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**pTSC: Data File Editing
for the Tokamak Simulation Code**

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Abstract

The code pTSC is an editor for the data files needed to run the Princeton Tokamak Simulation Code (TSC). pTSC utilizes the Macintosh™ interface to create a graphical environment for entering the data. As most of the data to run TSC consists of conductor positions, the graphical interface is especially appropriate.

Introduction

The program "pTSC" is a Macintosh™ application, written to create and edit data files for the Princeton "Tokamak Simulation Code" (TSC).¹ TSC simulates an axisymmetric tokamak with arbitrary cross section. The code contains a two dimensional transport model, and allows interaction of the plasma with an arbitrary set of discrete axisymmetric conductors which obey circuit equations with possible active feedback.

To use this code it is necessary to create a file containing the parameters of the simulation. Do to the large number of these parameters, the file can easily be several hundred lines long. Each line consists of a set of eight fields; each field must be exactly ten characters long and represents a different input parameter. Conventionally the data file is constructed using a standard text editor, though this can be extremely time consuming. A large portion of the input data for TSC consists of positions for each of the conductors. Such information is more easily input graphically using a "pointing device" such as the the Macintosh™ mouse.

The Mac user interface is is ideally suited to rapid and clear manipulation of graphical data. It is based on extensive use of the mouse; yet, for the experienced user there are always several ways, including keystrokes, to accomplish each task. In pTSC the basic file structure of the TSC data file is reflected in the display of the data in an array with eight columns. The data file can be created and edited directly in its numerical form, using standard Mac editing features: selection with the mouse, or cursor keys, entry using "buttons", or the "enter" or "return" keys, etc. However the power of Mac interface is reflected in the use of multiple windows (each can contain a separate file or different views of the same file), copying and pasting between windows, graphical manipulation of data, and the use of dialog boxes to increase the ease of data entry.

¹S.C. Jardin, N. Pomphrey and J. Delucia, "Dynamic Modeling of Transport and Positional Control of Tokamaks," J. Comp. Phys. 66,481 (1986).

Obtaining pTSC

The application version of pTSC can be obtained upon request to the Librarian, Inst. Fusion Studies, University of Texas, 78712, on a 3.5 inch Mac disk. This application will run on any Macintosh™ computer (version 1.01 has been recompiled using the new Lightspeed C compiler so that it is compatible with the Macintosh™ II), though you must use system software which is version 3.2 or more recent, and at least 512K of memory is recommended. The program code, written in Lightspeed C™ will also be sent upon request. It is also available on the MFENET bulletin board. You can obtain it by typing "bulletin mac" and running FILEM to attach the file. This file contains the code in hexadecimal format. Once the file is downloaded onto the Mac you decode it using the program BinHex 4.0. This creates the double-clickable application.

Any questions or comments about the using the code, or extensions to it can be directed to the author. My E-mail addresses are

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pTSC Manual

To edit an existing data file, you must download the file from the mainframe to the Mac. One way to do this is to use the Kermit program on the MFE Cray. Run Kermit on the Cray, and use the "Kermit" option of your terminal emulator (for example on VersaTerm's file menu). This creates a copy of the data file on the Mac. Alternatively you can use NETOUT to create a file on your local machine, and then download that file with XMODEM, or MacPut, or whatever local program is available. Another technique is to display the file using VersaTerm, and then use the "copy," command to load it into the clipboard. It can then be pasted directly into pTSC (see the paste command below). Finally you can create the file from scratch using pTSC, and later upload it to the mainframe. You might consider running pTSC and VersaTerm simultaneously, using the Switcher program to allow rapid transfer between editing and running.

Run pTSC, by opening the icon on the Mac as usual (e.g. double click). You must have **system file version 3.2** or later, since this has a package, the List Manager, which I use extensively. When the program opens, you will see three menus. To open the file select "open" from the file menu. You will see a list of text files available on your disk. Select the data file you wish and hit "return", or click "okay".

To open **multiple files** simply select open from the file menu. Each file will appear in it own list window. The number of files is limited only by memory, you can open at least three small files in 128K. Copying and pasting of data between files is supported, see Edit menu commands below.

The **List Window** containing the data will appear (Be patient, if the file is long it may take a while to open it). The window contains the data in a spreadsheet form: each number is in a cell 10 characters wide. The file must have a carriage return at the end of each line to be properly displayed. The file must also be smaller than 32K (about 408 lines) for the List Manager to work. If

you have a longer data file, split it into pieces. You can open several files at once on pTSC, by selecting "open" from the file menu for each one.

The first cell in each row is the "card type". It indicates which data is to follow. For example the type 00 card contains information on program control; type 01, the dimensions of the computational box; type 10, the positions of conducting coils, etc. Every file must end with a type 99 card. This card is automatically entered in the file when pTSC creates it.

The screenshot shows the pTSC software interface. At the top is a menu bar with the following items: File, Edit, Set Parameters. Below the menu bar is a control bar with buttons for "Enter" and "Cancel", and a text field containing "1.429". The main area is a window titled "New File" containing a table of data. The table has 8 columns and 17 rows. The first column contains card types (0, 1, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10). The second column contains values from 0.0 to 16.0. The third column contains values from 0.0 to 1.125. The fourth column contains values from 0.0 to -1.190. The fifth column contains values from 50.0 to 2.0. The sixth column contains values from 10.0 to 1.0. The seventh column contains values from 10.0 to 1.0. The eighth column contains values from 0.0 to 0.0. The cell containing "1.429" in the fifth column of the 7th row is highlighted and labeled "Active Cell". A mouse cursor is pointing at the cell containing "1.310" in the fifth column of the 8th row. The interface also includes a status bar at the bottom with navigation icons. Callouts with arrows point to the "Menu Bar", "Edit Window", "Active Cell", and "List Window".

Card Type	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
0	0.0	0.0	0.0	50.0	10.0	10.0	0.0
1	29.0	22.0	4.5	2.5	1.0	1.0	0.0
10	1.0	1.125	1.905	2.0	1.0	0.00	
10	2.0	1.125	1.786	2.0	1.0	0.00	
10	3.0	1.125	1.667	2.0	1.0	0.00	
10	4.0	1.125	1.548	2.0	1.0	0.00	
10	5.0	1.125	1.429	2.0	1.0	0.00	
10	6.0	1.125	1.310	2.0	1.0	0.00	
10	7.0	1.125	1.190	2.0	1.0	0.00	
10	8.0	1.125	1.071	2.0	1.0	0.00	
10	9.0	1.125	0.952	2.0	1.0	0.00	
10	10.0	1.125	0.833	2.0	1.0	0.00	
10	11.0	1.125	0.714	2.0	1.0	0.00	
10	12.0	1.125	-0.714	2.0	1.0	0.00	
10	13.0	1.125	-0.833	2.0	1.0	0.00	
10	14.0	1.125	-0.952	2.0	1.0	0.00	
10	15.0	1.125	-1.071	2.0	1.0	0.00	
10	16.0	1.125	-1.190	2.0	1.0	0.00	

To **edit** you select any cell with the mouse: simply click on a cell, and type to change its contents. Hit **enter** or **return** or **tab** when you are through with that cell. Data is automatically entered in the correct position. Note that when a cell is selected, its data appears in the "**Edit window**" at the top of the screen. You can select the data in the edit window with the mouse, use backspace, cut, copy, delete, or clear (in the edit menu), to change the data. You can also click on the **enter** or **cancel buttons** in the edit window to enter the data into the current cell, or cancel the change. You must, however, click one of the buttons, or hit the enter, return, tab or cursor keys to actually cause the cell data to change (Yes there are always many ways to do the same thing on the Mac. Choose the one you like best, or if you can't remember the appropriate command, experiment).

To **move around** in the data file, use the mouse or the tab key to move to the right, and the return key to move down, or the Mac plus cursor keys to move in any direction. Use the "scroll bars" on the right and bottom of the List Window to scroll to portions of the file not visible. You can resize the window by grabbing the "size box" in its lower right corner, or clicking on the "zoom box" in the upper right corner.

To **delete** a data card from the file, select any cell in the card you want to delete, and pull down the edit menu to "Delete Card" (or type "command d"). All rows with selected cells will be deleted. To delete multiple cards simply select the ones you want to delete (see below) before typing Cmd-d.

To **add** a data card, select any cell in the row above where you want the new card to be added. Use "Command a", or the "Add Card" menu item to add one new card. To add a card as the first card, unselect all cells by clicking in the list window, below the bottom of the list, then type Cmd-a.

To select multiple cells. 1) double click on a cell to select an entire row. 2) hold down the shift key and drag the mouse to select a contiguous group of cells. 3)

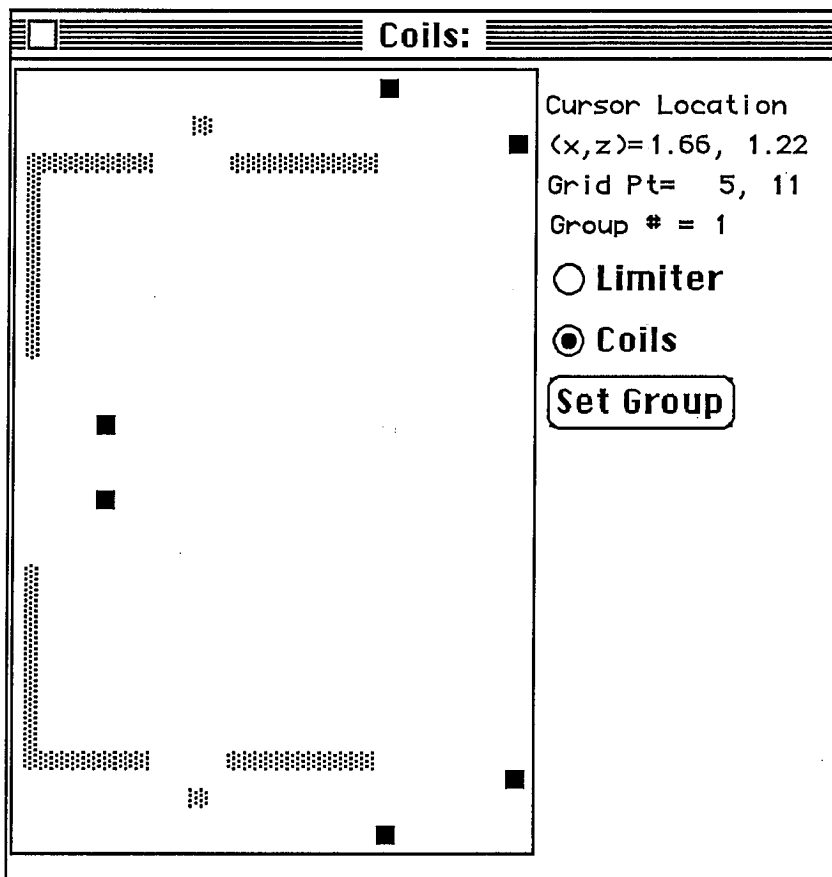
hold down the command key and click with the mouse to select a discontinuous set of cells.

To add, or edit **Type 00** or **Type 01** cards, which have the “control” and “dimensions” parameters, use the Control-Dimensions command under the Set Parameters menu. This brings up the **control dialog window**, which has items for each of the seven variables on the 00 and 01 cards. If there are no such cards currently in the file, you will see default values for these variables. If these cards currently exist, you will see the current values. Change values by editing the numbers in the EditText boxes, or clicking on the “radio” buttons (those little circles) or checking the square boxes to activate that option. Hit return or enter, or click the OK button. The data will be automatically entered into the file. If you don't want to make the changes, click the Cancel button.

Control Type 00		Dimensions Type 01	
<input checked="" type="radio"/> Start Run		<input type="text" value="29.0"/>	NX, no. of zones
<input type="radio"/> Restart from SPRSINA		<input type="text" value="22.0"/>	NZ
<input type="radio"/> Equil File EQFILEA		<input type="text" value="4.5"/>	ALX, outer major rad.
<input type="checkbox"/> Write Restart File		<input type="text" value="2.5"/>	ALZ, half height
<input type="checkbox"/> Write Pest File		<input type="text" value="1.0"/>	CCON, inner major
<input type="text" value="50.0"/>	NCYCLE	<input checked="" type="checkbox"/> Force up-down symmetry	
<input type="text" value="10.0"/>	NSKIPR	<input checked="" type="radio"/> Regular Run	
<input type="text" value="10.0"/>	NSKIPL	<input type="radio"/> Read PBX data ENINA	
<input checked="" type="radio"/> Regular Graphics		<input type="radio"/> Read TFTR data ENINA	
<input type="radio"/> B/W Movie			
<input type="radio"/> Color Movie			
		<input type="button" value="OK"/>	<input type="button" value="Cancel"/>

To add, or edit **Type 10**, or **Internal Coil** and **Type 05** or **Limiter** cards, use the Coil Placement menu item. If you currently have NX, and NZ set to reasonable values and ALX>CCON, you will see a new **coil graphics**

window. Each coil, given by a type 10 card in the file, will be displayed as a square box in the window. You can add or delete coils merely by clicking in this window. Coils are automatically placed on the nearest grid point. The display on the right of the coil window shows the position of the cursor in meters (as given in the coordinates defined on the Type 01 card) and below that, the position in grid points. If you click on a blank location, a new coil will be added to the data file at that location. If you click on a coil, it will be deleted from the data file. Limiter points are displayed in a brick pattern.



If you click on the **Set Group** button, a dialog box will appear allowing you to set the group number, and current profile characteristics for a group of coils. This group number will be active for subsequently entered coils. Coils belonging to the active group (this is displayed in the graphics window) will be black, and

those belonging to an inactive group will be grey. The current profile information will be automatically entered as a **type 15** card in the data file.

pTSC Menus

File

1. **New** (cmd n)
 - a. Open a new data file. The file will open with just one row, a type 99 card. You can add data to it by using the add command in the Edit menu.
2. **Open** (cmd o)
 - a. Open an existing file. You will see the standard Macintosh™ file dialog box, Select the file you want from the list with the mouse, or by typing the first few letters of its name. Hit return or click Open.
 - b. The file must be smaller than 32K in size, and must have returns at the end of each data line. The 32K limitation will be hard to get around, so I hope it's sufficient. It should give a file of more than 400 lines.
3. **Close**
 - a. Close the frontmost window.
 - b. If this is a list window you will be asked if you want to save the changes or not.
 - c. If this is the graphics window, the new coil data will be inserted in the list window in the proper format.
4. **Save** (cmd s)
 - a. Save the frontmost data file. Keeps the same name, i.e. the old file is overwritten.
5. **Save as...**
 - a. Save the frontmost data file with a new name. You type the new name in the EditText box.
6. **Revert**
 - a. Discard the changes you have made in the frontmost list window since the last save. Prompts you to make sure this is what you want.
 - b. Opens the last saved version of the file.
7. **Quit** (cmd q)
 - a. Quit pTSC. Prompts you if you want to save any changes made in the open files.

Edit

1. **Undo** (cmd z)
 - a. Not supported, except for desk accessories
2. **Cut** (cmd x)
 - a. If you select text in the edit window, "cut" deletes it to the clipboard. You can then paste it somewhere else, or in another application.
 - b. If you select a set of cells in a list window, "cut" will copy the selection to the clipboard, AND delete every row with a selected cell.
3. **Copy** (cmd c)
 - a. Copies selected text to the clipboard.
 - b. If you select a multiple cells in a list window, the data is copied in order increasing column first, then increasing row.
4. **Paste** (cmd v)
 - a. To paste the clipboard into the edit window, click where you want it, and choose the paste item.
 - b. To paste into a list window, select the group of cells to paste to, and then choose paste. If the clipboard data and paste region do not match in size, then only the number of cells corresponding to the number in the clipboard will be filled, and they are filled in column order first, then by row.
5. **Clear**
 - a. Deletes the selected data, in edit or list window.
 - b. Data is lost forever. You might be able to recover by using Revert under the file menu.
6. **Add Card** (cmd a)
 - a. Add a card after the last row with a selected cell
 - b. If no cells are selected, card will be added at the beginning of the file.
7. **Delete Card** (cmd d)
 - a. Deletes every row with a selected cell.
 - b. The data does not go into the clipboard, its gone forever! You might be able to recover by using Revert under the file menu.
8. **Sort Cards** (cmd s)
 - a. Sorts the rows in numerical order according to the card type (i.e. column one) first, then according to the second column.
 - b. Card type is read as a two digit integer in the first two characters of the first column of each row.

Set Parameters

1. Control-Dimensions

- a. Opens a dialog window for setting the parameters of type 00 and type 01 cards. These parameters set the type of run, and the size and dimensions of the grid.
- b. The First column sets the 7 data values of a type 00 card, and the second for type 01 card.
 - i. the Circles are "radio" buttons, only one can be selected. These are for items that have values ranging over a few integers.
 - ii. The square boxes are check boxes. Checking this sets the data value to 1. Unchecking it sets the value to zero.
 - iii. The EditText boxes can be typed into with the usual Mac editing conventions. Use Tab to go from one to another.
- c. This data will be automatically written to the list window in the correct format if you click okay.

2. Coil Placement

- a. Opens a graphics window which displays the positions of the internal coils and the limiter points of the frontmost list window.
 - i. If there are many coils you may have to wait a minute for this loading.
 - ii. You must set the parameters NX, NZ and the sizes ALX, ALZ and CCON (<ALX) (Type 01 card) to be able to use the graphics window.
 - (1). NX must be between 2 and 134 for the window to fit on the conventional Mac screen.
 - (2). NZ must be between 2 and 120 and odd when symmetry is not checked, and between 2 and 60 for the symmetric case. In the symmetric case there will be $2(NZ-1)+1$ grid points.
 - iii. If you don't the program prompts you.
 - iv. Each coil is represented by a square. The size of the square is adjusted depending on the values of NX and NZ, to keep the size of the graphics window reasonable.
- b. Click on a position with the mouse to add or delete a coil.
 - i. The position of the mouse in meters and in grid points (horizontal first, then vertical) is displayed at the right side of the window.
 - ii. Coils are automatically put at the nearest grid point, and are automatically numbered in position order.
 - iii. If you click on a currently present coil, it will be deleted.
 - iv. If you hold the mouse button down you can continuously add or delete coils.
 - v. If the symmetry option is checked, you will add or delete two coils each time you click. The data in the file is automatically symmetrized.
- c. To add Coils with a particular group number, click the group number button.

- i. This opens a dialog box allowing you to set the group number, # of turns, and resistance. These parameters apply only to subsequently added coils.
- ii. You also can set the current in this coil group (Type 15 card) at the six times TPO(I). A type 15 card is automatically added for this group when you click okay.
- iii. The current coil group # is displayed in the graphics window: coils with this group # are black, others are grey.
- d. To add Limiter Points, click the Limiter "radio button."
 - i. These are displayed in a brick pattern.
 - ii. The Type 05 cards are written to the list window automatically.
- e. When you close the Graphics window, or click on the list window, the current coil data is written to the list window automatically.