Minutes of the 46th Meeting of the PRC

DESY 13-14th January 1999

PRC members present:

M.Albrow (FNAL), J.Arvieux (IPN-Orsay), J-J.Aubert (CPP-Marseille), S.Bethke (Aachen), S.Bertolucci (INFN-Frascati), W.Buchmüller (DESY), A.Buras (TU-Munich), L.Foá (CERN), D.Froidevaux (CERN), U.Gensch (DESY-Zeuthen), G.Heinzelmann (Hamburg), E.Hughes (Caltech), K.Jakobs (Mainz), L.Rolandi (CERN), C.Kleinwort (DESY,HERA-expt. coordinator), D.H.Saxon (Glasgow), H.v.d.Schmidt (DESY), D.Trines (DESY), A.Wagner (DESY), N.Wermes (Bonn), B.H.Wiik (DESY,chairman), C.Youngman (DESY,secretary).

Non PRC members attending closed session items:

HERA - F.Willeke and B.Holzer (DESY).

HERMES - E.Kinney (Colorado), J.Steward (Liverpool), A.Simon (DESY) and N.Makins(Illinois).

H1 - J.Dainton (Liverpool), C.Niebuhr (DESY), E.Elsen (DESY), C.Kiesling (MPI-Munich), M.Klein (DESY-Zeuthen), M.Fleischer (DESY).

ZEUS - B.Foster (Bristol), B.Loehr (DESY), P.Iacobucci (INFN-Bologna), T.Haas (DESY) and S.Schlenstedt (DESY-Zeuthen).

AMANDA - C.Spiering (DESY-Zeuthen).

HERA-B - A.Schwarz (DESY), J.Spengler (DESY), R.Eckmann (Austin), B.Schmidt (Heidelberg).

Polarization 2000 - T.Behnke (DESY) and F.Zetsche (Hamburg).

The PRC received the following documents:

PRC 99/01. A Forward Silicon Tracker for H1.

PRC 99/02. Proposal to upgrade the LAr Calorimeter Trigger: The Jet Trigger. (H1 collaboration).

PRC 99/03. Proposal to Merge Level-4 and Level-5 Systems of the H1 Experiment.

PRC 99/04. Proposal for an Upgrade of the HERA Polarimeters for HERA 2000. (Polarization 2000 group).

Agenda:

Open session. January 13th, 10:00-13:00, Main Auditorium

HERA status report. B.Holzer (DESY).

H1 status report. E.Elsen (DESY).

ZEUS status report. T.Haas (DESY).

HERA-B status report. R.Eckmann (Austin).

HERMES status report. E.Kinney (Colorado).

AMANDA status report. C.Spiering (DESY-Zeuthen).

Closed sessions: January 13-14th

1. Approval of the minutes and matters arising from the last meeting.
2. Review of HERA.
3. Review of HERMES.
4. Review of AMANDA.
5. Review of HERA-B.
6. Review of Polarization 2000.
7. Review of H1.
8. Review of ZEUS.
9. Miscellaneous.

Item 1. Approval of the minutes and matters arising.

The chairman welcomed Luigi Rolandi to the PRC.

Y.Totsuka could not attend the PRC. As this would have been his last PRC he was warmly thanked for his contributions.

The minutes of the 45th PRC meeting were approved, subject to the corrections requested.

Item 2. Review of HERA.

The chairman thanked B.Holzer for his presentation and opened a discussion of the material presented.

The following points were raised during the discussion of the presentation.

It was stated that 50-60% polarization should always be attainable at HERA. The difficulties seen in 1998 had arisen from the method used to tune the machine for polarization after a shutdown which required the use of pre-shutdown machine parameters as a starting point for tuning. This method failed and, after some delay, dedicated electron beam running was used to tune the machine for polarization. The conclusion derived from this experience is that dedicated electron beam shifts will be required in future to optimize polarization.

The beam line modifications at H1 and ZEUS (insertion of spin rotators, removal of their compensating magnets, etc.) to be made during luminosity upgrade should not effect the ability of HERA to provide high polarization. This has been studied extensively and all the experts are in agreement.

No requests have been received, from the experiments, to increase the electron beam energy. Any increase would require an increase in the available RF power.

No electron beam related problems remain after the installation of the NEG pumps, but a final statement can only be made after detailed electron beam lifetime studies are concluded. The current behaviour is coloured by the poor, but improving, vacuum conditions in HERA, although everything seemed to be good.

The chairman then asked F.Willeke to review the status of the luminosity upgrade.

- The design of the super conducting sextupole magnets, which are inserted inside the ep experiments, is essentially complete and prototypes are being built at Brookhaven.
- No show stoppers are expected and the required cables, etc. have been ordered.
- The conventional magnets required have been ordered in St.Petersburg.
- The low beta quadrupole magnet production has started and production of the more complicated magnets is being prepared.
- The compact dipole magnet order is out for tender.
- The design of the keyhole synchrotron radiation path and the rest of the beamline within 20m of the ep interaction points are almost complete.
- The design of mechanical supports for the sextupoles in the experiments is at an advanced stage.
- Power supplies and other standard components, with short delivery times, will be ordered later.

Item 3. Review of HERMES.

The chairman thanked the open session speaker for his presentation and proposed that the HERMES spokesman should review the experiment's future plans.

Ed Kinney stated that the 2001-2005 planning had not been finalized and reviewed the current planning. A report on the long range planning should be available for presentation at the next PRC.

The physics program is exciting with detailed measurement programs in the different polarization regimes: longitudinal (flavour decomposition, precise Δs and first measurements of ΔG), transverse (a complete twist description of partons) and unpolarized (spin transfer, coherence length, hadronization, structure function ratios, etc.). Results from the 1998-2000 running will be published in 2001, well before COMPASS, RHIC and neutrino experiments, and approximately at the same time as E155X.

The commitment to the collaboration remains firm with almost all the groups committed to running after the 2000 lumi upgrade shutdown. There is a strong desire to complete the longitudinal program first and to continue unpolarized running. The transverse program will be developed at a workshop held in parallel with DIS99 which will also be used to attract new collaborators.

The experiment is reviewing a number of detector and machine related issues: target improvements (high lumi cell, carrier jet, laser driven source), HERA e-beam performance (analysis requires good HERA performance and ΔG and ΔS physics may require additional data taking after the lumi upgrade), and, worryingly, the beam polarization after the lumi upgrade is expected to drop which reduces the analysing power of the experiment.

During the ensuing discussion the following points were raised.

None of the collaborating groups is expected to leave the collaboration on completion of the longitudinal physics program.

The polarized deuteron target is well suited for ΔG measurements and should allow HERMES to make a significant first measurement, ie. establish the sign.

A funding request for the recoil detector has been submitted, but a final detector cannot be expected before 2000.

A decision about replacing RICH mirrors should converge within the next few months. The rigidity of the originals has been disappointing.

The performance of the longitudinal polarimeter is acceptable.

The PRC then discussed HERMES in closed session.

The PRC took note of the progress made by HERMES and made no specific recommendations.

Item 4. Review of AMANDA.

The chairman thanked Ch. Spiering for his open session presentation.

J.-J. Aubert opened the referee's report by reviewing the basic features of ice based cosmic ray experiments. The angular resolution of muon tracks depends on a number of properties (measured length of the track, timing accuracy, number of measurements points (PMTS), signal amplitude etc.). The resolution of the muon energy (LogE) is 0.3% for energies above 1TeV. Below 1 TeV the measurement is difficult and the resolution is worse. The effective surface volume depends on the angular resolution and on the up/down rejection. The first results available from the AMANDA B10 PMT strings have a 3 degree angular resolution.

During the open discussion a number of points were raised.

The practice of separating the data into odd and even day samples is common in cosmic ray analysis. The cuts used are tuned on one sample and applied during the final analysis to the second sample. This technique protects against tuning the cuts to keep or exclude certain events from the data sample.

The letter of intent for the ICECUBE kilometer cube experiment is being prepared and should be finalised in a couple of months. Some intermediate funding for bridging the period between AMANDA and ICECUBE has been requested from NSF, since the AMANDA manpower will be the core of ICECUBE. The final ICECUBE proposal will not be submitted until AMANDA II data has been analysed which is expected to be 2000 or 2001. The primary purpose of ICECUBE will be to map extragalactic neutrino point sources, investigate very high energy neutrino events and look for exotic behaviour.

The PRC then discussed AMANDA in closed session.

The PRC took note of the status of AMANDA II and its analysis. After a discussion of possible steps beyond AMANDA II (ICECUBE) the PRC recommended that a proposal should be submitted after results from the analysis of the existing data become available.

Item 5. Review of HERA-B.

The chairman thanked the HERA-B speaker for his open session presentation and introduced the HERA-B members to the committee.

K.Jakobs gave the referees report which resulted from two oneday reviews.

The HERA-B running in 1998 was reviewed and significant progress has occurred in several areas.

Existing hardware components, excluding the inner tracker (ITR) and transition radiation detector (TRD), had been operated in a common DAQ environment. The RICH detector was fully operational and rings were reconstructed. All the pad/tube muon trigger chambers (MU1,MU3 and MU4) installed saw reconstructed track segments. Operation of 17 silicon detectors 13mm from the beam had no adverse effects on it. Target running at 40 MHz is now a routine operation.

Problems were nevertheless encountered. The J/psi electron pair decay mode could not be seen due to trigger latency, readout problems and lack of running time. Only a few % of the ECAL pretrigger was equiped, no tests of the muon pretrigger and no operational experience with the ITR were other setbacks.

The remaining running time has to be used judiciously. More data taking at 40 MHz. is required to address a number of issues: understanding the trigger with J/psi electron pair events, improvement of the ECAL calibration, muon pretrigger tests, ITR and outer tracker (OTR) aging measurements in the detector environment, improvement in the understanding of track segment matching between the existing detector elements, understanding operation with the magnet on, and more running of the second level trigger (SLT) with a realistic trigger configuration.

The HERA-B commissioning schedule for 1999 was then reviewed.

The primary aim is to integrate a significant fraction of the ITR, OTR and first level trigger (FLT). Many components are not yet available. ITR chambers will probably not be available, to the FLT, due to oscillation problems in the Helix 2.2 readout chips. Significant progress has been made with the OTR and a good chance exists that the far half of the PC1,PC4,TC1,TC2 chambers will be installed in May and that these will survive at least one year of operation. A bottleneck exists in the ECAL pretrigger due to difficulties in the multi-layer board production. Prototypes exist of all the muon pretrigger boards and the installation is scheduled for the summer. The mass production of the many thousand optical links required by the readout and trigger system and the associated sender/receiver boards has not started, and only those for the first 40 FLT link boards will be available. The bulk of the track following (TFU) trigger units must undergo a design iteration, but several sets of components will be available for commissioning in the summer.

Those HERA-B problems which might prevent data taking with a complete and fully commissioned detector in the Spring of 2000 were then reviewed.

The muon pixel chambers have unsatisfactory noise behavoir and the nominal chamber design has twice the readout density so far prototyped.

The radiation hardness of the Helix readout chip (2.2) remains a concern as does the operational problems seen (oscillation, common mode, use of the chip in a harsh environment and other problems). It is not known whether the next version of the chip (3.0) may solve these problems. The ITR cannot be installed easily if the May shutdown schedule is missed and this depends on the availability of readout chips.

The ITR production is on schedule but has been halted due to the observation of new ageing problems. The following ITR problems have been reported since the last PRC meeting: sparks (which can be eliminated by reducing the drift and transfer fields), hydro carbon deposits (can be recovered with X-ray irradiation), and new MSCG/GEM ageing effects not previously seen. The last two effects may have resulted from the use of contaminated gas.

The OTR prototypes have survived 10% of a HERA-B year and a two year equivalent alpha beam. There is reasonable hope that the final chambers will survive a few years of HERA running. The mass production schedule remains tight. The design of the straw tracker back up solution for the highest radiation dose regions of the detector is progressing, but the effort should be strengthened.

The electron pretrigger has been delayed by the poor quality of multilayer PCB board production. The present schedule is now very tight and an alternative supplier should be found.

The muon pretrigger has not been tested in HERA-B and the schedule is also very tight. Maximum effort should be made to have a large fraction of the system installed by the summer.

The FLT system's TFU version 4.0 board production is scheduled to start in April with 80-100% of the production finished by October. The commissioning of this complex component cannot start before the end of 1999.

The referees made the following recommendations:

- An effort should be made to take 10^6 s at 40 MHz before the May 1999 shutdown.
- Highest priority should be given to obtaining the largest fraction of electron amd muon pre-triggers operational for partial commissioning of the FLT before summer 1999.
- An in-depth review of the Helix 2.2/3.0 chip is required as soon as possible.
- Further ITR tests at PSI are needed to understand the problem with radiation damage.
- The OTR straw backup solution has to be strengthened to ensure that the technology is viable by summer 1999.
- Results of tracking test measurements with fully equipped modules/chambers for VDS, ITR and OTR should be presented to the next PRC.

During the ensuing discussion the following points were raised.

The ITR sensitivity w.r.t. bad gas was confirmed and it is hoped that this is the reason for some of the operational problems seen.

The experiment is confident that the OTR trigger chambers (TC) can be finished on time. A mini TC will be installed in front of the calorimeter. The gas tightness of these chambers may, however, be an issue.

An additional, or alternative, ECAL multi layer trigger board supplier has not been considered, since the current supplier has successfully produced other comparable boards.

The discussion continued in closed session.

The PRC took note of the status of HERA-B and agreed with the recommendations of the referees.

Item 6. Review of Polarization 2000.

The PRC had received a report on the HERMES longitudinal polarimeter (LPOL) status from A.Simon during the HERMES closed session.

The Polarization 2000 working group extended this information by: reviewing the membership of the group, highlighting the physics with polarized electrons (or positrons), reviewing the current TPOL (measures the average polarization of all bunches with 1% statistical accuracy per minute and 1% point to point and 3.3% scale uncertainty) and LPOL (individual bunch measurements, 1% statistical accuracy per minute, and 1-2% and 4.3% point to point and scale accuracy respectively) status, and explaining the underlying physics of the two methods and the implementations of the polarimeters.

The aim of HERA polarization measurements, following the lumi upgrade and installation of the ZEUS and H1 spin rotators, is the measurement of polarizations of the individual bunches using both TPOL and LPOL polarimeters at an accuracy of better than 2%.

The plans for the required upgrade of the TPOL detector and its DAQ system were then described.

A lively discussion of the review raised the following points.

The sensitivity of the HERA ep experiments to additional right handed gauge bosons depends on the mass. A 600 GeV W could be established with 500 pb^{-1}.

The collaboration between the LPOL and TPOL groups is good and weekly meetings are held.

The need for shower position measurement in the TPOL calorimeter was discussed as well as the reversal of the laser light helicity. Position accuracy had usually proved useful in luminosity measurements.

The advantages of the TPOL single photon measurement mode should be investigated for use with the LPOL. A possible problem with this will be the higher backgrounds in the LPOL due to its position behind RF cavities.

The discussion was continued in closed session.

The PRC recommended the upgrade of the electronics of the transverse polarimeter.

The PRC was not satisfied with the present lay-out of the polarimeters and requested a detailed discussion of the lay-out at its next meeting, including a discussion of all the errors. It requested futhermore a full diagnosis of the performance of the logitudinal polarimeter. The PRC noted that all aspects which prevent the operation of the longitudinal polarimeter in single photon mode should be studied and , if possible, worked on.

Item 7. Review of H1.

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

The spokesman, J.Dainton, reviewed the status and time schedule of the on-going detector upgrades. All projects are currently progressing smoothly and are expected to be completed on schedule.

M.Albrow then gave the referees report which concentrated on the proposals.

Forward Silicon Tracker (FST).

The aim is to upgrade the forward tracking by repositioning existing silicon microstrip detectors from the backward silicon tracker (BST), which due to the luminosity upgrade are no longer useful in that region, into the forward region (ie. the FST). The physics benefit is the improvement in acceptance for high Q^2 and heavy flavour physics.

Progress is being made on understanding the BST common mode noise problem. A significant amount of R&D has been carried out and the problem is almost certainly on the silicon detector and possibly associated with the guard rings. A work-around requiring a new chip design has been found that will work for low occupancies.

RTWH Aachen and Prague University are joining the FST group and the schedule anticipates completion of the BST/FST upgrade by the end of the 2000 shutdown.

Level 1 Jet Trigger of the liquid argon calorimeter.

By further sub-division of the LAr calorimeter front-end inner trigger tower electronics a four fold increase in the trigger's energy topology sensitivity is proposed. This will improve the triggers capability beyond single electron type decision level, improve background reduction and increase the existing trigger efficiencies. The project is seen as a natural development of the existing system and a half octant test setup will be tested soon.

The merger of the Level 4 and 5 trigger systems.

A simplification of the trigger is proposed using commercially available Fast, and later, Giga ethernet connectivity between trigger data sources (VME) towards the front-end and downstream processing units (CPU PC farms). A fall back solution for the PC using existing experience of VME based CPUs exists. The final system will require less code and hardware maintenance and reduces the number of single points of failure.

A number of points were raised during the discussion of the proposals.

The collaboration may address an additional weakness in the track trigger by submitting a proposal for improving charm selection. This would be the last track trigger upgrade.

The PRC continued its discussion in closed session.

The PRC recommended the approval of all three proposals. In addition it recommended proceeding with the new chip design proposed for the BST.

Item 8. Review of ZEUS.

The chairman thanked the ZEUS open session speaker and suggested that the spokesman, B.Foster, review the status of experiment.

The experiment published 11 papers in 1998 although the amount of luminosity taken was lower than had been anticipated. The on-going detector upgrades (silicon micro vertex detector (MVD), straw tube tracker (STT)) are on schedule as are the beampipe and associated detectors (beam pipe calorimeter (BPS)) which are being modified as a result of the lumi 2000 upgrade. A Be/Al beampipe will be used. The most important target for 1999 is the acquisition of a large luminosity sample. This will allow the collaboration to bind groups to interesting physics during the long 2000 shutdown.

During the open discussion the following points were raised.

The design of the replacement luminosity monitor for use after the lumi 2000 HERA upgrade is progressing and the collaboration is reviewing the need for a replacement leading proton spectrometer (LPS).

The extensive ZEUS development and testing effort in upgrading the Helix readout chip for the MVD is expected to produce chips with the correct functionality and radiation hardness as required by ZEUS, ie. Helix 3.0. These chips are not likely to be useful for use in HERA-B.

The ZEUS measured open B cross-section reviewed in the open session presentation is higher than the leading order prediction and is compatible with the H1 measurement.

There was a lively discussion of the interpretation and significance of the electro-weak results presented in the open session.

Without making specific recommendations the PRC noted the progress made.

Item 9. Miscellaneous.

The 1999 meetings of the PRC are scheduled for June 29-30th and November 18-19th.

The current list of PRC referees is:

H1 - N.Wermes and M.Albrow
HERA-B - D.Froidevaux and K.Jakobs
HERMES - S.Bertolucci and J.Arvieux
ZEUS - S.Bethke and E.Hughes
AMANDA - J-J.Aubert
Polarization 2000 - J.Arvieux

(C.Youngman - 1st May 1999)