SLUO
SLAC USERS ORGANIZATION

## Summary of the SLUO Meeting, SLAC February 7th 2008

### *"Redefining the User Facility"*

### A User Perspective

On February 7th, the SLAC Users Organization (SLUO) convened a meeting to explore the relationship between SLAC and its users in an era of growing involvements in off-site international projects.

The Department of Energy has charged the P5 subpanel of the High Energy Physics Advisory Panel (HEPAP) with re-evaluating the U.S. particle physics program for the next ten years. The subpanel's final report is due April 15; a visit to SLAC is planned for February 21-23.

The February 7th SLUO meeting was designed to help provide input into this process. This meeting included presentations and discussion directed explicitly at possible future SLAC programs. The guiding goal of the meeting was not to establish scientific priorities, but rather to evaluate how SLAC, in the context of its growing involvement in off-site international projects, could best support the scientific programs discussed and serve the scientific interests of the user community. The full agenda is attached at the end of this document.

The SLUO Executive Committee intends this Summary to form a representative view of the interests of the present and potential future SLAC international community, in particular as relevant to roles that SLAC may play as a national U.S. lab, and as one of the main international facilities for particle physics and astrophysics (PPA). The plan was not to emerge with a set of priorities, but to develop a perspective on where the strongest interests lie and on which aspects SLAC can provide a solid base. It was believed that as a message directly from the user community, this will be of substantial interest in the overall planning process.

### The Presentations

The presentations covered a broad range of scientific topics in the PPA area, demonstrating the wealth of the field in the exciting intellectual questions emerging from the three current frontiers that have similar high priorities: the energy frontier, the luminosity frontier, and the cosmic frontier. A very strong consensus emerged that there are many compelling scientific projects to pursue in which SLAC could play important roles. These projects address the most fundamental questions of our field. This excitement is in stark contrast with the bleak funding problems of the field.

The meeting included a presentation by SLAC PPA Director Steve Kahn on the Directorate's current thinking regarding the future of the laboratory, and nine presentations by users describing current and potential future experimental programs. The program included presentations and discussion on "traditional" accelerator-based HEP experiments (ILC detector, ATLAS, Super-B

SLUO
SLAC USERS ORGANIZATION

Factory), particle astrophysics experiments (SNAP, LSST, GLAST and more generally very high energy particle astrophysics experiments like AGIS for instance, CMB), experiments foreseen in the Deep Underground Science and Engineering Laboratory (DUSEL), and research directed towards future accelerators.

In the Introduction to this meeting Gérard Bonneaud, the current chair of the SLUO, emphasized the internationalization of particle physics and astrophysics. Most, if not all, of the future PPA programs will inherently be international collaborations. Gérard raised the urgency for setting up guidelines and rules efficient enough, and recognized by the international community, to ensure credible partnerships to build and to operate international projects on pluriannual fundings. Also, he stressed the importance for the PPA international community to keep and to develop a few internationally recognized facilities, among which SLAC is one of the most prestigious ones, where such a culture of international scientific cooperation can be fostered.

**PPA Directorate:** Steve Kahn presented the current thinking of SLAC PPA directorate on the future of particle physics and astrophysics at SLAC. At this time, by his own admission, the management does not have a clear answer to the question, "What is the role of SLAC as a high energy physics *user facility* going forward?" The current process involves SLAC management, SLUO, P5, and the DOE Office of High Energy Physics all working in parallel, which is not an optimal situation but is nonetheless the one we are faced with.

From the laboratory's point of view, the current mix of programs is ideal, with near-equal effort going towards "traditional" HEP experiments, particle astrophysics, and accelerator R&D. Dr. Kahn presented several scenarios for how the PPA program might evolve in the next decade. This emphasizes that there is still a wide "menu" of possible program options for SLAC PPA, but also the fact that choices will have to be made – "*we can do many things, but cannot reasonably hope to do everything*". In particular, there are already conflicts developing in the allocation of engineering resources. In addition, SLAC must find a way to allocate beam time for test beam studies relevant to high-energy physics projects in the era in which BES has stewardship of the SLAC linac. The availability of beams and its engineering capabilities are two of the features of the laboratory which were brought up repeatedly in the course of the day by speakers on an assortment of topics.

**Particle Astrophysics:** there were four talks on current or future particle astrophysics experiments, indicating the growing importance of this field of study for SLAC. The talks included both space-based experiments and ground-based studies and facilities, and included existing experiments, near-term experiments, and experiments and facilities which are further in the future.

The particle astrophysics speakers outlined a set of key competencies and features of SLAC which make the laboratory an attractive collaborator and a vital user facility in particle astrophysics experiments. First and foremost of these is the Kavli Institute itself - KIPAC, a world-class organization for the study of particle astrophysics. It was envisioned that the strong core of researchers at SLAC would attract other collaboration members to visit the laboratory for extended periods of up to one year, in order to work closely with the KIPAC staff. In order to take advantage

of this possibility, it would be necessary to make arrangements locally which would make such visits possible: the provision of office space, in the KIPAC building or as close to it as possible, was one example of the necessary arrangements.

SLAC has engineering capacity, both in the form of equipment and staff, which would be welcome on any future experiment in particle astrophysics and would attract users to work closely with the local equipment and experts. SLAC is relatively unique amongst the national laboratories involved in high-energy physics in its demonstrated competence in developing hardware and software for space-based experiments. This capability will be very important for future space-based experiments in particle astrophysics. A closely-related role for SLAC as a user facility for particle astrophysics is as host to collaboration meetings in the field. It was remarked that particle astrophysics collaborations have relatively few meetings with large time intervals between them. Collaborations with more sophisticated instrumentation and data-handling issues will need to meet more often. SLAC's presence as a reliable host for such meetings would allow this situation to improve considerably.

**Accelerator-Based HEP:** Three presentations on accelerator-based high energy physics experiments, at ATLAS, at an ILC and at a Super-B factory, were presented at the meeting.

SLAC is a member of ATLAS, and supports an ATLAS "Tier-2" computing facility. The SLAC Tier-2 center is atypically large, and supports computing facilities for data analysis by users, which is unusual for a Tier-2 facility. SLAC's computing infrastructure and expertise at analysis of massive quantities of HEP data were mentioned by several speakers throughout the day as important features of the laboratory for the user community going forward. SLAC's strong capabilities in detector design and engineering are seen as potentially useful to the ATLAS upgrades which are foreseen as part of the LHC luminosity upgrade (SLAC is already involved in the accelerator upgrade through the US LHC Accelerator Research Program - LARP). At the moment SLAC is not strongly involved in the ATLAS upgrades, but a stronger role going forward would seem to be a logical development from the present state of affairs.

The SLAC theory group is an important resource for the ATLAS user community. The partnership between ATLAS members and the SLAC theory group is rapidly developing, with common discussions on physics issues. Since it is a center for particle theory with strong expertise in hadron collider physics and strong ties to the experiment, the SLAC theory group also provides an interface to the broader theoretical community. SLAC has been involved in creating a "West Coast LHC Theory Network" to assist collaboration among university theorists interested in LHC physics. Historically, it has been a tradition at SLAC that theorists, experimenters, and accelerator experts talk and plan together. Members of the SLAC theory group have become involved with major projects – most recently the B Factory and the ILC – at a very early stage, bringing their understanding to the selection of parameters and physics justification. The SLAC theory group has also hosted physics studies for these projects and they have advanced and edited major volumes on the physics case and experimental programs. In the era in which SLAC is not running an accelerator for high-energy physics but is supporting the physics effort of a large and diverse user base, the SLAC theory group

should continue to have an active role in support of the broader theoretical and experimental communities.

The strength of the SLAC experimental effort in ATLAS and the theory group, as well as the synergy with the ATLAS group at Berkeley and Santa Cruz, could potentially make SLAC an intellectual center for ATLAS physics. The ATLAS community would benefit from a center that can recognize topics on which intense common discussion can lead to progress, host meetings on these topics, and thus stimulate productive work in the user community. The major US laboratories involved in ATLAS, and SLAC in particular, could be useful in this role.

Since the beginning of the international effort to propose the next generation $e^+e^-$ linear collider (the International Linear Collider – ILC is widely viewed as that collider), SLAC plays a central role for the US community in the R&D efforts towards a detector. It has been pointed out several times during the meeting that ILC and its detector(s) are a complex, challenging, and multi-billion dollar investment and that the project requires international commitments and strong regional leaders. The SLAC detector/instrumentation expertise and infrastructure relevant to detector R&D are multiple: electronics, HEP-related engineering, detector expertise, computing facilities and simulation/software capabilities, detector test beams, to cite a few of them. In addition SLAC, with the presence of its linear accelerator on site with a typical linear collider bunch timing structure, offers a unique opportunity to work on the machine-detector interface issues that are crucial to design a competitive detector.

The current vision for a Super B factory calls for a new international facility constructed at a "green field" site in the vicinity of Frascati, in Italy. Such a facility appears to be a major tool to find and understand physics beyond the Standard Model: for instance, it will be crucial to an understanding of the flavor sector of any type of new physics which is discovered at the LHC. In addition, polarization at Super B will be a unique way to probe the chiral structure of lepton flavor violation processes. However, the access to new physics effects in the flavor sector would benefit from a data sample 100 times the total existing BABAR + Belle sample and therefore an asymmetric $e^+e^-$ collider with about 100 times the luminosity of the current B Factories is called for. SLAC's participation in both the accelerator and the detector design and construction would be a natural extension of the PEP-II/BABAR activities. Indeed, the current proposal calls for re-use of a substantial fraction of the PEP-II beamline hardware in the Super-B collider, and possibly even the use of BABAR itself (or at least some of its subsystems) as the detector, though of course some upgrades would be necessary. Building on its leadership in $e^+e^-$ colliders and the physics derived there from, SLAC can become naturally the regional center for US involvement in the Super B project.

**Underground Facilities:** The US National Science Foundation (NSF) is preparing a plan for the construction of a Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake mine. DUSEL will be a very substantial project, with a budget for facilities and experiments of about $500 million. DUSEL will offer new opportunities in particle physics and a complementary approach to some of the physics problems that SLAC is traditionally interested in. Also, the mandatory move from small experiments (table-top) to large and even very large detectors

SLUO
SLAC USERS ORGANIZATION

(DUSEL could eventually be host to experiments which would be in the 100 kiloton range) requests a dramatic change of culture for which SLAC could play a central role, desired by the interested community. A possibility highlighted at the meeting was SLAC participation in a ton-scale dark matter detection experiment in DUSEL. More generally, SLAC could bring much-needed engineering capacity to the proposal, especially given the large scale of some of the planned experiments and the large construction spaces around SLAC. As an NSF proposal, DUSEL is primarily backed by university groups, which are largely bereft of engineering capacity and certainly do not have the resources to build such large scale experiments themselves. Finally, SLAC could also participate in DUSEL as a user; DUSEL would be a natural site for the full-scale EXO experiment.

**Accelerator R & D:** SLAC's strengths as an accelerator research facility are well-known, and it is one of the few national laboratories accessible to university user groups in accelerator physics. SLAC is also world-recognized as one of the very few international resources in this field. For many years, the Final Focus Test Beam was the main facility for user-driven accelerator research, but the FFTB was demolished to make room for the Linac Coherent Light Source (LCLS). The current proposal to build a new set of facilities for accelerator research would draw users from all over the world to SLAC to perform experiments to develop advanced accelerator concepts for next-generation of accelerators and wider scientific applications. The availability of test beams with a variety of capabilities and in-house expertise is attractive to both accelerator and non-accelerator projects, including astrophysics, primarily for developing and testing detector hardware. It appears that it would be useful to include the user community in planning for these test beams. However, the main issue raised during the meting was how to maintain a critical core competency in the coming era of no HEP accelerator experiment based on site.

**Summation:** The speakers pointed out a number of key features of SLAC which would be valuable to users even in the absence of an onsite experiment. These include the lab's computing infrastructure, engineering expertise and facilities, detector design and construction skills, competence in space-based experiments, beam facilities for accelerator research and for detector development via test beams, high density of excellent staff in a variety of fields, and experience in the management of extremely large projects. It was pointed out in discussions that SLAC dare not become a "job shop" in these capacities – that to ensure that the quality of the work performed at SLAC remains high, the SLAC scientific staff must be engaged in any project for which the laboratory provides these facilities. The selection of which projects SLAC will participate in must therefore balance the limits of the lab's capacity, the interests of the scientific staff, and the priorities of the field as a whole.

Finally, it appears from this meeting that for SLAC's users, as the National Academy EPP2010 committee concluded "…although setting priorities is essential, it also is critical to maintain a diverse portfolio of activities in particle physics, from theory to accelerator R&D to the construction and support of new experimental facilities…". Planning and maintaining such an ambitious enterprise, a national/international facility as SLAC appears to be up to now, is invaluable since SLAC will thus remain an ideal partner for university groups that do not have the facilities and the experienced manpower, and an appropriate interlocutor and a natural leader on the international arena.

SLUO
SLAC USERS ORGANIZATION

**February 7th 2008 - SLUO Meeting**

***"Redefining the User Facility"***

**Agenda**

***07:30 - 08:00 - Breakfast***

**Chair: Michael Peskin**
08:00 - 08:20 Gerard Bonneaud (Ecole Polytechnique & SLAC) - Introduction;
08:30 - 09:10 Steve Kahn (SLAC) - Draft P5 talk;
09:30 - 09:50 Greg Tarle (U Michigan, on the phone) [SLAC contact Aaron Roodman] - SNAP;

***10:10 - 10:30 break***

**Chair: Tim Barklow**
10:30 - 10:50 Ray Frey (U of Oregon) [SLAC contact John Jaros] - ILC detector R&D;
11:10 - 11:30 Gabriella Sciolla (MIT) [SLAC contact David MacFarlane] - DUSEL user base, including CDMS, EXO;
11:50 - 12:10 James Rosenzweig (UCLA) [SLAC contact Tor Raubenheimer] - ILC & advanced accelerator R&D;

***12:30 - 1:30 catered lunch, general discussion*** - **convenor Chris Hearty**;

**Chair: Steve Sekula**
1:30 - 1:50 David Kirkby (UCI) [SLAC contact David Burke] - LSST;
2:10 - 2:30 Jason Nielsen (UCSC) [SLAC contact Su Dong] - ATLAS upgrade/computing/user support;
2:50 - 3:10 Rene Ong (UCLA) [SLAC contact Stefan Funk] - GLAST/TeV/UHECR;

***3:30 - 3:55 break***

**Chair: Peter Tenenbaum**
3:55 - 4:15 David Hitlin (Caltech) [SLAC contact Blair Ratcliff] - SuperB;
4:35 - 4:55 Sarah Church (SLAC KIPAC) - CMB polarization;
5:15 - 6:30 General discussion - **convenor Frank Porter**;

***6:30 – 8:30 Breezeway Reception***