

17th KEKB Accelerator Review Report

Andrew Hutton

for the

Accelerator Review Committee

Committee Members

- Andrew Hutton, Chair JLab
- Yunhai Cai SLAC
(replacing John Seeman)
- Alexander Chao SLAC
- Oswald Gröbner CERN
- John Fox SLAC
(attended via EVO)
- Stuart Henderson FNAL
(unable to attend)
- Gwo-Huei Luo NSRRC
- Won Namkung POSTECH
- Evgeny Perevedentsev BINP
- David Rice Cornell
University (unable to attend)

- Bob Rimmer JLab
- Kem Robinson LBNL
- John T. Seeman SLAC
(unable to attend)
- Zhao Zhentang SINAP
- Frank Zimmermann CERN

Ex Officio Members

- Katsunobu Oide KEK
- Kazunori Akai KEK
- Atsushi Enomoto KEK
- Haruyo Koiso KEK

Introduction

- The Seventeenth KEKB Accelerator Review Committee meeting was held on February 20-22, 2012
- The meeting followed the standard format, with two days of oral presentations by the KEKB staff members, followed by discussion between the Committee members
- The Committee was impressed by the high standard of the presentations, which dealt with the earthquake recovery as well as the design of SuperKEKB
- It was particularly pleasing to have several presentations given by recently hired junior staff members
- The Committee evaluated the present status of the project and prepared recommendations, which were presented to the KEKB staff members before the close of the meeting

Contents of Report

- KEK Roadmap
- Recovery of Linac after the Earthquake
- Overview of Design Issues
- Overview of Construction Status
- Belle II Construction and Commissioning
- Dynamic aperture and IR modeling
- Error Tolerance and Optics Correction
- IR Magnets
- Beam Background
- IR Vacuum Chamber and Assembly
- Collision Feedback
- Magnet
- Beam diagnostics, Feedback systems
- Photon Monitors
- Beam Background
- Magnet
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- Photon Monitors
- Beam Background
- Development of New LLRF System
- Improvement of Superconducting Cavities
- Cavity for Damping Ring
- Production Status of Vacuum Components
- Baking equipment and coating equipment
- RF Gun and Low Emittance Transport
- Positron Source
- CSR in Damping Ring
- Synchrotron Injection
- Beam Abort System
- Control and Timing System

Executive Summary

- The SuperKEKB Project has made considerable progress since last year despite the massive earthquake that did considerable damage to buildings and equipment
- However, the effort applied to a rapid recovery of the linac and Photon Factory was not available to make progress on the project, so all the schedule float has already been used up
- There has been rapid progress in some areas, for example the vacuum system, with large quantities of components being delivered; this has overloaded the staff assigned to inspection and quality assurance
- In other areas, notably the Interaction Region components, the very specialized components are still being designed, and should be prototyped before going out for final order
- **The schedule is extremely tight to complete everything in the time available**

Executive Summary (cont)

- The progress in the linac area is impressive; the earthquake caused considerable damage to the linac, but the linac group managed to resume beam operations within two months
- In addition, the new linac is designed and components are on order
- Magnet refurbishment is proceeding; the wiggler magnets survived being banged together in the storage area, but it is feared that the LER Magnets did not fare as well
- Progress in the design and beam dynamics of the rings has been steady, but this is an extremely difficult machine and there are still unanswered questions

Executive Summary (cont)

- Overall, the Committee rated the **cost risk to be low** for the entire Project
- The **technical risk and the schedule risk to be low** for the Injector chain, facilities and the ring components
- The **technical risk and the schedule risk to be high** for the Interaction Region
- The Committee therefore believes that a mitigation strategy should be developed, modifying the commissioning plan to enable the project to reach T=0 on time and to advance the start of physics operation as much as possible

Recommendation 1

- Develop a back-up plan to commission the collider rings without the Interaction Region components to establish the required beam current, to carry out low emittance tuning and to approach the required vacuum by beam scrubbing of the ring
- This plan would be activated in case of delays in delivery of the interaction region components to minimize the impact to the start of the physics program

Recommendation 2

- KEK management should continue to do everything possible to ensure that the staffing needed for SuperKEKB is made available as soon as possible
- Some progress has been made by short-term and some permanent hiring, and through collaborations with universities and other institutes, but shortage of qualified staff continues to be a major risk to successful completion of the project, the commissioning and operation

Recommendations 3 & 4

- Develop a clear set of milestones for the production of the IR SC magnets and cryostats so that progress can be carefully tracked, because the Committee is concerned about the schedule risk
- Re-examine the IR Vacuum design to ensure that the vacuum required for the experiment can be obtained in a reliable way. It is also necessary to find sufficient space and accessibility for vital machine elements

Recommendation 5

- Develop, with benchmarking, the necessary simulation tools to study the various critical path beam dynamics effects affecting the SuperKEKB performance
- These simulations should include at least the 3D IR modeling, the error effects, dynamic aperture, beam-beam interaction, intrabeam scattering, and the outcome figures of merit will include the achieved luminosity, detector background, and Touschek lifetime

Recommendation 6

- Continue to aggressively pursue the timely completion of the components of the injector chain while maintaining the ability to simultaneously inject into the PF and AR
- Complete hardware demonstrations of key components and simulations with the goal of a self-consistent end-to-end description of the injection system that meets all of the requirements