IFERC Newsletter

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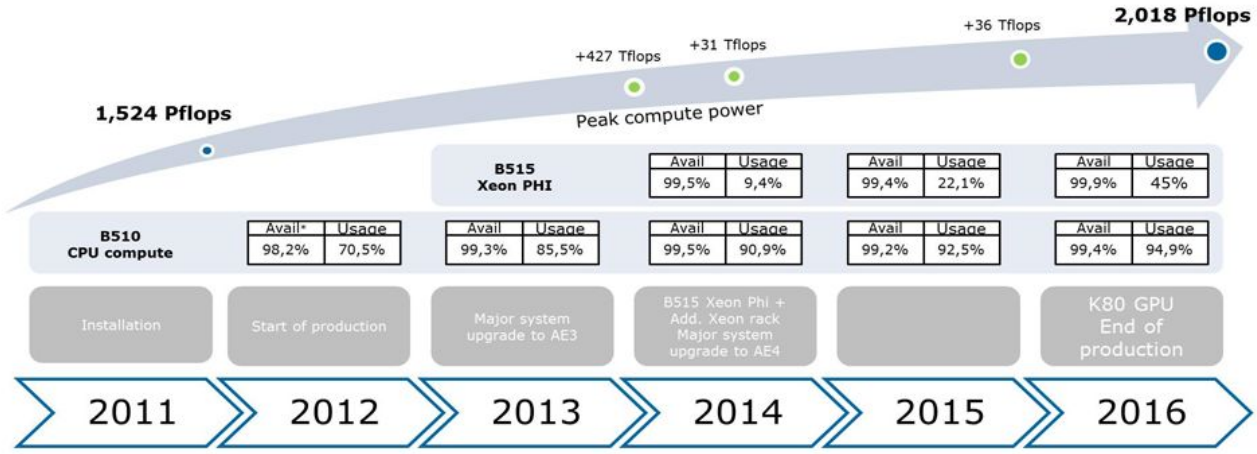
International Fusion Energy Research Centre, Rokkasho, Aomori 039-3212, Japan

CSC

Final Report of CSC Activity



Evolution of the Helios configuration overtime

The Computational Simulation Centre (CSC) was established in the IFERC Centre in Rokkasho, and has provided to the EU and Japan fusion communities a state-of the art supercomputer and free operation and support for five years, between 2012 and 2016.

The CSC activities have now been completed, and the Final Report has been submitted to the IFERC PC and will be edited as a glossy brochure for the all stakeholders in Broader Approach.

A summary of the tasks performed by the IAs and of the achievements of the CSC is given below.

The main tasks of the European Implementing Agency (F4E, and CEA on its behalf, through a contract with ATOS/Bull) were to procure the supercomputer – called Helios, the peripheral equipment and to provide the associated operation and maintenance. The main tasks of the Japanese Implementing Agency were to prepare the building and services, the cooling system, and to contribute to the seamless integration of the IT equipment and services, in particular by providing support to the users. The operation and day-to-day service was performed by the integrated project team, including members of the central Project Team, the Implementing Agencies, their associates and suppliers. The tasks of selecting computational projects, assigning computer resources, and evaluating the scientific output was given to a group of independent scientists representing the EU and Japanese fusion communities.

The CSC project has been a success from all points of view:

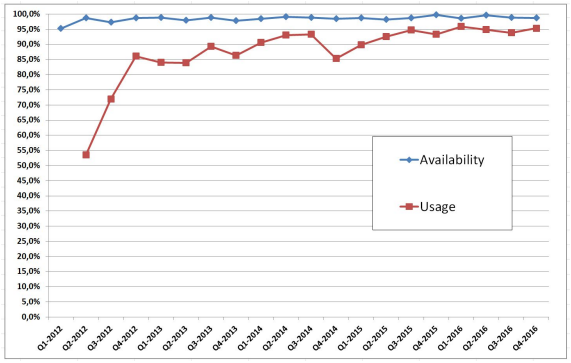
- The Helios supercomputer has demonstrated an excellent availability, exceeding 98% of the planned production time;
- Helios has demonstrated excellent performance, thanks to the precise tuning with fusion benchmark codes during the procurement phase, and the careful scheduling and operation performed by the operation team;

The Helios Supercomputer

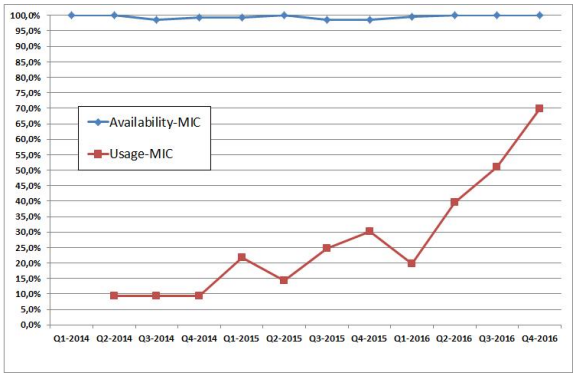
- The CSC has demonstrated that establishing a supercomputer centre in a remote location with different time zones for users posed no problem once a series of good practices were established;

indeed the users have repeatedly expressed a high level of satisfaction in various surveys;

- The CSC centre has pioneered a number of practical solutions to administrative issues (e.g. local taxation, export control, work of European contractors in JA sites) which have then been adopted by the other BA projects;
- The procedures established for the selection of projects by an independent expert group proved to be fair and satisfactory, combining the respect of the provisions established in the BA agreement regarding the sharing of computer-time between Europe and Japan with a solid commitment to scientific excellence through a peer review process;
- The CSC organised regularly training sessions, both in Europe and in Japan, that were well received by the users. These sessions covered basic training – to learn about the CSC environment, and webinars on specific topics or tools for advanced users;
- By installing in the later stages of operation novel processors with accelerators, the CSC provided the fusion community users with an opportunity to adapt their codes to the future generations of supercomputers; specific training sessions explaining how to adapt existing programs to these new technologies were organized;



Usage and availability of the Intel Xeon partition



Usage and availability of the Intel Xeon Phi partition

Regarding the scientific results,

- The Helios numerical simulations projects covered all key fusion research areas, including large scale plasma physics simulations as well as support for the development of fusion technologies;
- The availability of better computational capabilities allowed extensive and detailed comparisons with experiments such as the JET, JT-60U, DIII-D, ASDEX-Upgrade, MAST, Tore Supra and FT2 tokamaks, and the W7X, LHD, Heliotron J, TJ-II stellarators, together with predictive simulations of future devices such as JT-60SA and ITER; and the inclusion of more sophisticated models.
- These new extended models enlarged the validity domain of the simulations to higher plasma pressure with applications to both Tokamaks and Stellarators. These studies were accompanied by the development of novel numerical techniques that were extensively tested on Helios, which improved significantly the accuracy and efficiency of the simulations.
- The majority of computational resources were devoted to plasma turbulence simulations, but fast particles, plasma edge physics, disruptions, MHD calculations, heating and current drive, and all aspects of plasma physics were represented.
- Computer resources dedicated to DEMO materials calculations increased after the early operation period, and a significant number of simulations to solve ITER design issues (e.g. neutronics) were also carried out.
- The ratio of the number of peer-reviewed papers in three fields; physics, technology including materials, and ITER-oriented research is about 70%, 20% and 10%. This ratio does not change so much from the 2nd cycle to the last 5th cycle.
- The overall very good performance has resulted in a very high number of peer-reviewed papers. To date, 639 peer-reviewed papers have been accepted or published in major scientific journals.

Finally, besides excellent technical results, the CSC has promoted excellent relationships between the HPC and the modelling communities in Europe and Japan.

Closing ceremony of IFERC/CSC

(CSC Integrated Project Team)