Prototype Calibration

Test beam October 2003

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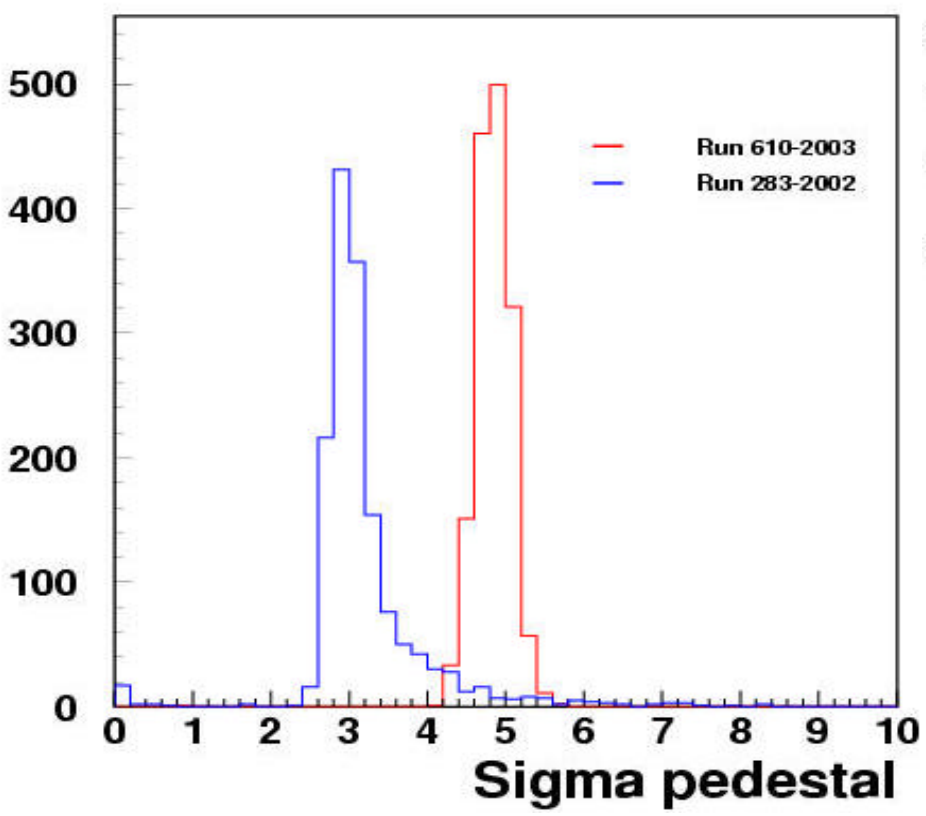
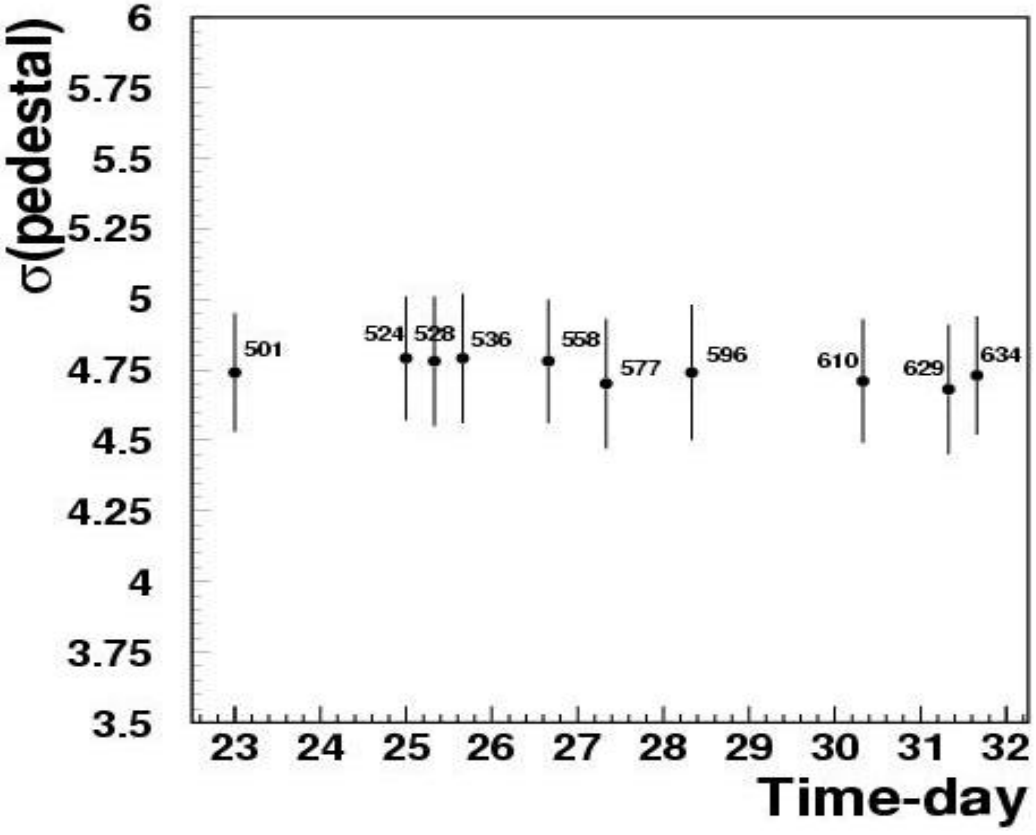
Detector Performance

- Status of the 1536 channels
- Pedestals behaviour
- PMT Gain
- High / Low Amplification

Status: Very good performance, only 1 dead channel

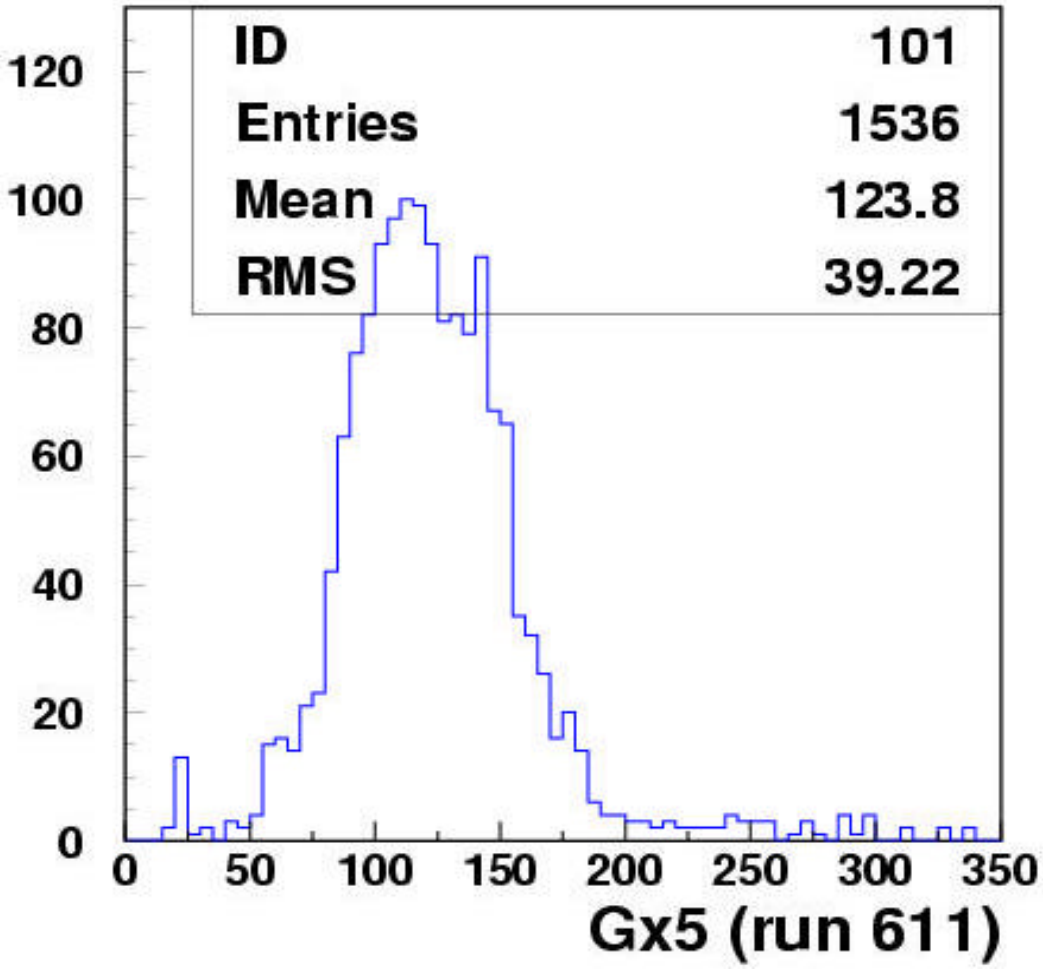
Pedestals: wider than tb-2002 but stable

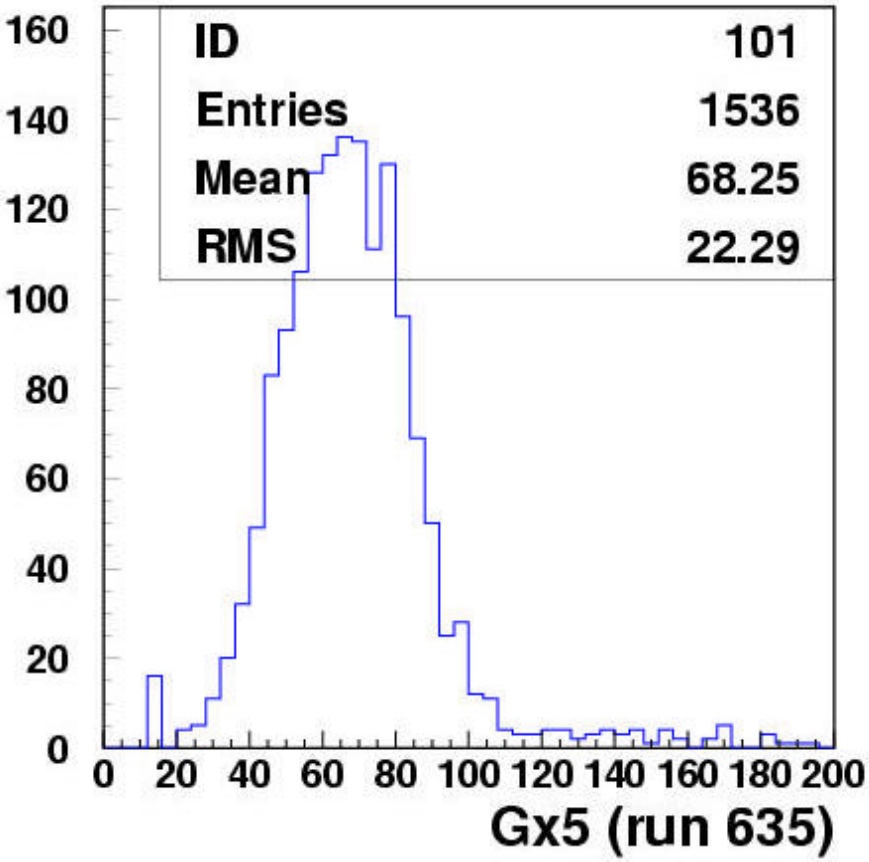




Gain: Only 2 LED runs in raw mode ➡ 611, 635 (HV=HV-50)

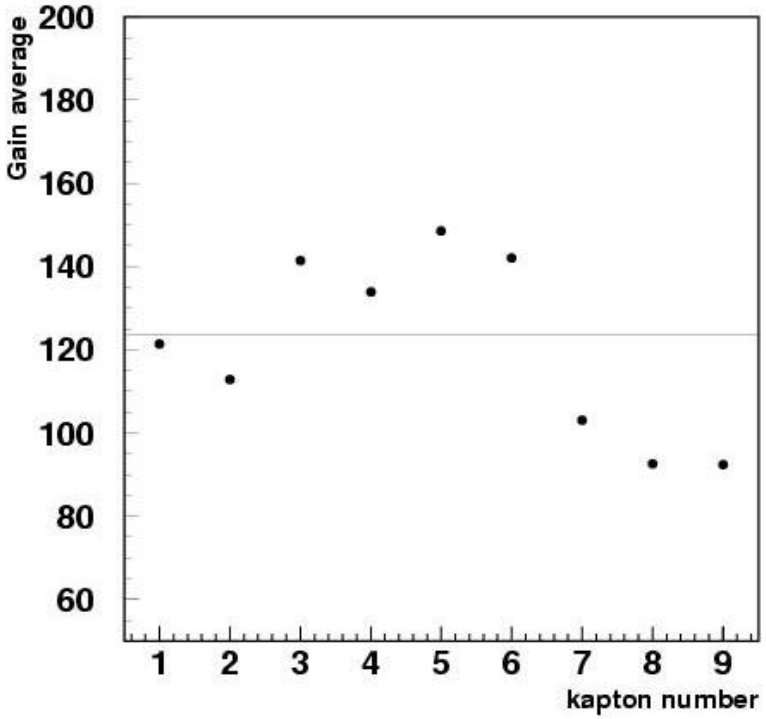
(In addition, a very first LED run: 1001)

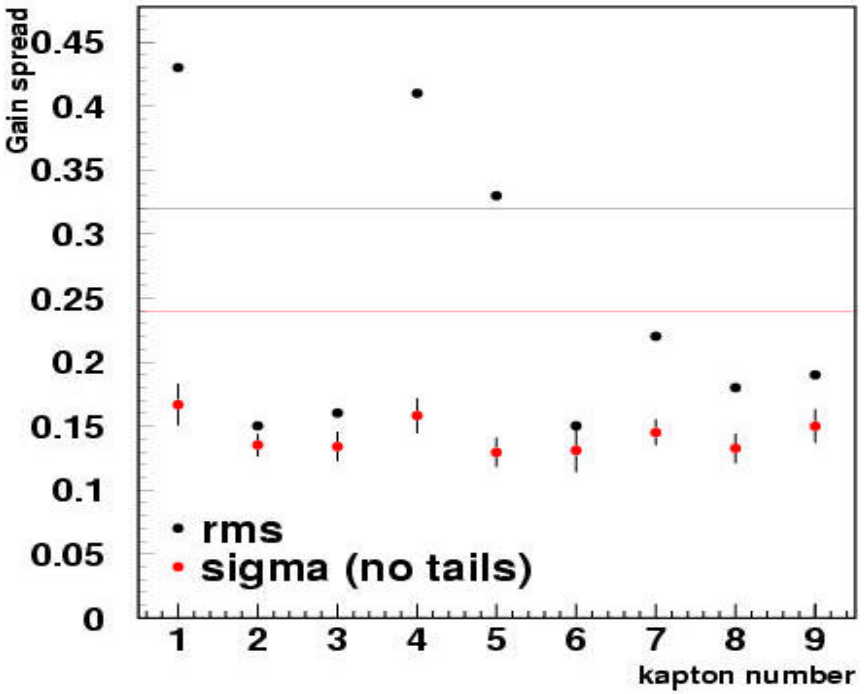


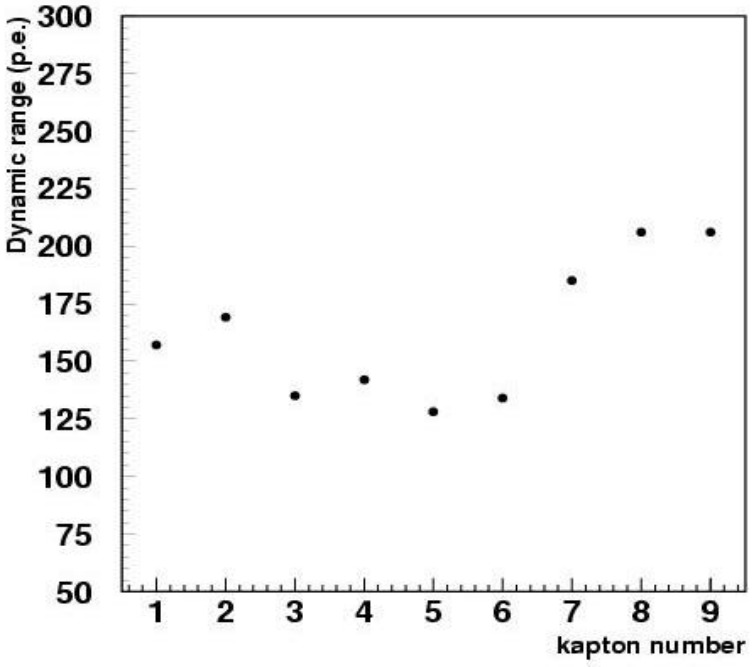


These values are used in the reconstruction

Gain distribution in the PMT plane



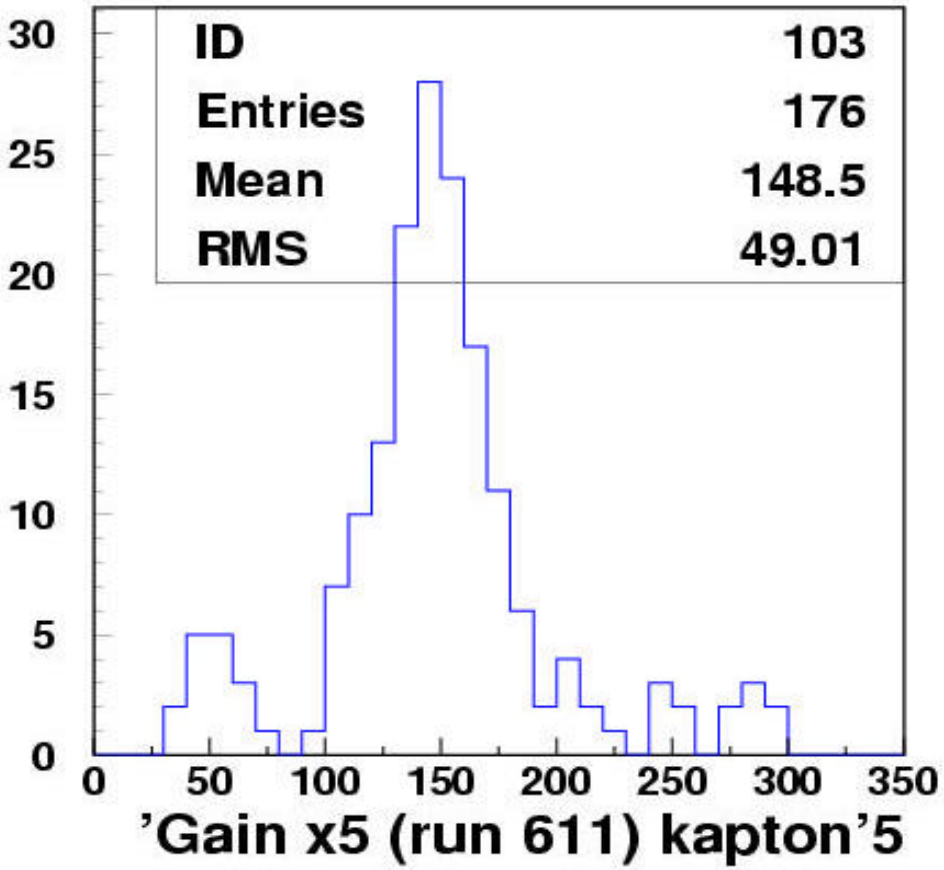




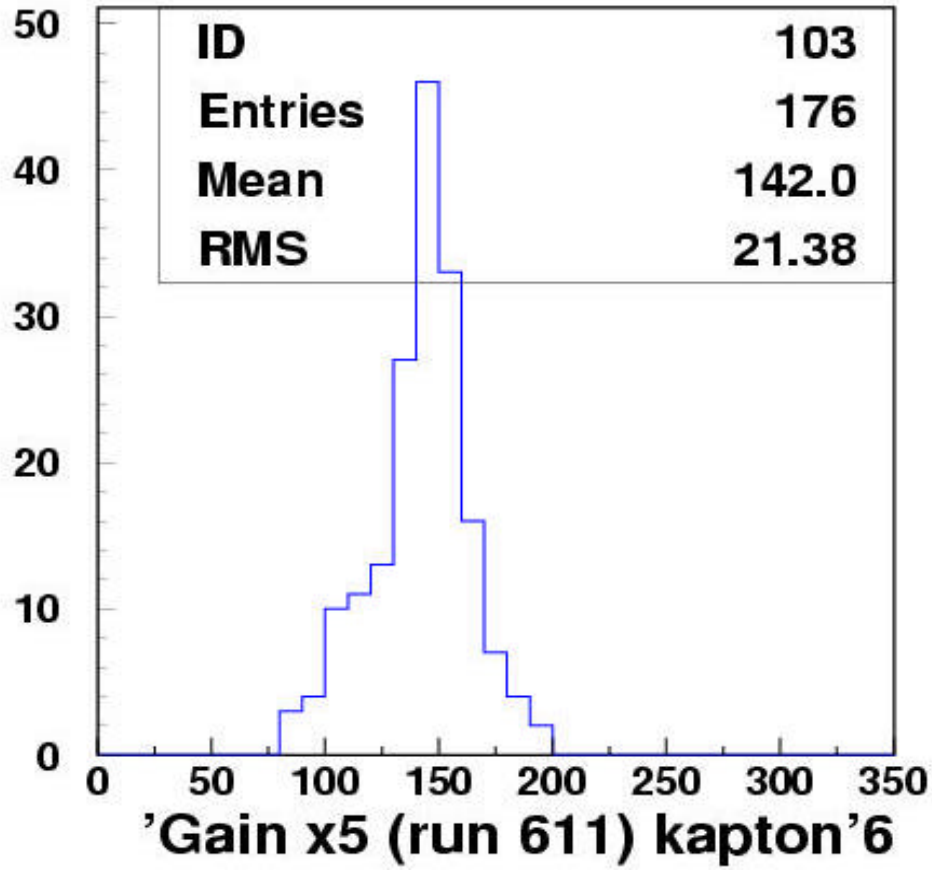
- Peaking time and voltages are well tuned inside a kapton (not always)
- The global spread is due to differences among kaptons and leads to very different dynamic ranges

For example, a PMT with Gx5=200 has a d.r. of 95 p.e. . For Fe, hits with this number of p.e. are expected

Low gain PMTs together with PMTs of very high gain on the same kapton

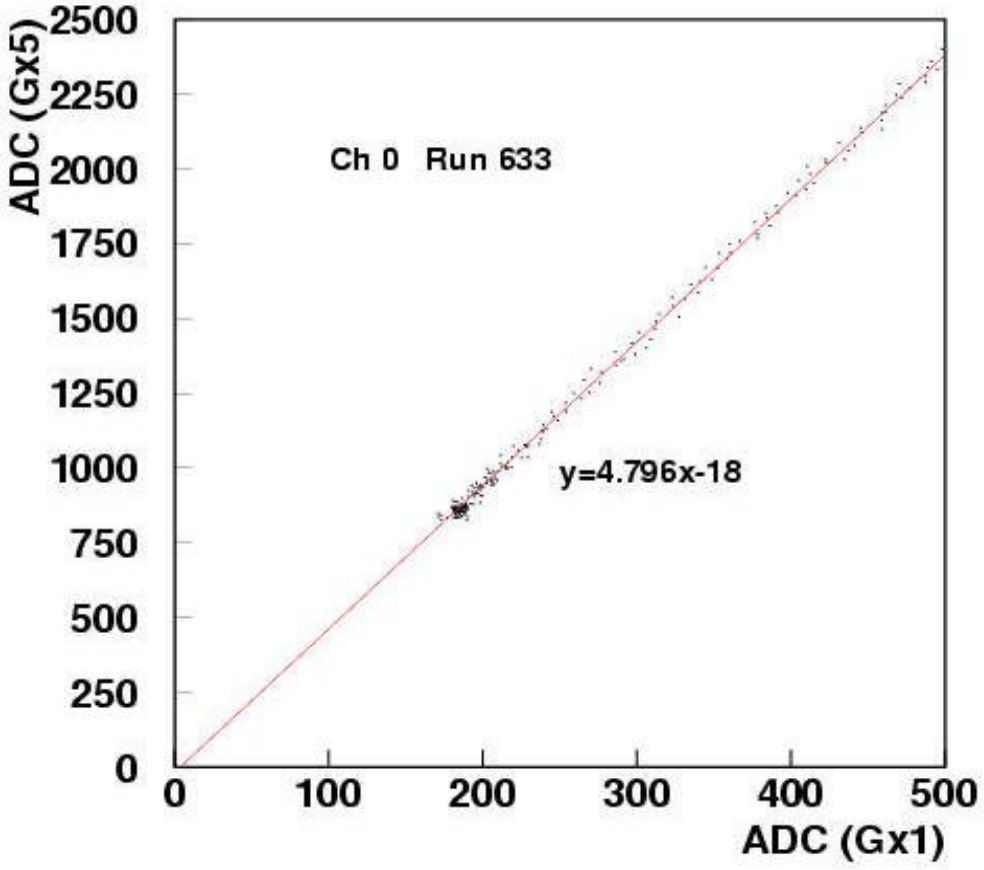


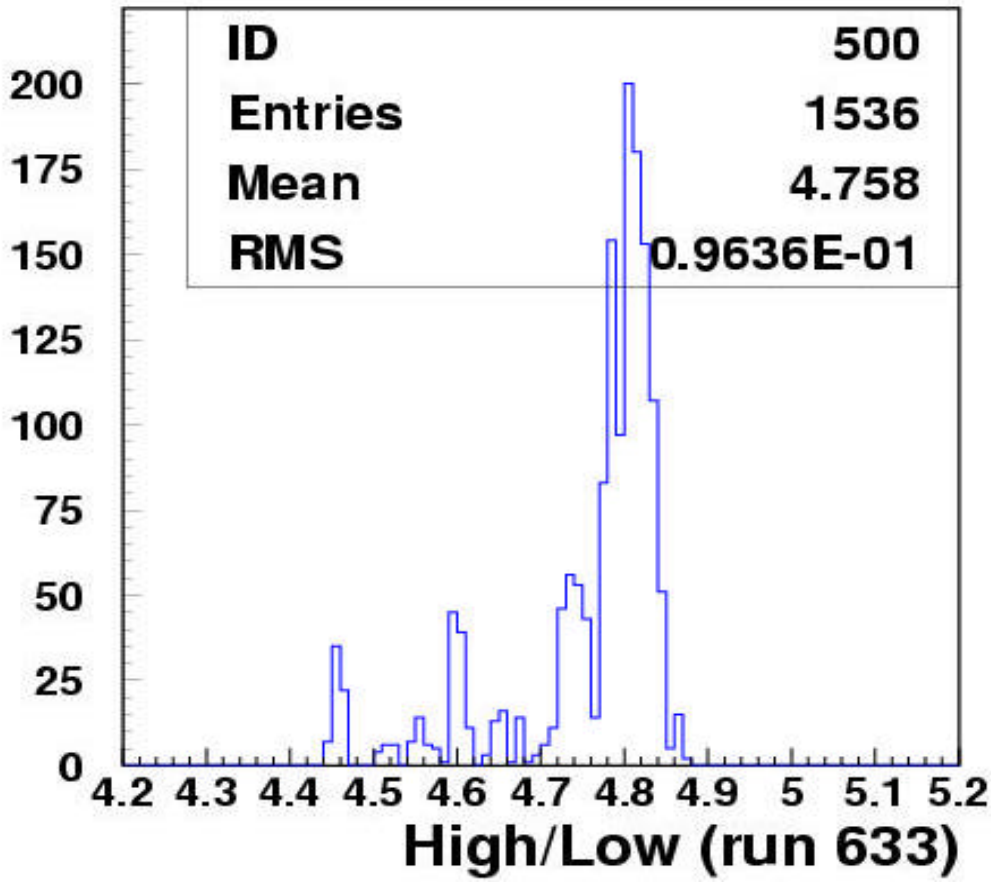
Unnecessary high gain for all the PMTs on the same kapton



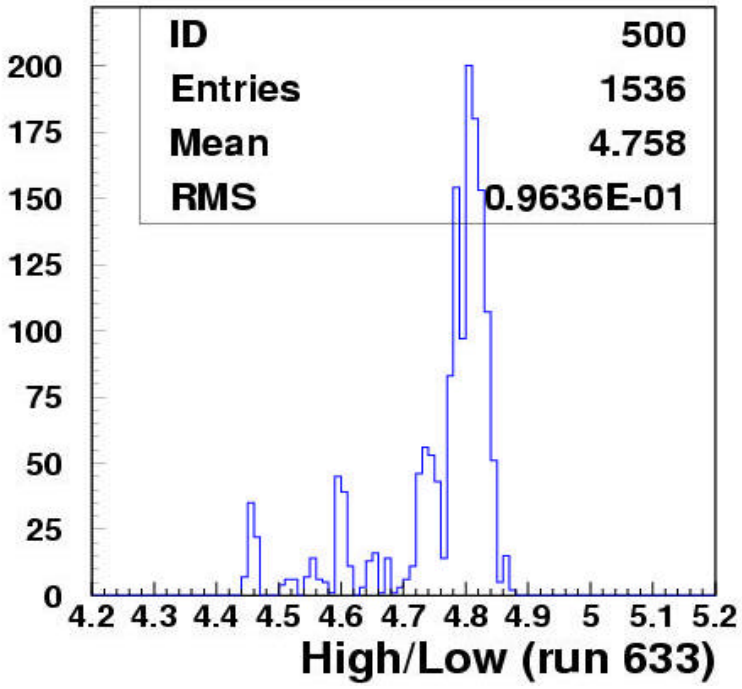
High / Low Amplification:

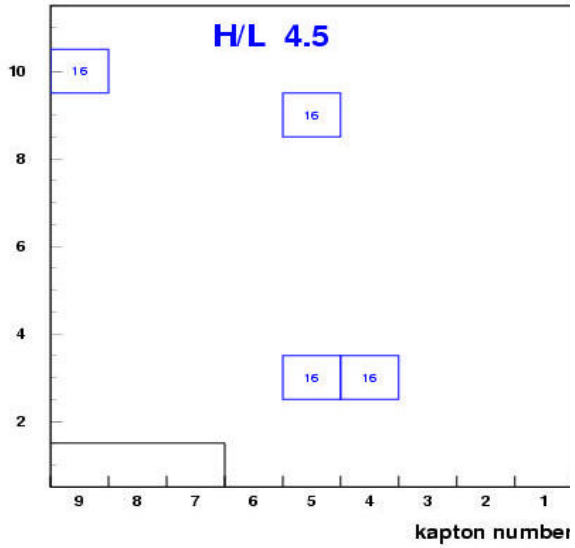
- Using raw data, both readouts are available.
- H/L factor could be obtained for each channel from these scatter plots.
- The same factor is valid for all the dynamic range
- H/L is not the same for all the pmt,s

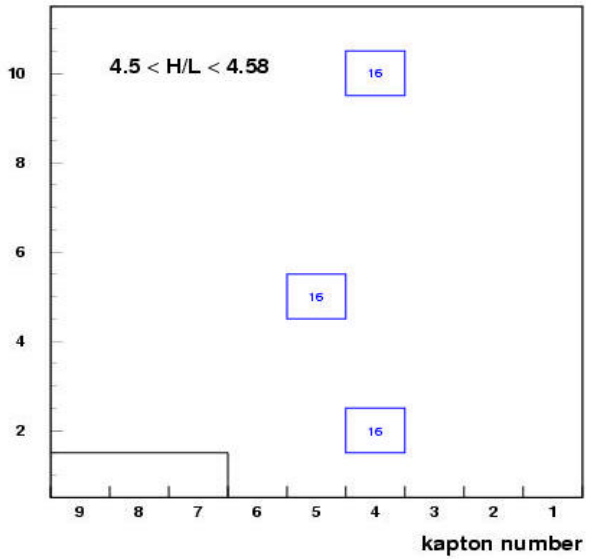


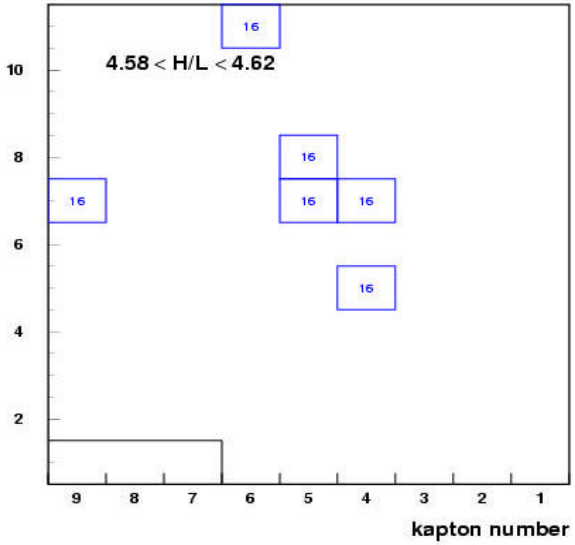


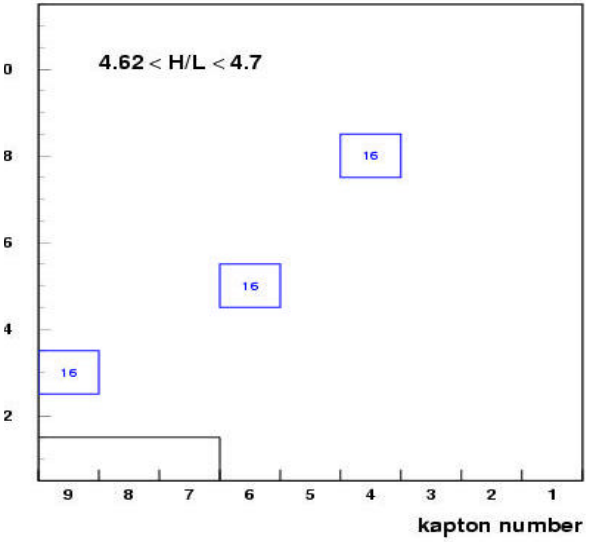
Each bin corresponds to a PMT



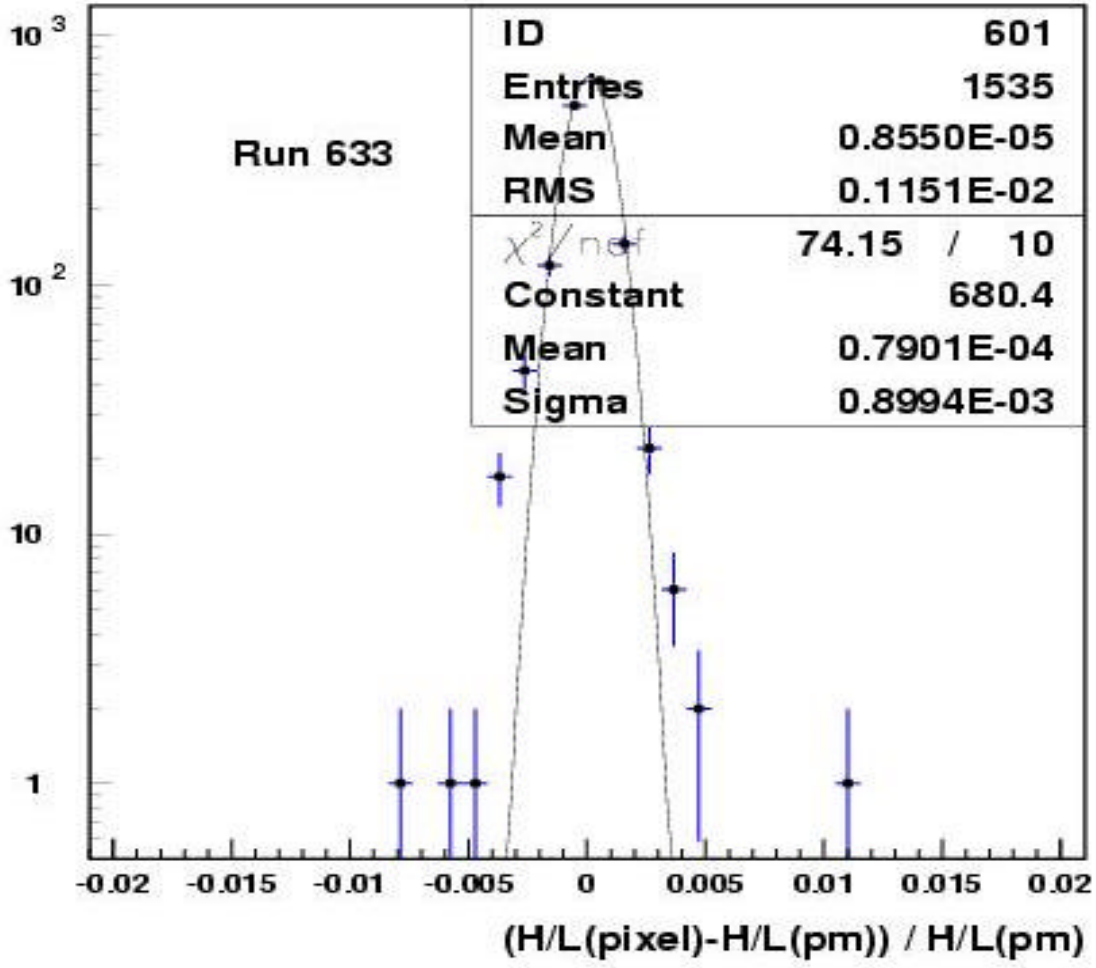






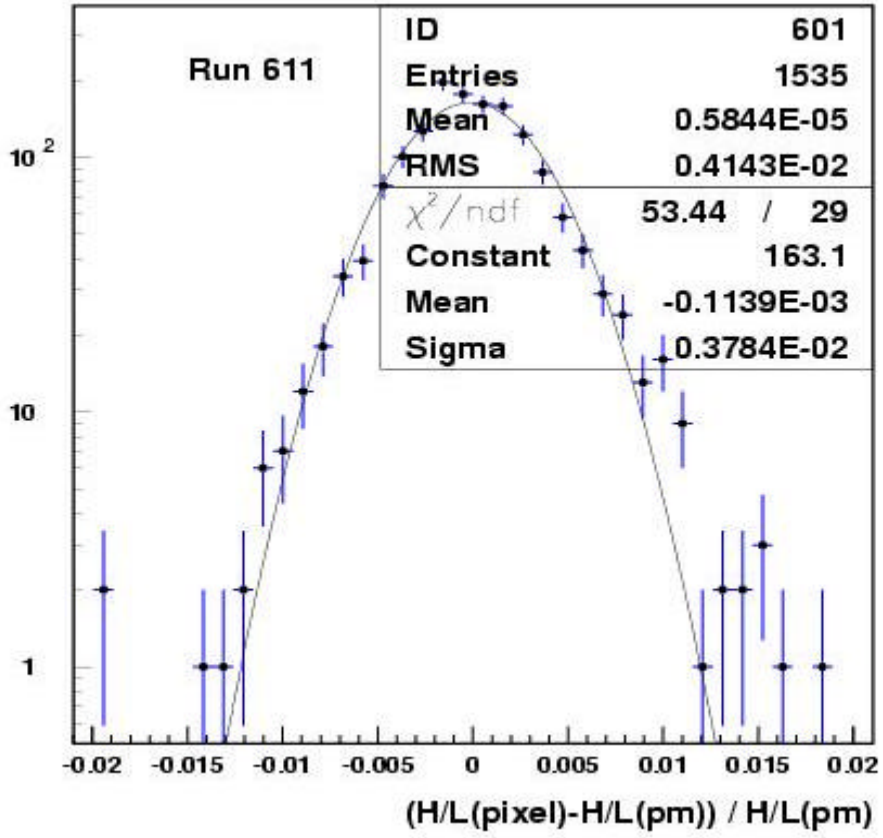


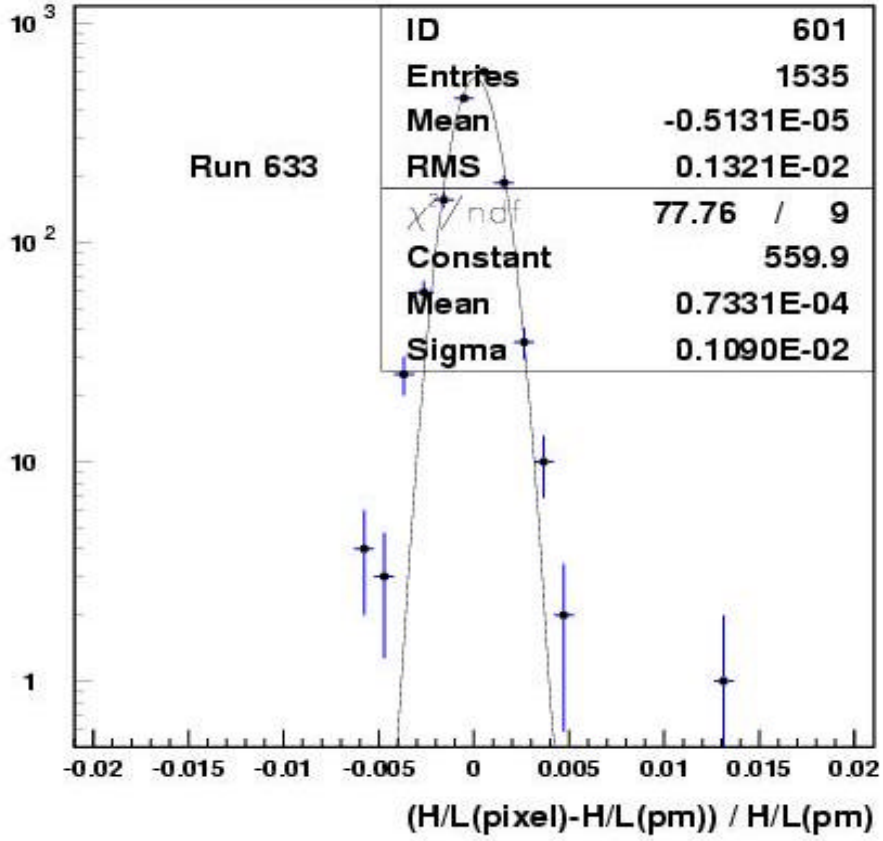
These factors are known with very high accuracy
As we have a value of H/L for each PMT, we can measure the error as the spread around this mean value.



Using a LED run with a smaller dynamic range the error is larger.

A wide dynamic range with small statistics (10%) is enough to reach an error smaller than 0.5%



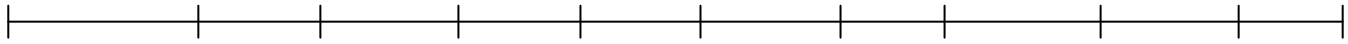


In order to calibrate the amplification, runs with double redout (but only for fired channels) will be very useful. A high statistics is not necessary only data with a wide dynamic range.

Stability along the test beam

To calibrate the detector, LED and Pedestal runs are available

Pedestal runs:	1000	501	524	528	536	558	577	596	610	629	634
LED runs:	1001	502			537	559		597	611		635
Time:	17	23	25	25	25	26	27	28	30	31	31



Bad channels:

Channel 655 (pm 40, px 15): no signal

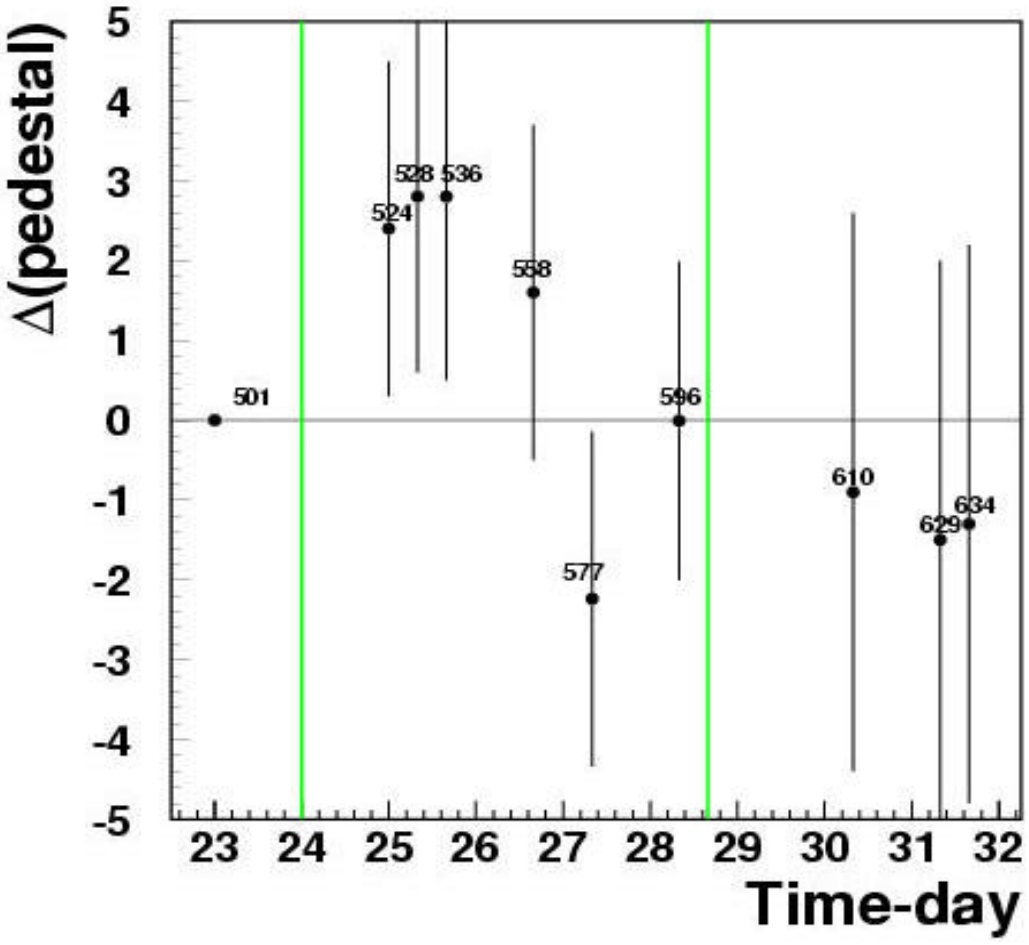
Channels 95, 166, 147 negative pedestal (from run 524 to run 596)

PMT 10 and 23 double or negative pedestals (from run 524 to run 596)

The first kapton channels are not used from run 507 to run 523 (big pedestals movement to smaller values)

Pedestals:

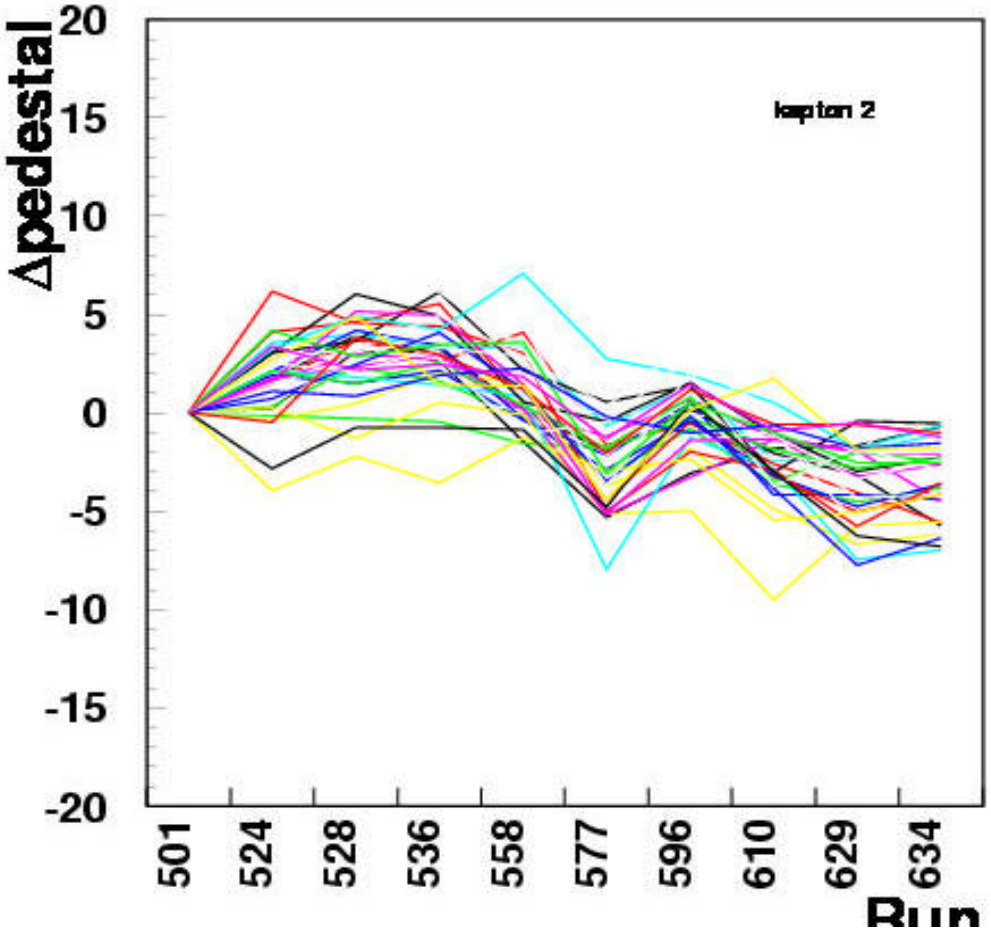
- Appreciable pedestal movement
- Mostly during interventions: It is not observed either inside a run or when there is not intervention between pedestal and LED runs

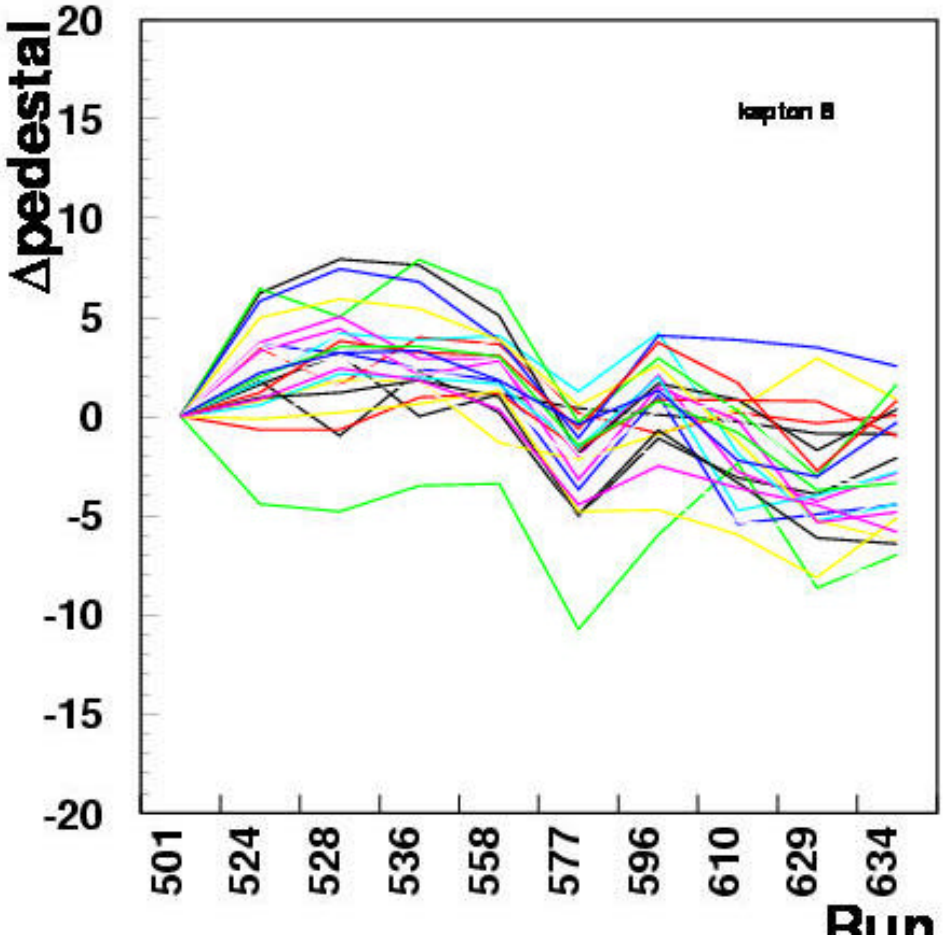


? (pedestal) is obtained from the distribution of the pedestal shift. The mean value and the r.m.s. (error) are plotted for each run

During the time bound by green lines some channels presented problems (reported before) and the first kapton channels are not considered because of the large shift. From run 610 the first kapton pedestals came back close to the primitive values (run 510)

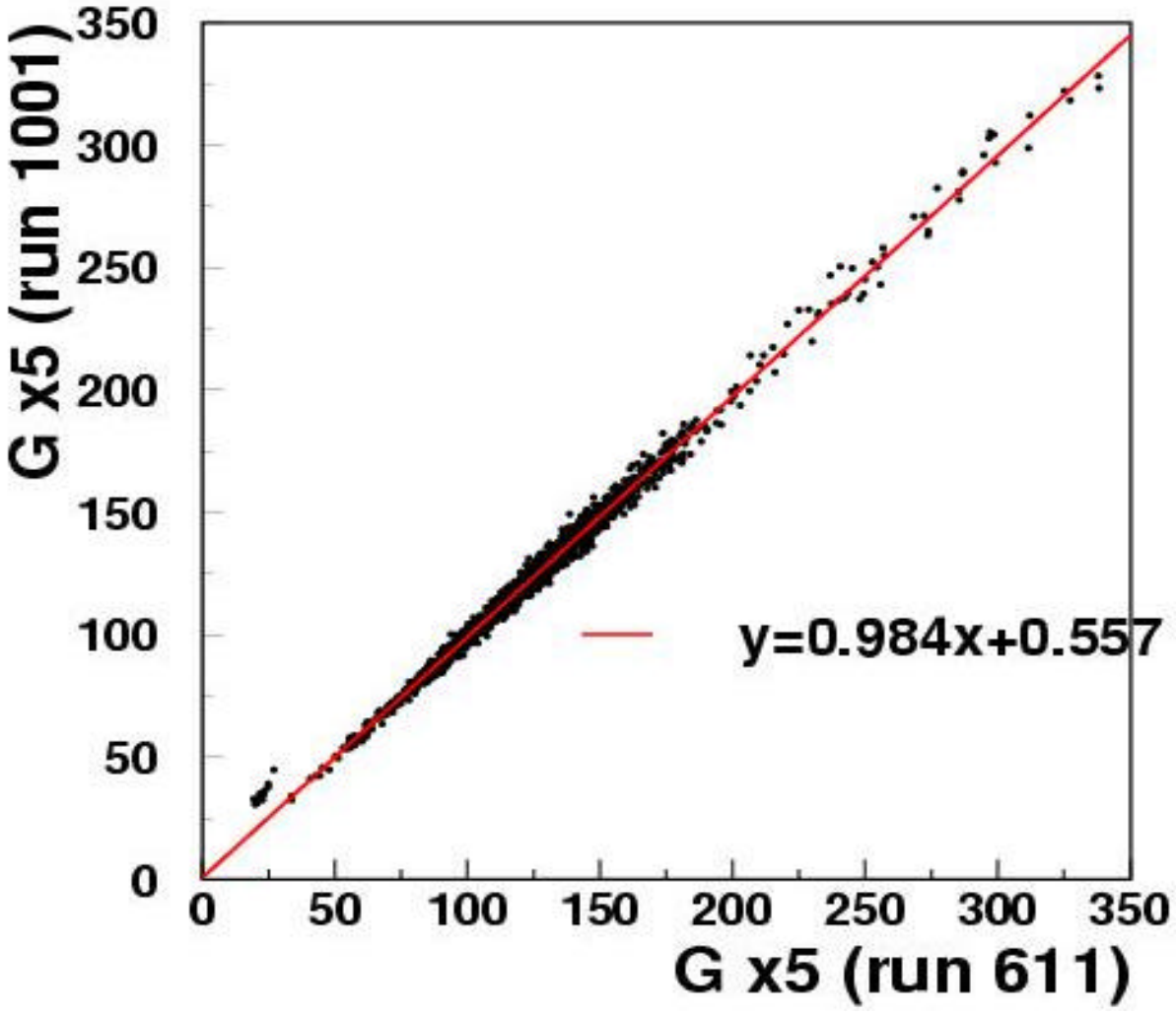
❖ All the channels move on the same direction





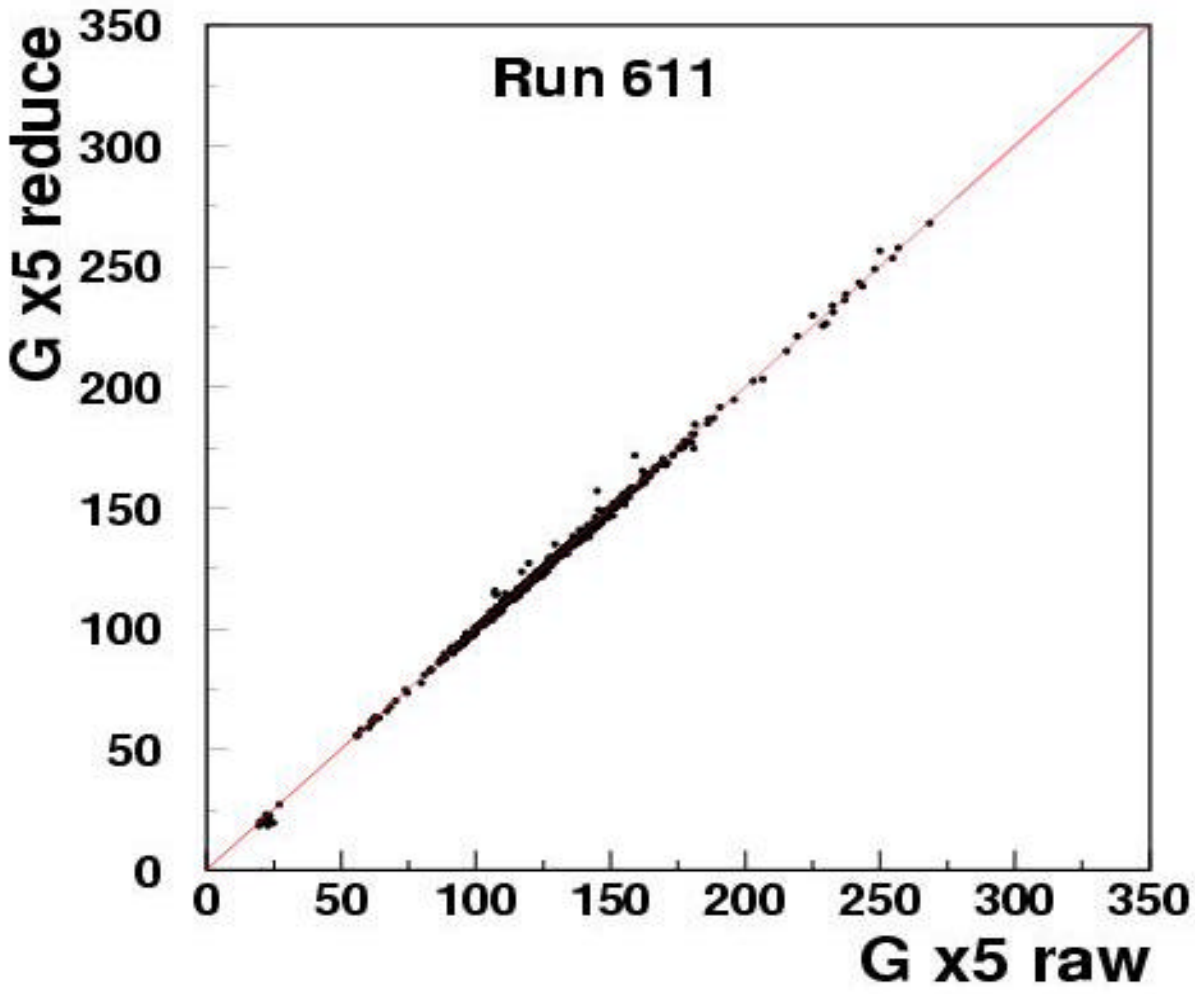
Gain:

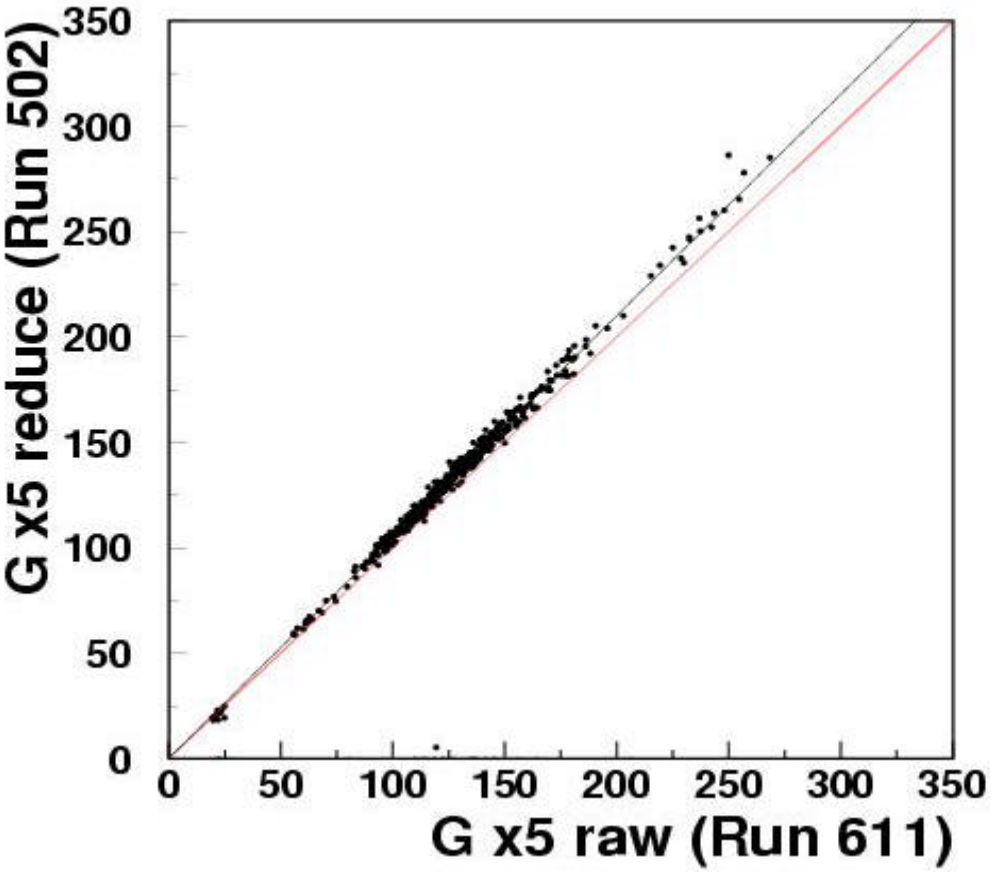
- LED runs in raw mode agree within 2%

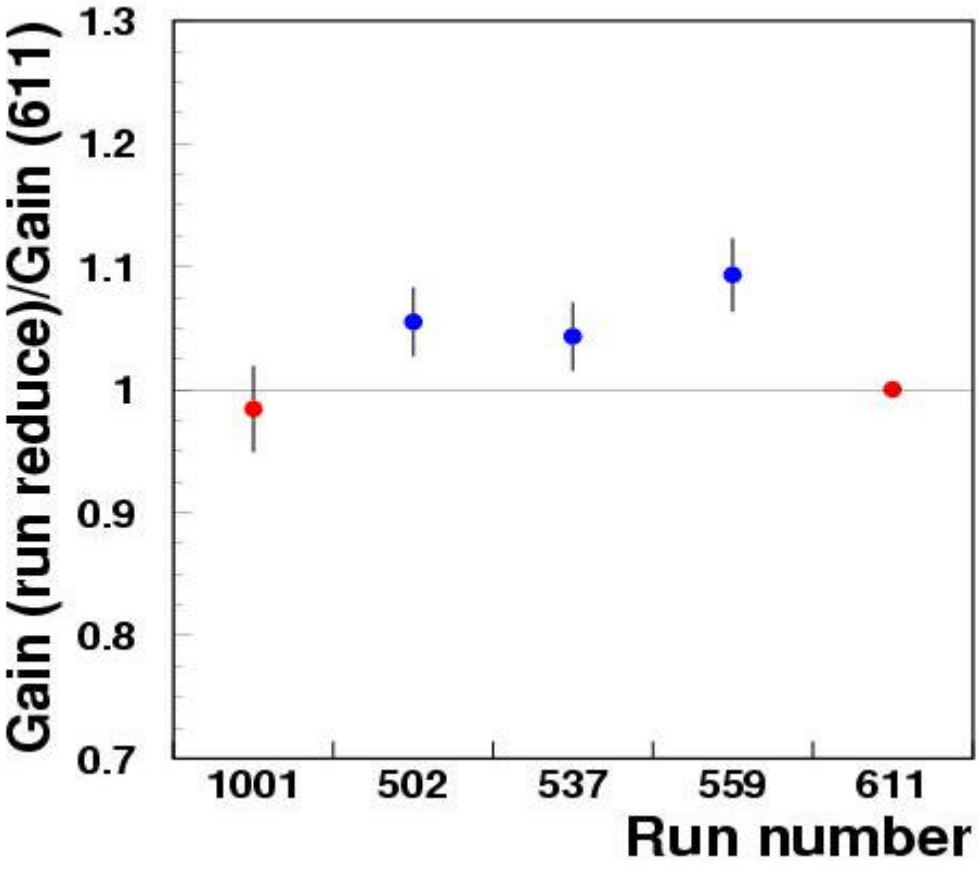


We have tried to use LED runs in reduced mode to calibrate the PMT

To test the fit method for reduced LED runs, the run 611 is converted to reduced mode applying a threshold on Pedestal +15 ADC







- LED runs in reduced mode have a gain 5% larger than run 611
- This variation is not appreciable in data runs
- The information about pedestal position is missing in reduced mode and we know there are frequent pedestal movements
- The calibration of LED runs in reduced mode is not used

Conclusions

- Very good detector performance
- Problems: Pedestal movement and very dificult gain monitoring (no LED runs in raw mode)
- For the future: Reduce the spread of gains among kaptons and HV lines, trying to reach a homogeneous dynamic range
- To monitorize H/L factor, “raw” data runs are prefered to the LED run because of their wider dynamic range