

# NOvA DAQ Software

Steve Magill  
Jon Paley

NOvA DAQ Control and Monitoring (Jon)

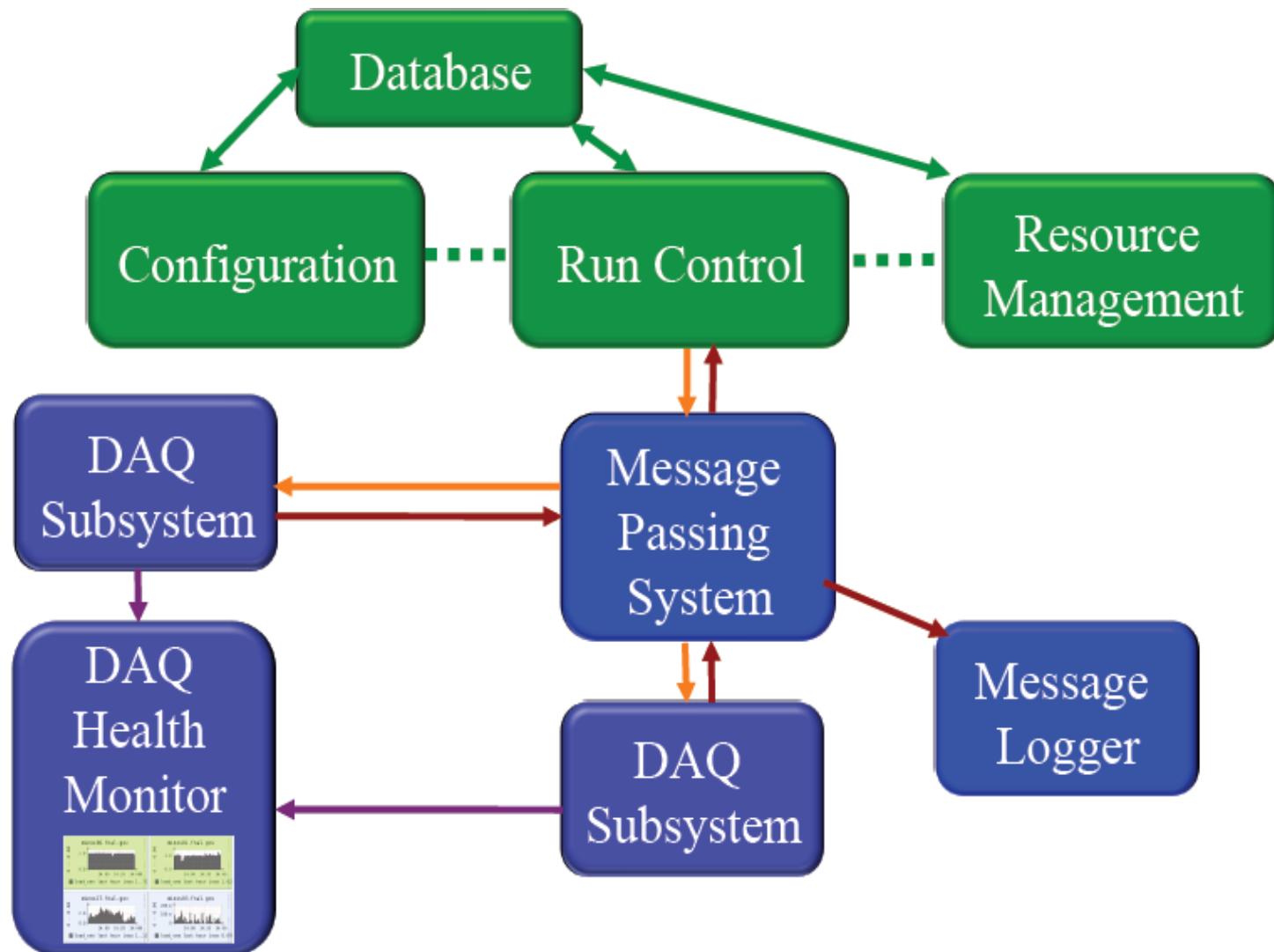
- > Run Control
- > Online Database
- > Resource Management

NOvA DAQ Software Subsystems (Steve)

- > Data Logger

Summary and Plans for Ash River

# NOvA DAQ Control and Monitoring Systems



# Resource Manager

The image displays two windows from the Resource Viewer application. The left window, titled 'ResourceViewer <@novadaq-ctrl-master.fnal.gov>', shows the 'DCM Status Table'. It contains two tables of status information for DCMs across various partitions. The top table covers partitions dcm-3-01-01 through dcm-3-04-01, and the bottom table covers partitions bnevb005 through bnevb012. Both tables have columns for 'Partition Established', 'Connections Loaded', 'Connections Made', 'Hardware Config Loaded', 'Hardware Configured', 'Run Config Loaded', 'Run Configured', and 'Run State', each represented by a green checkmark icon. The right window, also titled 'Resource Manager <@novadaq-ctrl-master.fnal.gov>', shows a hierarchical tree view under the 'Resources' tab. The tree includes categories for Managers, DCMs, and BNEVBs.

**Resource Manager**

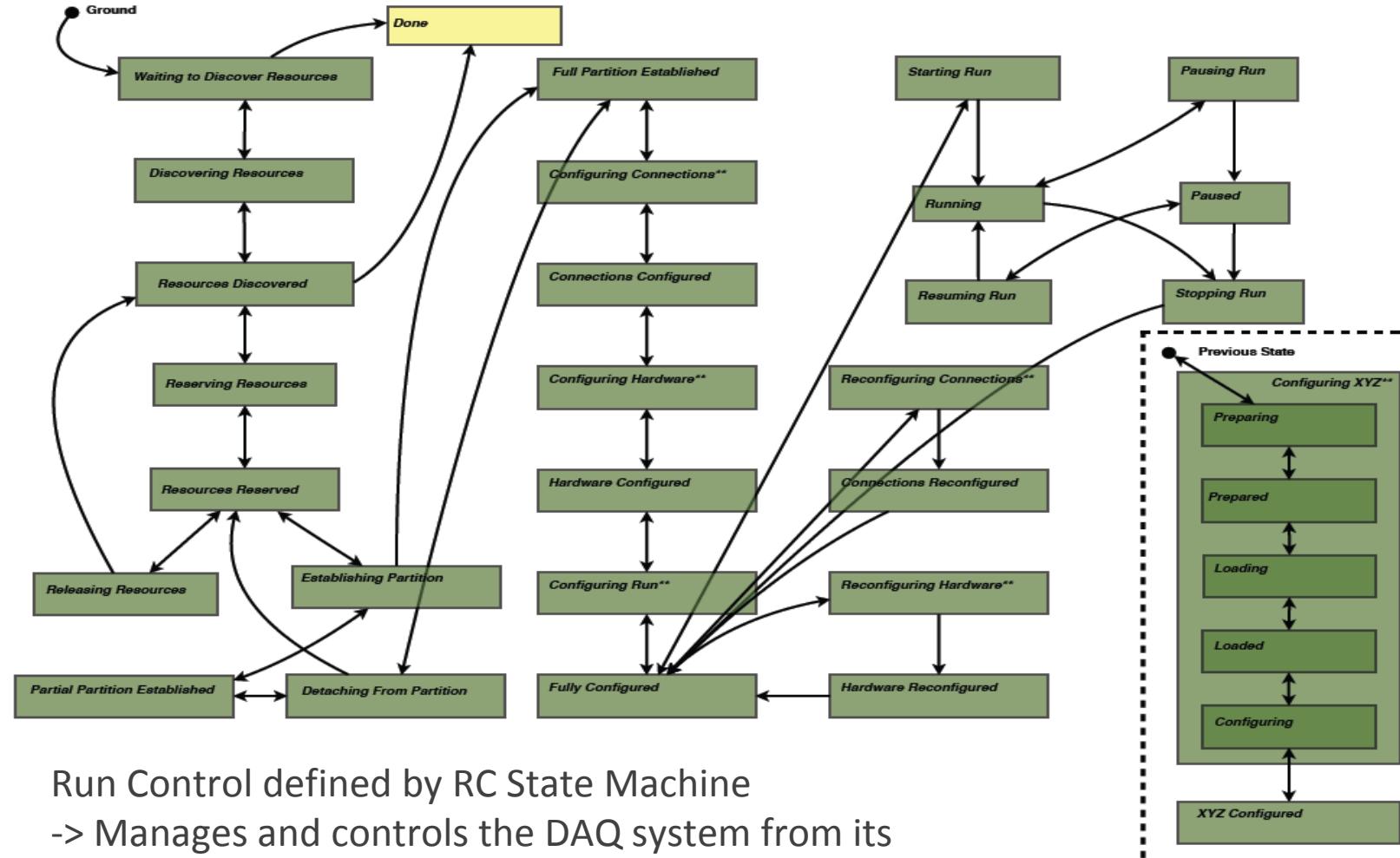
- > defines resources needed for data-taking
- > interactive window for shift crew
- > displayed on Resource Viewer showing status of selected resources for the run

**Online Database**

- > contains run history including configuration state of the run, resources used in data-taking and Detector Control System (DCS) information



# Run Control State Machine



Run Control defined by RC State Machine  
-> Manages and controls the DAQ system from its ground state through various configured states to the fully-configured data-taking mode

# Run Control GUI

The screenshot displays two windows side-by-side. On the left is the **RCMainWindow** window, which has a menu bar with File, Configuration, Resources, View, Help. Below the menu is a toolbar with buttons for Discover Resources, Select Resources, Reserve Resources, Release Resources, Establish Partition, Detach from Partition, Break Connections, Prepare Connections, Load Connections, Make Connections, Prepare Hardware Config., Load Hardware Config., Configure Hardware, Prepare Run Config., Load Run Config., and Configure Run. A large green "Begin Run" button is at the bottom. Below the toolbar is a text input field labeled "Execute command:" followed by a scrollable log window showing run status messages. On the right is the **MessageFacility MsgViewer** window, which shows a message count of 3203 and a partition of 0. It features a message filter section with Set Filters and Reset ALL buttons, and categories for DLRCC, NdmcMetric, Progress, and RunControl. The main pane displays a list of log messages categorized by severity: Error, Warning, Info, and Debug. The log messages include:

- INFO / RunControl: 23-May-2011 11:02:24 CDT novadaq-ctrl-triggerfnal.gov (131.225.198.135) NovaGlobalTrigger (24770) NovaGlobalTrigger / GTSpillTrig / MF-online Spill time is in the future
- WARNING / Time Shear: 23-May-2011 11:08:46 CDT novadaq-ctrl-triggerfnal.gov (131.225.198.135) NovaGlobalTrigger (24770) NovaGlobaltrigger / GTSpillTrig / MF-online Spill time is in the future
- INFO / RunControl: 23-May-2011 11:13:01 CDT novadaq-ctrl-dataldisk-01.fnal.gov (131.225.198.132) NovaDataLoggerapp (11251) DataLogger / DataLogger / MF-online BeginNewSubrunRequest received
- INFO / RunControl: 23-May-2011 11:13:01 CDT novadaq-ctrl-master.fnal.gov (131.225.198.138) rcWindow (9586) rcWindow / rcWindow / MF-online Success
- INFO / RunControl: 23-May-2011 11:13:02 CDT novadaq-ctrl-master.fnal.gov (131.225.198.138) rcWindow (9586) rcWindow / rcWindow / MF-online Started subrun 1

## Run Control

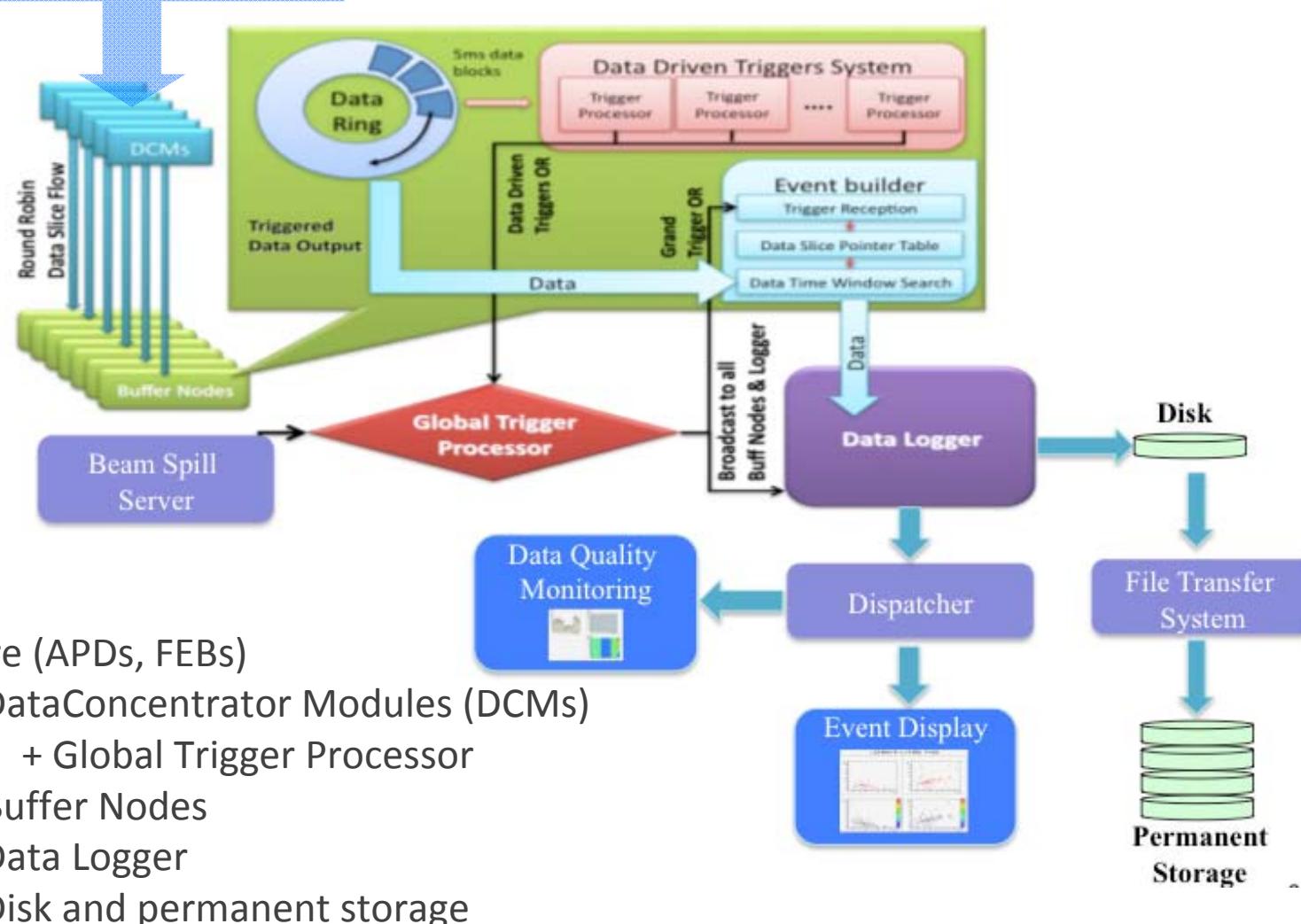
-> RC Server – software for RC

-> RC GUI – interface to RC Server, shift crew interaction with experiment



# NOvA DAQ Software Subsystems

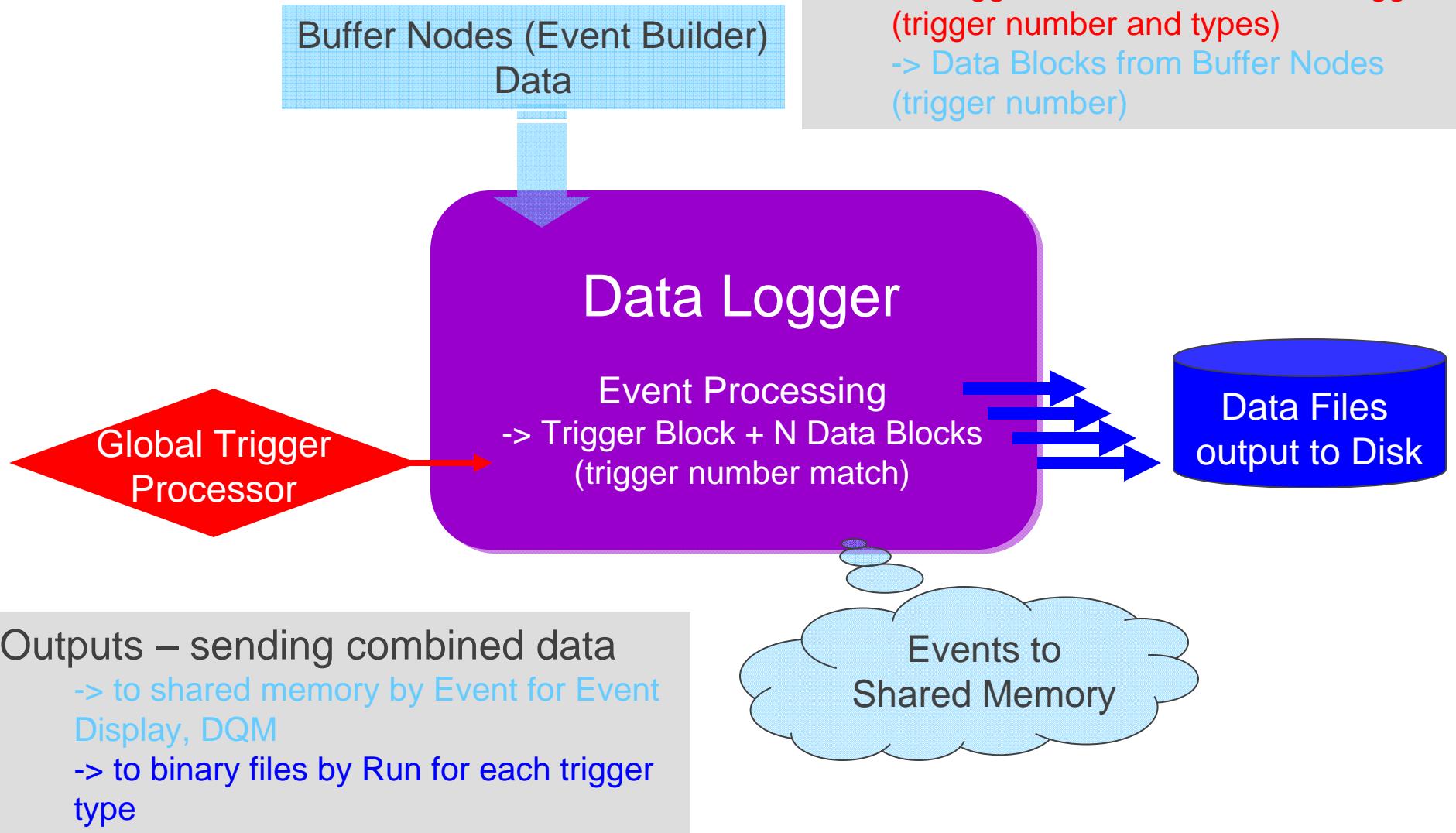
## Hardware Components



## Hardware (APDs, FEBs)

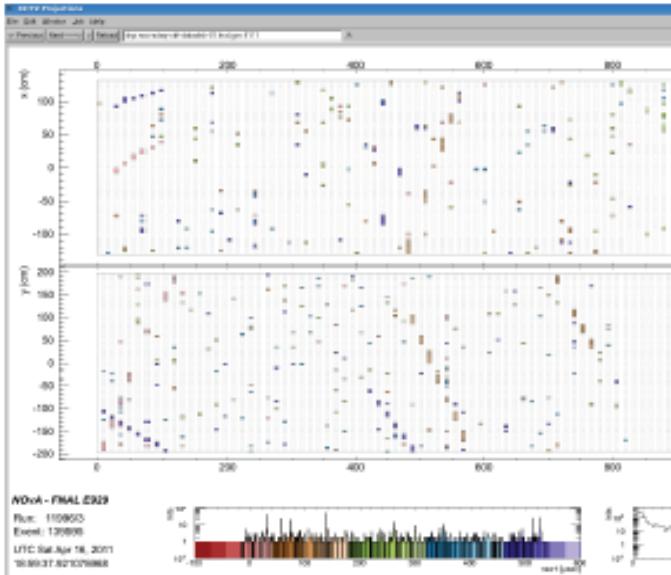
- > DataConcentrator Modules (DCMs)  
+ Global Trigger Processor
- > Buffer Nodes
- > Data Logger
- > Disk and permanent storage

# NOvA Data Logger



# NOvA Data Logger - Shared Memory

## Online Event Display



Event Dispatcher reads events from the shared memory segment -> displays in online Event Display and in Event Viewer

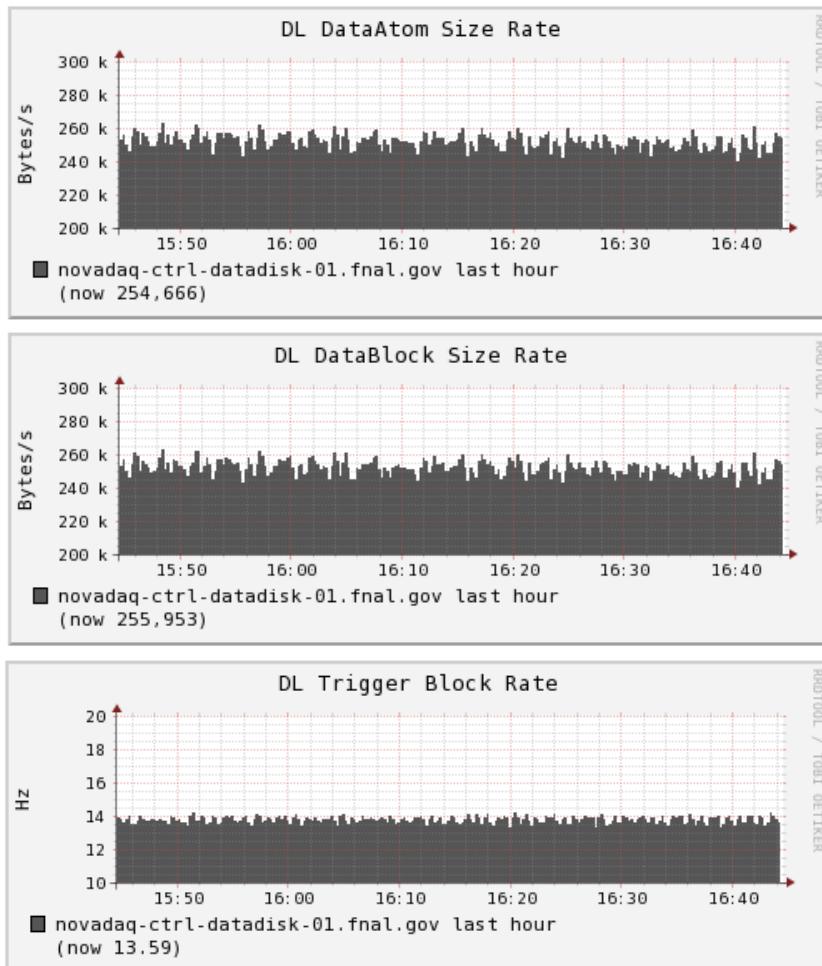
NOvA Data Logger writes events into a shared memory segment

## Online Event Viewer



# NOvA Data Logger - Monitoring and Testing

## Ganglia Histograms of Input and Output to NDL



Integtests with Trigger/Data Simulation :

-> Tests integrated DAQ system including DataLogger

-> Can simulate and test many situations, e.g. loss of an input BN to NDL, increased trigger rates and widths

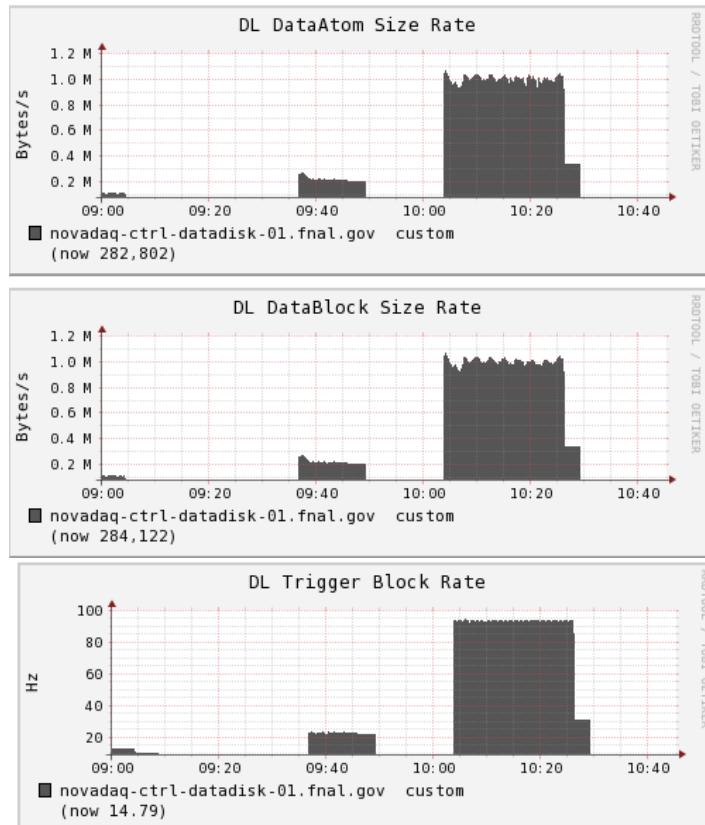
-> Validation of NDL performance



# DAQ Stress Tests

Recent tests have been performed to force data-taking at higher trigger rates and larger trigger widths

- > understand/fix choke points in the DAQ Software chain
- > map 2-D space of successful DAQ performance in rate vs width



Using Data Logger monitoring histograms :

- > increased trigger rate from ~10 Hz to ~95 Hz
- > see corresponding increase in both input and output data rate (Bytes/sec)
- > Successful tests in this range of trigger rates



# Summary

ANL HEP joined NOvA DAQ Software group in February 2010, filling 2 large holes :

- > Run Control of DAQ components
- > Logging of NOvA data

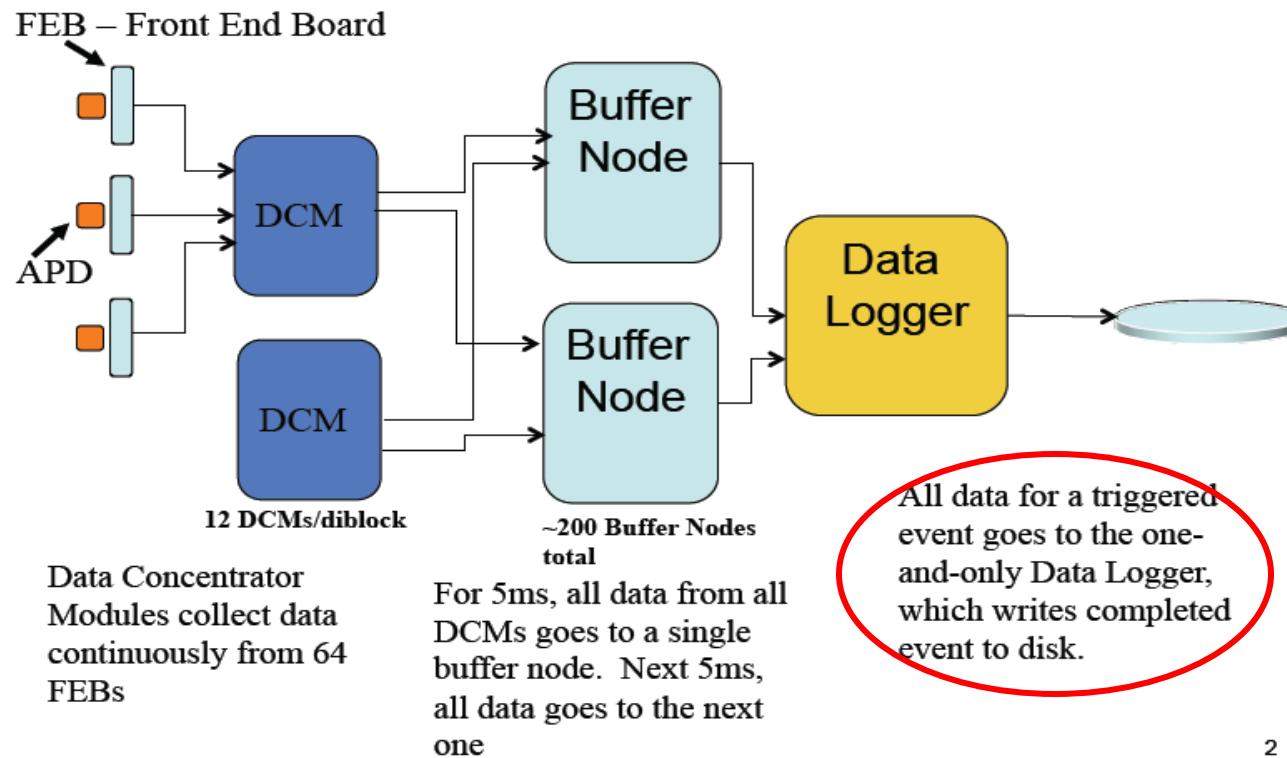
NOvA DAQ performs stably and reliably

- > Began data-taking with NDOS in November 2010
- > runs routinely last for > 8 hours without user intervention
- > RC GUI complete and easy to use by shift crews
- > *~NO events lost* due to software “features” since startup
- > Simulated development (Integtests) -> successful real DAQ operation



# Future Plans for Run Control, Data Logger

- > Test implementation of partitioning for data-taking while commissioning
- > separate RC GUI (at Fermilab) from RC Server (at Ash River)
- > add more run history information to database
- > Test Data Logger's ability to handle more data (continued stress tests)



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