

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 is 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 weeks. 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.