Status quo and future plans for the Vienna VLBI Software (VieVS)

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Introduction

The Vienna VLBI Software VieVS has been developed by the VLBI group at the Vienna University of Technology since 2008. VieVS is designed for the analysis of geodetic VLBI observation data as well as for scheduling and simulation of different VLBI sessions. The software incorporates the latest IERS Conventions and uses the concept of continuous piecewise linear offsets at integer hours for the parameter setup, consistent with the terms of reference of the GGOS. We present the status of the software focusing on the capabilities of the newest release 2.2.

VieVS structure
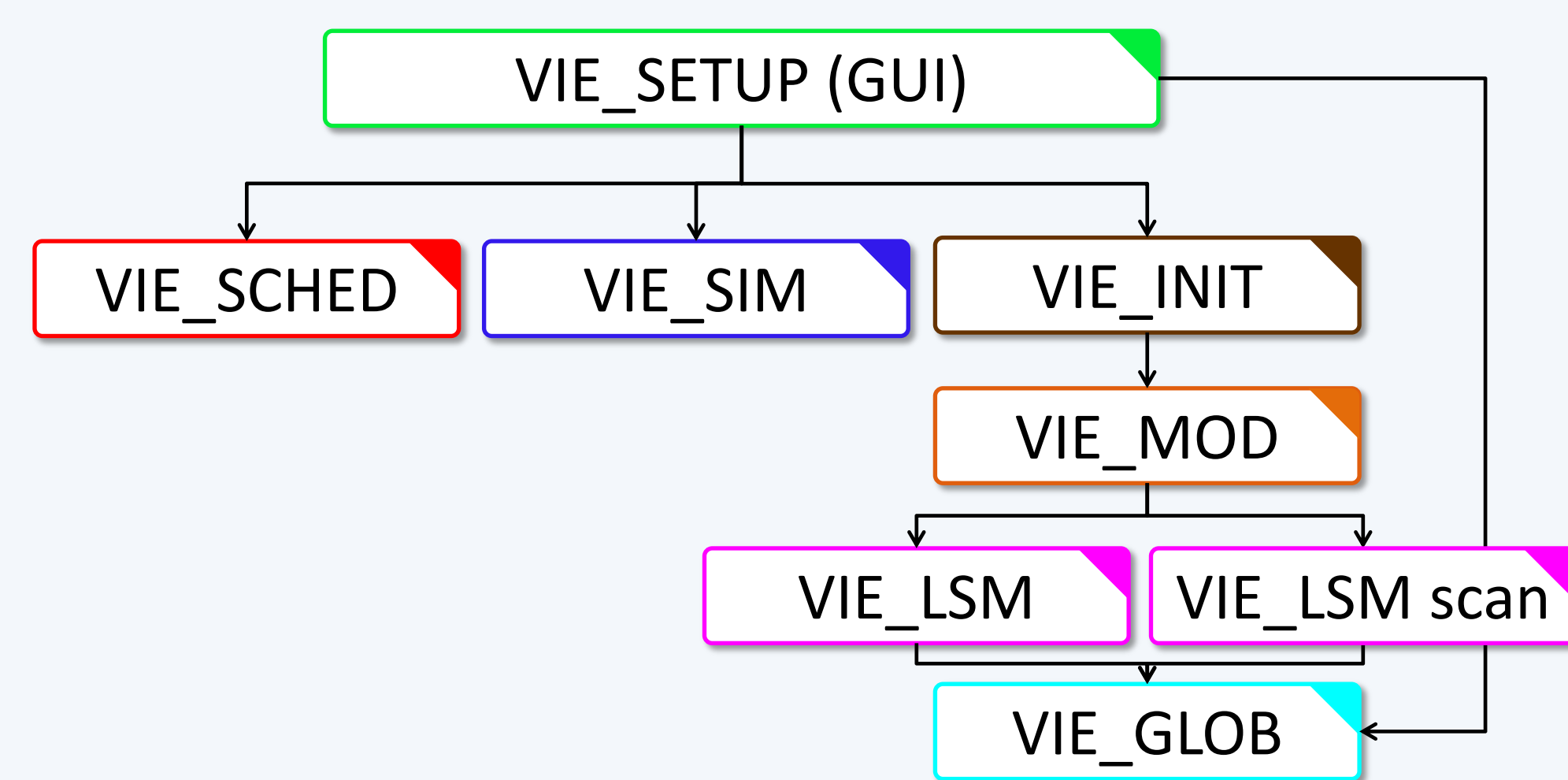
VIE_SETUP
- The processing setup is realized in one common graphical user interface (GUI).
- Start single session solution as well as single modules (scheduling, simulation, global solution).

VIE_SCHED
- Scheduling of observations → ngs-files for simulation, skd-files for antenna steering.

VIE_SIM
- Simulation of observations from real sessions or sessions scheduled with VIE_SCHED.

VIE_INIT
- Reading of observations, station coordinates and velocities, source coordinates.
- Removing of outliers and bad observations, exclusion of stations, sources or baselines.

VIE_MOD
- Calculation of theoretical delay and partial derivatives.
- Accounting for station corrections.

VIE_LSM & VIE_LSM scan
- Computation of least squares adjustment (inversion of whole design matrix or scan-wise update of normal equation matrix).
- Setup and storing of normal equations for global solution.

VIE_GLOB
- Stacking of single session normal equations to obtain global parameters.
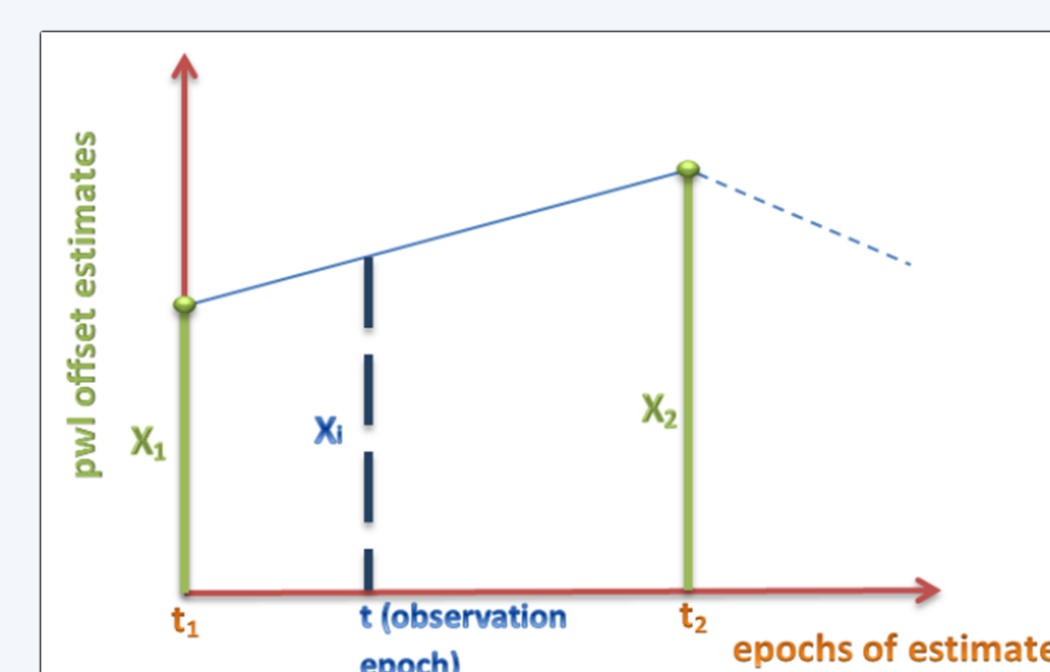
VieVS features

Session analysis
Single session analysis
Select session and parameters via a simple GUI.
Estimate Parameters as continuous piece-wise linear offsets:
- EOP
- Station and source coordinates
- Zenith wet delays
- Clock offsets

$$x_i = x_1 + \frac{(t - t_1)}{(t_2 - t_1)}(x_2 - x_1)$$

Multi session analysis
Analysis of a predefined process list with the same parameterisation

Scheduling and simulation
Scheduling
- Prepare schedules for VLBI observing sessions automatically
- Include twin telescopes
- Station- or source based strategy
- AUST sessions are scheduled with VIE_SCHED

Simulation
- Monte-carlo-simulations
- Simulated parameters:
- ➢ Clocks
- ➢ White noise
- ➢ Troposphere
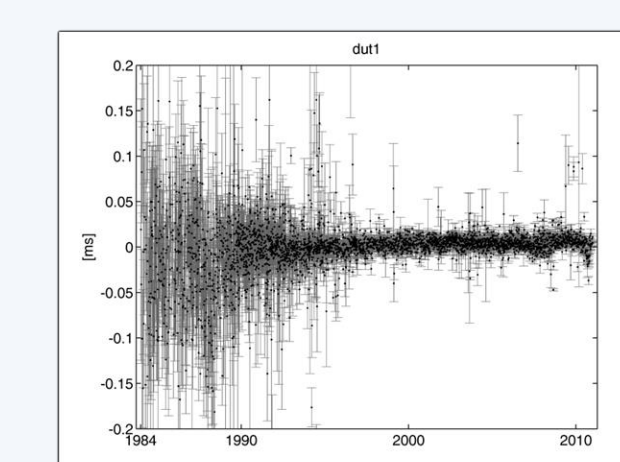- ➢ Source structure simulator

Global Solution
Estimate parameters which are common to all VLBI sessions
- Station coordinates and velocities (TRF)
- Source coordinates (CRF)
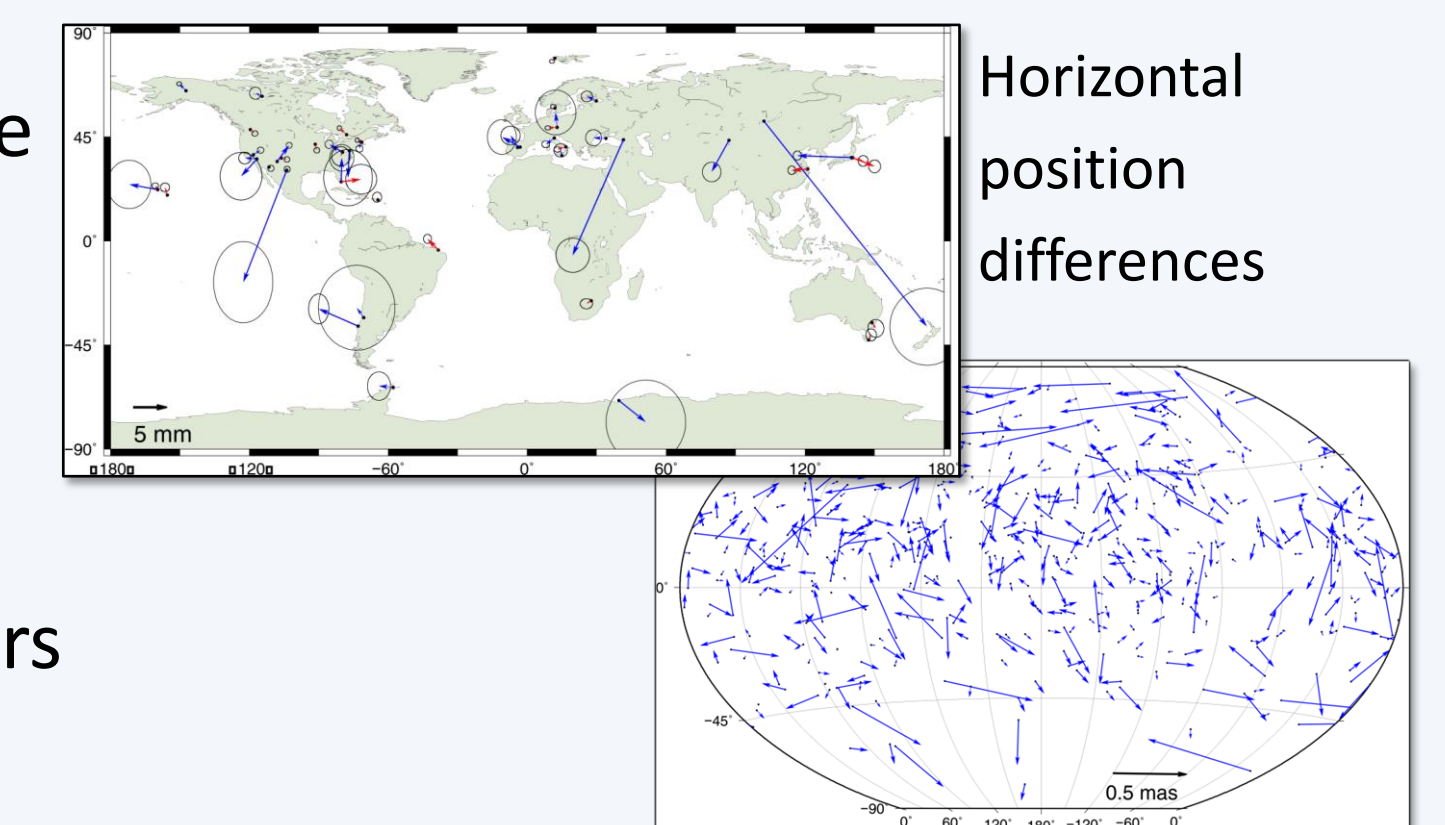- Earth orientation parameters EOP

Backwards solution for reduced parameters:
- Tropospheric delays, gradients
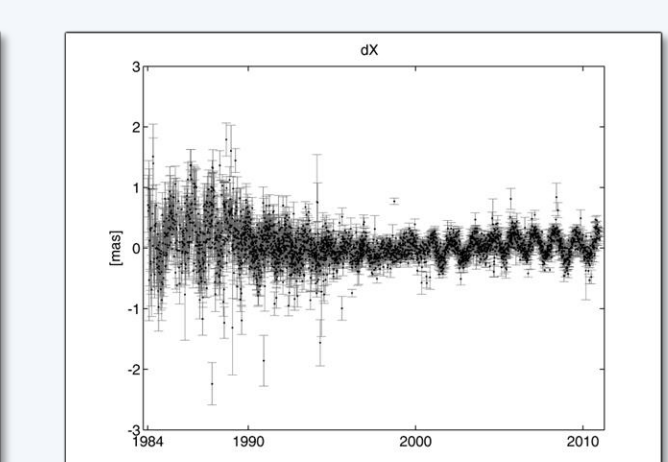- Station and source coordinates
- EOP e.g.:

Horizontal position differences

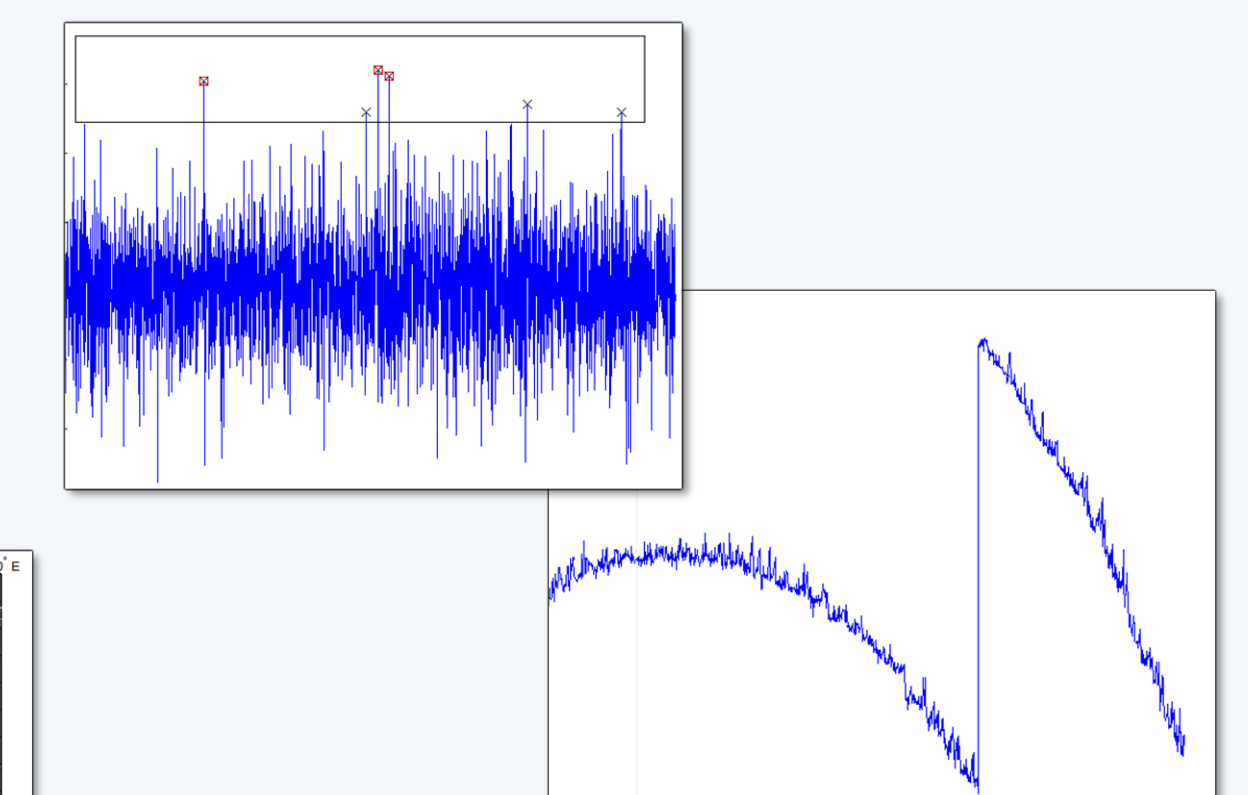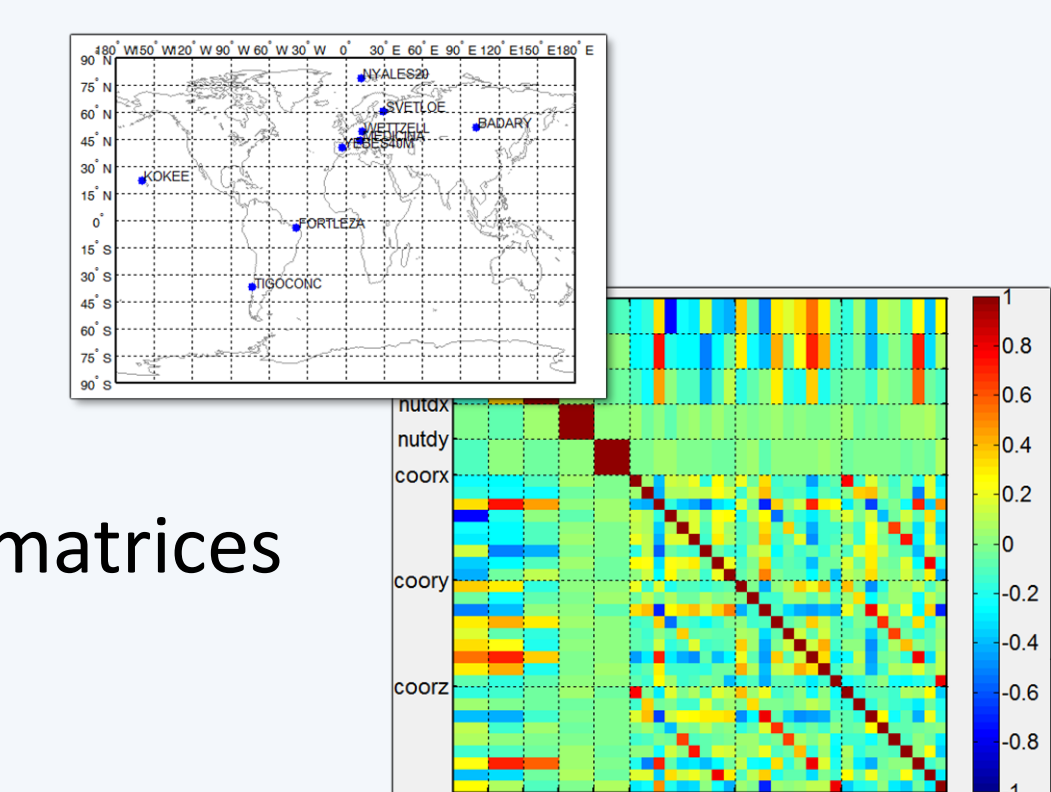source positions in VieCRF10a w.r.t. ICRF2

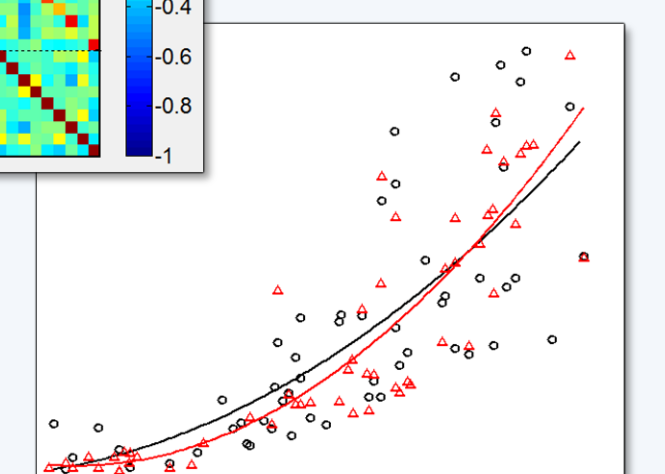Nutation dX

dUT1 (UT1-UTC)

Plotting tool
- Plot residuals and parameters per station, baseline etc.
- Interactive selection of outliers and clock breaks
- Analyse sessions
- ➢ Plot network

- ➢ Plot correlation matrices

- ➢ Plot baseline length repeatability

How can I become a user?

- VieVS is available free of charge for registered users.
- Registration: If you want to have access to VieVS, take a look at the requirements for external users and send a letter to Johannes Böhm (signed by the head of your institution) where you describe for which purposes you would like to have access to VieVS.
- The requirements for external users and a template for the application can be downloaded from the VieVS webpage (http://vievs.geo.tuwien.ac.at/) under the heading "Get VieVS".
- Reference: J. Böhm, S. Böhm, T. Nilsson, A. Pany, L. Plank, H. Spicakova, K. Teke, H. Schuh. The new Vienna VLBI Software VieVS, in Proceedings of IAG Scientific Assembly 2009, International Association of Geodsy Symposia Series Vol. 136, edited by S. Kenyon, M. C. Pacino, and U. Marti, pp. 1007-1011, 2012.

Future plans

Source structure simulator
- Correct observations for effects due to source structure

Schedule observations of satellites
- Interactive scheduling approach
- Orbit calculation based on Two Line Element (TLE)
- Generation of scheduling files (VEX) capable to perform actual satellite observations with VLBI antennas

More sophisticated scheduling module
- Schedules for VGOS
- Mixing legacy and new antennas

Ray tracing delays for all VLBI observations

Use of VGOS DB

System requirements

- MATLAB 7.6 (R2008a) or later.
- About 7.5 GB of disk space, including all data files
- Should work with any operating system able to run this MATLAB version (tested on Windows and Linux).