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The Critical Importance of Software for HEP

Particle physics has an ambitious and broad global experimental programme for the coming decades. Large investments in building new facilities are already underway or under consideration. Scaling the present processing power and data storage needs by the foreseen increase in data rates in the next decade for HL-LHC is not sustainable within the current budgets. As a result, a more efficient usage of computing resources is required in order to realise the physics potential of future experiments. Software and computing are an integral part of experimental design, trigger and data acquisition, simulation, reconstruction, and analysis, as well as related theoretical predictions. A significant investment in computing and software is therefore critical.

Advances in software and computing, including artificial intelligence (AI) and machine learning (ML), will be key for solving these challenges. Making better use of new processing hardware such as graphical processing units (GPUs) or ARM chips is a growing trend. This forms part of a computing solution that makes efficient use of facilities and contributes to the reduction of the environmental footprint of HEP computing. The HEP community already provided a roadmap for software and computing for the last EPPSU, and this paper updates that, with a focus on the most resource critical parts of our data processing chain.

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