PRELIMINARY DESIGN OF A TANDEM MIRROR REACTOR
by
Jeanmarie Nolley Strohmayer

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ABSTRACT

The purpose of this thesis is to examine the TARA mirror experiment as a possible tandem mirror reactor configuration. This is a preliminary study to size the coil structure based on using the smallest end cell axial length that physics and engineering allow, zeroing the central cell parallel currents and having interchange stability. The input powers are estimated for the final reactor design so a Q value may be estimated. The Q value is defined as the fusion power divided by the total injected power absorbed by the plasma.

A computer study was performed on the effect of the transition size, the transition vertical spacing and transition current. These parameters affect the central cell parallel currents, the recircularization of the flux tube and the ratio of central cell beta to anchor beta needed for marginal stability.

Two designs were identified. The first uses 100 keV and 13 keV neutral beams to pump the ions that trap in the thermal barrier. The Q value of this reactor is 11.3. The second reactor uses a pump beam at 40 keV. This energy is chosen because there is a resonance for the charge exchange cross section between $D^0$ and $He^{++}$ at this energy, thus the alpha ash will be pumped along with the deuterium and tritium. The Q value of this reactor is 11.6.

Thesis Supervisor: Jay Kesner
Title: Principle Scientist
Thesis Supervisor: Robert E. Potok
Title: Research Scientist
Thesis Reader: J. P. Freidberg
Title: Professor of Nuclear Engineering