

High-end GNSS based Application used for the German Railway Clearance Measuring Train

Ivo Milev

International *EUPOS*[®] Steering Committee

c/o technet-rail 2010 GmbH
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Introduction

Preconditions for **high end GNSS** based applications (clearance measurement)

- Ground based augmentation systems
- Bidirectional data exchange
- DGNSS based service /GSM/GSMR
- Processing options /on the train or service center

Examples

Conclusions



SC-104 Differential GNSS Standardization

Participants include vendors, service providers, and government agencies from around the world

Standards are subjected to performance and interoperability testing prior to adoption and publication

Achieving compatibility and interoperability

-between the service providers

-between different manufactures

we are able to guaranty the trans border use of positioning and navigation services without any looses

EUPOS® characteristic

EUPOS is an common realization of high density reference station networks (single segments)

Common terms of reference and standards for building up and managing the GNSS infrastructure

High redundancy based on additional stations (65-70 km for the 2cm accuracy in real time)

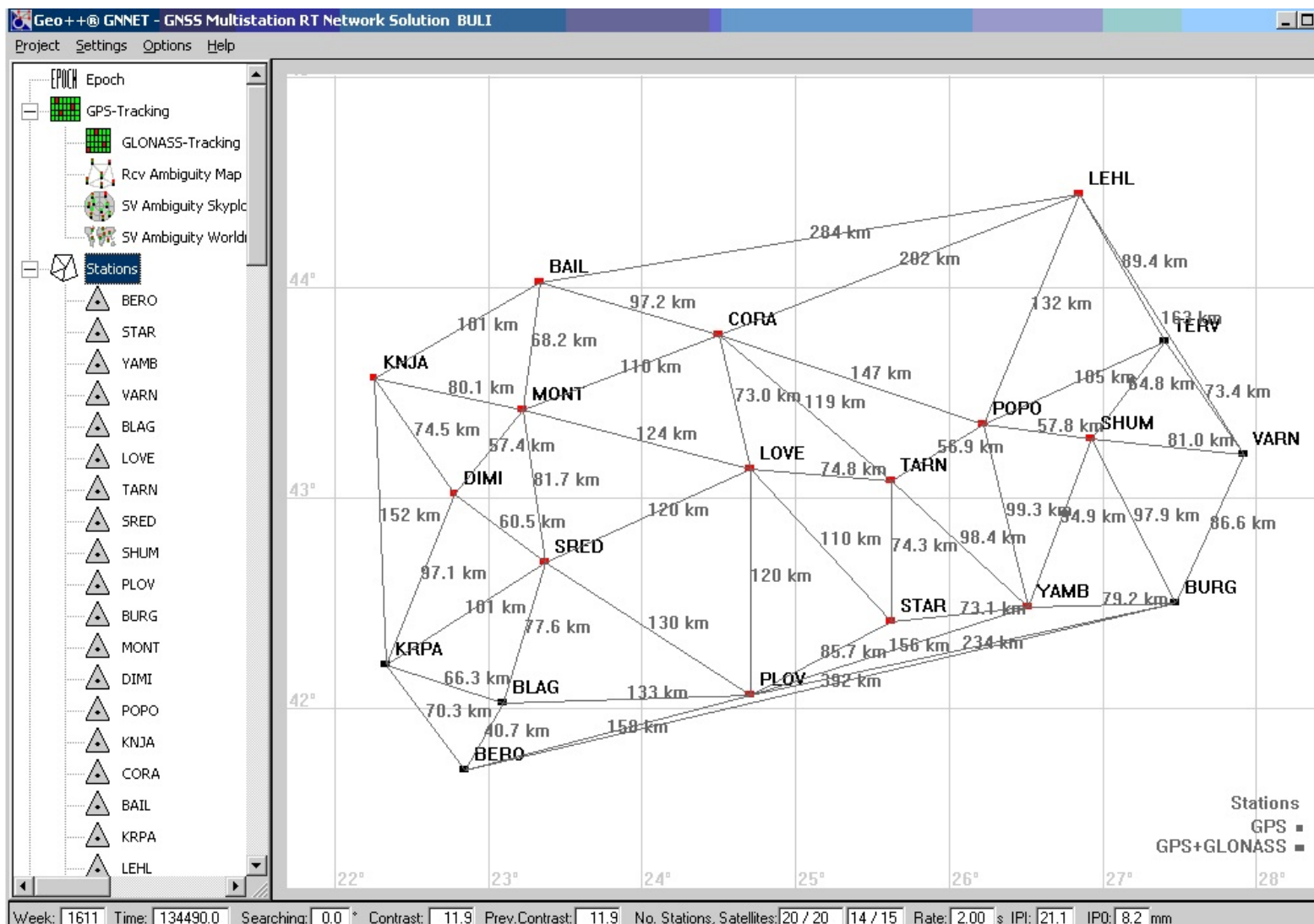
different used signals GPS , GLONASS, GALILEO



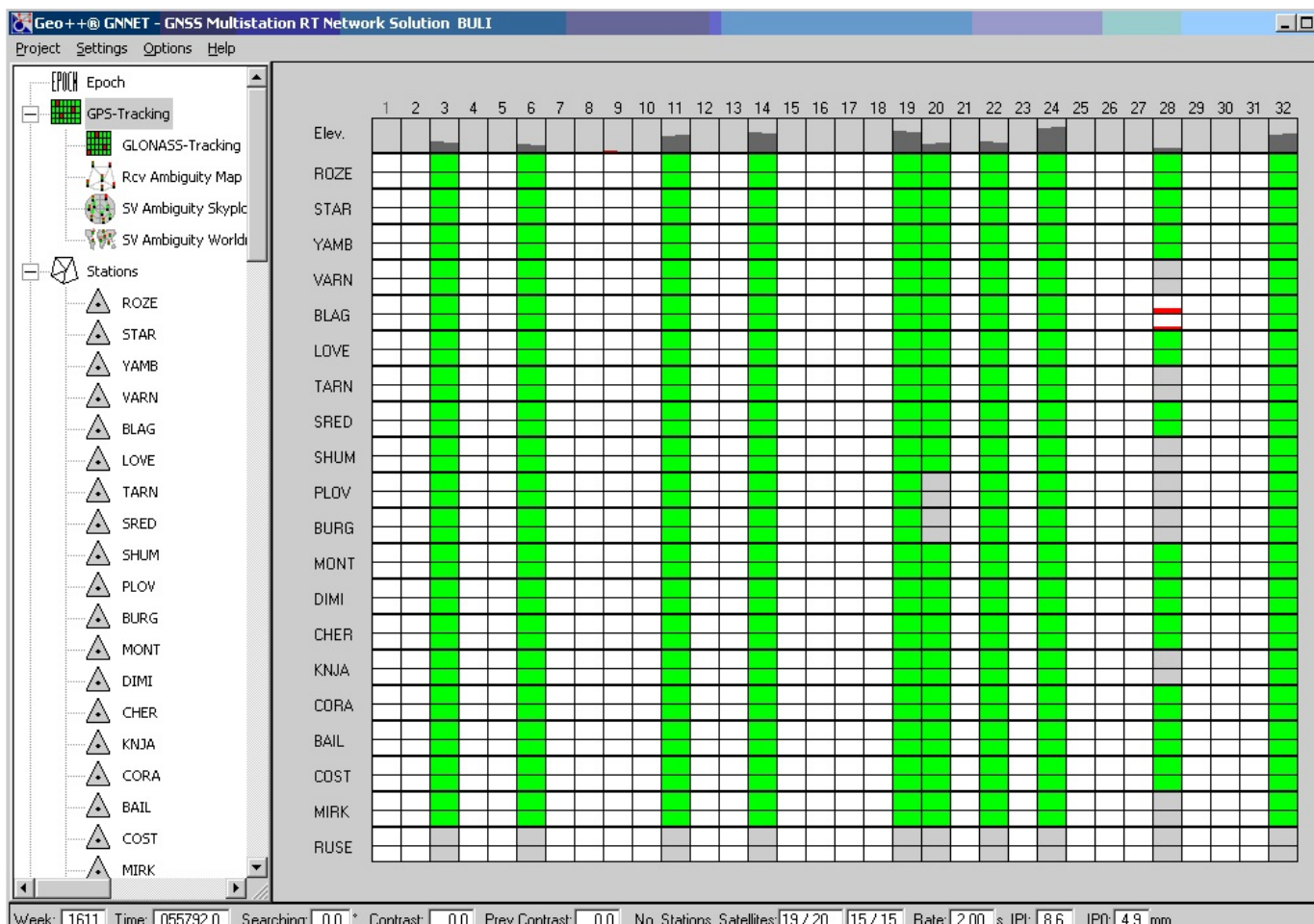
EUPOS Transmitted correction models

- **FKP*** – area modeled corrections
- **VRS*** – Virtual Reference Station (non physical ref. station)
- **MAC*** – Master Auxiliary Concept
- Using NTRIP Internet Protocol as transport layer from multi casting servers
- * Worldwide standardized in RTCM version 3.1

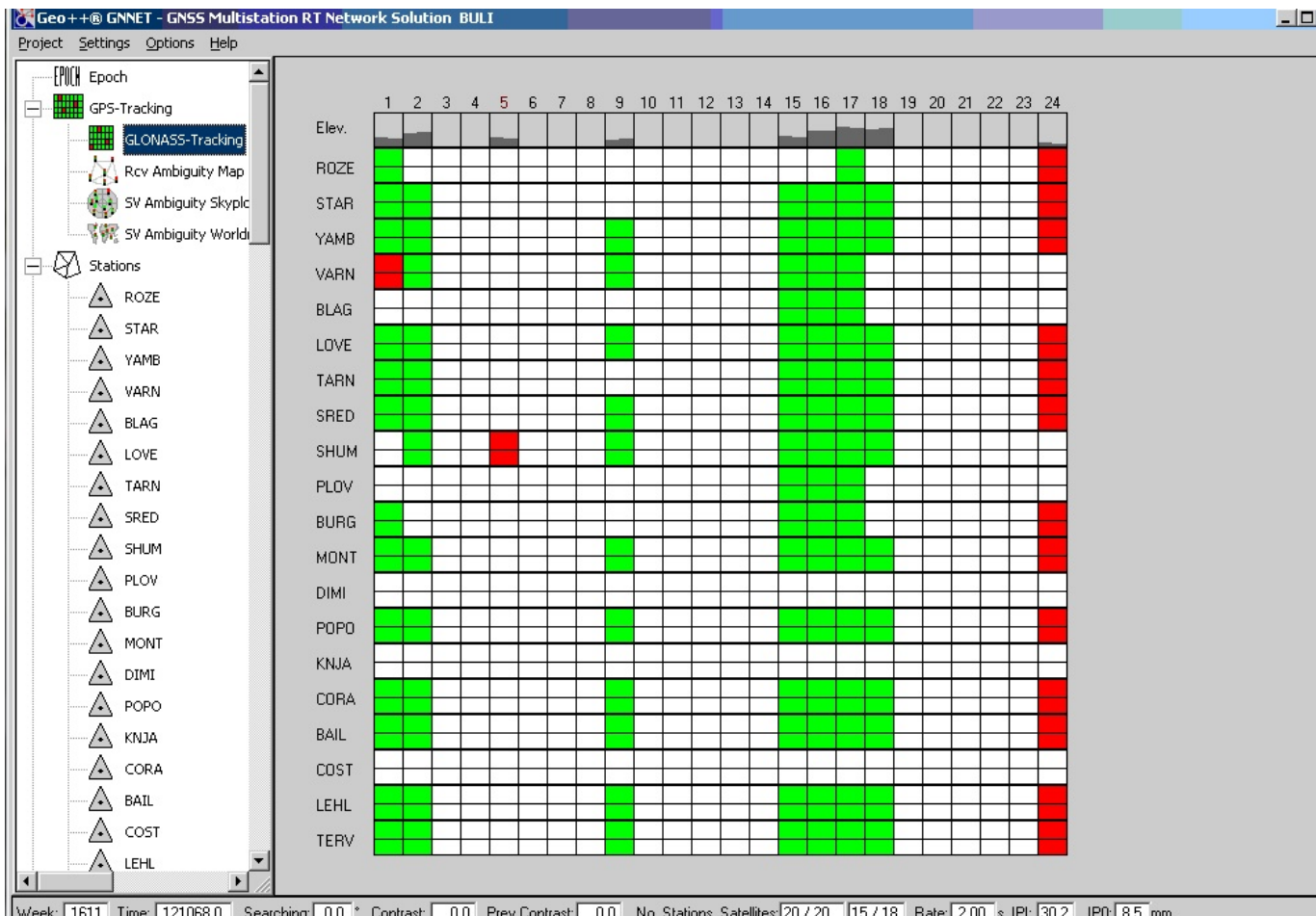
EUPOS Sparse or Dense network design



GPS availability

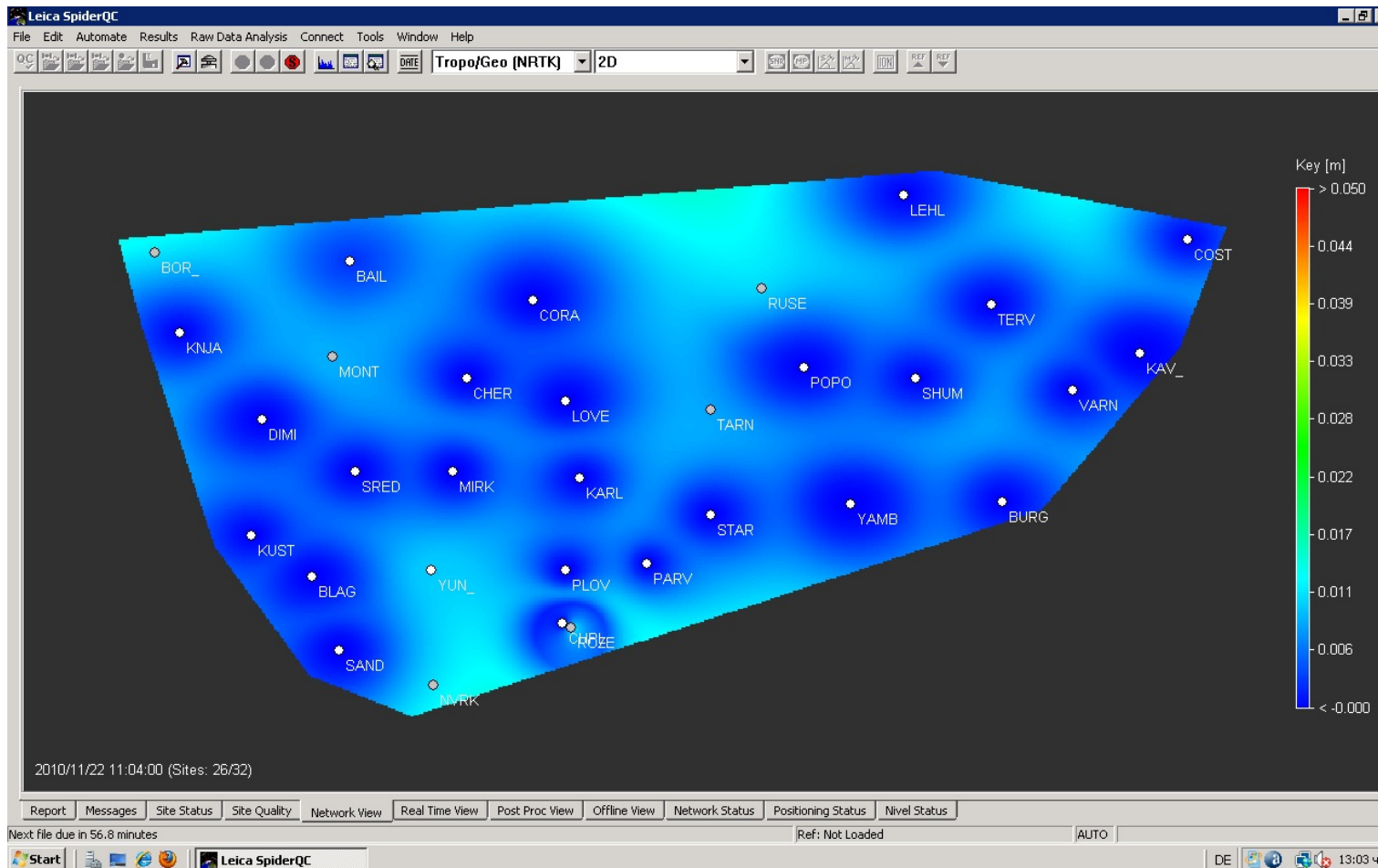


EUPOS - different receivers only GPS and GPS/GLONASS



ETRS89 based

Quality control

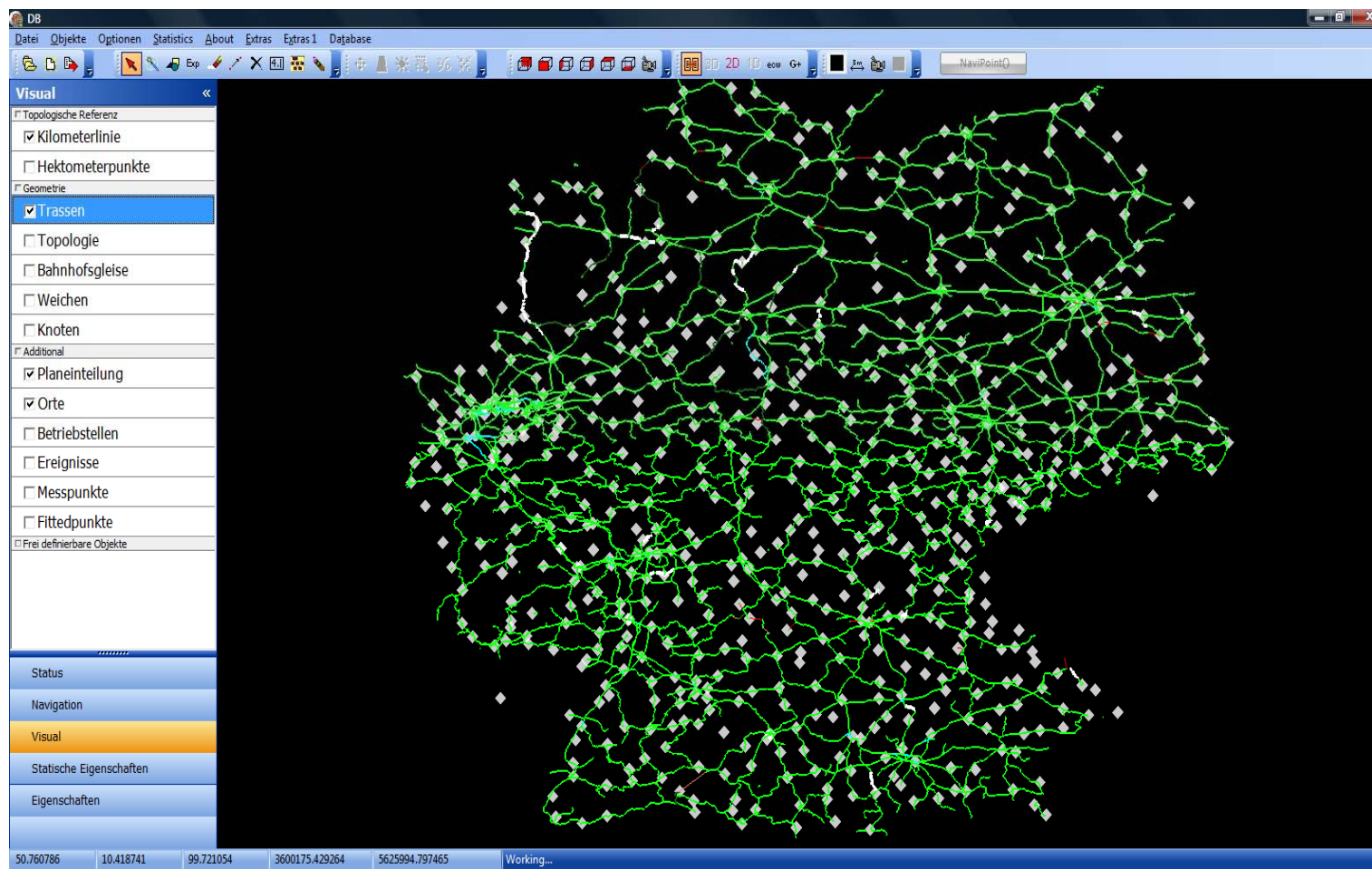


EUPOS Services

Service	Description	Accuracy	Format*	Transport Layer	DGNSS System
BULiPOS PP	Post processing	5 mm	RINEX	Internet	GPS+GLONASS
BULiPOS VS	Post processing virtual station	5 mm	RINEX	Internet	GPS+GLONASS
BULiPOS RT Precise	Real time processing high accuracy	<2 cm	RTCM 2.x, RTCM 3.x	GSM, GPRS NTRIP	GPS+GLONASS
BULiPOS RT	Real time processing	0,5-3m	RTCM 2.x, RTCM 3.x	GSM, GPRS NTRIP	GPS+GLONASS

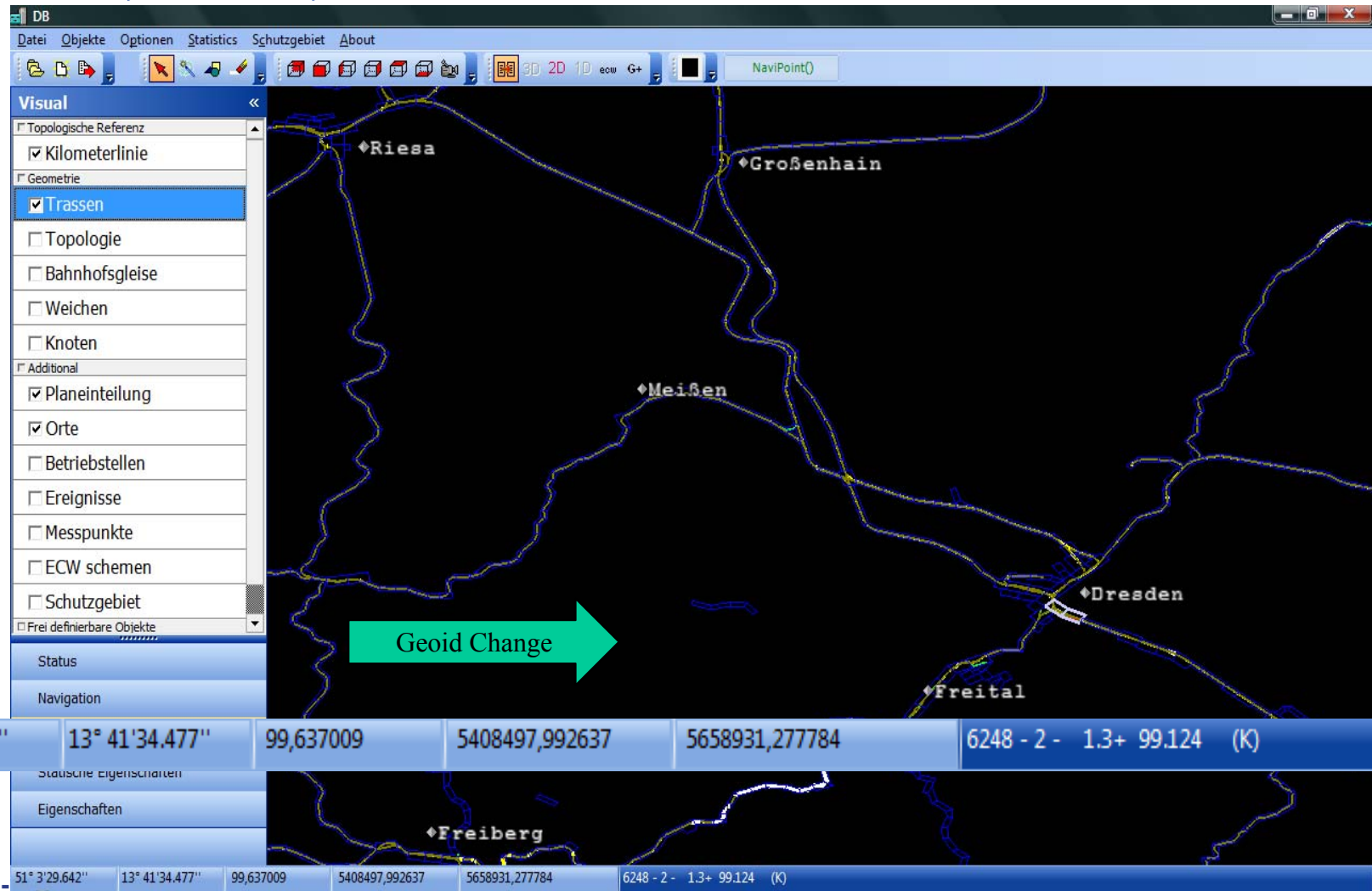
*Based on ETRS89

Railway spatial Database for rising the infrastructure maintenance performance of the German Railway

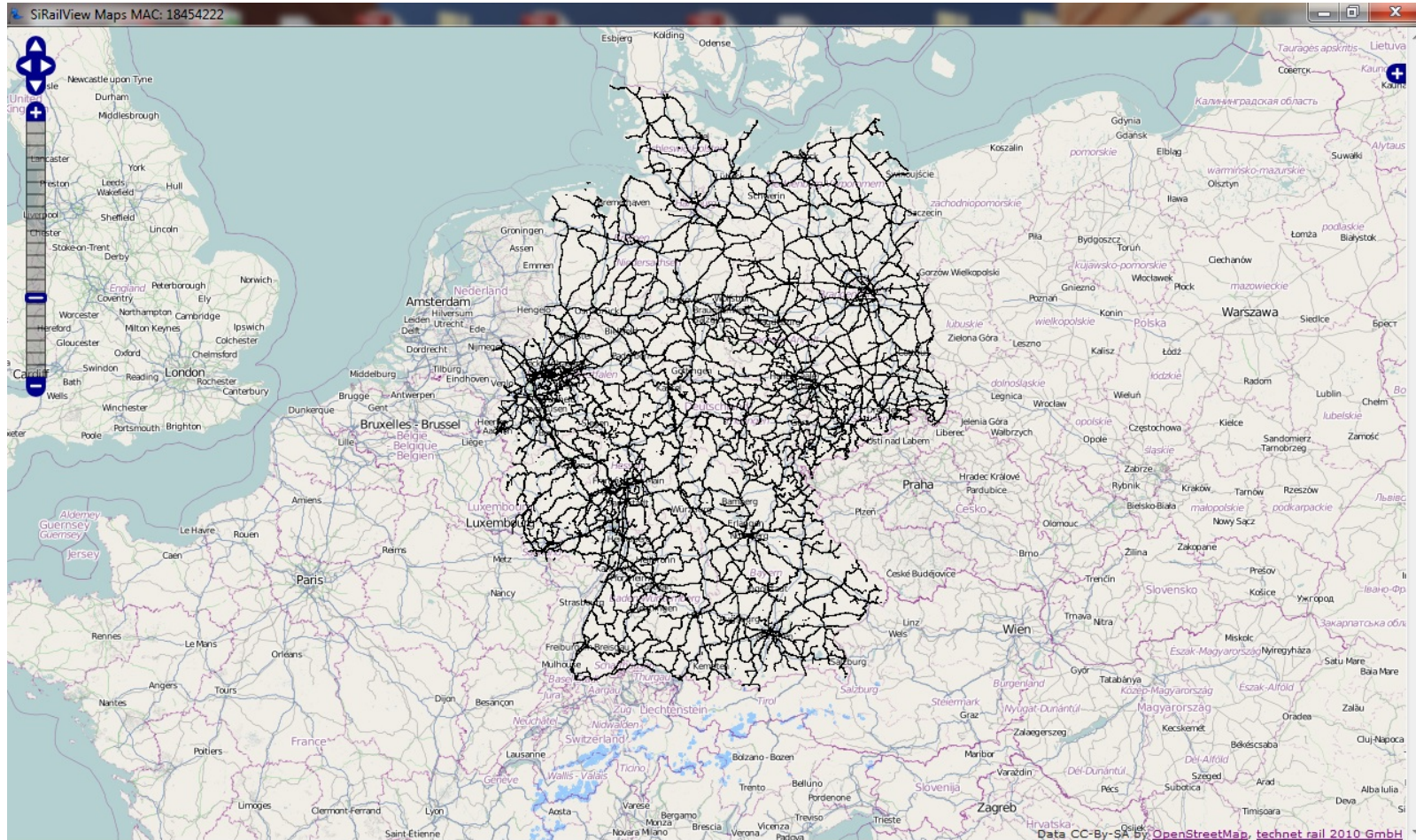


Integrity of the railway navigation database

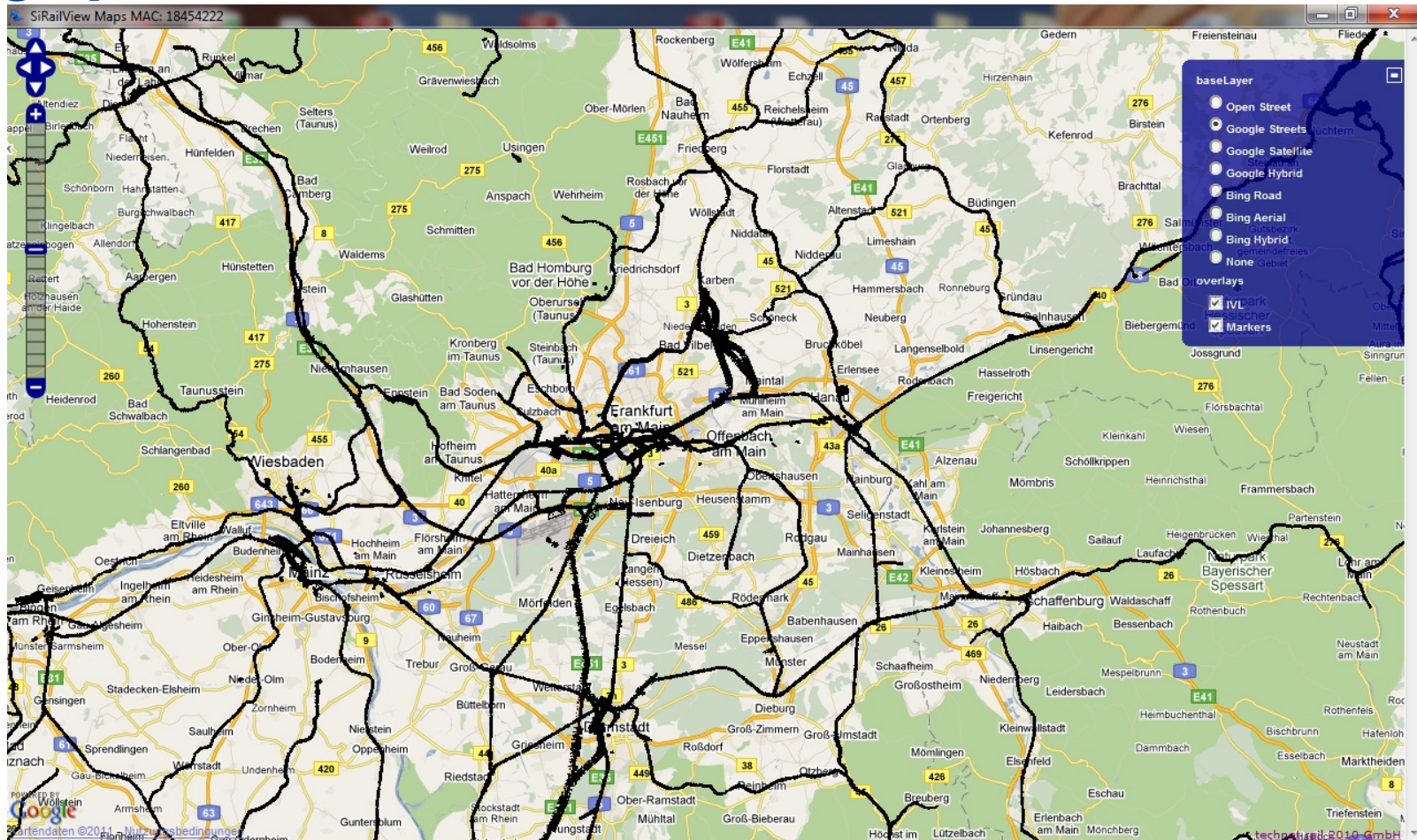
Ambiguity free system determination



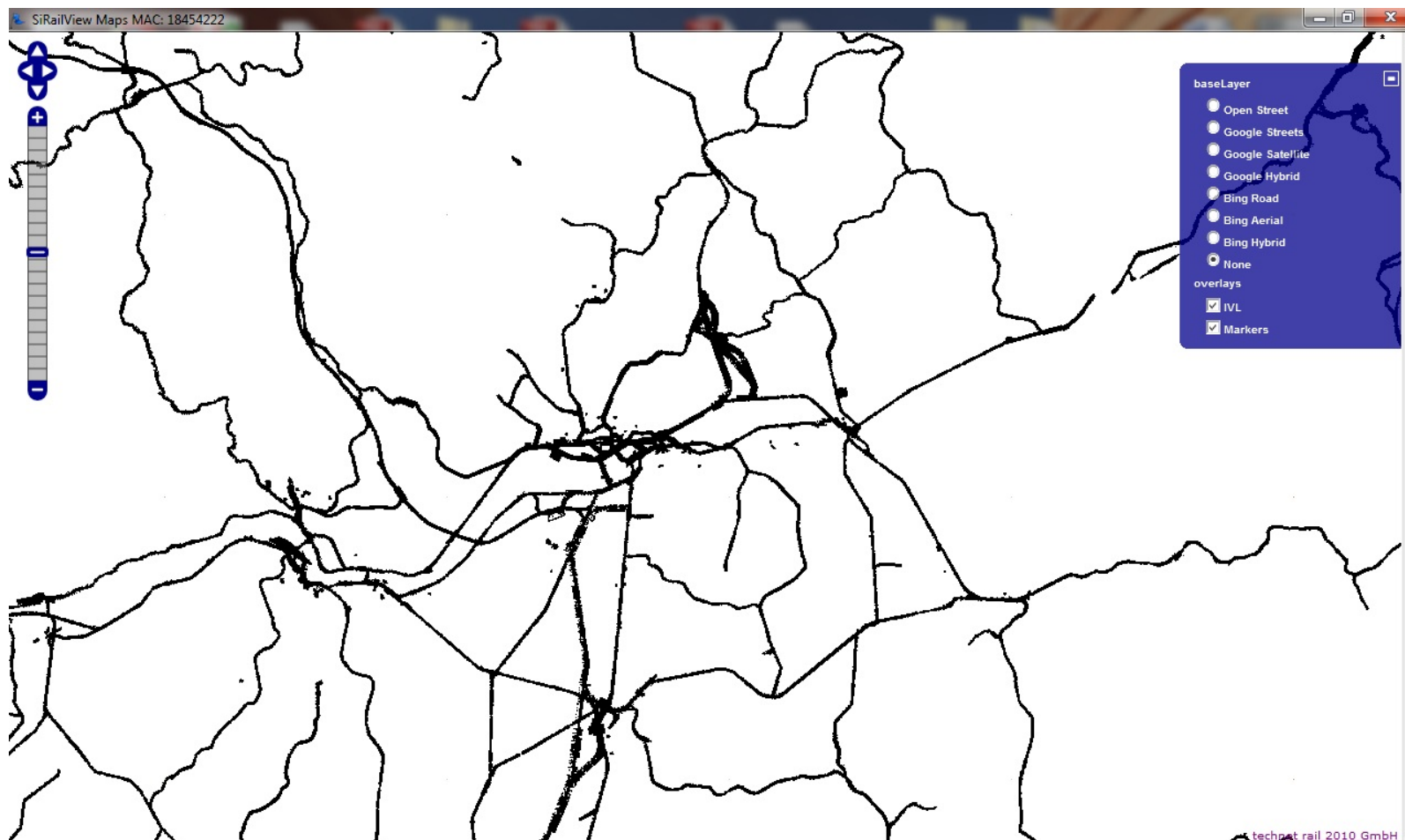
German railway network



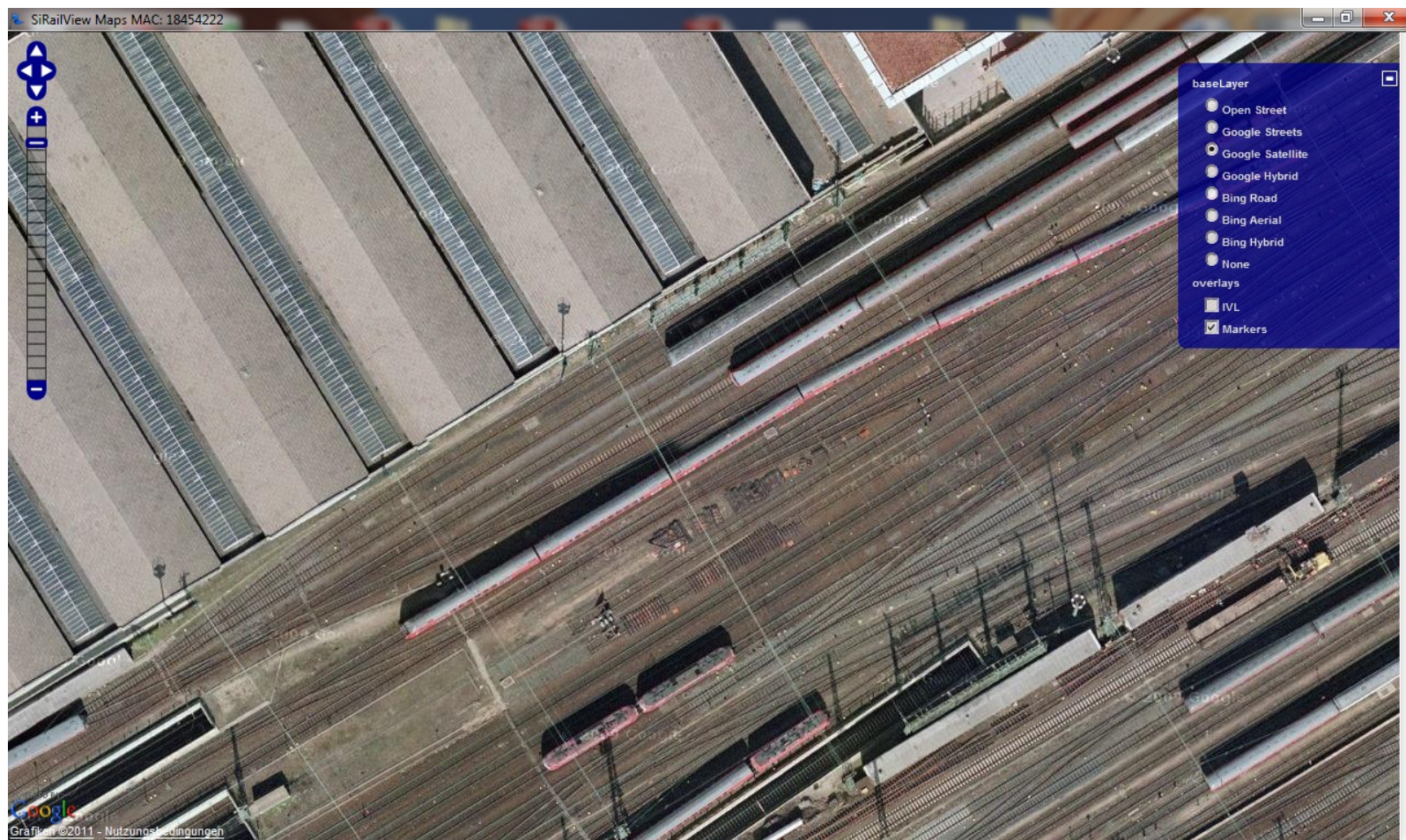
High precision corridors



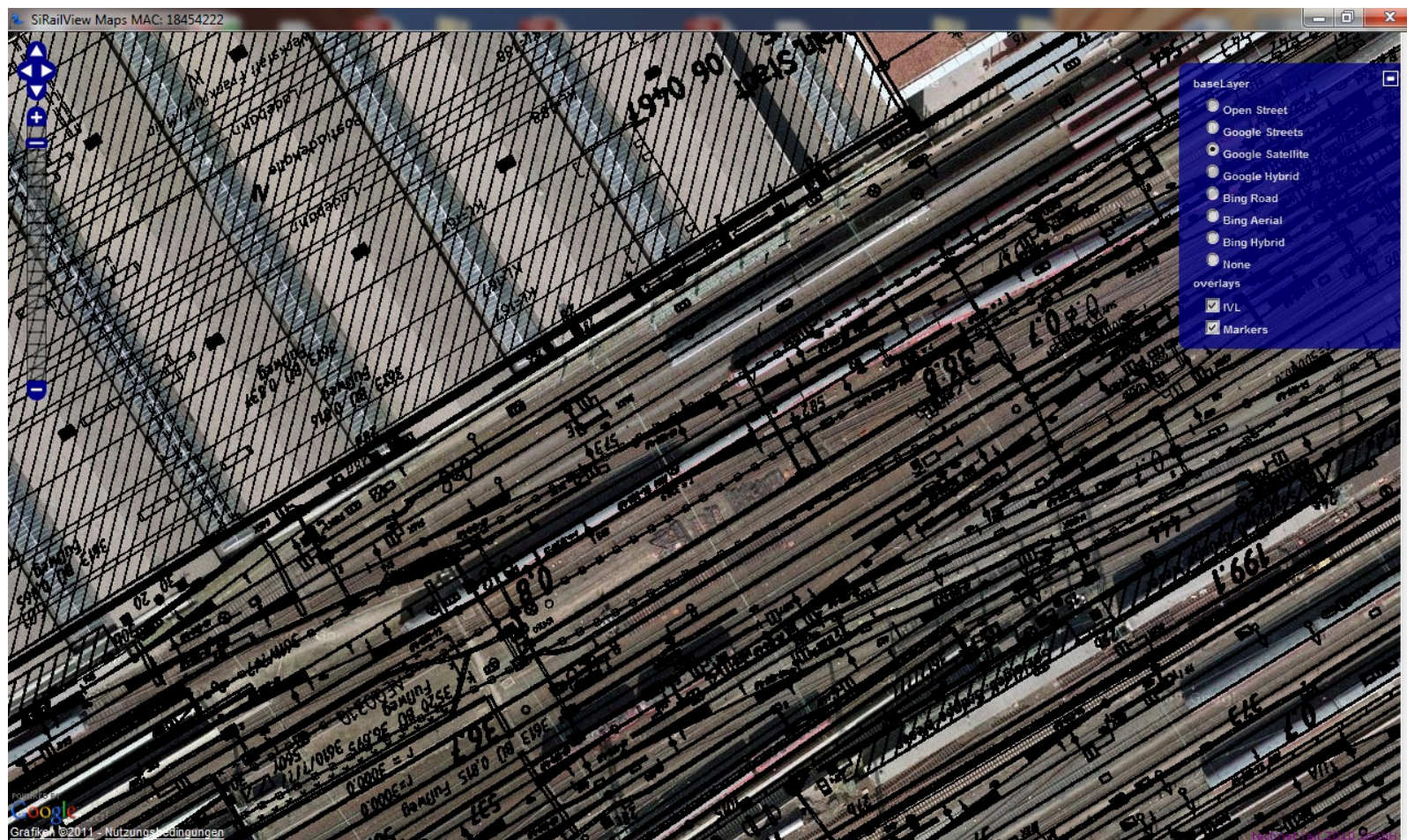
High precision corridors



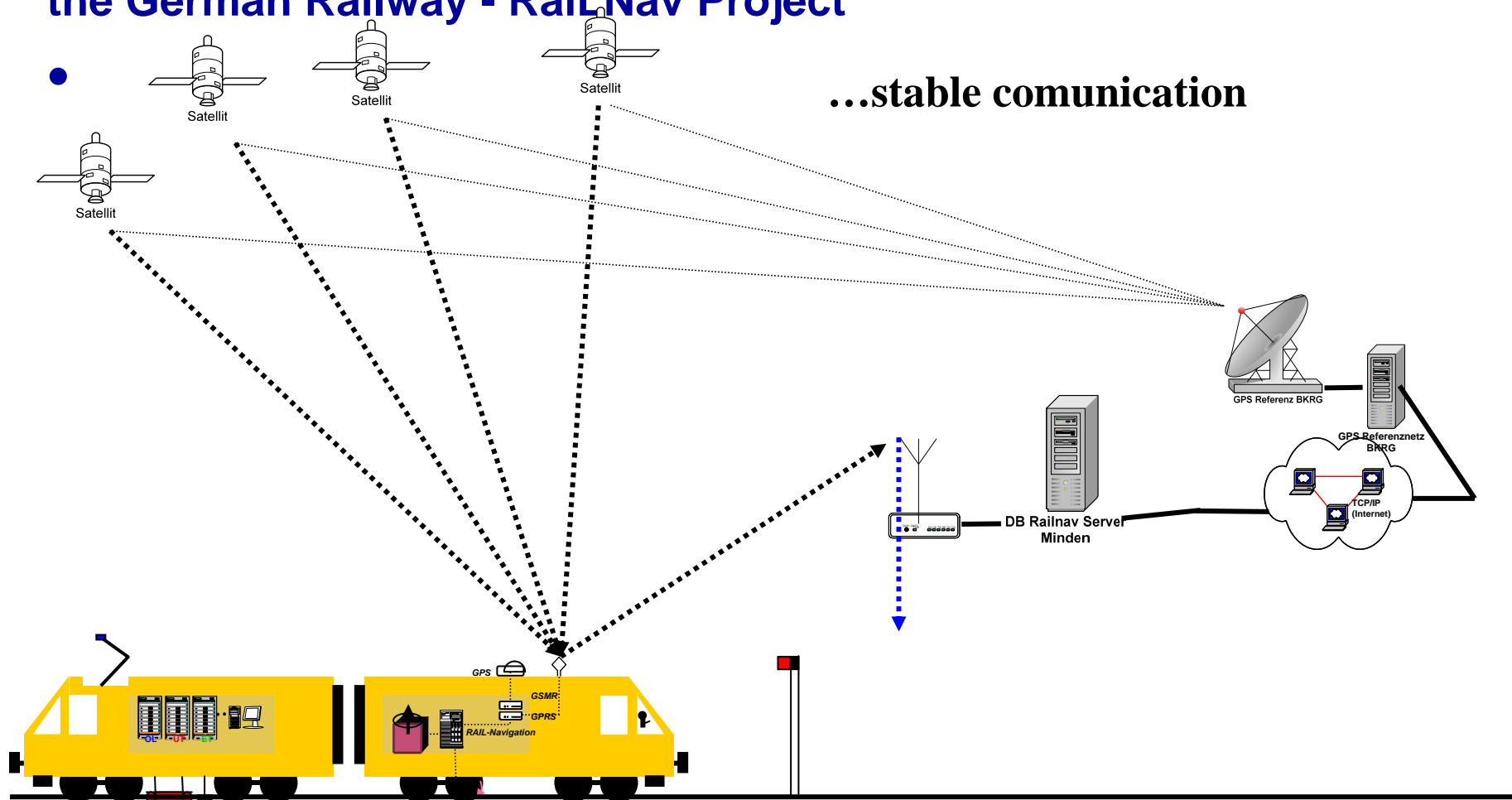
Client – Server based web application



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EUPOS/SAPPOS-based Vehicle Scheduling and Control System by the German Railway - RailNav Project

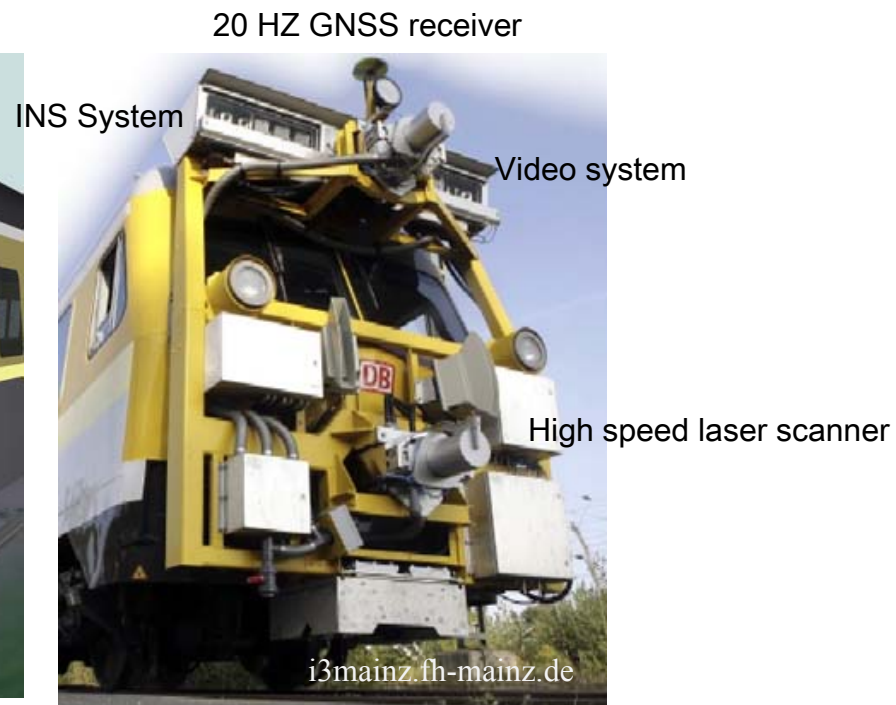
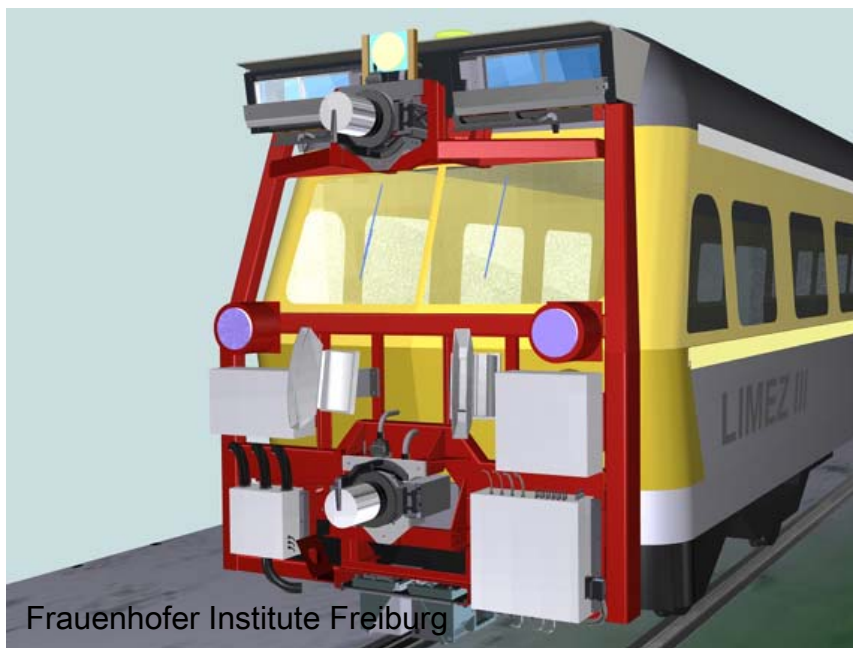


...stable communication

• Source Mr. Lahr DB AG / GEO++ Garbsen

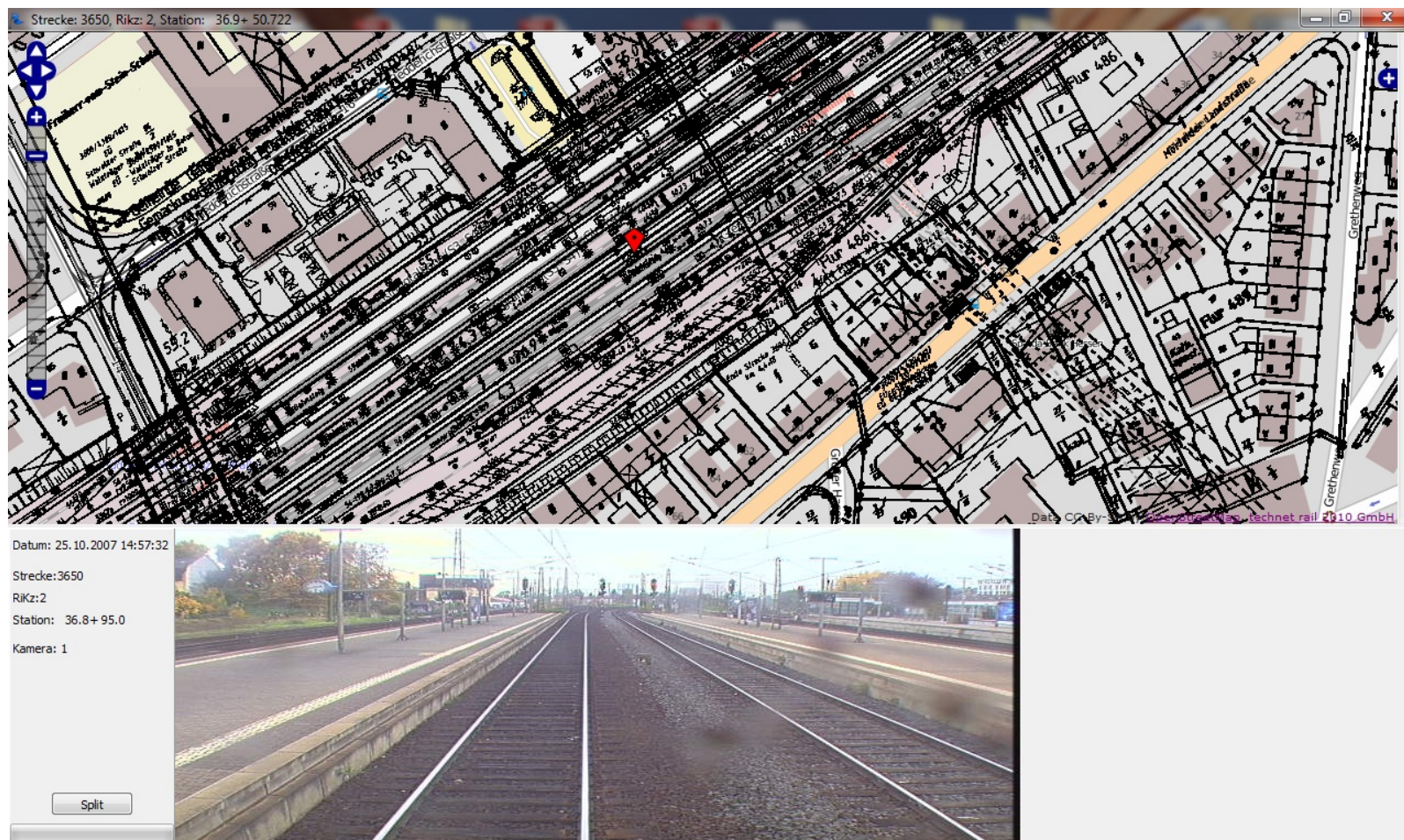
Länge: 9°24'23,43"
Breite: 46°48'37,20"
Höhe: 709,1m
Zeit: 12h33'07"

3D clearance measuring train

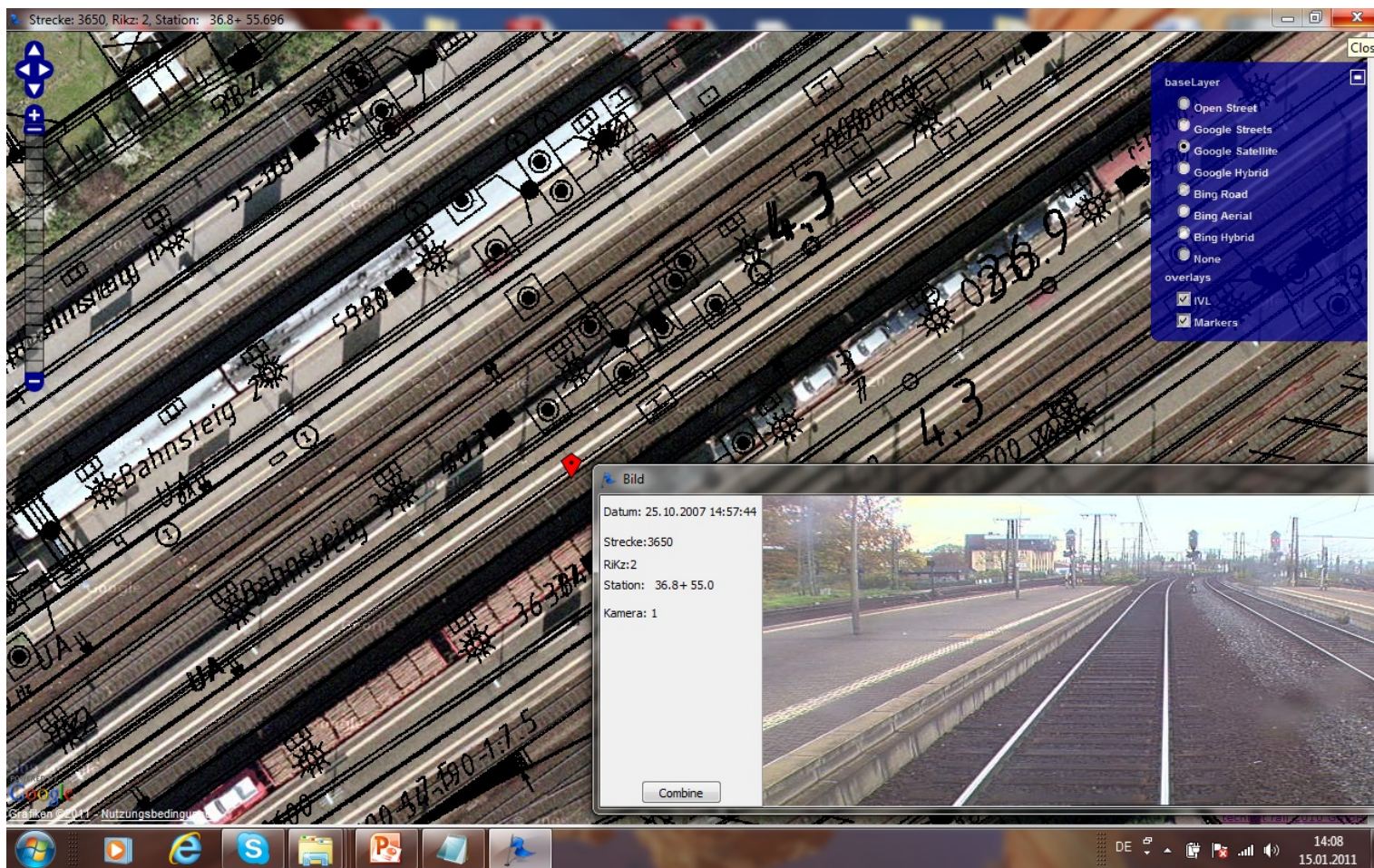


Measuring trains:
for Wire condition
for Rail head condition

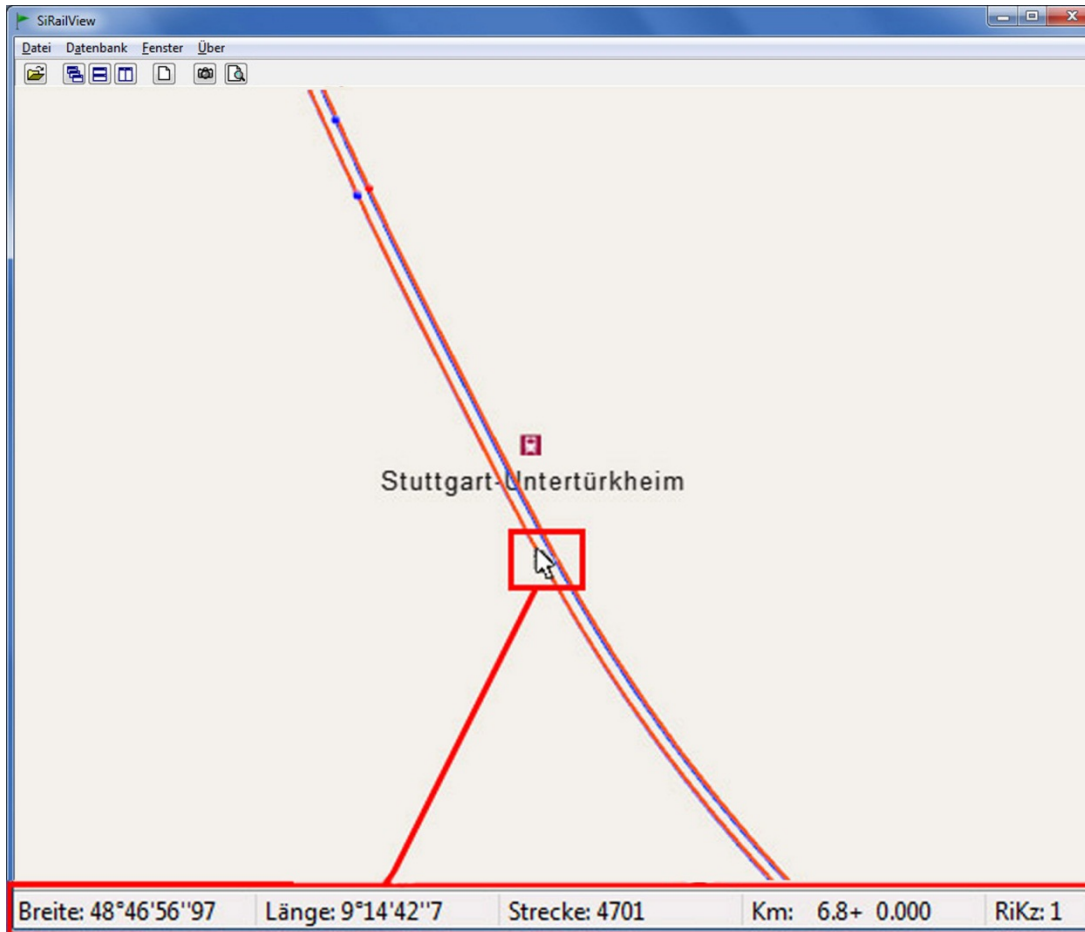
DB_VIS the image information set



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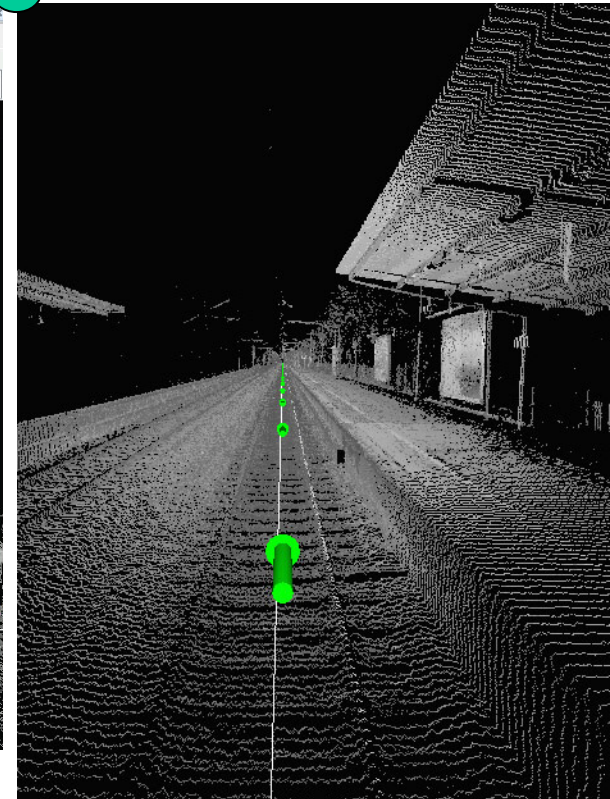
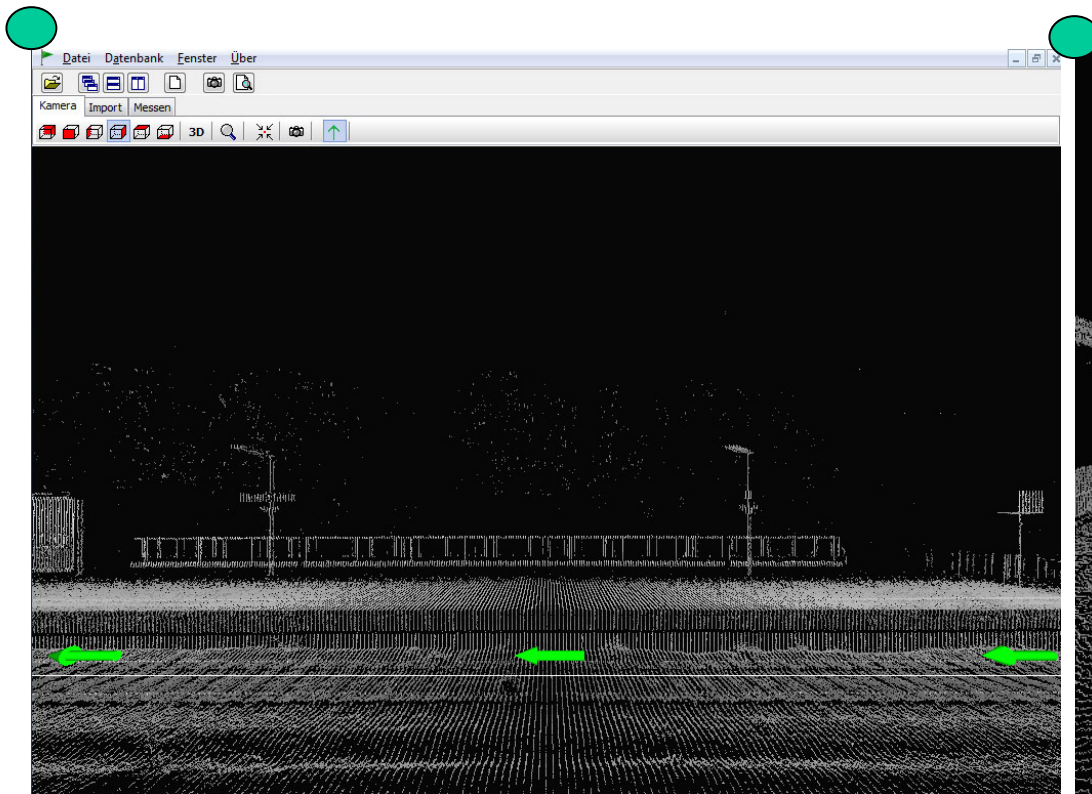
Position related to geocoded maps



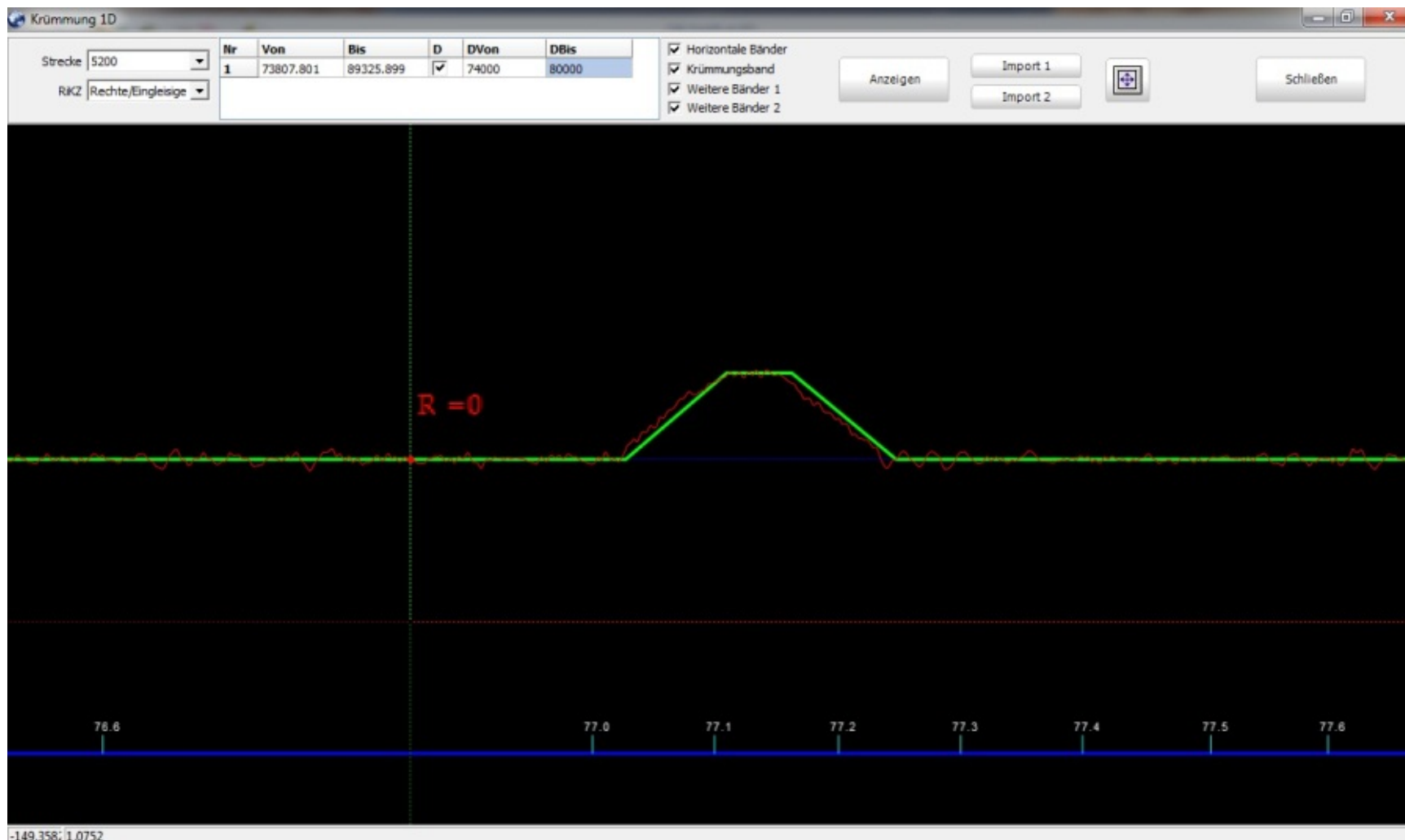
Map matching (position, length and scale)



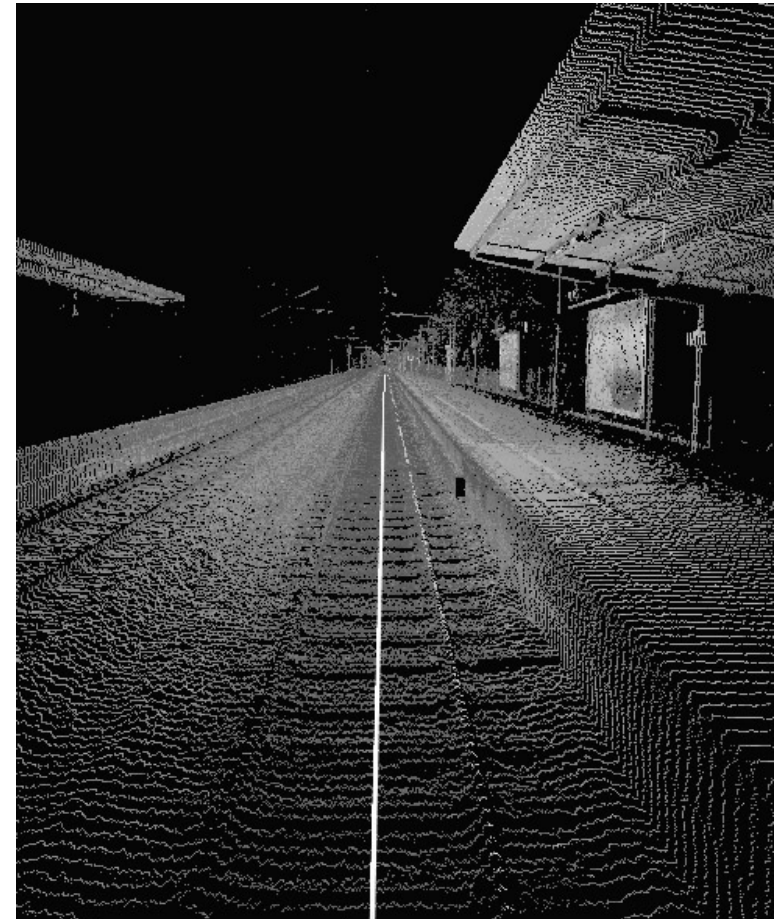
Chainage direction



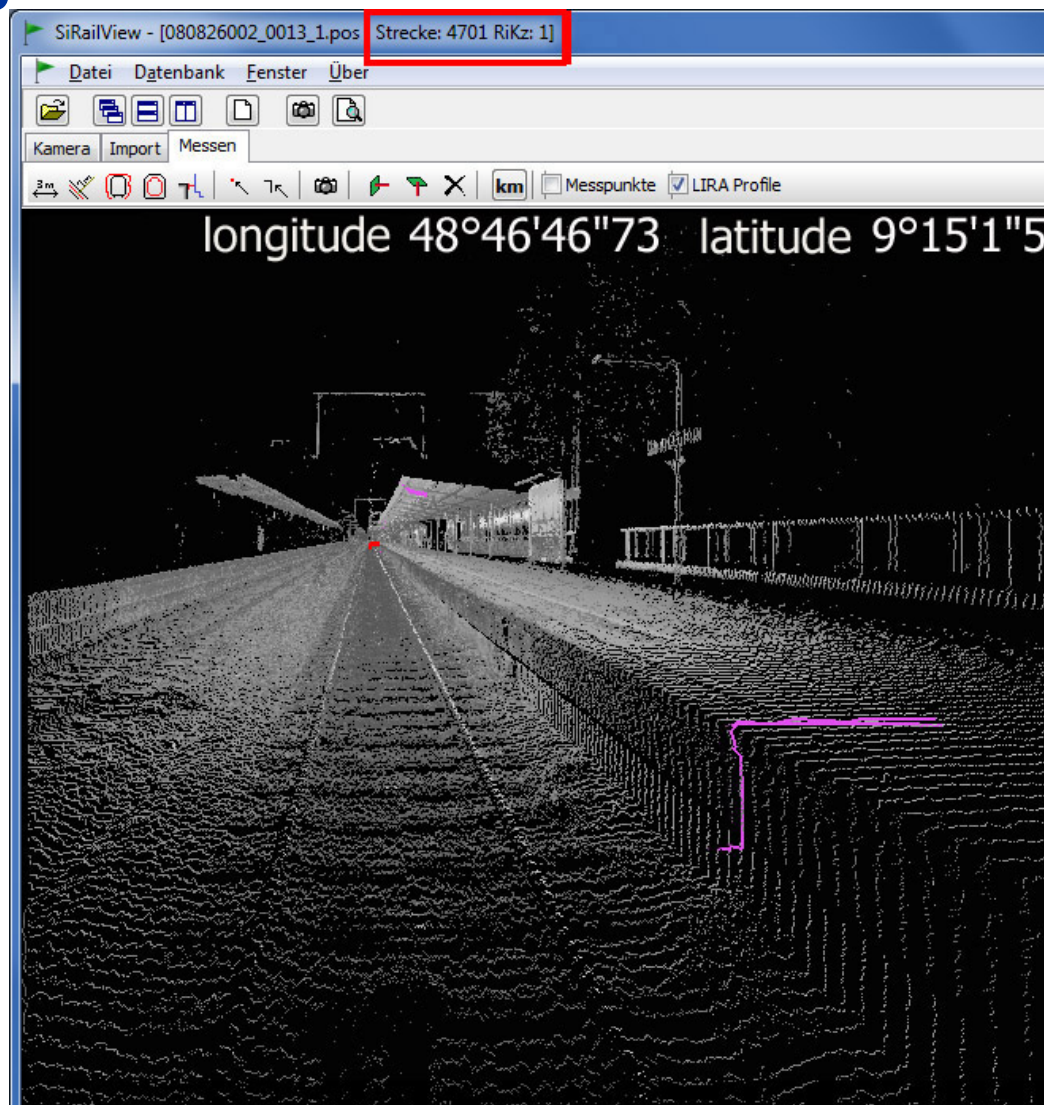
Curvature elements based on the recorded INS data



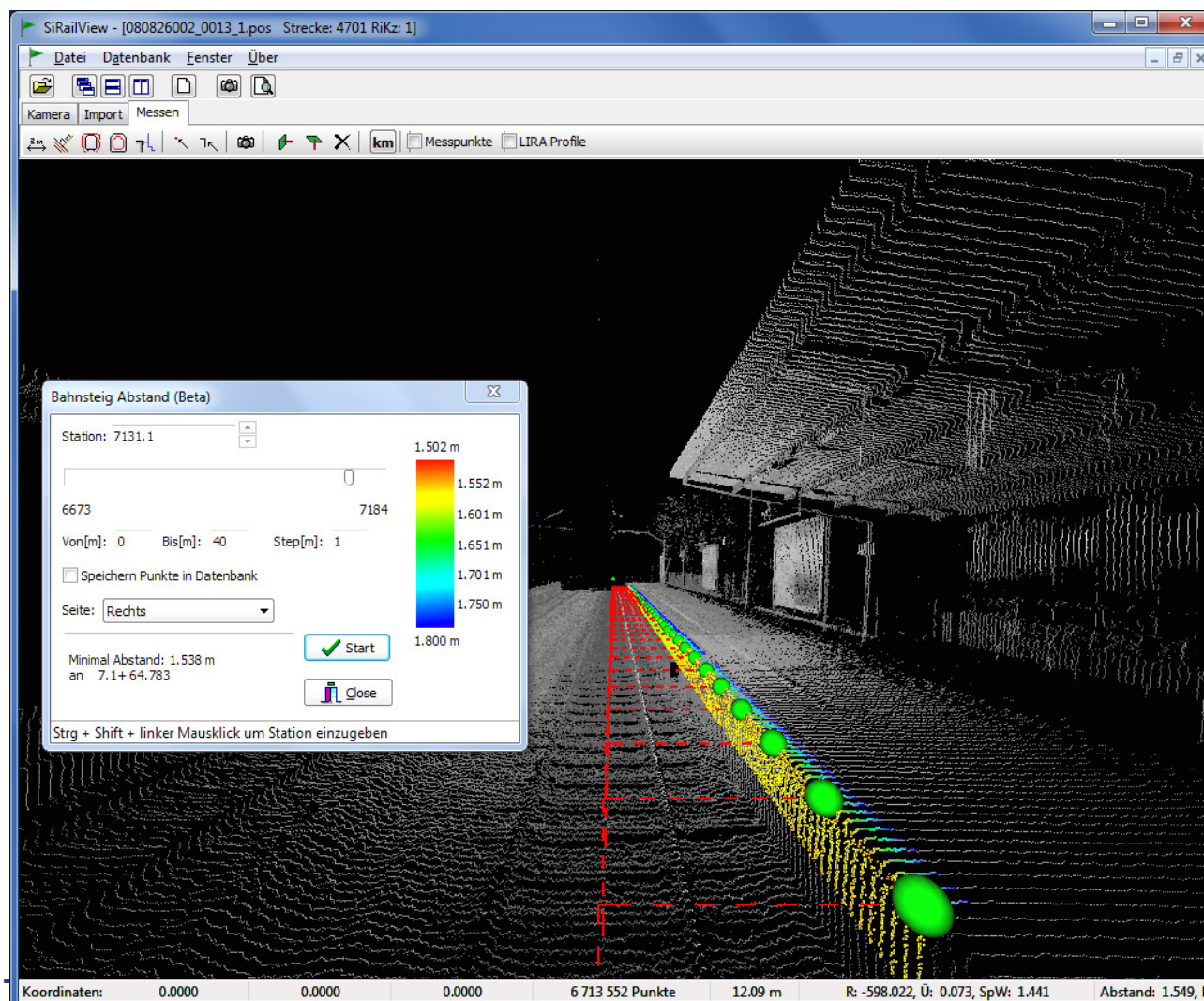
Comparison image - scan



LIRA database objects



Generate platform edge – strategy to open the railway market



Conclusions

Preconditions

- 3D spatial data as basis
- GBAS

- Clearance analyzing
- Measurements direct in 3D space, also to clearance gauge (distance, collision simulation)
- Import of old LIRA profiles, add photographs
- Export of captured values = “geo clearance objects” as products



برج خليفة



Image by oel van Cranenbroeck - when it has to be right

