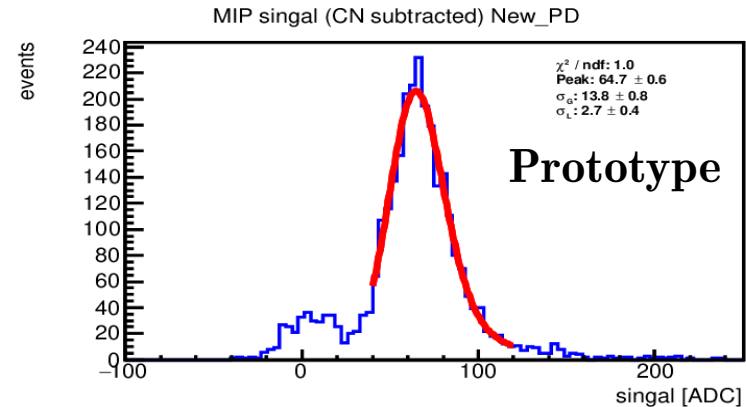
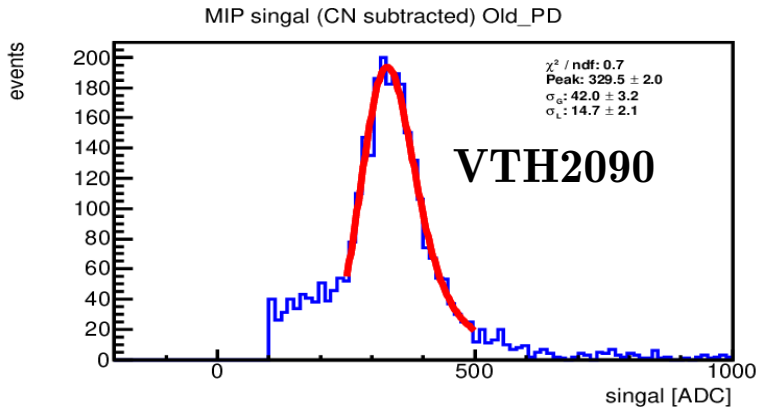


# Measurement of new excelitas prototype PDs using ground muons.

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## Introduction

- We received a first excitax prototype PD with 5x5 mm<sup>2</sup> active area
- First measurement by using Amptek system: signal of new PD is ~3.3 time smaller than the lodl PD (VTH2090, 9.2x9.2 mm<sup>2</sup>). Ratio between areas: 3.38.
- First measurement using HIDRA and chinese LYSO: MIP → 65 ADC (VTH MIP is → 320 ADC)

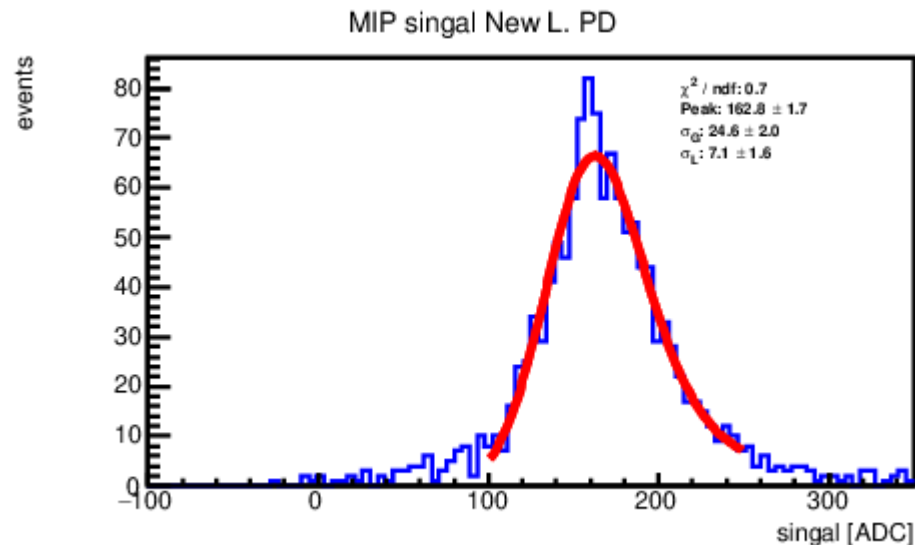
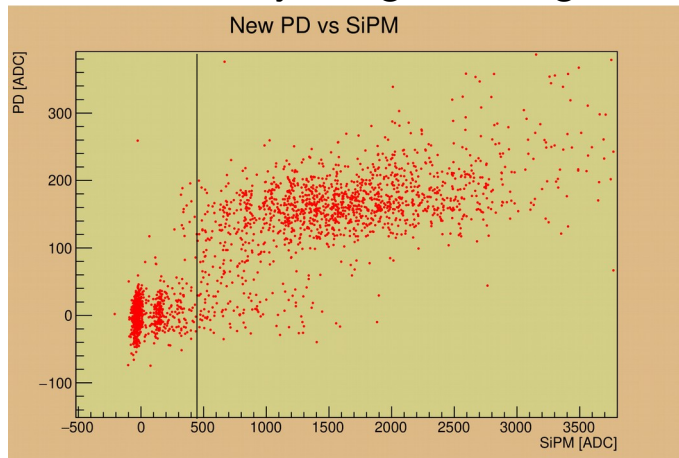


- Few months ago we received 2 new prototype PD and new LYSO crystals provide by Perugia: light yeald should be similar with respect to the Chinese LYSO.
- Main difference: all the cube faces are polished (Chinese cube have one polished area only).

## First measurement: Perugia cube + new PD

- Thanks to Olek, we assembled a LYSO from Perugia with ESR film, WLF fiber connected to SiPM, A new PD.

MIP selected by using SiPM signal



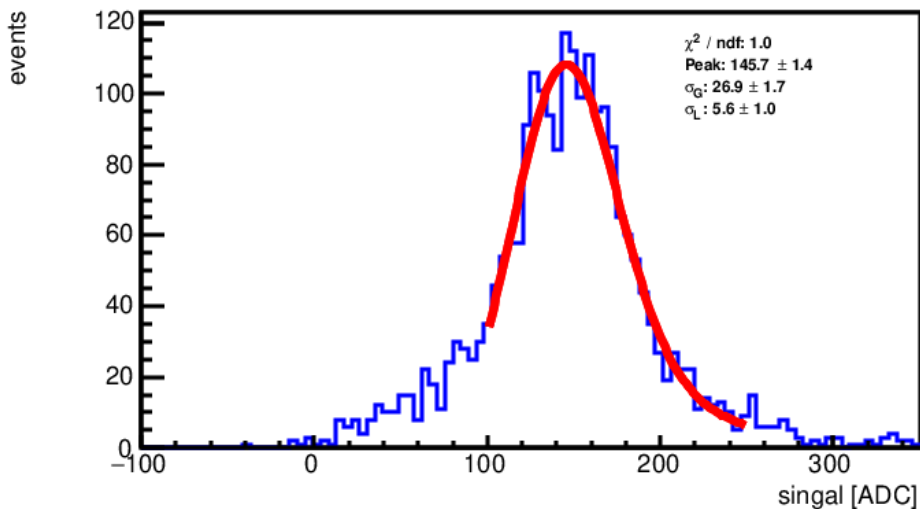
- Very high signal with respect the expected one:

- is it due to the crystals?
- is it due to the new PD?

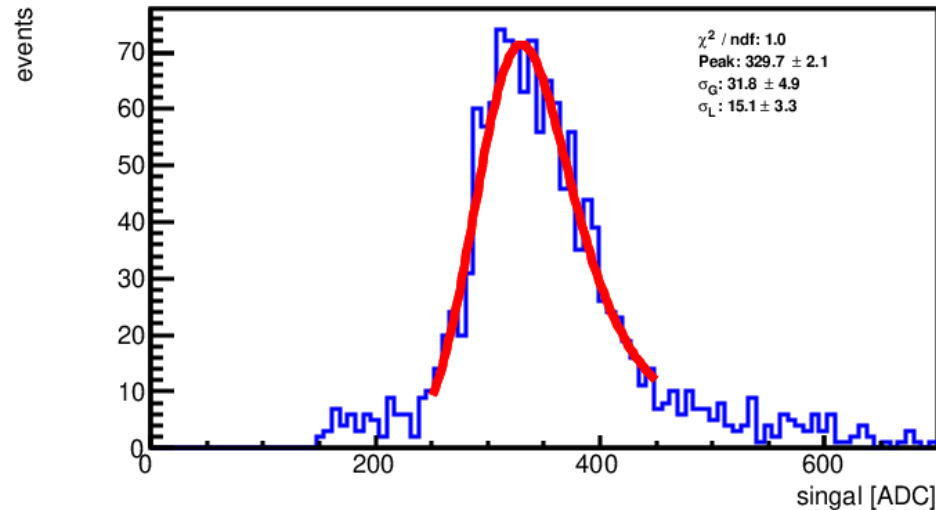
## Perugia cube + different new PD

- Same test using a different new PD, which is the one we received month ago (5x5), and a old PD (VTH2090)

MIP singal New L. PD



MIP singal Old L. PD

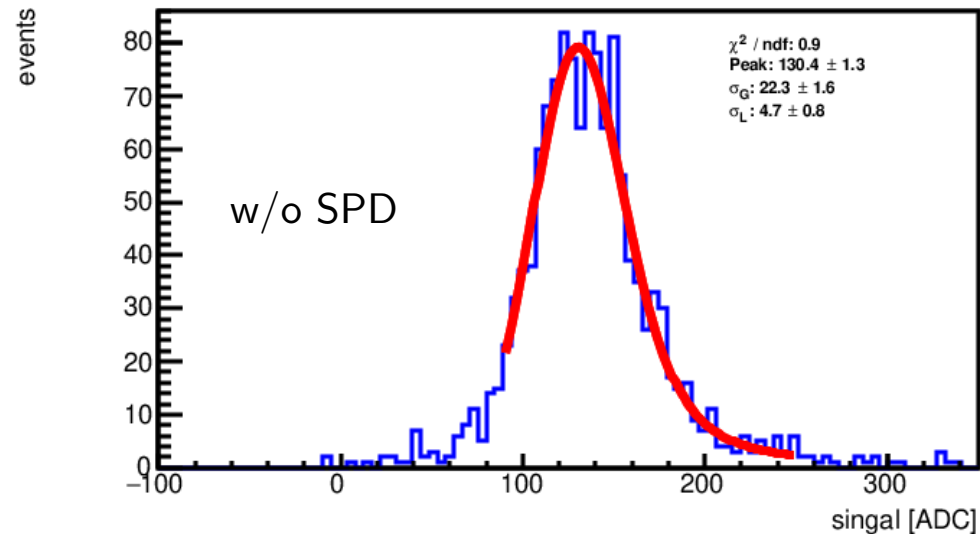


- VTH2090 signal consistent with the expected.
- Different new PDs feature similar signals.

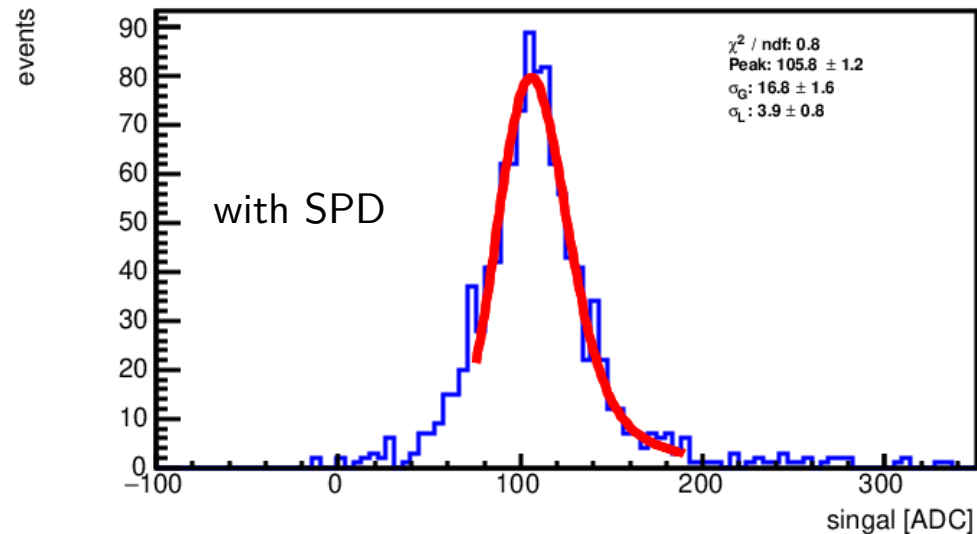
## LYSO cube + different new PD

- We tested two PDs (so far) with Chinese LYSO

MIP singal New L. PD



MIP singal New L. PD

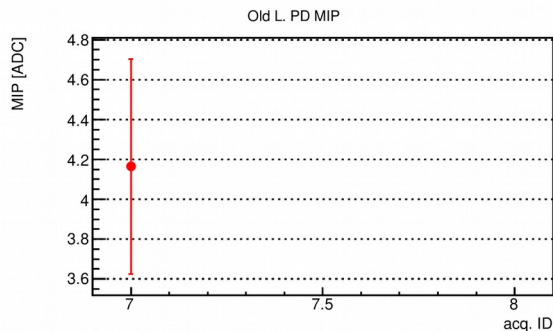
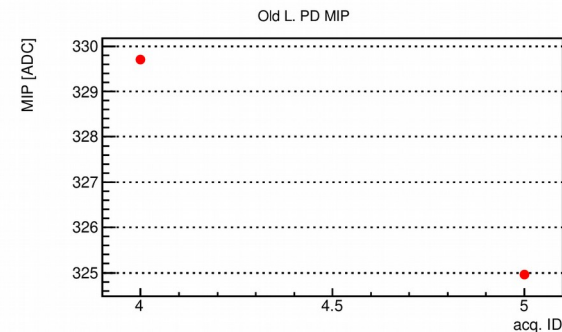
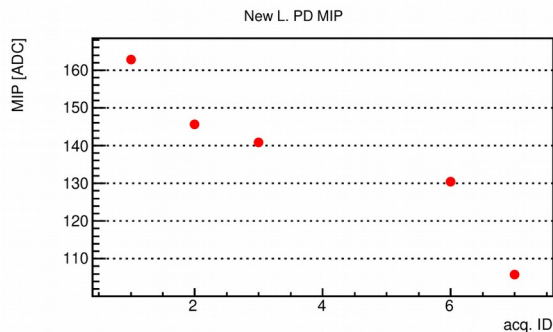


- Second test: a small PD is also connected to the crystals (it slightly decrease the signals on the LPD?)
- Slightly smaller signals but  $\gg 65$  ADC

# Summary of all the tested config

First prototype is: 7423

ID	New LPD	Old LPD	SPD	LYSO
1	7425			Perugia
2	7423			Perugia
3	7392			Perugia
4		A		Perugia
5		B		Perugia
6	7392			IHEP
7	7423		a	IHEP



- All the LPD 5x5 features large signals  $> 100$  ADC.
- Seems that the Perugia LYSO feature slightly bigger signals than the IHEP.
- It is not clear if the SPD “subtracts” light to the big one.

## Discussion regarding lab tests

- PD 5x5 signals is  $\sim 2$  times greater than the expected
  - Problems in the assembly or wrapping of the cube used for our first test??
  - Was the optical greases used in our first test?
- To do asap:
  - Test another couple of new PD small PD with a single cube.
  - Test the old PD with Chinese cubes.
- Very important: confirm the MIP value or at least the ratio between PD 5x5 with VTH
  - Use cubes by Perugia?
  - Ask more cube from IHEP? “Destroy” some cubes already assembled with old diode?
  - Retrieve the forth new PD from Milano?
  - Ask/buy more 5x5 PDs thus we can use optical glue and have stable results?
  - ...

## Discussion regarding analysis/simulation

- If we confirm MIP  $\sim 120$  ADC, we should review our computation of:
  - Saturation level? Which now is 250 TeV ( $\rightarrow$  125 TeV)
  - Overlap between PDs? Now SPD has  $\sim S/N$  of 20 ( $\rightarrow$  10) when the LPD saturates.
- We must find the minimum  $S/N$  required to properly calibrate the large/small PD ratio.
  - Dedicated “toy MC” should be sufficient as a first study.
  - HerdSoftware already contains digitization/calibration algorithm of Calo using PD system.
  - @ CNAF simulation of electrons and protons should be available (Valerio V.?).
  - How to evaluate the expected systematic due to the PD ratio measurement.?
- Study about the number of PDs:
  - Trigger: is done by Madrid colleagues.
  - Calo performance: Sergio B.