Introduction to Run Control for the novice shifter (definitions and data flow summary at end)

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Here is how to fly PHENIX

GETTING RUNNING STARTED THE ORDER MATTERS!
PLEASE WAIT FOR ONE ACTION TO FINISH BEFORE STARTING THE NEXT ONE

1. **Crate Communication Windows:**

   Usually on the PHONCSC machine, the screen has a number of open windows. The colored windows are connected via a serial link (through the terminal server) to display debug information from the crate controllers in various DAQ electronics racks. The contents are mainly of interest to the experts, and (mostly) report the status of the CORBA communications with various crates. The controller name of the crate and what devices are in that crate shows up at the top of each window box.

   Blue = DCM
   Pink = Level 1 trigger
   Green = GTM

   These windows should be running on the PHONCSC machine and should be kept open at all times. Often the blue window for DCM crate iocondev2c will be missing from the display, since it is for MVD and MUID.S granules which are still doing separate testing.

   If these windows are not running, open a new window on PHONCSC and do the following:

   ```
   ssh phoncs@phoncs0.phenix.bnl.gov
   setuponcs
   setupWindows.sh
   ```

   If there is a problem with a given crate (see list of problems below), you may need to reboot one of the crate controllers. To reboot the crates, type a control-X in the relevant green, pink or blue window. Sometimes the crate controllers can crash in a way that rebooting remotely does not work. In this case, you need to press the RESET button on the relevant controller (the module on the far left of any crate).

   a) If you reboot the Level 1 trigger crate (pink windows), you will need to restart the Level1 GUI and then the Partition Server (see sections below).

   b) If you reboot the GTM crates (green windows), you will need to restart the MasterClock GUI, the Level 1 GUI and the Partition Server (see sections below).

   c) If you reboot the DCM crates (blue windows), you will only need to restart the Partition Server

(see sections below).

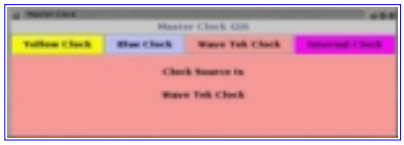
When they are started up or rebooted, each one should say "server ready" before any further operations are attempted. Some of these messages may scroll off the screen.

2. **Select the clock:**

   Now open a new window on PHONCSB (in a new desktop - call it A) and do the following:

   ```
   ssh phoncs@phoncs0.phenix.bnl.gov
   setuponcs
   MasterClock &
   ```

   this opens a gui, which allows you to click on the clock to use. The clock gui looks like the following:

    (click picture for larger view)

   If RHIC is not colliding, then choose the WaveTek clock. When we are taking real data, the yellow clock should be used. The time to switch over is after RHIC has successfully passed transition. You can tell that this has happened by looking at the RHIC screen in the corner, next to the HV screen. It shows the amount of beam in blue and yellow rings as a function of time. When they start acceleration in RHIC, they put a blue vertical link on the screen. When they go through transition, they put a red vertical line on the screen. You should look for that pair of vertical lines - if the beam losses are not too large (and the store has >200 10^6 in both rings after transition) then you can prepare for real data taking by switching to the yellow clock.

   - NB1 - Change back to the WaveTek clock whenever the beams are dumped.
   - NB2 - Any time the clock is set or changed, one needs to follow the procedure listed below.

   Note 1. If the MasterClock GUI does not work properly (will not select a clock source), try rebooting iocondev10 and iocondev11 (green windows on PHONCS) by typing Ctrl-X in their monitoring windows.

   Note 2. There must always be an active clock and a glink clock (go to the feed.pl GUI and press clock fix) or some of the FEMs may be harmed. When beam is off, switch to WaveTek and press feed.pl -> clock fix.

   Note 3: In the case of a clock change or a clock glitch you should reload the GL1 and LL1 configurations via the "Run Config Script" in the level1gui window. Remember that reloading these configurations will reset everything to their defaults, so fo instance the scaledowns and triggers will reset to whatever is saved for that configuration.

3. **Level 1 GUI:**

   In the same window on PHONCSB, start up the level1 GUI to allow trigger control by typing:

   ```
   level1gui &
   ```

   This gui has two tabs, one for global level 1 (GL1) and one for BB local level 1 (BBC). These are

used for a variety of things, but almost all of the buttons are for use by the experts only. The shift crews use this gui to load the trigger configuration files. These need to be loaded

- upon a cold start
- when Level 1 crate controller has been rebooted
- when configuration is to be changed

The level1 gui looks like the following:

 (click picture for larger view)

First select the tab GL1 (at the upper left). Then click on the button labeled "Run Config Script". You will get a menu in which you should (for normal data running) select the directory BONA_FIDE_QGP . Then select the only file inside that directory (GL1.config). The blue progress bar scrolls from 0 to 100%, with a little pause at 27% in the GL1 crate. When configuring GL1, you will get a dialog box that asks whether to reconfigure the partition server. You should say no.

Then when done with this load, select the BBC tab. Then select the BBC "Run Config Script" button and do the same load - for our data taking use BONA_FIDE_QGP (same name for both crates). NB This filename is the same for both crates when we run all granules together. If we are running in a case with some subsystem out of the main partition, then the GL1 needs to have BONA_FIDE_QGP_XXX configuration file loaded instead; XXX refers to the missing subsystem. For more info on the exact file name, look at the trigger documentation.

4. **ARCNET and Timing Initialization**

   In the same desktop on PHONCSB pull up another window and type

```
ssh phoncs@phoncs0.phenix.bnl.gov
setuponcs
feed.pl &
```

   This will call up a GUI that allows subsystem-by-subsystem synchronization via a set of ARCNET and GTM commands. The feed.pl gui looks like the following:

 (click picture for larger view)

   You need to be careful of these because some subsystems take a LONG time (15-20 minutes) to do. If you have just turned on (or cycled power on) the front end electronics, then obviously you need to do each one. If the FEMs have been running, then calling up the GUI doesn't change the state. If it says "unknown" that does **NOT** mean there is a problem - it means that the previous situation is maintained but the GUI doesn't remember what the status was.

Before EVERY NEW RUN (ie. before pressing "start" in the RBIB run control window) EITHER press "clock-fix" OR press "RICH-E" and "RICH-W" quit reset in the feed.pl GUI.

It is customary to leave the feed window open.

5. **Partition Server:**

   The partition server is a executable that communicates with the crates and event builder and tells them who belongs together with whom (granules to partitions).

   Go to a new desktop (call it B) on the PHONCSB machine and open a new xterm:

```
ssh phoncs@phoncs0.phenix.bnl.gov
setuponcs
oncs_cleanup.sh
oncs_cleanup.sh (this should always be done twice for good measure)
PartitionServer
```

   Be sure and run the cleanup anytime you have stopped the Partition server and are going to start it up again.

6. **Run Control for GL1:**

   Now we are ready to start a run for reading out the global level 1 data. In the same desktop (again B) on the PHONCSB machine open a new xterm:

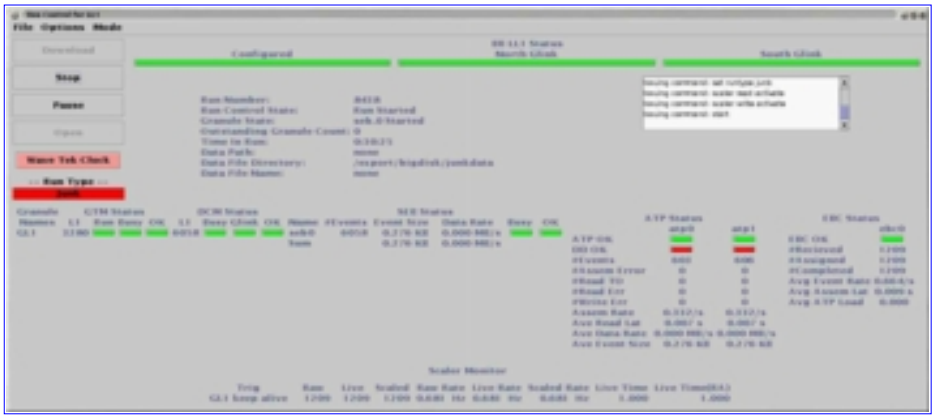
```
ssh phoncs@phoncs0.phenix.bnl.gov
setuponcs
rc &
```

   A little window in the upper left will pop up, offering you a choice of partitions to work on. Choose the GL1 option. This will pop up a new control GUI window.

   Then click on the following: Make sure to wait until each step is done before proceeding.

```
-->MODE -->EVB -->on (be patient, it may take a while)
download
start
```

   This procedure prepares one particular DCM and SEB.0 of the event builder to receive the GL1 data. The run control GUI with event builder on looks like the following:


(click picture for larger view)

7. **Run Control for Main Partition (RBIB):**

   Now you need the second run control window for running the main partition, so in the same window type:

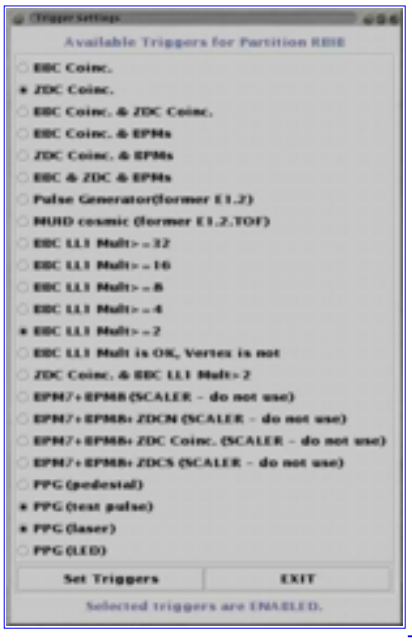
   ```
   rc & (a second time)
   ```

   the window in the upper left will pop up again, and offer you a choice of unused partitions. this time you should choose RBIB. You will get a second run control GUI, in which you actually start the run.

   If you have TO CHECK, SET OR CHANGE THE TRIGGER MIX, then select

   ```
   -->options -->set trigger
   ```

   This will pop up the following window:



(click picture for larger view)

   If the left circle is black, then this trigger is to be made active. To change the triggers, select and/or de-select the desired triggers, then click "Set Triggers" button. Then click the "Exit" button. In order to update the run control display, select the following:

```
-->options -->Update Scaler Status Panel
-->options -->Activate Scaler Status Panel
```

These changes in which triggers are active should NEVER be executing during an active run!

Before starting a new run, re-initialize the RICH FEMs by pushing "RICH-E" and "RICH-W" in the feed.pl GUI quick reset. This is not necessary if "clock fix" has been done to start a new run.

Once you are done selecting the triggers, then do the following:

```
-->MODE -->EVB -->on (be patient, it may take a while)
-->download  (be even more patient as this takes longer)
-->open (this step is needed to be writing the data to disk)
-->start
```

Now you should be taking data !!!!! Keep an eye on the run control panel to make sure that events are coming in.

Sometimes when adding the Event Builder or in running the size of the run control GUI is too small (and thus some text is off screen). You can do the following to resize the window.

```
-->Option -->repack (be patient, it may take a minute)
```

Note. When the beam goes off, switch to the WaveTek clock and run feed.pl -> clock fix (see note in section 2)

8. **Monitoring Event Builder Operation**
    - **Status indicators -- color definitions**
        - **SEB OK**

          red - not in running mode

          green - in running mode, DCM connection established

          yellow - in runing mode, DCM connection not established/broken

          black - failed (likely the SEB process has not started properly or has crashed)
        - **SEB Busy**

          green - SEB is idle: not actively processing an event or handling request from an ATP

          orange - SEB is active: either processing event from DCMs or handling request from ATP

          red - SEB is busy: SEB is trying to read an event and its event buffers are filled
        - **ATP OK**

          green - ATP in running mode, partition started

          orange - ATP in running mode, partition not started

          red - ATP not in running mode

black - failed (likely ATP process has not started or has crashed)

- **(ATP) DD OK**

  red - Connection to DD not open

  orange - Connection to DD open, run not started

  green - Connection to DD open, run started

  black - DD output has "failed" (likely the ndd_event_server has crashed)

- **EBC OK**

  green - EBC in runing mode, partition started

  orange - EBC in running mode, partition not started

  red - EBC not in running mode

  black - failed (likely EBC process has not started or has crashed)

Comments on indicators

- If you have enabled and downloaded the event builder in the GL1 run-control, when you start a partiion run-control GUI and enable the event builder, the ATPs and EBC should come up with orange OK indicators which means that they are running but not handling events for that partition. If they come up "black", it likely means that you didn't do a download in the GL1 run-control.
- When you start a partition run-control GUI, the SEB's should come up with red OK unless you have just restarted the partition server. They will go red when you do a download. If they do not go green when you issue a start, then there's a problem with that SEB.
- You should only get fleeting glimpses of yellow OK indicators for the SEBs since with the current run-control, the DCMs connect immediately. If you see the SEBs stay yellow when you have started a run, this signifies a problem with either the SEB or the DCM process.
- Black almost always implies a problem with the event builder process on the given machine except when you are starting these processes for the first time after restarting the partition server (in GL1 for ATP, EBC).
- **Counts, rates, etc (all averages over last 100 events)**
  - **SEB**

    # Events - the number of events received from the DCMs.

    Event size - Average size of the sub-events received

by SEB.

Data Rate - Average data rate = Average event size/average time between arrival.

- **EBC**

  # **received -** the number of events received on this partition from the GL1 DCM.

  # **assigned** - the number of events actually assigned on this partition to an ATP.

  # **completed** - the number of events which have been finished by an ATP (with or without errors).

  Avg Event Rate - The average rate for completion of assembly of events on this partition.

  Avg Assem Lat - Average time between assignment to ATP and completion of assembly.

  Avg ATP Load - Average (over ATP) number of outstanding assignments to the ATPs **(NOT being filled yet).**

- **ATP**

  # **assembly errors** - the number of times an ATP encountered an error tryin to assemble an event.

  # **read TO** - the number of times the ATP timed out reading data from the SEBs but recovered on retry.

  # **read errors** - the number of times the ATP failed to correctly read data from one or more SEBs.

  # **write errors** - the number of times that the ATP encountered an error while writing to DD.

  Assembly rate - The rate at which the ATP completes assembly of assigned events (with or w/o error).

  Avg Read Lat - The average time it takes the ATP to read data from SEBs.

  Avg Data Rate - Average aggregate rate for events assembled by the ATP for this partition.

  Avg Event Size - Average full event size of events assembled on this partition by this ATP.

Comments on counts and rates

- If you start a run on a partition and see events arriving at the DCMs and SEBs, you should see the EBC received event count increasing roughly in sync with the DCMs and SEBs. If you see the EBC received event count remaining at zero (0), then you likely have encountered a GL1 trigger bug (see problems section).
- If you see the event rate on a partition suddenly

drop, and the ATP assembly and read error counts increase together with the ATP event count, then it is likely that the ATP is failing to fetch data from one of the SEBs (see problems section).

- Don't be concerned if the two (or more) ATPs don't operate in sync, especially if there are multiple partitions running. You may observe that one ATP gets and processes events while the other looks idle but it is likely that the other ATP may be handling events on another partition. YOu will especially notice this behavior if the two partitions run at similar trigger rates.

9. **DAQ Monitoring:**

Always check the integrity of the data when running.
daq_monitor is a program that checks all data packets and that their parity is okay and that the FEM event counters are aligned with the GL1 granule counters.

Under a new desktop (call it C) on PHONCSB, open a new xterm and do the following:

```
ssh phoncs@phoncs7.phenix.bnl.gov
setuponcs
setenv DISPLAY phoncsb.phenix.bnl.gov:0.0
```

You can check the data while it is being taken by pointing at the dd pool

```
daq_monitor
```

Checking the dd pool, the default is partition 1, which is our big data taking partition.

Always RESTART daq_monitor for each new run!

You need to be aware of the current state of each granule in order to understand whether an error reported is an actual error that needs to be addressed or if it is already known and people are working on it. For example (and it is not the only one) the TEC has 1 FEM which will occasionally report parity errors and the TEC group knows about this problem. If you do notice an error, the shift leader must decide what to do. Sometimes the problem can be solved by reinitializing the FEM's using feed.pl. This is a good idea for most FEMs, but some can take over 20 minutes to initialize. There are call lists for each subsystem to help in the decision making process.

Below is a partial list of presently known errors:

- TEC packets 5080- may occasionally show clock alignment errors
- TEC packets xxxx- may occasionally show parity errors
- .....

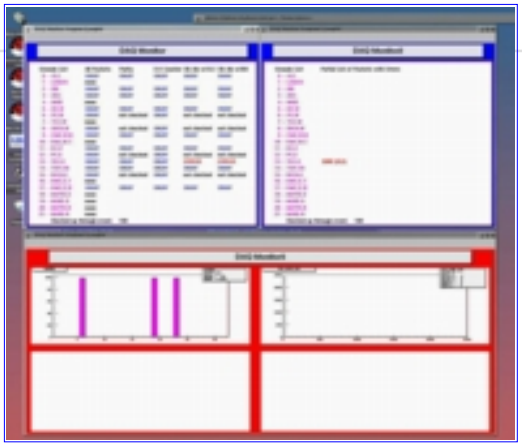
If you want to check the data from an existing file type:

```
daq_monitor -f filename
```

where filename is the name of a PRDF file just written.

An example display is shown below. The upper left window gives an overview of any errors from any system. In the upper right window it gives a list of FEM packets with errors (but can display only up to the first four). If you see errors but they are only in one FEM out of many, note that in the log book. However, if you see many FEM packets with errors, in particular Event Counter or Clock Alignment errors, or any error from BB or ZDC, you should stop the run and try re-downloading. Call an expert if problems persist.

The lower window, upper left plot shows the various trigger bits for incoming events. The other plots are from the ZDC's and are currently being worked on to be standardized.

 (click picture for larger view)

IN CASE OF PROBLEMS

1. **Changing Clocks or Clock Glitches:**

   If you lose the clock or need to change clocks (for example when the machine has both beams through transition you want to switch to the yellow clock), you need to follow the following procedure.

   - Stop all current data taking runs, but you do not need to close the windows (unless stop does not work - see instructions below). If stop does not work, kill partition server and run control processes.
   - Select a new clock source, if necessary.
   - In the feed.pl GUI window, click on the button called "Clock Fix"
   - This procedure takes about 4 minutes and does many glink resets and some necessary ARCNET downloads
   - If this fails (Red Light Results), check on which subsystem it failed and reload their ARCNET directly. Then try the "Clock Fix" again.
   - If this fails (Red Light Results), check that the arcnet node for that subsystem is okay (see instructions below for arcnet problems).
   - If this still fails, call in the DAQ or subsystem expert. Occasionally we have had to recycle the low voltage power for some subsystems.
   - Assuming this has worked, restart partition server and run control if necessary, goto the run control for GL1 and click "download" and then "start". Then goto the run control for RBIB and click "download" and then "start".

- If this fails to work, check if some subsystem has failed to GLINK lock to the DCM's (look for red status light). In this case go back to the step above with feed.pl.

2. **ARCNET problems:**

   If you encounter errors or problems with using feed.pl (downloading to ARCNET), it could be a problem with the ARCNET server or a given arcnet node. First, check which arcnet node the granule you are having problems with is on (sometimes a granule is on more than one arcnet node!). In a window on phoncs0, type:

   ```
   setuponcs
   more $ARCNET_DATA/gdb.dat
   ```

   Once you have found the relevant ARCNET nodes (eg. /dev/arc2), then you can do the equivalent of a ping to see if it is alive.

   ```
   ssh phoncs@phoncs1.phenix.bnl.gov
   setuponcs
   cd arcnet/utility
   netmap /dev/arc2  (instead of 2 use the relevant node number)
   ```

   This function then gives a list of the id numbers that the node sees.

   If no numbers appear then the node is dead. In this case either a given systems on that node is hanging the node completely (call an expert), or the ARCNET_SERVER is having a problem. To restart the ARCNET_SERVER, go into the electronics room (next to the magnet computer) and sit down at phoncs1 (its monitor has a yellow color). Then look for the ARCNET_SERVER and kill it. Then restart it by typing:

   ```
   start_arcnet_server.csh
   ```

   If **ONLY** one subsystem numbers do not appear, you might try recycling that subsystems low voltage. (Remember for systems like the TEC, only TEC experts can recycle their low voltage - thus call a TEC expert!).

3. **Run Control Hangs and/or Crashes:**

   There are many ways in which run control can hang or crash. Often the runs end where one or more granules are simply busy and do not continue to read out. This can be complex to diagnose.

   Note that sometimes the run control GUI is just hung (it may have something to do with the GNOME linux windows system). In this case you just will have to kill the windows.

   Here are a few guidelines for what to try and then what to check if that does not work.

   - Start by ending any run control GUI's. If they do not exit, just kill the windows using the (x) in the upper right hand corner.
   - If run ends normally, just try to download and start again.

     If that does not work:

   - Then kill the Partition Server by typing Ctrl-C in that window.
   - Then type "oncs_cleanup.sh"

- Then type "oncs_cleanup.sh" again
- Then type "oncs_cleanup.sh" again (three times is the charm)
- Then restart the Partition Server
- Then launch the GL1 run control GUI and follow procedure #6
- Then launch the MAIN RBIB run control GUI and follow procedure #7
- If this does not work, try checking the Event Builder machine for a dialog error window (**see instructions below under Event Builder section**).
- If this does not work, you should check the following three items:

  (1) Check for error messages from the blue DCM crate controller windows. You may want to try rebooting them. After rebooting you can simply start the MAIN RBIB run control again.

  (2) You should also check that if either of the green GTM crate controller windows is hung (does not respond to keyboard command) or has an error message (example: memory access violation). If either does, reboot the crate. If you reboot the GTM crate iocondev10, you have "glitched" the clock and should follow the above "Clock Changes or Clock Glitches" procedure.

  (3) If this does not work, try checking that the WaveTek clock is okay (that it has not been reset by power dip).
- If all else fails, try starting everything from scratch. If there is beam, you should have called the DAQ expert a long time ago !!!!

Sometimes for extra diagnostics you can open another window to phoncs0 and type:

```
tail -f $ONLINE_LOG/rc.01.log
```

which will then give a log printout from run control. Sometimes this helps to figure out where things died.

4. **Rich-E multiplexing problem:**

   Sometimes iocondev2b monitor window shows a stream of error messages about incorrect alignment. This is due to an occasional problem with multiplexing for the RICH. The problem is fixed by going to the feed.pl GUI and doing RICH-E -> Reset, at least once. Then, restart the run after downloading again.

5. **Nameserver issues:**

   Typing on a phoncs0 windows:

   ```
   psit
   ```

   checks for any active servers. You should always see "phoncs/daqns" listed, which is the nameserver. If you do not see this then the nameserver is not running You can restart it by typing:

   ```
   startns
   ```

   This command will restart the nameserver and reconnect all the timing, dcm and GL1 objects which live in the crate controller (green, pink, blue windows).

For experts only, if the nameserver is still there but you suspect a problem, you can kill the nameserver with the "killit" command.

If you are having problems with Run Control or Partition Server crashes or hangs, you may want to check if certain objects have died and are thus not registered with the nameserver. You can do this by typing:

```
nsviewer
```

Be warned that the list is long, and that the objects do not have to appear in a particular order.

You may also view the objects which are registered in the nameserver by typing the command:

```
nsmanager &
```

This utility allows you to view the objects which are registered with the nameserver and also to remove an entry. To remove an entry, click on the entry from the displayed list and click the remove button. Click on the 'Update' button to view the new list of registered objects.

6. **Event Builder issues:**

Using the event builder Video/keyboard/mouse switch

- The event builder terminal in the control room is connected to a switch that lets you interact with any of the event builder PCs as if you had direct keyboard, mouse and terminal connections.
- Access to the various nodes is provided through an on-screen menu interface to the switch itself.
- If the menu is not visible (blue window on upper right hand side of terminal screen) hit the scroll-lock key twice quickly. This should cause the switch to display the menu.
  - Once you've caused the switch menu to be displayed, you can no longer type into the display of the currently accessed PC. However, you can still use the mouse.
- There are actually two switches in use:
  - the first switch connects to the currently available set of SEBs
  - the second switch connects to the EBC and ATPs.
  - Second switch is accessed from menu item 16 on the first switch.
- You can use the up/down arrow keys and page up/page down keys to scroll through two windows of 8 entries on each switch.
  - The menu items are labelled with the name of the node to which they connect.
  - By hitting the <enter> key, you will cause the switch to set the focus of the keyboard, mouse, and monitor to the selected machine.
- If you select "switch2" from the first menu, you will access the second switch's menu.
  - Note: don't be alarmed if the switch2 menu jumps around or the up/down arrow acts strangely on the second menu.
  - This is a problem that is currently being investigated, but the switch is still functioning correctly.

Diagnosing and fixing event builder node crashes

- If you have reason to suspect that one of the event builder nodes has crashed, follow the directions above to open up the console for that node on the event builder terminal.
- If you see the windows-NT "blue screen of death", with a dump of machine registers and symbol table, then that machine will have to be rebooted.
  - Walk out to the rack room and find the event builder racks with PC's adjacent to the DCM racks.
  - Find the PC with the appropriate label. There are two racks of SEBs with SEB0-7 in the rightmost rack and SEB8-SEBC in the adjacent rack. The ATPs are in the left-most rack and the EBC is by itself underneath the terminal.
  - Push the (smaller) reset button to reboot the machine.
  - Verify on the console that it has rebooted correctly. It is not necessary for you to log in.
- If you see a little windows dialog box indicating an error, you have to clear that box before the event builder process can be properly restarted.
  - Click the "OK" button in the dialog box.
  - The process should terminate itself taking the terminal window with it.

Restarting the event builder process

- You will need to exit out of run-control and restart the partition server using the instructions above.
- The partition server when it initializes kills and restarts the event builder processes on all nodes
- You should see an NT "ms-dos" window pop up on the screen with text output from the process as it goes through its initialization.
  - If you see the process start spewing error messages that look like "exception in impl_is_ready", it means there's a more serious problem. Contact Brian Cole or a DAQ expert.

BITS and PIECES - POTENTIALLY USEFUL INFORMATION

1. should you need to run the GTM gui: type in a phoncs0 window

   ```
   gtm GTM.XXX.X
   ```

   XXX.X is the granule name you want to modify timing for (e.g. use RICH.W to modify the RICH timing)
2. To check for errors on the disks to which files are written

   ```
   tail -f /var/adm/messages
   ```
3. To change the number of BBC PMTs required by the BBLL1: on phoncs0:

   ```
   $LL1_MAIN/config/BBCcfgC &
   ```

   this will pop up a small window. choose BONA_FIDE_QGP on board 2 (labeled BBC2_>GL1) this gives a GUI which shows windows with various limits, mainly on the vertex calculation in LL1 and on the # of hits required. You can change these by typing in new values. The boxes of main interest are the min number of hits. After changing the values as desired, select save settings then quit This will save your new values to the file which is downloaded into L1 whenever you download configuration in the L1 GUI. To change the value to what you have just set as the new defaul, you must go to the L1 GUI, select BB and redo the download of the configuration file you just modified.
4. **Main Magnets**

   To view the status of the main magnets, type the command on a phoncs0 window:

   ```
   monitormagnets &
   ```

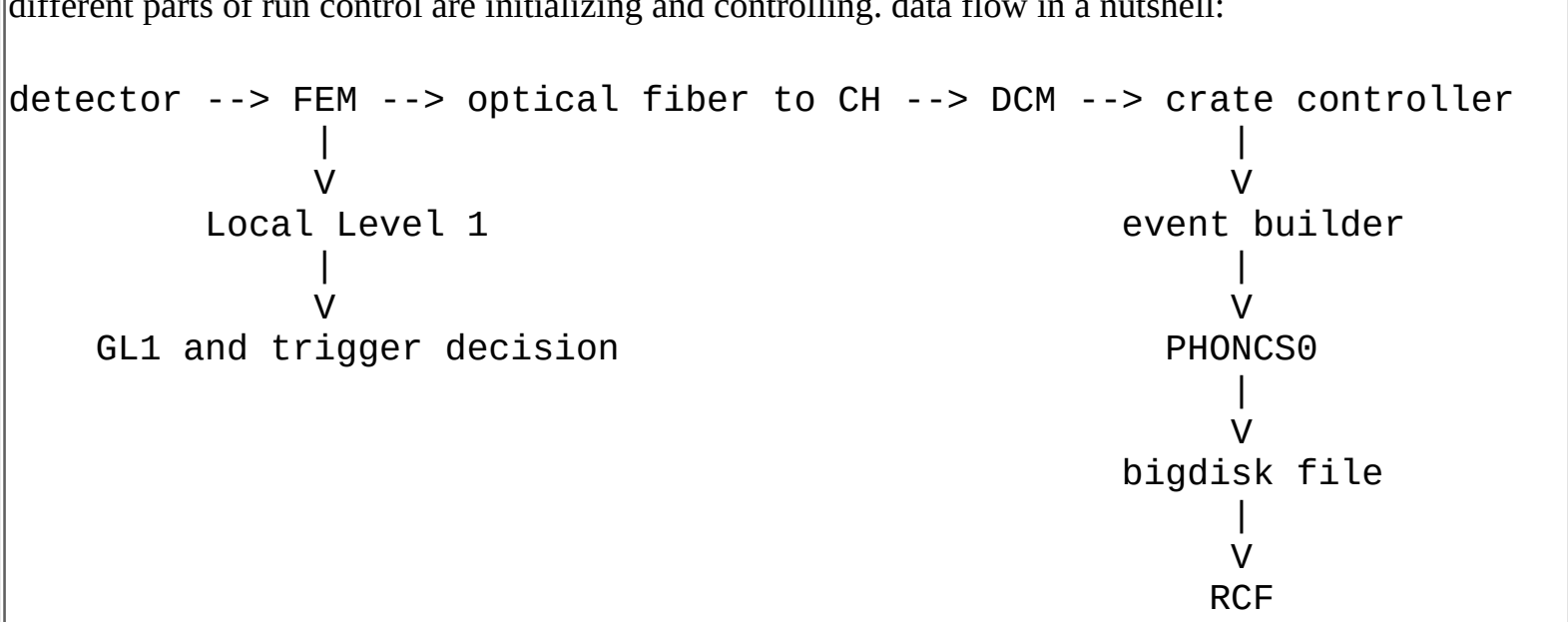
   This displays the current parameters for the north , central and south main magnets. Individual faults may be displayed by clicking in the faults textfield which is indicating a fault in red text
5. **Rhic Monitor**

   To view the RHIC ring parameters issue the following command on a phoncs0 window:

   ```
   rhicmonitor &
   ```

   This will bring up a display of the ring parameters for the blue and yellow rings.

Here is a VERY brief introduction to the data flow in PHENIX. this is to help understand what all the different parts of run control are initializing and controlling. data flow in a nutshell:



A few words making up the shell of the nut: Data flow from the detectors into Front End Modules (FEM's) that reside either on the detectors or in crates very near them. The FEMs buffer the data via either analog memories (AMUs) or digital memories. The buffering allows time for a trigger decision to be made by Level1 as to whether the event should be read out. Level1 includes Local and Global Level 1, where the local is within a subsytem and global collects from the locals and makes the final level 1 decision. Level 1 trigger information comes from the FEMs along a different path than the main bulk of the data. When the Level 1 trigger indicates that an event is to be read out, the FEMs select the correct memory location to read from, serialize the data appropriately and send it out over an optical fiber. These are the GLINKS. The entire system is synchronized together with a common clock, allowing us to pipeline our data transfers and minimize deadtime. This synchronization to a common clock is the reason we have to establish and maintain "lock". The clock used is the RHIC clock (we like yellow better than blue) or some reasonable facsimile thereof (the WaveTek clock). Control information is passed around PHENIX using ARCnet. The GLINKs send the data over the orange coated optical fibers to the counting house, where they go into the Data Collection Modules (DCMs). The DCMs have processing power in the form of FPGA's (Field Programmable Gate Arrays) and DSP's (digital signal processors) and they perform zero-suppression, formatting, and various data integrity checks. At some later date they will do further useful and clever things with their processing power. >From the DCMs the data go to the Crate controllers (later they will go directly into the Event builder) and from there they go into the Event Builder. We sometime run the backup, slower way by collecting the data from the crate controllers directly into PHONCS0 via the ethernet.

If you have comments or suggestions E-Mail me at: Achim@BNL.GOV