How EUROfusion Advanced Computing Hubs leverage high-performance computing to accelerate research and engineering in nuclear fusion

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Abstract

Within the framework of the EUROfusion consortium, the Advanced Computing Hub HPC centers of excellence actively engage in enhancing existing European fusion simulation codes. This effort is geared towards enabling researchers to fully harness the enhanced capabilities offered by the latest generations of supercomputers. These simulation codes are specifically designed for modeling plasmas within tokamaks and stellarators in order to accelerate the design of fusion experiments, such as ITER and JT-60SA, as well as the DEMO demonstration power plant.

Our presentation outlines the overarching strategy that the EPFL ACH has adopted for porting multiple fusion research codes onto GPUs (Graphics Processing Units). In particular, we focus on an approach which centers on maintaining a single codebase by employing unified OpenACC or OpenMP directives in order to achieve performance portability across diverse hardware architectures, including NVIDIA, AMD and Intel GPUs, while ensuring compatibility with various compilers.

To provide concrete insights into the depth of our strategy, we showcase results obtained using multiple fusion codes across various European supercomputing platforms.