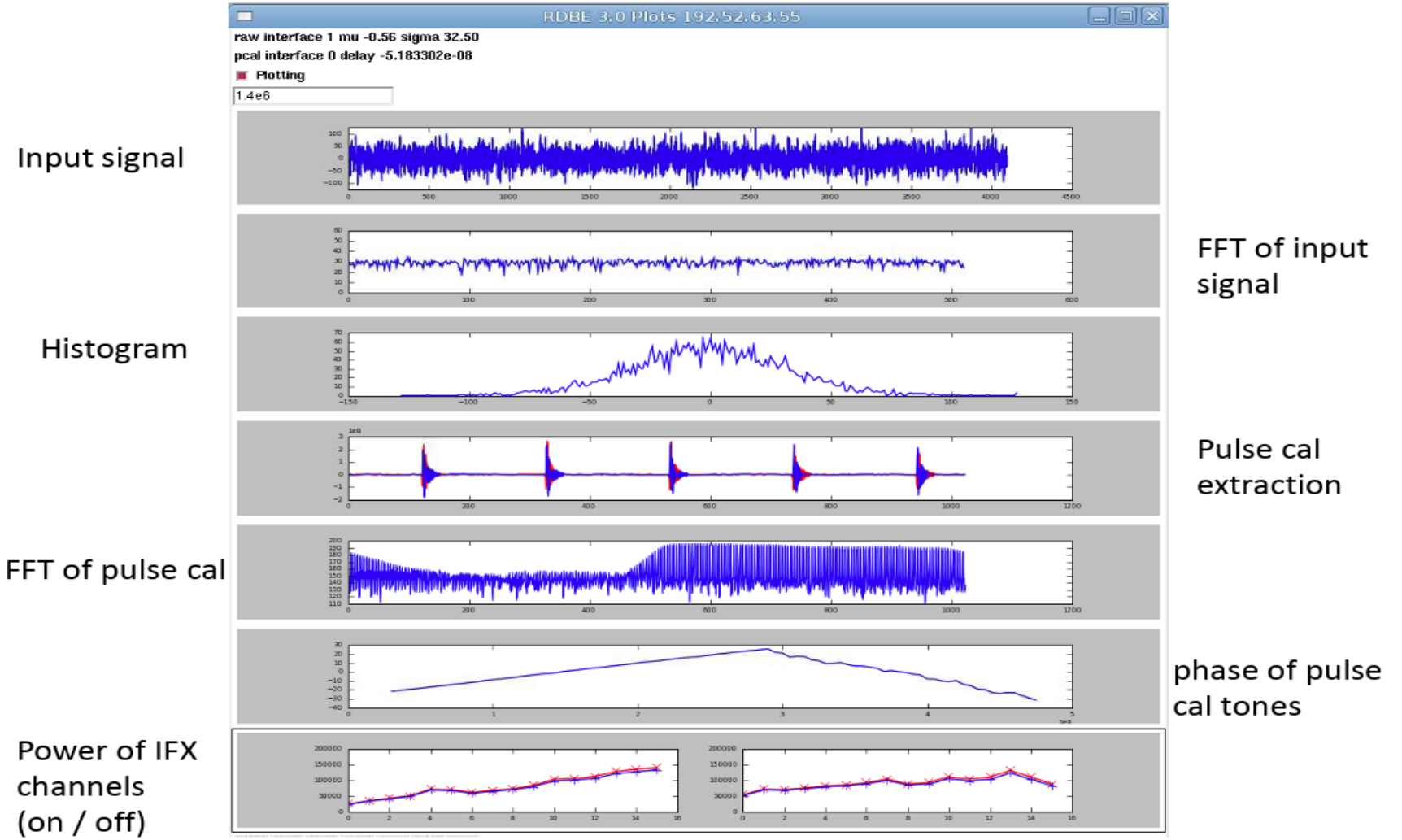
VLBI OPERATIONS

SYNCRONIZED SWIMMING IN DIFFERENT POOLS

RDBE RAW Capture Mode: Provides ability to see the incoming signal from the iADC before it is processed by the FPGA personality. This can be incorporated in the FSPC software as a snap command with "client=mon" feature.



TOW 2015 Notebook, RDBE Setup and Operations, Chet Ruszczyk, slides 27-28

TOW 2025
VLBI Session Pre-Checks
For VGOS Systems Class Discussions

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1. Walking into your VGOS/VLBI site

a. What do you see, hear, or smell?

2. Experiment SNAP and procedure files

a. We must retrieve and create the .snp and .prc files for your session
   i. **fesh <schedulename> -d**
   ii. **feshp -d <schedulename> (prints snap summary and session notes)**

b. Legacy:

   i. Retrieve your .skd file from CDDIS
   ii. Drudg <sessionname>.skd
      1. Create the SNAP and procedure file.
      2. Print hardcopies of the schedule and session notes.
   iii. Edit the session procedure file to insert station-specific parameters such as IF distributor attenuator settings needed for your station.
   iv. Be sure to create a new procedure file for each session from the .skd or .drg file.
      1. ***Do not use default set-up procedures in the station procedure file***

3. Computer control

a. Start the FS by issuing the following command:
   i. **fsclient** This should bring up the standard operational windows

b. Check that the FS is controlling the VLBI terminal and antenna. Some stations have multiple operational control systems.

4. Station timing

a. All station clocks should be identified and confirmed synced within spec prior to any VLBI session.

b. PCFS CPU (2 weeks)

c. PCFS (correct second)

d. ACU (Antenna) (Correct second)

e. GPS (Offset from station equipment <50 us)

f. R2DBE (4) (correct second)

g. R2DBE epoch (4) (time from last sync?)

h. Mark6 (correct second)

i. NTP

j. GPS 1 PPS Offset

   i. Using a counter with time interval measurement accuracy <100 ns, measure the time interval between the 1pps signals from:

      1. R2DBE and GPS receiver
      2. Maser and GPS receiver.

   ii. This offset should be within a few microseconds of each other. This number should be monitored as it could be the first indication of a possible system failure.

5. Feed polarization

a. Some stations may have multiple receivers and configurations. Before each session you should make sure that the feed polarization is correct.

   i. For geodetic S/X observations, the correct polarization is RCP.

   ii. For VGOS use linear X (H) and Y (V).

6. Receiver

a. Confirm Your receiver choice is VGOS and all receiver cable connections are correct

b. 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.

c. Check that other receiver parameters (helium pressure, voltages, currents) that are monitored are within their normal ranges.

7. RF distributor

a. Confirm output cables are connected to the correct UDC inputs

8. Antenna focus

a. Some antenna sites have moveable feed positions.

   i. For VLBI observations, the focus should be stationary in its correct position.

9. Antenna pointing

a. Check antenna pointing:

   i. If possible using two or more widely-separated sources.

   ii. Position the antenna on a source

   iii. fivept this will generate the offset numbers

b. Pointing errors in both axes should be smaller than beamwidth/10 at the highest observation frequency.

10. System Equivalent Flux Density (SEFD)

a. Once you confirm your pointing offsets. Have the system generate your SEFD numbers

b. **onoff** This measures the SEFD in each frequency band and polarization and the station compares against the nominal historic value. Some sites are measuring all channels not just the standard 8-channels from the typical on-off.

c. ONOFF should be run after you open the log file for the session you are about to start

   i. Using a strong radio source of known flux density, measure T_{source}/T_{sys}.

   ii. 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).

11. System temperatures

a. With the antenna pointed near zenith (clear sky), measure the system temperatures in all broadband channels, and compare against nominal values.

12. Phase calibration signal

a. Confirm your PCAL levels are correct on your PCFS monitor window or using a

spectrum analyzer.

13. Cable calibration

a. The cable counter should be operating in single–sample mode, not averaging.

b. The cable counter reading should be in the normal range.

c. Single–sample readings should be stable to ±1 μsec.

d. Check that the cable calibration system measures cable length changes correctly.

1. **cable** this puts the cable reading into the log

ii. Insert a short cable length in the cable from the ground unit to the antenna unit, and log the cable reading using the following command:

1. cablelong

iii. Remove the short cable and log the cable reading again

1. cable

iv. Compare the change in readings with the nominal value.

1. cablediff

14. Mark 6 Recording systems

a. 8-Pack module Installation –

b. Remove the 8-pack from the shipping box and anti-static bag.

c. Inspect for damage.

d. Pull front lever down so that it is horizontal.

e. Slide 8-pack easily into Mark6 machine until it stops.

f. Lift front lever which will insert the 8-pack into the connector. **DO NOT PUSH**

g. Insert the data cables into the correct connectors on the front of the module

h. Turn the key switch to the right until it stops.

i. The module lights will blink in a specific order and pattern

i. Recognize this and confirm all lights indicate correctly

ii. This may be you first detection of a module problem

j. Individually repeat this for multiple modules if requires for the session

15. Conditioning the modules

a. 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 lengthy gap in operations. With the larger modules it may take multiple days to condition. These larger modules should be done over the weekend if possible when there are no operational sessions. Please see attached conditioning memo.

16. Meteorological sensors

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

17. More extensive testing

a. After any **equipment, software 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 could include:

   i. Measure pointing offsets over the full sky.

   ii. Check for RFI and for jumps in the phase cal phase and cable cal as the antenna is slewed across the sky.

   iii. Measure the DC level and AC ripple in the any system or equipment power supplies.

   iv. Clean all equipment filters and cooling fan port

18. Begin Pre/Ops Checklist

IVS Operations workshop TOW 2025

1. Starting a schedule

a. The basic steps in starting a schedule are:

b. Reporting problems when you need urgent help.

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

d. 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.

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

f. 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, Mario Bérubé,

and John Gipson.

g. 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.

2. Review session notes

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

3. Start schedule

a. Confirm the antenna source is in the correct wrap zone for your antenna
b. The preferred form of the "schedule" command uses the line number to start with, e.g., "schedule=na225gc,#1", to start at line 1.

4. Send the Ready message.

a. **rdbemsg** this will send the information in a standard format and is recommended by the IVS

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

   i. Comments about anything that may affect 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.

   ii. 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.

   iii. R2DBE to GPS clock offset. This is needed by the correlator to find fringes. If the backend 1 PPS starts the measurement please report this as the RDBE to GPS offset; if GPS 1 PPS starts, please report it as the GPS to RDBE offset.

   iv. WX: temperature, pressure, humidity, and sky conditions. This assists the analysts in understanding the atmospheric

conditions and interpreting the SEFD and Tsys data.

v. 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.

vi. Pointing values: Please report both band and polarization 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.

vii. Tsys values. Please report the system temperature all bands and polarizations.

5. Send the Start message

a. 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@lists.nasa.gov via your automated system. If this is not functioning an email to the correct address including all of the data can be sent.

6. Making comments in the log

a. 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 get to the correlators. 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.
b. It is important to describe the problem even if not fully understood at the time of detection. If the problem is resolved a full description and solution should be entered into the log.
c. In this time of more remote and un-attended operations all local information regarding function entered into the session log is critical.

7. Periodic monitoring, I: each scan is correct:

a. For each scan the following information should be verified:

i. source

ii. equipment status, scan-check, system errors?

iii. on-source

8. Periodic Monitoring II

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

b. Sky conditions entered as comments

in log Cloud cover, wind,

precipitation, etc.

c. Disk pack full?

d. Check mk6=mstat?all 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.

9. System failures

a. This may include failure of the main site power, Antenna system, Receiver, Cryogenics, R2DBE, UDC, Mark6, Disk Modules, networks, and power supplies,
b. All impact data collection and analysis. The decision to continue observing or stop and repair the system depends on the nature of the failure. Is the data degraded, or missing?

10. Post experiment

a. 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.

b. Check cable calibration

c. This verifies that the cable system still detects the calibrated cable correctly and hence has not failed during the experiment.

d. Complete end check-list

e. 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.

f. Send the Stop Message

   i. 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@lists.nasa.gov. Be sure to include the session name in the subject line. The End Message should have the following components:

   ii. Scans missed

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

   iv. Comments

   v. 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.

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

   vii. Stop time

      1. Indicate the time data collection stopped.

   viii. Clock offset information

      1. 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.

ix. Disk Pack

x. Report the module inventory in the ‘End” message.

g. Close log

h. 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.

i. Send Log (plog -l) **That is a lowercase L**

ii. Additional Module Shipping Information

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

11. Additional Experiments Comments

a. 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.

12. Running "logpl"

a. 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.

b. Interactive Use

c. "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.

d. Selecting a log file

e. 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".

f. Plotting Data

g. 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.

h. Entering New Parameters

    i. 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.

i. Printing Plots

j. 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.

k. Non-interactive Use

l. "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.

KPGO VGOS BONN jive/m5copy (CentOS)

*****check webpage for transfer speed and port availability**

F1 Window (oper)

```
Key on disk
da-client
group=mount:<slot>
group=open:<slot>
mstat?all
Verify
     RAID "closed:unprotected:raid"
     SG "open:ready:sg"
```

F2 Window (oper)

```
cd /mnt/raid/
mkdir <experiment>_k2
cd <experiment>_k2

gator.py -t <slot> "<experiment>*.vdif"
/mnt/raid/<experiment>_k2

this will take a while… 30TB ~ 7 hours
ls -1 | wc -l verify scans are there
```

F1 Window (oper)

```
group=close:<slot>
group=unmount:<slot>
Key off disk
mstat?all
quit
```

F5 Window (oper)

```
If jive is not running
jive5ab-3.2.0-64bit-Debug
```

F4 Window (oper)

```
m5copy file:///mnt/raid/vo1123_k2/vo*
file://89.1.14.226/data/vo1123/k2/ -udt -p 2633 -r 1200M -
resume;
```

Note: Correlator directory has to be setup and available for this to work.

Westford VGOS Setup Checklist

	A	B	C
1		**Session Name _____Correlator_____Scans _____ Date**	_____
2		*When used, carrots denote a variable. Do not type the < > characters*	
3		*so, <sched> becomes vo2027 <station id> becomes wf Examples are in green.*	
4		Check hardware connections between RF distributor and UDC	
5		**Start in Login Shell window**	
6		**fesh -d <sched> Automatically gets files and creates session files**	
7		***Drudg .skd file to generate snap summary for operational reference***	
8		If the schedule already exists on the FSPC, you will see an error saying it is there already	
9		**fsclient** This opens all operational windows to run session	
10		**Move to Operator Input Window**	
11		**check_ntp** Verify the NTP is sync'd, *one line has an asterisk*	
12		**log=<sched><station id>** vo1201wf	
13		**rdbe_status** 0x0941	
14		**mk6=dts_id?** !dts_id?0:Mark6-5002:2.0.2-5:1.2;	
15		*Confirm MCI is running by viewing display and confirming clock is running, top right*	
16		**mk6=msg?** 0:NA; *clears mark6 message queue*	
17		**If needed erase module:**	
18		**mk6=group=unprotect:<group>**	
19		**mk6=group=erase:<group>**	
20		**If needed initialize module:** *If not skip ahead to* ***Create, Mount, and Open***	
21		**mk6=mod_init=<slot>:<#disks>:<msn>:<type>:new** `mk6=mod_init=1:8:HAY%0001:sg:new`	
22		**Create, Mount, and Open the module for operations**	
23		**mk6=group=new:<slots>** mk6=group=new:1	
24		**mk6=group=mount:<slots>**	
25		**mk6=group=open:<slots>**	
26		**mk6=group?** *Confirms if group is created properly*	
27		**Resume here if the module is already set up**	
28		**mk6=mstat?1** *Query for group 1 (can use 1,2,3,4,all)*	
29		**time** *This will display the RDBE pps,dot, and gps*	
30		*If there needs to be a time correction use the* ***fmset*** *command* ***(more Info needed)***	
31		**mk6in** *Confirms RDBE data is streaming (2Gbps from each)*	
32		**If needed to re-initialize the RDBE:**	
33		**In a new shell window:**	
34		**ssh oper@wfmark5-19**	
35		**cd /srv/r2dbe_software/**	
36		**./r2dbe_init_all** *(can replace 'all' with either a,b,c,d)*	
37		*wait for message saying completed successfully after X tries (time?)*	
38		**Resume here if the R2DBE is already set up**	
39		**Turn on antenna**	
40		**Start pointing checks:**	
41		**proc=point**	
42		**initp**	
43		**casa**	
44		**proc=<schedule name><station id>** vo1201wf	
45		**setupbb**	
46		**ifdbb**	

	A	B	C
47		**mk6bb**	
48		**rdbe=dbe_atten=**	
49		**proc=point**	
50		**onsource**	
51		**fivept** *Westford normal offsets less than .025 degrees xoffset* **AZ_____EL_____**	
52	SKIP	**onoff** *Sefd numbers 2000-5000 are normal* **(not working)(Show for Michael Lindqvist)**	
53		**azeloff=0d,0d**	
54		***Write a test scan on the Mark6***	
55		**mk6=input_stream?**	
56		**mk6=record=on:15:15:mk6tst:wf;**	
57		**mk6=record?** *Do this command quickly while recording to show status*	
58		**mk6=rtime?** *Displays recording space left on disk*	
59		**mk6=scan_check?**	
60		**Cable cal check**	
61		**cable** *measures cable length delay*	
62		**Insert piece of test cable inline with Type N cable in Mk3 IF3 module top of RF Rack**	
63		**cablelong** *measures long cable length* delay	
64		**Remove piece of test cable and reconnect original cable**	
65		**cable** Measures *normal length cable delay*	
66		**cablediff** *difference between long and normal cable states, should be approx (666 US)*	
67		**In a separate window, only if requested:**	
68		**Gator test scan on Mark6**	
69		**DQA vdif files from test scan to confirm no problems**	
70		**Resume here if no test scan needed:**	
71	SKIP	start_mlog This starts the multicast data **(not working)**	
72	NEW	Use Spectrum Analyzer to look at PCAL across Band……Should be about -100 dbm	
73		**Send Ready Message using the blue vgos-msg-gui window**	
74		**Ctrl+Shift+m** *Opens blue window for session messages*	
75		*Confirm Email address is in window is '**ivs-ops@lists.nasa.gov**'*	
76		Or, In a new shell window:	
77		rdbemsg	
78		input weather, first source name and time, R2DBE information, dewar information	
79		*May be easier to start the schedule at this time, to get the first source information!*	
80		**In the operator input Window:**	
81		**schedule=<session><station id>,#<nnn>**	
82	LOOK	**Special VR sessions ONLY command**	
83		**From the Mark6 login window**	
84		**dboss s 1**	
85	LOOK	**On Pointing PC in lockable rack**	
86		**Start Westford pointing program**	
87		**Start recording encoder readings 1 second interval**	
88		*Confirm session start and good first scan_check result*	
89		**Send Start message using the Blue vgos-msg-gui window**	
90		**Ctrl+Shift+m** *Opens blue window for session messages*	
91		*Monitor session*	
92		*enter hourly WX* "weather : clear skies , *and any operational comments in Operator Input*	

	A	B	C
93		End of Session:	
94		schedule=	
95	SKIP	stop_mlog **(not working)**	
96	LOOK	**Special VR sessions ONLY command**	
97		**From the Mark6 login window**	
98		**dboss s 4**	
99		Do pointing checks:	
100		proc=point	
101		casa	
102		proc=<schedule name><station id> vo1201wf	
103		setupbb	
104		ifdbb	
105		mk6bb	
106		rdbe=dbe_atten=	
107		proc=point	
108		fivept Westford normal offsets less than .025 degrees xoffset AZ_____EL_____	
109		onoff	
110		azeloff=0d,0d	
111		**Send Stop message with Blue vgos-msg-gui**	
112		**Ctrl+Shift+m** *Opens blue window for session messages*	
113		Gator and Send tests scan to the correlator: (only if requested)	
114		From the Mark6 terminal:	
115		gator -t <slots> <scanname>.vdif ~/	
116		Wait till the prompt reappears: ~5 minutes	
117		dqa <scanname>.vdif	
118		Confirm fill pattern is 0 and all threads are present	
119		Send files to Haystack:	
120		scp <scanname>_*.vdif oper@evlbi1.haystack.mit.edu:/data-st11/vgos/	
121		Wait for confirmation from correlator that all data look good	
122		Continue Here if no test scan needed. For Bonn/Hays:	
123		Procedure to remove module for shipping:	
124		mk6=group=close:<slots>	
125		mk6=group=unmount:<slots>	
126		Turn key OFF on disk module	
127		mk6=mstat?all	
128		Procedure for e-transfer (all other Correlators):	
129		Leave module mounted and open	
130		Insert RAID module in any other slot and follow e-transfer instructions	
131		Transfer log session file	
132		log=station	
133		client=exit (this kills the local FS and closes all windows)	
134		From Login Shell	
135		plog –l This is an “L”	
136		cd ../log	
137		drudg <sched> (drudg vo1201wf.log) (prints module label for shipping)	
138		**Stow Antenna**	

	A	B	C
139		*On Thumper 2: Xterm Umbrla window:* **park** *then press enter*	
140		**Antenna should slew to AZ 180 El 45**	
141		**Turn off antenna system**	