Trip Report: Visit to JET
Jan 15 - Jan 24, 1997

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1 Introduction

The general purpose of this visit was to work with members of the Data Analysis and Modeling Group at JET who are involved with myself (RMW) and Doug McCune here at PPPL in the TRANSP-EFIT free boundary code development initiative. Members of this JET group include Denis O'Brien (DOB), Pam Stubberfield (PS), Bernard Balet (BB) and Jean-Paul Jeral (JPJ). Also involved at JET, as part of the EFIT group there, is Wolfgang Zwingmann (WZ).

The stated purpose of this collaborative project is to develop a working version of TRANSP that incorporates a *free-boundary* equilibrium model. The current version of TRANSP uses one of several fixed-boundary equilibrium codes. The two free-boundary equilibrium codes that are in the process of incorporation are EFIT and VMEC.

The specific purpose of the visit was to debug problems that had been identified in the EFIT to TRANSP interface. These problems had been plaguing us for the last six months and it was felt that only by a dedicated visit of this length could we resolve the situation. That turned out to be the case.

1.1 Debugging the EFIT to TRANSP interface

Several days of intense debugging of the entire TRANSP-EFIT interface led to the elimination of almost all of the problems that we had been encountering. We were much aided in this process by being able to debug identical versions of the code on the HYDRA computer at PPPL and the TRANSP computer at JET. The case we worked on was a JET plasma. I worked on the PPPL computer through an internet connection, while Pam debugged the same case on their TRANSP machine. The only problem encountered was the drastic degradation of the connection quality back to PPPL after about 3 pm local time at JET.

1.2 Accomplishments

By the end of this 10 day visit the following had been accomplished:

1st TRANSP/EFIT run on a JET plasma successfully completed The results have been compared in somewhat preliminary fashion against a fixed boundary equilibrium run on the same shot,using essentially the same boundary from a standalone EFIT run. The results are encouraging. There is no evidence of any instability in the EFIT evolution of the plasma equilibrium as run within TRANSP. There is reasonably good agreement between the TRANSP evolved pressure and the EFIT pressure that results from the reconstruction. The biggest payoff comes from observing a difference in the q profiles resulting from the two runs. The reconstructed q profile from EFIT, which derives directly from the complete set of magnetic measurements made on the plasma, differs noticeably in places from the q profile evolved internally by TRANSP using a poloidal B field diffusion model.

We expect this newly outfitted version of TRANSP to provide us with a whole new set of tools for analyzing measured plasma behavior. We should be able to apply more of the measurable quantities such as q0, magnetic axis position, etc. as constraints in reconstructing the plasma equilibrium, including the plasma current.

Further discussion of design issues We discussed the design of the user interface to this new package, with an eye to simplifying and localizing the new input parameter set that will control the EFIT features. We also discussed what additional results should be passed out of EFIT and back into the TRANSP RPLOT plotting package, to make it easier to monitor the behavior of the code.

Plan of action for the near term future

1. Refine the TRANSP-EFIT interface further to eliminate minor inconsistencies in quantities reported out by the two codes
2. Get a TFTR version of TRANSP-EFIT working at PPPL
3. Fully incorporate EFIT into the TRANSP code management system
4. Work on further enhacements to the TRANSP-EFIT mode of operation to more fully exploit the tremendous potential of EFIT equilibrium reconstruction

1.3 Other items of interest at JET

Improved JET performance It was reported that on the evening of January 23, a shot with D-D neutron rate of 5.0E16 neutrons/sec was achieved.

Adoption of IDL It was announced internally that IDL was to become the officially supported display package for the JET physics program.

Sun Workstation Upgrades for TRANSP Progress was made in formulating a plan to upgrade the TRANSP workstation ensemble. This involves upgrading the current single Sun workstation to a Sun Ultra workstation with two processors.

The PPPL-JET Collaboration I had dinner there one night with Jim Strachan, Lane Roquemore , Robert Heeter (graduate student working there through May, 1997), and Pete Van Bell of the JET neutron group. We discussed the things that could be done to provide Jim with more support for his work on the program there at JET. One suggestion arose out of this discussion, namely to provide the PPPL collaboration team with an on-site VMS workstation connected to the inside-the-firewall network. Initially, it would be used to run LOCUS/ISAM, which is a compact but powerful database program in use at PPPL.

Jim felt that there were a number of areas where TFTR analysis tools and practices could have a substantial impact on the JET DT campaign. The advantage of providing a VMS workstation, and using the transparent interconnectivity of different machines that todays networking setups provide, is that there is no startup cost to Jim and other PPPL visitors in terms of using the tools. There is then only an investment required in connecting to the JET database.