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Systematic reduction of lattice complexity through variant minimization

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The design of an accelerator system requires translating the lattice into an engineering design model from which the machine can be built, fulfilling the requirements of beam dynamics and from mechanical engineering. To achieve this in an efficient manner, a systematic and manageable iterative design process has been established, which ensures consistency between the lattice and the mechanical model and enables a fast translation of the calculated lattice into a CAD model with correctly placed components within one day through the use of newly developed automation tools. An analysis process of the lattice, a highly modular CAD structure focused on maximal reuse, and strategic variant management together minimize the number of variants necessary. As a result, design, manufacturing and logistics efforts are significantly reduced. This approach establishes a fundamental toolkit. It ensures the traceable integration of physics and engineering requirements throughout the system design process of PETRA IV, the planned next-generation synchrotron light source at DESY.

Footnotes

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