Design Point for a 1 MW Fusion Neutron Source

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We are developing a design point for a spheromak experiment heated by adiabatic compression for use as a compact neutron source. Compact fusion neutron sources are currently serving important roles in medical isotope production and could be used for waste transmutation if sufficient fluence can be attained.

We use the CORSICA and NIMROD MHD codes as well as analytic modeling to assess a concept with target parameters R_0=0.3m, R_f=0.1m, T_0=0.2keV, T_f=1.8keV, n_0=$10^{19}m^{-3}$, and n_f=$10^{21}m^{-3}$, with radial convergence of $C=R_0/R_f=3$. These parameters are selected to achieve a target rate of 10^{19} n/s. We present results from CORSICA showing placement of the coils and passive structure to ensure stability during compression. Simulations of magnetic compression are in progress, using the NIMROD code to examine the role of rotation on the stability and confinement of the spheromak as it is compressed.

The power supplies consist of 4 separate banks of 2 MJ each; Pspice simulations and power requirement calculations will be shown. We outline the diagnostic set that will be required for an experimental campaign to address issues relating to both formation efficiency and energy confinement scaling during compression.

Work supported by DARPA grant N66001-14-1-4044 and IAEA CRP on compact fusion neutron sources.