

B-factory Programme Advisory Committee

Short Report for Focused Review Meeting

24-25 September 2024, Remote meeting

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Short Summary

A focused review meeting of the B-factory Programme Advisory Committee (BPAC) took place remotely on 24th and 25th of September, where the committee heard presentations from the accelerator and Belle II groups. This short report gives the committee's feedback on the four questions asked by the management of the Institute of Particle and Nuclear Studies. A detailed report on the broader findings of the committee will be described in a separate document.

1. Optimisation of Short-Term Run Plan: Is the current short-term run plan effectively optimised to meet the immediate needs of data collection and machine performance improvements?

The committee considers the sudden beam loss phenomena as currently the most critical issue. Therefore, it supports the plan giving priority to the machine study and development to overcome the problem of sudden beam loss, while operating the detector in a safe way against radiation damage. Once flipping some of the beam pipe sections with electrodes and knocking of the beam pipe show improvement, increasing the beam currents that is mandatory for achieving higher

luminosities could become more feasible. Reaching a luminosity of $10^{35}\text{cm}^{-2}\text{s}^{-1}$ during the coming run period would be an important target. Evaluating different strategies with the increase of beam currents and decreasing β^* might be useful depending on the machine behaviour. The committee supports the plan to flip the remaining beam pipe sections with electrode as much as possible during the coming shutdown periods. Injection efficiency and stability are key elements for achieving not only high instantaneous luminosities but also high integrated luminosities. The machine group has already been introducing many hardware improvements for stable operation of the injector chain, and the committee strongly encourages this effort to continue. Solving the problem of emittance increase and achieving efficient two-bunch injection are among the priority items. All those efforts could benefit from having an organisational structure with clear authority for defining priorities and further consulting experiences from other accelerators. Having such an organisation could also help to obtain the required resources and expertise.

- 2. Belle II Contribution to SuperKEKB Operations: Is the contribution of Belle II to the operation of SuperKEKB well organised? Are there specific areas where Belle II's contributions could be enhanced? If so, what suggestions can be made?**

The committee finds that the machine group and Belle II collaboration have been working together very well. The Belle II team contributes significantly to the hardware and analysis effort to improve the machine operation to achieve the luminosity goal with an acceptable background level. A particularly important area where the joint effort could be strengthened is to develop further ways to detect the start of beam instabilities resulting in sudden beam loss and abort the beams as quickly as possible.

- 3. Detector Operation Concerns: Have all issues and concerns related to the operation of the Belle II detector been appropriately addressed?**

The overall status of the Belle II detector is good. The detector should be able to collect data with the quality needed for the physics goals in the coming run. Concerning PXD2, the committee supports the decision to keep it switched off until the sudden beam loss phenomenon is under control. At the same time, the PXD group should establish beam condition criteria for switching the detector on and develop scenarios for its operation once it is switched on, optimising for the detector safety and physics output. The committee stresses again the importance of retaining crucial technical knowledge of departing personnel. The CDC team should continue the effort to establish a clear picture of the gain loss due to the beam background. This will affect the upgrade strategy of the Belle II tracking system.

- 4. Physics Analysis Planning: Are the plans for physics analyses well-structured and on track to achieve significant results in time for the upcoming winter conferences?**

The Belle II collaboration has been successfully producing interesting results ex-

ploiting the unique features of the experiment. The committee appreciates the state of analysis activities, planning and organisation as satisfactory, and is confident that further interesting results will emerge for the forthcoming winter conferences.

The committee congratulates the accelerator group and Belle II collaboration on their achievements and for maintaining the successful data taking at the highest luminosity e^+e^- collider. It must be stressed that providing an adequate running time in the coming years is crucial for the Belle II experiment to remain competitive.