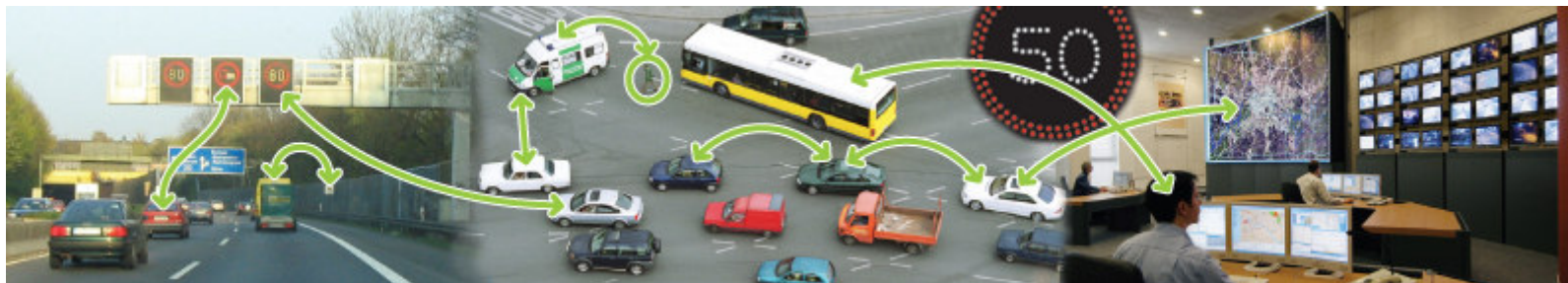


Positioning, Mapping and Location Referencing

Validation Workshop May 21 2010
Boudewijn Schokker





High Level Objectives



- **POMA-OB-1 → POSITIONING**

To provide an open API (Applications Programmer Interface) for positioning and map services that will run on the CVIS reference platform, and that will:

- Integrate different positioning techniques (GNSS, road-side beacons, inertial)
- Provide overall quality of service and integrity indicators on resulting positions
- Provide new techniques for infrastructure based positioning

- **POMA-OB-2 → MAPPING**

CVIS mapping tools shall:

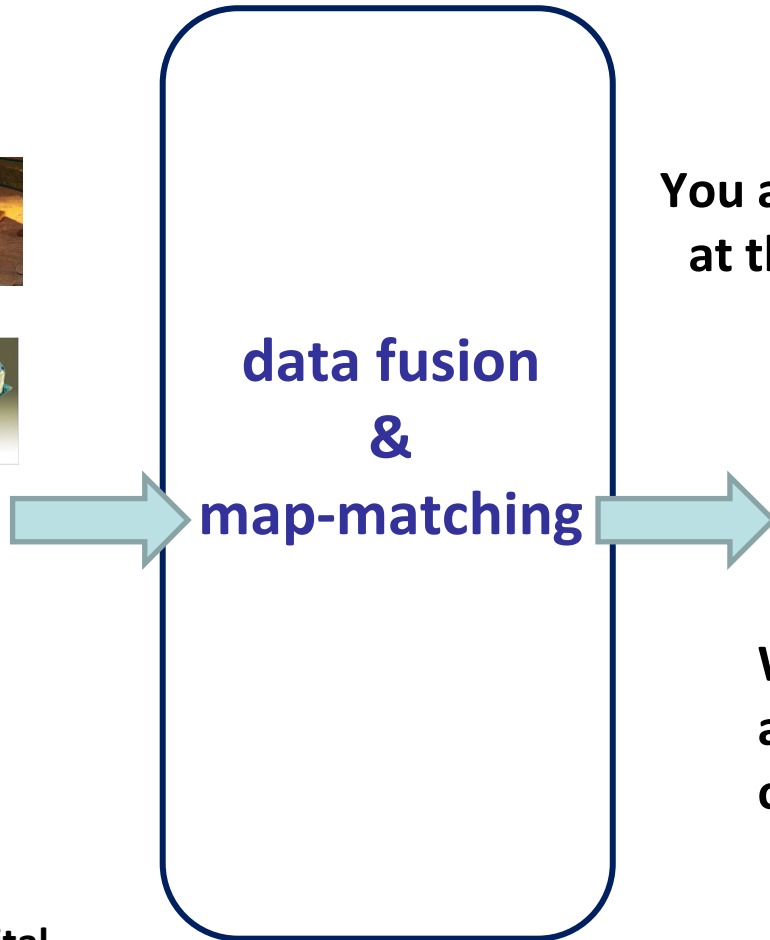
- Include new map content enhancing locally the standard map specification
- Support distribution and integration of map updates and related content
- Support the sharing of geo-referenced data across CVIS entities



POMA Expected Results



EMAP: enhanced digital road database



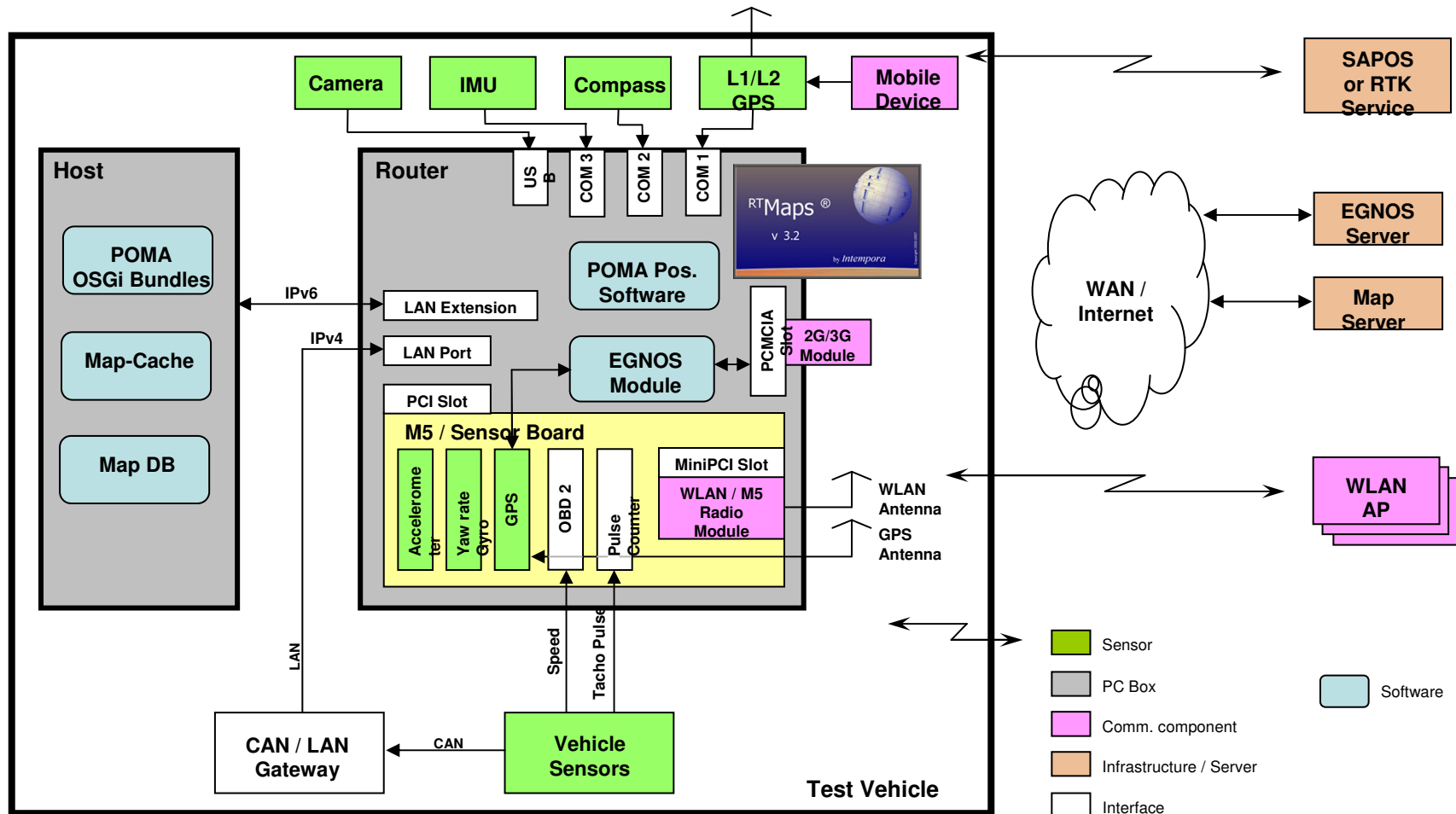
**You are here, on this segment,
at this abscissa, on this lane!**



**With position on the map
and relevant attributes
of the road segment**



CVIS POMA positioning configuration





POMA positioning today



- **Standalone GPS**
- **POMA « standard » - based on low cost sensors, first order lane level accuracy**
 - M5 / Sensor board
 - UBlox GPS receiver (EGNOS Enhanced)
 - 2 axis accelerometer
 - Vertical gyrometer
 - OBD-II or FMS
 - WLAN based positioning
- **POMA « ultimate » - adds state of the art positioning sensors for validation or lane-level positioning accuracy and integrity**
 - L1/L2 RTK GPS / SAPOS
 - IXSEA LandINS navigation system
 - Crossbow VG700 or IMU400 (vertical gyros)
 - KvH Ecore2 gyro
 - CAN bus data (vehicle speed, odometers)
 - Numerical compass – KvH C100
 - Front camera

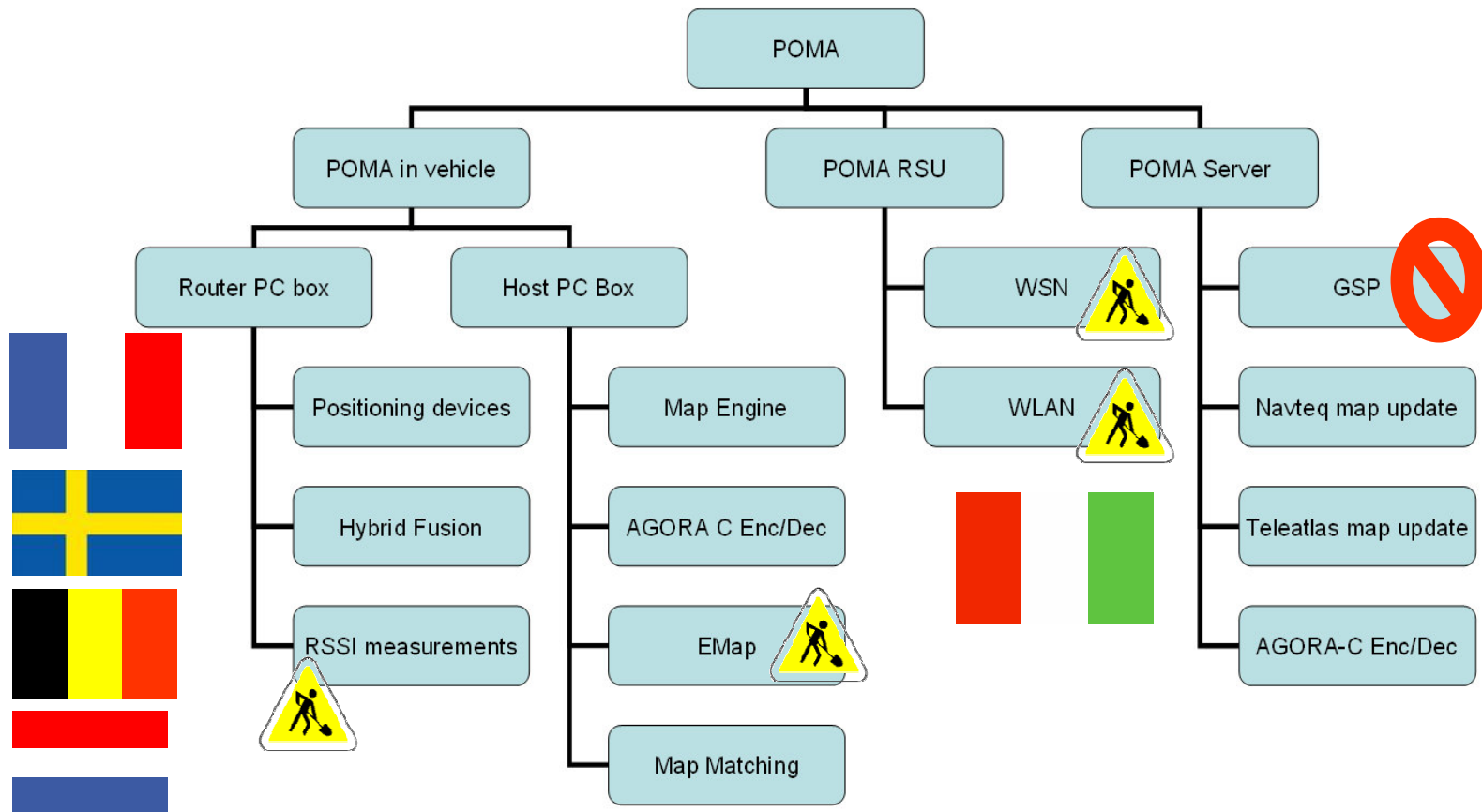


POMA Main Activities & Achievements

POMA SW prototype development
Using CVIS HW prototype

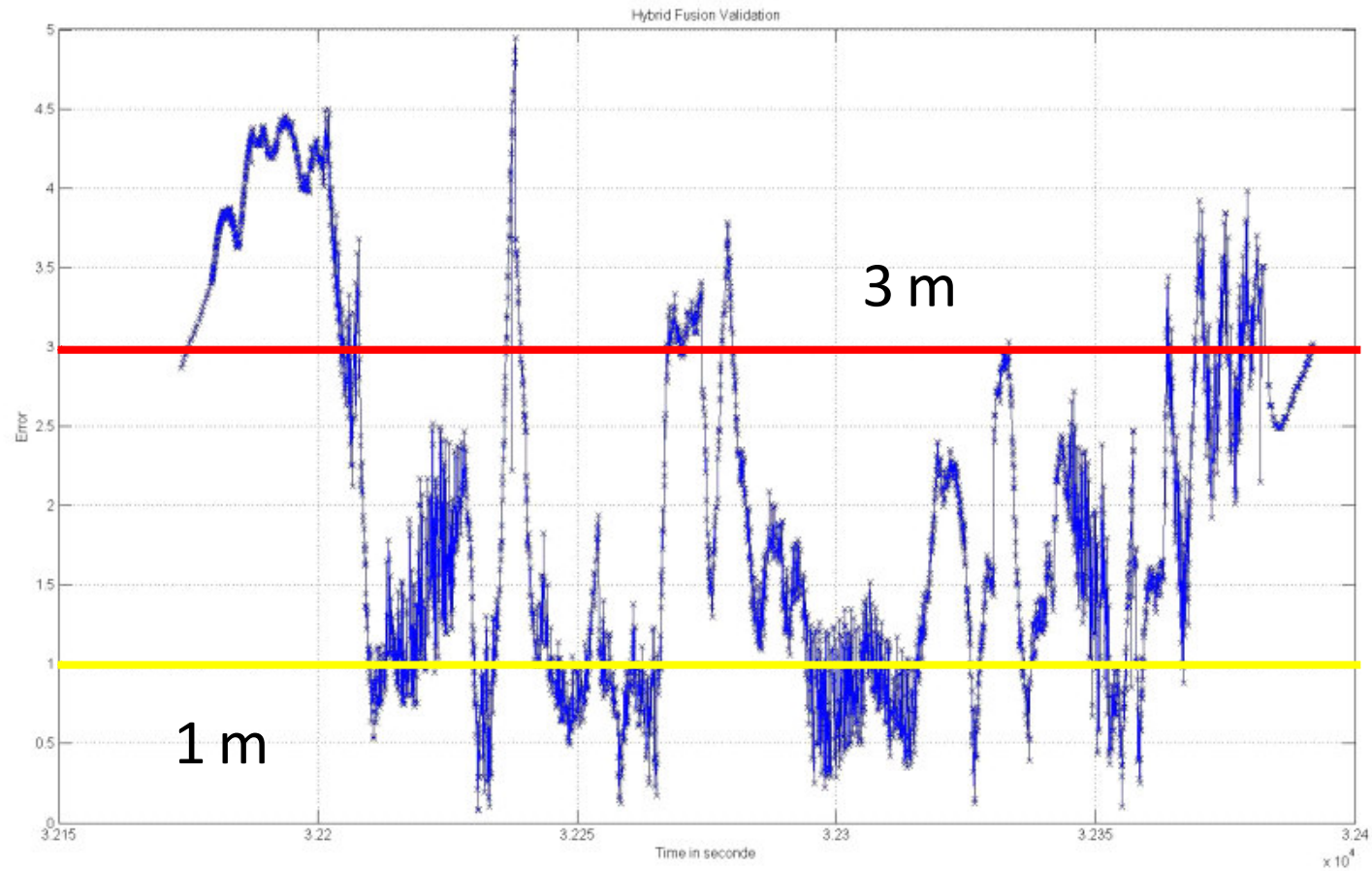


means Research Topic





Positioning performance





Map-matching



(Percentage with 2300 matched positions)				
<i>Map</i>	FAR(%)	MDR(%)	OCDR(%)	GIDS(%)
Map i	0.4	4.3	95.3	99.7
Map j	0.2	6.2	93.6	99.9

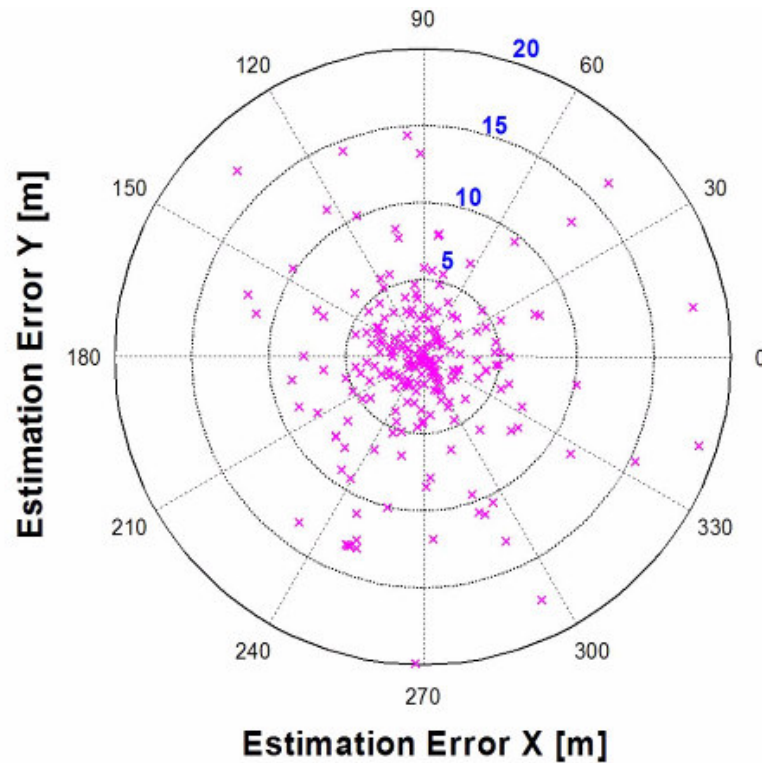
March 2008

April 2009

(Percentage with 3302 matched positions)			
<i>Map</i>	FAR(%)	MDR(%)	OCDR(%)
Map i	0.66	0.57	98.77
Map j	1.33	0.91	97.76



Wireless positioning

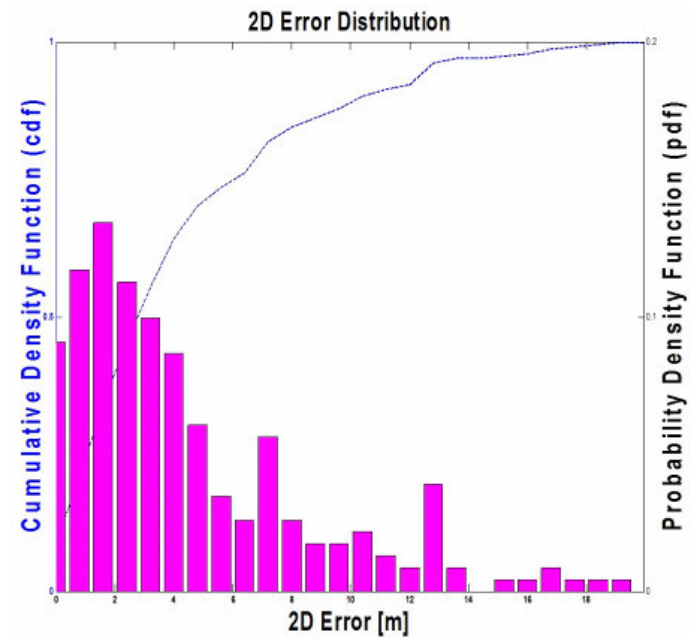


~ 250 measurements

Avg_ErrorLoc: 6 m

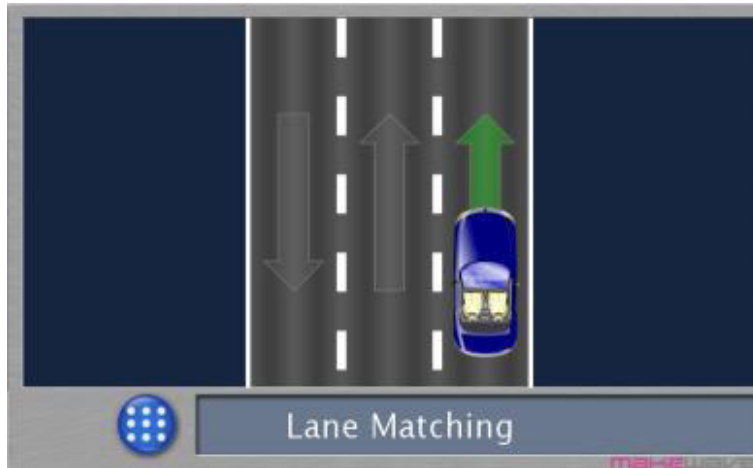
Std_ErrLoc: 7 m

RMS_ErrLoc: 9 m

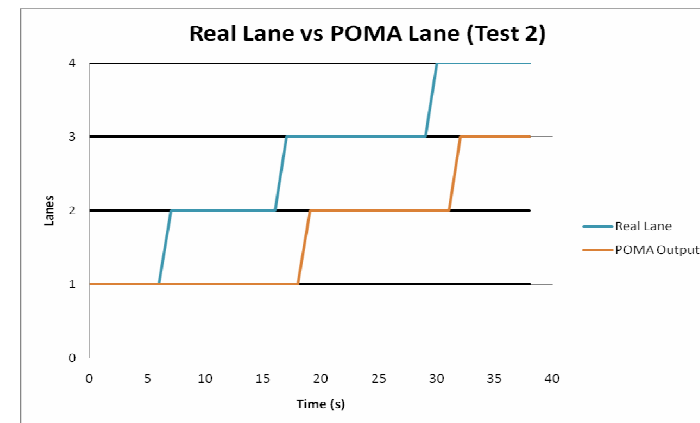
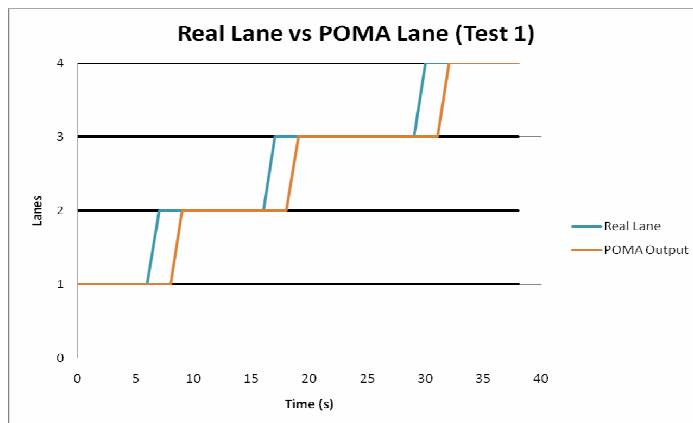




Lane Positioning

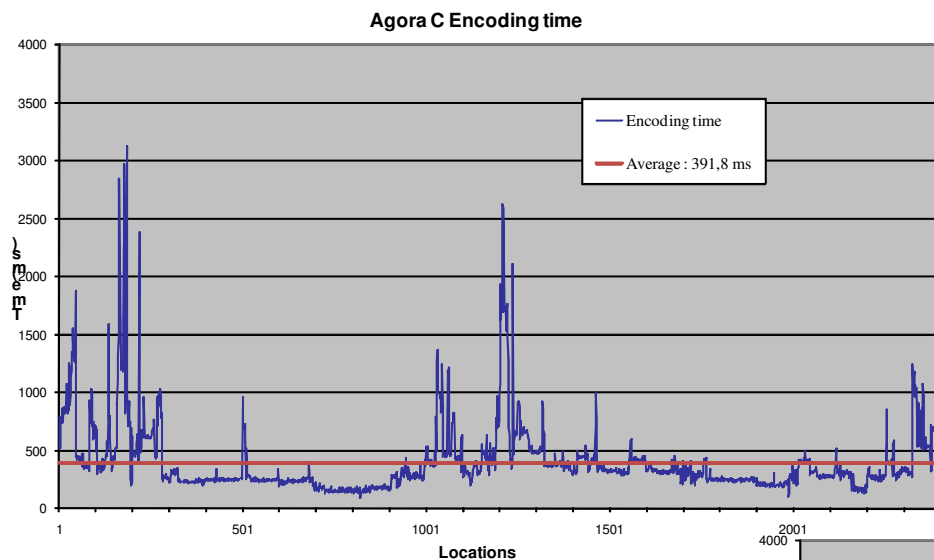


- Showed in Stockholm and Amsterdam
- Still under research
- Ready to provide lane positioning information when Global Navigation Systems will deliver enough accuracy



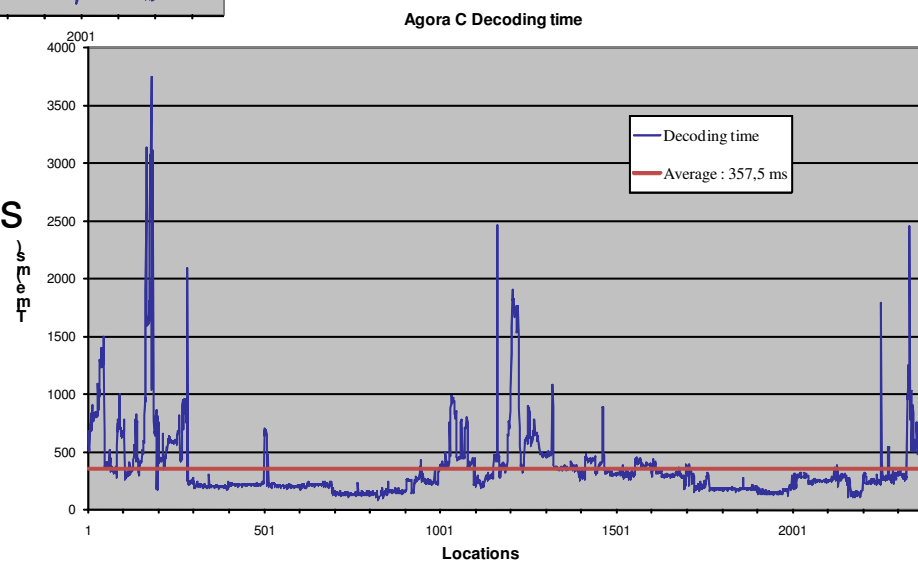


Location referencing



~2390 measurements
Average Encoding time: 391,8 ms

~2390 measurements
Average Decoding time: 357,5 ms





Correctness of Agora C

Agora C strings provided by Teleatlas

	Bavaria	Hessen	Decoder	Success (%)
Urban Points	10	0	PTV	100 %
	10	5	BOSCH	94%
Inter Urban Points	5	0	PTV	100 %
	5	5	BOSCH	87 %
Motorway Points	5	0	PTV	40 %
	5	5	BOSCH	100 %
Total Points	20	0	PTV	85 %
	20	15	BOSCH	93 %





Lessons Learned

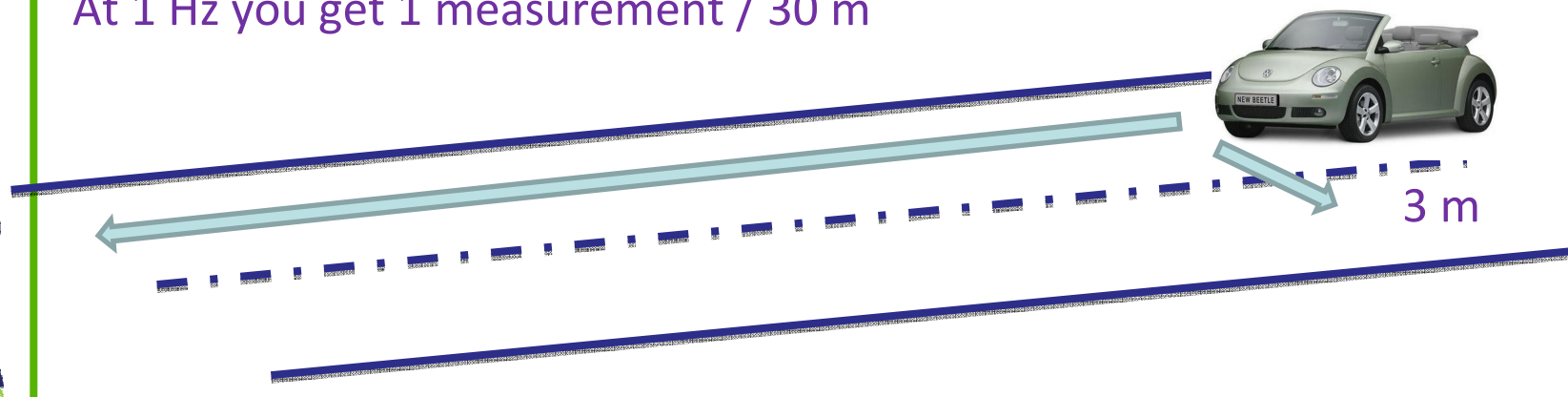


- POMA has today a position with an error ~3 meters
- POMA has a map-matched position up to the requirements (OCR 95%)
- Agora C is a good standard for location referencing. However Map providers need to agree on the version to use
- There is still some space for improvement
 - CVIS HW: sensor board timestamp
 - EGNOS: not certified & under-used
 - Galileo: deployment could improve final accuracy
- Validation challenges in an R&D project
 - Development delays leave little time for proper integration and testing
 - Too many partners involved imply a lot of management for a test campaign



Challenge for new applications

Speed: 110 km/h = 30 m/s
At 1 Hz you get 1 measurement / 30 m



If a position per 1 m is needed, then use at least 30 Hz !



Apps: use full POMA potential

- Sampling frequency: 30 Hz
- Car size wrt position accuracy
- Response time driver: 1-2 s
- Precise absolute timing: 1 ms (10 ms max)
- Reduce latency in the system





Future perspective

Latest issues under investigation:

- Time synchronisation POMA-COMM
- Interoperability Navteq vs Teleatlas AGORA-C
- Licensing after CVIS project ends

Wish list:

- OpenLR as location referencing standard
- Add integrity to real-time lane level mapmatching
- Solve new apps integrity requirements