



Department of Energy
Washington, DC 20585

Dr. Persis Drell
Deputy Director
Director of Particle & Particle Astrophysics
Stanford Linear Accelerator Center
2575 Sand Hill Road, Mail Stop 75
Menlo Park, CA 94025

Dear Dr. Drell:

I have enclosed a copy of the report resulting from the DOE review of the SABER proposal that was held at SLAC on December 6-7, 2006. I very much appreciate the work that the laboratory invested in preparation for this review and in the presentations to the Review Committee.

The Committee confirmed that the research conducted at the FFTB on plasma wake-field acceleration and dielectric wake-field acceleration was highly successful and influential, and that future work in these areas is promising. However, on the basis of the review, I recommend that you strengthen the proposal by following the Committee's suggestion of significantly broadening the scientific program and user base. The proposed SLC South Arc tunnel location appears to be a challenging one, and I encourage you to design a facility that will provide the most science at the lowest cost, capital as well as operating.

I hope that the review report is helpful to you in planning your laboratory's program.

Sincerely,

A handwritten signature in black ink, appearing to read "Robin Staffin".

Robin Staffin
Associate Director
Office of High Energy Physics

Enclosure

cc:
P. Dehmer, SC-22
G. Crawford, SC-25
M. Procaro, SC-25



**DOE Review Committee Report
on the
Review of the SABER Proposal**

December 6–7, 2006

Background

SLAC's Final Focus Test Beam (FFTB) facility has been dismantled to make way for the construction of the Linac Coherent Light Source (LCLS). Laboratory management has proposed modifications of the SLAC linac complex to deliver high energy beams of electrons or positrons to a new experimental area in the SLC south arc, called the South Arc Beam Experimental Region, or SABER, that would allow the FFTB experimental program to be continued there. Three major modifications are proposed: an upgrade of the south arc beam optics to produce a small beam spot for experiments; addition of a positron pulse compressor; and construction of a linac bypass line to allow independent, simultaneous operation of SABER and LCLS. The laboratory proposed a three-year schedule to carry out the modifications at an estimated cost of \$17.3 M. The cost could be reduced to \$12.4 M by reusing the PEP-II HER injection bypass line. Estimated annual operating costs to the DOE Office of High Energy Physics (OHEP) range from \$6 M for a four-month SABER run to \$11.5 M for ten months, in addition to \$11.7 M annually for linac maintenance to be funded by the DOE Office of Basic Energy Sciences (OBES).

The OHEP conducted an onsite review of the SABER proposal on December 6 and 7, 2006. The objective was to evaluate the plans for restoring the FFTB experimental capability and to evaluate the merits of the proposed scientific program at SABER. The Review Committee was composed of three DOE members – Philip Debenham (chair), John Kogut, and LK Len – and five technical consultants – William Barletta (MIT & FNAL), Rodney Gerig (ANL), Thomas Marshall (Columbia), Philip Pfund (FNAL), and Michael Zisman (LBNL). The Committee's findings and recommendations are summarized below.

Findings

Concerning options, the Committee found that the availability of a positron beam is vital for the primary line of research, which is directed toward electron-positron colliders at the energy frontier. This, in turn, requires the SLAC linac operating at approximately 30 GeV and eliminates the option of substantial cost saving by lowering the energy. The Committee also found the proposed bypass line necessary for the success of the experimental program. Likewise, the ability to produce an appropriately spaced witness bunch is essential to demonstrating that a plasma wake field, for example, can accelerate a useful beam.

Overall, the Committee found the proposed technical design to be sound, with minimal risk of not delivering beams with the properties required for the experiments. However,

the south tunnel location would severely constrain the research activities at SABER, and the End Station B option that was explained at the Committee's request does not appear to offer sufficient added R&D opportunities to warrant its higher cost.

The Committee found the construction cost estimate credible, with an appropriate level of detail for the current state of planning. They strongly endorsed the option of using part of the PEP-II HER bypass line to reduce the cost of SABER, and recommended exploring the reuse of magnets from unused portions of the HER bypass line for additional cost savings. The Committee's consensus is that the proposed three-year schedule could slip to four years due to a combination of a back-loaded funding profile and competition for personnel resources in the LCLS era. Construction of SABER should be managed as a project with an overall project manager, rather than as a collection of accelerator improvement projects. SLAC has experienced personnel who are well qualified to manage SABER construction. The Committee noted the relatively high operating costs and suggested formalization of the important OBES contribution.

The proposed research program is based upon a highly successful and internationally recognized research program in plasma wake-field acceleration and dielectric wake-field acceleration conducted at the FFTB. The future work in these areas proposed at SABER is promising. However the Committee's opinion is that the large capital and operating costs of SABER are not justified by the proposed research program. They recommend pursuing a broader research program, including topics critical to the ILC detector and machine-detector interface, and possible cost sharing with other programs. Researchers working elsewhere who would be better served by the unique beam properties of SABER could be recruited. The Committee realizes that the limited space in the south arc tunnel makes this recommendation very challenging.

Recommendations

1. Approval to proceed with SABER should be conditional on SLAC developing a significantly broader scientific program and user base to justify the costs of construction and operations, and on designing experimental facilities to accommodate this program.
2. SLAC should seriously consider producing a detailed plan, backed with accelerator simulations, for an experimental program to demonstrate to the entire HEP community the credibility of using a plasma wake-field afterburner to extend the energy reach of an ILC.

The following recommendations apply if SABER is approved.

3. Use a portion of the PEP-II HER bypass line for the SABER bypass line as proposed to reduce cost, and evaluate the reuse of components from unused portions of the HER bypass line for additional savings.

4. Advance the beam physics design to reflect the use of the PEP-II bypass line, and perform start-to-end simulations including errors.
5. Manage the construction as a project, directed by a project manager who holds the contingency.
6. Operate SABER as many months per year as feasible to support a vigorous experimental program.
7. OHEP and OBES should execute a memorandum of understanding that defines their commitments to funding the operations and maintenance of SLAC linac sectors 0-20 for SABER.
8. To foster a genuine user facility supporting a broad range of research, institute a dedicated SABER program advisory committee structured similarly to that for the ATF at BNL.