VLBI Session Pre-Checks for Mark IV, VLBA and DBE Systems

See also: "Basic Checklists" section of Mark IV Field System manual
Sample checklist in Operations workshop notes
Draft VGOS set-up in Operations workshop notes

Please note that all references to Mark IV apply to Mark III as well unless specific separate instructions are given for Mark III. The same applies to VLBA and VLBA4.

Experiment SNAP and procedure files

- Run DRUDG on the session (.skd or .drg) file to create the SNAP and procedure file. Print hardcopies of the schedule and session notes.
- Edit the session procedure file to insert station-specific parameters such as IF distributor attenuator settings.
- Be sure to create a new procedure file for each session from the .skd or .drg file. Do *not* rely on default set-up procedures in the station procedure file in case system set-up parameters have changed such as the frequency sequence.

Computer control

- Check that the FS is controlling the VLBI terminal and antenna.
    - On a Mark IV terminal, check that the remote/local switches on all the modules are set to remote.
- Set up the VLBI terminal with the session set-up procedure (e.g., setupa).
- Refer to the VGOS RDBE set-up instructions. Draft in progress.

Station timing

- Check that the formatter time agrees with GPS time at the one-second level. If it does not, use 'fmset' to adjust the formatter time. For Mark III you must set the time manually.
- Check that the FS clock is correct to <1 second. If it is not, enter the command 'sy=run setcl offset &'. This command should also be issued whenever the formatter time is reset. If 'fmset' is used to set the formatter time, the FS time will automatically be reset when 'fmset' exits.
- If a computer other than the FS computer controls the antenna pointing, check that its timing agrees with GPS to <1 second.
- RDBE, to check time and offsets use FS 'time'. Run 'fmset' if necessary. Cycle through

bands a,b,c,d (Avoid "s"ync) and exit.

- Using a counter with time interval measurement accuracy <100 ns, measure the time interval between the 1pps signals from
    - formatter clock and GPS receiver
    - maser and GPS receiver.

  The formatter should be within a few microseconds of GPS, but in any event should be no more than ±30 milliseconds away.
- Check that the formatter/GPS/maser 1pps offsets are consistent with other recent measurements.

Feed polarization

- Ensure that the feed polarization is correct.
- For geodetic S/X observations, the correct polarization is RCP.
- For VGOS use linear X and Y.

Receiver

- Check that the physical temperatures of the 20 K and 70 K stations in the Dewar are within their normal ranges and are not rising.
- Check that other receiver parameters that can be monitored, such as FET currents, LO and phase cal temperatures, power levels, power supply voltages, etc., are within their normal ranges.
- Check that the receiver LO is set to the correct frequency.
- If there is any uncertainty about the LO frequency, measure it.
    - If the LO is accessible, measure its frequency directly with a counter.
    - Alternatively, radiate a coherent test tone at a frequency in the RF passband toward the antenna and measure its frequency in the IF or at baseband. Suitable test tones can be generated up to a few GHz by using an amplifier and frequency multiplier on the LO monitor output of a BBC or VC.

IF distributor/IF3 module/IF upconverter or downconverter

- Check that the inputs to these modules are connected to the correct IF signals.
- In a Mark IV DAT, check that the VC inputs are connected to the correct IF signals (IF1/IF2 low/high or IF3). The IF switch box controlled through the IF3 module can be used to switch the VC03 and VC10 inputs automatically between low and high bands.
- For VGOS all 'sigma' values should be close to 32.

Video or baseband converters

- Measure the frequency of each VC/BBC LO with a frequency counter and compare against the correct value.
- Check that the baseband bandwidth in each VC/BBC is correct.
- In a VLBA DAR, check that the IF input to each BBC is correct.
- Check that the baseband power levels are in the proper range.
    - In a Mark IV DAT, adjust the IFD/IF3 attenuation to give USB and LSB power readings of 0.1–2.0 on the front-panel meter of each VC, with the 10-dB attenuators in. Use the largest amount of IFD/IF3 attenuation that keeps all channels being recorded above 0.1 volt.
        - If readings of 0.1–2.0 cannot be achieved in all VCs, as a temporary measure the lower limit can be relaxed to 0.05, or small (1–3 dB) SMA attenuators can be added to the inputs to the stronger VCs.
        - Do not use large (≥10 dB) attenuators on the VC inputs, as those VCs without attenuators are liable to saturate.
    - In a VLBA DAR, check that the baseband power readings are all approximately 16000 counts. The AGC gain in each BBC should be between −10 dB and +10 dB.
    - The proper long-term solution to strongly frequency-dependent VC power readings or BBC gains is to flatten the IF passband with appropriate filtering. Please find this describe in more detail in the Ops Impact on Analysis chapter.
- For a Mark IV system, the command ‘ifadjust’ may be used to set the attenuators automatically, provided the VC TPI readings are working and RFI is not severe. The DAT must first be configured with the set-up procedure from the experiment procedure library. The antenna should be pointed near zenith (or toward any direction that gives nearly the minimum system temperatures), and the weather should be clear. If ‘ifadjust’ converges, the results should be the optimum attenuation for that mode. (No changes should be necessary during the experiment as the source elevation or the weather changes.) The resulting values should be edited into the IFD set-up procedure for the mode. If there is more than one mode in an experiment, this procedure should be repeated for each mode.
- For VGOS RDBE use FS 'setupbb' and 'auto'.

Antenna focus

- For geodetic and astrometric observations, lock the focus at the position that gives peak response at mid-elevations.

- For astronomy-only (i.e., source mapping) observations, the focus may be adjusted with elevation angle to give maximum gain.

Antenna pointing

- Check antenna pointing on two or more widely-separated sources.
- Pointing errors in both axes should be smaller than beamwidth/10 at the highest observation frequency.
- The FS command 'fivept' may be used to automate the measurement.

System Equivalent Flux Density (SEFD)

- Measure the SEFD in each frequency band and compare against the nominal value.
    - Using a strong radio source of known flux density, measure T_{source}/T_{sys}.
    - Convert to SEFD by dividing T_{source}/T_{sys} into the source flux density (corrected for size effect if the source angular extent is comparable to, or larger than, the antenna beamwidth).
    - The FS command 'onoff' may be used to automate the measurement.

System temperatures

- With the antenna pointed near zenith, measure the system temperatures in all VC/BBC and broadband IF channels, and compare against nominal values.

Phase calibration signal

- Use an oscilloscope and 10–kHz viewing filter to examine the baseband phase cal signal in each USB channel. (This section assumes that phase cal is present at 10 kHz in each baseband USB channel, as will be the case with a 1 MHz phase cal pulse rate and a total LO frequency of nnn.99 MHz.) Trigger the oscilloscope with a timing signal derived from the maser (e.g., the frame sync VS-14 module).
    - Phase cal should be present with the proper amplitude.
    - Phase cal should be stable in phase relative to the maser timing signal.
- Use the same equipment to examine each LSB channel.
    - The LSB phase cal level should be >20 dB weaker than in USB.
- A good end-to-end system test is to check for phase cal in the bit stream from each USB data track.
    - For a Mark IV system, connect one of the decoder DATA outputs to the 10–kHz viewing filter input. Enter the commands 'enable=s1' and 'st=for,0,on'. Select USB tracks with the 'repro=byp,<trackA>,<trackB>,,<rate>' command and check for phase cal on the oscilloscope.
    - For a VLBA system, use the 'repro' and 'dqa' commands to measure the phase

cal amplitude in each USB channel.

- For VGOS RDBE run RDBE monitor program.

Cable calibration

- The cable counter should be operating in single–sample mode, not averaging.
- The cable counter reading should be in the normal range.
- Single–sample readings should be stable to ±1 μsec.
- Check that the cable calibration system measures cable length changes correctly.
    - Log the cable reading.
    - Insert a short cable length in the cable from the ground unit to the antenna unit, and log the cable reading again.
    - Remove the short cable and log the cable reading again.
    - Compare the change in readings with the nominal value.

Mark 5A

Please note that Mark-5A operational procedures are in the TOW07 notebook. Mark-6 will be in the TOW15 notebook. Additional guidelines for both the Mark-5 and Mark-6 can be found in the Systems failure chapter of the TOW15 notebook.

- 8-Pack Installation –
    1. Remove the 8-pack from the shipping box and their shipping covers.
    2. Inspect for damage.
    3. Pull front lever down so that it is horizontal.
    4. Slide 8-pack easily into Mark5A machine until it stops.
    5. Lift front lever which will insert the 8-pack into the connector.
    6. Turn the key switch to the right until it stops.
    7. Repeat with second 8-pack.
- Conditioning the 8-Pack –

  If there is time each 8-pack that is received at a station should be conditioned before it is used to verify there has been no shipping damage. This can be done in any appropriate length gap in recording (4 hours or more) or left running overnight or over a weekend. Please see ftp://web.haystack.mit.edu/pub/mark5/Conditioning.txt for more information. A copy of this document follows in this section. Please note that the SSErase program is run outside the Mark 5A. If the 8-pack is write protected, you will be prompted to remove the write protection, and you should do so. When the conditioning is complete, please check the results to confirm that the 8-pack is okay before using it.

- Mark5A Start-Up –
  1. From the Mark5A terminal, login as oper.
  2. Enter the password.
  3. From the prompt, start a script running by entering 'script -f anyname'.
  4. To start the Mark5A running, enter 'Mark5A -m0 -f0 &'.
  5. To stop the Mark5A, enter 'EndM5'.

- Field System Checks –
  1. Test the communications with the Mark5A by entering 'disk_serial' at the Field System prompt. Sample output:

     2003.245.16:42:48.40/disc_serial/VNVF11G6G9BS9L,VNVF11G6G9BW6L,VNVF11G6G99V7L,VNVF11G6G9BVDL,VNVF11G6G9BUVL,VNVF11G6G9A2HL,VNVF11G6G99XZL,VNVF11G6G9A2XL,
  2. Enter 'disk_pos'. This will give the position of the disk pointers. Sample output:

     2003.245.16:42:53.42/disc_pos/81952,0,
  3. Enter 'mk5=VSN?'. This will check if a VSN is assigned to the 8-pack.
  4. Erase the disk with 'mk5=reset=erase'. Be very careful that the disk installed should be erased before entering this command.
  5. Enter 'disk_pos'. This will respond with the disk pointers at 81952,0 (or it may be 0,0, depending on the version of erase).
  6. Set up the procedure file that will be used for the session, e.g., 'proc=r1087wf'.
  7. Issue the set-up command from the session, e.g., 'setup4f'.
  8. Enter 'disk_record=on'.
  9. Enter 'disk_pos'. Repeat this command many times to confirm recording.
  10. Enter 'disk_record=off'. This stops the recording.
  11. Enter 'scan_check'. Sample output:

      2005.115.17:41:54.26/scan_check/2,r1172_0552+398_115-1741,mark4,32,2005y115d17h41m1.080s,49.1s,8.000000,0
  12. Erase the disk with 'mk5=reset=erase'.

Meteorological sensors

- Check that the values of barometric pressure, temperature, and relative humidity reported by the 'wx' command are reasonable and repeatable.

‘Ready’ message

- Approximately an hour before the session is to start, or as soon thereafter as possible, send a “ready” email message containing the following information:
    - comments on any unusal conditions
    - pointing offsets and source az/el
    - SEFDs and source az/el
    - system temperature for each IF
    - formatter offset from GPS
    - source and epoch of first scheduled observation
    - tape drive relative humidity
    - weather and sky conditions

  See the Operations workshop notes for more information.

More extensive testing

- After any equipment changes or if a long period of time has elapsed since the last VLBI session, more extensive testing of the VLBI systems should be carried out. More rigorous testing should also be conducted on a periodic basis (monthly to annually). Such tests include:
    - Measure pointing offsets over the full sky.
    - Check for RFI and for jumps in the phase cal phase and cable cal as the antenna is slewed across the sky.
    - Calibrate the meteorological sensors, especially the barometer.
    - Measure the DC level and AC ripple in the DAT/DAR power supplies.
    - Measure the strength of the phase cal signal by observing how much the IF or baseband power level changes when phase cal is turned off.
    - Measure the levels of spurious phase cal signals:
        - with phase cal turned off via the ground unit switch
        - with phase cal turned on and the receiver LO unlocked
        - with the cable driving the antenna unit disconnected from the ground unit.
    - For each VC/BBC:
        - Check that the LO will lock over the full design frequency range (100–500 MHz for a VC, 500–1000 MHz for a BBC).
        - Measure the LO phase noise at 2-3 frequencies spanning the design range.

        - Measure the USB/LSB image rejection at the upper and lower ends and middle of the baseband frequency range.
        - Check each sideband signal on a spectrum analyzer for anomalous shape.

- Monthly execution of the 'overnite' procedure is recommended to check the stability of the VLBI systems. The procedure should be run for at least 12 hours, and preferably 24 hours, with the antenna stationary. At a minimum, the values of the following quantities should logged at least every 15 minutes:
    - wx
    - cable
    - formatter-GPS time interval
    - system temperatures in all channels
    - phase cal amplitude and phase in at least 1 channel per frequency band
    - receiver parameters: dewar temperatures, phase cal temp, etc.
    - other station-specific parameters

IVS Operations workshop TOW 2015

1.0 Starting a schedule

The basic steps in starting a schedule are:

1.1. Reporting problems when you need urgent help.

An e-mail list has been set up for items needing urgent attention by the IVS Coordinating Center. The address is: ivs-urgent@ivscc.gsfc.nasa.gov

This list should be used by anyone needing urgent attention by or advice from the Coordinating Center. You can expect an answer normally within a few hours, if the message is sent during US East Coast working hours. Messages sent on weekends or after hours may take a little longer.

Please use this address rather than sending messages to ivs-ops or ivs-stations. If the reply from the Coordinating Center is of interest to a broader audience, we will copy the appropriate lists on the response.

Anyone can post a message to this list. The only recipients for this list are the Coordinating Center staff: Dirk Behrend, Ed Himwich, Cynthia Thomas, Rich Strand, and John Gipson.

Examples of the types of messages that should be sent to this list are: problems with schedules, problems running drudg or the Field System, schedules that seem to be made for the wrong date, schedules that do not include the right stations, operational problems during observing, and any urgent issue that impacts operations and you need advice on how to handle.

1.2. Review session notes

This provides one last opportunity to verify that nothing special has been missed in the set-up for this experiment.

1.3. Correct cable wrap for AZ/EL antennas

For AZ/EL antennas it is important to verify that the antenna is on the correct cable wrap for the first source. If the antenna starts on the wrong wrap it is all but guaranteed that at some point in the schedule one or more scans will be lost because the antenna will have to unwrap unexpectedly.

The wrap for each source is shown in the listings and in the "source=…" commands for each source. You can perhaps get the antenna onto the right wrap by either driving it manually or giving it a series of source commands that will "walk it around." Please be sure to look into this issue far enough before when you start the schedule so that

you will have time to swing the antenna around if it is needed.

1.4. Make sure there is no old test log on disk

If you made a test running of the schedule be sure to delete the test log file before starting the schedule for real.

If Mark5B is being used, load both decks with an empty eight-pack and verify the Mark-5B system is operational. The Mark-5B verification and use notes can be found in this handbook. The Mark-6 check-out can be found in the VGOS Draft at the end of this chapter.

1.6. Start schedule with "schedule=…"

The preferred form of the "schedule" command uses the line number to start with, e.g., "schedule=na225gc,#1", to start at line 1. Start the schedule as early in the pre-session checklist as possible. This will allow you to record as many of the checks as possible, directly in the log, with comments.

1.7. Check cable sign

The key points are:

1.7.1. Do the cable check before or after the experiment in the experiment log. Do not do it during the experiment as this is likely to cause problems.

1.7.2. Check that the cable counter is not using averaging

Averaging should not be needed. The cable counter should be stable at the 1 μsecond (about 1 mm of one-way cable delay) level without averaging; which is more than sufficient. If it isn't stable at this level there is probably some problem that needs to be corrected. Using averaging would only obscure a problem that needs to be corrected instead of providing any useful improved accuracy.

1.7.3. Do a "cable" with the normal cable.

This establishes the "normal" reading.

1.7.4. Install a short calibrated extension cable

You should have a short cable with a male N connector on one end and a female N connector on the other end. A cable of 30 cm will give a reading change of about 600 microseconds.

1.7.5. Do a "cablelong" command once the cable calibrator has stabilized again

This establishes the "long" reading.

1.7.6 Do a cablediff command.

This will automatically find the difference and report the sign. If the difference was as expected, enter a comment to that effect. A suggested format for the comment is "change of xxx usecs is nominal, longer cable increases/decreases reading".

If the difference was not as expected, you should troubleshoot the cable cal system if you have time.

1.7.7. Remove the extension cable

Return to normal cable length. If you leave the extension cable in by mistake, please do not remove it after the experiment starts. Leaving it in will cause no harm, taking it out is likely too.

1.7.8. Do a "cable" to make sure everything is back to normal

This is final check that everything is back to normal. You should get approximately the same reading as before.

1.8. Finish start check-list

Complete any remaining items in the pre-experiment checklist. A copy of a sample checklist is included at the end of this workshop write-up as a reference.

1.9 Send the Ready message. The FS utility *msg* will send the information in a standard format and is recommended.

This message summaries your status and let's the world know you are ready. It should be sent to ivs-ops@ivscc.gsfc.nasa.gov. Be sure to include the session name in the subject line. Please include the following information.

1.9.1 Comments about anything that may effect the data quality. If you have more than one polarization available it is recommended that you check the polarization to make sure it is correct and note that it has be checked.

1.9.2 The source and start time for the first scan. This assists the coordinator center in determining if you have the right schedule if an update was issued.

1.9.3 Formatter to GPS clock offset. This is needed by the correlator to find fringes. If the Formatter 1 PPS starts the measurement please report this as the Formatter to GPS offset; if GPS 1 PPS starts, please report it as the

GPS to Formatter offset.

1.9.4 WX: temperature, pressure, humidity, and sky conditions. This assists the analysts in understanding the atmospheric conditions and interpreting the SEFD and Tsys data.

1.9.5 Cable difference. Please report whether a longer cable makes the reading larger or smaller. Please also report the difference you observed in the reading when you lengthened the cable and whether it was nominal (as expected) or not.

1.9.6 Pointing values: Please report both X and S SEFDs, source used for measurement, its azimuth and elevation when measured, and the pointing offsets on each axis. You can include as many sources as you think are useful.

1.9.7 Tsys values. Please report the system temperature for each IF: X (lower X), S and X2 (upper X). If you have interference you may need to report the values from a video (base-band) channel for the effected IFs.

You can refer to the Summary of Ops Messages near the end of the notes for the Operations workshop. That summary includes an example of the recommended format for Pointing and Tsys data.

If your FS PC has *sendmail* installed you can use the graphical FS utility *msg* to send Ready, Start, and Stop messages. It can be configured to add all the information to the experiment log. Please note there are reports of problems with *msg* utility if you use the “keypad” (typically on the right side of keyboards, sometimes used for numeric entry). This appears to be due to a bug in the operating system or its utilities.

1.10. Send the Start message

This lets the world know that you started and whether there are any problems. Any additional useful information for the record doesn't hurt either. The message should be sent to ivs-ops@ivscc.gsfc.nasa.gov. Be sure to include the session name in the subject line.

1.10.1. When started and first source

1.10.2. Any problems

2.0 Making comments in the log

Making comments in the log when problems occur is one of the most important functions of an operator. It is the primary way of information about problems to the correlators (for some correlators, in particular the VLBA, it is the only way). Please provide as full a description of a problem and its consequences as possible. Many of the data analysts are

not familiar with the acquisition hardware. It is important to describe the implications in high level terms, such as which channels are affected. For example, don't just say "A and B cable switched", say "A and B cables switched; cables were wrong from the beginning of the experiment until now; the IF channels had the wrong signals; X and S band were reversed; no valid data in any channel until now."

Entering comments as a problem is being trouble-shot is desirable since it creates a record of what happened. Once a problem is resolved or by the end of the experiment in any event, please make sure the following information has been entered in comments:

2.1. The nature of the problem

2.2. How it was resolved if it was

2.3. The consequences of the problem: how the data was affected.

2.4. The time period for which data was affected.

2.5. TOW Failure Recover class will cover the most common failures.

3.0 Periodic monitoring I: each scan correct:

For each scan the following information should be verified:

3.1. source

3.2. mode (configuration), frequency sequence, formatter mode, IF patching

3.3. on-source

4.0 Periodic monitoring II: hourly (at least)

These items need to be checked less frequently than every scan. Every hour is a reasonable interval.

4.1. Sky conditions entered as comments in log

Cloud cover, wind, precipitation, etc.

4.2. Phase-cal present in all VCs

Visual checks of the phase-cal with 10 kHz viewing filter is desirable. Displaying the values from a phase-cal extraction system is helpful if they are available as well. The phase should be stable and the amplitude at the expected level. An occasional check of the sidebands that are not supposed to have a signal is desirable to verify that the image rejection mixer hasn't failed. Use the phase-cal check for VGOS.

4.3. Formatter time/date correct

A comparison of the formatter to GPS is desirable. If the formatter doesn't have a display, it is recommended that you NOT run "fmset" to do this check. Instead check that the error reported by "setcl" (last entry of the first line of output) is small. And compare the FS time displayed by "monit2" (System Status Display) agrees with GPS. You should also check the pointing computer's time it if has one and is used for pointing calculations. The "setcl" error output is useful for tracking jumps of integer seconds in the formatter time.

4.4. Formatter-GPS offset reasonable

The Formatter-GPS offset should not show any significant jumps in value. If you are monitoring other clock offsets, e.g., Formatter-Maser, Maser-GPS, or Maser-Other clock, these should be checked too. It is desirable to have at least one loop, e.g., Formatter-GPS, GPS-Maser, and Maser-Formatter, to help isolate the guilty party if a jump is detected. Since the clock offsets are based on 1 PPS signals they are useful for detecting jumps of less than one second.

4.5. Cable and WX readings reasonable

These readings should be checked to make sure the displayed values haven't jumped outside a reasonable range.

4.6. Tsys reasonable in all VCs

Monitored Tsys values give some indication of whether the system temperature is remaining stable and hence whether a problem with the receiver may be developing. One way to think about these values is that they provide a less complete, but still useful, check on the sensitivity of the system, when a full SEFD measurement is not possible, such as during observations in a schedule. The interpretation of the Tsys data requires a little care since it may become elevated because of weather conditions (particularly at X-Band) or because of ground pick-up on low elevation scans.

4.7. Disk pack full?

Check get_stats? output to see whether a disk pack has filled up and if so, swap it out with a fresh one. The disk pack that is not being recorded should always be a fresh one and a full disk pack should always be swapped out as soon as possible. This applies even if the one currently being recorded “should” be the last.

5.0 Each shift change III: (at least)

This section describes some things that should be monitored even less frequently than once an hour. Mostly this is because it is necessary to develop some history of data to

look for trends and outliers. It is useful to run "logpl" to plot these values. With a command file, "logpl" can generate all the plots automatically for you to view when they are ready. See the section on "logpl" for more information on running it.

5.1. WX parameters

5.2. Cable

5.3. Tsys, all IFs

5.4. Clock offsets

5.5. Other station specific values

5.6. For disk, check remaining disk capacity

6.0 Rack electronic failures

This may include failure of power supplies, BCC OR VC modules, formatters and Dewars, disc packs and more. All impact data collection and analysis. The decision to continue observing or stop and repair the system depends on the nature of the failure. Dewar failures and Base Band or Video converter problems cause data loss and is described in detail in the Ops Impact on Analysis chapter.

7.0 Clock Jumps

Handling clock jumps is a somewhat delicate operation. The handling depends on which clock jumped. If the formatter jumped, but appears now to be stable, there is normally no point in resetting the formatter since this will just introduce another clock jump. Except in specific circumstances, described in the last paragraph of this section labeled as **LARGE FORMATTER CLOCK JUMPS**, the formatter should not be reset. If the Maser or GPS or some other clock jumps, it is even more obvious that it is probably best to not make any changes to the formatter time. In any event the jump, which clock is affected, and the span of data affected by the jump, should be noted in comments in the log.

It is useful, mandatory really, for identifying clock jumps to be comparing at least three different clocks, e.g., formatter, Maser, and GPS. It is unlikely that two will jump at the same time. Of course monitoring even more clocks will reduce the probability further of being fooled by such an event.

To remove the error message generated by setcl for a clock that doesn’t need to be corrected, please refer to the /usr2/fs/misc/fstime.txt file. The section on HANDLING PROBLEMS and SETCL (the case for “a positive or negative integer or zero”) are useful in this regard. This document contains other useful information about how time is used in the FS and is recommended reading

LARGE FORMATTER CLOCK JUMPS: If the formatter has jumped and the new offset results in the sub-second portion of the Formatter to GPS offset (as reported by gps-fmout or fmout-gps) being greater than ±30 milliseconds or the integer second portion (as reported by “sy=run setcl &”) is greater than ±5 seconds, the formatter clock must be reset. There will be no fringes from the Haystack, Bonn, or WACO correlators until it is. However if the jump is not as large as described in this paragraph, the formatter should not be reset, but monitored closely instead.

8.0 Power Failure recovery

Power failure (or general disaster) recovery can only be learned by practicing it and this highly recommended. A detailed discussion of the basics for doing it is included in the Experiment Operations manual in Vol. 1 of the FS Manuals. Some key concepts are presented here.

8.1. Determine the next source

The most important issue is to pick a source that will give you enough time to get everything set-up, and the antenna positioned. You should probably get all the equipment up and working before trying to pick the next source, unless your antenna moves very "majestically", i.e., slowly. In that case the time required to move the antenna may dominate everything else. Consider the following factors when selecting the next source to observe:

8.1.1. Where is the antenna?
Consider how long will it take the antenna to slew from its current position to the new source. If you have an AZ/EL antenna be sure to make sure that you have considered whether you will need to force the antenna to a different cable wrap.

Mark-5A setup?

Mark5A presents some special considerations after a power failure. The following guidelines and Mark5A commands will help save pre-recorded data and allow recording the session to continue after restarting the mark5A program.

If recording is aborted because of some problem before the "disk_record=off" command is executed by the Mark 5A, then all data recorded since the previous "disk_record=on" may be lost. If you are using the "2004y351d" (16December2004) version, or a later version, of the Mark5A program, then as described below, in most of these cases, it is possible to update the record pointer (but not the directory) on the disk pack to reflect the data that had been recorded. This procedure will prevent the data from being overwritten by new recordings and allow the data from the aborted recording to be correlated. This command seems to work well in at least two cases:
(1) the Mark5A program is ended prematurely by crash or some other problem or

(2) the power is lost to the Mark5A unit.

It does not seem work as well in the case where the key switch is turned off during recording (care should be exercised of course to avoid turning the key switch on the selected disk pack). Regardless of the cause of the aborted recording, the best recovery procedure is to execute the following FS commands

(after re-starting the Mark5A program):

mk5=bank_set=<bank with aborted recording>;

mk5=recover=0

If you do not know which bank has the aborted recording, it is probably the one that is neither empty nor full. You can use the monit5 'disk space remaining' display and the 'bank_status' command to see which bank is neither empty (100% remaining) nor full (0.x% remaining). If recording aborted during the first scan, then that bank would show 100% remaining.

It is probably not worthwhile to recover short recordings particularly if doing so would prevent other scans from being recorded. However, for longer recordings, particularly if several scans have been recorded "continuously" and a problem prevented a proper "disk_record=off", recovery may be helpful. Since at this time directory information is not recovered properly, this won't be helpful for scans transferred off-line after an experiment with software that depends on the directory information. In that case, the transfer will not work, but this will at least preserve the data on disk.

The Mark5A "recover" command is available with the "2004y351d" (16December2004) or later versions of the Mark5A program. It is documented in the "Mark 5A command set" document

<http://web.haystack.mit.edu/mark5/command5a.pdf>.

8.2. Position antenna.

Once it has been determined which source to use, position the antenna in preparation for restarting.

8.3. Restart schedule with “schedule=...,#n,1” line number form

The value of "n" should be the starting line from the listing of the intended next observation. The effect of using "1" as the number of lines to execute will be to only command the source. While the antenna is moving, you can use the "list" command to see if there are any commands coming that you want to avoid. If you find there are no commands you want to skip, you can restart the schedule with a "cont" command. If you do want to skip some commands, then restart the schedule at the line number

where you want to restart.

9.0 Post experiment

The post-experiment checks provide an opportunity to "close-the-loop" on the pre-experiment checks and verify that some things that cannot be checked during the experiment, such as the SEFDs, are still okay.

9.1. Check cable sign again

This is repeated for good measure in case either there was some problem with the initial check. This also verifies that the cable system still detects the calibrated cable correctly and hence has not failed during the experiment. Please see the "Start schedule" section for more details on how to do the check.

9.2. Complete end check-list

There are several other items on the end of experiment check-list. This should all be completed. The results of some of the tests will go in the End Message. A sample post-experiment checklist is included at the end of this write-up for reference.

9.3. Send the Stop Message

The End Message lets the world know you have completed the experiment and your status at the end. This is especially useful for the correlator since it will help them prepare for correlating the data. This information should all be reported in comments in the log as well. It should be sent to ivs-ops@ivscc.gsfc.nasa.gov. Be sure to include the session name in the subject line. The End Message should have the following components:

9.3.1. Scans missed

List the scans missed, not by line numbers, but by the time spans that data was lost for.

9.3.2. Comments

Please describe any unusual conditions that affected data collection. Please describe any equipment problems. This might not be limited to things that affected the data collection, but also include items that require maintenance.

Please include any other information that you think might be useful for the correlator or the data analysts.

9.3.3. Stop time

Indicate the time data collection stopped.

9.3.4. Clock offset information

Report the final clock offset information. Use the same format as described above for the Ready message. Reporting the clock offset a second time may seem redundant but it has two purposes. First in case there was an error in reporting the first value, it provides a back-up. Secondly if there was no error in the first value it can be used to a rough estimate of the clock drift rate. Please also include any information about clock jumps and the time span of data affected by any jumps.

9.3.5. 8-pack inventory

Report the module inventory in the ‘End” message.

9.4. Close log

As with the pre-experiment tests, the post-experiment tests should be done as much as possible in the experiment log. Once the post-experiment tests have been completed, you can close the log, either using the "schedule=…" command with a null or non-existent schedule, by changing the log file with a "log=station" command, or by terminating the FS.

9.5. Delog parameters for the record

Use "logpl" to delog the ancillary data, cable, WX, clock offsets, comments, etc. It is best to do this before sending the end message so that any problems that are discovered from the plots can be reported in the End Message. If you do discover problems, open the log again with the "log=…" command and add explanatory comments. DO NOT EDIT THE LOG MANUALLY. (The log is intended to be a record of what happened during the experiment.

If you edit it, and change or delete anything, you defeat this purpose. No one minds if there are some start-up or other errors in the log. It is more important for the log to be a faithful record of what happened than for it to be neat.) Save the hardcopy plots along with the listings you printed which might include handwritten notes. See the section below about running "logpl".

9.6. Transfer log to cddisa/astbo1/aspen

The log needs to be placed on the appropriate server depending on which correlator will handle the data.

9.7. Send 8-pack(s) to correlator
Prepare the 8-pack(s) for shipping.

9.8 The TRACK program is currently under construction.

9.9. Send the Wrap-up Message

This message contains the last few items related to an experiment. You can optionally include this information in the Stop message. It should be sent to ivs-ops@ivscc.gsfc.nasa.gov. Be sure to include the session name in the subject line.

9.9.1. Log Placement Info

Report where the log was placed: server, directory, and file name.

9.9.2. Additional Shipping Information

If you have any additional information about the shipping such as the routing, this would be a good place to send it.

9.9.3 Additional Experiments Comments

If you have become aware of any additional problems or if there is any special information you either have discovered since the experiment ended or forgot to place in the Stop message, this is a good place to send it. You can of course send follow-up information as often as necessary.

10.0 Sample Checklist

```
Station experiment check list, Experiment _____________ Date ___________
START
1. Pointing: Sky Conditions __________
Source Az/El Offsets SEFDs: X/S
________ ________/________ _______/_______ _______/________
________ ________/________ _______/_______ _______/________
________ ________/________ _______/_______ _______/________
2. TSYS IF 1(A) __________ IF 2(B) _____________ IF 3(C) _______________
3. Cable sign with comments in the log
_____________ normal
_____________ long
_____________ difference, nominal ____, okay? ____
longer cable: increases ____ decreases ___ reading
extra cable removed? ________
4. WX temperature ________ Pressure _____ Humidity _____
5. Formatter time _________________________
6. formatter-GPS offset _________________ Counter Starts: GPS ___ FMOUT ___
7. MASER -GPS offset _________________ Counter Starts: GPS ___ MASER ___
8. VCs phase-cal ________ Levels __________ Frequencies _________
9. Local checks ____________________________
10. Send "ready" e-mail with TSYSs, SEFDs, pointing offsets, source, az-el,
weather, sky conditions, gps-fmout offset, first source and time,
recorder humidity, any problems, confirmation of any unusual set-up,
equipment condition
11. send "start" message
EVERY HOUR or more often
1. enter WX and sky condition comments
2. Check Phase-cal all VCs
3. Check VC signal levels
4. Check system temperatures
5. check formatter time
```

```
6. formatter offset reasonable
7. Check cable value reasonable
8. Check WX reasonable
9. parity errors okay
END
1. Pointing: Sky Conditions __________
Source Az/El Offsets SEFDs: X/S
________ ________/________ _______/_______ _______/________
2. TSYS IF 1(A) __________ IF 2(B) _____________ IF 3(C) _________________
3. Cable sign with comments in the log
_____________ normal
_____________ long
_____________ difference, nominal ____, okay? ____
longer cable: increases ____ decreases ___ reading
extra cable removed? _________
4. WX temperature _________ Pressure _____ Humidity _____
5. Formatter time ____________________
6. formatter-GPS offset ___________________ Counter Starts: GPS ___ FMOUT ___
7. MASER -GPS offset ___________________ Counter Starts: GPS ___ MASER ___
8. VCs phase-cal _________ Levels ____________ Frequencies __________
9. Local checks ____________________
10. Send "end" message with log location
```

11.0 Running "logpl"

This section describes the basics of running "logpl", a graphically oriented program for plotting data from the log. This program is a more modern version of the old "logex" program (which is still available). Please refer to the "logpl" manual available in PostScript form on the FS servers in the doc sub-directory.

11.1. Interactive Use

"logpl" can be started from a shell prompt by just entering "logpl". The program uses the X display, so the starting used must have access rights to the X display. If you are using X server and open new window (C-S-W) and type "logpl" at the prompt, it should start okay.

2 Selecting a log file

If the FS is running, the log that is open will be selected automatically. If the FS isn't running or if you want to use a different log, use the "File" menu item and select the "New Log File" option. Enter the name of the log file you wish to examine. The directory will default to "/usr2/log" and the extension to ".log".

11.3. Plotting Data

You can plot up to four "channels" of data simultaneously. The menu items "Channel1", "Channel2", and so on are pull-down menus that let you select the data to be plotted for each channel. The "Options" menu item allows you select whether the plot are superimposed or shown separately and whether to connect the points with a line.

11.4. Entering New Parameters

You can enter new parameters to plot either by updating the "logpl.ctl" control file and restarting "logpl" or by interactively using the "Options" menu item and selecting "Edit Selections" options. Any changes that are made interactively are not preserved when "logpl" is terminated.

11.5. Printing Plots

Once you have a plot you would like to print, you can print it as PostScript either to a printer or to a file. Use the "File" menu item and select the "Print" option to print the file.

11.6. Non-interactive Use

"logpl" also has a non-interactive, or command mode, for automated processing. This is particularly useful for automatically generating plot of ancillary data for inspection at shift changes and after the experiment is over. To use "logpl" in command mode use the "-cmd" command line option: "logpl -cmd". You can start processing from a command file automatically by entering: "logpl -cfile xxx" where "xxx" is the name of the command file. You can even select the log file to process on the command line by entering "logpl -log lll -cfile xxx", where "lll" is the name of the log file.

11.7. Sample Experiment Delogging Command File

The following is a sample command file that will delog some general ancillary experiment data. If you want to use this command file you should customize it for your station.

```
output=temp,overwrite
Channel=1
command=wx/
parm=1
Channel=2
command=wx/
parm=2
Channel=3
command=wx/
parm=3
Channel=4
command=cable/
parm=1
SCALE=.038308,.038365
Plot
Output=temp,append
Channel=1
command=tsys1/
parm=9
Scale=55,75
Channel=2
command=tsys1/
parm=10
Scale=50,70
Channel=3
Command=tsys2/
parm=7
Scale=70,100
Channel=4
Select=0
plot
```

```
output=temp2,overwrite
Command="
glist
```

11.8. Sample Output

The list below and two pages of plots show sample outputs from "logpl" using the sample command file from the previous sub-section. The list of comments is given here and the plots are shown after the page titled “Summary of Ops Messages”, although that is not the order they would normally appear in.

```
------------------------------------------------
Filename: /usr2/log/ca034gc.log
Selected data: Cmd=" Parm=7
9811117293172:" CA034 1998 GILCREEK A Gc
9811117293172:" A GILCREEK XYNS 7.3152 60.0 0 -86.0 86.0 60.0 0 -73.5 73.5 25.9
Gc 101
9811117293172:" Gc GILCREEK -2281547.29145 -1453645.07155 5756993.15313 40476601
9811117293172:" 101 MOJ-VLBA 1217640
9811117300862/newtape/"to continue, use label command"
9811117320970;"now doing cable length check
9811117323316;"adding extra cable
9811117334902;"removing extra cable
9811117345251;"shorter cable is higher measurement
9811117351006;"gps - maser 11.23 micros.
9811117352465;"gps - formout 11.8 micros.
9811117595001&preob/"nsource
9811118022476;" mostly clear skys
9811119010572;" scattered cumulus clouds
9811120003368;" scattered cumulus clouds
9811121001114;" scattered cumulus clouds
9811122150632;" mostly cloudy skys
9811123031029;" mostly cloudy skys
9811200001880;" mostly cloudy skys
9811201012244;" mostly cloudy skys
9811202000276;" mostly cloudy skys
9811203012995;"weather rpt.partly cloudy
9811204040763;"weather rpt.partly cloudy
9811205025448;"weather rpt.partly cloudy
9811206035266;"weather rpt.partly cloudy
9811207275178;"weather rpt.partly cloudy
9811208070338;"weather rpt.partly cloudy
9811209000615;"weather rpt.partly cloudy
9811210001989;"weather rpt.partly cloudy
9811211015214;"weather rpt.partly cloudy
9811211553262;"weather rpt.partly cloudy
9811213111449;"weather rpt.partly cloudy
9811214050071;"weather rpt.partly cloudy
9811215041480;" partly cloudy skys
9811216035476;" partly cloudy skys
9811217000980;" thin high stratus clouds
9811218003191;" thin high stratus clouds
9811218025818;"now doing cable length check
9811218031886;"adding extra cable
9811218041157;"removing extra cable
9811218050979;"shorter cable is higher measurement
9811218052061;"gps - maser 11.26 micros.
9811218053098;"gps - formout 11.8 micros.
9811218054115&unlod/"**dismount this tape now**"
Glist: Time from 9811117293170 to 9811218065785.
Data points listed: 684.
```

12.0 Mark 5A Issues

Mark-5A operational procedures can be found in the TOW07 notebook.

12.1 When to change disk packs

During an experiment, the FS will use a pack until it is full. It will then attempt to switch to the other bank. The full pack should be swapped with a fresh pack as soon as is practical. Great urgency is obviously not important here since it should be hours until the new pack is needed. Mounting a fresh pack as soon as possible will minimize the chances that data is lost if the other pack has problems that causes it to be filled early. In that case data may be lost if there is not an empty pack in the other bank. A problem such as this should be rare. However, periodically monitoring the predicted time for next pack change may help to discover a problem before it occurs. In addition, the output of the “mk5=get_stats?” commands in the “postob_mk5a” procedure may show symptoms that may alert you to a problem. These statistics should be periodically monitored. Both of these checks should be included in the hourly, at least, checks.

Currently there is no automatic method to predict the time when a disk pack will be full and ready to be changed. You can however get a pretty good idea by comparing the GB count on the schedule summary print-out with the capacity of the disk and using a little math. This technique is pretty accurate except in the case where there may be a problem with a pack. In that case, the pack will fill sooner than expected. Additional information is available from Monit-5 (Control-Shift-5) “Mark5 Remaining Capacity” display. This display shows which pack is active, the remaining capacity of each pack (if it is known) in three different units, and the UT time when this information was most recently determined for each pack. The display of the remaining capacity of the active pack is updated during the set-up for each observation. The remaining recording time in the current mode that is displayed is not the remaining clock time. The clock time will depend on the recording duty cycle. For example, for geodesy, the recording duty cycle is typically about 50%. So the active pack may last about twice as long as the amount of time shown. This will vary from session to session and station to station: your mileage may vary.

12.2 Changing disk packs

When the FS detects that the current pack is full, it will attempt to switch to the other pack. A pop-up window will be displayed asking the operator to change the full pack (the display includes information on which pack to remove). The full pack can be removed at anytime. However, the Mark5 will become unresponsive to the FS for up to about 20 seconds when the mount switch is turned to (lock) when the new pack is inserted. In order to avoid having this impact the session, please be sure to do this only when the FS system will be quiescent for at least 20 seconds, either between scans or while recording. In either case, it should be done 20 seconds or more before the next scheduled event. After completing the pack change, dismiss the pop-up window to avoid confusion in the future.

12.3 Starting Mark5A and Recording Mark5A debug output

In order to help debug problems with the FS, Mark5A, and their interaction, we would like to ask all stations to record the debug output generated by Mark5A. In order to this we recommend that every time you start Mark5A, you use the following commands on the Mark5:

```
cd
script -af <name>
Mark5A -m0 |& LLogr &
#(running of experiment occurs here)
EndM5
exit
```

The sequence above shows that you need to execute an "exit" (or Control-D) to terminate "script" recording. Please be sure to terminate Mark5A and exit the "script" recording after each experiment.

Please note the commands above assume you are using csh (or tcsh) as the shell.

You will need to adjust this accordingly if you are using a different shell, but you can always start a csh (or a tcsh) and enter the commands as shown.

The "script" command shown above will cause all screen output to be put in a file with the name "<name>" in your home directory. For "<name>", we suggest you use the name of experiment with ".txt" appended, e.g. "r4174wz.txt" or if you are not running a schedule, you might use the date for the part before the ".txt", e.g., "040224.txt".

If a problem is encountered with Mark5 control please send us the ".txt" file and the corresponding FS log. This will aid greatly in debugging.
Periodically, you should delete old debug output files on the Mark5 so that the file system

13.0 Running "plotlog"

This section describes running "plotlog", an non-interactive program for generating plots from log files. It was developed for analyzing the logs collected for the "overnite" and short-term stability tests in "systests" . Basically, it plots any of the typically recorded ancillary data in a log file. It plots everything it finds including: wx/, cable/, gps-fmout/, setcl#time/, tsys/, receiver parameters, and phase-cal from the Mark IV decoder. Other items to be plotted can easily be added, please let Ed (Ed.Himwich@nasa.gov) know if you want to include plots of other data or want other command line options.

13.1 Basic Command-line Use
The "plotlog" program is only run from a shell command-line or from a script. The basic usage is:

cd /usr2/log
plotlog log_file
where "log_file" is the name of the log file, with the path if needed, including any suffix, such as the typical ".log". This will display the plots on your terminal (press return to step through the pages until your reach the last).

13.2 Plot Output to a File

The plots can be sent to a file for printing and/or other purposes, use:

cd /usr2/log
plotlog -f file/device log_file
where "log_file" is above, and "file" is the name of the output file, with the path if needed, including any suffix such as the typical ".eps". The "device" should typically be vps (for portrait orientation PostScript). You can use -f \? to be prompted for the device and at that point there is an option to display a list of available devices.

See the "Sample Command and Output" subsection below for an example.

13.3 Command-line Options

There are several command-line options available to tailor the output. You can use "plotlog -h" to display a help page with a full listing of options. You may not need any of the command-line options, but the most useful ones are:
-c value -- delete certain cable values
this command allows you to delete the cable readings that were generated when the extra cable was added for the sign check if "cablelong" wasn't used. If "value" is negative, all points that far below the maximum value are deleted. If "value" is positive, all points that far above the minimum value are deleted. The units for "value" are the the ones on the vertical axis of the plot and so are affected by whether the "-r" option is selected.
-p -- also plot phase-cal amplitude versus phase for available tones
-r -- show cable in raw units, rather than relative delay
-t value -- edit tsys values
All tsys points of zero or below and all tsys points greater than"value" are deleted
-z value -- deletes PCal amplitudes less than "value"
See the "Sample Command and Output" subsection below for an example of the "-t" and "-c" options.

13.4 Sample Command and Output

The command:

plotlog -t 500 -c -1000 -f /tmp/ca043gc.eps/vps ca043gc.log was used to generate sample out from the same log as in section 11, for "logpl". The output is included after the sample "logpl" plots at the end of this write-up. Typically, it should not be necessary to use the "-t" or "-c" options, but they were needed for this old (1998) log. No phase cal plots appear because there was no Mark IV decoder phase-cal data in the log.

13.5 Description of Plots

The subsection describes the basic features of "plotlog" output. The plots appear as up to six plots per page. All time plots on all pages have the same horizontal time axis for easier comparison. The reference time for "0 hours" appears in the title of the plot along with the station name and the log name. No data editing is applied unless specified by command-line options. The plots are auto-scaled to show all included data. All of the included data appears within the box of the plot, never along the edges. Points that were not numeric or were excluded by editing criteria appear along the top edge of _that_ plot. The pages are numbered. On the last page the text "Last Page" is included so it is clear how many pages there should be.

Summary of Ops Messages

Send all messages to ivs-ops@ivscc.gsfc.nasa.gov. Please include the session name, station name and type of message in the subject line. Please avoid the use of tab character and HTML for these messages. The *msg* utility available now the FS has forms for Ready/Start/Stop messages (In the initial version, the clock offset in the stop message must be entered as comment).

1. Ready message
comments
first source and time
formatter to gps clock offset
WX: temp, pres, humid, sky conditions
Cable difference: longer cable makes reading larger/smaller
change in microseconds and is/is not nominal
Pointing values (as many as appropriate):
SEFD X/S Source Az/El Offset1 Offset2
707/705 Cas-A 352/34 -.004 .008
Tsys (x1/s/x2): 123/77/109
recorder humidity
(The suggested format of the pointing and Tsys entries is shown above.)

2. Start message
after starting, report source and start time

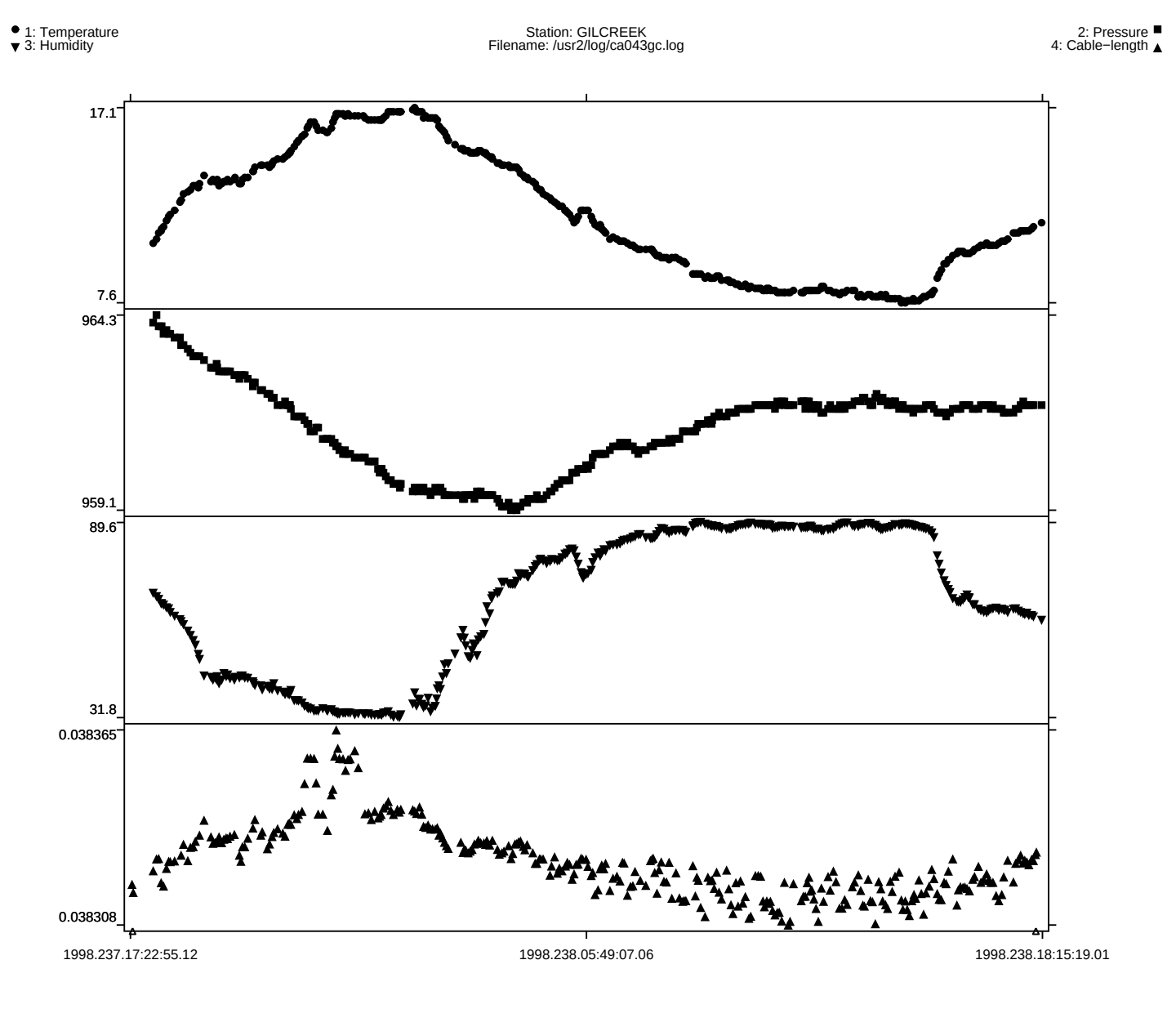
3. Stop message
comments

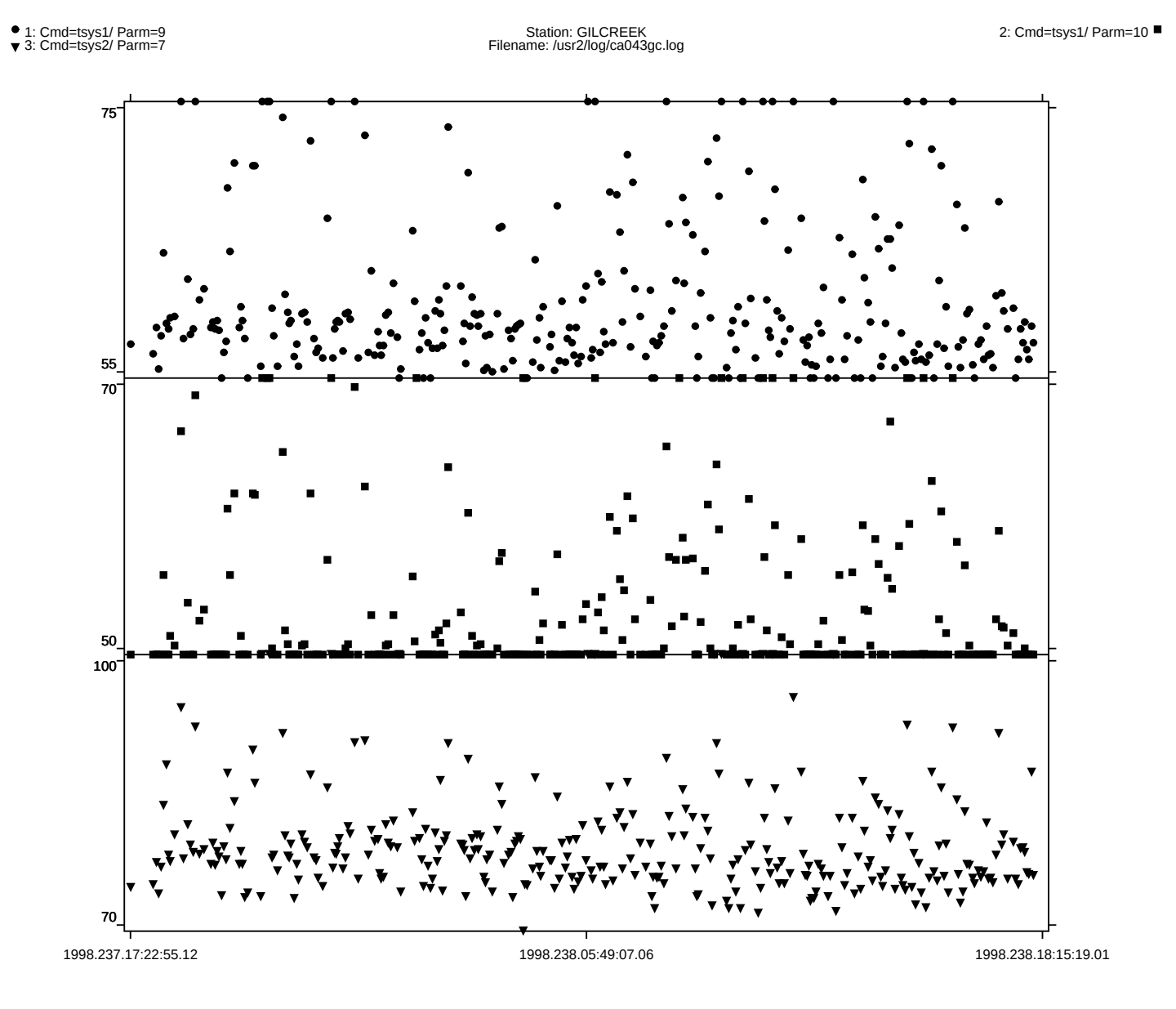
end formatter to gps clock offset
list of problem scans
tape inventory on site
observation end time
All tape shipping information (VSN, AWB, shipper) should be placed in TRACK. Please wait until you have the AWB numbers available to do this unless it would cause an unreasonable delay. This item is not part of the message, just a reminder to enter the information into TRACK.

4. Wrap-up message

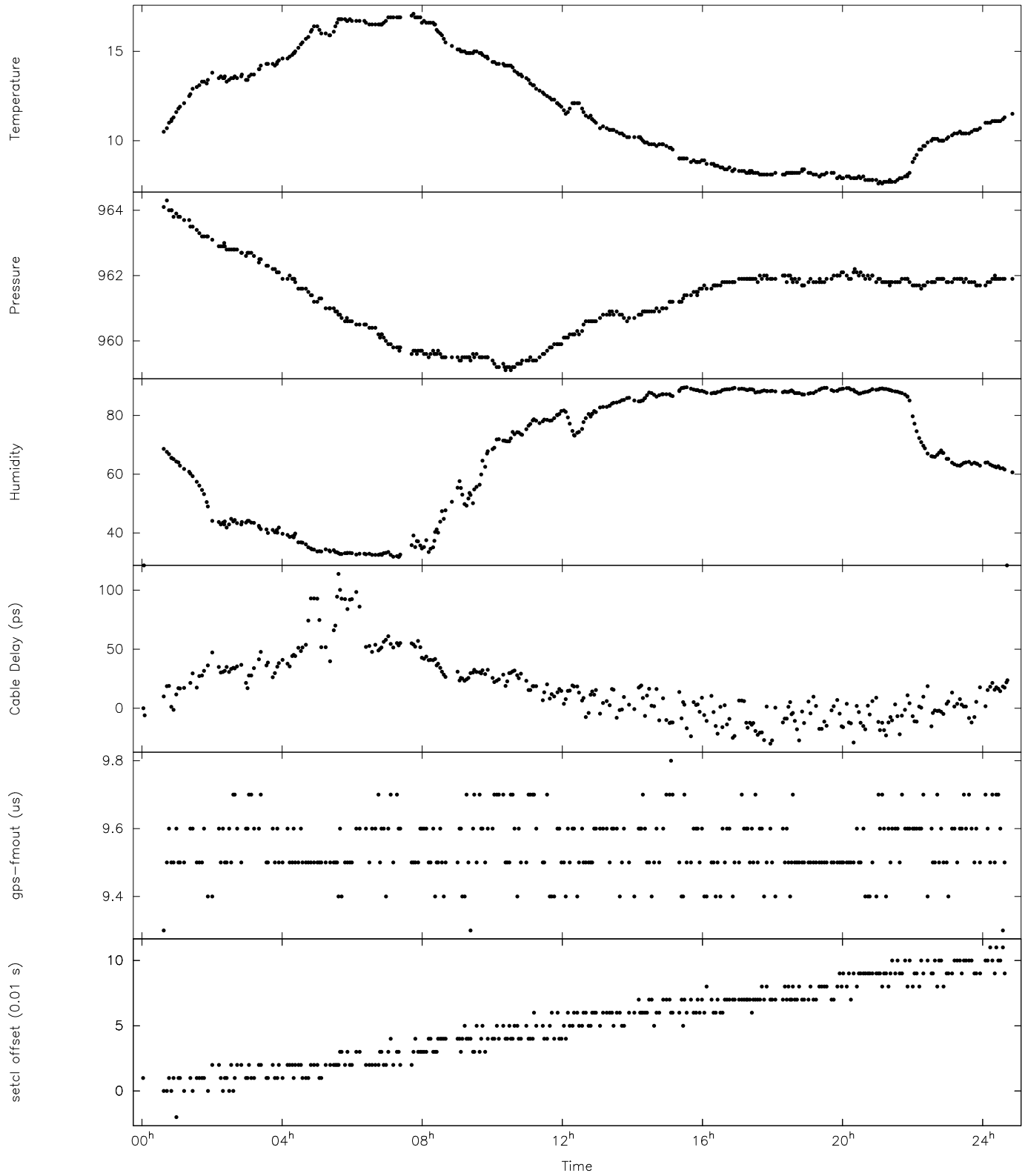
Optionally this information may be included in the Stop message, you can of course send as many of these follow-up messages as you need. The wrap-up message may also contain log placement information, any additional shipping information.

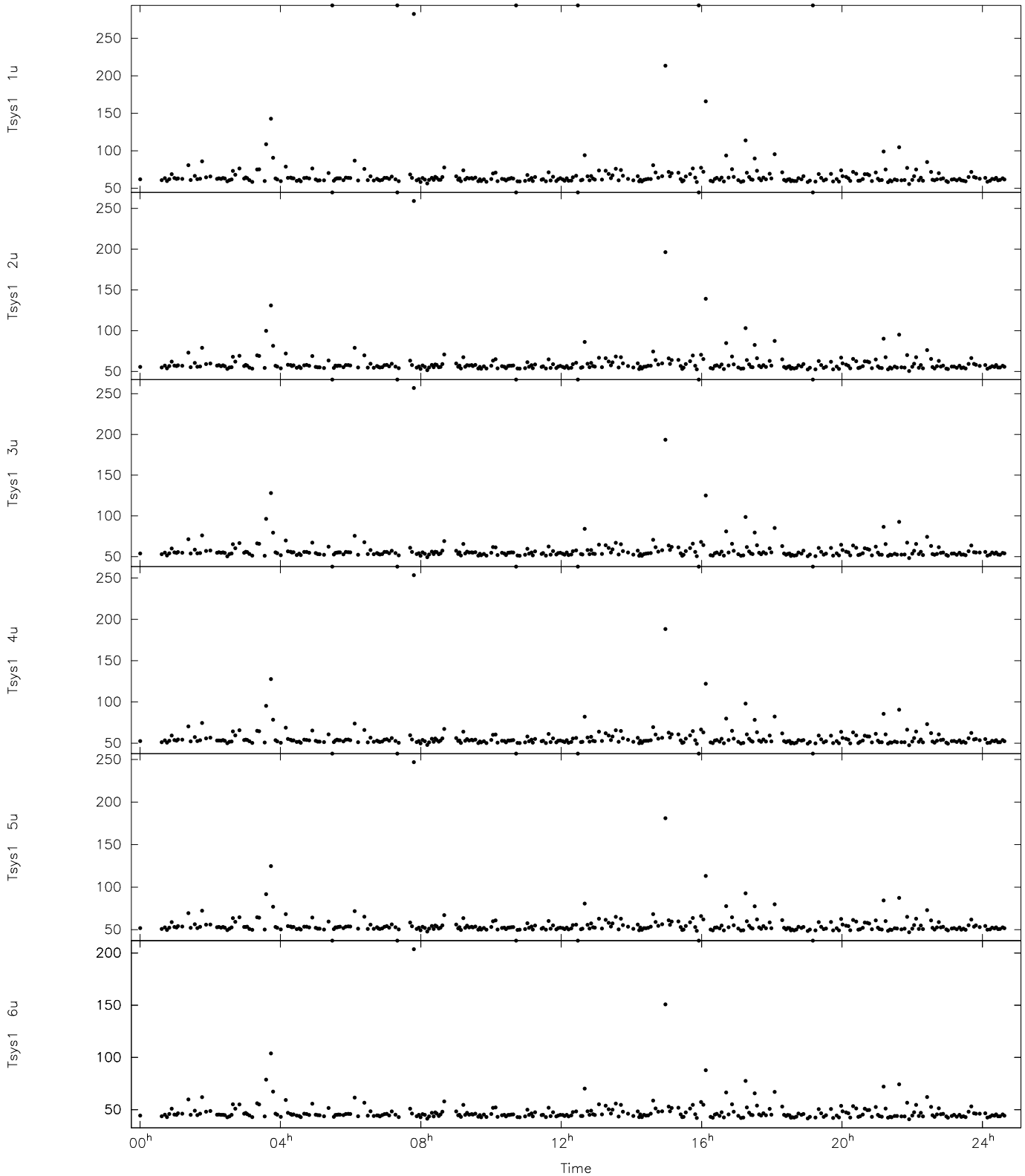
Additional information about problems during the session should be sent as a wrap-up message at any time after discovery post observing.

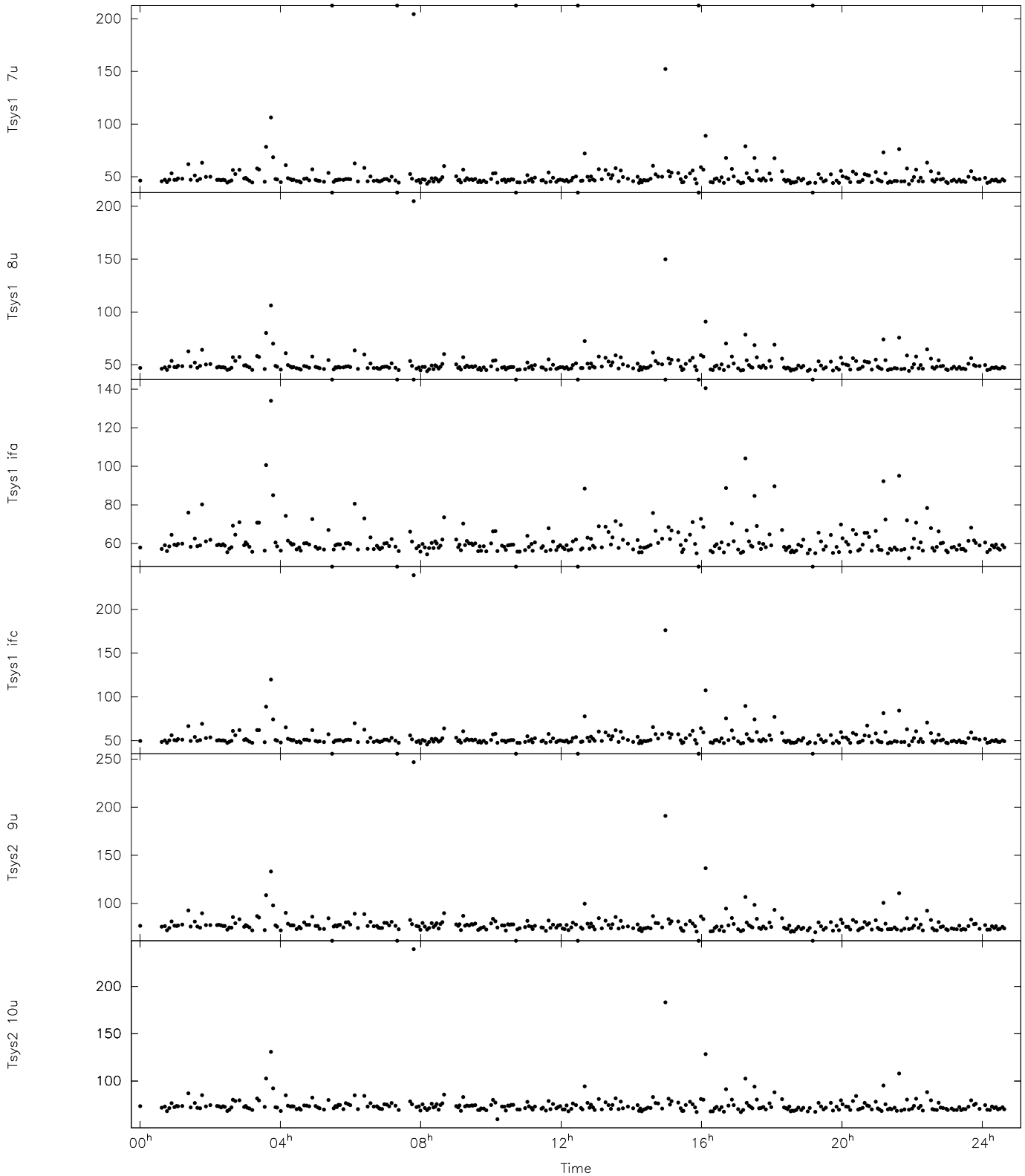

1: Temperature
3: Humidity
Station: GILCREEK
Filename: /usr2/log/ca043gc.log
2: Pressure
4: Cable−length
17.1
7.6
964.3
959.1
89.6
31.8
0.038365
0.038308
1998.237.17:22:55.12
1998.238.05:49:07.06
1998.238.18:15:19.01

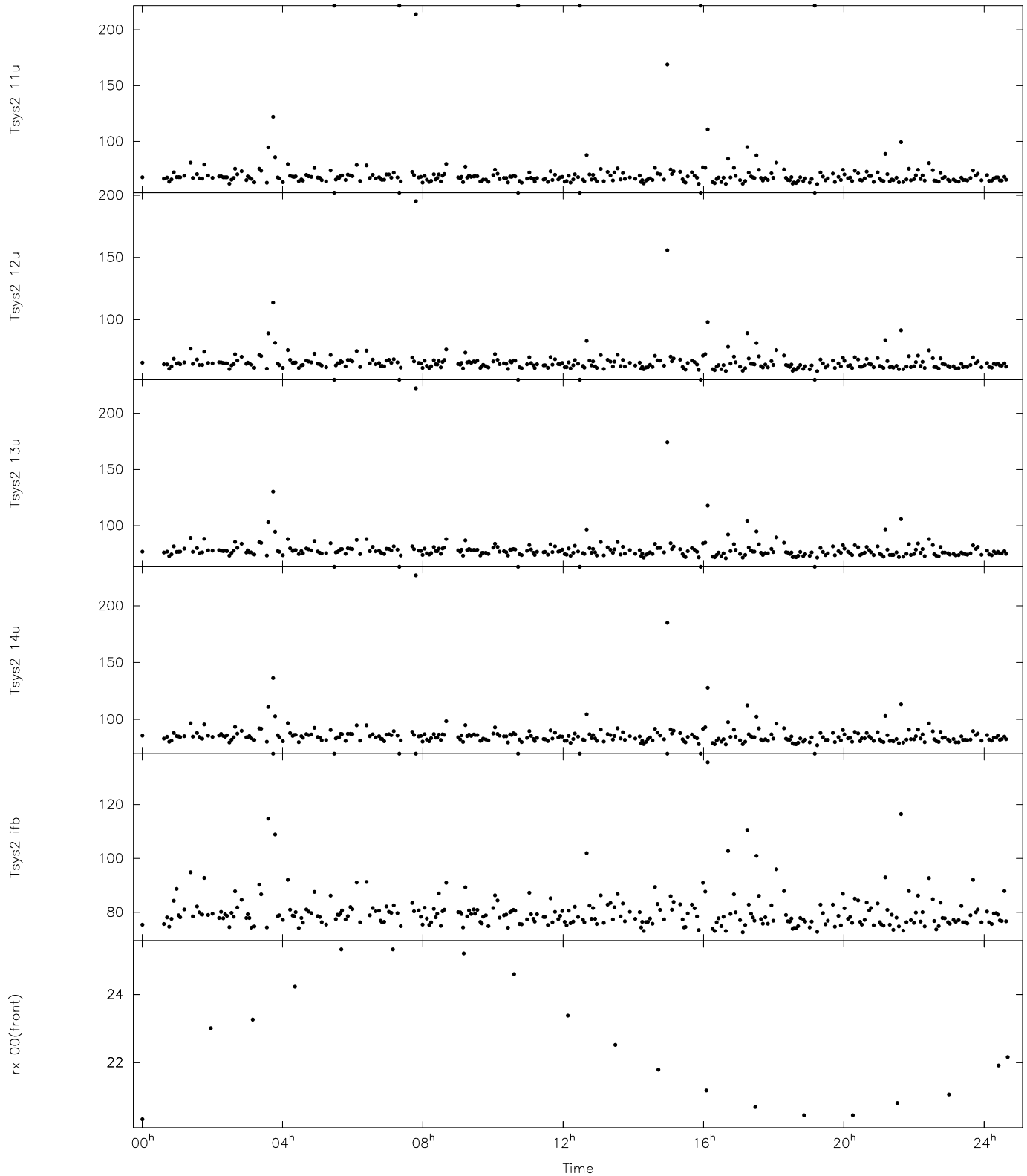

1: Cmd=tsys1/ Parm=9
3: Cmd=tsys2/ Parm=7
Station: GILCREEK
Filename: /usr2/log/ca043gc.log
2: Cmd=tsys1/ Parm=10
75
55
70
50
100
70
1998.237.17:22:55.12
1998.238.05:49:07.06
1998.238.18:15:19.01

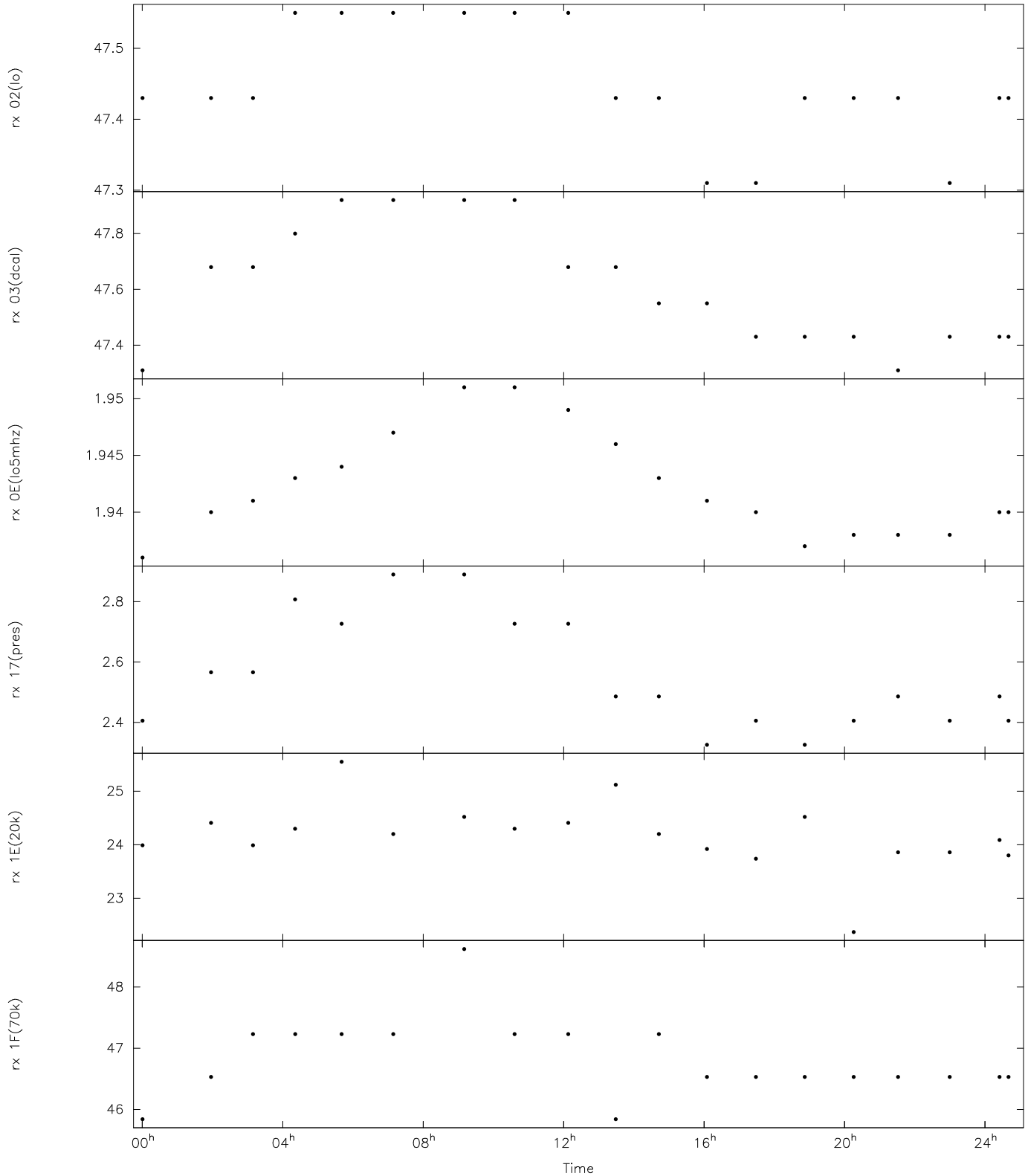
GILCREEK Log Plots -- 1998.237.17:22:55.13 ca043gc.log Page 1




Tsys1 1u
Tsys1 2u
Tsys1 3u
Tsys1 4u
Tsys1 5u
Tsys1 6u
250
200
150
100
50
00h
04h
08h
12h
16h
20h
24h
Time


Tsys1 7u
200
150
100
50
Tsys1 8u
200
150
100
50
Tsys1 ifa
140
120
100
80
60
Tsys1 ifc
200
150
100
50
Tsys2 9u
250
200
150
100
Tsys2 10u
200
150
100
00h
04h
08h
12h
16h
20h
24h
Time


Tsys2 11u
200
150
100
Tsys2 12u
200
150
100
Tsys2 13u
200
150
100
Tsys2 14u
200
150
100
Tsys2 ifb
120
100
80
rx 00(front)
24
22
00h
04h
08h
12h
16h
20h
24h
Time


rx 02(lo)
47.5
47.4
47.3
rx 03(dcal)
47.8
47.6
47.4
rx 0E(lo5mhz)
1.95
1.945
1.94
rx 17(pres)
2.8
2.6
2.4
rx 1E(20k)
25
24
23
rx 1F(70k)
48
47
46
00h
04h
08h
12h
16h
20h
24h
Time

FS VGOS Operations

Version 0.4

April 23, 2015

1. Set-up of RDBE from a cold start (if needed):

A. Start RDBE server, from FS PC shell prompt:

`ssh root@rdbeX` X=a, b, c, or d , logs into RDBE-X

On RDBE:

```
rbin
nohup ./rdbe_server 5000 6 &
exit
```

repeat this for each RDBE restarted. You can verify when all the RDBEs have restarted from the FS with:

`rdbe_status`

There will be error for each RDBE that is not ready. When all RDBEs respond with a status value, proceed to step B.

B. From the FS, load the firmware for RDBE-X:

`rdbe_fpgaX` X=a, b, c, or d

to load all RDBEs, use:

`rdbe_fpga`

There will be an error for each RDBE since it will not respond right away and will time-out. You verify when this is finished from the FS with

rdbe_status

as above. This time you are looking for third digit from the right in the status message to be '1':

`0x`*`z`*`1`*`zz`* where the *z* positions are any other hex digits

When all status values reach the correct value, proceed to step C.

C. From the FS, initialize the configuration for RDBE-X:

`rdbe_initX` X=a, b, c, or d

You should get a "success" message.

To load all RDBEs, use:

`rdbe_init`

You should get four "success" messages.

2. Set-up of Mark 6 from a cold start (if needed):

A. Start cplane and dplane

`ssh root@mark6a` Login to mark6

Check if `cplane` and `dplane` are running:

`ps aux | grep plane`

To start them if they are not running:

```
/etc/init.d/dplane start
/etc/init.d/cplane start
```

3. DRUDG experiment files:

A. Put schedule, `v15`*`xxx`*`.skd`, *xxx*=day of year in `/usr2/sched` on FS PC

B. Run DRUDG, from FS PC shell promo

```
cd /usr2/sched
drudg v15xxx.skd
```

XX	select your station code *XX*
3	make `.snp`
12	make `.prc`
9	change printer output destination
v15*xxxXX*.lst	destination file
	three more **<Return>**s
5	print summary
0	exit DRUDG

4. Experiment set-up

A. In FS, open the experiment log so the set-uo will recorded in that log:

```
log=v15xxxXX
```

B. In FS, initialize pointing setup and send antenna to test source:

```
proc=point
initp
casa
```

C. In FS, set-up experiment mode and adjust attenuators

```
proc=v15xxxXX
setupbb
ifdbb
mk6bb
auto                    sets all attenuators three times
```

D. In FS, check RDBE time and offsets:

```
time
```

The offsets should be small and the DOT times should be the same and the same as the FS log timestamps. If not, run FMSET (**<Control><Shift>T**) and verify and set times (avoid **s** for sync) by cycling through RDBEs (type each band letter: **a**, **b**, **c**, **d**), and be sure to exit (**<Escape>**)

E. Run RDBE Monitor program (**<Control><Shift>6**), check for each RDBE that:

1. DOT ticking and correct time
2. DOT2GPS value small (a few μseconds) and stable (varies by 0.1 μseconds or less)
3. RMS value close to 32
4. Tsys IF0 and IF1 about 50-100, may be jumping a bit
5. Phase-cal amplitude about 10-100, phase stable to within a few degrees

Leave the window open for later monitoring but position out of the way as necessary.

F. In FS, Check pointing and SEFDs on test source when you have reached the source

```
onsource                result should be TRACKING
fivept                  verify xoffset offset values are small
onoff                   verify SEFDs for eight bands are reasonable, ~2000-3000
azeloff=0d,0d           zero offsets
```

G. Make test recording:

a. Initialize module; create, mount, and open module

Check status:

mk6=mstat?all;

If the Mark 6 does not know the module:

mk6=mod_init=<*slot#*>:<*#disks*>:<*MSN*>:<*type*>:<*new*>;

(example: **mk6=mod_init=1:8:HAY%0001:sg:new**;)

Create, open and mount the group:

mk6=group=new:<*slots*>;
mk6=group=mount:<*slots*>;
mk6=group=open:<*slots*>;

To query if the group is created properly:

mk6=group?;

Print out should have the group number at the end. If it is a "-" something has gone wrong

b. In FS, record some test data:

mk6=record=on:30:30;

verify that lights flash appropriately. You can check recording status with:

mk6=record?;

It should progress starting as "recording" then transitioning to "off".

c. Once recording ends, check quality:

mk6=scan_check?;

Results should show vdif, time of 'record=on', 30 seconds of data, 30 GB of data and 8 Gbps data rate.

5. Start experiment

A. Start non-FS multi-cast logging:

From a FS PC shell prompt, connect to mark5-19 (Wf) or monkey (Gs):

ssh oper@mark5-19 or **ssh oper@monkey**

Clean-out old monitor data as appropriate, to delete all:

rm -i rdbe30_mon_dat_*.log

Start logging:

start_multicast_logging
exit

B. Start schedule

In FS PC Shell, look at v15*xxxXX*.lst file (maybe **less v15*xxxXX*.lst**), find first observation, note line number 'nnn' after scan name at start of line.

In FS, start schedule:

schedule=v15*xxxXX*,#nn*n*

6. Monitor experiment

A. To display scan_check results as they come in (and the old ones so far) open a new window (**<Control><Shift>W**), then

scan_check

(which does `tail -f -n +1 /usr2/log/`lognm`.log| grep scan_check`)

Results should show vdif, reasonable record start time, about equal seconds and GBs of data (typically 30+), and 8 Gbps data rate

Position and size window for convenient viewing, new output will follow any changed size. You can stop this with **<Control>C**.

B. Check RDBE Monitor display for reasonable values:

1. DOT ticking and correct time

2. DOT2GPS value small (a few μseconds) and stable (varies by 0.1 μseconds or less)
3. RMS value close to 32
4. Tsys IF0 and IF1 about 50-100, may be jumping a bit
5. Phase-cal amplitude about 10-100, phase stable to within a few degrees

7. Post experiment

A. Stop the schedule:

```
schedule=
```

B. Stop multicast logging

From a FS PC shell prompt, connect to mark5-19 (Wf) or monkey (Gs):

```
ssh oper@mark5-19      or    ssh oper@monkey
stop_multicast_logging
exit
```

C. Send test scan data files (example ***<scan name>***: **104-1535**)

```
ssh oper@mark6a
gator "*<scan name>.vdif" .              this takes several minutes
dqa -d *<scan name>.vdif                 this takes several minutes
scp *<scan name>_0.vdif oper@evlbi1.haystack.mit.edu:/data-st12/vgos/
scp *<scan name>_1.vdif oper@evlbi1.haystack.mit.edu:/data-st12/vgos/
scp *<scan name>_2.vdif oper@evlbi1.haystack.mit.edu:/data-st12/vgos/
scp *<scan name>_3.vdif oper@evlbi1.haystack.mit.edu:/data-st12/vgos/
```

If the directory is full, the **dqa** command will fail. The user has to log into the mark6 and remove old `.vdif` files that have been gathered and sent already. The transfers will take roughly 20 min per 10 seconds of data.

D. Remove the module for shipping:

```
mk6=group=close:<slots>;
mk6=group=unmount:<slots>;
mk6=mstat?all;                    to check the modules are unmounted
```

E Transfer log file

In FS, close experiment log:

```
log=station
```

In FS Shell prompt

```
cd /usr2/sched
ftp cddisin.gsfc.nasa.gov
user                                    Supply your user cddisin user name
password                                Supply your user cddisin password
put v15xxxXX.log
quit
```

F. Transfer multi-cast log:

Details to be added.