

# The Advanced Computing Hub at BSC: improving fusion codes following the principles of EUROfusion standard software

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In the European Research Roadmap to the Realisation of Fusion Energy [1], there is a need to accelerate the understanding and predictive capabilities of simulation models to guide ITER [2] operation and DEMO [3] design. A key factor to achieve this milestone is the production of a high-quality suite of research codes called EUROfusion-standard software to model data from existing EUROfusion facilities and to reliably extrapolate to these future devices. EUROfusion-standard software [4] is basically a common development platform following modern software engineering standards that will benefit EUROfusion users with free availability of up-to-date release versions of the research source codes to be used for production runs.

To enable large-scale numerical simulations, several Advanced Computing Hubs (ACH) [4] provide essential expertise and support in developing a suitable portfolio of EUROfusion standard software codes. In particular, these centres will provide expert support to users under three categories: 1) High-Performance Computing working in scalable algorithms, code parallelization, performance optimization, code refactoring, and GPU-enabling, among others; 2) Integrated Modelling and Control working in code adaptation to IMAS framework; and finally, 3) Data management developing open access to data and data analysis tools.

Barcelona Supercomputing Center (BSC) is one of the ACH involved in this complex task. Several fusion codes were selected, installed and analysed in order to meet the developers' requirements, ranging from portability to GPU, improving the performance, getting better data management, extending the capacity of coupling with other codes, etc. In this presentation, we will describe the work developed by BSC and some of the tasks that are carried out. We will explain briefly how the project is faced and the amount of work required to create good quality codes, i.e. robust and trustable software capable to run efficiently in many HPC systems.

## References

[1] <https://www.euro-fusion.org/>

[2] <https://www.iter.org/>

[3] Ciattaglia S. et al. "The European DEMO fusion reactor: Design status and challenges from balance of plant point of view". EEEIC / I&CPS Europe, (2017).

[4] Litaudon, X et al. EUROfusion-theory and advanced simulation coordination (E-TASC): programme and the role of high performance computing. Plasma Physics and Controlled Fusion, IOP Publishing, (2022)