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The EUROTeV Initiative

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More than 20 European laboratories have joined forces on a Design Study for the International e^+e^- Linear Collider reaching the TeV range. In a bid submitted to the European Union the consortium tries to gain support for research that addresses some of the remaining high ranking issues identified, e.g. in the report of the TRC. It is expected that these studies will be complemented by similar activities in Asia and in the Americas.

1 Introduction

The international High Energy Physics community has reached an overwhelming consensus in setting the priority for the next big tool for physics research that is to follow the commissioning of the Large Hadron Collider (LHC): an International Linear Collider (ILC) operating at centre of mass energies between 90 GeV and up to 1 TeV [1]. To realise such a machine two technology approaches are vigourously pursued. The high frequency X-band linear accelerator is based on warm copper structures and the L-band machine employs a super-conducting RF technology. The maximum gradients for both technologies have been pushed to higher and higher values such that it seems now feasible that a length of some 30-40 km will suffice to attain the required centre of mass energy.

While the acceleration technology has been in the focus of worldwide research there are topics that have received less attention. The ILC-TRC identified in its report [2] several topics that require further research and development full design specification. In the meantime the European Union extended its support for the *Research Infrastructure in Europe* to *Design Studies* with the primary goal of improving large scale research in Europe on a midterm scale.

27 European research institutes and universities seized the opportunity in March 2004 and submitted a bid [3] to the European Union to support the *ancillary* research needed to specify the design of a high energy e^+e^--linear collider. The primary goal was to provide the remaining research for such a facility in time to enable timely implementation of the ILC. The proposal thus encompasses e.g. studies on the damping rings as well as research on focussing techniques for the colliding beams. In parts the *study* naturally extends to investigations for future facilities in which even more advanced acceleration technologies will be required [4].

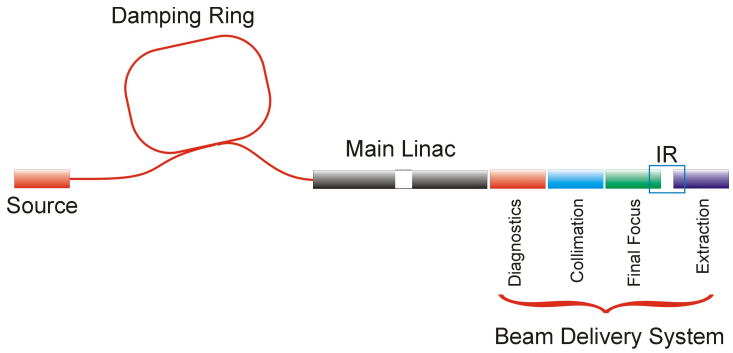

Figure 1: The activities of EUROTeV affect many aspects of a linear collider design.

2 The Scope Of The EUROTeV Bid

With the explicit exception of the main accelerating structures EUROTeV research comprises the main components of a linear collider (Fig. 1) extending from the (polarised) source for positrons to the final focus of the beams. Altogether seven *work package*s of research have been identified:

BDS The beam delivery system *work package* is concerned with the transport of the beams from start to end. It comprises studies on the optics lattice for the final focus and the collimator spoiler system and includes the wakefield calculations. Fast intra-bunch train feedback is key to the successful operation of a linear collider. The strong quadrupole doublet close to the interaction point will have a paramount influence on the luminosity and on the generated backgrounds. A super-conducting version is proposed in this *study*. Finally, at least one of the two interaction regions will be served by beams crossing under a finite angle. A super-conducting RF cavity could provide the necessary separating fields.

DR A key question in the design of damping rings for high currents beams is the suppression of electron clouds spoiling the beam. Both theoretical modelling of the various materials for the beam pipe and the experimental verification, e.g. at DaΦne, of the predicted effect is required to come to an improved and robust design. RF separators will be studied as well as will be the influence of wigglers, which are the primary tool for beam damping. The influence of non-linear wiggler fields and their limitation for the ring dynamics will be explored.

PPS The production of intense positron beams suitable for a linear collider constitutes a major challenge. The PPS *package* will investigate the production of positrons off a target in an intense photon beam. The photons are generated in an undulator which provides longitudinal polarisation. The ionisation energy of the primary charged particle beam is thus avoided. The design package comprised actual construction of an undulator prototype, measurement of the polarisation of the produced positrons and the simulation of their transport to high energies.

DIAG A linear collider is almost synonymous with sophisticated diagnostics tools. Key ingredients of this *study* are the fast scanning laser-based beam profile monitor, time and phase monitors and wide band current monitors. A fast luminosity monitor will be required to optimise the beams. Finally precision polarimetry will be required at both beams.

ILPS This is the core *package* to simulate the luminosity yield given the foreseen tuning and feedback systems downstream the damping rings. It will include the bunch compression, the main linac and the beam delivery. Failure modes will be explored. The beam-beam effect will be investigated as will be the extraction of the beam in detailed simulations.

METSTB The beams will only interact if they are thoroughly held in place. Active mechanical stabilisation systems will be studied that provide stability at the level of a few 10 nm. The success depends largely on the cancellation of ground motion which will be spectrally characterised. For that matter a rapidly operating tunnel reference system will be developed. The results of the measurements will serve as the basis for simulations.

GANMVL The global accelerator laboratory *work package* will investigate the possibility for remote operation and monitoring of a linear collider facility. They will develop a mobile Multipurpose Virtual Laboratory and thus put the idea of remote controlling in practical context.

3 The European and The World Perspective

The EUROTeV bid addresses the European Union for support of its research in Europe. The goal is to foster the European expertise in the growing field of advanced accelerator research and to contribute to an area where European has excelled in the past. The International Linear Collider itself will be constructed in a combined world effort. It is thus important that this design initiative is well imbedded in the global efforts to complete the research for the

ILC. It is for this reason that EUROTeV has imbedded into its management structures the contact to the American and Asian research efforts. An external scientific advisory committee (Fig. 2) will inform and advice the EUROTeV management in questions of scientific relevance and priority in conjunction with efforts elsewhere.

A milestone in this endeavour will be the forthcoming technology decision between the "warm" and "cold" technologies that is expected during the course of this year [5]. An early decision could help to sharpen the research effort and lead to an even more effective use of the resources.

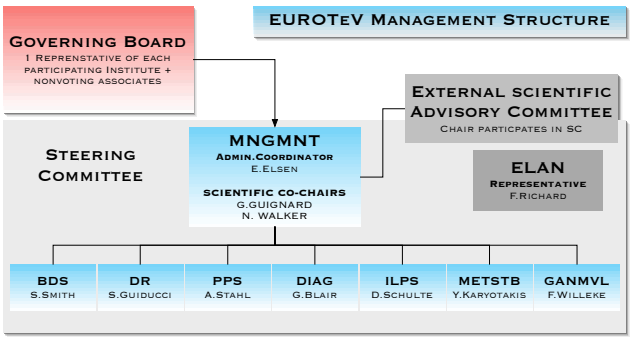

Figure 2: The management structure of EUROTeV.

4 Conclusion

The EUROTeV initiative assembles a large number of European institutes around a design study that is meant to advance the technology base for an International Linear Collider. With its primary goal of addressing the imminent project this research will broaden the expertise in Europe for future accelerator science application.

References

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