PROCEDURE FOR EVALUATION OF A UT INDICATION

AT

INDIAN POINT

NUCLEAR POWER PLANT UNIT THREE

USING THE ULTRASONIC DATA RECORDING AND PROCESSING SYSTEM (UDRPS)

2.2 SETTING SYSTEM DELAY AND IFB DELAY - System Delay and IFB Delay are set to ensure that digitization of the waveform begins before the wave enters the entry surface of the examination volume.

A. Begin by setting System Delay = 5000 and IFB Delay = 1

B. Place the transducer over weld No. 10 on the vessel. Adjust the gain such that the front surface response measures 80% screen height.

C. Record this information using the data acquisition program, VESSL. Display this data using the data display program, IMPROSMB.

D. Using position readings within IMPROSMB, measure the mpl location (mpl1) of the front surface. Next, measure the mpl location (mpl2) of the actual location of the front surface (i.e. Z_T = 0.00 where the front surface signal should appear). Calculate the new delay to be added to the old delay using the following formula.

Change in Delay = (mpl2 - mpl1) (RRC) uS

Adjust the System Delay and IFB delay such that,

Change in Delay = (System Delay) (.2) + (IFB Delay) (RRC)

Where:

mpl1	= no. of RRC from target location
mpl2	= no. of RRC from desired target location
RRC	= Range Resolution Cell Size (uS)
System Delay	= Time Delay (.2 uS units)
IFB Delay	= Buffer Delay (RRC uS units)

Change in Delay = new delay to be added to the system by adjusting both System Delay and IFB Delay (uS units)

2.3 INTERPULSE PERIOD - The interpulse period is set to ensure that a sufficient number of waveforms are digitized and recorded as the transducer passes across the examination volume.

A. The transducer head should be mounted on the Westinghouse manipulator.

B. Place the window frame with 3 vertical piano wires into the vessel. Align the center wire over the centerline of weld No. 10 before locking the frame onto the I.D.

C. Have Westinghouse set their scan axis motion to 1 "/sec.

D. Set the following parameters as follows:

Recircs = 1
PRF = 50

E. Have Westinghouse run the scanner back and forth across the weld. Record the data using the program VESSL.

F. Using the program IMPROSMB, measure the number of ASCANS between the three piano wires. Calculate the (IPP/interpulse period) as follows.

$$IPP = \frac{\text{distance bet wires}}{\text{no ascans bet wires}}$$

G. Using the SNRL Program, display the data and measure the number of pulses per beamwidth (PPBW) with the L-cut feature.

H. Adjust the number of pulses per beamwidth by changing the PRF with the following formula:

$$\text{NEW PRF} = \frac{\text{OLD PRF}}{\text{PPB}} \times 10$$

I. Input the new PRF into the parameter file and iterate this process again beginning with step 'E'. Do this until the number of PPBW falls between 8 and 22. The number of PPBW should be 10.

J. Once the PRF is finalized to obtain the appropriate number of pulses per beamwidth, set the following parameters in the parm file.

PRF = PRF X 4
Recircs = 4
IPP = (as calculated above)

2.4 TARGET MOTION - Target Motion is the change in range to a target across the beam (the apparent motion an indication exhibits as it walks across the screen). The actual Target Motion value describes the slope of a line and is a function of IPP and RRC.

A. Once the RRC size and IPP have been finalized in accordance with the above criteria, scan across the indication. Acquire the data with program VESSL.

B. Then using the program SNRL, do an L-cut on a representative side drilled hole. Record the target motion value.

3.0 DATA ACQUISITION

The following procedure describes (in step by step detail) how to acquire data using the program VESSL.

3.1 ASSIGN WORKING DIRECTORY /ACQ TO YOUR SESSION

A. You must be in working directory /ACQ in order to run the acquisition program.

B. To assign working directory /ACQ, type 'WD /ACQ'.

```
CI> WD /ACQ
```

C. To interrogate what working directory you are in, type 'WD'.

```
CI> WD
```

D. HP will respond with:

```
Working directory is ::ACQ
CI>
```

3.2 RUNNING THE TRANSFER FILE TO BID THE ACQUISITION PROGRAM

A. Determine the appropriate parameter file to the used for the examination.

B. Run the transfer file by typing 'TR', your initials, parm file.

```
CI> TR, RBF, PMXX20
```

C. HP will respond by running:

```
OF COUT1
OF DOUT1
OF DIMS1
OF ROUT1
OF MONIT
.etc.
.etc.
.and so forth.
RU VESSL, PNXX20,,,RBF
```

D. You will then drop into the main menu of program VESSL.

3.3 RUNNING THE ACQUISITION PROGRAM 'VESSL'

A. Once in the acquisition program, note the following main menu.

```
VESSL:  MAIN MENU

By your command:  PARM FILE = PMXX20::PARMS:11

0]  EXit
1]  Currently Channel Number is 1

2]  Production Mode Data Acquisition Set-up
3]  Set-up Data Acquisition Parameters
4]  Download Data Acquisition Parameters
5]  Control Data Acquisition Sets

6]  Display / Modify Various Scan Parameters

?]  Monitor Current Status of all Channels

Okay, what's it to be?
```

B. Enter the Production Mode menu by typing a `2'.
Note the following production mode sub menu.

```
VESSL:  SUB MENU 2 - PRODUCTION MODE DATA ACQUISITION

Purge Files (0=DELETE/1=CREATE)   0]

Data File.....................   1]  DA0001::D1  GA0001::C1
Component / Weld Number........   2]  Exam 1
Buffer Type on RAMTEK Display..   3]     3
CSCAN Data Indicator...........   4]     0
CSCAN Peak Value...............   5]     0
CSCAN Data Divider Value.......   6]     0
Real-Time Blockmap Indicator...   7]     0
Number of Sweeps to be Taken...   8]     0

                                     SHORT     MEDIUM    LONG

Scan Direction.................   9]    1         1         1
Starting X.....................  10] 0.00 11]  0.00 12] 0.00
Starting Y.....................  13] 0.00 14]  0.00 15] 0.00
Block Thickness................  16] 0.00 17]  0.00 18] 0.00
CSCAN Data Tube Selection......  19]    0 20]     0 21]    0

Enter #, data ---->
```

C. Enter the Data File name in item `1'.

Enter #, data ----> 1, DA0001

D. Enter back into the Main Menu by hitting `<cr>'

E. Download to channel 1 by typing a `4' in the main menu.

Okay, what's it to be ----> 4

F. HP will respond with:

```
Setting up Channel 1
----> Saving Documentation
----> Downloading FE Parameters
----> Downloading New FE Parameters
----> Downloading AP Parameters
----> Downloading Detection Thresholds
----> Downloading Detection Thresholds
----> Downloading Detection Thresholds
----> Starting the AP
```

3.4 CONTROLLING DATA ACQUISITION SETS

A. Enter into the Control Data Acquisition Menu by Typing a `5' from the main menu.

B. Note the following sub menu for controlling the acquisition process.

VESSL: Sub Menu 5 - Control Data Acquisition Sets

Data File	Parameter File	Sweep Number	Dir S	Dir M	Dir L	Blk Cnt	% Disk Usage
DA0001::D1	PMXX20::PARMS	0	0	1	1	0	0.00
N/A	N/A	0	0	0	0	0	0.00
N/A	N/A	0	0	0	0	0	0.00

By your command:

0] Return to Main Menu
1] Channel Number is 0 (0 means all 2 channels)

2] Perform auto scan (0 (0 seconds) sweeps)
3] Currently Front End is OFF
4] Currently FE Trigger is OFF

5] Ramtek Display is channel 1 buffer 3
6] Download Scan Direction values to FE/AP
7] Shut down acquisition

Okay, what's it to be?

C. At this point, Westinghouse should be in position to begin scanning. Check the gain settings on all receivers. The Baseline noise should be between 5-10% screen height. Turn Front Ends on by typing a `3'.

D. Inform Westinghouse that UDRPS is on, and that they can begin scanning.

F. Once the examination is finished, turn Front Ends off by typing a `3'. Then close data files by typing a `7'. Return to the main menu by typing a `0'. Exit the acquisition program by typing another `0' from the main menu.

3.5 MONITORING CURRENT STATUS OF ALL CHANNELS

A. To monitor status of all channels from the data acquisition control menu, type a <space bar>
<space bar>
<cr>. This will refresh the entire screen and update the control parameters at the top.

B. Another way to monitor status is to type a `?' and <cr> from either the main menu of the data acquisition control menu. This will put you in continuous update mode. The HP will respond as follows:

VESSL: Continuous Update Mode

Data File	Parameter File	Sweep Number	Dir S	Dir M	Dir L	Blk Cnt	% Disk Usage
DA0001::D1	PMXX20::PARMS	0	0	1	1	0	0.00
N/A	N/A	0	0	0	0	0	0.00
N/A	N/A	0	0	0	0	0	0.00

Hit <cr> then type `BR' to return

4.0 PROCEDURE FOR DISPLAYING THE DATA

4.1 ASSIGN WORKING DIRECTORY /SCRATCH TO YOUR SESSION

A. You must be in working directory /SCRATCH in order to run the data display, and analysis program..

B. To assign working directory /SCRATCH, type `WD /SCRATCH'.

```
CI> WD /SCRATCH
```

C. To interrogate what working directory your in type `WD'.

```
CI>   WD
```

D. The HP will respond with:

```
Working directory ::SCRATCH
CI>
```

4.2 BID THE DATA DISPLAY PROGRAM, IMPROSMB

A. In general, there will be one data file associated with each vessel examination (raster). Each data file will contain one buffer of data.

B. Before any analysis can begin, the examination data file (i.e. DA001) must reside on the winchester hard disk. If the files do not exist on the analysis system, then they must be loaded onto the system from either magnetic tape or optical disk.

C. Bid the data display program, IMPROSMB, by typing the following:

```
CI>  IMPROSMB, DA0001, 3
```

D. IMPROSMB will then drop you into its main menu as shown below.

```
IMPROSMB:  MAIN MENU

    Some of the things you might be doing

[A]  Select a sweep.  Presently on sweep a 1 of DA0001 B3
[B]  Select a new channel for display
[C]  Display your regular old TOP
[D]  Scale the TOP display
[E]  Generate a centroid blockmap
[F]  Do a KSCAN from the TOP cube cutout
[G]  Do a JSCAN from the TOP cube cutout
[H]  Show the blockmap
[I]  Change window offsets for even and odd sweeps
[J]  Top display with centroids & detections
[K]  ASCAN displays
[Q]  Color table manipulations
[R]  Generate a Bscan of the present sweep
[S]  Display the Bscan
[Y]  Change parms
[X]  Done for now

    Let go your inner feelings ---->
```

F. Respond to the main menu by typing an `E' to generate a centroid block. If your eyes are really quick you will see the following eventually flash across the screen.

```
    Let go you inner feelings ----->  E

Raw boundaries are  1 to 18
Raw boundaries are 19 to 35
Raw boundaries are 37 to 94
Raw boundaries are 55 to 72
```

G. You are now ready to begin the analysis.

4.3 BLOCK MAP ANALYSIS

A. The block map display overlays the centroids from all four channels in a 3-dimensional engineering drawing layout using Top, Side, and End view displays. Display the blockmap by typing an `H' (Show the blockmap) from the main menu of IMPROSMB.

Let go your inner feelings ----> H

B. The blockmap will be displayed on the Ramtek Monitor, and the following sub menu will appear at your terminal.

IMPROSMB: SUB MENU H - SHOW THE BLOCKMAP

Things to do with TROIDS

[1] Threshold target display
[2] Threshold off
[3] Cut an area out
[4] Show cutouts
[5] Inverse universe
[6] Show all the troids
[7] Take position readings
[8] INPUT a new troid size
[9] Toggle the hardcopy/monitor color table
[A] Input an RBF Y bias to the even sweep troids
[B] Selective channel display. Option is now OFF.
[X] Turn off selective display switch
[C] Toggle for TO-SCALE/NOT-TO-SCALE Blockmap
Currently Image is NOT to scale
[D] Re-initialize the cubes
[E] Threshold on SNF
[F] RETURN to main menu

I think I want option ----->

C. Notice that the blockmap displays the data file names and their buffer types, the SNR threshold range for all 4 files, and the amplitude threshold which defaults at 1 to 255. Notice also that the blockmap display is also nonuniform. Enter option `C' to get the uniform (to scale) blockmap display. This display might give you a better picture of the actual examination volume. Choose whichever display gives you a better feel for the data.

D. At this point its a matter of searching for potential indications that exhibit high signal to noise ratios and high scan to scan correlations. Blockmap has a number of tools to help aid in these matters.

E. SELECTIVE CHANNEL DISPLAY - Option `E' allows the analyst to selectively view each of the four channels individually. This feature helps the analyst to discern the differences between the different angles, and it helps him to mentally superimpose them.

F. THRESHOLD ON AMPLITUDE - Option `1' allows the analyst to threshold the blockmap display based on amplitude (i.e. 1-255 counts). Thresholding on amplitude sometimes helps to clear the blockmap clutter from those centroids having either very low or very high amplitudes. Option `S' turns this thresholding off.

```
Example:  Option 1

I think I want option -----> 1
Enter low cutoff value (0-255) ----> 150
Enter high cutoff value (low-255) ----> 245
```

G. THRESHOLD ON SNR - Option `E' allows the analyst to threshold the blockmap display based on signal to noise ratio. Thresholding on signal to noise ratio can help quantify the strength or weakness of a group of centroids based on signal to noise ratio. There is no specific option that will turn the SNR thresholding off. Instead, bid option `E' again and input a lower threshold of 1 and an upper threshold that is artificially high say 20. This will effectively turn the thresholding off.

```
Example:  Option `E'

I think I want option -----> E
SNR low and high values are 1.222 8.222
Enter low snr threshold -----> 2.4
Enter high snr threshold -----> 4.0
```

H. CUBE CUTOUTS - Option `3' allows the analyst to cutout a 3-dimensional volume in the blockmap. After making cuts with the joystick only those centroids within the defined volume are displayed. This option helps to separate potentially correlated centroids from those that are not. This option also allows the analyst to save this cutout so that it might eventually be displayed along with other cutouts.

Example: Option 3

I think I want option ----> 3
Do the Y-band cut (click two boundaries in TOP or SIDE View)
Do the Z-band cut (click two boundaries in END or SIDE view)
Do the X-band cut (click two boundaries in TOP or END view)
Save this cube cutout (Y/N)?

I. INVERSE UNIVERSE - Option `E' will display all centroids that are not indicated within a previously saved cube cutout. This option can be used with two different approaches.

a. The analyst using the cube cutout option will cutout all essential centroids (i.e. indications) of interest. Inverse Universe will allow him to see if there are any indications of interest other than the ones previously found and cut out.

b. The analyst using the cube cutout option will cutout a group of centroids or all the centroids that are definitely uncorrelated and of no interest. Doing an Inverse Universe will then show all centroids left that might be of interest without the clutter of those centroids that are definitely not of interest.

It is the analyst's responsibility using the tools mentioned above to review this data and to record all indications that exemplify scan to scan correlation.

If there are any questions as to the nature of the data or the characterization of an indication, the analyst has the option to go back to the raw data for further review.

4.4 RAW DATA ANALYSIS - TOP DISPLAY

A. The raw data from any transducer on any scan line can be displayed using the top display. To begin this analysis, one must be in the main menu of IMPROSMB. First choose which transducer is to be displayed with option `B', select a new channel for display.

Example: Option `B' - Select a new channel for display

Let go you inner feelings -----> B

You have the following channels available

1] DA0001 buffer 3
2] DA0001 buffer 2
3] DB0001 buffer 3
4] DB0001 buffer 2

Which channel do you want, Guys? 2
Look at target motion signs? N

B. Next choose which scan line you want to be displayed with option `1'.

Example: Option A - Select a sweep. On sweep 1 of DA0001 B2

Let go your inner feelings ------> A
24 sweep exist in this file. Which do you want?
----> 24

C. Now display the raw data using option C. The top display will appear on the ramtek monitor. If the scan line is so long that it will not all fit on the monitor, then the terminal will ask you if you would like to scroll the display. Otherwise you will drop into the Top Display sub menu.

Example: Option C - Display your regular old TOP

Let go your inner feelings -----> C
Hit <CR> to scroll, S to stop S

D. Once the top display is up on the screen, you will drop into the following sub menu.

IMPROSMB: SUB MENU C - DISPLAY YOUR REGULAR OLD TOP

Things to do

1] Take position readings
2] Cut a YZ box for Jscans and Kscans
3] Do a JSCAN on the box cut
4] Do a KSCAN on the box cut
5] Mark points and differential positions
6] Toggle MONITOR/HARDCOPY color table
7] Done doing things

I want to do ----->

E. Once in the top display, note that the horizontal axis represents the metal path length and the vertical axis represents scan direction. Option 1 of this sub menu allows the analyst to take position readings by moving the cursor over the top display. The following information will appear on the ramtek monitor.

a. Data File Name
b. Sweep Number
c. X - Position
d. Transducer Y and Block Y Position
e. Transducer Z and Block Z Position
f. Amplitude
g. Ascan Number and RRC Number

To exit position readings click the enter switch on the Joystick.

F. Although not shown on the sub menu, a <cr> will increment the sweep counter and display the next top. A space <cr> will decrement the sweep counter and displays the previous top.

G. CUTTING A YZ BOX - Option 2 allows the analyst to define a YZ box using the top display. Once this YZ box is defined, other options, KSCANS, JSCANS, and RSCANS, allow the analyst to pan thru the raw data at a very high speed, using this template to define the area of the top to be viewed. For a more detailed discussion, refer to the next section.

Example: Option 2 - Cutting a YZ Box

I want to do -----> 2
Mark lower left corner (Use ramtek cursor, mark corner, hit enter)
Mark upper right corner (Use ramtek cursor, mark corner, hit enter)

4.5 PANNING THE RAW DATA - KSCANS, JSCANS, AND RSCANS

A. Panning the raw data allows the analyst to quickly view select portions of the raw data by panning from sweep to sweep. The display itself looks very much like a subset of the top display. The window of the raw data being displayed is defined by YZ box cut from either the Top Display or the Blockmap. Note that the YZ box defined from the top display is cut from the top display sub

menu. The YZ box defined from the Blockmap is taken from a user specified cube cutout that has previously been cutout and saved (see 4.3H). Note that when doing a cube cutout from blockmap, the analyst defines X, Y, and Z boundaries. When panning thru the data the YZ box is defined by the Y and Z boundaries. The first X boundary defines which scan line (sweep) the panning will start with.

B. JSCANS or RSCANS may be bid from either the Main Menu or from the Top Display Sub Menu. When either option is bid from the Main Menu, the analyst is ask to define his YZ box from the Top, note the following example.

```
Example:  Options F or G - KSCANS or JSCANS

Let go your inner feelings ----> F
USE cutout from [1] TOP or [2] blockmap ----> 1
Advance the cutout box in Y -----> Y
The box-up offset done was 0
How many "boxes-up" to advance ----> 1
```

When defining the YZ box from the blockmap, note the following example.

```
Example:  Options F or G -KSCANS or JSCANS

Let go your inner feelings ---->
USE cutouts from [1] TOP or [2] blockmap ----> 2
Number of cuts made is 3
Which cutout do you want -----> 2
```

Note that defining a YZ box from a blockmap cutout does not allow the analyst to advance the cutout box in Y. Defining a YZ box from the TOP display does allow the analyst to advance the cutout box in Y. Advancing the cutout box in y moves the starting Y cut type specified number of boxes. This allows the analyst to systematically review all the raw data sweep by sweep while preserving scan to scan correlation.

C. JSCANS - Once involved, JSCAN will attempt to put up as many top displays as possible onto the Ramtek Monitor. The data in the top display will correspond to the chosen cut-out box. control of the Jscan option is passed on to the following control menu.

Example: JSCAN Menu

Try out one of the following
<cr> to show the next 16 sweeps
- to show the previous 16 sweeps
S to show tops beginning at a select sweep
O to set flag to reset zoom scale
O to clear the screen
P to PAN the JVIEWS

R to RETURN to main menu

Enter your option ----->

D. KSCANS - Once invoked, KSCAN will allow the analyst to display consecutive tops on the Ramtek monitor. The data displayed will correspond to the chosen cut-out box. Control of the KSCAN option is passed on to the following menu.

Example: KSCAN MENU

5 HC - Download Hardcopy color table
4 SB - Pan thru tops, slow backwards
3 SF - Pan thru tops, slow forwards
2 FB - Pan thru tops, fast backwards
1 FF - Pan thru tops, fast forwards
0 PR - Position Readings

Input a number according to the chart.
Return to the main menu with the letter 'C'

4.6 ANALYSIS FORM

The appropriate analysis shall be completed by the designated analyst for each examination performed. The form will be signed, dated, completed, and filed with the final report. A copy of this form is attached.

APPENDIX C

UDRPS PLOTS

73

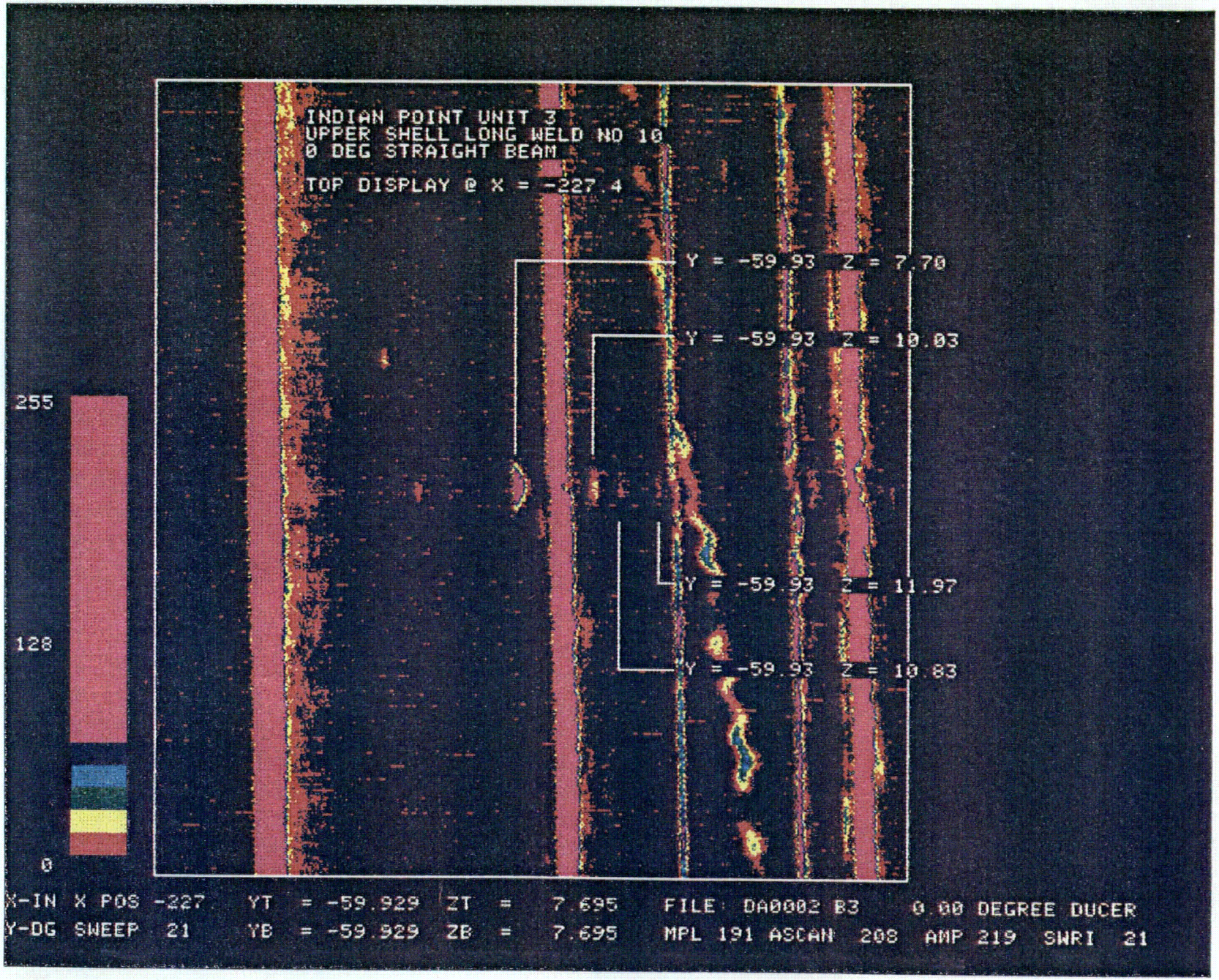

Figure C—1: Indian Point Unit 3, Weld 10, 0° Map at 227.4" (High Resolution)

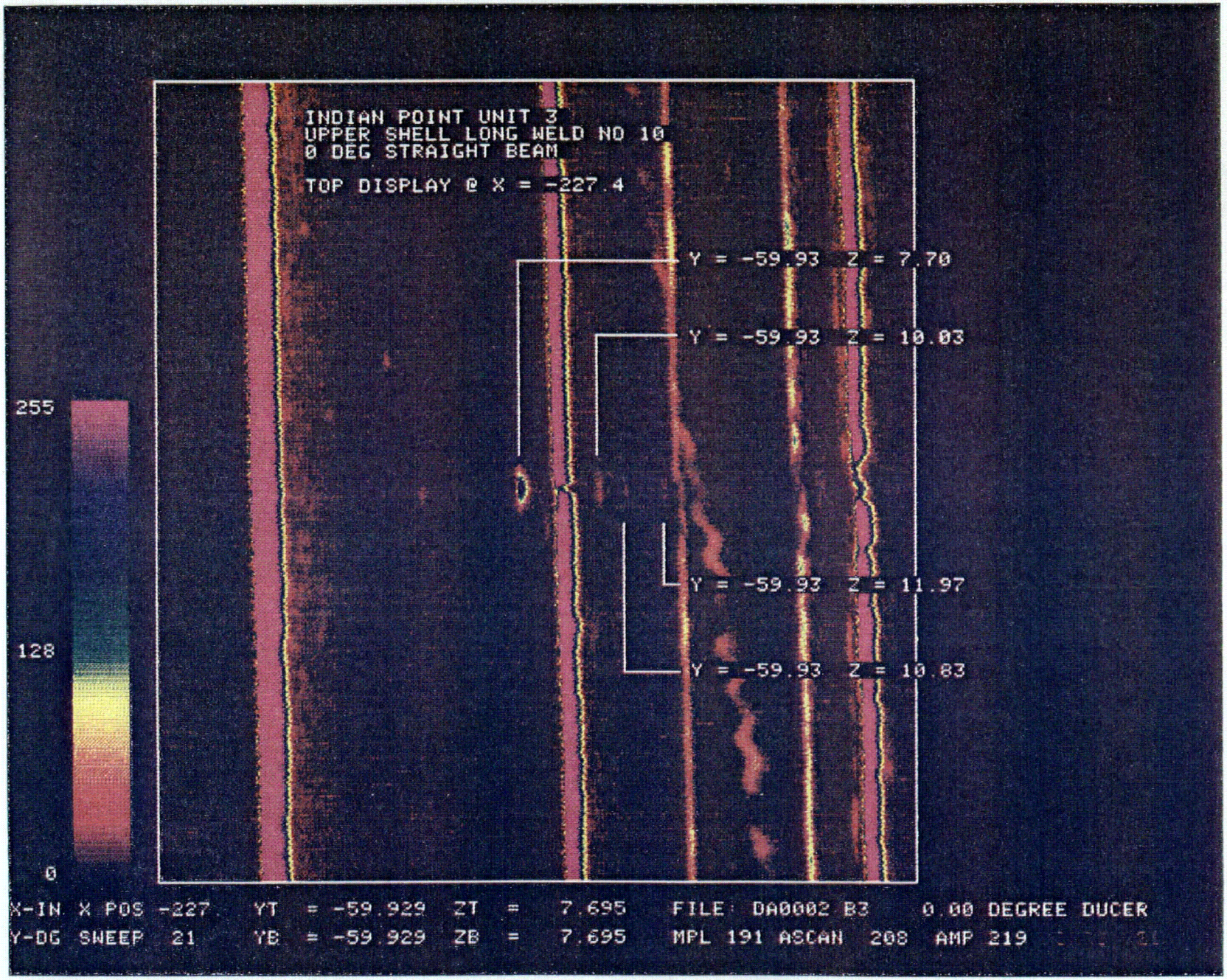

Figure C—2: Indian Point Unit 3, Weld 10, 0° Map at 227.4"

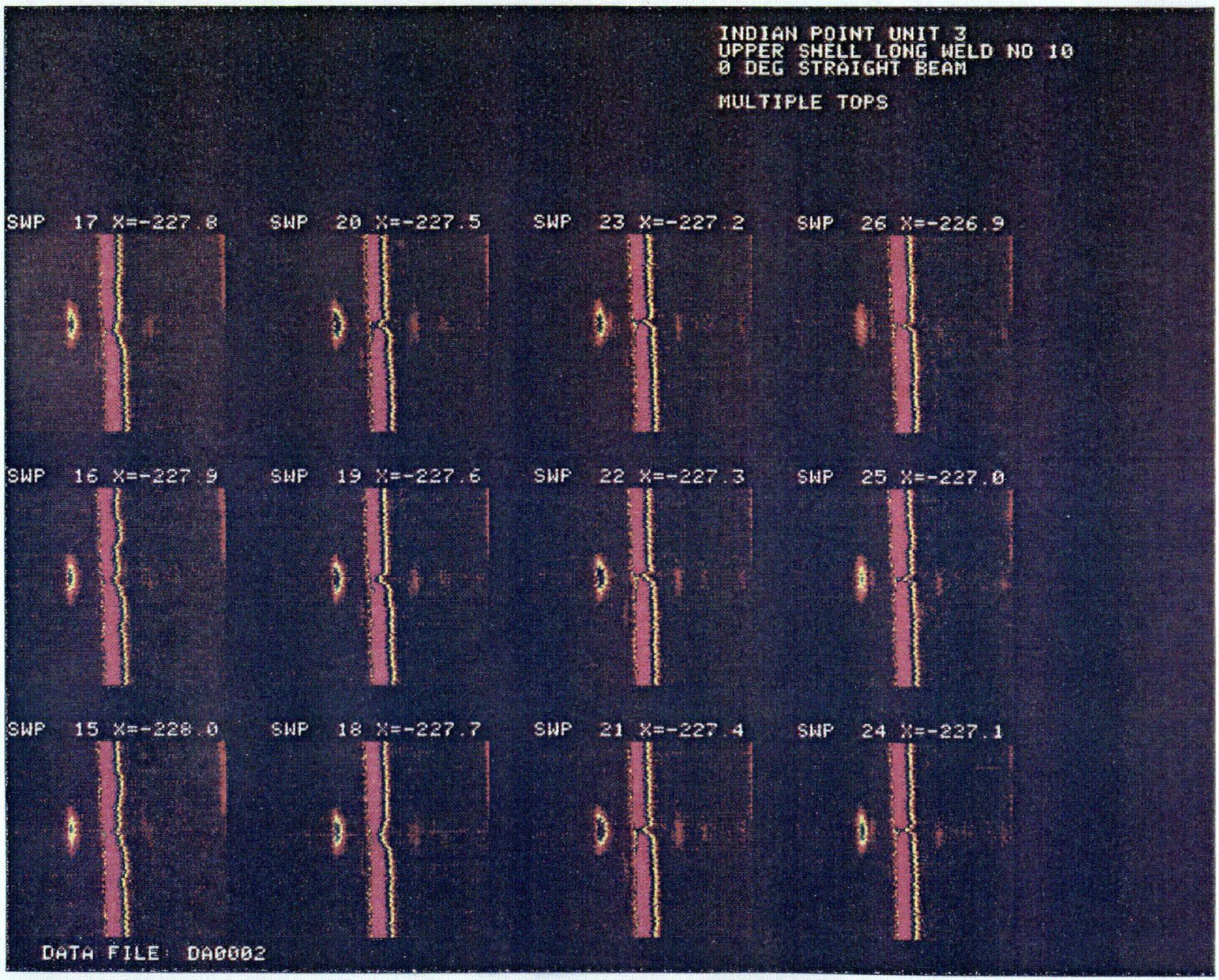

Figure C—3: Indian Point Unit 3, Weld 10, 0° Slices, 226.9" to 228.0"

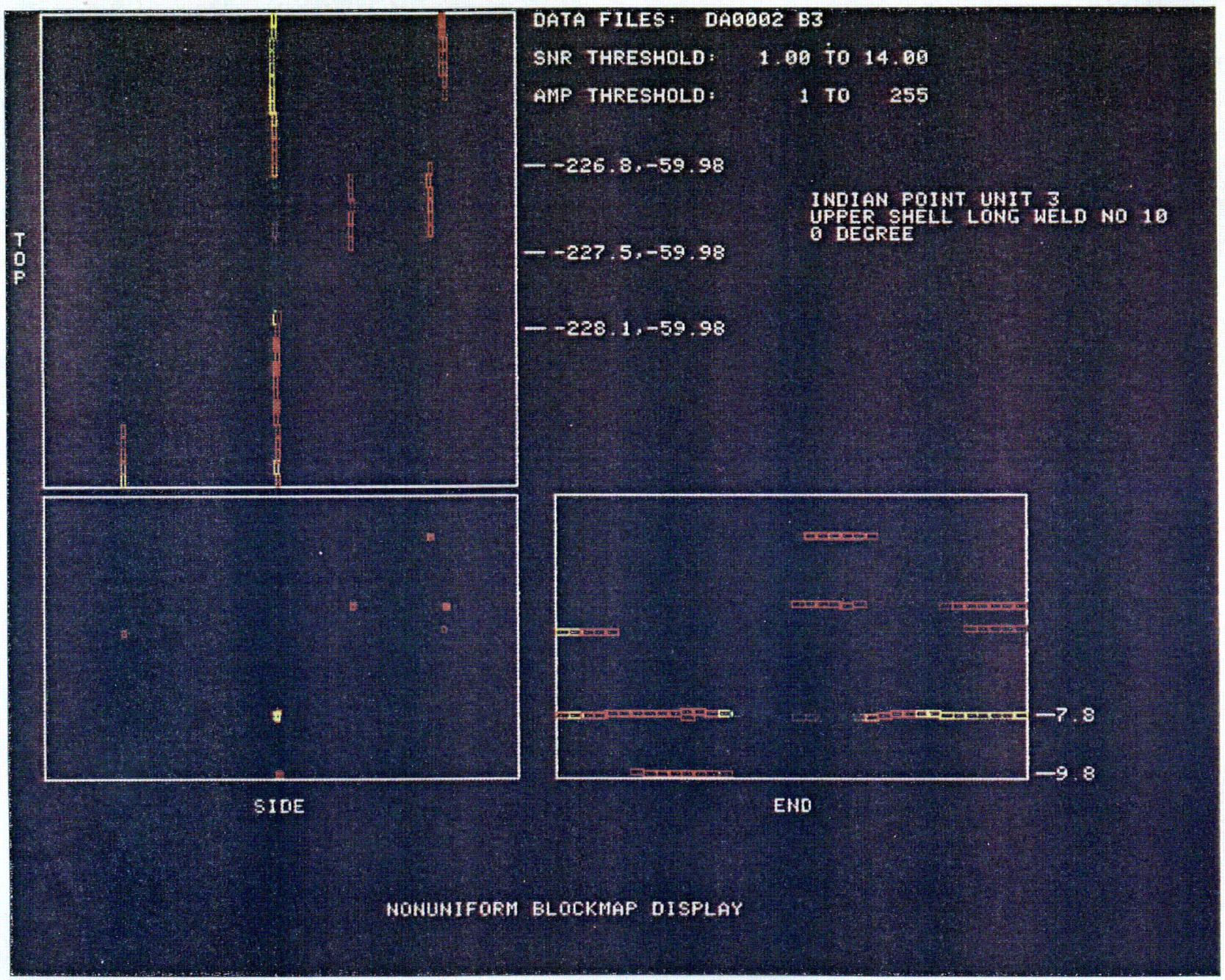

Figure C—4: Indian Point Unit 3, Weld 10, Blockmap Display

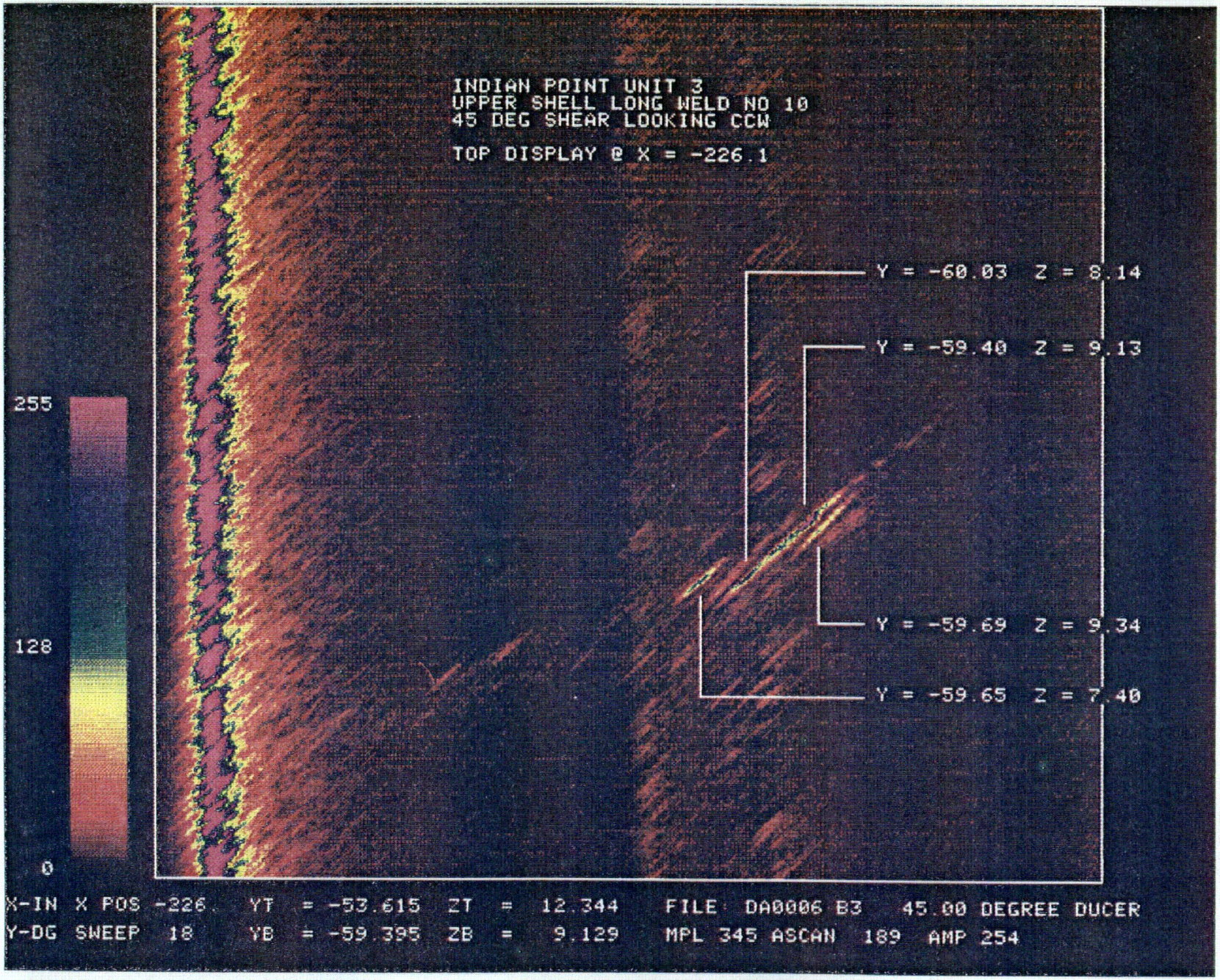

Figure C—5: Indian Point Unit 3, Weld 10, 45° CCW Map at 226.1"

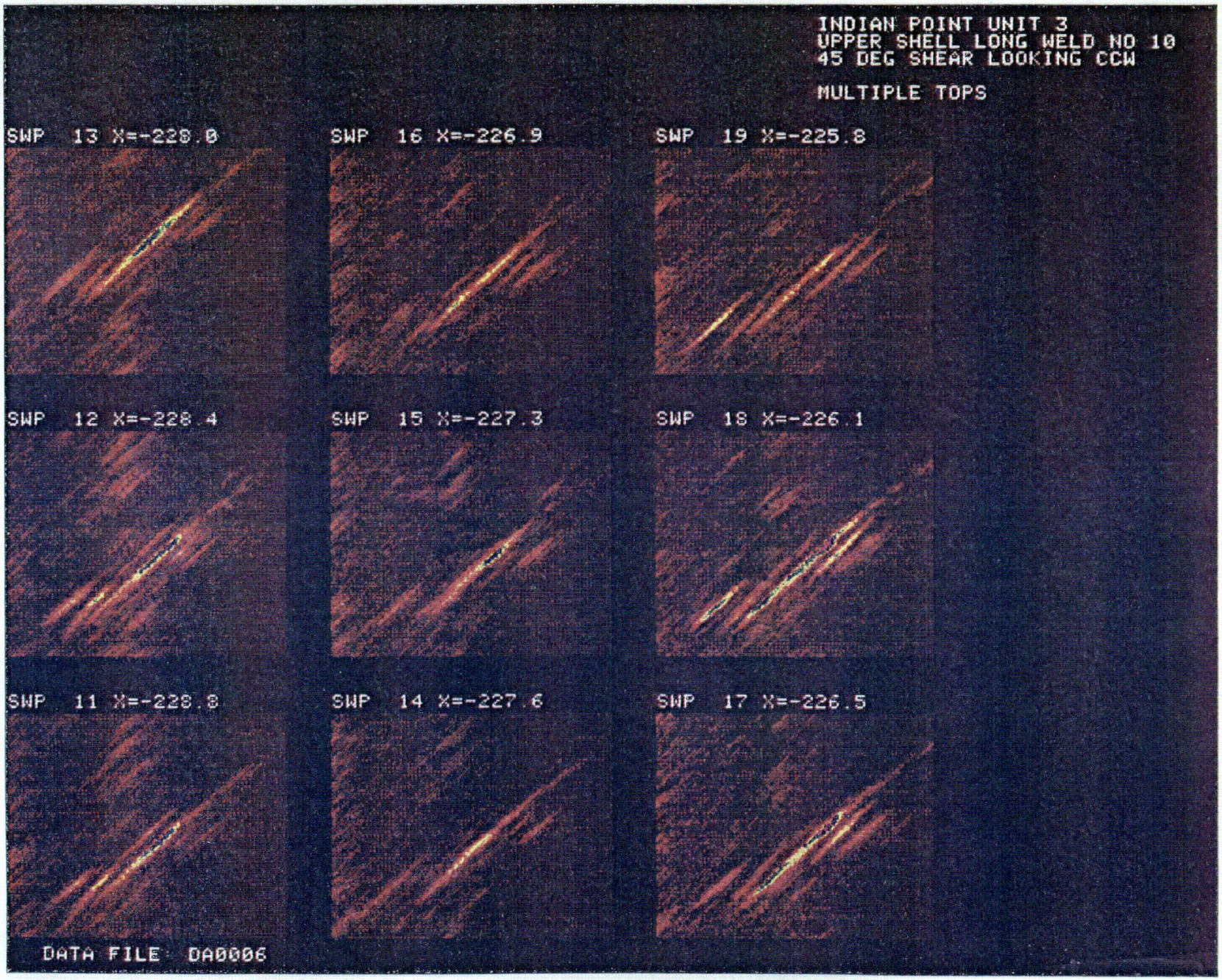

Figure C–6: Indian Point Unit 3, Weld 10, 45° CCW Maps 225.8" to 228.8"

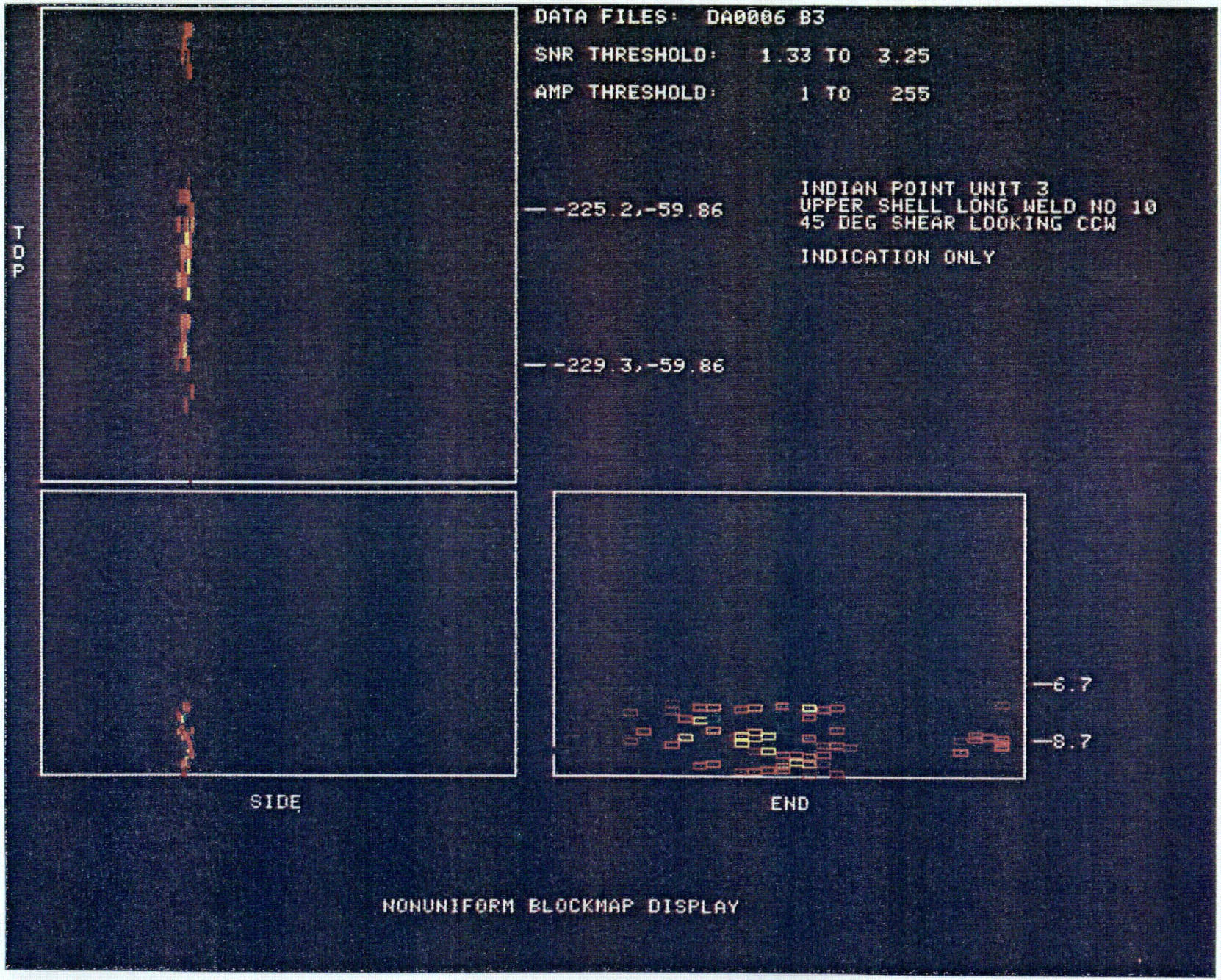

Figure C-7: Indian Point Unit 3, Weld 10, Blockmap Display- 45° CCW

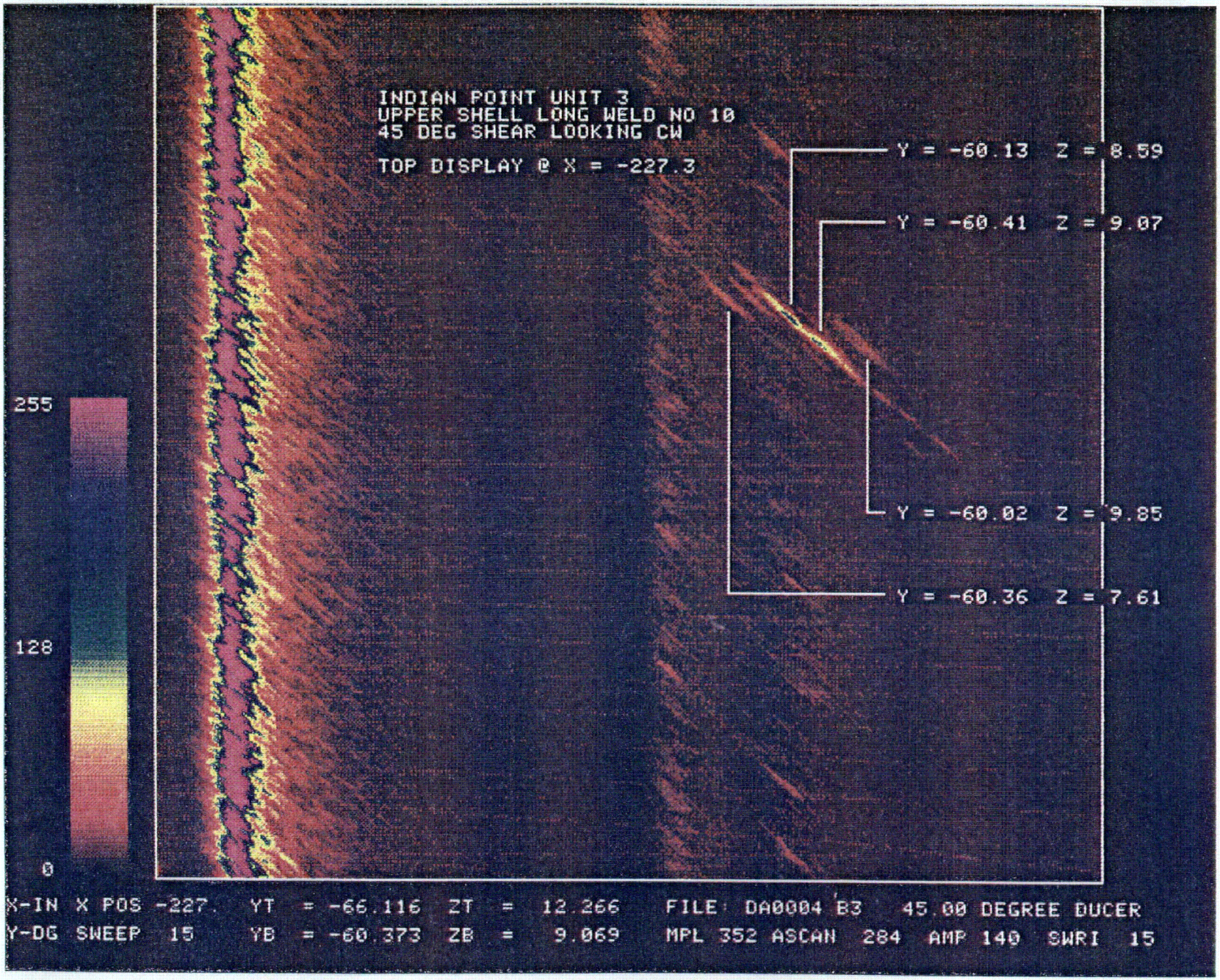

Figure C—8: Indian Point Unit 3, Weld 10, 45° CW Map at 227.3"

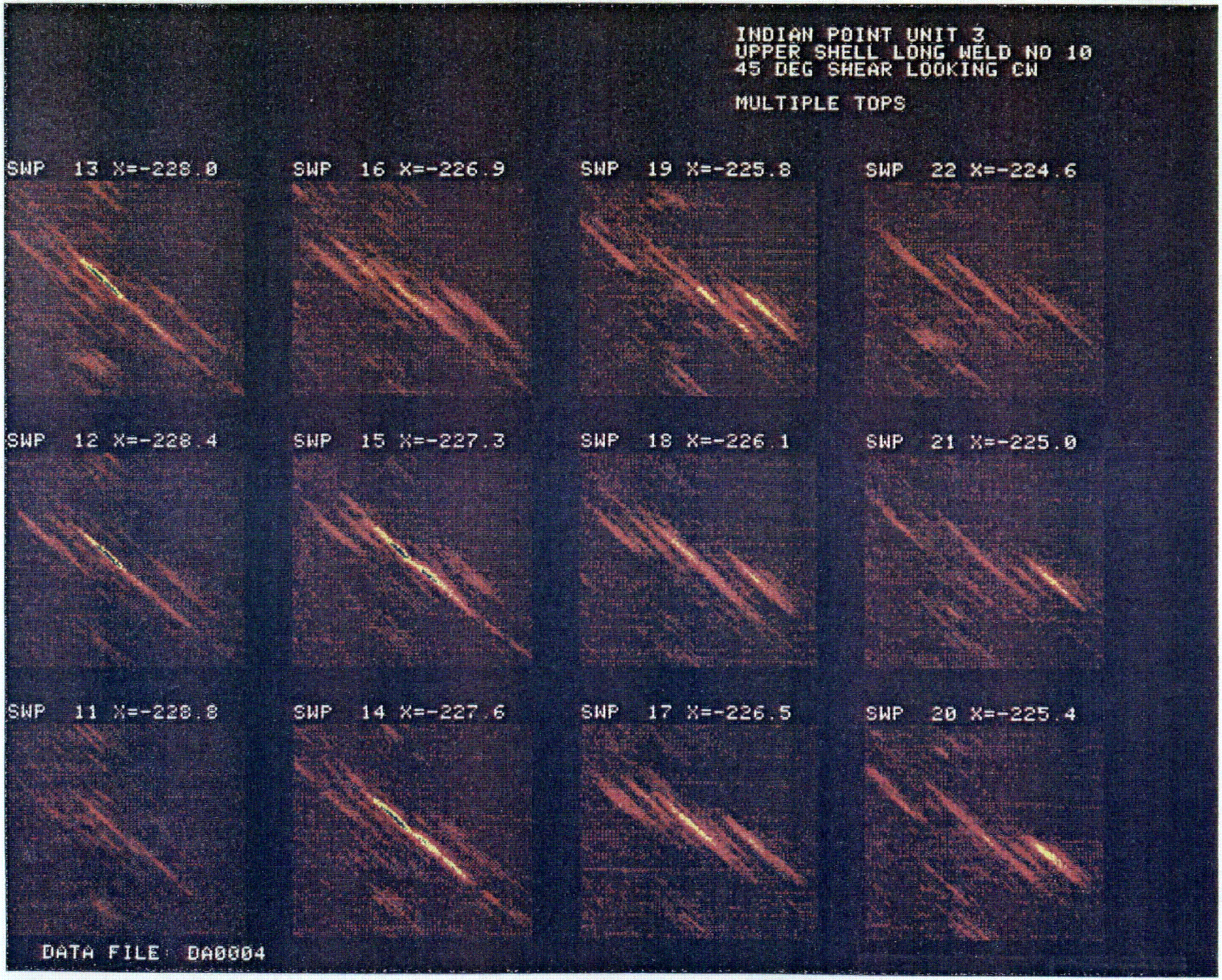

Figure C–9: Indian Point Unit 3, Weld 10, 45° CW Maps 224.6" to 228.8"

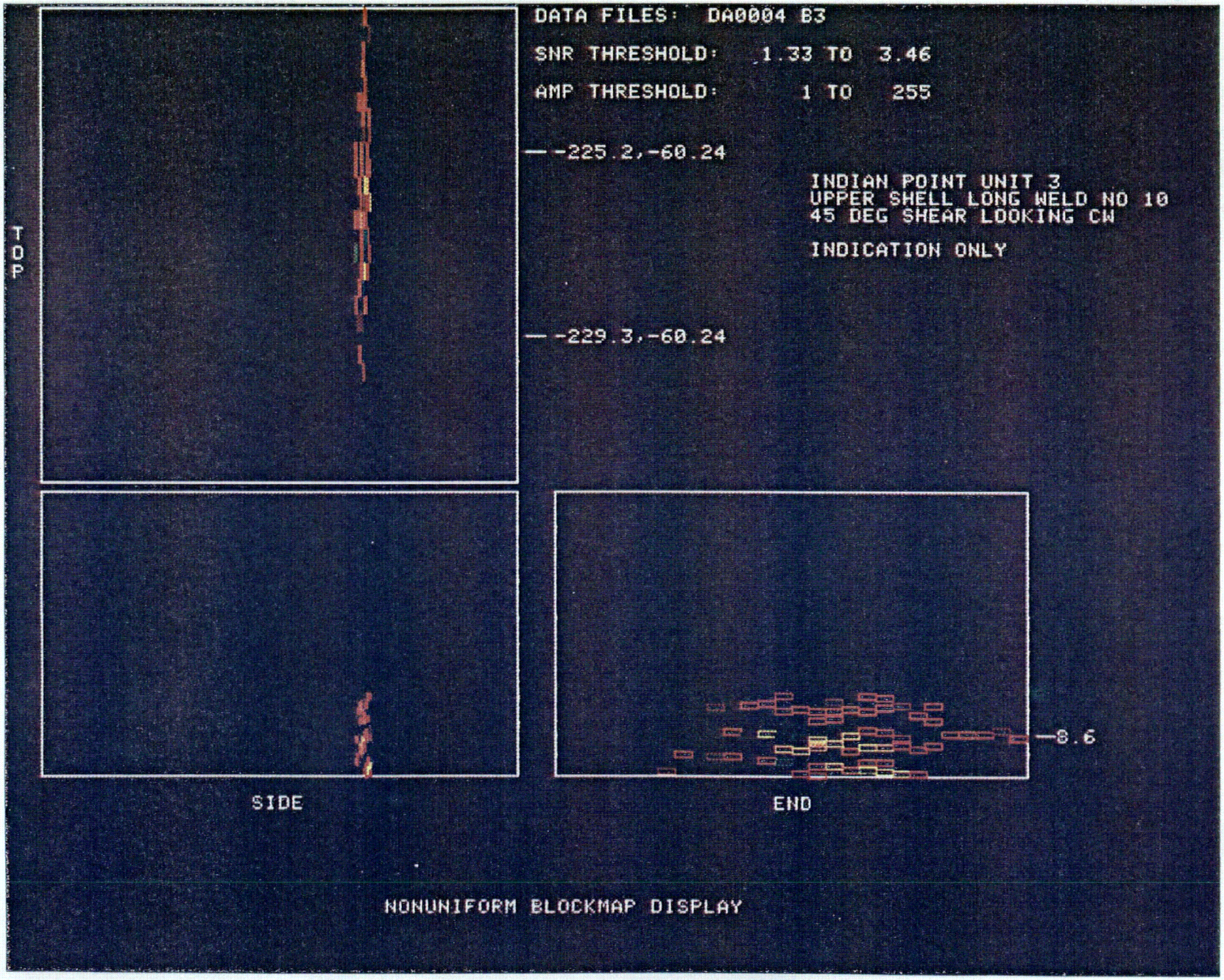

Figure C-10: Indian Point Unit 3, Weld 10, Blockmap Display- 45° CW

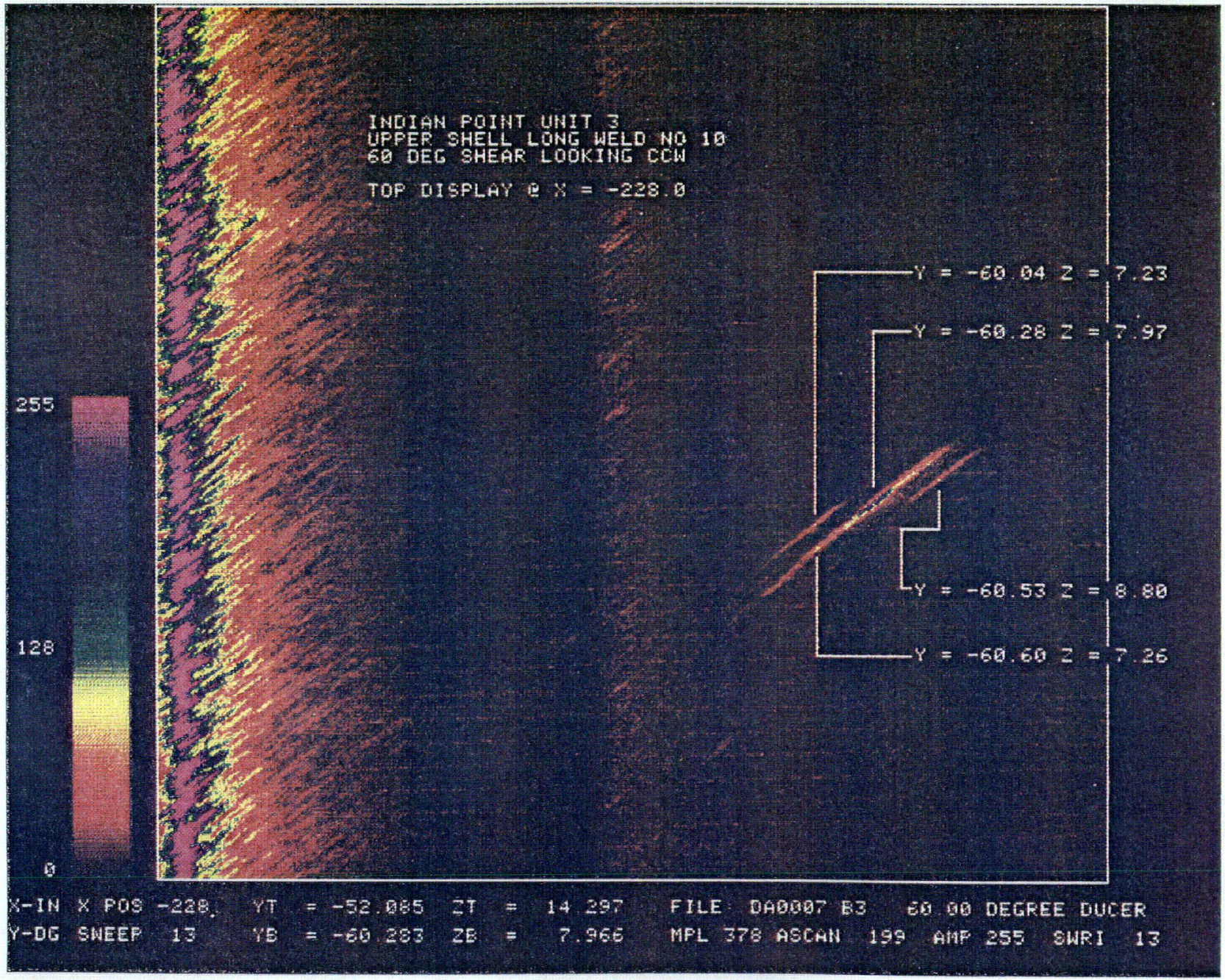

Figure C—11: Indian Point Unit 3, Weld 10, 60° CCW Map at 228.0"

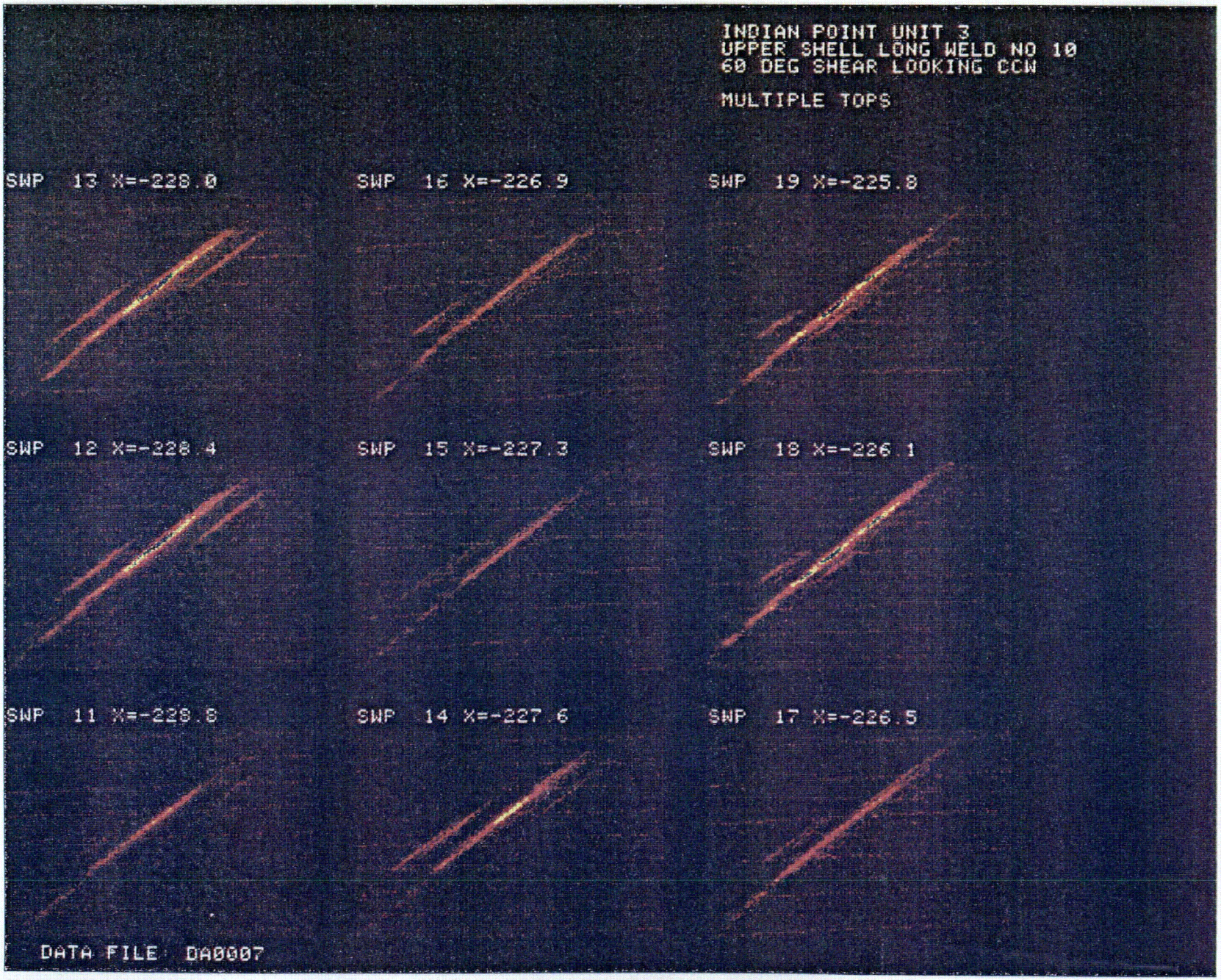

Figure C—12: Indian Point Unit 3, Weld 10, 60° CCW Maps 225.8" to 228.8"

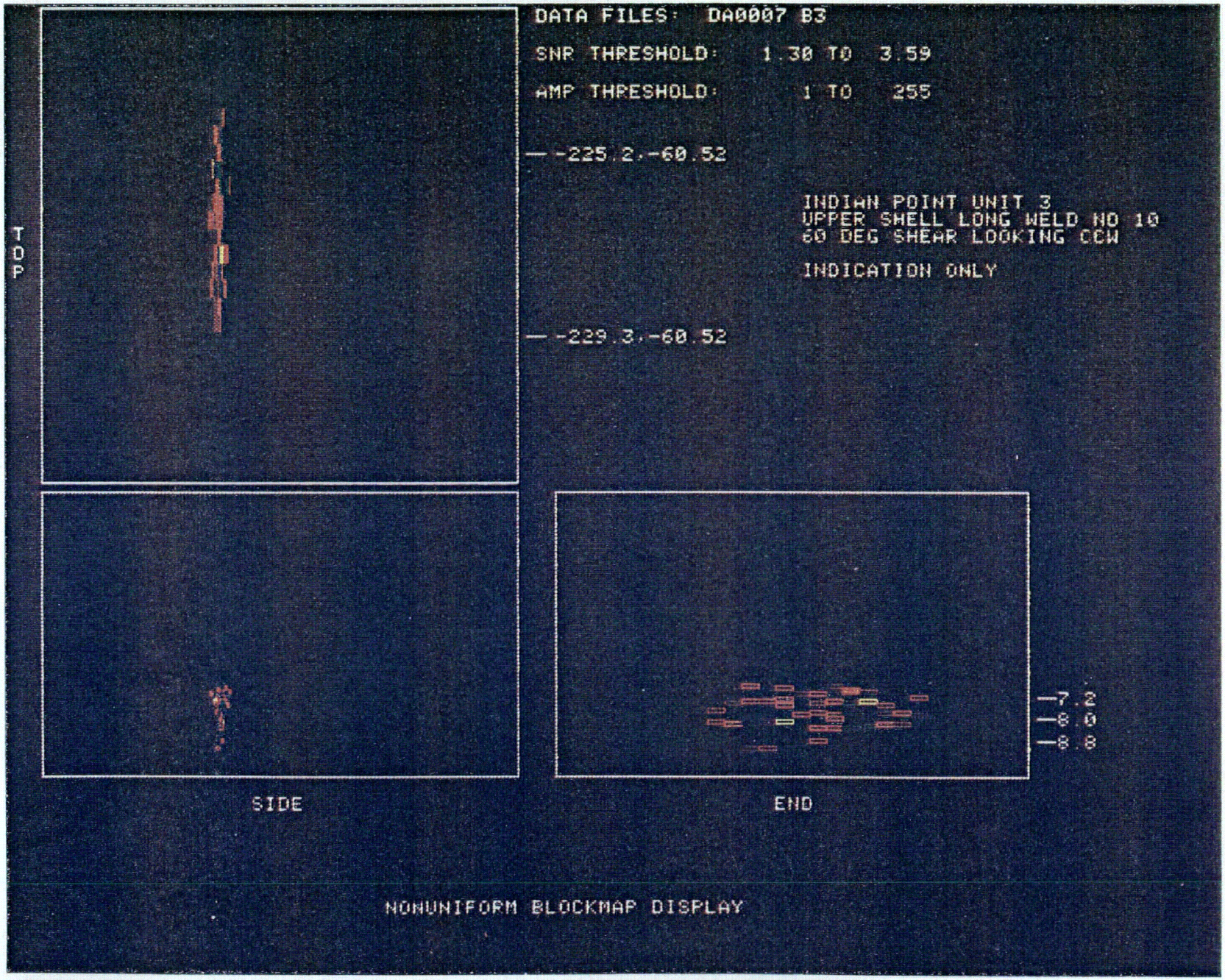

Figure C—13: Indian Point Unit 3, Weld 10, Blockmap Display— 60° CCW

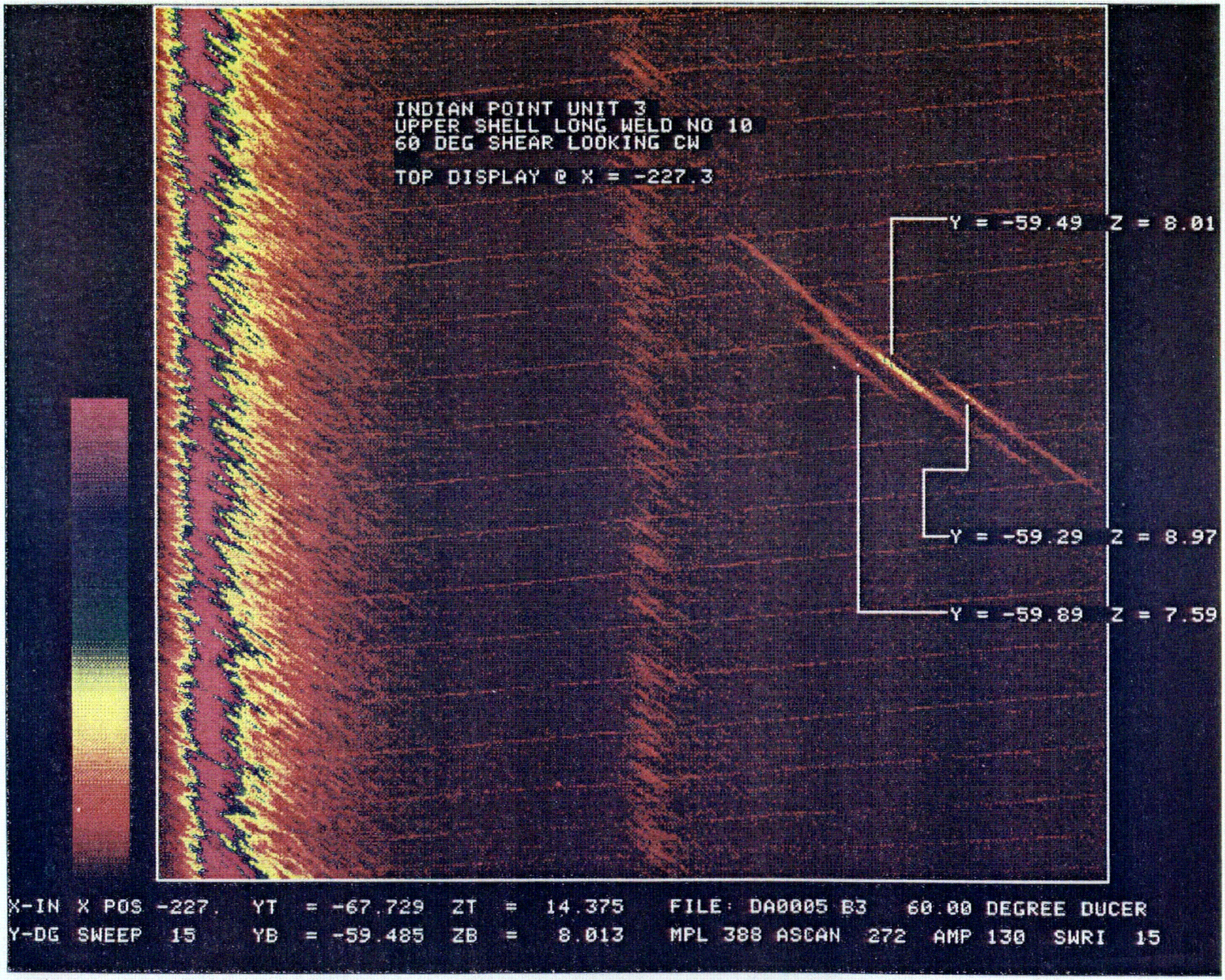

Figure C—14: Indian Point Unit 3, Weld 10, 60° CW Map at 227.3"

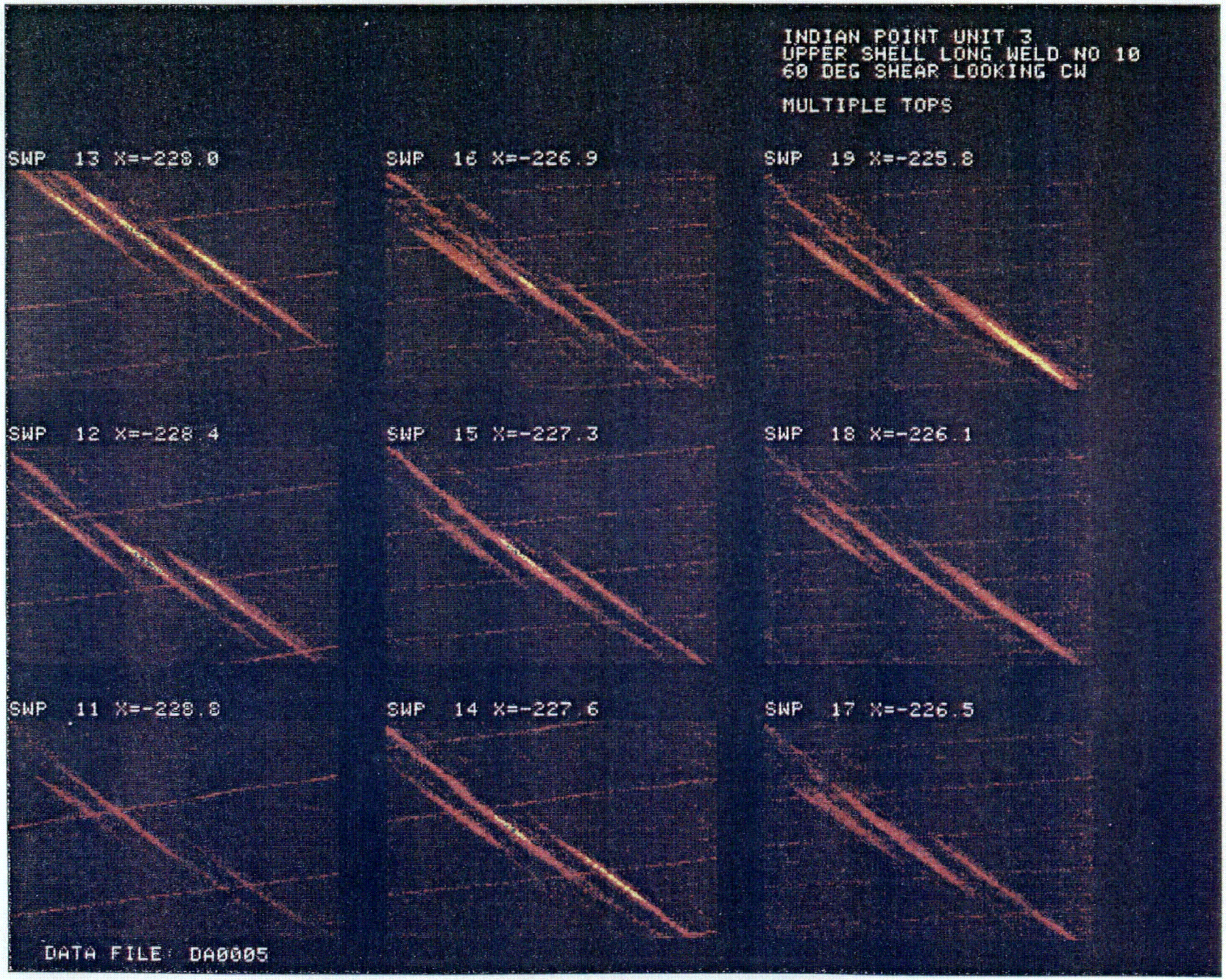

Figure C—15: Indian Point Unit 3, Weld 10, 60° CW Maps 225.8" to 228.8"

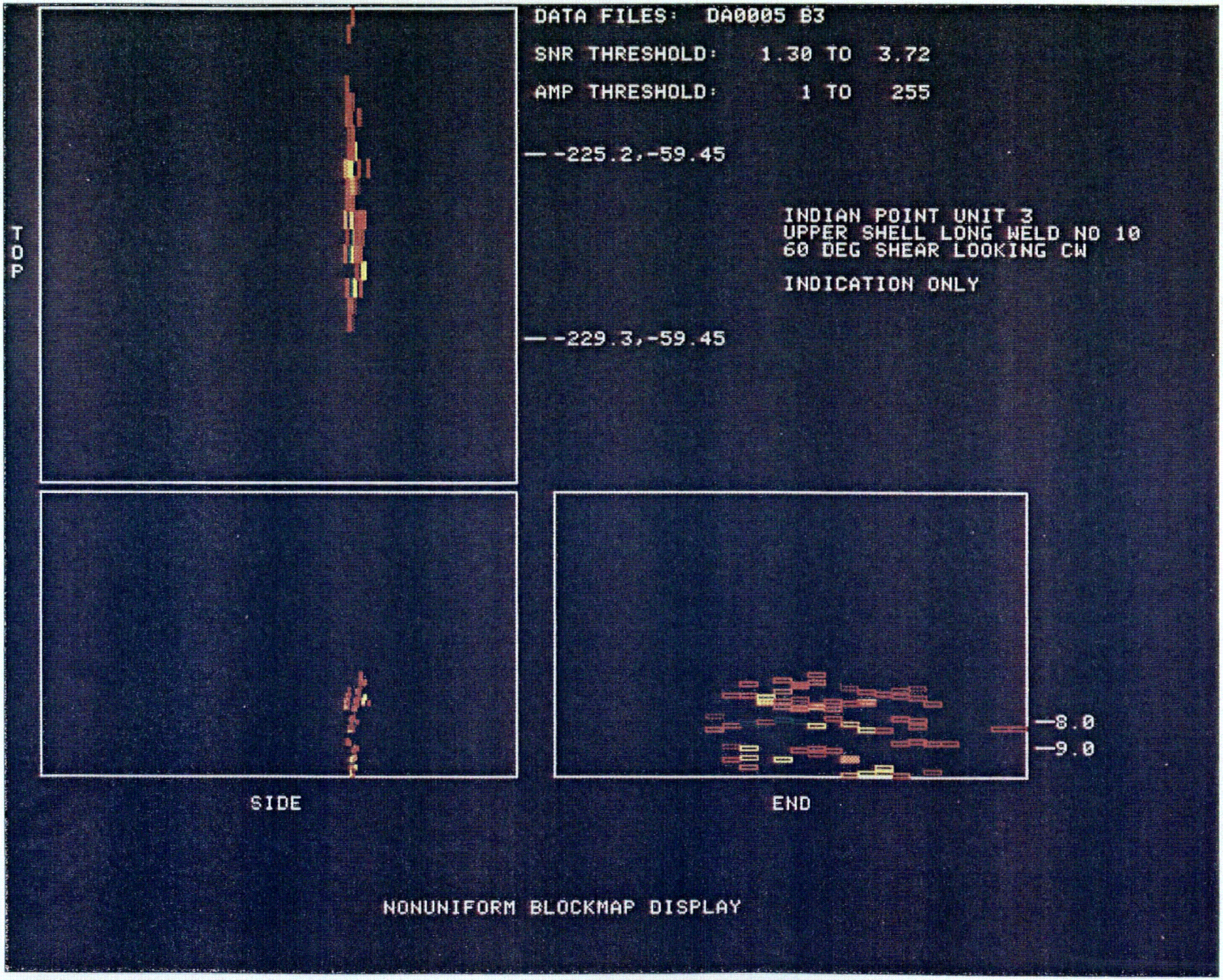

Figure C—16: Indian Point Unit 3, Weld 10, Blockmap Display— 60° CW

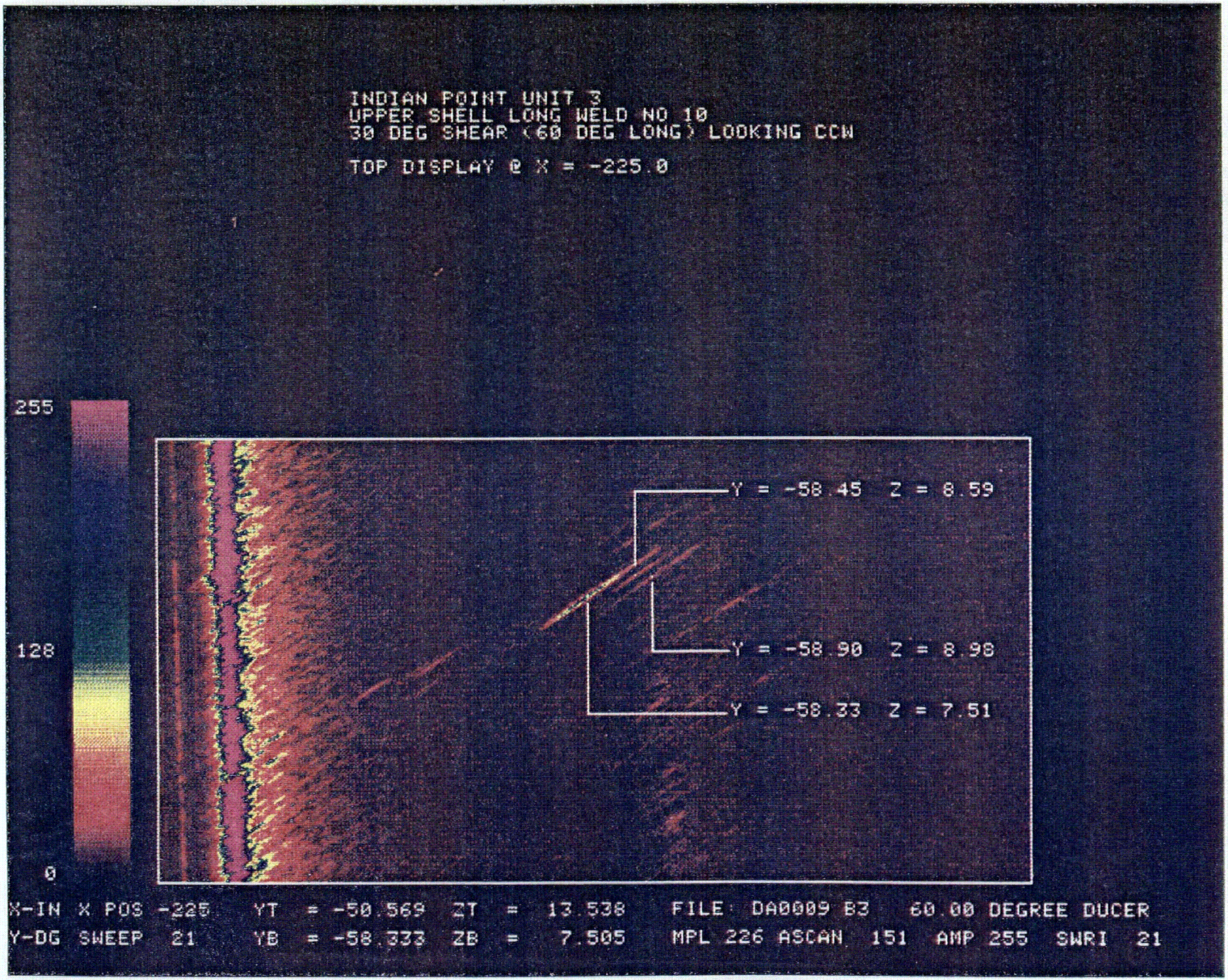

Figure C-17: Indian Point Unit 3, Weld 10, 30° CCW Map at 225.0"

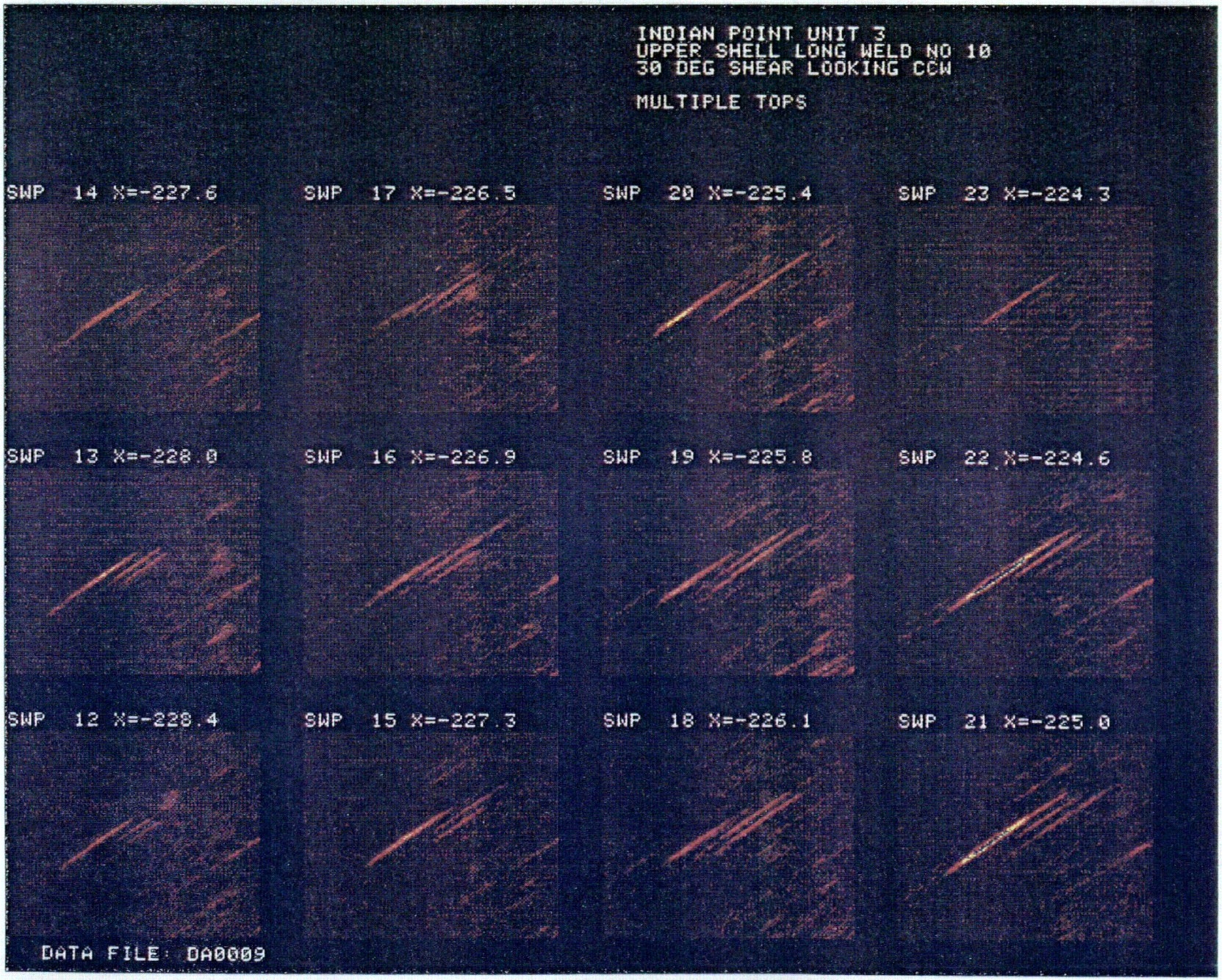

Figure C—18: Indian Point Unit 3, Weld 10, 30° CCW Maps 224.3" to 228.4"

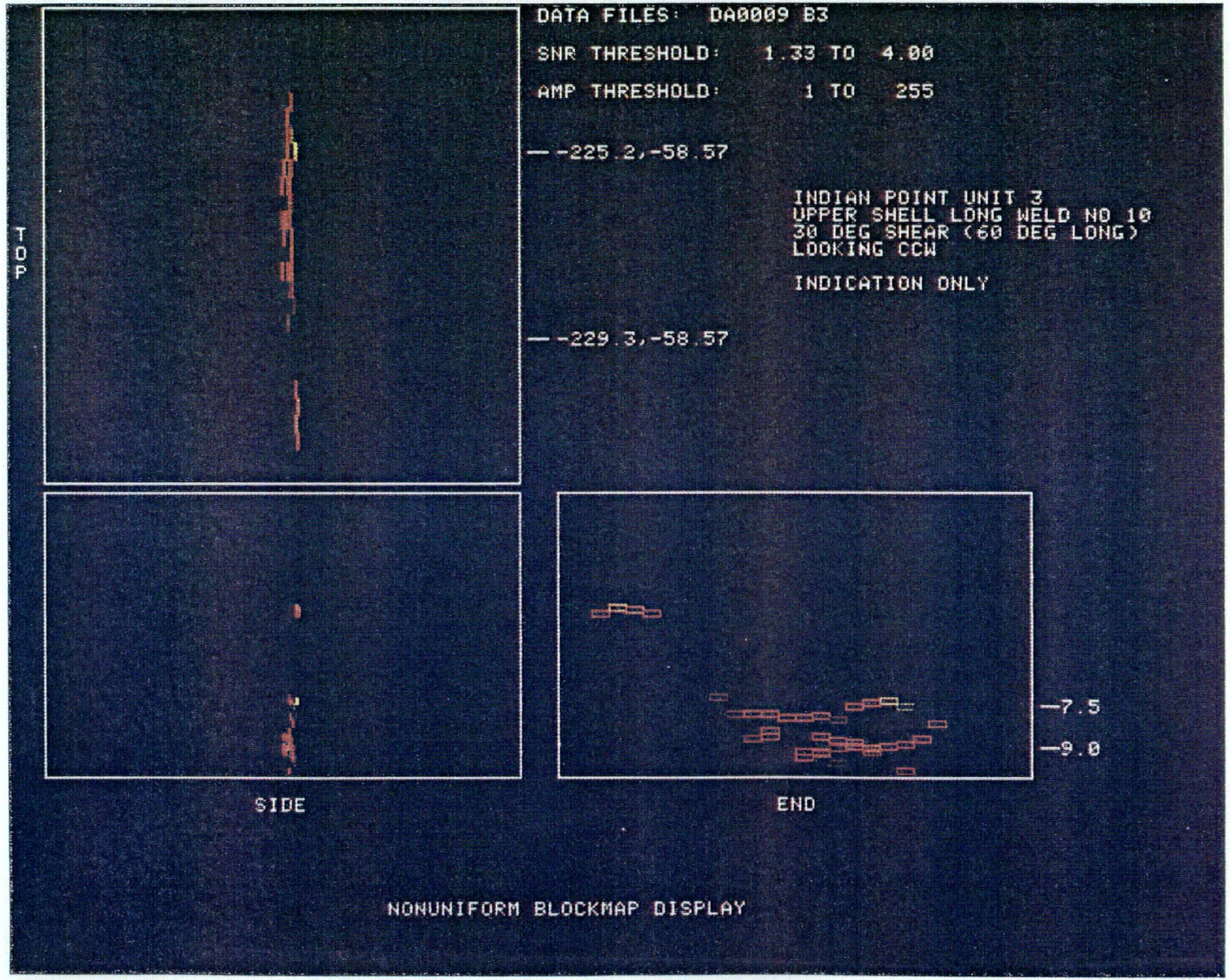

Figure C-19: Indian Point Unit 3, Weld 10, Blockmap Display- 30° CCW

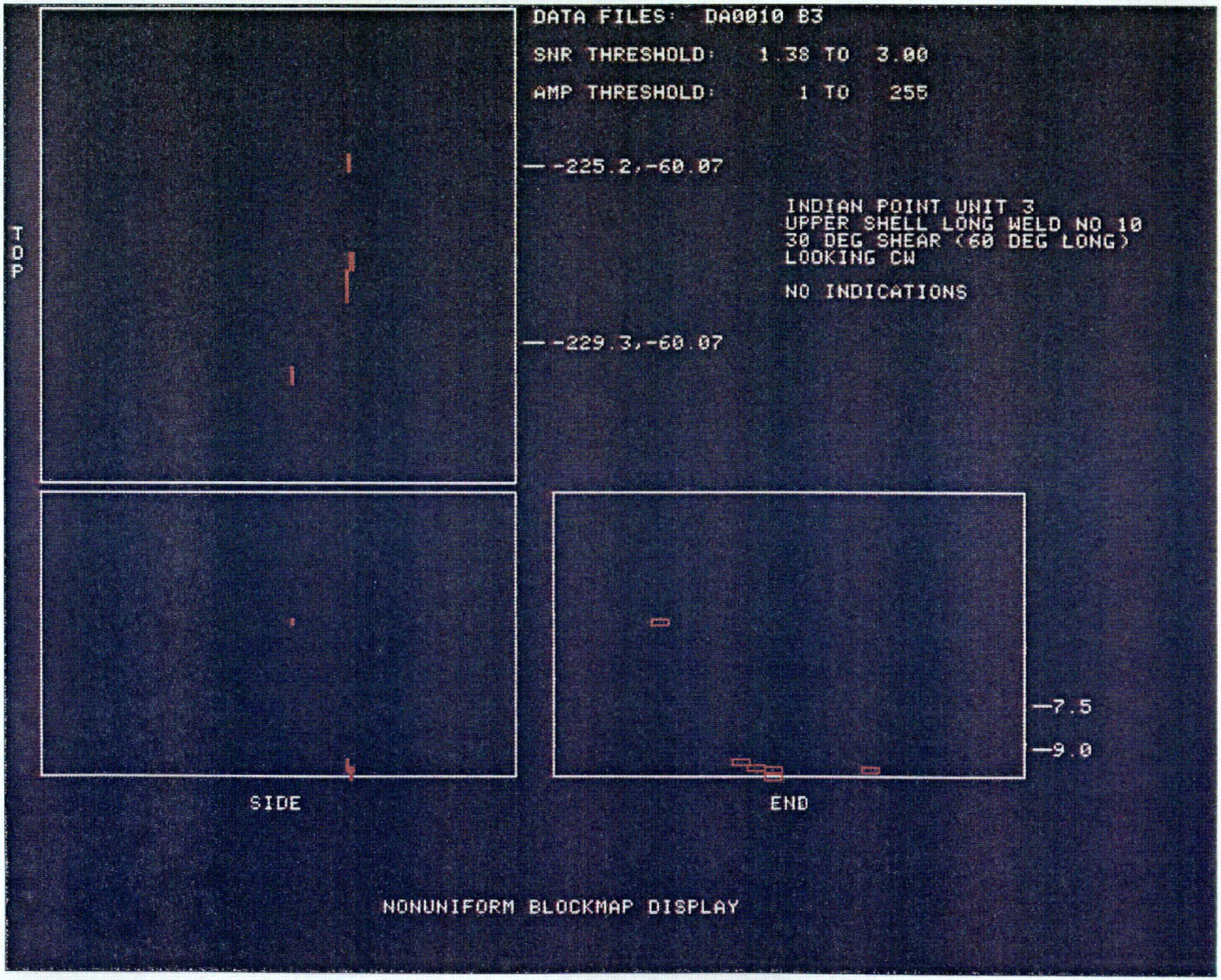

Figure C–20: Indian Point Unit 3, Weld 10, Blockmap Display– 30° CW

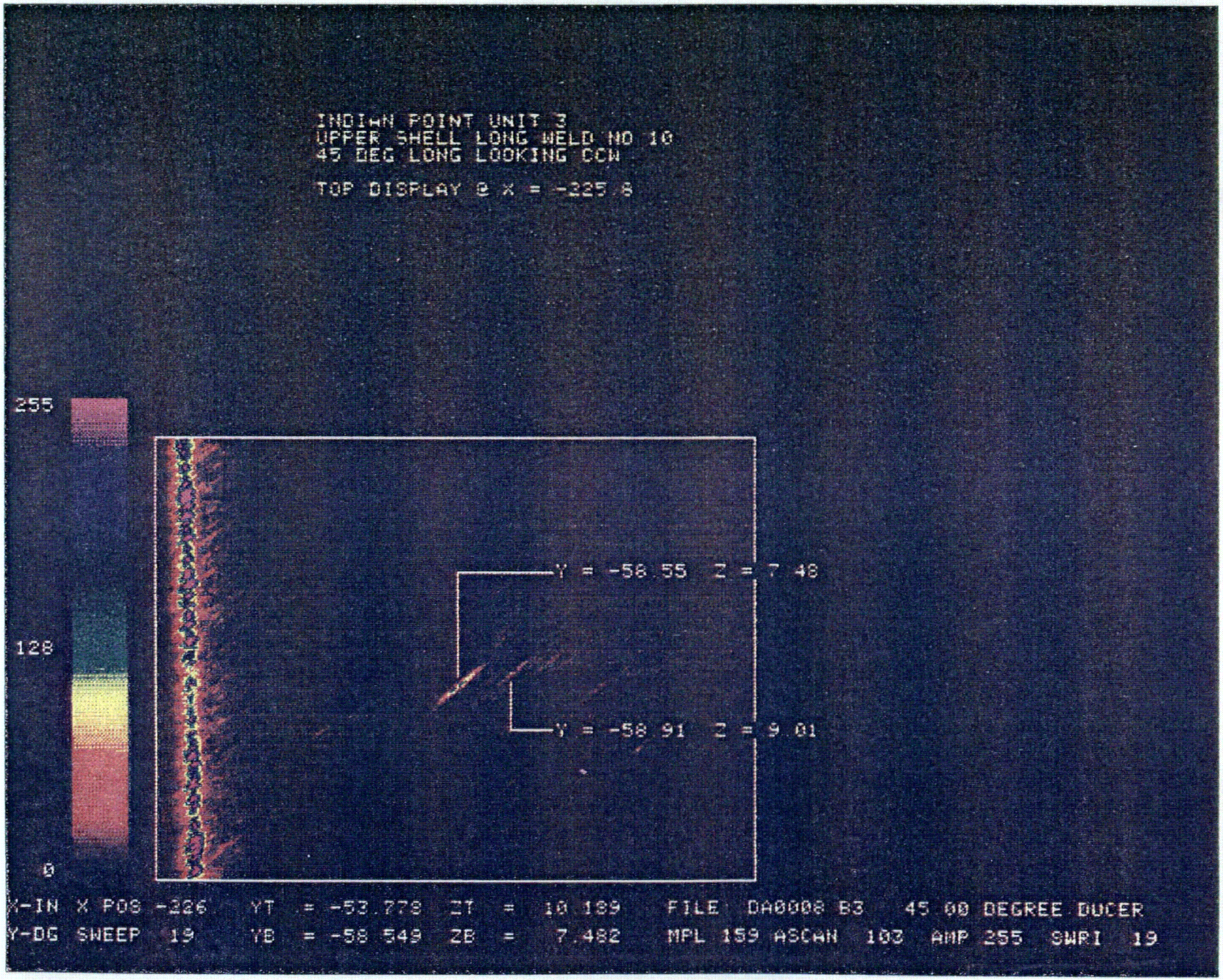

Figure C–21: Indian Point Unit 3, Weld 10, 45°L CCW Map at 225.8"

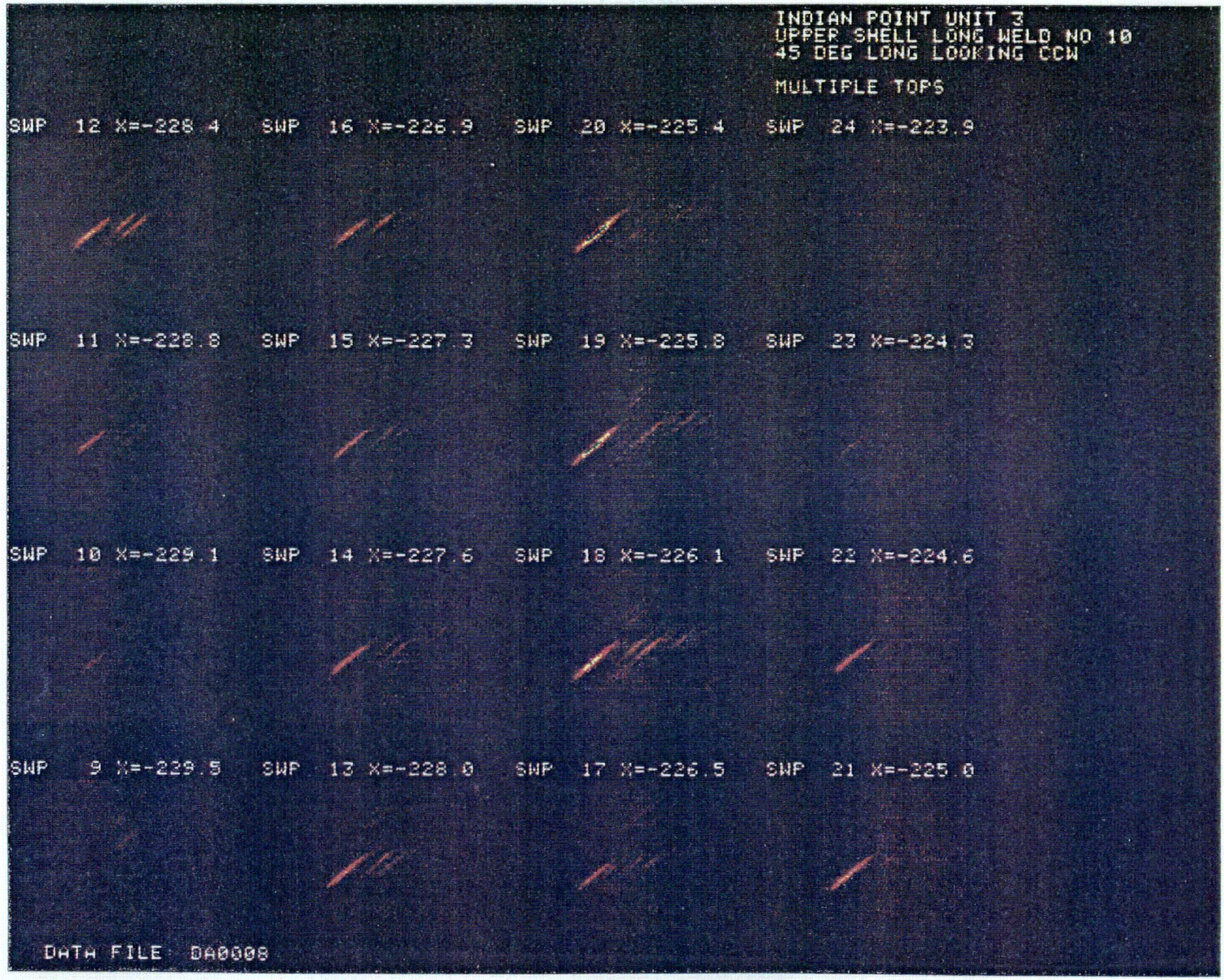

Figure C—22: Indian Point Unit 3, Weld 10, 45°L CCW Maps 223.9" to 229.5"

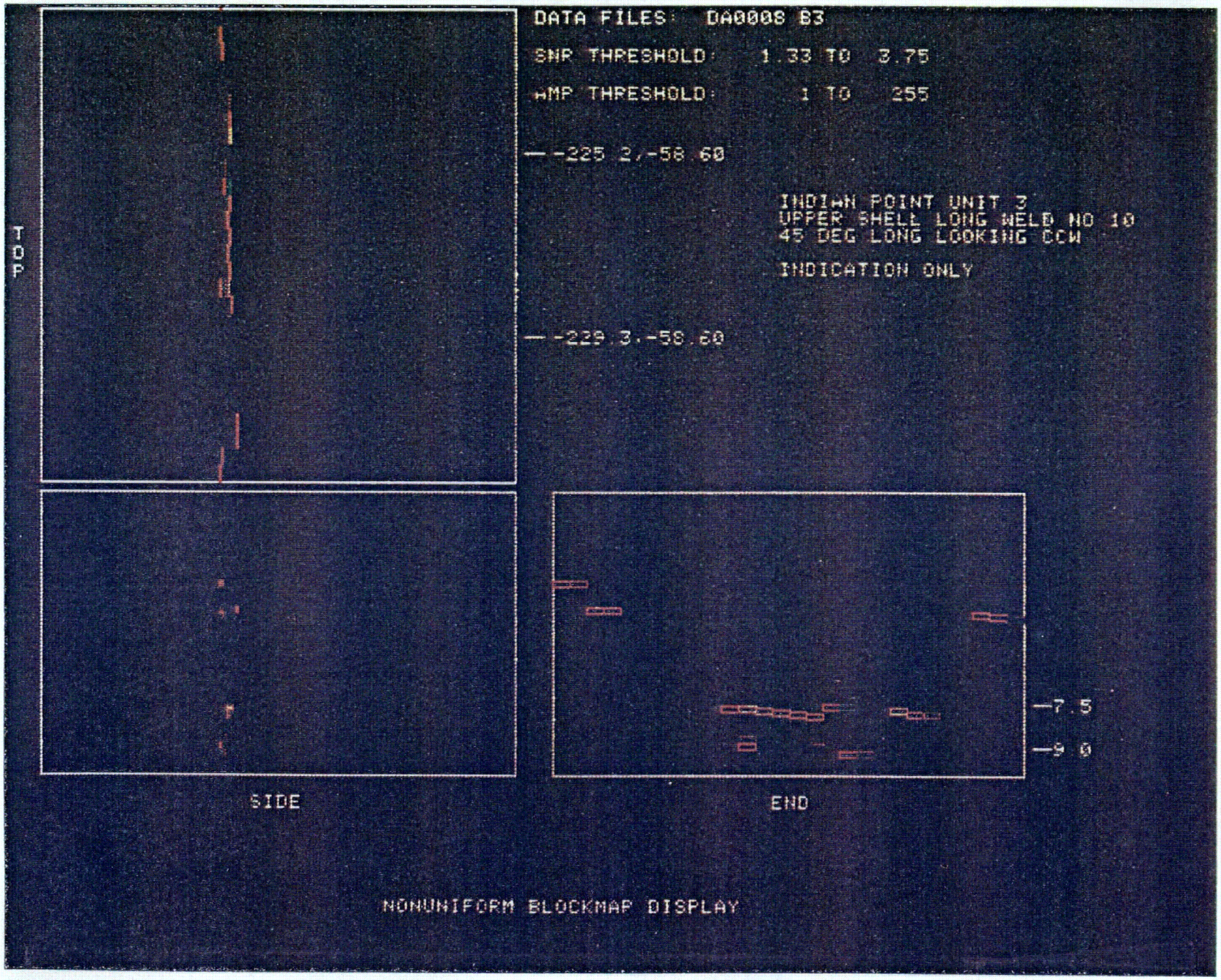

Figure C—23: Indian Point Unit 3, Weld 10, Blockmap Display— 45°L CCW