

## **REPORT OF THE SECOND MEETING OF THE ILC PROJECT ADVISORY COMMITTEE (PAC)**

9/10 May 2009; Vancouver

**Committee:** Jean-Eudes Augustin, Paris (Chair); Lyn Evans, CERN; Günther Geschonke, CERN; Don Hartill, Cornell; Steve Holmes, Fermilab; Enzo Iarocci, Rome (ILCSC Chair—ex officio); Akira Masaike, Kyoto; Robert Orr, Toronto; Raj Pillay, TIFR; Roy Rubinstein, Fermilab (Secretary); Masakazu Yoshioka, KEK.

### 1. **Introduction**

The PAC was formed in 2008 to assist the International Linear Collider Steering Committee (ILCSC) in the ILCSC's oversight of the Global Design Effort (GDE) activities on ILC accelerator design and also of the ILC detector activities. The PAC mandate is given in Appendix I.

The second meeting of the ILC Project Advisory Committee (PAC) took place on 9/10 May 2009 at the Hyatt Regency Hotel, Vancouver. It consisted of one day of presentations on the ILC accelerator status and plans, and a half day of presentations on the status and plans for ILC detectors. The PAC warmly thanks the presenters and the leadership of the accelerator and detector efforts for all of their work to allow this evaluation of their activities by the PAC. The meeting agenda is given in Appendix II, and the presentations to the Committee are in Appendix III.

This meeting took place shortly after a 3.5-day review of the GDE activities by the GDE Director's Accelerator Advisory Panel (AAP). An oral report on the AAP's review was given to the PAC, as well as a preliminary written report.

### 2. **Accelerator Reports Presented to the PAC Meeting**

A. Barry Barish mainly responded to the recommendations of the first (October 2008) PAC meeting, and he also noted that some recommendations would be addressed in more detail by other GDE presenters. He said that the GDE/CLIC collaboration was progressing well; Release 3 of the Technical Design Phase (TDP) was now available; some R&D will continue past 2012; the GDE must be prepared if a shallow site is proposed by any country; and the detector LOI activity was proving crucial for IR design and the validation of push-pull operation of two ILC detectors.

In answer to questions, Barish said that he was not anticipating significant overall funding changes for ILC activities before 2012. While GDE is working hard on accelerator cost reduction, he did not expect more than ~10-15% reduction from the Reference Design Report values.

B. R&D resources were discussed by Marc Ross. He noted the increasing global investment in SCRF and the advantages that the ILC could take of this effort. He believed that critical path R&D items were covered by resources under GDE control, or those of related projects like XFEL, or generic R&D; the challenge is to manage those resources not fully under GDE control.

In answer to questions, Ross said that GDE has control of ~100 FTEs out of 250 in the Americas. There are no funds for testing the UK built undulators, and no strong R&D program for a liquid positron target. Conventional facilities can be fully optimized only when a particular site is known. There are no resources for industrialization before 2012.

C. Akira Yamamoto reviewed the progress on SCRF. Cavity yield now is 45% at 35 MV/m from a qualified vendor, and 50% at 33 MV/m; 80% yields have been achieved at 25 MV/m. The KEK Quantum Beam Project will constrain ILC work there and lead to delays, but it is useful preparation for industrialization. Yamamoto gave reasons that a string test in each region was valuable, and he gave the objectives of the industry visits. He believes that more effort is needed towards mass production.

In answer to questions, he said that the cavity gradients achieved so far vary from vendor to vendor. A string test with beam in each region should be encouraged, since it gives each region valuable accelerator physics expertise in addition to expertise in cavity production.

D. A report on some of the available test facilities was given by Mark Palmer. There has been progress on damping ring issues at both ATF and CesrTA, and results already obtained have been integrated into the damping ring design. Among the topics under study are electron cloud effects, the damping ring kicker program, and the progress towards achieving the ATF emittance goals.

E. Nick Walker discussed the test goals and results to date at ATF2 and TTF/FLASH. Both facilities have characteristics that make them very valuable for testing ILC concepts. TTF/FLASH has SCRF acceleration similar to ILC. These tests will continue for the next few years.

Walker also gave reasons why SCRF tests with beam in each region, while not strictly needed for the ILC, were nevertheless very useful so that each region gained expertise in all aspects of the ILC accelerator technology.

F. Ewan Paterson discussed the "Minimum Machine" program; this will lead to a re-baseline of the ILC in 2010, and will be the basis for TDP-2. Several items are being looked at critically, including a klystron cluster distributed RF system, compact central region, traveling focus, and a low-power option. The low-power option could lead to a damping ring of half the

size of the RDR design. Paterson said that potential cost reductions from these studies would be ~10%. Some design choices need to be made by 2010.

G. Some aspects of a Project Implementation Plan were presented by Brian Foster. He said that he and others were looking at the governance of ITER, ALMA, SKA, XFEL, and FAIR, and he described some of the pros and cons of each of these models. He expected that an interim report would be available around mid-2010. Foster noted that the OECD has authorized a study on options for establishing large international research infrastructures.

H. Peter Garbincius talked about collaboration with CLIC, with emphasis on conventional facilities and on cost and schedule. CLIC will have a CDR with cost estimate in 2010, and the two groups are discussing commonalities and differences in their methods. Garbincius said that good progress in this work has been made in the six months since the collaboration began.

I. A preliminary report of the April 2009 Accelerator Advisory Panel (AAP) review of GDE activities was handed out by Eckhard Elsen. He described the process and the major topics reviewed, and gave brief comments on each. In the future, AAP people will be assigned to GDE technical areas. The next AAP review will be in January 2010.

In answer to questions, Elsen commented on key people being taken from ILC work at labs. The attitude of labs to their ILC commitments varies among the regions, with people being at present a bigger problem than resources.

### 3. **Detector Reports Presented to the PAC Meeting**

A. Research Director Sakue Yamada, described the current detector management structure, which now has all positions filled and has been fully active since November 2008. Three LOIs (ILD, SiD, 4<sup>th</sup>) were submitted by the 31 March 2009 deadline, and IDAG has now started its validation review. Yamada gave the number of authors, institutions and countries on each LOI, and brief descriptions of the proposed detectors. The IDAG validation report is expected at the ALCPG Workshop in Albuquerque on 29 September-3 October 2009. Following validation, the LOI groups will proceed with R&D and produce detailed baseline designs by 2012. IDAG will oversee the process. Yamada will produce a written interim report in 2010.

Yamada reviewed the funding available for detector R&D in the three regions, noting the differences between the regions. He also said that cooperation with CLIC on detectors was progressing.

B. Karsten Buesser reported on activities of the Machine Detector Interface Common Task Group. There has been close contact with the GDE BDS group, and the two groups recently produced an IR interface document, listing the functional requirements for the IR region; this was sent to Sakue Yamada and the LOI groups. Buesser described which equipment elements moved with the detectors in the push-pull two-detector arrangement, and the differences

necessitated by each detector. He also presented the respective regions of responsibility for the detectors and the BDS, and the requirements for such items as alignment and radiation shielding.

C. Activities of the Common Task Group on Engineering Tools were described by Catherine Clerc. She noted the different CAD software used so far by the different LOI groups; there are possible questions of interoperability of the different systems. There is also the issue of document and information sharing among such groups as the detectors, BDS, MDI, and civil engineering. In spite of the progress made, Clerc felt that significantly more work is needed on such issues

D. Marcel Demarteau of the Detector R&D Common Task Group described the Group's mandate, noting that one item not in the mandate is to coordinate existing R&D activities. He said that the LOI groups want detector R&D to reach a point where a rapid decision on options can be made when a project is approved in ~2012. Demarteau discussed the critical R&D areas which each LOI group has identified. He described the four major existing R&D collaborations, and also the very non-uniform regional distribution of R&D manpower effort; such manpower availability is becoming sub-critical in some regions.

Demarteau described the rather complex funding resources for ILC detector R&D, and the fact that funding is not assured to complete the existing R&D programs. He commented that resources are sparse, and the ILC detector community is fragile.

E. Activities of the Software Common Task Group were reported by Norman Graf. He discussed the LOI physics benchmark process, event generation, the 250 GeV Standard Model Higgs sample, and issues with use of the Grid. For the near future, the highest priority is to respond to IDAG requests for the LOI process. The Group sees a need to understand the software requirements of TDP-1 in 2010 and TDP-2 in 2012.

#### 4. PAC Summary and Recommendations

##### General

1. The PAC members very much appreciated the work of the ILC accelerator and detector leaderships and the meeting presenters for their efforts to answer the Committee's questions and to provide the information to allow evaluation of their activities.
2. The PAC notes that no preparatory documents were available to the Committee prior to this meeting, and requests that it be given material two weeks in advance of future meetings.
3. Satisfactory progress is being made towards a Technical Design Report in 2012. At some time in the future, ILCSC guidance will be needed for activities beyond that date.

##### Accelerator

1. The PAC is impressed with the progress achieved since its October 2008 meeting, in spite of the limited resources available to the GDE. It is also pleased to hear of the start of links to industry as a prelude to technology transfer and industrialization.
2. Cavity tests have shown good progress, and allow some optimism that the desired yield and gradient may be achieved.
3. There is some concern by the PAC on whether there will be enough cavities available to obtain meaningful statistics on the yield, and more information on the needed statistics would be helpful. Some help on this may be forthcoming from the XFEL, Project X and Quantum Beam projects.
4. The "plug compatibility" concept allows useful R&D and tests, but eventually there has to be a single cavity design for the whole linac.
5. Changes in the commitments of the major labs to ILC activities, particularly in the area of key manpower, have negatively impacted the GDE's R&D activities. The PAC strongly recommends that the ILCSC meet with lab directors to find ways to avoid this situation.
6. The S1 test schedule is challenging, and achieving it will require significant effort by the participating labs.
7. It appears that there will be delays in S2 beam tests in two of the three regions, although this should not seriously impact GDE schedules.
8. The PAC supports the "Minimum Machine" activities to carefully review the RDR design, although it is not enthusiastic about the use of the term "Minimum Machine". The Committee believes that this activity should not compromise the existing ILC physics goals, and reiterates its belief that the 1 TeV upgrade option should be maintained.
9. The programs at test facilities are essential to ILC accelerator design, including studies of emittance delivery from the damping rings, fast kicker development, high gradient acceleration with high beam current, beam delivery and final focus parameters, and beam instrumentation. The PAC acknowledges the strong support by DESY of the FLASH beam tests.
10. Positron source model undulators have been successfully constructed, but this effort unfortunately will be wasted if no funding for beam tests can be made available.

11. The ILC-CLIC cooperation on common accelerator issues is progressing well, and the PAC expects this to continue.
12. The Project Implementation Plan studies of other large science facilities are useful, particularly in illuminating the problems which may arise in various governance schemes. However, the GDE should focus more on the management requirements of the ILC.
13. The PAC supports the GDE Director's AAP process, and endorses the conclusions of the AAP's recent review. It looks forward to seeing the response to the AAP's recommendations.

### Detectors

1. The PAC is pleased to see the progress being made on the experimental program, and notes the important work carried out by all of the recently formed Common Task Groups.
2. The PAC is impressed with the current status of the detector LOI process. The three LOIs were delivered on time, and contain much information. The IDAG was well prepared to receive the LOIs, and the validation process appears to be moving swiftly. Following the completion of the validation process later in 2009, a plan should be formulated to arrive at a detailed conceptual design of the detectors by 2012.
3. The work already accomplished, and ongoing, on the push-pull concept for two ILC detectors is very important, and the PAC encourages even more discussion on this issue between those involved with the accelerator and those involved with the detectors.
4. The Detector R&D Panel is commended for its work so far. It is important that the best use be made of the less-than-ideal R&D funds currently available, and that duplication of effort is avoided.
5. The PAC is very appreciative of the Physics Panel's study in late 2008 of a possible gamma-gamma collider Higgs factory as a precursor to the ILC.
6. The work on ILC physics and detectors, and its visibility, is very important for maintaining the enthusiasm of the particle physics community for the ILC project.

5. **Next PAC Meeting**

The next PAC meeting will be take place in Pohang, Korea, on 2/3 November 2009.

## **Appendix I**

### ILC Project Advisory Committee (PAC) Mandate

1. The International Linear Collider Steering Committee (ILCSC) is responsible for the oversight of the Global Design Effort (GDE) activities and of the ILC experimental program.
2. PAC will assist ILCSC in this function and report to the ILCSC.
3. PAC will review the GDE accelerator activities and, in addition, the ILC detector activities.
4. In its review activity, PAC will examine the overall consistency and realism of the project, in relation to physics, technical design, cost, and schedule.
5. PAC shall comprise about nine members, appointed by the ILCSC for terms of two or three years, and will meet a few times per year until the completion of the Technical Design Phases I and II.
6. The PAC Chair will be appointed by the ILCSC, normally for a two-year term.

## Appendix II

### ILC PAC Review

Hyatt Regency Hotel  
Vancouver

All presentations in Georgia Room, 2<sup>nd</sup> floor.  
All executive sessions in Lord Byron Room, 4<sup>th</sup> floor.

Tentative agenda

#### Saturday 9 May 2009

8:30. Executive Session	
9:00. GDE Overview (50+10)	Barry Barish (GDE)
10:00. Break	
10:15. R&D Resources (30+10)	Marc Ross (Fermilab)
10:55. Superconducting RF (30+10)	Akira Yamamoto (KEK)
11:35. Executive Session	
12:15. Lunch	
13:15. Test Facilities 1: CesrTA, ATF (20+5)	Mark Palmer (Cornell)
13:40. Test Facilities 2: TTF2/FLASH, ATF2 (20+5)	Nicholas Walker (DESY)
14:05. "Minimum Machine" (30+10)	Ewan Paterson (SLAC)
14:45. Project Implementation (30+10)	Brian Foster (Oxford)
15:25. Break	
15:40. Cooperation with CLIC (30+10)	Peter Garbincius (Fermilab)
16:20. Accelerator Advisory Panel---Report on April Review (30+10)	Eckhard Elsen (DESY)
17:00-18:45. Executive Session	

#### Sunday 10 May 2009

8:30. Executive Session	
9:00. RD Report, including LOI Overview (50+10)	Sakue Yamada (KEK)
10:00. Break	
10:15. Reports from Common Task Groups	
Machine-Detector Interface (30+10)	Karsten Buesser (DESY)
Engineering Tools (15+5)	Catherine Clerc (Ecole Polytechnique)
Detector R&D (30+10)	Marcel Demarteau (Fermilab)
Software (20+5)	Norman Graf (SLAC)
12:20. Lunch	
13:20. Executive Session	

14:20-15:00. Closeout

### **Appendix III**

The presentations given to the PAC are available at

<http://www.fnal.gov/directorate/ILCPAC/ILCPACMay2009/AttachmentsILCPACMay2009.htm>