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## SciBmad: A full-featured ecosystem for modern, differentiable accelerator physics simulations

*Thursday, 3 October 2024 15:00 (20 minutes)*

SciBmad is a new, open source software project that will provide a modern, differentiable, and full-featured toolkit for all types of accelerator physics simulations and design tasks. A set of modular, extensible packages providing all the fundamental tools needed for accelerator physics simulations is currently being developed in the Julia programming language. Julia is a relatively new high-level, high performance computing language that adopts multiple dispatch with just-in-time (JIT) compilation as a central paradigm, and includes a powerful type system providing universal, ad-hoc, and subtype polymorphisms; such features drastically simplify the code, and enable automatic differentiation of type-agnostic code with zero extra effort. Furthermore, users instantly have access to the entirety of Julia's rich ecosystem of optimizers, integrators, machine learning toolkits, plotting packages, etc. SciBmad will include, in a fully-differentiable environment, all features currently in present Bmad (fully nonlinear tracking, normal form analysis including spin and radiation, and multipass lattices to name a few), and significantly more capabilities, including GPU-parallelized particle tracking and machine learning. In this work we detail the current status of SciBmad development and plans for the future.

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