FUSION DEVELOPMEMT FACILITY (FDF) COIL MECHANICAL AND STRUCTURAL DESIGN

P.H. Titus, J.P. Smith, R.D. Stambaugh, and F.A. Puhn
General Atomics, PO Box 85608, San Diego, CA 92186-5608
peter.titus@ga.com

The Fusion Development Facility (FDF) is intended as an intermediate step between ITER and DEMO. It is intended to provide a long term, high fluence test bed for blanket components. ITER provides long pulse operation, but the neutron exposure of the ITER first wall components is well below what will be experienced in DEMO. FDF would be a nuclear machine, requiring remote handling. Coil systems would have to be de-mountable in order to access and change-out blanket modules and other internal components. FDF is intended to be a steady state copper machine to satisfy a low initial cost, at the expense of large resistive power losses in the magnets. Active water-cooling is required for steady-state operation.

Structural solutions are investigated that allow support of the large centering and separating forces in the TF coils, while providing a capability to disassemble the legs of the TF coils. The TF coil configuration is a picture frame coil made up of straight legs with joints at the corners. Two types of joints are being considered. Sliding joints analogous to those used in C-Mod and MAST are the first joint to be considered. These allow relative motion to occur at the corners of the picture frame. Large forces acting on the TF coils produce large strains that would normally concentrate at a corner in a rectangular coil layout. The sliding joints allow relative motion to relieve these strains. Both the C-Mod and MAST sliding joints are inertially-cooled. FDF sliding joints would have to have active cooling added. A scheme to accomplish this, developed for the Steady Burn Experiment (SBX), is discussed

The second joint concept being considered is a sawtooth compression joint. Steady state, low cycle operation, with minimal fatigue considerations allows this type of joint to be considered. Large compressive forces are supplied by an external preload ring. Analysis of these two concepts addresses the feasibility of the concepts. Other joint concepts such as that developed for the Tokamak Fusion Core Experiment (TFCX) are discussed.

This work was supported by General Atomics under internal funding.