DRAFT Minutes of the 43$^{\mathrm{rd}}$ Meeting of the PRC

DESY 24$^{\mathrm{th}}$ July 1997

PRC members present:

S. Bethke (Aachen), W. Buchmüller (DESY), F. Eisele (Heidelberg), L. Foà (CERN), D. Froidevaux (CERN), G. Heinzelmann (Hamburg), J. Rander (Saclay), Y. Totsuka (Tokyo), A. Wagner (DESY), B.H. Wiik (DESY, chairman), L.A.T. Bauerdick (DESY, secretary)

Non PRC members attending closed session items:

AMANDA — C. Spiering (DESY-Zeuthen), R. Wischnewski (DESY-Zeuthen)

HERA — F. Willeke (DESY)

Workshop on Future Physics at HERA — A. de Roeck (DESY)

H1 — R. Eichler (ETH-Zürich), D. Pitzl (ETH-Zürich), P. Biddulph (Manchester)

ZEUS — A. Caldwell (Columbia Univ.), W. Zeuner (DESY), R. Klanner (Hamburg), B. Löhr (DESY),

HERA-B — A.S. Schwarz (DESY), M. Bruschi (INFN-Bologna), J. Spengler (DESY), R. Mankel (Berlin), H. Kapitza (Dortmund)

HERMES — E. Kinney (Univ.Colorado), A. Brüll (MPI-Heidelberg), A. Simon (Freiburg), H. Jackson (Argonne)

The PRC received the following documents:

PRC 97/05 Proposal. Upgrade of AMANDA-B towards AMANDA-II

Agenda:

Open Session 24$^{\mathrm{th}}$ July 1997, 10:00 – 12:50, Main Auditorium

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

- HERA status report, F. Willeke (DESY)
- H1 status report, D. Pitzl (ETH-Zürich)
- ZEUS status report, W. Zeuner (DESY)
- HERA-B status report, M. Bruschi (INFN-Bologna)
- HERMES status report, E. Kinney (Univ. Colorado)

Closed Session 24$^{\text{th}}$ **July 1997, 13:30 – 19:00**

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

2 Review of AMANDA

3 Review of HERA

4 Future Physics at HERA workshop

5 Review of H1

6 Review of ZEUS

7 Review of HERA-B

8 Review of HERMES

9 Miscellaneous

Item 1. Approval of the minutes and matters arising.

The minutes were approved and the proposed agenda was accepted.

U. Gensch, M. Kasemann, A. Martin, D. Saxon, P. Söding and D. Trines could not attend the PRC meeting.

Item 2. Review of AMANDA

The chairman thanked the open session speaker for his presentation.

C. Spiering added to his open session presentation in addressing a few specific questions.

Concerning the future of the south pole station, there are strong indications that it will continue to be maintained by the US.

The dust concentration in the ice has been measured. Results suggest that at the south pole it should have a peak at a depth of 1700 m, below that it should be rather small.

The readout using optical fibers shows a better performance than the electrical readout and provides the required dynamic range. Damage to fibers and connectors leading to failures are under study.

The timetable foresees in 1998, the deployment of the first three strings for AMANDA-II, the minimum needed to perform important tests. The following year will be used for the preparation of AMANDA-II. Zeuthen will be involved in improving the DAQ system using VME access from PCs running the Linux operating system, thus allowing direct network access to the experiment.

D. Froidevaux asked to be demonstrated that one can sufficiently reduce the rate of fake events. In reply it was stated that the Monte Carlo (MC) proves that the signal to noise ratio can still be improved. Experience at Baikal shows that the MC extrapolation is reliable. This view received support from Y. Totsuka, who pointed out the simplicity of detector and simulation.

The chairman proposed that the review of the AMANDA-II proposal by G. Heinzelmann and Y. Totsuka should be reported.

G. Heinzelmann pointed out that the physics goals are very interesting and valid to be pursued. Although the, yet to be proposed, cubic-km size (KM3) detector will be more appropriate for most of the physics, like AGN, WIMP searches, and super-novae burst watch, AMANDA-II will be the first step in this direction, giving a factor of around 60 in effective area over AMANDA-B.

Y. Totsuka stated that with AMANDA-II already there is a good chance to see interesting physics. He is optimistic that e.g. point sources can be identified with the achievable angular resolutions. He judges AMANDA-II to be an important experiment on its own. There is no concern with respect to competition from ocean detectors, which seem to face many difficulties.

No basic technological problems are seen. The ice properties have been studied and understood. The timetable is reasonable. The Zeuthen group is very experienced. Concerning available manpower, a further permanent position in the Zeuthen group would be desirable. Also, further collaborators should be sought.

The referees recommend that ARMANDA-II should be pursued.

In the following open discussion A. Wagner asked for the tolerable failure rate of photo multipliers (PMs). It was stated that experience at Baikal shows that one needs to be better than 5%. The current failure rate is 3%, which is stable after the strings are frozen in.

J. Rander stated that AMANDA is very far ahead the Ocean projects. The technical problems should however not be underestimated, and more tests could be necessary.

S. Bethke asked if the technology of AMANDA-II will be appropriate for the KM3 detector. It was stated that one could build such a detector using PMs of a different type with different electronics, at however prohibitive costs. The demand on manpower and data volume would probably be similar to Kamiokande.

In answer to a question by L. Foà it was stated that AMANDA-II should be an important step before one can propose a KM3 detector. However, at this moment the funding is not available to propose a detector of this size.

B.H. Wiik pointed out that in the development towards KM3 there is a need for a scientific center in the field, and that Zeuthen could become a crystallization point, where HEP know-how would be accessible.

F. Eisele remarked that this project gives Zeuthen a clear project for the future and its own profile. The man power on the project should be strengthened.

The PRC gives strong support to the AMANDA-II project. It is very happy with its development and recommends approval.

Item 3. Review of HERA

The chairman thanked the open session speaker for his presentation.

F. Eisele inquired about on the impact on luminosity when running protons at a higher energy of 920 GeV. F. Willeke stated that in principle the luminosity upgrade (LU) and changing the proton energy are orthogonal. However one needs to optimize the lattice for a given proton energy. One could loose about 5 to 10% luminosity when running at around 900 GeV on a lattice optimized for 820 GeV.

B.H. Wiik remarked that the driving force for running at higher proton energy is HERA-B. In October a test run is planned at around 900 GeV. The cryogenic temperature will be 3.7 K to keep operational safety against quenches. At this temperature the cryogenic system of transfer lines and machine are run at underpressure. It will be checked how much air is leaking into the system. The parameters will then be fixed to the highest energy the machine can be run reliably.

F. Eisele reminded that for high x physics running at higher CMS energy would increase the cross section by a factor of 1.5 to 2.

D. Froidevaux asked what possibilities existed to improve the 40% efficiency of HERA. F. Willeke answered that there is no easy way to improve. All failures causing longer down times were unique events. One would need to exchange a enormous number of components and old systems, which are possible candidates for future failures. A successful improvement program is ongoing, as every failing power supply gets replaced.

F. Willeke briefly outlined the planned LU program, which is aiming at increasing the luminosity by about a factor of 5. Superconducting magnets will be installed to allow for a higher β near the interaction points. Those combined function and dipole magnets will have to be installed inside the H1 and ZEUS experiments, where they will just fit into the existing space. The increase in synchrotron radiation has to be dealt with. Especially critical is the small beam pipe inside H1 needed for the central silicon tracker.

The impact on both experiments is significant and under study. A scheme which looks feasible has been found in close collaboration between machine and experiments.

There were questions on the impact on backgrounds, trigger rates and polarization. All these issues are still under study but are believed to be solvable.

The PRC congratulated to the efforts from the machine groups and experiments towards the LU program.

Item 4. Future Physics at HERA workshop

The chairman asked A. de Roeck to inform the PRC about the workshop on "Future Physics at HERA" which took place between September 1995 and May 1996, organized by G. Ingelmann, R. Klanner and A. de Roeck.

The aim of the workshop was to work out and review prospects for future physics at HERA running in collider and fixed target modes, with the options of high luminosity, higher energies, polarized beams and nuclei. For the studies two scenarios for the estimated integrated luminosity between now and the year 2005 were used, namely 250 pb^{-1} for the HERA design luminosity case and 1000 pb^{-1} for the case of a HERA luminosity upgrade.

A two volume proceeding with 150 contributions of around 300 participants has been published and is available since November 1996. A. de Roeck outlined some highlights of workshop results. One main result of the workshop was a big push towards larger luminosity in HERA, supporting the HERA LU program.

The PRC acknowledged the successful workshop and took note of the physics cases for a luminosity upgrade program for HERA.

Item 5. Review of H1

The chairman thanked the open session speaker for his presentation.

There were no outstanding issues

The chairman asked D. Pitzl to report new results on the observation of events at high Q^2.

The previous result was updated using data corresponding to an integrated luminosity of 9.5 pb^{-1} taken during 1997. Six new events, making a total of 18 events were observed at $Q^2 > 15000$ GeV^2 and $0.1 < y < 0.9$, where from neutral current (NC) interactions 8.0 ± 1.2 were expected. In the charged current (CC) channel 2 new events were observed at $Q^2 > 15000$ GeV^2, within errors consistent with the standard model expectation.

The H1 spokesman R. Eichler outlined future running requests from H1.

The experiment would like to run with electrons in 1998 and expects to collect 5 to 10 pb^{-1}. In 1999, H1 would also like to run at higher beam energies and collect 60 pb^{-1} with electrons or positrons, depending on the outcome of the 1998 running. The higher beam energy would give higher sensitivity to possible new physics at high x. A second beam energy could also allow a measurement of the longitudinal structure function F_L at low x.

B.H. Wiik replied that a decision on the precise machine schedule would be made by the end of 1998.

The PRC had no specific recommendations with respect to H1.

Item 6. Review of ZEUS

The chairman thanked the open session speaker for his presentation.

The ZEUS spokesman A. Caldwell reported that data taking in 1997 was very efficient. He then presented briefly the status of ZEUS upgrades.

The assembly of the proposed forward plug calorimeter (FPC) is almost complete and CERN test beam measurements are planned for September. The detector is on schedule.

The proposal for the micro vertex detector MVD underwent some changes. An analog readout scheme has been adopted based on the Helix-128 chip, also used by the HERA-B experiment. The question of radiation hardness is under study. The new elliptical beam pipe design allows for a much improved impact parameter resolution. The exact dimensions are under consideration and need to be coordinated with the requirements of the HERA luminosity upgrade.

Concerning the latter, extensive studies have been performed, concerning the layout of the interaction region, the magnet support, installation procedures, synchrotron radiation shielding, impact of the magnets on the detector performance etc. No major problems are seen so far. ZEUS would like to strongly push for the luminosity upgrade in 1999/2000.

D. Froidevaux asked why a double-sided layout for the silicon MVD was not pursued. R. Klanner answered that availability and costs of silicon detectors speak against this option within the tight time schedule given.

B.H. Wiik remarked that clearly a electron beam dump is needed for radiation safety and that DESY will have to install it.

The chairman asked about new results on high Q^2 events. In the observation region of $x > 0.55$ and $y > 0.25$ defined previously by ZEUS one more NC event was observed in the 97 data analyzed so far. The significance of a possible excess over standard model prediction slightly detoriates with this result. No new CC event was observed at very high Q^2, but at Q^2 around 10000 GeV^2 there is some tendency for the data to lie above expectation.

The PRC had no specific recommendations with respect to ZEUS.

Item 7. Review of HERA-B

The chairman thanked the open session speaker for his presentation.

F. Eisele reported on the status of the Inner Tracker (ITR).

The evaluation of a scintillating fiber tracker alternative to the Micro Strip Gaseous Chamber (MSGC) is finished. Although this option could be built, it turns out to show only marginal performance. The light yield would degrade severely after irradiation with 1 Mrad, which corresponds to 1 year of HERA-B running, leading to a poor efficiency. The costs would be excessive, 5 MDM more than the MSGC, and the detector would have to be replaced regularly. This option thus cannot be funded.

The tests of the MSGC with gas electron multiplier (GEM) were all positive so far, solving the spark problem of the MSGC. The chambers work at 40 MHz target rate, are fully efficient at reasonable voltage and allow stable operation with a margin for higher gain. The resolution in the B-field is as expected and agrees with the result of Sauli. The long term aging tests are not yet done.

A new mechanics was designed which is simpler, more robust and allows faster installation. A full size chamber will be build as soon as the GEM foil arrives from CERN. Pre-series production will start beginning of September. If aging tests are successful 40 more substrates (out of 200 needed in total) will be ordered for end of October. The prototype boards for read out should be ready end of September allowing a full system test in the lab, and at the PSI test beam with the final electronics in November.

It was stated in reply to S. Bethke that the new mechanics design should allow to assemble two chambers per working day. One complete station should be installed in 1998. Before the mass production a test of the infrastructure will be done in HERA-B.

D. Froidevaux remarked that GEM solves the operational stability problem but still is not a trivial part of chamber building. Concerns about the availability of the foil were answered in that CERN has promised their delivery.

H. Kapitza reported on the status of the Outer Tracker (OTR).

Production of about 1000 OTR chamber modules in 6 different labs has started and 70 modules have been produced. Tests of the chambers have revealed serious problems with steadily rising chamber currents at high constant target rates. Although the aging tests were performed with up to 4 C/cm, under HERA-B test beam conditions the problems occurred already at about 0.05 C/cm, which corresponds to 10% of a HERA-B year.

Systematic studies are underway. Dissection of damaged modules showed a deposited film on the foils which is visible by eye, which could be a polymer layer caused by the Malter effect. Also drops of glue or solder resin are observed and halogenes are detected in the X-ray spectrum analysis. The effect can be reproduced in the lab using a high rate X-ray source. Dedicated test modules using different designs were built and irradiated. The results indicate that the effect is related to the G10 strips in the chambers which divide the long wires into two halves, where they are soldered, cut and sealed with Araldite glue.

The preliminary conclusion is that the problem is initiated by the Araldite coated solder points on the G10 strips, and that the chamber is damaged by secondary processes. Further tests are going on. It is studied if a change of chamber gas can recover the produced modules and how and if the design has to be modified.

Concerning the OTR installation in the 1997/98 shutdown the module production was not on the critical path yet. Production has not been stopped. As many as possible $-x$ segments should be installed, up to 5 segments should be feasible. It will be difficult to install them later and also it is preferred for detector optimization. In 1998 segments will accumulate and installation would need additional shutdown time.

In conclusion, there is a working assumption that the cause of the damage is related to the G10 strips. Results on using a different gas should come during the next days.

If a revised design is required outside experts will be consulted.

In response to L. Foà it was stated that the experiment cannot work without the OTR.

D. Froidevaux remarked that the results are not yet consistent. However, hypotheses can now be checked in the lab.

R. Mankel reported on studies of detector optimization for the 1998 physics run.

The goals of the 1998 run are both to install and commission parts of the detector, DAQ and reconstruction, as well as to establish the $b \rightarrow J/\psi$ signals and to measure the $b\bar{b}$ production cross section. Scenarios for detector installation were considered and a set of recommendations were delivered that allow to optimize the detector to achieve the physics goal.

A J/ψ-trigger is expected to work even without the OTR. MC studies show that the separation of the $\mu\mu$ signal into a exponential and direct component should be feasible with the reduced detector. The vertex resolution should be around 300μm. For a running time of 10^6 seconds at 4 MHz about 100 J/ψ from b decays should be reconstructed.

The chairmen asked the referee D. Froidevaux to summarize the HERA-B review.

The OTR problem with operational stability is a major setback and puts the construction schedule on the critical path. The trigger and DAQ system show very good progress. There is the concern that the first level trigger (FLT) will be tested only in 1999. For the ITR the situation as unclear as a year ago. However, the step to GEM-MSGC needs less extrapolation and resources than the step to the scintillating fiber tracker. The installation for the Silicon tracker and RICH looks ok, but on a tight schedule. The OTR tracker installation in the shutdown 1998/99 gives major concerns.

There has been major progress during the last year in many areas, including the RICH, trigger, DAQ, software. System integration is well under way and the cohabitation seems to be solved. The physics run in 1998 should establish the J/ψ signal from beauty.

However, two crucial systems, ITR and OTR, still need R&D at levels too fundamental to launch mass production The ITR development needs to be followed closely and should be reviewed with outside experts. The OTR may have a fundamental problem and no real solution is in sight, yet. Concerns are also in the area of readout electronics, where only a small part exists, and on the MC simulation, which has not yet been adapted to predict the physics background in 1997.

The goal for 98 of finishing the construction and to integrate complete parts of all systems into the experiment seems to be on track except for ITR and RICH. This should have priority over getting physics results. An operational test of the FLT, which needs at least 3 OTR segments, is needed before 1999 physics running. In order to achieve the goals of the 1999 physics run to measure the asymmetry needs the almost complete detector and a trigger at the first two levels.

The referee sees a serious risk that HERA-B will not be in a position to get a first evidence for CP violation in the B system in 1999, giving a lead to the competing experiments in the year 2000.

The referee recommends that once the OTR schedule is understood the duration of the 1998/99 shutdown should be re-assessed. A possible necessity for an additional shutdown should overweigh the loss of physics for the other HERA experiments. For the 1998 physics run one should not overdo the pressure to produce physics results. The DESY management should plan for the unavoidable increase in the load on DESY group over the coming year in the areas of installation, assembly and software.

The HERA-B spokesman A.S. Schwarz commented that the triggers will be tested even with dying chambers in OTR. He states that the MC is in a reasonable shape, however the CPU power was not yet available to run productions.

The committee then discussed the status of HERA-B in closed session.

The PRC, with concern, took note of the report of the referee and did not make a recommendation.

Item 8. Review of HERMES

The chairman thanked the open session speaker for his presentation and introduced E. Kinney as the new HERMES spokesman.

There was a short discussion on HERMES physics results.

The PRC had no specific recommendations with respect to HERMES.

Item 9. Miscellaneous

The next meeting of the PRC was originally scheduked for 4-5th November 1997, but was later shifted to 3-4th February 1998.

(L.A.T. Bauerdick, secretary)