BEAM CONTROL AND MATCHING ON THE UNIVERSITY OF MARYLAND ELECTRON RING (UMER)*

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The transport of intense beams for heavy-ion inertial fusion demands tight control of beam characteristics from the source to the target. The University of Maryland Electron Ring (UMER), which uses a low energy (10 keV), high current ($\sim$100 mA) electron beam to model the transport physics of a future recirculator driver, employs real time beam characterization and control in order to optimize beam alignment and envelope matching throughout the strong-focusing lattice. We describe in this paper the main components and operation of the diagnostics/control system in UMER, which employs phosphor screens, real-time image analysis and iterative beam steering and quadrupole-current scans. The procedure is not only indispensable for optimum single-turn transport (over $\sim$ 12 m, or 36 FODO periods), but also provides important insights into the beam physics involved. Some of the issues discussed are: quadrupole rotation errors, mechanical alignment, rms envelope matching, halo formation and emittance growth. Understanding of the single-turn physics provides the basis for multi-turn operation in UMER.

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