Minutes of the 44^{th} Meeting of the PRC

DESY 3-4^{th} Feb. 1998

PRC members present:

S.Bethke (Aachen), W.Buchmüller (DESY), L.Foá (CERN), D.Froidevaux (CERN), U.Gensch (DESY), G.Heinzelmann (Hamburg), K.Jakobs (Mainz), M.Kasemann (DESY), T.Lohse (Humboldt Univ.,Wissenschaftlicher Rat), 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 attending closed session items:

HERA - F.Willeke (DESY), R.Bacher (DESY).
HERMES - E.Kinney (Univ. Colorado), A.Bruell (MPI-Heidelberg), W.Lorenzon (Michigan), J.Steward (Liverpool) G.van der Steenhoven (NIKHEF).
H1 - J.Dainton(Liverpool), U.Straumann (Univ. Heidelberg), P.Biddulph (DESY/Manchester), M.Klein (DESY-IfH Zeuthen), W.Bartel(DESY).
ZEUS - A.Caldwell (Columbia), S.Schlenstedt (DESY-IfH Zeuthen), B.Löhr (DESY) H.Tiecke (NIKHEF), R.Klanner (HH).
HERA-B - A.S.Schwarz (DESY), U.Straumann (Univ. Heidelberg), W.Hofmann (MPI-Heidelberg), H.Kolonoski (DESY-IfH Zeuthen).

The PRC received the following documents:

PRC 98/01 Proposal to complement the H1 Backward Silicon Tracker (BST) with phi strip detectors. (H1 Collaboration).
PRC 98/02 H1 high luminosity upgrade 2000 CIP and Level 1 vertex trigger. (H1 Collaboration).
PRC 98/03 HERA luminosity upgrade - report for funding agencies. (ZEUS Collaboration).
PRC 98/04 EP physics beyond 1999. (H1 Collaboration).

Agenda:

Open session. Feb. 3^{rd}, 10:00-12:50, Main Auditorium

HERA status report. R.Bacher (DESY).

HERMES status report. E.Kinney (Univ Colorado).

H1 status report. M.Klein (DESY Zeuthen).

ZEUS status report. S.Schlenstedt (DESY Zeuthen).

HERA-B status report. R.Mankel (Humboldt-Univ,Berlin).

Closed sessions: Feb. 3-4^{th}

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

2. Review of HERA.
3. Review of AMANDA.
4. Review of ZEUS.
5. Review of H1.
6. Review of HERMES.
7. Review of HERA-B.
8. Miscellaneous.

Item 1. Approval of the minutes and matters arising.

The chairman welcomed K.Jakobs as a new member of the PRC.

The chairman stated that new ideas for experiments at HERA should be discouraged because of the complicated situation w.r.t. the DESY budget for the next years.

The chairman reported that the HERMES and AMANDA proposals (PRC 97-05 and 97-06, respectively) were approved by a meeting of the directorate in December 97.

The minutes were approved subject to minor modification and the proposed agenda was accepted.

Y.Toksuka could not attend the PRC meeting.

Item 2. Review of HERA

The chairman welcomed the representatives of the machine group and thanked R.Bacher for his open session report.

The discussion was started by D.Saxon, who queried the relatively long commissioning phase of the e-machine. F.Willeke replied that a significant amount of basic work was required since the vacuum system had been completely opened and all the magnets were touched. Thus a very careful and systematic turn on procedure was required. The cleaning of the vacuum system is performed with synchrotron radiation and the required duration has been evaluated from experience with DORIS. The schedule shown is optimistic.

D.Froidveaux asked for a clarification of the proton losses which arise during HERA-B target movement. These losses are 20% of the tail of an RF bucket. F.Willeke explained that the problem is being studied and more measurements will be made. The losses represent a very small fraction of the total beam (10^{-4}) and since the HERA machine is very sensitive to the operation of the target it may be that the effect is induced by the target.

The luminosity upgrade was then discussed. D.Saxon summarized his impressions by stating that the problems foreseen were caused by budgetary problems, rather than technical ones. B.Wiik agreed and explained that D.Trines is negotiating with the local power supplier. The aim is to negotiate a contract which removes the requirement of power saving during the winter; this would remove a constraint on the timing of the shutdowns. F.Willeke added that within the tight, but realistic, schedule the delivery of all necessary components is planned for the last quarter of 1999.

J.Rander asked about the design progress w.r.t. those magnets which are to be installed within the experiments. F.Willeke stated that the design of some of these magnets is being revised, and that this work will be finished in the next few weeks. The installation will require 6 weeks from the opening of the experiment. The new design should reduce the likelihood that unscheduled access to the magnets is required. The experience with the existing superconducting magnets shows that this is a realistic assumption.

Item 2. Review of AMANDA

P.Söding reported on the present status of the AMANDA experiment. The collaboration has identified the first neutrino candidates from the four string array. The data from the 10 string array is now available and a complete analysis is expected in 98.

During the present season three 1200m. long strips have been deployed and the Zeuthen data acquisition system is fully operational. The next step is the deployment of 5-8 AMANDA II strings in the 1999-2000 season. Additionally a proposed workshop will prepare a letter of intent for the ICECUBE experiment. This will be forwarded to NSF who are strongly supporting the polar station and there are good chances that the ICECUBE experiment will be implemented. The DESY attitude to ICECUBE remains to be defined.

The committee asked that the collaboration give a report on the first results at the next PRC meeting.

The PRC made no specific recommendations to AMANDA.

Item 3. Review of ZEUS

The chairman welcomed the representatives of the ZEUS collaboration and thanked the speaker for the open session presentation.

Questions from the committee w.r.t. to the results presented were answered by the ZEUS representatives.

A.Caldwell summarized the status of ZEUS and it's future plans. 1997 had been an excellent year for data taking and also very fruitful for analysis. In 1998 ZEUS will run with extended coverage in the forward region due to the installation of the FPC (Forward Plug Calorimeter).
The development of the MVD (Micro Vertex Detector) is progressing well although the schedule remains tight.
Preparations for the luminosity upgrade have started, the design of the magnets is nearly complete and the dimensions of the beampipe are fixed. The collaboration is currently discussing the possible replacement of the TRD by a straw-tracker. This decision will be made at the next collaboration meeting in February 1998 and, if required, a proposal will be submitted to the PRC.

In the discussion of these items, B.Wiik asked the collaboration whether they are committed to be ready for the luminosity upgrade in the 1999/2000 shutdown. A.Caldwell stated that the collaboration will be ready.

L.Foá asked about the availability of the HELIX chips which are an important component of the MVD. It was stated that the production of the chip is a critical item and the probability exists that the chip will be delayed.

The ZEUS referees had no specific requests, but pointed out the importance of having a sufficiently long running in period for the MVD.

The PRC made no specific recommendations to ZEUS.

Item 5. Review of H1

The chairman welcomed the H1 representatives and thanked the open session speaker for his presentation.

Before discussing the proposals made by H1, the members of the committee had the opportunity to discuss some physics questions remaining from the open session presentation.

N.Wermes, the H1 referee, presented his evaluation of the BST upgrade proposal submitted to the committee.
The BST upgrade had been presented in the proposal for the original BST in 1994. The collaboration will install 8 disks of Si. detectors with sensors which allow measurement of the azimuthal (phi) coordinate which compliments the existing r measurement. The physics benefits of this are clear and readily supported. The technical issues are solved, because the techniques used in existing Si. detectors will be used. The measured signal to noise ratio of 12 is acceptable, however, the low efficiency of the pad detector, which is also a part of the BST, is unacceptable and not understood. The anticipated elliptical beampipe for the luminosity upgrade may cause some complications to the BST and solutions are being investigated. The referee recommends that the proposal be approved. The chairman opened the discussion of this proposal by asking whether possible production delays would have implications for the anticipated 1999/2000 shutdown. It was stated that the collaboration intends to be ready for that shutdown and that a long access to the detector will not be possible in the years after the luminosity upgrade.

M.Klein replied to L.Foá question that no new design of the disk mechanics was required. A discussion of the production scenario ensued. The experience with the present detector supplier and with the supplier of the prototypes suggest that two suppliers be involved in the production.

J.Rander queried the implications of the elliptical beampipe installation for the BST. It was stated that in the horizontal plane short detectors would be installed which requires the production of an additional detector type. For the r-strip detector short phi-strip detectors will be installed back-to-back which will result in a somewhat reduced r resolution in this area. Given the low occupancy, enough redundancy is guaranteed for pattern recognition.

The H1 referee then reviewed the CIP and Vertex trigger upgrade proposal. It is proposed to adapt the trigger and z-granularity to the high luminosity running by replacing the inner z-drift chamber (CIZ) and the two cylinders of the inner proportional chamber (CIP) by 5 new cylinders of proportional chambers with a four times higher granularity, thus providing a completely new track trigger. The upgrade will be performed in two steps. The new trigger will cope better with higher luminosity and beam related backgrounds and will be more robust than the existing setup. It will also provide a trigger component for the planned FTD (Forward Tracking Detector) upgrade a proposal for which is being prepared. The higher redundancy in the z-measurements will reduce the ambiguities of the CIP and provide a better bunch timing evaluation. Technically the project is based on well understood techniques used in the existing CIP, but it works with lower gas gain and has a complex strip line readout which has to be carefully tested. The readout electronics uses the HELIX chip which has to be modified for the different multiplexing and trigger options required. Since there are many HELIX customers and the current development is somewhat delayed there exists a risk of delay. The collaboration states that there is a fall back solution using existing components. In summary the referee stated that the foreseen upgrade was required for the high luminosity running and that it is justified from the physics point of view. The time schedule is also feasible. The proposal should therefore be approved.

In the following discussion A.Wagner stated that the number of groups wanting to use the HELIX chip, with and without modifications, would lead to delivery delays. U.Straumann replied that a member of H1 has already been allocated to following the HELIX chip development. The present HELIX problems are associated with the analogue design, these must be solved by the experts, the modifications required affect the digital part and these are less demanding.

S.Bethke pointed out that the installation was planned for 2000/2001. In reply it was stated that the formulation was a little unfortunate. The work required later was associated with the electronics and will not require opening the detector.

N.Wermes then reviewed the status of the 11 projects submitted, by H1, to the PRC since 1994. Not all projects were working as planned and some had required longer than scheduled to implement. In the discussion that followed A.Wagner asked about the problems seen in the horizontal FPS (Forward Proton Spectrometer) in 1997. W.Bartel reported that a loss of beam into the detector and associated electronics was the probable cause of the problems. The reason for the accident is still under investigation by the machine group. Since there are no spares the detector will, eventually, have to be replaced by a prototype module.

The H1 representatives left the meeting and the proposals were discussed in closed session.

The PRC recommended that the BST and CIP upgrade proposals should be approved.
The committee request that an addendum to the CIP proposal be provided. This document should give the results of a detailed simulation of the system w.r.t. to the physics advantages to the H1 detector, and show, if present,

any drawbacks to other detector components.
The committee expressed concern w.r.t. the problems associated with the BST pad detector and the present status of the BST trigger. The collaboration is requested to provide a detailed report for the next PRC.

Item 6. Review of HERMES

The chairman welcomed the representatives of HERMES and thanked the speaker for the open session presentation.

The experiment's referee, D.Saxon, congratulated the experiment on the quality of its data and analysis.
The ongoing upgrades are progressing well. The muon wall readout has been implemented with a delay line system which has reduced the number of channels and hence the cost. It will require careful testing.
The non understanding of the absolute scale error of the the two polarimeter remains and further investigation is required.

L.Foá asked about the status of the RICH detector. It was stated that a bottleneck in the delivery of the soft iron plates exists, but an installation in May 98 is still possible. In order to accelerate the installation a mock-up, with 256 photomultipliers, will be constructed in order to understand cabling and assembly issues.

J.Rander pointed out that the Si. detector upgrade also uses HELIX chips. It was stated that the current HELIX production design can be used for the Lambda-wheels and it was assumed that no additional delays would be incurred.

N.Wermes asked for details concerning the production of Si. wafers with a thickness of 100μm. G.van der Steenhoven explained in detail the technique.

In a lively discussion the committee tried to understand the polarimeter scale calibration problem, finally it requested HERMES to provide a short report on the electron beam polarization for the next closed session meeting of the PRC.

The PRC made no specific recommendations to HERMES.

Item 7. Review of HERA-B.

The chairman welcomed the HERA-B representatives and thanked the open session speaker for his presentation.

D.Froidveaux gave the report of the two referees. Two review meetings had been held with the experiment, in November and February, and the status of the detector components and trigger system was described in detail.
Components without problems are:
1) The calorimeter which will be fully operational in 1998 excluding the pretrigger.
2) The RICH which will be operational in 1998 despite the large amount of outstanding work.
3) The TRD which will be ready (80% channels) in 1998.
Components with only scheduling problems:

1) The muon chambers. MU1 will be fully assembled in a few weeks. MU3 and 4, which are built in the same way, will most probably not be ready before the end of the current shutdown. These systems can be ready in 1999 and will require a long shutdown for installation. It is not clear when MU2 will be ready.
2) the silicon tracker. About 30% of the detector will be installed using, probably, double sided detectors and a functioning version of the HELIX readout chip. The schedule is tight for both the electronics and mechanics to provide a complete system in 1999, however, even an incomplete detector in 1999 will be useful in the initial physics run period.
3) Inner tracker. There has been significant progress in the last 6 months. The MSCG/GEM concept has been fully validated with measurements using X-ray, and partially with hadrons. Many detailed design problems have been solved elegantly. A small fraction of the final detector will be installed during 1999. This is very important for the the overall testing of HERA-B. Many problems remain to be solved: coating the GEM with diamond to obtain a more uniform chamber resistivity, understanding the variations of gas gain over the GEM surface (also as a function of time) and the HELIX chip which in its present version cannot be used for triggering and which is not radiation hard enough. The present scenario foresees installation in February 1999, but no additional margins exist.
4) Pretrigger electronics, which are absolutely required for physics with HERA-B. The calorimeter pretrigger was 50% operational at the end on 1997 and will be fully operational in 1999. The muon pretrigger is in an early stage of design, only a small fraction can be available in 1998, and it is not obvious that the full system can be available in 1999. The collaboration should give a very high priority to the pretrigger project. It needs more manpower and an aggressive time schedule.
5) Additional trigger and DAQ systems. There was a successful test in 1997 and a major upgrade in the architecture for 1998. A large fraction of the hardware has been delivered. The high level trigger algorithms and network functionality will not be tested in 1998 and the amount of software to be written is probably very large. The collaboration should strengthen the team now for the problems that will show up in two years.

Component with fundamental problems:

The outer tracker (OTR). After reviewing the history of the outer tracker two fundamental problems remain before mass production can be started. Notably the coating of the Pokalon surface and the gas flow through the chamber. The large number of production sites, 6 sites with 22 tools, and quality control, has also not been fully setup. Thus there will be an inevitable delay in the HERA-B physics plans. If possible, the small PC1,2,3 chambers should be installed to allow FLT (First Level Trigger) tests as soon as possible.

As an alternative, the collaboration has been evaluating a design with straw tubes, but no clear design or action plan has been shown to the referees. If the collaboration decides to switch to the straw design, there will be no detector before 2000 and the costs are unknown.

The referees concluded their report by listing required actions:

1) The OTR should define a clear plan with milestones for the difficult decisions required. More expertise is needed to specify the operating parameters, the choice of materials and to ensure appropriate production capabilities. Both existing and straw solutions must be targeted.
2) Given the existing problems it is important to plan for a complete OTR in 2000.
3) HERA-B should present the range of possible physics achievable in 1998 with the operational equipment.
4) The collaboration should define clearly the priorities (mu-pretrigger, HELIX, OTR,..).

A.Schwarz replied to the referees' report. He agreed with most of the statements, but pointed out that detailed plans for the OTR and the gas system were available, but that these required changing due to the new understanding of the detector.

H.Kolanoski then presented the collaboration's view of the OTR. This reviewed the problems which occur with the building material of the chamber when exposed to high levels of radiation and the investigations carried out to understand the effects. It was concluded that heavy ionizing particles caused a plasma polymerization on the Pokalon surface which leads to an insulation layer on the cathode (Malter effect). This problem could be corrected by a suitable surface coating with graphite, chromium or gold.
An alternative OTR design is the straw tracker. This technique has the advantage of being radiation hard and has understood gas requirements. The collaboration is studying the design and a prototype is being built at Dubna.
The current OTR design could enter full production after April when a decision w.r.t. the foil coating will be made. In any case the collaboration will make a decision about which option to use in August.

There followed a discussion concerning the foil coating. It became clear that graphite and chromium coated prototypes will be available for testing in Karlsruhe. Currently a few m^2 have been coated, the total requirement is 1000 times larger.

B.Wiik queried the gas flow problems. It was stated that the glueing of the folded Pokalon foils is not as perfect as expected. There exists a flow of gas outside the honey-comb structure. Tests on a full size prototype are being made and it is hoped that this can be resolved by better glueing techniques.

B.Wiik repeated that the 1998/1999 shutdown would be short, which would have implications for the installation of big chambers in HERA-B. The precise dates of this shutdown would be fixed in 1998. The installation of some chambers to test the FLT must be made in 1998.

D.Froidveaux remarked that a sufficiently rigid system of quality control has not yet been installed. A.Schwarz explained that new production management and logistic schemes will be installed in the 6 sites.

On the gas gain problems, of the inner tracker, U.Straumann answered that the observed variations of 30% are due to an edge effect which does not endanger the functionality of the chamber. Further studies are being made.

In reply to a question regarding the HELIX chip availability, U.Straumann replied that at low trigger rates the existing chips are sufficient. A.Schwarz added that it was more important to install chambers and test the analogue output.

W.Hofmann reviewed the HELIX chip production schedule. The May version is expected to fix the radiation hardness problem. The version in September should fix the observed triggering problem. It was stated that ZEUS was now helping in the production of functioning chips. The sentiment of the committee was that sufficient help should be provided by all possible users of the chip to the designers.

The question of installing the inner tracker (ITR) without the OTR was answered by J.Spengler. This would require a special mechanical solution which is relatively simple. In this context the referees underlined the statement that a careful planning of the schedule is absolutely mandatory.

A number of other items were briefly touched during the remaining discussion. There is still a funding problem with the TRD. The muon chambers can be installed in 2-3 weeks and could be installed in a short shutdown. The software is less worrying than other items. Real data is required to make useful tests.

The HERA-B representatives then left and the closed discussion began.

The PRC made the following recommendations to HERA-B.
Concern is expressed w.r.t. the rate of progress made.
The collaboration is encouraged to install and operate as many detector elements as possible in 1998. This will add to the understanding of the functionality of the full detector.
The committee asks the collaboration to define the physics issues which can be addressed with the 1998 installed elements.

Item 8. Miscellaneous

The next meeting of the PRC will be on July 8-9^{th} 1998.

The H1 and ZEUS experiments should provide further upgrade proposals for the next meeting.

There will be a review of HERA-B in April 1998.

The chairman thanked J.Rander and A.Martin, who are leaving the PRC, for their valuable contributions.

The current list of PRC referees is:

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

(J.Bürger - 1^{st} April 1998)