Response to the Recommendations #1, #2, and #8 of Hall D KLF Experiment Phase 1 ERR

PAC-approved experiment E12-19-001, also known as K-Long Facility or KLF, which is planned to be performed in Hall D, underwent a Phase 1 Experimental Readiness Review by the Physics Division of Jefferson Lab on August 2nd, 2023. The final report of the Review Committee contained eight recommendations, three of which requested responses by the end of September 2023. In this document we provide our answers to the three recommendations from the review that were due at the end of September of 2023.

1. Complete a bottom-up cost estimate (30% accuracy) and deliver to Physics Division management by the end of September 2023 – prior to awarding any major procurements.

   Response:

   - As was requested by the review committee, we updated our quotes for the cost estimates for the KLF project. The table with the estimates for main items required for KLF is attached below. The estimated material cost for CPS increased from $973K to $1,178K, while the material cost for KPT went from $231K to $279K. In addition, we estimated that we will spend approximately $752K to purchase external labor that cannot be performed by Hall D and target group staff. When assessing the amount of labor that will be procured versus what Hall D staff will provide, we assumed that all designer work will be performed by the designers borrowed from other departments of the laboratory, while one half of the engineering cost estimate will be spent to pay for an engineer from

another department, and one third of the expected technician labor will be borrowed from other groups.

- The overall project cost estimate for KLF is $2,478K (see the table below) with an overall contingency of approximately 30%. If such a contingency is all utilized, the KLF cost would be $3,226K. We also attached three Excel spreadsheet files with more details that went into these estimates.
    - The CPS cost estimates are based on our preliminary estimate of the material and work based on the current CPS model that is being studied. The cost was estimated based on the quotes as well as estimates from previous experience. We assigned a 25% uncertainty to these projections.
    - The KPT estimate was made based on the existing engineering model and quotes from potential vendors. We assigned a 20% uncertainty to these assessments.
    - The KFM cost estimate has a large uncertainty as we still do not know the exact scope of installations. It is still not known whether the option with an MRI magnet will be chosen, which may result in a significant cost increase of KFM installations. Therefore, we assigned 100% uncertainty to our cost estimates for KFM.
    - The cryo-target and beamline estimates are based on a rough assessment of the material and labor that would be required for KLF. We assigned 50% uncertainties to these cost estimates.

Component	Material Cost ($M)	External labor costs ($M)	Total cost ($M)
CPS	$1.178	$0.636	$1.813
KPT	$0.279	$0.099	$0.378
KFM	$0.150		$0.150
Beamline	$0.100	$0.017	$0.117
Target	$0.020	$0.000	$0.020
Totals	$1.726	$0.752	$2.478
Totals + Contingency	$2.286	$0.939	$3.226

2. Work with lab management, including RadCon, to document requirements for decommissioning and disposal of the KLF apparatus and incorporate this information to develop designs that are compatible with required timelines for removal and disposal of equipment. Make all efforts to obtain this guidance from lab management by the end of September 2023.

   Response:

   - We discussed the decommissioning plans for the KLF related equipment with the lab management, in particular with the radiation control group leadership. Since currently there are plans by some members of the Jefferson Lab user community to submit Letters of Intent and Proposals for experiments that would use the KLF beamline, our plan is to move CPS and KPT to the side such that the GlueX photon beamline can be fully restored. CPS and KLF will be removed at the end of the Hall D program when other activated equipment of the hall, such as beam dumps, will be decommissioned. To that end, we will design CPS and KPT in such a way that would allow us to remove the external shielding during decommissioning and to leave a “core” that could be removed as a single unit with a fork-lift or a crane. While the residual dose rates inside the “core” will be too high to disassemble it, the residual dose rates at the outer boundaries of the “core” will allow us to handle it during decommissioning. In the case of CPS, based on FLUKA simulations, we estimated that such a “core” can weigh less than ten metric tons, and it can be carried out of the tagger hall on a forklift. The KPT “core” can weigh up to twenty tons, and most likely the whole device can be considered as such a “core,” and it will be rolled out of the collimator cave on a rail system onto the upstream platform and craned into a flat-bed truck. The

conceptual and engineering designs of CPS and KPT will be modified according to this plan.

8. Within 2 months, assign a dedicated scientist or team to assess radiation tolerance of equipment, in the tagger hall in particular, and assess if any components will need to be shielded or potentially replaced to restore GlueX.

   Response:

   - As was recommended by the Review Committee, KLF Collaboration identified a dedicated scientist who will assess all equipment in the tagger hall and in the collimator cave to make sure that they are properly shielded during KLF experiment. Vitaly Baturin, a research scientist from Old Dominion University, volunteered to perform this task.