Cost Update, STAR-TOFp Implementation

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Abstract

This document updates the cost sections of the TOFp Implementation Plan.

In this update[1] to the TOFp Implementation plan of Oct. 5, 1999,[2] the cost estimates based on the latest quotes and the final design are discussed. These are summarized in Table 1. The contingencies assumed are shown between the parentheses in this table. The meaning of the numbers in parentheses for the quantity and cost columns differ, as now described. In the quantity column, the notation, *e.g.*, "45(4)" means that 45 slats are to be purchased, and of these 45, four are extras as a "unit contingency." For the corresponding cost column, the cost listed is the unit cost ($98.50) times 45, scaled upwards by the "cost contingency" shown in the parentheses, *i.e.* 45*98.50*1.1 = $4875.75. If the cost is shown in italics, this is a contributed item and is not included in the final totals at the bottom of the table.

First some comments from the original implementation plan. No R&D remains. The costs listed are for the construction of the final pieces only. All "pre-production" costs have already been covered by the SysTest-I funding. The slat assembly construction, testing, and tray construction are all performed by physicists. The actual installation cost for 120 trays of STAR CTB was zero dollars, excluding physicists' hours. Thus, the installation cost of one (1) TOFp tray is also zero dollars. The TOFp installation will also be done entirely by physicists. The costs for the components for a pVPD detector are included in the table. As discussed elsewhere, and seconded by the TOFp Review II Committee, we feel it is not reasonable to implement a TOFp without a pVPD. No additional money is requested for the pVPD. Contributions from collaborating institutions will provide the scintillator, shields, cables, and simple clam-shell mounting pieces. All other pVPD components are obtained at no cost from previous experiments or from equipment pools such as HEEP. The work on more solid plans for the pVPD is still in progress.

Now described are the very recent developments impacting the total cost estimate. The possibility of purchasing all ∼45 PMTs via the Beijing/Wuhan connection to

[1] ftp://bonner-mac8.rice.edu/TOF/TOFp_Imp_CostUpdate.pdf.

[2] ftp://bonner-mac8.rice.edu/TOF/TOFp_Implementation.pdf.

Hamamatsu was considered. Also considered was the purchase of all PMTs in the US (either via BNL or Rice), using for 25 of these the funds from China. After considering all of these options, it was decided to transfer the Chinese funds for 25 PMTs to Rice University. Rice would then purchase these PMTs from Hamamatsu USA at a considerable savings considering the required tariffs for purchasing and importing. Furthermore, we have received approval (last week) from Rice's Office of Sponsored Research for the instantiation of a new account at Rice for STAR-TOFp equipment purchases that will not be charged overhead. This will save our Chinese collaborators approximately 15 k$ for the 25 PMTs they are donating. We expect to place this 25 PMT order from Rice to Hamamatsu USA in the next week or two, once the final paperwork is all in order and the money has been wired to Rice.

These PMT orders will include the specification of upper limits on both the RT ($\leq$2.5ns) and TTS ($\leq$500ps), which go beyond the standard gain specification used for the CTB of 1:10. The latest cost per R5946 with the additional timing specs and as of last week is $1,278 each.

The table includes and overhead (30%) for one item only, which is the FEE stuff and test. Our experience with FEE versions 1 through 5 is that it takes 6 hrs per channel to stuff and test, including 1 hrs of time contingency per channel. Thus, to stuff 45 channels requires 270 hrs, of which 45 are contingency. Assuming a rate of 25 $/hr and including the 30% overhead, the FEE fabrication thus costs 270*25*1.3 = $8775.00, as listed.

The "tray hardware" cost item is now based on a much more mature design of the tray interior, based in part on the ongoing mechanical development using the "fake TOFp." Also much more mature now is the design of the TOFp cooling loop and its interface to the STAR water systems. Agreement on the connections and required parts exists amongst TOFp and the TPC water contacts (B. Stringfellow and A. Lebedev).

Items that were neglected in the original costs tabulation due to insufficient information on the design have now been added to the table (specifically the thermocouple interface), as these areas have become fully defined since the Review II. The LV power supply, power distribution, and remote threshold control are also areas in which costs were neglected in the previous cost estimate. These areas are now fully defined. However, the costs for these has been covered by the Systest-I funding and we are already buying/building these pieces. The quotes and delivery time A.R.O. estimates for the other significant items in this table have also been double-checked.

Thus, when comparing the present version of the cost table to the previous one, there will be many changes, but none would probably be considered significant in itself. The original total cost estimate excluding contributions was **$65330**. The present cost estimate, again excluding contributions, but as described with both unit and cost contingency as well as overhead on one item, is **$73036**. At this point, it is difficult to imagine that this bottom line will change in the future by any significant amounts of any significance.

Table 1: The updated cost for the TOFp System, including contributions from collaborating institutions. The contingency assumed for certain items is shown between parentheses. The costs shown in italics are the costs of contributed items. Overhead is included for only one item, the FEE stuff/test. See the text for the details.

Item	Source	Quantity	Labor ($)	Equipment ($)
Tray Interior				
Tray hardware	Oaks Precision	1	0	1740(20%)
BC420 slats	Bicron	45(4)	0	3465(10%)
Foam/Glue/Wrapping	various		0	1250(25%)
R5946 PMTs†	Hamamatsu	25	0	*31950*
R5946 PMTs	Hamamatsu	20(4)	0	28116(10%)
FEE Boards	Rice v.5	12(2)		
Parts			0	5520(20%)
Stuff/Test§			8775(17%)	0
Cables				
RG-58/U Coax int.	Belden	80×20'	0	400(10%)
RG-58/U Coax ext.	Belden	80×250'	0	3960(10%)
Low voltage & buses	Newark	1	0	200(25%)
Connectors	Lemo & BNC	80*($9+$4+$2)	0	1320(10%)
HVSys				
Cells	Astakhov *et al.*	45(4)	0	4500(20%)
System Module‡	Astakhov *et al.*	1	0	2750(10%)
Platform				
Patch Panel	Rice	1	0	3000(20%)
CAMAC Crate	HEEP	1	0	0
NIM Bin & logic	HEEP	1	0	0
P/S 708 Disc	HEEP	6(2)	0	0
LRS ADC & TDC	HEEP	6(2) ea.	0	0
Trigger TCD Board	LBNL	1	0	4200(20%)
1992 Thermocouple Term. Panel	Kinetics	1	0	730
3514 Scanning A/D	Kinetics	1	0	3110(10%)
3922 Crate controller†	Kinetics	1	0	*5000*
2601 24bit I/O†	BiRa	1	0	*1000*
2306 CPU, 32MB†	Motorola	1	0	*3000*
Installation				
Shipping	Rice			500(25%)
pVPD				
Detectors††		18(2)	0	*4000*
Mounting‡‡		2	0	*1000*
RG-58/U Coaxial‡‡	Belden	40(4)	0	*1200*
FEE	HEEP (or Rice v.5)	18(2) ch	0	0
Totals			8775	111411
Total				120186
Total, excluding contributions				73036
Total per channel,¶ excluding contributions				1623

† Contribution from IOPP/CCNU *et al.*, Wuhan and Beijing, China.
†† Contribution from Kent State University, Kent, Ohio.
‡‡ Contribution from Rice University, Houston, Texas.
‡ One HVSys System Module (to be the backup) is already in hand.
§ 25$ per hour for FEE stuff/test was assumed, and a 30% overhead for technician labor was also included.
¶ 45 channels constructed was assumed, 41 of these are installed in the TOFp tray.