technical note technical

A Survey of Computer Utilization at the En Route Air Traffic Control Centers (2.12 System, 1982 - 1983)

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March 1983

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16. Abstract

This report contains the quantitative results of an air traffic computer capacity study performed at the Federal Aviation Administration (FAA) Technical Center for 19 of the 20 en route centers in the National Airspace System (due to a manpower shortage, Chicago did not participate in this survey). Based on field data consisting of several thousand observations collected during air traffic operations, the study is an extension of a task started 2 years ago during a Senate investigation. Over a period of time, such work has become part of the FAA's continuous effort to monitor the dwindling capacity of the en route computers until a replacement is available. The analysis addresses central processing as well as selector channel utilization for the current A3d2.12 software system. Several comparisons are made with the older A3d2.9 and 2.10 systems measured in the past. The sites with the fast IBM 9020D computers continued to have ample processing capacity, while those with the slower 9020A systems had their high utilization noticeably reduced through recent improvements. Despite this change, the 9020A processing utilizations remain quite high relative to those of the 9020D.

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EXECUTIVE SUMMARY

BACKGROUND.

The study described in this document addresses computer utilization at 19 of the 20 en route air traffic control centers for the 1982-83 period (Chicago did not participate in this study due to its manpower shortage). Started over 2 years ago, this kind of work belongs to a series of efforts during which the FAA monitors the remaining capacity of field computers until a replacement becomes available later this decade. For instance, a previous study similar to this one was conducted in 1980-81 because Senate investigators expressed concern over the safety and reliability of field computers. In that study, the Federal Aviation Administration (FAA) supplied extensive measurement results concerning the en route computer capacity situation throughout the nation when asked to respond to a Senate Subcommittee request. This was the first time since the computers were installed in the field that the Agency has performed a computer evaluation task of this scope. The present study is a continuation of that initial work since the Air Traffic Service has extended indefinitely these computer surveys.

Accordingly, this report presents computer utilization results for the A3d2.12 software system currently operating in the field (1982-83 period), and then compares these results with those for the older A3d2.9 and 2.10 systems measured in 1980-81. Unlike previous figures, which involved only central processing utilization as a computer performance measure, the present results include, in addition, selector channel utilization because the selector channels were singled out as potential system bottlenecks during the original Senate investigation.

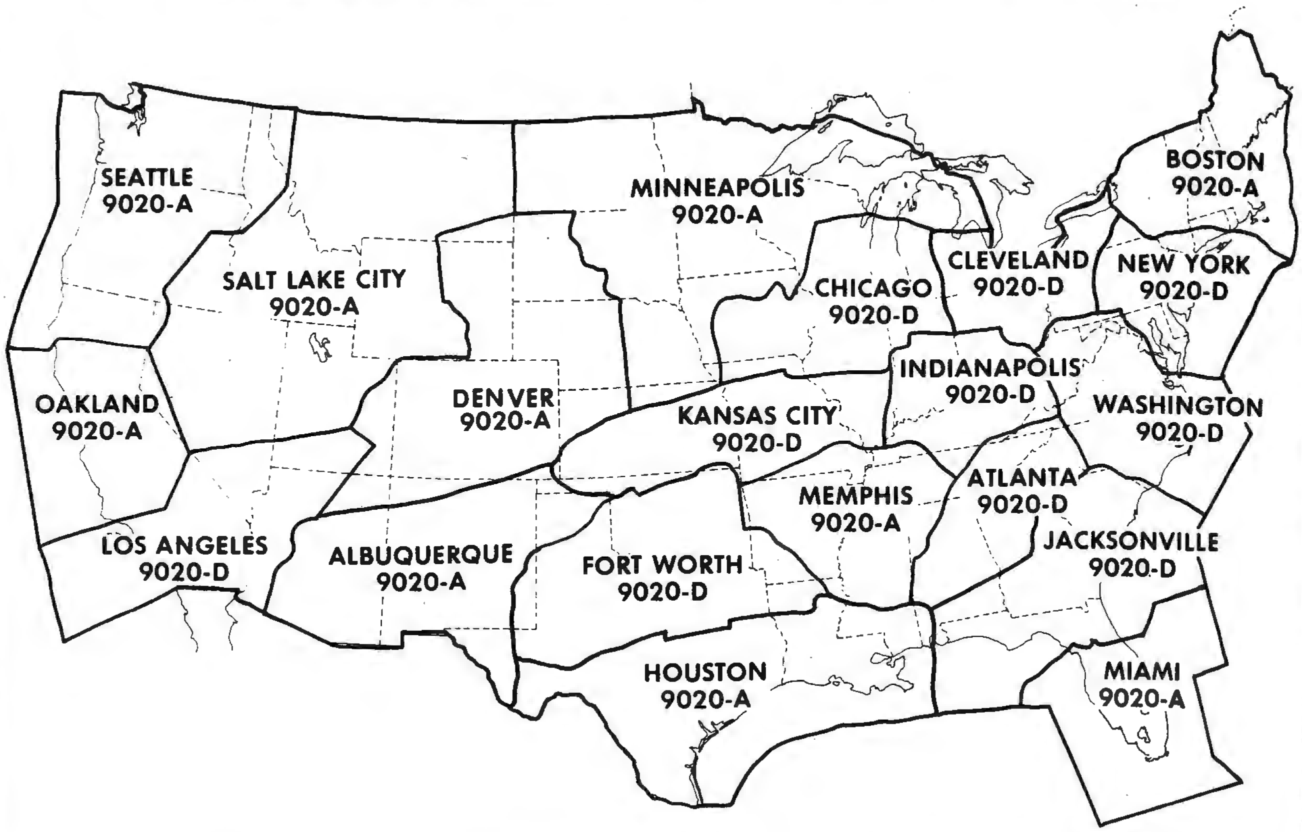
METHODOLOGY.

The numbers stated in this document are based on several thousand observations collected minute by minute at each facility during actual air traffic operations. According to a planned scenario, the Air Traffic Service recorded these values for several days (see dates shown in figure 1E) and then forwarded them to the FAA Technical Center where they were analyzed through special software tools. During this analysis, statistical equations were eventually derived to represent each site's computer performance since these equations have become consistent estimators of computer use over the past 2 years. Additional details on the methodology are discussed later in this report.

HIGHLIGHTS OF THE STUDY.

Due to recent software changes, central processing utilization shows a marked decrease at the 9020A sites while the 9020D centers continue to have ample processing power when 1982-83 results are compared with those of the previous survey. Figures 2E and 3E illustrate the remaining central processing capacities by showing the current highest observed load along with the projected workload which will send utilization to its maximum level. In these figures, workload is expressed in terms of tracks because radar tracks represent a good overall load measure at each facility. There is a visible increase in computer capacity from the 1980-81 to 1982-83 projections for most of the 9020A's in figure 2E, but that change is not seen in figure 3E for the 9020D's. Considered as an improvement, this increase is mostly due to the recent Input/Output Control Element (IOCE)

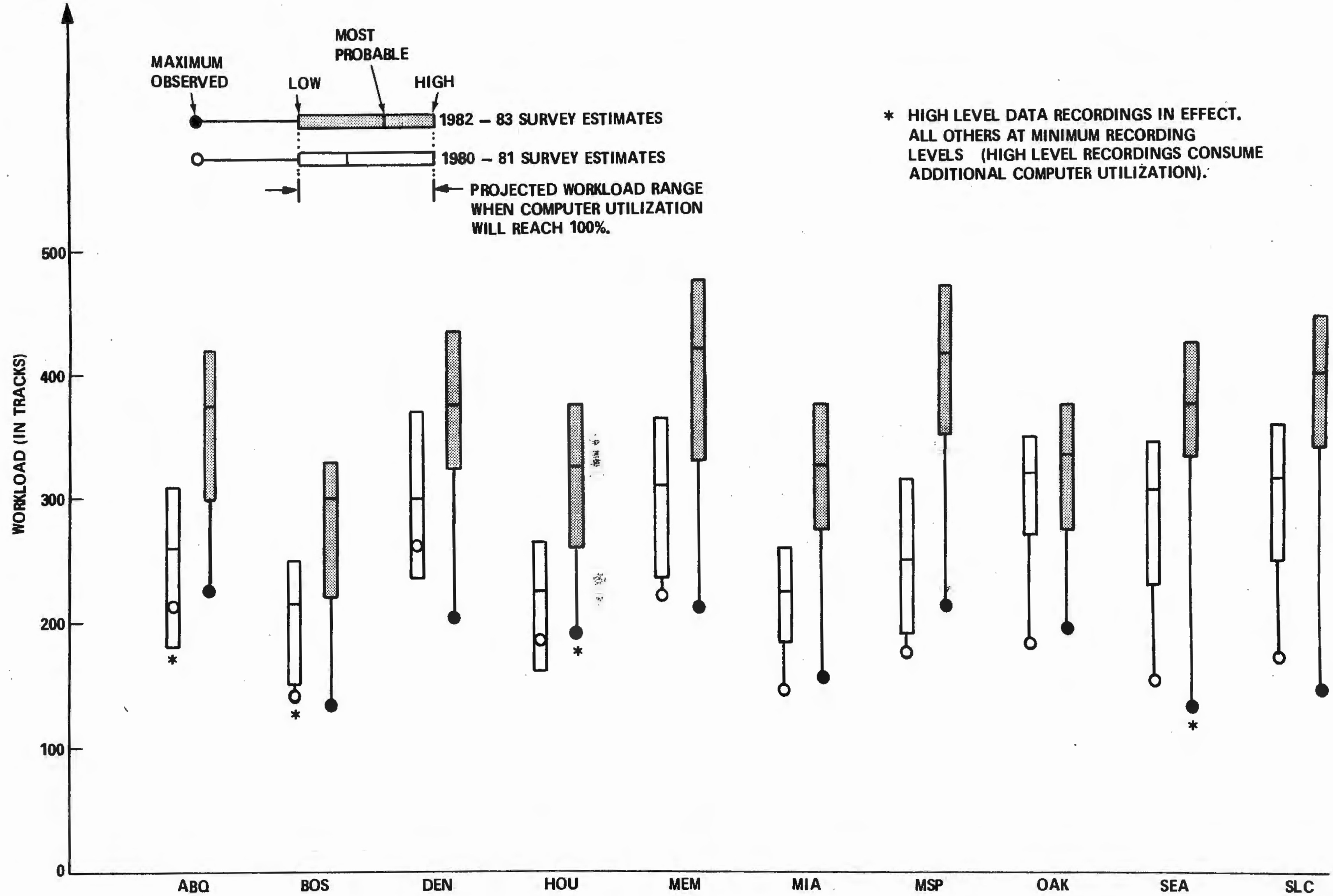
GEOGRAPHICAL COVERAGE OF THE NAS EN ROUTE CENTERS



CENTER NAME	ABBREVIATION	COMPUTER	MEASUREMENT DATES
ALBUQUERQUE	ABQ	9020–A	07/19/82–07/23/82
ATLANTA	ATL	9020–D	07/26/82–07/31/82
BOSTON	BOS	9020–A	06/21/82–07/03/82
CLEVELAND	CLE	9020–D	05/31/82–06/04/82
WASHINGTON	DCA	9020–D	10/04/82–10/07/82
DENVER	DEN	9020–A	08/04/82–08/08/82
FORT WORTH	FTW	9020–D	02/08/82–02/12/82
HOUSTON	HOU	9020–A	11/05/82–11/09/82
INDIANAPOLIS	IND	9020–D	10/10/82–10/17/82
JACKSONVILLE	JAX	9020–D	08/23/82–08/27/82
LOS ANGELES	LAX	9020–D	08/12/82–08/16/82
MEMPHIS	MEM	9020–A	07/26/82–07/31/82
MIAMI	MIA	9020–A	06/07/82–06/11/82
KANSAS CITY	MKC	9020–D	07/19/82–07/24/82
MINNEAPOLIS	MSP	9020–A	10/18/82–10/22/82
NEW YORK	NYC	9020–D	12/27/82–12/31/82
OAKLAND	OAK	9020–A	08/19/82–08/22/82
SEATTLE	SEA	9020–A	06/08/82–06/12/82
SALT LAKE CITY	SLC	9020–A	05/23/82–05/27/82

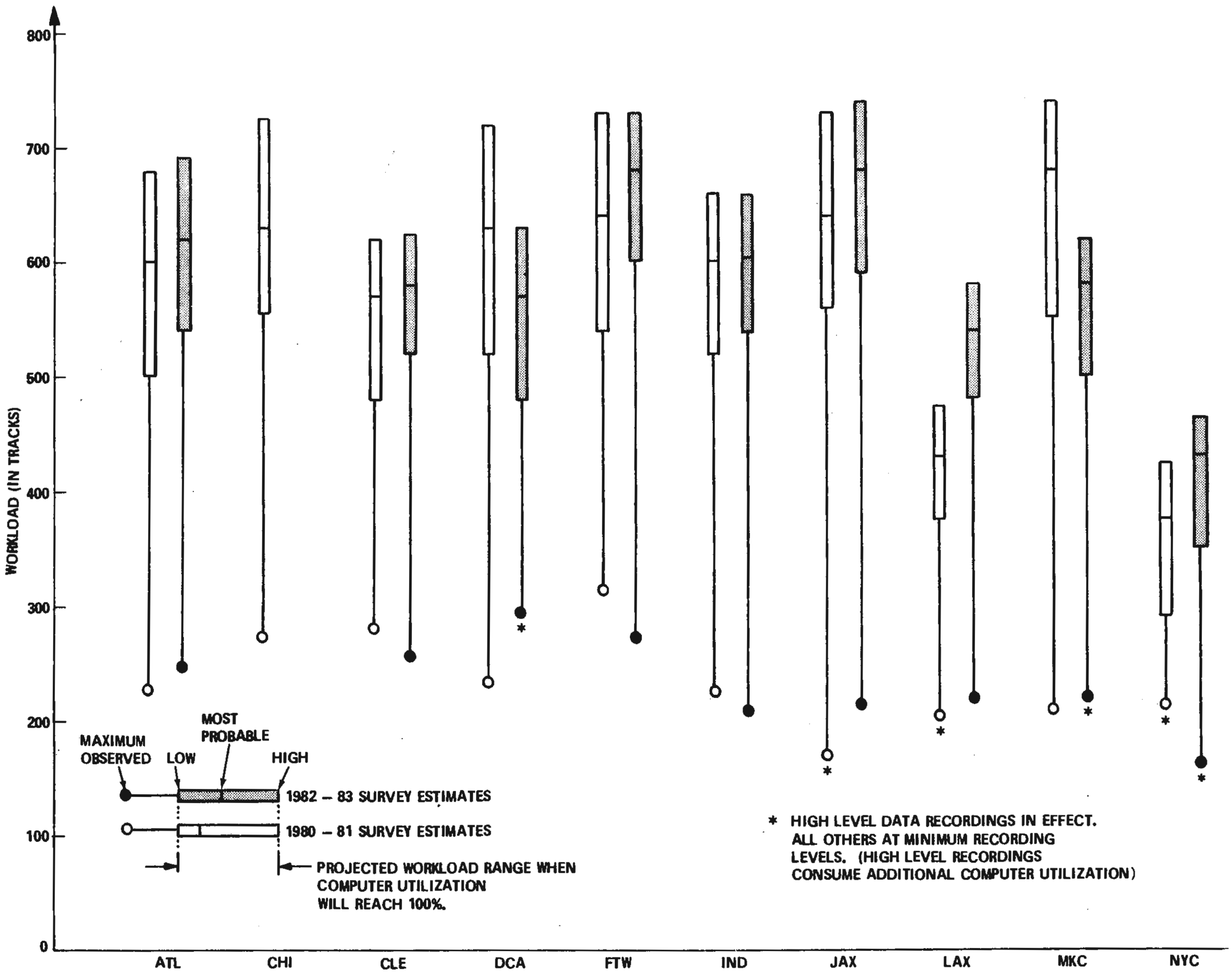
83-11-1E

FIGURE 1E. GEOGRAPHICAL COVERAGE OF THE NAS EN ROUTE CENTERS



83-11-2E

FIGURE 2E. ESTIMATED REMAINING WORKLOAD CAPACITIES FOR THE 9020A COMPUTERS (ASSUMING NO FURTHER IMPROVEMENTS)



83-11-3E

FIGURE 3E. ESTIMATED REMAINING WORKLOAD CAPACITIES FOR THE 9020D COMPUTERS (ASSUMING NO FURTHER IMPROVEMENTS) offloading function which is active at the "A" sites while turned off at the "D" sites. In some 9020D cases (e.g., Washington, and Kansas City) capacity was downgraded from what it was in 1980-81 because of an augmented computed utilization at these sites. Higher levels of data recordings, airspace expansions, or arrival metering are some possible reasons for this increase.

On the average, selector channel utilization does not exceed central processing utilization for all the measured sites. Consequently, channel capacity, based on the average of four available channels per system, is not expected to disappear before the computers totally deplete their central processing power. Despite this ample mean capacity, a usage imbalance has been observed when individual channels sometimes were quite busy while their neighboring channels maintained a low activity during the measurements. Handling data movement between main core, disks, tapes, and controller displays, the selector channels were measured nationwide for the first time during the 1982-83 survey. Consequently, no 1980-81 figures exist to compare the channel results with previous measurements. For this reason, figure 4E shows only 1982-83 channel results. It displays for all sites the maximum observed utilization based on an average of four available channels. From these data points, vertical lines lead upwards to channel utilizations projected to occur when central processing utilization will reach 100 percent. Results are inconclusive in the case of Memphis. According to figure 4E, the 9020D's generally have a higher channel utilization than the 9020A's, a condition reflecting brisk computer activity at the D sites.

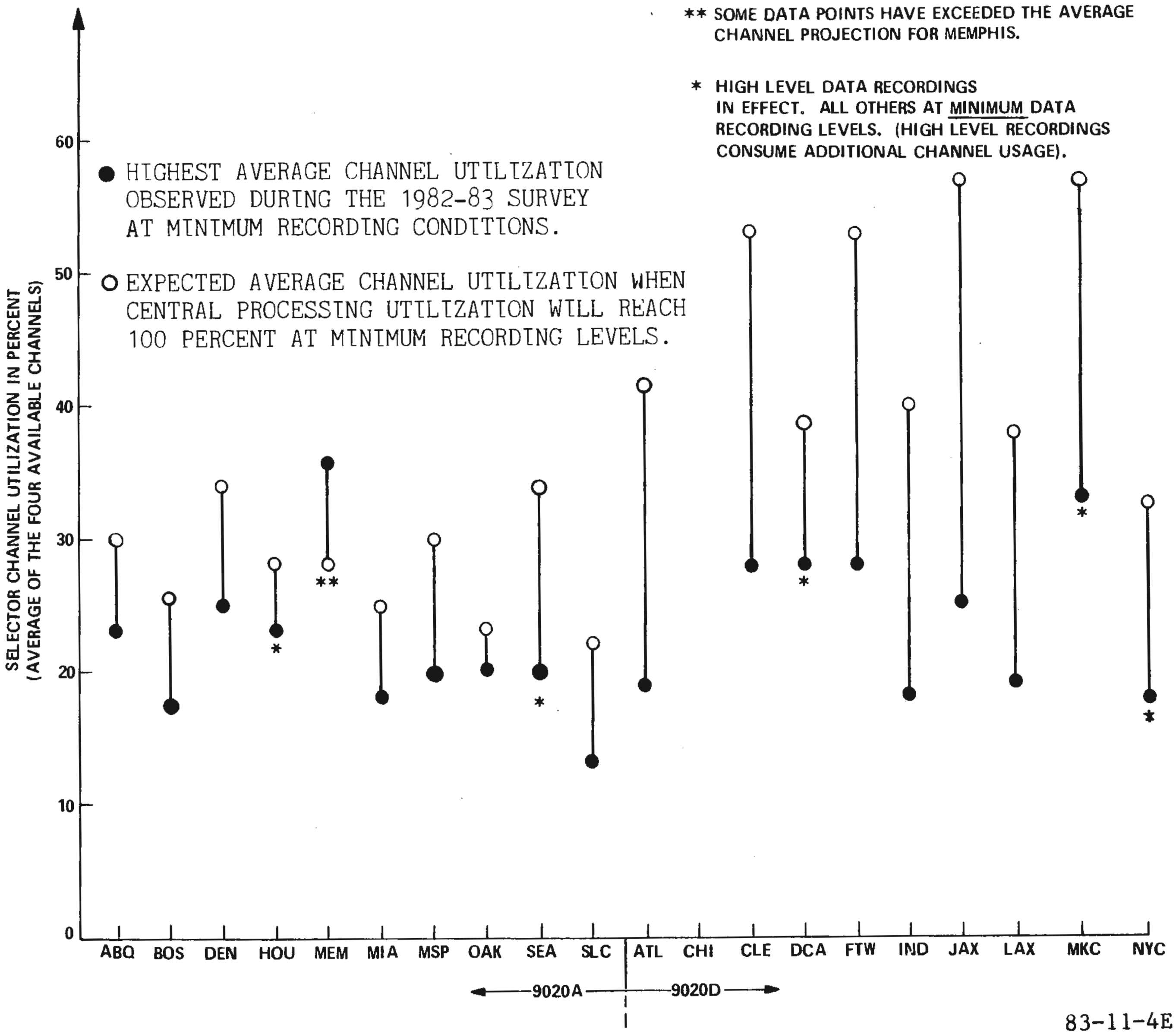


FIGURE 4E. SELECTOR CHANNEL UTILIZATION (A3d2.12 SYSTEM)

INTRODUCTION

SYSTEM OVERVIEW.

The airspace over the continental United States is divided into 20 geographical areas, each falling under the jurisdiction of an En Route Traffic Control Center as described in figure 1E in the Executive Summary. A computer complex, operating in real-time at each center, provides automation support to air traffic controllers by performing several processing functions simultaneously, all related to the efficient handling and safe separation of en route traffic. Designated as the 9020 Central Computer Complex, it is a system based on the IBM 360 family. As shown in the last column in figure 1E, ten of the busiest centers have 9020D equipment, while the remaining ten sites have the slower 9020A computers. The 9020D processes data approximately 2.5 times faster than the 9020A.

RECENT DEVELOPMENTS.

Since 1980-81, the Air Traffic Service made several software improvements in the field to streamline computer processing. Two major enhancements are "Input/Output Control Element (IOCE) Offloading" which taps previously reserved processing power, and "Direct Route Processing Improvement" which eliminates duplicate calculations during flight plan processing. A complete list of software changes appears in appendix A. In all, the changes intended to reduce computer utilization have been effective, particularly at some sites where the 9020A computer capacity was almost exhausted. These gains may have been offset, however, at certain facilities by the introduction of "Arrival Metering," an additional process deemed necessary for efficient timing of aircraft arriving at major hubs.

Aside from software changes, a controllers strike, occuring just after the 1980-81 computer survey was completed, curtailed traffic and indirectly reduced computer utilization from what it was in 1980-81. Furthermore, the strike necessitated center boundary realignments. These airspace changes shifted traffic loads between some facilities and caused 1982-83 computer usage levels to differ from those of 1980-81. On the hardware side, 1982 was the year when all centers acquired additional memory units. This new option can improve computer performance by allowing for a larger buffer space to execute programs normally stored on disk. Some heavily loaded sites, such as Houston, Washington, Atlanta, and Los Angeles, have already taken advantage of this capability. Other sites will probably follow the Houston example if they have not already done so.

SYSTEM PERFORMANCE ANALYSIS.

The analysis portion of this study identifies critical performance and workload measures for the central computer complex and includes them in a statistical model to predict future system performance. Toward this end, central processing utilization, a parameter expressing the percentage of time that the arithmetic nucleus spends processing data, was selected as a key performance measure. In addition, selector channel utilization, an important input/output channel activity indicator, was also considered as a system performance measure because it represents the amount of time spent in major data transfer, aside from computation time. Another type of channel, known as multiplex, was not taken into account since its data transfer load is not as significant as in the case of the selector channels.

Meanwhile, in the process of defining a proper workload measure, it was determined that diverse air traffic conditions and a wide variety of controller requests constitute the load on the computer. The inclusion of all these factors in a model results in a complex expression which becomes difficult to calibrate and to apply in practice. As a result, the selection was simply narrowed down to two important workload factors: the instantaneous number of tracks and active flight plans processed by the computer. The study assumes that these two values substantially reflect the total load on the system. This generalization holds because, although air traffic demands a multitude of services from the computer complex, its two essential functions are to process flight plans and to track aircraft. Tracks and flight plans must, therefore, be ultimate measures of the total workload.

In a previous study, a detailed examination of available modeling tools led to the conclusion that regression equations were an effective way to model the connection between computer utilization and active flight plans or tracks for the Houston Center. In these equations, utilization is the dependent variable, while the number of active flight plans or tracks represents the independent variable. Based on the Houston experience, this study derives similar regression equations to serve as a computer performance model for each air traffic control center.

SYSTEM MEASUREMENTS.

Two software tools, known as the on-line central processing utilization and selector channel utilization monitors, were used to provide the date, time of day, average central processing, and selector channel utilizations (expressed as a percentage of the total available working time capacity), along with the track and flight plan load imposed on the computer during each minute of air traffic operations. These data, recorded for several days at the centers, were used in the regression analysis. Other real-time software recording options are often activated at the centers. The major options consist of System Analysis Recording (SAR), Timing Analysis Reports (TAR's), and Resource Monitoring (REMON). These recordings can affect utilization significantly and, to negate their influence, have been turned off or reduced to minimum levels during most of the measurements.

DISCUSSION OF RESULTS

Numerical results showing how changes have impacted computer use since 1980-81 appear throughout this report. Although the survey results are extensive, only a summary is given here while the details appear in appendixes B through I.

To accentuate the differences between sites and between 1980-81 and 1982-83, figure 1 describes how the cost in central processing utilization for every 100 tracks varies from site to site as well as from one survey to another. Figure 2 is similar to 1 but shows, instead, the constant processing overhead necessary to maintain the system in a real-time mode regardless of aircraft load. Both figures are based on regression equations found in appendix I and apply to minimum background data recordings unless noted otherwise.

The projections in figures 2E and 3E in the Executive Summary assume no further software improvements. This assumption may be shortlived however, for as of this writing, the Air Traffic Service is proceeding with new changes, the most prominent

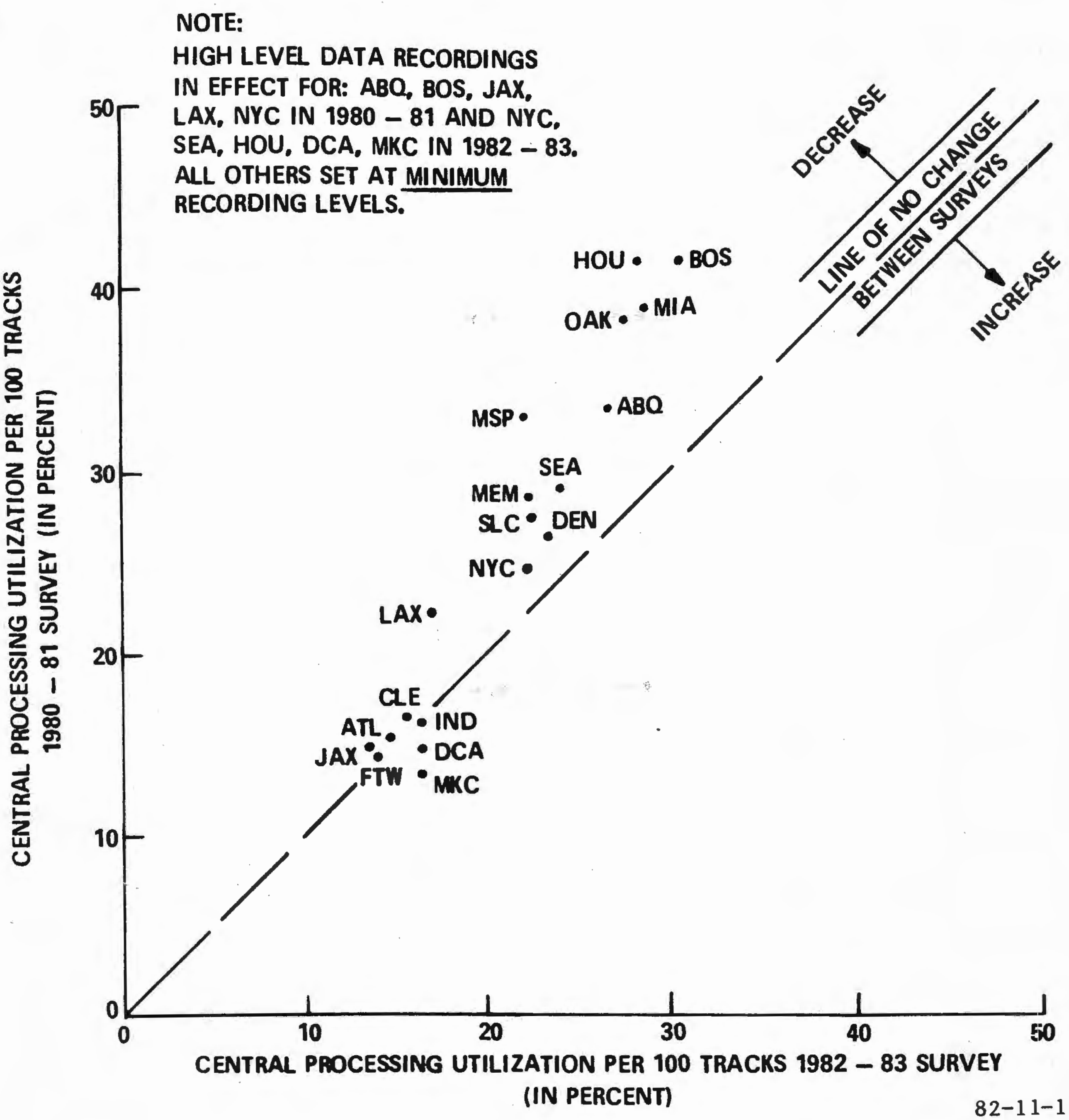


FIGURE 1. CENTRAL PROCESSING UTILIZATION — A COMPARISON BETWEEN 1980-81 AND 1982-83 SURVEYS

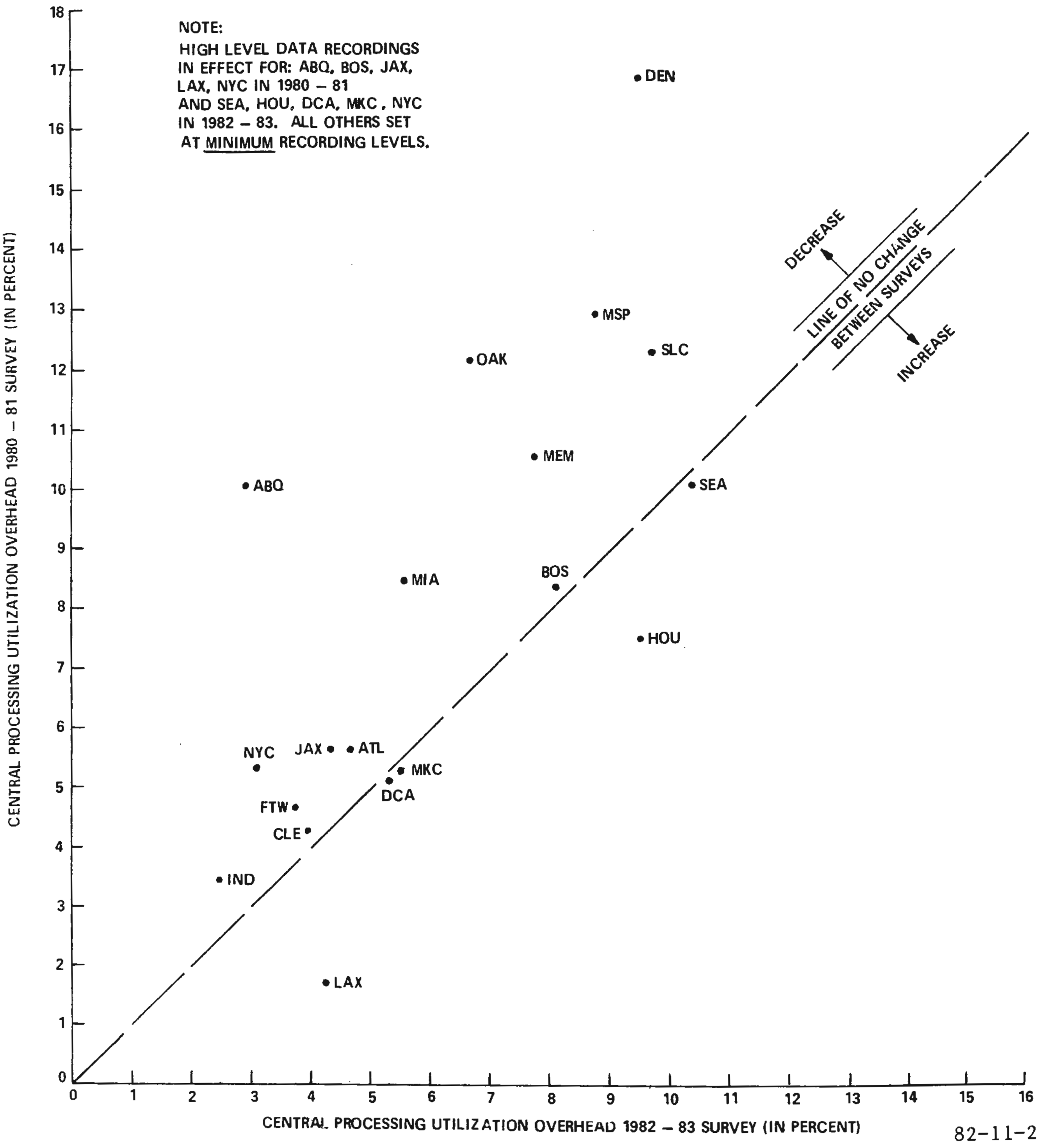


FIGURE 2. CENTRAL PROCESSING UTILIZATION OVERHEAD — A COMPARISON BETWEEN 1980-81 AND 1982-83 SURVEYS

of which is the "Host/Non-Host" case file (number ZJXDS-CPF-048). Once in the field, this new procedure will allow centers to process two-way handoff communications from terminal facilities adjacent to them but actually belonging to their neighboring centers' airspace. Moreover, the 9020A projections assume total use of the IOCE's and concentrate instead on the remaining Computing Elements (CE's) capacity. The IOCE's may have a remaining capacity of their own, however, but whatever they have left over cannot be observed at this time because no accurate measurement tool is available for this purpose.

Despite that limitation, the CE usage reduction created when IOCE's fully participate in data processing can be quantified by examining central processing utilization results with and without IOCE offloading for the 2.12 system. Accordingly, figure 3 summarizes this special analysis by showing how some 9020A sites reduced their CE utilization when they activated their offloading option during the measurements. Because IOCE offloading permits both the CE's and the IOCE's to engage in data processing, a measure of all the individual elements (CE's and IOCE's) would contribute further information on the remaining computer capacity. At present, only CE utilization is being reported on a continuous basis during these surveys. The 9020D sites, with ample processing power, have not elected to fully activate their IOCE's and, thus, a data processing reserve exists in their computer too, beyond the projections in figure 3E.

Despite ample capacity shared among all four selector channels, individual channel usage climbed in the 70 an 80 percent range on several occasions which were not necessarily related to heavy traffic periods. Single channels locked to tapes or disks during extensive data exchanges prevent other channels from equally participating in the data transfer and this may explain why high individual usage peaks were reached during the measurements. Unlike the disk and tape channels, the display channels were only slightly used even during heavy traffic periods.

Stressing site differences, figure 4 contains a plot showing how individual sites spend their channel and central processing power. Three clusters are apparent in the figure: one scattered 9020A site group and two separate 9020D groups. Reasons why two separate 9020D groups appear in figure 4 remain to be determined through a special analysis.

So far, utilization has been discussed on the basis of an average of four available channels. On an individual basis, however, a single channel sometimes remains quite busy and its utilization reaches transient peaks, while its neighboring channels show much lower utilization. During this imbalance, some sites have individual channels busy up to 70 or 80 percent of the time (see the maximum channel utilization tables near the end of appendix F).

Beyond central processing and channel utilization, other results related to the 1982-83 survey are available in the appendixes. Among the prominent ones, results concerning memory sizes appear in appendix H and are summarized in figures 5 and 6. These figures express in terms of Storage Elements (SE's) (1 SE = 32,761 computer words of memory) how much space is allocated to various components making up the en route software. Mostly because of data base differences, Seattle is able to fit its software in 18 SE's, while larger sites, such as Atlanta and Washington, need 24 SE's to operate effectively.

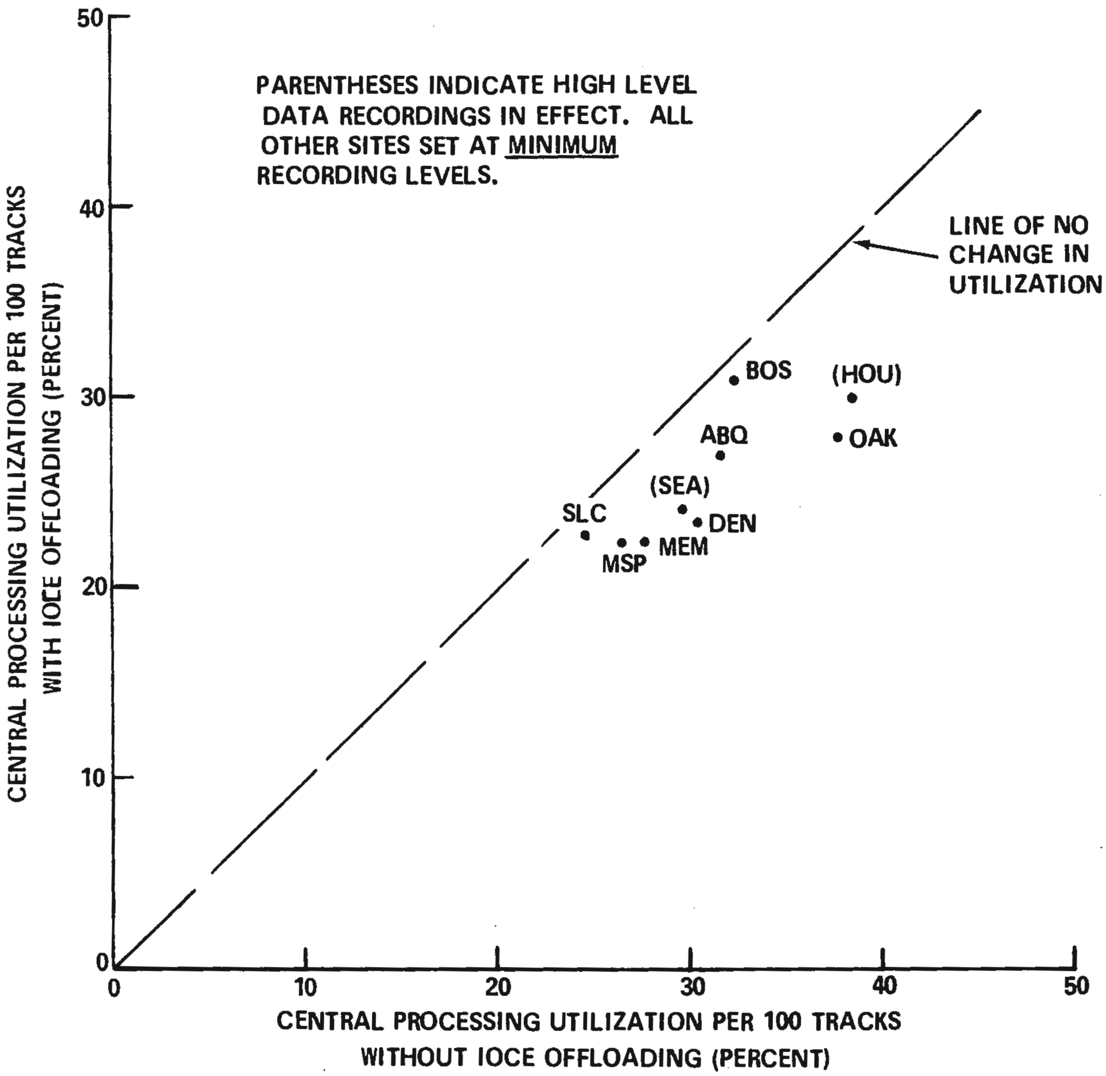


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FIGURE 3. COMPARISON OF CENTRAL PROCESSING UTILIZATION AT SOME 9020A CENTERS WITH AND WITHOUT IOCE OFFLOADING (A3d2.12 SYSTEM)

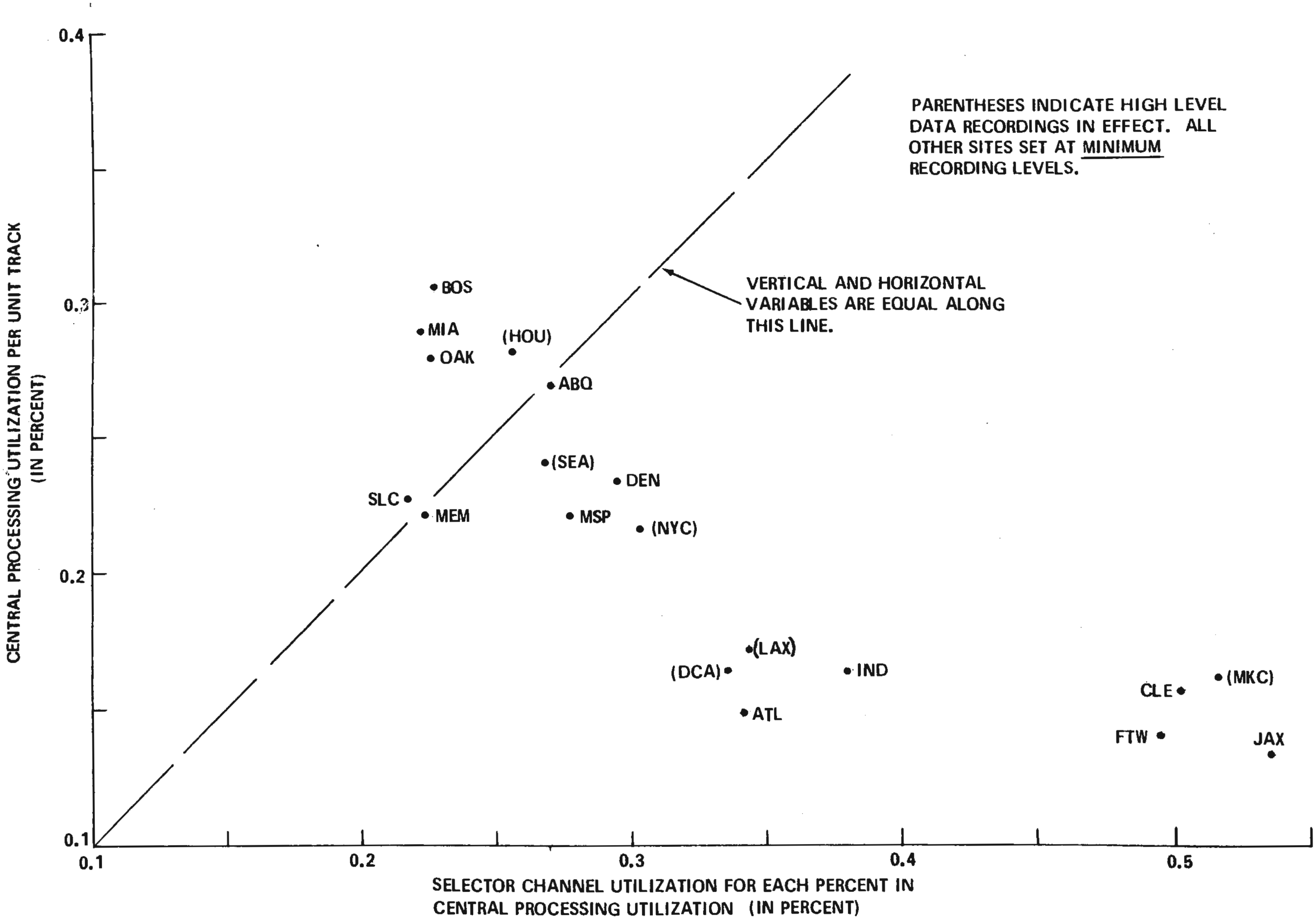

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FIGURE 4. DIFFERENCES BETWEEN CHANNEL UTILIZATION AND CENTRAL PROCESSING UTILIZATION (A3d2.12 SYSTEM)

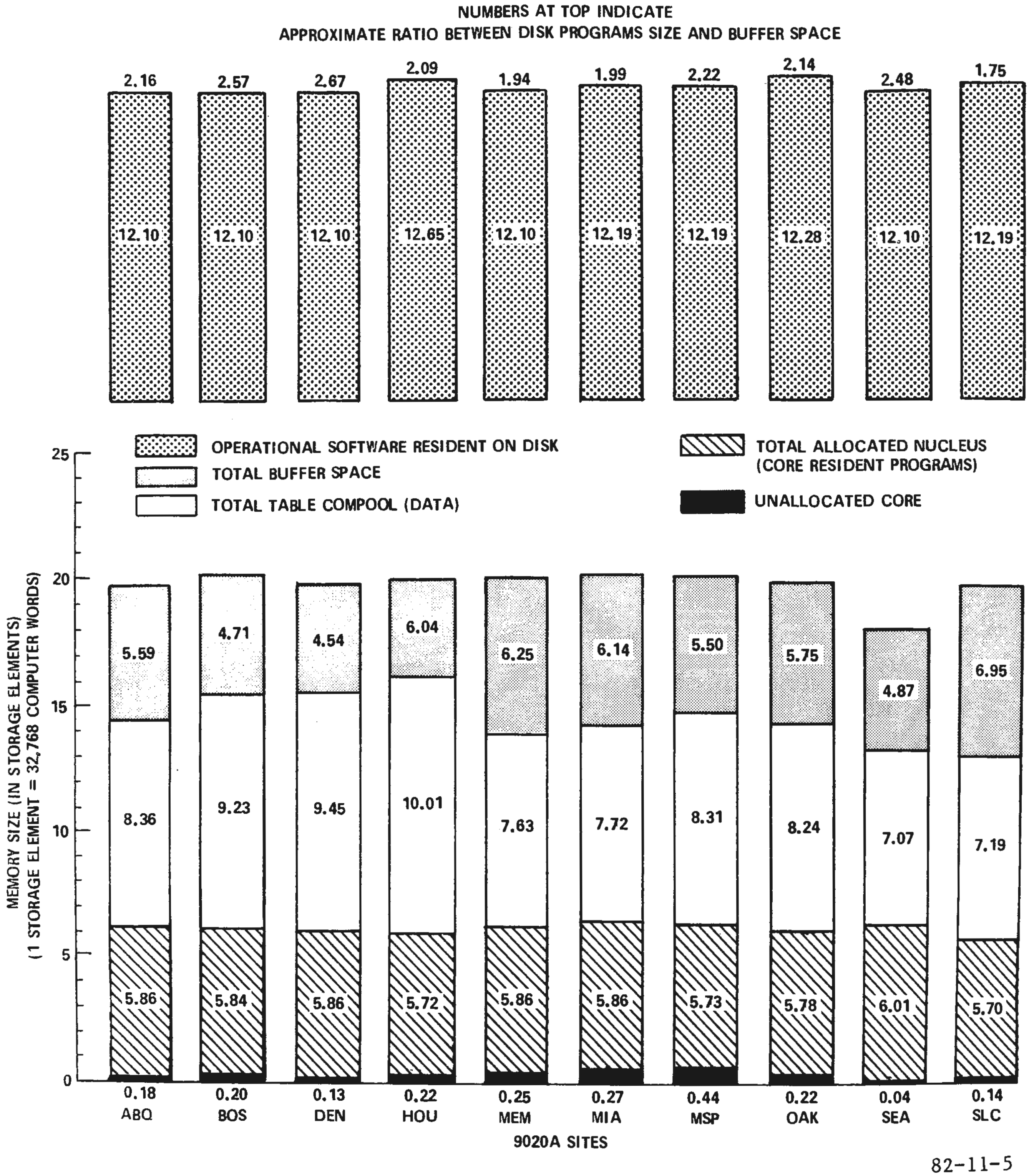

FIGURE 5. 9020A COMPUTER MEMORY SPACE

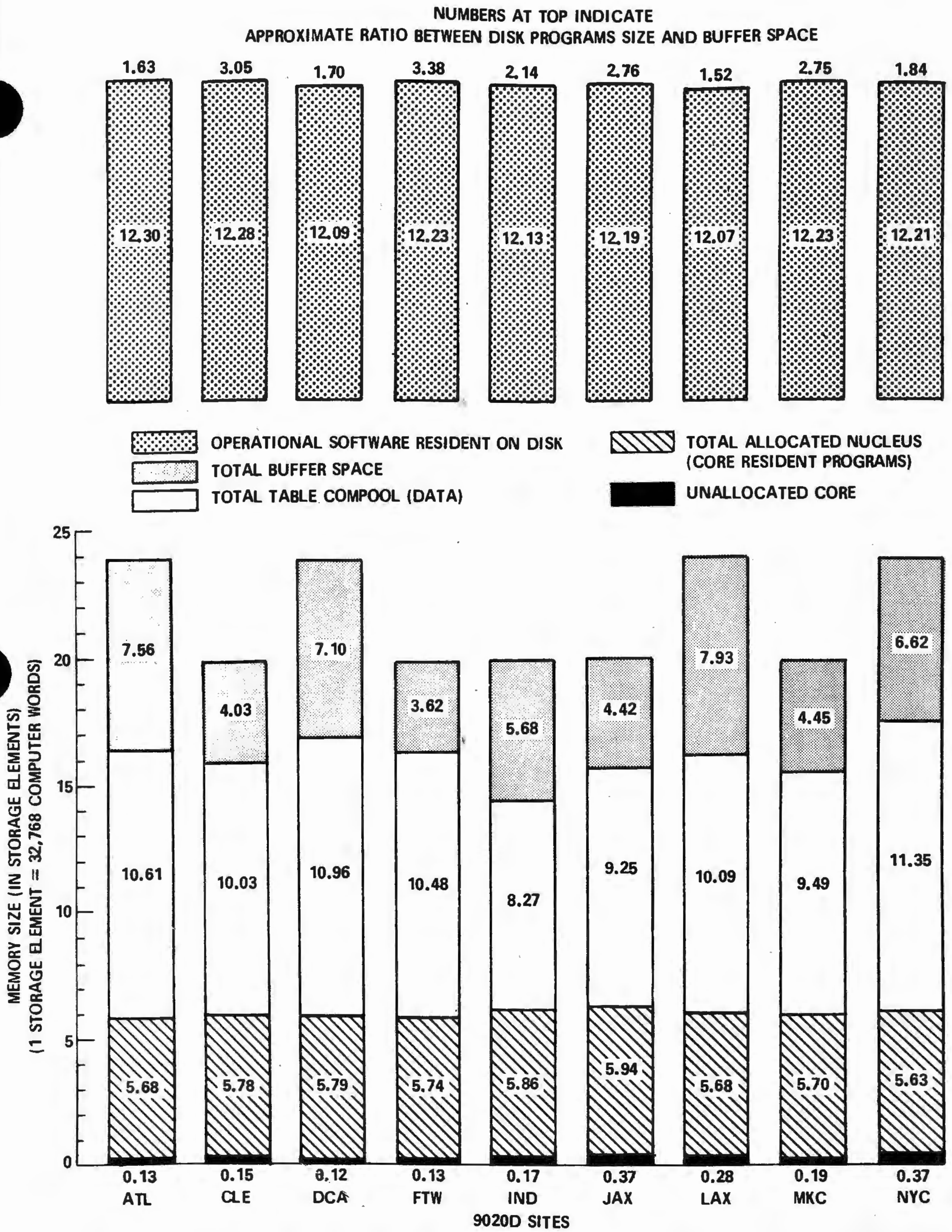

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FIGURE 6. 9020D COMPUTER MEMORY SPACE

DESCRIPTION OF THE DATA

Several scatter diagrams have been prepared to visualize the collected data for each site and to derive regression equations which can best describe this information. Scatter diagrams are X-Y plots which contain coordinate pairs of various fields found in each data record. The scatter diagrams in appendix B, for example, are plots of central processing utilization (shown as a percentage of the total available capacity along the y-axis) and the corresponding track count (shown along the x-axis). Digits in the graphs denote single or repeated observations taken at different times. A "2", for instance, indicates two identical observations, a "3" denotes three observations, and so on. For counts greater than 9, the letter A denotes 10 observations, B denotes 11 observations, etc. An asterisk signifies that 36 or more observations have identical coordinate pairs.

The formula stated at the very bottom of each plot corresponds to the calculated least squares first-order equation which best fits the data. The "N" near the bottom left indicates the sample size, while the "COR" represents the coefficient of correlation between the vertical and horizontal variables. A COR close to 1.0 indicates a strong correlation. The utilization and track scatter follow a linear trend, which suggests that a straight-line regression equation is an appropriate way to describe the data.

Appendixes C, D, and E are similar to B but apply to the selector channels instead of central processing. Appendix F contains tables of maximum values observed during the measurements.

Scatter diagrams depicting performance and workload parameters as a function of time have been produced to illustrate traffic build-up patterns, traffic intensity peaks, and the corresponding computer utilization variations as the day progresses at each facility. For example, figures in appendix G represent the daily trend in active flight plan load, track load, and computer utilization. All variables are plotted as a function of local time over several days.

The scatter diagram abbreviations found in the appendixes discussed so far are described as follows:

CPU	Central Processing Utilization (in percent).
ACTIFP	Number of Active Flight Plans.
CHT	Average total Selector Channel Utilization (in percent). It equals the sum of the four active Selector Channel Utilizations divided by four.
DSKTP	Average "disk/tape" Selector Channel Utilization (in percent). It equals the sum of the two Selector Channels dedicated only to tapes and disks divided by two.
DC	Average "Display Channel" Selector Channel Utilization (in percent). It equals the sum of the two Selector Channels dedicated only to the Display Channel divided by two.
N	Represents the number of observations (sample size) in the data and is located at the lower left hand corner of each plot.

COR	Below "N", stands for the coefficient of correlation between the vertical and horizontal variable.
RES.MS.	Residual Mean Square. It represents the square of the mean of vertical deviations of the data from the straight line drawn through the plot.
Y	Represents the vertical parameter.
X	Represents the horizontal parameter.

The shape of the scatter diagrams showing utilization versus workload for each site indicates that a straight-line equation is sufficient to express utilization as a function of active flight plans or tracks. Based on this premise, first-order equations have derived for each center through the least squares method. The latter minimizes the sum of the squares of the lengths of the vertical segments drawn from the observed data points for a given site to the straight line being fitted to these points. The smaller the deviations of the observed values from the line (and consequently, the smaller the sum of the squares of these deviations), the closer the line is to the data. The formula for the best fitting line then becomes the regression equation or model for the particular site. The derived equations for the 20 sites are given in appendix I.

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APPENDIX A

FUNCTIONAL MODIFICATIONS TO THE A3d2.10, A3d2.11, AND A3d2.12 VERSIONS OF THE NAS EN ROUTE SOFTWARE

This appendix provides a list of modifications that have been made to the NAS En Route Software since the 1980-81 computer performance study. These changes, listed by case file number, are stated here according to their title. A detailed description of each case can be requested from the Air Traffic Service (AAT-550), FAA Technical Center.

A3d2.10 SOFTWARE FUNCTIONAL MODIFICATIONS

Case File	Title
AT500-CPF-052	NAS ICAO, Processor (Patch)
AT500-CPF-055	Slant Range Correction Alt. (SLCA) Parameter
ZMPAF-CPF-058A D4191B	Interim On-Line Certification
ZIDAF-CLC-118 5376	Eliminate "Not Updating Messages" on Resume Mode Recovery
ZLADS-CPF-209E T5064	Enhancement to CA-Conflict Alert (Patch)
ZLAFF-CPF-228 D4779	Excessive Fail Poll Messages
ZLAAF-CPF-238 D4911	Wrong SCON Message Causes NAS Lock Up
AF360-CPF-318 D5603	IOCE Off-Loading
AF360-CPF-321	CE Hard Stops Caused by Looping On I/O Interrupts
AT500-CPF-489B	Use No Discrete Data Counter Before Going to XLSA
AT500-CPF-497A	Prevent Backup of Mesages on MSP (Patch)
AT00-CPF-555	PAM Replacement for PAM Adapter Error (Patch)
AT500-CPF-601	Add Controlling Sector Number to EMSAW Alert on HSP Printout
AT500-CPF-603	Withdrawal of Controlled Visual Flight (CVF) Rules (Patch) CVF-AT500-CPF-544 D5582
AT500-CPF-605	Lack of Failure Warning and Assignment When FSP Second Backup Out
AT500-CPF-606	Limit Messages on FDEP Queue
AT500-CPF-607	FDEP With Open Line Causes Continuous Interrupts
AT500-CPF-608	Reduce Flight Plan Summary Output Excessive Data, Data Manipulation and Channel Use of FP Summary
AT500-CPF-613	Restrict CTM's Associated With RB to ARTS
AT500-CPF-614	HSP Primary Backup Failure (Patch)
PI-10129-238Z	FP Summary at SU/SO

A3d2.10 SOFTWARE FUNCTIONAL MODIFICATIONS (CONTINUED)

Case File	Title
PI-09129-197Z	HSP Primary/Backup Failure
PI-09129-198Z	FAD (Fuel Advisory Departure) Add Tab to Prevent Extra Blanks in Output
PI-09129-199Z	Excessive SVC Demand for RCD

A3d2.11 SOFTWARE FUNCTIONAL MODIFICATIONS

Case File	Title
AT300-CPF-036E	En Route Arrival Metering
AT500-CPF-562	Adjacent Facility Update for En Route Arrival Metering
AT500-CPF-497A	Prevent Backup on MSP (A3d2.10 Patch to be Carried Over)
AT500-CPF-555	PAM Replacement for PAM Adapter Error (A3d2.10 Patch to be Carried Over)
AT500-CPF-561A	Tailor the Letter "K" from 4-Character Fixes
AT500-CPF-605	Capability to "ASGN" Second Level Backup GSP (A3d2.10 Patch to be Carried Over)
AT500-CPF-613	Terminate RB Processing When Multiple "No Response" UTM's Occur (A3d2.10 Patch to be Sourced)
AT500-CPF-614	HSP, Primary Backup Failure (A3d2.10 Patch to be Carried Over)
PI-102690979W	Deduplication of Table FF
PI-07026-459Z	Bypassing SAR Label Checking (A3d2.10 Patch to be Sourced)
AT300-CPF-052	Modification of ICAO Processor (A3d2.10 Patch to be Carried Over)
AT500-CPF-603	Withdrawal of Controlled Visual Flight (CVF) Rules (A3d2.10 Patch to be Carried Over)
ZLADS-CPF-209E (T5064A)	Conflict Alert to First Previous Controlling Sector (A3d2.10 Patch to be Carried Over)
ZMPAF-CPF-058A (D4191B)	Interim On-Line Certification (A3d2.10 Patch to be Carried Over)
AF360-CPH-313A (D5843A)	Change Threshold Value for TVE Messages (No CCC Impact)
ZMPAF-CPF-083	Elimination of Erroneous IOCE Error Charges Due to CDC (A3d2.10 Patch to be Carried Over)
AT500-CPF-617	Editorial Changes to NAS-MD's (Incorporate Into Level L, A3d2.11)

A3d2.12 SOFTWARE FUNCTIONAL MODIFICATIONS

CCD's/Case Files of Three New AT Functions Sourced in A3d2.12

Case File	Title
AF310-COD-010	Beacon Run Length Reporting
AT500-CPF-611	IOT Failure (Primary and Backup)
AT500-CPF-612	Prevent "REPL" of Only Usable Data Set

CCD's/Case Files of Four Previously Patched AT Functions Sourced in A3d2.12

Case File	Title
AT500-CPF-497A	Prevent Backup of Messages on the MSP
AT500-CPF-605	Capability to "ASGN" Second Level Backup FSP
AT500-CPF-614	HSP Primary/Backup Failure
AT300-CPF-052	Modification of the NAS ICAO Processor

Two Program Improvements Sourced in A3d2.12

Case File	Title
PI-05290-098Z	Improve Direct Route Processing Time
PI-03061-079Z	Validate All FZ Chains Once per Minute

CCD's/Case Files of Four AT Functions Carried Over to A3d2.12 As Patches

Case File	Title
AT500-CPF-603	Withdrawal of Controlled Visual Flight (CVF) Rules
ZLADS-CPF-209E	Conflict Alert to First Previous Controlling
ZMPAF-CPF-058A	Interim On-Line Certification
ZMPAF-CPF-083	Elimination of Erroneous IOCE Error Charges Due to CDC

NOTE: The CPFS errata will not be incorporated into the A3d2.12 updated NAS-MD's because of the patch status of each Case File. Sourcing in future systems is planned.

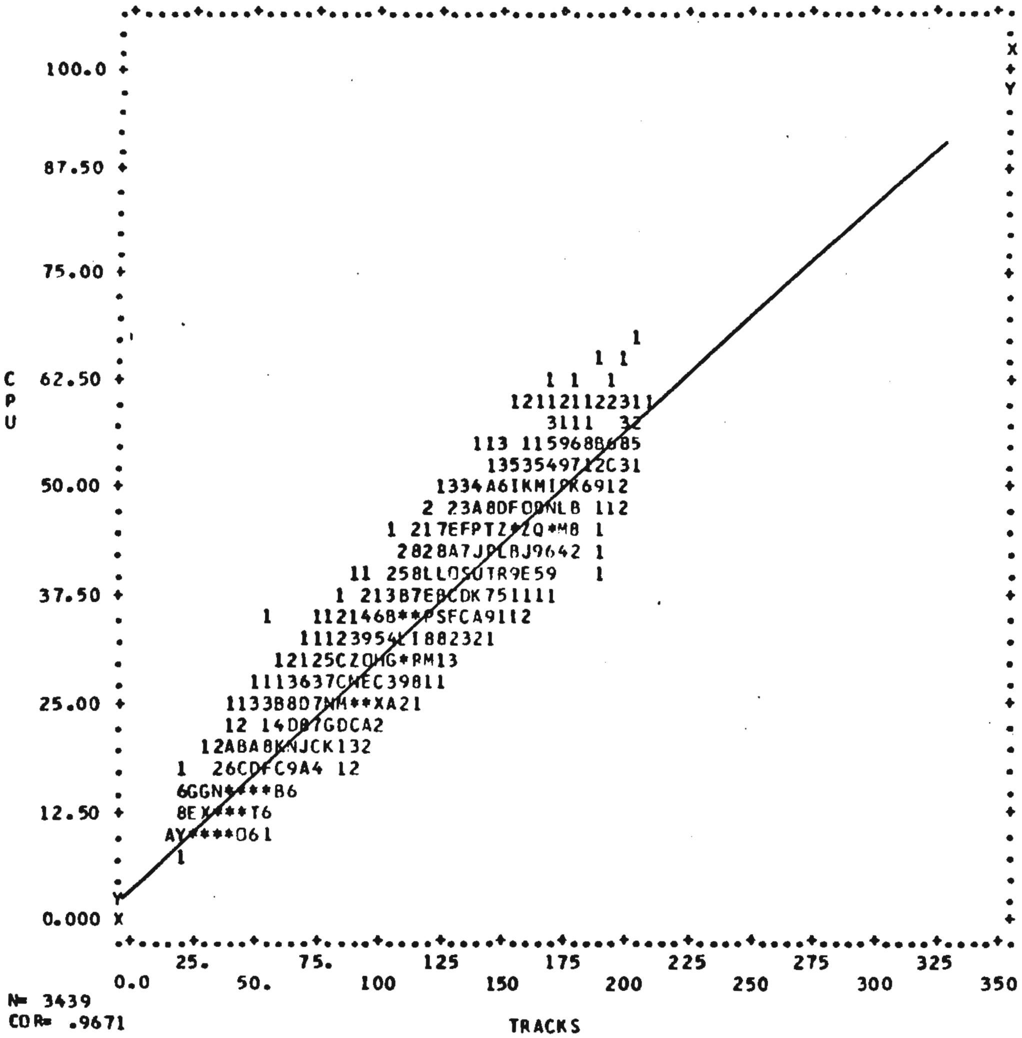
APPENDIX B

SCATTER DIAGRAMS SHOWING CENTRAL PROCESSING UTILIZATION AS A FUNCTION OF TRACKS

As done in previous studies, scatter diagrams have been prepared in order to characterize central processing utilization data as a function of tracks. Appendix B presents the graphic results of this data analysis. Unless noted otherwise, the data contained in these figures reflect system performance information collected during actual operations while the computer was recording data at a minimum level, namely, System Analysis Recording Category (SARC) = "1," Timing Analysis Reports (TAR's) = "OFF," and Resource Monitoring (REMON) = "OFF." The figures indicate that the linear relationship established in previous studies remains applicable for the A3d2.12 software release.

The diagrams appear in the following order:

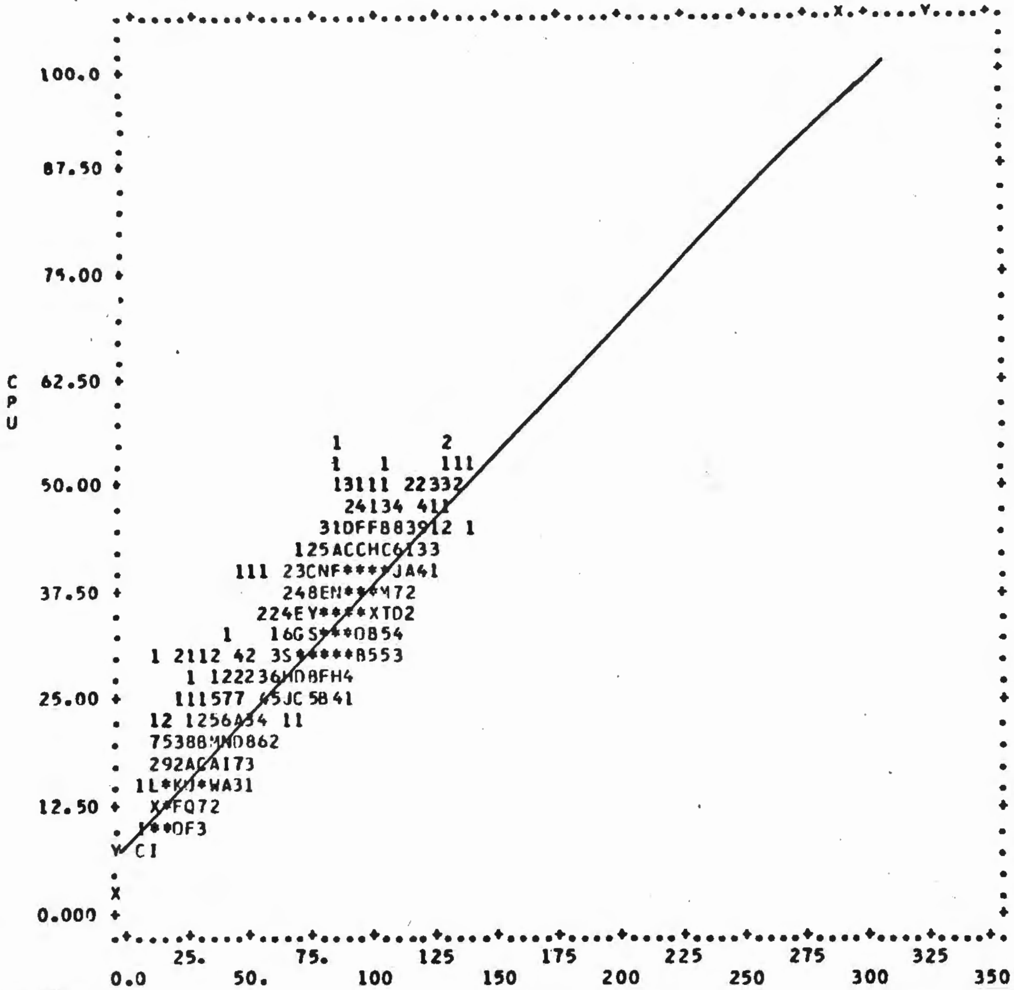
ALBUQUERQUE 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 3439
COR= .9671

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	29.473	14.204	Y= .26871*X+ 2.8883	13.063

BOSTON 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/21/82 AND 07/03/82

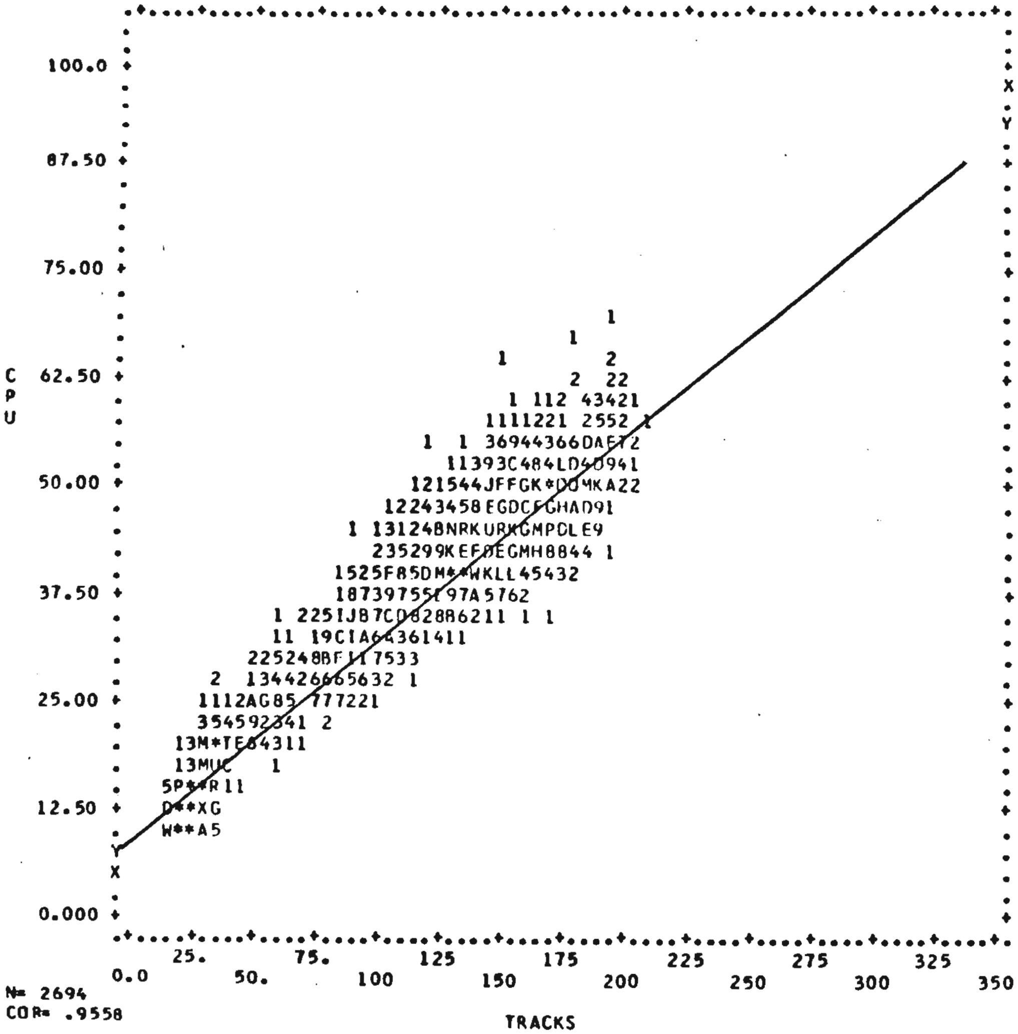


N= 2760
COR= .9336

TRACKS

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	28.747	10.791	Y= .30528*X+ 8.1129	14.960

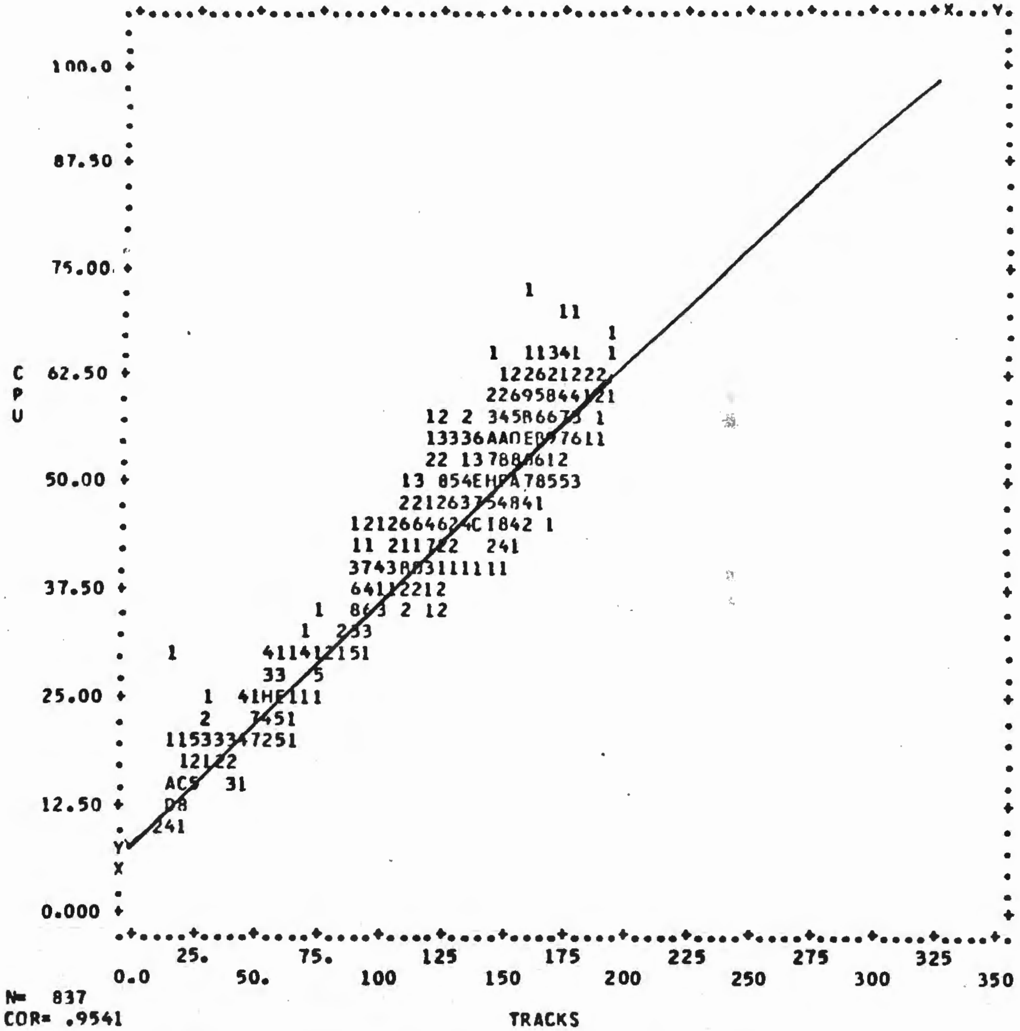
DEN 2.12 "A" SARC4 (RCOPS REDUCE TO UDS SARC1),TARS=OFF, OFLD=ON,3 CE,MEAS BETWEEN 8/4 TO 8/9/82



N= 2694
COR= .9558

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	34.967	14.278	Y= .23429*X+ 9.4294	17.622

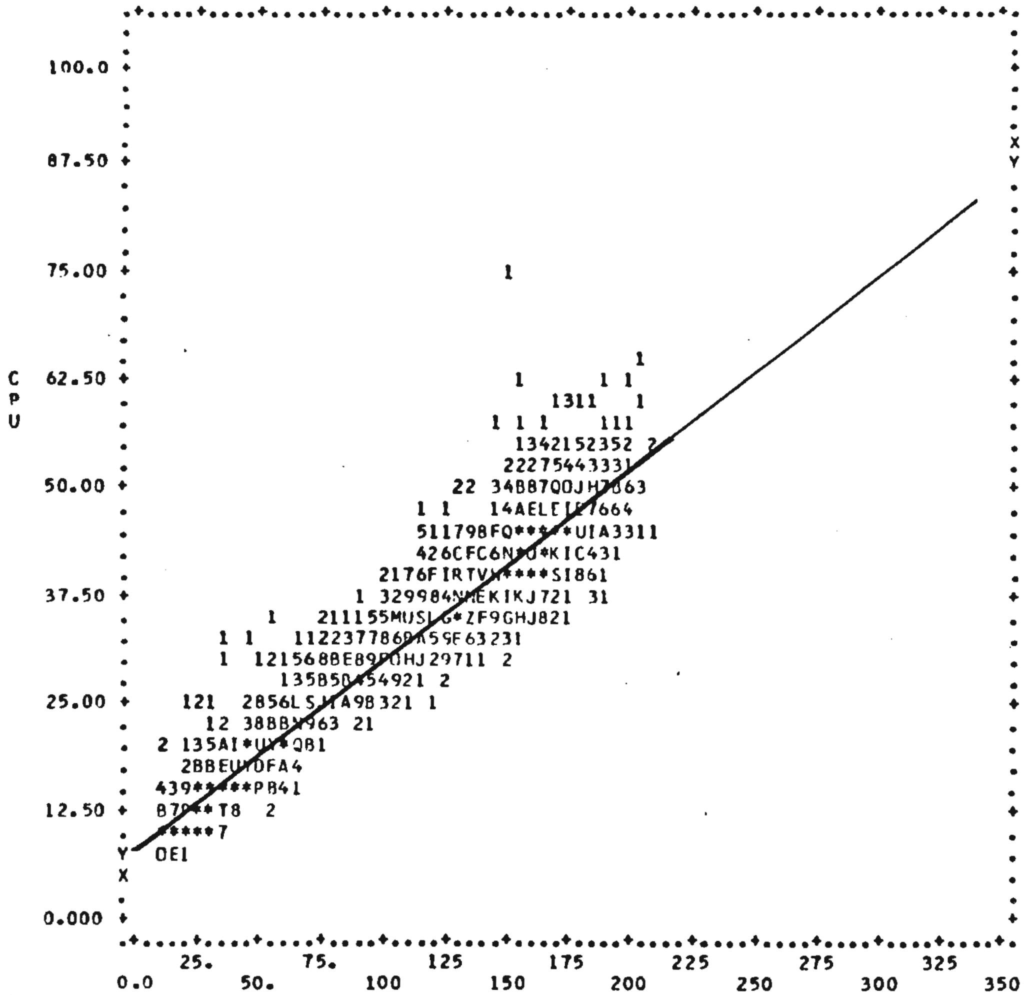
HOUSTON 2.12 9020A SARC2.TARS=0000.IOCEOFLD=CN.3 CE. MEASURED BETWEEN 11/5/82 AND 11/10/82



N= 837
COR= .9541

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	43.322	14.336	Y= .28127*X+ 9.4699.	18.461

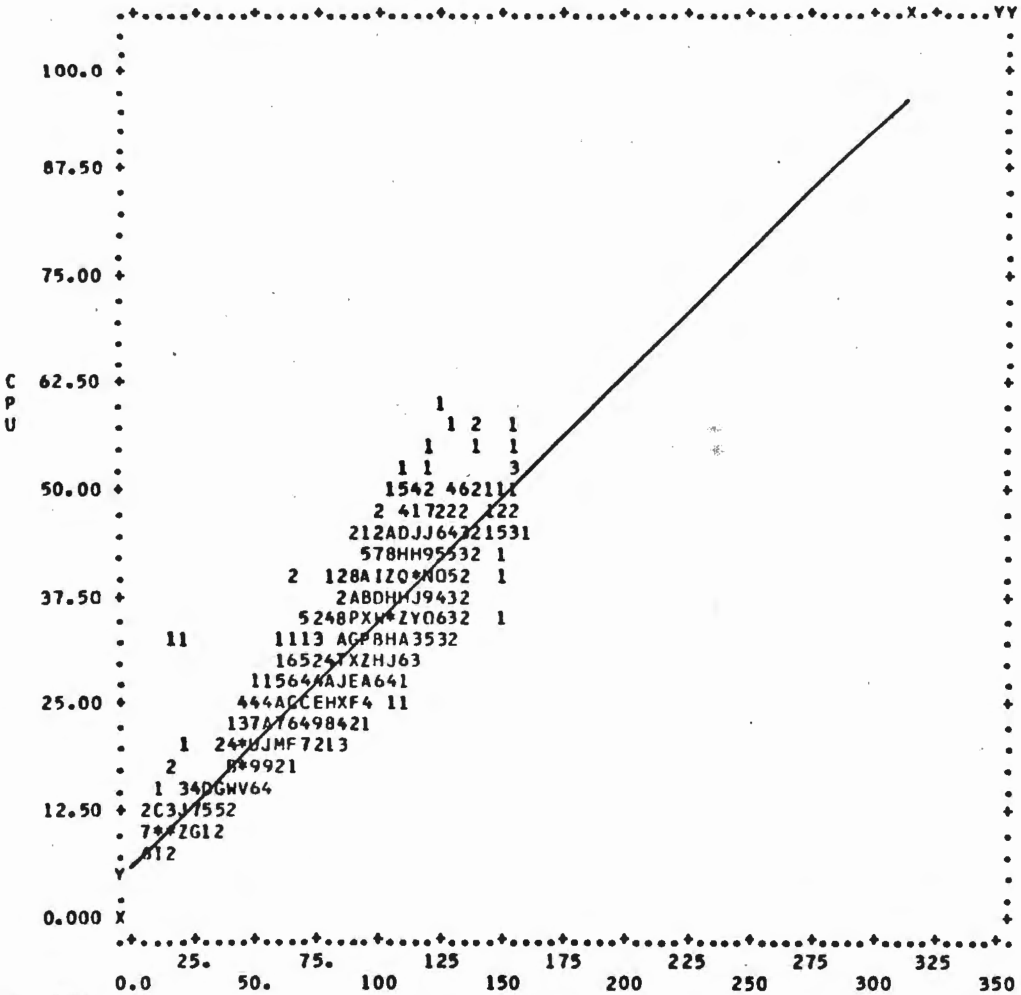
MEMPHIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82



N= 3743
COR= .9614

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	30.564	13.377	Y= .22126*X+ 7.7207	13.551

MIAMI 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/08/82 AND 06/12/82

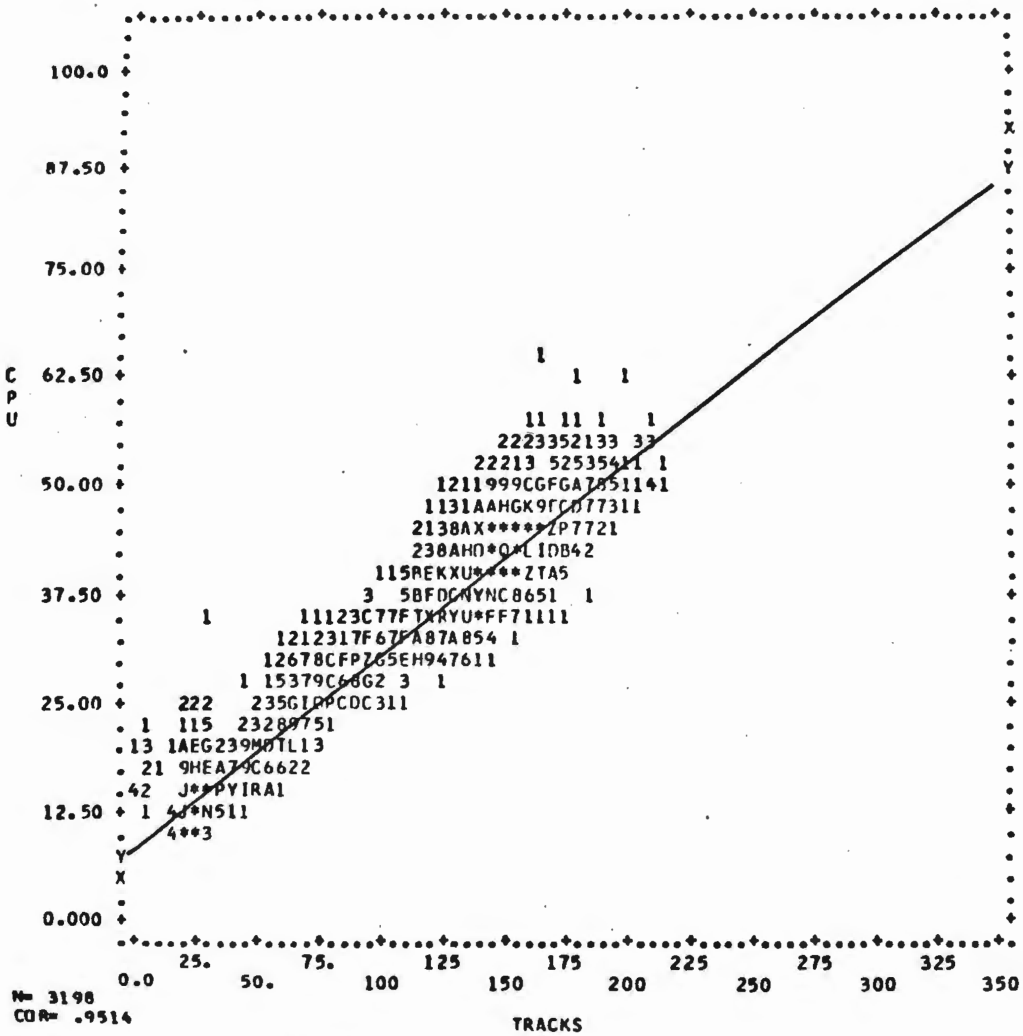


TRACKS

N= 1923
COR= .9310

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	28.810	11.284	Y= .28932*X+ 5.5540	16.980

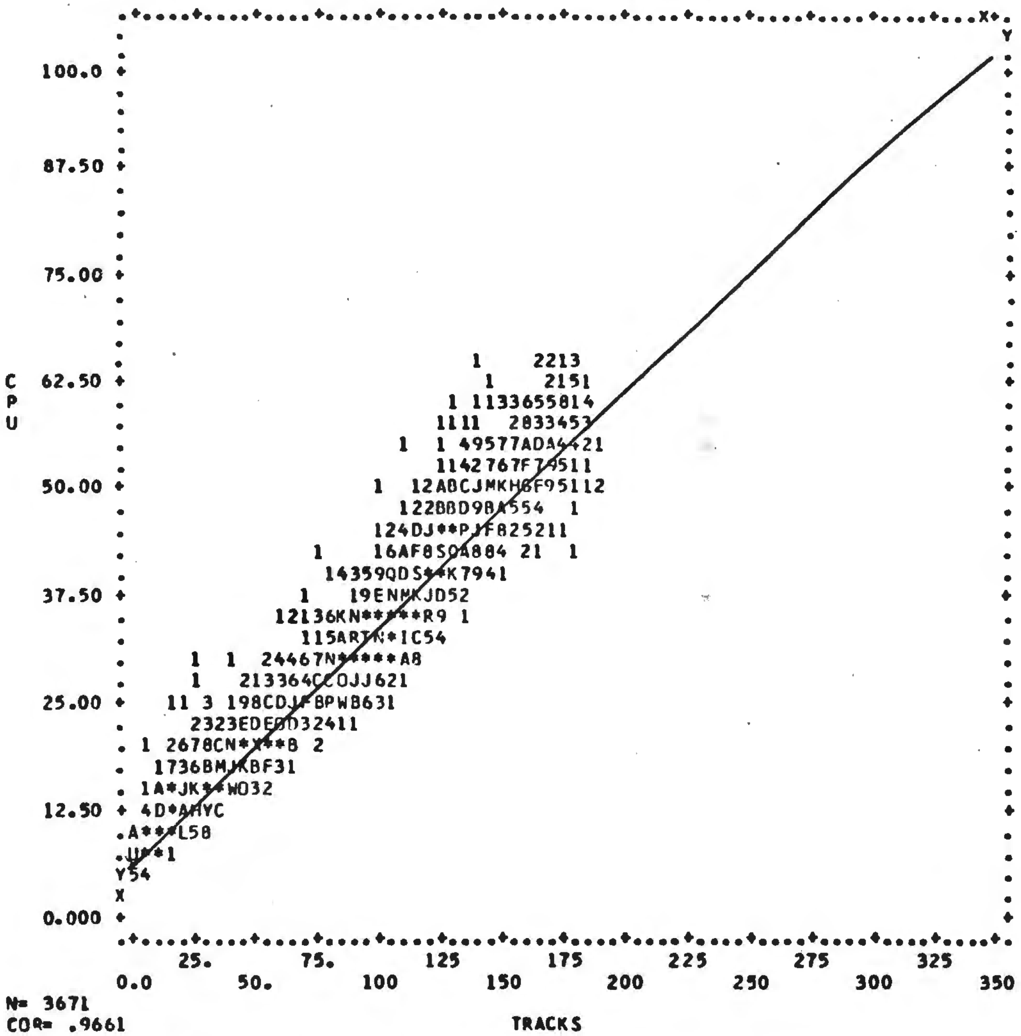
MINNEAPOLIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 10/18/82 AND 10/23/82



N= 3198
COR= .9514

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	33.534	12.056	Y= .22141*X+ 8.7503	13.797

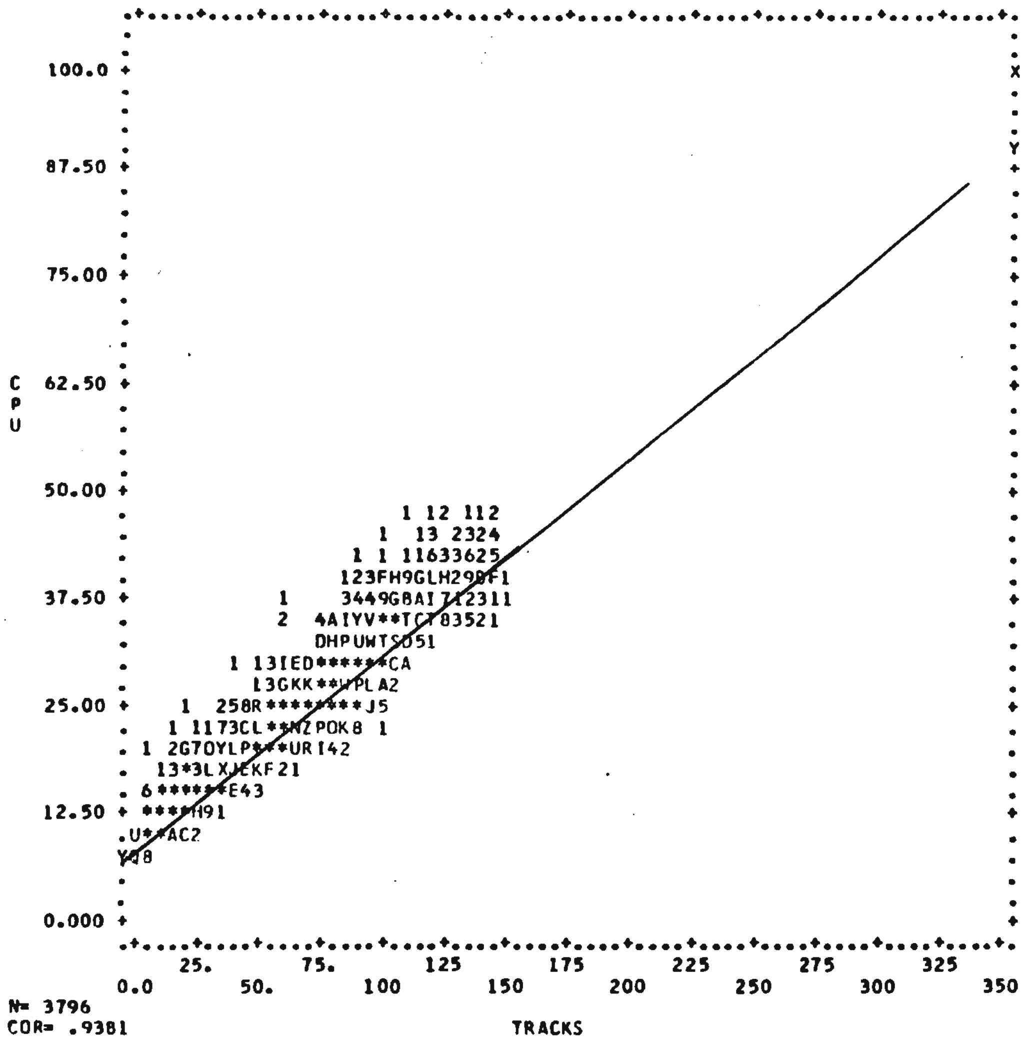
OAKLAND 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 08/15/82 AND 08/22/82



N= 3671
COR= .9661

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	29.741	13.919	Y= .27892*X+ 6.6328	12.928

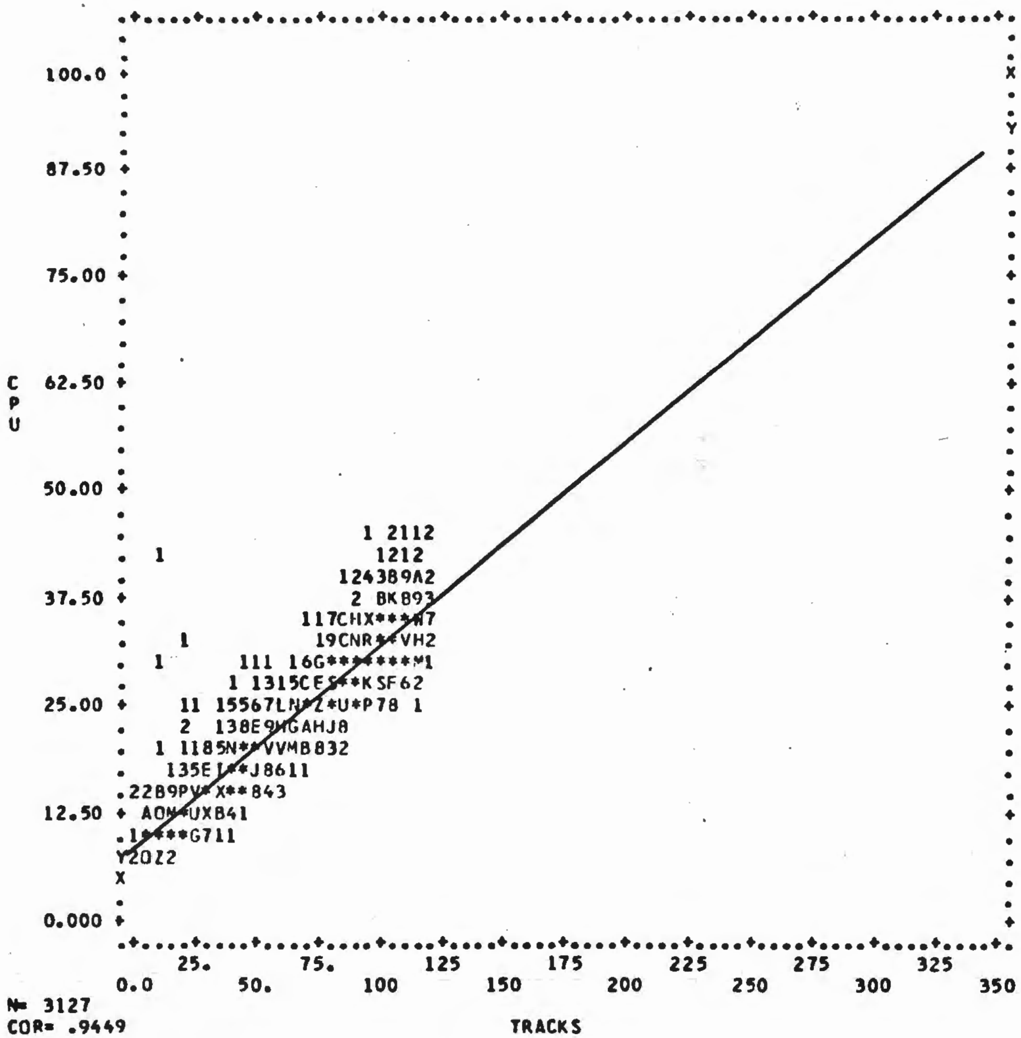
SALT LAKE 2.12 9020A SARC1,TARS=OFF,IDCEOFLD=ON,3 CE, MEASURED BETWEEN 05/23/82 AND 05/28/82



N= 3796
COR= .9381

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	23.800	8.5433	Y= .22719*X+ 9.6374	8.7518

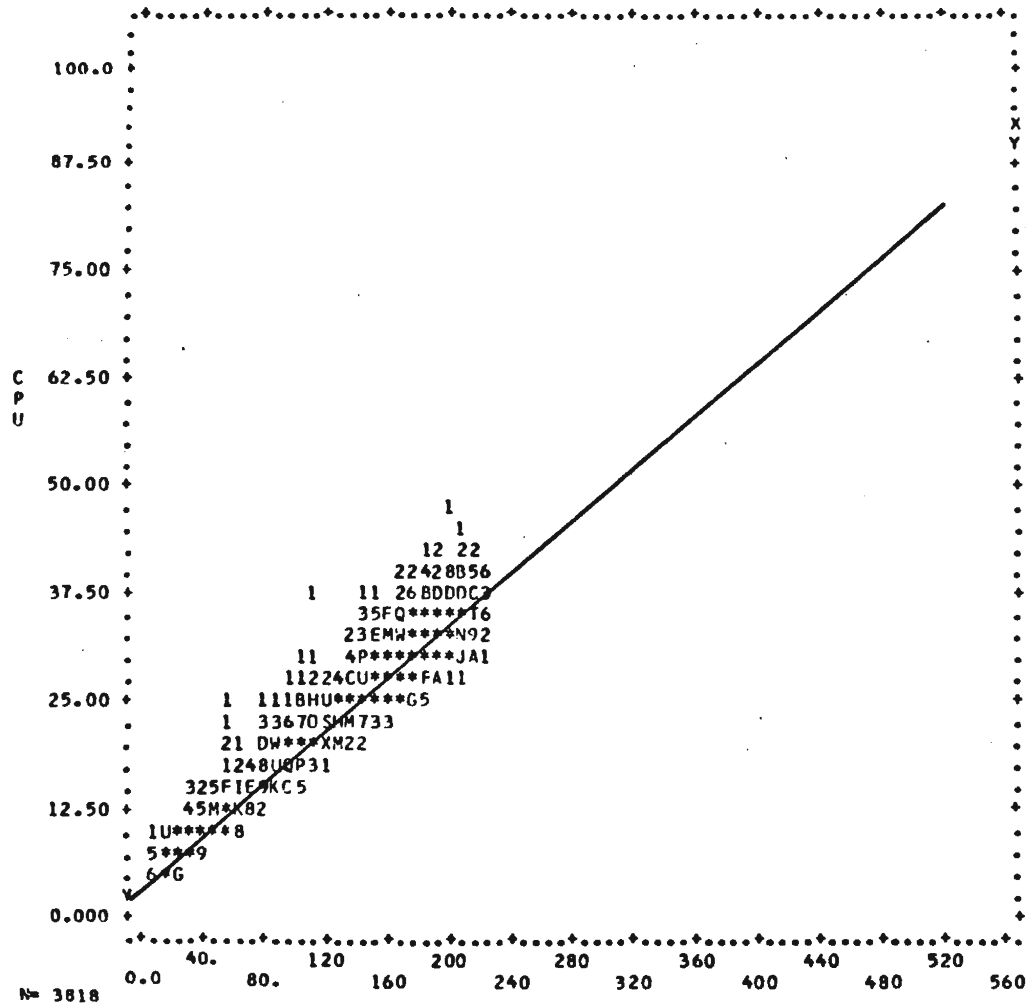
SEATTLE 2.12 9020A SARC4,TARS=OFF,IOCEOFLO=ON,3 CE, MEASURED BETWEEN 06/07/82 AND 06/12/82



N= 3127
COR= .9449

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	22.705	9.0483	Y= .23988*X+ 7.5770	8.7719

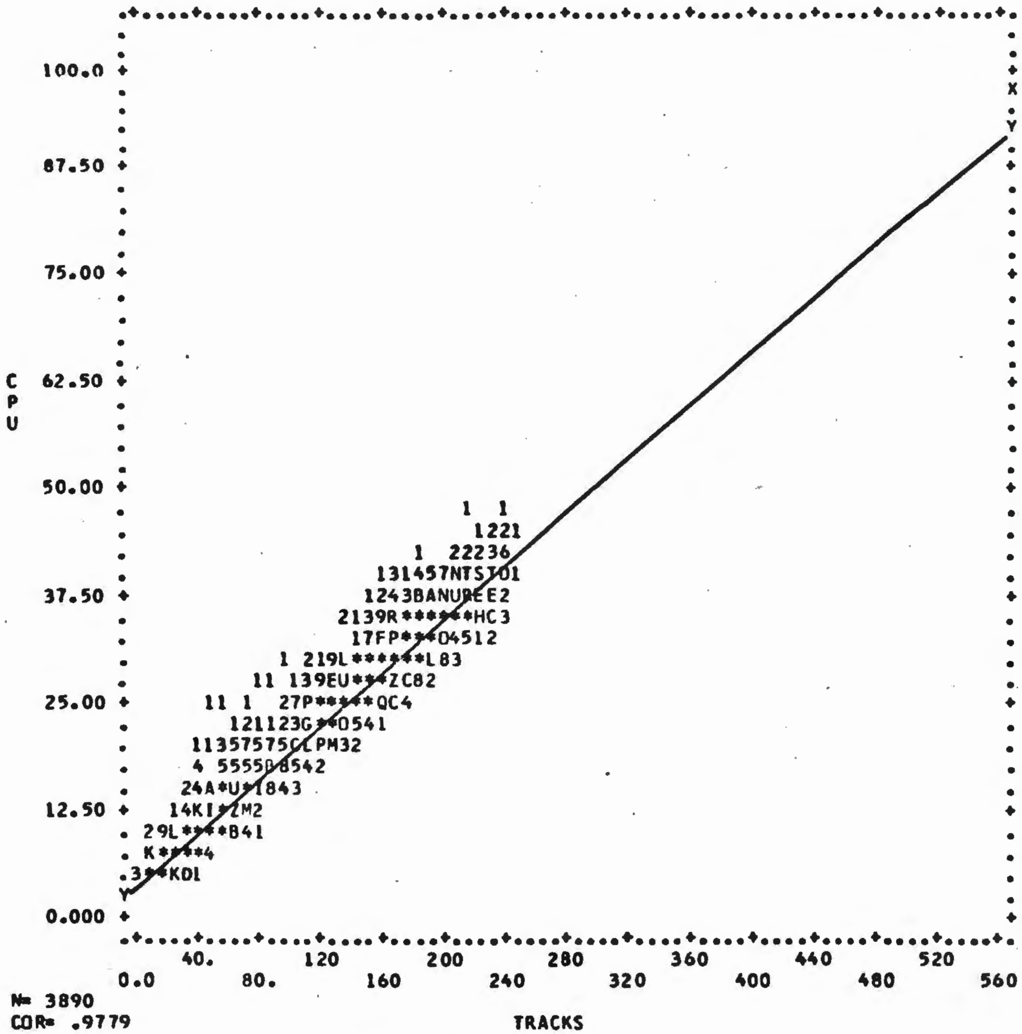
ATLANTA 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82



N= 3818
COR= .9698

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	23.012	9.9942	Y= .14886*X+ 4.6079	5.9459

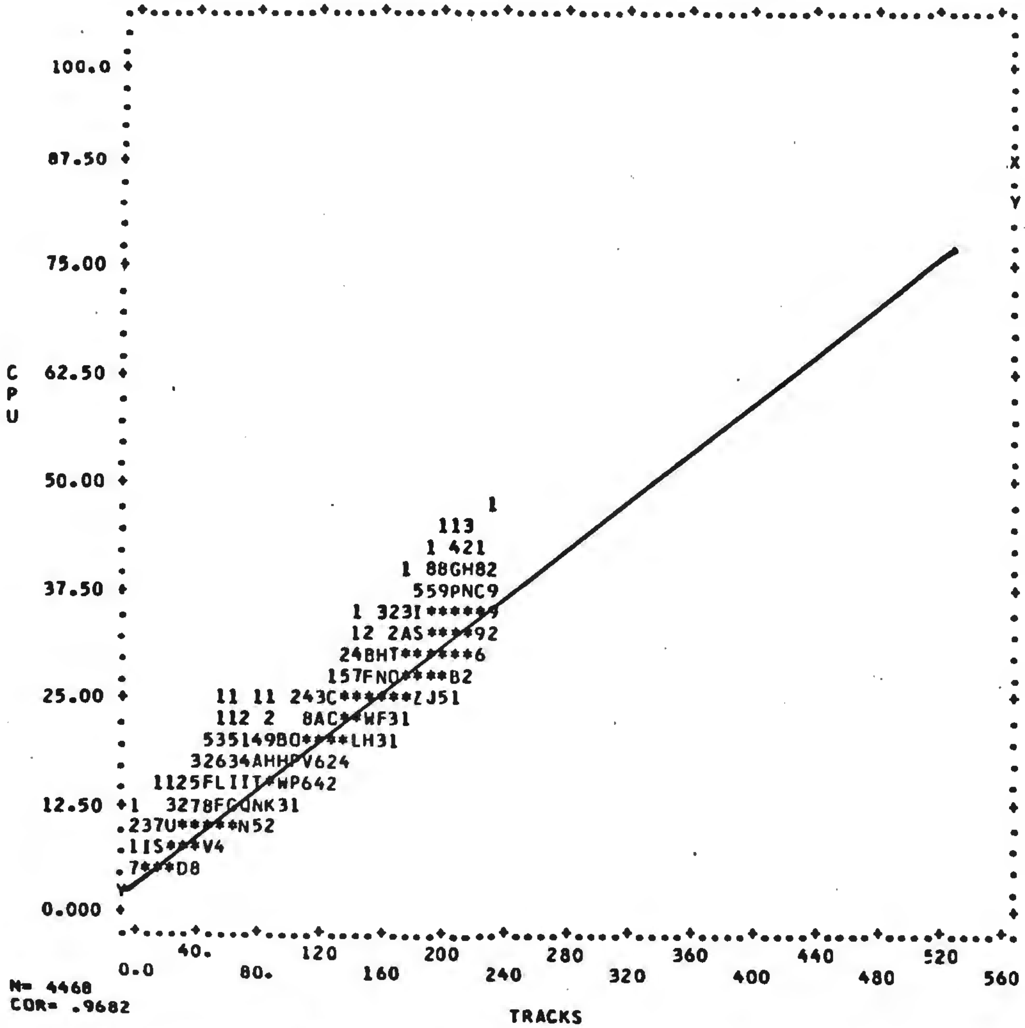
CLEV 2.12 9020D SARC1,TARS=OFF,IDCEOFLD=OFF,2 CE, MEASURED BETWEEN 05/31/82 AND 06/05/82



N= 3890
COR= .9779

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	22.241	10.917	Y= .15705*X+ 3.9715	5.2085

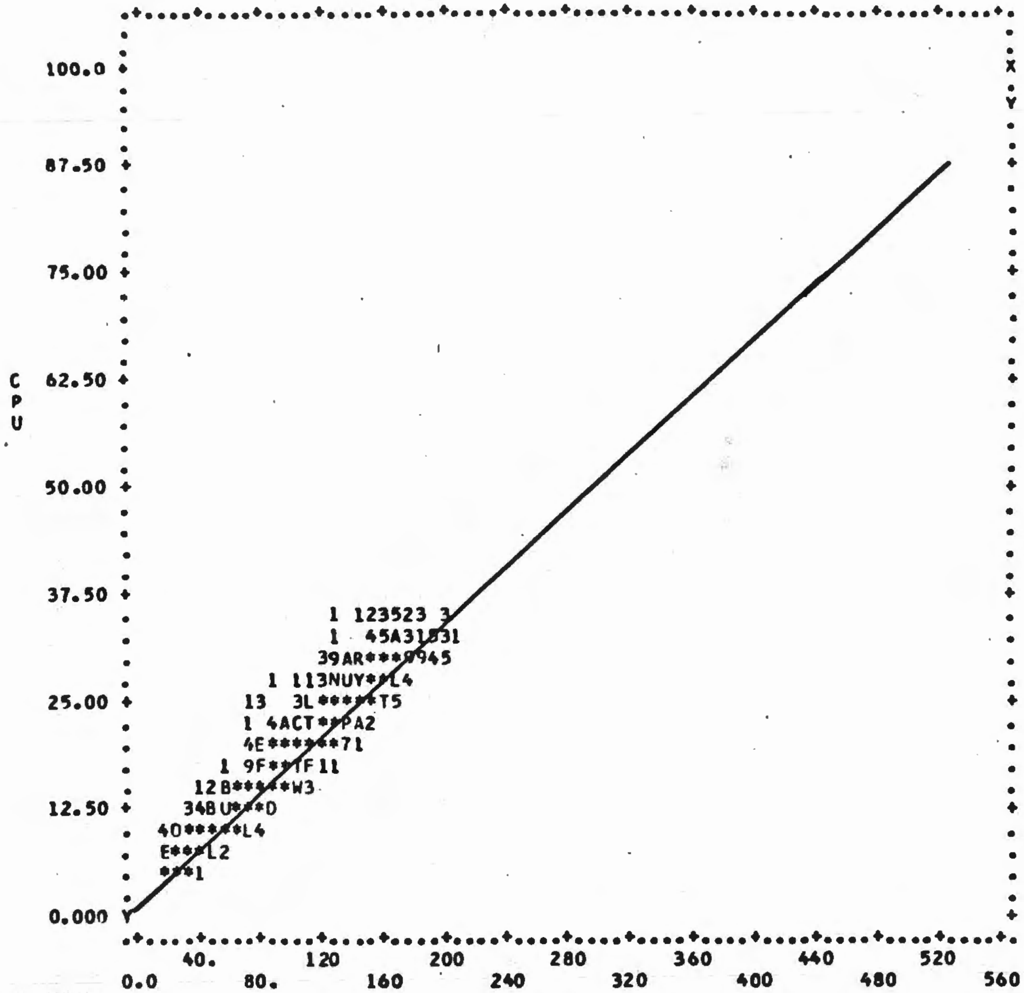
FT WORTH 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 02/08/82 AND 02/13/82



N= 4468
COR= .9682

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	22.588	10.100	Y= .14042*X+ 3.7231	6.3822

INDIANAPOLIS 2.12 9020D SARC1,TARS=OFF,IOCEOFLO=OFF,2CE, MEASURED BETWEEN 10/10/82 AND 10/17/82

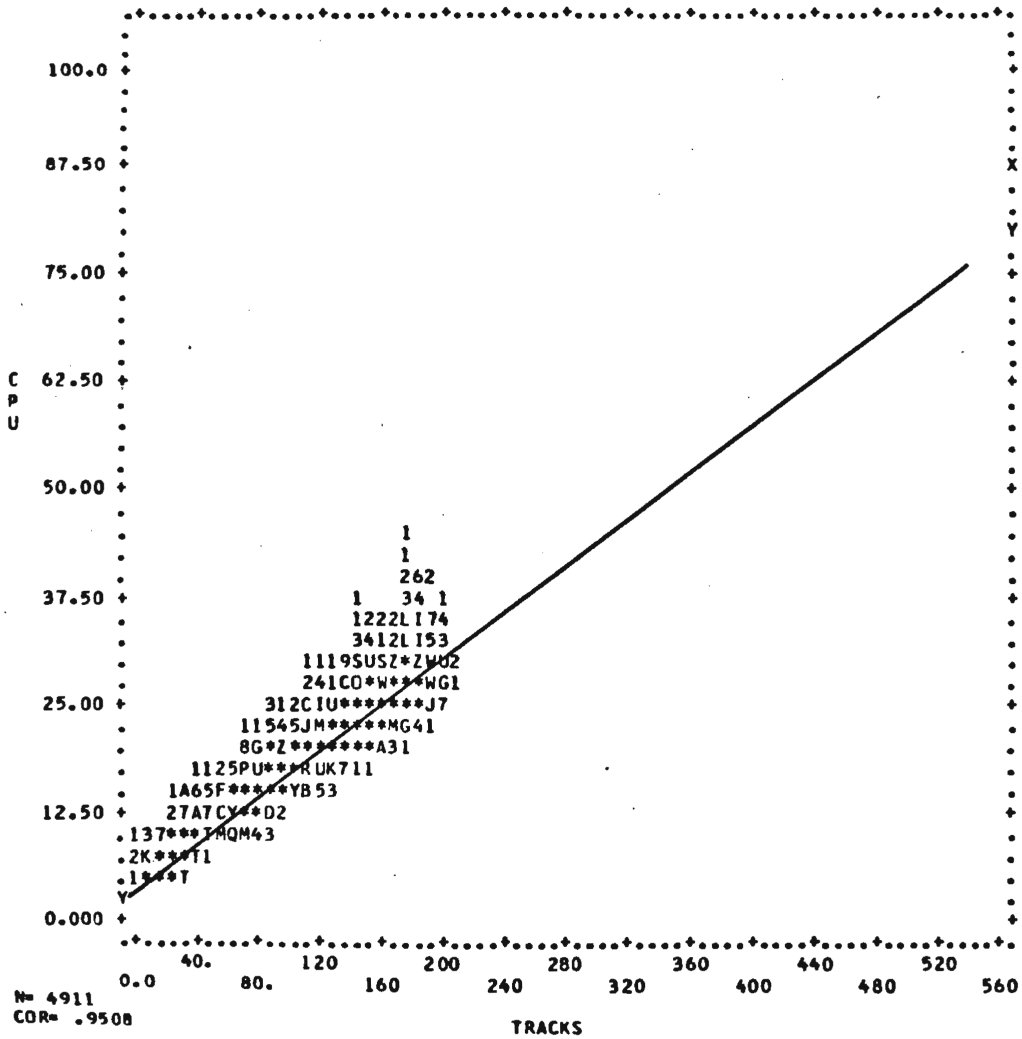


N= 3841
COR= .9652

TRACKS

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	16.985	7.6019	Y= .16350*X+ 2.4233	3.9541

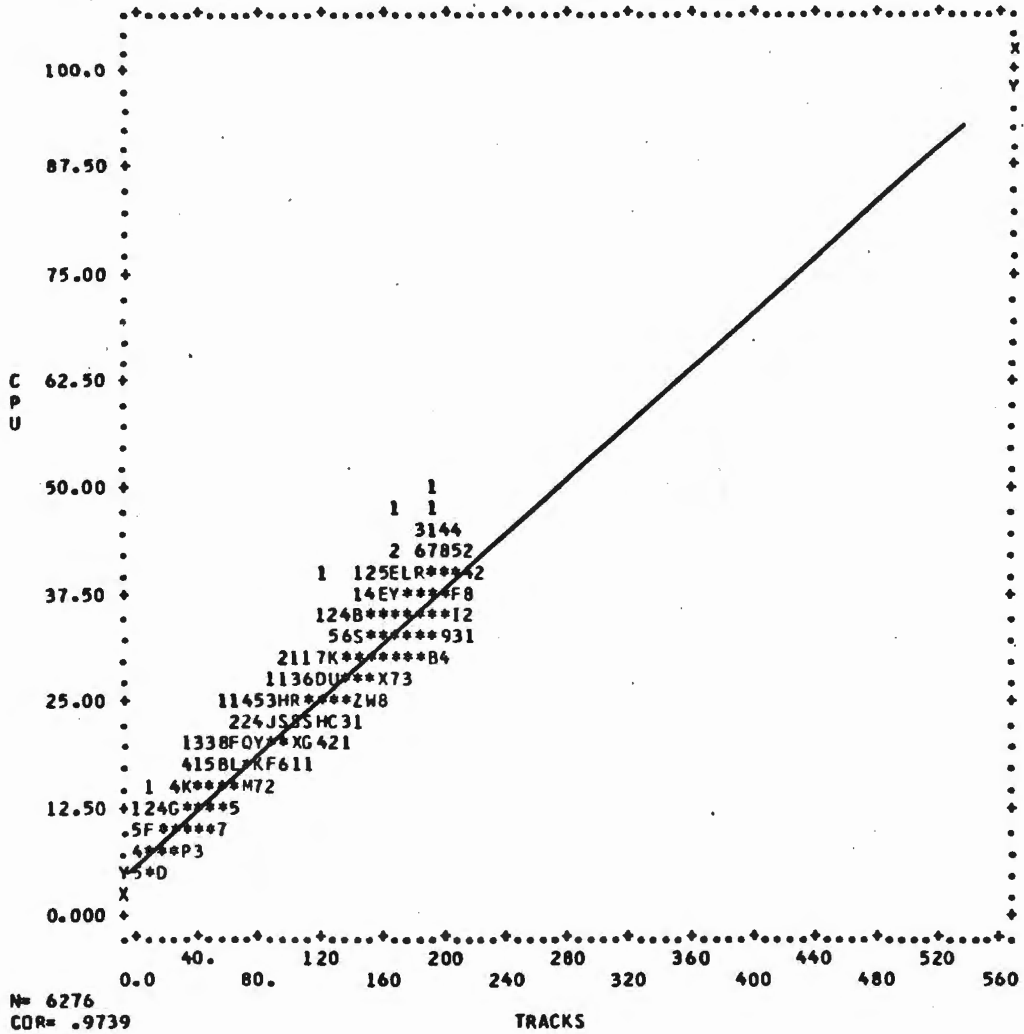
JACKSONVILLE 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 08/23/82 AND 08/27/82



N= 4911
COR= .9508

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	18.238	8.0712	Y= .13376*X+ 4.3151	6.2558

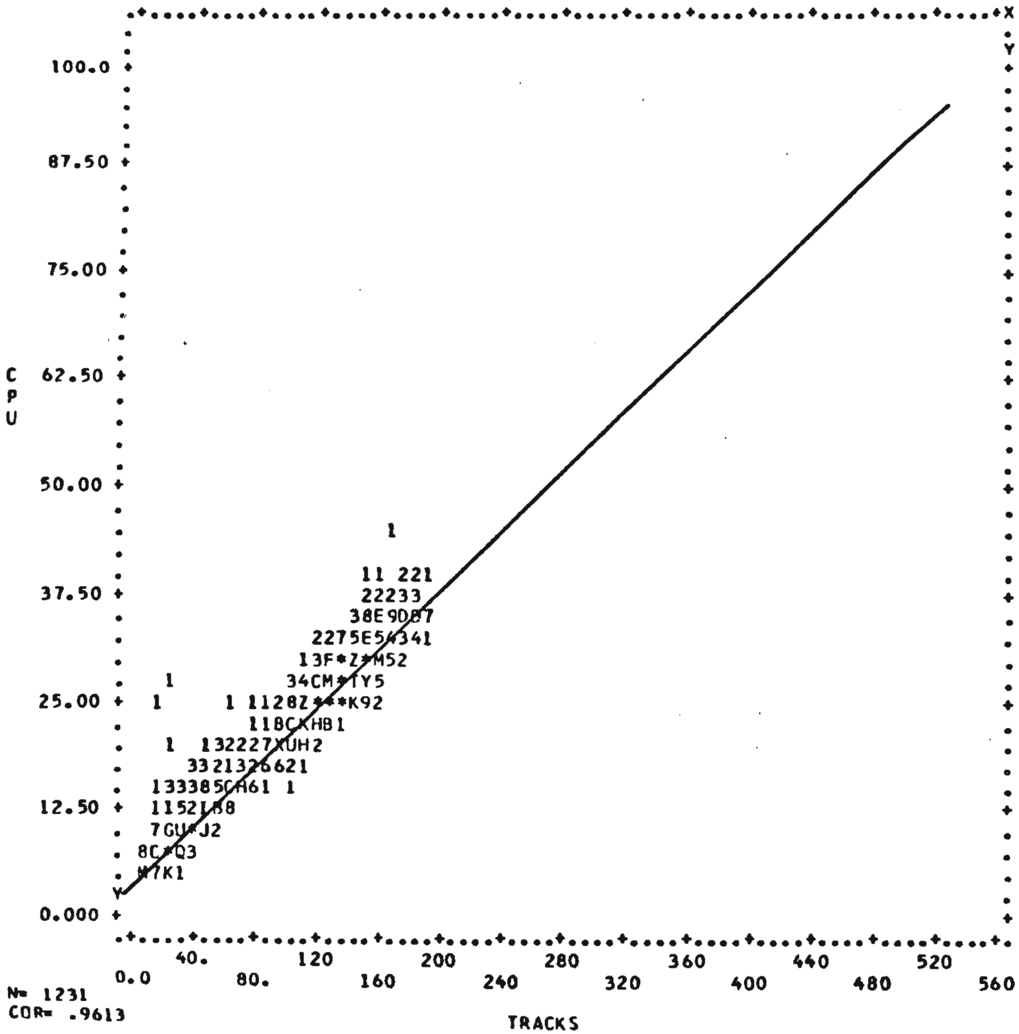
KANSAS CITY 2.12 9020D SARC4,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 6276
COR= .9739

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	24.608	10.371	Y= .16184*X+ 5.4688	5.5353

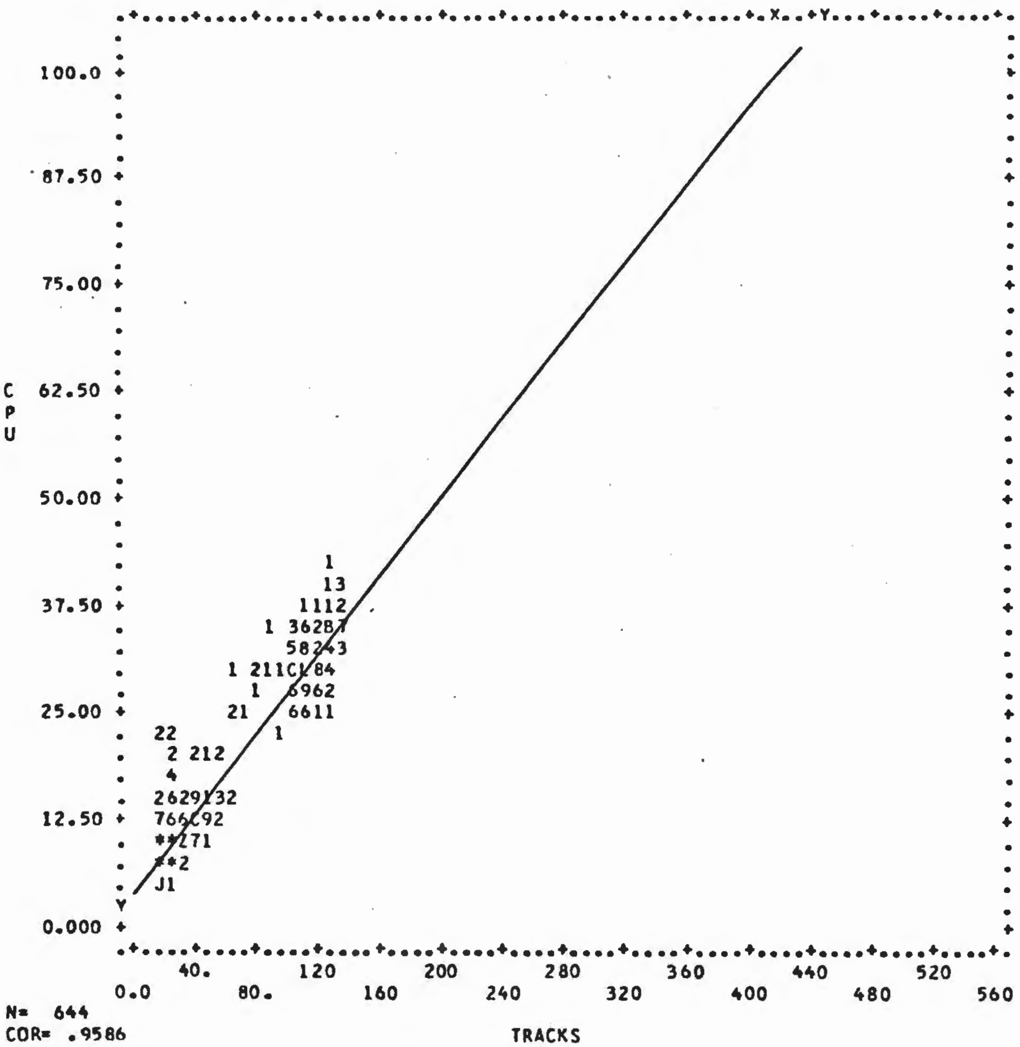
LOS ANGELES 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 08/12/82 AND 08/16/82



N= 1231
COR= .9613

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	101.93	50.161	X= 5.4078*Y-15.025	191.25
Y	21.627	8.9165	Y= .17087*X+ 4.2098	6.0429

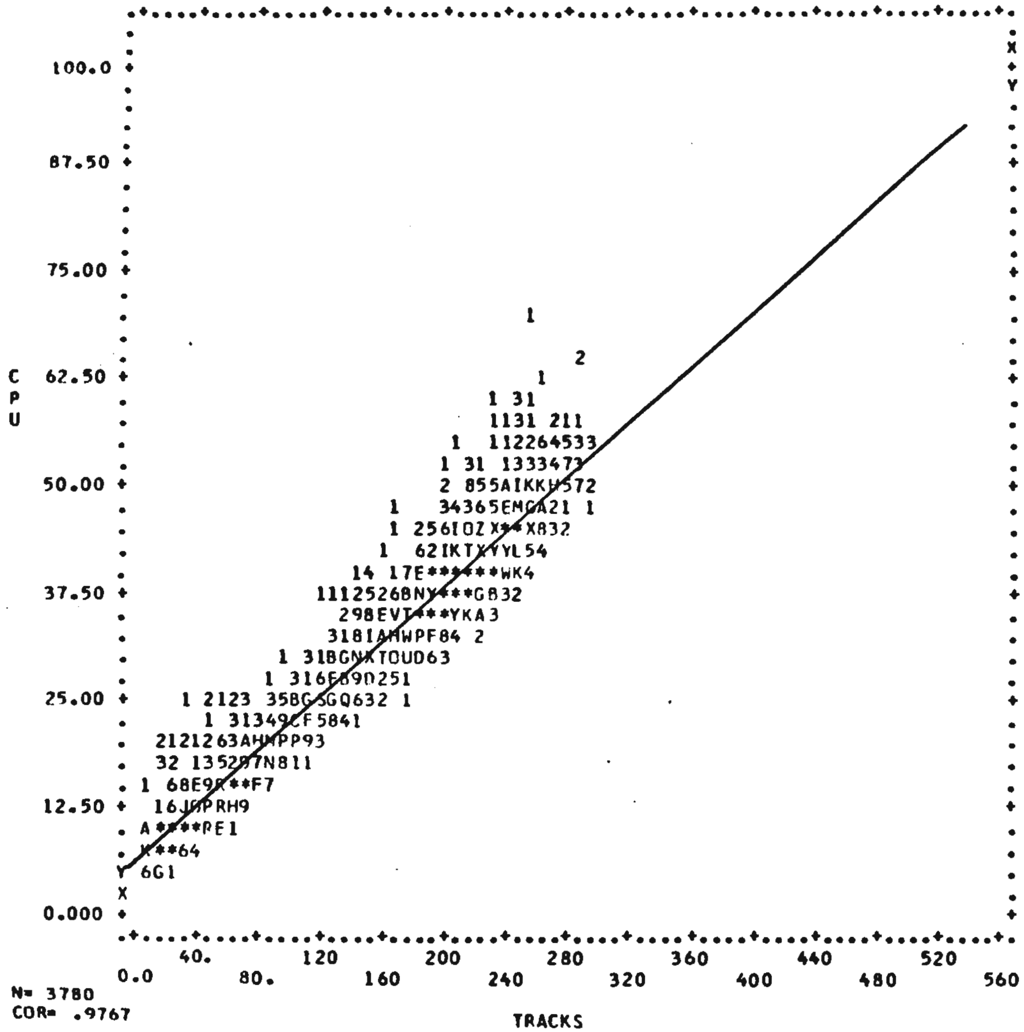
NEW YORK 2.12 9020D SARC20,TARS=7FFC,IUCEOFLD=OFF,2 CE, MEASURED BETWEEN 12/27/82 AND 12/31/82



N= 644
COR= .9586

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	14.756	9.5485	Y= .23008*X+ 4.4032	7.4069

WASHINGTON 2.12 90200 SARC4,TARS=ON,IOCEOFLD=OFF.2 CE. MEASURED BETWEEN 10/04/82 AND 10/07/82



N= 3780
COR= .9767

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	29.364	14.119	Y= .16355*X+ 5.3104	9.1773

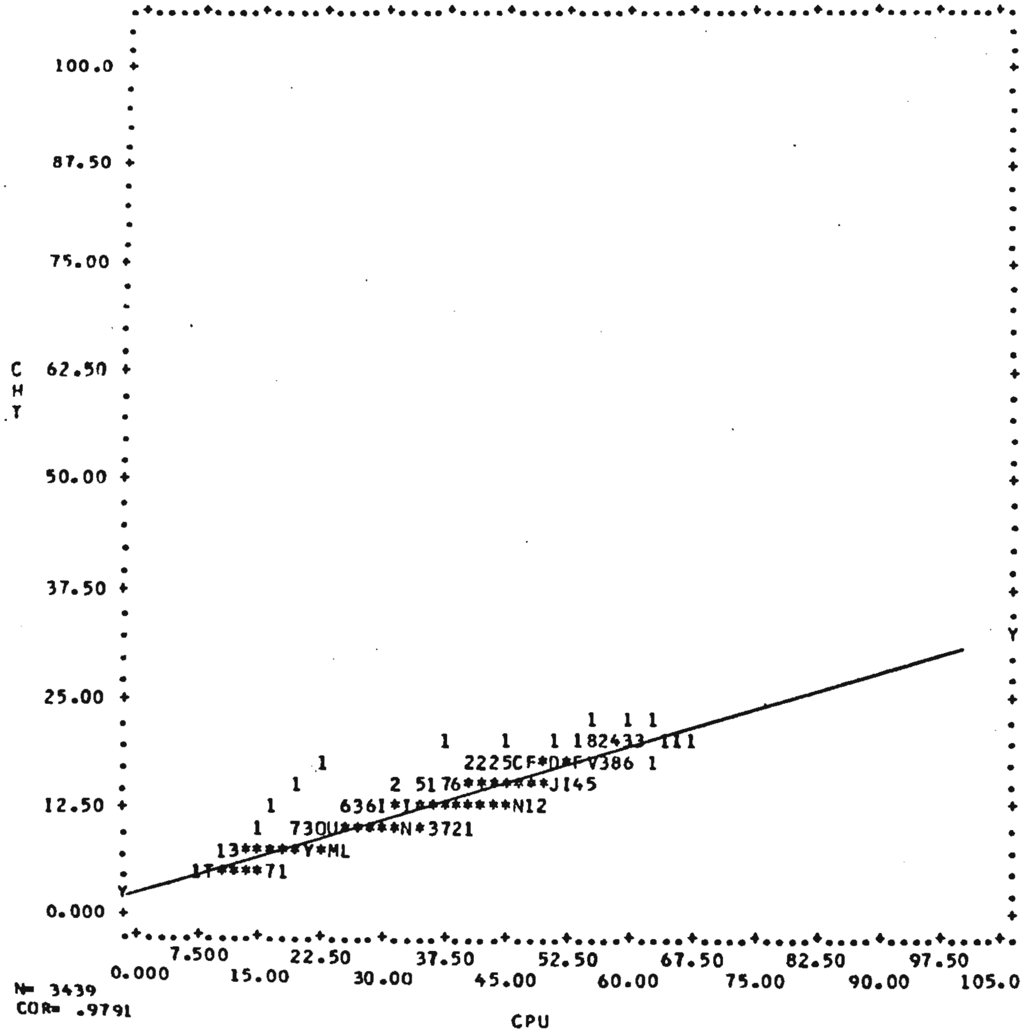
APPENDIX C

SCATTER DIAGRAMS SHOWING AVERAGE SELECTOR CHANNEL UTILIZATION AS A FUNCTION OF CENTRAL PROCESSING UTILIZATION

Appendix C presents scatter diagrams showing how the average selector channel utilization increases when central processing utilization grows with load. The average selector channel utilization is computed as the sum of the observed active channel utilizations divided by four (two channels per IOCE times two IOCE's per system). All values are in percent.

The sites appear in the following order:

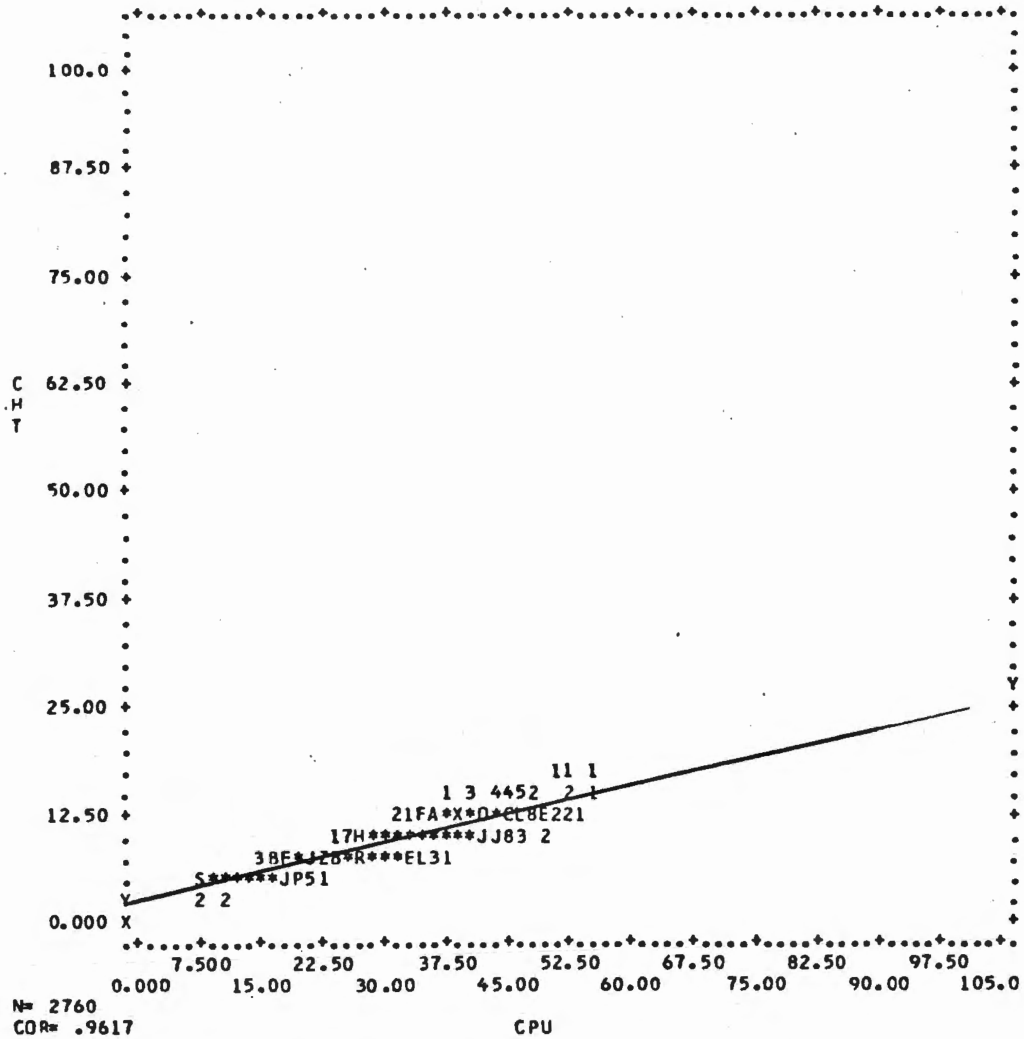
ALBUQUERQUE 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 3439
COR= .9791

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	10.387	3.9401	Y= .27160*X+ 2.3821	.64313

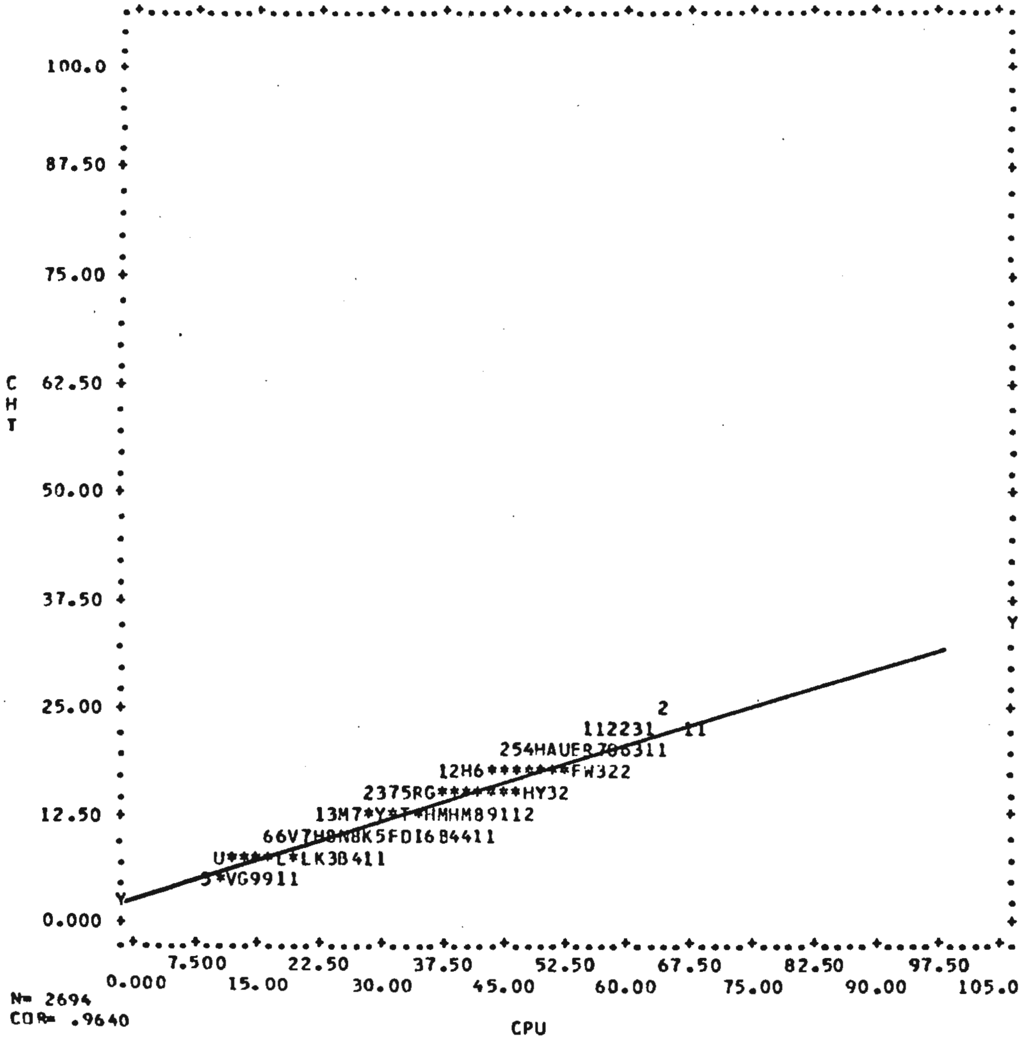
BOSTON 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/21/82 AND 07/03/82



N= 2760
COR= .9617

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	8.6572	2.5738	Y= .22939*X+ 2.0629	.49757

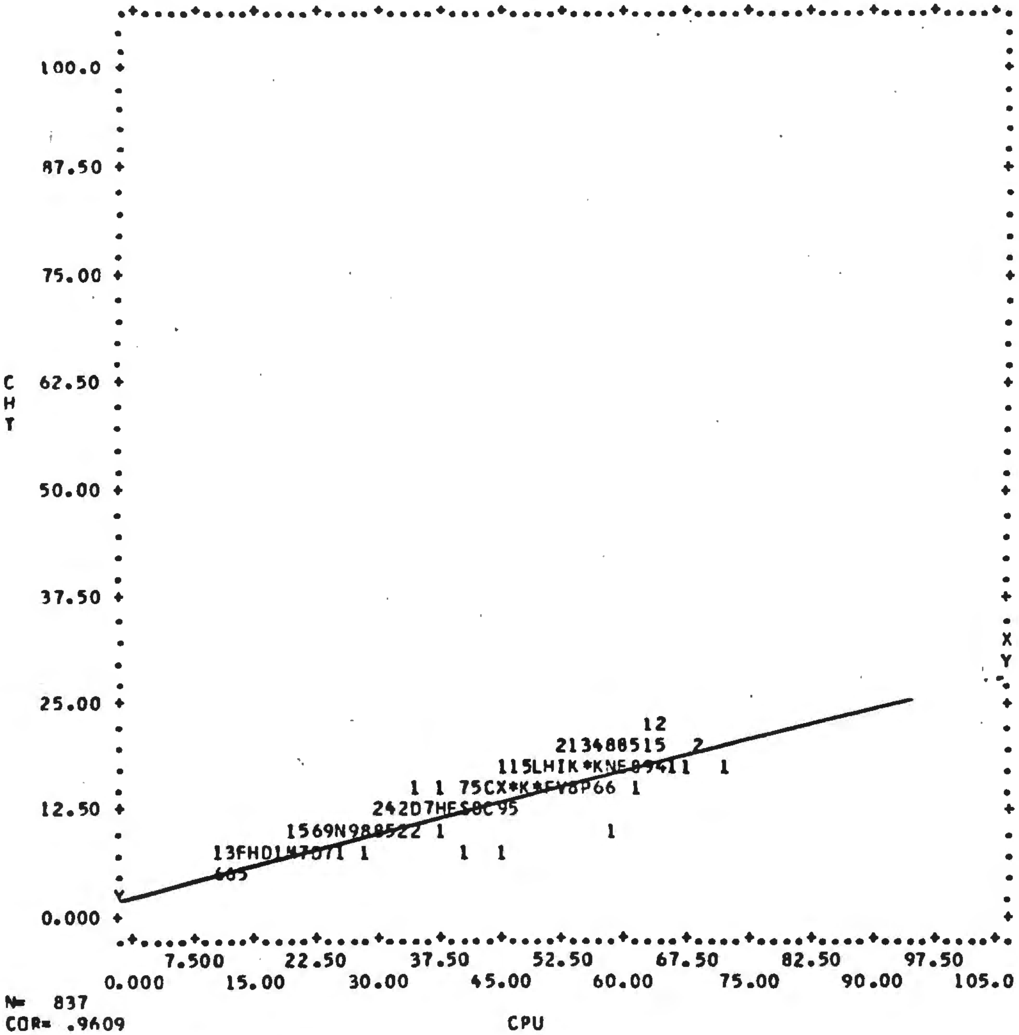
DEN 2.12 "A" SARC4 (RCOPS REDUCE TO UDS SARC1),TARS=OFF, OFLD=ON,3 CE,MEAS BETWEEN 8/4 TO 8/9/82



N= 2694
COR= .9640

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	13.043	4.3707	Y= .29510*X+ 2.7242	1.3508

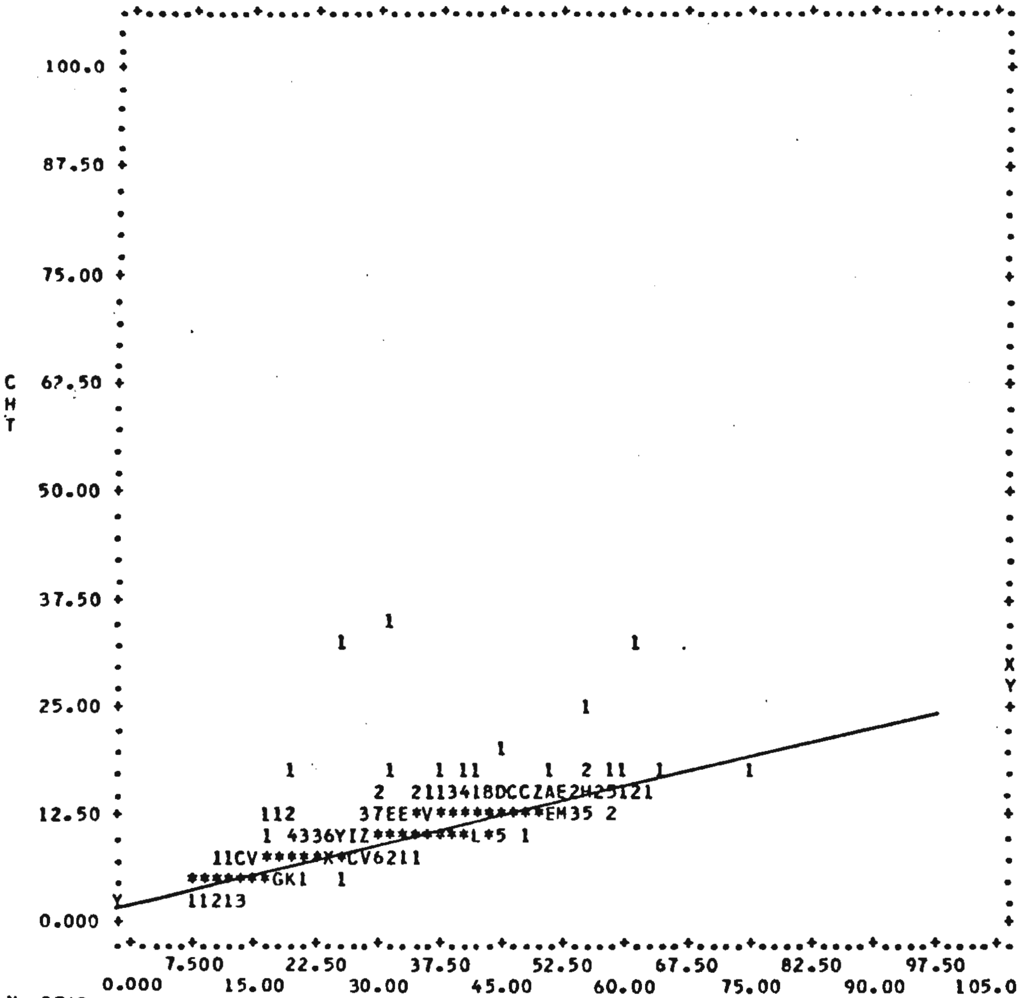
HOUSTON 2.12 9020A SARC2,TARS=0000,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 11/5/82 AND 11/10/82



N= 837
COR= .9609

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	13.975	3.7754	Y= .25305*X+ 3.0123	1.0950

MEMPHIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82

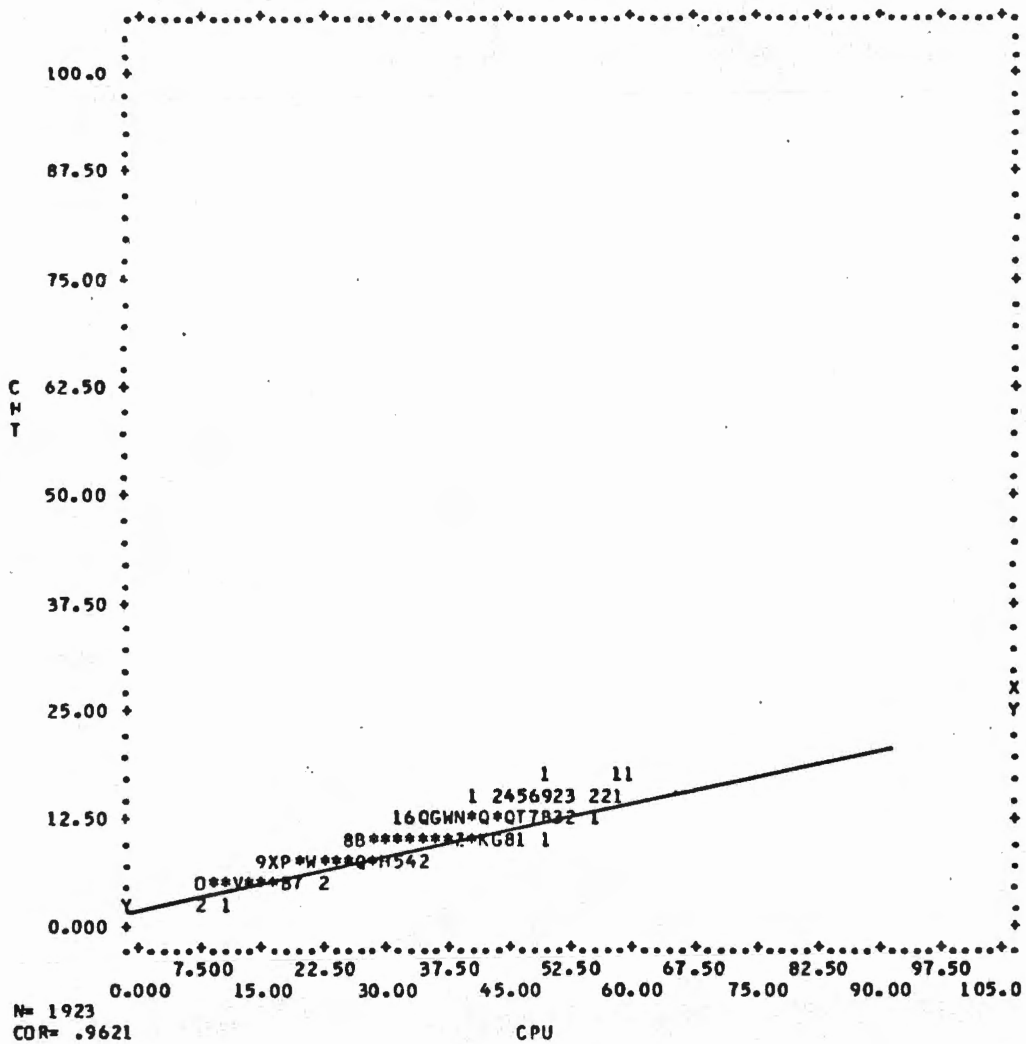


N= 3743
COR= .9399

CPU

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	9.4786	3.2046	Y= .22516*X+ 2.5970	1.1971

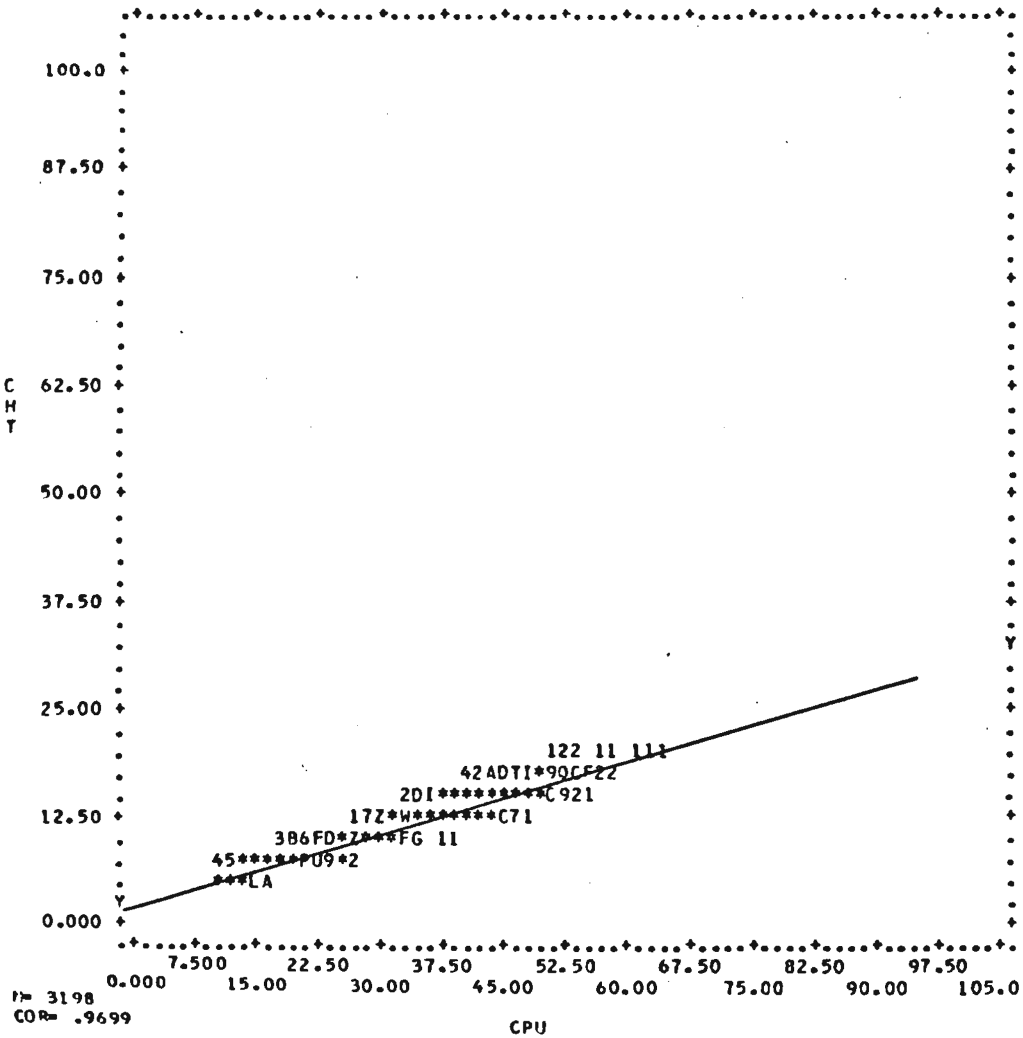
MIAMI 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/08/82 AND 06/12/82



N= 1923
COR= .9621

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	8.9061	2.6167	Y= .22309*X+ 2.4788	.50994

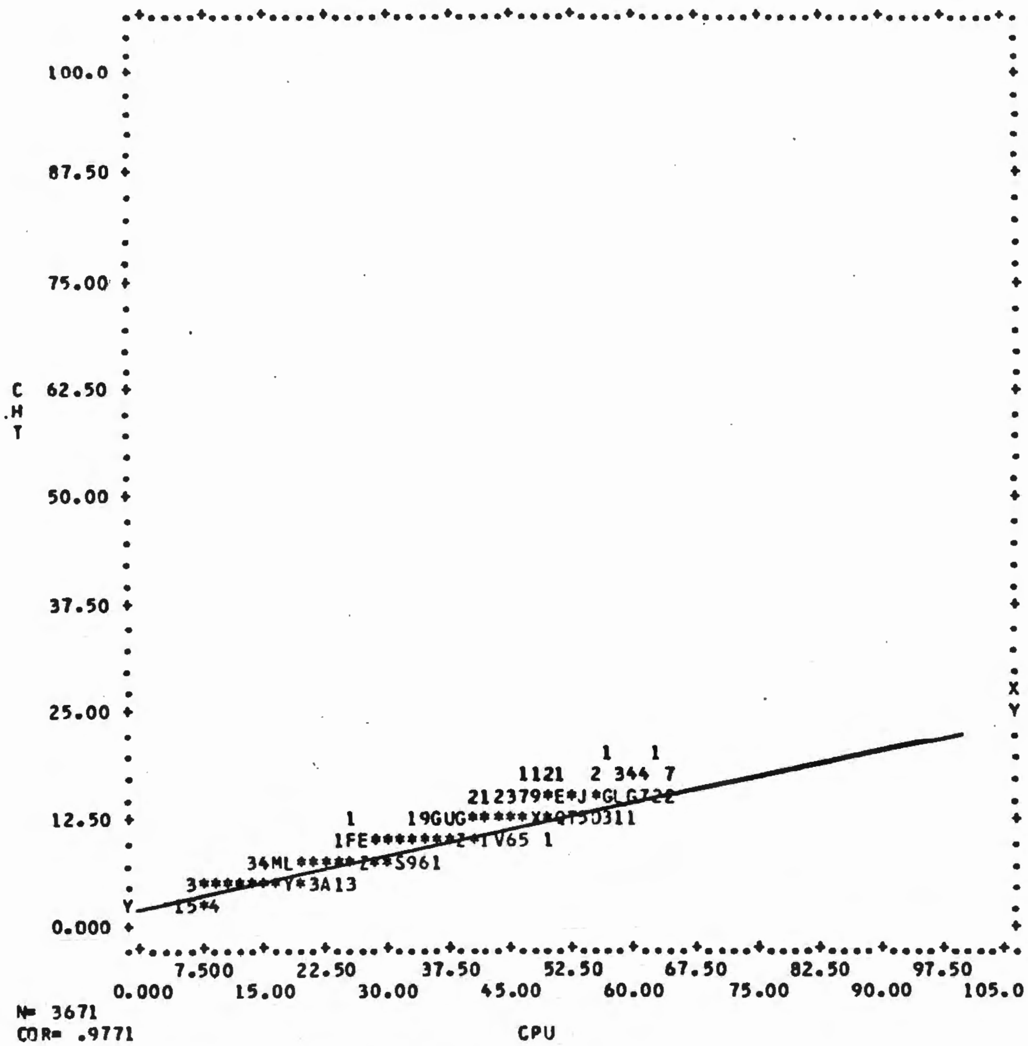
MINNEAPOLIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 10/18/82 AND 10/23/82



N= 3198
COR= .9699

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	11.985	3.4586	Y= .27825*X+ 2.5541	.70855

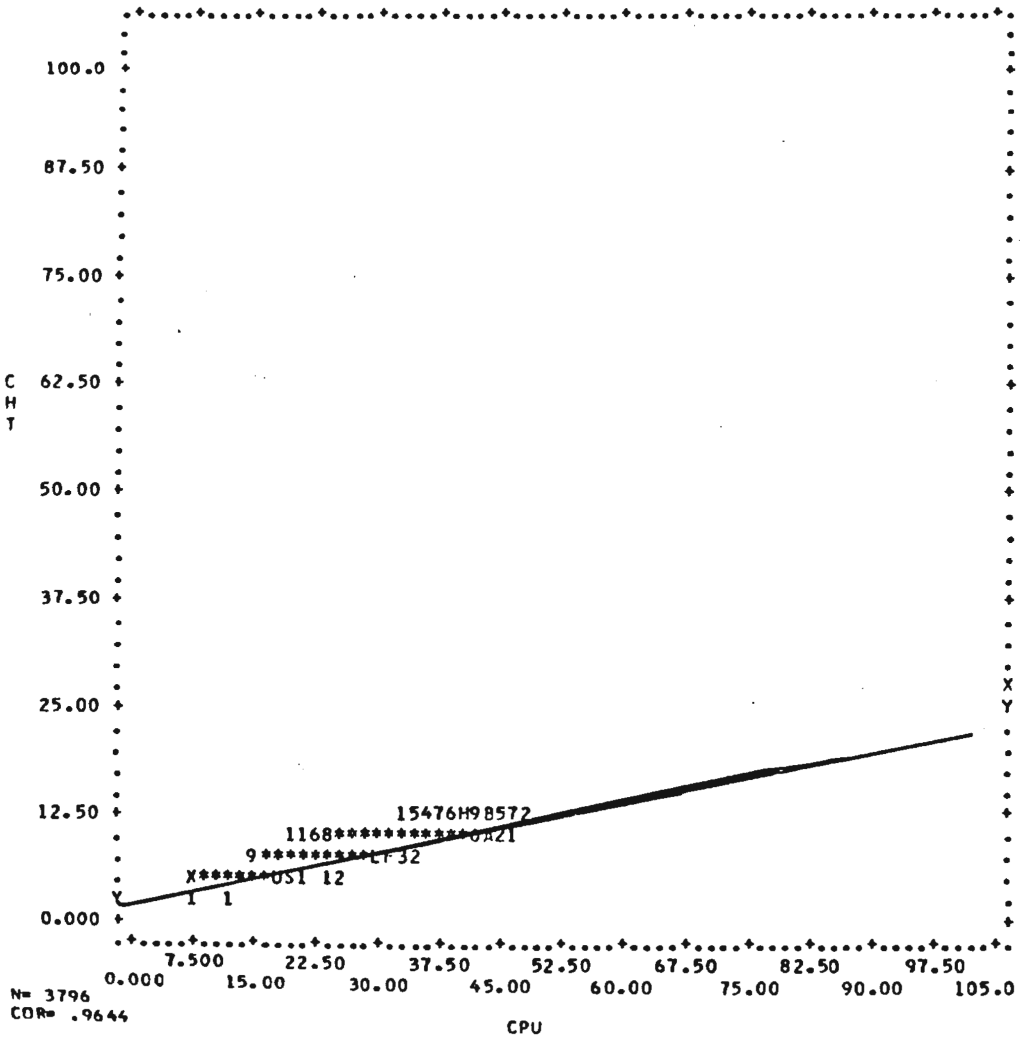
OAKLAND 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 08/15/82 AND 08/22/82



N= 3671
COR= .9771

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	8.9186	3.2161	Y= .22576*X+ 2.2045	.46938

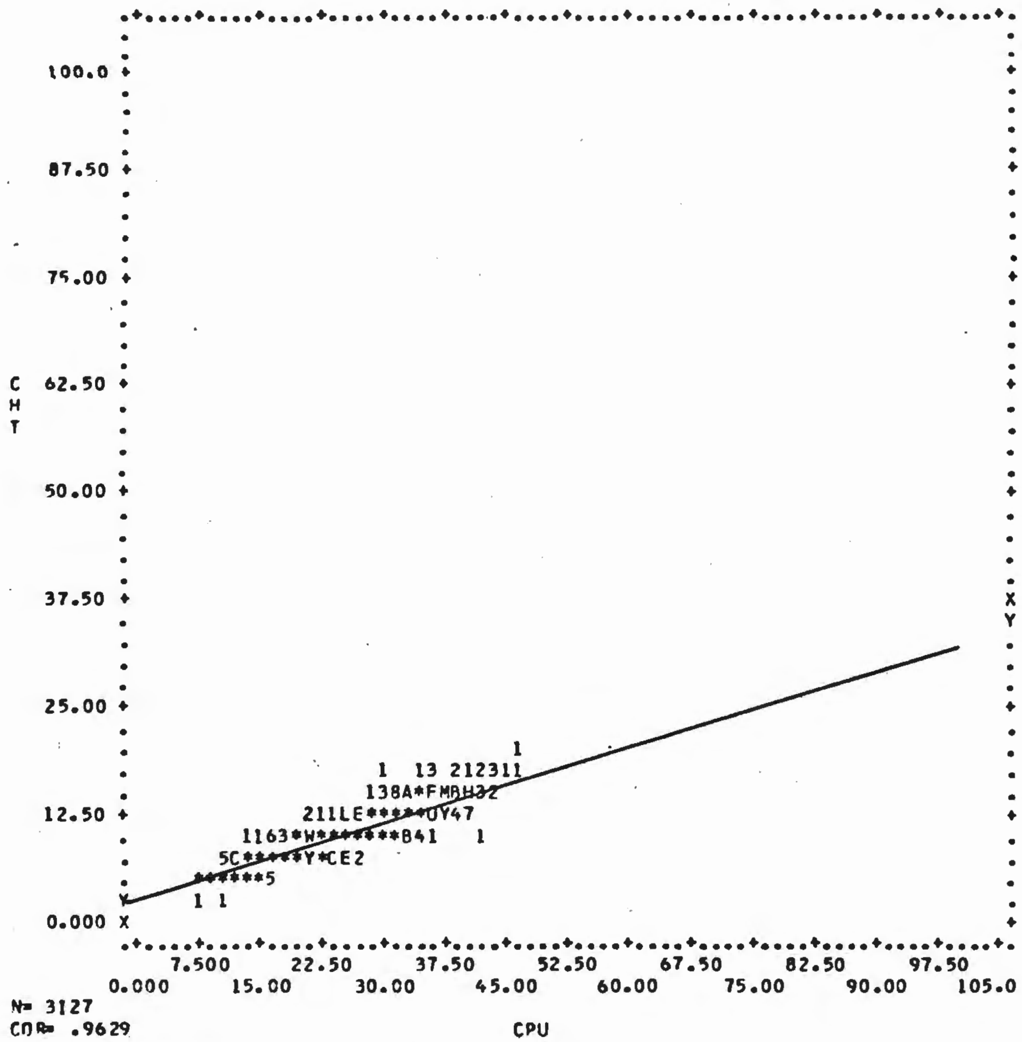
SALT LAKE 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE. MEASURED BETWEEN 05/23/82 AND 05/28/82



N= 3796
COR= .9644

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	7.7475	1.9285	Y= .21770*X+ 2.5664	.26027

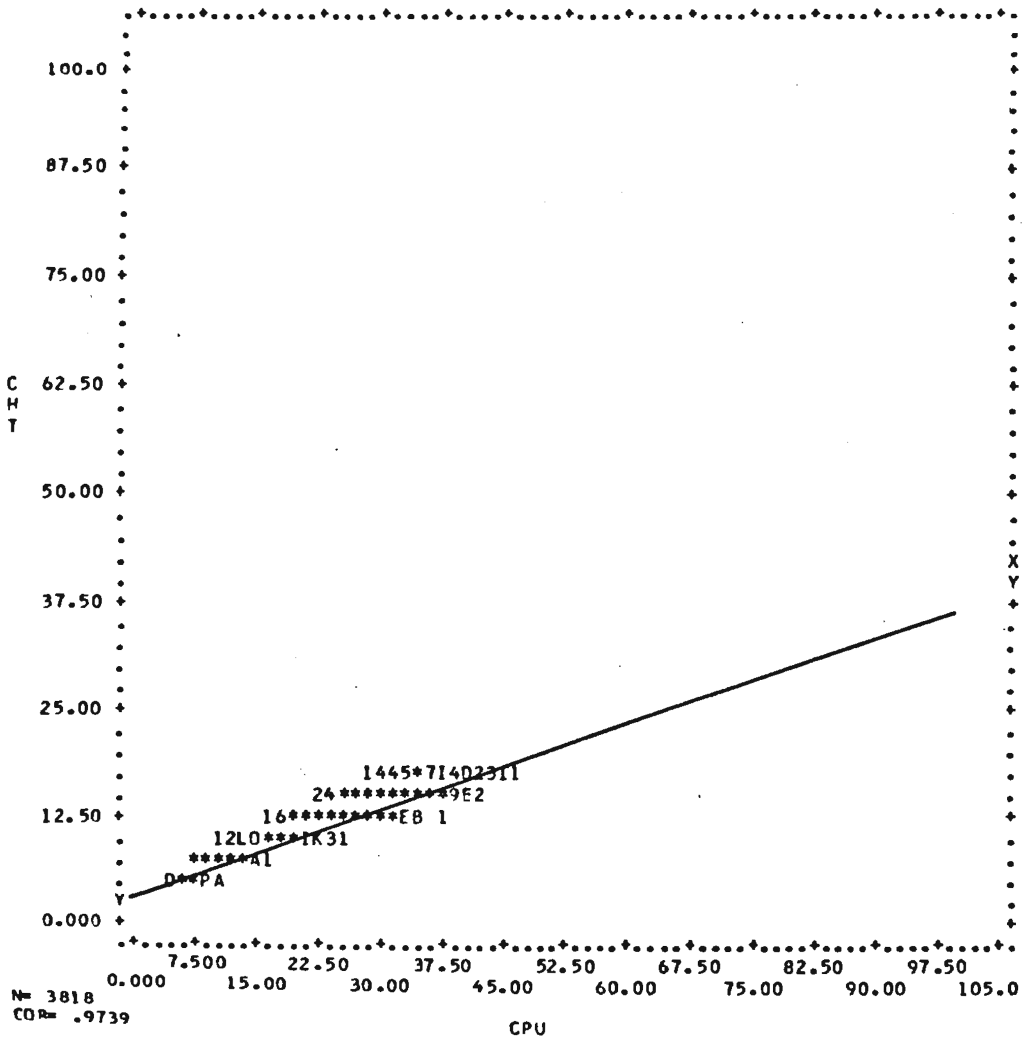
SEATTLE 2.12 9020A SARC4,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/07/82 AND 06/12/82



N= 3127
COR= .9629

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	9.1233	3.0044	Y= .31972*X+ 1.8643	.65811

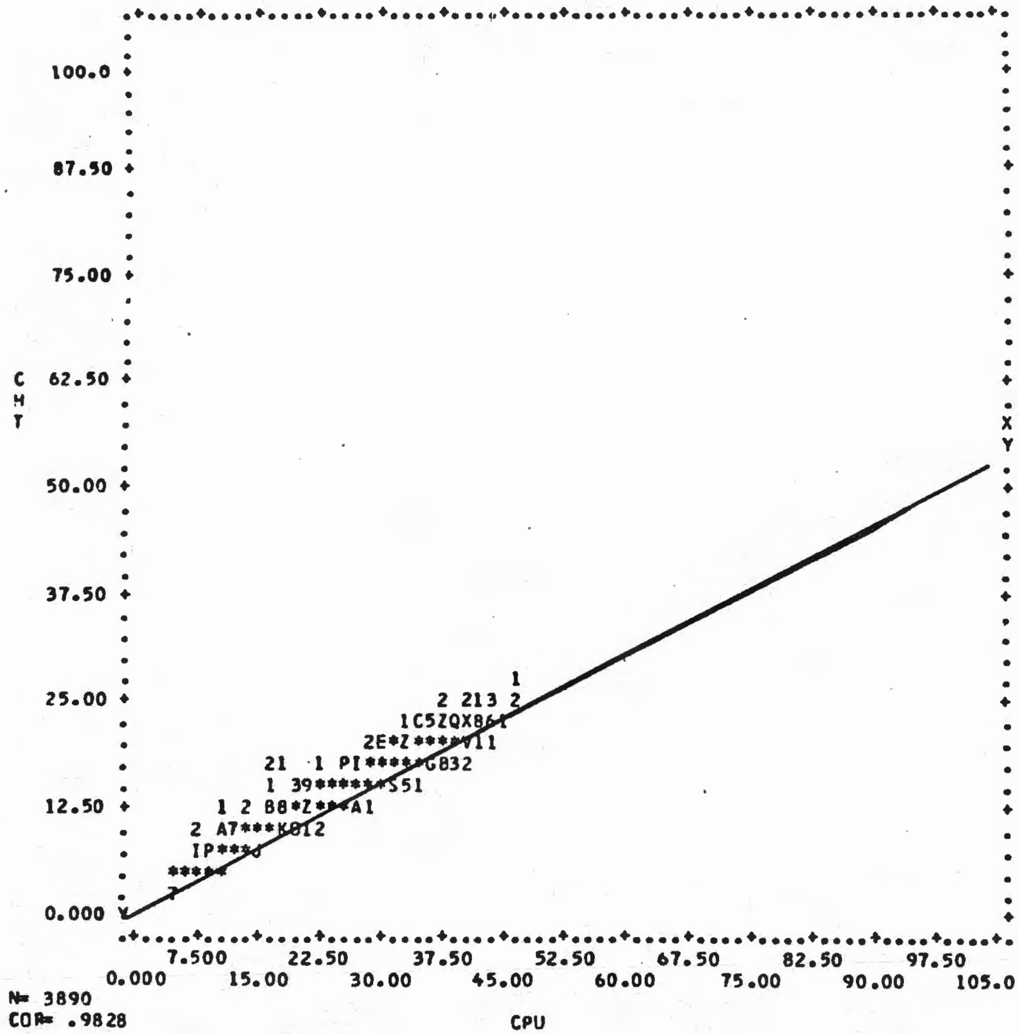
ATLANTA 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82



N= 3818
COR= .9739

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	11.677	3.5000	Y= .34106*X+ 3.8284	.63150

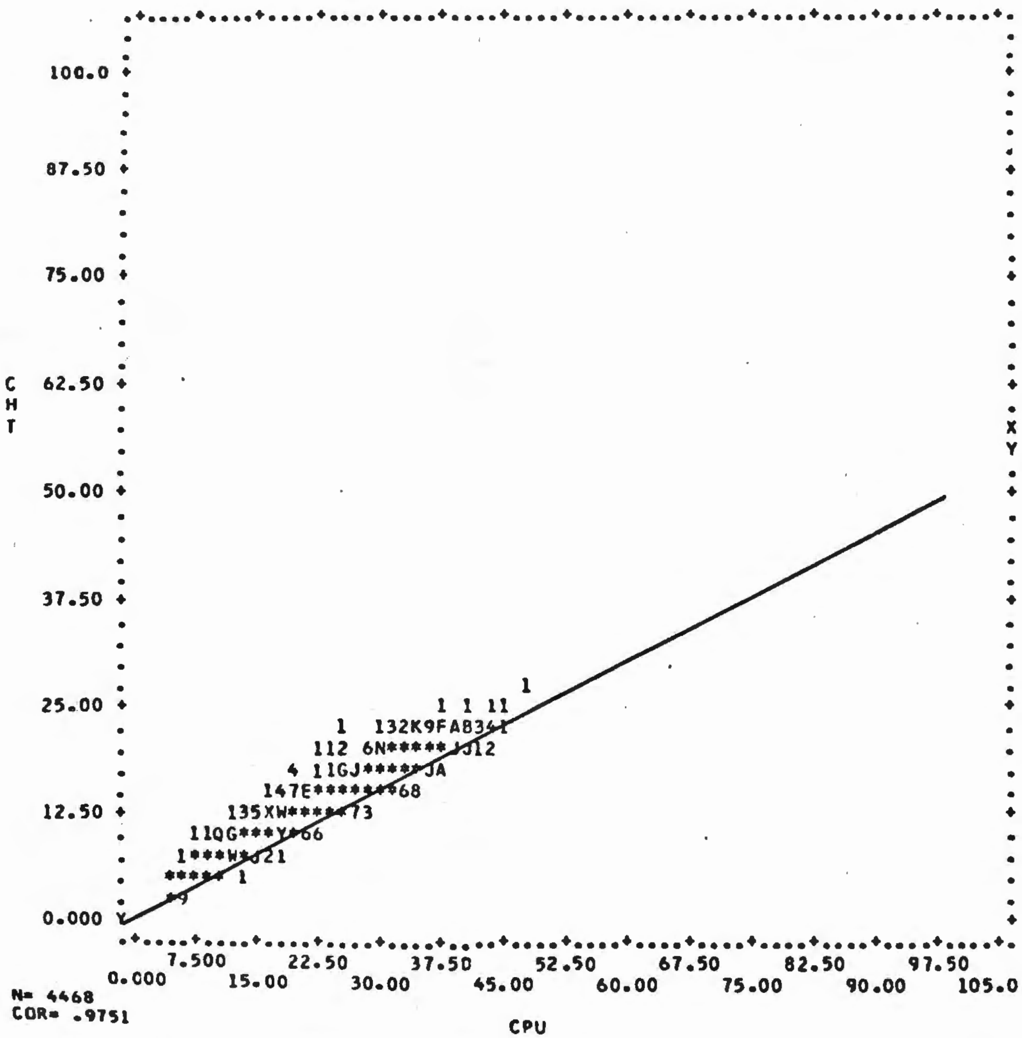
CLEV 2.12 90200 SARC1,TARS=OFF,IOCEOFLO=OFF,2 CE, MEASURED BETWEEN 05/31/82 AND 06/05/82



N= 3890
COR= .9828

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	12.874	5.5891	Y= .50317*X+ 1.6826	1.0673

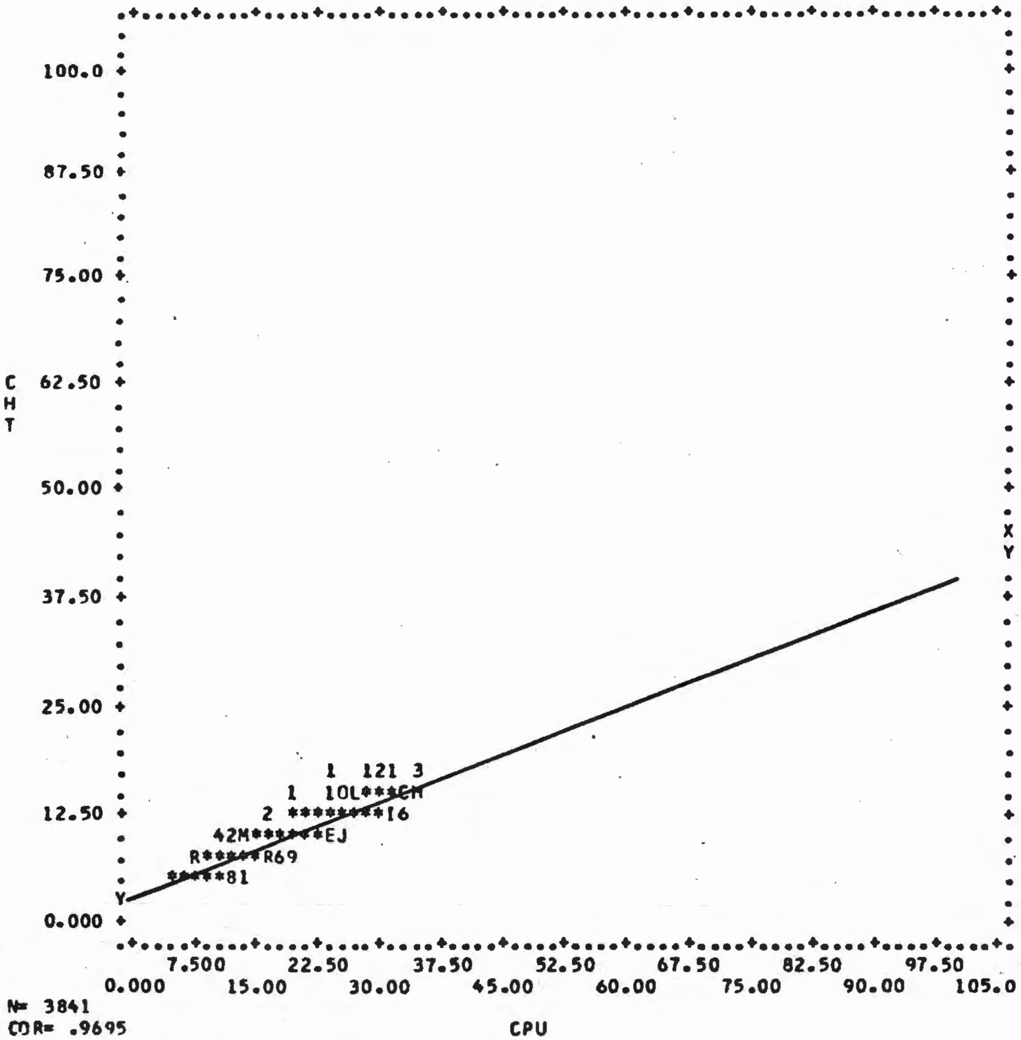
FT WORTH 2.12 90200 SARC1,TARS=OFF,IOCEOFLO=OFF,2 CE, MEASURED BETWEEN 02/08/82 AND 02/13/82



N= 4468
COR= .9751

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	13.172	5.1281	Y= .49511*X+ 1.9888	1.2914

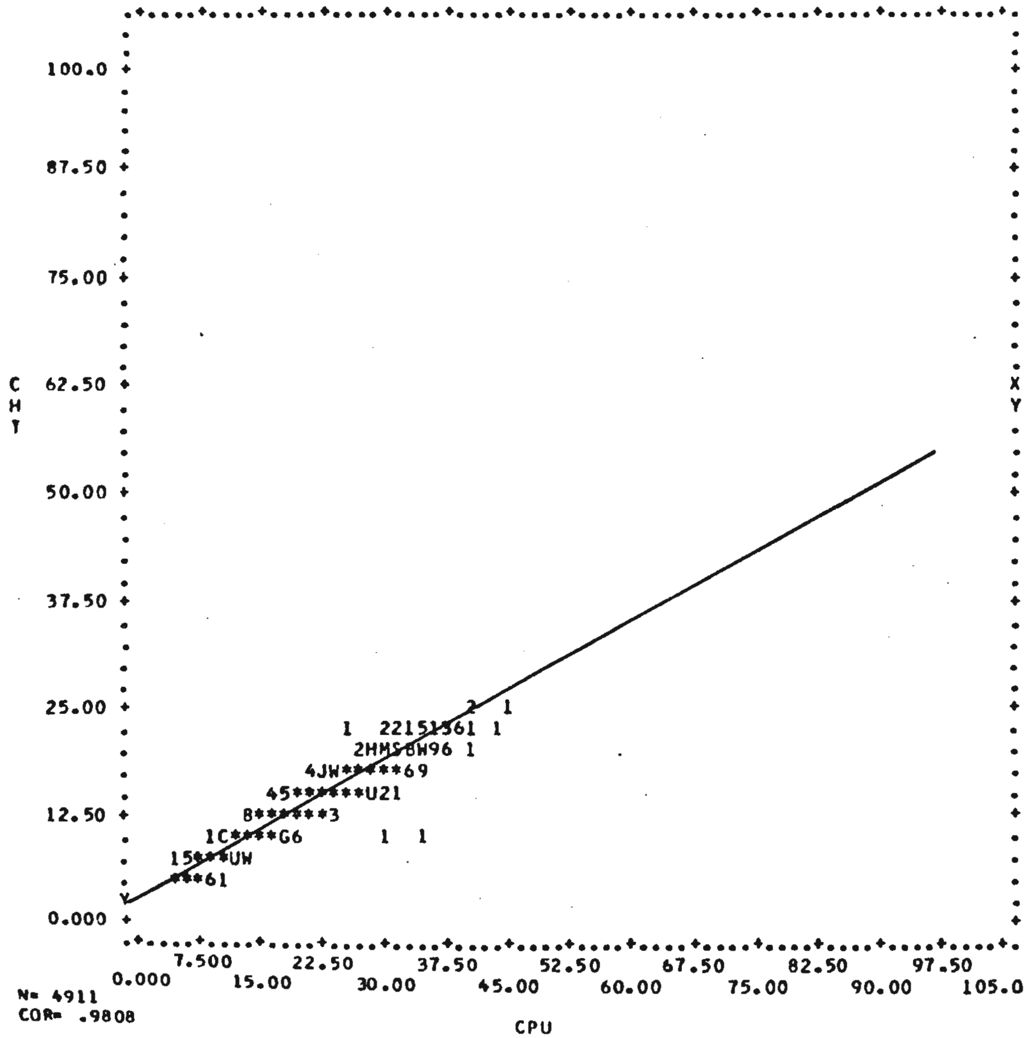
INDIANAPOLIS 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 10/10/82 AND 10/17/82



N= 3841
COR= .9695

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	9.2498	2.9825	Y= .38039*X+ 2.7888	.53388

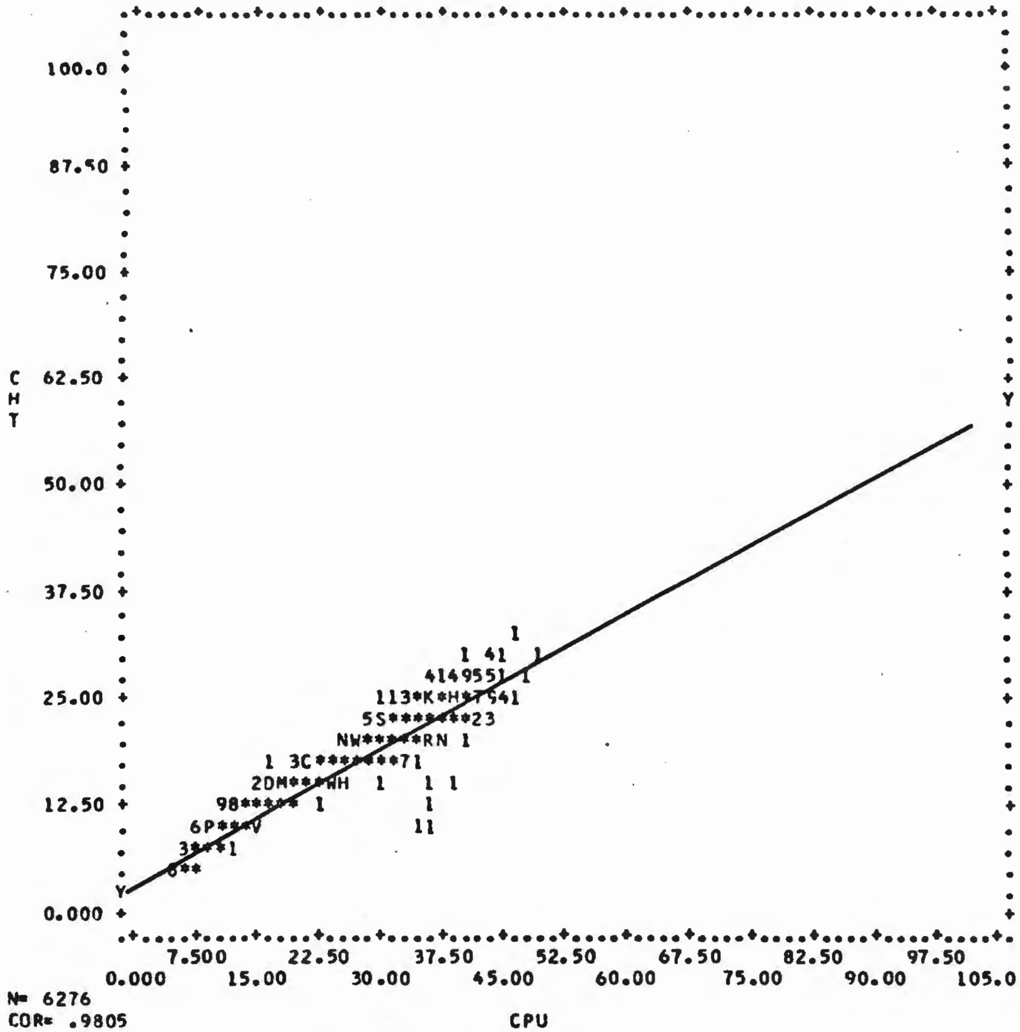
JACKSONVILLE 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 08/23/82 AND 08/27/82



N= 4911
COR= .9808

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	12.252	4.4027	Y= .53503*X+ 2.4940	.73631

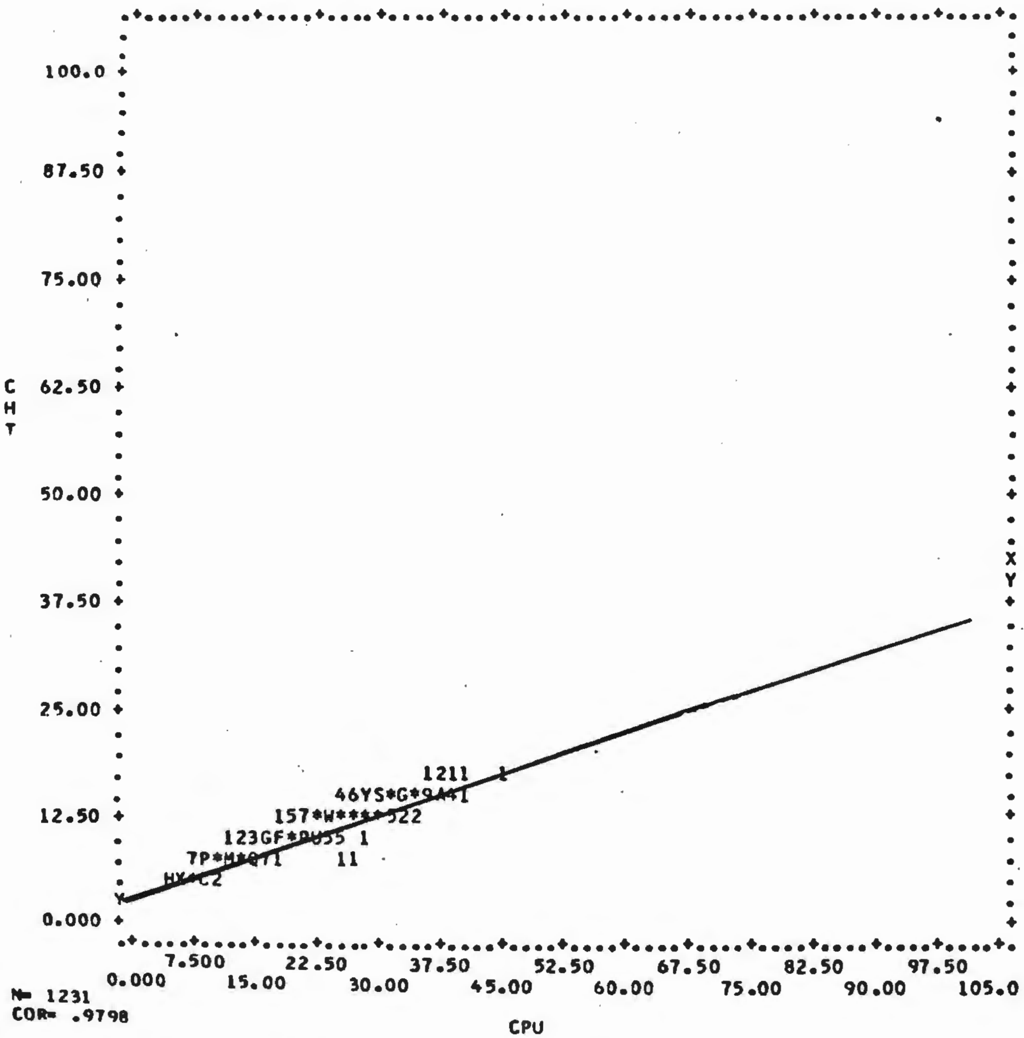
KANSAS CITY 2.12 9020D SARC4.TARS=OFF.IOCEOFLD=CFF.2 CE. MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 6276
COR= .9805

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	16.556	5.4604	Y= .51626*X+ 3.8516	1.1490

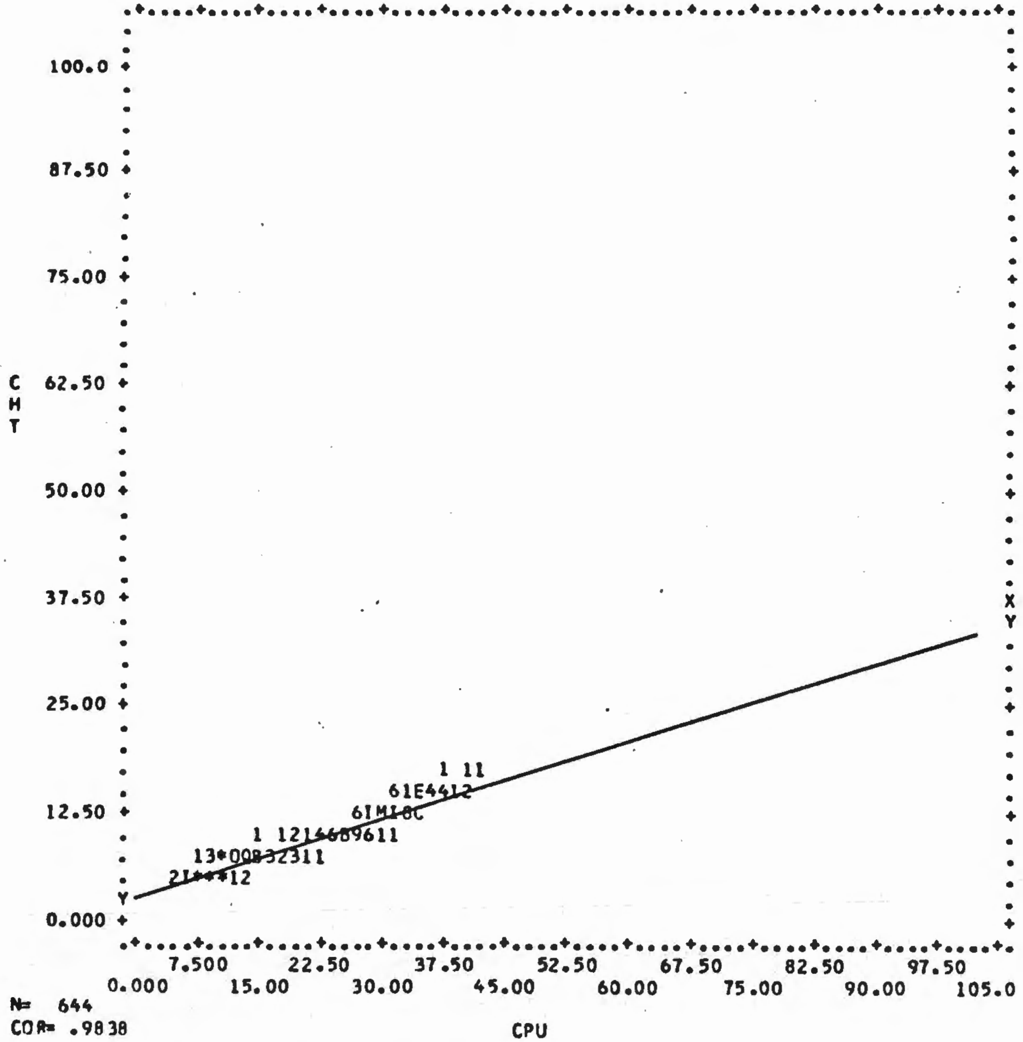
LOS ANGELES 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=CFF,2 CE, MEASURED BETWEEN 08/12/82 AND 08/16/82



N= 1231
COR= .9798

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	10.846	3.1326	Y= .34424*X+ 3.4015	.39225

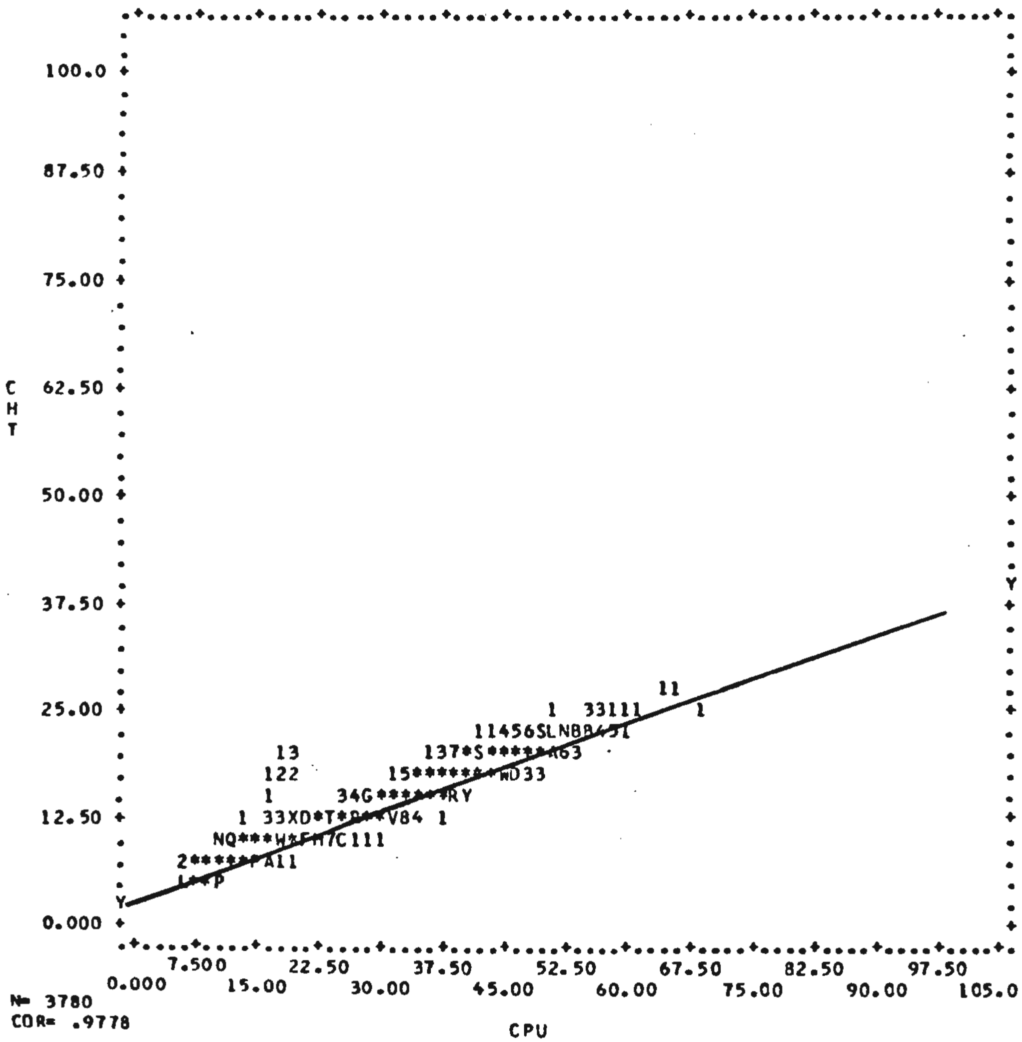
NEW YORK 2.12 9020D SARC20,TARS=7FFC,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 12/27/82 AND 12/31/82



N= 644
COR= .9838

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	7.5542	2.9849	Y= .30753*X+ 3.0163	.28763

WASHINGTON 2.12 9020D SARC4,TARS=ON,IDCEDFLD=OFF,2 CE, MEASURED BETWEEN 10/04/82 AND 10/07/82



N= 3780
COR= .9778

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	13.896	4.8554	Y= .33627*X+ 4.0213	1.0333

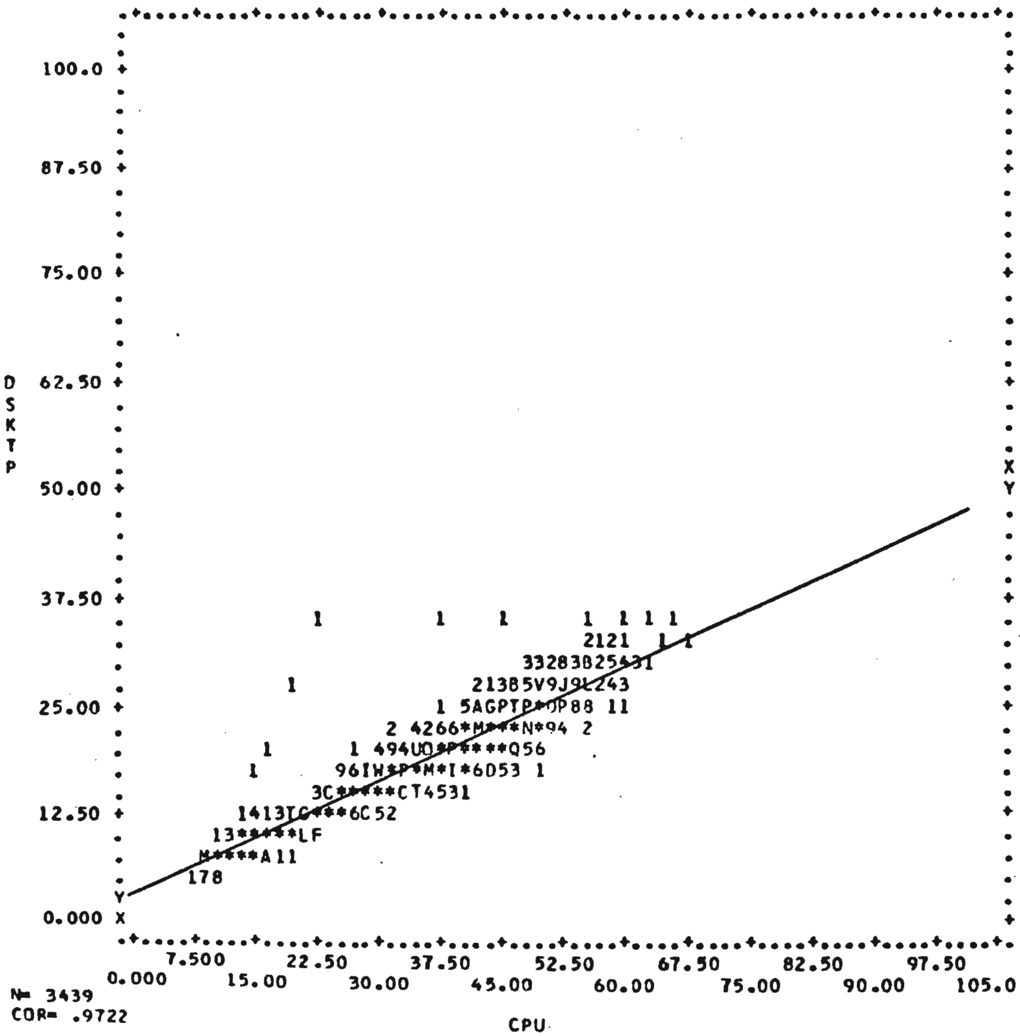
APPENDIX D

SCATTER DIAGRAMS SHOWING AVERAGE DISK/TAPE SELECTOR CHANNEL UTILIZATION AS A FUNCTION OF CENTRAL PROCESSING UTILIZATION

This appendix is identical to appendix C except that it applies to the two selector channels dedicated to disks and tapes only. The average "disk/tape" selector channel utilization is computed by dividing by 2 the sum of all the observed "disk/tape" selector channel utilizations. All values are in percent.

The site data appears in the following order:

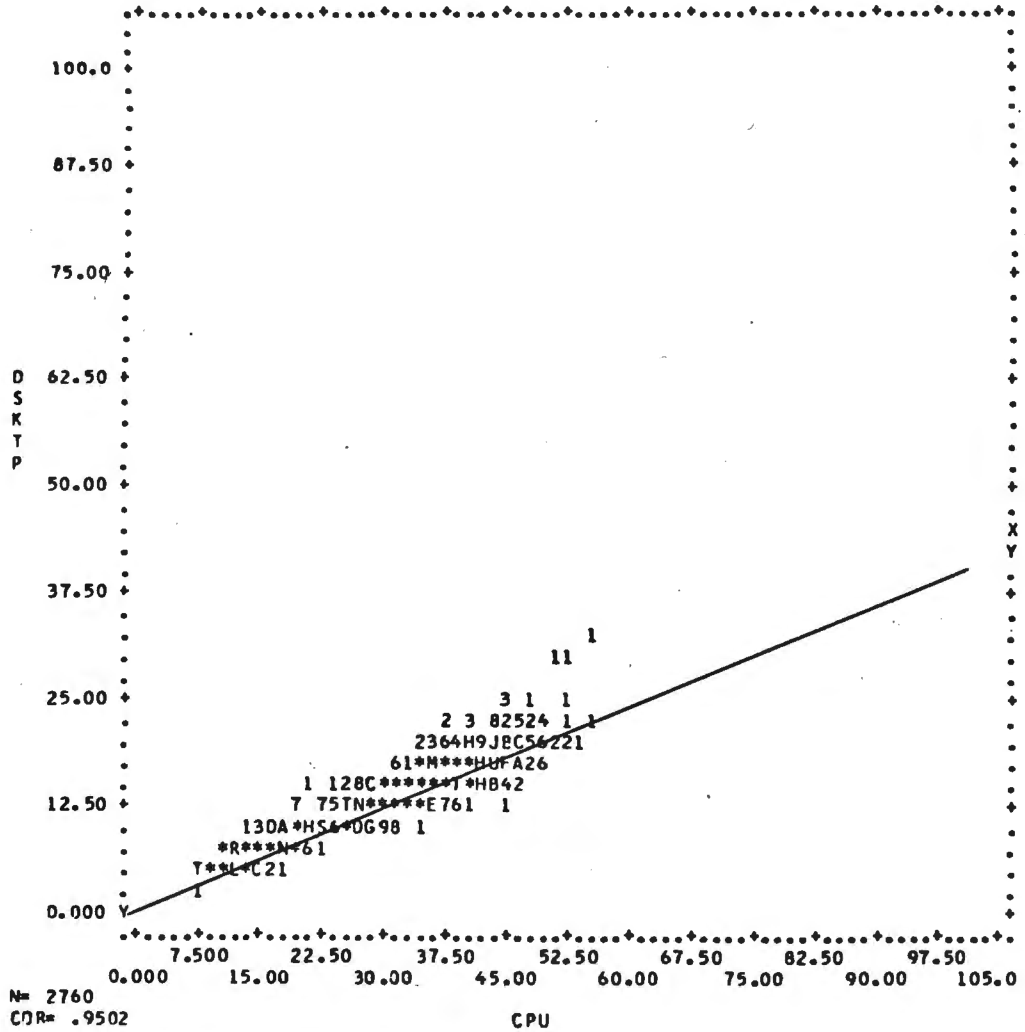
ALBUQUERQUE 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 3439
COR= .9722

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	15.488	6.6119	Y= .45259*X+ 2.1485	2.3940

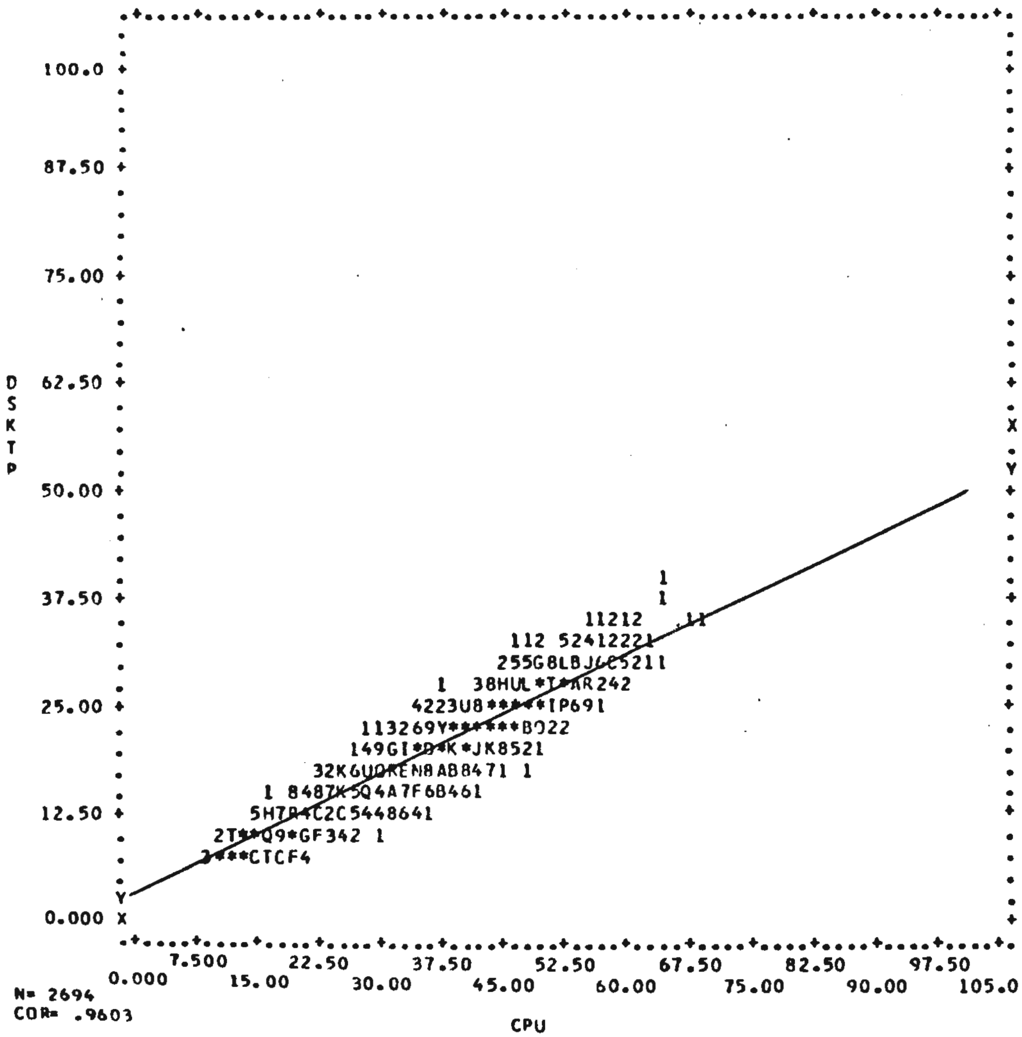
BOSTON 2.12 9020A SARC1,TARS=OFF,IDCEOFLD=ON,3 CE, MEASURED BETWEEN 06/21/82 AND 07/03/82



N= 2760
COR= .9502

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	12.571	4.2818	Y= .37706*X+ 1.7317	1.7797

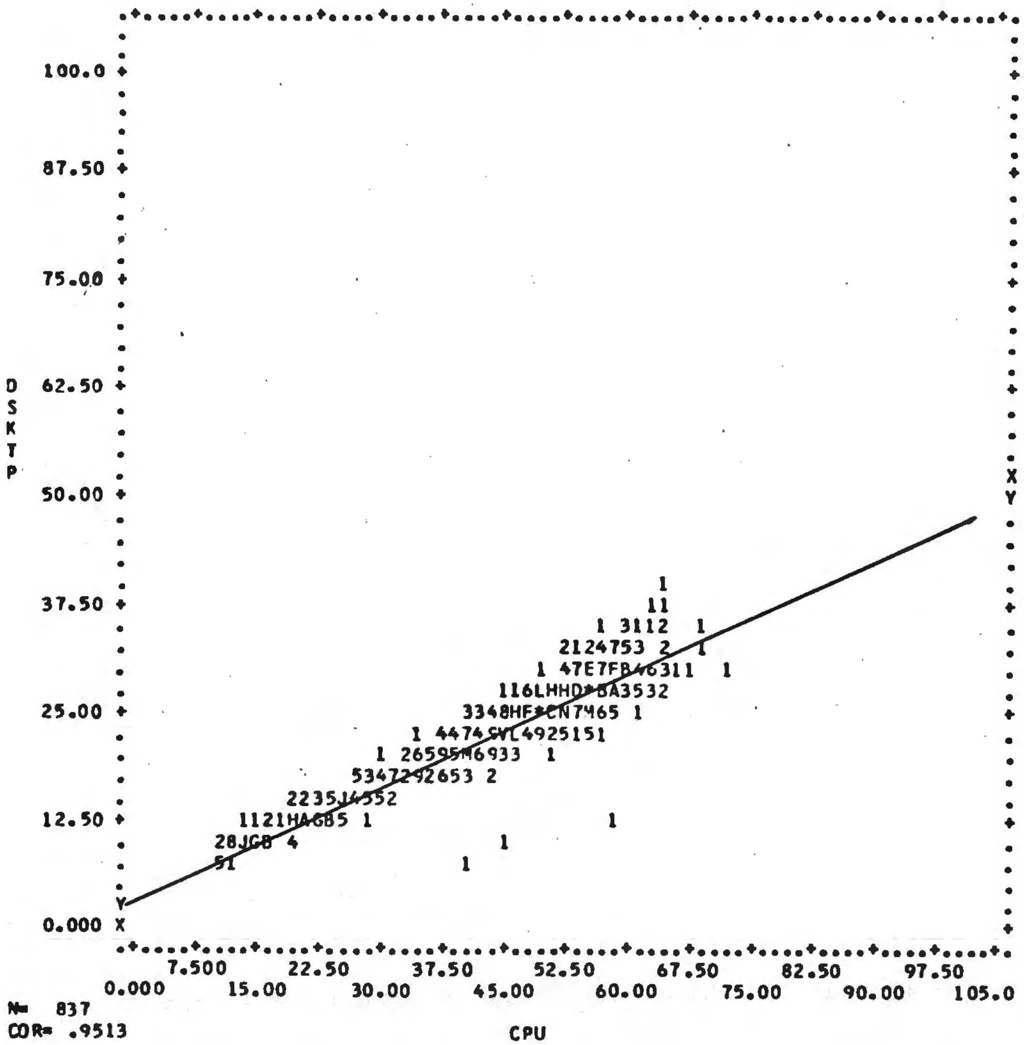
DEN 2.12 "A" SARC4 (RCOPS REDUCE TO UDS SARC1),TARS=OFF, OFLD=ON,3 CE,MEAS BETWEEN 8/4 TO 8/9/82



N= 2694
COR= .9603

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	19.014	7.1753	Y= .48260*X+ 2.1388	4.0052

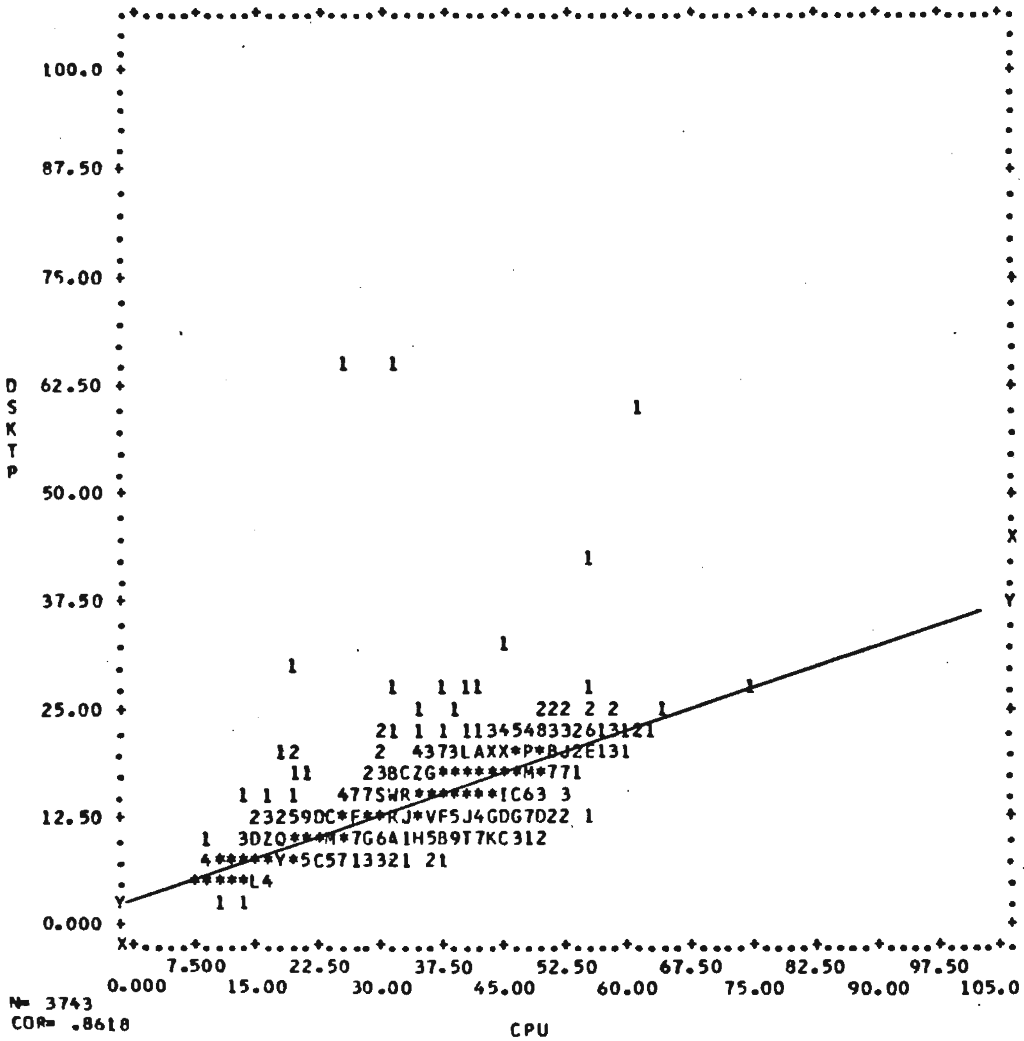
HOUSTON 2.12 9020A SARC2,TARS=0000,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 11/5/82 AND 11/10/82



N= 837
COR= .9513

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	22.320	6.5169	Y= .43245*X+ 3.5853	4.0408

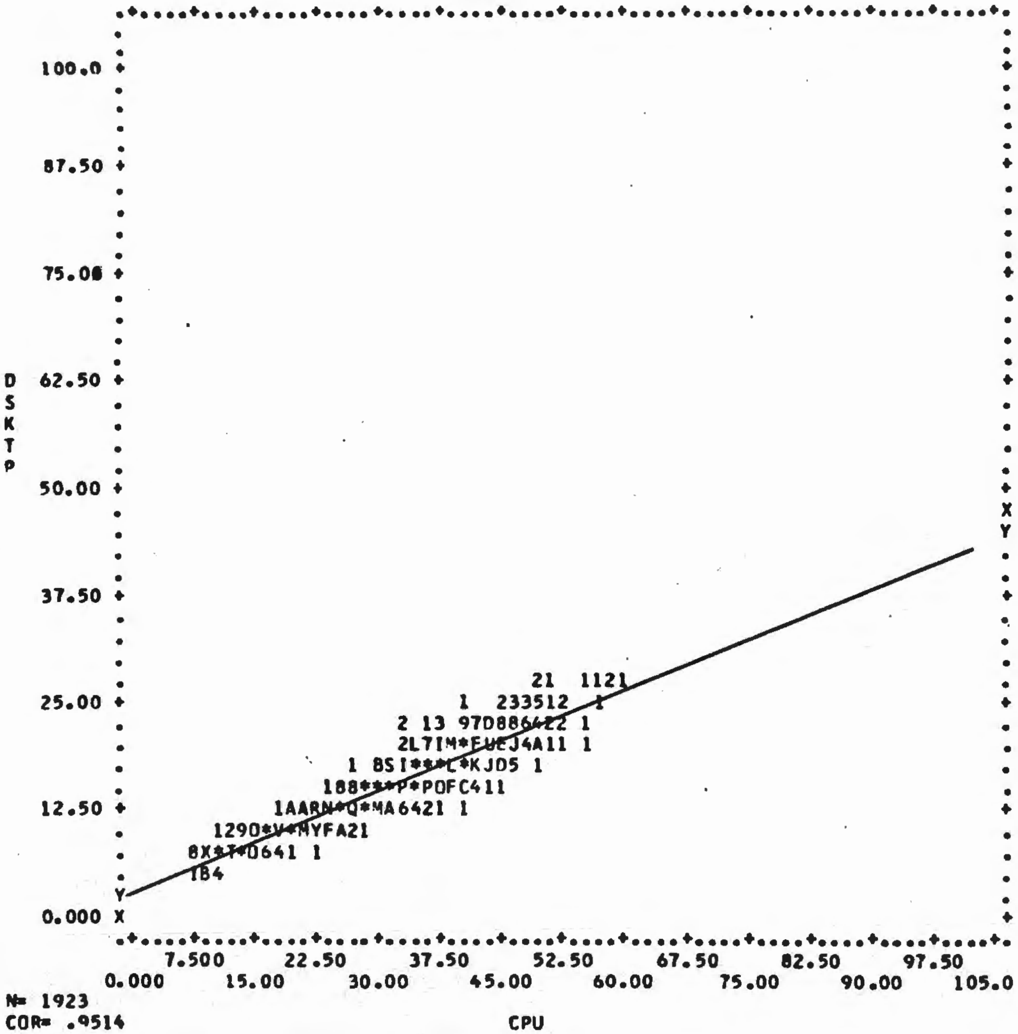
MEMPHIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82



N= 3743
COR= .8618

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	12.729	5.0413	Y= .32477*X+ 2.8025	6.5406

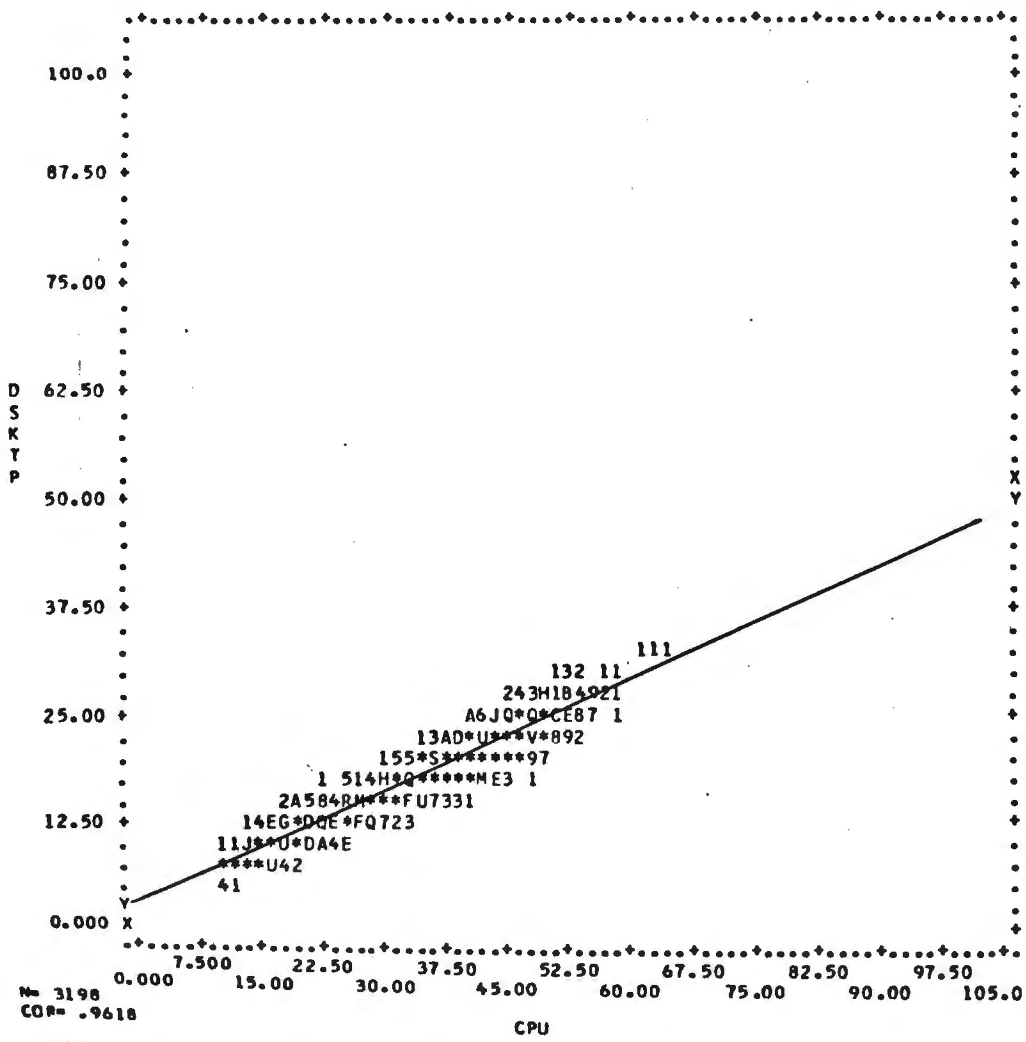
MIAMI 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/08/82 AND 06/12/82



N= 1923
COR= .9514

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	14.051	4.5708	Y= .38538*X+ 2.9484	1.9818

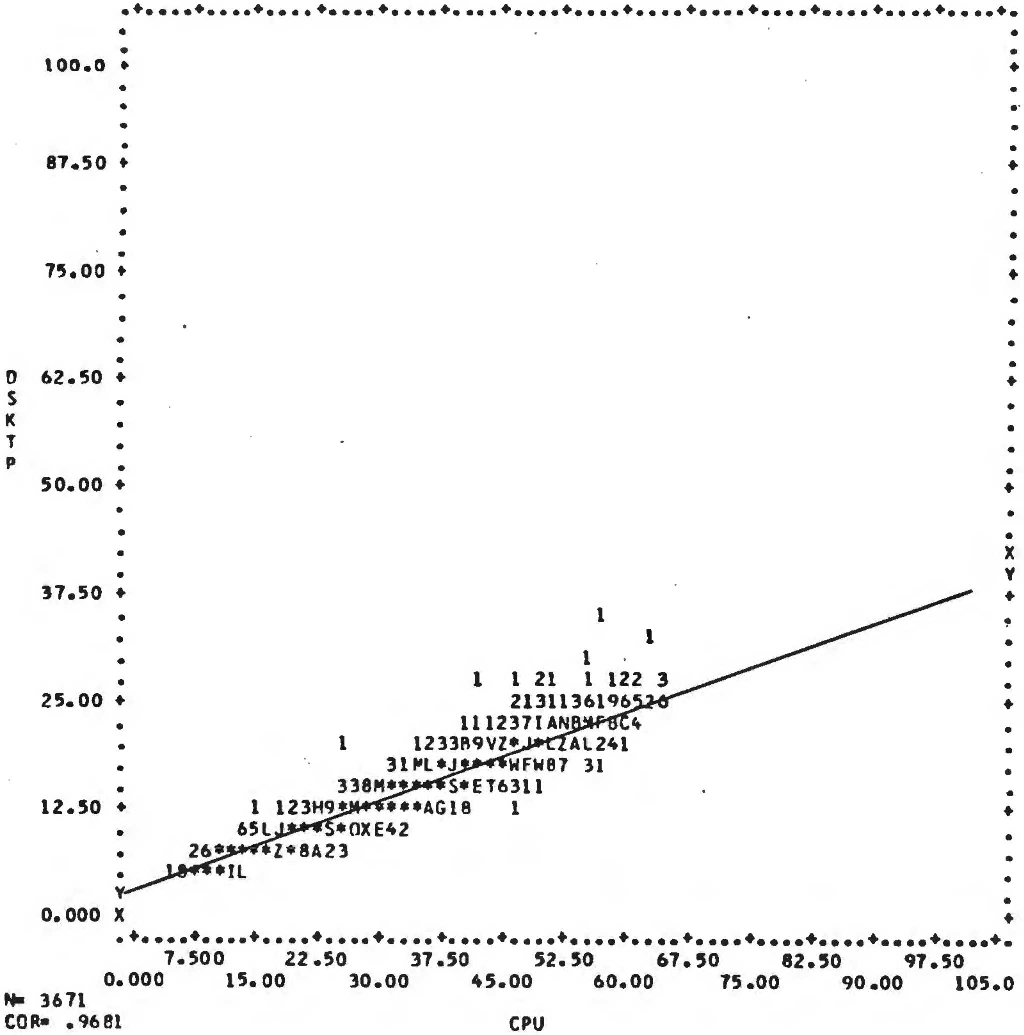
MINNEAPOLIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLO=ON,3 CE, MEASURED BETWEEN 10/18/82 AND 10/23/82



N= 3198
COR= .9618

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	17.078	5.4638	Y= .43590*X+ 2.4603	2.2360

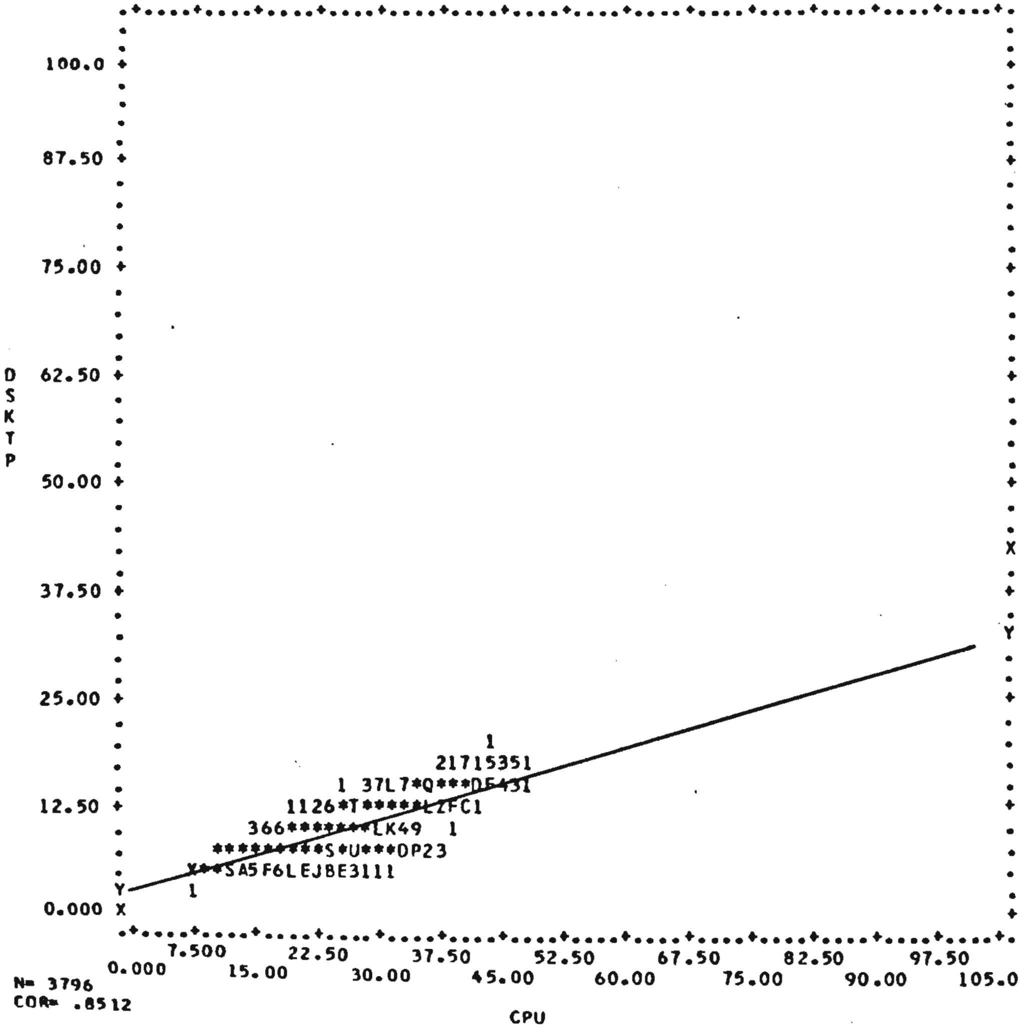
OAKLAND 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 08/15/82 AND 08/22/82



N= 3671
COR= .9681

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	12.818	5.1392	Y= .35744*X+ 2.1874	1.6590

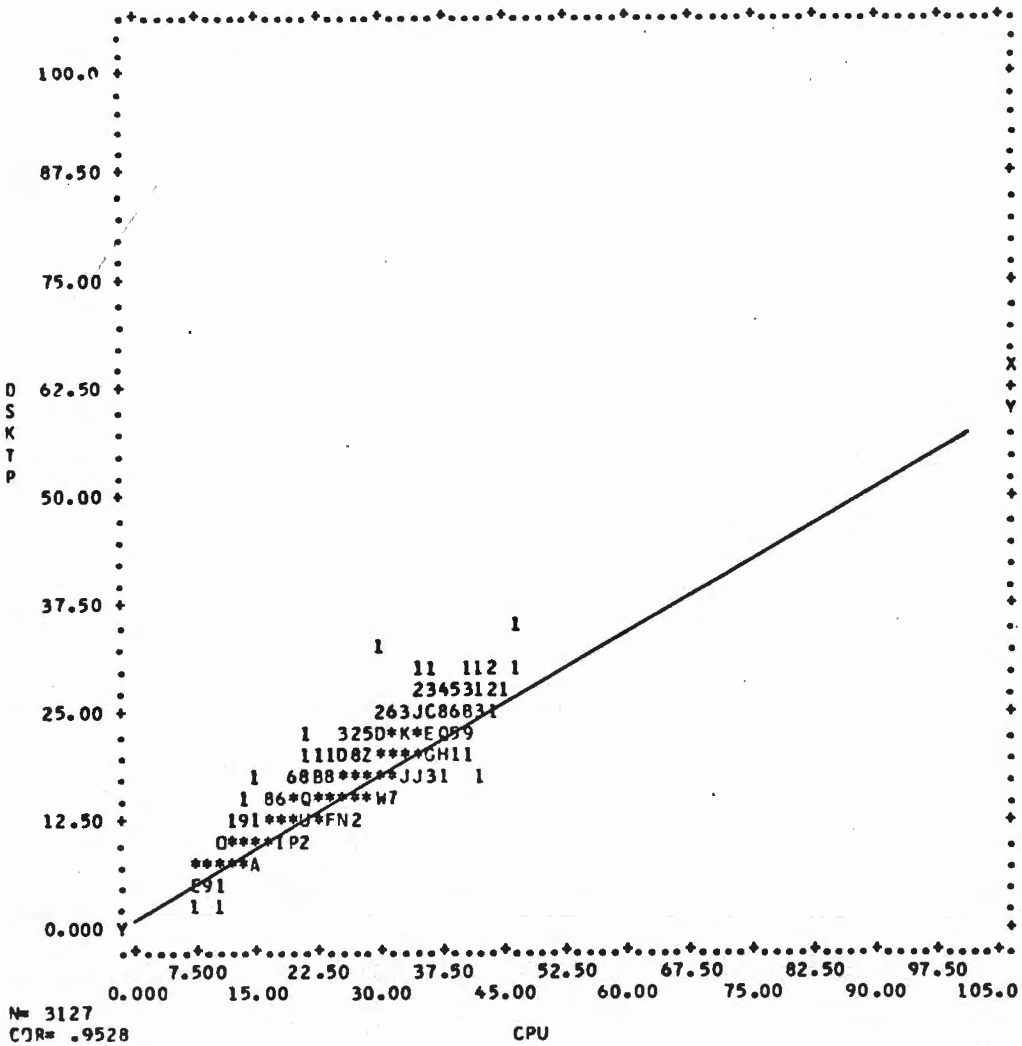
SALT LAKE 2.12 9020A SARC1.TARS=OFF.IOCEOFLO=ON.3 CE. MEASURED BETWEEN 05/23/82 AND 05/28/82



N= 3796
COR= .8512

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	9.5028	2.8183	Y= .28081*X+ 2.8196	2.1880

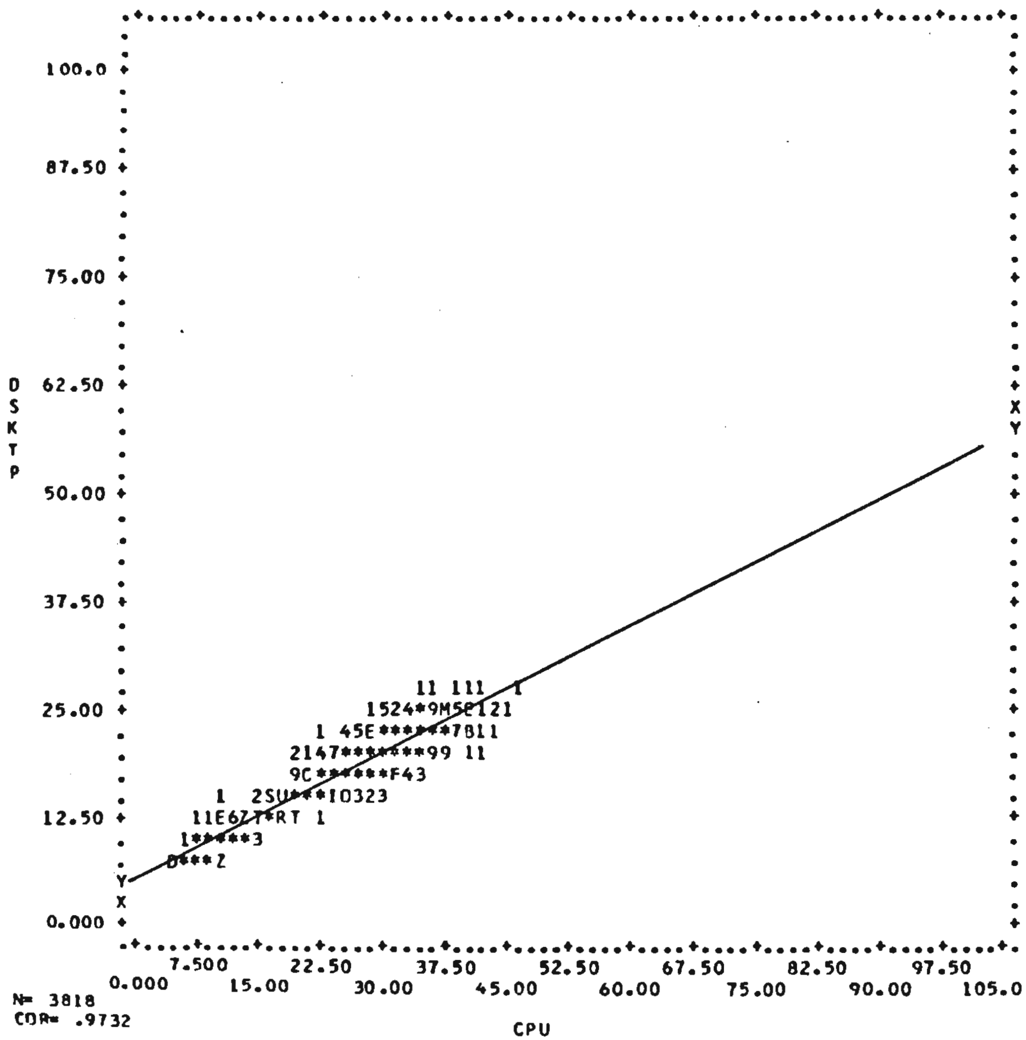
SEATTLE 2.12 9020A SARC4,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/07/82 AND 06/12/82



N= 3127
COR= .9528

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	14.525	5.2757	Y= .55553*X+ 1.9121	2.5673

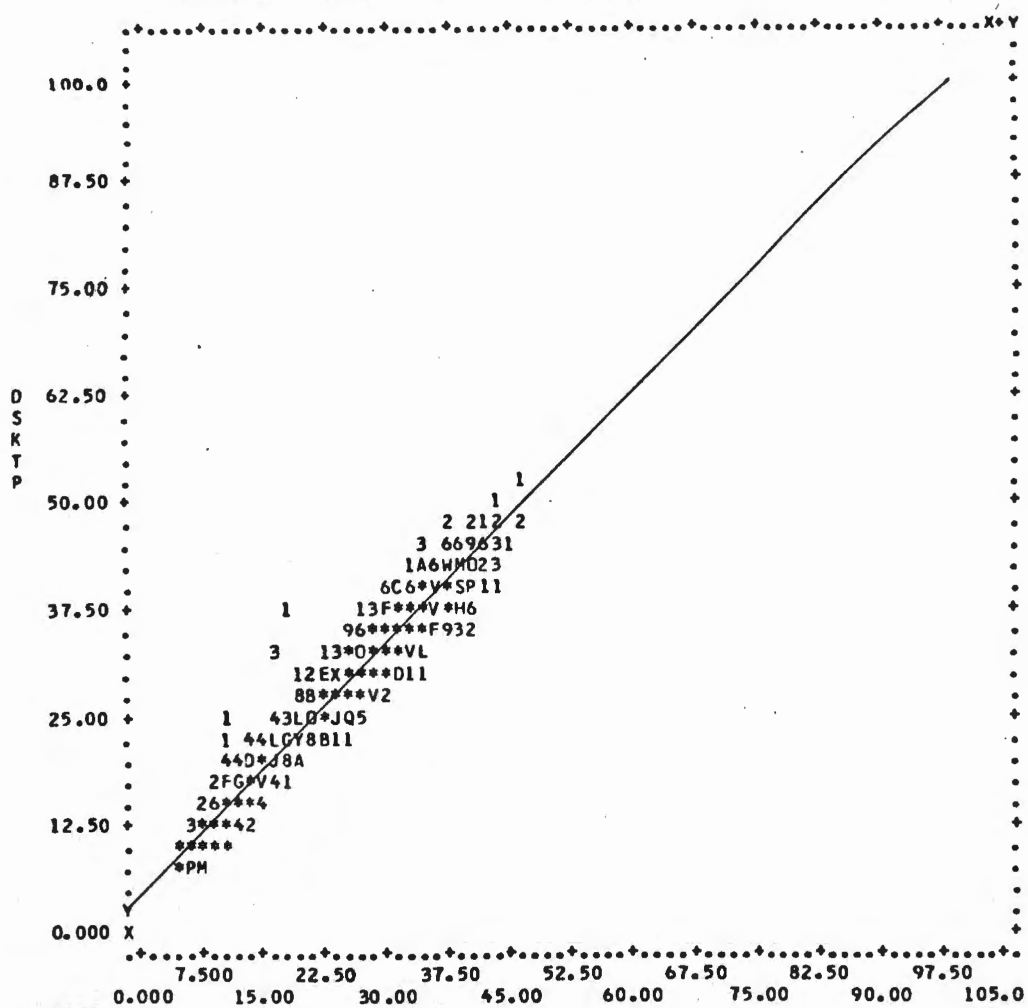
ATLANTA 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82



N= 3818
COR= .9732

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	16.343	5.1753	Y= .50394*X+ 4.7464	1.4177

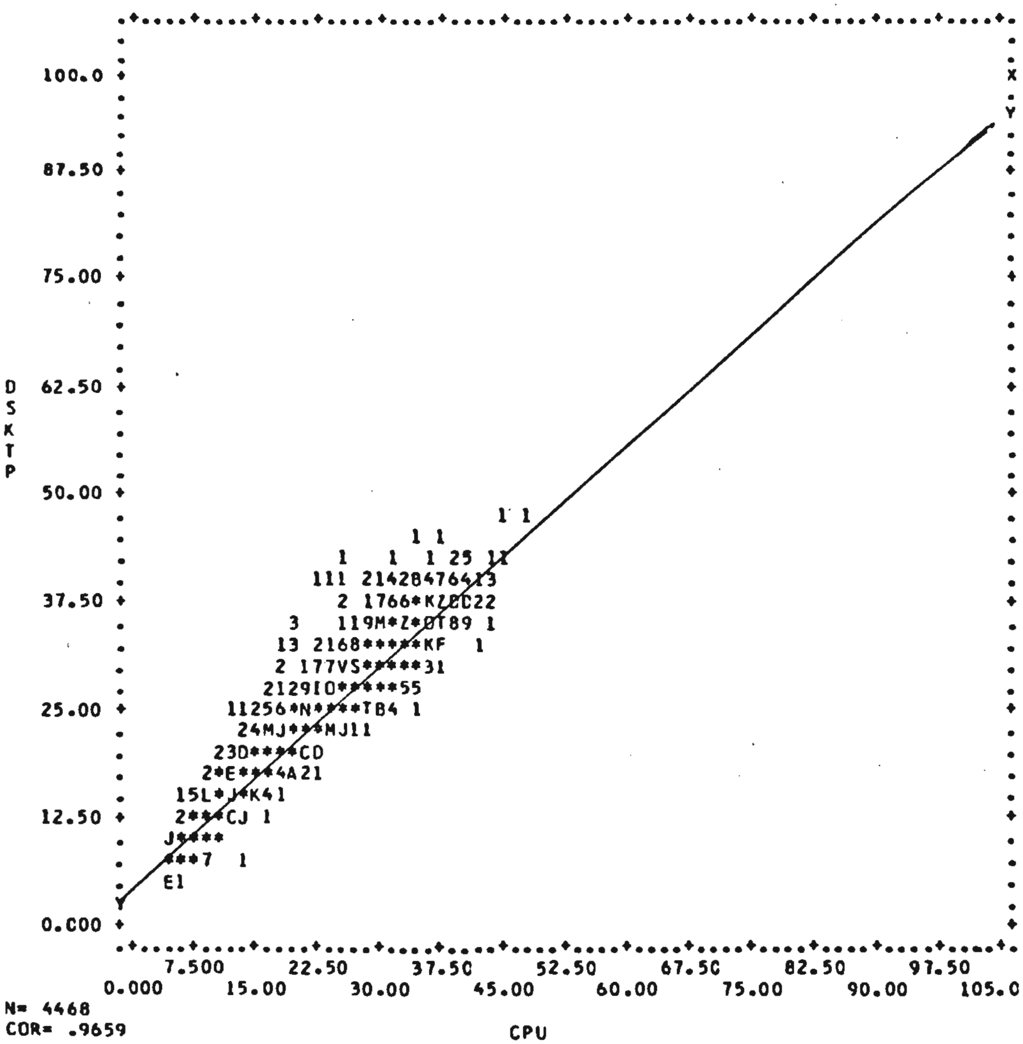
CLEV 2.12 9020D SARC1,TARS=CFF,IOCEOFLD=OFF.2 CE, MEASURED BETWEEN 05/31/82 AND 06/05/82



N= 3890
COR= .9817

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	25.321	10.893	Y= .97961*X+ 3.5337	4.2980

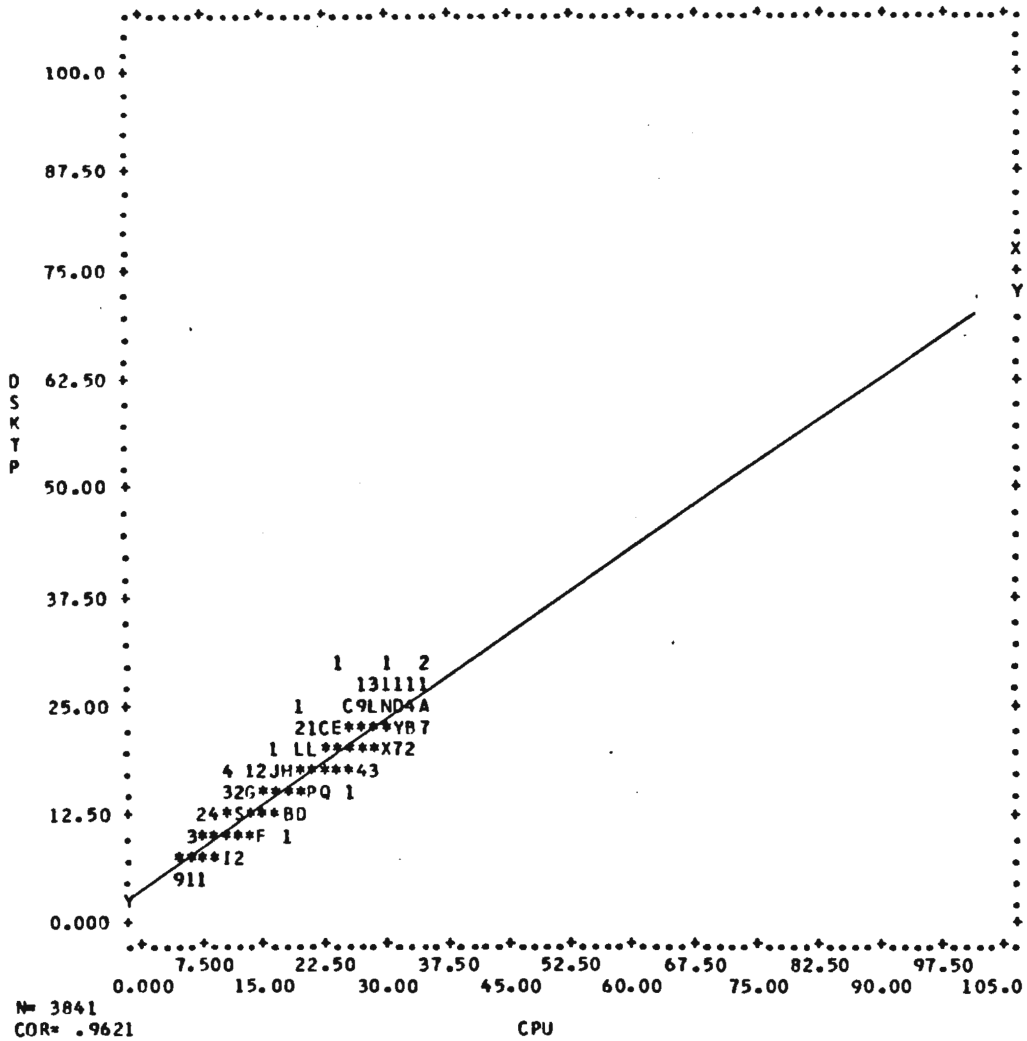
FT WORTH 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 02/08/82 AND 02/13/82



N= 4468
COR= .9659

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	23.957	8.9774	Y= .85849*X+ 4.5652	5.4108

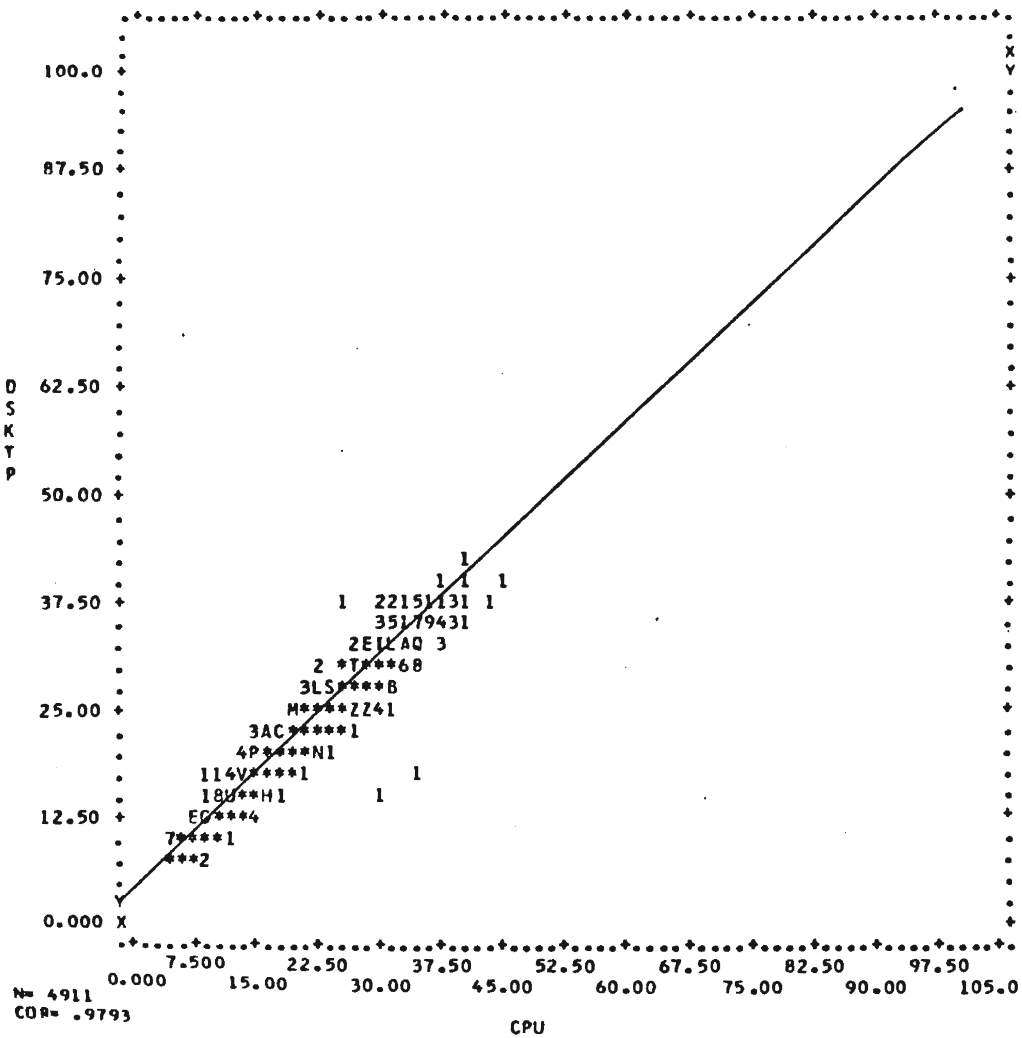
INDIANAPOLIS 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 10/10/82 AND 10/17/82



N= 3841
COR= .9621

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	14.586	5.1061	Y= .64622*X+ 3.6100	1.9406

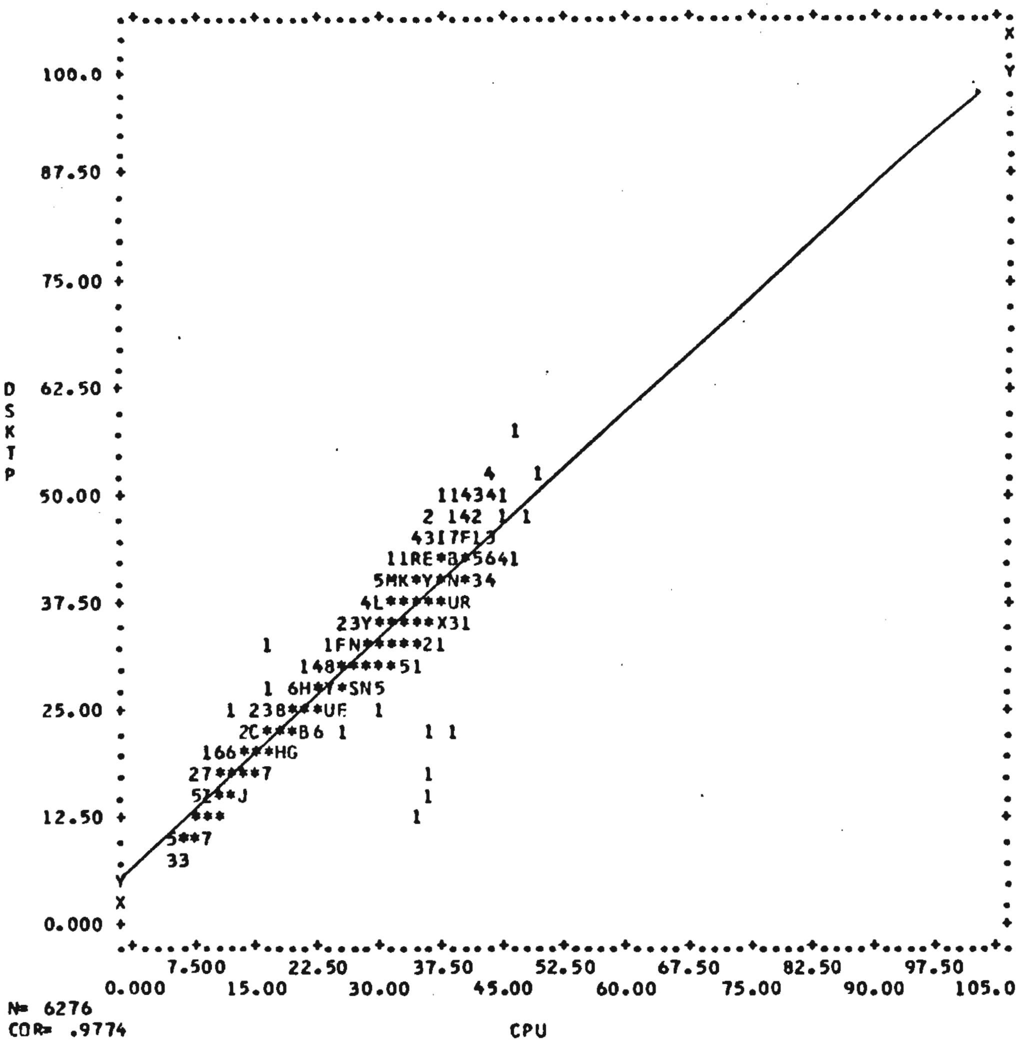
JACKSONVILLE 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 08/23/82 AND 08/27/82



N= 4911
COR= .9793

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	19.455	7.4292	Y= .90138*X+ 3.0154	2.2642

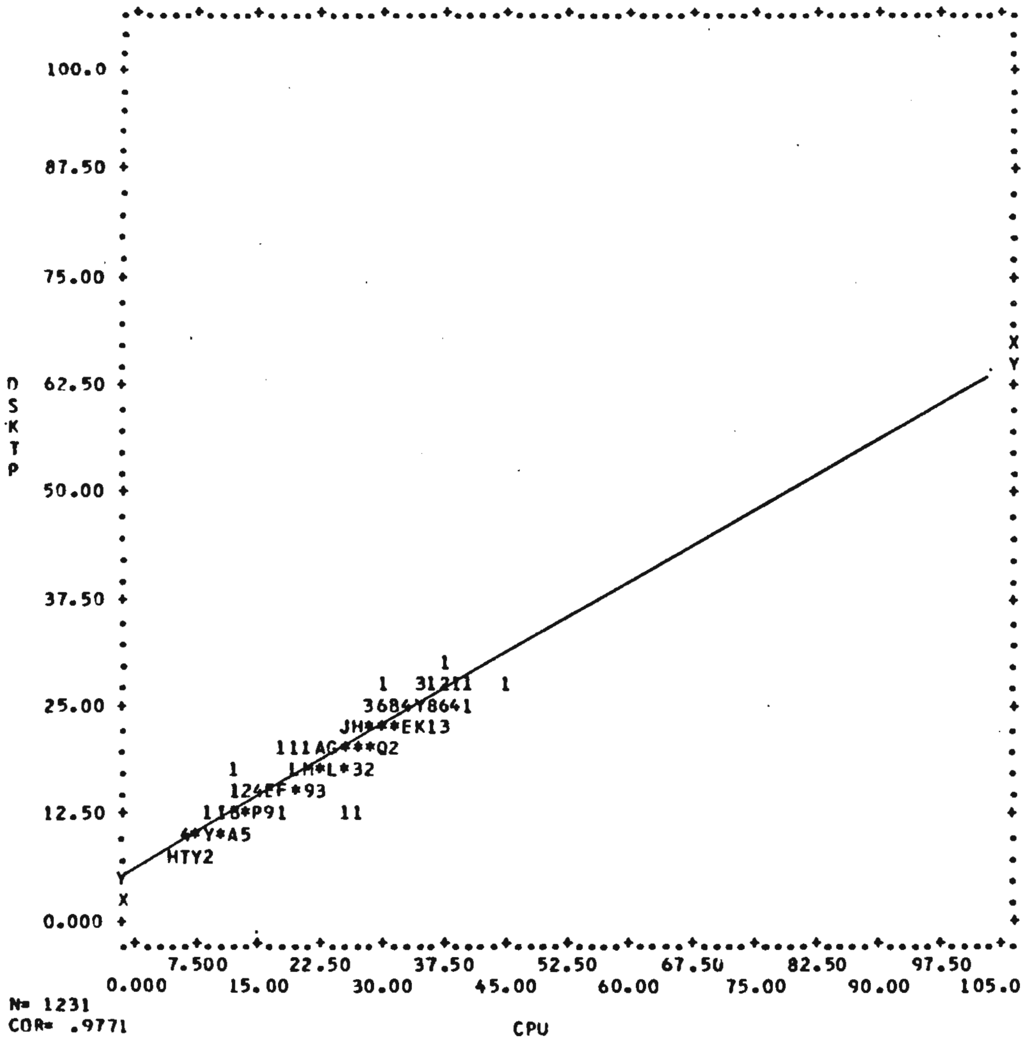
KANSAS CITY 2.12 9020D SARC4,TARS=OFF,IOCEOFLO=OFF,2 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 6276
COR= .9774

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	27.553	9.5282	Y= .89796*X+ 5.4557	4.0584

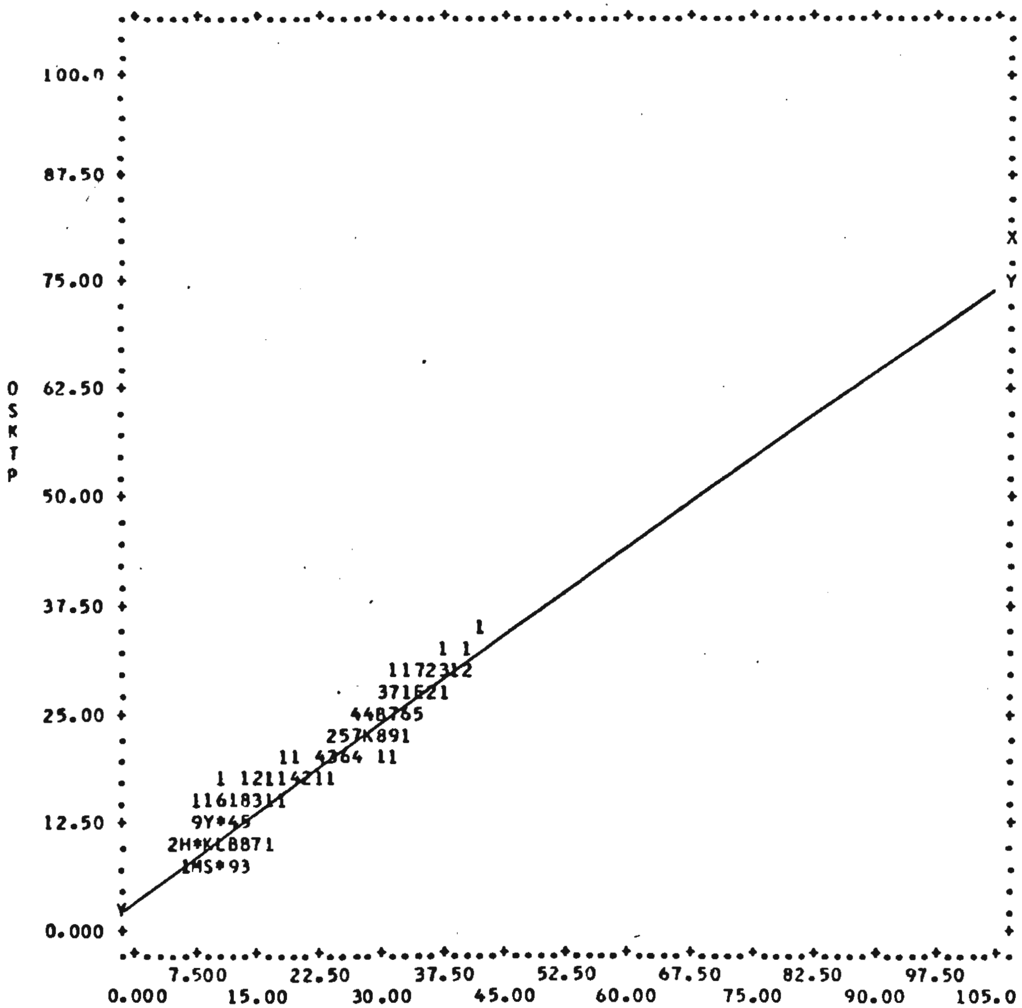
LOS ANGELES 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 08/12/82 AND 08/16/82



N= 1231
COR= .9771

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	17.201	5.2641	Y= .57688*X+ 4.7248	1.2540

NEW YORK 2.12 9020D SARC20,TARS=7FFC,IOCEOFLD=OFF,1 CE, MEASURED BETWEEN 12/27/82 AND 12/31/82

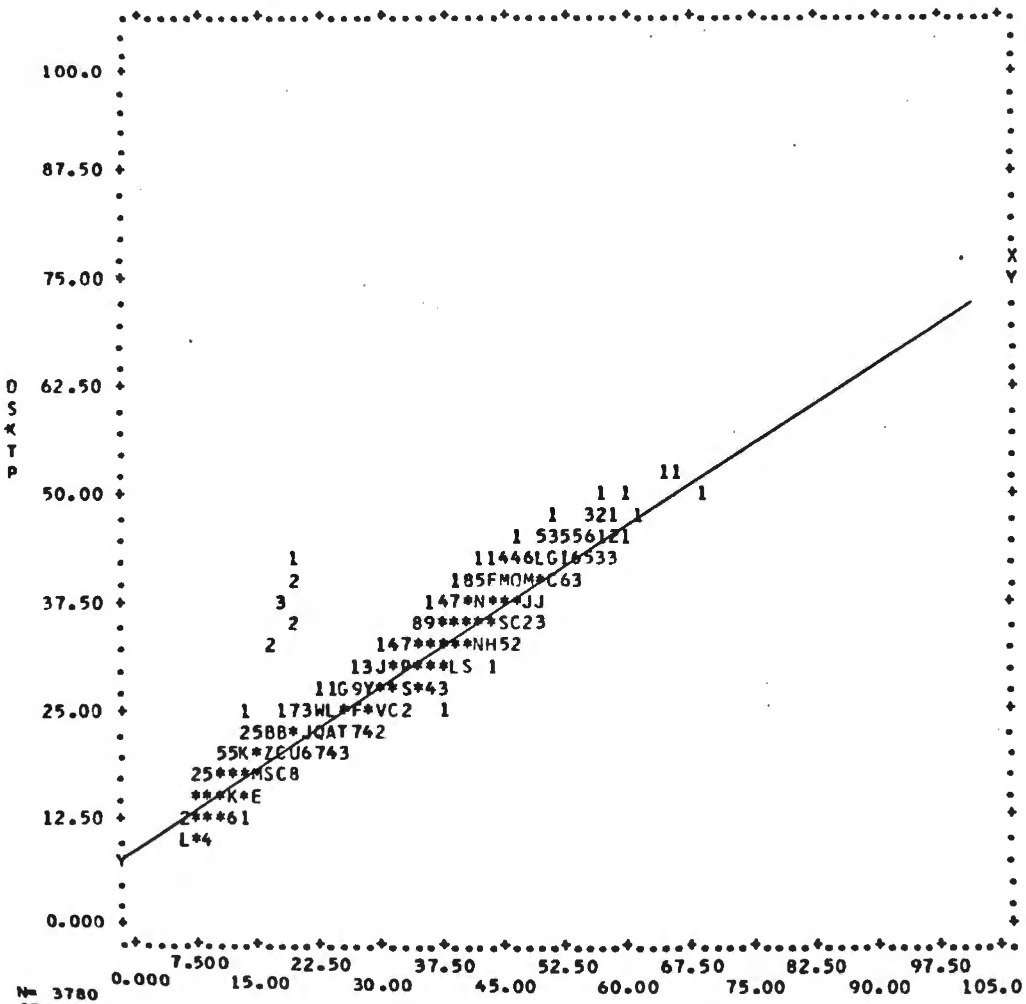


N= 644
COR= .9528

CPU

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	14.040	6.5672	Y= .65533*X+ 4.3703	3.9784

WASHINGTON 2.12 90200 SARC4,TARS=ON,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 10/04/82 AND 10/07/82



N= 3780
COR= .9757

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	27.175	9.1887	Y= .63499*X+ 8.5292	4.0536

APPENDIX E

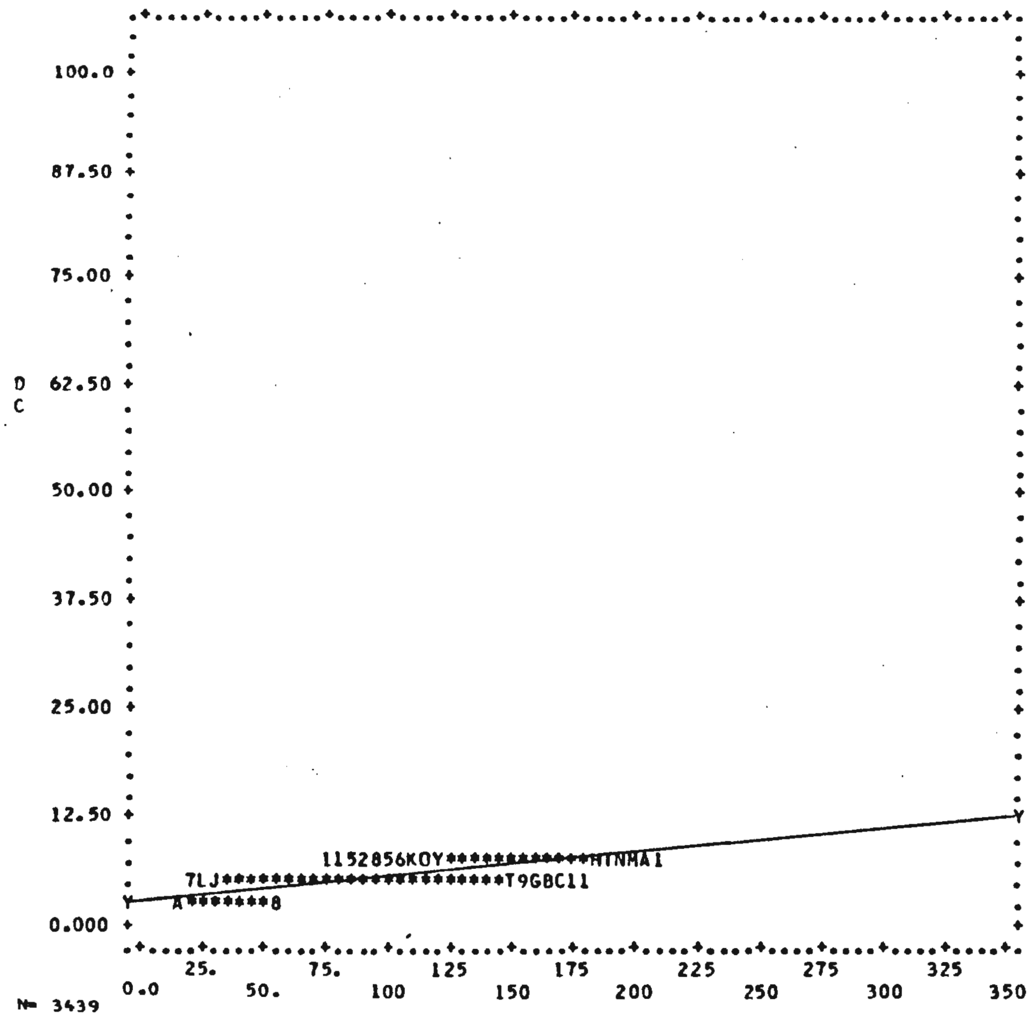
SCATTER DIAGRAMS SHOWING AVERAGE DISPLAY SELECTOR CHANNEL UTILIZATION AS A FUNCTION OF TRACK LOAD

Appendix E is similar to appendix D except that it shows the average of the "display" selector channel utilization as a function of track load. The average is computed by dividing by 2 the sum of all the observed "display" selector channel utilizations.

The sites appear in the following order:

Site	Computer System	Page Number
Albuquerque	9020-A	E-2
Boston	9020-A	E-3
Denver	9020-A	E-4
Houston	9020-A	E-5
Memphis	9020-A	E-6
Miami	9020-A	E-7
Minneapolis	9020-A	E-8
Oakland	9020-A	E-9
Salt Lake	9020-A	E-10
Seattle	9020-A	E-11
Atlanta	9020-D	E-12
Cleveland	9020-D	E-13
Fort Worth	9020-D	E-14
Indianapolis	9020-D	E-15
Jacksonville	9020-D	E-16
Kansas City	9020-D	E-17
Los Angeles	9020-D	E-18
New York	9020-D	E-19
Washington	9020-D	E-20

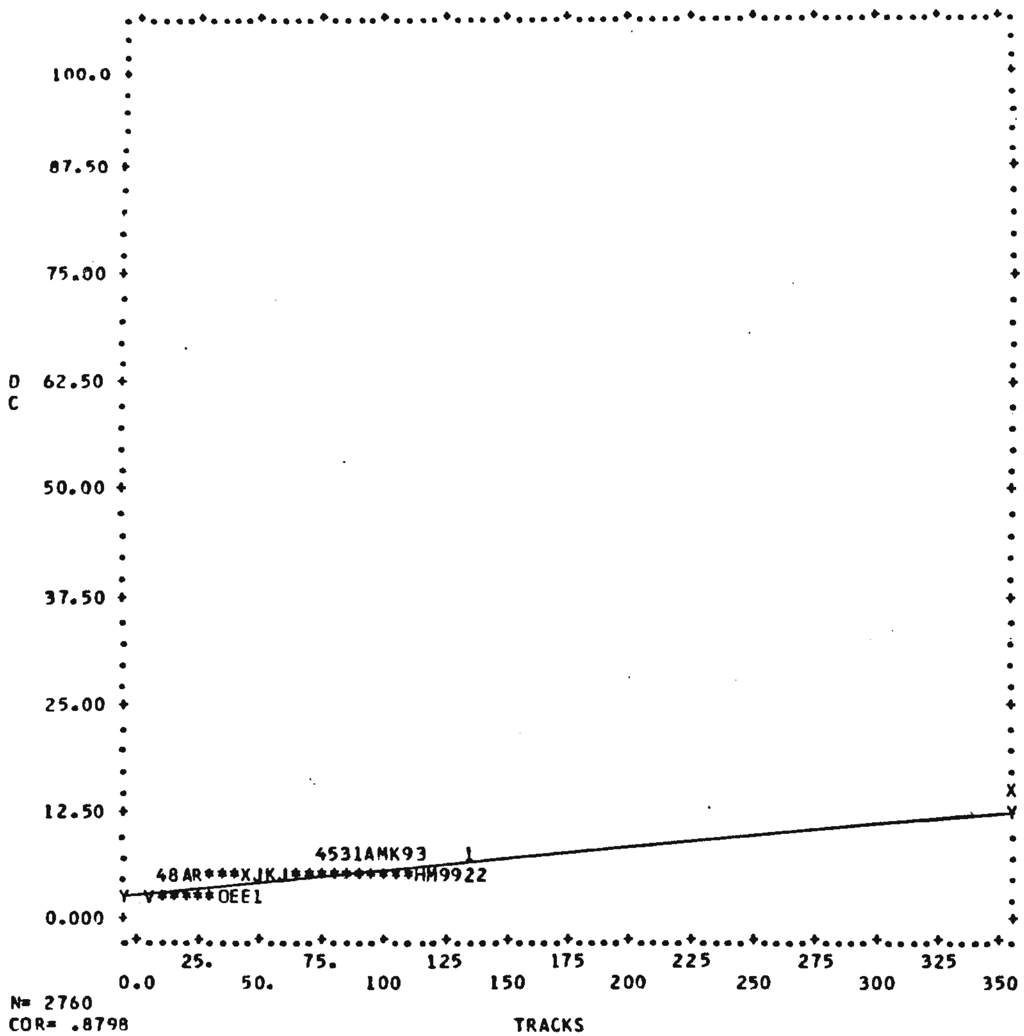
ALBUQUERQUE 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 3439
COR= .9315

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.2822	1.3602	Y= .02479*X+ 2.8300	.24498

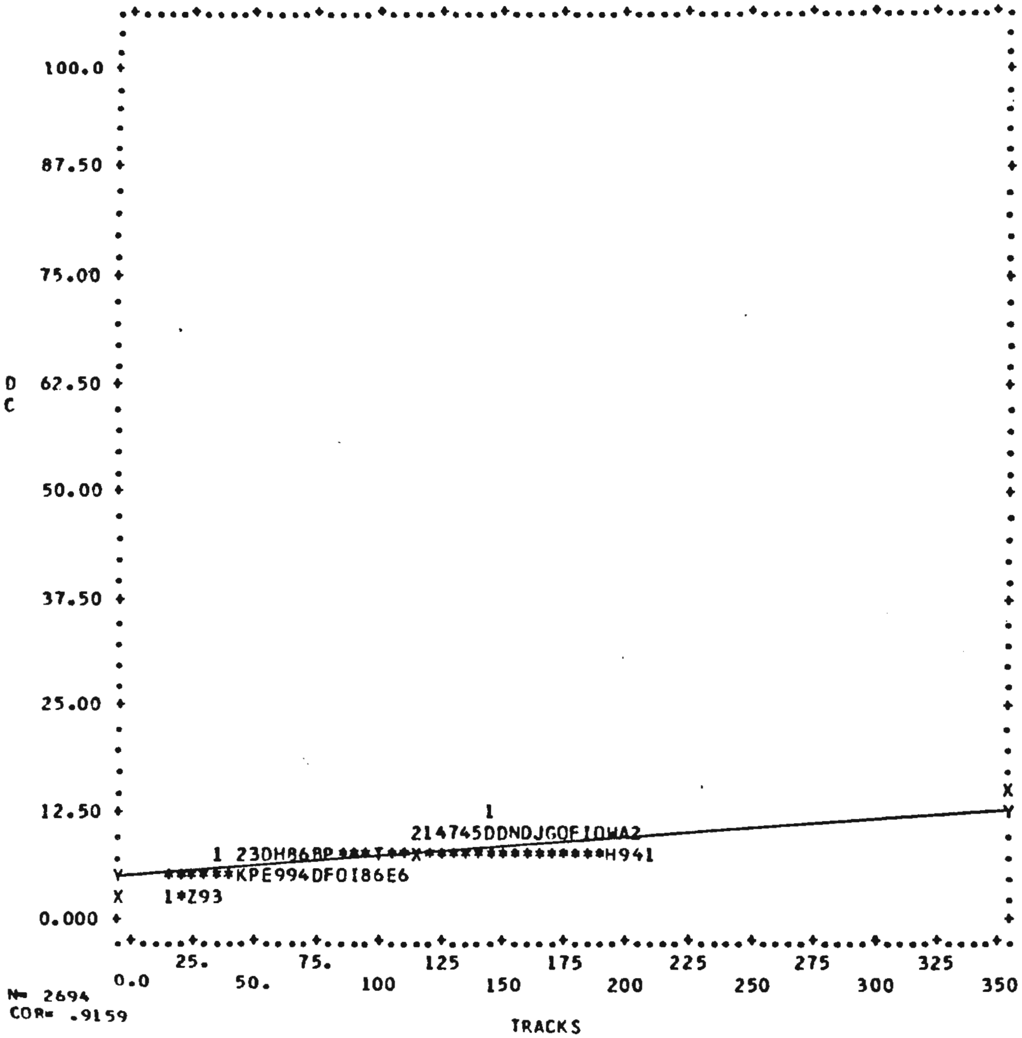
BOSTON 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 06/21/82 AND 07/03/82



N= 2760
COR= .8798

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	4.7432	1.0050	Y= .02680*X+ 2.9320	.22823

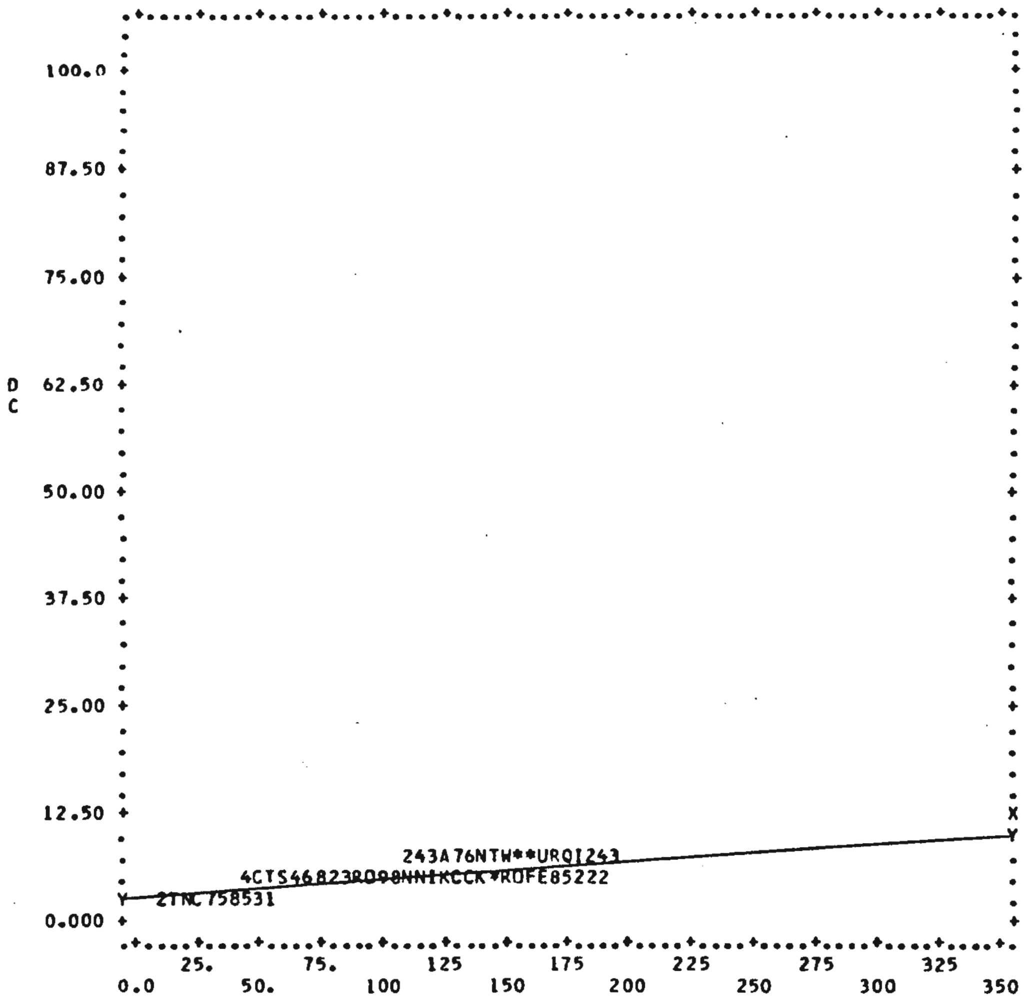
DEN 2.12 "A" SARC4 (RCOPS REDUCE TO UDS SARC1),TARS=OFF, OFLD=ON,3 CE,MEAS BETWEEN 8/4 TO 8/9/82



N= 2694
COR= .9159

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	6.8962	1.6756	Y= .02635*X+ 4.0243	.45253

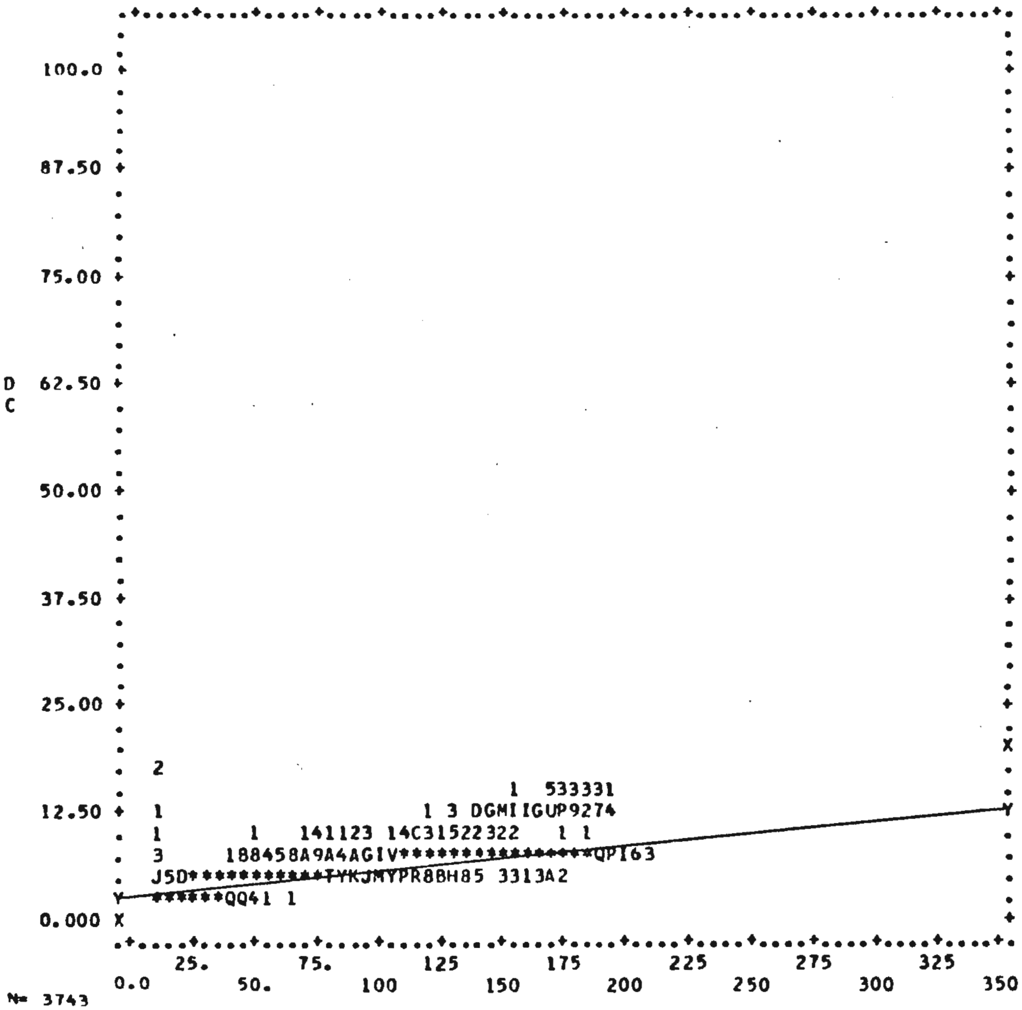
HOUSTON 2.12 9020A SARC2,TARS=0000,IOCEOFLD=ON,3 CE. MEASURED BETWEEN 11/5/82 AND 11/10/82



N= 837
COR= .9363

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.6299	1.1296	Y= .02175*X+ 3.0121	.15761

MEMPHIS 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82

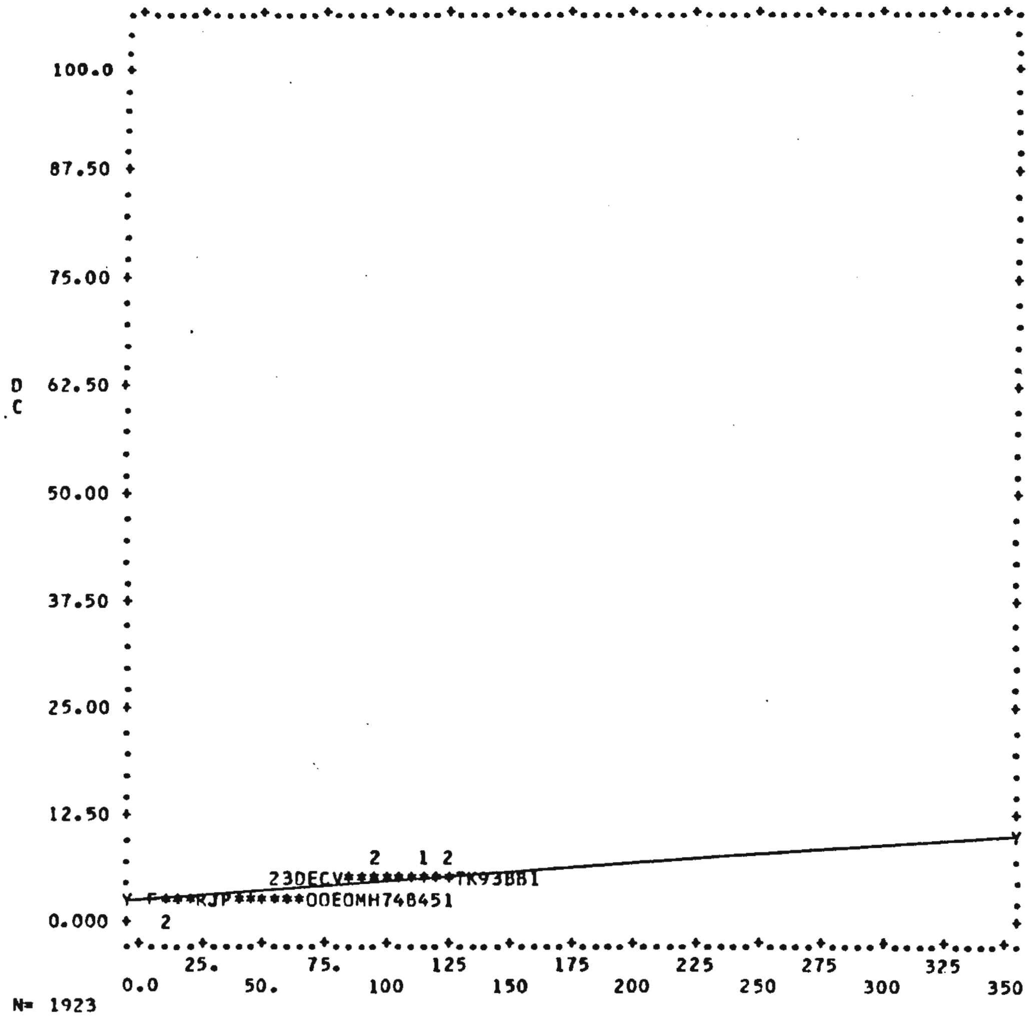


N= 3743
COR= .7607

TRACKS

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	6.2285	2.2345	Y= .02924*X+ 3.2096	2.1043

MIAMI 2.12 9020A SARC1,TARS=OFF,IOCEDFLD=ON,3 CE. MEASURED BETWEEN 06/08/82 AND 06/12/82

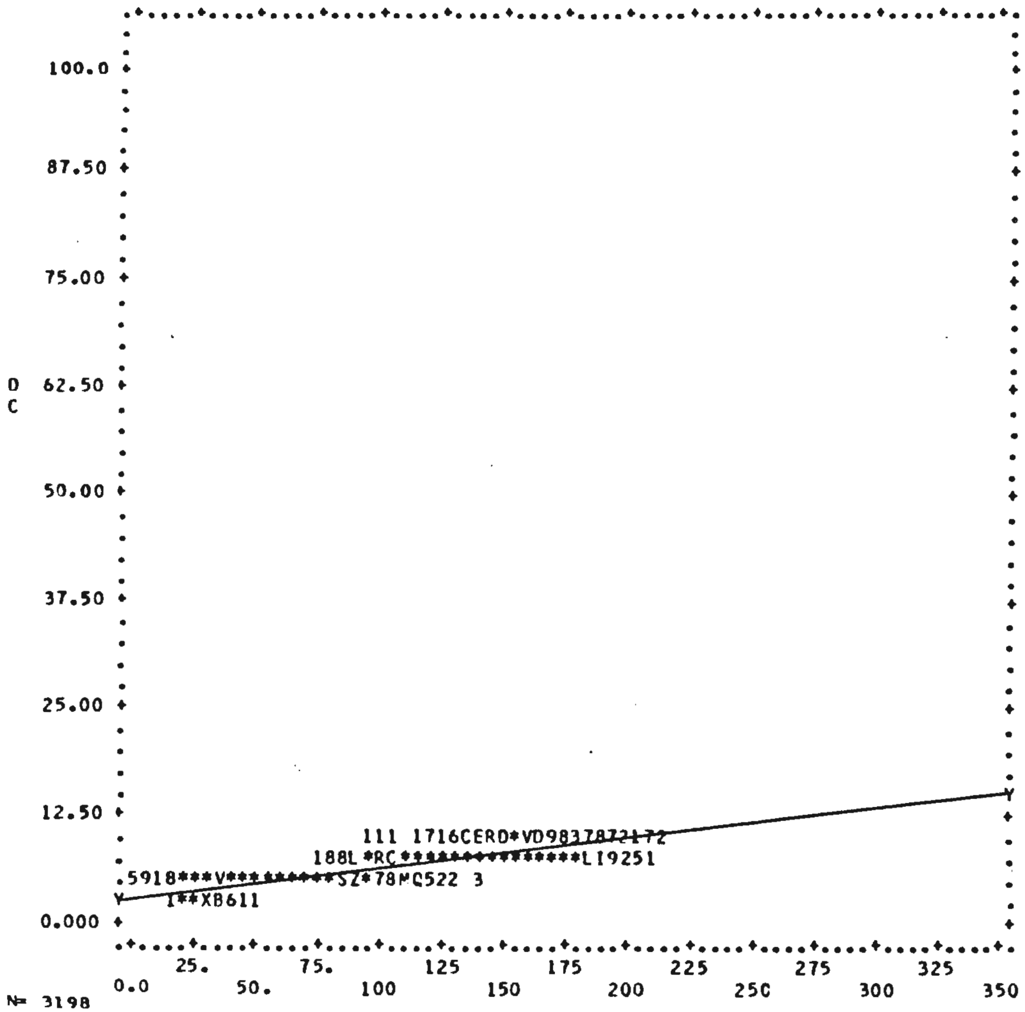


N= 1923
COR= .8741

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	3.7601	.80738	Y= .01944*X+ 2.1978	.15385

E-8

MINNEAPOLIS 2.12 9020A SARC1.TARS=OFF,IOCEOFLD=ON.3 CE. MEASURED BETWEEN 10/18/82 AND 10/23/82

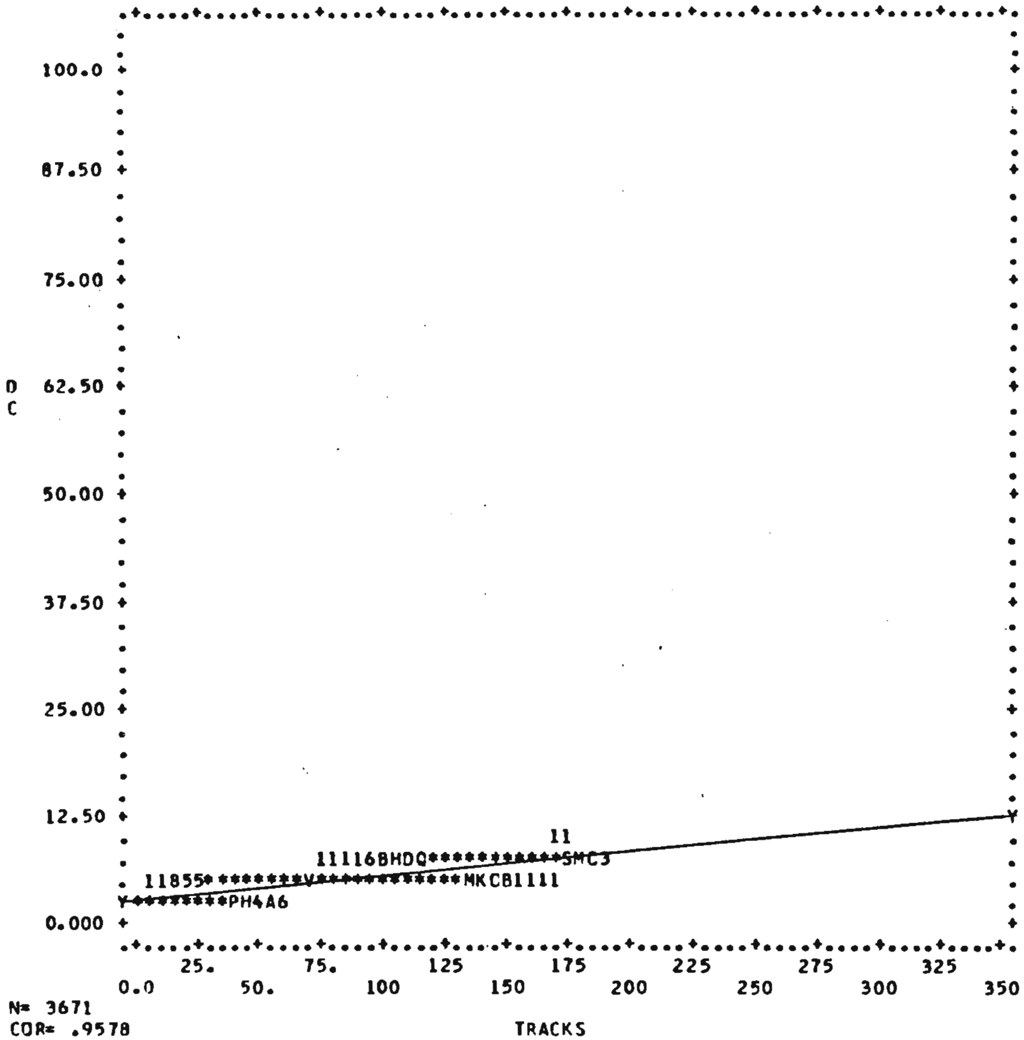


N= 3198
COR= .9067

TRACKS

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	6.6813	1.6691	Y= .02921*X+ 3.4114	.49598

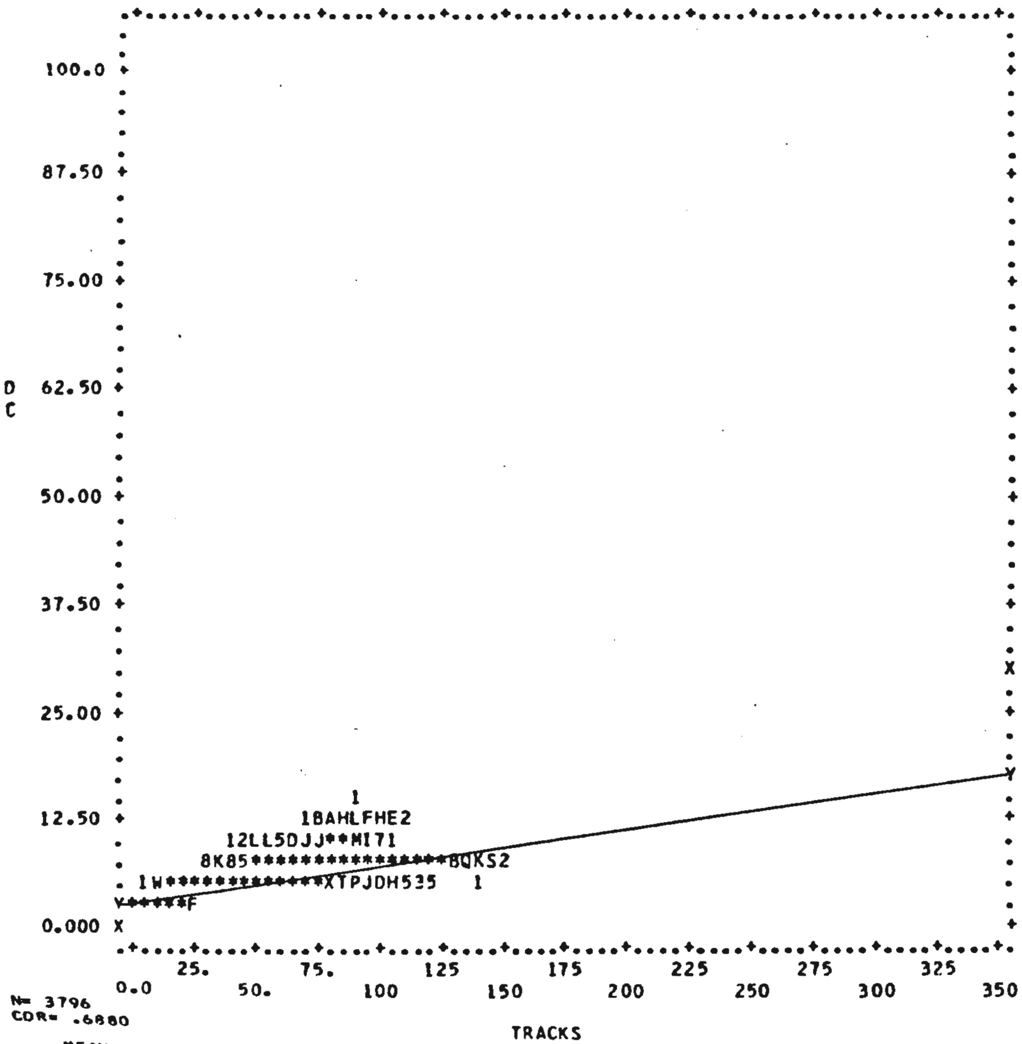
OAKLAND 2.12 9020A SARC1,TARS=OFF,IOCEOFLD=ON,3 CE, MEASURED BETWEEN 08/15/82 AND 08/22/82



N= 3671
COR= .9578

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.0193	1.3861	Y= .02754*X+ 2.7380	.15894

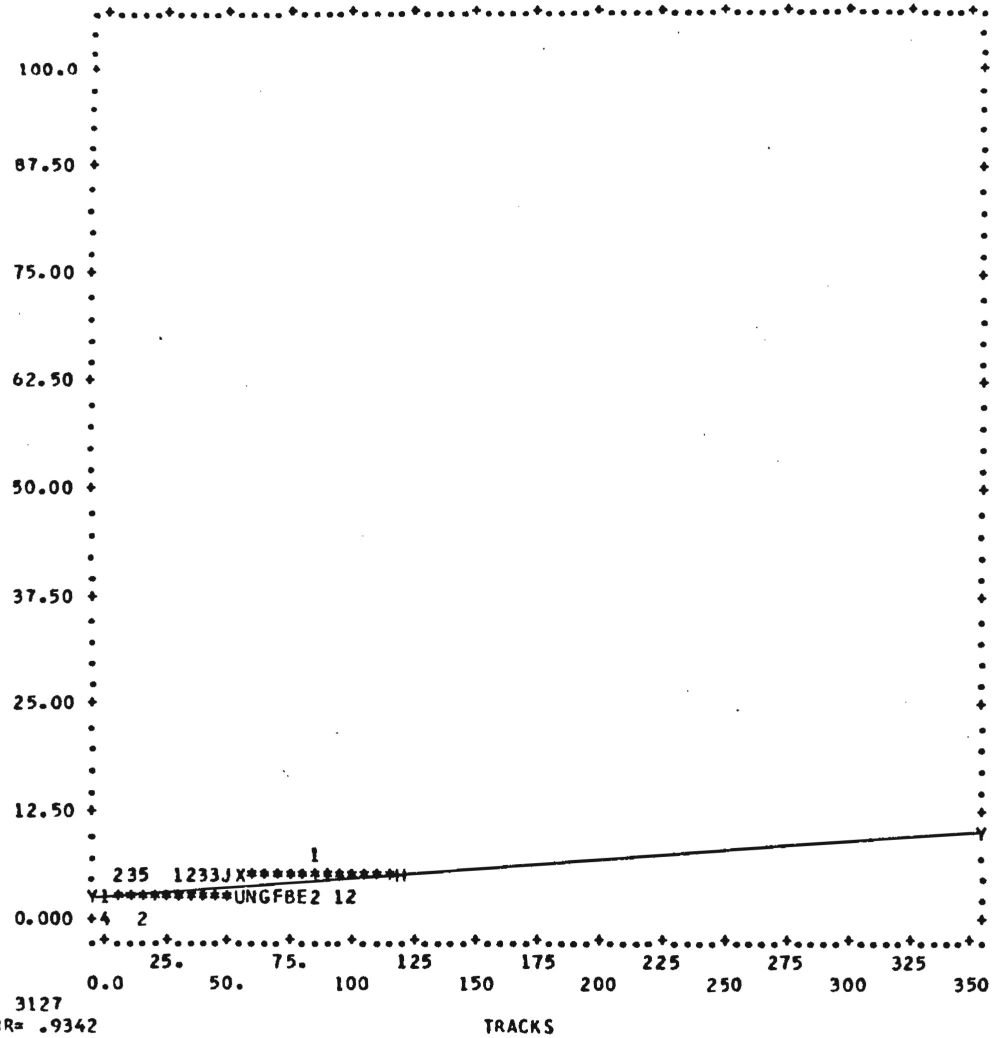
SALT LAKE 2.12 9020A SARC1,TARS=OFF,IJCEDFLD=ON,3 CE, MEASURED BETWEEN 05/23/82 AND 05/28/82



N= 3796
CDR= .6880

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.9922	2.0256	Y= .03950*X+ 3.5297	2.1616

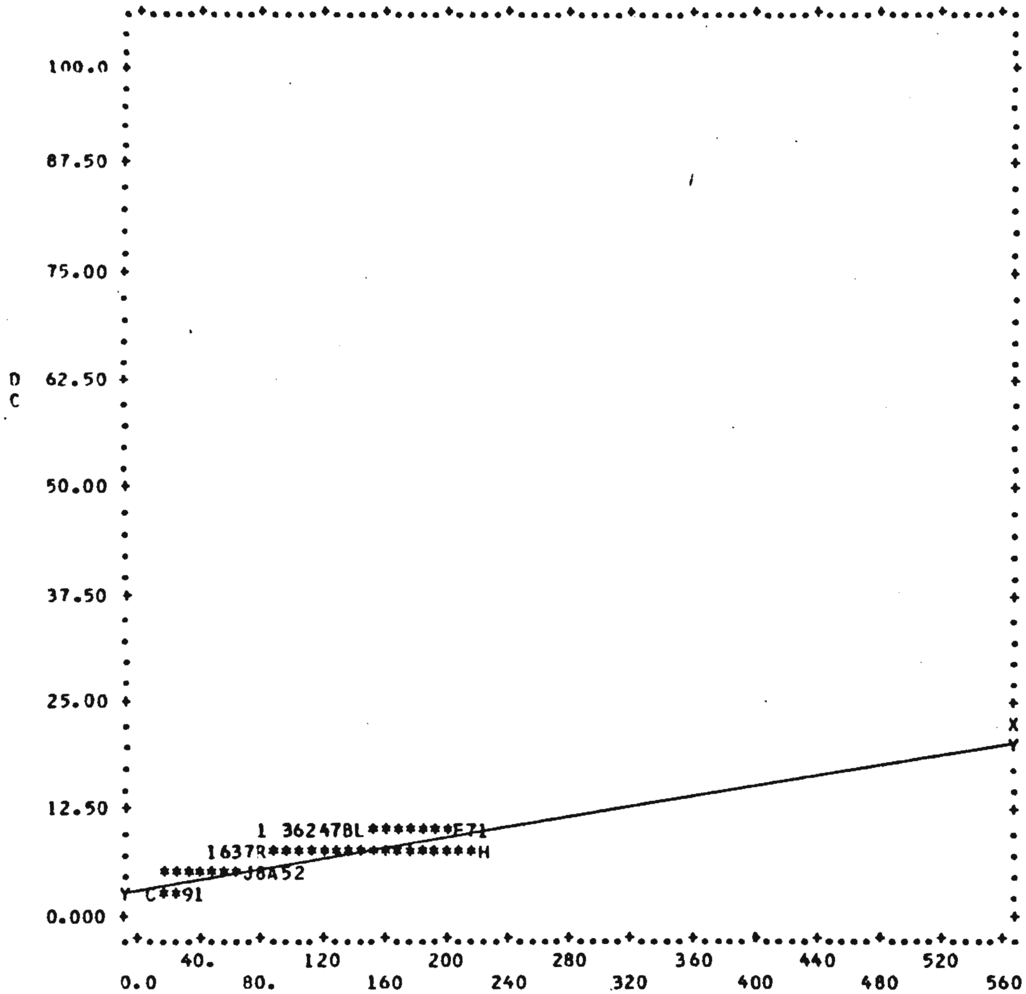
SEATTLE 2.12 9020A SARC4,TARS=OFF,IOCEOFLD=ON,3 CE. MEASURED BETWEEN 06/07/82 AND 06/12/82



N= 3127
COR= .9342

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	3.7214	.83284	Y= .02183*X+ 2.3448	.08831

ATLANTA 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 07/26/82 AND 07/31/82

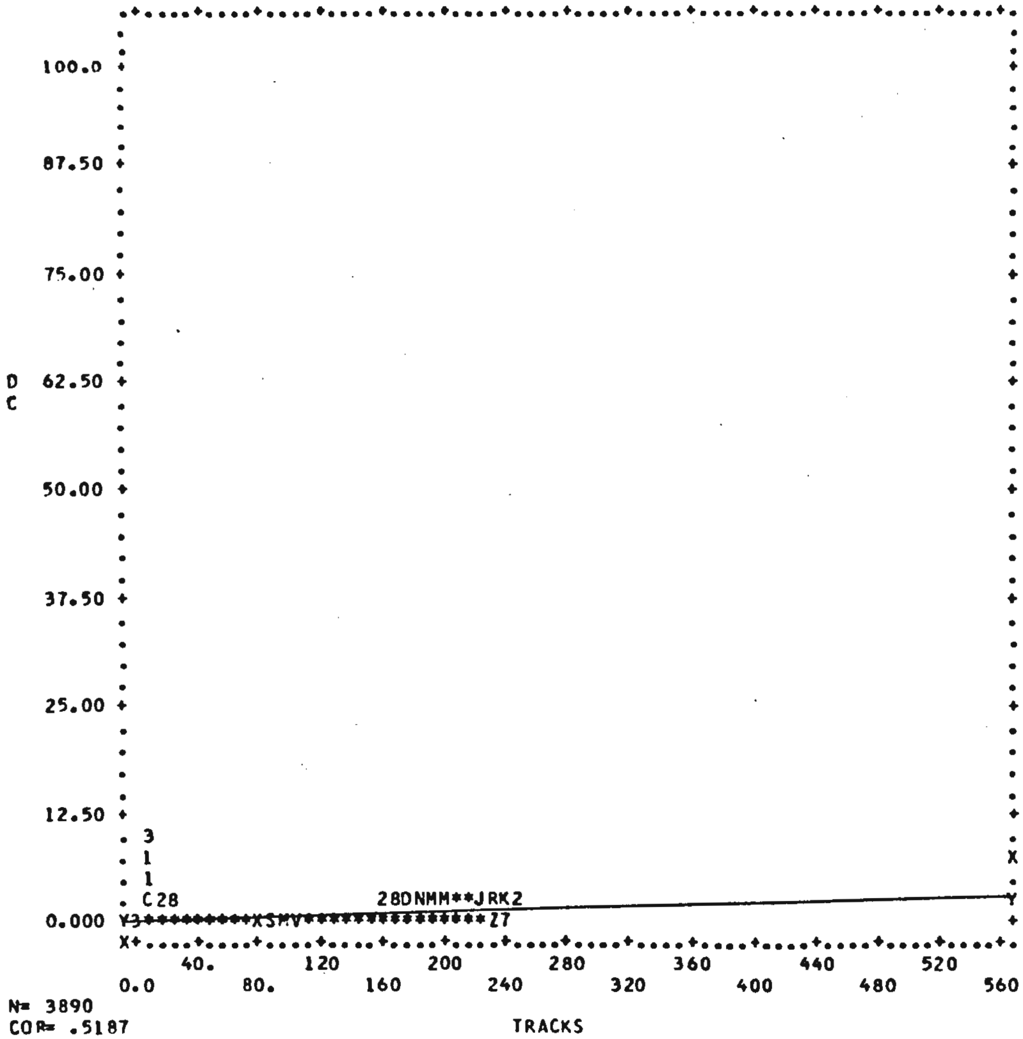


N= 3818
COR= .9105

TRACKS

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	7.0012	1.9529	Y= .02731*X+ 3.6250	.65263

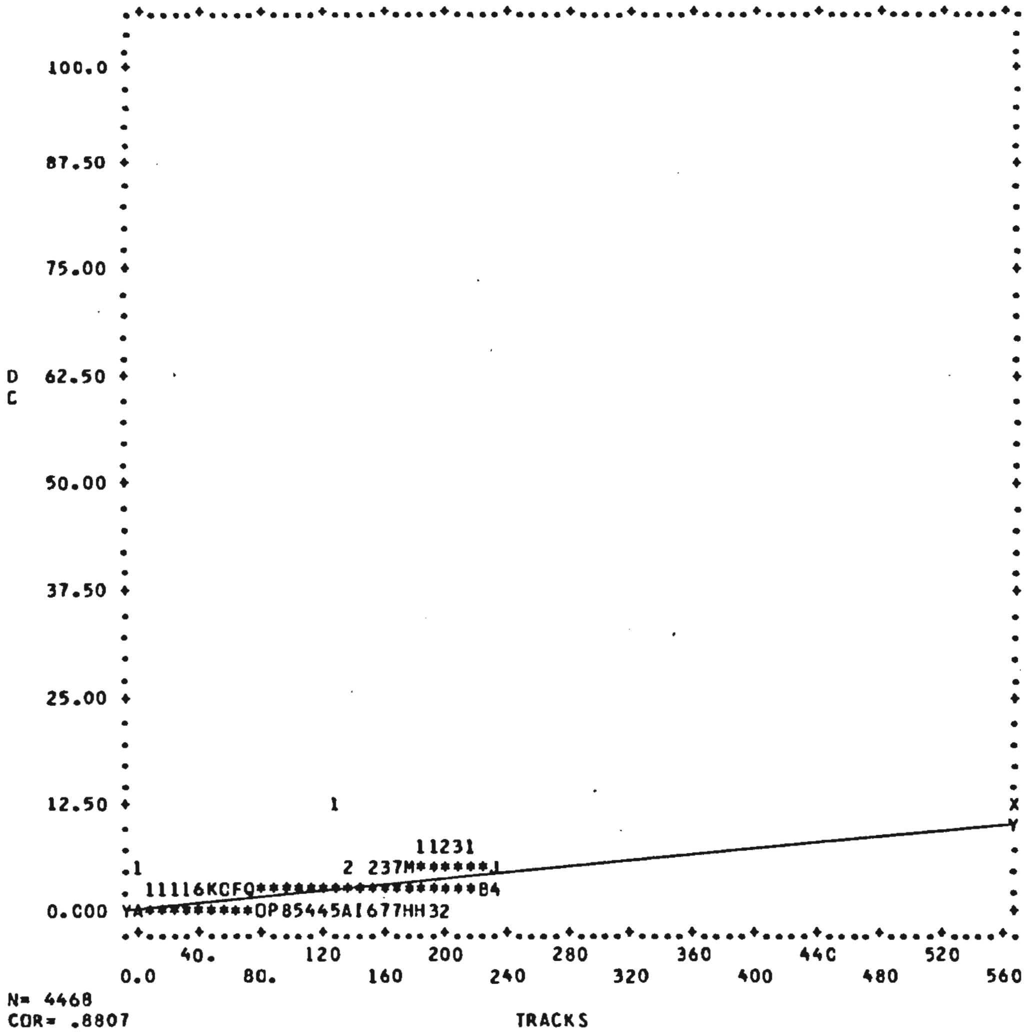
CLEV 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE. MEASURED BETWEEN 05/31/82 AND 06/05/82



N= 3890
COR= .5187

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	.41360	.57919	Y= .00442*X-.10051	.24528

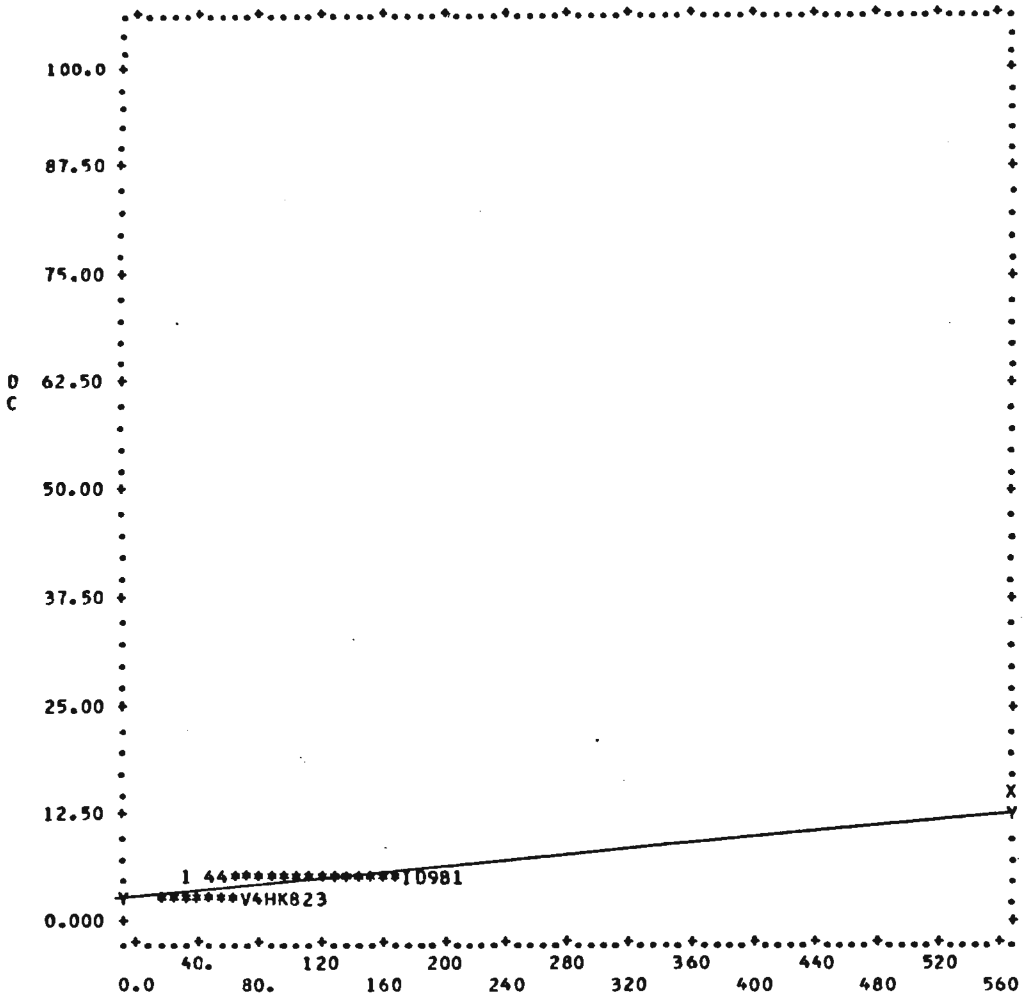
FT WORTH 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 02/08/82 AND 02/13/82



N= 4468
COR= .8807

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	2.3725	1.5117	Y= .01912*X-.19581	.51299

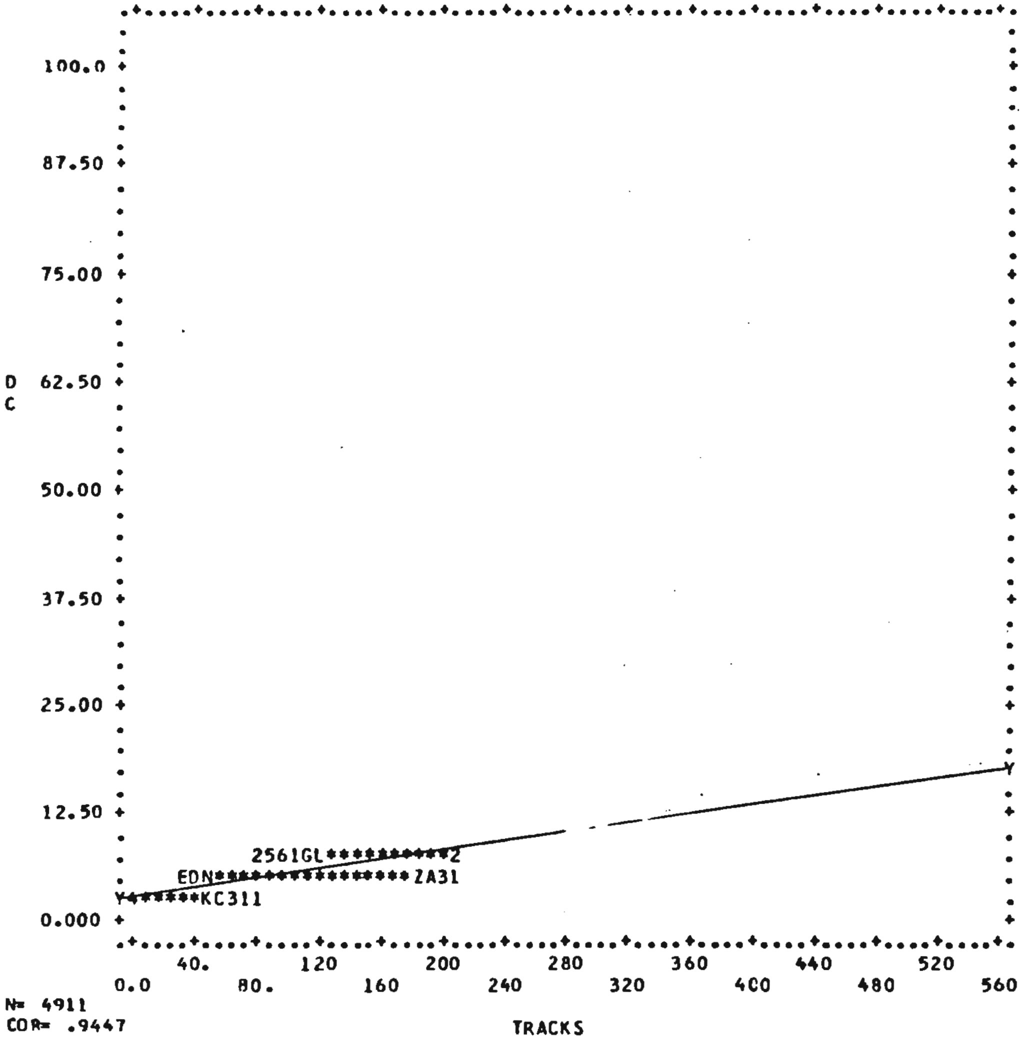
INDIANAPOLIS 2.12 9020D SARC1,TARS=OFF,IOCEOFLO=OFF,2CE, MEASURED BETWEEN 10/10/82 AND 10/17/82



N= 3841
COR= .9250

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	3.9109	.97193	Y= .02003*X+ 2.1266	.13639

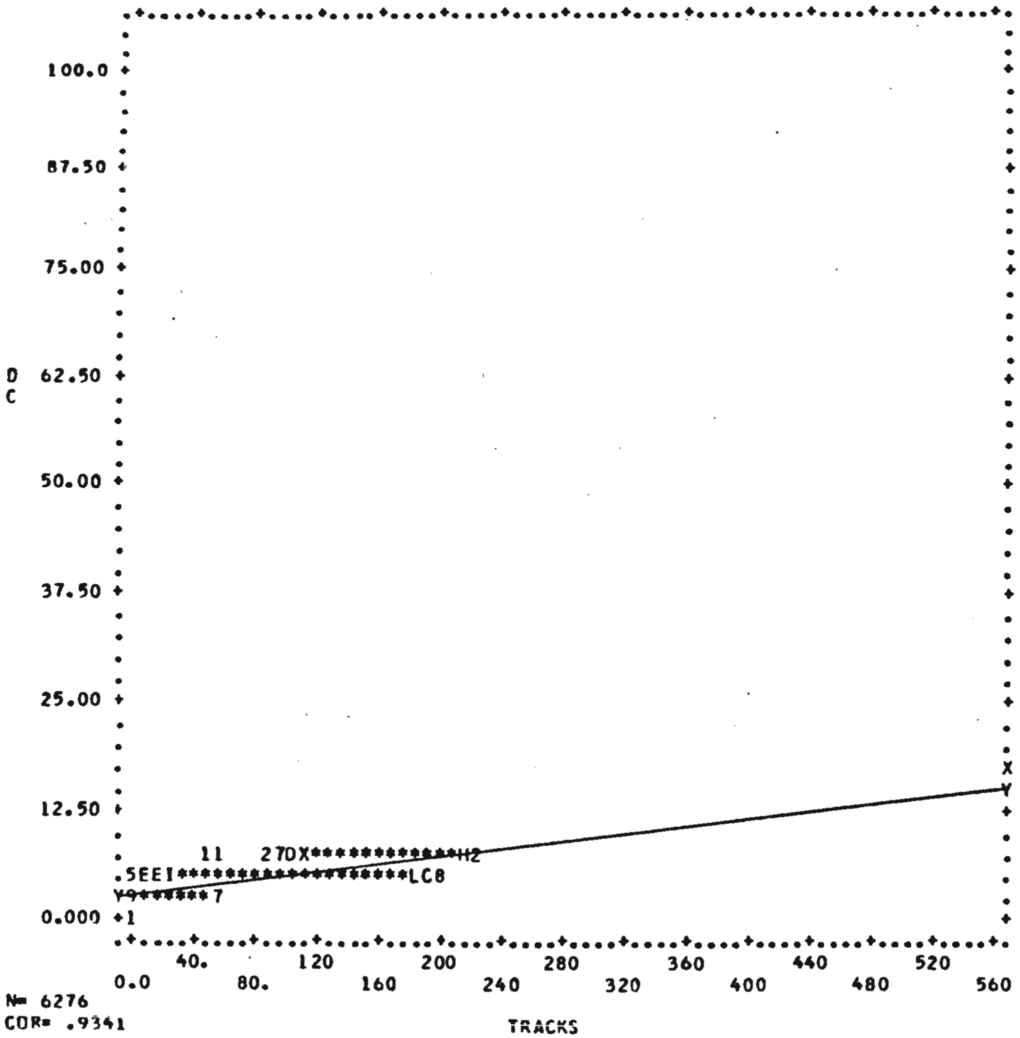
JACKSONVILLE 2.12 90200 SARC1,TARS=OFF,IOCEOFLD=OFF,2CE, MEASURED BETWEEN 08/23/82 AND 08/27/82



N= 4911
COR= .9447

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.0322	1.4788	Y= .02435*X+ 2.4976	.23522

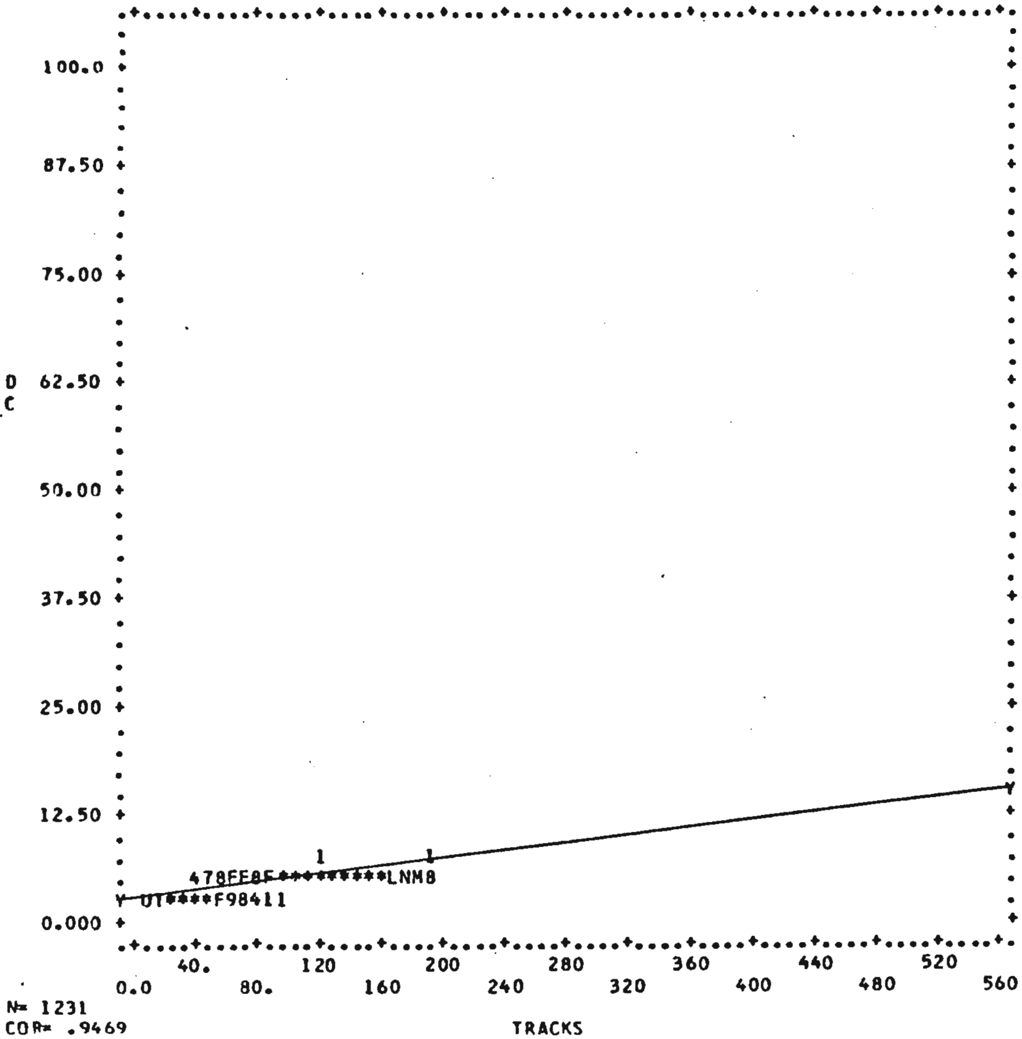
KANSAS CITY 2.12 90200 SARC4.TARS=OFF.IOCEOFLD=OFF.2 CE. MEASURED BETWEEN 07/19/82 AND 07/24/82



N= 6276
COR= .9341

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	5.5688	1.5120	Y= .02263*X+ 2.8926	.29155

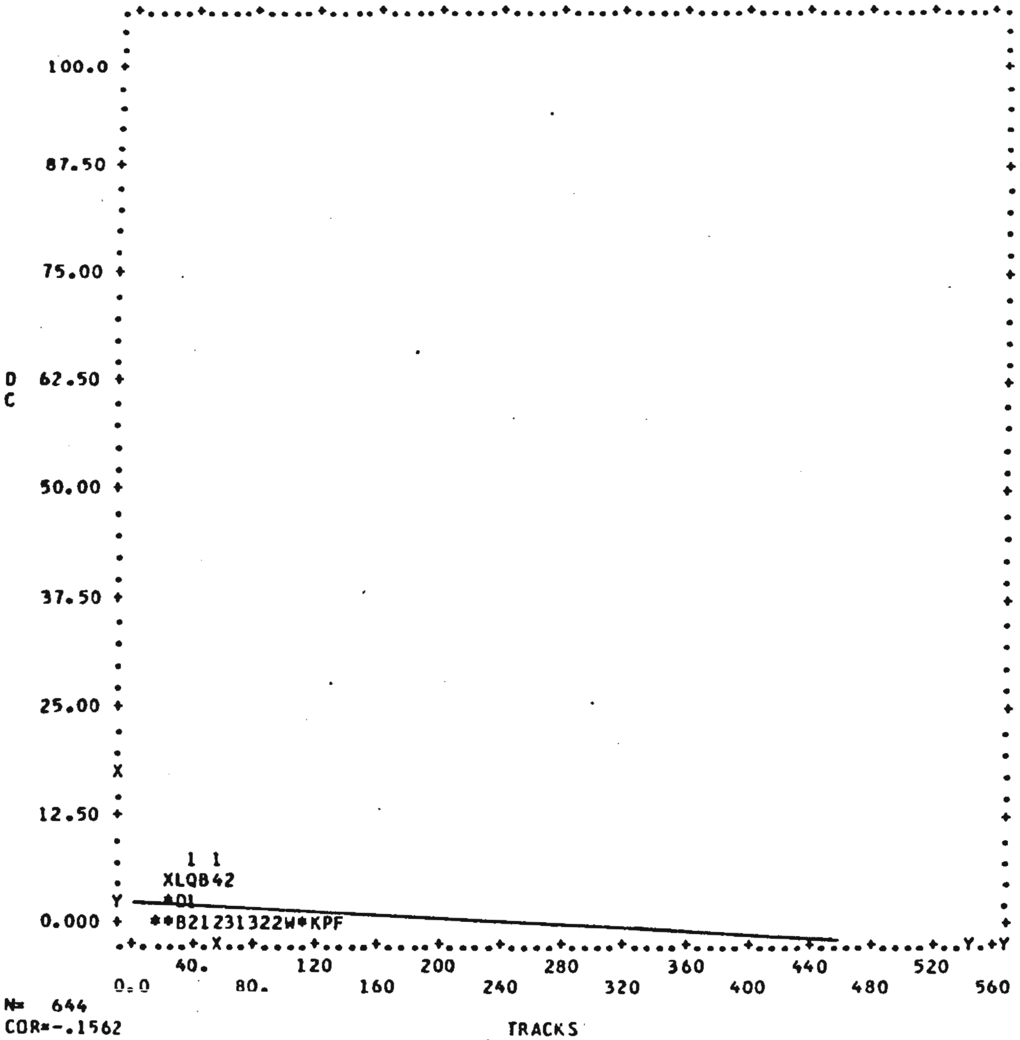
LOS ANGELES 2.12 9020D SARC1,TARS=OFF,IOCEOFLD=OFF,2 CE, MEASURED BETWEEN 08/12/82 AND 08/16/82



N= 1231
COR= .9469

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	4.4881	1.0673	Y= .02015*X+ 2.4343	.11782

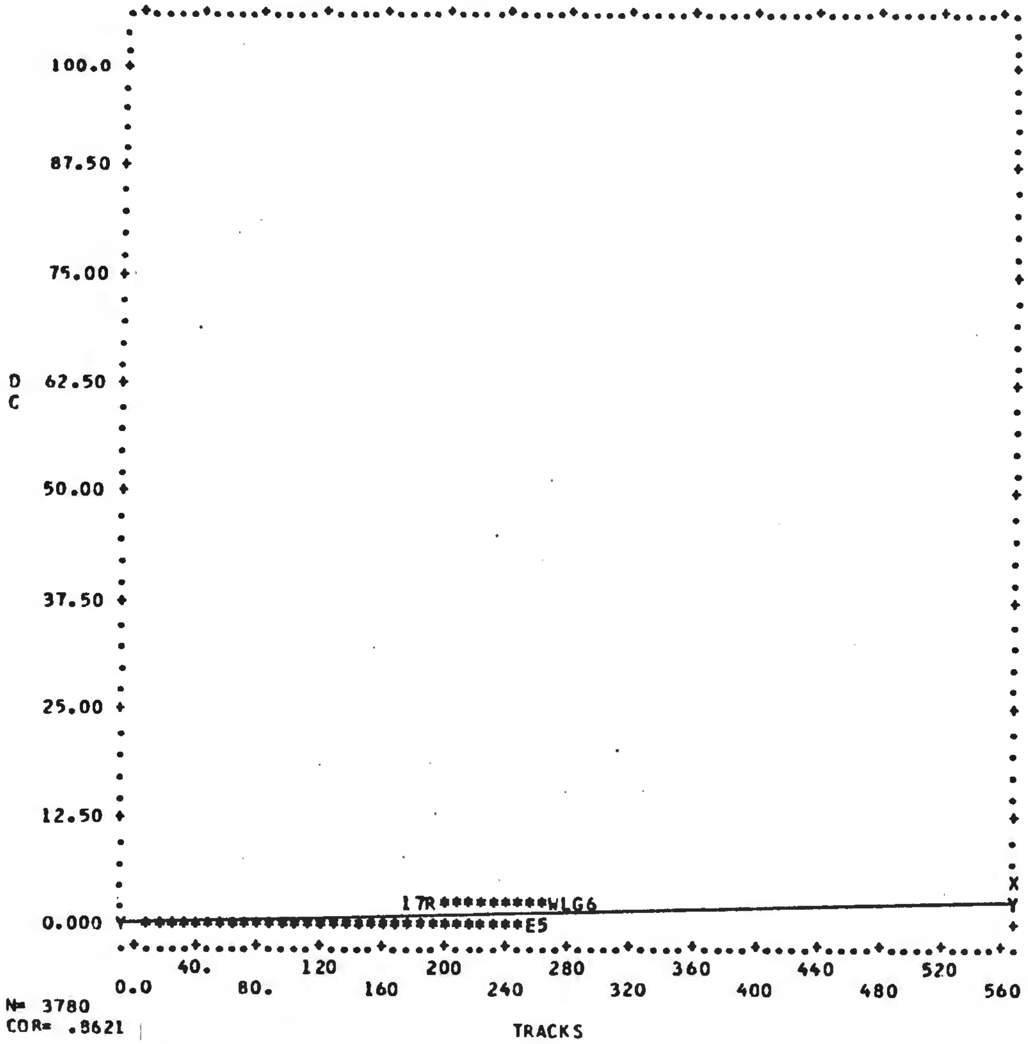
NEW YORK 2.12 90200 SARC20,TARS=7FFC.IOCEOFLD=CFF,3 CE, MEASURED BETWEEN 12/27/82 AND 12/31/82



N= 644
COR=-.1562

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	1.0680	1.8096	Y=-.00710*X+ 1.3877	3.1999

WASHINGTON 2.12 90200 SARC4,TARS=ON,IOCEUFLD=OFF,2 CE, MEASURED BETWEEN 10/04/82 AND 10/07/82



N= 3780
COR= .8621

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
Y	.60394	.61736	Y= .00631*X-.32441	.09788

APPENDIX F

MAXIMUM VALUES OBSERVED DURING THE MEASUREMENTS

The tables contained in this appendix show the maximum values observed during the measurements. Dates and times for these maximums are also specified because these values can change depending on the time of the year. That is, the maximums found in this appendix are not necessarily yearly maximums. In each table, the ten 9020A sites appear first in alphabetical order, followed by the ten 9020D sites. A table for each of the six possible selector channels is given near the end (channels are labeled 1, 2, 5, 6, 9, and A).

TABLE OF MAXIMUM VALUES FOR ACTIVE FLIGHT PLANS

MAXIMUM ACTIVE FLIGHT PLANS

OTHER PARAMETERS AT TIME OF 2.12 MAX ACTIVE FLIGHT PLANS

SITE NAME	2.12 MAXIMUM DATE (1982)	TIME GMT	ACTIFP	2.9/2.10 MAXIMUM DATE (1980-81)	GMT TIME	ACTIFP	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CH9%	CHA%
ABQ	7/23/82	17:23	328	6/20/80	17:27	306	208	76	48.8	15.5	31.2	1.6	-	0.0
BOS	6/22/82	20:43	233	7/17/80	20:59	232	131	50	17.6	11.5	20.7	-	-	0.0
DEN	8/06/82	16:05	286	8/28/80	16:42	330	202	56	-	-	25.7	16.9	28.0	1.6
HOU	11/09/82	22:39	292	6/20/80	15:34	309	176	54	-	-	26.9	10.9	27.8	1.3
MEM	7/25/82	19:44	294	7/22/80	13:59	332	182	46	16.0	13.4	-	-	21.0	1.3
MIA	6/11/82	17:59	251	6/13/80	18:17	246	146	65	31.9	8.5	23.7	1.1	-	0.0
MSP	10/19/82	14:48	285	6/19/80	15:40	266	211	56	-	-	26.9	16.2	26.7	1.7
OAK	5/26/82	16:34	299	10/23/80	17:47	271	173	61	25.0	1.4	26.1	14.2	-	0.0
SEA	6/11/82	21:38	178	10/10/80	23:21	186	126	48	24.0	8.9	25.0	1.1	-	0.0
SLC	5/26/82	17:10	203	6/21/80	17:12	233	146	40	15.4	13.9	15.2	-	-	0.0
ATL	7/29/82	15:14	423	8/01/80	20:01	387	206	42	27.7	17.0	42.4	-	-	0.0
CHI				1/21/81	22:26	399	131	50	17.6	11.5	20.7	-	-	0.0
CLE	6/03/82	20:45	387	6/24/80	12:54	471	230	43	42.9	1.1	48.4	1.2	-	0.0
DCA	10/06/82	19:25	439	7/26/80	14:20	361	298	56	65.5	1.9	29.5	1.5	-	0.0
FTW	2/12/82	20:48	389	12/04/80	22:27	435	248	47	-	-	28.8	1.9	35.4	41.1
IND	10/14/82	21:26	367	DAY 8/80	22:27	356	166	32	16.1	10.4	-	-	27.8	0.0
JAX	8/26/82	15:13	387	6/24/80	15:03	344	200	30	29.4	2.3	27.3	10.4	-	0.0
LAX	8/12/82	16:42	386	6/19/80	17:20	333	207	35	-	-	27.6	12.8	20.7	0.0
MKC	7/21/82	15:23	283	7/06/80	17:50	254	216	40	36.0	14.5	42.4	-	-	0.0
NYC	12/29/82	20:23	317	7/02/80	20:15	381	166	40	-	-	16.2	18.0	18.4	-

TABLE OF MAXIMUM VALUES FOR TRACKS

MAXIMUM NUMBER OF TRACKS							OTHER PARAMETERS AT TIME OF 2.12 MAX TRACKS							
SITE NAME	2.12 MAXIMUM DATE (1982)	GMT TIME	TRACKS	2.9/2.10 MAXIMUM DATE (1980-81)	GMT TIME	TRACKS	ACTIVE FLIGHT PLANS	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CH9%	CHA%
ABQ	7/22/82	16:09	221	6/20/80	17:41	210	311	68	29.0	13.7	25.9	1.7	-	0.0
BOS	6/22/82	20:57	138	7/17/80	21:18	145	232	52	18.1	11.9	22.7	-	-	0.0
DEN	8/06/82	16:08	209	8/29/80	16:53	260	268	57	-	-	30.0	15.7	28.0	1.6
HOU	11/09/82	20:01	197	6/19/80	19:21	193	274	66	-	-	31.0	11.6	29.8	1.4
MEM	7/24/82	19:26	211	7/23/80	19:07	219	284	55	19.3	14.2	21.8	1.2	-	0.0
MIA	6/09/82	19:19	160	6/10/80	20:40	154	229	46	18.8	8.0	17.3	1.3	-	0.0
MSP	10/19/82	14:47	213	6/19/80	15:54	179	283	52	-	-	22.4	17.0	22.6	1.4
OAK	8/16/82	20:30	190	10/21/80	16:19	186	295	55	21.7	1.6	20.9	13.3	-	0.0
SEA	6/11/82	20:39	135	10/10/80	23:25	159	167	46	24.3	7.3	23.7	1.1	-	0.0
SLC	5/26/82	17:15	148	6/21/80	17:12	177	201	38	14.5	13.7	15.9	-	-	0.0
ATL	7/29/82	20:25	246	8/01/80	19:52	229	401	53	20.5	18.0	58.2	-	-	0.0
CHI				1/21/81	22:26	271	232	52	18.1	11.9	22.7	-	-	0.0
CLE	6/03/82	21:30	246	6/24/80	12:51	279	381	44	42.7	1.5	47.8	1.3	-	0.0
DCA	10/06/82	19:25	298	7/26/80	20:56	231	439	56	65.5	1.9	29.5	1.5	-	0.0
FTW	2/12/82	19:57	271	12/04/80	22:34	316	385	56	-	-	36.8	1.8	39.3	46.5
IND	10/15/82	21:41	204	7/09/80	12:50	227	354	32	16.9	11.0	-	-	27.1	0.0
JAX	8/26/82	14:29	204	6/24/80	14:14	172	360	28	29.9	2.3	29.8	10.9	-	0.0
LAX	8/12/82	17:40	222	6/19/80	17:14	200	371	33	-	-	27.5	11.4	19.3	0.0
MKC	7/21/82	15:27	220	7/07/80	15:06	210	280	40	33.3	13.9	44.0	-	-	0.0
NYC	12/29/82	20:23	166	7/02/80	21:28	213	317	40	-	-	16.2	18.0	18.4	-

TABLE OF MAXIMUM VALUES FOR CENTRAL PROCESSING UTILIZATION

MAXIMUM CENTRAL PROCESSING UTILIZATION

OTHER PARAMETERS AT TIME OF 2.12 MAX C.P.U.

SITE NAME	2.12 MAXIMUM DATE (1982)	GMT TIME	C.P.U. (IN %)	2.9/2.10 MAXIMUM DATE (1980)	GMT TIME	C.P.U. (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CH9%	CHA%	
ABQ	7/23/82	17:11	89	6/20/80	17:36	96	317	208	55.9	17.2	39.3	2.6	-	0.0	
BOS	7/02/82	18:31	77	7/17/80	21:11	75	168	99	39.2	11.1	28.2	1.4	-	0.0	
DEN	8/08/82	16:01	78	8/29/80	16:53	96	223	178	61.4	16.0	N/A	2.3	-	-	N/A=NOT AVAILABLE
HOU	11/08/82	22:02	98	6/18/80	21:16	95	235	164	-	-	48.3	12.6	23.9	2.4	
MEM	7/24/82	16:37	95	7/23/80	14:31	87	216	139	20.7	17.8	48.1	-	-	0.0	
MIA	6/11/82	18:01	80	6/09/80	18:23	84	243	145	37.6	8.4	28.3	1.6	-	0.0	
MSP	10/22/82	21:01	81	6/18/80	20:00	89	226	154	-	-	32.1	19.1	72.6	1.9	
OAK	8/19/82	15:46	83	10/20/80	16:17	97	256	152	23.0	17.0	-	-	24.4	20.3	
SEA	6/11/82	19:00	65	10/09/80	20:42	86	158	107	31.7	7.5	30.9	1.3	-	0.0	
SLC	5/27/82	16:00	61	6/21/80	17:12	73	152	110	27.7	12.9	14.0	-	-	0.0	
ATL	7/29/82	20:12	58	8/01/80	20:02	63	388	227	57.7	18.8	28.0	-	-	0.0	
CHI				1/21/81	21:30	62	168	99	39.2	11.1	28.2	1.4	-	0.0	
CLE	6/04/82	19:31	55	6/26/80	12:15	70	348	220	44.2	1.3	84.3	1.1	-	0.0	
DCA	10/06/82	18:30	69	7/23/80	21:55	74	375	256	31.9	1.9	68.2	1.3	-	0.0	
FTW	2/12/82	21:30	66	12/04/80	19:52	85	360	231	-	-	49.5	1.5	50.7	50.3	
IND	10/14/82	18:52	35	7/09/80	20:30	44	290	142	27.7	9.9	-	-	30.8	0.0	
JAX	8/26/82	19:30	45	6/25/80	13:35	58	319	172	37.4	2.1	44.6	11.0	-	0.0	
LAX	8/15/82	16:14	45	6/19/80	17:15	57	339	168	23.5	11.1	33.3	-	-	0.0	
MKC	7/21/82	20:00	49	7/06/80	13:02	47	250	194	N/A	13.6	53.4	-	-	-	N/A=NOT AVAILABLE
NYC	12/28/82	21:44	50	7/02/80	20:30	71	270	134	-	-	20.9	1.1	36.0	-	N/A=NOT AVAILABLE

TABLE OF MAXIMUM VALUES FOR TRACKS

MAXIMUM NUMBER OF TRACKS — OTHER PARAMETERS AT TIME OF 2.12 MAX TRACKS

SITE NAME	2.12 MAXIMUM DATE (1982)	GMT TIME	TRACKS	2.9/2.10 MAXIMUM DATE (1980-81)	GMT TIME	TRACKS	ACTIVE FLIGHT PLANS	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CH9%	CHA%
ABQ	7/22/82	16:09	221	6/20/80	17:41	210	311	68	29.0	13.7	25.9	1.7	-	0.0
BOS	6/22/82	20:57	138	7/17/80	21:18	145	232	52	18.1	11.9	22.7	-	-	0.0
DEN	8/06/82	16:08	209	8/29/80	16:53	260	268	57	-	-	30.0	15.7	28.0	1.6
HOU	11/09/82	20:01	197	6/19/80	19:21	193	274	66	-	-	31.0	11.6	29.8	1.4
MEM	7/24/82	19:26	211	7/23/80	19:07	219	284	55	19.3	14.2	21.8	1.2	-	0.0
MIA	6/09/82	19:19	160	6/10/80	20:40	154	229	46	18.8	8.0	17.3	1.3	-	0.0
MSP	10/19/82	14:47	213	6/19/80	15:54	179	283	52	-	-	22.4	17.0	22.6	1.4
OAK	8/16/82	20:30	190	10/21/80	16:19	186	295	55	21.7	1.6	20.9	13.3	-	0.0
SEA	6/11/82	20:39	135	10/10/80	23:25	159	167	46	24.3	7.3	23.7	1.1	-	0.0
SLC	5/26/82	17:15	148	6/21/80	17:12	177	201	38	14.5	13.7	15.9	-	-	0.0
ATL	7/29/82	20:25	246	8/01/80	19:52	229	401	53	20.5	18.0	58.2	-	-	0.0
CHI				1/21/81	22:26	271	232	52	18.1	11.9	22.7	-	-	0.0
CLE	6/03/82	21:30	246	6/24/80	12:51	279	381	44	42.7	1.5	47.8	1.3	-	0.0
DCA	10/06/82	19:25	298	7/26/80	20:56	231	439	56	65.5	1.9	29.5	1.5	-	0.0
FTW	2/12/82	19:57	271	12/04/80	22:34	316	385	56	-	-	36.8	1.8	39.3	46.5
IND	10/15/82	21:41	204	7/09/80	12:50	227	354	32	16.9	11.0	-	-	27.1	0.0
JAX	8/26/82	14:29	204	6/24/80	14:14	172	360	28	29.9	2.3	29.8	10.9	-	0.0
LAX	8/12/82	17:40	222	6/19/80	17:14	200	371	33	-	-	27.5	11.4	19.3	0.0
MKC	7/21/82	15:27	220	7/07/80	15:06	210	280	40	33.3	13.9	44.0	-	-	0.0
NYC	12/29/82	20:23	166	7/02/80	21:28	213	317	40	-	-	16.2	18.0	18.4	-

TABLE OF MAXIMUM VALUES

FOR

CENTRAL PROCESSING UTILIZATION

	MAXIMUM CENTRAL PROCESSING UTILIZATION						OTHER PARAMETERS AT TIME OF 2.12 MAX C.P.U.								
SITE	2.12 MAXIMUM			2.9/2.10 MAXIMUM			ACTIVE	TRACKS	CHANNEL UTILIZATION:						
NAME	DATE (1982)	GMT TIME	C.P.U. (IN %)	DATE (1980)	GMT TIME	C.P.U. (IN %)	FLIGHT PLANS	COUNT	CH1%	CH2%	CH5%	CH6%	CH9%	CHA%	
ABQ	7/23/82	17:11	89	6/20/80	17:36	96	317	208	55.9	17.2	39.3	2.6	-	0.0	
BOS	7/02/82	18:31	77	7/17/80	21:11	75	168	99	39.2	11.1	28.2	1.4	-	0.0	
DEN	8/08/82	16:01	78	8/29/80	16:53	96	223	178	61.4	16.0	N/A	2.3	-	-	N/A=NOT AVAILABLE
HOU	11/08/82	22:02	98	6/18/80	21:16	95	235	164	-	-	48.3	12.6	23.9	2.4	
MEM	7/24/82	16:37	95	7/23/80	14:31	87	216	139	20.7	17.8	48.1	-	-	0.0	
MIA	6/11/82	18:01	80	6/09/80	18:23	84	243	145	37.6	8.4	28.3	1.6	-	0.0	
MSP	10/22/82	21:01	81	6/18/80	20:00	89	226	154	-	-	32.1	19.1	72.6	1.9	
OAK	8/19/82	15:46	83	10/20/80	16:17	97	256	152	23.0	17.0	-	-	24.4	20.3	
SEA	6/11/82	19:00	65	10/09/80	20:42	86	158	107	31.7	7.5	30.9	1.3	-	0.0	
SLC	5/27/82	16:00	61	6/21/80	17:12	73	152	110	27.7	12.9	14.0	-	-	0.0	
ATL	7/29/82	20:12	58	8/01/80	20:02	63	388	227	57.7	18.8	28.0	-	-	0.0	
CHI				1/21/81	21:30	62	168	99	39.2	11.1	28.2	1.4	-	0.0	
CLE	6/04/82	19:31	55	6/26/80	12:15	70	348	220	44.2	1.3	84.3	1.1	-	0.0	
DCA	10/06/82	18:30	69	7/23/80	21:55	74	375	256	31.9	1.9	68.2	1.3	-	0.0	
FTW	2/12/82	21:30	66	12/04/80	19:52	85	360	231	-	-	49.5	1.5	50.7	50.3	
IND	10/14/82	18:52	35	7/09/80	20:30	44	290	142	27.7	9.9	-	-	30.8	0.0	
JAX	8/26/82	19:30	45	6/25/80	13:35	58	319	172	37.4	2.1	44.6	11.0	-	0.0	
LAX	8/15/82	16:14	45	6/19/80	17:15	57	339	168	23.5	11.1	33.3	-	-	0.0	
MKC	7/21/82	20:00	49	7/06/80	13:02	47	250	194	N/A	13.6	53.4	-	-	-	N/A=NOT AVAILABLE
NYC	12/28/82	21:44	50	7/02/80	20:30	71	270	134	-	-	20.9	1.1	36.0	-	N/A=NOT AVAILABLE

T A B L E   O F   M A X I M U M   V A L U E S

F O R

C H A N N E L " 1 " U T I L I Z A T I O N

	MAXIMUM CHANNEL 1 UTILZ.			OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL 1								
SITE NAME	2.12 MAXIMUM DATE	TIME	CH 1 (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH2%	CH5%	CH6%	CH9%	CHA%	
ABQ	7/23/82	19:04	57.2	259	170	75	16.0	31.3	2.8	-	0.0	
BOS	7/02/82	5:51	53.2	40	15	30	4.9	74.8	-	-	0.0	
DEN	8/08/82	17:02	63.6	254	184	74	17.3	31.8	1.8	-	0.0	
HOU	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
MEM	7/26/83	4:40	70.5	58	33	32	5.4	60.2	2.8	-	0.0	
MIA	6/11/82	17:46	37.6	235	148	73	9.5	26.6	1.6	-	0.0	
MSP	0	:00	0	0	0	0	0.	0.	0.	0.	0.	CHANNEL UNUSED
OAK	8/21/82	16:46	56.1	170	108	57	-	17.5	10.9	-	0.0	
SEA	6/11/82	0:41	44.4	146	126	52	8.1	25.7	1.3	-	0.0	
SLC	5/27/82	16:00	27.7	152	110	61	12.9	14.0	-	-	0.0	
ATL	7/29/82	19:01	59.3	377	218	52	18.7	31.2	-	-	0.0	
CHI												
CLE	6/04/82	18:00	69.3	269	165	44	1.4	52.1	1.3	-	0.0	
DCA	10/06/82	19:30	70.4	417	287	66	1.9	32.2	1.5	-	0.0	
FTW	2/09/82	14:31	43.8	254	184	35	1.5	44.4	-	-	0.0	
IND	10/16/82	21:37	30.6	148	82	24	8.2	-	-	27.9	0.0	
JAX	8/26/82	19:55	45.7	332	189	41	2.3	39.9	11.1	-	0.0	
LAX	8/15/82	16:32	26.0	333	150	38	10.8	29.5	-	-	0.0	
MKC	7/21/82	20:18	68.9	256	194	47	13.4	45.4	-	-	0.0	
NYC	12/30/82	18:58	26.8	281	136	36	1.4	-	-	40.8	-	

TABLE OF MAXIMUM VALUES
FOR
CHANNEL " 2 " UTILIZATION

	MAXIMUM CHANNEL 2 UTILZ.			OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL 2								
SITE NAME	2.12 DATE	MAXIMUM TIME	CH 2 (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH5%	CH6%	CH9%	CHA%	
ABQ	7/20/82	7:28	55.3	53	27	30	9.8	-	-	7.4	1.2	
BOS	6/21/82	21:22	12.8	164	78	43	21.0	14.6	1.3	-	0.0	
DEN	8/04/82	21:02	20.9	211	147	58	27.6	-	-	25.2	1.7	
HOU	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
MEM	7/24/82	16:40	80.5	219	142	38	16.1	25.5	-	-	0.0	
MIA	6/11/82	15:04	10.8	243	132	67	25.4	40.9	-	-	0.0	
MSP	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
OAK	8/19/82	22:31	37.5	220	128	55	13.4	-	-	13.7	14.5	
SEA	6/09/82	15:15	11.1	110	85	33	23.2	22.9	1.4	-	0.0	
SLC	5/25/82	22:47	22.8	130	92	42	13.3	-	-	13.6	5.0	
ATL	7/26/82	17:39	21.4	306	160	29	19.1	20.7	-	-	0.0	
CHI												
CLE	6/04/82	5:18	22.1	54	41	14	10.8	14.5	-	-	0.0	
DCA	10/05/82	5:27	5.2	29	20	16	21.0	23.0	-	-	0.0	
FTW	2/09/82	10:05	4.0	21	13	8	21.7	9.5	-	-	0.0	
IND	10/14/82	21:45	12.0	324	158	30	18.4	-	-	28.2	0.0	
JAX	8/27/82	9:16	6.9	0	0	21	21.6	23.9	8.1	-	0.0	
LAX	8/13/82	17:15	27.8	307	184	30	13.5	-	-	12.1	8.6	
MKC	7/20/82	15:21	16.0	229	165	33	36.8	32.2	-	-	0.0	
NYC	12/27/82	16:00	1.9	257	140	47	19.6	-	-	33.7	-	

TABLE OF MAXIMUM VALUES

FOR

CHANNEL " 5 " UTILIZATION

	MAXIMUM CHANNEL 5 UTILZ.			OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL 5								
SITE NAME	2.12 MAXIMUM DATE	TIME	CH 5 (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH6%	CH9%	CHA%	
ABQ	7/23/82	8:28	74.0	60	34	28	6.4	5.2	-	-	0.0	
BOS	7/02/82	5:51	74.8	40	15	30	53.2	4.9	-	-	0.0	
DEN	8/08/82	17:52	58.9	238	176	78	45.3	16.8	2.8	-	0.0	
HOU	11/08/82	22:02	48.3	235	164	98	12.6	23.9	2.4	-	0.0	
MEM	7/24/82	16:39	76.0	221	141	40	21.4	18.4	-	-	0.0	
MIA	6/09/82	20:50	55.5	195	123	49	-	-	5.6	66.5	N/A	(N/A=NOT AVAILABLE)
MSP	10/22/82	16:00	51.9	202	138	65	-	-	17.5	29.6	1.5	
OAK	8/22/82	8:01	33.3	35	0	70	38.7	-	13.1	-	0.0	
SEA	6/09/82	23:56	34.7	156	122	46	36.4	7.7	1.5	-	0.0	
SLC	5/22/82	16:29	25.5	155	113	49	12.1	13.2	-	-	0.0	
ATL	7/29/82	19:55	63.3	398	225	57	20.6	19.9	-	-	0.0	
CHI												
CLE	6/04/82	19:46	86.0	357	204	50	44.2	1.6	1.6	-	0.0	
DCA	10/06/82	10:16	69.6	407	281	55	25.2	1.6	1.3	-	0.0	
FTW	2/12/82	20:05	49.6	380	253	64	-	-	2.6	52.0	50.4	
IND	10/11/82	20:35	31.6	238	131	31	-	-	10.0	23.9	0.0	
JAX	8/27/82	14:08	47.1	353	191	35	26.0	2.1	12.1	-	0.0	
LAX	8/12/82	17:56	33.9	346	207	36	-	-	12.0	21.9	0.0	
MKC	7/23/82	19:02	57.6	268	197	40	36.5	13.7	-	-	0.0	
NYC	12/28/82	20:06	27.8	288	139	40	-	-	1.8	33.3	-	

T A B L E   O F   M A X I M U M   V A L U E S

F O R

C H A N N E L " 6 " U T I L I Z A T I O N

MAXIMUM CHANNEL 6 UTILZ.				OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL 6								
SITE NAME	2.12 MAXIMUM DATE	TIME	CH 6 (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH9%	CHA%	
ABQ	7/21/82	8:52	3.0	67	37	12	6.9	5.9	9.1	-	0.0	
BOS	7/02/82	10:23	3.6	31	16	17	4.2	6.0	7.5	-	0.0	
DEN	8/06/82	16:00	18.7	275	205	56	-	-	29.8	27.6	1.6	
HOU	11/09/82	15:41	14.6	268	169	70	-	-	25.1	46.9	1.3	
MEM	7/26/82	3:10	5.4	91	52	23	11.8	7.9	8.0	-	0.0	
MIA	6/09/82	21:00	8.5	175	118	44	-	-	21.5	22.4	1.4	
MSP	10/22/82	21:30	20.6	223	158	70	-	-	25.9	65.7	1.4	
OAK	8/16/82	16:37	16.4	279	174	60	27.1	1.9	26.7	-	0.0	
SEA	6/11/82	10:51	3.5	15	12	17	-	-	10.9	59.5	5.2	
SLC	5/28/82	5:46	3.0	55	46	29	13.7	8.4	7.3	-	0.0	
ATL	7/30/82	18:06	20.7	374	204	45	-	-	18.6	57.9	0.0	
CHI												
CLE	5/31/82	15:36	5.5	187	111	45	34.4	5.4	47.6	-	0.0	
DCA	10/05/82	20:40	1.9	394	268	57	28.1	2.0	66.4	-	0.0	
FTW	2/09/82	23:46	14.7	301	199	34	34.1	1.1	29.6	-	0.0	
IND	10/11/82	22:37	11.3	241	131	30	-	-	17.5	27.6	0.0	
JAX	8/27/82	15:35	13.6	330	190	39	40.0	2.6	39.0	-	0.0	
LAX	8/12/82	17:01	14.3	379	211	40	-	-	32.1	24.4	0.0	
MKC	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
NYC	12/31/82	21:35	32.8	219	105	47	-	-	13.5	14.9	-	

CHANNEL "9" UTILIZATION

SITE NAME	MAXIMUM CHANNEL 9 UTILZ. 2.12 MAXIMUM DATE	TIME	CH 9 (IN %)	OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL 9: ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CHA%	
ABQ	7/19/82	15:35	23.9	217	140	65	19.9	17.7	-	-	11.0	
BOS	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
DEN	8/04/82	21:16	39.6	219	152	65	39.4	17.5	-	-	1.9	
HOU	11/09/82	15:39	48.5	263	167	71	-	-	24.8	12.2	1.8	
MEM	7/25/82	06:59	74.3	26	21	25	57.9	2.7	-	-	0.0	
MIA	6/09/82	20:50	66.5	195	123	49	-	-	55.5	5.6	N/A	(N/A = NOT AVAILABLE)
MSP	10/22/82	21:01	72.6	226	154	81	-	-	32.1	19.1	1.9	
OAK	8/20/82	16:30	32.9	242	164	79	27.8	16.9	-	-	17.5	
SEA	6/11/82	10:51	59.5	15	12	17	-	-	10.9	3.5	5.2	
SLC	5/25/82	23:04	16.8	143	103	45	18.4	19.9	-	-	3.2	
ATL	7/30/82	20:30	61.4	361	199	52	-	-	19.1	17.0	0.0	
CHI												
CLE	6/04/82	07:16	17.4	57	39	15	-	-	33.2	-	0.0	
DCA	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
FTW	2/12/82	16:31	53.9	341	236	58	-	-	49.1	2.1	48.0	
IND	10/15/82	21:29	32.5	351	173	34	19.8	10.9	-	-	0.0	
JAX	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
LAX	8/12/82	17:35	27.5	366	211	37	-	-	30.5	12.2	0.0	
MKC	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
NYC	12/30/82	19:02	48.9	278	132	43	24.3	1.8	-	-	0.9	

TABLE OF MAXIMUM VALUES FOR CHANNEL " A " UTILIZATION

	MAXIMUM CHANNEL A UTILZ.			OTHER PARAMETERS AT TIME OF 2.12 MAX CHANNEL A								
SITE NAME	2.12 DATE	MAXIMUM TIME	CH A (IN %)	ACTIVE FLIGHT PLANS	TRACKS COUNT	CENT. PROC. UTILZ. (IN PERCENT)	CHANNEL UTILIZATION: CH1%	CH2%	CH5%	CH6%	CH9%	
ABQ	7/19/82	15:25	12.0	204	138	60	15.1	17.0	-	-	18.1	
BOS	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
DEN	8/09/82	5:42	28.1	31	22	28	8.8	6.4	-	-	6.5	
HOU	11/08/82	17:04	3.3	178	118	55	-	-	18.3	11.3	27.3	
MEM	7/22/82	1:19	31.0	109	67	38	7.2	19.7	-	-	10.5	
MIA	6/09/82	20:04	5.8	173	97	36	-	-	17.7	7.1	17.2	
MSP	10/20/82	6:42	2.3	39	32	16	-	-	6.7	6.6	8.9	
OAK	8/19/82	16:49	46.9	251	147	77	21.2	9.4	-	-	21.2	
SEA	6/11/82	10:51	5.2	15	12	17	-	-	10.9	3.5	59.5	
SLC	5/25/82	23:13	14.1	143	103	36	8.4	12.3	-	-	8.4	
ATL	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
CHI												
CLE	6/04/82	8:04	33.7	49	39	16	-	-	10.1	-	10.8	
DCA	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
FTW	2/12/82	19:55	53.8	379	266	61	-	-	40.2	2.0	42.4	
IND	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
JAX	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
LAX	8/14/82	7:46	25.6	29	24	20	20.7	7.9	-	-	24.0	
MKC	-	-	-	-	-	-	-	-	-	-	-	CHANNEL UNUSED
NYC	12/31/82	19:31	22.8	200	84	49	-	-	22.8	26.2	25.9	

APPENDIX G

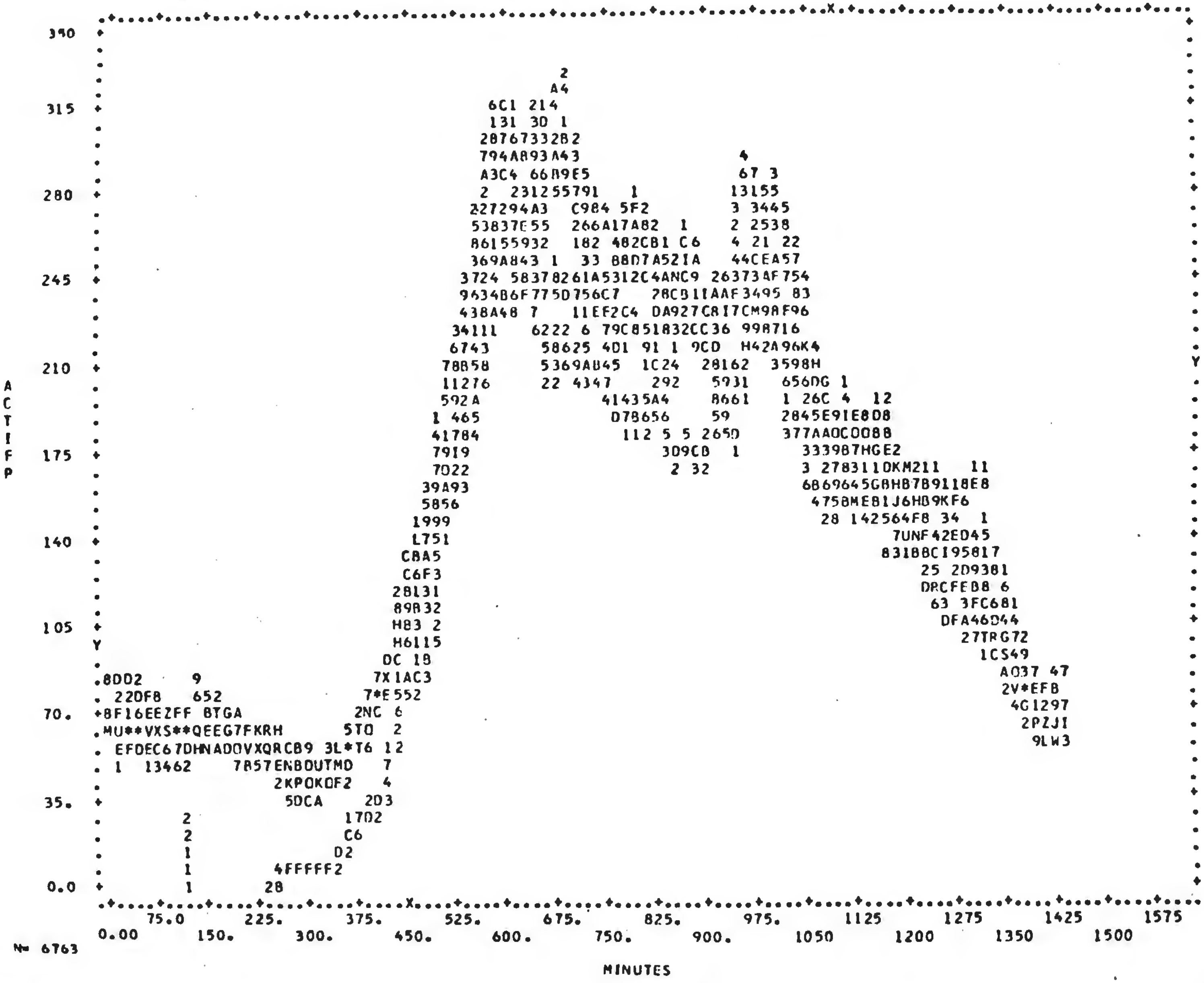
DAILY PATTERNS OF TRAFFIC LOADS, CENTRAL PROCESSING, AND SELECTOR CHANNEL UTILIZATION

side from the scatter diagrams presented so far, this appendix provides four sets f graphs which show how traffic load and computer use vary as the day progresses each measured site. In each plot the x-axis represents local time in minutes rom midnight, while the y-axis identifies active flight plan count (ACTIFP), track ount, central processing utilization (CPU), and average selector channel utiliza- ion (CHT) in the first, second, third, and fourth set, respectively. The "N" near he bottom of each graph represents the sample size of the data.

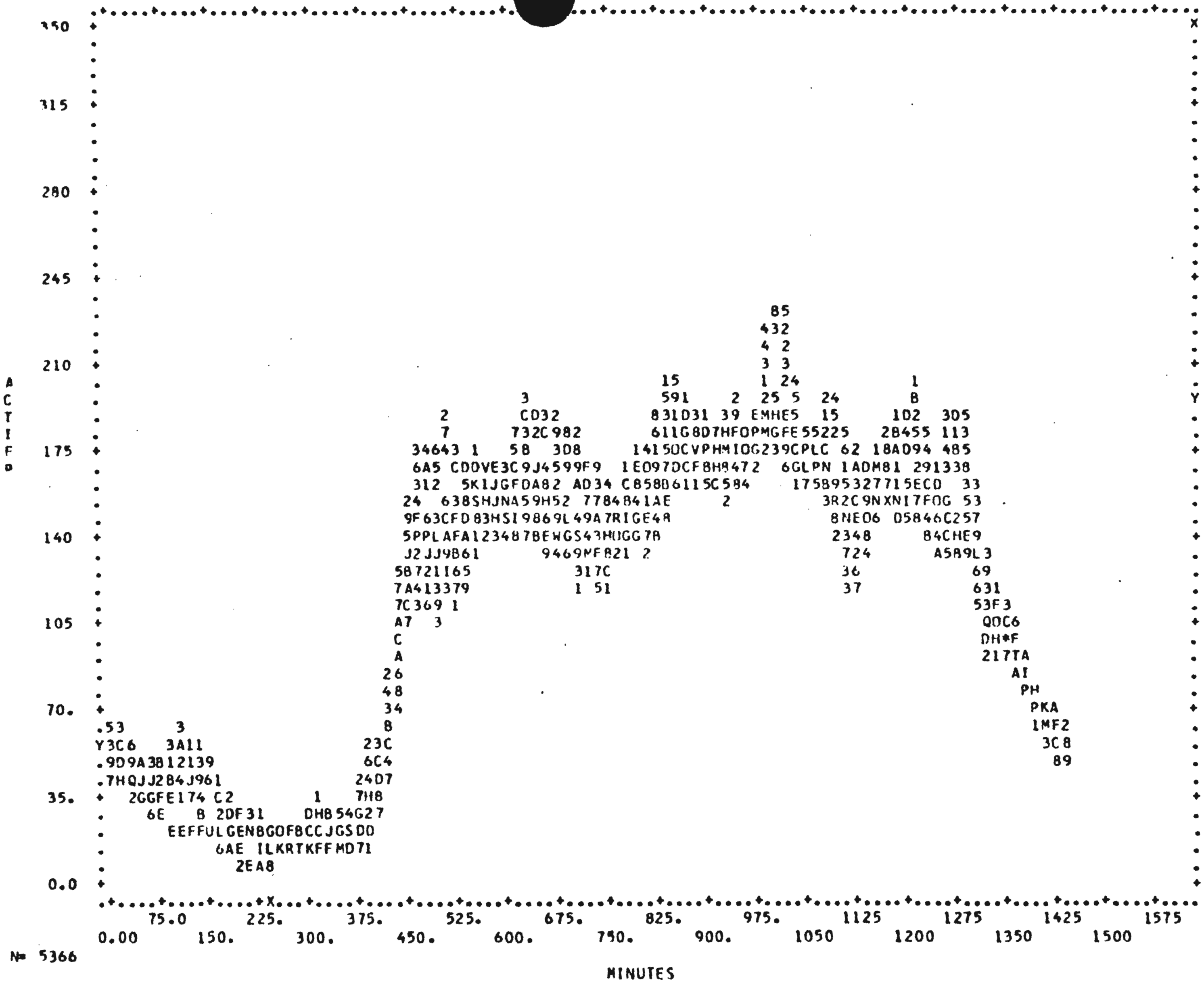
n each set the sites appear according to the following order:

Site	Computer System
Albuquerque	9020-A
Boston	9020-A
Denver	9020-A
Houston	9020-A
Memphis	9020-A
Miami	9020-A
Minneapolis	9020-A
Oakland	9020-A
Salt Lake	9020-A
Seattle	9020-A
Atlanta	9020-D
Cleveland	9020-D
Fort Worth	9020-D
Indianapolis	9020-D
Jacksonville	9020-D
Kansas City	9020-D
Los Angeles	9020-D
New York	9020-D
Washington	9020-D

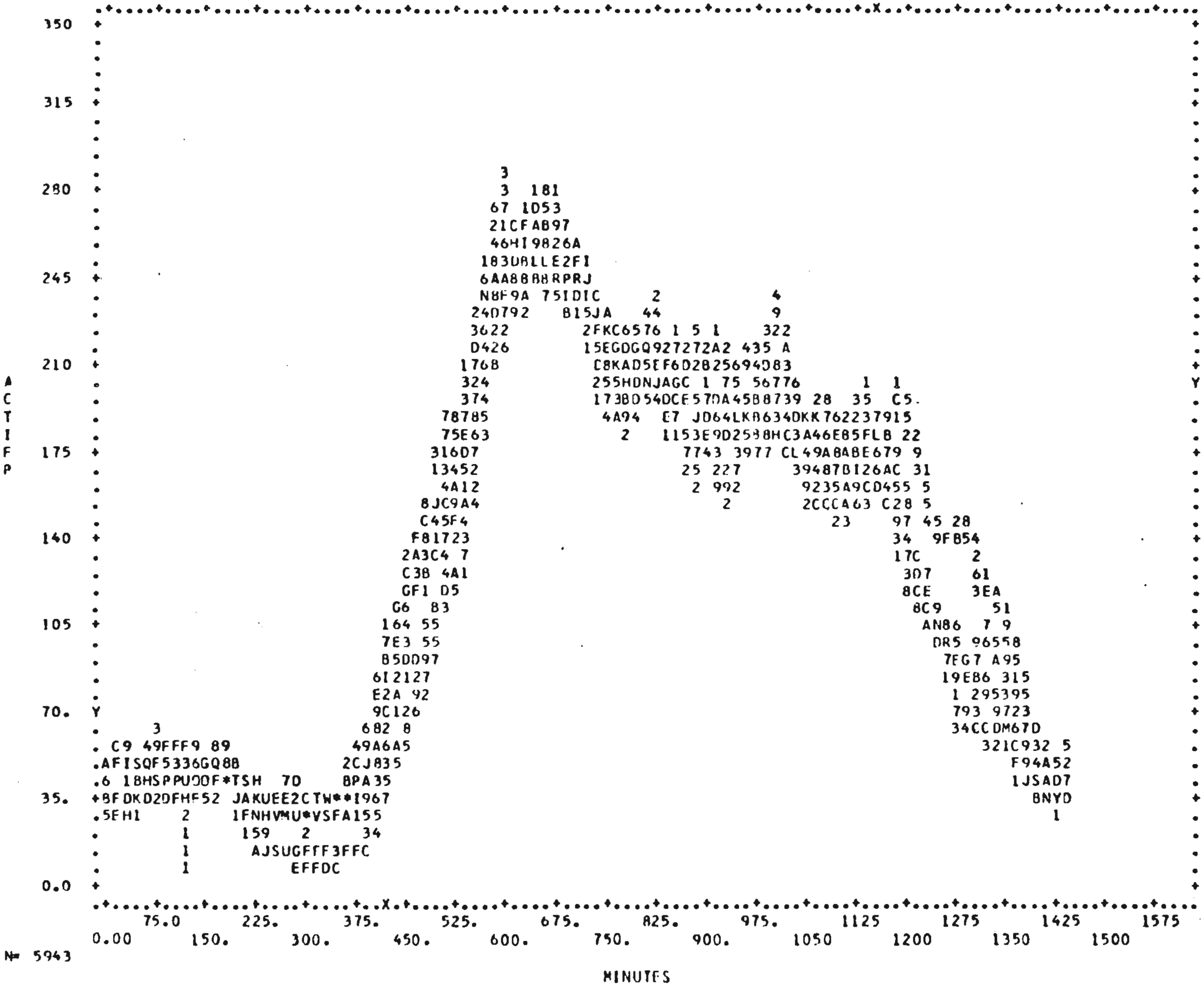
ALBUQUERQUE 2.12 902CA ALL TIMES MEASURED BETWEEN 07/19/82 AND 07/24/82



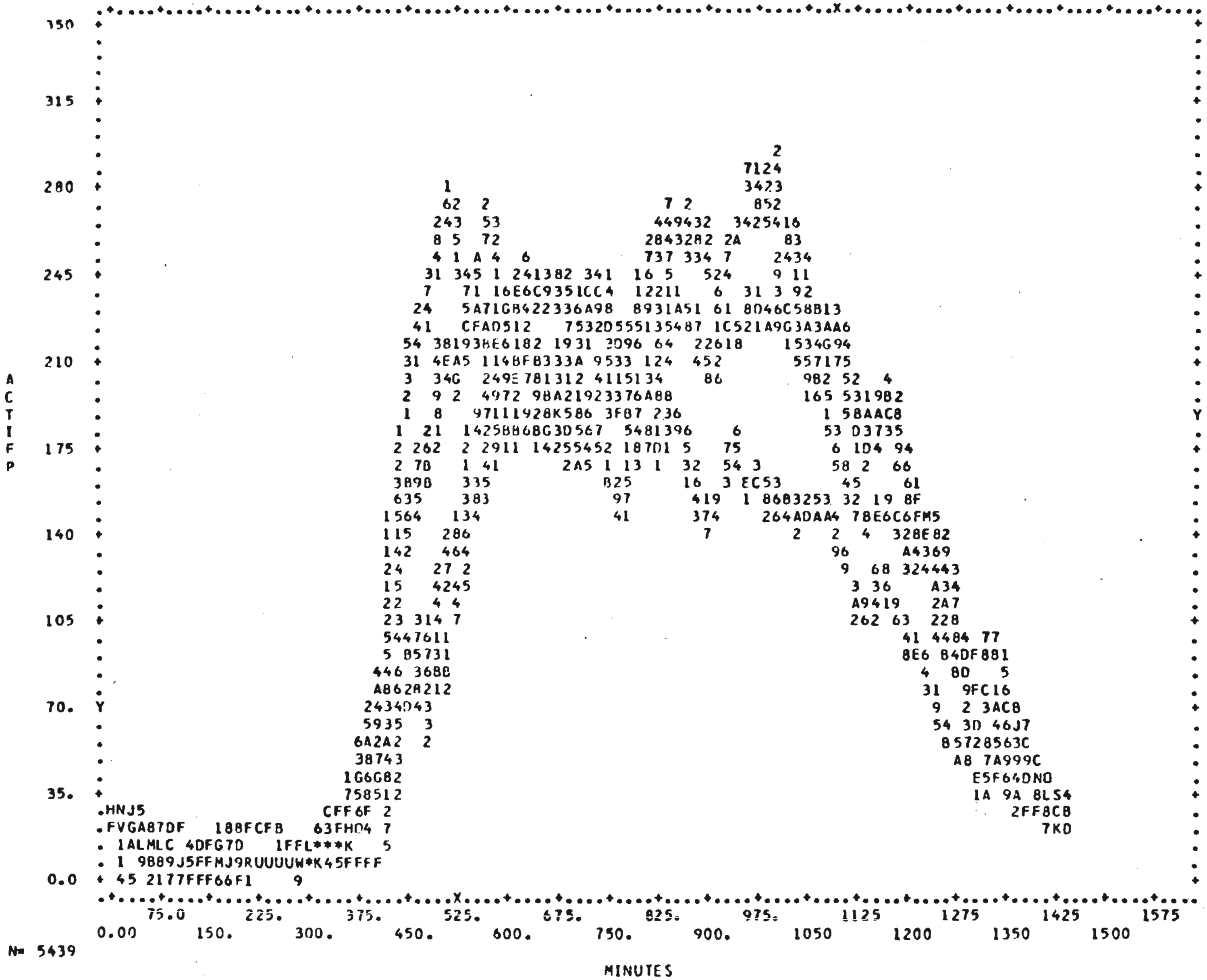
9020A ALL TIMES MEASURED B[illegible]N 06/21/82 AND 07/03/82



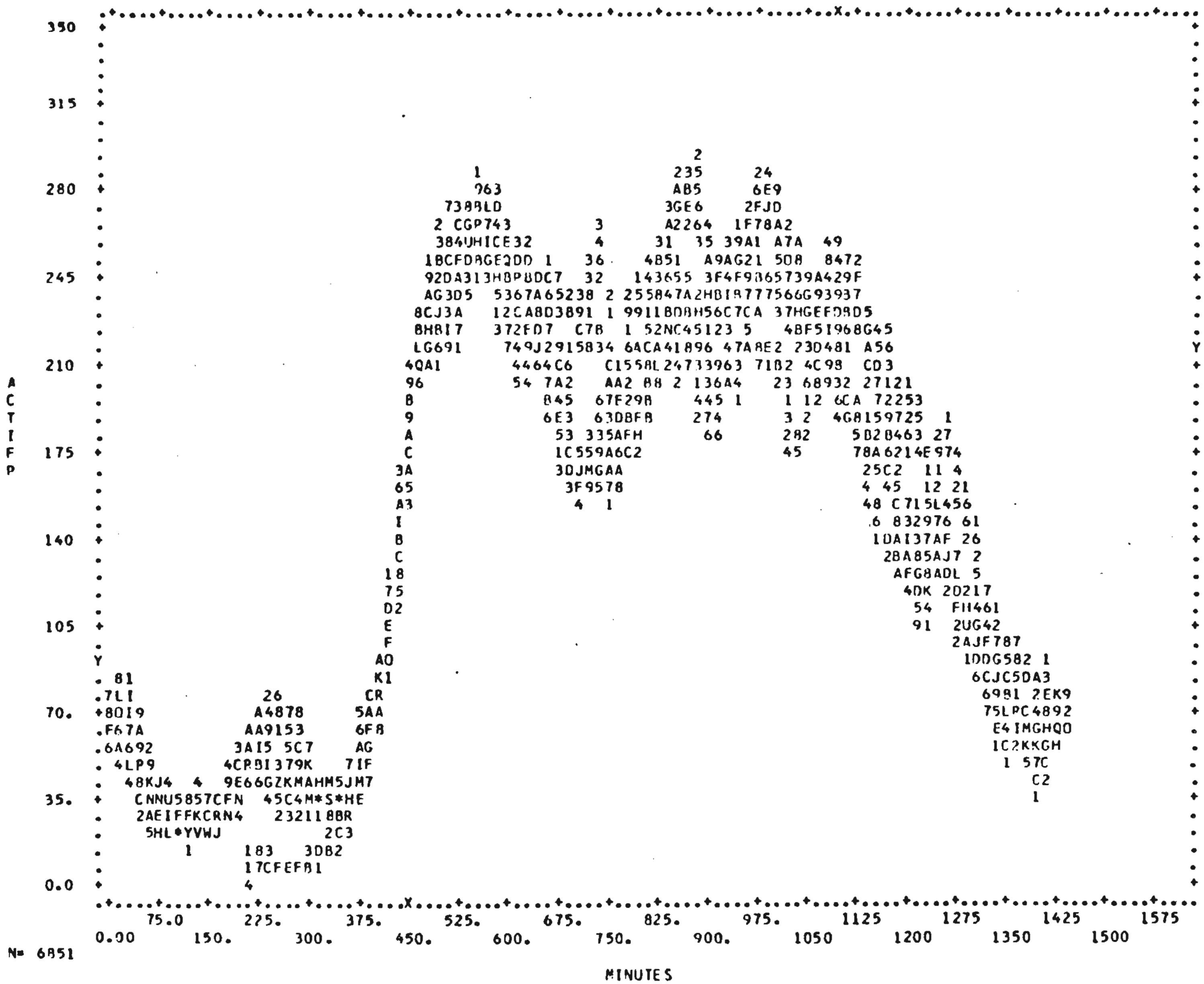
DENVER 2.12 9020A ALL TIMES MEASURED BETWEEN 08/04/82 AND 08/09/82



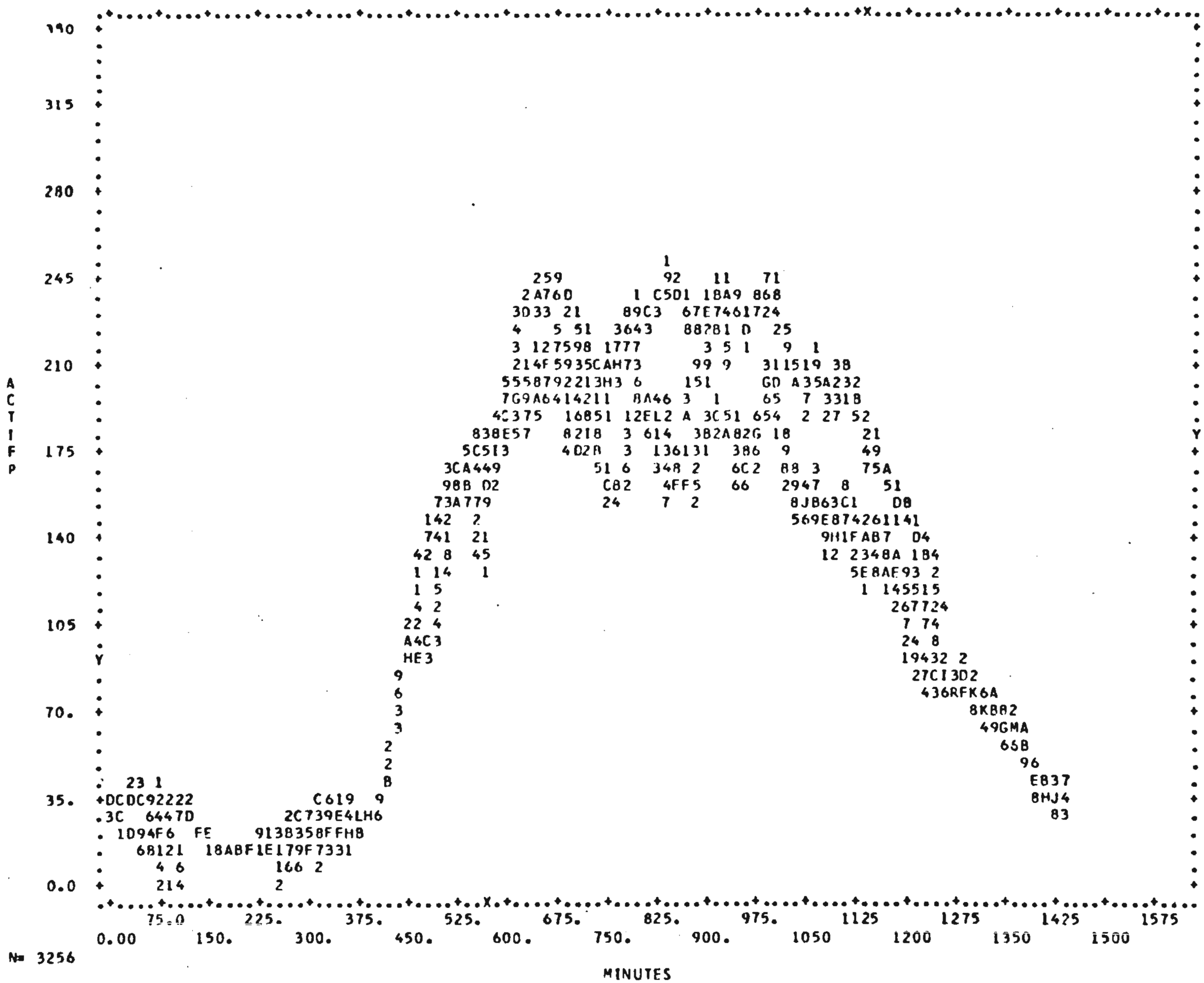
HOUSTON 2.12 9020A ALL TIMES MEASURED BETWEEN 11/5/82 AND 11/10/82



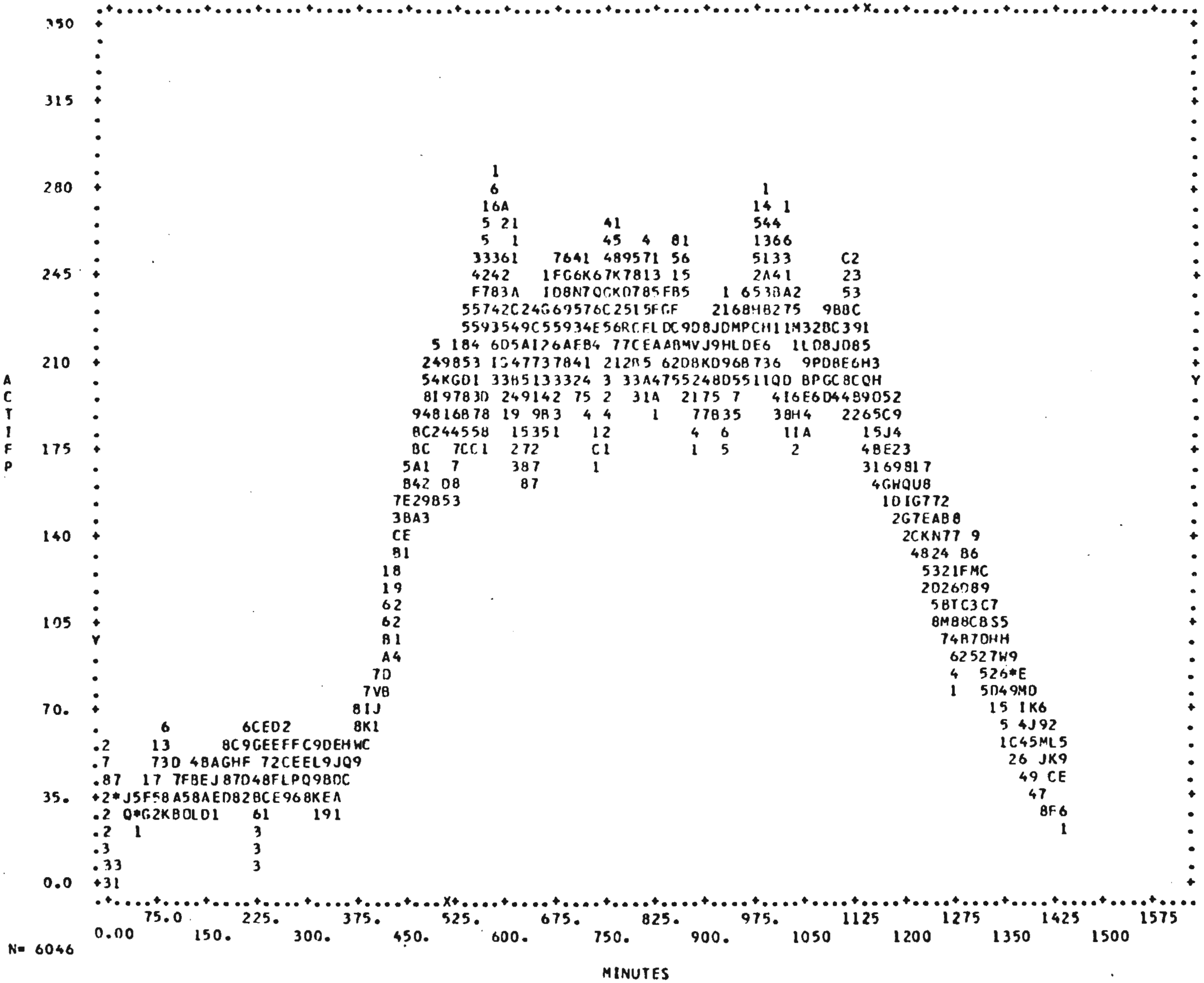
MEMPHIS 2.12 9020A ALL TIMES MEASURED BETWEEN 07/26/82 AND 07/31/82



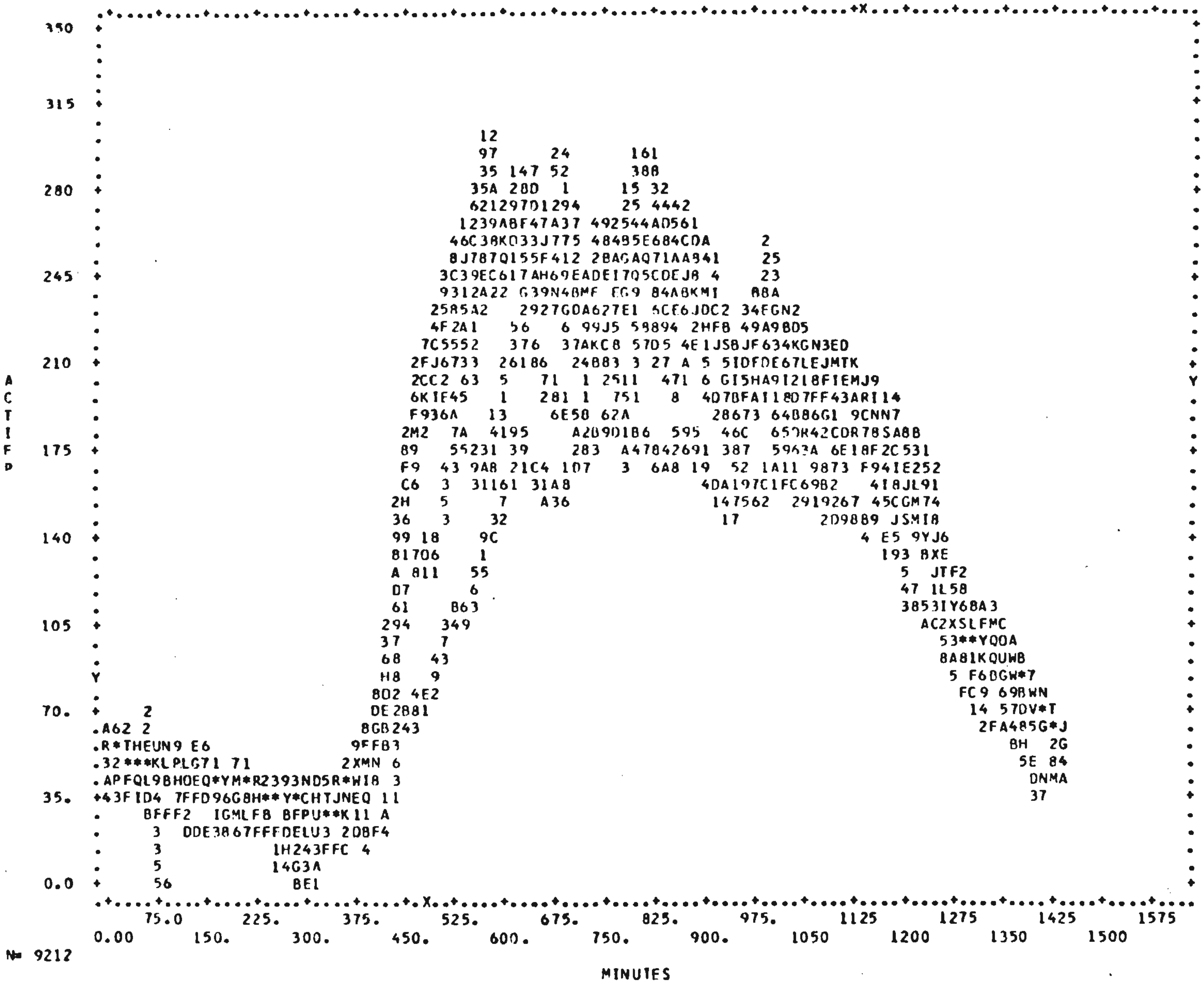
MIAMI 2.12 9020A ALL TIMES MEASURED BETWEEN 06/08/82 AND 06/12/82



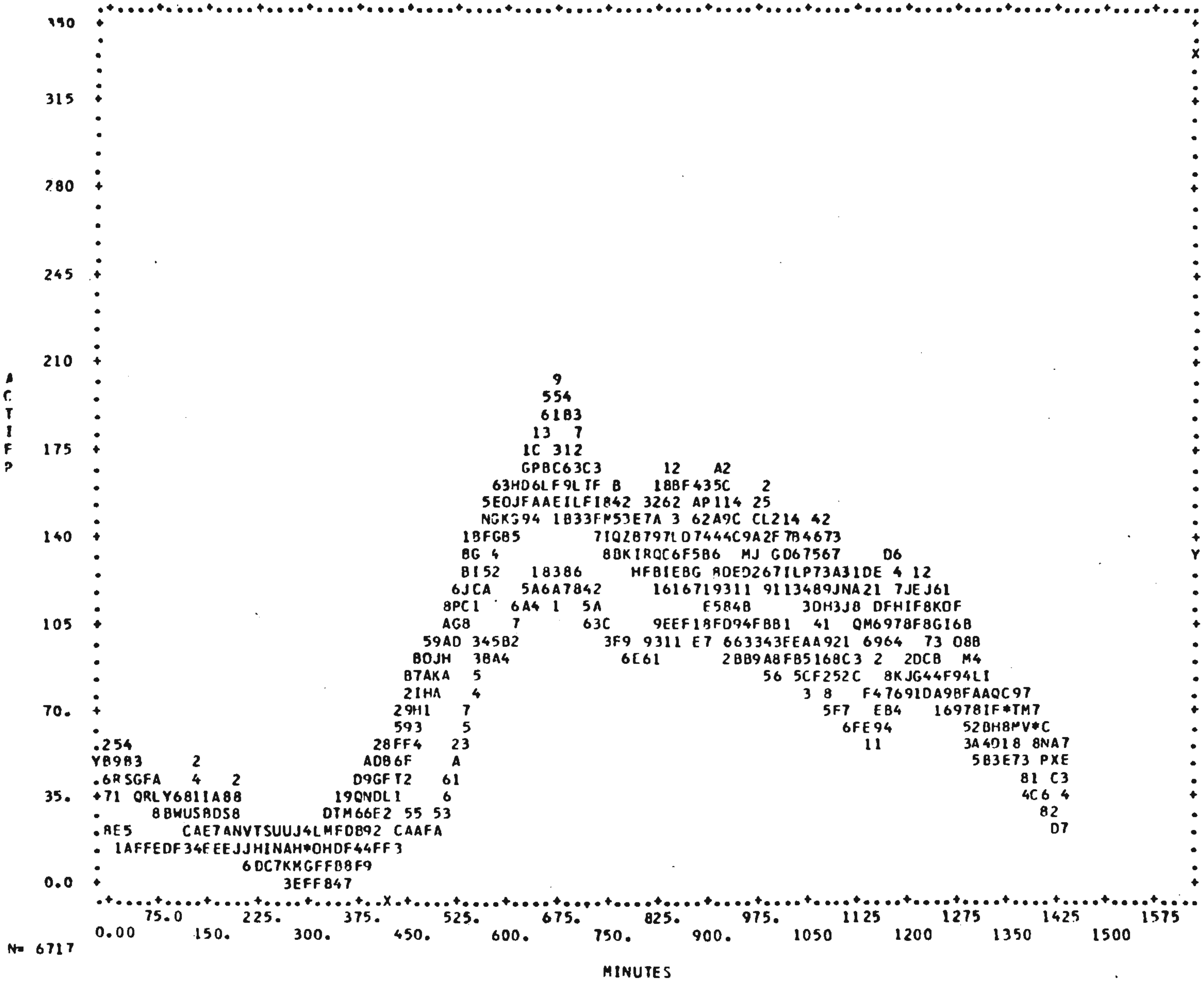
MINNEAPOLIS 2.12 9020A ALL TIMES MEASURED BETWEEN 10/18/82 AND 10/23/82



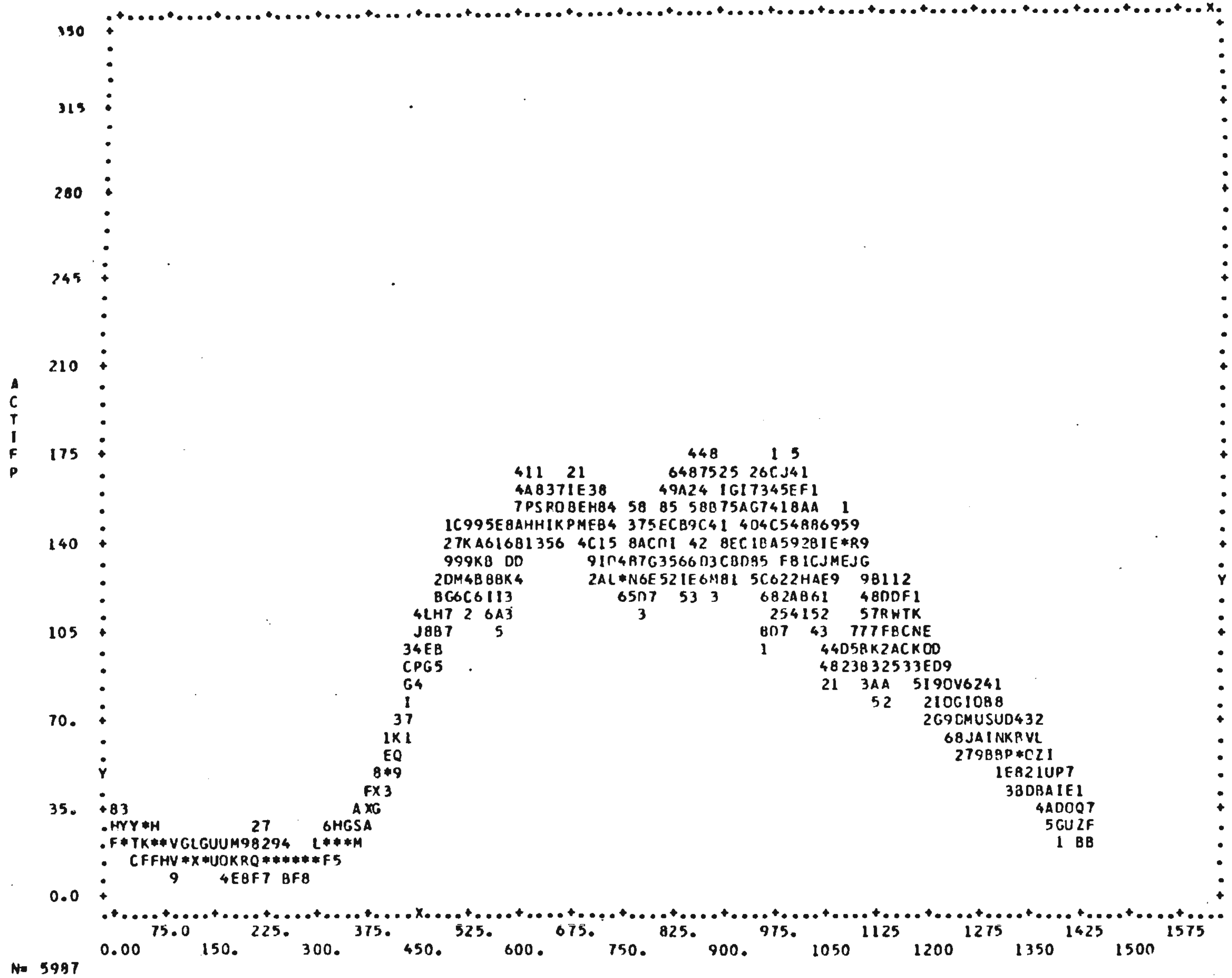
OAKLAND 2.12 9020A ALL TIMES MEASURED BETWEEN 08/15/82 AND 08/22/82



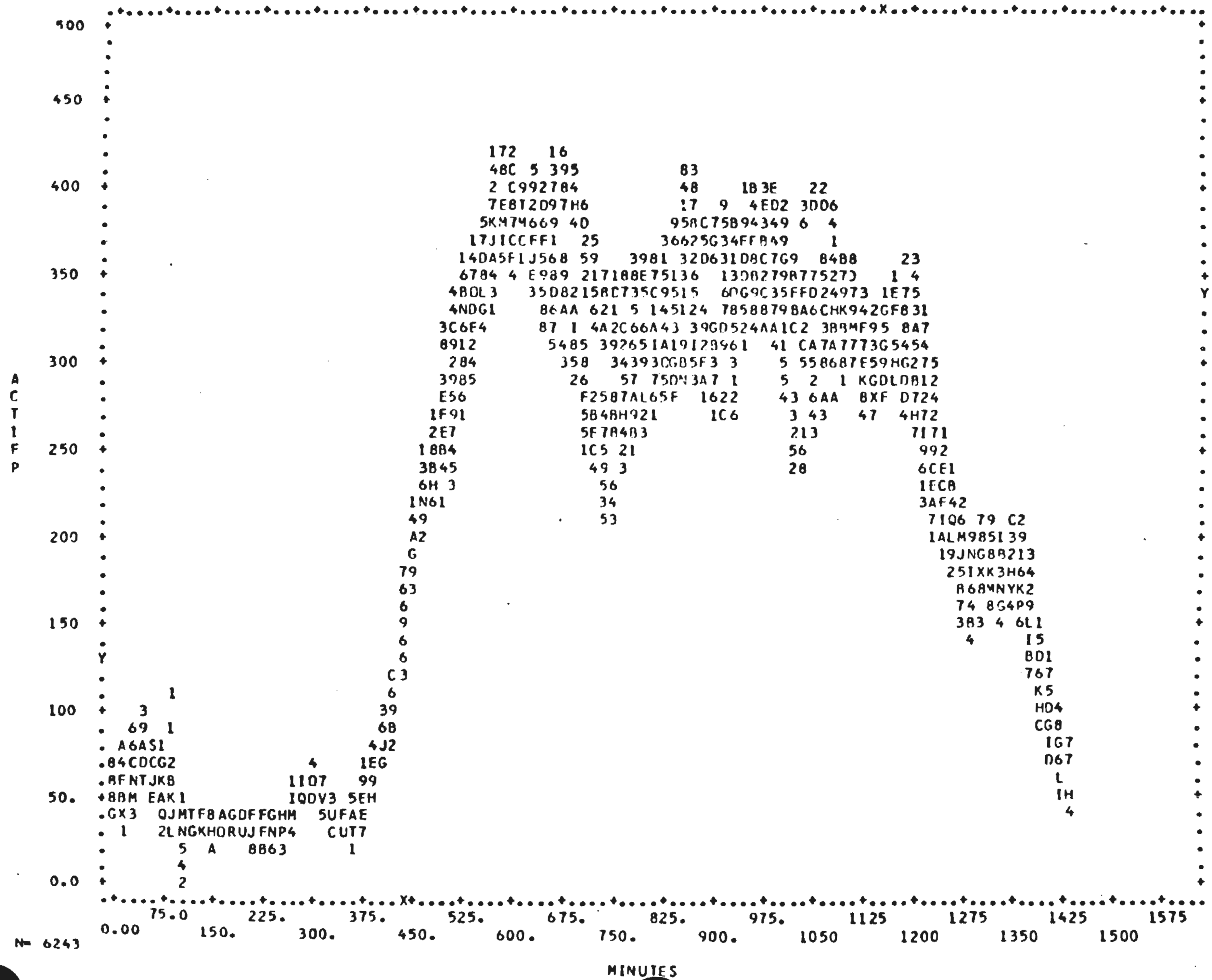
SALT LAKE 2.12 9020A ALL TIMES MEASURED BETWEEN 05/23/82 AND 05/28/82



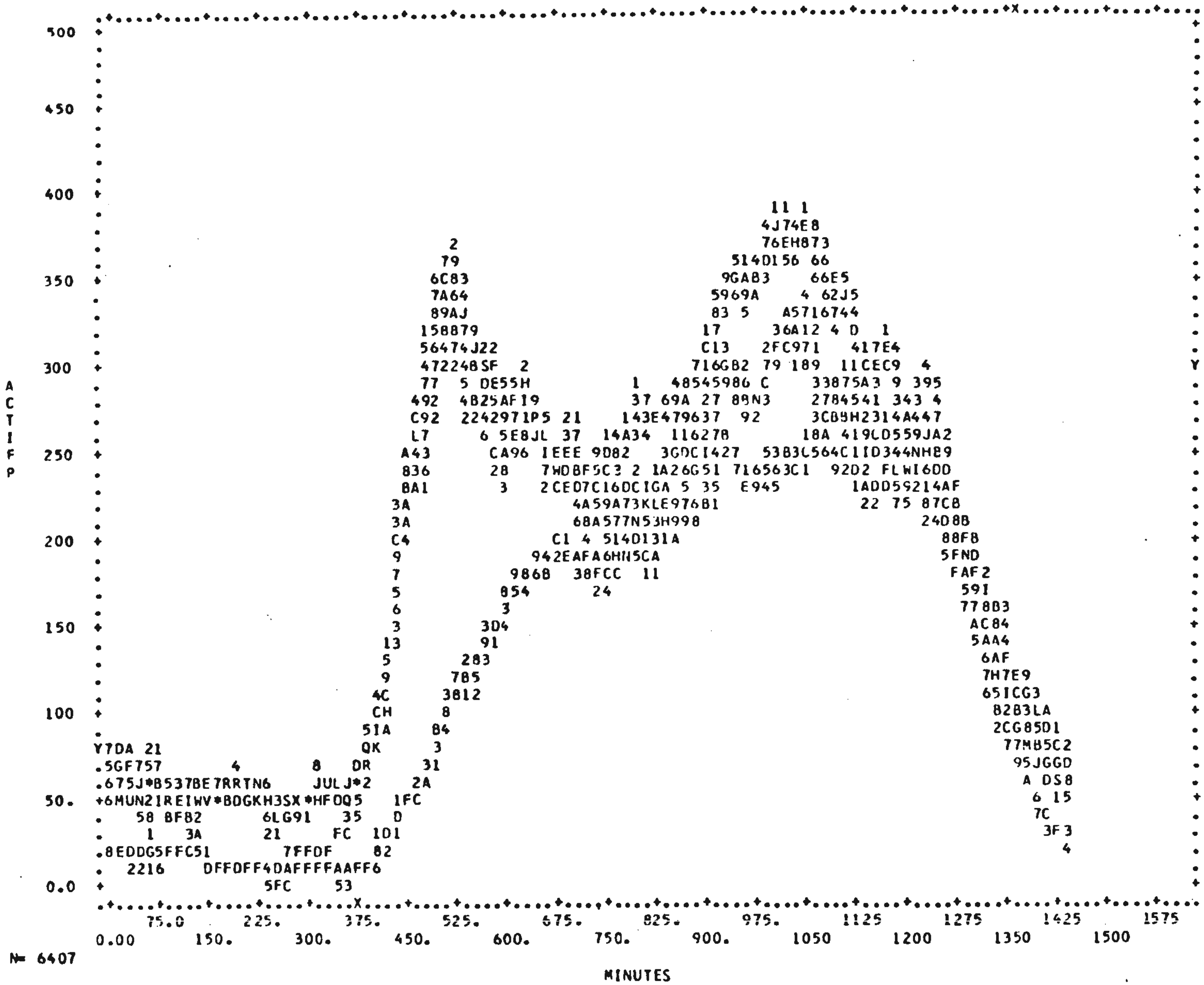
SEATTLE 2.12 9020A ALL TIMES MEASURED BETWEEN 06/07/82 AND 06/12/82



ATLANTA 2.12 9020D ALL TIMES MEASURED BETWEEN 07/26/82 AND 07/31/82



CLEV 2.12 9020D ALL TIMES MEASURED BETWEEN 05/31/82 AND 06/05/82



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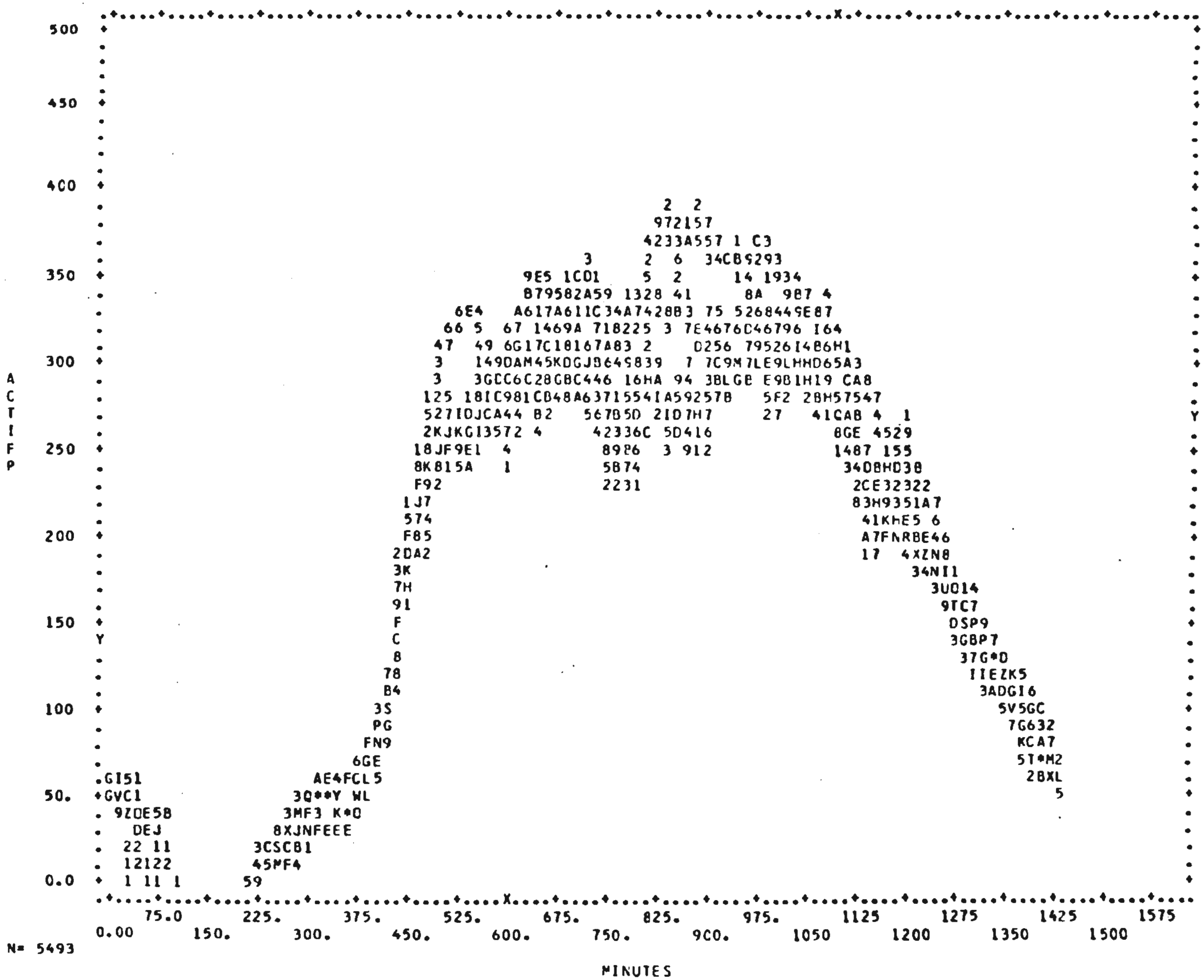
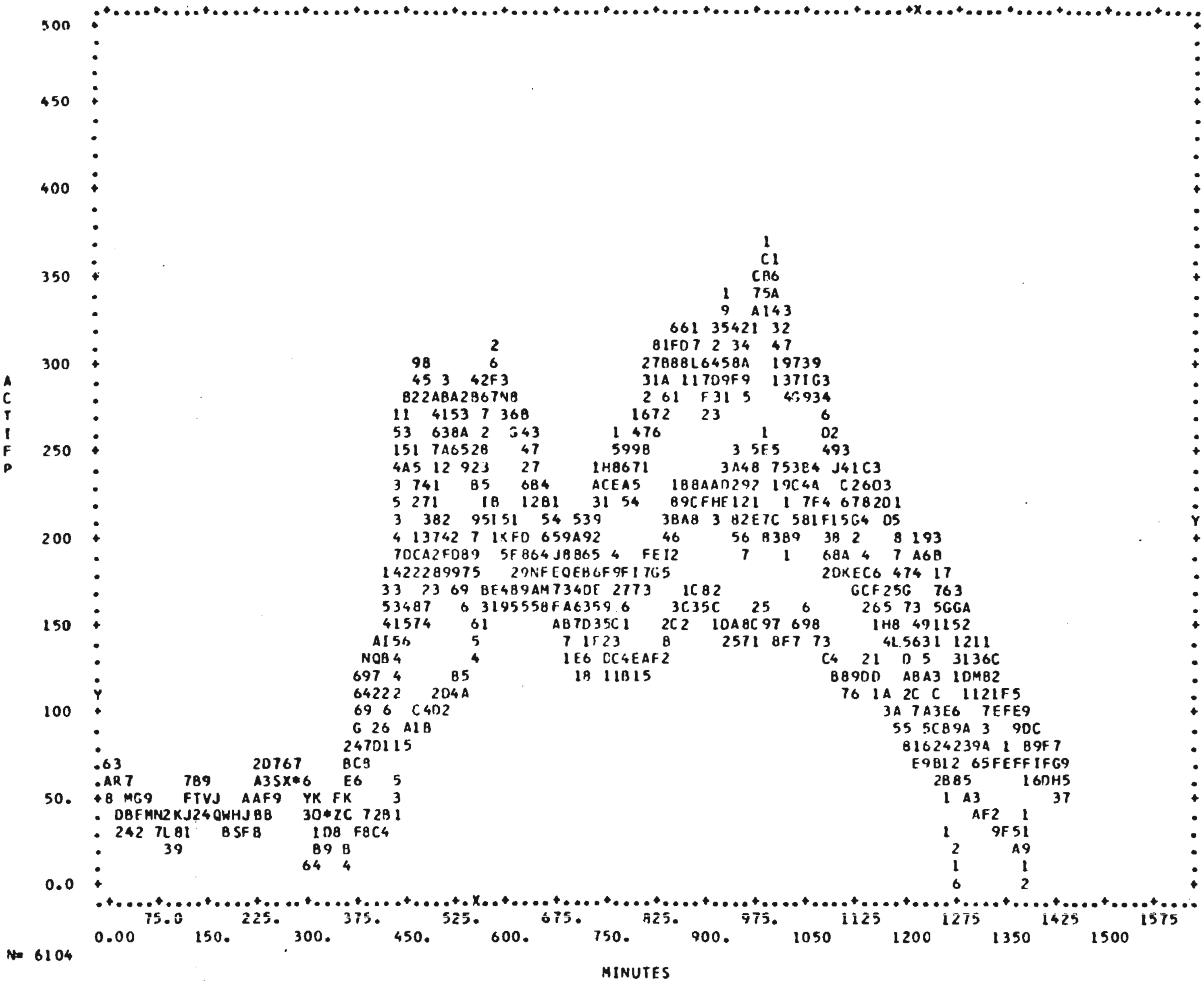
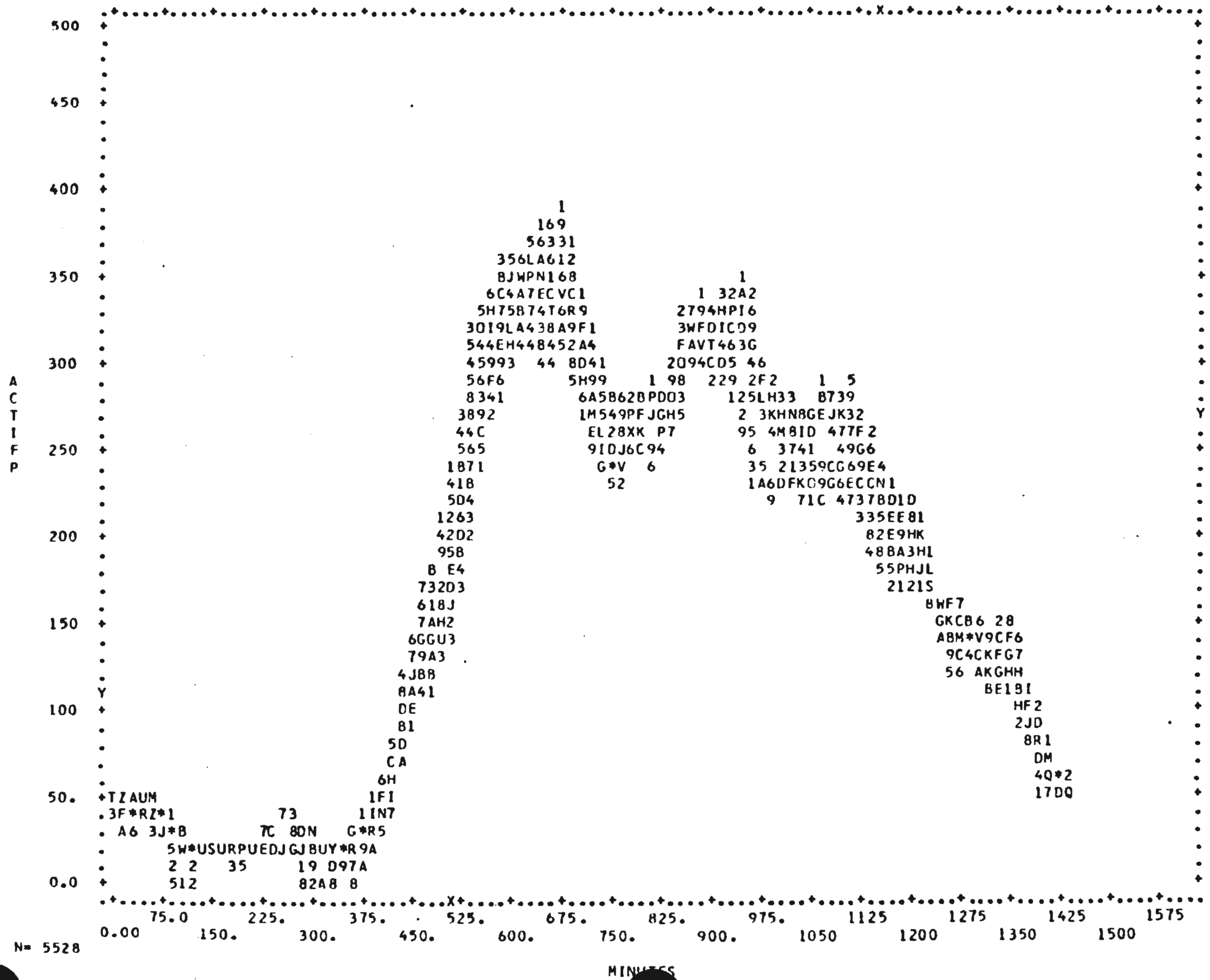
FT WORTH 2.12 90200 ALL TIMES MEASURED BETWEEN 02/08/82 AND 02/13/82



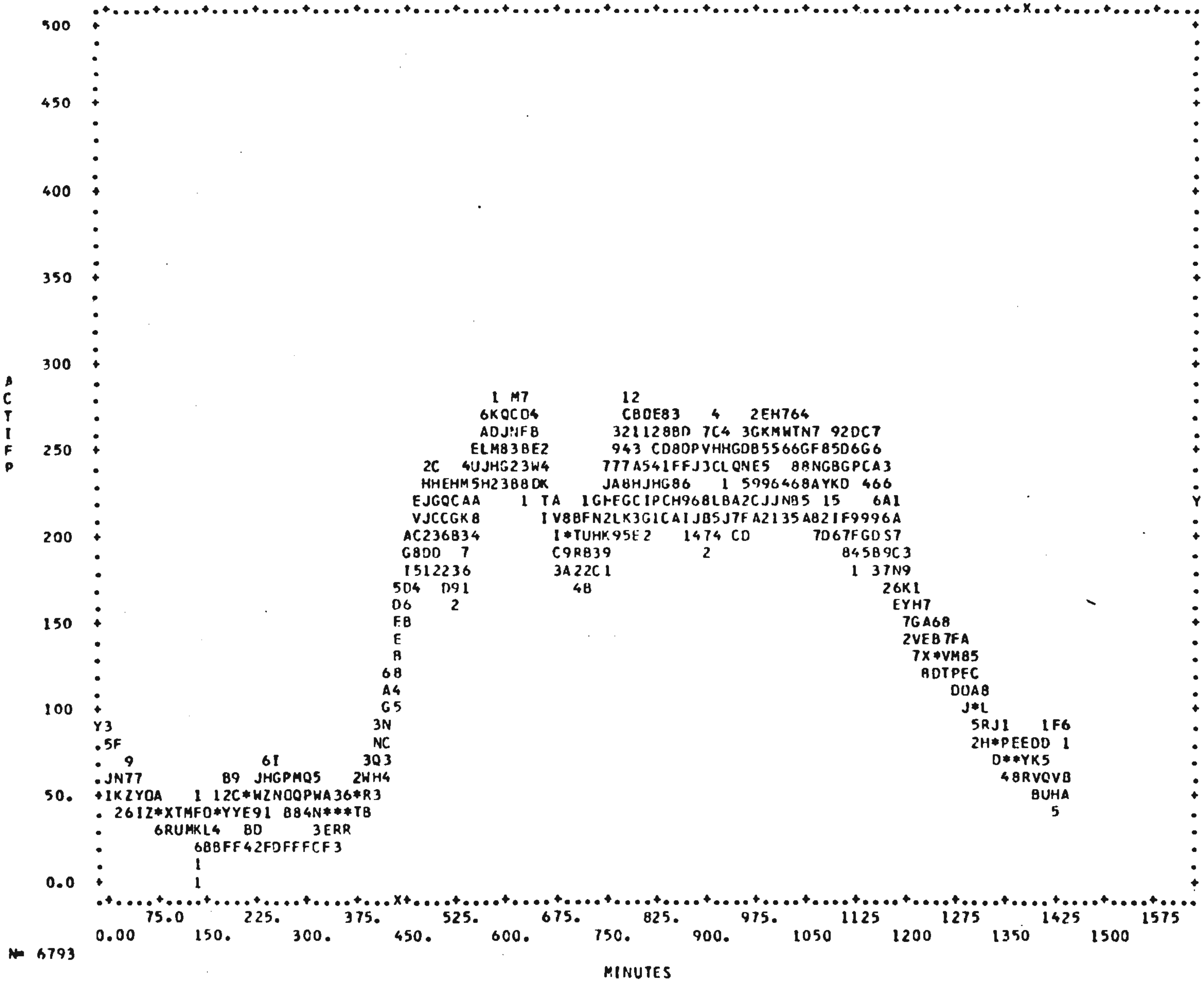
INDIANAPOLIS 2.12 90200 ALL TIMES MEASURED BETWEEN 10/10/82 AND 10/17/82



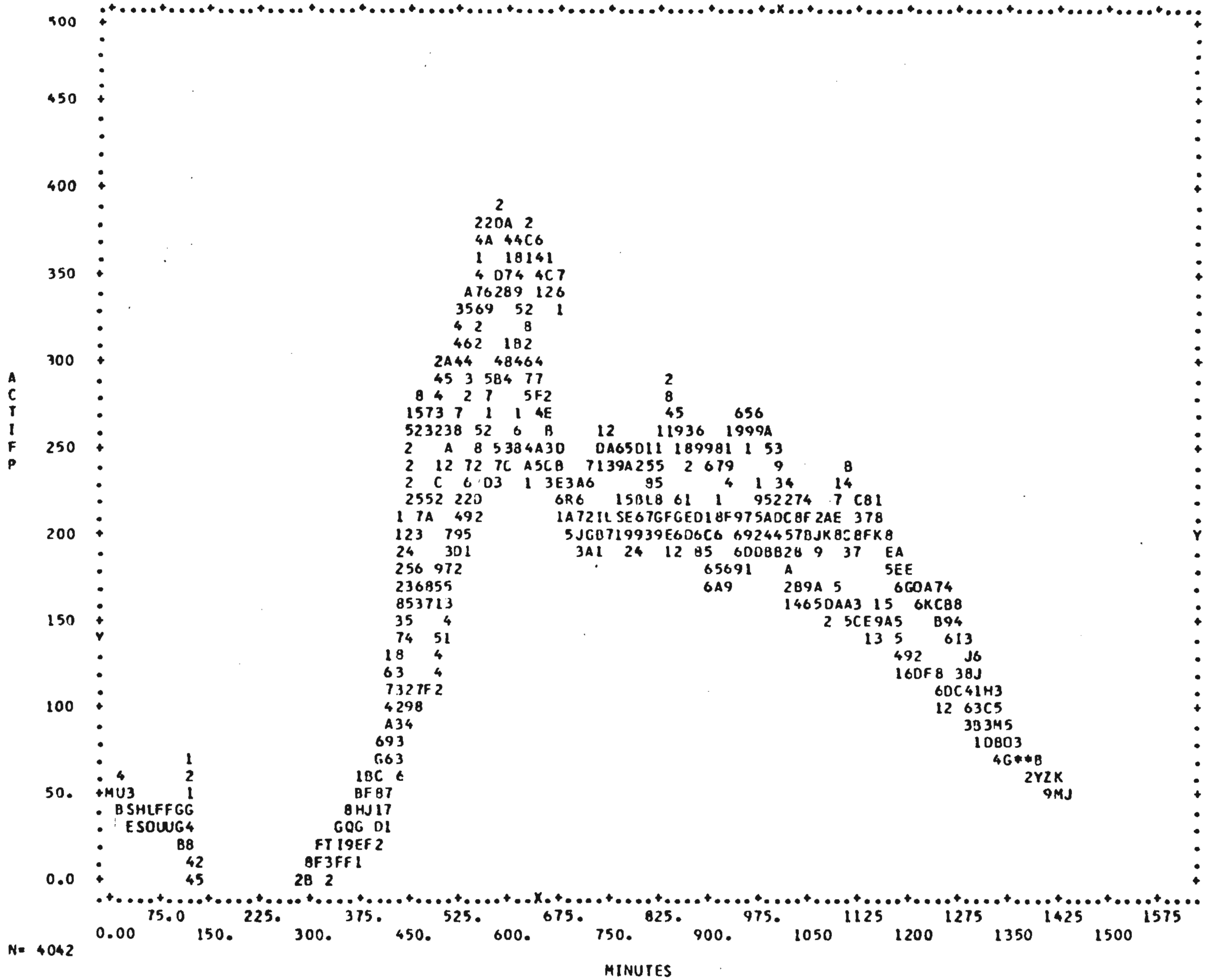
JACKSONVILLE 2.12 9020D ALL TIMES MEASURED BETWEEN 08/23/82 AND 08/27/92



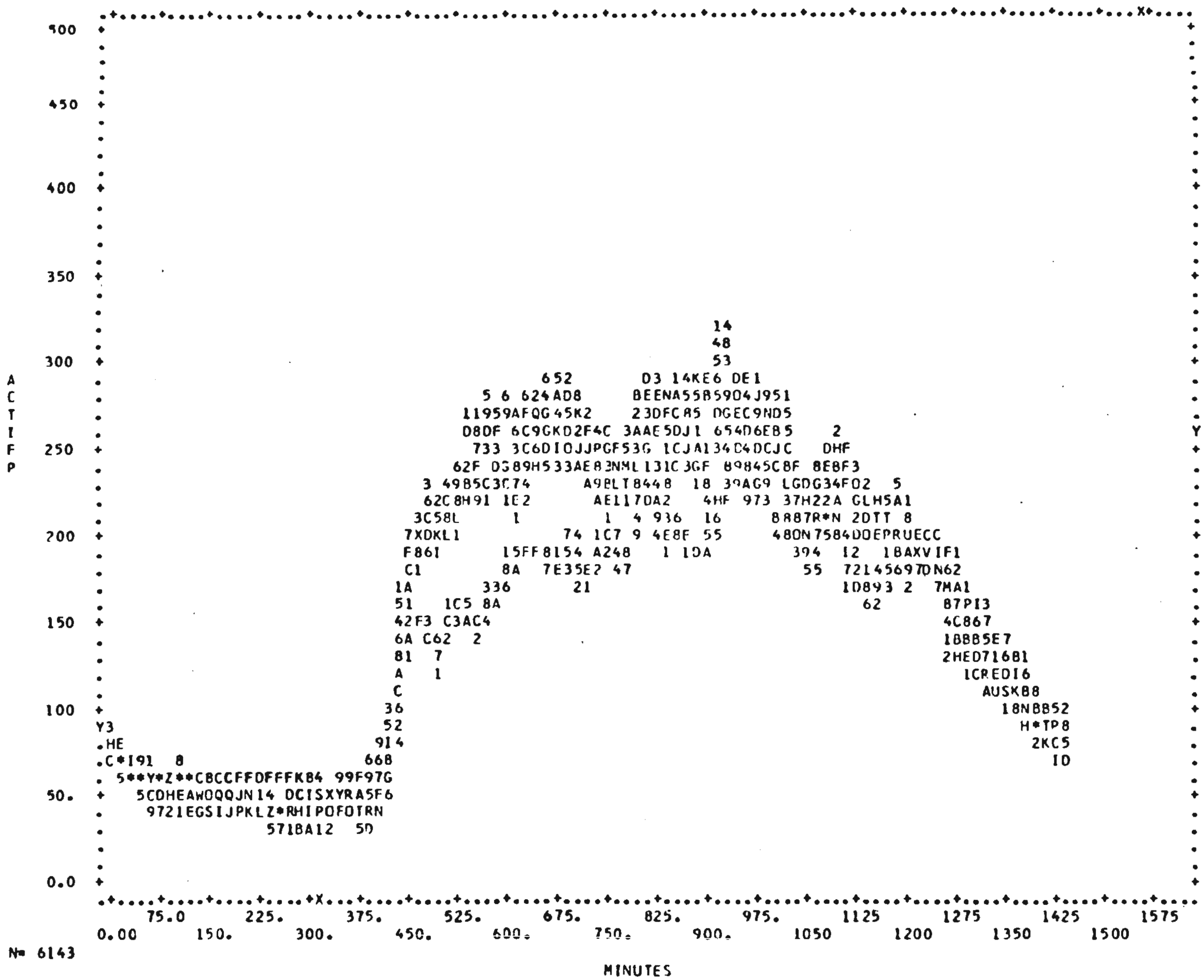
KANSAS CITY 2.12 9020D ALL TIMES MEASURED BETWEEN 07/19/82 AND 07/24/82



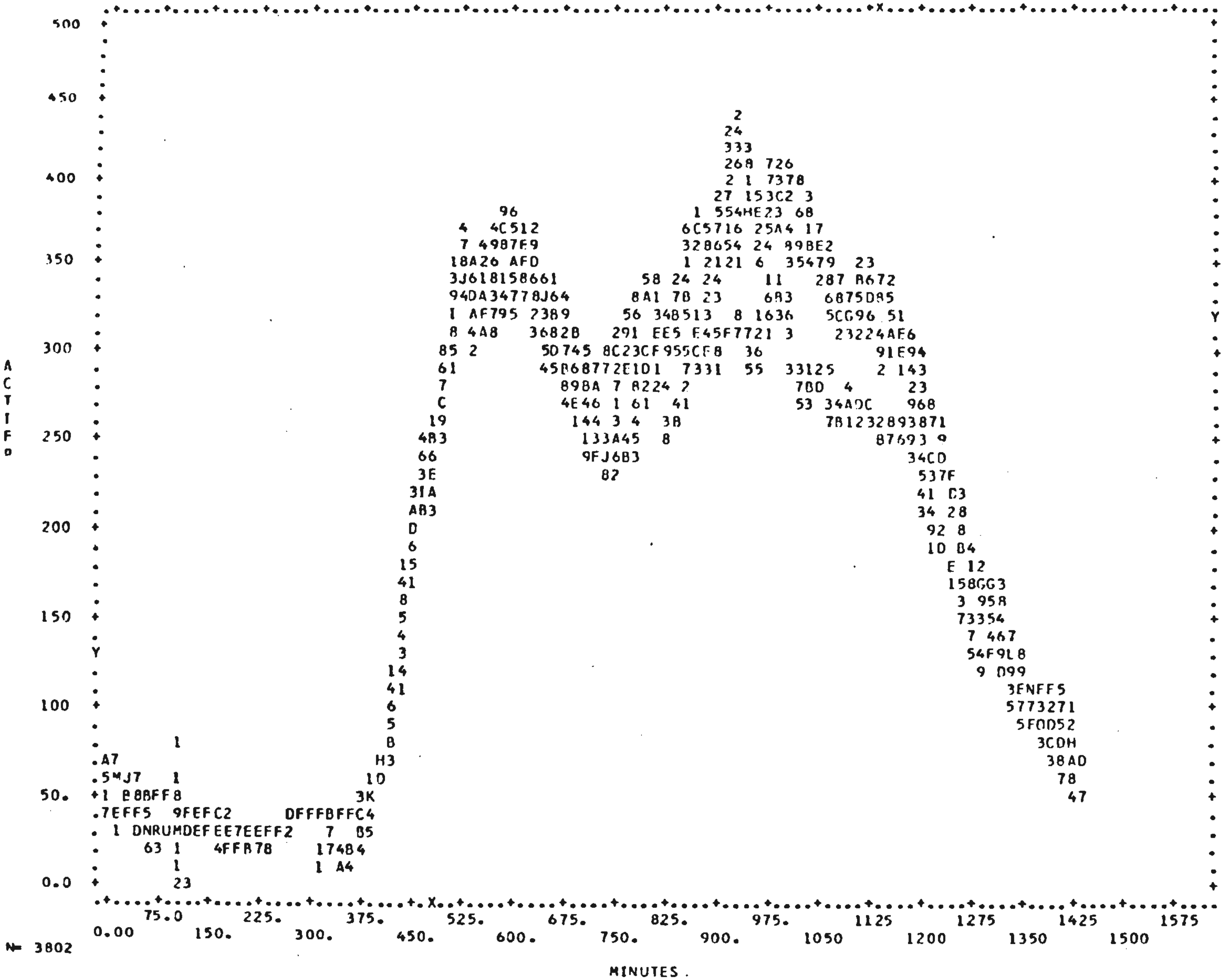
LOS ANGELES 2.12 9020D ALL TIMES MEASURED BETWEEN 08/12/82 AND 08/16/82



NEW YORK 2.12 90200 ALL TIMES MEASURED BETWEEN 12/27/82 AND 12/31/82



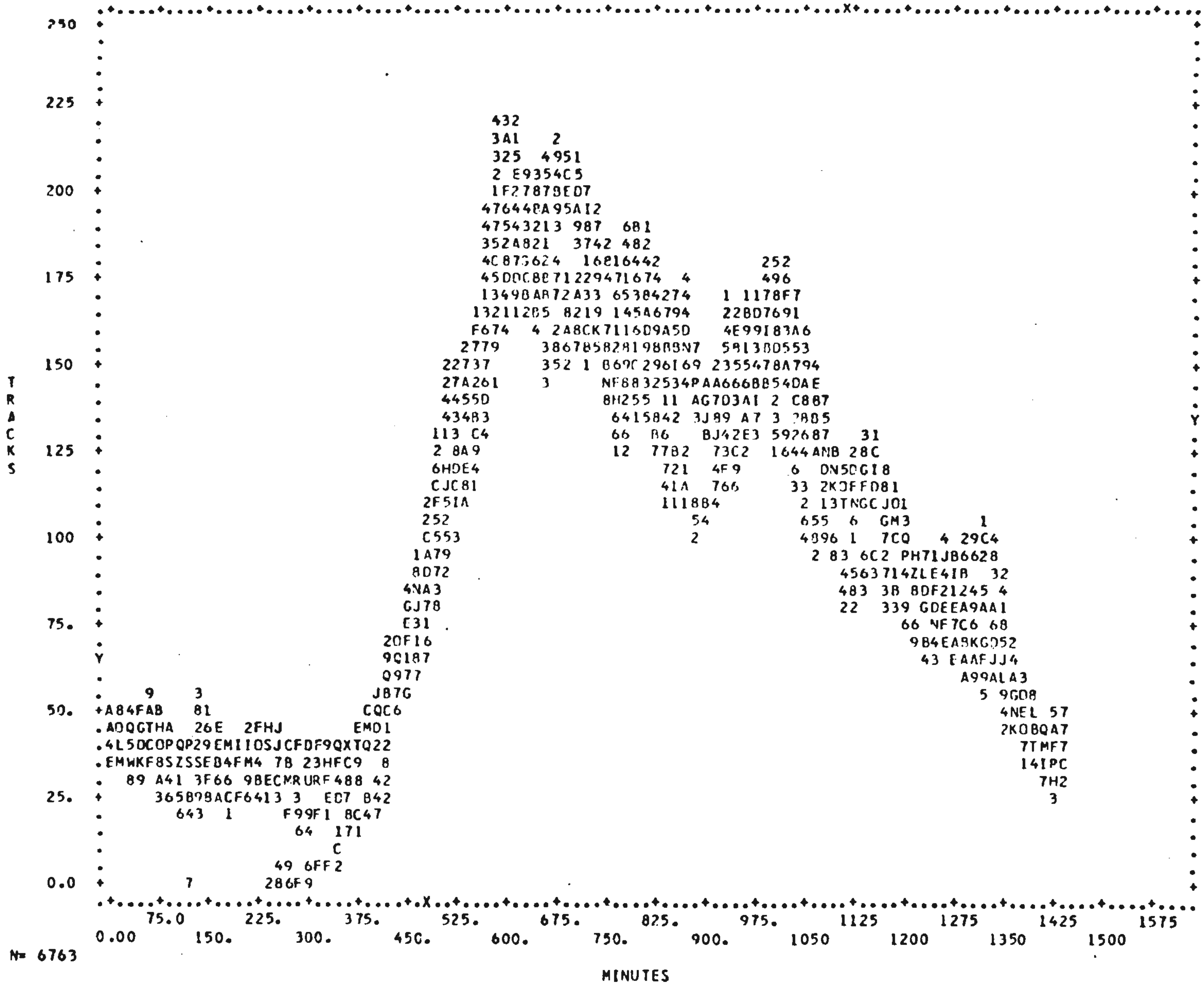
WASHINGTON 2.12 90200 ALL TIMES MEASURED BETWEEN 10/04/82 AND 10/07/82



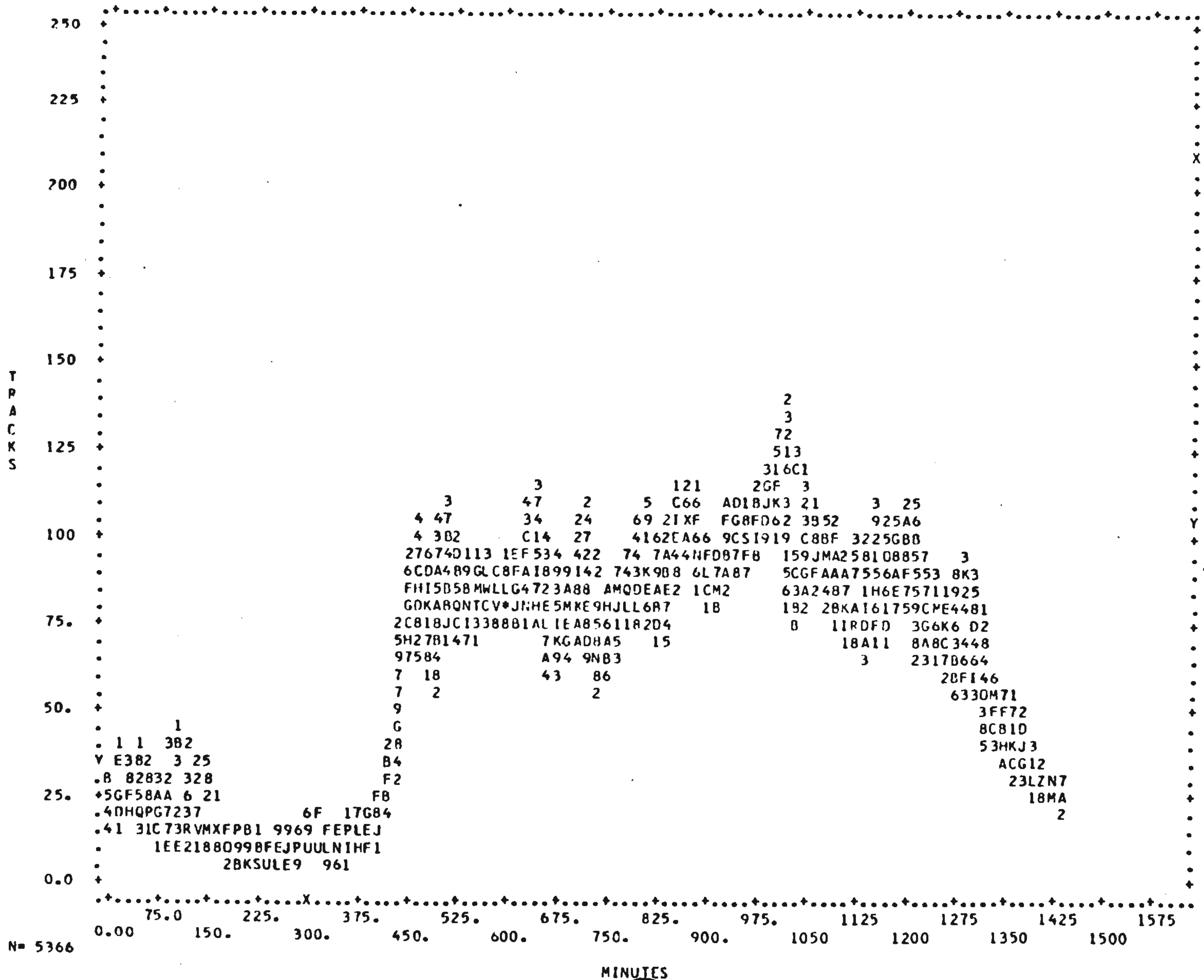
N= 3802

G-20

ALBUQUERQUE 2.12 9020A ALL TIMES MEASURED BETWEEN 07/19/82 AND 07/24/82



BOSTON 2.12 9020A ALL TIMES MEASURED BETWEEN 06/21/82 AND 07/03/82



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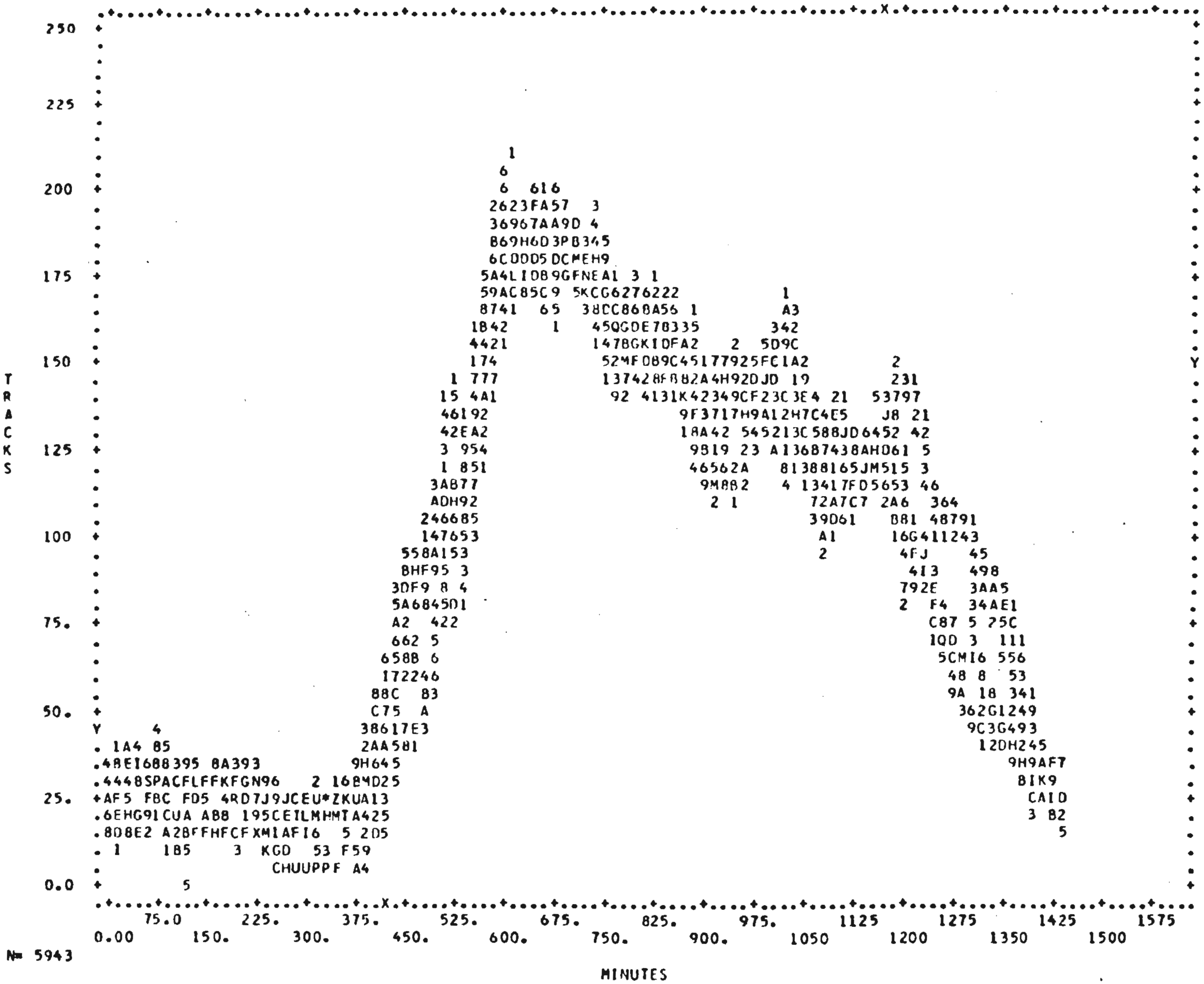

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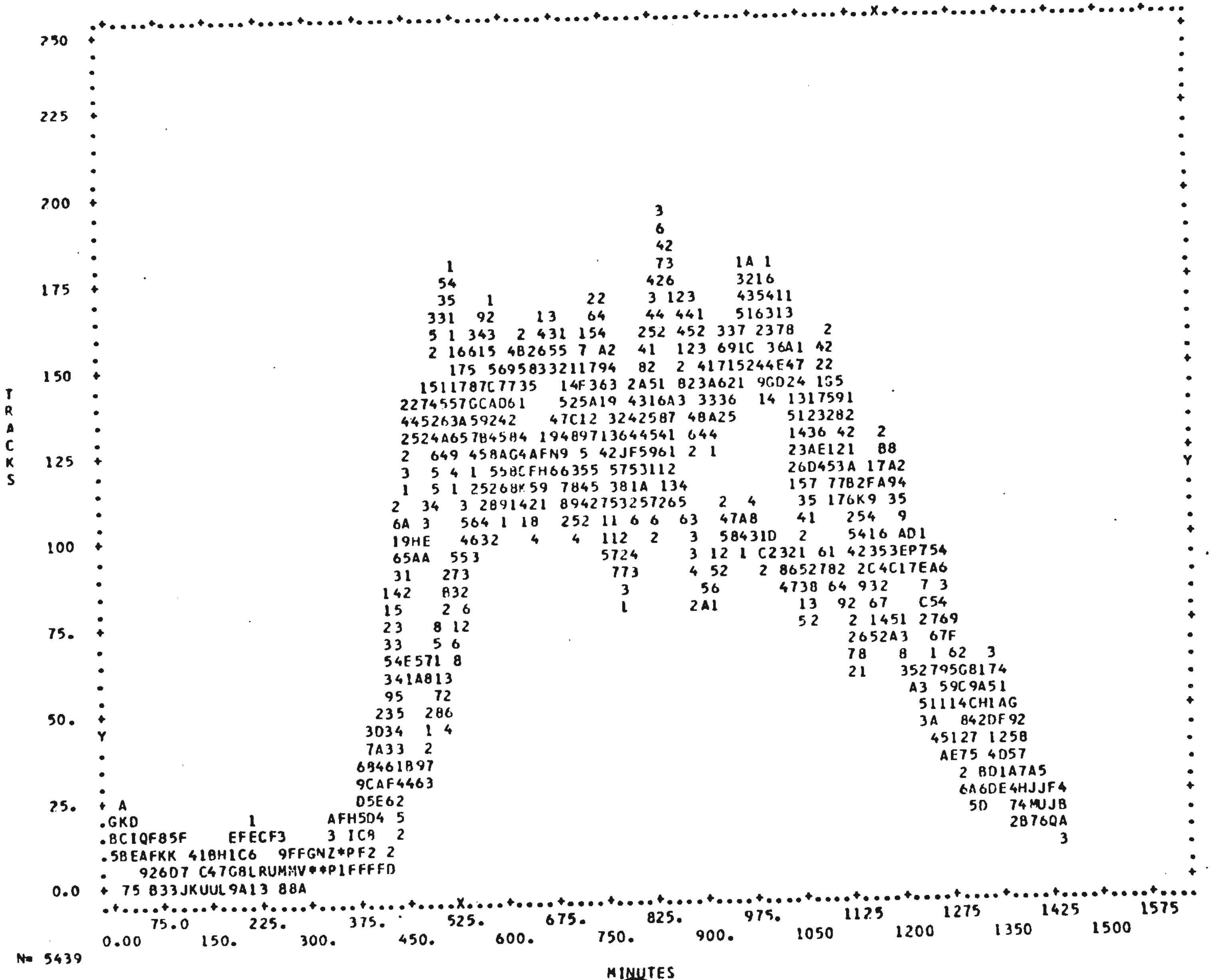

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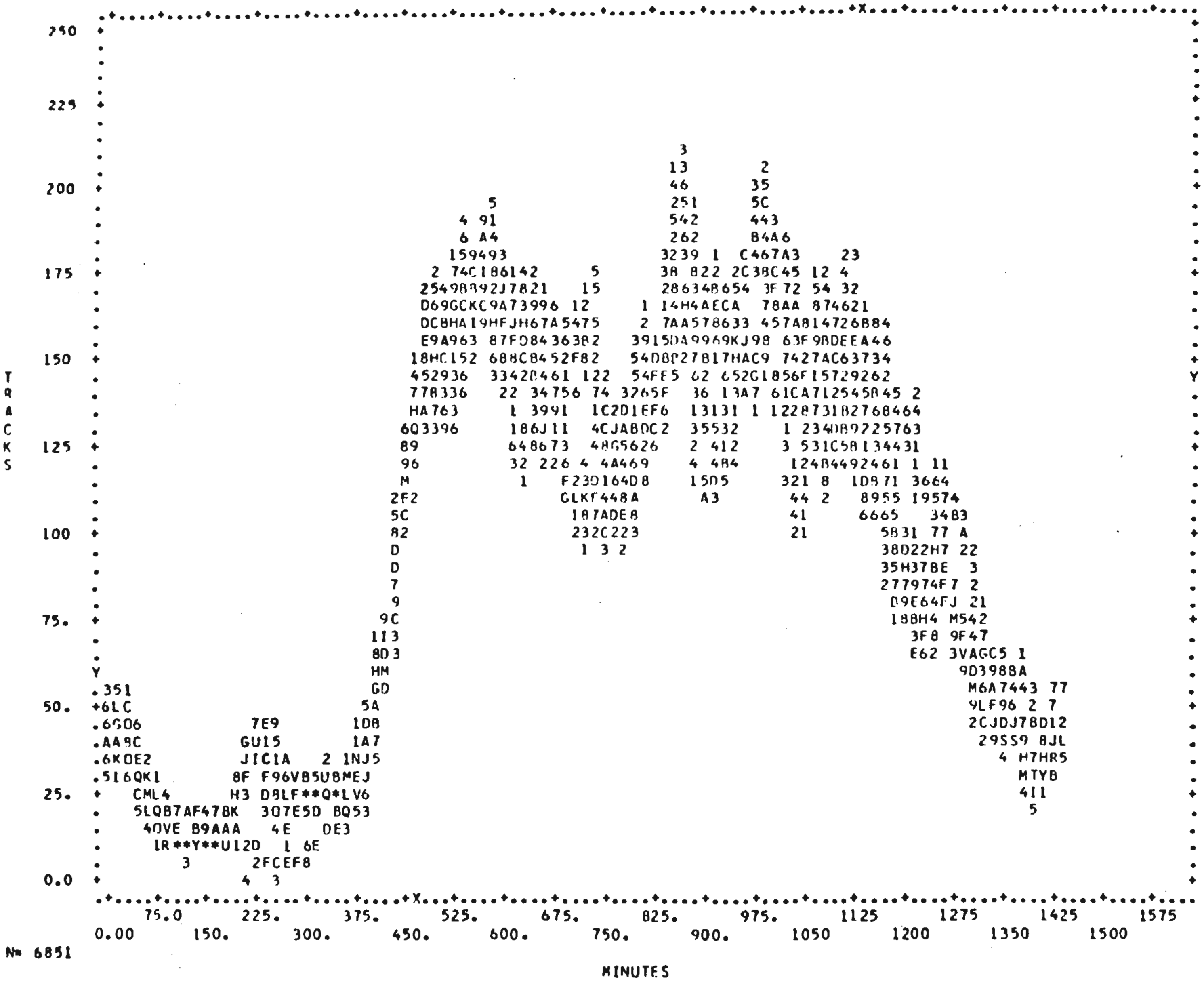

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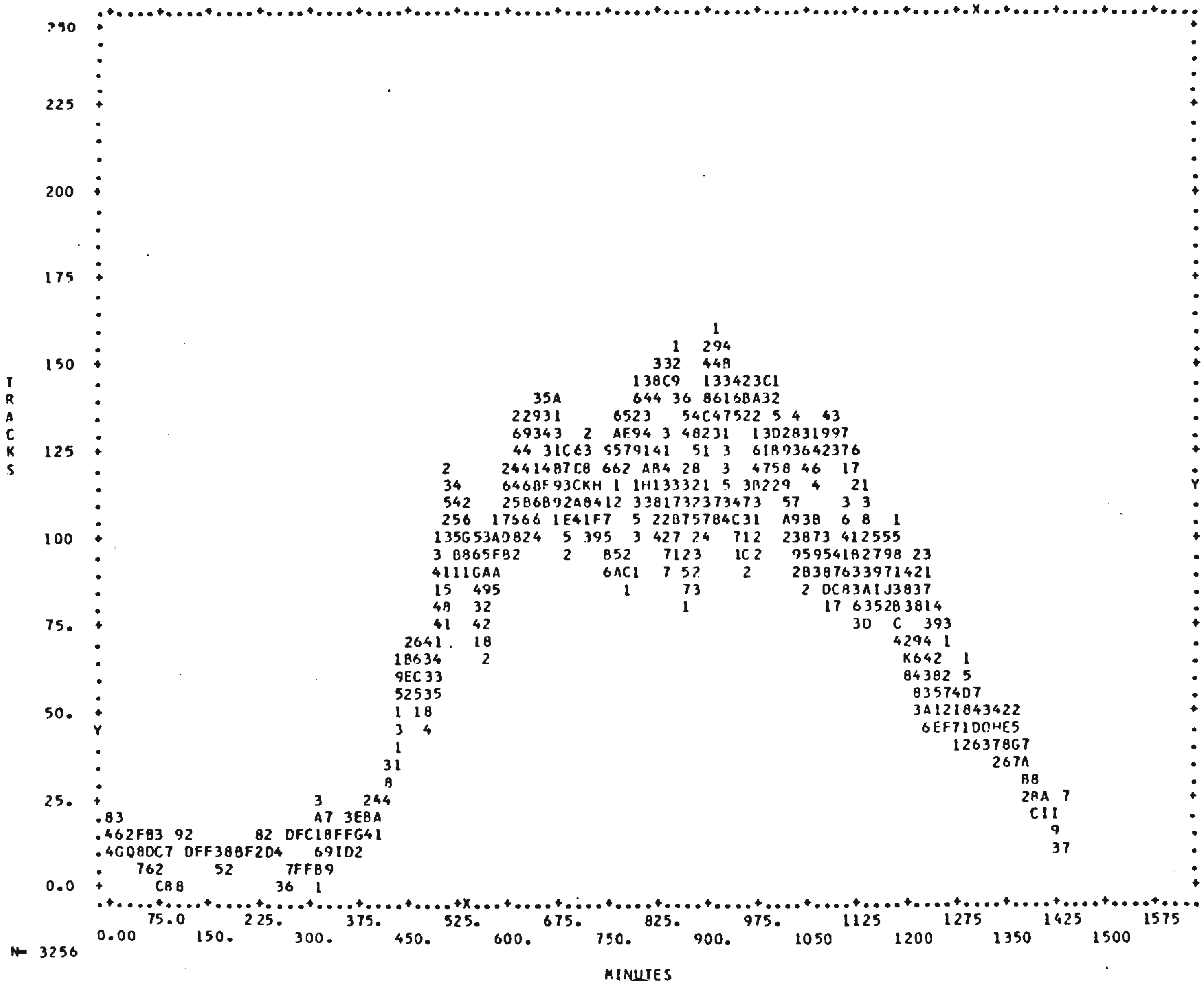

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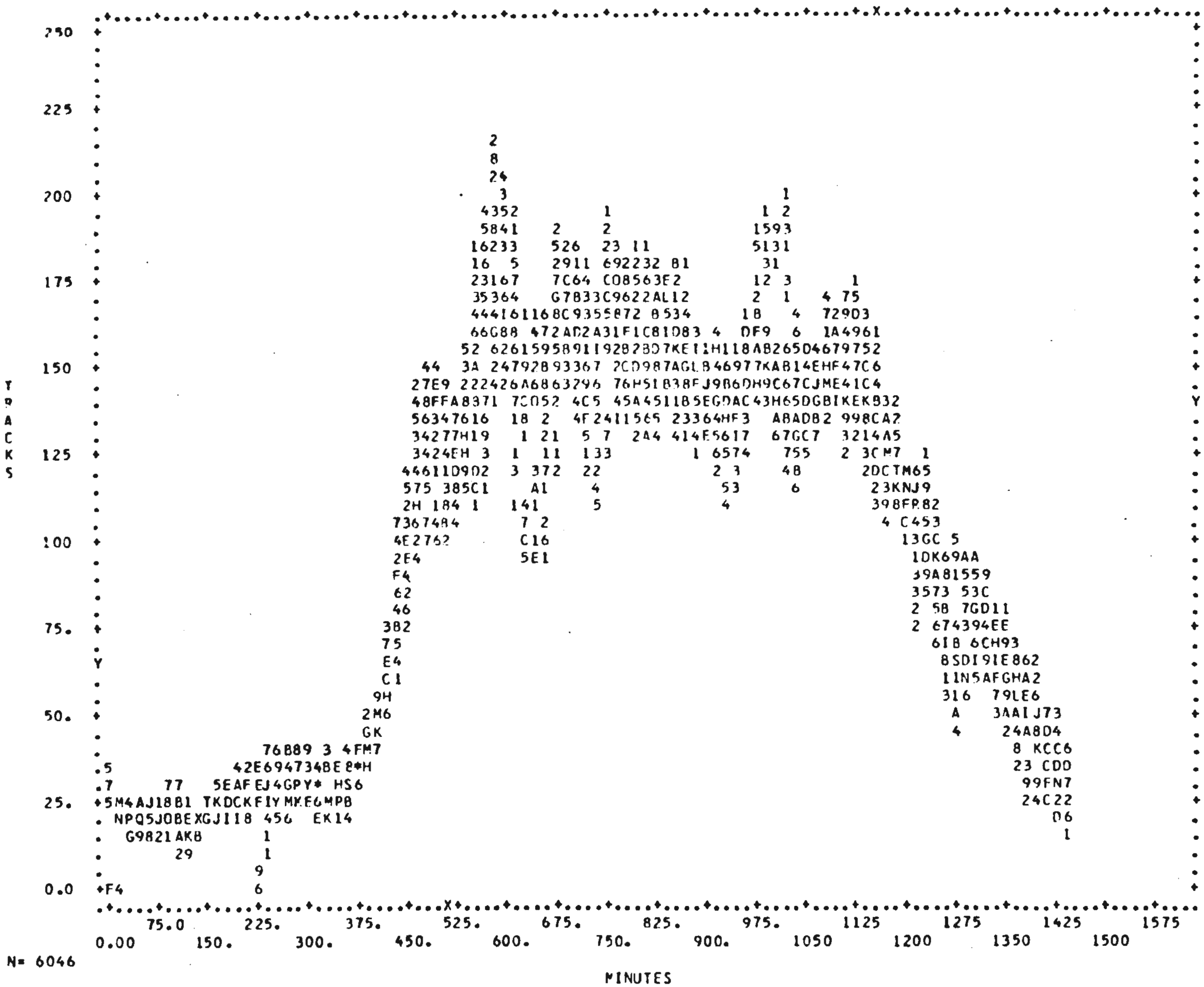

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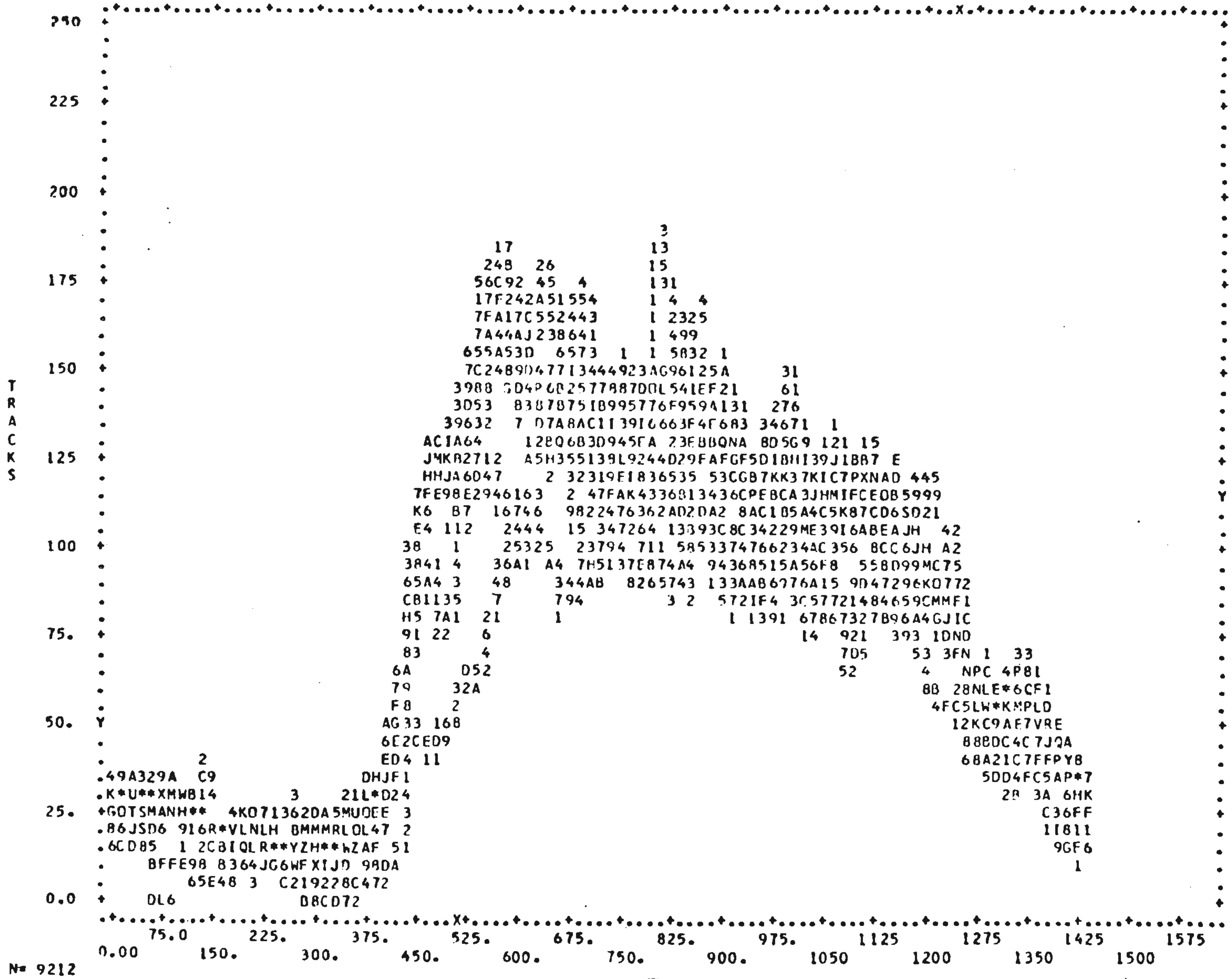

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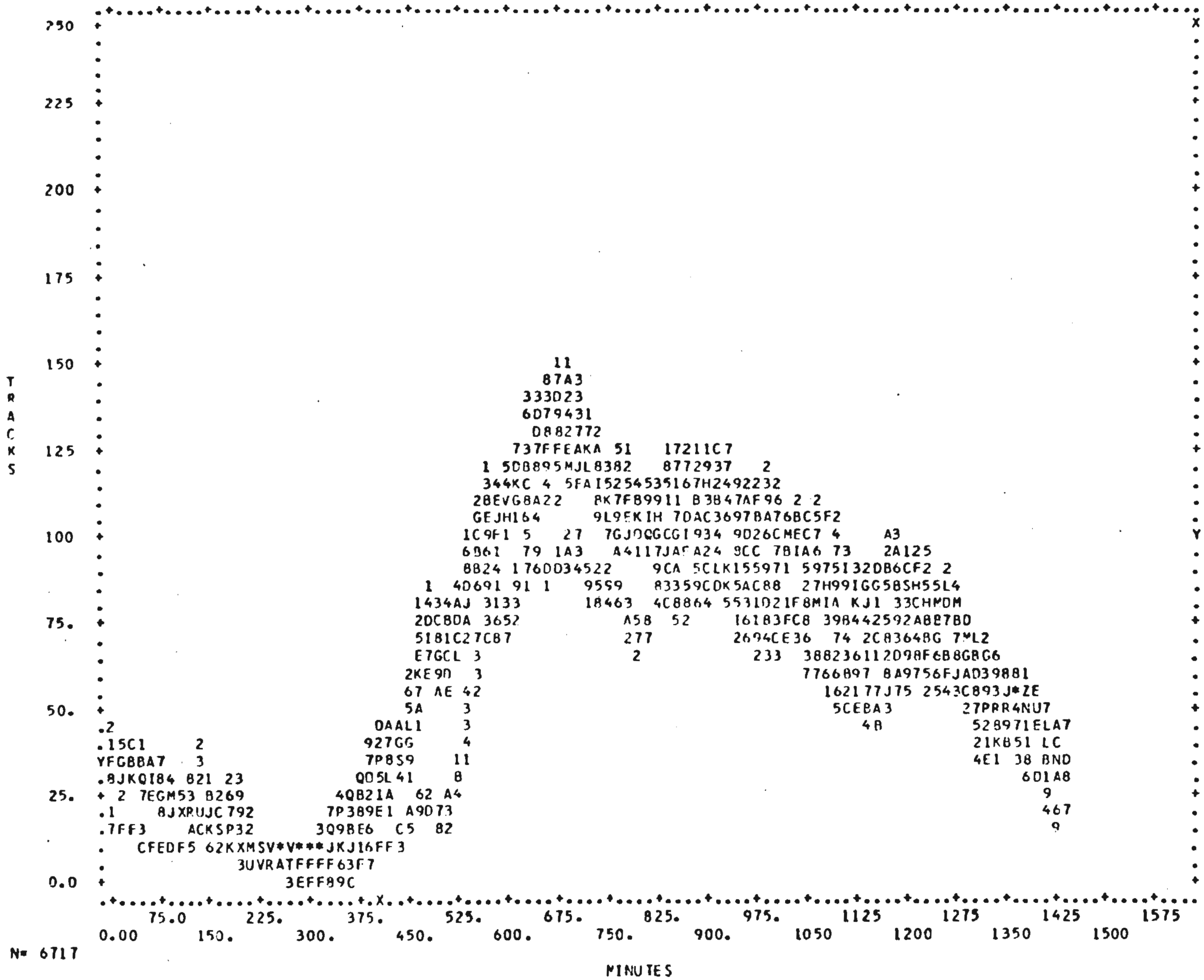

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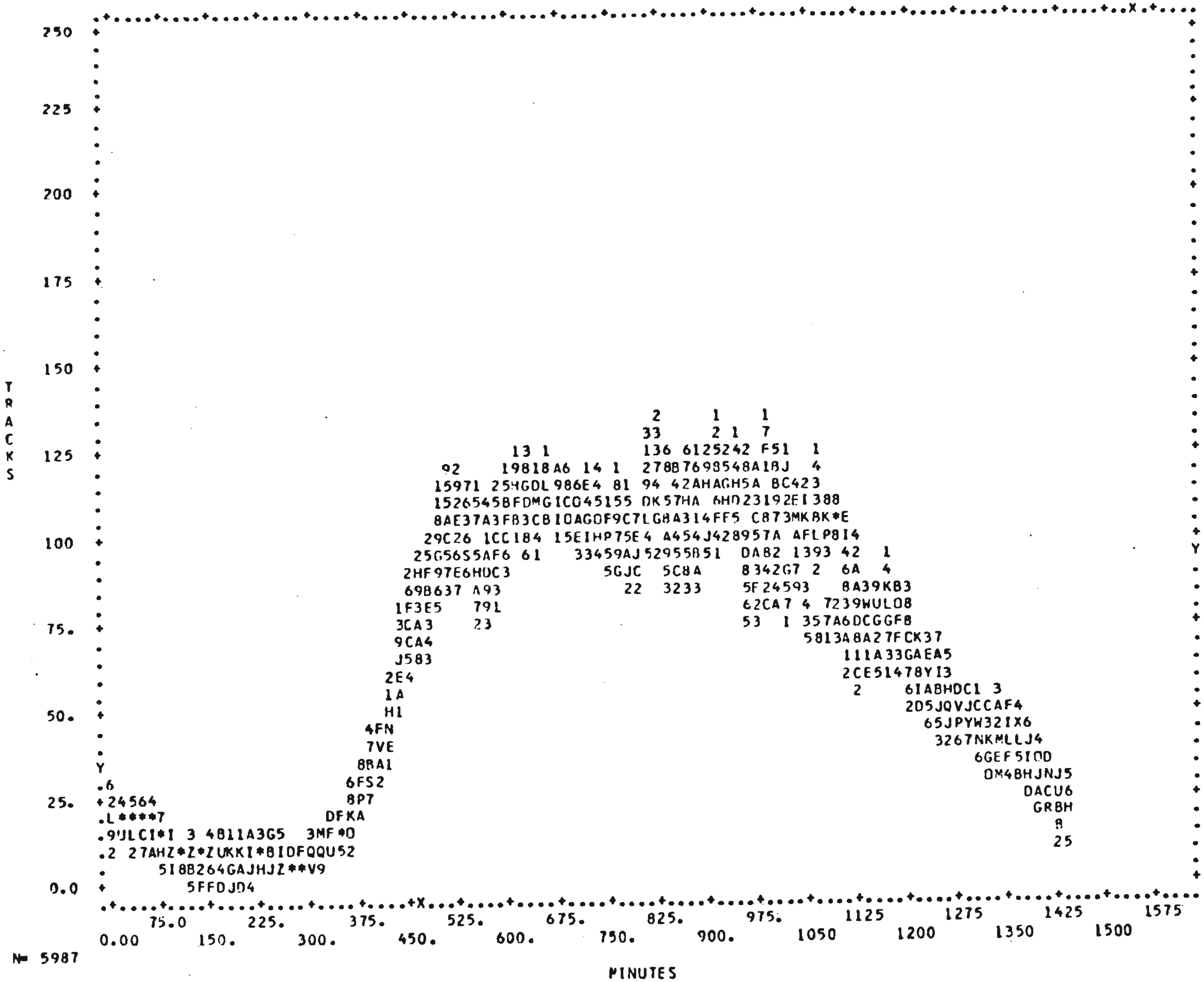

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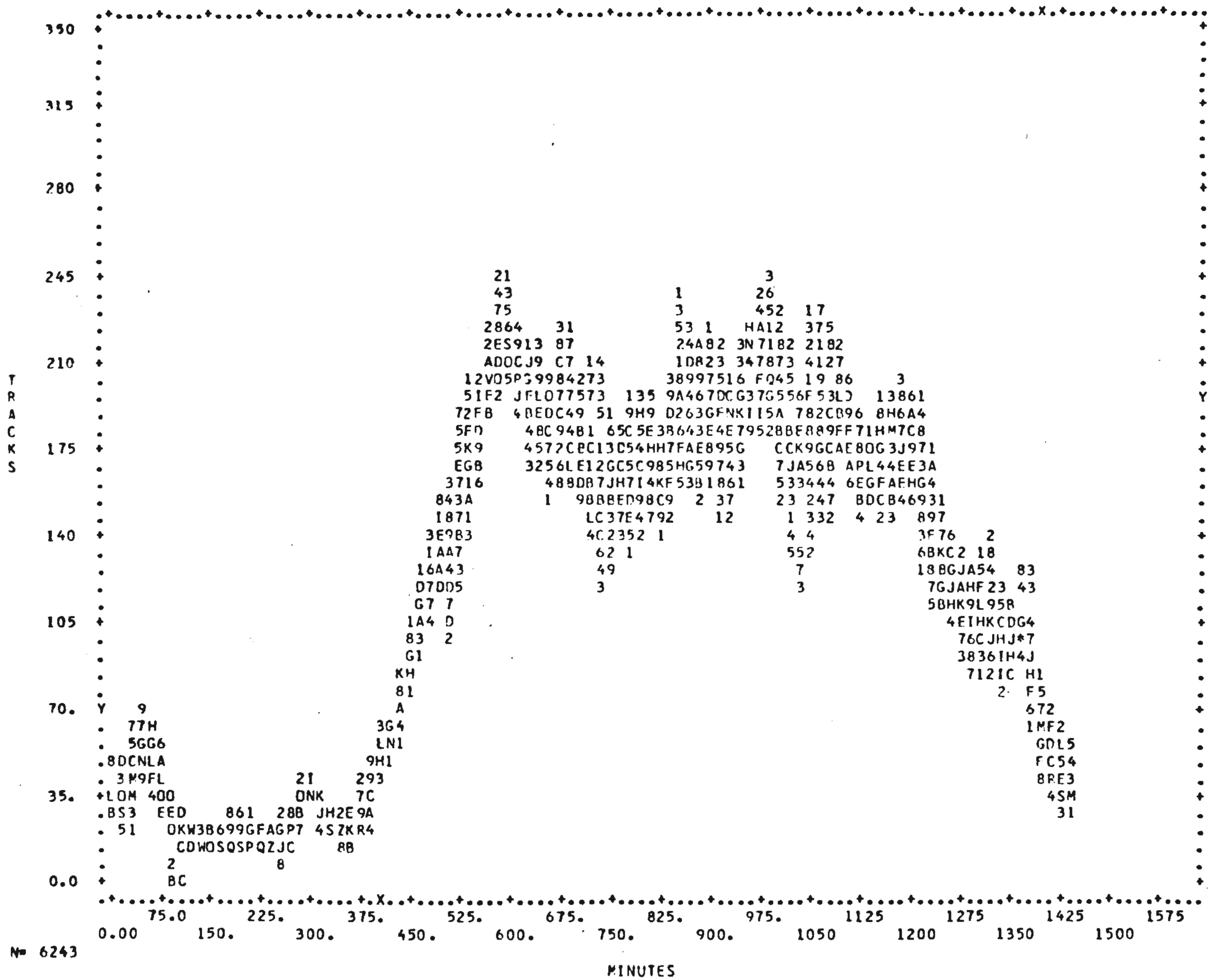

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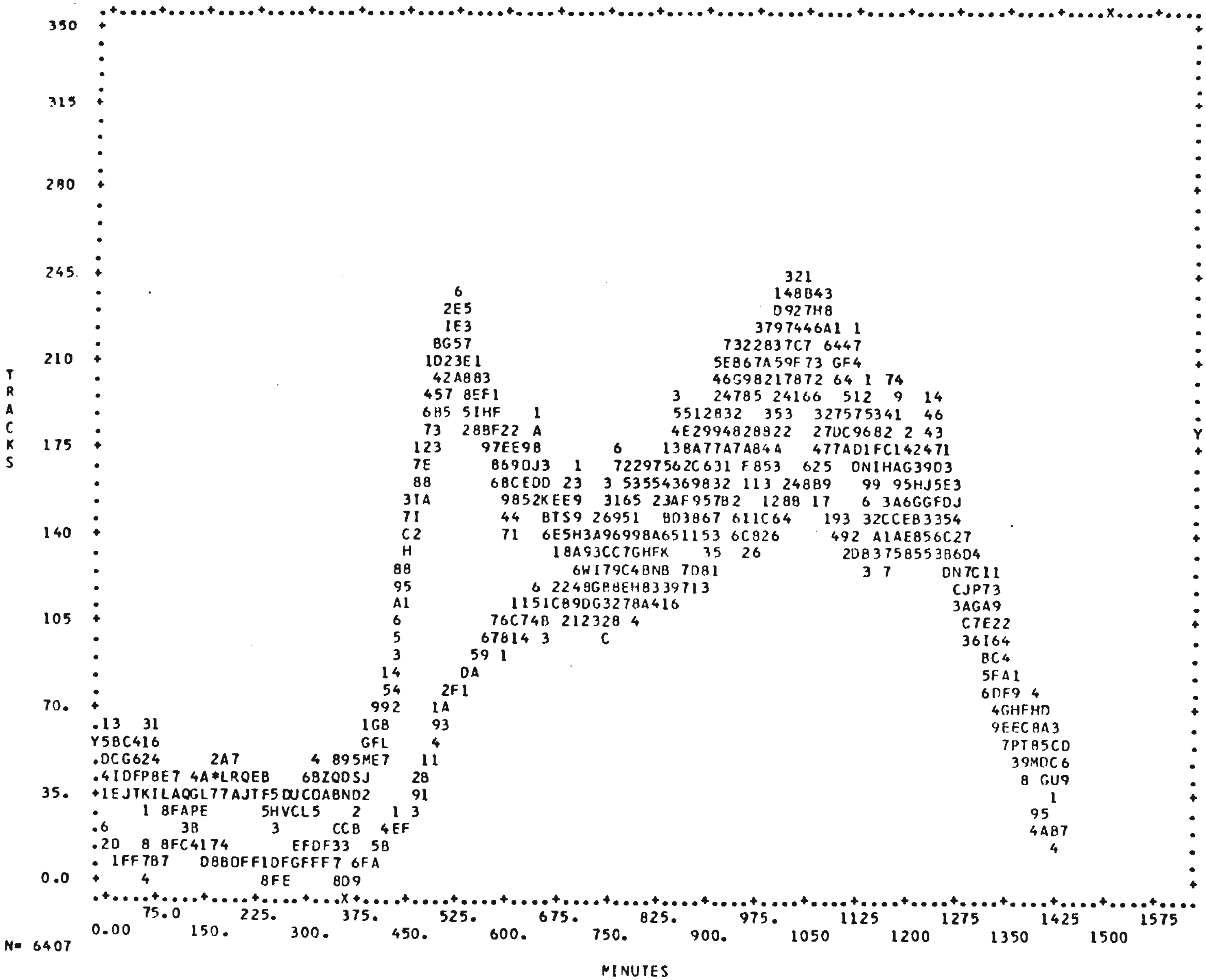

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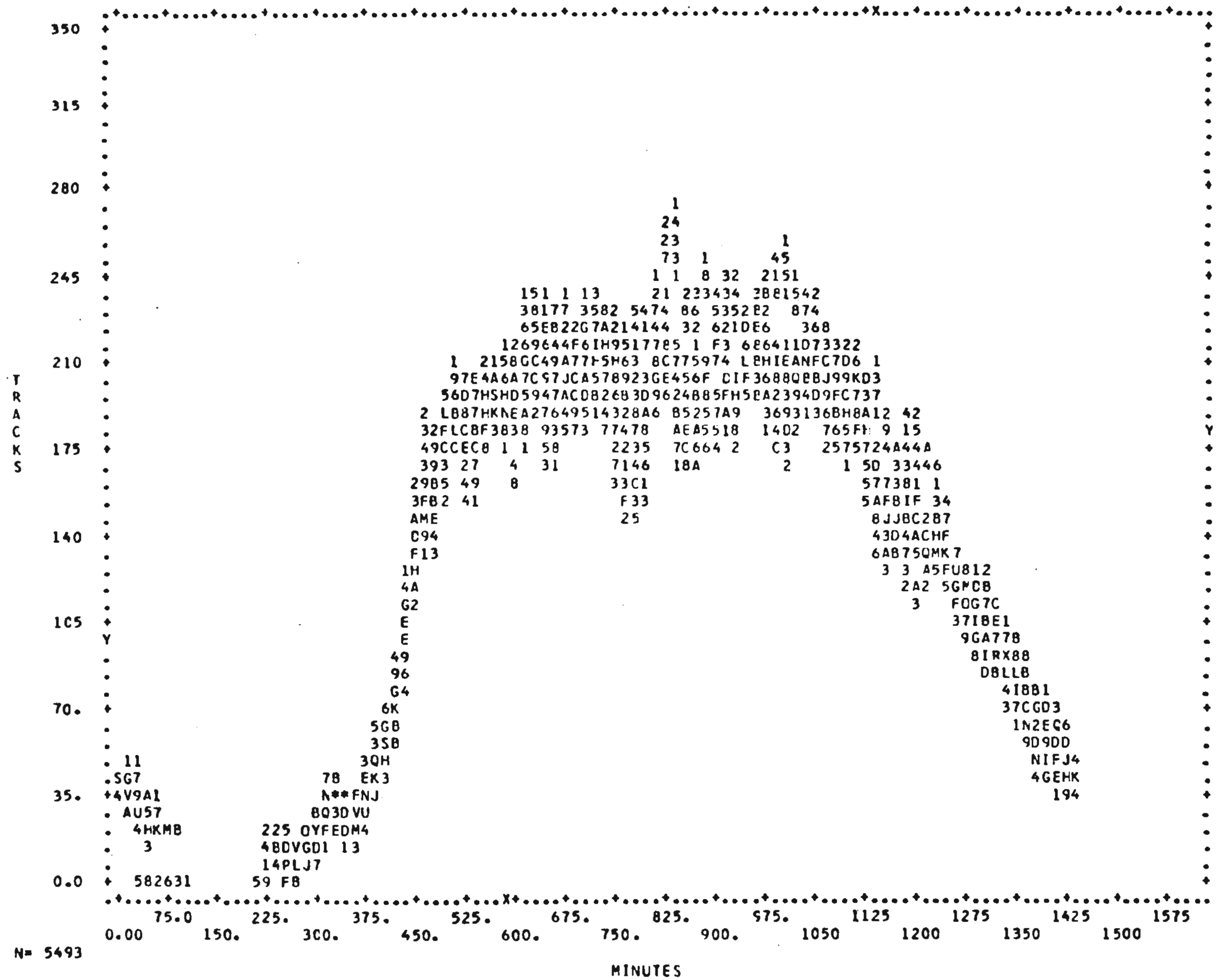

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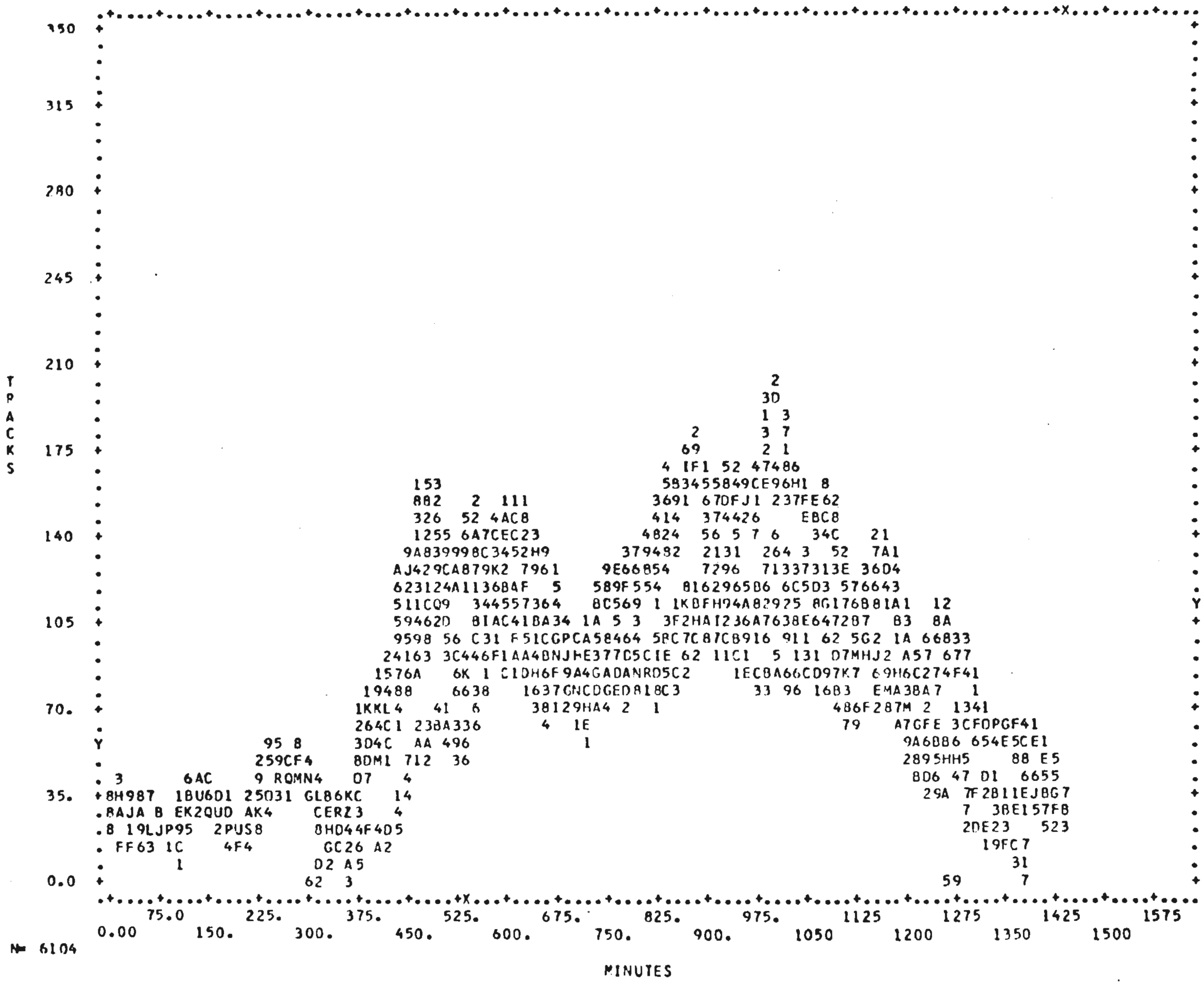

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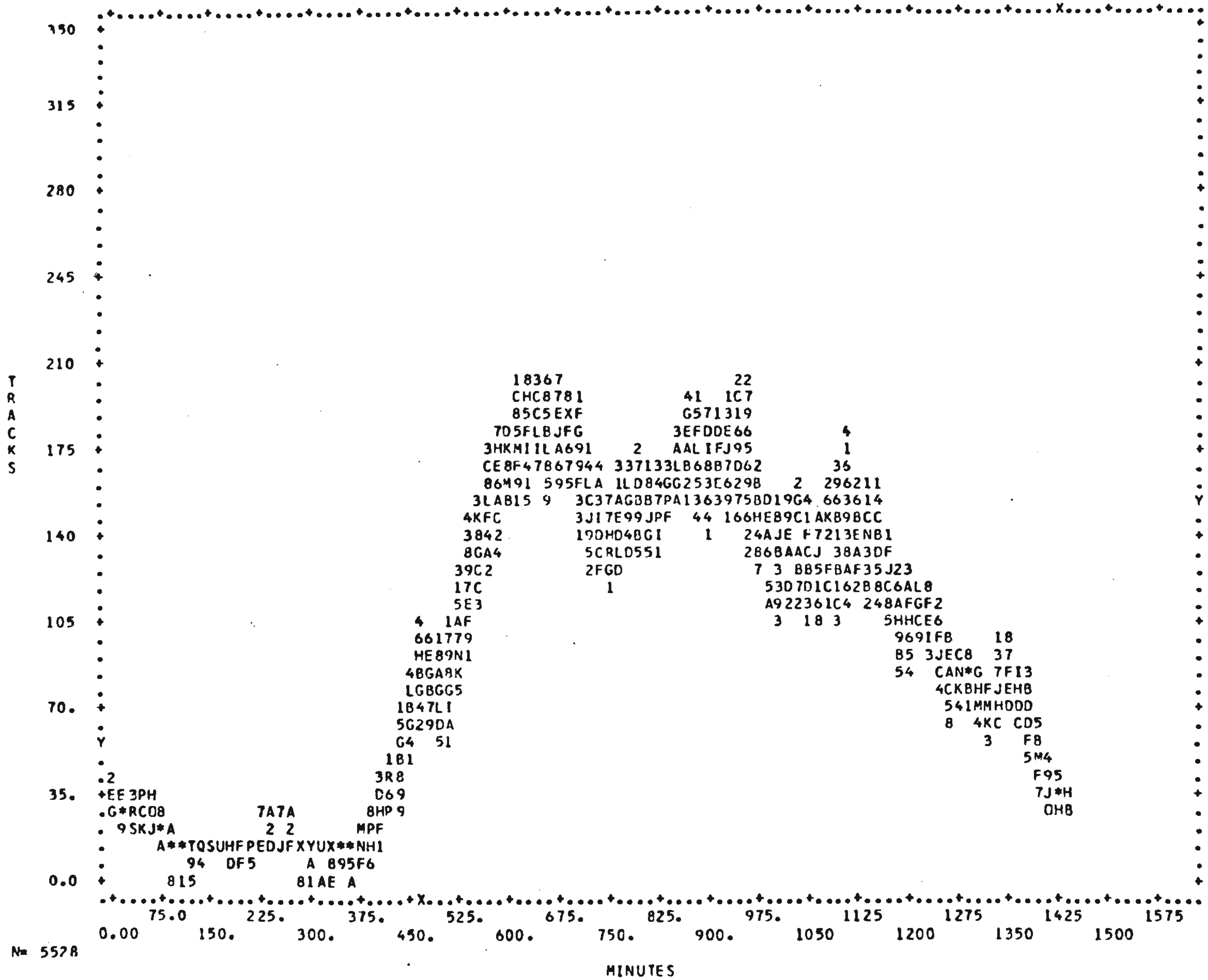

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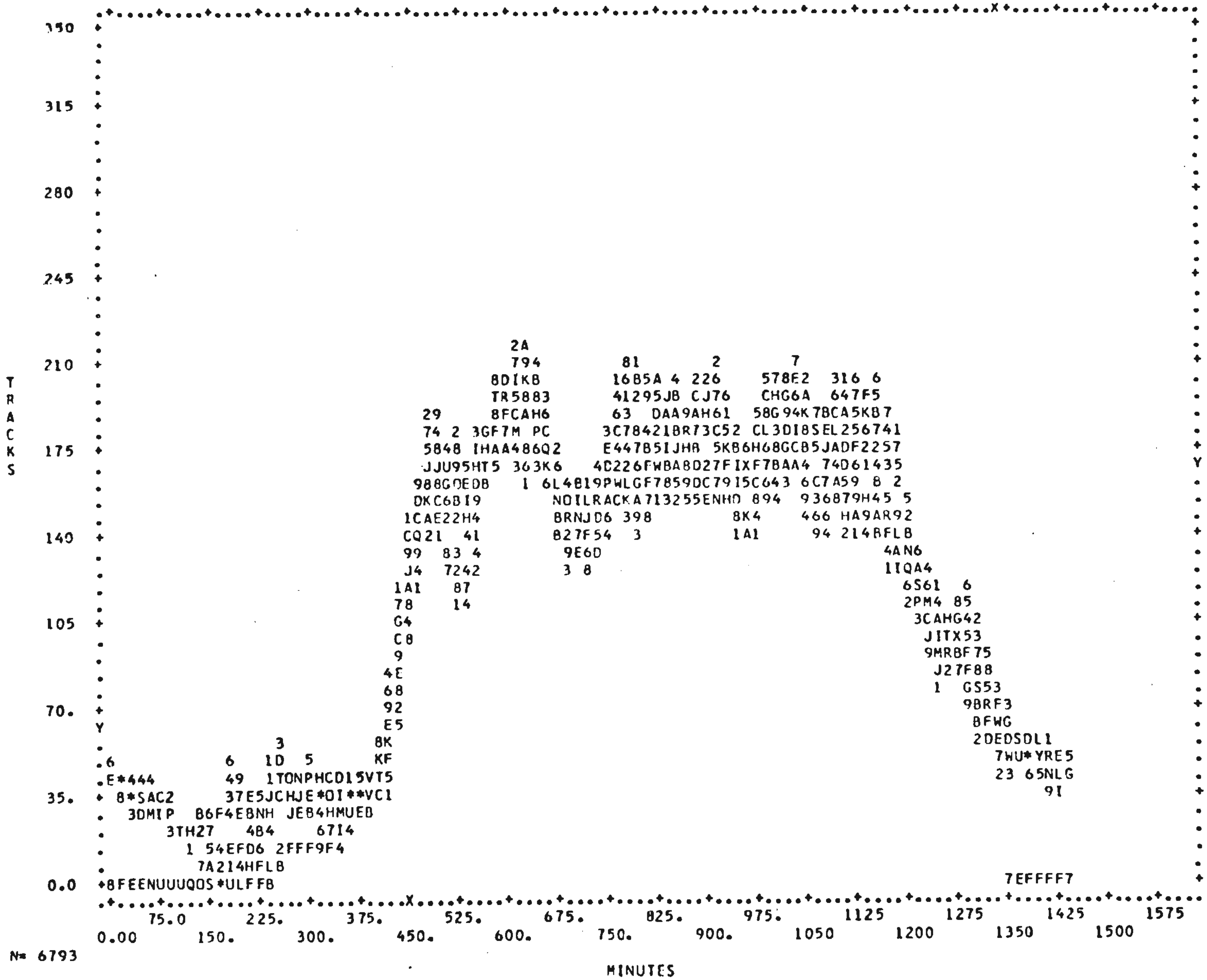

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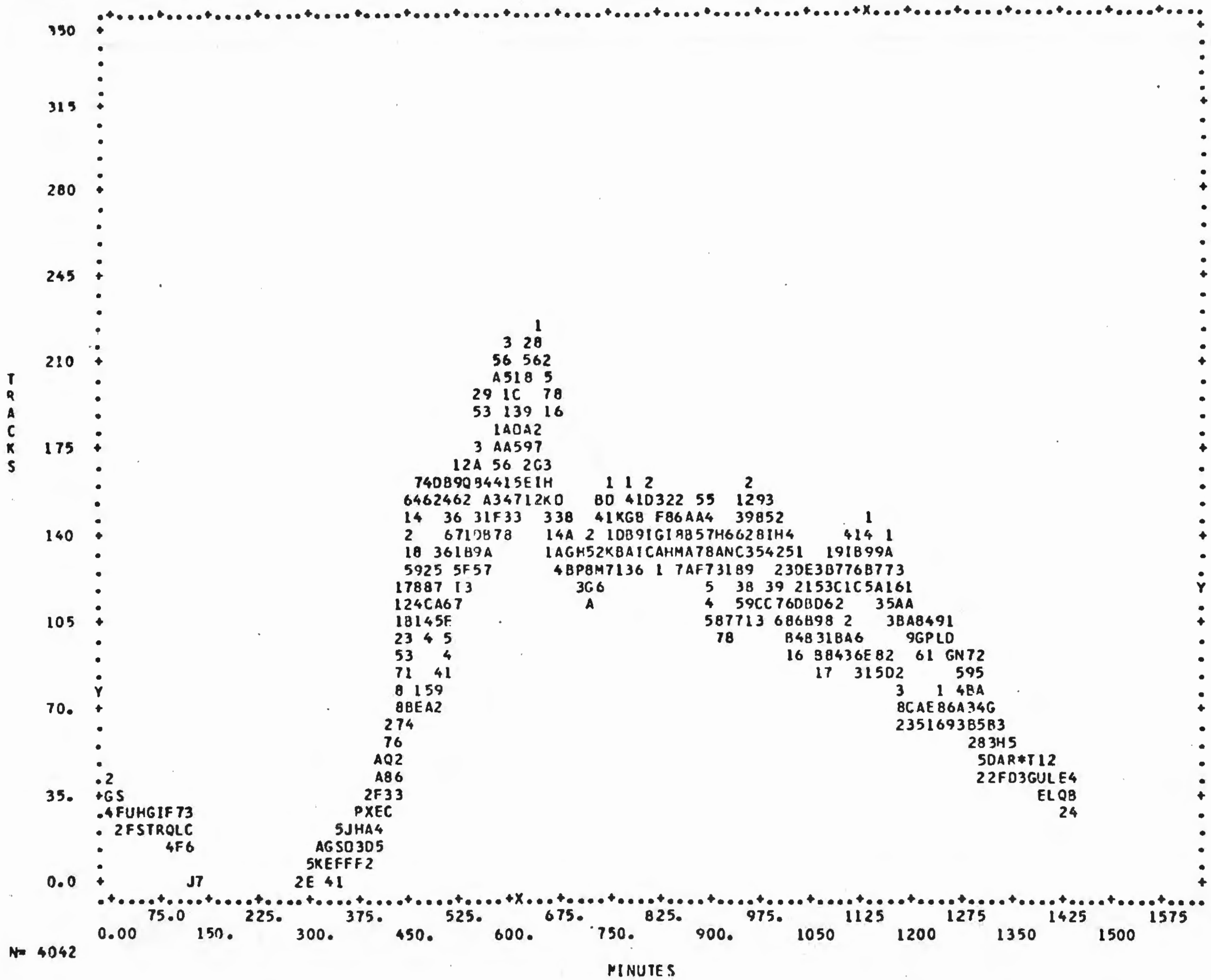

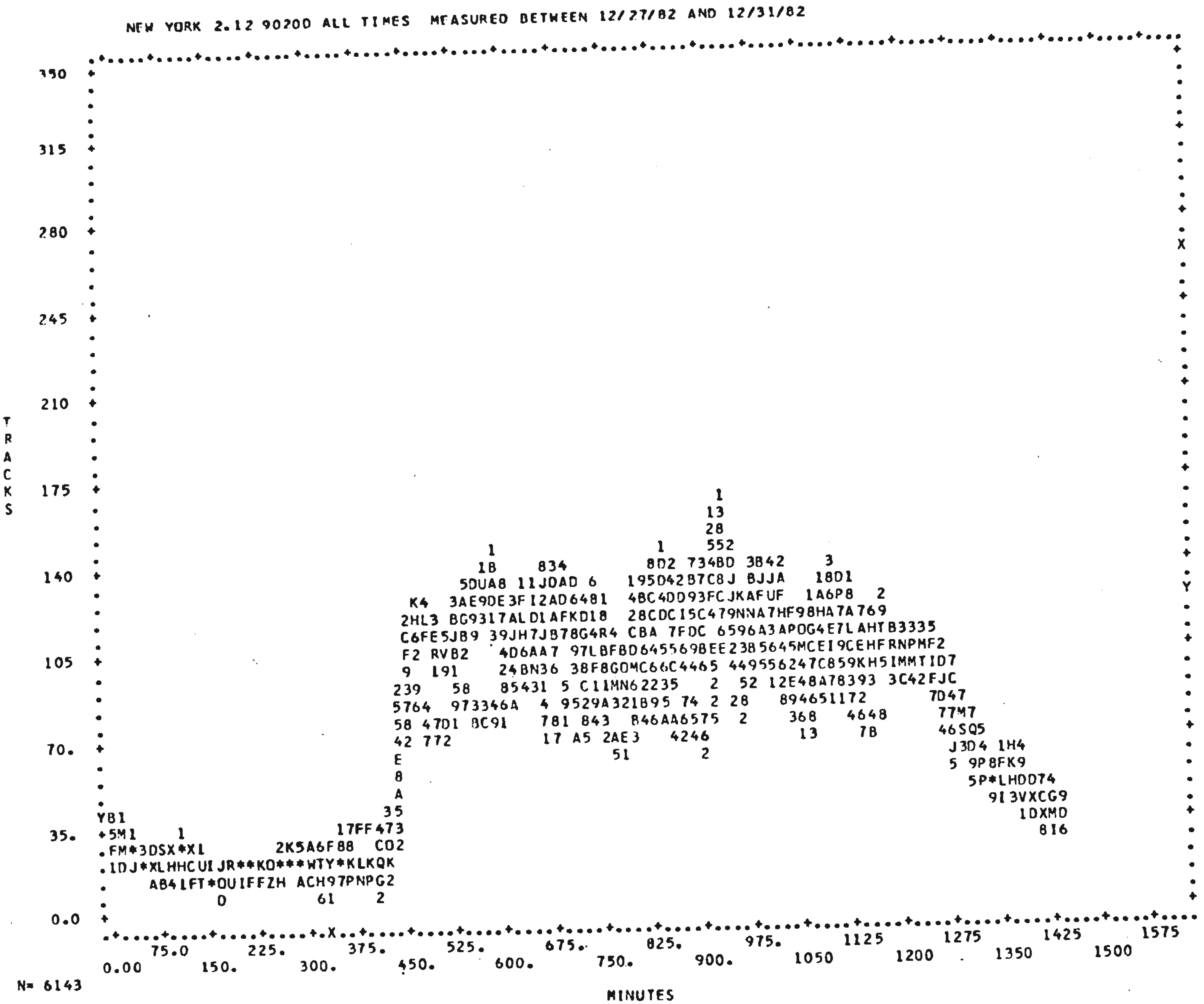
NEW YORK 2.12 90200 ALL TIMES MEASURED BETWEEN 12/27/82 AND 12/31/82
TRACKS
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245
210
175
140
105
70.
35.
0.0
0.00
75.0
150.
225.
300.
375.
450.
525.
600.
675.
750.
825.
900.
975.
1050
1125
1200
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1575
MINUTES
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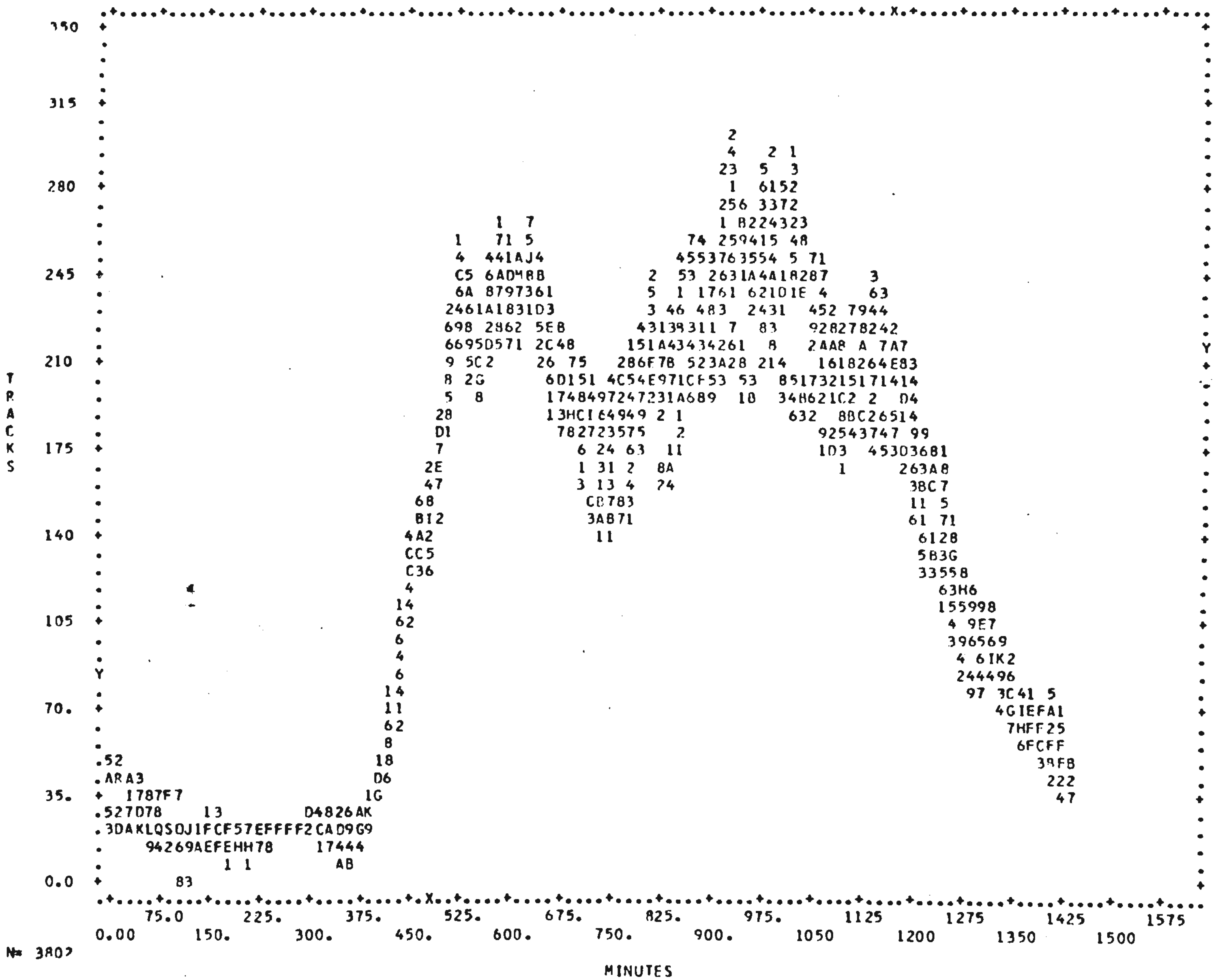

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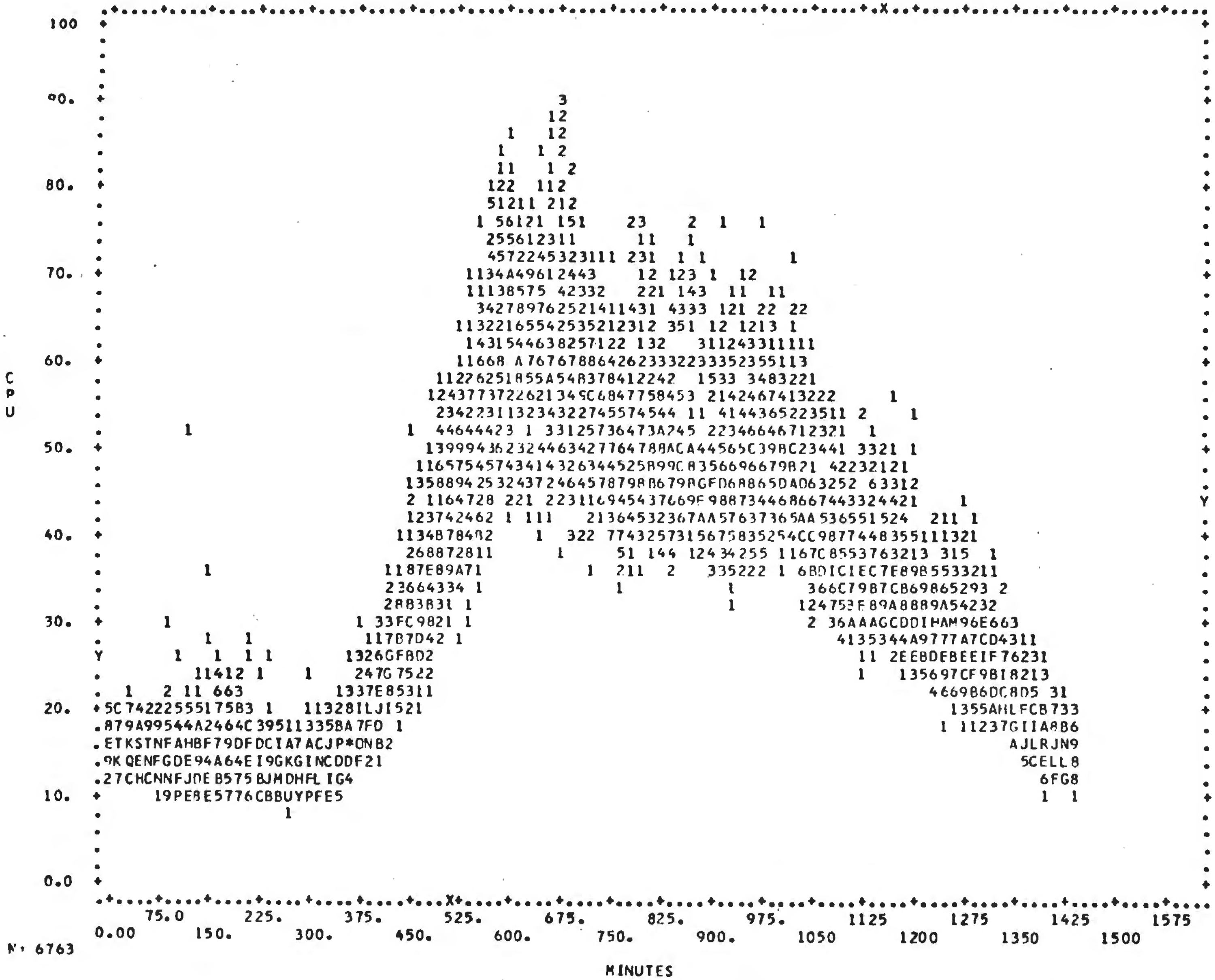

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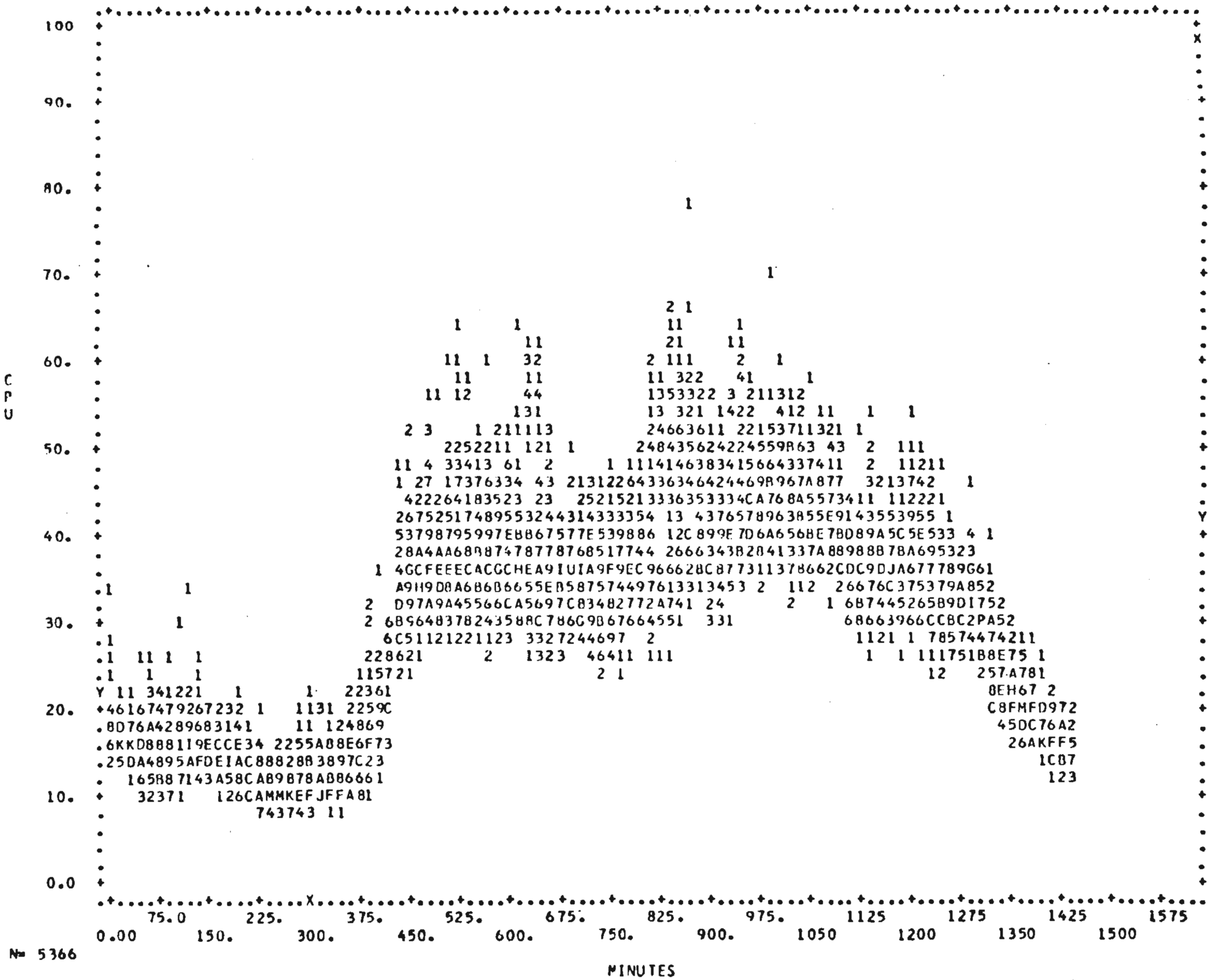

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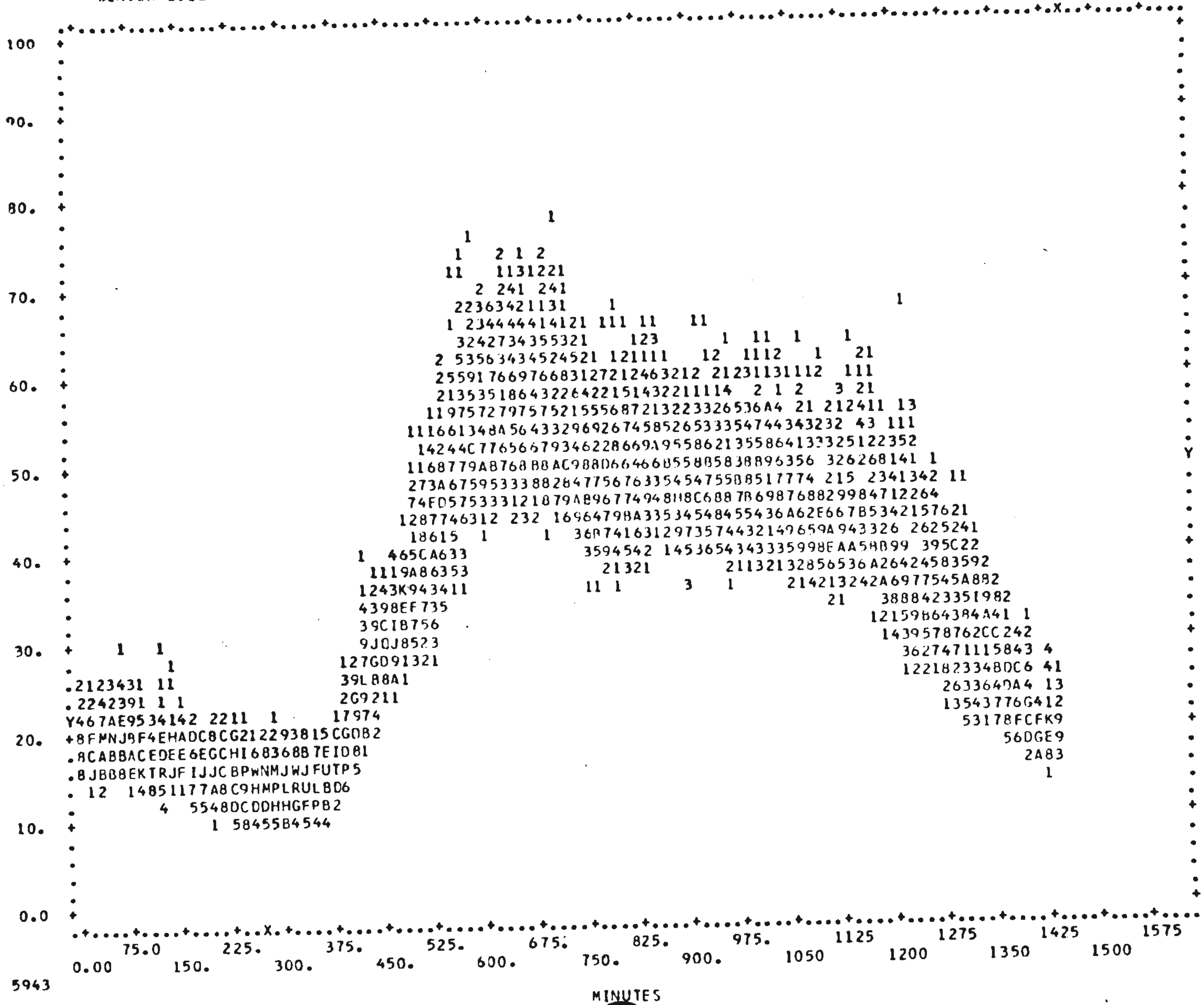

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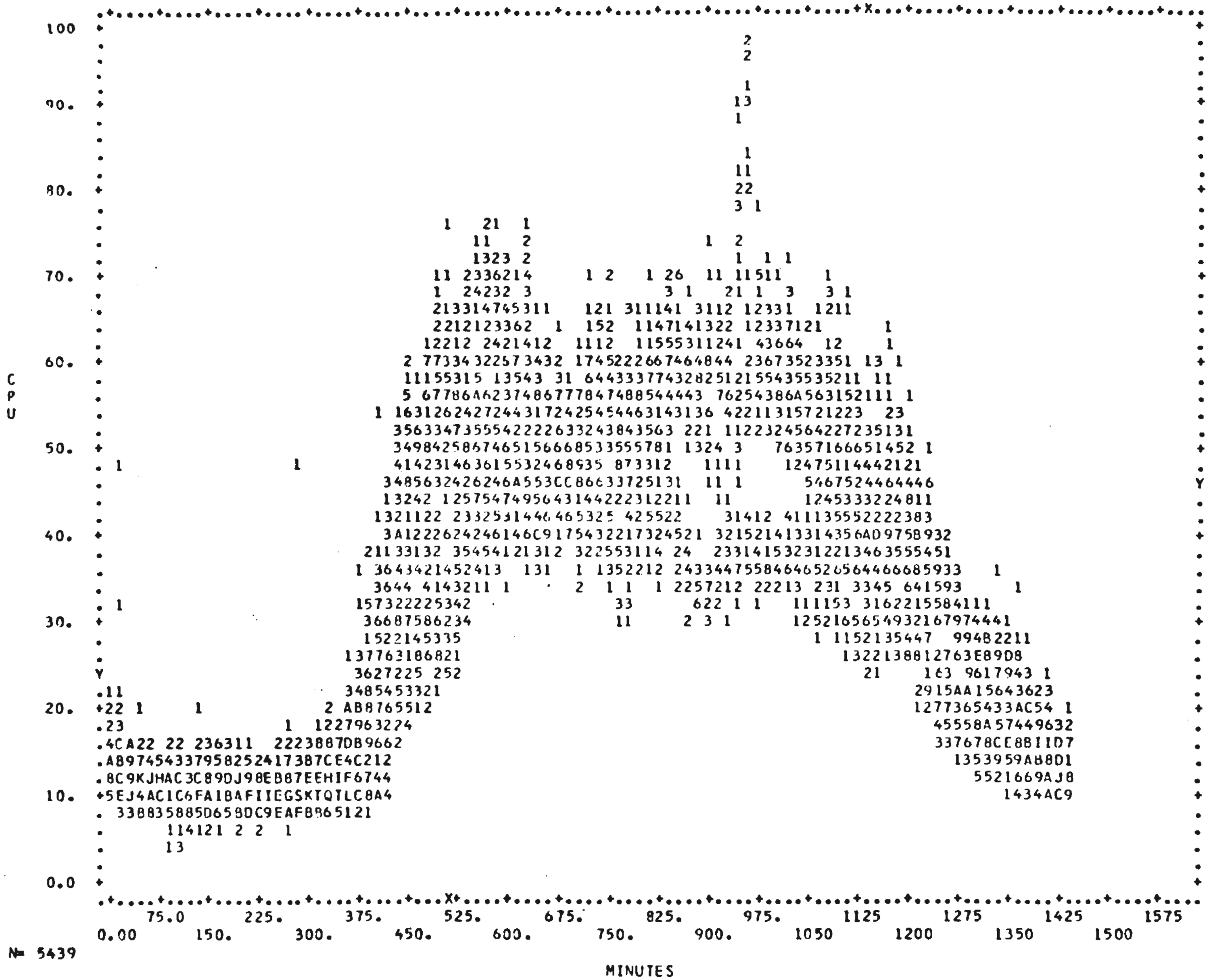

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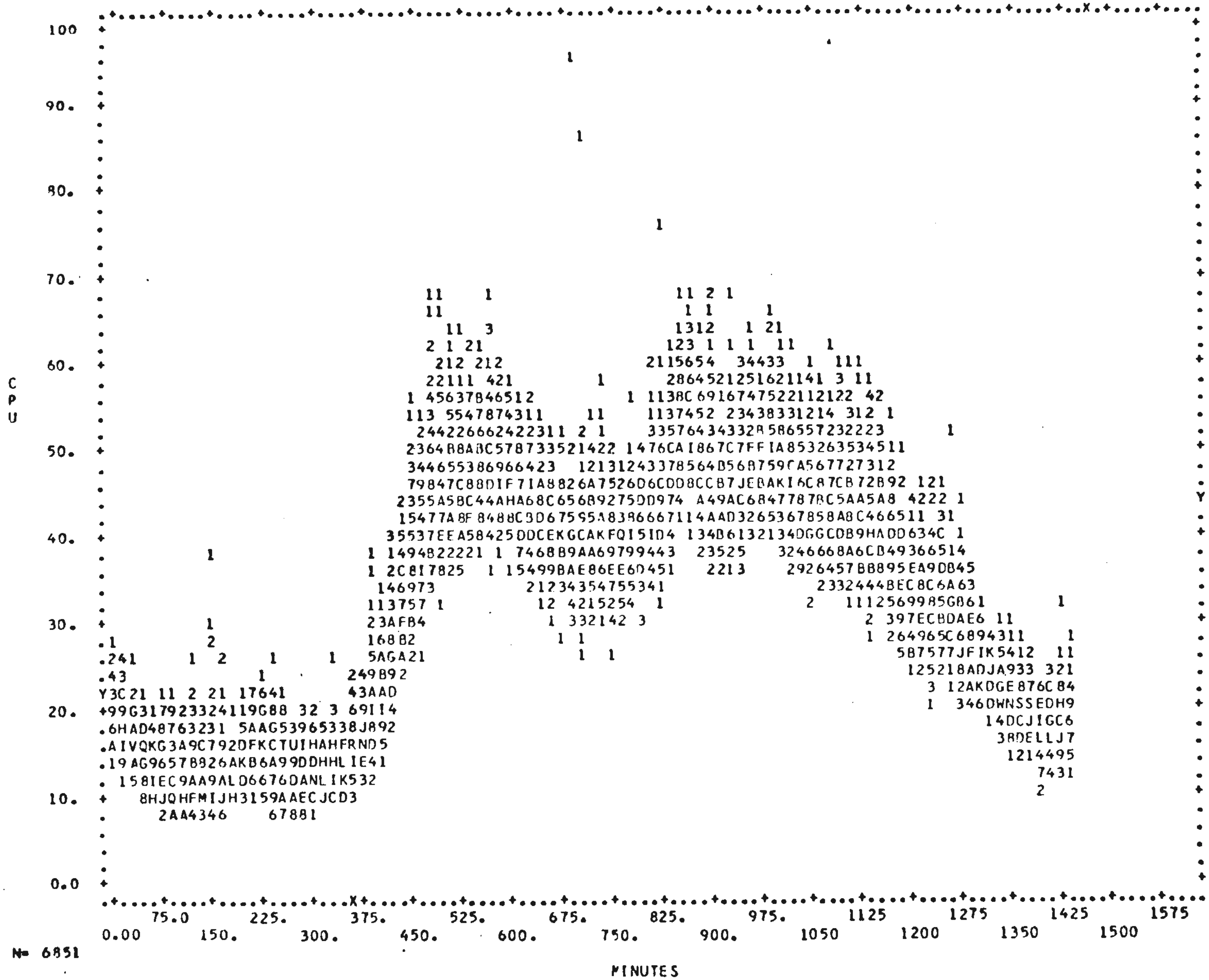

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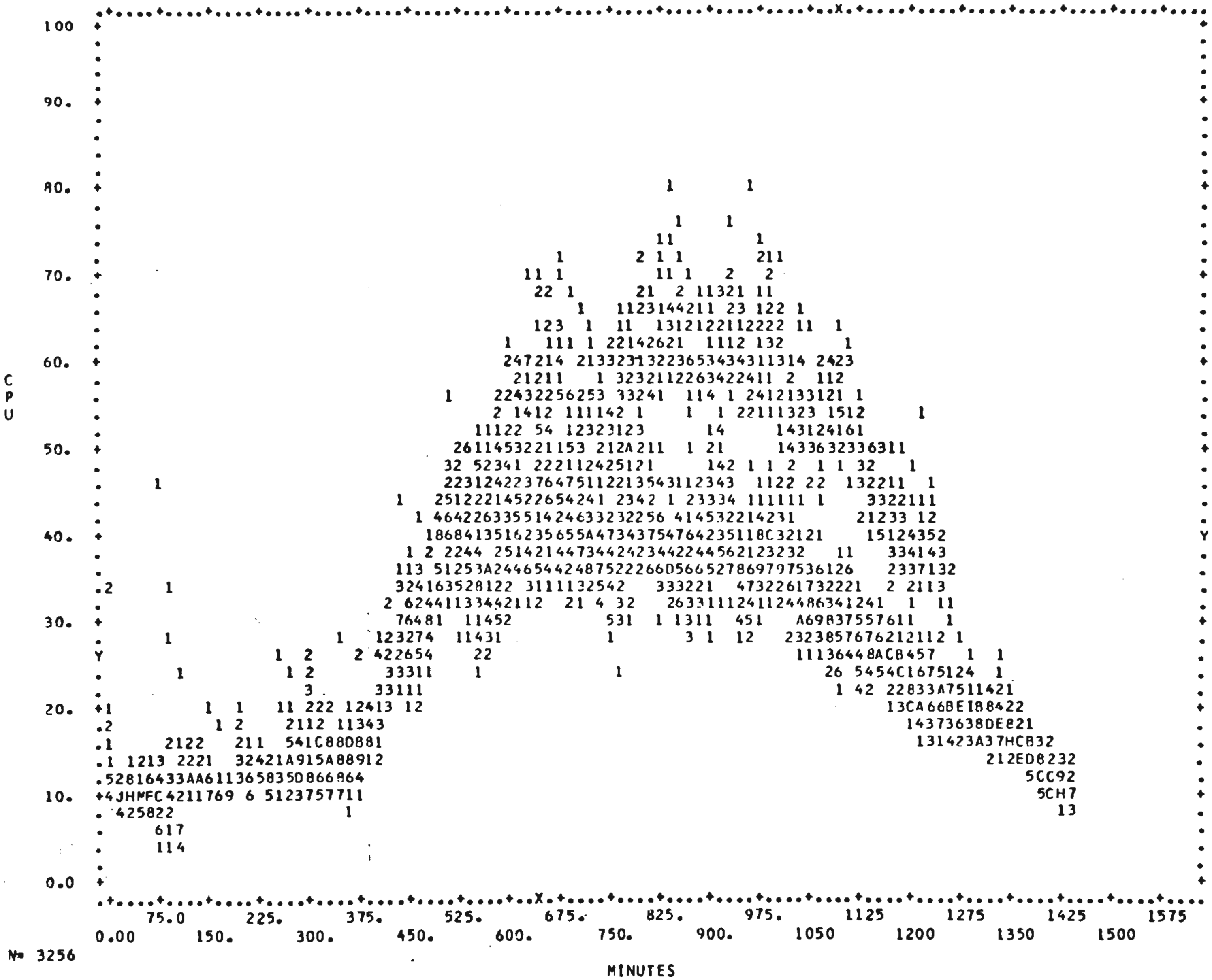

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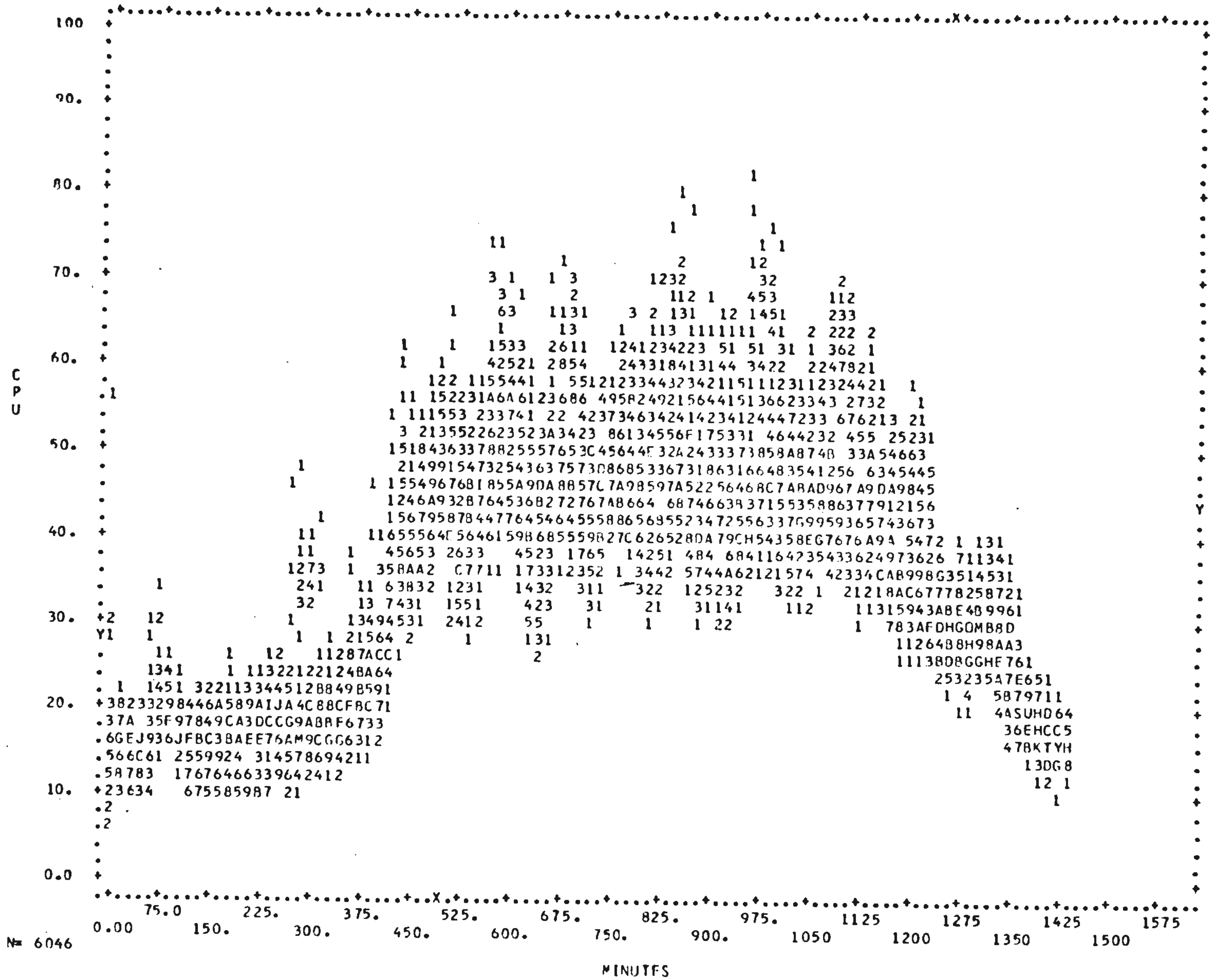
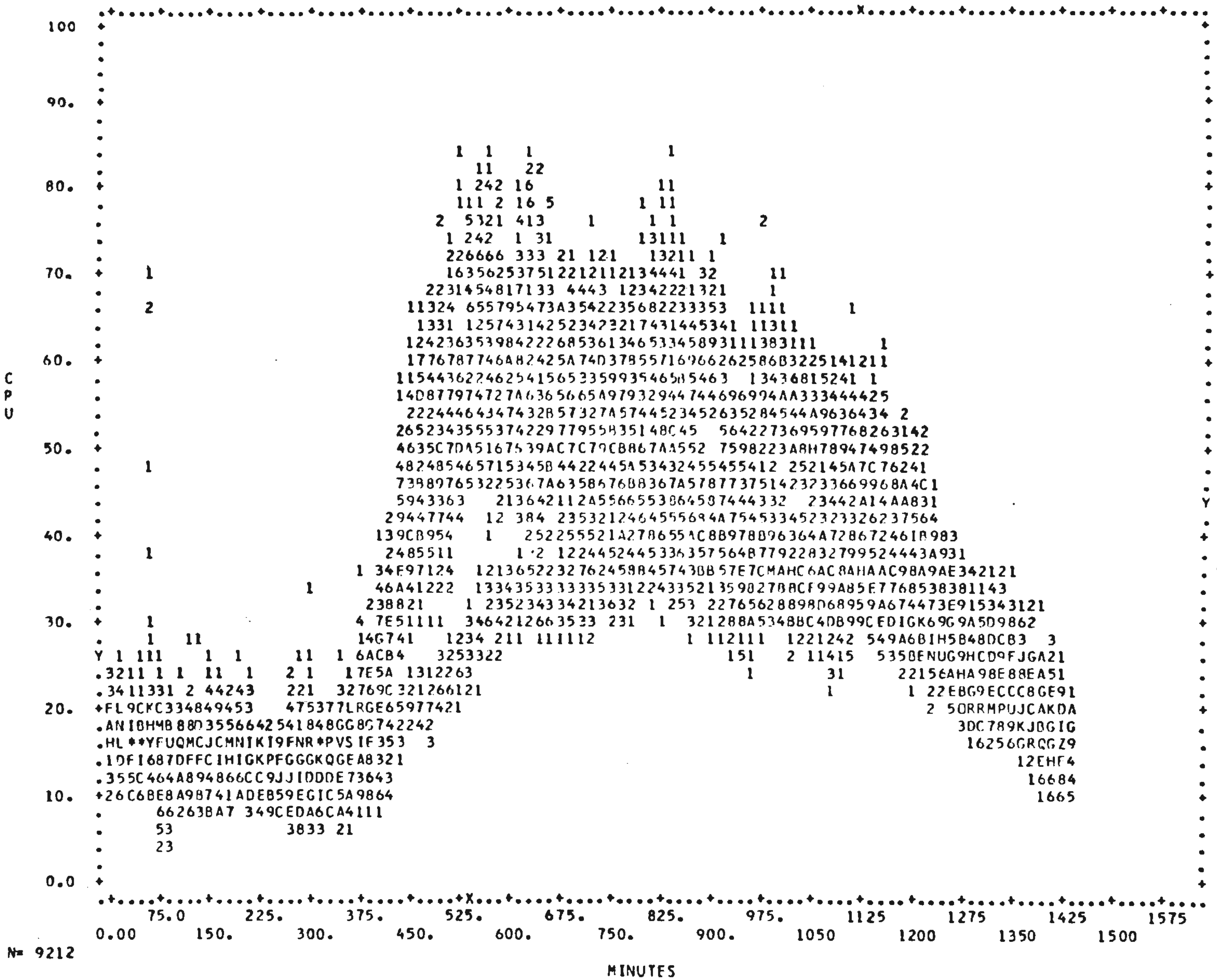
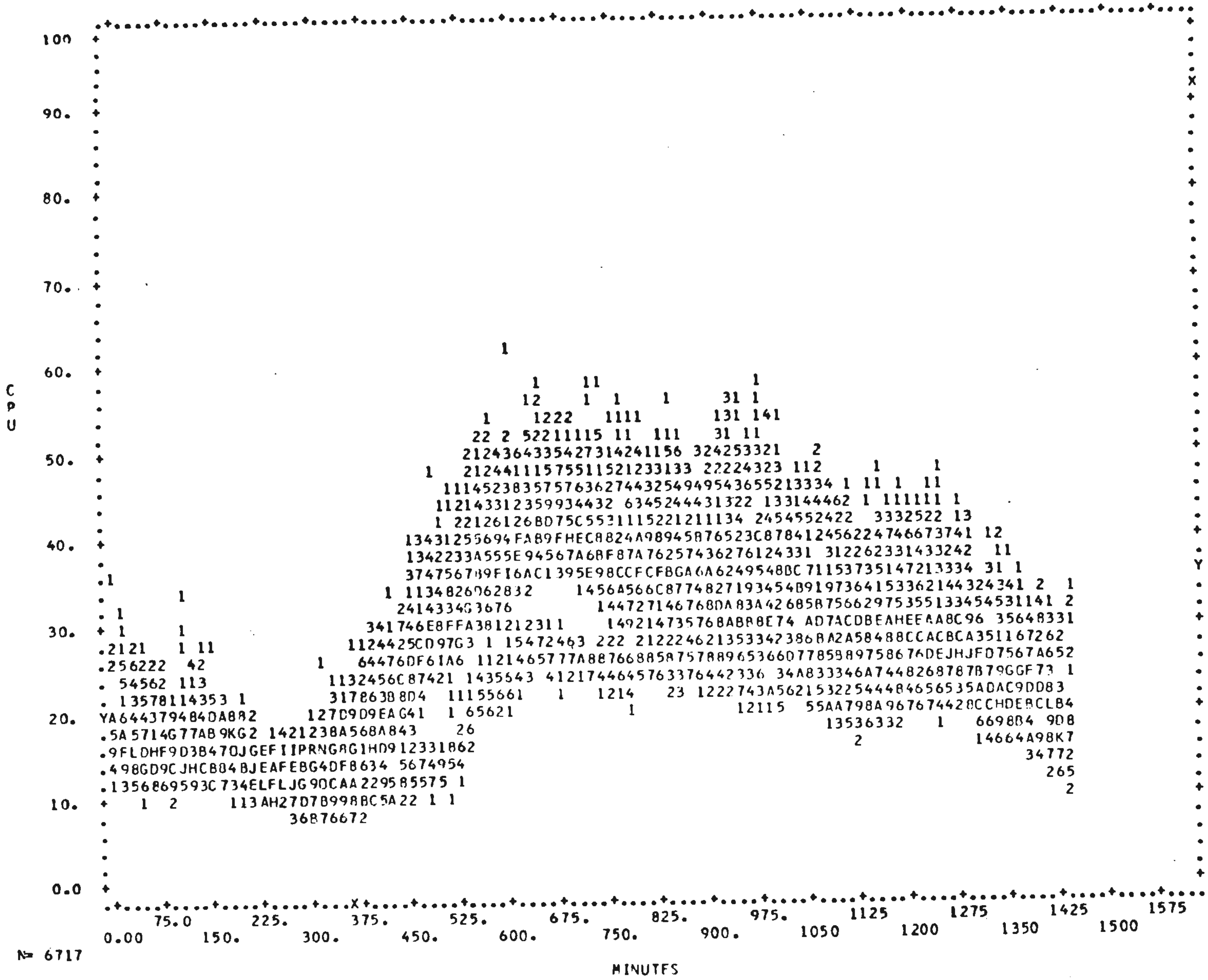


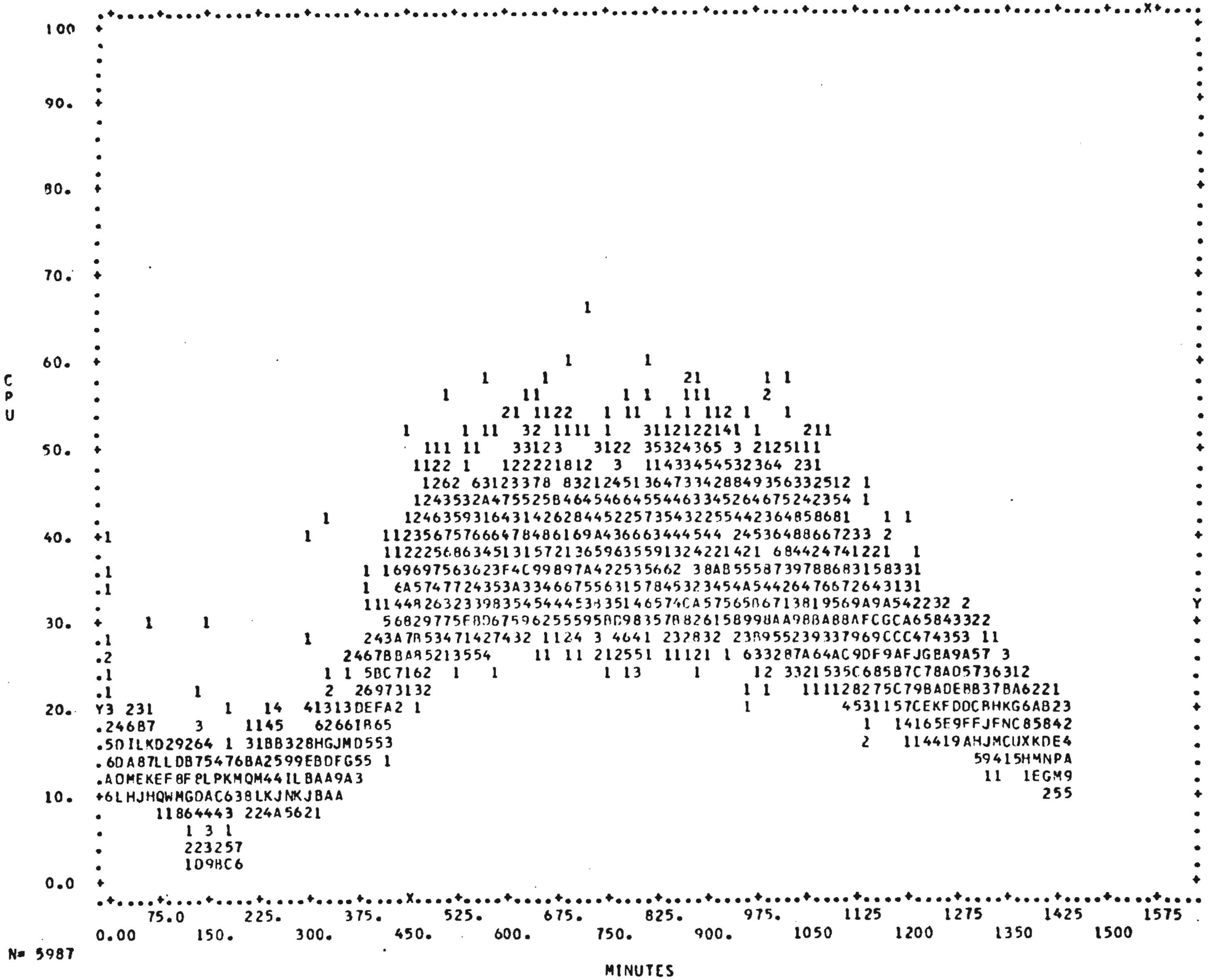
OAKLAND 2.12 9020A ALL TIMES MEASURED BETWEEN 08/15/82 AND 08/22/82



SALT LAKE 2.12 9020A ALL TIMES MEASURED BETWEEN 05/23/82 AND 05/28/82



SEATTLE 2.12 9020A ALL TIMES MEASURED BETWEEN 06/07/82 AND 06/12/82



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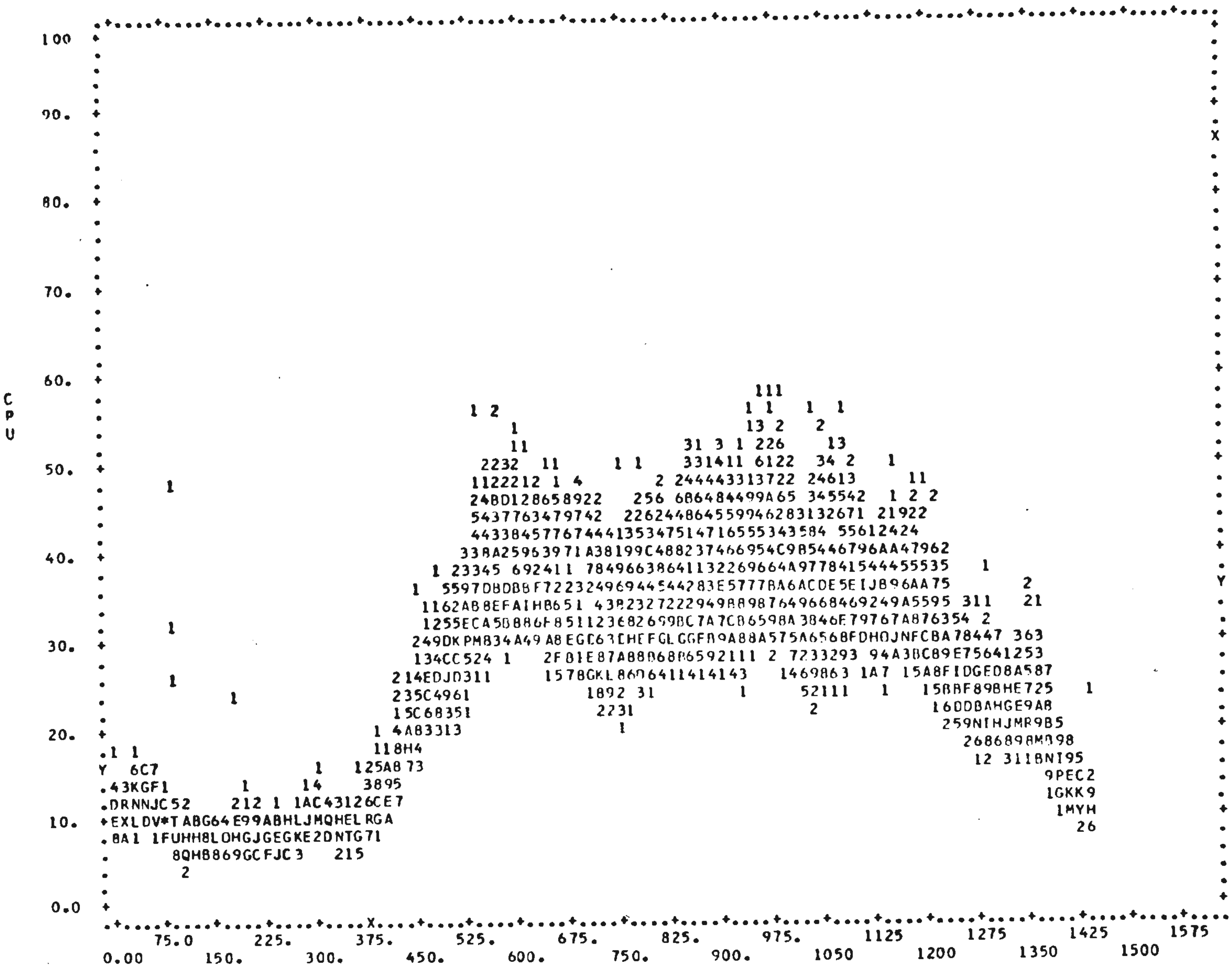

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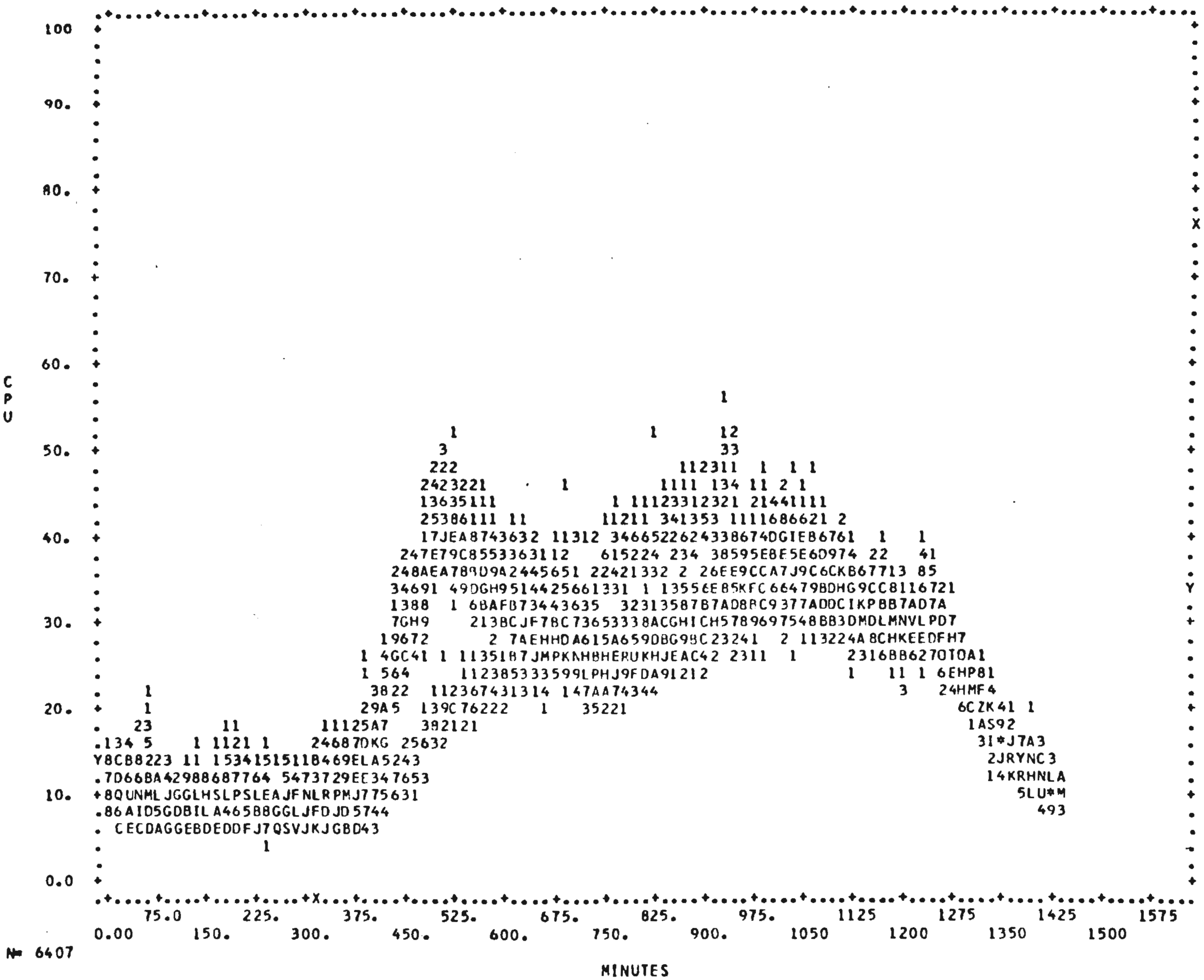
CLEV 2.12 90200 ALL TIMES MEASURED BETWEEN 05/31/82 AND 06/05/82



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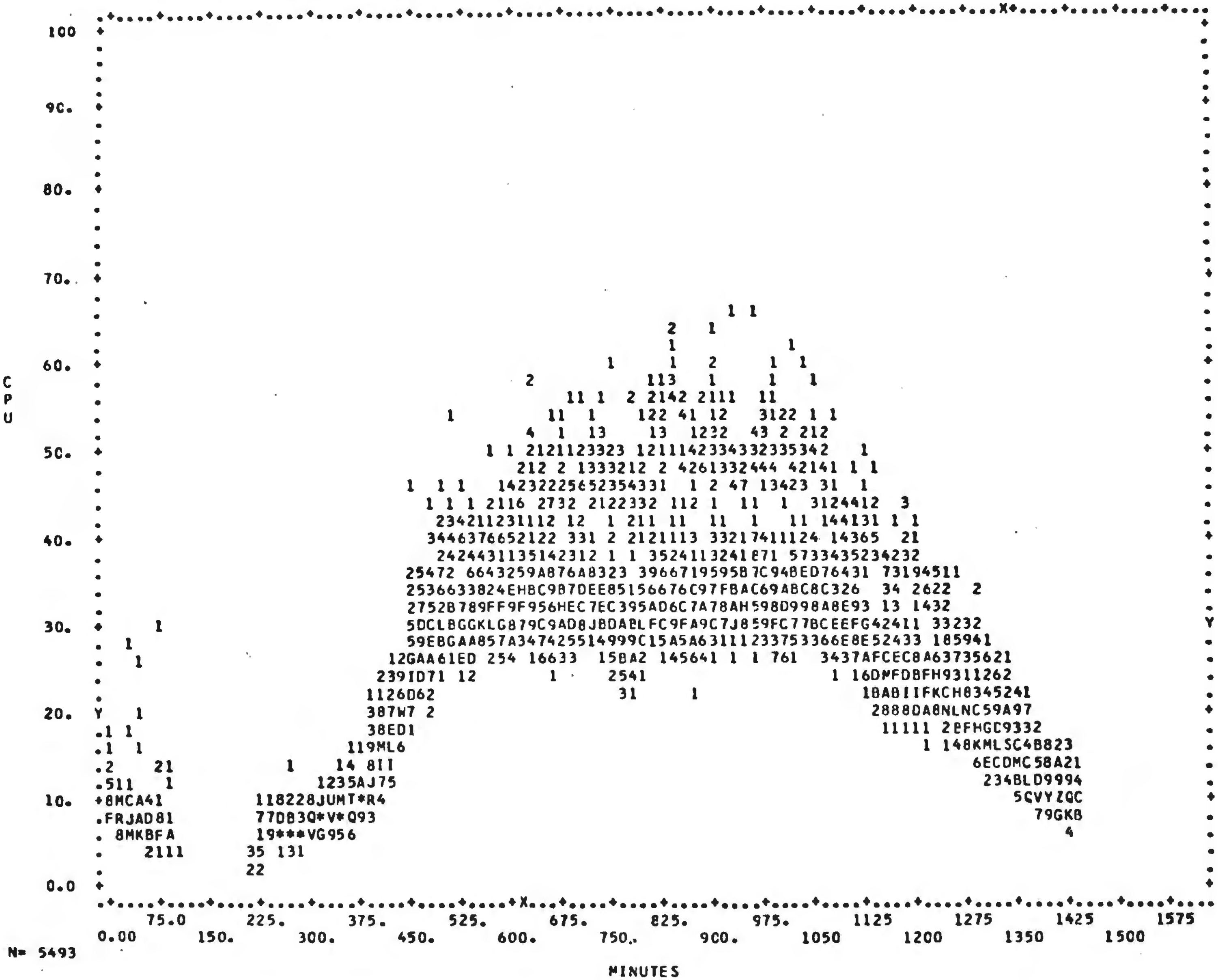

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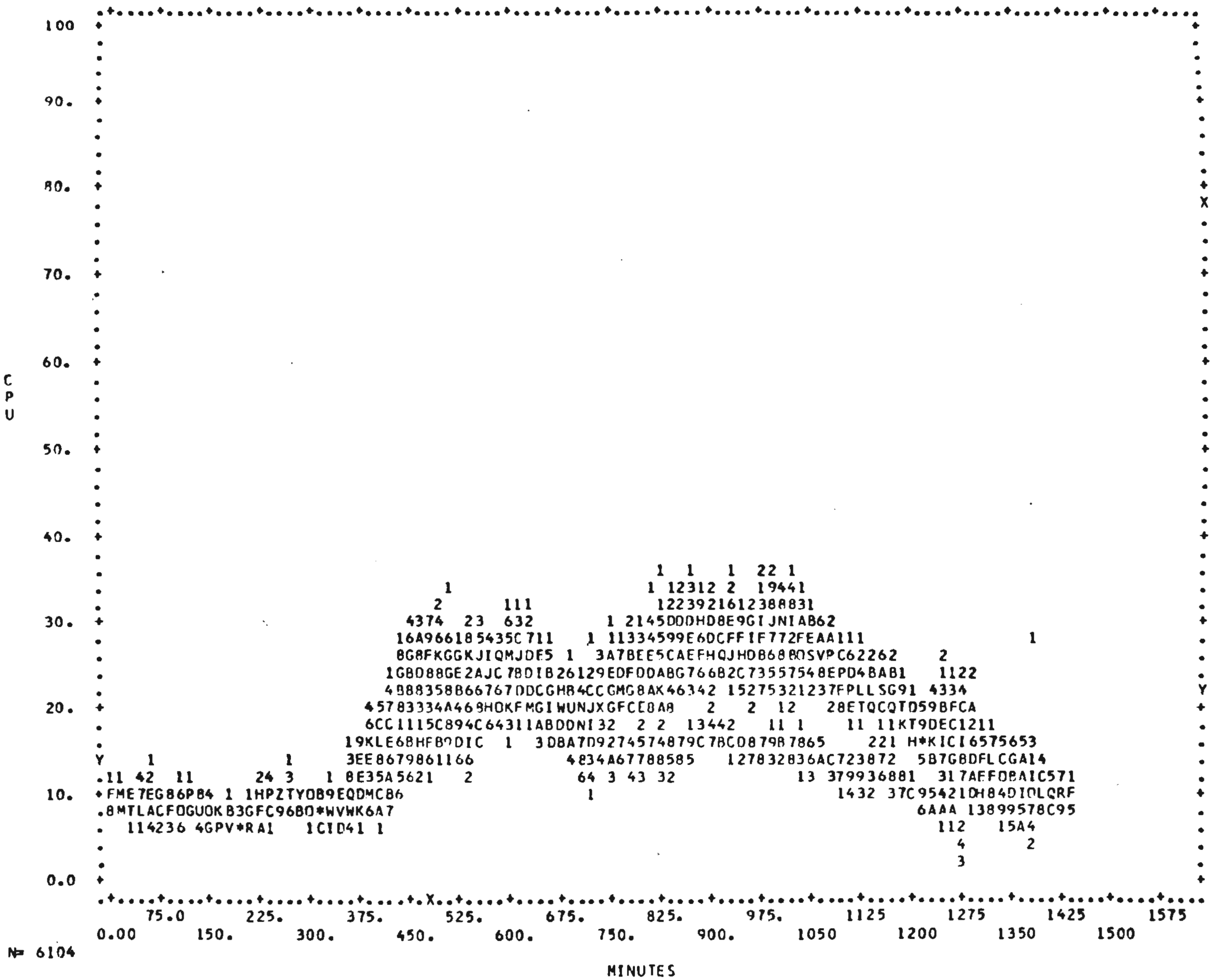
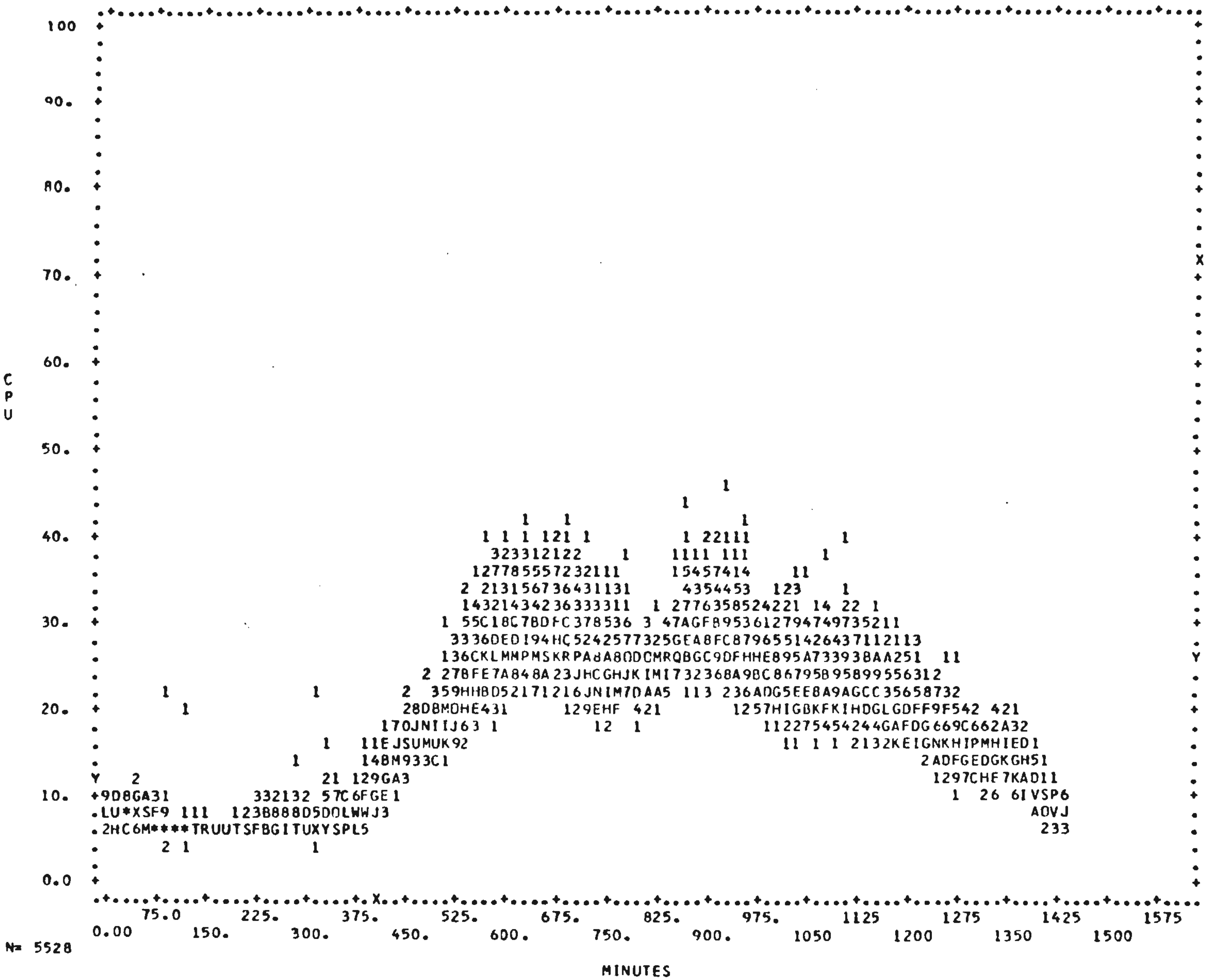


JACKSONVILLE 2.12 9020D ALL TIMES MEASURED BETWEEN 08/23/82 AND 08/27/82



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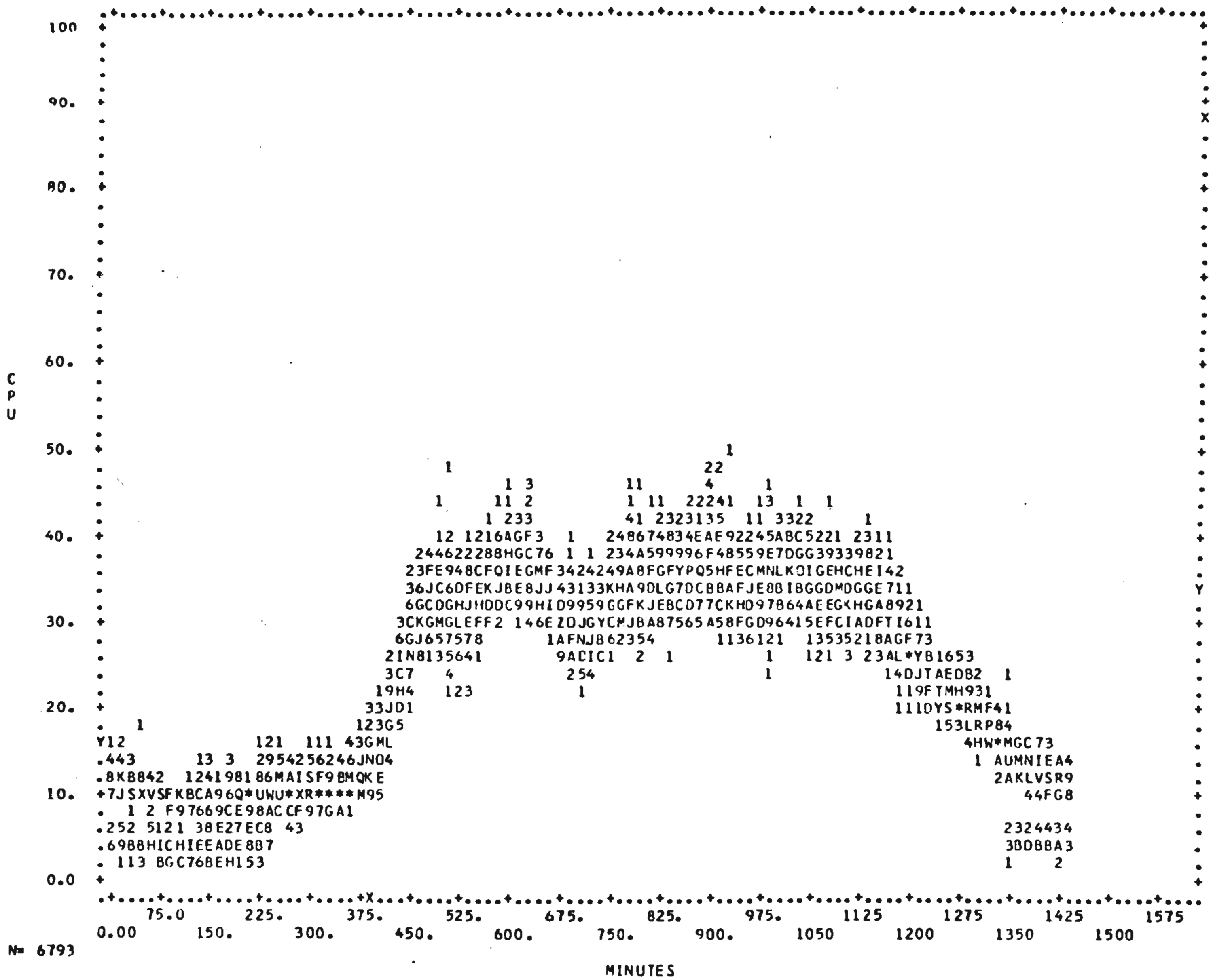

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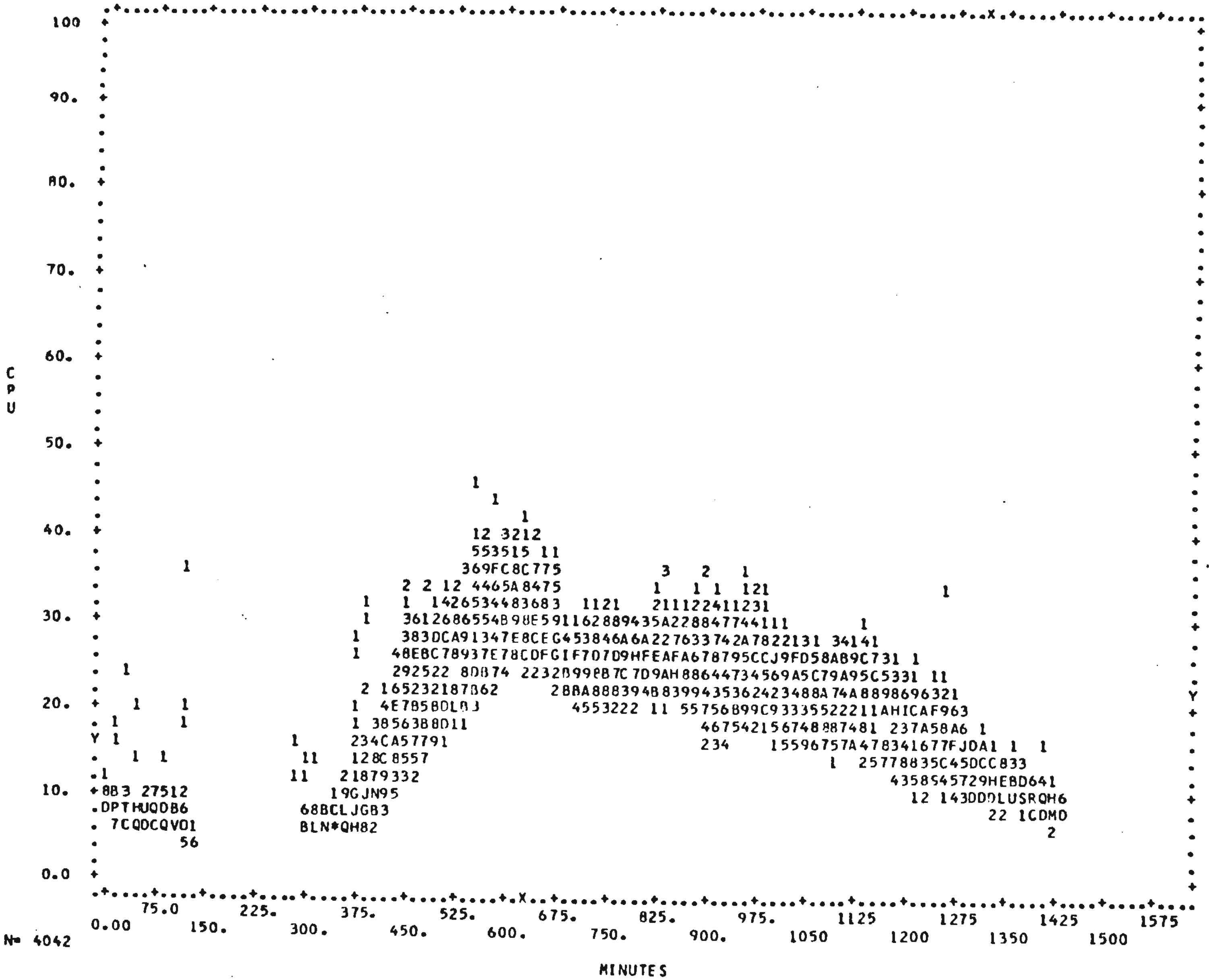
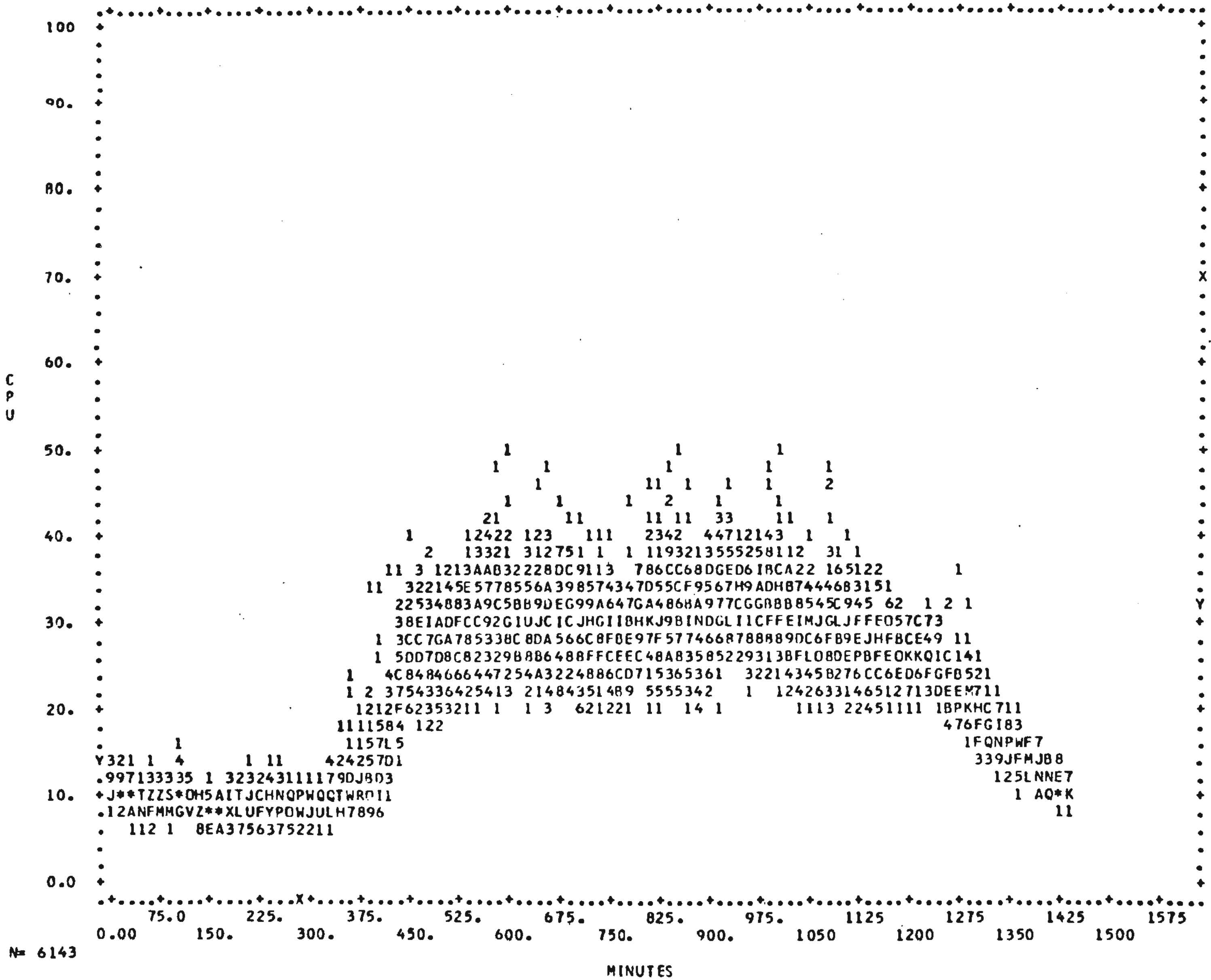


NEW YORK 2.12 9020D ALL TIMES MEASURED BETWEEN 12/27/82 AND 12/31/82



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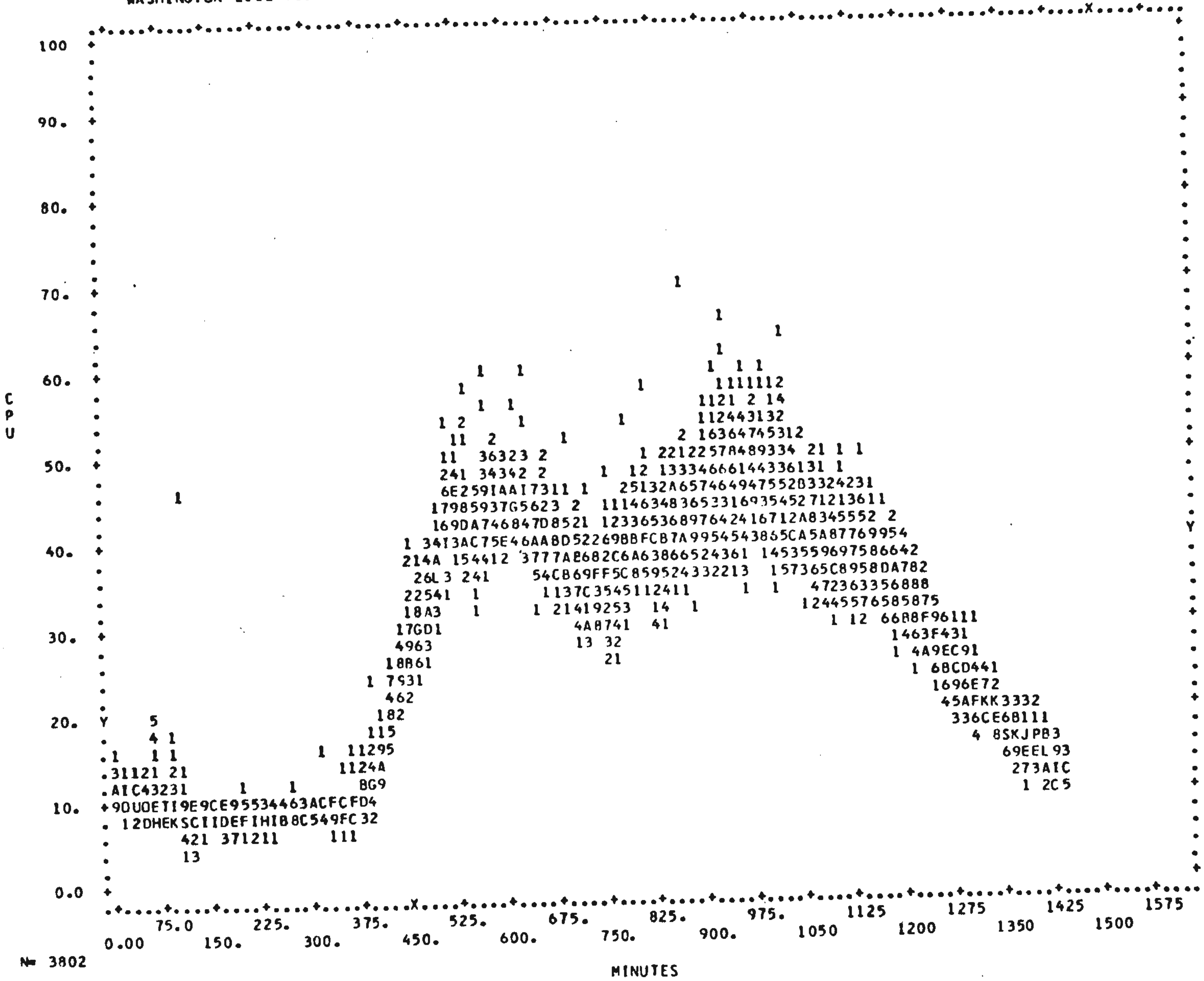

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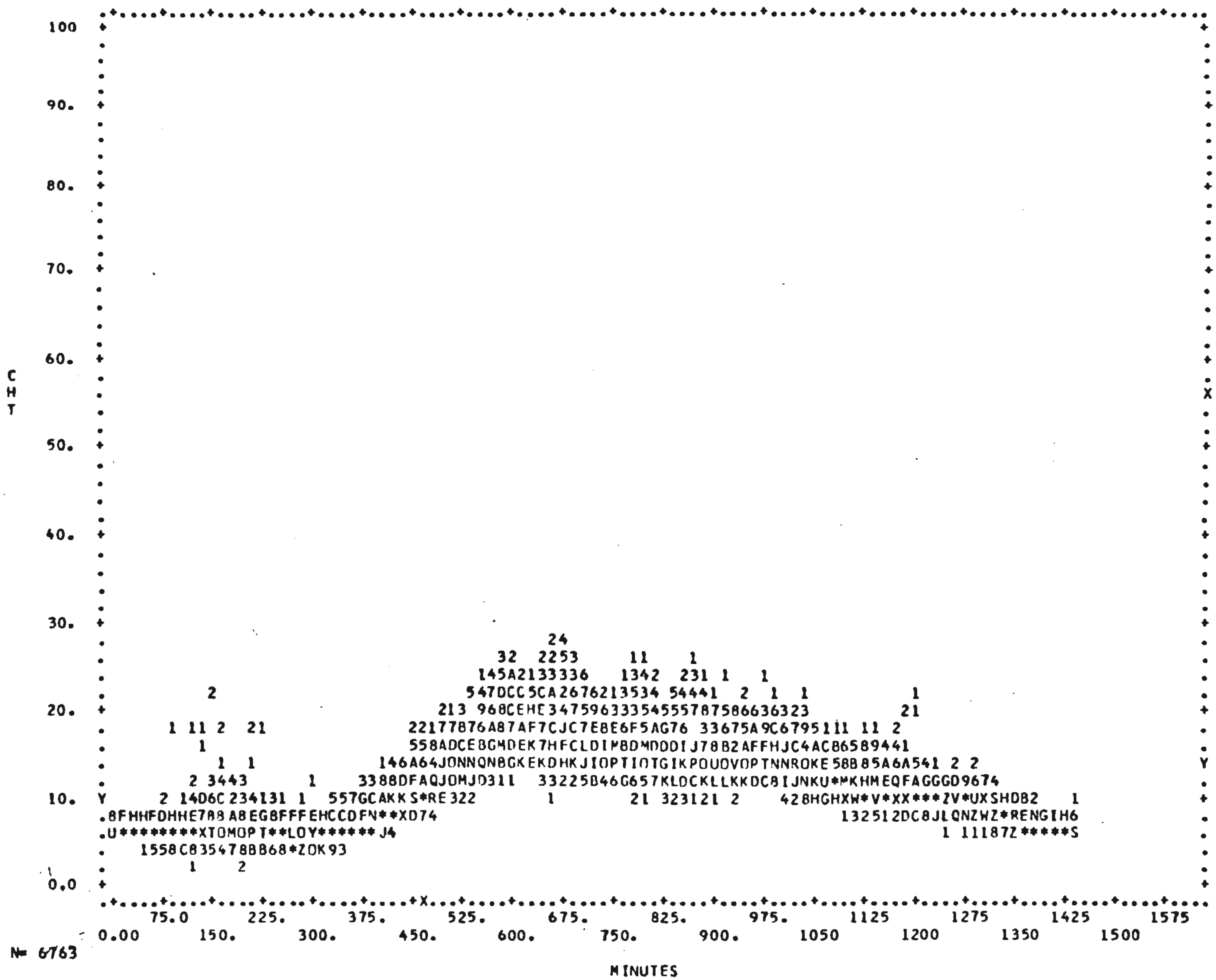

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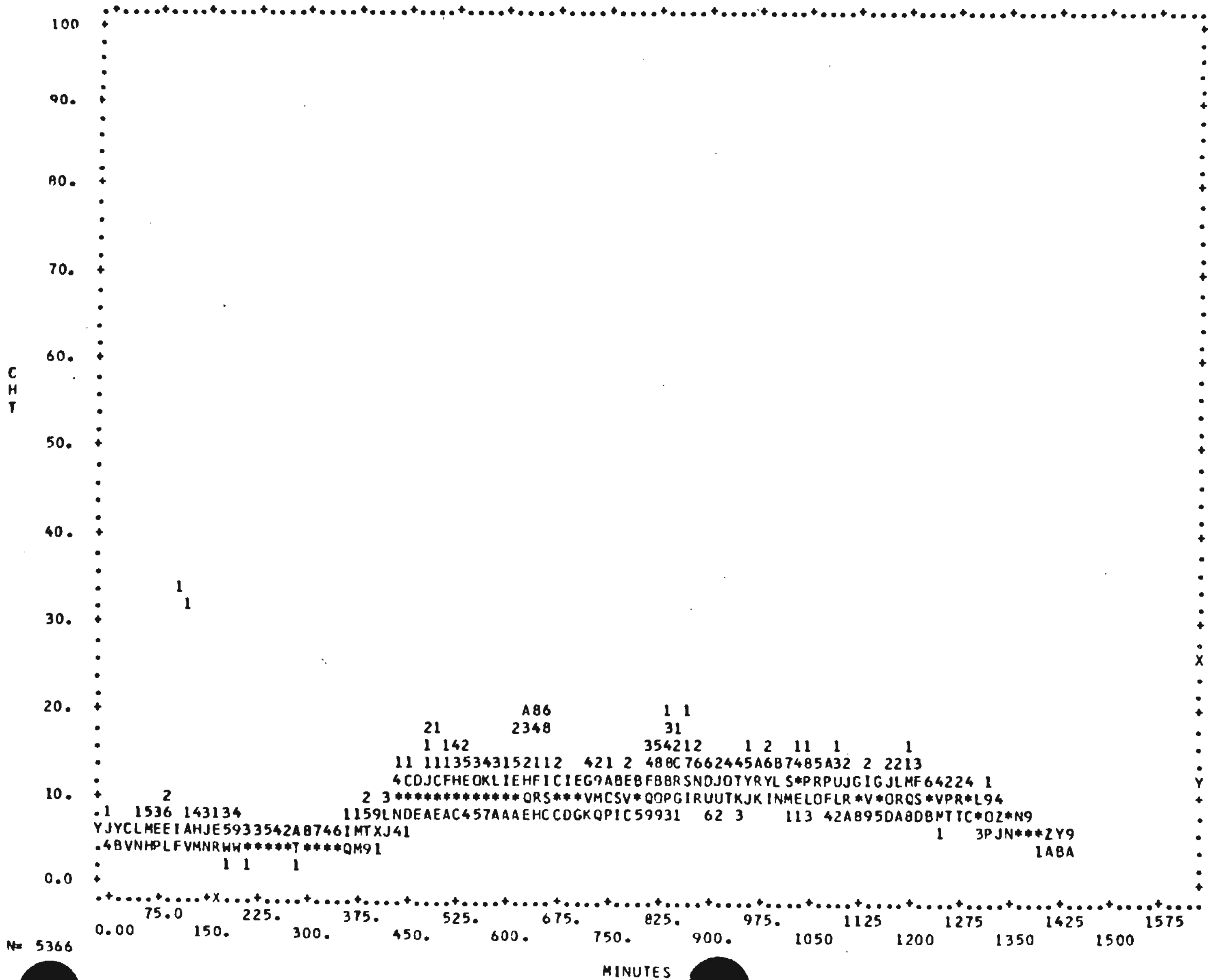
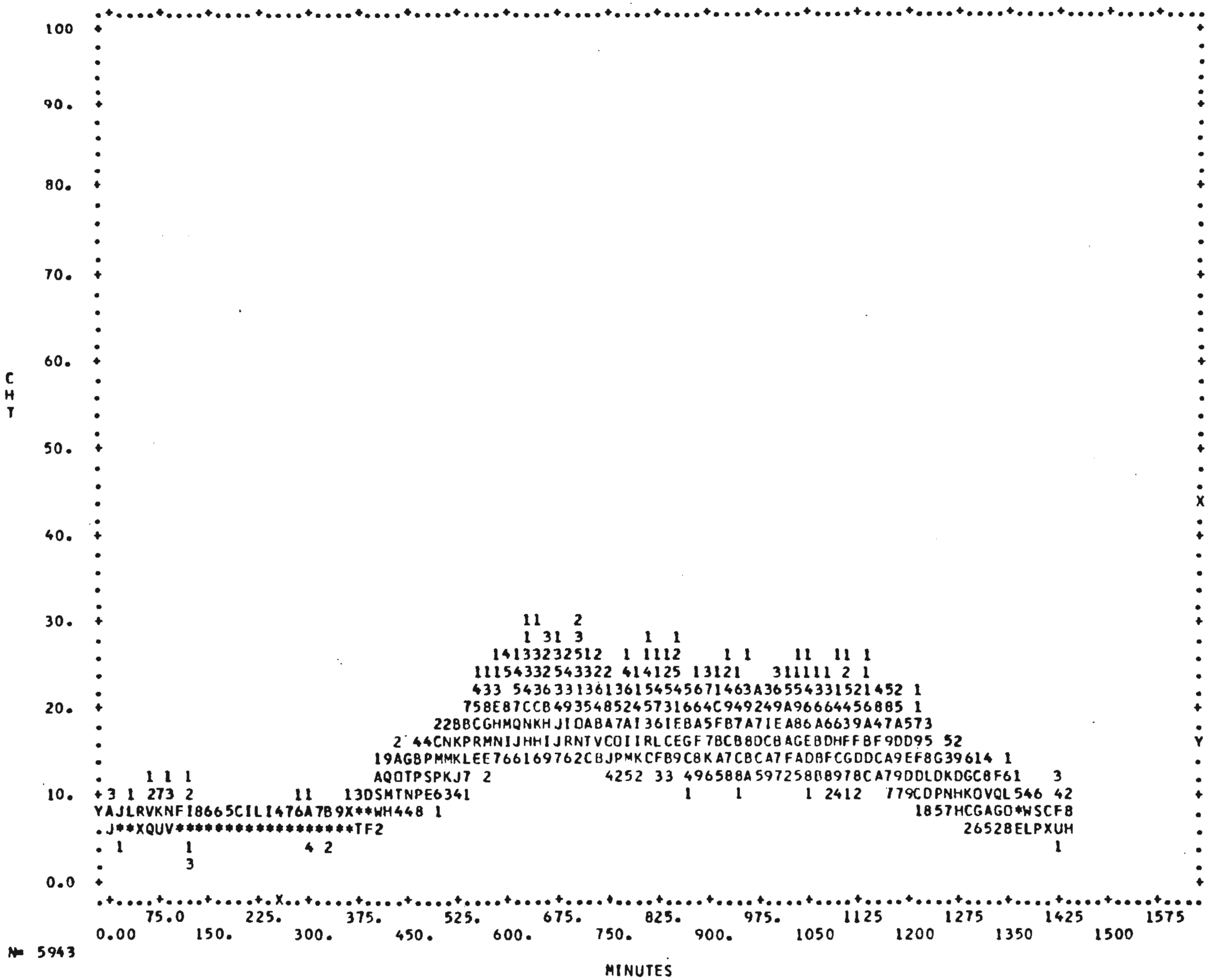
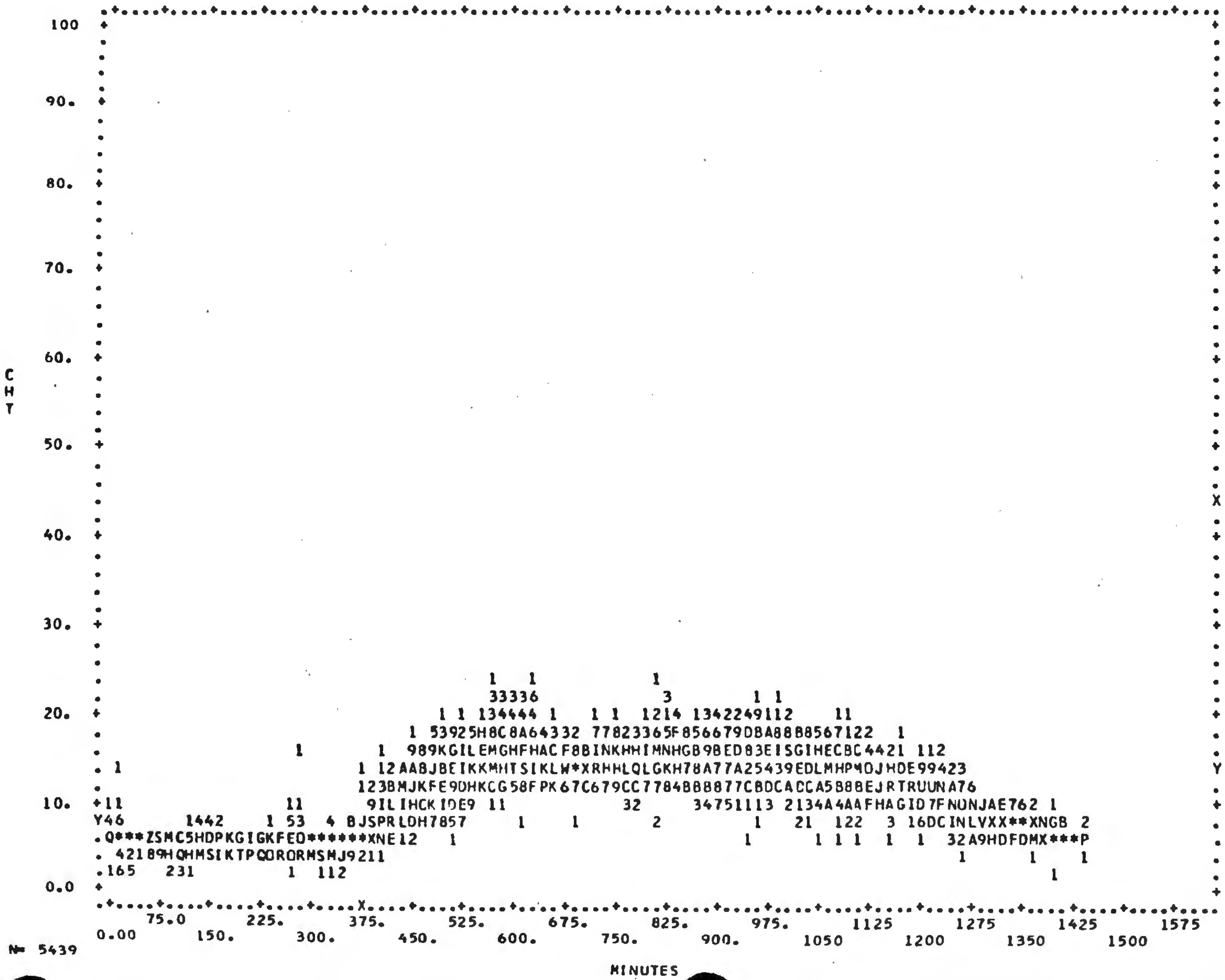


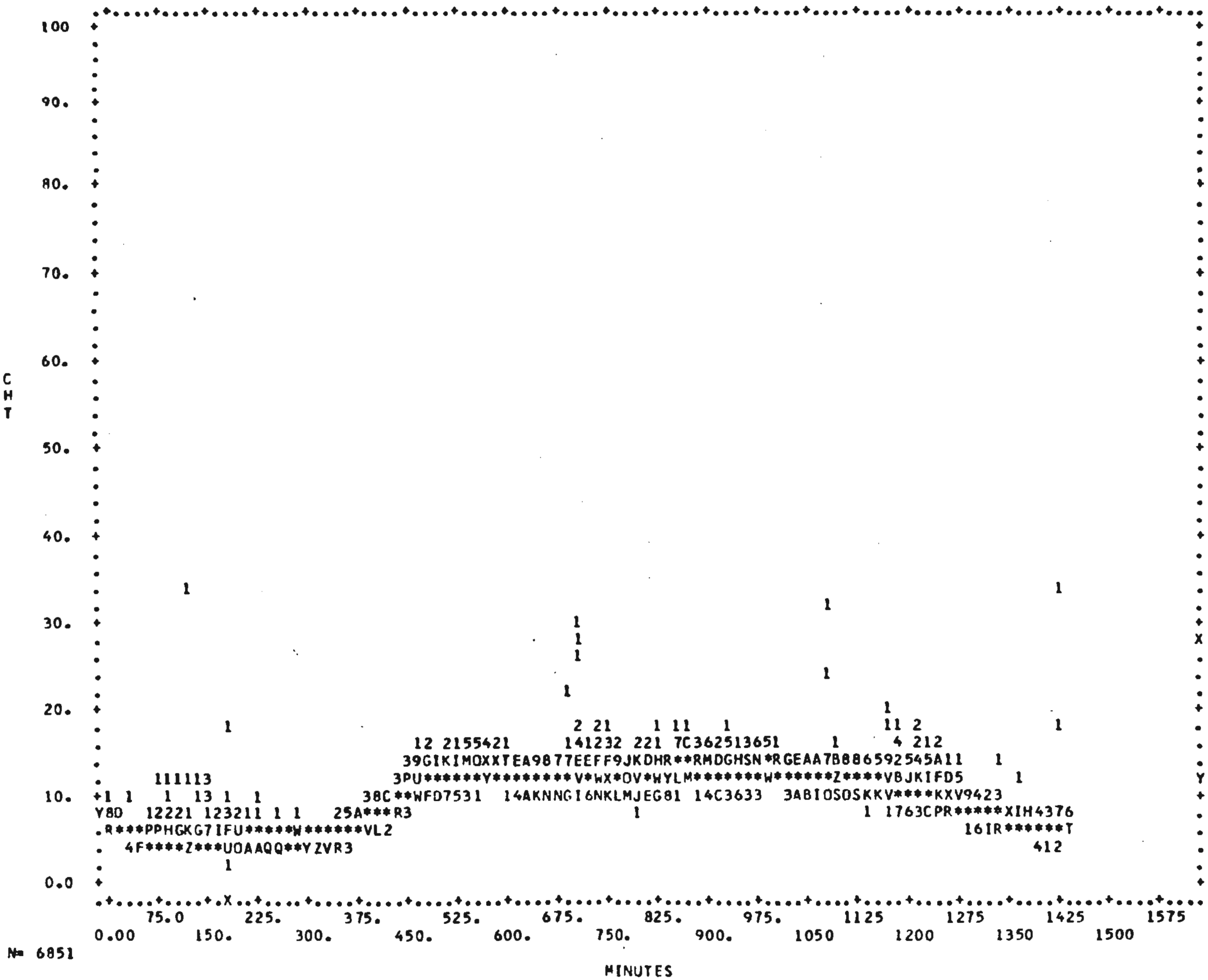
DENVER 2.12 9020A ALL TIMES MEASURED BETWEEN 08/04/82 AND 08/09/82



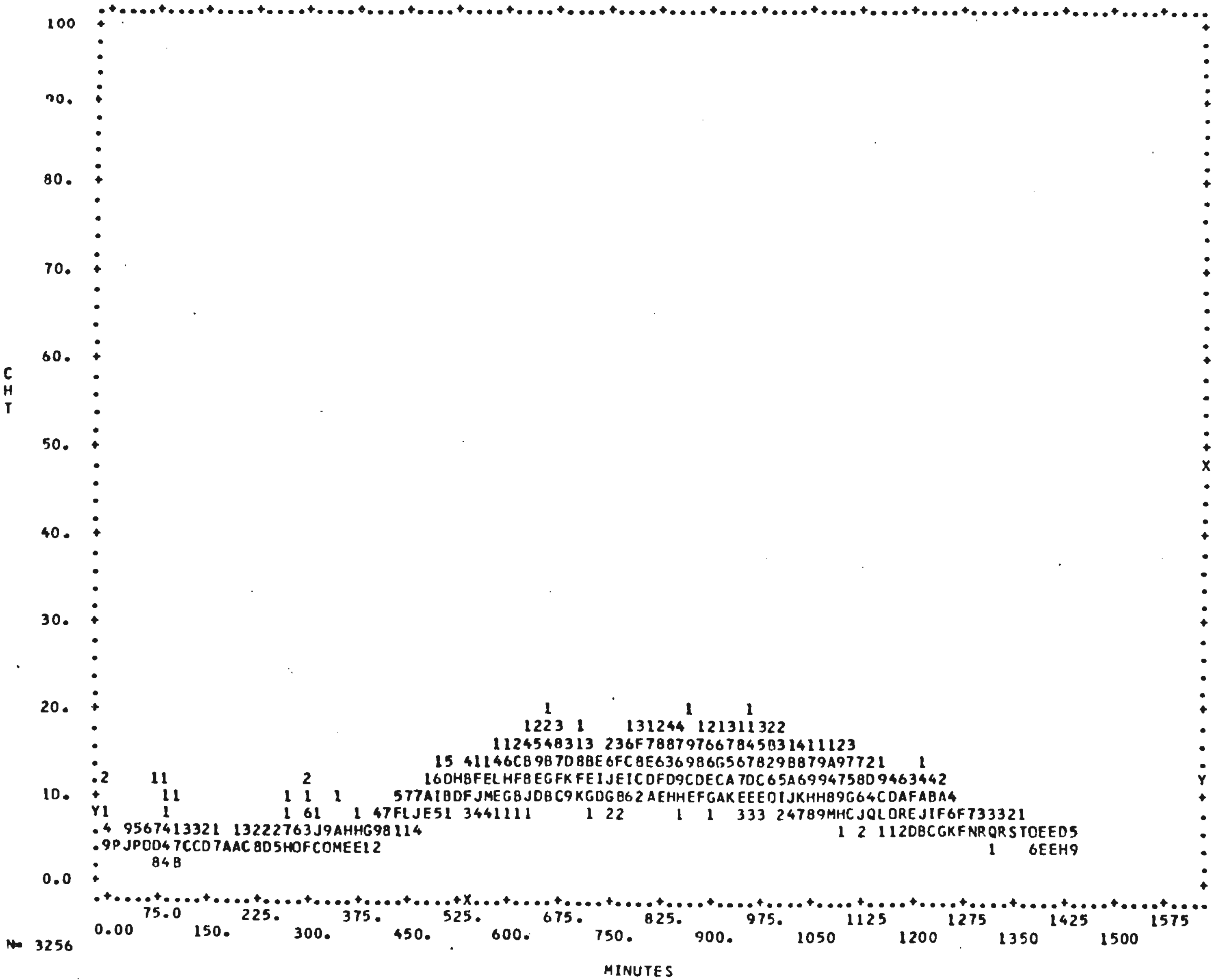
HOUSTON 2.12 9020A ALL TIMES MEASURED BETWEEN 11/5/82 AND 11/10/82



MEMPHIS 2.12 9020A ALL TIMES MEASURED BETWEEN 07/26/82 AND 07/31/82



MIAMI 2.12 9020A ALL TIMES MEASURED BETWEEN 06/08/82 AND 06/12/82



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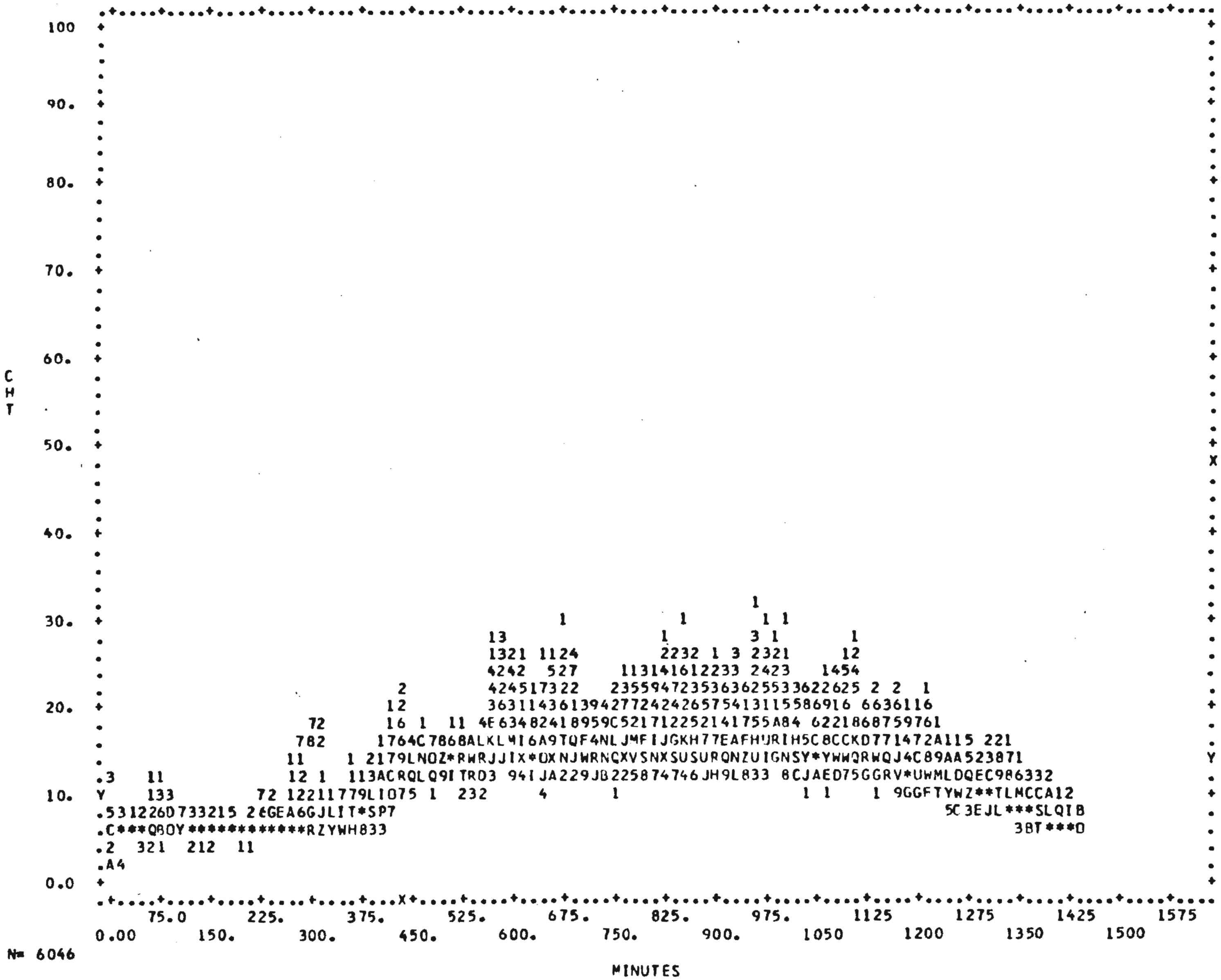

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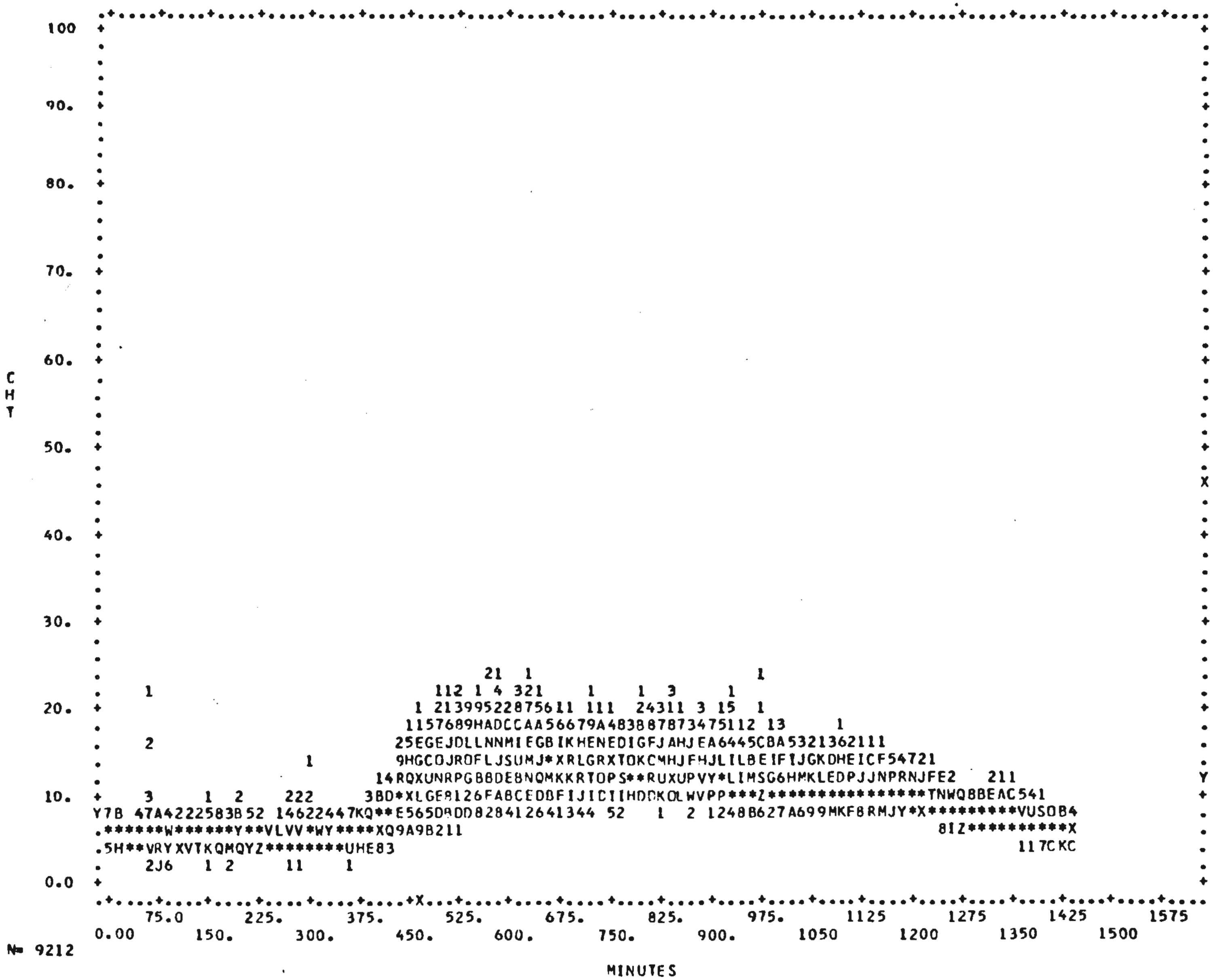
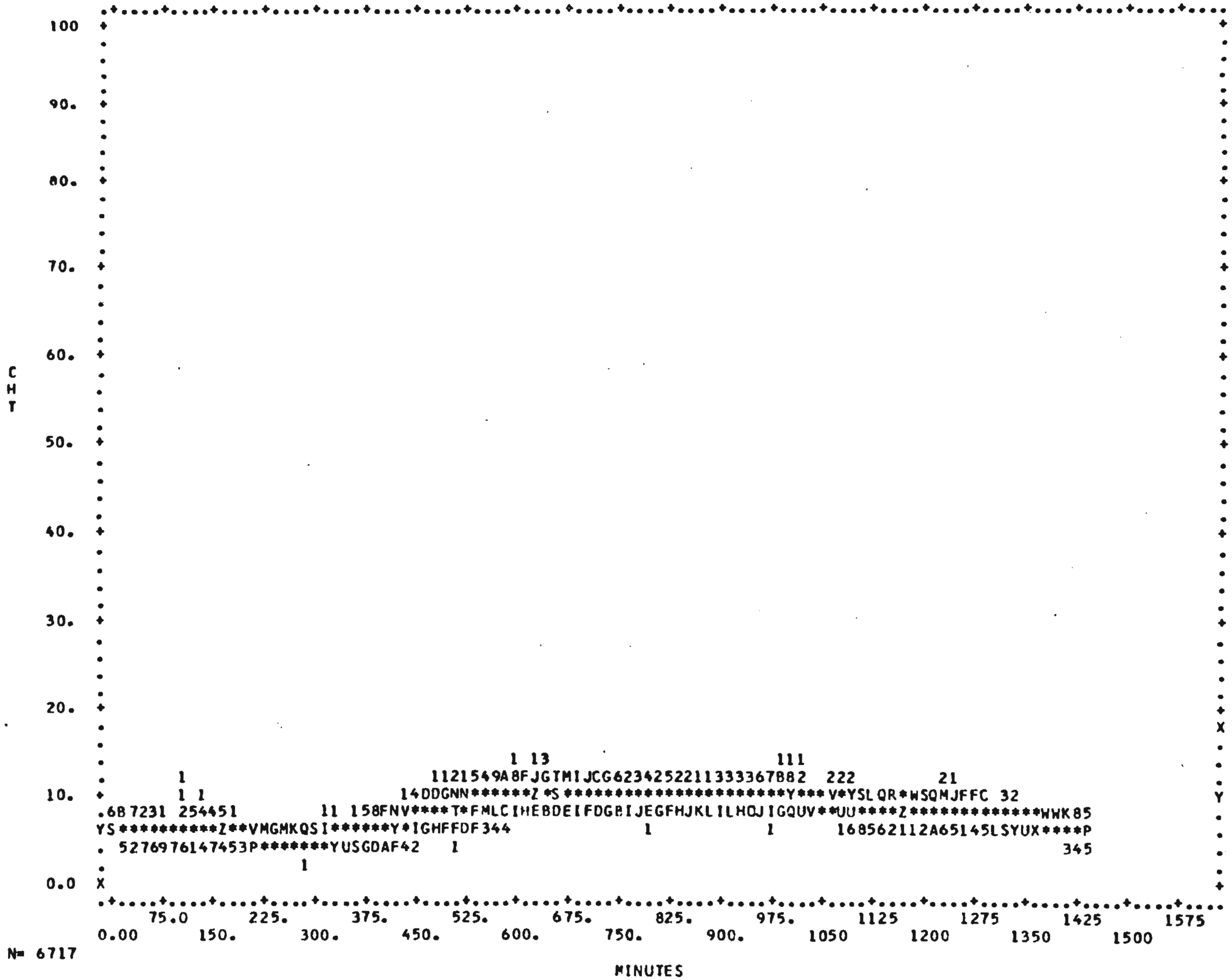
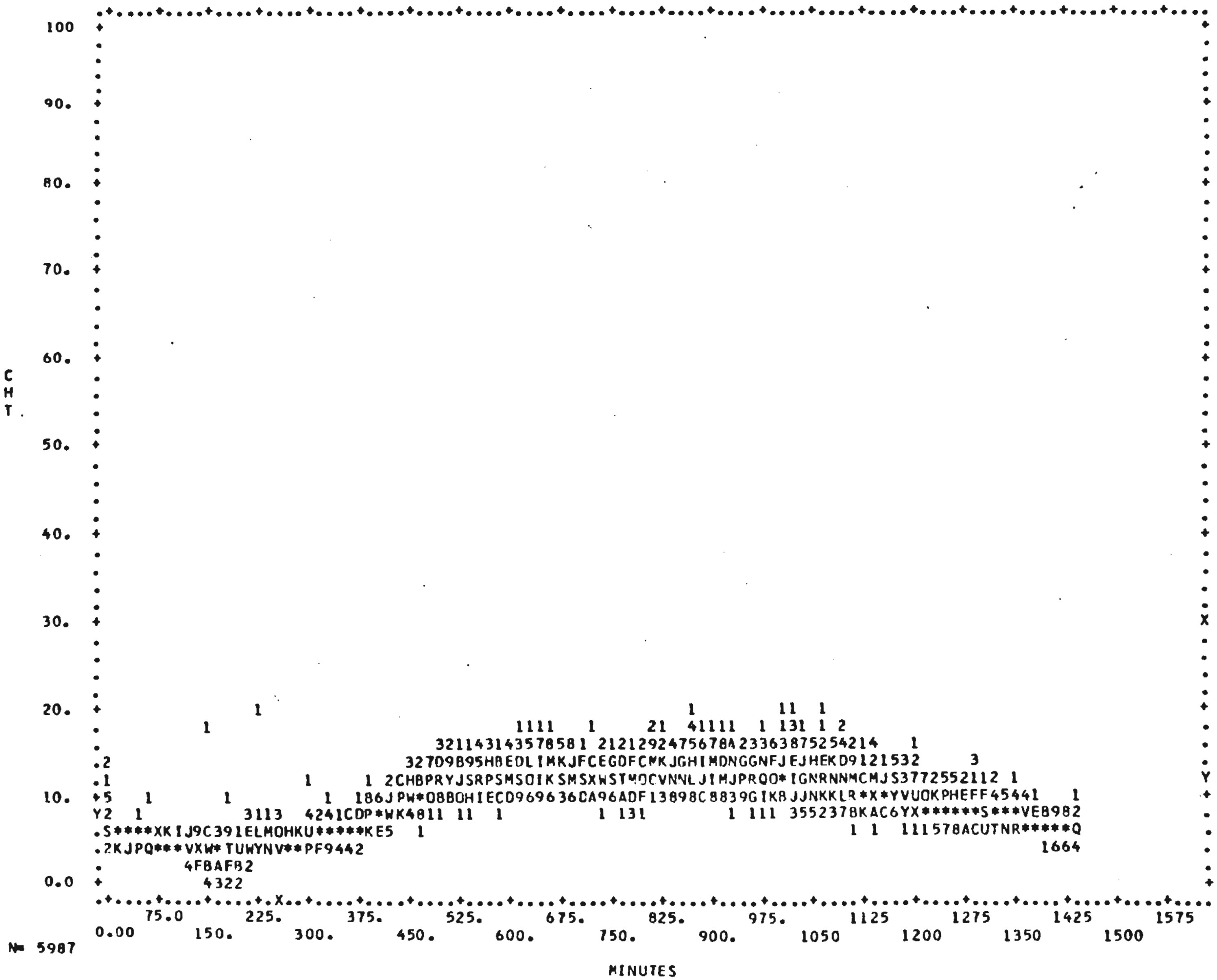


SALT LAKE 2.12 9020A ALL TIMES MEASURED BETWEEN 05/23/82 AND 05/28/82



SEATTLE 2.12 9020A ALL TIMES MEASURED BETWEEN 06/07/82 AND 06/12/82



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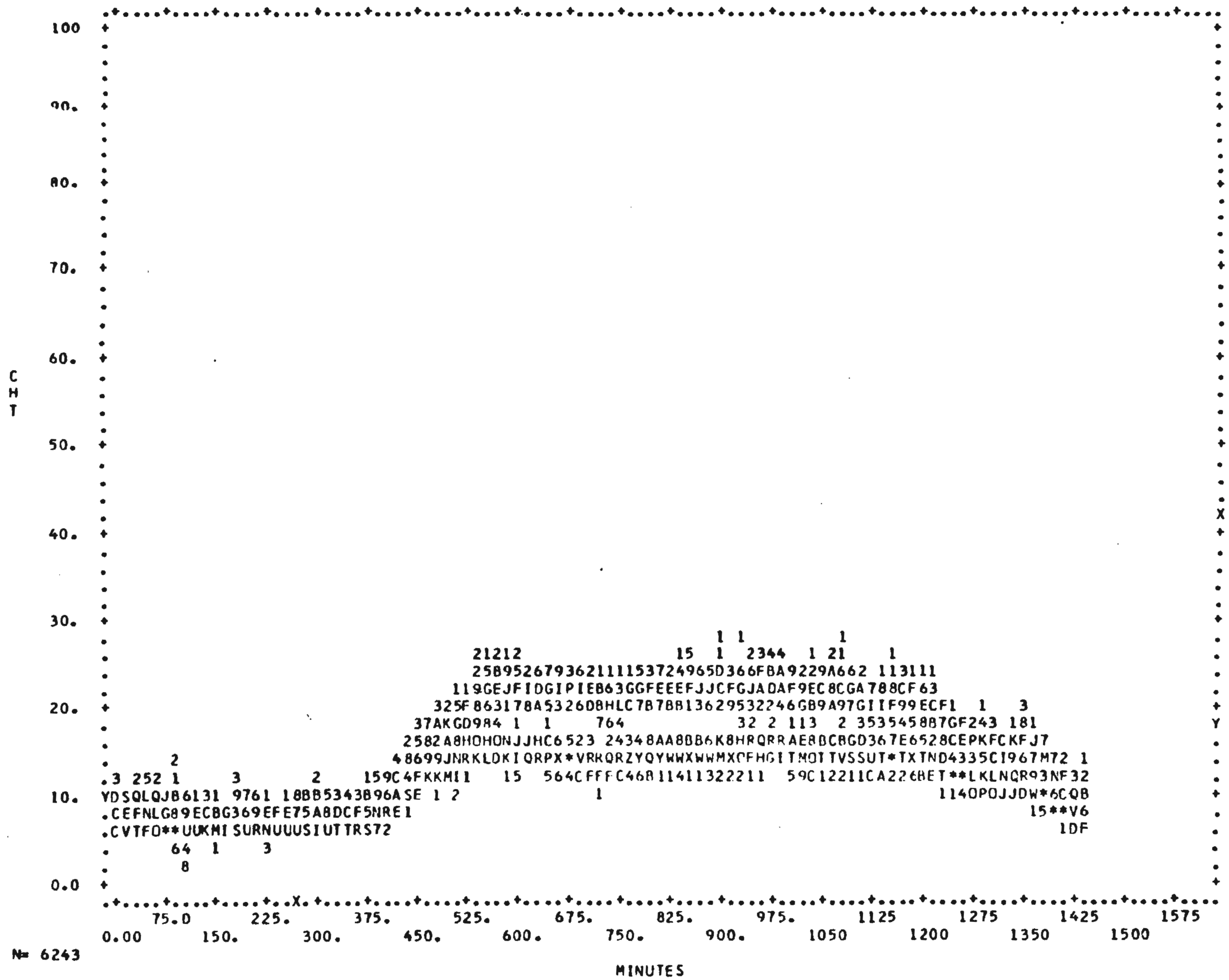

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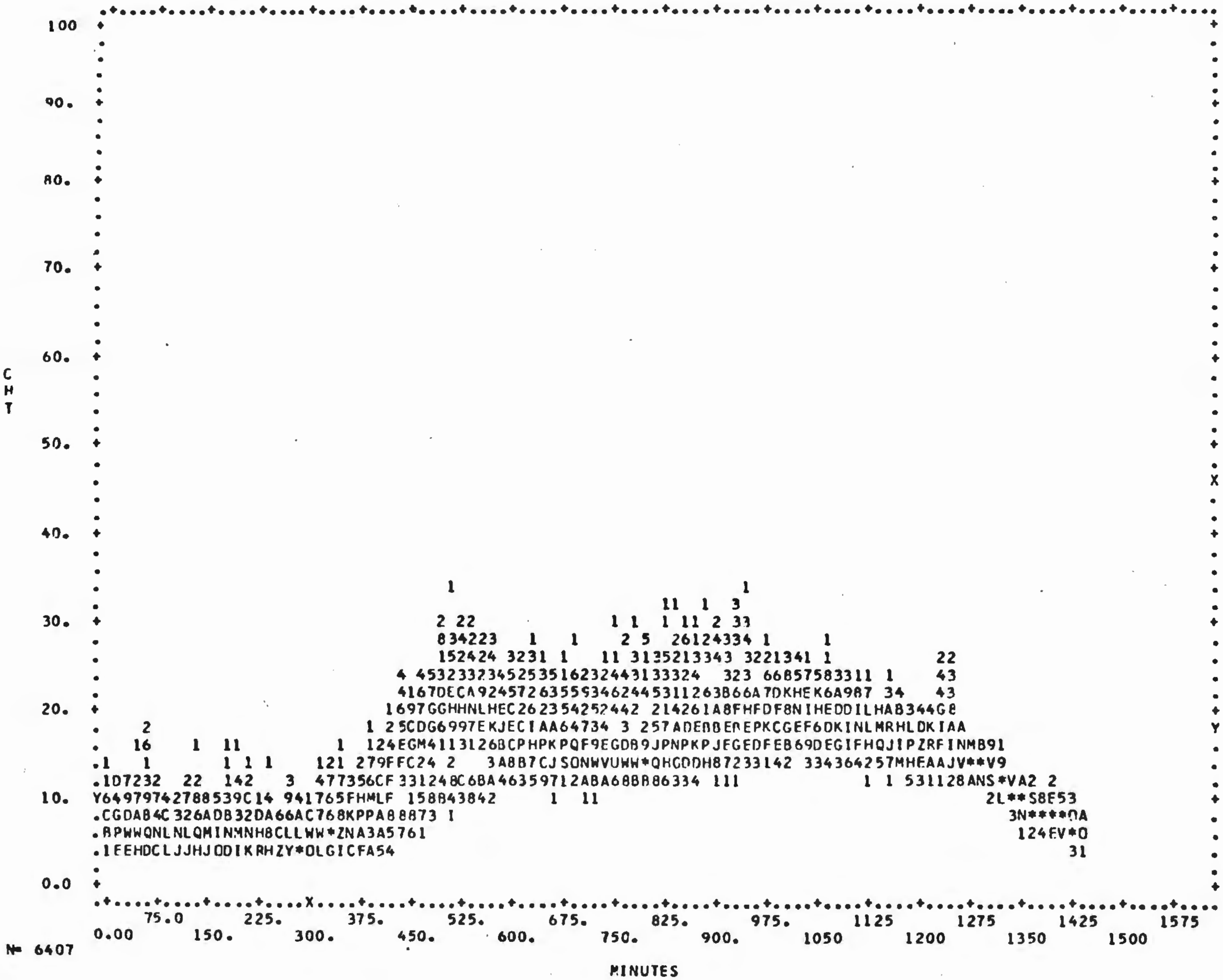

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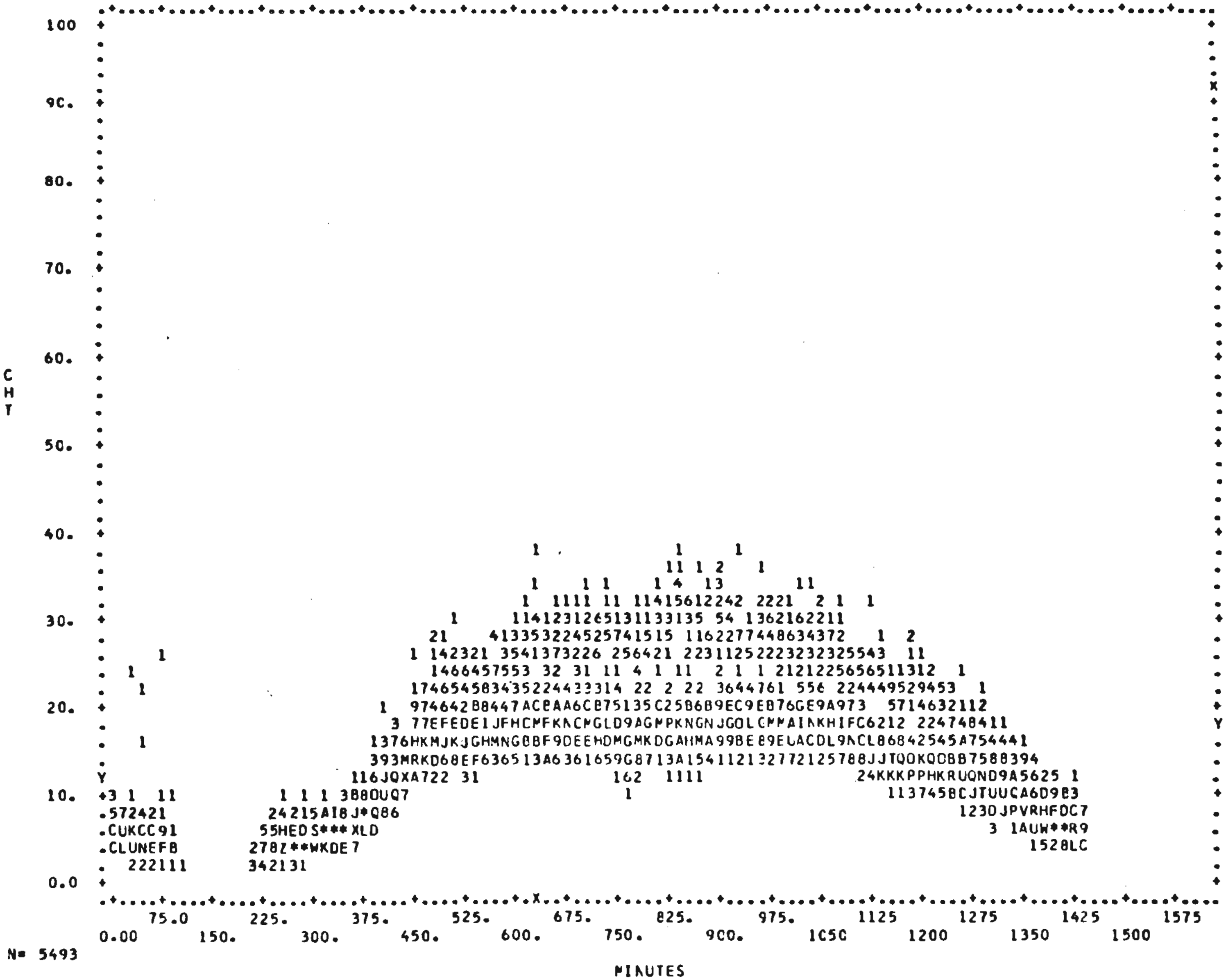

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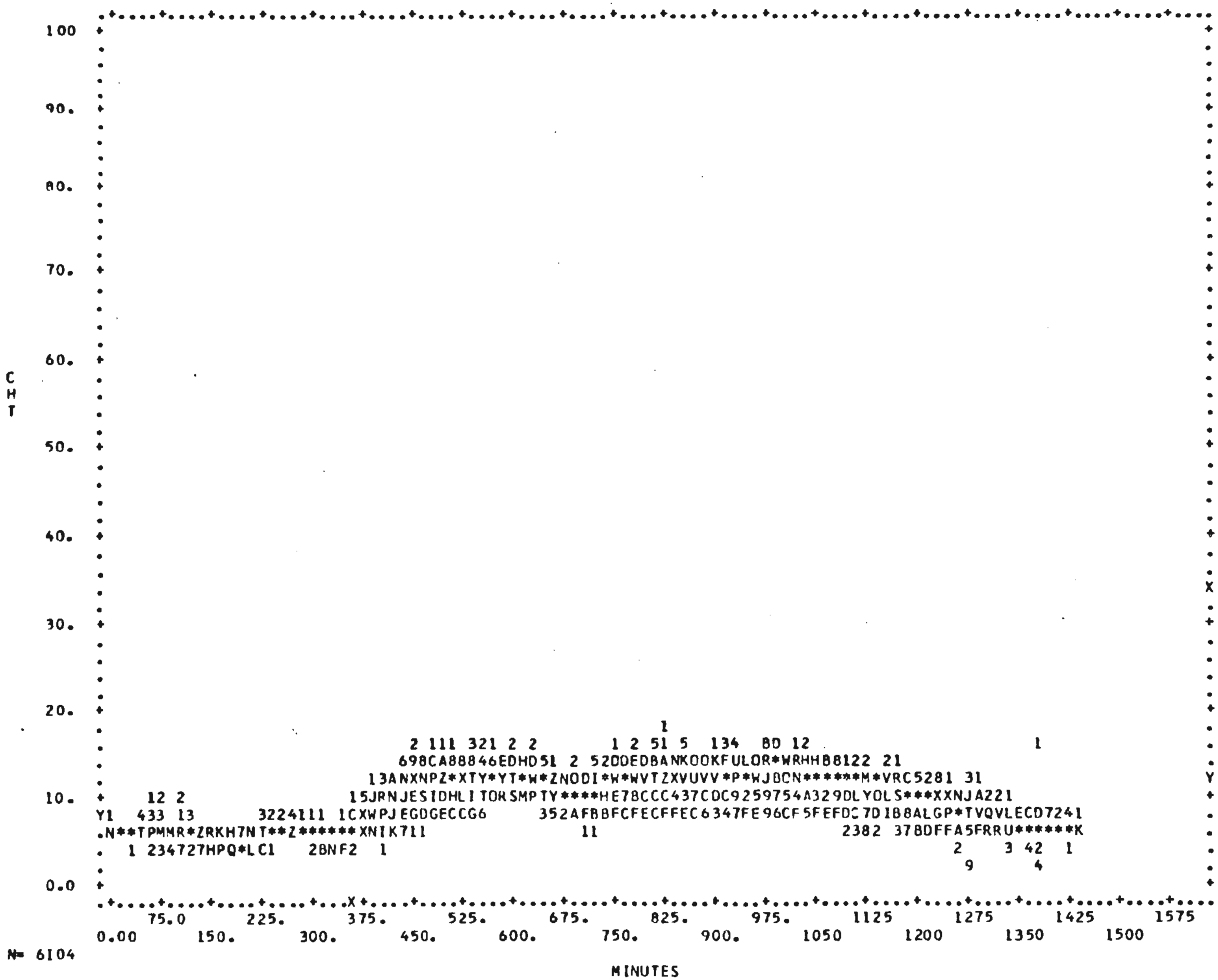
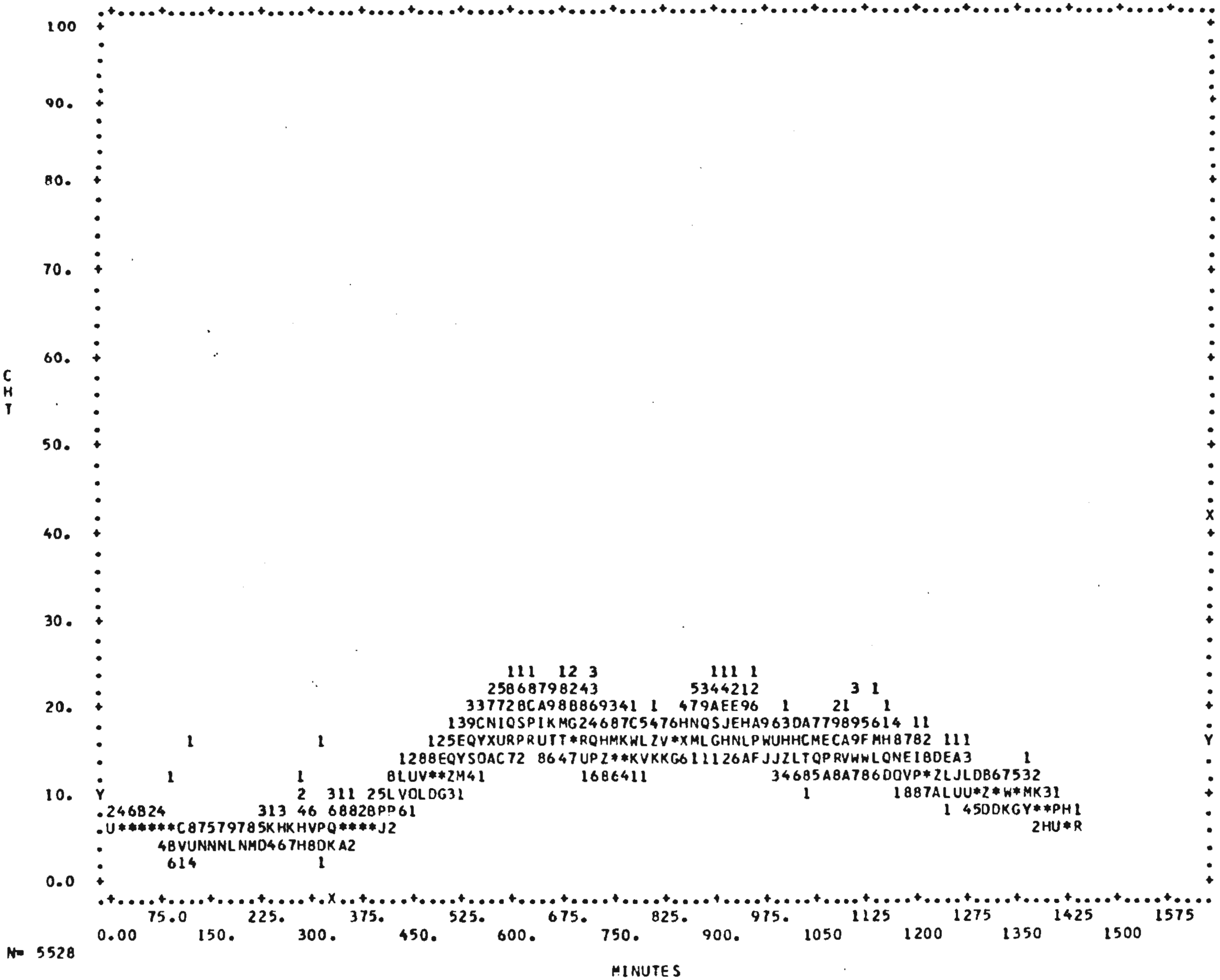
G-71

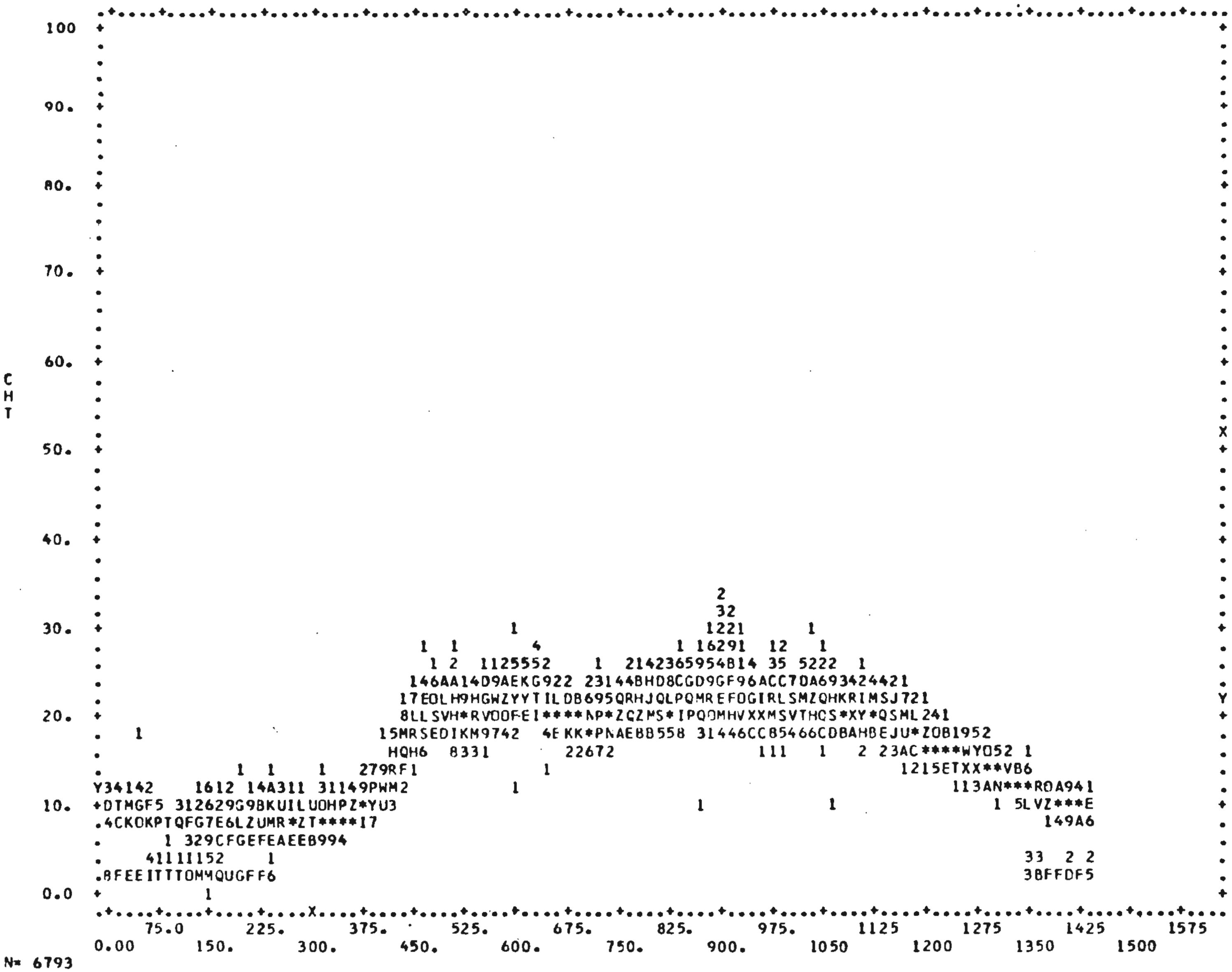
INDIANAPOLIS 2.12 9020D ALL TIMES MEASURED BETWEEN 10/10/82 AND 10/17/82



JACKSONVILLE 2.12 9020D ALL TIMES MEASURED BETWEEN 08/23/82 AND 08/27/82



KANSAS CITY 2.12 9020D ALL TIMES MEASURED BETWEEN 07/19/82 AND 07/24/82



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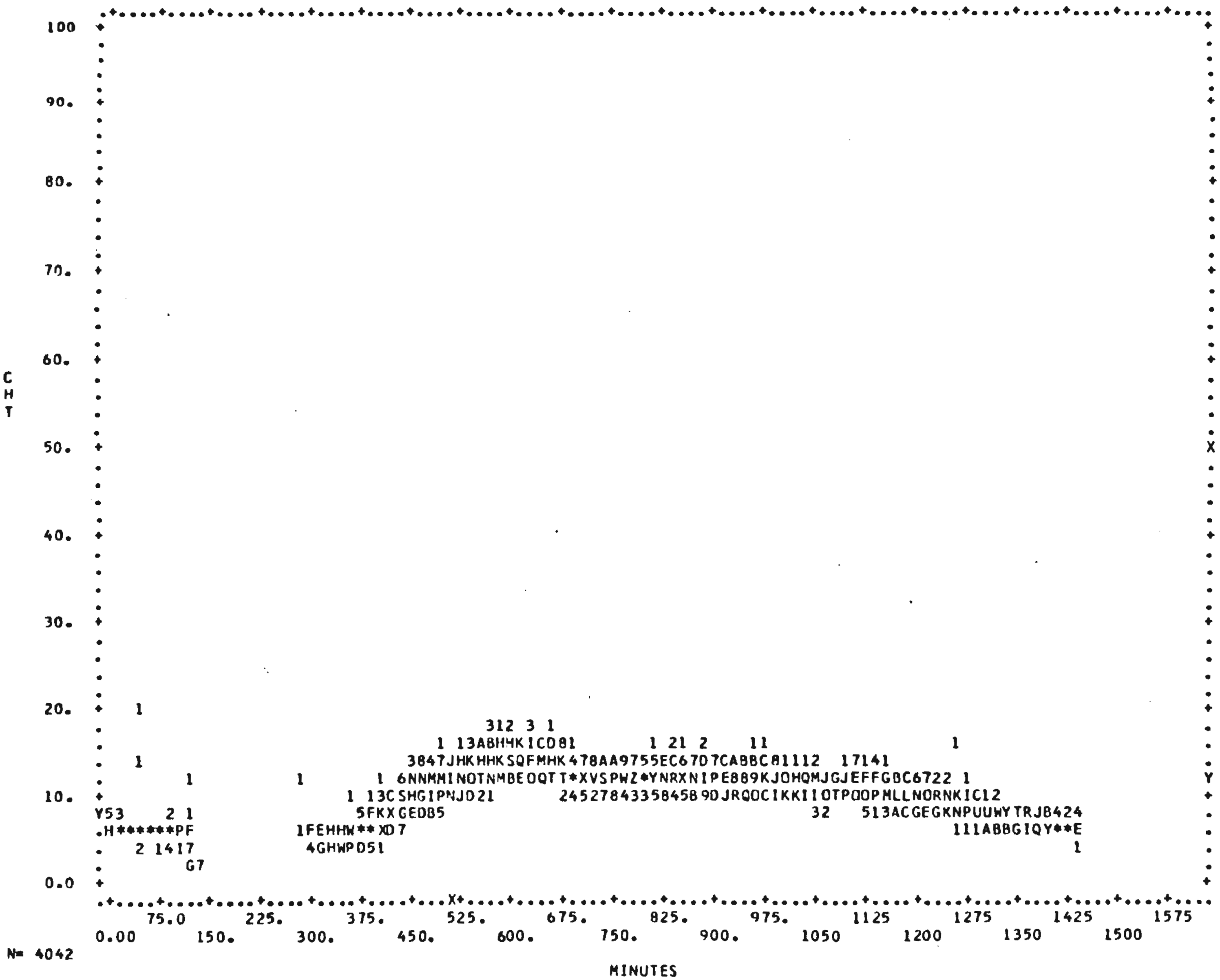
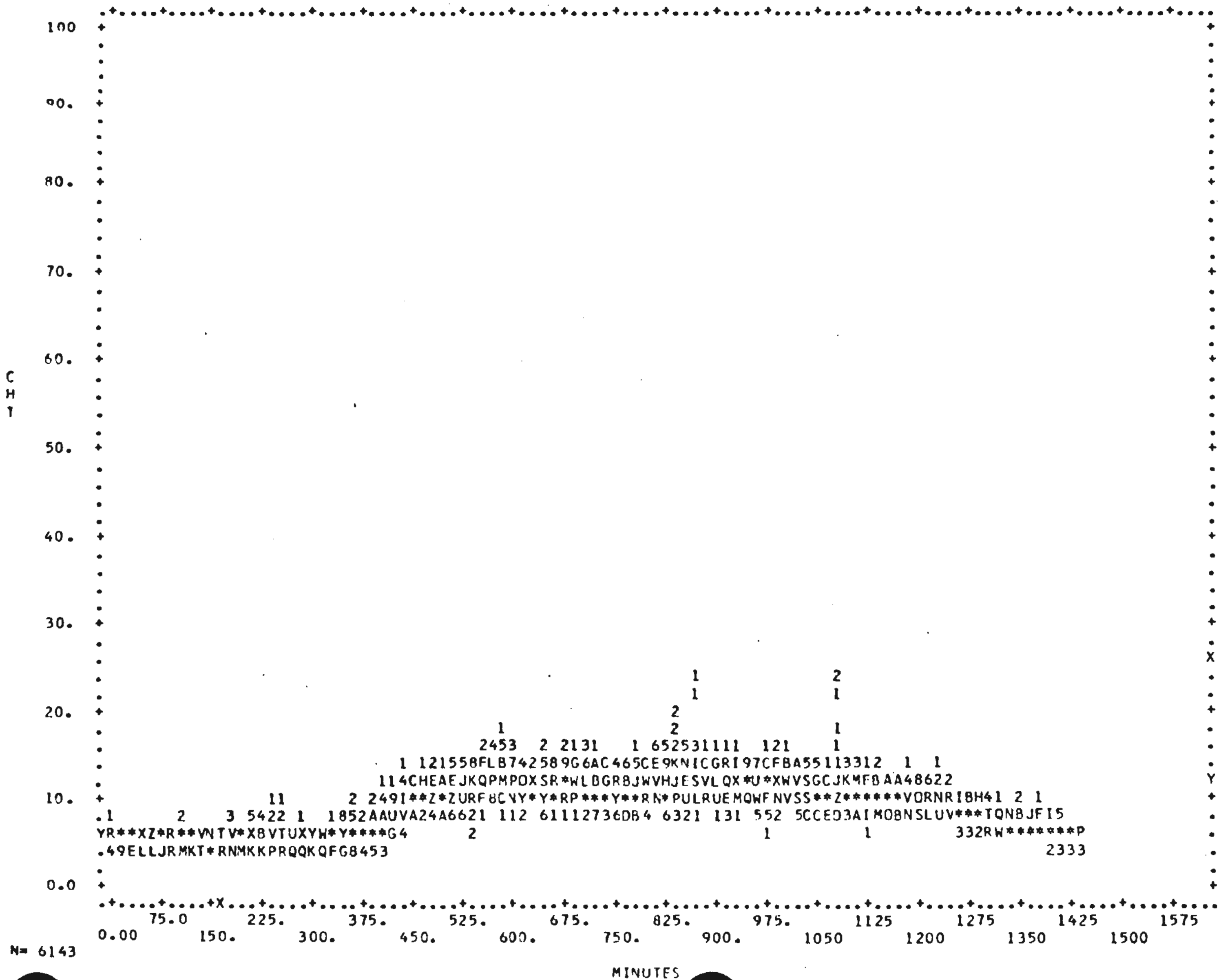
LOS ANGELES 2.12 9020D ALL TIMES MEASURED BETWEEN 08/12/82 AND 08/16/82



NEW YORK 2.12 9020D ALL TIMES MEASURED BETWEEN 12/27/82 AND 12/31/82



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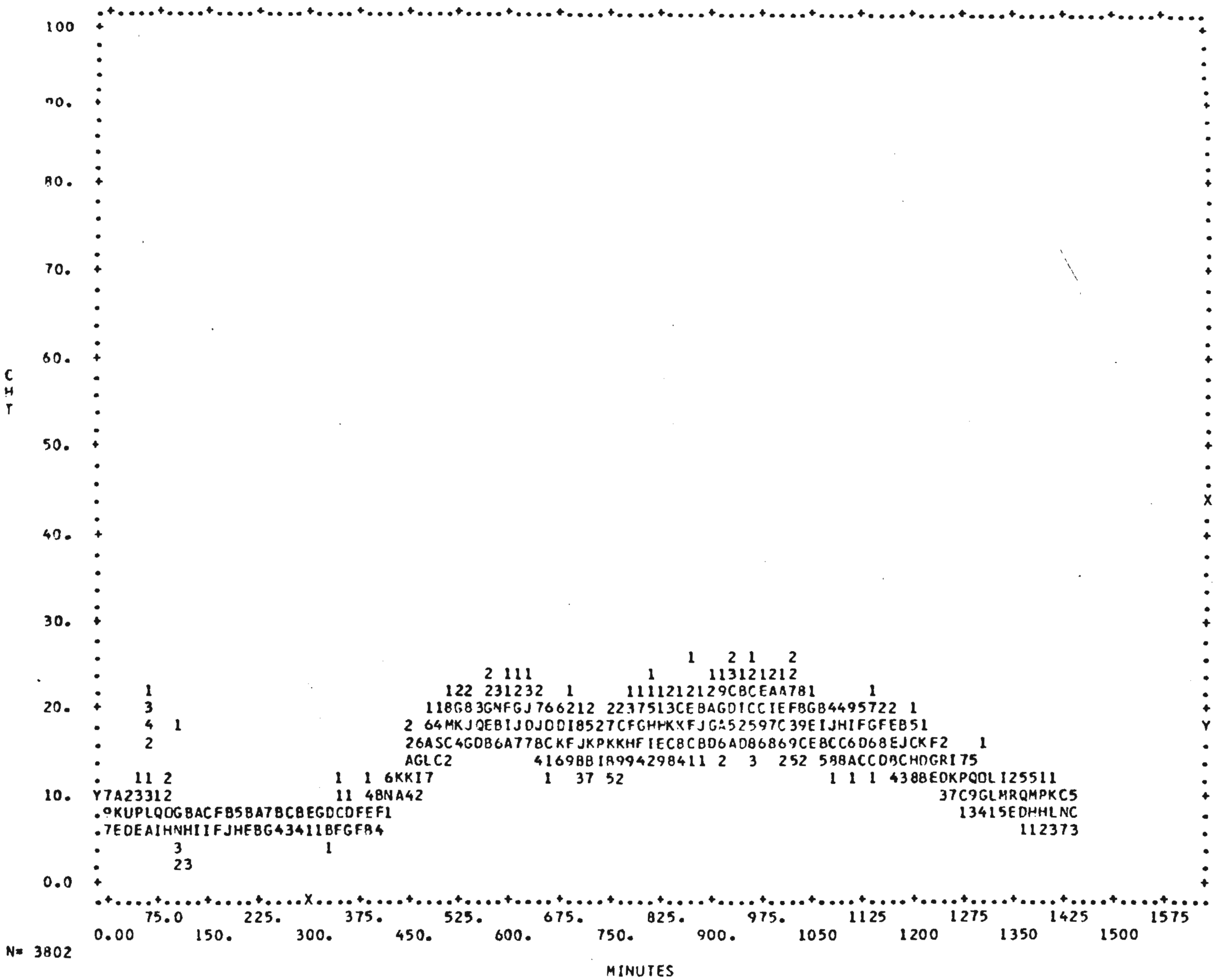
WASHINGTON 2.12 90200 ALL TIMES MEASURED BETWEEN 10/04/82 AND 10/07/82



APPENDIX H

COMPUTER MEMORY SPACE

This appendix contains a table which summarizes the amount of computer core dedicated to various elements making up the NAS En Route Software. For example, according to the table the total main core memory at Fort Worth is contained in 20 logical Storage Elements (SE's) (1 logical SE = 32,768 IBM computer words, 20 SE's = 655,360 words). As part of this space, the nucleus, consisting of core resident programs, occupies about 5.74 SE's, while the data base, known as the Compool, is almost twice as large with 10.48 SE's. Due to size limitations, not all programs reside in core, and those with an assigned lower priority reside on disk, but can be copied into a special core buffer when needed for execution. The amount of core set aside for total buffer size is contained in 3.62 SE's.

C O M P U T E R   M E M O R Y   S I Z I N G

					SIZING VALUES — EXPRESSED IN STORAGE ELEMENT (S.E.) UNITS (1 S.E. = 32,768 COMPUTER WORDS)				
SITE	MEASUREMENT DATES	CENTRAL COMPUTER COMPLEX	DISPLAY CHANNEL	SYSTEM RELEASE LEVEL	TOTAL ALLOCATED NUCLEUS	TOTAL TABLE COMPOOL	TOTAL BUFFER	UNALLOCATED CORE	TOTAL STORAGE ELEMENTS
ABQ	07/19/82-07/23/82	9020 A	CDC	2.12	5.86	8.36	5.59	0.18	20
BOS	06/21/82-07/03/82	9020 A	CDC	2.12	5.84	9.23	4.71	0.20	20
DEN	08/04/82-08/08/82	9020 A	CDC	2.12	5.86	9.45	4.54	0.13	20
HOU	11/05/82-11/09/82	9020 A	CDC	2.12	5.72	10.01	6.04	0.22	22
MEM	07/26/82-07/31/82	9020 A	CDC	2.12	5.86	7.63	6.25	0.25	20
MIA	06/07/82-06/11/82	9020 A	CDC	2.12	5.86	7.72	6.14	0.27	20
MSP	10/18/82-10/22/82	9020 A	CDC	2.12	5.73	8.31	5.50	0.44	20
OAK	08/19/82-08/22/82	9020 A	CDC	2.12	5.78	8.24	5.75	0.22	20
SEA	06/08/82-06/12/82	9020 A	CDC	2.12	6.01	7.07	4.87	0.04	18
SLC	05/23/82-05/27/82	9020 A	CDC	2.12	5.70	7.19	6.95	0.14	20
ATL	07/26/82-07/31/82	9020 D	CDC	2.12	5.68	10.61	7.56	0.13	24
CLE	05/31/82-06/04/82	9020 D	DCC	2.12	5.78	10.03	4.03	0.15	20
DCA	10/04/82-10/07/82	9020 D	DCC	2.12	5.79	10.96	7.10	0.12	24
FTW	02/08/82-02/12/82	9020 D	DCC	2.12	5.74	10.48	3.62	0.13	20
IND	10/10/82-10/17/82	9020 D	CDC	2.12	5.86	8.27	5.68	0.17	20
JAX	08/23/82-08/27/82	9020 D	CDC	2.12	5.94	9.25	4.42	0.37	20
LAX	08/12/82-08/16/82	9020 D	CDC	2.12	5.68	10.09	7.93	0.28	24
MKC	07/19/82-07/24/82	9020 D	CDC	2.12	5.70	9.49	4.45	0.19	20
NYC	12/27/82-12/31/82	9020 D	DCC	2.12	5.63	11.35	6.62	0.37	24

APPENDIX I

REGRESSION EQUATIONS

Appendix I contains several tables stating the relation between key performance variables. This relationship is expressed as linear regression equations obtained from analyzing the several thousand field data points. In each table the 9020A sites are listed first, followed by the 9020D sites.

The following notes apply to the tables:

1. The 2.9, 2.10, or 2.12 next to each site name corresponds to the software system release level, i.e., A3D2.9, A3D2.10, etc.

2. The "SE" column stands for the standard error of estimate, which indicates the standard deviation of the data points around the regression line and is a measure of error variation.

3. The "FIT" column contains the coefficient of determination; the closer this value is to 1.0, the closer is the fit of the curve to the data.

4. "UTILZ." stands for central processing utilization of the Computing Elements (CE's) excluding Input/Output Control Elements (IOCE's) utilization.

5. "IOCEOFLD" stands for IOCE offloading, an option which allows concurrent processing by IOCE's and CE's. It can be either on or off. "NO IOCEOFLD" means this option was not available in the past.

6. "SCUTLZ." stands for Average Total Selector Channel Utilization.

7. "CEUTILZ." stands for Central Processing Utilization of the Computing Elements (CE's), excluding Input/Output Control Elements (IOCE's) utilization.

8. "DSKTPUTLZ." stands for total average disk/tape selector channel utilization.

9. "SAMPLE SIZE" represents the number of data points used in deriving the regression equation.

10. "SARC" stands for Systems Analysis Recording Category. It represents a level (an amount) of data recording. "SARC = 1" consists of a minimum level. "SARC = 0," "SARC = 20," or "SARC = 4" are all higher levels of recording.

11. "TAR's" stands for the Timing Analysis Recordings option. "TAR's = FFFF," "7FFE," or "7FFC" consists of full recordings. "TAR's = FFFF (ITAR)" means TAR's are computed but not recorded on tape.

12. The site name abbreviations correspond to those used in figure 1E of the Executive Summary.

CENTRAL PROCESSING UTILIZATION
(FIRST ORDER EQUATION ESTIMATES)
VERSUS ACTIVE FLIGHT PLANS

- FOR 9020 A NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT UTILZ. AS FUNCTION OF ACTIVE F.P.)	'FIT'	SE	SAMPLE SIZE	REMARKS
ABQ 2.9	A	UTILZ=10.608 + 0.224 X ACTIVE FLIGHT PLANS	0.894	6.18	3617	SARC 1, TARS=OFF(ITAR), NO IOCEOFLD
ABQ 2.12	A	UTILZ= 1.849 + 0.179 X ACTIVE FLIGHT PLANS	0.929	3.77	3439	SARC 1, TARS=OFF, IOCEOFLD=ON
ABQ 2.12	A	UTILZ= 8.661 + 0.218 X ACTIVE FLIGHT PLANS	0.898	5.08	1239	SARC 1, TARS=OFF, IOCEOFLD=OFF
ABQ 2.12	A	UTILZ= 3.051 + 0.217 X ACTIVE FLIGHT PLANS	0.967	4.11	545	SARC 1, TARS=7FFC, IOCEOFLD=ON
ABQ 2.12	A	UTILZ= 2.701 + 0.242 X ACTIVE FLIGHT PLANS	0.960	4.27	1289	SARC 4, TARS=7FFE, IOCEOFLD=ON
BOS 2.9	A	UTILZ= 7.982 + 0.234 X ACTIVE FLIGHT PLANS	0.815	6.50	3184	SARC 1, TARS=OFF(ITAR), NO IOCEOFLD
BOS 2.12	A	UTILZ= 7.501 + 0.172 X ACTIVE FLIGHT PLANS	0.858	4.07	2760	SARC 1, TARS=OFF, IOCEOFLD=ON
BOS 2.12	A	UTILZ= 8.902 + 0.221 X ACTIVE FLIGHT PLANS	0.886	4.75	1392	SARC 1, TARS=7FFC, IOCEOFLD=OFF
BOS 2.12	A	UTILZ= 8.943 + 0.210 X ACTIVE FLIGHT PLANS	0.535	2.44	209	SARC 1, TARS=OFF, IOCEOFLD=OFF
DEN 2.10	A	UTILZ=13.668 + 0.212 X ACTIVE FLIGHT PLANS	0.904	5.44	1580	SARC 1, TARS=OFF, NO IOCEOFLD
DEN 2.12	A	UTILZ= 8.584 + 0.174 X ACTIVE FLIGHT PLANS	0.924	3.95	2694	SARC 4(= SARC 1),TARS=OFF,OFLD=ON
DEN 2.12	A	UTILZ=10.280 + 0.221 X ACTIVE FLIGHT PLANS	0.939	4.55	2070	SARC 4(= SARC 1),TARS=OFF,OFLD=OFF
DEN 2.12	A	UTILZ=11.904 + 0.212 X ACTIVE FLIGHT PLANS	0.516	4.16	53	SARC 4(= SARC 1),TARS=7FFC,OFLD=ON
HOU 2.9	A	UTILZ= 8.438 + 0.236 X ACTIVE FLIGHT PLANS	0.951	5.12	4281	SARC 1, TARS=OFF, NO IOCEOFLD
HOU 2.12	A	UTILZ= 8.971 + 0.178 X ACTIVE FLIGHT PLANS	0.922	3.98	837	SARC 2, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	UTILZ= 7.939 + 0.191 X ACTIVE FLIGHT PLANS	0.941	3.70	2889	SARC 3, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	UTILZ= 9.197 + 0.241 X ACTIVE FLIGHT PLANS	0.961	4.23	1457	SARC 3, TARS=OFF, IOCEOFLD=OFF
MEM 2.9	A	UTILZ= 9.219 + 0.195 X ACTIVE FLIGHT PLANS	0.936	4.72	4168	SARC 1, TARS=OFF, NO IOCEOFLD
MEM 2.12	A	UTILZ= 7.005 + 0.148 X ACTIVE FLIGHT PLANS	0.928	3.59	3743	SARC 1, TARS=OFF, IOCEOFLD=ON
MEM 2.12	A	UTILZ=10.212 + 0.184 X ACTIVE FLIGHT PLANS	0.931	3.98	1299	SARC 1, TARS=OFF, IOCEOFLD=OFF
MIA 2.9	A	UTILZ= 8.412 + 0.231 X ACTIVE FLIGHT PLANS	0.868	5.16	3138	SARC 1, TARS=OFF, NO IOCEOFLD
MIA 2.12	A	UTILZ= 4.559 + 0.180 X ACTIVE FLIGHT PLANS	0.885	3.82	1923	SARC 1, TARS=OFF, IOCEOFLD=ON
MIA 2.12	A	UTILZ= 9.459 + 0.214 X ACTIVE FLIGHT PLANS	0.930	4.91	1100	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.9	A	UTILZ=10.689 + 0.231 X ACTIVE FLIGHT PLANS	0.893	5.64	3002	SARC 1, TARS=OFF, NO IOCEOFLD
MSP 2.12	A	UTILZ= 8.004 + 0.156 X ACTIVE FLIGHT PLANS	0.907	3.67	3198	SARC 1, TARS=OFF, IOCEOFLD=ON
MSP 2.12	A	UTILZ=11.322 + 0.226 X ACTIVE FLIGHT PLANS	0.883	5.02	730	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.12	A	UTILZ=10.373 + 0.193 X ACTIVE FLIGHT PLANS	0.914	4.65	1907	SARC 1, TARS=OFF, IOCEOFLD=OFF
OAK 2.10	A	UTILZ=11.458 + 0.239 X ACTIVE FLIGHT PLANS	0.810	6.90	1434	SARC 1, TARS=OFF, NO IOCEOFLD
OAK 2.12	A	UTILZ= 5.774 + 0.164 X ACTIVE FLIGHT PLANS	0.913	4.11	3671	SARC 1, TARS=OFF, IOCEOFLD=ON
OAK 2.12	A	UTILZ= 6.711 + 0.217 X ACTIVE FLIGHT PLANS	0.936	4.66	1394	SARC 1, TARS=OFF, IOCEOFLD=OFF
SEA 2.10	A	UTILZ= 9.387 + 0.233 X ACTIVE FLIGHT PLANS	0.895	4.03	1967	SARC 1, TARS=OFF, NO IOCEOFLD
SEA 2.12	A	UTILZ= 7.040 + 0.183 X ACTIVE FLIGHT PLANS	0.886	3.05	3127	SARC 4, TARS=OFF(ITAR), IOCEOFLD=ON
SEA 2.12	A	UTILZ=10.023 + 0.221 X ACTIVE FLIGHT PLANS	0.920	3.72	2771	SARC 4, TARS=OFF(ITAR), IOCEOFLD=OFF
SLC 2.9	A	UTILZ=11.720 + 0.205 X ACTIVE FLIGHT PLANS	0.860	5.06	2200	SARC 1, TARS=OFF, NO IOCEOFLD
SLC 2.12	A	UTILZ= 9.689 + 0.172 X ACTIVE FLIGHT PLANS	0.890	2.84	3796	SARC 1, TARS=OFF, IOCEOFLD=ON
SLC 2.12	A	UTILZ=10.794 + 0.187 X ACTIVE FLIGHT PLANS	0.936	2.39	1368	SARC 1, TARS=OFF, IOCEOFLD=OFF
SLC 2.12	A	UTILZ=13.343 + 0.225 X ACTIVE FLIGHT PLANS	0.926	3.18	1348	SARC 4, TARS=7FFC, IOCEOFLD=OFF

CENTRAL PROCESSING UTILIZATION PROJECTIONS
(FIRST ORDER EQUATION ESTIMATES)
VERSUS ACTIVE FLIGHT PLANS

- FOR 9020 D NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT UTILZ. AS FUNCTION OF ACTIVE F.P.)	'FIT'	SE	SAMPLE SIZE	REMARKS
ATL 2.9	D	UTILZ= 5.218 + 0.082 X ACTIVE FLIGHT PLANS	0.836	3.36	2644	SARC 1, TARS=OFF, NO IOCEOFLD
ATL 2.12	D	UTILZ= 5.032 + 0.082 X ACTIVE FLIGHT PLANS	0.944	2.37	3818	SARC 1, TARS=OFF, IOCEOFLD OFF
ATL 2.12	D	UTILZ= 6.158 + 0.099 X ACTIVE FLIGHT PLANS	0.942	3.16	2390	SARC 4, TARS=FFFF, IOCEOFLD OFF
CHI 2.10	D	UTILZ= 4.532 + 0.098 X ACTIVE FLIGHT PLANS	0.926	2.90	2227	SARC 1, TARS=OFF, NO IOCEOFLD
CLE 2.9	D	UTILZ= 3.904 + 0.096 X ACTIVE FLIGHT PLANS	0.915	3.42	3035	SARC 1, TARS=OFF, NO IOCEOFLD
CLE 2.12	D	UTILZ= 4.286 + 0.098 X ACTIVE FLIGHT PLANS	0.958	2.24	3890	SARC 1, TARS=OFF, IOCEOFLD OFF
CLE 2.12	D	UTILZ= 6.372 + 0.104 X ACTIVE FLIGHT PLANS	0.899	3.66	2497	SARC 4, TARS=7FFC, IOCEOFLD OFF
DCA 2.9	D	UTILZ= 4.387 + 0.096 X ACTIVE FLIGHT PLANS	0.837	3.97	3400	SARC 1, TARS=OFF, NO IOCEOFLD
DCA 2.12	D	UTILZ= 4.859 + 0.112 X ACTIVE FLIGHT PLANS	0.960	2.81	3780	SARC 4, TARS=7FFC, IOCEOFLD OFF
FTW 2.10	D	UTILZ= 4.544 + 0.101 X ACTIVE FLIGHT PLANS	0.812	4.57	3231	SARC 1, TARS=OFF, NO IOCEOFLD
FTW 2.12	D	UTILZ= 3.899 + 0.094 X ACTIVE FLIGHT PLANS	0.936	2.56	4468	SARC 1, TARS=OFF, IOCEOFLD OFF
FTW 2.12	D	UTILZ= 3.240 + 0.131 X ACTIVE FLIGHT PLANS	0.938	3.48	919	SARC 4, TARS=FFFF, IOCEOFLD OFF
IND 2.9	D	UTILZ= 2.576 + 0.102 X ACTIVE FLIGHT PLANS	0.930	2.59	4155	SARC 1, TARS=OFF, NO IOCEOFLD
IND 2.12	D	UTILZ= 3.743 + 0.081 X ACTIVE FLIGHT PLANS	0.942	1.83	3841	SARC 1, TARS=OFF, IOCEOFLD OFF
IND 2.12	D	UTILZ= 5.109 + 0.093 X ACTIVE FLIGHT PLANS	0.919	1.83	2217	SARC 4, TARS=FFFF(ITAR),IOCEOFLD OFF
JAX 2.9	D	UTILZ= 5.979 + 0.076 X ACTIVE FLIGHT PLANS	0.824	3.05	2218	SARC 1, TARS=OFF, NO IOCEOFLD
JAX 2.12	D	UTILZ= 4.868 + 0.071 X ACTIVE FLIGHT PLANS	0.893	2.64	4911	SARC 1, TARS=OFF, IOCEOFLD OFF
JAX 2.12	D	UTILZ= 7.288 + 0.079 X ACTIVE FLIGHT PLANS	0.935	2.52	412	SARC 0, TARS=FFFC, IOCEOFLD OFF
LAX 2.9	D	UTILZ= 1.797 + 0.126 X ACTIVE FLIGHT PLANS	0.932	2.54	561	SARC 1, TARS=7FFC, NO IOCEOFLD
LAX 2.12	D	UTILZ= 5.026 + 0.092 X ACTIVE FLIGHT PLANS	0.932	2.33	1231	SARC 1, TARS=OFF, IOCEOFLD OFF
LAX 2.12	D	UTILZ= 4.769 + 0.083 X ACTIVE FLIGHT PLANS	0.905	2.43	2758	SARC 1, TARS=OFF, IOCEOFLD ON
MKC 2.9	D	UTILZ= 4.818 + 0.104 X ACTIVE FLIGHT PLANS	0.890	2.18	3128	SARC 1, TARS=OFF, NO IOCEOFLD
MKC 2.12	D	UTILZ= 5.157 + 0.122 X ACTIVE FLIGHT PLANS	0.950	2.32	6276	SARC 4, TARS=OFF, IOCEOFLD OFF
NYC 2.9	D	UTILZ= 5.129 + 0.132 X ACTIVE FLIGHT PLANS	0.830	5.14	3449	SARC 20, TARS=7FFC, NO IOCEOFLD
NYC 2.12	D	UTILZ= 2.777 + 0.130 X ACTIVE FLIGHT PLANS	0.912	2.84	644	SARC 20, TARS=7FFC, IOCEOFLD OFF

CENTRAL PROCESSING UTILIZATION PROJECTIONS
(FIRST ORDER EQUATION ESTIMATES)
VERSUS TRACKS

- FOR 9020 A NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT UTILZ. AS FUNCTION OF TRACKS)	'FIT'	SE	SAMPLE SIZE	REMARKS
ABQ 2.9	A	UTILZ =10.167 + 0.338 X TRACKS	0.879	6.59	3617	SARC 1, TARS=OFF(ITAR), NO IOCEOFLD
ABQ 2.12	A	UTILZ = 2.888 + 0.269 X TRACKS	0.935	3.61	3439	SARC 1, TARS=OFF, IOCEOFLD=ON
ABQ 2.12	A	UTILZ =10.063 + 0.316 X TRACKS	0.938	3.95	1239	SARC 1, TARS=OFF, IOCEOFLD=OFF
ABQ 2.12	A	UTILZ = 2.828 + 0.321 X TRACKS	0.959	4.57	545	SARC 1, TARS=7FFC, IOCEOFLD=ON
ABQ 2.12	A	UTILZ = 3.137 + 0.361 X TRACKS	0.957	4.42	1289	SARC 4, TARS=7FFE, IOCEOFLD=ON
BOS 2.9	A	UTILZ = 8.359 + 0.417 X TRACKS	0.844	5.98	3184	SARC 1, TARS=OFF(ITAR), NO IOCEOFLD
BOS 2.12	A	UTILZ = 8.113 + 0.305 X TRACKS	0.872	3.87	2760	SARC 1, TARS=OFF, IOCEOFLD=ON
BOS 2.12	A	UTILZ = 6.086 + 0.338 X TRACKS	0.715	3.93	476	SARC 4, TARS=OFF, IOCEOFLD=ON
BOS 2.12	A	UTILZ =10.214 + 0.399 X TRACKS	0.892	4.62	1392	SARC 1, TARS=7FFC, IOCEOFLD=OFF
BOS 2.12	A	UTILZ = 9.380 + 0.322 X TRACKS	0.523	2.48	209	SARC 1, TARS=OFF, IOCEOFLD=OFF
DEN 2.10	A	UTILZ =16.885 + 0.268 X TRACKS	0.891	5.79	1580	SARC 1, TARS=OFF, NO IOCEOFLD
DEN 2.12	A	UTILZ = 9.429 + 0.234 X TRACKS	0.914	4.20	2694	SARC 4(= SARC 1),TARS=OFF,OFLD=ON
DEN 2.12	A	UTILZ =11.640 + 0.293 X TRACKS	0.931	4.81	2070	SARC 4(= SARC 1),TARS=OFF,OFLD=OFF
HOU 2.9	A	UTILZ = 7.498 + 0.415 X TRACKS	0.947	5.28	4281	SARC 1, TARS=OFF, NO IOCEOFLD
HOU 2.12	A	UTILZ= 9.470 + 0.281 X TRACKS	0.910	4.30	837	SARC 2, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	UTILZ= 8.296 + 0.299 X TRACKS	0.940	3.84	2889	SARC 3, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	UTILZ= 9.126 + 0.383 X TRACKS	0.954	4.55	1457	SARC 3, TARS=OFF, IOCEOFLD=OFF
MEM 2.9	A	UTILZ =10.504 + 0.287 X TRACKS	0.927	5.02	4168	SARC 1, TARS=OFF, NO IOCEOFLD
MEM 2.12	A	UTILZ = 7.721 + 0.221 X TRACKS	0.924	3.68	3743	SARC 1, TARS=OFF, IOCEOFLD=ON
MEM 2.12	A	UTILZ =11.443 + 0.275 X TRACKS	0.930	4.00	1299	SARC 1, TARS=OFF, IOCEOFLD=OFF
MIA 2.9	A	UTILZ = 8.495 + 0.390 X TRACKS	0.866	5.20	3138	SARC 1, TARS=OFF, NO IOCEOFLD
MIA 2.12	A	UTILZ = 5.554 + 0.289 X TRACKS	0.867	4.12	1923	SARC 1, TARS=OFF, IOCEOFLD=ON
MIA 2.12	A	UTILZ = 9.312 + 0.365 X TRACKS	0.934	4.75	1100	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.9	A	UTILZ =12.948 + 0.331 X TRACKS	0.890	5.74	3002	SARC 1, TARS=OFF, NO IOCEOFLD
MSP 2.12	A	UTILZ = 8.750 + 0.221 X TRACKS	0.905	3.71	3198	SARC 1, TARS=OFF, IOCEOFLD=ON
MSP 2.12	A	UTILZ =10.964 + 0.334 X TRACKS	0.898	4.73	730	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.12	A	UTILZ =12.474 + 0.264 X TRACKS	0.917	4.58	1907	SARC 1, TARS=OFF, IOCEOFLD=OFF
OAK 2.10	A	UTILZ =12.124 + 0.384 X TRACKS	0.846	6.21	1434	SARC 1, TARS=OFF, NO IOCEOFLD
OAK 2.12	A	UTILZ = 6.633 + 0.279 X TRACKS	0.933	3.60	3671	SARC 1, TARS=OFF, IOCEOFLD=ON
OAK 2.12	A	UTILZ = 6.809 + 0.379 X TRACKS	0.953	4.01	1394	SARC 1, TARS=OFF, IOCEOFLD=OFF
SEA 2.10	A	UTILZ =10.024 + 0.292 X TRACKS	0.896	4.00	1967	SARC 1, TARS=OFF, NO IOCEOFLD
SEA 2.12	A	UTILZ =10.335 + 0.296 X TRACKS	0.921	3.70	2771	SARC 4, TARS=OFF(ITAR), IOCEOFLD=OFF
SEA 2.12	A	UTILZ = 7.577 + 0.240 X TRACKS	0.893	2.96	3127	SARC 4, TARS=OFF(ITAR), IOCEOFLD=ON
SLC 2.9	A	UTILZ =12.245 + 0.277 X TRACKS	0.856	5.12	2200	SARC 1, TARS=OFF, NO IOCEOFLD
SLC 2.12	A	UTILZ = 9.637 + 0.227 X TRACKS	0.880	2.96	3796	SARC 1, TARS=OFF, IOCEOFLD=ON
SLC 2.12	A	UTILZ =11.635 + 0.244 X TRACKS	0.932	2.46	1368	SARC 1, TARS=OFF, IOCEOFLD=OFF
SLC 2.12	A	UTILZ =13.957 + 0.290 X TRACKS	0.925	3.19	1348	SARC 4, TARS=7FFC, IOCEOFLD=OFF

CENTRAL PROCESSING UTILIZATION PROJECTIONS
(FIRST ORDER EQUATION ESTIMATES)
VERSUS TRACKS

- FOR 9020 D NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT UTILZ. AS FUNCTION OF TRACKS)	'FIT'	SE	SAMPLE SIZE	REMARKS
ATL 2.9	D	UTILZ = 5.653 + 0.153 X TRACKS	0.829	3.43	2644	SARC 1, TARS=OFF, NO IOCEOFLD
ATL 2.12	D	UTILZ = 4.608 + 0.149 X TRACKS	0.941	2.44	3818	SARC 1, TARS=OFF, IOCEOFLD OFF
ATL 2.12	D	UTILZ = 5.181 + 0.189 X TRACKS	0.946	3.07	2390	SARC 4, TARS=FFFF, IOCEOFLD OFF
CHI 2.10	D	UTILZ = 4.610 + 0.145 X TRACKS	0.810	4.61	3231	SARC 1, TARS=OFF, NO IOCEOFLD
CLE 2.9	D	UTILZ = 4.267 + 0.168 X TRACKS	0.917	3.39	3035	SARC 1, TARS=OFF, NO IOCEOFLD
CLE 2.12	D	UTILZ = 3.972 + 0.157 X TRACKS	0.956	2.28	3890	SARC 1, TARS=OFF, IOCEOFLD OFF
CLE 2.12	D	UTILZ = 5.605 + 0.174 X TRACKS	0.899	3.65	2497	SARC 4, TARS=7FFC, IOCEOFLD OFF
DCA 2.9	D	UTILZ = 5.117 + 0.148 X TRACKS	0.803	4.37	3400	SARC 1, TARS=OFF, NO IOCEOFLD
DCA 2.12	D	UTILZ = 5.310 + 0.164 X TRACKS	0.954	3.03	3780	SARC 4, TARS=7FFC, IOCEOFLD OFF
FTW 2.10	D	UTILZ = 4.610 + 0.145 X TRACKS	0.809	4.61	3231	SARC 1, TARS=OFF, NO IOCEOFLD
FTW 2.12	D	UTILZ = 3.723 + 0.140 X TRACKS	0.937	2.53	4468	SARC 1, TARS=OFF, IOCEOFLD OFF
FTW 2.12	D	UTILZ = 1.653 + 0.202 X TRACKS	0.937	3.52	919	SARC 4, TARS=FFFF, IOCEOFLD OFF
IND 2.9	D	UTILZ = 3.432 + 0.161 X TRACKS	0.927	2.65	4155	SARC 1, TARS=OFF, NO IOCEOFLD
IND 2.12	D	UTILZ = 2.423 + 0.164 X TRACKS	0.932	1.99	3841	SARC 1, TARS=OFF, IOCEOFLD OFF
IND 2.12	D	UTILZ = 5.172 + 0.182 X TRACKS	0.925	1.76	2217	SARC 4, TARS=FFFF(ITAR),IOCEOFLD OFF
JAX 2.9	D	UTILZ = 5.767 + 0.149 X TRACKS	0.831	2.99	2218	SARC 1, TARS=OFF, NO IOCEOFLD
JAX 2.12	D	UTILZ = 4.315 + 0.134 X TRACKS	0.904	2.50	4911	SARC 1, TARS=OFF, IOCEOFLD OFF
JAX 2.12	D	UTILZ = 7.795 + 0.146 X TRACKS	0.934	2.54	412	SARC 0, TARS=FFFC, IOCEOFLD OFF
LAX 2.9	D	UTILZ = 1.748 + 0.224 X TRACKS	0.919	2.75	561	SARC 1, TARS=7FFC, NO IOCEOFLD
LAX 2.12	D	UTILZ = 4.210 + 0.171 X TRACKS	0.924	2.46	1231	SARC 1, TARS=OFF, IOCEOFLD OFF
LAX 2.12	D	UTILZ = 3.903 + 0.144 X TRACKS	0.925	2.15	2758	SARC 1, TARS=OFF, IOCEOFLD ON
MKC 2.9	D	UTILZ = 5.229 + 0.134 X TRACKS	0.878	2.29	3128	SARC 1, TARS=OFF, NO IOCEOFLD
MKC 2.12	D	UTILZ = 5.469 + 0.162 X TRACKS	0.948	2.35	6276	SARC 4, TARS=OFF, IOCEOFLD OFF
NYC 2.9	D	UTILZ = 6.508 + 0.247 X TRACKS	0.861	4.63	3449	SARC 20, TARS=7FFC, NO IOCEOFLD
NYC 2.12	D	UTILZ = 4.403 + 0.230 X TRACKS	0.919	2.72	644	SARC 20, TARS=7FFC, IOCEOFLD OFF

TOTAL AVERAGE SELECTOR CHANNEL UTILIZATION
(FIRST ORDER EQUATION ESTIMATES)
VERSUS CENTRAL PROCESSING UTILIZATION

- FOR 9020 A NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT SCUTLZ. AS FUNCTION OF CEUTILZ.)	'FIT'	SE	SAMPLE SIZE	REMARKS
ABQ 2.12	A	SCUTLZ = 2.382 + 0.272 X CEUTILZ	0.959	0.80	3439	SARC 1, TARS=OFF, IOCEOFLD=ON
ABQ 2.12	A	SCUTLZ = 2.586 + 0.199 X CEUTILZ	0.948	0.74	1239	SARC 1, TARS=OFF, IOCEOFLD=OFF
ABQ 2.12	A	SCUTLZ = 1.682 + 0.265 X CEUTILZ	0.966	1.12	545	SARC 1, TARS=7FFC, IOCEOFLD=ON
ABQ 2.12	A	SCUTLZ = 4.180 + 0.252 X CEUTILZ	0.975	0.87	1289	SARC 4, TARS=7FFE, IOCEOFLD=ON
BOS 2.12	A	SCUTLZ = 2.063 + 0.229 X CEUTILZ	0.925	0.71	2760	SARC 1, TARS=OFF, IOCEOFLD=ON
BOS 2.12	A	SCUTLZ = 3.743 + 0.212 X CEUTILZ	0.863	0.62	476	SARC 4, TARS=OFF, IOCEOFLD=ON
BOS 2.12	A	SCUTLZ = 1.883 + 0.198 X CEUTILZ	0.732	1.68	1392	SARC 1, TARS=7FFC, IOCEOFLD=OFF
BOS 2.12	A	SCUTLZ = 1.572 + 0.222 X CEUTILZ	0.705	0.51	209	SARC 1, TARS=OFF, IOCEOFLD=OFF
BOS 2.12	A	SCUTLZ = 4.064 + 0.201 X CEUTILZ	0.820	0.70	430	SARC 4, TARS=7FFC, IOCEOFLD=ON
BOS 2.12	A	SCUTLZ = 1.653 + 0.231 X CEUTILZ	0.723	0.68	83	SARC 1, TARS=7FFC, IOCEOFLD=ON
DEN 2.12	A	SCUTLZ = 2.724 + 0.295 X CEUTILZ	0.929	1.16	2694	SARC 4(= SARC 1),TARS=OFF,OFLD=ON
DEN 2.12	A	SCUTLZ = 1.095 + 0.304 X CEUTILZ	0.860	2.25	2070	SARC 4(= SARC 1),TARS=OFF,OFLD=OFF
HOU 2.12	A	SCUTLZ = 3.012 + 0.253 X CEUTILZ	0.923	1.05	837	SARC 2, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	SCUTLZ = 3.094 + 0.236 X CEUTILZ	0.955	0.78	2889	SARC 3, TARS=OFF, IOCEOFLD=ON
HOU 2.12	A	SCUTLZ = 2.712 + 0.209 X CEUTILZ	0.959	0.92	1457	SARC 3, TARS=OFF, IOCEOFLD=OFF
MEM 2.12	A	SCUTLZ = 2.597 + 0.225 X CEUTILZ	0.883	1.09	3743	SARC 1, TARS=OFF, IOCEOFLD=ON
MEM 2.12	A	SCUTLZ = 2.602 + 0.179 X CEUTILZ	0.905	0.88	1299	SARC 1, TARS=OFF, IOCEOFLD=OFF
MEM 2.12	A	SCUTLZ = 3.038 + 0.249 X CEUTILZ	0.559	1.05	88	SARC 0(= SARC 4),TARS=OFF,OFLD=ON
MIA 2.12	A	SCUTLZ = 2.479 + 0.223 X CEUTILZ	0.926	0.71	1923	SARC 1, TARS=OFF, IOCEOFLD=ON
MIA 2.12	A	SCUTLZ = 2.038 + 0.218 X CEUTILZ	0.973	0.68	1100	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.12	A	SCUTLZ = 2.554 + 0.278 X CEUTILZ	0.941	0.84	3198	SARC 1, TARS=OFF, IOCEOFLD=ON
MSP 2.12	A	SCUTLZ = 2.866 + 0.320 X CEUTILZ	0.896	1.61	730	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP 2.12	A	SCUTLZ = 2.348 + 0.233 X CEUTILZ	0.917	1.11	1907	SARC 1, TARS=OFF, IOCEOFLD=OFF
OAK 2.12	A	SCUTLZ = 2.205 + 0.226 X CEUTILZ	0.955	0.69	3671	SARC 1, TARS=OFF, IOCEOFLD=ON
OAK 2.12	A	SCUTLZ = 1.956 + 0.188 X CEUTILZ	0.953	0.77	1394	SARC 1, TARS=OFF, IOCEOFLD=OFF
SEA 2.12	A	SCUTLZ = 1.588 + 0.269 X CEUTILZ	0.937	0.91	2771	SARC 4, TARS=OFF(ITAR), IOCEOFLD=OFF
SEA 2.12	A	SCUTLZ = 1.864 + 0.320 X CEUTILZ	0.927	0.81	3127	SARC 4, TARS=OFF(ITAR), IOCEOFLD=ON
SLC 2.12	A	SCUTLZ = 2.566 + 0.218 X CEUTILZ	0.930	0.51	3796	SARC 1, TARS=OFF, IOCEOFLD=ON
SLC 2.12	A	SCUTLZ = 2.546 + 0.190 X CEUTILZ	0.913	0.55	1368	SARC 1, TARS=OFF, IOCEOFLD=OFF
SLC 2.12	A	SCUTLZ = 2.947 + 0.165 X CEUTILZ	0.934	0.51	1348	SARC 4, TARS=7FFC, IOCEOFLD=OFF

TOTAL AVERAGE SELECTOR CHANNEL UTILIZATION
(FIRST ORDER EQUATION ESTIMATES)
VERSUS CENTRAL PROCESSING UTILIZATION

- FOR 9020 D NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT SCUTLZ. AS FUNCTION OF CEUTILZ .)	'FIT'	SE	SAMPLE SIZE	REMARKS
ATL 2.12	D	SCUTLZ = 3.828 + 0.341 X CEUTILZ	0.948	0.79	3818	SARC 1, TARS=OFF, IOCEOFLD OFF
ATL 2.12	D	SCUTLZ = 5.477 + 0.390 X CEUTILZ	0.974	0.84	2390	SARC 4, TARS=FFFF, IOCEOFLD OFF
CLE 2.12	D	SCUTLZ = 1.683 + 0.503 X CEUTILZ	0.966	1.03	3890	SARC 1, TARS=OFF, IOCEOFLD OFF
CLE 2.12	D	SCUTLZ = 1.760 + 0.534 X CEUTILZ	0.921	1.80	2497	SARC 4, TARS=7FFC, IOCEOFLD OFF
DCA 2.12	D	SCUTLZ = 4.021 + 0.336 X CEUTILZ	0.956	1.02	3780	SARC 4, TARS=7FFC, IOCEOFLD OFF
FTW 2.12	D	SCUTLZ = 1.989 + 0.495 X CEUTILZ	0.951	1.14	4468	SARC 1, TARS=OFF, IOCEOFLD OFF
FTW 2.12	D	SCUTLZ = 1.941 + 0.552 X CEUTILZ	0.981	1.07	919	SARC 4, TARS=FFFF, IOCEOFLD OFF
IND 2.12	D	SCUTLZ = 2.789 + 0.380 X CEUTILZ	0.940	0.73	3841	SARC 1, TARS=OFF, IOCEOFLD OFF
IND 2.12	D	SCUTLZ = 2.986 + 0.381 X CEUTILZ	0.917	0.74	2217	SARC 4, TARS=FFFF(ITAR),IOCEOFLD OFF
JAX 2.12	D	SCUTLZ = 2.494 + 0.535 X CEUTILZ	0.962	0.86	4911	SARC 1, TARS=OFF, IOCEOFLD OFF
JAX 2.12	D	SCUTLZ = 2.154 + 0.544 X CEUTILZ	0.978	0.81	412	SARC 0, TARS=FFFC, IOCEOFLD OFF
LAX 2.12	D	SCUTLZ = 3.402 + 0.344 X CEUTILZ	0.960	0.63	1231	SARC 1, TARS=OFF, IOCEOFLD OFF
LAX 2.12	D	SCUTLZ = 3.435 + 0.344 X CEUTILZ	0.931	0.74	2758	SARC 1, TARS=OFF, IOCEOFLD ON
MKC 2.12	D	SCUTLZ = 3.852 + 0.516 X CEUTILZ	0.961	1.07	6276	SARC 4, TARS=OFF, IOCEOFLD OFF
NYC 2.12	D	SCUTLZ = 3.016 + 0.308 X CEUTILZ	0.968	0.54	644	SARC 20, TARS=7FFC, IOCEOFLD OFF

TOTAL AVERAGE DISK/TAPE SELECTOR CHANNEL UTILIZATION
(FIRST ORDER EQUATION ESTIMATES)
VERSUS CENTRAL PROCESSING UTILIZATION

- FOR 9020 A NAS ENROUTE CENTERS -

NAS ENROUTE CENTER		COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT DSKTPUTLZ. AS FUNCTION OF CEUTILZ .)	'FIT'	SE	SAMPLE SIZE	REMARKS
ABQ	2.12	A	DSKTPUTLZ = 2.149 + 0.453 X CEUTILZ	0.945	1.55	3439	SARC 1, TARS=OFF, IOCEOFLD=ON
ABQ	2.12	A	DSKTPUTLZ = 2.445 + 0.237 X CEUTILZ	0.912	1.17	1239	SARC 1, TARS=OFF, IOCEOFLD=OFF
ABQ	2.12	A	DSKTPUTLZ = 1.771 + 0.435 X CEUTILZ	0.956	2.12	545	SARC 1, TARS=7FFC, IOCEOFLD=ON
ABQ	2.12	A	DSKTPUTLZ = 6.759 + 0.417 X CEUTILZ	0.969	1.59	1289	SARC 4, TARS=7FFE, IOCEOFLD=ON
BOS	2.12	A	DSKTPUTLZ = 1.732 + 0.377 X CEUTILZ	0.903	1.33	2760	SARC 1, TARS=OFF, IOCEOFLD=ON
BOS	2.12	A	DSKTPUTLZ = 3.210 + 0.394 X CEUTILZ	0.855	1.20	476	SARC 4, TARS=OFF, IOCEOFLD=ON
BOS	2.12	A	DSKTPUTLZ = 3.113 + 0.390 X CEUTILZ	0.832	1.32	430	SARC 4, TARS=7FFC, IOCEOFLD=ON
DEN	2.12	A	DSKTPUTLZ = 2.139 + 0.483 X CEUTILZ	0.922	2.00	2694	SARC 4(= SARC 1),TARS=OFF,OFLD=ON
HOU	2.12	A	DSKTPUTLZ = 3.585 + 0.432 X CEUTILZ	0.904	2.01	837	SARC 2, TARS=OFF, IOCEOFLD=ON
HOU	2.12	A	DSKTPUTLZ = 4.147 + 0.392 X CEUTILZ	0.943	1.46	2889	SARC 3, TARS=OFF, IOCEOFLD=ON
HOU	2.12	A	DSKTPUTLZ = 3.849 + 0.342 X CEUTILZ	0.946	1.75	1457	SARC 3, TARS=OFF, IOCEOFLD=OFF
MEM	2.12	A	DSKTPUTLZ = 3.242 + 0.247 X CEUTILZ	0.861	1.51	1299	SARC 1, TARS=OFF, IOCEOFLD=OFF
MIA	2.12	A	DSKTPUTLZ = 2.948 + 0.385 X CEUTILZ	0.905	1.41	1923	SARC 1, TARS=OFF, IOCEOFLD=ON
MIA	2.12	A	DSKTPUTLZ = 3.515 + 0.372 X CEUTILZ	0.968	1.26	1100	SARC 4, TARS=FFFF, IOCEOFLD=ON
MIA	2.12	A	DSKTPUTLZ = 1.615 + 0.437 X CEUTILZ	0.833	0.45	118	SARC 1, TARS=OFF, IOCEOFLD=OFF
MSP	2.12	A	DSKTPUTLZ = 2.460 + 0.436 X CEUTILZ	0.925	1.50	3198	SARC 1, TARS=OFF, IOCEOFLD=ON
MSP	2.12	A	DSKTPUTLZ = 3.792 + 0.524 X CEUTILZ	0.861	3.12	730	SARC 4, TARS=FFFF, IOCEOFLD=ON
MSP	2.12	A	DSKTPUTLZ = 2.785 + 0.351 X CEUTILZ	0.851	2.34	1907	SARC 1, TARS=OFF, IOCEOFLD=OFF
OAK	2.12	A	DSKTPUTLZ = 2.187 + 0.357 X CEUTILZ	0.937	1.29	3671	SARC 1, TARS=OFF, IOCEOFLD=ON
OAK	2.12	A	DSKTPUTLZ = 1.680 + 0.303 X CEUTILZ	0.935	1.48	1394	SARC 1, TARS=OFF, IOCEOFLD=OFF
OAK	2.12	A	DSKTPUTLZ = 1.424 + 0.358 X CEUTILZ	0.657	0.56	103	SARC 1, TARS=OFF(ITAR), IOCEOFLD=ON
SEA	2.12	A	DSKTPUTLZ = 1.411 + 0.474 X CEUTILZ	0.929	1.72	2771	SARC 4, TARS=OFF(ITAR), IOCEOFLD=OFF
SEA	2.12	A	DSKTPUTLZ = 1.912 + 0.556 X CEUTILZ	0.908	1.60	3127	SARC 4, TARS=OFF(ITAR), IOCEOFLD=ON
SLC	2.12	A	DSKTPUTLZ = 2.820 + 0.281 X CEUTILZ	0.725	1.48	3796	SARC 1, TARS=OFF, IOCEOFLD=ON
SLC	2.12	A	DSKTPUTLZ = 4.341 + 0.235 X CEUTILZ	0.911	0.85	1348	SARC 4, TARS=7FFC, IOCEOFLD=OFF

TOTAL AVERAGE DISK/TAPE SELECTOR CHANNEL UTILIZATION
(FIRST ORDER EQUATION ESTIMATES)
VERSUS CENTRAL PROCESSING UTILIZATION

- FOR 9020 D NAS ENROUTE CENTERS -

NAS ENROUTE CENTER	COMPUTER SYSTEM	REGRESSION EQUATION (PERCENT DSKTPUTLZ. AS FUNCTION OF CEUTILZ.)	'FIT'	SE	SAMPLE SIZE	REMARKS
ATL 2.12	D	DSKTPUTLZ = 4.746 + 0.504 X CEUTILZ	0.947	1.19	3818	SARC 1, TARS=OFF, IOCEOFLD OFF
ATL 2.12	D	DSKTPUTLZ = 7.932 + 0.647 X CEUTILZ	0.977	1.31	2390	SARC 4, TARS=FFFF, IOCEOFLD OFF
CLE 2.12	D	DSKTPUTLZ = 3.534 + 0.980 X CEUTILZ	0.964	2.07	3890	SARC 1, TARS=OFF, IOCEOFLD OFF
CLE 2.12	D	DSKTPUTLZ = 3.186 + 1.061 X CEUTILZ	0.918	3.66	2497	SARC 4, TARS=7FFC, IOCEOFLD OFF
DCA 2.12	D	DSKTPUTLZ = 8.529 + 0.635 X CEUTILZ	0.952	2.01	3780	SARC 4, TARS=7FFC, IOCEOFLD OFF
FTW 2.12	D	DSKTPUTLZ = 4.565 + 0.858 X CEUTILZ	0.933	2.33	4468	SARC 1, TARS=OFF, IOCEOFLD OFF
FTW 2.12	D	DSKTPUTLZ = 2.842 + 0.684 X CEUTILZ	0.959	1.98	919	SARC 4, TARS=FFFF, IOCEOFLD OFF
IND 2.12	D	DSKTPUTLZ = 3.610 + 0.646 X CEUTILZ	0.926	1.39	3841	SARC 1, TARS=OFF, IOCEOFLD OFF
IND 2.12	D	DSKTPUTLZ = 4.396 + 0.626 X CEUTILZ	0.899	1.36	2217	SARC 4, TARS=FFFF(ITAR),IOCEOFLD OFF
JAX 2.12	D	DSKTPUTLZ = 3.015 + 0.901 X CEUTILZ	0.959	1.50	4911	SARC 1, TARS=OFF, IOCEOFLD OFF
JAX 2.12	D	DSKTPUTLZ = 2.811 + 0.916 X CEUTILZ	0.975	1.44	412	SARC 0, TARS=FFFC, IOCEOFLD OFF
LAX 2.12	D	DSKTPUTLZ = 4.725 + 0.577 X CEUTILZ	0.955	1.12	1231	SARC 1, TARS=OFF, IOCEOFLD OFF
LAX 2.12	D	DSKTPUTLZ = 2.942 + 0.532 X CEUTILZ	0.654	3.05	2758	SARC 1, TARS=OFF, IOCEOFLD ON
MKC 2.12	D	DSKTPUTLZ = 5.456 + 0.898 X CEUTILZ	0.955	2.01	6276	SARC 4, TARS=OFF, IOCEOFLD OFF
NYC 2.12	D	DSKTPUTLZ = 4.370 + 0.655 X CEUTILZ	0.908	1.99	644	SARC20, TARS=7FFC, IOCEOFLD OFF