Measurement variation within automotive display assessments

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Outline

- Overview of research
  - Vehicle interiors under ambient light
  - Controlled lighting
- Measurement geometry
- Improving control of measurements

Vehicle interiors under ambient light

- Colour matching

- Distracting & disabling reflections

- Display readability

Vehicle interiors under ambient light

- Create a standardised lighting environment

- Controlled, repeatable & reproducible measurements

- Comparable to daylight

Loch Lomond, 15th September 2013

Why not just test outside?

Controlled lighting

*Ford Motor Company, Visual Performance Evaluation Lab , 2011*

Alenia Aeronautica, Sky Light Simulator, 2009

Controlled lighting

- Specified lighting to be comparable to daylight
  - Direct (sun)
    - Luminance, colour, direction, apparent diameter
  - Diffuse (sky)
    - Luminance, colour, distribution
- Lighting technologies
- Controlling the direction & distribution
  - Angle, height, distance – Azi & El
  - Repeatability & reproducibility & stability

Measurement geometry

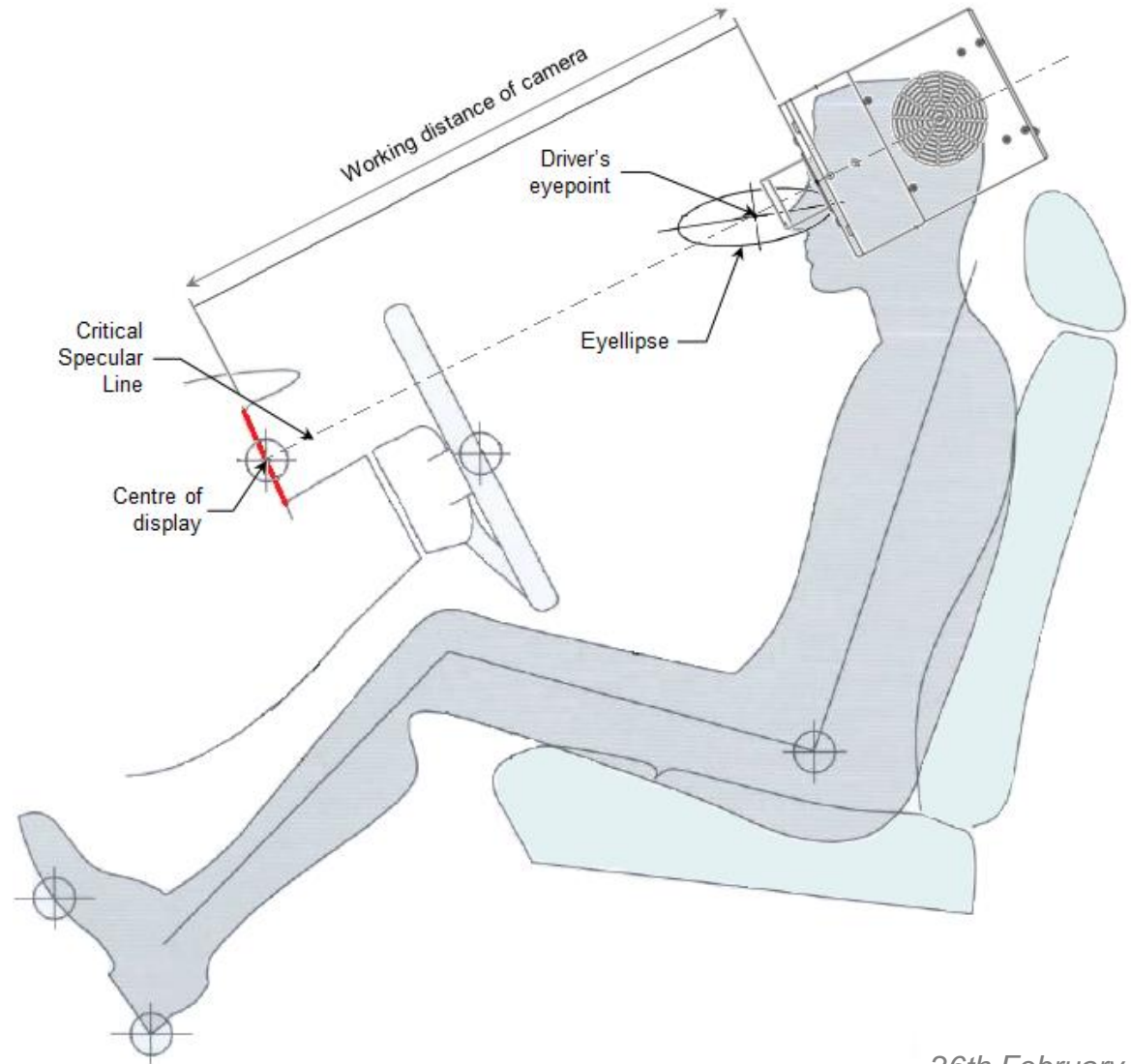## High ambient light illumination simulation
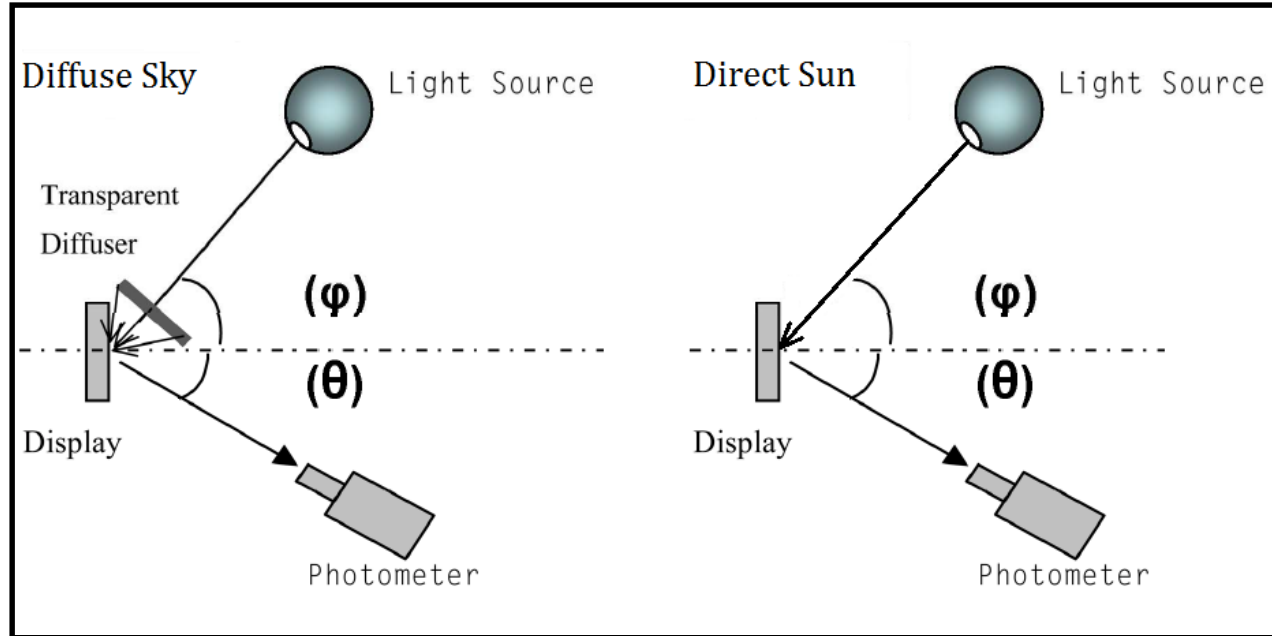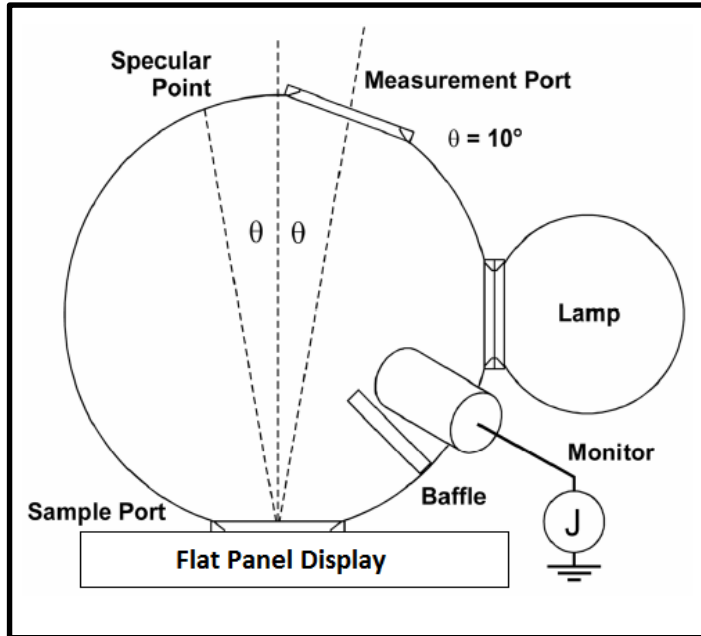
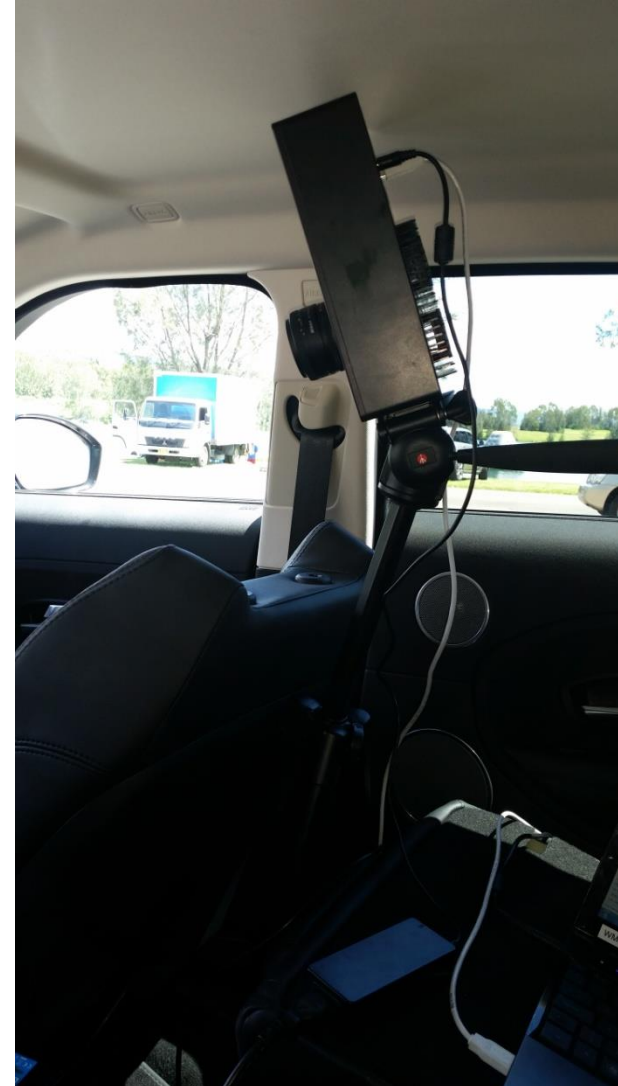*SAE J1757-1 Standard Metrology for Vehicular Displays, 2007*

- Test bench or in-situ measurements
- Diffuse and direct illumination

Measurement geometry

- Eyepoint

- Alignment to display centre

- Movement

Working distance of camera

Driver's eyepoint

Eyellipse

Critical Specular Line

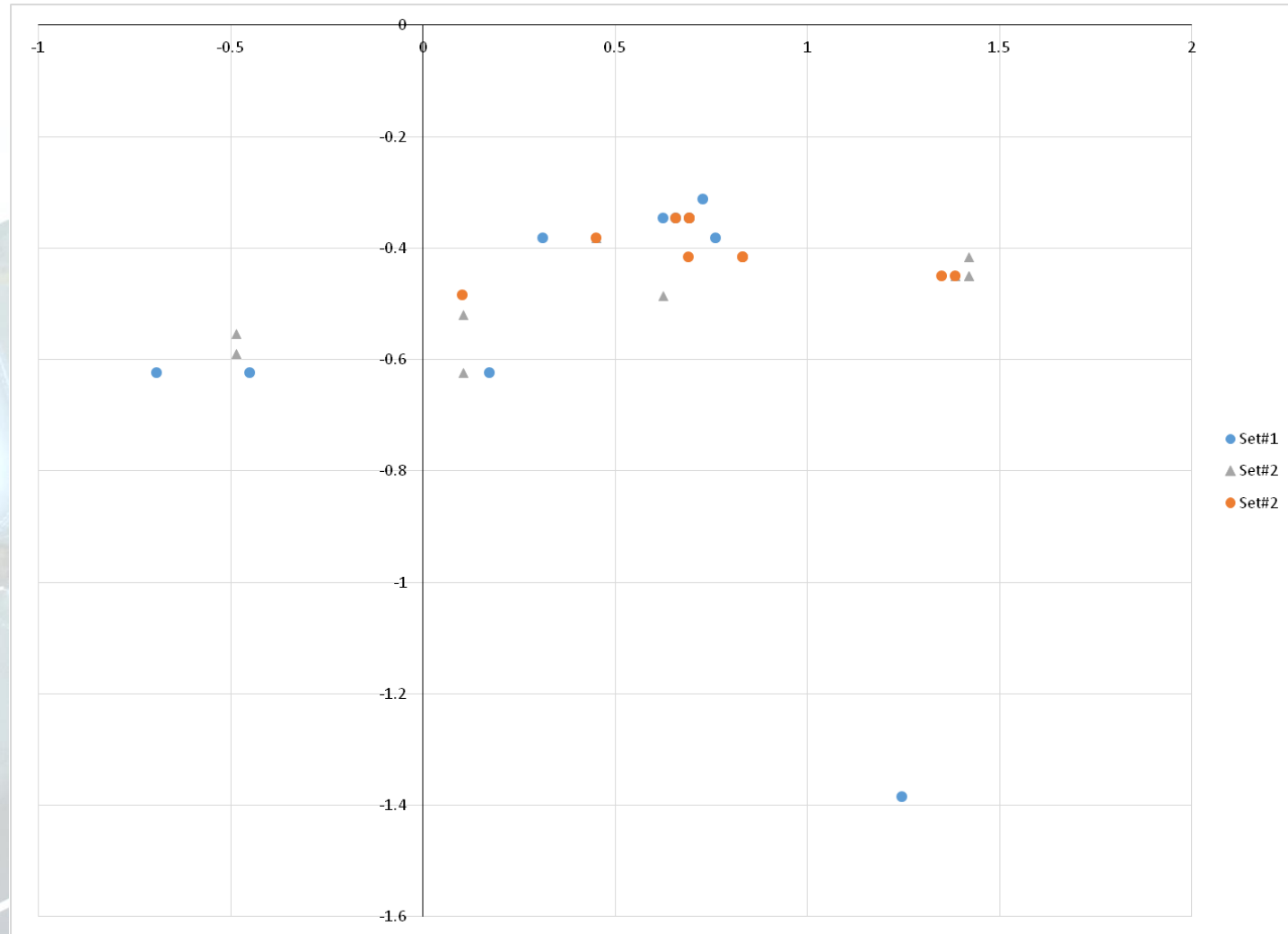Centre of display

Measurement geometry

Measurement geometry – Setup #1

– Alignment

  ▪ Min = 0.49mm

  ▪ Max = 1.86mm

  ▪ StdDev = 0.373

– Main issues

  ▪ Vibration from door closing

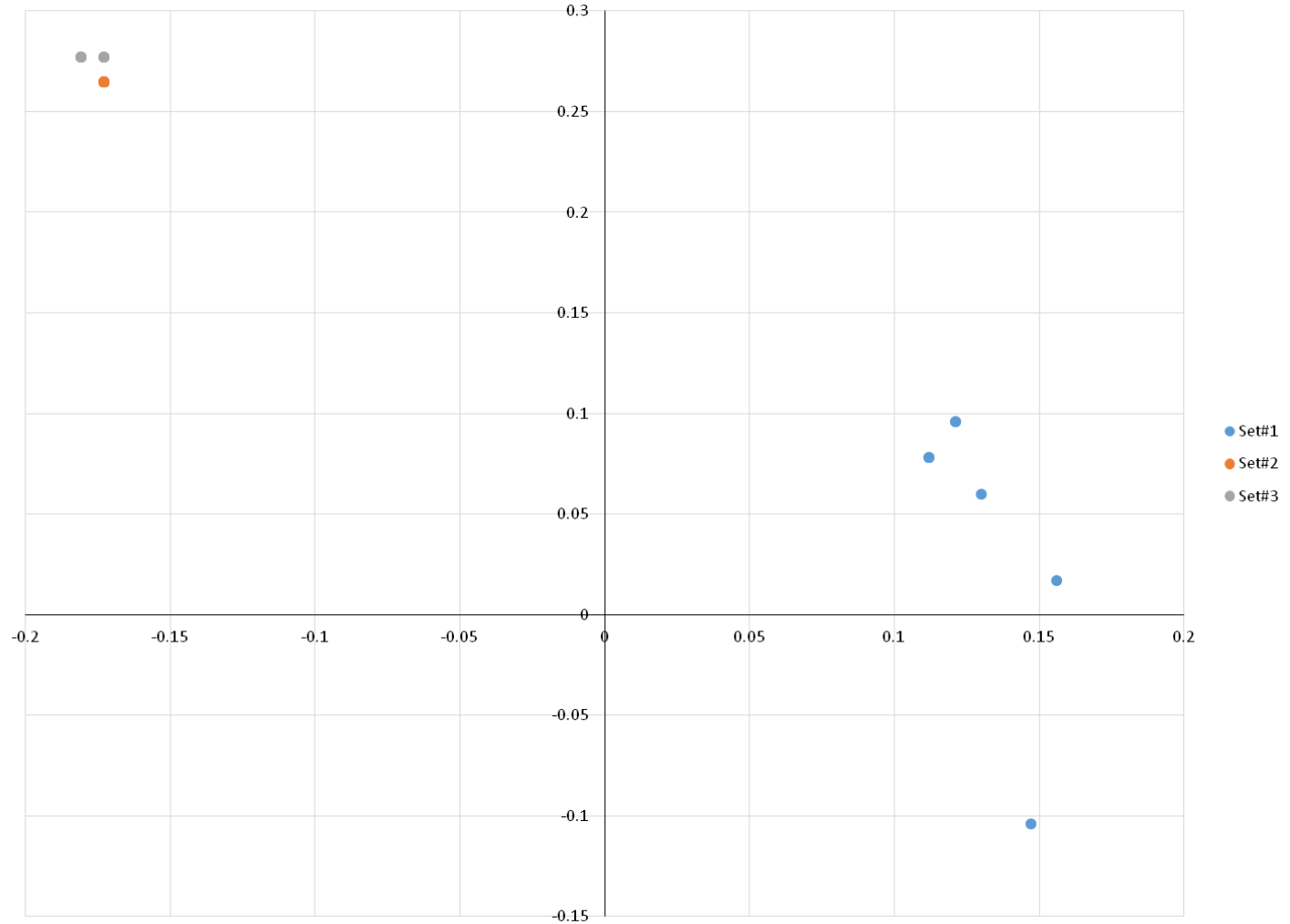 ▪ Compressibility of seat

  ▪ Eyepoint

  ▪ Precision alignment

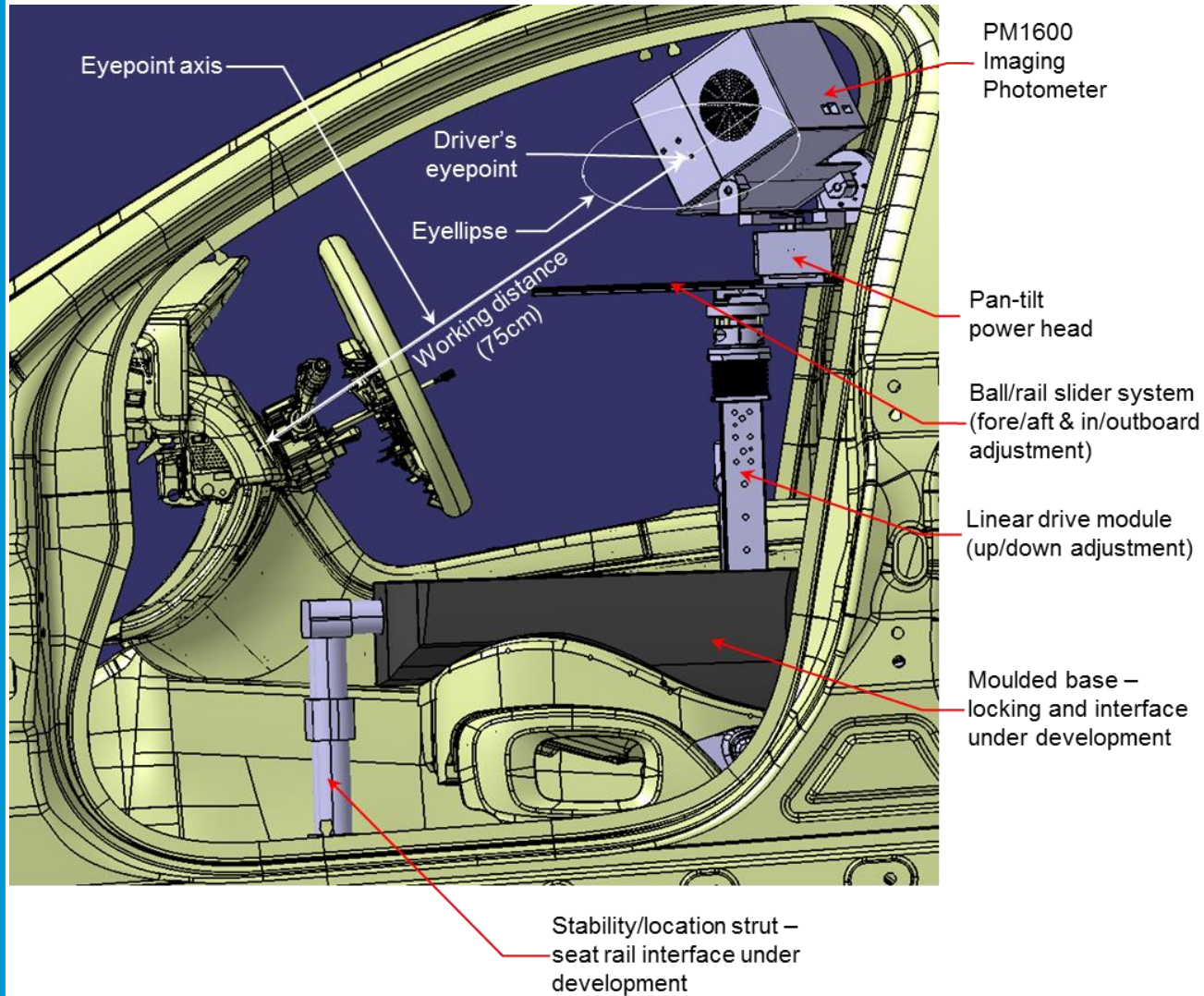# Measurement geometry – Setup #2

– Alignment

  ▪ Min = 0.136mm

  ▪ Max = 0.331mm

  ▪ StdDev = 0.0089

– Main issues

  ▪ Eyepoint

  ▪ Precision alignment

Improving control of measurements

PM1600 Imaging Photometer

Eyepoint axis

Driver's eyepoint

Eyellipse

Working distance (75cm)

Pan-tilt power head

Ball/rail slider system (fore/aft & in/outboard adjustment)

Linear drive module (up/down adjustment)

Moulded base – locking and interface under development

Stability/location strut – seat rail interface under development

– Relate eyepoint to a physical location

– Fine tune alignment

– Reduce movement in the system

– Reduce error between operators

Summary

- Vehicle interiors under ambient light
- Controlled lighting
- Measurement geometry
- Improving control of measurements

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