THE INTERNATIONAL LINEAR COLLIDER (ILC) ORGANIZATION AND PLANS

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Abstract

A discussion of the current organization and Central Team functions will be given. A possible project organization at the stage where governance by government funding agencies becomes needed is given. Goals for the first year of the Global Design Effort will be presented together with a technically limited time line.

WHAT IS IT?

Of course, the hardware aspect of the ILC includes two oppositely directed linear accelerators and their civil infrastructure for accelerator and detectors. But, the ILC is much more than that. It is an enterprise that will need to cross three frontiers: the energy frontier in e+e- physics; the technology frontier in colliders; the social frontier in project and resource organization.

Overarching Principles

The ILC is envisioned as a project and not a new laboratory institution. All qualified and willing participants share in the intellectual ownership of the facility and access to it for pursuing science. As much of the work as possible will be carried out by existing institutions. In the beginning phase an MOU among the participants will express their mutual obligations in the collaboration.

HISTORY

The linear collider concept was first discussed in 1965, driven by the fourth power law of synchrotron radiation energy loss and the need for ever higher luminosities at the energy frontier. By the time of the 1983 International Particle Accelerator Conference there were already rather detailed studies of how one might realize a collider using linear accelerator technology. The proceedings of that conference included a plan for a 1 TeV collider from BINP in Novosibirsk. The SLC, the first linear collider, was underway. By 1993KEK, SLAC, DESY, BINP were hard at work on both normal and superconducting versions. It had also become clear that international collaboration was going to be an essential feature of any effort leading to realization of a linear collider in the TeV range. Consequently, An International Collaboration toward TeV Scale Electron-Positron Linear Colliders was formed by the leading laboratories with the purpose of focusing global efforts on common goals. In aid of this purpose, an international Technical Review Committee, TRC, under Prof. Gregory Loew was formed to survey progress and catalog design features of the various approaches. The report was published in 1995.

As the internationalism of the grass roots effort grew, ICFA, the International Committee on Future Accelerators took action to consolidate the international status of the effort on the broadest possible grounds within the world particle physics community. An early measure, 2001, was reconstituting the TRC under Greg Loew. In addition, ICFA commissioned a study on how to proceed in this broader context, leading to the formation of the International Linear Collider Steering Committee, ILCSC, to act as agent in promoting and coordinating linear collider work.

The TRC published its extensive report in 2003. This landmark document still serves as an essential reference for linear collider activities. In 2003 an International Technology Recommendation Panel, ITRP, was constituted by the ILCSC. In 2004 they delivered their recommendation that the global effort focus on the use of superconducting rf technology for the international effort, ILC. A first workshop ILCWS I was successfully held at KEK in late 2004 to begin building a baseline concept design founded on superconducting rf technology. In 2005 a Global Design Effort, GDE, was formed and a Central Team began to be organized to direct and coordinate the work. A second ILCWS has been scheduled for a joint accelerator and physics and detector workshop at Snowmass Aug. 14 – 27.

ORGANIZATION

During the initial, “grass roots” stage of the international efforts to begin realization of a 1 TeV range collider we relied on a chain of responsibility put in place almost 30 years ago by IUPAP, the International Union of Pure and Applied Physics, the well known, non government organization of scientists around the world. In 1976 they founded ICFA, inspired by the vision that someday, international collaborations would be needed to go forward with accelerator based physics. As mentioned above, ICFA constituted the ILCSC to be its agent in pushing forward with the collider. A subcommittee of the ILCSC drafted parameters describing the high level attributes the collider must have from the particle physics perspective. Another, the ITRP, recommended a technology for our common work and used the expertise in the Accelerator subcommittee of the ILCSC for expert technical input.

After wide discussion the ILCSC proposed the Global Design Effort as a framework for tackling the needed design, R&D and cost estimating work needed to under gird a proposal to the world funding agencies concerned with elementary particle physics. This proposal was accepted by ICFA and is now being put in place. Direction and coordination of the international work is assigned to a Central Team for the GDE, reporting, pro tempore, to the ILCSC. The Central Team is envisioned

to carry out its responsibilities through Regional Teams, each having its own Director who is also a member of the Central Team. The composition of the Central Team is evolving. Currently it is seen to embody a Director, three cost engineers, one from each region, three Regional Directors and other Technical Principals and their support staffs. The location will be "virtual", rotating among the three regions. The members will remain attached to their current institutions and serve approximately half time. The needed strength is estimated at 15 – 20 FTE which means, perhaps, as many as 30 individuals. This is a work in progress and will evolve as experience is gained. The Director is Barry Barish, appointed on March 18, is well known for scientific and project leadership in the field of particle physics and "astro – particle physics and is currently Director of LIGO.

Still in the community self-governance phase, the regional teams will need to operate in ways commensurate with the requirements of the regional support agencies and will thus be organized in different ways. In any case there will need to be two functions carried out: resource management and work package and task management. In managing the work packages and tasks, the GDE Central Team will need to have its own Machine Advisory Committee for technical matters as well as a Resource Board consisting of the managers of the participating institutions from which the resources must come in the initial stages of the work. In resource management the Regional Teams will be connected to their support agencies for accountability as will each of the individual institutions leading work packages or tasks. This approach is already common in large detector collaborations which can be used as models for emulation.

INTERNATIONAL FUNDING AGENCY ORGANIZATION FOR ILC (FALC)

Even though accountability to the support agencies is provided for in the above arrangements, it will soon be necessary for the support agencies to take a more direct hand in managing the enterprise. There are at least two reasons for this. First, the magnitude of the resources needed to produce a credible design and cost estimate will be significant on current scales. Second, practicing with governance of a global project with equal intellectual ownership across regional cultures will be important in finding a practical way to proceed.

In the era of world agency governance it is envisioned on the science community side that the inter-agency, international Oversight Board will replace the ILCSC in connecting directly to a Central Project Team, each level having its advisory boards and connections to regional entities.

The regional agencies concerned with these matters have already begun to meet more than a year ago, exploring how they might begin to deal with this challenge. The most recent meeting was attended by UK, Italy, France, Germany, CERN, US, Canada, Japan, Korea, India and China. This group, terming themselves FALC, will meet twice a year for the time being. They have appointed a "FALC Resources Board" with representatives from each agency to meet more frequently and interface with the scientific community. Initial leadership of FALC has been furnished by PPARC, the UK support agency for particle physics and astronomy. In the international spirit of this enterprise, the INFN of Italy has now taken up the leadership role. It seems that if no unexpected events occur, FALC might begin to take some active governance role as early as 2007 or '08.

GDE TECHNICAL PROGRESS

ILC Workshops

Some two months after the technology choice, KEK was host to a first worldwide workshop ILCWS I to begin converging on a design based on superconducting technology. More that 200 participants were involved, a most remarkable success.

The activities were divided among five working groups: WG1, Overall Design; WG2, Main Linacs; WG3, Injector; WG4 Beam Delivery; WG5, High Gradient Cavities. Their primary issues of concern were

WG1 – Overall Design
- choice of initial and final energies & accelerating gradient
- review parameters and inter-relationships + impact on machine design
- conventional facilities, e.g. 1 vs 2 tunnels
- damping ring designs, dog bone or other
- positron source, undulator or "conventional"
- beam x-ing angle at IR
- beam dynamics issues and tolerances

WG2 – Main Linacs
- RF power sources
- RF power distribution
- RF controls on the cavities
- Cryogenic systems including cryomodule design

WG3 – Injector
- polarized e+ sources
- positron source system design
- damping ring designs

WG4 – Beam Delivery
- final focus
- MDI (detector interface)
- MPS (protection system)
- Beam dump
- Everything else down stream of the linacs

WG5 – High Gradient Cavities
- set baseline performance goals
- consider potential benefits of yet higher gradient

There was good progress in all areas and working groups continue through ILCWS II to be held at Snowmass Aug. 14 – 27 in conjunction with a physics and detector workshop. Interested parties are invited to attend.

The overall objective now is to develop optimizations strategies and drive towards a Baseline Concept Design, BCD, by the end of calendar 2005.

TIME LINE

While the time line possible is dependent upon factors beyond community control, it seems useful to project what one terms a "technically limited" schedule in which no resource limitations are taken into account. Such a consideration gives a lower limit to the time it will take to arrive at the ultimate objective – doing science at the e+e- energy frontier. With this proviso we envision the following:

- 2005 – Initial concept design + R&D plan with change control procedures established
- 2006 – Review concept design
- 2007 – Begin engineering design (selected sites in the three regions for specificity)
- 2009 – Have Technical Design Report + cost estimate
- 2010 – Review LC approach and LHC results
- 2015 (+) Begin operation

CONCLUSION

Despite the many challenges that one can easily imagine in moving forward with such an international enterprise, great progress has been made. This is a wonderful tribute to the international scientific community and its supporting and supportive infrastructure. Surely the collegiality of science engendered by its overarching goals of understanding the world around us at the deepest, humanly possible level has something important to say about how to manage human relationships in the here and now.