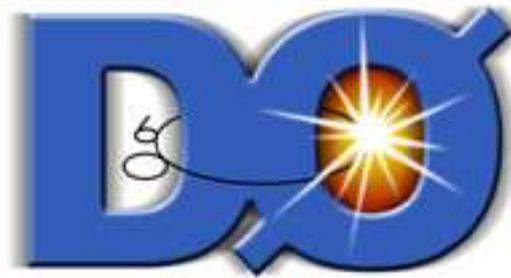


# DAQ Shifter Tutorial: Level3/DAQ



Yunhe Xie  
Brown University  
DAQ Shifter Tutorial Meeting  
April 26, 2005

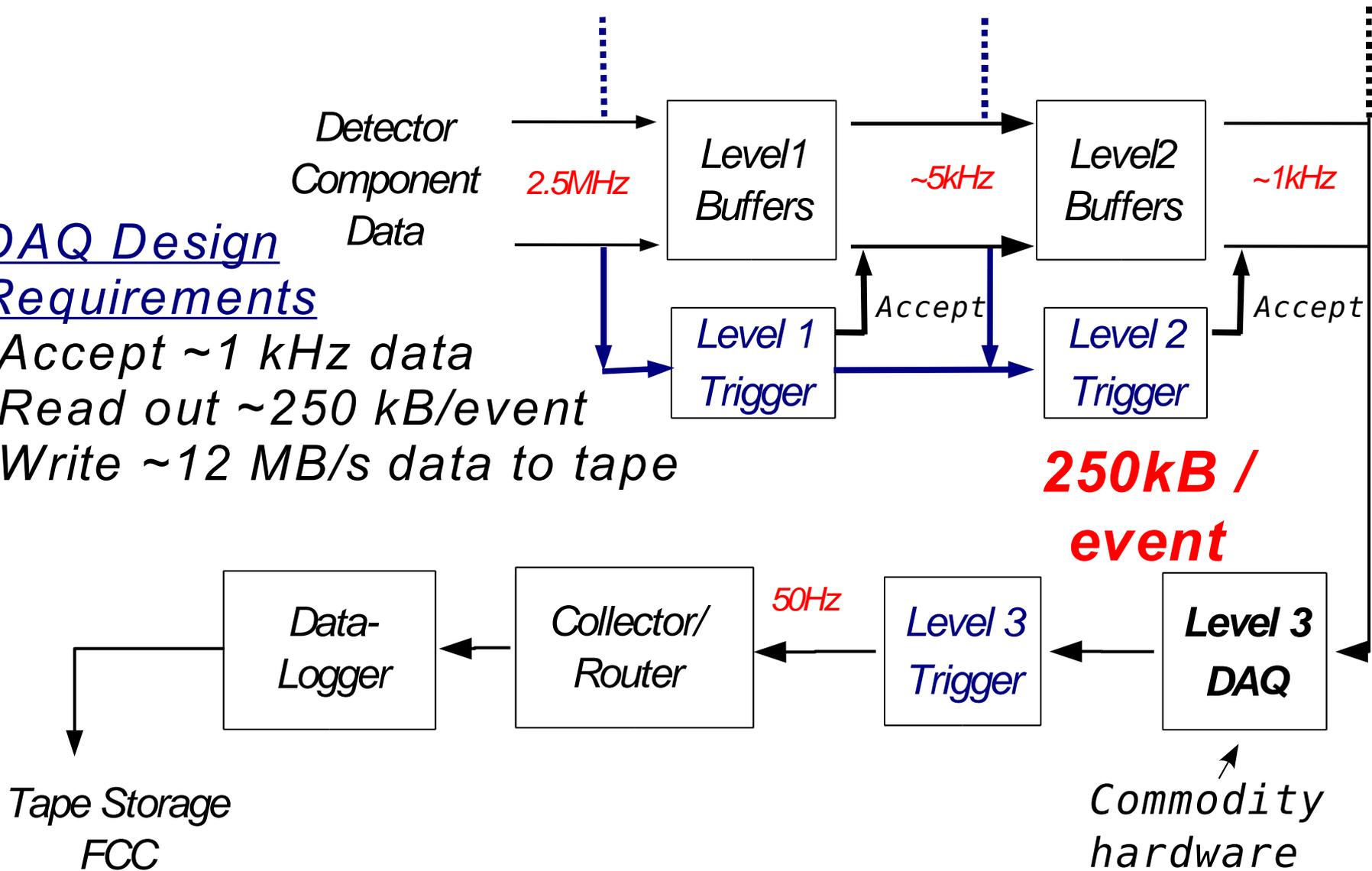
# Outline

- D0 Data Acquisition System
  - L3DAQ Overview
- Level3 Components
  - SBC, Farm Nodes, Routing Master, Supervisor, SBC software, Event Builder
- Monitoring
  - Monitor Server, daqAI, üMon, füMon ...
- What To Do When
  - Starting/Stopping/Reseting SBCs or Farm Nodes, Contact List

# D0 Data Acquisition System

## DAQ Design Requirements

- Accept  $\sim 1$  kHz data
- Read out  $\sim 250$  kB/event
- Write  $\sim 12$  MB/s data to tape



# Level3 Components

*Level3 has both a hardware and software side*

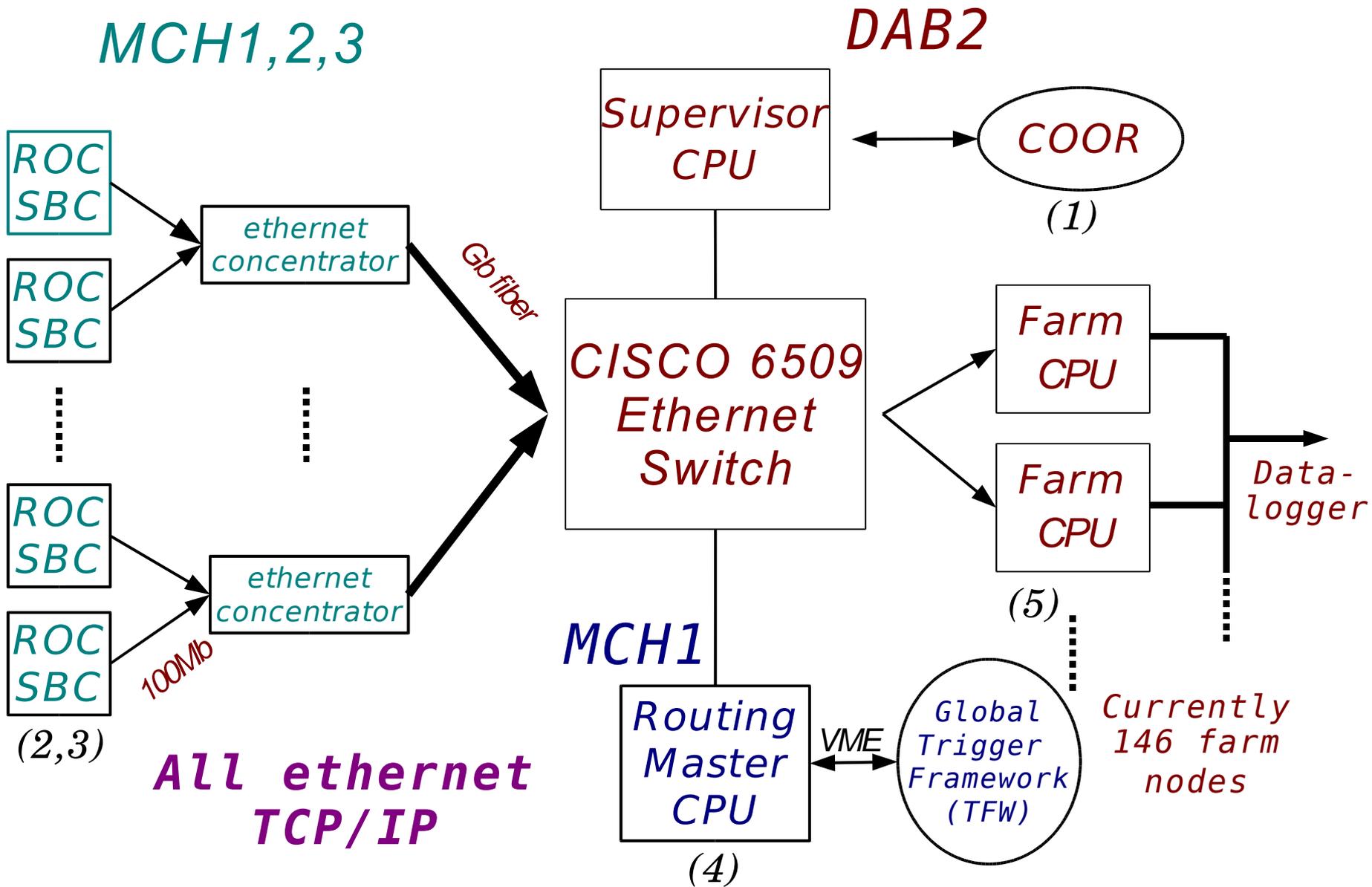
- Hardware

- SBCs  
(Single Board Computer)
- 2948G Ethernet concentrator switches
- 6509 CISCO Ethernet switch
- Farm Nodes

- Software

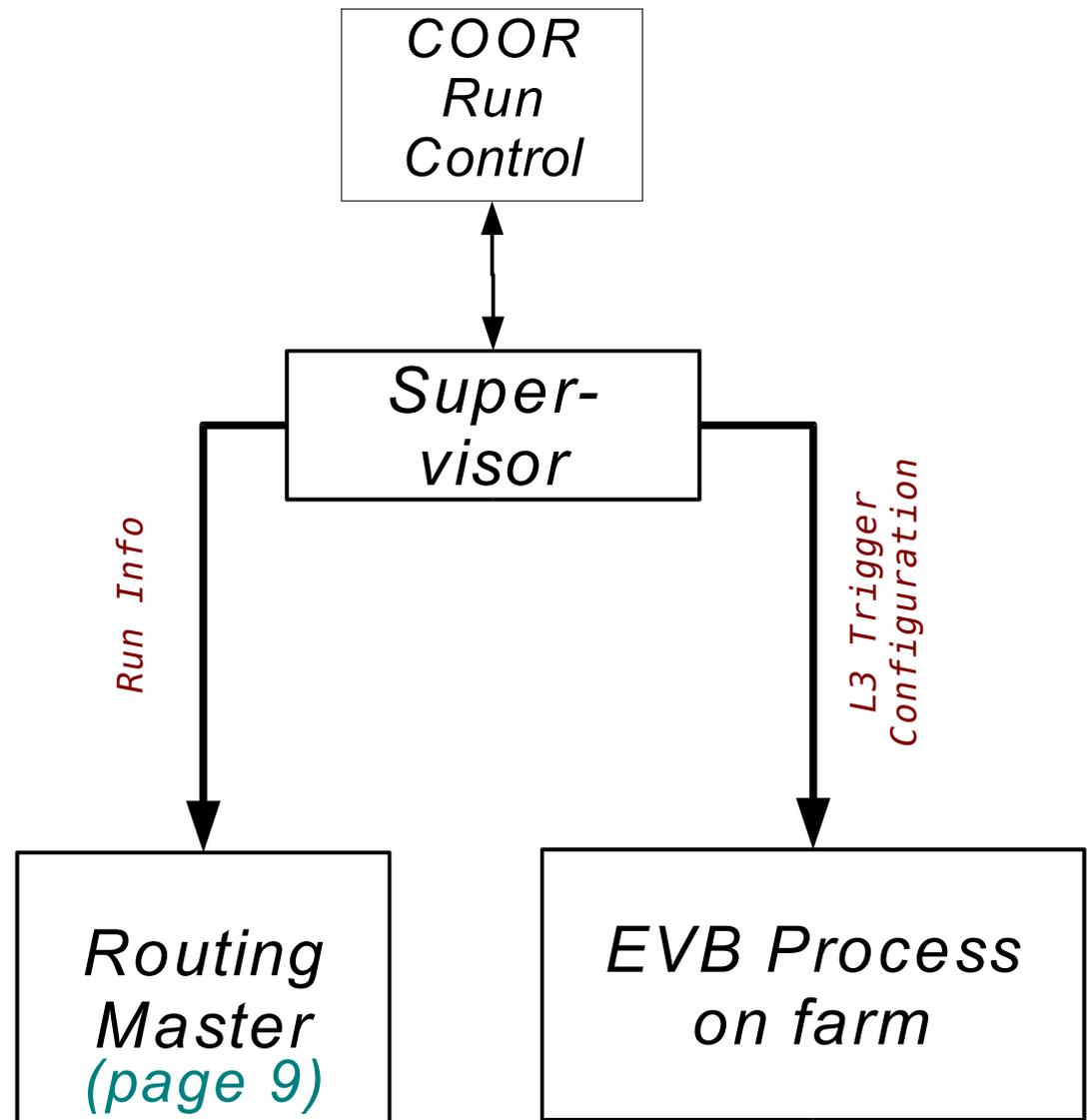
- Routing Master
- Supervisor
- Event Builder
- SBC Event Sender
- Level3 Trigger
- Monitoring

# Level3/DAQ System



# Starting a Run – Interact with COOR

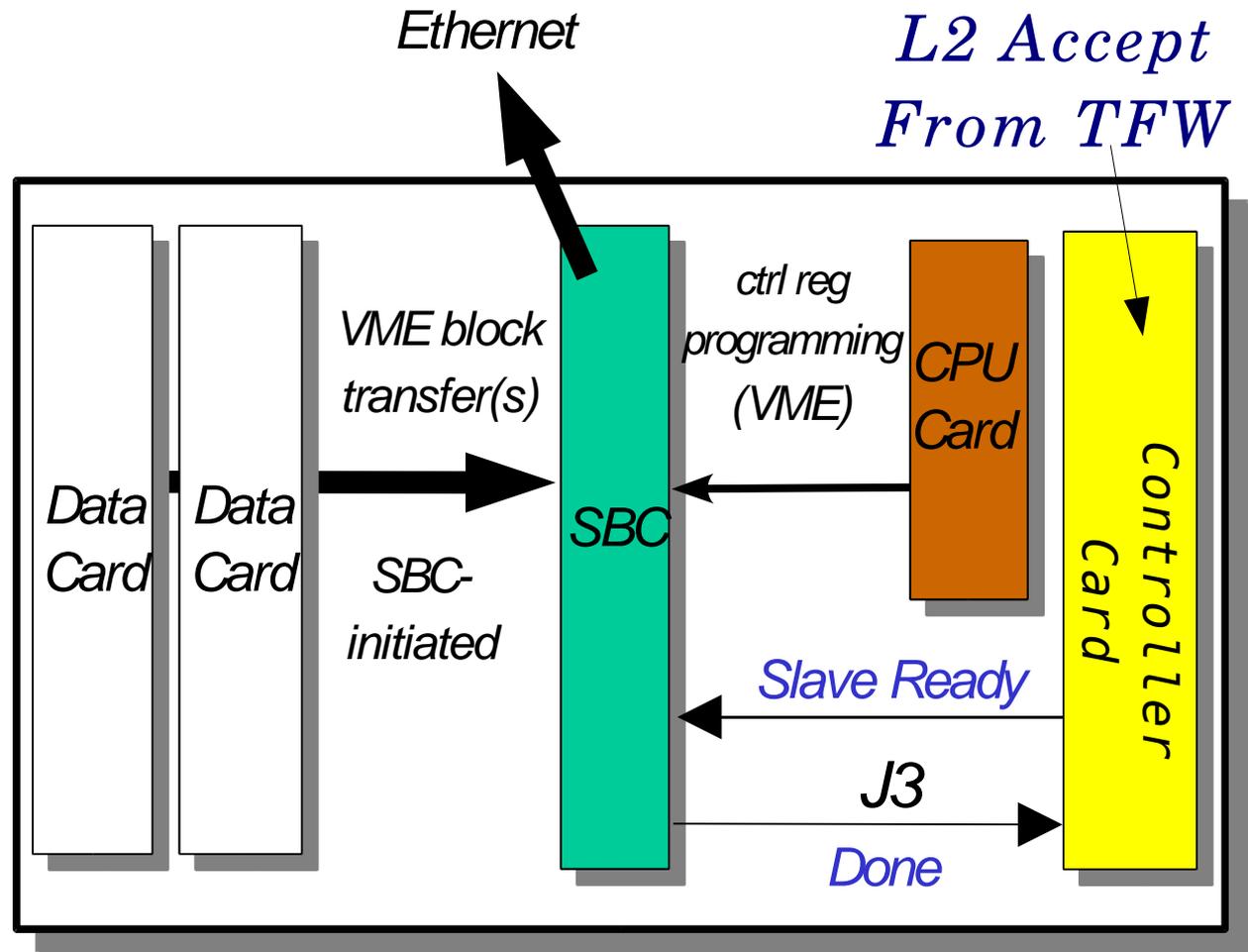
- When start a run
  - Pick crates with CRATER and download trigger with TAKER
  - COOR tells the supervisor routing groups info and L3 trigger configuration
  - COOR checks that there are a minimum of 9 nodes in the run
  - Supervisor sends the crate list, trigger info and list of farm nodes to the RM
  - Supervisor sends the L3 trigger configuration to Event Builder process running on the farm



# VME Readout Crate

In the run, we now want to read out data if L2 accept

- Controller card checks crate data size
- Level2 accept comes from trigger framework
- Controller card asserts a slave ready to the SBC
- This tells the SBC to read crate data cards.
- Data is stored in RAM memory on the SBC
- SBC event sender software starts running (page 10)



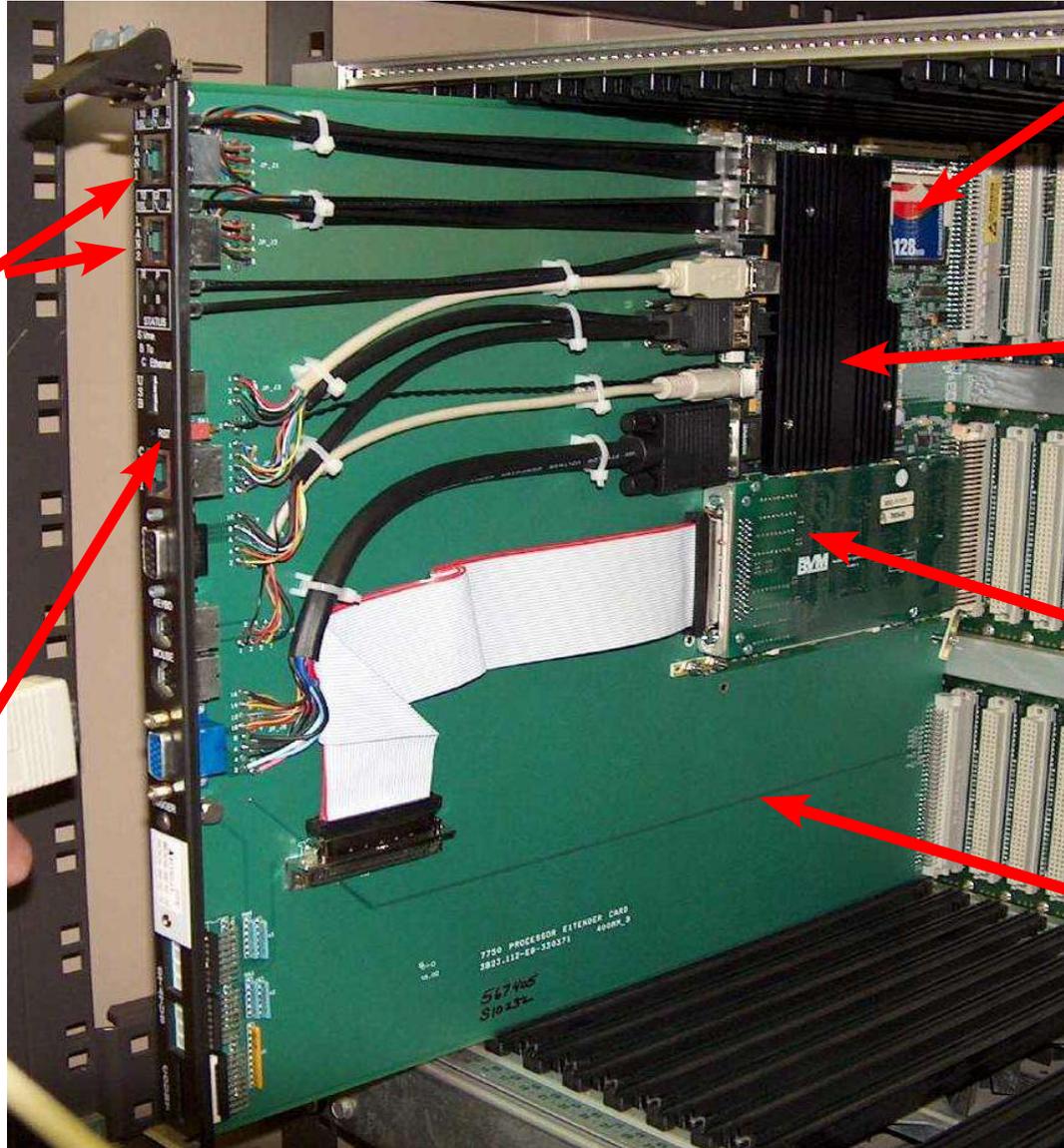
- Data card, CPU, and Controller cards specific to crate type

# Single Board Computer (SBC)

PIII 933MHz  
128MB RAM  
128MB flash

Dual 100Mb/s  
ethernet  
(24MB/s)  
(Data sent to  
farms over  
ethernet)  
*(page 10)*

Reset  
Button



128MB Flash ROM  
•Stores  
configuration file

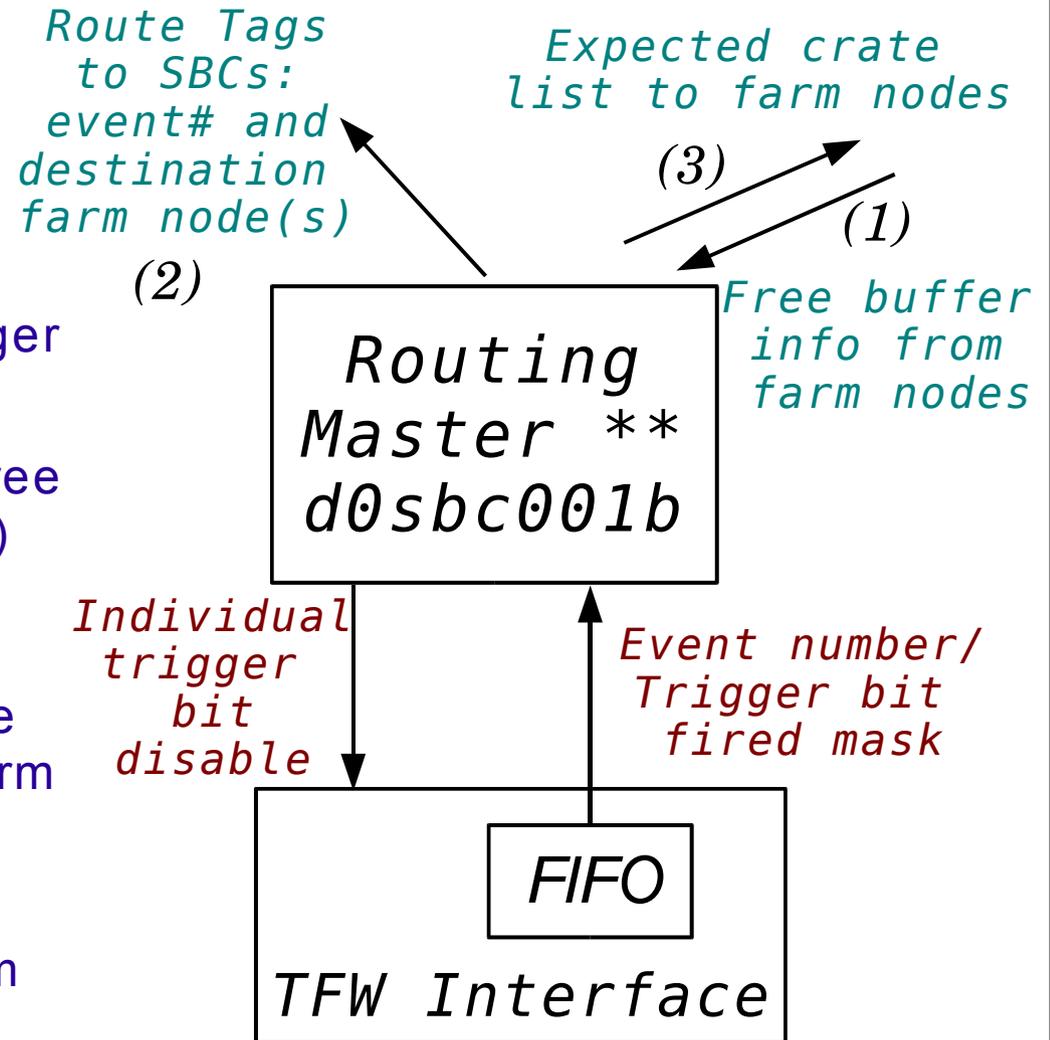
Tundra Universe II  
•PCI-VME  
Interface

PMC Digital IO  
Card  
•Coordinates VME  
Readout

J3 Handshake  
Slave Ready &  
Done Lines

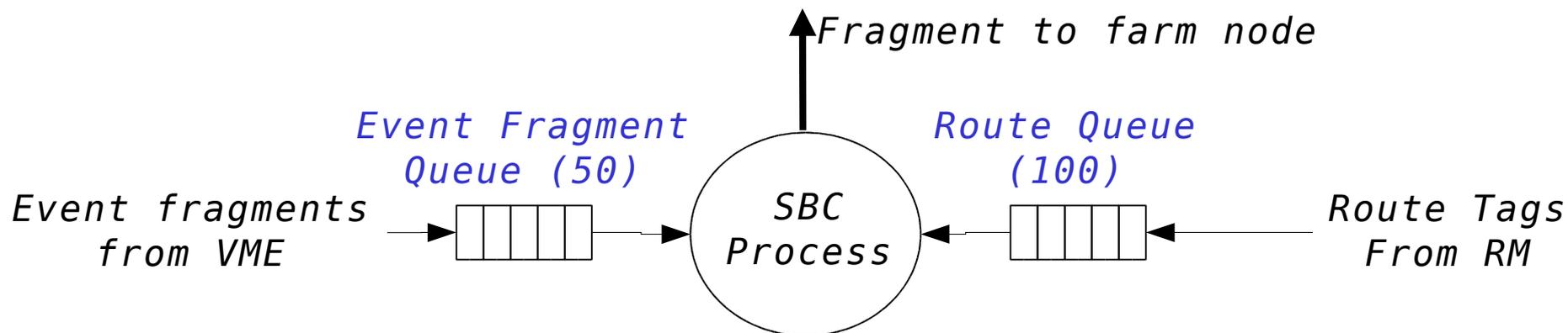
# Routing Master

- Serves two purposes
  - Connect to TWF
  - Event routing
- Connection to TFW
  - Gets event number and fired trigger bitmask from TFW
  - Disable L1 triggers if number of free buffers is too low (back pressure)
- Event Routing
  - Decides which farm node gets the event based on free buffers on farm nodes
  - Sends event number, expected crate list, and fired triggers to farm nodes
  - Tells SBCs which nodes to send their data



\*\* Dedicated SBC (001b) Located in MCH1 Rack 100 (If problem, CALL!!!)

# SBC Event Sender Process



- Event fragment queue stores event fragments from VME crate with event number tag
- Route queue stores routing tags from the RM consisting of event number tag and a list of farm nodes
- SBC Event Sender Process compares the event number of the head event fragment tag with that of the head routing tag
- In the case of a match, it will send the fragment to a particular farm node. Otherwise it will drop the tag with the higher event number tag
  - This causes the crate box in üMon to go red

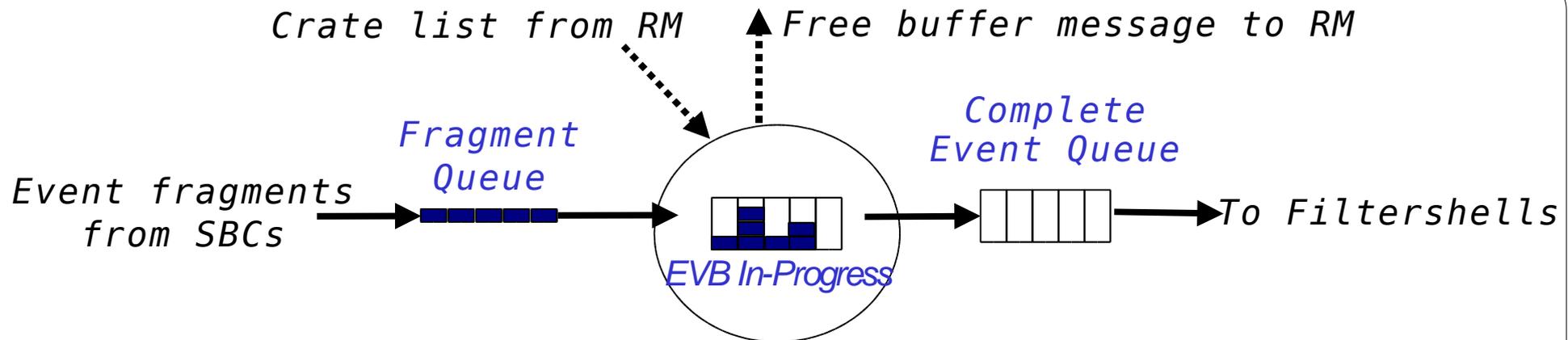


# Level3 Farm

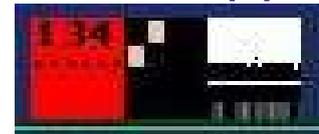


- Runs level3 trigger software and EventBuilder
- 146 Nodes in all
  - 48 Dual 1 GHz PIII Processors (nodes 1-48)
  - 34 Dual 2 GHz AMD Athlon Processors (nodes 49-82)
  - 32 Dual 2.8 GHz Zeon Processors (nodes 83-114)
  - 32 Dual 2.8 GHz Zeon Processors (nodes 115-146)
- Dual 100Mb ethernet ports
  - One connects to L3DAQ (in)
  - One connects to online (out)

# Event Builder



- Recap: The RM told each SBC where to send their data and it told the particular farm node which SBCs are sending data.
- EventBuilder strings together all the SBC data fragments into an “event”.
- Now at level3, all detector components are available
- Event will wait for 1 second for the SBCs to send their data.
  - If it does not receive what is expected, the event is dropped
  - This will show up as a **red** node box in füMon.



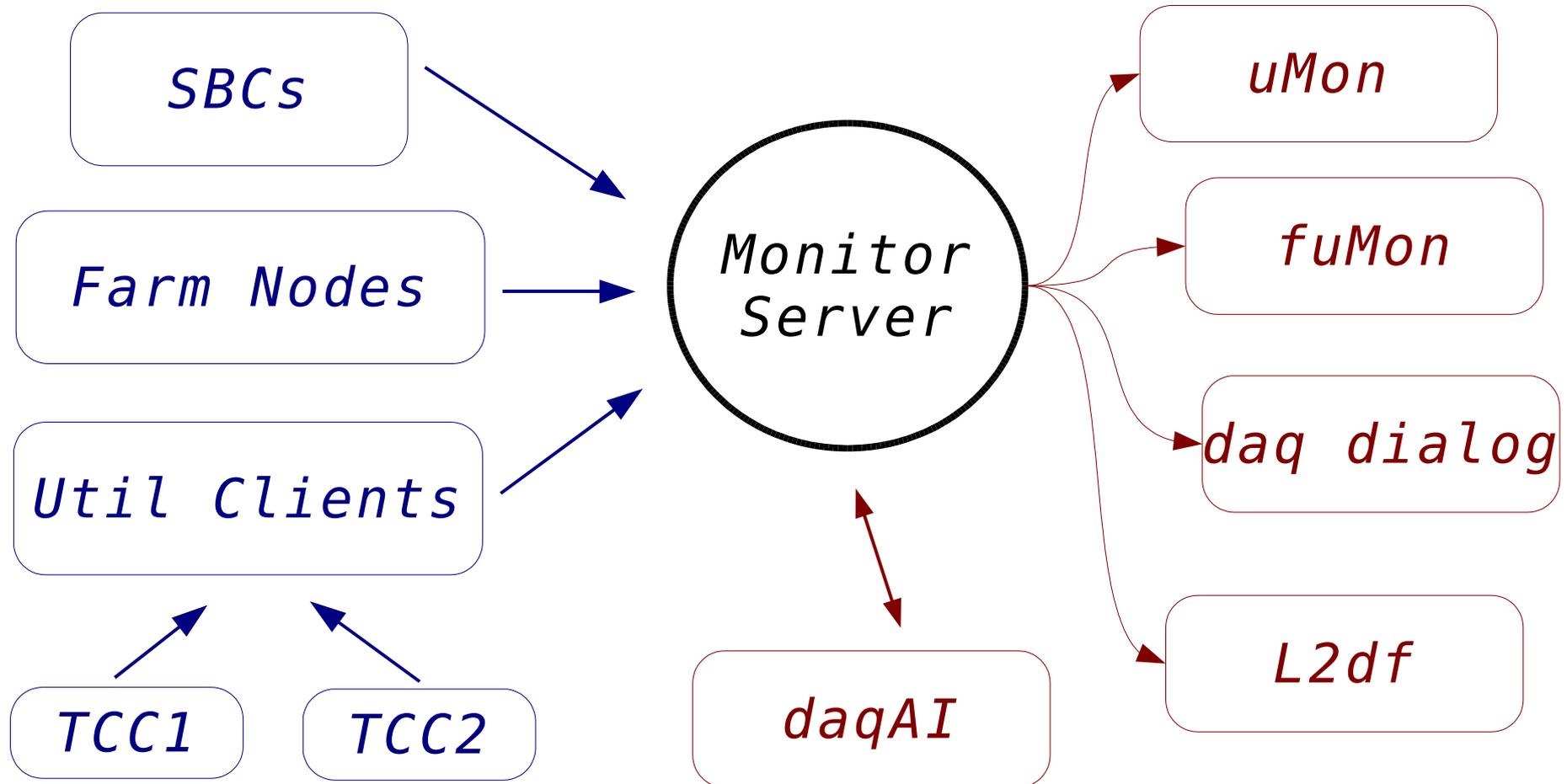
# L3DAQ Monitoring – 99% of your time

## Clients:

### *Monitor Server:*

- *Runs on d0l3mon2.fnal.gov*
- *Pull status from clients*
- *Responds to display queries*

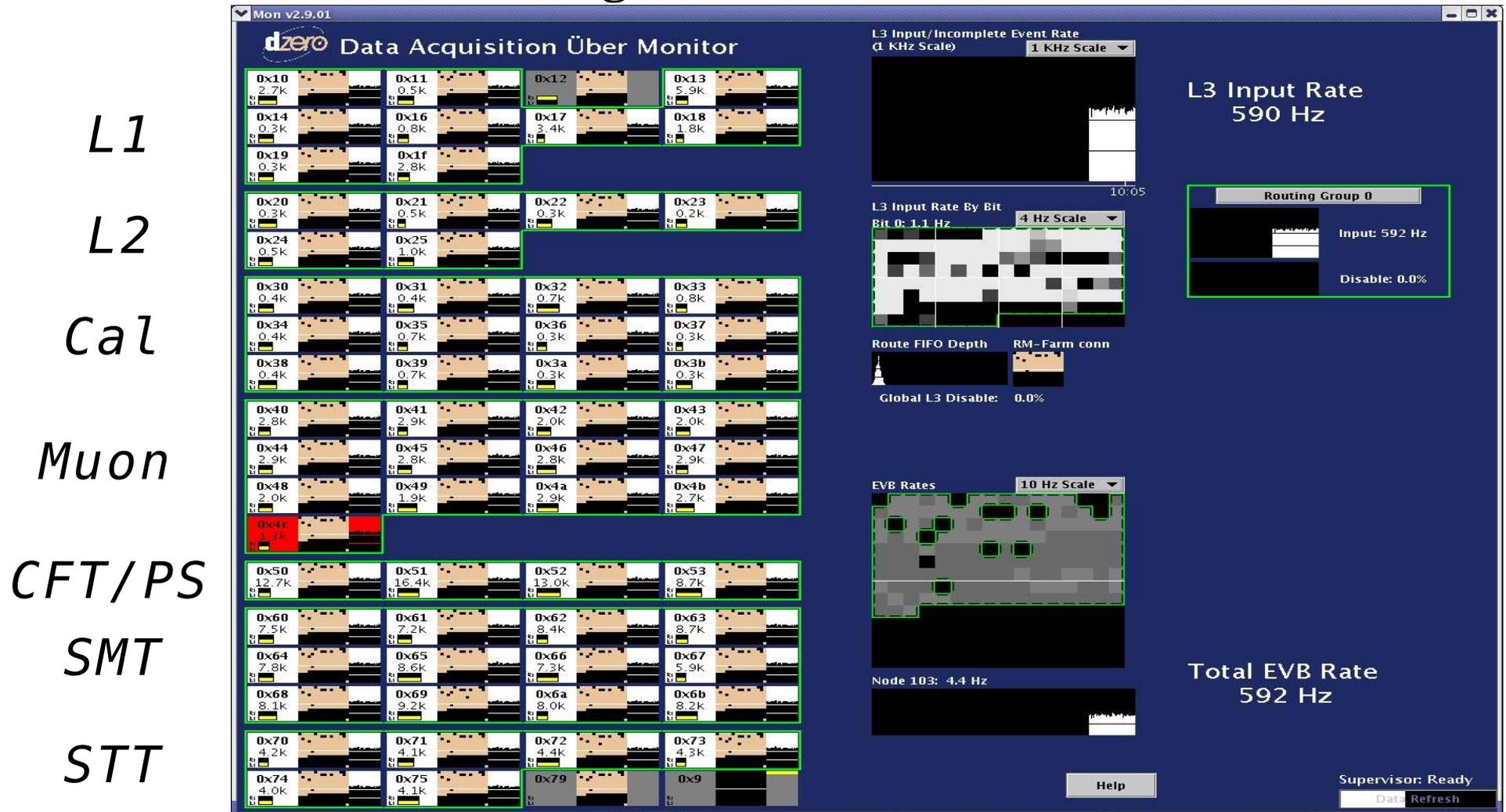
## Displays:



# Monitoring Tools: ümon – SBC monitoring

*Sits at top left black monitor at daq console*

- *Outlined green crates are “in the run”*



# Monitoring Tools: ümon – Crate Info



Farm node Connections:

- *Beige* means live connections
- *Black* means no or >2 connections
- Lower right is RM connection

Crate Number

Crate Size

Route queue depth

Event queue depth



Rate at which SBC reads VME

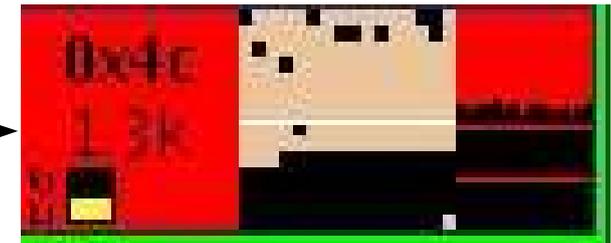
# Monitoring Tools: ümon -- Various States



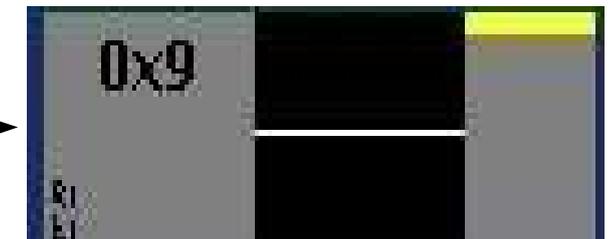
*Normal crate  
in the run* →



*Mis-matched  
RQ & EQ: Drop* →



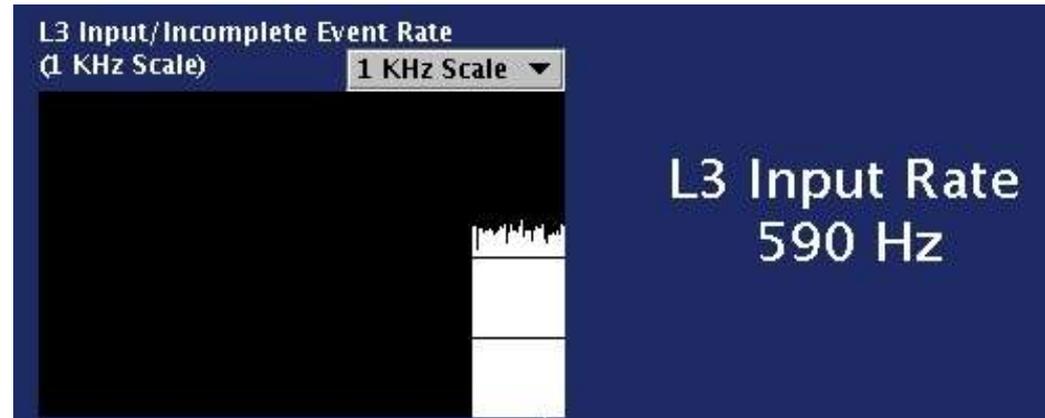
*Crate is not in the run &  
there is no monitoring info* →



*Crate is not in the run* →



# Monitoring Tools: ümon – Other



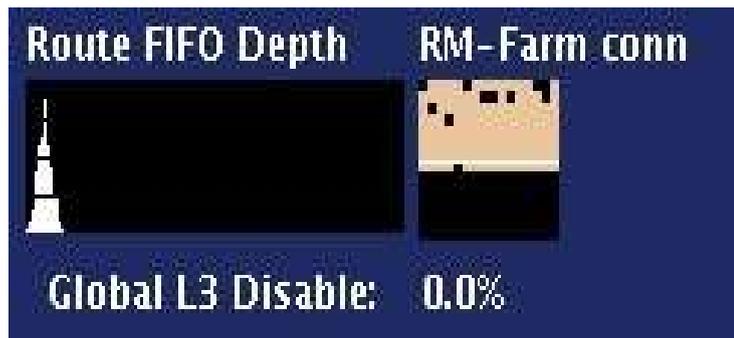
## Level 3 Input Rate

*This is the RM send/receive rate*

*Typically ~700 Hz for physics runs*

## RM-Farm Connection:

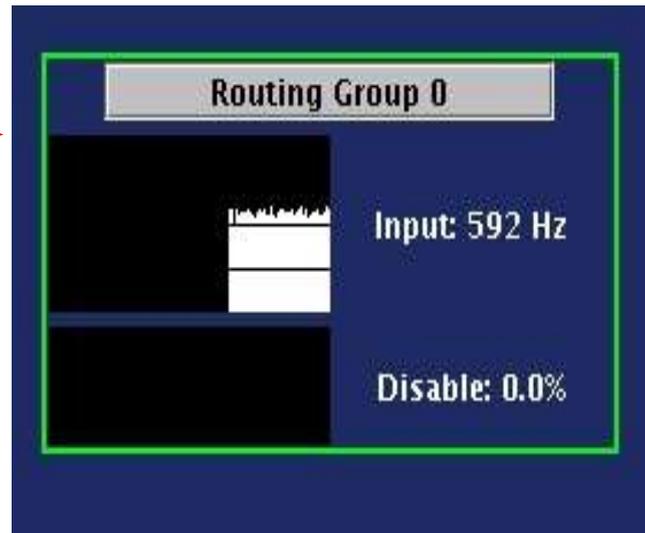
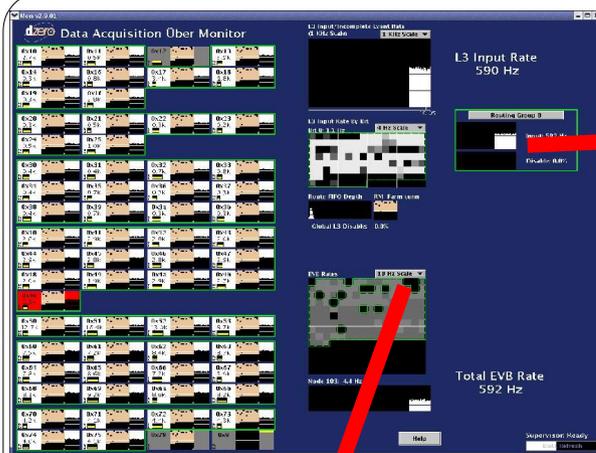
*Beige means RM is connected to that farm node*



## FIFO Depth:

*Histogram of the number of events in the TFW FIFO as polled by the Routing Master*

# Monitoring Tools: ümon – Other



Routing Groups:

- Input rate and disable Fraction for each group
- Clicking on a group will Highlight the associated crates



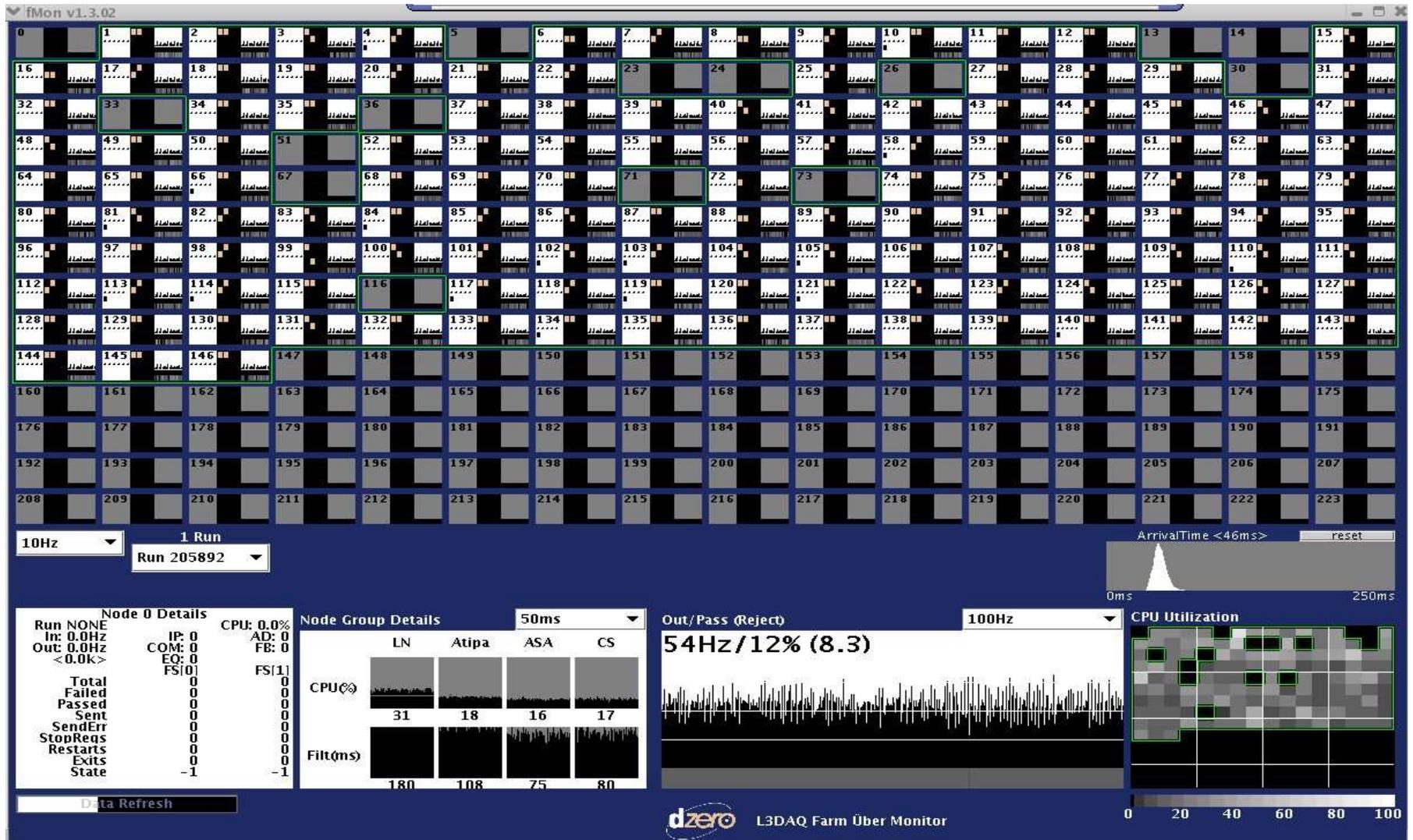
EventBuilder Rates:

- This is the EventBuilder input rate for each farm node. Scale is chosen by the pull-down menu
- The strip chart shows the total EVB rate over the last 20 minutes for a particular node
- Also shown is the total EVB rate.

# Monitoring Tools: fūmon

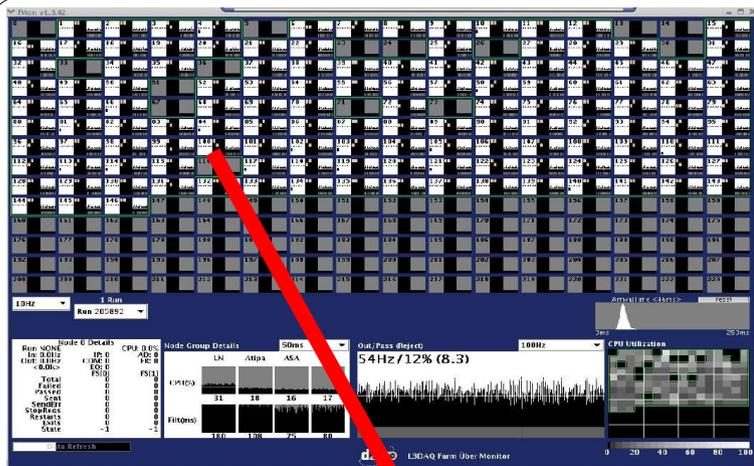
*Sits at top right black monitor at daq console*

- Outlined green nodes are “in the run”*



# Monitoring Tools: fūmon

## – Node Info



Two beige boxes represent the two Level3 filtershell states:

- 1<sup>st</sup> Waiting
- 2<sup>nd</sup> Filtering
- 3<sup>rd</sup> Flattening
- 4<sup>th</sup> Sending

Node  
Number

Number of  
advertised  
buffers

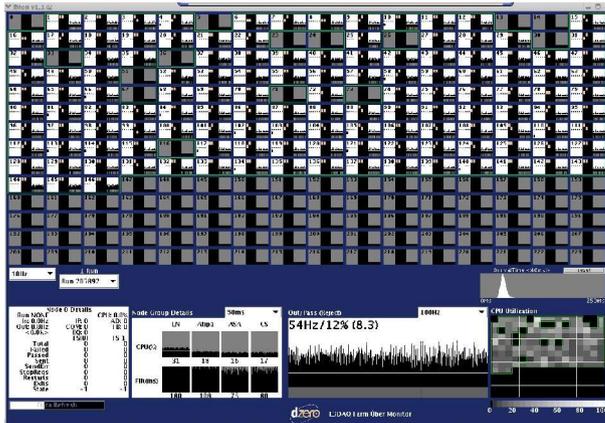
EVB buffer  
status



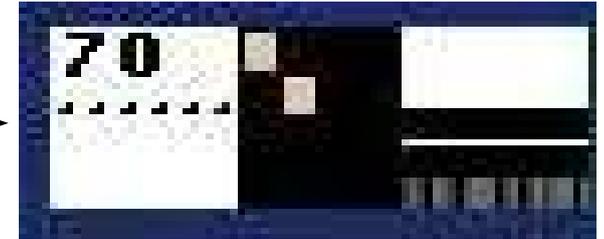
Event rate  
into  
filtershell

Filtershell  
pass  
fraction

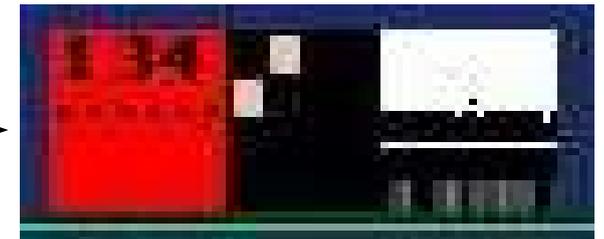
# Monitoring Tools: fūmon – Various States



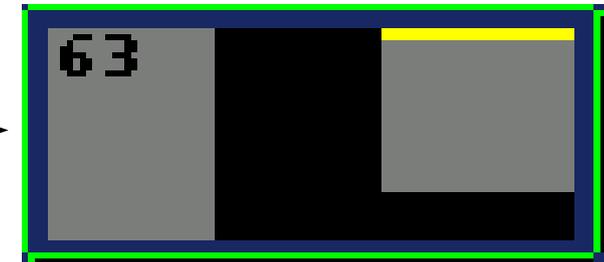
*Normal node  
in the run*



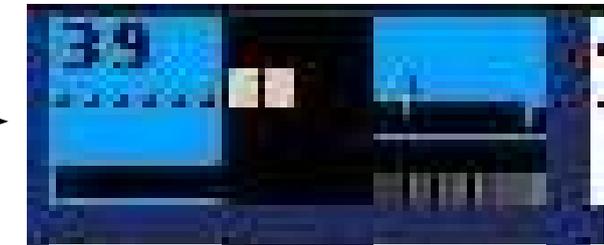
*Missed event  
from SBC: Drop*



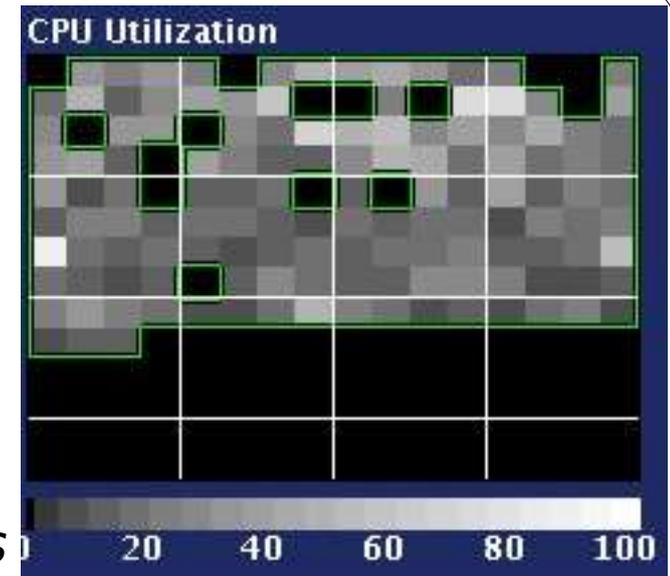
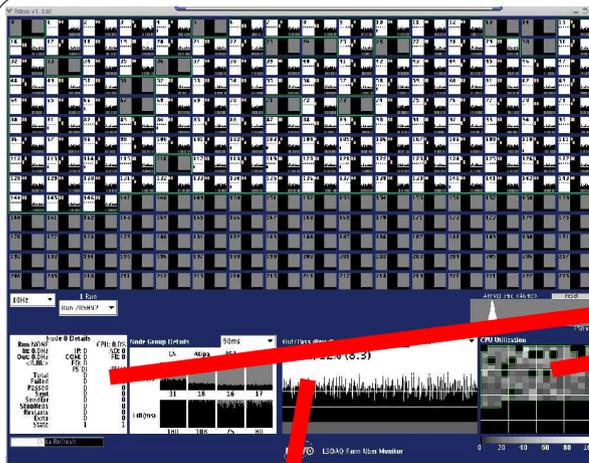
*Node is not in the run &  
there is no monitoring info*



*10 or more EVB buffers  
are filled up*

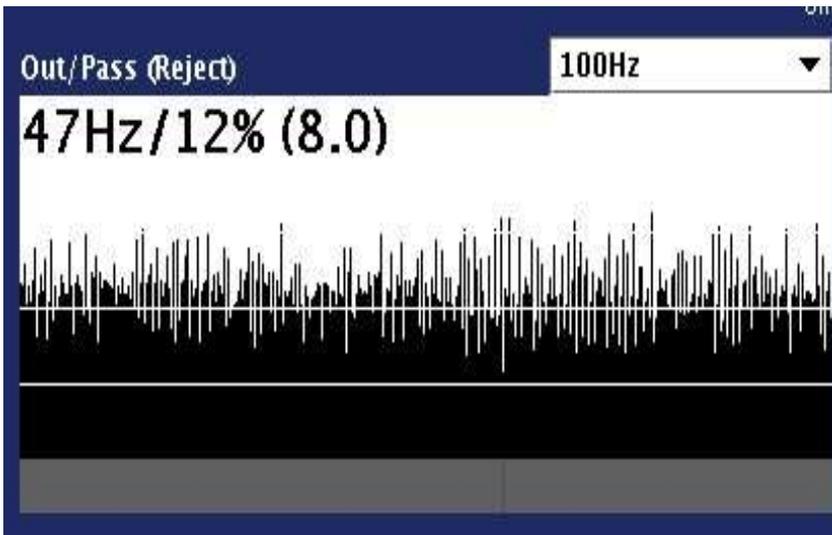


# Monitoring Tools: fūmon – Output/CPU



## CPU Utilization:

- This is the % use of the CPUs on the nodes

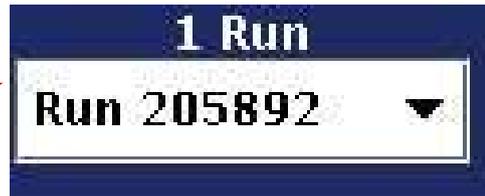
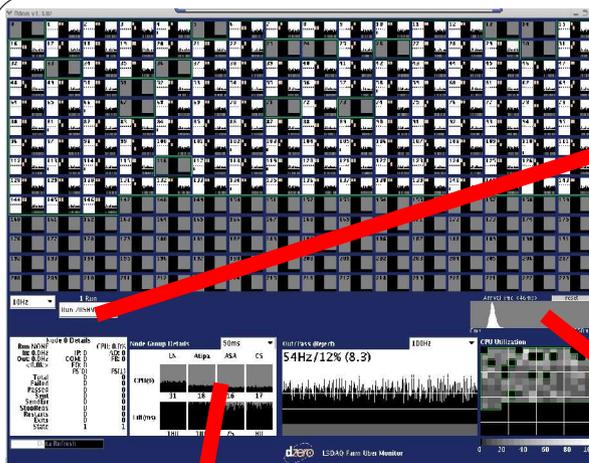


## Level3 output rate:

- The 47 Hz is the rate at which events are passing the l3 filter
- The 12% is the pass fraction
- The (8.0) means 1/8 events pass the level3 filter

# Monitoring Tools: fūmon

## – Run/Node Group Info

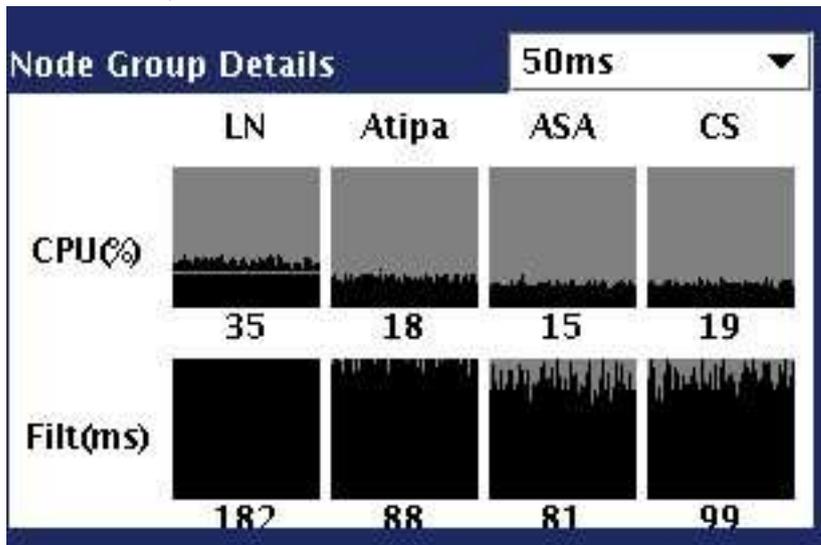


### RUN Info:

- How many runs
- Run number



Arrival Time Info:  
Last crate arrival time (ms)



### Node Group Info:

- The average CPU usage (%) for each node group
- The average Filtering time (ms) for each node group

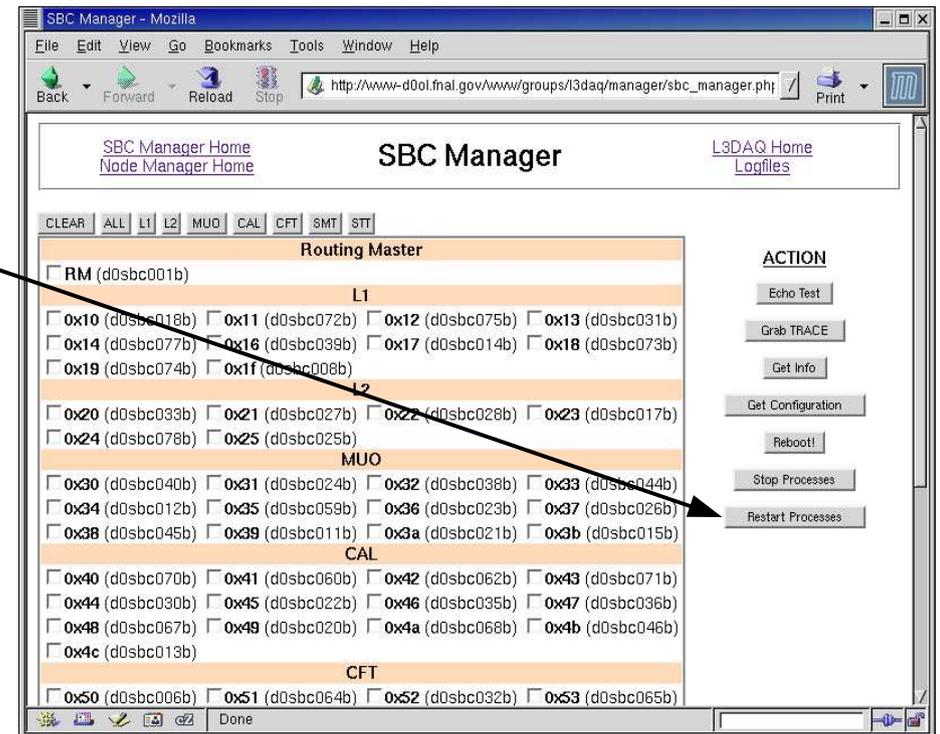
# daqAI

- Runs on predefined rules in the background
  - Checks for crates loosing sync, sbcs that crash, missing slic inputs, etc...
- The Stephen Hawking style voice you will hear from time to time.
- Takes care of most of the problems you'll encounter on shift.
  - SCLinits (x24 Lost sync)
- Check your efficiency.
- Only on during physics runs
  - > start\_daq daqai
  - > start\_daq daqai\_gui



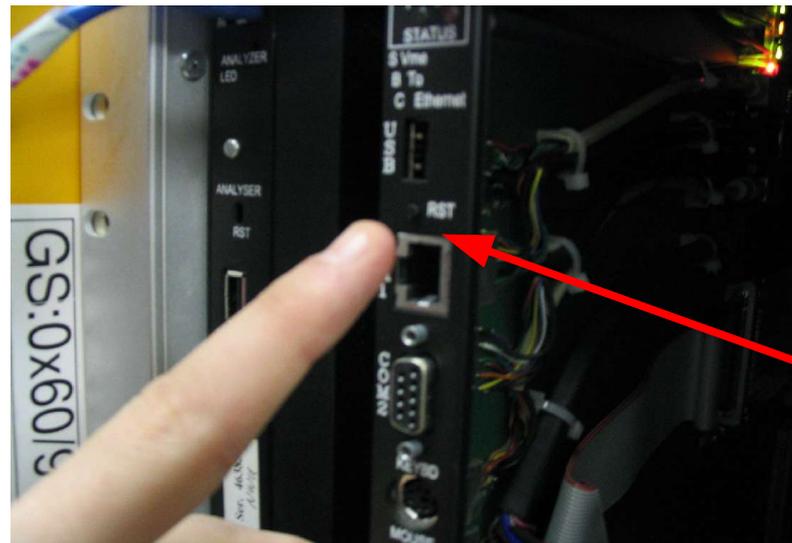
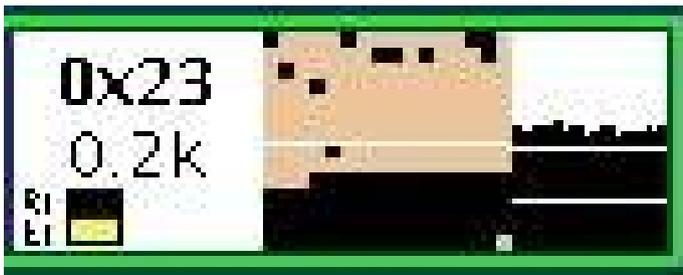
# Common Problems – SBC Reset

- An SBC crashes and need to be reset. How do you do that?
  - From the command line:
    - > l3xdaq\_reset xXX <- crate number (in Hex)
  - From the SBC manager webpage
    - Mark the sbc
    - Click “restart process”
    - Then click ok on the next page



# Common Problems – SBC Reboot

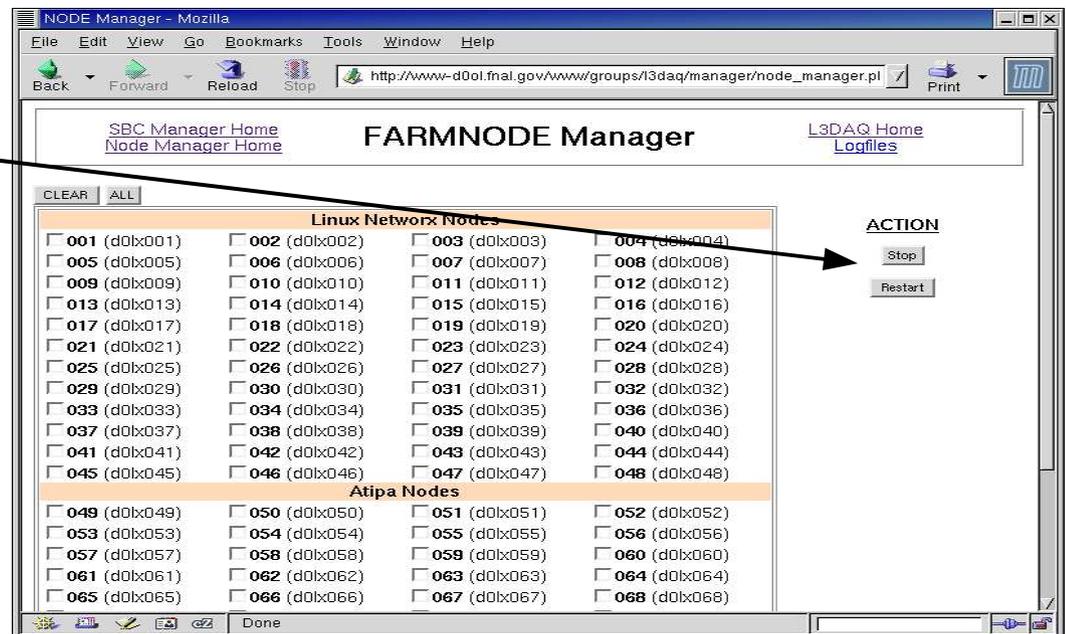
- You try to restart an SBC, but the webpage tells you the SBC is not pingable
  - This means the SBC has crashed and needs a reboot
  - Steps:
    - Find the rack with the SBC (You'll have to leave the CR)
    - Find the reset button and hold it for 5 seconds.
  - It'll take ~1 minute to come up. You can see when it does on üMon.
    - > ping d0sbc0xx



*Reset  
button*

# Common Problems – Node Reset/Stop

- Level3 expert can't get to a computer and needs you to reset/stop a farm node from running.
  - From the command line:
    - > setup d0online
    - > l3xreset/stop 094 <- node number
  - From the node manager webpage
    - Mark the node number
    - Click restart/stop
    - Then click ok on the next page

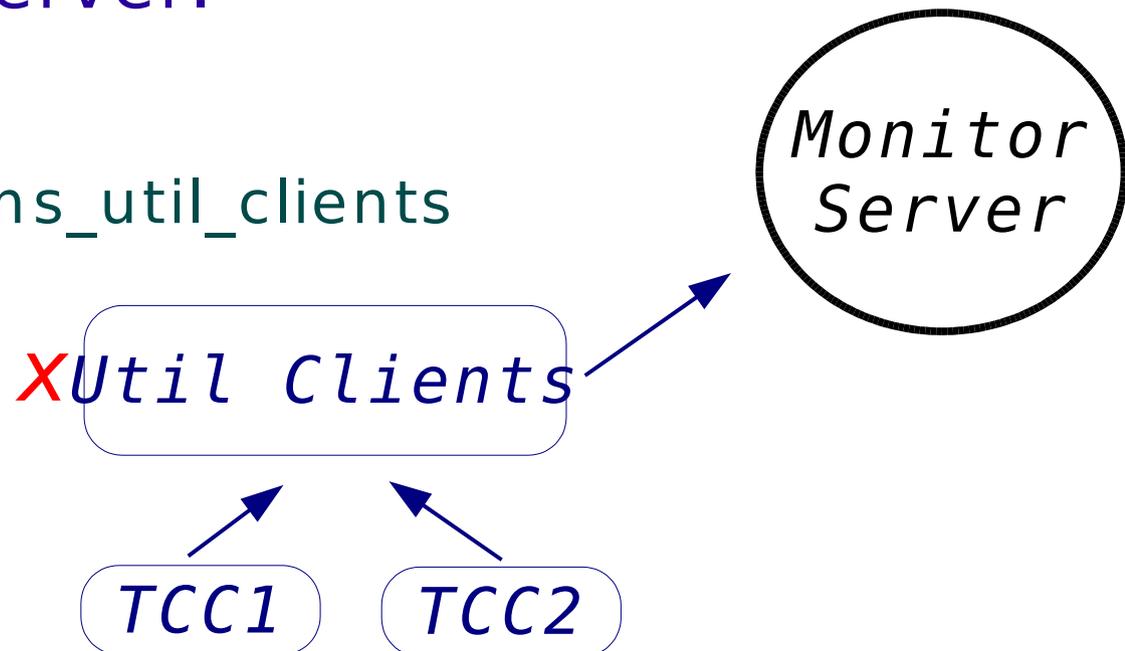


# Resetting Farm Nodes

- DON'T DO IT!!!
- If you feel there aren't enough farm nodes in the run, page a level3 expert.
- There is a list of nodes that should be down on a dry erase board next to the daq shifters console
- If a node drops out of the run, that's fine. It happens all the time unfortunately.
  - Stop the node if you see it falling out of the run
  - Send an email to [d0daq@fnal.gov](mailto:d0daq@fnal.gov)
  - We may try to revive it otherwise we'll add it to the list

# Common Problems – MS\_Util\_Clients

- Daq dialog goes yellow and the level2 data flow gui is gray
  - This happens all the time.
  - The culprit is the l3ms\_util\_clients which acts as an interface between the TCC clients and the monitor server.
  - Solution:
    - `start_daq l3ms_util_clients`

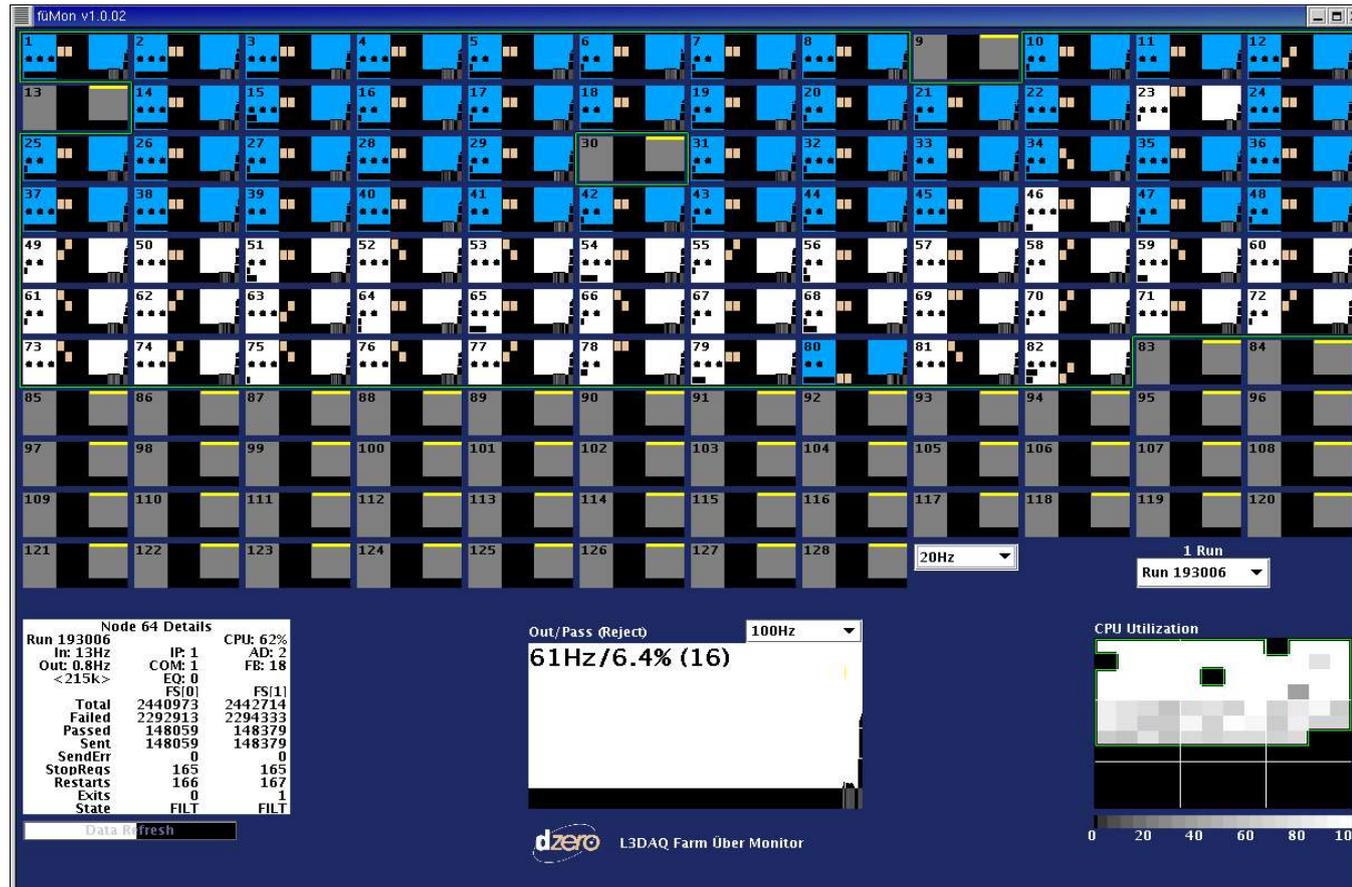


# Common Problems – Monitor Server

- üMon and füMon go gray and say something like No Monitoring Information. DaqAI will also not respond and say something about the monitoring
- Solution:
  - You will just need to restart the monitor server. There is no need stop the run. It's just the monitoring that's down. We are still taking data
  - > start\_daq l3ms

# Common Problems – FūMon States

- At high luminosities (beginning of the store), you may see a lot of the nodes will be blue
- This basically means the EVB complete buffers are full even though filtershell is running full steam



# Common Problems – FūMon States

- You may see a lot of the nodes turn red at some point
- This probably means a readout error so the EventBuilder dropped all the events that were using that SBC.



# Problems.txt!!!

- This is an extremely useful guide for all daq

---

Problem: Most or all of the linux farm nodes (from 1 to 48) in the fuMon are blue. The luminosity is high and the L1, L2, and L3 rates are normal.

Solution: Look in the small white box labeled Node Group Details at the bottom of the fuMon. If the CPU(%) below LN is close to 100 there is no problem, the old Linux Nodes are just not fast enough for the high luminosity. The number of blue nodes will slowly decrease with time. If LN CPU(%) is not near 100, there is another problem and you should let an expert know! (There is a similar problem where all the nodes are blue and the solution is to restart the datalogger, do not restart the datalogger if you do not have to.)

Entry: August 08, 2004 Joe Haley

---

Problem: Coor lost connection with logbook. start\_daq auto-elog didn't work.

Solution: l3fserver was taking all the resourses of d0o103 then the logbook database couldn't run. l3fserver was killed then everything started to work.

Entry: 6/30/04 Jovan, Mario

Note: kill l3fmonitor in addition to stop\_daq l3fserver. (Ammon 10/13/04)

---

Problem: Daq AI is not speaking up and showing "No data from Monitor Server!?" in the shift (and other) tabs. All other gui's (umon, fumon) appear to be working fine.

Solution: setup d0online  
start\_daq daqai

Entry: 18 April 2004 - Ike Hall

# L3DAQ Webpage

- [www-d0online.fnal.gov/www/groups/l3daq](http://www-d0online.fnal.gov/www/groups/l3daq)
- Linked off the daq shifters homepage

## L3DAQ Homepage

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**Shifter Page:** All shifters should go here.

**Public Talks:** Public talks and publications

**Documentation:** Talks, UniverseII, SBC software

**Monitoring:** The latest and greatest monitoring tools.

**Expert Tools:** SBC inventory DB access

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Doug Chapin

Last modified: Tue Dec 2 16:08:46 CST 2003

# L3DAQ Shifter Webpage

- [www-d0online.fnal.gov/www/groups/l3daq/shifter](http://www-d0online.fnal.gov/www/groups/l3daq/shifter)
- Linked off the L3daq homepage

## L3DAQ Shifter Page

[home](#)

- 
- What to do when:** List of known problems and solutions. Start here.
- Tutorials/Talks** Links to L3DAQ tutorials for daqshifters.
- üMon Documentation:** An attempt at describing the features of üMon, the L3DAQ Über Monitor.
- füMon Documentation:** An attempt at describing the features of füMon, the Farm Über Monitor.
- SBC Manager** Run commands on SBCs--restart, getInfo, etc. Requires online access.
- Node Manager** Stop and Restart farm node processes. Requires online access.
- Logfiles** SBC, Supervisor, Monitor Server, and daqAI logfiles
- L3DAQ On-call List:** The expert call list.

---

*[Doug Chapin](#)*

Last modified: Sun Mar 28 21:07:03 CST 2004

# Contact List

- Linked off the L3DAQ webpage and daq shifter homepage

## L3 DAQ On-Call List

[<- prev](#)

11 APRIL through 5 JUNE

	Primary	Secondary
11 APRIL - 24 APRIL	Aran	Gordon
25 APRIL - 8 MAY	Yunhe	Gordon
9 MAY - 22 MAY	Yunhe	Thomas
23 MAY - 5 JUNE	Thomas	Aran

- You'll find phone numbers at the bottom
  - If during the day, try building paging
  - If after hours just call the cell phone number listed
- People: Thomas Gadfort (UW), Aran Garcia-Bellido (UW), Gordon Watts (UW), Yunhe Xie (Brown), Doug Chapin (Brown).