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The most recent version is available at

<https://docs.google.com/a/lbl.gov/document/d/1IFkFCYKE7436fUkl78FpMyLCVwYpy41c1EFxHN67vFs/edit?usp=sharing>

# PXL Shift Crew Manual

## PXL Detector Expert Contact Info:

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## Local Contacts

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If you cannot reach the experts, please send a message to [hftops-hn@www.star.bnl.gov](mailto:hftops-hn@www.star.bnl.gov)

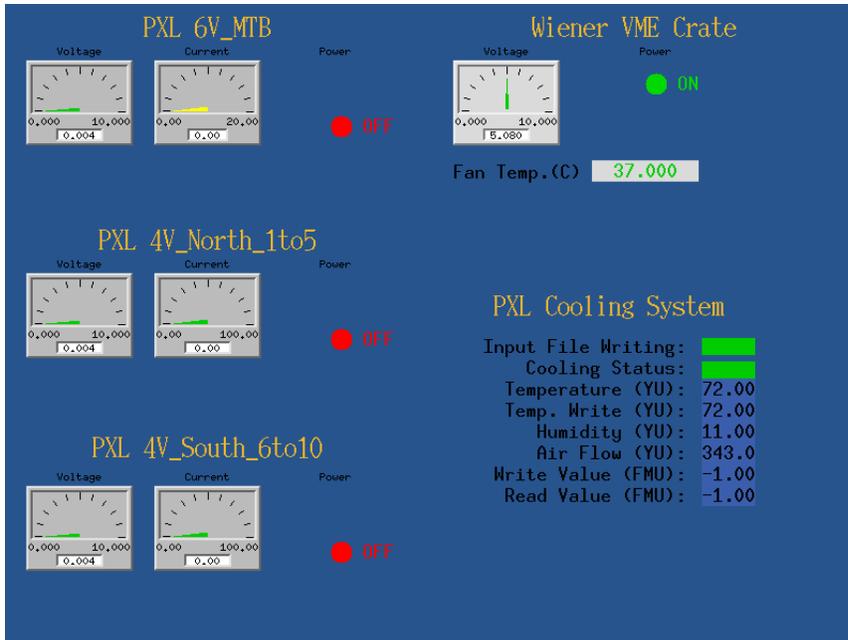


# PXL detector slow controls terminal

The PXL detector slow controls terminal is located behind the shift leader’s chair, left to the L3 event display terminal. The username is “sysuser”. The password is in the shiftleader red book.

On the slow control machine, one should keep the following two windows open

PXL PowerSupply Control Window



PXL Configuration GUI



If the PS control window (left) is not present:

1. On the pxlctrl-cr.starp machine, open a terminal window
2. type: pxl\_control

If the “PXL Configuration GUI” (right) is not present

1. On the pxlctrl-cr.starp machine, open a terminal window
2. Log onto the PXL control PC (PXL-SC2):
  - Use the shortcut SC2 from the top taskbar OR type ssh pixel@pxl-sc2
  - No password is required from the pxlctrl-cr.starp machine
3. cd /home/pixel/hft/operator <- operator directory
4. ./PXL\_GUI.py <- script to start the PXL control GUI

# The PXL control GUI

In the PXL slow control terminal, you should have the following GUI window open

	<ul style="list-style-type: none"><li>← close the GUI window</li><li>← control panel label</li><li>← Button - press to start PXL configuration</li><li>← Button - press to stop PXL (switch off all ladders)</li><li>← Button - press to reset PXL</li><li>← status indicator (shows the start time, “in progress” and the end time of the configuration sequence)</li><li>← error indicator - updated after programming has been completed</li></ul>
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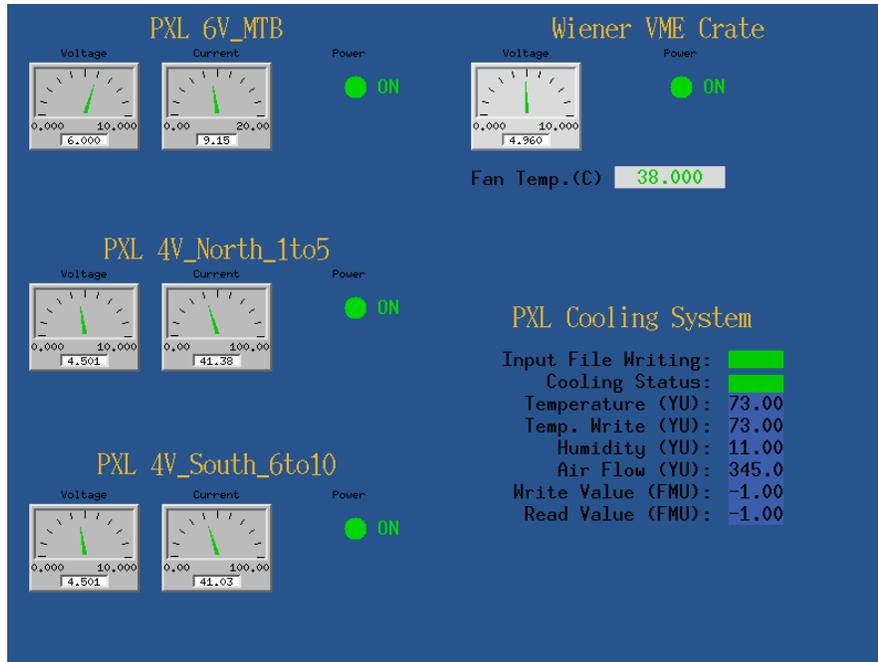
Use the PXL GUI buttons to operate the PXL detector, read the status indicator and the error indicator when the procedures are executed

You can follow the execution of the procedures in the log terminal below:

```
pixel@pxl-sc2:~/hft/operator
File Edit View Search Terminal Help
Sector 1: (T VA VD IA ID) 23.92 3.23 3.29 1.42 0.71 22.70 3.26 3.29 1.41 0.72 22.70 3.30 3.31 1.40 0.74 22.70 3.28 3.34 1.40 0.96
****Stopping Sector 1****
INFO: lurout: 0x7f13 lurin: 0x7f03
INFO: lurupdated: 0x7f03
Board: 1 - VDA: 5 5 5 5 - VDD: 5 5 5 5 - LU: 0x10f1
****Stopping Sector 2****
INFO: lurout: 0x7f13 lurin: 0x7f03
INFO: lurupdated: 0x7f03
Board: 2 - VDA: 5 5 5 5 - VDD: 5 5 5 5 - LU: 0x20f5
****Stopping Sector 3****
INFO: lurout: 0x7f13 lurin: 0x7f03
INFO: lurupdated: 0x7f03
```

# The PXL power supply and cooling indicators

In the PXL slow control screen, you should have the following power supply and cooling panel open



In this panel you can see the indicators (status and parameters) for:

- 6V Power Supply (the main PXL power supply, provide power to the electronics)
- 4V\_North Power Supply (provides power to the silicon in Sectors from 1 to 5)
- 4V\_South Power Supply (provides power to the silicon in Sectors from 6 to 10)
- Wiener VME Crate (provides power to the PXL read-out boards)
- PXL Cooling System (ECU unit)

## PXL detector states

The PXL detector has 2 states, **OFF** and **ON**:

### OFF

- **when:** During Beam Injection, Planned beam dumps, Beam development, Magnet ramp.
- **description:** The power supplies are switched off. The detector can't take data.

### ON

- **when:**
  - Physics running with stable beams before start taking physics data.
  - Machine setup or RHIC down with no beam (with no beam expected for at least 15 mins) before start taking pedestal data.
  - Cosmic ray data taking during extended no-beam periods
- **description:** The power supplies, VME crate and ECU are switched on and operating. The detector is configured and in running mode.

# PXL Operations

## Start PXL

1. Verify in the PXL PowerSupply Control window that the Cooling System is running.
  - 1.1. You can find the PXL Cooling System information on the right part of the PXL Power Supply Control window; The two status bars should be green. Temperature should be ~73. Air Flow should be ~340.
  - 1.2. **If the status bars turn red, STOP any further operation and contact the expert immediately.** If any status bar turns red, STOP and contact the PXL expert.
2. Power and Configure PXL:
  - 2.1. Press the “Start PXL” green button from the PXL\_GUI (only once, wait for a response, which could be a few seconds)
  - 2.2. Wait for the process to be completed and check the ERROR message in the GUI (~2 mins) If no errors are listed, the PXL detector is ready to take data. The terminal window goes through all 10 Sectors in turn and configures them. The configuration for the whole system typically takes about 2 minutes.
  - 2.3. Once the configuration is finished, check the currents:  
6V\_MTB - ~**9A**      4V\_North- ~**41A**      4V\_South- ~**41A**

**If the number of errors shown in the PXL\_GUI is not zero or the current are different from what expected, contact the PXL expert**

## Stop PXL

Use the slow controls windows described above to turn off the PXL system.

1. Press the “STOP PXL” button in the “PXL control GUI” window. Wait for “STOPPED” to appear in the GUI.
2. Make sure all currents return to zero.

The Wiener VME crate supply should be left ON all the time!

## Slow Control Alarms

- You will hear some alarms when you turn ON or OFF or configure the detector. This is safe to proceed.
- If you get a low current alarm when the PXL is on, push the button Reset PXL on the PXL GUI: the detector will be reset in 10 seconds. You don't need to stop the run to reset PXL. If you still getting the same alarm after the Reset PXL, please call the PXL expert
- If you get a BEAM\_INJECTION PXL alarm, bring the PXL detector OFF: it is dangerous for the PXL to stay ON during Beam injection.
- Please call the PXL expert if you get a Slow Control alarm for PXL at any other time. Wait for PXL expert instructions.

**At any time, if you see the VME Wiener is OFF or the PXL Cooling System turns red, please call the expert immediately.**

## Daily Pedestal Runs

Once per day during beam off time, take the pedestal run for PXL. We should allow in total 10 mins to complete the full procedure

1. Follow the procedures described above to bring the PXL to ON status. This typically takes 2 mins, so you can start this process when you are doing the pedestal runs for other subsystems.
2. At the Run Control, select the Run Configuration: "**pedAsPhys\_pxl**", include **TRG+DAQ+PXL** subsystems, start the run with **300K** events. It will take ~2 mins to finish.
3. After the pedestal run is completed, follow the normal procedure to turn off the PXL detector and make an entry in the ShiftLog about this run.

## Known Issues

Please pay attention to the alarms and take action as described in the section above.

Please monitor the DAQ dead time for PXL in the DAQ monitoring display: PXL **dead time** in data taking **is around 4%** (you can check it from the DAQ monitoring page).

- if PXL is **>10% dead** for more than a minute (make sure the screen has been refreshed) please follow this procedure:
  1. **press the button Reset\_PXL** from the PXL GUI and wait 10 seconds (the detector will go busy for 10s and will be reset with the same procedure used during the periodic reset occurring every 15 minutes)

2. if the problem in the event-by-event plots persists\* and/or the dead time is still >10%: **stop the run, power cycle the PXL** detector (which means Stop PXL and then Start PXL), restart the run.
3. If **PXL is still >10% dead in the new run, exclude PXL from data taking and call immediately the PXL expert** leaving the PXL detector ON. Follow the general STAR running procedure in case of exclusion of the PXL detector from the data taking
4. In rare cases the DAQ monitor page may show PXL errors (in red, right hand column). Please inform the **PXL expert** if that is the case, can indicate RDO errors.

# PXL Online QA Plots

## Instructions for the shift crew:

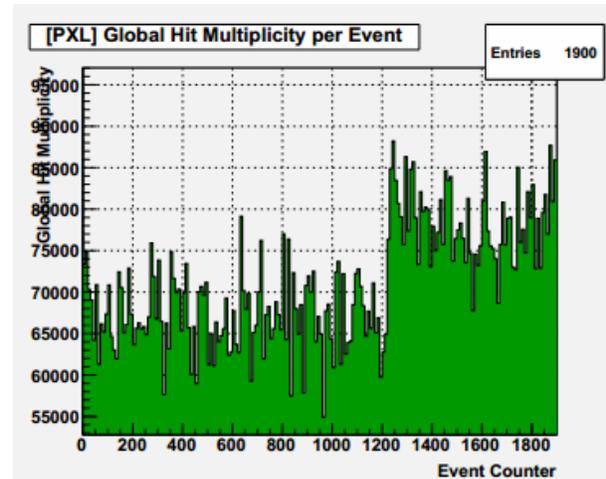
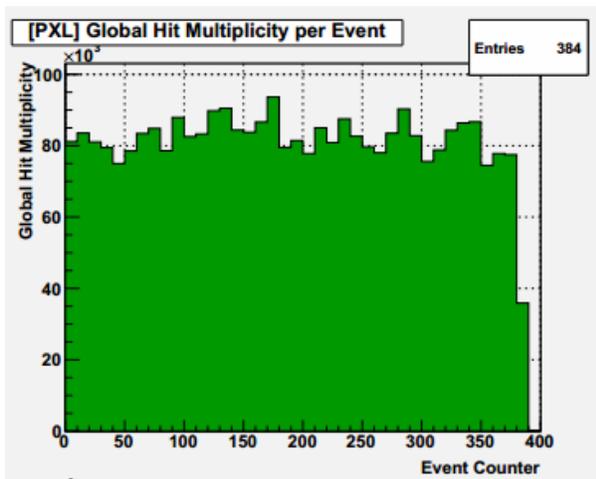
The “**Hit Mult**” page of the PXL Online QA plots shows the hit multiplicity recorded by the PXL detector. The shift crew is requested to monitor the page and compare the online plots with the set of reference plots included in this manual.

The possible problems visible from the online plots and described below are supposed to be solved by the automated periodic reset which happens every 15 minutes. When it happens, the PXL shows 100% dead time in the DAQ monitoring page for 10 seconds, and there is a DAQ message saying “Resetting PXL, please wait 10s”.

Reference plots are shown below. If any problems are found, please note them in the shift log. It is not necessary to take other action. The problem should be cleared by the next PXL auto-reset.

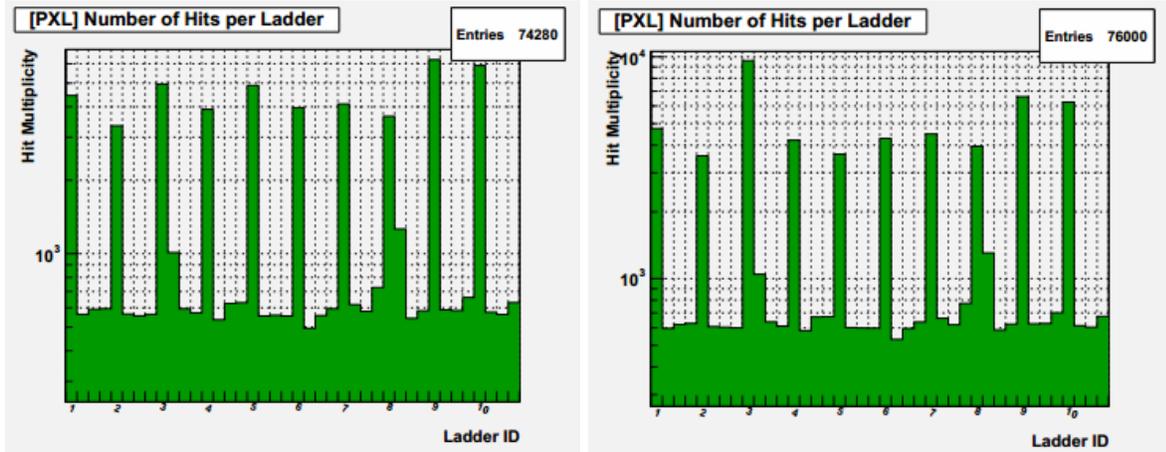
## Reference plots and description of possible problems:

### Global Hit Multiplicity per Event



The **Global Hit Multiplicity per Event** (see *left*), is constant during a single run, with bin-by-bin oscillations within  $\sim 20\%$  around the average value. A **permanent drop or increase** (see *right*) in the Global Hit Multiplicity indicates a problem in the PXL detector. If you notice it, please make a note in the shift log. No other action is necessary, the automatic reset should clear this issue. If the problem remains for more than 16 minutes, contact the expert.

## Number of Hits per Ladder

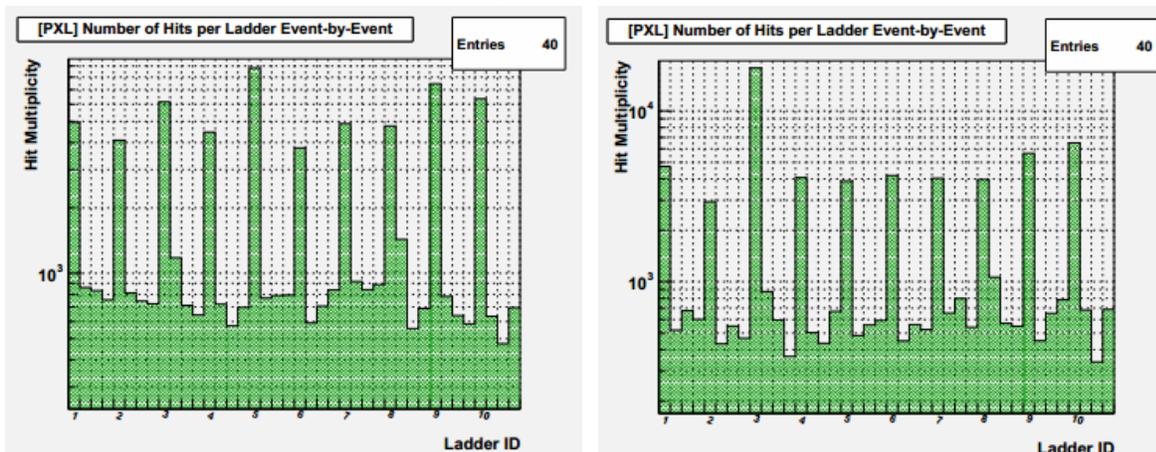


The **Number of Hits per Ladder** plot (see left) shows the multiplicity by ladder averaged over the run: each Sector (Sectors are numbered from 1 to 10 in the plot) is composed of 4 ladders (1 inner + 3 outer). The high bins correspond to the inner ladders, the lower bins correspond to the outer ladders.

An evident change with respect to this reference plot, like **empty bins** or **bins higher than usual by a factor 2 or more** (see the inner ladder on Sector 3, in the plot on the right) indicates a problem in the PXL detector.

If you notice it, please make a note in the shift log. No other action is necessary, the automatic reset should clear this issue. If the problem remains for more than 16 minutes, contact the expert.

## Number of Hits per Ladder Event-by-Event

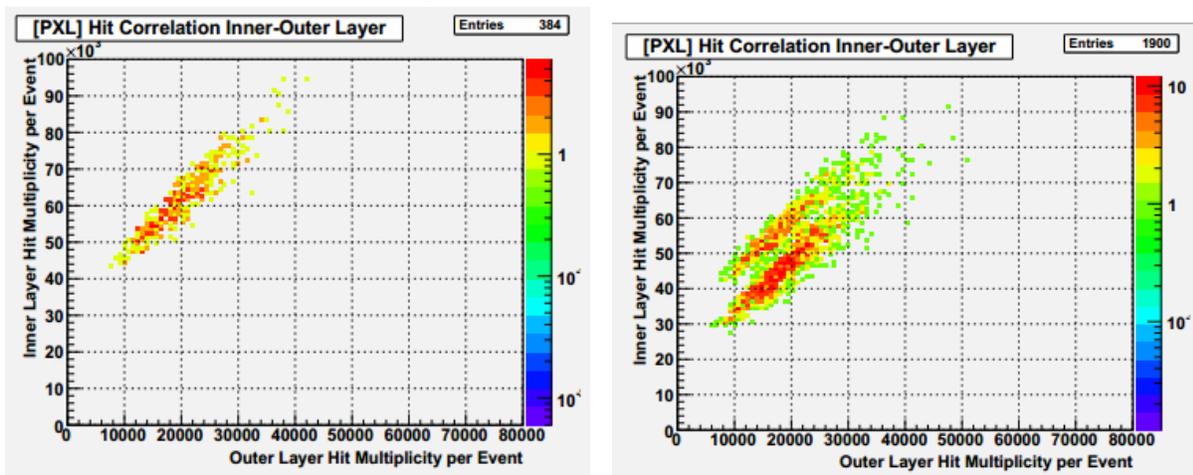


The **Number of Hits per Ladder Event-by-Event** plot (see left) shows the multiplicity by ladder for each event. Each Sector (Sectors are numbered from 1 to 10 in the plot) is composed of 4 ladders (1 inner + 3 outer). The high bins correspond to the inner ladders, the low bins correspond to the outer ladders.

A **permanent change** with respect to this reference plot, like empty bins or bins higher than usual by a factor 2 or more (see the inner ladder on Sector 3, in the plot on the right), **repeated for many consecutive events**, indicates a problem in the PXL detector.

If you notice it, please make a note in the shift log. No other action is necessary, the automatic reset should clear this issue. If the problem remains for more than 16 minutes, contact the expert.

### Hit Correlation Inner-Outer Layer



The **Hit Correlation Inner-Outer Layer** plot (see left) shows the correlation between the hit multiplicity measured on the Inner and on the Outer layer for each event.

A **dual distribution** (see right) along two separate lines indicates a problem in the PXL. If you notice it, and there is no change in the PXL DAQ dead time, continue running.

*\*Note: the inner-outer layer correlation plot (see below) keeps a memory of the temporary problem, showing the dual correlation for the duration of the run. The single distribution should get restored after a new run is started.*

In case the plots you see online are not similar to the examples shown in this manual, please make a note in the shift log.