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Analysis of a Helium Brayton Power Cycle for a Direct-Drive Inertial Fusion Energy Power Reactor SCOTT WAGNER, University of Michigan, CHARLES GENTILE, ROBERT PARSELLS, CRAIG PRINISKI, Princeton Plasma Physics Laboratory — Presented is a thermodynamic model analysis and optimization of a helium Brayton power cycle for direct-drive inertial fusion energy (IFE) reactor. Preliminary reactor design goals include production of 2GW of thermal power and an estimated 700MW of electricity using a tertiary indirect helium Brayton cycle. A thermodynamic analysis of the proposed helium Brayton cycle is performed using baseline technology specifications and generalized thermodynamic assumptions. Analytic equations are developed using first and second law analysis. The model constraints are the turbine inlet temperature and pressure set by the reactor temperature of $\sim$700°C and current turbine specifications of 7MPa, respectively. Optimization of this model is then performed using iterative numerical programming for key variables. Previous analysis shows a 51% cycle efficiency using current technology; best estimates of near-term technology increase the cycle efficiency to 64%.[1] Results will be presented.

[1]R. Schleicher, A. R. Raffray, C. P. Wong, "An Assessment of the Brayton Cycle for High Performance Power Plant," Fusion Technology, 39 (2), 823-827, March 2001.

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