STATION 1: COMMISSIONING AND (PRE)ONLINE MONITORING

Version 2 – 18/01/06

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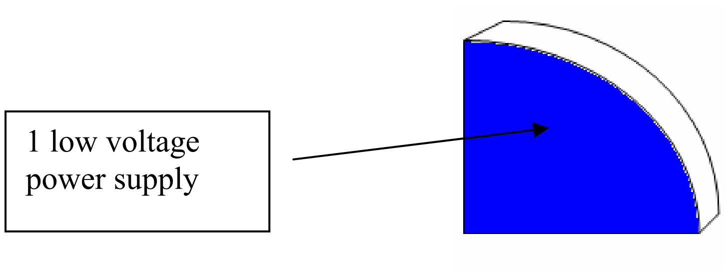
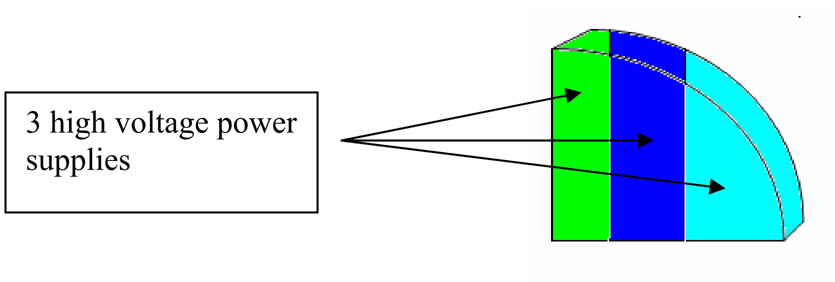
A few reminders to begin:

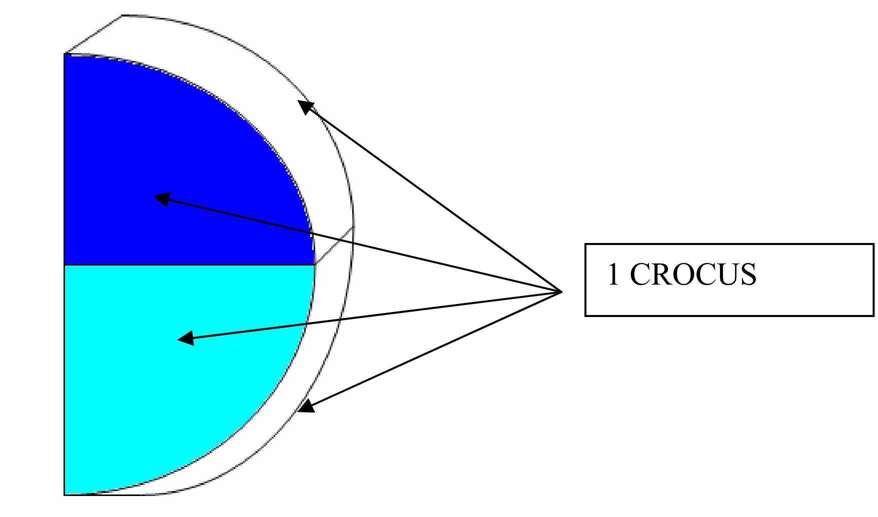
- There are 226 (225) MANUs per cathode plane bending (non-bending) per quadrant
- Low voltage power supplies mapping:
  there is one power supply per cathode plane per quadrant, which means 16 units for station 1. One unit corresponds to 3 values +2.5, -2.5, and 3.3 V.



- There are 3 high voltage power supplies per quadrant, which correspond to 3 vertical strips. That leads to 24 units for station 1.



- CROCUS mapping: there are 4 CROCUS for station 1. Each one corresponds to 2 quadrants of one chamber (top and bottom left, or top and bottom right), or 4 quadrant cathode planes.



1) Assembling:

First thing, the mappings need to be checked.
During the plugging of the electronics on the detectors, the MANUs bar codes and positions have to be filled in the DataBase.

2) Commissioning:

Let us recall that we have to deal with ~200000 channels for station 1, as for all the other stations. As we cannot histogram 200000 channels, the goal is to find meaningful elements, and to make plots for these elements.

With the high voltage OFF, the first histograms which can be plotted are the pedestals for each cathode plane of each quadrant. This leads to 16 spectra of ~12500 channels.

Visualizing the zero channels on 16 corresponding bidimensional plots, Pad Y versus Pad X, allows to detect faulty:

- single channels
- groups of 16 channels, or MANAS
- groups of 32 channels, or ADCs
- MANUs, which appear as dead parts of rows, from the faulty MANU which does not deliver the token down to the end of the corresponding row (the following MANUs being not read in this case)
- single rows. In that case, the problem may come from either the translators, or the ribbon , or the first MANU of the row.
- all the rows on different quadrant cathode planes, which can be related to a faulty CROCUS
- quadrant cathode planes, related to a low voltage power supply default. In that

case, we know which value of the low voltage failed, but to locate the short circuit will be extremely difficult (Fig.1).

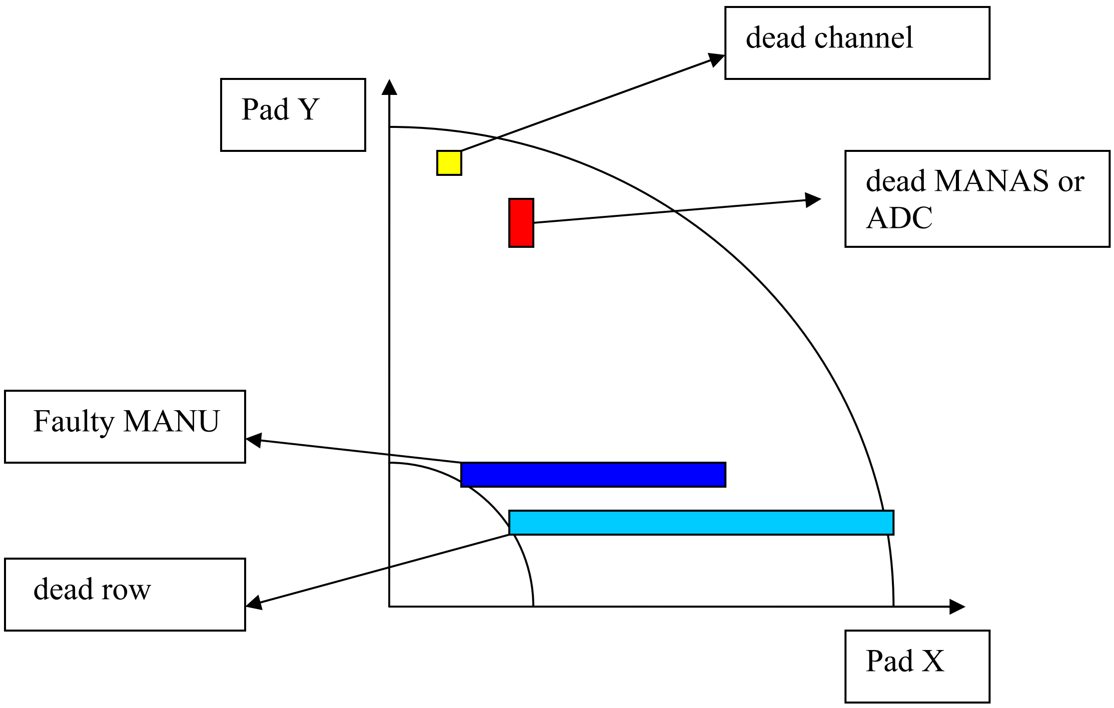


Figure 1 : Visualization of the zero channels (this is the complement to what is usually plotted)

The 16 pedestal histograms should be compared; pedestals must be positive and not too large (between channels ~ 100 and ~ 400) .

Noises can then be studied. As the pad size depends on the zone under study, the meaningful element would no longer be the quadrant cathode plane, but the zone per plane (there are 3 zones per plane). This gives 12 noise histograms per zone per cathode plane. The noisy channels can be visualized on 12 bidimensional spectra: Pad Y versus Pad X.

3) Online monitoring:

We consider 2 stages:

a) high voltage ON and beam OFF
b) high voltage and beam ON

a) High voltage ON and beam OFF:

We have first to study the current, then to perform the same study as described in the previous section. Pedestals and noises should remain unchanged.

We can measure for each cathode plane of each quadrant the yield of channels "surviving" after a 2σ, 3σ, and 4σ zero suppression. If it is purely gaussian, we should get:

- 2.28 % surviving channels at 2σ
- 0.135 % surviving channels at 3σ
- 0.003 % surviving channels at 4σ.

The comparison between the 16 plots would give us information on disparities between the different quadrants.

b) High voltage and beam ON:

We first have to check the different high voltage power supplies by studying the 16 bidimensional plots Pad Y versus Pad X of the hit pads with zero suppression.
A faulty high voltage power supply will give an empty vertical strip in the bending and the non-bending cathode planes in the same quadrant.

Working with zero suppression, general histograms should be studied, such as the number of words per cathode plane (per event) to get a general idea of the occupation rate, which should be smaller than 5%. After decoding, the study of the errors (parity errors, overflows, address errors) has to be undertaken.
The histogram of the number of hit pads per cathode plane (per event) is also important.

The total charge, with zero suppression and pedestals subtracted, per cathode plane per quadrant versus the high voltage can be measured in order to study the disparities among the quadrants (gain, hot spots,….). Looking at the hit pads bidimensional plots per quadrant cathode plane, event by event, should allow to localize these hot spots.

In the same way, the total charge per zone per plane can be studied.

To perform this study, we need a normalization of the number of particles seen by the chamber, which cannot be given by the trigger because of the iron wall. The idea is to take the same large number of events in order to have the same normalization for the different high voltage values.

Next, we can define a reference zone per cathode plane per quadrant, in the central zone, in order to study (if there is no hot spot):

- the total charge
- the percentage of 2 hit pads in the bending direction
- the percentage of 3 hit pads in the bending direction
- the saturations in the histogram of the maximum charge

versus the high voltage.
The goal is to determine the nominal high voltage.
At this stage, it is important to know the results of the source tests, namely the gain differences between the quadrants, to balance the quadrant gains. This will be done by tuning the high voltage and looking at the total charge histograms per quadrant cathode plane.

The maximum charge histograms, as well as the bidimensionals of the maximum hit pads will be studied. The balance of the gains of the 3 zones inside each quadrant will be also performed.

The histograms of the number of hit channels per quadrant should be useful to follow the pedestal drift when working with zero suppression.

(Actually, we are planning 300 hits per plane per central PbPb collision, which means 75 hits per quadrant, or ~750 hit pads per cathode plane per quadrant. If we assume a one channel variation of the pedestals, from 3σ (0.135% *12500 = 17) to 2σ (2.28%*12500 = 285), we expect 270 more hit channels, as compared to 750, which is sizeable.)