Minutes of the 48th Meeting of the PRC

DESY 18-19th November 1999

PRC members present:

M.Albrow (FNAL), J.Arvieux (IPN-Orsay), J-J.Aubert (Marseille), S.Bertolucci (INFN-Frascati), A.Buras (TU Munich), U.Gensch (DESY-Zeuthen), E.Hughes (Caltech), K.Jakobs (Mainz), R.Klanner(Hamburg), C.Kleinwort (DESY,HERA expt. coordinator), E.Reya (Dortmund), L.Rolandi (CERN), D.Trines (DESY), H.v.d.Schmidt (DESY), B.Spaan (TU Dresden), A.Wagner (DESY,chairman), N.Wermes (Bonn), C.Youngman (DESY,secretary).

Non PRC members attending closed session items:

HERA - F.Willeke (DESY).

HERMES - E.Steffens (Erlangen), J.Steward (Liverpool), A.Simon (Friburg), N.Makins (Illinois) and A.Miller (Triumf).

ZEUS - B.Foster (Bristol), B.Loehr (DESY), K.Piotrzkowski (CERN/Cracow) and R.Yoshida (Argonne).

AMANDA - Ch.Spiering (DESY-Zeuthen) and R.Wischnewski (DESY-Zeuthen).

POL 2000 - T.Behnke (DESY), A.Simon (DESY), D.Barber (DESY), K.Long (IC London) and E.Elsen (DESY).

H1 - E.Elsen (DESY), C.Niebuhr (DESY), A.Schoening (ETH-Zurich) and A.Specka (Ecole Polytechnique).

HERAB - A.Schwarz (DESY), J.Spengler (DESY), and B.Schmidt (Heidelberg).

The PRC received the following documents:

PRC 99/07. Addendum to the H1 FTT proposal.

PRC 99/08. HERMES long term plan.

PRC 99/09. ZEUS luminosity monitor upgrade report.

Agenda:

Open session. November 18th, 10:00-13:00, Main Auditorium

HERA status report. F.Willeke (DESY).

HERMES status report. E.Steffens (Erlangen).

HERA-B status report. B.Schmidt (Heidelberg).

H1 status report. A.Specka (Ecole Polytechnique).

ZEUS status report. K.Piotrzkowski (CERN/Cracow).

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

Closed sessions: November 18-19th

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

Item 2. Review of HERA

Item 3. Review of HERMES

Item 4. Review of ZEUS

Item 5. Review of AMANDA

Item 6. Review of POL2000

Item 7. Review of H1

Item 8. Review of HERA-B

Item 9. Miscellaneous

Item 1. Approval of the minutes and matters arising.

The chairman welcomed the new PRC members E.Reya and B.Spaan, and congratulated R.Klanner the designate DESY research director.

D.Froidevaux and R.Cashmore could not attend the meeting.

The minutes of the 47th PRC were approved with minor corrections.

Item 2. Review of HERA. The chairman thanked the open session speaker for his detailed presentation and opened the discussion of the HERA status by reviewing the current understanding of the running schedule.

The running schedule is being reviewed w.r.t. a possible 3-4 month extension of data taking before the long luminosity upgrade shutdown which would allow HERA-B to collect a more significant data sample. The necessary milestones that HERA-B would have to satisfy should be defined during the PRC meeting after which a decision, taking into account the requirements of the machine and the other experiments, will be made towards the end of January by the directorate. The case for dedicated HERA-B running was also discussed.

The PRC then addressed issues raised during the HERA status report.

The production, at Brookhaven, of HERA super conduction magnets to be installed during the shutdown is proceeding although some delays have occured. Winding of a magnet GO was started in August and 5 coil layers have been finished. A decision will be made soon regarding the winding of an additional layer for field corrections. Measurements of the magnetic field with warm coils are within specifications and the cold field parameters be measured during the cool down scheduled for 6-10th December. A second winding machine will be available for winding GG magnets and this will alleviate possible delays due to the longer winding times experienced; one week is required per coil rather than the anticipated 2 days.

The first GO magnet is scheduled to be shipped at the beginning of February, but the first GG magnet is not expected to arrive at DESY before July. Experience with similar magnets at DESY suggests that the tight schedule should not be problematic, provided the cold tests are satisfactory, and that the magnets will be ready for installation as foreseen in the May shutdown schedule. The GO magnets are scheduled for installation during Sept./Oct. with GG installation starting two weeks later.

The post upgrade restart schedule for HERA operation has not been finalized. After machine commissioning it is anticipated that three months will be required to regain stable luminosity operation after which a further month will be required to tune the polarization. During this period some runs without spin rotators and solenoids will be required. Optimization of luminosity for H1 and ZEUS and high rate target running for HERA-B can only be addressed when experience with the new machine has been gained.

The HERA experiment coordinator, C.Kleinworth, then gave a review of the current cohabitation situation. Interference seen between the ZEUS Leading Proton Spectrometer (LPS), the H1 Forward Proton Spectrometer (FPS) and the wire target setups of HERA-B was reviewed as a function of running period. During the 1997 running good running conditions with target rates up to 40 MHz were established. The 1999 running, based on the 1997 parameters, has been considerably worse, the LPS suffers high rates already at 5MHz wire rate and FPS operation is difficult if the LPS is inserted. FPS operation and wire rates of 40 MHz are possible if the LPS is out. Generally all the experiments are now closer to the beam than in 1997 which could cause problems and more studies are required, but the problem may be due to a possible difference in the positioning of the LPS in 1999 compared to 1997.
The current running conditions were summarized. HERA-B is using the Carbon wire at 5MHz apart from two special fills per week where rates up to 40 MHz can be tested. Coasting beam is now being removed using a kicker magnet, but more studies are required to evaluate the performance of the system.

Immediately after the PRC meeting it was confirmed that the LPS position was different. Using the 1997 position allowed running of the LPS and FPS at HERA-B wire target rates up to 20 MHz with acceptable background conditions.

The discussion continued in closed session.

The PRC made no specific recommendations for HERA.

Item 3. Review of HERMES. The chairman thanked the open session speaker for his presentation and proposed that the deputy spokesman, A.Simon, review the current HERMES running.

The experiment is successfully taking data and no background problems have been encountered with the positron currents, 35-40mA, provided. Proton beam backgrounds have been acceptable and HERMES is sensitive only to ZEUS LPS operation where rates increase on insertion. The polarization has been similar to that seen at the end of 1997 and the experiment acknowledge the improved procedures and continuous efforts made to tune the polarization during luminosity running and in particular after the mini shutdowns. Reversal of the electron polarization by moving the spin rotators, to study systematic effects, are proposed in coincidence with the mini shutdowns, provided polarization tuning is made shortly after the shutdown and the loss of data is minimized. The experiment is definitely in favour of extending the running period to allow more significant physics usage of the recent RICH and charm upgrades. Dedicated HERA-B runs can also be used by HERMES.

During the discussion of the open and closed session presentation the following points were raised.

The observed difference in the ratio of DIS cross-sections, $\sigma_A/\ \sigma_D$, for ^{3}He, ^{2}D, ^{14}N between HERMES and NMC is difficult to understand although the Q^2 is different and this is taken to be evidence for an atomic weight dependence of R. The observed spin azimuthal asymmetry is probably related to the te Collins fragmentation function.

The installation of the proposed recoil detector is being delayed by funding which when available will allow the detector to be installed during the luminosity upgrade schedule.

S.Bertolucci gave the HERMES referees's report. The rate and quality of published (flavour decomposition of the spin structure of the nucleon, first detection of gluon polarization, suppression of DIS at low x and Q^2, etc.) results has been impressive. The installed detector upgrades are commissioned and producing physics results. The long term plan document, PRC 99/08, expands on the physics requirements of HERMES for the post luminosity upgrade. These are:

- Two years of longitudinal ^{2}H data taking for Δs(x) and ΔG(x) studies.
- Two years of transverse ^{1}H for first transversity measurements.
- One year of various heavy nuclei targets and ^{1}H (with RICH) to finish flavour decomposition.
- One year of contingency.

Elements of the schedule can be carried out without beam polarization and in parallel with, eventual, dedicated HERA-B running. Some concerns exist w.r.t. to manpower especially in the DAQ and trigger systems, but the core of the experiment is committed to the long term schedule. Some of the manpower problems could be solved if HERMES were to have a stronger resident group and the PRC suggested the this could be addressed by the DESY directorate.

The discussion concentrated, initially, on the long term plan followed by physics analysis related issues.

The two track open charm trigger of the experiment allows 100-200 D->Kπ events/year to be accumulated. This rate is low compared to that expected at COMPASS. The first Δs results will be available during 2000. A new analysis of ΔG will be made when the enough data is available to half the existing error to 0.08.

The discussion was continued in closed session.

The PRC recommended that the post HERA luminosity upgrade physics program proposed be accepted. The experiment should be supported in its attempts to strengthen the collaboration.

Item 4. Review of ZEUS. The chairman thanked the open session speaker for his presentation and asked the spokesman, B.Foster, to report on the status of the experiment.

The experiment has published seven papers since the last PRC and a number of interesting analyses are in the pipeline. The 1999 running period has been excellent and the DAQ efficiency is high although the LPS, which is keen to accumulate 15 pb^{-1} of data before it's shutdown, is effected by cohabitation problems with HERA-B.

Concerning the upgrade some delays have been experienced with the delivery of the Al/Be beampipe, but the new March delivery date is within the schedule foreseen for the luminosity upgrade. Manpower difficulties exist w.r.t. the design of the supports for the cryo-tower.

The PRC/09 report describes the experiment's luminosity monitor after the luminosity upgrade. The intention is to upgrade the present photon detector, build a new electron pair spectrometer using existing sandwich scintillator calorimeters, and build an electron tagger located 6m from the interaction point. Significant parts of the existing luminosity and electron tagger systems can be reused and detector costs are relatively small. The spectrometer magnet will be manufactured in Brookhaven and it is understood that no compensator is required. Considerable effort is currently being made to provide a single front end and readout system for the detectors, which when available, should reduce the costings made in the document. The final accuracy of the luminosity measurement should be 1-2%.

The Micro Vertex Detector (MVD) project. All silicon detectors initially ordered have been received and a large fraction of the half modules required by the Barrel MVD (BMVD) have been produced. The quality control of HELIX 3.0 wafers at NIKHEF has been delayed by technical problems, now fixed. Quality problems have been experienced with the kapton connectors. These and other smaller problems imply a three month delay in the delivery of the detector which exhausts the contingency foreseen and cuts significantly into the time allocated for final system tests.

The Straw Tube Tracker (STT) project. The mechanical parts of the detectors are being produced on schedule and wiring of the detectors has, or is, about to start at the various production sites. The final detectors should be delivered to DESY by July. The ASDQ preamp chip has been tested and ordered. All electronics should be available at DESY by January 2001.

The following points were discussed.

The positioning of the LPS which caused bad data taking conditions and interference with other experiments was due to the difficulty of determining the position using ρ and ϕ events. This analysis showed that the position measured from the trigger counters was incorrect. The experiment's commitment to increasing the LPS data set before it's turnoff remains.

The accuracy of the luminosity measurement is ultimately limited by knowledge of the beam divergence, but the calorimeter energy scales, the acceptance, signal pile up, etc. all need to be understood, which is the reason for proposing two detector systems which can be used for intercalibration.

The HELIX chips used by ZEUS, H1, HERMES and the HERA-B Vertex Detector System (VDS) are acceptable since the trigger features of the chip are not used. The problems encountered by the HERA-B Inner Track Chamber (ITR) are associated with oscillation and other problems of the trigger circuit.

ZEUS is satisfied with the DESY directorates strategy for deciding when the luminosity upgrade shutdown should start. The delay associated with the MVD has weakened the ZEUS position w.r.t. a May shutdown.

E.Hughes, the ZEUS referee, then gave his report. The two detector luminosity monitor upgrade should be recommended. Nevertheless design of the front-end and readout system should be combined into a single solution to improve maintenance and reduce costs, and the photon calorimeter should be calibrated in test beam. STT module production has started and looks good, but attention should be paid to slippage in the ASDQ chip delivery. The MVD has been delayed and the collaboration should investigate probing the HELIX wafers in Heidelberg if the NIKHEF problem cannot be solved.

The discussion was continued in closed session.

The PRC recommends approval of the proposed luminosity monitor upgrade. It takes note of the delay in the detector upgrade schedule.

Item 5. Review of AMANDA.

The chairman thanked the speaker for his extensive open session presentation and proposed that points arising from should be discussed.

The angular resolution of the Antares experiment is approximately 10 times better than the 2-3 degrees currently measured at AMANDA. The AMANDA design resolution of 1 degree may be reached for highly energetic neutrinos.

The 116 atmospheric neutrino events used in the 1997 skyplot is significantly less than the signal (230) expected, because the Monte Carlo used does not simulate correctly the dust particles trapped in the ice which reduce the attenuation length of light. A concentrated effort is being made by the collaboration to improve the Monte Carlo and a workshop will be held at Zeuthen in January.

The measurement of oscillations in solar neutrinos is difficult with the AMANDA experiment. A task force has been created to investigate the systematics involved.

The chairman proposed that Ch.Spiering review the photomultiplier gain problem which had come to light at the last PRC.

A strong decrease in the gain has been seen on the PMs deployed with strings 11-13 in

1998. Most PMs loose 20-50% of the initial 10^9 gain during the first months of operation after which the loss stops for most tubes. Correlations with production batch, deployment depth, and readout electronics have not been found. Cold tests made at -30 degrees, the typical temperature at 1.5-1.6km depth, have, however, not been conclusive. Tests at Hamamatsu show 10% gain variation over 1 year at a lower HV. Recovery, 0.04%/day, of gain loss is seen if the HV is reduced by 500V.

In the following discussion the operation at 10^9 gain was considered to be risky. Lowering the gain considerably increases the lifetime of the PMs and will not degrade the time resolution of the experiment. For the time being no conclusive understanding exists of why earlier strings do not see the same problems although a similar symptom was seen at CDF.

The deployment of the next 6 strings was then discussed. Modifications and further developments of the readout system will allow 4.5 of the stings to use PMs running at lower voltages. The remaining 1.5 strings will test modifications and improvements mainly relevent to the ICECUBE proposal.

The PRC agrees with the planned deployment of an additional six detector strings. The PRC requires that physics results from AMANDA-II be presented before participation in the ICECUBE collaboration can be considered.

Item 6. Review of Polarization 2000.

The chairman welcomed the representatives of the longitudinal (LPOL) and transverse (TPOL) polarization groups.

A.Simon then reviewed the status of the LPOL operation. At the last PRC it was reported that the laser intensity scans of the NBW Cherenkov crystals and prototype sampling calorimeter had shown that both single and multi-photon modes could be used in polarization measurements, and that the difference in the measured TPOL and LPOL polarization was associated with the attenuation of the light between the crystals and PMs. Attenuation tests have now been made using the sampling calorimeter and similar effects are seen, ie. a LPOL/TPOL ratio of 1.0 and 1.3 for photon attenuation of 1.0 and 10^4, respectively. Further tests blocking the light to the PMs also showed a ratio of 1.3 and after detailed study it has been concluded that charged particles, leaking into the PMs, are causing signals which have an energy asymmetry corresponding to a ratio of 1.3. The NBW calorimeter is now being operated reliably in multi-photon, zero attenuation, mode with $\Delta P_L = 0.010$ (stat.) +- 0.009 (anal.power) +- ($\sim$)1.5 (syst.). In the short term NBW tests will be made to confirm the charge particle effect, but in the long term the detector will be replaced with the sampling calorimeter. A fibre hodoscope detector and Pb preradiator will be installed in December to allow fast position measurement and the determination of the spatial distribution of Compton photons and their multiplicity.

The following points were raised during the discussion. The NBW has been removed during yearly shutdowns and calibrated in test beam. NBW studies should be continued as the original choice of the detector was partly due to it's radiation hardness - a sampling calorimeter may fail this requirement. In multi-photon mode the polarization is calculated under the assumption that left and right handed photons are measured at the laser electron luminosity rate, this should be checked.

T.Behnke then reviewed the status of the TPOL. The manpower situation has improved, ZEUS has allocated three and the H1 group two postdocs/physicist to work on the project in 2000. The test DAQ system at DESY is almost complete and the logistics delays associated with the ADC are solved and a prototype is being tested in Paris. The final TDC/ADC system will not be available for the May system tests and a compatible slower system will be used. Prototyping work on the proposed position sensitive detector is continuing and a final decision on technology (diamond, Silicon, etc.) will be made by the summer. The current operation of the TPOL continues successfully and more details regarding the upgrade will be presented to the PRC when available.

The referee's report was given by J.Arvieux. The independent LPOL and TPOL measurements are now in good agreement and the understanding of the LPOL attenuation problem means that the development upgrades can be continued. LPOL operation in multi-photon mode allows rapid high precision polarization measurements , whereas single-photon operation is suitable for calibration and investigation of systematics. Both polarimeters should be monitored carefully if the $\sim 1\%$ measurement precision is to be reached.

The discussion was continued in closed session.

The PRC takes note of the progress in understanding the LPOL detector and the LPOL and TPOL upgrades.

Item 7. Review of H1.

The chairman thanked the open session speaker for his presentation and proposed that the experiment's technical coordinator, C.Niebuhr, review the running status.

In general running is smooth and high DAQ efficiencies are being reached. The background conditions have improved although FPS running with the ZEUS LPS inserted remains difficult. Reduced tracking efficiencies has been incurred, since September, due to higher currents in the Central Jet Chamber (CJC). The removal of a broken CJC wire during the spring shutdown was successful and only one ($\sim$1%) sector remained inactive, unfortunately two additional broken wires have occurred and $\sim$10% of the sectors are affected. The additional broken wires will be removed during the extended Christmas shutdown - one of the wires may have slipped in it's feed through as a result of the increased temperatures due to the water leak of the Forward Tracking Detector (FTD) cooling system. FTD operation has continued with a reduced number of channels and the tracker cooling system is being reviewed.

The CJC current dependence on electron or positron running was discussed. No understanding exists for the increased currents associated with electron beam, or the difference between the 1997 and 1999 positron currents. The resulting loss of track efficiency is a cause of concern.

Two events with missing P_t and leptons have been seen in the 1999 data. The experiment is also investigating the benefit of reduced electron beam energy running in order to improve the low Q^2 F_2 analysis.

The status of the FTT was reviewed by A.Schoening. The addendum (PRC/07) document had been submitted to the PRC and the PPESP funding request for Trigger Level 1 has been submitted. The design of the front-end electronics modules and the Level 1 to 2 link has been started. Four man months, at SCS, have been funded to specify and produce a detailed technical description of the Level 2 by January 2000. ETH has requested an additional two man years for the Level 2 implementation. The technical break points were reviewed.

The review of the referees was given by N.Wermes. The PRC recommendation concerning the FTT proposal (PRC/06) was postponed at the last PRC and the collaboration was asked to answer questions regarding the trigger robustness (w.r.t. possible tracking efficiency loss) and physics in an addendum. The addendum elaborates the physics benefits for the experiment (tests of QCD using charm production, quasi elastic and elastic ρ, J/ψ production, etc.) and shows that the robustness of the trigger is satisfactory. The FTT proposal can be recommended if the project break points agreed with H1 are accepted. These foresee:

- completion of Level 2 studies by January which should demonstrate that the timing performance can be reached and that the software issues associated with the FPGA chips are soluble,
- completion of the Level 1 system, including ALTERA chip programming, by March 2000, and
- the availability of hardware prototypes by October 2000.

The discussion was continued in closed session.

The PRC recommends the approval of the FTT with the break points proposed by the experiment.

Item 8. Review of HERA-B.

The chairman thanked the open session speaker for his stimulating presentation and proposed that the referees report be given by K.Jakobs.

The collaboration should be congratulated on the progress made since the last PRC. The highlights have been: the Outer Tracker (OTR) was finished and installed ahead of schedule, the Vertex Detector (VDS) is operating routinely with good performance, significant progress has been made with the First Level Trigger (FLT), offline and, now, online J/ψ signal is seen, the requested review of the HELIX chip was made, and the mini shutdown installations have proved to be successful. The lowlights have been: FLT tests with chamber data have not yet been done, a physics b->J/ψ signal has not been seen, and the Inner Tracker (ITR) trigger boards will will not be operational in 2000 running, resulting in a 36% loss of gold plated triggers.

A detailed review of the status was given:

- The new thinner beampipe will be ready for installation at Christmas.
- VDS is ready for physics in 2000.
- The ITR trigger will not be available for running in 2000. The mass production of chambers is almost finished and running experience has been gained with the installed chambers. Full installation and commissioning is scheduled for mid March.
- Outer Tracking chamber (OTR) installation is finished. The next steps are calibration and track matching with other detectors. The TC2 chamber, the first installed, requires some minor repairs.
- The RICH is operational and the photon occupancy and angular resolution are good.
- The ECAL is ready for data taking, although some readout electronics is missing. Calibration with π^0, etc. has started.
- The MUON system is complete, the pixel chamber occupancy has been looked at, and work on the gas system is ongoing.
- The high P_T chamber pre-trigger system is progressing and will be ready by February. It is not required for CP physics in 2000.
- The ECAL and MUON pretrigger systems are essential for CP physics and they are not complete. ECAL board delivery is progressing and the first MUON boards have been delivered. The full systems are not expected before February.
- The FLT has made significant progress and completion is scheduled for April.
- The higher level triggers have made progress. The shown J/ψ plots were produced by running the Second Level Trigger (SLT) to look for tracks in the VDS only. The SLT is expected to be running at design performance in terms of input rate (50kHz) by February.
- A two day expert review of the HELIX chip used by HERA-B was held in Heidelberg. A new production run, HELIX 3.1, will be made to correct the problems (output driver current feedback into the analogue circuit, output driver overvlotage swings, preamplifier oscillation, etc.) encountered by HERA-B.

The referees recommended that FLT tests using chamber data be made soon, that the faulty ITR chambers be repaired and that the ITR operation be demonstrated. Efficiencies, resolutions and occupancies need to be measured for the tracking detectors and the combined system performance should be evaluated. The choice of the MUON system gas mixture to be used should be finalized and tested. The collabortaion should give high priority in to accumulating J/ψ -> e^+e^- events with the assumption that the trigger acceptance rate will improve in the early spring.

The PRC takes note of the progress made by the collaboration. If the rate of progress is maintained it is recommended that HERA-B be given every advantage (dedicated running and high priority in cohabitation problems) to maximize the chances of getting a significant CP violation measurement before the shutdown.

Item 9. Miscellaneous.

The next meetings of the PRC are scheduled for the 2-3rd May and 9-10th November 2000.

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 - E.Hughes
AMANDA - J-J.Aubert and L.Rolandi
Polarization 2000 - J.Arvieux

(C.Youngman - 21th December 1999)