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Snake matching in the EIC's hadron storage ring

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Pairs of Siberian Snakes allow the avoidance of first-order spin resonances during energy ramping in storage rings. Nevertheless, different combinations of multiple snakes lead to different higher-order resonances for the same bare ring. Finding an optimal combination of snakes is referred to as snake matching. Symmetries of the ring can be used to find optimal snake combinations that minimize first-order spin-orbit coupling integrals. In particular, for a 3-fold symmetric ring such as the HSR, 12 snakes are sufficient and their axes can be specified analytically. For a smaller number of snakes, the best snake combinations must be found by numerical optimization. While a 3-fold symmetric model is appropriate for RHIC and the HSR, 12 snakes seem excessive and numerical snake matching has therefore been performed with 6 snakes. We show the suppression of the strongest first-order resonances by varying the orientation of the snake axes in the horizontal plane and by optimizing the betatron phase advance in the arcs. Our 7-dimensional optimization leads to the weakest resonance structure using a variety of metrics and optimizes the polarization transmission.

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