Minutes of the 55^{th} Meeting of the PRC

DESY May 7^{th} and 8^{th} 2003

PRC members present:

S. Bertolucci (INFN-Frascati), H. Blümer (FZK), J. Brau (Oregon), R. Forty (CERN), U. Gensch (DESY-Zeuthen), W. Hollik (MPI), K. Jakobs (Freiburg), Y.K. Kim (Chicago), R. Klanner (DESY), J. Kühn (Karsruhe), J. Mnich (Aachen), E. Reya (Dortmund), L. Rolandi (CERN,Chairman), D. Trines (DESY), B. Spaan (TU Dresden), A. Wagner (DESY), J. Stewart (DESY,secretary), U. Schneekloth (DESY,HERA experiment coordinator).

Non PRC members attending closed session items:

HERA	F. Willeke (DESY).
Background Rev. Committee	C.A. Miller (Triumf).
Engineering Rev. Committee	A. Schwarz (DESY).
POL2000	S. Schmitt (Zurich).
HERAIII EoI-01	A. Caldwell (MPI-München), I. Abt (MPI-München), H. Abramowicz (Tel Aviv).
HERAIII EoI-02	M.Klein (DESY), T. Greenshaw (Liverpool), D. Pitzl (DESY).
Representatives from the Experiments:	
H1	M. Klein (DESY), P. Newman (Birmingham), D. Pitzl (DESY), A. Schoening (Zuerich).
ZEUS	R. Yoshida (ANL), M. Kuze (KEK), W. Zeuner (DESY), J. Butterworth (Penn. State), S. Paganis (Columbia).
HERA-B	M. Medinnis (DESY), B. Schmidt (DESY), A. Zoccoli (Bologna), J. Spengler (MPI-Heidelberg), T. Zeuner (Siegen).
HERMES	D. Ryckbosch (Gent), E. Aschenauer (DESY), M. Amarian (DESY), M. Bouwhuis (Illinois).
R&D for TESLA Detectors:	
	R.D. Heuer (DESY), F. Sefkow (DESY).
CCD	N. de Groot (Bristol).
MAPS	M. Winter (IReS).
DEPFET	M. Trimpl (Bonn), N. Wermes (Bonn), R. Richter (MPI-HLL),P. Fischer (Mannheim), G. Lutz (MPI-HLL).
SiLC	A. Savoy-Navarro (Paris), D. Gamba (Torino).
TPC	R. Settles (MPI-München).
R&D Tracking Reviewers:	
	U. Koetz (DESY), K.T. Knoepfle (MPI-Heidelberg), J. Brau (Oregon).

The PRC received the following documents:

New Experimental Proposals:

PRC 03/01	A New Experiment for the HERA Collider Expression of Interest
PRC 03/02	Electron-Deuteron Scattering with HERA, a Letter of Intent for an Experimental Programme with the H1 Detector.

New Detector R&D Proposals:

PRC R&D 03/01	A DEPFET Pixel Vertex Detector for TESLA Proposal and Prototyping Report.
PRC R&D 03/02	SiLC: Silicon Tracking for the Linear Collider.

Update Reports from Existing R&D projects:

PRC R&D 01/01 Update
PRC R&D 01/04 Update
PRC R&D 01/03 Update

Agenda:

Open session. May 7th 2003, Main Auditorium

TESLA Tracking R&D:
- DEPFET – M. Trimpl (Bonn),
- CCD – N. de Groot (Bristol),
- MAPS – M. Winter (IReS),
- SiLC – A. Savoy-Navarro (Paris),
- TPC – R. Settles (MPI-München).

HERA III EoI-1 – A. Caldwell (MPI-München).

HERA III EoI-2 – T. Greenshaw (Liverpool).

HERA II Machine – F. Willeke (DESY).

HERA I - Physics Highlights and 02/03/ running for H1 – A. Schoening (Zuerich).

HERA I - Physics Highlights and 02/03/ running for ZEUS – S. Paganis (Columbia).

HERA I - Recent Physics Highlights HERMES – M. Amarian (DESY).

HERA I - Recent Physics Highlights HERA-B – T. Zeuner (Siegen).

Closed sessions: May 7-8th 2002

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

Item 2. News from the Lab.

Item 3. Review of HERA.
- Report from 2nd Background Review Committee.
- Background Related Upgrades to HERA and the Experiments.
- Report from the Engineering Review Committee.
- Polarization Update.

Discussion.

Item 4. Review of H1.

Item 5. Review of ZEUS.

Item 6. Review of HERMES.

Item 7. Discussion on HERA III.

Item 8. Summary of HERA III.

Item 9. Review of HERA-B.

Item 10. Review of R&D for TESLA Detectors.
Detectors (Overview).
Review DEPFET.
Review CCD.
Review MAPS.
Review SiLC.
Review TPC.

Item 11. Miscellaneous.

Item 1. Approval of the minutes and matters arising.

The chairman opened the 55^{th} session of the PRC by welcoming the new members H. Blümer, J. Brau, W. Hollik, Y.K. Kim, and J. Kühn. He also thanked K. Borras for being the PRC scientific secretary for the past 2 years and J. Stewart for accepting the appointment as secretary for the next 2 years. A. Wagner briefly described the function and importance of the PRC.

R. Cashmore was unable to attend the meeting.

The minutes of the 54th session were accepted with minor changes.

Item 2. News from the Lab.

In his report A. Wagner concentrated on the recent developments in the linear collider and synchrotron light projects. The International Technical Review (Feb. 2003) for the linear collider stated that at present only TESLA has demonstrated the "R1" requirements for the main RF for a 500 GeV machine. By the end of 2003 the feasibility of 800 GeV, however without a beam test, should have been demonstrated. In November 2002 the German Scientific Council recommended that the federal government give its binding consent to German participation in the LC and to the TESLA X-FEL. The federal government decided on February 5^{th} 2003 to provide half the investment costs for the X-FEL which is to be built at DESY. The conversion of PETRA to a synchrotron light facility is seen by the German government as a national project and has been approved. No German site for the TESLA linear collider will be put forward at present, but DESY is asked to continue its R&D on TESLA in the existing international framework to facilitate German participation in a future global project. The next steps toward a linear collider aim at a joint selection of the technology in 2004 and an approval of the LC in 2006/2007.

It was asked that if the decision in one year will be for a warm technology then how will this affect DESY's contribution to the LC. A. Wagner replied that the laboratory would then need to investigate how its expertise can best be used. The contribution to the machine would then be reduced but the linear collider physics program would remain the top priority of the laboratory.

Concerning HERA–III, the PRC was asked to evaluate its scientific case and also to state its priority compared to the other particle physics projects. The PRC was reminded that the conversion of PETRA to a light source was a strategic decision of the laboratory and has been funded by the ministry. Therefore, a continuation of HERA would require a new injector. The directorate will decide on HERA–III based on the recommendations of the PRC, the discussions with the Extended Scientific Council, and the available resources.

A. Wagner stated that when the conversion of PETRA to a dedicated light source begins then HERA will no longer have an injector, so the end of 2006 with an uncertainty of up to half a year marks the end of HERA II. When asked what happens if the collider experiments do not have the promised 1 fb-1, he replied that if 80% of the projected statistics is collected then the resulting physics should not be strongly affected. However if a strong reason exists then a 1/2 year extension could be considered but a longer extension that would be difficult.

R. Klanner then presented the status of the HEP-Strategy group. The committee was formed after the February 5^{th} decision by the German government not to propose a German site for TESLA at that time. The mission of the group is to develop a strategy for HEP at DESY between 2004-2014 taking into account the existing commitments of the lab. A first report (" 0^{th} version") from the strategy group should be ready in September 2003. Comments and suggestions to the group are welcome.

Item 3. Review of HERA.

A. Miller reported on the conclusions of the 2^{nd} Meeting of the Background Review Committee which met on January 16^{th} and 17^{th}. In 2002/03 the collider experiments could tolerate only a fraction of the HERA–II design luminosity because of background. The sources of background are double scattered synchrotron radiation, secondary positrons, and proton beam gas scattering. Improvements to the synchrotron radiation collimators/masks should reduce the background rate to about 20% (5%) of the drift chamber budget for H1 (ZEUS). Concerns about higher order mode heating (HOM) and poor cooling of some masks resulting in outgassing remain. The secondary positron background is worse for ZEUS than H1 because of the smaller beam apertures and contributes significantly to the radiation dose in the silicon trackers. After upgrades the background from lepton beam scattering is expected to account for about 10% (25%) of the chamber current budget. The proton beam gas background is clearly associated with the vacuum degradation caused by the positron beam. Huge pressure increases in the IRs are seen at 12 GeV where HOM heating is largest. If an additional improvement in vacuum is assumed then p–gas background will account for about 45% (70%) of the drift chamber budget for H1 (ZEUS). The committee endorsed the planned modifications to H1 and ZEUS and concluded there were no compelling reasons to delay the start of the March shutdown. Recommendations for machine studies and HERA operation were given. It was also recommended to improve the collider beam abort systems, improve temperature and vacuum instrumentation, and to improve machine instrumentation to diagnose the cause of background "Spikes". They also recommended that significant engineering projects be reviewed by a multidisciplinary committee (Machine Advisory Committee).

When asked how much is relied on simulation, A. Miller replied that the understanding of the background relies very heavily on simulation.

U. Schneekloth presented the status of the background related upgrades. Improvements in the background rate with time are observed which are correlated with the vacuum pressure. Improvements to the ZEUS experiment include: modifications to C5a, C5b, and C5c, coating of the absorber SR11, and additional pumping. Improvements to H1 include a new C5b collimator with improved shielding and pumping. Numerous upgrades to the machine to increase pumping and reduce synchrotron background were presented. After the upgrades H1 should be able to operate at design luminosity. By relaxing their rate limit by a factor of 3 and reducing their HV to 95% (gain change of 2) ZEUS expects also to be able to operate at full luminosity under the assumption that there will be some improvement in the beamline pressure with time.

A. Schwarz reviewed the conclusions of the Engineering Review Committee. The committee was charged with reviewing the proposed background related upgrades. As the number of upgrades is large only the specific topics where outstanding concerns exist were presented. The effect of heating of the C5 collimators is not well understood. Beam induced vacuum leaks will need to be avoided by monitoring temperature and pressure in the beamline. The G0/GG magnets contain brass components and it is not known if the zinc will cause problems. The conclusions of the review committee were that the preparation work was proceeding on time but that some worries still remain. The committee felt that the background would likely limit the maximum luminosity and that the limits would likely be different for H1 and ZEUS. A. Schwarz recommended that a strategy and clear rules be established for the machine startup.

ZEUS feels that with the reduced HV and relaxed current limit there will not be any difference between the maximum currents allowable for the two collider experiments.

In response to the question if the radiation limits could be relaxed at startup so that the machine can commission, ZEUS replied that they were willing to tolerate some radiation at the startup but one must be very careful. Damage caused by accidents with the beam were observed. H1 insists that their radiation limits be maintained and point to the failure of the BST as justification. H1 will improve the shielding of the BST, improve the radiation monitoring, and upgrade their beam abort system (the old H1 abort system is slow).

No clear consensus concerning rules and policy during the startup phase was found but it was generally agreed that the machine will need substantial time to start up.

Shortly before the beginning of the shutdown the HERA crew succeeded in demonstrating ∼50% longitudinal polarization for HERMES, H1, and ZEUS with the experiment's solenoids switched on. This is a world–wide first for a high energy electron storage ring.

The PRC continued its discussion in closed session.

The PRC congratulates the HERA team for the progress in the operation of the machine and for the high level of longitudinal polarization achieved with the three pairs of spin-rotators and the experimental magnets switched on. The PRC acknowledges the efforts to understand the background and congratulates the HERA team, the experiments, the Background Committee and the Engineering Review Committee for the professionalism shown in planning the shutdown operations. The PRC understands that in spite of all these efforts there is still a certain degree of uncertainty in predicting the background level that will be achieved at start-up. The PRC agrees with the proposed start-up strategy that foresees a long period of optimization of the machine before starting data taking. The PRC understands that the experiments will adapt as much as possible to the background conditions in order to take data at high luminosity.

S. Schmitt reported on the status of the polarimeters. Both polarimeters are working and the agreement between the LPOL and TPOL is reasonable. A high polarization ($P > 50\%$) with all spin rotators on and colliding beams was observed. There is insufficient data for detailed systematic studies and calibrations. During this shutdown a laser cavity for the LPOL is being installed. The TPOL silicon detector which will be used for calibration is being repaired. It will be installed later this year if delayed. It was noted that additional manpower is needed to operate and analyze the polarimeter data. Additionally a new calorimeter needs to be built for the LPOL if the new laser cavity is used.

J. Mnich reported that he was impressed that the cavity is installed and working. A plan for the commissioning needs made. He also concluded that the group does not have sufficient manpower. This will be resolved by the steering committee of the Pol2000 group.

The PRC congratulates the polarization team for the installation of the cavity and for the results shown on the polarization measurement at HERAII. The PRC takes note that the steering group of POL2000 will take actions in order to find the required level of support from the experiments for the smooth running of the polarimeters and the analysis of its data.

Item 4. Review of H1.

J. Mnich presented the referee report for H1. The shutdown activities were summarized. The VFPS is installed including the bypass. The CIP has been repaired and all 5 layers are functional. The BST is being repaired and though the schedule is tight it should be on time. Critical BST components were replaced with radiation hard variants. Commissioning of the Fast Tracker Trigger can start when data is available. The recent conference contributions and the major new publications were reviewed.

The committee continued its discussion in closed session.

The PRC acknowledges the physics results presented and congratulates the Collaboration for the many contributions submitted to the DIS2003. The PRC takes note that the VFPS is installed, the CIP has been repaired and all 5 layers are operational, that part of BST electronics has been replaced with rad-hard components and that the hardware of for the fast track trigger is in place. The PRC also takes note of the comments by H1 that even under optimistic assumptions it appears difficult to complete the approved HERAII physics program by the end of 2006.

Item 5. Review of ZEUS.

R. Yoshida presented the status of ZEUS. He gave a detailed review of the ongoing analysis and publications. The detector status was then reviewed. Commissioning of the MVD is progressing as much as possible given the amount of data available. The main concern is radiation damage with a measured dose of 100 kRads near the detector. The straw tube tracker (STT) was repaired following the recommendations of a review committee. Since November 2002 both luminosity monitors have been in stable operation. Both currently have an accuracy of about 5%. The 6 m tagger will be ready at the start of data taking.

Key points concerning the background and future running were discussed. Assuming all background improvements are as expected and there is no further improvement in p–gas background, then in order to operate at full luminosity ZEUS plans to reduce the HV of the CTD by 5% and relax their chamber current limit by a factor of three. Studies indicate that it is possible to operate at 95% voltage (1/2 gain) with comparable efficiency as in 2000. Given the time frame of the HERA II program and the fact that no evidence for aging is observed at present the experts feel that the increase in current limit is acceptable.

B. Spaan gave the referee report for ZEUS. The collaboration is congratulated for the large number of physics results. The luminosity monitor is not yet fully functional. The design precision is far from being reached. However the 6 m tagger has been repaired and new shielding prepared. Problems have been identified and are being addressed. The radiation level at the MVD is too high with roughly 100 kRad of the total 300 kRad budget already used up. Severe problems with the STT (HV, crosstalk, fuses, and capacitors) rendered it unusable for physics. The problems were repaired and the detector is now installed and functioning. The change in the operating parameters for the CTD produce no immediate concerns but the overall performance of the detector should be monitored carefully for signs of aging. The shutdown work is going well and the collaboration is congratulated on keeping the tight schedule.

Even with all the planned improvements, a factor of 1.5 to 2 improvement in background is still needed. This is hoped to come from improved vacuum conditions, but a new operating plan may need considered if the vacuum doesn't improve. It was noted that the change to the FADC threshold was after the first level trigger so a change in gain of the post–amps is needed. This is being studied.

The committee continued its discussion in closed session.

The PRC acknowledges the physics results presented and congratulates the Collaboration for the many contributions submitted to the DIS2003. The PRC takes note of the good functioning of the MVD, of the successful repair of the STT in schedule and of the actions taken to repair the 6-m tagger. The PRC acknowledges the efforts done by the Collaborations to find new running conditions of the CTD that can stand higher backgrounds.

Item 6. Review of HERMES.

D. Ryckbosch reviewed the HERMES publications and then presented the status of the experiment. The target magnet and lambda wheel detector are being modified so they can be operated at the same time. The calorimeter PMT bases are being modified to improve longterm reliability. The status of the recoil detector was presented. The recommendations from an external review were summarized and the response of the recoil group shown. The status of the transverse physics program was reviewed in some detail. A possible future measurements program for the HERMES experiment was presented. It was shown that a productive measurement program could be foreseen which runs through 2008.

A. Wagner stated that the collaboration should not count on HERA II running beyond 2006.

S. Bertolucci gave the review of HERMES. The size of the collaboration is stable or slowly eroding. The maintenance work during the shutdown is proceeding smoothly. The recoil project was reviewed. The collimator studies are progressing. The recoil magnet should be delivered in November 2003. Some difficulties in the silicon detector project were summarized which have lead to a 6 month delay. Several prototypes of the scintillating fiber (SciFi) detector have been built but the measurements on the prototype are unsatisfactory. The SciFi detector is also delayed 6 months. In conclusion the recoil detector is progressing with some slipping in the schedule. Attention should be given particularly to the SciFi detector. HERMES is in general ready for a lot more data and the experiment supports an extension of HERA Run-2.

R. Klanner stated that the collaboration should make every effort to prevent additional delays. It should be investigated if there is any means to recover some of the lost time.

A meaningful list of milestones should be presented to the PRC at the next meeting. S. Bertolucci stated he plans to attend the next review of the project.

The PRC continued its discussion in closed session.

The PRC acknowledges the physics results presented and congratulates the Collaboration for the overall good status of the experiment. The PRC takes note of the progress on many components of the Recoil Detectors and notices that the silicon tracker and especially the SciFi tracker have accumulated some delays. The PRC asks the Collaboration to explore corrective actions that could reduce this delay and to present a new schedule and an updated set of milestones. The PRC takes note of the comment by the Collaboration that it appears difficult to complete the approved physics program by the end of 2006.

Item 7 and 8. Review of HERA III EoI 1 and 2.

The closed session item started with comments from the reviewers. E. Reya stated that the physics program is interesting and that studies of QCD are in general scientifically very interesting. But he asked if the lab makes a decision on this in 2003 what effect would this have on TESLA. A. Wagner replied it would have a negative influence. Y.K. Kim stated that the proposal deserved close attention and is valuable for the Tevatron and the LHC. B. Spaan stated that the physics program looked interesting and that it might be worthwhile to have a theory review of the merits of the proposal. He felt that a broad physics program was proposed but questioned whether or not the program was important enough to jeopardize other programs at the laboratory. The chairman then asked the laboratory director if the PRC should decide on political priorities. A. Wagner replied the PRC should first comment on if the two experiments will really lead to a deeper understanding of QCD. The PRC should also address what it would mean if the experiment is not done. It must be also kept in mind that the proposal will commit a major amount of resources for a long time. A new injector is required and 220 people are needed to run HERA.

As major additional resources must be found for the project it was asked if there is sufficiently broad community for the project especially in Germany. A. Caldwell referred to the author lists then he reviewed numerous workshops and conferences which he claimed demonstrate that the necessary community exists. He also referred to the letter from eminent theorists in support of the proposed program.

It was asked if the e–A program would be of interest to the air shower community. A. Caldwell stated that the Color Glass model and other effective theories give a deeper understanding to QCD. The e–A program would clearly benifit the air shower community.

It was stated that the dynamic change in the data at low–x and low–Q^2 calls for a high precision measurement. In reply it was stated that parton saturation and shadowing are old ideas. What is needed is a precision measurement of F_L to determining where the perturbative evolution starts. The precision measurement of F_L at large Q^2 is important and could be achieved at HERA–II. It however competes with the high energy program of HERA–II and thus has to be seen in the overall planning.

It was commented that though a factor of two improvement in the combined statistical and systematic error on the world average for α_s sounds impressive the uncertainty in α_s is limited by theory. It was also commented that the difference between the LEP and DIS measurements is larger than the total uncertainty which is not understood. In reply it was argued that by looking at the χ^2 variation due to renormalization effects one would conclude that the theoretical uncertainty is actually overestimated.

It was pointed out that the new experiments would disentangle parton distributions at low–x, in a range relevant to single W and Z production at the LHC experiments. The experiments argued that this is essential to measure the parton luminosities at LHC. It was asked whether or not it could happen that in 5 years people could ask for new data from HERA which is necessary to interpret the LHC data. It was replied that there are ideas how to extract the necessary information from the LHC data but it is not clear if this will work.

The PRC continued its discussion in closed session.

The PRC congratulates the proponents for the studies presented in the EOIs, describing measurements that would provide a significant step in the understanding of the strong hadronic interactions. The PRC acknowledges the interest of high precision measurement of FL, the investigation of the QCD radiation patterns over an extended range of eta, the improved understanding of the parton distribution functions and agrees that many of the proposed measurements cannot be done at other existing or foreseen facilities. The PRC takes note that the present level of the theoretical understanding of QCD does not allow predictions of the proposed measurements at the level of the precision achievable by the experiments. The PRC rates the HERAIII program at lower priority compared to the Linear Collider program.

Item 9. Review of HERA-B.

M. Medinnis summarized the debate within HERA-B concerning running beyond 2002. In December 2000 HERA-B requested the DESY directorate to support the data taking in the 2001/2002 HERA running period. There was a clear understanding at that time that several institutes would probably not participate in any run after 2002. In April 2003 the collaboration was surveyed and 12 institutes stated they will not support future running. This implies that the VDS, ITR, and Muon pre-trigger systems are completely unsupported, that the coordinators for the target, FLT, SLT, 4LT, DAQ, and alignment will leave, and that more that 50% the running team is leaving. The HERA-B management concluded that there was not sufficient manpower to complete the existing approved physics program. When informed the DESY directorate after discussion with the HERA-B management replied: “This marks the end of the physics programme for which HERA-B has been approved.” The directorate also requested that the detector be moved away from the beam for machine safety reasons but that the detector should be kept intact for 1 year. At present the HERA-B management is not supporting the preparation of a LOI for future HERA-B running but several members are actively working on an LoI. It is clear that such a LoI must be prepared quickly if the existing expertise is to be preserved, and that if the detector is moved to a safe position then an additional hurdle to restarting exists. Therefore HERA-B requests that the decision to move the spectrometer be postponed till the next PRC meeting.

M. Medinnis then summarized the status of the analysis. This year there will be sufficient manpower to maintain the analysis infrastructure and perform the physics analysis of the 2002/03 data. In conclusion HERA-B successfully accumulated 3×10^5 J/Ψ and 2×10^8 minimum bias events which is 10% of the planned sample and was limited by the delivered beam.

R. Forty presented the review from himself and K. Jakobs. The PRC requested that HERA-B focus on stable J/Ψ running rather than minimum bias which was done. The J/Ψ rate in 2002 was up to 1600/hr as compared to 35/hr in 2000. The detector status was summarized. About 25% of the ITR channels do not respond because of a problem traced to the glue used in past repairs. However the ITR is not used for the trigger so this is not critical for data taking. Beam excursions caused the tungsten wires to break repeatedly so 1/3 of the data was taken with carbon wires only. The FLT has unresolved problems. The analysis efforts were summarized and it was concluded that the analysis effort is very active and has sufficient manpower at present. The reviewers felt that though some of the members wished to continue the HERA-B experiment such a program was unlikely to succeed unless there is a substantial commitment from new groups. Nevertheless the detector is now in a state where it can finally do useful physics and the collaboration should be given time till the next PRC to submit a letter of intent.

D. Trines pointed out that the vacuum of HERA-B is coupled to that of the machine so it must be actively monitored. In addition in case of certain machine failures the HERA-B spectrometer would have to be moved to give access to the machine components. He expressed concern that enough experts must be available to act in case of an emergency.

The committee continued its discussion in closed session.

The PRC congratulates the Collaboration for the data taking with improved efficiency on the J/Psi trigger and for the preliminary results presented on the new data set. The PRC takes note of the decision of the Collaboration to not continue the data taking on the approved program after the shutdown and considers that the data taking of HERA-B is finished. New data taking with the spectrometer requires a new approved program. The PRC proposes that the detector stays on the beam line until the next shutdown of HERA provided that the Collaboration assures the support needed for the

monitoring of the vacuum and for interventions on the detector that may be needed for HERA operations.

Item 10. Review of Tracking R&D for a TESLA Detector.

An overview of the challenges in constructing a detector for TESLA was presented by F. Sefkow. The different tracking options were mentioned and the typical time development of the detector projects sketched. Finally the recent international initiatives were summarized.

Item 10a. Review of the DEPFET proposal.

G. Lutz summarized the advantages of the DEPFET detectors and the status of the research. DEPFET pixel detectors have very low noise, can be thin (50μm), have 100% charge collection, excellent S/N 70, low power consumption, and fast readout with zero suppression. The principle is demonstrated on small devices and medium size arrays are presently being tested. A prototype readout chip is in progress. The next steps are to produce a prototype system with existing components followed by beam tests and radiation hardness studies. A full size detector module should be ready in 2006. The group does not expect difficulties with radiation hardness.

K.T. Knoepfle reviewed the proposal. The Depleted Field Effect Transistor sensors are an intrinsic low noise device. The requirements for TESLA are reduction in pixel size $50 \rightarrow 25\mu$m , reduction in thickness $300 \rightarrow 50\mu$m, and a fast readout scheme 50 kHz $\rightarrow$ 50 MHz. The advantages are summarized in the previous paragraph. The conclusions of the referee were that the collaboration presented a sound R&D program that is a desirable alternative to the CCD and MAPS devices under development. The DEPFET collaboration combined outstanding expertise in silicon sensor design/fabrication and ASIC design for sensor readout. The R&D program also addresses silicon wafer thinning techniques. The major goals are well defined. The R&D is also applicable to X-ray detection. The issue of radiation hardness needs addressed and as the process is not standard alternate suppliers and costs issues need clarified. It was proposed to support the project.

The PRC continued the discussion in closed session.

The PRC is impressed by the proposal to develop a pixel detector using the DEPFET principle for a precision vertex detector for the LC and recommends the R&D program for approval. Given the high potential of this technology, the PRC finds it important that it be developed in parallel to the alternatives using CCDs and MAPS. The PRC asks the Collaboration to provide a schedule for beam tests and studies of radiation tolerance and looks forward to a status report in Spring 2005.

Item 10b. Review of the CCD based vertex detector.

N. de Groot stated that the company they are dealing with is now an independent company and is happy to work with the CCD collaboration.

K.T. Knoepfle reviewed the status of the project. The collaboration concentrated on both simulating vertex detector performance and detector R&D. Compared to alternate technologies CCDs may have the highest potential for reaching the desired performance for TESLA. The group plans to start with the SLD pixel detector design and increase the number of pixels, increase the readout speed, and thin the detectors while not increasing the power dissipation. Compared to the original schedule the project is delayed by 1.5 years because of funding and manpower problems. (Funding started in July 2002 only) The collaboration is a leading contributor to the vertex detector conceptual design. They are studying the feasibility to reduce the beampipe thickness to 0.25 mm Be. Studies of ladder construction with processed and unprocessed silicon are being performed. Tests of high speed clocking with reduced voltage look promising. Radiation damage studies are consistent with simulations. First Column Parallel CCDs (CPCCD) have been manufactured. Work on the readout IC is progressing.

The present estimate is that a new CCD generation will be available every 20 months and roughly 5 to 6 steps are needed. A first prototype ladder conforming to all specifications should be available in 2010. Considering the delay in funding the progress in detector development and simulation is significant. No other detector technology has yet demonstrated it will deliver the necessary performance. The present PRC is roughly 1 year too early for the results of the first high speed CPCCD so a review then would be interesting. Alternately a review in spring 2004/2005 of all technologies could be considered. It was recommended that the PRC give the program full support.

The PRC continued the discussion in closed session.

The PRC takes note of the delay in the start of funding and concludes that - accounting for this delay - the achieved progress is significant in both vertex detector and performance studies and CCD R&D. The PRC recommends the continuation of the program and looks forward to a status report in Spring 2005.

Item 10c. Review of MAPS.

M. Winter started the closed session with a discussion of some system integration issues not discussed in the open session. As 6 clock cycles are probably needed for readout with amplification and sparsification a 30 MHz clock implies only a 5 MHz effective readout speed. This will affect the mean number of pixels in a column. In order to get a low power dissipation the low voltage must be switched on and off. This has not been demonstrated.

K.T. Knoepfle presented the review of the MAPS project. Among several options, Monolithic Active Pixel Sensors (MAPS) provide one very promising technical solution for a vertex detector of outstanding performance. The existing collaboration has a very ambitions R&D program. The Collaboration has produced six devices since 1999 which study the effects of different epitaxial layer thicknesses, fabrication process, and base material. Tracking studies have been performed. Radiation tolerance measurements have produced positive results. A full scale pixel chip (M5) shows good performance and strongly supports the MAPS concept. A first prototype with integrated data processing is under test. The collaboration plans to have a first full scale prototype with fast readout by 2005. Additional system integration studies will be performed. In general the collaboration has a broad and rigorous R&D program with impressive results. It is recommended to continue giving the MAPS R&D program full support.

The PRC continued the discussion in closed session.

The PRC congratulates the Collaboration for the broad and rigorous R&D approach with important progress. The PRC recommends the continuation of the program and looks forward to a status report in Spring 2005.

Item 10d. Review of SiLC.

J. Brau reviewed the proposal. The SiLC collaboration proposes a broad program of R&D on silicon detectors for the Linear Collider. Silicon detectors are proposed both for tracking detectors which support the TPC and as a full detector for the American Silicon Detector. Issues the collaboration wishes to address include: micro-strip detector development, silicon drift detector development, new sensors, readout electronics, mechanical issues, test systems, and calibration/monitoring issues. The collaboration expects 2003 to mid 2004 to be a warm up phase while the collaboration organizes and the research begins. By mid 2006 results from their investigations will be available. The reviewer felt that this is a loose collaboration of groups interested in tracking applications for silicon detector at the LC and the goals of each group is defined by their application of interest. The participants bring a broad range of experience with silicon detectors to the collaboration. However the table of responsibility needs to be refined and lead groups for each task need to be identified. Specific technical goals for each task need identified for the next 2–3 years. More work on the integration of the VXD and Ecal needs done. A plan for test beams in needed. It was asked roughly how many FTE are working in the collaboration. The reply was about forty.

Tokyo is working on a GEANT4 simulation and the length of the microstrip sensors will be matched to the background. The detector should help with the momentum measurement but the influence of multiple scattering in the TPC needs accounting for in the simulation.

The PRC continued the discussion in closed session.

The PRC takes note of the new proposal of a broad program of R&D on silicon detectors for LC. The PRC recommends for approval the one year long warm-up phase proposed by the Collaboration and invites the Collaboration to present for the next PRC a document with the distribution of responsibilities and specific planning. The PRC looks forward to studies

of the performance with the proposed silicon layers that integrate also tracking with VXD and ECAL.

Item 10e. Review of the TPC.

U. Kötz presented the review of the TPC project. In 2001 numerous recommendations for the detector development were given by the PRC. As recommended a management structure has been implemented and all important areas are covered. Responsible groups are identified for the different readout technologies, field cage, gas system, simulations, and mechanical issues. Two high field test setups exist and measurements have been made with GEMS and Micromegas detectors for readout. Prototyping and testing of the field cage is ongoing. In general the LC TPC group has developed into an efficient group to tackle the problems of a TPC which is needed for experiments at a LC. It is recommended to build full prototypes which are as large as possible of all 3 readout technologies and study the performance over the readout area. The development of the detection and readout system should continue. Gases containing less hydrogen should be studied. And measurements should be made at as high a field as possible. It is recommended to increase the effort in simulation. If possible work on achieving a system design with the 10 μm accuracy should start. Necessary test beam setups should be considered.

The PRC continued the discussion in closed session.

The PRC congratulates the Collaboration for the progress achieved in many areas of the project and looks forward to tests of large area prototypes of the three readout technologies in high magnetic field. The PRC recommends the continuation of the program and looks forward to a status report in Autumn 2004.

Item 11. Miscellaneous.

The next meetings of the PRC will be on October 30-31st.

The current list of PRC referees is:

H1 - R. Cashmore and J. Mnich
HERA-B - K. Jakobs and R. Forty
HERMES - S. Bertolucci
ZEUS - Y.K. Kim and B. Spaan
AMANDA/IceCube - H. Blümer and L. Rolandi
Polarization 2000 - J. Mnich
R&D LC - J. Brau
W. Hollik, E. Reya, and J. Kühn - Theory

(J. Stewart - January 8, 2004)