Minutes of the 41^{st} Meeting of the PRC

DESY 8^{th} Oct 1996

PRC members present:

W.Buchmüller (DESY), F.Eisele (Heidelberg,Wissenschaftlicher Rat), D.Froidevaux (CERN), G.Heinzelmann (Hamburg), J.Jaros (SLAC), M.Kasemann (DESY), A.D.Martin (Durham), J.Rander (Saclay), D.H.Saxon (Glasgow), P.Söding (DESY-IfH Zeuthen), D.Trines (DESY), A.Wagner (DESY), N.Wermes (Bonn), B.H.Wiik (DESY,chairman), J.Bürger (DESY,secretary)

Non PRC members present:

HERA - F.Willeke (DESY).
HERMES - R.Milner (MIT), A.Bruell (MPI-Heidelberg), E.Steffens (MPI-Heidelberg).
HERA-B - A.S.Schwarz (DESY), A. Golutvin (ITEP-Moscow), J. Pyrlik (Houston), J.Spengler (DESY).
H1 - R.Eichler (ETH-Zurich), P.Biddulph (Manchester),A.Campbell (DESY), H.-U.Martyn (Aachen).
ZEUS - R.Klanner (DESY), U. Katz (Bonn), B.Lohr (DESY), R.Nania (Bologna).

The PRC received the following documents:

PRC 96/08
Statement of the H1 Collaboration answering the questions which were brought up by the PRC in it's session on July 1st and July 2nd concerning the VLQ spectrometer. H1 Collaboration.
Agenda:

Open session. Oct. 8^{th}, 10:30, Main Auditorium

HERA status report. F.Willeke (DESY).

HERA-B status report. A.Golutvin (ITEP-Moscow).

HERMES status report. A.Bruell (MPI-Heidelberg).

H1 status report. A.Campbell (DESY).

ZEUS status report. U.Katz (Bonn)

Closed sessions: Oct. 8^{th}, 14:30-18:30

1. Approval of the minutes and matters arising from the last meeting.
2. Review of HERA.
3. Review of HERA-B.
4. Review of HERMES
5. Review of H1.
6. Review of ZEUS.
7. Miscellaneous.

Item 1. Approval of the minutes and matters arising.

The chairman welcomed J.Bürger who acted as secretary for this meeting . The minutes were approved subject to minor modification and the proposed agenda was accepted.

F.Barreiro, S.Bethke, L.Foá, Y.Toksuka and U.Gensch could not attend the PRC meeting.

Item 2. Review of HERA

The chairman emphasized the importance of improving the efficiency of HERA. HERA is a complicated machine requiring a significant amount of time to regain efficient operation after a shutdown. The HERA schedule has therefore been reshaped for the next years. The minimum shutdown, allowed, is determined by the cost of electricity. This period allows significant machine studies, but does not permit major modifications of either the machine or the experiments. The mid term planning, as described by F. Willeke in the open session, foresees 1 month shutdowns for 96/97 and 98/99. A long shutdown is planned for 97/98. The later will allow installation of the NEG pumps in the electron ring and the installation of HERA-B. The machine will restart in May 98 with the commissioning of HERA-B and the bake out of the machine. With the exception of the 1 month shutdowns HERA will run almost continuously until the end of 99. High priority will be given to the startup and operation of HERA-B.

In the 99/00 shutdown the luminosity upgrade is foreseen. There are, at present, no firm commitments beyond the luminosity upgrade for further HERA development. Several options are under discussion namely polarized protons and heavy ions. The later project is being jointly discussed with GSI.
Running the HERA p-beam at lower energies is not foreseen for this year, it may take place in 97. Four months of operation are needed in order to get an in integrated luminosity of 3 pb^{-1} at low proton energy. The chairman concluded his report by congratulating the machine group for a year of improvements to HERA.

D. Saxon asked when the spin rotators for H1 and ZEUS would be installed. They will be most probably installed in the 99/00 shutdown.
F. Eisele proposed to have special runs for HERA-B with shorter p-beam lifetimes. According to B.Wiik this will not happen during the commissioning phase. F.Willeke explained that a study is underway to soften the p-beam edges, although a special program has, so far, not been setup. If it is decided to have dedicated runs for HERA-B the requested p-beam quality can be obtained on a short time scale. The idea to have a locally "bad" vacuum at HERA-B is not an acceptable solution.
D. Saxon asked how large the effect of the new NEG pumps will be. According to F.Willeke this is very difficult to quantify. From the experience with the present setup positive effects are visible. It's size is however dependent on many parameters.

Item 3. Review of HERA B

R.Klanner reported on the progress made by the "cohabitation task force". The aim of this group is to understand the cohabitation of HERA-B with the other experiments. High HERA-B target rate tests were performed to investigate interference with the other experiments and to find appropriate settings for the beam collimators for parasitic HERA-B running. The collimators have been used to absorb background whilst monitoring the rates seen at the other experiments. The target interaction rates studied, so far, are still below the anticipate rates required by HERA-B.

In conclusion, it was stated, that collimator settings could always be found which allowed H1 and ZEUS to survive, whilst providing HERA-B with moderate interaction rates. More studies are required for HERMES.
During October 96 more collimator studies are foreseen, furthermore a longer test run (1 week) is planned to obtain information about the long term behaviour.

In the following discussion HERA-B proposed to move the target wires just after p-beam ramping to 820 GeV into the beam. The time before ep "Luminosity Run" declaration could then be used. The HERA representatives were rather reluctant about this proposal and stated that tests of it will not be possible this year. A.Schwarz then proposed to add this to those items to be discussed at a later point. The issue of shorter p-beam lifetime was also added to this list.
J. Spengler requested that the wires should be moved into the beam independently of the states of the ZEUS LPS and FNC detectors. R.Klanner opposed this request, all changes in the sequence of HERA operation have to be made step by step and carefully analysed.
J. Jaros asked why the background conditions were much better in 96 compared to 95. F.Willeke replied that this was due to collimator positioning and the new beam optics used.
D. Froidvaux raised the question of allocation of dedicated beam time for HERA-B. R. Klanner argued that this is not needed for the background studies. A. Schwarz pointed out that so far HERB-B has made no specific request for dedicated beam time. It is, however, obvious that the present running mode for cohabitation studies is not the final data taking mode for HERA-B and that dedicated wire studies may need to be scheduled. A request will be made in due time.
The chairman resumed the discussion by stating that a cohabitation proof had been made, and that more details have to be studied in the future. He thanked the members of the cohabitation task force for their excellent work. The PRC recommended to continue the cohabitation studies, with dedicated running if required.

The chairman thanked the HERA-B collaboration for their informative open session presentation and opened the HERA-B detector discussion.

J.Pyrlik presented the RICH counter status and F.Eisele that of the MSGCs.

Following the decision to use photomultipliers technology in the RICH 3 months ago, significant progress has been made. Some items remain on the critical path. The photomultipliers have been ordered and delivery is expected Dec. 97. Bidding is in progress for the mirrors and the radiator vessel for which the bids are out (to be finished by March 97). Some items are still in the design phase: the focal plane, the light collectors and the readout. Two options for the light guides are under study. Plexiglas light guides and reflectors will work, but are complicated to assemble. An alternative lens system looks promising and can be easily assembled. In order to finalize the pending decisions there will be a RICH week in Nov. 96. Furthermore it was announced that a new collaborator (University of Barcelona) joined the group.

It had been shown during the last PRC meeting that diamond coated MSCG with gold electrodes showed excellent properties in terms of radiation hardness for the use at HERA-B. However, some sparking problems were seen at a rate of 1 cm^{-2} s^{-1} when exposed to a hadron beam. This damaged the gold electrodes. By reducing the cathode voltage the sparking rate can be reduced. Chromium cathodes are less sensitive to sparking, but the specific resistivity is too high for the anticipated strip length and read out speed. A better candidate is rhodium where test results will soon be available. If the rhodium option is successful, then MSGC series production can begin in March 97 as planed. So far the choice of material does not affect the schedule and two months remain for finalizing the MSGC design. Any additional delay would require prolongation of the 97/98 shutdown.

J. Jaros gave the HERA-B referee's report, starting with a review of the machine interface, followed by the detector construction and ending with the DAQ system.

The concept of "cohabitation" with the other HERA experiments has been proven. The request to install a different RF shield before the shutdown was still outstanding. The referees agreed with HERA-B that some dedicated running would be needed. The time required would be a small fraction of the total HERA running time. The measured detector occupancies agreed with the MC simulations.
The discussion focused on the quality of the MC predictions, the uncertainty of which are presently at the 20% level. W. Hofmann stated that at this phase of the project, the MC is certainly not perfect. The error on the predicted rates will become smaller by improving the MC. B. Wiik remarked that HERA-B should provide a schedule to the directorate w.r.t. dedicated running.

The detector construction phase has progressed from design to production. The schedule remains very tight. This applies to the TRD and Si detectors, and the RICH and MSCG which, sofar, have no large scale prototypes available. The rhodium option of the MSGC seems to be viable, but even if everything works as expected the schedule is extremely tight. If this option does not work there is no real back up solution and the tracker is vital for the experiment. In 98 HERA-B has to install enough components in order to understand the trigger systems.
In the discussion the necessity of having prototypes of MSGCs and RICH was underlined. The question of N. Wermes on the gas gain at the anticipated reduced voltage of the MSCGs was answered by F. Eisele to be 1400, which is enough to deliver $\geq$6000 electrons for a signal to noise ratio of about 15. D. Saxon asked whether alloys have been considered as cathode material. F. Eisele explained, that such material studies are extremely complicated. He felt quite comfortable with the small number of possibilities they presently have. The further discussion concentrated on backup solutions and the detectors which will be installed in the 97/98 shutdown. In this context F. Eisele stated that a) chromium with shorter strip is a possible solution which doubles the electronics required and will obscure parts of the sensitive volume and b) other solutions than MSGCs (e.g. scintillating fibres) are much more expensive. D. Froidveaux underlined that without an inner tracker there will be no real trigger available. Replying to questions about the status of the Si-tracker, W. Hofmann explained that the new readout chip will only be available in Feb. 97. In this context it became clear that HERB-B may ask for interruptions of the HERA running to install components which are not ready at the beginning of the run period.

The DAQ systems of the experiment are generally on schedule, although a lot of work remains and DESY has been asked for support. The 1st level trigger has to be ready for the 98 run. The design is in progress and simulations (occupancy,vetos,etc.) show that progress is being made. The collaboration has to make many DAQ architecture decisions in December 96, e.g. to use a farm instead of a pipeline as proposed in the TRD and on further trigger levels.

In summary the referees made the following recommendations. The cohabitation study program should be continued using dedicated running as required. Some minor interruptions to HERA running in 97 might have to be foreseen for late component installation. The collaboration has to continue the work on occupation studies for the missing components. A backup tracker solution must exist should the MSGCs fail. Beam prototyping of the final MSGC and RICH systems should be made. The DAQ architecture decisions have to be taken as scheduled. The experiment urgently needs more manpower especially in the areas of electronics, engineering and infrastructure.

The PRC agreed with the recommendations of the referees. The chairman concluded the discussions stating that DESY will help as much as possible. The collaboration is required to optimize it's organisation and distribution of manpower. The details of the schedule have to be discussed as well as the implementation of the RF shield. The collaboration should be congratulated for the progress made sofar.

Item 4. Review of HERMES

The referee of the HERMES experiment, D.Saxon, introduced his report by remarking that most of his concerns in the past have been overtaken by history and he congratulated HERMES for the impressive results achieved. In semi-inclusive physics they have become the world's leading experiment. The reversal of the polarization and implications remain an open question. The systematic errors of the polarization measurement requires more study.
R. Milner explained the organisation of the data analysis within the HERMES collaboration. There are two groups working independently. One is in Europe and the other in North America. He further listed the physics issues which are being studied by the two groups. In the discussion F. Eisele remarked, that the interesting subject of semi-inclusive studies is not very popular. D. Milner replied that other subjects, especially the evaluation of the structure function ${g_1}^n$, have higher priority, and that other subjects are covered with less manpower.
The question of reversing the spin direction of the e-beam was discussed. D. Trines explained that this is still foreseen, but it may be difficult to return the machine to good operation conditions afterwards. Most probably this operation mode implies a loss of total integrated luminosity. On the question how often HERMES would like to switch the polarization, R. Milner replied that the minimum would be once. D. Saxon asked whether there is an anti-correlation between luminosity and polarization. B.Wiik pointed out that F. Willeke had shown in his open session presentation that the tune shift may already have hit a physical limit. D. Trines added that these effects will soon be seen in detail, and that there is already work going on to study the effect and find possible cures. B. Wiik stated that present running of HERA tries to balance the interests of the collider experiments and of HERMES. E.Steffens illustrated in detail the methods available to reduce the systematic error of the polarization measurement. It is hoped to reduce these below the 4% level.

In summary the PRC recommended to schedule the reversal of e-beam polarization for the HERMES experiment.

Item 5. Review of H1

R.Eichler opened the H1 review by summarizing the H1 data taking during the current running period and explained the plans and priorities for the next two years. The H1 collaboration fully agrees with the new HERA schedule. A few worries exist concerning detector repairs and the installation of approved upgrades which have been postponed to the long shutdown in 97/98. There exists the possibility of installing a new plug calorimeter in the future.

H.U. Martyn then summarized the VLQ information requested at the last PRC and provided to the directorate (PRC 96-08). The H1 referee, N.Wermes, generally agreed with the answers, and stated that the backscattering is less than expected. There are, however, still details in the simulation which are not understood. If the GaAs detector could not work at the radiation levels expected, what would be used as a backup? In reply H.U.Martyn stated that there exists a large LHC RD project. Replacing GaAs with Si is possible, but very costly and the needed funds are presently not available for this option. The PRC took note of the answers and recommended the approval of the VLQ.
There was a lively discussion about the physics results of H1, namely on the D^* and the way of parameterizing the Pomeron. F. Eisele remarked that there is a difference in the results on diffractive physics between ZEUS and H1. R. Eichler replied that the methods and issues of the analyses are quite different and thus the results are not directly comparable. D. Saxon asked about the calibration of the Spacal. The inner part is calibrated by the kinematic peak, the outer part by cosmics and muons, which will improve with time. The stability is monitored by an LED system. D. Saxon further inquired whether the DAQ is sufficient for the high luminosity run. A. Campbell answered, that sufficient bandwidth is available, the L2 trigger can operate up to 200 Hz, and the L4 after tuning up to 90 Hz. If higher rates are unavoidable, a major modification of the hardware would be necessary.

Item 6. Review of ZEUS

R.Klanner introduced R.Nania as the new physics coordinator of ZEUS and summarized the status and planning of the experiment. In general the running conditions are excellent and he thanked the HERA crew for their efforts. In reviewing the trigger capabilities, it was stated that ZEUS is ready for higher luminosity. Concerning the new shutdown scenario for the next years the experiment welcomes the anticipated improvement in HERA running efficiency. Unfortunately the detector upgrades, BPRES and FHES, have had to be postponed to the 97/98 shutdown and that polarization and the high luminosity upgrade will not come before 2000. In his planning he assumed a low p-beam energy run for 97. The collaboration expects to have collected about 50 pb^{-1} of electron data, 35 pb^{-1} of positron data and 3 pb^{-1} of low p-beam energy data before the year 2000. He further announced that the collaboration is preparing a Si-microvertex detector for 2000. A proposal will be submitted to the next PRC.
Low p-beam energy running was discussed again, and D. Trines observed that in 97 20 pb^{-1} at full p-beam energy plus 3 pb^{-1} at lower p-beam energy could be possible. B.Wiik stated that low p-beam energy running would be reviewed again. D. Froidveaux asked whether the LPS has to be modified after the luminosity upgrade. In reply it was stated that the LPS would require considerable modification to fit to the anticipated

beam profile and that the position of the Roman pots would have to be changed. No details have been investigated so far. F. Eisele repeated his question about the differences of the analyses of the diffractive data between ZEUS and H1. R. Klanner answered that these differences are being studied. The two analyses and the corrections are very different. They hope that these differences will vanish with future data. In the discussion on this point it became clear that at least one group has underestimated its systematic errors. J. Rander asked for the consequences of running essentially continuously for two years. The ZEUS collaboration answered that in the past they used 3-4 month of the shutdown to reprocess their data. This will not be possible next year. They plan to use standard PCs for the data processing in order to free more CPUs for data analysis. The bottle neck remains the data storage capacities on tape and disk. There will not be enough space to store all data of 96/97 on random access media. The discussion on ZEUS ended without specific recommendations of the PRC.

Item 7. Miscellaneous

The next meeting of the PRC will be on February 19^{th} and 20^{th}, 97 as planned. At that meeting a report on the results of the workshop "Future Physics at HERA" should be given.

The current list of PRC referees is:

H1 - N.Wermes
HERA-B - J.Jaros and D.Froidevaux
HERMES - D.Saxon
ZEUS - J.Rander and S.Bethke
AMANDA - Y.Totsuka and G.Heinzelmann

(J.Bürger - 21^{st} November 1996)