Accumulator Ring Beam Optics

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Abstract – With ongoing developments in High Energy Physics (HEP), a Proton Accumulator Ring (PAR) is being proposed for an upgrade to the Accelerator Complex at Fermilab in order to create more opportunities for new experiments within the next decade. The location and design of the ring presents many challenges, but with the use of accelerator design software these can be negated. The design of the ring was developed with the use of a particle tracking software, Methodical Accelerator Design (MAD), which allows construction and simulation of optical elements within beam-lines or accelerator rings. Adjustments are made by integrating optical elements within the lattice of the accelerator, allowing for a study of the dynamics of the beam after invoking a tracking module. This provides the ideal constraints necessary to build a working particle accelerator. Similarly, initiating the Twiss module provides the parameters describing the dynamics of the beam. In particular, the Courant-Snyder (or Twiss) parameters $\beta_x^{1/2}$ and $\beta_y^{1/2}$ is related to the beam size at a given moment. Using MAD-X, the appropriate Twiss plot describing the beam through PAR is obtained by invoking the module.