YPP DESY
Considerations on the Strategy for High Energy Physics at DESY

by
YPP DESY

22nd September 2003

1 Introduction

This document contains considerations on the strategy of DESY concerning the future of high energy physics at this lab. While there is a clear commitment of the Federal Government for the TESLA XFEL, there is no such commitment for the high energy machine, and thus the future of particle physics at DESY is under discussion.

Therefore a panel 'Strategie Teilchenphysik' has been evoked by the DESY directorate, whose members are representatives of DESY and the universities. Currently they are working on a proposal for the future strategy of HEP at DESY. The considerations outlined in this presentation are aimed as contributions to this discussion from the young physicists at DESY.

The young particle physicists (YPP) at DESY would like to express their ideas of the future of HEP at DESY, taking into account different possible scenarios of the political developments, both inside and outside HEP, concerning the linear collider. It is not the aim of this text to outline the details of the realization of a certain strategy, but to give input to a broad discussion about the vision of the future of DESY.

For the YPP it is clear that the high energy physics community in Germany needs DESY as a strong particle physics lab, whether there will be a linear collider at DESY or not. It is necessary as a center and basis of a widespread and rich physics program and for the education of young particle physicists.

2 Considerations on the Strategy of HEP at DESY

We regard it as absolutely necessary that the complete laboratory, including both the high energy as well as the synchrotron radiation community, shows its commitment for the realization of the TESLA linear collider at DESY and the TESLA XFEL, *both* as highest priority future projects. There is a worldwide consensus in particle physics that a linear collider is the next big project of HEP. Both the TESLA LC and the TESLA XFEL rely on the same technological basis, both projects have been developed together, and both projects have a unique physics case beginning from relatively large scale structures in our everyday life, down to the dawn of time and space. Therefore they should not be played off against each other. They have been promoted to the public in the past in the light of this wide spread of science, and this should not be abandoned. The high energy physics community also promoted the XFEL, and DESY should continue to promote research about the basic structure of matter, time and space together with applied sciences with the same high priority as before.

From this follows, that the presentations of the XFEL project to the public should still include the 'brand' TESLA, even when a final name for the XFEL has been found, and still show the XFEL and TESLA as connected programs.

It is obvious that the highest priority present program of DESY is HERA II, whose success is of importance for the exploration of QCD, for the HERA collaborations, and also for the future of the lab. It is also obvious that a linear collider is the key future project of HEP, needed to explore the mechansism of electroweak symmetry breaking and a large variety of possible physics beyond the standard model. For the future program of the lab we now consider three scenarios: *TESLA@DESY*, *LC somewhere* (with a timescale of the decision of around 3 years from now) and *no LC in sight*, if no decision on the LC is achieved within the next three years.

In all three scenarios, the young particle physicists at DESY do not recommend that DESY contributes at a larger scale to an outside project like the Japanese Hadron Facility (JHF). We do not see that this project could deliver the physics data which is interesting for the physics communities at DESY, working on electroweak physics and high-energy QCD. In contrary, we do think that there are enough projects which can be done at DESY, from TESLA over an intermediate HEP program after 2006/2007 to test beam activities and R&D collaborations, for which DESY needs its full capacity.

1. *TESLA@DESY*

   For DESY with its well progressed R&D program on the TESLA technology it is highly desirable that a true worldwide consensus on the technology and required energy range of the linear collider is achieved as fast as possible. In our view a LC with an energy range of 500 to approximately 1 TeV has a strong independent physics case, ranging from standard model precision physics over the most precise measurement of the mechanisms of electroweak symmetry breaking to the possible precise measurement of new physics and its mechanisms and parameters. Furthermore, the linear collider and the LHC would be complementary programs which would benefit from each other in lots of different physics scenarios in the form of combined analyses.

   If this consensus is achieved within the next years, and if it is positive for the TESLA technology, and if furthermore a political consensus can be achieved to build TESLA at DESY, then the laboratory still needs an interesting physics program until the data taking at TESLA starts.

Therefore a good environment for R&D collaborations should be provided. Even if it is not feasible to build an interim physics program succeeding HERA II, enough test beam facilities for LC detector development should be created.

2. *LC somewhere*

   If a worldwide consensus on the technology on the linear collider is achieved, but if this is not the TESLA technology, then DESY obviously needs to push the global accelerator and detector network even more. The emphasis should then be placed on the question how to keep the laboratory interesting for outside users, even if there is no full high energy physics experiment at DESY. The laboratory should then be the European center for the development of the LC. For that purpose, test beam facilities for detector R&D should be provided. Sizeable groups at DESY should be responsible for the construction of a large part of the linear collider and the linear collider detector. Thus DESY can play a leading role also without a linear collider at DESY. Anyway this might be not sufficient to keep the laboratory interesting for a wide spread of outside HEP users, and thus to remain an independent international center of high energy physics. Strong physics groups at DESY should therefore not only concentrate on work for an outside LC Detector, but should try to establish own free R&D projects and international collaborations working at DESY, both experimental and theoretic, using its infrastructure, test beam facilities (see above), and developing new detector techniques and theories.

   Additional to the R&D work for the TESLA detector, we propose a prolongation of the HERA program. Either a new injector should be provided, or PETRA should not be given away as an injector completely. Either a prolongation of HERA II or HERA III would provide an ongoing physics program at DESY with data for physics groups and especially PhD students.

   The HERA-B target and vertex detector (with the tracking system of the detector removed) could be used as a unique hadron test beam facility. Test beam facilities should also contain lepton test beams from PETRA or (possibly later) the XFEL. Thus an ideal environment for Detector R&D would be provided, together with an ongoing physics program. Without test beam facilities, DESY could possibly not successfully claim to be the European center for the development of the LC detector.

   Otherwise a complete generation of young particle physicists will not find an appropriate experimental environment in Germany. A large laboratory with widespread facilities is necessary to train young physicists, both from DESY and universities, to work together in larger international teams on common projects.

   The same strategy should be applied in the machine physics case. If TESLA will not be built at DESY, this is not necessarily the end of the last HEP program at DESY. Until now DESY is occupied with R&D work for TESLA and the commissioning of HERA II, but once HERA II is running or even closed free capacities should be used to explore new, maybe unconventional ideas for the future of accelerators. Nobody can foresee future accelerator technologies without having done R&D on lots of different ideas at the forefront of technology.

3. *No LC in sight*

   Not to build a linear collider would be a serious threat for the progress of the exploration of the fundaments of matter, space and time. On the other hand, this has not to be the end of particle physics at DESY.

   Of course in this case all the considerations in the above point about independent projects at DESY are even more important.

   Especially, it then is important to keep a physics community at DESY as a focussing point of the activities of European universities. Therefore an ongoing physics program after 2006/2007 is needed. The prolongation of the HERA operation is highly desireable.

   If no large new international project with a strong contribution from DESY is in sight, the laboratory needs own physics data. Additionally to the prolonged HERA experiments, it then is even more important to provide intersting facilities for R&D collaborations, to gather excellence on certain topics of detector development, machine physics, theory and physics analysis. This aim can be achieved by enlarging the efforts for independent R&D on detector technology and machine physics at the forefront of our knowledge.

   Especially for R&D collaborations, it is necessary to have a full-scale test beam program at DESY, including both lepton and hadron facilities (see the above point).

   In addition to an emphasis on R&D at DESY, the laboratory then needs to find a new idea for a large-scale future project. This could be a refined LC proposal (in the light of LHC results). Also if no LC is in sight, a LC probably still will be the preferred next step of HEP. Additionally, lots of other ideas for new projects (muon collider, plasma accelerators, etc.) exist worldwide. DESY should contribute to this discussion with R&D and new ideas.

   DESY can show that excellence in science is not only attracted by big machines on site, but by excellent physics programs even on a smaller scale. No matter whether TESLA is built or not, DESY should clearly point out the richness of the future of HEP and its technologies, which is not only TESLA. Therefore high energy physics at DESY need not be over if TESLA is not realized. DESY should intend to stay at the forefront of accelerator R&D as well as developing new physics ideas.

3 Summary

If a clear strategy of a rich physics program at DESY is promoted, both to the public and inside the laboratory, and if this programs contains strong and interesting HEP projects both with and without a linear collider at DESY, then this imposes the best prospects for realizing TESLA at DESY, and the future of DESY as a strong and independent high energy physics laboratory is not endangered even if TESLA is not built.

In summary, the young particle physicists recommend:

- For the sake of the diversity of the field of particle physics in Europe DESY has to remain a particle physics lab with its own program on a worldwide scale. Young physicists need a rich and divers environment, and we need large laboratories forming collaborations.

- The next large-scale project of particle physics should be a linear collider. TESLA@DESY has to be DESY's highest priority for the future of the laboratory, together with the XFEL. The complete laboratory, including the synchrotron radiation community, should unite begind this goal, as the HEP community also supports the XFEL.

- If a linear collider is going to be realized elsewhere, DESY should concentrate on the facilities needed for the european centre of the linear collider detector and machine development. In addition, independent R&D projects should be fostered, and new ideas for future projects at DESY should be encouraged.

- There should be a perspective for an intermediate HEP program at DESY. HERA should not be given up, just because the injector is given away. No precise proposal is made here for a new long term HEP project at DESY in case no LC is in sight. Anyhow it is obvious that a large diversity of new ideas for future experiments exists.

- In any case, there are enough opportunities for new developments at DESY, ranging from a strengthening of R&D collaborations up to new ideas for particle physics experiments. DESY should therefore use free capacities to develop new technologies and ideas for future projects, instead of a large-scale contribution to JHF.

DESY has to keep the drive for promoting the linear collider, which is the key project for the future of HEP, and it has to keep the drive of R&D for the machine and detector of the linear collider. The pressure for the LC has to remain worldwide from the complete HEP community.