

Ambiguity Resolution in the Single Session Analysis Using VieVS

Presented by Peter Urban on September 15, 2026, at 1:30 p.m.

If you have any questions regarding ambiguity resolution in VieVS, do not hesitate to contact me:

Peter Urban

peter.urban@geo.tuwien.ac.at

1 Description

This exercise provides a brief introduction to the calculation of the ambiguity resolution for X/S sessions and to the use of them for VLBI analysis within VieVS. At first, the ambiguity resolution for the X- and S-band has to be calculated. On the basis of this two solution, the ionospheric calibration can be determined and used for VLBI analysis. In this exercise, the IVS session R41205 will be analyzed. To get more information about VLBI sessions, e.g. correlation and analysis reports, visit the IVS homepage "<https://ivscc.gsfc.nasa.gov/sessions/>".

2 Before you start

- Download VieVS from "<https://github.com/TUW-VieVS>".
The VLBI and Common directory is needed.
- Download "20250501-r41205.tgz" from the folder "*PU*" at TU Wien Cloud or alternatively from "<https://ivscc.gsfc.nasa.gov/sessions/2025/r41205/>" and save it to the folder *VieVS/VLBI/DATA/vgosDB/2025*.

3 Starting VieVS

- Start MATLAB
- Browse to your VieVS working directory *VieVS/VLBI/WORK/*
- Type "*views*" in the MATLAB command window
- Now VieVS should open, and the welcome panel appears.

4 Download EOP and VMF3 files

Type in the white box of the welcome panel “2025” and select “Download” to download the EOP, VMF3 and NTAL/VIE files for this year.

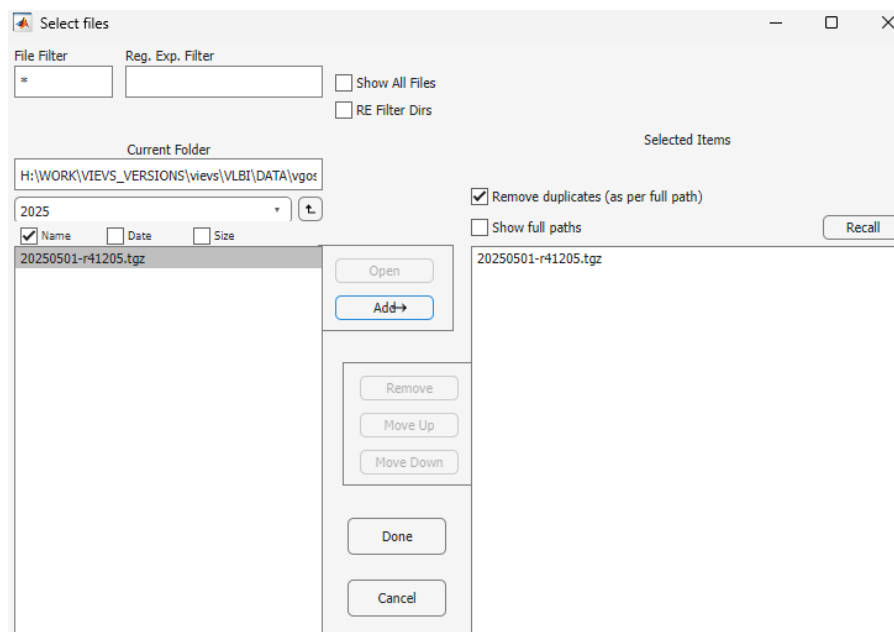


The download process is finished when this text appears in the Matlab Command Window:

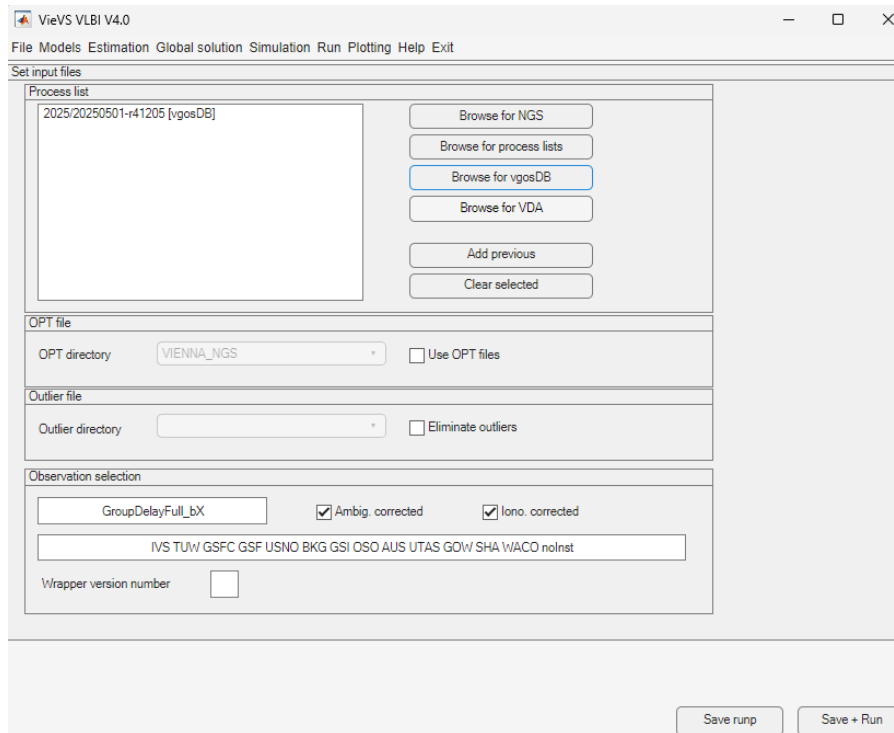
```
EOP files successfully written to ../EOP/.  
VMF3 and NTAL files downloaded successfully.  
>>
```

5 Select input files and preparation

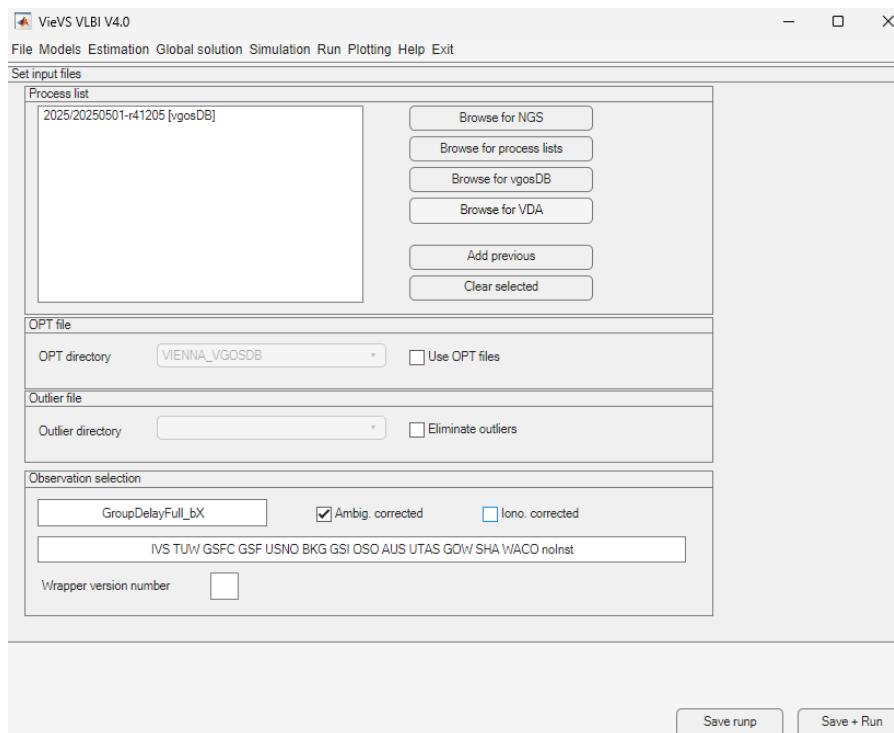
Select the menu “File/Set input files”. Select “Browse for VGOS-DB”. Add the “20250501-r41205” session (IVS-R41205) vgosDB file from the 2025 folder. If it is listed in *Selected Items*, click “Done”.



Now, the file should be listed in the “*Process list*”.



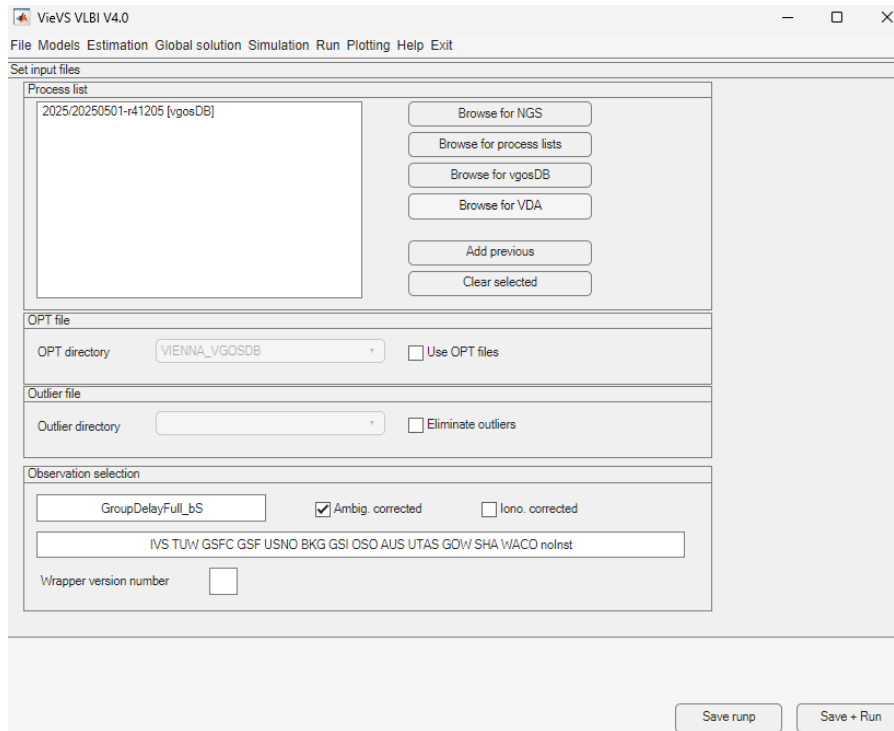
Select the menu “*File/Parameter Files/Load parameters*” and load the file “vie2025b_dsnx.mat”.



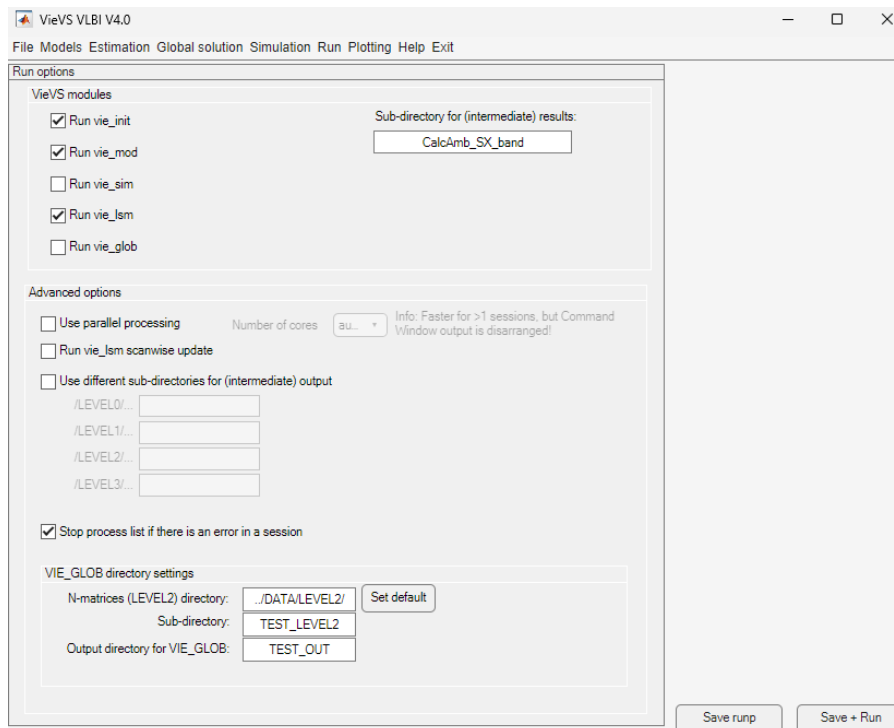
The next step is to deselect the checkbox “*Use OPT files*” and the checkbox “*Iono. corrected*”. Now, the preparation process is finished.

6 Ambiguity Correction in the S-band

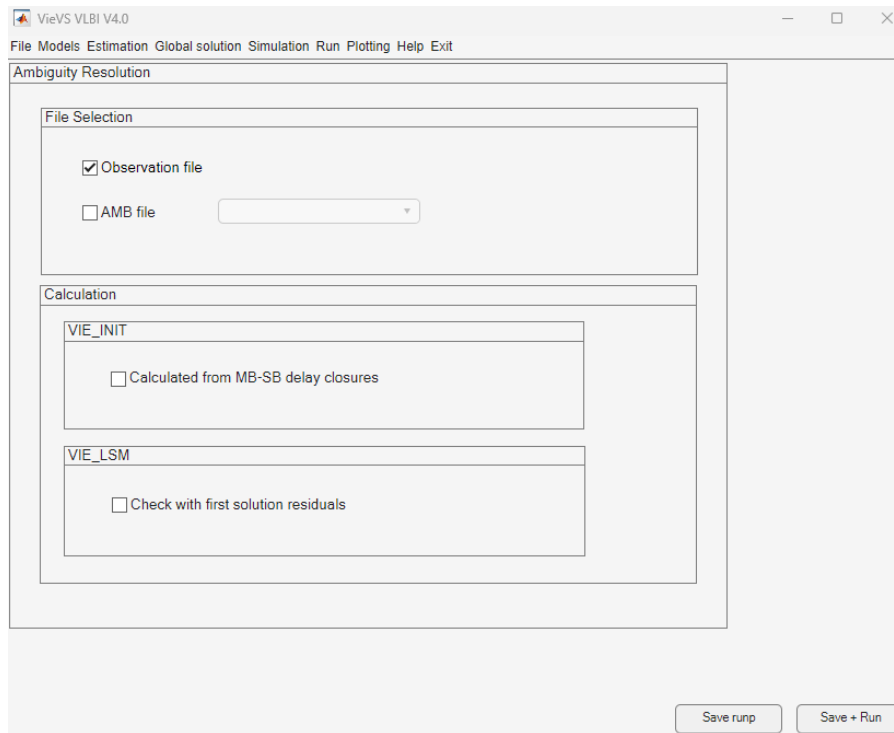
In the Observation selection, “*GroupDelayFull_bX*” needs to be changed to “*GroupDelayFull_bS*”:



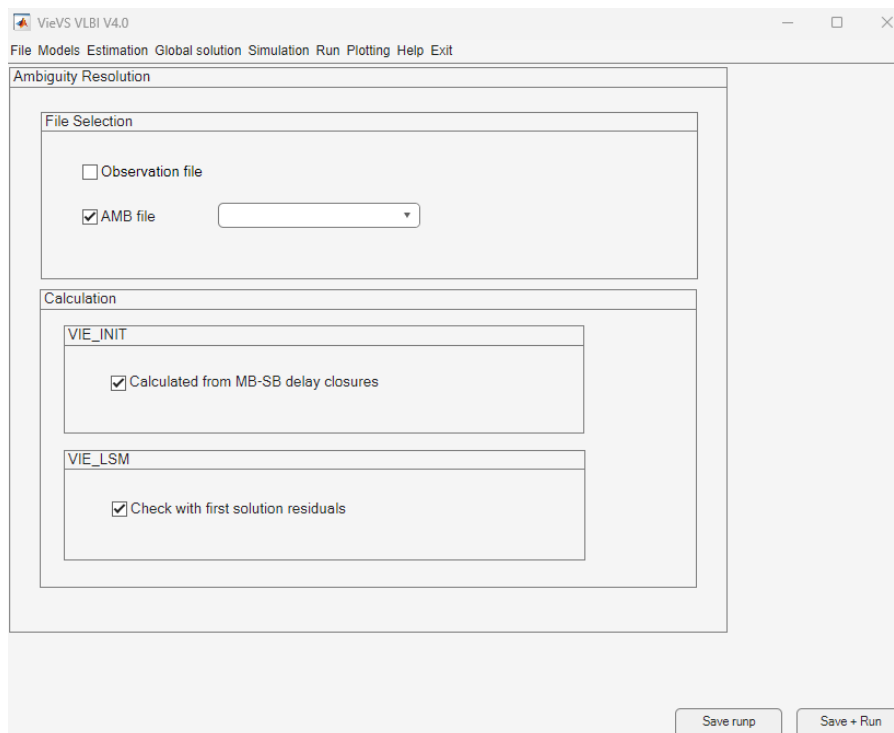
Select the menu “*Run/Run options/*” and type in a name for the sub-directory for the results (e.g.: “*CalcAmb_SX_band*”):



Select the menu “*Models/Ambiguities/*”. The default configuration stored in the parameter file “*vie2025b-dsnx.mat*” uses the ambiguities provided in the vgosDB. This setting is indicated by the “*Observation file*” checkbox:

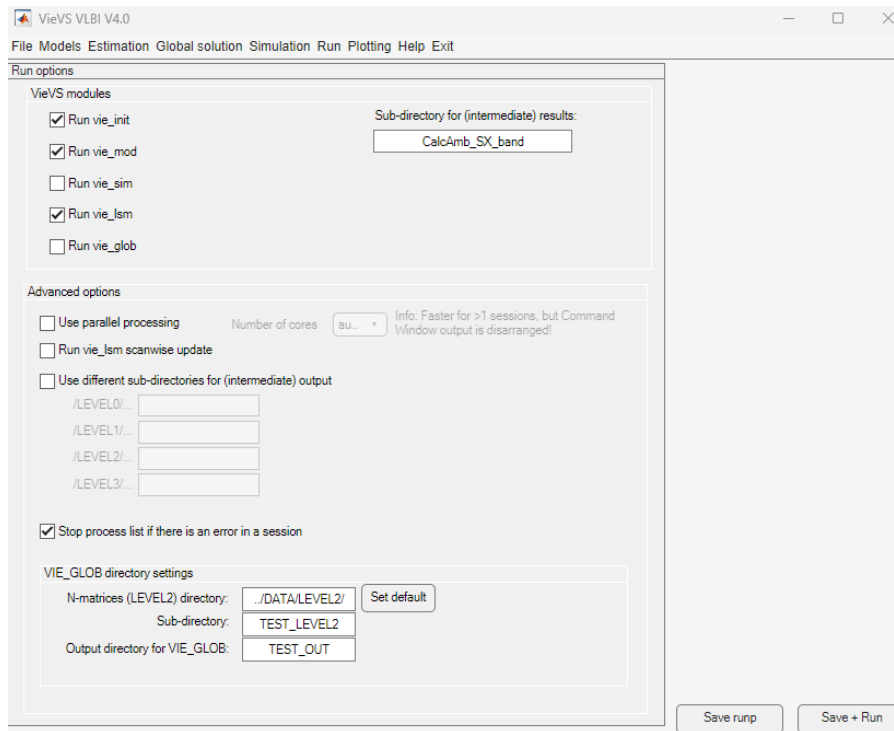


The next step is to deselect the checkbox “*Observation file*”. Then the other 3 checkboxes need to be selected:



The option “*AMB file*” stores the resolved ambiguities and uses existing ambiguities in the predefined subdirectory, although any other existing subdirectory can also be selected. The option “*Calculated from MB–SB delay closures*” performs ambiguity resolution in VIE_INIT based on multiband–single-band delay differences using closure relations. Finally, the option “*Check with first solution residuals*” verifies the ambiguity solution after the initial adjustment and applies minor corrections in VIE_LSM if some ambiguities were still remaining after the closure process.

Select the menu “*Run/Run options/*” and then click on the button “*Save + Run*” in order to run all 3 modules:



Then the following output appears in VIE_INIT:

```

-----
|                               Welcome to VIE_INIT                               |
-----

Set wrapper tag to default: all
Set wrapper version to default: highest_version
Reading wrapper: H:\WORK\VIEVS_VERSIONS\views\VLBI\DATA\vgosDB\2025\20250501-r41205\20250501-r41205_V005_iIVS_kall.wrp
vgosdb data source:
  observation:  ObsEdit/GroupDelayFull_bS_V001, nc field: GroupDelayFull
  sigma:       Observables/GroupDelay_bS, nc field: GroupDelaySig
  Iono corr: off
  Ambig corr: directly calculated in VieVS
               All closures are below the closure limit of 50 ns.
               Ambiguity list not available: ../DATA/AMB/CalcAmb_SX_band/20250501-r41205_S.AMB
               A total of 321 ambiguities were found.
               Ambiguities written to ../DATA/AMB/CalcAmb_SX_band/20250501-r41205_S.AMB
  Ambig corr: finished after 1.0 seconds
  Ambig corr: used from .amb-file
...reading the vgosDB file finished!

```

This appears in VIE_LSM with a detected ambiguity correction for one observation in the residual correction:

```

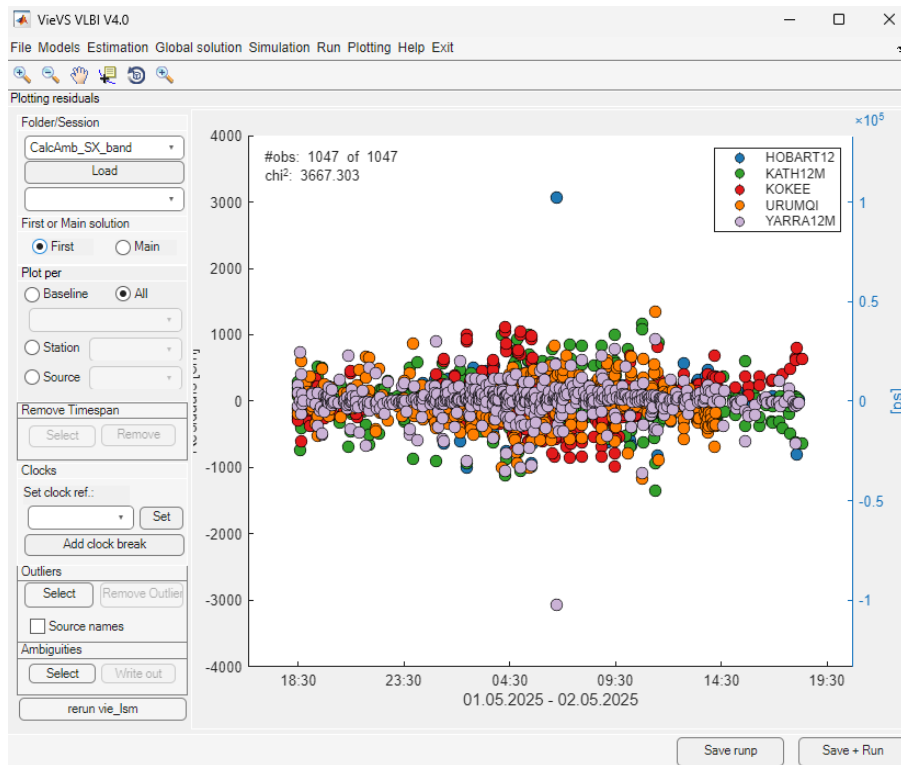
Ambiguities Residual Correction: On
Check ambpace: 100.0000 ns ... Success! Ambiguities found with ambspacing 100.0000 ns.
               HOBART12 YARRA12M 60797.280196759260 0420-014 100

Writing SINEX file ...
remove tidal UT
re-add tidal UT
SINEX file is saved as ../DATA/SNX/CalcAmb_SX_band/20250501-r41205_vie2025b.snx

-----
chi-squared of main solution vTPv/degOfFreedom: 353.798
WRMS of post-fit residuals sqrt(v_realTPv_real/sumOfWeights): 70.936 cm (2366.157 ps)
-----

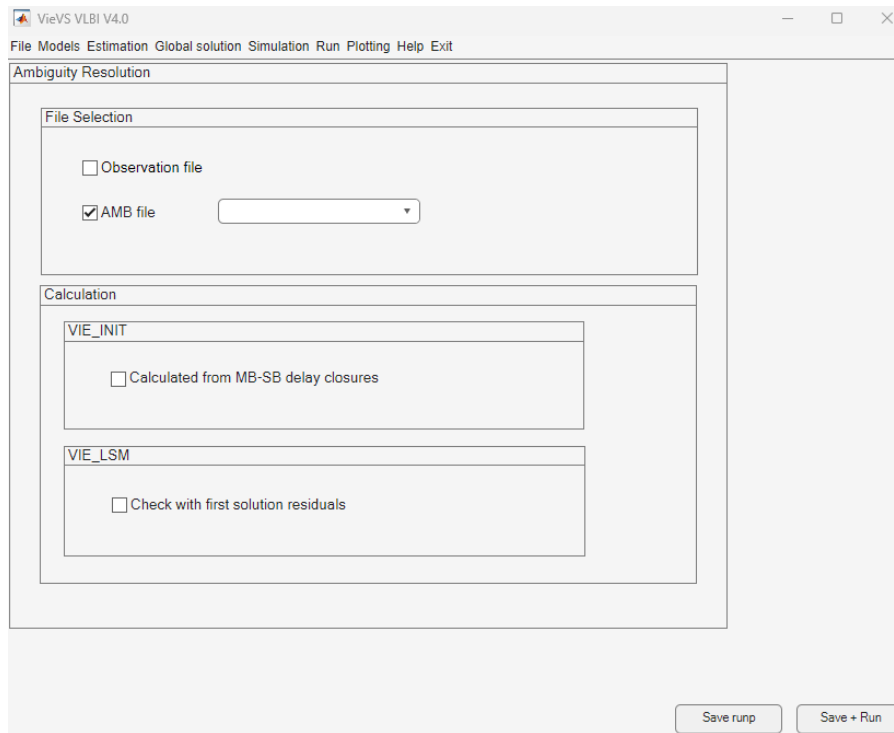
```

Now select the menu “Plotting/Residuals/” and then choose the Folder/Session “CalcAmb_SX_band” and click on “Load”. Then go to “First” to view the First Solution.



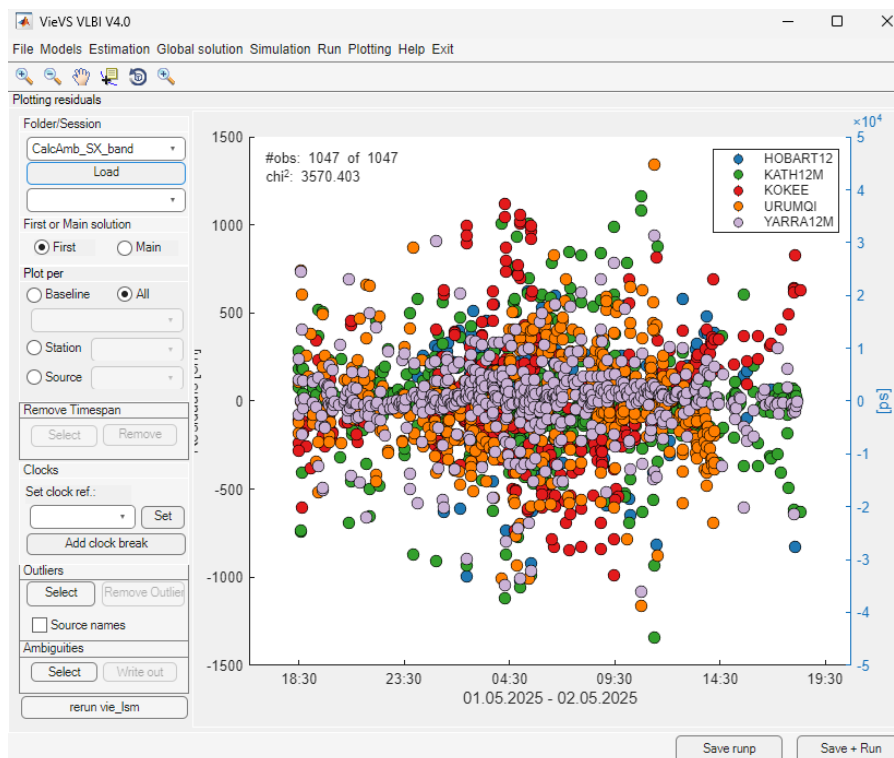
In order to correct the detected ambiguity for this observation, VIE_LSM is needed again. Please go to the menu “Run/Run options/” and deselect the 2 checkboxes “Run vie_init” and “Run vie_mod”:

Select the menu “Models/Ambiguities/”. Please deselect the 2 checkboxes “Calculated from MB-SB delay closures” and “Check with first solution residuals”.



Then click on the button “*Save + Run*”.

Now select the menu “*Plotting/Residuals/*” and then choose the Folder/Session “*CalcAmb_SX_band*” and click on “*Load*”. Then go to “*First*” to view the First Solution.

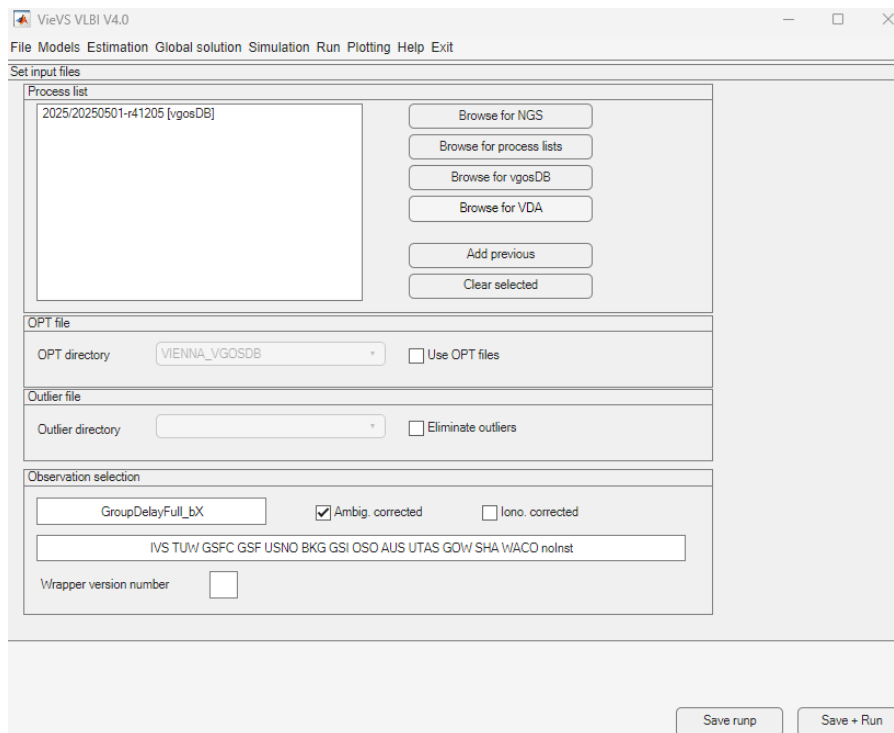


Now the Ambiguity Resolution for the S-band is finished. The AMB file “20250501-r41205_S.AMB” (txt-file) can be found in the folder *VieVS/VLBI/DATA/AMB/CalcAmb_SX_band*.

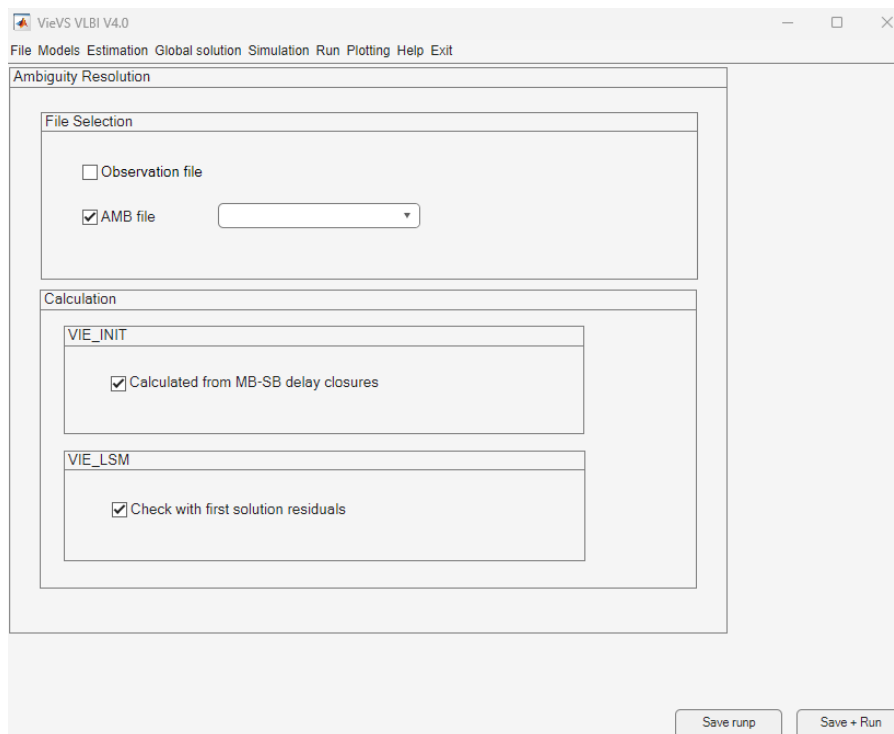
7 Ambiguity Correction in the X-band

Now, the same process has to be done for the X-band.

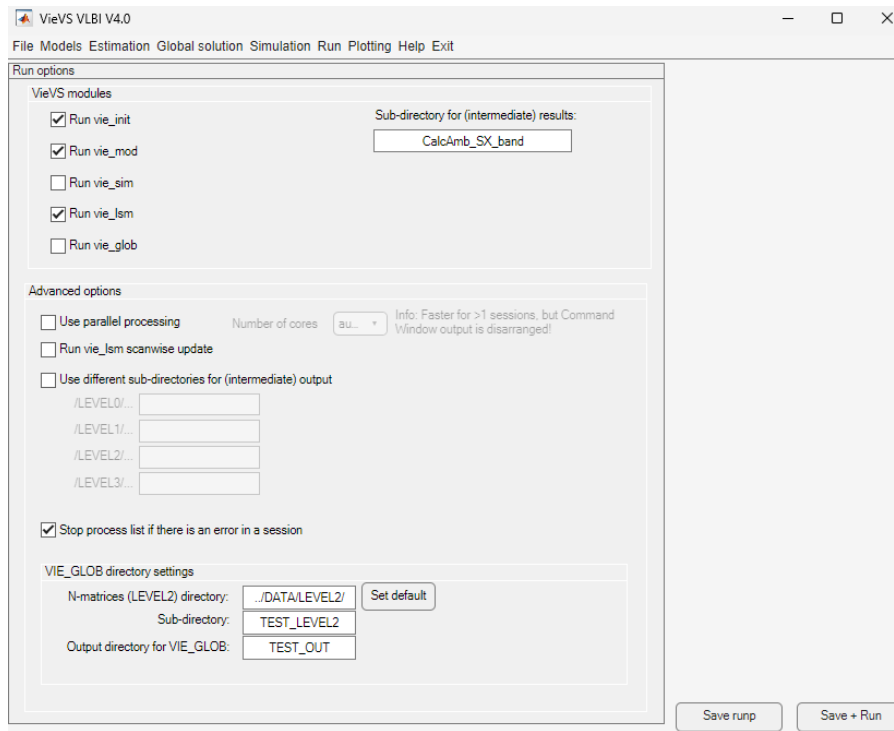
Select the menu “*File/Set input files*”. In the Observation selection, “*GroupDelayFull_bS*” needs to be changed to “*GroupDelayFull_bX*”:



Select the menu “*Models/Ambiguities/*”. The next step is to select 2 more checkboxes “*Calculated from MB-SB delay closures*” and “*Check with first solution residuals*”.



Select the menu “*Run/Run options/*” and select 2 more checkboxes “*Run vie_init*” and “*Run vie_mod*”:



The sub-directory for the results stays the same like for the S-band calculation (e.g.: “*CalcAmb_SX_band*”). Then click on “*Save + Run*”.

The following output appears in VIE_INIT:

```

-----
|                               Welcome to VIE_INIT                               |
-----

Set wrapper tag to default: all
Set wrapper version to default: highest_version
Reading wrapper: H:\WORK\VIEVS_VERSIONS\views\VLBI\DATA\vgosDB\2025\20250501-r41205\20250501-r41205_V005_iIVS_kall.wrp
vgosdb data source:
  observation:  ObsEdit/GroupDelayFull_bX_V001, nc field: GroupDelayFull
  sigma:        Observables/GroupDelay_bX, nc field: GroupDelaySig
  Iono corr: off
  Ambig corr: directly calculated in VieVS
    All closures are below the closure limit of 25 ns.
    Ambiguity list not available: ../DATA/AMB/CalcAmb_SX_band/20250501-r41205_X.AMB
    A total of 140 ambiguities were found.
    Ambiguities written to ../DATA/AMB/CalcAmb_SX_band/20250501-r41205_X.AMB
  Ambig corr: finished after 1.0 seconds
  Ambig corr: used from .amb-file
...reading the vgosDB file finished!

```

This appears in VIE_LSM where for several observations an ambiguity correction was detected:

```

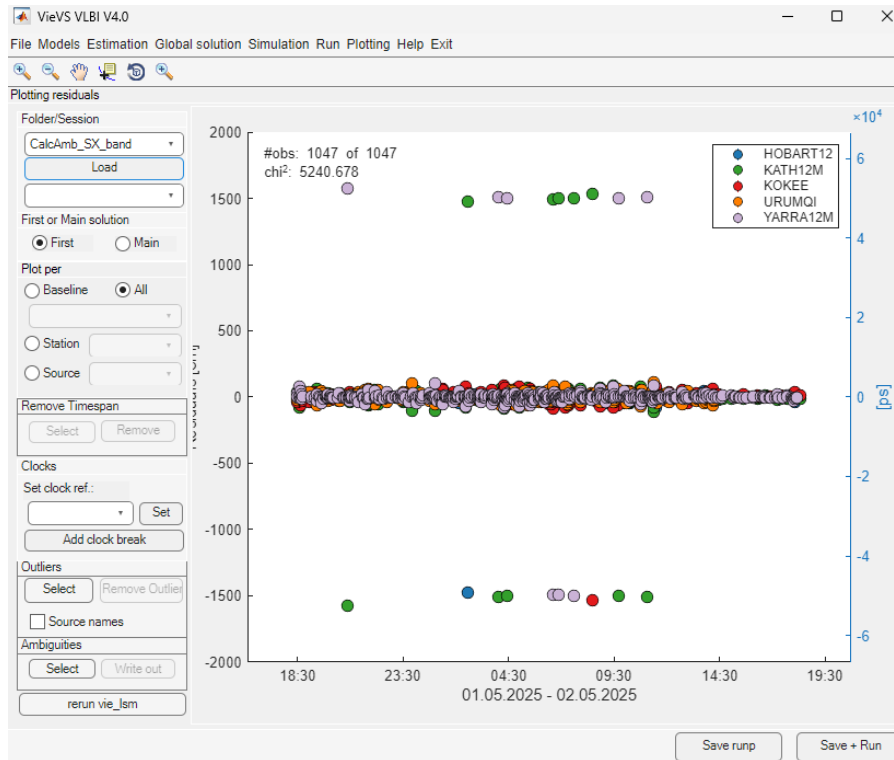
Ambiguities Residual Correction: On
Check ambspace: 50.0000 ns ... Success! Ambiguities found with ambspacing 50.0000 ns.
  KATH12M YARRA12M 60796.870486111118 0308-611 -50
  HOBART12 KATH12M 60797.106793981489 0119+115 -50
  KATH12M YARRA12M 60797.167858796296 0727-115 -50
  KATH12M YARRA12M 60797.185266203705 0119+115 -50
  KATH12M YARRA12M 60797.276412037034 1104-445 50
  KATH12M YARRA12M 60797.285740740743 1144-379 50
  KATH12M YARRA12M 60797.316030092588 1034-293 50
  KATH12M KOKEE 60797.352962962963 0812+367 50
  KATH12M YARRA12M 60797.404652777775 1144-379 -50
  KATH12M YARRA12M 60797.461805555555 1213-172 -50

Writing SINEX file ...
remove tidal UT
re-add tidal UT
SINEX file is saved as ../DATA/SNX/CalcAmb_SX_band/20250501-r41205_vie2025b.snx

-----
chi-squared of main solution vTPv/degOfFreedom: 4478.391
WRMS of post-fit residuals sqrt(v_realTPv_real/sumOfWeights): 57.402 cm (1914.715 ps)
-----

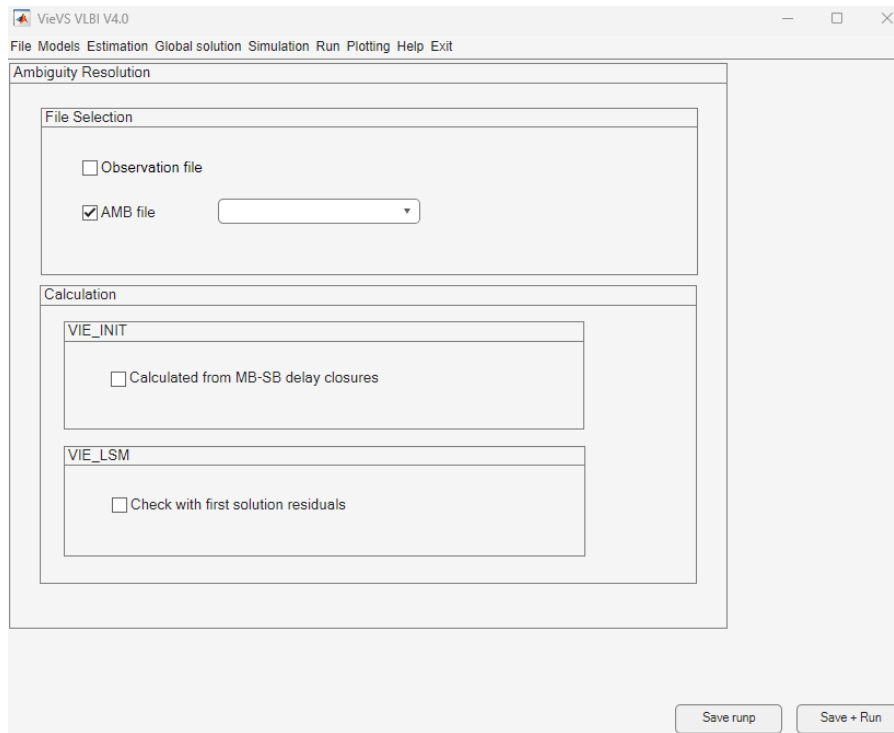
```

Now select the menu “*Plotting/Residuals/*” and then choose the Folder/Session “*CalcAmb_SX_band*” and then click on “*Load*”. Then go to “*First*” to view the First Solution. Here, all detected ambiguities from VIE_LSM can be seen:



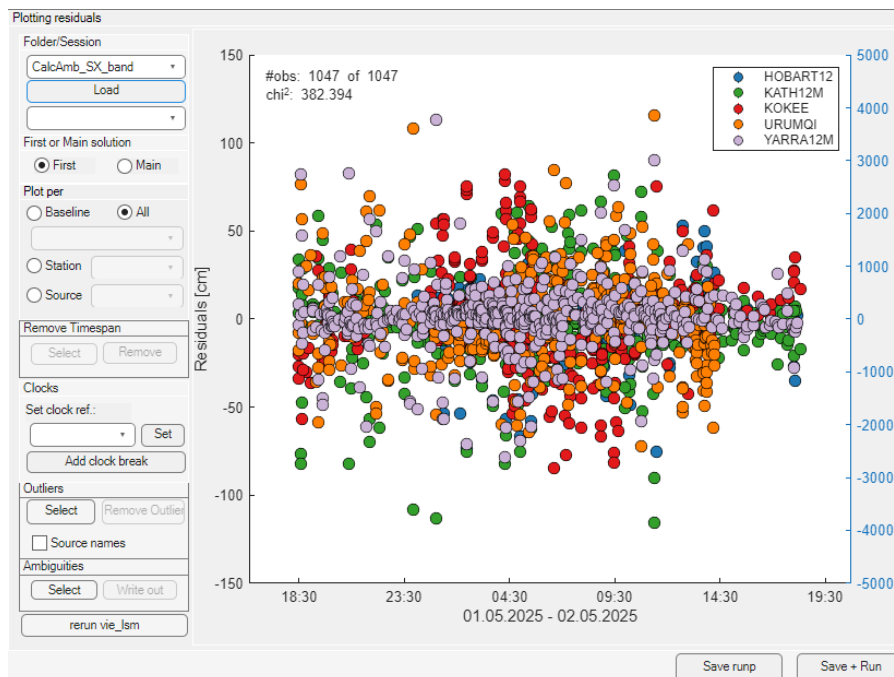
In order to correct the detected ambiguities, VIE_LSM is needed again. Please go to the menu “*Run/Run options/*” and deselect the 2 checkboxes “*Run vie_init*” and “*Run vie_mod*”:

Select the menu “*Models/Ambiguities/*”. Please deselect the 2 checkboxes “*Calculated from MB-SB delay closures*” and “*Check with first solution residuals*”.



Then click on the button “*Save + Run*”.

Now select the menu “*Plotting/Residuals/*” and then choose the Folder/Session “*CalcAmb_SX_band*” and click on “*Load*”. Then go to “*First*” to view the First Solution.

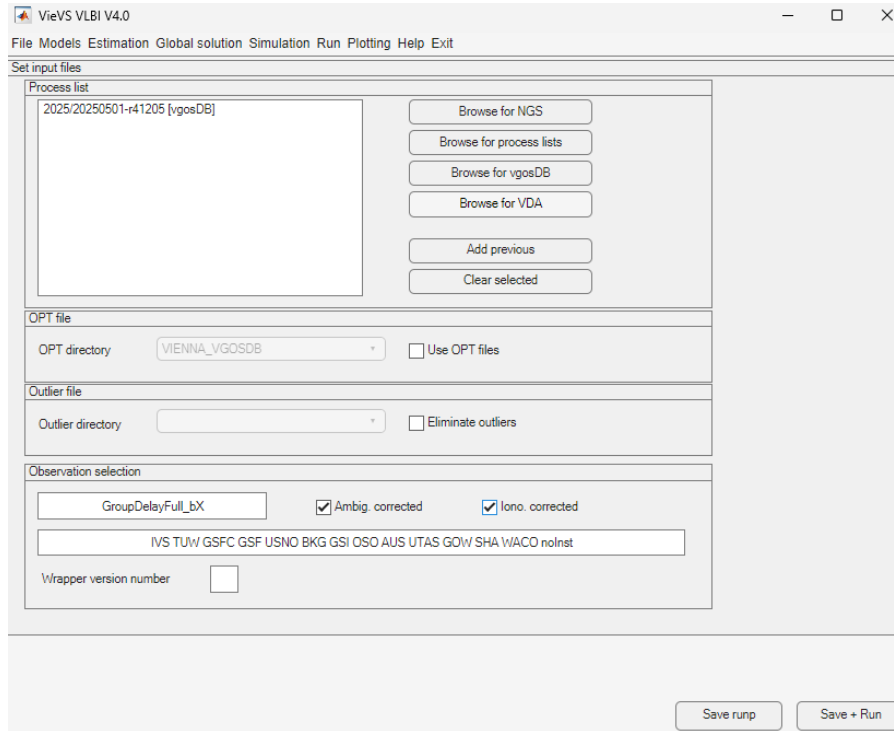


Now the Ambiguity Resolution for the X-band is finished. The AMB file “20250501-r41205_X.AMB” (txt-file) can be found in the folder *VieVS/VLBI/DATA/AMB/CalcAmb_SX_band*.

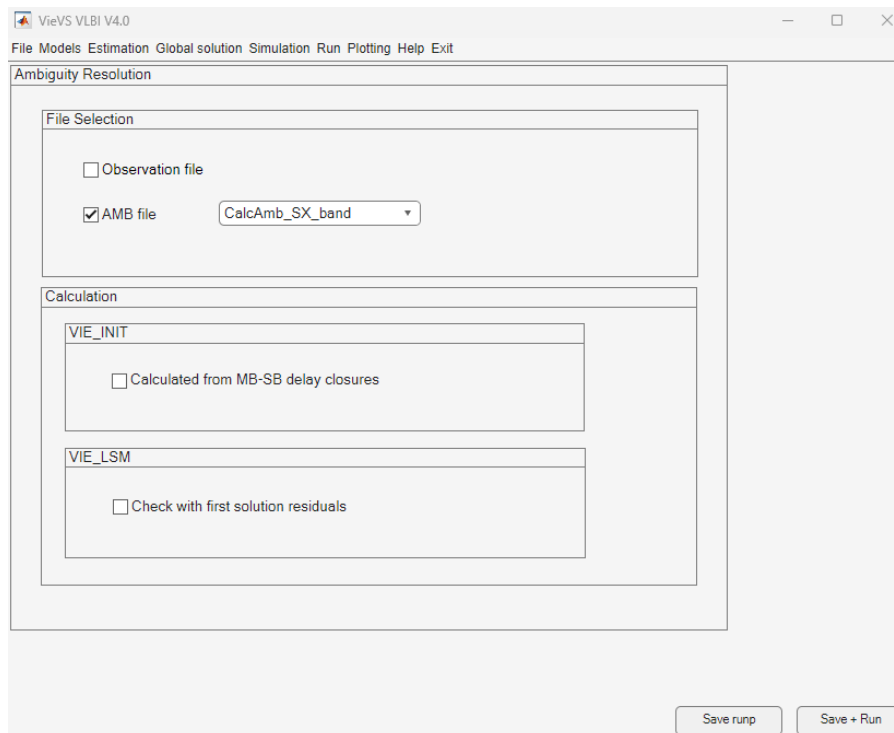
8 Ionospheric correction calculated with Ambiguities from VieVS

Select the menu “*File/Set input files*”.

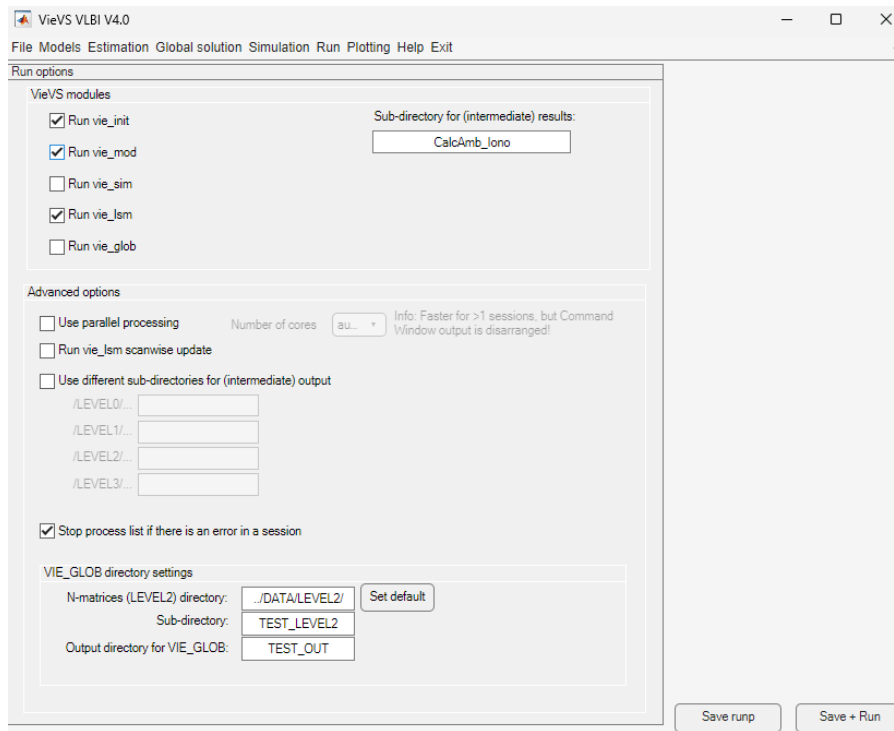
The next step is to select the checkbox “*Iono. corrected*”.



Select the menu “*Models/Ambiguities/*”. Select the menu “*File/Reload folders/*”. Then choose for the “*AMB file*” the folder “*CalcAmb_SX_band*” where the calculated X/S band AMB files are stored.



Select the menu “*Run/Run options/*” and select 2 more checkboxes “*Run vie_init*” and “*Run vie_mod*” and change the sub-directory to e.g. “*CalcAmb-Iono*”:



Then click on “*Save + Run*”.

The following output appears in VIE_INIT:

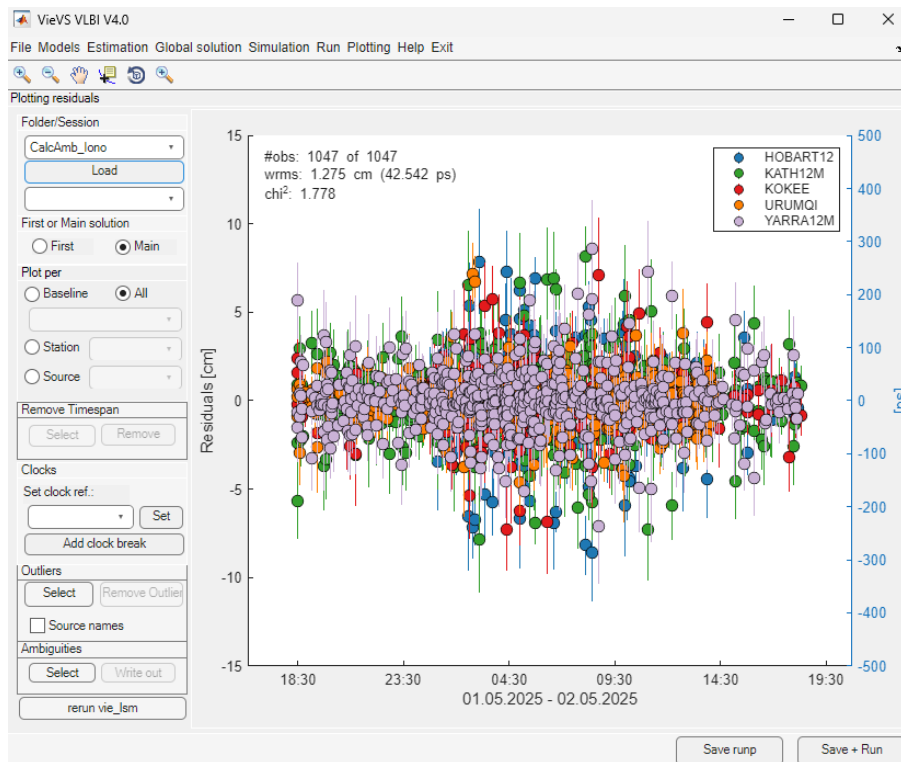
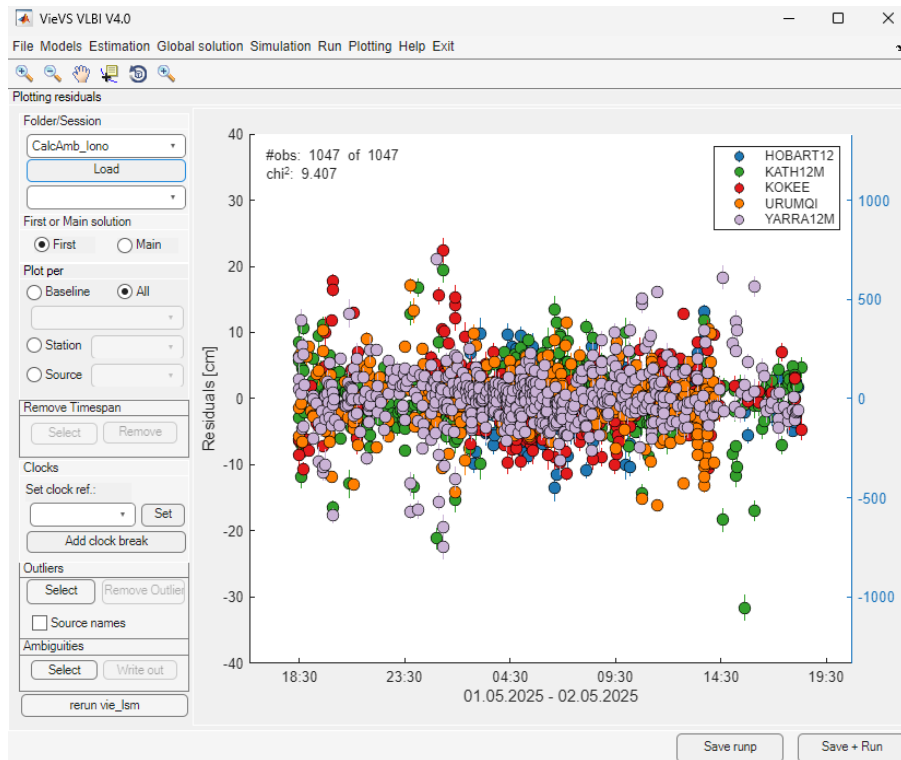
```

-----
|                               Welcome to VIE_INIT                               |
-----

Set wrapper tag to default: all
Set wrapper version to default: highest_version
Reading wrapper: H:\WORK\VIEVS_VERSIONS\views\VLBI\DATA\vgosDB\2025\20250501-r41205\20250501-r41205_V005_iIVS_kall.wrp
vgosdb data source:
  observation:  ObsEdit/GroupDelayFull_bX_V001, nc field: GroupDelayFull
  sigma:       Observables/GroupDelay_bX, nc field: GroupDelaySig
  Iono corr: on
- No nc file with ionosphere corrections defined in the selected wrapper file!
  Iono corr: directly calculated in VieVS
  Ambig corr: used from .amb-file
...reading the vgosDB file finished!

```

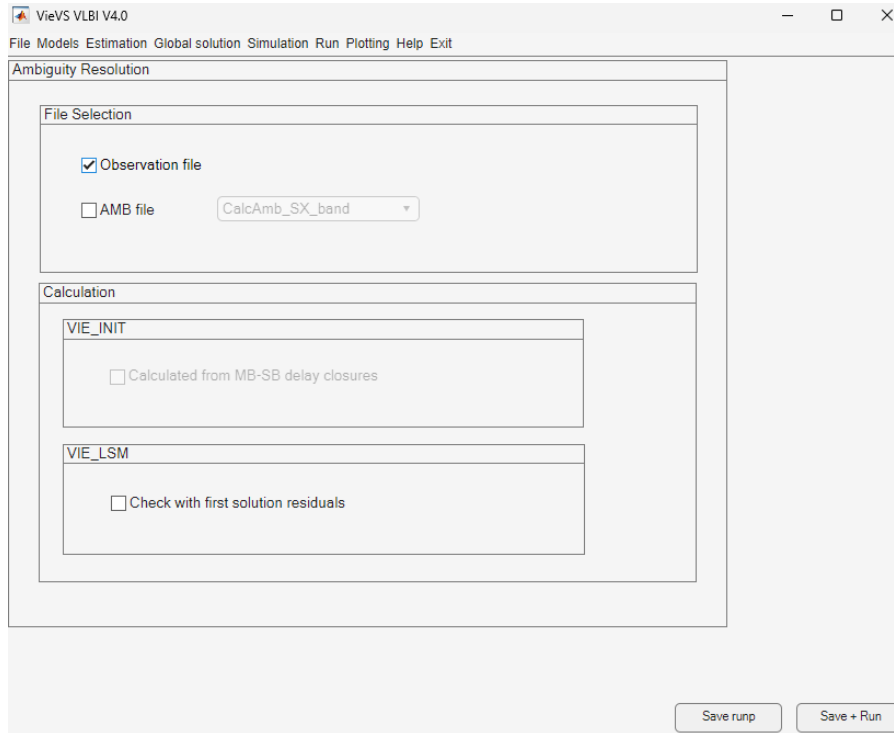
Now select the menu “*Plotting/Residuals/*” and then choose the Folder/Session “*CalcAmb_Iono*” and click on “*Load*”. Then go to “*First*” and “*Main*” to view the First and Main Solution.



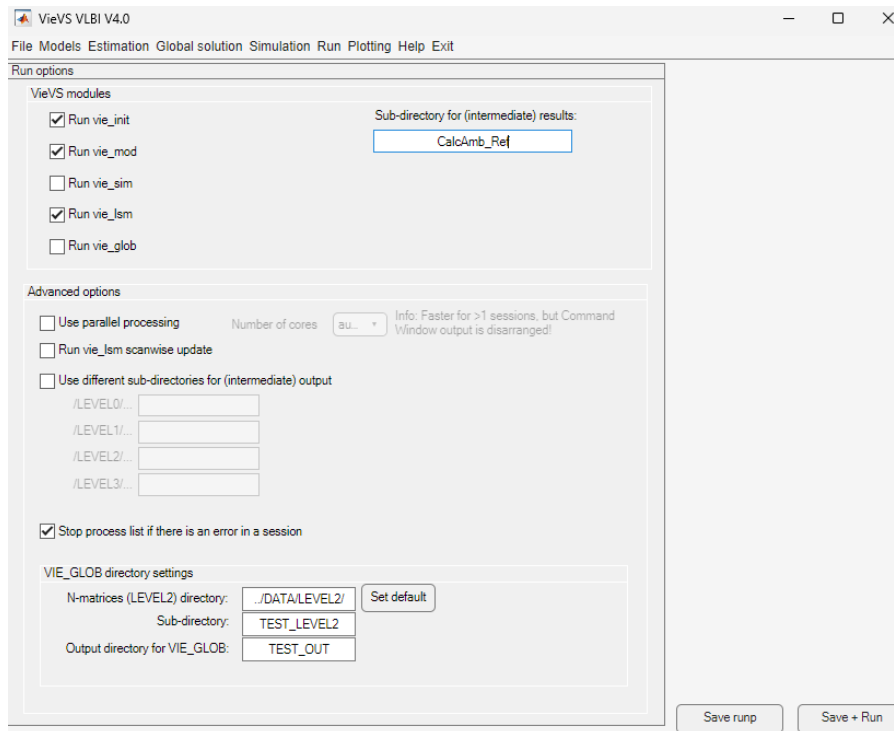
Now the VLBI Analysis is finished. No ambiguities can be seen in the first solution residuals, and the ionospheric calibration was calculated based on the X/S-band AMB files.

9 Check with Ambiguities from vgosDB

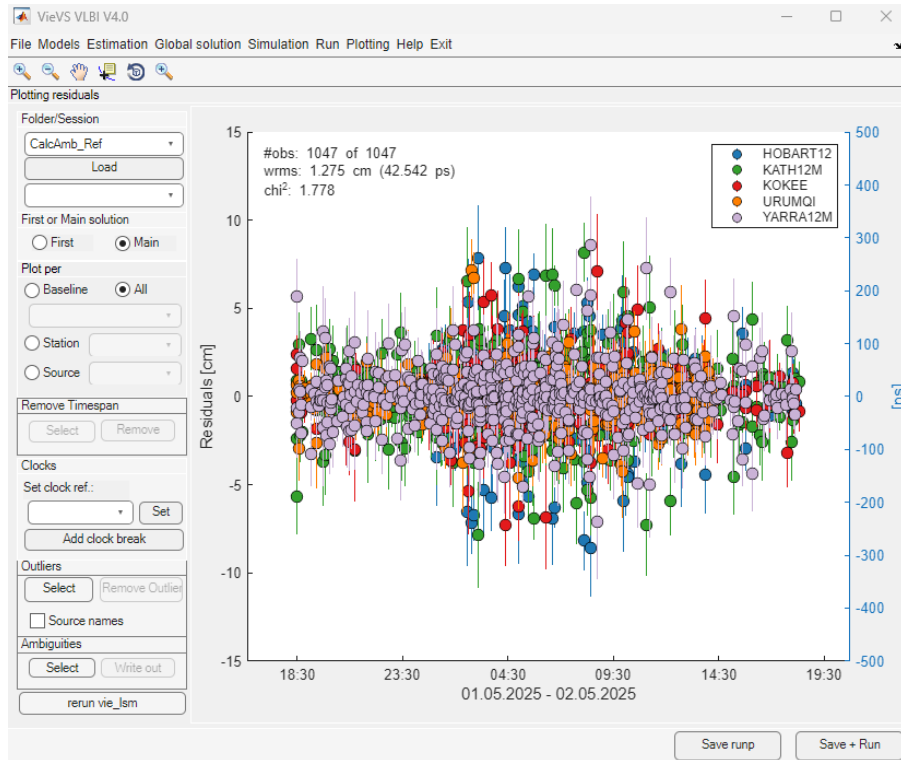
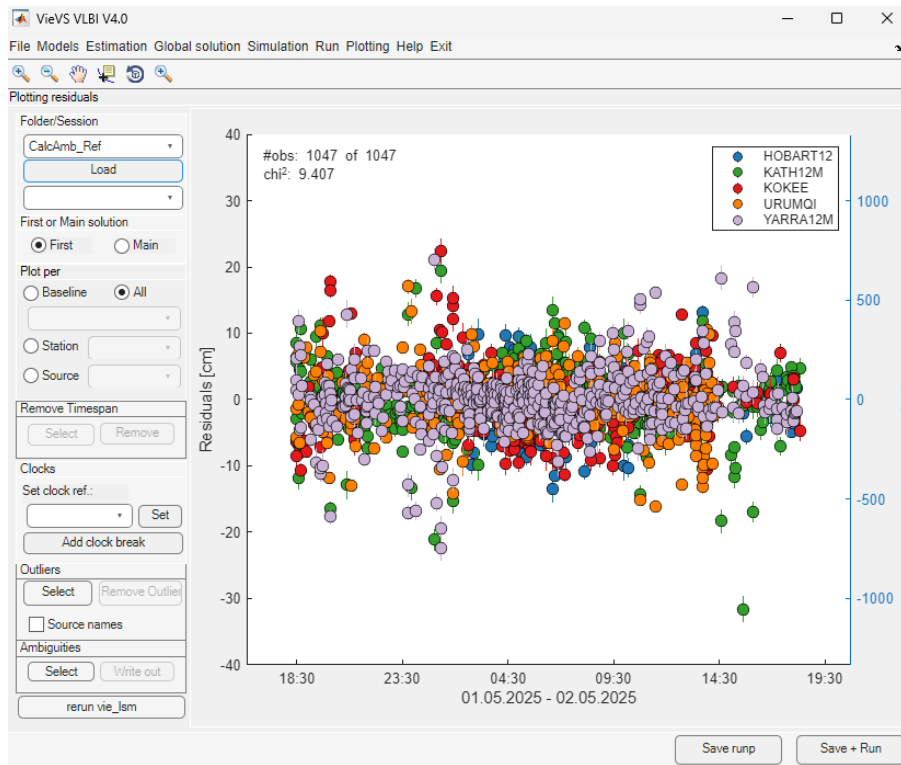
Select the menu “*Models/Ambiguities/*”. Then deselect the checkbox “*AMB file*” and select the checkbox “*Observation file*” to use the ambiguities of the vgosDB.



Select the menu “*Run/Run options/*” and change the sub-directory to e.g. “*CalcAmb_Ref*”:



Then Click on “*Save + Run*”. Now select the menu “*Plotting/Residuals/*” and then choose the Folder/Session “*CalcAmb_Ref*” and click on “*Load*”. Then go to “*First*” and “*Main*” to view the First and Main Solution.



The reference solution is identical to the solution of the calculated ambiguities with VieVS.