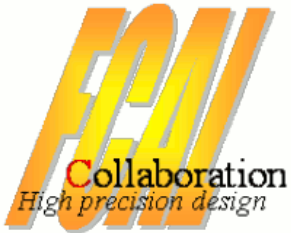


# TB 2015 system calibration

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**Itamar Levy**  
Tel Aviv University  
On behalf of Sasha

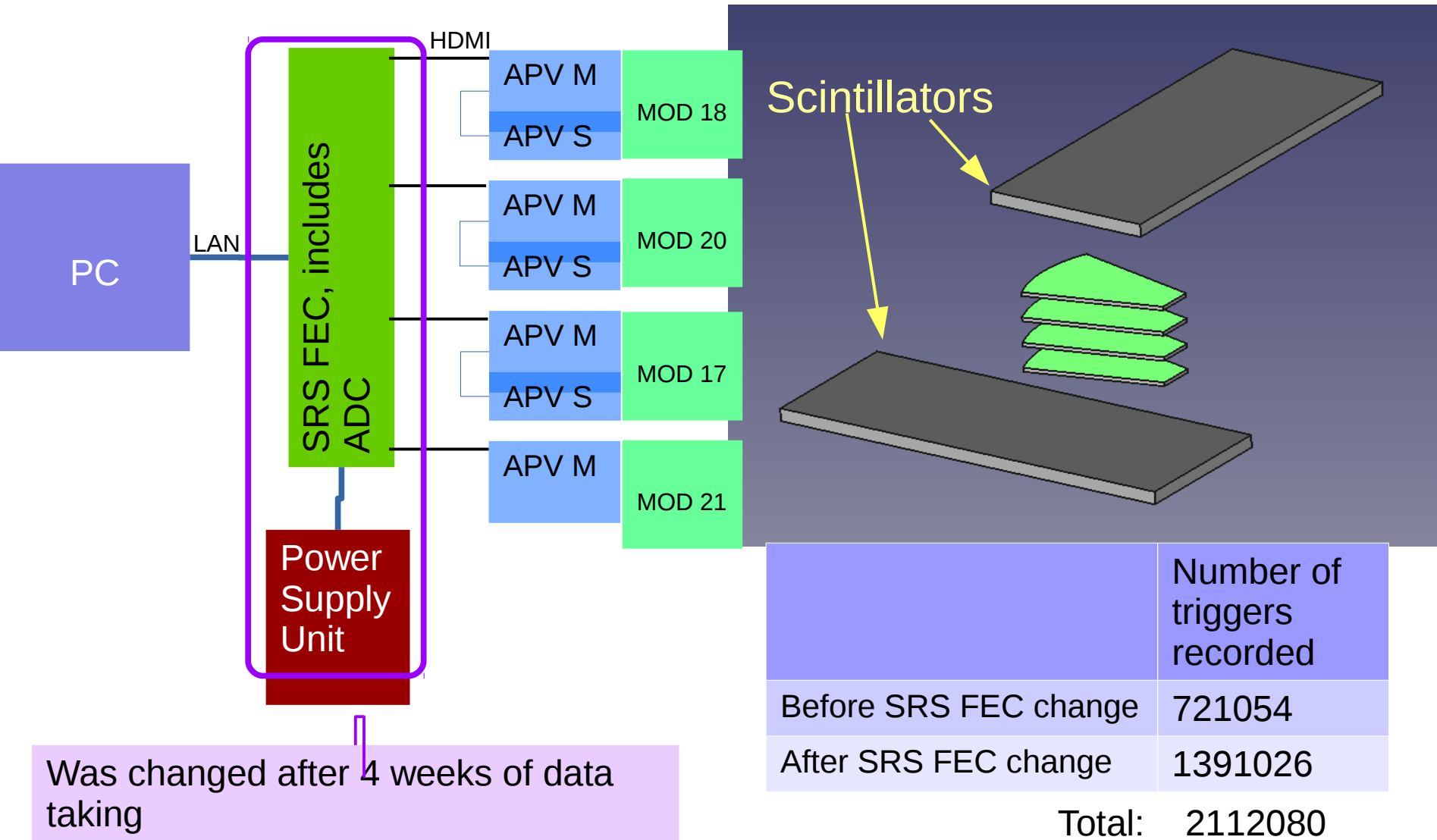


FCAL meeting  
March 2016  
JINR

# Introduction

- During the 2014 TB at CERN PS, we got electrons and muons in the beam.
- Since muons can be considered as MIP it is “easy” to calibrate energy units to it.
- At DESY there is only electrons in the TB.
- Calibration of the 2015 system need to be done differently.
- In addition electronic calibration is needed for measuring charge.
- In TAU we set a simple test bench for cosmic muons measurement with the 2015 system.
- We collected ~10 weeks of running.

# Cosmic Muons Run Setup



Was changed after 4 weeks of data taking

# Geometrical Acceptance of Cosmic Muons Setup

$$\frac{dN}{dAd\Omega dt} = I_0 \cos^2 \theta \quad \text{- muon flux on zenith angle distribution}$$

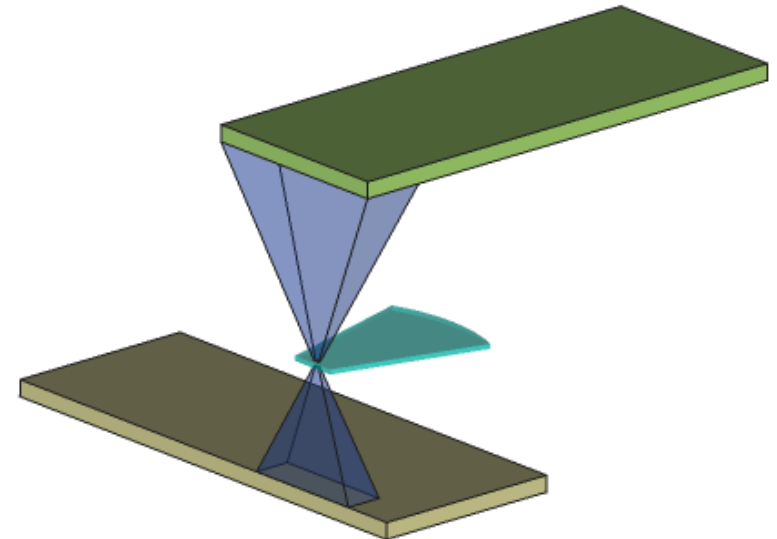
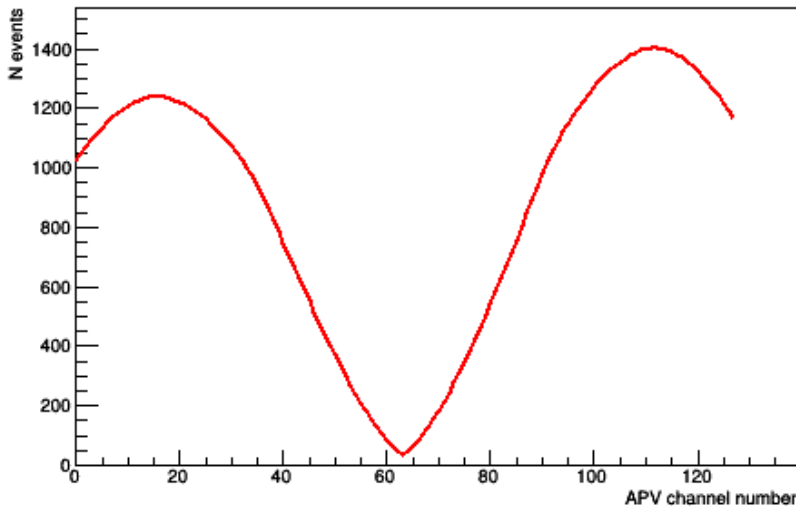
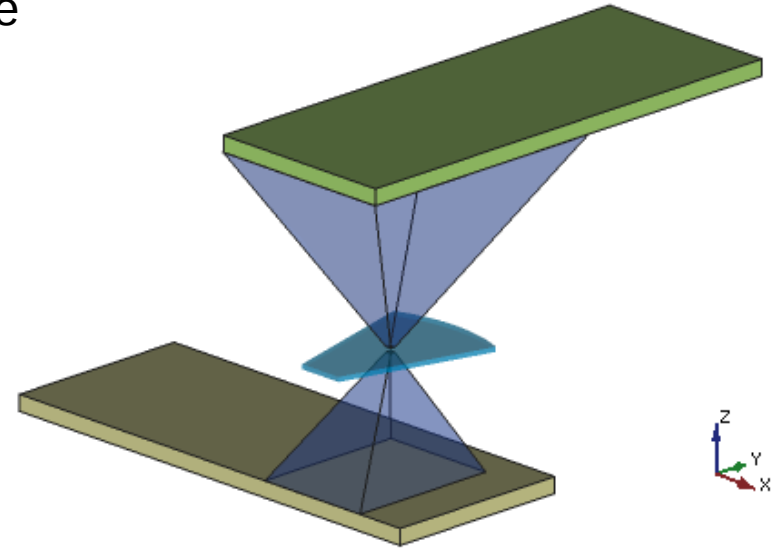
At sea level  $I_0 = 0.007 \text{ cm}^{-2} \text{ c}^{-1} \text{ sr}^{-1}$

$$\frac{dN}{dt} = I_0 S h^4 \int_{a_y}^{b_y} \int_{a_x}^{b_x} \frac{1}{(h^2 + (x-x_d)^2 + (y-y_d)^2)^{3/2}} dx dy$$

S – sensor pad area;

h – distance from the sensor to scintillator;

$x_d, y_d$  – position of the sensor pad;



# Signal Extraction Optimization

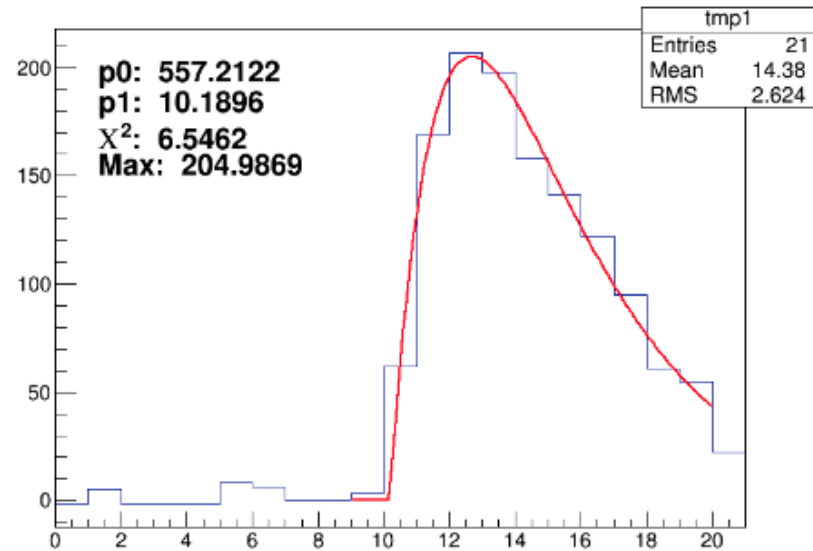
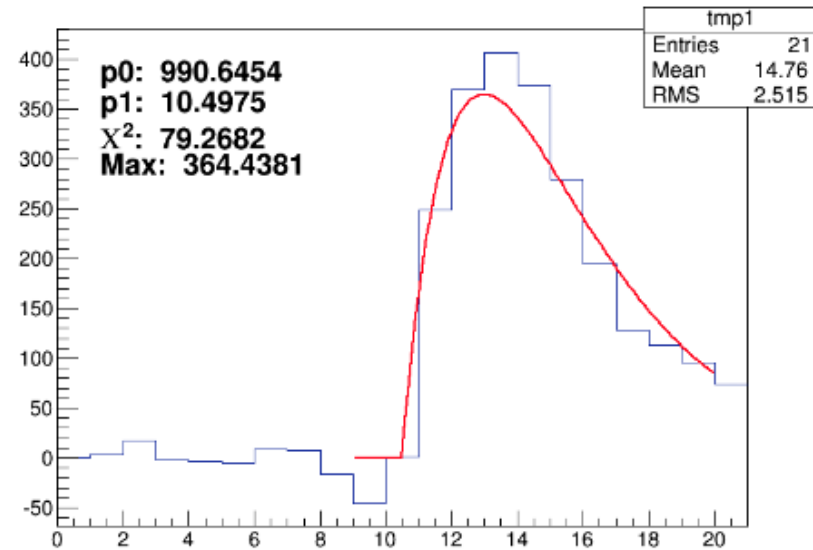
Fit signal with time response function of CR-RC filter:

$$V = \frac{e^{-\frac{t_0 - t}{\tau}} (t - t_0) P_0}{\tau}$$

Possible cuts on:  $\chi^2$  and  $t_0$ .

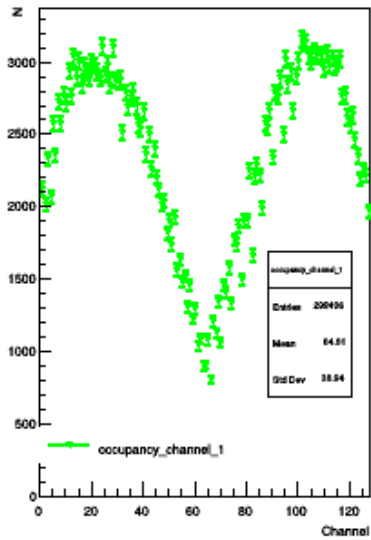
$\tau = 2.5$  (bins) is fixed.

Maybe it should be also fit parameter with predefined range?

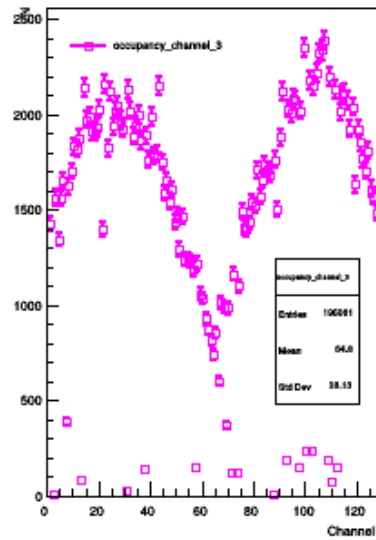


# Number of events in each channel w/ CM correction

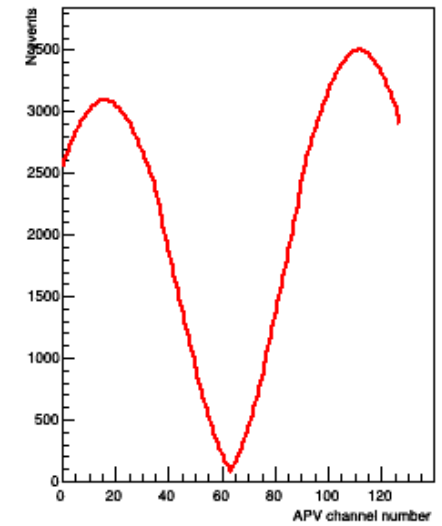
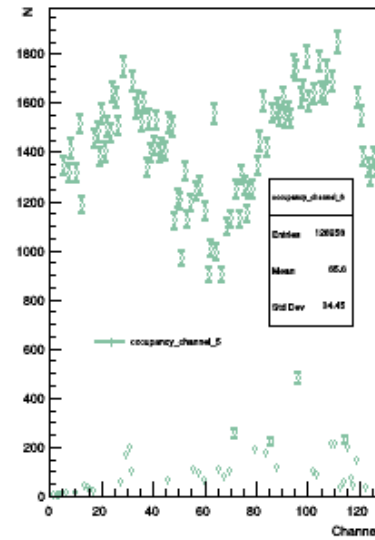
occupancy\_channel\_1



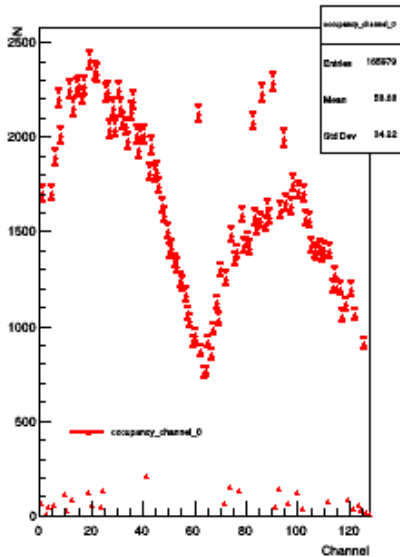
occupancy\_channel\_3



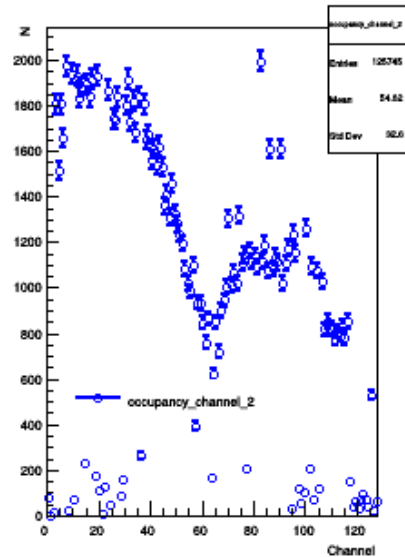
occupancy\_channel\_5



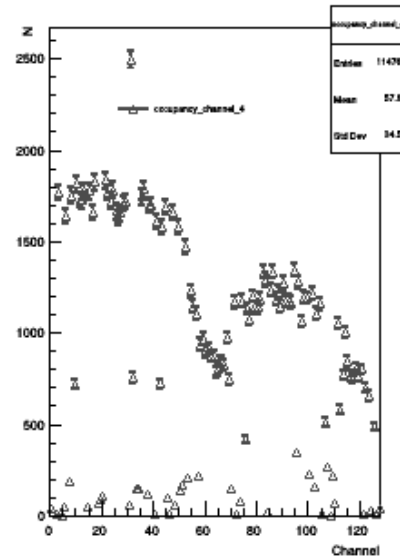
occupancy\_channel\_0



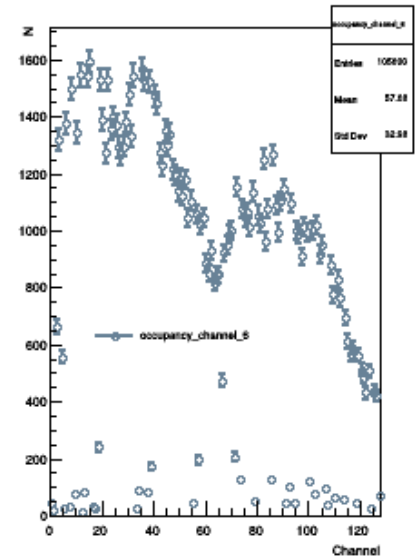
occupancy\_channel\_2



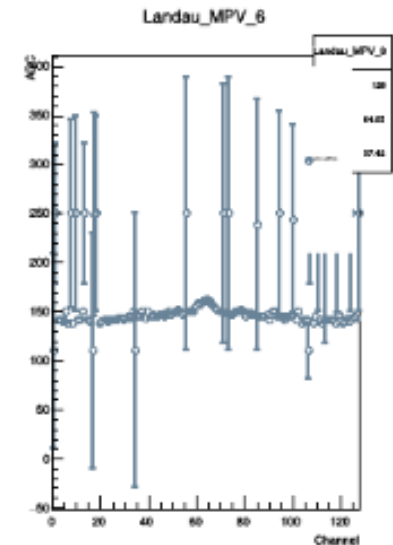
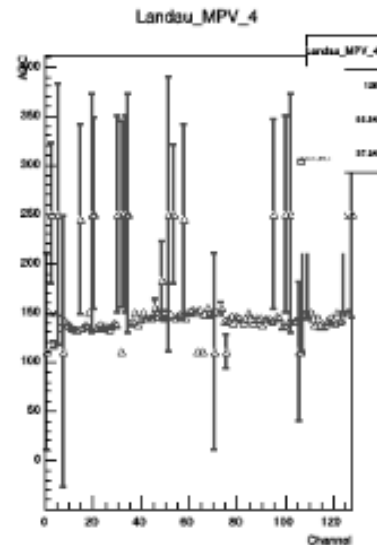
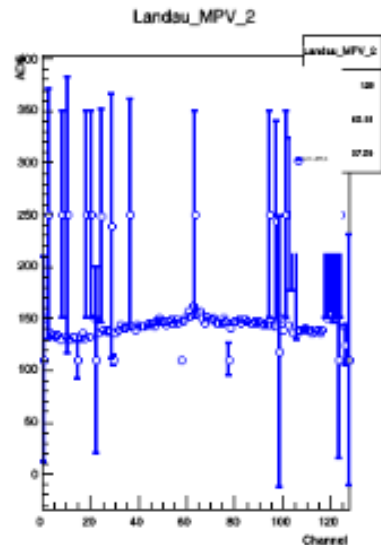
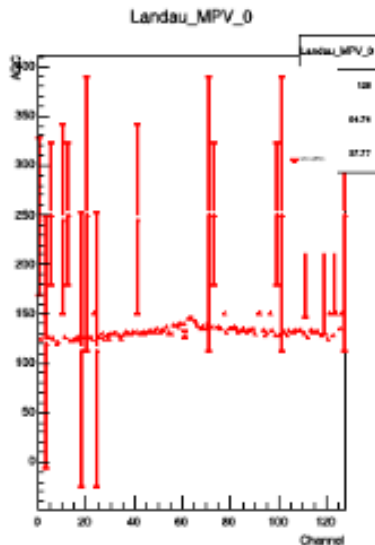
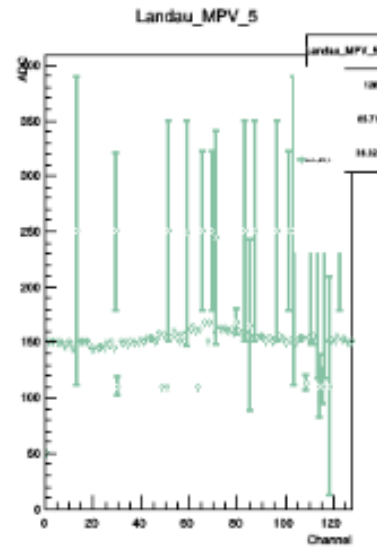
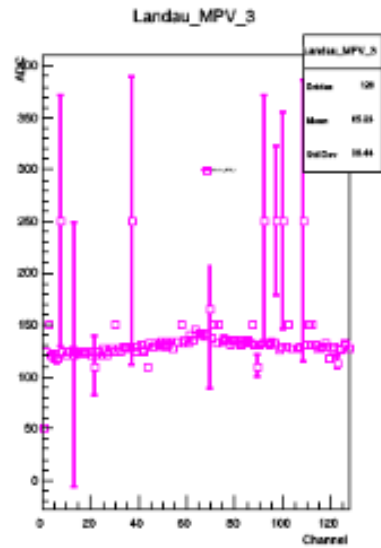
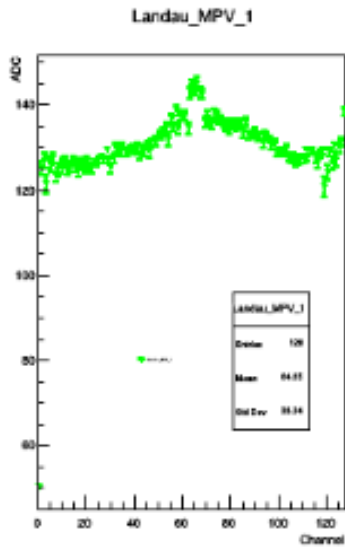
occupancy\_channel\_4



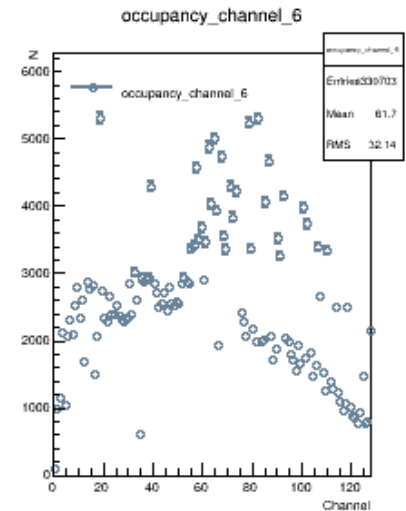
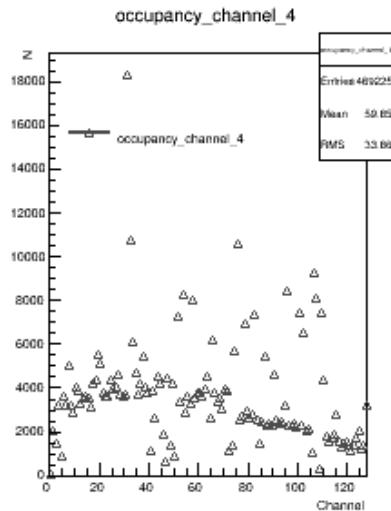
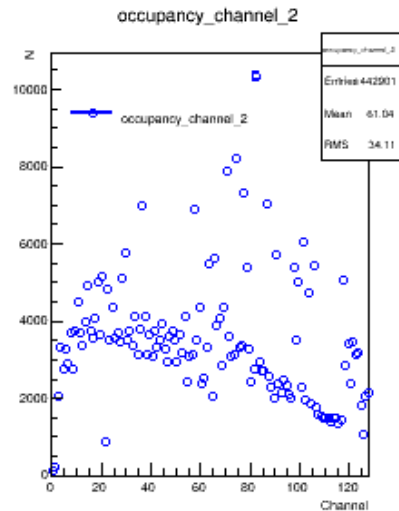
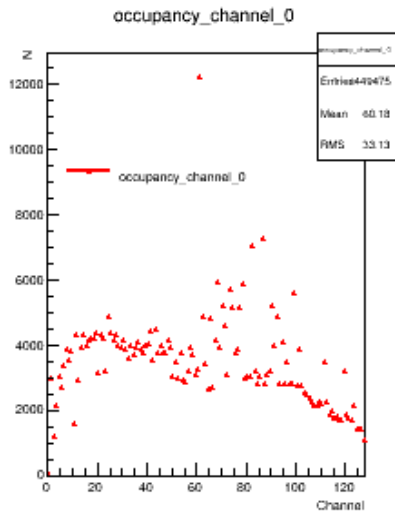
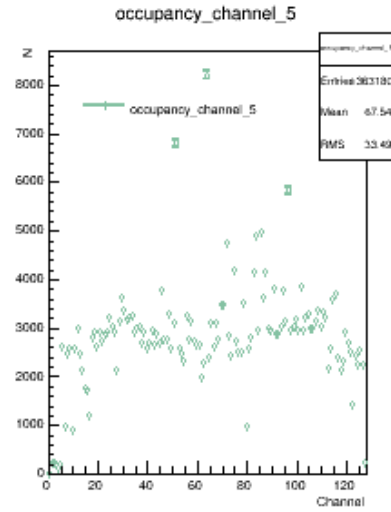
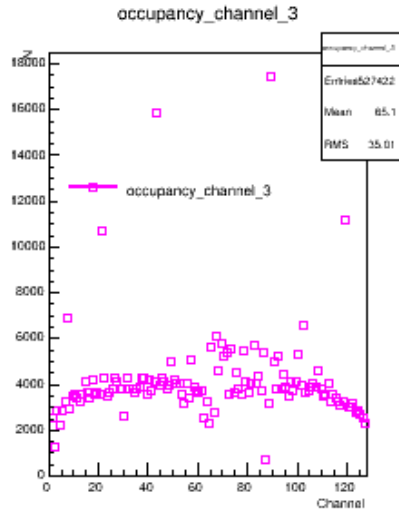
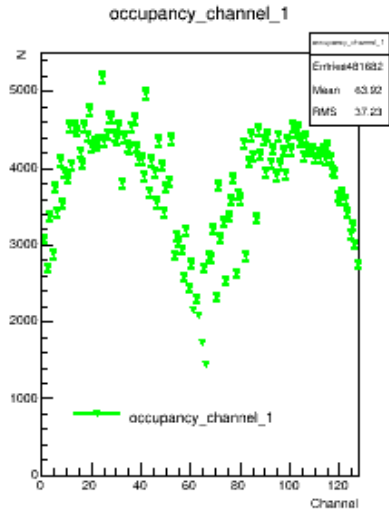
occupancy\_channel\_6



# MPV for Each Channel

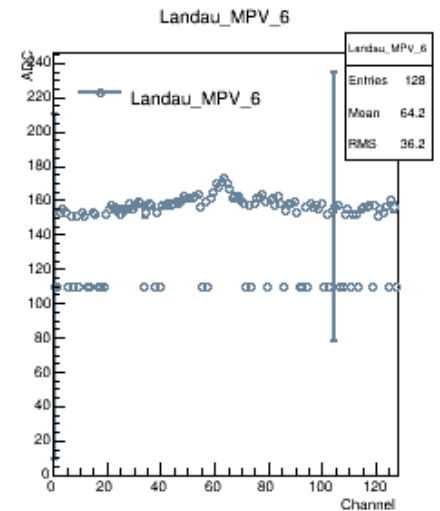
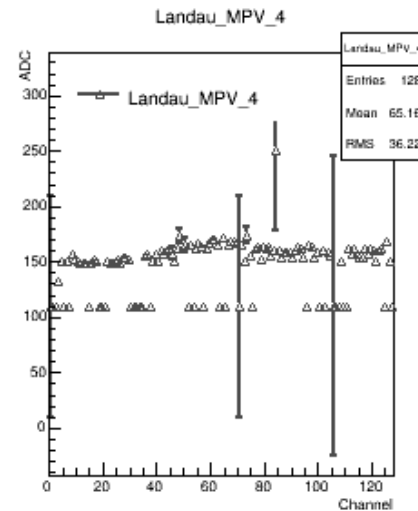
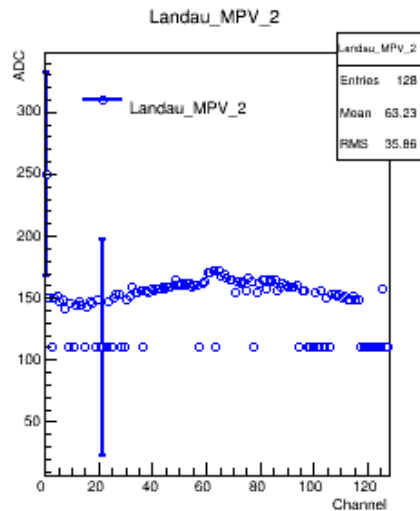
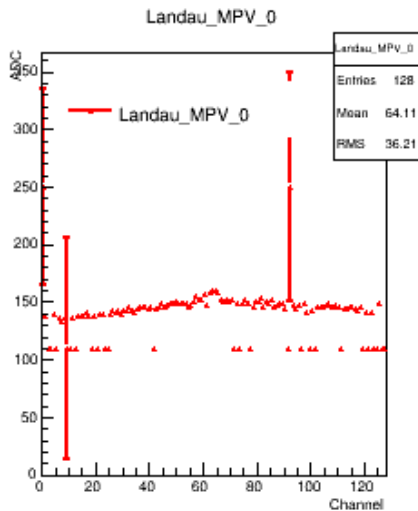
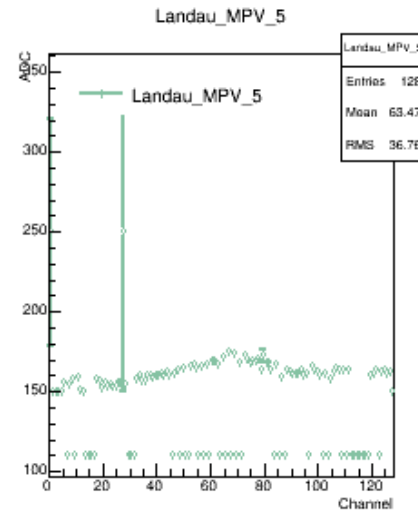
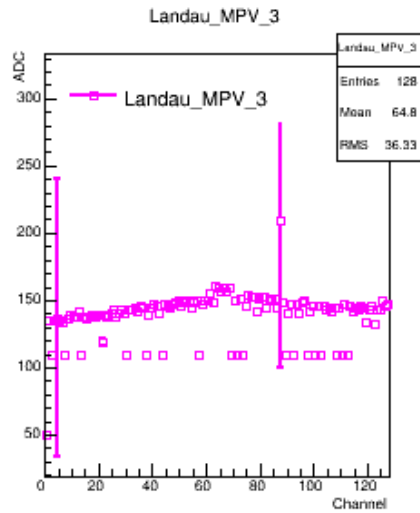
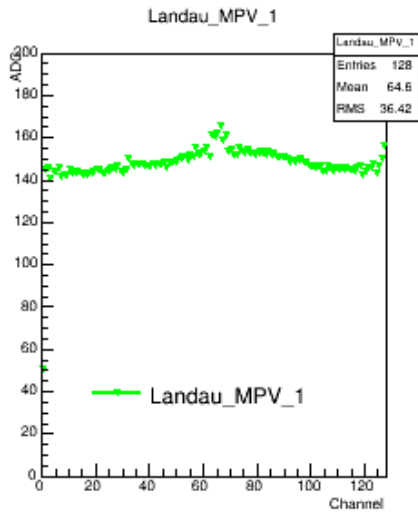


# Number of events in each channel w/o CM correction



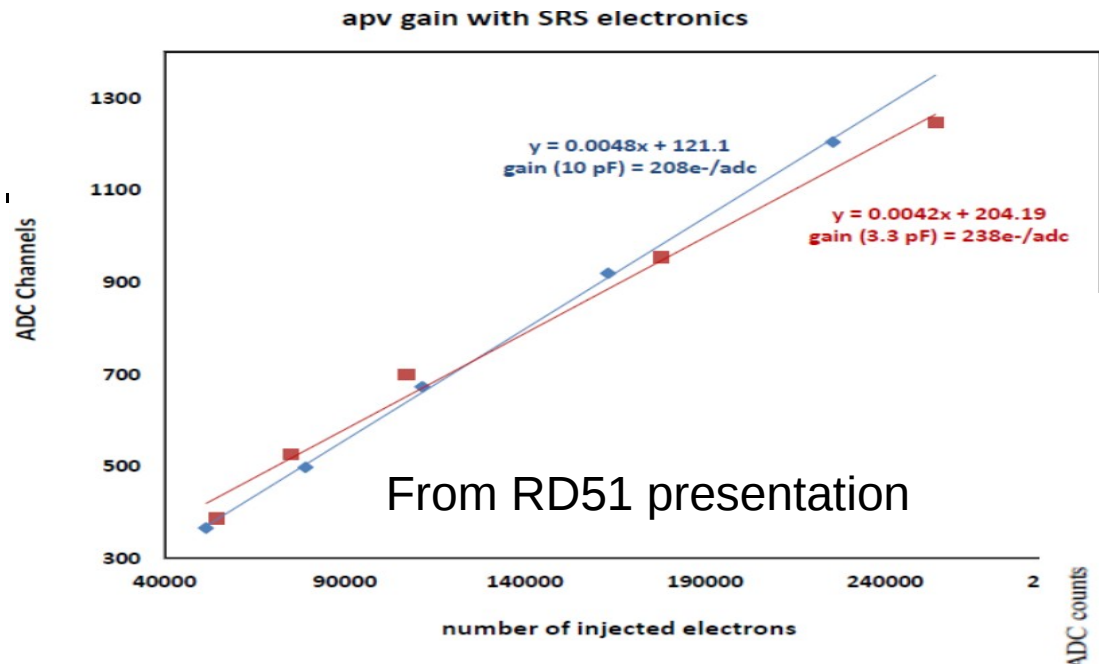


# MPV for each channel w/o CM correction

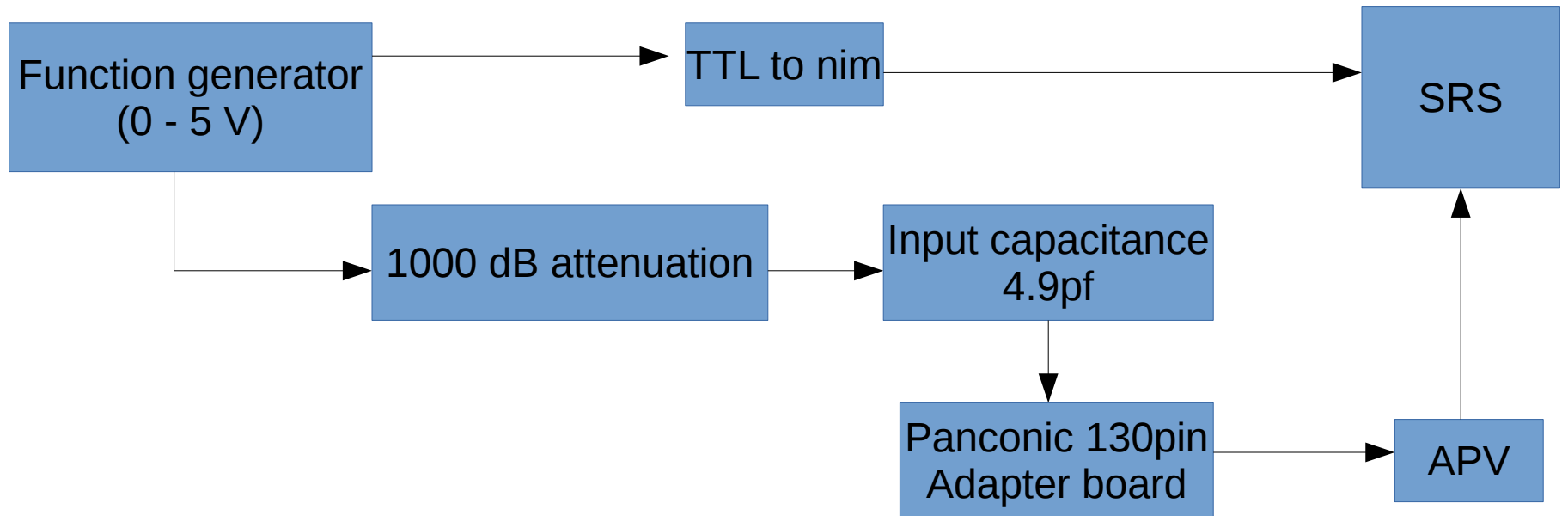


# Capacitance dependency

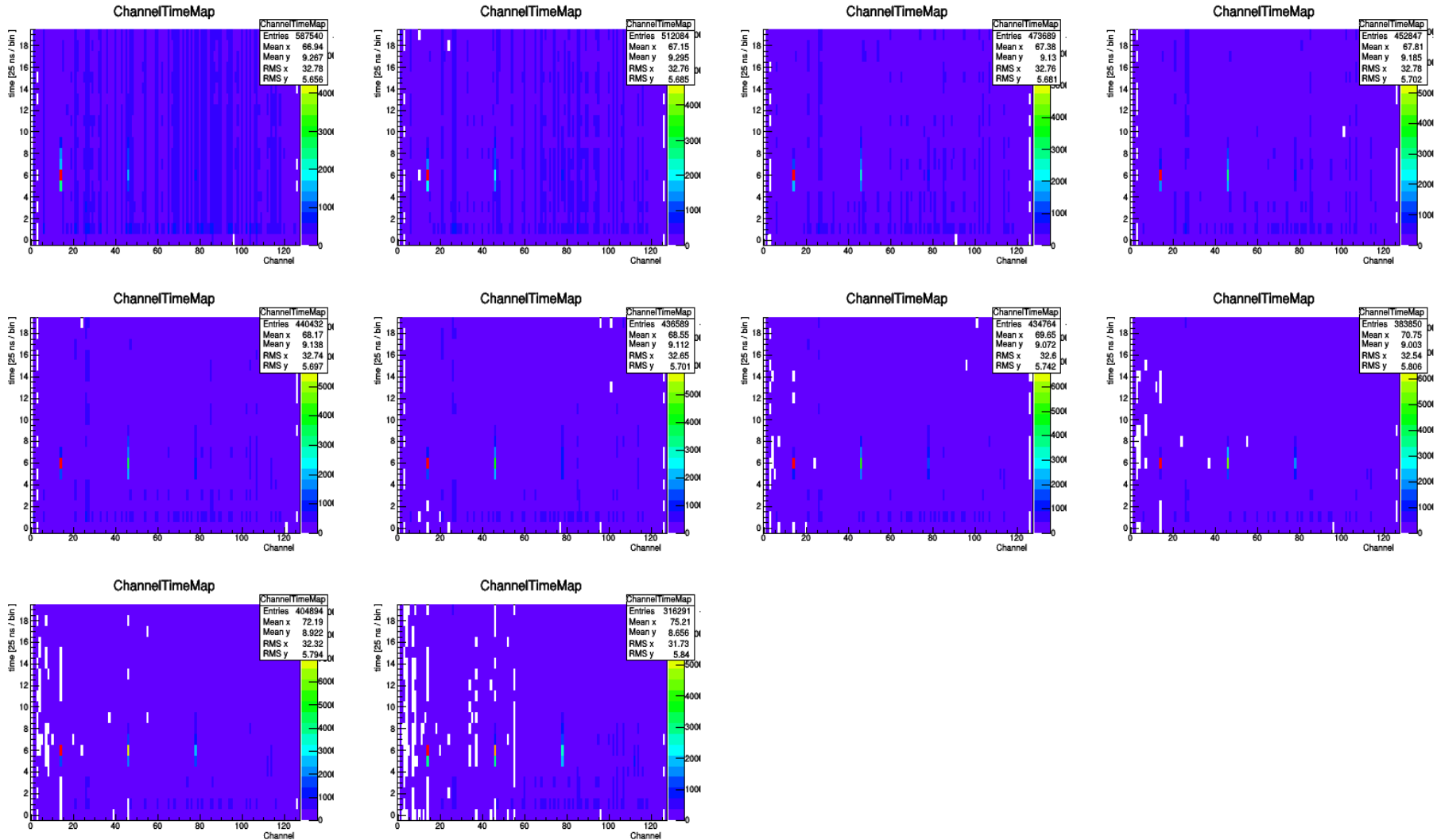
- In the MPV Vs pad number plots there is an expected behavior.
- MPV has inverted increased to the pad size.
- Could come from Input capacitance.



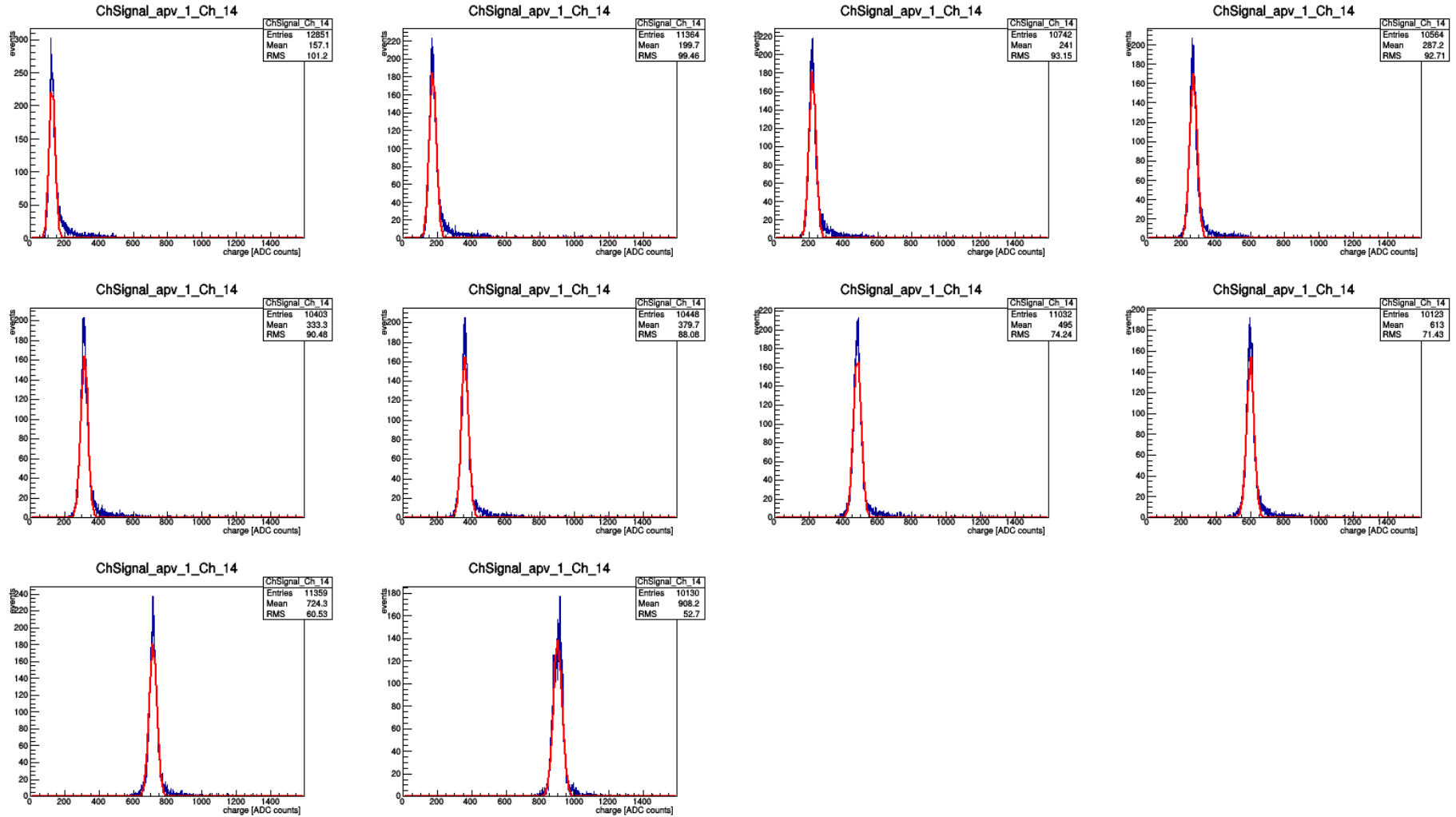
# Electronic calibration system



# Electronic calibration results

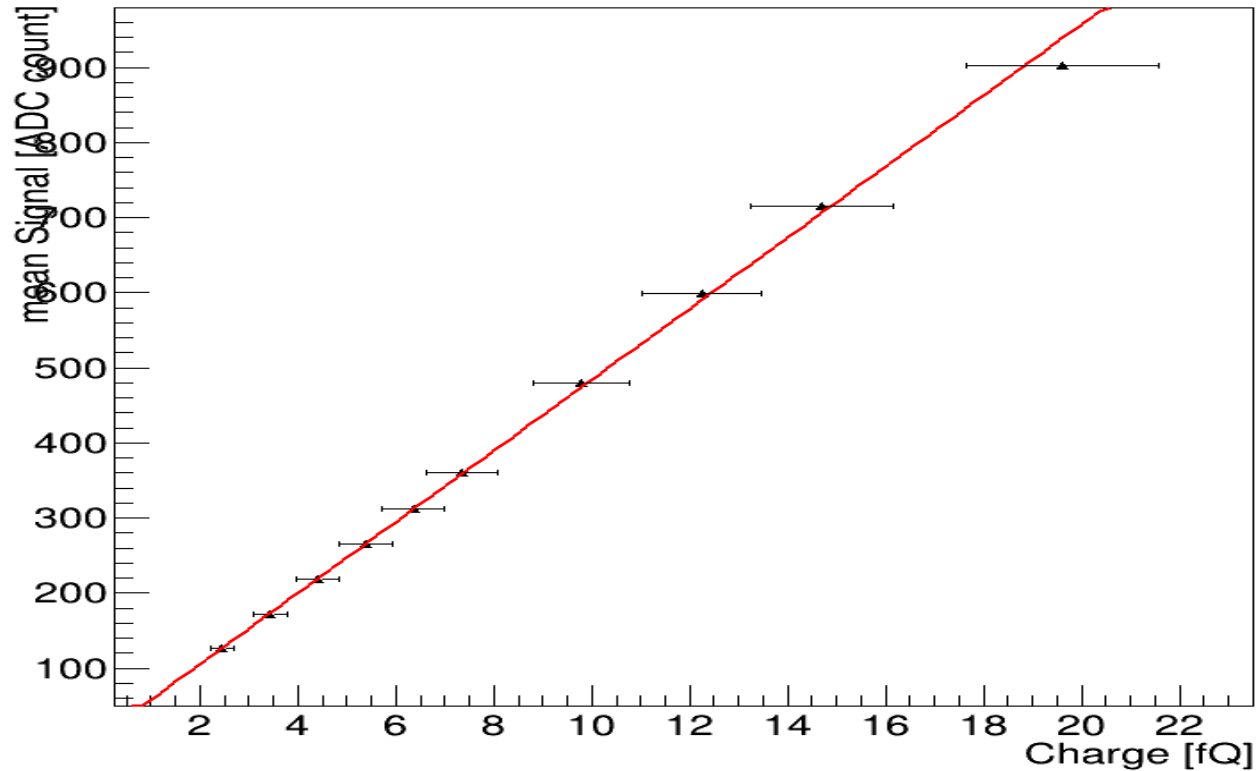


# Electronic calibration results



# Electronic calibration results

calibration gain



$$\text{ADC count} = 47.3 * Q + 10.6$$

# status

- ~2 weeks ago the sensor and DAQ sent to CERN for tilt test for the 2016 TB, and for repeating the cosmic measurement there with W absorber (not working yet).
- When the system will come back we will continue with electronic calibration.

# Summary

- Cosmic muon data collection for calibration is finished at TAU. Preliminary calibration parameters were calculated for each working channel with average statistics of more than 1000 events. The minimum number of events is around 400 for small number of channels.
- Optimize signal extraction, study CM more carefully and proceed with prototype performance study.
- Understand the problems with non working channels and try to recover them.
- Set a common signal extracting process for both calibration and TB data analysis (can be more than 1).
- To continue measurement of Signal capacitance dependence.



# Backup

# Gauss-Landau Fit for APV 1

