Minutes of the 59th Meeting of the PRC
DESY May 26th and 27th 2005

PRC members present:

G. Anton (Erlangen), J. Brau (Oregon), Buchholz (Siegen), R. Forty (CERN), W. Hollik (MPI-Munich), Y.K. Kim (Chicago), J. Kühn (Karlsruhe), T. Lohse (HU Berlin), N. Saito (Kyoto), B. Spaan (TU Dresden), J. Timmermans (NIKHEF/CERN), R. Heuer (DESY/U Hamburg), D. Trines (DESY), A. Wagner (DESY), J. Stewart (DESY, secretary), S. Riemann (DESY, next secretary), U. Schneekloth (DESY, HERA experiment coordinator)

R. Milner could not attend the meeting.

Non PRC members attending closed session items:

HERA: J. Keil (DESY), M. Bieler (DESY), M. Vogt (DESY)
Pol2000: T. Behnke (DESY), S. Baudrand (Orsay)
Representatives from the Experiments:
H1: M. Klein (DESY), T. Greenshaw (Liverpool), D. Pitzl (DESY), V. Chekelyan (MPI Munich), E. Sauvan (Marseille CNRS/IN2P3), G. Eckerlin (DESY), E. Perez (Saclay)
ZEUS: R. Yoshida (Argonne), R. Carlin (Padova), W. Zeuner (DESY), R. Mankel (DESY), M. Wing (UCL)
HERA-B: M. Medinnes(DESY), A. Zoccoli (U. Bologna), J. Spengler (MPI Heidelberg), H. Kolanoski (Humboldt U. Berlin)
HERMES: EC. Aschenauer (DESY), D. Hasch (INFN Frascati), P. Di Nezza (INFN Frascati), B. Zihlmann (Gent), M. Hartig (DESY), R. Kaiser (U. Glasgow), M. Düren (U.Gießen)
R&D On Silicon detectors for the ILC
DEPFET: P. Fischer (U. Mannheim), HG Moser (MPI Munich), R. Richter (MPI Munich), L. Andricek (MPI Munich), N. Wermes (Bonn U.), H. Krüger (Bonn U.), M. Trimpl (Bonn U.)
MAPS: M. Winter (IReS-IN2P3)
LCFI-CCD: S. Worm (RAL), T. Greenshaw (Liverpool)
SiLC: J. Genat (LPNHE - U. of Paris 6), V. Saveliev (Obninsk and DESY), A. Savoy-Navarro (LPNHE – U. de Paris 6)
HERA and the LHC: H. Jung (DESY)
External Experiment: J. Mnich (DESY)

External Referee: K.-T. Knoepfle

The PRC received the following documents:

Update Reports from existing R&D projects:
PRC R&D 03/01 update 01(05)

PRC R&D 01/01 update 02(05)
PRC R&D 03/02 update 02(05)
PRC R&D 01/04 update 02(05)

Agenda

Open session. May 26th 2005, Main Auditorium

HERA	J. Keil
POL2000	S. Baudraud
H1	E. Sauvan
ZEUS	R. Mankel
HERMES	M. Hartig
HERA-B	H. Kolanoski
LHC-HERA workshop	H. Jung
The ILC Project at DESY	E. Elsen
R&D on Silicon Detectors at ILC:	
DEPFET	P. Fischer
MAPS	M. Winter
LCFI-CCD	S. Worm
SiLC	A. Savoy-Navorro
External Experiment	J. Mnich

Closed sessions: May 26th and 27th 2005, Seminarraum 1

Item 1: Approval of the minutes and matters arising from the last meeting
Item 2: News from the Laboratory
Item 3: Combined HERA results
Item 4: Review of HERA
Item 5: Review of POL2000 Status
Item 6: Review of TESLA R&D
- Item 6.1: Review of DEPFET
- Item 6.2: Review of MAPS
- Item 6.3: Review LCFI-CCD
- Item 6.4: Review of SiLC

Item 7: Review of HERA-B
Item 8: Review of HERMES
Item 9: Review of H1
Item 10: Review of ZEUS
Item 11: Discussion concerning an External Experiment

Item 12: AOB

Item 1. Approval of the minutes and matters arising from the last meeting

The new members G. Anton, P. Buchholz and R. Milner were welcomed to the PRC.
The PRC would like to thank the leaving member J. Mnich for having served on the DESY PRC and would also like to thank J. Brau, Y.K. Kim and J. Kühn for agreeing to continue their PRC membership for another two years. The PRC thanked J. Stewart for being the scientific secretary for the past 2.5 years and S. Riemann for accepting the appointment as secretary for the next 2 years. R. Heuer briefly described function and importance of the PRC.

The minutes of the 58th session were accepted with minor changes.

Item 2: News from the Laboratory

A. Wagner presented the news from the laboratory. HERA is running successfully and delivers high luminosities but the polarization is clearly less than expected.
The Strategy Group consisting of representatives from DESY and German universities concluded in a general and broad consensus that DESY should participate in the LHC programme and recommended to join one of the large multi-purpose experiments. To fully exploit the connections of HERA and LHC physics and, complementary the ILC physics, effort from the theory is highly desired.
The next steps towards the ILC are to agree on a baseline configuration for the ILC with the goal of developing a Conceptual Design Report. A small set of candidate ILC sample sites in the three regions should be defined during that time, enabling site-dependent designs for the CDR to be produced by the end of 2006 followed by the TDR end 2008. Alternatives in design will also be considered to improve cost and performance as well as R&D on the process of building the machine, stressing the importance of technology transfer to industry.
The VUV-FEL is in operation, first experiments are being assembled. At present 47% of the time is assigned to user related research, 25% to research for the FEL and 25% for the linear collider. The TESLA technology collaboration is joined by many labs worldwide. A body will be formed to continue interests of European industry for the superconducting technology. The Planfeststellungsverfahren for the XFEL is in preparation. A memorandum of understanding to jointly prepare the foundation of the European XFEL has been signed by 11 countries.

The PRC takes note of the report presented by A. Wagner. The PRC endorses the proposal to review the activities of the theory group at DESY. Referees have been assigned and will report at the next PRC meeting. The PRC acknowledges the

importance of coherent world-wide efforts on ILC detector R&D, and will invite the chairperson of the international working group to report at the next PRC meeting.

Item 3: Combining HERA Experimental Results

There was no presentation on the combination of HERA results in the closed session.

The combination of HERA results achieves substantially reduced uncertainties and a coherent voice of the HERA experiments.The combined HERA results are of fundamental importance for the LHC physics.

H1 and ZEUS support the idea of a combined HERA working group. The overlap with the physics at HERMES will be discussed and HERMES results included.
The tense manpower situation requires the effort of all collaboration members to perform and complete the combination of physics analyses.

The PRC continued its discussion in the closed session.

The PRC welcomes the successful combination of the F_2 distributions from H1 and ZEUS that was recently achieved. The PRC strongly encourages the experiments to continue to put effort into the combination of their released results, which will form an important resource for future experiments. The PRC asks the H1 and ZEUS experiments to establish a clear working-group structure for those topics where the gains from combination are clear, with the names of conveners to be available for the next PRC meeting.

Item 3. Review of HERA

There was no presentation from the machine in the closed session.

The performance of HERA has been greatly improved. The high luminosity production with electrons exceeds that with positrons in 2004 and an integrated luminosity of 95 pb^{-1} was reached in 156 days. An integrated luminosity of more than 200 pb^{-1} is expected in 2005. The background conditions became good after the source of the periodic proton background spikes was found but again a machine failure was caused by a vacuum leak in the north area. The availability of HERA components and the operational efficiency is still too low. Longer dead times are also due to the complexity of the machine but a minimum of manpower is needed to have high quality beams. The situation with manpower is tense especially due to lack of experts.
The polarization of colliding bunches is low, effort has been invested for improvements (mirror tunes). The specific interaction between luminosity and polarization is under discussion.

The luminosity operation will be continued until the winter shutdown (14th Nov. 2005 – Jan./Feb. 2006).

It must be ensured that all data will be analyzed also beyond the end of HERA operation to justify the effort for high luminosity.

The PRC continued its discussion in the closed session.

The PRC congratulates the HERA team for the excellent performance of the machine, reaching integrated luminosities beyond 1 pb^{-1} per day. The PRC notes that there have been hardware failures and endorses the reactions taken by the machine group. However, the PRC expresses its concern about the reproducibility of beam conditions. Improved stability in the operation of the machine would help the experiments to record more data, and should help the polarization performance as well. The PRC encourages the DESY management to provide support for any improvements considered viable by the machine group, concerning for example beam diagnostics or the automation of operational procedures. As well as integrated luminosity, polarization is an important aspect of the HERA-II program, and the proposal to investigate an alternative machine tune to enhance the polarization is endorsed. The PRC encourages representatives from the experiments to be closely engaged with the HERA machine group and its operations.

Item 5: POL2000

In the closed session T. Behnke discussed the systematic errors of the polarization measurement and viable improvements. The goal of the POL2000 project is the measurement of the polarisation at HERA-II with an accuracy of 1-2%.Due to the reduced overall luminosity from HERA and the reduced overall level of polarization compared to the expectation the experiments have slightly relaxed requirements. They expect to complete the physics programme also with a 2% polarization error, through 1% would be better. An error of 2% for the TPOL polarization measurement seems achievable with intensified effort. In view of the person-power situation it will be difficult to reduce the 2% error which are nearly reached to the originally goal of 1%.
With the use of the cavity LPOL a significant reduction of the polarization error should be possible.

J. Mnich presented the reviewer's report for himself and P. Buchholz. In 2005 stable operation and a combined efficiency of 98.3% was obtained. The current systematic error of TPOL measurements is 3.5% and an intense analysis effort is required to reach a precision of 2%. The manpower is barely sufficient. The laser cavity LPOL is underway to deliver polarisation measurement, the procedure for the laser-e^--beam interaction is now established and the bremsstrahlungsspectra are understood. Problems with the DAQ are under study. The two LPOL calorimeters are not suitable for cavity operations. A new tungsten-quartz fibre calorimeter will be built by the end of June and put in operation immediately after. Testbeam calibration will be possible during the shutdown in November. The manpower for the new LPOL could be critical and the time to accomplish improvements is limited.

The PRC continued its discussion in the closed session.

The PRC acknowledges the steady progress made by the POL2000 group. The PRC recommends that priority should be given to improving the understanding of the existing TPOL and LPOL. The PRC notes that further analysis effort will be needed to reach 2% precision on the polarization measurement, and increased manpower will be needed. The PRC recommends the installation of the new LPOL to be scheduled so as not to interfere with the on-going polarization measurements.

Item 6: R&D on Silicon Detectors for the ILC

The ILC community world-wide is developing 3 detector concepts: a silicon based concept (SiD), a large detector concept (LDC) and an even larger detector concept (GLC). The concepts differ in dimension and technology, precise tracking and vertexing are needed to meet the physics requirements. Serious concerns for the detectors are radiation hardness, thermal load and electromagnetic interferences (EMI) from bunches passing the detector or pulsed cables.

The PRC encourages all the silicon detector R&D groups to investigate areas (such as mechanical and cooling issues, and test beam effort) where they might collaborate and share resources. The PRC notes that tolerance against EMI during the bunch train should be checked and looks forward to seeing results on this issue from the LCFI group. The next full review of the silicon detector R&D projects will be held two years from now. A short interim progress report (a couple of pages in length) is requested from each of the projects in one year.

Item 6.1: DEPFET

J. Timmermans presented the reviewer's report on the DEPFET project for himself and K.T. Knöpfle. The R&D is well focused to the ILC and very good progress has been reached. The technology for thin detectors is established and the pixel size is limited only by the manufacturing equipment. The complete removal of charges from the internal gate (clearing) works with short pulses at moderate voltages and no clocking of the clear gate is needed for the ILC. The radiation hardness was demonstrated up to 1 MRad for single pixels. The radiation tolerance of the readout and steering chips, the operation of the complete system with ILC speed and the production of thin sensors with larger matrices are still pending and are the next steps. The analysis of tests with a 4GeV electron beam is still under way. More manpower is desired.

The discussion was continued in the closed session.

The PRC congratulates the DEPFET group for their impressive progress, achieving the main goals presented at the last review, and concludes that their work should continue with full support. The clarity of the report that the group submitted was appreciated.

Given the success of their sensor development, the PRC supports their request to broaden the collaboration. It is pleased to see the DEPFET collaboration (Bonn, Mannheim, MPI Munich) increasing their effort towards the ILC.

Item 6.2: MAPS

K.T. Knöpfle and J. Timmermans reviewed the status of the MAPS project. The improved simulation of beamstrahlung lead to faster read-out requirements and enhanced radiation tolerance requirements w.r.t. the TESLA TDR.
A fast CMOS MAPS of column parallel architecture with low noise and small pixel-to-pixel dispersion has been developed. A prototype with 4 memory-cells per pixel is being fabricated and the cell precision vs. size can be exploited. The thinning to 50 μm seems to be ok. The radiation tolerance to 10 MeV electrons and 1 MeV neutrons is very satisfactory. Detailed detector performance studies including effects of dead material at the MAPS borders, the thinning and stitching of chips and the integration of the complete electronics on the chip are pending issues.

The discussion was continued in the closed session.

The PRC congratulates the MAPS group for their broad but well-focused R&D effort, with significant progress, and recommends that their R&D programme should continue with full support. The PRC notes that the sensors developed by the MAPS group are planned to be used in the upgrade of the STAR experiment, which should provide important information concerning the implementation of this technology in a full-scale detector.

Item 6.3: LCFI-CCD

K.T. Knöpfle and J.Timmermans refereed the status of the LCFI project for the CCD based vertex detector.
Heavy flavor identification and charge determination are crucial for physics at the linear collider. Based on detailed studies of the physics processes and detector simulations improved identification algorithms with high tagging efficencies can be provided.
For an optimized flavor identification sensors are being developed: Fast column parallel CCD sensors for a read-out during the ILC bunch trains and storage sensors for a read-out between the long bunch trains associated with the SC technology. The latter focus on In-situ Image Sensors (ISIS) and Flexible Active Pixel sensors (FAPS).

The discussion was continued in the closed session.

The PRC congratulates the LCFI group for their continuous output of relevant results concerning simulation and physics, as well as significant progress in detector R&D. Following the decision for superconducting ILC technology, the sensor development has been re-focused to include two lines of sensors with built-in storage, in addition to CCDs, to enable read-out to be performed between bunch trains. The PRC recognizes the

expertise of the LCFI collaboration for performing this broad programme of work, and recommends support of the full programme provided that sufficient funds are available.

Item 6.4: SiLC

In the closed session A. Savoy-Navarro gave a review on the organization of the collaboration, the responsibilities and the financial support of the participants.

J. Brau presented the review of the SiLC collaboration for himself and J. Timmermans. The reviewers commented that SiLC is a collaboration of many groups interested in tracking applications of silicon detectors for the ILC. The goal is to develop the next generation of large area Silicon trackers suited for performing very high precision measurements in spatial position and momentum. The objectives of each group are defined by application of interest and each institution proceeds R&D at own place and direction.
Important progress has been reached during the last two years, highlights are the characterization of long strips, the development of fabrication lines, front-end electronics in deep submicron CMOS technology, the development of Lab test bench for the precise measurements requested, the CAD of all tracking components for both, LDC and SiD and thermo-mechanical studies. Now test beam measurements are in preparation. A full tracking prototype with sensors and new front-end electronics is planned to be tested in fall 2006. The collaboration established close contacts to all three ILC detector concepts and the groups keep the synergy with LHC.

The discussion was continued in the closed session.

The PRC congratulates the SiLC group for the good progress of their R&D efforts, and recommends that their R&D effort should continue in support of the linear collider detector concepts. The PRC encourages the group to further develop their connections with the groups that are developing the detector concepts. The PRC asks the group to provide in the next few months an updated organizational structure that identifies the lead groups and responsibilities.

HERA Experiments

Given the fact that the HERA-II experiments expect to accumulate a large amount of data during 2007, the PRC is concerned to ensure that sufficient manpower is available up to 2010 and beyond, to complete the data analysis. The PRC asks the collaborations to provide, in time for the next meeting, an estimate of their manpower needs for operating and decommissioning the experiments and analyzing the data, and the profile of manpower that they currently expect to be available.

Item 7: HERA-B

A considerable list of interesting topics is under study and should be reasonably covered although the number of active collaboration members is decreasing. The goal is to produce draft publications by end of this year for most of the topics. M. Medinnes summarized the analysis topics and requirements. The support for Eastern countries visitors, computing infrastructure and travel to meetings and conferences should be continued. All students are expected to finish their major analyses in 2005; a few of them will need additional time for finalizing their work.

R. Forty presented the review of the collaboration. The analyses are progressing steadily, the effort will continue until end of 2005 and the DESY support for computing and Eastern visitors is important for the collaboration.

The PRC recognizes the progress made by the HERA-B collaboration in their physics analyses. The PRC encourages the collaboration to prepare the core topics for publication by the end of this year, including the necessary understanding of the J/ψ differential distributions. The willingness of the DESY management to support limited analysis effort continuing into 2006, particularly for students completing their thesis work, is welcomed.

Item 8: HERMES

E-C. Aschenauer summarized the HERMES physics activities and publications. HERMES is taking data with the best efficiency reached at HERA-II. The performance of the polarized target is very good but the beam polarization is low. The impact of low polarization and low luminosity for the HERMES HERA-II physics program was discussed. Polarization and its optimization must get a higher priority at HERA to accomplish the program.

The progress and status of the HERMES recoil detector was presented by R. Kaiser. The recoil detector has been completed; the subdetectors have been tested in various test beams. The detector has been assembled and is currently taking cosmics data. The software to ensure the safe running of the detector is available with minor exceptions. The analysis software is not yet completed. The strained manpower situation will improve towards the fall and sufficient manpower will be available for the commissioning and running of the detector. A detailed installation plan has been included in the HERA shutdown planning.

N. Saito presented the review of HERMES on behalf of himself and R. Milner. The reviewers were pleased with the status of data analysis, the status of the detector and the software. They asserted that the availability of polarization will affect the current and the future runs with the recoil detector. An optimization between luminosity and polarization is desirable and a 10% reduction in luminosity may result in significant polarization improvement. The reviewers recommended to implement some mechanisms to enhance the reproducibility of the machine performance which would also help to optimize luminosity and polarization.

Deeply virtual Compton scattering (DVCS) is an important physics issue. Before the high luminosity phase at eRHIC/ELIC, it can only be studied at HERMES exploiting the recoil detector (at Jlab the Q2 is lower). Beam tests have shown that the detectors work as expected and the TDR performance is reached. The TDC readout of the scintillating fiber tracker (SFT) has to be finalized. Ongoing tests of the full system with cosmics are planned to be completed mid September.

The PRC continued its discussion in the closed session.

The PRC congratulates the HERMES collaboration for its high productivity in physics results, and recognizes the steady progress on the recoil detector. The PRC considers that a further (light-weight) review of the recoil detector, focusing on full system performance, is desirable this Autumn to ensure success of the final data-taking period of HERMES. The detailed scheduling for that review is left to the referees, in close consultation with the experiment.

Item 9: H1

The H1 collaboration gave no presentation in the closed session.

T. Lohse presented the reviewer's report for himself and P. Buchholz. The collaboration is stable and dedicated and has a rich physics output. A luminosity of 40 pb^{-1} of left-handed $e^{-}p$ data has been recorded until now in 2005, 95 pb^{-1} were delivered. The recovery of the vacuum after the beam pipe repair last October and frequent proton beam spikes due to a faulty BU magnet are the reasons for this low efficiency. The Fast Track Trigger (FTT) is fully operational at level 1, the added trigger capacities from level 2 and 3 will be operational very soon. The hardware of the Very Forward Proton Spectrometer (VFPS) is under control and no radiation damage has been obtained. The physics analysis with the VFPS is starting. Very impressive progress has been reached concerning the repair of BST and FST.

The PRC continued its discussion in the closed session.

The PRC congratulates H1 for the rich physics results they have produced, including new ideas and approaches in data analysis. The PRC notes the problems caused to the data-taking of H1 by poor background conditions, and is very impressed by the progress made by H1 in the repair of the BST/FST.

Item 10: ZEUS

R. Yoshida presented the status of ZEUS in the closed session. The HERA-II luminosity is reaching (1pb-1/day). A good efficiency of data taking is achieved (approximately 80%) and maintained by incremental upgrades and continuous monitoring of problems and repairs. Efficiency losses are mainly due to beam conditions (BU magnet). The collaboration shifts much effort to the HERA II analysis.

B. Spaan presented the review of the ZEUS collaboration on behalf of himself and Y. Kim. The reviewers are pleased with copious high quality physics results. The detector operation was very stable apart from the straw tube tracker STT. The STT is presently switched off because of insufficient cooling. A repair that does not break the beam vacuum is in preparation. With the high data taking efficiency the luminosity delivered can be exploited. Even better HERA-II performance and improved polarization are appreciated. The DAQ is ready for higher luminosity. The HERA-II Monte-Carlo mass production is processed on computing grid. The manpower is at a minimal sufficient level to operate the detectors. More manpower would help to e.g. finalize MVD alignment, improve luminosity measurement and quickly turn HERA-II data into publications.

The PRC continued its discussion in closed session.

The PRC congratulates ZEUS for the rich physics results they have produced, including new ideas and approaches in data analysis. The PRC acknowledges the stable detector operation and high data-taking efficiency of ZEUS, and the efforts made to prepare for the possible repair of the STT.

Item 11: Discussion concerning an External Experiment

There was no presentation on the DESY participation in an external experiment in the closed session.

The PRC continued its discussion in the closed session.

The PRC enthusiastically supports the DESY plan to participate in the LHC programme, both by the contribution of a Tier-2 computing center and through joining one of the general-purpose experiments, ATLAS or CMS. The LHC will not only provide an exciting range of physics possibilities, with high discovery potential, but will also provide a bridge between the operation of HERA and the ILC era. There are synergies which can be exploited between the various programmes, both between HERA and the LHC, and between the LHC and the ILC. The choice of LHC physics programme should be include the exploration of physics at short distances, which connects with the present HERA programme, gives access to the largest discovery potential and can best be connected to the programme of the ILC. The PRC endorses the setting up of the Tier-2 computing centre at DESY for the use of both ATLAS and CMS initially, but with the possibility of future participation from other LHC experiments. The choice of which LHC experiment DESY will join, ATLAS or CMS, should be taken in the near future, and will be reviewed at the next PRC meeting.

Item 12: AOB

The dates for the next PRC meetings are November 10th-11th for the 60th PRC session and April 27th-28th for the 61st PRC session.

The current list of PRC referees is:
P. Buchholz, T. Lohse: H1
R. Forty: HERA-B
R. Milner, N. Saito: HERMES
Y.-K. Kim, B. Spaan: ZEUS
G. Anton: AMANDA/Icecube
P. Buchholz, R. Milner: POL2000
J. Brau, J. Timmermans: R&D Linear Collider
W. Hollik, J. Kühn: Theory
J. Timmermans: R&D on silicon detectors for the ILC
Y.-K. Kim, T. Lohse: Theory

Invited Reviewer:

K.-T. Knöpfle: R&D on silicon detectors for the ILC

(S. Riemann – Sept. 2005)