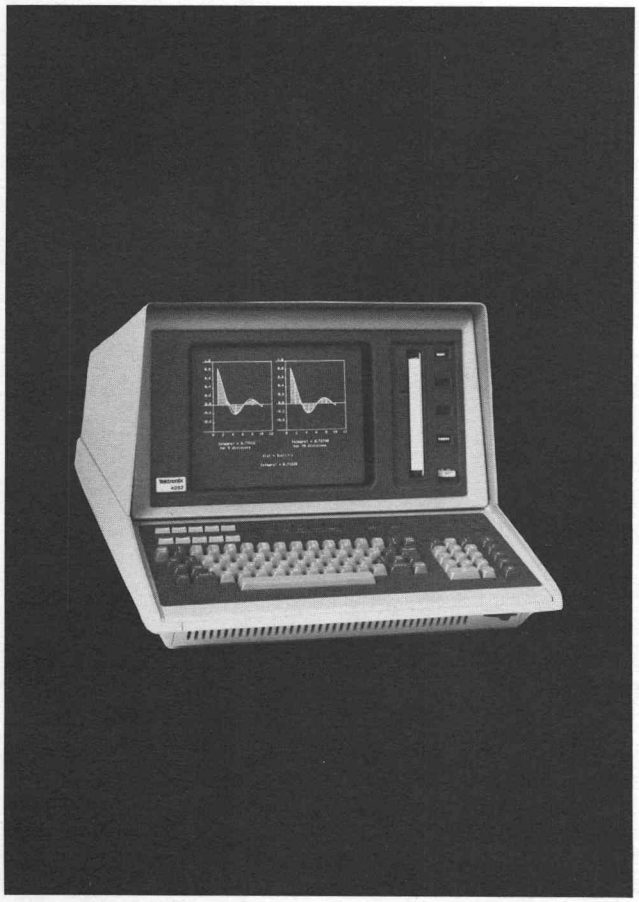
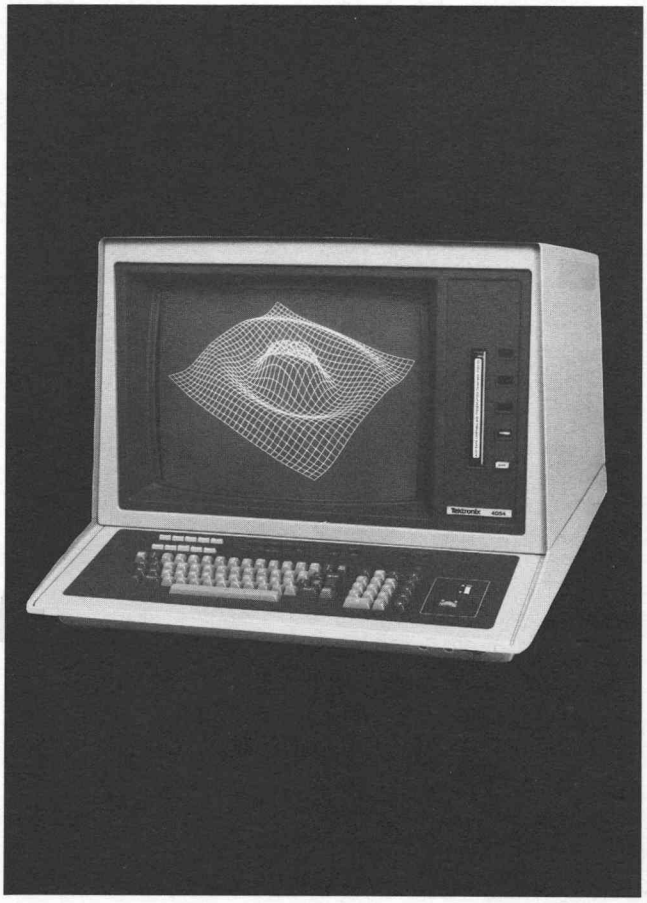
Tekniques

The 4050 Series Applications Library Newsletter May 1, 1979 Vol. 3 No. 3



The compact, high performance 4052 Graphic Computing System brings exceptional power to desktop computing.



The large display 4054 Graphic Computing System offers an unequaled combination of computing power and superior graphics. Its 19" DVST display gives the highest resolution, highest quality graphics ever seen in a desktop computer.

DESKTOP COMPUTING AT ITS BEST: THE 4052 AND 4054 GRAPHIC COMPUTING SYSTEMS

by Cathy Cramer

In April, the Graphic Computing Systems division of Tektronix announced two new desktop computers in the same family line as the 4051: the 4052 and 4054 Graphic Computing Systems. The 4052 and 4054 set new standards for performance and graphics excellence combined into a desktop package. The 4052 is powerful yet compact. The 4054, the first desktop system to have a 19″ display, has all of the processing power of the 4052, with the finest graphics capabilities of any desktop computer.

Introducing the 4050 Series

Together the 4051, 4052 and 4054 form the 4050 Series, the first fully compatible family of desktop systems. Building on the strengths of the 4051, the 4052 and 4054 offer superior performance and graphics, without sacrificing any of the essential ingredients that have made the 4051 so successful.

In This Issue

Family compatibility is the key to the 4050 Series. All three 4050 Series Systems contain the same typewriter-like keyboard and high capacity internal magnetic tape, combined with a high resolution DVST display. The programming language for all three is enhanced BASIC, with device-independent keywords and built-in graphics language statements. And the 4051, 4052 and 4054 all provide flexible data communications with the GPIB (IEEE 488-1975) standard interface, and the optional RS-232 Data Communications Interface.

The 4050 Series family compatibilities extend even further. The 4051, 4052 and 4054 are completely software and storage compatible, a first for the desktop computer industry. Software and storage compatibility means all BASIC programs written for the 4051 can be used on the 4052 or 4054; including all PLOT 50 software packages, all BASIC user programs, and programs from the 4050 Series Applications Library. In addition, the 4052 and 4054 are compatible with 4051 peripherals—but we'll come back to that later. The important point is that the 4050 Series family compatibilities make it easy for a 4051 user to upgrade to a 4052 or 4054—with little relearning, no reinvestment in software, and the ability to make use of the existing peripherals.

A Closer Look at the 4052 and 4054

The 4052 and 4054 are extremely fast. Their speed increases over the 4051 range from 4 to 40 times, depending on the nature and complexity of the operation being performed. In general, the more complex the computational task, the greater the speed increases you'll see in the 4052 and 4054. Simple tasks like the INTEGER or RND function are about four times faster on the 4052 and 4054. Slightly more complex operations like addition, subtraction, and simple MOVE and DRAW graphics are six to seven times faster on the 4052 and 4054. Heavier computation tasks like multiplication and division run 15 to 20 times faster; and the most difficult calculations of all, the trigonometric and transcendental functions, show speed increases of 30 to 40 times. The TAN or tangent function, for example, is a startling 38 times faster on the 4052 and 4054 than on the 4051.

The secret of the high performance of the 4052 and 4054 is that they both contain a new processor designed by Tektronix. The processor is based on state-of-the-art bit-slice technology, the chaining together of high speed four-bit chips. For the 4052 and 4054, we've linked four of these four-bit "slices" together, to form a 16-bit processor.

This gives us two reasons for the increased speeds of the 4052 and 4054. First, the bit-slice chips are inherently faster than most microprocessor chips. Second, the new bit-slice processor allows the 4052 and 4054 to operate on 16 bits at once, instead of 8 as on the 4051; and that means accessing twice as much information in the same amount of time.

A third and very important factor also contributes to the high speeds of the 4052 and 4054. Inherent to the bit-slice technology is the ability to create special "microcode sequences" during the design phase. Operations that are of particular value, or that need special assistance because of their complexity, can be selected for coding in a lower level, more machine-like language. Such microsequences execute more directly, and therefore much faster than assembly language or "macrocode" sequences like those in the 4051. In upcoming articles, we'll be discussing this more. For now, we can summarize by saying that microcode sequences for floating point operations are the reason for the extremely high speeds of certain operations on the 4052 and 4054. Heavy computation tasks, like the trigonometric functions that show tremendous speed increases in the 4052 and 4054, are precisely the ones that benefit the most from floating point microcode.

Memory

The 4052 and 4054 memory architecture is new, and optimized for speed. Memory is divided into data and instruction spaces, then partioned even further into even and odd memory address locations, to let the new processor access either 8 bits or 16 bits at once of instructions or data. The memory partitioning brings another advantage to the 4052 and 4054: increased memory capacity. For both the 4052 and 4054, the standard user memory is 32K bytes. A large memory option of 64K bytes (56K user accessible) is also available.

More New Features ...

The 4052 and 4054 bring more than extraordinary computing power to the 4050 Series. Both offer new features; enhancements suggested in many cases by 4051 users. First, the Binary Program Loader and Matrix Functions commands have been incorporated into the BASIC language of the 4052 and 4054. The functions come as part of the standard command set, and so do not require a ROM pack. Besides the added value and convenience of not having to insert a ROM pack, this has special significance for the Matrix Functions commands: extra speed. Bringing the matrix functions inside the System lets them benefit more from the fast new

TEKniques, the 4050 Series Applications Library Newsletter, is published by the Information Display Division of Tektronix, Inc., Group 451, P.O. Box 500, Beaverton, Oregon 97077. It is distributed to TEKTRONIX 4050 Series users and members of the 4050 Series Applications Library.

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processor. The processor can execute the commands directly, without having to access an external ROM pack. As an example, the 4052 and 4054 can invert a 20 X 20 matrix in 2.7 seconds. This unusually high speed is due in part to the addition of the INV command to standard BASIC.

Although the Binary Loader and Matrix Functions commands are new standard language elements for the 4052 and 4054, in one sense they are not really "new." They are identical in syntax to the 4051 ROM pack commands, thus maintaining 100% language compatibility with the 4051.

The 4052 and 4054 do offer three completely new commands:

```
FONT N
CALL "MTPACK"
CALL "WAIT", N
```

The first is the FONT command, used to select any one of eight unique character fonts. The keyword FONT is followed by a digit N to select one of the numbered fonts. FONT 0 is the default ASCII character font. FONT 8 is a special new font of particular value for generating high-quality final reports: it's like the default ASCII font, but has the "slashless" zero preferred by many for business and reporting applications.

CALL "MTPACK" is a new utility command that helps maintain the reliability of magnetic tapes. As tapes age, or if they are heated or dropped, they may start to sag or "bubble" on their reels. Improperly stacked tapes can lead to subsequent READ errors and loss of important programs or data. CALL "MTPACK" helps avoid the problem by completely winding the tape forwards and backwards, thus properly restacking the entire tape. It's a good idea to use CALL "MTPACK" periodically, as well as immediately before storing important programs or data.

CALL "WAIT", N is another new command for the 4052 and 4054. It's like the 4051 WAIT command, but allows you to specify a parameter N, the number of seconds to wait before passing on to the next program statement. When a CALL "WAIT" command is executed, the BASIC Interpreter waits either for an external interrupt, or for the specified number of seconds to pass, whichever comes first. You'll find CALL "WAIT" a useful tool for programming intentional time delays: pausing between several graphic displays for example. You no longer have to experiment with "dummy" or false loops to pause for a certain length of time.

ROM Packs

Because they both contain the same new processor, the 4052 and 4054 can share the same set of ROM packs. ROM packs available immediately for the 4052 and 4054 include an EDITOR ROM pack, a Signal Processing ROM pack #1, an Option 10 Printer Interface, and a File Manager ROM pack for the 4907 disc unit. These ROM packs are like the 4051 versions, but designed to fit in with the new memory architecture of the 4052 and 4054. (4051 ROM packs won't work on the 4052 and 4054, nor can 4052/4054 ROM packs work on the 4051, because of differences in internal structure.)

As a 4051 user, the difference you'll see in the ROM packs is speed. In conjunction with the new processor, 4052 and 4054 ROM packs function at least two times faster. Many computation tasks like some of the Signal Processing ROM pack commands run up to 11 times faster. At the same time, compatibility is carefully maintained. The EDITOR ROM pack for the 4052 and 4054 is 100% language-compatible with the 4052 EDITOR, for example. So those of you who've been accustomed to the 4051 EDITOR can make immediate use of the 4052 EDITOR, without ever looking at a manual. And if you already own a 4907 File Manager, you can upgrade it for use with the 4052 or 4054 simply by installing the new ROM pack. There are no compatibility problems to consider.

New Four-Slot ROM Backpacks

As on the 4051, the standard rear panel for both the 4052 and 4054 includes a backpack for inserting up to two special function or interface ROM packs. A brand new option is now being offered for the 4052 and 4054, a backpack that can accommodate up to four ROM packs at once. For many users, the four-slot backpack represents a special convenience, because it eliminates their need for a ROM Expander Unit. Like the standard two-slot backpacks, the new optional backpack comes in two versions: the regular backpack with four ROM slots, and the Data Communications Interface with four ROM slots.

Peripherals

The 4052 and 4054 are compatible with the current 4051 peripherals. For 4051 owners, this makes the addition of a 4052 or 4054 economical and convenient. The 4631 Hard Copy Unit can be shared simultaneously between a 4051, 4052 and 4054. The same 4952 Option 2 Joystick is compatible with all three Graphic Systems. The 4641 and 4642 Matrix Printers can likewise be used with the 4051, 4052, and 4054.

Compatibility extends to all of the GPIB peripherals. The 4662 and 4663 Plotters, the 4956 Graphics Tablet, the 4924 Digital Tape Unit, and the 4907 File Manager can all be used with any of the three 4050 Series Systems.

The Printers and the 4907 File Manager come standard with special purpose ROM packs for the 4051, but you

can obtain them with the appropriate 4052 and 4054 ROM packs as an option at no additional charge. The new ROM packs can also be ordered separately, if you are upgrading from a 4051 to a 4052 or 4054.

Software

The 4052 and 4054 are completely language and storage-media compatible with the 4051. In this, the 4050 Series is unique, and offers major benefits both for current 4051 users, and for newcomers to the 4050 Series.

First, for 4051 users, you're already familiar with 4050 Series BASIC. There's no new language to learn, so the 4052 and 4054 are immediately productive for you. No time lost poring through manuals, getting used to a completely new set of keywords. No tedious and error-prone conversions to a new language or storage format. You can simply carry over all of your 4051 program or data files to a 4052 or 4054. This includes BINARY as well as ASCII format, and disc as well as tape files. Programs will run the same, but much faster. (You will notice that timing delays intentionally coded using loops or other methods are much shorter. You may decide to lengthen them.)

For newcomers to the 4050 Series, software compatibility means being able to take advantage of the wealth of software already developed for the 4051. For newcomers and 4051 users alike, it's important that all PLOT 50 software packages and programs in the 4050 Series Applications Library can be used on the 4052 and 4054.

Data Communications

Like the 4051, the 4052 and 4054 offer Option 1 Data Communications Interfaces. The interfaces provide the same unique combination of communications modes as the 4051 Option 1 does: programmed I/O mode using BASIC keywords, communications mode with host transfers directly to and from the Graphic System's internal tape, and terminal mode, where the 4050 Series System acts as a Tektronix 4010 Series Graphics Terminal.

In terminal mode, the 4052 emulates the 4012 Terminal, just like the 4051 does. However, communications are faster on the 4052, because of the faster processor. Data communications rates for the 4052 Option 1 Interface include both 4800 and 9600 baud.

The Option 1 Interface for the 4054 also allows transfers at up to 9600 baud. In addition, the 4054 Option 1 allows the 4054 to enter terminal mode and act like a 4014 Graphics Terminal, rather than like the smaller-screen 4012. The 4054 also emulates the most commonly needed features of the 4014's Option 34 Enhanced Graphics Module. That means superior 12-bit resolution graphics in terminal mode, with a full-screen crosshair cursor for graphic input, and program selectable dot-dash vector patterns. And of course, the same access to PLOT 10 and other host-based software that the 4051 and 4052 Interfaces provide.

GPIB

The GPIB (General Purpose Interface Bus) comes standard with the 4052 and 4054, as with the 4051. The GPIB for all three Systems conforms to the same IEEE 488-1975 Standard, so differences are in speed only. The GPIB operates faster on the 4052 and 4054, as a result of the basic speed increases of the new Systems. If you've been using the GPIB to collect data from a device, you'll be able to read about three times as many samples per second using the 4052 or 4054. You may also notice that the GPIB-compatible 4956 Tablet digitizes faster, detecting more points while in STREAM or continuous mode.

4054 Graphics and Alphanumerics: Like No Other Desktop Computer

The 4054 has all of the computation power and added features of the 4052, with impressive enhancements in graphics. The most striking change is the display. The 4054 has a 19″ DVST display, the largest of any desktop computer. That's over 13 million addressable points, for the finest detail in both graphics and alphanumerics.

Alphanumerics on the 4054 are "stroke-generated." Characters are drawn as vectors, not using dot patterns as on the 4052 and 4051. The stroke-generated characters are clean and crisp, and provide extremely high quality hard copies. In addition, characters on the 4054 can be in any one of four character sizes. Either directly from the keyboard or under program control, you can use a special new 4054 keyword, CHARSIZE, to select one of the four character sizes. The sizes range from 35 lines to 72 characters each, to 64 lines of 132 characters each. You'll find the multiple character sizes are helpful in a variety of applications. Their uses include enhancing graphs by differentiating titles, axis labels, and text annotations by character size. And the small character size with its 132 characters per line makes the 4054 the only desktop computer that can be used to preview computer line printer output.

For graphics, the 4054 has a new vector generator. It's a constant rate vector generator, unlike the "constant time" vector generator of the 4052 and 4051. On the 4052 and 4051, vectors take the same amount of time to draw, regardless of their length. Not so on the 4054. On the 4054, vectors are drawn at a constant rate of 15,000 cm/sec, so short vectors take considerably less time to draw than long vectors. This saves drawing time, especially for the average application, where vectors normally are 2 to 3 cm long. You'll find that graphics on the 4054 draw up to 50% faster even than on the 4052.

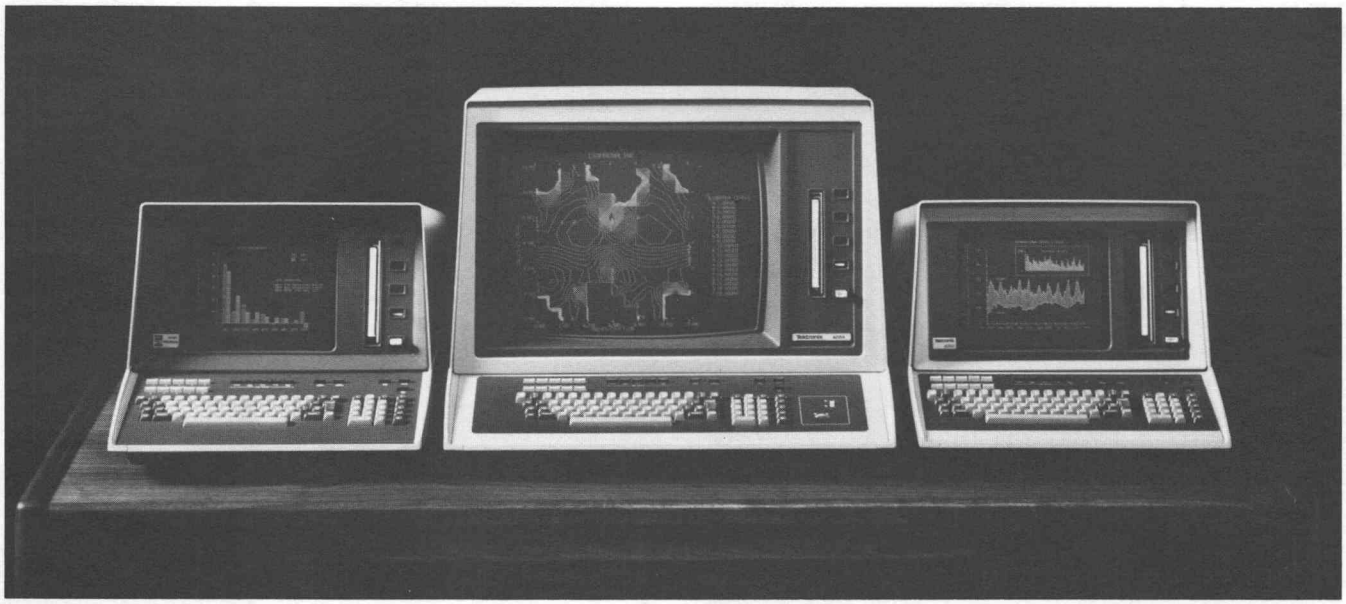
And that means up to **ten** times faster than on the 4051.

As a special graphics feature, the 4054 offers selectable dot-dash patterns for drawing vectors. You can choose any one of thirty-six unique patterns for subsequent vectors, using a new 4054 keyword DASH.

Finally, for graphic input the 4054 has a full-screen crosshair cursor, instead of the blinking arrow as on the 4051 and 4052. The crosshair cursor appears when the POINTER command is executed, and can be positioned on the display using either the 4952 Option 2 Joystick, or two new thumbwheels on the far right of the 4054 keyboard.

The next issue of TEKniques will tell more about the new 4054 graphics features. As you begin to use the 4052 and 4054, TEKniques will describe your interesting and unique applications that take advantage of the new capabilities.

Your local Tektronix Sales Engineer will be happy to discuss the features of the 4052 and 4054 in more detail.



The 4050 Series Graphic Computing Systems.

Graphics Display Treatment Planning on the 4051 Aids Radiotherapists

by Patricia Kelley

The University of Utah Medical Center at Salt Lake City has developed a radiation treatment planning system based on the 4051 Graphic System. It is one of the methods for approaching cancer therapy on an individual basis. Although this approach began twenty-five years ago, refinements have come about only recently, with the technical advances of body scanners, electron arc therapy, and low-cost stand-alone computers.

Dr. J. Robert Stewart, Professor and Head of the Division of Radiation Oncology, describes progress in the field of radiation therapy since the 1950s. It was the discovery of cobalt 60 that gave researchers the tool of higher energy. The initial impact of this change was getting a higher dose of radiation into a deep-seated tumor than ever before. But along with the improvement of tumor control, a whole new group of radiation complications reared up.

Dr. Stewart said that prior to this time the dose-limiting organ was the skin; it was not realized that the liver and heart were radiation sensitive. However, these organs as well as the lungs, kidneys, and other tissues were found to react to the higher dosages. He pointed out that subsequent research resulted in two-fold knowledge: the dose it takes to control different types of tumors, and the damaging dose for different tissues and organs.

This knowledge, coupled with the technical advances, enabled approaching treatment on an individual basis.

The Tools

4-MV Linear Accelerator

At the Medical Center a Varian Clinac-4, a four megavolt machine, produces X-rays for treatment of cancer. The patient lies supine on a motorized, moveable treatment couch, his position aligned with the aid of laser lights

mounted on the walls and recessed in the ceiling (Fig. 1). This alignment allows reproducible results from day to day. The Clinac-4 rotates to the predetermined treatment angle, allowing the patient to remain in a fixed position (Fig. 2). Wedges of varying thickness and angles modify the shape of the curves (Figs. 3 & 4). These are slid into place below the machine head. Outside the treatment room, a console and closed circuit television monitor the treatment and the patient (Fig. 5).

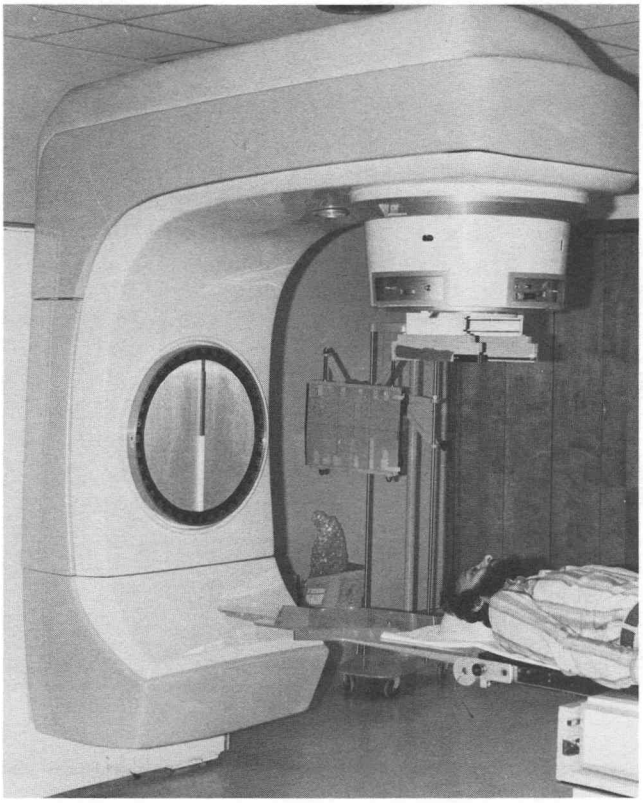


Fig. 1. Lou Fadell, student technician, demonstrates patient positioning for Clinac-4 X-ray treatment.

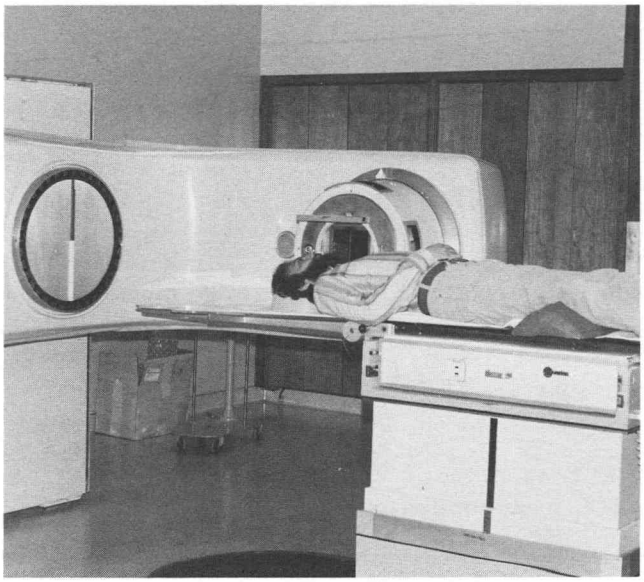


Fig. 2. The Clinac-4 rotates to gain proper X-ray angle. Because the table and X-ray machine are adjustable, a patient remains stationary during treatment.

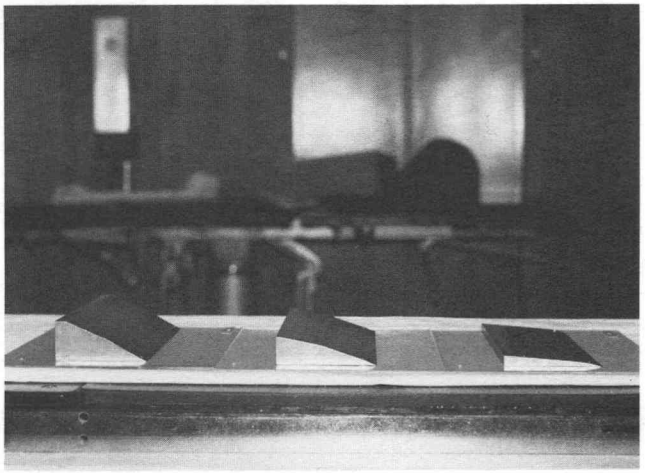


Fig. 3. Wedges with angles of 15, 30, 45 and 60 degrees modify dose distribution to be received by the patient.

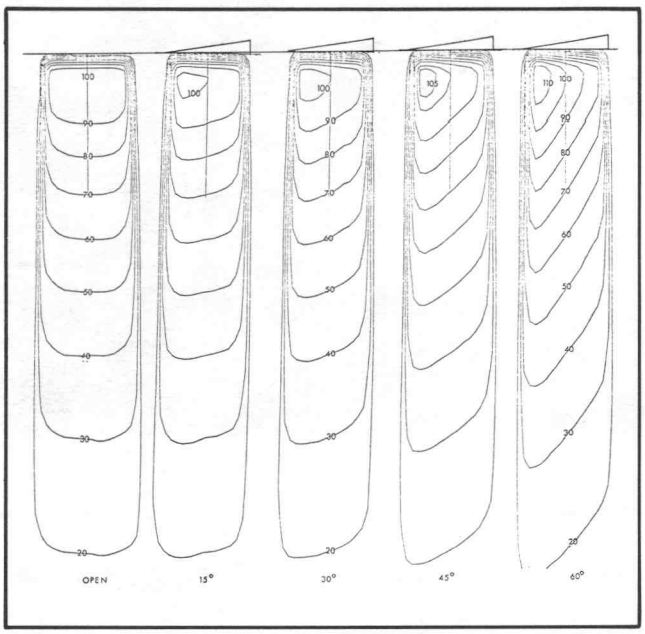


Fig. 4. Isodose distrubitions for open field, 15° wedge, 30° wedge, 45° wedge, 60° wedge.

Fig. 5. The console controls radiation and the closed circuit television monitors the patient.

18-MV Linear Accelerator

A newer, more powerful high energy machine, the Varian Clinac-18, produces X-rays at 10 million volts, or emits electrons at a range between 6 and 18 million volts (Fig. 6). Four- to five-inch thick tungsten collimators within the head of the machine adjust the size of the radiation beam from 0 to 35 cm. Individually shaped blocks composed of a lead alloy, cerrobend, mounted on plastic shelves (Fig. 7) can be slid into place below the machine head*. These devices shield the surrounding organs and tissues, limiting radiation to the tumor area only.

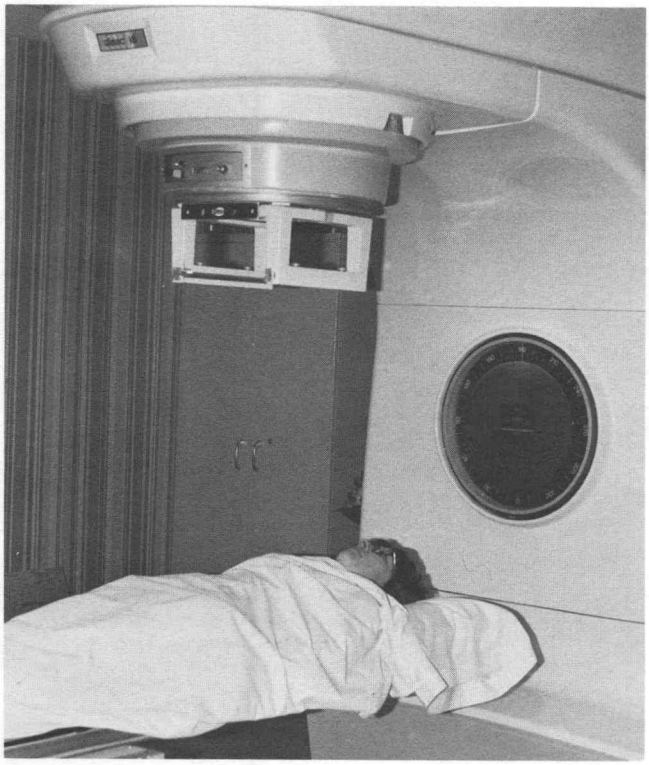


Fig. 6. The Varian Clinac-18 produces X-rays and electrons for treating cancer. Tilly Gibbs, radiation therapy technician, demonstrates patient placement.

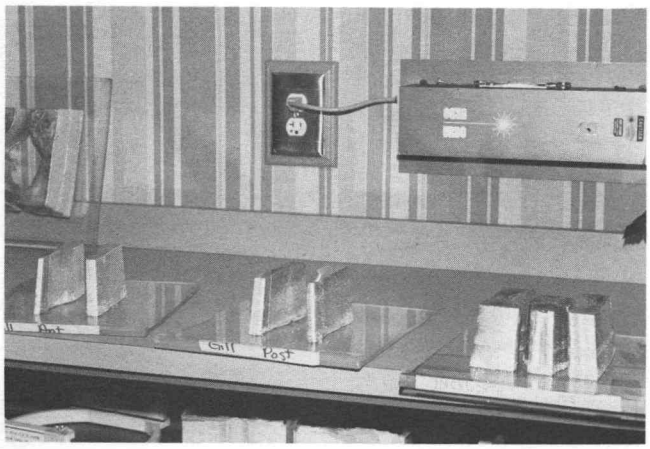


Fig. 7. Cerrobend wedges shape the beam field protecting tissues. The plastic shelf slides into the "handles" fastened to the head of the Clinac-18. Note the slots for the shelves in Figure 9.

***This statement applies to the Clinic-4 as well.**

Electron energy, unlike X-rays, can be finely adjusted for the depth of a tumor and is used for tumors less than 6 cm below the skin (Fig. 8). For instance, a tumor just under the skin can be treated with electrons without radiating underlying tissues. Or a chest wall can be treated without radiating the lungs underneath.

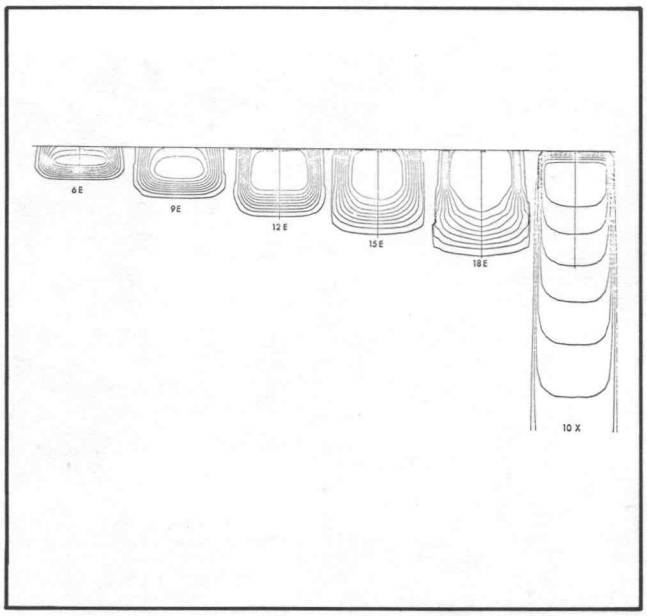


Fig. 8. Isodose distrubitions for electron energies of 6, 9, 12, 15, 18 million electron volts. Shown for comparison is the isodose distribution for 10 megavolt X-rays.

As with the Clinac-4, Clinac-18 patients are positioned with the aid of laser side lights and ceiling lights. Both therapy machines can also be rotated in a 360° arc (Fig. 9).

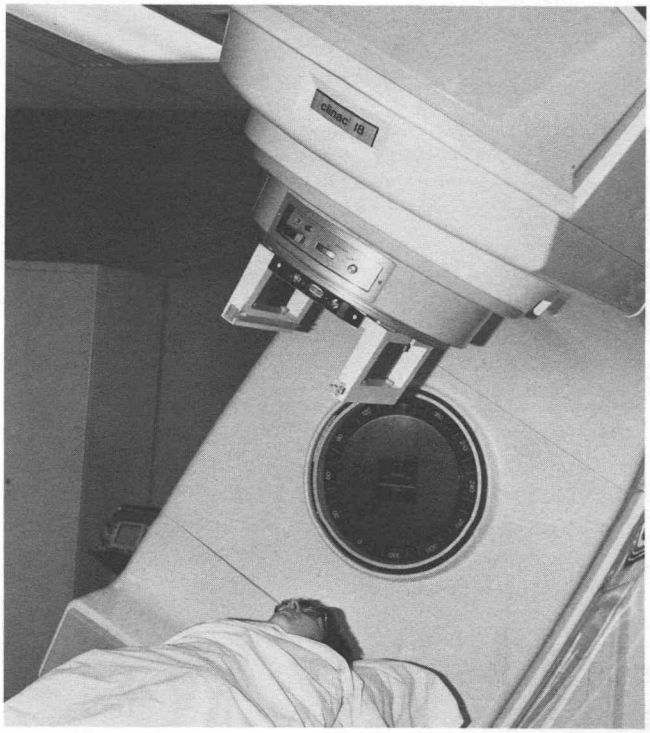


Fig. 9. The Clinac-18 rotates for desired treatment angle.

Simulator

A diagnostic machine with fluoroscopy, the Toshiba simulator is capable of reproducing the beam parameters of the treatment machines with diagnostic X-ray quality films. The simulator is the department's planning tool, displaying via film the anatomy encompassed by a simulated beam (Fig. 10).

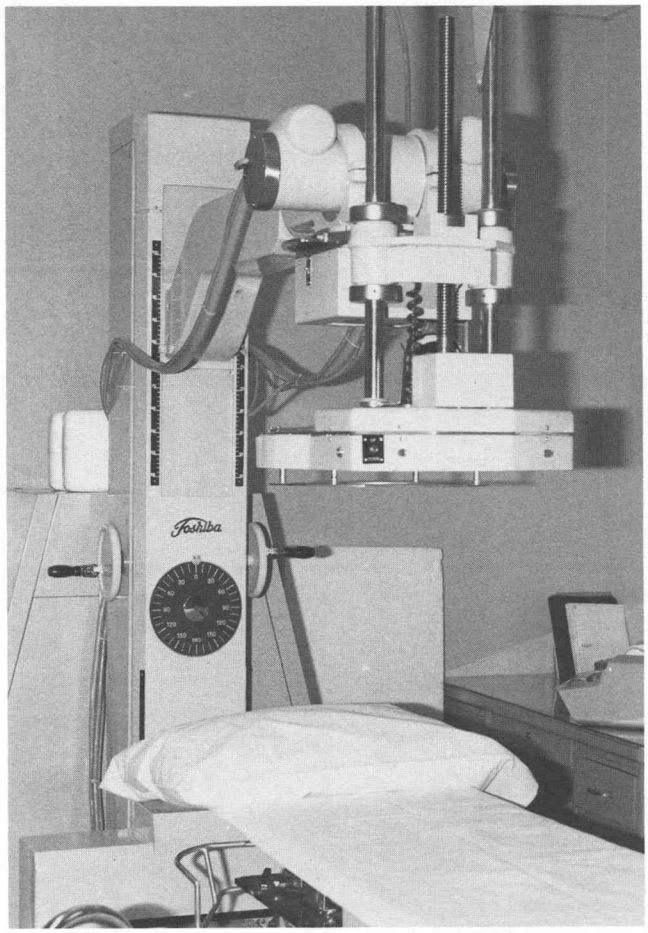


Fig. 10. The Toshiba Simulator provides a double check on the computer dosimetry. It also is capable of 360° rotation.

CT Scanner

One of the most sophisticated pieces of cancer therapy equipment is the Varian body scanner (Fig. 11). As the bed upon which the patient lies slowly moves into the tank, a rotating X-ray tube at the mouth of the tank scans horizontal sections of the body. The varying composition of body tissues results in different intensities coming from the beam passing through the body. The Varian computer reads these intensities and constructs a matrix of points for each section which it then reconstructs into a picture on a graphic screen. Thus, doctors may examine the internal structures of each patient, section by section.

The 4051's Part

The radiation dose during treatment is critical. If it is not high enough, the desired cure won't be achieved; if it is too high, surrounding tissues may suffer. Dr. Dennis D. Leavitt, with the help of Richard Sanborn and Judy Orr at the University's Department of Radiology, and Ralph Wilson of Transera Corporation, has written several programs to evaluate the alternatives within different treatment plans. By simulating techniques on the 4051 and portraying the results on the graphic screen or 4662 Plotter, the optimum treatment plan can be developed.

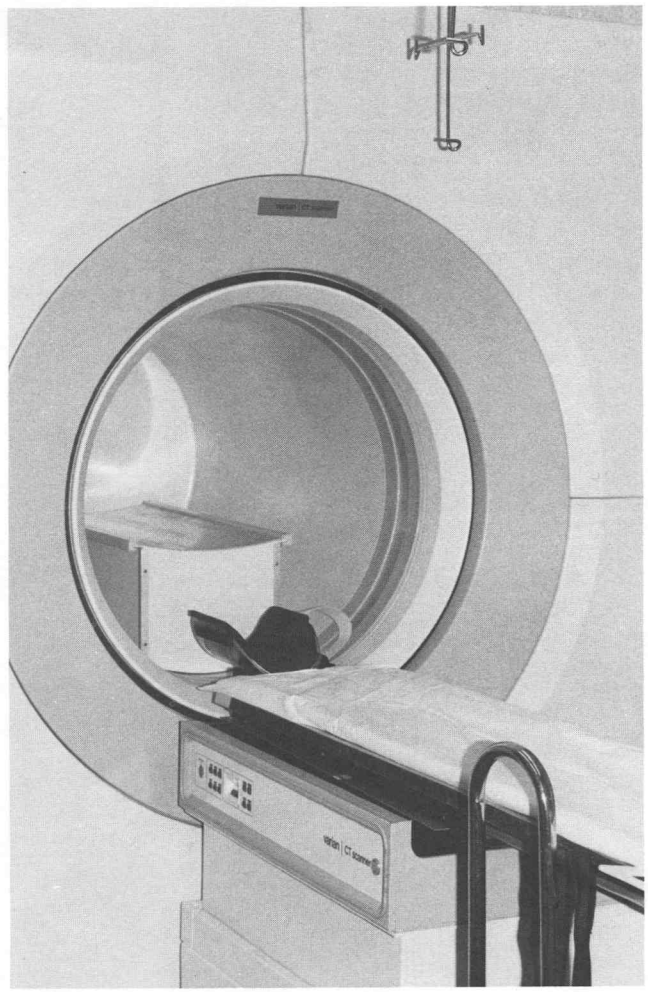


Fig. 11. A patient is positioned so the portion of anatomy to be scanned is entering the mouth of the body scanner. A rotating X-ray tube scans a cross section of the patient. The computer takes readings and reconstructs a picture of the intricate internal structures.

External Beam Treatment Planning Program

The External Beam Treatment Planning program is used most heavily in the University's Radiation Department. Using the 4051 to simulate varying radiation beam energies, beam types and their position during treatment relative to the individual patient enables rapid evaluation of alternate treatment plans.

A CT scan film of the tumor area is placed on a lighted tablet. The patient contour and tumor is digitized and data on internal structures, radiation beams, and reference points are entered through the tablet or the 4051

keyboard. The data is displayed on the graphic screen (Fig. 12) and any corrections are then made.

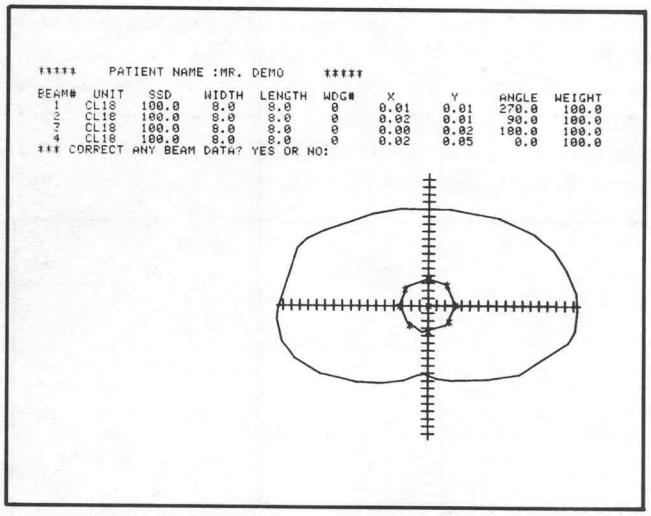


Fig. 12. The patient contour, reference points and beam parameters entered into the 4051 are displayed on the graphic screen for verification.

The program calculates the dose throughout the patient contour, one beam at a time, with corrections due to internal structures such as bone and lung whose densities are different than soft tissue. After calculation, the dose contribution of each beam, multiplied by that beam's weighting, is summed with contributions from the other beams to tally the total dose at each calculation point. The maximum value is displayed on the graphic screen along with patient contour, beam sizes, positions and directions. As the operator keys in isodose levels, the 4051 draws the contour lines corresponding to those levels (Fig. 13). A tabular listing of all relevant beam parameters, with total doses at the reference points, may be copied for the patient's chart (Fig. 14).

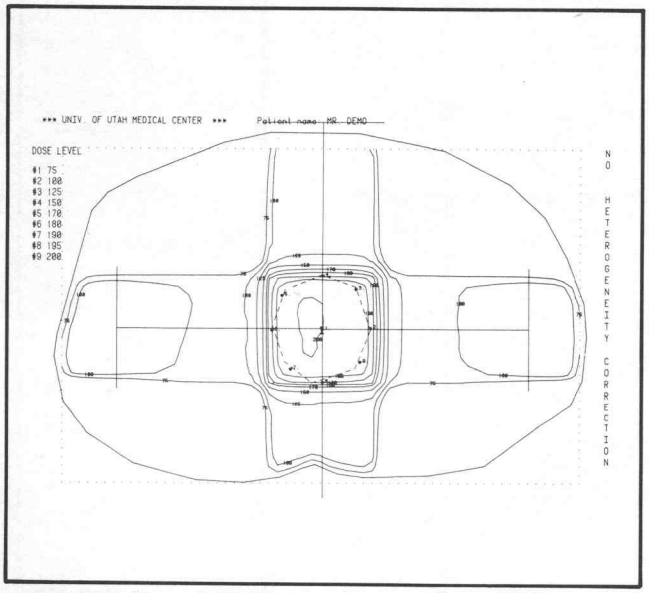


Fig. 13. Contour lines trace the various isodose levels throughout the treatment area.

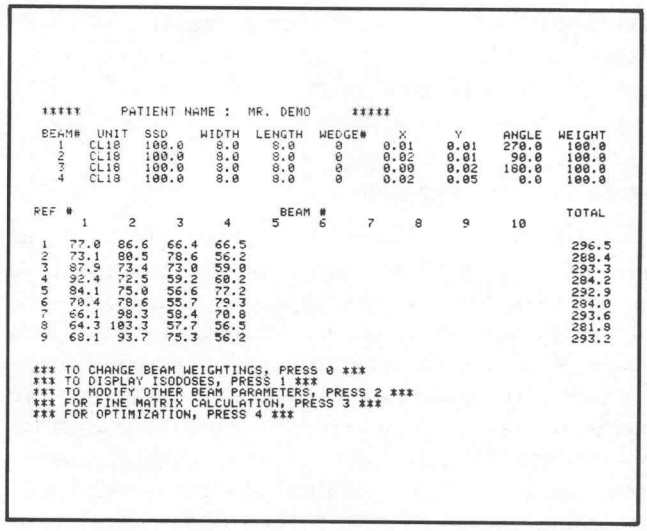


Fig. 14. Beam parameters and total dose at the reference points are available in a table.

At this point, the individual beam parameters may be manipulated for "what if" results. A final option modifies the individual beam weighting factors to minimize the variation between the total dose at each reference point and a desired dose at that reference point (Fig. 15).

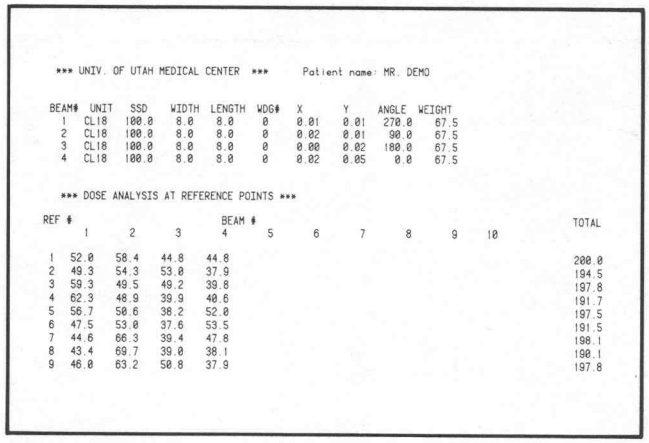


Fig. 15. After the operator enters the total desired dose (200) from all beams at reference point 1, the program considers beam parameters and displays the beam weights and dose distrubitions.

To allow more accurate beam profile data, an interface was developed between the 4051 and a Scanditronix water phantom and film densitometer. Measured data could then be transmitted directly from the water phantom to the 4051. This avoids the potential errors introduced by hand tracing isodose profiles.

Typical treatment plans may require two to eight external beams. The program is configured to handle a maximum of 10 external beams.

Rotational Beam Treatment Planning Program

This program is an extension of the External Beam Treatment program described above. The program

simulates a rotating beam by calculating a series of "fixed" beams, equally spaced through the arc. The weightings are adjusted so the total beam intensities are equal to the actual intensity of a rotating beam.

Irregular Field Program

Primary blocking, done by setting the machine collimators to a predetermined size, is only capable of providing square and rectangular shaped fields, whereas secondary blocking allows individualization of the beam shape. When secondary blocking, such as the individually tailored cerrobend blocks described earlier, is used to define the beam, this program incorporates their effect into the model. The calculations include doses at points in other areas, in addition to those along the central axis. The result is a good estimate of doses to shielded organs as well as doses in the primary field.

On the tablet, the field and points of calculation are digitized from an X-ray film exposed by the beam during the actual patient treatment. Other parameters are entered from the keyboard. The field, calculation points and dose rates for each point are displayed on the screen or plotter (Fig. 16). A tabular plot details the scatter doses and primary doses (Fig. 17).

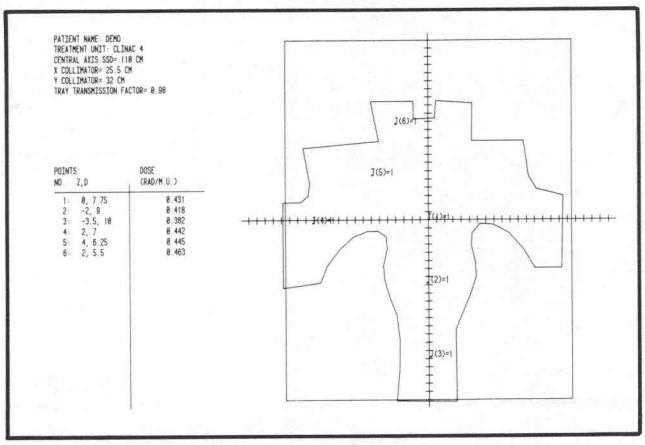


Fig. 16. A plot depicts an irregular beam field defined by collimators and wedges along with the doses at the reference points.

IRREGULAR FIELD DOSE ANALYSIS

Patient Name: DEMO
Treatment Unit: CLINAC 4
Field Description: MANTLE
Central Axis SSD: 110 cm
X Collimator: 25.5 cm
Y Collimator: 32 cm
Tray Transmission Factor: 0.98
Calibration Factor: 0.966279864311 Rads/M.U.
Calibration Distance: 81 cm

POINT #	SSD (CM)	DEPTH (CM)	COLL. FACTOR	OFF AXIS FACTOR	SAR	TAR0	AIR DOSE RADS/ M.U.	SCATTER DOSE RADS/ M.U.	PRIMARY DOSE RADS/ M.U.	TOTAL DOSE RADS/ M.U.
1	110.00	7.75	1.022	1.000	0.241	0.680	0.468	0.113	0.318	0.431
2	108.00	9.00	1.022	1.064	0.225	0.632	0.504	0.113	0.305	0.418
3	106.50	10.00	1.022	1.144	0.185	0.598	0.546	0.101	0.281	0.382
4	112.00	7.00	1.022	1.124	0.208	0.710	0.515	0.107	0.335	0.442
5	114.00	6.25	1.022	1.074	0.210	0.742	0.482	0.101	0.344	0.445
6	112.00	5.50	1.022	1.107	0.157	0.776	0.520	0.082	0.381	0.463

Fig. 17. A table lists the irregular field data.

Interstitial-Intracavitary Dosimetry and Seed Implant Programs

Treatment of cancer of the uterus or cervix are examples of treatments that require implanting the radiation source, leaving it until the desired dose is achieved. A collection of computer routines determine dose rates and distributions for up to 20 tubes or needles, and for seed implants in multiples of 50 seeds with no upward limit.

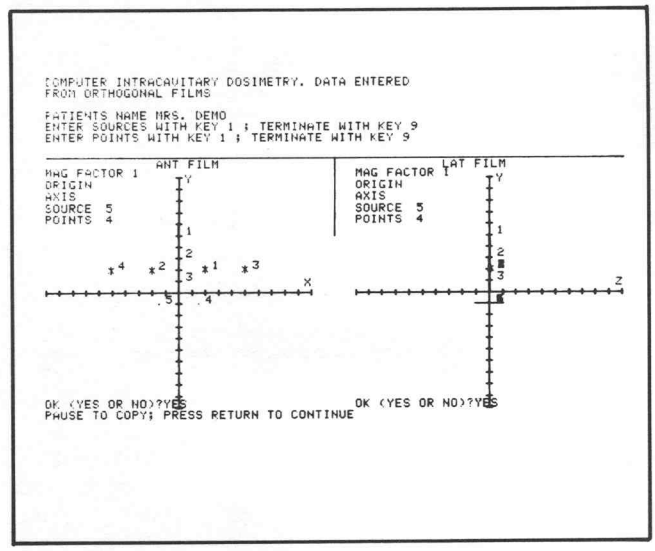


Fig. 18. The 4051 displays the source locations and reference points for an intracavitary treatment plan.

The source locations and calculation points are digitized into the 4051 through the tablet, and displayed on the screen for verification (Fig. 18). Source loadings may be changed and the result analyzed (Fig. 19). Figure 20 depicts the calculation points on the coronal plane. A quick check tells how many hours are required to achieve the desired dose rate.

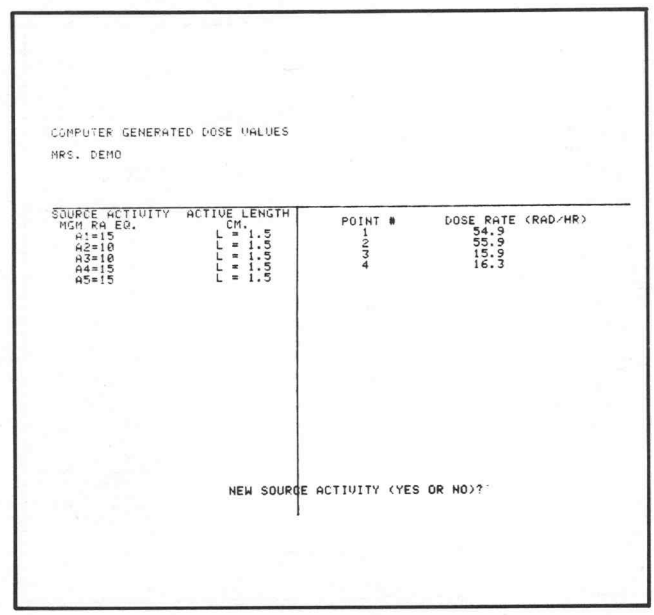


Fig. 19. The source loading can be manipulated to determine the best rate.

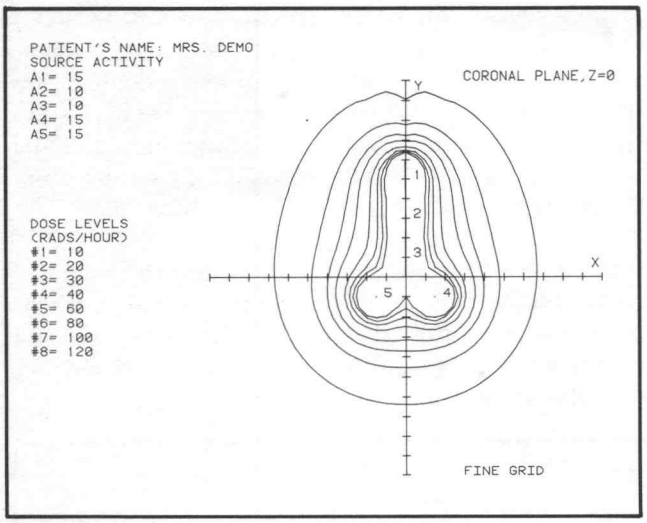


Fig. 20. Graphics help to determine location of radiation distribution and how many hours it will take to get the desired rate.

Prognosis

Dr. Stewart points out that improved diagnosis, improved surgical management, and chemotherapy contribute to the cure rates for cancer, with the improved radiation techniques which are the cornerstone for treatment of many forms of cancer. With new technology and knowledge affording precise control over the location and amount of radiation for each patient, the control rates have about doubled for several of these types of cancer and in some the improvement is even greater. For example, in the 1950s Hodgkin's Disease universally was considered to be fatal. Textbooks now quote a 75% cure rate; the rate zooms to 90% if the disease is caught during favorable stages. However, Dr. Stewart cautioned that overall cancer statistics are not as good since lung cancer incidence keeps rising and its cure rate being very low skews the entire picture.

While radiation therapy treatment planning has been around for awhile, it has been only on high-cost timeshare systems or expensive stand-alone minicomputers. Smaller hospitals and clinics were unable to justify the treatment planning for day-to-day applications. Because of Dr. Leavitt's efforts, with the support of his associates and the University, software has been developed for the low cost 4051 system permitting such treatment planning in usable, simple routines for application in smaller communities. The result will be a substantial upgrading of the quality of radiation therapy available to the general public.

Editor's Note: *The interview with Dr. Dennis D. Leavitt and tour of the Radiation Department of the University of Utah Medical Center was arranged by John Hess, Tektronix Sales Engineer at Salt Lake City. Dr. Leavitt provided interviews with Dr. J. Robert Stewart, Judy Orr and other personnel working with the equipment.*

*Editor's Note

Back Issues Available

Did you miss an issue of TEKniques, from Volume 1 or 2? We have back issues on hand in the TEKniques office. If you'd like to receive a copy of a previous issue of TEKniques, drop a note to the Applications Library serving you; Library addresses are located at the back of each TEKniques issue.

Program Tip Exchange

Send in your programming tip. Any one of the following 4051 Applications Library programs* will be yours when it's published. Simply jot down a brief description of the function, the code and your choice of program. Mail it to the 4050 Series Applications Library serving you; Library addresses are listed at the back of each TEKniques issue.

51/00-0101/0	51/00-5503/0
51/00-0702/0	51/00-7002/0
51/00-0715/0	51/00-8006/0
51/00-1401/0	51/00-9505/0
51/00-1402/0	51/00-9511/0
51/00-5401/0	51/00-9521/0

***Documentation and listing only.**

Questionnaire in This Issue

This issue contains a list of questions that can be the basis for a feature application article. If you've been thinking that your application might make an interesting story, let us know. We'll be glad to help. Take a look at "Your Application Article: A Place to Start."

New Catalogs Coming

New catalogs are being prepared for the 4050 Series Applications Library of software. These catalogs will be distributed with the June issue of TEKniques, so watch the mail. New programs will be in the catalog; they'll be of interest to you.

Programming Tips

CALL "DUP" and CALL "COMPRS" in 4907 File Management

by Jack Gilmore
Tektronix, Inc.

For file management, a CALL "DUP" command has many advantages over a CALL "COMPRS" command. When a disc is duplicated, several "clean-up" operations take place that may not occur during a compress operation:

1. Files may be shortened to just fit the data stored in them, (by specifying the last parameter of DUP as 1).

2. Each file is made contiguous again (after file expansion on the original disc caused the files to scatter).

3. All unused space is collected into one block.

4. Library names with no files in them are deleted, thus recovering more space.

5. The system verifies that all data on the disc can be read. Files that cannot be copied correctly are reported (Error Messages 32 or 34), and copied as well as possible.

Use the disc compress (COMPRS) command only after a "no space error" occurs—Message 55—during a CREate command with a **contiguous** attribute specified. CALL "CMPRS" may be able to make one whole space on the disc that is large enough to hold the file in question, but it may be at the expense of increased access time to other files on the disc. The CALL "COMPRS" command is not intended for overall file clean-up activities, but only as a last resort when CREate fails with the contiguous attribute specified.

Extending The Tape File Header

by Ed Sawicki
Tektronix, Inc.
Long Island

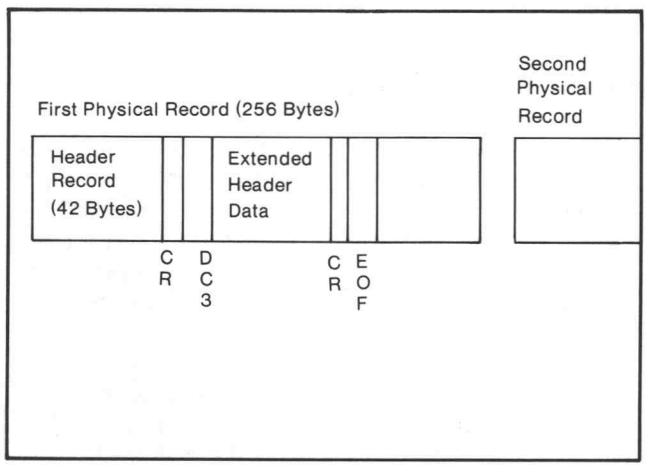
The first 256 byte physical record in a 4051 tape file contains the 42 byte header record (plus CR and DC3 characters). The remainder of this physical record can be used for storing a program name or a program description. It can also be used as a "hiding place" for data, since it cannot be seen during a TLIST and cannot be accessed by BASIC when in header mode. One caution: don't exceed a total of 254 bytes for the combined header.

The example program demonstrates how the extended header can be created. To access the extended header record, go into non-header mode, FIND the tape file and execute an INPUT @33:A$,A$. The string variable A$ will contain the extended header record.

```
90 REM * EXTENDED HEADER PROGRAM *
100 DELETE A$,I$
110 REM CAUTION: File destruction occurs if total length
120 REM     of A$ and I$ in line 280 exceeds 254 bytes.
130 DIM A$(254),I$(210)
140 REM Make a Carriage Return
150 C$=CHR$(13)
160 PRINT "Enter file number :";
170 INPUT F
180 REM Set No Header Mode
190 PRINT @33,0:0,0,1
200 FIND F
210 REM Get the old header
220 INPUT @33:A$
230 REM Add a CR and DC3
240 A$=A$&C$
250 A$=A$&"S"
260 PRINT "Enter extended header_:";
270 INPUT I$
280 A$=A$&I$
290 FIND F
300 REM Print the entire header record
310 PRINT @33:A$
320 REM
330 REM Now go back and read the extended
340 REM header for our example
350 FIND F
360 REM Read the 'real' header
370 INPUT @33:A$
380 PRINT A$
390 REM Read the extended header
400 INPUT @33:A$
410 PRINT A$
420 REM Restore no header mode
430 PRINT @33,0:0,0,0
440 END
```

Don't forget to restore header mode!

If the extended header contains file names, a short BASIC program can be written to do an "extended TLIST."



Salvaging Accidentally Re-MARked Files

by Jay K. Marshall
Sangamo Energy Management Division
Atlanta, Georgia
and Herman D'Hondt
Tektronix, Inc.
Sydney, Australia

TEKniques Vol. 2 No. 3 carried a short routine to salvage re-MARked files. Both Jay K. Marshall and Herman D'Hondt (the author) have sent in updates to that tip. The best of both of their routines were combined to produce the following program (Fig. 1). In addition, Mr. Marshall suggested a technique using the EDITOR ROM and Mr. D'Hondt has a routine for ASCII files only.

In the previous tip, on EOF the 4051 searches for a file behind the new LAST file. During the search, the 4051 counts the number of headers. When it reaches one, it checks the file number in the header against the file count *because it's in header mode.* If the two numbers don't match, the 4051 generates an error and returns to the loadpoint.

The following program, though still fairly simple, overcomes this problem. It requires two passes of the tape. In the first pass, it accesses all files beyond the new LAST file in non-header mode, changes each header so the file numbers will be the ones the 4051 thinks they should be, and prints the old and new headers to the screen. On the second pass, you can access the files in header mode, load the program/data and copy it to another tape or disc. If you don't have a 4924 Tape Drive or 4907 Disc system and have to switch tapes in the 4051 drive, statements 600 to 690 must be executed to access these files.

```
100 REM N=Number of new LAST file
110 N=4
120 ON EOF (0) THEN 300
130 PRINT @33,0:0,0,1
140 REM Find new LAST file
150 FIND N
160 INPUT @33:A$
170 GO TO 160
300 PRINT "OLD                              NEW"
310 REM Now renumber files to be retrieved
320 C$=CHR$(13)
330 FOR K=2 TO 256
340 FIND N+K
350 INPUT @33:A$
360 E$=SEG$(A$,9,1)
370 IF E$="L" THEN 490
380 G$=SEG$(A$,1,30)
390 PRINT G$;
400 B$=STR$(N+K)
403 IF VAL(B$)>>9 THEN 410
405 B$=B$&" "
410 A$=REP$(B$,1,LEN(B$))
420 A$=A$&C$
430 A$=A$&"S"
440 G$=SEG$(A$,1,30)
450 PRINT G$
460 FIND N+K
470 PRINT @33:A$
480 NEXT K
490 PRINT "FINISHED"
500 PRINT @33,0:0,0,0
510 PRINT "¿You may now find and load any file from ´"¡N+2¡"´"¡
520 PRINT "to ´"¡N+K-1¡"´.ĞĞĞ"
530 END
600 REM N=NEW LAST FILE
610 N=4
620 ON EOF (0) THEN 670
630 PRINT @33,0:0,0,1
640 FIND N
650 INPUT @33:A$
660 GO TO 650
670 PRINT @33,0:0,0,0
680 PRINT "YOU MAY NOW ACCESS YOUR NEXT FILE"
690 STOP
```

Fig. 1. This routine will retrieve marked over files beginning with the first full file after the new LAST file.

Depending on the location of the new LAST file in relation to the overwritten file, you may be able to access the overwritten file by inserting the following statements into the program. Note that A$ gives you a "listing" of your program. However, control characters are treated literally which results in a screen PAGE should a CONTROL L be in any statement.

```
200 REM Change target line in statement 120 to 200
210 REM Find file overwritten by LAST file
220 FIND N+1
230 PAGE
240 ON EOF (0) THEN 300
250 INPUT @33:A$
260 PRINT A$
270 GO TO 250
```

Fig. 2. Inserting this code into the above routine *may* retrieve the partially overwritten file.

Again, depending on where the new LAST file is sitting in the overwritten file, it may be possible to OLD in what remains of the overwritten program using the 4051R06 EDITOR ROM. Insert the EDITOR ROM into the 4051 backpack and issue the following commands.

```
PRINT @33,0:0,0,1
CALL "EDITOR"
FIND n
INPUT (Issue command until MT error generated)
```

Fig. 3. Using the EDITOR ROM and issuing these commands will bring you to the end of the new LAST file.

Then find the n+1 file and OLD it in. These results will be displayed.

```
PRI@33,0:0,0,1
CALL "EDITOR"
FIND 4
INPUT
 4       LAST                          3
INPUT


    LAST                          3              4
INPUT


    LAST                          3              4
INPUT


    LAST                          3              4
INPUT

OR ERROR                                        EDIT
Device at EOF - error number  146
INPUT
IEDITOR ERROR
MT File - error number  143
FIND 5
OLD
```

Fig. 4. It may now be possible to OLD in the partially overwritten file.

Alternatively, but only for ASCII programs and data, it's possible to access the files on the first pass in non-header mode, read the whole file into a large string variable, delete the header and other unwanted characters at the beginning and transfer the string to another tape.

```
100 INIT
110 ON EOF (0) THEN 180
120 PRINT @33,0:0,0,1
130 REM 3 IS THE NEW LAST FILE
140 FIND 3
150 PRINT @33,0:0,0,0
160 INPUT @33:A$
170 GO TO 160
180 REM THE FOLLOWING ROUTINE WILL DUMP AN ASCII FILE
190 REM INTO ONE LARGE STRING.
200 OFF EOF (0)
210 REM D$ MUST BE LARGE ENOUGH TO ACCOMMODATE THE
220 REM LARGEST STRING IN THE FILE
230 DIM D$(300),C$(1),B$(MEMORY-500)
240 B$=""
250 C$=CHR(13)
260 PRINT @33,0:0,0,1
270 REM FIND THE DESIRED FILE IN NON-HEADER MODE
280 FIND 5
290 ON EOF (0) THEN 340
300 INPUT @33:D$
310 D$=D$&C$
320 B$=REP(D$,1+LEN(B$),0)
330 GO TO 300
340 REM NOW REMOVE THE FILE HEADER FROM B$
350 B$=SEG(B$,257,LEN(B$)-256)
360 REM NOW STORE B$ ONTO ANOTHER TAPE
370 PRINT @33,0:0,0,0
```

Fig. 5. ASCII program and data files may be recovered by inputting them into a large string variable.

While more complicated than the original, these routines are still far simpler than alternative ways of accessing lost files. And, of course, the best method is to follow the accepted programming practice of backing up program and data tapes.

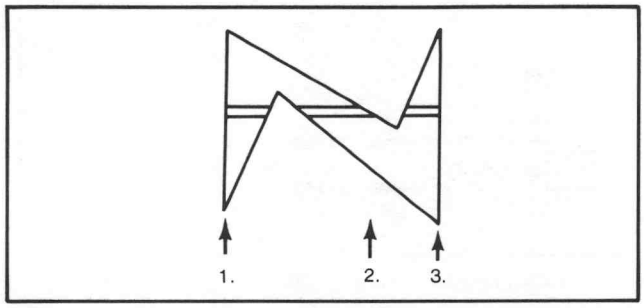
Shading Routine Update

by John Carter
Tektronix, Inc.
Santa Clara, CA

TEKniques Vol. 3 No. 1 carried the programming tip "Shading Routine for Complex Shapes." Line 220 of that routine should be corrected to read:

```
220 DIM P(2,N),W(2,N+1),X(N),P1(2)
```

With X dimensioned to N-1, the program will fail at line 500 on a dimension error if the shape of the polygon causes exactly half as many draws per sweep as there are sides to the polygon. For example, if the sides of the polygon are six and the shape of the polygon is a block letter N, then the program must shade three areas in one sweep:



Extended String Input

by Chuck Eng
Tektronix, Inc.

This quick routine overrides the 72 character buffer limitation when inputting strings. If you use this routine, you must incorporate any code peculiar to your own needs, such as error checks, data correction and so forth.

```
100 DELETE A$
110 REM L=NUMBER OF INPUT CHARACTERS
120 L=1000
130 DIM A$(L),Z$(1)
140 PRINT "PRESS RETURN TO END"
150 A$=""
160 GIN X1,Y1
170 X2=X1-1.793
180 FOR I=1 TO L
190 POINTER X,Y,Z$
200 IF Z$<>"" THEN 240
210 REM END OF INPUT, EXIT LOOP
220 I=L
230 GO TO 310
240 A$=A$&Z$
250 X2=X2+1.793
260 IF X2<129 THEN 290
270 X2=X1
280 Y1=Y1-2.81
290 MOVE X2,Y1
300 PRINT Z$;
310 NEXT I
320 END
```

Underlining

by Paul Brubacher
Project Engineer
Sinclair Radio Laboratories Limited
Concord, Ontario, Canada

When printing out several columns of numbers on the 4051 Graphic Screen, it's difficult to follow one line of type across the page. The following routine shows a method of drawing a line between lines of type. By including the counter 'C', it's possible to underline every third line.

```
100 C=-2
110 FOR I=0 TO PI STEP 0.01
120 IF C THEN 180
130 C=-3
140 GIN X,Y
150 MOVE 0,Y-0.2
160 RDRAW 130,0
170 MOVE X,Y
180 PRINT I,SIN(I),COS(I),I*I
190 C=C+1
200 NEXT I
210 END
```

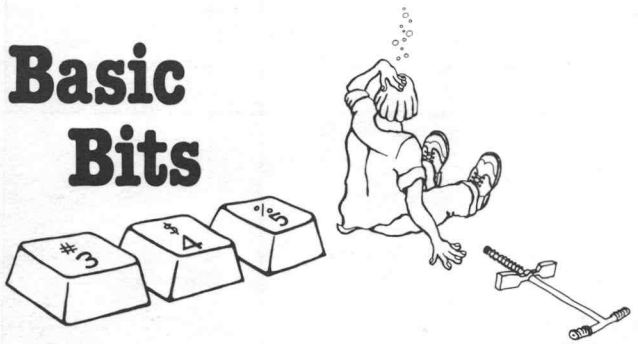
Dynamic Memory Management—Arrays

by Chuck Eng
Tektronix, Inc.

Do you have an array to which you'll be adding an

unknown quantity of data values? Use the 4051's dynamic memory capability. First, dimension the array for some maximum value (statement 330). Then input from tape the number of data points, n (statement 350); redimension your array to fit the data values on tape (statement 360) and bring those values into your array (statement 370). Now redimension to the maximum (statement 380), and you can start keying in your additional data (statement 400). Keep track of the number of data points by adding to n (statement 430). When finished, redimension the array to n (statement 460); save n and the data on tape (statement 480).

```
200 REM Construct initial array on tape
210 FIND 1
220 PRINT @33:2
230 PRINT @33:10,20
300 REM Add to Array
310 DELETE A
320 N1=50
330 DIM A(N1)
340 FIND 1
350 INPUT @33:N
360 DIM A(N)
370 INPUT @33:A
380 DIM A(N1)
390 PRINT "[When finished press [RETURN] without an entry]"
400 PRINT "Enter A(";N+1;")= ";
410 INPUT A$
420 IF A$="" THEN 460
430 N=N+1
440 A(N)=VAL(A$)
450 GO TO 400
460 DIM A(N)
470 FIND 1
480 PRINT @33:N,A
490 END
```



List by Pages

by Dr. John W. Senner
Oregon Regional Primate Research Center
Beaverton, OR

When writing programs longer than 50 lines, it is often convenient to list page-sized segments. This can be done automatically by including a series of PAGE; LIST mmm, nnn; and END statements in the USER-DEFINABLE KEYS segment of the program as shown in this example. This assumes that if User-Definable Keys 6 through 20 are used in your program, they will be coded after their use as a programming aid has terminated. Also, note that statement numbers are incremented by 10.

```
1 REM Go around listing routines to run program
2 GO TO 100
24 PAGE
25 LIST 1,23
26 END
28 PAGE
29 LIST 100,260
30 END
32 PAGE
33 LIST 260,390
34 END
36 PAGE
37 LIST 390,680
38 END
40 PAGE
41 LIST 680,807
42 END
64 PAGE
65 LIST 807,1007
66 END
68 PAGE
69 LIST 1007,1207
70 END
72 PAGE
73 LIST 1207,1507
74 END
76 PAGE
77 LIST 1507,1707
78 END
80 PAGE
81 LIST 1707,1907
82 END
```

Several points to keep in mind: 1) Don't include more than 20 lines in a page, which allows you room to make changes without erasing the page. 2) Initially, use "unusual" line numbers as parameters of the LIST command, as shown in lines 64 to 82, so that the number of lines in a page is not affected by making insertions and RENUMBERing. Later, after you are satisfied with a particular segment, you might want to change the parameters of the LIST to display only that segment, as shown in lines 24 to 42. 3) Overlap the pages by one line so that an inserted line can never "disappear" between pages. 4) Delete these lines when the program is finalized.

Plotter LOAD Button Test

by Bob Wheeler
North Ogden, Utah

When developing programs that use the 4662 Plotter, the following subroutine can be helpful. The subroutine is used to see if the Plotter's LOAD button is down, before any data is sent to the Plotter. If the LOAD button is down, then the subroutine will print a message to the screen and wait for the LOAD button to be released. After the LOAD button is released, the subroutine will "return."

The subroutine tests the Plotter's processor status word to see if or when the LOAD button is released. Lines 1010 and 1020 read the processor status word. Lines 1030 and 1040 test the PSW, and lines 1050 to 1080 print the message.

```
1000 H=0
1010 PRINT @1,0:0
1020 INPUT @1,0:X
1030 X=INT(X/2^9)
1040 IF NOT((X/2-INT(X/2))*2) THEN 1090
1050 IF H THEN 1010
1060 H=1
1070 PRINT "RELEASE THE LOAD BUTTONGGG"
1080 GO TO 1010
1090 RETURN
```

4051 Applications Library Program Abstracts

Order

Documentation and program listings of each program are available for a nominal charge. Programs will be put on tape for a small recording fee per program plus the charge for the tape cartridge. One tape will hold several programs. (The program material contained herein is supplied without warranty or representation of any kind. Tektronix, Inc. assumes no responsibility and shall have no liability, consequential or otherwise, of any kind arising from the use of this program material or any part thereof.)

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Program contributions or orders outside the U.S. must be processed through the local Tektronix sales office or sent to one of the Libraries serving your area. See Library Addresses section.

ABSTRACT NUMBER: 51/07-6108/0

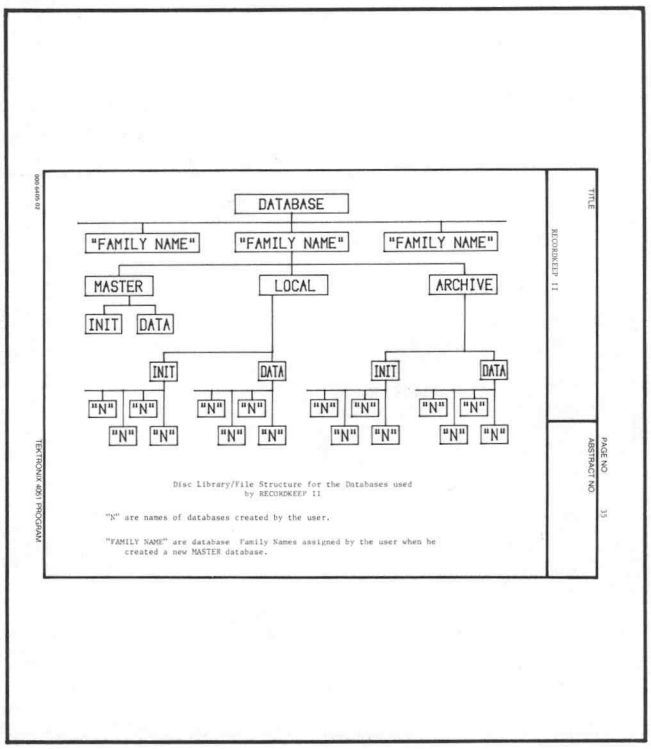
Title: **RECORDKEEP II**
Author: Jim Gish
Irvine Field Office
Tektronix, Inc.
Memory Requirement: 16K
Peripherals: 4907 File Manager
Optional—4631 Hard Copy Unit
4641 Printer
Statements: 2034
Files: 13 ASCII Program

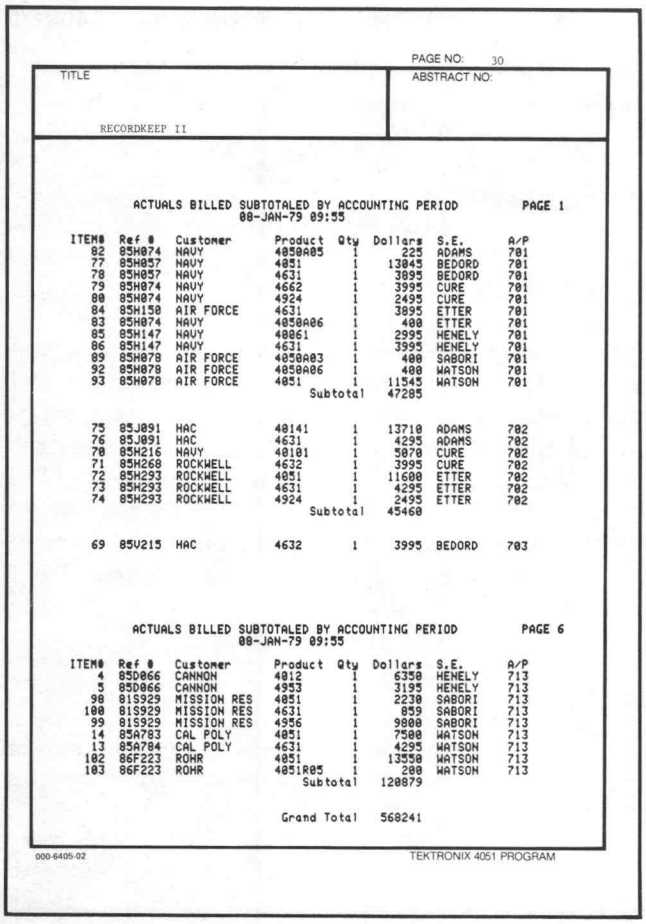
Tables and lists are two common ways in which people organize information to make comparisons or summarize data. RECORDKEEP II is a simple package that allows storing such a table on the 4907 File Manager. Reports can then be quickly generated from this table (database) through the RECORDKEEP II commands that allow editing, sorting, and table listing.

Twelve commands are available. They are broken down into three functional groups. The first group provides the commands necessary to edit the table, which we will call a database or file. Commands in the second group include file management operations that allow saving databases and creating smaller tables from existing databases. These tables can also be sorted and listed to emphasize their content by the third functional group. RECORDKEEP II can be applied in areas where you need to store and manipulate small inventories, sales history records, personnel records, patient history, or catalogues.

This software helps you organize and store information as well as put the information to work by summarizing it in a more effective tabular form.

Command 1— Add Items to Database
Command 2— Delete Items From Database
Command 3— Modify Items in Database
Command 4— List a Database
Command 5— Create a Local Database
Command 6— Archive a Local Database
Command 7— Make Local Databases From Archive
Command 8— List Directory
Command 9— Delete Archived Database
Command 10— Sort a Database
Command 11— List Database With Subtotals
Command 12— Stop





PAGE NO: 30

TITLE

ABSTRACT NO:

RECORDKEEP II

ACTUALS BILLED SUBTOTALED BY ACCOUNTING PERIOD PAGE 1
08-JAN-79 09:55

ITEM#	Ref #	Customer	Product	Qty	Dollars	S.E.	A/P
82	85H074	NAVY	4050A05	1	225	ADAMS	701
77	85H057	NAVY	4031	1	13045	BEDORD	701
78	85H057	NAVY	4631	1	3895	BEDORD	701
79	85H074	NAVY	4662	1	3995	CURE	701
80	85H074	NAVY	4924	1	2495	CURE	701
84	85H150	AIR FORCE	4631	1	3895	ETTER	701
83	85H074	NAVY	4050A06	1	400	ETTER	701
85	85H147	NAVY	4061	1	2995	HENELY	701
86	85H147	NAVY	4631	1	3995	HENELY	701
89	85H078	AIR FORCE	4050A03	1	400	SABORI	701
92	85H078	AIR FORCE	4050A06	1	400	WATSON	701
93	85H078	AIR FORCE	4051	1	11545	WATSON	701
			Subtotal		47285		
75	85J091	HAC	40141	1	13710	ADAMS	702
76	85J091	HAC	4631	1	4295	ADAMS	702
70	85H216	NAVY	40101	1	5070	CURE	702
71	85H268	ROCKWELL	4632	1	3995	CURE	702
72	85H293	ROCKWELL	4051	1	11600	ETTER	702
73	85H293	ROCKWELL	4631	1	4295	ETTER	702
74	85H293	ROCKWELL	4924	1	2495	ETTER	702
			Subtotal		45460		
69	85U215	HAC	4632	1	3995	BEDORD	703

ACTUALS BILLED SUBTOTALED BY ACCOUNTING PERIOD PAGE 6
08-JAN-79 09:55

ITEM#	Ref #	Customer	Product	Qty	Dollars	S.E.	A/P
4	85D066	CANNON	4012	1	6350	HENELY	713
5	85D066	CANNON	4953	1	3195	HENELY	713
98	81S929	MISSION RES	4051	1	2230	SABORI	713
100	81S929	MISSION RES	4631	1	859	SABORI	713
99	81S929	MISSION RES	4956	1	9800	SABORI	713
14	85A783	CAL POLY	4051	1	7500	WATSON	713
13	85A784	CAL POLY	4631	1	4295	WATSON	713
102	86F223	ROHR	4051	1	13550	WATSON	713
103	86F223	ROHR	4051R05	1	200	WATSON	713
			Subtotal		120879		
			Grand Total		568241		

000-6405-02 TEKTRONIX 4051 PROGRAM

ABSTRACT NUMBER: 51/00-6109/0

Title: **Inventory File System**
Author: John R. Zeigler
Tektronix, Inc.
Memory Requirement: 32K
Peripherals: Optional—4641 Printer
Statements: 406
Files: 2 ASCII Program
24 Data Files Required

The program implements a small inventory system. You can create files of various items where each item is composed of a part number, quantity, location, description, and cost. Each data file is assigned a name which is kept in file 14, thus forming a directory to the inventory.

Data files may be modified in any of the five fields: part number, quantity, location, description, or cost. User Definable Keys allow you to sort files, update files to tape, display the file, display the next line of a file, type the file to the 4641 printer, search the entire file listing for each occurrence of a desired string in a particular field, search for a part number and stop, modify a data entry, open a file, and create the directory.

A unique feature of the Inventory File System is that the directory may be accessed just as any data file. This means you can delete a file even though no User-Definable Key is provided for the task. The extra effort required to create the directory and to delete files assures that files won't be inadvertently deleted.

Dump of file "LIBRARY"

Part#	Quan	Location	Description	Cost
51/00-0100	20	61-181	PROJECT HOURS DATA MAINTENANCE	$15.00
51/00-0101	20	61-181	ENGINEERING EXPENSES DATA MAINT	$15.00
51/00-0301	20	61-181	AVERAGE ELASTICITY OF DEMAND	$15.00
51/00-0401	20	61-181	ARBITRAGE	$15.00
51/00-0501	20	61-181	INVENTORY/PRODUCTION MODELING	$15.00
51/00-0601	20	61-181	CHECK BOOK BALANCING	$15.00
51/00-0602	20	61-181	REQUIRED BANK RESERVE	$15.00
51/00-0701	20	61-181	MOVING AVERAGE	$15.00
51/00-0702	20	61-181	SINGLE MOVING AVERAGES W/GRAPHICS	$15.00
51/00-0703	20	61-181	DOUBLE MOVING AVERAGES W/GRAPHICS	$15.00
51/00-0704	20	61-181	SINGLE EXPONENTIAL SMOOTH W/GRAPH	$15.00
51/00-0705	20	61-181	DOUBLE EXPONENTIAL SMOOTH W/GRAPH	$15.00
51/00-0706	20	61-181	TRIPLE EXPONENTIAL SMOOTH W/GRAPH	$15.00
51/00-0707	20	61-181	SINGLE WEIGHTED AVERAGES W/GRAPH	$15.00
51/00-0708	20	61-181	DOUBLE WEIGHTED AVERAGES W/GRAPH	$15.00
51/00-0709	20	61-181	PETROLEUM RISK ANALYSIS I	$15.00
51/00-0710	20	61-181	PETROLEUM ECONOMIC ANALYSIS I	$15.00
51/00-0711	20	61-181	PETROLEUM WATER INFLUX I	$15.00
51/00-0712	20	61-181	OIL RESERVES	$15.00
51/00-0713	20	61-181	GAS RESERVES	$15.00
51/00-0714	20	61-181	TIME LAPSE ANALYSIS	$15.00
51/00-0715	20	61-181	MEASURES OF CENTRAL TENDENCY	$15.00

ABSTRACT NUMBER: 51/07-8025/0

Title: **4907 UTILITY**
Author: John R. Carter, Sr.
Santa Clara Field Office
Tektronix, Inc.
Memory Requirement: 8K
Peripherals: 4907 File Manager
Statements: 922
Files: 14 ASCII Program
40 ASCII Data

UTILITY is a package of routines that offer the new user of a 4907 the ability to learn the machine by example.

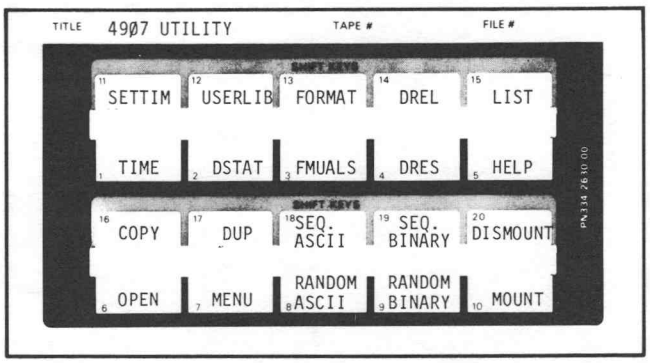
Not all commands are used in this package as there are some whose inherent simplicity can neither be further simplified nor exemplified. UTILITY details the more difficult commands to remember and use.

Each of the commands used offers two options: 1) how to input the command on the keyboard and 2) how to use the command in a program. There is a HELP routine which can review all commands in a brief form, gives more detail than the reference guide and less than the reference manual, is a practical on-line combination of

both. For those who cannot remember all the commands, there is a LIST routine.

The first thing a typical user might want to do is write data into a file and then read it back and later modify it. There are four routines which access any file, or create one, in ASCII or BINARY. The four routines are 1) Sequential in ASCII; 2) Sequential Binary (will handle numeric and alphanumeric data); 3) Random Access ASCII; and 4) Random Access Binary (will handle alphanumeric only).

It is helpful to use the reference manual to supplement this guide, for details beyond the scope of this application.



ABSTRACT NUMBER: 51/00-4001/0

Title: **COBALT-60 CALIBRATION CHART**
Author: C.S. Narayanan
Lutheran Hospital
Ft. Wayne, Ind.
Memory Requirement: 8K
Peripherals: Optional—4631 Hard Copy Unit
Statements: 48
Files: 1 ASCII Program

The program calibrates treatment time for CO-60 Teletherapy units, which are used to treat cancer patients. The CO-60 radioactive source decays (loses its strength) according to its half life. The output of the therapy unit must be calibrated and changed accordingly. This program will give you the output calibration. Enter the present output for various field sizes, and the calibrated output will be displayed. The display can be copied with the 4631 Hard Copy Unit.

WARNING

The recipient of this program is solely responsible for checking the accuracy and appropriateness of this program and procedure.

Your Application Article: A Place to Start

The TEKniques staff is always looking for interesting applications to share with other 4050 Series users. And we know that many of you are using your 4051 in ways that would be of interest to other TEKniques readers. Perhaps you've thought that your application would be of particular interest, but didn't know where to start. The following list of questions might help.

These questions are the basis for an applications article questionnaire, which we'll gladly send to interested contributors. However, if you're interested in featuring your application, just jot down the answers to these questions and mail them in to us. Include any other non-confidential background or information write-ups you might already have. Be sure to include your name, address, and phone number, so we can contact you for further information.

After we've written an article about your application, we'll send it to you for final review and approval; you retain the final say on the content of the article. So, if you're interested in featuring your application, answer the appropriate questions and send them back. We'll take it from there.

- What problems were you trying to solve with this application?

- How are you using your 4050 Series Graphic System to solve the problem?

- What equipment configuration is used? What special hardware and/or software was developed or modified? (Please include a diagram of the configuration.)

- What type of data goes into the system, and how? What is the output?

- What methods were used prior to development of this application?

- What are the advantages of the present application and equipment? Why is the graphics capability useful?

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Organization Name

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Information Display Group
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Beaverton, Oregon 97005

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