

Level 2 Trigger Overview

(for DAQ ...)



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L2 trigger group

(based on Reinhard's presentation from August 4)

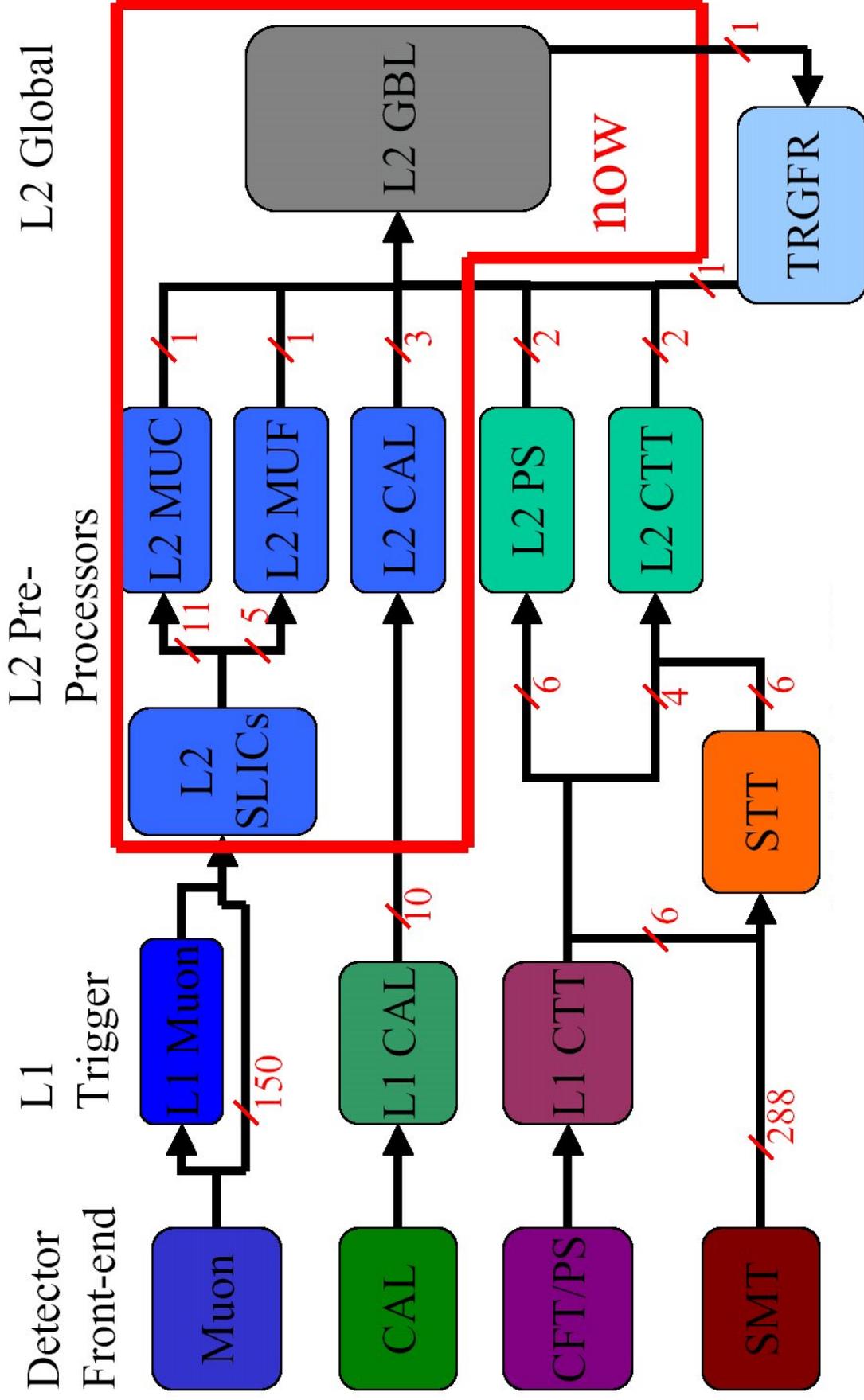
University of Oklahoma

DZero operations - December 1, 2003

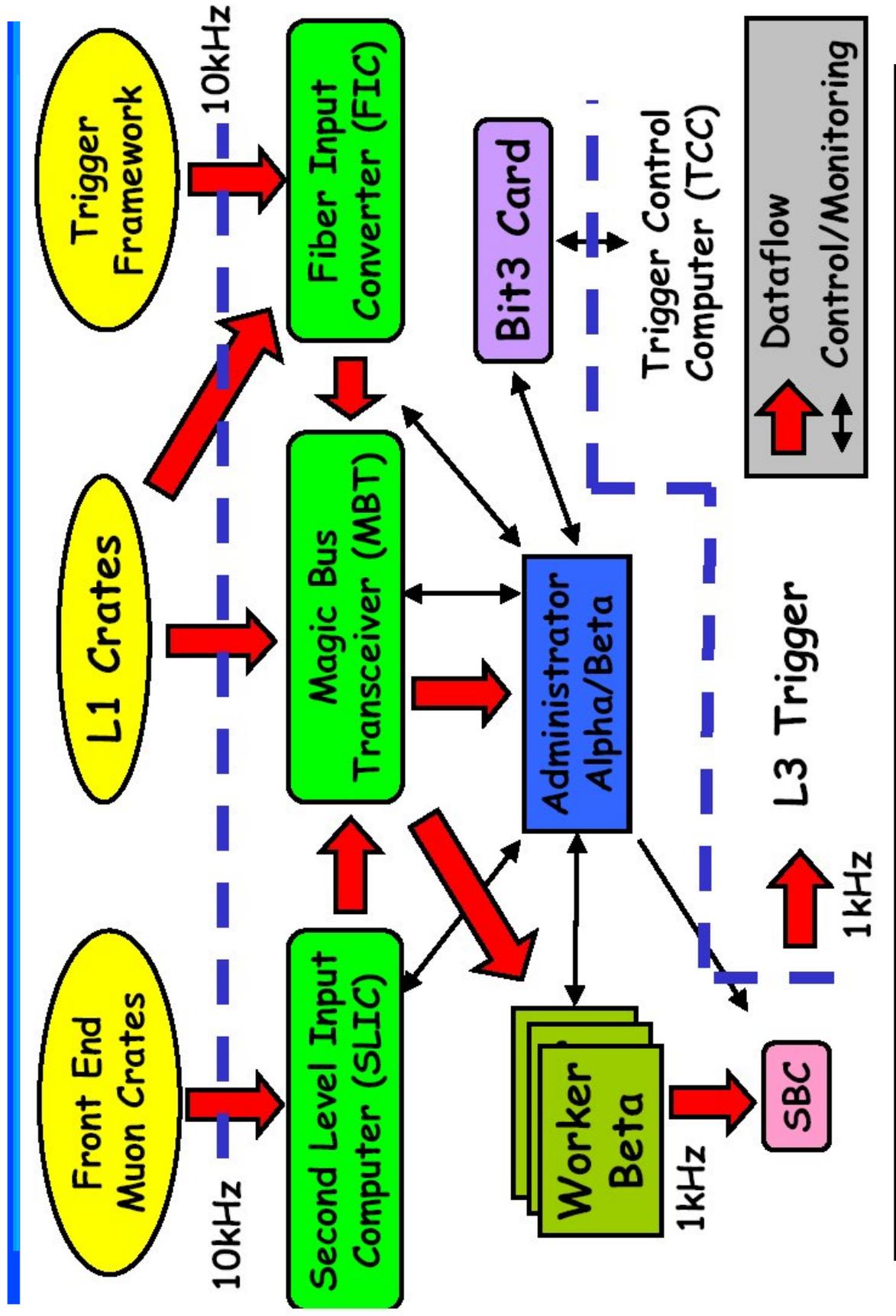
Outline

- L2 Trigger Data Flow
- L2 Controls
 - ◆ L2 Trigger Control Computer
- L2 Monitoring
 - ◆ L2 Data Flow GUI
- L2 Operations
 - ◆ Common Problems and Solutions
 - ◆ DAQ shifter vs. L2 expert
 - ◆ Resources (where to find info about L2)

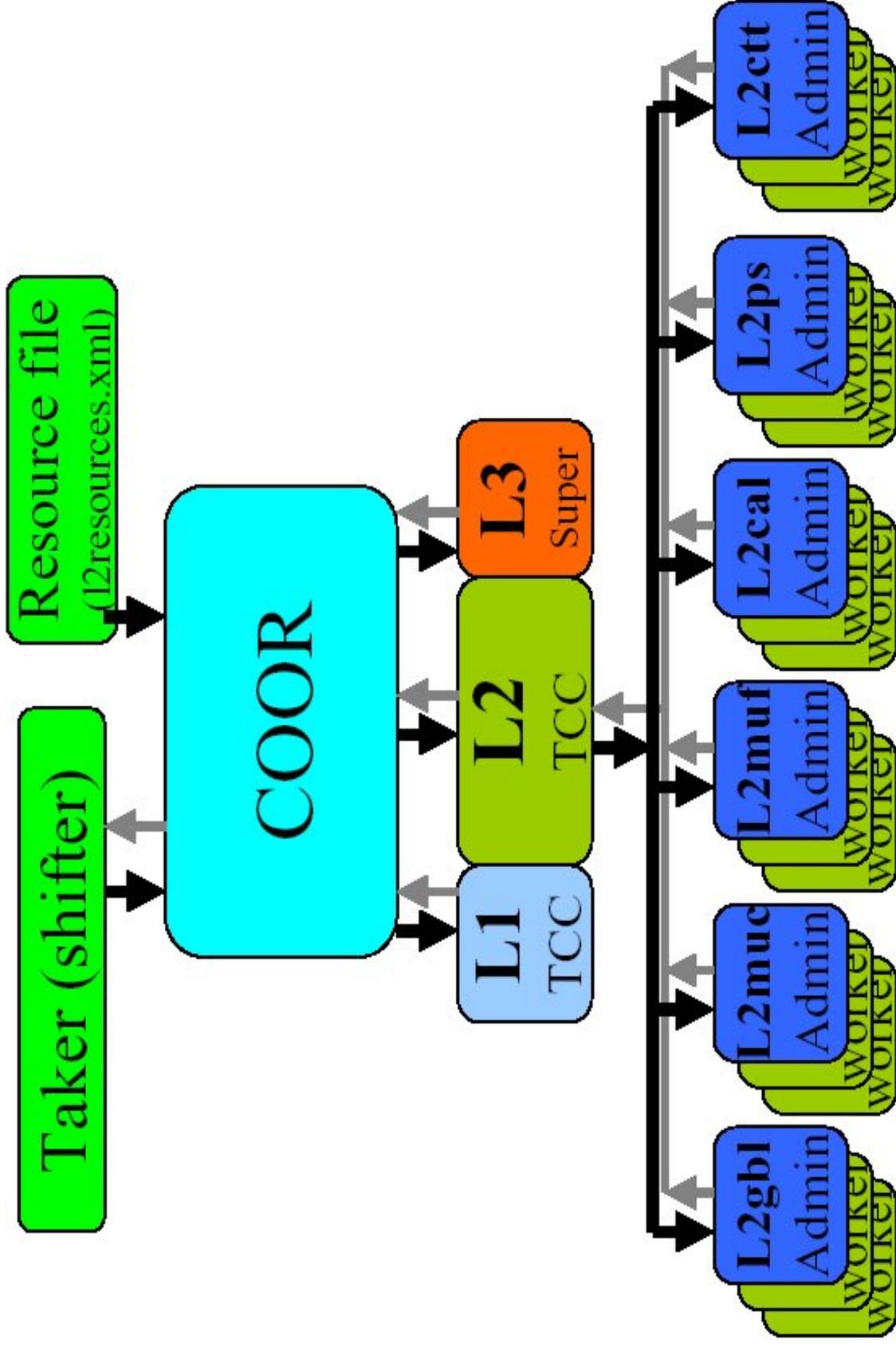
L2 Trigger Data Flow - trigger framework



L2 Trigger Data Flow - Single L2 Crate



L2 Trigger Data Flow - configuration



L2 Controls - L2TCC

- L2 Tripper Control Computer (or L2TCC)
 - runs L2 Relay Software (or L2RS)
- interface to COOR and monitor servers
- configures and controls all L2 crates
 - ◆ static configuration files loaded when COOR is initialized
 - ◆ Forwards and coordinates COOR messages to all L2 crates when run being started or stopped

L2 Controls - L2RS

- Equivalent to Trics in L1TCC
- Allows access for L2 experts to all L2 crates
 - ◆ send messages to L2 administrator (configure, exit/enter event loop, etc. ...)
- Provides a log window with recent activity
 - ◆ monitoring information: I\$ ("`<done>`")
 - ◆ message from COOR: M\$
 - ◆ error message: E\$ (e.g. "failure communication with admin")

Useful when debugging L2 problems!

You CAN look at it but you CANNOT touch it!

L2 Controls - L2RS

The screenshot displays the L2RS V3.1 software interface. The top panel, titled 'Crate Interface', contains several control elements: a 'Send LIFW Message to Self' button, a 'D0' display, 'L2 Fake COOR Messages' input, and 'Start Run' / 'Stop Run' buttons. Below these are radio buttons for 'Initialize' and 'L2 Mu Fwd'. A green arrow points from the 'Crate Interface' label to the 'Start Run' button. The middle panel, titled 'Log Messages', shows a list of system messages such as 'Monitor Data Length' and 'Err Msg Data Length'. A green arrow points from the 'Log Messages' label to the bottom of this panel. The bottom panel contains a 'Send Message Command File' section with a 'Send' button and a 'Syntax Rule' dropdown. The Windows taskbar at the bottom shows the Start button, system tray icons, and the time '12:59 AM'.

Crate Interface

Log Messages

L2 Controls - L2RS

```

I$ INPUT_DIRIO = 4, # ID 0x167
I$ Process Msg Command : <L2 Script for L2MuFwd Crate>
I$ <Done>
M$ Receive Msg # 2062 : 0000000000000107673 L2script L2CAL ADMIN IPMANAGER <
M$ ALPHACH0 = 0,
M$ ALPHACH1 = 1,
M$ ALPHACH2 = 1,
M$ ALPHACH3 = 1,
M$ ALPHACH4 = 1,
M$ ALPHACH5 = 1,
M$ ALPHACH6 = 1,
M$ ALPHACH7 = 1,
M$ ALPHACH8 = 0,
M$ ALPHACH9 = 0,
M$ ALPHACH10 = 0,
M$ ALPHACH11 = 0,
M$ ALPHACH12 = 0,
M$ ALPHACH13 = 0,
M$ L2CAL ADMIN PILOTMBT <
M$ UMESLOT = 20, # UME slot number of the card
M$ CHAN0 = -1, # none
M$ CHAN1 = 2, # L1CAL 1
M$ CHAN2 = 3, # L1CAL 2
M$ CHAN3 = 4, # L1CAL 3
M$ CHAN4 = 5, # L1CAL 4
M$ CHAN5 = 6, # L1CAL 5
M$ CHAN6 = 7, # L1CAL 6
M$ CHAN7 = 8, # L1CAL 7
M$ CHAN8 = 9, # L1CAL 8
M$ CHAN9 = 0, # L1CAL 9
M$ CHAN10 = 0, # none
M$ CHAN11 = 0, # none
M$ CHAN12 = 0, # none
M$ CHAN13 = 0, # none
M$ DISP_CHAN = 7, # Channel to display on the MBT front panel
M$ TEST_SCL = 0, # Disable testing mode
M$ CYCLE_BUFFERS = 4, # Cycle the buffers
I$ Process Msg Command : <L2 Script for L2Cal Crate>
I$ <Done>
M$ Receive Msg # 2063 : 00000000000107675 start run 173228 4
I$ Process Command : <Start Run #173228 for Exp Trig(s) # 4>

```

COOR
Download

Good
Start Run

```

I$ Admin has noticed the new commands for L2MuFwd Crate: ICC Waiting
I$ Admin Replied Ok for L2MuFwd Crate
I$ <Done>
M$ Process Msg Command : <Start Run for L2Cal Crate>
M$ Err Msg Data Length = 0x00000016d for L2MuFwd
M$ Monitor Data Length = 0x00000103d for L2MuFwd
M$ Sending ICC->L2Cal Admin Command <EXIT_EUENILLOOP>
M$ Waking Up L2Cal Admin
M$ Waiting for L2Cal Admin Reply
M$ Admin Replied Ok for L2Cal Admin
M$ ReLoading COOR Commands to L2Cal Buffer - 1 Commands, 1781 Bytes
M$ Waking Up L2Cal Admin
M$ Waiting for L2Cal Admin Reply
M$ Admin has noticed the new commands for L2Cal Crate: ICC Waiting
M$ Admin Replied Ok for L2Cal Crate
M$ Clearing L2Cal Crate Command Buffer
M$ Sending ICC->L2Cal Admin Command <ENTER_EUENILLOOP>
M$ Waking Up L2Cal Admin
M$ Waiting for L2Cal Admin Reply
M$ Err Msg Data Length = 0x000000095 for L2Cal
M$ Monitor Data Length = 0x000000dd5 for L2Cal
M$ Admin has noticed the new commands for L2Cal Crate: ICC Waiting
M$ Admin Replied Ok for L2Cal Crate
M$ <Done>
M$ Err Msg Data Length = 0x000000095 for L2Global
M$ Err Msg Data Length = 0x000000221 for L2MuGen

```

Error: Beta is
not responding
to L2TCC

COOR
Download

Good
Start Run

L2 Monitoring - L2 data flow GUI

The screenshot displays a complex monitoring interface for L2 data flow. It features several key components:

- Legend:** A color-coded legend at the top left identifies event types: wait_event (green), processing (orange), l2_answer (yellow), l3_readout (brown), collect_status (light blue), reply_worker (purple), and interrupt (red).
- Admin timing state:** A green box at the top center with an arrow pointing to a pie chart in the L2MUC section.
- SLIC input buffer:** A green box at the bottom left with an arrow pointing to a table of SLIC inputs.
- Crate nput buffer (MBT):** A green box at the bottom center with an arrow pointing to a table of MBT inputs.
- L1/L2 accept rates:** A green box at the top right with an arrow pointing to a pie chart in the Framework section.
- L1/L2 busy for L2 preprocessor:** A green box at the bottom right with an arrow pointing to a table of busy times.
- Tables:** Multiple tables are organized into sections:
 - L2MUC:** Lists SLIC inputs (e.g., SLIC 34, 35, 36) with values like 0/16 and L1Bsy=0.0%.
 - L2CAL:** Lists CAL inputs (e.g., CAL 1 eta, 2 eta) with values like 0/16 and L1Bsy=0.0%.
 - L2PS:** Lists CPS and FPS inputs (e.g., CPS axial 1, FPS north 1) with values like 1/16 and L1Bsy=0.0%.
 - L2CCTV/SIT:** Lists SIT inputs (e.g., SIT00, SIT01) with values like 0/16 and L1Bsy=0.0%.
 - L2GBL:** Lists global inputs (e.g., SCL, L1 HWFW) with values like 3/16 and L1Bsy=0.0%.
 - Framework:** Shows L1/L2 accept rates (L1Accept = 1036.64Hz, L2Accept = 452.95Hz) and L1/L2 busy times (L1 Await L2 = 0/16).
- Control Panels:** On the right side, there are buttons for 'Toggle Text', 'Strip Chart', 'Error Log', and 'Error Log ON'.

L2 Monitoring - L2 data flow GUI

- Information flow: from left to right
 - ◆ SLIC outputs - input for L2 muon crates
 - ◆ L2 crates outputs - input for L2 global crate
- small triangles = SLICs (one per SLIC)
- big triangles = L2 pre-processors (crate Admin)
- pie charts = timing information
 - ◆ await event, processing, L2 answer, L3 readout, collect status, worker replay, interrupt
- update - every 5 sec - L3 monitor server from DAQMON scraper

L2 Monitoring - L2 data flow GUI

GREEN color = idle/empty

- empty input buffer
- SLIC/Beta in idle state
- TFW is not waiting for L2 global

RED color = error

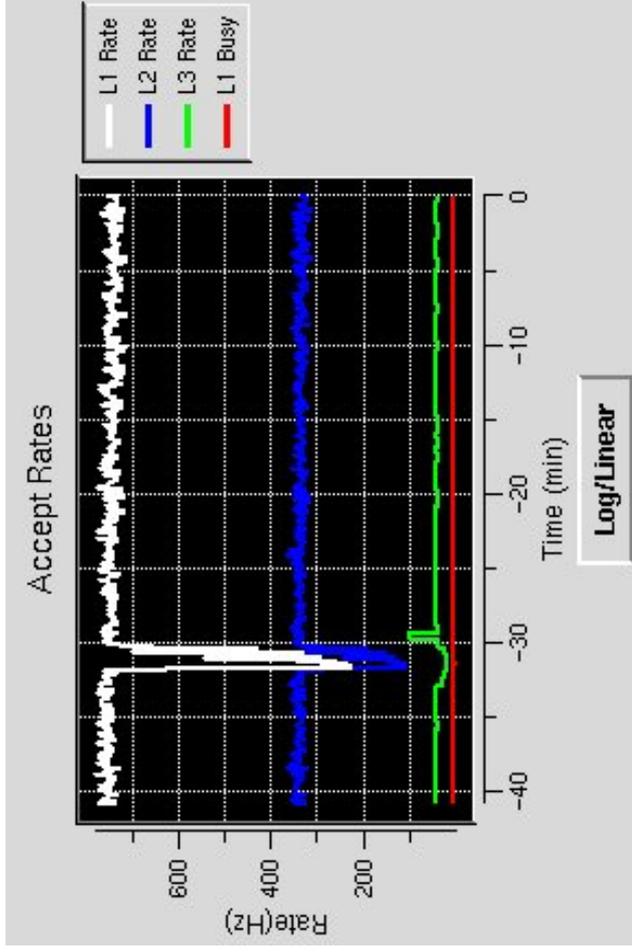
- Admin error (red box)
- input error

ORANGE/YELLOW color = working

- processing event (orange)
- input buffers filled (yellow)

GRAY color = inputs are disabled (for crates/SLICs)

L2 Monitoring - L2 data flow GUI



- **Stripmon** - up to 70 min of L1/L2/L3 and busy rates
- Also available as stand alone plot (usually part of **l2df**)
 - global L1/L2/L3 rates
 - specific triggers rates/busies
 - geo sector rates/busies

• **L2 message box**

- info about missing inputs
- time to last missing input

```
Copy Save Find Clear Save and Clear Quit message recieved 23 n
Sat Nov 29 12:30:55 2003 Missing Input: SLIC 39, Bc oet 2 SLIC Index 5, channel Index13,
ID x242, Readout crate x34 *FIXED*
Sat Nov 29 12:34:02 2003 Missing Input: L2M0C, MGT 0, channel 6, Alpha Index 7
Sat Nov 29 12:34:02 2003 Missing Input: SLIC 39, Bc oet 2 SLIC Index 5, channel Index13,
ID x242, Readout crate x34
Sat Nov 29 12:40:53 2003 Missing Input: L2M0C, MGT 0, channel 6, Alpha Index 7
Sat Nov 29 12:40:54 2003 Missing Input: SLIC 39, Bc oet 2 SLIC Index 5, channel Index13,
ID x242, Readout crate x34 *FIXED*
Sat Nov 29 12:41:05 2003 Missing Input: L2M0C, MGT 0, channel 6, Alpha Index 7
Sat Nov 29 12:41:05 2003 Missing Input: SLIC 39, Bc oet 2 SLIC Index 5, channel Index13,
ID x242, Readout crate x34
Sat Nov 29 12:45:45 2003 Missing Input: L2M0C, MGT 0, channel 6, Alpha Index 7 *FIXED*
Sat Nov 29 12:45:45 2003 Missing Input: SLIC 39, Bc oet 2 SLIC Index 5, channel Index13,
ID x242, Readout crate x34 *FIXED*
```

L2 Operations

- When DAQ shifter downloads trigger, COOR
 - configures L1 framework
 - sends L2 configuration to L2TCC
 - configures L3 supervisor
- When DAQ shifter starts run, COOR
 - sends start run to L1/L2/L3
 - L2TCC sends configuration to L2 admin and admin configures hardware (enables MBT channels) and workers
- TWF issues SCL-init

L2 Operations – problems and solutions

- **When/How DAQ shifter can see an L2 problem?**
 - by looking at l2df GUI
 - **red box**, pie chart is **orange/blue**
 - L2 crate is missing from events or is L1/L2 100% FEB
 - L2TCC (L2RS) contains red messages about L2 crate/crates
 - **When it is NOT an L2 problem?**
 - No red box but framework shows “14/16” and we have no rates or pie chart is **brown**
 - No red L2 crate in daqdialog/uMon
 - Some other crate is red in daqdialog/uMon
 - **Check daqdialog/uMon, l2df GUI, check taker messages and L2TCC (L2RS) messages**
-

L2 Operations - problems and solutions

The screenshot displays a network management interface with two main panels. The top panel shows a grid of SLIC (Service Layer Interface Controller) units, each with a status indicator (green or red) and a label. The bottom panel shows a list of SLIC units with their respective channel IDs and status. A red oval highlights the SLIC 37 unit in both panels, indicating a problem. An error message window is open in the foreground, displaying a list of error messages related to SLIC 37 and other units.

SLIC Unit	Channel ID	Status
SCL x50	x10 x20	Green
x30	x11 x21 x16 x36	Green
SCL x53	x12 x22	Green
x32	x13 x23 x15 x25 x35	Green
SCL x50	x100 x110 x120 x130	Green
x140	x200 x210 x220 x230 x240	Green
SCL x53	x101 x111 x121 x131	Green
x141	x201 x211 x221 x231 x241	Green
SCL x50	x102 x112 x122 x132	Green
x142	x202 x212 x222 x232 x242	Green
SCL x53	x103 x113 x123 x133	Green
x143	x203 x213 x223 x233 x243	Green
SCL x53	x104 x114 x124 x134	Green
x144	x204 x214 x224 x234 x244	Green
SCL x55	x105 x115 x135 x145	Green
x205	x215 x235 x245	Green
SCL x56	x106 x116 x136 x146	Green
x206	x216 x236 x246	Green
SCL x50	x107 x117 x127 x137	Green
x147	x207 x217 x227 x237 x247	Green
SCL x60	x70 x76 x278	Green
x60	x66 x160 x166 x260 x266	Green
SCL x62	x72 x74 x279	Green
x62	x64 x162 x164 x262 x264	Green
SCL x80	x90 x96 x298	Green
x80	x86 x180 x186 x280 x286	Green
SCL x82	x92 x94 x299	Green
x82	x84 x182 x184 x282 x284	Green

SLIC Status Summary:

- SLIC 34, L1 trig: Disabled
- SLIC 35, A East: 16
- SLIC 36, A West: 16
- SLIC 37, BC oct 0: 16
- SLIC 37, BC oct 1: 16
- SLIC 39, BC oct 2: 16
- SLIC 40, BC oct 3: 16
- SLIC 41, BC oct 4: 16
- SLIC 42, BC oct 5: 16
- SLIC 43 BC oct 6: 16
- SLIC 44 BC oct 7: 16

Error Messages:

- 10, Channel Index2, Channel ID x50, Readout Crate x3b
- Thu Jul 31 16:27:58 2003 Missing Input: L2MUC, MBT 0, Channel 4, Alp ha Index 5 *FIXED*
- Thu Jul 31 16:27:58 2003 Missing Input: SLIC 37, BC oct 0 SLIC Index 3, Channel Index2, Channel ID x50, Readout Crate x3b *FIXED*
- Thu Jul 31 16:28:04 2003 Missing Input: L2MUC, MBT 1, Channel 4, Alp ha Index 12 *FIXED*
- Thu Jul 31 16:28:04 2003 Missing Input: SLIC 44 BC oct 7 SLIC Index 10, Channel Index2, Channel ID x50, Readout Crate x3b *FIXED*

L2 Operations – problems and solutions

- DAQ shifters are able to deal with L2 problems, such as:

I. missing inputs to an L2 crate

- detected by daqAI, but it happens to l2muc/l2muf only
- Diagnosis:
 - all inputs buffers are **yellow** (at least 1 event) except one which is **green** (no events)
 - check the L2 message box, which tells you which input channel and which front-end crate it is
- Action: notify MUON/CAL shifter
- disabling of L2 input channel is done automatically when muon front-end channel is disabled (by MUON/CAL shifter)

L2 Operations – problems and solutions

Ib. disabling input (MBT) channels to L2 crates

- **should be done only by the L2 expert** (or following his instructions)
- using l2inputer program
 - stop run, start inputer
 - select input MBT, select channel, save changed configuration
 - re-initialize COOR, download the trigger, start run
 - entire process takes at least 2 min!
 - l2inputer **re-writes l2resources.xml** configuration file
- to save time, by disabling MUON channels also L2 input channels are disabled
- other crates (l2ps and l2ctt) – by disabling an L1 readout crate in taker also L2 input channels are disabled = **faster** (should be done by COOR)

L2 Operations – problems and solutions

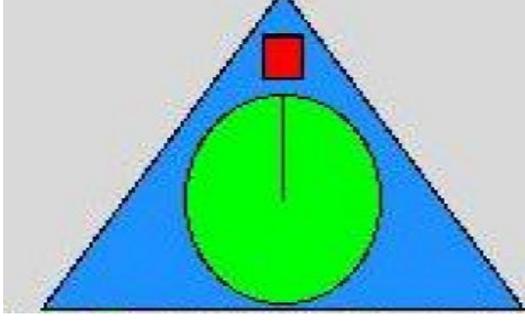
II. L2 crate is 100% FEB/missing from events

- also detected by daqAI
- it may/may not be something which requires L2 expert's attention
- Diagnosis:
 - daqdialog/uMon shows that crate
- Action:
 - issue an SCL-init (once or twice)
 - it may not help, better to contact the L2 expert and follow his instruction. The fix may require “medium hammer” or even “large hammer”. It is always the L2 expert's duty to do it.

L2 Operations - problems and solutions

III. Diagnostics of L2 errors

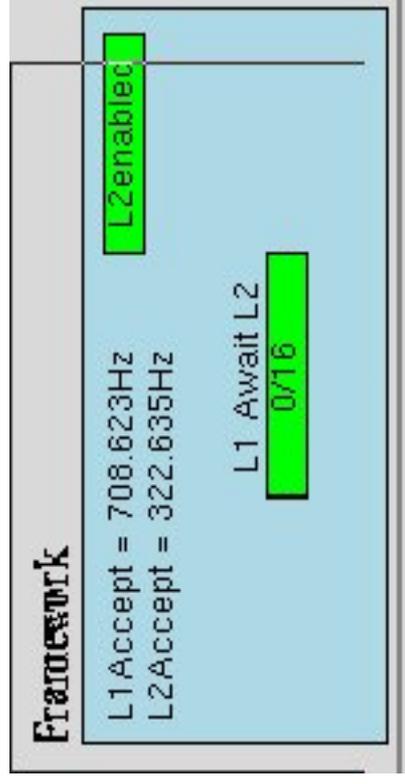
- red box in l2df



- requires an SCL-init
- typical problems may be:
 - **input sync errors** - recognized by daqAI
 - **configuration problem** - in L2 global. In this case run should be stopped, SCL-init should be issued and triggers re-downloaded

L2 Operations – problems and solutions

- L2 busy
 - l2df shows “L1 await L2: 14/16”
 - but no missing inputs



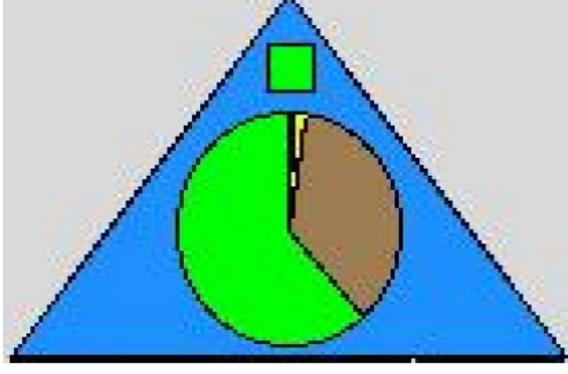
- check daqdialog for busy crate/crates

L2 Operations - problems and solutions

L1 Busy Percentage			L2 Busy Percentage						
0x9	0x10	0x11	0x12	0x13	0x9	0x10	0x11	0x12	0x13
	1.4%		100%					100%	
0x14		0x16	0x17	0x18	0x14	0x16	0x17	0x18	
0x19		0x1f			0x19	0x1f			
0x20		0x21	0x22	0x23	0x20	0x21	0x22	0x23	
0x24		0x25			0x24	0x25			
0x30		0x31	0x32	0x33	0x30	0x31	0x32	0x33	
0x34		0x35	0x36	0x37	0x34	0x35	0x36	0x37	
0x38		0x39	0x3a	0x3b	0x38	0x39	0x3a	0x3b	
0x40		0x41	0x42	0x43	0x40	0x41	0x42	0x43	
0x44		0x45	0x46	0x47	0x44	0x45	0x46	0x47	
0x48		0x49	0x4a	0x4b	0x48	0x49	0x4a	0x4b	
0x4c					0x4c				
0x50		0x51	0x52	0x53	0x50	0x51	0x52	0x53	
0x60	3.5%	0x61	3.6%	0x63	0x60	0x61	0x62	0x63	4.6%
0x64	3.9%	0x65	3.9%	0x67	0x64	0x65	0x66	0x67	
0x68	4.5%	0x69	4.1%	0x6b	0x68	0x69	0x6a	0x6b	1.2%
0x70		0x71	0x72	0x73	0x70	0x71	0x72	0x73	
0x74		0x75	0x79		0x74	0x75	0x79		

L2 Operations - problems and solutions

- SBC/L3 problem
 - l2df shows large "L3 readout" fraction in the pie chart
 - typically it's an L3 problem:



- reset the SBC
- reset Routing Master
- last resort - page the L3 expert

L2 Operations - DAQ vs. L2 expert

- August vs. November (pre- vs. post-shutdown)
 - L2 has two new preprocessors
 - l2ps - preshower preprocessor
 - l2ctt/stt - tracking preprocessor
 - do not require a special treatment BUT no triggers have been formed yet ...
- DAQ shifter watches daqdialog, uMon and fuMon
 - ✓ confront daqdialog and uMon information with l2df GUI
 - ✓ try SCL-init first
 - ✓ page the L2 expert (follow his instructions)

L2 Operations - DAQ vs. L2 expert

- L2 expert duties:
 - apply L2 hammers - small, medium, large
 - **small hammer** = SCL-init
 - **medium hammer** = restart l2 executable (l2reset <crate_name>)
 - **large hammer** = power cycle l2 crates
 - diagnose the L2 system
 - help to diagnose whether it's the L2 problem or others (it's not a Level 2 issue but we try to help)
- L2 experts pagers:
 - Primary pager: 630-266-0744
 - Secondary pager: 630-266-0750

L2 Operations - resources

- Documentation sits on the web!

General L2 web page:

www.pa.msu.edu/hep/d0/l2

L2 online web page:

www-d0online.fnal.gov/www/groups/trigger/l2/online

L2 DAQ web page:

www-d0online.fnal.gov/www/groups/trigger/l2/online/daq_shifter/index.html

L2 expert web page:

www-d0online.fnal.gov/www/groups/trigger/l2/online/expert/index.html

L2

- Only L2 muon preprocessors have SLIC inputs
 - L2df GUI
 - switches on the bottom
 - MUON channel
 - MUON readout crate
 - event occupancy (number of events)
 - L2 enabled/disabled
 - DAQ taker - L2 global is always IN!
 - Run with all L2 crates - even with l2ps and l2ctt - all the time!
-

L2

- COOR - L2 connection problems
- L2 crate/crates in error state:
 - red box in l2df
 - Red error messages in taker - L2TCC times out and fails to respond to COOR
 - red error messages in L2RS - Admin does not replay to L2TCC
- ✓ stop run, SCL-init, re-download, start run
- time out when starting run:
 - SLIC configuration has changed (some MUON input channels were enabled/disabled)
- ✓ wait ~ 30 sec and start run again

L2 - first β



Miroslav Kopal, DZero OP - December 1, 2003