SKPOS® (EUPOS®) network solution monitoring application

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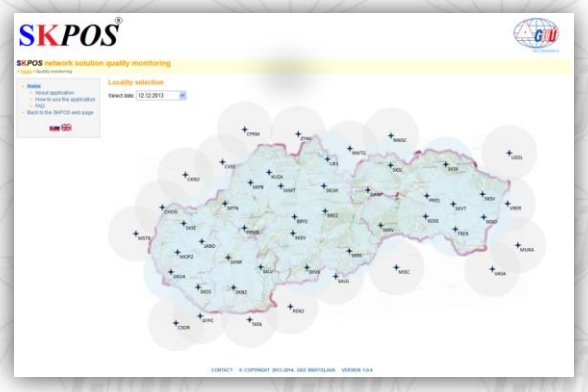
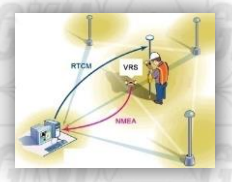
Motivation

- **SK*POS*®** represents the corner-stone of the geodetic controls in Slovakia (serves for precise ETRS89 coordinates determination)
- **SK*POS*®** administrator needed an independent tool for service quality evaluation in real time with the ability to provide the its results to users and to public
- Motivation resulted into web application „ **SK*POS*®** network solution quality monitoring“ creating



Tool design



RTKNAVI
www.rtklib.com

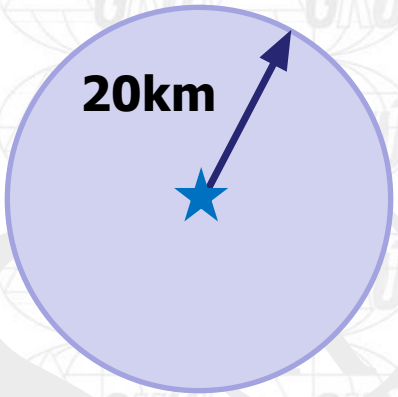
- Virtual solution (no real monitor stations)
- Baseline processing by RTKNAVI software
- Monitoring of the whole territory of Slovakia
- Fully automatic solution
- Results available via web (desktop/mobile)

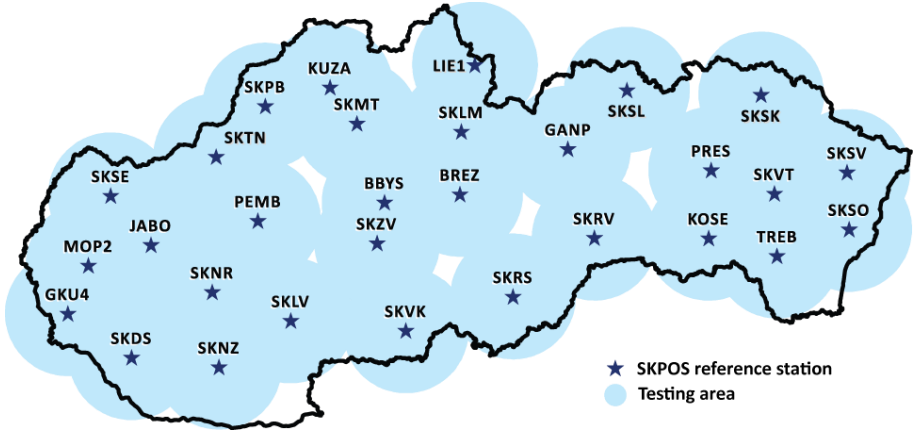
Principle: RTKNAVI simulates the rover (standing on the known point) connected to SK*POS*® and computes the baseline composed of VRS and the nearest SK*POS*® permanent station. VRS station is fixed and permanent station coordinate is computed and compared to original coordinates.

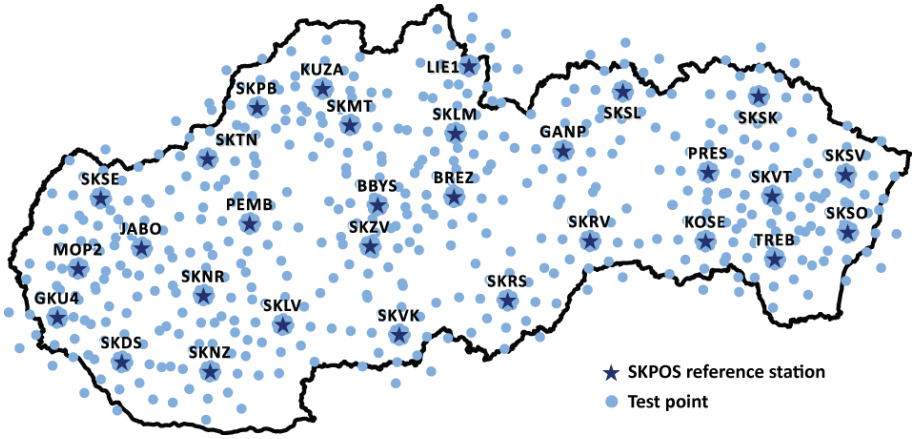
Test points distribution

- Slovakia is divided into circle regions with the SK*POS*® stations in the origins
- Distances from the centres to testing points: **2km**, **11km**, **20km**
- Azimuths of the testing points baselines:

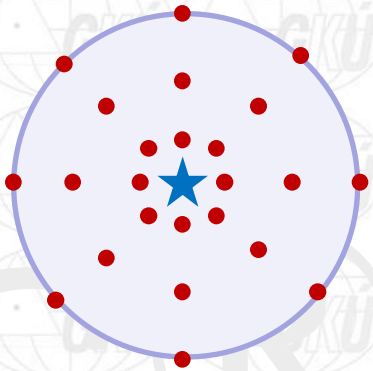
0°, 45°, 90°, ..., 315°







Test points selection



- Combination of distance and azimuth = 24 possibilities of the test points within one circle region
- Each locality is tested one time per hour
- Random generation of azimuth/distance combination is used
- Length of the one locality test takes 2 minutes

2 min

Criteria quality output

Fix √
~~Float~~

↓

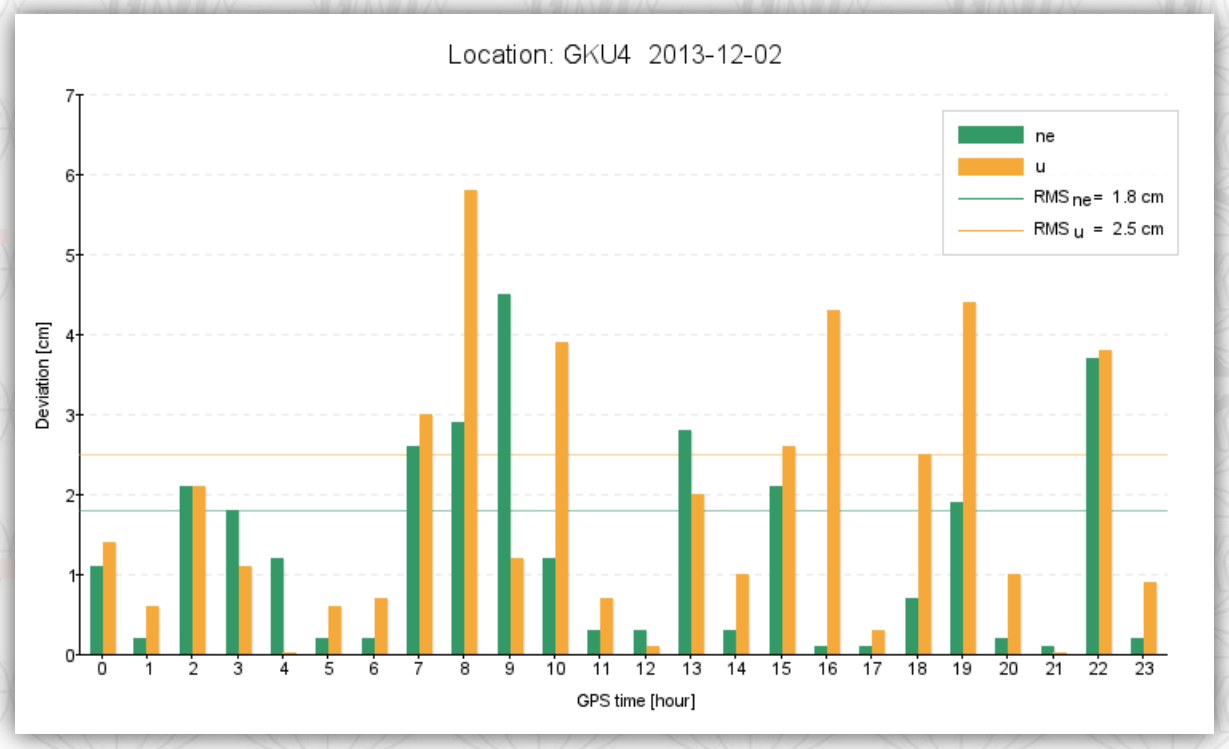
Grubbs test

↓

φ, λ, h → n, e, u

↓

Deviations computation (ne, u)



Fully Automatic solution

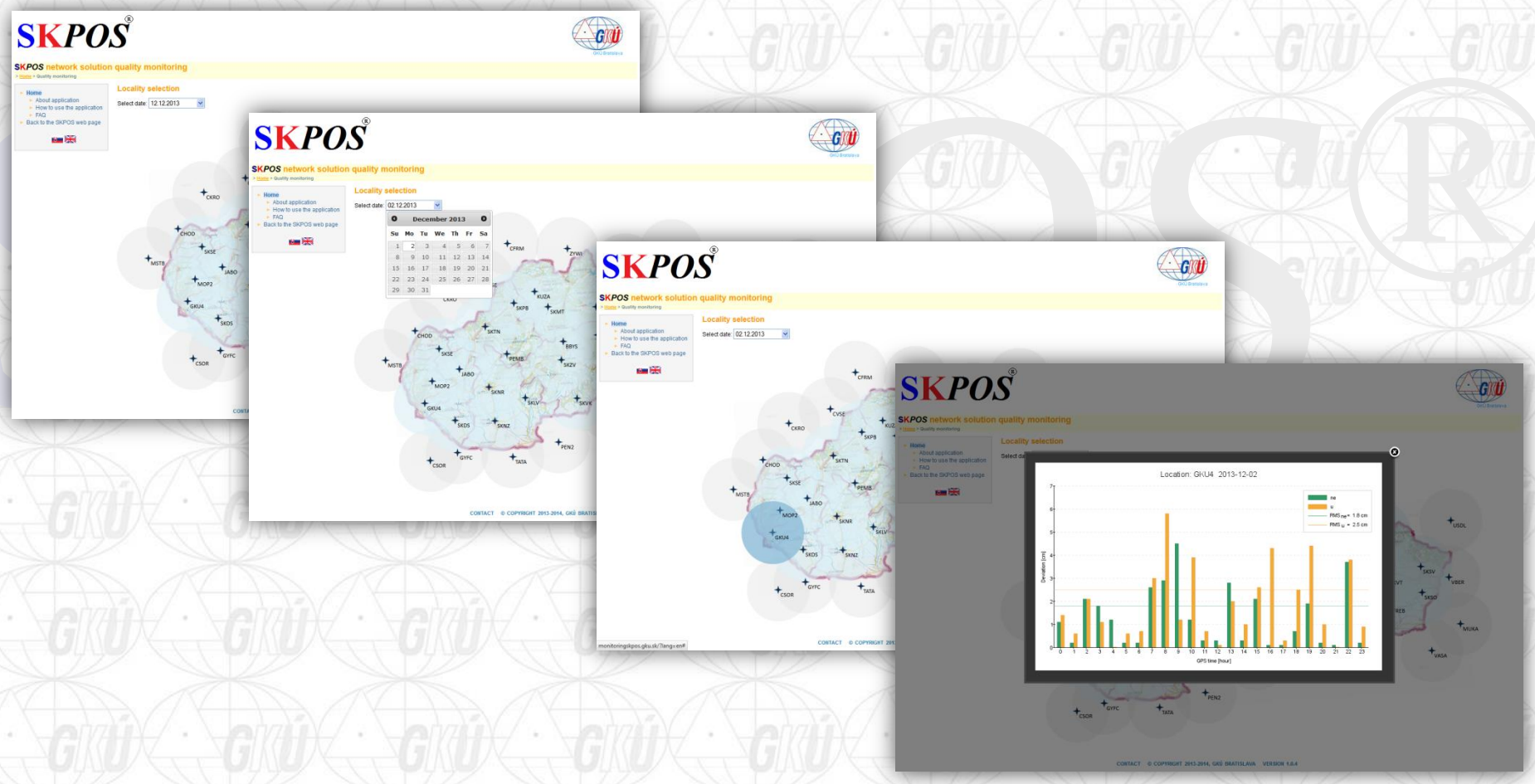
- RTKNAVI is controlled by the script tool **AutoHotkey**
- Processing is controlled by the PHP script
- Results are stored into MySQL database

Monitoring1

DATE	TIME	STATION	DISTANCE	ANGLE	LATITUDE	LONGITUDE
2013-04-11	14:00:21	JABO	13	225	48.399138	17.540874
2013-04-11	14:03:42	SKDS	13	180	47.878925	17.607287
2013-04-11	14:07:04	SKTN	3	0	48.915970	18.032948
2013-04-11	14:10:25	SKNR	13	315	48.392352	17.959952
2013-04-11	14:13:47	GKU4	3	225	48.138021	17.143393
2013-04-11	14:17:08	SKMT	3	180	49.055299	18.933680
2013-04-11	14:20:30	KUZA	13	315	49.306023	18.612505
2013-04-11	14:23:51	SKSE	23	0	48.886837	17.373121
2013-04-11	14:27:13	SKNZ	13	180	47.872697	18.170138
2013-04-11	14:30:34	PEMB	13	270	48.622421	18.164294
2013-04-11	14:33:56	BBYS	23	45	48.885800	19.372809
2013-04-11	14:37:18	SKPB	3	270	49.115094	18.403315
2013-04-11	14:40:39	SKLV	3	315	48.232327	18.577020
2013-04-11	14:44:01	MOP2	3	135	48.353412	17.302452
2013-04-11	14:47:22	SKZV	13	180	48.457719	19.122585

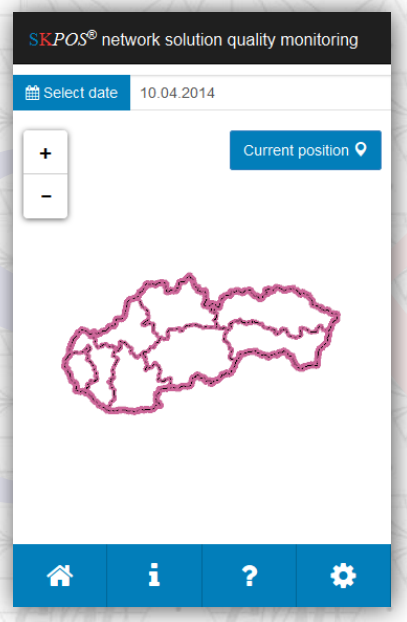
User interface – desktop version

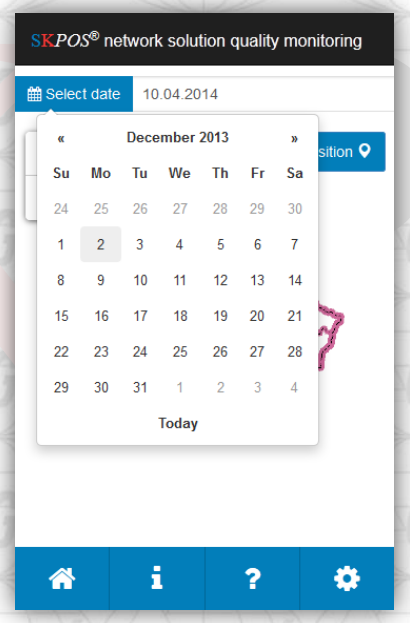
- http://monitoringSKPOS.gku.sk

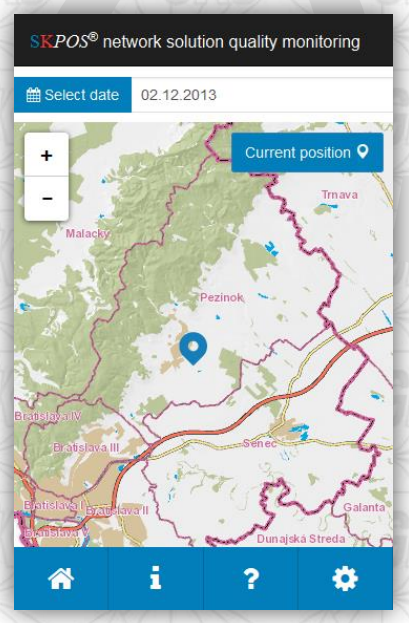


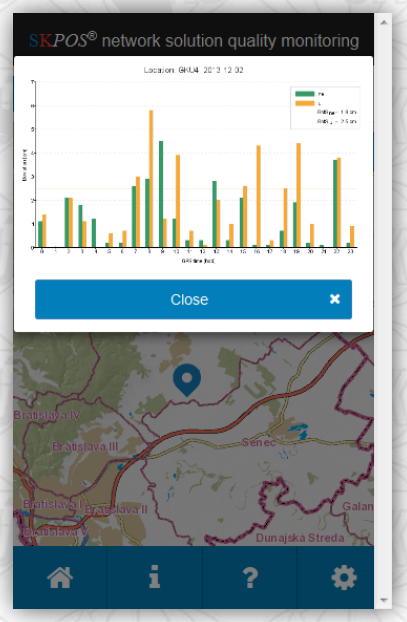
User interface – mobile version

- http://monitoringSKPOS.gku.sk/m









Application running first results

- Results from time period: 1/7/2013 – 28/4/2014 (300 days)
- Over 167,500 values analysed
- Statistics in the table

	Horizontal component (ne)	Vertical component (u)
Values	167,522	167,522
Maximal value	46.0 cm	44.7 cm
Average value	1.2 cm	2.4 cm
Standard deviation	1.73 cm	2.98cm
No fix	13 %	

Application running – first results

Day and night values comparison

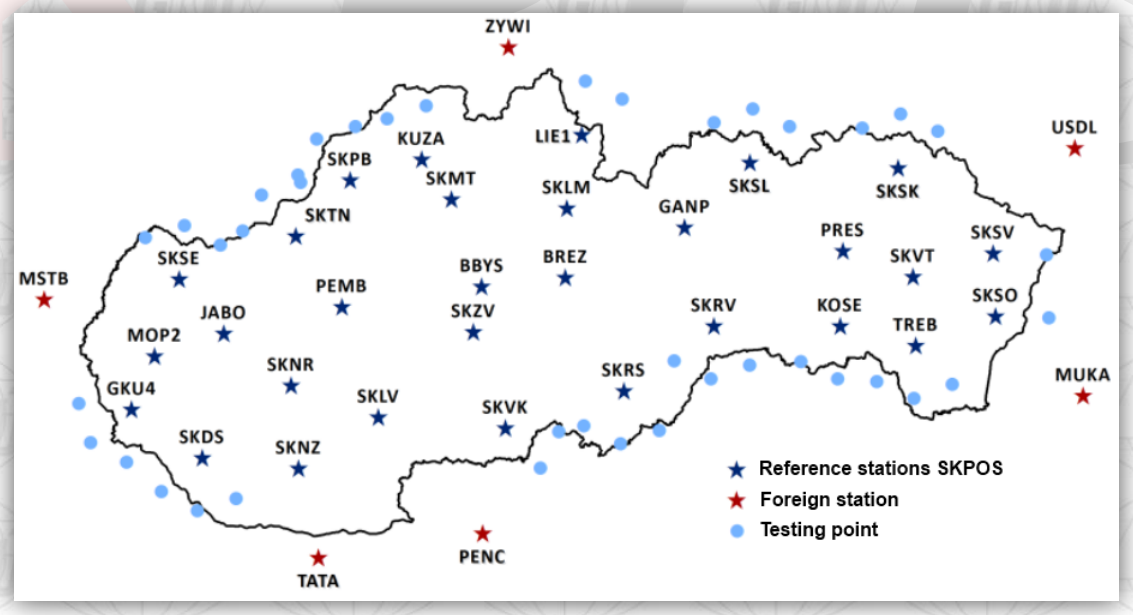
- Results from time period: 1/7/2013 – 28/4/2014
- 300 days analysed
- Statistics in the table

	Horizontal component (ne)	Vertical component (u)
Day	1.3 cm	2.4 cm
Night	1.0 cm	2.4 cm

Application running – first results
Border zone vs. whole Slovakia

- Results from time period: 1/7/2013 – 31/10/2013

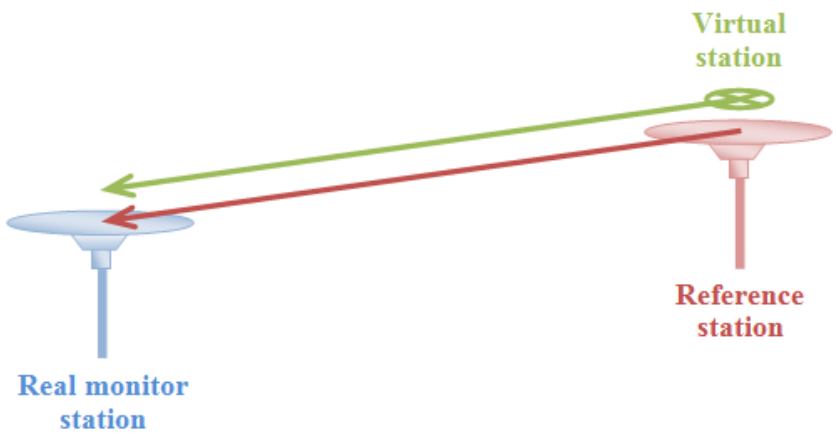
	Horizontal component (ne)	Vertical component (u)
Whole area	1.1 cm	2.3 cm
Border zone	2.1 cm	2.3 cm

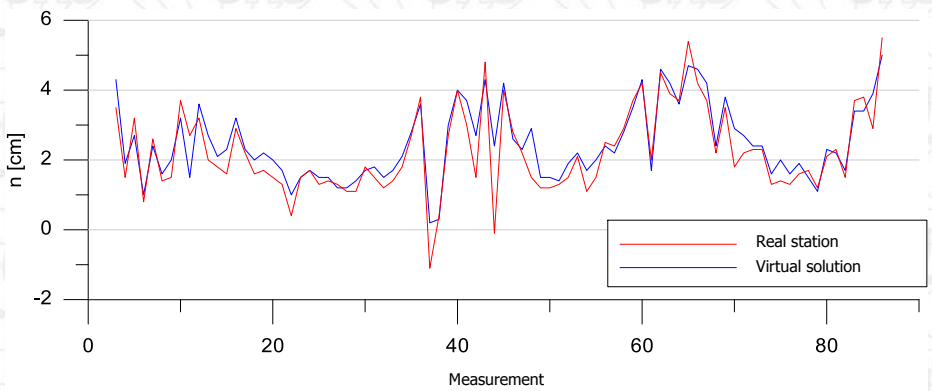


Quality evaluation of the virtual solution

- Virtual solution vs. Real monitor station (SUT1) comparison
- Time period: 1/7/2013 – 30/7/2013

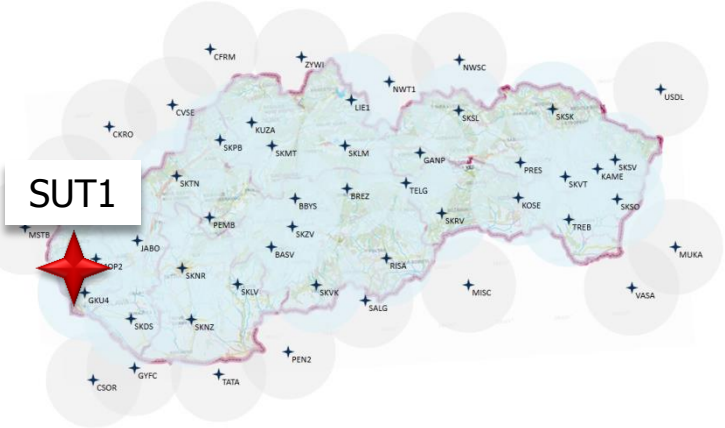
	n	e	u
Number of Values	32,478	32,478	32,478
Average deviation	0.2 cm	0.1 cm	0.9 cm





Quality evaluation of the virtual solution
New SK*POS*® monitoring station

- SK*POS*® (real) monitoring station is establishing in Bratislava – the name is SUT1
- SUT1 station is 4 km from the GKU4 SK*POS*® reference station
- SUT1 station is located in urban area
- Station will serve for:
  - real time comparison of real station and virtual solution monitoring
  - quality verification of virtual solution monitoring
- Results will be available from June 2014



Network RTK monitoring

Proposal

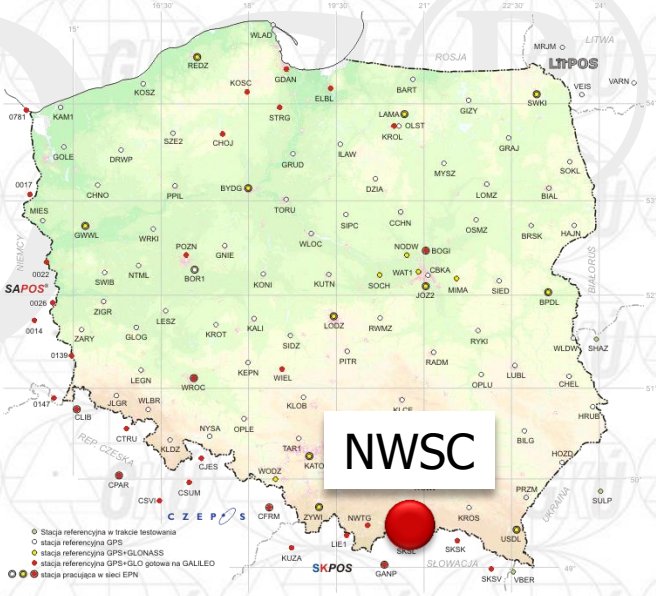
- Slovakia would like to monitor all *EUPOS* countries network solutions – no single station RTK monitoring
- ***EUPOS* network RTK monitoring = the new *EUPOS* tool**
- Results will be provided through the EUPOS web page and through *EUPOS* countries GNSS network web page

- What we need:
  - access to network solution (network RTK) and to all permanent stations via NTRIP Caster
  - corrections in RTCM 3.x format
  - information about reference stations coordinates (we need up to date information about station from ESDB)

Network RTK monitoring

ASG-EUPOS solution

- EUPOS Network RTK monitoring is tested
  - on ASG-EUPOS - station NWSC
- Connection is OK but some problem occurred
  - our PROXY server is problematic = NMEA message is sending not correctly
- First results
  - next EUPOS ISC meeting ☹



Acceptance of the monitoring into EUPOS® Technical Standards

- we plan to apply for monitoring acceptance into *EUPOS* technical standards (maybe in next *EUPOS* ISC meeting)
  - next *EUPOS* ISC we will have (we hope)
    - comparison of real monitor station with used virtual solution
  - Czech republic has their own virtual monitoring
    - we plan to compare the results with our solution
- After the monitoring will be accepted into *EUPOS* TS and EUPOS network RTK monitoring will be established, EUPOS will have one more own tool for quality evaluation ☺

Thank you for your attention

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