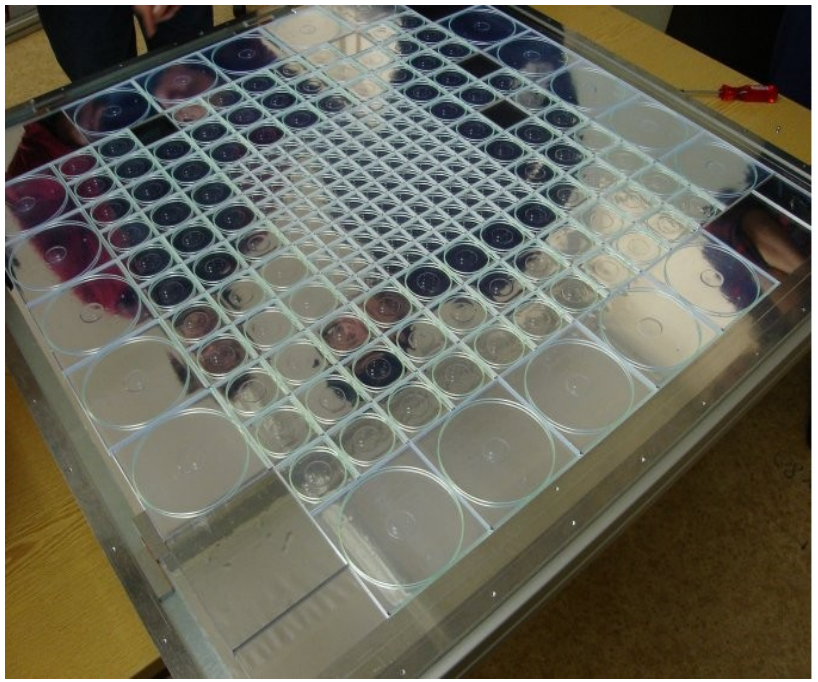
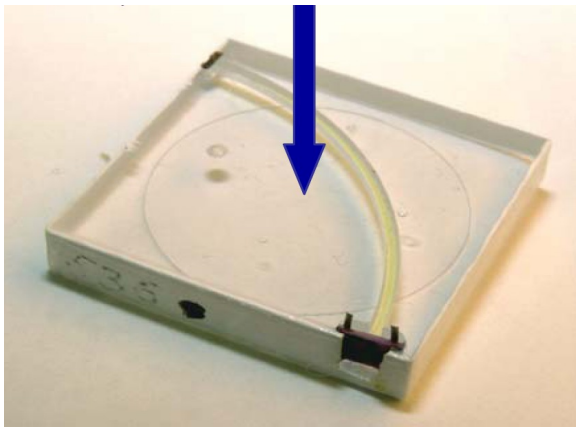
Direct readout of ILC HCAL scintillator tile by the Hamamatsu Micro Pixel Photon Counter (MPPC)



Outline

- The tile HCAL: present status
- Characterization measurements of MPPC
- Optical performance of MPPC directly coupled to the HCAL scintillator tile.

The tile HCAL: present status



A test beam prototype of 23 layers was completely equipped with these tiles. The test beam physics program is now ongoing at CERN.

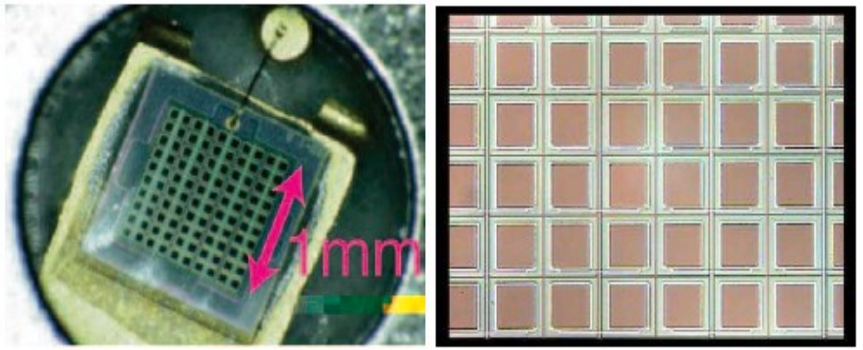
- Green sensitive SiPM produced by MEPHI/PULSAR
- A green wavelength shifter fiber is installed in the scintillator and coupled to the SiPM

The proposal: direct coupling

- We propose to couple directly the photo detector with the tile: the technical design will be compact and easy, ideal for a large scale detector.
- A Geiger mode multi pixel avalanche photo diode with **good blue sensitivity** is needed

The Hamamatsu MPPC

MPPC: Micro Pixels Photon Counter
Array of pixels with the design of an avalanche photodiode
Each pixels is operated in current limited Geiger mode



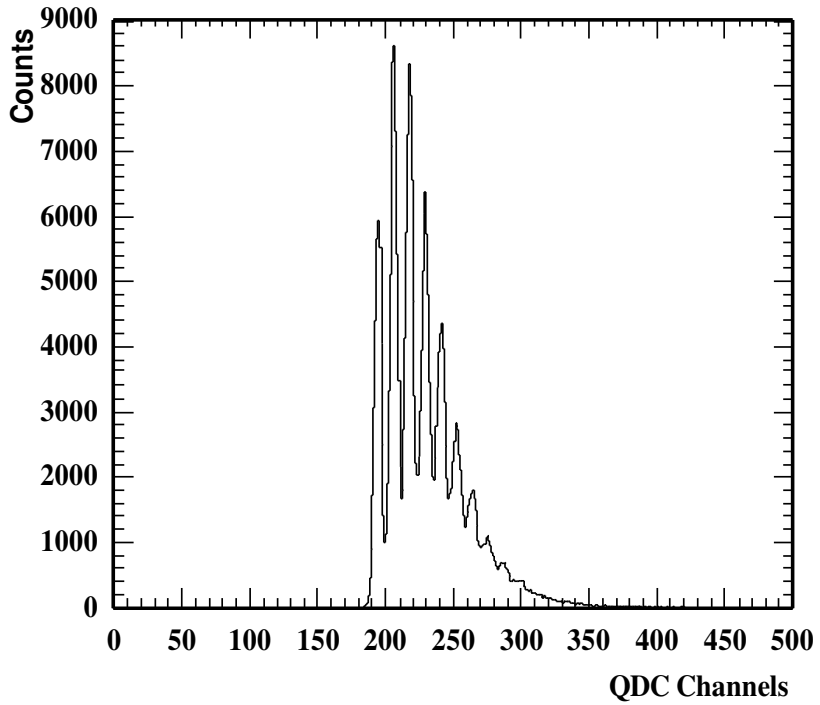
- 100 – 400 – 1600 pixels
- 1 mm^2
- Breakdown at 70-80 V
- C: 10-100 fF
- Gain: 10^5 – 10^6

We received in DESY 4 samples from two different batches.

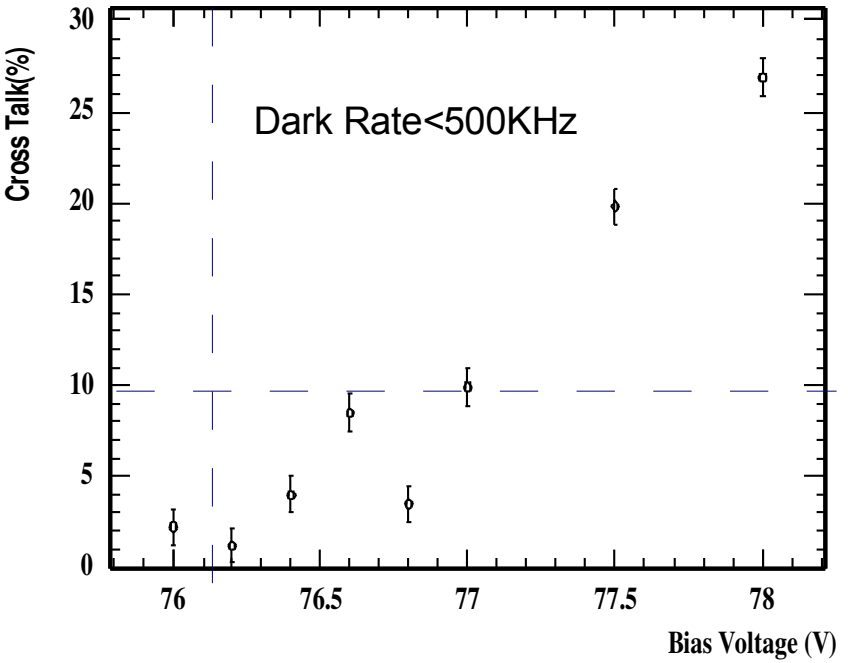
We focused our attention to the SiPMs from the batch with better blue sensitivity

arXiv:physics/0605241

MPPC: Characterization

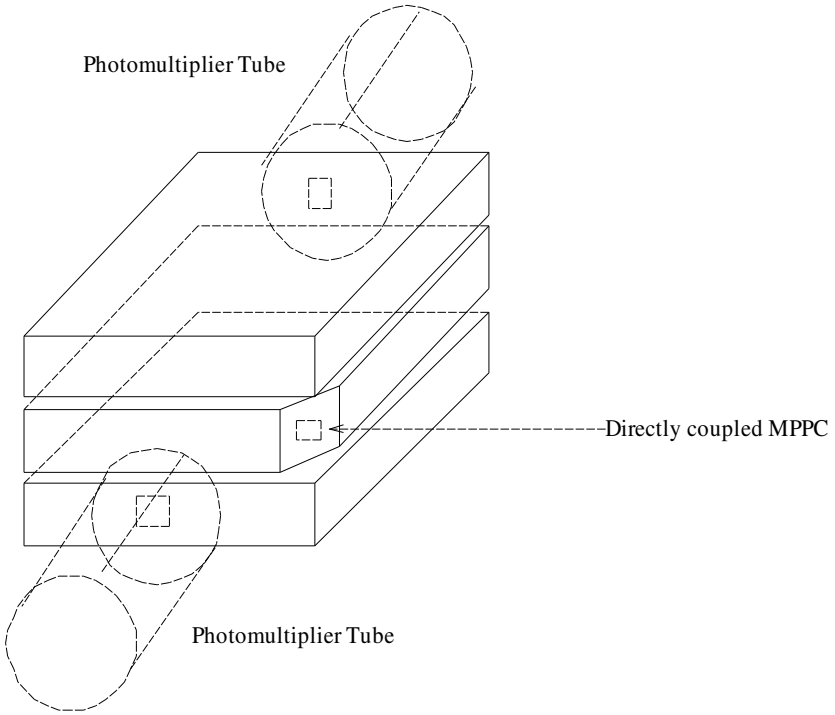


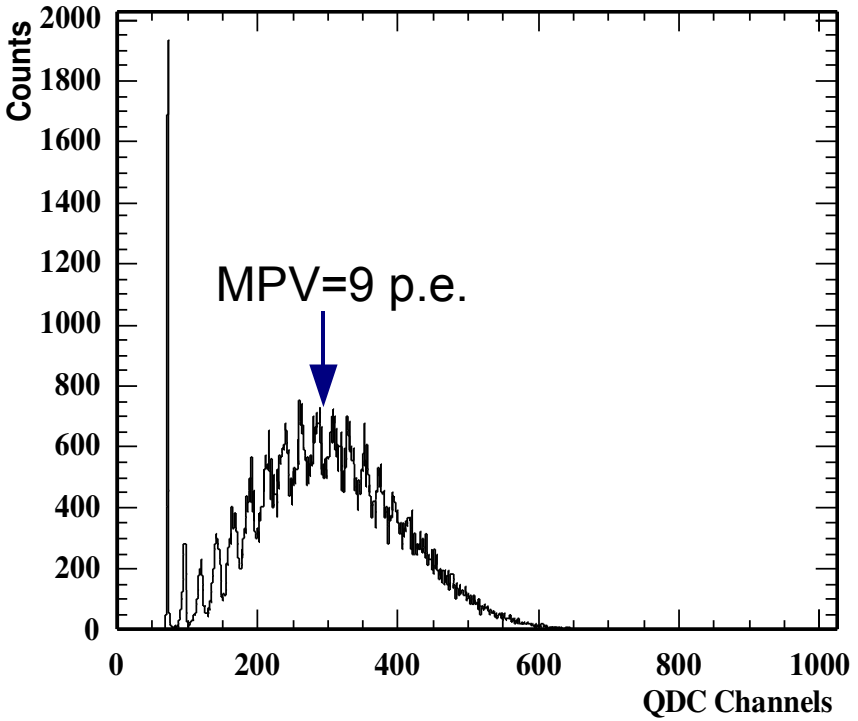
Spectrum acquired with a green LED directly coupled to the MPPC: the typical single photo electron spectrum can be observed.



Cross talk: deviation from the Poisson distribution of the LED response spectrum.
The dark rate is less than 600KHz for the shown voltages

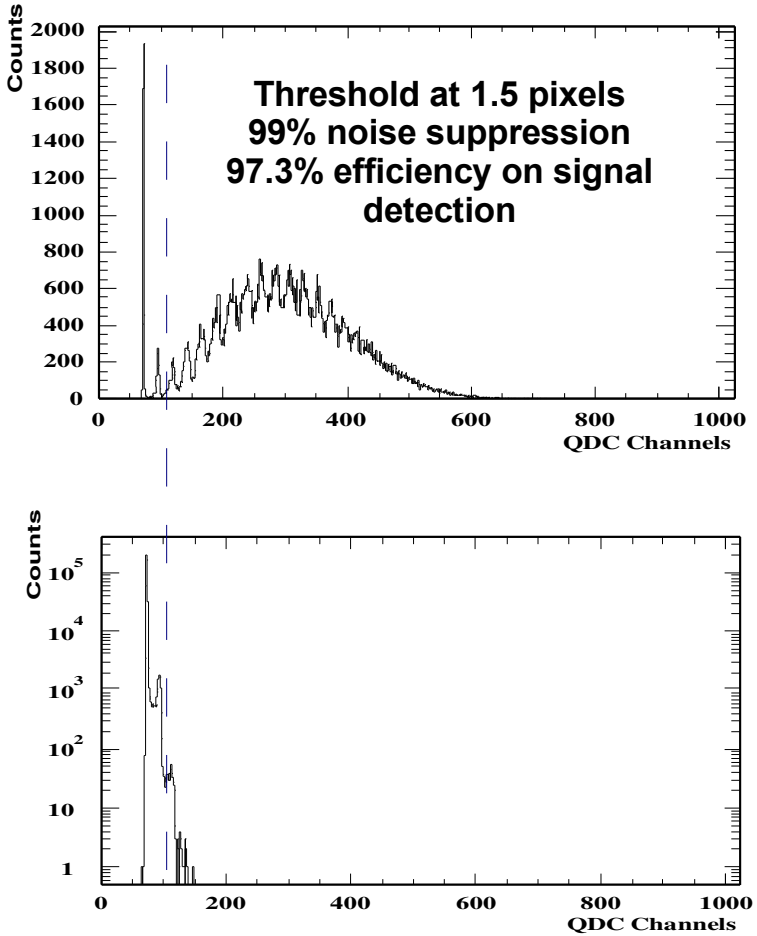
Direct readout of the HCAL scintillator tile

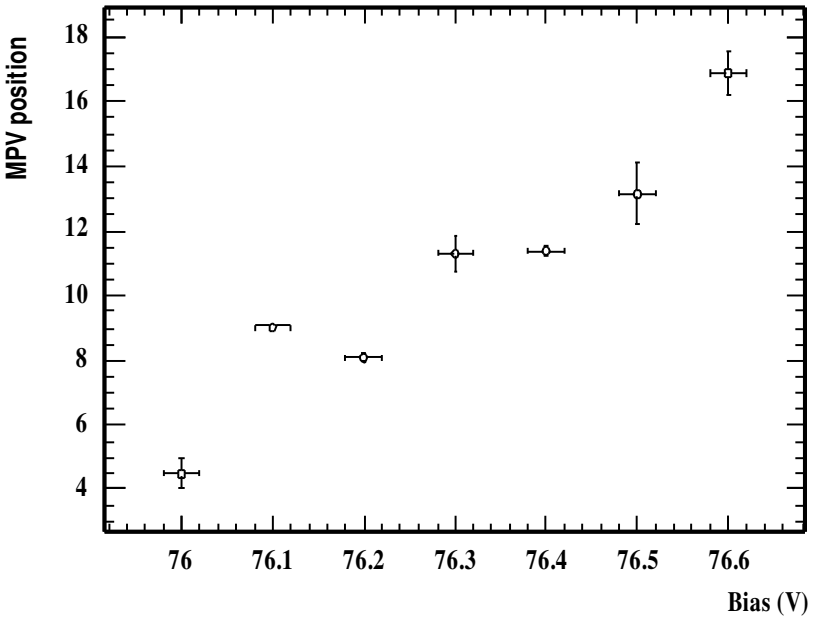




The direct readout of a HCAL tile calorimeter with a Hamamatsu MPPC. A source of Ru106 is used. Spectrum taken at 76.1V. **The MPV of the Landau distribution is at 9.02+-0.06 photoelectrons.**

The event discrimination





Dependence of the MPV position on the HV

Conclusions

- We have tested a direct readout of the tile hadron calorimeter with the multi pixel Geiger mode avalanche photo diode
- The study and characterization of the Hamamatsu MPPC make this product promising for this application: we will receive new samples to test by this month.
- More studies about the light readout uniformity and the optimal position of the MPPC in the tile have to be performed