



# Positioning among Vehicles – How precise can we be?

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# THE NEED FOR POSITIONING



## Cooperative Systems

- Communication is partly replacing sensors (vehicle & infrastructure)
- Sensor data from different vehicles are fused (coordinate frame problem)
- Many V2X protocols are georeferenced

# POSITIONING REQUIREMENTS

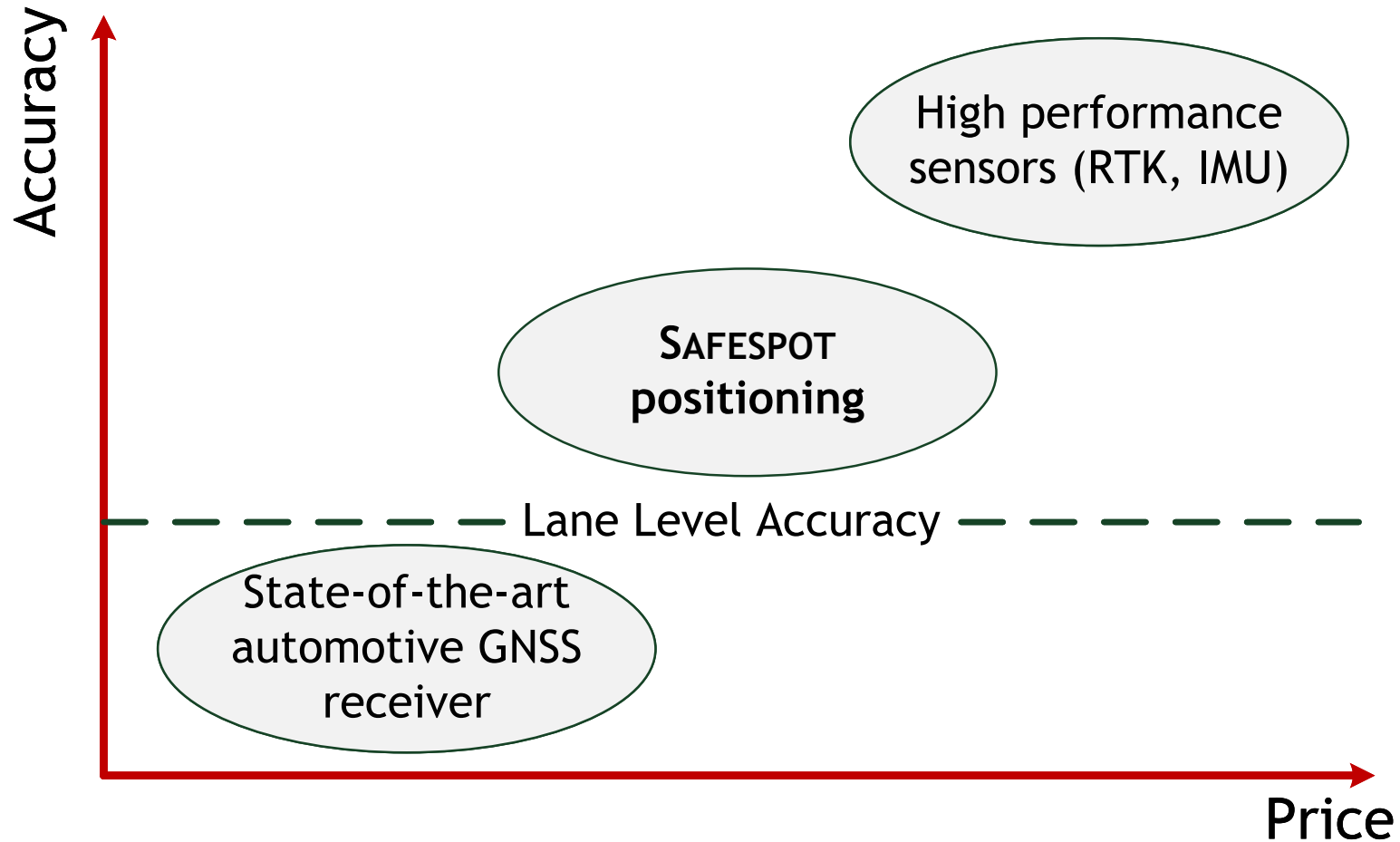
*Accuracy*

*Availability*

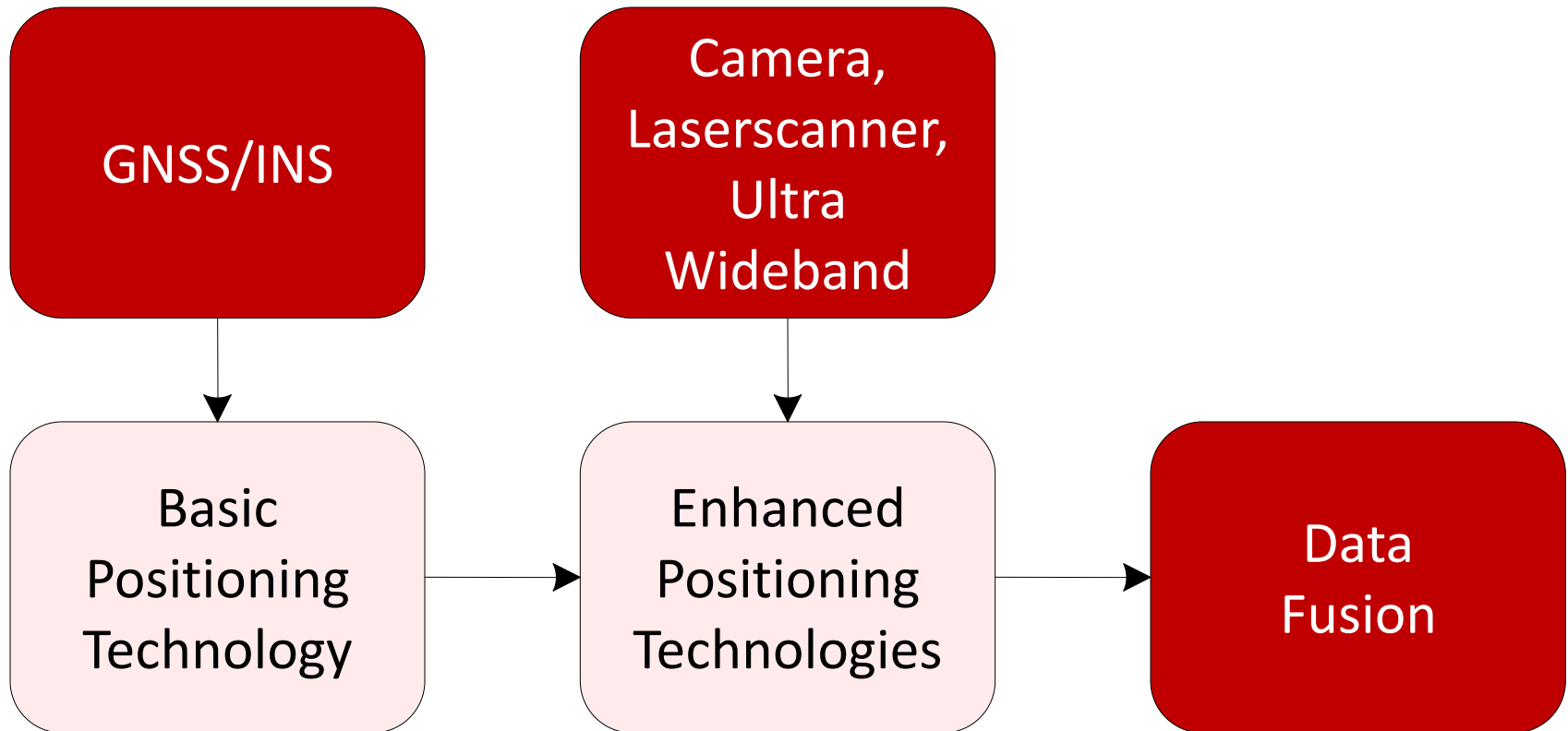
*Integrity*

*Cost  
Efficiency*

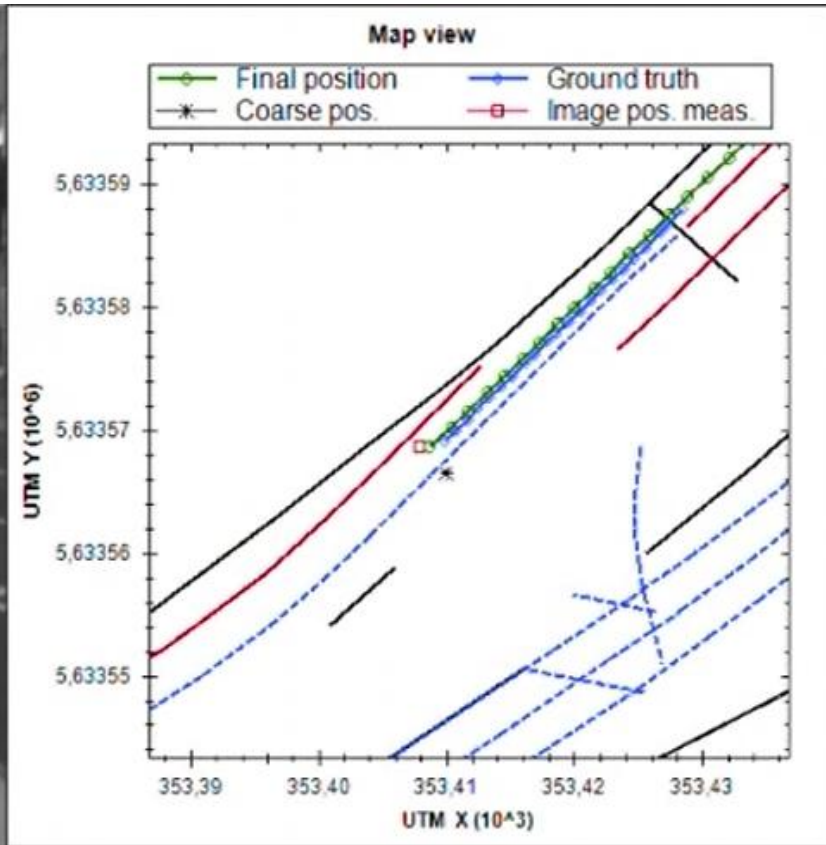
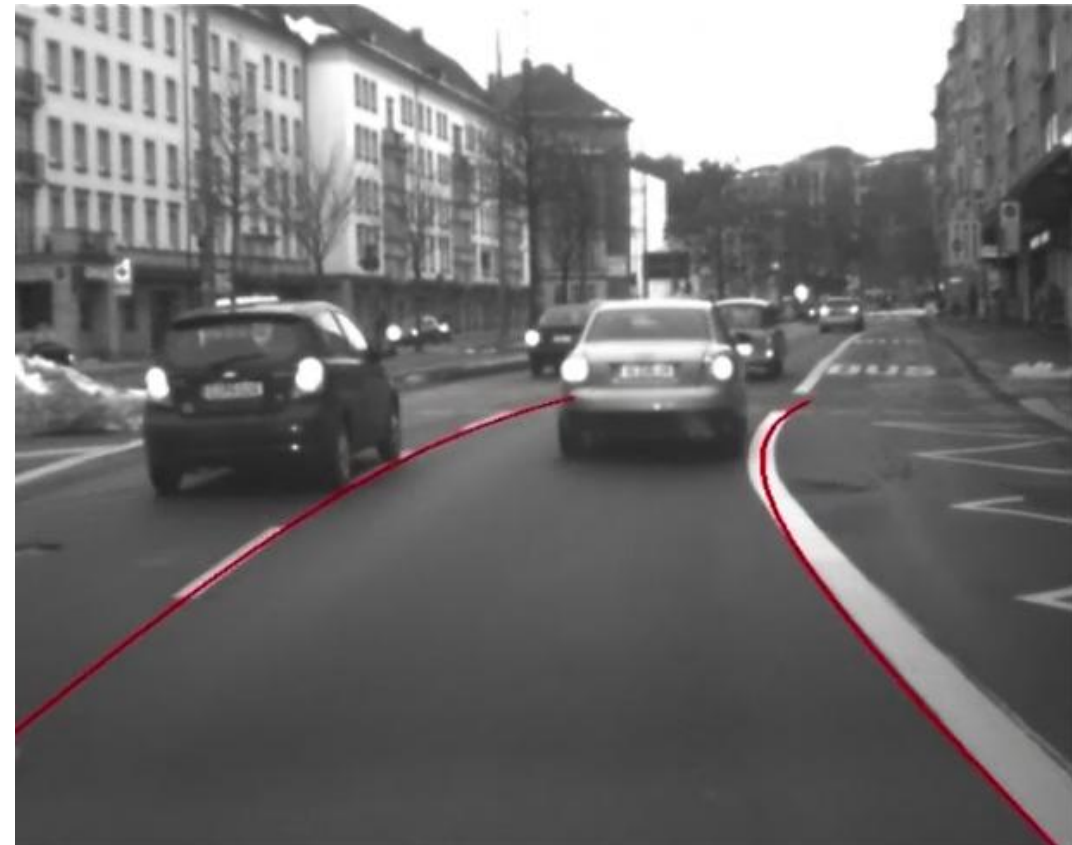
# PROGRESS BEYOND STATE OF THE ART



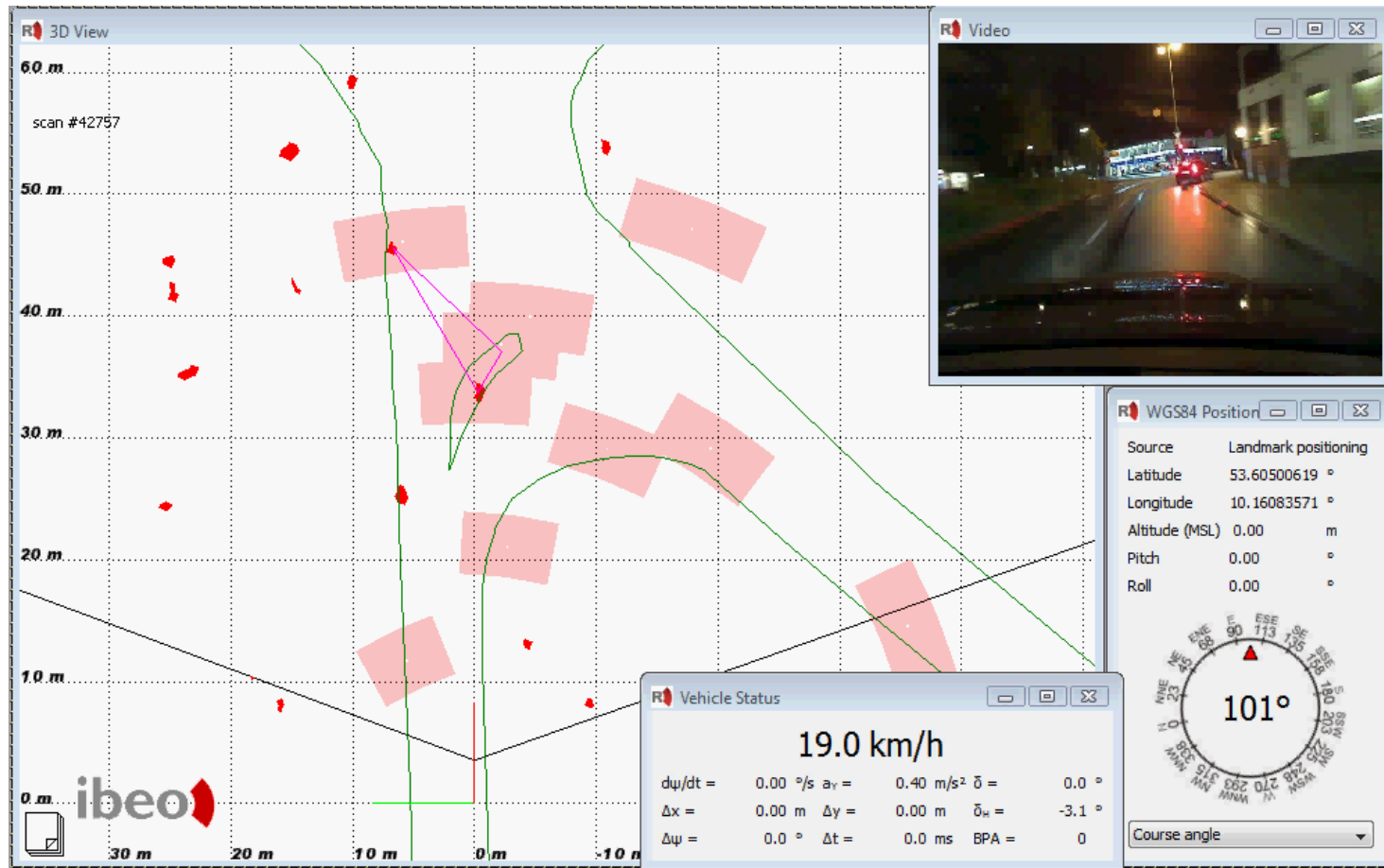
# SAFESPOT POSITIONING ARCHITECTURE



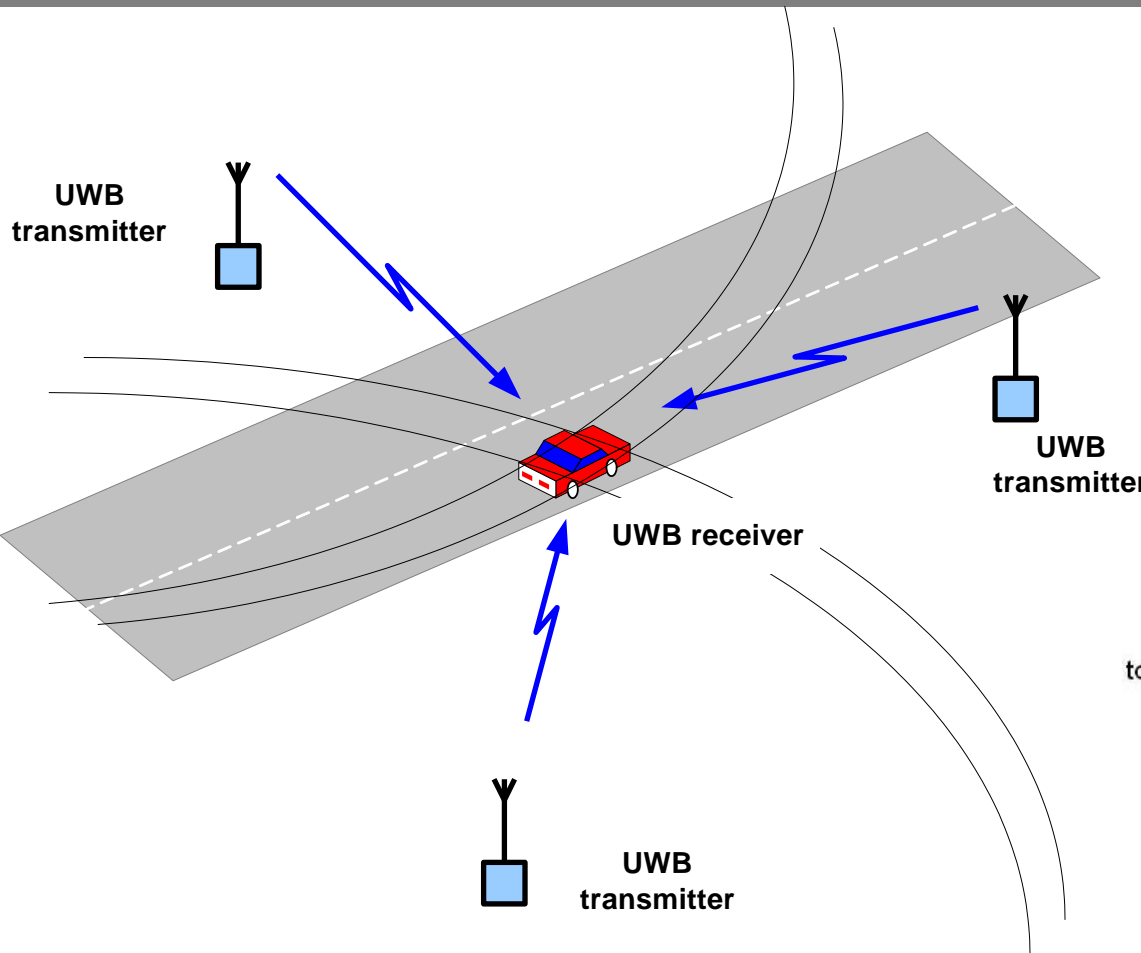
# CAMERA-BASED POSITIONING



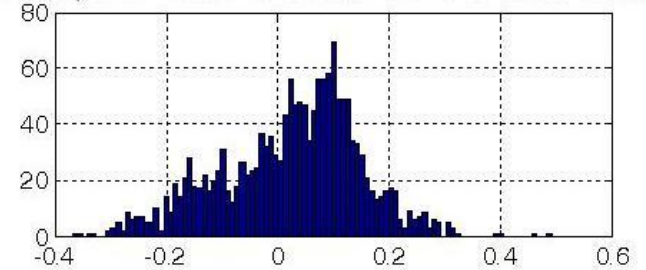
# LASERSCANNER-BASED POSITIONING



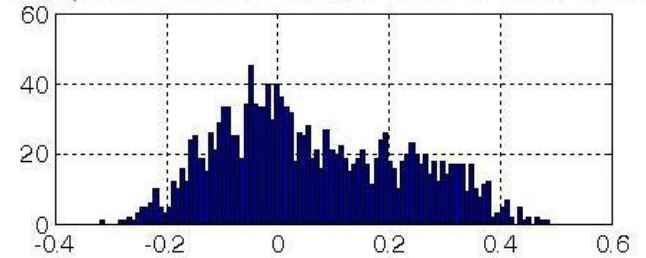
# ULTRAWIDEBAND-BASED POSITIONING



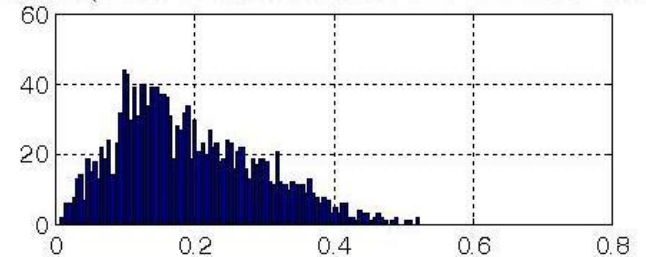
x error (mean = 0.025 m median = 0.041 m stdev = 0.125 m)



y error (mean = 0.064 m median = 0.036 m stdev = 0.163 m)



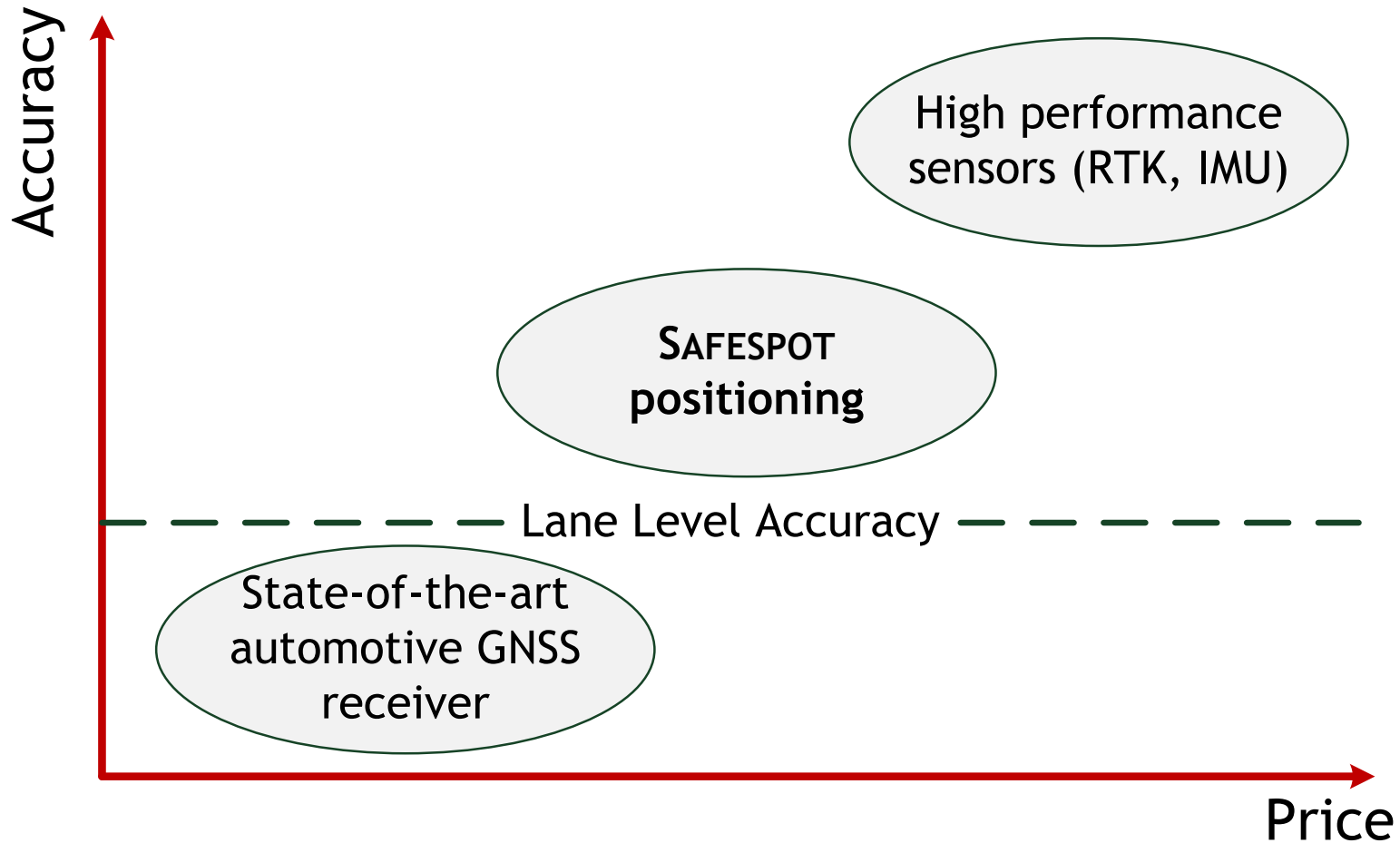
total error (mean = 0.192 m median = 0.174 m stdev = 0.100 m)



# KEY RESULTS OF THE SAFESPOT POSITIONING

Technology	Requirements	Error (CEP: 95%)	Comments
GNSS/INS	Low-cost GPS receiver + CAN gateway	4.32 m	State-of-the-art (reference)
Camera-based positioning	GNSS/INS + camera	0.93 m	Lateral Accuracy
Laserscanner-based positioning	GNSS/INS + Laserscanner	0.62 m	Intersection measurements
UWB positioning	UWB IPU's + VPU's	0.45 m	Infrastructure required

# LANCE ACCURACY BY USING ADDITIONAL SENSORS



# CONCLUSIONS & EXPLOITATION

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- Vehicle Positioning is crucial for Cooperative Systems
- State-of-the-art does not match requirements
- Lane accuracy was achieved using vehicle sensors
- Availability and integrity still open challenges
- Work on positioning continues ([www.covel-project.eu](http://www.covel-project.eu))

The logo for 'cooperative' features the word in a bold, lowercase sans-serif font. The 'oo' is highlighted in red, with a red arch above it that resembles a stylized 'c' or a signal icon.The text 'Conference 2010' is centered between two large, horizontal, red arrows. The top arrow points to the right, and the bottom arrow points to the left, creating a double-headed arrow effect.The word 'mobility' is written in a bold, lowercase sans-serif font, positioned below the double-headed arrow graphic.

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