

The background of the slide is a composite image. The top half shows a close-up of a red car's front end, including the headlight and grille. The bottom half is a dark purple gradient. On the left side of the purple area, there is a large, semi-transparent speedometer with a needle pointing to approximately 20 km/h. The speedometer has markings from 0 to 140 km/h. The title text is centered in the purple area.

Design and Evaluation of an Innovative Virtual Instrument Cluster for Automotive Dashboards



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**2nd Driver Distraction and Inattention Conference
Gothenburg 5-7 Sep. 2011**

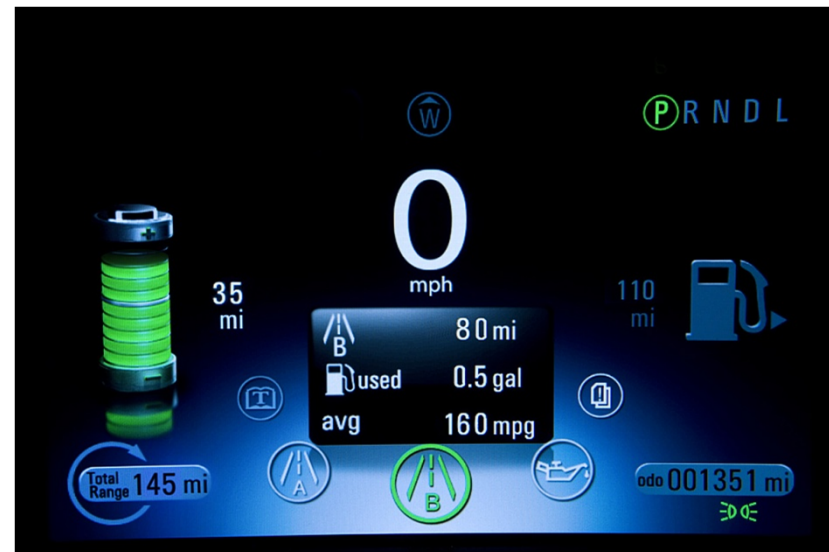
Motivations

- Technological advances in automotive industry
- Ubiquitous computing. Nomadic devices
- IVIS & ADAS
- Source of inattentions & distractions
- Need for integration. Sophisticated HMIs
- Trend: Full digital instrument cluster



Full Digital Instrument Cluster

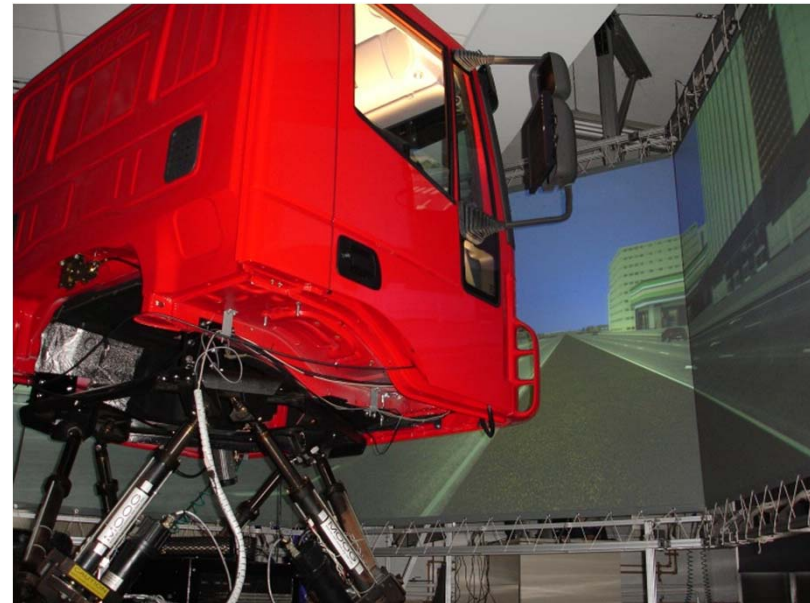
- ☺ Freedom, configurability, customization, useful in design and development stages, Easier integration of new systems
- ☹ Freedom, not tested, not conventional, user adaptation,
- Safe Instrument Cluster, chic but SAFE



Bus & Truck Simulator @ CEIT



- Full immersive truck and bus simulator
- Real Iveco Stralis Cabin
- 3 types of roads > 300 km. Failures simulation
- CEIT large experience in simulation. Lander Simulation & Training Solutions
- Built @ CEIT
- Absolute control about simulator Hw & Sw
- Use for research, design of new systems, models, etc.



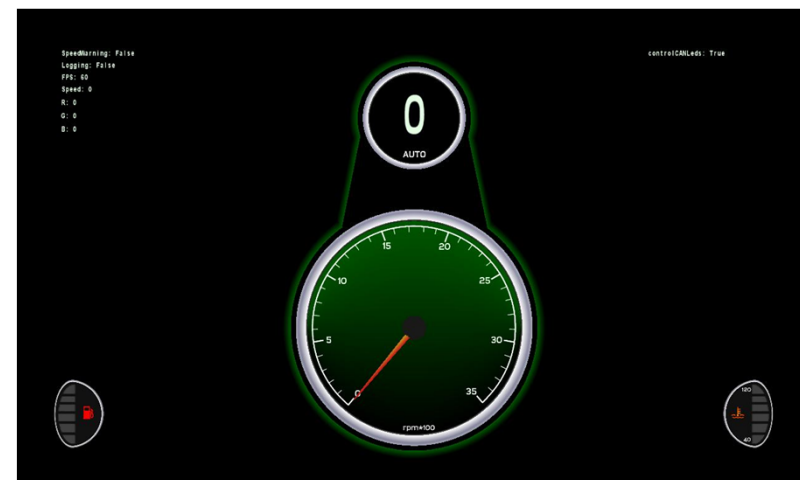
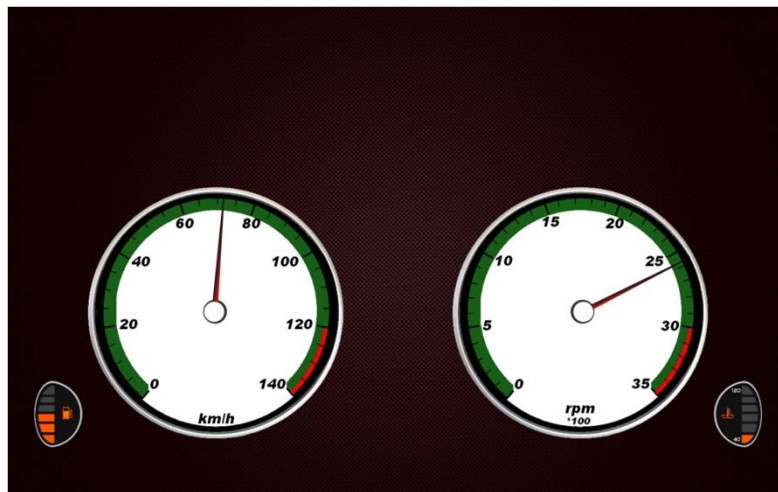
Before and After the VIC

- Replace the “real” one with PC connected to CAN bus and a TFT.
- No changes in communication protocols
- Experiments with drivers. They felt **confidence** with the VIC
- We reproduce VIC **new features** of the on board computer



VIC Profiles

- Absolute freedom to provide driving information, assistance and infotainment.
- HMI profiles related to driving objectives:
 - Sport, ECO, normal
- Colour coding to provide some information
- Integrate RGB to increase colour coding info



RGB Leds

- Connected to VIC. Receive Speed limits and calculate colour coding.
- New information channel using Peripheral Vision
 - Not only for Alerts
 - Complex information Speed
- Integration with Simulator
- Can be used for:
 - Speeding alert
 - Eco Driving
 - Risk Situations alert



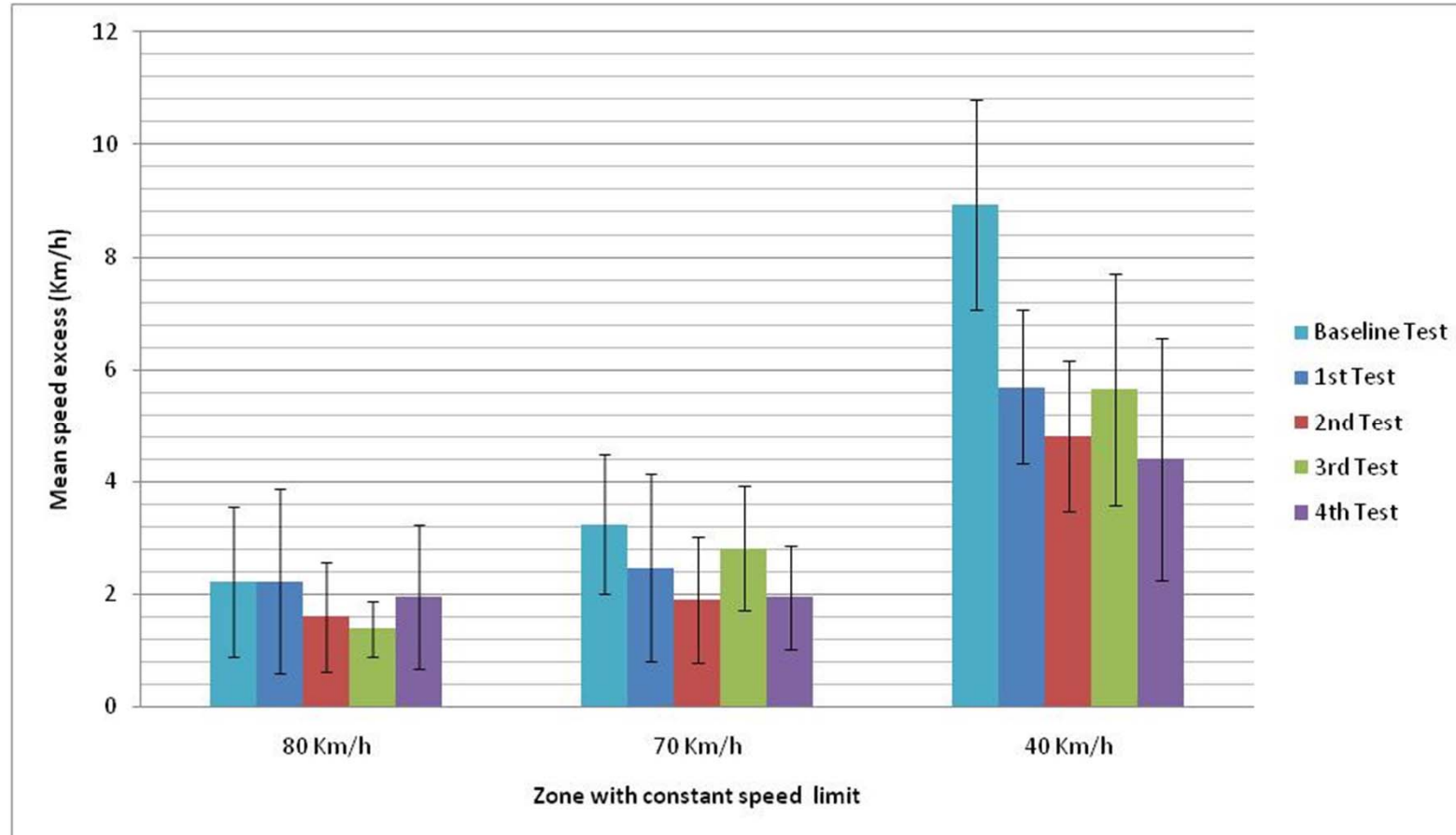
Evaluation as Speed Alert System

- Need for training? Useful?
- Hypothesis
 - The System can **reduce** the **number of glances** at the Instrument Cluster
- Experiments
 - Drivers: few at 1st stage. 3 professional drivers and 2 with more than 20 years driving and >20.000 km/year
 - Scenario: 15min. intercity with several speed limits: 80, 70 and 40 km/h

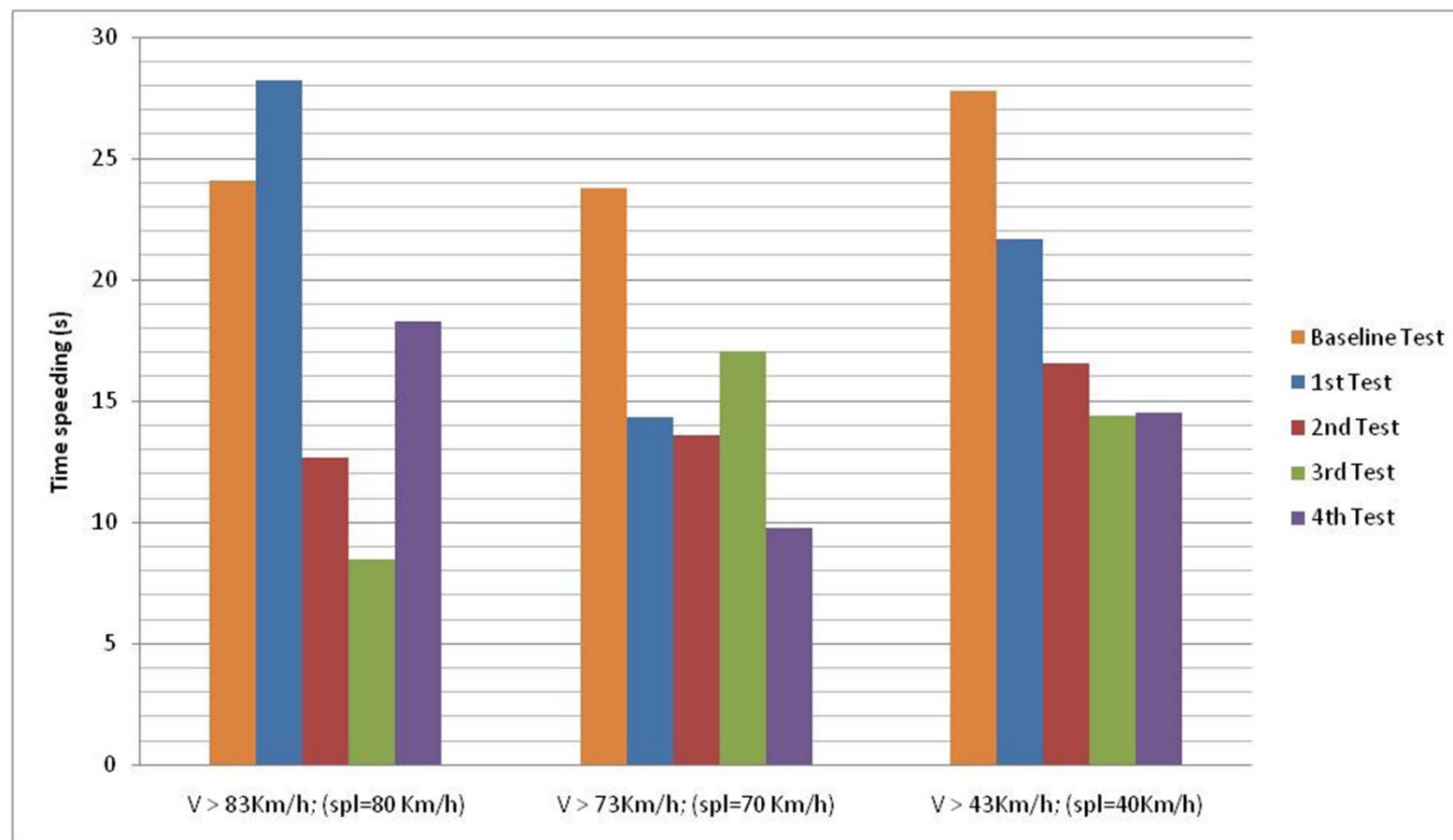
Tests with Speed Alert

- Tests
 - Simulator adaptation. Not used for the study
 - Baseline driving without peripheral vision speed alert
 - 4 times repeating the same test with the system installed
 - 1 test with an hard colouring profile
- Measures:
 - Mean speed excess
 - Speeding time
 - # glances at IC

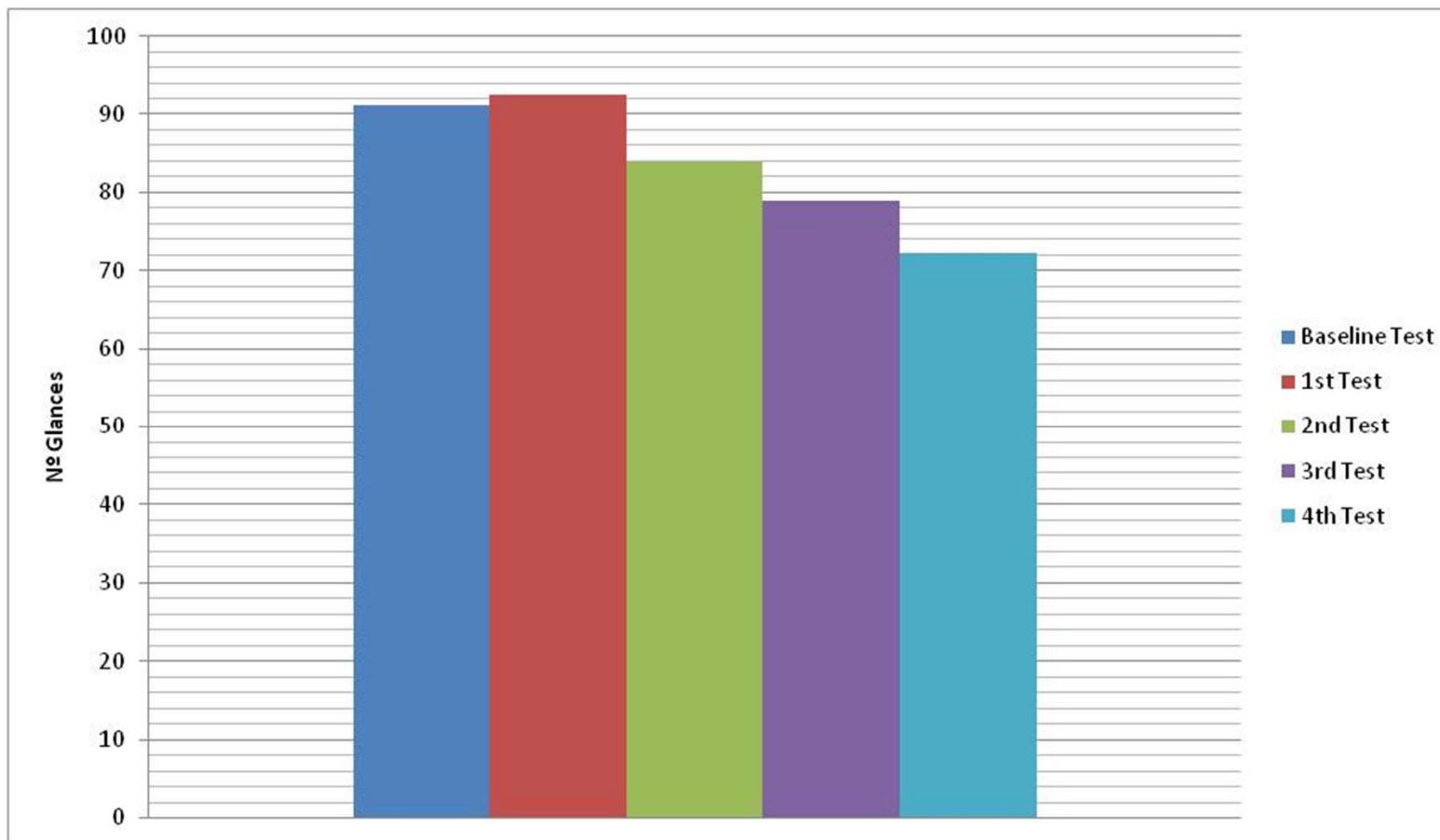
Mean Speed Excess



Speeding Time



glances al IC

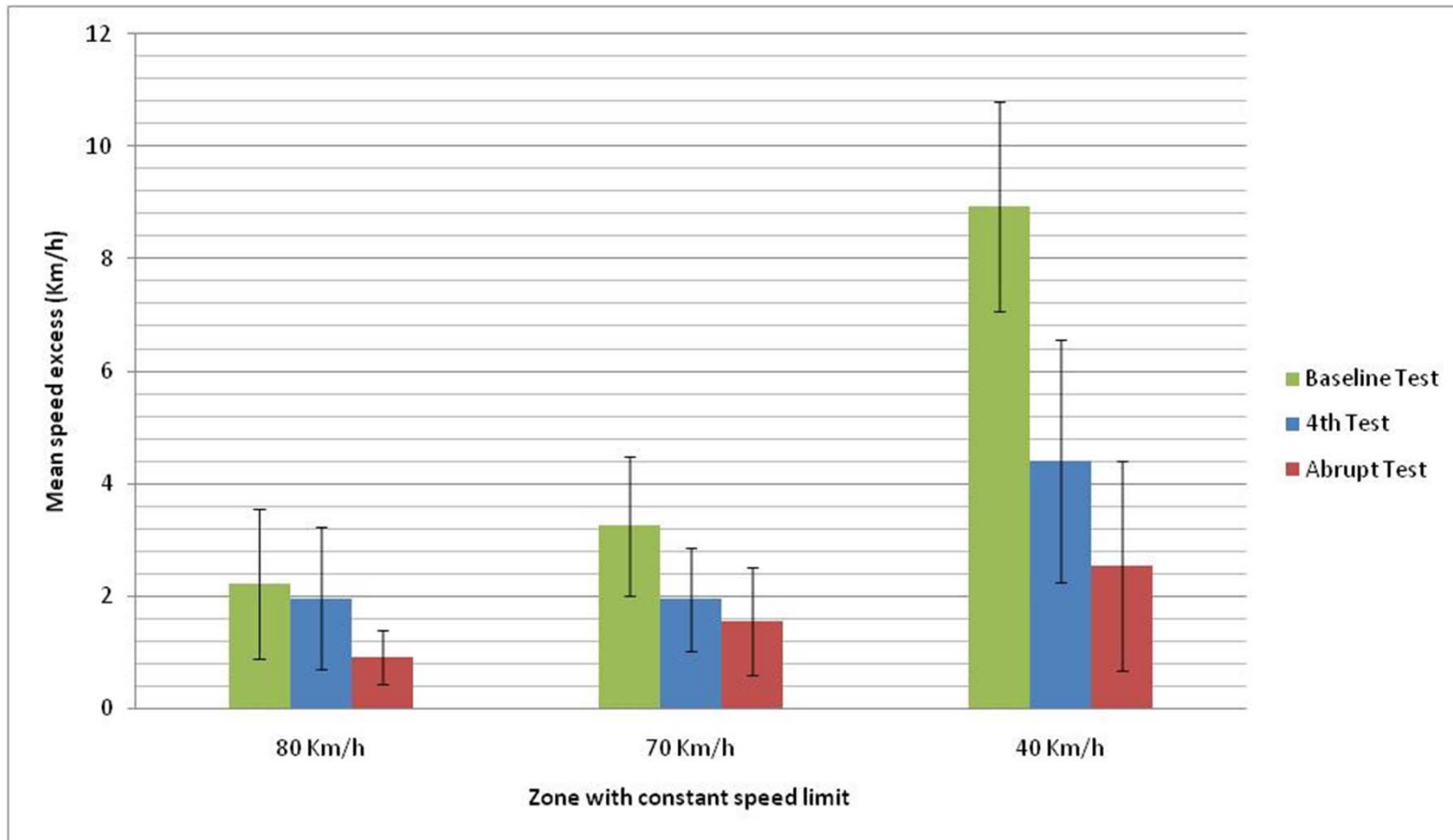


Results Comparison Baseline vs 1-4 test

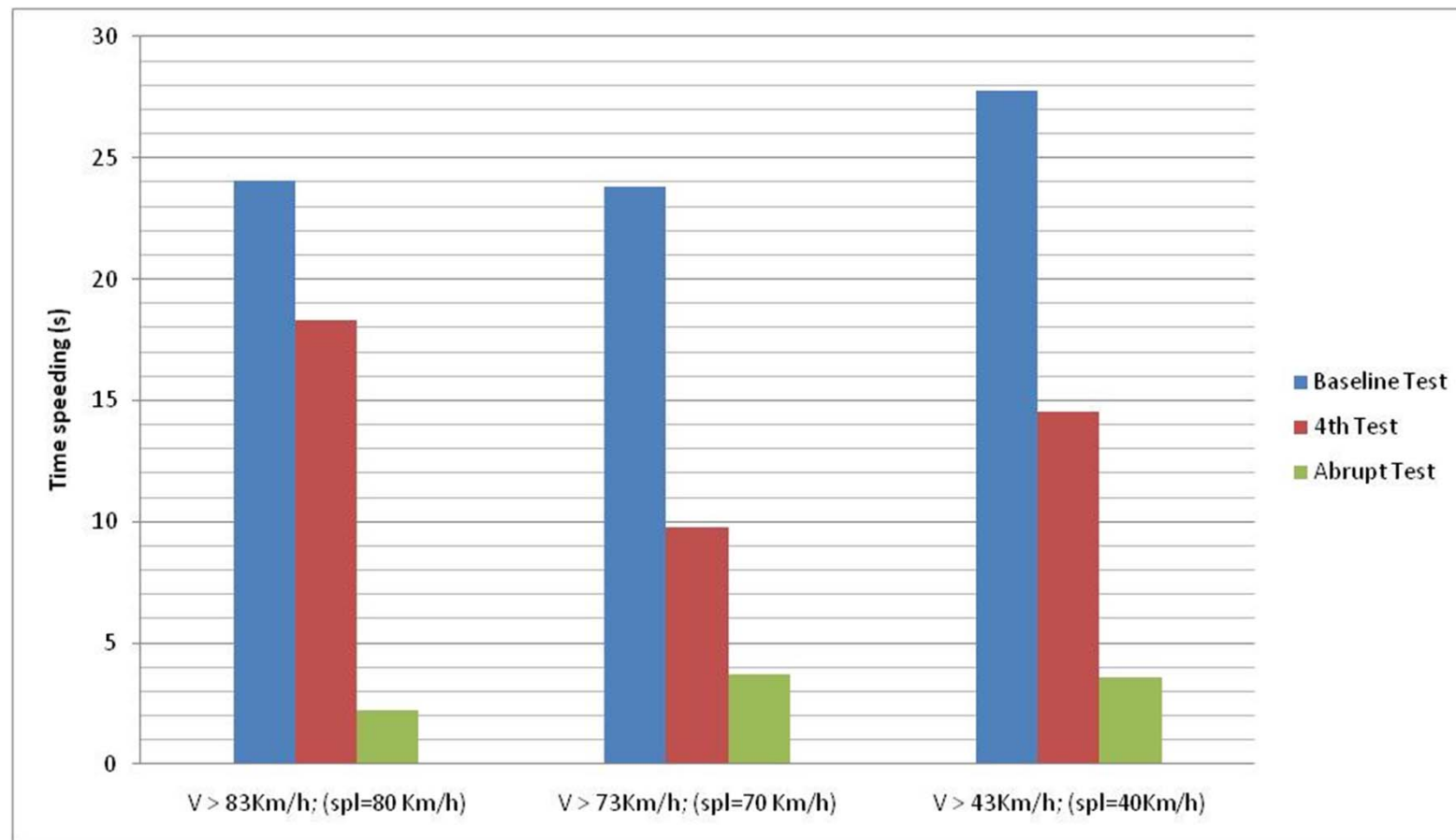


- **Mean speed excess**
 - 80km/h: slight.
 - 70 km/h: **5km/h -> 2 km/h**
 - 40 km/h: **9km/h -> 4.2 km/h**
- **Speeding Time** reduce around **50%**
- **Glances** at IC:
 - 1>Baseline. Drivers verified how the system works
 - Reduced in following tests. **4th around 20%**
- Speed reduction due to track recognition or does the system actually work?

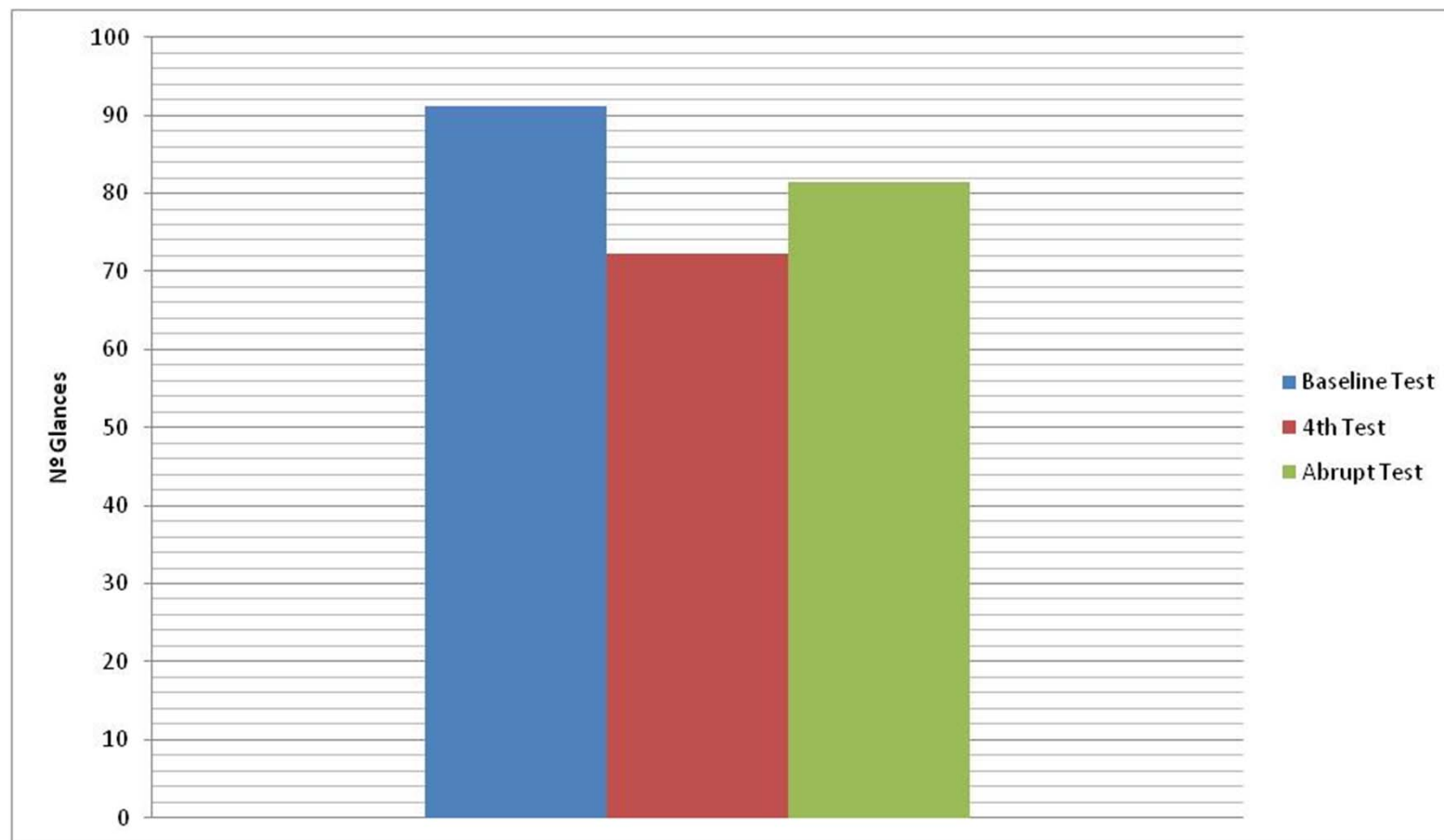
Mean Speed Excess. Hard Profile



Speeding Time. Hard Profile



Glances. Hard Profile



Results with hard profile



- Higher mean speed excess reduction
- Less speeding time
- Increase #glances. New profile need for verification how the system works
- Need for + tests

Conclusions from preliminary validation

- The system is useful to control the speed.
- After continuous tests the number of glances to IC is reduced
- Better speed control with less visual demand
- + drivers
- + tests. In another scenario with and without the system to compare the results.
- Test the system to provide eco driving information
- Only tested in the simulator with good/constant light conditions



Thanks for your attention
Questions?



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