THE PATH TO IDEAL HIGH-INTENSITY BEAMS IN ALTERNATING-GRADIENT FOCUSING SYSTEMS*

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A persistent challenge in high-intensity accelerator design is the optimization of matching conditions between a beam injector and a focusing system in order to minimize non-laminar flows, envelope oscillations, emittance growth, and halo production. It has been shown [1] that the fluid motion of a thin space-charge dominated beam propagating through a linear magnetic focusing channel consisting of any combination of uniform or periodic solenoidal fields and alternating gradient quadrupole fields can be solved by a general class of corkscrewing elliptic beam equilibria. The present work extends this discussion to asymmetric PPM focusing and derives conditions under which a uniform density elliptical beam can be matched to such a focusing channel by considering the fluid equilibrium in the paraxial limit. Methods of constructing such a beam are also discussed, with particular attention devoted to analytic electrode design for Pierce-type gun diodes of elliptical cross-section. A case of special interest for heavy-ion fusion applications is the realization of an ideal KV beam in an AG focusing channel.

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1. C. Chen, R. Pakter, R. Davidson, "Ideal Matching of Heavy Ion Beams," *Nucl. Inst. And Methods,* **A 464** (2001) p. 518-523.