# Update to the Second Report of the Standing Committee on Upgrade Installation-to-Physics Commissioning (SC-IPC)

June 17, 2005

# 1.0 Introduction

In the First Report of the Standing Committee on Upgrade Installation to Physics Commissioning (SC-IPC), dated October 12, 2004 and available at http://d0server1.fnal.gov/projects/run2b/SC-IPC/documents/SC-IPC_First_Report.pdf, the timelines and physicist effort requirements for installation and commissioning to physics of the several elements of the RunIIb upgrade were described and summarized.

Sometime after the release of the First Report the DØ spokespersons asked the SC-IPC to enumerate and identify the physicists expected to be available for the installation and commissioning tasks tabulated in the First Report. The SC-IPC working group leaders collected the required information during December 2004/January 2005 and their findings were presented in the Second Report, dated March 5, 2005 and available at http://d0server1.fnal.gov/projects/run2b/SC-IPC/documents/SC_IPC_Second_Report.pdf.

Recently the DØ spokespersons asked the SC-IPC to update the Second Report so that timely manpower information is available for the June 2005 Workshop. Also, since the time of the Second Report the Laboratory has proposed that the Fall 2005 shutdown will begin October 3, 2005. With this date in hand the SC-IPC working group leaders have once again polled the DØ institutions to identify the physicists who are committed to the installation and commissioning tasks tabulated in the DØ Installation Plan (available at http://d0server1.fnal.gov/projects/run2b/SC-IPC/documents/Installation_Plan.mpp, or printable summary at http://d0server1.fnal.gov/projects/run2b/SC-IPC/documents/Installation_Plan.pdf). Given the specific starting date, the DØ Installation Plan predicts when each portion of the installation will occur. It therefore defines when individuals must plan to be "on hand" to accomplish the technical and physics commissioning tasks they have committed to accomplish. The updated manpower information, including the names of the physicists committed to each task as of May 2005, is presented in this Update to the Second Report.

## 1.1 Evolution of Installation Planning Since the Second Report

As noted above, the SC-IPC assumes the 2005 shutdown of the Tevatron will occur October 3, 2005, and according to the current DØ Installation Plan, end January 6, 2006 for a shutdown of approximately 13.5 weeks. The same Installation Plan shows that physics commissioning will be completed by March 19, 2006, approximately 24 weeks after the start of the shutdown. These durations are substantially unchanged since the Second Report; the details of them will be presented below.

Evolution of the installation planning continues and efforts to reduce the duration of the time required in the collision hall have indicated that efficiencies might be achieved. Since these efforts are not mature, and no real contingencies were explicitly scheduled in the plan, the SC-IPC chooses at this time not to take advantage of any potential shortening of the installation period.

## 1.2 Explanation of the Tables

The Installation to Physics Timeline tables originally presented in the First Report and revised for the Second Report are presented herein once again, incorporating the updated manpower and schedule information prepared for this report.

As in the Second Report we once again enumerate the weekly peak requirements for physicist effort during the installation period. The second manpower line in each table enumerates the numbers of individuals

presently committed to the effort, and the third line shows the shortfall or excess for each week. The term "physicist" as we use it does not differentiate between full-time thesis researcher, postdoc, or senior physicist/faculty member.

We omit a summary table for the Trigsim effort (SC-IPC Working Group 4), since we believe the additional effort required over and above that provided by the Upgrade Project for Trigsim is already in place and functioning adequately, especially given the presence of the coordinator (Varelas) appointed to oversee the completion of the trigger effort for the upgrade. In the final summary table in this report we include relevant trigger milestones and trigger commissioning activities during the shutdown to indicate the progress of this group.

In the Second Report the summary tables for L1 Cal Trig, L1CTT & L1CalTrk, and L0 Silicon included a column labeled "Before" which indicated the effort required to conduct certain "infrastructure" preinstallation/precommissioning activities not explicitly provided by the Upgrade Project itself. We omit these columns in the tables in this report (except for L1CTT) since we believe the collaboration is adequately committed to these tasks, also largely due to the activities of the new coordinators (Mulhearne, Stone, Lammers, Melnitchouk) appointed to these elements of the upgrade. We leave the "Before" column in the L1CTT & L1CalTrk table since it so graphically indicates the installation and technical commissioning of these upgrades that takes place before the shutdown.

The shutdown for installation will occur after classes at most universities are in session. This has inevitably reduced the number of faculty members that might otherwise have been able to commit to the installation/commissioning tasks.

Three estimates for effort have been modified since the second report: the number of physicists required for the L2Beta technical commissioning was reduced from three to two Full Time Equivalents (FTE's), the number for Layer Zero timing and noise studies was reduced from 12 to eight FTE's, and the number for Layer Zero alignment, clustering, tracking and object ID was reduced two FTE's for each. These changes correspond to an overall reduction of less than 5% of the effort for the duration of the project. The new numbers are believed to be more accurate than the old ones. In addition, one new task was added to the L1CTT & L1CalTrack table: the modification of the Muon PDT front ends which adds two FTE's to the project during selected weeks.

## 2.0 Installation Effort Timelines

The Installation Plan contains the standard laboratory work week for the holiday times of Thanksgiving, Christmas and New Year's (i.e. two days for Thanksgiving, one-half day each for Dec 24 and Dec 31, and a full day each for Dec 25 and Jan 1). Weeks 12 and 13 are affected by these holidays. We assume the physicists committing to tasks during these periods intend to make themselves available during these weeks at not substantially greater vacation time-off rates.

The correlation between the weekly columns in the summary tables below and the shutdown calendar is as follows:

| Week | Calendar | Week | Calendar | Week | Calendar |
|---|---|---|---|---|---|
| 1 | Oct 2–9 | 9 | Nov 27 – Dec 4 | 17 | Jan 22 – 29 |
| 2 | Oct 9 – 16 | 10 | Dec 4 – 11 | 18 | Jan 29 – Feb 5 |
| 3 | Oct 16 – 23 | 11 | Dec 11 – 18 | 19 | Feb 5 – 12 |
| 4 | Oct 23 – 30 | 12 | Dec 18 – 25 | 20 | Feb 12 – 19 |
| 5 | Oct 30 – Nov 6 | 13 | Dec 25 – Jan 1 | 21 | Feb 19 – 26 |
| 6 | Nov 6 – 13 | 14 | Jan 1 – 8 | 22 | Feb 26 – Mar 5 |
| 7 | Nov 13 – 20 | 15 | Jan 8 – 15 | 23 | Mar 5 – 12 |
| 8 | Nov 20 – 27 | 16 | Jan 15 – 22 | 24 | Mar 12 – 19 |

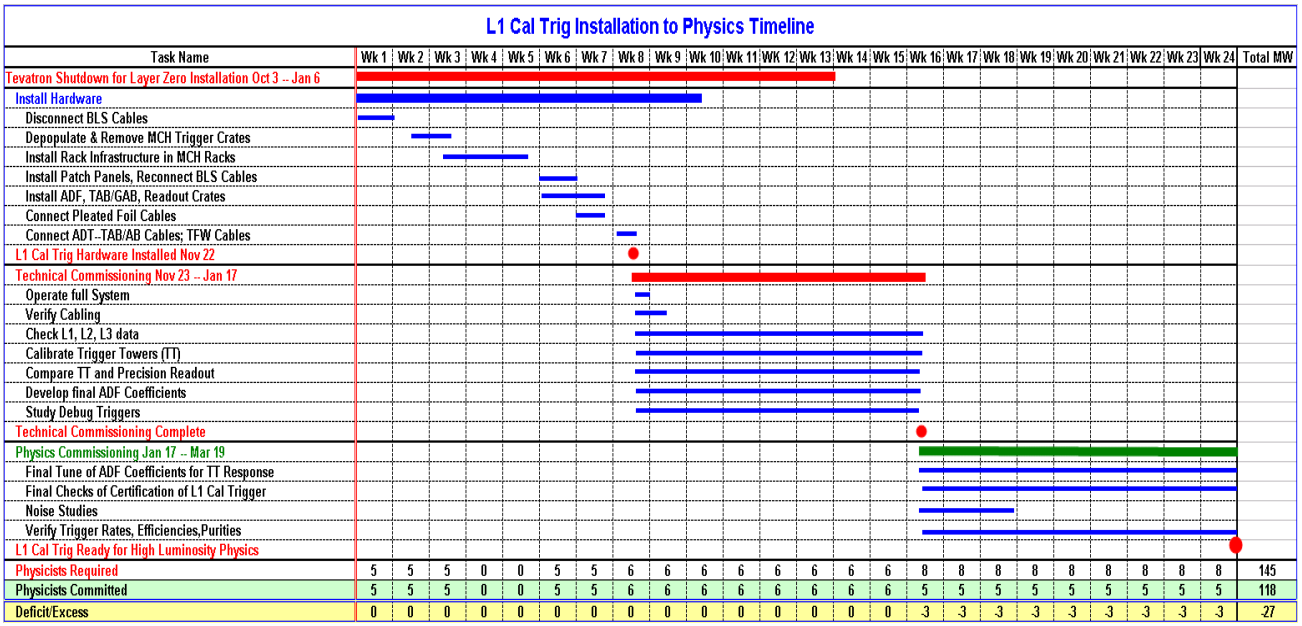
## 2.1 Working Group 1: L1CalTrig

Table 1 presents the timeline and effort summary required to take the L1CalTrig from the beginning of installation to the point that it is fully operational in high luminosity physics data-taking. Substantial effort will be required to achieve this in the time indicated. The SC-IPC estimates that six FTE's will be required for technical commissioning, and eight FTE's for physics commissioning. At this time, the following physicists have been identified as being available for technical commissioning: UIC (Stone), Columbia (Johnson, Lammers, Mulhearn), Delhi (Naimuddin), SMU (Renkel), NorthEastern (Fantasia), MSU (Unalan), York (post-doc to-be-hired), for an equivalent of five FTE's. In addition, Bagby (FNAL), Edmunds & Laurens (MSU) are also available. The SC-IPC therefore considers that the number of committed physicists at this time for technical commissioning is adequate.

For physics commissioning, the above mentioned physicists will still be available, except for Fantasia and the York post-doc. Bagby will be available at 70%. So overall the SC-IPC estimates that five FTEs are available, which results in a deficit of 3FTEs for physics commissioning.

We remind the collaboration that we believe having a core group of dedicated post-docs or experienced graduate students is crucial to get a complex system like the L1Cal trigger commissioned with minimum downtime. We believe that experienced faculty will be available for assistance & consulting but we do not count them as contributing to the intensive daily work at DAB during the period, unless they have been relieved from teaching duties.

Table 1 shows that the number of physicists identified for the L1CalTrig installation and commissioning has increased substantially compared to the second report. We note that additional physicists must be identified for the physics commissioning phase beyond week 15, and that the availability of long-term experts beyond the installation and commissioning phase is still unresolved. We remind the collaboration that physics commissioning will take place when the accelerator is running. It is therefore crucial that available physicists are identified soon to avoid increasing the luminosity cost to the project.




| Task Name | Wk 1 | Wk 2 | Wk 3 | Wk 4 | Wk 5 | Wk 6 | Wk 7 | Wk 8 | Wk 9 | Wk 10 | Wk 11 | Wk 12 | Wk 13 | Wk 14 | Wk 15 | Wk 16 | Wk 17 | Wk 18 | Wk 19 | Wk 20 | Wk 21 | Wk 22 | Wk 23 | Wk 24 | Total MW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tevatron Shutdown for Layer Zero Installation Oct 3 -- Jan 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Install Hardware | | | | | | | | | | | | | | | | | | | | | | | | | |
| Disconnect BLS Cables | | | | | | | | | | | | | | | | | | | | | | | | | |
| Depopulate & Remove MCH Trigger Crates | | | | | | | | | | | | | | | | | | | | | | | | | |
| Install Rack Infrastructure in MCH Racks | | | | | | | | | | | | | | | | | | | | | | | | | |
| Install Patch Panels, Reconnect BLS Cables | | | | | | | | | | | | | | | | | | | | | | | | | |
| Install ADF, TAB/GAB, Readout Crates | | | | | | | | | | | | | | | | | | | | | | | | | |
| Connect Pleated Foil Cables | | | | | | | | | | | | | | | | | | | | | | | | | |
| Connect ADT--TAB/AB Cables; TFW Cables | | | | | | | | | | | | | | | | | | | | | | | | | |
| L1 Cal Trig Hardware Installed Nov 22 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Technical Commissioning Nov 23 -- Jan 17 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operate full System | | | | | | | | | | | | | | | | | | | | | | | | | |
| Verify Cabling | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check L1, L2, L3 data | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calibrate Trigger Towers (TT) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compare TT and Precision Readout | | | | | | | | | | | | | | | | | | | | | | | | | |
| Develop final ADF Coefficients | | | | | | | | | | | | | | | | | | | | | | | | | |
| Study Debug Triggers | | | | | | | | | | | | | | | | | | | | | | | | | |
| Technical Commissioning Complete | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physics Commissioning Jan 17 -- Mar 19 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Tune of ADF Coefficients for TT Response | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Checks of Certification of L1 Cal Trigger | | | | | | | | | | | | | | | | | | | | | | | | | |
| Noise Studies | | | | | | | | | | | | | | | | | | | | | | | | | |
| Verify Trigger Rates, Efficiencies,Purities | | | | | | | | | | | | | | | | | | | | | | | | | |
| L1 Cal Trig Ready for High Luminosity Physics | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physicists Required | 5 | 5 | 5 | 0 | 0 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 145 |
| Physicists Committed | 5 | 5 | 5 | 0 | 0 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 118 |
| Deficit/Excess | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -27 |

**Table 1. L1CalTrig Installation to Physics Timeline & Effort Summary**

## 2.2 Working Group 2: L1CalTrack & L1CTT

Table 2 presents the timeline and effort summary required to take the L1CTT and L1CalTrack from the beginning of installation to the point that they are fully operational in high luminosity physics data-taking.

We identify Grünendahl (FNAL), Khalatyan (BU), and a yet-to-be-hired Notre Dame post doc as three full-time commitments to the CTT effort, plus a total of approximately two FTE's from the Arizona group (consisting of four physicists each able to contribute part-time) to the L1CalTrack effort. In addition, several people are available either part time or off-site for the CTT effort (Tomoto, Hensel, Han, Wu), which we count as two additional FTE's for selected weeks during the schedule. Note a new task has been added to the L1CalTrack & L1CTT schedule, namely, the muon PDT modifications. This new task requires two FTE's for weeks 1-4 and 15-19, with two FTEs from Fermilab identified: Kasper, Gutierrez, Ito.

As Table 2 shows, the number of physicists identified for the L1CTT and L1CalTrk installation and commissioning is most likely adequate. Nevertheless, the availability of long-term experts beyond the installation and commissioning phase is still unresolved.

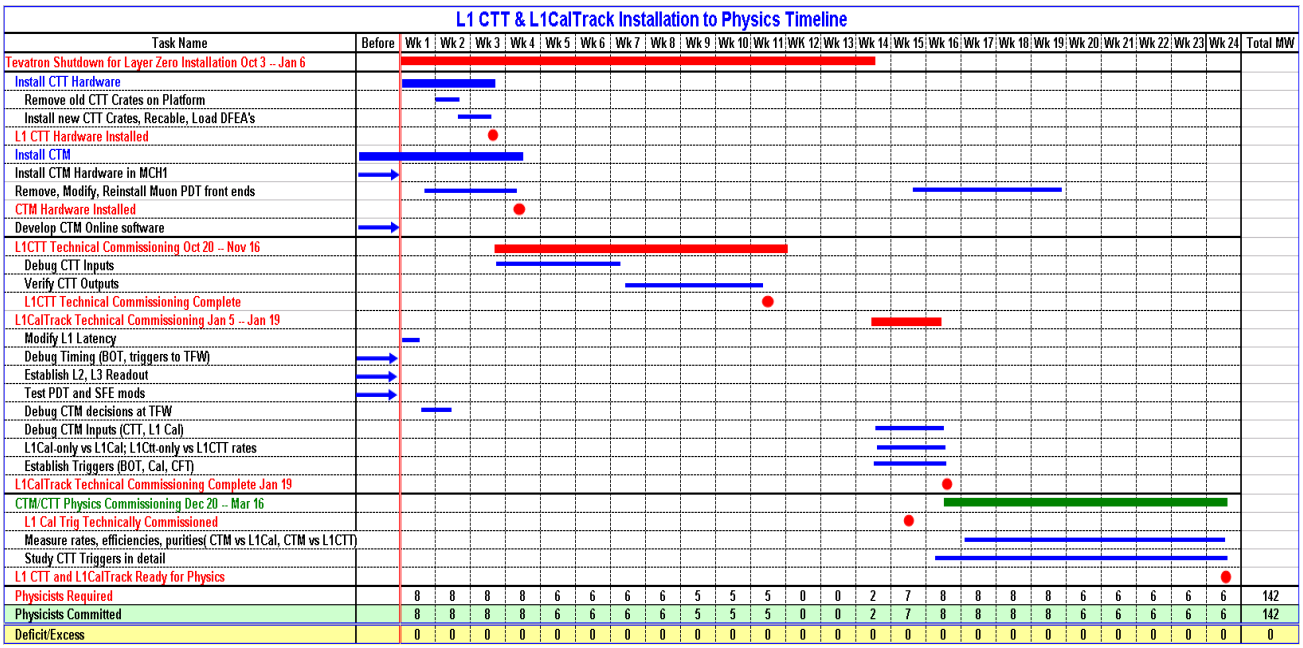



**Table 2. L1CTT & L1CalTrack Installation to Physics Timeline & Effort Summary**

## 2.3 Working Group 3: L2 βeta Upgrade & STT

Table 3 presents the timeline and effort summary required to take the L2 βeta and STT from the beginning of installation to the point that they are fully operational in high luminosity physics data-taking.

We believe the number of physicists identified for the L2 βeta installation and commissioning is most likely adequate, with two FTEs from Virgina (Kreymadhi & Hirosky) contributing to the installation and technical commissioning, and two FTE's total from Virginia (Kreymadhi) and Alberta (Chan, post-doc hiring almost complete, Moore) contributing to the physics commissioning.

We believe that additional effort will be needed for the L2 STT element. Currently, two FTE's total from Stony Brook (Zhu, Herner) and Columbia (Kathidze) have been identified for the technical commissioning and physics commissioning, which leads to the need for one additional physicist for the technical commissioning of the STT system.

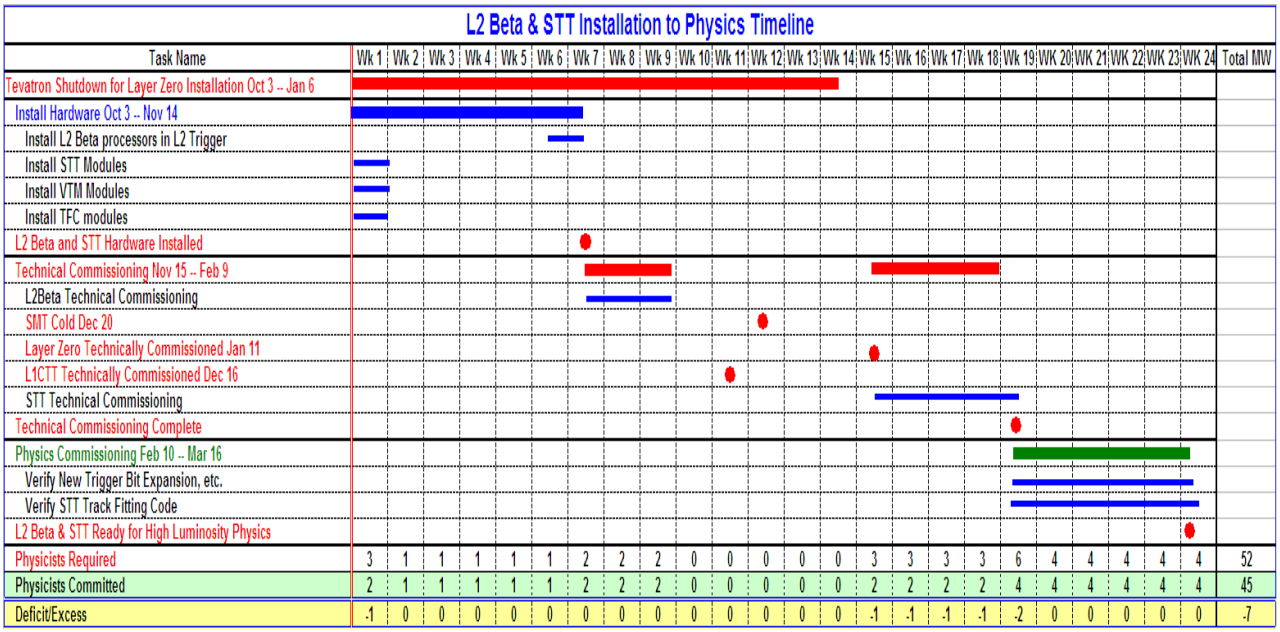



**Table 3. L2 βeta and STT Installation to Physics Timeline & Effort Summary**

## 2.4 Working Group 4: Trigsim

The SC-IPC endorses the recent action of the Spokespersons to create a trigger studies group, which among other activities, is contributing to the ongoing upgrade project trigger simulation effort. Given the recent reorganization, and the fact that most of the activities are being carried out in preparation for the 2005 shutdown and are therefore not specific to the installation period itself, we have excluded the Trigsim effort from the current report and corresponding Summary Table.

## 2.5 Working Group 5: Layer Zero Silicon

Table 4 presents the timeline and effort summary for the installation and commissioning of the silicon. We understand that sufficient expert physicists are available for the hardware installation. We find that eight FTE's are needed for the technical commissioning to demonstrate the operability of all channels (a total of three weeks are allowed for this work), with eight FTE's currently identified: FNAL (Hanagaki, Lipton, Weber), Stony Brook (Tsybychev, Guo), Northwestern (Strom, Youn), KSU (Harder), FSU (Kau), RUN (Kirby). Another two weeks of technical commissioning, including software functionality (examine and L3), require eight FTE's, with eight FTEs identified: FNAL (Hanagaki, Lipton, Weber), Stony Brook (Tsybychev, Guo), Northwestern (Strom, Buchholz), FSU (Kau), RUN (Kirby), KSU (Harder-examine), Imperial (Vint with help from Pettini/Bueselink-L3). These tasks require skilled, dedicated labor, to shake down the Layer Zero before the detector is closed and Layer Zero becomes inaccessible. Former SMT experts have indicated that they are available as a backup: Rapidis, Kajfasz and Quinn. In addition, Kirby is identified as a backup. The SC-IPC believes he will be spending most of his time on the SMT. SC-IPC evaluates that the committed physicists to the Layer Zero Silicon installation and technical commissioning is adequate.

The physics commissioning effort takes place with the detector closed. It requires 4FTEs for timing studies, with four FTE's identified: SUNY (Tsybychev, Guo), FNAL (Burdin, Weber); additional four FTE's for noise studies, with four FTE's identified: FNAL (Hanagaki, Weber), SUNY (Tsybychev, Guo), NW (Strom), FSU (Kau). (There is only one week overlap between these two tasks.)

Following the timing and noise studies, two FTE's each are required for alignment, clustering, tracking and physics objects. So far, one FTE has been identified for alignment from Lancaster (Sopczak), but only for the period October-January, pending available funding. Note that the alignment task starts in week 16, which corresponds to mid-January in the current schedule. This leads to a deficit of two FTE's for alignment starting in week 16. Two FTE's have been identified for each of the remaining software tasks. For clustering, FNAL (Fu, Burdin); for tracking, FNAL (Khanov), LU (Borisov), UMiss (Melnitchouk); for physics objects, (UMiss) Melnitchouk, FNAL (Burdin), UIC (Ten).

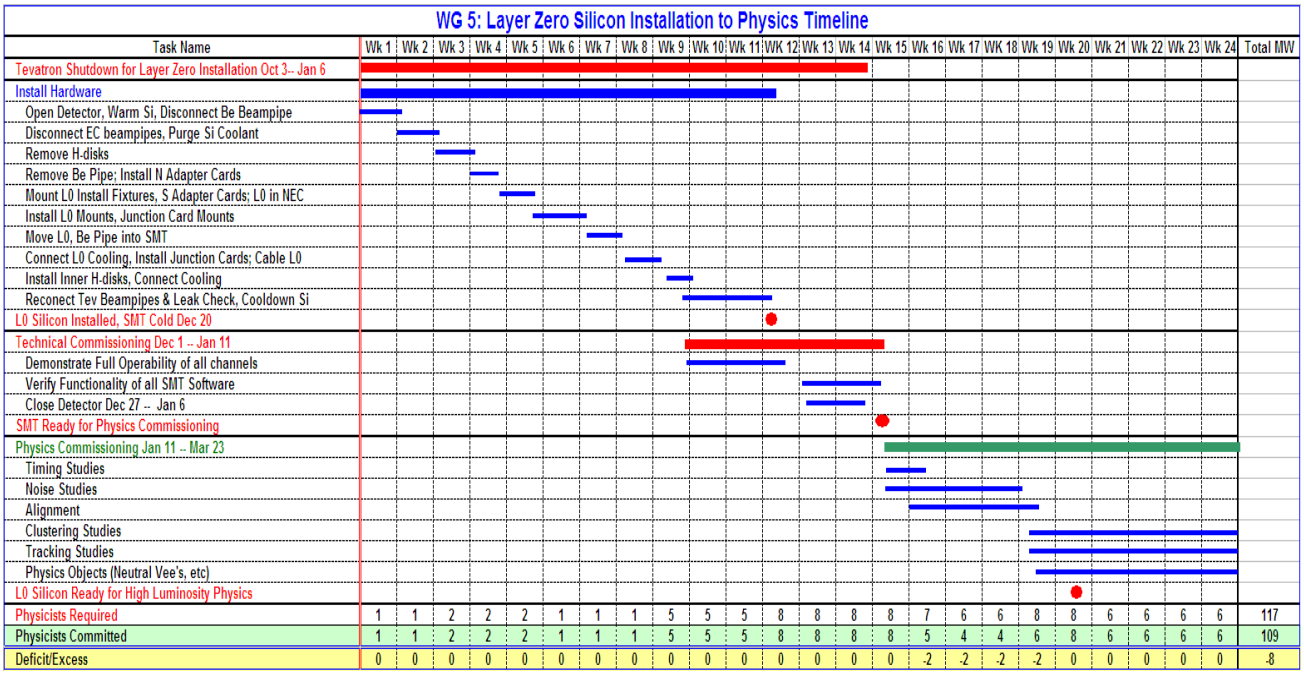



**Table 4. Layer Zero Silicon Installation to Physics Timeline & Effort Summary**

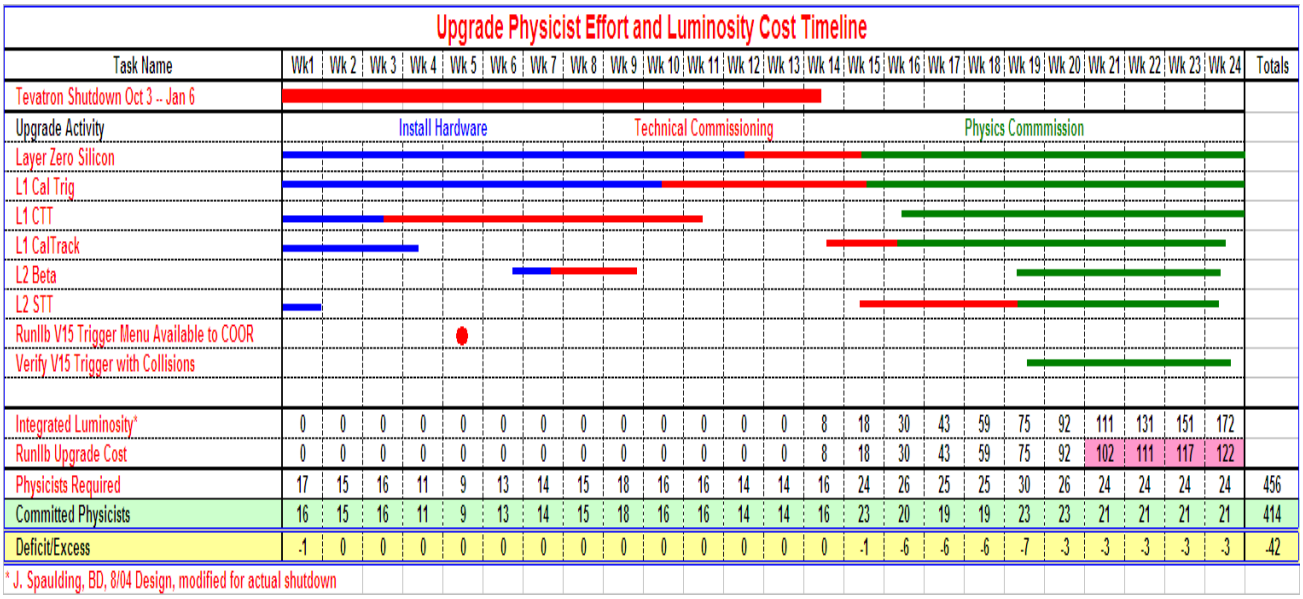
## 2.6 Summary

Table 5 summarizes the effort requirements summed for all of the upgrades. On average the additional number of physicists needed is slightly less than two FTE's for the duration of the installation/commissioning period.

Note that even though the overall *average* number of additional FTE's needed is modest, the number of additional FTE's needed averages five for the final nine weeks of the period. It appears to peak at 6-7 for four of these weeks. In week 19 it appears that 30 physicists are required. This is a daunting number and is likely inflated slightly by the one-week binning used in the Microsoft Project Schedule that underlies the table, and the substantial overlap of many tasks that just happen to take place that week. Likely a closer look at the schedule would show that on any one day only ~ 25-26 persons are actually engaged in the commissioning activities taking place during that week.

Taking into account additional factors, like the lack of contingency included in the timeline of the schedule shown in Table 5, and the fact that experts in one system will most likely not be able to assist with work on another upgrade system due to the diverse areas of expertise involved, the SC-IPC considers that a more

conservative estimate for the average number of additional physicists needed during the shutdown is at least four FTEs peaking at as many as 10 FTE's.




| Task Name | Wk1 | Wk 2 | Wk 3 | Wk 4 | Wk 5 | Wk 6 | Wk 7 | Wk 8 | Wk 9 | Wk 10 | Wk 11 | Wk 12 | Wk 13 | Wk 14 | Wk 15 | Wk 16 | Wk 17 | Wk 18 | Wk 19 | Wk 20 | Wk 21 | Wk 22 | Wk 23 | Wk 24 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tevatron Shutdown Oct 3 -- Jan 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upgrade Activity | | | | | | | | | | | | | | | | | | | | | | | | | |
| Layer Zero Silicon | | | | | | | | | | | | | | | | | | | | | | | | | |
| L1 Cal Trig | | | | | | | | | | | | | | | | | | | | | | | | | |
| L1 CTT | | | | | | | | | | | | | | | | | | | | | | | | | |
| L1 CalTrack | | | | | | | | | | | | | | | | | | | | | | | | | |
| L2 Beta | | | | | | | | | | | | | | | | | | | | | | | | | |
| L2 STT | | | | | | | | | | | | | | | | | | | | | | | | | |
| RunIIb V15 Trigger Menu Available to COOR | | | | | | | | | | | | | | | | | | | | | | | | | |
| Verify V15 Trigger with Collisions | | | | | | | | | | | | | | | | | | | | | | | | | |
| Integrated Luminosity* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 18 | 30 | 43 | 59 | 75 | 92 | 111 | 131 | 151 | 172 | |
| RunIIb Upgrade Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 18 | 30 | 43 | 59 | 75 | 92 | 102 | 111 | 117 | 122 | |
| Physicists Required | 17 | 15 | 16 | 11 | 9 | 13 | 14 | 15 | 18 | 16 | 16 | 14 | 14 | 16 | 24 | 26 | 25 | 25 | 30 | 26 | 24 | 24 | 24 | 24 | 456 |
| Committed Physicists | 16 | 15 | 16 | 11 | 9 | 13 | 14 | 15 | 18 | 16 | 16 | 14 | 14 | 16 | 23 | 20 | 19 | 19 | 23 | 23 | 21 | 21 | 21 | 21 | 414 |
| Deficit/Excess | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -6 | -6 | -6 | -7 | -3 | -3 | -3 | -3 | -3 | -42 |

* J. Spaulding, BD, 8/04 Design, modified for actual shutdown

**Table 5. Installation to Physics Timeline & Effort Summary**

Table 5 also shows the integrated luminosity cost ($pb^{-1}$) of the upgrade given that the physics-to-physics duration is forseen as 24 weeks. The total delivered luminosity during this period is 172 $pb^{-1}$, but we assume that during the penultimate two weeks of the period 50% or fewer special runs are required to complete physics commissioning, and during the final two weeks only 25% of the data is not of physics quality. While the cost (122 inverse picobarns) is large by historic standards (it exceeds that of all of Run 1), it is only 11% of that expected to be delivered during the 2006 year (1113 $pb^{-1}$) and SC-IPC remains convinced the overall cost to the experiment will be higher if this expenditure is not made as planned.

## 3.0 SC-IPC Recommendations

The SC-IPC believes that the collaboration has made significant progress towards the identification of available physicists to ensure that appropriate expertise is in place to allow for the timely return of the detector to high-luminosity physics data-taking. In addition, the collaboration has identified significant new management resources (e.g. L0 software leadership, Trigger software development leadership, L1 Cal Precommissioning leadership, and V15 trigger leadership). It must continue to exploit these resources to recruit the remaining needed physicist effort now that will underpin the success of the RunIIb Upgrades.

*In spite of the substantial recruitment progress detailed in the proceeding sections of this report, additional physicists must be identified. These needs can be summarized as follows:*

1. *L1 Cal Physics Commissioning (weeks 16 to 24), needs three FTE's*
2. *L2 STT Installation (week 1) and Technical Commissioning (weeks 15 to 19), needs one FTE*
3. *Layer Zero alignment (weeks 16 to 19), needs two FTE's*

Each institution must be encouraged to contribute towards the new talent required and each contributor should make every effort to involve those who can become the knowledgeable experts of the future in the operation of the detector.

In the Second Report the SC-IPC recommended that the collaboration schedule installation readiness assessments for each of the upgrade elements, to ensure that the optimum time is chosen for the installation shutdown and not a moment of it is wasted. *The SC-IPC understands that the Upgrade schedule now includes time before the shutdown for these assessments and it continues to believe that these efforts will contribute effectively to the success of the installation and commissioning.*

*The SC-IPC also recommends that each of the upgrade elements, including the V15 trigger, be assigned a commissioning coordinator or coordinators (the L1 Cal team already has such persons identified) who are charged with ensuring that all activities of technical and physics commissioning are planned and carried out in an optimum manner. These individuals can focus now on the planning and manpower issues identified by the SC-IPC in this Updated Report, and then as the shutdown nears can ensure that all personnel intend to be in residence at Fermilab as required during the shutdown. They will also interact with the Upgrade and Installation managers to ensure that the overall Installation Plan is optimal.*

*Expanding on this recommendation, the SC-IPC believes that these commissioning coordinators, plus a representative from the trigger group (perhaps taken from the Trigger Studies Group that is embedded in the new V15 Task Force), begin regular meetings to develop a run plan for the commissioning period. This run plan will define and schedule the required special runs each hardware team forsees, and it will take care to ensure that the requirements of each team and its anticipated readiness for special runs is compatible with the planned activities of the other groups. The run plan will also accommodate the activities of the muon group which is implementing the pipeline depth changes during the shutdown, and it will accommodate repair of detector components that is scheduled during the shutdown. Finally, the run plan will choose the optimum point to effect the RunIIb timing change and the introduction of the full V15 trigger list. It is understood by all that the run plan thus developed will be a general blueprint for the success of the commissioning effort. It is not an inflexible daily schedule of activities assumed in advance to take place in the control room during the period. The actual flow of commissioning taking place daily in the control room, guided as it will be by the general blueprint of the run plan, must inevitably react daily and even hourly to instantaneous conditions in the control room.*