Presented at EUREF 2004
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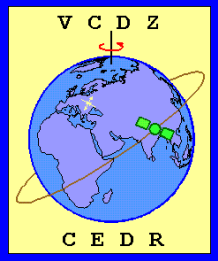

TEST OF THE GPS DUAL-FREQUENCY RECEIVER SEPTENTRIO *POLARX2* AT THE GEODETIC OBSERVATORY PECNY

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The reason of testing

- Instrument is produced by SEPTENTRIO company (Leuven, Belgium)
- Research Institute of Geodesy, Topography and Cartography at Zdiby (RIGTC) bought instrument last year to test it to be able operating at permanent geodynamical stations
- During *EUPOS* session in Berlin last year the representative of SEPTENTRIO company asks RIGTC to test this instrument with respect to some „standard“ instrument (*Asthech, Trimble*)

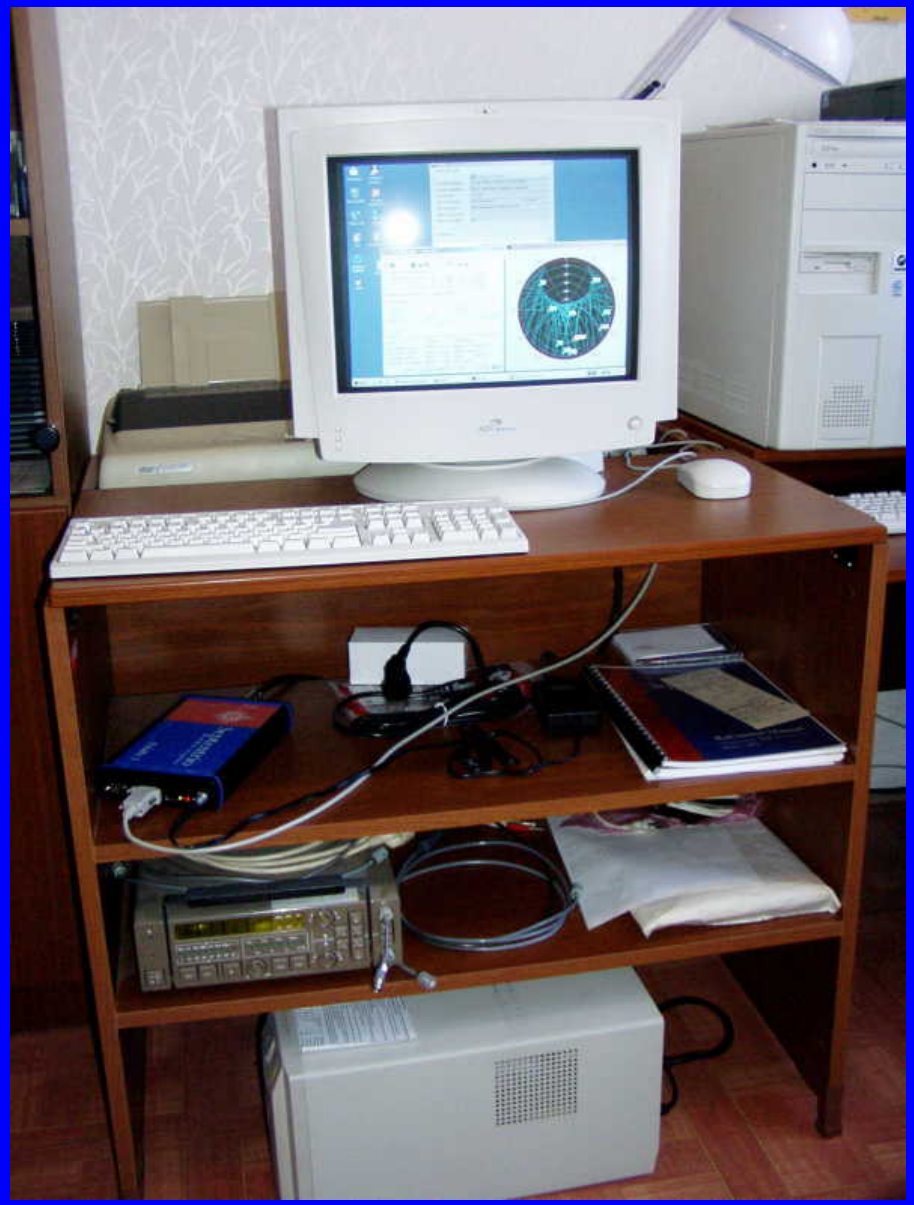
Experiment (1)

- Experiment was performed at Geodetic Observatory Pecný at Ondřejov

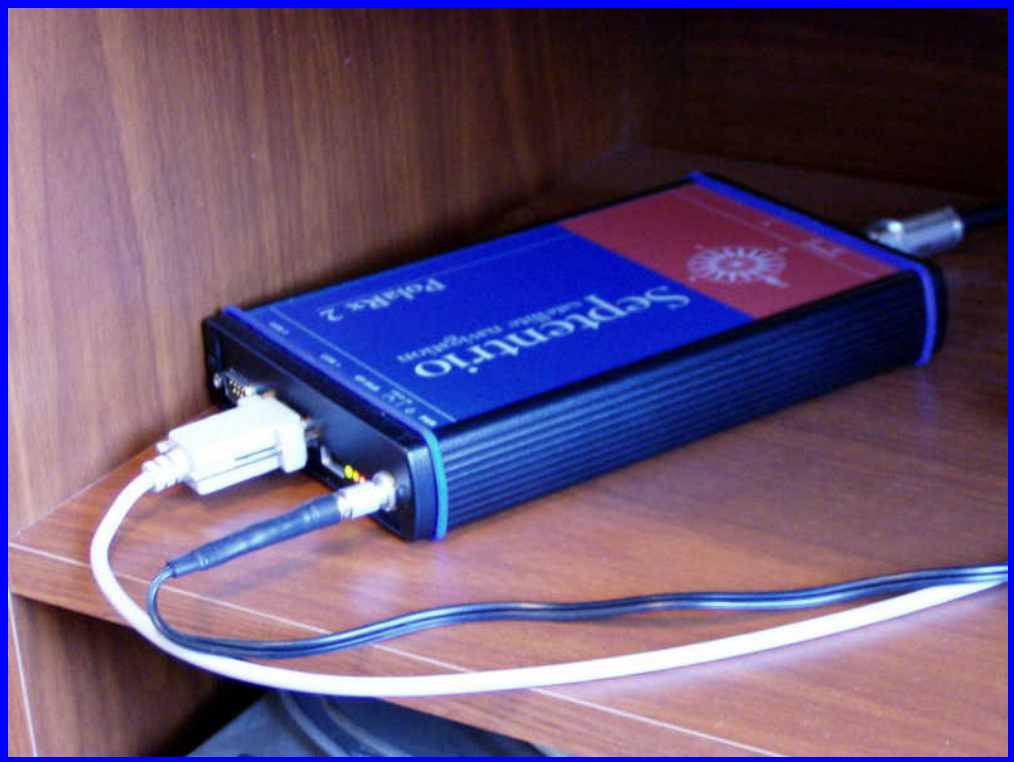
Experiment (2)

- Septentrio receiver *PolaRx2* is the receiver developed by the company Septentrio Ltd. in Leuven, Belgium. It is relatively small and cheap geodetic receiver.
- The *PolaRx2* receiver was connected to the *Topcon CR3 GGD* antenna with conical radome during the experiment.

Experiment (3)



SEPTENTRIO *PolaRx2* receiver



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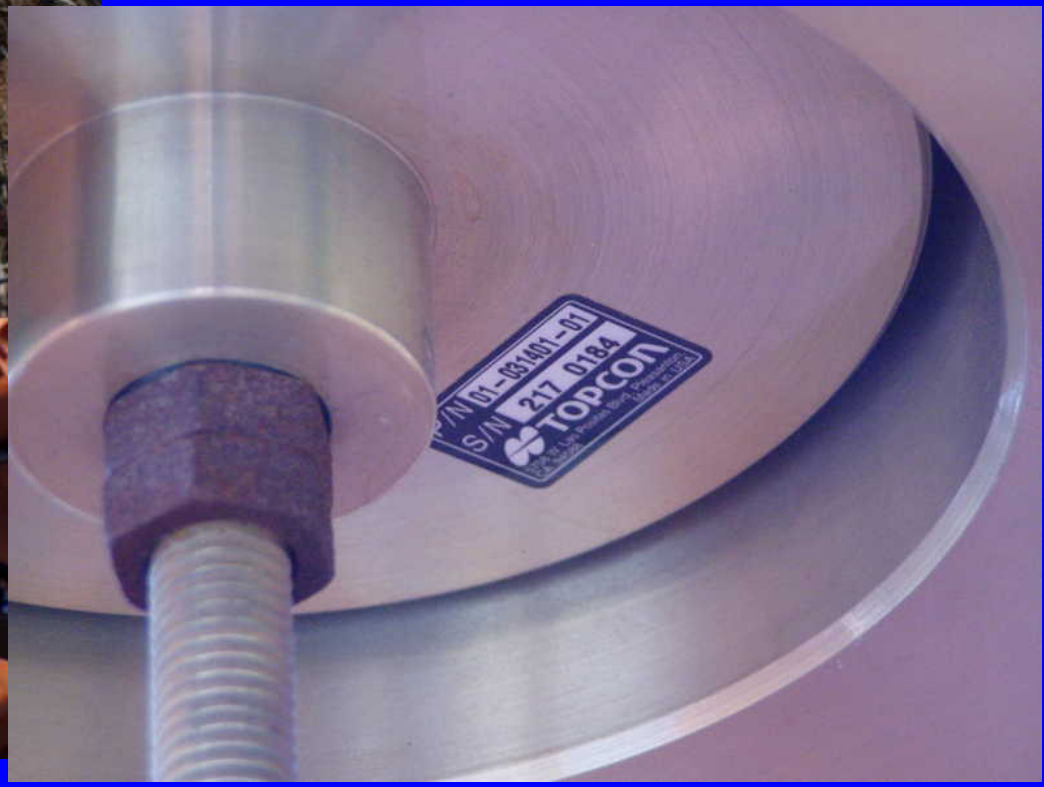
TOPCON CR-3
GGD antenna

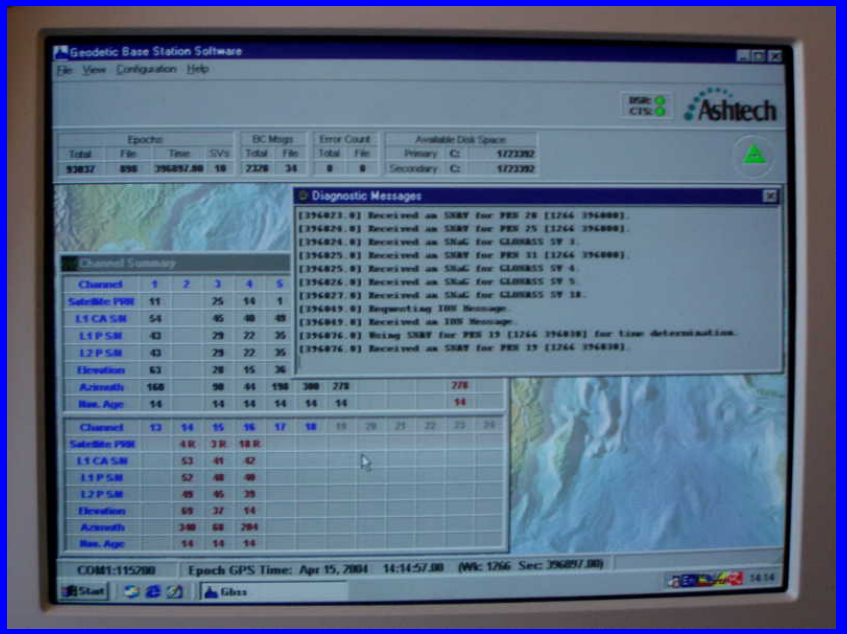


Experiment (4)

- We use for *PolaRx2* instrument mode with 15 dual-frequency GPS channels and 3 single frequency SBAS channels. We collect measurements on C/A-, P1-, P2-code and L1-, L2-carrier phase and Doppler counts in 1 Hz output rate. The 1 seconds output was decimated to 30 seconds output rate. The time of measurements is synchronized with true GPS time in range of 1 ms.

Experiment (5)

- The second instrument was *Ashtech Z-18*, operating at GOPE station since 1999 with
- *Ashtech choke-ring* antenna GG with snow radom



ASHTECH Z-18
receiver at GOPE

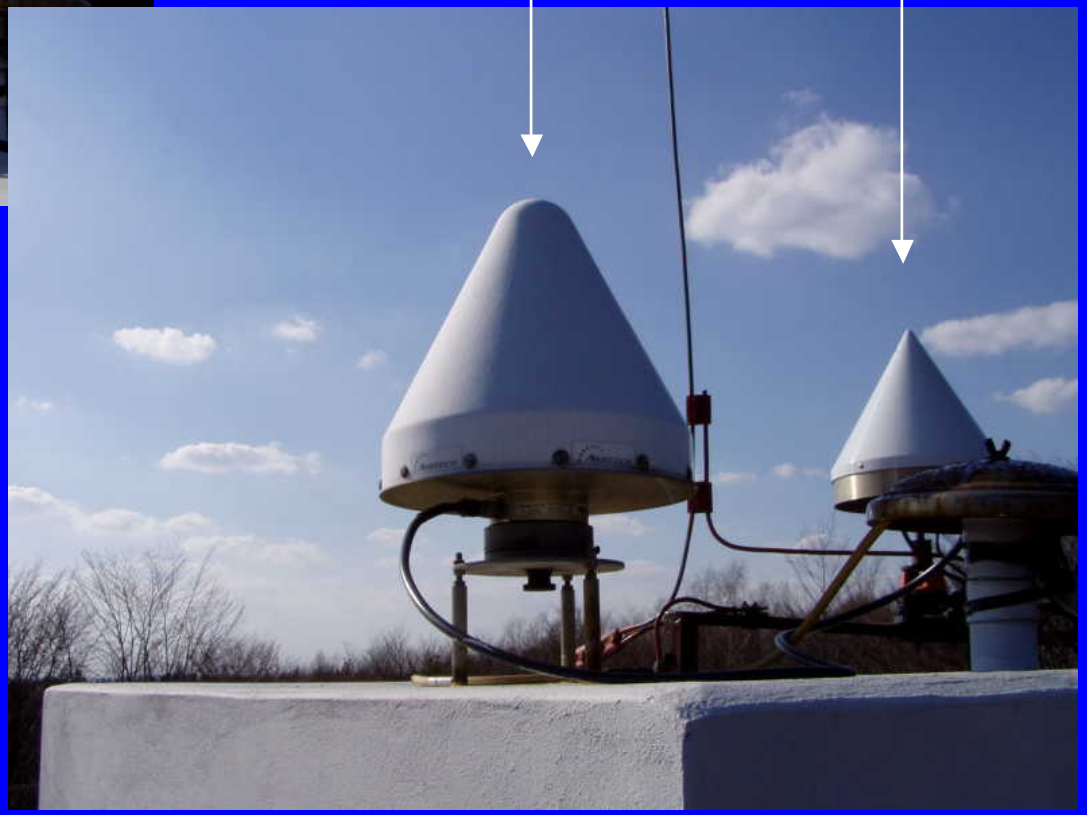
EUREF 2004, Bratislava, June 2004

ASHTECH choke-ring
antenna GG

Configuration of the testing stations

- First station – GOPE IGS/EPN observing pillar, occupied by *Ashtech Z-18*
- Second station – point at the iron hand-rail (unfortunately unstable point!), approximate 1.1 m north-north-west from GOPE station occupied by *PolaRx2* instrument

Ashtech PolaRx2

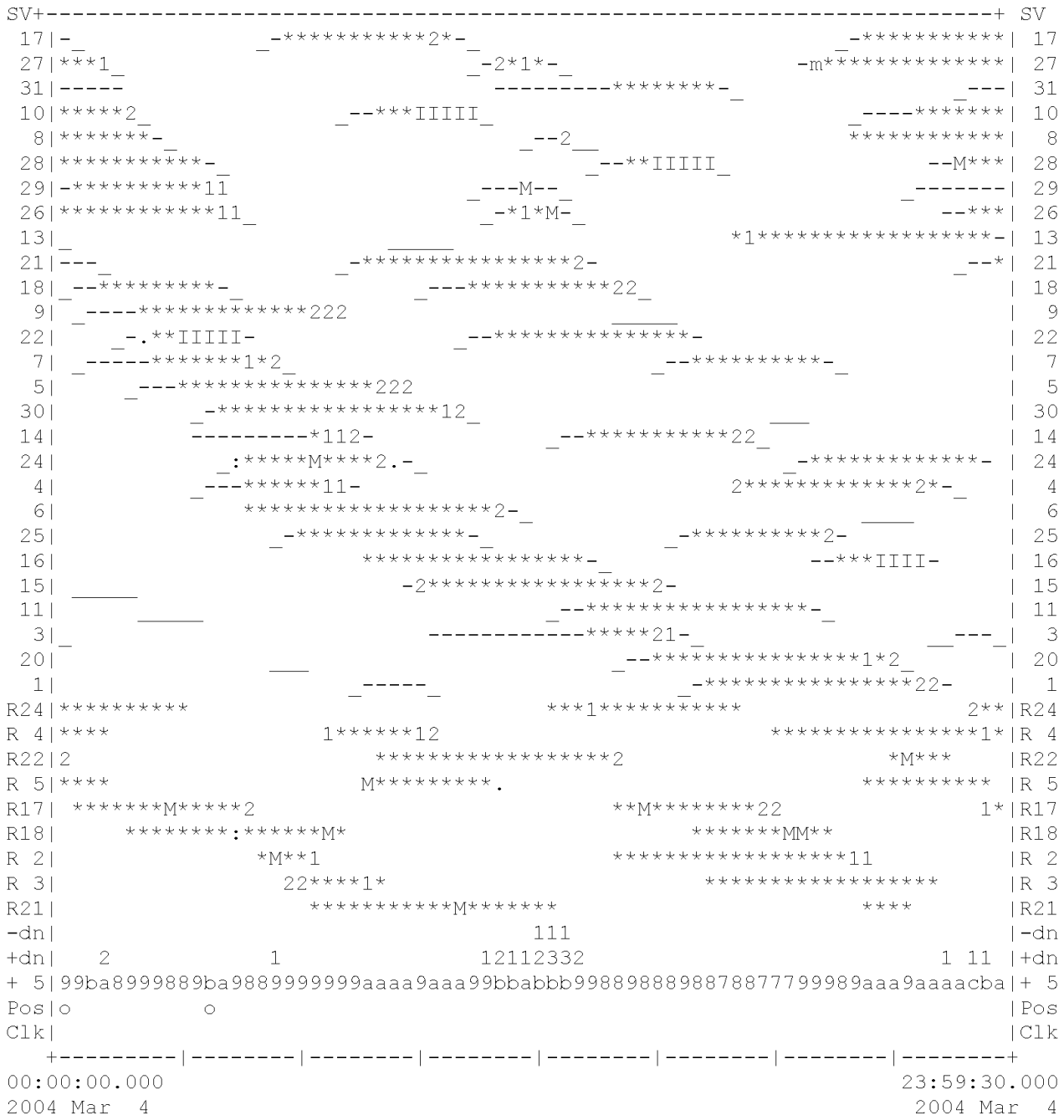


Processing of the data (1)

- Observing interval: 11th August 2003 – 8th March 2004
- Software GEOGENIUS (Terrasat/Trimble)
  - Observations after 30 seconds collected to daily files, elevation mask 5 deg.
  - Broadcast ephemeris were used (some epochs were processed with precise ephemeris, but no differences were observed)

Processing of the data (2)

- Due to internal oscillator aging the receiver *PolaRx2* inserts 1 ms jump for resetting internal clock every approximately 30 minutes.



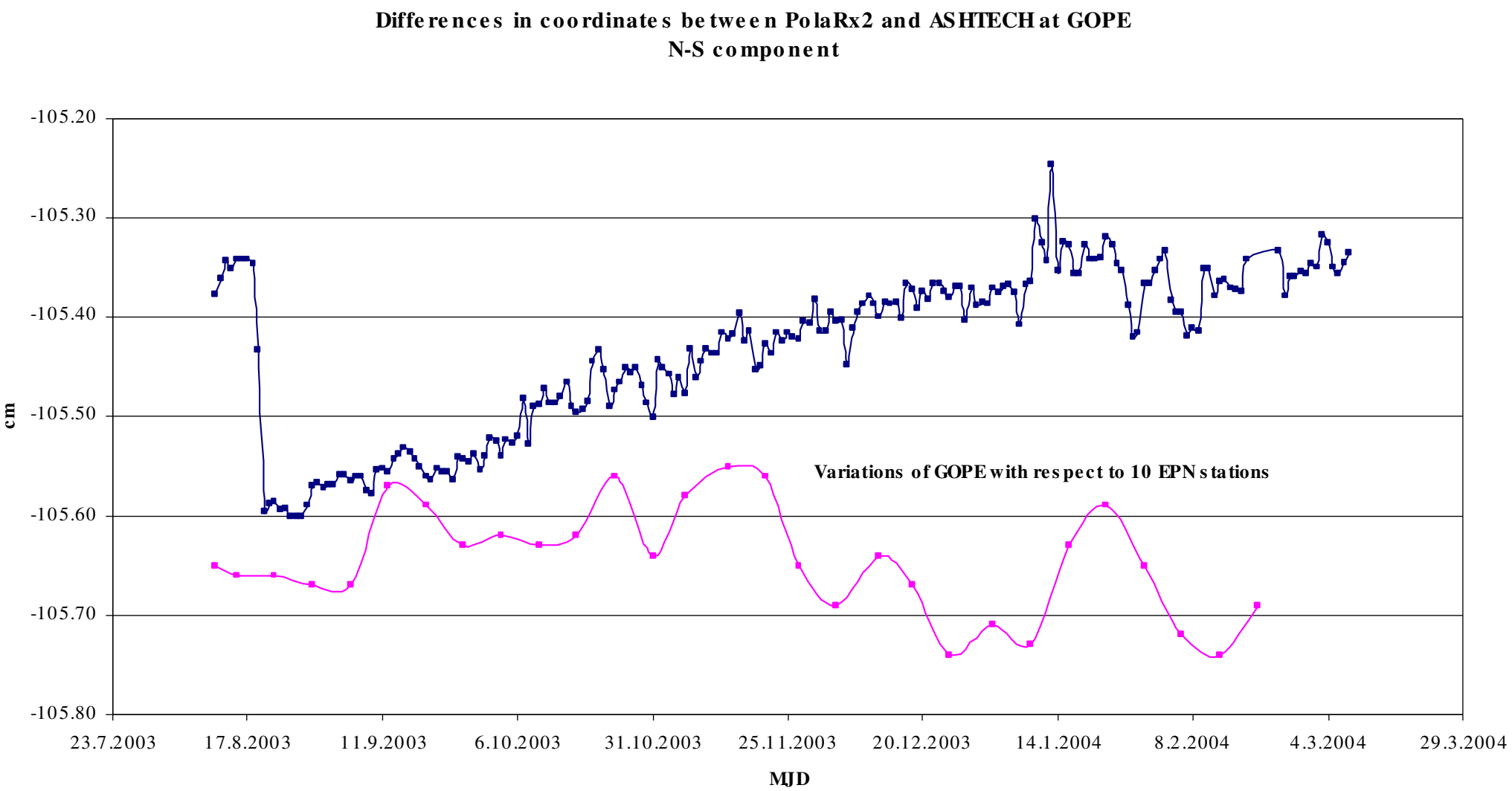
Part of *Ashtech* „TEQC“ protocol

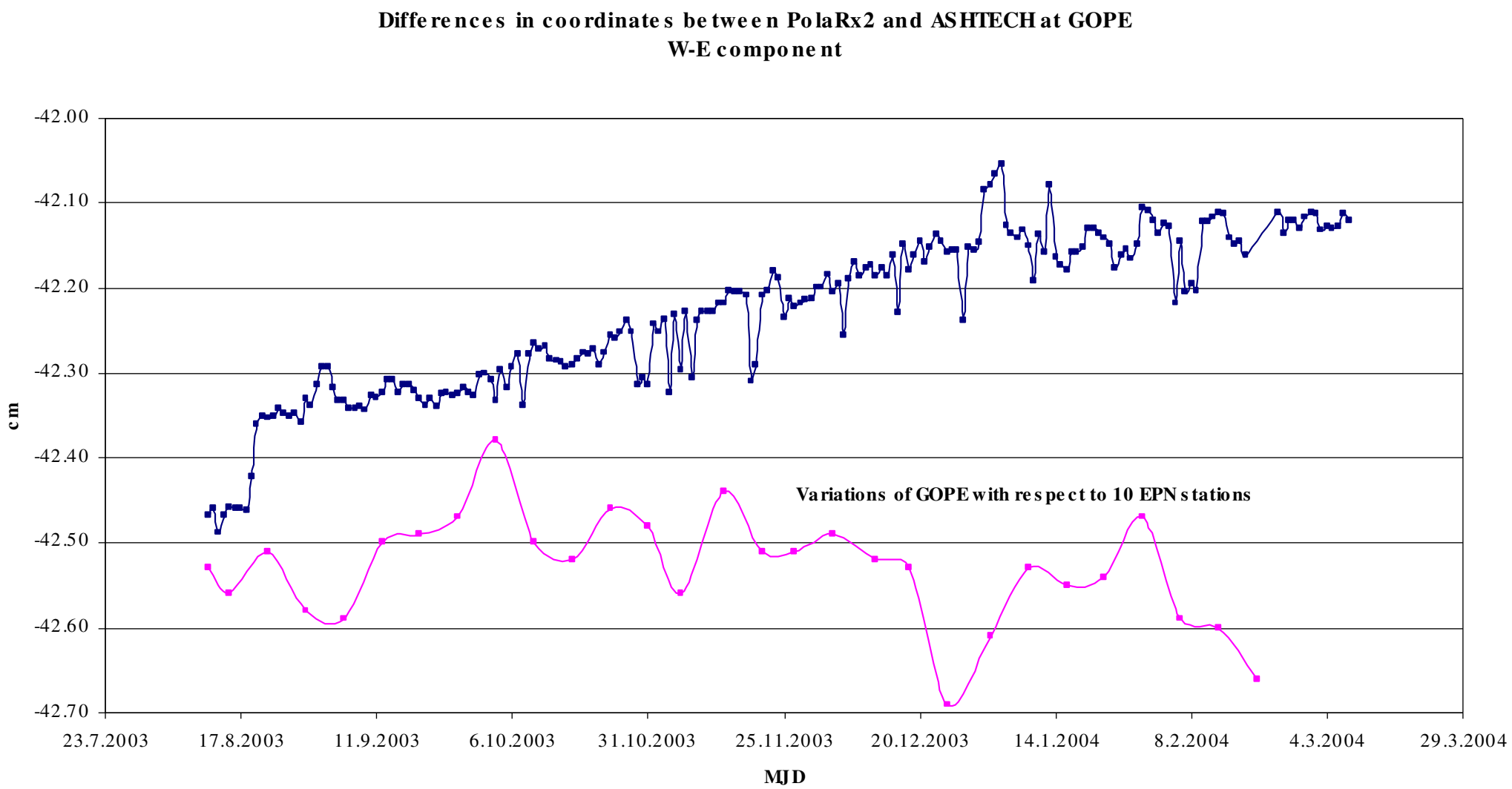
Part of *PolaRx2*
„TEQC“ protocol

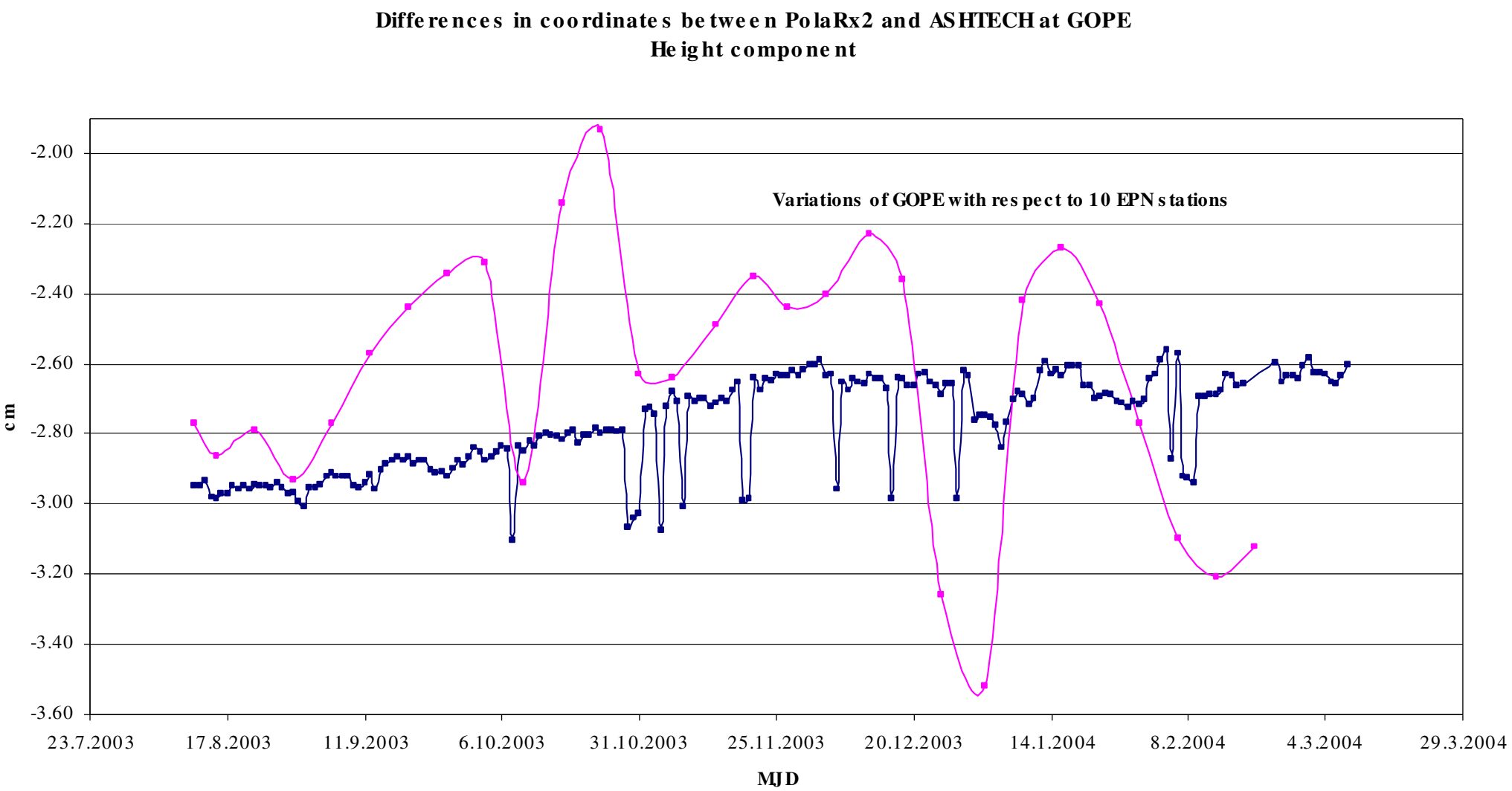
„C“ means receiver
clock synchronization

Processing of the data (3)

- For collecting *PolaRx2* data we use the RxControl program with our own superstructure. Main disadvantage for continuous running of receiver on any permanent station is that the RXControl software doesn't start logging of measurement to files automatic after the on-site computer starts.


Differences in coordinates between PolaRx2 and ASHTECH at GOPE
N-S component
-105.20
-105.30
-105.40
-105.50
-105.60
-105.70
-105.80
cm
Variations of GOPE with respect to 10 EPN stations
23.7.2003
17.8.2003
11.9.2003
6.10.2003
31.10.2003
25.11.2003
20.12.2003
14.1.2004
8.2.2004
4.3.2004
29.3.2004
MJD


Differences in coordinates between PolaRx2 and ASHTECH at GOPE
W-E component
-42.00
-42.10
-42.20
-42.30
-42.40
-42.50
-42.60
-42.70
cm
Variations of GOPE with respect to 10 EPN stations
23.7.2003
17.8.2003
11.9.2003
6.10.2003
31.10.2003
25.11.2003
20.12.2003
14.1.2004
8.2.2004
4.3.2004
29.3.2004
MJD

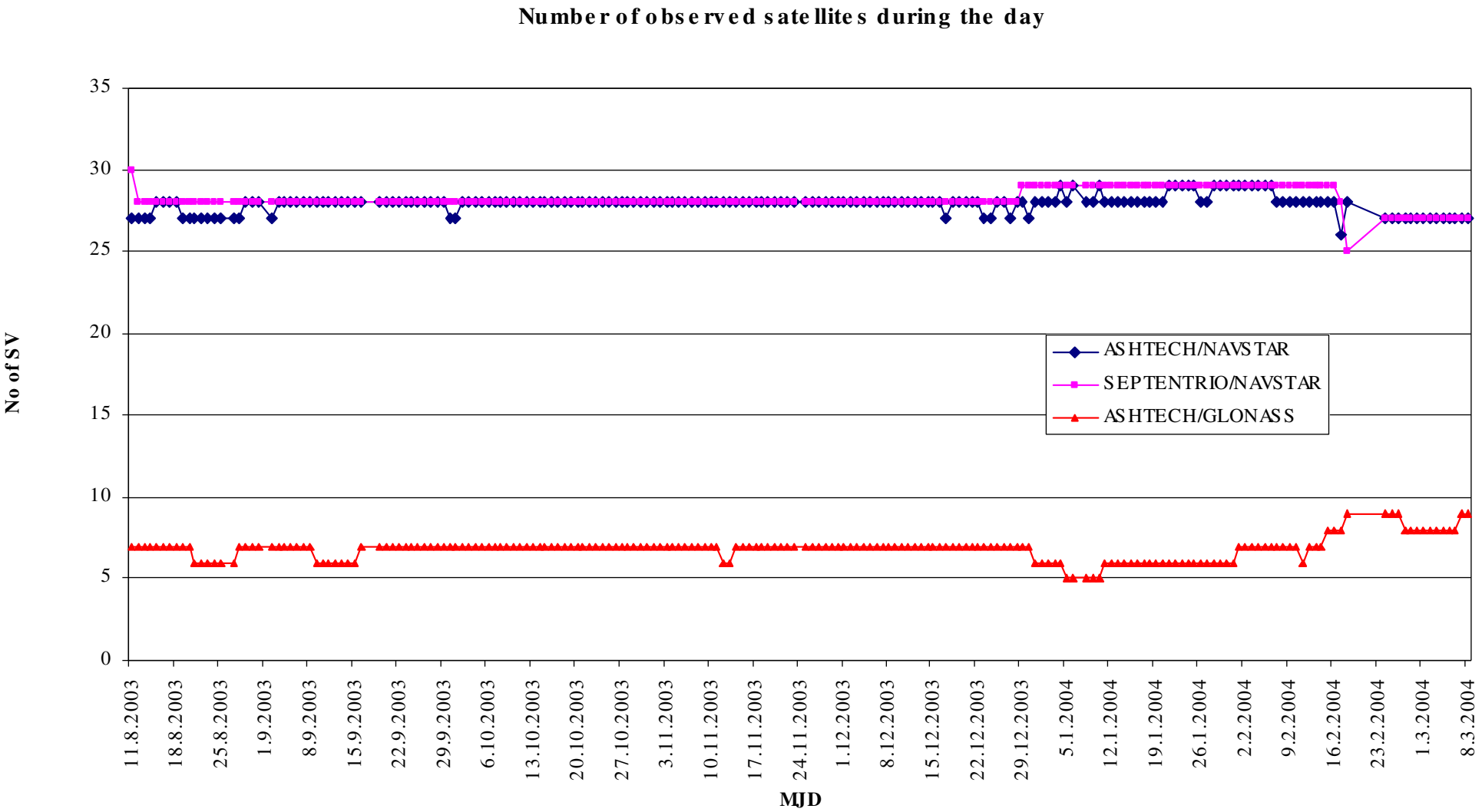

Differences in coordinates between PolaRx2 and ASHTECH at GOPE
Height component
Variations of GOPE with respect to 10 EPN stations
-2.00
-2.20
-2.40
-2.60
-2.80
-3.00
-3.20
-3.40
-3.60
cm
23.7.2003
17.8.2003
11.9.2003
6.10.2003
31.10.2003
25.11.2003
20.12.2003
14.1.2004
8.2.2004
4.3.2004
29.3.2004
MJD

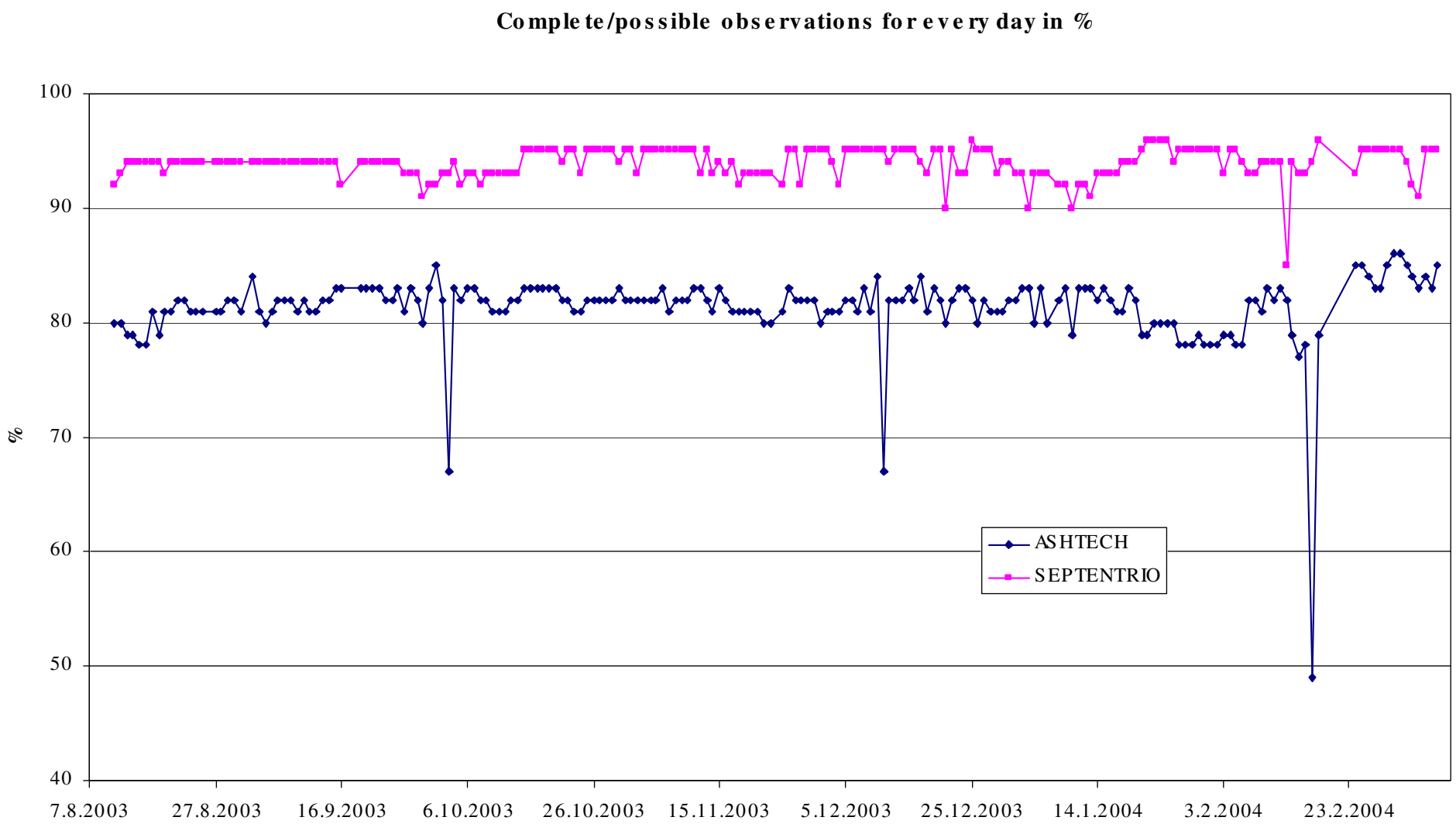
Results (1)

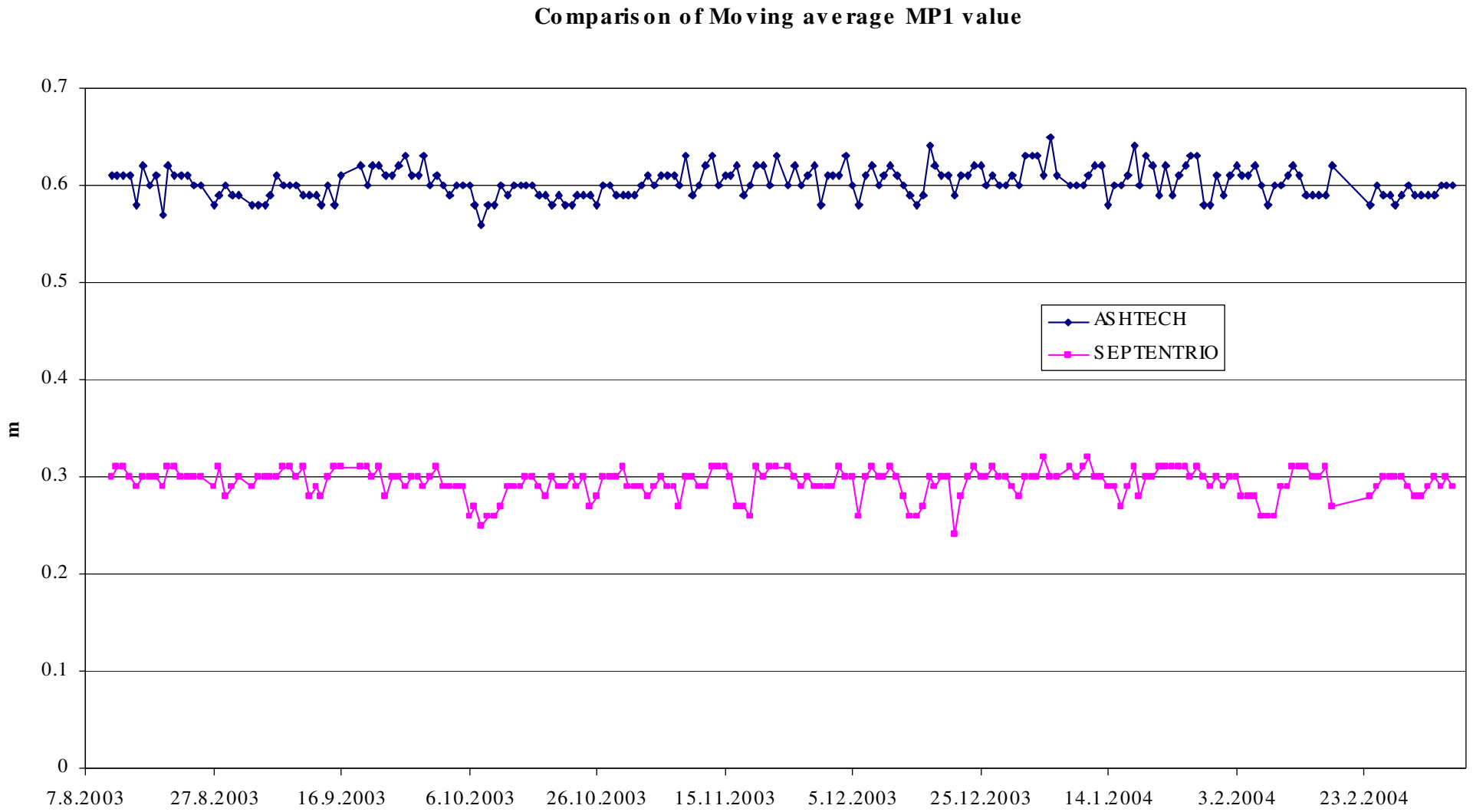
- Comparison of relative position determination shows *seasonal effect* caused probably by deformation of *iron hand-rail*
- Comparison with results of analysis of GOPE coordinates evolution from EPN data weekly solution set (fixed to 10 collocation station) can not explain this seasonal effect

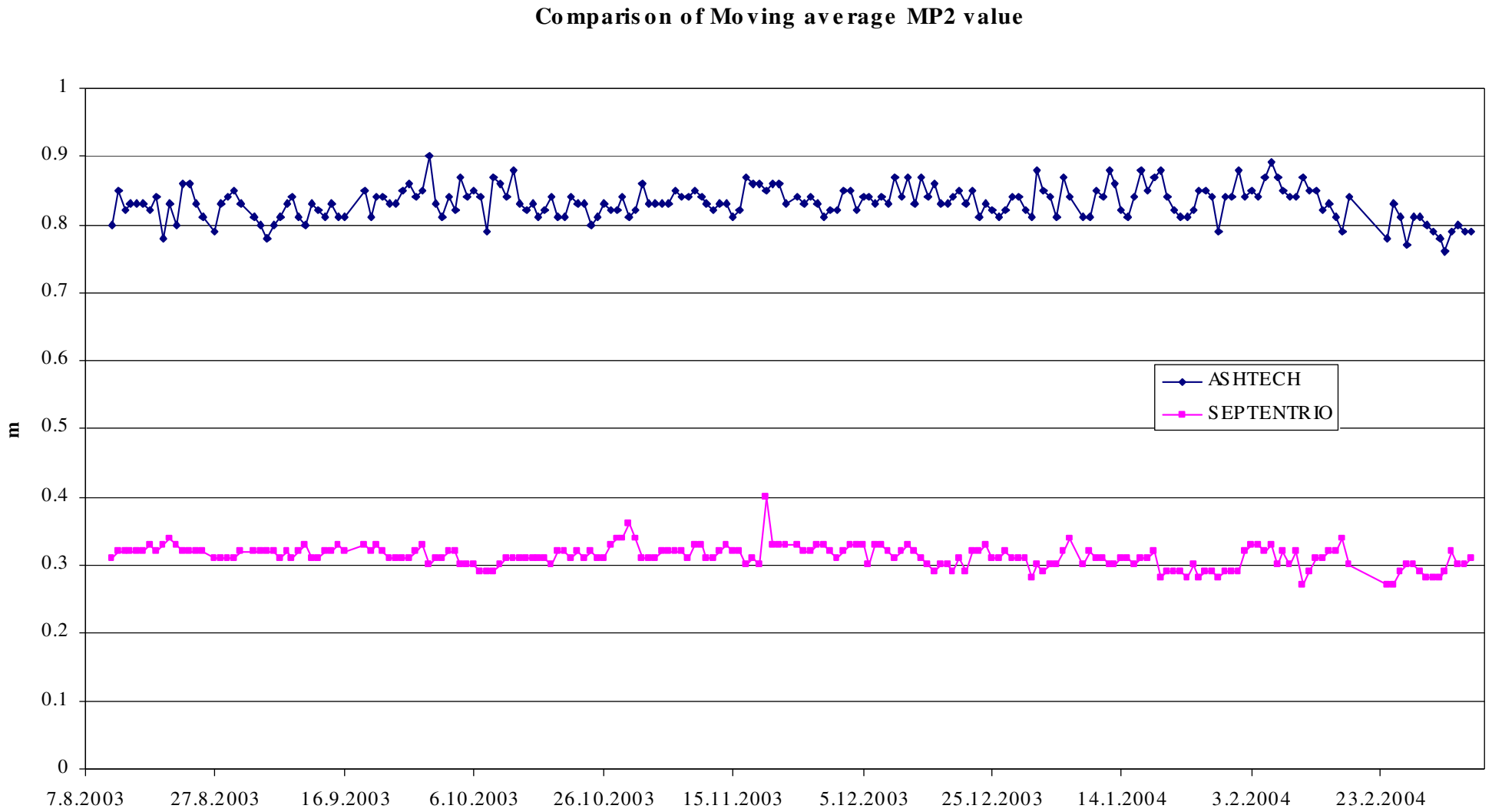
Results (2)

- Comparision of both receivers is possible using different parameters from TEQC (Translate Editing Quality Check) files produced everyday for both receivers


Number of observed satellites during the day
No of SV
35
30
25
20
15
10
5
0
ASHTECH/NAVSTAR
SEPTENTRIO/NAVSTAR
ASHTECH/GLONASS
11.8.2003
18.8.2003
25.8.2003
1.9.2003
8.9.2003
15.9.2003
22.9.2003
29.9.2003
6.10.2003
13.10.2003
20.10.2003
27.10.2003
3.11.2003
10.11.2003
17.11.2003
24.11.2003
1.12.2003
8.12.2003
15.12.2003
22.12.2003
29.12.2003
5.1.2004
12.1.2004
19.1.2004
26.1.2004
2.2.2004
9.2.2004
16.2.2004
23.2.2004
1.3.2004
8.3.2004
MJD


Complete/possible observations for every day in %
100
90
80
70
60
50
40
%
ASHTECH
SEPTENTRIO
7.8.2003
27.8.2003
16.9.2003
6.10.2003
26.10.2003
15.11.2003
5.12.2003
25.12.2003
14.1.2004
3.2.2004
23.2.2004


Comparison of Moving average MP1 value
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
m
ASHTECH
SEPTENTRIO
7.8.2003
27.8.2003
16.9.2003
6.10.2003
26.10.2003
15.11.2003
5.12.2003
25.12.2003
14.1.2004
3.2.2004
23.2.2004


Comparison of Moving average MP2 value
m
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
ASHTECH
SEPTENTRIO
7.8.2003
27.8.2003
16.9.2003
6.10.2003
26.10.2003
15.11.2003
5.12.2003
25.12.2003
14.1.2004
3.2.2004
23.2.2004

Conclusions

- Comparison of results of more then half of an year observations on the „very short basis“ shows that receiver *PolaRx2* with combination of *TOPCON antenna* gives results usable for GPS geodynamical research of highest quality

- The authors thank to their colleague *Vaclav Skoupy* for processing of the data by GEOGENIUS software