

SuperKEKB ITF

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The 27th KEKB Accelerator Review Committee

International Task Force (ITF) for SuperKEKB

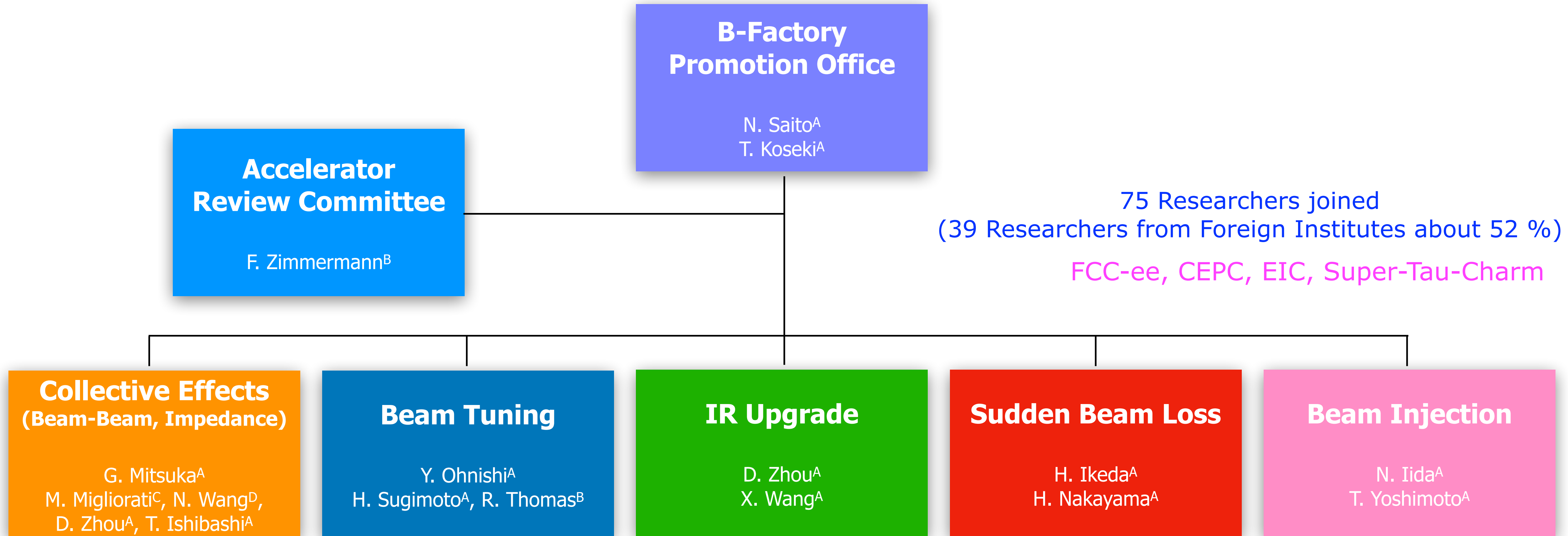


Find Realistic Path to 10^{35} cm⁻²s⁻¹ after LS1

Find Ideas to 6×10^{35} cm⁻²s⁻¹ after LS2 with Major Modifications

ITF 2023 Activities from January 2023 for 1 year

Chairperson: Y. Ohnishi



Organized under the B-Factory Promotion Office at KEK.

A) KEK, B) CERN, C) UNIROME1, D) IHEP

- Investigation of Factors Inhibiting Accelerator Performance Improvement
 - Understanding of **SBL**, Fireball Hypothesis, Collimators, **Impedance Budget**
 - Maintaining **Beam Orbit** and **Beam Optics** Corrected at Low Current (Resolving Time Fluctuation and Beam Current Dependence)
 - Beam-Beam Issues (**Beam Blowup**)
 - Understanding and Addressing **Injection Issues**
- Analysis of Data from Operation up to Summer 2022
- Strategies for Post-LS1 Operation
 - Shortest Path to $10^{35} \text{ cm}^{-2}\text{s}^{-1}$, Formulation of Machine Parameters, Safe Ways to Increase Beam Current, Squeezing β_y^*
 - Planning and Execution of Machine Studies
- Planning of Modifications for Post-LS2
 - **Large Modification of IR**

- Beam Injection:
 - Mitigation of CSR: "Canceling Optics" at Beam Transport Line Is One of the Candidates (FERMI, Italy).
 - Machine Learning Is Essential to Improve Injection Performance. APS Upgrade Is Presented.
- Sudden Beam Loss: Understanding of Physical Mechanism Is On-going. Plan of Simulating Beam-Collimator Interaction Is under Consideration (CERN)
- Beam Tuning:
 - New Method to Correct Local Coupling at IP Used at LHC, Feasibility of TBT BPMs, Stability of Cooling Water System.
- Collective Effects (Beam-Beam):
 - Strong-Strong Beam-Beam Simulations with Full Lattice: Ongoing Efforts of KEK, IHEP, and CERN
- Collective Effects (Impedance):
 - "PyHEADTAIL" Estimates Transverse-Mode-Coupling Instability (TMCI) Threshold Is ~ 1.8 mA/bunch. Introducing a Non-Linear Collimator System Will Raise the Threshold to ~ 2.1 mA/bunch.
- IR Upgrade:
 - Understanding Challenges in IR Optics for Upgrade among International Teams
 - Synergy with European Teams under the Support of EAJADE (F. Zimmermann)

ITF Future

- Developmental Reorganization. “ITF” to “International Working Group” (Tentative)
- Chairpersons of the Activity: 3rd, 4th, and 5th Division Head
- Compiles the Activities of International Cooperation Related to SuperKEKB.
 - Beam Tuning and Operation
 - Sudden Beam Loss (SBL)
 - Beam-Beam Interaction and Collective Effects
 - Beam Instrumentation
 - Future Upgrade
 - Each Working Group Is the Main Activity.
- On-Site Workshop (In Person and Remote)
- Activities and Results will Be Reported in the ARC.

- INDICO: <https://kds.kek.jp/category/2242/>
- "Mattermost": Information Sharing Business Chat Tool (<https://skb-itf-chat.kek.jp>)

Appendix

Beam Tuning Subgroup

- **February 14 2023: Beam Tuning (1)**
 - Issues to Be Discussed (Y. Ohnishi)
 - Brief Introduction of SuperKEKB Lattice (Y. Ohnishi)
- **March 14 2023: Beam Tuning (2)**
 - SuperKEKB Optics Measurements and Corrections (H. Sugimoto)
 - IR Coupling Correction in the LHC with Waist Shift (F. Soubelet)
 - Status of Turn-By-Turn Measurements in SuperKEKB (J. Keintzel)
- **April 19 2023: Beam Tuning (3)**
 - Vertical Fast Collision Feedback at SuperKEKB (H. Fukuma)
 - IP Orbit Control System and Operation (R. Ueki)
 - Continuous Closed Orbit Correction (CCC) and Orbit Stability (Y. Ohnishi)
- **September 19 2023: Beam Tuning (4)**
 - Beam Orbit Issues (H. Sugimoto)
 - Synchrotron Radiation at IR (M. Kikuchi)
 - IR Orbit (Y. Ohnishi)
 - Plan of Commissioning in 2023c and 2024a (Y. Ohnishi)

Beam Injection Subgroup

- **March 2 2023: Beam Injection (1)**
 - Injection Status and Issues (N. Iida)
 - Injection and Lifetime (Y. Funakoshi)
 - Injector Linac (M. Satoh)
- **April 4 2023: Beam Injection (2)**
 - Incoherent and Coherent Synchrotron Radiation in the SuperKEKB Electron Beam Transport (Y. Yoshimoto)
 - Measurement of Possible Long-Range Wake Field Effects of Primary E-Beam with 10nC/Bunch (T. Natsui)
 - Jitter Emittance in the Linac (N. Iida)
- **June 14 2023: Beam Injection (3)**
 - Lessons Learned From the FERMI DEL Zone (S. D. Mitri)
 - Theoretical Explanation of CSREffect on Emittance Growth Suppression with Vertical Bump Orbit (T. Mori)
- **September 27 2023: Beam Injection (4)**
 - ML-Based Optimization at APS and Plans for APS-Upgrade (N. Kuklev)
 - Machine Learning-Assisted Beam Tuning at Linac and SuperKEKB (G. Mitsuka)
 - 2023-2024 Linac, BT, SuperKEKB Operation Plan (N. Iida)

Sudden Beam Loss Subgroup

- April 7 2023: SBL (1)
 - Electron Cloud at Collimator (Y. Suetsugu)
 - Simulation of Electron Cloud Buildup at Collimators by the Modified CLOUDLAND (H. Fukuma)
 - Acoustic Wave Observation for Collimators (T. Abe)
- June 30 2023: SBL (2)
 - BOR Timing Analysis for Sudden Beam Loss Aborts (M. Aversano)
 - Simulation of Electron Cloud Buildup at Collimators by the Modified CLOUDLAND --Offset Beam-- (H. Fukuma)
 - The 1st Result of Beam Simulation for the Fireball SBL Hypothesis (T. Abe)

Collective Effects Subgroup

- Feb. 6 2023: Collective Effects (1)
 - Opening Remarks and Issues to Be Discussed (Y. Ohnishi)
 - Scope of Work in 2023 (G. Mitsuka)
- Feb. 7 2023: Collective Effects: Beam-Beam (2)
 - SCTR-CUDA (K. Ohmi)
 - Computation of Complex Error Function, Comparison of Accuracy and Speed (D. Shatilov)
- March 24 2023: Collective Effects (3)
 - FCC-ee Collective Effects (M. Migliorati)
 - Impedance Modeling and Single-Bunch Collective Instability Simulation for the SuperKEKB Main Ring (T. Ishibashi)
- June 1 2023: Collective Effects: Beam-Beam (4)
 - Beam-Beam Mode Coupling (K. Ohmi)
 - Beam-Beam Simulation for Post-LS1 Target Luminosity 10^{35} (D. Zhou)
- July 7 2023: Collective Effects (5)
 - IHEP and CEPC Activities on Collective Effects (N. Wang)
 - Summary of Bunch Length Measurements at KEK (G. Mitsuka)

IR Upgrade Subgroup

- **Feb. 17 2023: IR Upgrade (1)**
 - Opening Remarks (Y. Ohnishi)
 - Overview of SuperKEKB IR (K. Shibata)
 - Discussion on Tasks/Goal of ITF-IR Subgroup (D. Zhou)
- **March 7 2023: IR Upgrade (2)**
 - A Proposal for the Upgrade of the Final Focus System of SuperKEKB (M. Koratzinos)
 - Final Focus Beam Dynamics Studies (P. Raimondi)
- **March 28 2023: IR Upgrade (3)**
 - Current QCS Magnet System (Y. Arimoto)
 - Constraints on Investigations of SuperKEKB IR-Upgrade Under the ITF-IR Framework (D. Zhou)
- **April 18 2023: IR Upgrade (4)**
 - Beam-Induced Background Status and Expectation in Belle II (A. Natochii)
 - Dynamic Aperture for Crab Waist in LER (Y. Ohnishi)
- **May 23 2023: IR Upgrade (5)**
 - Comments on Detector Constraints on IR Design (F. Forti)
 - Tentative Parameter Table for Post-LS2 SuperKEKB and Strategy for ITF-IR Workgroup (D. Zhou)