
First trials of the LORADD integrated eLoran/GPS/WAAS receiver

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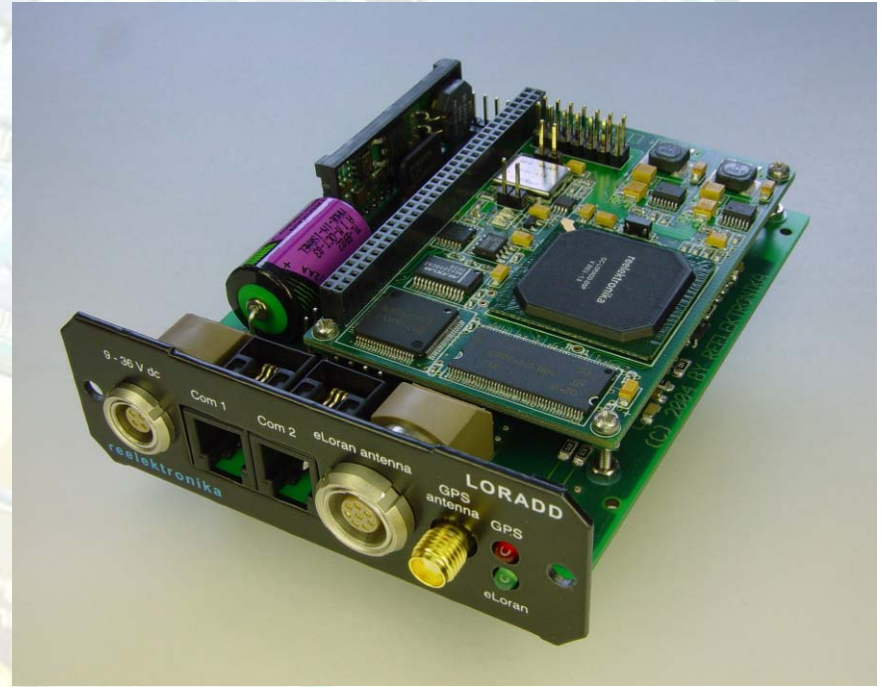
Reelektronika B.V.

Contents of presentation

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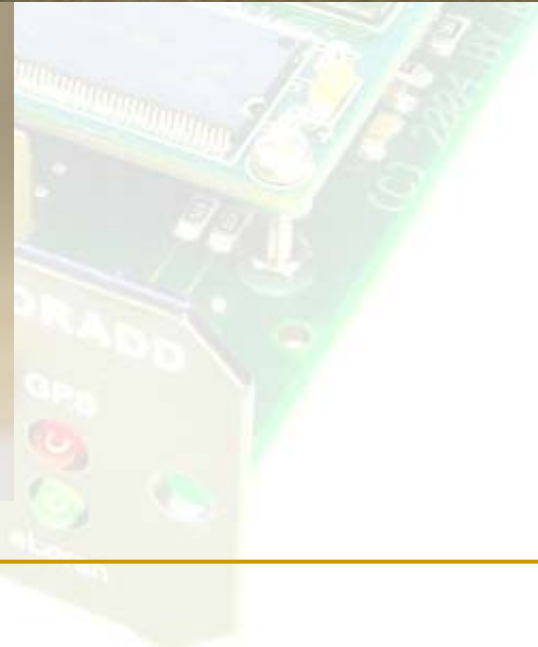
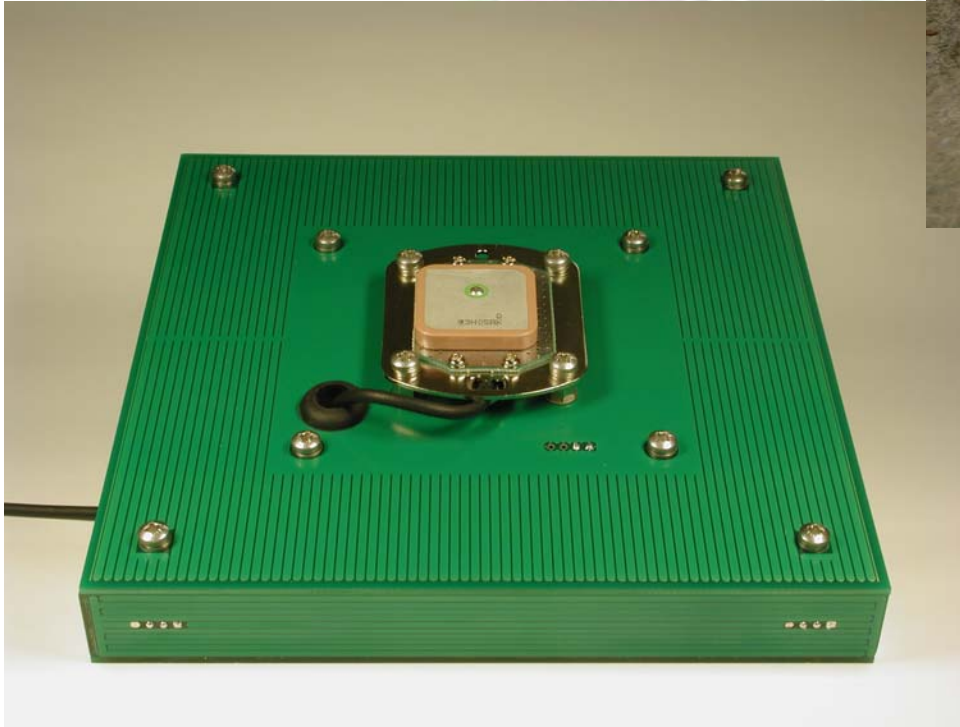
The Hardware

Reelektronika DSP platform



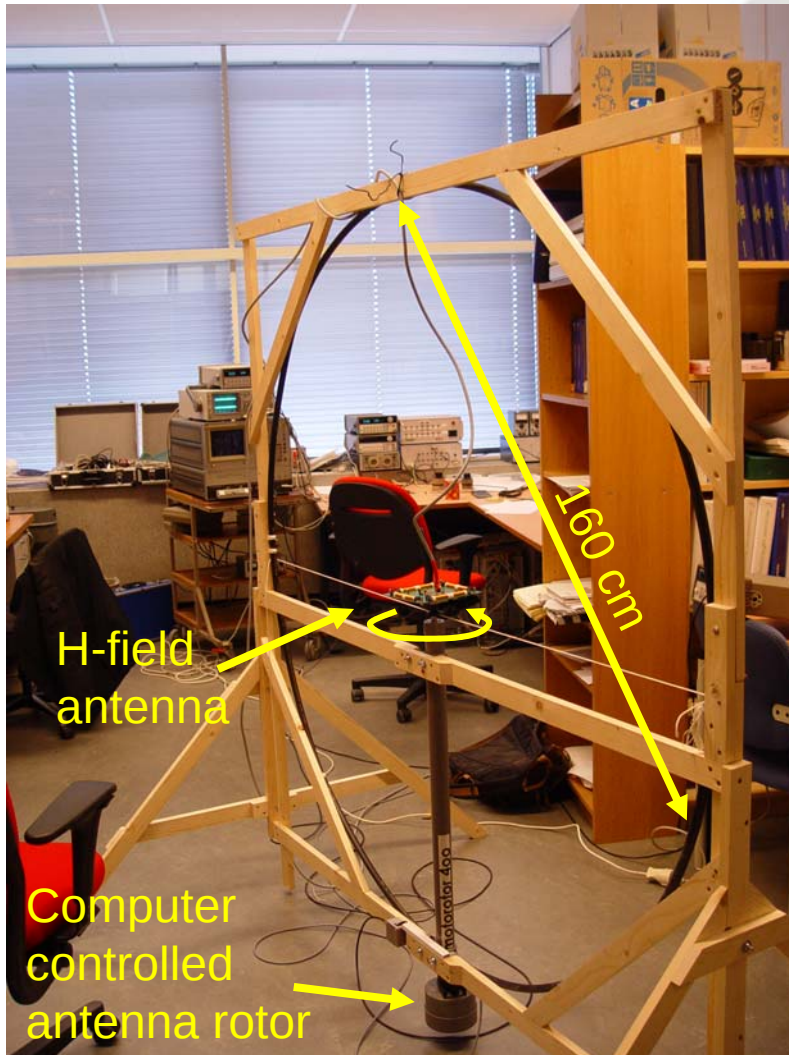
The Sensor

Dual-loop H-field antenna

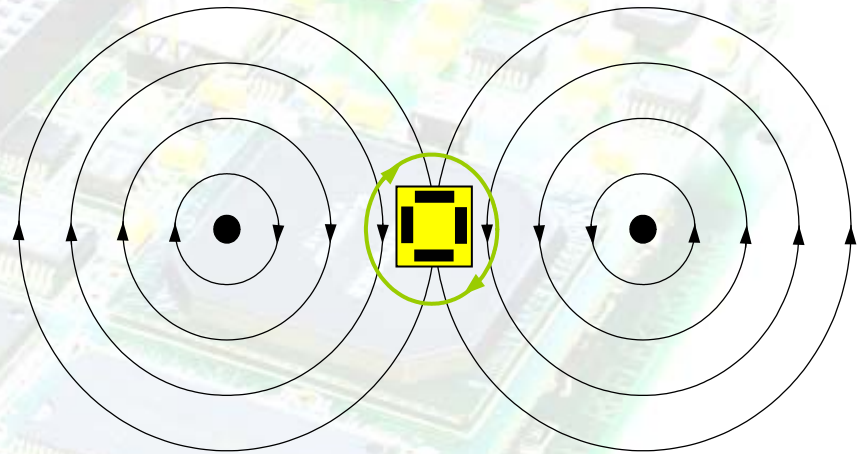


The Sensor

Dual-loop H-field antenna - measurements



Measurement Setup



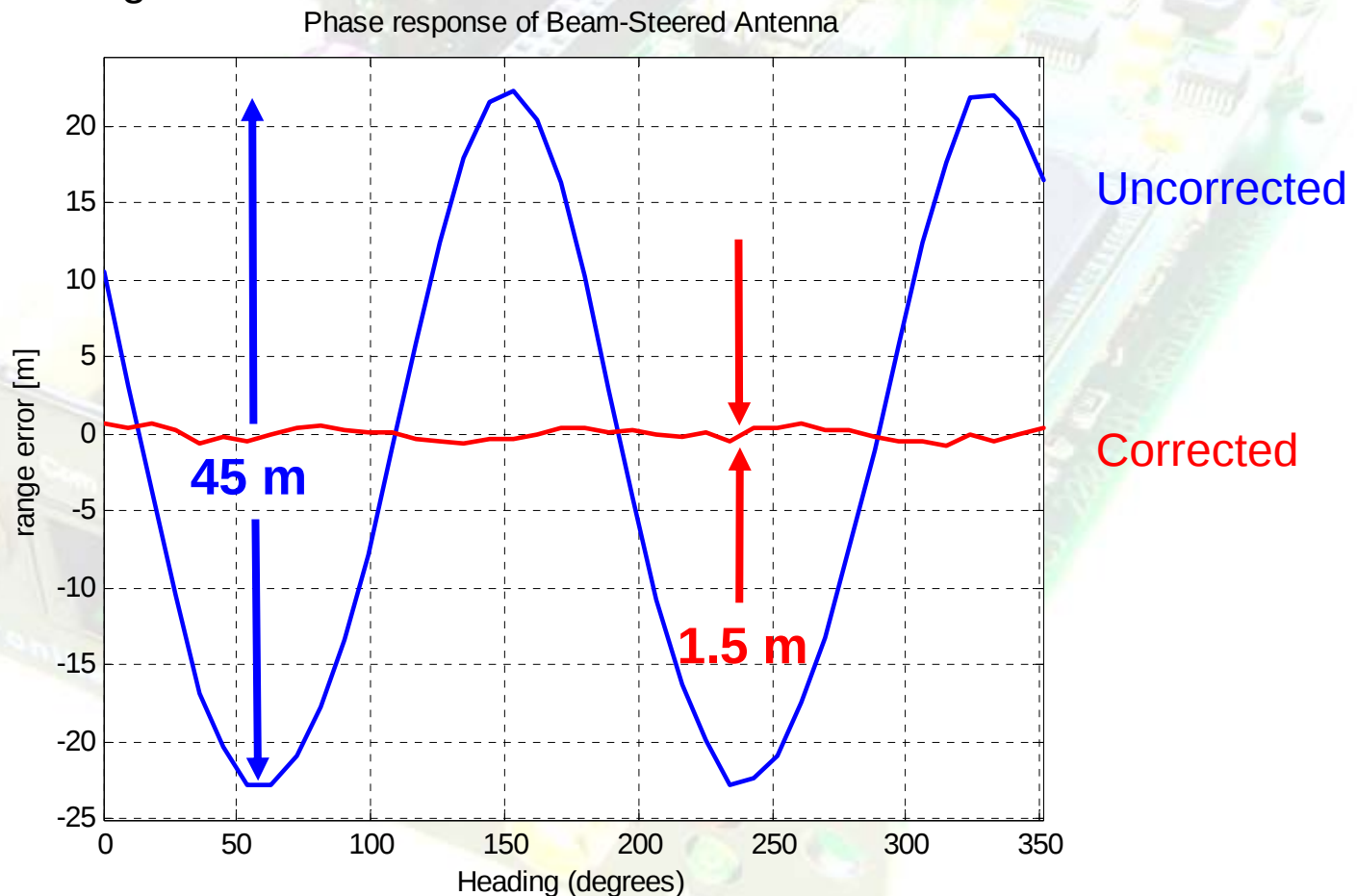
Cross-section of measurement setup

The H-field antenna is rotated inside a measurement loop. The field at the centre of the loop is quite homogeneous due to the large diameter of the loop (1.60m)

The Sensor

Dual-loop H-field antenna - compensation

- Comparison of Uncorrected and Feed-Forward Corrected Response after Beam-Steering



The Algorithms

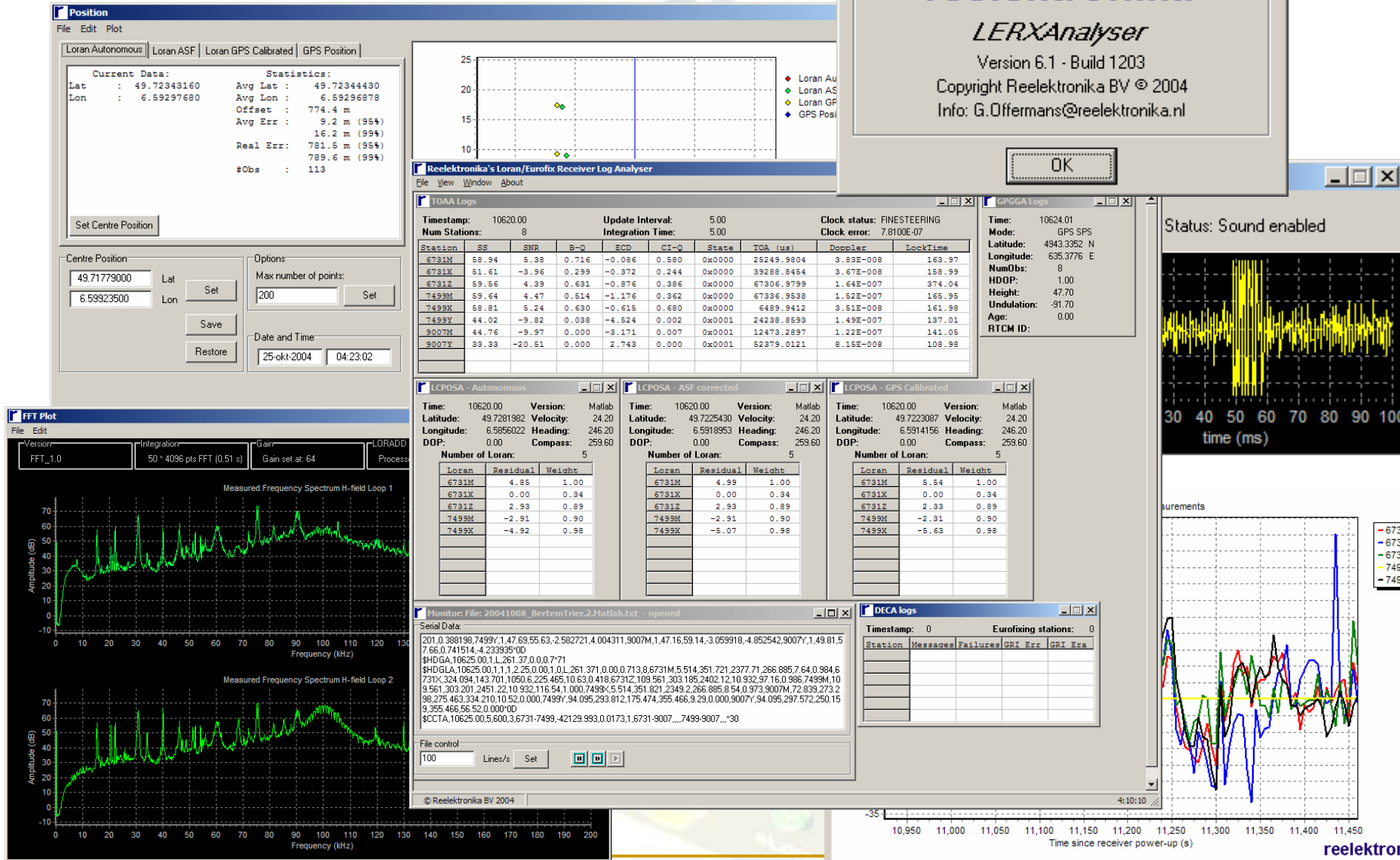
- Algorithms are a result of many man-years of research – started in 1999
- Features of the Reelektronika eLoran receiver:
 - ❑ Multichain all-in-view Loran signal tracking
 - ❑ Fast acquisition (<30 seconds)
 - ❑ Interference mitigation
 - ❑ Integration with GPS
 - ❑ ASF and Differential Loran capabilities
 - ❑ Data demodulation
 - ❑ Regular position updates (e.g. every 5 seconds)
- Outputs:
 - ❑ TOA / TD
 - ❑ Position
 - ❑ Compass heading

The Application

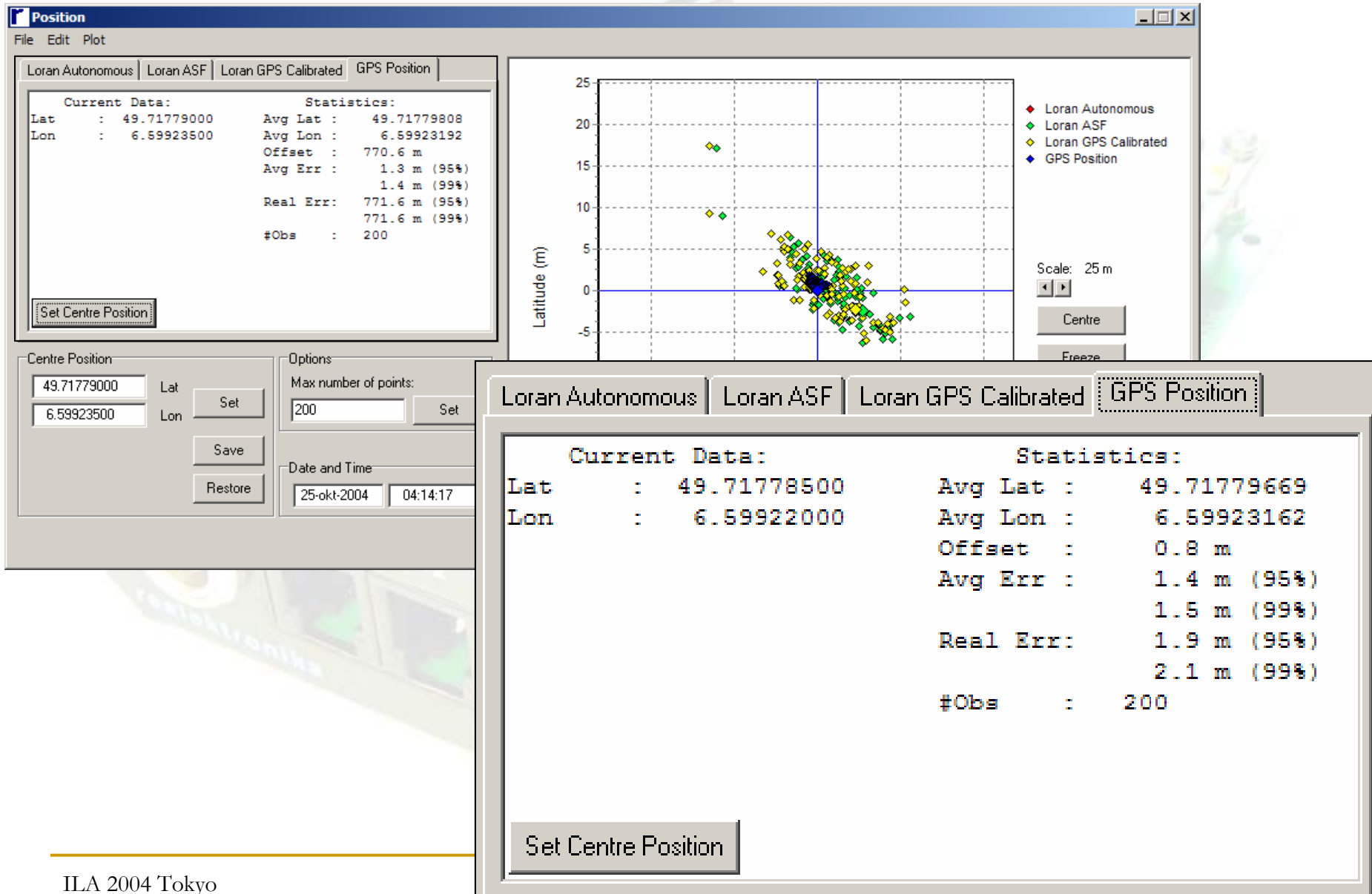
Modes of position calculation

1. DGPS, WAAS/EGNOS/MSAS mode
 2. DGPS, SPS Radiobeacon mode
 3. DPGS, SPS Eurofix mode
 4. GPS, SPS mode
 5. Differential Loran-C mode
 6. Loran-C, (D)GPS calibrated mode
 7. Loran-C, ASF-table calibrated mode
 8. Loran-C, stand-alone mode
 9. Fix not available
- **Simultaneous output of selected modes**
 - **Automatic mode**
 - Proprietary NMEA sentences: **\$PRLK**

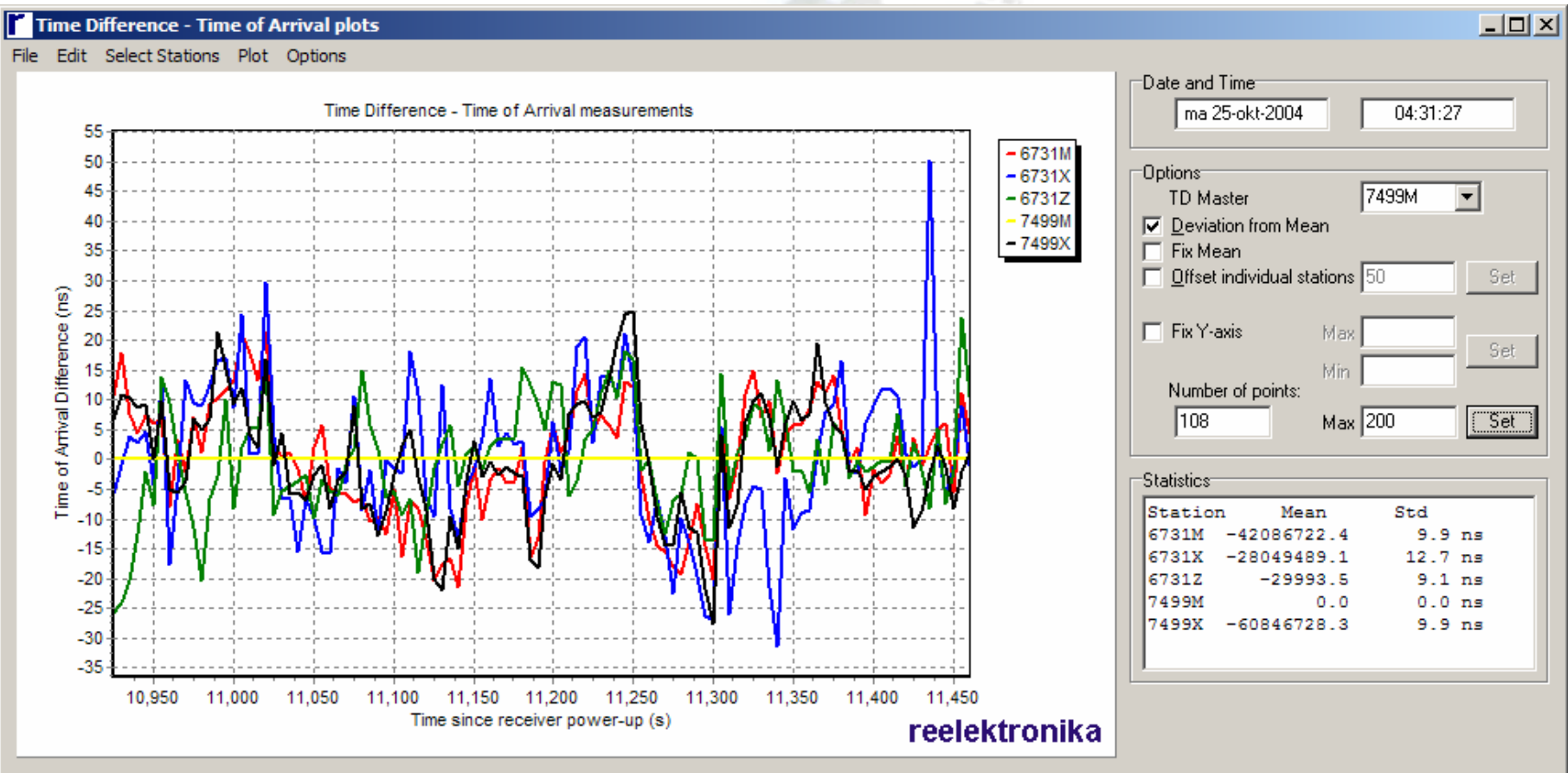
Tools: LerxAnalyser



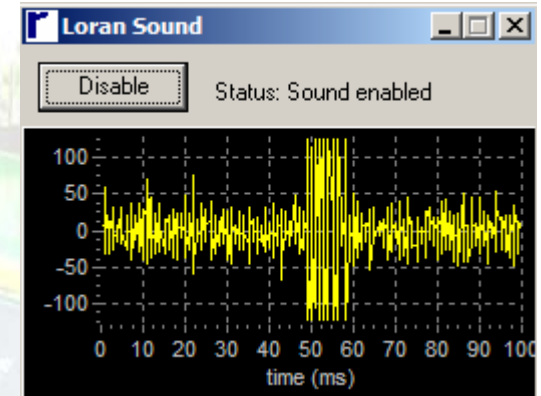
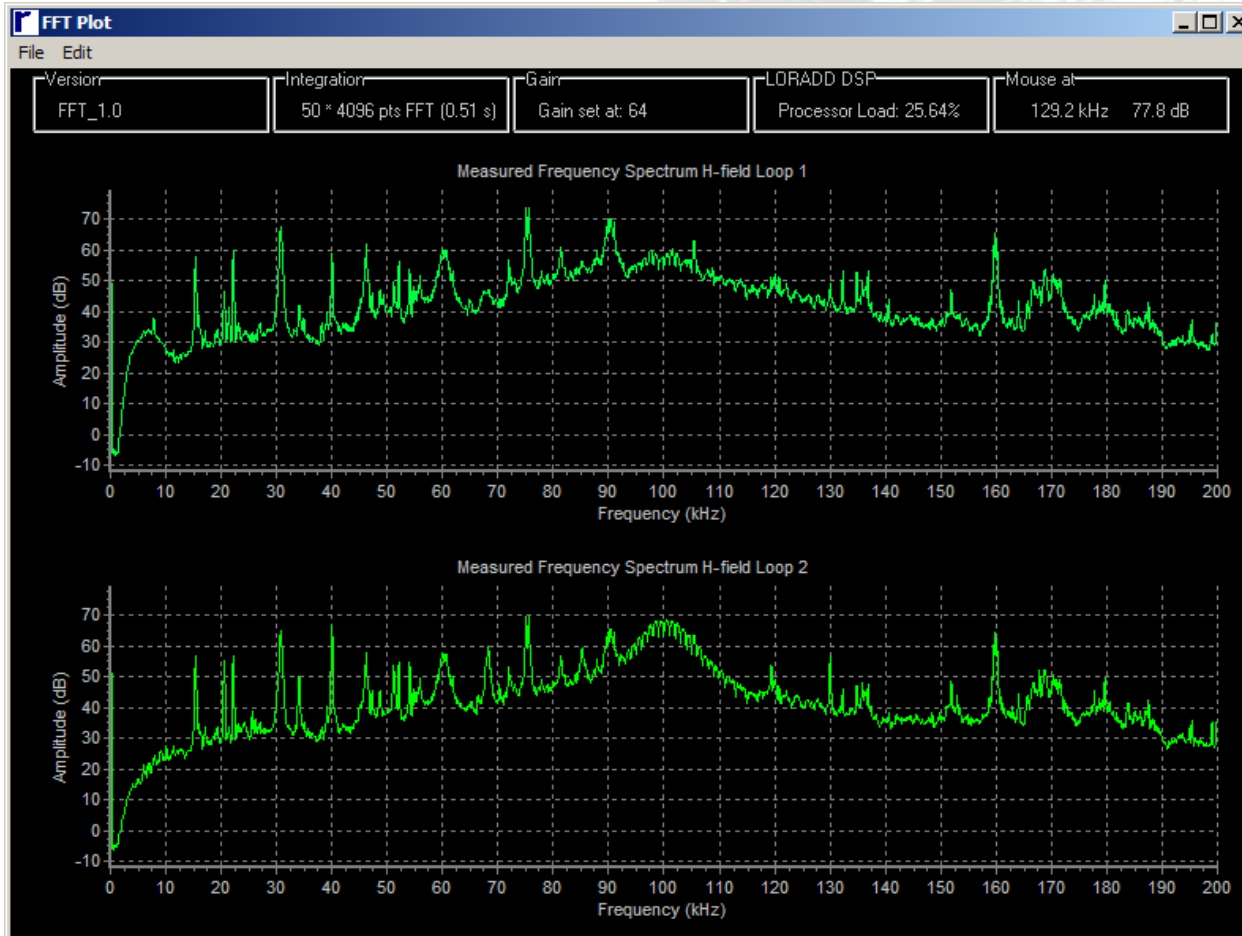
LerxAnalyser: Position



LerxAnalyser: TOA/TD & Heading



LerxAnalyser: Installation tools



-  No interference
-  Local interference
-  Powerline

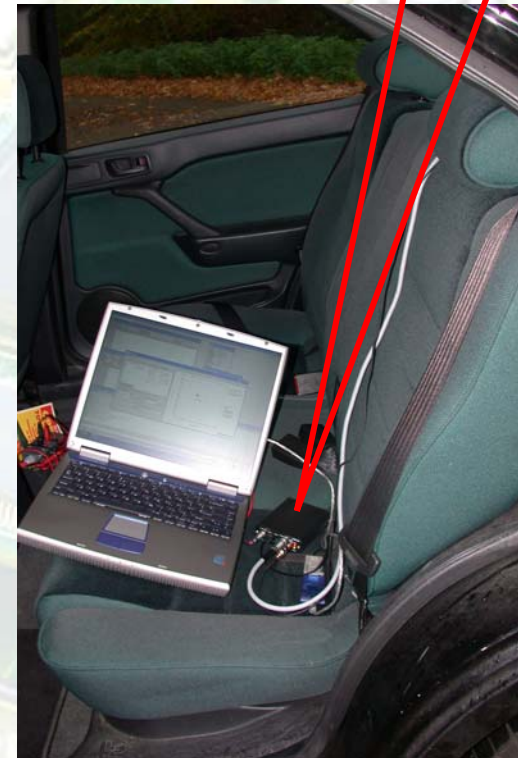
Measurements



GPS antenna

Loran H-field
antenna

LORADD Rx

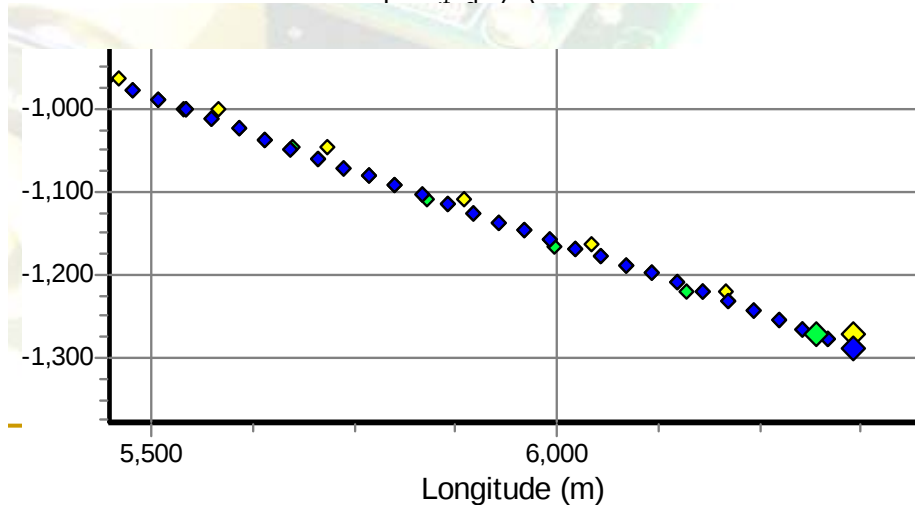
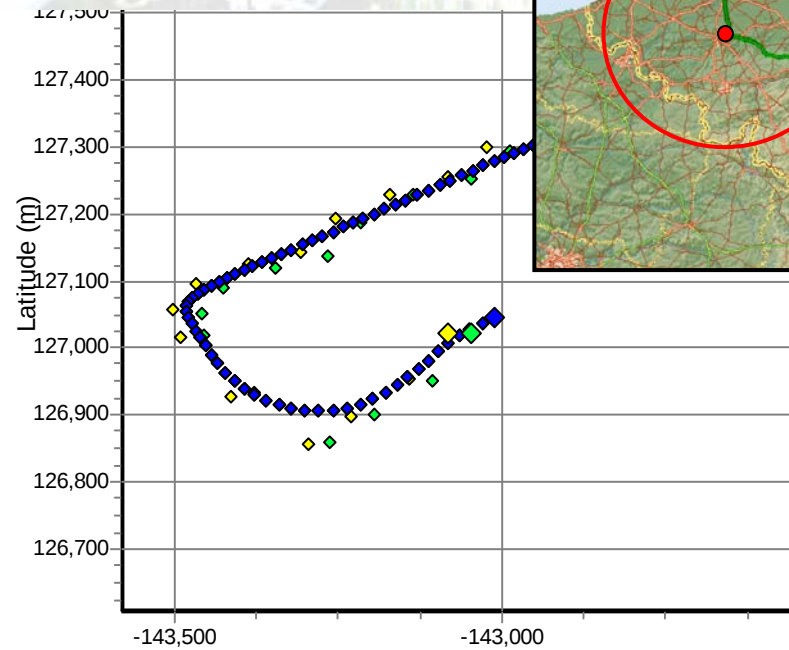
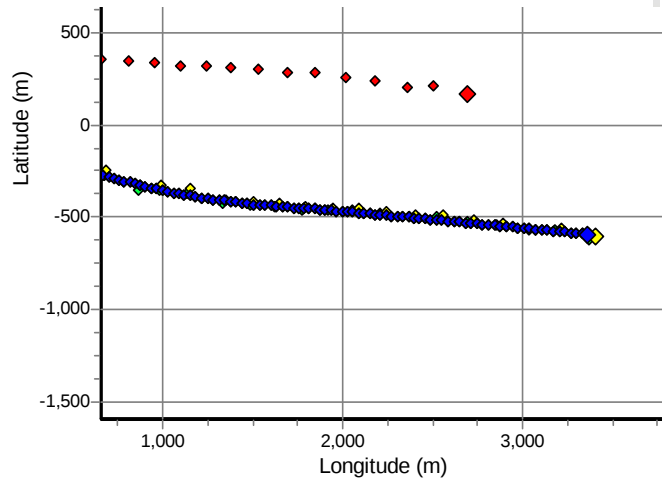
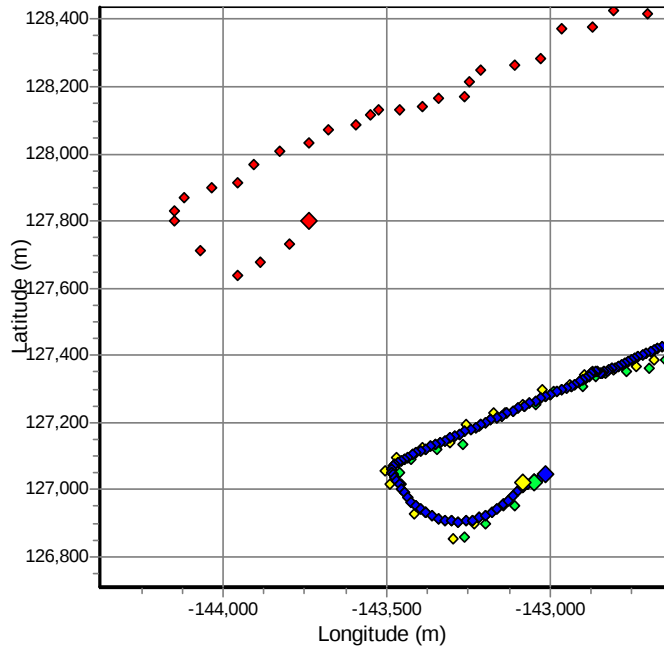


- Static measurements Reeuwijk (NL)
- Static measurements Boston (US)
- Static measurements Trier (D)
- Dynamic measurements Delft (NL)-Utrecht (NL) – Bertem (B) – Trier (D)

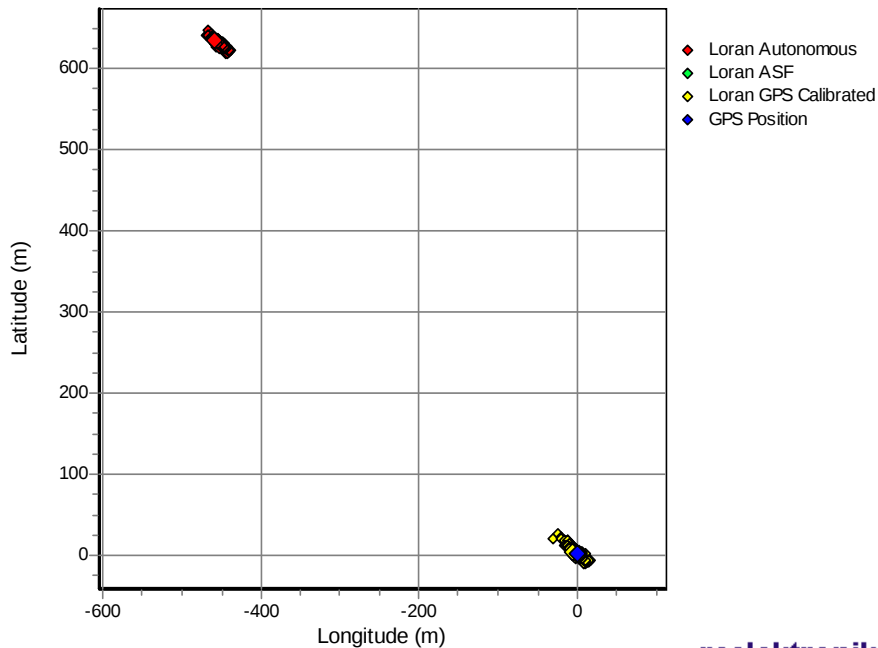
Utrecht (NL) – Bertem (B) – Trier (D)



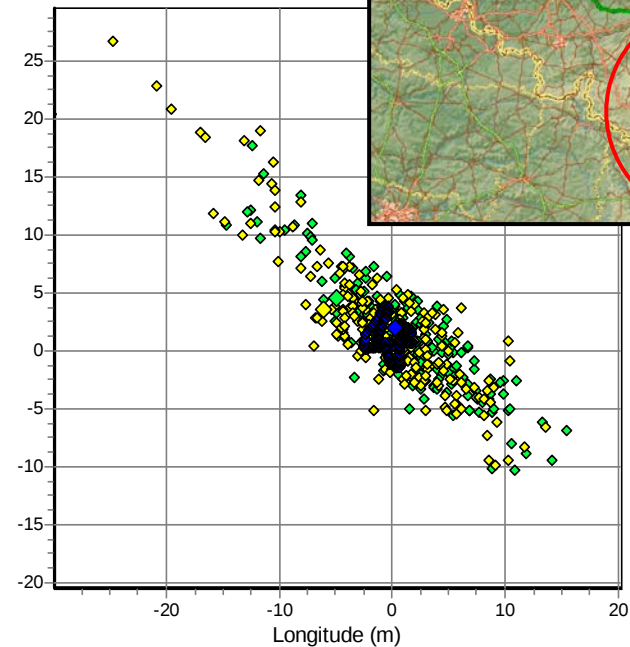
Bertem (dynamic)



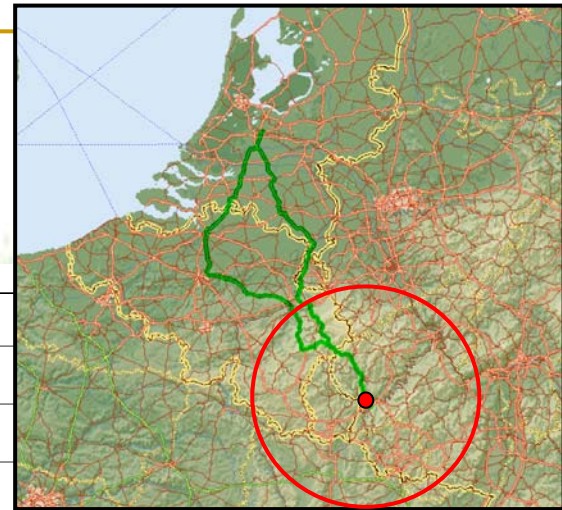
Trier, static



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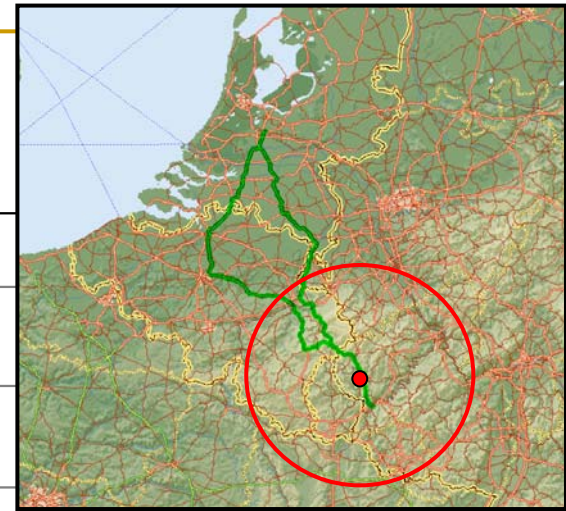
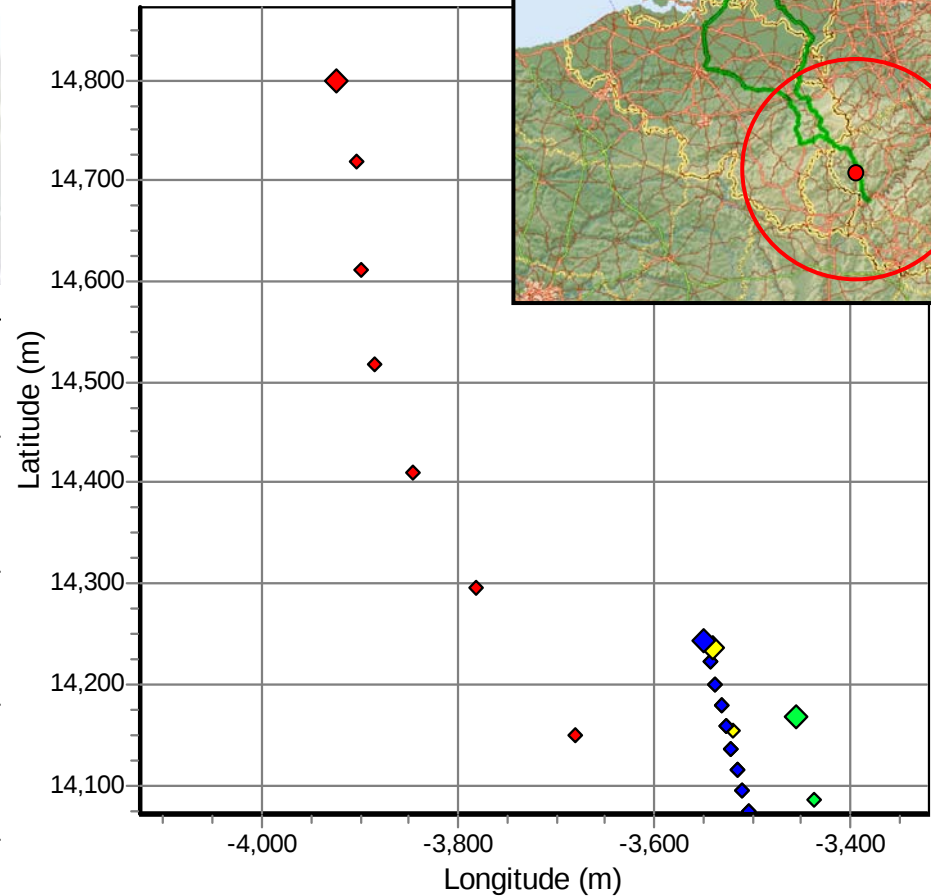
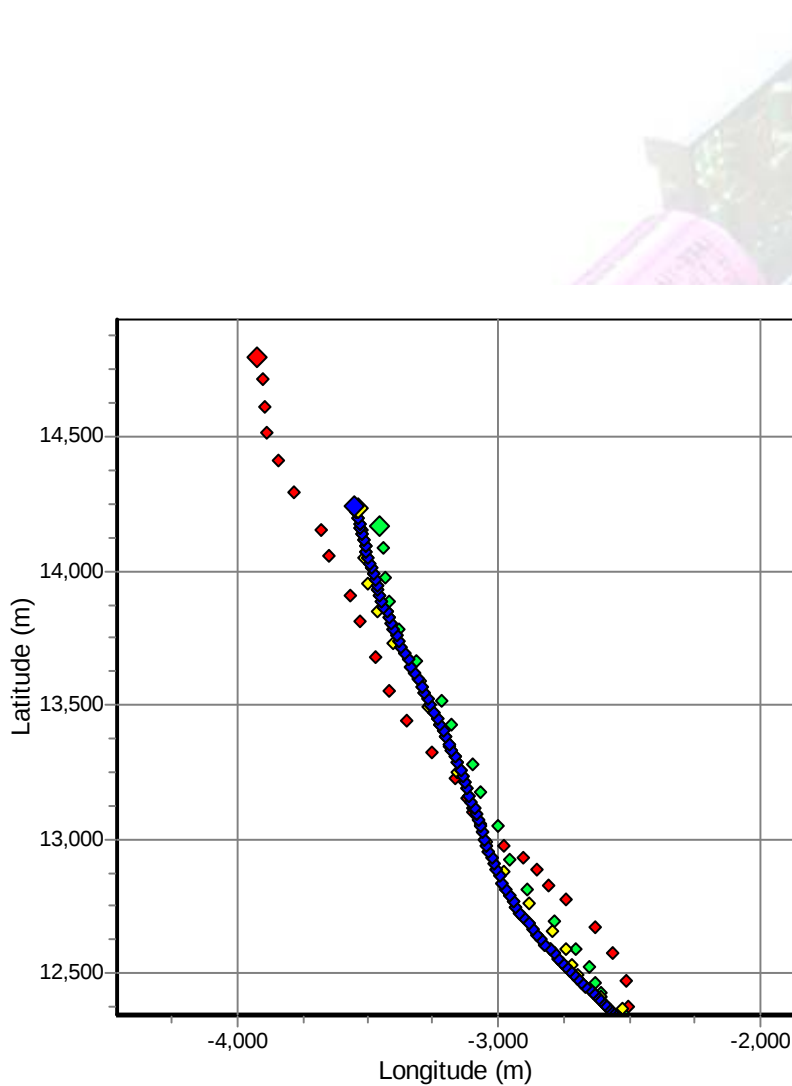
Loran Autonomous: 14.7m 95%, offset 776m

Loran ASF: 14.7m 95%, offset 1.7m

Loran GPS Calibrated: 16.5m 95%, offset 2.6m

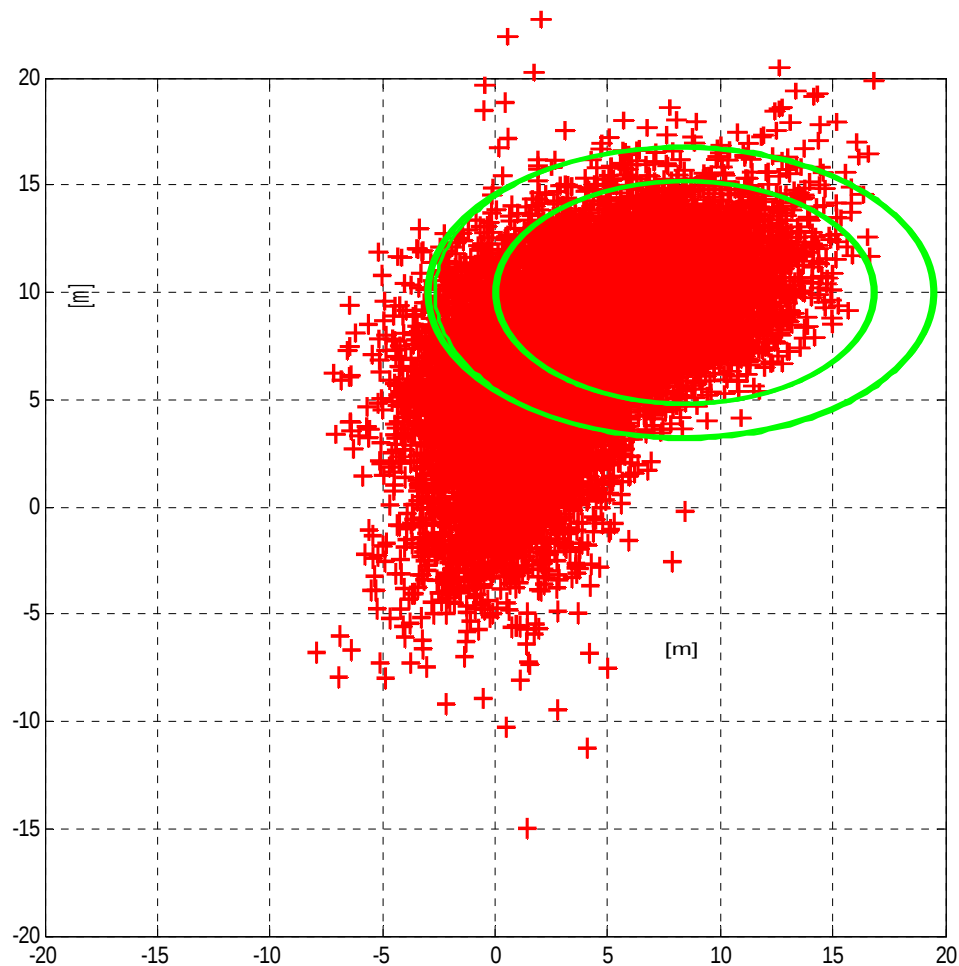
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Trier, dynamic (highway)



- ◆ Loran Autonomous
- ◆ Loran ASF
- ◆ Loran GPS Calibrated
- ◆ GPS Position

Boston (static, 72 hours)



Receiver status

- “1st time right” hardware design
- Algorithms finalized
- Pilot testing is ongoing
- First 50 units produced and sold

