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## Item 0.4

# Automotive Front Lighting

## Roadmap GTB Front Lighting WG

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**GTB**

*The International Automotive Lighting  
and Light Signalling Expert Group*

*Groupe de Travail "Bruxelles 1952"*

# Automotive Front-Lighting

## Agenda

Future Trends

Future Needs

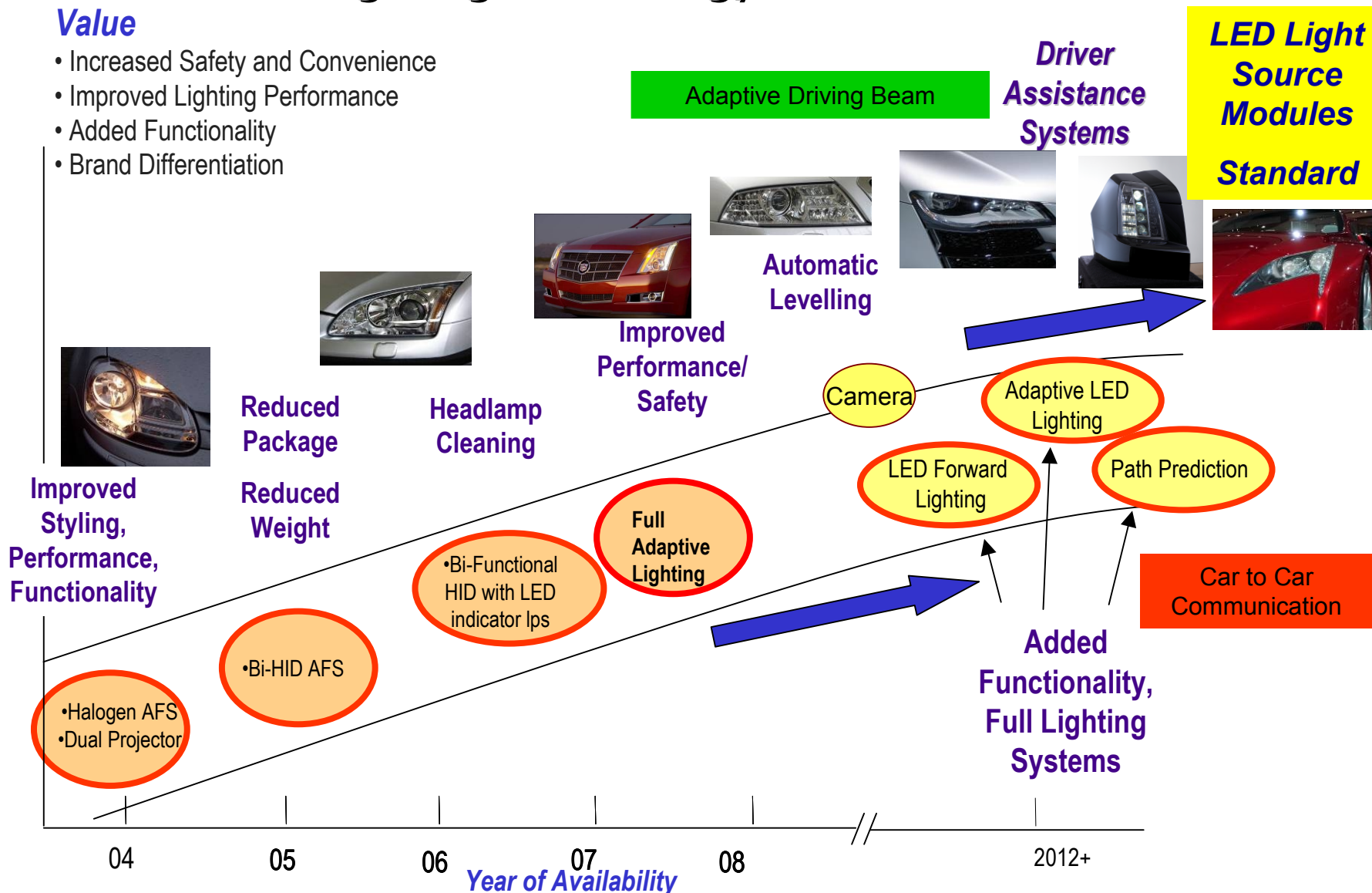
Short Term Actions

Summary & Outlook

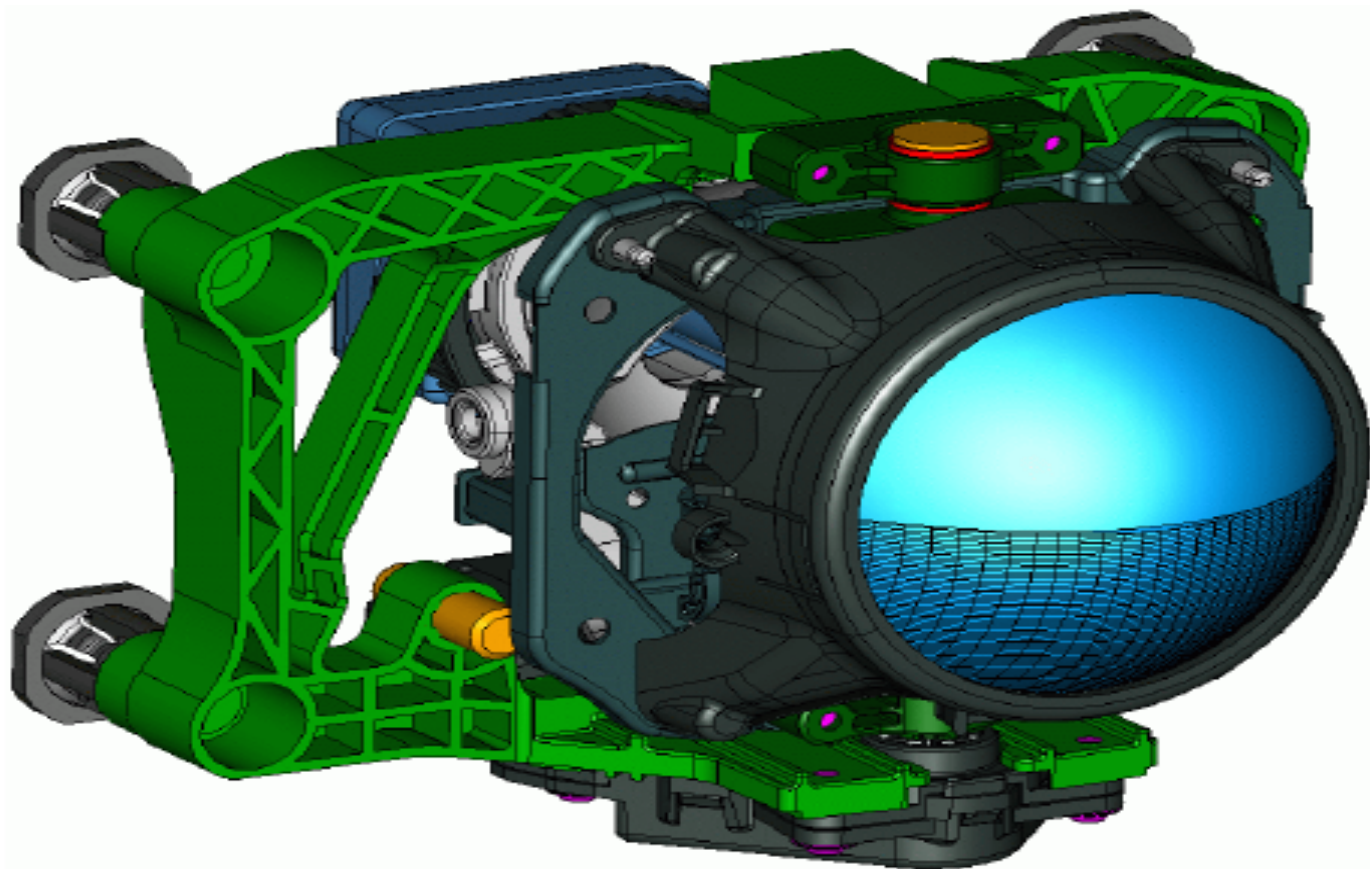
# Front Lighting Technology Market Demands

## Value

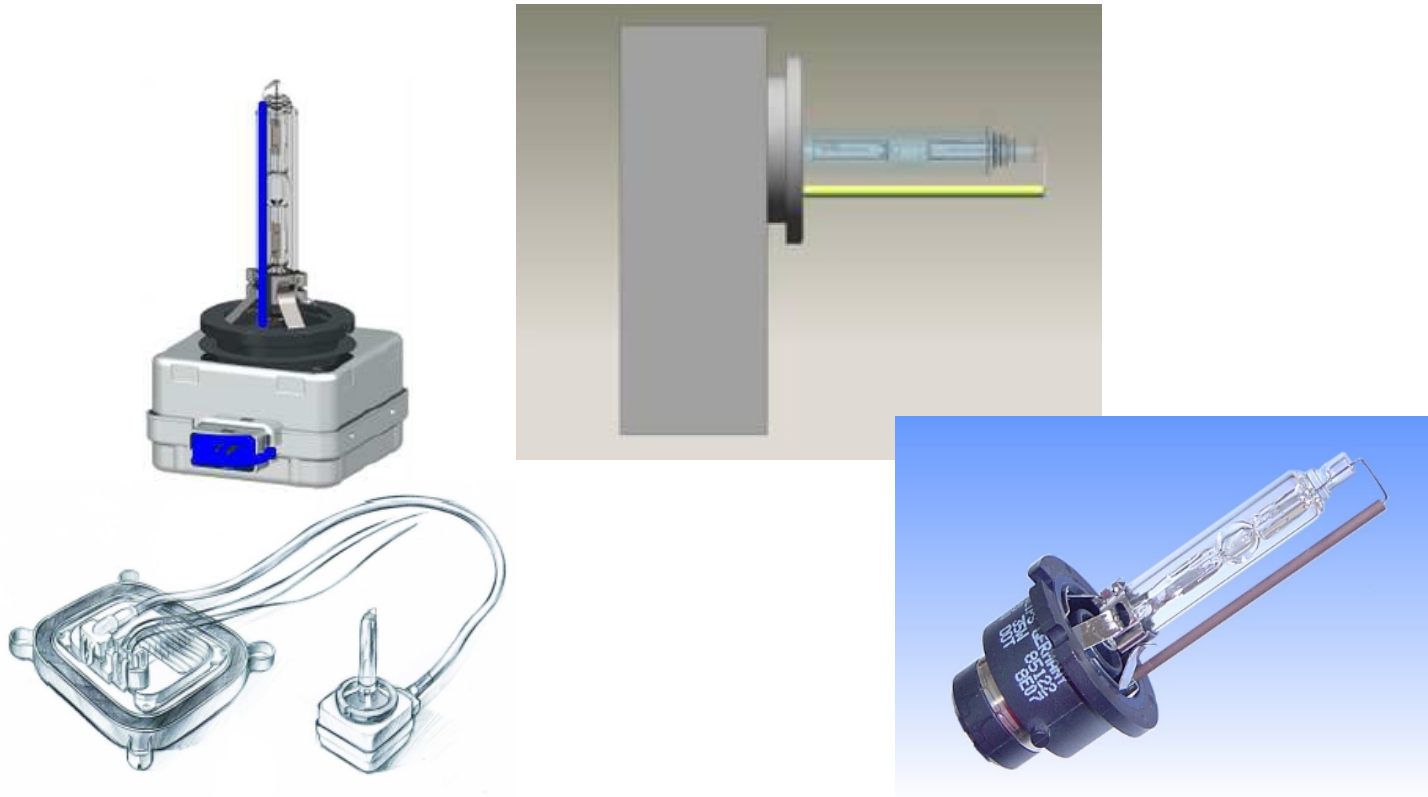
- Increased Safety and Convenience
- Improved Lighting Performance
- Added Functionality
- Brand Differentiation



# Bi-Xenon Full AFS Projector 70mm

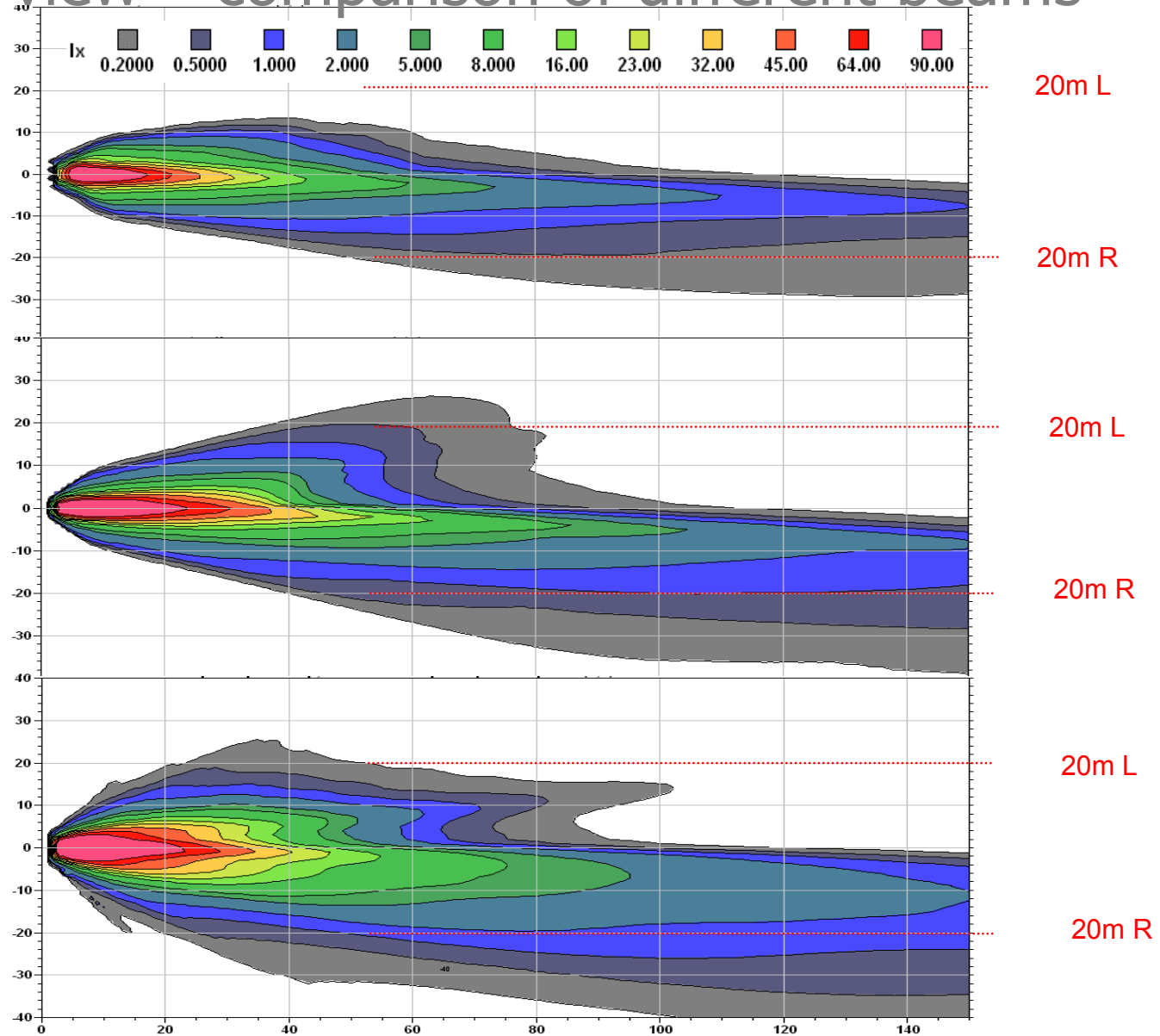


# • HID 25W SYSTEMS



# Bird's eye view – comparison of different beams

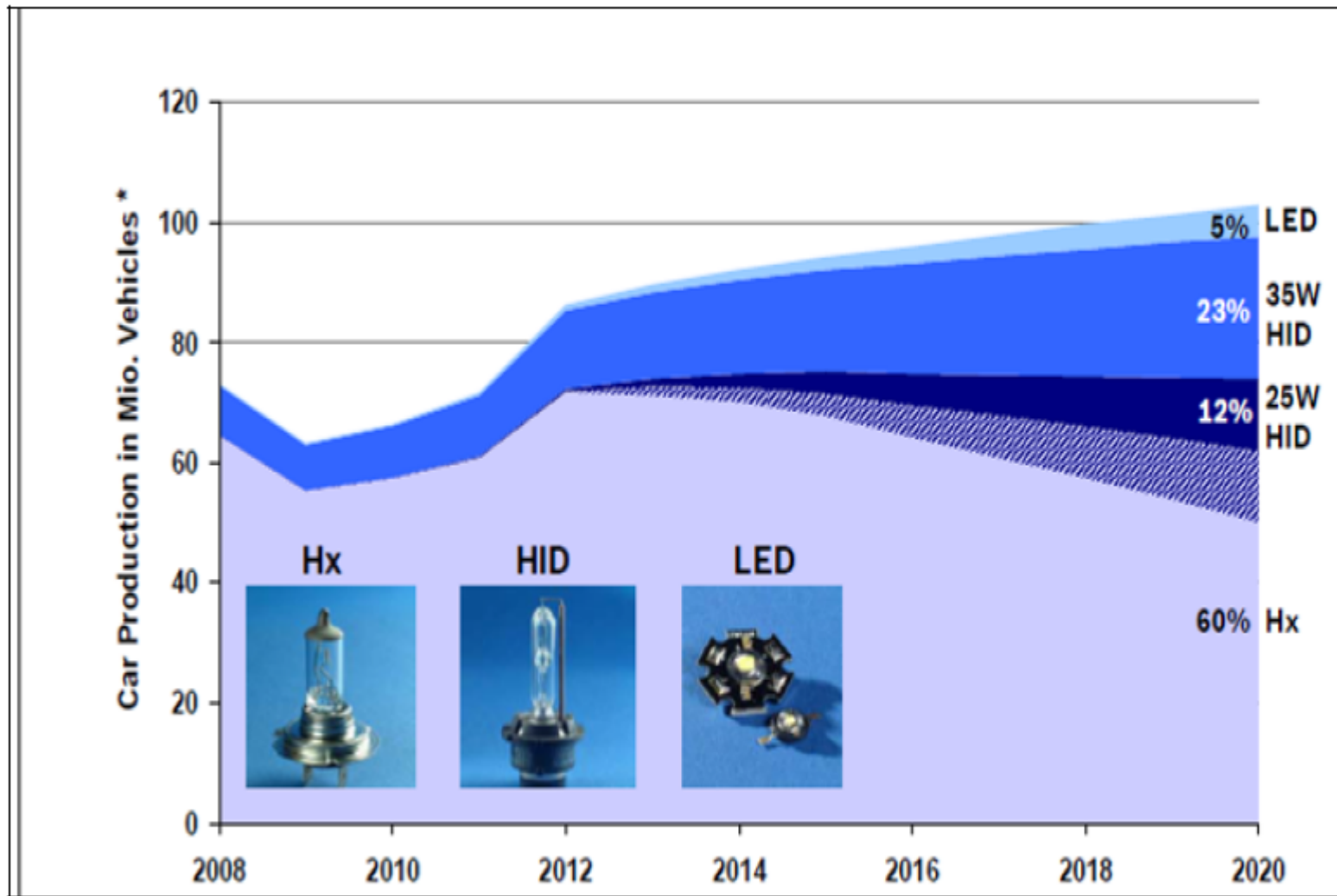
- H7 projector



- Bi-HID 25W projector

- Bi-HID 35W projector

# Technology Roadmap - Headlamp Global

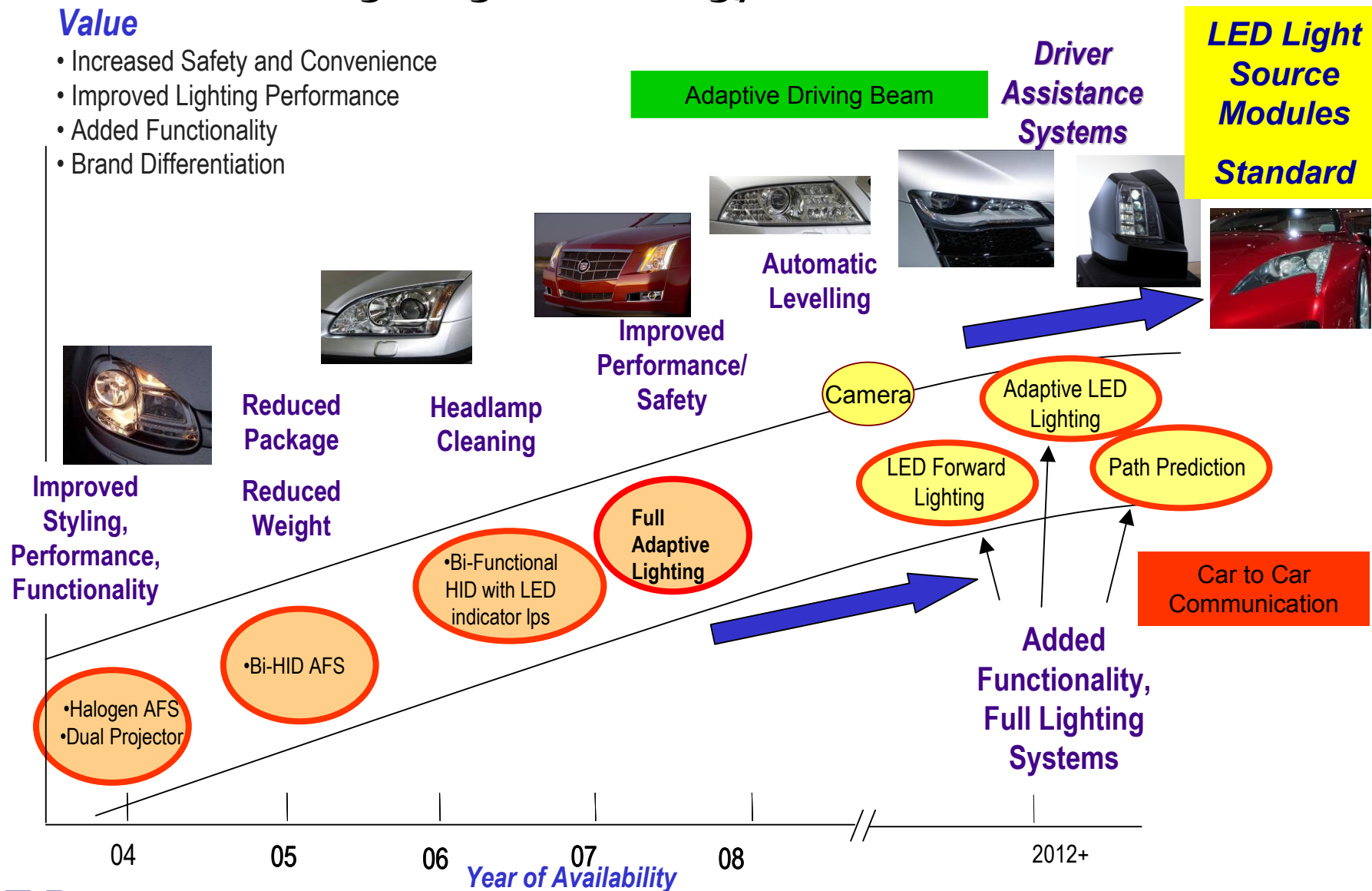


Penetration 2020: LED HB/LB 5% - Xenon 35%

# Front Lighting Technology Market Demands

## Value

- Increased Safety and Convenience
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# LED Headlamp - Premium Class Vehicle



# Future Trends

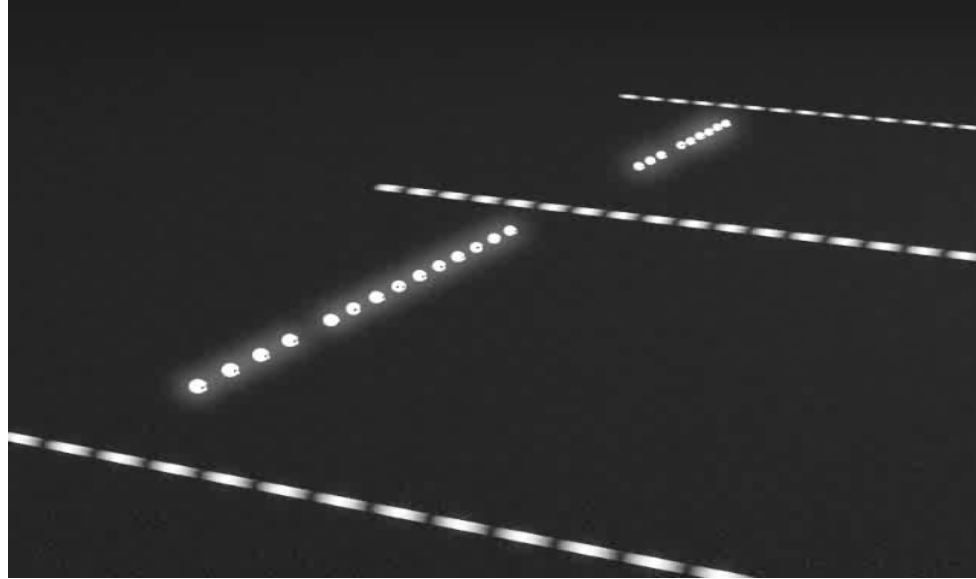
- Green Car Initiative (Electrical / Hybrid vehicles) requires:
- Power Consumption Reduction
- Fuel Consumption Reduction
- CO2 Reduction
- Weight Reduction
- Long Life Time



**LED**

## Attractive Styling

# Color – Effect

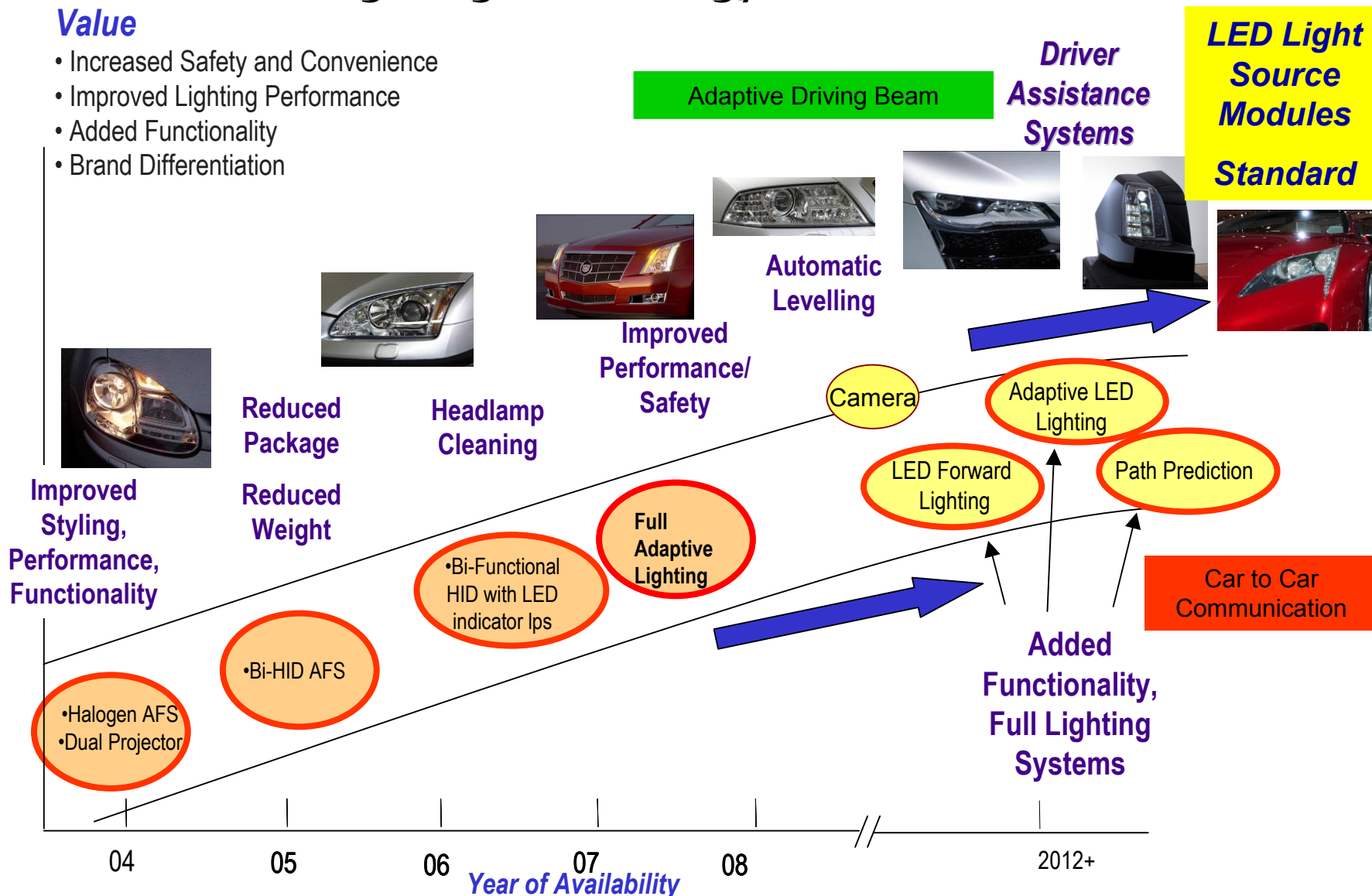


<http://www.ass-cuna.org/Video1.wmv>

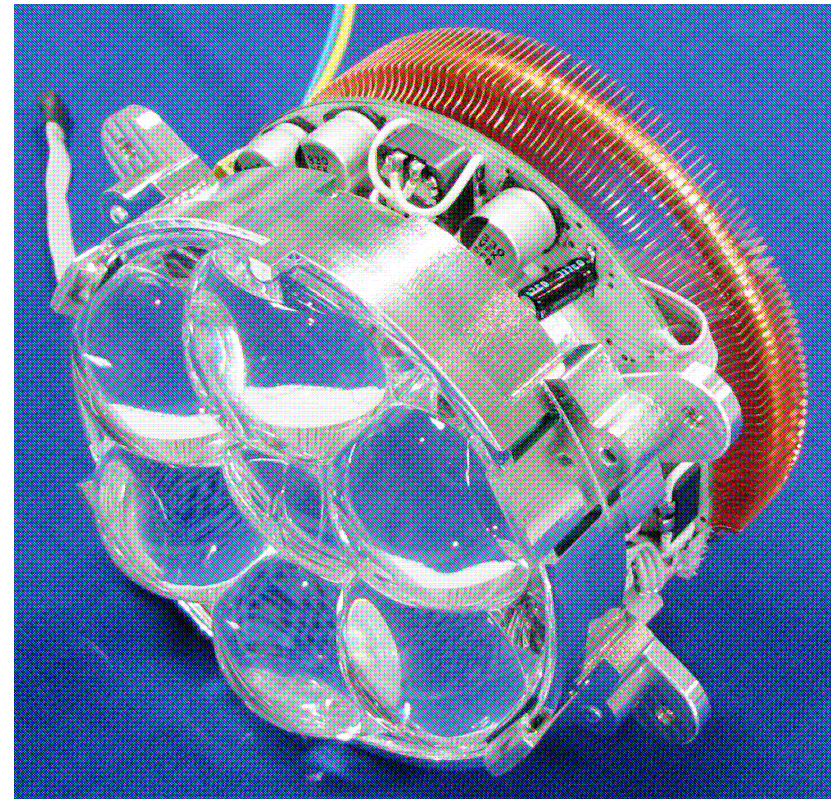
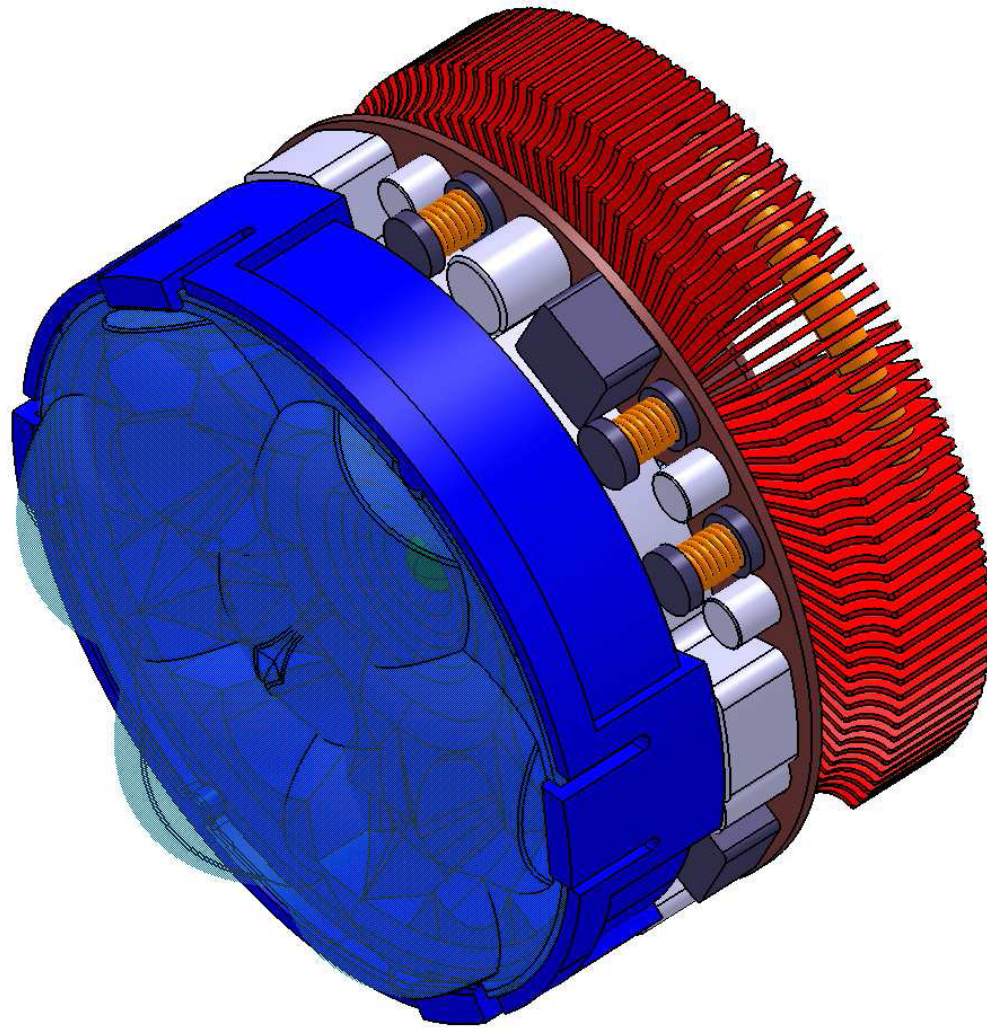
# Front Lighting Technology Market Demands

## Value

- Increased Safety and Convenience
- Improved Lighting Performance
- Added Functionality
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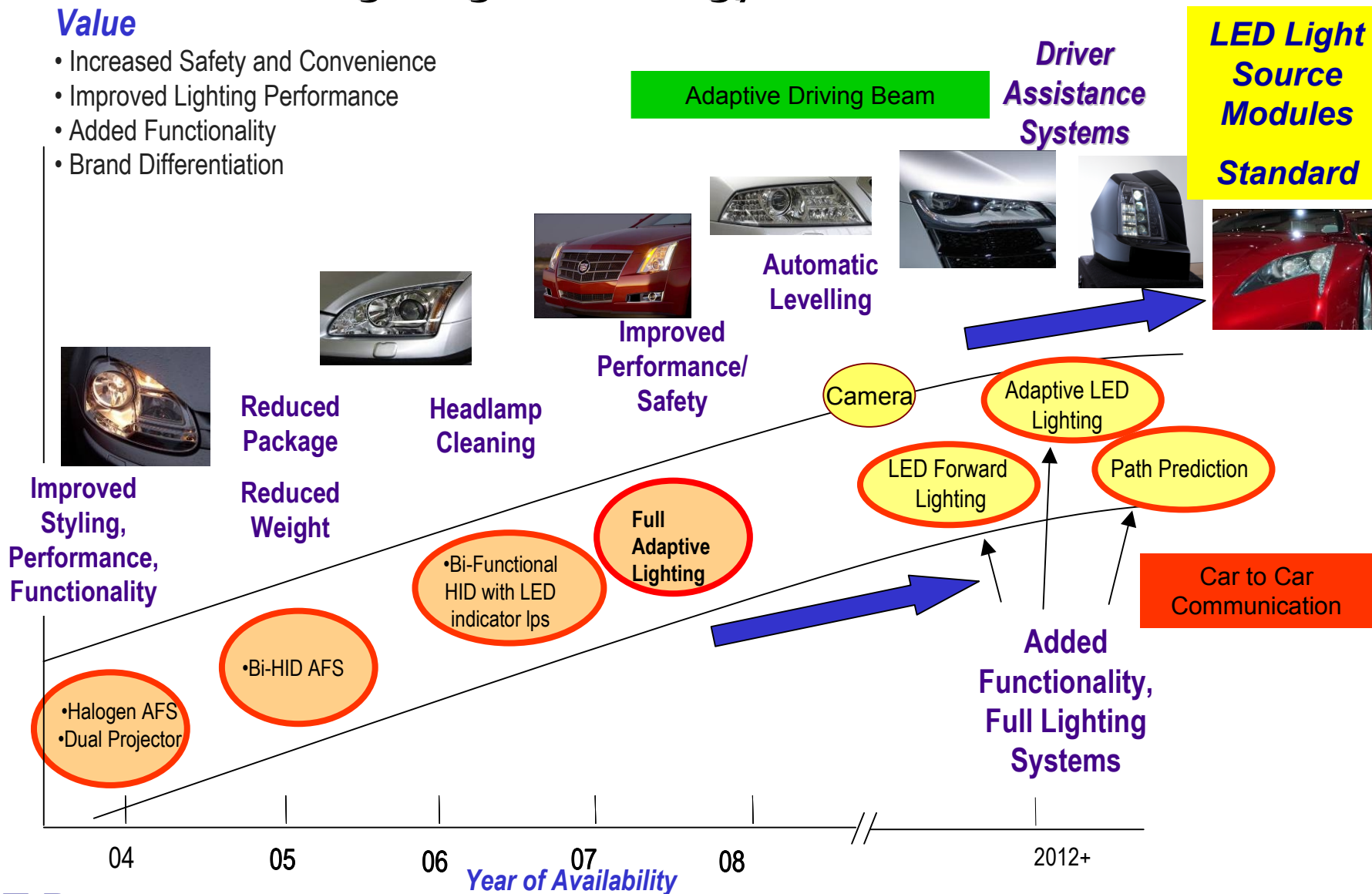
# LED Light Source Module (DRL/Driving Beam)



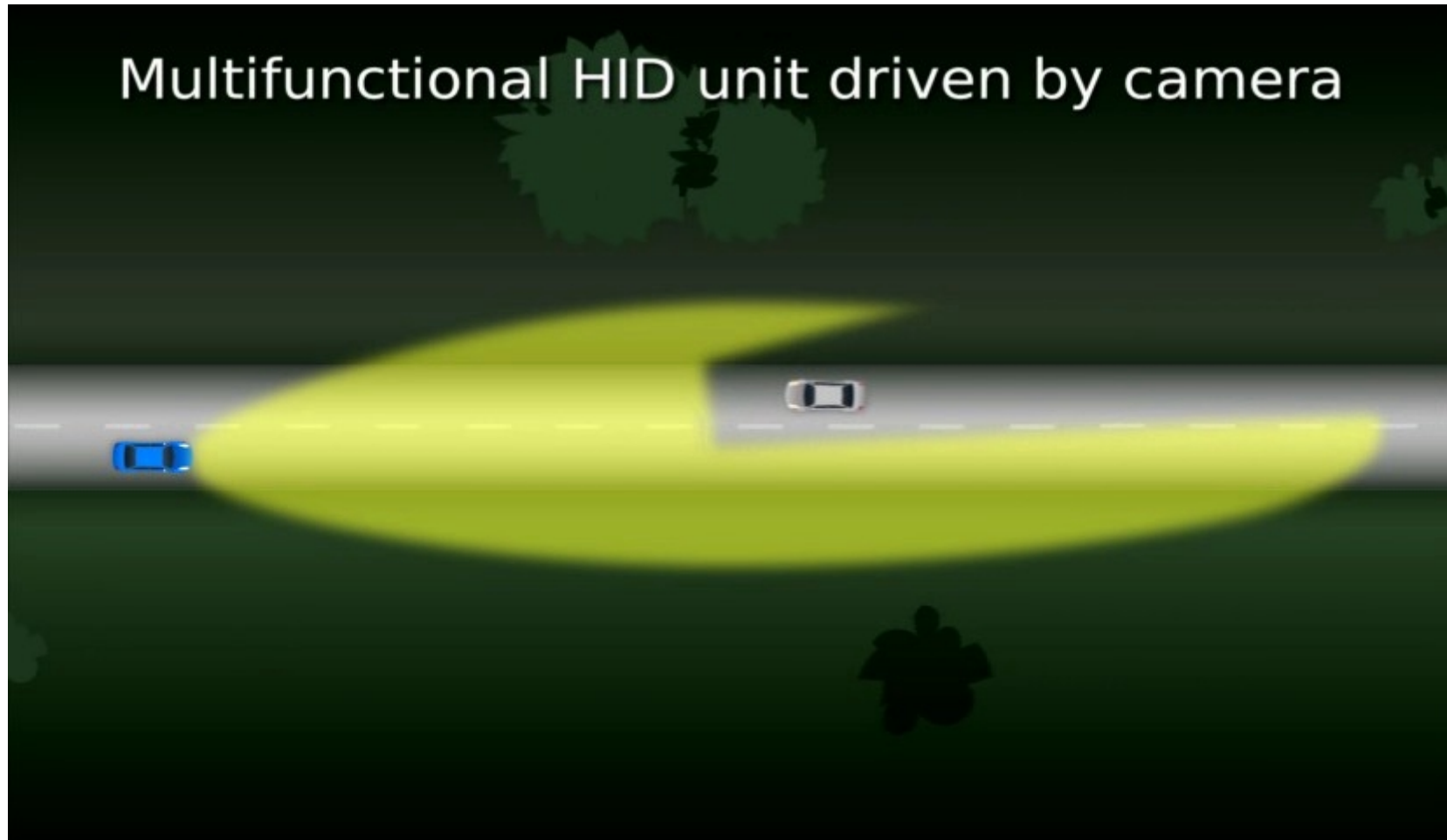
# Front Lighting Technology Market Demands

## Value

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# Adaptive Driving Beam



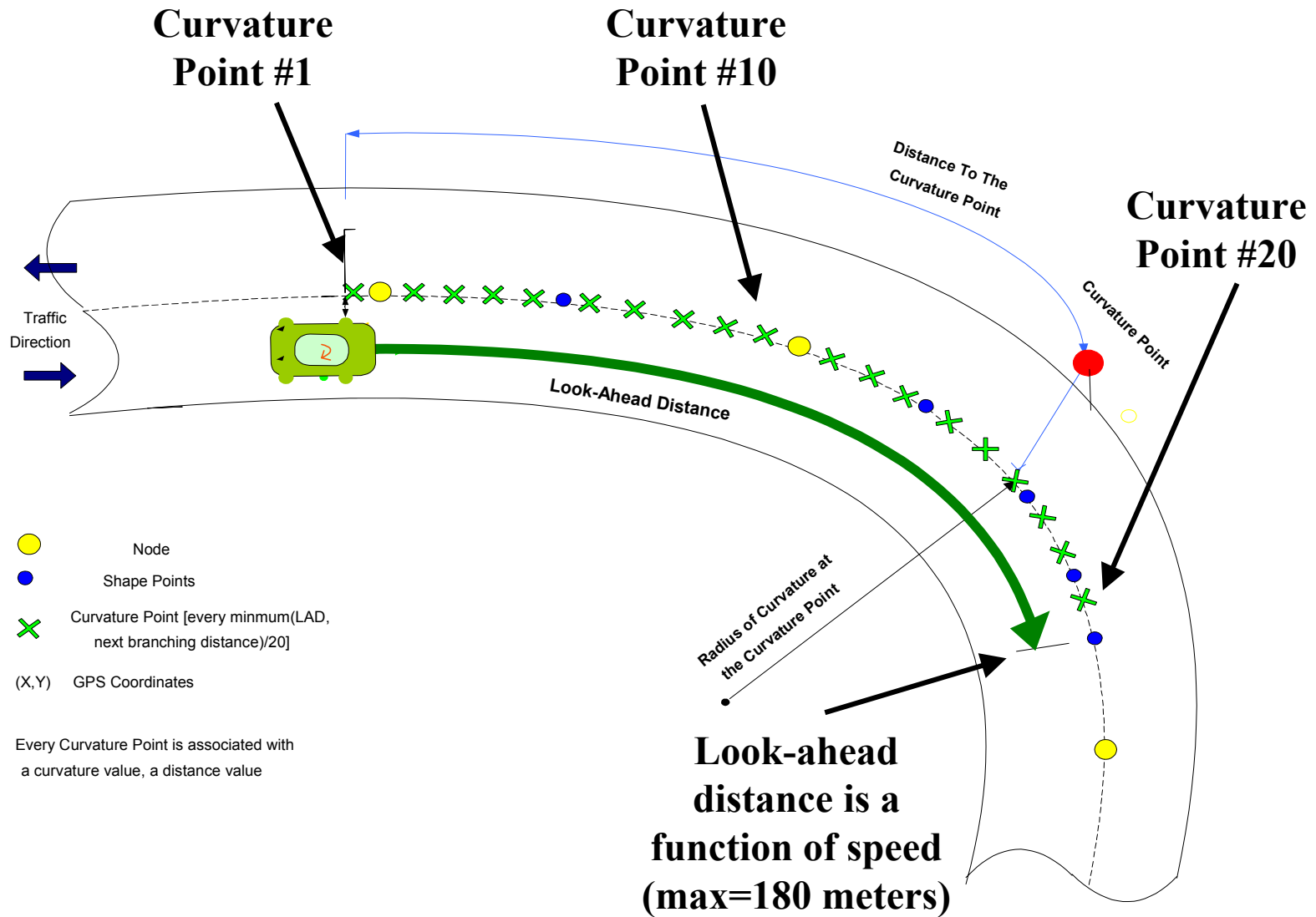
# Driver Assistance Systems



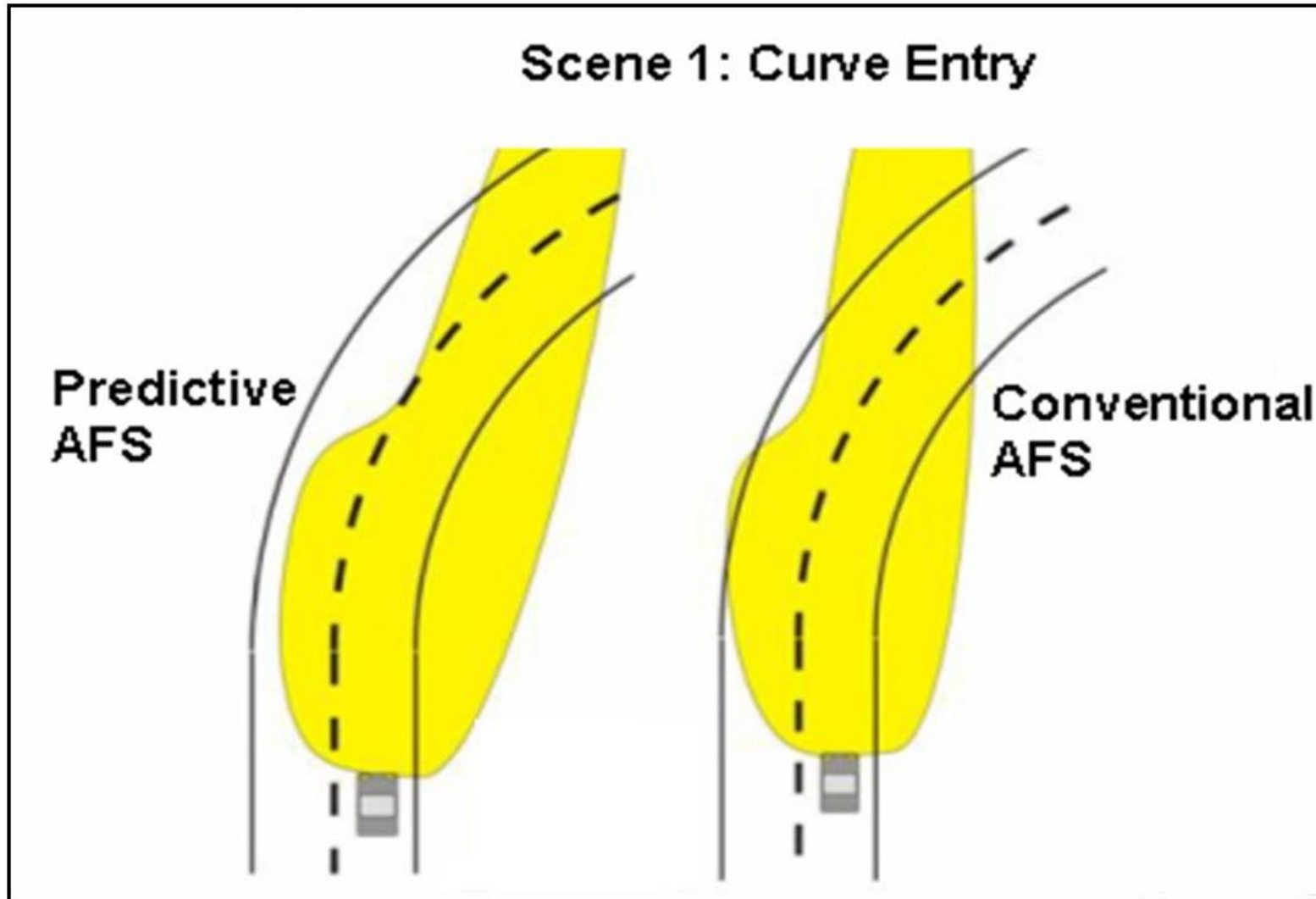
<http://www.ass-cuna.org/Video2.wmv>



# Path Prediction Using GPS/Map Data



# Predictive AFS



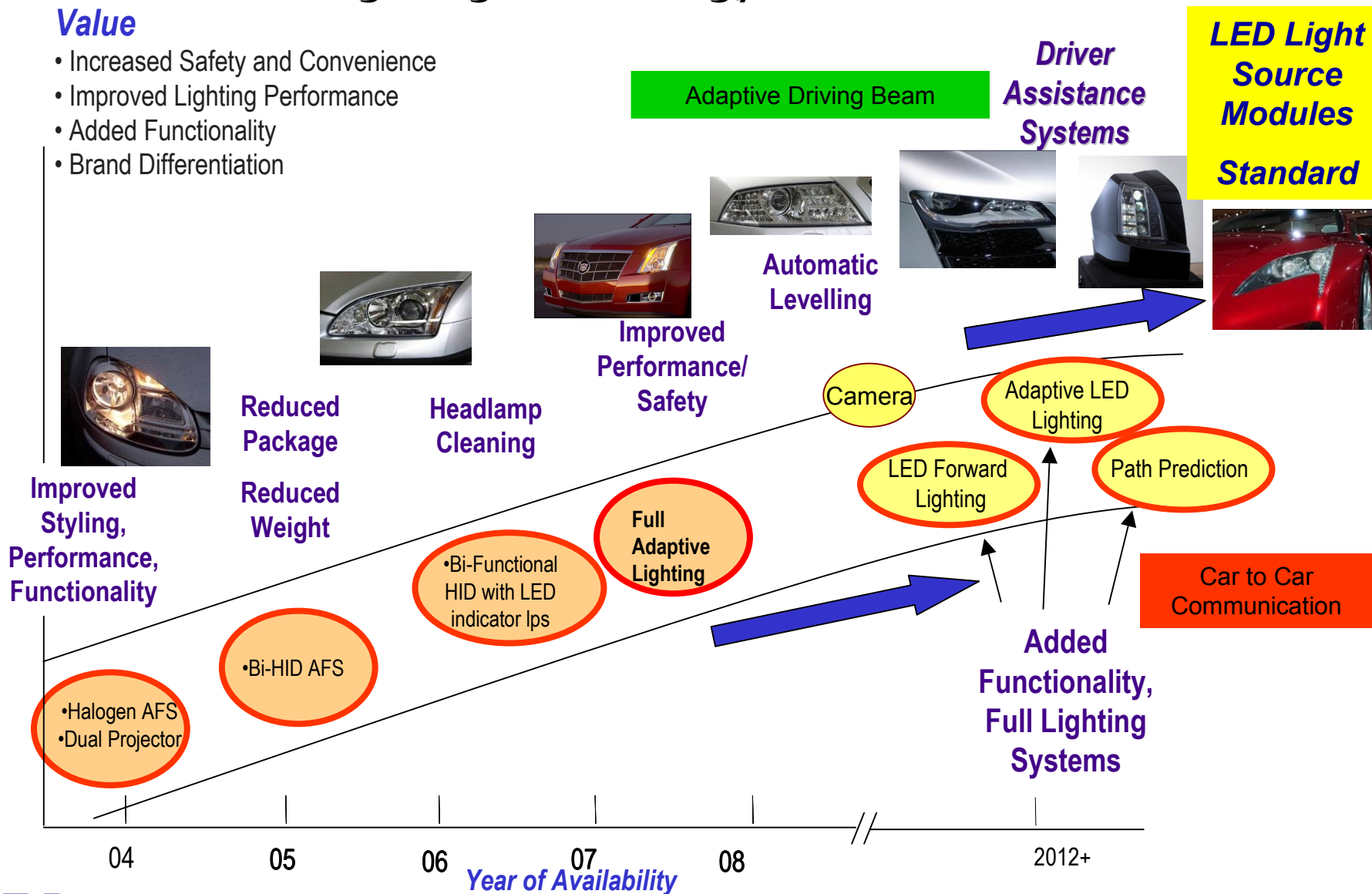
## Addressable LED chip array driven by camera



# Front Lighting Technology Market Demands

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# Car to Car Communication



# Traffic Conditions

Unternehmen & Märkte | Automarkt Indien



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# Future Needs

- There are two main categories, which we do have to cover from legislation point of view
  - 1) Harmonization of legislation with all kind of light sources (Halogen, Xenon, LED) and all kind of light applications standard dipped/main beam, AFS, LED-array generated or micro-mirror variation of light distributions
  - 2) Driver assistant lighting systems with external parameter variation of light pattern (e.g. Adaptive Driving Beam, Predictive AFS, Car to Car Communication)

# Short Term Actions

- Automatic Levelling
- Headlamp Cleaning
- 2000 lm criterion



# Automotive Headlamps - Comparison Current Status

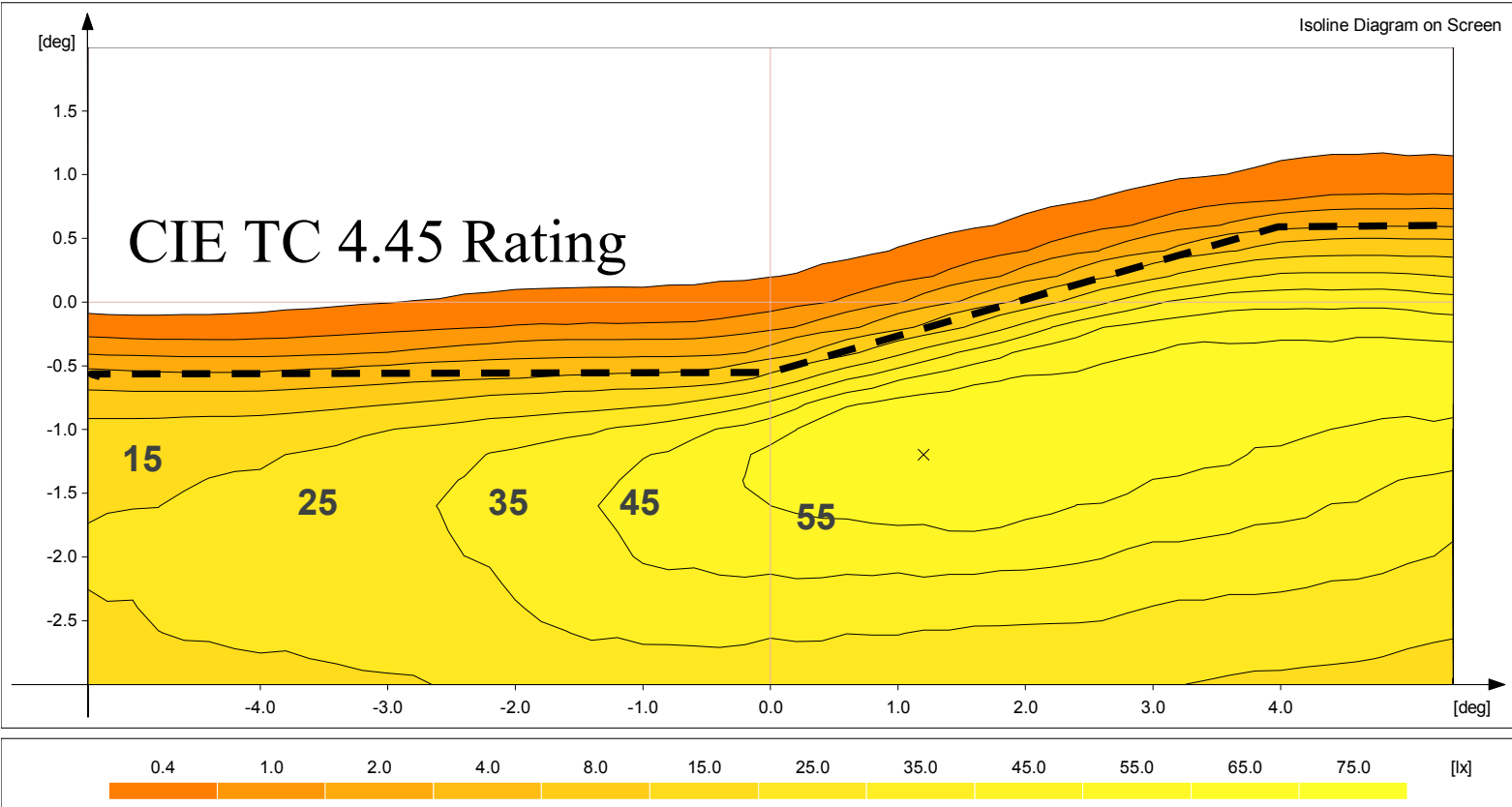
	Halogen		Xenon		LED	
	<2000lm	>2000lm	<2000lm	>2000lm	<2000lm	>2000lm
Automatic Levelling	-	X	-	X	X	X
Headlamp Cleaning	-	X	-	X	-	X

# 2000 lm Criterion

1. 2000 lm hurdle for automatic levelling and cleaning device was historically introduced to avoid glare caused by high power Halogen bulbs (HIR bulbs)
2. There is and was no scientific argument for a 2000 lm definition and limit for whatever automotive Front-Lighting request
3. This has caused some confusion and corresponding special solutions avoiding such an amount of light volume

# Bi-Xenon Light Distribution

Glare situation for inclination: Cut-off  $\Delta = +0,5^\circ$



- The GTB Front Lighting Working Group Forum
- Turin, Italy – 25 January 2011
  
- **“The Contribution of Mandatory Installation**
- **of Static Auto-Levelling to reduced glare”**
  
- 6 Speakers, 40 GTB experts
  
- An Overview of the Main Points

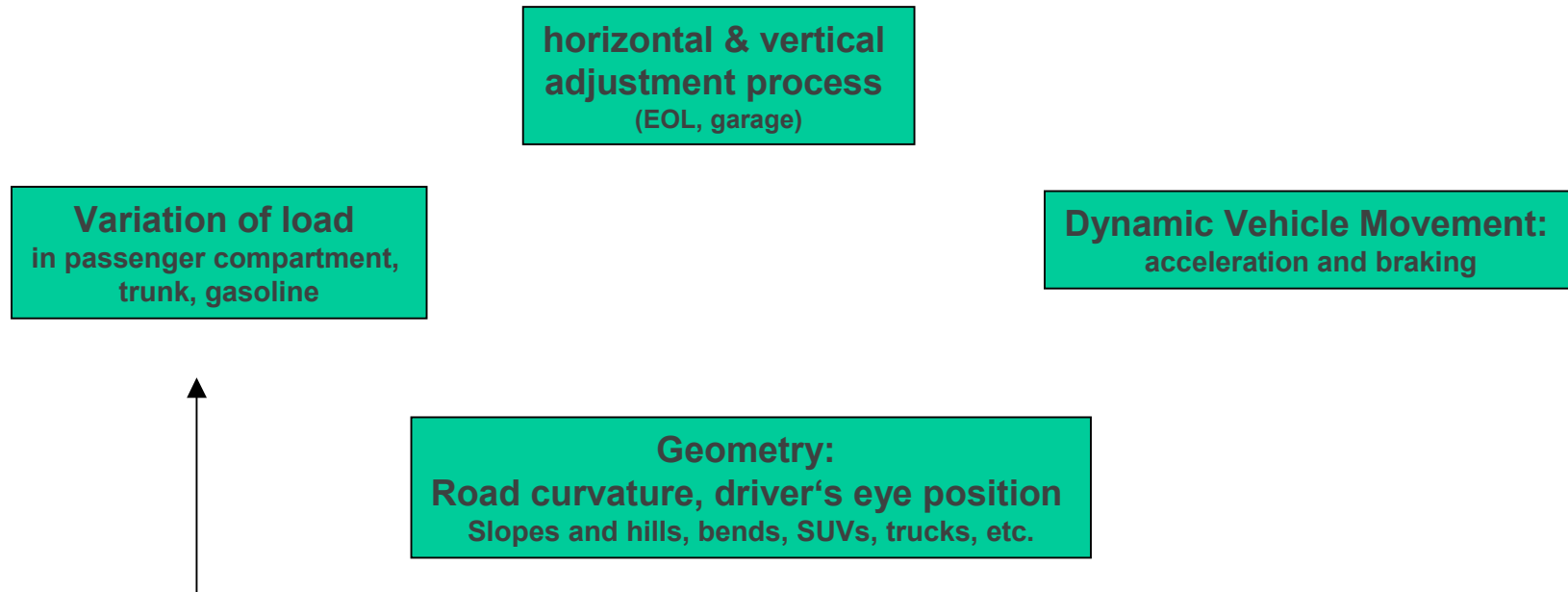
- The GTB Front Lighting Working Group Forum
- Turin, Italy – 25 January 2011
- **Presenters**
- Dr. Wolfgang Huhn: “Cost-Benefit Analysis of mandatory requirement of auto levelling”.
- Dr. Ernst-Olaf Rosenhahn: “Glare and Auto-Levelling: degree of influence and future outlook.”
- Paul-Henri Matha: “Reality of car production tolerances and automatic levelling involvement”
- Aurélie Darnoux: “Automatic Levelling: Safety aspects and real application in motor vehicles.”
- Dr. Tomasz Targosinski: “Aiming influence for visibility distance and glare”
- Dr. Thomas Reiners: “Headlamp cleaning effectiveness.”

# Factors Influencing Passing Beam Misaim resulting in Increased Glare or Reduced Forward Visibility

Factor	Research Findings
Horizontal & Vertical Adjustment Process (Assembly line, Garage, Changes during use)	PAL1999 – Huhn "Lichtest" Germany (2001 -2007) UK- VCA Survey 2007 Motor Transport Institute – Warsaw, Poland
Dynamic Vehicle Movement: acceleration and braking	PhD Dissertation 1995 - Joachim Damasky
Geometry: Road curvature, driver's eye position Slopes and hills, bends, headlamp mounting height, etc.	PhD Dissertation 1995 - Joachim Damasky
Variation of load in passenger compartment, in trunk and due to weight of fuel <b>Static Automatic Levelling will only address these variations</b>	UMTRI 2007 Matha 2010 Mobility Investigation 2008 (Funded by German MOT) GTB study 2011

## Glare and Headlamp Levelling

Different effects and tolerances in „real life“, which lead to glare or decreased range of headlamp light distributions:

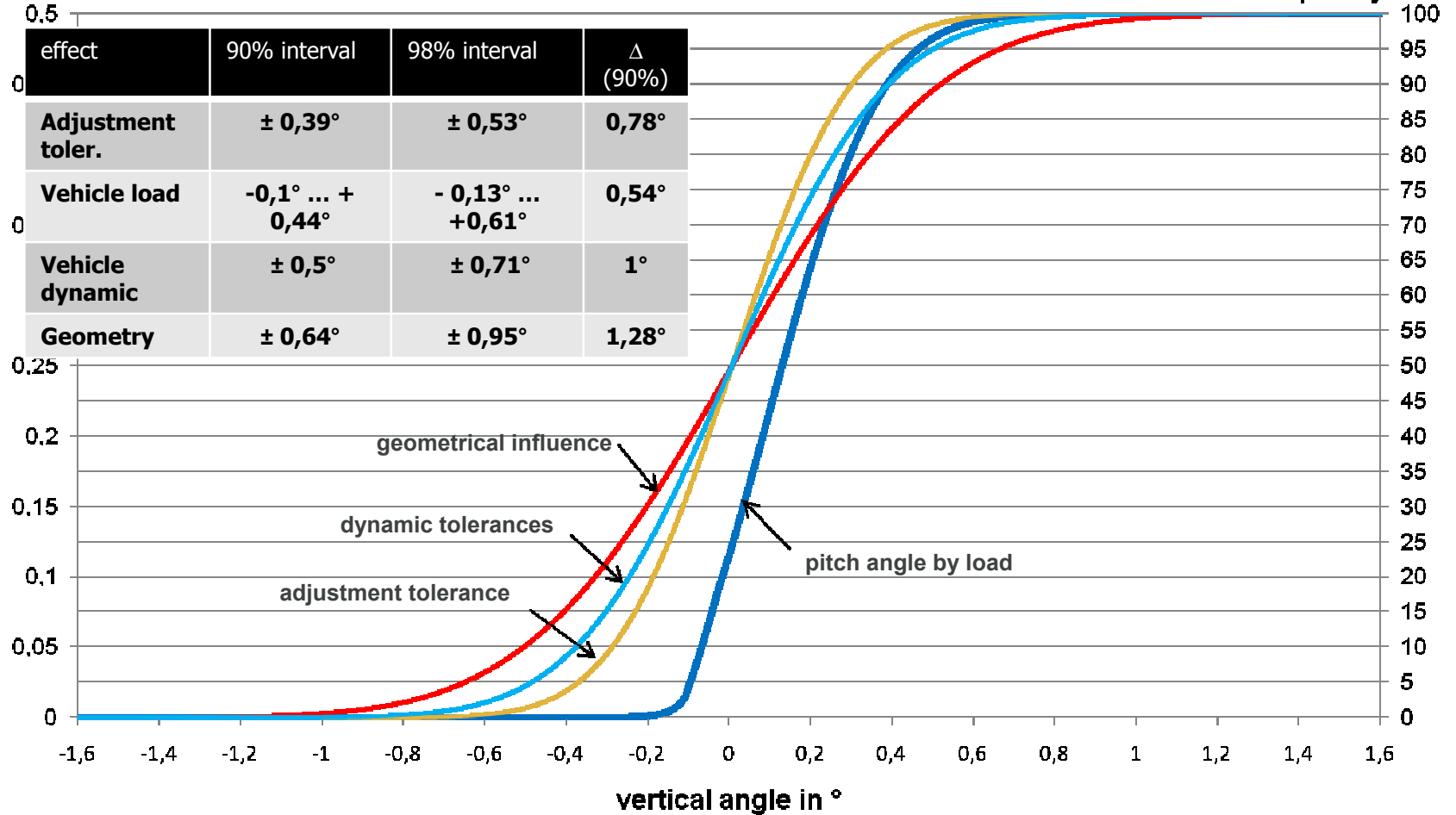


## Automatic Levelling

# Vertical Frequency Spectrum

## Summary

frequency / 1



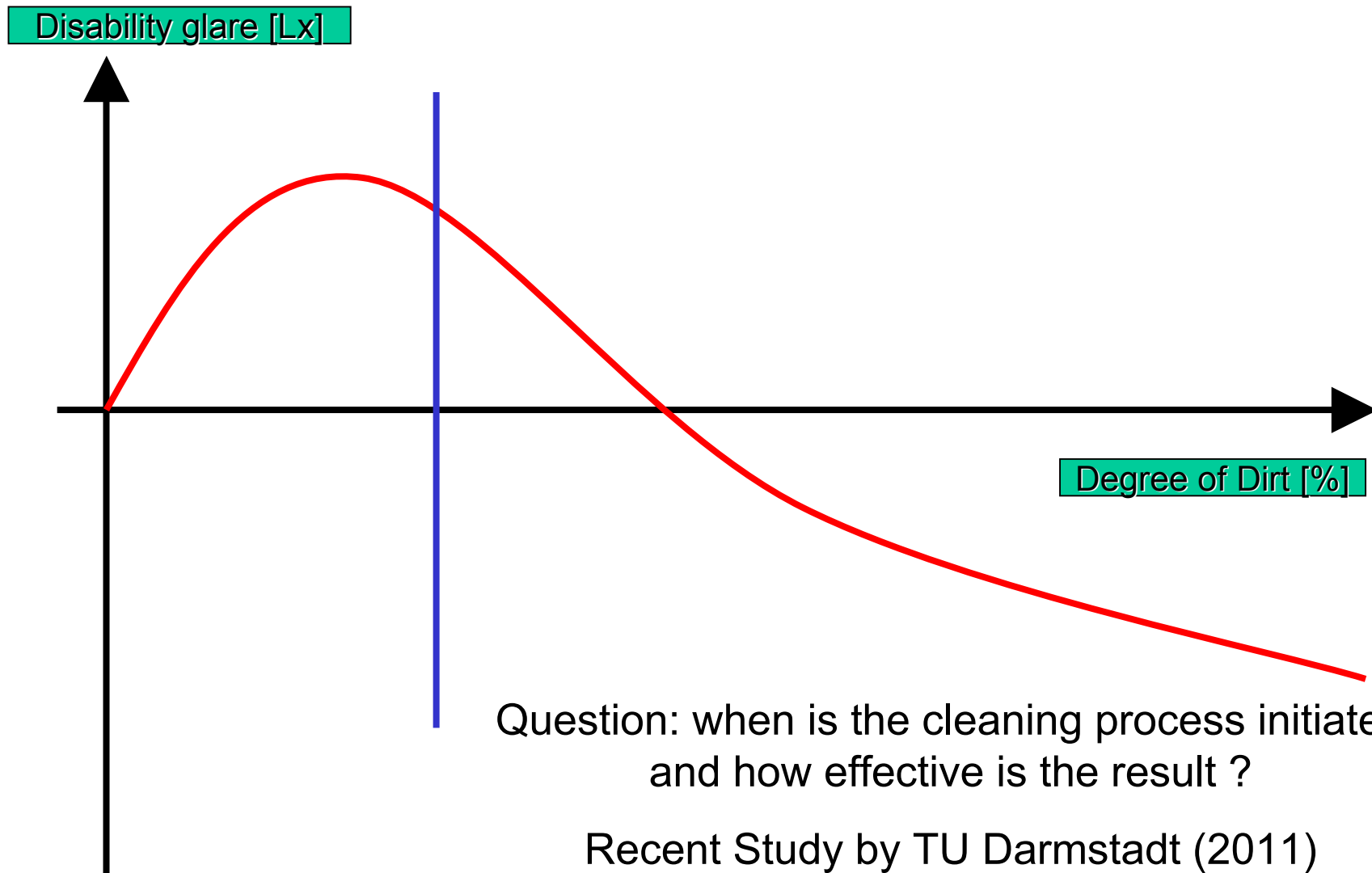


# Additional Cost and Weight

- Differences between manual and automatic levelling :  
To set up the automatic levelling, we need to fit the vehicle with more wiring (cable harness), a calculator and two or more additional sensors  
Only the thumb wheel of the manual device can be removed
- These additional sensors and wiring will cost between 20 and 35 euros (up to 40 Euros for certain electronic designs of vehicle).  
Total costs of app. 500 Mio Euros per year in Europe !  
The thumb wheel is only around 3 Euros
- This automatic device weighs at least an additional 400-500g per vehicle
- This generates cost and weight which can only be imposed with a real safety justification

1. Headlamp Cleaning Device was introduced as a mandatory feature first in Sweden in 1973 as a comfort feature (geographical situation, not to avoid discomfort glare)
2. First Introduction of Xenon in 1991 : Regulation required Cleaning Device
3. Application: operates in connection with windshield wipers

# Headlamp Cleaning



# Summary & Outlook

- Front Lighting is developing rapidly
- Regulation has to make sure, that innovations will be approved and used to improve safety at night
- Pro-active action has to be organized in order to be on time when innovations enter the market
- Challenge to define future driving assistance systems with many parameters precise, accurately, and as simple as possible

# Thanks for Your Attention !