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## Plotting and Summary Routines for TASK8

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## **PLOTTING AND SUMMARY ROUTINES FOR TASK8<sup>1</sup>**

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### **Abstract.**

Plotting and summary routines available for the TASK8 microprobe operating system are able to accept both spectral and quantitative data. All of the routines are able to be run as subroutines from within the TASK8 program or as stand alone programs. Additionally, the spectral plotting routine can be run from within a modified version of SQ. The quantitative summary and plotting programs are able to read the formats of all of the quantitative routines currently in use with TASK8. Quantitative output can be sent by the summary program to a serial port that is connected to a VAX or PC in addition to printing it. The plotting codes have been written so that either a Tracor Northern TN2000 or a TN5xxx analyzer may be used with either a Hewlett Packard HP7221 series or a HP7470/HP7550 series plotter. The plotting routine for spectra incorporates a user definable "usual way" option to simplify most input procedures. The quantitative plotting routine offers numerous options including scale expansion, smoothing, auto-labeling, special symbols, and multiple pens.

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# PLOTTING AND SUMMARY ROUTINES FOR TASK8

## Introduction

Plotting and summary routines available for the TASK8 microprobe operating system<sup>1</sup> are able to accept both spectral and quantitative data. All of the routines are written in Flextran<sup>2</sup> and are able to be run as subroutines from within the TASK8 program or as stand alone programs. Additionally, the spectral plotting routine can be run from within a modified version of SQ.

The quantitative summary and plotting programs are able to read the formats of all of the quantitative routines currently in use with TASK8 (BA, PRZ, ZAF, and SQ).<sup>3,4,5</sup> If the TASK8 MINCODE option is used, the quantitative summary routine gives the option of listing the code (and, if applicable, the associated tag) for each point of a file. It then will summarize each requested MINCODE separately. Quantitative output can be sent by the summary program to a serial port that is connected to a VAX or PC in addition to printing it. This capability permits collecting the data in a data base.

The plotting codes have been written so that either a Tracor Northern\* TN2000 or a TN5xxx analyzer may be used with either a HP7221 series or a HP7470/HP7550 series plotter. The plotting routine for spectra incorporates a user definable "usual way" option to simplify most input procedures. The quantitative plotting routine offers numerous options including scale expansion, smoothing, auto-labeling, special symbols, and multiple pens.

This document describes the operation of the various plotting and summary routines available for TASK8.

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\* Tracor Northern is now known as Noran Instruments, Inc. Throughout this document, it is referred to as Tracor or Tracor Northern.

## General Nomenclature

The Sandia TASK8 operating system is designed to support several printers and plotters. This support is via subroutines. Among the supplied programs are "669" and "UTILITY". UTILITY is used to save, list, and perform variable searches in any of the programs in the TASK8 set. 669 is a special program/subroutine that tells the TASK8 system needed information about your printer and plotter. 669 must have been run once before attempting to use any of the routines described in this document. To do this, X 669↓.<sup>1</sup> 669 asks some questions about both your printer and your plotter. First, you have to indicate which printer subroutine to use. If you have a DEC LA100 or LA120, use subroutine 680. If you have a C-ITOH, use 682. If you have anything else, you will probably have to write your own printer handler or just use 683, the handler for "dumb" printers. Be sure that the proper subroutine is on your system disk. If you have plenty of room you can put the whole 680→683 set on -- otherwise, just put on the one you need. The printer handlers are used by TASK8 and its associated routines to get nice formats. We normally use lines 2 through 64 on a page. If you are using a C-ITOH printer, you can't set the top margin to anything else but 1 so drop the 64 to 63 and set the paper so it is down a line. Once you have answered all of the questions about the printer, you will be asked to indicate which plotter series you have, how many pens it has, and what its "character shape factor" is. The "character shape factor" was introduced because Hewlett-Packard changed the aspect ratio associated with their characters during the HP7221 production. Later 7221 plotters and all 7475 or 7550 plotters should use a character shape factor of 1.0. Earlier 7221 plotters need a shape factor of 0.85 to achieve the same plot. Start out with a shape factor of 1 and modify it if you don't like the appearance of the output. 7221 and 7550 plotters have a built-in symbol font that can be called. 7475 plotters, however, have no such font so each symbol must be drawn by issuing a "macro" that describes each pen stroke for it. The plotting routines look at flags set in 669 to know which procedure must be followed. After describing both your printer and the plotter you will be instructed to "GO 247" to save the answers. [G(O) 247↓, then enter S↓ for save and your master drive number as the drive to save the program and subroutine on.] If you have a TN5xxx (TN5xxx indicates any of the TN5400/TN5500 series analyzers), are not using drive one as your master, and think that you may have a program 669 or subroutine 670 on a lower numbered drive, give the command >OP M,M (M represents the master drive number) before this step. We have developed a convention where we save a copy of each subroutine file as a "type-12" or Flextran program file as well as the subroutine file. This convention permits us to more easily edit the files and allows us to mix interpreted and compiled subroutine files. Additionally, some routines (including all of the routines described in this document) are written so that they can be run as either subroutines or programs. All of our program files contain a special block, block 247, which calls a portion of the 'UTILITY' program to give several options. One of these options is to save the program as a type-12 file and, if it is a subroutine file, also as a type-10 file after incorporating the date as part of the file label. (Other options include short-form and long-form listings and searching for any

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<sup>1</sup> Throughout this document,     indicates human input and ↓ indicates a carriage return. Information that is printed by the computer is indicated by using Courier type face. Some responses may have optional parts. If so, the optional portion is enclosed in parentheses. This is especially evident in the responses to questions that can be answered by YES or NO. Wherever feasible, questions have been worded so that the most logical answer is a YES so a ↓ is interpreted as a YES response. Thus, YES/NO responses are indicated as (YES)↓ and N(O)↓ to indicate that any portion of YES may be used and both N and NO are acceptable negative responses.

string in the program.) You will actually save two things. First will be a very short subroutine that contains the answers to the questions about the printer and the plotter. Second will be the program that asked the questions along with your answers. If you run 669 again, you will be offered your most recent answers as defaults. Note: When you save 669 on a TN2000, you will be asked to enter the current date and time before the system saves the program. Our programs automatically encode the date in the program titles and write the current time in a program line to let us keep track of our updates. The current time is very important to the TASK8 system.

Once 669 has been run and saved, any of the plotting or summary routines can be called. Of course, if you have not yet collected any quantitative data via TASK8, the only useful routine would be the spectral plotting routine, TL1. TL1 would be called by typing the command X 'TL1'↓ or X 2529↓, the program number corresponding to TL1. The first line of output in response will have the form

```
TL1 SUB 8C 13-Feb-90.
```

The 8C is the version number of the routine, the date is the date that the routine was last saved, and TL1 SUB is the name of the routine. If one were to list the files on the disk, one would find two entries for 2529. One of these would be a "type 12" Flextran file having the name above. The second would be a "type 10" subroutine file which might have the same name or might have a name of the form:

```
TL1 sub 8C@2 900213.
```

In the first case, the subroutine and the Flextran program would both be interpreted. The second name form is used for compiled routines. In this case, the 8C is again the version number, the "@" indicates that it is compiled, the "2" indicates that it was compiled with a compiler that is compatible with the TN2000, and the six-digit code indicates the last revision date (year, month, day). With the exception of TASK itself, all of the type 12 Flextran routines associated with the TASK8 system are maintained in an interpreted state. Most of the subroutines associated with these routines are compiled. The compilation is for two reasons: first because of the size reduction associated with compiling and second for speed. Both of these factors are much more important on a TN2000 system than on a TN5xxx.

The following sections describe the usage of each of the plotting and summary routines -- both as stand alone programs and as routines called via TASK8 commands.

## Spectral Plotting

The spectral plotting routine, TL1, is capable of plotting the spectrum resident in the first half of the spectral memory of a TN5xxx or a TN2000 on an HP7221 or HP7470/HP7550 series plotter. It can detect the type of spectrum (EDS vs. WDS), automatically include proper units with the axes, and provide both titles and labels. Both the date and the file number are optionally plotted. When TL1 is run stand alone, the initial question gives the opportunity of setting the "usual way" options for the program. If the plotting branch is taken, this question is followed by a request to identify the type of microprobe you are using. This information is needed in order to provide proper axis labeling. These two questions are not asked if TL1 is called from TASK8 via the PL(OT) command. The following examples illustrate the various plots and options available for TL1.

Example: X 'TL1'↓ to set the "usual way" options. As delivered, "usual way" will use plot position 3, plot the date and file number, use the label as the title, plot peak labels, use pen 1 for the spectrum, and will not fill under the spectrum. This example shows setting these options. If you want others, use this method to change the defaults. Note that when you resave the routine the current date will be saved with it. Also, the subroutine saved will be interpreted. We have checked the time required for this routine to plot a spectrum when it is compiled vs. when it is interpreted and have found less than a second difference. The interpreted routine will also fit in a TN2000 memory so there is no need to worry about compiling it.

TL1 SUB 8C 13-Feb-90

24-Apr-90 2:13 PM

Set defaults for usual way (Y/N) ? (YES)↓

Plot position (CR=Top, 1=Bottom, 2=Full Tall, 3=Full Side)?3↓  
Figures 1 through 4 show examples of the plot positions. Positions 0 and 1 yield the same size plot.

Fill Under Spectrum (Y/N) ? N(O)↓  
Normally an outline plot is all that is desired.

Plot date and file # (Y/N) ? (YES)↓  
A YES causes the current date and the file number (if the spectrum has been stored) to be plotted at the upper left hand corner of the plot.

Use the label as the title (Y/N) ? (YES)↓  
This refers to the 20 character (TN2000) or 43 character (TN5xxx) spectrum label. If the answer is NO, each time a plot is made this label will be offered but you will be given an opportunity to change it.

Use which pen for the spectrum?1↓  
If the plot is going to be xeroxed, black works best. If you are making viewgraphs, you probably won't be taking the "usual way" option.

Plot peak labels (Y/N) ? (YES)↓  
All of the EDS peak labels can be plotted. The routine has internal checks to keep them from plotting on top of each other.

Now save this routine via a GO 247

G(O) 247↓

SAVE, VSEARCH, LIST, QLIST or MEMORY SIZE ? S↓

This question is from the UTILITY routine and is used in saving the routine or in searching for variables or getting listings of the routine.



Save pgm on >OP #?1↓ & sub on >OP #?↓ 24 Apr-90 2:15 PM  
 'TL1' saved as a subroutine (Type '10')  
 and  
 'TL1' (2529) saved as a Type '12' file

The drive number to save the program to is indicated. The ↓ to the question about the subroutine says to use the same drive number. A negative number as a response to either question would suppress saving that form of the routine. The UTILITY routine detects that the routine can be saved as a subroutine by the fact that the first character of line 1,1 is a "[". If any other character had been present, only the question about saving the program would have been asked.

Example: X 'TL1'↓ or use the TASK8 PL(OT)↓ command to plot a WDS spectrum collected with an LIF crystal on a JEOL microprobe, using the TR(ACE) command. The TR(ACE) command has set the display so that it is in mm and its label shows which spectrometer was used. The dialog and resulting plot could take the following form:

TL1 SUB 8C 24-Apr-90

This line is only printed when called stand alone. Note that the date was set when the "usual way" options were set.

18-Dec-90 2:13 PM

Set defaults for usual way (Y/N) ? N(O)↓

This question is only asked when called stand alone.

ENTER 2 FOR JEOL, 4 FOR ARL, OR 5 FOR MBX ?2↓

This question sets the flags for the axis labeling. The CONFIG variables in TASK8 contain this information so it is only asked when TL1 is called stand alone.

Save this spectrum (Y/N) ? (YES)↓

Drive No. ?2↓

Saved as spectral file # 225 on Disk # 101

TASK8 sets a flag that TL1 can check whenever it saves a spectrum. The flag is cleared when a new spectrum is taken. If TL1 is run stand alone or if it is called from TASK8 and the spectrum has not been saved, TL1 asks if you want to save it. We recommend doing so. If it is valuable enough to plot it is valuable enough to save. Disk memory is cheap!

Usual Way (Y/N) ? N(O)↓

The following responses up to the "Add a Label" can be defaulted by a (YES)↓. In order to set the defaults, refer to the first example.

Fill Under Spectrum (Y/N) ? N(O)↓

Plot the outline.

New axis (Y/N) ? (YES)↓

The system stores the axis parameters in a virtual array so several plots can be overlaid on the same axis. Obviously, the first time PLOT is called a new axis must be drawn.

CR=Top, 1=Bottom, 2=Full Tall, 3=Full Side, 4=Big, 5=User ?↓

Six different plot sizes are offered. The first three are for a vertical 8-1/2 x 11 sheet. "Side" is for a horizontal 8-1/2 x 11 sheet. "Big" is for a horizontal 11 x 17 sheet. "User" gives the operator the option of setting any size plot that he/she needs by positioning the pen to the lower left

corner, pressing ENTER on the plotter, positioning the pen to the upper right corner, and pressing ENTER again. "Top" was used to generate the plot shown in Figure 1. Options CR and 1 differ only in their placement on the page. Option 3 is illustrated in Figure 4 and option 2 in Figure 3. Option 4 is a large version of option 3. Options 4 and 5 can not be specified via the "usual way".

Full screen (Y/N) ? (YES)↓

If a N(O)↓ had been input here, the system would ask for starting and ending X coordinates. Note: When the "Full screen" option is taken 500 of the 512 (or 1000 of the 1024) channels are plotted to make the X axis labels come out nicely.

Y-axis MAX (CR for auto-scale)?↓

The axis is drawn here. Auto-scale chooses a vertical scale such that the maximum peak being plotted is about 90% of full scale and the scale is evenly divisible by 4. The full scale value is 100, 120, 160, 200, 240, 300, 400, 500, 800, 1000, 1200, 1500, 2000, 2500, 3000, 4000, 5000, 8000, etc. (loop from 1000 with factors of 10). Usual way always chooses auto-scale.

Plot date and file # (Y/N) ? (YES)↓

Put the date and file number at the upper left hand corner of the title area.

Default Title = SPEC 2. Use This (Y/N) ? N(O)↓

New Title (CR for none) : Stainless Steel↓

Since we don't want the proffered label we put in our own.

Use pen # ?↓ scale factor (CR=1 ) ?↓

The default pen is always the current one. We kept the black one (#1) for this document. If we had been making a slide, we would have used a colored one. The spectrum is drawn at this point and the pen positioned for the title. The contents of the label field are offered as the default title.

If this spectrum had been an EDS collection, the question:

Plot peak labels (Y/N) ? (YES)↓

would have been asked here. The routine keeps track of the vertical spacing of the labels and provides sufficient offset between labels so they do not plot on each other. This question is not asked for WDS data.

We now enter a loop where we can put in as many additional labels as we want. Each of the "Fe" etc. labels on our WDS example was entered through this loop.

Add a Label (Y/N) ? (YES)↓ Enter label: Fe↓

Use pen # ?↓ position pen, press ENTER on plotter

The plotter loads the requested pen and waits for you to position the pen to the point where you want the label and to press its ENTER button.

When you do so it plots the label and loops back to:

Add a Label (Y/N) ? N(O)↓

One iteration is required for each label to get here.

No. of Additional copies (CR=0)?↓

The HP-7550 plotter can rapidly make additional copies. This question is asked only if you have indicated in the device setup routine (# 669) that you have a 7550 plotter.

Advance page (Y/N) ? (YES)↓ This question is asked for a 7221T or a 7550 plotter that has automatic page advance. It is skipped for a 7221S or a 7470 plotter.

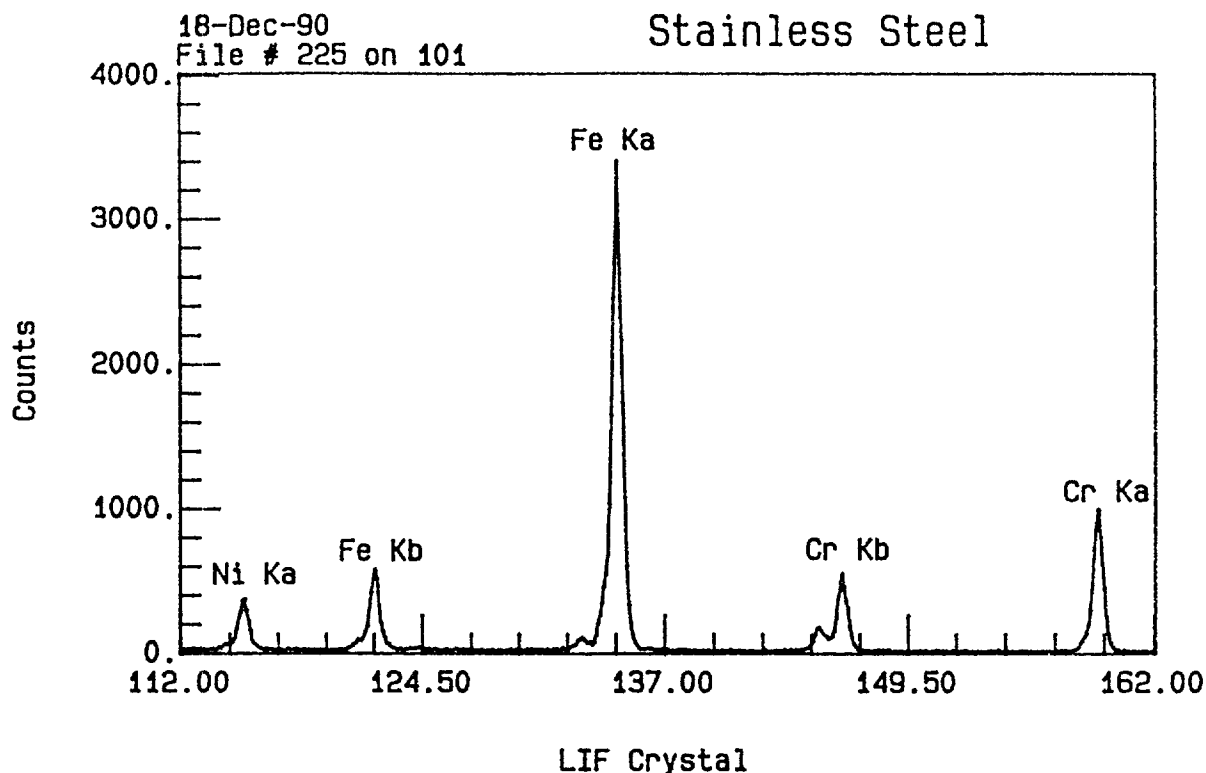


Figure 1. PL(OT) output for a WDS TR(ACE) on a Stainless Steel.

Example: X 'TL1'↓ or use the TASK8 or SQ command PL(OT)↓ to plot an EDS spectrum from the first half of memory. The dialog and resulting plot could take the form shown below. The resulting plot is Figure 2.

TL1 SUB 8C 24-Apr-90

This line is only printed when called stand alone. Note that the date was set when the "usual way" options were set.

18-Dec-90 2:13 PM

Set defaults for usual way (Y/N) ? N(O)↓

This question is only asked when called stand alone.

ENTER 2 FOR JEOL, 4 FOR ARL, OR 5 FOR MBX ? 2↓

This question sets the flags for the axis labeling for WDS plots. Any answer is acceptable for EDS. It is only asked when TL1 is called stand alone.

Save this spectrum (Y/N) ? N(O)↓

Once again, we recommend saving spectra. This answer is to illustrate the plot results if it is not saved.

Usual Way (Y/N) ? (YES)↓

Use the defaults defined in the first example.

Add a Label (Y/N) ? N(O)↓

You are given the opportunity of adding extra labels to the plot.

No. of Additional copies (CR=0) ? ↓

The HP-7550 plotter can rapidly make additional copies. This question is asked only if you have indicated in the device setup routine (# 669) that you have a 7550 plotter.

Advance page (Y/N) ? (YES)↓

This question is asked for a 7221T or a 7550 plotter that has automatic page advance. It is skipped for a 7221S or a 7470 plotter.

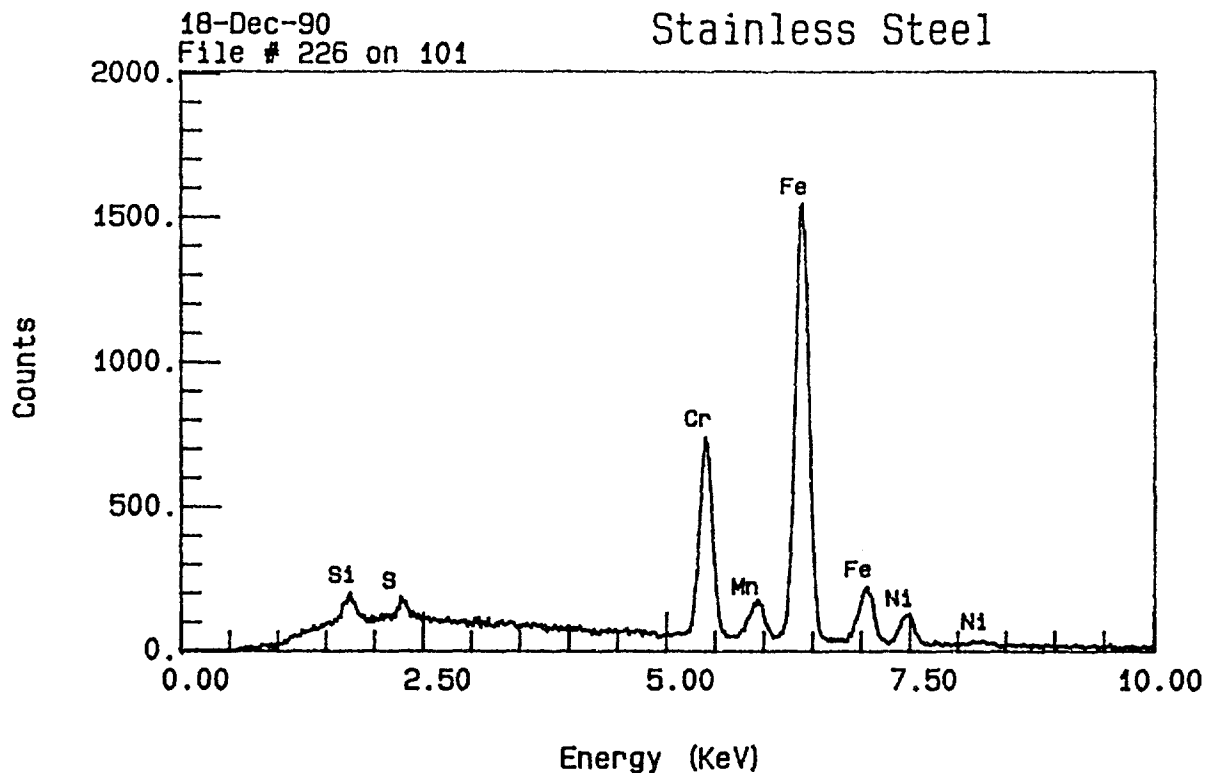


Figure 2. Usual way PL(OT) output for an EDS spectrum of a Stainless Steel.

## Quantitative Data Plotting

Program TI6, file 2510, provides plotted output of data collected by the TASK8 Q(UANT) command and one of the correction programs (BA, PRZ, ZAF, or SSQ). It accepts data from disk files and provides plots on the HP potters<sup>1</sup>. The routine offers numerous options including scale expansion, smoothing, auto-labeling, special symbols, and multiple pens. Its usage is illustrated by the following examples.

Example: X 'TI6'↓ or use the TASK8 command OP (LOT)↓ to plot the quantitative output of a Bence-Albee trace of a pyrope from BA85. The resulting plot is Figure 3.

TI6 QNTPLT 8C 21-Sep-89 Data Drive # 1 ?7↓

This line is only printed when called stand alone. Indicate the drive number where your data file is.

1st Data File # (-1 to abort) ?23↓

A "-1" response terminates the program. We want to plot file 23, the Bence Albee trace across a Pyrope that is used for the summary of Figure 5.

Min TTL to plot 50.00 ?95↓

Data points having analytic totals less than the specified value will not be included in the plot. If run stand alone, the default is 50 wt %. If run from TASK8, the default is specified by MVAR TTL. If TTL is -1, the question is not asked.

CR = Measured values 1 = Normalized values ?↓

The choice is yours.

New axis (Y/N) ? (YES)↓

Several plots can be overlaid on the same axis. Obviously, the first time QNTPLT is called a new axis must be drawn.

CR=Top, 1=Bottom, 2=Full Tall, 3=Full Side, 4=Big, 5=User ?2↓

Six different plot sizes are offered. The options are the same as in the PLOT command (TL1).

Plot from point # 1 ?↓..to 20 ?↓. 3363 μm.

The defaults are the first and last points of the file. Any number of sequential points may be plotted so long as you don't try to go beyond the end of the file. The distance covered by the plot is calculated and printed. If you start your plot from other than point 1, you are given the option of adding an X offset. The offset is relative to the first point that you plot. E.g., if you start with point two and have an offset of 100 μm, point two will be plotted at an X-axis position of 100 μm.

# μm full span 3364 μm. ?↓

---

<sup>1</sup> There are several versions of the Tracor driver for the HP plotters. It is imperative that the proper version is used with your hardware combination or your system is guaranteed to crash. Proper versions are as follows (Letters indicate revisions and may be later so 7D/80 would be acceptable but 7B/80 might not work properly):

	<u>TN2000</u>	<u>TN5xxx</u>	
Library 15	1D/33	6B/80	7221 plotter
	2E/33	7C/80	7475/7550 plotter

# 2635/7 PYROPES-5

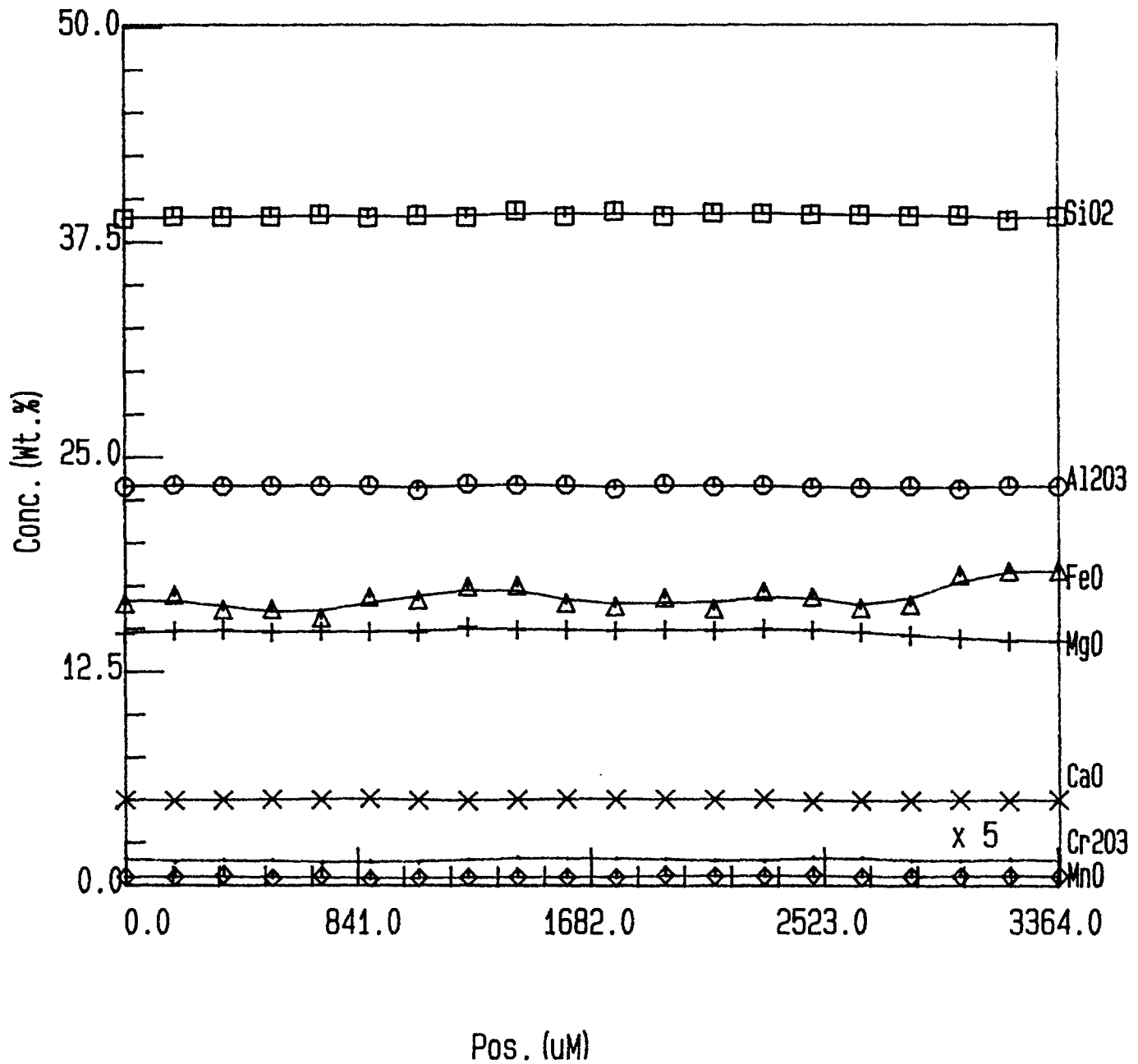


Figure 3. QP(LOT) output for a Bence-Albee trace from a Pyrope.

A number that is divisible by four is offered so the axis label isn't weird. If you are going to overlay several plots, be sure to enter a span that is large enough to contain the longest.

Wt % min 0 ?↓ Max 100 ?50↓

Offsets can be specified globally here or individually later on.

Auto label (Y/N) ? (YES)↓

Each oxide name will be automatically labeled at the right hand side of the graph.

Full border (Y/N) ? (YES)↓

A negative response would suppress the drawing of the lines at the top and right hand side of the plot.

Plot date (Y/N) ? N(O)↓

If a positive response were given, the date would have been plotted in the upper left hand corner.

Default Title = 2653/7 PYROPES-5

Use this (Y/N) ? (YES)↓

You may use the default title or enter your own with a length of up to 40 characters. The print size will scale down for longer titles.

Cation=SI↓

The cation associated with the first oxide to plot.

Use pen # ?↓

Default says to use the current pen. All of these were plotted in black for this report. If only a few copies were being made or a transparency or slide was being prepared we would have used different colors.

Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓

The offset and scale factor for each component can be individually specified. If this is done, you must indicate this through the "Add a label" question at the end. There is no automatic marking of offsets or scale factors.

Symbol # (CR = none)?1↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓

If each component had its own color, we probably wouldn't have used a symbol. The full range has been used for this demonstration. If a symbol number that is too big is entered (legal values are 1 to 6) it is converted to a legal number by taking modulus 6 of the number; thus, symbol 8 becomes symbol 2, etc. After the points are plotted, one has the option of leaving them or drawing a line through them. If a line is drawn, one may choose any number of three point smooths (including 0).

# of smooths 1 ?↓

The default is 1 smooth.

Another Oxide (Y/N) ? (YES)↓

This sequence is repeated for each oxide. In the example, we have used all of the symbols. Each line has been smoothed once. Cr<sub>2</sub>O<sub>3</sub> has been plotted with a scale factor of 5. No offsets were used.

Cation=Al↓

Use pen # ?↓

Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓

Symbol # (CR = none)?2↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓

# of smooths 1 ?↓

Another Oxide (Y/N) ? (YES)↓

Cation=FE↓  
 Use pen # ?↓  
 Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓  
 Symbol # (CR = none)?3↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓  
 # of smooths 1 ?↓  
 Another Oxide (Y/N) ? (YES)↓  
 Cation=MG↓  
 Use pen # ?↓  
 Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓  
 Symbol # (CR = none)?4↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓  
 # of smooths 1 ?↓  
 Another Oxide (Y/N) ? (YES)↓  
 Cation=CA↓  
 Use pen # ?↓  
 Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓  
 Symbol # (CR = none)?5↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓  
 # of smooths 1 ?↓  
 Another Oxide (Y/N) ? (YES)↓  
 Cation=MN↓  
 Use pen # ?↓  
 Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?↓  
 Symbol # (CR = none)?6↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓  
 # of smooths 1 ?↓  
 Another Oxide (Y/N) ? (YES)↓  
 Cation=CR↓  
 Use pen # ?↓  
 Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?5↓  
 Symbol # (CR = none)?↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓  
 # of smooths 1 ?↓  
 Another Oxide (Y/N) ? N(O)↓

**We finally got them all!**

Special Label (Y/N) ? (YES)↓ Enter label: x 5↓

These questions are like those found in the EDS plot. Add the Cr scale factor as an extra label to the plot.

Use pen # ?↓ position pen, press ENTER on plotter

The plotter loads the requested pen and waits for you to position the pen to the point where you want the label and to press its ENTER button.

When you do so it plots the label and loops back to:

Another Label (Y/N) ? N(O)↓

Only one extra label was needed.

No. of Additional copies (CR=0)?↓

The HP-7550 plotter can rapidly make additional copies. This question is asked only if you have indicated in the device setup routine (# 669) that you have a 7550 plotter.

Advance page (Y/N) ? (YES)↓ This question is asked for a 7221T or a 7550 plotter that has automatic page advance. It is skipped for a 7221S or a 7470 plotter.

Additional Plots (Y/N) ? N(O)↓

You have the option of making more plots without leaving the routine.



Example: X 'TI6'↓ or use the TASK8 command OP (LOT)↓ to plot the quantitative output of a  $\Phi(\rho z)$  trace across a diffusion couple from PRZ85. The resulting plot is Figure 4. Note the similarity to the dialog for the Bence-Albee output. The only significant difference is the use of the word "Element" instead of "Cation" with the corresponding labeling of the element rather than the oxide. The routine detects from the output file whether the data were collected via BA, PRZ, or ZAF. The treatment of PRZ and ZAF files is identical. In this example, points 271 through 370 of a 1000 point trace are plotted. The full data set required files 61 and 62; however, only the starting file number is required for QPLOT.

TI6 QNTPLT 8C 21-Sep-89 Data Drive # 1 ?7↓

This line is only printed when called stand alone. Indicate the drive number where your data file is.

1st Data File # (-1 to abort) ?61↓

A "-1" response terminates the program. We want to plot file 61.

Min TTL to plot 95.00 ?↓

Data points having analytic totals less than the specified value will not be included in the plot. If run stand alone, the default is 50 wt %. If run from TASK8, the default is specified by MVAR TTL. If TTL is -1, the question is not asked.

CR = Measured values 1 = Normalized values ?↓

The choice is yours. Since the values sum to within 0.5% of 100, we will use measured..

New axis (Y/N) ? (YES)↓

Several plots can be overlaid on the same axis. Obviously, the first time QNTPLT is called a new axis must be drawn.

CR=Top, 1=Bottom, 2=Full Tall, 3=Full Side, 4=Big, 5=User ?3↓

Six different plot sizes are offered. The options are the same as in the PLOT command (TL1). This time we demonstrate the "Full Side" selection which is often chosen as the default. Had we chosen "User", we would have been asked to position the plotter pen to the lower left and upper right corners of the desired plotting area, pushing the plotter "Enter" button after each choice.

Plot from point # 1 ?271↓..to 992 ?370↓. 990  $\mu\text{M}$ .

The defaults are the first and last points of the file. Any number of sequential points may be plotted so long as you don't try to go beyond the end of the file. The distance covered by the plot is calculated and printed.

Offset zero relative to 1st plotted point (Y/N) ? YES

We want the plot X-axis to start at 0  $\mu\text{M}$  rather than at the position in the file.

1st Pt is at 2701  $\mu\text{M}$ . Offset how many  $\mu\text{M}$  2701 ?

The required offset to start the plot at 0  $\mu\text{M}$  is offered as the default.

Offset data (Y/N) ? YES

Match the data with the new axis label. This is almost always done when the axis is offset but it is not required.

#  $\mu\text{M}$  full span 992  $\mu\text{M}$ . ?1000↓

A number that is divisible by four is offered so the axis label isn't weird. In this case, 1000 is better than the proffered number.

Wt % min 0 ?↓ Max 100 ?20↓

Offsets can be specified globally here or individually later on.

Auto label (Y/N) ? (YES)↓

Each element name will be automatically labeled at the right hand side of the graph.

Plot date (Y/N) ? (YES)↓

Plot the date in the upper left hand corner. If your terminal has a bell, it will ring twice with this request.

Default Title = 2918/DIFFS/1 901106

Use this (Y/N) ? N(O)↓

NEW title: Diffusion Couple

You may use the default title or enter your own with a length of up to 40 characters. The print size will scale down for longer titles.

Element=NI↓

The first element to plot. If your terminal has a bell, it will ring twice each time an element is requested.

Use pen # ?↓

Default says to use the current pen. All of these were plotted in black for this report. If only a few copies were being made or a transparency or slide was being prepared we would have used different colors.

Y-Offset (%) = 0.00 ?-70↓ Scale factor = 1 ?↓

The offset and scale factor for each component can be individually specified. In this case, we are subtracting 70% from each Ni value before it is plotted so its variation can be shown at the same scale as Cr and Mo. Whenever this is done, you must indicate this through the "Special label" question at the end. There is no automatic marking of offsets or scale factors.

Symbol # (CR = none)?↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓

See the previous example for a discussion of symbol usage.. After the points are plotted, one has the option of leaving them or drawing a line through them. If a line is drawn, one may choose any number of three point smooths (including 0).

# of smooths 1 ?0↓

The default is 1 smooth.

Another Element (Y/N) ? (YES)↓

Element=CR↓

Use pen # ?↓

Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?5↓

Symbol # (CR = none)?↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓

# of smooths 1 ?0↓

Another Element (Y/N) ? (YES)↓

Element=MN↓

Element=MN NOT FOUND! Element=MO↓

MN was entered instead of MO. The bell rings before and after the warning if it can.

Use pen # ?↓

Y-Offset (%) = 0.00 ?↓ Scale factor = 1 ?5↓

Symbol # (CR = none)?↓ Ok (Y/N) ? (YES)↓ Line (Y/N) ? (YES)↓

# of smooths 1 ?0↓

Another Element (Y/N) ? N(O)↓

There were four elements but we are plotting only three of them.

Special Label (Y/N) ? (YES)↓ Enter label: Ni offset by 70%

These questions are like those found in the EDS plot. Add the message about the Ni offset as an extra label to the plot.

Use pen # ?↓ position pen, press ENTER on plotter

The plotter loads the requested pen and waits for you to position the pen to the point where you want the label and to press its ENTER button.

When you do so it plots the label and loops back to:

Another Label (Y/N) ? N(O)↓

Only one extra label was needed. If you delay too long before you start moving the plotter pen to position it for a label the plotter will automatically store it. You can still position the carriage without the pen and press enter to get the label.

No. of Additional copies (CR=0) ?↓

The HP-7550 plotter can rapidly make additional copies. This question is asked only if you have indicated in the device setup routine (# 669) that you have a 7550 plotter.

Advance page (Y/N) ? (YES)↓

This question is asked for a 7221T or a 7550 plotter that has automatic page advance. It is skipped for a 7221S or a 7470 plotter. Don't advance the page if you are going to overlay data from another file or make a second plot on the same page.

Additional Plots (Y/N) ? N(O)↓

You have the option of making more plots without leaving the routine.

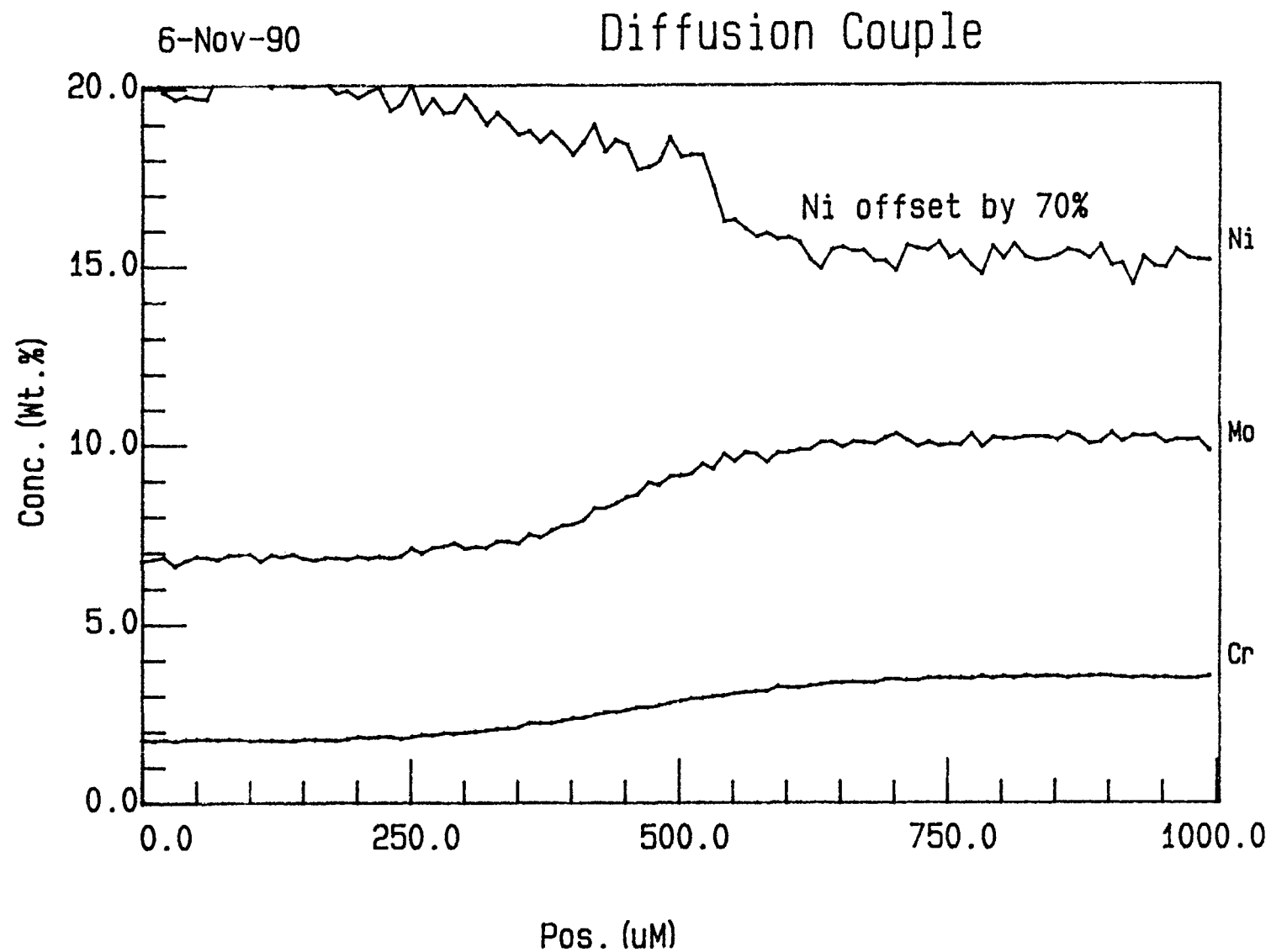


Figure 4. QP(LOT) output for a  $\Phi(\rho z)$  trace across a portion of a complex diffusion couple.

## Quantitative Data Summaries

Program TI0, file 2504, provides a printed summary of data of data collected by the TASK8 Q(UANT) command and one of the correction programs (BA, PRZ, ZAF, or SSQ). It accepts data from disk files and prints either analytic or normalized values, along with a brief statistical analysis of the data. If data have been collected with the Bence Albee (BA) routine and the MINCODE option is used, TI0 gives the option of listing the code (and, if applicable, the associated tag) for each point of a file. It then will summarize each requested MINCODE separately. Since it assumes that you probably want to summarize several MINCODEs, it asks "Usual Way?" after each summary rather than dropping into the normal question sequence. Quantitative output can be sent to a serial port that is connected to a VAX or PC in addition to storing the data in the Tracor system and printing it. This capability, which can be activated in both the quantitative analysis programs and in the summary program, permits collecting the data in a data base. If you have installed the +DV module supplied with TASK8, this port may be any one of the six possible serial ports of the TN5xxx (ports 0 to 5 corresponding to devices 1 to 6); however, if it is not one of the four standard ports (ports 0 to 3) be especially careful to make sure that all of the DLV11E interface requirements are met<sup>1</sup>. The usage of TI6 is illustrated by the following examples.

Example: X 'TI0'↓ or use the TASK8 command QS(UMM)↓ to summarize the quantitative output of the Bence-Albee trace across the pyrope sample which was plotted in Figure 3. The resulting summary is shown in Figure 5 where the print size has been reduced in order to keep everything on one page.

```
TI0 QSUMM 8C 26-Jan-90
```

This line is only printed when called stand alone.

```
Data Drive # 2 ?7↓
```

```
PC port # (CR for none)?↓
```

These questions are only asked when called stand alone. If you have a PC or VAX connected to one of your serial data ports and want to send data to it, input the port number here and you will later be given the

---

<sup>1</sup> The TN5400 and TN5500 are standardly equipped with four serial ports available through 9-pin connectors on the back. These ports are labeled serial 0 through serial 3 and are accessed via the software commands >+DV 1 through >+DV 4 respectively. Two more serial lines may be added by using DLV-11E modem cards. Port 4 has address '77755x' and vector '7x' while port 5 has address '77750x' and vector '22x' where x is 0 for input and 4 for output. Using the standard version of +DV, referencing these ports is more complicated, requiring a specification of both the address and vector instead of just the port number plus 1 (>+DV 0 references the printer on the parallel port); thus, an output device on port 4 is referenced by the command >+DV '777554','74'. Three of the original ports have specific devices assigned to them by Tracor. If a plotter is on the machine, Library 15 expects it to be on port 3. Library 52 expects to find the TN5600 on port 2. If a TN8502 imaging system is in use, it requires port 0. If all possible serial devices that TASK8 can accommodate are installed, all six ports would be required (TN8502, TN5600, plotter, CRT terminal, JEOL 8600 column control, and output to a VAX or PC). The software for the 8600 column control must run on the DLV11-J card, therefore it must use one of the first four ports. Tracor has provided us with the source for +DV. We have modified it to recognize ports 5 and 6 and included it on the disk as +DV 2B/80. If all your normal ports are used, put your CRT and/or your PC on ports 4 and 5 (referenced by >+DV 5 and >+DV 6). (Our modification to +DV also eliminated the flashing "OUTPUT BUSY" message that didn't mean anything.)

option of sending the data to that port. This example assumes that you do not.

. . .Printer (Y/N) ? (YES)↓  
This question is asked if your 669 file indicates that you have a separate printer.

Data File # (0 to abort) ?23↓  
A "0" response terminates the program. We want to summarize file 23, the Bence Albee trace across a Pyrope that was used for the plot of Figure 4.

Usual way (Y/N) ? (YES)↓  
The "usual way" gives a long form average of all points using measured values and performs a statistical summary on the entire group. If the program is run stand alone, the minimum analytic total for inclusion is 50 weight % if the program is run stand alone or the value set by MVAR TTL if it is run from TASK8. If MVAR TTL is -1, all data are included and no questions concerning homogeneity totals are asked.. The results of this dialog are given in Figure 5. Notice that the header includes the analysis program, the date of the analysis, the analyst, the system run conditions, and the detection limits of the first reported point. The statistical summary includes averaged analytical values, averaged counting statistics for each element or oxide, the 1-sigma standard deviation of the analytic average as a result of counting statistics, and the 95% confidence limits of the mean analytic total based on Students' T for the number of points of the analysis.

CR=Avg, 1=Long form avg, 2=Edit, 3=New file, 4=End ?↓  
The program is often exited at this point. For purposes of illustration, we will demonstrate both short-form averaging and editing.

Summarize from Pt # (CR = All) ?↓  
You may specify the starting and ending points if desired. If you specify a starting point, the system will offer you the last point of the file as the default end point.

Group size 20 ?5↓  
The entire group is offered as a default. We choose here to break the file into 4 groups of 5 points.

Min TTL for homogeneity 50.00 ?95↓  
Data points having analytic totals less than the specified value will not be included in the analysis. If run stand alone, the default is 50 wt %. If run from TASK8, the default is specified by MVAR TTL. If TTL is -1, the question is not asked.

CR = Measured values 1 = Normalized values ?1↓  
We have already used measured values so this illustration is for normalized values.

Advance page (Y/N) ? (YES)↓  
You may want to look at the statistical summary of the entire group after editing certain points out of the file. If so, you probably don't want to use a separate sheet of paper for each summary.

CR=Avg, 1=Long form avg, 2=Edit, 3=New file, 4=End ?2↓  
Every operation terminates here. Next, we will demonstrate editing.

CR = Disable or 1 = Enable ?↓

Data points are not removed from the file. The "Disable" function sets a flag to tell the summary and plotting programs to ignore this datum. "Enable" clears the flag.

From point # (CR to End) ?5↓..thru # 5 ?↓

The default "thru" is the starting point. Any number of points may be disabled or enabled in sequence so long as you don't try to go beyond the end of the file.

From point # (CR to End) ?↓

You may take out as many sequences as you desire.

CR=Avg, 1=Long form avg, 2=Edit, 3=New file, 4=End ?4↓

This completes the example. Calling option 3 causes the program to loop from the "Printer (Y/N)?" question.

18-Dec-90 4:54 PM

Summary of File 23, Disk 74

2635/7 PYROPES-5  
BA, version 85A

19-Aug-88 10:22 AM  
Analyst: P. F. HLAVA

System run conditions:

15 KEV, 20.6 NA Beam Current  
Beam size (UM) = 16  
WDS Min Time= 5 Sec. 0.5 % Desired Standard deviation  
with 1.0 = Min Peak/Background necessary for Max Time  
BA definitions file # 199 Setup file # 1 BA Matrix # 4077

Detection limits of 1st reported point

NA2O	0.019 Wt %	MGO	0.024 Wt %	AL2O3	0.021 Wt %
SIO2	0.019 Wt %	P2O5	0.026 Wt %	K2O	0.019 Wt %
CAO	0.020 Wt %	TIO2	0.016 Wt %	CR2O3	0.018 Wt %
MNO	0.021 Wt %	FEO	0.021 Wt %	NIO	0.021 Wt %

Pt #	NA2O	MGO	AL2O3	SIO2	P2O5	K2O	CAO	TIO2	CR2O3	MNO	FEO	NIO	Total	uM
1	0.00	14.66	23.20	38.76	0.04	0.00	4.97	0.01	0.32	0.49	16.40	0.06	98.92	0.0
2	0.00	14.83	23.32	38.89	0.04	0.00	4.94	0.04	0.26	0.50	16.89	0.06	99.79	177.0
3	0.00	14.87	23.24	38.85	0.05	0.00	4.98	0.05	0.29	0.61	16.04	0.06	99.04	354.0
4	0.00	14.73	23.27	38.87	0.04	0.00	5.01	0.04	0.30	0.43	16.07	0.08	98.84	531.0
5	0.00	14.80	23.25	39.01	0.05	0.00	4.99	0.03	0.25	0.56	15.56	0.09	98.60	708.0
6	0.00	14.78	23.30	38.81	0.04	0.00	5.08	0.05	0.29	0.38	16.78	0.06	99.57	885.0
7	0.00	14.73	23.00	38.95	0.05	0.00	4.97	0.04	0.27	0.46	16.60	0.07	99.14	1062.0
8	0.00	15.06	23.38	38.84	0.05	0.00	4.93	0.02	0.30	0.47	17.37	0.08	100.49	1239.0
9	0.00	14.90	23.31	39.22	0.03	0.00	5.00	0.03	0.33	0.50	17.44	0.04	100.79	1416.0
10	0.00	14.91	23.34	38.90	0.04	0.00	5.04	0.06	0.31	0.50	16.43	0.07	99.60	1593.0
11	0.00	14.84	23.08	39.19	0.05	0.00	5.01	0.03	0.32	0.48	16.24	0.09	99.32	1770.0
12	0.01	14.87	23.36	38.90	0.03	0.00	5.03	0.02	0.31	0.60	16.72	0.07	99.91	1947.0
13	0.01	14.82	23.23	39.10	0.02	0.00	5.00	0.04	0.29	0.55	16.08	0.10	99.24	2124.0
14	0.01	14.95	23.30	39.07	0.04	0.00	5.05	0.03	0.28	0.53	17.10	0.02	100.38	2301.0
15	0.00	14.88	23.16	39.00	0.04	0.00	4.87	0.07	0.33	0.60	16.78	0.06	99.80	2478.0
16	0.00	14.72	23.12	38.96	0.03	0.00	4.92	0.02	0.32	0.46	16.11	0.03	98.68	2655.0
17	0.00	14.52	23.22	38.90	0.04	0.00	4.89	0.03	0.28	0.50	16.30	0.07	98.75	2832.0
18	0.00	14.36	23.05	38.95	0.07	0.00	4.97	0.02	0.28	0.52	18.03	0.05	100.29	3009.0
19	0.00	14.20	23.24	38.64	0.04	0.00	4.91	0.03	0.31	0.53	18.26	0.04	100.20	3186.0
20	0.00	14.19	23.19	38.86	0.04	0.00	4.96	0.04	0.29	0.52	18.27	0.05	100.41	3363.0

Statistical summary of 20 points with anal TTL > 95 WT %  
Students' T (95%) = 2.0929

	NA2O	MGO	AL2O3	SIO2	P2O5	K2O	CAO	TIO2	CR2O3	MNO	FEO	NIO	Total
AVG	0.00	14.73	23.23	38.93	0.04	0.00	4.98	0.04	0.30	0.51	16.77	0.06	99.59
+-	0.00	0.10	0.16	0.28	0.01	0.00	0.06	0.01	0.02	0.05	0.22	0.03	Avg Count
+-	0.00	0.24	0.11	0.14	0.01	0.00	0.06	0.01	0.02	0.06	0.77	0.02	1-Sigma
+-	0.00	0.11	0.05	0.07	0.00	0.00	0.03	0.01	0.01	0.03	0.36	0.01	95% Conf
	0.00	14.79	23.32	39.09	0.04	0.00	5.00	0.04	0.30	0.51	16.84	0.06	Norm Wt %

Figure 5. QS(UMM) Output for a Bence-Albee Trace from a Pyrope.



## Calling the Routines from TASK8 or SQ

All of the plotting and summary routines are available directly from TASK8. The spectral plotting routine can be called from our version of SQ, the Tracor Standardless Quantitative analysis routine. When the spectral plotting routine is called from SQ, it behaves exactly as though it were called from TASK8 with the restriction that no WDS spectra can be plotted. Since the routines are designed to plot from the first half of memory, be sure that you have either collected your data into that section or have moved it there. Operation from TASK8 is very similar to stand alone operation except the setting of flags in TASK8 eliminates the need for initialization questions. The relevant TASK8 and SQ commands are listed below.

PL(OT)	Plot the first-half spectrum on an HP7221, HP7475, or HP7550 series plotter. Required parameters are requested as needed. (TASK8 or SQ.)
QP(LOT)	Plot the output from a QUANT run. (TASK8 only.)
QS(UMM)	Summarize the output from a QUANT run. (TASK8 only.)

A softkey "tree" for command selection is enabled in SQ or if TASK8 is running on a TN5xxx analyzer. In this case, any of the summary or plotting routines can be called via the tree as follows:

Spectral Plotting from TASK8 (the PL(OT) command). Either

**EDS                  PLOT**

or

**WDS                  WDS\_Set\_2          PLOT**

The routine itself detects whether the spectrum is EDS or WDS data but the call is located in two branches of the tree for operator convenience.

Spectral Plotting from SQ (the PL(OT) command).

**INPUT/OUTPUT          PLOT**

Plotting of quantitative data from TASK8 (the QP(LOT) command):

**QUANT          OUTPUT          Quant\_PLOT**

Summary of quantitative data from TASK8 (the QS(UMM)ary command):

**QUANT          OUTPUT          Quant\_SUMMARY**

One of the TASK8 MVARs affects the output of both QP(LOT) and QS(UMM). MVAR TTL defines the minimum analytic IoIaL for inclusion in QS(UMM) or QP(LOT) output. If TTL is set to -1, all data are included and the questions regarding limits are suppressed. If TTL is positive, it is interpreted as the analytic total below which data are ignored. This is especially important when the "usual way" option is taken. The as-delivered default value of TTL is 95%. If you are working with systems where you get meaningful data with lower analytical totals than the default value, you should either change MVAR TTL before running QS(UMM) or QP(LOT) or you should change the default value via CONFIG8.

## Routine Descriptions

Subroutines are grouped in files that can be loaded from disk when they are needed and "killed" when they are no longer needed. The rapid and, to the user, transparent loading process permits an effective memory management scheme for increasing the capabilities of the system. A set of conventions above and beyond the TN conventions have been followed in writing subroutines. They are:

1. Two copies of the subroutine are maintained -- one as a type 10 (normal subroutine) file and one as a type 12 (program) file. This procedure simplifies maintenance by permitting the easy use of the UTILITY editing routines and by making it easier to keep name integrity when the compiler is used. (Also, the TN2000 and TN5xxx operating systems do not permit the partial loading of a subroutine file.)
2. All subroutines in a particular file have their names listed in line 1,1 of the file and followed by the file number or hashed name. The first subroutine name is preceded by a colon (:) and the last subroutine name is followed by a colon. For example, 1,1 [:YN,TIME,IN,IN1:670 says that subroutine file 670 contains subroutines YN, TIME, IN, and IN1. By following this naming convention, it is possible to tell at a glance which subroutines are in a particular file. Also, the Flextran <S command summarizes the subroutine files currently in memory by listing the first subroutine of each file along with its arguments. Thus, Flextran thinks that the first subroutine of file 670 is :YN and that it has arguments TIME, IN, and IN1:670 so a <S tells us all of the subroutines in memory rather than just the first one of each file. If we want to edit this file we do so by the command <E :YN↓.
3. Line 1,2 is either a D 200;END or just END and no other lines before 1,100 are used. If line 1,2 is END, an X 'FILE'↓ will simply bring the type 12 version of the file into memory for editing. Some of the subroutines, however, have been written so that they can function either as a program or as a subroutine. If this path has been chosen, the portion of the subroutine/program that controls its operation as a program resides in block 200 and an X 'FILE'↓ will cause it to be run as a normal program. The quantitative summary routine, 'T10', the quantitative plotting routine, 'T16', and the EDS plotting routine, 'TL1' are all examples of the latter.
4. Subroutine names start with line 1,100. They are separated by 10 line increments.
5. Global variable calls and variable allocations that are common to all subroutines in a particular file are made in block 2. Thus, most subroutines have a line of the form 1,105 D 2;D xxx;E where xxx is the block that performs the task assigned to the subroutine. Global variable calls and variable allocations that are unique to a particular subroutine are made as they are needed.
6. Global variables are called in alphabetic order.
7. Block 99 contains code for saving a corrected version of the subroutine. This block does *NOT* save the type 12 file and is useful only when debugging an interpreted version of the subroutine. This block is automatically deleted when a subroutine is compiled. Note that a compiled subroutine may be modified by replacing a line of code with interpreted code in a similar manner to Flextran programs but *IT CAN NOT*

*BE RESAVED.* Since TASK8 dumps and reloads subroutine files on a regular basis, this feature is not really useful. If a subroutine must be modified, make the modification in interpreted code, be sure that the modification is in the type 12 file, and then, after testing, create a compiled subroutine with the type 12 file as the input to the compiler.

8. Subroutines must occupy only blocks 1 through 199 of a file. As mentioned above, if the routine can double as a program its program control block is 200. Parts of the file that are unique to the program mode reside in blocks 200 through 239. Block 240 is used to document changes to the subroutine file. (Since it is not saved with the executable subroutine file it adds no overhead.) Blocks 241 through 246 are reserved for general comments and documentation. Block 247 is a special block that is present in all of the type 12 versions of the subroutine files and provides an easy way to perform variable searches, get listings, and save the file. These functions are performed by the UTILITY program which should be resident on your system disk. Whenever a file is saved by UTILITY, the date and time are written into line 247,30 and the date is automatically made a part of the disk label. Blocks 1 through 247 are saved as a type 12 file but only blocks 1 through 199 are saved as a type 10 file. This convention permits some internal documentation of the file without a run-time memory penalty.

'TI0', 'TI6', and 'TL1' all fall in the machine independent subroutine group for the TASK8 system. They and the general subroutines that they call are described below.

#### Plotting and Summary Routines

<u>File</u>	<u>Subroutine Names Associated With Each Routine</u>		
2504 'TI0'	QSUM	Provide a summary with limited statistics of data collected by any of the quantitative analysis programs. TI0 can be run as an off-line program via an X 'TI0'.	
2510 'TI6'	QPLT	Plot the data collected by any of the quantitative analysis programs. TL6 can be run as an off-line program by X 'TI6'.	
2529 'TL1'	PLOT	The spectral plotting routine. It handles both EDS and WDS data and, by checking flags set by DEVICE, can output to the HP7221, the HP7475, or the HP7550 plotter. If TL1 is run as a program (X 'TL1'), options for the "usual way" response can be set. Note: TL1 must be resaved after the options are set ( <u>G(O) 247↓</u> to save).	
	PLOT1	The PLOT call for Sandia SQ.	
	PLOTE	The PLOT call for TL0 when TL0 is run as a program. We recommend using SQ rather than TL0 for EDS work.	

## General Subroutines

<u>File</u>	<u>Subroutines</u>	
669	DEVICE	Read the descriptors for the console device, the system printer (if any) and the plotter for the system. This routine is executed as a program to set the device descriptors for the system.
670	YN	Provide YES/NO question and response. Print " (Y/N) ? " and return 0 for a NO or 1 for a YES response.
	TIME	Print the current time on paper and into a buffer.
	IN	Read an argument from the input command line.
	IN1	Read an argument in immediate mode after printing the current value of the variable in question.
671	CLOCK	Set the system clock on a TN2000. (Use the touchpad on a TN5xxx.)
672	DISKNUM	Return the number of the disk in the specified drive.
680→683	PR	The printer subroutines. One of these routines is chosen when the system is installed. 680 is for LA100/LA120's, 682 for C-ITOH, and 683 for "dumb" printers.

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