Short report on the First ILC Workshop

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Abstract

The First International Linear Collider (ILC) workshop was hold at KEK on November 13-15, 2005, with many participants from Americas, Asia and Europe (over 200). The present report gives a brief and condensed summary of the content of the workshop and of the status at the end of the workshop. It is generated by starting from the presentations given during the workshop and it is made of edited viewgraphs preceded by a short introduction & summary.

Introduction and summary

The "First ILC Workshop" has been organized under the auspices of ICFA and ILCSC and took place at KEK on November 13-15, 2004. It aimed at facilitating the world-wide formation of an international design team of a linear collider. Its charge is recalled first in p.4. The Workshop created an opportunity for in-depth and comprehensive discussions on design and development issues of a linear collider, which is to be based on the advanced superconducting RF technologies. This report gives a short summary on the march of the workshop in the form of copies of viewgraphs prepared for an oral presentation.

This recommendation to base the main linac technology of a TeV scale electron-positron linear collider on superconducting RF cavities has been issued in August 2004 by the International Technical Review Panel. The content of the recommendation, endorsed by ICFA and ILCSC, is recalled in pp 5-6. Now, a large number of high-energy physicists, accelerator scientists and engineers are actively exploring the path towards rapid development of a conceptual design of an International Linear Collider (ILC). The status of these activities and proposals of possible contributions were presented in messages from the various regions involved. Extracts of the message from the Americas are given in pp 7-10, the ACFA statements and KEK possible plans are summarized in pages 11-15 and the existing European collaborations prepared to contribute to the ILC design work are recalled in pp 16-19.

The five working groups (WG) of the workshop are listed in p.20, with the main topics they addressed. WG1 created interim working groups to define the parameter ranges (in the next 2 months), the construction schedule, type of positron source and tunnel configuration, the low emittance transport and the instrumentation. WG2 concluded that the technology for the power sources, modulators, multi-beam klystrons and the cold technology were mature, with XFEL synergy for industrialization. It took note of the announcements of interest for new R&D facility plans (one at FNAL/US, one at KEK/Japan and one at DL/UK) beside TTF at DESY/D, for possible checks of superconducting modules. WG3 noted controversial items on the injectors (type and size of the damping rings, scheme of positron production) and the progress on simulation studies of collective effects (e-cloud included). WG4 made significant progress and was able to come with recommendations on the working hypotheses for the BDIR (Beam Delivery and Interaction Region). It emphasized the urgent needs (next 8 months) to become closer to a complete design and announced the MDI workshop at SLAC (January 6-8. 2005) and the BDIR workshop at Oxford (Spring 2005), the milestone being the Snowmass meeting in August 2005. WG5 discusssed major issues such as fabrication of cavities and modules, cost reduction and industrialization (many of these issues being adressed in the JRA1 termed SRF of CARE). It announced significant progress in unifying the ILC community and cooperation, the plans for new test infrastructures in USA, Japan and DESY, as already mentioned.

The basic concept of the Global Design Initiative (GDI), the complicated organizational GDI chart for the early phase and the proposed very tight time line are recalled on pp 21-23. The last pages 24-25 give the latest status of the GDI formation with comments on the reporting to the ILCSC. Different committees and groups have been formed in this context. First, a World-wide Study (WWS) of Physics and detectors is carried out. This organization includes coordinating presentations of whole-detector studies leading eventually to TDRs and coordinating with Central Team on detector issues. Detector concept teams are forming. Second, a search committee for a Central Team Director has been created. It discussed the qualifications required and the regions nominated 13 candidates. It is hoped that a recommendation for a director will be made to ILCSC by its 10 February 2005 meeting. Third, an evaluation committee of a central team site has also been created. It formulated a set of questions related to the central team site requirements, such as the availability of specific services and of administrative support. It also defined criteria for selecting the site among the offers received. Concerning the Memorandum of Understanding (MoU) under which the laboratories should express their obligations to carry forward the initial design work, a draft was circulated in. the ILCSC meeting of Nov. 16, 2005. No final agreement was reached, some items still to be settled, and a new MoU draft will be circulated among the ILCSC members.

All the presentations given during the First ILC Workshop, either in the plenary sessions or in the WG parallel sessions can be found at the following URL address :
http://lcdev.kek.jp/ILCWS/
This workshop is intended to be followed by a Second ILC workshop, ILC2, suggested to be the accelerator part of the Snowmass meeting on HEP, planned for 14-27 August 2005.

Acknowledgements

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First ILC Workshop

Workshop Charge

The workshop charge is as follows:

- Initiate the work for the ILC (pre-GDI) after the technology choice of superconducting RF technology.
- Review the Technical Issues with SC-LC.
- Develop lists of design elements and decide whether they are
  1. non-controversial in concept and may only need some optimization; or
  2. should be considered open to reevaluation, in the conceptual design phase.
- Work according to the list above.
- Present the topics the different groups are interested in, and can contribute to the overall design

The Recommendation

- **We recommend that the linear collider be based on superconducting rf technology (from Exec. Summary)**
  - **This recommendation is made with the understanding that we are recommending a technology, not a design. We expect the final design to be developed by a team drawn from the combined warm and cold linear collider communities, taking full advantage of the experience and expertise of both (from the Executive Summary).**
  - **We submit the Executive Summary today to ILCSC & ICFA**
  - **Details of the assessment will be presented in the body of the ITRP report to be published around mid September**
  - **The superconducting technology has features that tipped the balance in its favor. They follow in part from the low rf frequency.**

Remarks and Next Steps

- The linear collider will be designed to begin operation at 500 GeV, with a capability for an upgrade to about 1 TeV, as the physics requires. This capability is an essential feature of the design. Therefore we urge that part of the global R&D and design effort be focused on increasing the ultimate collider energy to the maximum extent feasible. (from Exec Summary)
- A TeV scale electron-positron linear collider is an essential part of a grand adventure that will provide new insights into the structure of space, time, matter and energy. We believe that the technology for achieving this goal is now in hand, and that the prospects for its success are extraordinarily bright. (from Exec Summary)

Interests in ILC R&D- Universities

- Two groups of universities in the US,
  - the Linear Collider R&D Group (**LCRD**, DOE-funded), and
  - the University Consortium for Linear Collider R&D (**UCLC**, NSF-funded),

have proposed to do both accelerator and detector R&D for the International Linear Collider.

- Together, the two groups assembled 71 sub-proposals from 47 universities.
- The accelerator R&D proposals offer the opportunity for university-based physics and engineering groups to bring their considerable intellectual resources to bear on the challenges of the ILC.
- Accelerator R&D work, funded by both DOE and NSF, has been started at 12 universities in the past year.

Interests and capabilities in ILC R&D- US Labs

Injectors

System	ANL	Cornell	FNAL	JLab	LBNL	LLNL	MSU	SLAC
e- source			X	X				X
e+ source	X	X		X		X		X
DR-design and simulation	X	X	X		X		X	X
DR-Fast kickers		X	X			X	X	X
Bunch compressor					X		X	X

Interests and capabilities in ILC R&D- US Labs

Main Linacs and Beam Delivery Systems

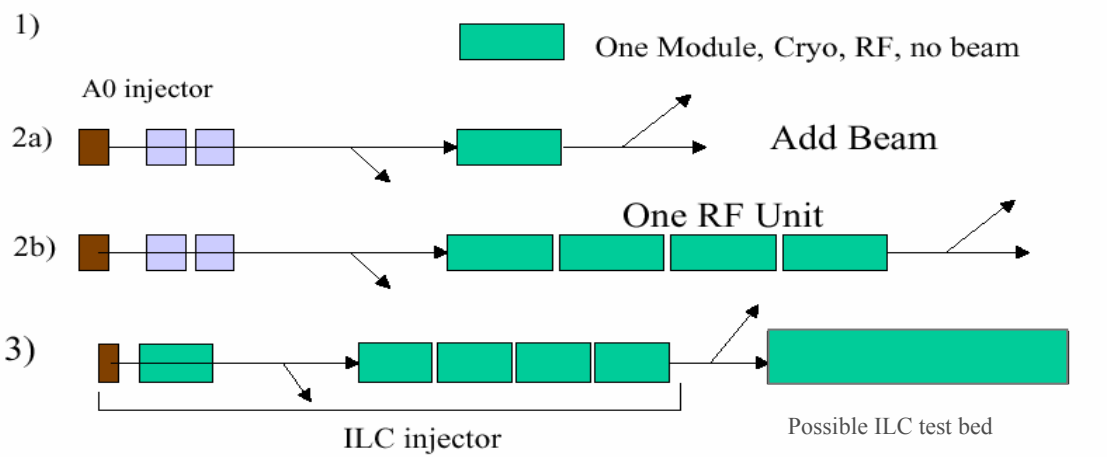
System	BNL	Cornell	FNAL	JLab	LANL	LLNL	MSU	SLAC
Main Linac: Modulators, RF distribution, LLRF			X	X	X			X
Main Linac: Klystrons					X			X
Beam dynamics, DR to IP		X	X	X	X		X	X
Beam delivery systems	X		X		X	X	X	X

Main Linacs: Cavities and Cryomodules

ANL, BNL, Cornell, FNAL, JLab, LANL, LBNL, MSU, ORNL, SLAC

ILC Cryomodule Fabrication and SMTF

- **Expression of Interest submitted to Fermilab Director.**
  - Based on commitment to play a leading role following the cold decision.
  - Provisional goal is fabrication and testing of three U.S. plus one European high gradient cryomodules by 2008. (in close coordination with the GDE).
  - Cryomodule test facility to be constructed at Fermilab
- **Interested partners:** ANL, BNL, Cornell, FNAL, JLab, LANL, LBNL, MIT, MSU, NIU, ORNL, Pennsylvania, SLAC (, DESY, INFN, KEK)
- **Concept of a possible evolution (ILC portion):**



2005-06

2008-…

Third ACFA Statement on Linear Collider

9th ACFA mtg at Kolkata, India, Nov.2004

- ACFA welcomes the truly international nature of the decision on technology for the ILC. This sets the stage for international collaboration in the design efforts for the ILC.
- ACFA reaffirms that the ILC, the next major high-energy physics project, should be realized by world-wide efforts. In such International collaboration, ACFA and scientists in ACFA countries should play crucial and leading roles.
- ACFA reconfirms the importance of hosting ILC in Asia, which will make high energy physics and accelerator science truly global.
- ACFA urges the Japanese Government to fully support the efforts of KEK and Japanese scientists to host the ILC in Japan.

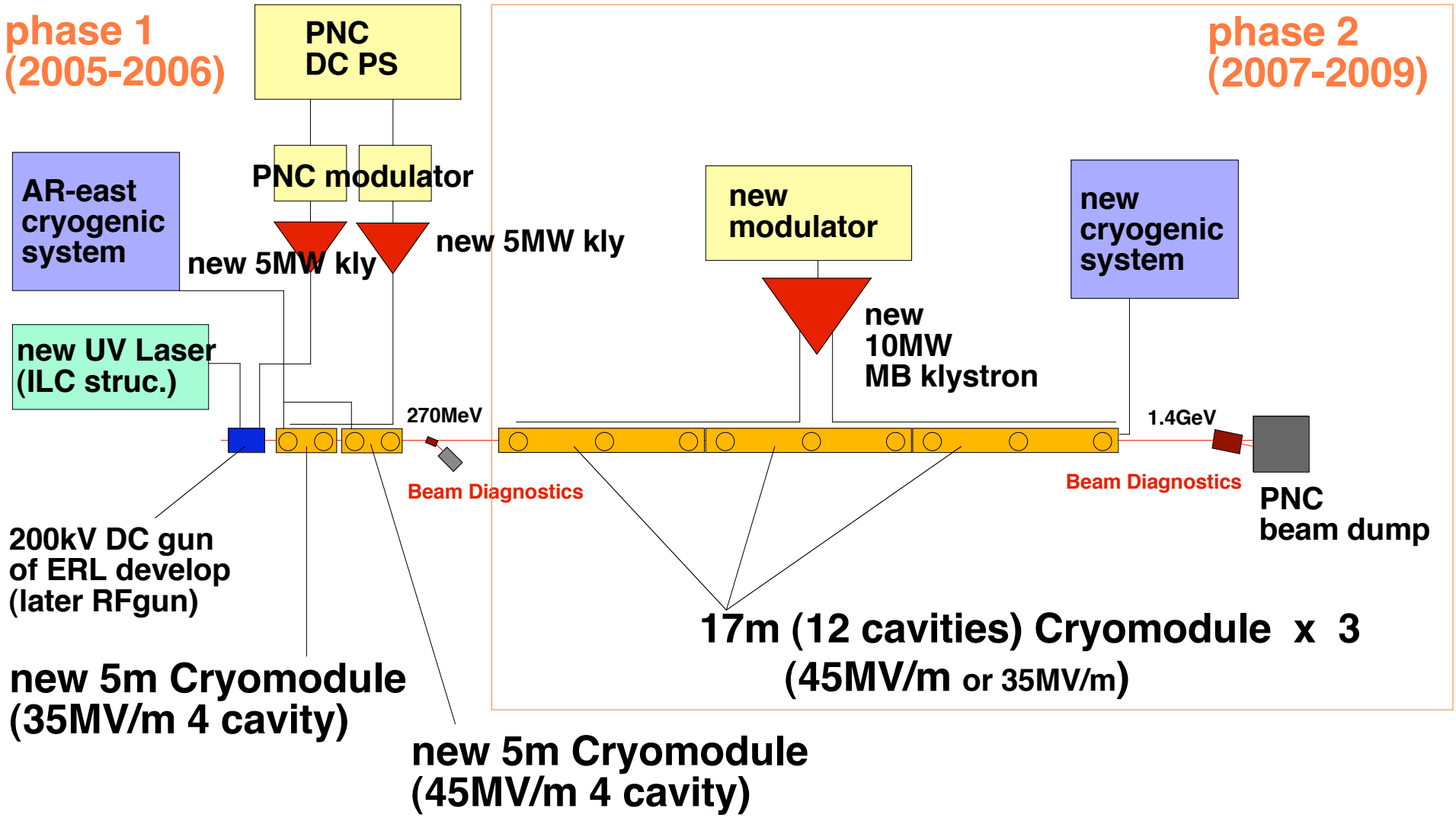
ACFA Statement continued

- ACFA reconfirms that KEK is the best suited institute for hosting the Central Team of GDI.
- ACFA urges KEK to establish the Asian Regional Center for R&D in GDI and encourages other Asian countries to actively participate in GDI.
- With ILC entering this important phase, ACFA urges Governments of Asian countries to support participation of their scientists in GDI.

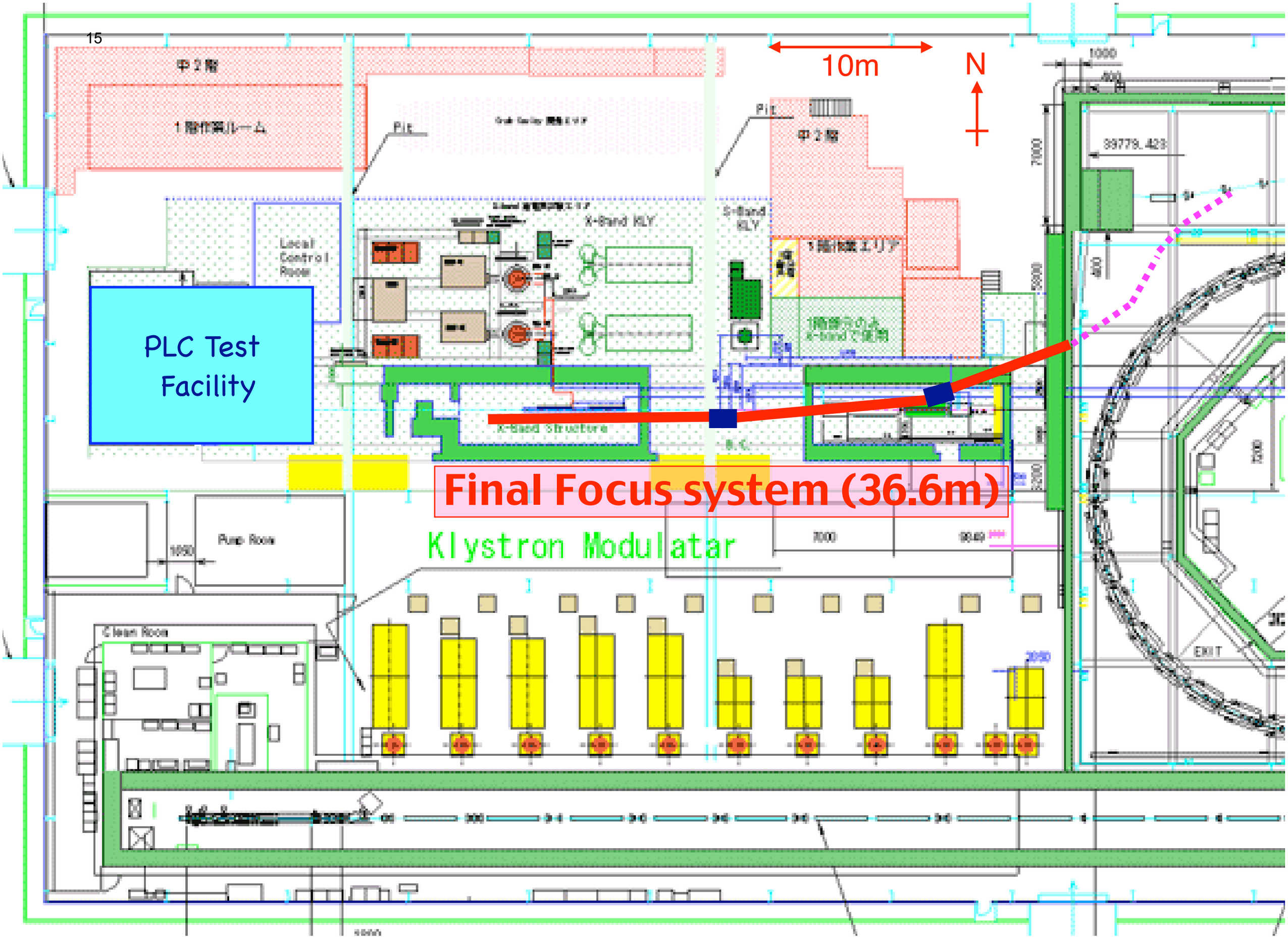
Reform

- The ICFA announcement was in fact a shocking news, but
- Rapid reformation on the way
  - SC group already powerful since TRISTAN, KEKB...
  - Re-organizing X-band group
  - ATF group is of course active
  - Participation of other groups
- Formation of ILC Asia Working Group
- Active involvement from industries
- Would like to contribute to both linac rf and injector/BDS/design

Plan of Superconducting Cavity Test Facility (STF)



V1.0 Hitoshi Hayano, 11/07/2004


10m
N
PLC Test Facility
Local Control Room
X-Band KLY
S-Band KLY
Pit
Pit
中２階
１階作業ルーム
１階作業エリア
X-Band Structure
Final Focus system (36.6m)
Klystron Modulatar
Pump Room
Clean Room
EXIT

Euro Collaborations

- TESLA (wider than Europe alone)
- European XFEL
- Coordinated Accelerator Research in Europe
- EuroTeV - LC research programme

EU Funded -> 2008

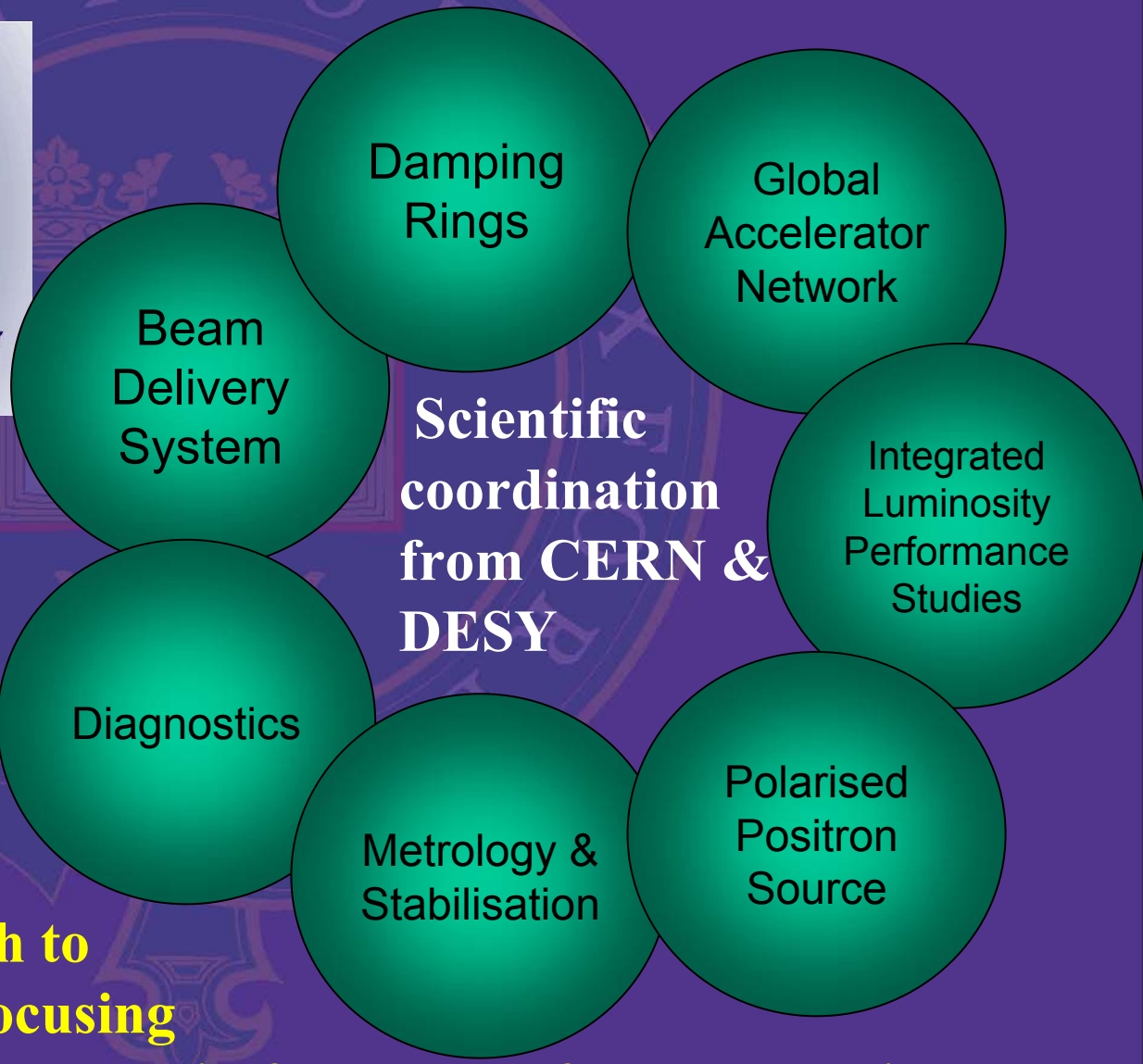
- UK Linear Collider Accelerator & Beam Delivery
  LCABD – PPARC & CCLRC-funded

Other funding via national agencies (i.e. many soruces)

CARE

- CARE is EU FP6-funded programme on Coordinated Accelerator Research in Europe. It is a very broad programme, incorporating e.g. work on SC high-intensity proton linacs, high-field magnet development, etc. Here we are concerned only with those elements directly related to ILC.
- The most relevant workpackage is on SCRF. Here there are 11 institutions involved: DESY, CEA/DSM/DAPNIA, CNRS-IN2P3-Orsay, INFN Legnaro, Milano, Roma2, Frascati, Paul Scherrer Institute, Technical University of Lodz, Warsaw University of Technology, IPJ Swierk.
- Budget is 15 M€ over 5 years, incorporating ~44 FTE. There is significant overlap with TESLA / TTF / XFEL.

EuroTeV



- **EuroTeV programme also EU FP6 funded. It is purely concerned with LC – generic matters of use both to ILC and CLIC. Focusing on ILC-TRC R2 items. Will form part of Europe Design Team.**

CERN

- R&D on generic key issues independent of technology:
  -Participation in EUROTeV, CARE and ELAN network
  -R&D on Beam dynamics, Beam diagnostics, BDS, Ecloud…..
  Resources: 2.3 MEur. Material + 25 staff-y +
  20 fellows-y = 6.75 MEur. total

- Additional key issue common to ILC and CLIC (not funded):
  Multi-Beam Klystrons with long RF pulse aiming for very high efficiency (80%) (novel scheme based on RF cavities with high order modes)

- Tests with beam in CTF3 Test facility:
  Beam instrumentation and benchmarking of beam simulation codes. Beam combination as possible DR injection/extraction with RF transv. cavities

List of Working Groups

WG1 - Overall Design: Discuss on the overall design including the conventional facilities; parameters, choice of 1 versus 2 tunnels, choice of positron source design, damping ring design, crossing angle, beam dynamics and tolerances

WG2 - Main linacs: Main linac system issues, RF power sources; cryo-modules; test-facilities

WG3 - Injector: Electron/positron sources, damping rings, and bunch compressors

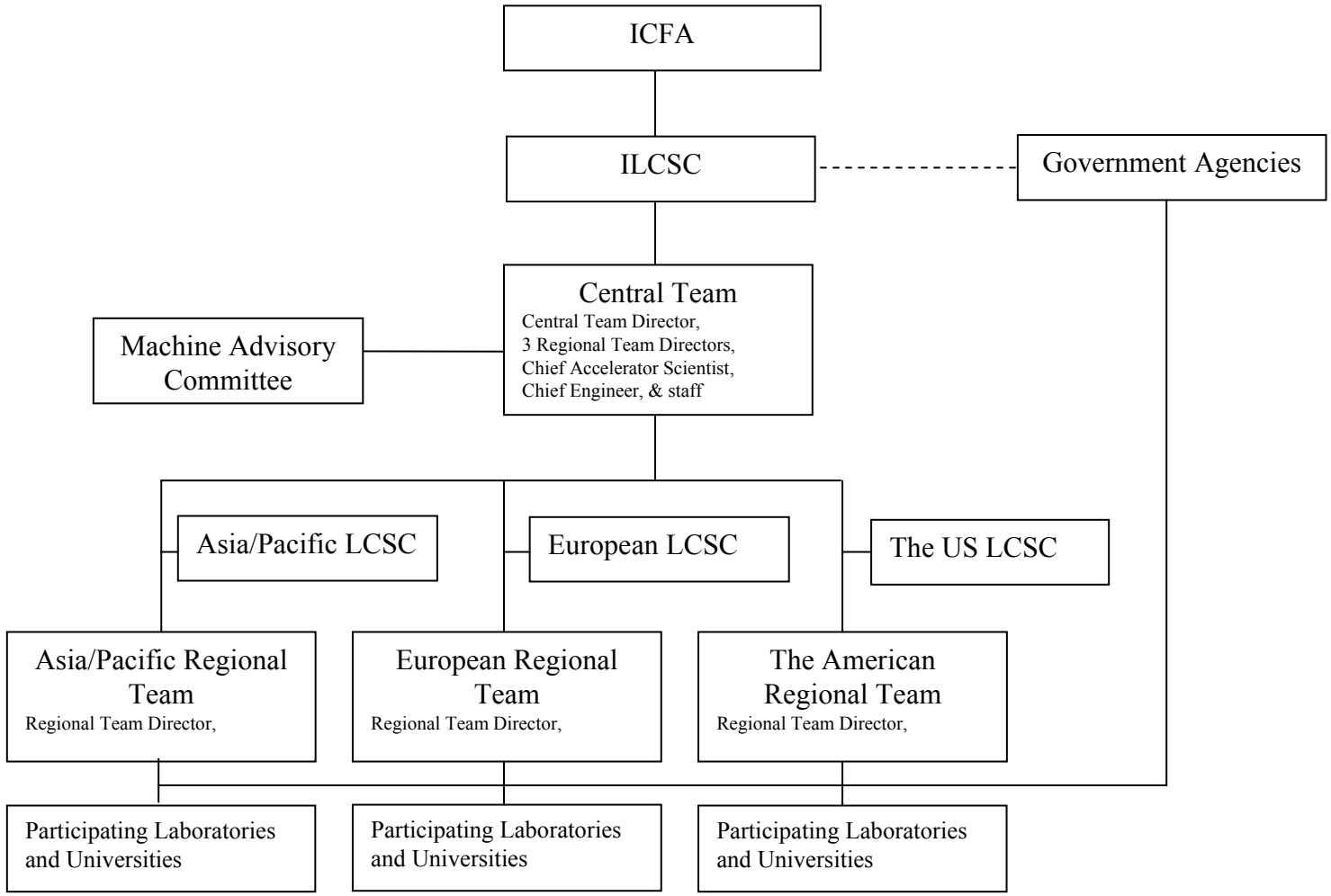
WG4 - Beam Delivery: Collimators, machine protection, final focus, machine detector interface, beam dumps:

WG5 - High gradient cavities: accelerating cavities, the baseline performance and going beyond it

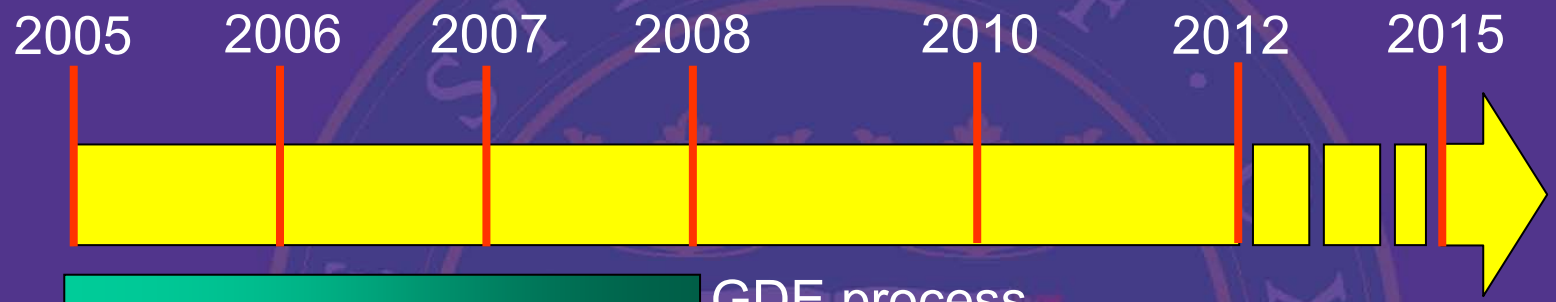
Basic Concept of GDI

1. The ILCSC will initiate the ILC Global Design Initiative (GDI) as an inter-regional undertaking as soon as the technology choice is made based on the ITRP recommendation.
2. Its first mission is to quickly progress from the technology decision to a globally agreed upon CDR of the machine, including its parameters and layout, and to develop the roadmap for future activities including the R&D.
3. This Initiative in its early phase will be established using MOU's among the participating institutions, and will be supported by their funds,

Proposed Org. Chart of the GDI in its Early Phase



Project Timelines



GDE process

CDR

TDR

construction

commissioning

physics

ILC

preparation

construction

operation

EURO XFEL

EUROTeV

CARE

UK LC-ABD

GDI Formation Status

- Recruit Director for Central Team
  - Search committee appointed in August
  - Chair appointed
  - First report Nov. 16 : 13 candidates, Some interviews expected in Dec. 04, recommendation planned on 10.2.05 (ILCSC).

- Evaluate site offerings for Central Team Host
  - evaluation committee of 6 appointed in August
  - Chair appointed *
  - 9 offers received (KEK, LBNL, SLAC, TRIUMF, FNAL, BNL,CORNELL, RAL (2), DESY
  - First report Nov. 16 :

List of requirements established (Services, administrative support, ...)

Defined the criteria for the selection

- *Ratify MOU under which the "big" labs will express their obligations to carry forward the initial work of the ILC design, planning, etc.*
  - *initial draft circulated and discussed in August. Revised draft to be discussed at KEK meeting, Nov. 16:*
    no final agreement, new draft issued

- *Interim Activities*
  - *This First ILC Workshop*
  - *possible follow on activities to be discussed at ILCSC meeting Nov. 16 : 2nd ILC workshop, at Snowmass, 14-27 Aug 2005*

- *Hope to have Director and Central Team location decided at or before the next formal ICFA meeting in Feb. 2005*