

Summary of AAP Review during TILC'09

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PAC



Report on the AAP Review at TILC'09
April 17-21, 2009, Tsukuba, Japan
Overview

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Role of AAP

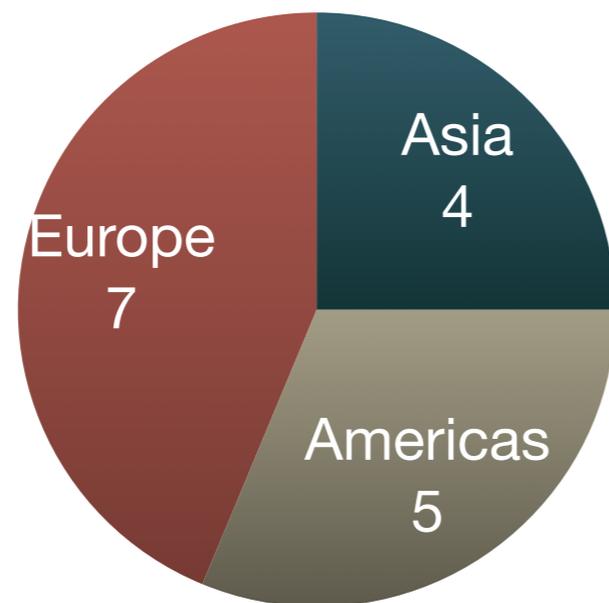
- Internal Review Body
 - of technical matters
 - reporting to director
- Support the project
 - examine the technical progress
 - reflect on management structures

*AAP considered this
an experiment;
explore and adapt till
the answer is there*

AAP Reviewers

- Regular Members

- C Damerell
- J Dorfan
- E Elsen
- T Himel
- M Kuriki
- O Napoly (*)
- K Oide
- H Padamsee
- T Raubenheimer
- D Schulte
- W Willis



- External Members

- N Holtkamp (*)
- L Rossi (*)
- T Tajima
- M Uesaka
- F Zimmermann

(*) apologies received

- F Lehner served as the scientific secretary for this meeting

Basis for review

- Followed the goals of the TDP
 - thematic priorities
 - timelines

*overriding goal:
readiness of the ILC
in 2012*



Key Topics

- Project management
- Civil facilities and siting
- electron cloud
- superconducting RF
- Test Facilities
 - ATF
 - FLASH

*and for
completeness*

- accelerator systems
 - sources
 - damping ring
 - BDS etc.

Preparation of review started early*

- **e-cloud**

- **Will e-clouds impose an operation limitation for the ILC?**

- Is the theoretical understanding sound?
- What are the uncertainties in extrapolation for the ILC?
- What are the mitigation techniques?
- Which aspects of the theory and of the mitigation techniques have been tested experimentally and independently in positron and proton rings?
- Damping ring test facilities
 - CsrTA
 - e-cloud
 - impedance limitations
 - PEP II
 - KEK B
 - high current operation
 - future options
 - DaΦne
- Is there a DR design for the ILC for safe operation wrt e-cloud?
 - What is the design and how has it been verified?
 - What are the remaining uncertainties and how are they covered in the design proposal?
 - What are the side effects: impedance, acceptance, emittance, bunch, etc...
- What is the operation margin?
 - bunch charge
 - shorter bunches
 - smaller rings

typical example:
look at high level
context

experimental
input

risks

margin

* details appended
to report

Example of a Review Day

19.04.2009

| | | | |
|-------|------|-----------------------------------|--------------------|
| 8:30 | 1:00 | Executive Session | |
| 9:30 | 0:10 | Introduction | <i>A Yamamoto</i> |
| 9:40 | 0:35 | R&D to improve the gradient | <i>L Lilje</i> |
| 10:15 | 0:15 | Decision process | <i>A Yamamoto</i> |
| 10:30 | 0:30 | Break | |
| 11:00 | 0:30 | Cavity integration | <i>H Hayano</i> |
| 11:30 | 0:30 | Cryomodule | <i>N Ohuchi</i> |
| 12:00 | 0:20 | Role of Plug compatibility | <i>J Kerby</i> |
| 12:20 | 0:10 | Cryogenics | <i>T Peterson</i> |
| 12:30 | 1:30 | Working Lunch | |
| 14:00 | 0:20 | HLRF | <i>S Fukuda</i> |
| 14:20 | 0:20 | MLI beam dynamics and quadrupoles | <i>C Adolphsen</i> |
| 14:40 | 0:20 | STF at KEK | <i>H Hayano</i> |
| 15:00 | 0:20 | NMF at FNAL | <i>M Champion</i> |
| 15:20 | 0:10 | Summary and Discussion | |
| 15:30 | 0:30 | Break | |
| 16:00 | 1:00 | ATF2 | <i>A Seryi</i> |
| 17:00 | 2:00 | Executive Session | |
| 19:00 | | End | |

Conventional Facilities & Siting (CFS)

- Tunnel Configurations

- 2 deep sites,
5 shallow

- RF Distribution

- KlyCluster
- Distributed RF
(many ~1MW klystrons)

- 3d Tools

- Big progress

The AAP encourages the CFS groups to continue their efforts to explore the various tunnel configurations with a uniform approach and common methodology.

Technical designs of configurations such as RF power distribution and the treatment of operational reliability (downtime for klystron replacement etc.), safety and radiation aspects should be handled in a consistent and transparent manner. ...

The AAP is impressed by the progress. ... tools...an important aid in understanding critical aspects of a chosen layout, where the benefits from the resource-intensive implementation efforts may be justified.

CFS cont'd

- Conventional Facilities and Siting
 - contact to other technical areas

The AAP encourages further exchange between the various area groups. In many cases, guidance from the project managers is necessary for systematic application across the project. For these CFS efforts to be most useful, it is important to define clearly the main assumptions and technical choices.

e-cloud

- CesrTA
 - wiggler dominated damping ring
 - impressive effort and progress in instrumentation
 - Low emittance is a (known) challenge

The AAP encourages the CesrTA collaboration to continue with their ambitious e-cloud experimental program. It is important that the phenomenon be fully characterized. In particular it is important that the various input quantities for the simulation be separately and independently determined to increase the predictive power.

The AAP also encourages the CesrTA collaboration to achieve further reductions in vertical emittance by applying more diagnostics and correction techniques, especially for the vertical dispersion.

e-cloud cont'd

- Understanding e-cloud

The AAP notes that once the current rounds of measurements are completed and the modeling software has been updated to incorporate what has been learned from the measurements, the impact of the e-cloud must be reevaluated for the 12 ns and 6 ns bunch spacings in the damping ring designs. This will provide an updated assessment of the risk to damping ring performance from the effects of the e-cloud. Should the risk factor be too high, the AAP observes that a lower-current ILC machine with half the number of bunches in the 6-km configuration, i.e. 12 ns bunch spacing would operate in a safer regime with regard to electron cloud. Reducing the positron ring circumference to 3-km may risk losing this back-up solution.

The AAP would like to see a plan laid out showing how the damping ring group plans to arrive at a decision for the viability of the ILC damping ring choice with respect to electron-cloud immunity. A clear set of criteria for the vacuum system should be developed that will lead to the choice of a baseline solution. Alternates along with required RGD can also be specified. A schedule for establishing the criteria and the baseline should be shown.

FLASH

- High current beam (9 mA running)
- test system behavior at cryomodule level
- test of LLRF

...exploit FLASH for the maximum benefit towards ILC.

All aspects of LLRF should be explored and exercised under various bunch loading conditions to gain a complete understanding of the necessary control mechanisms. The program should include a study on HOM losses under operating conditions. Dark currents should be measured and characterized. These studies will allow better understanding of the system behavior at the level of a cryomodule.

... extend both the international participation and the DESY engagement

The studies are crucial for the success of ILC. The studies can only be successful if a sufficient share of beam time is reserved at FLASH for dedicated high beam current running.

ATF

- Demonstration of low emittance and Final Focus
 - $\epsilon_n = 30$ nm
 - 35 nm spot size vertical
 - currently have achieved $\epsilon = 20$ pm (still exceeding the earlier value of 4 pm)

The AAP commends the ATF collaboration for the sequence of successful experiments that have been carried out and led to an impressive record of successful publications. The flexibility of the ATF to react to experimental proposals has been impressive.

The AAP applauds the strong and well-organized effort of the collaboration to commission the ATF2 beam line. The collaboration is encouraged to focus on the diagnostics which are critical to understanding the ATF2 beam line

Minimum Machine

- Design and integration initiative
 - identification of cost gradients
 - recognize many interdependences
 - least result:
 - reduced risk

The AAP suggests developing sufficient simulation and modeling capability to understand ... dependences quantitatively.

The cost of ameliorating any degradations should be assessed to allow informed decisions on which aspects of the MM design to include in the new baseline.

The AAP encourages the Project Management to form and vigorously engage the planned task force to assess the re-baselining effort. The decision making on the emerging new definition should involve representatives of the MDI group and must be collectively propagated throughout all subgroups. The redesign should only be considered for those components and aspects where the benefits are high. During the transition time the RDR solution must be preserved to maintain readiness for construction of the ILC.

SCRF

- Considerable progress in cavity gradient

The AAP recommends a strong interaction between laboratory experts and new vendors during all stages of cavity fabrication. The AAP recommends that for the yield study further evaluation be made of the quality of cavities (Q-values) along with gradient. Electron loading and x-ray intensities at 35 MV/m should be closely monitored.

- New cryomodule assembly facilities at KEK and FNAL

The AAP recommends that a strong effort be made to complete this test on schedule.

SCRF cont'd

- S1-Global effort

The AAP suggests adapting the scientific goals for S1-global effort at KEK to better match the expectations.

- Effort to integrate various cavity varieties in one cryomodule

The AAP encourages support for the ongoing cryomodule efforts at DESY, in the context of the XFEL activities, and at FNAL.

- New cryomodule assembly facilities at KEK and FNAL

The AAP recommends an evaluation of the Quantum beam Project at KEK on the timeline for achieving the S2 goal.

The AAP recognizes that the entire R&D program will not conclude by 2012, and still need results of these test facilities. The XFEL and Project-X will be also important, especially in evaluation of the manufacturing cost of a large linac.

- Expand industrial base

Similar efforts to expand the industrial base for other components such as couplers, tuners and the cryomodule should also be explored.

Plug Compatibility

- Definition of interfaces
 - eases international collaboration and fosters technological progress
- ILC design should be uniform
 - operation
 - maintenance

The AAP fully supports the plug-compatibility concept for the SCRF RGD and suggests introducing an element of competition by maintaining a score list of advantages and disadvantages of individual design variants for cavity, coupler and tuner.

The AAP encourages the Project Management to develop criteria for evaluating and eventually selecting optimal design variants.

The AAP believes that the final machine design, namely the design that will be sent to industry for manufacture, requires a single design for the RF components.

RF Power Distribution

- RF Distributions
 - KlyCluster
 - Distributed RF (x13 klystrons)

The AAP recognizes the merits of the proposals and suggests continuing the value engineering of these options. The value engineering must include a risk assessment, i.e. availability studies and maintenance ability in addition to the cost comparison.

Accelerator Systems

- e- source

- e+ source

The positron flux margins for the current layout are tight. The AAP suggests carrying out the detailed simulation studies to fully understand the requirements and possibly adapt the layout or choice of components.

The AAP suggests studying or, if applicable, compiling the existing documentation on, the effect of the 150 m undulator on beam emittance, stability, and possibly implied constraints on, and requirements for, linac tuning.

- damping rings

- beam delivery

Project Planning

- Goals of 2010 and 2012
 - AAP recognizes tremendous effort of the Project Managers
 - have to aim for more project-style control
 - ascertain the support from the participating laboratories

The AAP suggests that the following linked strategies would be helpful in sharpening the focus of the GDE effort:

a) reserve, and protect, more time for the GDE Director and the troika to formulate and agree upon project objectives

b) actively and visibly (to the GDE team at large) rebalance the objectives so that they are more focused on the milestone-related goals and less emphasize an ever broadening R&D program

c) take active steps to create, and support broad and coherent ownership of the core goals.

Part of the 2012 report will be a new cost estimate. Unless the project simply wants to use the XFEL cryomodule costs it is necessary to start preparing this estimate.

Project Planning cont'd & Conclusion

- Preparation for 2012
 - some technical goals will have to be pursued beyond the timeline
 - gradient development and string test
- LHC will be running
 - time is ripe for a decision
 - Have to prepare pro-actively
 - plan for success
 - develop a long-term strategy

The AAP suggests asking ILCSC to consider displaying and arbitrating the use of laboratory resources more formally. Proper orchestration of the in-kind contributions is mandatory to advance the likelihood of implementation of the ILC. Sudden changes in commitment should be avoided and, if necessary, should be communicated in the ILCSC.

Final remarks

- Thorough review thanks to
 - close collaboration with the project managers beforehand
 - tremendous effort of all experts to collect and present material
 - tireless effort of the reviewers
and in particular of the external reviewers who had to absorb a tremendous amount of information in a short time