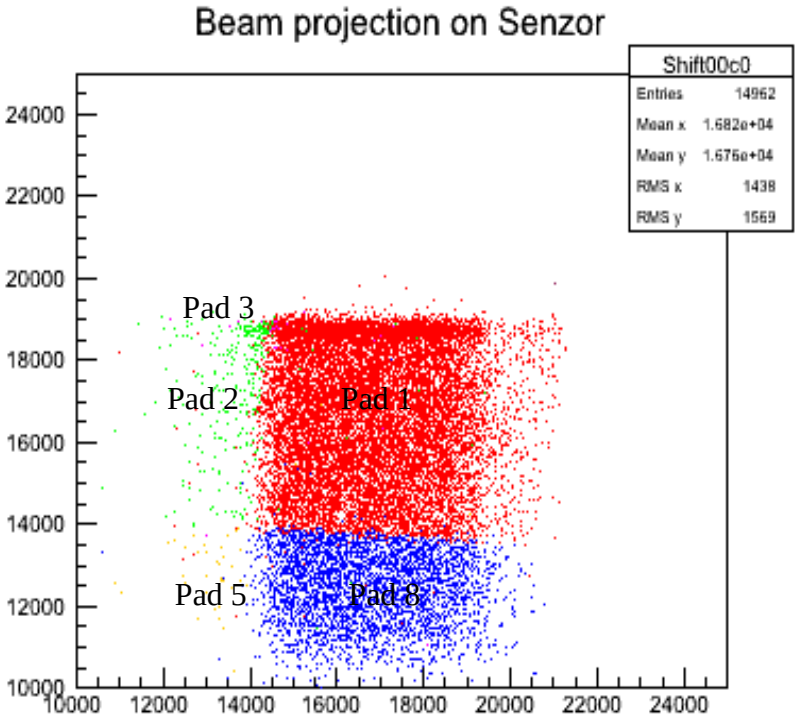
1. Each trigger with hits number = 1 is characterized by 2 vectors:
   a. (X,Y) – track intersection with sensor
   b. (S_{p1}, S_{p2}, …, S_{pn}) with n>0 and S_{p1}>=S_{p2}>=S_{p3}..., where S_{ps} are the Signals in pads p1, p2, …., pn in ADC Channels;

2. We map (X,Y) coordinates to the pad p1 with the biggest Signal;

3.We have assumed that the biggest Signal represents dE/dX of the electron interaction with sensor. The small Signals for the same trigger, are produced due to effects like edge and cross-talk;

4. The coordinate system is given in the bellow picture.





I.2. Results

1. We represent:
   a. (X,Y) and
   b. Color the maximum of the (S_{p1},S_{p2}, …, S_{pn}) vector
2. Blue Histogram represents ADC Signals for Ch0 (Pad 1) with only condition:

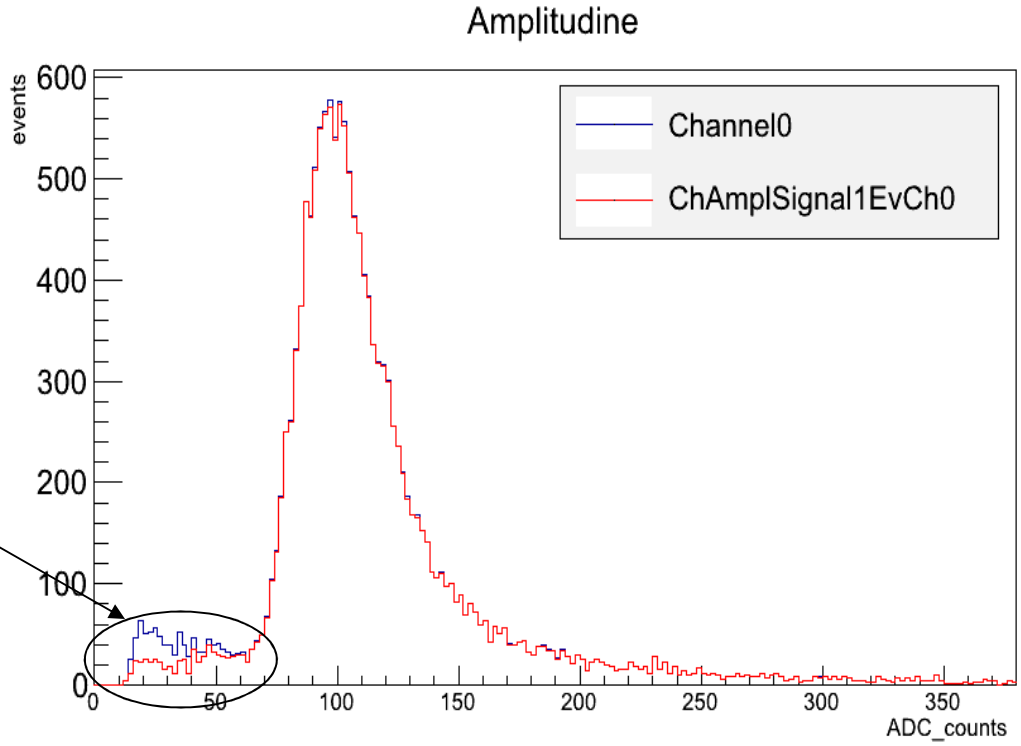
MAXC(pad_nr)>Eped (pad_nr) + 3*RMS(pad_nr)

It includes **signals of all orders (Sp1,Sp2, …, Spn), that means it includes e**lectrons interaction with pad and also other effects (**edge + crosstalk effects**);

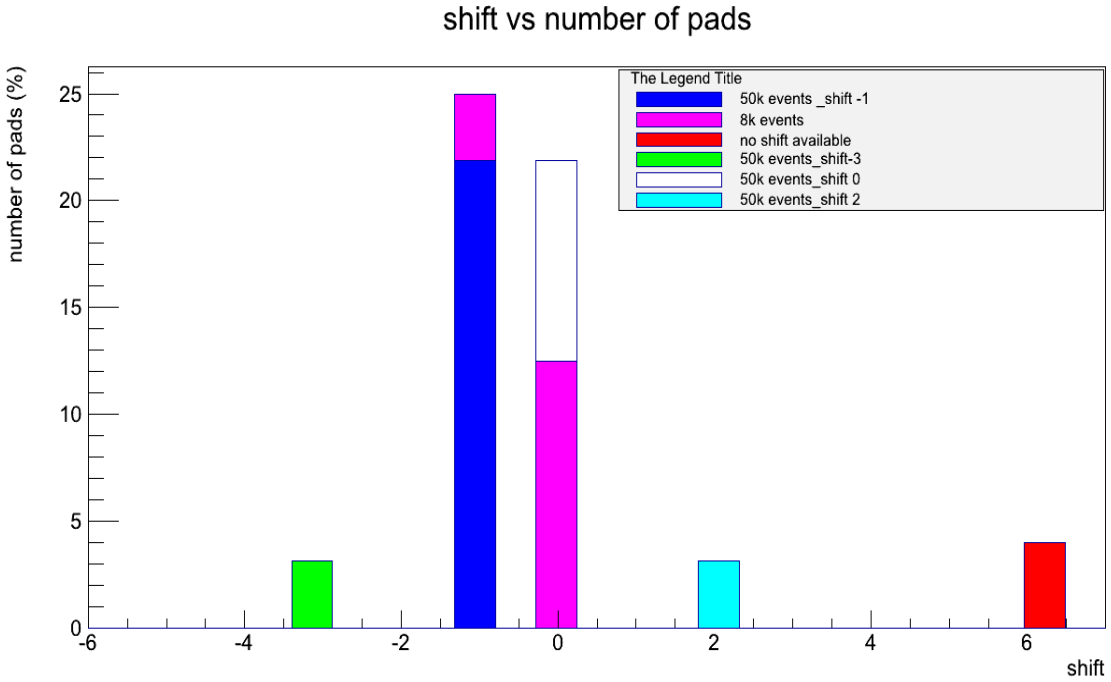
3. Red Histogram represents ADC **Signals** with above condition and in addition Sp1(**maximum signal**). It has to include only the signal produced by electron interaction with sensor;

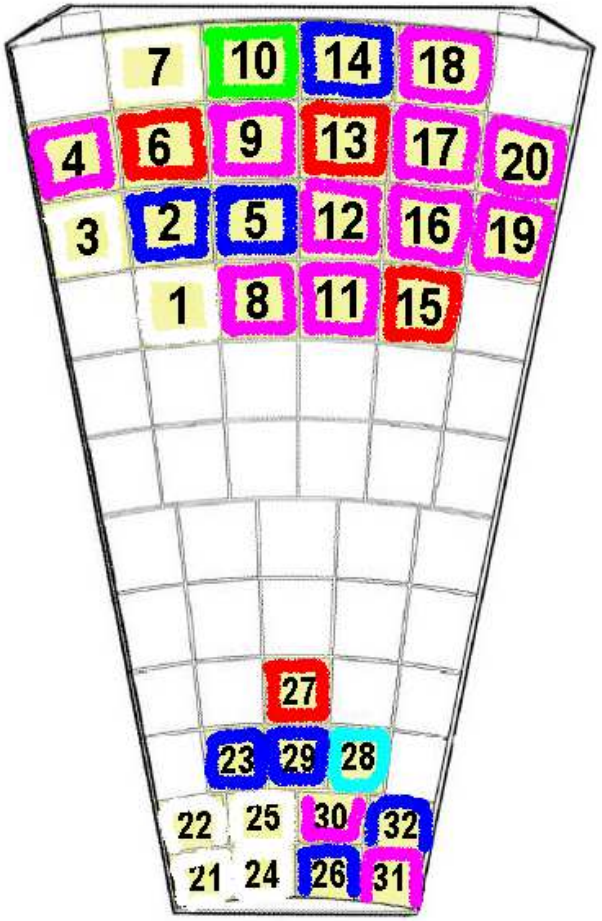
- For pads reconstruction we used only one run/pad,
- Pad 1, run 248

Edge and cross-talk efects induced in pad 1

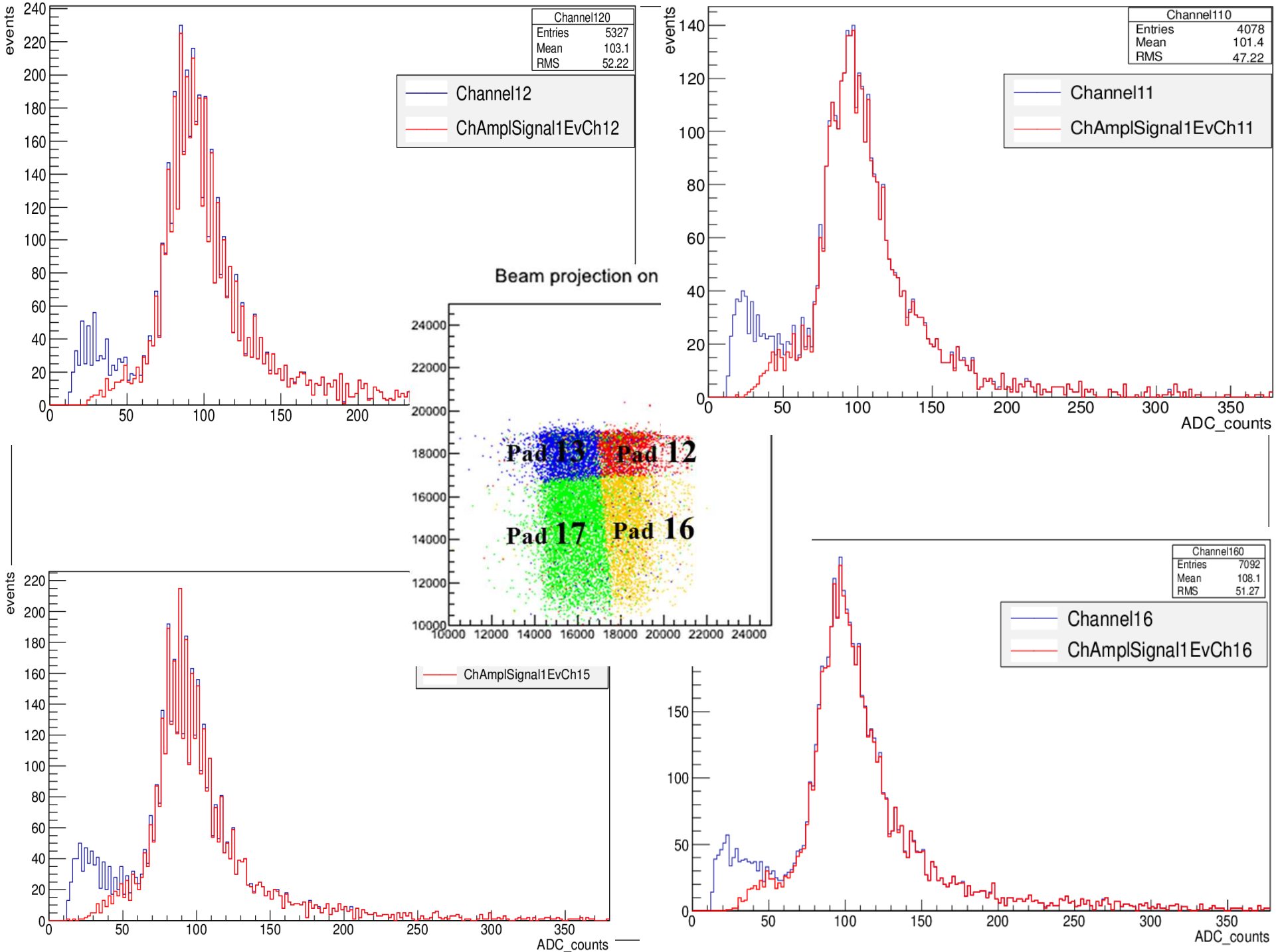


Shifts between FCAL and TelAna triggers





- 11 shifts, [-5, -4, ...0 … 4, 5], between TelAna and FCAL triggers according with Szymon methods;
- The shift effect has been studied for 50k events and for 8k events (???)

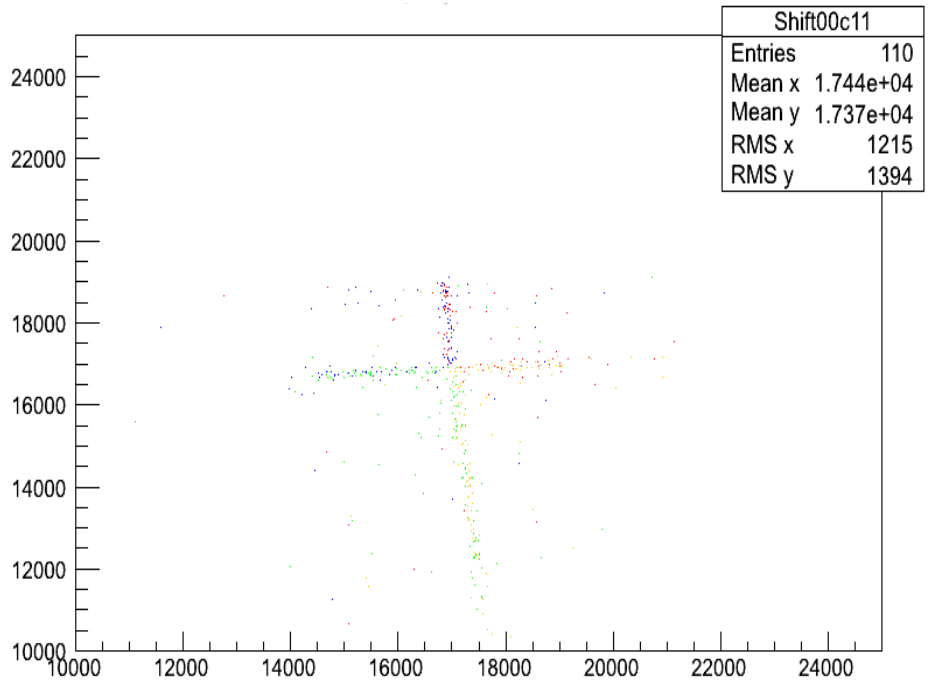

Channel120
Entries 5327
Mean 103.1
RMS 52.22
Channel12
ChAmplSignal1EvCh12
events
Channel110
Entries 4078
Mean 101.4
RMS 47.22
Channel11
ChAmplSignal1EvCh11
ADC_counts
Beam projection on
Pad 13
Pad 12
Pad 17
Pad 16
ChAmplSignal1EvCh15
Channel160
Entries 7092
Mean 108.1
RMS 51.27
Channel16
ChAmplSignal1EvCh16

Attempt for a qualitative study of edge + cross-talk effects

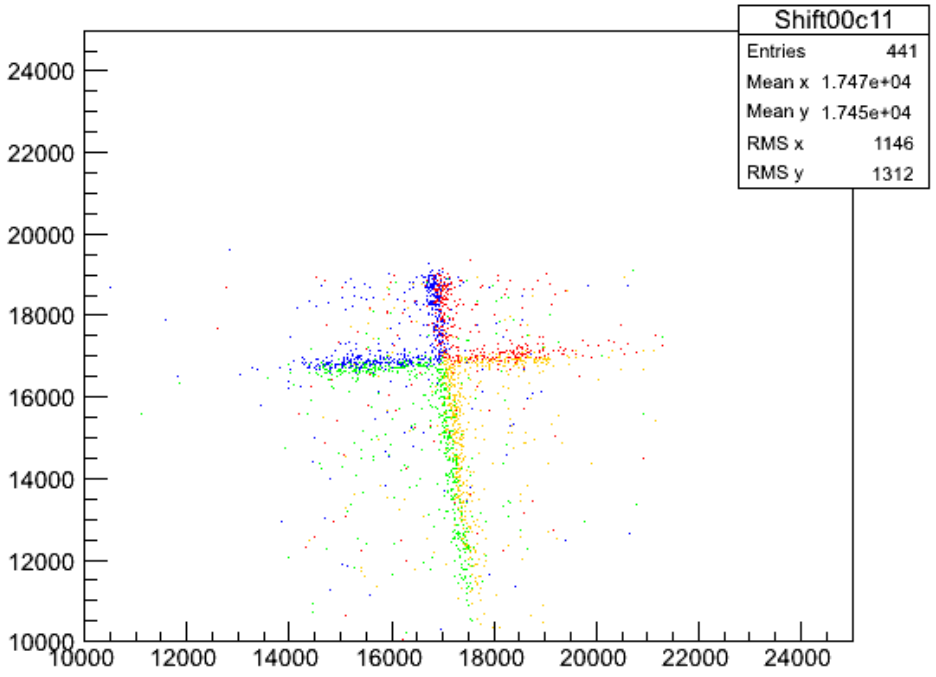
- Pads 12, 13, 16, 17, run 400;
- We study the effects for: $(S_{p1}\text{-}Sp2)/S_{p1}$ from 10% to 100%;

where: Sp1 = dE/dx signal, Sp2 = Induced signal

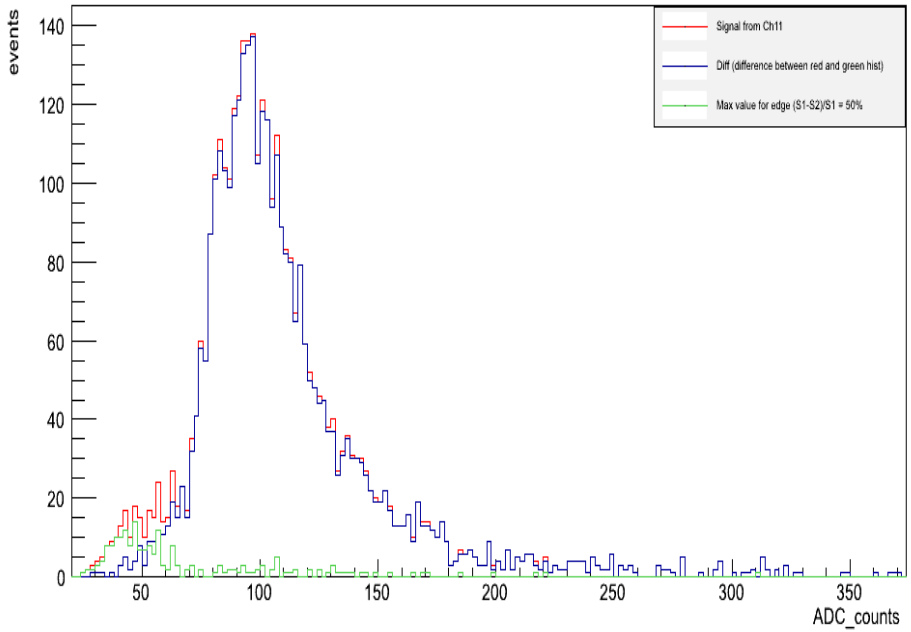
Threshold = 20;
$(S_{p1} - S_{p2})/S_{p1}$ = 30%;

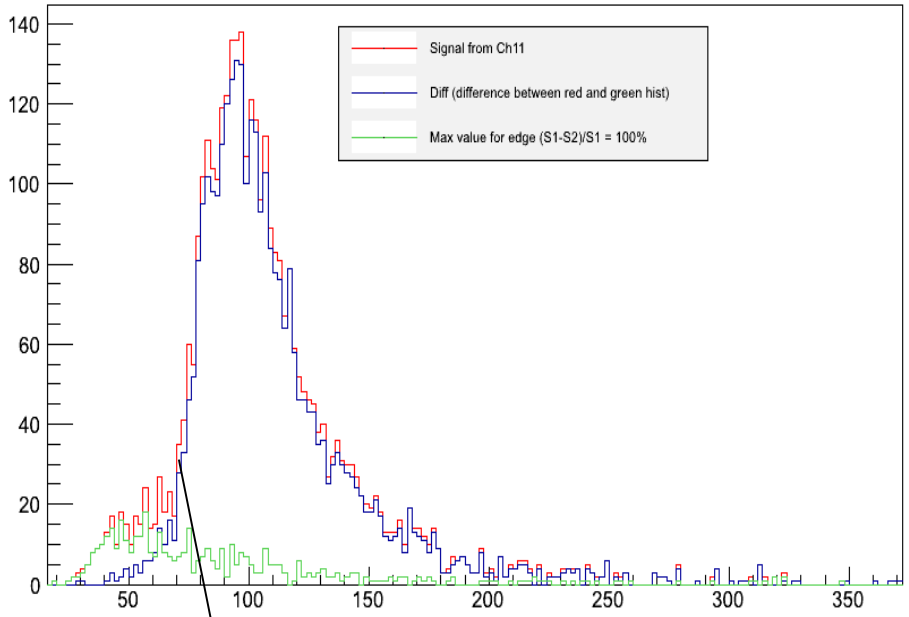


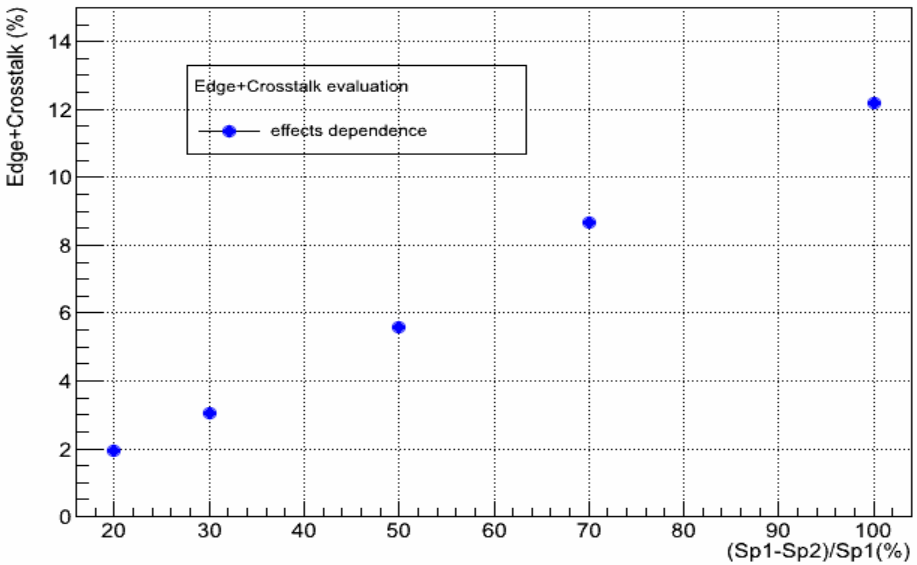
Threshold = 20;
$(S_{p1} - S_{p2})/S_{p1}$ = 100%

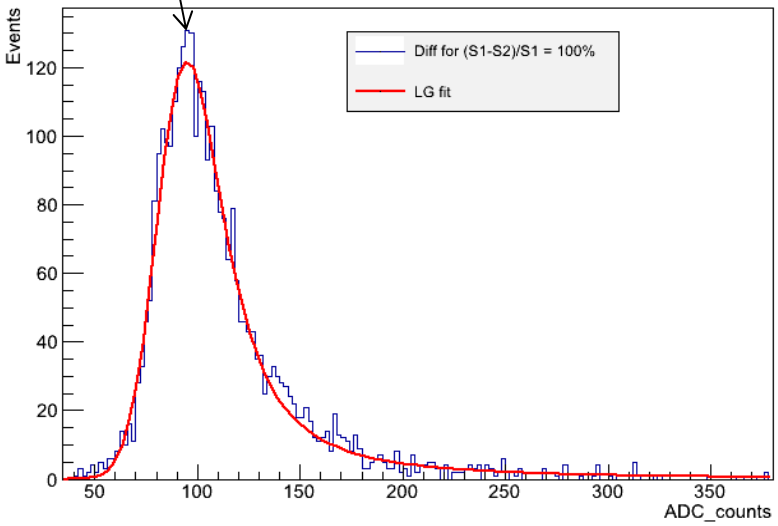


Attempt for a quantitative study of edge + Crosstalk effects









Conclusions

- We developed a methodology for track reconstruction;
- We didn't find trigger shift values for some pads;
- We could see clear patterns for pads and also for edge effect;
- We found a maximum of edge effect + cross-talk of about 12% for pad 12, run 400 produced by three neighbors pad (13, 16, 17);