



Department of Energy
Office of Science
Washington, DC 20585

December 8, 2006

Dr. Hendrik Weerts
Director
High Energy Physics Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Dear Dr. Weerts:

Harry

This letter reports on the Office of High Energy Physics (OHEP) Annual Program Review of the Argonne High Energy Physics Division (HEPD) conducted on March 30-31, 2006. This review serves as the primary peer review of the high energy physics program at Argonne, and is an important element in the Department's oversight responsibilities. This letter conveys our evaluation of the Laboratory's program using the findings of the review committee and our assessments, along with our future expectations.

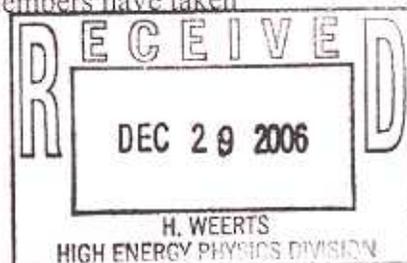
I would like to first take the opportunity to thank you for your hospitality and for the quality of the review. I am sorry that I was not able to attend personally, but my staff and the Review Committee recognized and expressed their appreciation for the high quality of the presentations.

Overall, the High Energy Physics research program at Argonne is impressive in its productivity and noticeable strength, despite tight financial circumstances. It continues to play an important role in the national program, featuring many areas of excellence and leadership. The experimental and accelerator R&D programs are very impressive and cost-effective. I appreciate that more attention has been given to the Theory Group by the Argonne management over the last few years as there has been a clear indication of improvement in quality of research.

In the following sections, I will comment on specific topics in more detail.

Experimental Program

The experimental group at Argonne is very strong, with elements of excellence. The physicists participate in the world's most important experiments in both collider and neutrinos physics (CDF, ATLAS, ZEUS and preparatory for an ILC experiment - as well as MINOS and preparatory for NOvA). These are the two of the important elements of the current U.S. HEP program which Argonne is making a significant contribution with a balanced combination of hardware, software, and management support. The Division team members have taken



important leadership roles, including spokespersonships, Level 2 and Level 3 project management, and many others. When appropriate, this has even led to salary funding by some projects, most recently for help with the horns used for the NuMI beam at Fermilab - a validation of the importance placed on Argonne contributions. Some comments were provided regarding a Midwestern Physics Analysis Center for the ATLAS experiment. The committee in general agreed that such a center can help optimize the physics obtained from the LHC by U.S. physicists. However, some concerns were expressed regarding possible lack of understanding or appreciation on what it would take to make such center a success. It will require a more proactive effort by U.S. ATLAS and ANL management. In addition, it could benefit from more significant involvement of the theory group which can provide a "critical mass."

In addition to the above major participation, Argonne is involved in a number of new initiatives in various stages of development—ILC detector R&D, future neutrino programs and experimental astrophysics. These are all excellent initiatives, but they cover a very wide range, and clearly management will need to make choices and decide experimental priorities so that the program does not become stretched too thin.

The group has outstanding mechanical and electronics capabilities, good hands-on management, and is doing extremely well under current budget constraints. A large fraction of the most significant contributions of the experiment group is based on their expertise in calorimeters, both in detectors and read-out systems. One concern is how the group can maintain its capabilities as there will be more likely large time-gaps between projects as the number of projects continues to be reduced and the duration of programs lengthened. Being part of a much larger national laboratory could provide some benefit in this regard for example, the Electronics Support Group does play a cross-Divisional role at the Laboratory due to its history and leadership. The Mechanical Support Group does not have such a tradition as a result of its different history. New initiatives might also be a useful mechanism for maintaining expertise. However, there may not be a useful match depending on the choices of new initiatives and their funding. Management should make decisions as soon as possible on scaling back low priority experiments to reduce the workload and on which new starts the division will ultimately pursue.

In summary, the ANL experimental research program compares well with that of other national laboratories making good use of its technical resources, interacting well with theorists at Argonne and elsewhere and being productively involved in a number of physics analyses activities. Overall, the review committee was quite positively impressed with the quality, strength, and appropriateness of the experimental HEP work at Argonne.

Accelerator Physics

The Argonne HEP accelerator group has had a distinguished history dating back some 20 years. It has become well known by its development and study of wakefield's set up in dielectric structures, offering a possibility of new advanced accelerator technologies. It is a vibrant, capable group and unique in the world that is pursuing exciting and cutting edge advanced accelerator and beam physics research and continues to produce excellent physics. The work is innovative and important for the future of the field.

In the past few years upgraded equipment has been brought into service, with new results coming in this year. The progress towards a new gun with high charge/bunch and 64 bunches is impressive. Although the current goal is to achieve ~ 100 MeV/m with the present apparatus, the group should be encouraged to proceed as rapidly as possible to find the largest wakefield, in the range of 300~500 MeV/m, that can be sustained by a suitable dielectric that experiences a transient (\sim few psec) wakefield without breakdown damage.

The work on dielectric loaded accelerators is in progress however, a suggestion made from last review to perform parametric studies on the geometries, frequencies and materials has not been carried out. Such study can maximize the experimental benefit of the prototypes and at the same time get closer to demonstrating a real, efficient accelerator structure based on this technology on a short time scale. The proposal to upgrade the facility with an additional klystron and power modulator will result in a higher energy beam with a long and high current pulse, which will make that beam even more valuable and potentially can capture a larger user community.

The group presented several new and novel ideas such as studies on active accelerator structure and left handed materials, which are related and important for the future of this research area. Although these efforts could broaden the group's portfolio, the scale of these efforts must remain modest to avoid diluting the group's primary focus in the area of wakefield acceleration.

In summary, the accelerator group is vibrant and capable and is pursuing several exciting and cutting edge advanced accelerator research programs and we continue to be impressed with the competence, attitude and standing within the worldwide HEP community of the accelerator group at Argonne.

Theory

A strong and vital theory group at Argonne is necessary for the health of the overall program, as well as for the national HEP theory program. Several past reviews of the theory group raised questions regarding performance, morale, and the lack of hires at the tenure track level. However, it is clear that there has been a significant improvement, especially over last couple of years.

The consultants assess that the Argonne high energy theory group is again strong and covers a wide variety of physics topics, including QCD, collider physics, physics beyond Standard Model, electroweak model building, astrophysics and cosmology, lattice field theory and formal quantum field theory. The group has a strong overlap in interest with the experimental program and is an integral part of the HEP group, providing a valuable service to the laboratory. The number of publications of the group appears to be adequate and the impact of the published work on the field is significant. In addition, the members of group have been involved in the organization of workshops, summer schools, and conferences both at ANL and elsewhere.

In summary, the group is in good shape. Productivity of the group is adequate, and the quality of the produced work is very high. Revitalization is in progress, and should continue if Argonne can manage to hire more young people on tenure track positions.

Future Direction and Management

FY 2006 budget has presented the HEP program at ANL with severe difficulties, forcing critical personnel reductions and hard programmatic decisions. The laboratory management is to be commended for their willingness to deal with these problems and to make difficult decisions while carrying out the present work and planning for the future. Impact from the budget trends in past few years underscores the importance of long range planning. The five-year vision presented by the Division Director has set the right priorities with a strategic outlook both for the field and the laboratory program. However, a few concerns were expressed by our consultants.

One of concerns was the small number of post docs and junior staff in all three program areas, especially given the presented need for more young Physicists in the Division. The fact that the Laboratory and the University of Chicago have recognized this in the recent past by providing additional support for a number of post docs has been greatly appreciated. However, a longer term staffing plan which is inline with the priority, balance and budgetary environment will have to be clearly planned.

Expanding collaborations in the Midwest region was cited in a number of contexts as part of the planning for going forward in a number of program areas, such as ATLAS Physics Analysis Center, accelerator R&D program, ILC detector R&D and a couple of potential new initiatives. This should be encouraged, but should focus on building on strengths at each collaborating institution. It should not be simply a way of expanding breadth and lead to making Argonne and the HEP Division in particular, more diffuse and spread too thin.

The laboratory management asked our review consultants for advice on the nascent planning for a Laboratory-wide Astrophysics Center. Since the plan is at a very early stage and the consultants did not review anything outside the HEP Division, only the following general observations and comments can be made at this time. A reasonable plan will require consideration across the Laboratory, of Argonne scientist's physics and technology interests, strengths and commonalities, as well as the scientific opportunities. Any intentions for an expansion in this direction by the high energy physics group must be evaluated within the boundaries of the resources of budget and personnel, with special consideration given to long-term strategic planning. Among the missing elements was any presentation of how the elements of an Astrophysics Center would be brought into close physical proximity or how disparate sources of funding would be melded into the pursuit of a coherent set of physics priorities. Without consideration of such issues, the Astrophysics Center idea risks being only a paper idea or a paper organization, not benefiting from the exchanges characteristic of the most successful interdisciplinary efforts.

Summary

Overall the ANL HEP Division is extremely competent with a high level of morale. Despite the stringent budgets, its programs are strong and effective and are well positioned for the future. Finally, I would like to commend the ANL management for doing an outstanding job during a difficult period.

Sincerely,

A handwritten signature in black ink, appearing to read "Robin Staffin". The signature is fluid and cursive, with the first name "Robin" written in a larger, more prominent script than the last name "Staffin".

Robin Staffin
Associate Director
Office of High Energy Physics

cc: Robert Rosner, ANL
Alfred Sattelberger, ANL