Test of 16 1-in PMTs in the pressure vessel with the PMm2 DAQ

Videoconference – Orsay – March 16, 2010

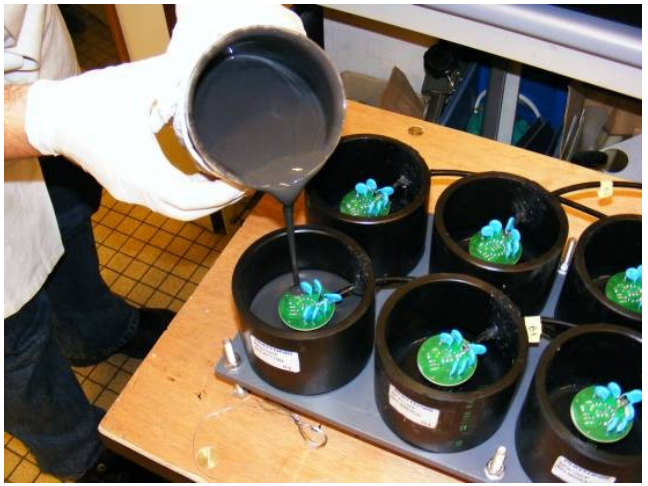
IPNO detector dept.

http://ipnweb.in2p3.fr/~detect

Outline

- 16 1-in PMTs have been tested in the pressure vessel with the PMm2 DAQ, from February 8 to March 8
- When running, we performed at least one acquisition per day, at 1200 V and several DAQ thresholds
- Water leaks occurred
- The failures raise the issue of a necessary slow control
- We performed investigations on the water leaks
- Conclusions for the demonstrator

Preparing the PMTs

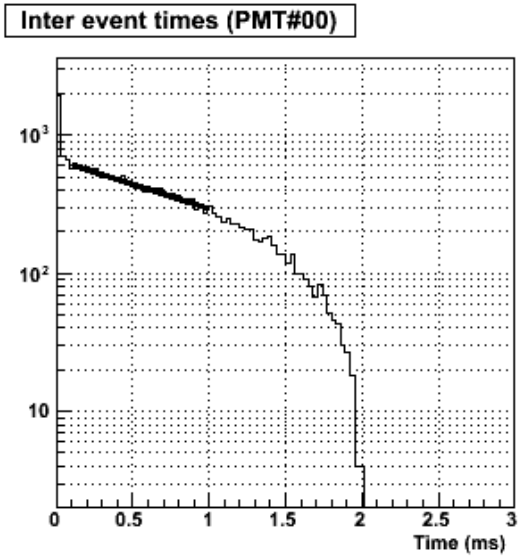


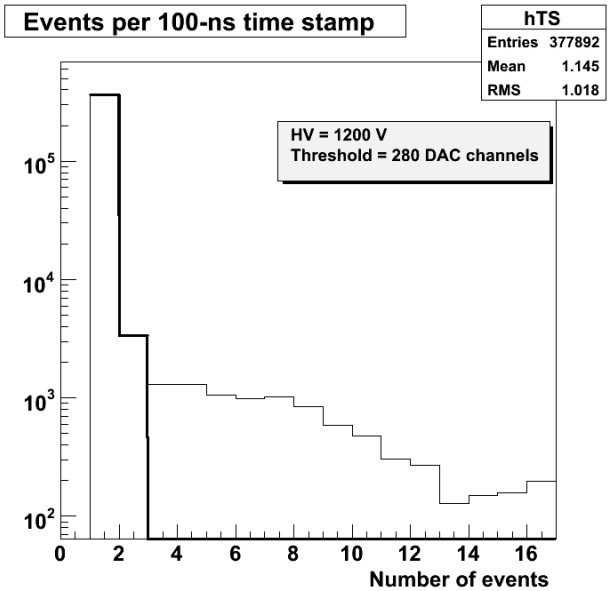
- 16 XP3102 1-inch PMTs
- Measured with the FE board + DAQ before potting (pedestals, charge – cf. previous meeting)
- Potting
- Measured before flooding

Routine tests

- High voltage: 1200 V
- Thresholds (DAC channels): 250, 280, 300, 350
- « random » configuration of PARISROC channel gains, common gain at maximum (always the same)
- Gain adjustment, with a target of 1500 ADC channels (to validate the stability of the fitting algorithms)

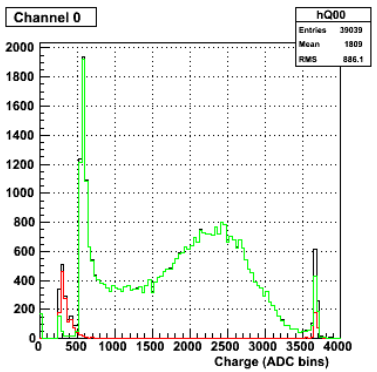
Counting rate measurement

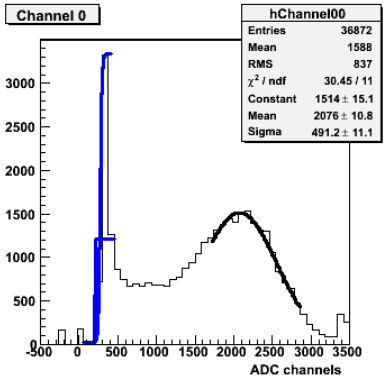


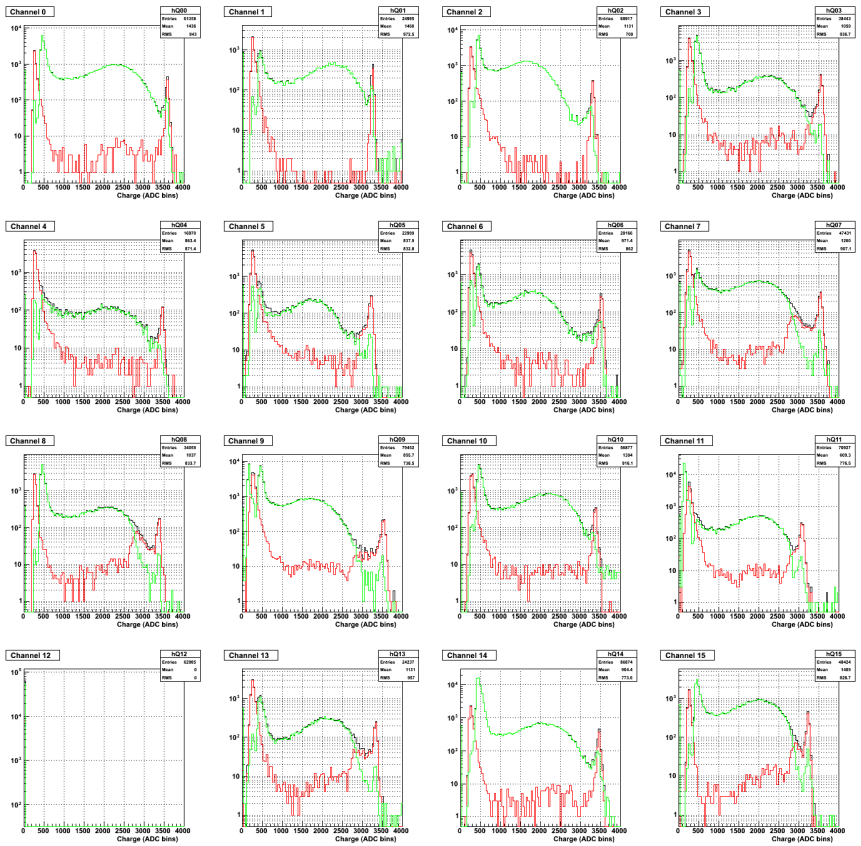


- The inter-event time is the most reliable
- Measurement on 2 ms maximum due to a software limitation
- Comparison with the number of events over the acquisition time: 50 % dead time!
- Occupancy per 100 ns: non Poissonian

Single electron peak

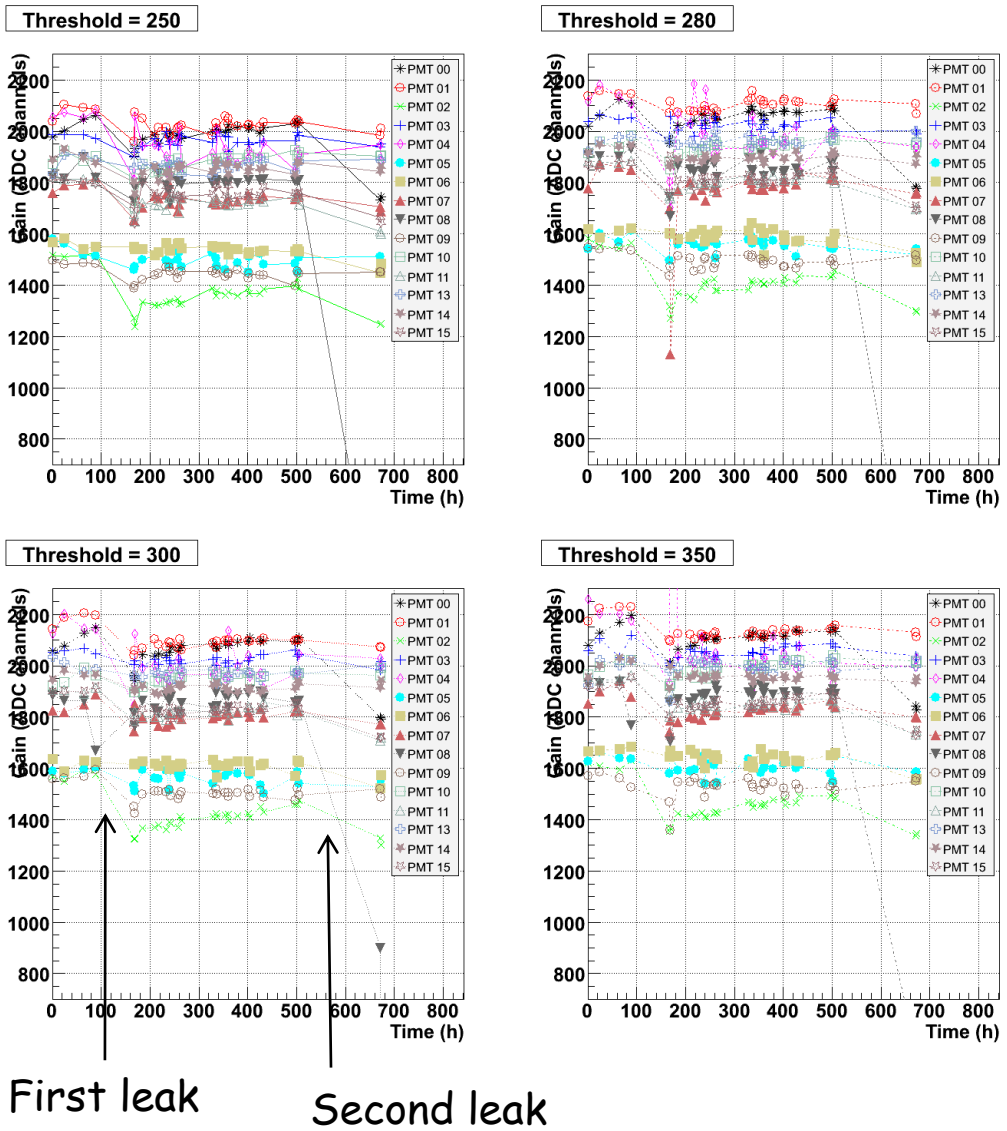






- Method adopted after several different runs (problems of convergence with some PMTs after the leak due to an increased crosstalk)
- Suppress events where too many coincidences
- Automated fit method: peak detection (ROOT), fit around the peak from an estimated relative width of 30 %

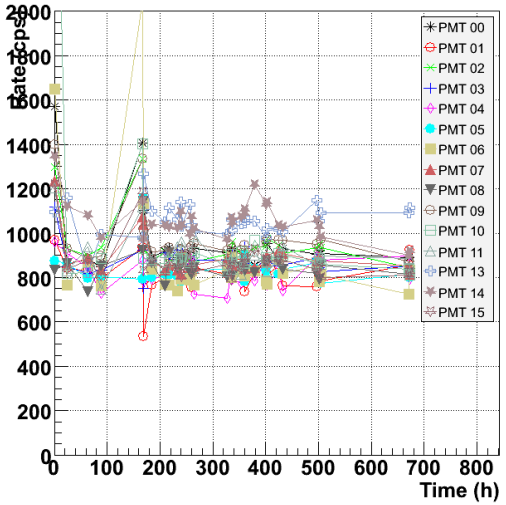
Routine tests: gain



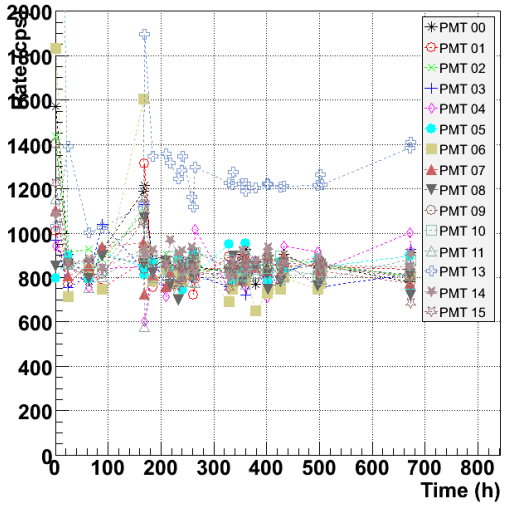
- Change for nearly all tubes after the first light leak
- Followed by a slight increase
- we don't know whether it is caused by the power supply, bias instability due to a slight water leak, or something else

Routine tests: rate

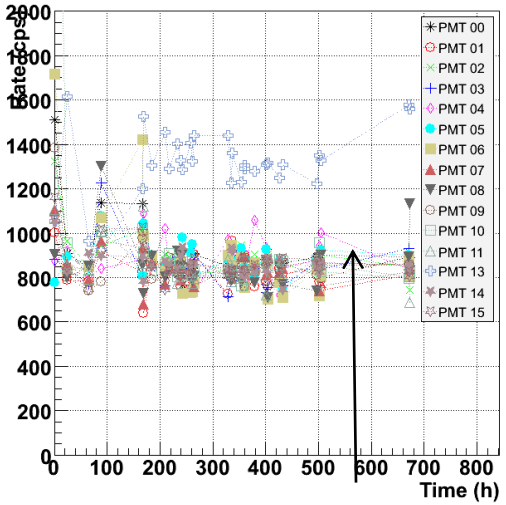
Threshold = 250



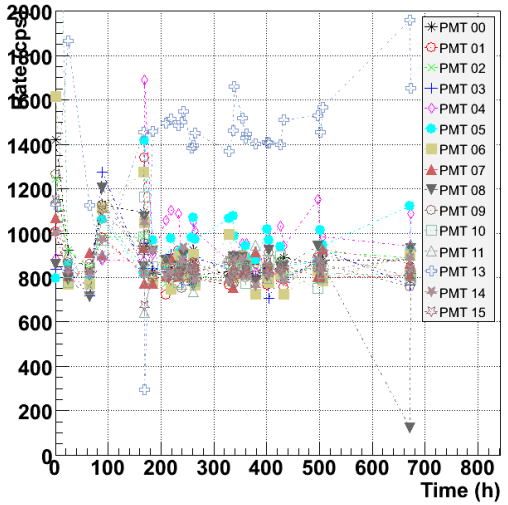
Threshold = 280



Threshold = 300

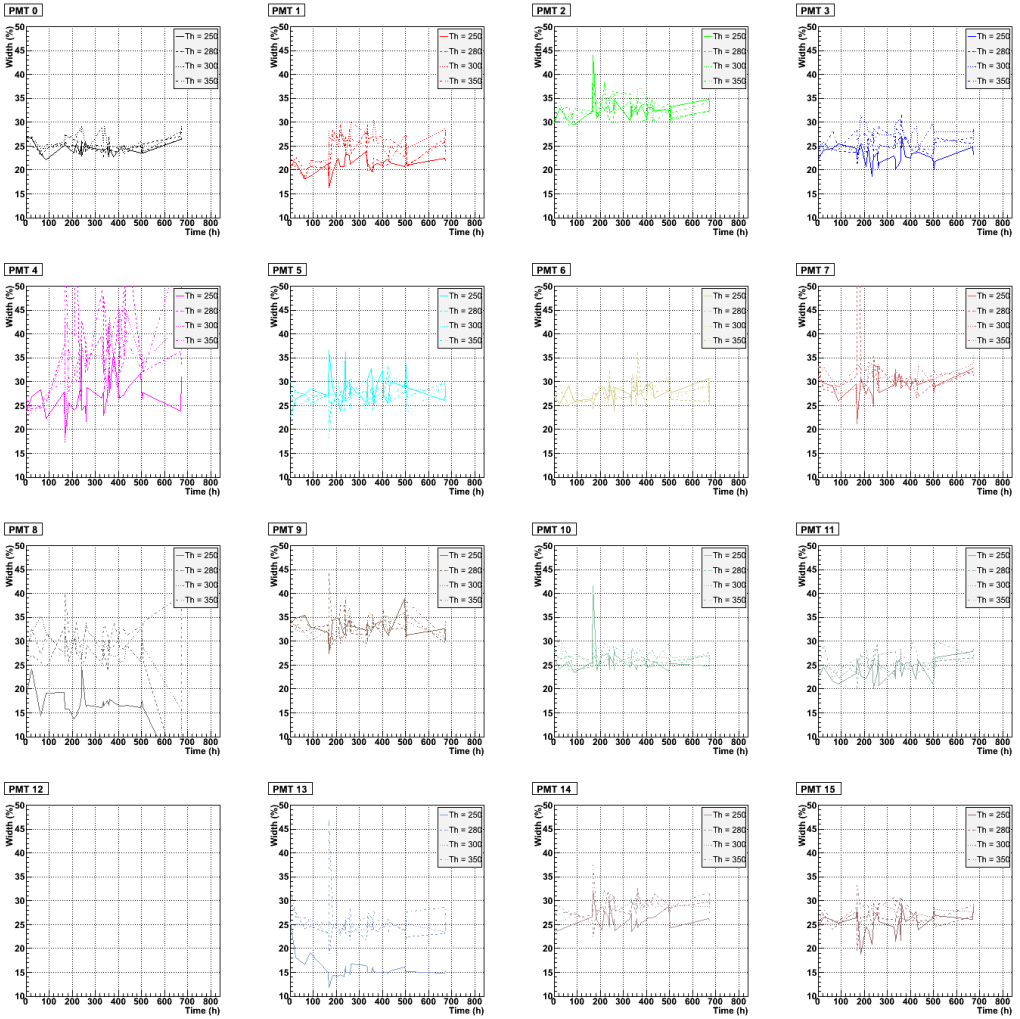


Threshold = 350



- Fit not always converging

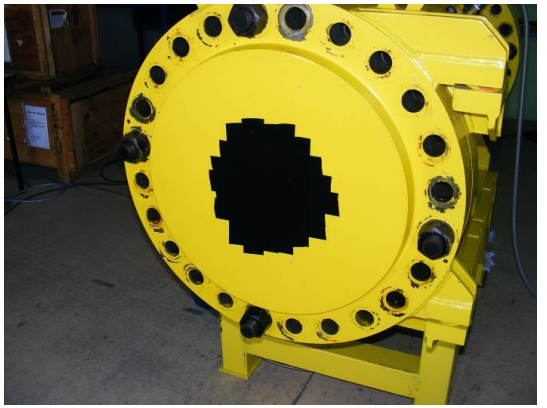
Routine test: width



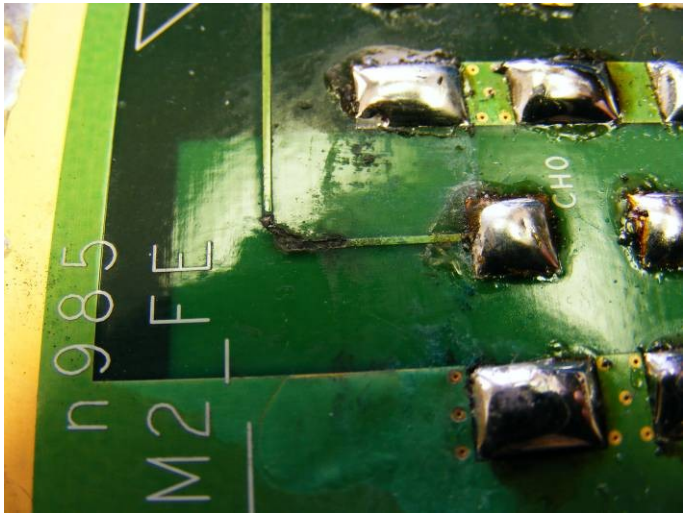
- Difficulties to fit = peak too large / not enough points
- Rather stable / slight increase, except for PMT#4 and #8

First water leaks

- First detected by an increase of the counting rate, then by an absence of single electron peak.
- First: troubles with the enclosure joint. Replaced.
- Suspected troubles in the pressure vessel's water tighness. Corrected



Second water leaks



- Troubles on PMT#8: high counting rate, high voltage does not go above 800 V (short circuit)
- Short circuit due to the water: burns on the PCB!
- More details in T. Nguyen Trung's memo

Need for a slow control

- Monitor the current (preferably per PMT)
- Monitor the high voltage
- Remote switches on the high voltage, per PMT

Conclusions for the demonstrator

- If no update can be achieved for the front-end board (implementation of a slow-control), use the same procedure / code as the one used for the 1-in PMTs
- Make use of a rigid envelope (e.g. with glands) to stabilize the cable potting.