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USING LINE AS AN INTERACTIVE GRAPHICS PACKAGE

Interfacing Line and Topdraw in 43 or 24 VM*

by

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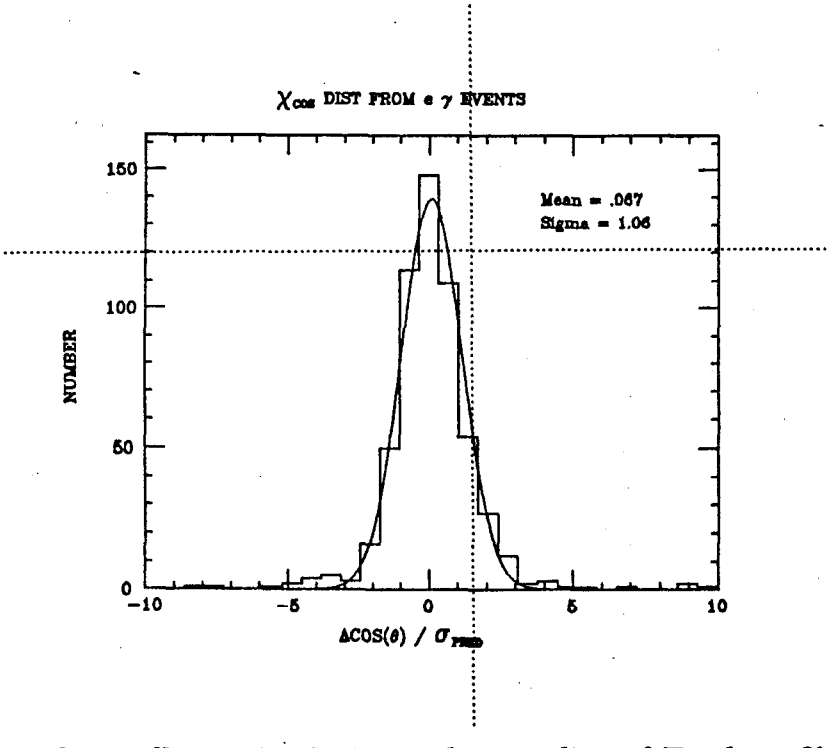

A guide to efficient displaying and appending of Topdraw files.

This memo serves to describe interactive graphics with the *LINE* exec for use with any Topdraw file. In particular, the operation of *LINE* for positioning of Topdraw titles is described.

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Notes to new users of *LINE*

LINE is an exec which is on the WDISK here at SLAC (as of 4/10/85). All the operating programs and help files are on this disk and you must issue a GIME WDISK in order to access them. *LINE* is used to do interactive graphics, and is well adapted to full screen VM. The *LINE* exec has two main functions: creating Feynman graphs† and appending titles to Topdraw files which have already been created. The latter function is described in this manual.

The features described in this manual assume that you are operating *LINE* from its full screen menu on an Ann Arbor graphics terminal (such as the Ambassabor or XL series with the graphics master). *LINE* fully supports operation only under these circumstances. Since the Ann Arbor XL series has been choosen as the SLAC standard (as of 1985), this should not be a problem for the general user operating from 24 or 43 VM. Users of other Tektronix 4013 emulating terminals will also be able to utilize many of the features of *LINE*. This includes users of VT100 and CITOH terminals. These users must consult Appendices VII and VIII for more details.

Lastly, for those users who wish to use *LINE* only to position titles, please bear in mind that *LINE* also serves to draw a tremendous array of different Feynman graphs, and not all of the machinery used for this overlaps with the machinery you use for titling. Therefore, some of the features (and nomenclature) may not apply to your application, and a little tolerance is required. Nevertheless, this exec gets the job done, and done well.

† This function is described in technical note TN 85-01, *Introduction to LINE*, which is available from the SLAC publication office.

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Reference card – Using *LINE* for Titling

GIME WDISK
LINE XS (M E *or* LINE XS (M E H fn
Input : Topdraw filename
Optionally XMD Set font duplex
Cursor readout : XMD CUR 1
Input title and case
Keep (Y/N) title ?
Display crosshairs ?
PF03 to quit *or* XMD NEW filename

Introduction

This memo describes the extended features of *LINE* which allow it to be used as an interactive graphics interface to Topdraw. Using the full screen menu of *LINE*, the user can display the Topdraw file, or xedit it, with just the touch of a PF key. Certain modes of operation make *LINE* especially well suited to the task of exactly positioning titles on the plot. The following four features of the exec allow this to be done optimally:

- The direct input area of the menu, where you can type, verbatim, the additions you want to append to the Topdraw file. (The menu screen is shown in Appendix III).
- The CURSOR option, which allows you to exactly locate the coordinates of points on the plot (so that you can position Topdraw titles, etc.).
- The SEQ4013 option, which allows the plot to be updated without having to regenerate the entire plot for each addition.
- The XMD mode commands, which allow the exec to be operated from the direct input area.

The direct input area of the menu consists of lines where the data to be appended to the Topdraw file is typed in. This area can be set up so that the input is immediately appended to the Topdraw file when a carriage return is entered, or it can be used to update the plot so that the user can subsequently decide if the Topdraw file is to be updated. Thus, the user can propose a title and view it on the plot, and then decide to keep it or not, without ever having to directly edit their Topdraw file.

The XMD commands can be used to issue commands to the exec, and to set the different modes of operation of the menu's direct input area. These modes allow the user to run the exec from the input area, where they can issue commands to put up the graphic crosshairs, read out the coordinates, and input titles to the Topdraw file. All the XMD commands can be issued from the direct input area of the menu. The input area's mode of operation can also be set when *LINE* is invoked (and should be, if *LINE* is used for titling).

The next two features are fully supported only for the Ann Arbor Ambassabor and XL series terminals (other users must refer to the appendices for the abilites of their particular terminal). The first feature is implemented by running *LINE* with the CURSOR option. This allows *LINE* to put up a set of crosshairs on the graphics screen. These crosshairs (graphics cursor, or cursor for short) can be moved on the screen with the cursor control keys on the number pad. The cursor moves in eight directions: N, S, E, W, NE, NW, SE,

and SW. When the user enters any key on the character keyboard, *LINE* reads out the position of the cursor on the screen. *LINE* can then convert these terminal coordinates into the "TEXT" coordinate system used by Topdraw. If the user wishes, the cursor can also read out positions with respect to their data coordinate system as well.

The last feature to be introduced here is the ability of *LINE* to selectively display and *erase* portions of the plot. This feature is enabled by the SEQ4013 option. Basically, it allows the exec to interact with the user in a much more efficient fashion, speeding up the interactive process. It is an option which must be loaded when *LINE* is invoked. Hopefully, this option is transparent in its operation, other than the resultant increase in interactive speed due to its use. This option is described in greater detail in a later section.

Overview

The envisioned use of *LINE* for putting titles on a Topdraw plot is as follows: the user invokes *LINE* with the prescribed set of arguments and options as suggested in the section *Running LINE*. The exec first plots the user's initial Topdraw file. The exec returns from the graphics screen (after a carriage return is entered) and then displays the full screen menu (see fig. 1). The exec is operated from this menu. At this point the user enters a command to return to the graphics screen with the graphic crosshairs enabled. The crosshairs can be moved anywhere on the screen with the cursor keys. The crosshairs should be used to locate the position of the title. The user marks this location and returns to the menu. The coordinate readout of the crosshairs appears on the menu, allowing the user to construct their Topdraw title.

The title can be entered from the menu, exactly as if it were being typed (in upper case)† directly into the Topdraw file. The exec then displays the plot with the new title added. Upon return to the menu the user is prompted for the disposition of this title. In other words, the user is given the chance to keep (or not keep) the title after seeing it on the plot. If the title is kept it is appended to the Topdraw file, otherwise, the Topdraw file is not appended and the title is erased from the plot. The user is given the opportunity to redisplay the crosshairs before erasing the title (or continuing to the next title), allowing a misplaced title to be referenced while repositioning it with the crosshairs. Incorrectly

† Note: the default setting of the full screen menus is to translate all input fields to upper case automatically. If the user wishes to have the case respected for their input (and CMS commands) they must issue a "XMD SET CASE MIXED" command.

placed titles can be recalled on the menu, so that the user can correct the coordinates without retyping the input. (Incorrect titles can also be recalled so that the title text can be modified as well). Other titles can be positioned in exactly the same fashion. The user finally exits from the exec to make a hardcopy of their updated Topdraw file.

The Cursor Option

There are two ways to put up the graphics cursor: either with the "Display crosshairs" prompt on the menu, or by using the "XMD CUR" command. The former only works at selected times in the exec's operation while the latter can be entered from the direct input area. There are a variety of options for how the cursor can be used. Most of these choices are for use in drawing Feynman graphs. The entire range of choices is shown in Appendix V.

The cursor selection menu can be displayed by entering "XMD CUR" from the direct input area of the menu, or by answering "yes" to the "Display crosshairs" prompt (at the appropriate time). The recommended option to be used for titling is option 1 (i.e. Normal Ordering). This allows the user to locate two points on the plot. (If the position of only one point is desired, it will have to be read out twice). This option can be directly selected by typing in "XMD CUR 1" or by answering "1" for the "Display crosshairs" prompt. In either case, the exec immediately toggles into the graphics screen with the crosshairs displayed. The crosshairs can be moved with the cursor control keys. Once positioned, the coordinates are entered by hitting any character key. After the second point is read out the exec returns to the menu, displaying the coordinates of the points in the X1, Y1, X2, and Y2 fields. The user can then use the coordinates in constructing their Topdraw titles.

The cursor readout in EXTMODE is, by default, done with respect to the 10x13 default Topdraw coordinate system. However, by using the cursor 0 option, "Initialization", the user can reference their data coordinate system (provided it is linear). This suggests other possible uses of the cursor readout.

The SEQ4013 Option

The SEQ4013 option, together with the XMD internal commands, naturally extend *LINE*'s interactive capacity, allowing full screen interactive graphics (for Topdraw files) at SLAC. The SEQ4013 option is briefly discussed below.

When the SEQ4013 option is on, *LINE* no longer plots the entire file each time it is to be modified and displayed (as when adding a title, or a photon line, etc.). Instead, the plot remains on the screen, and the additions are overplotted on it as the session progresses. The additions to the plot can also be selectively erased. Therefore, the entire Topdraw file is only replotted when specified by request (i.e. with the PF09 key).

This style of operation saves time in two ways. First, a SEQ4013 file for the entire Topdraw file need only be generated once, when *LINE* originally displays the plot at invocation. Thereafter, only the proposed additions to the plot are processed into SEQ4013 files. *Even more importantly,* there is a major savings in the time involved in actually displaying the plot, since the I/O to the terminal is cut to a minimum. The improvement in efficiency is both obvious and welcome. Erasing the unwanted addition is achieved by manipulating its *already* generated SEQ4013 file, and the internal operation of the graphics terminal, so that the SEQ4013 file is again sent to the terminal; but this time the image is erased, pixel for pixel. (These erase features are currently supported only for the Ann Arbor graphics master).

The typical interactive process for modifying the Topdraw file with *LINE* is to first show how the plot looks with the proposed addition. The exec returns to the menu and prompts the user for whether this addition should be kept (the actual wording of the prompt is, "Keep this line?"). The user can choose to keep it, in which case the Topdraw file is appended. If the user decides not to keep it then the Topdraw file is not appended and the addition is erased from the graph. The addition is erased only when the entire plot is redrawn and redisplayed, when the SEQ4013 option is not used.

If *LINE* is being run with the cursor option on, then a "Display crosshairs" prompt appears on the menu. This prompt can be used at the same time the "Keep this line ?" prompt is used. This allows the user to return to the graphics screen with the crosshairs displayed before an unwanted addition is erased. An instance of this would be when the user answered "no" to the keep prompt and "yes" or "1" to the crosshair prompt. This would be useful when moving a title a little to the left, say. Note that the addition would be erased before a XMD command could be issued to put up the crosshairs.

The XMD Commands

The complement of the SEQ4013 features are the XMD commands. The XMD commands allow the user to conveniently and efficiently alter the operation of the *LINE* exec. Foremost among these are the internal modes: EXTMODE, TMODE, INPUTMODE, and CMSMODE. These modes affect the operation of the direct input area of the full screen menu.

Of most interest to the general user is EXTMODE, which allows the exec to be used to exactly position Topdraw titles with the minimum number of iterations. When this mode is turned on, two other modes are also set on. One of these (INPUTMODE) positions the cursor on the first line of the direct input area and causes the exec to ignore the Feynman graph features. The other mode (TMODE) causes the Topdraw input to be displayed before being appended to the output file. The user is subsequently prompted for the disposition of this input. Thus, when the SEQ4013 option is used in conjunction with EXTMODE, a title can be input, displayed, and then either added or erased in seconds while operating in full screen VM. You can even input new Topdraw files to *LINE* with the XMD NEWFILE command.

Two more features have been added in order to optimize this procedure. First of these is the XMD CURSOR command. When run in EXTMODE the exec automatically converts the graphic coordinates read from the cursor crosshairs into the default TEXT coordinate system of Topdraw. The readout appears on the full screen menu allowing exact placement of titles anywhere on the plot. Even so, the process may still be an iterative one, and with this realization the SYSTEM REQUEST key (i.e. the PAUSE key on the Ann Arbors) has been programmed to recall the previous data entered into the direct input area of the menu. For instance, you can reposition a title without having to retype it by using this key to recall the input (both title and case) and then modifying the coordinates.

For users who wish to fully utilize *LINE* as an interactive graphics environment, the capacity to reprogram the PF6 and PF12 keys has been added. Thus, if the user has their own Fortran driver and wishes to write an exec to manage I/O for certain control parameters (e.g. similar to the LINEDEF and LOOPDEF menus), there are two PF keys available to them. Other XMD commands are described later. All the details of XMD and running *LINE* are contained in later sections, and are also available in online help files.

The last extension of *LINE* that will be discussed in this section is the XMD POLYGON feature. This feature in no way affects your final Topdraw plot. In fact, it has no

affect on any file. Instead, it communicates directly with the Ann Arbor terminal causing the graphics master to go into POLYGON mode. The user specifies the exact nature of the polygon to be drawn (or erased) through a series of five prompts, which include how the polygon is defined (with the cursor or by data points), the texture chosen to fill the polygon (solid, bricks, zigzag, etc.), whether the perimeter border is drawn, and whether the terminal plots it, unplots it, or toggles the pixels according to whether they are already on or off. If all the defaults are chosen the polygon encloses an area which is *erased,* but *only* at the terminal. This might conceivably be useful if you have plotted the file and then deleted a portion of it by hand. The plot on the screen could then be updated by hand. Actually, the XMD ERASE n command is used to streamline the polygon fill procedure when it is used to erase. The parameter, n, specifies the number of vertices used (2 [default] for a rectangle where the diagonal corners are input, 3 for triangles, etc.)

The polygon fill option has been included in order to fully utilize the abilities of the Ann Arbor graphics master. It has been installed with an eye towards the future. Currently, SLAC has no printers attached to the Ann Arbor for getting high resolution hard copies of the graphics screen. However, this may not always be so, in which case the uses of the polygon fill become obvious.

Suggestions for Running Line

The exec can be run in external mode at invocation by putting "MODE EXTMODE" (shorthand version "M E") in the options string. When using the generalized feature of *LINE* to position titles in Topdraw plots, the recommended set of options is gotten by:

```
LINE   XS   (M   E
```

where,

- XS gets both the cursor option and the SEQ4013 option.
- M E is equivalent to MODE EXTMODE, and sets EXTMODE on.

If the titles are to be set in duplex font then the user must issue a "XMD SET FONT DUPLEX" command from the direct input area since the original Topdraw file is not referenced when creating SEQ4013 files for the additions (when the SEQ4013 option is in effect). If the user wishes to they can control the creation of all SEQ4013 files by inputting

a Topdraw header file to *LINE* . This can be done by:

```
LINE   XS   (M   E   H   fn
```

where,

- H is short for HEADER and fn is the filename of the header Topdraw file.

The header file could contain a SET FONT DUPLEX command in it. It could also contain other Topdraw commands, like the set window and set limits commands, or a set title size command. You should simply copy the necessary setup from the top of your Topdraw file to the header file, including a "SET AXES OFF" command in order to avoid replotting the axes more than once.

Other useful commands to use when *LINE* is running are:

XMD CUR 1 : this selects cursor option 1, allowing two points to be located on the plot.

PF09 : this will plot your Topdraw file as it currently exists.

XMD SET TMODE OFF : this allows the direct input area to directly append the Topdraw file without doing any plotting or prompting. Note, however, that the menu's default operation is to translate all input to upper case.

XMD QUERY MODE : provides information on the exec's current operating conditions.

XMD NEWFILE fn : loads a new file to *LINE* without having to quit the exec.

XMD XEDIT HEADER : xedits the header file used with the SEQ4013 option.

XMD SET FONT DUPLEX : this inserts a "SET FONT DUPLEX" command into the Topdraw header file used with the SEQ4013 option.

XMD ? : enters a XMD help file.

SYSTEM REQUEST : recalls previous data entered into the direct input area.

CMSUT1	TOPDRAW	Topdraw header file
CMSUT2	GMOPTNS	Gmplot options file

Table I: Temporary files used by *LINE* with the SEQ4013 option.

The conditional input to the user's Topdraw file is stored in a temporary Topdraw file until it is given the go ahead to be appended. When the SEQ4013 option is used, the conditional input is turned into a SEQ4013 file independent of the user's Topdraw file. The conditional input could be a line or a loop (e.g. a photon line) if the user is drawing Feynman graphs, or it may be a title (e.g. when in EXTMODE). In order to properly turn the proposed input into a SEQ4013 file for display, it may be necessary to prefix it with a set of Topdraw header commands. This is the job of the CMSUT1 TOPDRAW file shown in Table I above.*

For example, if you are using *LINE* to create Feynman graphs, then you are operating with a predefined set of window and limit Topdraw commands (see TN 85-01, Appendix IX). Hence, you never need to worry about this issue, unless you use the direct input area to insert titles. Then you will find that the CMSUT1 header file does not have a duplex font command in it. So if you want your titles to be plotted on the screen in duplex font, you will have to edit CMSUT1 TOPDRAW and put a "SET FONT DUPLEX" command in it, or equivalently, issue a XMD SET FONT DUPLEX command.

As another example, you might have invoked *LINE* in EXTMODE without a header file and then discovered that you really wanted your titles in duplex font after all. There is no need to exit *LINE* since you can once again issue a XMD SET FONT DUPLEX command.

Again suppose that you invoked *LINE* in EXTMODE without a header file. Suppose further that you entered a set of x y coordinates into the input area with a Topdraw command to join them. What happens when you hit enter? The exact same thing as when you enter the same commands, by themselves, into a Topdraw file: Topdraw scales

* Other temporary files used by *LINE* are described in Appendix VI of TN 85-01.

the axes to the data points entered. This may not be what you intended, especially if you had any set limit commands in your original Topdraw file, and so, the graph may look very confused. You should elect not to keep these results, so that they are erased from the plot. Then you should edit the CMSUT1 file and put in the needed header commands. This can be done with the command XMD X H (short for XEDIT HEADER). If your plot is still viewable, you can use the SYSTEM REQUEST key (the PAUSE key on Ann Arbors) to recall previous input and then proceed. If the plot is unreadable you can redraw the entire Topdraw file with PF09 and then proceed. One *very important point* should again be made here: you should be sure to include a "SET AXES OFF" command in your header file so that you do not replot the axes every time you make an addition. After all, this is exactly what we are trying to avoid.

Again referring to Table I, we finish this section with an explanation of how the CMSUT2 GMOPTNS file is used. The GMOPTNS file is used to prevent GMPLOT from clearing the graphics screen. It is modified throughout the session, setting the screen line size to 60 lines when plotting and to 24 or 43 lines while erasing. The reason for the latter is because the exec does not toggle between the menu and the graphic display when unplotting, and the menu would behave in an odd fashion if the number of lines was not set to the VM default.

Both of the temporary files described in Table I are erased at the end of the session.

Appendix I: Notes to new users of Ann Arbor graphics terminals

The Ann Arbor terminals contain two internal memory buffers: one is used to store the alphanumerics screen, the other to store the alphagraphics screen. For instance, when a plot is being displayed, the computer is writing to the alphagraphics screen; and when a menu is being displayed, the computer is writing to the alphanumerics screen. To avoid this clumsy nonmenclature the two screens are hereafter referred to as the menu screen and graphics screen. There are two ways to toggle between the screens: either by commands sent by the computer (e.g. issued from execs), or by commands issued locally at the terminal (e.g. by specially programmed keys or by escape sequences). By convention, most users (and execs) program the SEND key to toggle between the two screens. However, there are some complications in using this key exclusively, as will be discussed below.

The *LINE* exec operates by getting input from the menu and, when asked, plotting the results on the graphics screen. When the exec displays a plot, it pauses in the graphics screen, until you enter a carriage return to continue. The exec then returns to the menu until told what to do next. The plot remains in the internal memory of the terminal and can be redisplayed by using the SEND key to toggle to the graphics screen. Note, however, that in this case the exec is still operating from the menu screen and does not know that you have used the SEND key (which acts locally) to put up the graphics screen. Therefore, you should return to the menu screen before typing any characters or carriage returns.

The SEND key can be used to return to the menu since it toggles from one screen to the other. However, using it to return is not recommended since it sets the number of lines on the screen to be 60 and not 43 or 24 (as in 43 or 24 VM). The SEND key does this in order to fully display the plot. In order to avoid this problem it is handy to have a key programmed which toggles back from the graphics screen with the correct number of lines. An exec on the ECPUB 192 disk, called AMSETUP, programs the otherwise unused PRINT key to do just this. You may reference this exec, or copy it to your own disk. (HELP AMSETUP completely describes its action). Almost equivalently, you can return with the SEND key and then issue a CTRL-L. The CTRL-L will refresh the screen and restore the correct number of lines (the drawback here is that you have to wait for the screen to refresh). Fortunately, you do not have to worry about any of this if the exec displays the plot, since it manages the line size for you.

Appendix II: Notes to users who have the TN 85-01 manual. †

This memo describes the latest additions to *LINE*. For those who have used *LINE* these additions will be obvious improvements to the previous release. The drawing of the Feynman graphs procedes exactly as before, only now the SEQ4013 option helps speed up the process, while the XMD commands allow titles to be added even more conveniently. These are the two most important extensions to *LINE*, and they are documented in this manual.

All of the new features have been made in an upwards compatible fashion with only one exception: the exec now issues CMS commands from the direct input area when they are prefixed by CMS and entered with a carriage return. This can be turned off with the command "XMD SET CMSFLAG OFF". Another change is in the initialization of the conversion factors for the readout of the graphics cursor position (cursor option 0). This option now allows the user who has been using the cursor to readout the data coordinates to switch the readout to the TEXT coordinat system (the 13x10) used by Topdraw.

Appendix X of TN 85-01, "Running LINE", has been updated in this manual and appears here as Appendix I. The new XMD commands are also documented here (see Appendix III). Both of these updates are documented online: do HELP LINE, or HELP LINE_XMD.

† An apology is also in order for the following mistakes: the hyperbolas are generated by HYPER and not HYBER (pages 7,8); and the IARROW control for lines (p. 46) never puts arrows on photons, gluons, etc., rather it can be used to remove arrows from fermions, etc.

Appendix III: LINE Exec Master Menu†

```
============= Line Exec Master Menu ==============

Line or Loop   (      )          If Loop, L or B option (   )

Type of line or loop (       )


Input coordinates....   X1 (          )
                        Y1 (          )

                        X2 (          )
                        Y2 (          )

Do you want to view the graph ? (     )
      Keep the last line ?      (     )
      Display crosshairs ?      (     )

Stack exec option  (     )

Direct input area below

(                                                                    )
(                                                                    )
(                                                                    )
(                                                                    )

                    Press enter to draw the above

                       PF02 to erase the screen

 1= Help  2= Clear  3= Quit  4= Line Ctrl Menu  5= Loop Ctrl Menu  6= Abacus

7= Xedit Top  8= Help Ctrl  9= Plot  10= Xedit Stack  11= Next  12= CMS Input
```

† This shows the full screen menu when LINE is run with the cursor option in 43VM.

Appendix IV: Running LINE

The LINE EXEC is an interactive program used to create physics diagrams. It can create a magnitude of different shapes (photons, gluons, scalars, fermions, etc.) as lines, loops, or bubbles. The exec creates a Topdraw file as output. The output file may be plotted from within the exec. By running LINE with the cursor argument the user can directly position the elements of the plot (e.g. titles).

The LINE EXEC also serves as an interactive interface to Topdraw allowing the user to interactively utilize the full capacity of graphics terminals like the Ann Arbor Ambassabor and XL series. In particular, titles can be exactly located using the graphics crosshairs available on 4013 emulating terminals (VT100's and CITOH's are thus included).

The exec is invoked as follows:

FORM:

```
+------------------------------+
|                              |
|  LINE [Arguments [( Options  |
|                              |
+------------------------------+
```

Arguments & Options may be omitted.

Arguments : control internal operation of LINE.

Options : are used to interface external user files with LINE, or to control the operation of the direct input area.

PARM:

Arguments =	(none)	-	runs exec in line by line prompt mode.
	Go	-	runs exec without this notification.
	Menu	-	runs exec in full screen menu mode.
	X	-	runs exec in menu mode with option to read in graphic coordinates with cursor.
	GS,MS,XS	-	runs exec as above but with the SEQ4013 option (selective draw and erase).
Options =	(none)	-	use default plotting procedure.
	Plot fn1	-	use user supplied routine, fn1 EXEC.

```
Fort fn2     -  use user supplied routine, fn2 FORTRAN.
Mode <Mode>  -  set internal exec modes: EXTMODE, TMODE, etc.
Header  fn   -  specifies header file for SEQ4013 option.
Setup   fn   -  specifies setup file for initialization.
GMoptns fn   -  specifies GMOPTNS file for use in plotting.
```

The graphical elements are specified by a short mnemonic and positioned by two endpoints. The exact geometries of the graphical elements can be controlled by the user. A manual on the use of this exec is available from the SLAC pub office as TN 85-1. This manual contains examples of the Feynman graph generator. Another manual, TN 85-3, (to be published) contains a description of LINE's use as an interactive interface to Topdraw. The notes which follow here contain some of the techinical details of the operation of LINE. A number of online help files contain more descriptions of LINE's operation. They are gotten by:

Help LINE_XMD - describes the XMD commands, especially useful for operating LINE to do Topdraw titles, etc.

Help LINEMENU - describes, in a simple fashion, the full screen menu mode of operating LINE.

Help LINEDEF - describes, in a simple fashion, the full screen menu style of changing the control parameters used to draw Feynman graphs.

Help LINECTRL - describes the detailed effects of the control parameters used to draw Feynman graphs.

Help LOOPCTRL - is similar to LINECTRL.

EXAMPLES:

LINE X : runs the exec from the full screen menu with the crosshair option. This allows the user to quickly position endpoints.

LINE XS : runs the exec from the menu, with both the crosshair and the SEQ4013 option on. This is the recommended invocation when line is used to make Feynman graphs.

LINE XS (FORT DRAFT : runs the exec as above, but with the user's fortran program DRAFT loaded in. All the menu

features and conveniences are available to the user. So are a couple of the PF keys - see the XMD help file.

EXAMPLES FOR MAKING TOPDRAW TITLES

LINE XS (M E

Runs the exec from the full screen menu, with the SEQ4013 option, in EXTMODE. This is the recommended invocation of LINE when used to input title in files made externally from LINE.

LINE XS (M E H DATA

Runs the exec as above but with a Topdraw header appended to the titles before a seq4013 file is made. This file might be used to set up the header so that LINE knows the window and limits of your axes for inputting more data. Please include a SET AXES OFF Topdraw command in your Header file.

LINE X (M E S VT100X GM VT100X

Runs the exec in EXTMODE for doing titling on a Topdraw file. The S in the options string flags for the SETUP file VT100X. The GM flags for the GMOPTNS file VT100X. This is the suggested invocation of LINE for VT100 terminals.

NOTES:

1. The program is very new and so changes can be expected. The support for the program may also be unreliable at times.

2. The MENU OPTION is valid for 24 and 43 VM. It is the recommended style of operation. Line by line mode is supported, but some features are not.

3. The CURSOR OPTION can only be used with the full screen menu on any Tektonics 4013 emulating terminal. The default support is only for Ann Arbor Ambassabor and XL series terminals. (Other users on VT100 and CITOH terminals [for instance] will also need to reference the TERMINAL and GMOPTNS options). The cursor option here refers to the graphic crosshairs, which allow exact positioning of points on the plot. It utilizes the cursor keyboard and terminal readout directly without going through Unified Graphics (much like GMPLOT).

The rest of this section is specific to Ann Arbor terminals. In order to prevent the series 1 emulator from hanging it was necessary to reprogram the return key. In the extremely unlikely event of a system crash while waiting for the ASCI READ this key will need to be reprogramed: the procedure is very simple - consult the Ann Arbor terminal manual (under DCS key programming). The break key is also reprogrammed - full restoration is done either

with:

I.) SETUP t ESC "Og ESC P'+~M ESC P'(y~[{E} ESC \
or
II.) SETUP z CTRL g

The latter is a global reset of all the keys to their default function after logon. The disadvantage is that any keys the user may have programed will now be lost (e.g. the SEND key will no toggle into the graphics screen until another plot is made).

4. The PLOT OPTION allows the user to specify their own plotting procedure. The default option is run an internal procedure which creates a Topdraw SEQ4013 file which is then plotted by GMPLOT. GMPLOT is immediately exited, but the user can view the graph by using the SEND key. If the plot option is used the user must have an exec with that filename on a R/W disk. Furthermore, the exec must accept two arguments; the filename and filetype of the Topdraw file to be plotted. The cursor option may still be used provided that the exec is being run from a graphics terminal.

5. The FORT OPTION allows the user to utilize the structure of the exec to run their own fortran to generate the graphic output. The exec provides for this by having the user type USER when asking for the fortran program (typically LINE or LOOP). When run from the menu the user must conform to the standard protocol. This is as follows: five entries will be put onto the program stack before fortran execution, they are the choice of line (character*5) and four coordinates (real*8); x1, y1, x2, y2. These are the endpoints for the typical line, the user can do with them what they wish here, provided that they pull these values off the program stack; otherwise the exec will drop the stack and go into prompt mode. The output of the fortran program must be to unit 7. If any input is needed (besides the five standard entries), it can be done through unit 8, where the input file is has the same filename as the fortran, but has filetype CTRL. The input file can be a MODULE (created by GENMOD for instance), a TEXT file, or a fortran file; the exec searches in this order. If the file is a TEXT or MODULE file it must be on a R/W disk. If the file is a

FORTRAN file LINE will automatically compile the fortran (with the FORT exec) to create a TEXT file. The MODULE will be directly run, the TEXT file will be loaded and started (MODULES are recommended). The user's TXTLIB at time of execution will be used for the latter, unless it is null, in which case LINE supplies a default TXTLIB.

6. The STACK OPTION is available only from the full screen menus. It allows the user to save the session in an exec with the same name as the input Topdraw file. This exec can be invoked at a later time in order to recreate the session and reproduce the output file. This is useful as a savings in disk space, the exec can be factors of 5 (or more) smaller than the Topdraw file and is completely able to recreate the Topdraw file in seconds. When this option is turned on the session's commands (including changes in the control parameters) are saved inside the exec. The exec stacks all these commands and then recreates the session by calling LINE with the special stack option. Note that this exec file can be directly manipulated by the user allowing a great degree of versatility to modify the session. This option should only be used for this purpose, or for saving the graph over a long duration with a minimum of storage.

7. The SEQ4013 OPTION is fully supported only for Ann Arbor terminals. (However, the SETUP option allows it to potentially be used with other terminals, see below). The SEQ4013 option allows the user to to most optimally operate the LINE exec by reducing the redunacy typically involved in creating and displaying a SEQ4013 file at the terminal. The graph is plotted in pieces, starting with the original file (which may be an externally supplied plot or the default axes for Feynman graphs), additional graphic elements are then added to the plot. The only time the entire plot is remade is when the user enters PF09. Once the SEQ4013 file is made the user is given the option of keeping the addition. If they choose not to, the SEQ4013 file is manipulated and the terminal is set up to erase the exact plot, pixel for pixel. This prevents an unwanted addition from confusing the plot, without having to redo the entire plot.
Note: the PLOT option (see note 4) cannot be used in conjunction with this option.

8. The HEADER FILE is used in conjunction with the SEQ4013 OPTION. Since Topdraw allows the user such great versatility, LINE cannot anticipate the exact nature of the plot. These features include the SET FONT, SET WINDOW, SET LIMITS, and SET SCALE commands. However, the user need only copy the heading from their file into a temporary file so that LINE can append the input to it to make the SEQ4013 files. Note, that if LINE is being used to only input titles in the TEXT coordinate system that a header file is not necessary (except to set

the font duplex). However, if the user plans to use the DATA coordinate system (for instance), then a header file is needed.

9. The MODES are used to control the direct input area on the full screen menu. The modes that can be set when LINE is invoked are as follows: TMODE, INPUTMODE, CMSMODE, and EXTMODE. They are a subset of the XMD commands for LINE, which are so important they have their own help file. The modes can be set from the menu's input area, when LINE is invoked, or in the SETUP file (using the SETUP option). Only the effect of EXTMODE will be discussed here (do HELP LINE_XMD for a full description of all the XMD commands). EXTMODE is designed to allow LINE to be used to input titles into a Topdraw file. This feature allows users to use LINE for files made externally from the exec, and disables many of LINE's Feynman graph features (which are irrelevant in this case). Furthermore, the cursor readout will automatically be in the Topdraw TEXT system when EXTMODE is on.

10. The SETUP option is primarily designed to allow users of terminals other than Ann Arbor's to be able to use some of the features of LINE. It is also able to issue XMD SET commands at invocation (do HELP LINE_XMD). This option causes LINE to read in a file whose filename you specify, and whose filetype must be LOPTNS. This file can contain ASCII strings which allow your terminal to do (for instance) cursor readout of positions on the plot. LINE will need these strings in order to operate with VT100, CITOH, ... , terminals. These strings must be tailor made for your terminal, just as your GMPLOT OPTIONS file must be. Because these terminals may not toggle between the graphics screen and the menu screen it may be necessary to occassionally display both at the terminal at once (as when you return to the menu to put up the crosshairs). In order to eventually erase the graph you can program a PF key from the SETUP LOPTNS file to do just this. Note, that on these terminals the cursor position may need to be marked by hitting a character key followed by a carriage return (unlike the Ann Arbors). Your usual GMPLOT OPTIONS file typically erases the graph when returning to the menu to avoid displaying both screens at once. However, this does not allow the cursor to be displayed at the same time the plot is there. In order to put up the cursor and the plot simultaneously it may be necessary to use a file other than your usual GMPLOT OPTIONS. The LINE exec allows you to use another file to run GMPLOT; fn GMOPTNS, where you have provided the filename, fn, in the options string for LINE, see note 11 below. For VT100 and CITOH terminal users the necessary files are on the W-disk for you to use (and/or copy). They are called VT100X GMOPTNS and VT100X LOPTNS, etc. Note to other programmers, all the strings must be in EBCDIC form. The EBCDIC form of all the

ASCII characters which are unprintable (except DEL), '00'x to '1F'x, are available to you as mnemonic variables (e.g. esc = '27'x). The VT100X LOPTNS file programs PF06 to be a global clear. Note that the string is passed to CMS directly in this case so that the exec variables are unavailable. Only one more difficultily is left; the Series 1 (a computer which does the data transfer between the IBM and your terminal when you are emulating) programs the cursor keys so that they do not work in graphics mode. Hence, the cursor cannot be moved unless you do a local initialization of your terminal. For VT100's this can be achieved by doing SETUP 0 (I believe this is true for CITOHs as well). The only major change that I have found this causes is that the number pad keys no longer act as PF keys. This is not a problem for VT100s and CITOHs since an esc # is equivalent to PF# (where esc -,= are PF11 and PF12 respectively). When you are finished with LINE you can do an CTRL g which causes the Series 1 to redo its initialzation (i.e. it is equivalent to logging on to the Micom again).

11. The GMOPTNS option can be used to specify a GMOPTNS file to be used by the plotting routine (i.e. GMPLOT). This is needed for users on non- Ann Arbor terminals who do not have a GMPLOT OPTIONS file, or who wish to have a GMOPTNS file specific for LINE (see note 10).

Appendix V: Cursor Options

```
Cursor selection options:
-------------------------

Choose from the following (cr= 1):

    0. Initialization
    1. Normal ordering
    2. Reverse ordering
    3. Pivot
    4. Translation
    5. Translation and Rotation
    6. Return
    7. Help

Help message:

  Crosshairs are used to input coordinates to menu.
They are moved by cursor controls on the terminal.
Hit any character key in order to input the postion.
Pick an integer according to the following list:

0. Initialization   : To establish conversion factors.
                      Needed if default axes aren't used.
                      Two choices for operation, either
                      the text coordinate system (Topdraw
                      default) or the data coordinate system.
                      Be careful to pick points diagonally
                      in the latter case.

1. Normal ordering  : Starting point, finishing point.

2. Reverse ordering : Finishing point, starting point.

3. Pivot            : Only one coordinate is changed.
                      You can do it with the cursor
                      or by entering a rotation angle.

4. Translation      : Element's endpoints are translated
                      according to your input vector.

5. Translation      : Similar to 4, only you are also
   and Rotation       prompted for a rotation angle(in deg).
                      Rotation(ccw) about midpoint of element.

6. Return           : Returns you to the menu.
```

Appendix VI: XMD Commands

XMD - issues commands directly to the Line Exec from the master menu. It is meant to be issued from the direct input area of the master menu, although the modes can be set in the option string when Line is invoked. XMD acts as an escape sequence which signals that the rest of the line is to be treated as an internal command to the exec. In this fashion the user can alter the operation of the exec or cause the execution of certain extended functions.

FORM:

```
+-----------------------------------------------------+
|                                                     |
| XMD  SET     <mode>       ON | OFF    [ Quiet ]    |
|              COordmode  TEXT | DATA                |
|              CASE      Mixed | Upper               |
|              FONT          <font>                   |
|              CMSFlag .     ON | OFF                |
|              <PFn>          <fctn>                  |
|                                                     |
|      Query   Mode                                   |
|             <mode>                                  |
|                                                     |
|      CURsor    [ <cur_optn> ]                       |
|      NEWfile     <filename>                         |
|      REname      <escape>                           |
|      EValuate    <exp>                              |
|      Xedit        Header                            |
|                                                     |
|      POLYfill                                       |
|      ERase     [ <num> ]                            |
|      BOX                                            |
|                                                     |
|      ?                                              |
|                                                     |
|                                                     |
+-----------------------------------------------------+
```

PARM:

<mode> = Tmode, Inputmode, Extmode, or Cmsmode.

<escape> = Name of user defined synonym for XMD escape.

<filename> = Name of new Topdraw to be loaded to LINE.

<cur_optn> = Optionally selects for the cursor display option. Otherwise, the user is prompted.

<PFn> = Is either PF6 or PF12.

<fctn> = Is a command to be issued to CMS (e.g. an exec name).

<font> = Standard Topdraw fonts: DUPLEX, EXTENDED, BASIC.

<num> = Optionally selects for the number of vertices used to specify the polygon fill. The default is for 2 (i.e. the opposite corners of a rectangle).

<exp> = Is a single REXX expression to be evaluated.

NOTES:

XMD SET <mode> ON OFF

The exact nature of the exec's operation can be tailored to meet the user's needs by the XMD SET <mode> commands. These XMD commands focus on altering the operation of the direct input area. The modes are set either on or off. Their settings can be viewed by typing XMD Query Mode or XMD Query <mode> in the input area (see below). The different modes and their active setting (i.e. on) functions are as follows (they can be specified by a single letter in the command line, and so take precedence over other SET commands).

TMODE - this causes the direct input to the Topdraw file to be plotted before it added to the file. The user is provided the opportunity to add these lines to the Topdraw file, or not, after seeing the plot.

INPUTMODE - this forces the exec to position the cursor in the first line of the input area for its default position. Under this mode the input area becomes the operating area and the exec no longer draws lines or loops. The PF keys still operate however.

EXTMODE - is the mode to be used when using Line to do interactive graphics with an externally made Topdraw file. When this mode is turned on both TMODE and INPUTMODE are automatically set on (although they are not set off automatically when EXTMODE is set off). In addition, when this mode is set on the cursor readout is in terms of the TEXT coordinate system (the 13x10 default coor-

dinate system of Topdraw). Finally, the Topdraw file will be copy be copied from your other disks onto your A-disk if it doesn't exist there already (unlike the normal initialization of Line). If the input file is not found it is only then created on the A-disk.

CMSMODE - this mode forces all the data entered in the input area to be passed directly to CMS when a <CR> is entered, with the obvious exception of subsequent XMD commands (e.g. set cmsmode off). This mode has an optional argument, QUIET, which suppresses the default echoing of CMS commands by Line.

* * * *

XMD SET PF6 PF12 <fctn>

This XMD command(s) allow the user to custom design the menu for individual needs. Two of the master menu PF keys can be reprogrammed- the PF6 key (default function is ABACUS) and the PF12 key (whose default function is CMS input).

XMD SET <PFn> <fctn> - this command will reprogram the PF keys according to the function string provided by the user. This function string is thereafter passed to CMS for execution when that PF key is used.

* * * *

XMD SET COORDMODE TEXT DATA - this allows the user to determine wh ther the crosshair readout of positions on theplot is done with respect to the TEXT coordinte system (the 13x10 Topdraw default) or with rspect to the DATA coordinate system (the 10x10default defined by LINE, which can be updatedby the user with cursor option O).

XMD SET CMSFLAG ON OFF - allows the CMS escape to be turned off. The default (i.e. ON) is for LINE to recognize 'cms' when it is the first word on a line in the direct input area and to pass the rest of the line to CMS.

XMD SET FONT <font> - is to be used when the SEQ4013 option is on.

It allows the user to append the header file (i.e. CMSUT1 TOPDRAW) with a Topdraw set font. Fonts can be DUPLEX, EXTENDED (the default), or BASIC.

XMD SET CASE MIXED UPPER - is used to control the case translation f data entered in the menu. Its default setting s UPPER, so that all data is automatically translaed to upper case and then read in to the exec. he user can only enter titles in mixed case when his parameter is set to MIXED.

* * * *

XMD QUERY MODE - can be used to report the status of all the XMD modes. The setting of CMSFLAG and COORDMODE are also reported.

XMD QUERY <mode> - this command can be used to query any one of the XMD modes and settings of the XMD QUERY MODE command. However, the value of the setting is reported to the menu screen.

* * * *

XMD NEWFILE <filename> - this command will take the supplied filename and load a new Topdraw file into LINE, subject to the same conditions as when invoking LINE. This can be used to input a new file to LINE without having to leave the full screen menu. Note: the treatment of the new file proceeds according to the EXTMODE setting, in particular, the SEQ4013 header file is also loaded at this time.

* * * *

The other XMD commands cause immediate execution of internal routines in Line. These commands can be issued only when the exec is being run with the cursor option on.

XMD CURSOR <cur_optn> - this command will cause the crosshair subroutine to be entered directly, without using the plot option. It can only be used when the CURSOR option is on. When <cur_optn> is supplied the cursor option is directly selected. The crosshairs then read out the coordinates of points on the graph. (See the cursor option discussion in the LINE HELP file). Note: this option overlaps and compliments the crosshair prompt on the menu.

XMD EVAL <exp> - this command will cause the REXX expression <exp> to be evaluated and then displayed on the menu. Only one REXX expression can be evaluated at a time. You do not leave then menu unless there is an error (e.g. in syntax), in which case you return to the menu after notification. This REXX expression uses REXTRY for its evaluation and is supported only as far as REXTRY is supported. As an extension of REXTRY LINE provides for two variables to be used: PI and RAD. As an example XMD EVAL sin(90/rad) will return 1.0000 to the menu.

XMD XEDIT HEADER - this command xedits CMSUT1 TOPDRAW, the Header Topdraw file used with the SEQ4013 option.

XMD BOX - this enables the cursor readout allowing you to draw a box on the Topdraw plot. The two positions read out by the cursor form the opposite corners of a rectangle. If TMODE is set on the Topdraw file is plotted and you are given the opportunity to erase the box. (This cannot be used in EXTMODE).

XMD POLYGON - this feature extensively utilizes the features of the Ann Arbor graphic terminals. It prompts the user for the many parameters used to draw polygons with the Ann Arbor. Given the fact that SLAC currently (4/5/85) does not have the Ann Arbors hooked to printers for high resolution graphic output the main usefulness of this command is for erasing portions of the graph (when LINE is run with the SEQ option). On the other hand, this option anticipates the day when SLAC has such graphic printers so that the polygon fill becomes useful. The prompts for this feature are for the following:

GMODE : 0 for drawing, 1 for erasing, 2 for complimenting.

GMODE : 0 for drawing, 1 for erasing, 2 for complimenting.

TEXTURE : 0 Blank
1 Solid
2 Halftone
3 Horizontal hatch lines
4 45 degree diagonal hatch lines
5 Vertical hatch lines
6 135 degree diagonal hatch lines
7 Horizontal and vertical crossed lines
8 Diagonal crossed lines
9 Horizontal zig-zag lines

10 Vertical zig-zag lines
11 Bricks
12 Stagger-dots

IBORDER : 1 for a border surrounding the polygon
0 for no border

By choosing the defaults for all of the above the area within the polygon is erased (i.e. GMODE = 1, TEXTURE = 1).

XMD ERASE <num> - is essentially the same as XMD POLY only with all of the defaults chosen to erase the area enclosed by the polygon. If no argument is used then the default of two vertices are used (which again are the opposite corners of a rectangle). Note this very important fact- this routine is local to the terminal and does not have any affect on the Topdraw file.

* * * *

XMD ? - is used to get this help file online.

* * * *

Appendix VII: Notes to VT100 Users

Notes: The suggested form of invocation of LINE, for users of VT100 terminals with graphics capability is:

```
LINE X ( S VT100X GM VT100X,
```

for drawing Feynman graphs, and,

```
LINE X (M E S VT100X GM VT100X,
```

when LINE is used for titling external files.

Please read notes 10 and 11, pages 14 and 15 for more information about the SETUP and GMOPTNS options used above. The X in the argument string turns on the graphics cursor option, which necessitates using the SETUP and GMOPTNS files for the VT100 terminal. These files are available on the W-disk and so, will probabily not need to be copied onto your A-disk. However, they are included in this document for completeness. The SETUP file, VT100X, programs many of the strings LINE uses to directly control the graphics operation of the terminal. Also included is an XMD command to program PF06 to perform a global clear of both the graphics and menu screens. This must now be done manully in order to allow you to display the crosshairs on the plot. Be sure that you have reinitialized the cursor keys on your terminal (with a SETUP 0) or else you will not be able to move the cursor. Also be sure to hit a character key and then a carriage return to locate the point whose coordinates you want. It will be necessary to occassionally display both the graphics screen and the menu screen on top of each other. You can always do a PF6 to clear the graphics screen without losing any of the data on the menu. (The clear string for PF6 is gs | | esc | | ff | | can).

Lastly, if you do not need the cursor readout you can still use LINE, and can invoke it as:

```
LINE M
```

for drawing Feynman graphs, or,

```
LINE M (M E
```

for titling external files.

In this case you can use a GMPLOT OPTIONS file to control the plotting, or, can supply a filename of a GMOPTNS file to LINE with its GMOPTNS option.

```
VT100X LOPTNS W
---------------
clearstr = ''
setupstr = ''
alphastr = ''
displayclearstr =  ''
exitstr  =  gs | | esc | | ff | | can
exitstr  =  ''
setup_gin_str = ''
enter_gin_str = ebctoasc(gs | | esc | | sub )
xmd set pf6   WRTASCI (TR STR ????
exit_gin_str  =  can
```

```
VT100X GMOPTNS W
----------------
clearstr = '1D270C'X
setupstr = ' '
alphastr = '18'X
exitstr  = '18'X
lcopystr = ' '
zoomtype = ' '
```

Appendix VIII: Notes to CITOH Users

Notes: The suggested form of invocation of LINE, for users of CITOH terminals with graphics capability is:

```
LINE X ( S CITOHX GM CITOHX,
```

for drawing Feynman graphs, and,

```
LINE X (M E S CITOHX GM CITOHX,
```

when LINE is used for titling external files.

Please read notes 10 and 11, pages 14 and 15 for more information about the SETUP and GMOPTNS options used above. The X in the argument string turns on the graphics cursor option, which necessitates using the SETUP and GMOPTNS files for the CITOH terminal. These files are available on the W-disk and so, will probabily not need to be copied onto your A-disk. However, they are included in this document for completeness. The SETUP file, CITOHX, programs many of the strings LINE uses to directly control the graphics operation of the terminal. Also included is an XMD command to program PF06 to perform a global clear of both the graphics and menu screens. This must now be done manully in order to allow you to display the crosshairs on the plot. Be sure that you have reinitialized the cursor keys on your terminal (with a SETUP 0) or else you will not be able to move the cursor. Also be sure to hit a character key and then a carriage return to locate the point whose coordinates you want. It will be necessary to occassionally display both the graphics screen and the menu screen on top of each other. You can always do a PF6 to clear the graphics screen without losing any of the data on the menu. (The clear string for PF6 is gs | | esc | | ff | | esc | | 2).

Lastly, if you do not need the cursor readout you can still use LINE, and can invoke it as:

```
LINE M
```

for drawing Feynman graphs, or,

```
LINE M (M E
```

for titling external files.

In this case you can use a GMPLOT OPTIONS file to control the plotting, or, can supply a filename of a GMOPTNS file to LINE with its GMOPTNS option.

```
CITOHX LOPTNS W
---------------
clearstr = ''
setupstr = ''
alphastr = ''
displayclearstr =  ''
exitstr  =  gs | | esc | | ff | | esc | | 2
exitstr  =  ''
setup_gin_str = ''
enter_gin_str = ebctoasc(gs | | esc | | sub )
xmd set pf6   WRTASCI (TR STR ?????2
exit_gin_str  =  esc'2'



CITOHX GMOPTNS W
----------------
clearstr = '1D270C'X
setupstr = ' '
alphastr = esc'2'
exitstr  = esc'2'
lcopystr = ' '
zoomtype = ' '
```