

Scheduling a Geodetic VLBI Experiment using VieVS

1 Description

This exercise will give a short introduction to the possibilities of creating a geodetic VLBI schedule using the Vienna VLBI and Satellite Software (VieVS).

All IVS sessions are listed in a session master file which can be found here: <https://ivscc.gsfc.nasa.gov/sessions/2018/>. We want to schedule yesterdays session *CRDS94* with an geodetic point of view.

2 Starting VieVS

- start MATLAB
- browse to your VieVS folder **/VieVS/WORK*
- type *vievs* in the matlab command window

now VieVS should open

3 Select main scheduling parameters in VieVS

The scheduling GUI can be found at *Scheduling/General_setup*

- Select your participating stations in the “*Station Network*” panel. The “*Available*” list depicts all available antennas. Click on the antennas you want in your session and they will appear in the “*Selected*” list. You can save your list and it will appear in the “*Predefined*” list when you restart VieVS.

We want the following stations to participate in our session:

- HART15M
 - HARTRAO
 - HOBART26
 - KATH12M
 - WARK12M
 - YARRA12M
- In the “*Parameters*” panel specify the minimal distance for sources to the sun with 4 degrees. Because of atmospheric turbulences we use a cut-off elevation of 5 degrees. You can set the minimum strength of the sources which should be observed to 0.25 Jansky.
 - Select your session start time and duration in the “*Time options*” panel. Our session starts at 2018/03/21 at 18:00:00 and the duration is 24 hours.
 - Select the station-based strategy in the “*Strategy*” panel

Now everything should look like this:

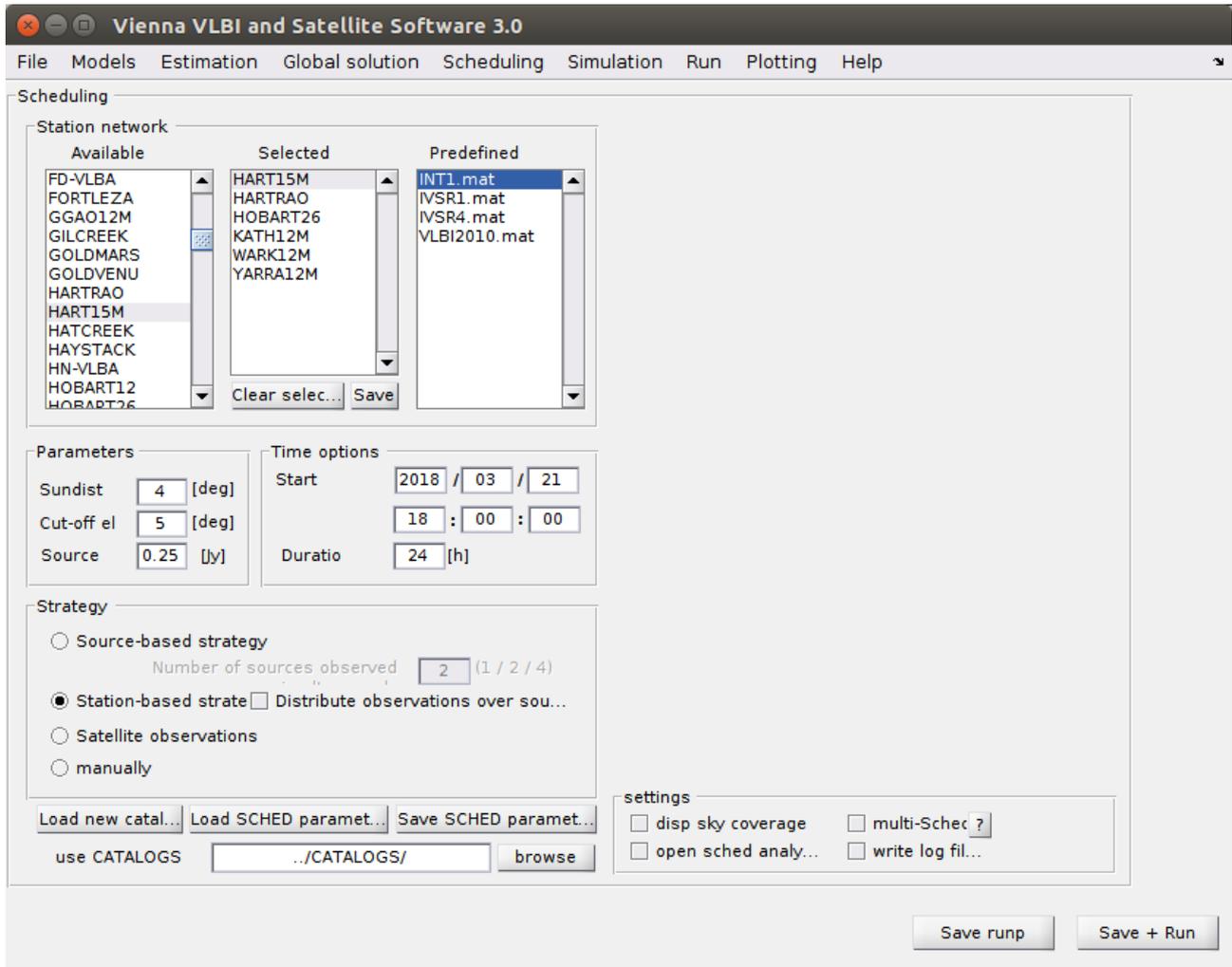


Figure 1: VieVS - Scheduling - General setup

additional comments:

- If the VieVS scheduling software starts you will get a lot of text displayed in the MATLAB command window. If you check “*write log file*” in the “*settings*” panel this output will not be written in the MATLAB command window, but in separate text files in your output directory (see section 9 of this exercise). You don’t need to select this option for this exercise.
- If you select “*disp sky coverage*” you will get an overview plot with the sky-coverage for each station. You don’t need to select this now, because this plot is also saved in your output directory (see section 9 of this exercise)
- You can also open a sched analyser software if you select “*open sched analyser*”. You can also start this software via *Plotting/Scheduling*

4 Select minor scheduling parameters in VieVS

Now browse to *Scheduling/Minor_parameters*

- Choose a nice experiment code name and description in “*General parameters*” panel
- Make sure the “*Create and use new source file*” checkbox is checked
- Make sure all options in the “*Output options*” panel are checked

The result should look like this:

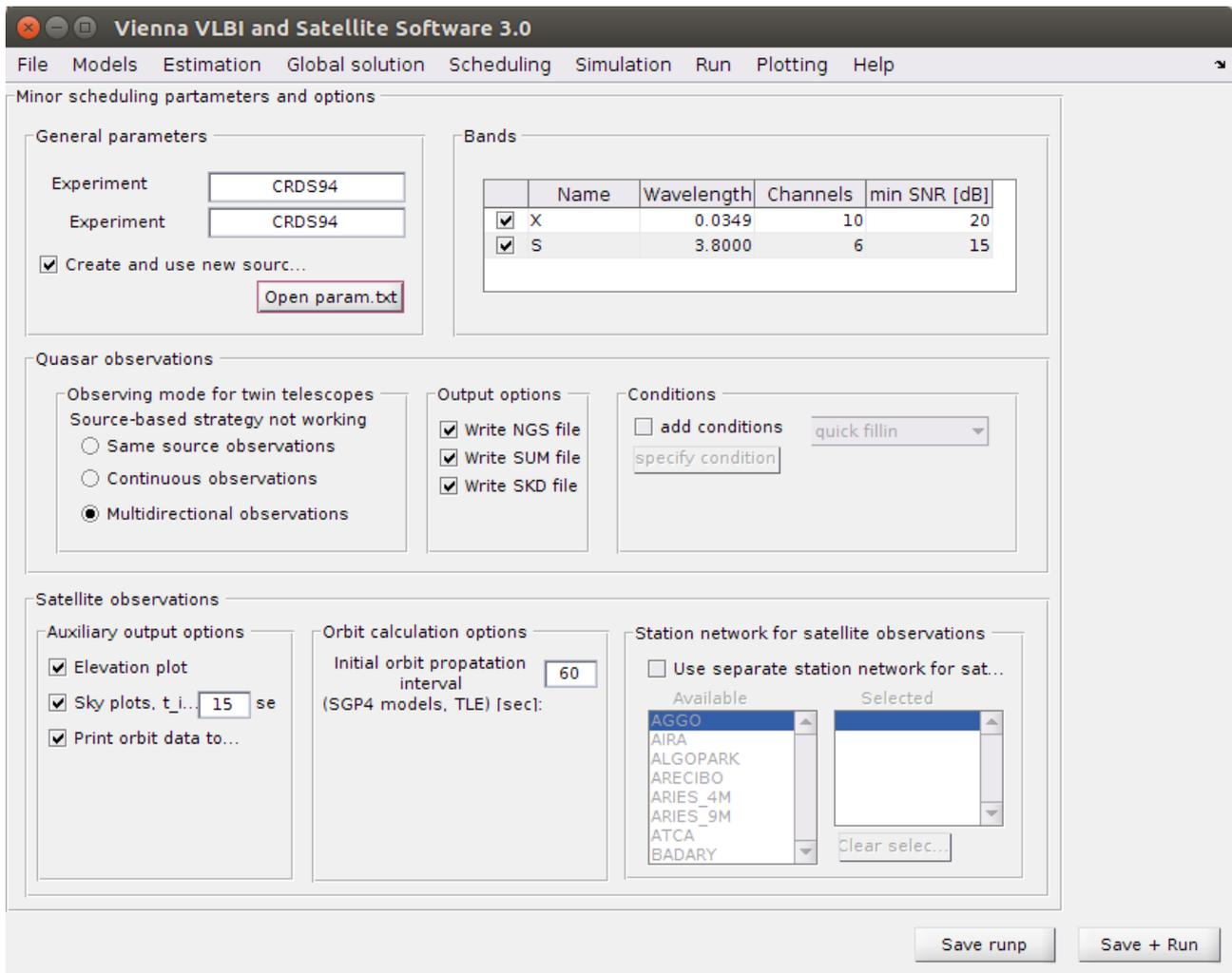


Figure 2: VieVS - Scheduling - Minor parameters

5 Minor scheduling parameters from param.txt

Press the button “param.txt” in the “*General parameters*” panel. Now an editor should open with a text file called param.txt. If this file looks strange open an explorer and browse to the following file `*/VieVS/CATALOGS/param.txt` right click this file and open it with a different editor like gedit/Notepad⁺⁺.

In this file you can specify dozens of other scheduling parameters. Some important are:

- **PARA.MIN_SRCRP** The interval that the same source won't be observed twice [min]
- **PARA.MAXSLEWTIME** Maximum time to allow an antenna to slew [sec]
- **PARA.MAX_WAIT** Maximum time to wait for the slow antenna [sec]
- **PARA.FILLINMODE** If use fill-in mode (0/1/2/12)
- **PARA.MAX_SCAN** Maximum allowable scan time [sec]
- **PARA.MIN_SCAN** Minimum allowable scan time [sec]
- **PARA.MIN_STASCAN** Minimum station number per scan
- **PARA.MIN_STANUM_FI** Minimum station number for fillin-mode
- **PARA.SUBNETTING** Number of created subnets (1/2)
- and many more ...

You can also find the very important weight factors here:

- **PARA.WEIGHT_NUMBER_OF_OBS** weight factor for number of baselines
- **PARA.WEIGHT_SKY_COVERAGE** weight factor for sky coverage
- **PARA.WEIGHT_SCAN_END_TIME** weight factor for scan end time

For this exercise everything should already be set up accordingly.

6 Start the scheduling process

Browse to *Run/Run options*

- in the “VieVS modules” panel, select only “*Run vie_sched*”
- specify a sub-directory for (intermediate) results

Now it should look like this:

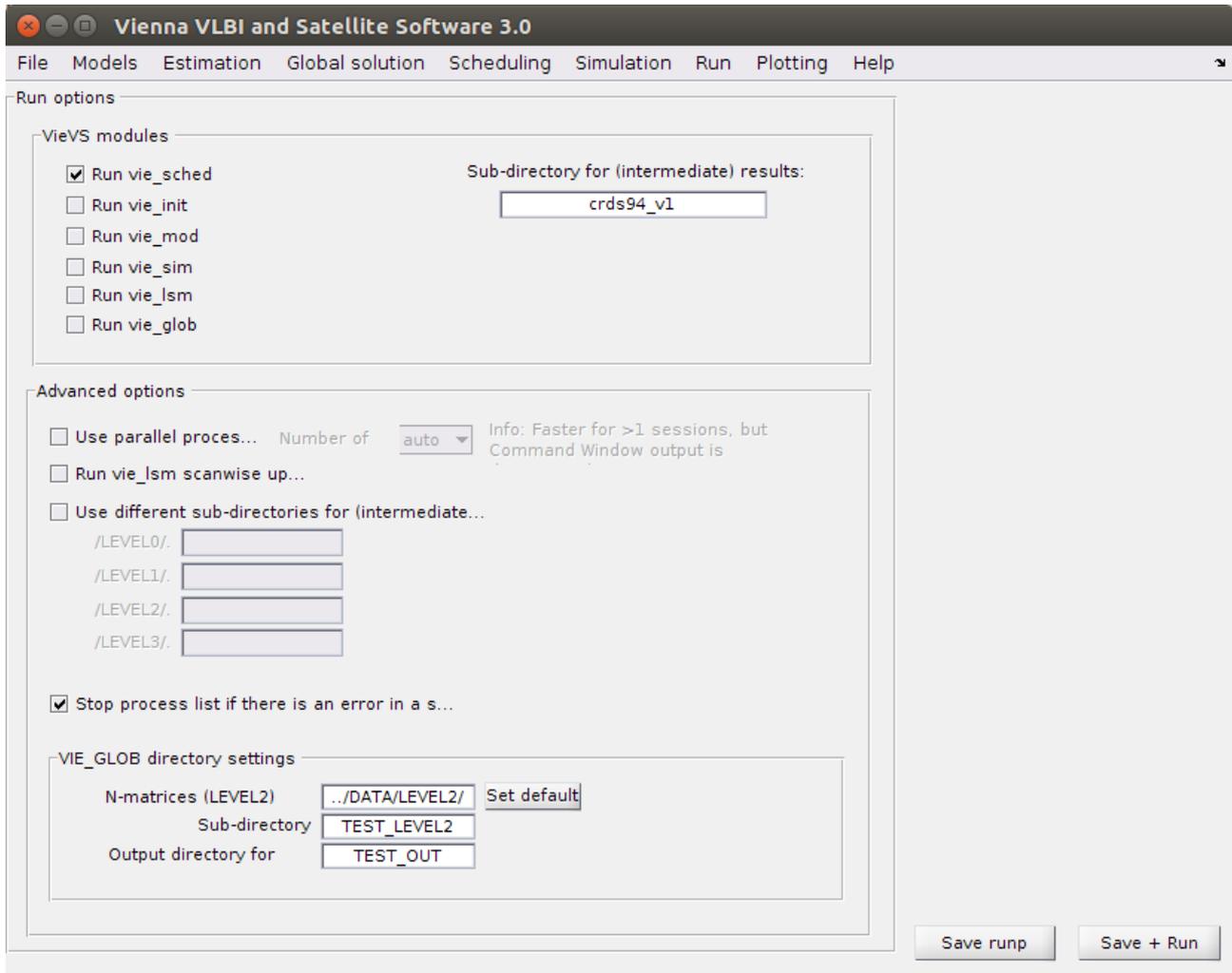


Figure 3: VieVS - Run - Run options

If everything looks fine press the “*Save + Run*” button at the bottom right. Now there should be a lot of text coming in the MATLAB command window.

7 VieVS input

- VieVS reads a lot of different CATALOG files from **/VieVS/CATALOGS*. These files contain all necessary information about the stations, sources and observation modes. Additionally some internal VieVS CATALOGS are used

This is a list of some important CATALOG files:

- **source.cat** Information where the sources are

```
0003-066 $          00 06 13.892888    -06 23 35.33533 2000.0 0.0  2010a glob
0048-097 $          00 50 41.317388    -09 29 05.21027 2000.0 0.0  ICRF2 def
```

- **flux.cat** Information how strong sources are, two formats “B” and “M”

```
1749+701 X B 0.0  0.37  900.0  0.31  1530.0  0.31  2600.0  0.29  4420.0  ...
1749+701 S B 0.0  0.39  900.0  0.36  1530.0  0.31  2600.0  0.22  4420.0  ...
```

- **anteanna.cat** Information about antenna type and cable wrap

```
*ID Name  Axis  Offset  Rate1 C1  Lim1  Lim1  Rate2  C2  Lim2  Lim2  ...
J HARTRAO  HADC  6.69220  24.0  45  -88.0  88.0  22.2  45  -89.0  45.0  ...
J HART15M  AZEL  1.47000  120.0  3  -185.0  275.0  60.0  3  2.0  88.0  ...
```

- **position.cat** Information about where antennas are

```
*ID Name          X (m)          Y (m)          Z (m)          Lon  Lat
Hh HARTRAO        5085442.77838  2668263.49215  -2768697.04037  332.31 -25.89
Ht HART15M        5085489.54000  2668160.83400  -2768691.93300  332.32 -25.89
```

- **equip.cat** Information about antenna equipment and SEFD

```
*Antenna  ID  DAT_Name  Heads  Tape_len  X  SEFD  S SEFD  SEFD param/Equip
HARTRAO   34  TDVS-VX1  2x56000 17640  X  1500  S 1300  none MARK5B
HART15M   Ht  HART15M  2x56000 17640  X  1400  S 1050  DBBC MARK5B
```

- and many more...

8 VieVS scheduling

- scheduling is done scan by scan
- VieVS tries all different possibilities, all sources and all possible network configurations → thousands of possibilities per scan → time consuming
- MATLAB command window displays information about scheduled scans
- “main” scans are called “*x-scan subnet*”
- first line is scan number, observed source, scan start time and number of stations in this sub-network
- after first line information about all participating stations is displayed. Station name, slew time in seconds, idle time in seconds, observation time in seconds
- observation time is different for each baseline
- if there is a lot of idle time between “main” scans, there is the possibility to squeeze in “fill-in” scans

```
=====
----- 2-scan subnet ----- (sched: 199)
scan 296 0104-408 2017-09-14 00:19:53 #sta: 3
HART15M 20slew--> 101idle--> 44obs
HARTRAO 228slew--> 21idle--> 54obs
YARRA12M 17slew--> 0idle--> 54obs
scan 297 1334-127 2017-09-14 00:20:16 #sta: 3
KATH12M 24slew--> 84idle--> 23obs
WARK12M 41slew--> 67idle--> 20obs
HOBART12 40slew--> 0idle--> 23obs
=====
----- fill in 1 scan ----- (sched: 200)
scan 298 0J287 2017-09-14 00:21:58 #sta: 4
HOBART12 31slew--> 33idle--> 20obs
KATH12M 39slew--> 25idle--> 20obs
WARK12M 34slew--> 33idle--> 20obs
YARRA12M 55slew--> 0idle--> 20obs
----- 1-scan subnet ----- (sched: 201)
scan 299 0458-020 2017-09-14 00:24:13 #sta: 5
HART15M 119slew--> 81idle--> 45obs
HARTRAO 190slew--> 0idle--> 55obs
HOBART12 45slew--> 154idle--> 55obs
KATH12M 48slew--> 151idle--> 51obs
YARRA12M 72slew--> 118idle--> 38obs
=====
```

9 VieVS output

- After the scheduling process finishes some statistics are displayed and an independent check runs to verify all slew and observation times.
- The output files are created in **/VieVS/DATA/SCHEM/*your_subdirectory_name**

Your output files contain:

- .skd file: This is your main result where all necessary information about your schedule is saved. It contains several blocks, most of these blocks are copies from the corresponding CATALOG files. Important is the \$SKED block

```
$SKED
1034-293 10 8F PREOB 17256180000      48 MIDOB      0 POSTOB ...
... W-HW ... YNN 48 48
3C446 10 8F PREOB 17256180000      46 MIDOB      0 POSTOB ...
... J-A-K-Y- ... 26 32 46 46
1057-797 10 8F PREOB 17256180139     124 MIDOB      0 POSTOB ...
... HWKWW-YW ... 101 115 124 124
2113+293 10 8F PREOB 17256180307      36 MIDOB      0 POSTOB ...
... J-A- ... YNN 36 36
0458-020 10 8F PREOB 17256180504      76 MIDOB      0 POSTOB ...
... H-K-WWY- ... 61 76 76 67
```

- skdsum file: Summary file, containing some source and station based statistics.
- NGS file: Empty observation file which lists all observed baselines. Because we don't have any observations everything is set to zero. It is used in other VieVS modules to simulate observations.

```
WARK12M HOBART12 1034-293 2017 09 13 18 00 0.0000000000 101
000000.00000000 .00000 -000000.0000000000 .00000 0 I 102
.00000 .00000 .00000 .00000 0.0000000000000000 0. 103
.00 .0 .00 .0 .00 .0 .00 .0 104
-.00000 -.00000 .00000 .00000 .00000 .00000 105
0.000 00.000 000.000 000.000 00.000 00.000 0 0 106
0.0000000000 .00000 -.0000000000 .00000 0 108
0.00000000 .00000 0.0000000000 .00000 0 I 109
```