

XFT REVIEW COMMITTEE – DECEMBER 8 2004

The project has made tremendous progress since July, with preproduction boards either ordered or in hand for all parts of the XFT upgrade. However, there is a lot of work to do in the next eight months to complete the upgrade.

With all the current personnel being extremely busy with their piece of the upgrade, there is need for a **good manager** to coordinate the testing of the complete system. The engagement of **several more physicists** in the development of diagnostic tests and online code is also needed. The Committee also recommends that:

- There is no slippage in the installation schedule for components in the collision hall (XTC, Transition card, Optical fibers), which must be complete in the 2005 shutdown.
- The development and full simulation of the firmware be completed as soon as possible for the XTC, the Finder and the SLAM board. Given the tight schedule, two issues stand out. First, the testing of the firmware for the XTC card needs to be completed by December 20 in order to install the 126 required XTC cards with the planned TDC modifications. Second, the firmware for the SLAM board is currently in flux and could require a different FPGA, due to the tight time constraints on the arrival of information at the SLAM board and departure to XTRP.
- A detailed and realistic schedule is needed now for standalone testing of the boards and integration tests. This includes the development of diagnostic firmware and code to be ready for the arrival of the preproduction boards. There is only about 10 weeks in the schedule to test the preproduction boards for the Finder and the SLAM board, so preparing in advance for the tests is crucial.

Current system - pT threshold for Axial Finders

A register controlling the pT threshold is now part of the default Finder design, so there is no longer any issue of CDF dead time while switching Finder designs. A new Linker design with curvature confirmation allows continued running with the preferred 1.5 GeV/c threshold. Although this is

a low priority request, the Committee would like to know what effect increasing the Finder pT threshold now has, given this new Linker design.

XTC mezzanine board

Preproduction boards are in hand, the schedule for the production order is currently **20 December** with delivery in **late January**. Uneven time bins have been observed, with 6-10 ns differences between the six ~24ns wide time bins for all preproduction boards. This could be a design flaw of routing in the firmware. Future operating conditions may require different firmware designs, so it is not enough that the board works for one design. Committee recommends investigating this with the **highest priority** – if the timing on the XTC doesn't work, then all bets are off on this upgrade.

For the installation in the collision hall, it is critical to avoid slippage in the schedule for ordering and testing these boards. The current plan is to combine the installation of the XTCs with that of the modified TDCs, starting at a crate per time in **late January**. This is advantageous since it minimizes the risk of damage to delicate cables attached to the TDC.

The Committee recommends that software development of teststand code for production checkout be completed as soon as possible in order to be ready to speedily commission boards in late January.

Transition board

Second prototype boards are in hand, the schedule for the production order is currently April with checkout not finished until August. As this component must be installed in the collision hall, the Committee thinks the production order should be made as soon as possible. This requires integration tests with the Finder as soon as working Finder preproduction boards are available. The Committee also requests documentation on tests of the transition board with optical mezzanine cards on either end.

XFT Stereo Finder board

Preproduction boards were ordered this week, with delivery in late January. The delay in schedule was due to careful layout of this sophisticated 16-layer board. The Committee recommends complete testing of preproduction finder boards, *i.e.* send signals onto board and capture them off the board.

This would require 3 boards – 1 input, 1 Finder, 1 output. Could configure two Finders as data sources and sinks but this requires extra personnel to write diagnostic firmware as FNAL engineer Scott Holm will be busy completing the standard firmware until the arrival of preproduction boards. Another possibility is to use Pulsar boards, as Steve Chappa is writing firmware to test XTC.

The teststand code needs extension from existing code for “sandwich” tests with input-XTC-Finder-output. This is a place where additional personnel could easily contribute.

For firmware design and testing, the 1.5 GeV/c threshold should be the baseline design of the stereo finder.

SLAM board

Preproduction boards were ordered this week, with delivery in late January. The firmware, which adds stereo information into the L1 trigger path, is still under extensive development due to the tightness of time constraints. The Committee requests completion of firmware and full simulation of chip timing as soon as possible. The current chip has 60% of logic elements in use, so there is little extra space to alter the current design. The Committee recommends to also stuff a preproduction board with a larger chip to give more flexibility to firmware designers. A larger chip may mean slower performance, but it may be possible to then run parts of the algorithm in parallel and save time that way.

The teststand code needs extension from existing code for “sandwich” tests with input-SLAM-output and input-Finder-SLAM-output. This is a place where additional personnel could easily contribute.

Timing

The design for the SLAM module had assumed that stereo information would be available several CDF clocks before axial tracks. This is not true because sending stereo information from XTC to Finder in 6 time bins takes over 3 CDF clock cycles. The Committee agreed that everything possible should be done to make the stereo data reach the SLAM board earlier. There are no easy options:

- XTC to Finder cable run is currently 200 ft. Possible to shorten cable length? If run fibers through a penetration – could save 50 ft - about ½ CDF clock. Where are the available spaces? Are they convenient? No easy access in collision hall. Could play games with allocation of fibers to cable tray and penetrations.
- 2 format clock ticks in XTC to Finder and 2 format clock ticks in Finder to SLAM – any way to shorten these in firmware? Any hybrid data ordering that could save a clock tick?
- Can any more of the Linker output formatting be moved to SLAM to save time?
- A higher speed link between XTC and Finder? Possible to make cables “shorter” by sending data faster? Unlikely as this requires redesign of optical mezzanine cards.
- Descope from 6 to 4 time bins sent over 2 CDF clocks – could save a clock cycle. Do not propose that this is studied now, but could be a fallback option. The new XTC card is flexible and allows firmware changes.

Commissioning

A detailed and realistic plan is needed for the commissioning of a vertical slice of the system as well as the full system. The specification of the format of new diagnostic banks and online readout needs coordination with the DAQ group. Other items like TrigMon software and dead COT wire database will need extension. This is currently a lower priority than the actual hardware and firmware, but is a place where off-site personnel could easily contribute.

People

One of the participants needs to take charge as the **project manager** to make detailed and realistic plans and to coordinate the efforts of the group.

Need more dedicated personnel. This project is crucial and has to be ready on time. That will require sacrifices from the physicist personnel on the

project. The Committee recommends engagement of personnel on the fringes of project like Purdue, Davis (L2 interface) and Pisa (SLAM input to new L1 two-track board) with integration tests now.

Miscellaneous concerns

No time in schedule to absorb any changes in board design for production order.

Density of optical fibers coming into XFT rack in the L1 trigger room. May be better to route into next rack for space?

J3 backplanes for Finder crates– do they exist?

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