

# Computing for experimental particle physics

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The Institute of High Energy Physics in Vienna is studying particle physics at three frontiers of research: As a member of the CMS experiment at the LHC Collider at CERN it participates in the search for new phenomena in high energy collision, as a member of the Belle experiment at the SuperKEKb in Japan it is performing precision studies in the area of heavy quark physics and as a member of the CRESST Collaboration it looking for signs of Dark Matter in nuclear interactions. From this activities arise diverse requirements for computing, some of them very demanding.

In particular, the large collaborations at LHC have established a worldwide network of computing centers, the WLCG Grid. As of today it connects 170 computing centers in 4 countries, runs over 2 million tasks run every day using 1 million computer cores and has about 1 exabyte of storage. To participate in these experiments, it is required that Austria contributes some resources according to the relative size of the community. On the other hand, the Austrian Scientists can profit from access to the remote resources. While the paradigm of grid computing is an excellent fit for this community, the development has continued in other science fields. This requires that one needs to explore the coexistence of the grid model with other paradigms, as HPC computing and also Clouds.

For particle physics the resource requirements are rapidly growing. New developments, as the start-up of the B factory in Japan or upcoming High Luminosity LHC, results in a growth, that exceed Moor's law. To satisfy the needs it has been necessary to extend the use of resources not only on classical grid computing centers, but also on Cloud resources and HPC facilities.

In Austria, we try to address this need in a common project with the life science institutes of the Austrian Academy of Sciences. For a small county - as Austria - such collaborations are obligatory when trying to establish a sustainable solution. Currently, work is ongoing to implement the particle physics analysis system on the flexibly computing stack provided by the CLIP environment (see the separate talk by our colleagues). In a first phase, this will allow us to move the grid-based computing environment into the settings of a HPC facility. The facility will allow us also to provide access to computing resources using portals and services. New requirements arise also from the increasing demand from our Machine Learning community, that requires not only access to the data but also to GPU resources (see a separate talk).

The Technical University and the VSC is a partner in the project. We hope that the experience of establishing multidisciplinary data facility with a flexible HPC model will provide valuable contributions for the development of sustainable computing solution for data intensive sciences in Austria.