The Alberding Beacon.net software

Tamás Horváth

Alberding GmbH

DISC' 13 Belgrade

04 December 2013

Alberding
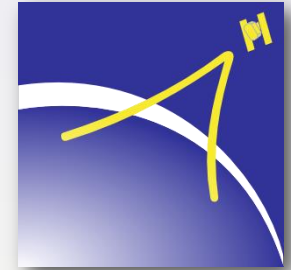GmbH

Outline

Alberding GmbH

Beacon.net

Recent installations

Current development

Alberding GmbH

- German GNSS software development company

- Founded in 1994

- Based in Wildau (near Berlin)

- GNSS software development since 2003

- Integrated GNSS hardware development since 2010

- Independent from GNSS receiver manufacturers

Alberding GmbH experience

- **Software and system solutions for GNSS infrastructure projects**
  - GNSS data management and processing (EuroRef, EuroNet)
  - GNSS data conversion (DataConv)
  - Monitoring (coordinates, availability, system performance, etc.)
  - Internet based data communication (Ntrip)
  - Customer specific adaptation and system solutions

- **GNSS standardisation** (Ntrip 2.0, RTCM MSM, SSR)

- **Technology development** (PPP, NAV4BLIND)

- **Consulting & studies** (i.e. feasibility studies)
  - VERIPOS (GNSS service quality in a world wide network)
  - Vattenfall Europe Mining AG (RTK performance in open cast mines)
  - via donau (VRS system for inland waterways)

Current projects

- Maritime and inland waterway DGNSS positioning

- GNSS reference station monitoring

- DGNSS/RTK service performance monitoring

- Landslide monitoring

- Machine positioning

- Navigation assistance for the blind

- Validation of GNSS receivers

- Rental of Internet server capacity

- Map server (OSM data)
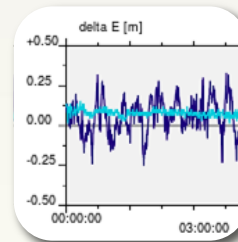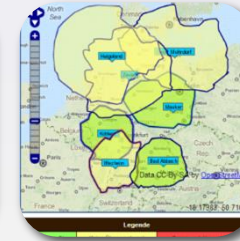
Alberding GmbH

Beacon.net

Recent installations

Current development

Beacon.net

- **Modular GNSS software** designed for the operation of **maritime and inland waterway DGNSS services**

- **Virtual Reference Station (VRS) concept**
    - Differential GNSS corrections and integrity information generated at a central site
    - Separating the correction generation from the data transmission technology (radio beacons, AIS, etc.)
    - The VRS solution is in line with the IMO e-Navigation strategy

Alberding Beacon.net modules

- **GNSS raw data input**
  - IALA beacon stations
  - AIS DGPS base stations
  - Other GNSS reference stations
  - Supports GPS and GLONASS

- **VRS server**
  - Network DGNSS processing
  - Generation of virtual corrections
  - No GNSS receiver needed at transmission sites

- **Integrity monitoring**
  - Before transmission (position and SV domains)
  - Far field monitoring (position and signal quality)

- **Data transmission**
  - IALA radio beacons, AIS, Ntrip (GPRS, WLAN)
  - RTCM 2.x, 3.x, AIS Type #17

Alberding GmbH
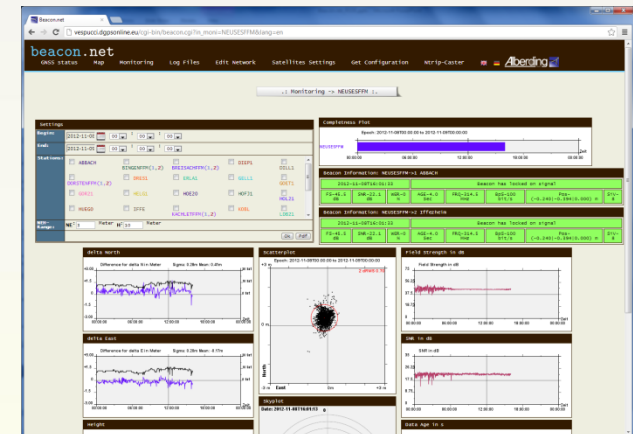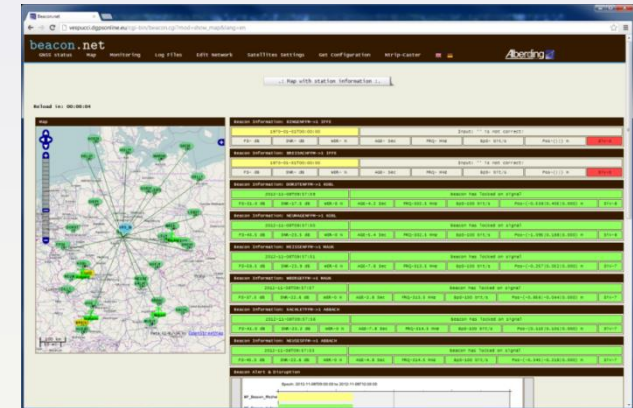
Beacon.net with EGNOS

Data conversion module

- EGNOS RTCA data conversion to RTCM corrections for user definable positions: **"EGNOS VRS"**

- Input data sources:
  - EGNOS enabled GNSS receiver
  - EDAS (EGNOS Data Access Service) via IP

- Rebroadcast via
  - IALA radio beacons, AIS, Ntrip

- EGNOS is a free service

- Can be used as a backup solution to conventional DGNSS

Alberding GmbH

Beacon.net

Recent installations

Current development

WSV VRS system

In operation since 2011

- 16 GNSS raw data input streams
  - GREF, EPN reference stations

- Central VRS processing

- 7 Pre-Broadcast Monitoring stations

- 4 IALA DGPS beacons
  - Koblenz, Mauken, Iffezheim, Bad Abbach

- 8 Far Field Monitoring stations

- Ntrip Caster
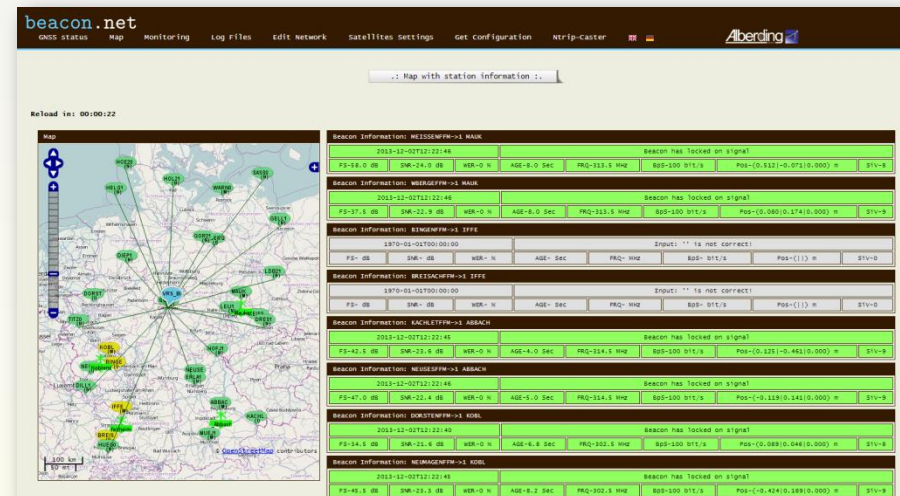
Complete Beacon.net system in Austria

Previous status at via donau (DoRIS):

- 23 AIS base stations

- 2 AIS DGPS base stations (Alkoven, Korneuburg)

- No integrity monitoring

viadonau
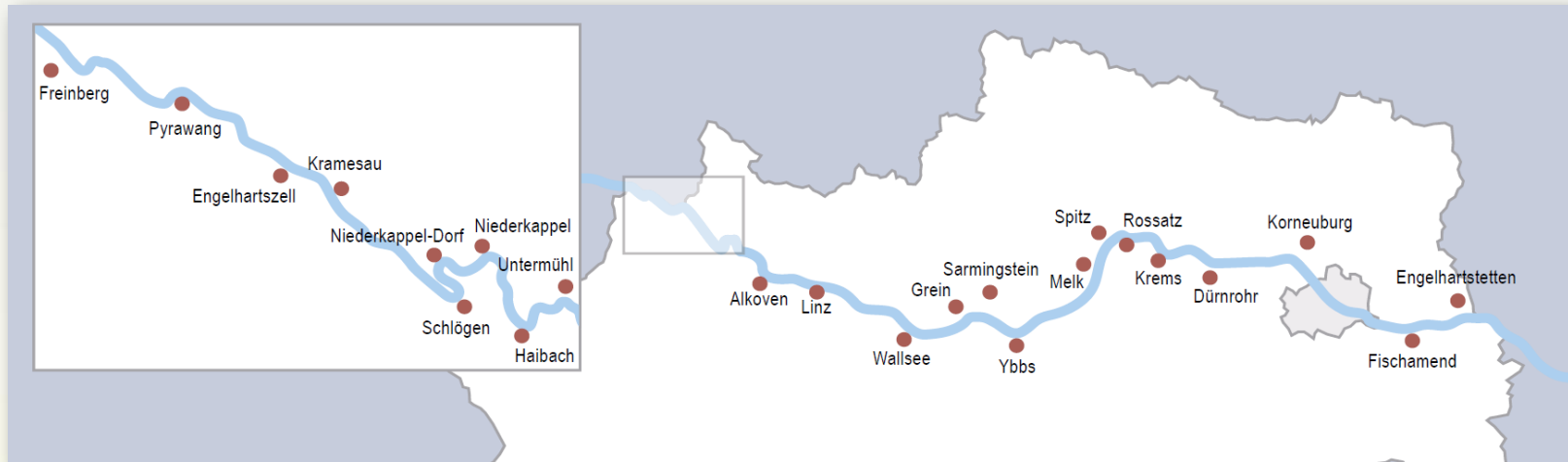
Complete Beacon.net system in Austria

Virtual Reference Station system installation (2013):

- 5 new GNSS reference stations
  - Maierhof, Abwinden, Persenbeug, Altenwörth, Bad Deutsch Altenburg
  - L1/L2/L5 GPS+GLONASS receivers with raw data output (sw upgraedable to Galileo)

- Central VRS DGNSS processing

- 23 individiual RTCM correction streams for the AIS base stations

- Pre-Broadcast Monitoring of the corrections for each site

- Far Field Monitoring at 2 dedicated monitoring stations
  - (Alkoven, Korneuburg)

- Ntrip Caster
  - high accuracy RTK data distribution

- Central web interface
  - configuration, monitoring, alarming

Alberding GmbH

via donau station distribution
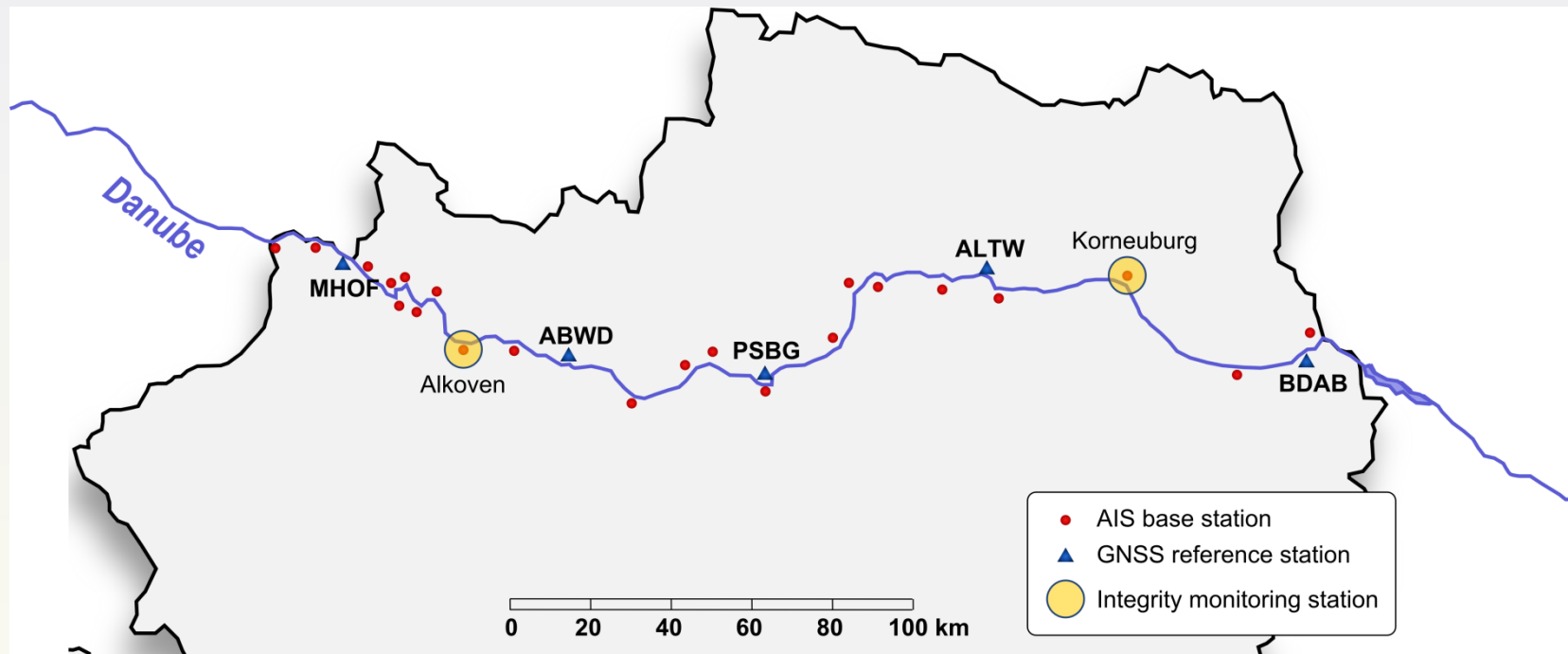
via donau system installation

Far Field Monitoring in Poland

DGPS-PL system

- Maritime Office in Gdynia
- 2 existing IALA beacons with RSIM
  - Dziwnów, Rozewie

Alberding GmbH (2013):

- 3 Far Field Monitoring stations
  - Swinoujscie, Jaroslawiec, Gdansk
- 2 RTK base stations
  - Gdansk, Swinoujscie
- Ntrip Caster
  - Data collection
  - RTK correction broadcasting

Beacon.net web interface in Poland

Performance monitoring in Poland

Performance monitoring in Poland
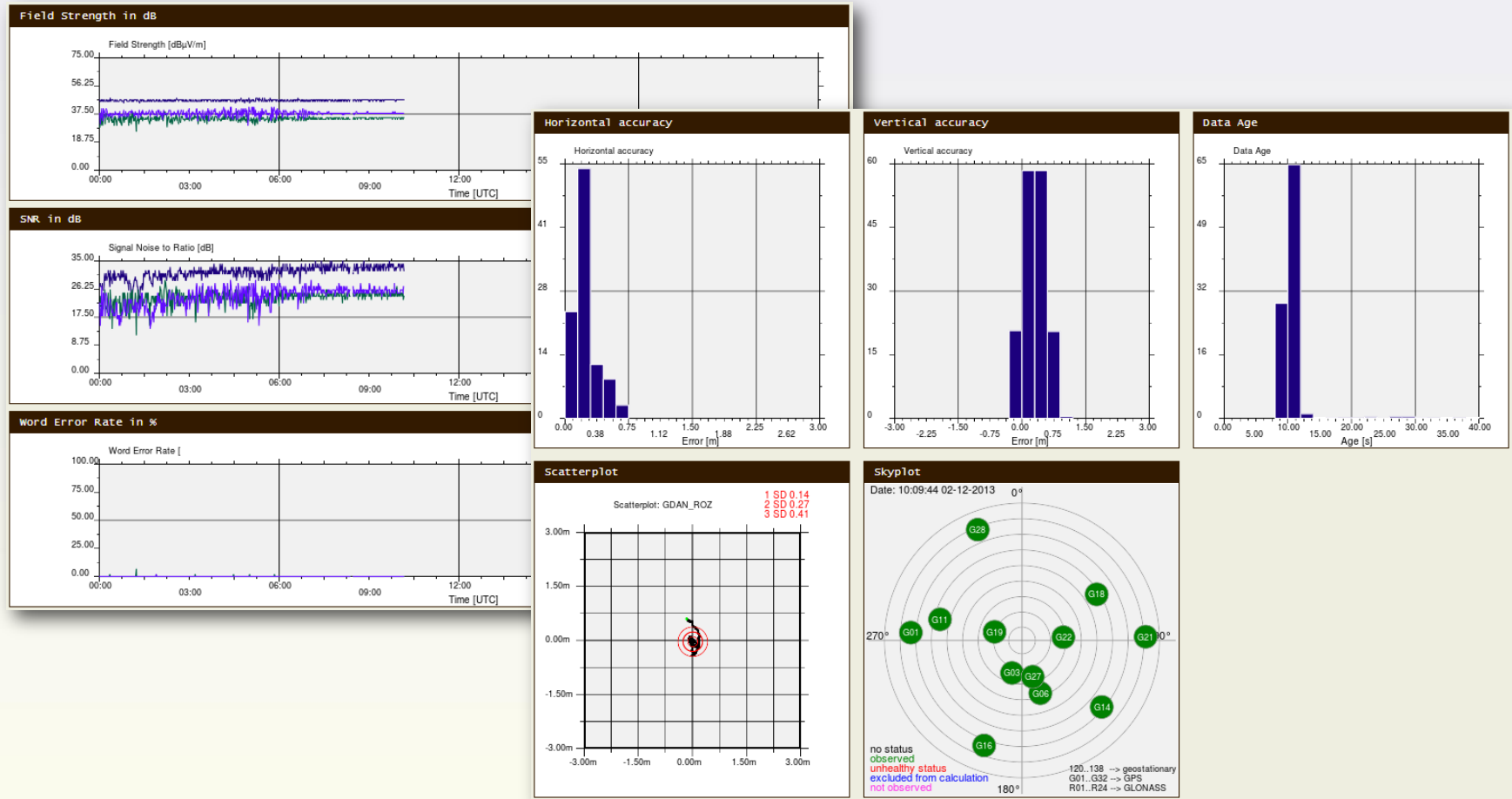
Beacon.net alarm settings (Poland)

Integrity monitoring in Hungary

Current status at RSOE (PannonRIS):

- 11 existing AIS base stations

- 3 AIS DGPS base stations (2 active)

- No integrity monitoring

Alberding GmbH (2013-14):

- Pre-Broadcast Monitoring
  - Monitoring stations in Budapest and Paks

- DGPS performance evaluation
  - AIS DGPS vs IALA DGPS vs EGNOS

Legend:
- ● AIS Base Station
- △ AIS DGPS Base Station
- ☐ AIS Monitoring Station
- ○ AIS Control Centre

System architecture in Hungary
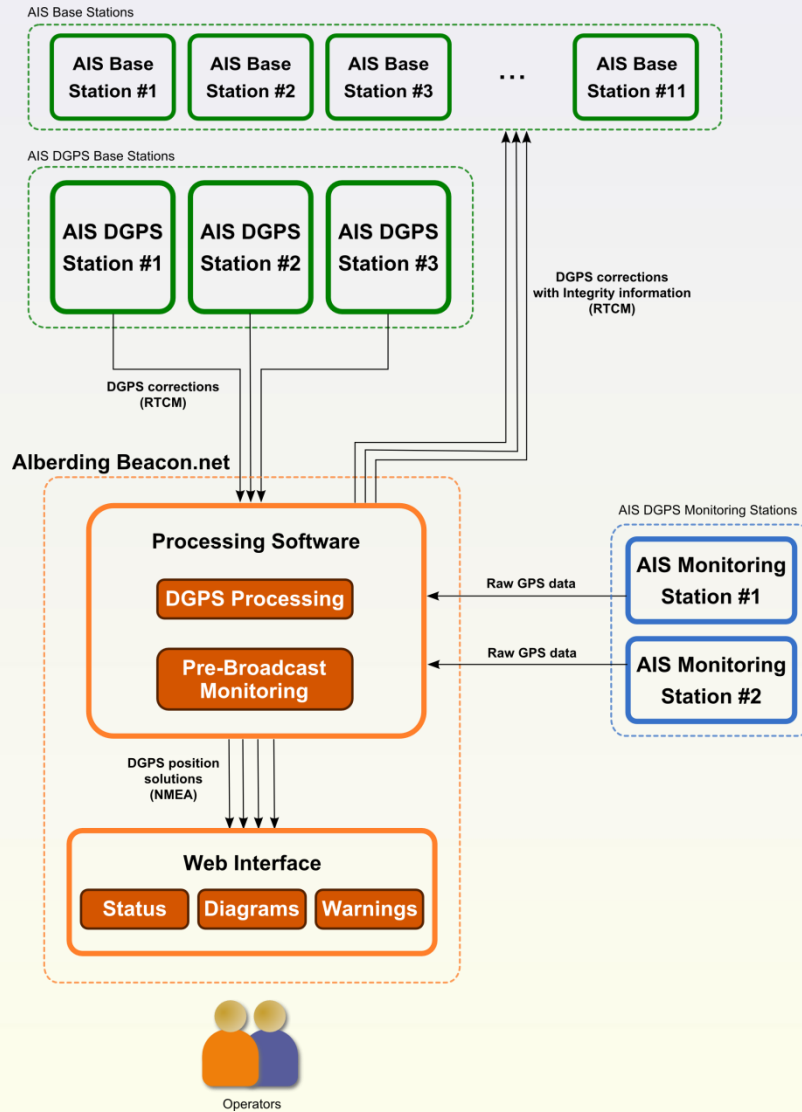
EGNOS performance monitoring

Trinity House (Harwich, UK) study

- EGNOS performance at the borders of the coverage area

- EDAS SISNeT input

- RTCM v2.x correction output for user defined locations

- Alberding DataConv software RTCA → RTCM

- Positioning by standard DGNSS hw

- Evaluation by Trinity House

User information tool

- ## Web-based tool to provide DGNSS status information to registered users

  - Integrity monitoring status

  - Coverage area

  - Positioning accuracy

  - Correction data age

  - MF signal quality (Field strength, SNR, WER)

User information tool "Start"

The „Start" menu is visible for everybody

User information tool "Registration"

For more information the users have to "register"
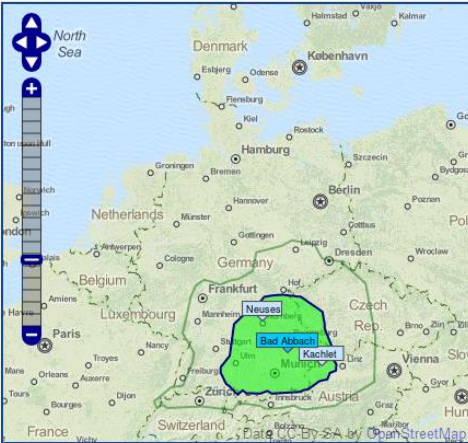
User information tool "System Status"

**The system status page provides real-time information
from the FFM stations**

User information tool "Details"
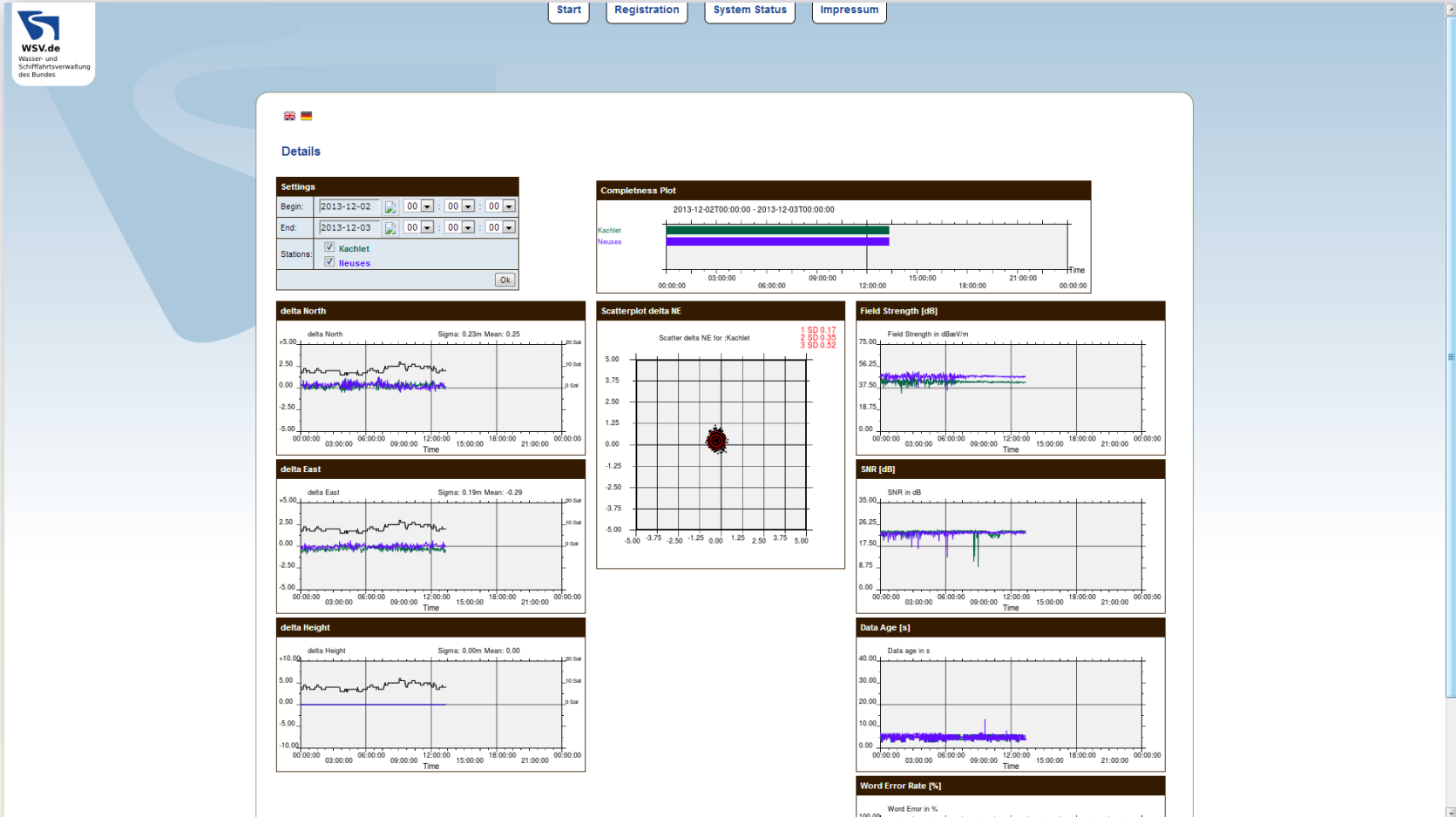
The detailed plots provide all the FFM information

Alberding GmbH

Beacon.net

Recent installations

Current development

R-Mode feasibility study

In the framework of the **ACCSEAS** project (e-Navigation in the North Sea) Alberding GmbH together with Alion Science and Technology

R-Mode motivation:

- GNSS vulnerable to intentional and unintentional interference
- Need for resilient PNT (robust, reliable and dependable)
- In line with the e-Navigation strategy

R-Mode positioning technique:

- Ranging mode, allows for range determination based on time of arrival (TOA) measurements
- Different systems provide time of emission (TOE) broadcasts
- Ranging signals from MF radiobeacons, AIS and eLoran
- "All in view" receivers
- Redundant positioning (backup PNT to GNSS)

R-Mode positioning concept

The vision: integrated solutions for PVT

Image source:
Jan-Hendrik Oltmann,
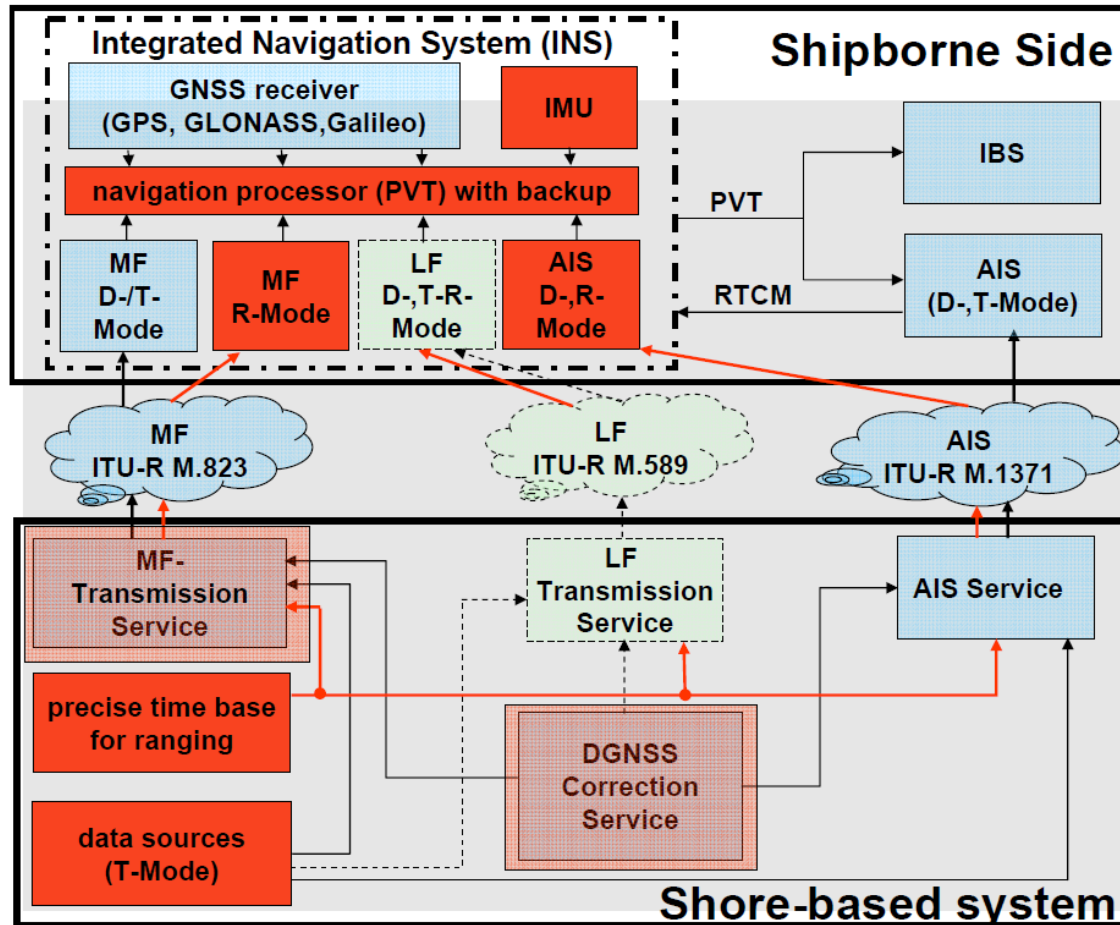Michael Hoppe
(WSV)

Under development

- New generation reference station receiver

- Alberding A17

- **Primary functions:**

  - **DGNSS monitoring station**

    - RTCM DGNSS correction input

    - NMEA position output

    - L1 raw data output

  - **RTK reference station**

    - RTCM RTK correction generation and output via Ntrip or local VHF radio transmitter

    - L1/L2/L5 raw data output via Ntrip

- **Backup function:**

  - **DGNSS reference station**

    - RTCM DGNSS correction generation and output via local transmitter

Alberding A17

- Trimble BD982 (scalable) GNSS receiver
- 2 x 220 channels,
- GPS L1 to GPS, GLONASS, Galileo
- Dual GNSS antenna input
- GPRS/UMTS modem
- Integrated PC with Alberding sw
- Internal 2 channel beacon receiver (optional)
- Ethernet port

Thank you for your attention!

Contact:

Tamás Horváth

Alberding GmbH
Schmiedestraße 2
D-15745 Wildau
Tel.: +49 3375 52 50 370
Fax: +49 3375 52 50 377
Web: www.alberding.eu

Office in Hungary
1139 Budapest, Petneházy u. 50-52.
Tel.: +36 1 7843 813
Mobile: +49 151 188 048 99
E-Mail: horvath@alberding.eu