**MUSE Basis of Estimate**

**Scintillation Detector Construction WBS #**

I. General Information

Task Name: Construction of scintillation detectors

Unique ID Number

Date of Estimate: 12/19/2015

Estimate Generator: Steffen Strauch

Cost Category:

 M&S

XSWF

Comments:

Vendor Quote Number if Applicable:

Drawing Reference Number or Attachment:

Costing Method: estimate based on JLab FTOF experience for construction time

Total Task Cost: $237,684

Total Contingency: $33,276

II. Cost Estimate Breakdown

Cost of each element, along with justification

We request full support for one graduate student and half support for one postdoctoral scholar, with salaries of $24,000 and $22,000, respectively. The second half of the support for the postdoctoral scholar will be covered by the group’s regular NSF grant. During the construction phase graduate students will be critical to train undergraduates to perform manufacturing tasks, supervise the manufacturing process, perform quality control at the completion of each task, and analyze the data taken to evaluate the performance of the detector elements. During the construction phase, the funding will partially support several graduate students to work a portion of their time on this project. The postdoctoral fellow will be critical in supervising the graduate students during construction, in adapting the existing FToF12 data analysis soft- ware and database for the PSI-specific scintillators and setup geometry, for writing the step-by-step construction manual for the setup, and for developing the MUSE scintillation-detector calibration software.

Undergraduate Students Supervised USC undergraduate students will construct the MUSE scintillation detectors. The process includes the inspection and testing of the plastic scintillators, masking the ends of the scintillators with tape except for a circular window, gluing the PMTs to the ends of the bars, wrapping the bare counters with precision-cut aluminized Mylar and DuPont Tedlar foils, cosmic-ray testing of the counters, and securing the counters to its support structure. The work is done in batches of six scintillation bars at a time; 19 batches will be processed to complete the project; 11 batches in year one and 8 batches in year two. From our FToF12 experience we estimate that two students will work for 72-hours on one batch, on average. With a compensation of $12 per hour the total undergraduate manpower cost $32,832 in total over two years, not including the fringe benefits. We request $19,008 in year one and $13,824 in year two.

The University of South Carolina fringe benefits are 24.70% for our post doc. For the 50% support of our post doc we include also half of $858.08 and $11.72 per month for health and dental insurances. The fringe benefits are 0.65% of graduate and undergraduate students salaries when enrolled and regularly attending classes; the fringe benefits are 8.31% when not enrolled during summer. For this budget we assume that the main part of the construction will be done during the summer months and assume 8.31% for fringe benefits.

|  |  |  |
| --- | --- | --- |
| No of batches | 19 |  |
| Time/batch | 9 | days |
| Workers (UG students) | 2 |  |
|  | 8 | h/day |
| hourly compensation | $12 | 1/h |
| Total hours worked | 2736 | h |
| UG compensation | $32,832 |  |
| GS compensation | $48,000 |  |
| PD compensation | $44,000 |  |
| Fringe total | $28,023 |  |
| Indirect cost (46.5%) | $71,078 |  |
| GS Tuition | $13,751 |  |
| **Total** | **$237,684** |  |

III. Contingency and risk analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Technical | Design | Cost | Schedule | Contingency |
| Personnel for construction | 2 | 0 | 4 | 6 | 14% |

IV. Time Estimates and contingency on time

Time estimate is (optimistic+pessimistic+4\*most-likely)/6.

Sigma is (pessimistic-optimistic)/6.

Be sure to indicate if work days or calendar days.



Comments: No estimate yet.

