

Declaration by the scientific representative of the project coordinator¹

I, as scientific representative of the coordinator¹ of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate):
 - has fully achieved its objectives and technical goals for the period;
 - has achieved most of its objectives and technical goals for the period with relatively minor deviations¹;
 - has failed to achieve critical objectives and/or is not at all on schedule².
- The public website is up to date, if applicable.
- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 6) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 5 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator¹: Dr. Eckhard Elsen

Date://

Signature of scientific representative of the Coordinator¹:

¹ If either of these boxes is ticked, the report should reflect these and any remedial actions taken.

² If either of these boxes is ticked, the report should reflect these and any remedial actions taken.

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1 Publishable summary

1.1 Project logo:



The logo underlines the important role of ILC-HiGrade for the ILC effort in Europe.

1.2 Project Summary and Context

There is worldwide consensus that the e^+e^- International Linear Collider (ILC) is the next major project in High Energy Physics following the imminent commissioning of the LHC; it is a high priority in the European Strategy for Particle Physics agreed by CERN Council. The ILC will constitute the precision tool for the Terascale, the scale of electroweak symmetry breaking. The ILC complements the potential of the LHC, which will initially chart this unknown territory.

The ILC-HiGrade project brings together the key players in Europe to engage towards the realisation of the ILC. They constitute a large fraction of the European element of the Global Design Effort (GDE) that has led to the publication of the Reference Design Report (RDR) in 2007. The report forms the basis for the Technical Design Phases I and II of the ILC, which the GDE will complete by mid-2012. The proposal for the ILC will then be presented to the global stakeholders, i.e. governments and funding agencies to seek approval. The technically driven schedule envisages start of construction as early as 2012. Project approval and start of construction is a two-stage process.

Starting in 2008, the ILC-HiGrade Consortium started to address important elements in this two-stage process with siting of the facility as one major ingredient. Currently there are site proposals in Japan, US and in Europe. Their benefits are being evaluated and the international framework in which the project will be realised will be developed. ILC-HiGrade encompasses the European side in this global endeavour. The participating laboratories and universities contribute their long-standing experience in conceiving large-scale experiments and the organisation of large collaborations to a process that establishes the global framework for an organisation that will support start of construction matching the technical timelines.

It should be noted here that the Technical Phase has been divided into Phase I and II following the delays in commissioning the LHC and the science funding in the US and UK for the 2008 fiscal budget. The ILC has adapted the technical schedule over its original form by focussing the Technical Design Phase I on the key issues to be largely resolved by 2010

and a Technical Design Phase II that extends into 2012 to complete the overall technical design. This delay does not directly affect the approval process since the relevant technical uncertainties for the ILC will have been resolved.

The linacs of the ILC constitute a major cost-driver. Their design and their cost depend on the achievable accelerating gradient for the ILC. The global gradient development programme will establish a realistic operational gradient for the ILC by employing proven preparation techniques, with European laboratories leading the effort. In the course of ILC-HiGrade, the partners will prepare at least 24 fully dressed cavities, which will initially serve as a technical reference for the decision on the choice of gradient and eventually as the industrialisation of the high-gradient process. Important steps have been made to prepare the facilities and the instrumentation for this technical step.

The timelines of this 4-year project are well aligned with those of the Global Design Effort, aimed at establishing the technical basis for proposing the ILC by mid-2012. There is a world-wide consensus that at this time the design and physics capabilities of the ILC will be evaluated in the environment following the first physics and operational results from LHC in order to chart the path towards approval of the ILC in 2012 and construction beginning soon after.

From a European perspective, all crucial elements necessary to produce this outcome, both technical and political are reinforced and explicitly supported in the ILC-HiGrade project.

1.3 Project webpage

The webpage of the project is hosted at <http://www.ilc-higrade.eu>.

2 Project objectives for the period

There are two main objectives of the preparatory phase: firstly, to ensure that the crucial R&D has been carried out to allow the project to be constructed within the internationally agreed cost envelope; secondly, to establish all necessary structures and technical capabilities to ensure that the ILC can be brought to governments for submission for approval in 2012 and that the site choice has been technically prepared.

There is no doubt that the major technical challenge of the ILC in the preparatory phase is to ensure that the superconducting accelerating structures, currently produced in laboratory conditions in excess of the ILC specification, can be industrially produced with the required reproducibility and field gradient. This requires substantial R&D both in laboratories and in an industrial environment and close collaboration between ILC scientists and engineers and industrial companies. In particular, the production of final prototypes of the accelerating modules plays a key role in this and is a major objective of the preparatory phase. The achievement of this will require the provision and construction of new test facilities in Europe beyond those for the XFEL to match those under construction in the US and in Asia. While there are many other technical developments and R&D necessary to ensure that the ILC can be successfully built, the successful establishment of the necessary parameters for the superconducting accelerating structures is a *conditio sine qua non* for the success of the project. This work builds on immense European expertise in this technology, nurtured by support through the CARE and EUROTev programmes in FP6.

The second main goal of the preparatory phase is the development of appropriate organisational infrastructure and governance structures to supervise the preparation of the ILC project for submission to stake-holding governments for approval. The ILC is a global project with a well-developed international management structure. The Global Design Effort (GDE) under GDE Director, Barry Barish, supervises the worldwide effort aimed at producing an engineering design. The GDE Executive Committee, chaired by the GDE Director, includes three Regional GDE Directors, one of whom is the Regional GDE Director for Europe. Although the GDE has a sophisticated and functional management, much remains to be done as the project moves into a new phase now that the reference design phase is complete. The structures to develop include the GDE Project Management Team, further work on the development of a European site and a variety of questions on governance, legal issues etc. These goals can be achieved by the engagement of the appropriate individuals to devote substantial fractions of their time to this end. The European Regional GDE Director directs the overall strategy of the ILC-HiGrade project and interacts with the other Regional GDE Directors and the GDE Director in developing the best structures for the project. The European member of the GDE Project Management Team also plays a major role in this, as well as steering the technical development of the work packages. The Representative of the Coordinator of the ILC-HiGrade project (Coordinator) is fully devoted to this task and is assisted by accelerator physicists from the two major European centres, DESY and CERN. Civil engineering effort is also required to develop further the European site proposal. Legal advice on the appropriate way in which to frame the structures for the final governance of the ILC will also be very important. A final vital element necessary for the success of the project is to fund attendance at and organisation of the necessary international meetings where the progress of the project can be reviewed and to facilitate outreach to governments and the general public by, amongst other things, the provision of appropriate documentation and descriptive material in major European languages.

Specifically ILC-HiGrade will address the following objectives in its work packages:

- WP1: Management of the Consortium
- WP2: Integration and optimisation of the European contribution within the global GDE organisation as the ILC project moves through the GDE Technical Design Phases
- WP3: Ensure that the characteristics and importance of the ILC, and its place within the world of science and research, is widely disseminated to the peoples of the European Union, and their governments
- WP4: Investigate features and develop possible schemes of governance for the ILC, exploiting expertise of CERN (LHC) and DESY (HERA) in international projects
- WP5: Prepare and investigate possible European sites for ILC construction
- WP6: Investigate and monitor the production process that yields high-gradient cavities with high yield. Establish the process in industry
- WP7: Optimization of the coupler conditioning at reduced cost
- WP8: Demonstrate suitability of tuner design in tests. Establish a cost-effective tuner production

The overall success of the project will be measured in

- the establishment of governance structures for Europe that are adequate and match the equivalent efforts in other regions;
- the choice of a realistic accelerating gradient with an overall assessment of cost.

3 Work progress and achievements during the period

3.1 WP2 – Coordination of European GDE Activity

| | | | | | | | |
|--------------------------------------|---------------------------------------|--------------------------------------|---|--|--|--|---|
| Work package number | WP2 | Start date or starting event: | | | | | 1 |
| Work package title | Coordination of European GDE Activity | | | | | | |
| Activity type | COORD | | | | | | |
| Participant id | 1 | 3 | 6 | | | | |
| Person-months per beneficiary | 6 | - | 3 | | | | |

The GDE activity is coordinated and managed in a coherent worldwide activity but with a significant regional management component. The GDE is managed by the Director, Prof. B. Barish (Caltech, USA), with the advice of the Executive Committee (EC). The EC has approximate regional balance and consists of three Regional Directors (for Americas, Asia and Europe; B. Foster is the European Regional Director), three Project Managers (one from each region; N. Walker is the European Project Manager) and miscellaneous experts, currently E. Paterson, the GDE Integration Scientist. This body, chaired by the Director, has weekly one-hour duration phone conferences and meets face to face on a regular basis, generally an average of once every two months. The structure of the GDE is illustrated in Figure 1.

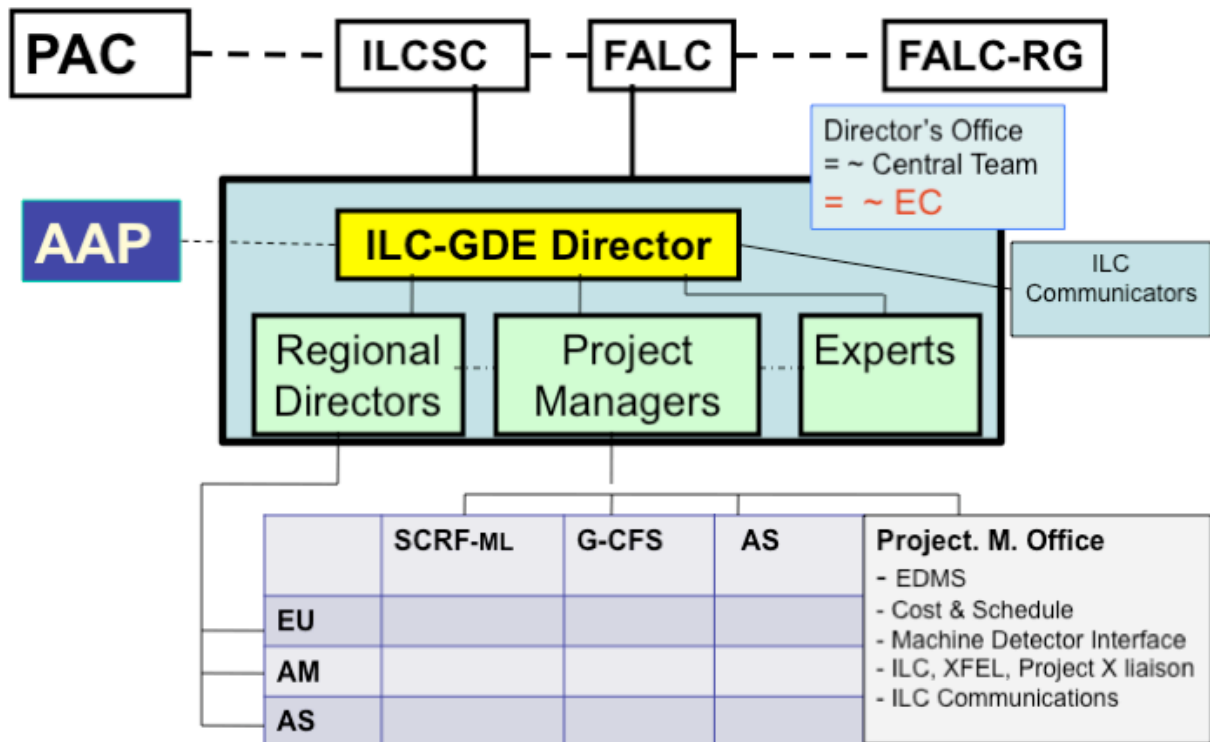


Figure 1: Structure of the GDE management. The boxes at the top correspond to bodies to whom the GDE in one sense or another reports. These are defined in the report on WP4. The blue box defines the Director's office, which is equivalent to the EC defined in the text. The AAP is the Accelerator Advisor Panel, a body that reports to the EC and which can be charged to carry out specific reviews of any area of GDE activity. The ILC communicators contain representative of each from each region and are responsible for public outreach. The Project Managers' Office is responsible for delivering the R&D programme defined by the EC.

The Director, advised by the EC, sets the overall policy to be followed by the GDE. The Project Managers are responsible for implementing that policy and producing the deliverables agreed by the EC. The role of the Regional Director varies from region to region. The Regional Director for the Americas is also the US R&D programme manager, who is responsible to the Department of Energy for the expenditure of the R&D funding devoted to ILC. He is also charged by DoE with the responsibility to decide on the subdivision of the resources between the various national labs involved in the programme and the universities. The European Director, on the other hand, does not have budgetary responsibility for any resource and instead has a role optimisation in coordinating and steering the general direction of the national R&D programmes that together make up the European contribution to the ILC. Part of his role consists in ensuring good communications between the projects and the European funding agencies and the GDE. The European Regional Director and the European Project Manager thus have a key role in the optimisation of the European ILC effort. They, together with the Deputy Regional Director from CERN, who also runs the CLIC project, have regular telephone meetings and meet regularly face to face.

Another key role of the European Regional Director is to ensure good communications inside the GDE group in Europe. This is facilitated by a number of measures, include the ILC-HiGrade web site, where minutes of meetings and other information are regularly posted, and the organisation of meetings where the European GDE members can exchange views and establish strategy and priorities. Currently these meetings are held either in the framework of the general GDE meetings, held twice yearly, or in the ILC-HiGrade meetings, of which one has been held in the review period, in August 2008 in Hamburg. The GDE meetings in 2008 were held in Dubna, Russia in June and in Chicago, USA in November. The European effort in the preparation of these meetings mostly concentrated on the June meeting where the siting issue of the ILC was topical.

The major tasks in the last twelve-month period have been centred around the production, and regular updating, of the ILC Resources Plan. The first version of this plan was produced in June 2008. The plan has several roles, all of which are interdependent. It catalogues the R&D tasks in a clear and coherent way, enumerates those working on them and the resources that are available. It gives milestones and goals for each project and describes some of the design choices and options that will need to be considered. The R&D plan is updated on a six-months time scale, with the overall resources updated every twelve months. Several GDE members including the Regional Directors and Project Managers are involved in the updating exercise, which is complex and onerous as resources come from many different sources, including national funding authorities, universities and supranational organisations such as the EU. This review of resources was carried out to prepare the first R&D plan in the early summer of 2008 and is due again in the summer of 2009.

CERN is a unique European resource and centre of excellence and is a reservoir of talent in specialised areas, e.g. cryogenic engineering and civil construction as related to specialised areas of particle physics infrastructure construction. In order to ensure the best use of the resource for the ILC project, it is essential that the European Regional Director keeps in close contact with the CERN management. To this end, J.P. Delahaye is also Deputy European Regional Director and plays a full part in discussions of the European GDE. As Project Manager for the CLIC project, he is also in an excellent position to work with the European Regional Director and European Project Manager to ensure the maximum possible synergy of the ILC and CLIC projects. Both have the goal to produce a highly performant linear electron-positron collider and many of the R&D goals are similar or have very significant commonality. In the period under review, there has been a significant strengthening of the cooperation between the two projects and agreements on areas of common interest have been

carried through. Working groups have been set up with regular meetings on a number of these topics of mutual interest. Both the European Regional Director and the European Project Manager, as well as the other Project Managers, attended the CLIC Plenary meeting at CERN from 14.-17.10.2008. A talk on ILC progress was presented at that meeting.

In order to maintain good contacts with funding authorities and governments inside Europe, the European Regional Director of the GDE has continued a programme of visits including to the French CNRS, where on January 5th he met with M. Spiro, G. Wormser and M. Auge in Paris. As well as matters related to governance (see the report on WP4), he discussed cooperation and R&D related to superconducting RF issues and commonality with the developments for the XFEL. Also in January the European Regional Director visited Madrid and held discussions with the Spanish community on the integration of their growing efforts into the R&D programme. A number of matters of mutual interest were discussed, including the possible involvement of industrial companies in ILC developments. On a visit to CIEMAT, the European Regional Director held interesting discussions with the Director-General, Sn. J.-A. Rubbio on expanding technical collaboration, particularly in the area of superconducting quadrupole magnet development. The European Regional Director and European Project Manager with the other Project Managers discussed R&D, mostly in the area of the damping ring, with colleagues at Frascati National Laboratory, Italy. They also had useful discussions with the Director of the INFN on technical collaboration and in particular synergy and common areas of research with the proposed SuperB factory at the Tor Vergata site in the vicinity of Frascati National Laboratory.

In summary, coordination of the European contribution to the ILC through the ILC-HiGrade project is working well and is carried forward on a daily basis primarily through the European Regional Director and European Project Manager, with the assistance of a large number of other colleagues.

| Meeting | Venue and Date | Purpose and Programme |
|-------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| JINR, Dubna, Russia | 3.-7.6.2008 | GDE Meeting http://www.linearcollider.org/cms/?pid=1000500 |
| Chicago, University of Chicago, USA | 16.-20.11.2008 | GDE Meeting during LCWS08 http://www.linearcollider.org/lcws08/ |

3.2 WP3 – Dissemination and Outreach

| | | | | | | | |
|--------------------------------------|----------------------------|------|--------------------------------------|---|--|--|--|
| Work package number | WP3 | | Start date or starting event: | 1 | | | |
| Work package title | Dissemination and Outreach | | | | | | |
| Activity type | COORD | | | | | | |
| Participant id | 1 | 4 | 5 | 6 | | | |
| Person-months per beneficiary | 12 | 6.53 | - | - | | | |

A summary of the activities and links can be found at the ILC-HiGrade webpage <http://www.ilc-higrade.eu/e10/e38725/>.

The core of European ILC communication is a team of two communication specialists with combined physics and journalistic backgrounds, who work in close collaboration with American and Asian colleagues, the scientific ILC community and a wider network of particle physics communication specialists from around the world. Ever since its formation four years ago, the international ILC communications team has had very active communication and

outreach activities, producing publications and brochures aimed at an international audience. These publications were mainly produced in English. To complement this work, the European team considers it essential to develop European-specific communications tools and translate the existing ones, into the main languages of the member states of the EU.

Although the ILC is a global project and should be promoted as one, we also consider it important to deliver further specific messages to selected audiences in Europe. In autumn 2008, the ILC European Outreach Advisory Subgroup, chaired by B. Foster, approved a new strategic ILC European communication plan for the four years of the ILC-HiGrade project. Our strategies are both internal in that our activities aim to strengthen the ILC collaboration as an international endeavour, and external, by developing tools to present the ILC to European governments and funding agencies and reaching out to the larger scientific community and key political representatives, always following the ultimate goal of building the ILC.

This is illustrated by a number of concrete actions taken this past year.

3.2.1 ILC-HiGrade website

Delivered on August 2009, <http://ilc-higrade.eu> is a concise and illustrated website which gives an overview of ILC-HiGrade project. A section called “general information” presents in short and simple terms the goals and challenges of the ILC project and machine.

The site is updated regularly and contains contact information for each work package.

3.2.2 ILC-HiGrade poster

This A0-format poster was presented at Versailles, France for the Fifth European Conference on Research Infrastructures (ECRI08). Written in simple and non-technical language, this poster comprises a short introduction to the ILC project in general, a schematic view of the accelerator and a description of its main components. It also summarises the goals and challenges of ILC-HiGrade and lists the participating institutes.

Link to the poster: <http://www.ilc-higrade.eu/e10/e38725/>

3.2.3 Press

In order to promote the launch of the ILC-HiGrade project, a press release was sent by the European ILC communicators on 3 July 2008 to a wide network of journalists in Europe and all over the world. Key media in the UK, Germany and Italy and France were targeted. The press release was translated into German and French.

The press release was picked up by a number of newspapers and news services, including two articles in the French newspapers Le Monde “Deux collisionneurs sont déjà à l’étude pour succéder au LHC vers 2025” on 5 July and Libération “L’après LHC déjà en ligne de mire - Un accélérateur plus précis est à l’étude pour les années 2020.” on 26 August and the German newspaper Physikjournal “Synergie in Bestform” on 3 July.

- Read the press release “Five million Euros to prepare Europe for the International Linear Collider” here: <http://www.interactions.org/cms/?pid=1026394>

3.2.4 Translation of the main ILC publications

A companion document, a glossy 40-page brochure ‘The International Linear Collider – Gateway to the Quantum Universe’, to the rather technical four-volume ILC Reference Design Report, was produced by the ILC communicators as core part of a committee representing the whole ILC community. The final document was released in print and on a

dedicated website in October 2007 and distributed widely to the key audiences of policy makers and the wider scientific community.

In 2008 the WP3 coordinators coordinated and edited the French, German, Italian, Russian and Spanish versions of this document. These documents are now available on the ILC website and we foresee to start printing and distributing some of these versions in the year to come.

Related ILC webpage: <http://www.linearcollider.org/cms/?pid=1000446>

3.2.5 ILC Weekly Newsletter NewsLine

Since August 2005, the birth of the Global Design Effort (GDE), the ILC communicators have published the electronic newsletter ILC NewsLine every week, including its 100th issue on 2 August 2008. The communicators are responsible for the content of the ILC website's public face, and tasks include updating it regularly with new news clippings, current and attractive images of R&D and other milestones. ILC NewsLine presently counts 2090 subscribers and the number of its readers is continuously increasing (+13% in 2008).

This year, 150 articles were published in ILC NewsLine, 33 of those written by one of the three WP3 coordinators.

Forty-one articles on European R&D, milestones and scientific milestones were published, mainly on the ILC, but also some about related projects. Indeed, in Europe, it is particularly important to connect the ILC to other projects in particle physics, like the Large Hadron Collider (LHC) at CERN, the European X-Ray Laser Project (XFEL) at DESY or the Compact Linear Collider (CLIC) Study. In particular, the launch of the LHC on 10 September 2008 was a huge opportunity to tap the public and media interest in particle physics at an unprecedentedly high level. In ILC NewsLine, 10 articles and photos related to LHC were published in 2008. We also devoted six articles in total to XFEL and CLIC projects.

ILC NewsLine current issue: <http://www.linearcollider.org/newsline>, archive: <http://www.linearcollider.org/newsline/archive/index.html>

3.2.6 ILC Technology transfer brochure

Commissioned by the Funding Agencies for Large Colliders (FALC), "The International Linear Collider – Gateway to Technology" is a four-page outreach brochure that aims to describe possible industrial, socio-economic transfers and the wider societal implications of the ILC project. It is based on a FALC report entitled "Technology Benefits Deriving from the International Linear Collider".

The European communicators worked with their Asian colleagues to write and realise this document, in close collaboration with, for the European aspects, the European Industry Forum for Accelerators with SCRF Technology (EIFast). In the future, this document should be translated on-demand.

Technology transfer brochure website: <http://www.linearcollider.org/cms/?pid=1000623>.

3.3 WP4 – Governance

| | | | | | | | |
|--------------------------------------|------------|--------------------------------------|---|---|---|--|---|
| Work package number | WP4 | Start date or starting event: | | | | | 1 |
| Work package title | Governance | | | | | | |
| Activity type | SUPP | | | | | | |
| Participant id | 1 | 3 | 4 | 5 | 6 | | |
| Person-months per beneficiary | - | 1.46 | 3 | - | 3 | | |

The governance study for the International Linear Collider cannot be carried out in isolation. Although every major international project is different, there are also many common threads. The overall thrust of our first year in the ILC-HiGrade project has been to establish contact with the various cognate international activities, at all stages of their development, and to begin to distil from these contacts and the information derived from them lessons that can be learned for the ILC project.

Because the ILC is a truly international project, its structure must reflect its nature. Thus input to the question of governance is necessary from all three major participating continents: Asia; the Americas; and Europe. This requirement is reflected in the structure we have set up to study the governance question. This is illustrated in Figure 2.

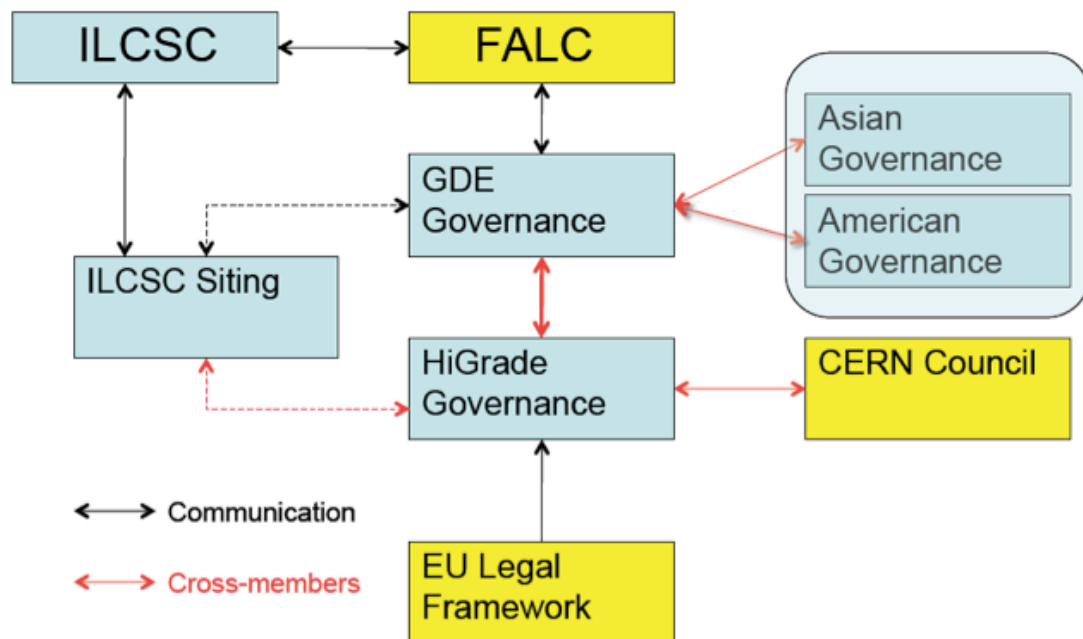


Figure 2: Structure of the governance activity in the ILC. The blue-shaded boxes represent committees set up inside the high-energy physics community. Those surrounded by the light-blue shaded box are currently not active. Yellow boxes represent committees external to the particle physics community. Black arrows represent communication paths, while red arrows represent cross-membership between committees.

In Figure 2, FALC is the acronym for Funding Agencies for Large Colliders, a body which meets typically twice per year and contains representatives from most major funding authorities with an interest in particle physics. CERN Council represents the smaller European countries, while France, Germany, Italy and the UK have their own representatives. This body is currently chaired by P. Coulombe, head of the Canadian Research Council. The CERN Council is custodian not only of the affairs of the European Laboratory for Particle Physics, CERN, but also sets the European Strategy for particle physics, which, after wide consultation among the European particle physics community, feeds directly into the ESFRI roadmap. The ILC project is the next major priority for a new facility for Europe. The EU legal framework discussions on Research Infrastructures have been very helpful to our discussions on the possible legalities of a body to run the future ILC laboratory. We await its final specification eagerly. However, given the requirement that any international body under its aegis must be

predominantly European, it cannot be directly applied to the ILC project. Nevertheless, we do not doubt that it will be very influential in shaping the final form of the ILC Laboratory.

The internal particle physics structures are controlled directly or indirectly by the International Committee for Future Accelerators (ICFA), which is an organ of the C11 Commission for Particles and Fields of the International Union of Pure and Applied Physics, IUPAP, itself an organ of UNESCO. ICFA is currently chaired by A. Suzuki, Director-General of KEK, the Japanese National Laboratory for Particle Physics. It contains representatives of each of the three regions as well as the heads of the major international laboratories, for example the Director-General of CERN is an ex-officio member. It meets twice yearly and sets overall policy for the world particle physics community. Although it has no executive authority, its influence is very great.

The International Linear Collider Steering Committee, ILCSC, is charged by ICFA with overseeing the activity towards realising the International Linear Collider. It is currently chaired by Enzo Iarocci, former Chair of CERN Council and Director of the Italian funding authority for particle physics, INFN. It contains senior members of the particle physics community. Each of the three regions has ex-officio representation. From Europe this includes the Chair of the ELCSC, the European Linear Collider Steering Committee. The current chair, Karlheinz Meier, is the Chair of the European Committee for Future Accelerators, ECFA, which is an organ of CERN Council. This committee typically meets twice per year, in advance of the meetings of ELCSC.

The ILCSC siting group is a subgroup of the ILCSC and is discussing mechanisms and procedures to establish the preferred site for the ILC. It consists of the Chair of ICFA and two other members, current Albrecht Wagner, recently retired Chairman of the DESY Directorate, and Pier Oddone, Director of Fermi National Accelerator Laboratory, USA.

The other two bodies in Figure 2 are both chaired by the European Director of the Global Design Effort for the ILC, B. Foster. They maintain close contact with each other and will hold some common meetings in future. The GDE Governance group contains representative of all three regions and is a subset of the Executive Committee of the GDE. Membership of this Governance groups is: B. Foster (chair), B. Barish (Director, GDE), M. Harrison (Americas Regional Director, GDE), E. Paterson (Integration Scientist, GDE) and S. Yamada, (ILC Research Director).

The ILC-HiGrade working group is the main organ to produce the deliverables of the WP4 work package. It is chaired by B. Foster, European Director of the Global Design Effort, and consists of the following members: J.-P. Delahaye, Deputy European Director, GDE; U. Dosselli, Deputy Director, INFN; E. Elsen, Scientific Coordinator of ILC-HiGrade; F. Richard, former director of LAL, Orsay, France and Steering Committee for the Worldwide Study for the Physics of the Linear Collider; S. Stapnes, Secretary of the Strategy Group of the CERN Council; A. Wagner, Chairman of the DESY Directorate Emeritus and G. Wormser, Director of LAL, Orsay.

The group was setup in the aftermath of the approval and commencement of the ILC-HiGrade FP7 activity. It has had three meetings in the reporting period, two of which were face-to-face and one of which was a teleconference. The minutes of both the GDE and the ILC-HiGrade Governance Committee meetings are posted on the ILC-HiGrade web site, <http://www.ilc-higrade.eu>.

The GDE and ILC-HiGrade working groups are well coordinated by virtue of their common chair and their minute are commonly available through the ILC-HiGrade website. The activities of the work package began with a study of the documents that had been produced by

previous study groups set up in the regions, including the Kalmus Report set up by a previous Chair of ECFA. It was agreed that although the general thrust of these documents was sound, substantial revisions are required in the light of the currently prevailing climate. In addition it was agreed that some of the assumptions made, such as ruling out a “green-field” site, well away from a current particle physics laboratory, were no longer appropriate. The committees agreed to approach the problem with as few preconditions as possible.

Other work of the groups has so far concentrated on conversations with, and studies of, the various cognate international projects that we have identified. One member of each committee has been deputed to maintain contact with, and report on, the activities and ideas of these projects. Those studied currently include: ALMA; ESS; FAIR; ITER; SKA; European XFEL. Members of the committee have made contact with appropriate members of these projects and discussed lessons to be learnt from current progress and the thinking being evolved by the projects. These preliminary discussions have been presented at the meetings of the group. Detailed discussions of the presentations have taken place. The chair of the committees has reported to the Programme Advisory Committee (PAC) of ILCSC, charged with reviewing the progress of the ILC project, and FALC at its meeting in Spain.

Currently the committees are employed in drawing together the lessons learned from the projects currently under study. This phase will reach a first set of conclusions in time for the PAC meeting in Vancouver in May 2009. These will be presented by the chair and then further refined in time for a presentation to the FALC meeting in Quebec in July. The analysis to be prepared for these meetings will be based on a SWOT analysis of each of the main projects studied together with a synthesis of what can be learnt for the ILC project. This will be further refined in the months to come by continued contact with the projects.

In order to maintain good contacts with funding authorities and governments inside Europe, the European Director of the GDE has continued a programme of visits including to the French CNRS, where on January 5th he met with M. Spiro, M. Wormser and M. Auge in Paris to discuss ILC governance matters and the future of CERN. Also in January he visited Madrid and gave a talk on governance to the Funding Agencies for Large Colliders Meeting. He discussed these issues with the Director of the INFN in Frascati. He will visit the BMBF in Bonn in June 2009 to exchange views with Frau B. Vierkorn-Rudolph on the German approach to ILC Governance. In addition B. Foster gave a presentation on governance issues to the Programme Advisory Committee set up by the ILCSC. He will make a further report at the PAC meeting in June in Vancouver.

The first major milestone of WP4 is the production of an interim report of governance to be presented at the same time as the interim report on the ILC Technical Design Report Phase I, due for the ICHEP Conference in Paris in July 2010. We are well on course to meet this milestone.

The deliverable for this period is a report on the full management model and implementation in the engineering studies. This report has been issued and is continuously updated at http://ilc-edmsdirect.desy.de/ilc-edmsdirect/file.jsp?edmsid=D0000000*813385. The version issued in June 2008 has been made available together with this report. This report addresses the global approach to the technical design work. It has been composed by the three Project managers and hence receives large input from the European Project Manager.

3.4 WP5 – ILC Siting in Europe

| | | | | | | | |
|--------------------------------------|----------------------|--------------------------------------|---|--|--|--|---|
| Work package number | WP5 | Start date or starting event: | | | | | 1 |
| Work package title | ILC Siting in Europe | | | | | | |
| Activity type | SUPP | | | | | | |
| Participant id | 1 | 3 | 4 | | | | |
| Person-months per beneficiary | 12 | 2.42 | - | | | | |

The purpose of this work package is the preparation and the investigation of possible European sites for the construction of the International Linear Collider. The initial goals are a study of potential sites and the preparation of site selection process. The work in the past period was concentrated on the investigation of potential sites in Europe in the framework of the GDE activities. One deep site near CERN at Geneva has been considered. This is the only European site discussed in the Reference Report of the International Linear Collider. The tunnel is in bedrock between 100 and 150 m below the surface. A low level of ambient ground motion is the main advantage of rock tunnels compared to tunnels in soil, which is about one order of magnitude smaller. The other two RDR sample sites in Asia and the Americas are also about 100 m below the surface in bedrock similar to Geneva site. Another possibility is a near-surface solution as it was chosen for the European XFEL project in Hamburg which is currently under construction. A proposal for a site near Hamburg was also developed for the Linear Collider project TESLA. The big advantage of this design could be the cost savings especially if one would make use of a single tunnel design. For the RDR a twin tunnel solution was considered. One disadvantage of the close to surface solution is the stability of the tunnel which would be predominately in soft ground. A second European sample site near DESY in Hamburg is developed for the International Linear Collider. This site is significantly different from the RDR sites. The tunnel is about 15 m below surface and extends for the 1 TeV upgrade some 50 km north-northwest of DESY. Figure 3 shows the ILC footprint partially beginning on the existing campus. Figure 4 shows the elevation of the main tunnel following the curvature of the earth excepting the Beam Delivery System, which is laser straight. The tunnel would be placed in the water table nearly over its entire length. The sagitta of a laser straight tunnel over the total length (maximum difference in reference to the curvature of earth) is too large (about 50 m). It is very difficult to construct a laser straight tunnel in the water table because the water pressure in the watertight compartment of the tunnel-boring machine has to be limited during maintenance. The ground consists of about 70% sand and the rest marl with blocks as it was formed by the glacial periods. A tunnel in this ground conditions has to be reinforced by watertight precast concrete blocks. On the other hand the surrounding water absorbs one order of magnitude more heat losses compared to a tunnel in bedrock, which practically thermally insulated. Therefore a tunnel in the water needs no additional air conditioning, which could induce additional vibration (floor motion).



Figure 3: Partial footprint of the ILC site starting at DESY in Hamburg.

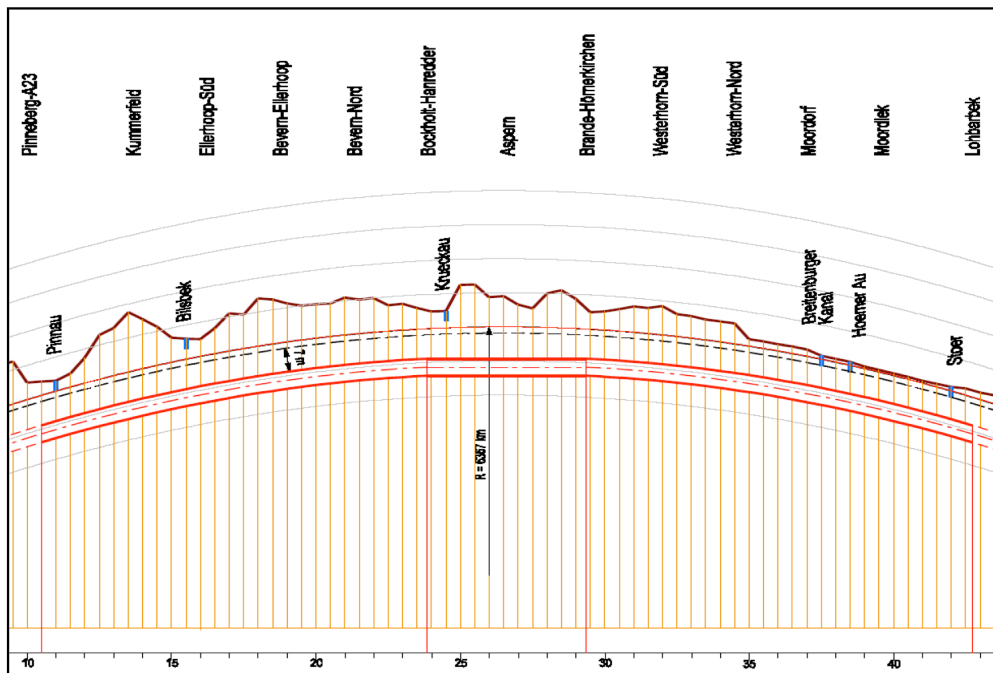


Figure 4: Elevation of the main tunnel at the potential ILC site at DESY in Hamburg.

In addition, the Joint Institute for Nuclear Research (JINR) has also proposed a shallow tunnel soft ground site in the neighbourhood of Dubna in the Russian Federation. Figure 5 shows the general layout of the potential ILC site near Dubna. The tunnel starts near the JINR Institute in Dubna and runs at a depth of about 20 m south of the Volga river. Close to surface buildings are constructed using an open pit method and the tunnel by a boring machine. Here a single tunnel solution is possible where the most of the infrastructure will be installed at the surface. The approach promises a significant cost savings for the ILC civil engineering and conventional facilities cost which are currently the largest fraction of the total costs.

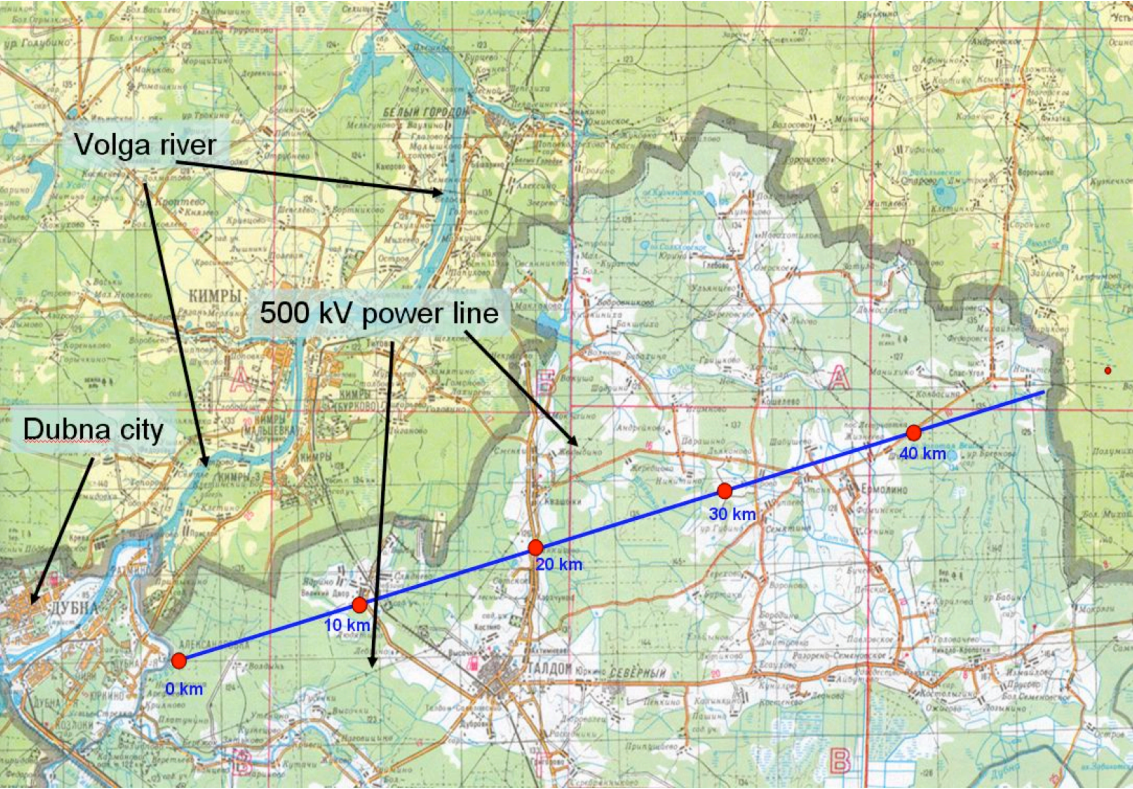


Figure 5: General layout of the potential ILC site near Dubna.

Table 1 summarizes the meeting where to site development was discussed. The references are a collection of the presentations of work during the last year.

| Meeting | Frequency |
|--------------------------------|------------------|
| GDE-Meeting | Every four month |
| GDE-WebEx-Meeting | Weekly |
| CF&S-WebEx-Meeting | (Bi-)Weekly |
| CF&S-WebEx-Meeting with Russia | Sporadic |

Table 1: Frequency of regular phone meetings

Specific topics jointly investigated in the work package 5 are the ambient ground motion and temperature stability in the different tunnel designs. Figure 6 shows a model for analytical the heat flow calculation of a tunnel in bedrock below the water table. With the result of the calculation the limit of heat losses without additional air conditioning is easy to estimate.

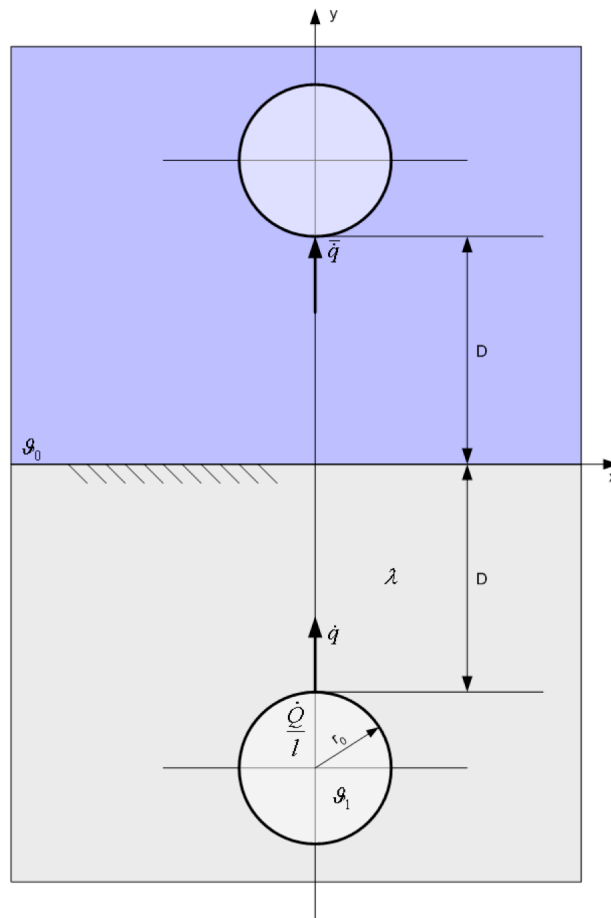


Figure 6: Use of a "mirror" tunnel for the heat flow calculation of a tunnel in bedrock below the water table.

References:

1. Wilhelm Bialowons, Cost Reduction Strategies, TILC08 Joint ACFA Physics and Detector Workshop and GDE meeting on International Linear Collider, Tohoku University, Sendai, Japan, March 3 to 6, 2008.
2. Wilhelm Bialowons, and Frank Lehner, Process Cooling Water Cost Reduction Strategies, ILC Cost Management Group Workshop, Deutsches Elektronen-Synchrotron DESY, Hamburg, May 5 to 8, 2008.
3. Wilhelm Bialowons, Potential International Linear Collider Site at DESY in Hamburg, GDE Meeting - ILC Conventional Facilities and Siting Workshop, Joint Institute for Nuclear Research JINR, Dubna, Russia, June 4 to 6, 2008.
4. Wilhelm Bialowons, Process Cooling Water Cost Reduction Strategies, GDE Meeting - ILC Conventional Facilities and Siting Workshop, Joint Institute for Nuclear Research JINR, Dubna, Russia, June 4 to 6, 2008.
5. Wilhelm Bialowons, WP 5 ILC Siting in Europe work package Report, ILC-HiGrade Kick-Off Meeting, Deutsches Elektronen-Synchrotron DESY, Hamburg, August 29, 2008.

6. Wilhelm Bialowons, The International Linear Collider · From RDR to TDP, XXI. Russian Particle Accelerator Conference RuPAC 2008, Zvenigorod, Russia, September 29 to October 3, 2008.

3.5 WP6 – High gradient cavities

| | | | | | | | |
|--------------------------------------|----------|--------------------------------------|--|--|--|--|---|
| Work package number | WP6 | Start date or starting event: | | | | | 1 |
| Work package title | Cavities | | | | | | |
| Activity type | RTD | | | | | | |
| Participant id | 1 | 2 | | | | | |
| Person-months per beneficiary | 52.8 | 3 | | | | | |

The goals of the activities in this work package are focussing on reaching a high yield of superconducting cavities performing at high gradient. High-gradient cavities have been produced in the laboratory with gradients well above 30 MV/m. It is thus assumed that the manufacturing process of such cavities is sufficiently well understood to yield high-performance cavities. To achieve a high yield in the production process thus necessitates high reproducibility of the manufacturing process and thus stringent quality assessment.

Several preparatory steps have been taken to improve the reproducibility of the production and to assess the properties of the cavities. Once established they will be exercised in the production of the cavities that are taken as test samples. At the same time, ILC-HiGrade has been exercising the methods on existing cavities produced for the FLASH upgrade at DESY and for the preparation of the XFEL.

3.5.1 Vertical Insert

Cavities will be shipped in batches of four from the manufacturer. It is important that the transport of the cavities from the manufacturer to DESY and the transport between Saclay and DESY introduce a minimum disturbance to the cavities themselves.

DESY has thus engineered a transport frame, the vertical insert, which is shown in Figure 7 in a schematic drawing. This frame has been developed to reduce the manual intervention on the cavities and accommodates up to four cavities. The module will be loaded at the manufacturer and be transported as a whole to tests at DESY. The entire frame will then be lowered into a vertical cryostat with matching dimensions. The procedure allows quickly connecting the support lines and the RF feeds to the cavities.

The cavities will be shipped in standard transport trucks. The delicate cavities, which have been mechanically tuned to their 1.3 GHz operating frequencies, will hence be exposed to vibrations during transport. The transport gear is to absorb these shocks to the best possible extent. The cavities have thus been examined thoroughly for vibrational modes occurring during transport. For that matter the assembly has been tested at the BFSV institute near Hamburg. The institute simulates the typical acceleration sequence encountered during the anticipated road transport. It is thus possible to investigate cavity detuning during transport.

The results proved satisfying for the current set-up. The accelerations that will be encountered can be supported.

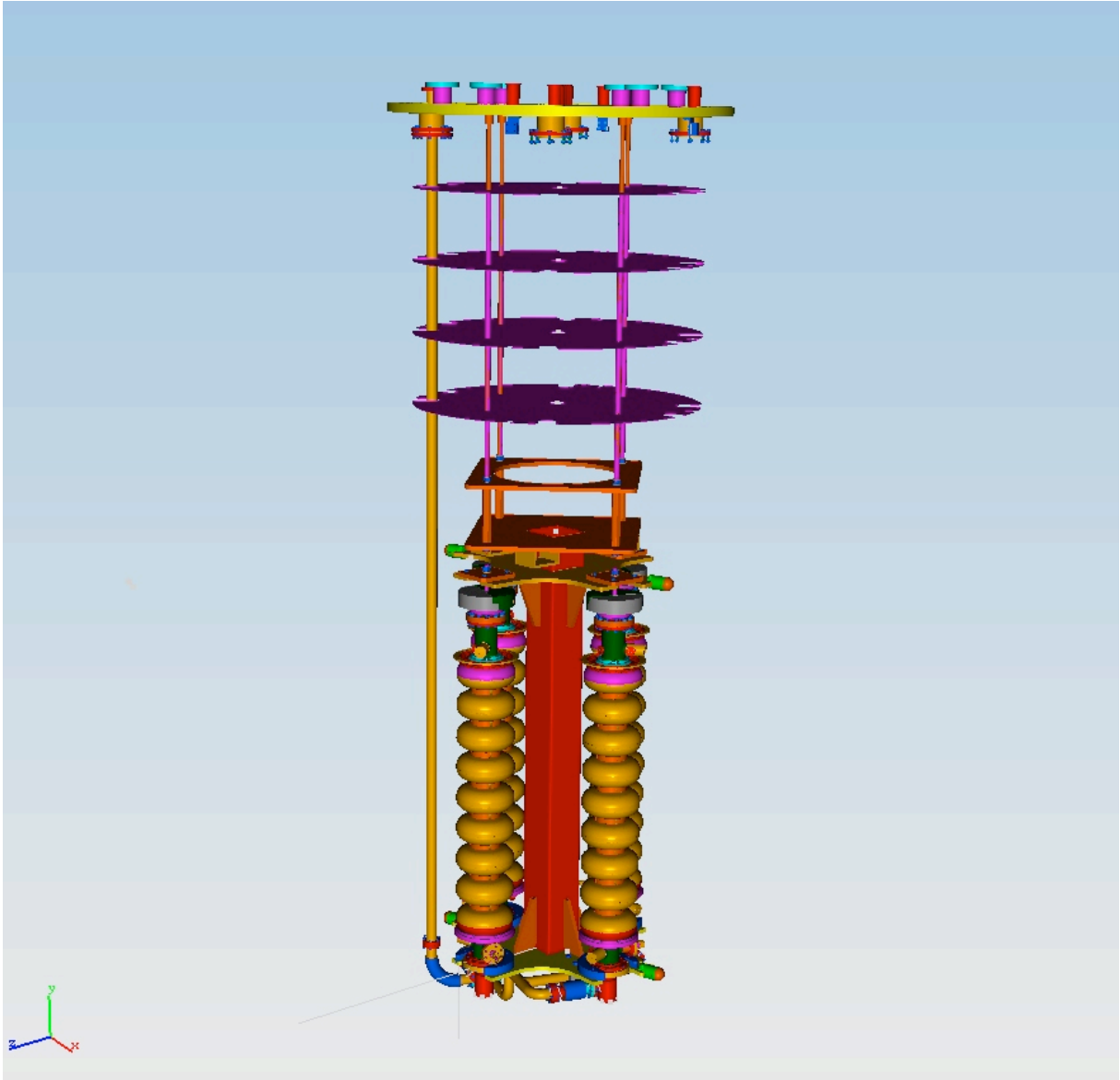


Figure 7: Vertical Insert housing four cavities

3.5.2 *Optical Inspection System*

Since August 2008 the prototype of a high-resolution camera system that was developed at KEK and Kyoto University is available at DESY. It allows inspection of the inner surface of cavities with a level of detail that was unprecedented.

Up to now 26 cavities have been inspected. In parallel the system is being optimised in collaboration with the colleagues at KEK and Kyoto University in order to improve the accuracy and reach a completely automated inspection process.

The camera is intended to be used both as a research instrument in the laboratory, investigating the defects that limit the accelerating gradient, as well as a possible part of quality assurance in cavity mass production. Included into the production process it can be a useful tool for detection of defects at an early point of time.

First matches have been found in several cavities between the locations of the breakdown of the superconducting state (quench), that are detected as hotspots in a thermometry measurement (Figure 8a), and defects that are visible during the optical inspection of the corresponding spot (Figure 8b).

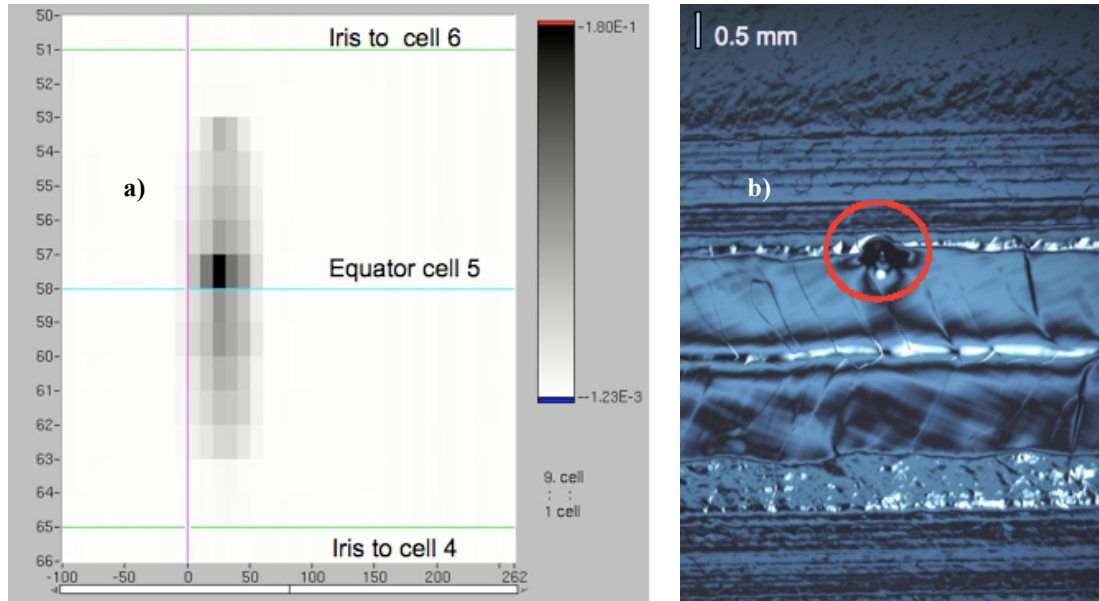


Figure 8: a) Quench location found in thermometry, b) Picture of the same location revealing a defect at the welding seam

One topic of interest is the evolution of defects during the various steps of preparation of the surface in order to understand the mechanism of their formation and possible means of curing them. A total of 12 cavities have been inspected before any surface treatment to document the condition as manufactured. The chemical treatment and the subsequent RF tests are ongoing.

3.5.3 HF Controls

When pushing the gradient performance of a superconducting cavity it is mandatory to measure the quality parameters with high reliability. Typically, the quality parameter, the Q-value, which characterizes the frequency selectivity of a cavity and is a measure of the storable energy fraction in the cavity, can be determined from the decay curve of the resonance frequency. With Q-values for good cavities in the range of several 10^{10} and inadequate cavities several orders of magnitude lower the dynamic range of the measurement process has to be large which adds to the complexity of the measurement. Up to now most of the measurements have thus been made with manual intervention.

The goal of the HF-Controls-Activity is to standardize and fully automate the measurement process. Highly integrated digital electronics will drive the control circuits and measure the behaviour of the cavities. Such a system is being commissioned and will be taken into operation. In addition to providing reliable performance measurements the process will also reduce the time required to measure the cavities. Both effects are beneficial for the characterization of cavities as required for the ILC-HiGrade programme.

3.5.4 Cavity Surface Preparation Studies

Surface preparation processes are key to the performance of superconducting cavities. The ILC project pursues electropolishing as the main process for chemical surface treatment. The process is identical for the European XFEL. In 2008, a comparative study between two potential finishing surface preparation methods was performed at DESY with the main focus to reduce cost in the overall cavity production cycle. The two processes studied were:

- the application of electropolishing also for this final finishing process and

- the usage of a short etching process.

There is a fundamental difference in the study of this year. The preparation processes were followed through to the level where the helium tank vessel is mounted to the cavity. Only then a RF performance test is made. This is a likely scenario for a mass production of cavities like XFEL or ILC where fully dressed cavities will be delivered to the involved laboratories for the quality control RF performance test. The results are shown in the figure below.

- The first conclusion drawn from this data is that the cavity process simulating the mass production scenario yields very similar results to the earlier process, which has not included fully dressed cavities. Thus both final processes can be principally implemented in a streamlined mass production scenario.
- The second conclusion is that the final electropolishing process gives slightly better performance, which has been demonstrated in earlier studies.
- The third conclusion is that there is still a wide scatter of performance data. Whilst average performance is above the XFEL goals, some cavities show very poor performance below 20 MV/m. This is not acceptable for either project.

Initial studies indicate that this is related to the mechanical fabrication process. Defective areas could be identified using thermal mapping methods identifying the region limiting the cavity performance. Subsequent usage of optical inspection yielded results and has shown surface defects at these locations. In a mass production environment, these cavities would need to be discarded (or repaired). Thus, a targeted quality control process including optical inspection methods is needed.

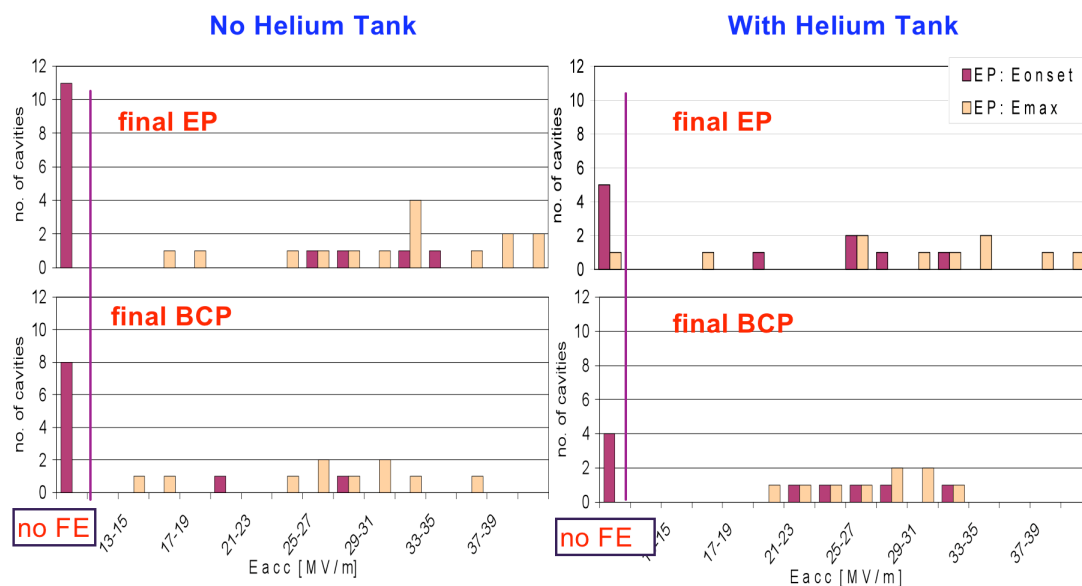


Figure 9: Results of the comparative study. Gradient performance for older data of a batch of cavities without the helium tank is shown on the left. On the right the data set includes only cavities with helium tank (Data courtesy of D. Reschke, to be published at SRF2009)

A decision of using XFEL type cavities within the ILC-HiGrade programme has been taken. This will allow focussing the R&D programme on the improvements on the cavity surface preparation process while not being disturbed of potential cavity design differences affecting the cavity performance. The material of choice will be fine-grain material. As alternative materials are pursued in other laboratories participating in the ILC R&D effort, the European

programme takes over the responsibility of maturing the most promising surface process for very high accelerating gradients.

The ILC-HiGrade cavities will serve as an important tool within the XFEL project with a full defect-mapping using temperature detection under cold conditions. Subsequent optical inspection will allow feedback to the XFEL main production as well as guidance for higher gradients needed for ILC.

Following this initial quality control step, the ILC cavity preparation, which mainly consists of an electropolishing surface treatment, will be applied and in a second qualified test. Finally, an additional potentially cost saving preparation step using a vertical electropolishing setup will be applied to compare performance to the ILC standard recipe.

Thus considerable effort focussed on reaching an agreement with the XFEL project. The general timeline and procurement procedures have been discussed. Aside of this the general test sequence as described above has been agreed upon with the participating labs.

3.6 WP7 – RF couplers

| | | | | | | | | |
|--------------------------------------|----------|--------------------------------------|--|--|--|--|--|---|
| Work package number | WP7 | Start date or starting event: | | | | | | 1 |
| Work package title | Couplers | | | | | | | |
| Activity type | RTD | | | | | | | |
| Participant id | 4 | | | | | | | |
| Person-months per beneficiary | 5.28 | | | | | | | |

Work package 7 deals entirely with optimizing the performance of RF-coupler for use in the cavities. The programme focussed on the following activities:

3.6.1 4 Hz conditioning procedure

We are developing various techniques and methods to reduce the conditioning time without decreasing in a significant way the RF exposure time. Important tests were worked out on the TTF3 couplers prototypes to effectuate a processing procedure at 4 Hz (instead of the usual 2 Hz). This allows the reduction of the waiting periods between the different power steps in the processing process but it increases the RF beneficial exposure integrated period. The results are very promising. Different pairs were conditioned with this procedure and the average processing time is ~20 h. A typical conditioning curve for the 4 Hz conditioning is illustrated in Figure 10.

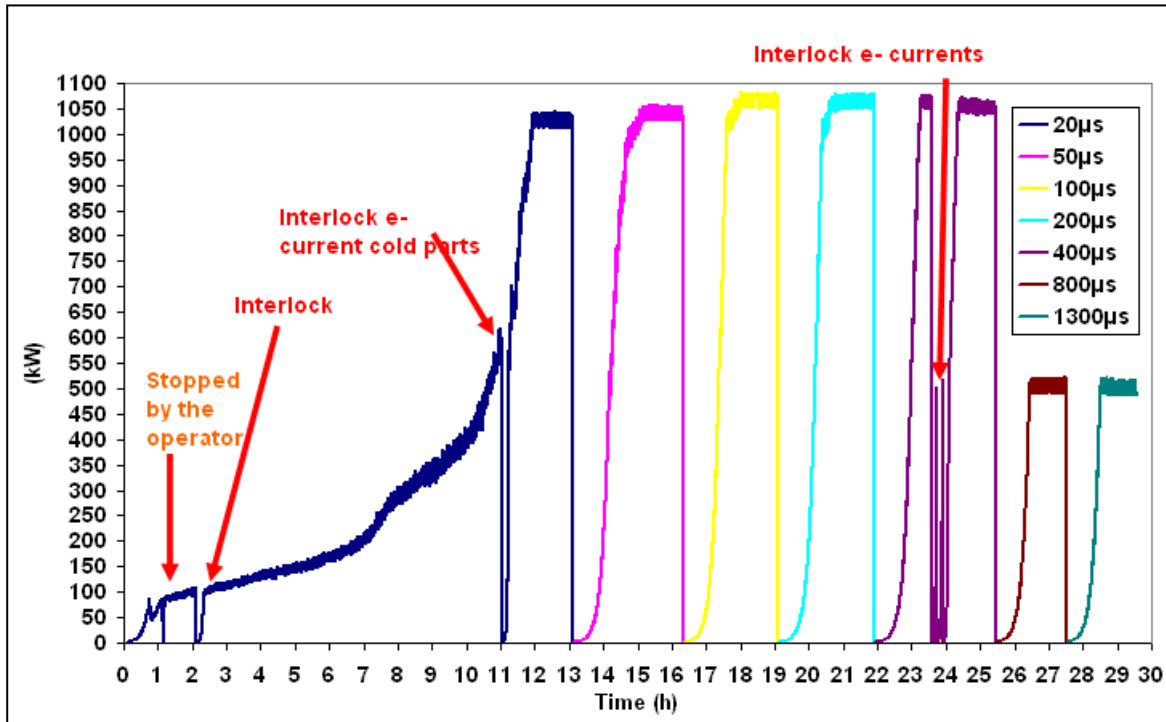


Figure 10: Cavity conditioning process in February 2009

3.6.2 ILC conditioning procedure:

To validate different prototypes, the TTF 5 couplers were designed in LAL and produced in industry. One of the prototypes pairs have been conditioned in collaboration with the KEK – Japan laboratory that is a privileged partner for LAL in the ILC framework. The first conditioning showed an excellent behaviour of the TTF5 couplers up to 2 MW and 400 μ s pulse length. After this, a problem occurred in the local vacuum system. At present we are reconditioning to validate the entire ILC procedure.

3.6.3 Temperature measurement:

Compared to the couplers used for the XFEL project, the ILC procedures need a higher power level with longer pulses. For this, the TTF 3 design has already demonstrated to withstand the 2 MW level. But one of the critical aspects is to check, in this context, the local temperature increase. For this reason we implemented in our processing studies a temperature continuous monitoring. First results were obtained on a TTF3 pairs as shown in Figure 11. The next step will be to have a data analysis to fit the experimental results with the simulations. These will allow the extension of the thermal estimation to the higher power regime of ILC.

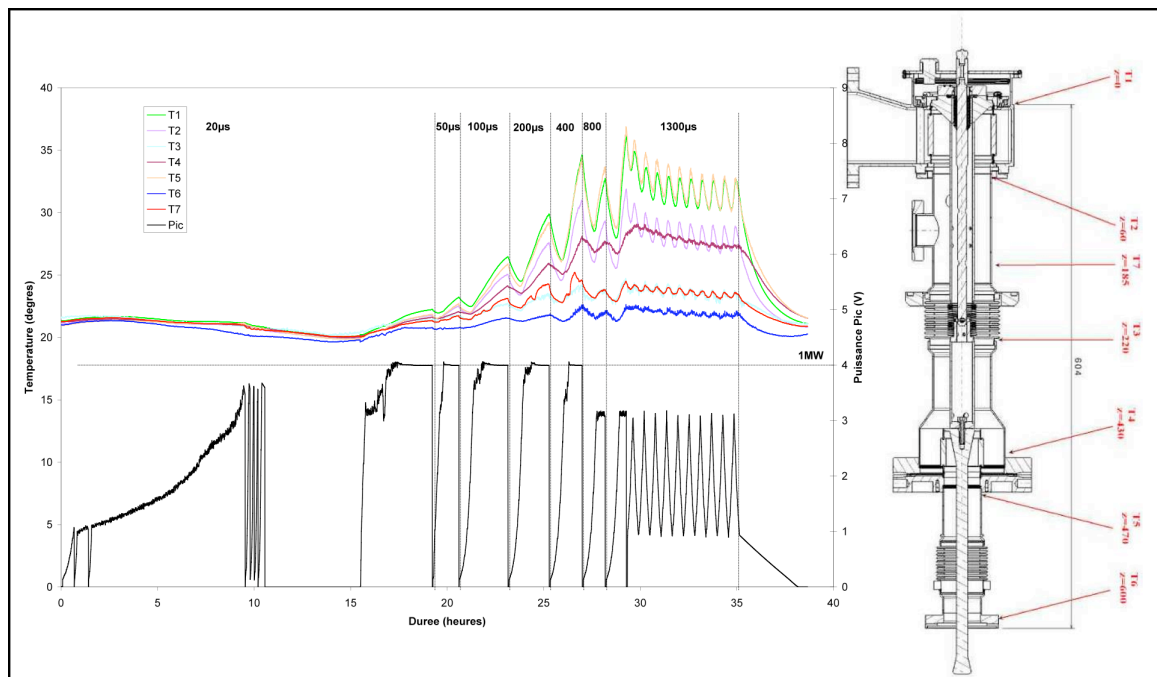


Figure 11: TTF3 temperature recording during typical conditioning cycle

3.6.4 Coupler design:

For the important aspect of the cost reduction we ordered two pairs of couplers in industry. These couplers are the results of continuous communications with the industries to individualise and test all technical solutions of the fabrication process that may lead to a cost reduction of the series production. The two pairs were received and at least one of them showed an excellent processing time (~ 22 h). Further studies are foreseen especially in the context of the long duration test. In any case, the validation of these prototypes will be an excellent basis for the further production of the ILC-HiGrade couplers.

3.6.5 Quality control:

The reduced processing time of the couplers in a series production is possible only if the fabrication (Figure 12) and assembling processes (Figure 13) are completely determined and submitted to the quality assurance criteria already in the industry. For this we have developed a database that stores all the analysis data for the different couplers that we received, before and after conditioning. A procedure for visual inspection has been established and the documented information stored for two series of 30 Couplers. This methodology allows the acceptance or the rejection of different pairs following to the noticed defects.

3.6.6 Planning

For ILC-HiGrade, we have to provide 24 couplers. The European-XFEL provides an excellent opportunity for synergy because it will allow a cost reduction due to the quantity. Moreover, we will take advantage of the strong effort made by XFEL coupler team to manage the coupler quality (one person will be present in the company to control each coupler).

In that baseline plan, we will be able to deliver 24 couplers, ready to mount on cryomodule for middle of 2011 (Figure 14).

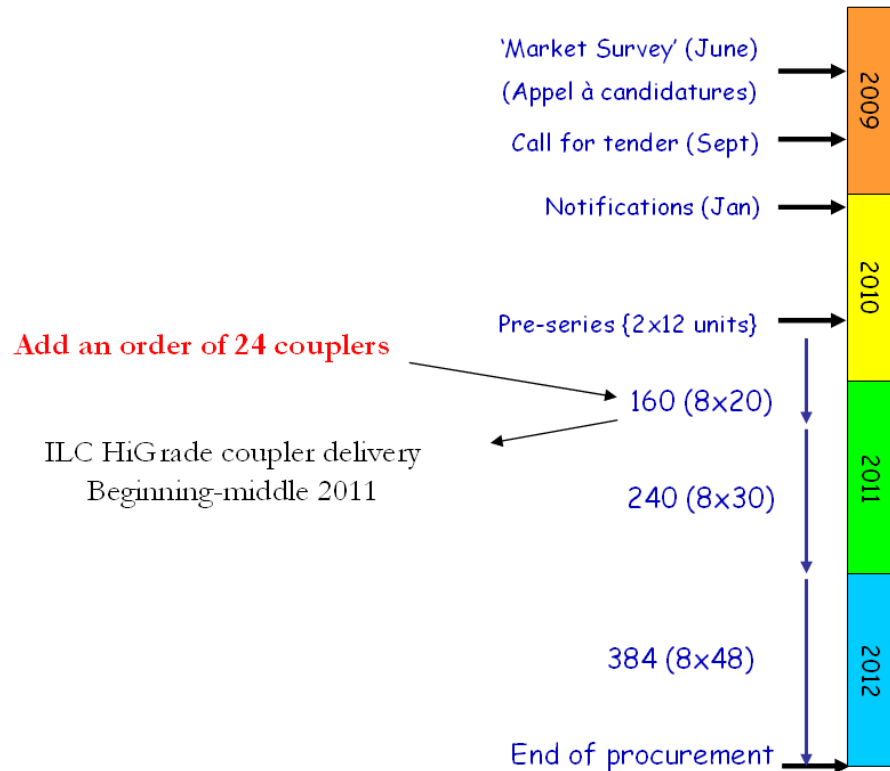


Figure 14: XFEL schedule including ILC-HiGrade schedule

3.7 WP8 – Cavity tuners

| | | | |
|--------------------------------------|--------|--------------------------------------|---|
| Work package number | WP8 | Start date or starting event: | 1 |
| Work package title | Tuners | | |
| Activity type | RTD | | |
| Participant id | 5 | | |
| Person-months per beneficiary | 12 | | |

3.7.1 Introduction

Long-term frequency drifts of the cavities, e.g. due to changes in helium pressure, have to be compensated by a slowly operated mechanical system. Under RF load cavities undergo mechanical deformation due to the Lorentz force such that the frequency of the cavity is detuned during the RF pulse. Given the high Q-value of superconducting RF cavities, the efficiency of the acceleration is immediately affected. It is hence mandatory to counteract the Lorentz force with a tuning device also capable of fast compensating action.

Originally developed as a possible solution for the superstructures option in TESLA, the Blade Tuner has been specifically designed with the aim of minimizing inter-cavity distance to reduce the accelerator footprint. The Blade Tuner working principle is to transfer azimuthal rotation, provided by a stepper motor into longitudinal motion by means of bending blades, piezoceramic actuators add dynamic tuning capabilities, allowing compensation of fast dynamic instabilities. As a consequence, the present ILC reference layout, as well as for the TESLA design report before it, assumes a coaxial solution since the reduced total cell-to-cell space is incompatible with the current TTF tuner overall dimension.

3.7.2 *Achieved progresses and results*

In the time frame considered, significant results have been achieved in view of the demonstration of suitability of tuner designs in tests and establishment of a cost-effective tuner production that represent the final goal of this work package.

3.7.3 *Prototype manufacturing and cold test*

Two prototypes of a coaxial Blade Tuner have been initially realized, one made from Titanium and the other from Stainless Steel (SS) with Inconel blades. The first cold test inside horizontal cryostats has been performed, inside CHECHIA, at DESY (Hamburg Germany), in pulsed RF regime. Then two other test sessions with CW RF have been done inside HoBiCaT, at BESSY (Berlin, Germany). The tuner has been installed at DESY on a TESLA superconducting cavity (Z86) manufactured by Zanon (Schio, Italy), using a modified helium tank, with the insertion of a central bellow, to allow for coaxial tuning operation (see Figure 15).

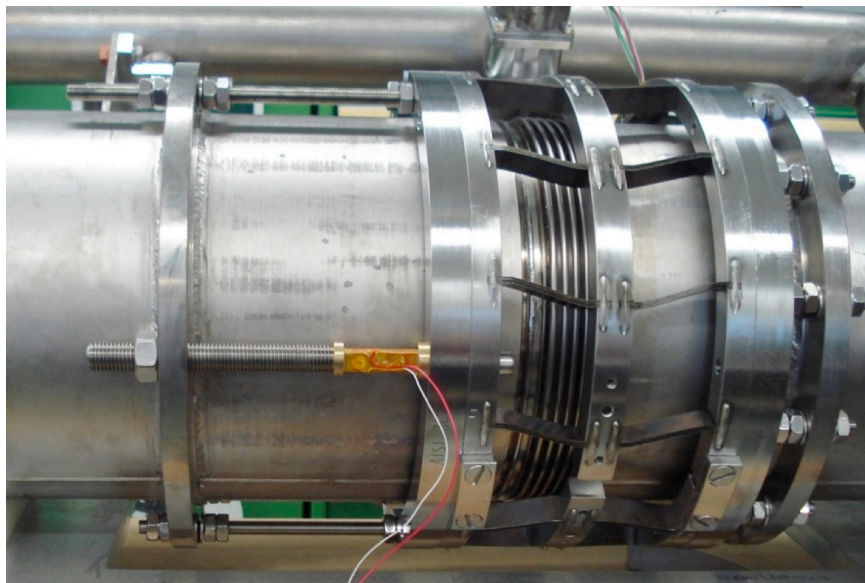


Figure 15: the Blade Tuner completely installed before cold test at BESSY; piezo actuators are in place and the central bellow is also visible

Among several other parameters (working point tuning range, piezo actuator DC tuning range, transfer functions and loading effect analyses), the whole tuning range has been extensively measured. All the measurements made proved that the slow tuning performances meet expectations. More than the required 600 kHz of tuning range has been achieved, with a tuning sensitivity of 1.5 Hz/half-step.

In conclusion, cold tests performed certified that the coaxial Blade Tuner has successfully overcome the prototype phase, providing a wealth of useful information for its further design optimization in view of the cost-effective production of the tuners of the ILC-HiGrade programme.

3.7.4 Final revision of Blade Tuner design

Taking into consideration all experimental results and experience gained in the prototype cold tests, few modifications have been implemented to the tuner design thus achieving the final Blade Tuner design.

The introduction of thicker blades re-distributed along the circumference allowed incrementing the tuner strength and stiffness, also in order to satisfy the requirement in terms of pressure vessels regulations. In particular, a double blade pack has been designed to be close to the piezo position, where the force is applied.

All load cases have been taken into account, both in work condition, transitory phases and accidental overpressures in order to realize a complete simulation of the new design making use of modern Finite Element Modelling (FEM) software and techniques (see Figure 16).

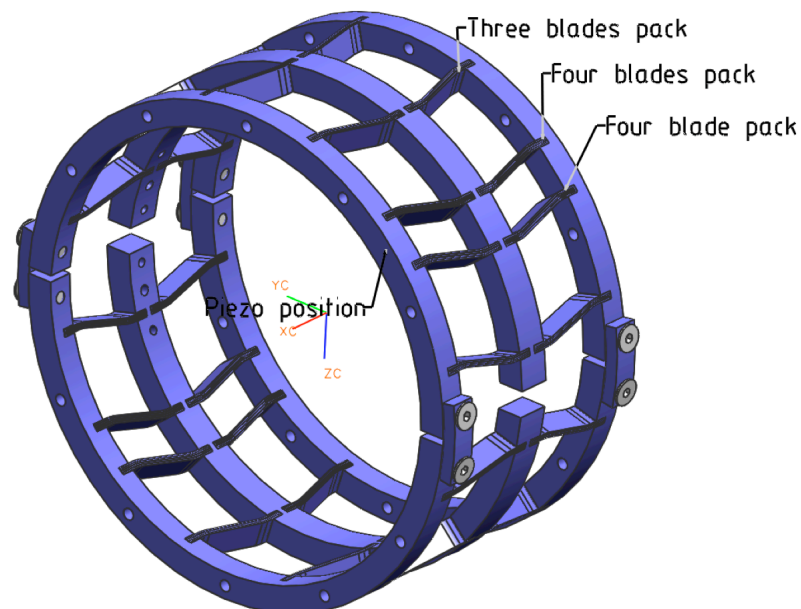


Figure 16: FE model of the Blade Tuner. Highlighted is the upgraded blade positions and distribution.

A revised tuner design has been developed in close collaboration with research groups of different laboratory jointly interested in possible future large scale Blade Tuner installation, as Fermilab (Batavia, IL, US) and DESY (Hamburg, Germany).

In conclusion, the Blade Tuner design meets all specifications and requirements for what concerns stiffness, tuning range and capability to withstand with margin the maximum tensile and compressive forces required.

3.7.5 First small series production and qualification tests

After the detailed analysis and simulation phase of the activity, the first small series of 8 Blade Tuner units have been manufactured by Ettore Zanon S.p.A. (Schio, Italy) with our close and continuous collaboration during the fabrication (see Figure 17).

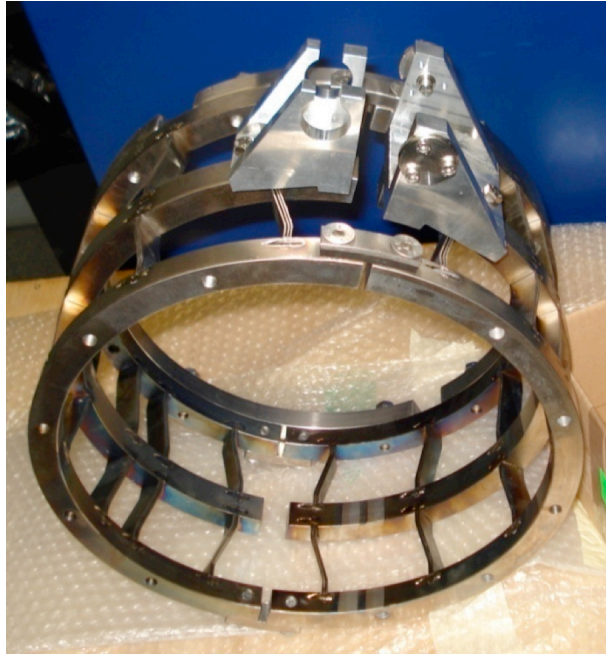


Figure 17: one of the first series of 8 Blade Tuner manufactures

With the delivery of first produced units, an accurate process of validation started. Beside visual and dimensional check for all components, several experimental tests have been conducted with the help of devoted test facilities realized at the LASA laboratory (Milan).

Blade Tuner components have been separately characterized, even at cryogenic temperature in some cases making use of dedicated equipment based on liquid nitrogen or liquid helium as a refrigerant. Then the complete and assembled tuners have undergone combined RF/mechanical qualification tests in a devoted facility, at room temperature conditions, based on TESLA shaped single-cell cavity. Results met expectations in term of predictions and homogeneity among produced units.

In conclusion, after the experiences gained with the prototyping phase as well as with the design revision and analyses, a first small series of 8 Blade Tuner units have been successfully produced and qualified.

3.7.6 Use of EC resources

EC funding has been fundamental throughout the entire period considered for this report.

Regarding personnel funding, 6 persons of INFN Milan staff have been involved, at different levels, in the activities presented: Dr. A. Bosotti, Dr. P. Michelato, Dr. P. Pierini, Dr. D. Sertore, M. Bonezzi and M. Fusetti.

As already mentioned throughout this report, consumable and travel funding through the EC contribution, in addition to institutional funds from INFN research programs, sustained the several collaborations involving INFN on the WP8 topics as well as the realization of several analyses and experimental tests on Blade Tuner and its components.

4 Deliverables and milestones tables

4.1 Deliverables (excluding the periodic and final reports)

| TABLE 1. DELIVERABLES³ | | | | | | | | | |
|------------------------------------------|---------------------------|---------------|-------------------------|---------------|----------------------------|------------------------------------------------|-------------------------|----------------------------------------|-------------------------------------------|
| Del. no. | Deliverable name | WP no. | Lead beneficiary | Nature | Dissemination level | Delivery date from Annex I (proj month) | Delivered Yes/No | Actual / Forecast delivery date | Comments |
| 2.1 | Organisation of GDE Mtg 1 | WP2 | 6 | R | PU | 6 | yes | 5 | Meetings held in Dubna and Chicago. |
| 3.1 | ILC-HiGrade Webpage | WP3 | 6 | R | PU | 6 | yes | 1 | |
| 4.1 | GovWG_1 | WP4 | 6 | R | PU | 6 | yes | 4 | The report is continuously being updated. |

³

For Security Projects the template for the deliverables list in Annex A1 has to be used.

4.2 Milestones

| TABLE 2. MILESTONES | | | | | | | |
|----------------------------|---------------------------|------------------------|-------------------------|-----------------------------------|------------------------|-------------------------------------------|------------------------------------|
| Milestone no. | Milestone name | Work package no | Lead beneficiary | Delivery date from Annex I | Achieved Yes/No | Actual / Forecast achievement date | Comments |
| 1 | GDE Project Management | WP2 | 6 | 3 | Yes | 4 | |
| 2 | MAC ⁴ Report 1 | WP2 | 6 | 6 | Yes | 9 | The report of the PAC is attached. |
| | | | | | | | |

⁴ The Machine Advisory Committee (MAC) has since been recreated as Physics Advisory Committee (PAC). The PAC met in Paris in October 2008 and gave strong support for the ILC during its technical design phase.

5 Project management

| | | | | | | | |
|--------------------------------------|---------------------------------------|--------------------------------------|---|--|--|--|--|
| Work package number | WP1 | Start date or starting event: | 1 | | | | |
| Work package title | Coordination of European GDE Activity | | | | | | |
| Activity type | MGT | | | | | | |
| Participant id | 1 | | | | | | |
| Person-months per beneficiary | 15 | | | | | | |

5.1 Organisation of the Consortium

The ILC-HiGrade work package activities started with the beginning of the year 2008 even though the formalities of the Consortium could not immediately be resolved. The legal status of the coordinating institute, DESY, public or private body, was left pending for a while so that the formal start of the project (1.2.2008) was not immediately effective. In the course of the summer 2008, ILC-HiGrade was informed that the start was indeed February 2008 as originally foreseen. This delay had no impact on the actual work in the work packages that proceeded as originally foreseen.

ILC-HiGrade thus visibly started with the Kick-off Meeting August 28, 2008 in Hamburg. All participating institutes were represented. The meeting gave an overview of the activities in the work packages and nominated the work package Coordinators. The work underway in the work package and its evolution over the course of the reporting periods was discussed.

The Kick-off meeting also featured a presentation of the European strategy by the representative of the CERN Council Strategy working group. The CERN Council Strategy serves as direct input to the ESFRI process for large infrastructures in Europe. The goal was to identify the role of the ILC-HiGrade in the European Strategy, as it is being updated and refined by CERN Council. ILC-HiGrade regularly reports to C.E.R.N Council.

The 1st Annual meeting was held in Orsay in early March 2009. All Work packages reported on their progress, which is well under way.

The reporting process had been initiated earlier by the Coordinator, who was in contact with the respective partners. The financial statements were received and entered into the FORCE tool. Given the respective spending profiles formal audits were only necessary for one partner, DESY.

5.1 Use of ILC-HiGrade webpage

The ILC-HiGrade webpage has been further developed. Most of the activities are described in the Outreach Work package 4. The webpage is also used as a communication tool inside the collaboration. Some of the webpages, notably affecting governance issues, find themselves on webpages with restricted access as they are in a developing stage. Results and conclusions of those meetings that are interesting for a wider audience are made accessible to everyone.

5.2 ILC-HiGrade embedded in European Infrastructure Discussion

ILC-HiGrade entered the ESFRI-list of Research Infrastructures via the CERN Council Strategy document that represents the European strategy for particle physics. For the development of the ILC project it is thus important to follow the strategic decision of CERN Council concerning its future plans. As the LHC is being taken into operation key decision on the future of the field will be taken. ILC-HiGrade is well embedded into this process as is being evidenced by the participation in various bodies below.

5.2.1 ECFA

ECFA, the European Committee for Future Accelerators, is the representation of users of accelerator projects in Europe. It regularly pays visits to the countries participating in High Energy Physics and reports on the involvement of these countries. ECFA discusses future accelerator projects.

In July 2008, ILC-HiGrade made a presentation to Restricted ECFA, <http://indico.cern.ch/conferenceDisplay.py?confId=37382>, to introduce the particular developments on siting the ILC in Europe. It was important to recognize the options for realization of the ILC in Europe itself. The baseline choice for the ILC in Europe is a deep tunnel site, located e.g. in the vicinity of CERN in Geneva.

5.2.2 Scientific Policy Committee

In the course of advancing the European Strategy for Particle Physics the CERN Scientific Policy Committee (SPC) invited a presentation of the ILC-HiGrade project. The talk was welcome and provoked several thoughts on the developments of Research Infrastructures for Europe and beyond. Many of the issues raised resonate with the interest of CERN to invite foreign participation to the CERN organization and to define a more global role.

5.2.3 Other Global Projects

Amongst the consortia engaging in building large Research Infrastructures in Europe the ILC is special: from the start the International Linear Collider is a project that engages partners in Asia and in the Americas in addition to the strong European effort. There is also Russian participation. In all three regions Americas, Asia and Europe plans are being made how to host such a facility. A similar requirement is only seen for SKA, the Square Kilometre Array radio telescope, which will be built outside of Europe. How can an engagement be organised with prominent participation of European scientists when the facility is remote? Such challenges seem to be less prevalent on the technical side where remote control rooms start to be a reality. On the political side, and particularly in Europe given its national variety, the process is still undefined. To date very few successful examples exist.

Several Meetings have been organised between SKA- and ILC-representatives both on technical matters, such as Project Management and issues like Governance.

5.2.4 Initiative of the European Commission

The initiative of building European Research Infrastructures, defining their operational status and regulating the participation of foreign institutes is thus very important. It was very much welcome that a framework for a European approach has now been released which includes the assessment of tax regulations etc. However, for the ILC, such a framework has to be expanded into a global framework.

Again it is a happy coincidence that CERN is also intensifying the discussion of how to expand the engagement beyond European borders. ILC-HiGrade is well embedded in this process.

5.3 Meetings organised or attended

| Meeting | Venue and Date | Purpose |
|---------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| ILC-HiGrade Kick-Off Meeting | Hamburg, 29.8.2008 | Kick-off meeting of ILC-HiGrade |
| Restricted ECFA Meeting | Hamburg, 17.7.2008 | Report on planned ILC-HiGrade Governance Activities |
| CERN Scientific Policy Committee | CERN, 17.9.2008 | Report on ILC-HiGrade Programme |
| Information day on Reporting, payments, communication and new developments for FP7 Research Infrastructure projects | Brussels, 29.9.2008 | Information on reporting etc. and preparation of Infrastructure Projects; discussion with project representatives with similar requirements, e.g. SKA |
| ECRI 2008 | Versailles, 9.-10.12.2008 | Poster Presentation on ILC-HiGrade |
| 1 st Scientific Meeting | Orsay, 6.3.2009 | Presentation of the results of ILC-HiGrade and preparation of presentation for Annual Report |
| 1 st Annual Meeting | Orsay, 6.3.2009 | Preparation of the Financial Statements, discussion Management of the project and communication. |

6 Explanation of the use of the resources

| TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY 1, DESY, FOR THE PERIOD | | | |
|----------------------------------------------------------------------------------------------------------------------|------------------------|-------------|-------------------------------------------------|
| Work Package | Item description | Amount | Explanations |
| 1, 3, 5, 6 | Personnel costs | 596794.55 € | Salaries |
| 1, 2, 4 | Other | 3154.67 € | Travel to Brussels, Governance and GDE meetings |
| | Remaining direct costs | | |
| TOTAL DIRECT COSTS | | 599949.22 € | |

| TABLE 3.2 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY 2, CEA, FOR THE PERIOD | | | |
|---------------------------------------------------------------------------------------------------------------------|------------------------|-----------|--------------|
| Work Package | Item description | Amount | Explanations |
| 7 | Personnel costs | 5258.39 € | Salaries |
| | Remaining direct costs | | |
| TOTAL DIRECT COSTS | | 5258.39 € | |

| TABLE 3.3 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY 3, CERN, FOR THE PERIOD | | | |
|----------------------------------------------------------------------------------------------------------------------|------------------------|------------|--------------|
| Work Package | Item description | Amount | Explanations |
| 4, 5 | Personnel costs | 49437.68 € | Salaries |
| | Remaining direct costs | | |
| TOTAL DIRECT COSTS | | 49437.68 € | |

| TABLE 3.4 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY 4, CNRS, FOR THE PERIOD | | | |
|----------------------------------------------------------------------------------------------------------------------|------------------|------------|-----------------------------------------------------|
| Work Package | Item description | Amount | Explanations |
| 3, 4, 7 | Personnel costs | 93228.84 € | |
| 4 | Travel | 255.50 € | Participation in EC Information meeting in Brussels |
| TOTAL DIRECT COSTS | | 93484.34 € | |

| TABLE 3.5 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY 5, INFN, FOR THE PERIOD | | | |
|----------------------------------------------------------------------------------------------------------------------|------------------|------------|-------------------|
| Work Package | Item description | Amount | Explanations |
| 4, 8 | Personnel costs | 54853.56 € | Salaries |
| 8 | Major cost item | 3050.00 € | Mock-up End group |
| 8 | Remaining | 29706.08 € | |
| TOTAL DIRECT COSTS | | 87609.64 € | |

**TABLE 3.6 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS
FOR BENEFICIARY 6, UOXF.DL, FOR THE PERIOD**

| Work Package | Item description | Amount | Explanations |
|--------------------|------------------|------------|--------------|
| 2, 3, 4 | Personnel costs | 61750.33 € | Salaries |
| TOTAL DIRECT COSTS | | 61750.33 € | |

7 Financial statements – Form C and Summary financial report

The Form C has been submitted for each beneficiary using the FORCE tool. Printed copies are attached separately.

8 Certificates

List of Certificates, which are due for this period, in accordance with Article II.4.4 of the Grant Agreement.

| Beneficiary | Organisation short name | Certificate on the financial statements provided? yes / no | Any useful comment, in particular if a certificate is not provided |
|--------------------|--------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1 | DESY | Yes | |
| 2 | CEA | no | Expenditure threshold not reached |
| 3 | CERN | no | Ditto. |
| 4 | CNRS | no | Ditto. |
| 5 | INFN | no | Ditto. |
| 6 | UOXF.DL | no | Ditto. |