Resource Justification

1. Resource request summary

This section provides a justification for the computing resources required by the Canadian group in the Belle II high energy physics (HEP) experiment situated in the KEK Laboratory in Tsukuba, Japan. A description of the scientific motivation, the team, its role in the training of HQP and the resource request were given in the Strategic Plan document. In this document, we present our 2018-2020 request and a long-term outlook.

The resource estimates have been generated by the Belle II Collaboration. Canada fraction of the computing is approximately 5%, based on the size of the Canadian group. An international Memorandum of Understanding (MOU) between the international partners in Belle II is currently under review and expected to be signed by many countries in 2017 and 2018.

Resource Type	**Year 1 FY2018**	**Year 2 FY2019**	**Year 3 FY2020**
Storage (TB)	100 disk	400 disk	800 disk
Compute Cloud (VCPU) (core-years)	500	800	1000
CC Support (Y/N)	Y	Y	Y

The Belle II Canada group is requesting 500, 800 and 1000 core-years of cloud computing resources from Compute Canada in 2018, 2019 and 2020, respectively. One compute core is estimated to be 15 HEPSpec06 units. Currently we use the cloud resources in Victoria and Sherbrooke.

We are requesting 100 TB in 2018 increasing to 800 TB in 2020 of disk storage. The storage needs to be configured within a WLCG Storage Element (as is provided today) though we starting to use object storage systems with a data federation (developed in our CFI Cyberinfrastructure project).

The experiment will begin recording collision data in 2018 and intiially the raw data will be stored at the KEK Laboratory in Japan and a second copy at the Brookhaven National Laboratory (BNL). In 2021, Canada and other countries are expected to store and process a fraction of the raw data (the size of the raw data set is estimated to be 30 PB by the end of 2021). Canada is expected to store approximately 3 PB in 2021. Currently, the Canadian raw data assignment is estimated to be 5, 7 and 10 PB for 2022, 2023 and 2024, respectively. The storage of critical raw data is oftened refered to as Tier-1 type computing by the HEP community. Compute Canada was unable to provide the compute resources for the ATLAS-Canada Tier-1 facility and a separate CFI application was submitted. We request feedback from Compute Canada on whether the Belle II Canada group must also find independent funding for its Tier-1 computing.

We currently run 8-core VMs with 16-24 GB of RAM and local cache fast storage (250-500 GB). We assume that Compute Canada will continue to run clouds using the OpenStack software. We starting to run data-intensive applications and we will require gigabit/second connectivity to each VM instance.

The use of the resources will be constant with the occasional idle period. Our system is designed for opportunistic use and we can make use of idle resources in a dynamic manner.

High-speed network access from the cloud nodes to the storage systems is extremely important (10 gigabit/second to nodes with 8 or more cores) and 100 gigabit/second external network connectivity is essential.

It is critical that we retain the access to the Compute Canada WLCG and cloud expertise.