INSTRUCTION MANUAL

Model
550A

ClayMapper
Ground Penetrating Radar Control Program

March 20, 2008

Program Version: 3.200

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1.0 Introduction

The 550A Ground Penetrating Radar Control Program (ClayMapper) controls, acquires and displays images from a Sensors & Software Noggin ground penetrating radar unit. The software also monitors an encoder connected to a distance wheel to provide distance measurement. The ClayMapper software will operate in data display mode when not connected to a GPR or a distance wheel.

The software triggers the Noggin GPR unit based on the current distance determined from the distance wheel encoder.   Data is stored on the internal hard drive and automatically copied to a USB flash drive. A separate file is created each time the Noggin is triggered by the software.

Digital filters are incorporated in the software to suppress noise associated with the surface interface. Signals from the more distant reflective sources are boosted in order to improve the resolution of these weaker signals.

The GPR PC unit is designed to interface with two GPR instruments; one on the ceiling and one on the floor but, at this point, the software only controls a single Noggin GPR unit which is normally located on the ceiling.

New program versions or configuration files are automatically installed if they are present on the USB flash drive when the system is powered on.

1.1 What's New in Version 3.2

Many improvements and new features have been incorporated in version 3.2 of the ClayMapper program. A list of improvements and new features follows.

General Improvements
- Complete implementation of metric or Imperial distances
- Command line switches to allow for:
    1. −swapport   Start program with RS-232 COM ports mapped so that encoder to COM1 and GPR Roof to COM3
    2. −fakegpr   Start program with emulated Noggin signals
    3. −hispeed   Start program using high speed data communications on RS-232 COM ports for use when GPR unit is truck mounted
    4. −truckmode   Start program in truck mode which doesn't perform calculations and update of video display until the user requests this.
- Calculation and display of duty cycle when acquiring radar signals. This measurement allows the user to track whether the radar unit is moving too fast for the program to keep up with.

2.0 Specifications
Model: 550A ClayMapper Ground Penetrating Radar Control Program

Software
Operating System: Linux
Language: C
Interface: Touch screen
Image Functions: Contrast, Full Screen

Communications   - Uses 4 RS232 serial ports for communication
  Normal Setting
  COM1:   Connected to ceiling Noggin GPR
  COM2:   Connected to floor Noggin GPR (not implemented)
  COM3:   Connected to distance wheel quadrature encoder
  COM4:   Connected to touch screen
  Swap Switch -swapport
  COM1:   Connected to distance wheel quadrature encoder
  COM2:   Connected to floor Noggin GPR (not implemented)
  COM3:   Connected to ceiling Noggin GPR
  COM4:   Connected to touch screen

Filtering Functions   - Improves display quality, only applies to displayed data
  Direct Wave Average: Averages the data for the first 60 samples of each trace across selected number of traces and then subtracts this average from all samples in all traces. Since the direct wave tends to be constant for all traces it can be removed with this simple averaging algorithm. Direct Wave Filter Width is set in the configuration file.
  High Pass Filter: Applies an nth order high pass filter to the data. Filter cut off frequency and filter order are set in configuration file.
  Trace Enhancement: Applies a quadratic enhancement to the data to boost the signal strength of distant reflections.

Data Recording   - Creates separate data file for each radar trace
  Raw Data: All data is stored in raw data format without filtering
  Trigger: Distance traveled, set in configuration file
  File Format: Binary data, 1 radar trace per file

3.0 Quick Start Guide

3.1 Instrument Setup

The GPR PC can operate either with or without the distance encoder and the ground penetrating radar. If either of these instruments is not connected then the ClayMapper software will start in data display mode. If both units are attached at power up then the software will start in data collection and display mode. All software is pre-installed on the GPR PC.

Attach the ceiling radar unit to the connector labeled **GPR Roof** using the GPR data cable provided. Attach the distance wheel encoder to the connector labeled **Encoder** using the Distance Wheel cable provided.

Plug the USB Flash drive into the USB port located on the bottom side panel.

The model 550A must be connected to a 12VDC power source with a current capacity of at least 5 amperes. Ensure that the correct polarity for the input power is observed. Further details of installation and setup of the instrument can be found in the hardware manual.

3.2 Starting the ClayMapper Program

The ClayMapper program is started by pressing the momentary contact power switch that is located on the bottom side panel. Once the GPR PC finishes the boot up process the program will start automatically. The program will then check to see if a Noggin GPR unit and an encoder are attached. If these units are not found then the program will go to the Main screen, request startup data and then go into data display mode. If the units are found then the program will also go to the Main screen, request startup data but it will then go into operate mode.

Two parameters must be entered at program startup, Pass Number and Position. Figure 1 shows the display as it appears while waiting for the Pass Number to be entered. Simply press the numbers displayed on the screen to set the Pass Number. Once the correct number(s) are entered simply press the OK button to proceed. Figure 2 shows the Position data entry screen. Distances are entered in feet or in meters depending on the settings in the radar.cfg file. After the correct numbers have been entered press the OK button to continue. The screen will switch to data display mode as shown in Figure 3.

All functions of the GPR PC are operated using the touch screen.

Start Radar			
Stop Radar			
Shutdown	1		
Goto Setup	1	2	3
Contrast	4	5	6
Fullscreen	7	8	9
Hor - 200 m	DEL	0	OK
Ver - 3.0 m			
Pass 1	Position 517	Enter the pass number	

Figure 1 Startup Screen Showing Pass Number Data Entry
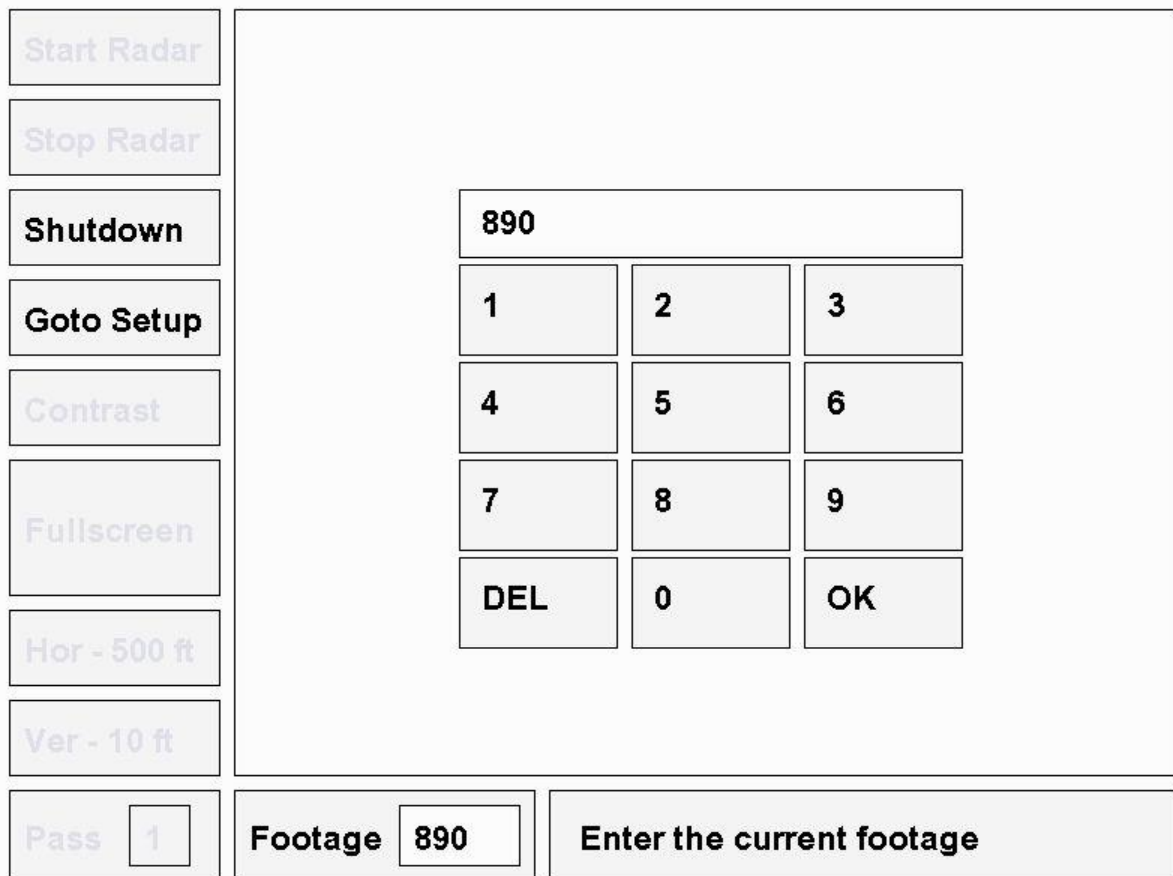
Figure 2 Startup Screen Showing Current Position Data Entry

Press the Start Radar button to start collecting data from the radar unit (see Figure 3). The radar unit is triggered and data is collected at prescribed distance intervals measured by the distance wheel. The data collection distance interval is set in the radar.cfg configuration file.

If the Noggin GPR unit or the encoder is not found at program startup then the data display screen will appear as seen in Figure 4. In this figure note that the Start Radar and Stop Radar buttons, located in the top left corner of the screen, are greyed out. This tells the operator that either the Noggin GPR and/or the encoder were not attached when the program started.

Located at the left side of the Main screen are buttons that provide access to the various functions of the program. Located along the bottom of the screen are status information boxes. Details of each of the buttons and status display boxes are provided in the next chapter.
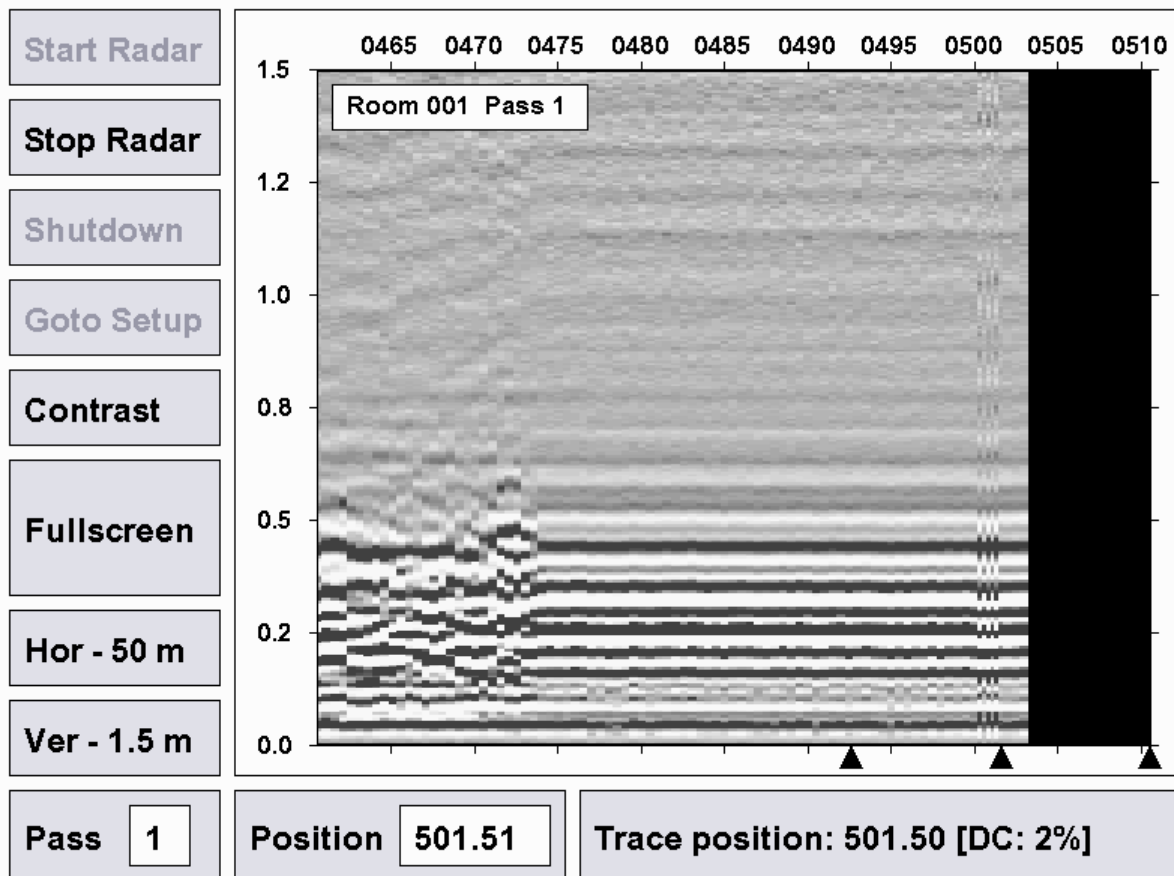
Figure 3 Operate Screen with Radar Started and GPR Triggered

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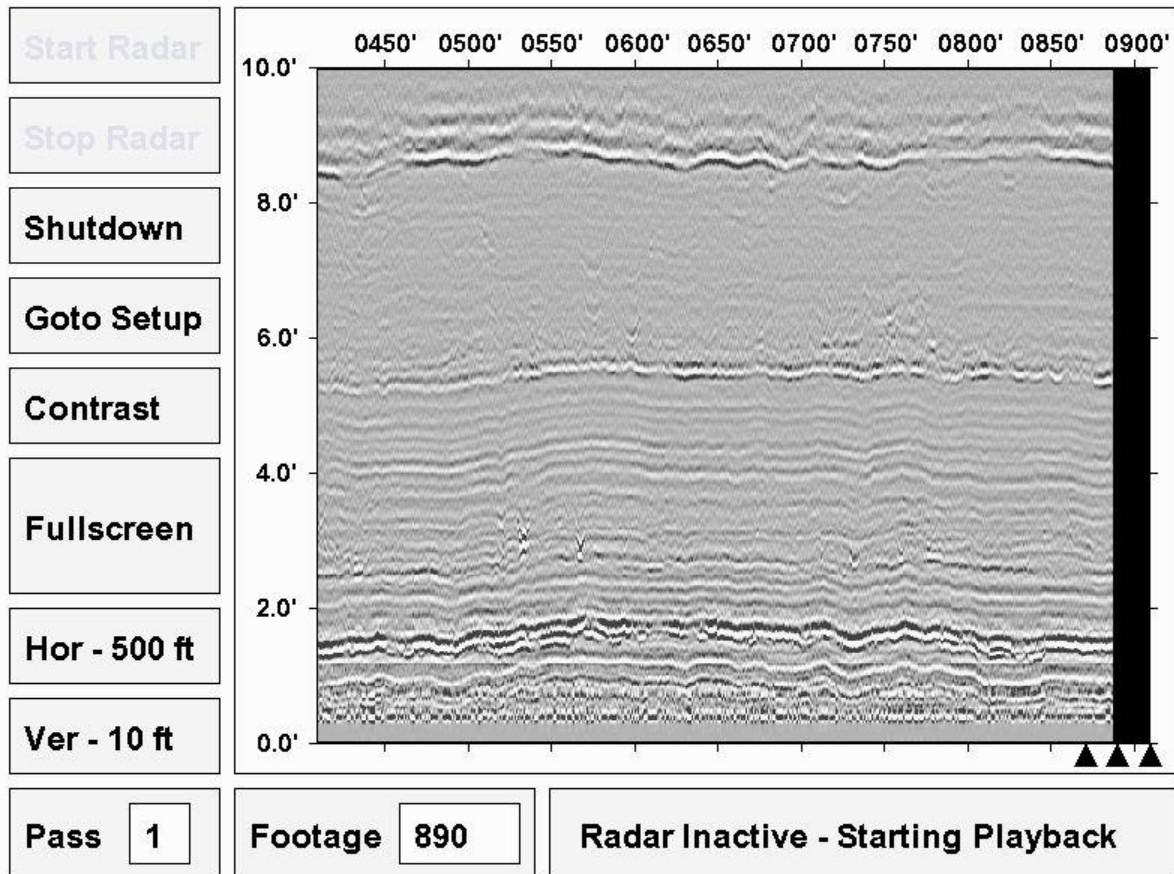
Figure 4 Operate Screen when there is no Noggin GPR or Encoder Attached

3.3 Entering Setup Information

Setup information is entered by accessing the Setup screen as shown in Figure 5. The Setup screen allows the operator to enter the Block Number, Panel Number, Room Number, Room Start X-Coord, Room Start Y-Coord and Room Direction information. See section 4.2 for details of the Setup Screen.

Block Number	A
Panel Number	1
Room Number	1
Room Start X-Coord	0
Room Start Y-Coord	0
Room Direction	45

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A	B	C
1	2	3
4	5	6
7	8	9
DEL	0	OK

CANCEL

Exit	Shutdown	Operate

Figure 5 Setup Screen

3.4 Stopping the ClayMapper Program

The ClayMapper program is stopped by first pressing the Stop Radar button and then pressing the Shutdown button. The program will save data, shutdown the program and then shutdown the PC itself. The complete shutdown procedure is as follows.

1) Press Stop Radar button
2) Press Shutdown button
3) Wait for program to exit and PC to turn off

4.0 ClayMapper Program

The ClayMapper program consists of two screens the Operate screen and the Setup screen.   Section 4.1 discusses the Main screen and section 4.2 the Setup screen.

4.1 ClayMapper Operate Screen

The ClayMapper operate screen consists of a data display area; eight control buttons located to the left of the screen and status information along the bottom of the screen (see Figure 6).

4.1.1 Data Display

The data display presents the radar images obtained at each horizontal distance traveled versus distance into the ceiling. The Y axis of the display indicates distance into the ceiling rock measured in either feet or meters depending on the settings in the radar.cfg file. 0.0 indicates the Noggin radar antenna. Normally there is some small uniform grey zone between the 0.0 mark and the ceiling which corresponds to the distance between the antenna and the ceiling.

The X axis is the horizontal distance traveled by the mining machine measured in feet. There are three black triangles at the bottom right side of the display. These triangles represent the front of the miner, the position of the GPR Noggin radar unit and the back of the miner. There will always be a black vertical band to the right of the middle triangle as the data for the region between the cutting face and the radar unit has not measured. The miner travels from left to right across the screen.

For a new room there has been no data collected so for the first part of the pass there will be a black area to the left of the graph. In Figure 6 the starting position was entered as 500 m and the miner has only moved about 17 m (to the 517 m mark) and therefore there is no data for positions less than 500 m and consequently the screen is black in this region.

In Figure 7 a pass has been completed and the full screen shows data. Varying grey scales are used to indicate the strength of the return radar signal obtained by the Noggin GPR unit. Black indicates a strong negative reflection; white indicates a strong positive reflection and grey indicates background or average levels. In the data shown in Figure 7 three clay layers can be observed at 1.5', 5.5' and 9' distances.
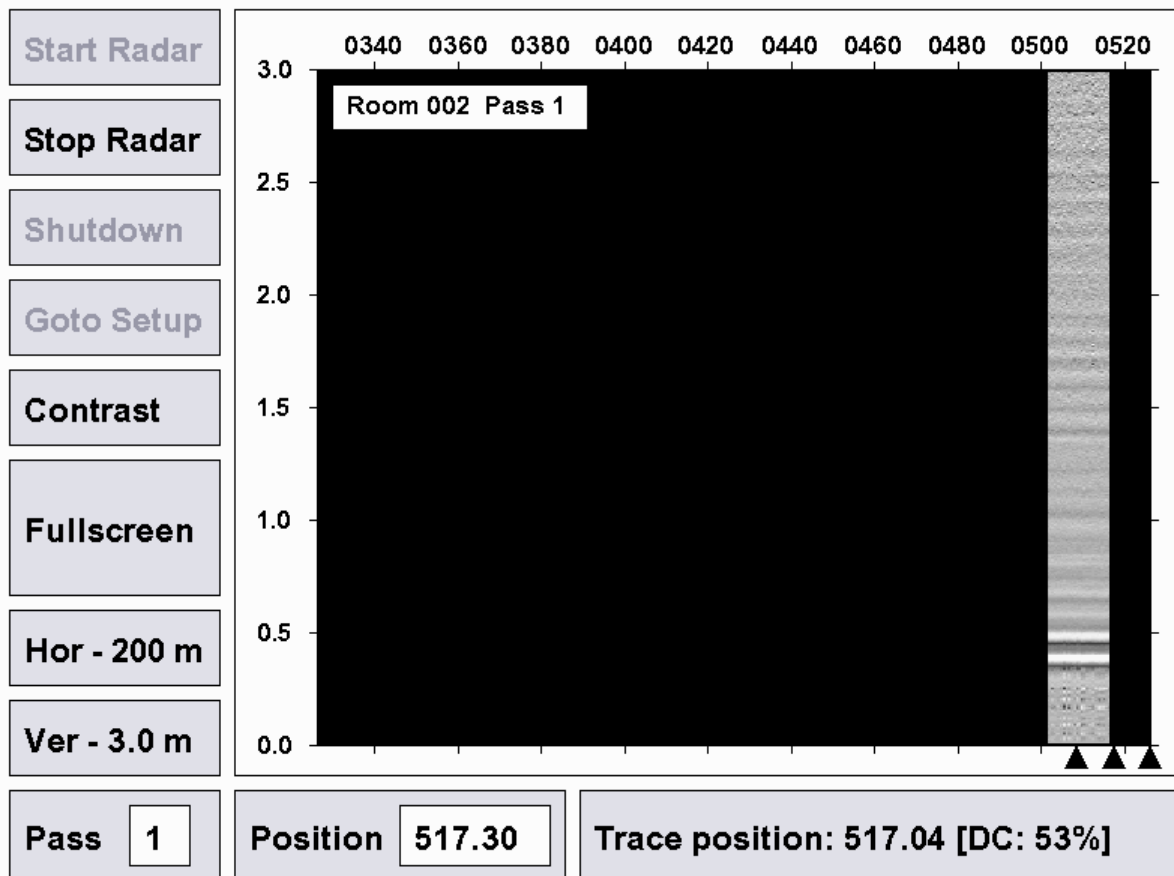
Figure 6 Operate Screen Showing Data Display and Control Buttons
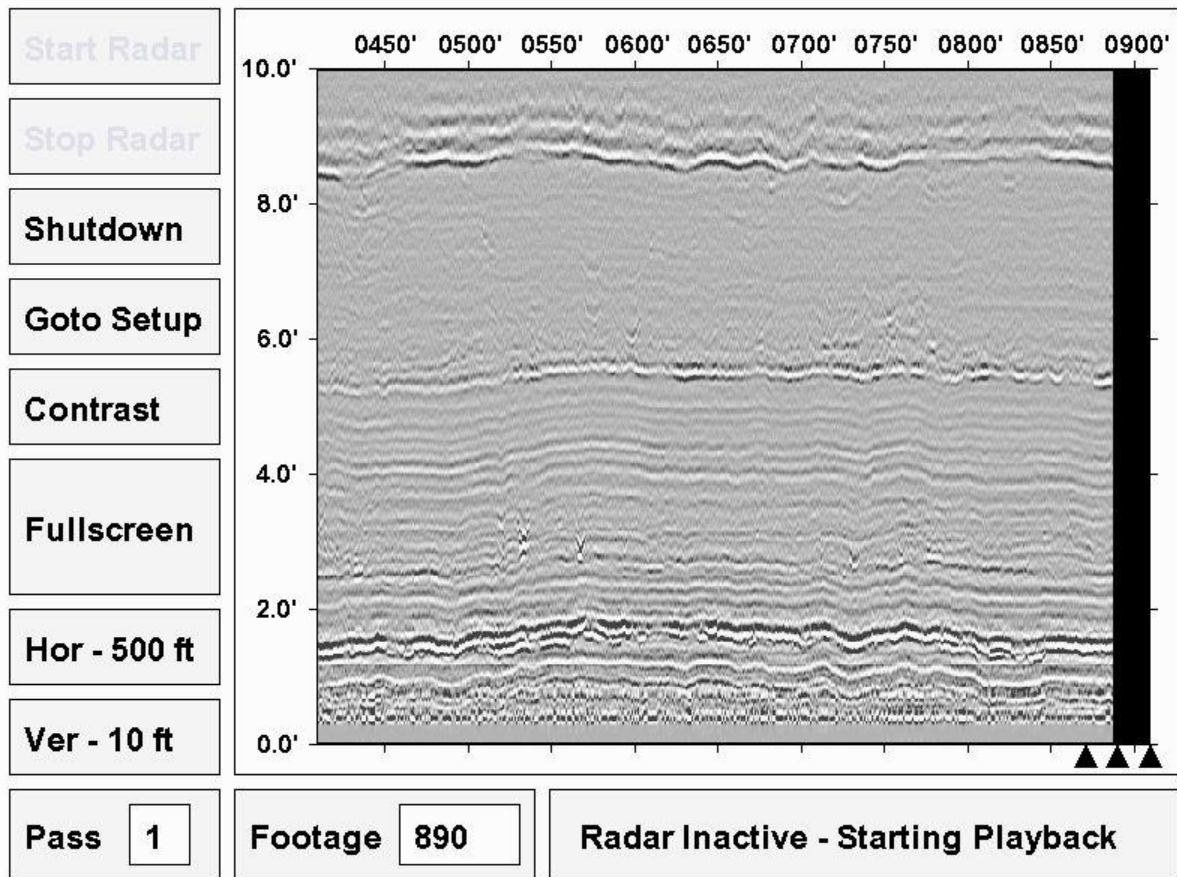
Figure 7 Screen Showing Three Clay Layers

4.1.2 Control Buttons

There are eight control buttons located on the left side of the Operate screen (see Figure 6).

Start Radar Button
When pressed the Start Radar button will start the program triggering the Noggin GPR unit based on the distance measured by the distance wheel. The distance is continuously monitored and whenever the preset interval distance is reached the radar unit is triggered and the data is read from the radar unit and stored in a data file. The data is also digitally filtered by the program and added to the data display. If the Start Radar button is greyed then the Noggin GPR or distance wheel were not discovered on program startup. If the radar is connected after program startup the user must exit and restart the program to go through the hardware detection routine again.

Stop Radar Button

When pressed the Stop Radar button stops the program triggering the Noggin GPR unit based on the distance measured by the distance wheel. The distance is not monitored. Normally the radar will be stopped before shutdown or whenever the miner is halted for a period of time. Other reasons for stopping the radar include maintenance of the Noggin unit or the apparatus holding the Noggin next to the ceiling. It is recommended that the Stop Radar button be pressed before approaching the Noggin GPR unit.

Shutdown Button

When pressed the Shutdown button will exit the ClayMapper program and shutdown the PC. The only method of restarting the PC and the ClayMapper program is to press the momentary contact main power switch located on the bottom panel. When the PC powers up the program will start automatically.

Goto Setup Button

When pressed the Goto Setup button will switch the display to the Setup display where Block Number, Panel Number, Room Number, Room Start X-Coord, Room Start Y-Coord and Room Direction information and can be entered. See section 4.2 for details of the Setup Screen.

Contrast Button

When pressed the Contrast button will sequentially sequence the contrast of the screen from 0.0 to 1.0 in steps of 0.1. See Figure 9 for a screen shot with the contrast set to 0.3. Each button press advances the contrast setting by 0.1.

Fullscreen Button

When pressed the Fullscreen button will show the data display in full screen mode removing all of the control buttons and the status information from the screen. This allows the data to be seen in better detail (see Figure 8). Pressing the screen anywhere returns the display to the Operate screen. While in Fullscreen mode several new buttons appear at the bottom of the screen, these are:

Single
T: Current Pass
B: Previous Room
<<
Reset
>>

Single/Split Button

When pressed this button cycles between **Single** and **Split**. Single shows the current pass while split shows both the current pass and the previous room.

T: Current Pass/Previous Room Button

When pressed this button cycles the top graph between showing the Current Pass or showing the Previous Room (see Figure 9).

B: Current Pass/Previous Room Button

When pressed this button cycles the bottom graph between showing the Current Pass or showing the Previous Room (see Figure 9).

<< Button

When pressed this button moves the graph to the left.

Reset Button

When pressed this button resets the graph to align the current location with the middle triangle.

>> Button

When pressed this button moves the graph to the right.
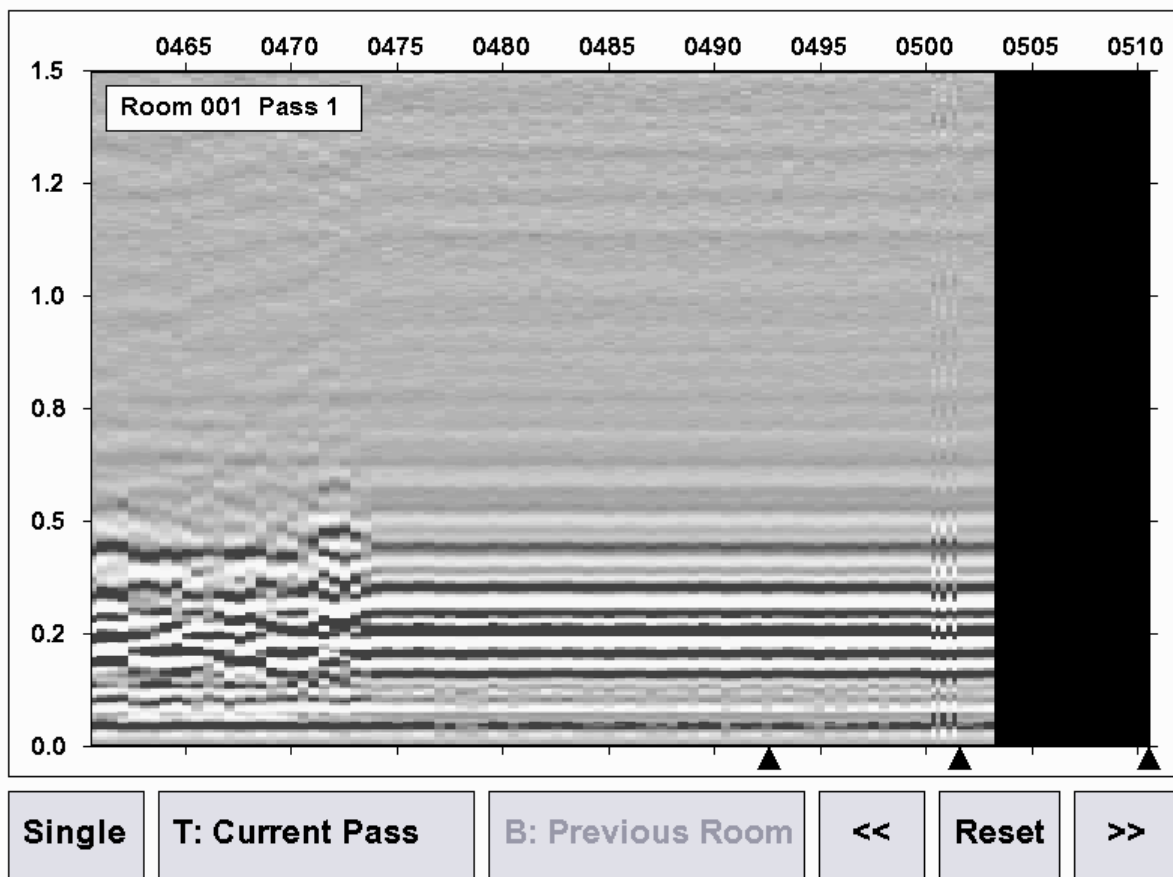
Figure 8 Fullscreen Data Display
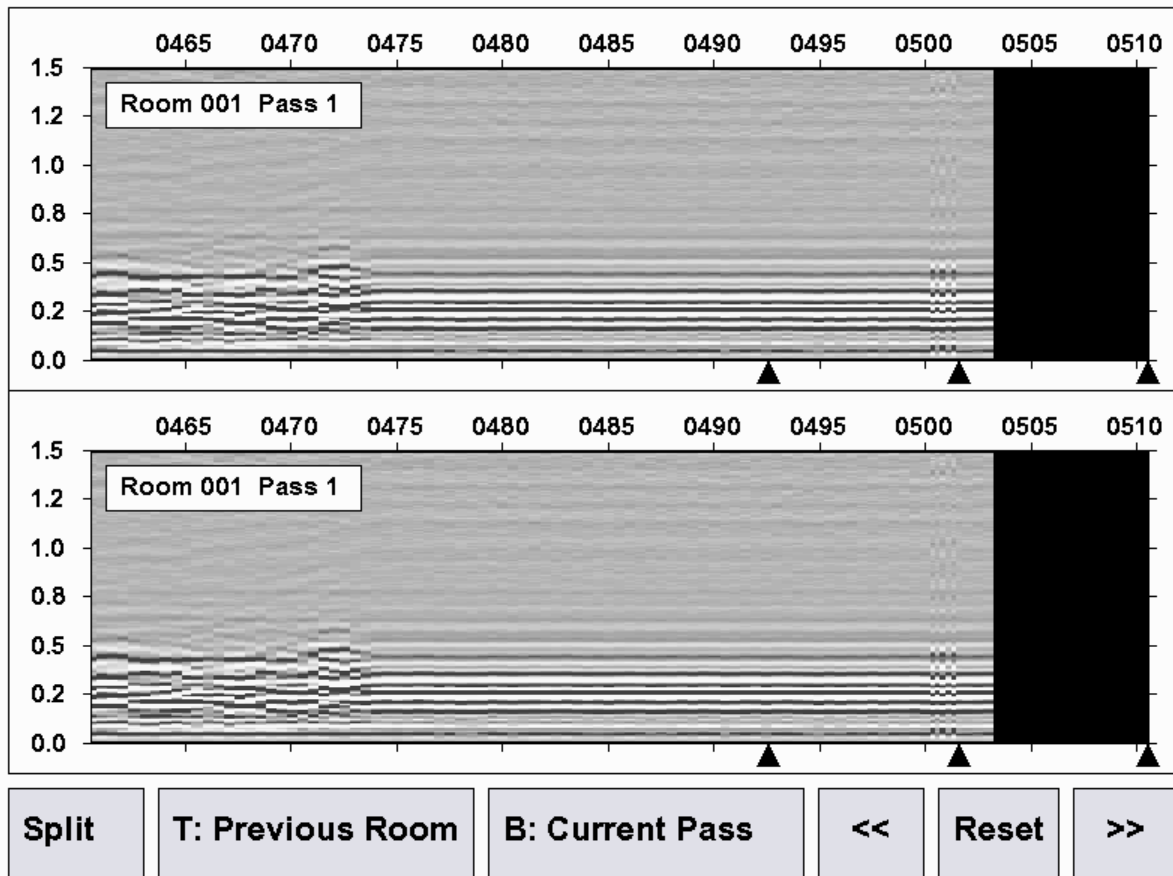
Figure 9 Fullscreen Data Display showing Split Screen Mode

Hor Button

     When pressed the Hor button will sequence the horizontal distance axis between horizontal distances preset in the radar.cfg file, (see Figure 10). This provides a zoom capability so the operator can better see details in the most recent portion of the pass. The text in the horizontal control button will also change to show the current Distance scale, the possibilities are Hor – 500 ft, Hor – 200 ft and Hor – 100 ft when operating the program in Imperial units or Hor – 200 m, Hor – 100 m and Hor – 50 m when the program is running in metric units.
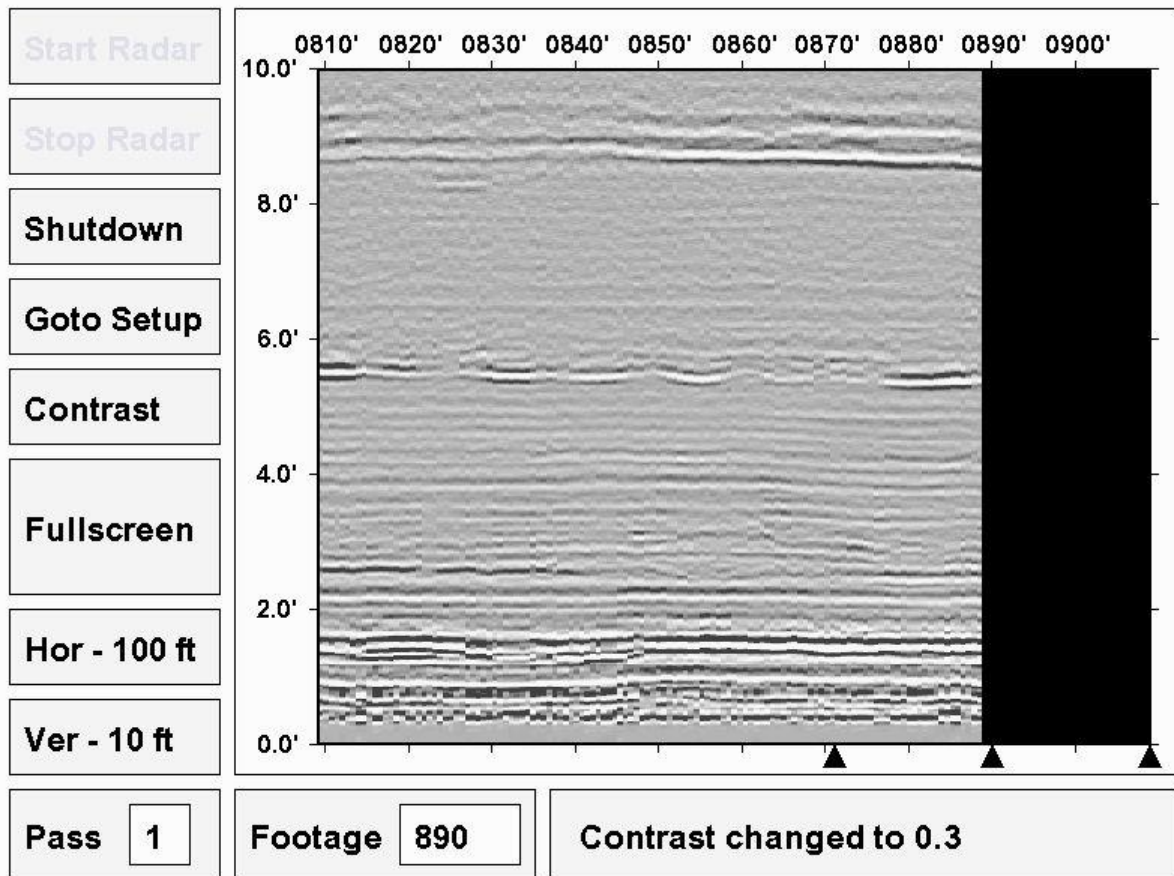
Figure 10 Horizontal Distance Set to 100 ft

Ver Button

When pressed the Ver button will sequence the vertical distance axis between vertical distances preset in the radar.cfg file (see Figure 11). This provides a zoom capability so the operator can better see details in rock closest to the ceiling. The text in the vertical control button will also change to show the current Distance scale, the possibilities are Ver – 10 ft and Ver –5 ft when operating in Imperial units or Ver – 3 m, Ver – 1.5 m when operating in metric units.
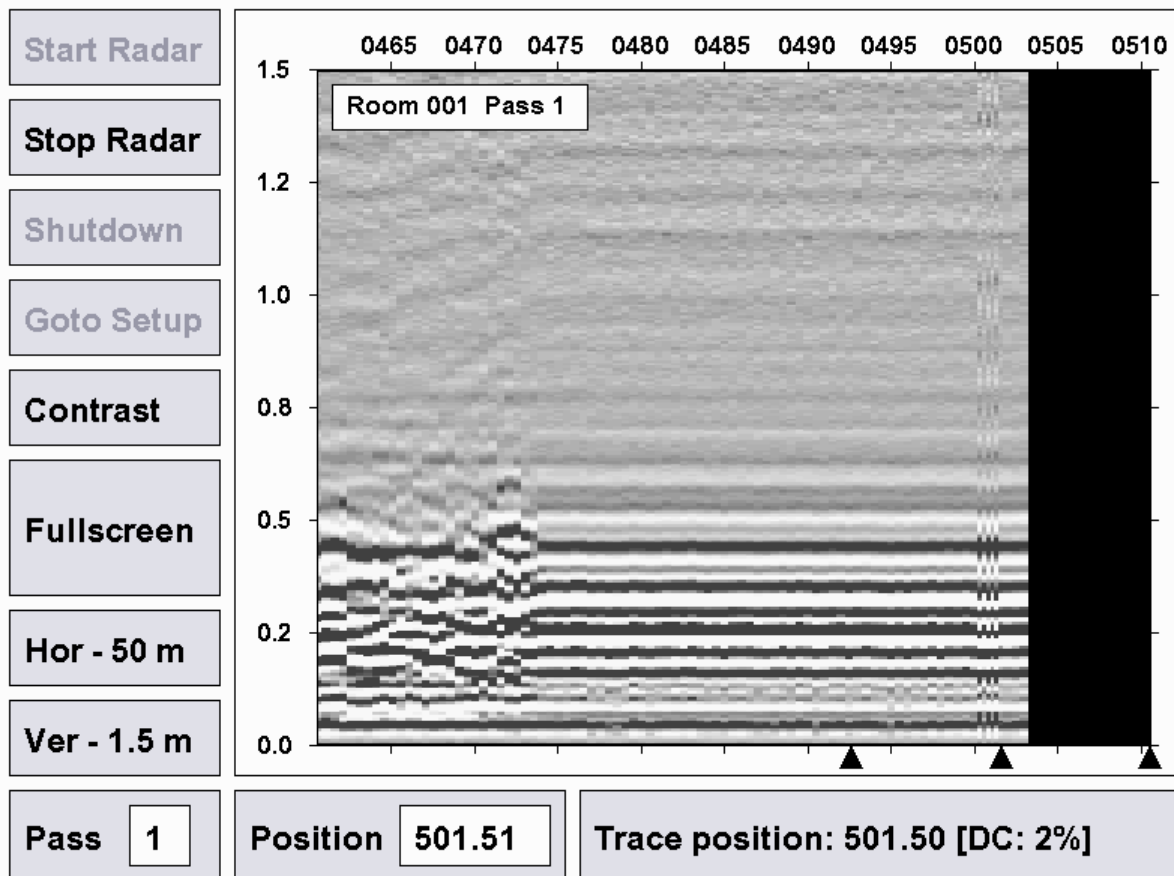
Figure 11 Vertical Distance Set to 1.5 m

4.1.3 Status Information

There are three status information boxes at the bottom of the screen as shown in Figure 11. These are: Pass number, current Position and program messages.

Pass Information Box

The Pass number information box shows the current pass as was entered on program startup. This information must also be entered each time the program enters the Operate screen from the Setup screen.

Position Information Box

The Position information box shows the current miner position in feet or meters depending on the setting in the radar.cfg file. This number is updated according to the position measured by the distance wheel.

Program Message Information Box

This box shows various program messages including information about whether the radar is started or not, the contrast setting and when the radar is started and being triggered by the encoder the information box shows trace position when the last trigger occurred and a

DC value. The DC value is a measure of the distance travelled between the time the radar was triggered and when the program received the data from the Noggin GPR and finished processing it. The DC value is presented as a percentage where 0% corresponds to the program receiving and processing the data at the same location as the Noggin was triggered. 100% indicates that the data was received and processing was complete at the next triggered position. Percentages greater than 100% indicate that the Clay Mapper PC did not finish receiving and processing the data until after the next scheduled trigger location and therefore that location will not be present in the data. As an example, assume that the radar is set to trigger every 0.5 m. If the radar is triggered at the 500 m mark then the next trigger should occur at the 500.5 m mark. If the Clay Mapper PC finishes processing the 500 m data at the 500.25 m mark then the DC value will be 50% ((500.25 – 500)/0.5). If instead the PC doesn't finish until the 500.6 m mark then the sample that should have occurred at 500.5 m will not be triggered and the DC value will be (0.6/0.5 = 120%). In this case the next triggered position will be 501 m. The Trace Position message will turn red whenever the DC value exceeds 80%. This is a warning to the operator to slow down the rate of travel or positions will be missed. Note: when a Clay Mapper is mounted on a mining machine there is little chance that the rate of travel will ever be high enough to miss trigger points. The DC value is especially useful when the Clay Mapper PC is truck mounted and the rate of travel is higher.

4.2 ClayMapper Setup Screen

The Setup screen consists of an information display area located on the left side of the screen, a data entry area on the right side of the screen, three control buttons located at the bottom right side of the screen and program version information at the bottom left of the screen (see Figure 12).

Figure 12 Setup Screen

4.2.1 Setup Information Display

The Information display shows the numerical settings for each of the various items on the screen and also allows the operator to change these values. To change values simply press on the text box you want to change. The numerical value will become un-greyed and the data entry box will also un-grey to allow new information to be entered (see Figure 13). After the information is entered pressing the OK button will update the numerical text box and the box will become grey again. Proceed through all of the data entry items and update as required.

4.2.2 Setup Data Entry

The Data Entry portion of the screen consists of a standard numeric keypad with delete (DEL), enter (OK) and cancel (CANCEL) function buttons. There are also three alpha entries (A, B, C) provided at the top of the numeric keypad. After pressing the desired information box on the left side of the screen the data entry keypad will become un-greyed to allow the operator to type in the new data using the keypad. When complete simply press OK to update the information.

Figure 13 Setup Screen Showing Block Number Data Entry

4.2.3 Setup Control Buttons

The Setup control buttons are Exit, Shutdown and Operate.

Exit Button

Pressing the Exit button will shutdown the ClayMapper program and then reboot the PC in a command line Linux logon screen. A keyboard must be plugged into the PS2 port on the bottom panel of the GPR-PC before pressing the Exit button. The Exit button is only used by personnel needing to make changes to the ClayMapper program, the Linux operating system or to the PC configuration. Always reboot the PC after making changes to the configuration. The ClayMapper program will automatically restart after a reboot.

Shutdown Button

This button has the same function as the Shutdown button present on the Operate screen. When pressed the Shutdown button will exit the ClayMapper program and shutdown the PC.

Operate Button

The Operate button will exit the Setup screen and return the program to the Operate screen which allows for data display and collection. Note: when the Operate button is

pressed the program will prompt the operator to enter the Pass Number and Current Position before proceeding to the data display screen.

5.0 ClayMapper Configuration File

The ClayMapper program uses a configuration file to set up the instrument for data collection. The configuration file is stored in the /home/radar/bin directory and it is called radar.cfg. The contents of a typical configuration file in Imperial units are shown below.

```
GPR PC Configuration File
Created: Fri Nov 30 19:57:48 2007
Mine Units (0:ft 1:m): 0
Radar Sampling Interval (ft): 0.500000
Distance Wheel Radius (ft): 1.000000
Number of Scans per Trace: 4
Radar To Face Distance (ft): 19.000000
Radar To Back Distance (ft): 19.000000
Vertical Display Range #1 (ft): 5.000000
Vertical Display Range #2 (ft): 10.000000
Current Vertical Display Range # (1-2): 2
Horizontal Display Range #1 (ft): 100.000000
Horizontal Display Range #2 (ft): 200.000000
Horizontal Display Range #3 (ft): 500.000000
Current Horizontal Display Range # (1-3): 3
Contrast (0-1): 0.500000
Trace Display Coefficient A: 100.000000
Trace Display Coefficient B: 100.000000
Direct Wave Filter Length (samples): 60
Direct Wave Filter Width (ft): 500.000000
High Pass Filter Corner Freq: 40.000000
High Pass Filter Order: 4
Block Number: C
Panel Number: 1
Room Number: 74
Room Start Xcoord (ft): 0
Room Start Ycoord (ft): 0
Room Direction (deg): 45
Pass Number (1 or 2): 2
Footage (ft): 500.000000
Room Numbering (-1:decrease or 1:increase) with time: -1
Previous Room Pass Number (1 or 2): 1
TouchScreen Type Code (1-5): 5
TouchScreen XLeft: 3505
TouchScreen XRight: 590
TouchScreen YTop: 3420
TouchScreen YBottom: 670
```

The radar.cfg configuration file is an ASCII text file. The file may be edited to change configuration data but it must be saved as a text file and not as a word processor files such as Word's .doc format. If the configuration file is to be edited on a Windows PC then use the Notepad program to do the editing, do not use Word to edit this file.

The contents of the data file are as follows.

Header Information

The header consists of the first two lines. The first line identifies the file and the second provides the creation date and time.

Mine Units (0:ft 1:m)

The Mine Units are specified as a 0 for feet or a 1 for meters.

Radar Sampling Interval

The Radar Sampling Interval is the distance in the Mine Units specified that the miner must more in order to trigger the radar unit to take data. This distance is calculated from the distance wheel encoder signal. A typical value is 0.5 ft (0.152 m).

Distance Wheel Radius

The Distance Wheel Radius is the radius of the distance wheel measured in the Mine Units specified. This value is used to calculate the linear distance traveled by the miner. The distance traveled is used to trigger the radar unit and to plot radar data versus distance.

Number of Scans per Trace

This sets the number of radar scans to average to generate one trace file. A typical value for use on a miner would be 4 whereas a typical value for use on a truck mounted unit would be 1.

Radar to Face Distance

This is the distance, measured in Mine Units, between the location of the Noggin radar unit and the face of the mining machine.

Radar to Back Distance

This is the distance, measured in Mine Units, between the location of the Noggin radar unit and the back of the mining machine.

Vertical Display Range #1

This is the vertical distance measured in Mine Units that the data display can be zoomed to. The Ver - ## button cycles the display between this number and the number set by Vertical Display Range #2. A typical value is 5 ft (1.5 m).

Vertical Display Range #2

This is the vertical distance measured in Mine Units that the data display can be zoomed to. The Ver - ## button cycles the display between this number and the number set by Vertical Display Range #1. A typical value is 10 ft (3 m).

Current Vertical Display Range # (1-2)

This is the vertical distance that the display will be set to on program start. Typical value is 2.

Horizontal Display Range #1
  This is the horizontal distance measured in Mine Units that the data display can be zoomed to. The Hor - ### button cycles the display between this number and the numbers set by Horizontal Display Range #2 and Horizontal Display Range #3. Typical value is 100 ft (30 m).

Horizontal Display Range #2
  This is the horizontal distance measured in Mine Units that the data display can be zoomed to. The Hor - ### button cycles the display between this number and the numbers set by Horizontal Display Range #1 and Horizontal Display Range #3. Typical value is 200 ft (50 m).

Horizontal Display Range #3
  This is the horizontal distance measured in Mine Units that the data display can be zoomed to. The Hor - ### button cycles the display between this number and the numbers set by Horizontal Display Range #1 and Horizontal Display Range #2. Typical value is 500 ft (150 m).

Current Horizontal Display Range # (1-3)
  This is the horizontal distance that the display will be set to on program start. Typical value is 3.

Contrast (0-1)
  This is the contrast setting for the display that will be set on program start. Possible values are: 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0. A typical value is 0.2.

Trace Display Coefficient A
  The Trace Display Coefficient controls the amount of gain applied to the radar data signal before it is plotted on the data display. The overall signal gain is based on a quadratic function of the form.

$$y' = Sy$$

where y' = enhanced signal
         y = raw data from Noggin radar unit
         $S = (1+A)t + Bt^2$
         t is normalized time that runs from 0.0 to 1.0.

The radar trace consists of 500 samples spaced equally in time. The Trace Display Coefficient A is a linear gain on the raw data signal term. As can be seen from the form of the scaling factor S the first sample will have no gain applied to it and the amount of gain will increase linearly with increasing sample number. Typical value is 100.0.

Trace Display Coefficient B
  The Trace Display Coefficient controls the amount of gain applied to the radar data signal before it is plotted on the data display. The overall signal gain is based on a quadratic function of the form.

$$y' = Sy$$

where   y' = enhanced signal
                                   y = raw data from Noggin radar unit
                                   $S = (1+A)t + Bt^2$
                                   t is normalized time that runs from 0.0 to 1.0.

The radar trace consists of 500 samples spaced equally in time. The Trace Display
Coefficient B is a quadratic gain on the raw data signal term. As can be seen from the form
of the scaling factor S the first sample will have no gain applied to it and the amount of gain
will increase in a quadratic manner with increasing sample number. Typical value is 100.0.

Direct Wave Filter Length (samples)
          The Direct Wave Filter Length (samples) controls the number of samples over which
the program will remove the direct wave. Note this removal of the direct wave is only
performed for the data display and the raw data remains unaltered in the data file. The data
for each sample ranging from 1 to the Direct Wave Filter Length are averaged over the
number of data traces set by the Direct Wave Filter Width or all traces if the total number of
traces is less than the Filter Width. These average values are then subtracted from all traces
to remove the effect of the direct wave. A small discontinuity (a horizontal line) is often seen
in the data trace at the Direct Wave Filter Length sample number. This is normal and is a
result of the removal of the average signal from these samples. Typical value is 60.

Direct Wave Filter Width
          The Direct Wave Filter Width (ft/m) controls the number of traces that are averaged
to determine the effect of the direct wave. If the Width is set to 500 ft then all of the traces
collected over the last 500 feet are averaged in order to determine the direct wave intensity.
This average value is then subtracted from all data traces. If the number of traces collected is
less then the value set by the Direct Wave Filter Width parameter, then the program averages
over all traces collected. A typical value is 500 ft (150 m).

High Pass Filter Corner Freq
          The High Pass Filter Corner Freq is the frequency measured in MHz that is used in
the high pass filter calculation. All frequencies below the cutoff frequency will be attenuated
by the filter. This filter is only applied to the plotted data; it is not applied to the data stored
in the data files. A typical value is 40.0.

High Pass Filter Order
          The High Pass Filter Order is the order of the high pass filter used to filter the radar
data before display. A typical value is 4.

Block Number
          The value is the Block Number set in the program when the program was last
shutdown. It is the value that will appear the next time the program starts.

Panel Number

The value is the Panel Number set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Room Number

The value is the Room Number set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Room Start Xcoord

The value is the room starting X coordinate, measured in Mine Units, set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Room Start Ycoord

The value is the room starting Y coordinate, measured in Mine Units, set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Room Direction (deg)

The value is the azimuth in degrees of the room that was set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Pass Number (1 or 2)

The value is the pass number that can be either 1 for the first pass or 2 for the return pass. This is the value set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Footage (ft/m)

The value is the current position of the miner. This is the value set in the program when the program was last shutdown. It is the value that will appear the next time the program starts.

Room Numbering

The value determines if room numbering will increase or decrease with time. A (-1) causes a decrease with time while a (1) causes an increase with time.

Previous Room Pass Number

The value determines the previous room's pass number either 1 or 2. It is the value that will appear the next time the program starts.

TouchScreen Type

The type of hardware built into the touch screen will determine the proper code to use for the TouchScreen Type. This value is normally factory set and will not need to be changed unless the touch screen monitor is replaced.

TouchScreen XLeft

The X coordinate of the left side of the touchscreen. This value is determined through the use of the calibrate_touch program and is normally factory set. The value will not normally require changing unless the monitor is changed.

TouchScreen XRight

The X coordinate of the right side of the touchscreen. This value is determined through the use of the calibrate_touch program and is normally factory set. The value will not normally require changing unless the monitor is changed.

TouchScreen YTop

The Y coordinate of the top of the touchscreen. This value is determined through the use of the calibrate_touch program and is normally factory set. The value will not normally require changing unless the monitor is changed.

TouchScreen YBottom

The Y coordinate of the bottom of the touchscreen. This value is determined through the use of the calibrate_touch program and is normally factory set. The value will not normally require changing unless the monitor is changed.

5.1 calibrate_touch Program

The calibrate_touch program is used to calibrate the touch screen. The program is located in /home/radar/bin and is used as follows.

1) Plug a keyboard into the PS2 keyboard connector located on the bottom panel.
2) Exit the ClayMapper program using the Exit button. This will reboot the PC in Linux command line mode.
3) Login: radar, password: radar
4) cd /home/radar/bin
5) calibrate_touch
6) Enter Code: 1-5. Most 800x600 screens will be code 4 or 5. A 1024x768 screen is normally code 3.
7) Follow the program instructions and press the upper left corner of the screen. You should see some numbers displayed on the screen, if not then the code you entered is incorrect for the screen. If this is the case then type ^c (hold control key and press lower case c key) and then restart the program by typing calibrate_touch. Pick a different code and see if the screen responds correctly.
8) Follow the program instructions and press the lower right corner of the screen. You should see some numbers displayed on the screen.
9) The program will exit and provide you with the Code, XLeft, XRight, YTop and YBottom values that must be entered in the radar.cfg file.
10) Edit the radar.cfg file. Type joe radar.cfg which will start a simple line editor.
11) Cursor to the bottom of the file and enter the Code, XLeft, XRight, YTop and YBottom values provided by the calibrate_touch program.

12) Exit the joe editor by typing ^k x (hold Control key while pressing lower case k key and then release the control key and press the x key).
13) Login as superuser. Type su and then enter the password: root.
14) Type shutdown –r now which will cause the PC to reboot and restart the ClayMapper program.

5.2 Using Switches to Control Program Execution

The ClayMapper program includes several command line switches that control the program's execution. These switches are:

–swapport   Starts the program with RS-232 COM ports mapped so that the encoder is connected to COM1 and the GPR Roof is connected to COM3.

–hispeed   Starts the program using high speed data communications on RS-232 COM ports. This is only needed when the 550A Clay Mapper PC is truck mounted.

–truckmode Starts the program in truck mode which doesn't perform calculations or updates to the video display until the user requests this by pressing the Fullscreen button.

–fakegpr   Starts the program with emulated Noggin signals. This switch is normally only used to test a model 550A when a Noggin is not present.

Any or all of these switches can be added to the command line which starts the ClayMapper program. In order to add these switches the GPR unit must be in Linux command line mode and the user must be logged in as superuser. Use the following procedure to add command line switches.

1. Plug a keyboard into the PS2 keyboard connector located on the bottom panel.
2. Exit the ClayMapper program using the Exit button. This will reboot the PC in Linux command line mode.
3. Login: radar, password: radar
4. Login as superuser. Type su and then enter the password: root.
5. cd /etc/rc.d
6. Edit the rc.local file. Type joe rc.local which will start a simple line editor.
7. Cursor to the section that starts with # automatically start the radar program if it exists
8. add –switch to the command that starts the ClayMapper program. Let's assume that the program is to be started for use on a truck mounted radar unit where travel speeds are higher than with a miner. The command line should be changed to ./radar -hispeed –truckmode NOTE: if the –swapport switch is already present then leave it there and append the other switches after it.
9. Exit the joe editor by typing ^k x (hold Control key while pressing lower case k key and then release the control key and press the x key).
10. Type shutdown –r now which will cause the PC to reboot and restart the ClayMapper program.

6.0 Installation of a New Version of the ClayMapper Program

This chapter provides a brief description of the procedure required to update to a newer version of the ClayMapper program.

Aurora Scientific Inc. has a policy of continual product improvement. We are pleased to receive user comments about the program including suggestions for new functions.

Updating ClayMapper Program

New versions of ClayMapper will be made available via email. Once you have received a new version of the program please follow the procedure listed below to upgrade your system.

1. Copy the update file to one of the two flash disks that were delivered with the GPR-PC. Note: copy the radar executable program to the top level directory on the flash stick, do not put the program in the /gprdata directory on the flash stick.
2. Plug the flash disk into the USB port on the GPR-PC before turning on the power.
3. On power up the GPR PC will look for a new version of the program to be present on the flash disk. If a new version is present then this version will be copied to the PC automatically. After copying the new program the new version of the program will be erased from the flash stick. Therefore if you need to update the program on multiple 500A Clay Mapper PCs then you will need to place the new version of the program on one flash stick per PC.
4. When the program starts you should note that the version number present in the status area of the Setup screen has been updated to the latest version.

If you experience any difficulties while updating your system please contact Aurora Scientific Inc.

Updating Configuration File

New configuration files can be installed on the GPR-PC in a manner similar to that used for program updates.

1. Copy the configuration file to one of the two flash disks that were delivered with the GPR-PC. Note: copy the radar.cfg file to the top level directory on the flash stick, do not put the .cfg file in the /gprdata directory on the flash stick.
2. Plug the flash disk into the USB port on the GPR-PC before turning on the power.
3. On power up the GPR PC will look for a configuration file on the flash disk. If a new version is present then this version will be copied to the PC automatically and then deleted from the flash stick.
4. When the program starts you should note that the new configuration data is present.

7.0 Warranty

The 550A GPR-PC system is warranted to be free of defects in materials and workmanship for one year from the date of shipment. Aurora Scientific Inc. will repair or replace, at our option, any part of the 550A system that upon our examination is found to be defective while under warranty. Obligations under this warranty are limited to repair or replacement of the instrument. Aurora Scientific Inc. shall not be liable for any other damages of any kind, including consequential damages, personal injury, or the like. Damage to the system through misuse will void this warranty. Aurora Scientific Inc. pursues a policy of continual product development and improvement therefore we reserve the right to change published specifications without prior notice.

7.1 Contacting Aurora Scientific Inc.

Technical assistance is available by regular mail, email, phone, or fax. Use the information below to contact Aurora Scientific Inc.

Address: Aurora Scientific Inc.
            ClayMapper Technical Assistance
            P.O. Box 2724
            Richmond Hill, Ontario, CANADA
            L4E 1A7

Phone: 1 905 727-5161
Toll Free: 1 877 878-4784 (North America)
FAX: 1 905 713-6882
E-mail: info@AuroraScientific.com
Web site: www.AuroraScientific.com

8. 0 Terms and Conditions for Returning Equipment

1.   Aurora Scientific Inc. **will not** accept any equipment returned without prior authorization in the form of a return material authorization number.

1.   **Please call Customer Service at (905) 727-5161 or toll free at 1-877-878-4784 to obtain an RMA number. Please be prepared to supply the model and serial number, these can be found on the ASI tag affixed to the GPR-PC.**

2.   Please package equipment properly. Goods that are damaged in shipment are the responsibility of the shipper.

3.   **Aurora Scientific, Inc. withholds the right to assess charges for the repair or replacement of such damaged goods, regardless of warranty status.**

4.   Warranty repairs will be shipped back to the customer via FedEx. If you require or request another form of shipment, the cost of such service is your full responsibility.

5.   Aurora Scientific, Inc. **will not** be responsible for any return or replacement **shipping charges** incurred due to an incorrect order placed by the customer.

Return Shipping Address:

Aurora Scientific Inc.
360 Industrial Pkwy. S., Unit 4
Aurora, ON, Canada
L4G 3V7
Attn: RMA Returns

Appendix A – ClayMapper Data File Naming

Data File Naming for Files Created by ClayMapper

A separate data file is generated each time the Noggin GPR is triggered to take data. These files contain the raw GPR data and they don't include any filtering or signal enhancement as is seen in the on screen data display. The data is stored in binary format in order to keep the files as compact as possible. An example of a data file name is as follows.

C2P006R004P1F0998.50.dat

In this data file:

C2 = Block number
P006 = Panel number
R004 = Room number
P1 = Pass number
F0998.50 = Position
.dat = filename extension

All data files are stored on the GPR PC hard drive in the /gprdata directory. In addition to the data files there is also a filelist file that keeps an index of all data files on the PC. When the program starts it reads the filelist file and identifies any data files that have not been copied to the flash drive. The program then copies these data files to the flash drive and updates the filelist file to indicate that the files have been copied. Note: the flash disk must be formatted in FAT32 format if using a Windows PC to format it. If formatting it on a Linux PC then use VFAT format. The flash stick must contain a subdirectory called /gprdata. The PC will keep up to 50,000 individual data trace files on the hard drive. Once the 50,000 file limit is reached the program will then replace the oldest files with the newest ones. For a typical 1,000 foot pass with the Radar Sampling Interval set to 0.5 feet the program will generate 2,000 files. Therefore the 50,000 file limit corresponds to about 25 passes. It is expected that a flash disk will be placed in the PC each day and then brought to the surface for data archiving at least once per week.