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Generalized gradient map tracking in the Siberian snakes of the AGS and RHIC

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Accurate and efficient particle tracking through Siberian Snakes is crucial to building comprehensive accelerator simulation model. At the Alternating Gradient Synchrotron (AGS) and Relativistic Heavy Ion Collider (RHIC), Siberian Snakes are traditionally modeled in MAD-X by Taylor map matrices generated at specific current and energy configurations. This method falls short during ramping due to the nonphysical jumps between matrices. Another common method is to use grid field maps for the Snakes, but field map files are usually very large and thus cumbersome to use. In this work, we apply a new method called the Generalized Gradient (GG) map formalism to model complex fields in Siberian Snakes. GG formalism provides an analytic function in x and y for which automatic differentiation, i.e. Differential Algebra or Truncated Power Series Algebra can find accurate high order maps. We present simulation results of the Siberian Snakes in both the AGS and RHIC using the Bmad toolkit for accelerator simulation, demonstrating that GG formalism provides accurate particle tracking results.

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Footnotes

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