

B-factory Programme Advisory Committee
2019 Annual Review Meeting
Short Summary

11–13 February 2019 at KEK

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21 February 2019

Short Summary

An annual meeting of the B-factory Programme Advisory Committee (BPAC) took place from 11th to 13th of February 2019 at KEK, with presentations covering all aspects of the status for the Belle II experiment, including strong and successful ongoing analyses of Belle data. This document is a short summary focusing only on the most important issues and a complete report will follow soon.

The Belle II experiment is about to start the Phase 3 run for physics. There have been impressive achievements toward understanding the machine backgrounds with the Phase 2 data. However, there are still backgrounds that cannot be reproduced by the simulation and their origins have not yet been identified. Further studies to determine the individual background sources are encouraged in order to improve the understanding of the SuperKEKB machine. For Phase 3, new masks against synchrotron radiation have been introduced, as well as additional collimators, and extra diamond sensors have been placed around the interaction region. These sensors will carefully monitor the background and will be used to protect the experiment. However, given that the Belle II detector is equipped with the full first layer of pixel sensors located very close to the beam, the Phase 3 commissioning must proceed very carefully. The close collaborative work with the machine group established during the Phase 2 run should continue and be strengthened for Phase 3. The Belle II collaboration should remain prudent in order to avoid damaging the detector in this critical phase.

There is not much time between the start of Phase 3 and the summer shutdown. A very interesting set of measurements has been identified for presentation at the summer conferences. The plan for detector commissioning, including calibration, and for data taking may require careful optimisation and prioritisation in order to achieve those measurements.

The committee was pleased to see that the Vertex Detector system (VXD), although the second layer of the Pixel Detector (PXD) is only partially equipped, is now installed and ready for data taking. Testing the capability of the VXD for taking data at the nominal rate, including gating for the PXD, is now important. The present PXD will be replaced by a new one with two fully equipped layers during the long shutdown in 2020, at the earliest. A detailed planning for the construction of the new PXD shows that the group is making good progress. However, the work must be carefully monitored to ensure the timely completion of the detector.

While the Central Drift Chamber (CDC) is now ready for Phase 3, an occasional high dark current in some outer layers is a serious concern. The committee welcomes the creation of a task force of experienced members of the Belle II collaboration to deal with this problem. For the Phase 3 startup, a set of systematic and structured step by step approaches should be devised addressing different possible causes for the problem. Gas detector experts outside of the collaboration, including those from BPAC, should also be consulted to set up this programme and to analyse the results. In parallel, the committee recommends that the collaboration set up a team who should construct a small test chamber with exactly the same material to observe the long term behaviour of the chamber.

The barrel particle identification system (TOP) has been operating reliably. Particular care should be taken to monitor that the bar boxes and DAQ operations remain stable. The case for the wrong starting time (T_0) for the propagation time measurement must be understood. Preparations for replacing radiation damaged photon detectors (the non-ALD MCP-PMTS) during the long shutdown in 2020, at the earliest, is progressing well. Although the photon detectors might last longer than currently anticipated, depending on the actual background level, the preparation work should be carried out as planned assuming the 2020 date. The ARICH end-cap particle identification system cooling issue has been resolved. Although some more work is required to complete the full system, the required steps seem to be well understood and the committee sees no particular concern for attaining good operation in Phase 3.

While, the Electromagnetic Calorimeter (ECL) is ready for Phase 3, the committee is concerned about the status of the K-Long Muon detector (KLM). Integration of the barrel and end-cap KLM teams to work as a single group seems to be working well. But the overall human resources seem to be still scarce. The well functioning KLM, including its trigger, is essential for the physics programme planned for the early period of Phase 3. The KLM group, together with the Belle II management, is encouraged to carefully examine and prioritise commissioning tasks in light of the detector elements needed most for the first physics results.

Although not all the subsystems are ready to provide trigger primitives, the overall trigger is adequate for the physics goals of Phase 3.

Experiments cannot operate without well functioning online and control systems, even if all the subsystems are working well. The committee is glad to observe all the elements for the control and online systems are in place. On the other hand, the committee feels that the overall system is in a fragile state. Operation with the complete Phase 3 detector at nominal rate is still to be demonstrated. Although improvements have been made to increase the core group members, the work still relies on a small number of experts. The committee has already suggested deployment of technical support personnel who would take care of the computing and electronics infrastructure. Another important step is to enlarge the online group by recruiting not only experienced people but also early career people to guarantee long term support of the system and to explore modern working practices, commonly used by large scale experiments, for the development and deployment of the system. Using some of the maintenance and operation funds for supporting people at KEK should also be considered. While the high workload of the central online team is readily acknowledged by the committee, the team is urged to keep paying attention to the needs of the sub-detector teams for their commissioning work.

The physics software is now in a good shape. All the important elements of the offline computing infrastructure are steadily making good progress. The committee thinks that the computing team should now shift their attention to the robustness of the complete chain from the raw data storage to the physics analysis. Operation must be automated as much as possible for ensuring smooth running. The committee recommends introduction of Rucio-based distributed data management for long term sustainability, although the changeover of the system should not disrupt data taking.