TFTR Physics Collaborator Guide

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December 1995

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Abstract

The TFTR Physics Collaborator (TPC) facilities support real-time interactive participation in the TFTR experimental program by qualified off-site collaborators. Data and other relevant information available in the TFTR Control Room is relayed to remote users. These users can perform the same functions as on-site personnel for specific diagnostics and experiments.

This document describes some of the TPC utilities. This version is acknowledged to be preliminary and incomplete. Please send comments to mthompson@pppl.gov. This document was last updated December 12, 1995.

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1. Documentation Sources

Information that is useful to TFTR collaborators is available in several forms. For a set of hardcopy documents, contact Terry Greenberg (tgreenberg@pppl.gov).

Some of the more useful documents are:

Accessing TFTR Data : basic overview document

LOCUS User's Guide : accessing Ingres data base tables

CUPLOT User's Guide : plotting all kinds of TFTR data

Collaborator's Guide : this document

SNAP User's Guide : how to setup SNAP runs and understand the output

Various information, including these documents, is available via the Web page `http://www.pppl.gov/TFTR`. Another source is the VMS help files.

2. The XP Process

PPPL has implemented a process for evaluating proposals for experiments on TFTR. Experimental proposals (XPs) are first presented to and reviewed by a selected task force. This initial review is informal, and is intended to be wide-ranging. Often an experiment is changed significantly on the basis of review within the task force. All aspects of the proposed experiment are reviewed, but the important issues tend to fall into one of the following categories:

- Does the experiment address an important question in tokamak physics?
- Does the proposed experiment make use of unique TFTR capabilities? Could it be done elsewhere?
- Can the proposed experiment actually answer the questions it seeks to address, e.g. do we have the necessary diagnostics?
- Are the proposed machine conditions (R, a, B_t, I_p, P_b, P_{rf}, $\overline{n}_e$, q_ψ, W_{tot}) feasible and are they consistent with diagnostic limitations, e.g. the CHERS diagnostic for measuring T_i and v_ϕ requires that sources from beamline 5 be injected.
- What limiter conditions are required, low recycling or highly saturated with deuterium?

- What can be done to minimize the risk of disruption?
- How much tritium does the experiment require?
- Optimization of the proposed sequence of shots, e.g., how to order the shots by plasma current, heating power, tritium usage, etc.
- Can the shot list be reduced? The XP proposer is generally asked to identify the highest priority shots, to be prepared for the possibility that the allocated run time is later decreased due to scheduling or technical difficulties.

If the XP involves the use of tritium, it is then presented to the entire TFTR group at a physics meeting. Comments, suggestions, objections, etc., from this meeting are recorded in the form of written "chits". The proposer's responses to these chits, including any changes to the XP itself, are reviewed by a committee headed by Rich Hawryluk. This committee either approves the XP or else sends it back for revision.

Once approved, the XP is stamped with an XP number and becomes an offcial TFTR document. Subsequent changes to the proposed shot conditions in an XP must be approved in writing, on a special form, by Kevin Mcguire or Rich Hawryluk. In practice, this requirement has not proven to be a significant impediment.

3. Computer Account Setup

Remote users will need to have accounts on the PPPL VMS cluster. To obtain an account with the necessary privileges and quotas, contact Lena Scimeca (lscimeca@pppl.gov).

This section describes network information, and terminal emulators. The "Accessing TFTR Data" document, which is available in hardcopy (contact tgreenberg@pppl.gov), by typing `HELP TFTR`, or via the TFTR Web page (http://w3.pppl.gov/tftr/helpdocs/tftr_data/tftr_data.html). describes how to setup your account and do basic functions using VMS.

3.1. Network Connection

The recommended connection is via the Internet to one of the VMS nodes; e.g., telnet birch.pppl.gov. In the event of network failure, TELNET and SLIP access is available by dialing 609-243-2925. The modems servicing this line group autobaud detect speeds up to 14.4Kbs. Required settings are 8 Databits, no parity, and 1 stop bit. You will be asked for a username/password that are independent of your account on the cluster.

3.2. Terminal Emulators

At present all the TPC components assume that you are running a terminal emulator in your workstation window, logged on to one of the PPPL VMS cluster nodes.

All TPC components output either to a VT100 text screen, or to a Tektronix 4014 or 4107 compatible graphics screen. For the VT100 displays, use any emulator that supports the VT100 character sets and keypad keys. XTERM, which provides both a VT100 window and a 4014 graphics window, is available on all workstations. From an XTERM session on your workstation you can do a remote login to a PPPL node, or you can use the PPPL utility DWLAUNCH to create session(s) that run on a PPPL node with the window on your workstation. If your IP address is a.b.c.d, to start a DECterm (VT100) session running on PPPL node BIRCH:

```
$ DWLAUNCH/server_node=a.b.c.d/client=birch/connect=tcpip create-
/term=decterm/det/wind=(title="BIRCH",icon="BIRCH")
```

For graphics output, the PPPL utility XTC is a 4014/4105 emulator that buffers plot frames and allows you to recall, print, or save any frame. Print output can be in Tektronix or PostScript format. If your user name is "doodle", to create an XTC window on your workstation, and route the graphic output from programs running in your XTERM/DECterm window to it:

```
$ set display/node=a.b.c.d/create
$ spawn/nowait/input=nl: xtc
$ define/nolog plot xtc_mbx_0_doodle
```

4. Ways to Access TFTR Information

4.1. Audio/Visual

The TFTR Control Room is currently wired to transmit video images via CU-SeeMe and audio via Maven. CU-SeeMe runs on bath Macintosh and PC Windows platforms using an IP network connection. For a description, system requirements, and download: `http://cu-seeme.cornell.edu/Welcome.html`
CU-SeeMe reflectors at PPPL include:

```
connect to 192.55.106.82          TFTR Control Room
connect to 198.32.12.50           TFTR Conference Room
```

Maven, a Macintosh-based audio conferencing tool, is available via:
`http://www.rpi.edu/Internet/Guides/decemj/itools/cmc-group-maven.html`
Maven senders at PPPL include:

```
Add User 198.35.1.36        TFTR PA System
```

Plans are in progress to add MBone transmission of the Control Room audio and video.

4.2. TFTR Web Pages

The TFTR home page at PPPL is:

```
http://www.pppl.gov/TFTR/
```

The most useful sections on this page are "TFTR Physics", which duplicates the "bulletin TFTR" described in the next section, and "TFTR Documents".

4.3. Bulletins

The TFTR bulletin contains various items including a summary of the daily 8:30 Operations meeting, and the 9:00 Physics meeting.

```
$ bulletin tftr
```

4.4. Info_TFTR Macintosh File Server

The Macintosh file server info_TFTR contains descriptions of the XP's and other useful information. To access it:

```
via Chooser, select Appletalk
Zone PPL-ENET PH2
server HLDAS File Server
volume info_TFTR
```

5. Computer Displays

5.1. Shot Clock

The TFTR shot clock program is an emulation of the shot clock in the TFTR Control Room. It shows the most recent event (SOS, SOP, EOP, etc.) and the time, relative to T0, in seconds. While the clock is counting down, the display updates every second.

The TFTR shot clock display runs on any VMS node in a VT100 window. It receives clock events from the TFTR Computing System and does an internal count-down between events.

The minimal display is 3 lines long and 80 characters wide, so you can size the display window to fit this. Options allow you to use oversize characters, and to display additional information.

To run the clock type:

```
$ SHOTCLOCK_EXE
```

The display is usually about 5 seconds behind the actual clock; the amount of delay introduced by the network connection is unknown at this time. If you simply get a separator line across the screen, TFTR is not running.

For more information, do "HELP SHOTCLOCK".

5.2. Task Force Leader Log

The Task Force Leader (TFL) Log is an INGRES data base of comments and shot parameters entered for each shot by the Task Force Leader. Two programs that allow users to view this database are described here.

TASKLOOK is an INGRES-forms program that allows you to view the TFL run summary interactively; it automatically updates whenever a new entry is made in the log. It displays the XP title, and the comment, grade, and parameters for every shot in a scrollable box. TASKPRINT is a non-forms based program which can select a set of entries based on date and XP number, and list these on your terminal or put them into a print file.

To run TASKLOOK type

```
$ TASKLOOK
```

This program uses the INGRES forms system, which assumes a 24 line VT100 screen. The bottom line has a list of menu commands, most of which have a keypad key equivalent. To execute a menu command, move to the menu line by typing the keypad "clear" key and type the command word (or enough to uniquely identify the command), or type the single keypad key equivalent. For example if the menu line contains "View(1)", you execute the "View" command by hitting the keypad "1" key or by hitting the keypad "clear" key (to move to the menu line) and typing "VIEW". If the menu line ends in a ">", there are more commands to the right that are not visible. To scroll to the menu line, hit the keypad "clear" key when you are on the menu line. To leave the menu line, type "CR".

When you are not on the menu line, several control keys let you navigate around the screen:

```
TAB         moves to the next field
ctl-P       moves to the previous field
up-arrow    moves up one line in the shot box
dn-arrow    moves down one line in the shot box
keypad -    scrolls up one page in the shot box
keypad +    scrolls down one page in the shot box
```

TASKLOOK always starts with today's date. When TFTR is running it will also start with the current XP information. To have the screen automatically update as new entries are made, use the AUTO(4) command. To look at entries for a previous date and/or XP, use the FIND(2) command. For on-line help, hit the keypad "=" key; when the help screen appears, type keypad "1" (WhatToDo).

For more information type "HELP TASKLOG".

5.3. Physics Operator Log

The Physics Operator Log is an INGRES data base of comments entered for each shot by the Physicist In Charge (PIC). OPERLOOK is an INGRESforms program that allows you to view the PIC comments interactively, along with a one-line display of the TFTR shot clock; it automatically updates whenever a new entry is made in the log. OPERPRINT is a non-forms based program which can select a set of entries based on date or shot range, and list these on your terminal or put them into a print file.

To run OPERLOOK type

```
$ OPERLOOK
```

This program uses the same INGRES forms system described for TASKLOOK.

To run OPERPRINT type

```
$ OPERPRINT
```

5.4. TFTR Control Room Graphic Displays

Several of the batch jobs that provide shot-related processing of TFTR data output graphs to the bank of screens in the Control Room. The system that controls these screens is the VAX Graphics Distribution System (VGDS), hence these screens are sometimes called the VGDS screens. To see which plots are assigned to which screens type

```
$ SHOW LOG/TABLE=LNM$TFTR_SCREENS
```

To look at the graph currently display on the MAG_SCREEN_1 screen:

```
$ VLOOK/DEV=MAG_SCREEN_1
```

or

```
$ XPLOT/NOQ MAG_SCREEN_1
```

To set your screen to display what is on MAG_SCREEN_1 and update automatically every time that screen updates:

```
$ VSLAVE/DEV=MAG_SCREEN_1
```

The top row of screens is used for LOCUS plots. The middle and bottom rows are used for diagnostic specific, and comparison plots. The descriptions of the diagnostic screens are in the file TFTR_INF:DIAG_SCREENS.INF.
Presently this is:

name	description
MAG_SCREEN_1	magnetics waveforms, e.g., taue vs time
MAG_SCREEN_2	more magnetics waveforms
HAL_SCREEN	time history of Halpha and Carbon emission
HAL_SCREEN_2	Halpha emission vs. time and angle
FM_CONTOUR_PLOT	contour plot of n_e(R,t)
BRAD_SCREEN_1	3D chordal P_rad (horizontal bolometer)
BRAD_SCREEN_2	time history of fraction of radiated power
BRAD_SCREEN_3	chordal P_rad (vertical bolometer)
MHD_FAST	MHD mode ID approx 100 kHz
MHD_SLOW	MHD mode ID < 5 kHz
MHD_SCREEN_2	magnetic fluctuation from Mirnov coils
ML2_SCREEN	locked mode analysis
TI_SCREEN	2D/3D SW ion temperature
TE_SCREEN	2D/3D YG electron temperature

5.5. Shot Triggered CUPLOT Display

The CUPLOT utility can be set to execute a specified command every time data is ready for the next shot. For example to plot the beam power, neutron count, and total power for each shot do:

```
$ CUPLOT
Command[ ]? OP PA N              !turn off the pause after each plot
Command[ ]? DE NB-BP-SL NE-SP-SL D-PTOT ;
Command[ ]? XT 2 6               !set time window
Command[ ]? SH NEXT
```

To do something more complicated than just read the data and plot, put your commands in a file, such as "MY_COMMAND.COM" and use:

```
$ CUPLOT
Command[ ]? OP PA N             !turn off the pause after each plot
Command[ ]? DE NB-BP-SL NE-SP-SL D-PTOT ;
Command[ ]? WD
Name of event to wait for[ANT_ALL]? ,
Command string[ ]? @MY_COMMAND
```

where MY_COMMAND.COM could contain:

```
R                   !read the data
```

```
SM F* ,,          !smooth it
P                 !plot it
```

Note that the file does not set the shot number; this is set for you to the most recent shot by the WD command.

5.6. Useful Files

Several files in the area TFTR_INF contain useful information:

```
TFTR_INF:DIGRAPH.INF        digraphs and who is responsible
TFTR_INF:PHONES.INF         phone numbers in the Control Room
TFTR_INF:WAVEFORMS.INF      description of TFTR waveform data
```

6. Diagnostic Control

6.1. Diagnostic Control

Off-site collaborators who wish to control their experiments should set up appropriate mechanisms specific to the diagnostic.

6.2. Sending Diagnostic Graphs to a Remote Screen

A diagnostic shot-triggered batch job can send its plots directly to a remote user's window instead of one of the screens in the Control Room. For information, type "HELP VGDS".

7. Telephone Numbers and E-mail Addresses

Type or print TFTR_INF:PHONES.INF for a list of all phone numbers in the TFTR Control Room. For all problems related to networks, computer access, CU-SeeMe, etc., between 9am and 5pm, call or e-mail to the Help Desk (helpdesk@pppl.gov).

name	extension	location
Help Desk	x2275	network and computer problems
Computer Center	x3444	cluster problems
CICADA operator	x2680	CICADA problems
HLDAS phone	x2710	HLDAS operator, Task Force Leader
Control Room	x2400	at end of HLDAS station
Physics Operator	x2195	Physics Operator

8. Glossary of TPC Utilities and TFTR Jargon

BES The Beam Emission Spectroscopy diagnostic on TFTR which measures density fluctuations.

CHERS The charge-exchange recomdination spectrometer diagnostic which measures the T_i and v_ϕ profiles in TFTR.

COE Chief operating Engineer in the TFTR control room, responsible for programming of the toroidal field and other power supplies.

CUPLOT An interactive program that can display a variety of data acquired from TFTR including waveforms and 1-D and 2-D Ufiles.

DIGRAPH The original data acquisition system used on TFTR consisted of Gould SEL computers which allowed only short file names. For this reason the only two ascii characters could be reserved to identify the data files written for a particular diagnostic, and so each diagnostic been come to be known by its associated "digraph". For example, the digraph for the MIRI diagnostic (multiple far infared interferometer) which measures density profiles is FM. For a listing of TFTR digraphs and what they mean, see Appendix B of the "Accessing TFTR Data" document.

HLDAS Operator Physicist responsible for overseeing the collection of diagnostic data during an experiment. The HLDAS operator typically uses: ISC, YPLOT, SNAP, and CUPLOT to examine the incoming data. This is a great job. If you would like to be a HLDAS operator, contact Steve Scott, sscott@pppl.gov.

ISC A program which automatically adds about 100 waveform values at about 10 selected times for each TFTR shot to a large waveform database table (WAVEF). Selected plots, e.g., beam power vs shot number) are automatically updated in the TFTR Control Room.

LOCUS A PPPL-developed database program, based on the commercial INGRES database software, which is widely used to display and analyze TFTR databases.

MINGL A PPPL-developed database entry program which allows the user to conveniently generate databases from a wide variety of standard PPPL data-file types, including waveforms, 1-D and 2-D ufiles, and SNAP and TRANSP transport results.

MSE The Motional Stark Effect diagnostic on TFTR which measures the q-profile.

NBOE Neutral-beam operating engineer. This is the engineer in charge of the neutral beams in the TFTR control room. The Session Leader works closely with

the NBOE during the course of an experiment to define which neutral beams should fire; beam timing, and beam isotope (deuterium/tritium).

OperLog A program used by the Physics Operator to record comments about TFTR shots in a Physics Operator Log database.

OperLook An interactive program used by everyone to display the current contents of the Physics Operator Log database.

OperPrint A program that prints out contents of the Physics Operator log from previous run days.

Physics Operator (Also called the Physicist in Charge) Physicist in charge of controlling the plasma current waveform, gas puffing, and other parameters of a shot. The Session leader works closely with the Physics Operator throughout an experiment.

Session Leader The person, usually a physicist in the TFTR control room, who directs an experiment. He or she is expected to nominally follow the experimental plan described in a written experimental proposal (see "XP") and as succintly summarized in a proposed "shot list" which is distributed a day or so before the experiment is carried out.

SNAP A steady-state 1-D transport analysis code. Typically run at one time point on every high-priority shot during an experiment to verify that all of the transport diagnostics are functioning properly.

TaskLog The program used by the Task Force Leader (TFL) to enter comments and shot parameters about the current day's TFTR shots into a database.

TaskLook A interactive program that displays the automaticaly-updated TFL run summary from the TaskLog database.

TaskPrint A program that prints out the contents of any day's run comments from the TaskLog database to a printer or terminal screen.

Task Force Leader This term unfortunately is ambiguous. In recent years, the TFTR experimentists have been grouped into 4-5 "task forces" each focused on studying some aspect of tokamak physics. The leader of each task force is called, surprise, the task force leader.

However, in previous years, the person actually controlling a particular experiment from the TFTR control room was called the task force leader (this position is now called the session leader, but many of us still refer to the session leader as the task force leader).

Tritium Shift Supervisor Engineer in the TFTR control room ultimately responsible for movement and use of tritium during an experiment. The session leader works closely with the Tritium Shift Supervisor to request tritium delivery to particular neutral beam sources, tritium gas puffs, etc.

Waveforms 1-D vectors compiled from various diagnostics for each TFTR shot into a file which remains on-line for at least 3 years.

XP Formally, this is a 5-20 page "experimental proposal" that describes a proposed experiment in detail. Informally, it is used to designate the experiment itself, e.g. "We're doing XP619 today."

YPLOT A program used by the HLDAS operator to display a large number of waveforms automatically after each shot on screens in the TFTR control room. Typically each screen displays 4-10 waveforms on each of eight screens.