AHORN 2012

SoftGNSStrusted

Genaue und sichere Positionsbestimmung für kritische Anwendungen im alpinen Raum

TeleConsult Austria GmbH

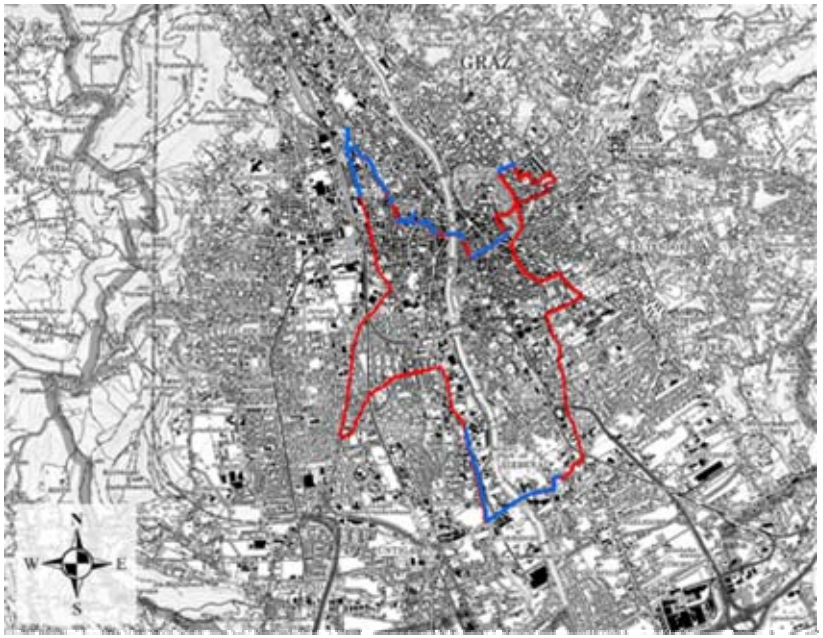
Jürgen Seybold

Schwarzbauerweg 3,
A-8043 Graz, Austria

juergen.seybold@tca.at
www.tca.at
P: +43-316-381015-15
F: +43-316-381015-55

Objectives

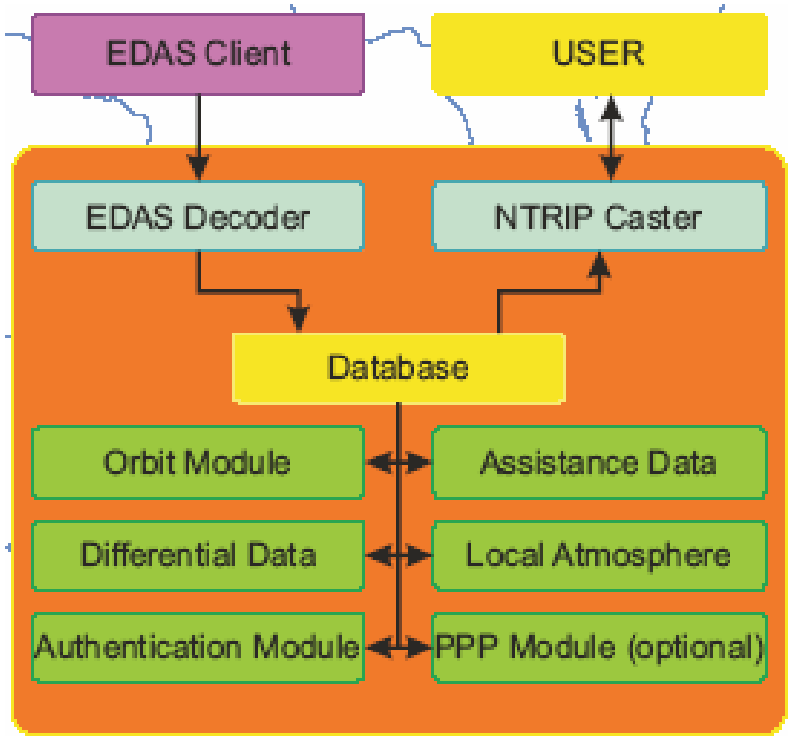
- Integration of EGNOS/EDAS into vehicle on-board and personal mobility technologies
- Integration of a signal authentication functionality in order to provide the required level of integrity
- Integration of an innovative GNSS PVT (Position, Velocity, Time) software solution into positioning unit facilitating EGNOS/EDAS processing
- Improvement of the overall positioning performance (accuracy, availability, integrity) in demanding environments (alpine, urban, etc.)



EGNOS coverage in the city of Graz
on a vehicle trajectory
(blue: EGNOS available;
red: EGNOS unavailable)

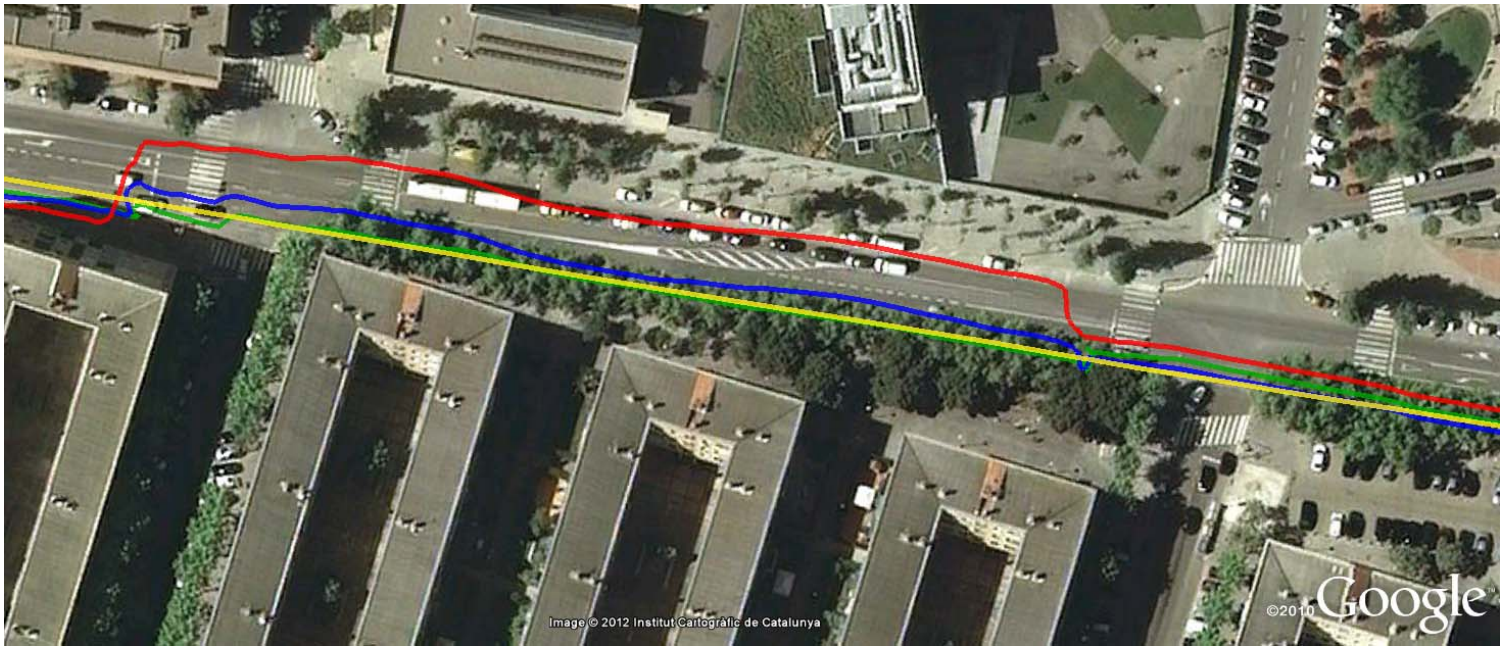
TCA‘s PANDAS server

- PANDAS (Positioning and Navigation Data Assistance Service) is TCA’s modular built server which provides EDAS and assistance data for demanding applications to significantly improve accuracy and integrity
- PANDAS provides data in many different applicable formats



PANDAS results

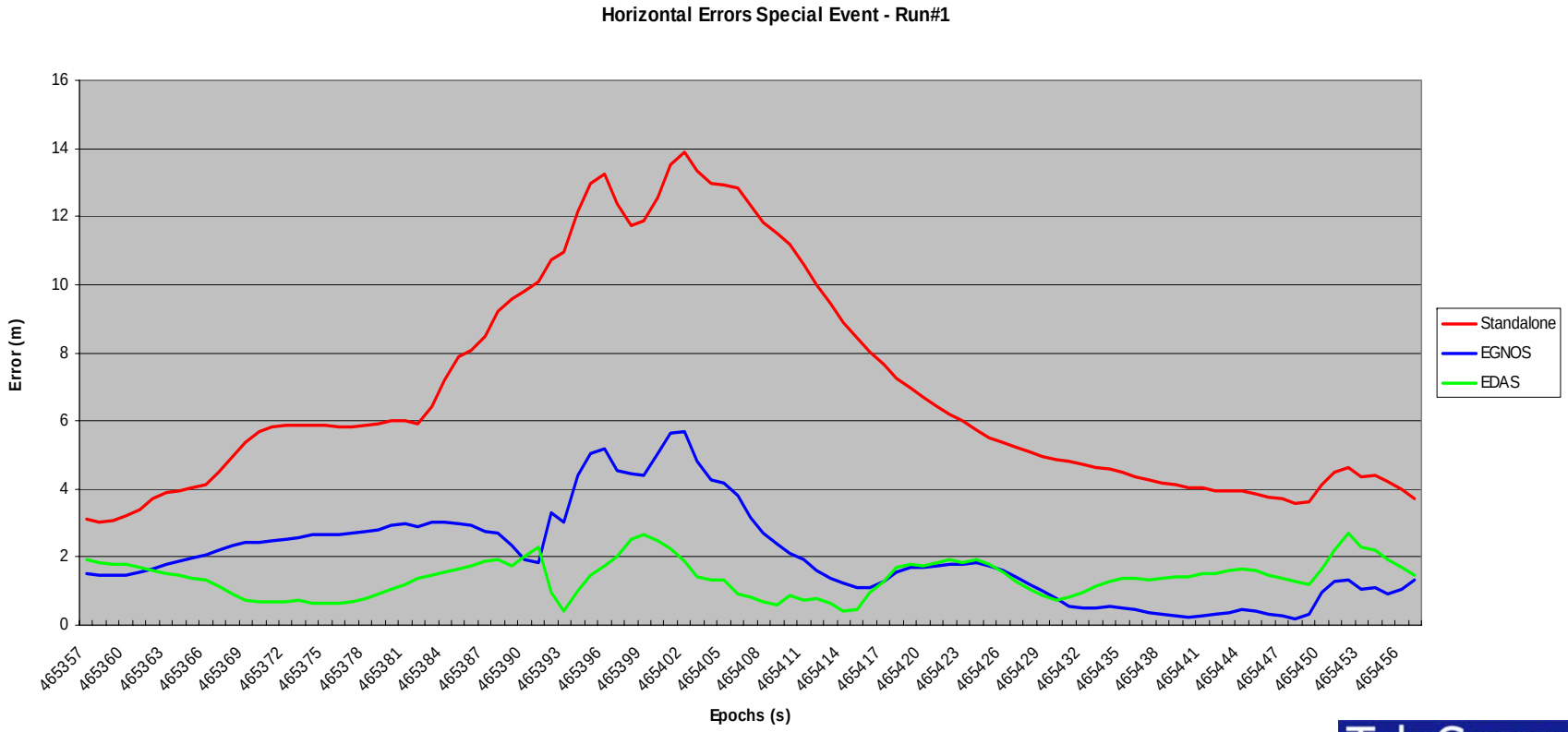
- **PANDAS (using EDAS) as certified service** increased positioning accuracy to an user accepted level as required for charging and thus, **is one key enabler for the charging application**



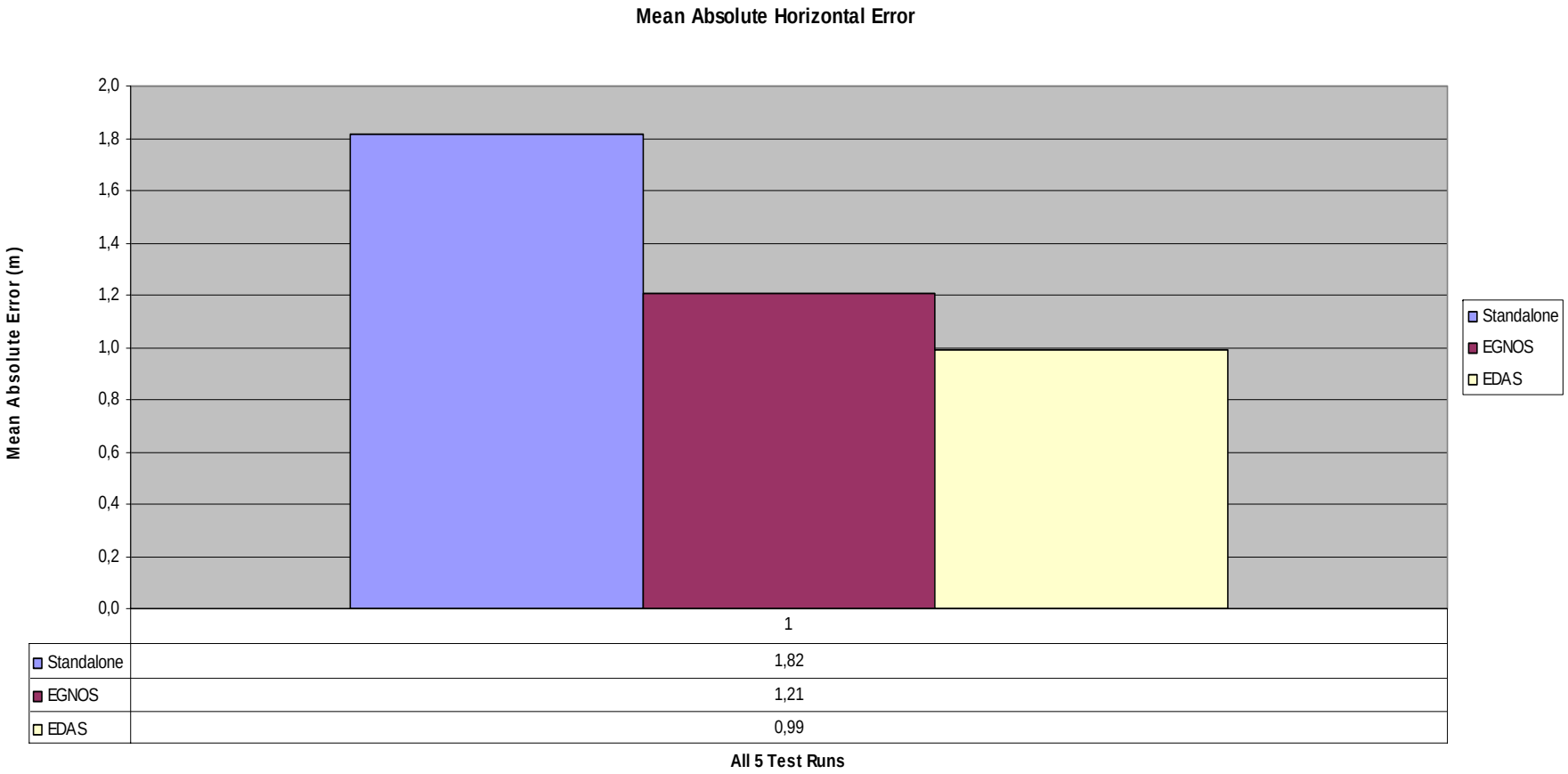
Comparison of the trajectories obtained from different positioning solutions: RTK (**yellow**), standalone GPS (**red**), EGNOS (**blue**) and EDAS (**green**)

PANDAS results

- Comparison of the absolute errors obtained from different positioning solutions: standalone GPS (**red**), EGNOS (**blue**) and EDAS (**green**)



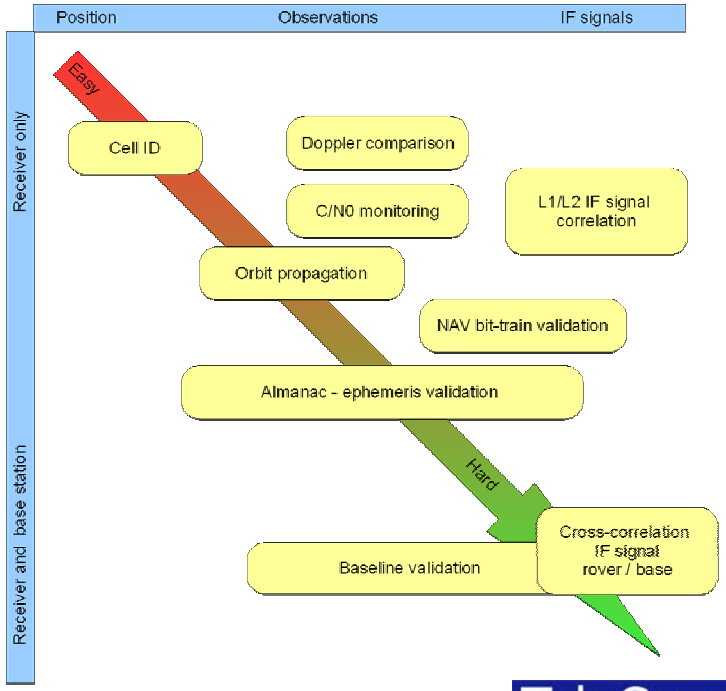
PANDAS results



Signal and position authentication

- GNSS Security Threats
  - Jamming, Spoofing, Meaconing
  - Volpe Report 2001: Vulnerability Assessment of the Transportation Infrastructure Relying on the GPS

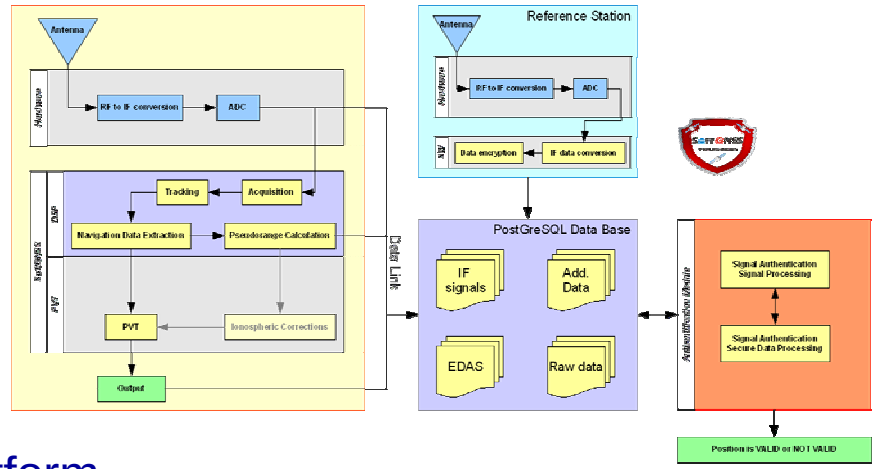
- Countermeasures
  - Signal processing algorithms
  - Data processing algorithms



Authentication algorithms

- Signal processing
  - IF signal cross-correlation between rover and base
  - IF signal cross-correlation between L1 and L2
  - Very sophisticated but requires to process large amount of data

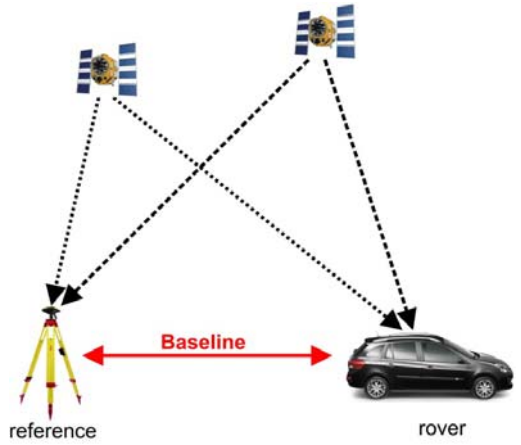
- Data processing algorithms
  - Validation of ephemeris/almanac
  - C/N0 monitoring
  - Baseline verification



- EDAS/PANDAS used as reference platform

Baseline verification

- Single Point Solution unable to reveal spoofing attack
- Comparison of baselines
  - Baseline out of coordinate differences
  - Baseline computed relative positioning

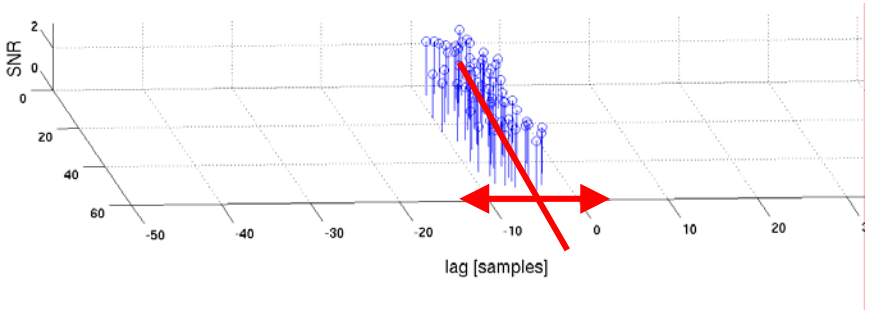


- Relative positioning can be done
  - based on code measurements (Double-Differences)
  - based on IF signal correlation between rover and base

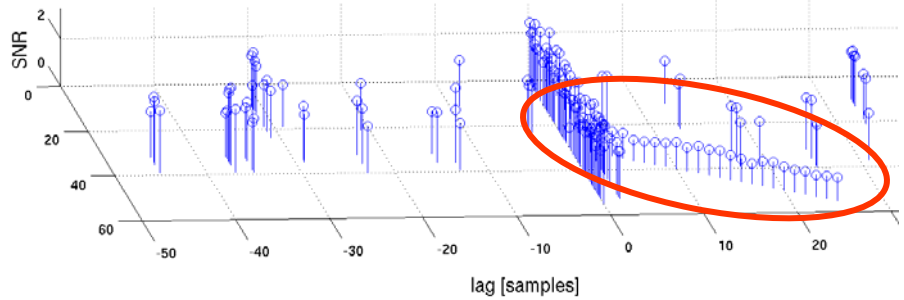
- Relative algorithm is capable of detecting spoofing attacks

Authentication results

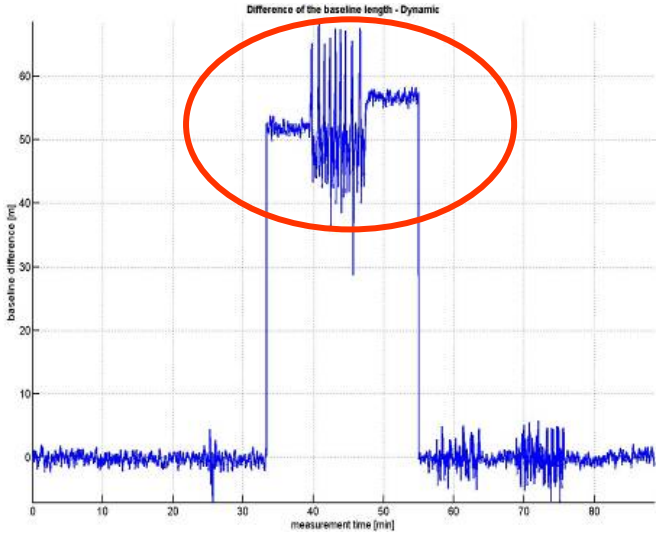
- IF signal cross-correlation results
  - Normal mode



  - Spoofing attack



- Baseline differences



Conclusions

- EDAS/PANDAS
  - Position accuracy enhancement through correction data based on EDAS and other algorithms
- Signal and position authentication
  - Detection of spoofing attacks using signal processing and data processing algorithms
- EDAS/PANDAS in combination with signal authentication are the key enabler demanding applications since these technologies provide the required level of accuracy and reliability for the overall mission

AHORN 2012

SoftGNSStrusted

Genaue und sichere Positionsbestimmung für kritische Anwendungen im alpinen Raum

TeleConsult Austria GmbH

Jürgen Seybold

Schwarzbauerweg 3,
A-8043 Graz, Austria

juergen.seybold@tca.at
www.tca.at
P: +43-316-381015-15
F: +43-316-381015-55