

# XFT Review May 25 2004

We commend the XFT upgrade group for excellent presentations. The results presented by Greg Veramendi, Kevin Lannon and Ben Kilminster were clearly based on huge efforts and give a consistent and clear picture. The recent simulation studies show that track efficiency and  $p_T$  and  $\phi$  resolution of current axial system is satisfactory at high luminosities, in contrast to the studies in the Run IIb TDR. However, still need to improve purity of XFT tracks to stop quadratic growth in trigger cross-sections and cubic growth in trigger rates with instantaneous luminosity. Kevin Pitts estimates that need to:

- Reduce high  $p_T$  single track fakes by a factor of 3-4. This is from linear extrapolation of current trigger cross-sections to design instantaneous luminosity of  $2.7 \times 10^{32} +$  conservative overhead =  $4.0 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$ .
- Reduce scenario C cross-section by a factor of 2-4. This is from linear extrapolation of current trigger cross-sections to base instantaneous luminosity of  $1.5 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$ .

How well do the various XFT upgrade designs perform? Note with degraded COT, the baseline trigger rates are higher by factor of 50-100%. However, the upgrades still perform well and show similar reductions to default COT.

- **6-bin finder+linker gives a factor of 3 reduction.** However, the committee finds it not feasible to replace the entire axial system in 16 months. The current axial system is robust in terms of maintenance and flexibility. The axial system is the core of the CDF Level 1 and Level 2 trigger system. There is significant risk of downtime for high  $p_T$  and B physics programs during the commissioning of a new system, when we could otherwise be filling bandwidth with physics.
  - We can gain some relief (20% reduction) with the current axial system by increasing the minimum  $p_T$  track. This could be implemented immediately. Even possible as part of the trigger table, where relax the minimum  $p_T$  back to 1.5 GeV/c from 2.5 or 2.0 for the substantial parts of a store that are at lower instantaneous luminosity.
  - Investigate possible reduction in high  $p_T$  fake rate from option of requiring both slope bits for high  $p_T$  segments.
- **stereo for SL5 and SL7 give a factor of 2 in reduction.** The committee finds it feasible to do this in 16 months since it can be commissioned parasitically with no risk. Using the stereo information seems like an intrinsically good idea, especially the outer layers, especially when we are still concerned about COT aging issues.
  - Map out what a new base line of ‘as is’ axial and additional stereo would buy and show clearly the case for the 6 instead of 2 bin stereo. A table like Ben Kilminster showed (page 18) with the columns filled out for the following assumptions: 2 bit axial always assumed; 1.5 GeV/c 2.0 GeV/c and 2.5 GeV/c variations for each of 2 bin and 6 bin stereo. Check if SL3 adds anything. Check some of these options with degraded COT and with degraded SL5 and SL3 as well. What are implications for TDC hardware to instrument SL3, 5, 7?

- The committee strongly requests a detailed plan to show that the XFT upgrade group has the required resources to make the stereo upgrade happen in the next 16 months.
- The extra credit option of confirmation using the stereo information at L1 should be explored; it should be below the radar but could be very important for extending the 2 track data reach, provided this is not killed by continued problems with the COT. This option was envisioned early on in the hooks (extra bits) between XFT and XTRP. As Peter Wilson mentioned, would have to fit in with timing of existing L1 trigger system.

The committee believes that there is too much uncertainty in future accelerator performance, length of Run 2, etc. to decide now that the stereo upgrade alone will be enough for the life of the experiment. It may be that a source of funds and manpower (and necessity) will come at a later time, without the same constraints as we have now, so that we can make the axial upgrade. Any decisions made now should leave open that possibility. Specifically, this means the new stereo finder should be built under the assumption that it could be used for the later axial finder upgrade, as Terri Shaw suggested. Other technical decisions should also be made with this in mind.

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