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# Large scale computing for designing plasma-based particle accelerators

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Plasma accelerators can enable accelerator based applications at the university campus or large hospital level thanks to their reduced footprint and relatively low acquisition and operation costs. Their operation is described by the Vlasov-Maxwell equations coupled to the Lorentz force equation, so that their design requires solving of a system of highly non-linear partial differential equations; moreover, the physical problem is multi-scale (cm to 10s of um). Baseline configurations can be obtained by reduced physics models running on desktops, but the complete study of jitters and instabilities need running fully 3D Particle In Cell (PIC) codes. These runs may require up to 10^5 - 10^6 hours/core and produce terabyte of data; hence the need for large scale computational farms, efficient algorithms and dedicated storage. In this contribution, we showcase a selection of simulation codes and the result of their application to the EuPRAXIA and EuAPS projects.

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