Minutes of the 61st Meeting of the PRC
DESY May 11th and 12th 2006

PRC members present:

J. Brau (Oregon), P. Buchholz (Siegen), R. Forty (CERN), U. Gensch (DESY), R. Heuer (DESY/U Hamburg), W. Hollik (MPI Munich), Y.K. Kim (Chicago), J. Kühn (Karlsruhe), T. Lohse (HU Berlin), G. Quast (Karlsruhe), J. Schneider, J. Timmermans (NIKHEF), D. Trines (DESY), S. Riemann (DESY, scientific secretary), D. Pitzl (DESY, HERA experiment coordinator)

N. Saito (Kyoto U) attended the meeting via phone.
G. Anton (Erlangen), R. Milner (MIT) and A. Wagner (DESY) could not attend the meeting.

Non PRC members attending closed session items:

HERA: F. Willeke, (DESY)
Pol2000: T. Behnke (DESY), S. Baudrand (Orsay)
ILC R&D:
FCAL: W. Lohmann (DESY), R. Ingbir (U Tel Aviv), H. Abramowicz (U. Tel Aviv), L. Zawiejski (INP PAS Cracow), I. Bozovic-Jelisavcic (VINCA INS Belgrade), W. Wierba (INP PAS Cracow.), Z. Rakocevic (VINCA INS Belgrade)
TPC: R. Settles (MPI Munich), P. Wienemann (U Freiburg), T. Behnke (DESY)
Representatives from the Experiments:
H1: M. Klein (DESY), C. Diaconu (Marseille CNRS/IN2P3), G. Eckerlin (DESY), E. Perez (Saclay), O. Behnke (U Heidelberg), C. Vallee (Marseille), J. Bracinik (MPI Munich)
ZEUS: E. Gallo (INFN Firenze), K. Nagano (KEK), Y. Yamazaki (KEK), M. Corradi (INFN Bologna), U. Schneekloth (DESY), A. Caldwell (MPI Munich)
HERMES: EC Aschenauer (DESY), J. Stewart (DESY), B. Zihlmann (DESY), D. Hasch (INFN Frascati)
LHC: J. Mnich (DESY), K. Mönig (DESY), M. Medinnes (DESY), V. Gülzow (DESY), P. Wegener (DESY), W. Zeuner (DESY)
AOB A. Ringwald (DESY)

External Referees: J. Gayler, U. Kötz

The PRC reviewed the following documents:

Update Reports from existing R&D projects:
PRC R&D 02/01 Update 04(06)
PRC R&D 01/03 Update 04(06)

Documents on HERA running strategy:
PRC 06/01 ZEUS: Proposal to Run HERA at Lower Proton Energy
PRC 05/01 H1: Running at Low Proton Beam Energies

Agenda

Open session: May 11th 2006, Main Auditorium

HERA and POL2000	F. Willeke (DESY)
ZEUS	K. Nagano (KEK)
HERMES	J. Stewart (DESY
H1	J. Bracinik (MPI Munich)
Invited talk on BCD ILC	B. Foster (Oxford U)
R&D at the ILC:	
FCAL (former LCAL –LAT)	R. Ingbir (U Tel Aviv)
TPC	P. Wienemann (U Freiburg)

Closed Sessions: May 11th and 12th, Seminar Room 1

Item 1: Minutes and matters arising since last meeting
Item 2: News from the Laboratory
Item 3: ILC Detector R&D
- 3. 1. Accelerator R&D
- 3. 2. Detector R&D
- 3. 2. 1. FCAL
- 3. 2. 2. TPC

Item 4: Review of HERA
Item 5: HERA Running
Item 6: POL2000
Item 7: HERA Experiments
- 7. 1. H1
- 7. 2. ZEUS
- 7. 3. HERMES

Item 8: LHC
Item 9: AOB

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

The PRC welcomed G. Quast as a new member. The minutes of the 60th session were accepted with minor changes.

Item 2: News from the Laboratory

R. Heuer presented the news from the laboratory. HERA had an excellent start after the shutdown. It is expected to reach until July 2007 almost the luminosity goal for HERA II set in the Helmholtz programme strategy 2005-2009. FLASH (former name TTF) started the user

operation. The beam time is divided between user FEL experiments, studies to develop the FEL and accelerator studies in a general sense, i.e. also for the X-FEL and ILC related studies. Important experience is being accumulated operating the superconducting linac. In April laser flashes with a wavelength of 13.1 nm wavelength were obtained. With the sixth accelerating module the design value of 6 nm is planned to be reached in 2007. Until 2009 FLASH will be the only user facility with a wavelength range down to 6 nm.
The preparatory phase for the XFEL is close to completion. The BMBF budget supplements funding for specific scientific large-scale equipment in basic science, the German part of the construction costs for PETRA III and the X-FEL are secured. A workshop by the European Industry Forum for Accelerators with Superconducting RF-Technology was held in May at DESY to inform potential suppliers and interested research institutions. U. Gensch added news from DESY in Zeuthen. The final APE installation is reached and is working reliable; problems with the speed of processors will be solved after summer. Eight IceCube strings with optical modules were deployed, 24 IceTop tanks installed. In the weeks before the end of the season the drilling and installation speed was reached needed for the scheduled installation of 14-16 strings per season.

The PRC takes note of the report presented by R. Heuer. The PRC notes that there are many things for which the laboratory deserves congratulations. They include FLASH (formerly known as TTF) achieving 13 nm wavelength, the management's commitment on maintaining the collider physics theory group at full strength, the successful deployment of 8 strings of IceCube optical modules (the next challenge is to deploy 16 strings next season), and attracting talented young scientists such as Helmholtz young investigators and recipients of fellowships and awards. The PRC notes that the DESY MAC recognizes DESY's contributions on SC RF development undertaken through ILC/XFEL efforts, and industrialization through the XFEL project. Bilateral negotiations concerning external contributions to the European XFEL project have started recently. The financial contributions of Germany to the construction of the XFEL have now been secured and included in the long term financial perspective of BMBF.

Item 3: ILC Detector R&D

3. 1. Accelerator R&D

There was no presentation in the closed session on accelerator R&D. The European Union funded EUDET project started. The goal is to improve the European infrastructure for future detector development. The project is coordinated by DESY.
The operation of FLASH and the preparation of the XFEL construction provide input for the ILC and the development of superconducting RF cavities.

The PRC appreciated the presentation by Brian Foster on the status of world-wide ILC R&D effort. Many of XFEL developments are relevant to the ILC, but this needs to be properly recognized by the ILC community. The ILC community would welcome further involvement in the ILC R&D effort from DESY. The PRC encourages the DESY management to ensure that the DESY ILC group has sufficient personnel and other resources to continue to play a visible role.

3.2 Detector R&D

3.2.1. Forward Calorimeter

W. Lohmann briefly reported on the FCAL (Forward Calorimeter) collaboration. Since the last PRC meeting new members entered the collaboration. The European groups are part of the EUDET project, in addition the participating labs made firm commitments. The project is also supported by EUROTeV, NoRHDia, INTAS and an agreement between BMBF and JINR Dubna. Applications to the National Funding Agencies are in preparation in Poland and pending in Israel. Up to now the main work was focused on simulations, it is planned to increase until 2008 the part of the hardware contributions to 50%. Highest priority is given to large area radiation hard sensors, to thin sensor planes with integrated bias supply and signal transmission lines, to sensor plane positioning and position control with μm accuracy and to integrated readout systems. So far the hardware development is centered on DESY.

J. Brau presented the referee report on the FCAL project for J. Gayler and himself. Forward calorimetry includes the luminosity measurement (LumiCal: silicon-tungsten), fast beam diagnostics (BeamCal: diamond-tungsten) and the detection of photons from beamstrahlung (PhotoCal). Simulation studies were done for different crossing angles to optimize the design. The feasibility of high precision luminosity measurements is shown, for 20 mrad crossing angle the inner radius of the LumiCal must be enlarged. A digital calorimeter is studied as alternative technology. Precision at the μm level is required for the positioning of silicon sensor boards of the luminosity calorimeter. A laser alignment and precision monitoring system is developed, measured and reached 2.5 μm precision. Since 2004 no progress has been reported on a detailed mechanical design with decoupled sensors and absorbers; no progress reported yet on planned 2x15 deg calorimeter segment with tungsten and sensor layers with possible tests at DESY and CERN. The development of diamond sensors for the BeamCal has started with parameter measurements of pCVD diamond samples from several production sources. The results are mixed; the costs of this technology are also a concern. Alternative technologies are radiation-hard planar silicon and planar GaAs. A prototype for the BeamCal with diamonds cannot yet be proposed. Effort for the readout electronics started and needs to be intensified. Simulation studies were done on electron reconstruction to veto $\gamma\gamma$ events for various beam energies.

The PRC recognizes that the FCAL team has pioneered the study of the issues and solutions to the ILC forward calorimetry. These issues are a critical component of the studies for the ILC detectors and they interface significantly with the ILC machine effort. The FCAL effort should now move from the extensive simulation studies and initial hardware developments to an intensified effort on the sensor, electronics, and mechanics hardware R&D. This will only be possible with increased support. The PRC encourages enhanced support for this important effort from all laboratories and funding agencies. The project will be reviewed in the PRC 64 meeting.

3.2.2. TPC

The TPC has been chosen as central tracker for all of the ILC detector concepts except the all-silicon detector concept; R&D aims at improving on traditional TPC performance.

A brief overview on the status of the project and the work done since the 58th meeting of the PRC was given by R. Settles. The collaboration was enlarged by groups from US, Asia and Europe. The R&D work with small prototypes will be continued to map out the parameter space, to understand resolution etc, to prove the feasibility of a micro pattern gas detector (MPGD) TPC. A Large Prototype has to be built and operated to examine the performance scaling to larger chambers, to test manufacturing techniques for MPGD endplates, field cage and electronics. The work for the design started, about 3 years will be needed to build and test the large prototype. Then the endplate technology for the Linear Collider TPC will be decided and the work on the final design started. The project is supported by contributions within work packages of the EUDET.

R. Forty presented the referee report on the ILC-TPC project for U. Kötz and himself. As recommended by the last time PRC the effort was globalized successfully. Good progress has been made but slower than foreseen; the project is expected to last a further 4 years. The viability of MPGD solutions has been established. Additional confidence in the new detectors comes from successful use in running experiments (COMPASS, NA48, CAST). The T2K near detector will have 3 TPCs with MPDG readout. GEM, μMegas and wire end-plates are compared in the KEK test beam. Ongoing issues concern ion backflow, gas choice and the resolution. First experiences were gained with silicon pixel readout; the next step is a TimePix chip with additional timing information. The Large Prototype will bring together all end-plate detector options, for the initial phase the common readout will comprise ALTRO (ALICE TPC Read Out) chips.

The PRC congratulates the LC-TPC collaboration for successful operation of many small prototypes, both GEM and Micromegas, and interesting developments with silicon pixel readout. The PRC recommends that the organization be strengthened to coordinate world-wide R&D efforts. The PRC encourages efforts on simulation studies, in particular for the eventual choice between detector options. The PRC supports the large prototype detector as the next major focus of R&D that is ready for operations by the end of 2007. Therefore, the project will be reviewed in the PRC 65 meeting.

4. Review of HERA

At the end of the run in 2005 production rates of 1.5 pb^{-2}/day were achieved. Technical problems in the beginning and middle of the run led to substantial luminosity loss; about 50% of the failure time was due to a few incidents. Improvements of electron injection efficiency, in diagnostics, machine protection and the automation of the timing and synchronization system gave a positive impact on the operational efficiency and operability of the accelerators.
A luminosity increase of 25% could be reached due to reduction of the beam cross sections at the collisions. A first step is the implementation and test of a longitudinal broad band damper system during the start-up; protons can now be accelerated without longitudinal emittance blow

up. Until this PRC meeting in 2006 HERA delivered 60 pb^{-1} at an operational efficiency of 55-60%; the polarization was 30-40%.

Concerning luminosity, the PRC is greatly impressed by a remarkable start-up of HERA after the winter shutdown and the PRC congratulate the HERA staff for this success that results from the excellent efforts of the accelerator staff. Concerning the polarization, the PRC notes that the polarization is about 30% on overage, which is somewhat lower than hoped for.

5. HERA Running

Following the requirements of the experiments, the remainder of HERA luminosity should be split equally in electron-proton and positron-proton collisions. At least one switch of leptons per run is needed which would last 25 days. The shutdown in June necessary to replace the HERMES target should be used to switch leptons and to save time.

The theory review on running of HERA at low proton energies was presented by W. Hollik. HERA has the possibility to do a (probably unique) measurement of an important structure function at low proton energies: the measurements of F_L yields crucial information on the gluon distribution function $g(x,Q^2)$ and gives impact on the overall determination of PDF's with DGLAP evolution equations. The knowledge of gluon density is interesting by itself and also an important input quantity for LHC processes.

The H1 collaboration has always considered a low energy run to be an essential part of its physics programme. With the reduction of experimental uncertainties and an increase of luminosity it becomes possible to directly measure the inclusive and the diffractive longitudinal structure functions. The H1 collaboration expresses its firm interest in a run at low proton energy of an integrated luminosity of the order of $10pb^{-1}$.

E. Gallo presented the position of the ZEUS collaboration that is strongly in favor of a low energy run. The importance of the F_L measurement for the understanding of small-x physics outweighs the luminosity loss due taking 100 days of running to run at lower proton energies. ZEUS proposes a task force be set up between HERA and the 2 colliding beam experiments to study the impact of the low energy beam configuration on the detector backgrounds and performance and the risks for HERA and the experiments.

The running of HERA with low proton beam energy of 460GeV will require a considerable effort for preparation and the accumulation of an integrated luminosity of 10 pb^{-1} on tape. The total time of 86 days needed for the low energy run will reduce the overall HERA luminosity yield by 10% ($86pb^{-1}$).

Given the situation where a shutdown in June 2006 is necessary to install a new target cell and the silicon detector of HERMES, the PRC supports the DESY management's decision on switching from electrons to positrons right after the June shutdown. The PRC

recognizes the unique physics opportunity with HERA running at low energy, and recommends that the DESY management accept a low energy run requested by the collider experiments and endorsed by the HERMES experiment. The PRC recommends the start time be after accumulating about 100 pb^{-1} of a high energy positron run, and the duration be about 3 months (time to accumulate ~10 pb^{-1}). The PRC recommends HERA machine and experiments form a task force to check all the possible difficulties (e.g. background, luminosity estimate, triggers, etc.) that might be associated with the low energy run, and prepare to be ready for the low energy run as soon as possible so that they can take advantage when an unforeseen opportunity arises.

6. POL2000

T. Behnke presented a status report for POL2000. In 2006 both polarimeters TPOL and LPOL have run reliably but the problem of the unstable LPOL/TPOL ratio remains and is not understood. The observed variations should be taken into account by inflating the error on polarization from 3.5% to 5.5 %. The solution of the problems is hampered to large extent by a lack of person power. Systematic studies are ongoing. Alternative studies using the Si strip detector to determine the polarization are pursued for the TPOL although this detector is too slow for an on-line measurement.

The status and plans for the Fabry-Pérot cavity LPOL were presented by C. Pascaud. Since the winter shutdown after moving the feedback system near to the cavity a very stable locking of the cavity LPOL has been observed. The fiber-tungsten calorimeter was reinstalled and additionally shielded. The performance improved but needs further investigation. A first polarization measurement was performed successfully using the sandwich calorimeter. Systematic studies and optimization of the polarization measurement are planned. The goal is to be ready to use the cavity polarimeter either as a regular running device or as a precise reference device for other polarimeters.

P. Buchholz presented the referee report for R. Milner and himself. Due to the persistent discrepancy of the TPOL and LPOL measurements the new cavity LPOL measurement has become even more important than before. A high priority should be given to the development of detailed measurement and analysis procedures in order to obtain as fast as possible a significant measurement from the cavity LPOL. A substantial increase of the person power is needed otherwise the whole project will fail.

Despite the continuous efforts, the value of the LPOL/TPOL ratio is not understood. The PRC recommends the DESY group organize a mini workshop with participation of HERA experiments and external experts (e.g. experts from SLAC) to resolve this issue.

Using HERMES experiment's sandwich calorimeter, Cavity LPOL now provides the first result. However the systematic uncertainty is not ready to be presented and the PRC recommends the highest priority be to achieve the systematic uncertainties of the

measurement. The PRC also recommends the group regularly take data with the sandwich calorimeter and provide a detailed plan for achieving the systematic uncertainty.

7. HERA Experiments

7.2. H1

There was no presentation by the H1 collaboration in the closed session.
P. Buchholz presented the referee report for T. Lohse and himself. The H1 collaboration is stable and very productive. H1 had the best start-up and running ever. Until the PRC meeting 60 pb^{-1} were delivered and 37 pb^{-1} taken for physics. The improvement of the overall efficiency to 61% is mainly due to a higher HV efficiency. All detector components are in a good shape; major systems are repaired successfully und upgrade projects are finished. The efficiency of the VFPS is 80%, the FTT is in routine operation and the level 3 Trigger is validated in spy mode. The silicon detectors are back and operational; the commissioning of the readout chain and the new SiDAQ is almost finished.
The excellent physics output includes results from HERA II measurements; 8 papers were published since the last PRC meeting. First physics results are obtained with the upgraded detector (FPS/VFPS and FTT).
H1 is technically prepared to switch to low energy running whenever it seems appropriate.

The PRC congratulates the H1 collaboration for the excellent start-up of data taking since the shutdown, the significantly improved data taking efficiency, and the first publications of HERA II results. The detectors including the FTT and VFPS upgrades are in good shape. The PRC notes that the FST/BST were installed, but the commissioning efforts are on going, and the Level 3 Trigger is ready to be put in operation.

7.3. ZEUS

E. Gallo briefly reviewed the ZEUS status. The data-taking in 2006 started smoothly and with high efficiency (75%) limited by proton background spikes. In 2006 58.75 pb^{-1} were delivered to ZEUS and 41.22pb^{-1} were gated with HV on until the PRC meeting. During the shutdown the STT cooling system was upgraded successfully and is now taking data. The alignment of the Micro Vertex Detector (MVD) was improved by using ep tracks, first results on charm and beauty cross sections are expected for the summer conferences.
Focus is on finalising HERA I analyses; first HERA II results are published. Although the number of institutes in the ZEUS collaboration is constant the number of staff and postdocs is decreasing. The person power is sufficient to run the detector until the end of HERA but after 2008 a significant drop is expected. ZEUS prepared a list of high priority topics of analyses and is developing tools to facilitate analyses.

G. Quast presented the referee report for Y.-K. Kim and himself. The referees were pleased with copious high-quality physics results and appreciate the first HERA II publication. The

new rules to finalise HERA I papers are endorsed. The plan to facilitate analyses is welcomed and will help to ensure physics harvest of HERA II data despite the drop in person power.

The PRC congratulates the ZEUS collaboration for the excellent start of data taking since the shutdown, their excellent detector performance, high data taking efficiency, and the first publications of HERA II results. The PRC commends the successful repair of STT. The PRC notes that they have suffered from occasional proton backgrounds. The PRC appreciates that the collaboration has formulated strategies to deal with the decline expected beyond 2007, by prioritizing analysis, and optimizing the analysis model and computing strategy.

7.3. HERMES

E.-C. Aschenauer presented the HERMES status. Main problem is the damaged target cell. Its replacement scenario is tuned to have the least luminosity loss for HERA: one week shutdown is needed to take out the silicon detector and to replace the cell by one with minimal modifications. Another week of shutdown is necessary for reinstallation. The new cell will possess an improved cooling system; the repaired silicon detector will be installed with additional RF shield that might allow changing a T-cell without removal of the silicon. Further improvement is expected by closing the collimator already at injection but there is no possibility to protect the T-cell against accidental beam losses. During one month date will be taken without any information from the recoil detector which is needed to suppress non-exclusive background. The collaboration published 6 physics papers in 2005 and 1 in 2006, 3 will be submitted soon; 56 talks on physics results will be given until summer 2006.

N. Saito presented by phone the referee report for R. Milner and himself. Until March 10th the recoil silicon detector looked good but after this time the noise became worse. The silicon detectors just upstream of the target developed serious noise problems. The target temperature increased, holes in the target cell were found. The reason of the noise is not known but most likely due to erratic beam handling. The repair and the replacement actions have to be prepared in concert with accelerator groups and other experiments as well as the DESY management. The collimation procedure hast to be re-examined to protect the key detector for the success of the last year of the very successful experiment. The impact on the physics programme is not negligible but not disastrous either.

The PRC congratulates the HERMES collaboration for great progress on physics output. The PRC recognizes the recent problems they suffered with the target cell. The PRC endorses the recovery plan for the target and recoil detector, and encourages the HERA team to be involved in discussion of the eventual replacement target to be installed in June. The PRC is disappointed to note the continuing critical staffing level.

8. LHC

J. Mnich presented an overview on status, activities and plans of the DESY CMS group. The CMS Collaboration Board accepted DESY as new collaborator. Starting from summer 2006 DESY will send 1 FTE for one year to CMS to support detector installation, commissioning and technical coordination. Contributions to the CMS Higher Level Trigger, to computing and the preparation of data analysis are defined; all activities started.

K. Mönig summarized the ATLAS DESY effort. The expression of interest was submitted to ATLAS in February, the acceptance as collaboration member is foreseen in July 2006. As tasks of the DESY group the higher level trigger steering and monitoring has been identified; it is planned to make the H1 experience with fast shower parameterization available to ATLAS. There is a request by the collaboration to contribute to the central ATLAS production and Grid monitoring software. After starting the service work the physics contributions will be decided.

DESY will provide a Tier 2 to ATLAS and CMS. V. Gülzow introduced the Tier 2 ramp up project. It is a joint activity of Hamburg and Zeuthen supporting both LHC experiments at both sites. DESY will provide a part of the funding; additional financing will be arranged via projects. It is a 3 years project to set-up the Tier 2, and then it switches to standard operation mode. The Tier 3 demands have to be considered.

The PRC is encouraged by the reports from ATLAS, CMS and Computing groups at DESY, and is positively impressed by their enthusiasm on LHC projects. The PRC supports the DESY management trying to provide balanced support between the CMS and ATLAS experiments.

9. AOB

The PRC takes note of the Letter of Intent by U. Kötz, A. Ringwald and T. Tschentscher on "Production and Detection of Axion-Like Particles at the VUV-FEL" submitted to the PSC. The dates for the next PRC are October 23rd and 24th, 2006.

The current list of PRC referees is:

P. Buchholz, T. Lohse:	H1
R. Forty:	HERA-B
R. Milner, N. Saito:	HERMES
Y.-K. Kim, G. Quast	ZEUS
G. Anton:	AMANDA/IceCube
P. Buchholz, R. Milner:	POL2000
J. Brau, J. Timmermans:	R&D for the ILC
W. Hollik, J. Kühn:	Theory
J. Brau	R&D for the ILC: FCAL
R. Forty	R&D for the ILC: TPC
J. Brau, J. Timmermans	LHC
W. Hollik, J. Kühn, T. Lohse, G. Quast	Low Energy HERA Running

Invited Reviewer:

J. Gayler:	R&D for the ILC: FCAL
U. Kötz	R&D for the ILC: TPC

(S. Riemann – October 2006)