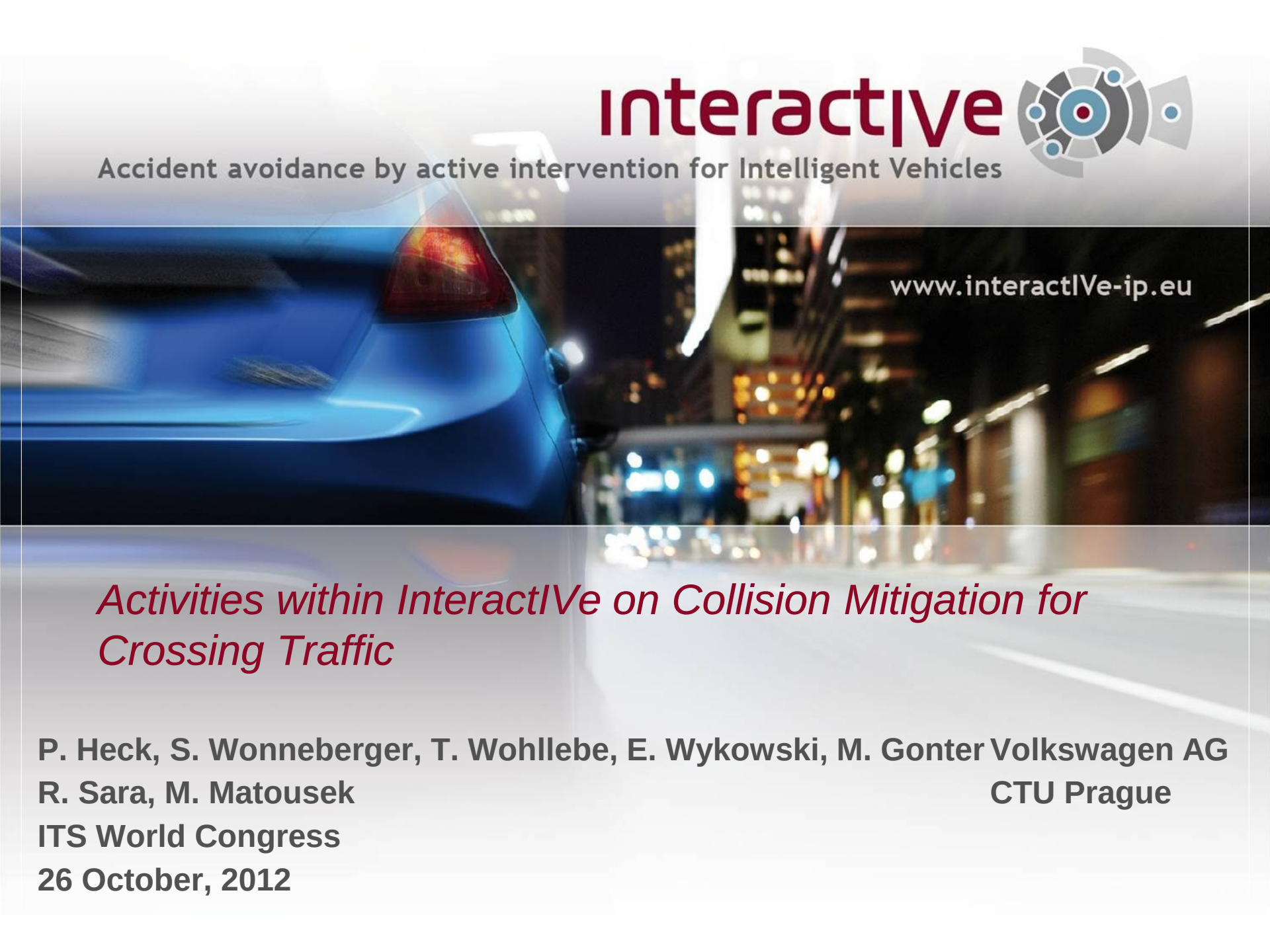


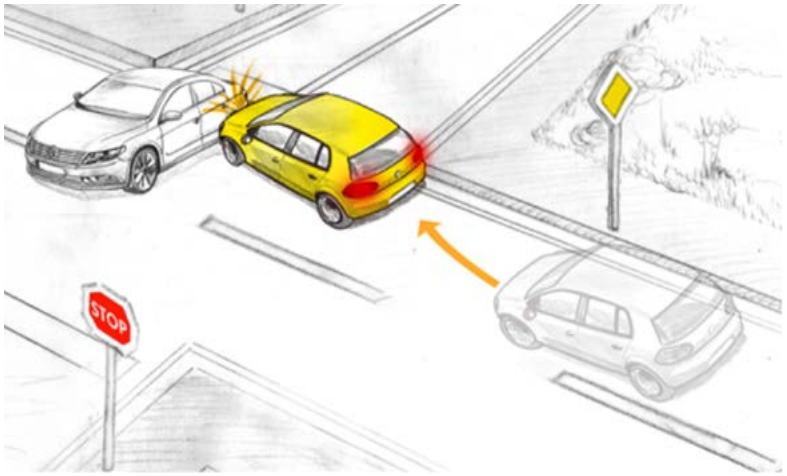
Activities within InteractIVe on Collision Mitigation for Crossing Traffic

P. Heck, S. Wonneberger, T. Wohllebe, E. Wykowski, M. Gonter Volkswagen AG
R. Sara, M. Matousek CTU Prague

ITS World Congress
26 October, 2012

Agenda

- Motivation and research needs
- Crossing Traffic Accident Analysis
- Detecting Crossing Traffic
  - Performance of Detection
- Action Concept for Collision Mitigation in Crossing Traffic
  - Capabilities and Achievements
- Summary



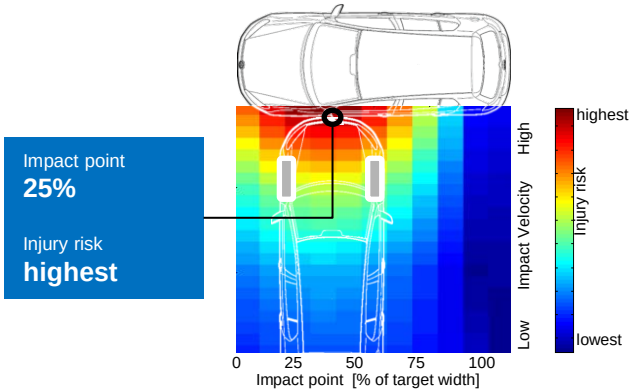
Motivation and research needs

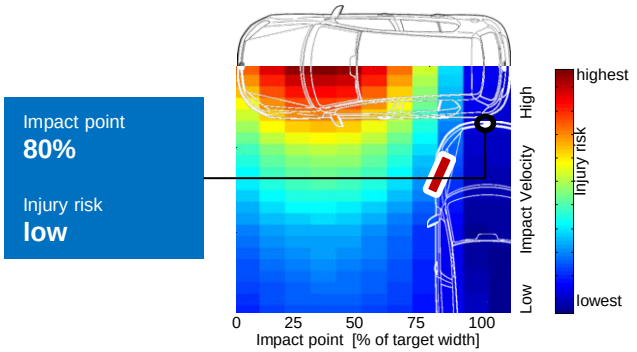
Video

Collision Mitigation for Crossing Traffic

- Previous systems focus on warning and avoidance.
- Main goal within InteractIVe to prevent collision with the passenger compartment

- Requirements
  - Intervention time < 800ms
  - Deceleration up to 9m/s²
  - Required total accuracy lower than 50cm
  - Collision outside passenger compartment



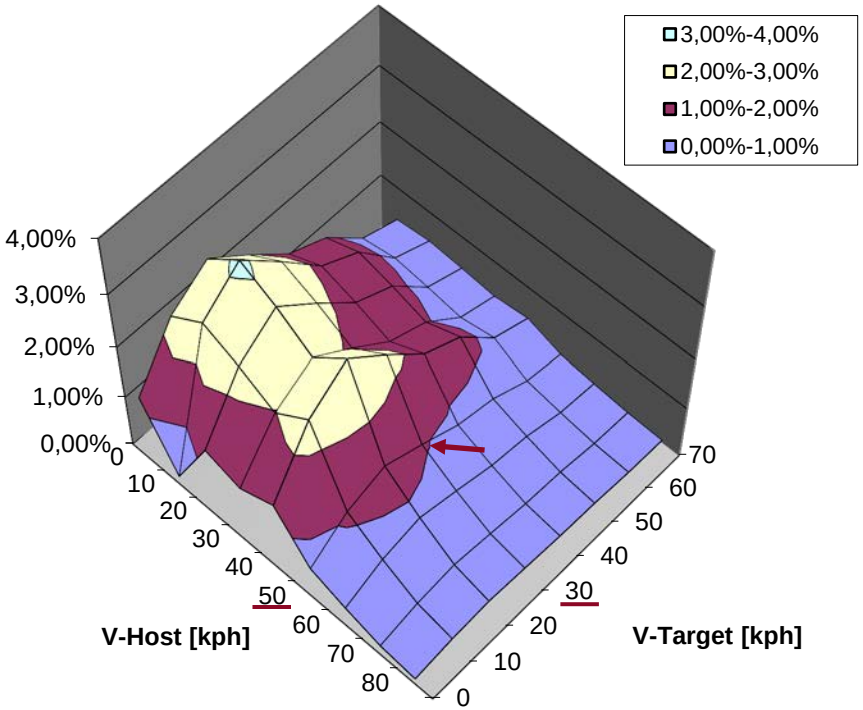


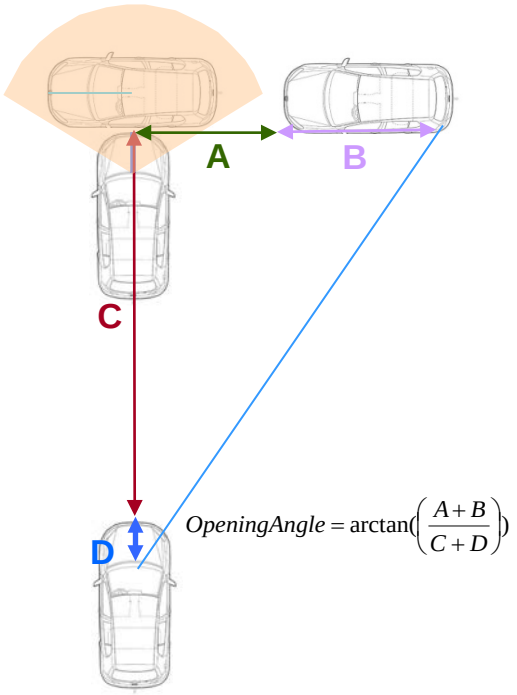
Action Concept for Collision Mitigation in Crossing Traffic

Initial collision	Targeted collision	Intervention type
Not a frontal Collision for host car (sidecollision) 	No intervention	No intervention (this is not addressed by system)
Collision with front end 	Right longitudinal Rail hits front wheel/axle 	1. Partial braking 2. No Steering
Collision with front wheel/axle 	No intervention due to high injury risk involved in possible resulting compartment collision	No intervention
Collision with compartment 	Left longitudinal rail Hits rear wheel/axle 	1. Full braking 2. Additional steering if required to produce lateral offset
Collision with rear end 	Avoidance 	1. Full braking 2. No steering

Crossing Traffic Accident Analysis - Car vs. Car accidents in Germany

- Sensor FoV ≈100° and < 20m in range
- Resulting in ~0,25s-2s TTC detection capability with 64%* of all accidents covered (50kph Host, 30kph Target)



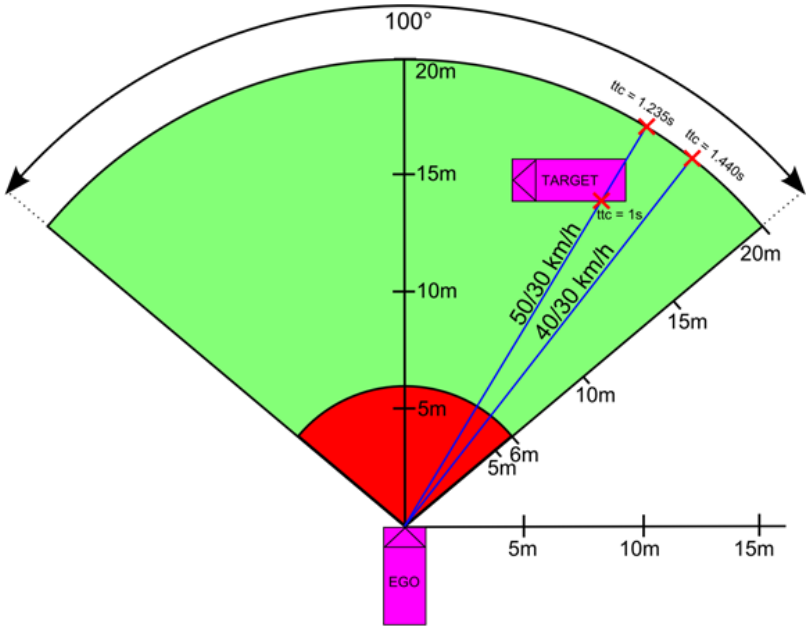


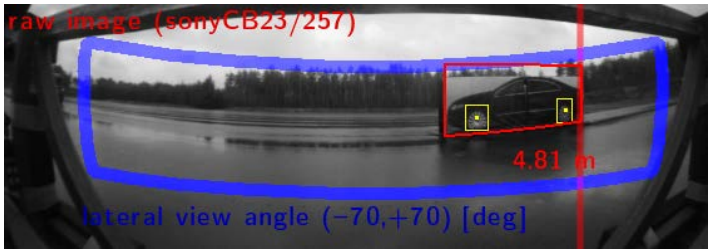
* Amount of vehicle-vs.-vehicle accidents in GIDAS database where the ego vehicle has a frontal collision..

Performance of Detection

$$z = \frac{b}{d} f$$

Property	Value (now)	Value (target)	Precision
distance (Euclidean)	4.0 – 15m	✓	±0.13m (std) at z=10m (plus ±5% for unknown true wheelbase)
angle	±50°	✓	±0.2° (std)
output cycle	36ms	✓	
latency	180ms	Lower deviation	±50ms





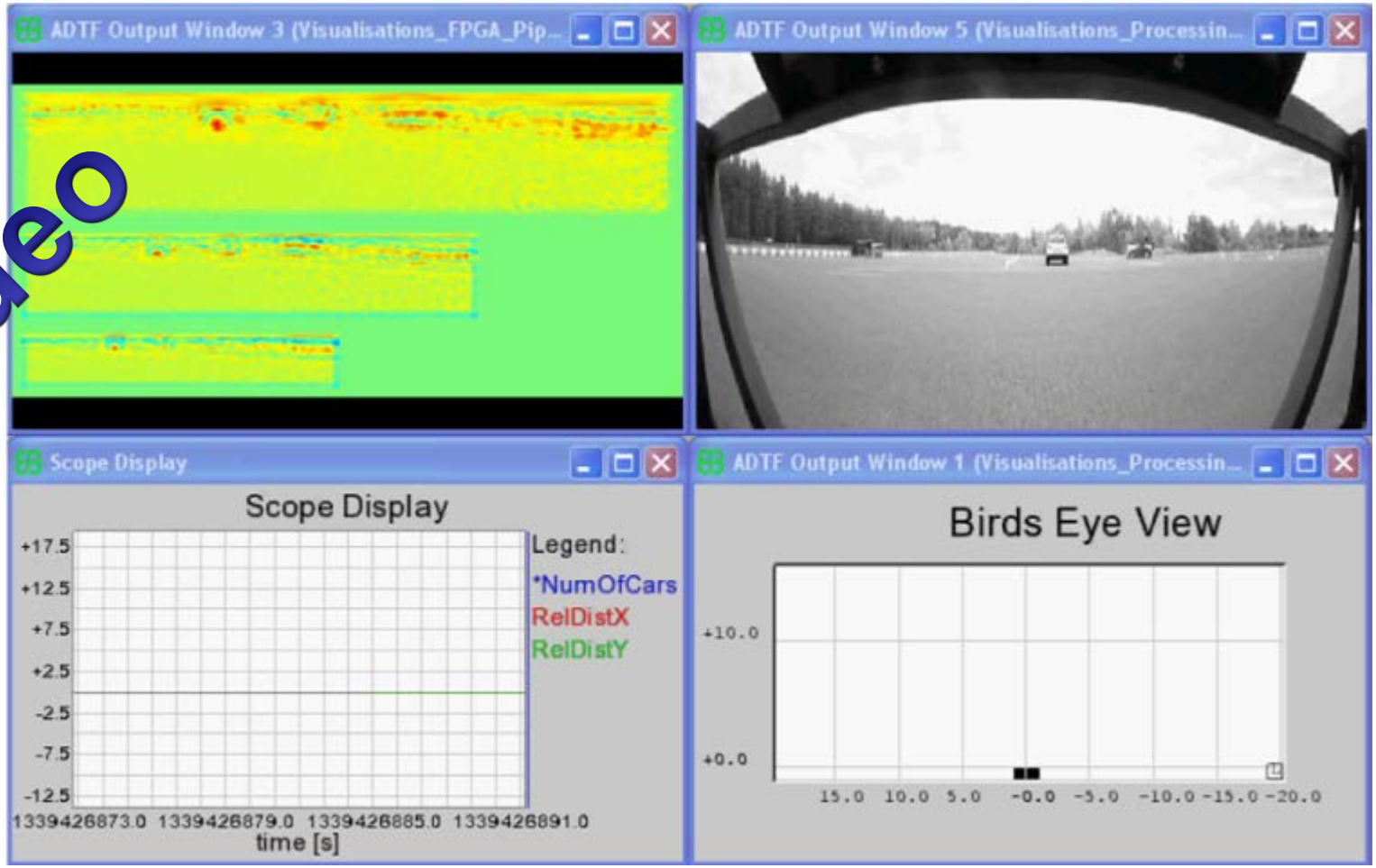
Technical Specifications of car detector:

part-based detector (now: wheels & wheelbase)
distance estimate
impact point estimate
relative speed vector estimate
trained on a large training set (CarSide 12k)

Future improvements

multiple frame tracking for speed estimation
dynamic wheelbase estimation

Capabilities and Achievments so far



Summary

- Accidents at intersections remain a topic for continuing research.
- Collision mitigation in crossing traffic requires more knowledge of the situation compared to longitudinal traffic.
- Collision mitigation in crossing traffic needs to take into account effects of the automatic intervention on accident severity
- Within InteractIVe a system for a situational dependent automatic intervention in crossing traffic is being researched. This approach extends that of previous systems for crossing traffic avoidance with situational dependent braking and steering.

interactIVe

Accident avoidance by active intervention for Intelligent Vehicles

www.interactIVe-ip.eu

Thank you.

Co-funded and supported by the European Commission

SEVENTH FRAMEWORK PROGRAMME

Philip Heck
Volkswagen Group Research
philip.heck@volkswagen.de

VOLKSWAGEN AKTIENGESELLSCHAFT