Minutes of the 9th ILC project meeting at DESY

DESY Hamburg, April 22, 2005

Announcements:

Eckhard reported on progress in setting up the GDE. After the appointment of B. Barish as director a search has started for three regional directors, and for three "Cost engineers". While the regional directors should be the central representative of the GDE in the regions, and as such serve a very important political role, the cost engineers should ensure that the project from the very beginning is done with a stringent costing model in mind. Nominations for either of these positions should be send to Brian Foster by May1, 2005.

From June 20 to June 23 London will host the "ILC European Regional Meeting", with contributions from the different European ILC projects like ELAN, EUROTEV, and the ILC working groups. This is seen as an important preparatory meeting for the Snowmass meeting later in the summer.

Report from the Daresbury Workshop

Positron Sources and Positron Capture (E. Elsen)

Several options are currently under study for a positron source at the ILC.

Conventional:

Studies are ongoing to investigate whether a conventional positron source is feasible. To optimize the positron yield a thick target is needed, such that the shower maximum is inside the target. This results in large deposits of energy in the target, with resulting heating and possibly damage of the target.

Recent studies done primarily at SLAC have resulted in a conceptual design which appears feasible. The target is realized as a wheel, which is rotating with some 3500 revolutions per minute. In this way the power of the beam is distributed over a sufficiently large area that an operation seems feasible.

Undulator Source:

The undulator source offers an attractive alternative to a conventional one since it relies on a beam of photons, rather than electrons, impinging on the target. Because of this the conversion into positron is more efficient, and the target can be designed as a thin target. This eases the thermal handling of the target, and also reduces potential risks of damage to the source. Studies are ongoing to on the detailed understanding of the thermal and other properties of such a source.

An area of intense R&D is the development of a helical undulator. Both permanent magnet and superconducting magnet solutions are under investigation. The integration of the undulator source into the overall machine layout is another area of discussion. Several schemes are being developed which reduce the coupling between the electron and the

positron linac in the case of a undulator based source. Along with these studies the reliability studies are revisited to understand the impact of different schemes.
Several scenarios are investigated on how to extract the beam from the positron source, and how to optimize the capture efficiency.
An alternative positron production scheme uses photons produced in the Compton backscattering of a high energy electron beam. While this is an interesting scheme, it was felt that it is still far from an established solution, and at this moment cannot be considered as one of the baseline options for the positron source.

In summary two baseline positron source options are under study: a conventional source, and an undulator based source. It appears that a conventional source is challenging, but feasible. For the undulator source helical undulators are the baseline.

Polarised Positrons (S. Riemann)

Over the past few years the physics case for a polarized positron source has been worked out in detail. It is by now well accepted in the community.
Polarised positrons can be produced quite naturally in an undulator based source. For a conventional source no worked out solution exists.
The E166 experiment at SLAC will be a proof od principle experiment for the production of polarized positrons at the ILC. It is scheduled to take data in May for the first time.
Intense R&D is ongoing to study different options for the undulator, as already discussed briefly in the previous section. In the UK two groups are working on prototypes for a superconducting undulator, which should provide important data in the near future.
The measurement of the polarization of the positrons (and the electrons) will most probably be done by Compton backscattering of the lepton beam. Solutions exist now for polarimeters both downstream and upstream of the interaction region.
A similar approach through Compton backscattering can also be used for the production of positrons. Here very intense lasers are needed. Conventional technologies are probably not easy to employ. There fore R&D is ongoing on the feasibility of a laser cavity, to boost the power from available lasers. Two different options are being pursued, one based on high power laser, low gain cavities, another one based on low power lasers, but high gain cavities.
The operational aspects of the different sources are being studied in great detail at several places. In general these sources are rather complex installations, and require a great deal of carefully planned infrastructure to work reliably. This is particularly challenging as many of materials in these sources will become radioactive through their operational lifetime, and need special handling facilities.
The reliability of the different sources is being studied. At the moment the conventional source is considered to be more reliable, but new ideas in particular on ways how to decouple the electron and the positron production result in very similar results on the reliability for both conventional and undulator based sources.

Electromagnetic Interference (T. Klimkovich)

A serious concern for the detector at the ILC, and a particular one for the vertex detector very close to the beam pipe is the possibility of electromagnetic interference from the bunches passing close to the detector. Another possible source of EMI is pulsed cables passing close to the detector.

The SLD vertex detector running at the SLC for many years was used as an example of such effects. There significant pickup was observed, which was at least partially cured by the introduction of an RF shield in the interaction region.

Such a shield might be more difficult to introduce into the ILC detector. The much higher levels of beam-beam background at the ILC make a rather complex beam pipe necessary, which in turn makes the introduction of a RF shield difficult.

At SLAC plans are being developed to use the still existing SLD vertex detector in the end station A and make tests of the significance of EMI. The accelerator can produce bunches which have a rather similar time and charge structure compared to the ILC, so that interesting tests can be done.

Tatsiana reported on discussions ongoing to explore whether TTFII could be used for such studies. A first test could be to simply measure the fields with a proper antenna during TTF operation. A possible location within TTF has been located at the OTR station. A number of people have expressed an interest to further pursue these tests, and to explore whether real tests are possible at the TTF.