• Trigger in “No Significant Issues” category of Lehman Review
  – (we all know what that means)

• But we’ve had our share of Reviews:
  – L1: 1/22/99
    • d0server1\Operations\Upgrade Project\TDRs\L1_report.ps
  – L2: 2/6/99
    • http://d0lbnl.lbl.gov/level2.ps
  – L3: 4/17/99
    • d0server1\...\TDRs\L3review_report_april99.ps

• Lots of Progress since then!
  – But can you stay awake to hear about it?

! Exciting Outline !

1) Trigger Sim        4) Level 1
2) Level 3           5) Trigger Lists
3) Level 2           6) Milestones
If All Else Fails... Simulate It!

~Done  Draft Design  In Progress  Started

7/2/99  H.Evans - Seattle D0 Meeting
…And Keep Simulating

• **Good Start on Most Elements**
  – Progress Quick w/ Concentrated Effort
  – Tools/Support Exist

• **Trigger Simulation has been an Impoverished Relative!**
  – Only beginning now to be more integrated w/ the rest of the trigger

• **Still a Long Way to Go !!!**
  – Easy for New People to make an Impact (contact Dave Toback)

Subtle Advertisement
Down on the Farm with L3

Front End Crate  - VRC 1  - Front End Crate
Front End Crate  - VRC 8  - Front End Crate

Primary Fiber Channel Loop #1
Primary Fiber Channel Loop #8

Front End Token Readout Loop
Event Tag Loop

L3 Node (1 of 16)
L3 Node (1 of 16)
L3 Node (1 of 16)
L3 Node (1 of 16)

To Collector Router

Segment Data Cables

ETG

Trigger Framework

G.Briskin - 4/17/99
The L3 Harvest

- **Goal**: provide continuous DAQ capability at DØ
  - Important for Detector Develop & Commiss
  - Already Exists! – Upgrades Ongoing

- **Detailed Hardware Design Underway**
  - Schedule in July

- **Tested**: Single Crate Readout & Connection to Online System at DØ
  - waiting for Trigger Framework for multi-crate / multi-detector & L1 Trig Integration

- **Online Test at Brown**
  - Build L3 Node Framework & Use ScriptRunner from L3 Filter
  - NT Compatibility Problems

- **Raw Data Packing/Unpacking**
  - Task Force formed to Address
Who’s Talking to Whom in L1 & L2

Detected → L1 Trigger → L2 Trigger

- 7 MHz
- 10 kHz
- 1 kHz

Detector → L1 Trigger → L2 Trigger

L1FW: towers, tracks

L2FW: Combined objects (e, µ, j)

- CAL
- FPS
- CPS
- CFT
- SMT
- Muon
- FPD

L1CAL → L2Cal
L1PS → L2PS
L1CFT → L2CFT
L1Muon → L2Muon
L1FPD

Global L2
L2 is All the Same (more or less)

Standard L2 Crates

- **All Crates:** Alphas, MBT, VBD, MPM
- **PS, CFT, CAL:** FIC
- **MUON:** SLIC, SFO

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More of the Same

• **Alpha:** Main L2 CPU (500 MHz DEC Alpha)
  
  **MBus:** Custom J3 Backplane
  
  – All Parts Function Properly (except L3 Cache)
  
  – Developing Software to Run Online
  
  – Mbus bandwidth Measured !!!
    
    * Faster than expected!
  
  – Alpha Delivery Delayed → Late Fall

• **MBT:** Interface to Alpha / SCL Receiver
  
  – Debugging Prototype

• **FIC:** Optical(G-Link) to Cable (Hotlink)
  
  – Production Cards at FNAL

• **SFO/CIC:** Fanout/Converter Cards
  
  – MoU in progress

• **SLIC:** Pre-pre-processor (L2 Muon)
  
  – Debugging Prototype
  
  – Personnel Crisis Looming !
    
    * Opportunities in Real-Time Coding
    
    * Talk with Hal Evans or Mike Fortner

7/2/99 H.Evans - Seattle D0 Meeting
...Except for STT

- **L2STT:**
  - Meeting at B.U. (6/11/99)
    - Identified Design Issues to Resolve this Summer
    - Signed Off on L1CTT Data Format
  - Fit Processor Options:
    1) DSPs or FPGAs
    2) Alphas
    - Both approx. equivalent in speed & cost
    - Alpha Option requires more crate space
      ⇒ Proceed w/ DSPs or FPGAs
  - Funding: waiting for results of MRI
In the Trenches with L1

- **Framework**: Installed at DØ!
- **L1MU**:
  - Final Layouts for muon L1 Trigger
  - Use Muon Trig. Manager for CTT, FPS, RPD
  - Goal: Cosmic Ray Triggers w/ PDTs by Fall
- **L1CAL**:  
  - Decision to use Quadrant Matching b/w L1CAL & CTT or CPS
- **L1CTT/PS**:  
  - Definition of Architecture/Protocols Final
    - http://d0server1.fnal.gov/www/protocols/
    - details of overlap regions for matching in flux
  - Design/Optimization Progressing
    - Need Personnel: (physicist & eng.)
      - 6 Daughterboards + 17 Firmware Versions
  - Use Minimum CTT $P_T$ of 1.5 GeV
  - Dual Level PS Discrimination & Digitization for CPS(axial & stereo), FPS downstream
  - Low & High $P_T$ e’s & $\gamma$’s + MIP Calibration
L1MU Trigger Status

- Finishing prototype testing
- Goal is to be generating cosmic ray triggers (with PDT’s) by mid-fall

![Bar chart showing % Complete for various components]
**Quadrant Matching**

- **Needs**: Driven by rates for low $P_T$ ee
  - No Matching $\Rightarrow \sim 1400$ Hz
  - Goal: geometric match between L1CAL objects and L1CTT or L1PS

- **2 Options**: that work w/ CAL Hardware
  - Both based on Trigger Tiles ($0.8 \times 2\pi/4$)
    1) **Tile**: use $E_{tile} >$ thresh
    2) **Tower**: count Trig Towers $> $ thresh in Tile
      - less sensitive to noise, low-E stuff, etc
      - takes longer in firmware (too long for 132ns)

- **Details**: Matching requires OR
  - e.g. $E1*P1 + E2*P2 + E3*P3 + E4*P4$
  - So far AND/OR terms really AND/OR-else
  - Solution: PTERMs = Pseudo AND/OR
    - HTERM: Hardware AND/OR only AND
      - limit = 256 from L1 Hardware
    - PTERM: In L1FrmWrk Firmware AND & OR
      - constructed from HTERMs: limit $\sim 40$
  - Trigger Terms = HTERMs AND PTERMs
More Matchmaking

- **Results:**
  - $J/\psi \rightarrow e^+e^-$ Rate Reduction:
    - $\times 3-4$ Tower Scheme
    - $\times 2-3$ Tile Scheme
    - $B \rightarrow J/\psi K^0_S$ Efficiency loss 10-15%
  - High $P_T$ Single-e Rate Reduction
    - Approximately $\times 2$

- **Decision:** (tentative)
  - Use Tower Scheme at start of Run II
  - Fall back to Tile Scheme for 132 ns Running
See http://d0server1.fnal.gov/www/protocols/
I’ve Got a Little List!

- **Trigger List now Divided by Objects**
  - [http://www-d0.fnal.gov/~lucotte/TRG/trigger_list.html](http://www-d0.fnal.gov/~lucotte/TRG/trigger_list.html)
  - [http://d0ntwg01.fnal.gov/run2_triggers/](http://d0ntwg01.fnal.gov/run2_triggers/)

- **Number of L2 Triggers now < 128**
  - continue to pursue decoupling L1/L2 Lists

- **New Tau Triggers**
  - Good Interaction w/ Hardware here!

- **Need Updated Rate Simulations**
  - TrigSim will be used

- **Not Enough People Giving Physics Input to Trigger List**
  - Act NOW - While there’s still Time!

More Advertising
<table>
<thead>
<tr>
<th>System</th>
<th>Milestone</th>
<th>Date</th>
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<tbody>
<tr>
<td>TrigSim</td>
<td>Integrated L1 &amp; L2 Sim. Prototype</td>
<td>Aug 99</td>
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<tr>
<td></td>
<td><strong>Full Simulator Available</strong></td>
<td>Nov 99</td>
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<tr>
<td>L3</td>
<td><strong>First Downloadable Executable</strong></td>
<td>Jul 99</td>
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<tr>
<td></td>
<td>Complete L3 Node Framework Software</td>
<td>Aug 99</td>
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<tr>
<td></td>
<td><strong>L3 Operational</strong></td>
<td>Apr 00</td>
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<tr>
<td>L2</td>
<td><strong>Alpha Cards Received</strong></td>
<td>Nov 99</td>
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<td>L2CAL Commissioned</td>
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<td>Other L2 Systems Commissioned</td>
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<td><strong>L2 Commissioned</strong></td>
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