EUREF 2014 Symposium, June 3-7, Vilnius, Lithuania

Military University of Technology (MUT)

Warsaw University of Technology (WUT)

ACTIVITIES IN THE FRAME OF THE EPN ANALYSIS COMBINATION CENTRE

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Since June 2013 duties of the EPN Analysis Combination Centre (ACC) are performed by the consortium of two Polish universities:

-**Military Univeristy of Technology (Warsaw, Poland)**

-**Warsaw University of Technology (Warsaw, Poland)**

The whole team consists of:

-Andrzej Araszkiewicz (MUT),

-Mariusz Figurski (MUT),

-Grzegorz Nykiel (MUT),

-Tomasz Liwosz (WUT),

-Karolina Szafranek (MUT).

In November 2013 **„Guidelines for the EPN Analysis Centres"** were updated:

- Final daily coordinate solutions **became mandatory**.
- Use of **orbits and clocks consistent with the analysis options and software** used by each LAC (or combined IGS products).
- Exclusion of **defective satellites**.
- Encouragement for LACs to perform specific tasks.
- **Update of processing options** (e.g. mapping functions).
- Changes to keep Guidelines up-to-date (e.g. IGS instead of ITRF).
- **Distribution of stations** among LACs (3-5 except twin stations).

CURRENT STATUS OF COMBINED SOLUTIONS:

-**Final weekly solution:** *submission since 1768;*

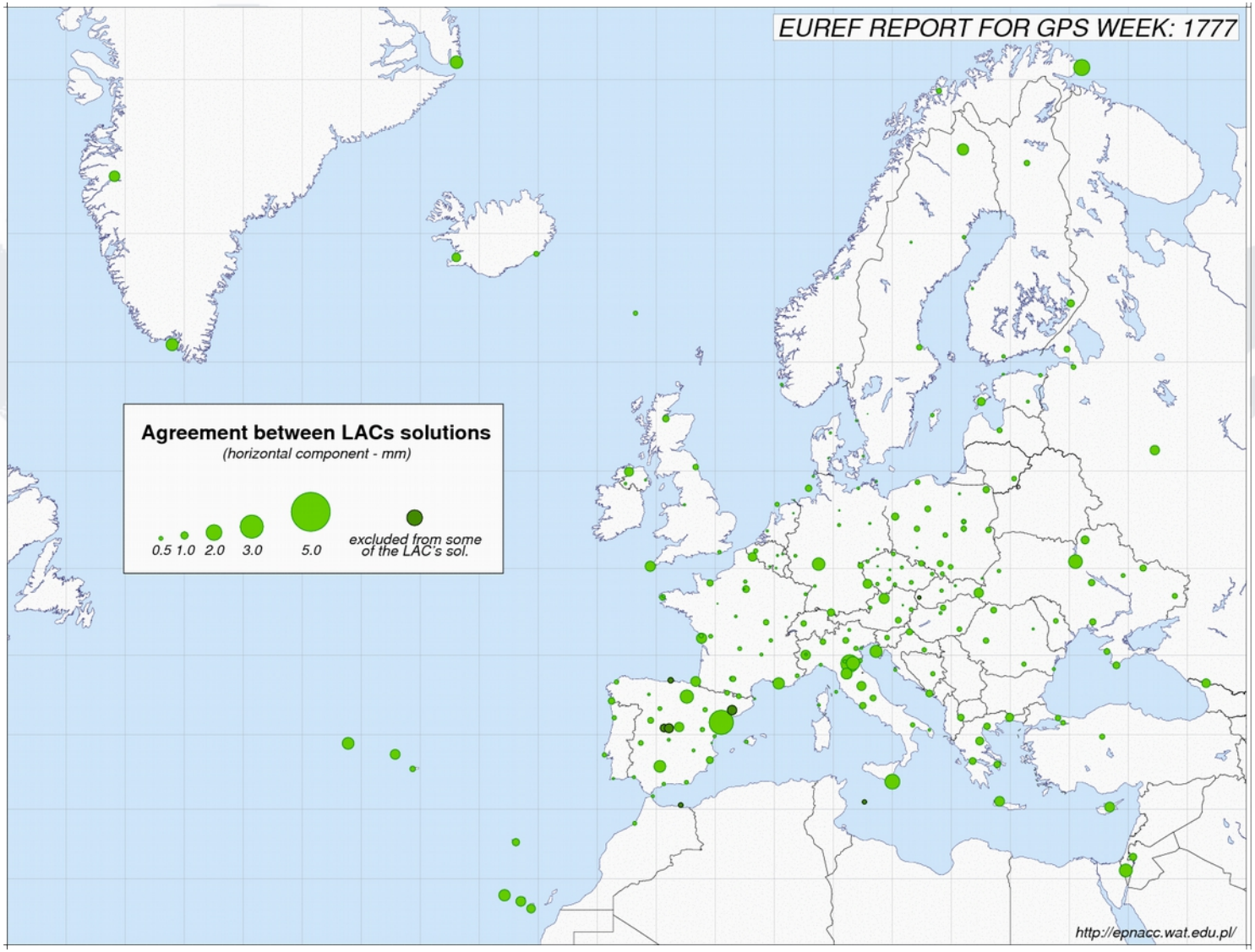
-**Final daily solution:** *submission since 1788;*

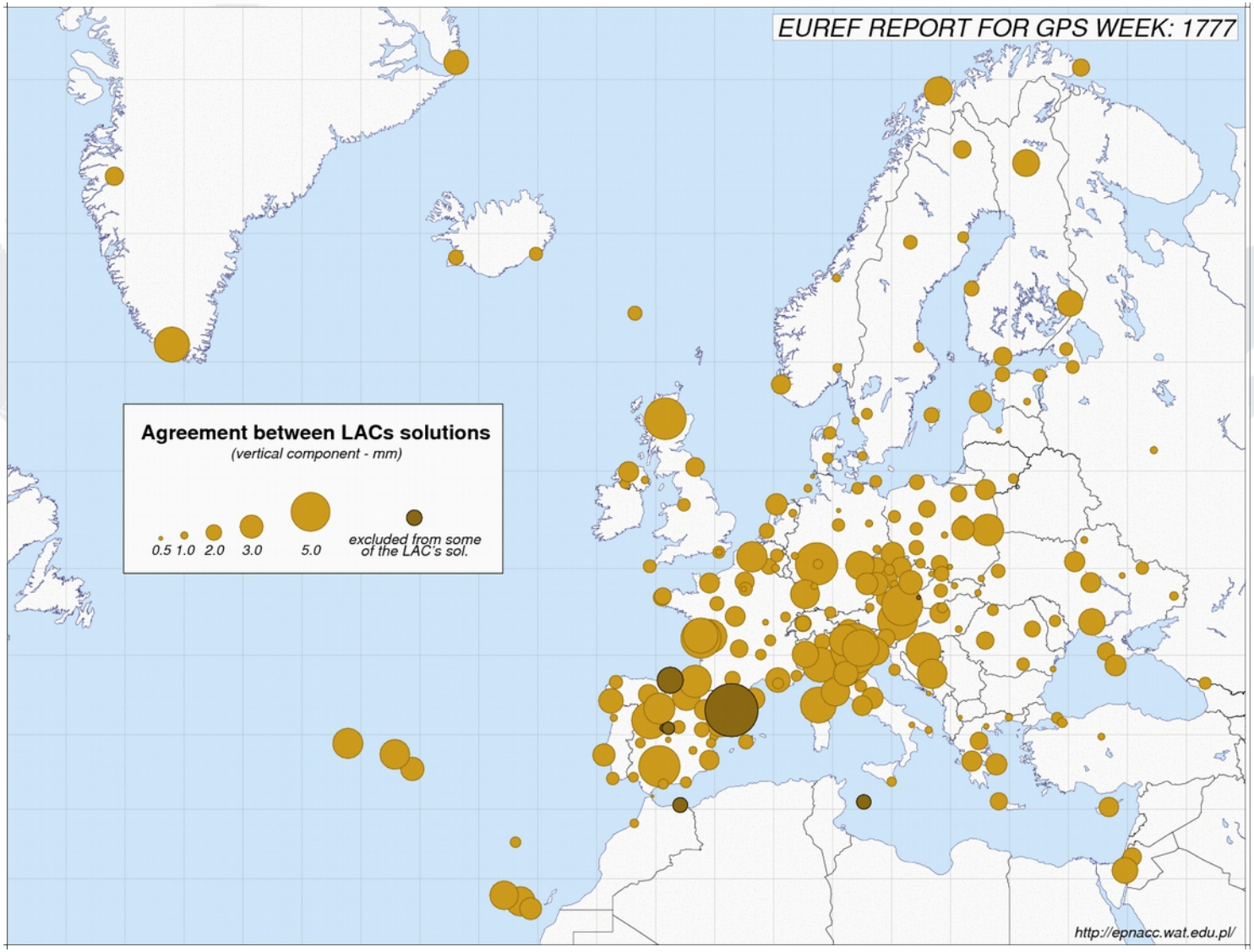
-**Rapid daily solution:** *submission since 1770;*

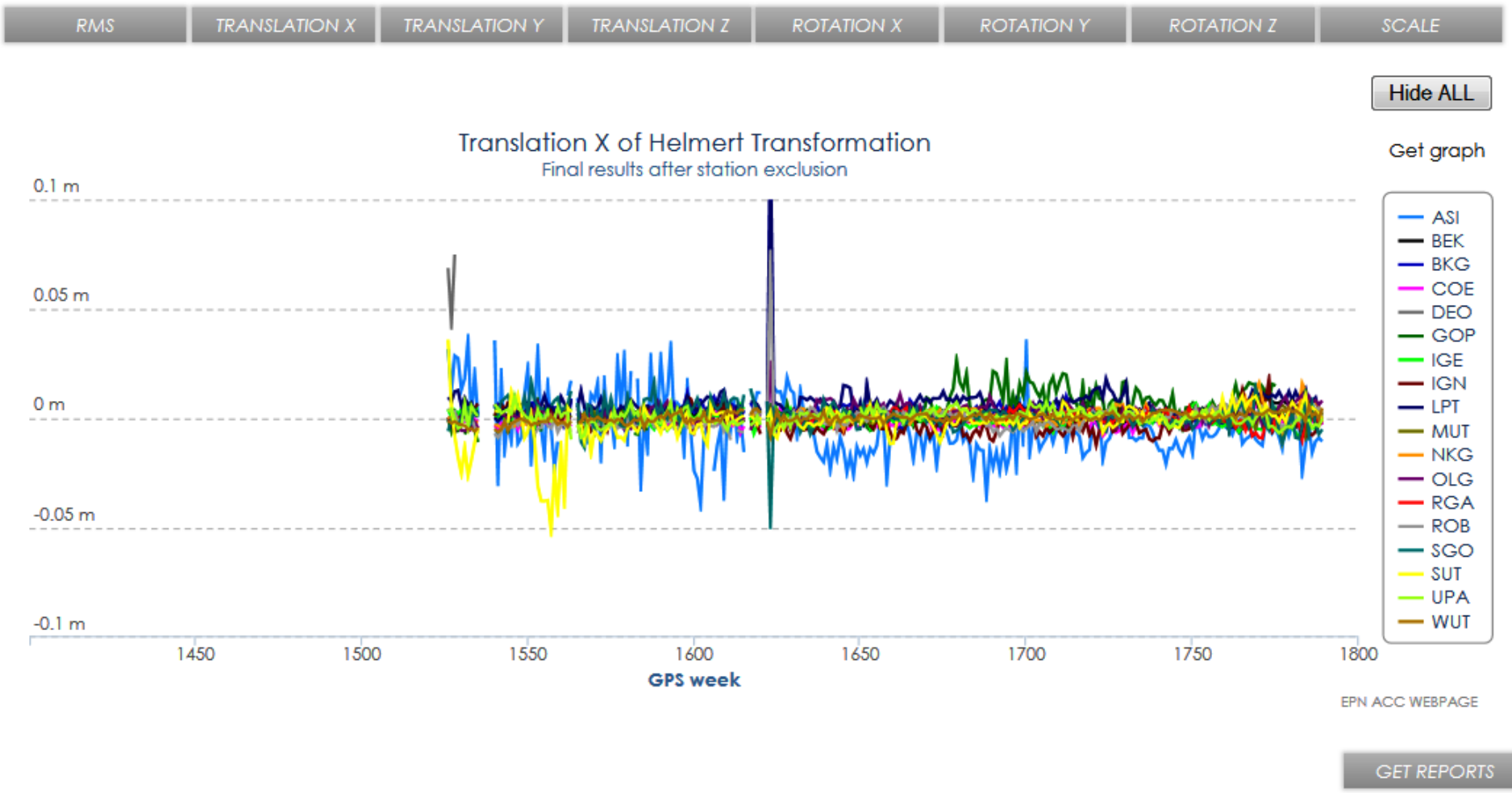
-**Hourly (ultra rapid) solution:** *submission since 17733;*

-TIGA subnetwork solution: *no submission.*

1. Solutions in SINEX are transformed into normal equations (SNX2NEQ).
2. All **normal equations are combined using ADDNEQ2** (1st iteration of combination). The alignment to the IGb08 is made by adding minimal constraints.
3. **Stations coordinates** specific for different LACs **are compared with their mean values**. In case the differences are higher than 8 mm horizontally or 16 mms vertically such station is eliminated from the specific solution - the whole set of normal equations has to be rebuilt.
4. **The adjustment is repeated** (2nd iteration) and the same criteria are checked again. If necessary, the 3rd iteration is also being made.
5. Helmert transformation parameters between weekly combined and reference solution are determined and **coordinates values of reference stations are also compared**. If the differences are higher than 8 millimetres horizontally or 15 millimetres vertically such stations is not being used as a reference and the adjustment is repeated.


EUREF REPORT FOR GPS WEEK: 1777
Agreement between LACs solutions
(horizontal component - mm)
0.5 1.0 2.0 3.0 5.0
excluded from some of the LAC's sol.
http://epnacc.wat.edu.pl/


EUREF REPORT FOR GPS WEEK: 1777
Agreement between LACs solutions
(vertical component - mm)
0.5 1.0 2.0 3.0 5.0
excluded from some of the LAC's sol.
http://epnacc.wat.edu.pl/

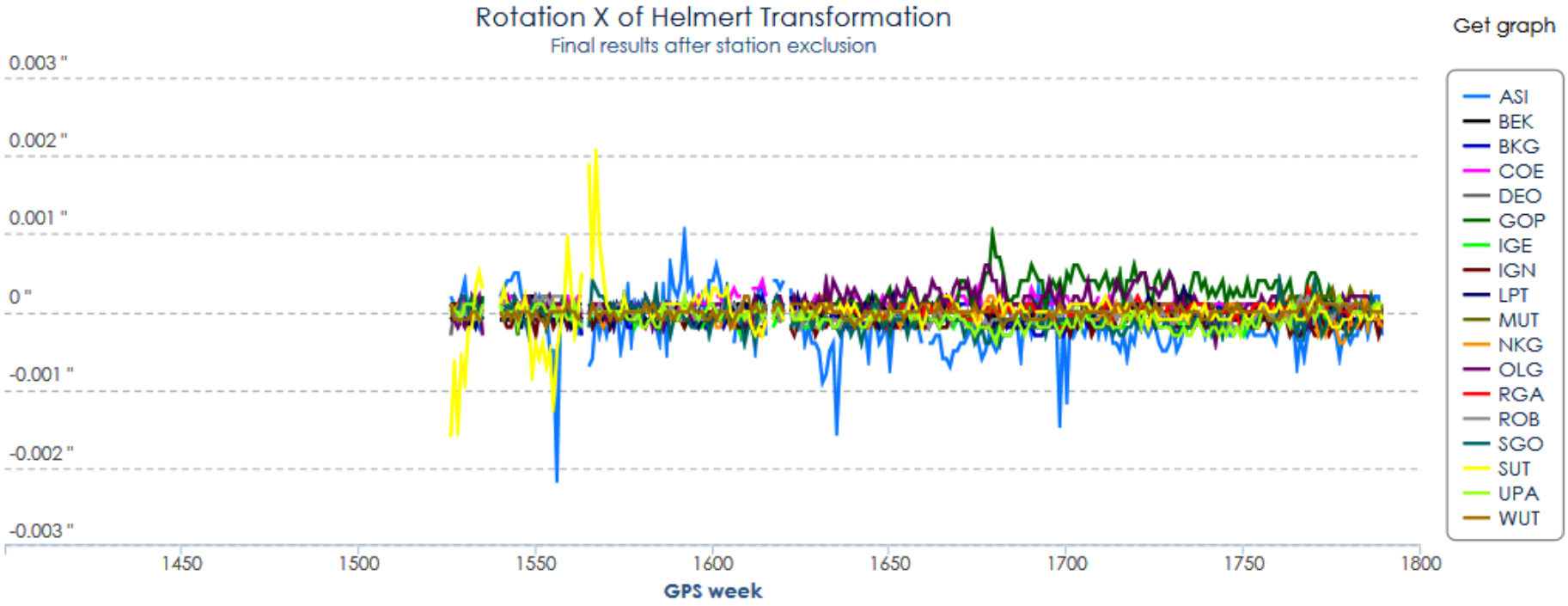


Time series of translation (X component) of Helmert transformation

RMS | TRANSLATION X | TRANSLATION Y | TRANSLATION Z | ROTATION X | ROTATION Y | ROTATION Z | SCALE

Hide ALL

Get graph

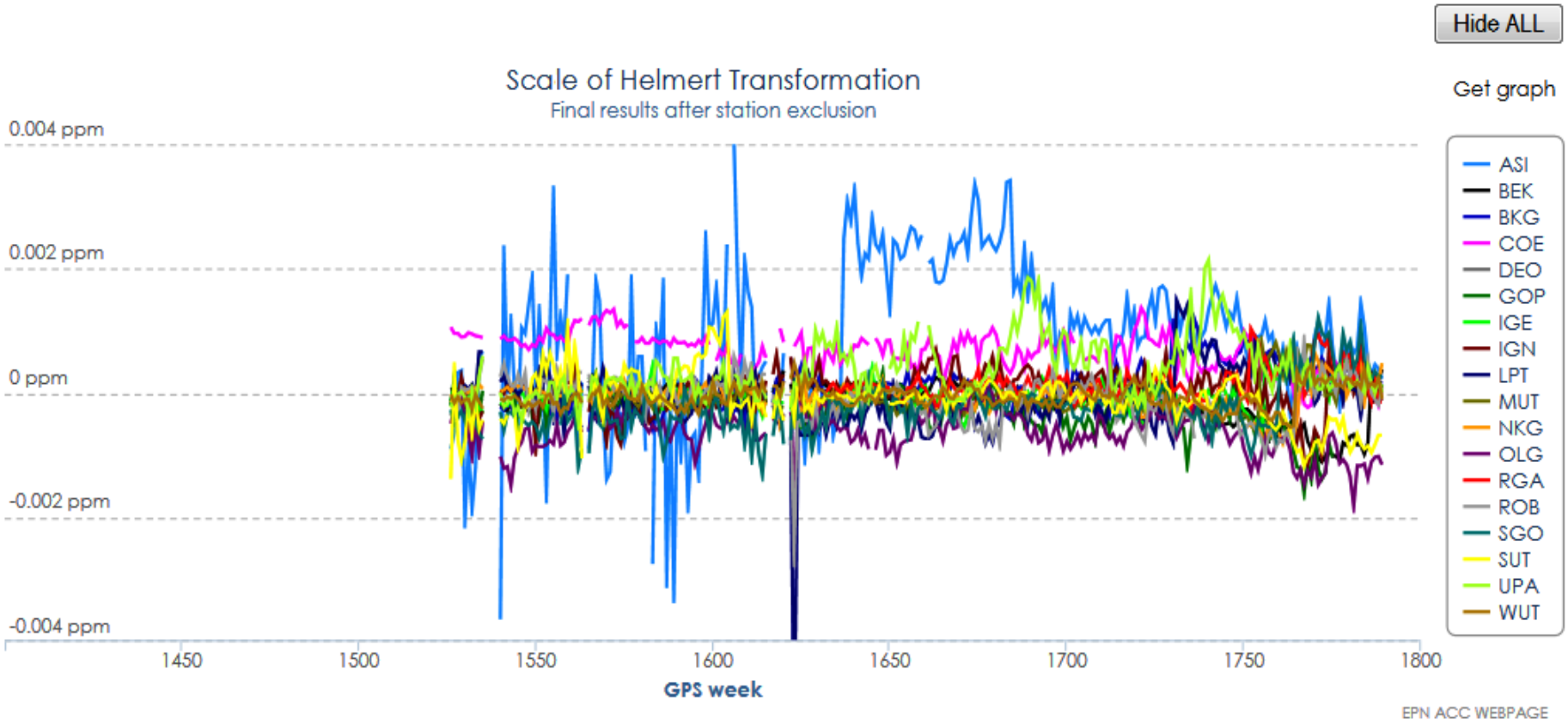


EPN ACC WEBPAGE

GET REPORTS

Time series of rotation (X component) of Helmert transformation

RMS | TRANSLATION X | TRANSLATION Y | TRANSLATION Z | ROTATION X | ROTATION Y | ROTATION Z | SCALE

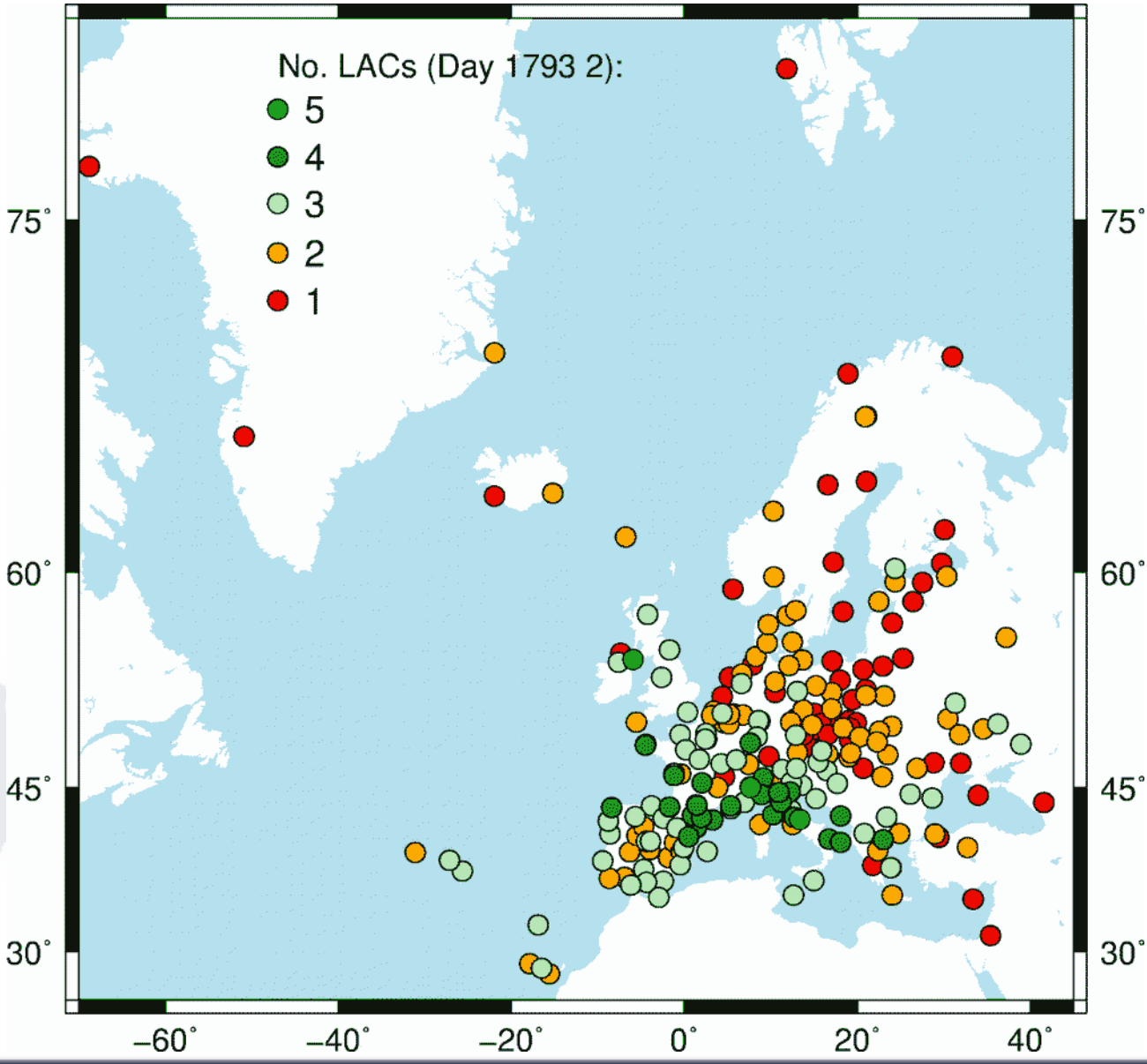


GET REPORTS

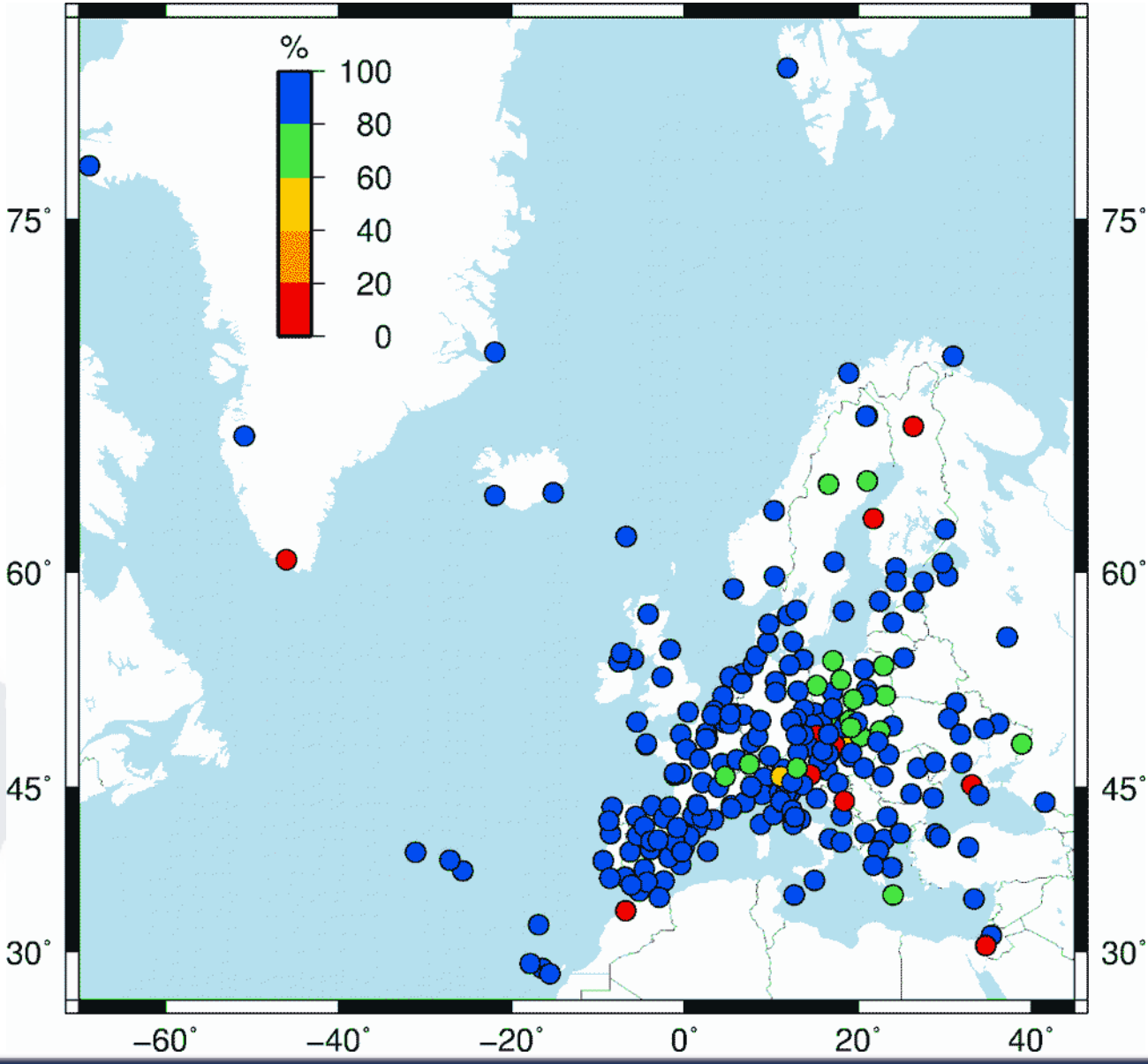
Time series of scale parameter of Helmert transformation

- **1 day latency**;
- **9 LACs contribute**;
- Currently ~**95% stations monitored** (but many processed by 1 LAC only);
- **Metadata in LACs SINEX files checked against log files**
  - problematic stations excluded,
  - notification emails already sent to LACs;
- Software used for combination: **Bernese 5.2**;
- Products and reports from combinations available at the **BKG EPN data center**.

Number of LACs processing each station in rapid daily combined solution *(example for day 17932)*



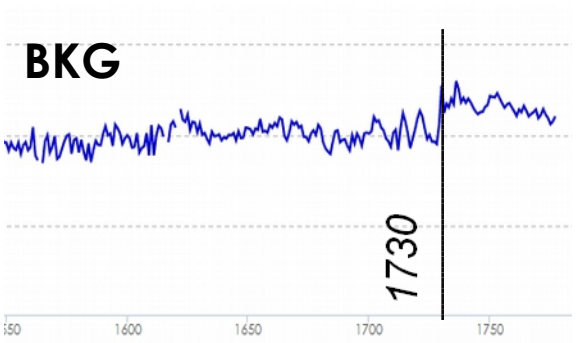
Stations availability in rapid combined solution for last 4 weeks
(1790 – 1793)

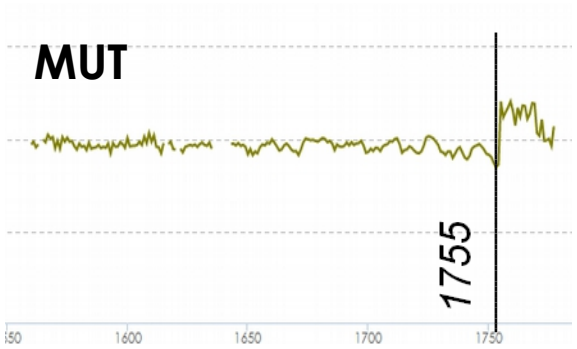


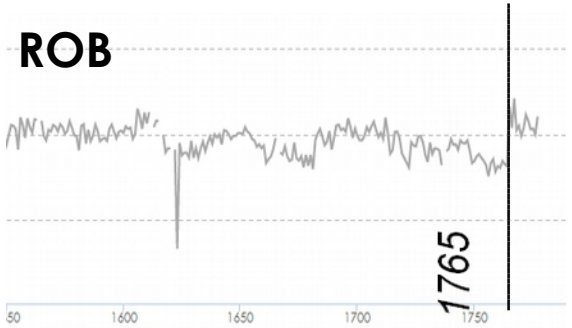
- **1 hour latency**;
- **Only 3 LACs** contribute;
- Near real time monitoring of EPN station positions;
- **Metadata in LACs SINEX files checked against log files** (problematic stations excluded);
- Software used for combination: **Bernese 5.2**;
- Products and reports from combinations available at the **BKG EPN data center**.

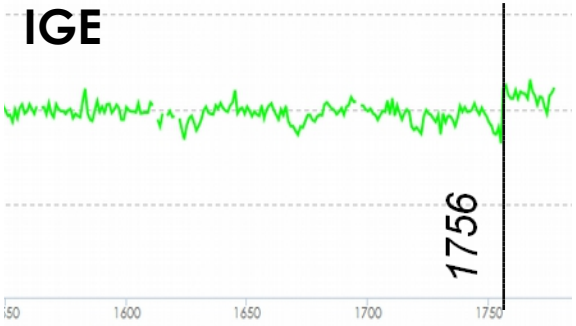
	GLONASS	BSW 5.2
BEK	1501	1786
BKG	1610	1730
COE	YES	1730
IGE	1756	1756
IGN	1774	1774
LPT	1400	1731
MUT	1755	1755
NKG	1765	1765
OLG	in progess	in progress
RGA	1752	1752
ROB	1400	1765
SGO	1760	1760
SUT	in progess	in progress
UPA	1764	1764
WUT	1609	1765

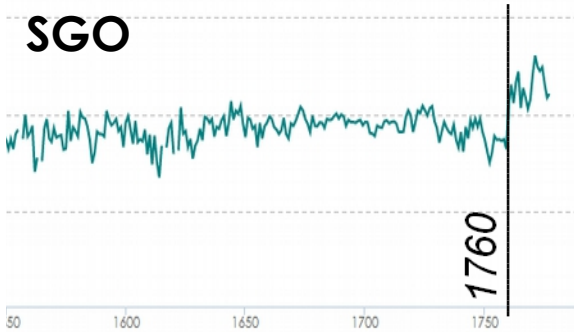
Use of Bernese 5.2 and GLONASS analysis (scale parameter)

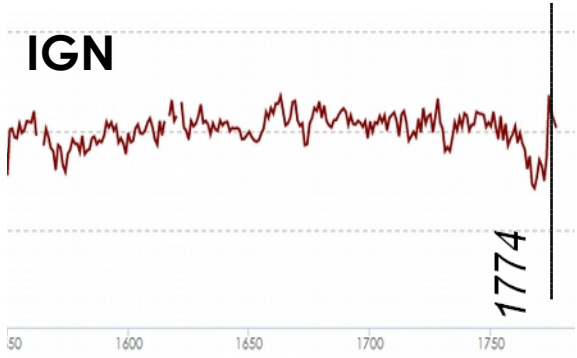


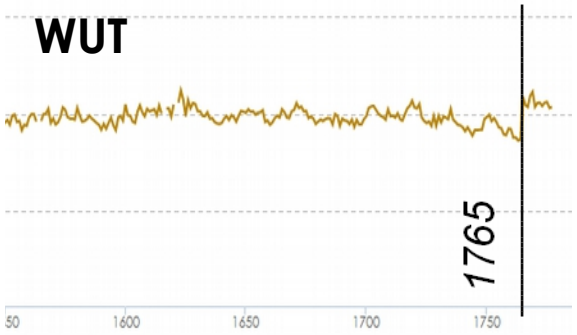










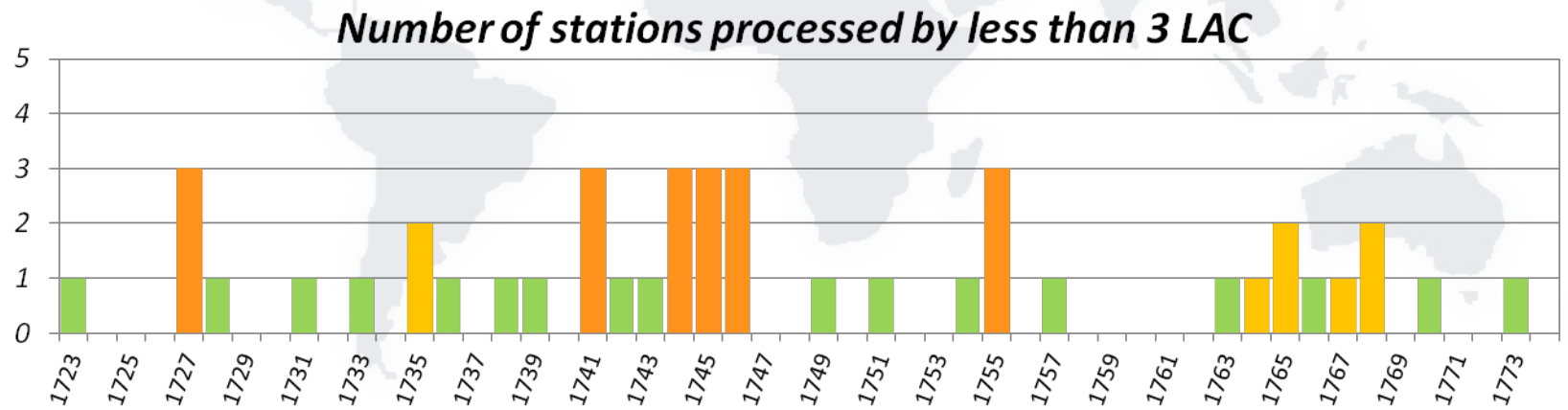


- **Change of reference stations for combined solution:**

At the beginning the same set of reference stations was applied as the one used by BKG - 97 (**82 in fact**) EPN stations with coordinates expressed in IGb08.

Since 1788 GPS week only stations belonging to the IGb08 are used – **only 41 stations** (differences in coordinates below 2 mm).

- **Exclusion of stations processed by less than 3 LACs** (1774 GPS week):



- **Shorter version of combination reports sent by mailing lists.**

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================================================================================
TABLE 1: NOTIFICATION OF DETECTED OUTLIERS - EXCLUDED STATIONS
================================================================================

 Station              LAC      Remark
 ------------------------------------------------------------------------------
 BELL 13431M001       IGN    -16.91   Too large residual in comparison between LACs.
 CANT 13438M001       IGN    -17.57   Too large residual in comparison between LACs.
 CEBR 13408M001       ASI     27.65   Too large residual in comparison between LACs.
 LAMP 12706M002       ASI     18.38   Too large residual in comparison between LACs.
 MELI 19379M001       ASI    -16.01   Too large residual in comparison between LACs.
 MOPI 11507M001       WUT     22.86   Too large residual in comparison between LACs.
 VILL 13406M001       ASI     19.17   Too large residual in comparison between LACs.

================================================================================
TABLE 2: FINAL COMPARISON OF SOLUTIONS
================================================================================

a) Helmert Transformation Parameters With Respect to Combined Solution

                              Translation (m)                  Rotation (")
 LAC      Rms (m)          X         Y         Z           X         Y         Z      Scale (ppm)
 ------------------------------------------------------------------------------------------------
 ASI      0.00268      -0.0138    0.0283    0.0125      -0.0006   -0.0006    0.0007      -0.00022
 BEK      0.00094       0.0081    0.0065   -0.0018      -0.0002    0.0002    0.0001      -0.00108
 ...
```

- **Full versions of reports are available on ftp servers: EPN CB.**

METAchecker - main features

- Checks availability of LAC snx files on BKG ftp server;
- Checks three section of SNX files wrt the euref.snx:
  - SITE/RECEIVER (***receiver model, s/n, date installed, firmware***),
  - SITE/ANTENNA (***antenna model, s/n, date installed***),
  - SITE/GPS_PHASE_CENTER;
- Automatically compares most recent versions of snx files (both for LAC and EUREF files);
- Possibility of checking all LAC at once;
- Possibility of checking LAC for any numbers of weeks;
- Error log sending by an e-mail;
- Supports both Windows and Linux OS;

METAchecker – example of error log file

lac17876.snx

##

$SITE/RECEIVER - RECEIVER MODELS

EUSK LEICA GRX1200GGPRO LEICA GR25

HOE2 LEICA GRX1200+GNSS JAVAD TRE_G3TH DELTA

##

lac17876.snx

##

$SITE/ANTENNA - RECEIVER ANTENNA MODEL

EUSK LEIAT504GG LEIS LEIAR25.R4 LEIT

##

lac17876.snx

##

$SITE/ANTENNA - RECEIVER ANTENNA S/N

EUSK 00460 25299

BADH 6-022 56022

Data in LAC.snx file

Data in euref.snx file

„According to the new challenges which EPN has to face, **current Local Analysis Centres are invited to contact EPN CB and ACC to discuss a possible re-orientation of their contribution to the EPN**. The most urgent necessities are related, among others, to the real-time analysis, control analysis using different types of software and analysis made for the purpose of testing new strategies and models."

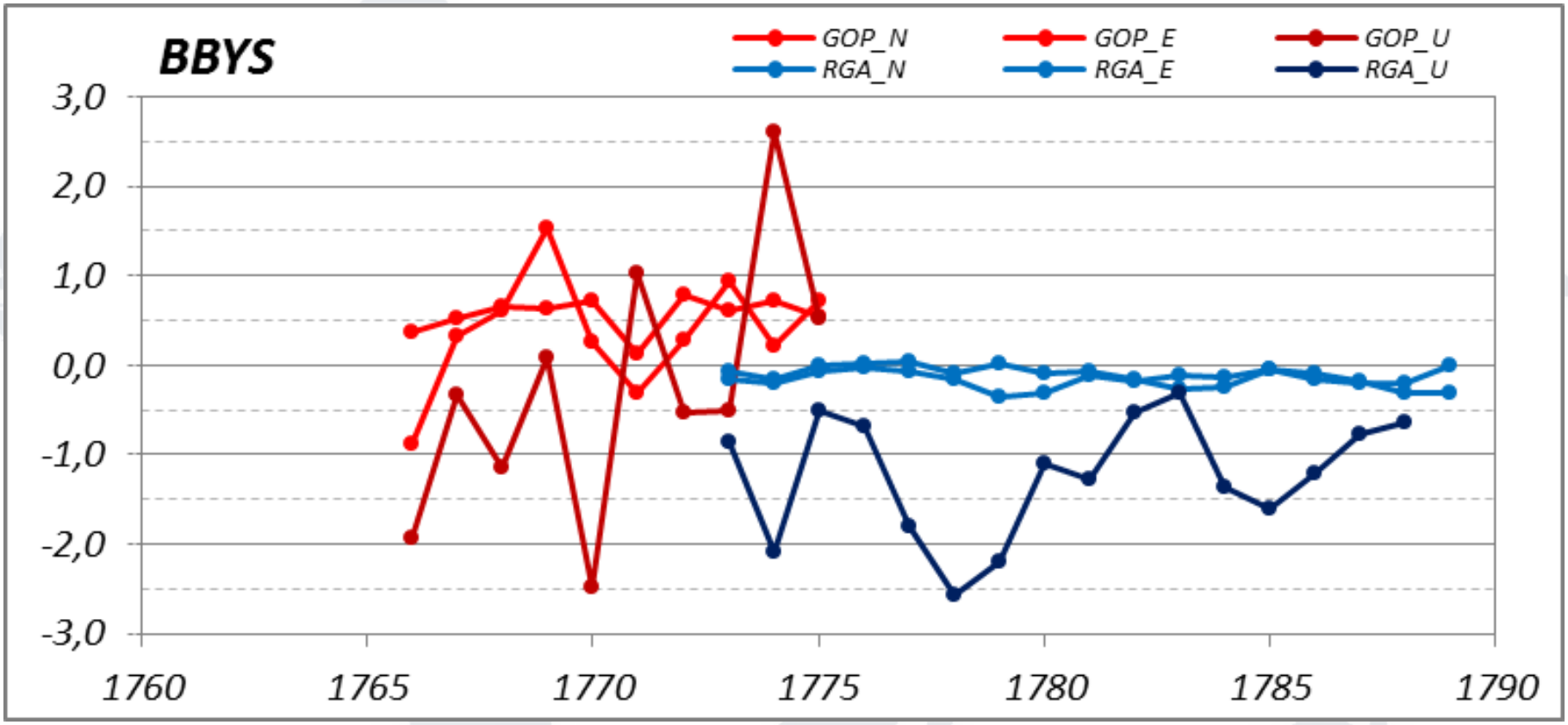
- **Local Analysis Centres** (LAC, routine contribution) estimate daily and weekly station positions and zenith tropospheric path delays for selected EPN stations.
- **Dedicated Analysis Centres** (DAC) analyse GNSS data as a contribution to EPN products which are still under development or products generated by EUREF Working Groups (e.g. reprocessing, densification, monitoring,...)

GOP (Geodetic Observatory Pecny) LAC decided to focus on the **reprocessing activties** and resign from routine weekly submissions (since 1773).

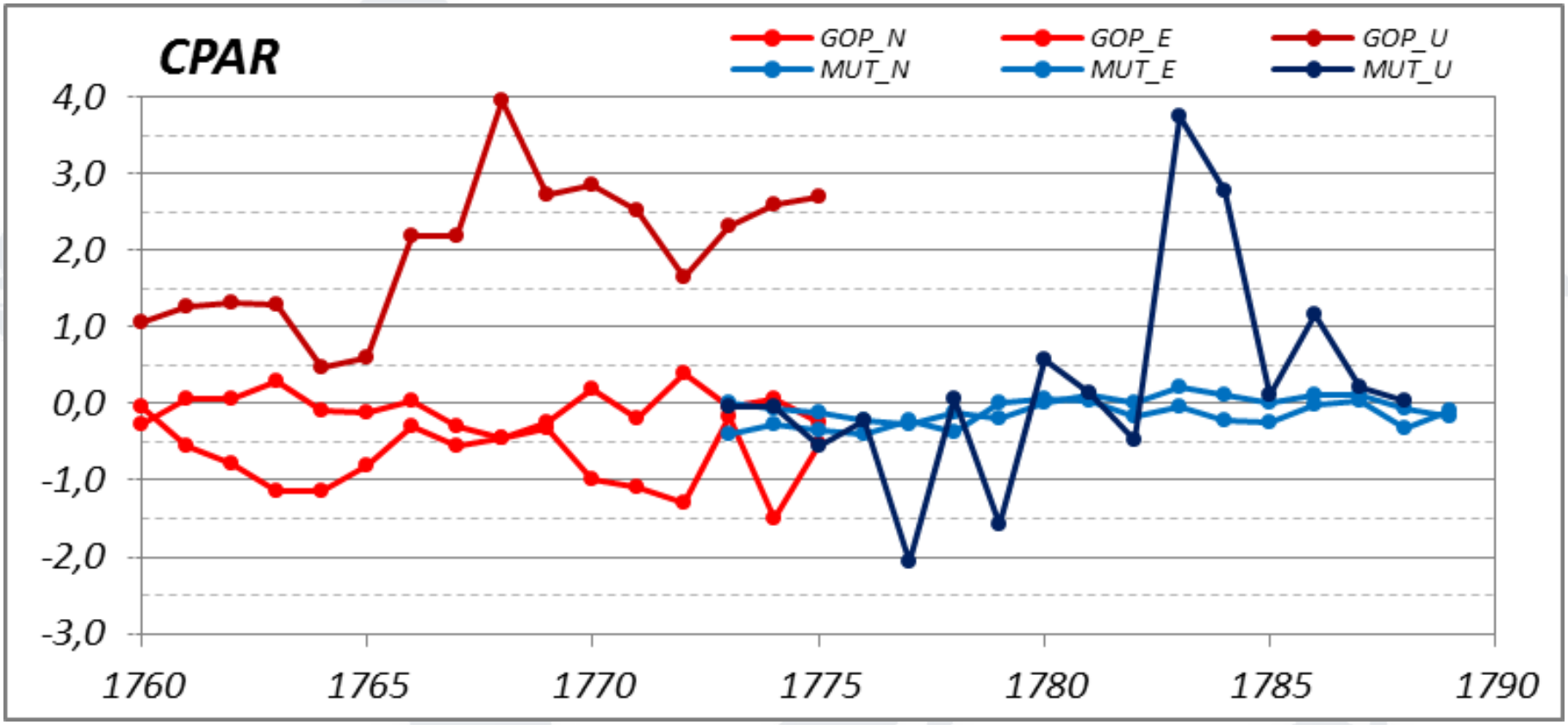
GOP LAC processed data from 71 EPN stations; Some of them were distributed among other LACs to make sure that all stations are processed by 4 or 5 LACs (3 is the minimum):

MUT LAC – added **10 stations** to the subnetwork;
OLG LAC – added **10 stations** to the subnetwork;
RGA LAC – added **10 stations** to the subnetwork;
WUT LAC – added **12 stations** to the subnetwork.

Currently all stations are processed by 4 or 5 LACs (except for the AUT1, MATE and ZIMM which are processed by 6 LACs).



Time series of BBYS station coordinates



Time series of CPAR station coordinates

Thank you for your attention!

http://www.epnacc.wat.edu.pl/

epn_acc@wat.edu.pl