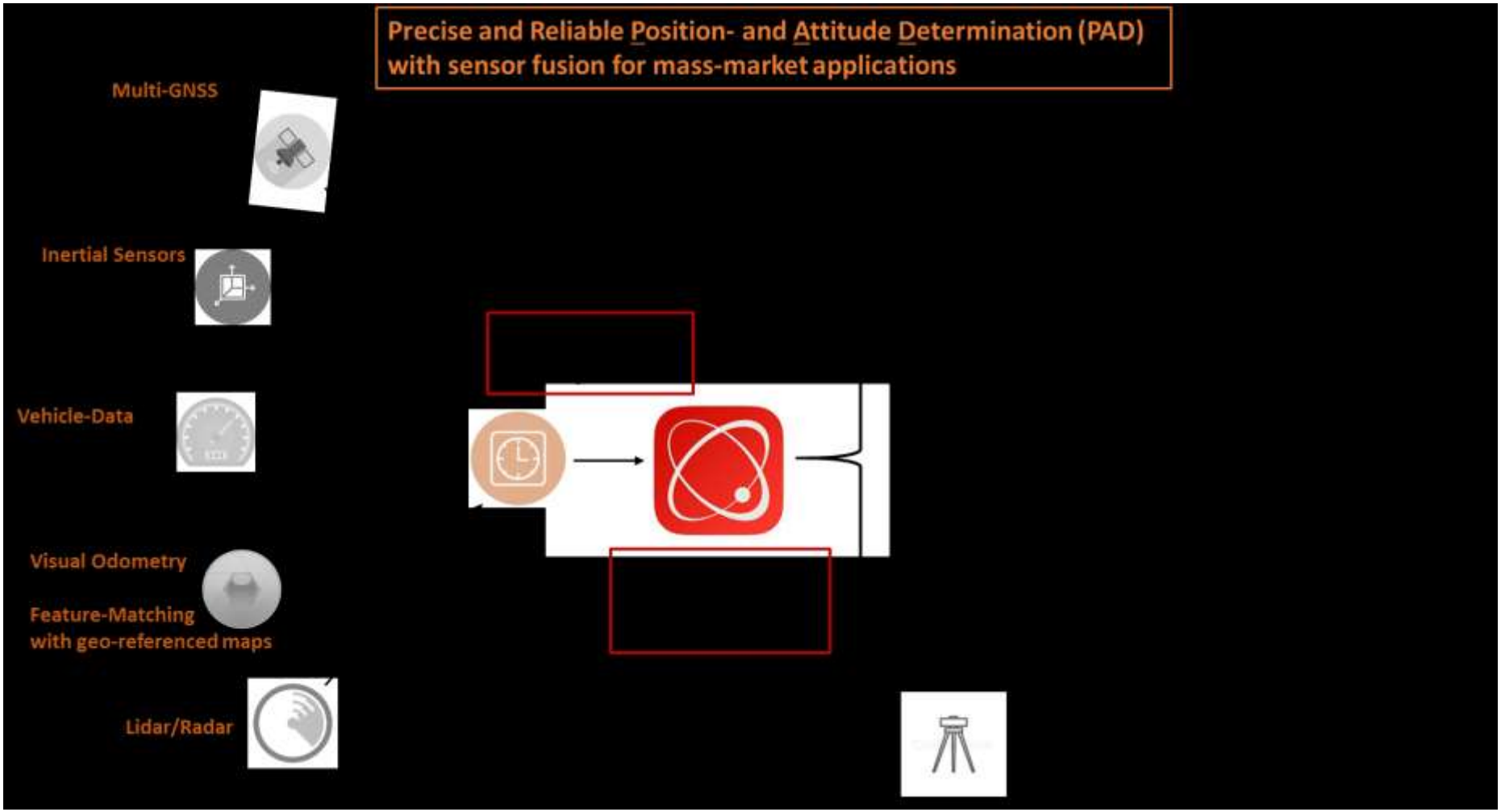
Precise Position Determination and Generation of Top-Actual Maps with ANavS Multi-Sensor RTK Module

Dr. Patrick Henkel,
Managing director of ANavS GmbH

Business of ANavS



Multi-Sensor RTK Module

- Multi-GNSS, Multi-Frequency RTK
- Centimeter-accuracy
- Small form factor and weight
- Easy system integration
- High number of interfaces:
  Ethernet, WLAN, USB, CAN, LTE, UART
- Breakthrough price

Reference station for RTK Positioning

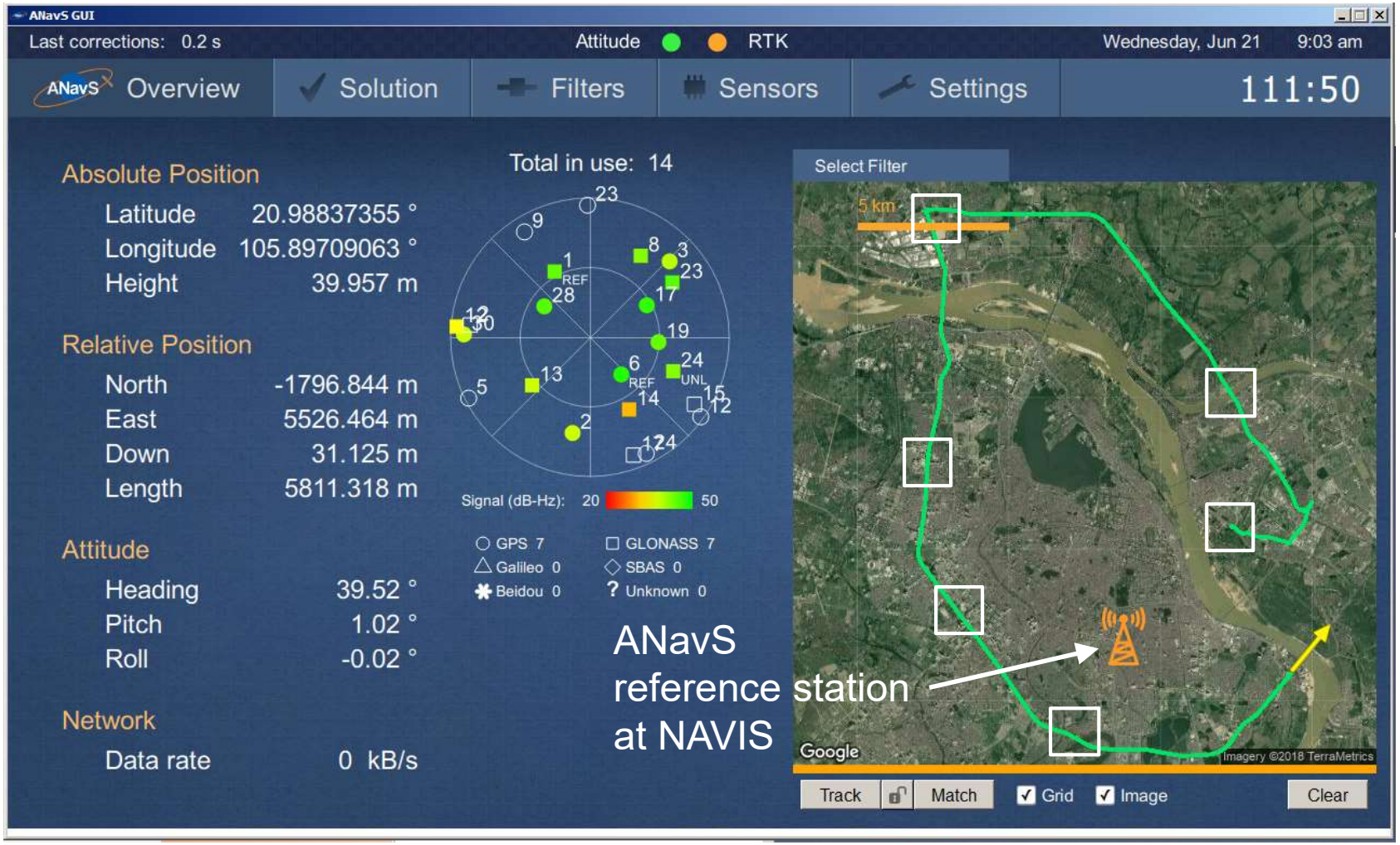
Key features:

- Provides corrections on satellite position and clock errors, satellite phase and atmospheric delays to enable precise RTK/ PPP positioning
- Includes Multi-GNSS receiver and barometric sensor
- Supports RTCM functionality and an additional propriertary format

Customers:

- Any user of RTK positioning

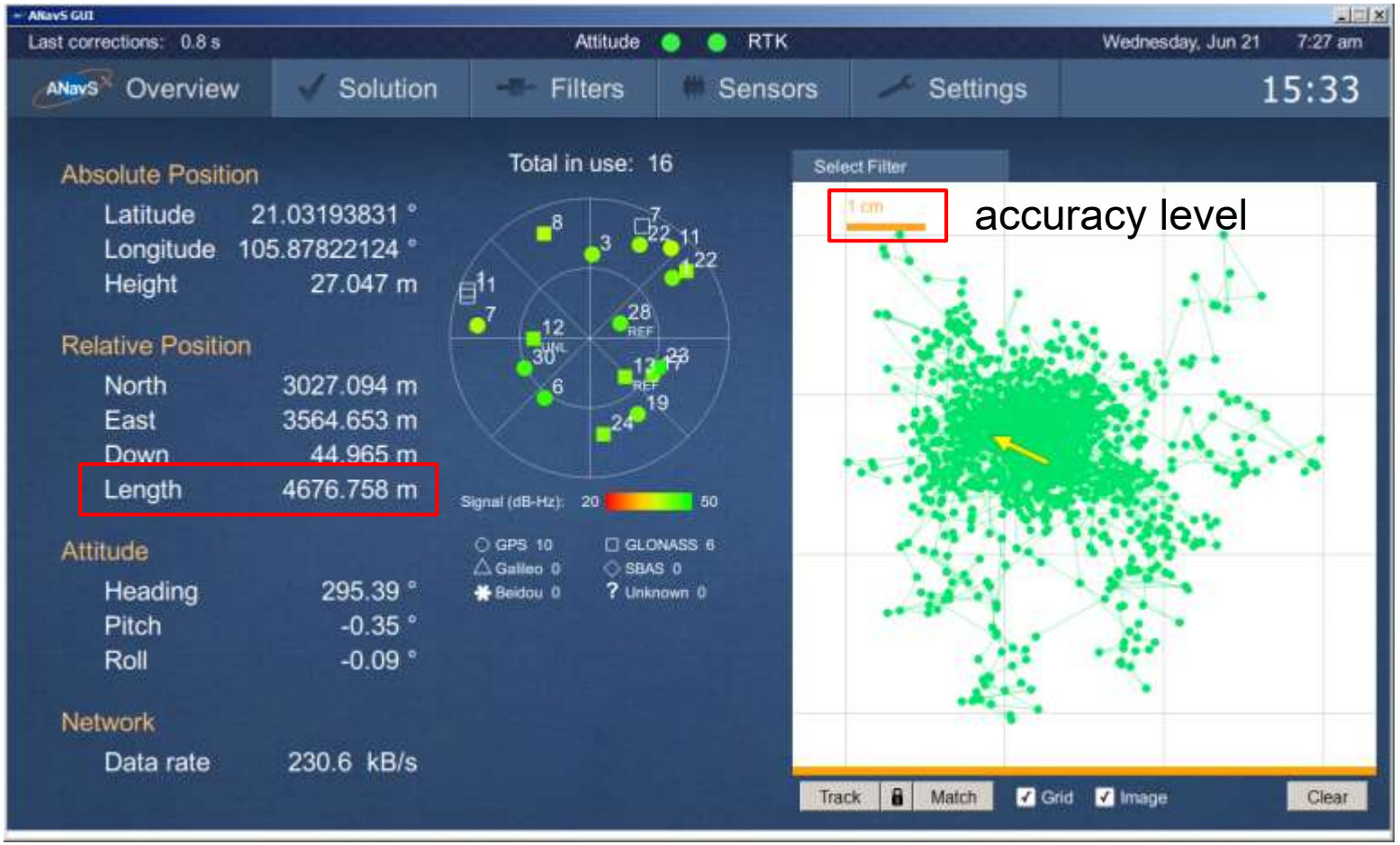
Track of test drive in Hanoi



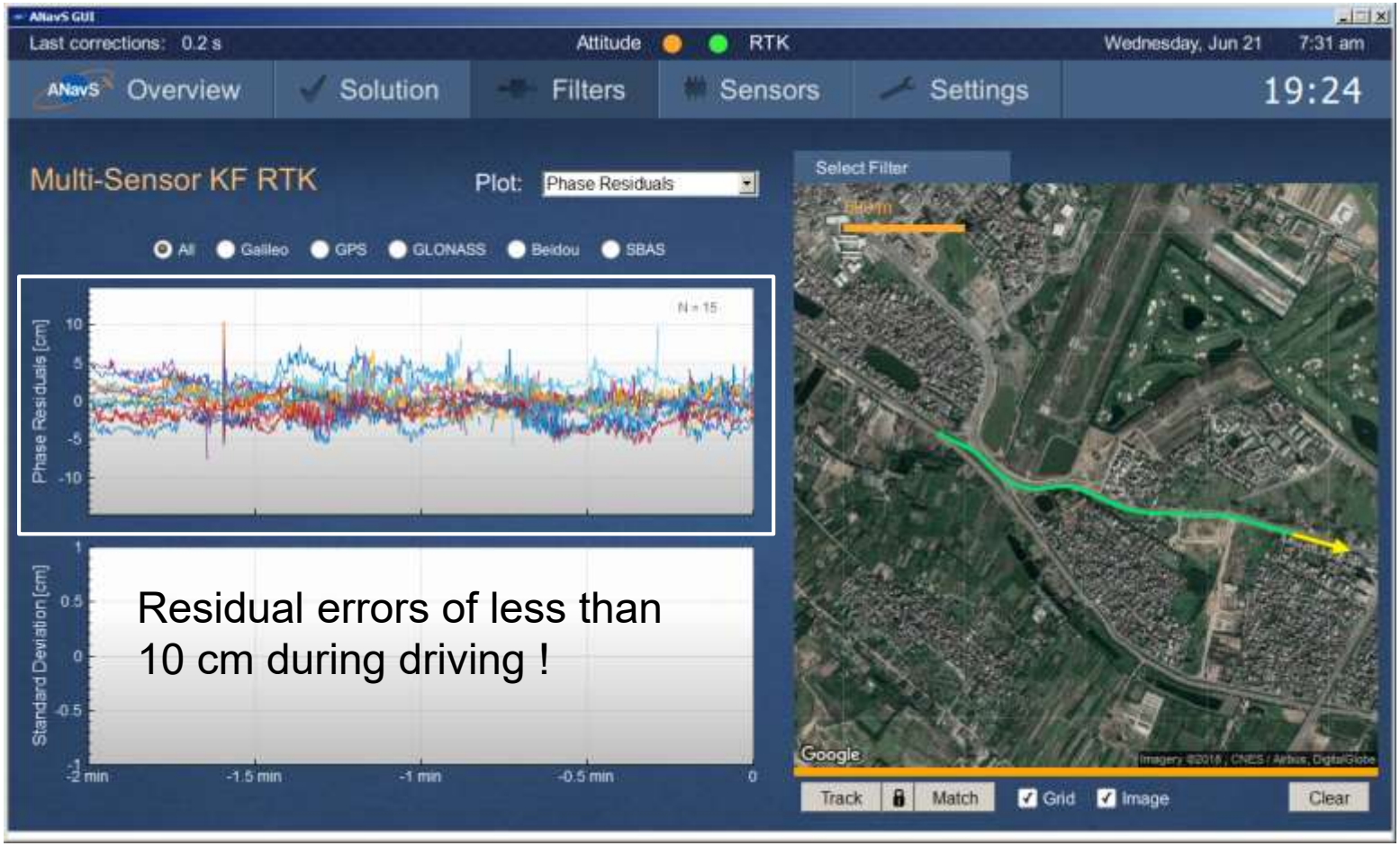
RTK fixing for centimeter-level accuracy

Distance to reference station

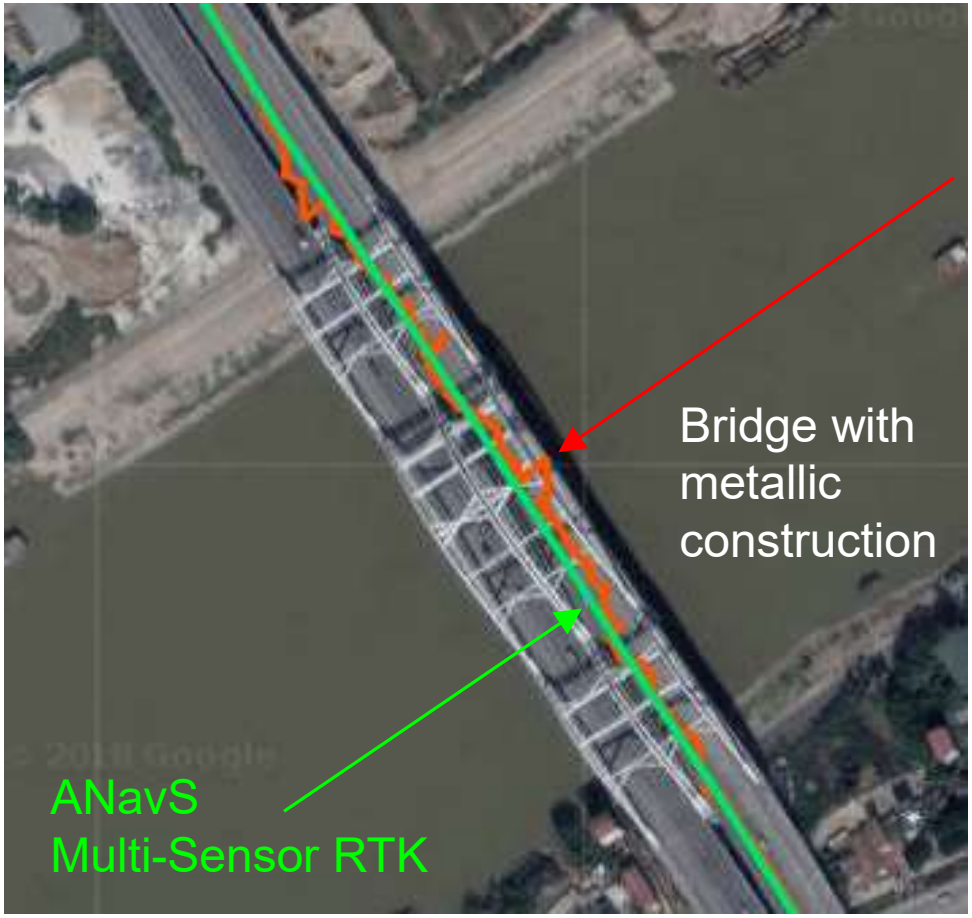
during initialization



Phase residuals of less than 10 cm during drive



Testing of challenging conditions



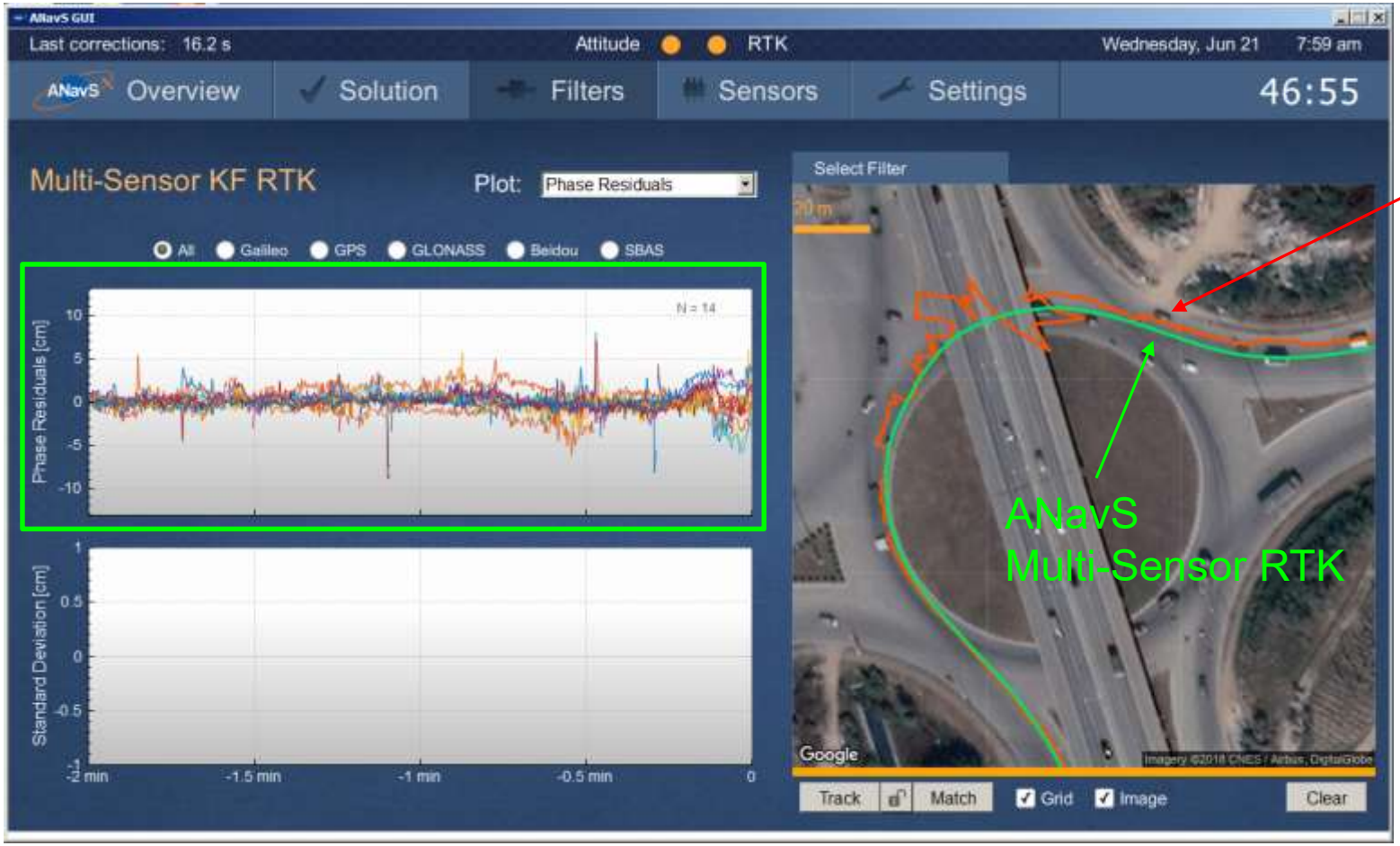
Single
point positioning

Accurate and
jump-free position
information

provided by

ANavS Multi-GNSS/
INS tight coupling !

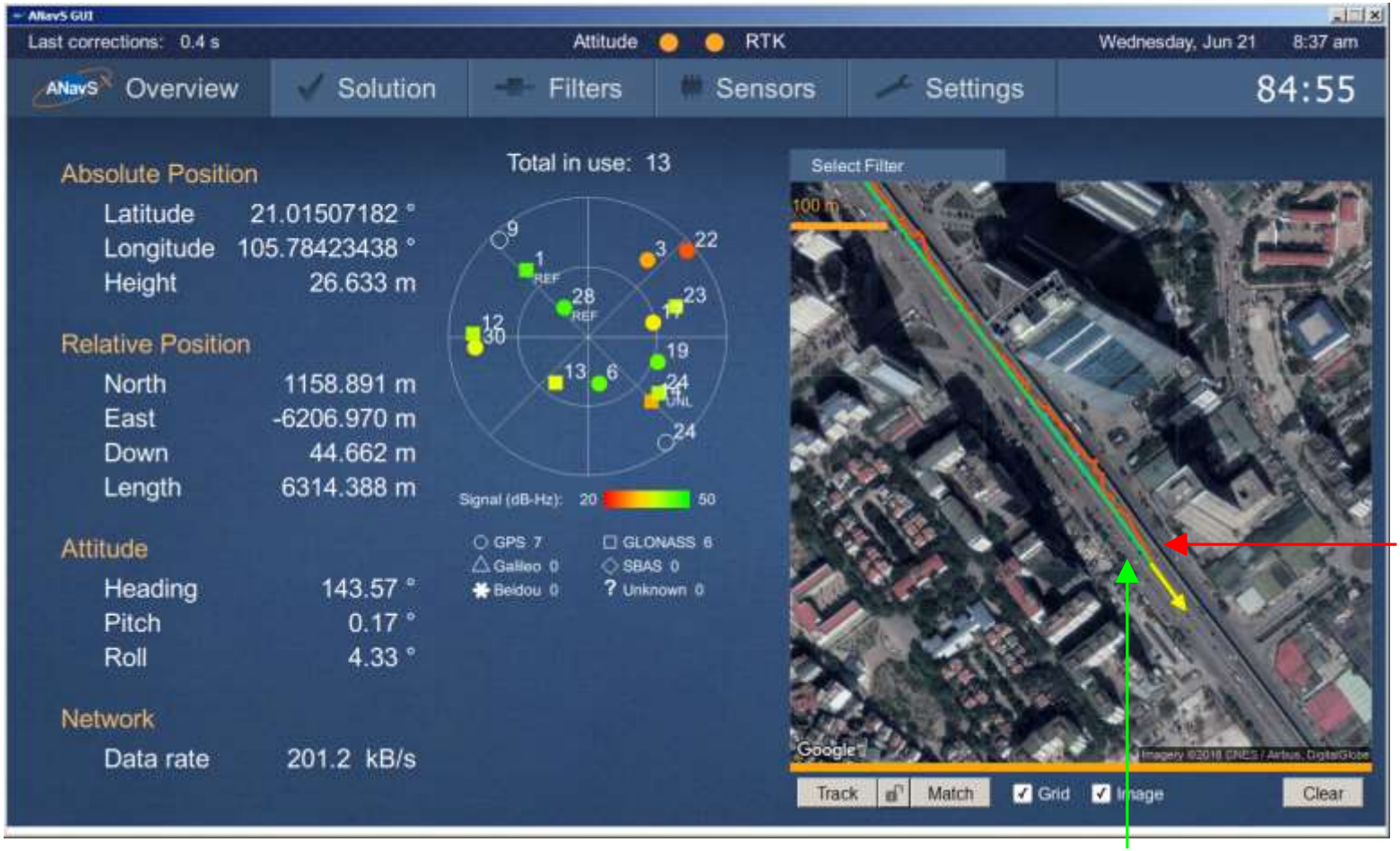
Testing of challenging conditions with bridges



Single point positioning

High performance even close to skyscrapers

High performance even close to skyscrapers



Single point positioning

ANavS Multi-Sensor RTK

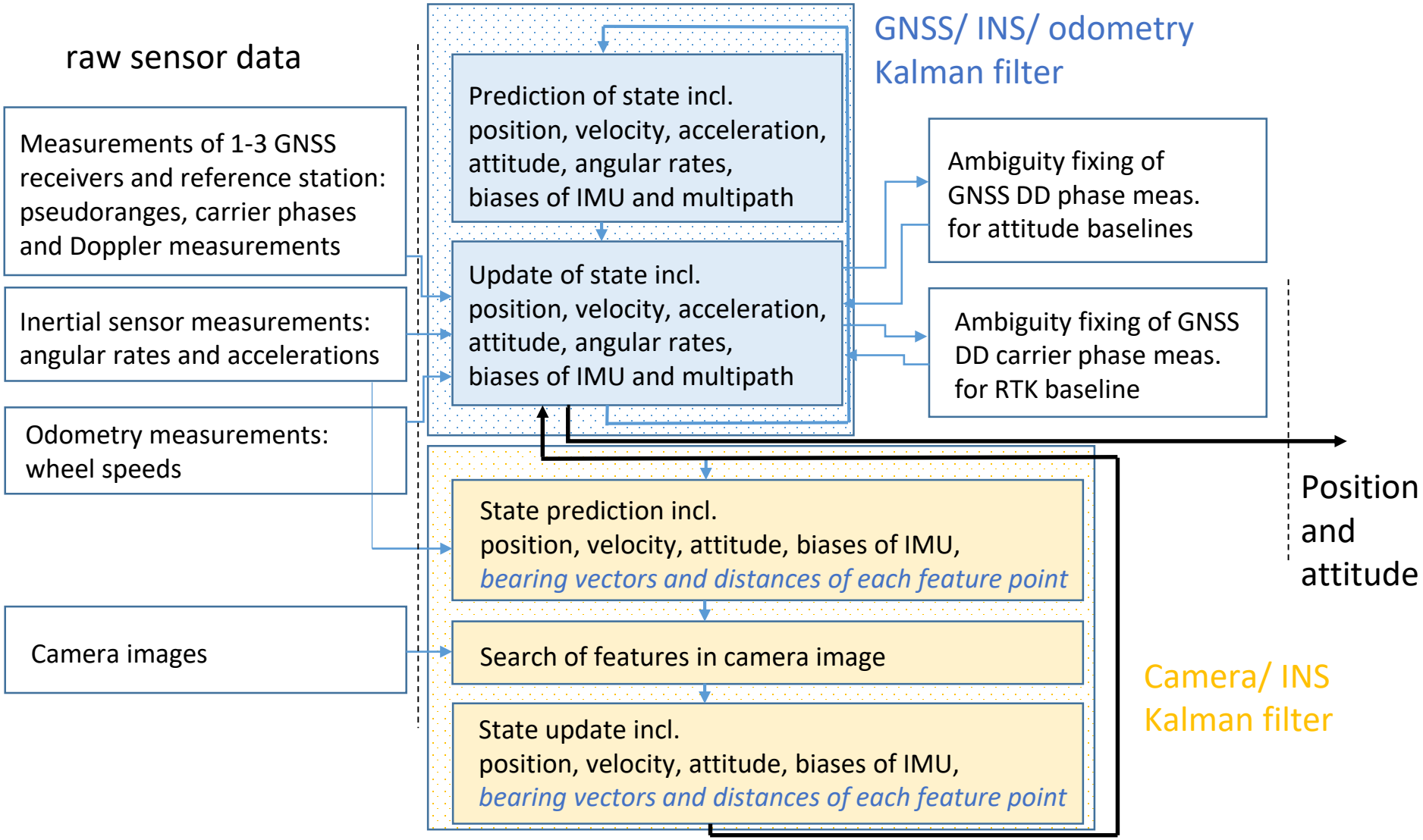
High performance even close to skyscrapers

ANavS Multi-Sensor RTK

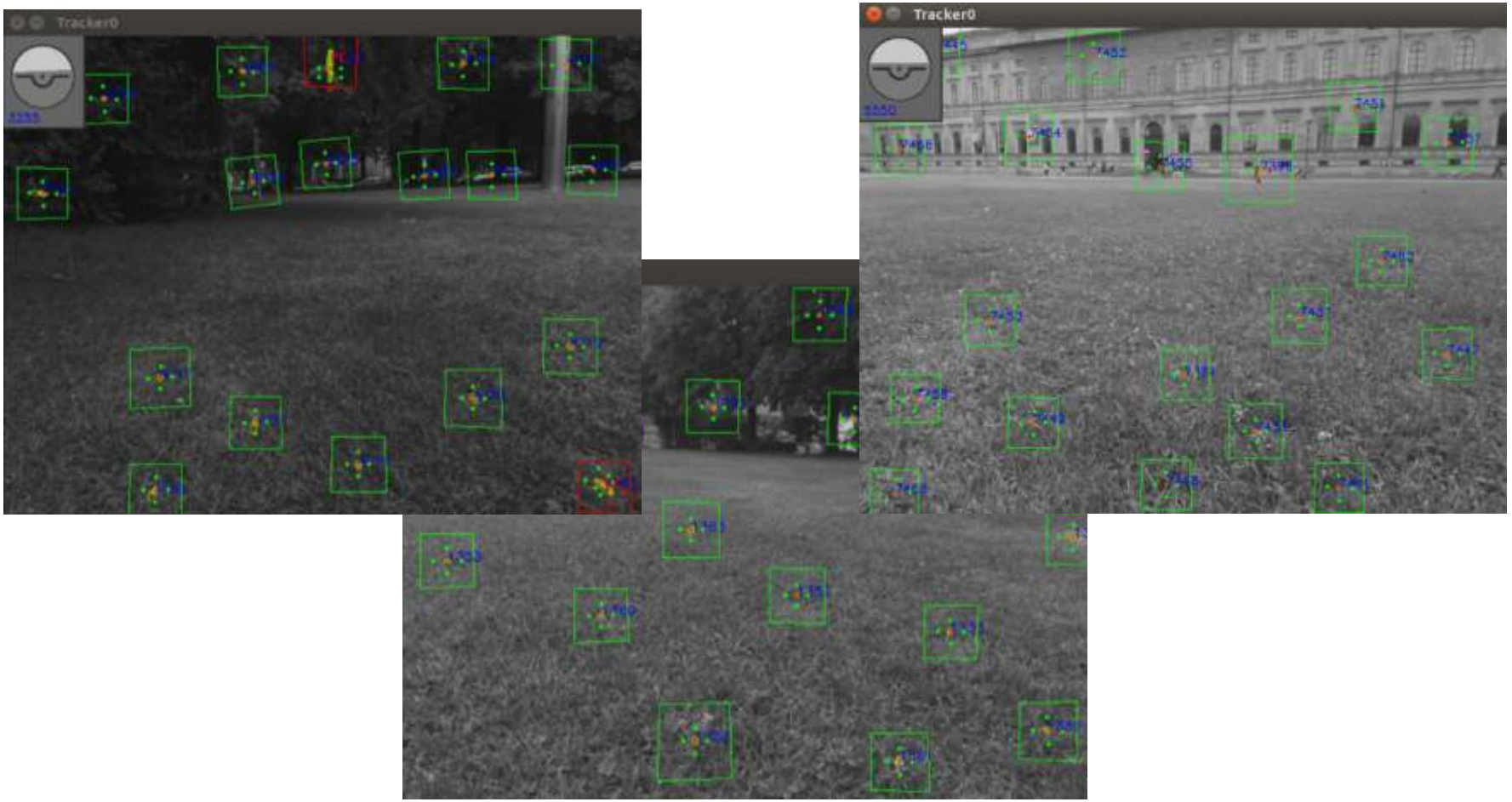
Integration of visual-inertial odometry

- GNSS signals not available below bridges, tunnels, indoors
- Inertial measurements can bridge
  only very short outages as position drifts
- Need for further sensor: here: camera
- Enables generation of top-actual maps

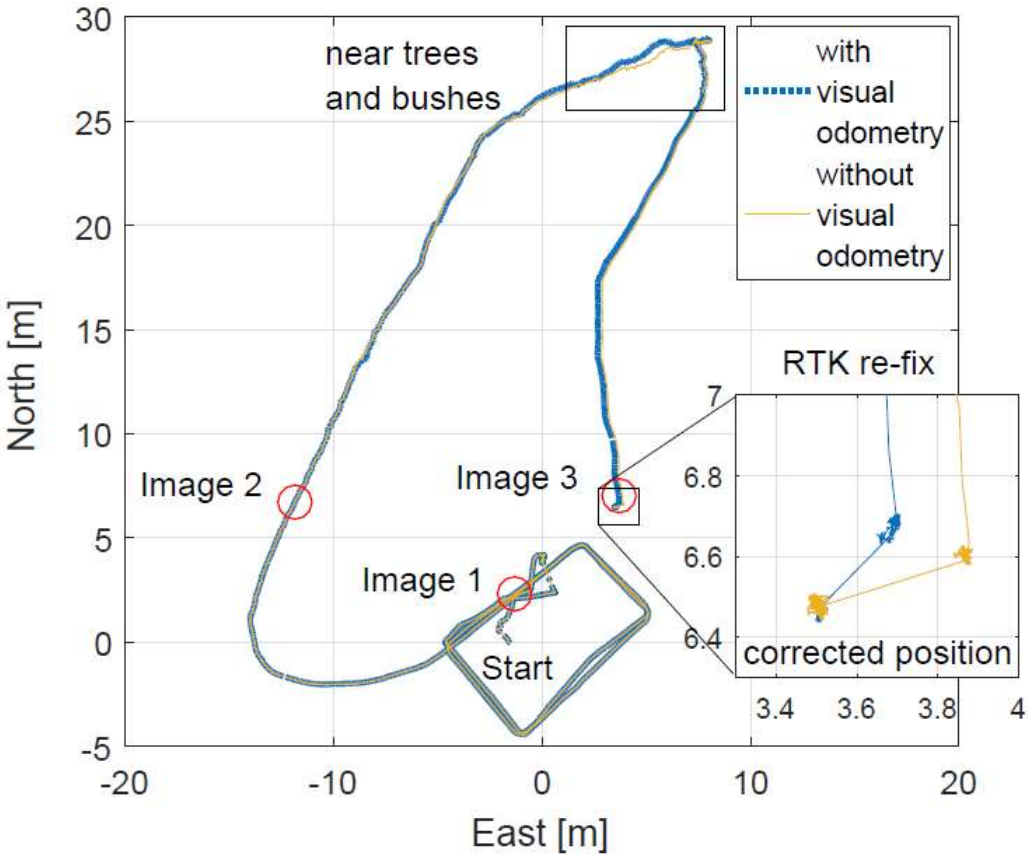
Integration of visual-inertial odometry


raw sensor data
Measurements of 1-3 GNSS receivers and reference station: pseudoranges, carrier phases and Doppler measurements
Inertial sensor measurements: angular rates and accelerations
Odometry measurements: wheel speeds
Camera images
GNSS/ INS/ odometry Kalman filter
Prediction of state incl. position, velocity, acceleration, attitude, angular rates, biases of IMU and multipath
Update of state incl. position, velocity, acceleration, attitude, angular rates, biases of IMU and multipath
Ambiguity fixing of GNSS DD phase meas. for attitude baselines
Ambiguity fixing of GNSS DD carrier phase meas. for RTK baseline
Position and attitude
State prediction incl. position, velocity, attitude, biases of IMU, bearing vectors and distances of each feature point
Search of features in camera image
State update incl. position, velocity, attitude, biases of IMU, bearing vectors and distances of each feature point
Camera/ INS Kalman filter

Tightly coupled GNSS/ INS/ visual odometry



Tightly coupled GNSS/ INS/ visual odometry



Key outcomes from ASEAN collaborations

- Cooperation with NAVIS Centre in Hanoi has enabled ANavS **to expand** its **network of RTK reference stations** into the **ASEAN region**

- Cooperation with NAVIS centre in Hanoi has enabled ANavS to **demonstrate the performance** of its **RTK positioning systems** in the ASEAN region

- ANavS has **technology** and **products** deployed in ASEAN region for numerous applications

- ANavS is developing a **name** and a **presence** in the ASEAN region thanks to BELS

Contact data:

Website: www.anavs.de
Email: patrick.henkel@anavs.de

Providing Orientation

Advanced Navigation Solutions