Lawrence Livermore Laboratory

PRODUCTION OF A HANDBOOK:
Nd-DOPED GLASS SPECTROSCOPIC AND PHYSICAL PROPERTIES

MASTER

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Production of a Handbook:
Nd-Doped Glass
Spectroscopic and Physical Properties

Abstract

The production of M-095 is described. The pros and cons of the method are presented. The bulk of the report is contained in detailed appendices which cover major aspects of production.

NOTICE

This report was prepared in accordance with the contract between the United States Government and the United States and the United States Department of Energy, under contract number M-095, and is being made available to the public. The report contains information that is not generally known and is not being disclosed to the public. The report is being made available to the public for informational purposes only. The report is not to be used for any other purpose without the express written permission of the United States Government.

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Production of a Handbook:
Nd-Doped Glass
Spectroscopic and Physical Properties

Introduction

Nd-doped Glass Spectroscopic and Physical Properties, LLL publication M-095 is a handbook containing a collection of properties of Nd^{3+} -doped glasses investigated in Laser Fusion Programs laser glass spectroscopy laboratory. The data was collected during a search for improved Nd laser glasses. While the writing of handbooks at LLL is unusual in itself, it is the unique method of production of this glass handbook which is the topic of this report.

The handbook is a collection of approximately 900 pages in a custom loose-leave binder. Seventy-one pages are devoted to information on data collection and processing methods, an explanation of the data pages, 9 indices, and bibliography. The remaining pages contain glass data in the 4-page format shown in figures 1 to 4. There are 61 properties, 3 graphs, and the glass composition, plus notes and references, for each of 192 glasses. The glasses are grouped by glass type (e.g., silicate phosphate, ...) with indices, compositional information, graphs, statistics, and tables of selected data prefacing each section. (Some examples of these are shown in Figure 5.)

In figures 1-4, note that data is in bold type, unknown values are represented by a dash, graphical data are darker than the grids on which the data is drawn, each page is titled and dated, and the print quality is excellent. If you had access to the handbook you might also note that various parts of the pages, such as measurement conditions in figure 4, may change from glass to glass. Notes and references obviously fall into this category. Although the format is the same throughout, many details, such as the appearance of a fourth column in Figure 3, are data dependent. None of these things would be noteworthy except for the fact that all but 15 pages of the data section illustrated by figures 1-4 were automatically generated on camera ready copy paper by our CDC 7600 computers. We did modify some parts of these pages (graph axes and portions of the graphs) by hand for reasons to be explained later, but none of these alterations involved data, notes,

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Current status: Commercial product

Melt: ED-2.2, 1973

COMPOSITION

Compound	Mole %	Weight %
SiO ₂	60.0	-
Li ₂ O	27.5	-
CaO	10.0	-
Al ₂ O ₃	2.5	-
CeO ₂	0.16	-
Nd ₂ O ₃	-	2.012

Measured neodymium concentration	2.012	wt % Nd ₂ O ₃
Neodymium number density ρ_N	$1.829 \cdot 10^{20}$	cm ⁻³

Compositional series:

PROPERTY SUMMARY

Peak stimulated emission cross section	σ_p	$2.7 \cdot 10^{-20}$	cm ²
Calculated radiative lifetime	τ_R	359	μ sec
Zero-concentration lifetime	τ_0	359	μ sec
Nd ³⁺ concentration @ $\tau_0/2$	Q	$3.89 \cdot 10^{20}$	cm ⁻³
Nonlinear refractive index coefficient	γ	$3.77 \cdot 10^{-20}$	m ² ·W ⁻¹
Nonlinear refractive index	n_2	$1.41 \cdot 10^{-13}$	esu
Refractive index at peak-fluorescence wavelength	$n(\lambda_p)$	1.56123	
Peak-fluorescence wavelength	λ_p	1061	nm
Linewidth (FWHM)	$\Delta\lambda$	27.8	nm
Linewidth (effective)	$\Delta\lambda_{eff}$	34.4	nm
Density	ρ	2.5394	g·cm ⁻³

Figure 1. Page 1 of the handbook data.

ABSORPTION PROPERTIES

Integrated absorption cross section relative
to ED-2 from 400 to 950 nm

1.00

Absorption efficiency coefficients for 15-mm
xenon flashlamp at $1000 \text{ A}\cdot\text{cm}^{-2}$
(340 to 910 nm):

$$\epsilon = A [1 - B \exp(-C\rho_N l) - (1-B) \exp(-D\rho_N l)]$$

where $\rho_N l$ is in $10^{20} \text{ Nd ions}\cdot\text{cm}^{-2}$

$$A = 0.108734$$

$$B = 0.712730$$

$$C = 0.134343$$

$$D = 1.116667 \text{ cm}^{-2}$$

Judd-Ofelt parameters:

$$\Omega_2 = 3.2 \pm 0.2 \cdot 10^{-20}$$

cm²

$$\Omega_4 = 4.6 \pm 0.3 \cdot 10^{-20}$$

cm²

$$\Omega_6 = 4.8 \pm 0.1 \cdot 10^{-20}$$

cm²

Figure 2. Page 2 of the handbook data.

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FLUORESCENCE PROPERTIES

Peak-fluorescence wavelength	λ_p	1061	(1335) [a]	nm
Linewidth (FWHM)	$\Delta\lambda$	27.8		nm
Linewidth (effective)	$\Delta\lambda_{eff}$	34.4	(67) [a]	nm
Peak stimulated emission cross section	σ_p	$2.7 \cdot 10^{-20}$ [k]	$(0.72 \cdot 10^{-20})$ [a]	cm^2
Calculated radiative lifetime	τ_R	359		μsec
Zero-concentration lifetime	τ_0	359		μsec
Nd^{3+} concentration $\times \tau_0/2$	Q	$3.89 \cdot 10^{20}$		cm^{-3}

Branching ratios:

$$({}^4F_{3/2} \rightarrow {}^4I_J) \quad J = 9/2, 11/2, 13/2, 15/2 \quad 0.421, 0.484, 0.091, 0.004$$

Measured decay properties: three e-folding times 309, 360, 358 μsec Decay function: $I/I_0 = A \exp(-Bt) + C \exp(-Dt) + E \exp(-Ft)$

A = 0.057261	B = 7434.59	sec^{-1}
C = 0.492229	D = 2272.96	sec^{-1}
E = 0.450510	F = 4387.23	sec^{-1}

Figure 3. Page 3 of the handbook data.

Table 20 (contd.)

Oxygen/fluorine ratio	Group V	Group III	Group II				Group I			Others				Sample number
	P	Al	Mg	Ca	Sr	Ba	Li	Na	K	Pb	La	Y	Nd	
2.3	41.4	13.8		8.7				35.7					0.3	1094
2.4	34.3	11.4				10.3	42.9						1.1	8113
2.4	34.3	11.4			10.3		42.9						1.1	8114
2.4	34.3	11.4		10.3			42.9						1.1	8115
2.4	34.3	11.4	10.3				42.9						1.1	8116
2.7	41.4	13.8						44.4					0.3	1092
2.8	41.2	13.7				22.2	22.2						0.6	8151
2.8	41.2	13.7				22.2		22.2					0.6	8152
2.8	41.2	13.7				22.2			22.2				0.6	8153
3.6	32.4	32.4						34.8					0.5	1126

October 1978

Fig. 23. Linear refractive indices, Abbe numbers, and lines of constant, nonlinear refractive index coefficients (10^{-12} m²/W) for fluorophosphate glasses included in this subsection.

C-4

Figure 5. Examples of information prefacing each section of the handbook.

Fig. 24. Range of peak cross-section values ($F_{32} \rightarrow {}^1H_{12}$) of fluorophosphate glasses in this subsection.

Table 21. Fluorophosphate glasses by increasing $F_{32} \rightarrow {}^1H_{12}$ cross section (10^{-20} cm^2).

Cross section	Sample no.	Common name	Cross section	Sample no.	Common name	Cross section	Sample no.	Common name
2.2	1106	E-142	2.2	8097	E-117	3.4	8098	E-223
2.2	1146	E-210	2.3	8099	E-119	3.4	8152	K-808
2.3	8060	IR-1	2.3	8103	E-121	3.4	8157	K-816
2.3	8189	K-871-1	2.5	8109	E-123	3.5	1091	E-114
2.4	1105	E-141	2.5	8108	E-120-8	3.5	1095	E-115
2.4	1109	E-144	2.5	1102	E-124	3.5	1158	E-259
2.5	1125	E-149	2.8	1117	E-125	3.5	8117	E-246
2.5	1129	E-154	2.8	1151	E-239	3.6	8118	K-800
2.5	1146	E-296	2.8	1153	E-240	3.6	1091	E-111
2.5	1141	E-309	2.9	1157	E-241	3.6	1092	E-112
2.5	1144	E-202	2.9	1159	E-203	3.6	8115	E-244
2.5	1161	E-269	2.9	8239	E-1056	3.6	8120	E-249
2.5	8236	K-1056	3.1	1093	E-113	3.6	8153	K-809
2.6	1131	E-181	3.1	1096	E-117	3.7	8114	E-243
2.6	6534	FK-53	3.2	1152	E-144	3.7	8151	K-807
2.6	6548	IG-812	3.2	1159	E-263	3.8	8113	E-242
2.6	8237	K-1057	3.2	8097	E-222	3.8	8156	K-815
2.7	1100	E-102	3.3	8096	E-221	3.8	8159	K-818
2.7	1126	E-121	3.3	8116	E-245	3.9	8119	E-218
2.7	1139	E-184	3.3	8118	E-247	4.1	1090	E-101
2.7	1143	E-199	3.3	8140	K-626	4.3	8158	K-817

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references, or their position except for 15 glasses, and those alterations were also done by computer. In addition, all tables (except composition summaries), graphs (again excepting composition), statistics, and indices were computer generated. The general composition tables and graphs, and the text (minus indices) were done by standard (pencil, paper, and word-processor) methods. The role of TID in this undertaking was as editor of handbook format and text, creator of the master computer version of Figures 1-4 (pages without data), and as printing manager. Creation of the data pages was under my control.

Advantages

There are many advantages to computer production of a handbook. Chief among these are that no errors are created in the data as it is transferred to camera ready copy. Machine production reduced the number of human manipulations of the data to three: collection of the data from files and data sheets, entry into the computer, and verification and correction. Traditional production methods would have added transfer of data to a standard format in preparation for typing on masters, typing, verification and correction of the masters. The last step is not simple since corrections often are in error or not done. Two verification iterations are a minimum and, judging from experience with the non-computer portion of the handbook, would not be sufficient to catch all transfer errors. In addition to minimizing data manipulation, machine production also eliminated artistic distortion of graphical data (optical spectra) and scrambling of data among glasses. The savings in terms of data integrity of the final copy cannot be understated.

The computer provides additional advantages for creation of a useful handbook. Tedious and error prone operations such as useful indices, statistical, tabular, and graphical presentation of data become quite easy. We produced 9 major indices of selected data as aids in guiding users of the book to glasses of interest to them. These indices contain 4 or 5 columns of data which act as cross references. For example, the index for peak fluorescence wavelength (sample shown in Figure 6) would list perhaps 30 glasses in some range of interest. In addition to sample numbers and names of those glasses, the glass type and emission cross section are also listed to aid glass selection.

Peak ${}^4F_{3/2} \rightarrow {}^4I_{11/2}$ fluorescence wavelength (nm)

Peak wavelength	Sample no.	Common name	Glass type	Cross section (10^{-19} cm^2)
1052	6544	LG-802	Fluorophosphate	2.7
1052	8139	K-625	Fluorophosphate	2.7
1052	8148	K-800	Fluorophosphate	3.5
1052.5	1103	E-123	Fluorophosphate	2.9
1052.5	1110	E-135	Fluorophosphate	2.8
1052.5	1154	E-249	Fluorophosphate	2.8
1052.5	1160	E-266	Fluorophosphate	2.9
1052.5	9114	9114	Phosphate	2.7
1053	1088	EV-2	Phosphate	1.1
1053	1100	E-102	Fluorophosphate	2.7
1053	1102	E-104	Fluorophosphate	2.8
1053	1143	E-199	Fluorophosphate	2.7
1053	5011	5011	Phosphate	1.2
1053	5027	LHG-7	Phosphate	3.9
1053	5041	LHG-5	Phosphate	1.1
1053	5091	LHG-8	Phosphate	4.0
1053	8096	E-221	Fluorophosphate	3.3
1054	9023	9023	Phosphate	2.4
1054.5	1093	E-113	Fluorophosphate	3.1
1054.5	1096	E-122	Fluorophosphate	3.1
1054.5	5033	LHG-6	Phosphate	4.1
1054.5	5035	5035	Phosphate	2.8
1054.5	5039	5039	Phosphate	4.4
1054.5	6505	LG-700	Phosphate	3.7
1054.5	6507	LG-710	Phosphate	3.8
1054.5	6531	FK-51	Fluorophosphate	2.6
1054.5	8012	E-113	Phosphate	2.3
1054.5	8098	E-223	Fluorophosphate	3.4
1054.5	8120	E-249	Fluorophosphate	3.6
1054.5	8140	K-626	Fluorophosphate	3.3
1054.5	8157	K-816	Fluorophosphate	3.4
1054	1089	EV-3	Phosphate	4.4
1054	1091	E-111	Fluorophosphate	3.6
1054	1092	E-112	Fluorophosphate	3.6
1054	1094	E-114	Fluorophosphate	3.5
1054	1095	E-115	Fluorophosphate	3.5
1054	1153	E-245	Fluorophosphate	2.9
1054	1156	E-259	Fluorophosphate	3.5
1054	1159	E-263	Fluorophosphate	3.2
1054	3040	P-102	Phosphate	3.5
1054	3043	P-105	Phosphate	3.7
1054	3044	P-107	Phosphate	3.8
1054	3077	P-113	Phosphate	4.3
1054	3078	P-114	Phosphate	4.5
1054	3079	P-115	Phosphate	4.7
1054	3118	Q-88	Phosphate	4.0

Figure 6. A portion of an index showing cross reference system used in indices.

Additions and changes to data pages or indices are simplified by computer since the change is made in the data, not in individual data pages or indices. Creation of any feature of the handbook depends on one source of data and not multitude of places the data ultimately resides. This advantage disappears during last minute panic changes.

Since the format of the data pages is also stored in the computer, changes before creation of the camera ready copy are also easily made. In fact, we made minor changes to the format as it was being generated on a glass by glass basis. These changes were data dependent and yielded a more visually pleasing handbook. The prime example of this is fluorescence data at 1300 nm which was present for very few glasses. Had the pages been formatted to accomodate this data, most pages would contain a ridiculously large space between 1060 nm data and the units. The computer was instructed to close this space whenever 1300 nm data was absent. This is shown in Figure 7A and B. Thus artistic deviations from an accepted format may be programmed to handle special cases. The desirability of a computer approach to such cases is that you have control of the deviation and it is uniformly made throughout the book. That there is a limit to programming such automated intelligence is evident from the 15 glasses where alterations were made after the data was placed in the standard format but before the computer submitted it for printing.

None of these advantages are worth anything unless the computer generated camera ready copy is of high quality. We are fortunate that our hard copy camera was installed at LLL for use by LBL for production of the seventh edition of Table of Isotopes. No other device at LLL can produce camera ready copy directly. An additional copy step would have been required and would have introduced considerable variation in quality if the hard copy camera had not been available.

Disadvantages

Computer generation of a handbook is not without disadvantages. The biggest problem is that you must tell the computer what to do, i.e., write programs to get the job done. Whereas an artist can be given a sketch or a typist a master plus data, the computers' "hand" must be guided for each character of the data. TID created the computer master for the data pages.

Peak-fluorescence wavelength	λ_p	1061.5	(1335) [a]	nm
Linewidth (FWHM)	$\Delta\lambda$	27.4		nm
Linewidth (effective)	$\Delta\lambda_{eff}$	34.4	(64) [a]	nm
Peak stimulated emission cross section	σ_p	$2.4 \cdot 10^{-20}$ [j]	$(0.65 \cdot 10^{-20})$ [a]	cm^2
Calculated radiative lifetime	τ_R	412		μsec
Zero-concentration lifetime	τ_0	415		μsec
Nd^{3+} concentration @ $\tau_0/2$	Q	$4.47 \cdot 10^{20}$		cm^{-3}

A: format when 1300 nm data is available.

Peak-fluorescence wavelength	λ_p	1065		nm
Linewidth (FWHM)	$\Delta\lambda$	30.69		nm
Linewidth (effective)	$\Delta\lambda_{eff}$	36.26		nm
Peak stimulated emission cross section	σ_p	$2.3 \cdot 10^{-20}$		cm^2
Calculated radiative lifetime	τ_R	410		μsec
Zero-concentration lifetime	τ_0	-		μsec
Nd^{3+} concentration @ $\tau_0/2$	Q	-		cm^{-3}

B: format when 1300 nm data is not available

Figure 7. An example of automatic format deviation.

This master instructed the computer where to put data and text but contained no data. I wrote the program to combine the master and data for a given glass into the information required to print the final pages. I also wrote programs to create and print the indices. Although these jobs may be given to someone unfamiliar with the data, it is not desirable to do so since third party intervention leads to mistakes and misunderstandings.

Although in principle you should be able to get exactly what you want from a computer, in practice you must depend on programs created by others. Peculiarities in those programs may cause unexpected alterations to the computer output. For example, we obtained x-axis labels which were unacceptable for publication and chose to correct these by hand. This decision caused an unbelievable amount of trouble since several artists made the corrections, they made more corrections than needed, and the quality was poor. Part of the reason for these troubles was the difference between computer generated fonts and those available at the printer. Further the artists felt that a change in x-axis numbers required a change in y-axis numbers and axes titles. (We stopped the title changes but the axes changes were beyond repair.) Thus simple corrections (letter or word replacement) are not easily or attractively done by hand. Unfortunately, one week turn around time for changes made by computer are excessive and force you toward hand methods.

Computer generation of camera ready copy uses resources normally dedicated to scientific calculations and impacts the division time allocation as well as the labs copy camera usage. We obtained a special charge account for production of the handbook to remove impact on the division time account. (We used 10 min per day.) Our impact on computer reproduction facilities was severe enough that we made attempts to find another film processing method during production of the data pages. (We were stuck in a 54 tape back log after producing all pages.) Data entry and program writing are tedious but do not impact the computer resources.

There is one disadvantage to machine production which may be enough to cause abandonment of the method in favor of conventional means; few managers understand computer programming or the complex interaction between your

computer job and the rest of the lab. Production speed is their only concern until the final product is before them when quality is paramount. Managers are used to taking rough ideas (written or verbal) to an artist who produces beautiful work in a few hours. This works because the artist has an idea of what you really want. Computers have no such ideas. You must therefore specify precisely what you want and this specification (the program) takes time. Most managers tend to solve the problem of the interaction of your computer job with everyone else's by raising job priorities. Since the hard copy camera replaces the instrument which produces microfiche for the entire lab, such a solution is not always viable. Finally, production responsibility rests with you as a programmer (or interface to a programmer) as there is no other human between you and the camera ready copy.

Decision

In addition to these advantages and disadvantages, there are many other factors to consider when making the decision whether or not to produce a handbook by computer. First, if you need (or already have) the data stored in the computer for other reasons, computer production is a reasonable choice. The entry and storage of data by computer is non-trivial. If that entry is being done solely for handbook creation, you might investigate spending your time (or someone else's) more wisely. If your data set is small, the work involved in entry and verification is not justified. If your data can be adequately represented by artist rendition, computer generation is wasted time. If statistical data or elaborate indices are not required, the job is best left to humans. If the handbook will not be updated, there is no need to have page generation instantly available on a computer. If speed of production is of prime concern, use the Xerox machine. If you are not willing to be solely responsible for production (i.e., no one to point fingers at), then use conventional means. If you cannot program the computer yourself or use a programmer who knows your data, then expect a longer time to ready the program or don't use the computer. Your programmer must have knowledge of

REDPP;* starting from scratch is a waste of time. You must know what the handbook is to look like. Have an artist create a master version and let your editor see it. This step is required whether you use a computer or not, but to begin programming before completion of this task is a disaster.

The laser glass handbook was created by machine for the following reasons. Our data was entered into the computer to be a part of a data correlation system for laser glasses. See Appendix F for description of this system. There were over 12,000 pieces of information to handle for the handbook. Extensive use of the correlation system was made to generate tables, figures, statistics, and indices for the handbook. We plan to update semi-annually by incrementally producing new pages as well as re-creating statistics, indices, etc. just before distributing the additions. Since I program in the language TRIX, creation of the program to combine data (from our correlation system, which I also wrote in TRIX) with the master data format was not a major problem. It did take time; all well done things do. Our format was created by John Emmett, drawn by an artist, and modified by our editor prior to creation of the TID computer master. The idea of computer generation was rejected before the data was entered into the computer but revived on the suggestion of TID when they discovered we were providing them with computer generated data for retyping. An example of a computer generated data pages was done before the decision was made.

*Computer terms are described in Table I.

Computer Languages

The languages, programs, and some terms used in handbook generation are described in Table 1. The central problem in computer generation of a handbook is one of character processing rather than number processing. This fact lead me to the language TRIx for both an element of the correlation system in which the data was stored and the program which transferred that data to the master data pages. Replication of the master with data inserted is a trivial job for TRIx although the program which does the job (FILL, see Appendix E) is quite involved in order to handle special cases. Since our correlation system is also written in TRIx, interfacing data and master was easier. In fact, the FILL program was run by the correlation system. Choosing a language built for the problem is most important to quick program creation and flexible response to special cases.

Another language, MATHSY, was used to create statistics and graphs for the handbook since it is designed to process and display numeric data. We used MATHSY to graph our spectra, calculate statistics, and make other special purpose graphs from our data. The correlation system has a command which provides MATHSY with data with which it can work.

The combination of the programs written in MATHSY and TRIx make a unified system of character and number processors which form the data correlation system (see Appendix H) and created the handbook. Both languages are interactive macro processors, ideal for rapid programming since each is suited to the job requested of it. Their role in creation of the handbook cannot be overstated -- without them I would not have participated in computer generation of the handbook.

Production Method

The major computer steps for creation of the four handbook pages are given here and illustrated in Figure 8. The detailed operations are in Appendix B. Once glass data from our lab or the manufacturer has been accepted, it is entered into the data correlation system by hand (an automated procedure will be implemented to eliminate transfer errors). The computer data is verified.

MAJOR STEPS IN THE CREATION OF GLASS HANDBOOK DATA PAGES

Figure 8

Table 1 Computer Terms

Languages

TRIX - interactive, intrepreative string manipulator*
MATHSY - " " math and graphics system

Programs

DCS - TRIX program for manipulation of glass data
DCSM - MATHSY " " " " " "
RED - TRIX report editor
REDPP - writes reports prepared by RED
PROXY - controller for other programs

Files

Libraries - collections of files
UX Files - graphics files created by UX80LIB graphics system

*Appendix F expands upon these buzz words

Absorption and fluorescence spectra are transferred from our PDP11 laboratory computer to a CDC 7600 computer, converted to a UX graphics file by a MATHSY program and stored. The correlation system combines data and handbook master to create a data book file along with a PROXY input file for running REDPP. If there are special additions to the data, they are added to the data pages file and PROXY is run to generate a file for the hard copy camera. During this step, REDPP automatically adds the UX graphics files to the data pages file. Because spurious spectral features may appear in our graphs and the axes are unpublishable, these features are hand corrected after the computer copy is delivered. The data pages are then ready for printing.

Commands in the correlation system produce graphs, tables, and statistics which preface each section of the data book. These are generally redrawn from 35 mm film images and are created as needed. Indices for each section and the entire handbook are created by use of two command files within the correlation system and printed on the hard copy camera although they are edited further before printing.

Production Costs

Although I cannot compare the time and dollar costs of computer production with standard methods*, I can list the computer related costs for this handbook. Appendix A gives a complete timeline for all phases of the handbook. Data entry into the correlation system, although not strictly a part of the handbook creation, took three people two weeks to complete. The initial data collection was modified throughout the project. Very little computer time was spent on this operation since it was mostly text editing.

Two days were spent writing and debugging programs on the PDP11 and 7600 computers to transfer spectral curves between the machines. A day was used to create the UX graphics files required for the handbook, although 28 days of PDP11 time were required for the transfer and initial 35 mm film versions of the data (which was to be used in the handbook but was not used). This time was mostly data retrieval (from tape) and transfer time -- we moved data in

*(Because I've never done this any other way.)

small blocks to prevent choking the 7600 (~200 files and 400 plots were involved). Twelve days were spent writing the FILL program and an additional 23 days were spent modifying it to handle special cases or correct problems unforeseen during creation of the handbook format. Production of the data pages took place over 9 days although output dribbled out over 20 days. The only real computer expense occurred here where ~\$1000 of machine time was used in 9 days. Creation of statistics and tables for each section of the book involved an hour. 13 days were spent on creation of the indices programs for the correlation system which were then used to generate the handbook indices. During that time, TID was engaged in text preparation and making corrections to the data page graphs. \$7000 were spent in printing 250 copies which took 28 days from the time it left our hands.

Generally computer costs were tiny. Personnel costs were high if you consider creation of the correlation system a vital part of the handbook production. I devoted 11 months to the correlation system and handbook with 5 months exclusively working on the handbook. Two of those months went into the "non-computer" method of production which was not used.

Conclusion

Computer generation of a handbook is a wise use of human and computer time as long as certain conditions are satisfied. It is important that the data is needed in a computer for purposes other than publication and that large amounts of data and reasonably complicated presentation of that data is to be made. The advantages of computer generation over traditional means overshadow all disadvantages except perhaps that of timely production. Computers can create the final copy very rapidly once the preparation is done, but that preparation is very time consuming. Having no previous experience producing handbooks, I cannot state whether time was gained or lost using computer production. I do know that computer production of 800 pages of data plus indices took 3 months while text preparation took 8. (Numerous rewrites to incorporate changes from many sources and extra time to correct uncorrected galley proofs contributed to this time.) Computers are being used increasingly in the publication field and there are few reasons why we should not employ our computing power for publication of scientific data.

ACKNOWLEDGMENTS

I thank Marv Weber and Stan Stokowski for their support during this adventure. Brian Jarman (our editor) suggested computer production and aided me during page production. Carl Schneider's creation of the handbook master is gratefully acknowledged. My thanks to John Beatty (who created REDPP and assisted Carl and myself) and Mark Blair (who created the UX graphics system and helped add it to REDPP) for making computer produced documentation a reality. I am grateful to Hank Moll (creator of TRIx) and Giles Peterson (creator of MATHSY) for their assistance during creation of both the correlation system and the handbook. I thank the crews of Bill Nay and Forrest Allen for expert handling of the overload of hardcopy output during production. I also appreciate the never ending job of Jeanne Lynch who provides data for the correlation system and the handbook. The assistance of Sandee Kuizenga and Sam Tindell in entering data into the correlation system is appreciated. Finally, LBL is congratulated and admired for their foresight in leasing the hardcopy camera and installing it at LLL for producing their own handbook.

Appendix A: Production Schedule

Chart A-1 shows the major events in the production of the handbook while chart A-2 details the computer programs. During format specification four major versions of the handbook data pages format were created, reviewed, and revised before the final choice was made. Text preparation included an initial version, creation of tables and graphs, much revision and editing. The second through final versions were typed under contract outside the Lab.

Transfer of our spectral data from the PDP11 in our lab to the CDC 7600 computers was done twice. The chart shows the initial transfer and production of 35 mm film which was printed by TID but not used. The second transfer took place after the computer was chosen as the production method. That transfer took one day and resulted in UX graphics files which were used by REDPP while printing the data pages.

Two data transfer programs were written and are shown on the chart without identification. The first program created a list of data for TID to type while the second produced files for REDPP to print. The first program and its data were produced on schedule. The decision to use the computer for production delayed the planned data page production schedule while the new programs were being written. The computer master was created during the delay between the planned date to transmit data to TID and the decision to use the computer. All the data pages were transmitted to TID after all corrections were made, at their request. For the original method, a phased transmittal was planned, explaining the overlap in planned transfer and production.

The indices were originally to be retyped by TID but we chose to use the computer to avoid transfer errors. While corrections to the data pages were being made, a formatted listing routine was written to produce the indices. The project slipped by 5 months from the planned schedule. I have serious doubts, however, whether hand generation of the data pages would have kept us on schedule.

LASER GLASS HANDBOOK HISTORY

LEGEND:

PLANNED

ACTUAL

COMPLETED

PROJECT : NEW LASER GLASS

DIVISION : LASER FUSION

REPORTED BY: R. A. SAROYAN

DATE: 12/21/78

TIME: 14:35:30

REPORT NO: FINAL

Chart A-1

GLASS HANDBOOK PROGRAMS

LEGEND:

WRITTEN

MODIFIED

PRODUCTION

PROJECT : NEW LASER GLASSES

DIVISION : LASER FUSION

REPORTED BY: R. A. SAROYAN

DATE: 12/21/78

TIME: 15:08:02

REPORT NO: FINAL

Chart A-2

Appendix B: Data Page Generation

The detailed instructions for creation of data pages are given here as a guide for periodic updates to our glass handbook and a more intimate view of the production process for those who might take this route. We assume the data to be printed was taken by and is stored in our PDP11 laboratory computer or on manufacturer's data sheets. The production procedures are given in the following format:

Task (computer; program; language)

- A description of task
- B procedure
- C notes
- D restrictions

The task is a short description of a given step and the procedures are specific commands with computer responses underlined. Knowledge of the computer systems is assumed.

Spectral Data Transfer (Part I) (PDP11; DBTAPE; BASIC)

- A To transfer laser glass spectral data to tape
- B Zero the tape before use unless adding to previous data. See that the sample files are on disk with the following extensions: .HDR, .LIN, .VOD, .FLH, .FLL.

Run DBTAPE:

- (1) File name (or END)? sample number
- (2) File name (or END)? END

Take the tape to the computer center; give it a name (for example, DB3)

- C Repeat (1) for each sample to transfer
- D If DBTAPE fails, give up and use any good data on the tape. Don't add anything else to the tape. DBTAPE fails whenever wavelength limits, sample lengths, or concentrations are unknown. Transfer small numbers of files (5-15).

Spectral Data Transfer (Part II) (CDC7600; RDANSI; FORTRAN)

- A To transfer 9 track tape data to 7600 disks
- B Run RDANSI
 - (1) Z00 RDANSI tape name
- C RDANSI lists file names (without extensions) as they are read from tape
- D If an error occurs while reading a tape, destroy all data and retry.
If it persists, check the data on the PDP11. It is good practice to keep the number of files on a tape small (5-15).

Spectral Data Plots (CDC7600; DBPLOTS; MATHSY)

- A To create UX files from spectral data
- B Spectral data and DCSLIB are required. Run DBPLOTS
 - (1) X Z00 Mathsy tv # box #
 - (2) RMAC DBPLOTS,,DCSLIB
 - (3) PLOT sample name
 - (4) END
- C Step (3) is repeated for each sample. The TV is turned off by PLOT. Keep a list of the sample in the order in which they are plotted.
- D Limit the number of samples for DBPLOTS to 10. An error means bad data; ignore it and continue. Check the frame numbers of a UX file after an error to see if one of the two plots was produced before the error.

Spectral Data Storage (CDC7600; XPORT, LIX, MCT; FORTRAN)

- A To save original and graphics data in libraries, long term storage, and 7 track tape.
- B Change the name of the UX graphics file (UxTV80DD80, where x = A,B---) to the form PLOTn where n is a number obtained from inspection of the "UXLIST" macro in FILL. FILL resides in DCSLIB and contains the current list of UX files. Add one to the last PLOTn file listed to get the new name, then run SWAT.
 - (1) SWAT UX-name PLOTn R. E.

Combine the data files (but not the UX files) into a library named DBm where m is a number obtained from the ".XLIBLIST" macro in FILL. This number will often be the same as that used for PLOT numbers. Whenever more than 10 files are in a library, it may be convenient to name the PLOT files PLOTnA, PLOTnB etc. so that DB numbers and PLOT numbers correspond. This is not a requirement.

- (2) LIX DBm NEWFILE length
- (3) OK. AL. sample-1 sample-2 ---
- (4) OK. RO ! END

Store the libraries and plot files on tape and long term storage. Run MCT and XPORT.

- (5) MCT CHECK FILES ADD. file list
- (6) C/W FILES LIST TAPE TCK. IC624 END
- (7) TAPE IC624 WAS WRITTEN ON THE Z MACHINE 7/7/78
DO YOU WANT TO WRITE OVER THIS TAPE?

***Look at what has been typed. IF you used the correct file name AND the word "ADD." was typed, then answer YES. Otherwise answer NO and do it correctly or get help. A mistake here is fatal.

- (8) YES

Duplicate the above for tape BH324

- (9) XPORT WR ,GLASSDATA [library names and plot names]

- (10) _ END

- C LIX requires a length for the library which may be found from the lengths of the original files. All lengths are in octal. Don't make a mistake in step (5).

Update FILL Tables (CDC7600; AC; TRIX)

- A To inform FILL of new spectral data.

- B Edit FILL using TRIX AC.

- (1) TRIX AC
- (2) _ GET!DCSLIB:FILL!0!FILL

(3) Add the next ".XLIB" name in this list plus the DB library name to the end of the .XLIBLIST macro. For example, if DB27 is to be added and .XLIBAB is the last entry in .XLIBLIST, then before the "\" in the last line of .XLIBLIST, add ".XLIBAC DB27 " (is a space and is important).

(4) Repeat the process for .UXLIST

(5) Create new macros .XLIBz and .PLOTw where z and w are the characters just used in .XLIBLIST and .UXLIST. These new macros are added after the old ones in FILL. The form of these are shown in FILL.

(6) Replace FILL in DCSLIB

(7) LIX DCSLIB!R. FILL!END

(8) Replace DCSLIB in data correlation system on tapes HD312, BH323 and long term storage.

- C If you are not sure of the frame numbers to put in the .PLOT macro, use UXTV to view the PLOT file. Be sure to check these numbers whenever an error occurs in DEPLOTS. Normally, the frame numbers are odd beginning with one. Don't ruin FILL, it prints Handbook pages.

Data Entry (CDC7600; DCS; TRIX)

A To enter numeric and composition data, notes and references into the data correlation system.

B Data entry is done currently by hand although the system contains a command to read a disk file created by the PDP11 -- the PDP11 does not currently create those files. Data entry can be done only by authorized members of our group. The input commands are:

(1) Command: DATA

(2) you are prompted for each property and the composition and given a chance to change them

(3) Command: NOTES

(4) Command: REFERENCES

(5) END

C (3) any number of lines may be entered for a sample

(4) references are of the following rigid format:

property reference letter [addition values and sources]
(conditions of measurements)

In addition, special rules for chemical fomulae, and units must be followed:

$\pm \rightarrow \wedge \pm$

For general style, see DATA-REF in DCSLIB

PRINTING (CDC7600; DCS and PROXY; TRIX and BEEP)

A To create and send the data pages to the hard copy camera

B DCS creates a file for printing by REDPP, and PROXY runs REDPP:

(1) TRIX DCS DCSLIB

(2) Command: PRINTBOOK!name-1 name-2 ...

(4) END

(5) PROXY RUNRPP/TALK /10 13

C You must place the proper plot files on disk before step (5). The command FIND!HBPLOTS, if issued after PRINTBOOK will tell you the proper Plot files. If FILL does not know about your sample, no pages will be generated.

Send to TID (and rejoice)

There are presently 15 glasses whose data pages must be modified before being given to REDPP. The changes to be made are listed here and the changes themselves may be found in the handbook. Composition references are not normal and are therefore patched in.

Handbook Special Cases

9101	}	Series list too long: split into 2 lines
9103		
9110		
9111		
9114		
9115		
9118	}	
9024	}	Add glass preparation note & composition reference
9028		
6512	}	Glass preparation reference
7503	}	Cross section value reference (columns move)
5019		
1009		
6522	}	Composition reference
6517		

Appendix C: Plot, Statistic, Table, and Index Generation

Generally the computer output described here was cosmetically modified before printing. Two DCS commands have been created to aid index and graphics preparation. Both files reside in DCSLIB and are executed by the command DO(DCSLIB). A listing of the command files is at the end of this appendix. The command file HB-INDEX prepares and prints the indices listed in Table C-1. Printing is a non-trivial operation and will take time. (You may need to start +REDPP[A] if the 15 minutes set aside for this operation are not enough.) The file HB-INDICES is left after printing and may be saved and re-sent if necessary.

The command file HB-TABLES creates the set of files shown in Table C-2 which are used by DCSM to create graphs needed by the handbook. These graphs are written on 35 mm film which is printed and modified by TID. The MATHSY commands are

```
X ZOO MATHSY tv# box#
```

```
RMAC DCSM,,,DCSLIB
```

```
STATDATA FROUT 1 2
```

(A) STATFILE name bin size

```
CORDATA
```

(B) CORFILES ANx SIX ABBE n_1 n_2 v_1 v_2

(A) and (B) are repeated for the files listed in Table C-2. The values n_1 , n_2 , v_1 , v_2 come from the data (look at the values used in the handbook). They are the refractive index and Abbe number ranges for each plot. Note: v_1 is greater than v_2 for the plots. (The value x in ANx and SIX represents the file numbers shown in Table C-2). For statistics, "bin size" is determined from the data (for example, .1 is reasonable for CS (cross section) data since it is the finest division of that data. If bin size is omitted a value is automatically chosen. Note: bin sizes are dependent on the number of data points and a chosen bin size will be overridden if too small.

The final data needed for the handbook are property tables for compositional series. The DCS command TABLE is used to produce these.

For example,

(A) USEPROP!DE SI NLC TWO FOUR SIX EL RL CS

DISK! name

(B) TABLE!UP.! sample list!title

TTY

PRINTF! name ! HSP

will create a table with density (DE), sodium index (SI) etc. and send it to the printer. These tables are retyped by TID. Step (A) sets the properties to the mnemonic "UP." so that step (B) may be repeated as often as desired without retyping the individual properties. Be sure to preface these commands by the HANDBOOK command to limit consideration to handbook samples only.

Table C1

Indices Required for Handbook

For all glasses:

Sample Number
Common name
Source
Refractive index
Nonlinear refractive index
Emission cross section
Peak wavelength
Radiative lifetime
Relative absorption

Within each glass section:

Common name
Cross section
Radiative lifetime
Peak wavelength

Table C2
Files Needed for Abbe' Plots and Statistics

General names:

SI	sodium index
AN	abbe' number
CS	cross section
PW	peak wavelength
RL	radiative lifetime

The suffixes represent the data for various glass types as follows

SI and AN:	null	all glasses
	1	silicates
	2	phosphates
	3	fluorophosphates
	4	beryllates
	5	borates
	6	miscellaneous
CS, PW, RL	null	silicates
	1	phosphates
	2	fluorophosphates
	3	beryllates
	4	borates
	5	miscellaneous

Indices and Statistics Command Files

```
\ COMMAND FILE TO PRODUCE HANDBOOK INDICES AND SECTION LISTS
\ ----- HB-INDEX .. 9:54 AM, FRIDAY , 2 FEBRUARY 1979 -----
\ SELECT GLASSES WHICH ARE IN THE HANDBOOK
HANDBOOK
\ CREATE A DISK FILE FOR THE INDEX DATA
DISK
TAB-IND
\ SUPPRESS REFERENCES
NOREF
\ CREATE SAMPLE NUMBER INDEX
SETF(X)
LL 2 0.4 CN 8 0.15 GT 25 0.18
LISTF
ALL
-SAMPLE -NUMBER
\ CREATE COMMON NAME INDEX
SETF(X)
CN 2 0.15 LL 20 0.4 GT 26 0.18
LISTF
ALL
-COMMON -NAME
\ CREATE SOURCE INDEX. SORT BY GLASS TYPE
SETF(X)
MA 2 0.16 LL 20 0.4 CN 26 0.15 GT 43 0.18
SORTFIELD4
LISTF
ALL
-SOURCE
\ CREATE REFRACTIVE INDEX INDEX. ROUND TO 4 DECIMAL PLACES
SORTFIELD1
ROUNDON ROUNDFIELD
I=4
SETF(X)
SI 2 1.6 LL 13 0.4 CN 19 0.15 GT 38 0.18
LISTF
ALL
-REFRACTIVE -INDEX AT 589.2 NM
\ CREATE NONLINEAR INDEX COEFF INDEX. ROUND REFRACTIVE INDEX TO 3 PLACES
ROUNDFIELD
SI=3
SETF(X)
NLC 2 2.2 LL 9 0.4 CN 15 0.15 GT 32 0.18 PI 52 1.3
LISTF
```

```

ALL
^CALCULATED ^NONLINEAR ^REFRACTIVE ^INDEX ^COEFFICIENT, 10&P+-20&P- M&P+2&P-^, ^W&P+-1&P-
\ CREATE CROSS SECTION INDEX
NOROUND SETF(X)
CS 2 1.1 LL 7 0.4 CN 13 0.15 GT 30 0.18 PW 50 4.1
LISTF
ALL
&P+4&P-^F&B+3/2&B- &M1.RTARR\ &P+4&P-^1&B+11/2&B- PEAK STIMULATED EMISSION CROSS SECTION, 10&P+-20&P- CM&P+2&P-
\ CREATE PEAK WAVELENGTH INDEX
SETF(X)
PW 2 4.1 LL 10 0.4 CN 16 0.15 GT 33 0.18 CS 53 1.1
LISTF
ALL
^PEAK ^FLUORESCENCE ^WAVELENGTH, NM
\ CREATE RADIATIVE LIFETIME INDEX
SETF(X)
RL 2 0.4 LL 8 0.4 CN 14 0.15 GT 31 0.18
LISTF
ALL
^CALCULATED ^RADIATIVE ^LIFETIME, 80+M&G-SEC
\ CREATE INTEGRATED ABSORPTION INDEX
SETF(X)
RA 2 1.2 LL 8 0.4 CN 14 0.15 GT 31 0.16
LISTF
ALL
^INTEGRATED ^ABSORPTION ^CROSS ^SECTION RELATIVE TO ^E^D-2
\ SET FORMAT FOR GLASS TYPE SAMPLE LISTS
SETF(X)
CN 2 0.15 LL 19 0.4 MA 25 0.16
\ CREATE SAMPLE LISTS FOR EACH GLASS TYPE
LISTF
SIL
^SILICATES BY ^COMMON ^NAME
LISTF
PHS
^PHOSPHATES BY ^COMMON ^NAME
LISTF
FLP
^FLUOROPHOSPHATES BY ^COMMON ^NAME
LISTF
BER
^FLUOROBERYLLATES BY ^COMMON ^NAME
LISTF
BOR
^BORATES BY ^COMMON ^NAME
\ ADD GLASS TYPE TO THE MISCELLANEOUS LIST

```

SETF(X)
CN 2 0.15 LL 19 0.4 MA 25 0.16 GT 43 0.18

LISTF
ZIR, GER, MIS,
^MISCELLANEOUS ^GLASSES BY ^COMMON ^NAME

\ SET FORMAT FOR CROSS SECTION LISTS

SETF(X)
CS 2 1.1 LL 7 0.4 CN 13 0.15

\ CREATE CROSS SECTION LISTS FOR EACH GLASS TYPE

LISTF
SIL,
^SILICATES BY ^CROSS ^SECTION
LISTF
PHO,
^PHOSPHATES BY ^CROSS ^SECTION
LISTF
FLP,
^FLUOROPHOSPHATES BY ^CROSS ^SECTION

LISTF
BER,
^FLUOROBERYLLATES BY ^CROSS ^SECTION
LISTF
BOR,

^BORATES BY ^CROSS ^SECTION
LISTF

ZIR, GER, MIS,
^MISCELLANEOUS ^GLASSES BY ^CROSS ^SECTION

\ SET FORMAT FOR RADIATIVE LIFETIME LISTS

SETF(X)
RL 2 5.1 LL 12 0.4 CN 20 0.15

\ CREATE LIFETIME LISTS FOR EACH GLASS TYPE

LISTF
SIL,
^SILICATES BY ^RADIATIVE ^LIFETIME
LISTF
PHO,
^PHOSPHATES BY ^RADIATIVE ^LIFETIME
LISTF

FLP,
^FLUOROPHOSPHATES BY ^RADIATIVE ^LIFETIME
LISTF

BER,
^FLUOROBERYLLATES BY ^RADIATIVE ^LIFETIME
LISTF

BOR,
^BORATES BY ^RADIATIVE ^LIFETIME
LISTF

ZIR, GER, MIS,
^MISCELLANEOUS ^GLASSES BY ^RADIATIVE ^LIFETIME

\ SET FORMAT FOR PEAK WAVELENGTH LISTS

\ COMMAND FILE FOR CREATION OF MATHSY FILES FOR GLASS HANDBOOK.

\ ----- HB-TABLES ...9:52 AM, FRIDAY , 2 FEBRUARY 1979 -----

\ SELECT GLASSES WHICH ARE IN THE HANDBOOK

HANDBOOK

\ SELECT SODIUM INDEX AND ABBE NUMBER PROPERTIES

USEPROP

SI AN

\ CREATE A MATHSY FILE OF INDEX AND ABBE NUMBER FOR ALL GLASSES

GET

P.

ALL.

^ALL ^GLASSES

\ ADD CROSS SECTION, RADIATIVE LIFETIME AND PEAK WAVELENGTH

\ TO LIST OF PROPERTIES.

USEPROP

SI AN CS RL PW

\ CREATE MATHSY FILES FOR EACH GLASS TYPE

GET

P.

SIL.

^SILICATES

GET

P.

PHO.

^PHOSPHATES

GET

P.

FLP.

^FLUOROPHOSPHATES

GET

P.

BER.

^BERYLLATES

GET

P.

BOR.

^BORATES

GET

P.

MIS.

^MISCELLANEY

END


```

SETF(X)
PH 2 4.1 LL 11 0.4 CN 17 0.15
\ CREATE PEAK WAVELENGTH LISTS FOR EACH GLASS TYPE
LISTF
SIL
  ^SILICATES BY ^PEAK ^WAVELENGTH
LISTF
PHO
  ^PHOSPHATES BY ^PEAK ^WAVELENGTH
LISTF
FLP
  ^FLUOROPHOSPHATES BY ^PEAK ^WAVELENGTH
LISTF
BER
  ^FLUOROBERYLLATES BY ^PEAK ^WAVELENGTH
LISTF
BOR
  ^BORATES BY ^PEAK ^WAVELENGTH
LISTF
ZIR GER MIS
  ^MISCELLANEOUS ^GLASSES BY ^PEAK ^WAVELENGTH
\ CLOSE THE INDEX FILE AND CREATE A PROXY INPUT FILE TO RUN REDPP
DISK
RUNPRX
#DS(<<IDS>,WFS>XIS\>")
#DS(<<EKE DCSLIB HBI-ASM DR. :ALLS\>")
#DS(<<EKE DCSLIB HBI DR. :ALLS\>")
#DS(<TRIX AC :.;A:TEXT;HBI:ALTER;HBI-ASM:ALLS\>")
#DS(<REDPP HB-INDICES NCID. NOTIME. STARTP. 1 SETMUL. 16000 PAPERR. DEFONT. 4 FRAME. .12 .12 .01 .01:BOX>")
#DS(<BOX ZGB HB INDICES:ALLS\>")
#DS(<DESTROY ^PROXY>")
\ CLOSE THE INPUT FILE AND SWITCH TO A DUMMY. RUN REDPP VIA PROXY
DISK
DUMMY
#BY(<PROXY>,<RUNPRX/YAKYAK>,<15,17,X>)
\ DESTROY THE INPUT FILE AND THE TRIX RED INFO FILE. QUIT
DELETE
#HBI RUNPRX
END

```

NOABORT NOKILL
RAP(< B1>,< ^B1>) RAP(< B4>,< ^B4>) RAP(< B8>,< ^B8>)
NF
#PS(<ADDING TRIX RED INFO>"")~
CA(1,9999,9999,<TAB-IND>,<HB1>)
NF
RAP(< >#DO(<\$EP>,7),<#PAGE>,1,9)
NF
#PS(<FORMATING THE INDICES>"")~
FORMAT(<HB1>,<HB-INDICES>)
#CF(<HB1>,X)~ #CF(<HB1-ASM>,X)~
END
THIS IS AN ALTER FILE TO CREATE A TRIX RED FILE FOR HANDBOOK
INDICES (GENERAL AND SECTION).
\\ ----- HBI-ASM .. 9:51 AM, FRIDAY , 2 FEBRUARY 1979 -----

1 #PAPERSIZE 54 80 .94 .21 .21 .09 .05

2

3

4 #MARGIN 1 80

5 #NOFILL

6 #PASS .RTARR &X+&D+&H1261/.08/.08//6//&K1&D-&X-

7 #PASS .DEG &X+&D+&H900/.08/.08//12//&K1&D-&X-

8 #PASS .BKTR &X+&D+&H1414/.06/.06//25//&D-&X-

9

Appendix D: Handbook Master Format File

The two listings contained here are the source for TRIX RED and the resulting master format file for the handbook. Complicated, isn't it?

[illegible]

```

1  papersize 54 60 .94 .21 .21 .09 .05
2  -----
3  sc
4  sc This is the source for the LLL laser glass handbook. In place of the
5  sc data which should appear here, the DCS mnemonics (enclosed in semicolons)
6  sc are used. Original programming was done by Carl Schneider (TID) and
7  sc John C. Beatty (COMP)
8  sc
9  sc ----- masterx .. 11:27 am, wednesday , 10 january 1978 -----
10 sc
11 sc Energy 1 80
12 sc
13 sc $tab $ 80
14 sc
15 sc ===== pass macros =====
16 sc =====
17 sc
18 spass .rtarr &x+&d+&h1261/.08/.08//&l&d-&x-
19 spass .deg &x+&d+&h900/.08/.08//&l&d-&x-
20 spass .oktr &x+&d+&h1144/.05/.05//&d-&x-
21 spass .wave &x+&t+&2000008+&t:textc/1/0./&e/40./05/1.0/1.0/22/&q*Wavelength (nm)&q-/&-&t-&x-
22 spass .abs &x+&t+&2000008+&t:textc/1/90./&e/5./30./1./1./42/&q*Absorption coefficient (cm&p+&-l&p)&q-/&-&t-&x-
23 spass .cross &x+&t+&2000008+&t:textc/1/90./&e/27.5/30./1./1./44/&q*Cross section (10&p+&-0&p+&-2&p)&q-/&-&t-&x-
24 spass .fluor &x+&t+&2000008+&t:textc/1/90./&e/5./30./1./1./28/&q*Relative fluorescence&q-/&-&t-&x-
25 sc =====
26 sc ===== rod macros =====
27 sc =====
28 sc
29 sc $set .pghum <<->&pgm<->
30 sc
31 sc ===== ltsscov =====
32 sc =====
33 sc
34 sc $def ltsscov
35 sc
36 sc -----
37 sc
38 sc
39 sc
40 sc
41 sc      name      name of the macro containing the header.
42 sc      xxl       the position at which to begin leftstr.
43 sc      leftstr   the string which is to be left adjusted.
44 sc      xxc       the x-position at which to center centerstr.
45 sc      centerstr the string which is to be right adjusted.
46 sc      xxr       the x-position at which to end rightstr.
47 sc      rightstr  the string which is to be right adjusted.
48 sc      llyc      the y-position at which to plot all strings.
49 sc      llineg    the gap between the underlines.
50 sc      lline     the width of the individual underlines.
51 sc
52 sc      llinec name string size xxx yyy      "line centered"
53 sc
54 sc      linell name string size xxx yyy      "line left justified"
55 sc
56 sc      linerl name string size xxx yyy      "line right justified"
57 sc
58 sc
59 sc Programmed by: John C. Beatty
60 sc

```

```

61      #c
62      #c      Sample use:
63      #c
64      #c      #read lcrdef readp x
65      #c      #shend hdst 10.0 -1- 40.0 -1- 70.0 -1- 1.0 0.2 0.02
66      #c      &r+&vA&r-
67      #c      &r+&d+&i/1.5/LHG-7N PHOSPHATE&i/1/&d-&r-
68      #c      &r+LLL-5027&r-
69      #c
70      #c
71      #c      #heading -x-
72      #c
73      #c
74      #c      &mhdst\
75      #c      &-x-
76      #c
77      #c      -----
78      #c
79      #c
80      #c
81      #c      #trix #ps{lcrdef 24 may 1978>"!)"#c
82      #c
83      #c      #def cstrlen string size
84      #c
85      #c      Add and variable width triples to string.
86      #c      Then get a macro name and make a pass macro whose body is the
87      #c      string to be printed. The name of the macro is left in .mname.
88      #c      .str contains n&m..., where n is the length of &m....
89      #c
90      #c      #trix #ns(.str, #od(26,off)<string>#od(26,on))#trix &ns(%rand, %rand+1)#trix #ns(.mname, <[[]%rand[]]> )#pass &
91      #c      &e\$.str\
92      #c
93      #c      #trix #ns(.str,#ed(26,off)<&n&e\$.mname\>#od(26,on))#trix #ns(.str,#od(26,off)%gc(.str)</>%str#ed(26,on))#c
94      #c
95      #c      #ifdef
96      #c
97      #c      -----
98      #c
99      #c
100     #c
101     #c      #def linoec name string size xxx yyy
102     #c
103     #c
104     #c      string ..... the text string to be printed
105     #c
106     #c      size ..... size characters to be used (1.0 for no change)
107     #c
108     #c      ..... to be used (r, d, i, d, w, y)
109     #c
110     #c      xxx ..... the x coordinate at which to center the string
111     #c
112     #c      #cstrlen -1- size
113     #c      string
114     #c      #pass name -em-
115     #c      &:textc/1/0/a/xxx/yyy/1.0/size/&e\$.str\
116     #c      -em-
117     #c
118     #c
119     #c      #endif

```

```

120 #c
121 #c
122 #c -----
123 #c
124 #c
125 #def linell name string size xxx yyy
126 #c
127 #cstrlen -l- size
128 string
129 #pass name -em-
130 &:textl/2/0/a/xxx/yyy/1.0/size/&a$.str\
131 #-em-
132 #c
133 #c
134 #endif
135 #c
136 #c -----
137 #c
138 #c
139 #c
140 #def linerr name string size xxx yyy
141 #c
142 #cstrlen -l- size
143 string
144 #pass name -em-
145 &:text/3/0/a/xxx/yyy/1.0/size/&a$.str\
146 #-em-
147 #c
148 #c
149 #endif
150 #c
151 #c -----
152 #c
153 #c
154 #c
155 #def shead name xxl lftstr xxc constr xxr rghstr yyy lineg linew
156 #c
157 #linell ::lft -l- 1.0 xxl yyy
158 lftstr
159 #c
160 #linecc ::con -l- 1.0 xxc yyy
161 constr
162 #c
163 #linerr ::rgh -l- 1.0 xxr yyy
164 rghstr
165 #c
166 #pass name -end-
167 &t-
168 &200000
169 &t-
170 &m::lft\
171 &a::con\
172 &m::rgh\
173 &:line/&a/xxl/0.0/a/xxr/0.0/linew/
174 &:line/&a/xxl/lineg/a/xxr/lineg/linew/
175 &t-
176 #-end-
177 #c
178 #c
179 #endif

```



```

180 #c
181 #c
182 #c -----
183 #read ppmacros docuse
184 #c -----
185 #c
186 #c
187 #def blinel string size font xxx
188 #c
189 #c
190 #c      string ..... the text string to be printed
191 #c
192 #c      size ..... size characters to be used (1.0 for no change)
193 #c
194 #c      font ..... font to be used (r, q, i, g, w, y)
195 #c
196 #c      xxx ..... char position at which to start (null for left margin)
197 #c
198 #c
199 #c      This macro plots the given string beginning at character position xxx
200 #c      and at the given size. Variable width spacing is used.
201 #c      The line is plotted in the bold form of the indicated font.
202 #c      Notice that we use w1 to form blank lines and to shape the
203 #c      text string into the form required by REDPP.
204 #c
205 #c      If xxx is null then use %lmargin-1 instead.
206 #c
207 #set .yyy #eq{<xxx>,<>,<%%lmargin-1>,<1>,<%%lmargin-1>,<xxx>}
208 #c carl's modification to bring heads left even when xxx is 1.
209 #c      The body of the macro:
210 #c
211 #break
212 #w1 -1- size q
213 string
214 &x+&200000&: +&zj/dfont/m/.05/.05/&:text1/2/0/u/&c\$.yyy\0/1.0/size/&c\$.str\&zj/dfont/m/.035/.05/&: -&x-
215 #c carl's modification to avoid blank lines. (but now you can't use i font)
216 #c
217 #c
218 #c
219 #c
220 #c
221 #break
222 #c
223 #c
224 #endif
225 #c
226 #c
227 #c -----
228 #c *****
229 #c ***** head text *****
230 #c *****
231 #thead hdstx 0.0 -1- 40.0 -1- 60.0 -1- 1.0 0.3 0.03
232 &q+&1/1/; &1/1/&q-
233 &q+&8+&1/1.75/&1/1/&d-&q-
234 &q+&8+&1/1.75/&1/1/&d-&q-
235 #c *****
236 #c ***** heading *****
237 #c *****
238 #heading -x-
239

```

```

240      &nhdstr\
241      $70 &x+&t+&o+&d+;amonth; ; lyser; &d-&o-&t-&x-
242      &sk 1
243      &c -M-
244      &c #####
245      &c ##### footing #####
246      &c #####
247      &footing -2-
248      &dh 1 80
249      &sk 1
250      &c #####
251      &c ##### pago 1 #####
252      &c #####
253      &25 &x+&t+&o+Current status; &o-&t-&x-2540 &x+&t+&o+&d+; &d-&o-&t-&x-
254      &25 &x+&t+&o+Molty; &o-&t-&x-2540 &x+&t+&o+&d+; &d-&o-&t-&x-
255      &sk 1
256      &dh 1 80
257      &sk 1
258      &fill
259      &hoad 3 -1- 0 1
260      COMPOSITION
261      &nofill
262      &dh 10 70
263      &sk 1
264      &21 &x+&t+&o+Compound&o-&t-&x-2538 &x+&t+&o+Molo 2&o-&t-&x-2554 &x+&t+&o+Weight 2&o-&t-&x-
265      &dh 10 70
266      &sk 1
267      &c composition starts here
268      &sk 13
269      &dh 10 70
270      &sk 1
271      $10 &x+&t+&o+measured neodymium concentration&o-&t-&x-2543 &x+&t+&o+&d+; &d-&o-&t-&x-2560 &x+&t+&o+wt % ; &o-&t-&x-
272      $10 &x+&t+&o+Neodymium number density &d+&p+&r&g-&d-&b+N&b-&o-&t-&x-2543 &x+&t+&o+&d+; nli; &d+&o+&e&q-&d-108p+208p-&d-
&o-&t-&x-2560 &x+&t+&o+cm&p+&3p-&o-&t-&x-
273      &dh 10 70
274      &sk 1
275      $10 &x+&t+&o+Compositional series; &o-&t-&x-
276      &break
277      &sk 3
278      &dh 1 80
279      &sk 1
280      &fill
281      &hoad 3 -1- 0 0
282      PROPERTY SUMMARY
283      &nofill
284      &sk 1
285      $10 &x+&t+&o+Peak stimulated emission cross section&o-&t-&x-2556 &x+&t+&o+&d+&g+&5&g-&d-&b+P&b-&o-&t-&x-2564 &x+&t+&o+
&d+;cs; &d+&o+&e&q-&d-108p+208p-&d-&o-&t-&x-2575 &x+&t+&o+cm&p+2&p-&o-&t-&x-
286      $10 &x+&t+&o+Calculated radiative lifetime&o-&t-&x-2558 &x+&t+&o+&d+&g+&t&g-&d-&b+R&b-&o-&t-&x-2564 &x+&t+&o+&d+;rl; &d-
&o-&t-&x-2575 &x+&t+&o+&g+&m&g-&d-&sc&o-&t-&x-
287      $10 &x+&t+&o+Zero concentration lifetime&o-&t-&x-2556 &x+&t+&o+&d+&g+&t&g-&d-&b+O&b-&o-&t-&x-2564 &x+&t+&o+&d+;tz; &d-&
&o-&t-&x-2575 &x+&t+&o+&g+&m&g-&d-&sc&o-&t-&x-
288      $10 &x+&t+&o+N&g+&3p- concentration @ &d+&g+&t&g-&d-&b+O&b-/2&o-&t-&x-2556 &x+&t+&o+O&o-&t-&x-2564 &x+&t+&o+&d+;qq; &
&d+&e+&e&q-&d-108p+208p-&d-&o-&t-&x-2575 &x+&t+&o+cm&p+&3p-&o-&t-&x-
289      $10 &x+&t+&o+Nonlinear refractive index coefficient&o-&t-&x-2556 &x+&t+&o+&d+&g+&c&g-&d-&o-&t-&x-2564 &x+&t+&o+&d+;nl;
&d+&o+&e&q-&d-108p+208p-&d-&o-&t-&x-2575 &x+&t+&o+&m&g+2&p-&o-&o+M&p+&1&p-&o-&t-&x-
290      $10 &x+&t+&o+Nonlinear refractive index&o-&t-&x-2556 &x+&t+&o+n&b+2&b-&o-&t-&x-2564 &x+&t+&o+&d+;nlwo; &d+&e+&e&q-&d-10
&p+&108p-&d-&o-&t-&x-
291      $10 &x+&t+&o+Refractive index at peak fluorescence wavelength&o-&t-&x-2556 &x+&t+&o+n(&d+&g+&l&g-&d-&b+p&b-)&o-&t-&x-2
564 &x+&t+&o+&d+; pi; &d-&o-&t-&x-

```

```

292 $10 &x+&t+&o+Peak-fluorescence wavelength&o-&t-&x-1556 &x+&t+&o+&d+&g+1&g-&d-&b+p&b-&o-&t-&x-1564 &x+&t+&o+&d+; pw;&
d-&o-&t-&x-1575 &x+&t+&o+nm&o-&t-&x-
293 $10 &x+&t+&o+Linewidth (FWHM)&o-&t-&x-1556 &x+&t+&o+&d+&g+D&g-&d-&d+&g+1&g-&d-&o-&t-&x-1564 &x+&t+&o+&d+; fw;&d-&o-&
t-&x-1575 &x+&t+&o+nm&o-&t-&x-
294 $10 &x+&t+&o+Linewidth (effective)&o-&t-&x-1556 &x+&t+&o+&d+&g+D&g-&d-&d+&g+1&g-&d-&b+&f&b-&o-&t-&x-1564 &x+&t+&o+&d
+; el;&d-&o-&t-&x-1575 &x+&t+&o+nm&o-&t-&x-
295 $10 &x+&t+&o+Density&o-&t-&x-1556 &x+&t+&o+&d+&g+r&g-&d-&o-&t-&x-1564 &x+&t+&o+&d+; d;&d-&o-&t-&x-1575 &x+&t+&o+&g&
o-&o+cm&p-13&p-&o-&t-&x-
297 *sk
298 *margin 1
299 *c *****
300 *c ***** page 2 *****
301 *c *****
302 *p
303 *fill
304 *head 3 -1- 0 1
305 ABSORPTION PROPERTIES
306 *nofill
307 *sk
308 *window 46 f -3-
309 ;uxfile; ;uxfrc;
310 0.96 .91 .061 .61
311 0 78
312 &x+&m, wave&m, mba&m, cross&x-
313 *sk 3
314 *margin 3
315 &x+&t+&o+integrated absorption cross section relative&o-&t-&x-
316 $5 &x+&t+&o+to ED-2 from 400 to 950 nm&o-&t-&x-1550 &x+&t+&o+&d+; re;&d-&o-&t-&x-
317 *sk
318 &x+&t+&o+Absorption efficiency coefficients for 15-nm&o-&t-&x-
319 $5 &x+&t+&o+xenon flashlamp at 1000 Å&o-&o+cm&p+2&p-&o-&t-&x-
320 *sk
321 &c the wavelength range for this calculation goes here
322 &x+&t+&o+&d+&g+&g-&d- = A [1-B exp(-D&d+&g+r&g-&d-&b+N&b-&d+&s+1&s-&d-) - (1-B) exp(-D&d+&g+r&g-&d-&b+N&b-&d+&s+1&s-
&d-)1&o-&t-&x-1550 &x+&t+&o+A = &d+; ap;&d-&o-&t-&x-1565 &x+&t+&o+B = &d+; ab;&d-&o-&t-&x-
323 $5 &x+&t+&o+where &d+&g+r&g-&d-&b+N&b-&d+&s+1&s-&d- is in 10&p+20&p- Nd ions&o-&o+cm&p+2&p-&o-&t-&x-1542 &x+&t+&o+1.
bkt&r&t-&x-1550 &x+&t+&o+C = &d+; ac;&d-&o-&t-&x-1565 &x+&t+&o+D = &d+; ad;&d-&o-&t-&x-1579 &x+&t+&o+cm&p+2&p-&o-&t-&x-
324 *sk 1
325 *sk
326 &x+&o+Judd-Ofelt parameters:&o-&t-&x-1540 &x+&t+&o+&d+&g+W&g-&d-&b+2&b-&o-&t-&x-1550 &x+&t+&o+&d+; two;&d+&o+&o+&d-
-; two;&d+&o+&s-&d-10&p+20&p-&d-&o-&t-&x-1578 &x+&t+&o+cm&p+2&p-&o-&t-&x-
327 $40 &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-1575 &x+&t+&o+&d+; four;&d+&e+&o-&d-; four;&d+&o+&s-&d-10&p+20&p-&d-&o-&t-
&x-1578 &x+&t+&o+cm&p+2&p-&o-&t-&x-
328 $40 &x+&t+&o+&d+&g+W&g-&d-&b+6&b-&o-&t-&x-1550 &x+&t+&o+&d+; six;&d+&e+&o-&d-; six;&d+&e+&o+&o-&d-10&p+20&p-&d-&o-&t-&x-
&x-1578 &x+&t+&o+cm&p+2&p-&o-&t-&x-
329 *margin 1
330 *c *****
331 *c ***** page 3 *****
332 *c *****
333 *p
334 *fill
335 *head 3 -1- 0 1
336 FLUORESCENCE PROPERTIES
337 *nofill
338 *sk
339 *window 46 f -3-
340 ;uxfile; ;uxfrc;
341 0.96 .91 .061 .592
342 0 78

```

-Gh-

```

343      &x+&m.wavelength.fluor\&x-
344      &sk 2
345      #margin 3
346      &x+&t+&o+Peak-fluorescence wavelength&o-&t-&x-2345 &x+&t+&o+&d+&g+1&g-&d-&b+p&b-&o-&t-&x-2352 &x+&t+&o+&d+; pw;&d-&o-
&t-&x-2361 &x+&t+&o+&d+; pw;&d-&o-&t-&x-2376 &x+&t+&o+nm&o-&t-&x-
347      &x+&t+&o+linewidth (FWHM)&o-&t-&x-2345 &x+&t+&o+&d+&g+D&g-&d-&b+&g+1&g-&d-&o-&t-&x-2352 &x+&t+&o+&d+; fw;&d-&o-&t-&x-
2376 &x+&t+&o+nm&o-&t-&x-
348      &x+&t+&o+linewidth (effective)&o-&t-&x-2345 &x+&t+&o+&d+&g+D&g-&d-&b+&g+1&g-&d-&o-&t-&x-2352 &x+&t+&o+&d+; o
1;&d-&o-&t-&x-2361 &x+&t+&o+&d+; o1w;&d-&o-&t-&x-2376 &x+&t+&o+nm&o-&t-&x-
349      &x+&t+&o+Peak stimulated emission cross section&o-&t-&x-2345 &x+&t+&o+&d+&g+&g+&g-&d-&b+p&b-&o-&t-&x-2352 &x+&t+&o+&d+; c
&d+&o+&o+&o-&d-10&p+20&p-&d-&o-&t-&x-2361 &x+&t+&o+&d+; c&g;&d-&o-&t-&x-2376 &x+&t+&o+cm&p+2&p-&o-&t-&x-
350      &x+&t+&o+calculated radiative lifetime&o-&t-&x-2345 &x+&t+&o+&d+&g+&g-&d-&b+p&b-&o-&t-&x-2352 &x+&t+&o+&d+; r1;&d-&o-
&t-&x-2376 &x+&t+&o+&d+&g+nm&g-&d-soc&o-&t-&x-
351      &x+&t+&o+Zero-concentration lifetime&o-&t-&x-2345 &x+&t+&o+&d+&g+&g-&d-&b+p&b-&o-&t-&x-2352 &x+&t+&o+&d+; t2;&d-&o-&t-
&t-&x-2376 &x+&t+&o+&d+&g+nm&g-&d-soc&o-&t-&x-
352      &x+&t+&o+N&d&p+3+&p- concentration @ &d+&g+&t&g-&d-&b+O&b-/2&o-&t-&x-2345 &x+&t+&o+O&o-&t-&x-2352 &x+&t+&o+&d+; qq;&d+&o
+&b&-10&p+20&p-&d-&o-&t-&x-2376 &x+&t+&o+cm&p+3&p-&o-&t-&x-
353      &sk 1
354      &x+&t+&o+Branching ratios:&o-&t-&x-
355      25 &x+&t+&o+p1&p+&g+3/2&b- &m1.rtran\ &p+4&p-1&b+1&b-) J = 9/2, 11/2, 13/2, 15/2&o-&t-&x-2350 &x+&t+&o+&d+; brd;
;brc; 1;brb; 1;bra;&d-&o-&t-&x-
356      &sk 1
357      &x+&t+&o+Measured decay properties: three e-folding times&o-&t-&x-2350 &x+&t+&o+&d+; of;&d-&o-&t-&x-2376 &x+
&t+&o+&d+&g+nm&g-&d-soc&o-&t-&x-
358      &sk 1
359      &x+&t+&o+Decay function: 1/(1&b+O&b- = A exp(-&t-) + C exp(-O&t-) + E exp(-F&t-)&o-&t-&x-
360      &g2 &x+&t+&o+A = &d+; t&g;&d-&o-&t-&x-2360 &x+&t+&o+B = &d+; t&b;&d-&o-&t-&x-2376 &x+&t+&o+oc&p+1&p-&o-&t-&x-
361      &g2 &x+&t+&o+C = &d+; t&c;&d-&o-&t-&x-2360 &x+&t+&o+D = &d+; t&d;&d-&o-&t-&x-2376 &x+&t+&o+oc&p+1&p-&o-&t-&x-
362      &g2 &x+&t+&o+E = &d+; t&e;&d-&o-&t-&x-2360 &x+&t+&o+F = &d+; t&f;&d-&o-&t-&x-2376 &x+&t+&o+oc&p+1&p-&o-&t-&x-
363      #margin 1
364      &g 2 *****
365      &g 3 *****
366      &g 4 *****
367      #page
368      #fill
369      #end 3 -1 0 0
370      OPTICAL PROPERTIES
371      #margin 3
372      #not fill
373      &x+&t+&o+Refractive index at sodium D line&o-&t-&x-2343 &x+&t+&o+n&b+O&b-&o-&t-&x-2352 &x+&t+&o+&d+; s1;&d-&o-&t-&x-
&x-
374      &x+&t+&o+Refractive index at peak fluorescence&o-&t-&x-2343 &x+&t+&o+n(&d+&g+1&g-&d-&b+p&b-)&o-&t-&x-2352 &x+&t+&o+&d+
+; p1;&d-&o-&t-&x-
375      &x+&t+&o+Abbo number, (n&b+O&b- - 1)/(n&b+&b- - n&b+O&b-1&o-&t-&x-2343 &x+&t+&o+&d+&g+n&g-&d-&o-&t-&x-2352 &x+&t+&o+&d+
&d+; &g;&d-&o-&t-&x-
376      &x+&t+&o+index temperature coefficient, &o-&t-&x-2343 &x+&t+&o+&n/OT&o-&t-&x-2352 &x+&t+&o+&d+; dndt;&d+&o+&o-&d-10&p
+&p&-&d-&o-&t-&x-2371 &x+&t+&o+nm1.d&g\O&p+1&p-&o-&t-&x-
377      &x+&t+&o+Thermal coefficient of optical path length&o-&t-&x-2343 &x+&t+&o+&o+5/OT&o-&t-&x-2352 &x+&t+&o+&d+; dsdt;&d+&o+
&o-&d-10&p+&p&-&d-&o-&t-&x-2371 &x+&t+&o+nm1.d&g\O&p+1&p-&o-&t-&x-
378      &sk 1
379      &x+&t+&o+Nonlinear refractive index coefficient&o-&t-&x-2343 &x+&t+&o+&d+&g+&g+&g-&d- calc&o-&t-&x-2352 &x+&t+&o+&d+; n1
&d+&o+&o-&d-10&p+20&p-&d-&o-&t-&x-2371 &x+&t+&o+nm&p+2&p-&o-&t-&x-2376 &x+&t+&o+&d+;
380      &x+&t+&o+&g+&g+&g-&d-10&p+20&p-&d-&o-&t-&x-2371 &x+&t+&o+nm&p+2&p-&o-&t-&x-2376 &x+&t+&o+&d+; n1;&x+&t+&o+nm&p
+2&p-&o-&t-&x-
381      &x+&t+&o+Nonlinear refractive index&o-&t-&x-2343 &x+&t+&o+n&b+2&b- calc&o-&t-&x-2352 &x+&t+&o+&d+; ntwoc;&g+&o+&o-&d-
10&p+1&p-&d-&o-&t-&x-2371 &x+&t+&o+nm&p+2&p-&o-&t-&x-2376 &x+&t+&o+&d+;
382      &sk 1
383      &g 3 &x+&t+&o+n&b+2&b- nm&o&o-&t-&x-2352 &x+&t+&o+&d+; ntwom;&d+&o+&o-&d-10&p+1&p-&d-&o-&t-&x-2371 &x+&t+&o+nm&p+2&p-&o-&t-
&x-
384      &x+&t+&o+Stress optic coefficient &o-&t-&x-2343 &x+&t+&o+&d+&g+O&g-&d-B&o-&t-&x-2352 &x+&t+&o+&d+; so ;&d-&o-&t-&x-2376

```

1 &x+&t+&c+nm&o-.&o+cm&o-.&o+kg&p+-1&p-&o-&t-&x-

```

385      #dh 1 80
386      #sk 1
387      #margin 1
388      #fill
389      #head 3 -1- 0 0
390      THERMAL PROPERTIES
391      #margin 3
392      #nofill
393      &x+&t+&o+Thermal expansion coefficient &o-&t-&x-1543 &x+&t+&o+&d+&g+&g-&d-&o-&t-&x-1552 &x+&t+&o+&d+; ox;&d+&o+&o-&
d-10&p+-&p-&-&o-&t-&x-1571 &x+&t+&o+&m1.dag\C&p+-1&p-&o-&t-&x-
394      &x+&t+&o+Specific heat at constant pressure &o-&t-&-1543 &x+&t+&o+&Cb+P&b-&o-&t-&x-1552 &x+&t+&o+&d+; hc;&d+&o-&t-&x-
-1571 &x+&t+&o+Thermal expansion coefficient &o-&t-&-1543 &x+&t+&o+&Cb+P&b-&o-&t-&x-1552 &x+&t+&o+&d+; ho;&d+&o-&t-&x-1571
395      &x+&t+&o+Thermal heat conductivity &o-&t-&-1543 &x+&t+&o+&Cb+P&b-&o-&t-&x-1552 &x+&t+&o+&d+; vp;&d+&o-&t-&x-1571 &x+&t+&o+&m1.dag\C&o-&t-&-&x-
396      &x+&t+&o+Softening point&o-&t-&-1543 &x+&t+&o+&Cb+P&b-&o-&t-&x-1552 &x+&t+&o+&d+; tp;&d+&o-&t-&-&x-1571 &x+&t+&o+&m1.dag\C&o-&t-&-&x-
397      &x+&t+&o+Transformation point&o-&t-&-1543 &x+&t+&o+&Cb+P&b-&o-&t-&x-1552 &x+&t+&o+&d+; tp;&d+&o-&t-&-&x-1571 &x+&t+&o+&m1.dag\C&o-&t-&-&x-
398      #margin 1
399      #dh 1 80
400      #sk 1
401      #fill
402      #head 3 -1- 0 0
403      MECHANICAL PROPERTIES
404      #margin 3
405      #nofill
406      &x+&t+&o+Density&o-&t-&-1543 &x+&t+&o+&d+&g+&g-&d-&o-&t-&-1552 &x+&t+&o+&d+; do;&d+&o-&t-&-1571 &x+&t+&o+&g&o-.&o
+cm&p+-&p-&-&o-&t-&-1571 &x+&t+&o+&Kg&o+&H&b-&o-&t-&-1552 &x+&t+&o+&d+; kh;&d+&o-&t-&-1571 &x+&t+&o+&kg&o-
.&o+nm&p+-&p-&-&o-&t-&-1571 &x+&t+&o+&kg&o-
408      &x+&t+&o+Young's modulus&o-&t-&-1543 &x+&t+&o+&E&o-&t-&-1552 &x+&t+&o+&d+; ym;&d+&o-&t-&-1571 &x+&t+&o+&kg&o-.&o+nm
&p+-&p-&-&o-&t-&-1571 &x+&t+&o+&kg&o-
409      &x+&t+&o+Shear modulus&o-&t-&-1543 &x+&t+&o+&G&o-&t-&-1552 &x+&t+&o+&d+; sm;&d+&o-&t-&-1571 &x+&t+&o+&kg&o-.&o+nm&p
+-&p-&-&o-&t-&-1571 &x+&t+&o+&kg&o-
410      &x+&t+&o+Poisson ratio&o-&t-&-1543 &x+&t+&o+&d+&g+&g-&d-&o-&t-&-1552 &x+&t+&o+&d+; pr;&d+&o-&t-&-&x-
411      #dh 1 80
412      #sk 1
413      #margin 1
414      #fill
415      #head 3 -1- 0 0
416      SOLUBILITY
417      #margin 3
418      #nofill
419      &x+&t+&o+Stability in water &o-&t-&-1552 &x+&t+&o+&d+; ws;&d+&o-&t-&-&x-
420      &x+&t+&o+Stability in acid &o-&t-&-1552 &x+&t+&o+&d+; as;&d+&o-&t-&-&x-
421      #dh 1 80
422      #sk 1
423      #margin 1
424      #fill
425      #head 3 -1- 0 1
426      REFERENCES and NOTES
427      #c #margin 3
428      #c [a] &x+&t+&o+Hoy&o-&t-&-&x-
429

```

100

[illegible][illegible][illegible]

```

1  0      34      12      33      8      0      redpp
2  54      80      94      21      21      .05
3
4
5
6
7
8
9

```

```

10 0000source sink rows cols case
11 masterx master 54 80 1
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
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55
56
57
58
59
60

```

```

machine-date-time formatted. cpu sys i.o. reads writes r-buff w-buff ac
r 08/07/78 11:10 30329094 378128 1843584 14 7 4379 3096 4

```

```

#pass and #ref table for post-processor (name count body)

```

```

. abs 55 &x+&t+&2000000&+&t: textc/1/90./a/5./30./1./1./42/&q+Abs
49 orption coefficient (cm&p+1&p-1&q-/&-&t-&x-&v&x
. bktr 36 &x+&d+&h14141./08./08./25/&q-&x-&v&x
. bullet 48 &x+&d+&h1639./08./08./19/&k1&d-&x-&v&x
. cross 55 &x+&t+&2000000&+&t: textc/1/90./a/27.5/30./1./1./44/&q+C
53 cross section (10&p+20&p- cm&p+2&p-1&q-/&-&t-&x-&v&x
. deg 38 &x+&d+&h9500./08./08./12/&k1&d-&x-&v&x
. fluor 55 &x+&t+&2000000&+&t: textc/1/90./a/5./30./1./1./28/&q+Rel
35 active fluorescence&q-/&-&t-&x-&v&x
. rterr 38 &x+&d+&h1261./08./08./6/&k1&d-&x-&v&x
. wave 55 &x+&t+&2000000&+&t: textc/1/0./a/40./05/1.0/1.0/22/&q+W
31 wavelength (nm)&q-/&-&t-&x-&v&x
. :can 42 &t: textc/1/0/a/40.0/1.0/1.0/1.0/8/&mt[21]\
. :lft 42 &t: text1/2/0/a/0.0/1.00/1.0/1.0/8/&mt[11]\
. :rgh 42 &t: textr/3/0/a/80.0/1.0/1.0/1.0/8/&mt[13]\
. hdsr 55 &t+&2000000&+&mt: lft&m: :can&m: :rgh&m: line/6/a/0.0/0.0
55 /a/80.0/0.0/0.03/&: line/6/a/0.0/0.3/a/80.0/0.3/0.03/&:-
3 &t-
17 &q+&1/1/1/&1/1/&q-
[11] 26 &q+&d+&1/1.75/&1/1/&d-&q-
[13] 26 &q+&d+&1/1.75/&1/1/&d-&q-
[14] 40 &q+&d+&+COMPOSITION&o-&d-&q-
[15] 49 &q+&d+&+PROPERTY SUMMARY&o-&d-&q-
[16] 55 &q+&d+&+ABSORPTION PROPERTIES&o-&d-&q-
4 &q-
. r[71] 55 &q+&d+&+FLUORESCENCE PROPERTIES&
6 &o-&d-&q-
[18] 53 &q+&d+&+OPTICAL PROPERTIES&o-&d-&q-
[19] 53 &q+&d+&+THERMAL PROPERTIES&o-&d-&q-
[110] 55 &q+&d+&+MECHANICAL PROPERTIES&o-&d-&q-
4 &q-
[111] 38 &q+&d+&+SOLUBILITY&o-&d-&q-
[112] 53 &q+&d+&+REFERENCES and NOTES&o-&d-&q-

```

```

user-defined command table (name source-line-number)

```

```

#abs 189 #head1a 189 #logala 189 #separat 189
#blinc 189 #head2 189 #linecc 107 #shoad 181
#blinel 189 #head3 189 #line11 131 #sart 189
#blinel 193 #head4 189 #linerr 146 #sbus 189
#charset 189 #head5 189 #ltsscov 33 #tsymbat 189
#charset 189 #headspcc 189 #ltsscoff 189 #tablina 189
#cover 189 #headtc 189 #mfeoff 189 #stablina 189
#ctrlten 84 #indomac 189 #ppmacros 189 #t1tov 189
#equal 189 #italtext 189 #refn 189 #undent 189
#expo 189 #keyword 189 #refsym 189 #v1 189
#hcd1 189 #lcal 189 #resetnum 189 #xxxx 189

```

61
62
63
64
65
66
67
68
69
70

online-flag\page-name\line-count

none\0\0

page-name\first-line-number\head-count\foot-count\last-line-number\file-disk

1\1\4\4\54\000001 2\56\4\4\109\000396 3\111\4\4\164\000630 4\166\4\4\219\000976


```

72      &mhdatr\
73
74
75      &x+&t+&o+Current status:&o-&t-&x-
76      &x+&t+&o+Melt:&o-&t-&x-
77      &x+&t+&o+&d+;&d-&o-&t-&x-
78
79      &x+&200000&s+&zj/dr/m/.05/.05/&t:tex1/2/0/a/0/0/1.0/1.25/8/&m[[4]]/&zj/dr/m/.035/.05/&-&x-
80
81
82      &x+&t+&o+Compound&o-&t-&x-
83      &x+&t+&o+Mole %&o-&t-&x-
84      &x+&t+&o+Weight
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100      &x+&t+&o+Measured neodymium concentration&o-&t-&x-
101      &x+&t+&o+wt %;&o-&t-&x-
102      ndi&d+&o+&g-&d-10&p+20&p-&d-&o-&t-&x-
103      &x+&t+&o+Neodymium number density &d+&g+&g-&d-&b+&b-&o-&t-&x-
104      &x+&t+&o+cm&p+3&p-&o-&t-&x-
105      &x+&t+&o+Compositional series:&o-&t-&x-
106
107      &x+&200000&s+&zj/dr/m/.05/.05/&t:tex1/2/0/a/0/0/1.0/1.25/8/&m[[5]]/&zj/dr/m/.035/.05/&-&x-
108
109      &x+&t+&o+Peak stimulated emission cross section&o-&t-&x-
110      &x+&t+&o+Calculated radiative lifetime&o-&t-&x-
111      &x+&t+&o+Zero-concentration lifetime&o-&t-&x-
112      &x+&t+&o+Nd&p+3&p-concentration @ &d+&g+&t&g-&d-&b+&b-&/2&o-&t-&x-
113      &x+&t+&o+Nonlinear refractive index coefficient&o-&t-&x-
114      &x+&t+&o+Nonlinear refractive index&o-&t-&x-
115      &x+&t+&o+ntwo,&d+&o+&g-&d-10&p+13&p-&d-&o-&t-&x-
116      &x+&t+&o+n(&d+&g+1&g-&d-&b+&b-&)&o-&t-&x-
117      &x+&t+&o+Peak-fluorescence wavelength&o-&t-&x-
118      &x+&t+&o+Lifewidth (FWHM)&o-&t-&x-
119      &x+&t+&o+Lifewidth (effective)&o-&t-&x-
120      &x+&t+&o+&d+;&d-&o-&t-&x-
121      &x+&t+&o+cm&p+2&p-&o-&t-&x-
122      &x+&t+&o+cm&p+3&p-&o-&t-&x-
123      &x+&t+&o+cm&p+2&p-&o-&t-&x-
124      &x+&t+&o+n&b+2&b-&
125      &x+&t+&o+&d+;&d-&o-&t-&x-
126      &x+&t+&o+&d+;&d-&o-&t-&x-
127      &x+&t+&o+&d+;&d-&o-&t-&x-
128      &x+&t+&o+&d+;&d-&o-&t-&x-
129      &x+&t+&o+&d+;&d-&o-&t-&x-
130      &x+&t+&o+&d+;&d-&o-&t-&x-
131      &x+&t+&o+&d+;&d-&o-&t-&x-
132      &x+&t+&o+&d+;&d-&o-&t-&x-
133      &x+&t+&o+&d+;&d-&o-&t-&x-
134      &x+&t+&o+&d+;&d-&o-&t-&x-
135      &x+&t+&o+&d+;&d-&o-&t-&x-
136      &x+&t+&o+&d+;&d-&o-&t-&x-
137      &x+&t+&o+&d+;&d-&o-&t-&x-
138      &x+&t+&o+&d+;&d-&o-&t-&x-
139      &x+&t+&o+&d+;&d-&o-&t-&x-
140      &x+&t+&o+&d+;&d-&o-&t-&x-
141      &x+&t+&o+&d+;&d-&o-&t-&x-
142      &x+&t+&o+&d+;&d-&o-&t-&x-
143      &x+&t+&o+&d+;&d-&o-&t-&x-
144      &x+&t+&o+&d+;&d-&o-&t-&x-
145      &x+&t+&o+&d+;&d-&o-&t-&x-
146      &x+&t+&o+&d+;&d-&o-&t-&x-
147      &x+&t+&o+&d+;&d-&o-&t-&x-
148      &x+&t+&o+&d+;&d-&o-&t-&x-
149      &x+&t+&o+&d+;&d-&o-&t-&x-
150      &x+&t+&o+&d+;&d-&o-&t-&x-
151      &x+&t+&o+&d+;&d-&o-&t-&x-
152      &x+&t+&o+&d+;&d-&o-&t-&x-
153      &x+&t+&o+&d+;&d-&o-&t-&x-
154      &x+&t+&o+&d+;&d-&o-&t-&x-
155      &x+&t+&o+&d+;&d-&o-&t-&x-
156      &x+&t+&o+&d+;&d-&o-&t-&x-
157      &x+&t+&o+&d+;&d-&o-&t-&x-
158      &x+&t+&o+&d+;&d-&o-&t-&x-
159      &x+&t+&o+&d+;&d-&o-&t-&x-
160      &x+&t+&o+&d+;&d-&o-&t-&x-
161      &x+&t+&o+&d+;&d-&o-&t-&x-
162      &x+&t+&o+&d+;&d-&o-&t-&x-
163      &x+&t+&o+&d+;&d-&o-&t-&x-
164      &x+&t+&o+&d+;&d-&o-&t-&x-
165      &x+&t+&o+&d+;&d-&o-&t-&x-
166      &x+&t+&o+&d+;&d-&o-&t-&x-
167      &x+&t+&o+&d+;&d-&o-&t-&x-
168      &x+&t+&o+&d+;&d-&o-&t-&x-
169      &x+&t+&o+&d+;&d-&o-&t-&x-
170      &x+&t+&o+&d+;&d-&o-&t-&x-
171      &x+&t+&o+&d+;&d-&o-&t-&x-
172      &x+&t+&o+&d+;&d-&o-&t-&x-
173      &x+&t+&o+&d+;&d-&o-&t-&x-
174      &x+&t+&o+&d+;&d-&o-&t-&x-
175      &x+&t+&o+&d+;&d-&o-&t-&x-
176      &x+&t+&o+&d+;&d-&o-&t-&x-
177      &x+&t+&o+&d+;&d-&o-&t-&x-
178      &x+&t+&o+&d+;&d-&o-&t-&x-
179      &x+&t+&o+&d+;&d-&o-&t-&x-
180      &x+&t+&o+&d+;&d-&o-&t-&x-
181      &x+&t+&o+&d+;&d-&o-&t-&x-
182      &x+&t+&o+&d+;&d-&o-&t-&x-
183      &x+&t+&o+&d+;&d-&o-&t-&x-
184      &x+&t+&o+&d+;&d-&o-&t-&x-
185      &x+&t+&o+&d+;&d-&o-&t-&x-
186      &x+&t+&o+&d+;&d-&o-&t-&x-
187      &x+&t+&o+&d+;&d-&o-&t-&x-
188      &x+&t+&o+&d+;&d-&o-&t-&x-
189      &x+&t+&o+&d+;&d-&o-&t-&x-
190      &x+&t+&o+&d+;&d-&o-&t-&x-
191      &x+&t+&o+&d+;&d-&o-&t-&x-
192      &x+&t+&o+&d+;&d-&o-&t-&x-
193      &x+&t+&o+&d+;&d-&o-&t-&x-
194      &x+&t+&o+&d+;&d-&o-&t-&x-
195      &x+&t+&o+&d+;&d-&o-&t-&x-
196      &x+&t+&o+&d+;&d-&o-&t-&x-
197      &x+&t+&o+&d+;&d-&o-&t-&x-
198      &x+&t+&o+&d+;&d-&o-&t-&x-
199      &x+&t+&o+&d+;&d-&o-&t-&x-
200      &x+&t+&o+&d+;&d-&o-&t-&x-

```

$d+8q+16q-8d-8b+off8b-8o-8t-8x-$ $8x+8t+8o+8d+;$ $o1;8d-8o-8t-8x-$ $8x+8t+8o+nm8o-8t-8x-$
 $8x+8t+8o+8d+;$ $de;8d-8o-8t-8x-$ $8x+8t+8o+8d+;$ $8e+cm8p+38p-8o-8t-8x-$ $8x+8t+8o+8d+8q+r8q-8d-8o-8t-8x-$
 119
 120
 121
 122
 123
 124
 125

```

127      smhdata\
128
129      &x+&t+&o+&d+;amonth; ;lyear;&d-&o-&t-&x-
130
131      &x+&200000&+&zj)/dr/m/.05/.05/&t:text1/2/0/m/0/0/1.0/1.25/8/5m[63j]/&zj)/dr/m/.035/.05/&t-&x-
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153      &x+&zv/8/78/0/46/x/;uxfile/;uxfre;/.065/.91/.061/.61/&x-
154      &x+&m.wave\&m.mbs\&m.cross\&x-
155
156
157      &x+&t+&o+integrated absorption cross section relative&o-&t-&x-
158      &x+&t+&o+to ED-2 from 400 to 950 nm&o-&t-&x-
159
160      &x+&t+&o+&d+;ra;&d-&o-&t-
161
162      &x+&t+&o+Absorption efficiency coefficients for 15-mm&o-&t-&x-
163      &x+&t+&o+xenon flashlamp at 1000 A&o-&o+cm&p+-2&p-&o-&t-&x-
164
165      &x+&t+&o+&d+&g+e&g-&d- = A [1-B exp(-C&d+&g+r&g-&d-&b+N&b-&d+&a+1&a-&d-)] - (1-B) exp(-D&d+&g+r&g-&d-&b+N&b-&d+&a+1&a-&d-)
166      &x+&t+&o+A = &d+;      &g+&d-&o-&t-&x-      &x+&t+&o+B = &d+;
167      &x+&t+&o+where &d+&g+r&g-&d-&b+N&b-&d+&a+1&a-&d- is ln 10&p+20&p- Nd ions&o-&o+cm&p+-2&p-&o-&t-&x-
168      &x+&t+&o+cm&p+2&p-&o-&t-&x-      &x+&t+&o+C = &d+;      &g+&d-&o-&t-&x-      &x+&t+&o+D = &d+;      &g+&d-&o-&t-
169
170      &x+&t+&o+Judd-Gfelt parameters&o-&t-&x-      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+cm&p+2&p-&o-&t-
171      &x+&t+&o+&d+;two;&d+&e+&e-&d-;two;&d+&e+&e-&d-10&p+-20&p-&d-&o-&t-&x-      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+cm&p+2&p-&o-&t-
172      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+cm&p+2&p-&o-&t-
173      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+cm&p+2&p-&o-&t-
174      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+&d+&g+W&g-&d-&b+4&b-&o-&t-&x-      &x+&t+&o+cm&p+2&p-&o-&t-
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Appendix E: FILL-data Page Generator

Figure E-1 shows the general computer procedure for producing the handbook data pages. The role of FILL is seen to be that of creator of the input file needed by REDPP. FILL is a dialect of TRIX which is run under TRIX DCS, the TRIX portion of the data correlation system. The FILL program creates a set of definitions useful for creating the REDPP input file and modifies the glass type tables within the correlation system. It is invoked by the DCS command PRINTBOOK (the major command in FILL) which reads the fill dialect and then executes the FILL definition of PRINTBOOK to produce REDPP input files. FILL may also be invoked by the DCS command HANDBOOK which modifies the glass type tables and is used when preparing statistics, indices, etc. for the handbook.

The major steps executed by the PRINTBOOK command are shown in figure E-2. .BEGIN and .SETPAGES are two macros called upon by PRINTBOOK which do the tasks shown. These, in turn, call other macros to perform special tasks. The creation of the RUNRPP file for PROXY is done while the FILL dialect is being read by TRIX. PRINTBOOK requests a list of glasses to be printed and then prepares REDPP input files for each in turn. This operation is in two parts. First, the UX file for the glass is found, the data from DCS is obtained, reference names are reset, and the master format file (hereafter called Master) is opened. If the search for the UX file fails, the entire job is aborted and control passes to DCS. Second, the data and master are combined. This step invokes many special purpose routines which take care of data insertion, reference and note creation, and format changes. When the last glass is prepared, the PROXY file RUNRPP is completed and control returns to DCS.

Instead of a detailed explanation of the remainder of the FILL program, I present the major program parts in flow charts. The program and the minimal comments within it are provided for completeness although few will be able to understand the language.

MAJOR STEPS IN THE CREATION OF GLASS HANDBOOK DATA PAGES

Figure E-1

PRINT BOOK command

Figure E-2

FILL Program Flow Charts and Program

-79-

```

52 \*****
53 \***** PRINTBOOK *****
54 \*****
55
56 \/////////////////////////////////////////////////////////////////
57 \
58 \ THIS IS THE PRINTING COMMAND FOR FILL. A LIST OF GLASSES IS OBTAINED
59 \ AND THE DATA IS COMBINED WITH THE MASTER HANDBOOK FORMAT TO PROVIDE A FILE
60 \ FOR REDPP TO PRINT ON THE HARD COPY CAMERA. A PROXY INPUT FILE IS CREATFO
61 \ TO MAKE THE JOB OF RUNNING REDPP EASIER.
62 \
63 \ VARIABLES;
64 \
65 \ .FROMLIST - LIST OF GLASSES TO BE PRINTED
66 \ .NUMFROM - NUMBER OF GLASSES TO PRINT
67 \ .SAMPLID - CURRENT GLASS BEING PRINTED
68 \ RUNRPP - NAME OF PROXY INPUT FILE
69 \
70 \ MACROS;
71 \
72 \ .LIST - GETS A LIST OF THINGS (GLASSES)
73 \ .REPPFROM - REPLACE ABBREVIATIONS BY THE REAL THING (SIL => SILICATES)
74 \ .BEGIN - GET DATA, TRANSFER TO MNEMONICS, AND SET REFERENCE COUNTER
75 \ .SETPAGES - COMBINE DATA WITH MASTER TO CREATE PRINT FILE
76 \/////////////////////////////////////////////////////////////////
77
78 PRINTBOOK=<\
79
80 \.LIST(<^SAMPLES: >,< .FROMLIST>,< .NUMFROM>)^ .REPPFROM(< .FROMLIST>,< .NUMFROM>)^
81
82 \#NS(< .FROMLIST,< $(< .FROMLIST> )> ^ \ SORT THE GLASS LIST
83
84 \#DO(<\
85 \#NS(< .SAMPLID,< $(< .FROMLIST> )> ^ $(< .SAMPLID">?)^ .BEGIN^ .SETPAGES^
86
87 \>,< .NUMFROM>)^
88
89 \#WQ(RUNRPP,<ALLOUT RJET 6 TALK BOX Z88 :ALL$^>,P)^
90
91 \#WQ(RUNRPP,<DESTROY +PROXY">,P)^ #WQ(RUNRPP,,T)^
92
93
94 >-
95 \ EJECT PAGE

```



```

96 \*****
97 \*****.BEGIN*****
98 \*****
99 \*****
100 ///////////////////////////////////////////////////////////////////
101 //
102 OPEN GLASS DATA, SET REFERENCE COUNTERS, REPLACE LEADING DECIMALS WITH
103 ZEROS, TRANSFER THE DATA TO THE MNEMONICS, AND OPEN THE MASTER FILE
104 //
105 VARIABLES:
106 //
107 .SAMPLID      - CURRENT GLASS
108 DB            - NAME OF THE DATA BOOK FILE (GLASS NUMBER + "-DB")
109 UXFILE        - NAME OF UX GRAPHICS FILE FOR THIS GLASS
110 UXFRA         - FRAME NUMBER FOR ADSORPTION DATA
111 UXFRB         - FRAME NUMBER FOR FLUORESCENCE DATA
112 LIBRARY       - DCS LIBRARY CONTAINING GLASS DATA
113 RUNRPP        - PROXY INPUT FILE NAME
114 PVALUE        - A PROPERTY VALUE FOR THE GLASS
115 NUMPROP       - NUMBER OF PROPERTIES IN THE SYSTEM
116 USEDREF       - LIST OF REFERENCES IN USE
117 NRF           - NUMBER OF REFERENCES
118 //
119 MACROS:
120 //
121 .FINDLIB       - FINDS LOCATION OF THE GLASS DATA IN THE DCS LIBRARIES
122 .FINDPLOT      - FINDS UX FILE NAME AND FRAME NUMBERS FOR THIS GLASS
123 .GETFILE       - OPENS A FILE
124 .FILEDATA      - READ DATA FROM FILE
125 .PNTOMN        - TRANSFERS DATA FROM PROPERTY MACROS TO MNEMONICS
126 //
127 ///////////////////////////////////////////////////////////////////
128 .BEGIN<
129 //
130 .FINDLIB($SAMPLID,<.LIBRARY>) #NS(DB,$SAMPLID<-DB>)^
131 //
132 \ LOOK FOR UX FILE FOR THIS GLASS. IF NOT FOUND S T O P .
133 //
134 .FINDPLOT($SAMPLID,<UXFILE>,<UXFRA>,<#3K>)^ #NS(UXFRB,UXFRA+1)^
135 //
136 .GETFILE($SAMPLID,45,$.LIBRARY) .FILEDATA #SP($AB,1) #CF($SAMPLID,X)^
137 //
138 #WQ(RUNRPP,<REDPP> >DB< NOID. NOTIME. STARTP. 1 SETMUL. 16000 PAPERR. DEFONT. 4 FRAME. .12 .12 .01 .01>,P)^
139 //
140 #WQ(RUNRPP,<:BOX;BOX 288 GLASS HANDBOOK:ALL DONES\>,P)^
141 //
142 #DO(<\
143 //
144 //EQ{#GC(<.PVALUE>%D0,1),<.>,<#NS(<.PVALUE>%D0,<0> #(<$.PVALUE>%D0)>},
145 //
146 //SP(<.PVALUE>%D0,1)>
147 //
148 }^
149 //
150 >,.NUMPROP)^
151 //
152 .PNTOMN^
153 //
154 #NS(.USEDREF)^ #NS(.NRF,0)
155 //

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156 #FU(<MASTER>,340)^
157
158 >^
159 \ EJECT PAGE

159
158
157

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160 /
161 /
162 /
163 /
164 /
165 /
166 /
167 /
168 /
169 /
170 /
171 *****
172 ***** .SETPAGES *****
173 *****
174 /
175 /
176 /
177 THIS MACRO WILL ACCEPT TEXT FROM A MASTER FILE AND REPLACE
178 REFERENCES TO DATA MNEMONICS BY THE DATA VALUES, ADD REFERENCES WHERE
179 NEEDED (INCLUDING CONDITIONS ON THE VALUES), AND WRITE AN OUTPUT FILE
180 CONTAINING FULL TEXT TO BE PRINTED.
181 /
182 VARIABLES :
183 /
184 MNRE - TEMPORARY LOCATION OF MELT NUMBER AND DATE RECEIVED
185 DB - NAME OF THE DATA BOOK FILE (GLASS NUMBER + "-DB")
186 .TEMP - TEMPORARY
187 /
188 MACROS :
189 /
190 .GETFILE - GET AND OPEN A DATA FILE
191 .DBGETREFS - ADD REFERENCE INFORMATION TO THE DATA
192 .INSERT - FIND MNEMONICS AND REPLACE THEM BY DATA AND REFERENCES
193 AND TRANSFER TO OUTPUT FILE
194 .FIXLINE - CHANGES REDPP MACRO LINES IF NEEDED
195 .TITLE - INSERT TITLE INFO IN REDPP MACROS
196 /
197 /
198 /
199 THE FORM OF THE TEXT LINE ORIGINALLY IS :
200 /
201 PROPERTY_DESCRIPTION SYMBOL ; MNEMONIC ; UNITS
202 /
203 AFTER PROCESSING, THE LINE MAY LOOK LIKE THIS :
204 /
205 PROPERTY_DESCRIPTION (CONDITIONS) SYMBOL VALUE (REFERENCE) UNITS
206 /
207 /
208 /
209 .SETPAGES=<\
210 /
211 *****
212 ***** PAGE 0 *****
213 *****
214 /
215 /
216 /
217 PAGE ZERO CONTAINS REDPP PASS MACROS WHICH MUST BE
218 MODIFIED TO PRINT THE GLASS TITLE LINE ON TOP OF EACH PAGE. MOST OF
219 THIS PAGE IS TRANSFERRED VERBATIM. DEPENDING ON TITLE LENGTH, PART OF THE

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220 \ MACRO DEFINITION LINES MAY ALSO BE CHANGED BY THE ".FIXLINE" MACRO.
221 \
222 \ MAKE SURE BERYLLATE SAMPLE NUMBERS ARE UPPER CASE; INSERT THE TITLES
223 \ AND TRANSFER THE REST OF PAGE ZERO.
224 \
225 \////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
226 \
227 \ #NS(.TEXT,1;) .FIXLINE~ #WQ($DB,#GC(.TEXT,336),P)^ \ TRANSFER LINE 1
228 \
229 \ .INSERT(2,29)^ #SM(LL,<"B>,<%00>,<#SM(LL,<"B>,<#NS(LL,<">$LL)>,<%00>) >)^
230 \
231 \ TITLE COMPLETES THE REDPP PASS MACROS FOR CREATING THE HEADING
232 \ ON EACH PAGE OF THE HANDBOOK.
233 \
234 \ .TITLE(30,17,$MA)^ .TITLE(32,26,$LL)^
235 \
236 \ CONVERT THE GLASS TYPE TO UPPER CASE
237 \
238 \ #WQ(.TEMP,#GC(GT,2) )^ #DO(< #EQ(#GC(GT,1),,< #DX->,<#WQ(.TEMP,<">$GC)^>) >)^
239 \
240 \ .TITLE(31,26,$CN< >#RO(.TEMP,99) )^ #WQ(.TEMP,,D)^
241 \
242 \ .INSERT(33,75)^
243 \
244 \ EJECT PAGE

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245 \*****
246 \***** PAGE 1 *****
247 \*****
248 \*****
249 \*****
250 \*****
251 \ PAGE 1 CONTAINS STATUS, COMPOSITION, AND SUMMARY DATA.
252 \*****
253 \ THE MELT NUMBER AND DATE RECEIVED GET A SPECIAL FORM DEPENDING ON WHAT
254 \ DATA IS AVAILABLE. A DASH IS PRINTED ONLY IF NOTHING IS KNOWN.
255 \*****
256 \*****
257 \ #NS(.TEXT,#TM(76;)) ^ #WQ($DB,#SM(.TEXT,<,>)$ST#GC(.TEXT,999),P)^ \ STATUS
258 \
259 \ #NS(MNRE,
260 \
261 \ $EQ($MN,<UNKNOWN>,$MN)#EO($RE,<UNKNOWN>,$EQ($MN,<UNKNOWN>,<->),
262 \ $EO($MN,<UNKNOWN>,$RE,<,>$RE))
263 \
264 \ )^
265 \
266 \ #NS(.TEXT,#TM(77;)) ^ #WQ($DB,#SM(.TEXT,<,>)$MNRE#GC(.TEXT,99),P)^ \ MELT AND DATE
267 \
268 \*****
269 \***** COMPOSITION *****
270 \*****
271 \*****
272 \*****
273 \*****
274 \ COMPOSITION IS ADDED HERE WITH THE FIRST COMPOUND LAST
275 \ 13 LINES ARE SET ASIDE FOR THE COMPOSITION. WHOLE NUMBERS ARE CHANGED TO THE
276 \ FORM N.O THE MEASURED WT% AND IONS/CC ARE PLACED AT THE BOTTOM!
277 \ ALONG WITH THE COMPOUND IN WHICH THE NO IS FOUND.
278 \*****
279 \*****
280 \ VARIABLES:
281 \
282 \ .TEXT - LINE BEING TRANSFERED
283 \ .X - TEMPORARY
284 \ .Z - FUNCTION TO TRANSFORM DATA
285 \ .NUMCOMP - NUMBER OF COMPOUNDS IN THE GLASS
286 \ .CNUM - CURRENT COMPOUND BEING PRINTED
287 \
288 \ MACROS:
289 \
290 \ .COMPO - FORMATS COMPOSITION LINE
291 \*****
292 \*****
293 \ .INSERT(78,84)^
294 \
295 \ #NS(.CNUM,2)^ \ START WITH THE SECOND COMPOUND IF THERE IS MORE THAN ONE
296 \
297 \ #EO(2 .NUMCOMP,1,<%00>,<
298 \
299 \
300 \
301 \ #DO(< .COMPO($CNUM)^ #NS(.CNUM,.CNUM+1)^ >,.NUMCOMP-1
302 \
303 \ >)^
304 \
305 \

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305 .COMPO(1)^ \ INSERT FIRST COMPOUND
306
307 #DO(< #WQ($DB,< >,P) >,13-.NUMCOMP) ^ \ FILL REST OF SPACE WITH BLANK LINES
308
309 #WQ($DB,#TM(98;),P)^ \ TRANSFER LINE 98
310
311 #NS(.TEXT,#TM(99;)) \ INSERT MEASURED WT AND IONS/CC AND COMPOUND (LINES 99,100)
312
313 #EQ($WM,<UNKNOWN>,<#NS(.X,< ->>,<#NS(.X,$WM)>)^
314
315 #WQ($DB,#SM(.TEXT,< >);$X)^
316
317 #WQ($DB,#SM(.TEXT,< >)$COMPI#GC(.TEXT,99),P)^
318
319 #NS(.TEXT,#TM(100;)) #WQ($DB,#SM(.TEXT,< > NDI;>)$NDI#GC(.TEXT,99),P)^
320
321 #WQ($DB,#TM(101;),P)^
322
323 \*****
324 \***** SERIES *****
325 \*****
326
327 \
328 \
329 \SERIES DATA GOES HERE. IF THE GLASS IS A MEMBER OF A SERIES, THEN A LIST
330 \OF GLASSES IN THAT SERIES IS CREATED. THE SAMPLE ITSELF IS REMOVED
331 \FROM THAT LIST. BERYLLATE SAMPLE NUMBERS ARE CAPITALIZED, AND BLANKS
332 \ARE REPLACED BY COMMAS AND BLANKS.
333 \THE SERIES TYPE IS THEN PRINTED ALONG WITH THE SERIES MEMBERS IN "( )".
334 \THREE SUCH SERIES ARE ALLOWED (MORE MEANS A SPECIAL FIX).
335 \
336 \THE MNEMONIC "SE" CONTAINS A BLANK DELIMITED LIST OF SERIES LETTERS (FROM DCS)
337 \WHICH WHEN COMBINED WITH ".S" BECOME A LIST OF GLASSES IN THE SERIES.
338 \THE SAME SERIES LETTER WHEN COMBINED WITH ".C" BECOMES THE TYPE OF SERIES
339 \THE GLASSES REPRESENT.
340 \
341 \VARIABLES:
342 \
343 \ .SSAMPL - LIST OF GLASSES IN A SERIES
344 \ .Z - A FUNCTION WHICH TRANSFORMS DATA
345 \ .FONTON - REDPP FONT CONTROL (ON)
346 \ .FONTOFF - REDPP FONT CONTROL (OFF)
347 \ .TEXT - LINE BEING TRANSFERRED
348 \
349 \
350
351 #NS(.TEXT,#TM(102;))
352
353 #EQ(#GS(SE),<UNKNOWN>,<#WQ($DB,$.TEXT,P)>,< \ LINE 102
354
355 #NS(.SSAMPL, #(<$.$>$%$GS)< > )^ .Z($.SAMPLID< >)=$.SSAMPL^
356
357 .SSAMPL=#TM($,Z)^ .Z(< >,<B>)=$.SSAMPL^ .SSAMPL=$.Z(< >,<B>)^
358
359 #WQ($DB,$.TEXT#DO(<< >>,17)$,FONTON #(<$,C>$%$GS)< (>$,SSAMPL)< >$.FONTOFF,P)^
360
361 >)^
362
363 \ADD NEXT SERIES OR BLANK LINES.
364

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365      #EQ(#GS(SE),,<#WQ($DB,< >,P)>,< \ LINE 103
366
367      #NS(.SSAMPL, #(<$S>$%GS)< > )^ .Z($SAMPLID< > )=$S.SSAMPL^
368
369      .SSAMPL=#TM($Z)^ .Z(< >,<B> )=$S.SSAMPL^ .SSAMPL=$S.Z(< >,<^B> )^
370
371      #WQ($DB,#DO(<< >>,26)$S.FONTON #(<$C>$%GS)< (>$S.SSAMPL< )>$S.FONTOFF ,P)^
372
373      > )^
374
375      #EQ(#GS(SE),,<#WQ($DB,< >,P)>,< \ LINE 104
376
377      #NS(.SSAMPL, #(<$S>$%GS)< > )^ .Z($SAMPLID< > )=$S.SSAMPL^
378
379      .SSAMPL=#TM($Z)^ .Z(< >,<B> )=$S.SSAMPL^ .SSAMPL=$S.Z(< >,<^B> )^
380
381      #WQ($DB,#DO(<< >>,26)$S.FONTON #(<$C>$%GS)< (>$S.SSAMPL< )>$S.FONTOFF ,P)^
382
383      > )^
384
385 \ *****
386 \ ***** SUMMARY *****
387 \ *****
388 \
389 \ THE KNOWN QUANTITIES OF NLC, NLM, AND NTWOC, NTWOM ARE RENAMED
390 \ NL AND NTWO FOR USE IN THE SUMMARY SECTION. OTHERWISE, DATA IS DIRECTLY
391 \ INSERTED INTO THE MASTER.
392
393      #EQ($NLM,<UNKNOWN>,<#NS(NL,$NLC)>,<#NS(NL,#GS(NLM))> )^
394
395      #EQ($NTWOM,<UNKNOWN>,<#NS(NTWO,$NTWOC)>,<#NS(NTWO,#GS(NTWOM))> )^
396
397      .INSERT(105,126)^
398
399 \ EJECT PAGE

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400 \*****
401 \***** PAGE 2 *****
402 \*****
403 \
404 \
405 \
406 \ BEGINING WITH PAGE 2, REFERENCES WILL APPEAR WITH ALL DATA. ".DBGETREFS"
407 \ ATTACHES THE REFERENCE INFO TO THE DATA IN THE MACRO "PVALUE"
408 \ AND ".PNTOMN" TRANSFERS THIS DATA BACK TO THE MNEMONICS. ".ADDW13" ADDS
409 \ 1300 NM DATA IF THERE IS ANY. THE MASTER MUST BE REOPENED HERE
410 \ SINCE THE REFERENCE FILE MAY HAVE BEEN OPENED IN ITS PLACE.
411 \
412 \ A SPECIAL CHECK FOR A REFERENCE IS MADE FOR THE ABSORPTION "A" COEFFICIENT
413 \ "AA". IF THERE IS A REFERENCE, IT IS REMOVED AND THE PROPER VODEP RANGE IS
414 \ PUT IN THE TEXT.
415 \
416 \ MACROS:
417 \
418 \ .DBGETREFS - CHECK FOR AND ADD REFERENCES TO DATA
419 \ .PNTOMN - TRANSFER NEW DATA TO THE PROPERTY MNEMONICS
420 \ .ADDW13 - ADD 1300 NM DATA IF IT EXISTS
421 \ .VODEP400 - 400-950 NM RANGE FOR VODEP IS ADDED
422 \ .VODEP340 - 340-950 NM RANGE FOR VODEP IS ADDED
423 \
424 \
425 \
426 \ .DBGETREFS($,SAMPLID)^ .PNTOMN^ .ADDW13^ #FU(<MASTER>)^
427 \
428 \ .INSERT(127,163)^
429 \
430 \ #SM(AA,<#>,<#NS(AA,$ZSM) .VODEP400^>,< .VODEP340^>)^
431 \
432 \ .INSERT(165,181)^
433 \
434 \ EJECT PAGE

```



```

435 \***** PAGE 3 ****
436 \***** PAGE 3 ****
437 \***** PAGE 3 ****
438 \***** PAGE 3 ****
439 \***** PAGE 3 ****
440 \***** PAGE 3 ****
441 \ PAGE 3 HAS THREE SPECIAL CASES: BRANCHING RATIO FORMAT , 1300 NM DATA
442 \ COLUMN POSITION, AND TRIPLE EXPONENTIAL COEFFICIENTS.
443 \ FOR THE BRANCHING RATIO, THREE DECIMAL PLACES ARE
444 \ ASSURED. FOR THE 1300 NM DATA, IF IT IS NULL, THE COLUMNS ARE MOVED SO
445 \ THERE WILL NOT BE SO MUCH SPACE BETWEEN DATA AND UNITS. FOR TRIPLE
446 \ EXPONENTIAL COEFFICIENTS, A NEW VALUE IS CREATED FROM
447 \ T-A-C AND NAMED "XX".
448 \
449 \ VARIABLES:
450 \
451 \     CSX      - 1300 CROSS SECTION
452 \     XX       - THE "E" COEFFICIENT IN A TRIPLE EXP FIT
453 \     .BLANKS  - NULL OR A REDPP COMMAND TO INSERT BLANKS
454 \
455 \ MACRO:
456 \
457 \     .ROUND   - ROUNDS NUMERIC DATA TO SPECIFIED DECIMAL PLACES
458 \
459 \*****
460 \
461 \ FIX BRANCHING RATIO FORMAT (3 DECIMAL PLACES)
462 \
463 \EQI(%GC(BRA),5,,3,<#NS(BRA,$BRA<00>) >,4,<#NS(BRA,$BRA<0>) >)>~
464 \EQI(%GC(BRB),5,,3,<#NS(BRB,$BRB<00>) >,4,<#NS(BRB,$BRB<0>) >)>~
465 \EQI(%GC(BRC),5,,3,<#NS(BRC,$BRC<00>) >,4,<#NS(BRC,$BRC<0>) >)>~
466 \EQI(%GC(BRD),3,,3,<#NS(BRD,$BRD<00>) >,4,<#NS(BRD,$BRD<0>) >)>~
467 \
468 \ CALCULATE 1-A-C IF A AND C ARE KNOWN
469 \
470 \#ED($TA,<UNKNOWN>),<#NS(XX,<UNKNOWN>)>,<
471 \
472 \#ED(4,DEC) #NS(XX,1-TA-TC) #ED(4,INT)^ .ROUND(<XX>,6)^
473 \
474 \>~
475 \
476 \ INSERT EXTRA BLANKS IF THERE IS NO 1300 NM DATA
477 \
478 \#EQI(%CSX,,<
479 \
480 \ .INSERT(182,212)^ #NS(.BLANKS,<87/5/>) .INSERT(213,220) #NS(.BLANKS) .INSERT(221,236)^ >,
481 \
482 \ < .INSERT(182,236)^>
483 \
484 \>~
485 \
486 \ EJECT PAGE

```

```

487 \ *****
488 \ ***** PAGE 4 *****
489 \ *****
490 \ //////////////////////////////////////
491 \
492 \ PAGE 4 CONTAINS THE MOST CONDITIONS AND A FEW SPECIAL CASES WHERE
493 \ CONDITIONS DO NOT APPEAR ON THE SAME LINE AS THE DATA. THE REFERENCES
494 \ ARE ALSO PLACED HERE ON 13 LINES RESERVED FOR THEM.
495 \
496 \ VARIABLES:
497 \
498 \     .CONOK      - FLAG FOR ADDING CONDITIONS
499 \     .CONDITION  - CONDITION TO BE ADDED
500 \
501 \ //////////////////////////////////////
502 \
503 \ LINES 245 AND 247 ARE TO HAVE CONDITIONS PLACED ON SEPARATE
504 \ LINES. TURN THE "CONOK" FLAG OFF FOR THEM AND ADD THE CONDITIONS HERE.
505 \
506 \ .INSERT(237,244)^ #NS(.CONOK,<NO>) .INSERT(245,245)^
507 \
508 \ #EQ($.CONDITION, <#WQ($DB, < >, P)>, <#WQ($DB, < (>$.CONDITION<)>, P)> >)
509 \
510 \ .INSERT(247,247)^ #EQ($.CONDITION, <#WQ($DB, < >, P)>, <#WQ($DB, < (>$.CONDITION<)>, P)> >)
511 \
512 \ #NS(.CONOK, <YES>)^ .INSERT(249,273)^
513 \
514 \ #WQ($DB, #RQ(<'REFS', 9999) ) \ ADD THE REFERENCES TO THE TEXT
515 \
516 \ #DB(< #WQ($DB, < >, P)^ >, 13-.NRF)^ \ FILL REMAINING SPACE WITH BLANK LINES
517 \
518 \ .INSERT(287,291)^ \ TRANSFER THE LAST LINES AND CLOSE THE FILE
519 \
520 \ #WQ($DB,,T)
521 \
522 \ >^
523 \ EJECT PAGE

```

— 34 —

```

564
565 \ START THE LINE WITH 22 BLANKS AND TURN THE FONT ON
566 #WQ($DB,#DO(<< >>,22)$FONTOFF)~
567
568 \ GET THE COMPOUND AND WRITE IT IN THE LINE ALONG WITH A TAB TO THE NEXT FIELD
569 #NS(.TEXT,$COMPPX) #WQ($DB,$TEXT$.FONTOFF#DO(<< >>,12))
570
571 \ GET THE MOLE % AND ADJUST THE DECIMAL SO ALL WILL LINE UP
572 #NS(.TEXT,$COMMOXX) \ XX IS THE CURRENT COMPOUND NUMBER
573 #EQ($TEXT,<UNKNOWN>,,< #SM(.TEXT,<.>,<#SP(.TEXT,1)>,<#NS(.TEXT,$TEXT<.0>) )^ >)^
574 #NS(.VALUE,$TEXT) .CHECKZERO^ .ADJUSTDEC(<.TEXT>,5,10)^
575
576 \ ENCLOSE DATA WITH FONT CONTROL
577 .Z($VALUE,<->)=$TEXT^ .TEXT=$Z($FONTOFF $VALUE $FONTOFF,$FONTOFF<->$FONTOFF)^
578 \ TAB (USING BLANKS) TO THE NEXT BOUNDARY
579 #WQ($DB,$TEXT #EQ($VALUE,<UNKNOWN>,<< >>,<#DO(<< >>,<#GC(.VALUE) )>) )^
580
581 \ GET THE WT % (AND REPEAT THE PROCESS)
582 #NS(.TEXT,$COMWTTX)
583 #EQ($TEXT,<UNKNOWN>,,< #SM(.TEXT,<.>,<#SP(.TEXT,1)>,<#NS(.TEXT,$TEXT<.0>) )^ >)^
584 #NS(.VALUE,$TEXT) .CHECKZERO^ .ADJUSTDEC(<.TEXT>,5,10)^
585
586 .Z($VALUE,<->)=$TEXT^ .TEXT=$Z($FONTOFF $VALUE $FONTOFF,$FONTOFF<->$FONTOFF)^
587
588 \ WRITE THE WT % AND TERMINATE THE LINE
589 #WQ($DB,#TM($TEXT),P)^
590
591 >^
592 \ EJECT PAGE

```

```

825 \*****\*****\*****\*****\*****\*****\*****\*****
826 \*****\*****\*****\*****\*****\*****\*****\*****
827 \*****\*****\*****\*****\*****\*****\*****\*****
828 \*****\*****\*****\*****\*****\*****\*****\*****
829 \*****\*****\*****\*****\*****\*****\*****\*****
830 \*****\*****\*****\*****\*****\*****\*****\*****
831 \THIS MACRO PATCHES THE REDPP MACROS FOR THE TITLE LINE. THESE
832 \MACROS CONTAIN A CHARACTER COUNT AND A TRAILING PERIOD. THE COUNT MUST
833 \BE CALCULATED USING ALL CHARACTERS (PRINTABLE OR NOT) AND
834 \THE PERIOD MUST RETAIN ITS POSITION.
835 \
836 \VARIABLES :
837 \
838 \      .BCTEXT - TEXT BEFORE THE CHARACTER COUNT
839 \      .ACTEXT - TEXT AFTER THE CHARACTER COUNT
840 \      .NCHAR  - THE NUMBER OF CHARACTERS FROM THE COUNT ON
841 \      .NEWT   - THE NEW TEXT AFTER THE COUNT (NO TRAILING BLANKS)
842 \
843 \ARGUMENTS:
844 \
845 \      LINE      - LINE NUMBER IN MASTER FILE OF THE TITLE MACRO
846 \      COUNT     - CURRENT COUNT FOR THIS MACRO (# CHARACTERS IN LINE)
847 \      STRING    - TEXT TO BE PUT IN THE MACRO
848 \
849 \*****\*****\*****\*****\*****\*****\*****\*****
850 \
851 \TITLE(<LINE>,<COUNT>,<STRING>)=<<
852 \
853 \      #NS(.TEXT,#TM(LINE;)) ) #NS(.BCTEXT,#SM(.TEXT,<COUNT>)) \ GET TEXT BEFORE COUNT
854 \
855 \      #NS(.NCHAR,#GC(.TEXT)-#GC(.BCTEXT)) \ CALC NUMBER OF CHAR IN REST OF TEXT
856 \
857 \      #NS(.ACTEXT,#SM(.TEXT,<;>)) \ GET TEXT BETWEEN COUNT AND ";"
858 \
859 \      #NS(.ATEXT,#TM(#SM(.TEXT,<.;>))) \ GET TEXT TO "."
860 \
861 \      \ INSERT TITLE AT POSITION OF ";" AND GRAB 56 CHARACTERS OF THE RESULT
862 \
863 \      #NS(.NEWT,$.ACTEXT<STRING>$.ATEXT)^#NS(.TEXT,#GC(.NEWT,56))
864 \
865 \      \ COMBINE TEXT BEFORE COUNT, NEW COUNT AND NEW TEXT AND ADD A "."
866 \
867 \      #WQ($DB,$.BCTEXT #(#GC(.TEXT)-1) $.TEXT #DO(<<>>,.NCHAR-#GC(.TEXT)-3)<.>,P)^
868 \
869 \      \ IF THERE ARE MORE THAN 56 CHARACTERS IN THE NEW LINE
870 \      \ THEN MAKE AN EXTRA LINE CONTAINING THE REMAINDER.
871 \
872 \      #GE(#GC(.TEXT),#GC(.NEWT),<%00>,<
873 \
874 \      #NS(.COWNT,#GC(.NEWT)-#GC(.TEXT)) #NS(.REST,#GC(.NEWT,999))^
875 \
876 \      #WQ($DB,#DO(<<>>,18) \ PAD WITH BLANKS TO START OF CONTINUATION LINE
877 \
878 \      \ INSERT THE COUNT (IN THE CORRECT COLUMN)
879 \
880 \      #EQ(#GC(.COWNT),1,<<>$.COWNT<>>,$.COWNT<>>).REST
881 \
882 \      #DO(<<>>,.NCHAR-#GC(.REST)-4)<.>,P)^ \ PAD WITH BLANKS, ADD THE "." AND END THE LINE
883 \
884 \>-

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685 >
686 \ EJECT PAGE

```

867 \*****
888 \***** INSERT *****
899 \*****
900
901 ///////////////////////////////////////////////////////////////////
902
903 THE MAJOR WORK IS DONE HERE. A LINE OF TEXT FROM THE MASTER FILE IS
904 OBTAINED, SEMICOLON PAIRS AND THE ENCLOSED GLASS PROPERTY MNEMONICS
905 ARE FOUND. THE MNEMONICS ARE REPLACED BY DATA REFERENCES ARE
906 ADDED IF NEEDED, AND THE LINE IS WRITTEN TO THE OUTPUT FILE.
907
908 VARIABLES:
909
910 .LINE      - CURRENT MASTER FILE TEXT LINE
911 .REF       - REFERENCE FOR THE DATA IN THE FORM [A,B]
912 .TEXT      - CURRENT TEXT FROM MASTER
913 .VALUE     - CURRENT DATA VALUE
914 .BTEXT     - MASTER FILE TEXT BEFORE THE DATA VALUE
915 .ATEXT     - MASTER FILE TEXT AFTER THE DATA VALUE
916 .BLANKS    - NULL OR REDPP COMMAND TO ADD BLANKS TO THE TEXT
917
918 MACROS:
919
920 .REPVALUE  - GETS MNEMONICS FROM MASTER TEXT AND
921              CONVERTS THEM TO DATA VALUES AND ADDS REFERENCES
922 .FIXVALUE  - CORRECTS "+-" NOTATION TO REAL THING
923
924 ARGUMENTS:
925
926 START     - FIRST LINE OF MASTER TO TRANSFER
927 END       - LAST LINE OF MASTER TO TRANSFER
928
929 ///////////////////////////////////////////////////////////////////
930
931 .INSERT(<START>,<END>)=<\
932
933 \ SELECT A LINE OF THE MASTER TO TRANSFER AND STORE IT INTO '.TEXT'
934
935 #NS(.LINE,START)-
936
937 .DO(< #NS(.REF)^ #NS(.TEXT,#TM(.LINE;)) ^
938
939 \ FOR EACH TEXT LINE, LOOK FOR SEMICOLONS WHICH DELIMIT THE MNEMONICS
940 \ WHICH ARE TO BE REPLACED BY VALUES FROM THE DATA. IF THERE ARE NO
941 \ SUCH REPLACEMENTS (IE. NO SEMICOLONS) THEN TRANSFER THE LINE TO THE
942 \ OUTPUT DATA BOOK FILE 'DB' CONTINUE TO LOOK FOR REPLACEMENTS UNTIL ALL ARE
943 \ DONE. THERE MAY BE MORE THAN ONE DATA VALUE PER LINE.
944
945 #DO(<\
946
947     #SM(.TEXT,<;>,<
948
949         < .REPVALUE^ #SM(.VALUE,< +->,< .FIXVALUE^,<200) #WO($DB,$BTEXT $BLANKS $VALUE)^ >,<
950
951         < #DX^
952
953     )-
954
955 >)^
956

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747 \ CHECK THE REFERENCE NAME TO SEE IF THERE WAS A REFERENCE. IF SO, ADD THE
748 \ REFERENCE NAME TO THE TEXT AFTER THE VALUE IN THE FIRST BLANK SPOT BIG
749 \ ENOUGH TO HOLD THE REFERENCE. IF NO REFERENCE, TRANSFER THE LINE UNTOUCHED.
750 \ MAKE SPECIAL CHECK FOR POWER OF TEN NOTATION AND PUT REFERENCES AFTER IT
751 \ THE CLOSING BRACKET IN THE REFERENCE IS ADDED HERE.
752
753 #EQ($REF,,
754
755 <#EQ($VALUE,<->,< \ IF DATA IS "-" THEN REMOVE POWER OF TEN IF PRESENT
756
757 #SM(.ATEXT,<&D+&E+>,<#NS(.TEXT, #SM(.ATEXT,<&P->,<%00>)#GC(.ATEXT,9999) )>,<%00>)
758
759 >,<%00>) #WQ($DB,#EQ($TEXT,< >,$.TEXT),P)
760
761
762
763
764 <#NS(.ATEXT, #SM(.ATEXT,<&D+&E+>,< \ INSERT REF AFTER POWER NOTATION IF PRESENT
765
766 <<&D+&E+>#SM(.ATEXT,<&P->)<&P-> $REF<1>#GC(.ATEXT,9999)>,<
767
768 << >$REF<1>$ATEXT>) )
769
770 #WQ($DB,$.ATEXT,P)- \ TERMINATE THE LINE
771
772 >)^
773
774 #NS(.LINE,.LINE+1)-
775
776 >,END-START+1)^
777 >^
778 \ EJECT PAGE

```



```

779 \*****
780 \*****.REPVALUE *****
781 \*****
782 \
783 \
784 \
785 \ THIS MACRO FINDS THE MNEMONIC IN THE TEXT FILE , CONVERTS IT TO A VALUE
786 \ AND CHECKS FOR REFERENCES. THE TEXT BEFORE AND AFTER THE VALUE ARE SET
787 \ HERE.
788 \
789 \ VARIABLE:
790 \
791 \ .BTEXT      - TEXT BEFORE THE DATA
792 \ .ATEXT      - TEXT AFTER THE DATA
793 \ .VALUE      - MNEMONIC AND THEN DATA TO BE ADDED
794 \
795 \ MACROS :
796 \
797 \ .REFVALUE   - CHECKS FOR REFERENCES AND SETS THEM IF NEEDED
798 \
799 \
800 \
801 .REPVALUE=<\
802
803 #NS(.BTEXT,$XSM) \ SAVE TEXT BEFORE THE DATA
804
805 #NS(.VALUE,#SM(.TEXT,<;>)) \ GET THE MNEMONIC BETWEEN THE ";" PAIRS
806
807 #NS(.VALUE,#(<$>#GS(.VALUE))) \ CONVERT MNEMONIC TO DATA VALUE
808
809 #NS(.ATEXT,#GC(.TEXT,999)) \ GET TEXT AFTER THE DATA
810
811 \ IF THE DATA IS NOT KNOWN, REPLACE BY "-" OTHERWISE CHECK REFERENCES
812 \ RESET THE TEXT TO THAT AFTER THE DATA SO CAN CHECK FOR MORE ";"
813
814 #EQ($.VALUE,<UNKNOWN>,<#NS(.VALUE,<->>)>,<.REFVALUE^>) #NS(.TEXT,$.ATEXT)^
815
816 >^
817 \ EJECT PAGE

```

```

818 \*****
819 \*****.REFVALUE*****
820 \*****
821
822 \
823 \
824 \ THIS MACRO SETS THE REFERENCE NAME, AND CHECKS FOR NOTES OR
825 \ CONDITIONS TO BE ADDED TO THE TEXT. IF NO REFERENCE, IT DOES NOTHING.
826 \
827 \ THE FORMAT OF THE DATA WHEN A REFERENCE IS PRESENT IS:
828 \
829 \ DATA**REF-LETTER [NOTES] (CONDITIONS)
830 \
831 \ VARIABLES :
832 \ .REFER - THE DCS REFERENCE MNEMONIC
833 \ .VALUE - THE DATA VALUE AFTER THE REFERENCE INFO IS REMOVED
834 \ .REFVAL - THE INFO AFTER THE DCS REFERENCE LETTER IN THE VALUE
835 \
836 \ MACROS :
837 \ .SETREFN - CREATES A UNIQUE REFERENCE NAME OF THE FORM [A
838 \ .NOTEREF - ADDS A NOTE TO THE DATA
839 \ .CONREF - ADDS A CONDITION TO THE TEXT
840 \
841 \ LOOK FOR A '*' IN THE VALUE. IF IT IS THERE, THEN A REFERENCE EXISTS.
842 \ GRAB THE DCS REFERENCE NAME (IT'S JUST AFTER THE '*').
843 \ STORE THE REST OF THE ORIGINAL VALUE IN 'REFVAL'
844 \ RESET THE VALUE TO JUST THE DATA (NO REFERENCE OR CONDITION INFO),
845 \ SET THE MAJOR REFERENCE NAME FOR THE DATA, AND CHECK FOR NOTES OR CONDITIONS
846 \ FOR THIS DATA.
847 \
848 \
849 \
850 .REFVALUE=<\
851
852 *SM(.VALUE,<*>),
853
854 \ GET THE DCS REFERENCE LETTER, AND GET THE NOTES AND CONDITIONS
855
856 <#NS(.REFER,#GC(.VALUE,1)) > #NS(.REFVAL,#GC(.VALUE,99)) >
857
858 #NS(.VALUE,$XSM) .SETREFN \ EXTRACT THE DATA VALUE AND SET THE REFERENCE NAME
859
860 *SM(.REFVAL,<[>,<.NOTEREF>,<%00>) \ IF THERE IS A NOTE, GET IT
861
862 *SM(.REFVAL,<[>,<.CONREF>,<%00>) >, \ IF THERE IS A CONDITION, GET IT
863
864 <#NS(.CONDITION)> \ NULL THE CONDITION
865
866 )^
867
868 >^
869 \*****.SETREFN*****
870 \*****.SETREFN*****
871 \*****
872
873 \
874 \
875 \ THIS MACRO SETS THE REFERENCE NAME BY CHECKING FOR
876 \ A PREVIOUS REFERENCE TO THE SAME DCS REFERENCE NAME. IF SUCH A
877 \ REFERENCE EXISTS, THE OLD TEXT REFERENCE IS USED. IF NO PREVIOUS

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878 \ REFERENCE IS FOUND, A NEW REFERENCE IS CREATED AND ADDED TO THE LIST
879 \ OF USED REFERENCE NAMES. THE REFERENCE NAME AT THIS POINT IS OF THE FORM
880 \ [A] THE CLOSING BRACKET IS ADDED WHEN THE REFERENCE QUEUE IS WRITTEN
881 \ AND WHEN THE FINAL REFERENCE IS FORMED. THE REFERENCE IS ADDED TO
882 \ THE QUEUE "REFS"
883 \ THE REFERENCE QUEUE CONTAINS THE TEXT TO BE PRINTED AT THE BOTTOM
884 \ OF THE PAGE. THESE LINES CONTAIN SINGLE REFERENCES OR NOTES
885 \ AND LOOK LIKE :
886 \
887 \ [A] HOYA
888 \ [C] 3.9 @ 25 C
889 \
890 \
891 \ VARIABLES :
892 \
893 \ .USEDREF - A LIST OF PREVIOUSLY USED REFERENCE NAMES
894 \           ( IT HAS THE FORM 'DCS_NAME ( TEXT_NAME ' )
895 \ .REF - THE TEXT REFERENCE ( ' [ TEXT NAME ' )
896 \ .NRF - THE NUMBER OF REFERENCES IN THE QUEUE "REFS"
897 \ .REFNAME - THE REFERENCE (SUCH AS "HOYA" ); * IS ONE CHARACTER
898 \ .REFERENS - ACTUAL REFERENCE
899 \
900 \
901 \
902 \
903 \ SETREFN=<\
904 \
905 \ #SM(.USEDREF,$.REFER<I>,\ LOOK FOR THIS REFERENCE
906 \
907 \ <#NS(.REF,<I>#GC(.USEDREF,1) ) #SP(.USEDREF,1) >,\ USE EXISTING REF LETTER
908 \
909 \ <#NS(.REF,<I>#GC(%AB,1) ) #NS(.USEDREF,$.USEDREF<>$REFER$.REF) \ GET NEW REF LETTER
910 \
911 \ LOOK FOR "N" REFERENCE -- IT'S REALLY A NOTE
912 \ GET FULL REFERENCE OR NOTE
913 \
914 \ #NS(.REFERENS, #EQ($REFER,<N>,<$#(GC(.REFVAL,999) 2:GC(.REFVAL))>,<#(<$REFNAME>$REFER)> ) )
915 \
916 \ ADD TO REFERENCE QUEUE - DON'T COMPRESS REF LETTER BETWEEN "I" AND "J"
917 \
918 \ #NS(.NRF, .NRF+1) #W(<'REFS',#DO(<<>>,<2><&X&T>$.REF<1&0>$.REFERENS<60-&T-&X->, P) >
919 \
920 \
921 \
922 \
923 \ EJECT PAGE

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924 \*****
925 \*****.NOTEREF *****
926 \*****
927
928 \
929
930 THIS MACRO CREATES A NOTE AT THE BOTTOM OF THE PAGE . THE FORM
931 OF THE NOTE IS LIKE A REFERENCE :
932
933 [C] NOTES_STUFF
934
935 TWO SEARCHES FOR NOTES ARE MADE . SUCH NOTES ARE NOT GIVEN SEPARATE
936 NAMES, THE DATA REFERENCE IS BUILT UPON SO THAT IT MAY HAVE THE FORM
937 [A,C] . THE NOTE AND REFERENCE LETTER ARE PUT IN THE REFERENCE QUEUE
938
939 VARIABLES :
940 .REFNOTE - THE TEXT TO BE IN THE NOTE ( FOUND BETWEEN 'I' AND 'J' )
941 .REFN - TEMPORARY VALUE OF THE REFERENCE NAME ( A SINGLE CHARACTER )
942 .REFVAL - NOTES AND REFERENCES
943
944 MACROS:
945
946 .FIXTHINGS - CHANGES FUNNY SYMBOLS TO REAL THING
947
948 \
949
950 .NOTEREF=<\
951
952 #NS(.REFN,#GC(%AB,)) #NS(.REFNOTE,#SM(.REFVAL,<J>)) \ GET REF LETTER AND NOTE
953
954 #SM(.REFVAL,<I>,\ LOOK FOR A SECOND NOTE AND ADD TO PREVIOUS (IF IT EXISTS)
955
956 <#NS(.REFNOTE,$.REFNOTE< ; >#SM(.REFVAL,<J>))>,
957
958 <ZOO>
959
960 )^
961
962 .FIXTHINGS(<.REFNOTE>)^ \ REPLACE SPECIAL SYMBOLS WITH SOMETHING PRINTABLE
963
964 \ STORE THE COMPLETE NOTE - DON'T COMPRESS REF LETTER BETWEEN "[" & "]"
965
966 #WQ(<'REFS>,#DO(<< >>,2)<X+&T+><I>$.REFN<J&O+ >$.REFNOTE<.&O-&T-&X->,P)
967
968 \ IF THERE IS NO PREVIOUS REFERENCE FOR THIS PROPERTY, PUT A "I" IN FRONT OF
969 \ THE REFERENCE LETTER. OTHERWISE, ADD A "," AND NEW REFERENCE LETTER
970 \ TO THE EXISTING REFERENCE.
971
972 #NS(.NRF,.NRF+1) #NS(.REF,#EQ($.REF,,<I>,$.REF,<J>)$$.REFN )^
973
974 >^
975
976 \
977 \*****
978 \*****.CONREF *****
979 \*****
980
981 \
982
983 THIS MACRO ADDS CONDITIONS TO THE TEXT. THE CONDITIONS ARE STORED

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984 \ IN THE REFERENCES BETWEEN '(' AND ')' , THESE ARE ADDED TO THE TEXT \
985 BEFORE THE DATA VALUE EXCEPT IN SPECIAL CASES WHERE THEY ARE \
986 ON A SEPARATE LINE. \
987 THE CONDITION IS SURROUNDED BY ( ) IN THE TEXT LINE. \
988 THE CONDITIONS ARE INSERTED ONLY IF THE CODITION FLAG IS "YES", \
989 \ \
990 VARIABLES : \
991 \ \
992 .CONDITION - THE TEXT BETWEEN '(' AND ')' IN A REFERENCE \
993 .CONOK - CONDITION FLAG (YES => ADD CONDITION) \
994 .REFVAL - REFERENCES AND CONDITIONS \
995 .BTEXT - TEXT BEFORE THE DATA VALUE \
996 .FONTON - REDPP FONT CONTROL (ON) \
997 .FONTOFF - REDPP FONT CONTROL (OFF) \
998 \ \
999 MACROS: \
1000 \ \
1001 .FIXTHINGS - CHANGE FUNNY CHARACTERS TO THE REAL THING \
1002 \ \
1003 //////////////////////////////////////////////////////////////////// \
1004 \ \
1005 .CONREF=<\
1006 \
1007 \ GET THE CONDITION AND REPLACE FUNNY SYMBOLS IT IT
1008 #NS(.CONDITION,#SM(.REFVAL,<)> ) .FIXTHINGS(<(.CONDITION)>)^
1009 \
1010 \ IF OK TO DO SO, INSERT THE CONDITION IN THE TEXT BEFORE THE DATA VALUE
1011 \ PUTTING IT WITHIN THE EXISTING FONT CONTROL (IF NONE, ADD IT).
1012 \
1013 #EQ(.CONOK,<NO>,<%00>,<
1014 #NS(.BTEXT, #SM(.BTEXT,<&0->,<$$SM< (>$.CONDITION<)><&0->#GC(.BTEXT,9999) >,
1015 << >$.FONTON<(>$.CONDITION<)>$.FONTOFF$.BTEXT> ) ^
1016 >)^
1017 >)^
1018 >^
1019 >^
1020 >^
1021 >^
1022 >^
1023 \ EJECT PAGE

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1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039 \ TRANSFER DATA FROM ".PVALUE" MACROS TO ".PNAME" MACROS (THE MNEMONICS)
1040
1041 .PNTOMN=< #DO(< #NS( #(<$ .PNAME>XDO), #(<$ .PVALUE>XDO) ) >, .NUMPROP)^ >^
1042
1043
1044
1045
1046
1047 \ THESE MACROS INSERT THE RANGE OVER WHICH VODEP WAS
1048 \ RUN INTO THE TEXT ON PAGE 2. THE RANGE IS CHOSEN BY THE PRESENCE OF A
1049 \ REFERENCE FOR THE "AA" COEFFICIENT (REF => 400-950).
1050
1051 .VODEP400=< #WQ($DB, #DO(< << >>, 4)<8X+8T+80+(400 TO 950 NM):&D-&T-8X->, P) >^
1052 .VODEP340=< #WQ($DB, #DO(< << >>, 4)<8X+8T+80+(340 TO 950 NM):&D-&T-8X->, P) >^
1053
1054
1055
1056
1057
1058
1059 \ SPECIAL SYMBOLS USED IN DCS ARE TRANSFORMED TO REDPP SYMBOLS FOR PRINTING
1060
1061 .FIXTHINGS(<THING>)=<\
1062
1063 .Z(< ^C>)= $THING^ THING=$ .Z(<&M1.DEG$^ ^C>)^
1064
1065 .Z(<MG/CM2/DAY>)= $THING^
1066
1067 THING=$ .Z(<MG&D-^, &D+CM&P+-2&P-&D-^, &D+DAY&P+-1&P->)^
1068
1069 .Z(< +->)= $THING^ THING=$ .Z(<&D+&E++&E-&D->)^
1070
1071 >^
1072
1073
1074
1075
1076 \ THE PLUS-MINUS FOR A VALUE IS " +-" IN DCS AND IS TRANSFORMED TO
1077 \ A PLUS OVER MINUS (WITHOUT THE SPACE) FOR PRINTING
1078
1079 .FIXVALUE=<\
1080
1081 .Z(< +->)= $ .VALUE^ .VALUE=$ .Z(<&D+&E++&E-&D->)^
1082
1083 >^

```

```
1084 \*****
1085 \*****.CHECKZERO *****
1086 \*****
1087
1088 \ LEADING DECIMAL POINTS ARE CHANGED TO "0."
1089
1090 .CHECKZERO=<\
1091
1092     #EQ(#GC(.TEXT,1),<.,>,<#NS(.TEXT,<0>$.TEXT) >,<#SP(.TEXT,1)>)<~
1093
1094 >~
1095 \*****
1096 \*****.FIXLINE *****
1097 \*****
1098
1099 \ REDPP HAS THE NUMBER OF PASS MACRO LINES STORED IN LINE 1. IF THE COMMON NAME
1100 \ AND THE GLASS TYPE ARE LONG, THEY WILL NOT FIT IN THE ONE LINE MACRO
1101 \ PROVIDED FOR THEM. ".TITLE" WILL INCREASE THE MACRO SIZE AND THIS
1102 \ MACRO (.FIXLINE) INFORMS REDPP OF THE CHANGE.
1103
1104 .FIXLINE=<\
1105
1106     #NS(.TEMP,#GC(CN)+#(#GC(6T)*2) )<~
1107
1108     #GE(.TEMP,30,<,.Z(<33>)=$.TEXT" ,TEXT=$.Z(<34>)<~>,<%00>)<~
1109
1110 >~
1111 \ EJECT PAGE
```

```

1112 \*****
1113 \*****.WT3 *****
1114 \*****
1115 \
1116 \ THIS IS A LIST OF ALL GLASSES WITH 1300 NM DATA
1117 \
1118 .WT3=< 1009 1004 3073 3044 5019 6501 5041 7503 >^
1119 \*****
1120 \*****.ADDW13 *****
1121 \*****
1122 \
1123 \
1124 \
1125 \ IF 1300 NM DATA EXISTS FOR A GLASS, THE DATA IS OBTAINED FROM THE NOTE
1126 \ FOR THAT GLASS AND STORED IN "PWX", "CSX", AND "ELX".
1127 \ THE DCS REFERENCE LETTER "Q" IS ADDED TO THE DATA (ALL DATA CAME FROM
1128 \ ONE ARTICLE).
1129 \
1130 \VARIABLES:
1131 \
1132 \.SAMPLID - SAMPLE NUMBER OF THE GLASS
1133 \.NOTE13 - THE 1300 NM NOTE IN DCS
1134 \ELX - EFFECTIVE LINEWIDTH
1135 \PWX - PEAK WAVELENGTH
1136 \CSX - CROSS SECTION (TIMES E-20 CM2)
1137 \
1138 \MACROS:
1139 \
1140 \.GETFILE - OPEN A FILE
1141 \.WT3 - LIST OF GLASSES WITH 1300 NM DATA
1142 \
1143 \
1144 \
1145 .ADDW13=<\
1146 \ SEARCH THE 1300 NM DATA FOR THIS GLASS. IF NOT FOUND, NULL THE 1300 NM DATA
1147 \
1148 #SM(.WT3,< >$.SAMPLID< >,<
1149 \
1150 \ 1300 NM DATA EXISTS. GET IT FROM THE "Q" REFERENCE.
1151 \
1152 .GETFILE(<DATA_NOTE>,80,<DCSLIB>) 1;1_#CR(1,14)< ~*[ >$.SAMPLID< ]*- >^ [;1_<[Q]>^
1153 \
1154 #SF(<#NS(.NOTE13,#TM([;]) ) \ GRAB THE REFERENCE (IF THERE)
1155 \
1156 #SM(.NOTE13,<,>,<X00>,<#PS(<1.3 MICRON NOTE BAD FOR >$.SAMPLID"?>)>^
1157 \
1158 #NS(PWX,<(<#GS(.NOTE13)<)>#Q> )^
1159 \
1160 #SM(.NOTE13,<,>,<X00>,<#PS(<ERROR IN 1.3 MICRON NOTE FOR >$.SAMPLID"?>)>^
1161 \
1162 #NS(ELX,<(<#GS(.NOTE13)<)>#Q> )^
1163 \
1164 #SM(.NOTE13,<,>,<X00>,<#PS(<ERROR IN 1.3 MICRON NOTE FOR >$.SAMPLID"?>)> )
1165 \
1166 #NS(CSX,<(<#GS(.NOTE13)<&D+&E+~&E-&D-10&P+-20&P-)>#Q> )^
1167 \
1168 >,<#PS(<COULD NOT FIND THE 1.3 MICRON NOTE FOR>$.SAMPLID"?>)>^
1169 \
1170 >,<#NS(CSX) #NS(PWX) #NS(ELX)>)^
1171 \

```

-ROT-

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```

1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188 *****
1189 ***** DBGETREFS *****
1190 *****
1191
1192
1193
1194 THE DCS REFERENCE FILE IS CHECKED TO SEE IF THERE ARE REFERENCES FOR A GLASS.
1195 IF THERE ARE, THE START AND END LINES IN THE REFERENCE FILE ARE FOUND
1196 AND THE REFERENCES ARE ADDED TO THE DATA.
1197
1198 VARIABLES:
1199
1200 .START - START OF A REFERENCE
1201 .END - END OF A REFERENCES
1202 .REFSAMPL - A LIST OF GLASSES WITH REFERENCES
1203
1204 MACROS:
1205
1206 .SETREFS - SETS DCS LETTER REFERENCES TO THE REAL REFERENCE
1207 .REFSAMPL - LIST OF GLASSES WHICH HAVE REFERENCES FOR SOME PROPERTY
1208 .GETFILE - GETS AND OPENS A FILE
1209 .DBREFSET - ADDS REFERENCE INFO TO DATA
1210
1211 ARGUMENTS :
1212
1213 SAMPLID - THE GLASS NUMBER WHOS REFERENCES ARE DESIRED
1214
1215
1216 .DBGETREFS(<SAMPLID>)=<\
1217
1218
1219 .SETREFS^ \ EQUATE DCS REFERENCE LETTERS TO THE TRUE REFERENCE (DONE ONCE)
1220
1221 *SM(.REFSAMPL,<SAMPLID>,\ SEE IF REFERENCE FOR THIS GLASS; IF NOT QUIT
1222
1223 \ THERE IS A REFERENCE: OPEN THE REFERENCE FILE AND GET THE LOCATION
1224 \ OF THE REFERENCE DATA FOR THIS GLASS.
1225
1226 < .GETFILE(<DATA_REF>,<DCSLIB>)^ .REFSTART; ]_#CR(1,14)< -*[ SAMPLID ]*- >^
1227
1228 #NS(.START,[+1]^ .START+1; ]_#CR(1,13)< -*[ END ]*- >^ #NS(.END,[+1]^
1229
1230 \ ADD THE REFERENCE INFO TO THE DATA
1231
1232 #DO(< .DBREFSET(2DO) > ,.START,.END)^
1233
1234 >,<200>)^
1235
1236 #SP(.REFSAMPL,1)^

```

```

1237 >^
1238 \*****
1239 \***** DBREFSET *****
1240 \*****
1241 \*****
1242 \
1243 \
1244 \
1245 \ REFERENCES ARE STORED IN THE FOLLOWING FORMAT BY DCS:
1246 \
1247 \ PROPERTY-MNEMONIC REFERENCE-LETTER [NOTES] (CONDITIONS)
1248 \
1249 \ THE DATA VALUES ARE MODIFIED SO THAT THEY HAVE THE FORM:
1250 \
1251 \ VALUE**REFERENCE-LETTER [NOTES] (CONDITIONS)
1252 \
1253 \ VARIABLES:
1254 \
1255 \ .REFTEXT - REFERENCE TEXT FROM DCS
1256 \ .PROPERTY - THE PROPERTY THE REFERENCE REFERS TO
1257 \ .REFN - THE DCS REFERENCE LETTER
1258 \ .PVALUE - THE PROPERTY VALUE
1259 \
1260 \ MACROS:
1261 \
1262 \ .GETPNUM - TRANSLATES A PROPERTY MNEMONIC TO A DCS PROPERTY NUMBER
1263 \
1264 \
1265 \
1266 \ DBREFSET(<LINE>)=<\
1267 \
1268 \ #NS(.REFTEXT,#TM(LINE;)) #NS(.PROPERTY,#GS(.REFTEXT))^ #NS(.REFN,#GS(.REFTEXT))^
1269 \
1270 \ .GETPNUM($.PROPERTY)^ #NS(#(<.PVALUE>$.PN), #(<$.PVALUE>$.PN)<*>$.REFN< >#GC(.REFTEXT,120) )^
1271 \
1272 \
1273 \ EJECT PAGE

```

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```

1334 >~
1335 NOTBER=<\
1336
1337 .Z(< B113>,< B114>,< B601>,< B141>)=$.BER~
1338
1339 .BER=$.Z~
1340
1341 >~
1342 NOTBOR=<\
1343
1344 .Z(< 7007>)=$.BOR~
1345
1346 .BOR=<6517 6522 >$.Z~
1347
1348 >~
1349 NOTZIR=<\
1350
1351 .Z(< 9042>)=$.ZIR~ .ZIR=$.Z~
1352
1353 >~
1354 NOTMIS=<\
1355
1356 .Z(<6517 >,<6522 >)=$.MIS~
1357
1358 .MIS=$.Z~
1359
1360 >~
1361 \*****
1362 \***** RESET THE SAMPL TYPES AND KILL 'CON' *****
1363 \*****
1364
1365 \CHANGE THE GLASS TYPE LISTS AND KILL THE DCS CON COMMAND
1366
1367 .FIXTYPES^ CON=<#PS(<^SORRY, ^C^D^N IS NOT AVAILABLE WHEN PRINT:  'HANDBOOK.>'?)^ >^
1368
1369 \ EJECT PAGE

```

```

1370 \*****
1371 \***** DATA LISTS *****
1372 \*****
1373
1374 \ THESE ARE THE LISTS OF GLASSES WHOSE ABSORPTION AND FLUORESCENCE DATA ARE
1375 \ STORED IN THE LIBRARIES SHOWN IN PARENTHESES. THEY ARE CODED FOR EASE OF USE
1376
1377 .XLIBA=< 1090 1091 1092 1093 1094 1095 1096 1097 1100 1102 1103 1109 \
1378 1110 5057 6003 6534 6544 >^ \ (DB5)
1379
1380 .XLIBB=< 1042 1043 3040 3042 3043 3046 3077 3078 3079 3082 3084 3118 5027 \
1381 5037 5036 5057 >^ \ (DB1)
1382
1383 .XLIBC=< 3038 3041 3044 3045 3073 3074 3076 3081 3083 5038 5039 5041 6505 \
1384 6507 7001 8012 >^ \ (DB2)
1385
1386 .XLIBD=< 9013 9015 9023 9101 9028 9111 9112 9113 9114 9115 9116 9118 \
1387 9119 9120 9121 9123 9128 9133 9134 9139 9140 9141 9155 9402 9900 9916 9126 >^ \ (DB3)
1388
1389 .XLIBE=< 1004 1006 1030 1040 1041 1044 5001 5002 5003 5005 5006 5007 5008 \
1390 5009 5010 5019 6004 6005 6007 6010 6501 7005 7006 7501 7503 8016 \
1391 8047 8083 8085 8087 8088 8089 8090 8130 8131 9008 >^ \ (DB4)
1392
1393 .XLIBF=< 8097 8113 8114 8140 8148 8157 8158 8159 8115 8116 8118 8120 \
1394 1143 1144 1146 1159 1154 1155 1158 1159 1160 1161 5045 >^ \ (DB6)
1395
1396 .XLIBG=< 1129 1130 1131 1139 1140 1141 1142 5068 5069 5092 5093 5548 8151 \
1397 8152 8153 8153 8236 8237 8238 5046 8239 >^ \ (DB7)
1398
1399 .XLIBH=< 3024 3026 5011 5013 6009 6517 6522 7007 7504 8021 8056 8059 \
1400 8063 8111 8127 8128 8129 8132 8133 9030 7010 >^ \ (DB8)
1401
1402 .XLIBI=< 1009 1067 1068 >^ \ (DB910)
1403
1404 .XLIBJ=< 9024 9101 9104 9110 9111 9114 9115 9118 1106 1107 1125 1126 5004 \
1405 5014 5060 8146 8189 >^ \ (DB1112)
1406
1407 .XLIBK=< 1088 5094 5033 9016 >^ \ (DB13)
1408
1409 .XLIBL=< 8139 8098 8096 5012 >^ \ (DB14)
1410
1411 .XLIBM=< 1089 >^ \ (DB15)
1412
1413 .XLIBN=< 8117 8119 >^ \ (DB16)
1414
1415 .XLIBO=< 8162 1105 8146 1152 6512 >^ \ (DB17)
1416
1417 \ EJECT PAGE

```

```

1418 \*****
1419 \***** PLOT LISTS *****
1420 \*****
1421
1422 \ THESE ARE THE LISTS OF UX FILES WHICH ARE USED BY REDPP TO MAKE
1423 \ THE GRAPHS ON PAGES 2 AND 3. THE GLASSES ARE LISTED ALONG WITH THE
1424 \ FIRST FRAME OF DATA. THE PLOT FILE NAMES ARE CODED FOR EASE OF USE. THE NAMES IN
1425 \ PARENTHESES ARE THE UX FILE NAMES.
1426
1427 .PLOT A=< 1090 1 1091 3 1092 5 1093 7 1094 9 1095 11 1096 13 1097 15 1100 17 \
1428 1102 19 >^ \ (PLOT5A)
1429
1430 .PLOT B=< 1103 1 1109 3 1110 5 5057 7 6534 11 6544 13 >^ \ (PLOT5B)
1431
1432 .PLOT C=< 1042 1 1043 3 3040 5 3042 7 3043 9 3046 11 3077 13 3078 15 3079 17 3082 19 >^ \ (PLOT1A)
1433
1434 .PLOT D=< 3084 1 3118 3 5027 5 5035 7 5036 9 5037 11 >^ \ (PLOT1B)
1435
1436 .PLOT E=< 3038 1 3041 3 3044 5 3045 7 3073 9 3074 11 3076 13 3081 15 3083 17 5038 19 >^ \ \ (PLOT2A)
1437
1438 .PLOT F=< 5039 1 5041 3 6505 5 6507 7 7001 9 8012 11 >^ \ (PLOT2B)
1439
1440 .PLOT G=< 9013 1 9015 3 9023 5 8101 7 9028 11 8111 13 8112 15 >^ \ (PLOT3A)
1441
1442 .PLOT H=< 8115 1 8116 3 8118 5 8119 7 8120 9 8121 11 8123 13 8128 15 8133 17 8134 19 >^ \ (PLOT3B)
1443
1444 .PLOT I=< 8139 1 8140 3 8141 5 8155 7 8402 9 8800 11 8816 13 8126 15 >^ \ (PLOT3C)
1445
1446 .PLOT J=< 1004 1 1006 3 1030 5 1040 7 1041 9 1044 11 5001 13 5002 15 5003 17 >^ \ (PLOT4A)
1447
1448 .PLOT K=< 5005 1 5006 3 5007 5 5008 7 5009 9 5010 11 5019 13 6004 15 6005 17 6007 19 >^ \ (PLOT4B)
1449
1450 .PLOT L=< 6010 1 6501 3 7005 5 7006 7 7501 9 7503 11 8016 13 8047 15 8083 17 >^ \ (PLOT4C)
1451
1452 .PLOT M=< 8085 1 8087 3 8088 5 8089 7 8090 9 8130 11 8131 13 9008 15 >^ \ (PLOT4D)
1453
1454 .PLOT N=< 8097 1 8113 3 8114 5 8140 7 8148 9 8157 11 8158 13 8159 15 8115 17 8116 19 >^ \ (PLOT6A)
1455
1456 .PLOT O=< 8118 3 8120 5 1143 7 1144 9 1146 11 1153 13 1154 15 1155 17 1158 19 >^ \ (PLOT6B)
1457
1458 .PLOT P=< 1159 1 1160 3 1161 5 >^ \ (PLOT6C)
1459
1460 .PLOT Q=< 1129 1 1130 3 1131 5 1139 7 1140 9 1141 11 1142 13 5068 15 5069 17 5092 19 >^ \ (PLOT7A)
1461
1462 .PLOT R=< 5093 1 6548 3 8151 5 8152 7 8153 9 8156 11 8236 13 8237 15 8238 17 5046 19 >^ \ (PLOT7B)
1463
1464 .PLOTS=< 8239 1 >^ \ (PLOT7C)
1465
1466 .PLOT T=< 3024 1 3026 3 5011 5 5013 7 6009 11 6517 13 6522 15 >^ \ (PLOT8A)
1467
1468 .PLOT U=< 7504 1 8021 3 8056 5 8059 7 8063 9 8111 11 8127 13 8128 15 8129 17 >^ \ (PLOT8B)
1469
1470 .PLOT V=< 8132 1 >^ \ (PLOT8C)
1471
1472 .PLOT W=< 1009 1 1068 5 >^ \ (PLOT8D)
1473
1474 .PLOT X=< 9024 1 9101 3 9104 5 9110 7 9111 9 9114 11 9115 13 9118 15 >^ \ (PLOT11)
1475
1476 .PLOT Y=< 1106 1 1125 5 1126 7 5004 9 5014 13 5060 15 8146 17 8189 19 >^ \ (PLOT12)
1477

```

1478 .PLOTZ=< 8133 1 9030 3 7010 5 >^ \ (PLOT8D)
1479
1480 .PLOTAA=< 1088 1 5094 5 5033 7 9016 9 >^ \ (PLOT13)
1481
1482 .PLOTAB=< 8139 1 8096 5 5012 7 >^ \ (PLOT14A)
1483
1484 .PLOTAC=< 8096 1 >^ \ (PLOT14B)
1485
1486 .PLOTAD=< 1089 1 >^ \ (PLOT15)
1487
1488 .PLOTAE=< 8117 1 8119 3 >^ \ (PLOT16)
1489
1490 .PLOTAF=< 8162 1 1105 3 8146 5 1152 7 6512 9 >^ \ (PLOT17)
1491
1492 \ EJECT PAGE


```

1493 \*****
1494 \*****.LIBLIST*****
1495 \*****
1496
1497 \ THIS LIST ASSOCIATES ".XLIB" LIBRARY NAMES WITH THE NAMES REALLY USED
1498
1499 .LIBLIST=<\
1500 .XLIBA DB5 .XLIBB DB1 .XLIBC DB2 .XLIBD DB3 .XLIBE DB4 .XLIBF DB6 .XLIBG DB7 \
1501 .XLIBH DB8 .XLIBI DB910 .XLIBJ DB1112 .XLIBK DB13 .XLIBL DB14 .XLIBM DB15 \
1502 .XLIBN DB16 .XLIBO DB17 \
1503 >
1504 \*****
1505 \*****.UXLIST*****
1506 \*****
1507
1508 \ THIS LIST ASSOCIATES ".PLOT" UX FILE NAMES WITH THOSE REALLY USED
1509
1510 .UXLIST=<\
1511 .PLOTA PLOT5A .PLOTB PLOT5B .PLOTG PLOT1A .PLOTD PLOT1B .PLETE PLOT2A .PLOTF PLOT2B \
1512 .PLOTG PLOT3A .PLOTH PLOT3B .PLOTJ PLOT3C .PLOTK PLOT4A .PLOTL PLOT4B .PLOTM PLOT4C \
1513 .PLOTN PLOT4D .PLOTN PLOT5A .PLOTG PLOT5B .PLOTG PLOT5C .PLOTG PLOT7A \
1514 .PLOTN PLOT7B .PLOTG PLOT7C .PLOTG PLOT8A .PLOTG PLOT8B .PLOTG PLOT8C \
1515 .PLOTW PLOT90 .PLOTX PLOT11 .PLOTY PLOT12 .PLOTZ PLOT8D .PLOTAA PLOT13 \
1516 .PLOTAB PLOT14A .PLOTAC PLOT14B .PLOTAD PLOT15 .PLOTAE PLOT16 \
1517 .PLOTAF PLOT17 \
1518 >
1519 \ EJECT PAGE

```

```

1520 *****
1521 ***** FIND *****
1522 *****
1523
1524
1525 ///////////////////////////////////////////////////////////////////
1526 THIS COMMAND WILL LOCATE A UXFILE OR LIBRARY WHICH CONTAINS DATA
1527 FOR A PARTICULAR GLASS. DATA TYPE IS "HBPLOTS" FOR UX-FILES AND ANYTHING ELSE
1528 FOR RAW DATA.
1529
1530 VARIABLES:
1531
1532 .TEMP          - MACRO TO RUN TO GET DESIRED DATA
1533 .PLACEA       - LIBRARY OR UX FILE
1534 .PLACEB       - NULL OR FIRST UX FRAME NUMBER FOR A GLASS
1535 .FROMLIST     - LIST OF GLASSES TO GET INFORMATION FOR
1536 .NUMFROM      - NUMBER OF GLASSES IN THE LIST
1537 .SAMPLID      - CURRENT GLASS
1538
1539 MACROS:
1540
1541 .FINDPLOT     - FINDS UX FILE NAMES AND FRAME NUMBERS FOR A GLASS
1542 .FINDDATA     - FINDS LIBRARY CONTAINING THE RAW SPECTRA FOR A GLASS
1543
1544 ///////////////////////////////////////////////////////////////////
1545 FIN \
1546
1547 .. AD(<.TEMP>,<^WHICH DATA ? >)^ #NS(.PLACEB)^
1548
1549 #EQ($.TEMP,<HBPLOTS>,<#NS(.TEMP,<.FINDPLOT>) >,<#NS(.TEMP,<.FINDDATA>) >)^
1550
1551 .LIST(<SAMPLES: >,<.FROMLIST>,<.NUMFROM>)^ .REFFROM(<.FROMLIST>,<.NUMFROM>)^
1552
1553 #NS(.FROMLIST,#$($.FROMLIST)) ^ \ SORT THE LIST
1554
1555 #DO(<\
1556
1557     #NS(.SAMPLID,#$($.FROMLIST)) ^ #($.TEMP,<$.SAMPLID,<.PLACEA>,<.PLACEB>)> ^
1558
1559     #DS(< >$.SAMPLID<=>$>$.PLACEA< >$.PLACEB")^
1560
1561     >,<.NUMFROM>)^
1562
1563 >^
1564
1565 ***** .FINDDATA *****
1566 *****
1567
1568 ///////////////////////////////////////////////////////////////////
1569
1570 FOR A GIVEN GLASS, THE LIBRARY MACROS (.XLIB) ARE SEARCHED TO FIND THE
1571 LIBRARY IN WHICH THE GLASS SPECTRAL DATA HAS BEEN STORED.
1572
1573 VARIABLES:
1574
1575 .LIBLIST      - A LIST OF ".XLIB" NAMES TO SEARCH
1576 .LIB         - THE CURRENT ".XLIB" BEING SEARCHED
1577
1578 ARGUMENTS:
1579

```

```

1580 \      SAMPL - THE SAMPLE (GLASS) BEING SEARCHED FOR
1581 \      LIBRARY - THE LIBRARY WHERE THE SPECTRAL DATA IS LOCATED
1582 \      DUMMY - NOT USED BY THIS ROUTINE (SEE "FINDPLOT")
1583 \      ESCAPE - A MECHANISM TO HANDLE CASES WHERE DATA IS NOT FOUND
1584 \
1585 \
1586 \
1587 .FINDDATA(<SAMPL>,<LIBRARY>,<DUMMY>,<ESCAPE>)=<\
1588
1589 #NS(LIBRARY,<NONE>)^ \ SET AN INITIAL VALUE FOR THE LIBRARY
1590
1591 #DO(<\
1592
1593 #GS(.LIBLIST,< \ GET A LIBRARY LIST TO SEARCH
1594
1595 #NS(.LIB,$%GS)^ \ SAVE ITS NAME AND SEARCH FOR THE GLASS OF INTEREST
1596 \ IF THE LIBRARY CONTAINS THE GLASS, RESET THE LIBRARY NAME AND QUIT.
1597
1598 #SM($.LIB,< SAMPL >,<#NS(LIBRARY,#GS(.LIBLIST)) #SP($.LIB,1) #DX^>,<#GS(.LIBLIST,<%00>)>)^
1599
1600 >,< #DX^>) >)^ \ SEARCH THOUGH ALL THE LIBRARY LISTS
1601
1602 \ IF NO LIBRARY WAS FOUND, ISSUE A WARNING AND ESCAPE (DO NOTHING OR ABORT)
1603
1604 #SP(.LIBLIST,1)^ #EQ($.LIBRARY,<NONE>,<#PS(<NO DATA FILE FOR SAMPL>"?) ESCAPE>,<%00>)^
1605
1606 >^
1607
1608 *****
1609 ***** .FINDPLOT *****
1610 *****
1611
1612 \
1613 \
1614 \ FOR A GIVEN GLASS, FIND THE UX FILE AND FRAME OF THE FIRST PLOT.
1615 \ THE MACROS ".PLOT" ARE SEARCHED FOR THE GLASS OF INTEREST.
1616 \
1617 VARIABLES:
1618
1619 .UXLIST - A LIST OF ".PLOT" LISTS CONTAINING UX FILE NAMES AND FRAME NUMBERS
1620 .PLOT - THE CURRENT ".PLOT" LIST BEING SEARCHED
1621
1622 ARGUMENTS:
1623
1624 SAMPL - THE GLASS OF INTEREST
1625 UXFILE - THE UX FILE CONTAINING THE GLASS PLOTS
1626 UXFRAME - THE FIRST OF TWO FRAMES IN THE UX FILE FOR THIS GLASS
1627 ESCAPE - A MECHANISM TO HANDLE CASES WHERE A FILE IS NOT FOUND
1628 \
1629 \
1630 \
1631 .FINDPLOT(<SAMPL>,<UXFILE>,<UXFRAME>,<ESCAPE>)=<\
1632
1633 #NS(UXFILE,<NONE>)^ \ SET AN INITIAL UXFILE VALUE
1634
1635 #DO(<\
1636
1637 #GS(.UXLIST,< \ GET A ".PLOT" LIST TO SEARCH
1638
1639 #NS(.PLOT,$%GS)^ \ SAVE THE ".PLOT" NAME AND SEARCH FOR THE GLASS

```

```
1640 \ IF THE GLASS IS FOUND, SET THE UXFILE NAME AND GET THE FRAME NUMBER
1641
1642
1643 *SM($,PLOT,< SAMPL >,<#NS(UXFILE,#GS(.UXLIST)) #NS(UXFRAME,#GS($,PLOT)) #SP($,PLOT,1) #DX^>,<#GS(.UXLIST,<X00>)>)>^
1644
1645
1646 >,< #DX^>) \ LOOK AT ALL THE LISTS UNLESS THE GLASS WAS FOUND
1647
1648 >)^
1649
1650 \ IF NO UXFILE FOUND, ISSUE A MESSAGE AND ESCAPE (GO ON OR ABORT)
1651
1652 *SP(.UXLIST,1) #EQ($UXFILE,<NONE>,<#PS(<NO UX DATA FOR SAMPL>"?) ESCAPE>,<X00>)>^
1653
1654 >^
1655 \ EJECT PAGE
```

1656
1657 /
1658 /
1659 /
1660 /
1661 /
1662 /
1663 /
1664 /
1665 /

INDEX

1667 \ *****
1668 \ ***** INDEX *****
1669 \ *****
1670
1671 / .AODW19 1145 .FIXLINE 1104 .REPVALUE 801 NOTFLP 1322
1672 / .CHECKZERO 1090 .FIXTHINGS 1061 .SETPAGES 209 NOTMIS 1354
1673 / .COMPO 583 .FIXTYPES 1293 .SETREFN 903 NOTPHO 1315
1674 / .CONREF 1005 .FIXVALUE 1079 .TITLE 651 NOTSIL 1308
1675 / .DBGETREFS 1217 .INSERT 721 .UXLIST 1510 NOTZIR 1349
1676 / .DBREFSET 1266 .LIBLIST 1499 FIND 1646 PRINTBOOK 78
1677 / .FINDDATA 1587 .NOTREF 951 NOTER 1335
1678 / .FINDPLOT 1631 .REFVALUE 850 NOTBOR 1342

Appendix F: The Data Correlation System

The data correlation system provides a means of manipulating by computer the raw data collected in our laser glass spectroscopy laboratory to obtain correlations of one property with another as a function of glass composition. These correlations may be in the form of lists, tables, statistics, graphs, and calculations. The system consists of the data and program written in the languages TRIX and MATHSY which are suited to the two tasks the system performs. On one hand, data is treated as a collection of characters (strings) which are displayed in various ways. Such processing is known as string manipulation and is the type of processing for which TRIX was designed. On the other hand, data is used mathematically to create new quantities of interest which are usually displayed in graphical form. MATHSY is a mathematics and graphics language developed for such tasks.

The system is composed of programs written in these two languages in order to obtain the benefits and avoid the disadvantages of both. Attempting to solve string problems in a mathematical language (and vice versa) is a great waste of time leading to complex and opaque programs. In addition to choosing two languages to perform system tasks, I also chose languages which make programming especially easy. Both languages are interactive and interpretive macro processors. An interactive language allow you to converse with it directly without need of programs. An interpretive language accepts commands as they are entered, converts these to machine instructions, and executes the instructions. A macro language provides the ability to group commands together, give the group a name, and use that name whenever that group of commands is required. The combination of these three features in TRIX and MATHSY provide a programming system which greatly simplifies the task of transforming ideas into commands used by the language. These commands are often assembled into programs but may also be issued without a program to explore an idea suggested by the data.

The TRIK portion of the data correlation system is the program DCS. It is composed of three parts: a table of properties, data independent routines, and data dependent routines. The properties table defines the data stored in the system. These definitions are used in the data independent routines which provide services required by any type of data. The data dependent routines were designed solely for laser glass data. This division allows the use of the system for other bodies of data by replacing the properties table and data dependent routines.

DCS contains commands for production of lists and tables, selection of glass by property value or composition, and creation of data files for MATHSY. These commands and a brief explanation of them is shown in TABLE F1. The commands issue prompts for input whenever it is not supplied with the command. There are a set of abbreviations which may be used in place of lists of glasses required by commands. For example, "SB." represents the glasses in compositional series B. Glass properties are assigned mnemonics which are used whenever properties are referenced in a command. CS, for example, specifies cross section. All output from the system is dated and titled. In addition, all data is internally dated so new and old data are distinguishable.

Commands may be grouped in several categories:

- informational
- specifying
- output

Informational commands tell you something about the system or the glasses in the system (example: WHO). Specifying commands select a mode for the system or glasses within the system (example: CON). Output commands do the things of interest -- lists, tables, files for MATHSY. (Example: LISTFORMAT). Commands may be written into a file and executed from that file rather than entered at a keyboard.

input commands (reserved) :

DATA	Input data for a glass
NOTES	Adds a note to a glass
REFERENCES	Add references for a glass
UPDATE	Place new data in the data library
FIX	Fix errors in the data just entered via the DATA command
CHANGE	Change an existing glass data file
	terminate with RETURN when a parameter is requested

output commands :

USEPROP	Sets the symbol 'up.' to be a set of parameters
USEDATA	Sets the symbol 'ud.' to be a set of glasses
CON	Set 'con.' to glasses satisfying a condition
WHEN	Get the date of entry for a parameter
WHO	Converts common names to LLL numbers
SAMPLES	Tells something about the glasses in the System
SAMPLELIST	List all samples in the system
UNITS	List the units used for given properties
LISTSERIES	List the composition series known to DCS
PRINTDATA	Print glass data on the RJET or HSP
PRINTFILE	Print any file on the RJET or HSP
PRINTBOOK	Print glass data in Data Book format
SHOWDATA	Display all the data for one glass
SHOWNOTE	Display glass notes
SHOWFILE	Use routine TUBE to display any file
TABLE	Obtain a table of specific data from specific glasses
LIST	Creates a sorted list of parameters
LISTCOMP	List compositions of glasses
SETFORMAT	Create a format for LISTFORMAT
SHOWFORMAT	Display the current format for LISTFORMAT
LISTFORMAT	List properties according to the format set by SETFORMAT
SORTFIELD	Select a field to be sorted for LISTFORMAT
ROUNDFIELD	Specify fields to be rounded for LISTFORMAT
ROUNDON, NOROUND	Turn rounding on or off
SORTON, NOSORT	Turn sorting on or off
REFON, NOREF	Turn reference display on or off
GET	Creates a disk file of a parameter for MATHSY
VOC	Creates MATHSY file of VODEP efficiency curves
DKC	Create a MATHSY file of decay coefficients
DO	Do the commands in a command file

utility commands:

TV(n) Select tv number n for display
 TV Select the teletype for display
 DISK Select disk file output
 PAGE Causes subsequent output to be on a new page (disk files only)
 RJNUM Sets the RJET number (27 is the default)
 INDEX Displays your file index
 CLOSE Close a file created by DISK
 DELETE Delete any file on disk
 STATUS Show the output modes currently in effect
 SAVE Save the current output modes
 RESTORE Restore the output modes saved by SAVE
 END Terminate the program

parameter mnemonics:

(cn) Common name, -	(ed) Absorption eff d, e20 cm2
(gt) Glass type, -	(qp) Quenching p, -
(ma) Manufacturer, -	(qq) Quenching q, e20 per cc
(mn) Melt number, -	(tz) Tau zero, usec
(ll) L L number, -	(ef) E-foldings, usec
(re) Received, -	(te) Triple exp a, -
(de) Density, g/cc	(tb) Triple exp b, per second
(two) Omega 2, e-20 cm2	(tc) Triple exp c, -
(twoe) Omega 2 error, e-20 cm2	(td) Triple exp d, per second
(four) Omega 4, e-20 cm2	(te) Triple exp e, per second
(fourer) Omega 4 error, e-20 cm2	(st) Status, -
(six) Omega 6, e-20 cm2	(se) Series, -
(sixer) Omega 6 error, e-20 cm2	(dndt) Index temp coeff, e-6 per deg C
(bra) Branch 15/2, -	(dsdt) Path temp coeff, e-6 per deg C
(brb) Branch 13/2, -	(se) Stress optic coeff, nm * cm / kg
(brc) Branch 11/2, -	(dt) Damage threshold, J/cm2
(brd) Branch 9/2, -	(ex) Expansion coeff, e-6 per deg C
(rl) Radiative lifetime, usec	(hc) Heat capacity, J/g/C
(ca) Cross section, e-20 cm2	(ho) Heat conductivity, W/m/C
(cse) Cross section error, e-20 cm2	(yp) Yield point, C
(pw) Peak wavelength, nm	(tp) Transformation point, C
(xx) unused,	(kh) Knoop hardness, kg/mm2
(fw) Full width half max, nm	(ym) Young's modulus, kg/mm2
(el) Effective linewidth, nm	(sm) Shear modulus, kg/mm2
(sl) Sodium index, -	(pr) Poisson ratio, -
(pl) Peak index, -	(wa) Water stability, variable
(en) Abbe number, -	(as) Acid stability, variable
(ntwoc) Calc n2, e-13 esu	(wn) Nominal weight %, wt%
(ntwom) Measured n2, e-13 esu	(wm) Measured weight %, wt%
(nlc) Calc n-linear coeff, e-20 m2/W	(ndi) Nd ions/cc, ions/cc
(nlm) Meas n-linear coeff, e-20 m2/W	(jos) J-g sigma, e-20 cm2
(ra) Relative absorption, integrated	(csx) 1300 nm sigma, e-20 cm2
(ae) Absorption eff a, -	(px) 1300 nm wavelength, nm
(eb) Absorption eff b, -	(elx) 1300 nm linewidth, nm
(ec) Absorption eff c, e20 cm2	() ,

The following abbreviations may be used in most commands :

GP. => cn pw cs brc pi si an aa ab ac ad fw tz
DK. => cn rl wn wm ndi qp qq ta tb tc td te
VD. => cn ra aa ab ac ad
JD. => cn gt two twee four fourre six sixe
OP. => cn si pi an tr th nlc nlm so dt
MP. => cn wn wm ndi da ex hc ho kh ym sm pr yp tp vs as

WT. => Composition in weight percent
MOL. => Composition in mole percent
SIL. => Silicates
PHO. => Phosphates
FLP. => Fluorophosphates
BER. => Beryllium Fluoride
BOR. => Borates
ZIR. => Zirconates
GER. => Germanates
TEL. => Tellurites
MIS. => Miscellaneous

CON. => Glasses which satisfied a condition specified by the 'CON' command

Sx. => Series x (for example : SA. specifies the A series)
Fx. => Format x (for example : FA. specifies the A format)

To illustrate the features of DCS, the command file shown in Figure F-1 was executed to produce the output shown in Figure F-2. Some comments on the input will be useful. (1) Lines beginning with "\" are comments inserted to aid understanding of the command file. The commands and input to the commands are on separate lines. (2) "bor.", "zir." are mnemonics for borate and zirconate glasses. "cs" is the mnemonic for cross section. "or." is a directive which specifies both borates and zirconates are to be used in the search. (3) "mol." specifies composition is to be listed in terms of mole %. (4) "con." is a mnemonic for glasses which satisfy the latest condition specified by the CON command. (5) Titles are often the last input in commands. Note upper and lower case is supported. (6) The LIST command has an optional argument "(pw)" which specifies the third column will contain the parameter pw (peak wavelength). If omitted, the third column is the data date of entry. (7) Sample numbers (1141, 6548 etc.) are used to specify glasses, thus avoiding problems of multinamed glasses. (8) The WHO command translates common names to sample numbers. For this command, ED-2, ED2, and ED2 etc. all specify the same sample. (9) SETFORMAT selects the format to be used by LISTFORMAT. The optional argument x inhibits printing of the selected format for verification. (10) The specification of a format is: property, starting column, and output format. The output format contains the number of places to allow before the decimal and the number after the decimal (separated by a decimal). For example, 4.1 means four places before the decimal and one after, while 0.16 specifies a left adjusted field of 16 places. (11) The SORTFIELD command selects sorting on a given field (2 in the example). (12) The ROUNDFIELD command sets fields for rounding using two arguments for each field: $n = m$ where n is the field to round and m is the number of decimal places to display. (13) The SHOWFORMAT command displays the current format and lists rounding, sorting, and reference options in effect. (14) LISTFORMAT uses the format specified by SETFORMAT to create a list for a set of glasses.

The MATHSY portion of the data correlation system consists of the program DCSM which contains commands to perform the functions listed in Table F2. Note that each group (ignoring the last two) begins with a command to select that groups functions. DCSM is a collection of programs using some common

- (1) \ an example command file for the data correlation system
 \ find glasses which are borates or zirconates and have cross sections
 \ between 2.5 and 3.0
- (2) con
 bor. or. zir. 2.5<=cs<=3.0
 page
 \ make a table of the compositions of these glasses; use mole %
- (3) table
- (4) mol.
- (5) con.
 Borates and Zirconates with 2.5 <= cross section <= 3
 page
 \ create a list of cross sections of selected glasses showing the
 \ peak wavelength
- (6) list(pw)
- (7) cs
 1141 6548 5057
 Nova Candidato Glasses
 page
 \ find date of entry for peak wavelength and density data for some glasses
 when
 pw de
 3118 1009 1141 5094
 \ find sample numbers for a set of glasses whose common names are known
- (8) who
 ed2 ED-2 ED2 1g-718 1g812
 \ find units for thermal heat conductivity and shear modulus
 units
 ho sm
 page
 \ display all data for sample 1105
 showdata
 1105
 page
 \ create a format for listing cross sections, radiative lifetimes, peak
 \ wavelengths, peak refractive indices, glass types, and manufacturer
 \ of a set of glasses
- (9) setformat(x)
- (10) cs 1 1.1 rl 6 4.1 pw 13 4.1 pi 20 1.3 gt 26 0.18 ma 46 0.16
 \ sort the list by radiative lifetime, and do not display references
 \ round the refractive index to 3 decimals. display the format and options.
- (11) sortfield2

- nonof
- roundof
- roundfield
- 423
- showformat
- \ list the miscellaneous glasses with this format
- (14) listformat
- mis.
- Miscellaneous Glasses

Figure F-1 (continued)

Borates and Zirconates with $2.5 \leq \text{cross section} \leq 3$
2 February 1979

Compound (mole%)	3024 L-107	3026 L-109	6009 6009	6129 K-557	6133 K-574	6126 6126	9024 9024	9026 9026
Nd2O3	0.7	0.7	0.85	1.0	1.0	0	0	0
B2O3	52.9	50.0	39.85	54.0	61.5	0	0	0
Li2O	12.8	0	0	45.0	37.5	0	0	0
BeO	15.8	30.0	9.95	0	0	0	0	0
La2O3	4.8	0	7.93	0	0	0	0	0
Al2O3	0	9.3	0	0	0	0	0	0
SiO2	0	0	17.51	0	0	0	0	0
CaO	0	0	23.88	0	0	0	0	0
NdF3	0	0	0	0	0	2.0	1.6875	4.2
ZrF4	0	0	0	0	0	50.0	60.625	53.0
NaF	0	0	0	0	0	25.0	0	3.4
BeF2	0	0	0	0	0	23.0	33.75	22.0
LaF3	0	0	0	0	0	0	3.9375	0
ThF4	0	0	0	0	0	0	0	7.7
LiF	0	0	0	0	0	0	0	6.9
PbF2	0	0	0	0	0	0	0	1.8
AlF3	0	0	0	0	0	0	0	0.6
CaF2	0	0	0	0	0	0	0	0.4

Nova Candidate Glasses
2 February 1979

LLL Number	Common Name	Cross section	Peak wavelength
1141	E-309	2.5	1050.5
5057	LHG-10	2.6	1050.5
6548	LG-812	2.6	1051

Figure F-2

(pw) Peak wavelength
3118 -- 27 december 1977
1009 -- 20 december 1977
1141 -- 23 January 1978
5094 -- 1 August 1978

(de) Density
3118 -- 27 december 1977
1009 -- 20 december 1977
1141 -- 23 January 1978
5094 -- 1 August 1978

ed2 => 1009

ED-2 => 1009

ED2 => 1009

lg-718 not found. Here are some close relatives :
LG-710 => 6507

lg812 => 6548

(ho) Heat conductivity : W/m/C
(sm) Shear modulus : kg/mm2

1105 4:32 pm, Friday, 2 February 1979

```

Common name ----- E-131 (cn)      Absorption eff d ----- .906934 (ed)
Glass type ----- Fluorophosphate (gt)  Quenching p ----- 2.0 (qp)
Manufacturer ----- Owens-Illinois (ma)  Quenching q ----- 9.36 (qq)
Melt number ----- E-131-2 (mn)      Tau zero ----- 575 (tz)
L.L. number ----- 1105 (ll)      E-foldings ----- 453, 516, 562 (ef)
Received ----- April 1977 (re)      Triple exp a ----- unknown (ta)
Density ----- 3.497 (do)      Triple exp b ----- unknown (tb)
Omega 2 ----- 1.6 (two)      Triple exp c ----- unknown (tc)
Omega 2 error ----- 2 (twoe)      Triple exp d ----- unknown (td)
Omega 4 ----- 3.8 (four)      Triple exp e ----- unknown (te)
Omega 4 error ----- 3 (four e)      Status ----- Research sample (st)
Omega 6 ----- 4.5 (six)      Soften ----- unknown (so)
Omega 6 error ----- 1 (size)      Index temp coeff ----- unknown (dndt)
Branch 15/2 ----- .005 (bra)      Path temp coef ----- unknown (dsdt)
Branch 13/2 ----- .085 (brb)      Stress optic coeff ----- unknown (so)
Branch 11/2 ----- .603 (brc)      Damage threshold ----- unknown (dt)
Branch 9/2 ----- .397 (brd)      Expansion coeff ----- 15.5 (1) (ex)
Radiative lifetime ----- 522 (rl)      Heat capacity ----- unknown (hc)
Cross section ----- 2.4 (cs)      Heat conductivity ----- unknown (ho)
Cross section error ----- 1 (cse)      Yield point ----- unknown (yp)
Peak wavelength ----- 1051 (pw)      Transformation point ----- 438 (2) (tp)
unused ----- 76 (w)      Knoop hardness ----- unknown (kh)
Full width half max ----- 27.23 (fw)      Young's modulus ----- unknown (ym)
Effective linewidth ----- 31.94 (el)      Shear modulus ----- unknown (sm)
Sodium index ----- 1.4372 (si)      Poisson ratio ----- unknown (pr)
Peak index ----- 1.43234 (pi)      Water stability ----- 0.47 (13) (ws)
Abbo number ----- 93 (an)      Acid stability ----- 23.0 (4) (as)
Calc n2 ----- .51 (ntwoc)      Nominal weight % ----- unknown (wn)
Measured n2 ----- unknown (ntwem)      Measured weight % ----- 2.09 (15) (wm)
Calc n-linear coeff ----- 1.49 (nlc)      Nd ions/cc ----- 2.190 (ndi)
Meas n-linear coeff ----- unknown (nlm)      J-g sigma ----- unknown (jgs)
Relative absorption ----- 73 (ra)      1300 nm sigma ----- unknown (csx)
Absorption eff a ----- .102858 (aa)      1300 nm wavelength ----- unknown (pwk)
Absorption eff b ----- .719841 (ab)      1300 nm linewidth ----- unknown (cix)
Absorption eff c ----- .121216 (ac)

```

Composition :

Number	Compound	Weight %	Mole %
1	NdF3	2.09	1.0
2	Al(PO3)3	7.18	2.57
3	AlF3	31.85	37.33
4	YF3	1.49	1.0
5	MgF2	6.35	10.0
6	CaF2	23.67	30.0
7	SrF2	12.8	10.0
8	BaF2	14.3	8.0

Notes for 1105 :

2:34 pm, Monday, 6 March 1978

Concentration from E-145-1 (1120) absorption. This glass is supposed to be the same as E-131-1 (1198).

References :

- [1] Owens-Illinois, 2nd Quart. Rpt., ERDA contract #EY-76-C-02-4080.8000 (Apr. 1977). (25 to 300 C)
- [2] Owens-Illinois, 2nd Quart. Rpt., ERDA contract #EY-76-C-02-4080.8000 (Apr. 1977).
- [3] Owens-Illinois, 2nd Quart. Rpt., ERDA contract #EY-76-C-02-4080.8000 (Apr. 1977). (mg/cm2/day, 50 C)
- [4] Owens-Illinois, 2nd Quart. Rpt., ERDA contract #EY-76-C-02-4080.8000 (Apr. 1977). (mg/cm2/day, 50 C, 0 IN H2SO4)
- [5] Owens-Illinois, 2nd Quart. Rpt., ERDA contract #EY-76-C-02-4080.8000 (Apr. 1977).

Figure F-2 (continued)

Sort field is r1, field 2
 Sorting active: no references will appear
 Fields rounded: 4=3

cs	r1	pw	p1	gt	ms
1	6	13	20	26	46
1.1	4.1	4.1	1.3	0.18	0.16

12345678(1)2345678(2)2345678(3)2345678(4)2345678(5)2345678(6)2345678(7)2345678(8)
 x,x ****,x ****,x *,xxx *****

Miscellaneous Glasses 2 February 1979

a	b	c	d	e	f
a.	b.	c.	d.	e.	f.
Cross section, e-20 cm2	Radiative lifetime, usec	Peak wavelength, nm	Peak index, -	Glass type, -	Manufacturer, -
1.8	349	1067	1.648	Aluminate	NBS
3.9	351	1055	1.513	Sulphate	American Optical
3.6	404	1055	1.536	Chlorophosphate	UCLA

Figure F-2 (continued)

routines and the selection commands are used to switch from one type of processing to another. Within each group (again excluding the last two) are two types of commands. One command obtains data and labels from disk files, performs a function and displays the result. The other commands assume the data to be present in arrays and operate on those arrays. Labels are requested and displayed with the data and may be changed as required. These commands allow data to be obtained and modified in any way before the function is performed.

Figures 3 through 6 illustrate some features of DCSM. The properties of cross section (CS), radiative lifetime (RL), Abbe numbers (AN), and sodium refractive index (SI) for fluorophosphate glasses (FLP.) are displayed in these figures. The data was obtained from DCS with the command

GET ! CS RL SI AN ! FLP.

Titles were provided and DCS created disk files with the titles, property labels, date, number of points, and the data. The files were given the mnemonic names of their properties. Figure 3 illustrates the basic correlation function of plotting one property versus another. The DCSM commands

CORDATA CORFILES RL CS

were used.

The data suggests a reciprocal relation for these data which is explored in figure 4. To obtain the figure, the reciprocal of the radiative lifetime is needed so the data is obtained and modified and fitted as follows

(A) FITDATA NPOINTS 85

(B) GETDATA GETX RL INV*1000000 X= GETY CS

(C) FITDATA FITXY.

(A) informs the fit program of the number of points to be fit, (B) stores the data from disk files RL and CS into X and Y arrays. The MATHSY commands "INV * 100000 X =" inverts the radiative lifetime data, rescales it, and store the new form back into the X array. There is no restriction on the mathematic processing which could have been done at this point. (D) fits the X and Y arrays with a line. An optional argument for the FITXY command is available to select higher order polynomials.

Fluorophosphates
10 January 1979

Figure F-3 A simple correlation

10 JANUARY 1979

Figure F-4 Curve fitting

Figure 5 illustrates the statistical processing of cross section data. The command `STATDATA STAFFILE CS .1` produced it. The histogram bin size may be selected (within limits imposed by the number of points) by the last argument in the command. If not given, bin size is determined from the data.

The final illustration demonstrates simple correlation and calculation ability of MATHSY and DCSM. In figure 6, the sodium index is plotted versus Abbe number using the standard commands `CORDATA CORFILES AN SI`. The lines of constant non-linear refractive index are added by the command `ABBE 1.3 1.6 110 50` which calculates the nonlinear index coefficient from the linear index and Abbe number and sets the plotting limits given at the end of the command.

These figures illustrate a central feature of the correlation system. The data is available for unlimited numeric processing and display by languages in which details of processing and display are encoded into simple commands.

Fluorophosphates
10 January 1979

Maximum 4.30000
Minimum 2.10000
Range 2.20000

Mean 2.92840
Standard deviation 0.51460

Number of data points 81.

Histogram bin size 0.10000
Maximum frequency 11. between 2.70000, 2.80000

Figure F-5 Statistics

Fluorophosphates
10 January 1979

Figure F-6 A more advanced correlation

MATHSY DCSM COMMANDS

Retrieval

GETDATA	Select data reading commands
GETz	Read file and put data in array z (A to J and X, Y)
SETLABEL	Create axes labels
MAPPING	Find nice plot limits
LABEL	Display graph labels

Correlation

CORDATA	Select correlation commands
CORFILES	Plot one file versus another
SETXY	Fix plotting limits from files
CORz	Plot one file versus another using label z = A to J

Fitting

FITDATA	Select data fitting Commands
FITFILES	Fit a polynomial to the data in two files
NPOINTS	Specify number of points for fit (used only with FITXY)
FITXY	Fit the data in X, Y arrays to a polynomial

Statistics

STATDATA	Select statistical data commands
STATFILE	Produce a histogram for a file
NPOINTS	Specify points for histogram (used only with STATS)
STATS	Produce histogram of Y array

Special plots

DKDATA	Plot decay data
VDDATA	Plot VODEP data
QDATA	Plot quenching data

ABBE	Adds lines of constant γ to a plot
------	---

Utility

RESET	Resets mapping limits for unrestricted view of data
UKOUT	Selects UX file generation
PROUT	Selects FR80 file generation
TTITLE	Obtain graph title from terminal
TLABELX	Obtain graph x-axis label from terminal
TLABELY	Obtain graph y-axis label from terminal
TDATE	Obtain date from terminal
TITLET	Display title
XLABELT	Display x-axis label
YLABELT	Display y-axis label
DATET	Display date