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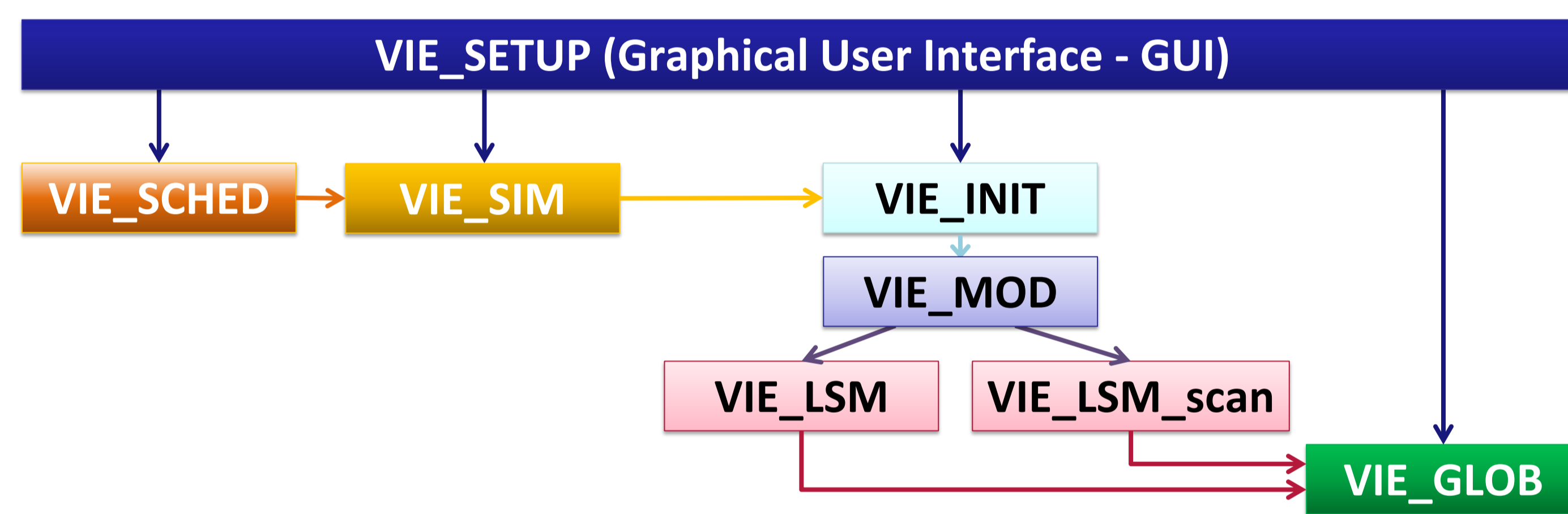
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Introduction

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. The current version, 2.1, which will be released in April 2013, aggregates all modules (i.e. data setup, least squares adjustment, global solution, scheduling, simulation, etc.) within one common graphical user interface. The interface also offers additional tools to plot estimated parameters, residuals, the session network, correlation matrices and baseline length repeatabilities. We present the status of the software focusing on the capabilities of the newest release 2.1. The latest development is the restructuring of the least squares adjustment into a scan-wise update of the normal equation system which enables the analysis of sessions with a very large data volume, e.g. VLBI2010 sessions.

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:

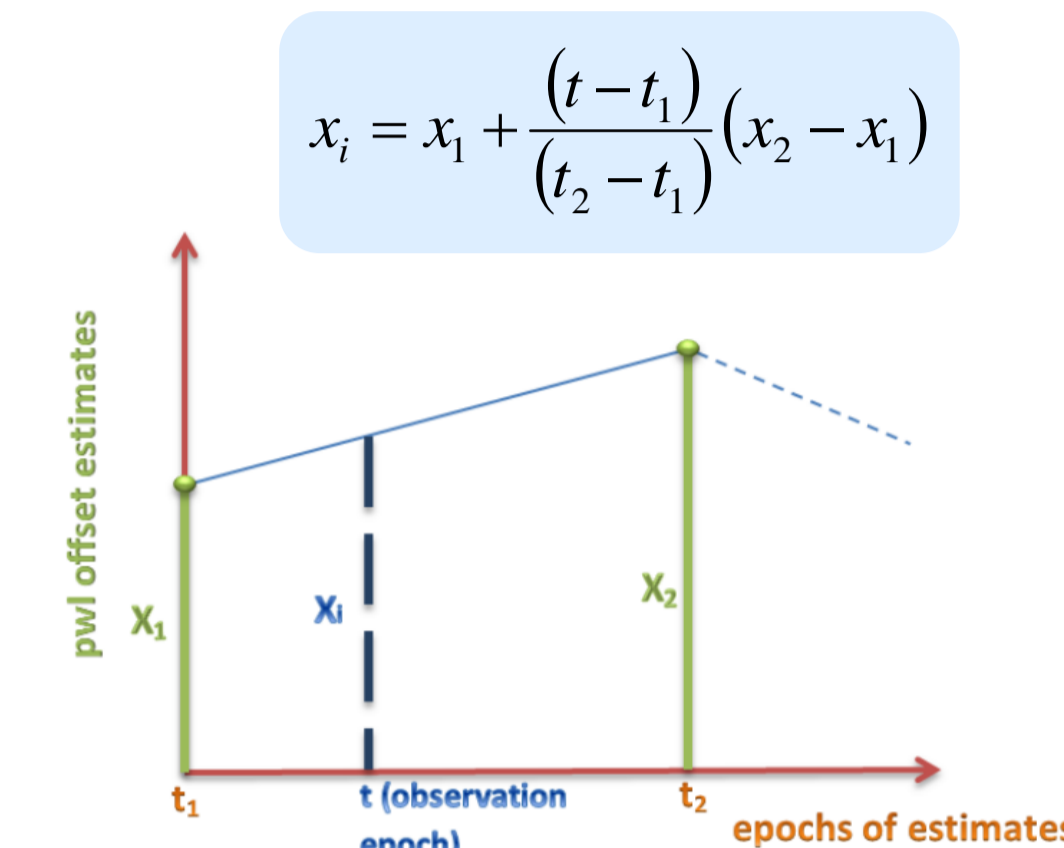
- Stacking of single session normal equations to obtain global parameters.

VieVS capabilities – new features

Single session analysis

Parameters as continuous piece-wise linear offsets:

- Clocks
- Zenith wet delays
- Tropospheric gradients
- EOP
- Selected station and source coordinates



Parameters as offset, rate and quadratic term:

- Clocks
- Station coordinates (Datum: fixing stations or NNR/NTT)

Multi-session analysis

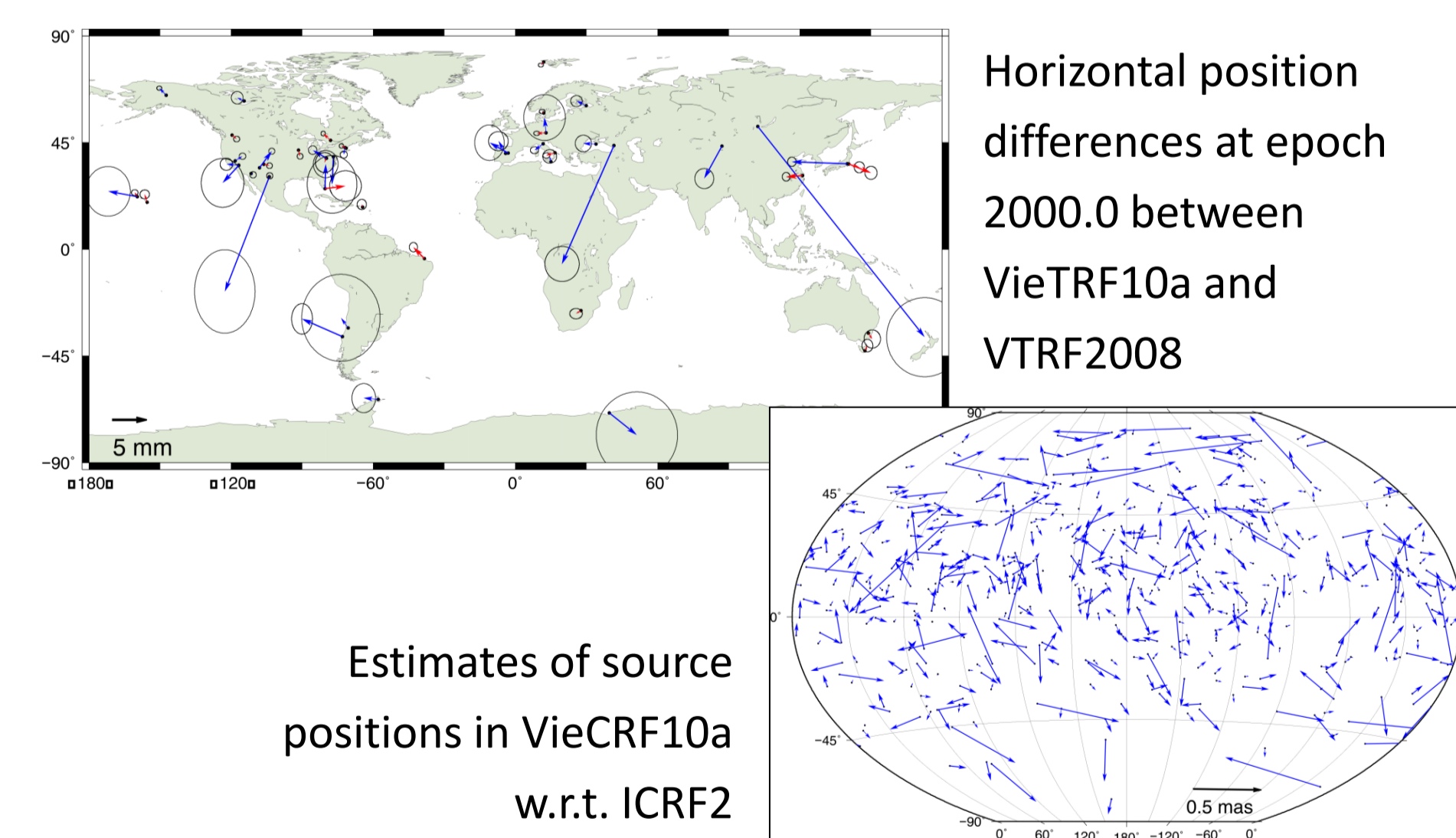
Analysis of multiple sessions from a predefined process list:

- from the GUI
 - remotely in batch mode
 - with
 - one parameterization
 - station- and source-wise parameterization per session
- ⇒ storing of normal equations for global solution

Global solution

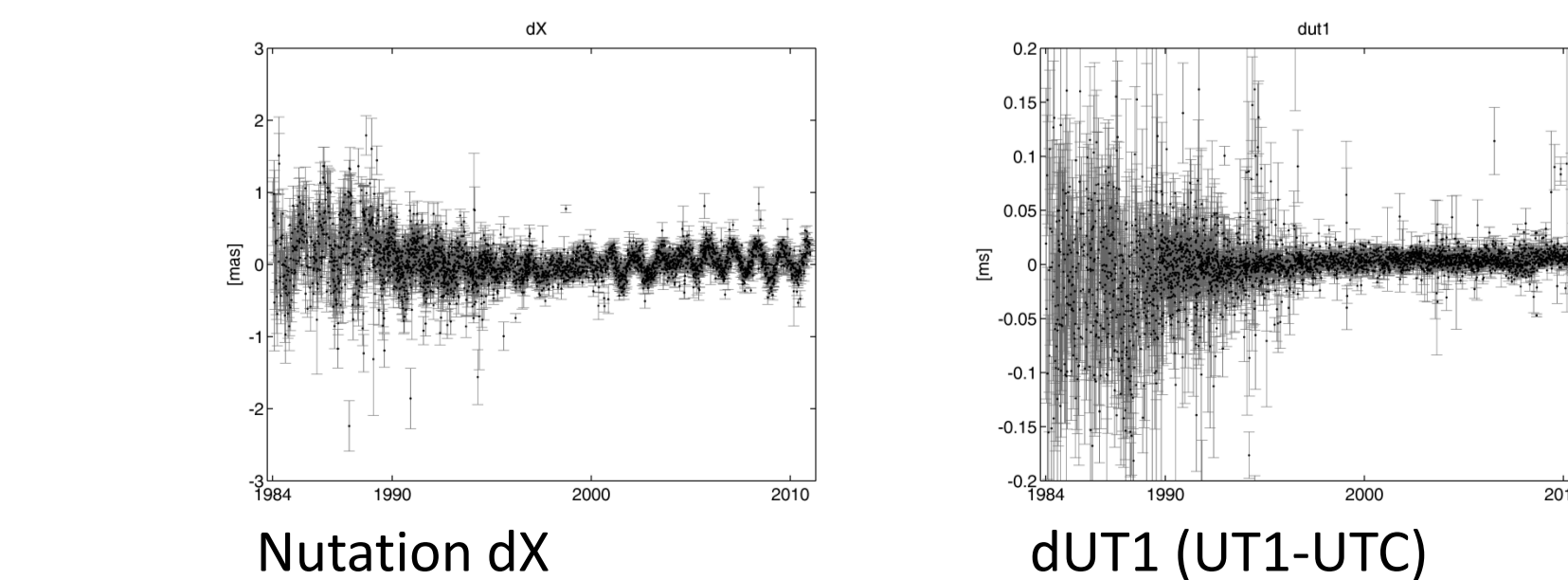
Multi-session combination:

- Station positions and velocities (TRF)
 - Source coordinates (CRF)
 - Earth orientation parameters (EOP)
- TRF and CRF solutions from VieVS (VieTRF10a, VieCRF10a)



Backwards solution for reduced parameters:

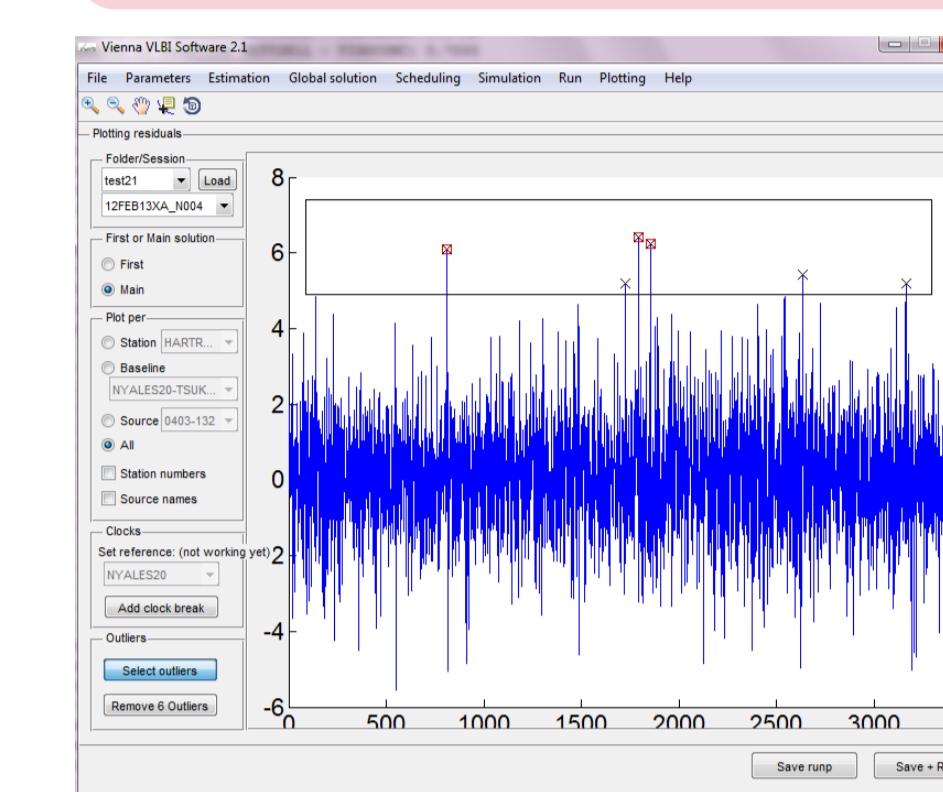
- Tropospheric delays, gradients
- Station and source coordinates
- EOP: e.g. estimates for dX and dUT1 1984-2012



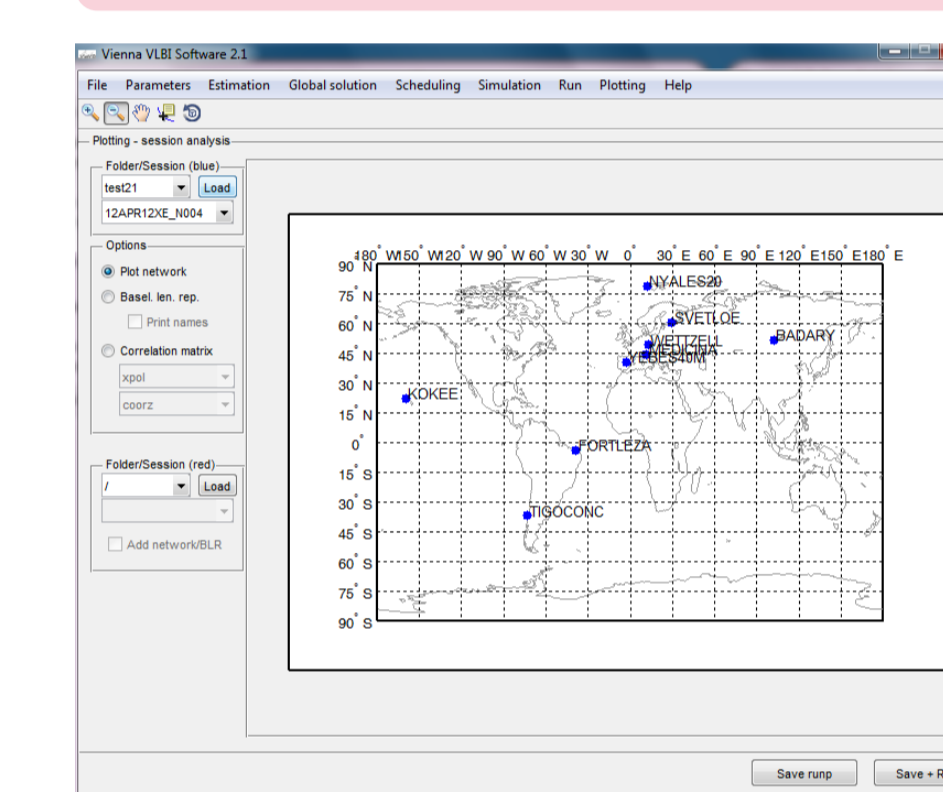
Plotting/analysis tools

Residuals per...

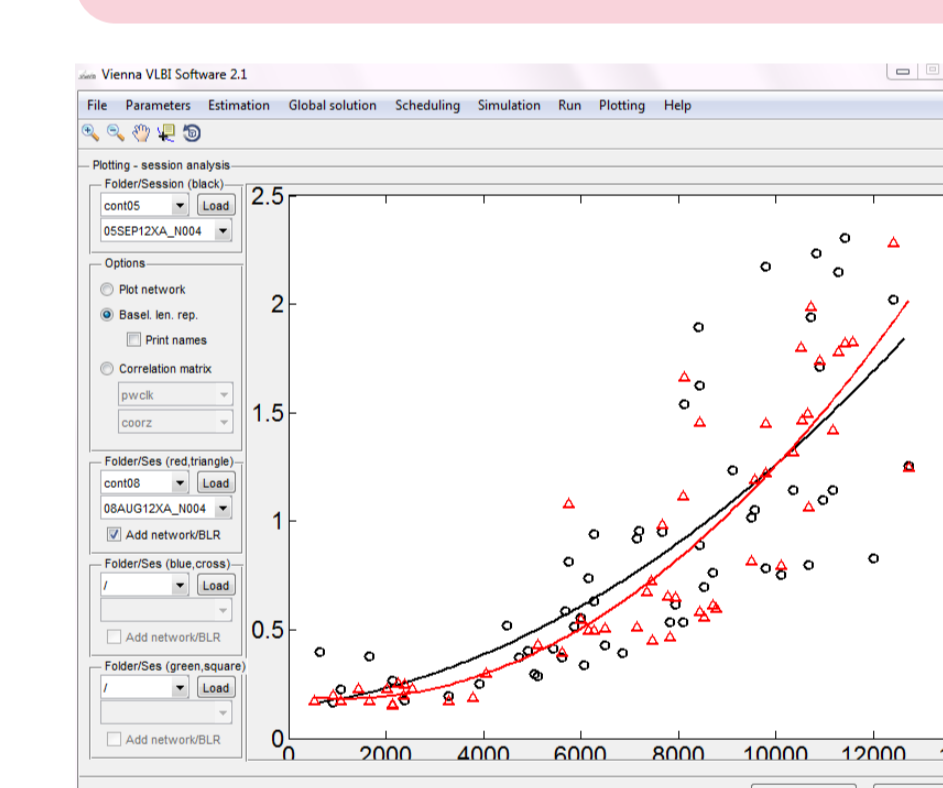
- station, baseline, source



- session network

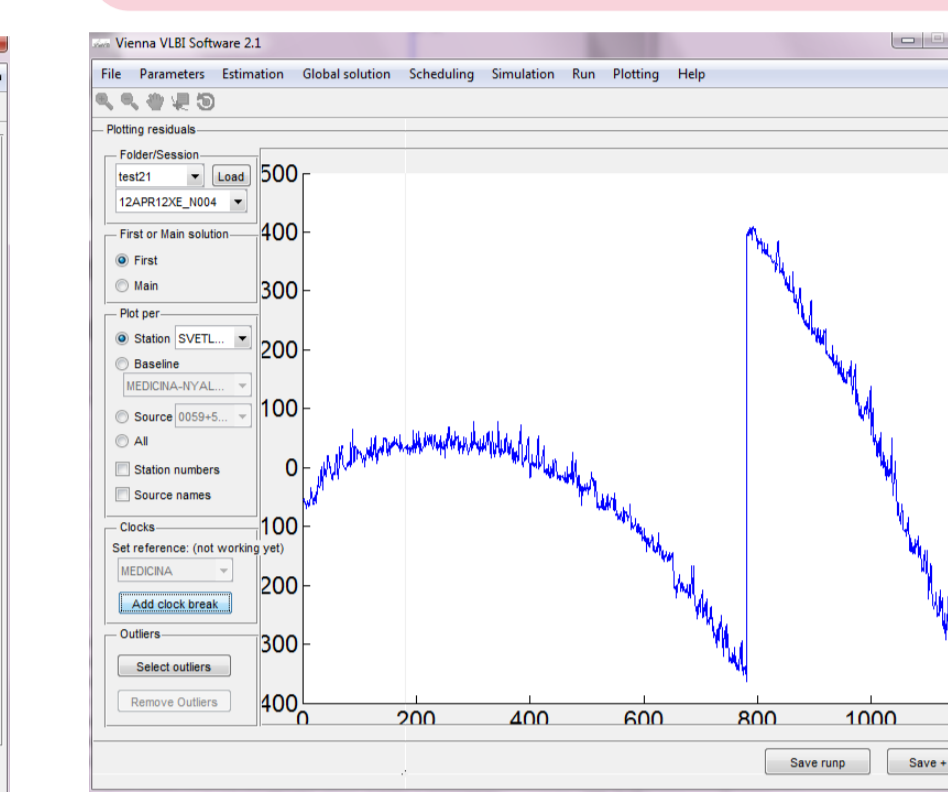


- Baseline length repeatabilities

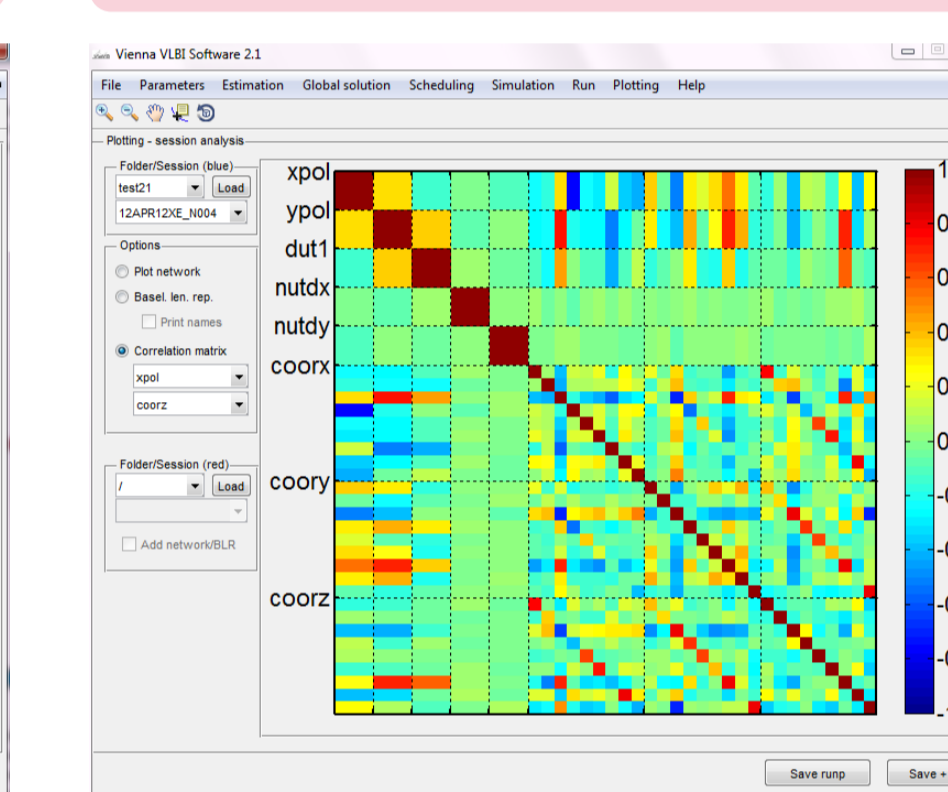


Interactive selection of

- outliers, clock breaks

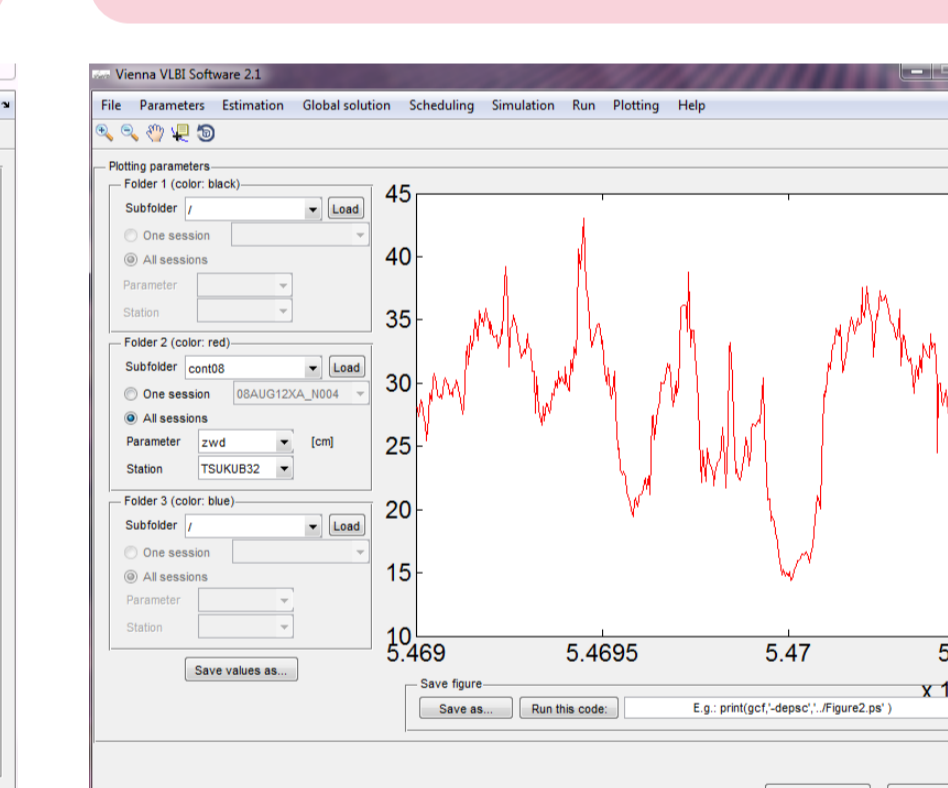


- correlation matrices



Estimated parameters...

- e.g.: zenith wet delay



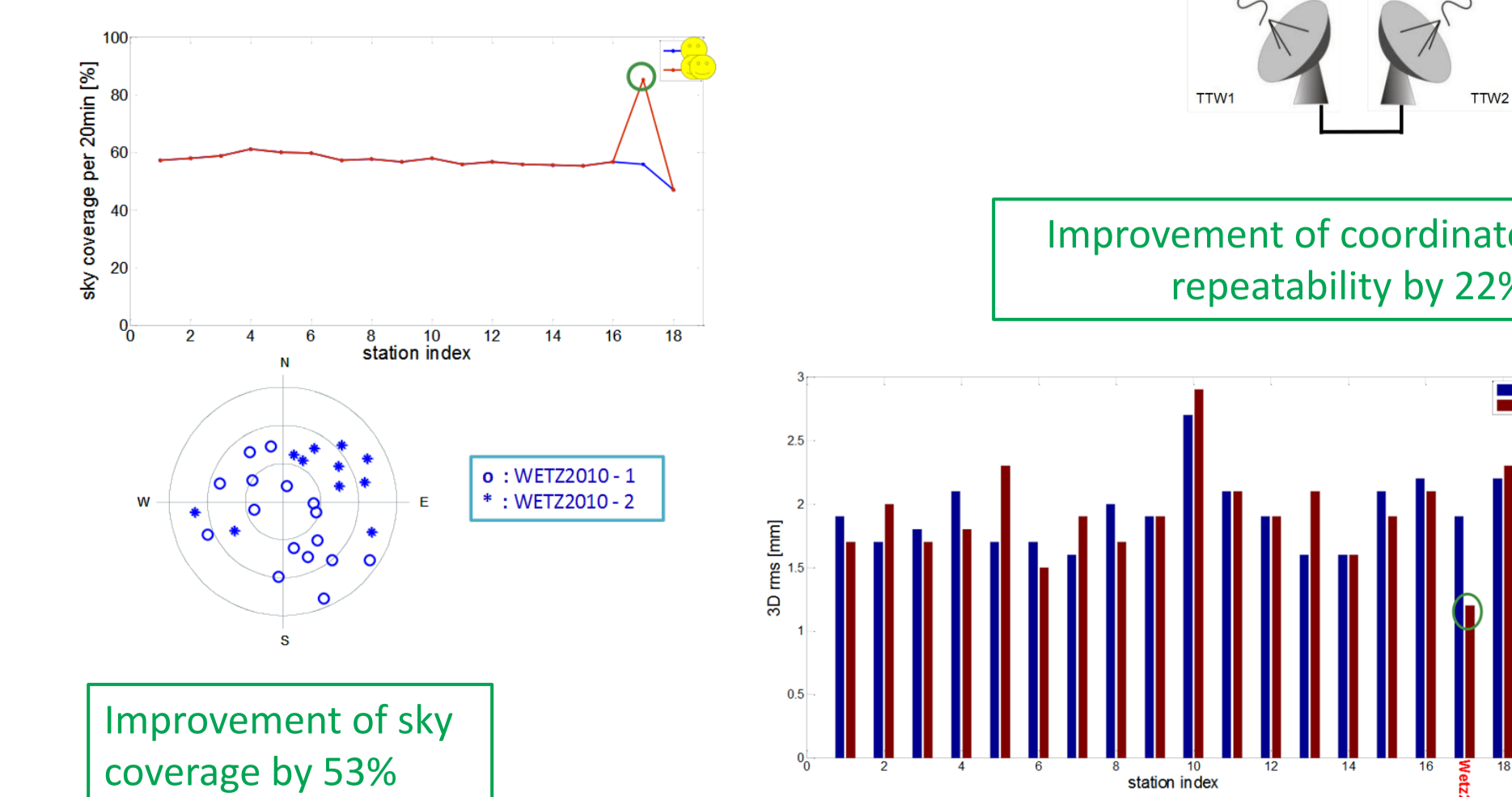
Scheduling and simulation

Scheduling:

- Station-based strategy
- Source-based strategy
- Twin telescopes (test version)
- 7 R&D sessions

Study - twin telescopes (J. Sun et al., 2012):

- Simulation network: 18 stations (Wetzell twin telescope)
- Example: multidirectional observations



Latest developments

LSM_scan:

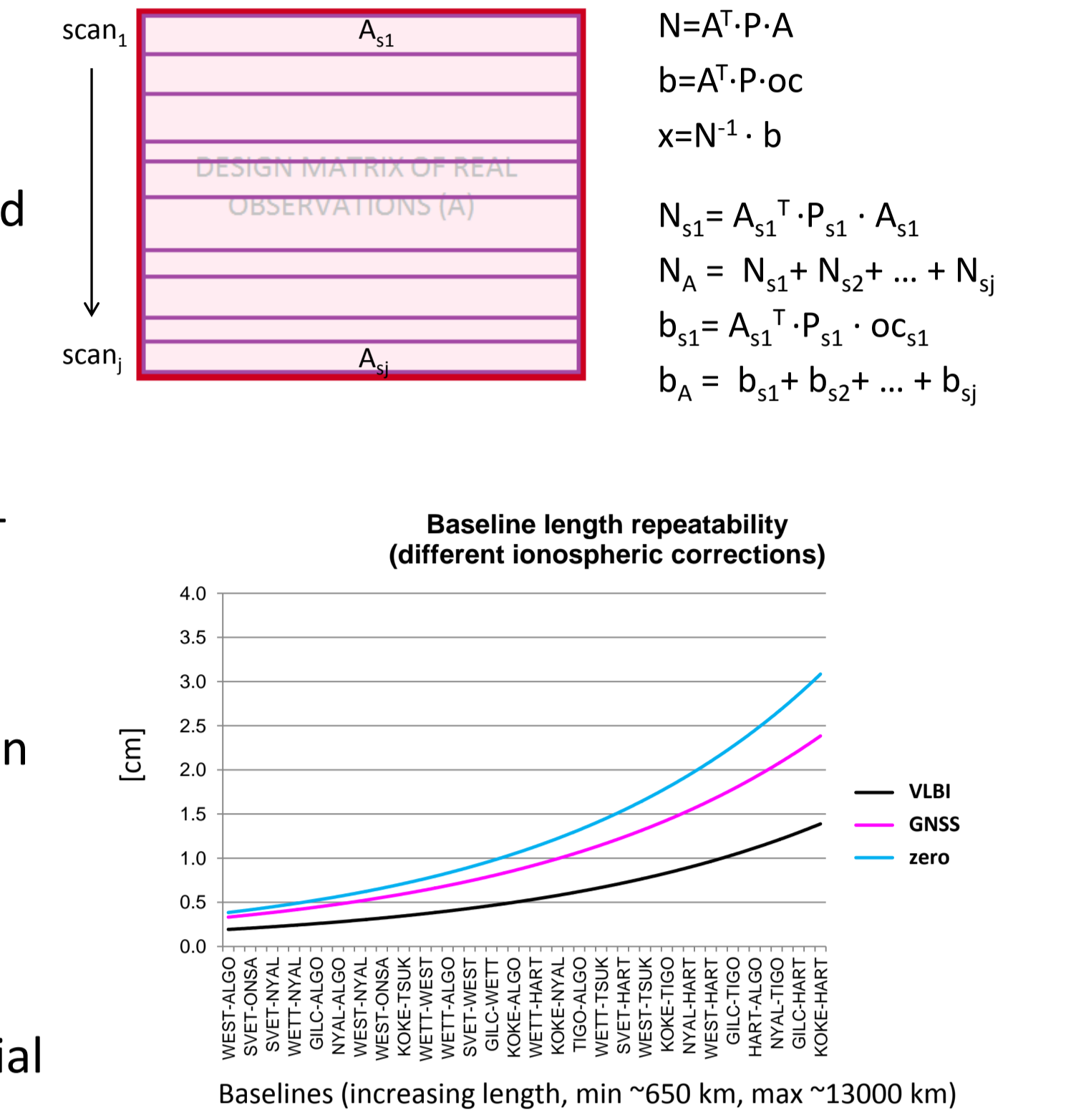
- Scan-wise update of normal equation matrix.
- Processing of sessions with large networks and many observations (VLBI2010).

External ionospheric files:

- Ionospheric delay is usually calculated from S- and X-band observations.
- If observations of only one frequency are available, external ionospheric information can be used → GNSS TEC maps.

External tropospheric files:

- Tropospheric parameter file (.trp) with a special format can be created and used in VieVS.
- E.g.: use of ray-traced delays for Intensives.



Ongoing research and future plans

Current research topics:

- Geophysical and astronomical parameter estimation (Love numbers, tidal parameters, galactic rotation, ...)
- Source structure (corrections, simulations)
- Scheduling (VLBI2010)
- VLBI to space probes (observing strategies, scheduling, frame ties)
- Sun corona
- ...

Future plans:

- Scheduling (old + new VLBI2010 systems)
- Sources, source structure
- Module for satellite observations
- Kalman filter
- Use of netCDF files
- ...

How to get VieVS – become VieVS 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.hg.tuwien.ac.at/>) under the heading "Obtaining 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 Geodesy Symposia Series Vol. 136, edited by S. Kenyon, M. C. Pacino, and U. Marti, pp. 1007-1011, 2012.

System requirements

- MATLAB 7.6 (R2008a) or later.
- About 7.5 GB of disk space, including all data files (NGS files 1979-now: 7.1 GB, source code: <10 MB, ...)
- Should work with any operating system able to run this MATLAB version (tested on Windows and Linux).