The Pixels in a Box @ GRUMM 2008

Souvik Das
Cornell University

1. Construction
2. Preparation
   a. Testing at the TIF
   b. Installation at Point 5
   c. Calibrations at Point 5
3. A Private Global Run
   a. The Setup
   b. The Results
4. The Pixels in a Box @ GRUMM 2008

8 April 2008

Construction

Viktor Veszpremi began assembling the *Pixels In a Box* (PIB) in the middle of January 2008.

It consists of:

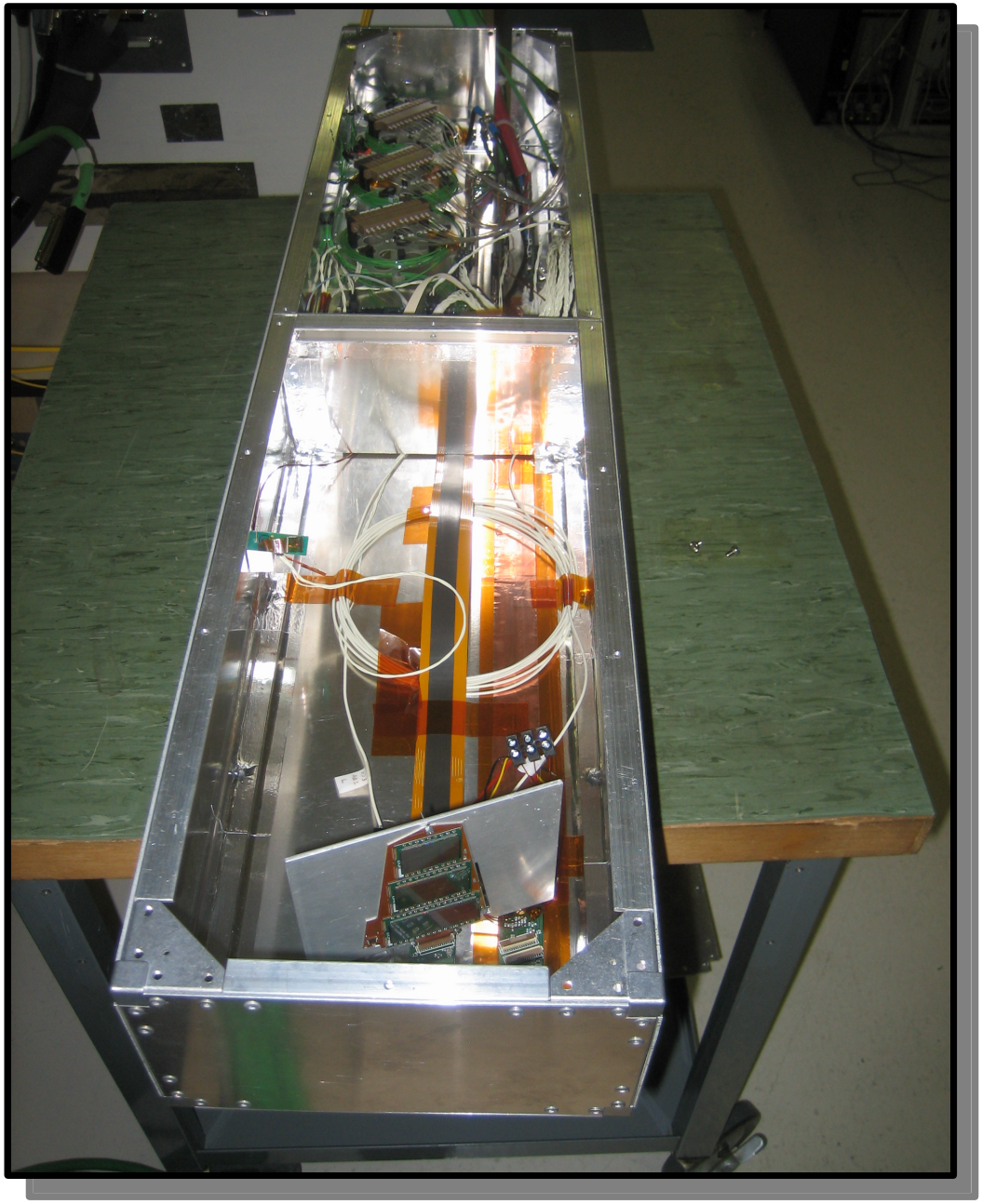
* One panel of 24 Read-Out-Chips from the Forward Pixel sub-detector. A total of 99,840 pixels,

* Attendant front-end electronics, like the Portcard PCB, and the Communication and Control Unit PCB,

* Temperature and humidity sensors,

* No cooling.

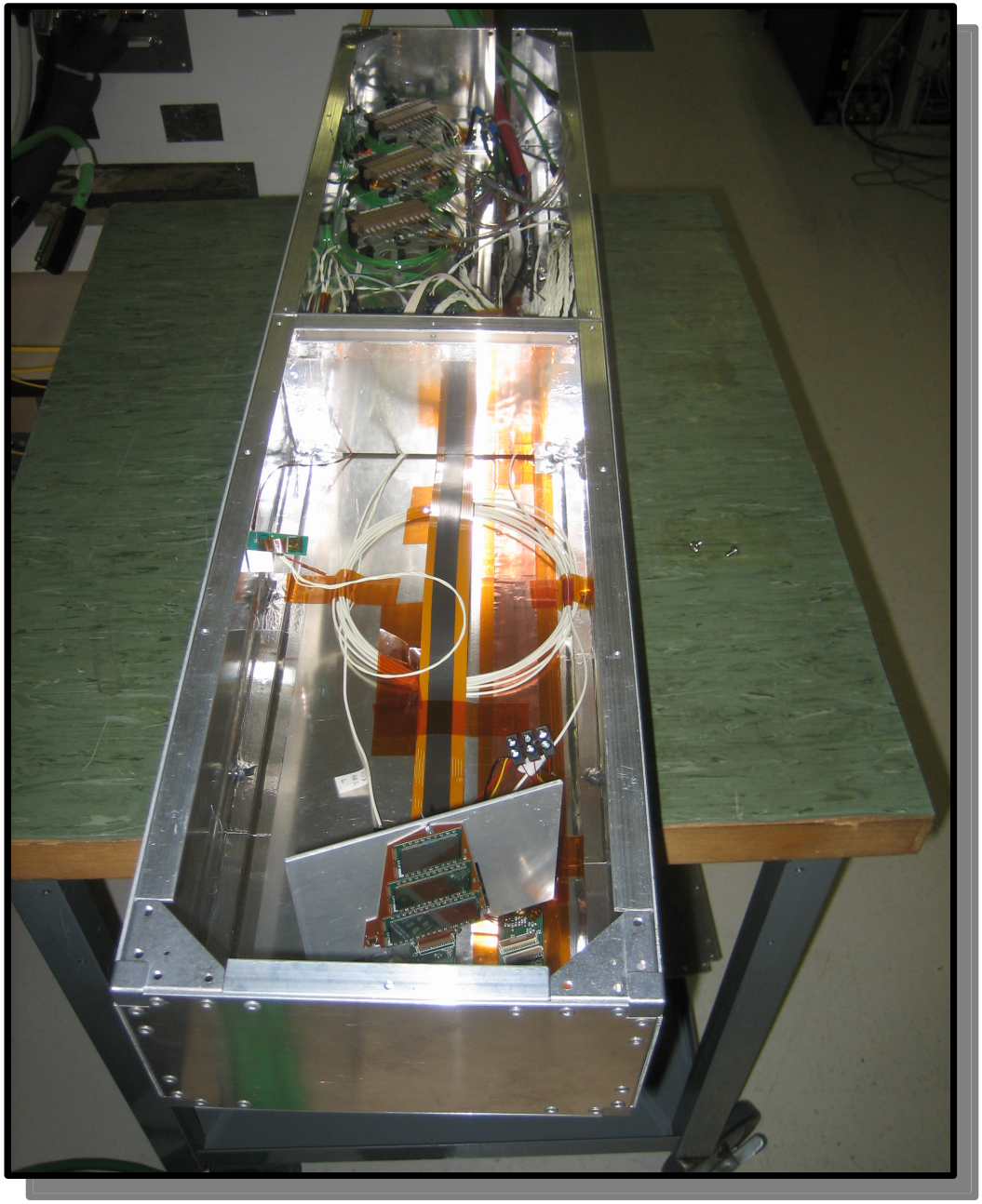
It was ready by the last week of February.



Preparation – Testing at the TIF

Anders Ryd and **Viktor** used the XDAQ section of Pixel Online Software (POS) version 2.6.7 to test the PIB at the TIF.

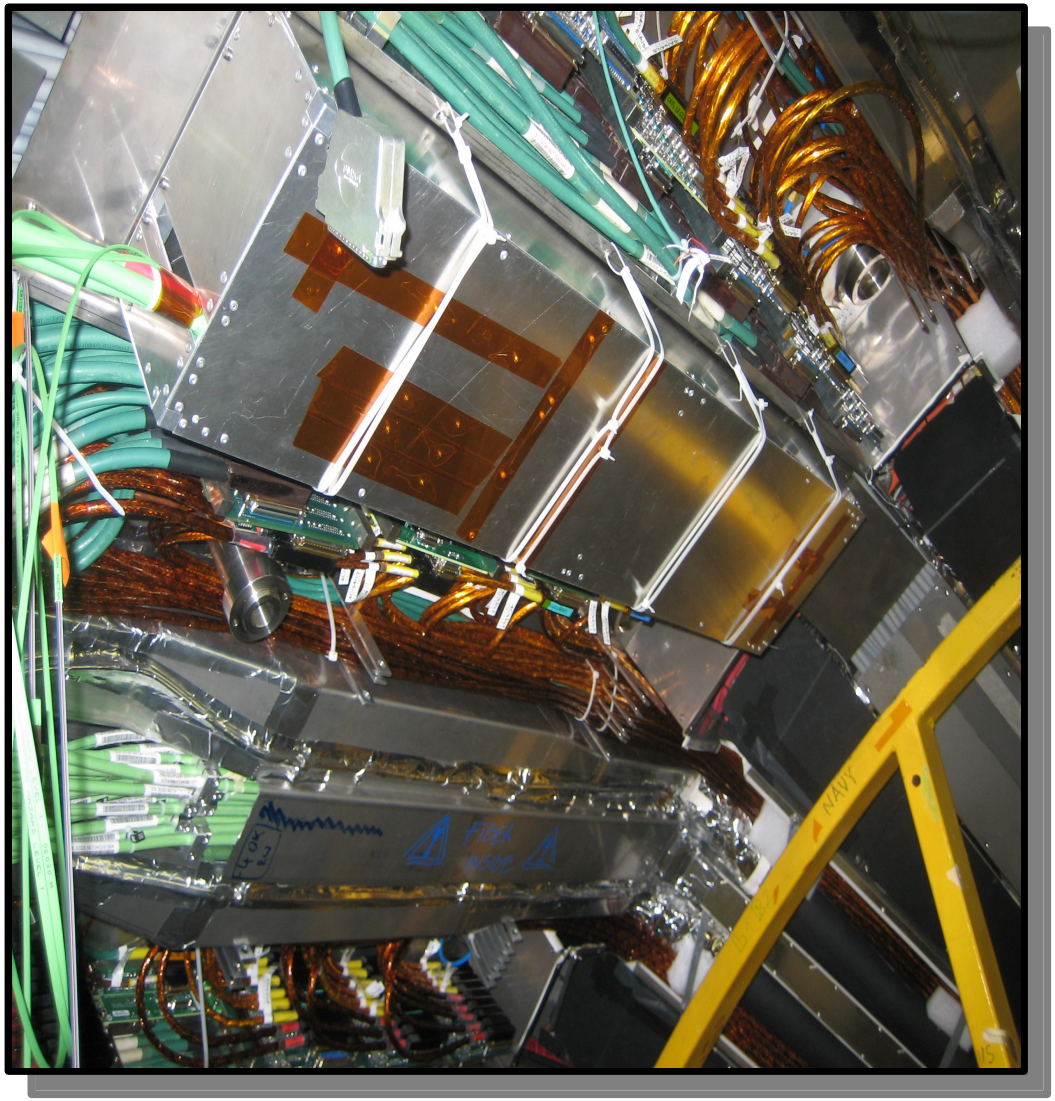
All calibration and data taking routines of POS_2_6_7 were exercised, albeit without Run Control.



Preparation – Installation at Point 5

On the 29th of February 2008, the PIB was harnessed to the – 5 C section of the CMS detector at Point 5. It was hooked up to the CAEN power supplies, the pixel Front-End-Controller card (pFEC), the tracker Front-End-Controller card (tkFEC) and the pixel Front-End-Driver card (pFED).

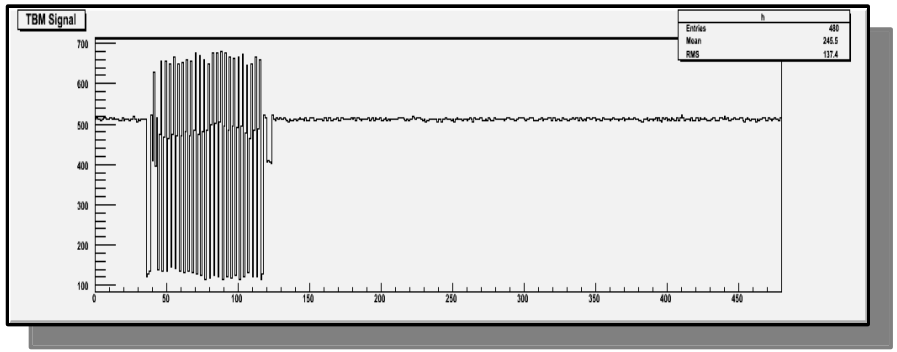
Between the 1st and 4th of March 2008, **Souvik Das** installed the version 2_7_1 of the Pixel Online Software complete with its Run Control part.



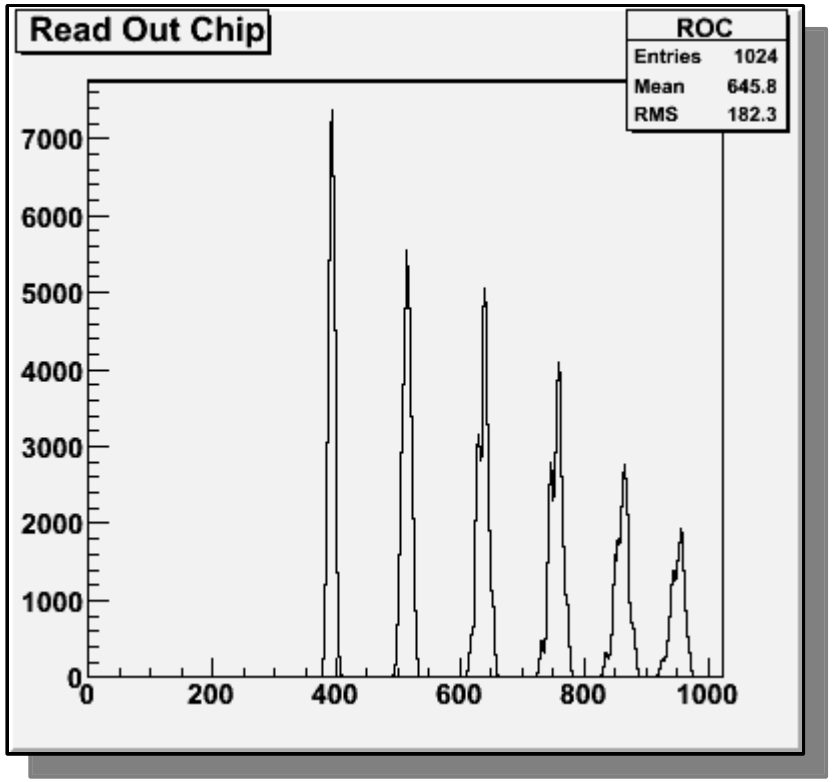
Preparation – Calibrations at Point 5

Using POS_2_7_1, we performed the following calibrations:

- A *Delay 25 Calibration* to account for the radical increase of all fiber lengths.
- A *VcThreshold versus CalDelay calibration* to maximize the hit sensitivity of pixels without making the ROCs shut off due to noise.
- A *FED Baseline Calibration* to fine tune the baseline of the analog signal to the center of the dynamic range.
- A *Clock Phase and Delay Calibration* to optimize the sampling moment of the analog signal.
- A *FED Address Levels Calibration* to determine the ADC levels required for digitizing the analog signal in the FED.
- A *Pixel Alive Calibration* to determine which pixels among the 99,840 were responsive...

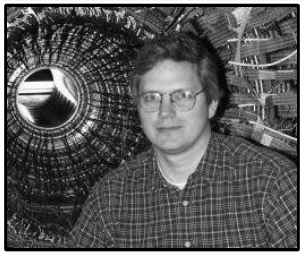


FED Baseline Calibration



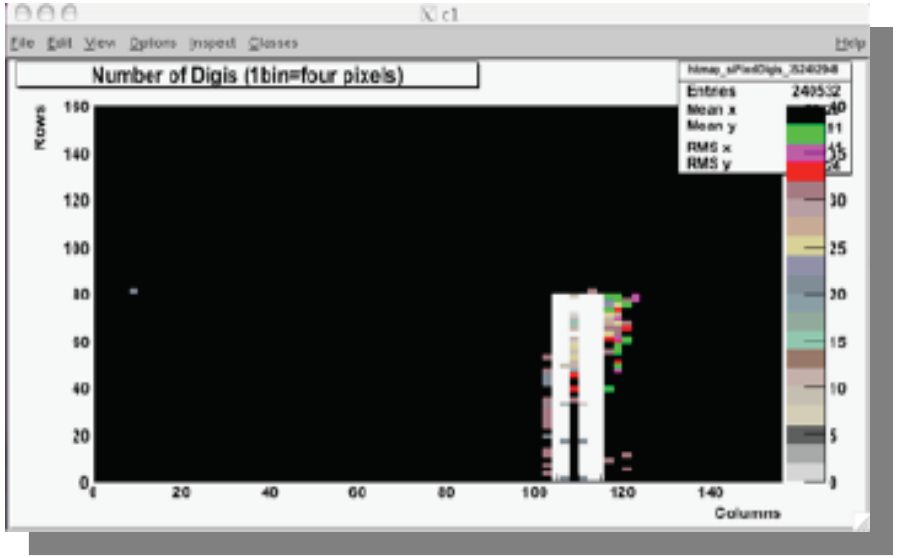
FED Address Levels

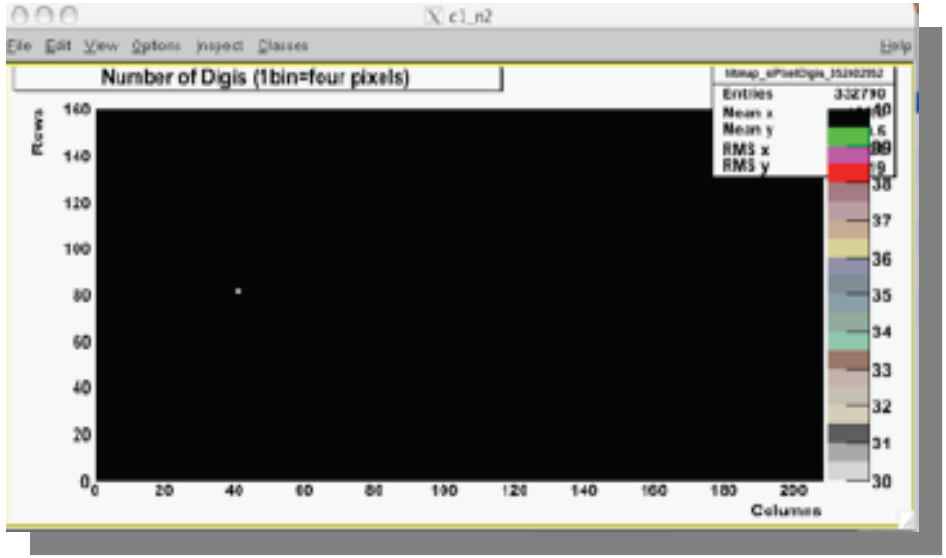
Preparation – Calibrations at Point 5



The Pixel Alive Calibration was initially immediately analyzed by **Karl Ecklund** using ROOT scripts

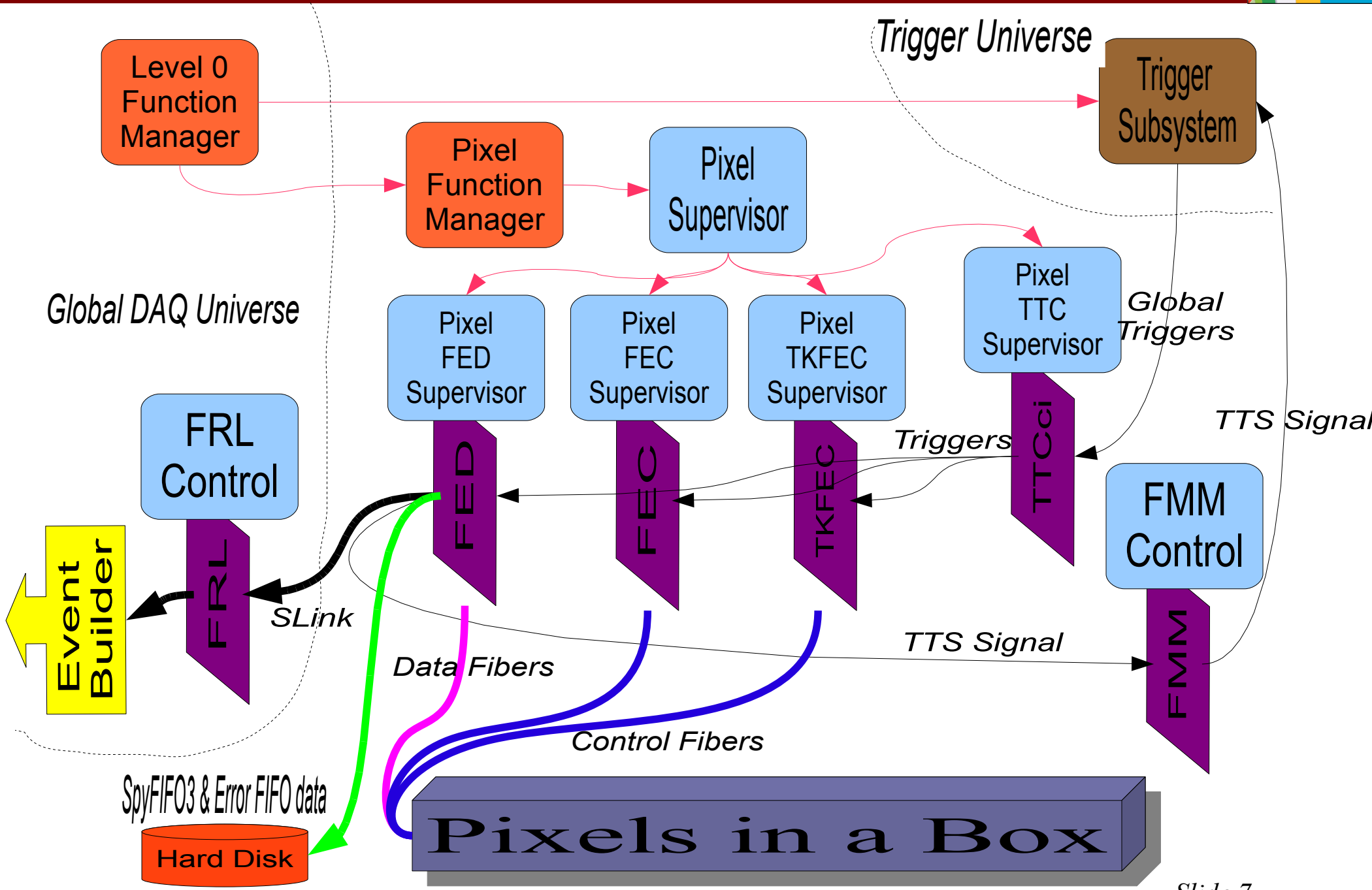
It was later analyzed again by **Vincenzo Chiochia** and the Pixel Offline Software team using CMSSW_2_0_X_2008-03-04-0200





Due to a flaw in the cabling map used in the CMSSW analysis, we found one plaquette of missing Read-Out-Chips.

A Private Global Run – the Setup



A Private Global Run – the Results

Organized a Private Global Run with Central Run Control on the 6th of March, 2008. **Vivian O'Dell** was the central DAQ shifter.

The Pixel Online Software ran on cue from the Level 0 Function Manager of Central Run Control. The FEDs collected data with Level One triggers being sent down from the Central Trigger Controller to our Trigger and Timing Control circuits.

However, we immediately experienced back-pressure from the Event Builder, which was correctly propagated upstream to the Central Trigger Controller and throttled triggers to a stop. Problem detected in Storage Manager which was writing one file per event! This was corrected soon.

Thereafter we ran smoothly with ~ 300 Hz of random triggers and ~ 14 Hz of Drift Tube triggers. No back-pressure was observed. Data was automatically pushed to TIER 0, CASTOR and CAF and published on DBS.

A commentary on the various runs taken during this Private Global Run from the Pixel's point of view may be found at: http://spreadsheets.google.com/pub?key=pBwd4hDF5QT-oABcMBvI7Fw&gid=1

More details for each run for the whole detector can be found by entering the Run Number you're interested in at: http://cmsmon.cern.ch/cmsdb/servlet/RunSummary?DB=cms_omds_lb

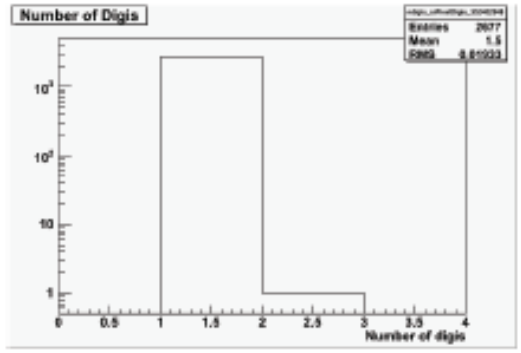
A pre-scaled sampling of the data taken via Spy FIFO 3 of the FED was written in vmepcs2b18-11.cms:/home/PIBData/

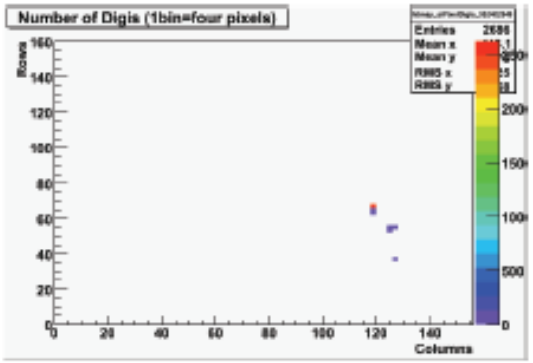
A Private Global Run – the Results

We varied the *VcThreshold* DAC value around its optimal value as determined by calibration to see if the expected variation of occupancy was observed. Higher value of *VcThreshold* means lower threshold and hence higher occupancy.

Vincenzo and the Pixel Offline Software group converted the data from RAW to DIGI format and produced these plots using the DQM Client to show the variation of occupancy with *VcThreshold*.

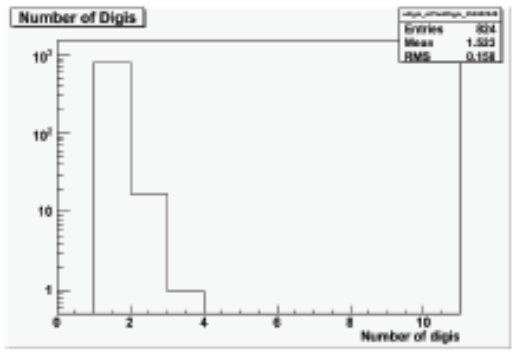
RUN 37298

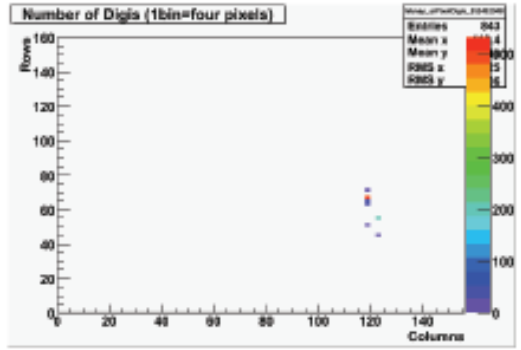




Optimal VcThreshold-10

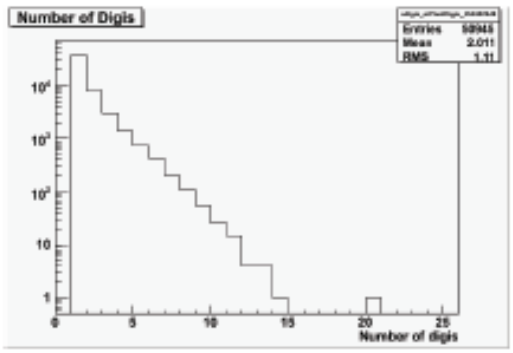
RUN 37266

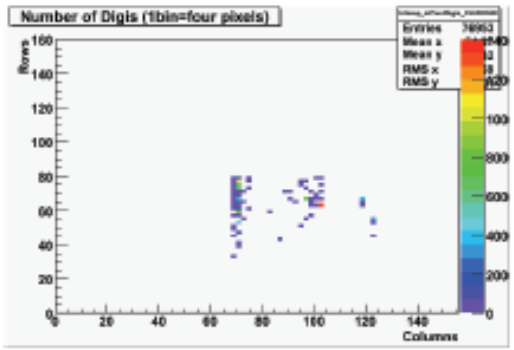




Optimal VcThreshold+10

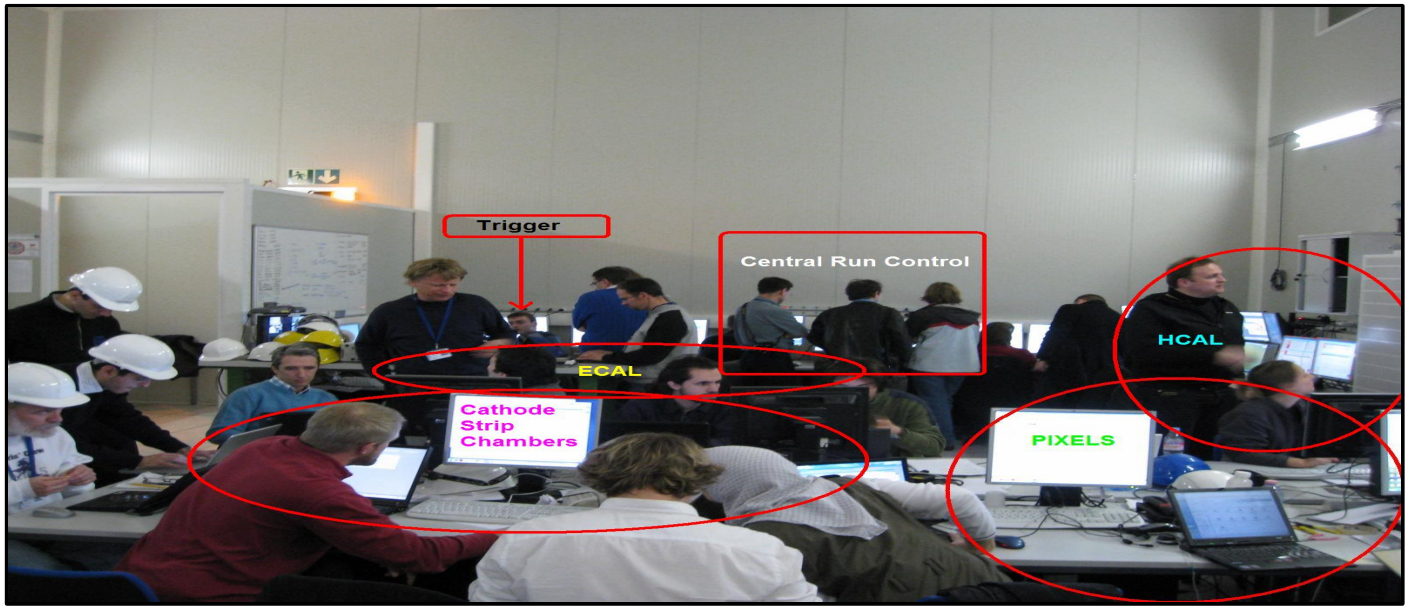
RUN 37292





Optimal VcThreshold+20

The Pixels in a Box @ GRUMM



The Pixels in a Box worked flawlessly with the ECAL, HCAL, DT (trigger) and RPC (trigger) at trigger rates of 70 Hz (DT triggers with 3 wheels of the DTs active) and ~ 300 Hz (random triggers). No back-pressure generated from us, or due to us in the EVB and zero time spent in TTS BUSY or WARN states.

Data logged with CMSSW_1_8_0 and available to be analyzed at Tier 0 and the CERN Analysis Facility.

Commentaries from the Pixel shifter's (yours truly) point of view are available at:
http://spreadsheets.google.com/pub?key=pBwd4hDF5QT-oABcMBvI7Fw&gid=2
http://spreadsheets.google.com/pub?key=pBwd4hDF5QT-oABcMBvI7Fw&gid=4

More details for each run for the whole detector can be found by entering the Run Number you're interested in at:
http://cmsmon.cern.ch/cmsdb/servlet/RunSummary?DB=cms_omds_lb

A pre-scaled sampling of the data taken via Spy FIFO 3 of the FED was written at:
vmepcs2b18-11.cms:/home/PIBData/