

Funding Agencies for Large Colliders

Presentation to CERN Council

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Background

- The FALC group was founded in 2003 on the initiative of Ian Halliday (UK) and is an informal body
- FALC meets twice yearly to discuss status and perspectives of particle physics
- FALC is composed of senior representatives from the main funding agencies in:
 - The Americas (Canada, US)
 - Asia (China, India, Japan, Korea)
 - Europe (France, Germany, Italy, Spain, UK; and CERN Council, CERN)

Timeline of FALC

2003-2005: UK chairs

2006-2008: Italy chairs

2009-2011: Canada chairs

Context

- Regional studies and reports commissioned in Europe, Japan, and the US have unanimously placed highest priority on exploration of *Terascale* energies at the LHC and a future linear collider
- The International Linear Collider has been identified by world-wide consensus of the community as a very high priority for a future facility
- Completion of the ILC technical design is on track for completion by end of 2012
- Studies of alternative CLIC technology that could potentially reach higher energies than the ILC are also in progress

Rationale

- The rationale of FALC derives from the fact that the particle physics program was increasingly confronted with the need for facilities on a global scale.
- Expansion of the program beyond a national or regional level created a new need for the funding agencies to interact.

Evolution

- At the inception of “Funding Agencies for the Linear Collider”, the prime focus was status of funding for R&D towards a sub-TeV lepton linear collider and perceptions of prospects for its future.
- While the initial R&D design phase could be funded through existing mechanisms, there was a need for global governance and an international design team as the ILC moved into an engineering design phase.
- In parallel, R&D towards CLIC, a potentially higher energy linear collider technology, was to be pursued.
- After choice in 2004 of superconducting technology for ILC, need for funding agencies and physics community to move forward in coherent manner was recognized.

Evolution *(cont'd)*

- Chairs of ICFA and ILCSC were thereafter invited to attend FALC meetings.
- When GDE was formed to produce a Reference Design, its Director was invited to all future FALC meetings.
- In addition, a FALC Resource Group was formed, with wider membership from funding agencies; it oversees a Common Fund for the ILC GDE.

Evolution *(cont'd)*

- In 2006, FALC branches out....
- Progress towards a construction decision for a linear collider could not be made in isolation without taking into account the wider picture of particle physics research.
- Remit expanded to promote global coordination of, and information exchange on, R&D programs for LHC upgrades, the near term (ILC) and future (CLIC) linear colliders, and the worldwide neutrino program (proton driver, neutrino factory).

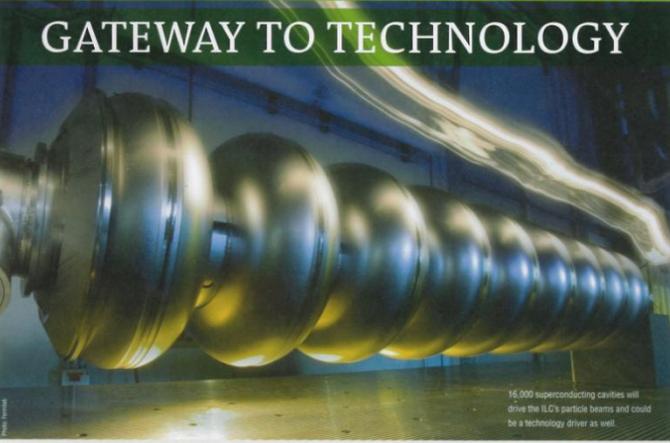
Evolution *(cont'd)*

- FALC acronym remains, but now “**Funding Agencies for Large Colliders**”.
- Consider the scenario: an LHC upgrade, a linear collider, and a global neutrino facility could all be **technically realisable** on similar timeframe – however, the **global resources available could very well be inadequate** to fund these opportunities on such a timescale.
- FALC considers coordination to be absolutely essential for the health and success of the global program.

Technological Impacts

**THE INTERNATIONAL
LINEAR COLLIDER**

GATEWAY TO TECHNOLOGY



16,000 superconducting cavities will drive the ILC's particle beams and could be a technology driver as well.

Humankind has always been driven by the desire to understand the world in which we live. The tools invented by scientists to gain this understanding in turn yield applications that benefit all of society and play a major role in the global economy.

Particle physics has been the source of many innovations not originally part of the quest for understanding the Universe. Many of these – medical diagnostics and therapy and the World-Wide Web are two striking examples – have changed the way we live and do business. Particle physicists continue their quest, and history tells us that the tools of the future should be the source of yet more technological breakthroughs, driving progress in industry and securing the workforce of the future. One of these tools is the proposed particle accelerator, the International Linear Collider or ILC.

Using unprecedented technology, the 31-kilometre-long ILC will hurl electrons and their anti-particles, positrons, toward each other at nearly the speed of light to collide 14,000 times every second at energies of 500 billion electron-volts. With the ILC, discoveries are within reach that could stretch our imagination with new forms of matter, new forces of nature, new dimensions of space and time and bring into focus Albert Einstein's vision of an ultimate unified theory.

Fundamental research is not done with the aim to make computers even faster, chips even smaller or medicine even better. We cannot be sure where the research into nature's most fundamental constituents will take us, and likewise cannot be sure what beneficial innovations will emerge. However, the track record makes us confident that technological advances will occur, in one form or another.

FALC commissioned a study to identify and enable the promotion of the technology implications of the R&D, focusing on the ILC.

Membership

- Representatives of funding agencies (up to 5-7 per region), or their nominees
- In attendance:
 - Chairs of ICFA and ILCSC
 - Chair of the FALC Resources Group
 - Director, ILC GDE

How does FALC function and what does it deal with?

As an illustration, the Agenda items from the latest FALC meeting held mid-January in Mumbai, India.

IN CONFIDENCE**FUNDING AGENCIES FOR LARGE COLLIDERS
DRAFT MEETING AGENDA**

17-18 January 2010

Mumbai, India

Tata Institute for Fundamental Research

17 January 2010

- 11.30 Pick up from hotel for TIFR
- 12:00 – 13:00 Lunch at Tata Institute for Fundamental Research
- 13:00 – 15:00 Meeting: FALC Preparatory/Governance Group

Full Meeting – Participation restricted to Funding Agencies Representatives / Officials

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|---|---------------|--|--------------|
| 1 | 15:00 – 15:10 | Opening Remarks and Welcome | W. Davidson |
| 2 | 15:10 – 16:50 | High-level verbal (i.e. not PowerPoint) regional reports from the Funding Agencies on their respective Plans (10 minutes each per country). Each Agency should address the issues: (1) Status/Outlook of their program for next fiscal year, (2) Major initiatives, and (3) Issues relative to international collaboration. <ul style="list-style-type: none"> • Canada, China, France, India, Italy, Japan, Spain, United Kingdom, United States | |
| 3 | 16:50 – 17:00 | Closing Remarks | W. Davidson |
| 4 | 17:00 – 17:45 | Presentation and Report on India | India, Hosts |
| 5 | 17:45 – 22:00 | FALC Dinner hosted by Tata Institute for Fundamental Research (preceded by 5 brief invited talks) | All |

18 January 2010: FALC Meeting

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|---|-------------|---|-------------|
| 1 | 9:00 – 9:05 | Introductory Remarks | W. Davidson |
| 2 | 9:05 – 9:15 | Approval of Minutes of the meeting held on 13 July 2009 <ul style="list-style-type: none"> - Public note - Detailed minutes | W. Davidson |
| 3 | 9:15 – 9:30 | Actions and matters arising | W. Davidson |
| 4 | 9:30 – 9:45 | Oral Report from Meeting of Preparatory/ | D. Kovar |

FALC Draft Meeting

Governance Subgroup of 17 January 2010

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|---|---------------|---|-------------------------------------|
| 5 | 9:45 – 10:30 | European Strategy Discussions of CERN <ul style="list-style-type: none"> - Status CERN's scientific and geographic enlargement | M. Spiro |
| 6 | 10:30 – 11:15 | Report from the Resources Group meeting held on 17 January 2010 (oral) <ul style="list-style-type: none"> - Expansion to include non ILC-centric initiatives? - FY10 GDE budget | R. Wade M. Hronek |
| 7 | 11:15 – 12:30 | ILC Progress Report <ul style="list-style-type: none"> - Status and progress of Global Design Effort - Research Director Report on Detectors - Update on ILC Governance Issues | B. Barish S. Yamada B. Foster |

12:30 – 14:00 Lunch and Visit of Tata Institute

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| 8 | 14:00 – 14:45 | Report from ICFA <ul style="list-style-type: none"> - ILCSC - Debrief on recent meetings | A. Suzuki J. Bagger |
| 9 | 14:45 – 15:30 | Update on status of current and planned projects (oral) <ul style="list-style-type: none"> - LHC and sLHC - Tevatron - KEK - J-PARC - Super B | R. Heuer P. Oddone TBD M. Yamauchi R. Petronzio |
| 10 | 15:30 – 16:15 | Definition of Global Projects <ul style="list-style-type: none"> - Discussion - Additional Candidate Projects for FALC Consideration - How frequently should reports on an individual Global Project be given at FALC? | TBD |
| 11 | 16:15 – 16:30 | Status Report on Considerations for Data Preservation | R. Heuer |
| 12 | 16:30 – 16:50 | Date and place of next meeting and other business | |
| 13 | 16:50 | Adjourn | |

Issues

1. The role of FALC
2. Projects appropriate for FALC consideration
3. Definition of what constitutes a Global Project

Role of FALC

After discussion, FALC affirmed the following as the description of FALC's role:

- FALC serves as a venue for funding agencies to communicate with one another information about their programs, program plans, and issues related to future large particle physics projects.
- The exchange of information serves to frame discussions of future multi-lateral projects and ensure governments are prepared for productive negotiations.
- Increased recognition of FALC so as to ensure governments are fully aware of its work.

Projects appropriate for FALC consideration

- FALC should continue to be well informed about the ILC, the most global project now in development. ILC requires tracking by FALC.
- The other lepton collider projects such as CLIC and the muon collider, while not as globalized as the ILC, merit discussion as well.
- Furthermore, each region should feel free to present information on projects with international aspects; this will keep FALC informed of new and ongoing initiatives.

Definition of a Global Project

- A clear understanding of the nomenclature is required to distinguish between international and global projects.
- Consideration of key attributes of a Global Project may include:
 - Size and cost of the project (e.g. resources required for construction exceed those of a single region)
 - Degree of internationalism
 - Equal weight participation by the parties
 - Type of governance
 - Of sufficient maturity that Agreements between parties based on multilateral discussions and formalized at treaty level can be undertaken

Definition of a Global Project (cont'd)

- It is important that the definition withstands the test of time.
 - E.g., in terms of fabricating detectors, the community has been global for two decades already. We now have to deal with facilities.
- FALC is continuing to grapple with these concepts and aiming to reach consensus.



Meeting of FALC at Tata Institute
in Mumbai in 2010

Meeting of FALC at Fermilab
in 2006



Wrap-up

- There are parallels and overlaps between what CERN Council and FALC are discussing. The appropriateness of their discussions on Global Projects is a case in point.
- FALC is still an informal body, now going into its 17th meeting.
- FALC is in place to ensure that its constituent funding agencies from around the globe are fully and mutually conversant with each other's program constraints and with the scale, the costs, the industrial relevance, and the governance issues of the successor machine to the LHC – the next lepton collider.
- FALC looks forward to CERN Council's observations.

Questions and Discussion