The Second KEKB Accelerator Review

Introduction

An international advisory Committee to review the KEKB accelerator design and status of development and construction was appointed by the Chairman of LCPAC (Lepton Collider Program Advisory Committee) in March of 1995. The first Committee meeting was held on June 7-10, 1995, and the second one on January 23-25, 1997. Three new Committee members were added to the second Committee meeting. The membership of the Committee is shown in Appendix A.

This second meeting consisted of a number of oral presentations by members of the KEKB-project and discussions by the Committee. The program is shown in Appendix B. The Committee wrote a draft report on the basis of discussion held on January 24 and 25; the report was then improved and finalized by e-mail communication among the Committee members.

Contents

Executive Summary

This was the second meeting of the KEKB machine advisory Committee. The first one took place one-and-one-half years earlier in June of 1995.

The Committee was impressed by the significant progress the project has accomplished in this time and wants to congratulate the project leader and staff on this achievement.

A set of milestones has been defined for the completion of this project. Among these the most important occurs in October 1998, at which time the installation of the machine will be completed and the commissioning phase will start. Hopefully, this will then lead to a start of the physics program early in 1999. The milestones define a very aggressive, though not unreasonable, schedule. The Committee feels that in the light of the huge amount of progress made during the last 18 months, the staff may be able to adhere to this schedule, but any shortening of it would be quite difficult.

At the first meeting the Committee made a number of suggestions and recommendations, most of which have been accepted and followed.

At that time, one of the biggest worries on the minds of Committee members was the choice of a crossing-beam geometry at the interaction point, which might lead to new nonlinear resonances and short beam lifetime. A large amount of computer tracking has been done meanwhile, checking the effects of machine imperfections, the choice of the working point in the tune-diagram and many others. None of these calculations pointed to a general problem associated with the crossing-beam geometry, and although many other simulations could reasonably be suggested, there is the general feeling that no unforeseen problems will be encountered. The continued work on the crab system, which would alleviate problems which might be caused by the crossing-beam geometry, was in this respect comforting. Should such problems arise, a crab cavity system would be available in the middle of 1999.

At the first meeting of the review Committee we heard of the highly original solutions planned for the RF system. The Committee was very impressed by the successful beam tests in the AR ring. Both the ARES systems and the superconducting cavity performed so well up to maximum beam currents of more than 0.5 A that both systems must be considered suitable for use in KEKB. During these beam tests in the AR rings, many other systems planned for KEKB were successfully tested, the most important one being the wideband feedback system for stabilization of transverse and longitudinal bunch motions. Thus the KEKB staff has already mastered the most crucial and demanding technical challenges of this project. Most of the other subsystems seem to be in perfect order, both as far as schedule and technical performance are concerned. This statement holds generally for such areas as magnets, vacuum system, power supplies, beam instrumentation and controls. The very involved and complicated interaction region hardware also seems to have found good technical solutions, although some important details still need to be finalized. The general radiation background to be expected by the large particle detector BELLE seems to be sufficiently small, although decisions about general collimator installation in the rings still have to be made.

The project leader explained in his summary talk, that a decision to build an accumulator/damping ring for the positron injection is being seriously considered and may be taken in the near future. Most of the review Committee members were greatly relieved by this prospect. Although the linac upgrade program is proceeding in a most admirable way and will lead to full energy injection capability into the two KEKB rings in the spring of 1998, direct injection of positrons into the LER ring will have only marginal or even unacceptably small rates. An accumulator/damping ring would not only improve the positron injection rates considerably, but because of the much smaller emittance beams it produces, it might also greatly reduce the radiation background at the detector during the injection process. Such a ring would be so beneficial that it might even be worthwhile to consider use of the AR ring, should the building of a dedicated accumulator/damping ring not be possible in time.

In conclusion, the Review Committee feels that the KEKB project is proceeding very well indeed.

Findings and Recommendations

A. RF System

General
The RF System of KEKB is in an excellent state from all points of view. Most of the components for generation and distribution of the power (klystrons, circulators and waveguides) are taken from TRISTAN and are therefore on hand; the low-power and control systems are under construction; cavity feedback has been tested in the AR, as well as both cavity systems, as discussed below.

ARES
The ARES structure consists of three coupled cavities operated in the $\pi/2$ mode: the accelerating cavity, a coupling cavity (with low fields) and a large cylindrical TE013 storage cavity. Its outstanding feature is its large stored energy which makes it very suitable for heavy beam loading. As a result, impedance-reducing RF feedback is not

even required in the LER (except as a backup) and the phase modulation due to an ion-clearing beam-gap in the HER is so small that a compensating gap in the LER is hardly required. Also, as the input power is fed into the storage cavity, some isolation of waveguides and circulators from HOM return power is provided.

ARES is a new development of KEK which has undergone several changes since its invention. The most recent development (ARES96) is the replacement of choke-mode HOM damping of the accelerating cavity by more conventional waveguide damping, leading to a simplification of construction. For this reason, ARES and the superconducting cavities discussed below have been developed in parallel as alternative solutions. During the last year, however, ARES has been fully developed, and it has been the subject of careful beam tests in the TRISTAN AR. These tests have been very successful with beam currents up to 0.5 A (not limited by the cavities).

Superconducting Accelerating Cavity

The progress which has been made on the superconducting accelerating cavities in the past year is extremely impressive. The results achieved in the Accumulation Ring tests have verified that the cavities are suitable for currents of half an ampere, and there was no hint that higher currents would be problematic.

Degradation of cavity performance due to poor beamline vacuum was fully consistent with the rule-of-thumb that superconducting cavities will tolerate an exposure of 10^{-9} Torr-years before having to be warmed up to release adsorbed gases. Improvement of the beamline vacuum in KEKB should make the beamline pressure near the superconducting cavity a non-issue. Cryopumping is one possible way of preventing beamline gases from entering the cavity.

It is not clear that the KEKB superconducting cavity input coupler suffers from the same multipacting problem as the LEP-II cavity, since the cavity exhibited no trips after the adsorbed beamline gas was eliminated. The coupler was equipped with a DC bias capability similar to the LEP-II cavity, but no trips were encountered to determine whether or not addition of the bias was useful. It is noted that ongoing gas desorption from the warm region of the coupler can condense on the thermal transition region of the coupler. Some of this gas will condense at locations where a slight rise in temperature will cause its desorption. Changes in the RF power or standing wave pattern in the coupler can change the temperature profile in the thermal transition zone, leading to desorption and the possibility of a runaway gas discharge. Intentional heating of the thermal transition zone between beam fills, using resistance heaters, might help to eliminate this problem. High pulsed power processing, as employed at Jefferson Lab to alleviate this problem, could also be used.

The possibility of shortening the cavity so that it would have an acceptably low R/Q for use in the low energy ring was calculated and found to require a gap of 5 cm. This question is now irrelevant, since the ARES cavity has been successfully tested in the interim, and development of a shortened superconducting cavity is unnecessary.

Choice of Cavities

The decision has been reached to equip the LER, where beam loading is strongest, with ARES alone (16 to 20 cavity systems for nominal high luminosity operation). The HER will be equipped with a combination of 12 ARES cavity systems and 8 superconducting cavities. In the commissioning phase, either system alone can provide the required voltage (at least 6 MV). This is a cost-effective solution since, by suitable adjustment of the relative phase-angle, it is possible to exploit the high voltage of the superconducting cavities as well as the high stored energy of ARES. Also, this hybrid solution makes full use of the TRISTAN experience with superconducting RF and of the refrigeration power already available at the Nikko straight section.

The Committee completely agrees with this choice.

A final decision as to the composition of the HER cavity system can only be made in the light of the commissioning results, but the plan to keep a mixed system as proposed seems an excellent one.

Crab Cavity
The laboratory tests on the crab cavity have been truly impressive in terms of the fields achieved, and in terms of the speed with which this cavity was developed by the small group of people working on it. Peak surface electric fields of 42 MV/m, corresponding to peak surface magnetic fields of 1210 Oersted, have been achieved, which is a remarkable accomplishment for a cavity of this complexity.

The ability to recover the cavity performance using high pressure water rinsing, following major degradation due to air exposure, is also an impressive and valuable result of general applicability.

The importance of tolerances for phases and amplitudes of the crab cavities was stressed. Avoiding degradation of the emittance in the remainder of the ring, requires phase balancing to within 1°. It is noted that use of an unpowered crab cavity, not necessarily superconducting, outside of the crabbing region might be a useful tool for determining whether or not the crab cavities are properly balanced in amplitude and phase.

The Committee recommends that tolerance and operational issues associated with the crab cavities, with and without gaps in the bunch trains, be examined in more detail.

It is essential to assume that the crab cavities will be needed, and to be prepared to install them as quickly as possible if they are needed. However, if they are not needed, their installation on a permanent basis would unnecessarily complicate operations.

The Committee wishes to express its appreciation of the excellent state of development of the KEKB RF system.

B. Instabilities and Beam Dynamics

Photoelectron Instability (PEI)
This is a subtle effect whose theory is still being developed. At KEKB, this work has been taken seriously, and the study has included analytical and numerical studies, as well as experiments performed at the BEPC in collaboration with IHEP, Beijing. The Committee endorses these efforts and suggests that, at this time, the PEI be treated as a potential threat to the performance of KEKB. In particular, it encourages the continuation of the study with the same vigor until it is demonstrated operationally that it is not a threat to KEKB.

In the mean time, it is also suggested that a clear idea of a solution be developed in case the PEI indeed is found to limit the performance of KEKB. It is important to have an idea of the impact on the feedback systems, if any, and whether the suggested solution (introducing a 20 Gauss solenoidal field) is practical at locations where photoelectrons are expected. There also needs to be a different back-up solution if such a solenoidal field turns out not to be practical or useful.

To be more specific about the present status of the theory of PEI, it is noted that the present theory does not take into account effects due to chromaticity, synchrotron motion, Landau damping, and the influence of magnetic bending fields. Although the instability observed at BEPC seems likely to have been caused by PEI, there are several details which seem inconsistent with this explanation at the present stage. For example, the observed instability demonstrated strong dependence on chromaticity, beam emittance and RF frequency, and these observations are difficult to explain using the present theory. Another observation which requires clarification is why it seems to occur only vertically and not horizontally.

Fast Ion Instability (FII)
Just like the PEI, it is necessary to improve the present status of the theory of the FII. Indeed, the FII is another subtle effect which must be taken seriously at the present stage of KEKB construction. The KEKB team has performed theoretical studies as well as experiments at the Accumulation Ring. Further experiments are being planned at PAL, Korea. The Committee suggests the continuation of this study with similar vigor.

More specifically, the studies still needed include getting better formulae for the instability threshold and growth rate, and finding a recommendation of how to suppress this instability effectively. In case additional gaps in the bunch train are needed, a quantitative estimate of the gap size is needed. It is also suggested that the effect of different ion species (other than CO) be investigated.

Beam-Beam Effects
With a beam-beam tune shift of 0.05, and with a ±11 mrad crossing angle, the beam-beam effect on the beam tail distribution (and thus the beam lifetime) is an important issue. In the last one-and-one-half years, a serious effort has been made on this issue by the KEKB group using a variety of simulation tools. The Committee is impressed by the good progress. In one extensive simulation, for example, 10^{13} particle-turns have been simulated with crossing angle and linear lattice in the strong-weak limit, and the beam tail distribution at the impressive level of 10^{-9} has been obtained. It is concluded that the beam tail growth due to the beam-beam effect is harmless. When lattice non-linearities are included, a simulation has been performed for $2x10^8$ particle-turns, and no excessive beam tail growth was observed in this case either.

The Committee is impressed by the progress of these studies, and regards the urgency of this issue basically addressed. The Committee feels that the choice of a ±11 mrad crossing angle seems justified; however further studies are nonetheless required. For example, it is necessary to increase the particle-turn number for tracking, and to include lattice non-linearities (especially those in the interaction region quadrupoles). Further studies may include the strong-strong effects, the effect of power supply ripple, and the effect caused by different tunes of the e^+ and the e^- beams. If problems with the crossing angle show up, either in the tracking studies or in actual operations, the Committee agrees that crab cavities would be the solution. For this reason, it is necessary that the crab cavity system design be pursued with full speed as presently planned.

Impedance Budget
As the detailed engineering components in the vacuum chamber are being built, it is suggested that a next iteration of the impedance budget be established. This includes both the broad band and narrow band impedances. Examples of broad band impedances include, among other things, those due to the titanium-coated ceramic pipe in the kicker area and the grid screen of the vacuum pump ports. Examples of narrow band impedances include those due to RF cavities, and trapped modes in the BPMs.

C. Interaction Region

There has been enormous progress in defining both the parameters and the engineering of the interaction region since the last Committee meeting. While the basic layout of the region has not changed, every item has come under scrutiny and many parameters have now been frozen. Nevertheless, this region of the machine is inherently difficult and much remains to be done.

The Committee raised many questions at the last meeting and most have been addressed, at least partially. For example, the effects of misalignment of the different elements have been calculated following a reasonable approach of evaluating the acceptability of the estimated construction tolerances.

There were several questions that still need to be addressed:

1) The vertical closed orbit of the beam through the detector and solenoidal field compensators should be evaluated and a correction strategy proposed.
2) Plans to monitor and adjust local dispersion and coupling in the IR region should be developed.
3) The limits on the allowed vibration of the final focusing doublet should be studied (probably of order $\sigma_y^*/10$) and compared with the engineering estimate.
4) The need for HOM absorbers to protect the Be beam pipe from HOM modes entering the IR should be determined and, if needed, the engineering design should be initiated.
5) We recommend that the cooling of the Be beam pipe be re-examined as the Committee was not convinced that gas cooling can guarantee adequate cooling, given the difficulty of estimating the heat load accurately.
6) The downstream high-power photon dump in the HER and LER should be designed.
7) The required multipole components in the IR quadrupoles should be defined.
8) An operational scenario for bringing the beams into collision should be developed and the need for a beta squeeze evaluated.
9) The design of the bellows with fingers near the Be pipe should be finalized and a prototype life tested.
10) A prototype "magic flange" near the QCS-L should be designed, built and tested to demonstrate that it can be made leak-tight. It would be worthwhile examining the prototype built at Cornell.
11) The design of the luminosity monitor should be completed.
12) The Committee was concerned that the 6 mm stepped mask could produce excessive HOM losses in a critical area; a smoother taper should be investigated.
13) There may be some operational advantage to being able to power the superconducting magnets in the out position and this should be evaluated.
14) The management of beam loss during injection is still a major problem which needs to be addressed in collaboration with the Belle Group and the Injection Group. It is vital to ensure that beam loss in the detector region is minimized by passive shielding and an active system to inhibit injection if the dose is too high. Similarly, if there is an RF trip, it is necessary to ensure that the beam is lost far from the detector.

All of these questions should not detract from the overall positive impression that the Committee received of the state of the Interaction Region. The Committee sees no reason why the proposed Interaction Region should not be successful.

D. Detector Background

The simulation is well developed as it is based on the successful techniques used at CLEO and CESR and BaBar and PEP-II. The good background environment obtained represents an excellent communication between the detector and machine group. This relationship should continue to ensure that the simulated environment is transferred to a real machine. It should also be noted that the background simulation gives a guide to the vacuum group as to where the pressure must be kept at a minimum in the interaction region.

The results are very promising. Background concerns are small, even assuming the full beam current, a realistic estimate of the pressure, and a simple masking geometry. Expected occupancies are well below 1% in the silicon, the expected trigger rate is quite tolerable, and the expected integrated dose on the CsI crystals is low compared to the measured threshold for significant light loss.

Areas of concern are:

1) The sensitivity of synchrotron radiation to misalignments between the components of the interaction region. A realistic estimate of the size of such misalignments should be made and used as an input to the machine simulation to identify any concerns with the proposed alignment tolerances as soon as possible.
2) It is not yet clear how the beams will be separated during injection. Possible schemes could lead to problems with the integrated dose on the detector. The machine simulation must be an input to the choice of injection schemes.
3) The expected dose on the readout chips of the critical silicon detector does not leave much margin. This must be a consideration for the commissioning plan as the silicon is a vital component of the physics program. A realistic estimate of the expected dose during injection should be undertaken. The experience at CESR and CLEO is that half of the total dose is taken in High Energy Physics running with the other half coming during injection and other non-HEP running. This is true both around the interaction point, and at the inner ring of the calorimeter. We agree that it is prudent for the detector group to investigate radiation-hard chips as a way of providing more margin.
4) The background monitoring systems for detector operation, and possibly for the commissioning phase, need to be addressed. The successful systems in use at CESR, and the planned systems at PEP-II, could be starting points for this.
5) The effect of the rest of the ring beyond the interaction region should be checked, although we agree that the contribution to the background is likely to be small.
6) The placement of limiting aperture collimators needs to be considered carefully to ensure that uncontrolled beam losses and beam tails are not a problem for the detector. Despite the concerns, we are impressed that the detector backgrounds are not a great concern at this stage.

E. Magnets and Installation

A large fraction of TRISTAN magnets will be reused for the HER after refurbishment. Almost all of the new storage ring magnets are in production or on order, with only a few skew quadrupoles which have not yet been ordered. The survey system for the arcs is well advanced. KEK is well equipped with magnetic measuring equipment and the schedule for magnetic field measurement and installation is well developed. The magnet transport vehicle has been delivered and tested successfully. The first magnets will be installed in the tunnel in February 1997.

Magnetic field measurements show adequate field quality on the first magnets to be delivered. In general, the Committee is strongly opposed to the use of backleg windings on the dipole magnets for horizontal orbit correction due to hysteresis effects. We recommend that their use in KEKB be carefully evaluated to see whether the disadvantages are outweighed by the advantages.

The design of the interaction region is very demanding with its unique magnets, difficult support structure, and stringent alignment tolerances. The Committee feels that this whole area needs more attention. A final, detailed layout is needed soon in order to meet the scheduled installation in March 1998.

F. Power Supplies

Observations

The number of power supplies for KEKB is 404 for bends, quadrupoles and sextupoles, 1971 for steering, and 10 for the superconducting QCS magnets in the interaction region. They must be installed in the existing buildings of the TRISTAN accelerator for which the number of power supplies was much smaller. Stability of around 1~5x10^{-4} is required for current ripple. To meet these conditions, R&D work was carried out on switched mode power supplies. Based on this successful development work, switched mode power supplies will be used for KEKB together with recycled power supplies from TRISTAN. The control system for the power supplies was also presented to the Committee. The R&D work and the progress of construction are impressive.

Recommendations
Care should be taken with the choice of the switching frequencies to avoid frequencies that are used in the instrumentation and diagnostics. This will avoid the possibility of cross-talk during machine operation.

Because a very large number of power supplies will be used, the reliability must be high and the lifetime must be long. Backup and/or replacement schemes should be considered in advance for the case of failure. A good monitoring system may be useful to detect early indications of malfunctioning.

Since KEKB magnets are used basically in DC mode, the effects of hysteresis may be more serious than in TRISTAN where energy ramping standardized the magnets automatically. The history record of magnet excitation current must therefore be made available for presentation to the operators.

G. Vacuum System

The layout of the vacuum system for the arcs of both the HER and LER has been finalized. In the case of the LER, production has started and some of the chambers are at KEK being tested and prepared for installation later this year. The production of the LER arc system is planned to be complete by June 1997; the HER arc system is scheduled to be finished by March 1998.

There have been problems with etching of the copper chambers and e-beam welding of the connection between the flanges and the chambers. These problems have been understood, and appear to be resolved. If welding from the outside is adopted, cleaning after the welding requires special care.

The effective pumping speed of the distributed NEG pump has been reevaluated, yielding somewhat lower values than anticipated. This should still be sufficient to obtain an average pressure near 10^{-9} torr, if the desired photo-desorption yields can be obtained.

The layout of the RF-shield at the bellows, which has been developed through discussion with SLAC, seems to be an excellent solution. Several of the screens have performed as expected during high current beam tests in the AR, where the temperature rise due to HOM losses has been measured.

The layout of the vacuum system in and close to the interaction region has not been studied in sufficient detail yet. As this is of vital importance for the background conditions of the BELLE detector and the technical solution may require a long time, the problem should be addressed immediately. It should be noted that the background simulation has indicated that the pressure must be held to a minimum in the LER 4-16 meters and in the HER 6-50 meters upstream of the interaction point.

H. Bunch Feedback System

The designs of the transverse and longitudinal feedback system have advanced significantly since the last Committee meeting. The changes in the design to use hybrids in the front-end electronics and two-tap filters combined with signals of two BPMs have made the system simpler and more flexible.

Beam tests of the feedback system in the TRISTAN AR in November-December 1996 were very impressive. The measured damping rates of the AR beams agree well with the calculated rates. The transverse feedback systems (horizontal and vertical) increased the maximum stored charge by a factor of about 20, which is significant. The longitudinal system was also successful in suppressing coupled bunch oscillations.

During the AR tests, several feedback components showed evidence of overheating. Even though the overheating is understood for these tests, the Committee suggests continuing the study of potential beam heating of feedback components. The beam conditions in KEKB will be more challenging, given the shorter bunch lengths of 4 mm in KEKB versus 15 mm in the TRISTAN AR.

The beam diagnostic capabilities of the feedback system with multi-bunch multi-turn data storage is a strong advantage. We encourage the continued development of feedback diagnostics as B-Factories depend heavily on robust feedback systems.

There is a strong connection between the high-power RF system and the longitudinal feedback system. Studies of potential noise sources in the high power RF system which could adversely affect the feedback operation should continue.

The DAØNE style longitudinal feedback structure is an interesting possibility for alternate longitudinal control and safety in cooling. Further investigation of the DAØNE structure is encouraged.

Finally, the instability growth rates for quadrupole modes have been calculated and are less than the radiation damping rate. However, the thresholds and growth rates should be rechecked using the new mode measurement from the RF cavity structures.

I. Linac Upgrade, Beam Transport Line and Injection System

Great progress has been made in the linac upgrade since the last review meeting:

1) The energy upgrade is going extremely well. The klystrons/modulators have been developed and modified in an economical way. The recent tests have shown that the energy gain per unit has reached about 160 MeV with SLED; an electron beam with a bunch charge of 4 nC has been accelerated to 1.1 GeV at the existing linac; and the new building for the linac upgrade is completed.
2) The positron production upgrade is under way. The tungsten target has been tested with 0.55 GeV electrons and produced a positron bunch charge of 0.022 nC and a positron production rate of 1.2%[e+/e-/GeV], a big step toward the design goal of 0.64 nC positrons and a production rate of 1.8%[e+/e-/GeV] at 3.7 GeV.

The design and construction of the beam transport line is going well:

1) The design of the energy collimation system and the emittance collimation system have been completed.
2) The design of the J-arc has been completed. All the magnets have been designed, ordered and are in fabrication.
3) The strip-line BPM system was developed, with a precision better than 0.2 mm.
4) The design of the injection system has been completed, and the prototype of the injection septum magnet is under construction.

The Committee believes that a positron accumulator/damping ring will be very helpful for positron injection, since the direct injection of positrons from the linac into the LER ring will have only marginal or even unacceptably small rates. An accumulator/ damping ring would not only improve the positron injection rate considerably, but because of the much smaller emittance beams it produces, it might also greatly reduce the radiation background at the detector during the injection process. The Committee is glad to learn that an accumulator/damping ring is being seriously considered by the KEKB team.

The impedance of the injection kicker magnet,which uses a ceramic chamber with coating on the inner surface, should be carefully evaluated, because of the possibility that it is dangerously high. If the impedance turns out to be excessive, the Committee suggests evaluating an alternative design such as that used at DESY.

J. Instrumentation

Remarkable progress was reported on instrumentation in general, especially on the most important devices - the Beam Position Monitors (BPM), the Synchrotron Radiation Monitors (SRM), and the DC Current Transformers (DCCT).

BPMs
Very impressive progress was reported on the BPM system (but see the comment on global data below). This system includes about 900 BPMs, with a resolution of <10 microns. Impedance issues have been well considered in the design and a satisfactory signal test was included in the recent AR experiments. The Committee is still concerned that the beam itself is needed to complete the system, due to the need for beam-based alignment.

SRM
Concern about resolution of the SRMs remains. Diffraction spreads the beam image to 30 - 40 microns, or 10 - 30% of the anticipated beam size. A double slit interferometer is planned for improved resolution. A pin hole camera should still be considered.

DCCT
The KEK DCCTs were successfully tested during the AR experiment and should be satisfactory for KEKB.

Commissioning
At the last meeting the Committee characterized beam loss monitors as "vital" and viewing screens as valuable for commissioning. This was in part because of skepticism about the timely readiness of BPMs and especially of single turn BPMs. The progress reported in the BPM system somewhat allayed this concern. Nevertheless, the Committee remains concerned about the diagnostics available for commissioning. Emphasis should be placed on single turn BPMs - and it would be preferable if all BPMs had single turn capability. In addition, some prototype (or even borrowed) loss monitors should be available for the commissioning period in case they are needed.

Other monitors
Work should proceed on the other monitoring systems which were not reported in detail, especially in defining those monitors which will be routinely displayed in the control room.

Abort System
The need for an abort system was discussed, and the Committee was divided. This issue needs discussion and resolution.

K. Controls

After announcing their decision to use EPICS at the last meeting of the Committee, the KEKB Controls Group has made an excellent start, as demonstrated by the use of EPICS for various aspects of the experiments recently performed on the AR. A contract has been signed with a contractor to assist with the control system development and installation, and work has begun on the installation of the network and some servers.

Some of the issues raised at the last meeting of the Committee have been addressed, and others have not.

Linac Communications

The issue of communication with the Linac Control System has been very well addressed using a Gateway, a shared control room and a shared commissioning team. Similarly, communication with BELLE is addressed using shared memory - elegant, simple and flexible. (It should be noted parenthetically that consistent with the advice to take advantage of the EPICS collaboration, the "portable channel access server," developed by the collaboration, was used for the Linac gateway).

Network

A new network architecture featuring a fast FDDI switch was presented. This should perform well, easily meet required bandwidth demands, and allow for future expansion. It also allows flexibility in the network architecture.

Dataflow

Although the network will undoubtedly meet all bandwidth requirements, a reasonable layout of IOCs (Input-Output Controllers) based upon a channel count should be developed soon. For example, underestimates of the required channels for interfacing with the RF systems have led to problems in other systems.

Manpower

As noted last time, manpower resources for control system development seems very limited. The use of "linkmen" is an excellent solution. In addition, it is critical that efficient use be made of the newly signed-on contractor. This concern was expressed last year; however, the strategy for optimally using the contractor (and local resources) is still not clear.

Development Environment

The Committee would like to reiterate the importance of including a software development environment in the system architecture. This should allow for development and testing separate from, but easily moved to, the operating system, and should include a strategy for configuration control. Nothing in the proposed architecture precludes such a capability, but it was not addressed explicitly.

Global Orbit Data

Once again, no strategy for global orbit corrections from collected BPM data was presented. Possibly the speeds required are sufficiently slow that this is not an issue.

Miscellaneous

Attention was paid to several other suggestions from the Committee. For example, no further mention was made of porting EPICS to Lynx OS, and an excellent justification was made for the selection of field buses to be used. The Committee also noted with satisfaction the linking of the EPICS Control Toolkit to the SAD accelerator physics code.

別紙 A

The Second KEKB Accelerator Review Committee Member List

Gustav-Adolf Voss	DESY	Chairman
Alex Chao	SLAC	
Dave Cinabro	Wayne	
Nikolay Dikansky	BINP	
Dave Gurd	LANL	
Andrew Hutton	TJLab	
Susumu Kamada	KEK	
Hasan Padamsee	Cornell	
Fleming Pedersen	CERN	
Wolfgang Schnell	CERN	
John Seeman	SLAC	
Dieter Trines	DESY	
Wang Shuhon	IHEP	
Fumihiko Takasaki	KEK	
Shin-ichi Kurokawa	KEK	Secretary

別紙 B

The Second KEKB Accelerator Review Program - January 23,24, and 25, 1997

January 23 (Thu)		
9:00- 9:20	Welcome address	H. Sugawara
9:20-10:00	Executive session	
10:00-10:30	Overview of KEKB accelerator and schedule	S. Kurokawa
10:30-11:00	Results of beam tests at AR	K. Akai/Y. Funakoshi
11:00-11:40	ARES development	T. Kageyama
11:40-12:20	Superconducting cavity development	S. Mitsunobu/T. Furuya
Lunch		
13:30-14:10	Crab cavity development	K. Hosoyama
14:10-14:40	Fast ion and photoelectron instabilities	H. Fukuma
14:40-15:10	IR overview	N. Toge
15:10-15:30	IR special magnets	N. Toge
Coffee		
15:50-16:10	IR superconducting quadrupole	K. Tsuchiya
16:10-16:50	Backgraound Issues	S. Uno
16:50-18:00	Executive session	
18:30-20:00	Reception	
January 24(Fri)		
9:00- 9:30	Linac upgrade	Y. Ogawa
9:30-10:00	Beam transport line	M. Kikuchi
10:00-10:30	Magnet and installation	R. Sugahara
Coffee	Coffee	
11:00-11:20	Power supply	T. Kubo/M. Yoshida
11:20-11:50	Vacuum system	K. Kanazawa
11:50-12:10	RF system	K. Akai
Lunch		
13:30-14:00	Feedback system	E. Kikutani
14:00-14:30	Beam instrumentation	S. Hiramatsu
14:30-15:00	Control	N. Yamamoto
15:00-18:00	Executive session	
18:00-20:00	Working dinner	
January 25(Sat)		
9:00-11:00	Executive session	
11:00-12:00	Closing	
12:00-13:00	Lunch	
13:00-15:30	Tour to KEKB site	