FW status
for the upcoming HADES beam time

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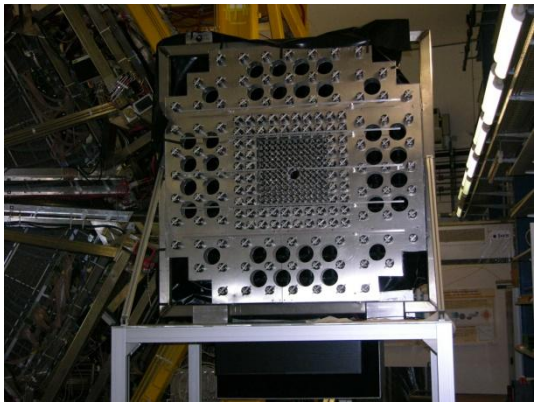
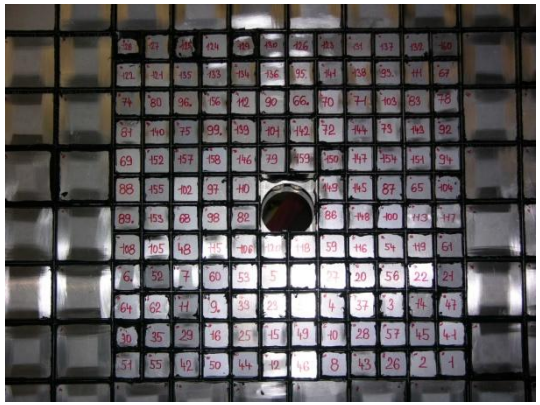
Outline

- Forward Wall for the HADES – goals and design
- FW test results (*Au-Au* collisions, 1.25 A GeV, August-2011)
  - Cell performance
  - FW time calibration
- What has to be done as soon as possible

Forward Wall for the HADES

The main FW goals is the determination of the reaction plane angle in heavy ion collisions.
In a heavy ion experiment **FW-cells have to separate spectators** with Z = 1, 2, 3,…….



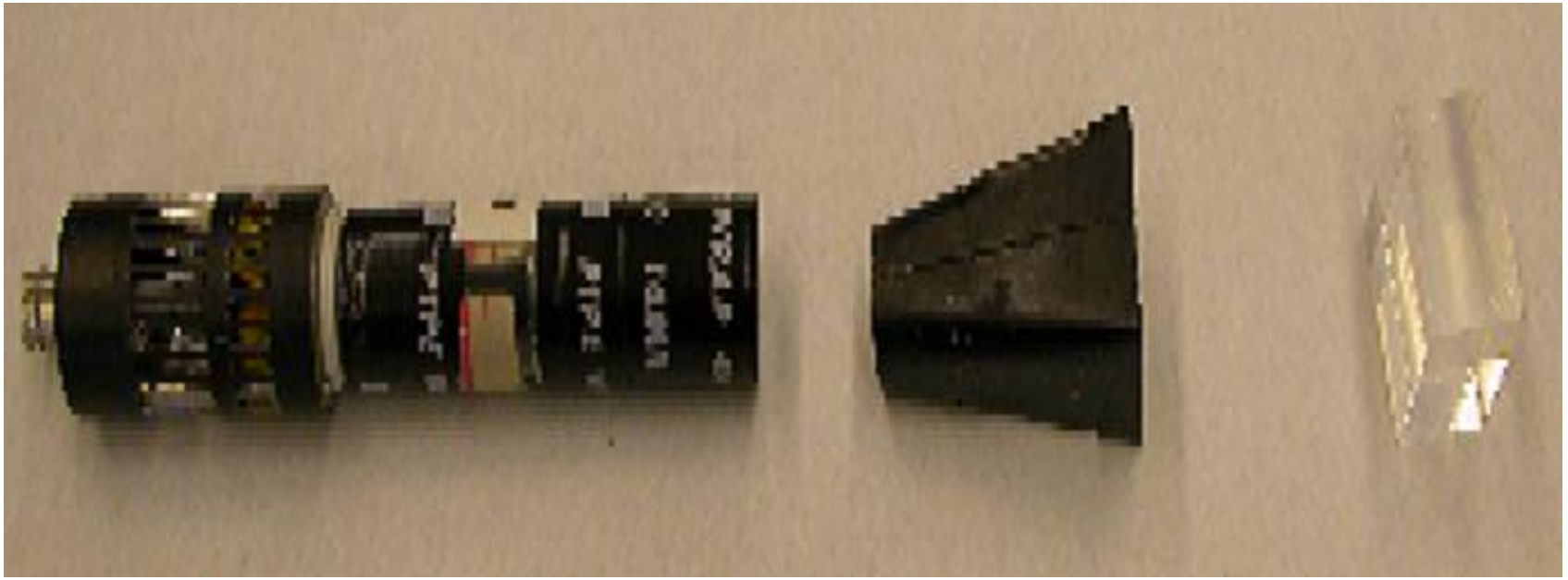


Forward Wall is the hodoscope of plastic scintillation detectors and consists of

144 – small cells, 40 x 40 x 25 mm
64 – middle cells, 80 x 80 x 25 mm
84 – large cells 160 x 160 x 25 mm

TOTAL = 292 cells

Design of the plastic scintillation detector (FW detector cell)

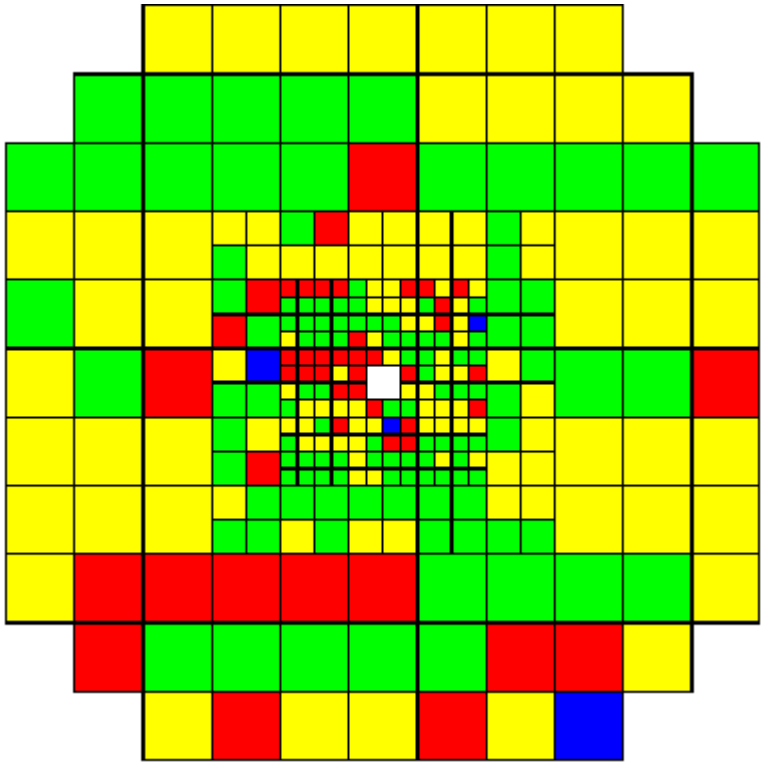


- plastic scintillator BC 408
- air light guide
-PMT XP2982 (XP2262)
- base

FW test results . Cell performance.
(*Au-Au* collisions, 1.25 A GeV, August-2011)

During the test run in August, we analyzed the performance of all detector cells.

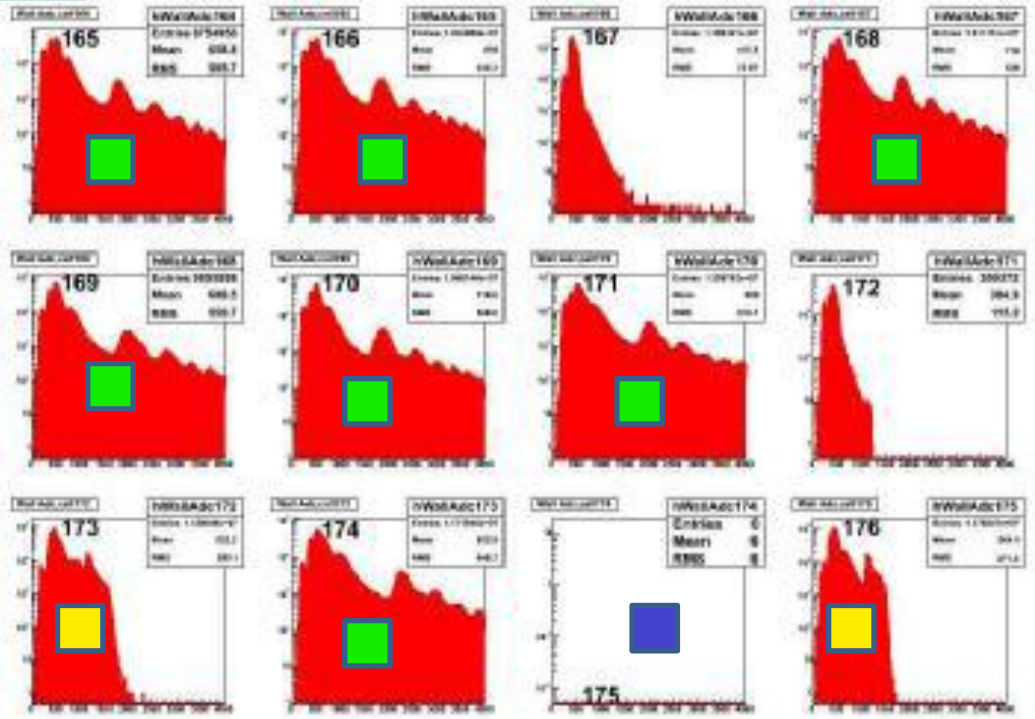
As result the color scheme shows the FW capability to identify of Z-number of secondary particles by different cells.

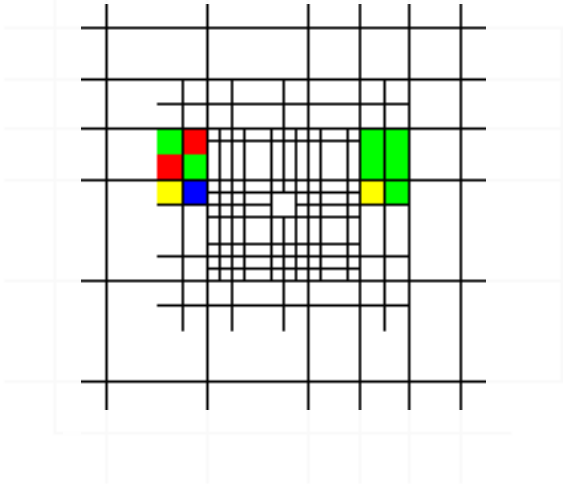


- **47 (16%) - 30 small, 4 middle and 13 large cells can separate particles with Z = 1 and Z =2.**
- **116 (40%) - 46 small, 28 middle and 42 large cells can separate groups of charged particles with Z = 1 , Z = 2 and Z = 3.**
- **125 (43%) - 66 small, 31 middle and 28 large cells can separate groups of charged particles with Z = 1, Z = 2, Z =3, Z =4 and more.**
- **4 "dead" cells**

The results were analyzed by M.Golubeva and Yu.Sobolev

FW test results (*Au-Au collisions, 1.25 A GeV, August-2011*)





As example, amplitude spectra (logy) for middle FW cells 165-176 are presented in Figure.

It is seen there is clear "cutting" of the TOT spectra for "red" cells in comparison with "green" or "yellow" ones.

The replacement the good detectors (from "green" modules) by the bad one (from "red" module) don't deform TOT spectra and, conversely, the good detectors on the bad AddOn electronics channel provide the "cutting" TOT spectra.

<u>Conclusion:</u> we have at least 47 broken AddOn electronics channels.

FW test results. Cell performance.

Tests have shown that most of the "yellow" cells are detectors with PMT having big noises due to overstated levels of HV.

The reason of such HV settings is
that the normalization of the cosmic-ray peak was done around the same amplitude channel (200-th channel) for ALL FW cells.

The simple way is to increase the scintillation light collection and thereby reduce HV.
For this aim we use a new effective reflector material - Tyvek paper (DuPont , Wilmington, DE).

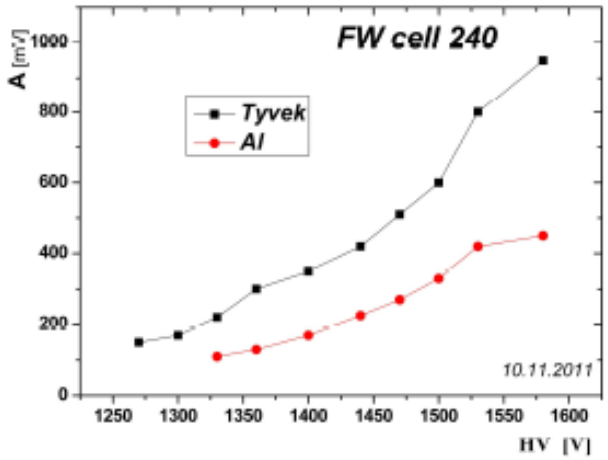
The tests were carried out by using the pion beam of 6 GeV/c at CERN

Reflector material	Aluminum	Mylar	Black paper	Tyvek
Mean amplitude (ch) (for scintillator 40 x 40 mm)	**180**	**140**	**50**	**270**

Beam test result: the amplitude for Tyvek is higher than the amplitude for aluminum in 1.5 times.

FW test results. Cell performance.

The FW-cell №240 response function tests were carried out on Na^{22} γ-source at GSI, November-2011. The different reflectors: Tyvek paper and standard FW Al-foil were used



The dependence of amplitude A [mV] on HV power supply shows that with the Tyvek cover we can decrease PMTs HV values on about 100 V for the same QE.

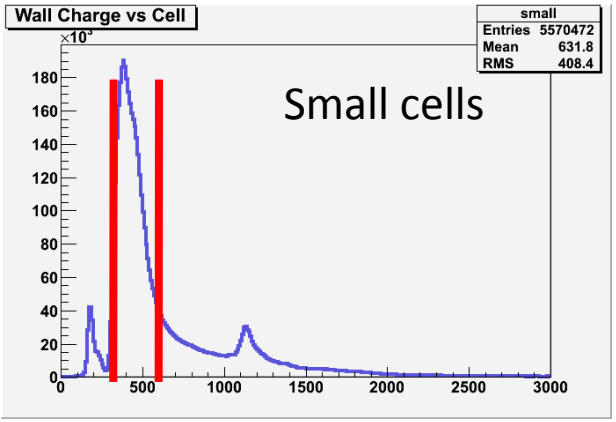
<u>Conclusion:</u> Tyvek cover enables to improve the performance of a "noisy" PMTs (yellow color marked)

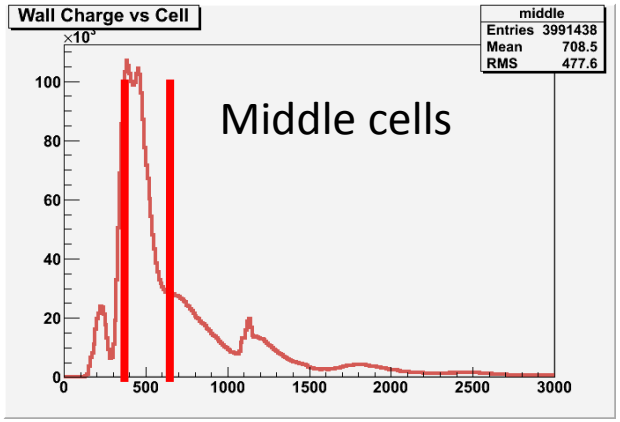
FW test results. Time calibration.

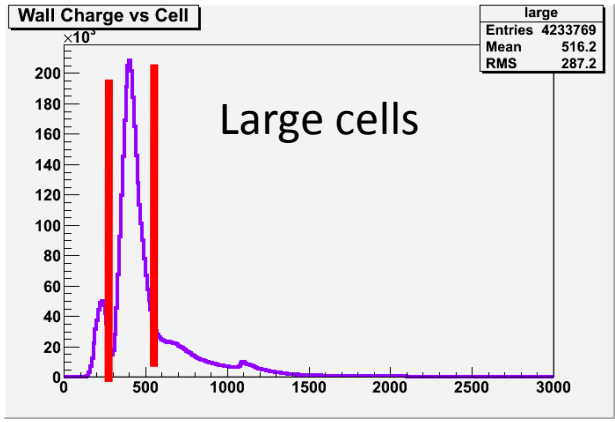
1st Stage

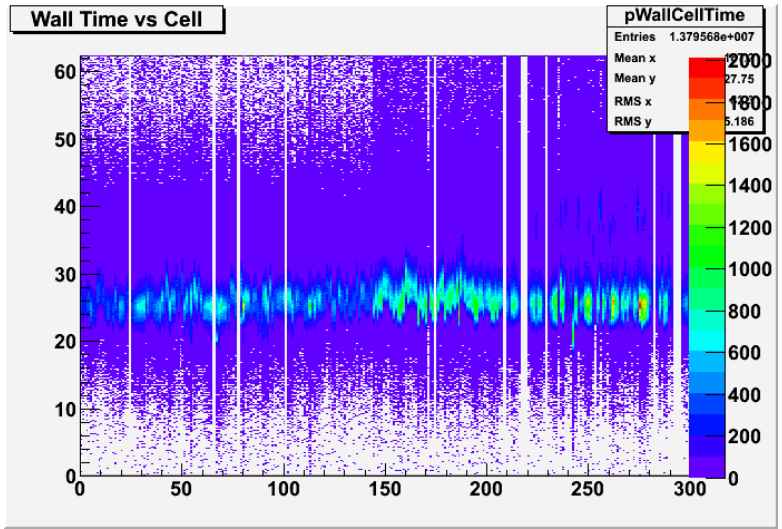
- **We selected events corresponding to Z=1 in Adc spectra.**
- **The selection is done with 3 different sets of cuts applied to small, middle and large cells.**
- **For selected events we produced tof spectra and calculated offsets for each cell comparing mean values of tof spectra with the calculated theoretical tof values.**

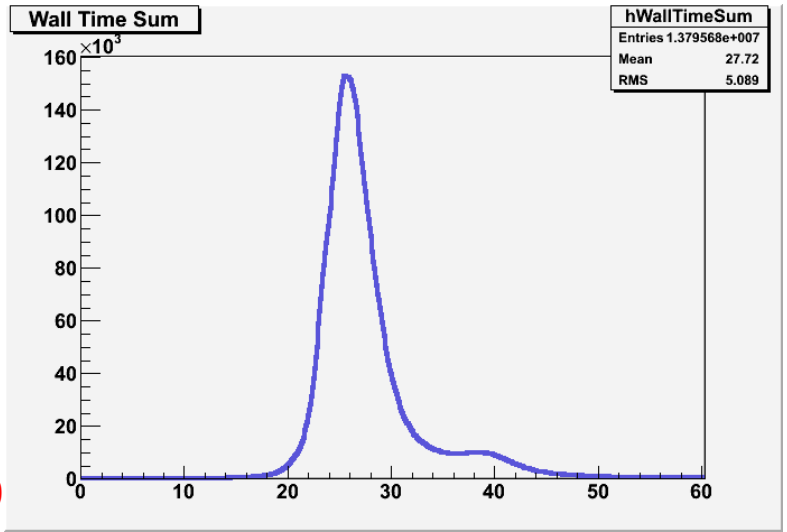
For theoretical values we know the spectators energy, distance to the FW and X,Y coordinates of the cell centers.









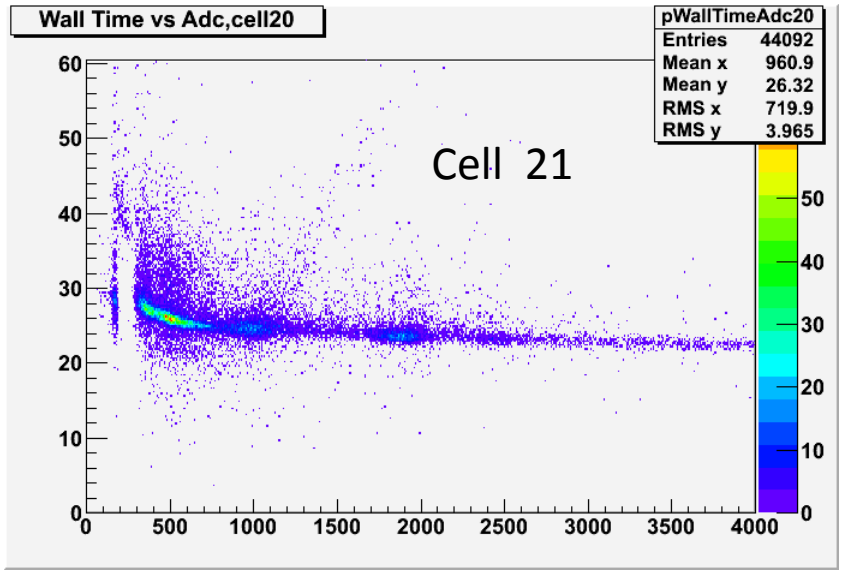


FW test results. Time calibration.

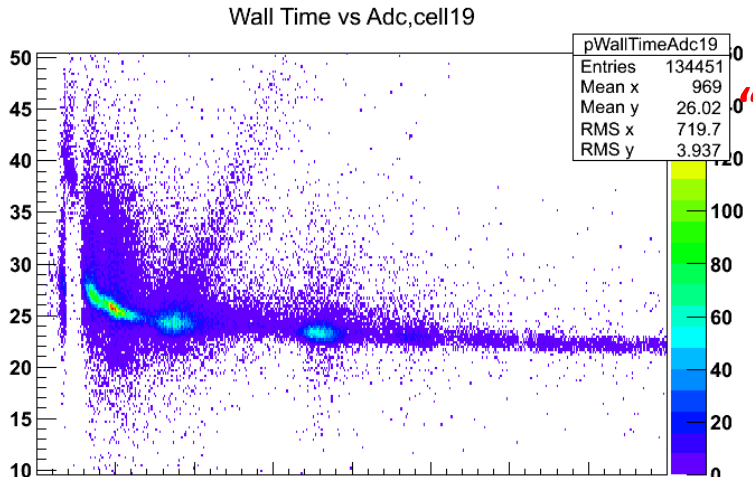
2nd Stage

Possible improvements in calibration procedure were proposed:

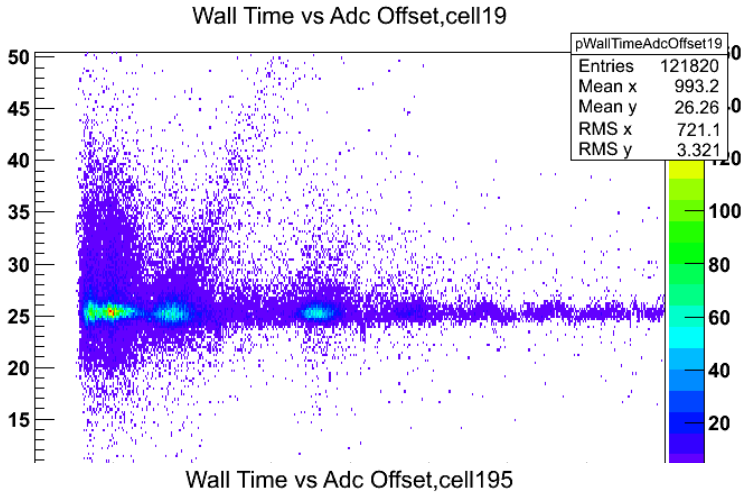
1. Time-Adc correction (“walk” correction).
2. Individual cuts for all FW cells to select peaks corresponding to different Z.

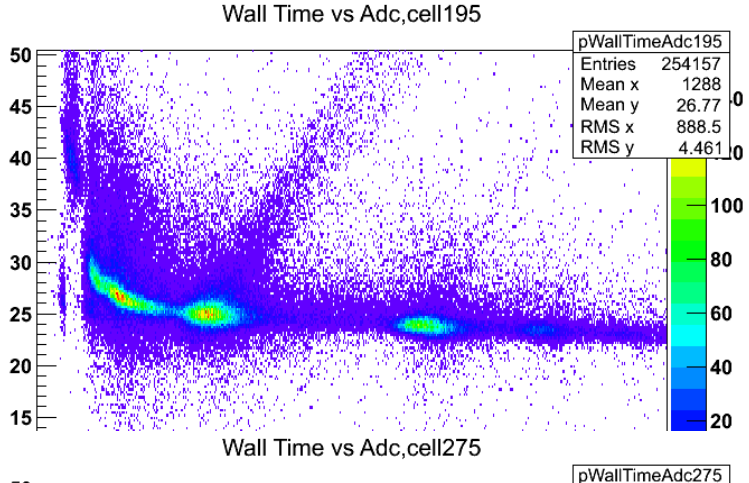


Resuts of “walk” correction

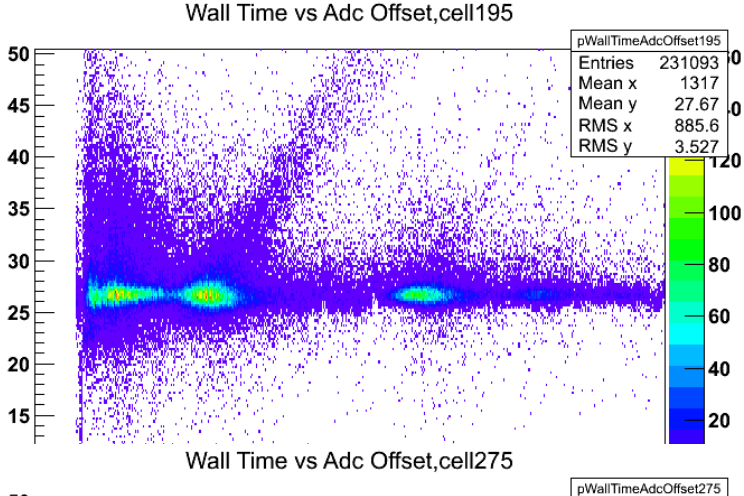


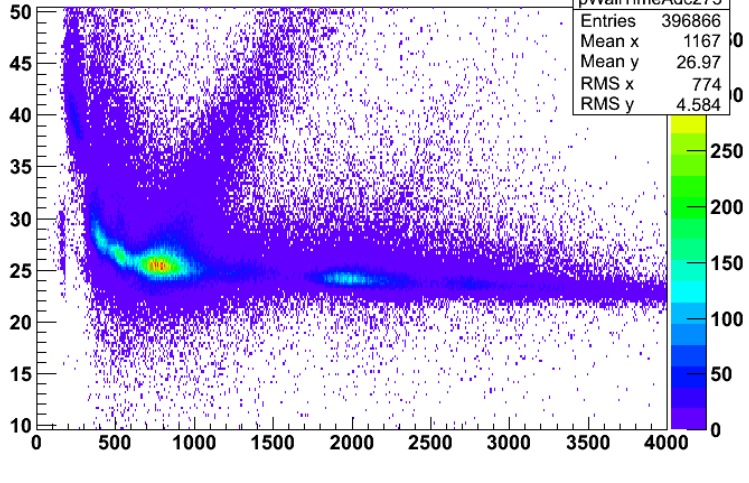
before after



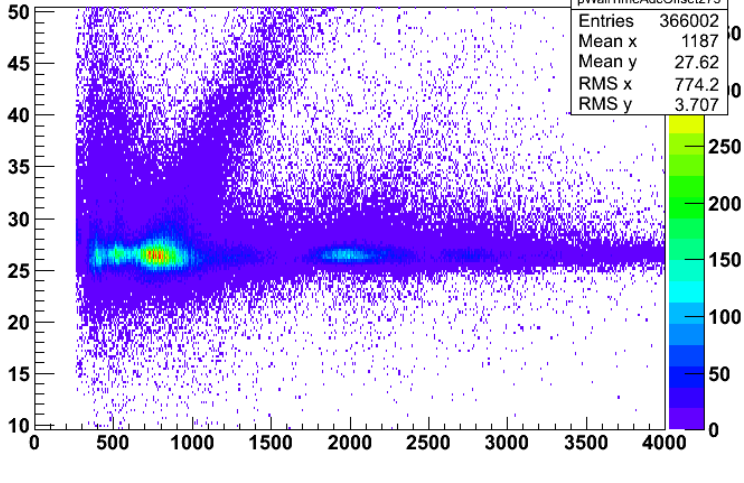


before after

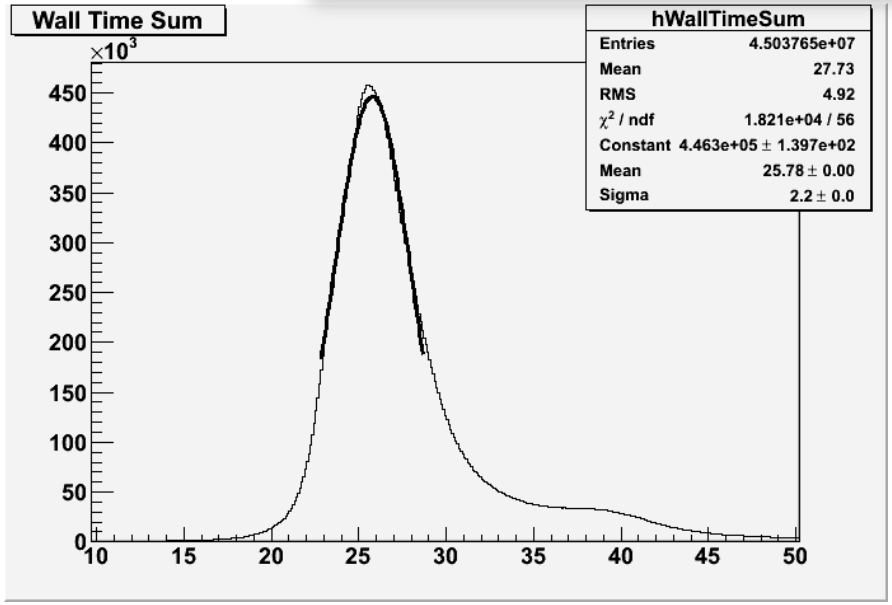




before after

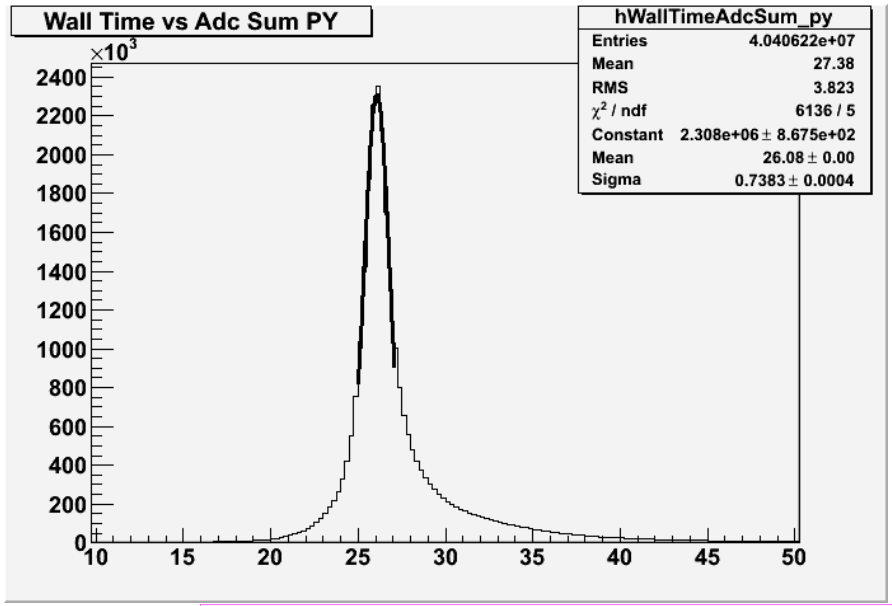


FW test results. Time calibration.



Calibration without "walk" correction and with 3 sets of Adc cuts.

FW time resolution: Sigma = 2.2 ns



Calibration after "walk" correction and with individual Adc cuts

FW time resolution: Sigma ≈ 0.7 ns

What has to be done as soon as possible

1. Replacement and testing of new electronics (3 new AddOn)
   (December, 2011)

2. To increase the light output in the "yellow" cells

   ⇓

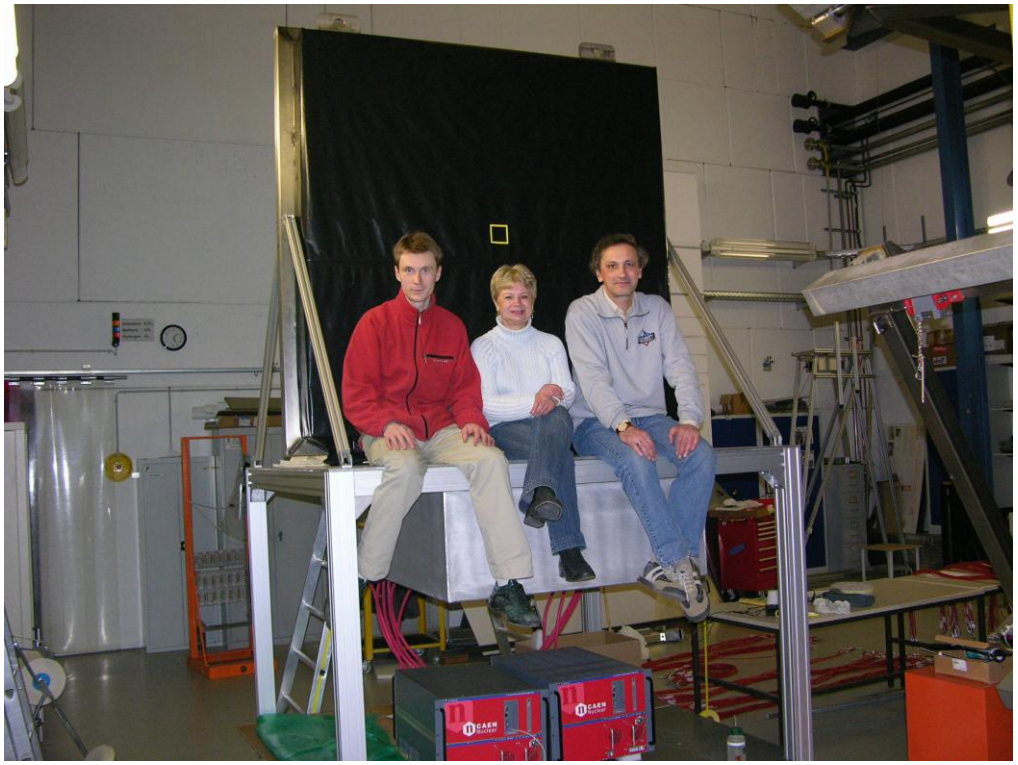
   to decrease HV on the photomultipliers

   ⇓

   the PMT noise reduction

(very desirable to do before HADES beam time)

Thank you for your attention !



Immer bereit, zu experimentieren !

Seit bereit !
zu experimentieren