<u>L2 issues:</u>

General: not clear who is requesting which functionality, with what authority and priority. Limited manpower at the expert level is a primary concern for major functional changes to the system.

<div align="center">Version 13</div>

<u>Recent progress:</u>

- L2CTT conflict with L2STT (tracks intermingled): Resolved
  Caused in large part by lack of multiple βeta software.
- L2STT IP tracks: > 4KB data source sizes breaks DMA engine on Beta, violated 4KB source size limit in buffer management code.
  Temporary fix: limit STT output to 200 tracks for commissioning studies.
  Hirosky studying DMA issue now.
- STT should now be ready to run for full commissioning studies.
- Muon scint timing data mangling, UBS studies point to FE readout problems.
- M200 crate tripping: Resolved
  Bugs in PS monitoring fixed
- MBT position dependence: Resolved by firmware changes in MBT
  Removes future worries about why we had this problem, and using multiple βetas
  Strong effort by Baden and Hirosky on site.
  But no ongoing MBT support from Maryland other than Baden.
  * Do we have a verification suite for new FW? * Upgrade FW in all MBT's over the summer
- Test Stand grounding problems: Resolved
  optical isolator installed for SCL_INIT cable to test stand

<u>Working Areas:</u>

CPS linkage with CTT:

- cannot change firmware for one without recompiling firmware for other. This will never go away, and will limit testing.

Online testing of L2CTT and L2CPS under v41/4x?:

- Some issues; still assessing behavior with version 41 (source code recovered)
- Format/parity wrong, but we can live with—software fix released
    - Will make list of outstanding issues with v41
    - Decide with Stefan G. which are worth fixing
- Can make fake tracks (low thresh during 0 bias) to test—couldn't in August
- Haven't verified what fraction of events have bad sector numbers etc (hope < 1%)
    - Haven't seen performance plots indicating we are ready to trigger on L2CTT
    - Doesn't mean they don't exist, but should be shown to L2, Trigger panel

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- May need UBS (UnBiased Sample) run for testing inputs carefully for CTT, CPS
  - But currently no software that compares L1 and L2 results!
- L2CPS needs uniform threshold settings—in progress
- Some synchronization problems for L2CPS inputs
  - Unlikely to totally prevent being in run to study
  - Currently running with one input disabled, however (fixed?)
  - Need fix to firmware before using to trigger

Muon SCINT times offset

- Scint times at L2 show 1-2ns differences with times unpacked from L3 RDC. Cause: data mangling in FE muon readout.

Some forward muon crashes (typically 1/week)

- Would need UBS run at 100% to check (test stand not sufficient)
  - Will likely be some deadtime cost if we wish to pursue
  - Can't do in test stand—not enough rate on single SLIC
  - Haven't proven whether really a crash; SLIC's hard to diagnose
- No current L2 support from Munich

L2MUON
Limited time window before Christos leaves (end of summer)
In addition to scintillator times questions above:
- Inventory of SLICs
- Selectively disabling of input channels for simulator
- Various SW fixes on Christos's list
- DOCUMENTATION:
  - L2MU simulator
  - managing online/offline packages
  - Instructions for setup of SLIC executable build machine
  - Debugging documentation for SLIC crashes

General Control Room Issues

- L2 often "blamed" for FE problems. In particular muon FE has little ability to diagnose data flow errors, often caught by cross checks done at L2. Need to improve dead time accounting practices.

Version 14 (the next 6 months)

L2 versioning   Required: Miroslav (or new apprentice)+Moore   weeks to months?

- Software in awkward state—quite hard to change a format of anything in L2.
    - Not really acceptable in long term.
    - Assistance from Roger (consulting or more) may be needed.
- Miroslav is main implementor—but no programmer-level documentation of IOGEN, and Miroslav tied up with commissioning L2CTT and supervising L2 commissioning in general

L2STT
- First co-exist with L2CTT, and then switch over to L2STT
- Need to be sure we can cleanly produce both Pt-ordered and impact-ordered lists
- Somewhat easier if had multiple βetas, but probably not required

L2CPS   ~months
- Optimize thresholds in front-end firmware
- Efficiency/rejection studies in physics samples
- Only Yuan, spread thin across whole commissioning project

L2MET/L2Cal   Required: 1 FTE   ~ weeks
- Only way to cut on MET direction is to calculate from scratch in L2: L1Cal does not deliver its results. No activity from L1Cal because of work on upgrade.
- Only manpower from UIC is grad student James Heinmiller; 2 postdocs down to 0
- Have a version working in simulator, but more work still needed to run online With multiple beta software, could run now
- Unclear we have CPU cycles available to run L2MET on top of L2JETS, L2EM
- James has been under a lot of pressure from Volker for changes to L2EM, but Volker has found no one from the entire New Phenomena group to help James with the testing effort for the changes. James needs more postdoc supervision, if only to help him be sure new code is better tested.

Multiple βetas in a single crate   Required: Hirosky/(Verdier ?) months
Time critical: finish before end of 2004 to prevent conflicts w/ teaching

- We built ~40 βetas; using ~8; without this software, wasted construction money
- Currently forcing multiple worker code into single processor
    - Has made some software issues harder (e.g. L2CTT/L2STT conflicts)
    - Special hand-work needed to do this in each case
    - Currently inhibiting running of L2MET online
    - Partial workaround is buying faster CPU's
    - Long-term needed for load balancing
    - Started by Dugan O'Neil; delayed by few alphas/late βetas

- Patrice Verdier made little progress in 12 months—physics work instead

Trigsim   Dugan O'Neil/Yann (SFU), Angela Bellavance (UN)
- Maintenance has not been the most effective, and even L2 implementors have complained of the difficulty of getting a reliably-compiling version. It took Christos 2 weeks to compile a recent L2 code change; Xiaojian Zhang has continually struggled with the simulation to perform online monitoring of L2   decisions vs the simulator. Trigsim lost Joe Steele (UVA, not replaced), who was doing some release testing. Dugan had been detached (and MSU couldn't replace him), and Angela hasn't felt primary responsibility. Josh Dyer has also been doing some testing, but could use more direction. Joe Kozminski (L1FW, L1Cal) hasn't self-started, and there are other problems in the L1 part of the simulation. A clear institutional commitment from SFU would be an important contribution.

L2Global
Josh Dyer (MSU); advice from Reinhard, Adam Yurkewicz: Months
- Adam Yurkewicz is currently in charge of L2Global. He is working hard on his analysis and intends to graduate within a year. Josh Dyer of MSU is a possible replacement; we are trying to get him up to speed. However, we would like to reiterate here that there needs to be more testing support from physics groups—it is unrealistic to expect implementers to do all testing of new code and proposed scripts. It is appropriate for the implementer to do "technical" verification—that the code does what was intended—but not to do "physics" verification—that the scripts using it do what physics groups desire.   Problems in Trigsim make it somewhat harder to achieve this. We would have severe problems with the thumbnail without the heroic efforts of Marco Verzocchi.
- Physics group input is essential to developing trigger tools/filters for Run2b. Insufficient resources in L2 to develop new tools to run online.

Global/Branching in L2   Required: Moore ~ months
                    Detailed comments are provided in a separate note
Time critical: finish before September 2004 to prevent conflicts w/ teaching

- This will also require some effort from the COOR and database side. This effort has also suffered manpower losses. MSU could not replace Roger Moore. Reinhard has mostly left L2 for physics, and likely won't be replaced this year. There is also competition for resources with the L1Cal upgrade, so the slow arrival of inputs to L2 (and the resulting requests for changes long after the bump in manpower associated with L2 construction) has combined to make this part of the manpower picture difficult, as well. Either we press Roger into service to deliver this now or will have great difficulty finding someone w/ the expertise necessary to do it later.

- Prefer to see a systematic argument that this expansion is necessary, particularly as the overall rejection goal of L2 has been continually downgraded, and now lies somewhere in the range of $\sim$2kHz/.85kHz = 2.4, where the design goal had been a

factor of 10. The critical factor, we suspect, is the disappointing bandwidth allowed into L2, which has been one aspect forcing us to push more rejection into L1, and much closer to 128 bits than the design value the collaboration agreed to, of 64 L1 bits, allowing branching to 128 L2 bits. However, there are also striking differences in triggering strategy between Run I and Run II, which have also consumed substantial triggering resources. It is of course for the collaboration to decide whether the effort of living within existing resources is a better solution than expanding the resources at L2.

<center>Recommendations from L2:</center>

V13
- continue with current push to validate use of L2CTT/STT as highest priority.
- If hand-written, non-recorded OR's are really felt to be essential for V13, then we can provide consulting help. But as noted above, L2 resources are currently stretched very thin as manpower has left the project; and the simulator—the environment in which software is developed—is painful to use and under-maintained.

V14:
- Addition of manpower is probably required if the L2 group is to carry out all requests
  - at least a postdoc's worth, perhaps two (if you include the trigsim and what ought to be the correlated verification/regression testing efforts—a clear commitment from, e.g. SFU, to have fully operating releases of trigsim as a normal operation would be most welcome).
  - Better coordination between L1CTT and L2 would be welcome, and maybe some manpower to help with software comparing L1 and L2 outputs. We are now meeting regularly with Stefan.

- We would recommend that some combination of Hirosky and Verdier implement the software to run multiple βetas in a single crate.

- We should also prepare a higher-speed βeta for online use soon, as insurance.

- Assuming we get clear direction to proceed with 256 or more bits, this work must begin immediately
  - Effort by COOR, Trigger Database, and Thumbnail also needed
  - Important to get a feel for the scale of those efforts.

- Advice and/or assistance from Roger will likely also be needed for versioning:
  - a minimum would be phone consultation,
  - but we would strongly urge his delivering the promised programmer-level documentation, though this will be painful for him.

RunIIb (the next 12-18 months)

The primary work for the L2 in the RunIIb era is to develop tools for efficient triggering and rejection under future running conditions. This is to a some extent outside the charge of the L2 group, since the triggerlist specifications must come from the physics groups by way of the Trigger Board. The L2 group can recommend possible tools or filters based on our knowledge of the data and our understanding of strengths/limitations in the system and can serve in an advisory roll to assist setting up in trigger studies. Physics group personnel will be largely dependent on a working and well documented trigger simulator to facilitate these activities.

Below we list some general ideas about features that may be added to the L2 toolbox for RunIIb.

L2FPS   ~months

• Only forward tracking info available at L2
• No manpower here except Yuan, make this project serialized after CPS

• More complex L2Global scripts
    Effort: (1-2 Months per study for a properly supervised student)
        • Phi wrt MET   not assigned
        • NN Tau ID with L1 input objects, ...   not assigned
        • etc.
• Few-cm Zvtx (from barrels on SMT)?
    Effort: (~ 1-2 Months for properly supervised student for feasibility study) – UVa
    Needs study of algorithm, timing, accuracy.
    In worst case: physics dependent
    Ideally: use to correct Et(cal), MET
• New PreProcessor tools:
     Effort: (~ 3-4 Months for properly supervised student)
        • Try for multiple-track displaced vertices???,
        • Fancier CPS/FPS algorithms?,
        • cleanup MET at L2, put L3 algo here?
        • etc...
• Advanced plans for L2 cal:
    Effort: 1 year student effort in collabration w/ L1/offline calorimeter groups
        • Tower by tower calibrations of L1 cal tower ET's
            Easier to change than L1cal gains?
• If cal. readout is upgraded, Can we get more precise calorimeter data? (do we want it?)
    Effort: 1 month Experts to develop proposal
                 1yr Postdoc for implementation

L2 NIM PAPER