1E08

# Equilibrium Reconstruction in Stellarators: V3FIT.

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## Abstract

The V3FIT code, currently under development, will do fast, accurate equilibrium reconstruction for stellarators. In a typical large tokamak experiment, data from diagnostics is used to accurately reconstruct the MHD equilibrium at many time slices during a discharge. This gives experimentalists information about the plasma position, flux surface shape and radial profiles as the discharge evolves. This information can be used to control the plasma position and to analyze the stability and transport properties. The EFIT [1] code is the most widely used tool for axisymmetric equilibrium reconstruction. Our goal is for V3FIT to be as helpful for stellarators as EFIT is for tokamaks.

The equilibrium reconstruction (ER) will use data from magnetic diagnostics to constrain an MHD equilibrium so that the magnetic fields computed from the equilibrium are as consistent as possible with the measured diagnostic signals. One portion of the ER problem is to compute the expected signal in a magnetic diagnostic coil, given an assumed MHD equilibrium. We have written two codes, V3RFUN and V3POST, that do these calculations. V3RFUN takes information about a magnetic field coil set and a magnetic diagnostic set, and calculates a) the mutual inductances between the diagnostic and the field coils, and b) the plasma response function of each magnetic diagnostic. The V3POST code takes as input a VMEC [2] equilibrium, and plasma response functions, and computes expected signals in the magnetic diagnostic coils. The V3RFUN and V3POST codes are currently being used to design magnetic diagnostic coil sets for the CTH and NCSX experiments. Preliminary results will be shown.

To be most useful for experiments, the ER codes will need to a) run rapidly, b) be flexible, and c) be extensible. Considerable effort has gone into designing the codes to achieve these ends. For the Equilibrium Reconstruction to be rapid, the magnetic signal calculation will need to be tightly coupled to the iterative equilibrium solution. Currently, efforts are concentrated on the VMEC equilibrium solver, which is the most widely used 3D equilibrium code. Our thoughts on iteration schemes for V3FIT will be shown.

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