

Vehicle Headlamp Levelling

Measurement data of several vehicles
equipped with automatic levelling
Influence of the components of the system



Summary

- Review of amendment proposals
- Headlamp levelling data
- Influence of the headlamp levelling system components
- Measurement tolerances



Headlamp levelling – review of proposals

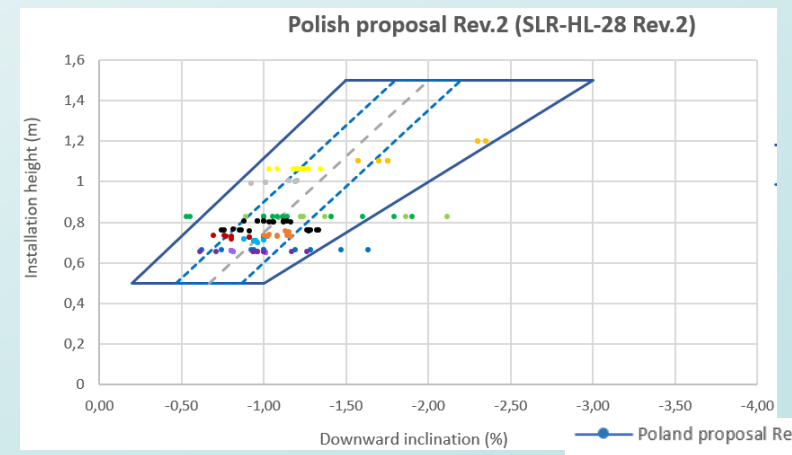
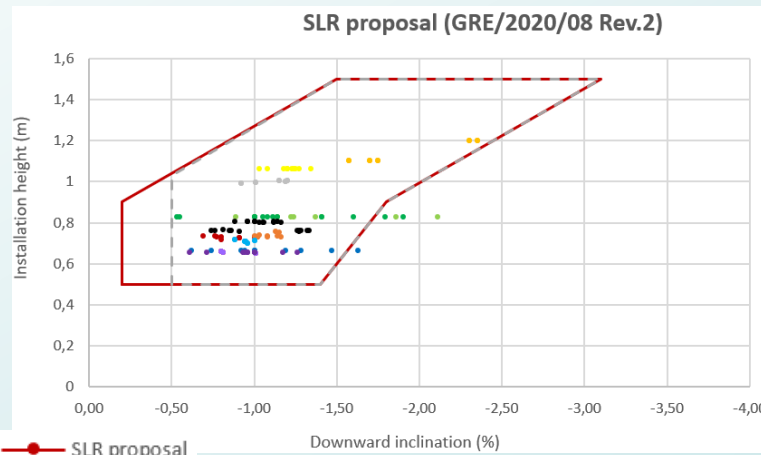
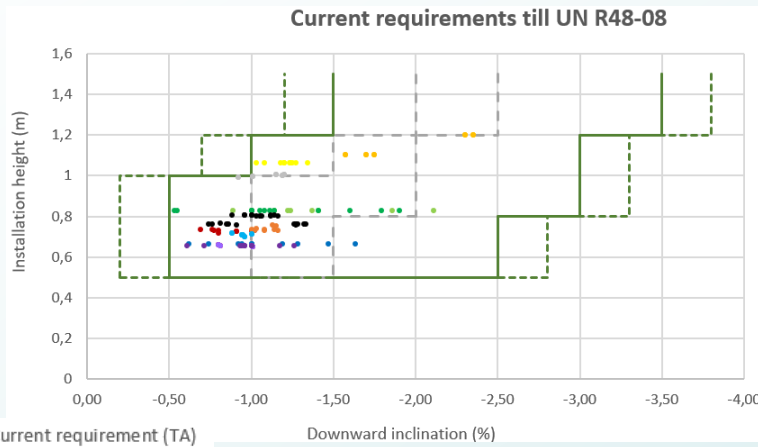
	Current requirements	SLR proposal	Revised Poland proposal	SLR ideas for compromise
Document	As in UN R48 today	GRE/2020/8/Rev.2 (link)	SLR-HL-28-Rev.1 (link)	SLR-HL-30 (link)
Levelling devices	Manual and automatic devices are allowed	Automatic device mandatory (except off-road vehicles)		
Diagram for TA				
Initial aiming	in accordance with diagram (dashed grey lines)	$\leq -0.5\%$, in the box limits (dashed grey limits)	$I = -h/0.75^*$ (dashed grey line)	Idea #1 : $\leq -0.5\%$ in box limits Idea #2 : $I = -h/0.75^*$ (dashed lines)
CoP requirements	Additional tolerance (dash green lines)	As TA requirements	As TA requirements	As TA requirements

Note : h is the installation height in meter (as defined in UN R48)



Headlamp levelling data vs requirements

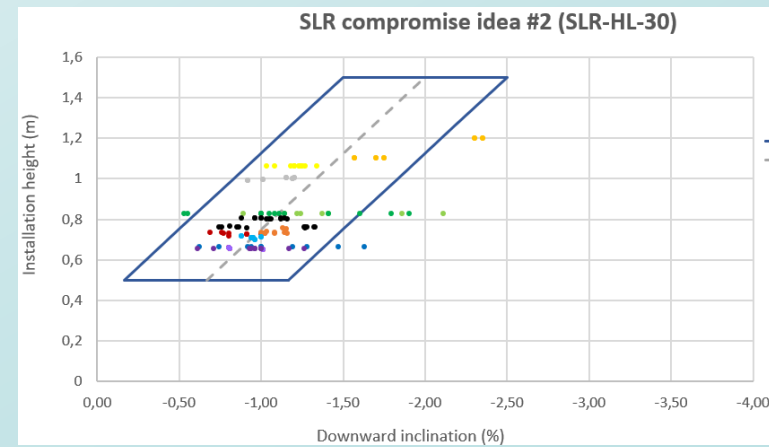
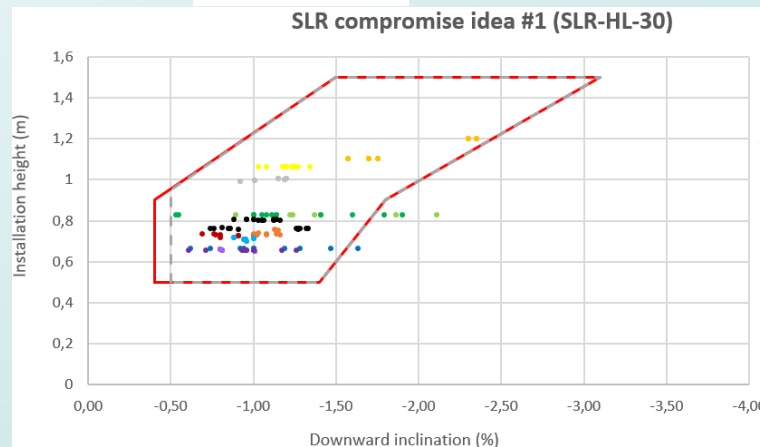
- Gathering of vehicle headlamp levelling data (dedicated format)
- Data results, representative of type-approval measurements, plotted in the various diagrams (last update with SLR ideas for compromise and revised Poland proposal SLR-HL-28 Rev.2)



● Current requirement (TA)
- - - Initial aim
- - - Current requirement (CoP)

● SLR proposal
- - - Initial aim

● Poland proposal Rev.2
- - - Recommended requirement
- - - Initial aim

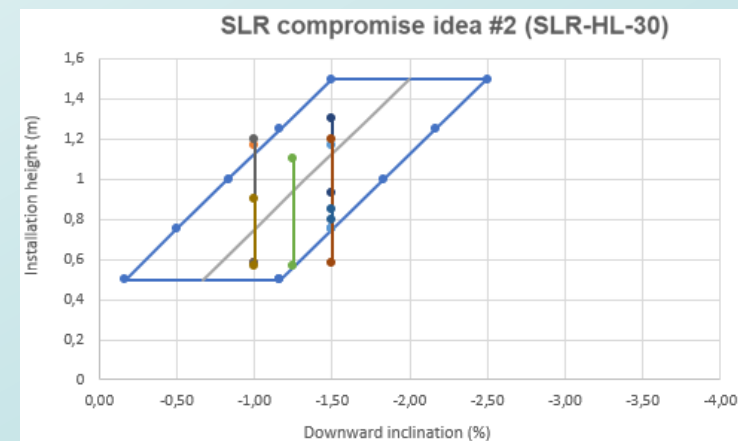
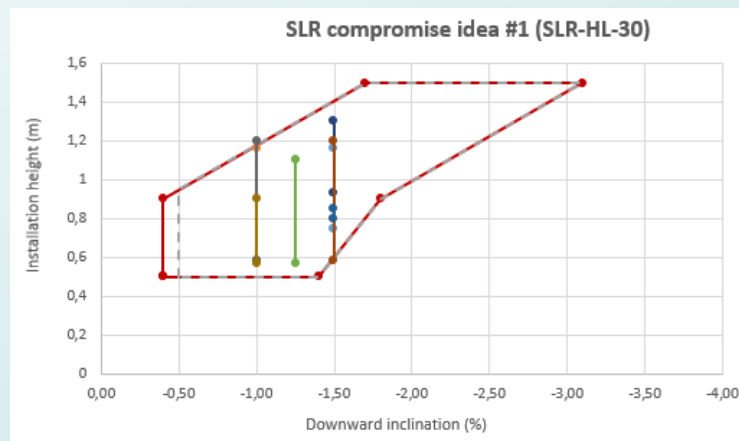
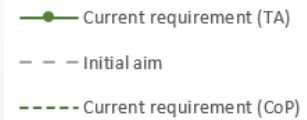
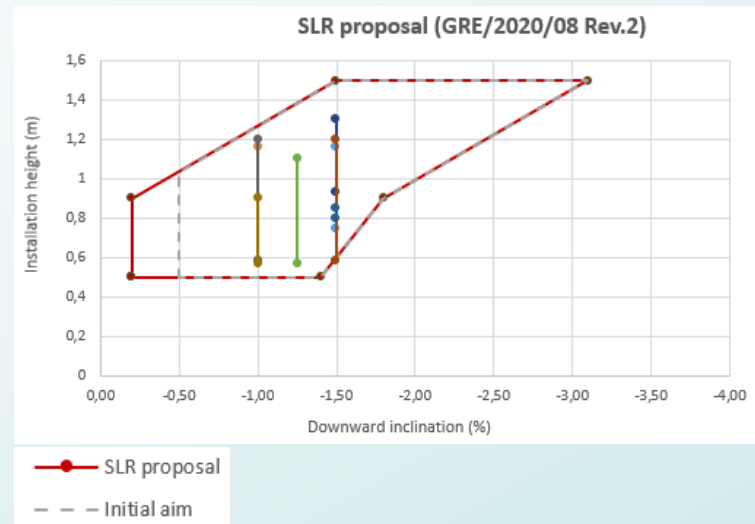
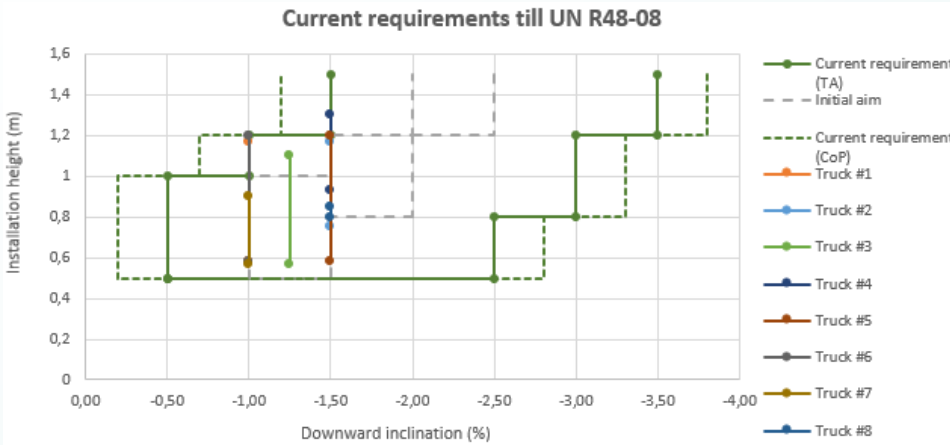


The data results are presented by a single colour for each vehicle.



Headlamp levelling data vs requirements

➤ Initial aiming for trucks





Analysis of measurement data

➤ Initial aiming :

- The requirements of the SLR proposal (GRE/2020/08 Rev2) can be met with existing automatic levelling devices, except for some truck categories.
- Variation in model derivatives and production tolerances result in changes of height that would require different initial aim markings.
- An automatic levelling system is designed to work for all variants of a vehicle model from basic to fully equipped, to remain within the aiming limits for all loading states.
- The data representative of trucks shows the large diversity of installation heights on a vehicle range, for a same headlamp model.



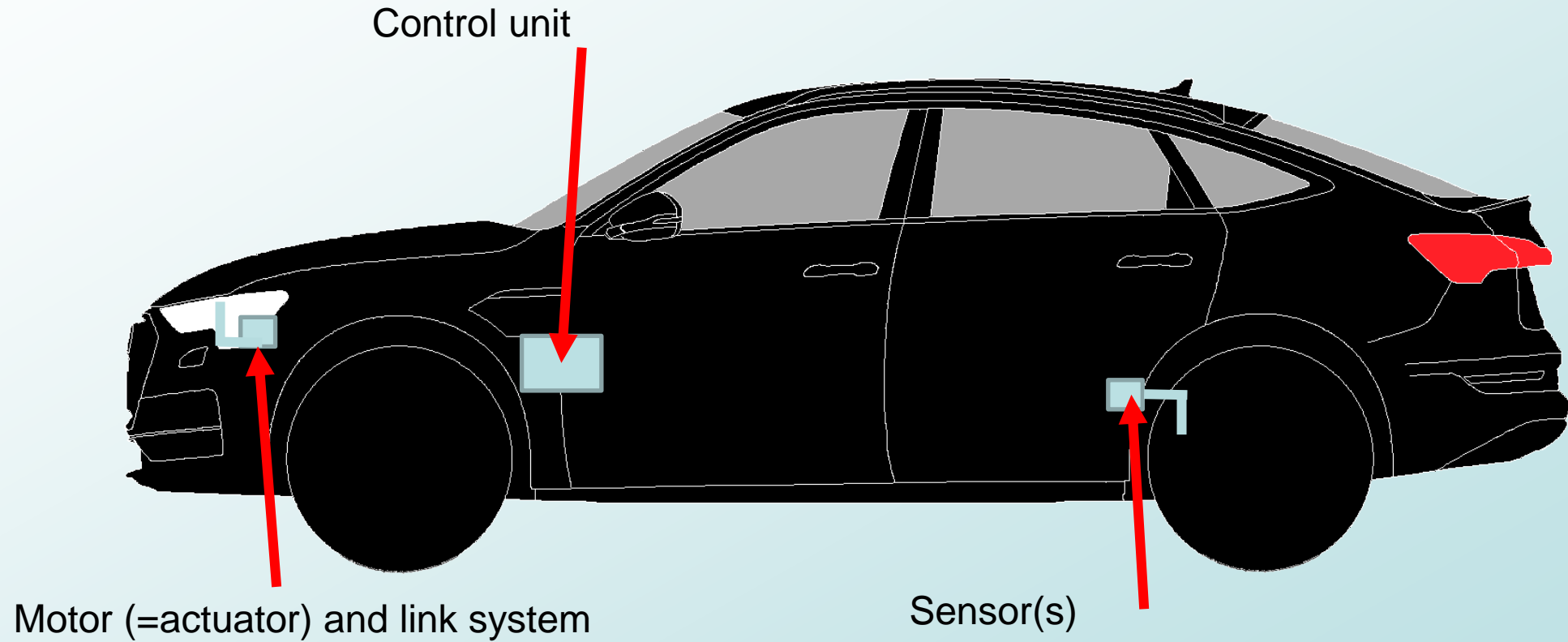
Analysis of measurement data

- Vertical inclination for all loading conditions:
 - With only a few exceptions, most automatic levelling systems installed on current passenger vehicles can meet the SLR proposal.
 - The same number of exceptions (vehicle data outside the boundary) apply equally to the SLR compromise idea #1.
 - However, for trucks, only the requirements of original SLR proposal and SLR compromise idea #1 could be met.
 - For all vehicle types, the range of the vertical inclination is too strict in SLR compromise idea #2 and the original PL proposal.



Automatic HL levelling systems : components

Example of typical system



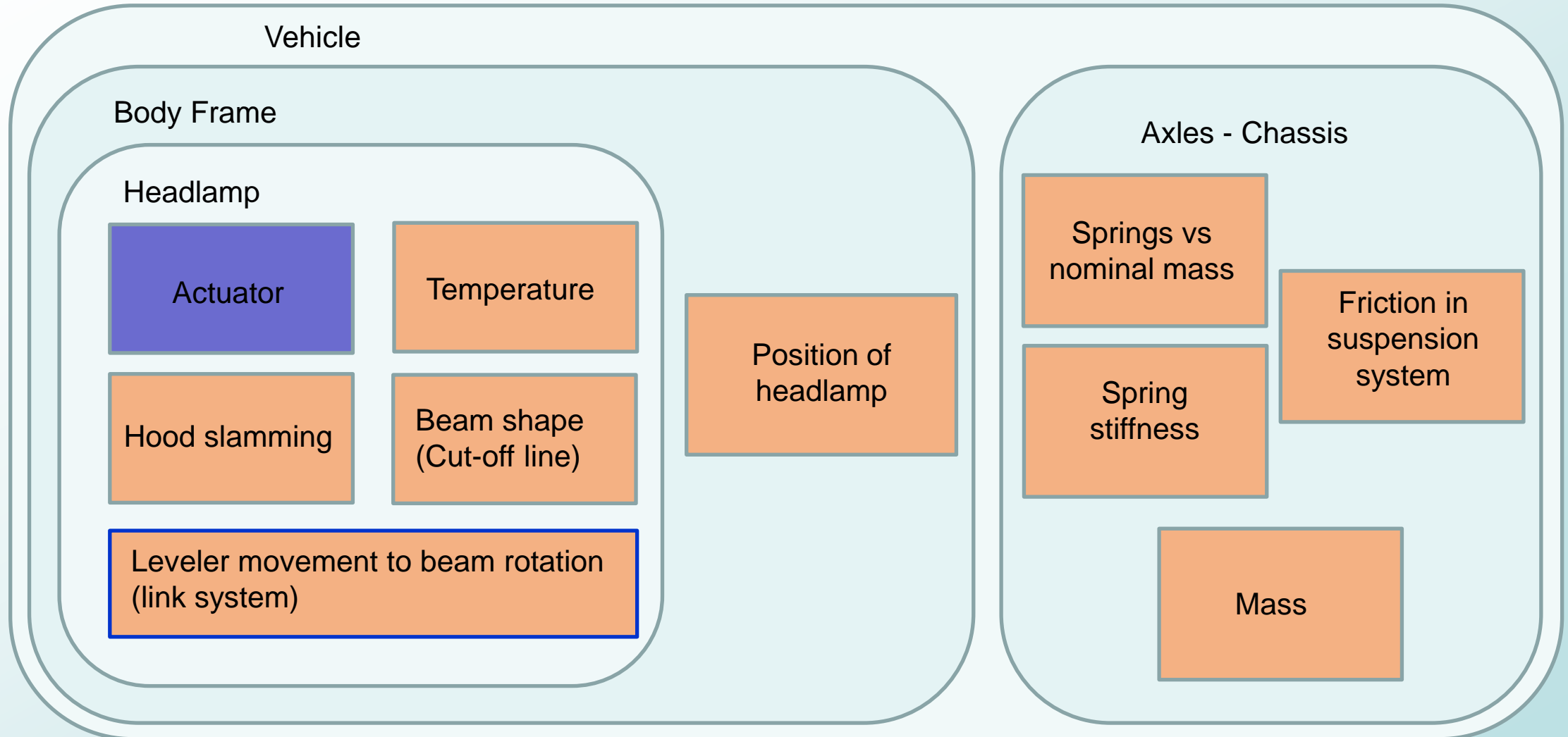


Automatic HL levelling systems : components

A complex nested system ...

Mechanical

Electrical

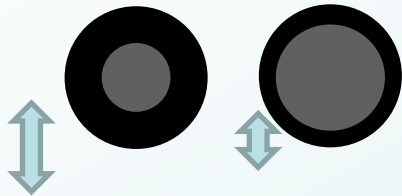




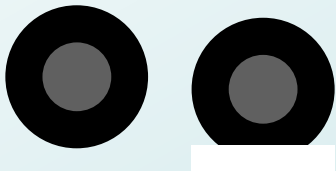
Automatic HL levelling systems : components

Pitch angle measurement

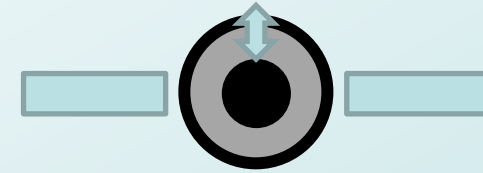
Tire and rim combinations



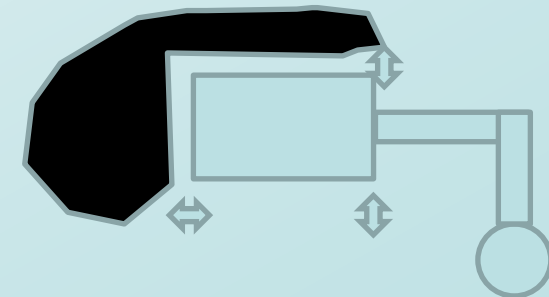
Tire pressure



Movements of the wheels due to the load



Impacts at sensor level

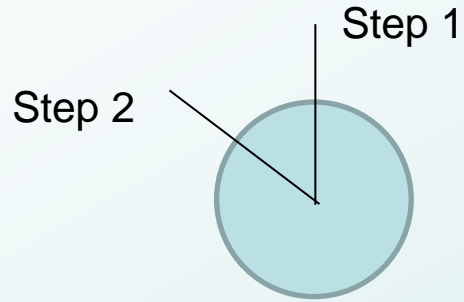




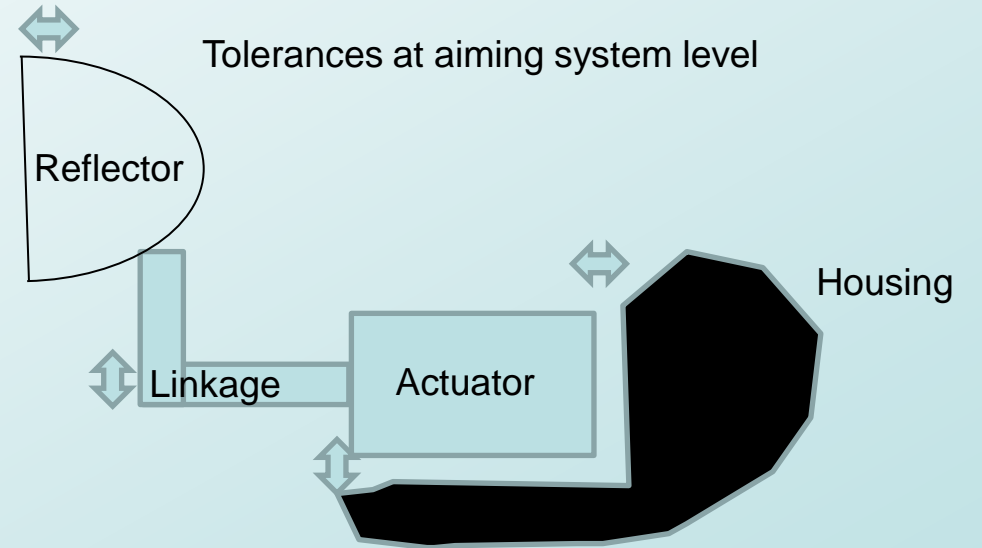
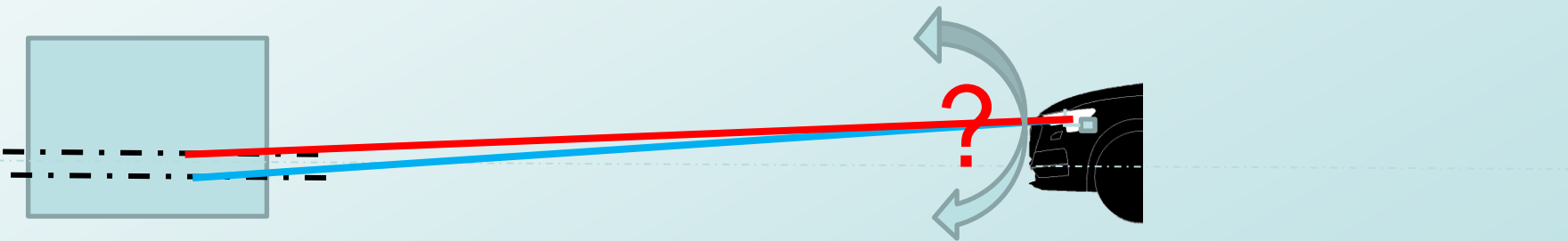
Automatic HL levelling systems : components

Aiming system of the headlamp

Stepper motors



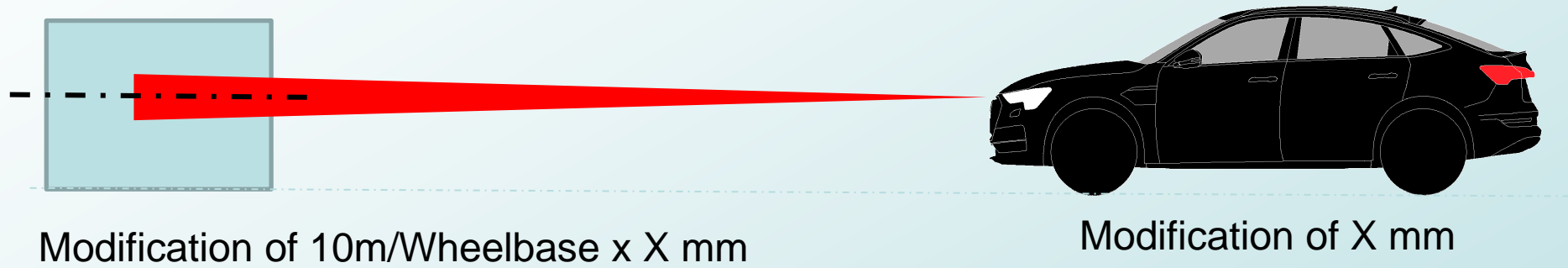
Influence of the temperature





Automatic HL levelling systems : components

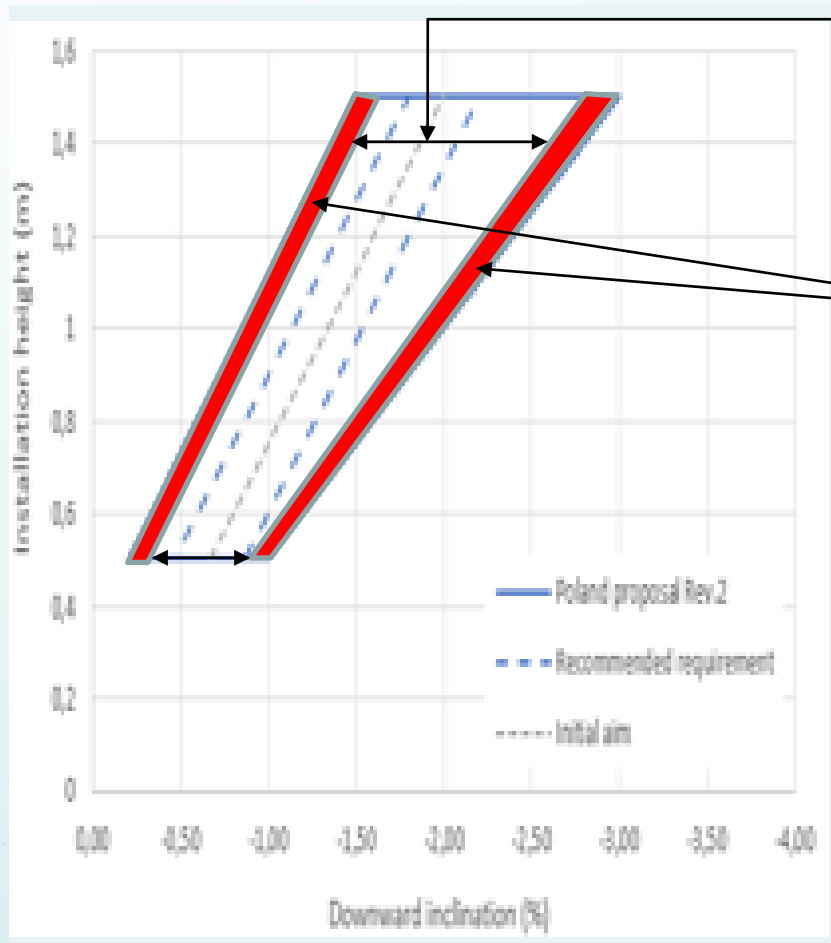
Amplification of tolerances





Measurement tolerances

Reason to mention measurement tolerances:



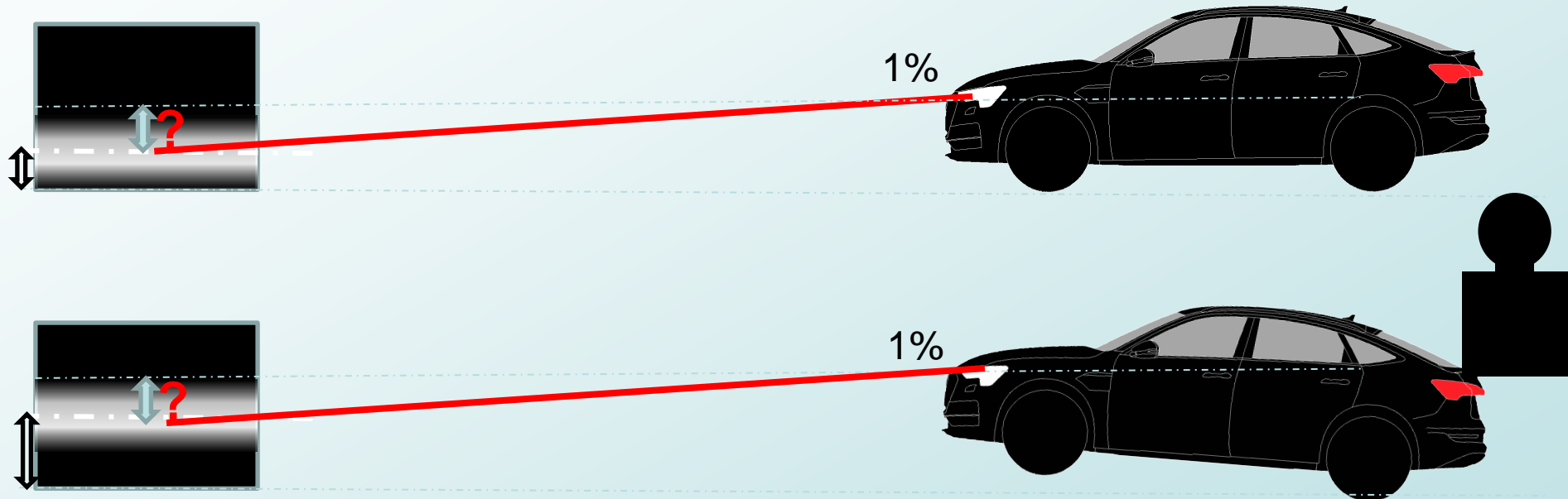
„Design“ boundary to get positive results

Red boundary area representing likely false negative results



Measurement tolerances

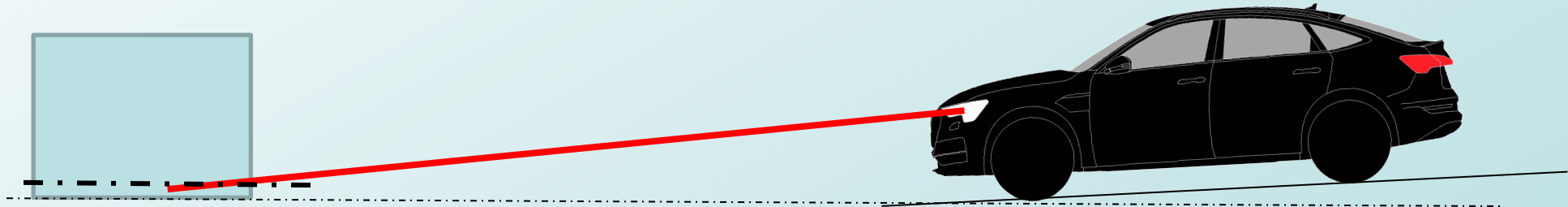
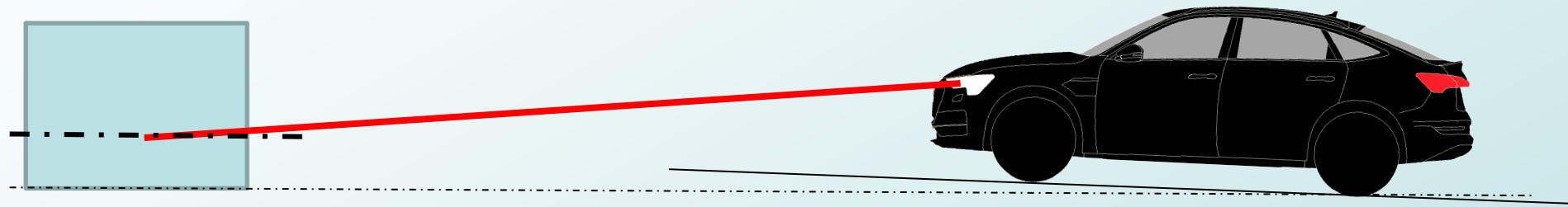
Cut-off line shape and sharpness





Measurement tolerances

Floor flatness quality at laboratory





Automatic HL levelling systems : components

Pitch angle measurement

