# The new Vienna VLBI Software VieVS

H. Spicakova <sup>(1)</sup>, J. Boehm <sup>(1)</sup>, S. Englich <sup>(1)</sup>, T. Nilsson <sup>(1)</sup>, A. Pany <sup>(1)</sup>, L. Plank <sup>(1)</sup>, J. Wresnik <sup>(1)</sup>, K. Teke <sup>(1)</sup>,

vie\_setup

vie\_init

vie\_mod

vie\_Ism

vie\_glob

Internal structure of VieVS

H. Schuh <sup>(1)</sup>, T. Hobiger <sup>(2)</sup>, R. Ichikawa <sup>(2)</sup>, Y. Koyama <sup>(2)</sup>, T. Gotoh <sup>(2)</sup>, T. Otsubo <sup>(3)</sup>, T. Kubooka <sup>(2)</sup>

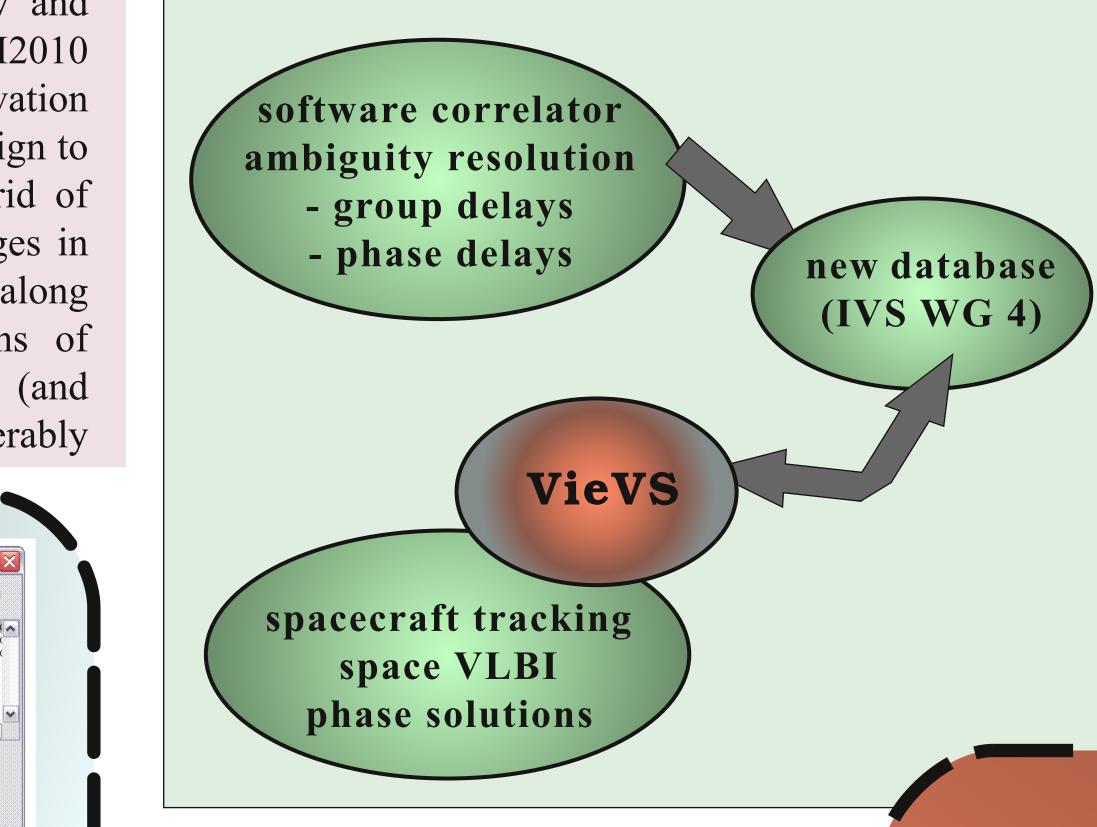


) Institute of Geodesy and Geophysics, TU Vienna, Austria; (2) National Institute of Information and Communications Technology, Tokyo, Japan; (3) Hitotsubashi University, Tokyo, Japan

A new VLBI (Very Long Baseline Interferometry) data analysis software, called Vienna VLBI Software (VieVS), is developed at the Institute of Geodesy and Geophysics in Vienna taking into consideration all present and future VLBI2010 requirements, e.g. phase delay solutions and a significantly denser observation schedule. Instead of updating existing software we carry out a complete re-design to make the software clearly arranged and of modular structure, and to get rid of obsolete features which have accumulated in existing VLBI software packages in the last decades. However, VieVS is not written from scratch, but we guided along the OCCAM VLBI software package which allows detailed comparisons of provisional results obtained with VieVS. The programming language Matlab (and its non-commercial counterpart Octave) is used, which eases considerably

VIC\_SCLUP

efforts programming because of many built-in functions and tools. This tremendously simplified and shortened the source code. Matlab is the high-end programming language used for education at the Vienna University of Technology and at many other institutes worldwide. Thus the new software will students attract and scientists to get interested in VLBI and to contribute to VLBI analysis.



NICT and IGG Vienna

Level O

Level 1

Level 2

CVPI

constraints.

Together with the National Institute of Information and Communications Technology (NICT, Japan) phase delay solutions will be implemented in VieVS and initial steps will be taken to equip the software with tools for spacecraft tracking and space VLBI. Furthermore, the existing gap will be closed between the correlator output provided by NICT and the Vienna VLBI software. The common efforts will result in a relevant contribution to the new specification of the VLBI data format, which is proposed to be defined as a NetCDF file within Working Group 4 on 'VLBI Data Structure' of the International VLBI Service for Geodesy and Astrometry (IVS).

#### VieVS/Data/

data is stored and exchanged between the program units in structure array format

antenna sources

In the structure array antenna all stations taking part in the session are listed. The data is of static type, including coordinates, reference catalogue temperature and pressure information from the correction models.

#### Level 0

- information from NGS/NetCDF - files

- catalogue coordinates

#### Level 1

- corrections to station coordinates

- corrections to time delay

- partial derivatives w.r.t. time delay (for A-matrix)

Level 2 - data for global solution

Level 3 - single solutions piecewise linear offsets:

Dynamic data is stored in

the structure scan. The array

is divided into three fields:

scan.stat (station dependent

data), scan.obs (baseline

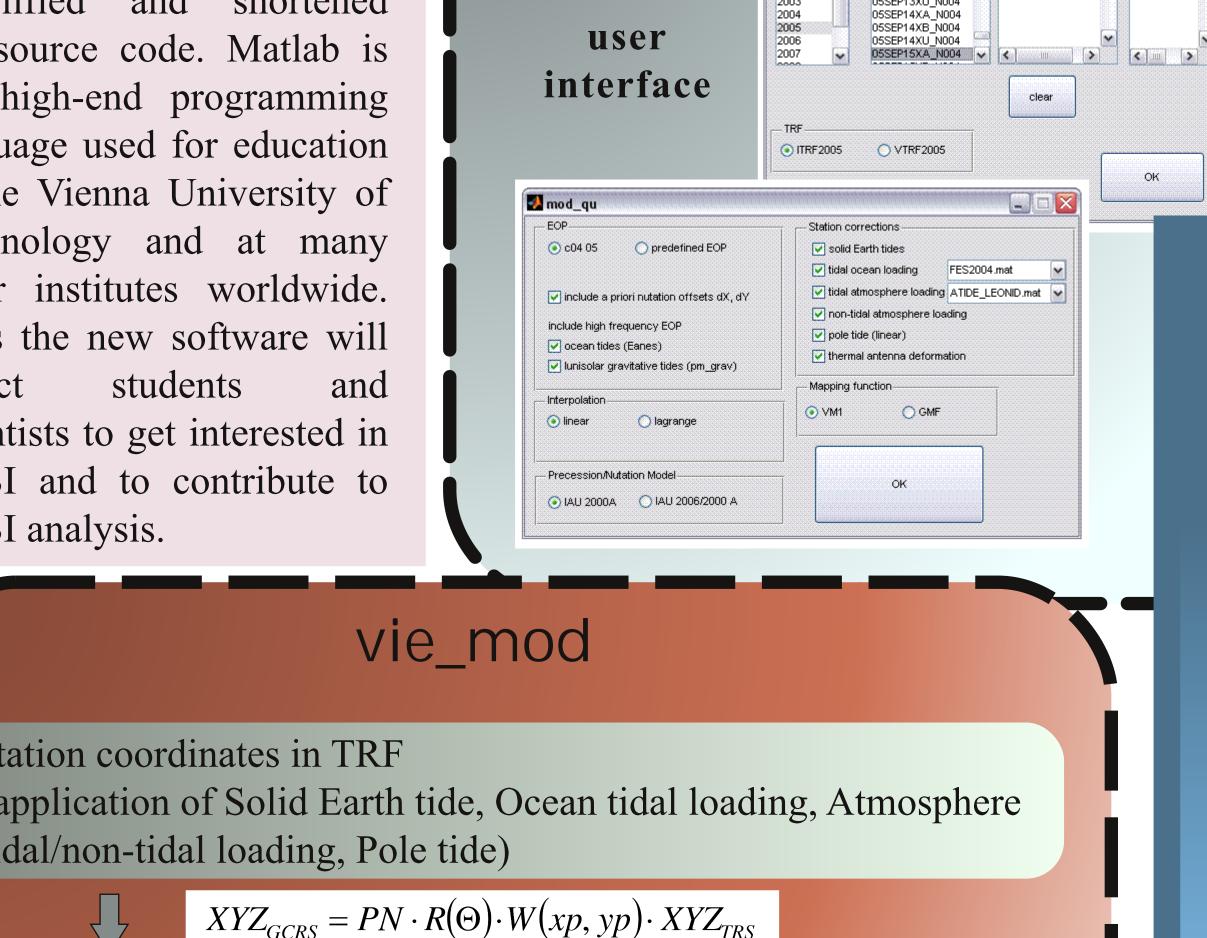
dependent data), scan.space

(EOPs, ephemerids of the

Sun, Moon, source).

A<sup>T</sup>Pl vector x vector

clocks, troposphere zenith delays, troposphere gradients, Earth orientation parameters, antenna coordinates



station coordinates in TRF (application of Solid Earth tide, Ocean tidal loading, Atmosphere tidal/non-tidal loading, Pole tide)  $XYZ_{GCRS} = PN \cdot R(\Theta) \cdot W(xp, yp) \cdot XYZ_{TRS}$ GCRF - Geocentric Celestial station coordinates in GCRF Reference Frame SSB - Solar System Barycentric Lorentz transformation station/baseline in SSB source, planets position in SSB  $\tau = \tau_{geometric} + \tau_{gravitational}$  compute gravitational delay Lorentz transformation VLBI-delay model according to delay in TT-scale **IERS Conventions 2003** 

> add troposphere delay, thermal deformation, axis offset correction

In the software VieVS we currently use the classical Gauss-Markov least-squares adjustment (adding of Kalman filter is foreseen). The parameters are estimated as piecewise linear offsets (a) at integer hours (t) (e.g., at 18 UTC, 19 UTC, ...), at integer fractions of integer hours (e.g., 18:20 UTC, 18:40 UTC, ...) or at integer multiples of integer hours (e.g. 18:00 UTC, 0:00 UTC, 6:00 UTC, ...). This makes our results easier compatible with those from other space geodetic techniques like the Global Navigation Satellite Systems (GNSS) or Satellite Laser Ranging (SLR).

## vie Ism $y(t) = a_{n-1} + \frac{a_n - a_{n-1}}{t_n - t_{n-1}} (t - t_{n-1})$ Example of output: Estimates of troposphere east gradient at station GILCREEK on 13 September 2005 with various estimation intervals and

53 626,6 53 626,8 53 627,0 53 627,2 53 627,4 53 627,6 53 627,8

### References

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