Addendum to

Heavy Photon Search Experiment at Jefferson Laboratory: proposal for 2014-2015 run

HPS Collaboration

June 21, 2013

Background

The Heavy Photon Search Experiment at Jefferson Laboratory has been designed and scheduled around an opportunity to run in Hall B at Jefferson Laboratory beginning in Fall 2014 and extending into Spring 2015. JLAB and Hall B management called this opportunity to the attention of the HPS Collaboration at their meeting in September, 2012. In response, in order to take advantage of this opportunity, HPS has modified its original design into one which can be implemented in time to be installed in September, 2014. This new design is the basis for the HPS proposal to DOE HEP which was submitted May 10, 2013.

While this scheduling opportunity has looked feasible since last September, it has only recently become official after the successful CEBAF12 Re-Baselining Review conducted by DOE NP at JLAB in early May. The results of this review were not available to HPS at the time of its proposal submission, but they have been discussed with HPS in detail since that time. On the basis of the new schedule, JLAB management is at last in the position to provide HPS a definite plan for when running could occur. In fact, JLAB management has explored several options for HPS running, and summarized them in the HPS Implementation Plan document which has been reviewed and accepted by DOE NP. A draft of the plan is attached below as Appendix I. It has been critical for JLAB to assure DOE NP that any beam delivery to experiments before the official completion of the 12 GeV Project not in any way compromise the schedule and budget goals of the Project. At the same time, JLAB has been eager to try to accommodate early HPS running, understanding that HPS can be ready to take advantage of the scheduling opportunity mentioned above if funded by DOE HEP in early FY2014. HPS is motivated to do so for many reasons, including staking claim to much of the heavy photon parameter space before other experiments, providing graduate students theses in a timely way, and the fundamental desire to begin the search for heavy photons with HPS as soon as possible. As shown in the implementation plan, one of the options considered by JLAB management does allow HPS running in the 2014-2015 time frame without interfering with 12 GeV Project goals or schedules. This option provides for HPS running in 2014 and 2015 as we had assumed in preparing our proposal.

HPS of course wants to adopt this option. It involves setting up the experiment downstream of where the CLAS 12 experiment will eventually reside, in the Hall B Alcove, instead of the position described in the proposal, which is upstream of the CLAS 12 experiment. By putting the experiment downstream of CLAS 12, it will be possible to run beam to HPS during the general construction periods required to assemble the large CLAS 12 superconducting torroid magnet without any fear of delaying the assembly process because of radiation around the coils. Running beam in the (present) upstream location in not compatible with torroid installation, because the electron beam would scatter in the HPS target and produce many secondaries, and both processes would activate the downstream beampipe and the torroid coils close to it. This would require delays in the construction for radiation monitoring and cooldown, so presents a very real risk to the CLAS 12 installation schedule that JLAB is unwilling to take. Of course beam running and torroid construction cannot occur simultaneously even in the downstream location, but they are compatible if beams are run evenings and weekends and at other times that active construction is not ongoing. In the downstream location, if there are delays or open periods in the torroid construction schedule, HPS can make good use of them. When it comes time to test the new superconducting coils, pump them down and cold test them, it will be possible to conduct such tests at the same time beam is being delivered to HPS, since the torroid testing can be done remotely, immediate access is not required, and the process takes many week. Adopting the downstream option is therefore essential to getting beams to HPS in 2014 and 2015, and is in fact the option preferred both by HPS and the JLAB management.

Budget Implications

Moving HPS to the Alcove location will have budget implications for the experiment. The major changes required include building new stands to support the chicane and analyzing magnets and allow for the analyzing magnet to be movable transversely, so it can move out of the beamline when CLAS 12 is eventually in operation. The magnet power supply for the analyzing magnet must be moved closer to the alcove so that power cables will reach. New quadrupoles and corrector magnets and diagnostics must be established upstream of the alcove for beam tuning and monitoring. These changes, including M&S, engineering, and manpower, will add $319k to the HPS budget, including overheads and contingencies. This expense is somewhat offset by some savings that will accrue by not using the present upstream location which eliminates the needs for the shielding wall and photon dump, the second Frascati vacuum chamber, and general beam line transport from the second Frascati to the Hall B beam dump. These savings total $74k, so the net change in the beamline budget is $245k. The total cost for HPS has increased from $2972k to $3217k because of these changes.

The HPS WBS and schedule have been updated with these changes. The new WBS for the beamline is attached below as Appendix II. As can be seen in the WBS, the new expenses have been categorized as “infrastructure.” The new platform additions in the Hall B alcove are usable in the future for other experiments which will use the Pair Spectrometer 18D36 magnet which HPS utilizes as its analyzing magnet. In fact, experiments have utilized this magnet in the past, and in its new location it is still valuable as a photon beam energy monitor. It will become part of the Hall B “tool kit”, and can be used once the HPS apparatus is removed from the magnet vacuum chamber, which only requires a day or two of work. Since the magnet is useful in this new location, it follows that it is justified to classify the expenses of moving the magnet power supply to the alcove as “infrastructure” as well. Finally, two girders with quadrupoles, corrector magnets, and diagnostics must be installed upstream of the HPS chicane to provide the small spot sizes and good beam stability required by the experiment. The CLAS 12 experiment will very likely make use of the upstream girder for its running. The CEBAF accelerator has a store of such girders, which it uses as spares for components in key locations. Using the CEBAF girders for HPS depletes the supply of spares, so HPS has been asked to provide replacements. It is clear, however, that this apparatus is of general utility now and in the future for CEBAF operations, and is therefore “infrastructure” as well.

HPS Implementation Plan

June 2013

The Heavy Photon Search (HPS) experiment is proposed for Hall B at CEBAF. The proposal is presently classified as Conditionally Approved (C1) based upon the recommendation of the Jefferson Lab Program Advisory Committee (PAC). Performance of the Silicon Trackers close to the electron beam was the primary concern. During the Hall B running in spring 2012, the HPS collaboration fielded a test setup that received photon beam but not electron beam. However, the collaboration believes that the data they acquired validated their simulations and addressed the concerns of the PAC.

HPS has submitted a new proposal to DOE-HEP to complete the construction of the experiment, primarily with FY14 funds ($1.8M total capital equipment). DOE-HEP has scheduled a review on July 11, 2013. The collaboration is proposing to complete the construction during FY14 and install in time for an engineering run in FY15, during Accelerator Periods III and IV of the re-baselined 12 GeV CEBAF upgrade project (see Figure 1). Running would occur during evenings and weekends or during other periods when it would not conflict with the regularly scheduled assembly of the CLAS12 Torus coils. This “engineering run” would produce important physics data with substantial impact. These data would further expand the search for heavy photons to new regions of parameter space. The collaboration is planning additional production runs to complete their data set with this apparatus in FY16-17.

Jefferson Lab has developed a clear position regarding the implementation of this proposed running plan in advance of the DOE-HEP review in July. This document examines the feasibility of this proposed plan, particularly with respect to potential interactions with and/or impact on the 12 GeV upgrade project.

Impact on 12 GeV Upgrade

The 12 GeV upgrade project is absolutely central to the future of Jefferson Laboratory and its success is the highest priority for the Lab. Any planned delivery of electron beam before CD4b completion of the project must be consistent with the project plan as re-baselined during the spring/summer of 2013. It is the firm position of the Laboratory that any beam delivery to an experiment before CD4b must be compatible with the optimal execution of the re-baselined 12 GeV upgrade project.

The proposed delivery of beam to the HPS experiment must clearly be consistent with the Laboratory’s position regarding the 12 GeV project. This document aims to review the proposed installation and running of HPS in this context, and evaluate its impact.

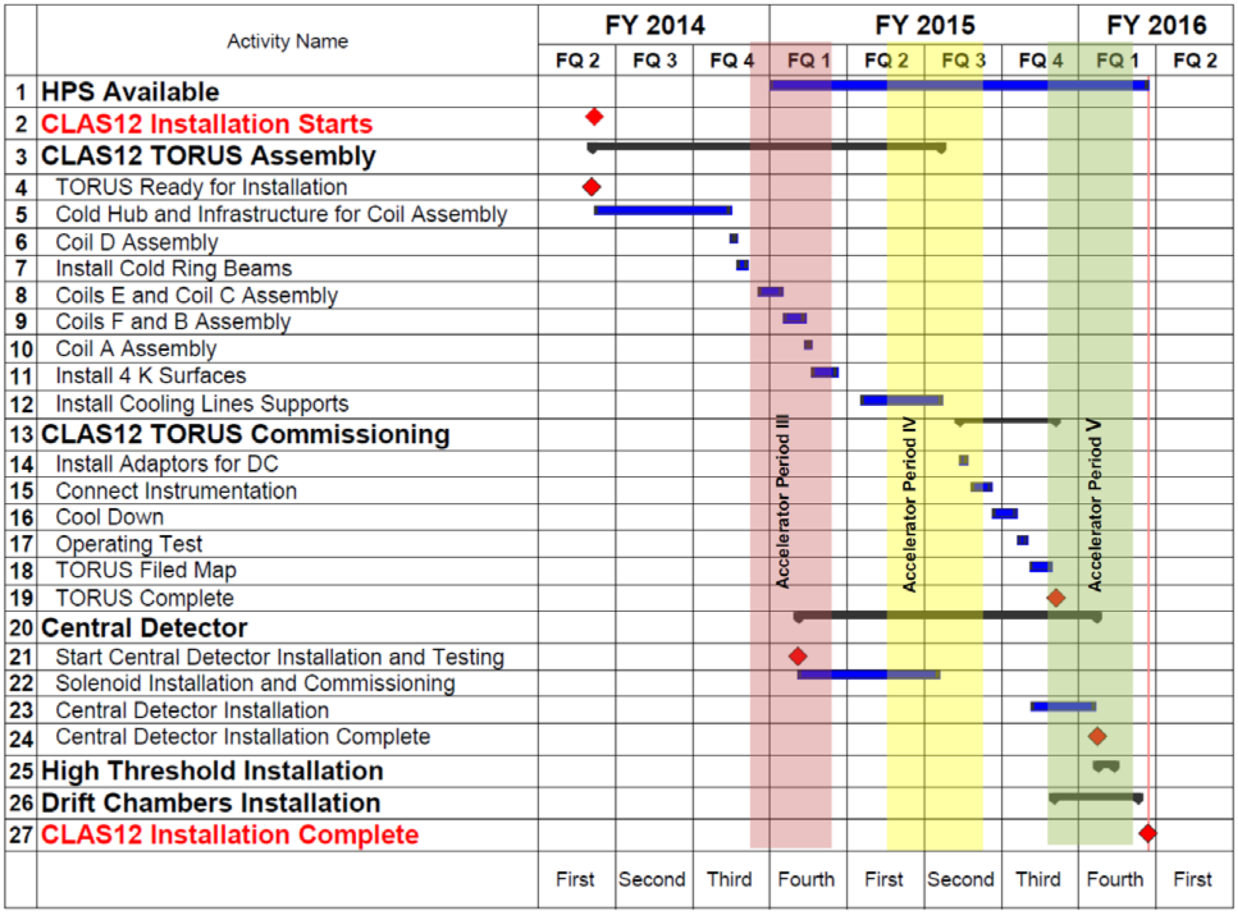

Figure 1. Overlap of the CLAS12 assembly and commissioning activities with the accelerator operations schedule.

FY15 Schedule

It is proposed to construct HPS to be ready for first beam in FY15. Figure 1 shows the present schedule (as per the re-baselined 12 GeV project) for beam delivery and Hall B. Beam delivery is scheduled for Halls A and D in two periods in FY15, as shown in Figure 1. It is anticipated that the accelerator system should also be capable of delivering good quality beam at 2.2 GeV to Hall B during these periods, although this is not presently planned due to activity to assemble and commission the CLAS12 Torus magnet in Hall B during this time.

CLAS12 Torus Schedule

The CLAS12 Torus assembly in Hall B is scheduled for much of FY14 and the first half of FY15 (Figure 1). During CLAS12 Torus assembly, it would be possible to commission the Hall B beamline. The Torus assembly plan involves Hall B access for 1 shift for 5 days per week during this period. Additional shifts or weekend work would be used as a contingency plan if needed to recover from schedule delays. Therefore, during Accelerator period III there would, in principle, be time available to run beam for beamline commissioning on nights and weekends.

The CLAS12 Torus Pump/Cool/Power test is presently scheduled for 6 weeks during Q3 and Q4 of FY15. This period starts with phase I: preparation of the commissioning of the CLAS12 Torus. This consists of testing the instrumentation, leak testing the helium circuit, and verifying the magnet protection circuit. During this phase access to the Hall is required. Next comes phase II: Pump down of the cryostat, which will take about 12 days from April 27, 2015 to May 8, 2015. During this period minimal access to the Hall is required for 12 GeV related work, so, in principle, it would be possible to deliver beam to HPS in Hall B on nights and weekends in Accelerator period IV without impacting Torus testing.

Phase III is the cool down of the magnet which is scheduled to start June 19, 2015 and be completed by July 17, 2015. During the cool down phase minimal access to the Hall is required, therefore HPS could run if the beam were available. However the present accelerator schedule does not include running during this period as shown in Figure 1, making HPS running unlikely at this time.

The final phase of the Torus commissioning consists of following the procedures to ramp up the Torus magnet to 3.77 KA, then ramping it down. Ramping tests will be followed by field mapping of the Torus.

The 12 GeV project team is considering the possibility of cold tests of the coils after fabrication and before delivery to Hall B for assembly. This may delay the start of the coil assembly in the Hall, and in that case there may be dedicated running possible in Hall B during Accelerator period III. However, it is premature to consider that possibility until a decision is made on the cold coil tests.

Note that the 12 GeV Upgrade Project schedule of activities as shown in Figure 1 represents the current rebaseline plan, and is subject to change as the work progresses. A re-evaluation of the interface between HPS activities and 12 GeV installation/pre-ops activities will be necessary following any 12 GeV Project schedule changes to ensure there is no interference from HPS.

Engineering Run (Installation and Operation)

Three options have been considered to satisfy the desire of the HPS collaboration to schedule its engineering run as soon as possible after they complete the construction of their apparatus. The layout of two Hall-B options is shown in Figure 2.

The first, “Hall B Upstream” involves siting the experiment upstream of CLAS12 in Hall B, where the equipment was located for the spring 2012 test run. (This was considered the default option, before 12 GeV rebaselining.)

The second option (“Hall B Downstream”) is to relocate the HPS experiment to the downstream alcove of Hall B. This would minimize the risk of activation of Torus assembly components during HPS running and could allow running HPS when Torus installation is not proceeding, like nights and weekends, without negative impact. If delays in the Torus assembly should occur, the commissioning and production runs could proceed without impeding the 12 GeV project. **This is now the preferred option**.

Another option considered (“Hall A”) was to relocate the experiment to Hall A to avoid any potential interference with Hall B installation. This involves additional costs and schedule issues.

Hall B Upstream Option

Considering only weekends, there will be more than 40 shifts available during Q1 of FY15 for the beam line commissioning. The beam line commissioning needs about 15 shifts and will use a low current beam, <10 nA, dumping it in the Hall-B photon tagger dump (dump in the floor at the upstream end of the Hall, ~10 meters upstream of the Torus location). This will ensure that the Torus assembly will not be irradiated. With the time available far exceeding the time needed for the beam line commissioning, there should be no impact on the 12 GeV upgrade work in the Hall. In any event, the 12 GeV work has ultimate priority and the beam commissioning work will be terminated if any interference would occur.

During Accelerator period IV, only 2 weeks of the requested 6 weeks for the engineering run would be possible.

This option, while allowing adequate time for beamline commissioning, only allows a third of the HPS engineering run and no production data could be acquired. There is also concern that activation of the Torus assembly components could occur when HPS is run in the Hall B Upstream location during the engineering run. Also, in this option HPS can no longer take data once the central CLAS12 detectors, in particular SVT, are installed, because of potential radiation damage to the silicon and electronics.

Hall B Downstream

The HPS apparatus could be installed before Q1 FY15, when the accelerator is scheduled for operation and coils are scheduled to be installed. Since installation of the three magnet chicane requires the forward carriage to be in its upstream position, this should be done before Q3 FY14 and the beginning of the Torus assembly. (If coil installation were delayed, there would be no conflict between running HPS and CLAS12 assembly; if it is on schedule, beamline commissioning could proceed on nights and weekends, without interfering with Torus assembly.) The detector commissioning with beams could also proceed without interfering if it were confined to evenings and weekends or other times not required for Torus assembly. This option has the additional advantage, from the perspective of the HPS experiment, of allowing production running to proceed in Q2-Q3 FY15, when the accelerator is again in operation. This would proceed along the same guidelines, eliminating interference with final Torus assembly and commissioning by running only on nights and weekends, or during schedule delays or other periods when no activities are planned for Hall B.

Activation of Torus components is extremely unlikely if HPS is moved to the downstream location because in this case pristine beam would be transported through the Torus assembly to the Hall B alcove and only then pass through a thin target, well downstream of the CLAS12 apparatus.

There are minor additional costs associated with this option. Based on the conceptual design and work evaluation conducted by the Hall-B engineering group, the total cost of the installation of the three magnet chicane in the alcove will be $61K for M&S, 6 MW of mechanical designer time, 2.4 MW of mechanical engineer time, and 6.5 MW of technician time. Additional beam line optics and diagnostics will cost $30K for M&S, 15 MW of mechanical designer, and 20 MW of mechanical technician time. These costs can be partially accommodated in the present HPS budget, which includes roughly $70k for beamline expenses that can be redirected to the alcove installation in their entirety (see Appendix). HPS, citing the new re-baselining schedule of the 12 GeV Upgrade project, will seek the minor additional expense by amending its present budget request from DOE HEP.

This is the preferred option for HPS.

Hall A

Relocating to Hall A offers the possibility to decouple HPS running completely from the 12 GeV upgrade project, and there is adequate and unobstructed space in the Hall for

HPS installation. However, there are additional costs and impacts that need to be considered for this option.

To install HPS in Hall-A, 2 meter-high stands must be constructed in addition to the support system required for the Hall-B downstream option. Also, new sets of cables for all magnets (assuming HPS can use existing power supplies in Hall-A) and optical links from the Hall-A to the Hall-B counting rooms will be needed.

One of the main challenges in running HPS in Hall-A will be beam tuning downstream of the standard target/pivot platform, similar to the challenge of running downstream in Hall B, and requiring low current beam delivery. It is critical to align the SVT planes on the beam at low beam currents, 5 nA to 10 nA, so damage to the silicon detectors can't occur. The Hall-A beamline is very well suited for high current running, >70 -100 nA, but for lower currents, the readout electronics on at least last five BPMs must be upgraded. Also, the beam cannot be tuned while it passes though the HPS detector system because damage could occur. Accordingly an insertable beam dump before HPS will therefore be needed. A tungsten calorimeter exists in the Hall A line which could be considered for this purpose, but might need additional cooling. To summarize, moving HPS to Hall-A will double the M&S costs and add 25% in manpower costs compared to the Hall B downstream option..

Another challenge for Hall-A option is to find a proper time to run HPS. The existing projected experimental schedule in Hall-A has experiments scheduled in 2014-2016.

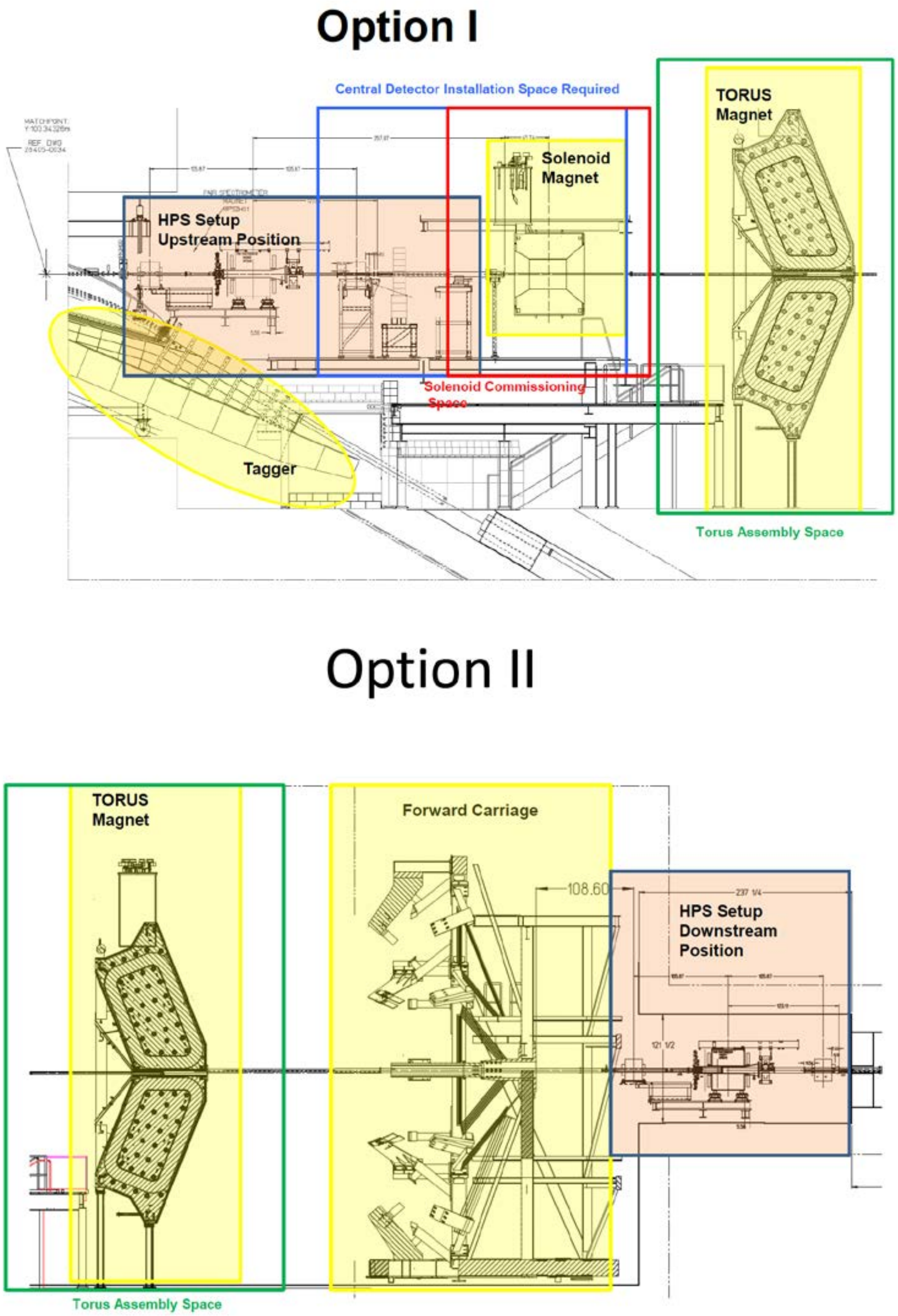

Figure 2. Two options for HPS in Hall-B (beam direction is left to right)

Table below summarizes the total cost of the relocating the HPS into the Hall-B downstream alcove. Based on a conceptual design of the deck for supporting the three-magnet chicane, see Figure 3. It includes also the cost of moving the pair spectrometer magnet power supply, labor necessary for the move, and the cost of beamline elements. This additional cost can partly be offset by the present HPS budget, which includes items that no longer will be needed. These items are related to the shielding, photon beam dump, and the beam line downstream of the HPS setup. In alcove location, downstream of the HPS setup is the beam dump, and no new shielding, or dump, and additional beam line are needed.

Item	M&S ($)	MD (MW)	ME (MW)	MT (MW)
Platform in alcove	41000	6	2.4	
Relocation				5
Magnet power	20000			1.5
Beamline controls	30000	15		20
WBS 1.1.7	-19,370			
WBS 1.1.10	-19,370			
WBS 1.1.11	-27,118	-2	-0.2	-2
Total	25142	19	2.2	24.5

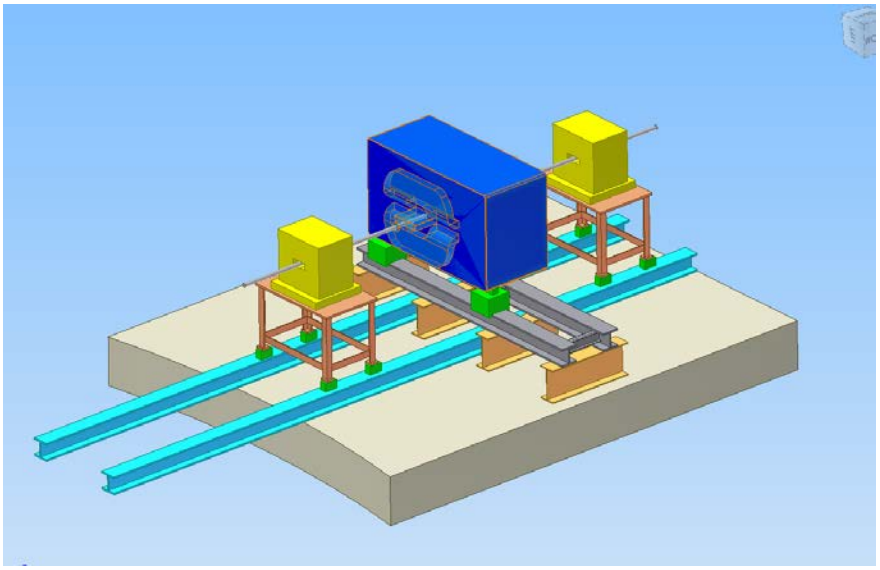

Figure 3. Conceptual design of the three-magnet chicane support system in the Hall-B downstream alcove.

Appendix II

WBS V500 Fri 6/21/13

ID	WBS	Task Name	Type	Labor	Ltotal	Material	Mtotal	Total	Spares	Prototypes	Total Operations	Total Infrastructures	Total Capital Equipments	D
1	**1**	1 HPS		$1,519,975.38	$1,960,167.89	$1,074,983.10	$1,257,308.48	$3,217,476.38	$77,915.31	$20,834.95	$927,517.86	$567,682.74	$1,722,275.78	C
2	**1.1**	1.1 Beamline		$219,204.04	$284,965.25	$141,210.00	$183,573.00	$468,538.25	$0.00	$0.00	$0.00	$325,366.24	$143,172.02	C
3	1.1.1	1.1.1 Beamline Design		$8,966.40	$11,656.32	$0.00	$0.00	$11,656.32	$0.00	$0.00	$0.00	$0.00	$11,656.32	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		MD Hall-B		*$8,966.40*	*$11,656.32*	*$0.00*	*$0.00*	*$11,656.32*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$11,656.32*	C
4	1.1.2	1.1.2 Beamline Review		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	C
5	1.1.3	1.1.3 Platform in the Alcove	INFRA	$43,539.52	$56,601.38	$41,000.00	$53,300.00	$109,901.38	$0.00	$0.00	$0.00	$109,901.38	$0.00	C
		Platform Alcove	*INFRA*	*$0.00*	*$0.00*	*$41,000.00*	*$53,300.00*	*$53,300.00*	*$0.00*	*$0.00*	*$0.00*	*$53,300.00*	*$0.00*	C
		MD Hall-B	*INFRA*	*$17,932.80*	*$23,312.64*	*$0.00*	*$0.00*	*$23,312.64*	*$0.00*	*$0.00*	*$0.00*	*$23,312.64*	*$0.00*	C
		ME Hall-B	*INFRA*	*$10,662.72*	*$13,861.54*	*$0.00*	*$0.00*	*$13,861.54*	*$0.00*	*$0.00*	*$0.00*	*$13,861.54*	*$0.00*	C
		MT Hall-B	*INFRA*	*$14,944.00*	*$19,427.20*	*$0.00*	*$0.00*	*$19,427.20*	*$0.00*	*$0.00*	*$0.00*	*$19,427.20*	*$0.00*	C
6	1.1.4	1.1.4 Magnet Power	INFRA	$6,664.20	$8,663.46	$20,000.00	$26,000.00	$34,663.46	$0.00	$0.00	$0.00	$34,663.46	$0.00	C
		Magent Power	*INFRA*	*$0.00*	*$0.00*	*$20,000.00*	*$26,000.00*	*$26,000.00*	*$0.00*	*$0.00*	*$0.00*	*$26,000.00*	*$0.00*	C
		ME Hall-B	*INFRA*	*$6,664.20*	*$8,663.46*	*$0.00*	*$0.00*	*$8,663.46*	*$0.00*	*$0.00*	*$0.00*	*$8,663.46*	*$0.00*	C
7	1.1.5	1.1.5 New Beamline Elements & Diagnostics	INFRA	$104,608.00	$135,990.40	$30,000.00	$39,000.00	$174,990.40	$0.00	$0.00	$0.00	$174,990.40	$0.00	C
		New Beamline Diagnostics	*INFRA*	*$0.00*	*$0.00*	*$30,000.00*	*$39,000.00*	*$39,000.00*	*$0.00*	*$0.00*	*$0.00*	*$39,000.00*	*$0.00*	C
		MD Hall-B	*INFRA*	*$44,832.00*	*$58,281.60*	*$0.00*	*$0.00*	*$58,281.60*	*$0.00*	*$0.00*	*$0.00*	*$58,281.60*	*$0.00*	C
		MT Hall-B	*INFRA*	*$59,776.00*	*$77,708.80*	*$0.00*	*$0.00*	*$77,708.80*	*$0.00*	*$0.00*	*$0.00*	*$77,708.80*	*$0.00*	C
8	1.1.6	1.1.6 Frascati beampipe 1		$0.00	$0.00	$7,450.00	$9,685.00	$9,685.00	$0.00	$0.00	$0.00	$0.00	$9,685.00	C
		Frascati beampipe 1		*$0.00*	*$0.00*	*$7,450.00*	*$9,685.00*	*$9,685.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$9,685.00*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
9	1.1.7	1.1.7 SVT Vacuum Box		$18,482.40	$24,027.12	$8,640.00	$11,232.00	$35,259.12	$0.00	$0.00	$0.00	$0.00	$35,259.12	C
		Electron Run Flange		*$0.00*	*$0.00*	*$5,400.00*	*$7,020.00*	*$7,020.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$7,020.00*	C
		Marco Oriunno (ME)		*$7,344.00*	*$9,547.20*	*$0.00*	*$0.00*	*$9,547.20*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$9,547.20*	C
		Matt Swift (MD)		*$11,138.40*	*$14,479.92*	*$0.00*	*$0.00*	*$14,479.92*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$14,479.92*	C
		Vacuum Flange hardware		*$0.00*	*$0.00*	*$1,080.00*	*$1,404.00*	*$1,404.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$1,404.00*	C
		Conflat gaskets		*$0.00*	*$0.00*	*$2,160.00*	*$2,808.00*	*$2,808.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$2,808.00*	C
		Linear Shifts		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Cooling Feedthrough		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
10	1.1.8	1.1.8 Electron Target		$12,790.80	$16,628.04	$4,320.00	$5,616.00	$22,244.04	$0.00	$0.00	$0.00	$0.00	$22,244.04	C
		ElectronTarget		*$0.00*	*$0.00*	*$4,320.00*	*$5,616.00*	*$5,616.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$5,616.00*	C
		Matt McCulloch (MT)		*$5,446.80*	*$7,080.84*	*$0.00*	*$0.00*	*$7,080.84*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$7,080.84*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Marco Oriunno (ME)		*$7,344.00*	*$9,547.20*	*$0.00*	*$0.00*	*$9,547.20*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$9,547.20*	C
11	1.1.9	1.1.9 SVT Collimator Protection		$9,531.84	$12,391.39	$14,900.00	$19,370.00	$31,761.39	$0.00	$0.00	$0.00	$0.00	$31,761.39	C
		ME Accelerator JLAB		*$3,554.24*	*$4,620.51*	*$0.00*	*$0.00*	*$4,620.51*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$4,620.51*	C
		MT Accelerator JLAB		*$5,977.60*	*$7,770.88*	*$0.00*	*$0.00*	*$7,770.88*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$7,770.88*	C
		SVT Collimator Protection		*$0.00*	*$0.00*	*$14,900.00*	*$19,370.00*	*$19,370.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$19,370.00*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
12	1.1.10	1.1.10 Beam Offset Monitor		$7,754.72	$10,081.14	$4,470.00	$5,811.00	$15,892.14	$0.00	$0.00	$0.00	$5,811.00	$10,081.14	C
		Beam Offset Monitor	*INFRA*	*$0.00*	*$0.00*	*$4,470.00*	*$5,811.00*	*$5,811.00*	*$0.00*	*$0.00*	*$0.00*	*$5,811.00*	*$0.00*	C
		ME Hall-B		*$1,777.12*	*$2,310.26*	*$0.00*	*$0.00*	*$2,310.26*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$2,310.26*	C
		MT Hall-B		*$5,977.60*	*$7,770.88*	*$0.00*	*$0.00*	*$7,770.88*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$7,770.88*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
13	1.1.11	1.1.11 Beam Profile Monitor		$0.00	$0.00	$10,430.00	$13,559.00	$13,559.00	$0.00	$0.00	$0.00	$0.00	$13,559.00	C
		Insertable YAG Viewer		*$0.00*	*$0.00*	*$10,430.00*	*$13,559.00*	*$13,559.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$13,559.00*	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C

ID	WBS	Task Name	Type	Labor	Ltotal	Material	Mtotal	Total	Spares	Prototypes	Total Operations	Total Infrastructures	Total Capital Equipments	D
14	1.1.12	1.1.12 Installation review		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	C
15	1.1.13	1.1.13 HPS Beamline Installation		$6,866.16	$8,926.01	$0.00	$0.00	$8,926.01	$0.00	$0.00	$0.00	$0.00	$8,926.01	C
		Stepan Stepanyan (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		Ken Moffeit (Phys)		*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	C
		ME Hall-B		*$888.56*	*$1,155.13*	*$0.00*	*$0.00*	*$1,155.13*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$1,155.13*	C
		MT Hall-B		*$5,977.60*	*$7,770.88*	*$0.00*	*$0.00*	*$7,770.88*	*$0.00*	*$0.00*	*$0.00*	*$0.00*	*$7,770.88*	C
16	1.1.14	1.1.14 Beamline Installed		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	C