System Fault Isolation with BIT

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Outline

- Introduction to BIT
- BIT as a program included in a schedule
- Using BIT as a fault isolation aid
- Details of BIT testing and interpretation of results

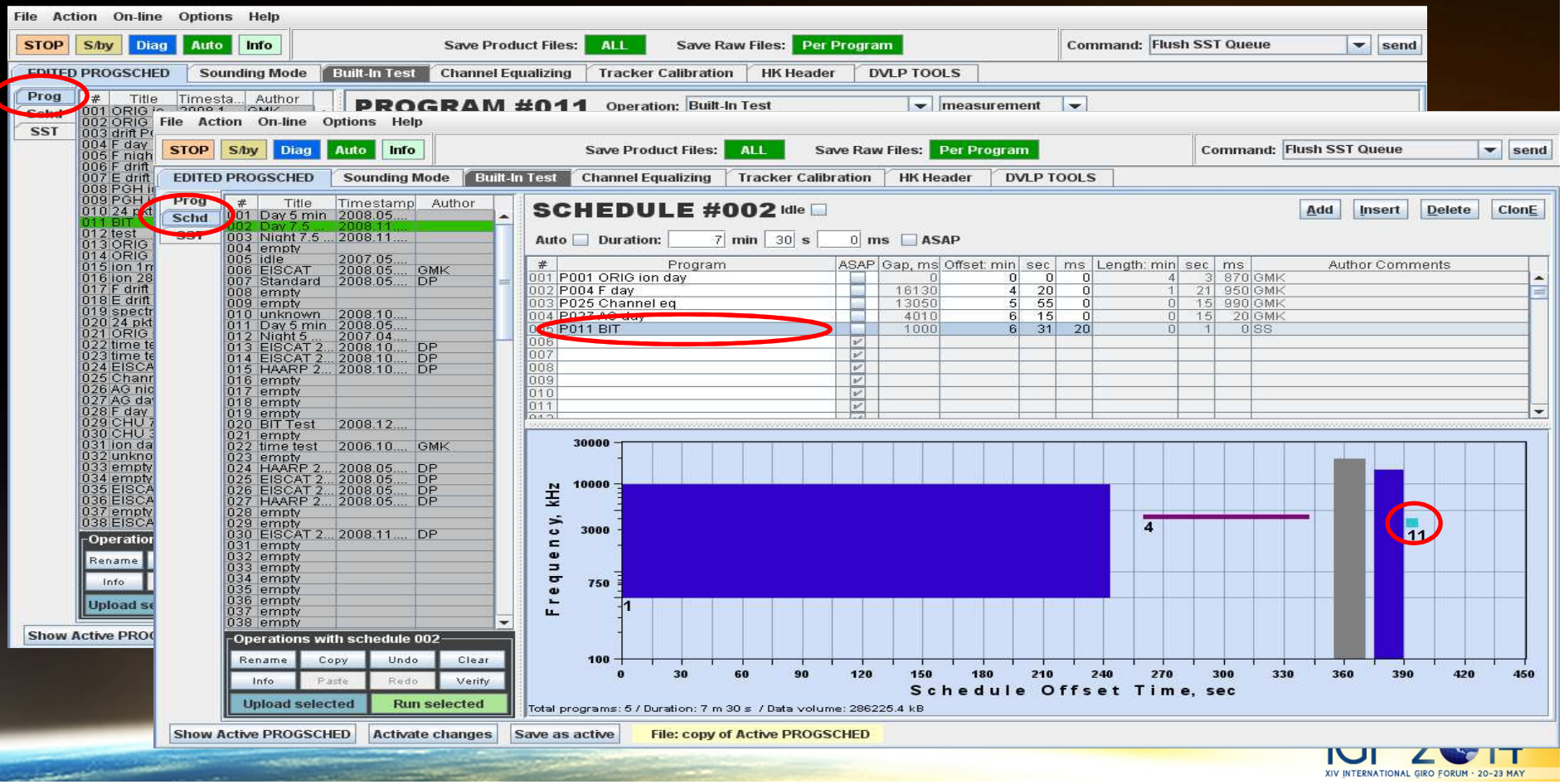
Introduction to BIT

- Earlier systems had troubleshooting assistance mechanisms but nothing automated
- Built-In Test (BIT) was introduced as an automated mechanism to determine and report Digisonde health
- Run on a user defined basis
- First place to look when problems arise
- Valuable aid in locating system fault

BIT Program

- BIT is a type of program that can be scheduled
- Please ensure it is included in the routine sounding schedule
- Can be run manually in DCART's "manual" mode
- Data display is available in 2 forms
  - Built-In Test Display
  - BIT Report
- BIT Report is also available on the Web Page

Example of BIT Included in a Schedule



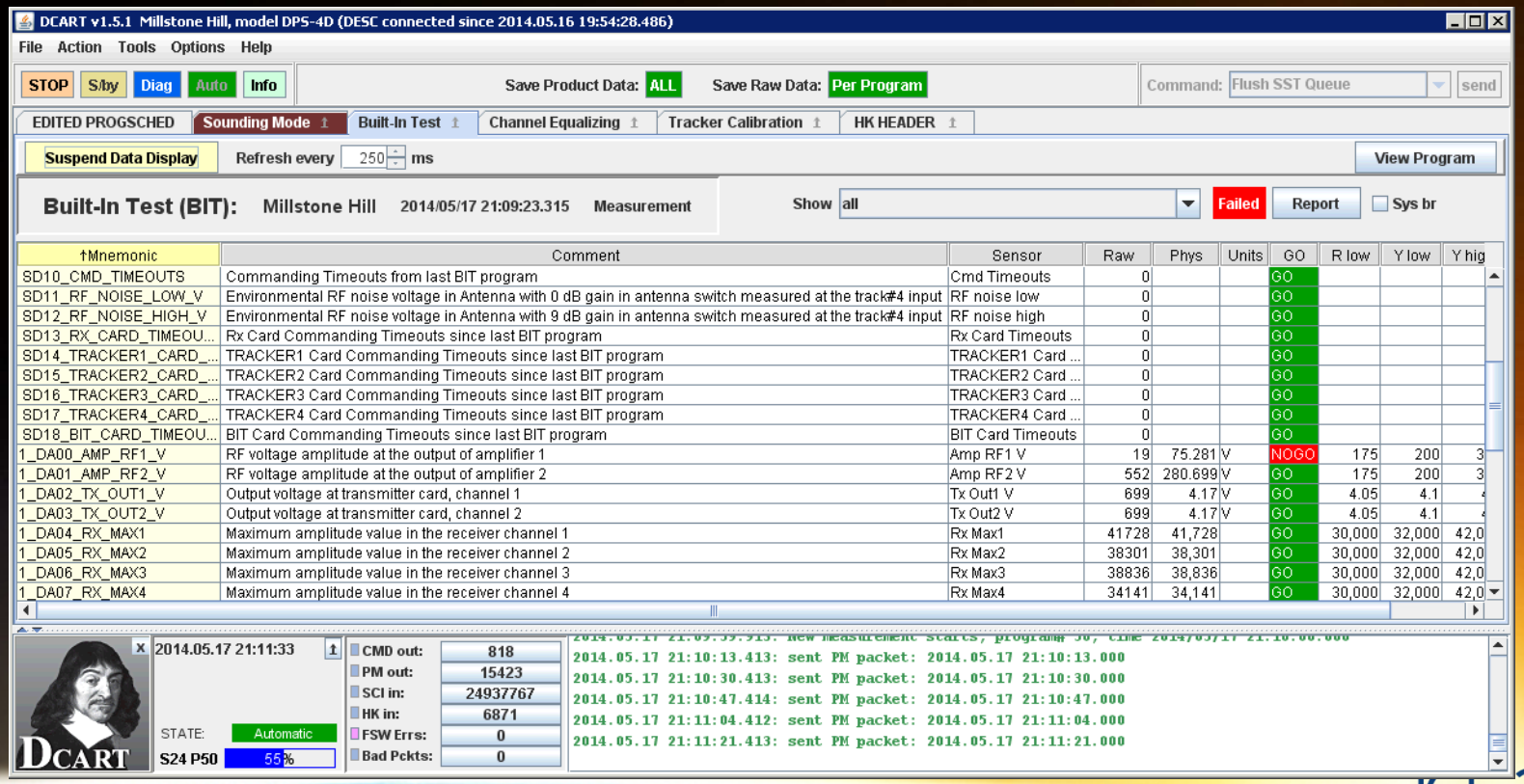
Indications of Potential Problems

- No data
- Blank data (empty ionograms)
- Observe weak data, strange directions, etc
- BIT is reporting errors

BIT as a Fault Isolation Aid

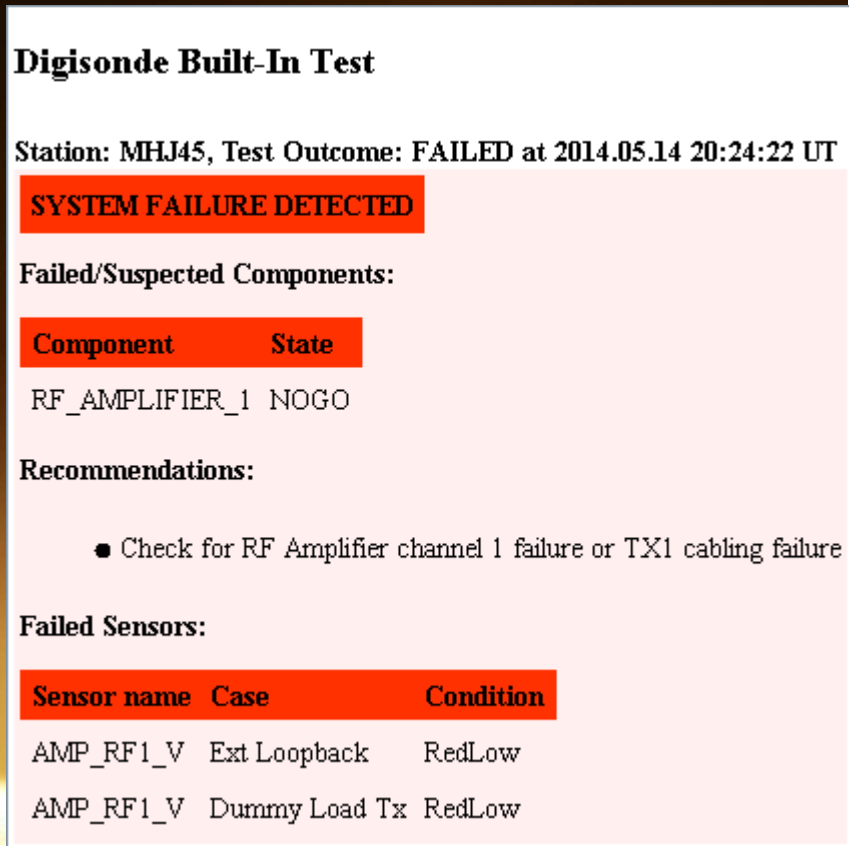
- Recommended as the first place to look
- Evaluate the BIT report
  - View BIT report within DCART or website
  - Interpret “raw” BIT sensor values
- When possible use the DPS-4D system as a troubleshooting tool through use of special operating modes.

DCART: BIT Tab



BIT Report Organization

- Report system failure if detected
- List suspected components
- Recommendations
- List of failed sensors, listing the “case” where failure occurred
- List of hardware by state: GO, NOGO, UNKNOWN
- List of sensor definitions
- List of sensor results by case



Digisonde Built-In Test

Station: MHJ45, Test Outcome: FAILED at 2014.05.14 20:24:22 UT

SYSTEM FAILURE DETECTED

Failed/Suspected Components:

Component	State
RF_AMPLIFIER_1	NOGO

Recommendations:

- Check for RF Amplifier channel 1 failure or TX1 cabling failure

Failed Sensors:

Sensor name	Case	Condition
AMP_RF1_V	Ext Loopback	RedLow
AMP_RF1_V	Dummy Load Tx	RedLow

Interpreting BIT Results

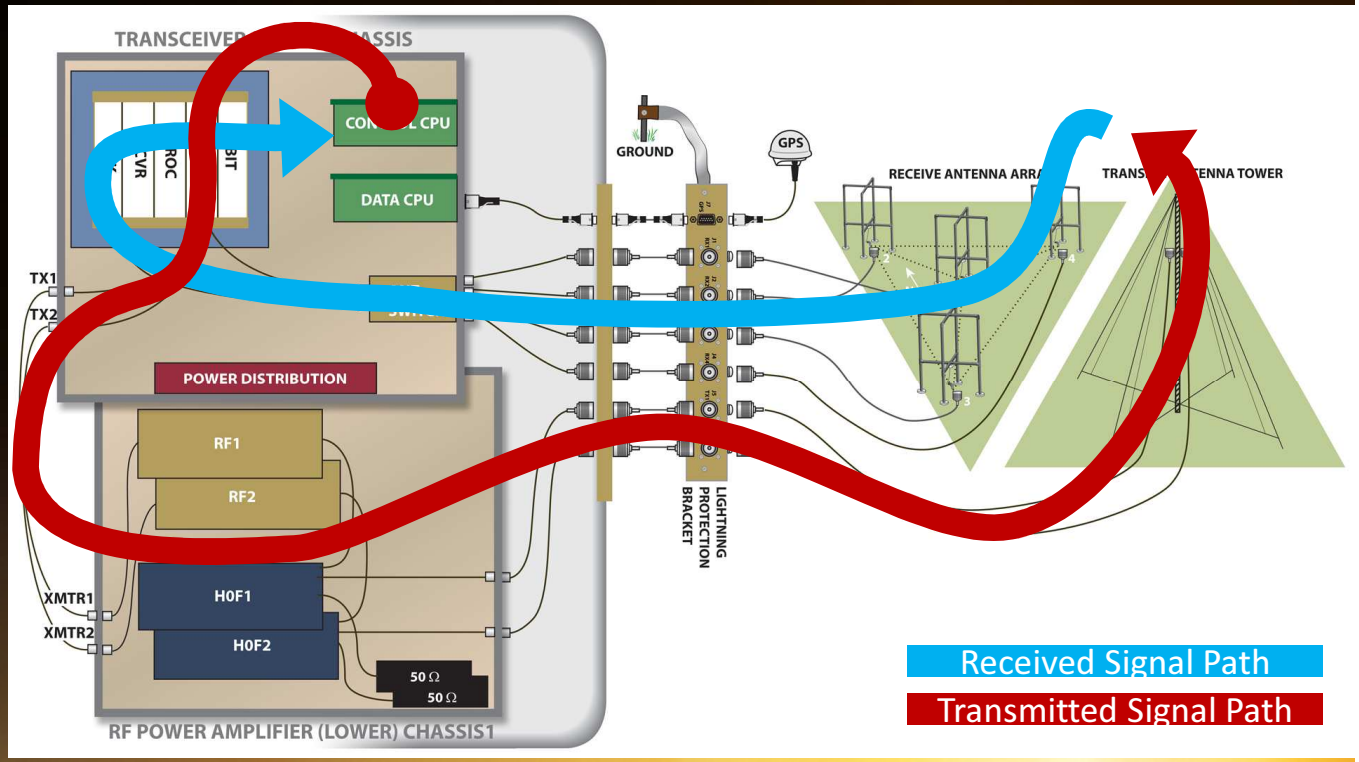
- Interpretation of BIT results may be required
- Having an understanding of how BIT tests the system helps
  - BIT runs 4 tests or “cases” to determine system health
- Understanding sensor names

4 Cases

- Case 1: External Loopback
- Case 2: Internal Loopback
- Case 3: Internal Loopback without Trackers
- Case 4: Transmission into Dummy Load

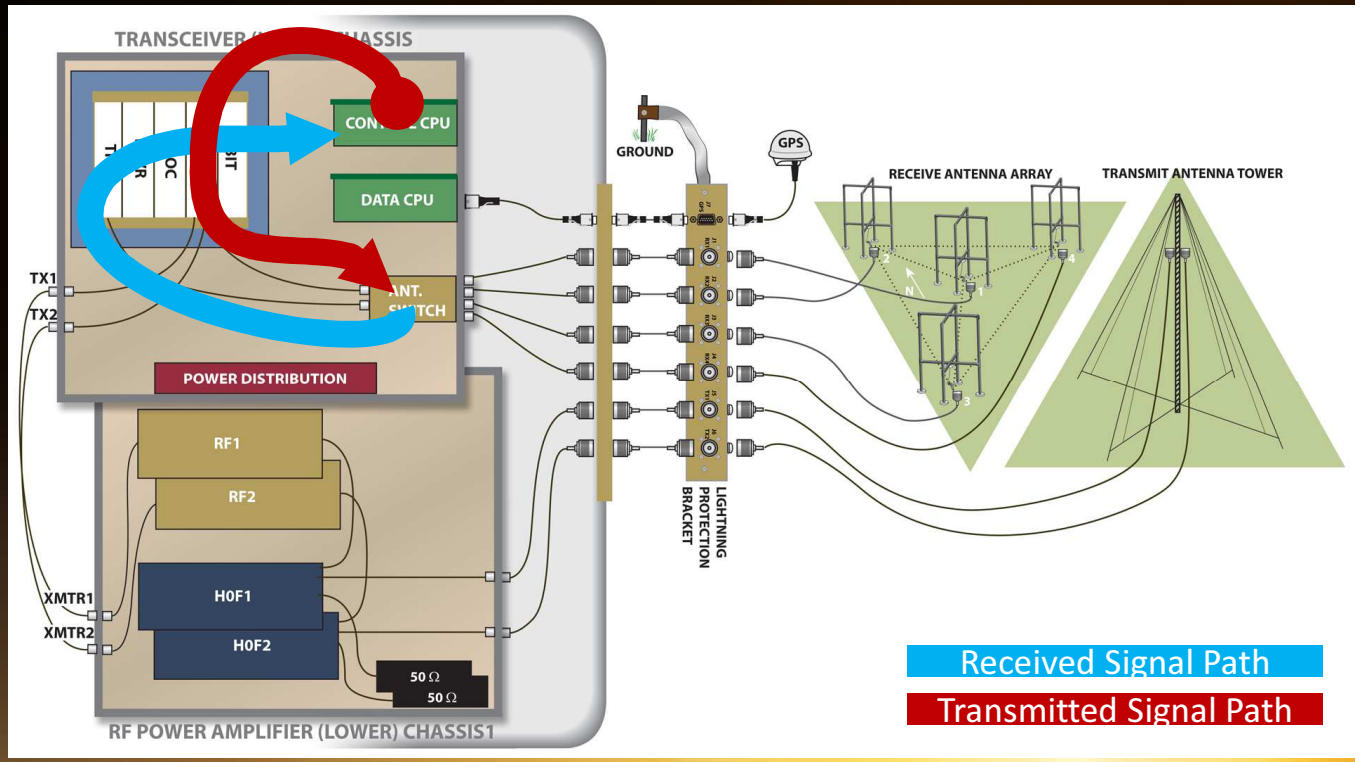
Case 1: External Loopback

- External Loopback
- Normal transmission as would be made during measurement
- Listening for direct reception of the transmitter pulse
- Signal enters through the receive antennas as it would during normal sounding



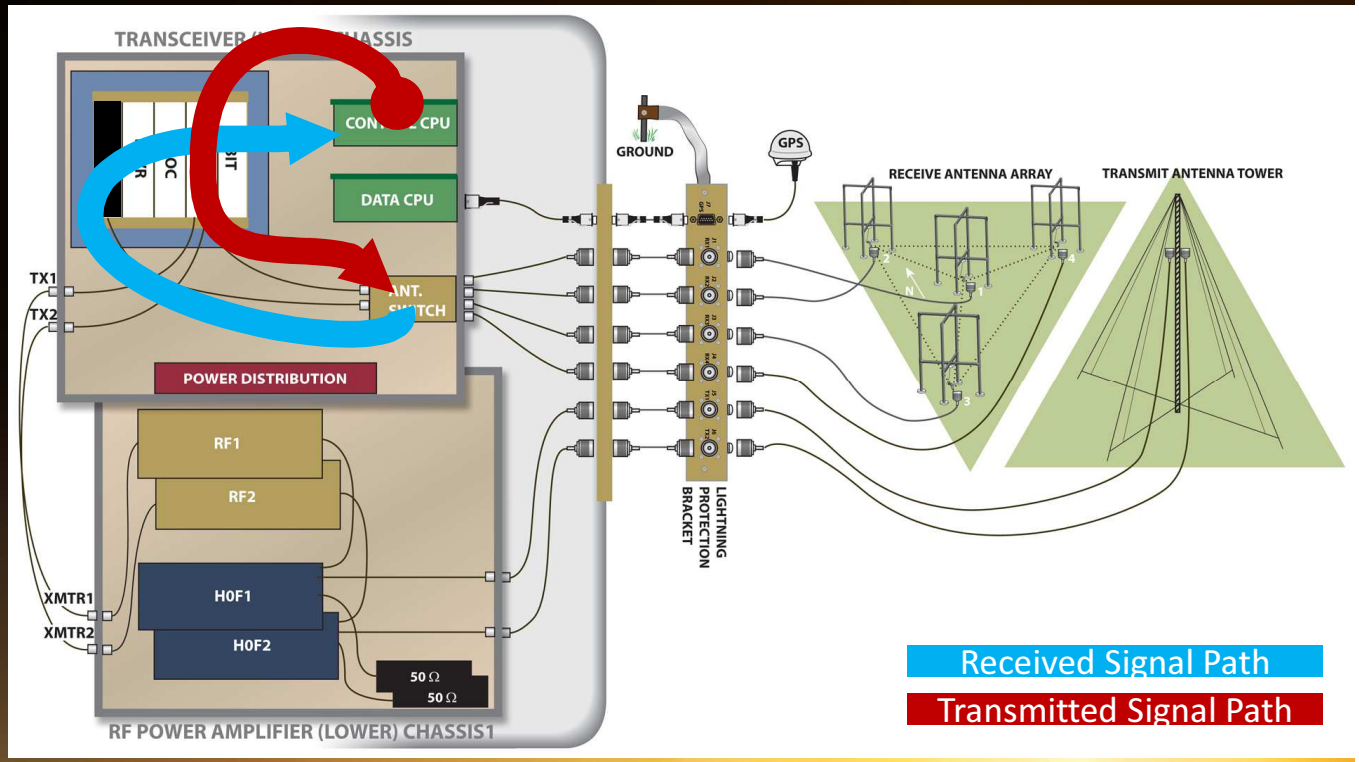
Case 2: Internal Loopback

- Internal Loopback
- CAL output to Antenna Switch
- Antenna switch routes signal to trackers



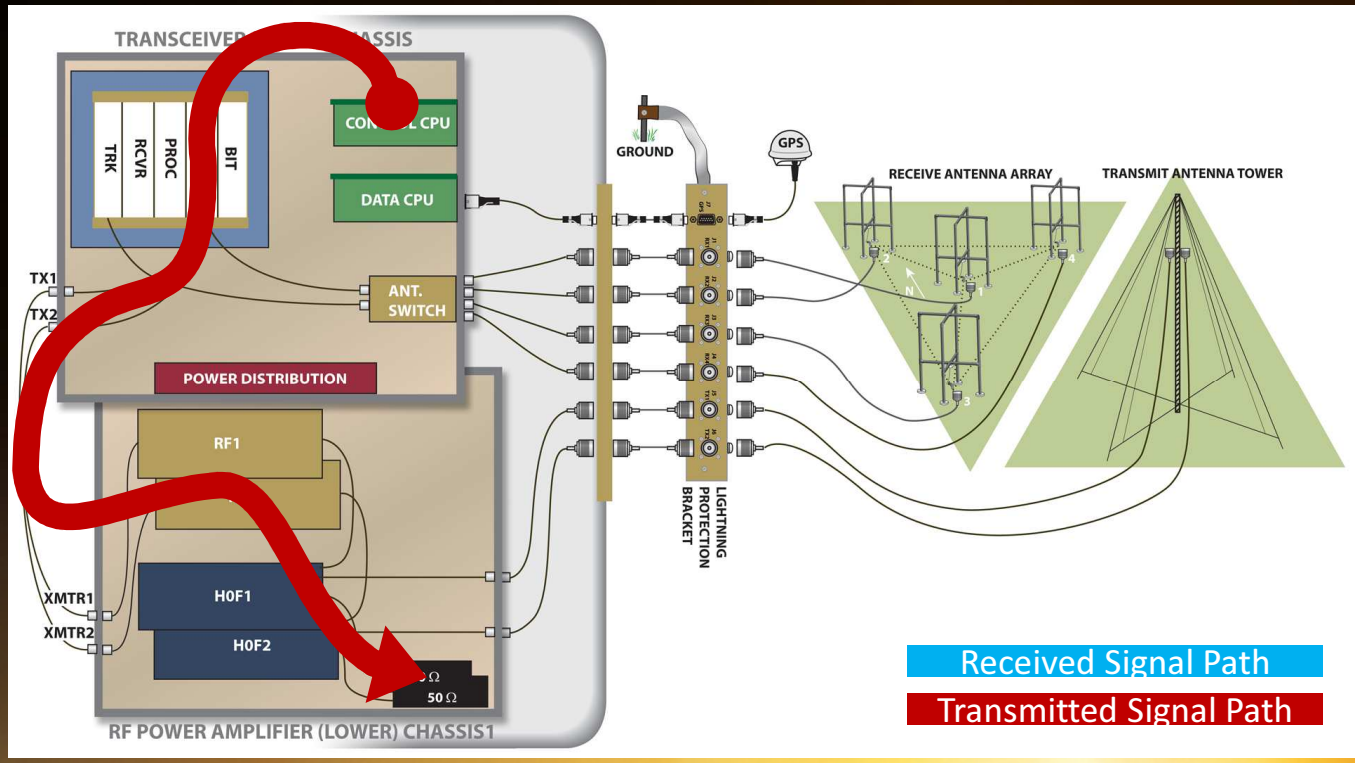
Case 3: Internal Loopback w/out Trackers

- Internal Loopback without trackers.
- CAL output to Antenna Switch
- Antenna switch routes signal to trackers
- Trackers switch input to output (are bypassed)



Case 4: Transmission into Dummy Load

- "Transmit" into dummy loads
- Half Octave Filters switch to dummy loads
- No transmission via transmit antenna
- This allows evaluation of the transmit antenna health



BIT Sensors

- X_YZAA_Name_Of_Sensor
  - X = Case Number
  - Y = When sensor is measured
    - S = Static
    - D = Dynamic
  - Z = Sensor type
    - D = Digital
    - A = Analog
  - AA = Sensor number, ie 04
  - Name = Name of sensor

†Mnemonic	Comment
SD10_CMD_TIMEOUTS	Commanding Timeouts from last BIT program
SD11_RF_NOISE_LOW_V	Environmental RF noise voltage in Antenna with 0 dB gain in anter
SD12_RF_NOISE_HIGH_V	Environmental RF noise voltage in Antenna with 9 dB gain in anter
SD13_RX_CARD_TIMEOU...	Rx Card Commanding Timeouts since last BIT program
SD14_TRACKER1_CARD_...	TRACKER1 Card Commanding Timeouts since last BIT program
SD15_TRACKER2_CARD_...	TRACKER2 Card Commanding Timeouts since last BIT program
SD16_TRACKER3_CARD_...	TRACKER3 Card Commanding Timeouts since last BIT program
SD17_TRACKER4_CARD_...	TRACKER4 Card Commanding Timeouts since last BIT program
SD18_BIT_CARD_TIMEOU...	BIT Card Commanding Timeouts since last BIT program
1_DA00_AMP_RF1_V	RF voltage amplitude at the output of amplifier 1
1_DA01_AMP_RF2_V	RF voltage amplitude at the output of amplifier 2
1_DA02_TX_OUT1_V	Output voltage at transmitter card, channel 1
1_DA03_TX_OUT2_V	Output voltage at transmitter card, channel 2
1_DA04_RX_MAX1	Maximum amplitude value in the receiver channel 1
1_DA05_RX_MAX2	Maximum amplitude value in the receiver channel 2
1_DA06_RX_MAX3	Maximum amplitude value in the receiver channel 3
1_DA07_RX_MAX4	Maximum amplitude value in the receiver channel 4
2_DA00_AMP_RF1_V	RF voltage amplitude at the output of amplifier 1
2_DA01_AMP_RF2_V	RF voltage amplitude at the output of amplifier 2
2_DA02_TX_OUT1C_V	Output voltage at transmitter card rev C and above, channel 1
2_DA03_TX_OUT2_V	Output voltage at transmitter card, channel 2
2_DA04_RX_MAX1	Maximum amplitude value in the receiver channel 1
2_DA05_RX_MAX2	Maximum amplitude value in the receiver channel 2
2_DA06_RX_MAX3	Maximum amplitude value in the receiver channel 3
2_DA07_RX_MAX4	Maximum amplitude value in the receiver channel 4

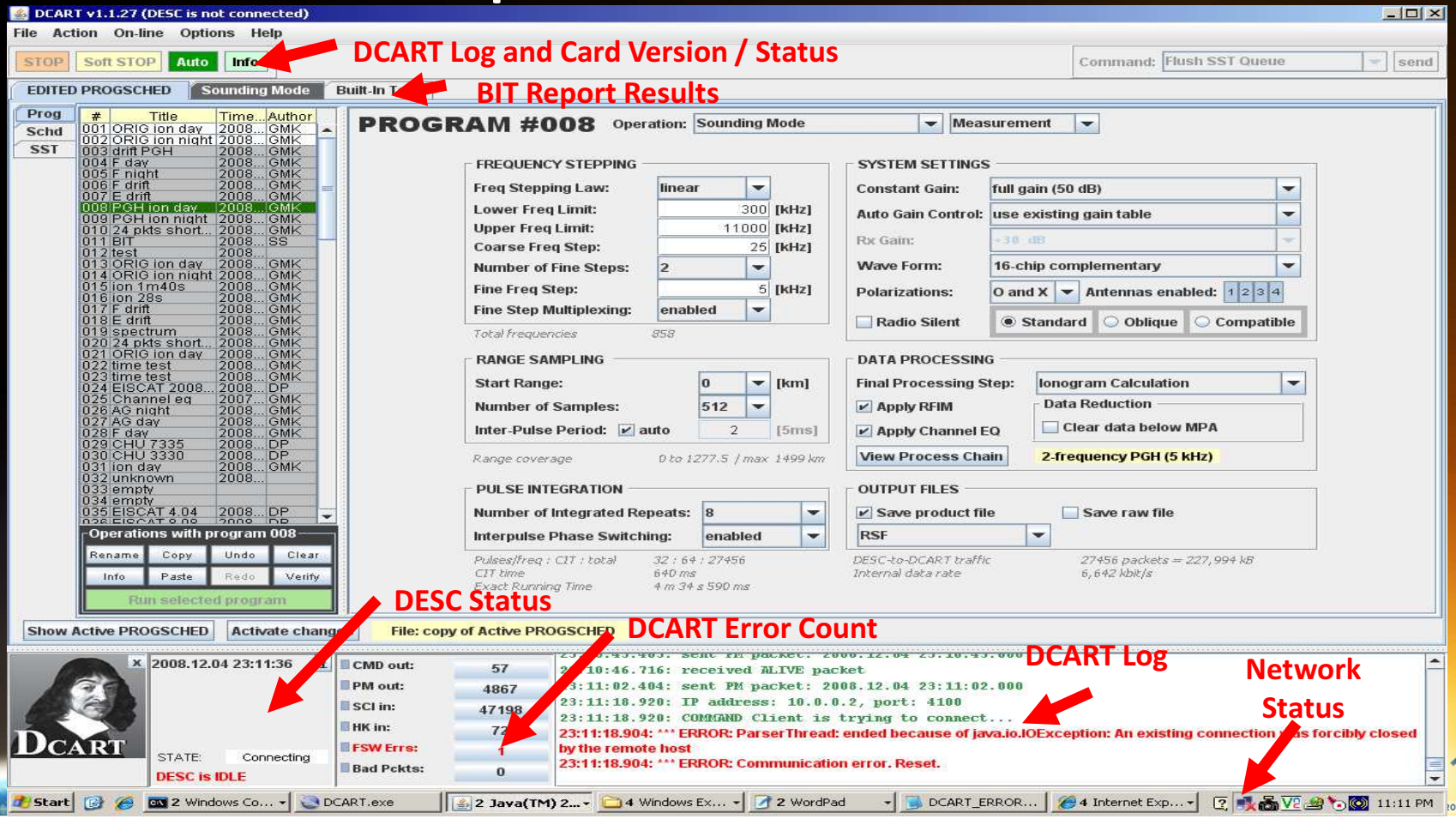
Analog Sensors thresholds

Red Low	Yellow Low	OK	Yellow High	Red High

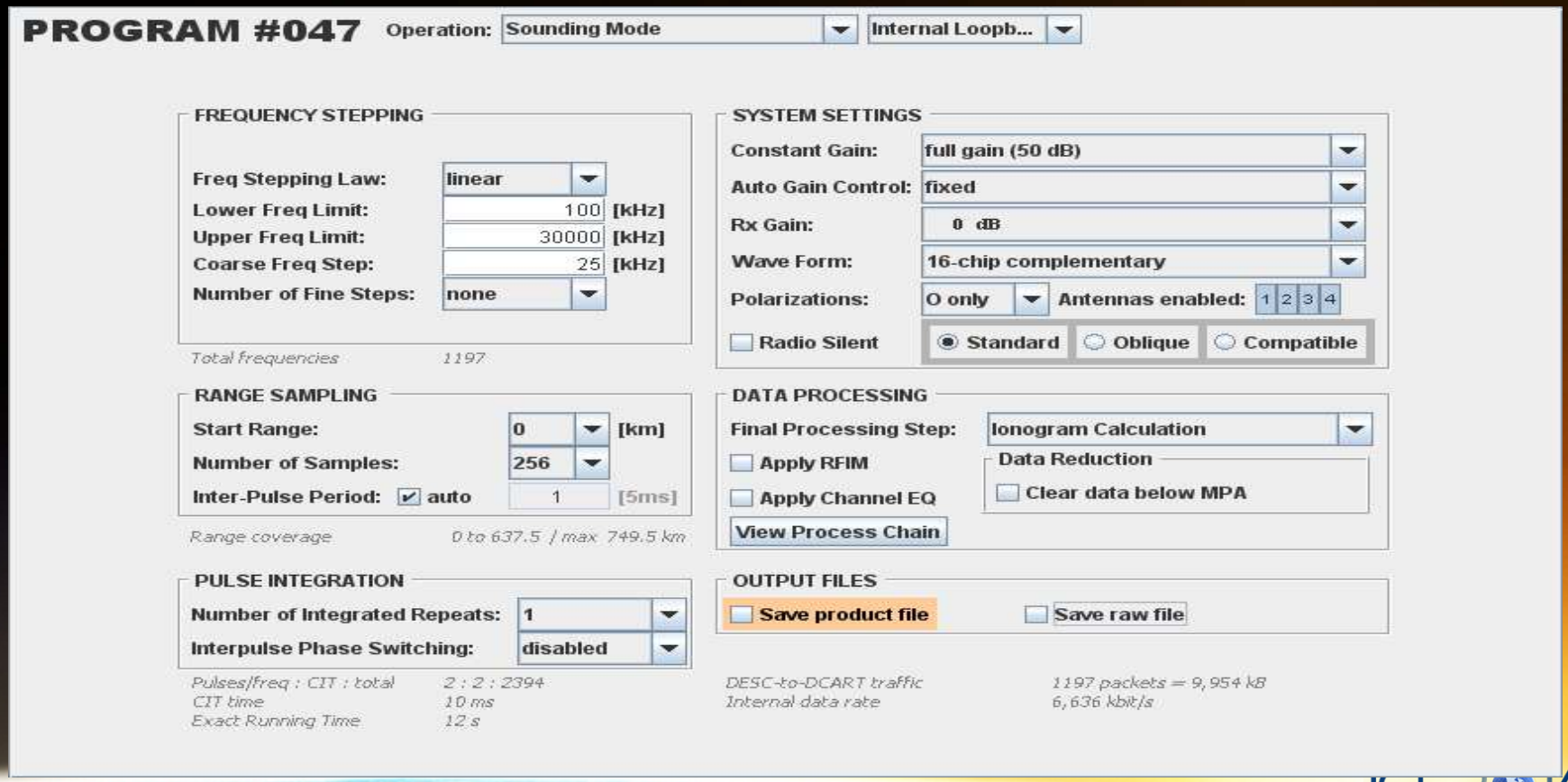
Additional Tips

- DCART provides other useful information
- Check DCART settings (DCART.ini corruption)
- Use of the system as a diagnostic tool through data displays (can be done remotely)
- Make program changes to sustain operations, if possible

DCART: Important Places to Look

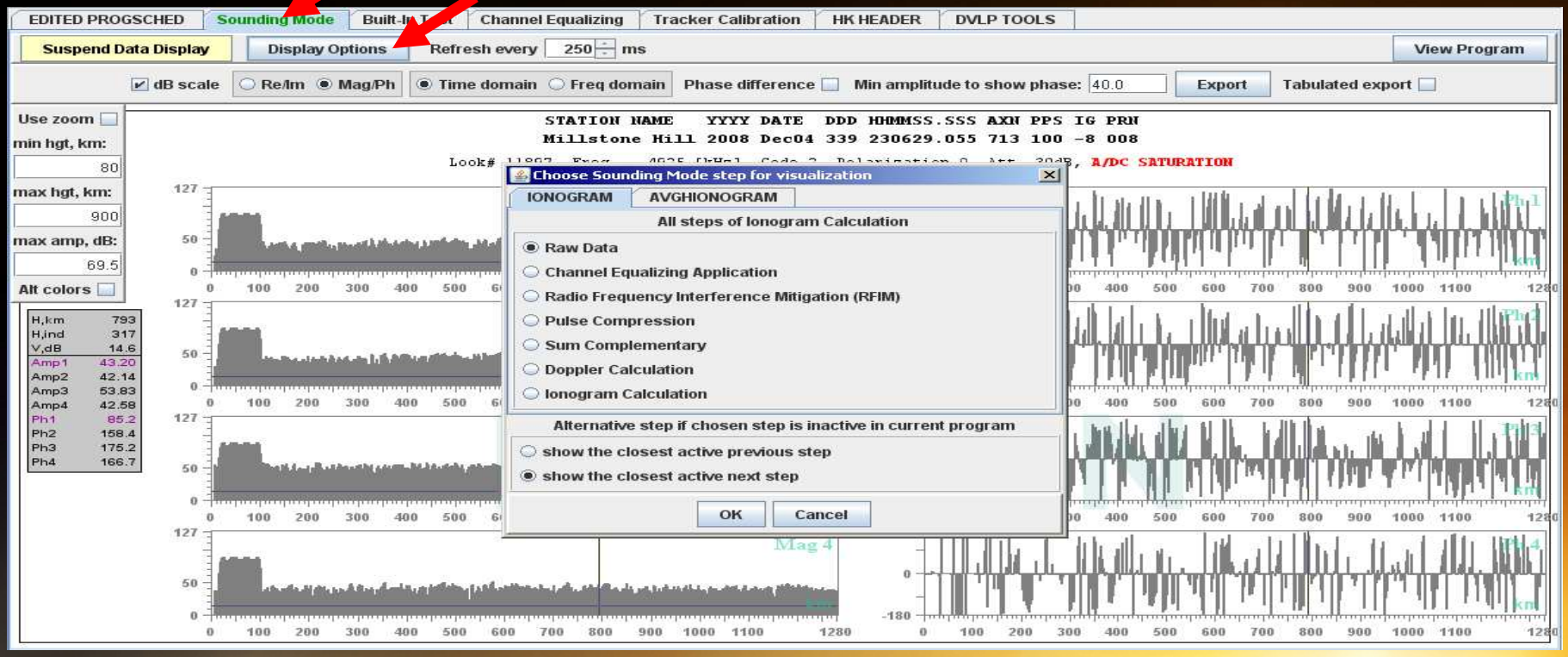


Internal Loopback Diagnostic Program

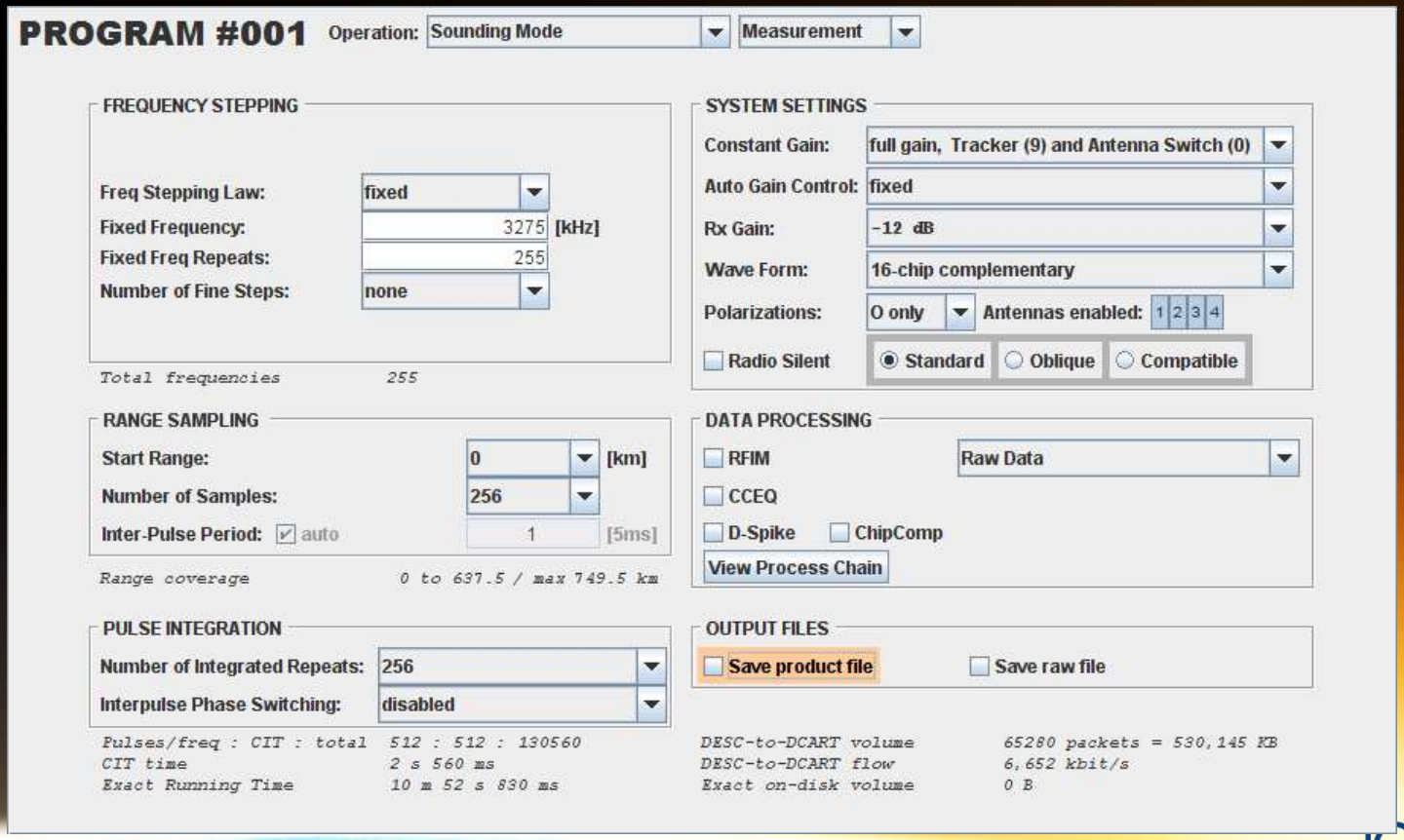


DCART Raw Data Display

Sounding Mode / Display Options. Note: This program is started at 0 height



Diagnostic Program for Oscope



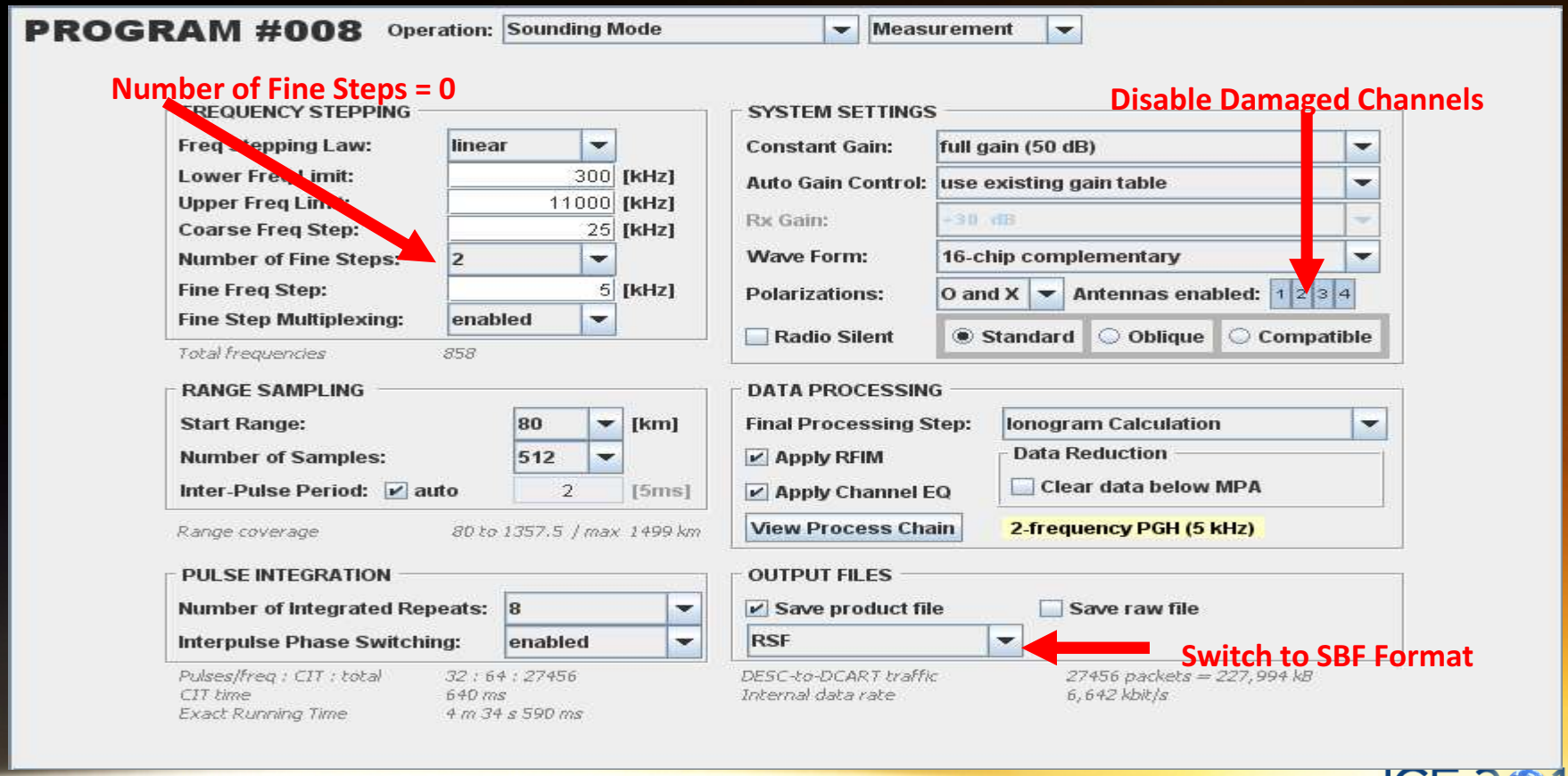
Sustainable Operations

- If damage has occurred along one or more receive channels, it may be possible to continue operating
- It may also be possible to operate if one transmit channel is damaged
- If computer damage or failure in a short (RF Amplifier) then it's unlikely system will be able to continue operating. DPS-4D could be off or unreachable

Damaged Receive Channel(s)

- Damage in Receive Antenna / Polarization Box, Antenna Switch, Tracker, or Receiver
- Switch from Precision Ranging RSF Ionograms to SBF data format
- SBF does not calculate directional information (only Doppler)
- When making SBF data, the system is capable of generating data using less than 4 channels

Changing from Routine Operation to Reduced Health Program



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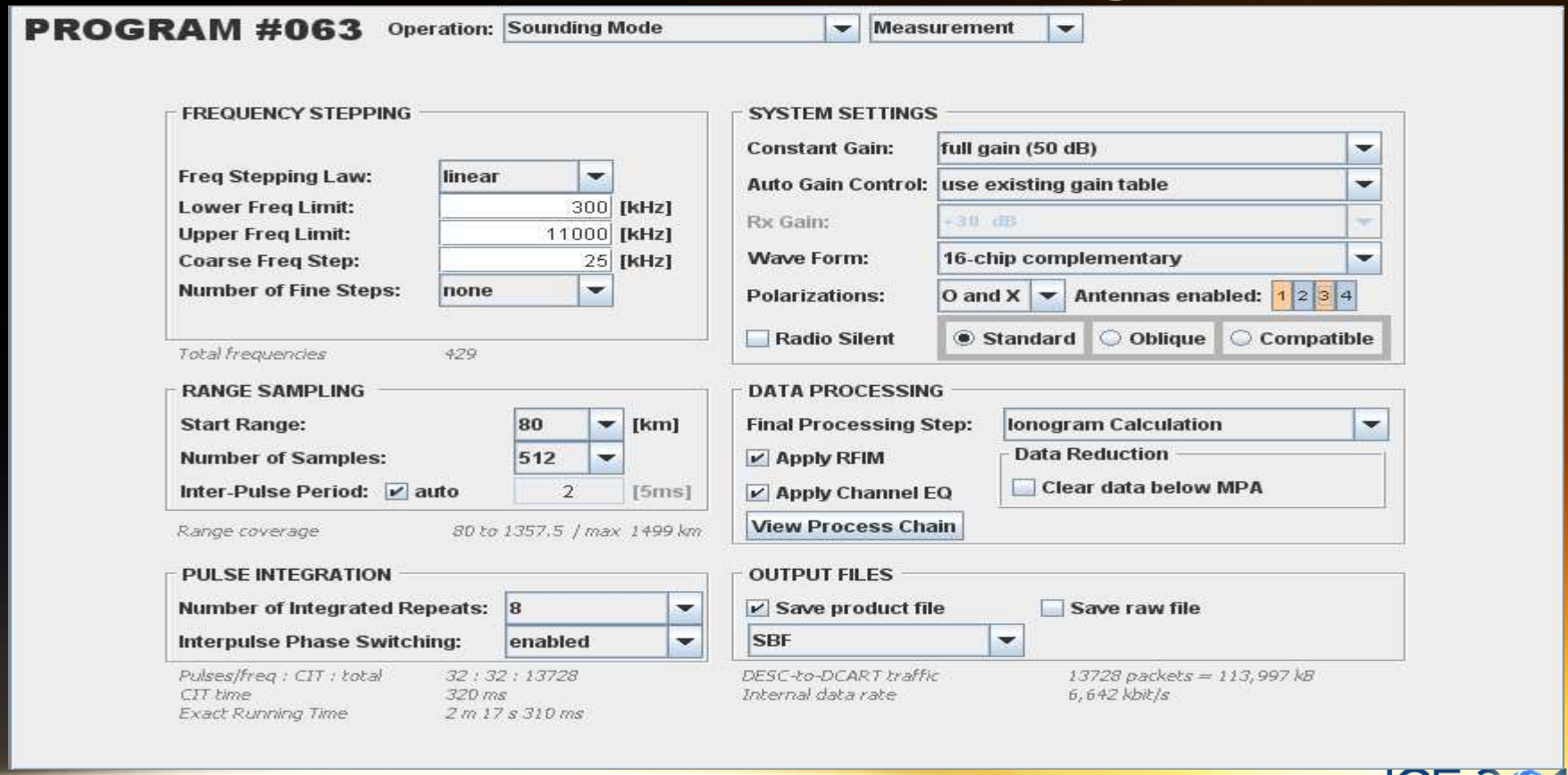
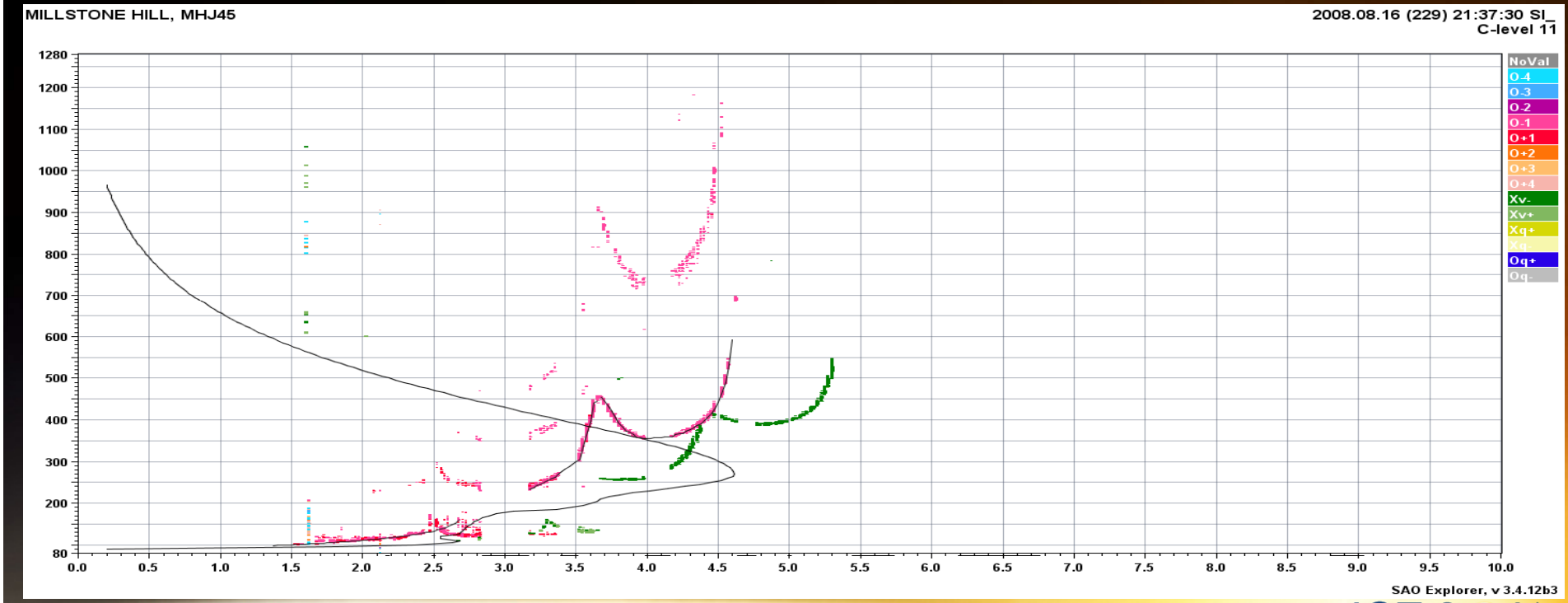
Reduced Health Program



SBF Ionogram

- Millstone Hill DPS-4D generating SBF using 2 channels




Dalu
감사합니다
Gracias
Danke
Ευχαριστίες
THANK YOU
Obrigado
Köszönöm
Grazie
Спасибо
Dank
Tack
谢谢
Merci
ありがとう
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BACKUP

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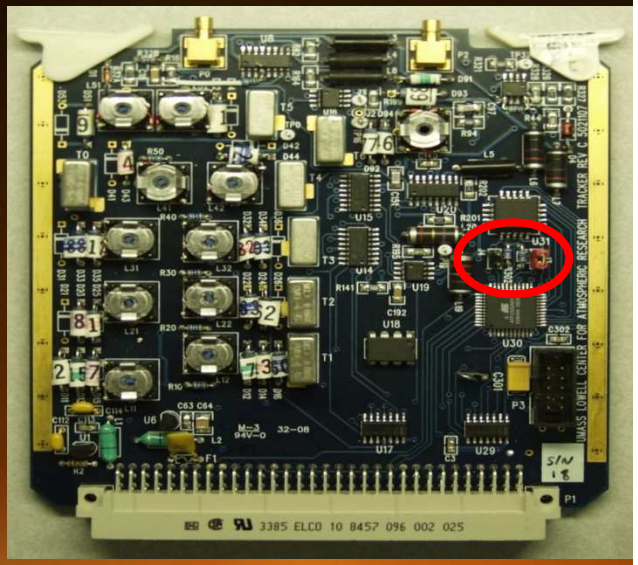
Control Computer Display

- Control Computer was not intended for use by the end user (no rear case connections exist)
- DESC does produce output to the screen which may be useful for troubleshooting
- 15 pin VGA output is available on the rear of the transceiver chassis
- It is possible to connect a monitor
(reset the control computer via the red reset button on the front of the transceiver chassis or cycle the switch on the power distribution board)
- Investigation of the DESC display would be made in tandem with instruction from LDI or UML

Note Regarding Spares

Spares Include

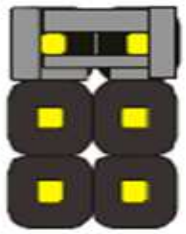
- Polarization Switch / Preamplifier
- BIT
- Transmitter
- Pre-Processor
- Receiver
  - Run Receiver cross channel equalizing after replacement
- 1 Tracker
  - Must set jumpers for position
  - Run Tracker Calibration after replacement
- Power Distribution Card
- Antenna Switch
- Computer
  - BIOS must be configured for use!
  - If in “Data Computer” role, must set jumpers properly for GPS connection
  - If in “Control Computer” role, a PS2 Keyboard is needed for BIOS configuration



Most significant , Least significant binary number. No jumper = 1. This tracker is set to binary 10 = 2 (and so is configured as tracker 3)

Data Computer Jumper Settings

The data computer should be jumper settings as follows:

	JCSEL1	JCSEL2
RS-422		

Pre BIT Fault Isolation