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HOLDUP MEASUREMENT SYSTEM II (HMSII)
(version 2.1)

USER'S GUIDE
AND
SOFTWARE DOCUMENTATION

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May 31, 1995

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**HOLDUP MEASUREMENT SYSTEM II (HMSII)
(version 2.1)**

**User's Guide
and
Software Documentation**

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HMSII Software Documentation

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Holdup Measurement System II (HMSII)

Functional Description

System Description

The Holdup Measurement System II (HMSII) software is a database management package for doing Holdup Measurements. It is based on the generalized geometry holdup (GGH) methodology taught in the U. S. Department of Energy Safeguards Technology Training Program, "Nondestructive Assay of Special Nuclear Materials Holdup." This program was developed and taught by Los Alamos National Laboratory (LANL). The HMSII was developed as a joint effort between LANL and the Oak Ridge Y-12 Plant, managed for the U.S. Department of Energy by Lockheed Martin Energy Systems, Inc.

The system is designed specifically for use with three types of Multichannel Analyzer (MCA): a Davidson Portable MultiChannel Analyzer (PMCA); a EG&G Ortec MicroNOMAD (μ NOMAD); or a new Miniature Modular MultiChannel Analyzer (M³CA) under development at LANL. It is also designed assuming a 512 channel spectrum from a low resolution (e.g., NaI) detector measuring Uranium or Plutonium. Another important hardware component of the system is a portable bar code reader (also called a DataLogger or Trakker), by Intermec Corporation. The 944X series and the JANUS 20XX series readers are compatible models with the HMSII. The JANUS series is a bar code reader which is also a 386 compatible palmtop PC with MS-DOS 5.0 built-in. Both series readers are programmable and control all the aspects of field holdup data collection from the MCAs.

The menu driven software for the system is written entirely in Microsoft FoxPro for DOS (version 2.6). A add-on software package, "CommTools for FoxPro" (version 2.0) by Pinnacle Publishing, is used to control the external serial device and FoxPro communications. The HMSII has been compiled into a stand-alone, executable program using Microsoft's FoxPro Distribution Kit. Neither FoxPro, nor CommTools, are required to run the system as it is distributed. (However, if modifying the database files is necessary, then a copy of FoxPro is required. FoxPro and CommTools are both required if modifications are made in the source programs.)

The HMSII software is designed to run on any 386SX or higher PC with greater than 1MB of RAM. Mouse capabilities are included if one is available. The PC must have a hard drive (> 40 Mb) or equivalent (e.g., a Bernoulli drive). If JANUS series bar code readers are to be used, a PCMCIA SRAM card drive is also needed. All the HMSII system files are stored in a single directory (e.g., C:\HOLDUP2). The system can be started by switching to that directory (e.g., CD\HOLDUP2) and at the DOS prompt typing HMSII. The default printer hooked to the HMSII PC must be capable of printing compressed print. (A laser printer is recommended.) For more information on the setup of the HMSII, including some important notes on password protection, see the README.1ST file included on the distribution disks.

The primary advantage of using the HMSII software is the complete integration of all the elements of holdup measurements. It controls hardware setup, calibration, measurement control, data collection, analysis, and archival for an almost infinite number of measurement points. The data can easily be retrieved for trending studies or plotted over time. The software provides a complete holdup data "management" system.

Measurement Procedure Summary

(MCA = PMCA, μ NOMAD or M³CA)
(Controller = 944X or JANUS 20XX)

1. Take a new Controller to a PC station and load the field holdup measurement program into it (Opt. #5/6).
2. Take new MCA/Detector pair to PC station and run setup program to set parameters (set ROIs, Gain, HV, etc.) (Opt. #5/5). PC can load basic setup parameters into MCA for a previously used MCA/Detector pair (Opt. #5/1, 5/2 or 5/3).
3. PC will verify the calibration of a previously used MCA/Det. pair. On a new pair, the calibration program is run at PC station. PC saves calibration constants in a file along with calib. parameters for each specific MCA/Det. pair (Opt. #1).
4. Take a Controller (with field program loaded) and load parameters specific to the MCA/Det. pair it will be controlling (Opt. #5/4). Parameters are stored in array A().
5. Operator takes out MCA/Det. with a Controller to do measurements in an assigned location. The operator records badge number into the Controller.
6. A bar code label is scanned at a holdup measurement point. The Enter key is pressed on the Controller to begin measurement. Controller sends command to MCA to collect for preset count time and then starts checking for a count complete status.
7. Once count is finished, the Controller will request the measurement point ROI data from the MCA. The data is stored in Controller Array B() and C(). It is then ready for next holdup point.

NOTE: The Controller will check the ref. peak cnt/s and centroid values against the stored initial values and limits in array A(). If OK, the Controller assumes the gain has not drifted and will continue.

8. A measurement control Check Source (a standard that is carried along) will be measured periodically (1 out of every 10, 20, etc. points). (Opt. #5/5)
9. Once all assigned points have been measured, the operator returns back to the PC station to dump the collected ROI data. All data from array B() & C() and some data from A() are saved in one database file (Opt. #2).
10. Once data has been dumped from the Controller and saved, the Controller data is cleared. [This is array B() and C().] The program is restarted and the Reader and MCA/Det. can go back out and make measurements. Start again at step #5.
11. On some basis, the calibration Step #3 would be repeated.
12. At the PC station, calculations are done regarding holdup values (Opt. #3).

Holdup Measurement System II

[Four Step Process]

BAR CODE READER OPERATION

The Intermec 944X series portable bar code reader (sometimes referred to as a Datalogger or Trakker) is essential to the HMSII. Another bar code reader introduced by Intermec, the JANUS 20XX series, is also compatible. *[Both will primarily be referred to in this document as "Controllers"!]* Their software prompts the user for required actions, controls all functions of the MCA, checks the quality of the MCA data, and stores the field holdup measurement data. The field software for the 944X series reader is written in Intermec IRL (Interactive Reader Language, ver. 2.2) and is designed for a standard (64 Kb) reader. [A larger capacity version will cause no problems for the software.] The software for the JANUS series reader is written in Microsoft QuickBasic (v4.5). [Programs and field measurement data are recorded on a PCMCIA SRAM card/disk.] All serial communications between the MCA, the HMSII PC and the Controllers are via standard RS-232 (9600 baud, 8 data bits, no parity, 1 stop bit). The Controllers will store a maximum of 300 field measurements, which include room background and check source measurements, before data transfer to the HMSII PC is required.

(See README.1ST file for further information on communications setup.)

HMSII Controller Software

Any Reader/Controller can be uploaded with the HMSII field software by using the HMSII Main Menu Option #5, "MCA & Controller Setup". [See HMSII Option #5/6 for more details.] The user can choose which field software (for PMCA, μ NOMAD or M³CA) to load. The software partitions the 944X reader's memory into three arrays: A, B, and C. [See Database File Structure Section for further details, including JANUS file structure.] The MCA setup parameters are stored in array A. The measurement point information (e.g., measurement point I.D., date, time, etc.) is stored in array B. The gross counts from the MCA Regions of Interest (ROIs) are stored in array C. The software is designed to give audible warning and display messages when a problem occurs. So, the operator should listen to the "beeps" that the reader makes. When the bar code is scanned correctly, a single loud "beep" will be heard. A bad scan or a wrong number scanned will result in several hi/lo "beeps". If a problem occurs with a measurement (e.g., MCA problems, gain drift, etc.), a long series of hi/lo "beeps" will be heard and a message will be displayed. Each holdup measurement point is identified by a unique, 7-digit bar code label (Fig. 1) that is affixed to the point. The HMSII must account for all points.

Fig. 1

HMSII Controller Setup

Before a Controller can be used with a MCA/Detector pair to do holdup measurements, the setup parameters for that specific pair must be downloaded to the Controller. Many of the parameters are used to check the operation of the pair in the field. These setup parameters can be modified by using the HMSII Main Menu Option #5, "MCA & Controller Setup". [see HMSII Option #5/5 for more details]. They can be transferred to the Controller by also using the Main Menu Option #5 [see HMSII Option #5/4 for more details].

944X Main Menu Options

The 944X series reader Main Menu consists of two displayed items. The first item (M) is for doing normal field holdup measurements. The second item (U) is used to update the MCA/Detector pair setup parameters being use by the 944X [see HMSII Option #5/4 for details]. When using the normal Measurement (M) option, the order of events at each measurement point should be:

<u>944X Display</u>	<u>Actions</u>
User Badge #	input user's badge number (only <u>once</u> , when program is started!)
Point #	scan 7-digit point location bar code label or "BKG-RUN" label for room background or "STD???" for a check source measurement
Start Measurement	press "S" key & orange "enter" key (or simply press "enter" key)
5 sec. pause	aim detector at point to be measured (at a specified distance)
Hold Detector	MCA will count for pre-set time, reader will store data when finished

move to next: Point

At the start of a measurement cycle, the MCA high voltage (on/off) and the battery voltage are checked by the 944X. At the end of a measurement cycle, the reference peak centroid and count rate are checked. If the measurement is a check source, the count rate in the source peak is checked. At the end of all measurements, the point location I.D. number is again displayed along with the counts/second in the analysis (or check source) peak and the peak background. The number of measurements stored in the reader [xx] and the number of measurements since last check source measurements (yy) are also displayed.

Notes: At the "Point #" prompt, entering the word "MENU" will return the display to the 944X Main Menu. When making a measurement control, check source measurement, begin the input at the "Point #" prompt with: **STD**. Also, should a bad bar code label be encountered that can not be scanned, the keyboard on a Controller can always be used to input data.

Two other items are available at the Main Menu, but NOT listed. The first of these is a (T) for Count Time. The user to change the count time in the 944X and the MCA as is needed. The fourth and final item depends on which type MCA the 944X is connected to. If the MCA is a M³CA, the other item is a (V) for High Voltage. It is used to turn ON the High Voltage if the M³CA had been turned on for some reason. If the MCA is a μ NOMAD, the other item is a (G) for Gain Stabilizer. It allows the user to turn on or off the gain stabilization feature while in the field. If the MCA is a PMCA, there is no fourth option.

944X Manual Functions

Exit HMSII Software:

While holding down the 'ctrl' key, press the 'enter' key and release both. Next, press the 'E' key. Display should then show READY.

Begin HMSII Software:

While display shows READY, hold down the 'ctrl' key, press 'enter' key and release both. Next, press the 'B' key.

Clear Holdup Data:

While display shows READY, hold down the 'ctrl' key, press the 'enter' key and release both. Next, press the 'C' key. Then press the 'Y' key to clear all data (including MCA/Det. setup parameters) out of reader.

JANUS Main Menu Options

The JANUS 20XX series reader Main Menu consists of four items. The (M) menu item is for doing normal field holdup measurements. The JANUS display for this option appears just as described in the previous 944X section. The (T) is to allow the user to change the count time in the JANUS and the MCA. The (Q) item is used to Quit the Controller program and go back to the DOS prompt. The remaining menu item is different depending on which type MCA the Controller is connected to. When connected to a PMCA, the (G) menu item is used to adjust the gain setting to center the reference peak. When connected to a μ NOMAD, the (G) menu item is used to turn the gain stabilizer on or off. Finally, on the M³CA, the (V) menu item is used to turn ON the High Voltage to the detector. The setup parameters are transferred to the JANUS by using the HMSII Main Menu Option #5, "MCA & Controller Setup". [see HMSII Option #5/4 for details].

At the start of a measurement cycle, the MCA high voltage (on/off) and the battery voltage are checked by the JANUS. At the end of a measurement cycle, the reference peak centroid and count rate are checked. If the measurement is a check source, the count rate in the source peak is checked. At the end of all measurements, the point location I.D. number is again displayed along with the counts/second in the analysis (or check source) peak and the peak background. The number of measurements stored in the reader [xx] and the number of measurements since last check source measurements (yy) are also displayed.

At the "Point #" prompt, entering the word **"SHOW"** will allow the user to download the last spectrum from the MCA, view it, and save it, if desired. [This spectrum is not used by any other part of the HMSII software!] It will be written to a subdirectory on the PCMCIA SRAM card/disk called SPECT. The maximum spectra storage limit is 300, which is controlled by the file - SPECTNUM.DAT.

Notes: At the "Point #" prompt, entering the word **"MENU"** will return the display to the JANUS Main Menu. When making a measurement control, check source measurement, begin the input at the "Point #" prompt with: **STD**. Also, should a bad bar code label be encountered that can not be scanned, the keyboard on a Controller can always be used to input data.

The HMSII field control program on the JANUS can be restarted from the MS-DOS prompt by typing: **?MCA.EXE**. (? = **P** for the PMCA, **N** for the μ NOMAD and **M** for the M³CA) If a JANUS model is used which has a PCMCIA back, the top/rear PCMCIA card drive letter will be "F:". If the PCMCIA card slot is used behind the battery on the any JANUS model, that is drive letter "A:".

JANUS Extra Programs

The program **REVIEW.EXE** is provided to allow the user to examine previously stored spectra on the JANUS while in the field.

The program **CONSPECT.EXE** is supplied to allow saved spectra to be converted to several other formats (e.g., EG&G Ortec .CHN) for further analysis.

HMSII Main Menu Overview

All the HMSII software is controlled from a Main Menu (Fig. 2). This menu has eight primary options, plus Quit to exit the system and return back to DOS. Each menu option executes a separate program module written for that specific task. When each option is finished, control is returned back to the Main Menu.

<u>Opt.</u>	<u>Description</u>
-------------	--------------------

1>	Calibration of a MCA/Detector pair is controlled from this option. This option provides a template for the input of response data collected for a GGH Calibration.
2>	The holdup measurement data collected in a 944X or JANUS bar code reader ("Controller") is copied or downloaded to the PC running the HMSII software using this option.
3>	Analysis and archival of the bar code reader holdup measurement data is controlled by this option. A warning is issued for points which exceed their individual specified limits.
4>	An analyst operating the HMSII software is required to comment/acknowledge any point where a warning was issued. This option allows the entry of that comment.
5>	Setup parameters for each MCA/Detector pair is controlled from this option. These parameters can be loaded into a MCA or into a bar code reader. Also, the field "controlling" programs for the bar code readers are uploaded from this option.
6>	The detailed physical information about each individual measurement point is controlled from this option. Points can also be assigned to groups for their results to be averaged.
7>	Measurement completion status for any given area can be obtained from this option. Individual missing or unmeasured points can be displayed for the requested area.
8>	Measurement summary and analysis information is obtained from this option. Various queries or reports can be displayed or printed using this summary information.

HOLDUP MEASUREMENT SYSTEM II (v2.1)

**This system, developed for the U.S. Department of Energy,
was a cooperative effort between:**

**Lockheed Martin Energy Systems, Inc.
Y-12 Plant, Enriched Uranium Operations
Oak Ridge, TN**

&

**Los Alamos National Laboratory
Safeguards Assay Group (NIS-5)
Los Alamos, NM**

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Acknowledgment Screen

HOLDUP MEASUREMENT SYSTEM II		(v2.1)
Tue. 05/16/95	MAIN MENU	10:43:44 pm
MEASUREMENT PERIOD: MAY, 1995		
1> MCA CALIBRATION	5> MCA & CONTROLLER SETUP	
2> RECEIVE MEAS. DATA	6> MEAS. POINT INFORMATION	
3> ANALYZE DATA FILE	7> MEAS. COMPLETION STATUS	
4> DATA FILE COMMENTS	8> SUMMARY REPORTS	
9> QUIT		
ENTER SELECTION:		

Fig. 2

HMSII Option #1

All the individual MCA/Detector pair calibration parameters used in doing holdup measurements are controlled from this module (Fig. 3). A template is provided for input of response data collected for a Generalized Geometry Holdup (GGH) Calibration. The Setup (HMSII Opt. #5/5) for each pair of instruments **MUST** be completed before a calibration can be done. Also, a calibration **MUST** exist before setup parameters can be loaded into a bar code reader/Controller to do field holdup measurements. Options 2, 3, & 4 of this module are password protected. (See README.1st file on distribution disks for more information.)

- 1> BROWSE The browse option will seek a specified MCA/Detector calibration. Once a parameter set is retrieved, all calibrations can be scrolled forward or backward. One can *Select* a MCA/Detector pair for future use in other menu options. The associated Radial Response data for each calibration can also be displayed. Copies of any calibration data may be printed by choosing Hardcopy.
- 2> EDIT Calibration parameters can be edited from this option. Only, items in gray screen boxes can be changed (Fig. 4), including Radial Response data (Fig. 5). If calibration parameters are changed, the other related parameters will be automatically recalculated. (See ADD)
- 3> ADD Adding a new calibration file for a MCA/Detector pair is accomplished with this option. All the parameters for a calibration must be entered in the gray screen boxed areas. Other related fields (yellow on screen) are calculated automatically when all gray fields are completed. The Radial Response (two-sided measurement) screen appears next and allows for 19 response points. (The number of points is currently fixed!)
- 4> REMOVE Removing a calibration for a MCA/Detector pair does not delete it! It is flagged as invalid and will be ignored by other parts of the HMSII software. (The flag can be removed using FoxPro and editing the file CALIB.DBF. Locate the record for the desired MCA/Detector and remove the "*" in the field DONOTUSE.)

HMSII OPTION 1		(v2.1)
CALIBRATE MCA/DETECTOR PAIR FOR HOLDUP MEASUREMENTS		
☐ BROWSE Calibrations	☐ ADD New Calibration	
☐ EDIT Calibration	☐ REMOVE Calibration	
☐ QUIT to Main Menu		
Enter Selection:		

Fig. 3

MCA/Detector Calibration DATABASE			
MCA S/N:	M332	U Mass/Area (g/cm ²):	1.276
Detector S/N:	HR-222	μ (186 KeV) (cm ² /g):	1.468
User Badge Number:	020285	Self-attn Corr Fact:	2.213
Calibration Date:	07/27/94	Std. Cont. Corr Fact:	1.205
SNM Material:	URANIUM	Number of Positions:	19
Det. Distance (cm):	30.00	Effect Length (cm):	18.883
Source Spacing (cm):	5.00	Uncty Effect Length:	0.304
Room Bkg (cnt/s):	0.20	Effect Area (cm ²):	376.148
Rm Bkg Uncty (cnt/s):	0.10	Uncty Effect Area:	7.817
Std. Peak ROI (cnt):	30893	Point Calib (Kp):	0.00888648
Std. Bkg ROI (cnt):	212	Uncertainty (Kp):	0.00888864
Std. Count Time (s):	600	Line Calib (Kl):	0.00813798
Std. Iso. Mass (g):	10.572	Uncertainty (Kl):	0.00888245
Std. Enrichment (%):	93.16	Area Calib (Ka):	0.00828693
Std. Diameter (cm):	3.366	Uncertainty (Ka):	0.00888456
Notes: Calib. for 1st. M3CA			
F=FORWARD, B=BACK, S=SELECT, H=HARDCOPY, R=RADIAL DATA, Q=QUIT:			

Fig. 4

Radial Response Data		iNUM	Times(s)	Peak Counts	Bkgrd Counts	MCA S/N: M332
		0	100	5222	45	
		1	100	4005	35	
		2	100	2341	26	
		3	100	958	19	
		4	100	229	32	
		5	100	53	15	
		6	100	55	20	
		7	100	35	14	
		8	100	48	15	
		9	100	43	22	
		-1	100	3905	29	
		-2	100	2071	27	
		-3	100	835	18	
		-4	100	152	19	
		-5	100	58	18	
		-6	100	51	19	
		-7	100	54	18	
		-8	100	42	14	
		-9	100	42	21	
Hit <Enter> key to continue...						

Fig. 5

HMSII Option #2

This module is used to download (or "dump") all the field holdup measurement data collected in a Controller to the PC where the HMSII software is running. Once this option has been selected, the user must choose the data input method. The HMSII software can "Dump" the data from a 944X series reader or can "Copy" it from the PCMCIA card/disk used with a JANUS 20XX series reader (Fig. 6).

944X Controller:

The "Dump" option will first prompt the user to check for the proper switch box setting and cable connections (Fig. 6a). When ready to receive, the computer will control all aspects of the data transfer. It will stop the field holdup data collection IRL program from running in the 944X. It will then request the 944X to transmit the data contained in reader array A (MCA Setup data - 50 items max.). Next it will request the data in array B (measurement point information - 300 items max.) be transmitted. Finally it will request the data in array C (gross count data for 9 ROIs - 300 items max.) be transmitted. The number of items in array B and C should be equal. If not the PC will request a re-transmit of data. The data is temporarily stored in MCADB1.dbf. The PC will print out the results of the data transfer. Then the user will be prompted whether or not to clear the reader of data. Generally, the answer is yes unless the printout results appear abnormal. If it does appear garbled, the user should just dump the reader again. (A backup of each dump is saved under the name, DUMPxxx.dbf. The xxx is from the reader dump # 001-999, which increments with each reader dumped.) HMSII Option #3 MUST be run immediately after using this option or the data just transmitted will be overwritten by the next field data transfer!

JANUS Controller:

The "Copy" option will prompt the user to input the disk drive designation. This is the drive, on the PC where the HMSII software is running, where the Controller's PCMCIA SRAM card/disk can be accessed (e.g., D, E, F, etc.). First, the field data collection program must be stopped with the "Quit" option from JANUS Main Menu. The SRAM card should be removed from the JANUS and placed in the PC's PCMCIA drive before answering the Drive prompt (Fig. 6b). [Several PCMCIA SRAM card drives are on the market for under \$300. Some drives can even share the PC's printer port.] The PC will copy the card files DATA_A.dat, DATA_B.dat and DATA_C.dat from the RAM card. These correspond to the same basic data structure as arrays A, B and C. [See Database File Structure Section for further details.] The data from these three files will be combined and temporarily stored in the file MCADB1.dbf. The PC will print out the results of the data transfer. Then the user will be prompted whether or not to clear the card file data. Generally, the answer is yes unless the printout results appear abnormal. If it does appear garbled, the user should just copy the data again. (A backup of each dump is saved under the name, DUMPxxx.dbf. The xxx is from the reader dump # 001-999, which increments with each reader dumped.) HMSII Option #3 MUST be run immediately after using this option or the data just copied will be overwritten by the next field data transfer!

HMSII OPTION 2	(v2.1)
RECEIVE MCA DATA FROM BAR CODE CONTROLLER (INTO DATABASE FILE: MCADB1.DBF)	
Do you want to proceed (Yes/No):	

MCA Data Input Method:
☐ Dump 944X Bar Code Reader
☐ Copy from Controller disk
Enter Choice:

Fig. 6

HMSII OPTION 2	(v2.1)
MAKE SURE: (using COM1:) 1. Reader is turned ON! 2. Cable is PLUGGED into reader! 3. Switch Box is SET to BAR CODE READER!	
Are you READY to RECEIVE (Yes/No):	

Fig. 6a

HMSII OPTION 2	(v2.1)
Select Drive Containing Bar Code Controller Disk!	
Enter Drive: <input type="text"/> (then press Enter)	

Fig. 6b

HMSII Option #3

The analysis and archival of the Controller's holdup measurement data is processed by this module (Fig. 7). [This option **MUST** be used immediately after using Option #2.] All the holdup data collected in a Controller and dumped in Option #2 to MCADB1.dbf, is added to a blank, temporary working file MCATEMP.dbf. The required information from CALIB.dbf and PT_DATA.dbf is then added to the file. Calculations are then done on each record (or measurement point) in the file. First the ROI gross count data is used to compute the Net (background subtracted) Area for the reference and SNM peaks. If a room background measurement exists in the reader's data for a given point (a B appears in summary report BKG field), it is found and applied. Next, the proper correction factors and calibration parameters are applied to calculate the SNM grams (point source), the SNM grams/cm (line source), or the SNM grams/cm² (area source). All these values are then stored within the record with the rest of the information on that measurement point. All Points are then checked to see if they exceed their individual alarm count rate level (a * appears in summary report WARN field). The temporary file is appended onto the end of Master Holdup Data file, MCADATA.dbf. A brief summary report is then generated and printed for the data just processed. If the answer for a point was not calculated, the summary report field **DNA** will have one of the following codes:

"S"	invalid supplemental information file
"N"	no supplemental information file found
"C"	invalid calibration file
"I"	no calibration file found
"D"	duplicate measurement point
"Q"	quantities will not be calculated!! (no associated area or length)

Option #3 has another useful feature. Instead of doing the normal analysis on the Controller data just dumped in Option #2, the data already contained in the Master Holdup Data file (MCADATA.dbf) can be re-analyzed. The program will take each point stored in the database and recheck it against the current Calibration and Supplemental Point Information files. If there were any changes since that point was first stored, the point would be re-calculated and stored. This could be useful if one had to do a re-calibration after points had already been measured. It could also allow you to easily recover from a mistake in the Supplemental Information file (e.g., duct wall thickness, attenuation material, CF, etc.).

HMSII OPTION 3	(v2.1)
ANALYZE MCA HOLDUP DATA & CALCULATE QUANTITIES (MAKE SURE PRINTER IS ON-LINE !!)	
Do you want to proceed (Yes/No):	

Fig. 7

HMSII Option #4

If a measurement point exceeds its individual alarm count rate level, a warning is generated in Option #3. The action taken to remedy this warning (e.g., point cleaned out, item removed, re-counted subtracting room background, etc.) must be documented by using this module (Fig. 8). This option is usually executed by the analyst designated to operate the HMSII PC. Point Area & Equipment are first selected on screens similar to that of Fig. 16 & 17. The specific point is then selected and the comments edited (Fig. 9). Also, this option can be used to enter additional notes on a specific measurement point.

HMSII OPTION 4	(v2.1)
EDIT MCA HOLDUP DATA FILE COMMENTS ON MEASUREMENTS (ACTION TAKEN FOR POINTS ABOVE ACTION LIMITS)	
Do you want to proceed (☒ Yes/ ☐ No):	

Fig. 8

HMSII OPTION 4
EDIT MCA HOLDUP DATA FILE COMMENTS ON MEASUREMENTS (ACTION TAKEN FOR POINTS ABOVE ACTION LIMITS)
Edit Point Location Number: 3

Old Comment: **POINT ACTION COMMENTS**

Do you wish to EDIT Comment (☒Yes/☐No):

Fig. 9

HMSII Option #5

This module controls the various setup functions of the HMSII (Fig. 10). Setup parameters for each individual MCA/Detector pair are added, retrieved, edited, or removed. This option controls the PC upload of setup parameters to either type MCA or Controller. It also controls the upload of the field control and holdup data collection program into a Controller.

Opt. Description

- 1> All setup parameters for a selected PMCA/Detector pair can be uploaded from the PC to the MCA using this option.
- 2> All setup parameters for a selected M³CA/Detector pair can be uploaded from the PC to the MCA using this option.
- 3> All setup parameters for a selected μ NOMAD/Detector pair can be uploaded from the PC to the MCA using this option.
- 4> If a setup and calibration are complete, this option will allow the setup parameters to be uploaded/copied into a Controller. This option can NOT be used if a setup & calibration do not exist for a specific MCA/Detector pair. Also, if a PCMCIA SRAM card/disk is used, the field executable program and two other setup files need to be on the disk first. Use Option #5/6 first to setup a formatted blank disk.

Note: If the Controller is a 944X series bar code reader, this option is used in conjunction with the "U" (update setup) option selected from the 944X main menu. The parameters are uploaded from the PC to the 944X. If the Controller is a JANUS series bar code reader, the setup parameters are copied to the SRAM disk. The setup parameters are from the SETUP.dbf file. Currently, only the first 34 items in this file are used by the Controllers.

- 5> This option allows the user access to the setup parameters used for each MCA/Detector pair. The user can browse, edit, add, and remove a specific pair's parameters. (See HMSII Option #5/5 for more details.)
- 6> This option is for uploading/copying the field MCA control and holdup data collection program into the Controller. The user can upload the field program from the HMSII PC to a 944X (Fig. 11) or copy the program to a JANUS's PCMCIA SRAM card/disk (Fig. 11a). The user must then choose which of the three MCA type program versions to load.

Note: If the Controller is a JANUS reader, this option must be used first to setup a formatted blank SRAM disk. If the Controller is a 944X reader, do not forget to follow the instructions to switch the reader's RS-232 port to 9600, 8, N, 1.

HMSII OPTION 5		(v2.1)
LOAD/MODIFY MCA SETUP PARAMETERS		
1> PMCA - LOAD Params	4> Controller - LOAD Params	
2> M3CA - LOAD Params	5> MODIFY/VIEW Params	
3> Nomad - LOAD Params	6> LOAD Controller Program	
7> QUIT to Main Menu		
Enter Selection:		

Fig. 10

HMSII OPTION 5/6	(v2.1)
<p>(1) Make sure reader is turned ON!!</p> <p>(2) ATTACH PC cable to reader & SET Switch Box to BAR CODE READER!!</p> <p>(3) STOP any reader program!! (Display should say READY if no program is running!) (a) On Reader, Hold Down ctrl key & Press enter key! (b) On Reader, Press the E key!</p> <p>(4) RESET reader to defaults!! (a) On Reader, Press the . + keys! (b) On Reader, Hold Down ctrl key & Press enter key! (Reader should beep 4 times when FINISHED!)</p> <p>(5) SWITCH Reader data bits & parity!! (a) On Reader, Press the \$ + I I B B \$ - keys! (b) On Reader, Hold Down ctrl key & Press enter key!</p> <p>(6) Are above five steps COMPLETE on 944X (Yes/No)?</p>	

Fig. 11

HMSII OPTION 5/6	(v2.1)
Select Drive Containing Bar Code Controller Disk!	
Enter Drive: <input type="text"/>	(then press Enter)

Copy which MCA program to Controller Disk:
(P=PMCA, M=M3CA, N=NOMAD, or Q=Quit)?

Fig. 11a

HMSII Option #5/5

This sub-module of HMSII option #5, controls the setup function of a MCA/Detector pair (Fig. 12). This Setup option must be completed for each pair of instruments before a calibration can be done. Once a setup and a calibration are complete for a pair, the setup parameters can be loaded into a Controller to do field holdup measurements. Options 2, 3, and 4 of this module are password protected.

- 1> BROWSE The browse option will seek a specified MCA/Detector setup (Fig. 13). Once a setup is retrieved, all setup files can be scrolled forward and backward. One can *Select* a MCA/Detector pair for future use in other menu options. The associated ROIs for each setup can also be displayed (Fig. 14). Copies of any parameters may be printed (Hardcopy).
- 2> EDIT All parameters can be edited with this option, including the ROI beginning and ending channel setup. (See ADD)
- Note:* The check source frequency can be any number from 1 to 300. If it is set to 0, then all prompting to run the check source is skipped.
- 3> ADD Adding a new setup file for a MCA/Detector pair is accomplished with this option. All the parameters for a setup must be entered in the gray screen areas. (The up and down arrow key can be used to move backward or forward in the menu.) Once complete, the ROI setup is requested (9 ROIs max.). Input parameters will change depending on which type MCA setup is being entered.
- Note:* It is assumed that there is one reference peak and it has one lower and one higher in energy background ROI (any channel width). The numbers of these ROIs must be the reference peak ROI number minus one & plus one. It is also assumed that the SNM Analysis peak and Check Source peak each have one higher energy background ROI (same channel width). These two background ROIs must be one ROI number higher than their associated peaks. Also, the Analysis peak and the Check Source peak can be the same ROI number. (This includes the background ROIs.)
- 4> REMOVE Removing a setup for a MCA/Detector pair does not delete it! It is flagged as invalid and will be ignored by other parts of the HMSII software. (The flag can be removed by using FoxPro and editing the file SETUP.DBF. Locate the record for the desired MCA/Detector and remove the "*" in the field DONOTUSE.)

HMSII OPTION 5/5		(v2.1)
MODIFY MCA/DETECTOR SETUP PARAMENTERS		
1> BROWSE Parameters	3> ADD New Parameters	
2> EDIT Parameters	4> REMOVE Parameters	
5> QUIT to Setup Menu		
Enter Selection:		

MCA Serial Number: **M332** Are These Correct? (Yes/No):
 Detector Serial Number: **HR-222**

Fig. 12

Calib: 07/27/94		MCA/Detector SETUP Parameters	MCA Type: M
MCA S/N:	M332	No. ROIs Used:	5
Detector S/N:	HR-222	Anal. Peak ROI #:	4
Memory Size:	512	Ref. Peak ROI #:	2
Mem. Group:	1	Ref. Peak Cent.:	100
Detector Type:	0	Ref. Cent. Limit:	5
Amp. Polarity:	1	Ref. Peak FWHM:	15
Coarse Amp. Gain:	4	Ref. FWHM Limit:	3
Fine Amp. Gain:	3600	Ref. Peak Cnt/s:	1950
High Voltage:	500	Ref. Cnt. Limit:	30
Stab. Gain:	0	Max. Gross Cnts:	000000
LL Discriminator:	100	Max. Bkg Counts:	000000
UL Discriminator:	4095	Chk. Src. ROI #:	4
Threshold:	50	Chk. Src. Cnt/s:	110
PU Rejector:	0	Chk. Src. Limit:	12
Preset Count Time:	20	Chk. Src. Freq.:	001
Time Units:	0	Low Batt. Value:	11.00
Notes: 1st. MCA setup parameters U cent.: 300			
F=FORWARD, B=BACK, S=SELECT, H=HARDCOPY, R=ROIS, Q=QUIT:			

Fig. 13

MCA S/N: M332 Det. S/N: HR-222 ROIs		
ROI #	Begin Chan. #	End Chan. #
1	66	68
2	70	125
3	127	129
4	261	340
5	387	466
Hit <Enter> key to continue...		

Fig. 14

HMSII Option #6

This module controls the supplemental information for all the individual holdup measurement points (Fig. 15). All points to be used with the HMSII must have the required physical information input using this option before any quantitative calculations can be done! A detailed knowledge of the field area to be measured is essential. The area (2 digit code) in the field where the measurement point resides is required (Fig. 16). The equipment (2 digit code) in the field where the measurement point resides is required (Fig. 17). [The numbers in parentheses in Fig. 17 are the total number of measurement points for that piece of equipment.] Finally, the identifying code (001-999) of the individual measurement point is required (Fig. 18). Options 2, 3, and 4 of this module are password protected.

- 1> BROWSE The browse option will seek a specified area, piece of equipment, and measurement point. Once retrieved, ALL points in an area can be scrolled forward and backward (Fig. 19)! The associated groups of points in an area to be averaged can be displayed (Fig. 20). Copies of any point data may be printed by pressing the "H" key for a hardcopy.
- 2> EDIT All parameters in the gray screen blocked areas can be edited with this option. The measurement point groups to be averaged can be edited from a second screen. When parameters are changed, all other related parameters (in yellow) will be automatically recalculated. (See ADD)
- 3> ADD Adding a new point to an area or piece of equipment is accomplished with this option. All point parameters must be entered in the gray screen blocked areas. Certain fields (yellow on screen) are calculated automatically when all other related fields are completed. For a point to be included in the summary quantitative calculations, it MUST have an Associated Area input if it is a Area Source or it must have an Associated Length input if it is a Line Source. If NOT, the point MUST be included in a group of area source points or line source points to be averaged! The Attenuating Material (e.g., duct wall) of a point is identified one of two ways. It can be identified as a Element with it's Atomic Symbol (e.g., FE, Iron). It can also be identified as a Compound with it's chemical composition (e.g., SI O2, Glass). The Material Thickness is always required. The Material Density is required ONLY if the attenuating material is a compound.
- 4> REMOVE Removing a point (or group of points) does not delete it! It is flagged as invalid and will be ignored by other parts of the HMSII software. (The flag can be removed using FoxPro and editing the file PT_DATA.DBF. Locate the record for the desired measurement point location and remove the "*" in the field DONOTUSE.)

HMSII OPTION 6		(v2.1)
MEASUREMENT POINT SUPPLEMENTAL INFORMATION		
1> BROWSE Information	3> ADD New Point(s)	
2> EDIT Information	4> REMOVE Point(s)	
5> QUIT to Main Menu		
Enter Selection:		

Fig. 15

AREA SELECTION	
SELECT HOLDUP MEASUREMENT AREA	
01> 9212: B-1 Wing 02> 9212: C Wing 03> 9212: C-1 Wing 04> 9212: Headhouse 05> 9212: D Wing 06> 9212: D-1 Wing 07> Bldg 27: Pipe Room 08> 9212: Recovery Roof 09> 9212: Recovery Bsmt. 20> 9212: Sp. Proc. Rm 1010	
(M - MORE AREAS) (Enter - BACK TO MAIN MENU)	
Select Area	7

Fig. 16

EQUIPMENT SELECTION	
SELECT HOLDUP MEASUREMENT EQUIPMENT	
01> Al Pipe	(10)
02> Pipe Array	(8)
03> Steel Pipe	(14)
04> Rectangular Duct	(5)
05> V-Blender (close)	(3)
06> V-Blender (away)	(1)
07> Floor Spot	(1)
08> Annular Tank	(4)
...NO MORE EQUIPMENT!	
(M - MORE EQUIPMENT)	
(Enter - BACK TO MAIN MENU)	
Select Equipment	1

Fig. 17

BROWSE MEASUREMENT POINT LOCATION(S)	
	DESCRIPTION
AREA: 07	9212: Reduction
EQUIPMENT: 01	Room Exhaust Duct System
Enter Point LOCATION: 3	

Fig. 18

Measurement Point Supplemental Information			
Point Area/Equip.:	0701	Assoc. Length (cm):	71.2
Point Location:	003	Len. Uncity. (cm):	1.00
Mod. User I.D.:	020285	Gamma Energy (KeV):	186
Mod. Date:	07/08/94	Atten. Mat. (E or C):	E
Mod. Time:	12:49	Atten. Mat. (At Sym):	AL
Alarm Pt. (cnt/s):	2000.0	Mat. Thickness (cm):	0.320
Source (P,L,A,O):	L	Mat. Dens. (g/cm ³):	2.700
Meas. Dist. (cm):	20.00	μ (cm ² /g):	0.12191337
Equip. Diam. (cm):	0.0	Equip. Wall CF:	1.11116741
Diam. Uncity. (cm):	0.00	Self-Atten. CF:	1.00000000
Assoc. Area (cm ²):	0.0	Geom. Resp. CF:	1.00000000
Area Uncity. (cm ²):	0.00		
Notes: AL Pipe			
F=FORWARD, B=BACK, H=HARDCOPY, A=AUG. GROUPS, Q=QUIT:			

Fig. 19

Area/Equip.: 0701				Measurement Point Groups/Sizes (cm) to Average							
#	Beg. Pt.	End Pt.	Length, Area, #	#	Beg. Pt.	End Pt.	Length, Area, #	#	Beg. Pt.	End Pt.	Length, Area, #
01	001	003	213.4	16	-	-	-	31	-	-	-
02	004	010	60.96	17	-	-	-	32	-	-	-
03	-	-	-	18	-	-	-	33	-	-	-
04	-	-	-	19	-	-	-	34	-	-	-
05	-	-	-	20	-	-	-	35	-	-	-
06	-	-	-	21	-	-	-	36	-	-	-
07	-	-	-	22	-	-	-	37	-	-	-
08	-	-	-	23	-	-	-	38	-	-	-
09	-	-	-	24	-	-	-	39	-	-	-
10	-	-	-	25	-	-	-	40	-	-	-
11	-	-	-	26	-	-	-	41	-	-	-
12	-	-	-	27	-	-	-	42	-	-	-
13	-	-	-	28	-	-	-	43	-	-	-
14	-	-	-	29	-	-	-	44	-	-	-
15	-	-	-	30	-	-	-	45	-	-	-

Hit <Enter> key to continue...

Fig. 20

HMSII Option #7

The status of completion of holdup measurements in a selected area is controlled by this module (Fig. 21). The status of a given area is first requested (Fig. 22). Then the equipment in that selected area is displayed in colors (Fig. 23). The measurements on a piece of equipment that is displayed in white have not been started. The measurements on a piece of equipment that is displayed in black have been completed. Measurement on a piece of equipment that is displayed in brown are underway. The incomplete equipment can be selected to display which individual points have not been measured (Fig. 24).

HMSII OPTION 7	(v2.1)
COMPLETION STATUS FOR HOLDUP MEASUREMENTS (ANALYZES HOW COMPLETE MEASUREMENTS ARE FOR ALL AREAS)	
Do you want to proceed (Yes/No):	

Fig. 21

AREA SELECTION	
SELECT HOLDUP MEASUREMENT AREA	
01>	9212: B-1 Wing
02>	9212: C Wing
03>	9212: C-1 Wing
04>	9212: Headhouse
05>	9212: D Wing
06>	9212: D-1 Wing
07>	Bldg 27: Pipe Room
08>	9212: Recovery Roof
09>	9212: Recovery Bsmt.
20>	9212: Sp. Proc. Rm 1010
(M - MORE AREAS) (Enter - BACK TO MAIN MENU)	
Select Area	7

Fig. 22

EQUIPMENT COMPLETION STATUS		
(NOT STARTED)	(UNDERWAY)	(COMPLETED)
01> Al Pipe		(10)
02> Pipe Array		(8)
03> Steel Pipe		(14)
04> Rectangular Duct		(5)
05> V-Blender (close)		(3)
06> V-Blender (away)		(1)
07> Floor Spot		(1)
08> Annular Tank		(4)
...NO MORE EQUIPMENT!		
(M - MORE EQUIPMENT)		
(Enter - BACK TO MAIN MENU)		
Select Equipment 1		

Fig. 23

MISSING LOCATION NUMBERS!!		
0701-	(Al Pipe	)
004 to 010		

Fig. 24

HMSII Option #8

The final summaries and reports for the operation of the HMSII are controlled from this module (Fig. 25). Summary reports can be requested for any Area/Equipment code for points generating a warning. The gram quantities for any Area or for a piece of equipment in an area can be requested. The net count rates for the points in a given Area/Equipment are available. Finally, the reports generated for the last bar code reader dumped (Main Menu Opt. #2) and the analyzed (Opt. #3), all can be reproduced. The complete archive file of all reader dumps (MCADATA) is accessed from this option.

<u>Opt.</u>	<u>Description</u>
-------------	--------------------

1>	Part of the data from a Controller dump is analyzed against an alarm set-point. When this is exceeded, a warning is generated for the specific measurement point. Main Menu Option #4 is used to record comments on the action taken to remedy that alarm condition. This menu item will search out the database for those points with warnings which still have <u>not</u> had comments entered. (By entering a '*' when selecting the Equipment Code, all pieces of equipment in the selected Area will be searched.)
2>	All measurement points that generated warnings will be returned when this option is selected. The comments entered for the points in the selected Area/Equipment code can be reviewed using this option.
3>	This is one of the most important selections in Option #8. It calculates then summarizes the amounts of SNM material for a selected Area or for a selected piece of Equipment in an Area. The data is presented in sorted ascending numerical order. This item also uses the group of points to be averaged (Main Menu Option #6) in it's calculations and summarizes the averaged data.
4>	This option is for reporting the count rates for the reference and analysis peaks, and the analysis background ROI for each measurement point in the selected Area/Equipment code.
5>	The HMSII system PC operator can retrieve another printout of the raw field data from the last Controller that has been dumped (Main Menu Opt. #2). The report can be printed in the order the points were actually measured or in sorted ascending numerical order.
6>	The HMSII system PC operator can retrieve another printout of the analysis data from the last Controller data analyzed by Main Menu Opt. #3. The report can be printed in the order the points were actually measured or in sorted ascending numerical order.

HMSII OPTION 8	(v2.1)
AREA/EQUIPMENT SUMMARY REPORTS OF HOLDUP DATA	
SUMMARY (High Points):	
1> Items above action limit (NO COMMENTS!)	
2> All items above action limit	
SUMMARY (Quantities):	
3> Totals grams for Area/Equipment Code	
4> Ref., Anal., Bkg. Peaks - Count Rates	
5> Last Reader Dumped - Raw ROI Data	
6> Last Reader Analyzed - Data Summary	
7> Quit to Main Menu	
Enter Selection:	

Fig. 25

Holdup Measurement System II (HMSII)

System Programs

<u>Program</u>	<u>Description</u>
MCAMAIN .PRG	This is the Holdup Measurement System's Main Menu program. It has eight primary options. Each of these options calls one of the separate program modules listed below.
MCACALIB .PRG	(Opt. #1) This is the MCA/Detector calibration program module for the system. The GGH calibration parameters and radial responses are input and K_p , K_l , and K_a are calculated.
BARDATA .PRG	(Opt. #2) The program module for dumping/copying holdup measurement data collected in the field from a Controller to the temporary file MCADB1.dbf.
MCAANL .PRG	(Opt. #3) This is the calculation, data analysis and archival program module for the system. It calculates g for a point source, g/l for a line source, or g/a for an area source.
MCAEDIT .PRG	(Opt. #4) This program module is used by the data analyst to enter comments for action taken on "alarmed" points.
MCALOAD .PRG	(Opt. #5) The load module uses several other modules to edit or load parameters, or programs into either the MCAs or the Controllers.
MCASETUP .PRG	This program module is used from MCALOAD.prg (Opt. #5/5). It allows control of all of the MCA/Detector setup parameter data.
BARLOAD .PRG	This program module is used from MCALOAD.prg (Opt. #5/6). It uploads/copies the field measurement (MCA control) program to a Controller.
MCAPOINT .PRG	(Opt. #6) The parameters for each of the individual field measurement point are input and edited from this program module.
MCASTAT .PRG	(Opt. #7) The status toward completion of measurements in a given area is compiled by this program module. Points not yet measured are listed.
MCAPRINT .PRG	(Opt. #8) The data analyzed in Opt. #3 is summarized and totaled by this program module. Also, reprinted reports from Opt. #2 & #3 are available.

<u>Program</u>	<u>Description</u>	(cont.)
MCARESET .PRG	This program archives a measurement period's (MCADATA) master file according to the month and year (e.g., SEP1994.dbf). It also zeros the reader dump number counter, deletes all previous dump backup files, and sets a new month and year for the measurement period.	
SETROI .PRG	A simple program to aid the user in setting up ROIs on a new PMCA. (Works for Uranium or Plutonium.)	
<hr/>		
MMCA .IRL	This is the M ³ CA version of the Controller program for the HMSII. The .IRL version (for the 944X) will be copied to MCAIRL.DBF before being uploaded into a Controller. The .EXE version (for the JANUS) will be copied to a PCMCIA (SRAM) disk.	
MMCA .EXE		
PMCA .IRL	This is the PMCA version of the Controller program for the HMSII. The .IRL version (for the 944X) will be copied to MCAIRL.DBF before being uploaded into a Controller. The .EXE version (for the JANUS) will be copied to a PCMCIA (SRAM) disk.	
PMCA .EXE		
NMCA .IRL	This is the μ NOMAD version of the Controller program for the HMSII. The .IRL version (for the 944X) will be copied to MCAIRL.DBF before being uploaded into a Controller. The .EXE version (for the JANUS) will be copied to a PCMCIA (SRAM) disk.	
NMCA .EXE		
<hr/>		
HMSII .EXE	The compiled FoxPro executable HMSII program.	
MCARESET .EXE	The DOS executable version of MCARESET.PRG.	
SETROI .EXE	The DOS executable version of SETROI.PRG.	
REVIEW .EXE	A program to allow a previously stored spectra to be displayed on a JANUS Controller.	
ATTEN .EXE	A LANL program written to calculate attenuation parameters. The program requires the data file ATTEN_2.DAT.	
CONSPECT .EXE	A program to convert stored spectra to several other formats. (Program requires ASC2CHN.exe and CHN2ASC.exe to run.)	

Holdup Measurement System II (HMSII)

System Files

<u>File</u>	<u>Description</u>
SETUP .DBF	Setup parameters for MCA/Det. pair are stored in this file. They are also downloaded and used in Controller array A for testing the MCA and data. (module MCASETUP)
SETUPNEW .DBF	Template file used for creating new setup parameter file for a PMCA/Detector pair. (Default/suggested values are stored in this file!)
SETUPNW2 .DBF	Template file used for creating new setup parameter file for a M ³ CA/Detector pair. (Default/suggested values are stored in this file!)
SETUPNW3 .DBF	Template file used for creating new setup parameter file for a μ NOMAD/Detector pair. (Default/suggested values are stored in this file!)
SETUPTMP .DBF	Temporary setup file used for creating new setup parameter file for a MCA/Detector pair.
ROI .DBF	ROI for MCA/Det. pairs are stored in this file. It is used in conjunction with SETUP.dbf. (module MCASETUP)
ROINEW .DBF	Template file used for entering the new ROIs for the setup parameters of a MCA/Detector pair.
ROITMP .DBF	Temporary ROI file used for creating new setup parameter file for a MCA/Detector pair.
CALIB .DBF	Full calibration parameters for each MCA/Det. pair are stored in this file. (module MCACALIB)
CALNEW .DBF	Template file used for creating new calibration for a specific MCA/Detector pair. (Default/suggested values are stored in this file!)
CALTEMP .DBF	Temporary file used for creating a new calibration for a specific MCA/Detector pair.
CAL_CNTS .DBF	Radial response data storage for each MCA/Det. calibration. It is used in conjunction with CALIB.dbf. (module MCACALIB)
CNTSNEW .DBF	Template file used for entering the Radial Responses for a new calibration.

<u>File</u>	<u>Description</u>	(cont.)
CNTSTEMP .DBF	Temporary file used for creating the Radial Responses for a new calibration for a specific MCA/Detector pair.	
PT_DATA .DBF	Supplemental information for each field holdup measurement point location is stored in this file. (module MCAPOINT)	
PTDATNEW .DBF	Template file used for entering the supplemental information for a measurement point. (Default/suggested values are stored in this file!)	
PTDATTMP .DBF	Temporary file used for creating the supplemental information for a new measurement point.	
LOCSAVG .DBF	Measurement point locations to be grouped and averaged, along with total length (cm) or area (cm ²) to be applied toward. It is used in conjunction with PT_DATA.dbf. (module MCAPOINT)	
LOCSNEW .DBF	Template file used for entering any measurement points to be grouped and averaged.	
LOCSTMP .DBF	Temporary file used for creating the groups to be averaged supplemental information for a new measurement point.	
ATTEN .DBF	This is the energy cross section data used by the system software (module MCAPOINT) to calculate the attenuation and correction factor for measurement points.	
AREA .DBF	The file for storing measurement point descriptions on a large scale. This is the first two digits (four digit area code) of a point's I.D. bar code label. (e.g., buildings, wings, floors, etc.)	
EQUIP .DBF	Detailed descriptions of measurement point locations. This is the second two digits (four digit area code) of a point's I.D. bar code label. Stores total number of points for a piece of equipment. (e.g., rooms, pieces of equipment, sections of ducts, etc.)	
MCADB1 .DBF	This is the temporary file built from a Controller data dump of arrays A, B, and C. When analyzed by Opt. #3 (module MCAANL), the results are archived to MCADATA.dbf. MCADB1 is overwritten by each data dump.	

<u>File</u>	<u>Description</u>	<u>(cont.)</u>
MCADB1A .DBF	These are the temporary files for input of the JANUS Controller's ASCII data files: DATA_A.dat, DATA_B.dat and DATA_C.dat. They are used to build MCADB1.dbf.	
MCADB1B .DBF		
MCADB1C .DBF		
MCADATA .DBF	This is the main archive file for all holdup data points. It is built from MCADB1.dbf - (Controller data dump), CALIB.dbf - (MCA/Det. calibration), and PT_DATA.dbf - supplemental meas. pt. info).	
MCABAKUP.DBF	This is a backup file create from MCADB1.DBF when Opt. #3 (module MCAANL) is executed.	
MCACHECK.DBF	This file is used in Option #7 (module MCASTAT) to temporarily store the measurement points that were missed.	
MCATEMP .DBF	This file is a temporary file used for calculate results (module MCAANL) before archiving final answers in MCADATA. (same file format as MCADATA)	
MCATEMP1.DBF	These two files are temporary files used to compile and sort all of the gram calculation data requested in Opt. #8/3. (module MCAPRINT) (same file format as MCADATA)	
MCATEMP2.DBF		
MCAOPT .DBF	The Month and Year of the inventory period for which the holdup data is collected is stored in this file.	
MCAIRL .DBF	This is a temporary file which will hold the PMCA, μ NOMAD or M ³ CA IRL program to be loaded into the Controller. (module BARLOAD)	
MCA_DET .DBF	This file temporarily stores the last MCA and Detector serial numbers selected for one of the menu options.	
BARDUMP .DBF	This is a one record (one field - DUMPNUM) file. It keeps count of the number of readers dumped during a measurement period (001-999).	
BADGENUM.DBF	The badge numbers and passwords for access to the add, edit, and remove selections of the software are stored in this file.	

<u>File</u>	<u>Description</u>	<u>(cont.)</u>
MCADB1A .FRX	This report form file is for the first page of a reader dump, the point information, Option #2. (module BARDATA)	
MCADB1B .FRX	This report form file is for the second page of a reader dump, ROI 1 to ROI 5, Option #2. (module BARDATA)	
MCADB1C .FRX	This report form file is for the third page of a reader dump, ROI 6 to ROI 9, Option #2. (module BARDATA)	
MCADATA .FRX	The report form file is for the final analysis report from Opt. #3. (module MCAANL)	
MCADATA1 .FRX	The report form file is for the re-analysis of the Master file (MCADATA.dbf) from Opt. #3. (module MCAANL)	
MCAACTS .FRX	This report form file is for the items that exceeded their set alarm points, Option #8/1 & 8/2. (module MCAPRINT)	
MCACOUNT.FRX	This report form file is for the count rates for each measurement point, Option #8/4. (module MCAPRINT)	
MCATOTAL.FRX	This report form file is for the gram totals calculated for each measurement point and also the subtotals for an Area/Equipment code, Opt. #8/3. (module MCAPRINT)	
<hr/>		
CTF25S .PLB	This is the "CommTools" communication module library (DOS). It is called from inside the various HMSII programs. It MUST be in the same directory as the HMSII programs and data files.	
<hr/>		

Note:

Source programs for HMSII are available through request to DOE Office of Scientific and Technical Information (OSTI).

Mailing Address

DOE Office of Scientific and Technical Information
P. O. Box 62
Oak Ridge, TN 37831

Holdup Measurement System II (HMSII)

File Structure

Holdup Data & MCA/Det. Setup Parameters Storage in a Controller

Structure for database: **SETUP.DBF**

(also)

944X Array: *A(50,10)* (50 MCA/Detector config. params, 10 char. long)

JANUS Files: *DATA_A.dat (MCADB1A.dbf)*

<u>Field</u>	<u>Field Name</u>	<u>Width</u>	<u>Used By</u>	<u>Description</u>
A(1)	MCA	[5]	MCA	mca serial number
(2)	DET	[8]	"	detector serial number
(3)	MDIV	[4]	"	memory (division-PMCA,size-M ³ CA,adc-μNOMAD)
(4)	MGROUP	[2]	"	memory groups
(5)	DETTYP	[6]	"	detector type
(6)	AMPPOL	[3]	"	amplifier polarity
(7)	GAIN	[5]	"	amp. gain (fine-M ³ CA)
(8)	HVPS	[4]	"	high voltage
(9)	STAB	[3]	"	stabilizer (on/off-PMCA,μNOMAD)(gain-M ³ CA)
(10)	LLD	[4]	"	LL discriminator
(11)	ULD	[4]	"	UL discriminator
(12)	ZERO	[2]	"	zero offset (pedestal-M ³ CA)
(13)	THR	[4]	"	threshold
(14)	PUREJ	[3]	"	pu rejector on/off
(15)	PTIME	[5]	"	present count time
(16)	TUNITS	[7]	"	time units
(17)	ROI	[2]	944X	number of ROIs used (9max.)
(18)	ANALROI	[2]	"	ROI # for analysis peak
(19)	REFROI	[2]	"	ROI # for reference peak
(20)	REFCENT	[4]	"	ref. peak orig. centroid
(21)	RCLIMIT	[4]	"	" " " cent. limit
(22)	REFFWHM	[5]	"	" " " FWHM
(23)	RFLIMIT	[5]	"	" " " FWHM limit
(24)	REFCNTS	[8]	"	" " " net cnt/s
(25)	RCNTLIM	[6]	"	" " " " " limit
(26)	GROSCNT	[8]	"	max. full spectrum gross cnt/s
(27)	BKGCNTS	[8]	"	max. anal. peak bkg. gross cnt/s
(28)	SRCNTS	[8]	"	check source orig. net cnt/s
(29)	SRLIMIT	[8]	"	" " " " " limit
(30)	SRCFREQ	[3]	"	check source meas. frequency
(31)	LOWBATT	[5]	"	low mca battery warning value
(32)	SRCROI	[2]	"	ROI # for check source peak
(33)	REFCH	[4]	"	total ref. peak channels
(34)	BKGCH	[4]	"	total ref. peak bkg. Channels
(35)	CALDATE	[8]	na	date of last calibration
(36)	MCATYPE	[1]	na	type MCA (P-PMCA,M-M ³ CA,N-μNOMAD)
(37)	GAINC	[3]	MCA	amp. gain (coarse-M ³ CA only)
(38)	MOD_USER	[6]	na	user i.d. for last modification
(39)	MOD_DATE	[8]	na	date of last modification
(40)	NOTES	[45]	na	notes on specific setup
(41)	DONOTUSE	[1]	na	setup not used flag

Holdup Data & MCA/Det. Setup Parameters Storage in a Controller cont.

944X Array: ***B(300,50)*** (300 meas. point information, 50 char. long)
 (one record!)

Measurement Point I.D.*	[7]	area and location of measurement pt.
User Badge Number	[6]	badge no. of user
Time of Measurement	[5]	time
Date of Measurement	[8]	date
Count Time	[5]	count time for that meas. pt.
Ref. Peak Centroid	[4]	centroid of ref. peak (high channel-PMCA, μ NOMAD)
Ref. Peak FWHM	[5]	FWHM of ref. peak (M ³ CA only)
Background Run Flag	[1]	flag set if meas. pt. is a bkg. run

plus a space between each item 48

***Note:** Meas. Pt. I.D.: 2 digits (XX) - building, wing, floor, etc. (area)
 2 digits (YY) - room & piece of equip., duct, etc. (area/equip)
 XXYY-ZZZ 3 digits (ZZZ) - each meas. point / piece of equip. (location)

JANUS Files: *DATA B.dat (MCADB1B.dbf)*

<u>Field Name</u>	<u>Width</u>	<u>Description</u>
AREA	[4]	area of measurement point
LOCATION	[3]	location of measurement point
USER_ID	[6]	badge no. of user
MCA_NUM	[5]	mca serial number
DET_NUM	[8]	detector serial number
DATE	[8]	date of measurement
TIME	[5]	time of measurement
CNTTIME	[5]	count time for that meas. pt.
REF_CENT	[4]	centroid of ref. peak (high channel-PMCA, μ NOMAD)
REF_FWHM	[5]	FWHM of ref. peak (M^3 CA only)
ANAL_ROI	[2]	ROI # for analysis peak
REF_ROI	[2]	ROI # for reference peak
SRC_ROI	[2]	ROI # for check source peak
REFCH	[4]	total ref. peak channels
BKGCH	[4]	total ref. peak bkg. Channels
BKGRND	[1]	flag set if meas. pt. is a bkg. run
WARNING	[1]	warning flag if controller has an error

plus a "," between each item 70

Holdup Data & MCA/Det. Setup Parameters Storage in a Controller cont.

[illegible]

ROI (#1) Gross Counts	[8]	e.g., low energy ref. peak bkg.
" (#2) " "	[8]	e.g., ref. peak gross cnts
" (#3) " "	[8]	e.g., high energy ref. peak bkg.
" (#4) " "	[8]	e.g., snm anal. peak gross cnts
" (#5) " "	[8]	e.g., high energy bkg. (same width as #4!)

plus a space between each item 44

JANUS Files: *DATA C.dat (MCADB1C.dbf)*

<u>Field Name</u>	<u>Width</u>	<u>Description</u>
ROI_1	[8]	ROI # 1 gross counts
ROI_2	[8]	ROI # 2 gross counts
ROI_3	[8]	ROI # 3 gross counts
ROI_4	[8]	ROI # 4 gross counts
ROI_5	[8]	ROI # 5 gross counts
ROI_6	[8]	ROI # 6 gross counts
ROI_7	[8]	ROI # 7 gross counts
ROI_8	[8]	ROI # 8 gross counts
ROI_9	[8]	ROI # 9 gross counts

plus a "," between each item 44

Note: MCADB1C.dbf also contains the associated uncertainties for ROI's #1-9. (UNC 1 to UNC 9 in the last nine field locations.)

ROIs are stored in file: **ROI.DBF** **(NOT STORED IN Controller!)**

<u>Field</u>	<u>Field Name</u>	<u>Width</u>	<u>Description</u>
1	MCA	[5]	mca serial number
2	DET	[8]	detector serial number
3	ROI_NUM	[2]	ROI number
4	BEGCHAN	[4]	beginning channel
5	ENDCHAN	[4]	ending channel

MCA/Detector Calibration File(s)

Structure for database: **CALIB.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	MCA	Character	[5]		Y	mca ser. number
2	DET	Character	[8]		Y	det. ser. number
3	MATERIAL	Character	[9]		N	type SNM material
4	USER_ID	Character	[6]		N	person calibrating sys.
5	CALDATE	Character	[8]		N	calibration date
6	NPTS	Numeric	[3]		N	no. radial respon. pts.
7	RO	Numeric	[6]	2	N	detect. - source distance
8	S	Numeric	[5]	2	N	source spacing
9	BK	Numeric	[8]	2	N	room bkg (cnt/s)
10	SIGMABK	Numeric	[6]	2	N	" " uncty (cnt/s)
11	PKCOUNT	Numeric	[8]	1	N	ref. std. peak counts
12	BKGRCOUNT	Numeric	[6]	1	N	ref. std. bkg. counts
13	T	Numeric	[5]		N	ref. std. count time
14	L	Numeric	[8]	3	N	effect. length (cm)
15	SIGMAL	Numeric	[6]	3	N	uncty effect. length
16	A	Numeric	[8]	3	N	effect. area (cm)
17	SIGMAA	Numeric	[8]	3	N	uncty effect. area
18	MO	Numeric	[8]	3	N	iso. mass of std. (g)
19	EN	Numeric	[8]	2	N	enrichment of std. (%)
20	D	Numeric	[6]	3	N	diameter of std. (cm)
21	PX	Numeric	[8]	5	N	elem. mass/area (g/cm ²)
22	MU	Numeric	[8]	3	N	μ (cm ² /g)
23	CCF	Numeric	[8]	3	N	std. container corr. fact.
24	CF	Numeric	[6]	3	N	self-atten. corr. factor
25	KP	Numeric	[10]	8	N	point src. calib. const.
26	SIGMAKP	Numeric	[10]	8	N	uncty in Kp
27	KL	Numeric	[10]	8	N	line src. calib. const.
28	SIGMAKL	Numeric	[10]	8	N	uncty in Kl
29	KA	Numeric	[10]	8	N	area src. calib. const.
30	SIGMAKA	Numeric	[10]	8	N	uncty in Ka
31	NOTES	Character	[45]		N	notes on specific calib.
32	DONOTUSE	Character	[1]		N	calib. not used flag

Structure for database: **CAL_CNTS.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	MCA	Character	[5]		Y	mca ser. number
2	DET	Character	[8]		Y	det. ser. number
3	INUM	Numeric	[3]		N	respon. position ID
4	TIME	Numeric	[5]		N	count time for meas.
5	PKCOUNTS	Numeric	[8]		N	ref. peak counts
6	BKGRCOUNTS	Numeric	[8]		N	bkg peak counts

Holdup Data Point Supplemental Information File(s)

Structure for database: **PT_DATA.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[4]		Y	part of meas. pt. I.D.
2	LOCATION	Character	[3]		Y	" " " " "
3	MOD_USER	Character	[6]		N	last user to edit file
4	MOD_DATE	Character	[8]		N	date of last user edit
5	MOD_TIME	Character	[5]		N	time of last user edit
6	ALARM_PT	Numeric	[8]	1	N	high count set point
7	SOURCE	Character	[1]		N	point, line, area or other
8	DIAM	Numeric	[8]	1	N	diam. assoc. with point
9	UNC_DIAM	Numeric	[6]	2	N	uncnty in diam. assumpt.
10	AREA_PT	Numeric	[8]	1	N	area assoc. with area pt.
11	UNC_AREA	Numeric	[6]	2	N	uncnty in area assumpt.
12	LEN_PT	Numeric	[8]	1	N	length assoc. with line pt.
13	UNC_LEN	Numeric	[6]	2	N	uncnty in len. assumpt.
14	KEV	Character	[3]		N	gamma energy desired
15	ATT_MAT	Character	[10]		N	attenuating material
16	EORC	Character	[1]		N	att. mat. elem. or cmpd.
17	THICK	Numeric	[6]	3	N	thickness of material
18	C_DENSITY	Numeric	[6]	3	N	compound density
19	MU	Numeric	[12]	8	N	μ (cm ² /g) for material
20	CORR_FACT	Numeric	[12]	8	N	CF for atten. material
21	CF_SELFATT	Numeric	[12]	8	N	CF for self atten.
22	CF_GEORESP	Numeric	[12]	8	N	CF for geom. assumpt.
23	R	Numeric	[6]	2	N	det. - src. dist. (meas.)
24	NOTES	Character	[45]		N	notes on specific point
25	DONOTUSE	Character	[1]		N	point not used flag

Structure for database: **LOCSAVG.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[4]		Y	part of meas. point I.D.
2	LOCSTART	Character	[3]		N	begin meas. pt. number
3	LOCEND	Character	[3]		N	end meas. pt. number
4	LENAREA	Character	[7]		N	tot. length/area for group (cm/cm ²)

Holdup Data Point Supplemental Information File(s) cont.

Structure for database: **ATTEN.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	ELEMS	Character	[2]		Y	element symbol
2	DENS	Numeric	[12]	8	N	density of element
3	LNGTH	Numeric	[3]		N	# of cross sec. data pts.
4	ATOMICWT	Numeric	[10]	5	N	atomic wt. of element
5	ENRGY	Numeric	[10]	3	N	energy for cross sect. data
6	CRSECT	Numeric	[15]	8	N	cross section data

Structure for database: **AREA.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[2]		Y	part of meas. pt. I.D.
2	DESCRIPT	Character	[25]		N	area description

Structure for database: **EQUIP.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[2]		Y	part of meas. pt. I.D.
2	EQ_NUM	Character	[2]		Y	part of meas. pt. I.D.
3	EQ_NAME	Character	[25]		N	area/equip. description
4	MAX_PT	Character	[3]		N	max. pts. for a area
5	TOT_PT	Character	[3]		N	tot. pts. meas. in a area
6	ALARM_PT	Character	[3]		N	tot. pts. alarmed a area
7	FCOLOR	Character	[2]		N	color flag for area done

Controller Reader Dump (Temporary) File

Structure for database: **MCADB1.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[4]		N	part of meas. pt. I.D.
2	LOCATION	Character	[3]		N	" " " " "
3	USER_ID	Character	[6]		N	user badge no.
4	MCA_NUM	Character	[5]		N	mca ser. number
5	DET_NUM	Character	[8]		N	det. ser. number
6	DATE	Character	[8]		N	measurement date
7	TIME	Character	[5]		N	measurement time
8	CNTTIME	Numeric	[5]		N	count time
9	REF_CENT	Character	[4]		N	ref. peak centroid
10	REF_FWHM	Character	[5]		N	ref. peak FWHM
11	ANAL_ROI	Character	[2]		N	ROI # of anal. peak
12	REF_ROI	Character	[2]		N	ROI # of ref. peak
13	SRC_ROI	Character	[2]		N	ROI # of chk. src. peak
14	REFCH	Character	[4]		N	total ref. peak channels
15	BKGCH	Character	[4]		N	" " " bkg. chan.
16	BKGRND	Character	[1]		N	bkg. run flag
17	WARNING	Character	[1]		N	high cnt/s flag
18	ALARM_PT	Numeric	[8]	1	N	high count set point
19	ROI_1	Numeric	[8]	1	N	gross counts ROI #1
20	UNC_1	Numeric	[6]	1	N	uncty (cnts) ROI #1
21	ROI_2	Numeric	[8]	1	N	gross counts ROI #2
22	UNC_2	Numeric	[6]	1	N	uncty (cnts) ROI #2
23	ROI_3	Numeric	[8]	1	N	gross counts ROI #3
24	UNC_3	Numeric	[6]	1	N	uncty (cnts) ROI #3
25	ROI_4	Numeric	[8]	1	N	gross counts ROI #4
26	UNC_4	Numeric	[6]	1	N	uncty (cnts) ROI #4
27	ROI_5	Numeric	[8]	1	N	gross counts ROI #5
28	UNC_5	Numeric	[6]	1	N	uncty (cnts) ROI #5
29	ROI_6	Numeric	[8]	1	N	gross counts ROI #6
30	UNC_6	Numeric	[6]	1	N	uncty (cnts) ROI #6
31	ROI_7	Numeric	[8]	1	N	gross counts ROI #7
32	UNC_7	Numeric	[6]	1	N	uncty (cnts) ROI #7
33	ROI_8	Numeric	[8]	1	N	gross counts ROI #8
34	UNC_8	Numeric	[6]	1	N	uncty (cnts) ROI #8
35	ROI_9	Numeric	[8]	1	N	gross counts ROI #9
36	UNC_9	Numeric	[6]	1	N	uncty (cnts) ROI #9
37	DUMPNUM	Character	[3]		N	seq. # of reader dump

Main Archive Holdup Data File

Structure for database: **MCADATA.DBF**

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
1	AREA	Character	[4]		N	part of meas. pt. I.D.
2	LOCATION	Character	[3]		N	" " " " "
3	USER_ID	Character	[6]		N	user badge no.
4	MCA_NUM	Character	[5]		N	mca ser. number
5	DET_NUM	Character	[8]		N	det. ser. number
6	DATE	Character	[8]		N	measurement date
7	TIME	Character	[5]		N	measurement time
8	CNTTIME	Numeric	[5]		N	count time
9	REF_CENT	Character	[4]		N	ref. peak centroid
10	REF_FWHM	Character	[5]		N	ref. peak FWHM
11	ANAL_ROI	Character	[2]		N	ROI # of anal. peak
12	REF_ROI	Character	[2]		N	ROI # of ref. peak
13	SRC_ROI	Character	[2]		N	ROI # of chk. src. peak
14	REFCH	Character	[4]		N	total ref. peak channels
15	BKGCH	Character	[4]		N	" " " bkg. chan.
16	BKGRND	Character	[1]		N	bkg. run flag
17	WARNING	Character	[1]		N	high cnt/s flag
18	MISSING	Character	[1]		N	missing point flag
19	ALARM_PT	Numeric	[8]	1	N	high count set point
20	ROI_1	Numeric	[8]	1	N	gross counts ROI #1
21	UNC_1	Numeric	[6]	1	N	uncy (cnts) ROI #1
22	ROI_2	Numeric	[8]	1	N	gross counts ROI #2
23	UNC_2	Numeric	[6]	1	N	uncy (cnts) ROI #2
24	ROI_3	Numeric	[8]	1	N	gross counts ROI #3
25	UNC_3	Numeric	[6]	1	N	uncy (cnts) ROI #3
26	ROI_4	Numeric	[8]	1	N	gross counts ROI #4
27	UNC_4	Numeric	[6]	1	N	uncy (cnts) ROI #4
28	ROI_5	Numeric	[8]	1	N	gross counts ROI #5
29	UNC_5	Numeric	[6]	1	N	uncy (cnts) ROI #5
30	ROI_6	Numeric	[8]	1	N	gross counts ROI #6
31	UNC_6	Numeric	[6]	1	N	uncy (cnts) ROI #6
32	ROI_7	Numeric	[8]	1	N	gross counts ROI #7
33	UNC_7	Numeric	[6]	1	N	uncy (cnts) ROI #7
34	ROI_8	Numeric	[8]	1	N	gross counts ROI #8
35	UNC_8	Numeric	[6]	1	N	uncy (cnts) ROI #8
36	ROI_9	Numeric	[8]	1	N	gross counts ROI #9
37	UNC_9	Numeric	[6]	1	N	uncy (cnts) ROI #9

Structure for database: **MCADATA.DBF** cont.

<u>Field</u>	<u>Field Name</u>	<u>Type</u>	<u>Width</u>	<u>Dec</u>	<u>Index</u>	<u>Description</u>
38	BKG	Numeric	[9]	3	N	bkg. run cnt/s
39	UNC_BKG	Numeric	[7]	3	N	uncty of bkg.
40	REF_PEAK	Numeric	[8]	2	N	net ref. peak cnt/s
41	UNC_REF	Numeric	[6]	2	N	uncty of ref. peak
42	ANAL_PEAK	Numeric	[9]	3	N	(net - bkg.) anal. peak
43	UNC_ANAL	Numeric	[7]	3	N	uncty of anal. peak
44	SOURCE	Character	[1]		N	point, line, area or other
45	DIAM	Numeric	[8]	1	N	diam. assoc. w/point
46	UNC_DIAM	Numeric	[6]	2	N	uncty in diam. assumpt.
47	AREA_PT	Numeric	[8]	1	N	area assoc. w/point
48	UNC_AREA	Numeric	[6]	2	N	uncty in area assumpt.
49	LEN_PT	Numeric	[8]	1	N	length assoc. w/point
50	UNC_LEN	Numeric	[6]	2	N	uncty in len. assumpt.
51	AVG_GROUP	Character	[3]		N	# of group to be avg.
52	AVG_LORA	Character	[7]		N	len./area for avg. group
53	ATT_MAT	Character	[10]		N	atten. material
54	THICK	Numeric	[6]	3	N	thickness of material
55	MU	Numeric	[12]	8	N	μ (cm ² /g) for material
56	CORR_FACT	Numeric	[12]	8	N	CF for atten. material
57	CF_SELFATT	Numeric	[12]	8	N	CF for self atten.
58	CF_GEORESP	Numeric	[12]	8	N	CF for geom. assumpt.
59	R	Numeric	[6]	2	N	det. - src. dist. (meas.)
60	RO	Numeric	[6]	2	N	det. - src. dist. (calib.)
61	KP	Numeric	[10]	8	N	point src. calib. const.
62	SIGMAKP	Numeric	[10]	8	N	uncty in Kp
63	KL	Numeric	[10]	8	N	line src. calib. const.
64	SIGMAKL	Numeric	[10]	8	N	uncty in Kl
65	KA	Numeric	[10]	8	N	area src. calib. const.
66	SIGMAKA	Numeric	[10]	8	N	uncty in Ka
67	ANSWER	Numeric	[12]	4	N	calc. SNM (g, g/l, g/a)
68	UNC_ANS	Numeric	[12]	4	N	uncty in answer
69	SD_GROUP	Numeric	[10]	2	N	std. dev. on grp. answer
70	EQTOTALS	Numeric	[10]	2	N	answer x (length/area)
71	UNC_TOT	Numeric	[10]	2	N	uncty in eqtotals
72	EDT_USER	Character	[6]		N	last analyst to edit file
73	EDT_DATE	Character	[8]		N	date of last analyst edit
74	EDT_TIME	Character	[5]		N	time of last analyst edit
75	COMMENTS	Character	[45]		N	com. from data analyst
76	DUMPNUM	Character	[3]		N	seq. # of reader dump
77	DONOTUSE	Character	[1]		N	results not used flag

Holdup Measurement System II (HMSII)

Wiring Diagrams

944X to (μNOMAD or PC)

INTERMEC con.
solder cup side

INTERMEC con.
front view

944X to PMCA

INTERMEC con.
solder cup side

INTERMEC con.
front view

944X to M³CA

RJ-11 front view

RJ-11 back view

INTERMEC con.
solder cup side

INTERMEC con.
front view

(JANUS or PC) to M³CA

(JANUS or PC) to μ NOMAD

Sub DB 9 pos.
(female connector)

PC

1
3
2
4
5
6
7
8
9

orange

red

blue

Sub DB 9 pos.
(female connector)

μ NOMAD

1
2
3
4
5
6
7
8
9