

# **BYK-mac i** **The Objective Eye for Effect Paint** **QC Solutions**

**Surface 2016, Henrik Folkerts, BYK-Gardner GmbH**

# Visual Assessment



# Visual Assessment



# Effect Coatings

80% of today's automotive finishes are effect coatings



- Metallic coatings accentuate the curved profile: Light – Dark Flop



- Pearlescent coatings result in a more spectacular color effect: Color Flop



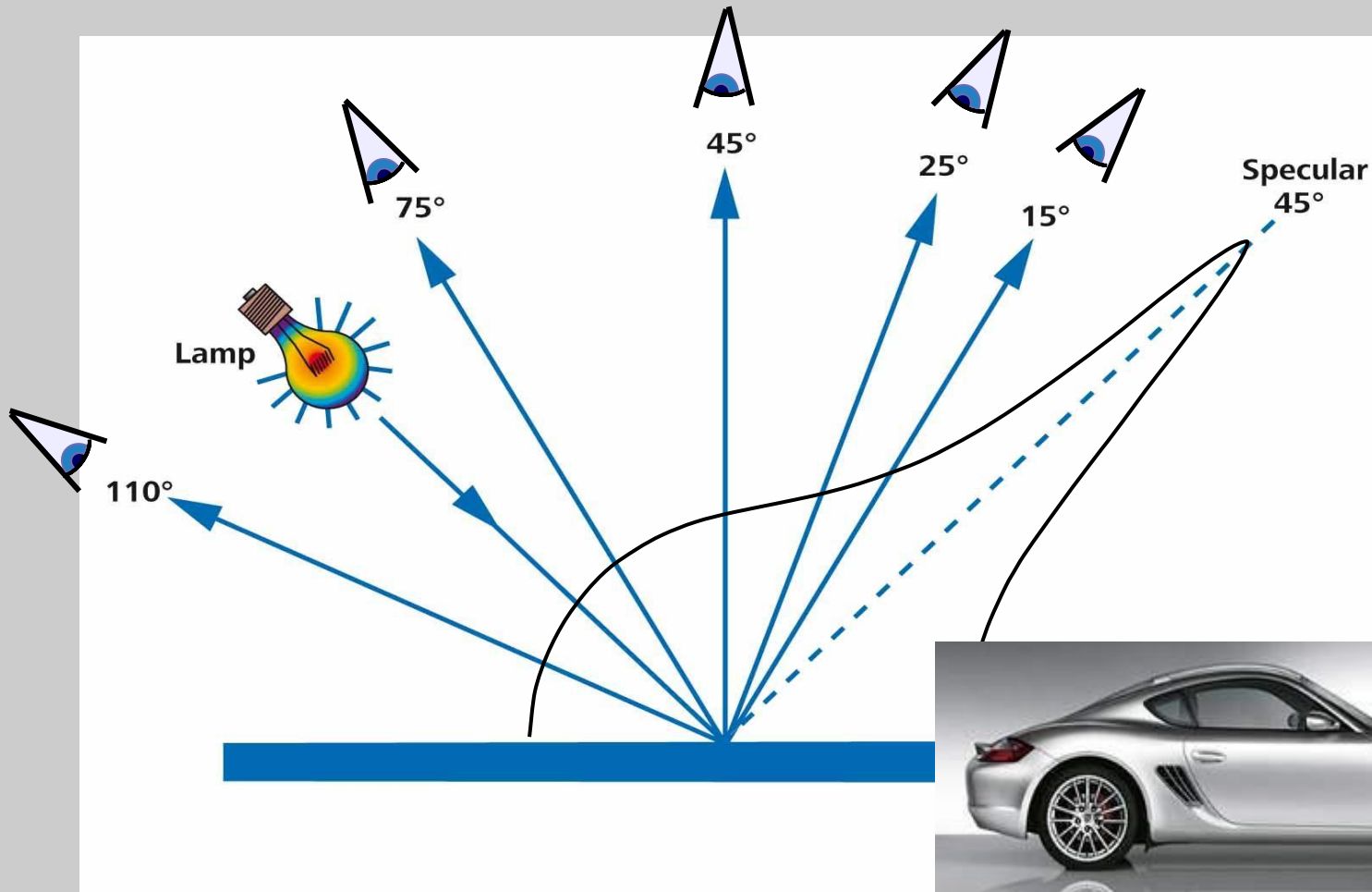
- Effect finishes with special glitter effect (Xirallics™), (Luxan™)

Photo: Courtesy of 



# Multi-angle Measurement Geometries

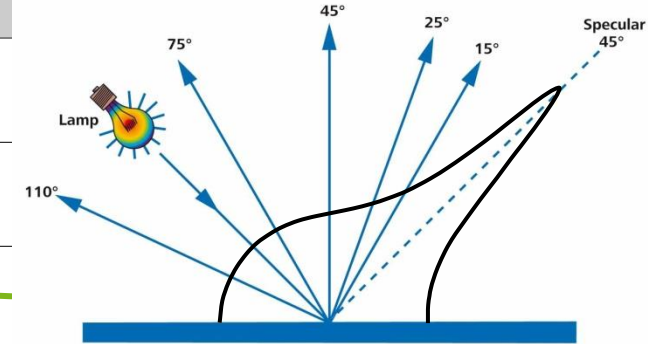
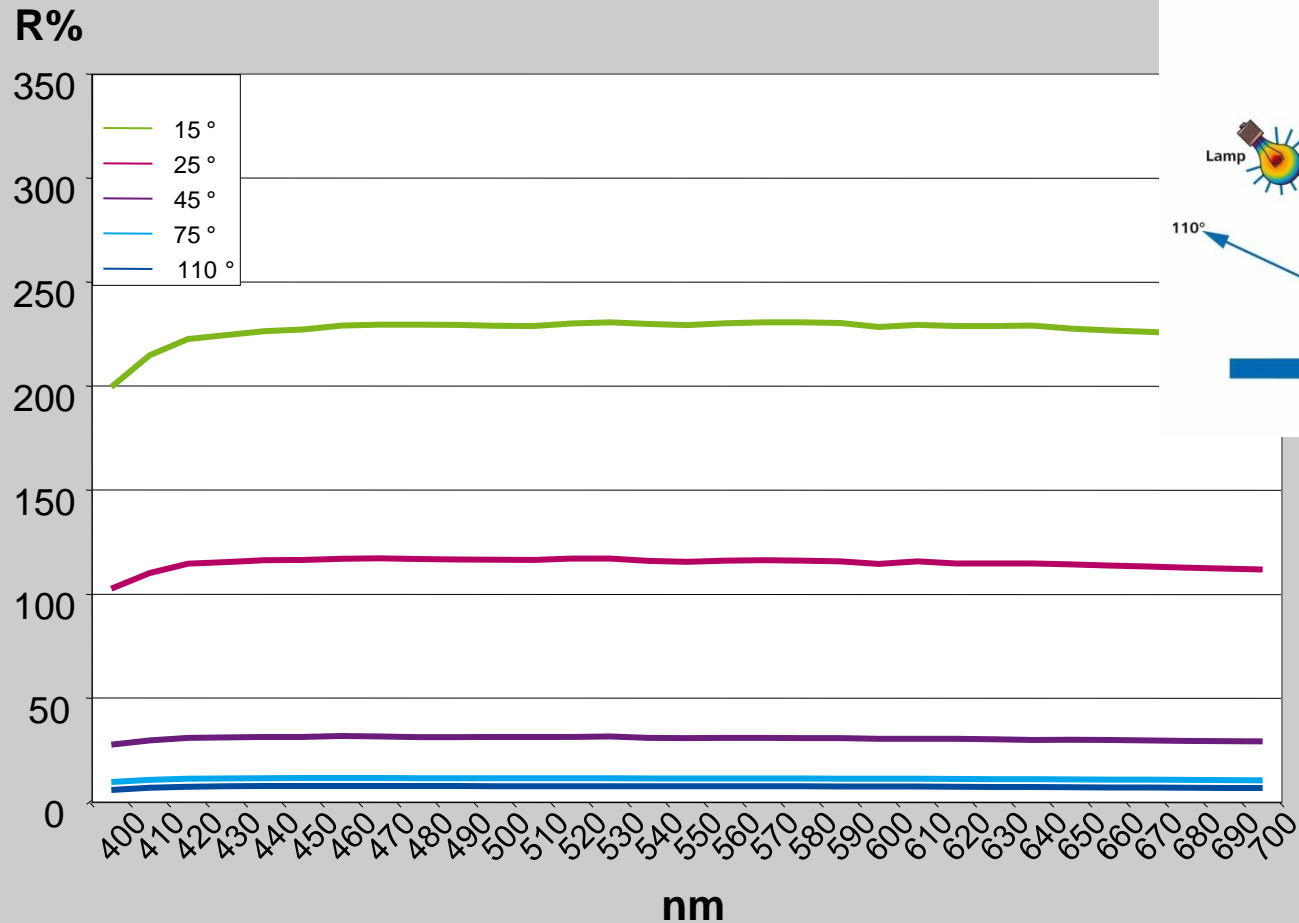
## Aspecular viewing angles





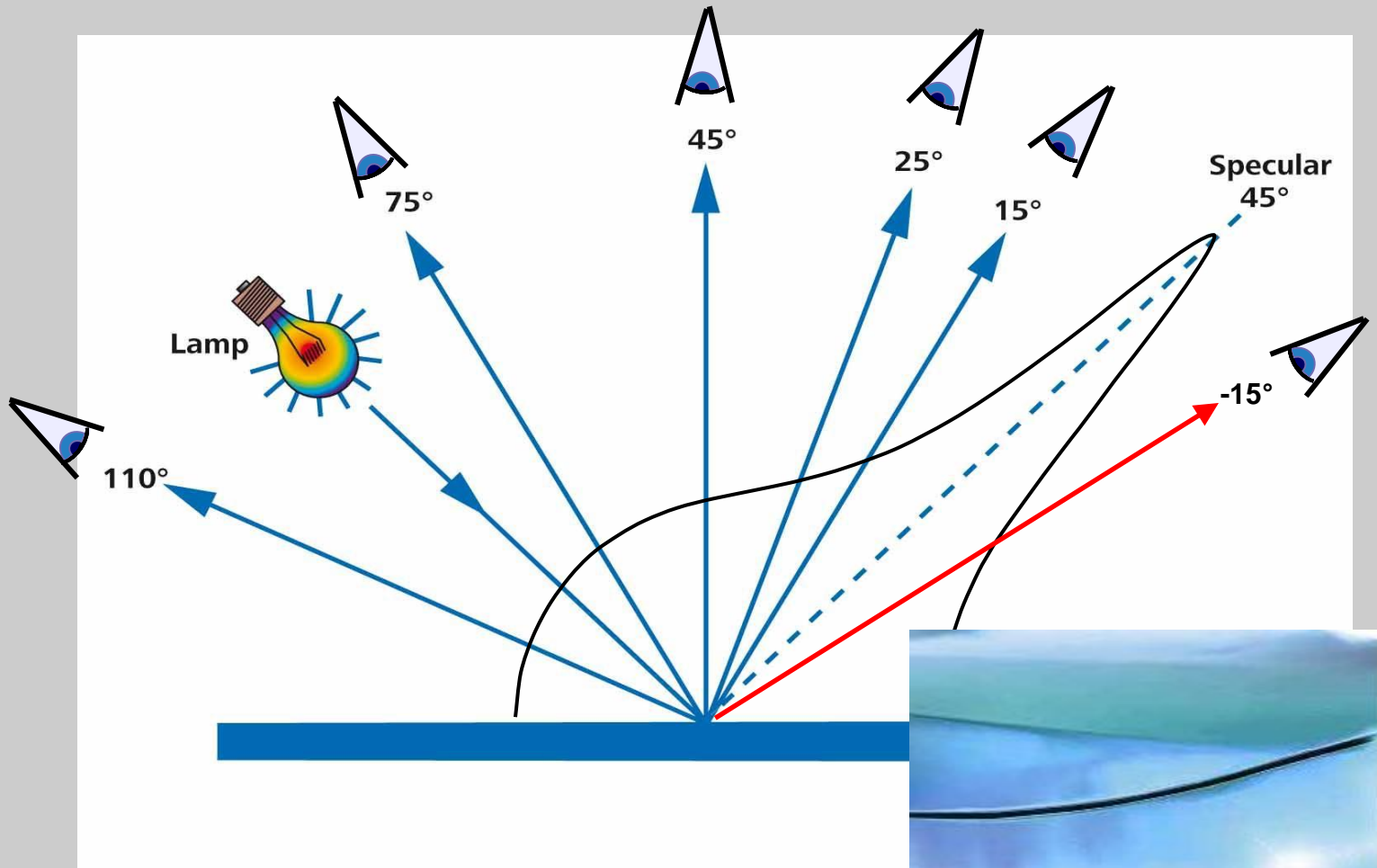
# Multi-angle Measurement Geometries

## Spectral reflectance – Metallic Silver



# Multi-angle Measurement Geometries

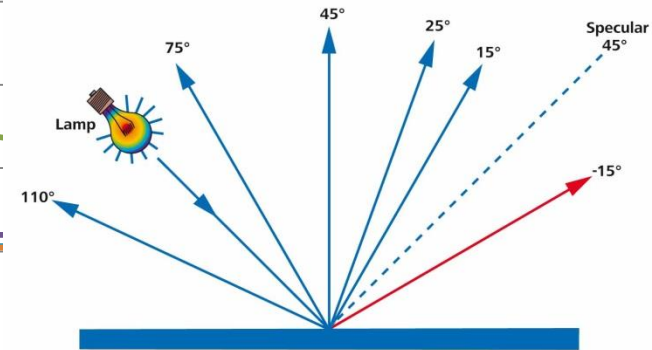
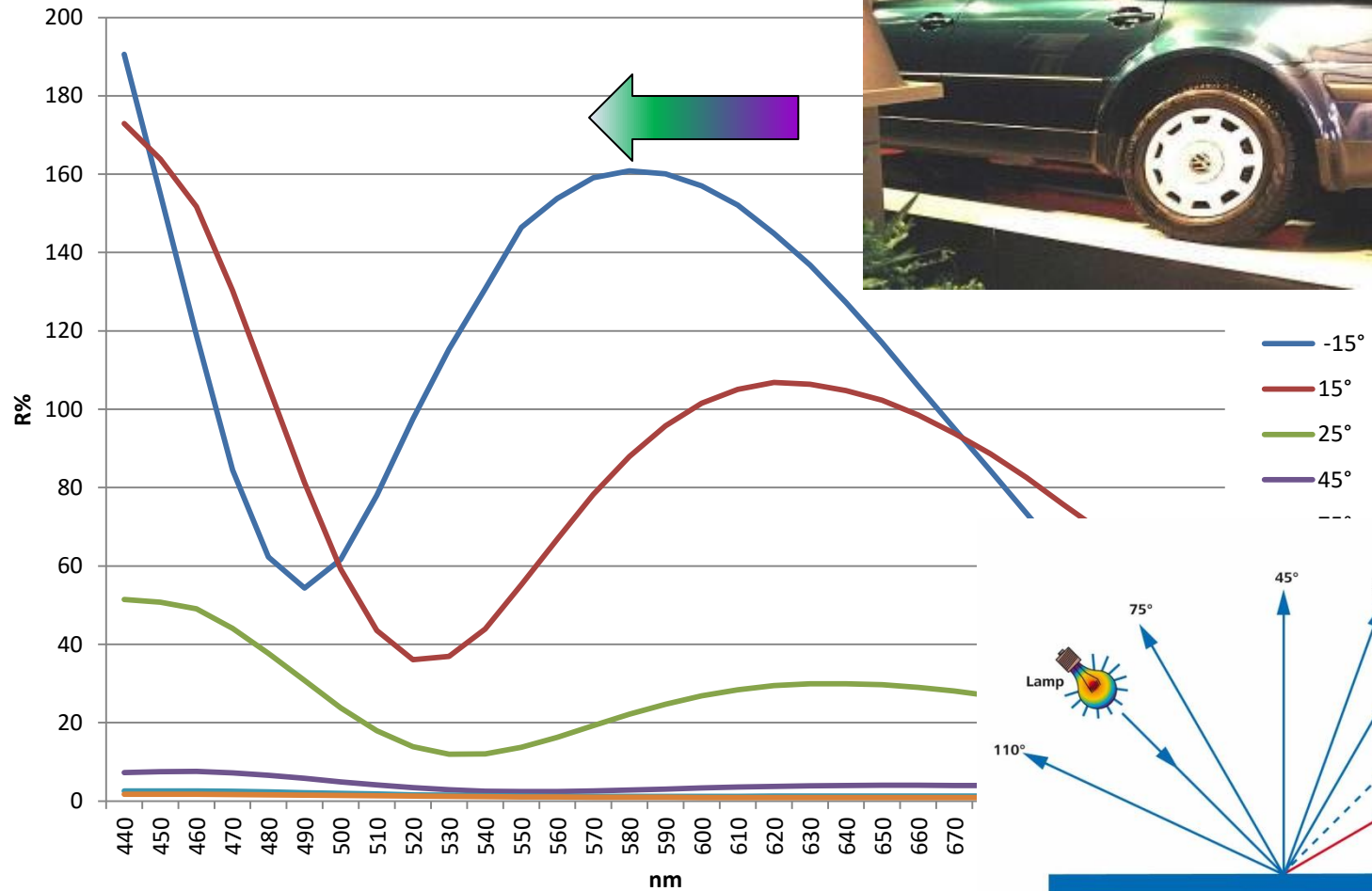
## Aspecular viewing angles



# Spectral Remission: Viola Fantasy™

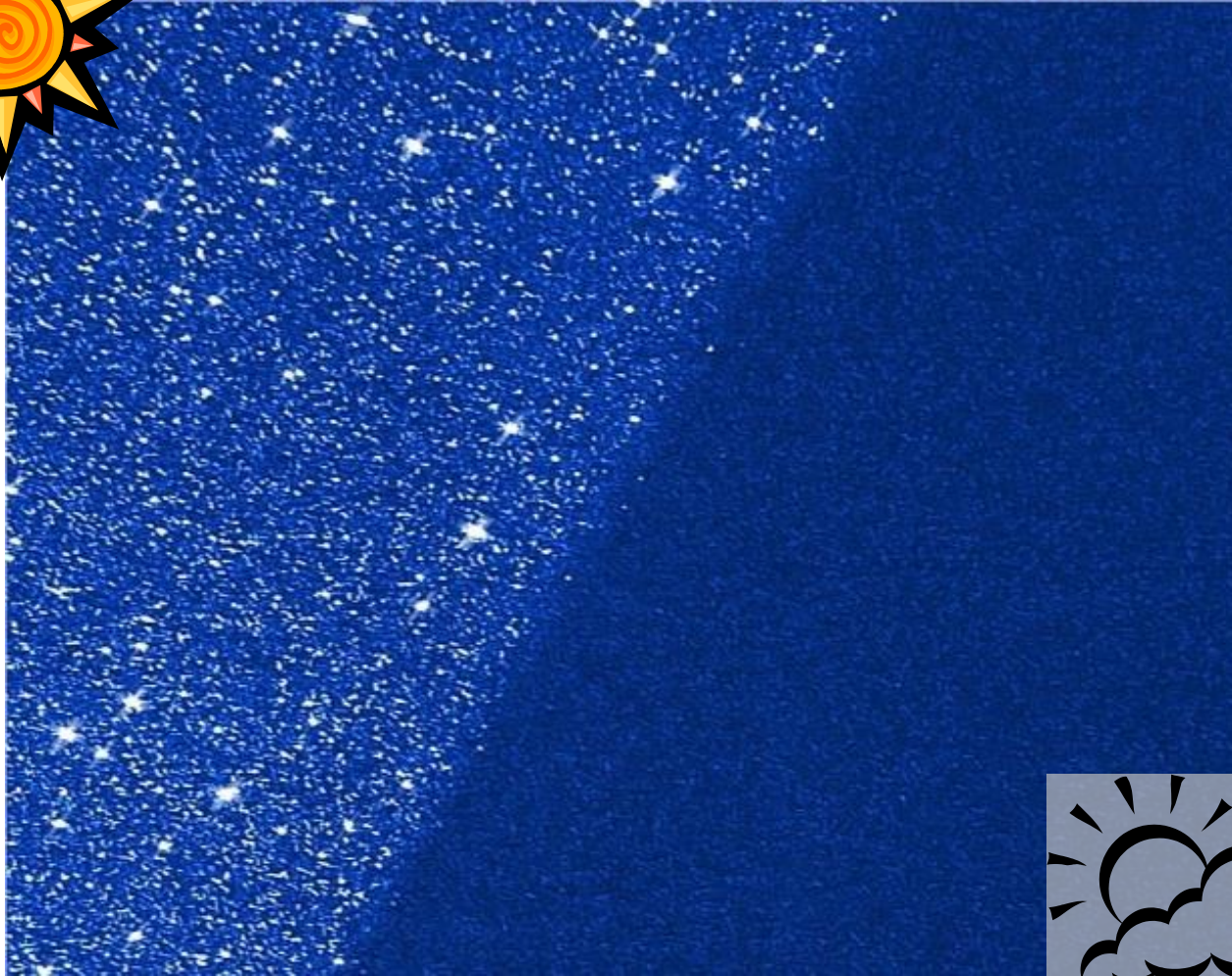
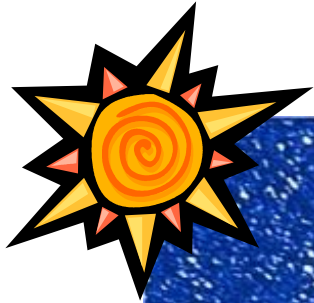
## Color Flop: Purple to Green

Viola Fantasy™



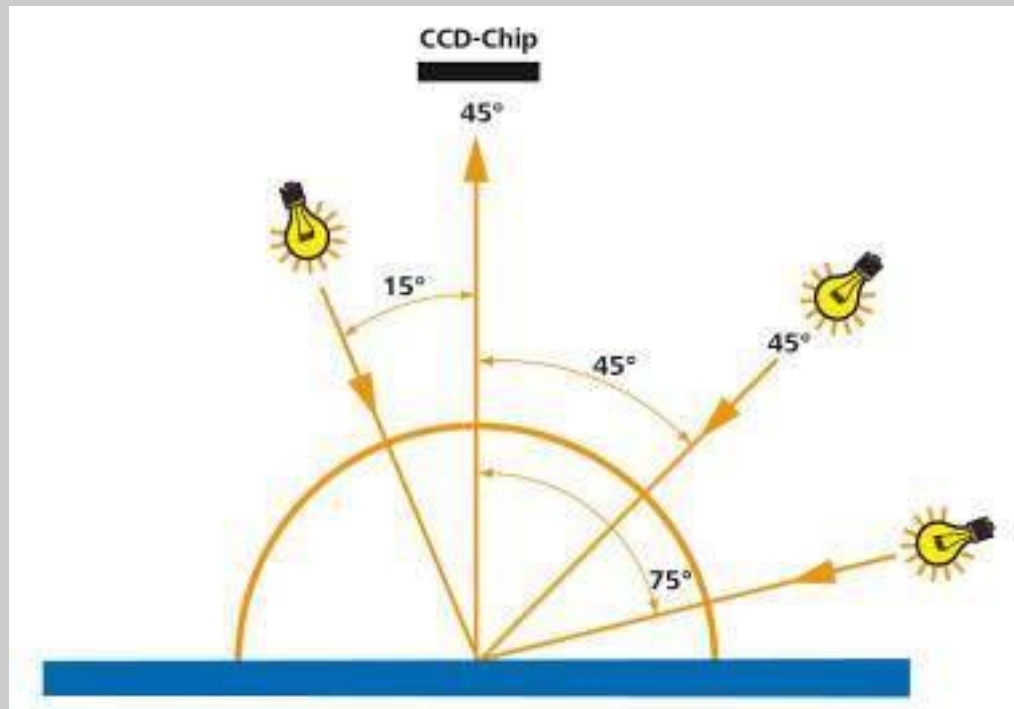


# Sparkle & Graininess



# Flake Characterization - Sparkle

## Evaluation of the optical properties



**Sunny sky:**  
**Direct illumination**

- Color starts to sparkle



# International Standards for Visual Evaluation of Effect Finishes

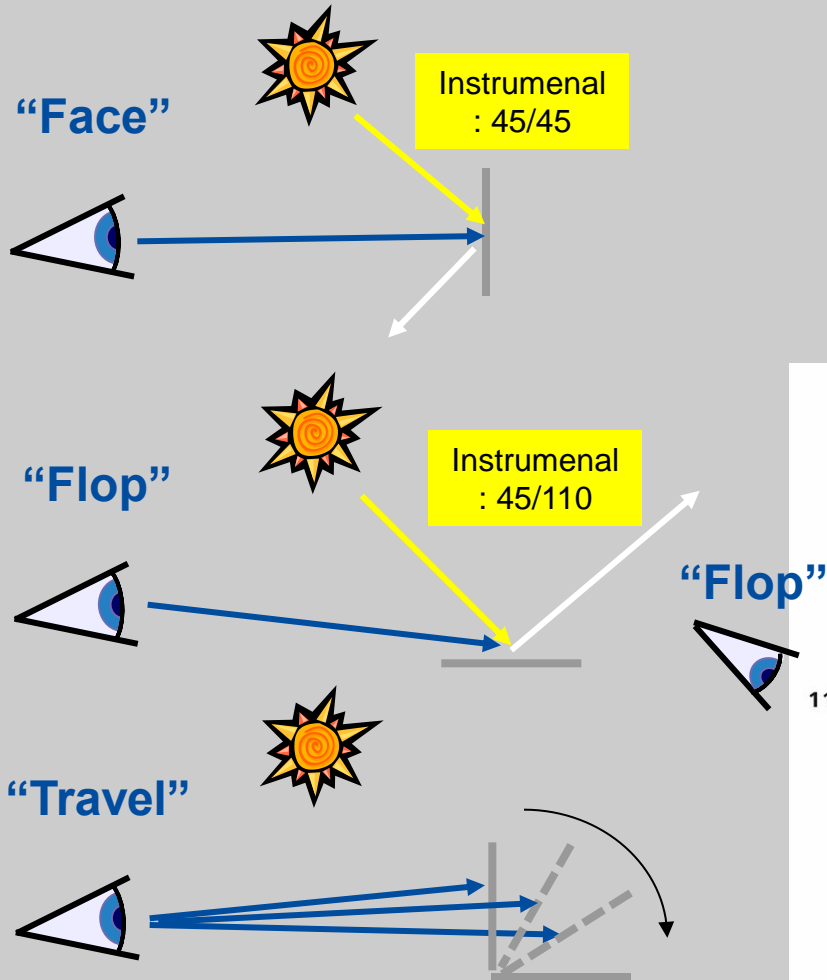
## **SAE J361:**

Procedure for Visual Evaluation of Interior and Exterior Automotive Trim

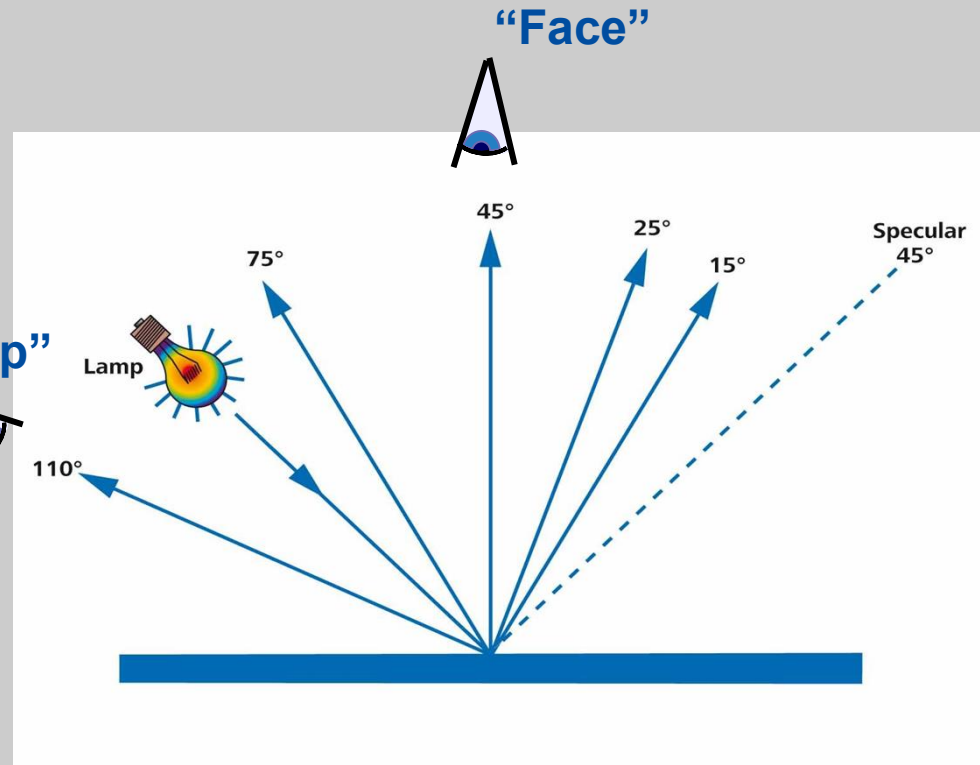
- Materials
- Lighting
- Viewing Environment
- Viewing and Positioning

→ Main focus on interior trim

# SAE J361 - Procedure for Visual Evaluation of Interior and Exterior Trim



How to match the visual impression with the instrumental measured ?



# International Standards for Visual Evaluation of Effect Finishes

## **VDA Guideline 280 Part 8:** Colorimetry for Motor Vehicles

- **Part A - General**  
Visual Color Matching and Color Assessment
- **Part B**  
Visual Color Matching Systems for Vehicle Interiors
- **Part C**  
Illumination for Color Matching of Effect Coatings  
on Vehicle Bodies or Parts of Bodies

# VDA 280 Part 8 C: Illumination for Color Matching of Effect Coatings on Vehicle Bodies or Parts of Bodies

## **Illumination and observation angles and the relationship to the measurement angle for metallic and slightly flip-flop effect paints**

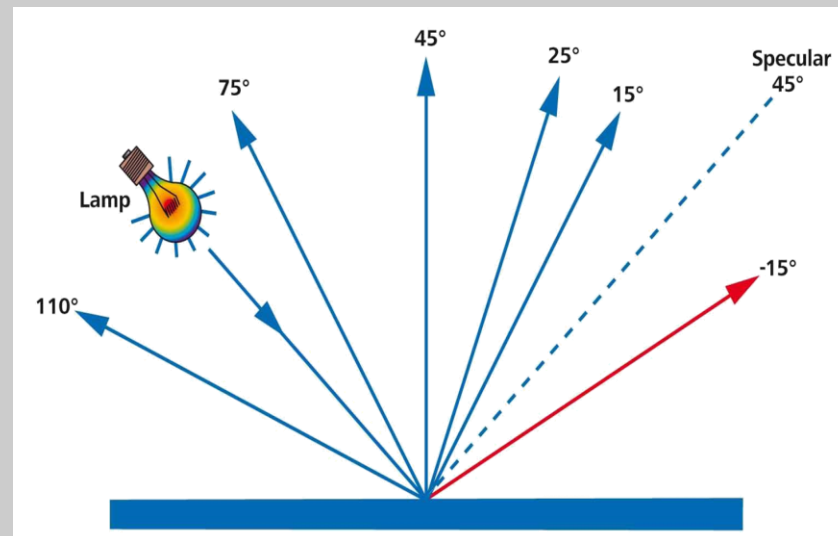
- Illumination and test environment
- Illumination angle  $45^\circ$  preferably fixed  
Viewing angle  $-15^\circ/15^\circ/25^\circ/45^\circ/75^\circ/110^\circ$
- Observation conditions for Color
  - movement of observer (observer modulation)
  - changing sample position (sample modulation)



# VDA 280 8 Part C: Illumination for Color Matching of Effect Coatings on Vehicle Bodies or Parts of Bodies

## Illumination and observation angles and the relationship to the measurement angle for metallic and slightly flip-flop effect paints

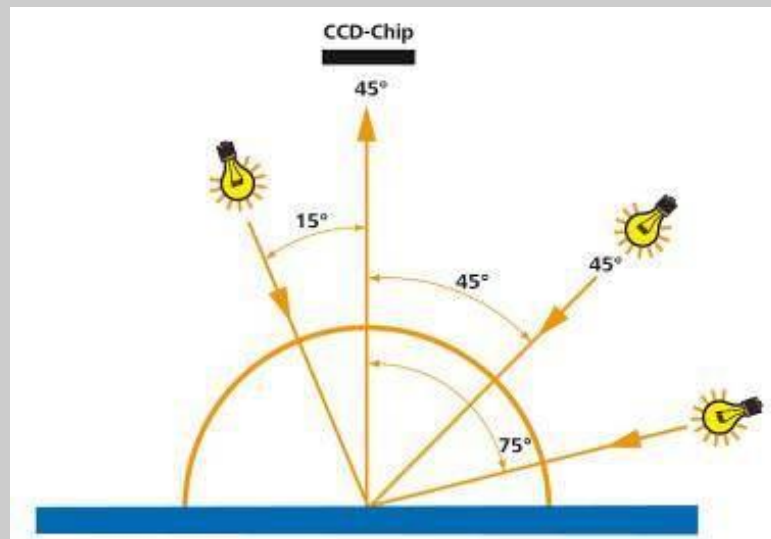
- Illumination and test environment
- Illumination angle  $45^\circ$  preferably fixed  
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# VDA 280 8 Part C: Illumination for Color Matching of Effect Coatings on Vehicle Bodies or Parts of Bodies

## Illumination and observation angles and the relationship to the measurement angle for metallic and slightly flip-flop effect paints

- Observation conditions for Sparkle  
→ illumination from several directions (illumination modulation)



# Visual Evaluation of Effect Finishes – What is used?

Color: Regular light Booth with Sample Holder



Viewing and Illumination conditions are changing

No direct illumination because of diffuser panel in front of light sources.



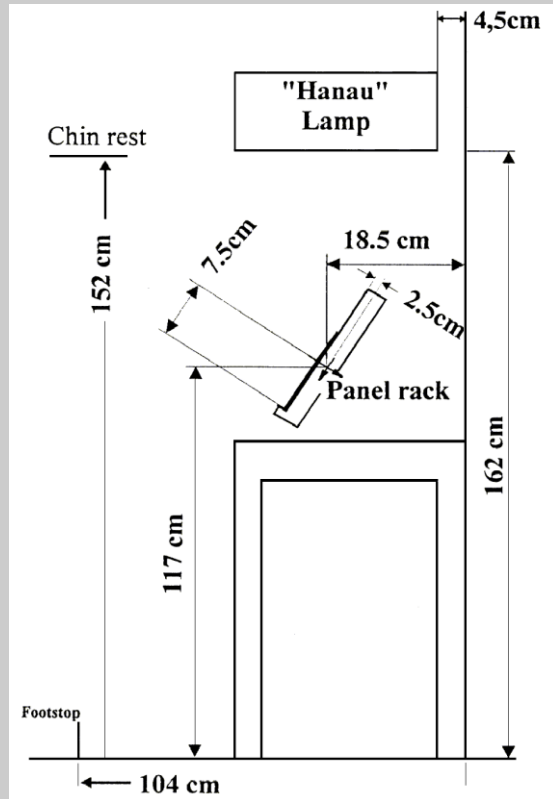
- Tilttable table



- Fixed angle table: 15° - 25° - 45° - 75° - 110°

# Visual Evaluation of Effect Finishes – What is used?

## Color: Individual Examination Stands

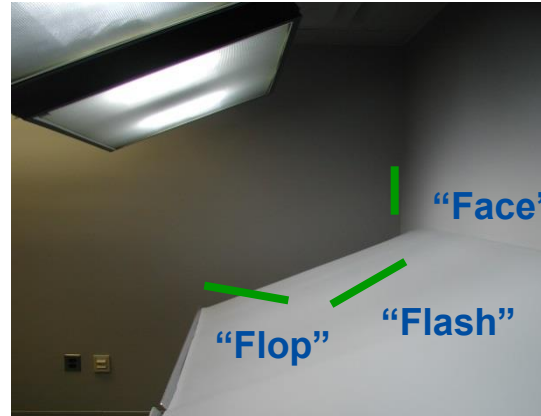


- Defined viewing position
- Enclosed room with color neutral walls or enclosed curtain
- Manual sample tilting or tiltable table to simulate different viewing angles

# Visual Evaluation compared to Instrument's Geometry Examination Stands

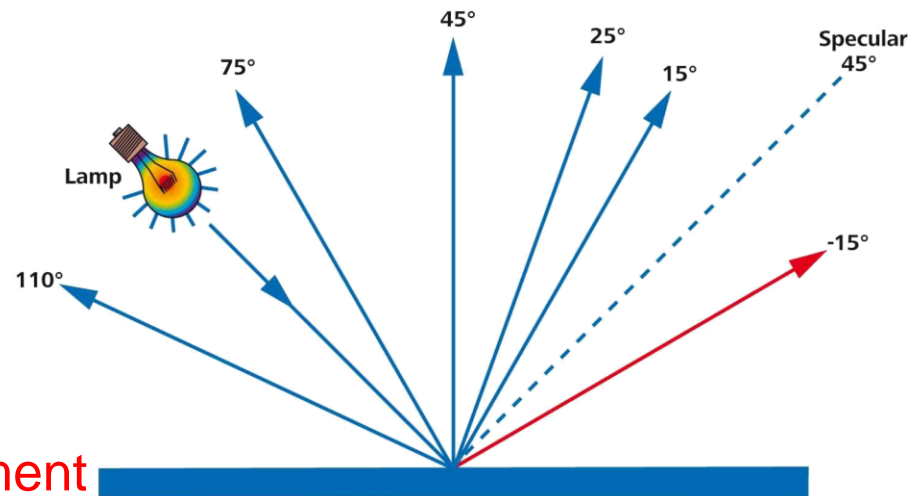
## Visual Evaluation:

Illumination and viewing angle are changing depending on panel position.



## Instrumental Evaluation:

Illumination angle is fixed and detection angle is always relative to specular reflection.



Potential risk of disagreement  
between visual + instrument

# Visual Evaluation of Effect Finishes – What is used?

## Lighting Studios (Willing)



Courtesy of Forchheim und Willing

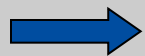
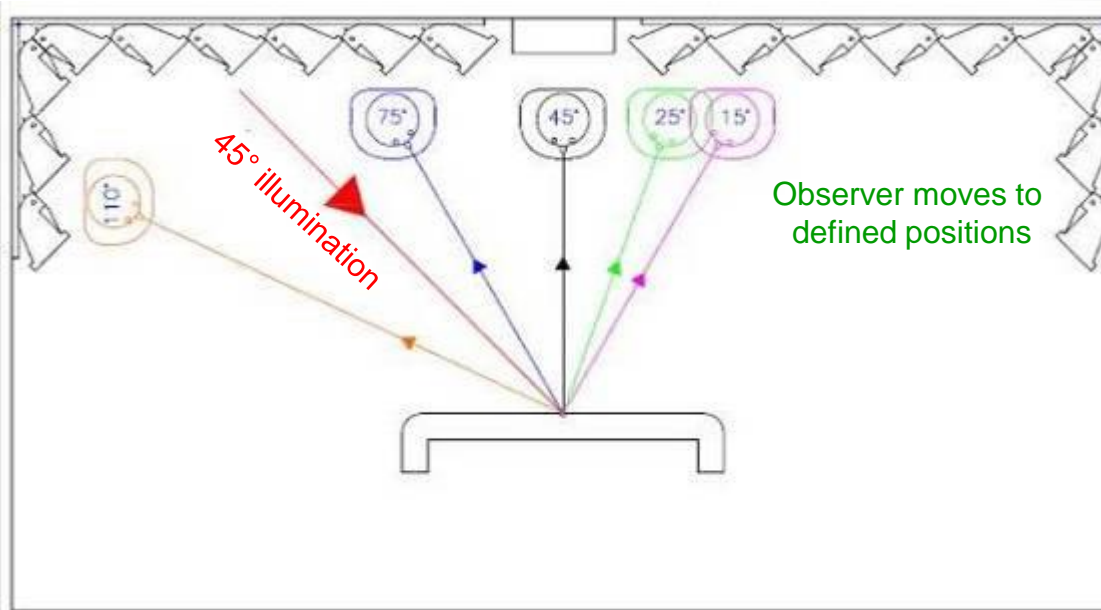
### Large lighting studios: – up to 8 m x 6 m

- Ideal for complete cars or add-on parts
- Fixed 45° illumination
- Observer can move within the studio to simulate different viewing angles

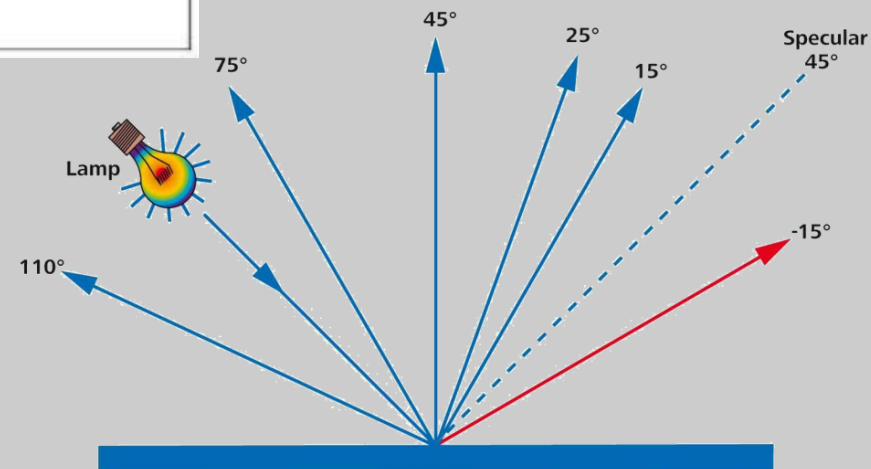


# Visual Evaluation of Effect Finishes – What is used?

## Lighting Studios



Good agreement with  
instrument's geometry



# Visual Evaluation of Effect Finishes – What is used?

## Sparkle: Sunshine or Spotlight

Appearance of effect finishes depends on illumination conditions:



**Sunny sky: Direct illumination**

- Color starts to sparkle

# Visual Evaluation of Effect Finishes – What is used?

## Sparkle: Sunshine or Spotlight



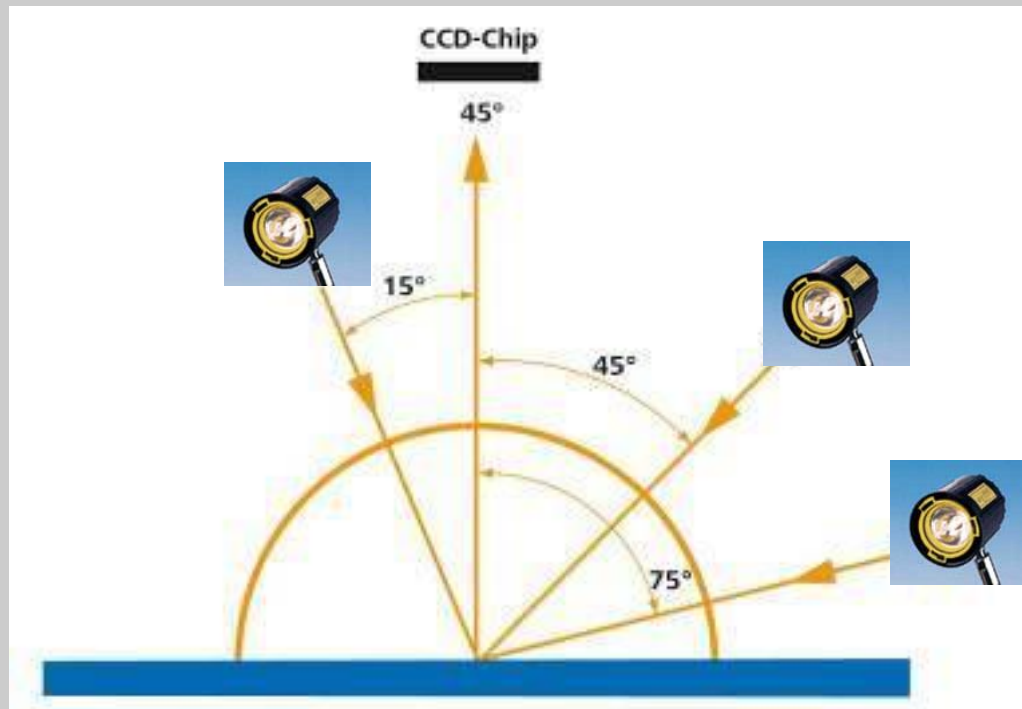
- Visual evaluation in bright sunshine  
→ Highly weather dependent

- Halogenlamp mounted on stand
- Quick check with Mini Maglite®



# Visual Evaluation of Effect Finishes – What is used?

## Sparkle: Sunshine or Spotlight



**Sunny sky:**  
**Direct illumination**

- Color starts to sparkle



# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



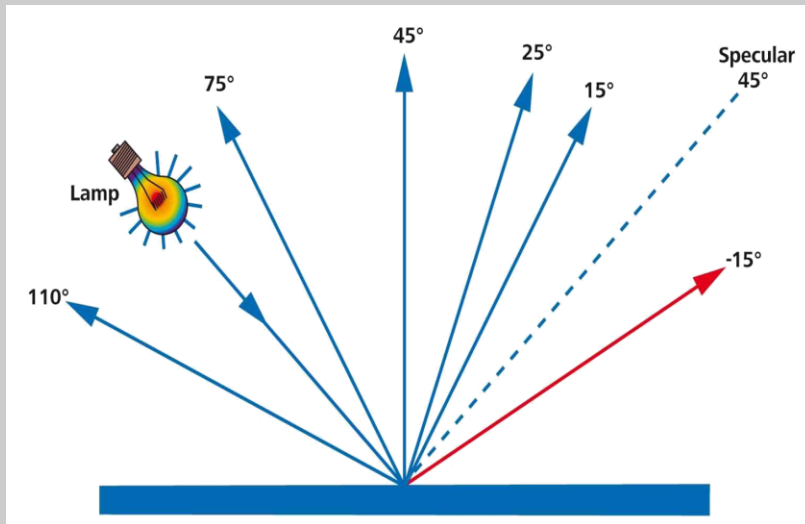
**byko-spectra *effect***

multi-angle color  
& sparkle control

# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*

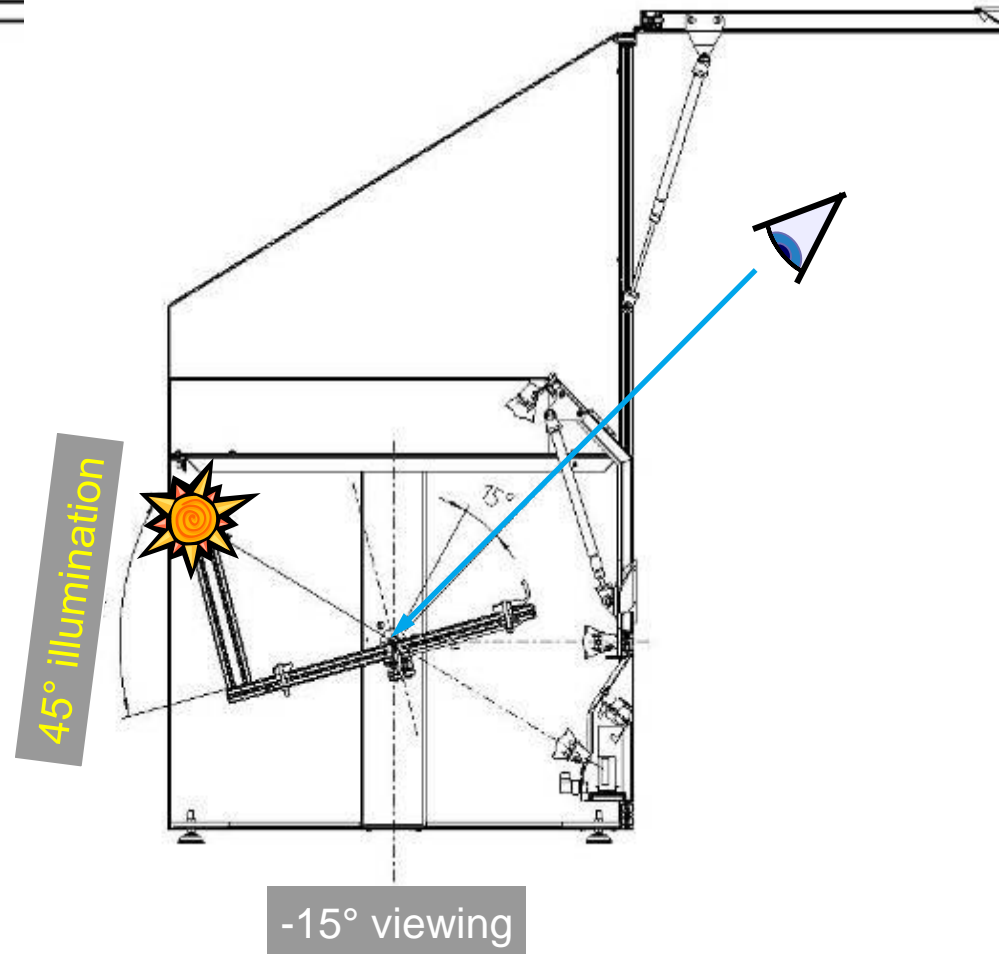
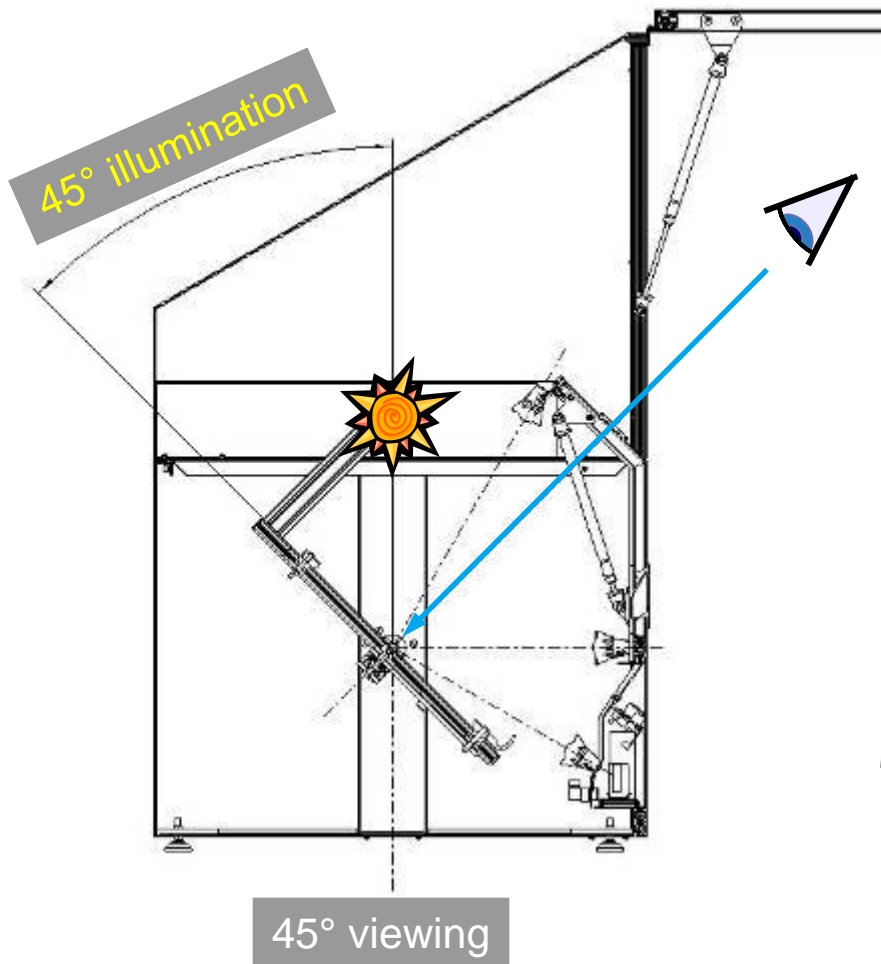
- Daylight illumination under  $45^\circ$
- Tiltable sample table to simulated 6-viewing angles:  
 $-15^\circ$ ,  $15^\circ$ ,  $25^\circ$ ,  $45^\circ$ ,  $75^\circ$ ,  $110^\circ$





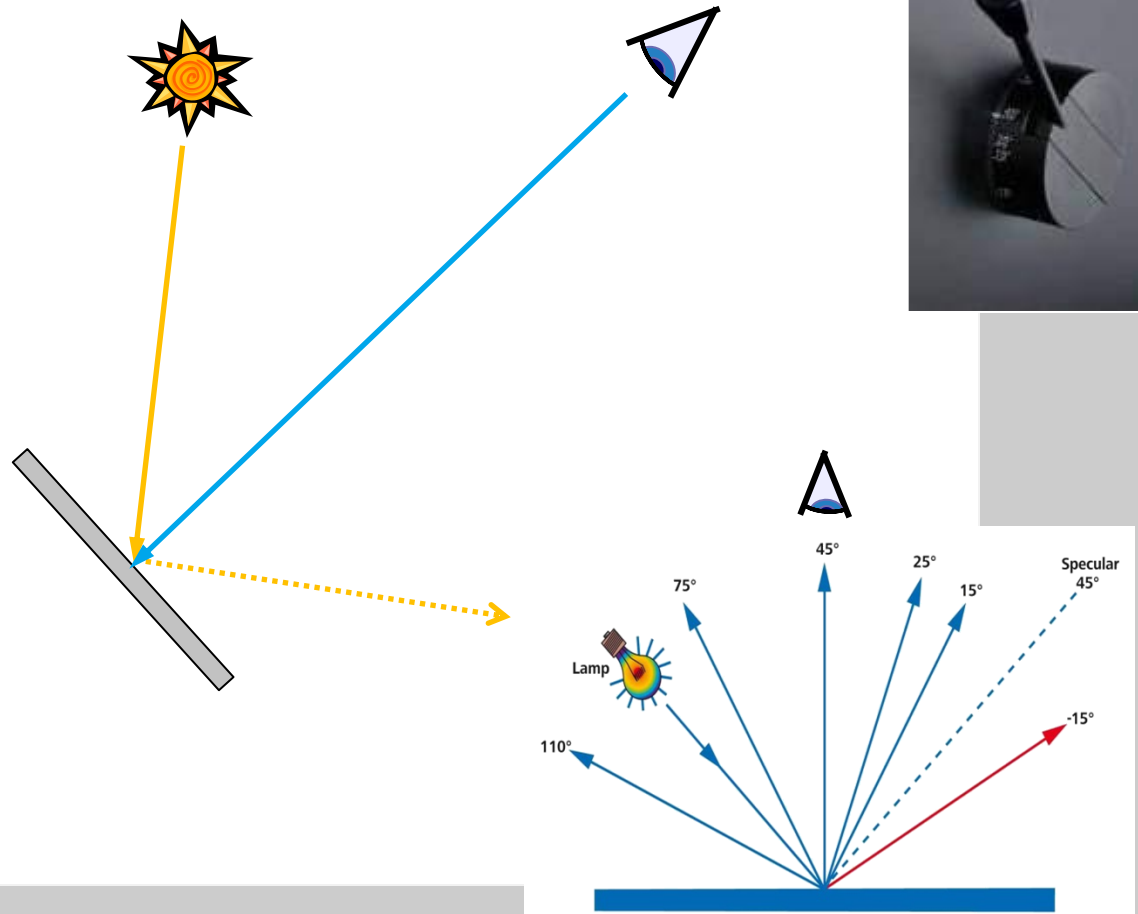
# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



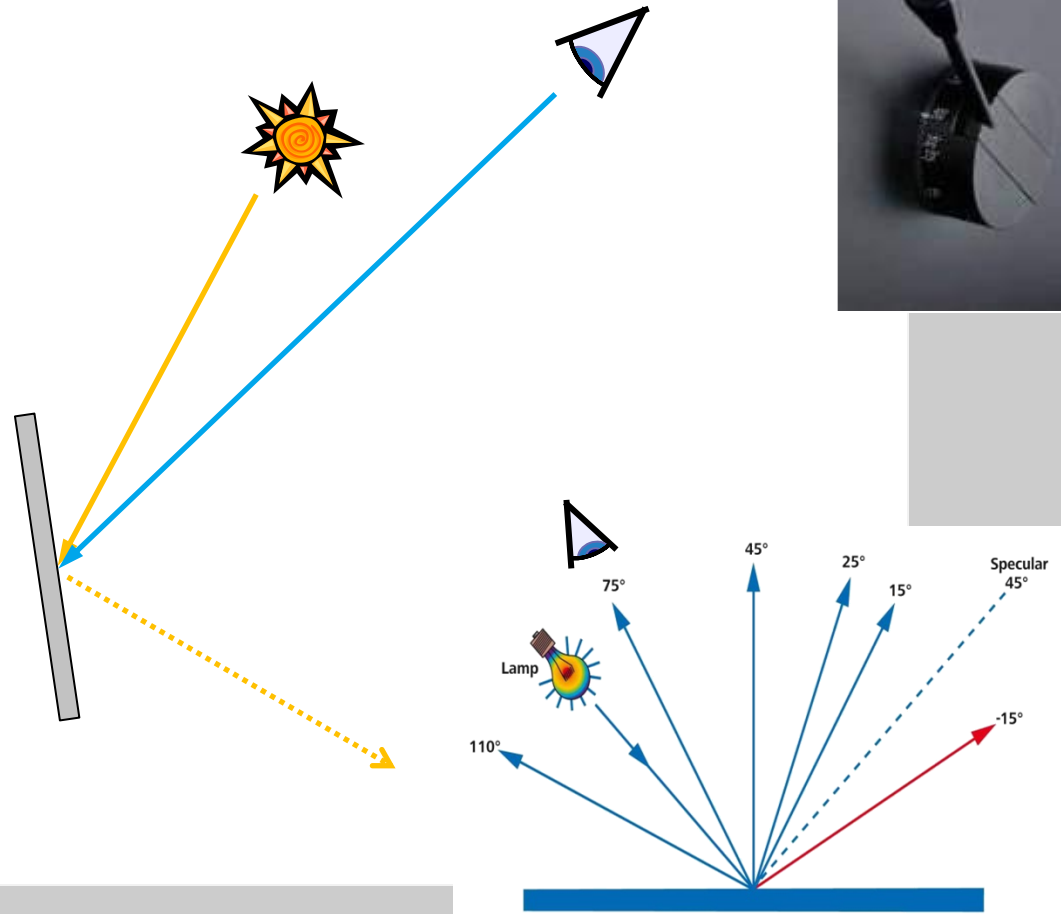
# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



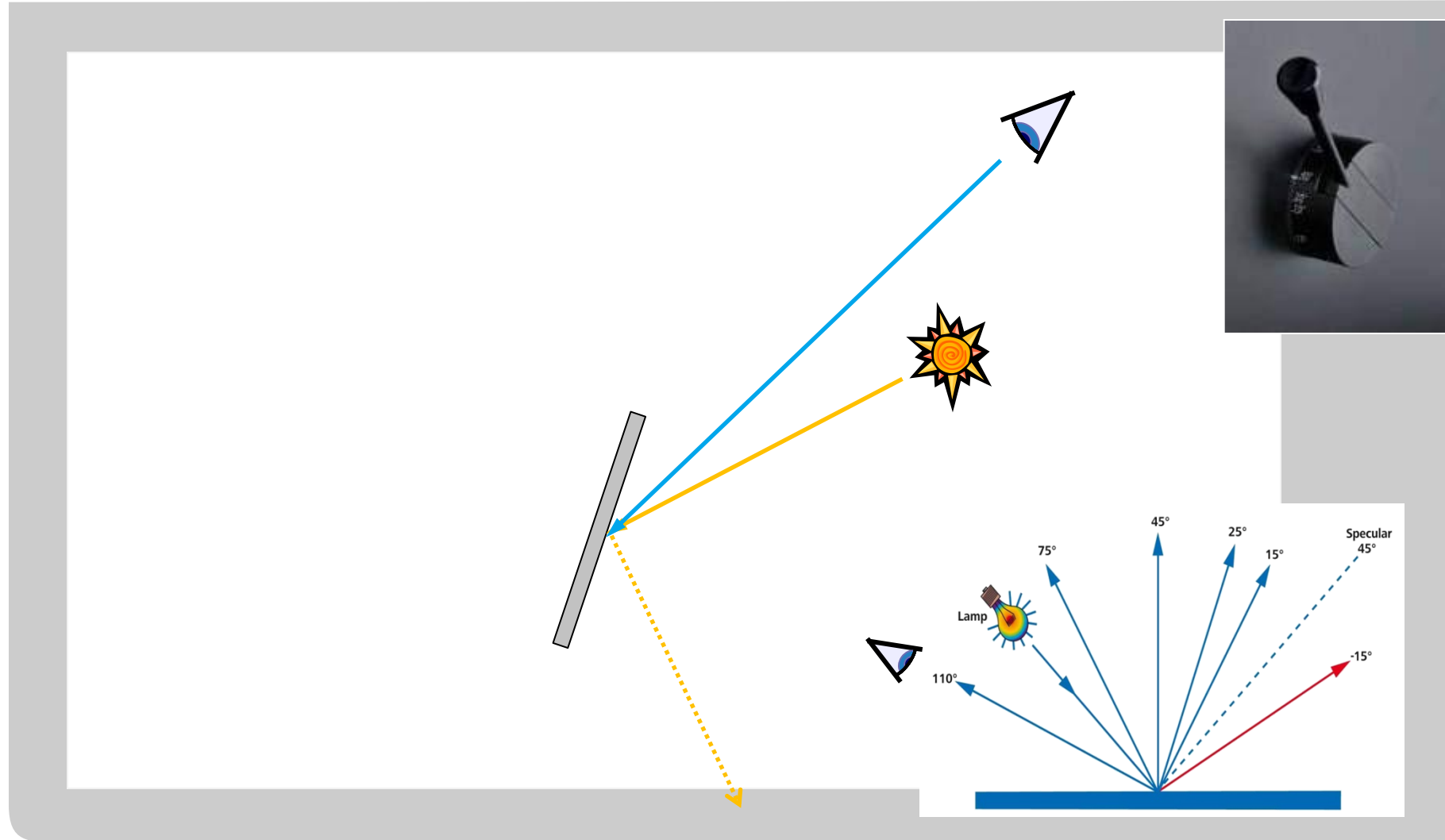
# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



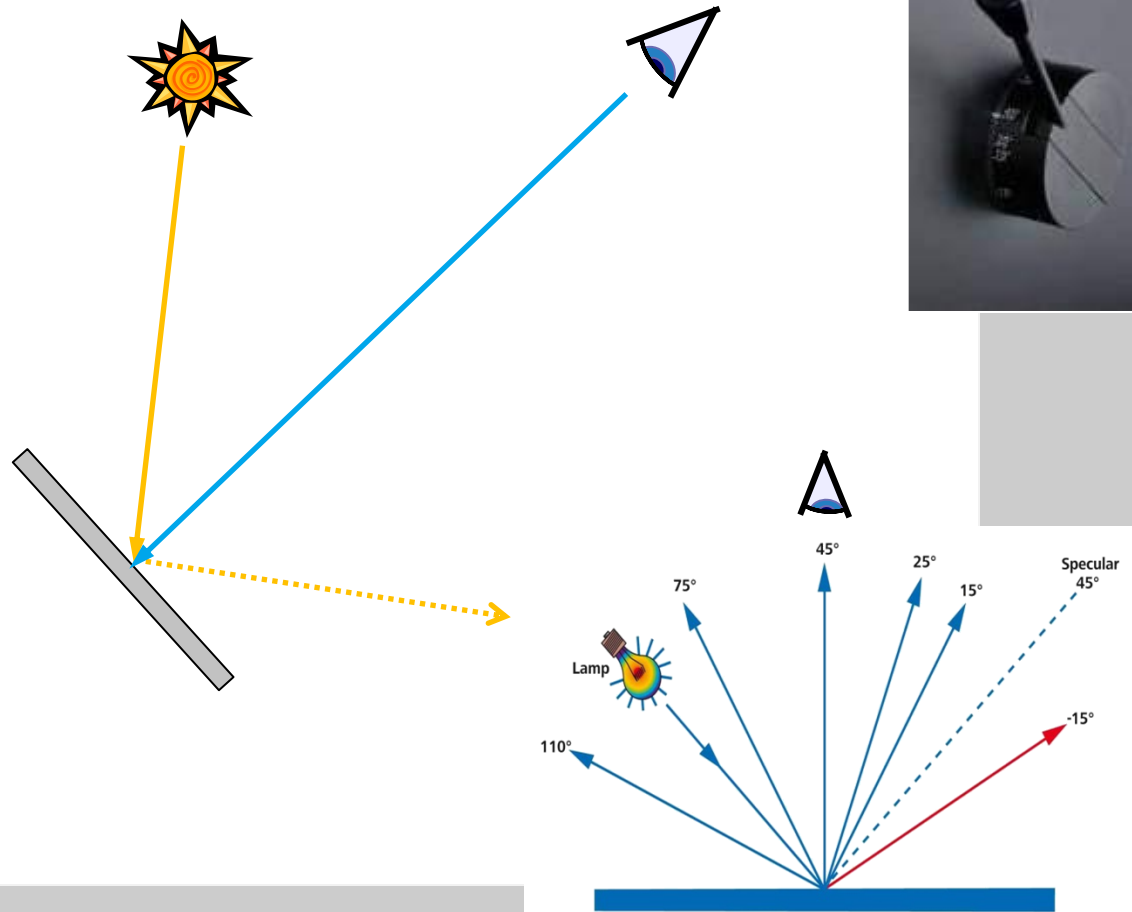
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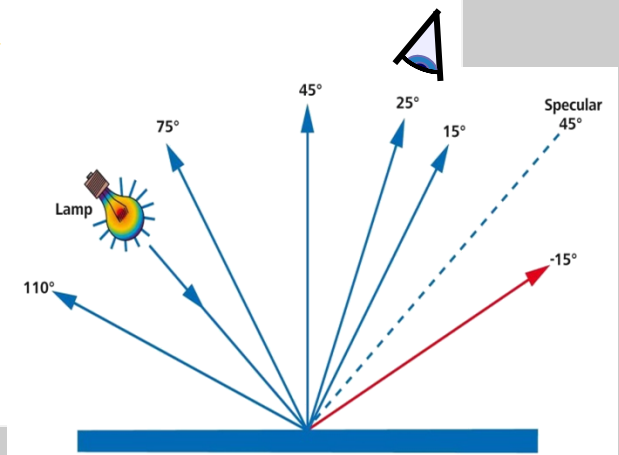
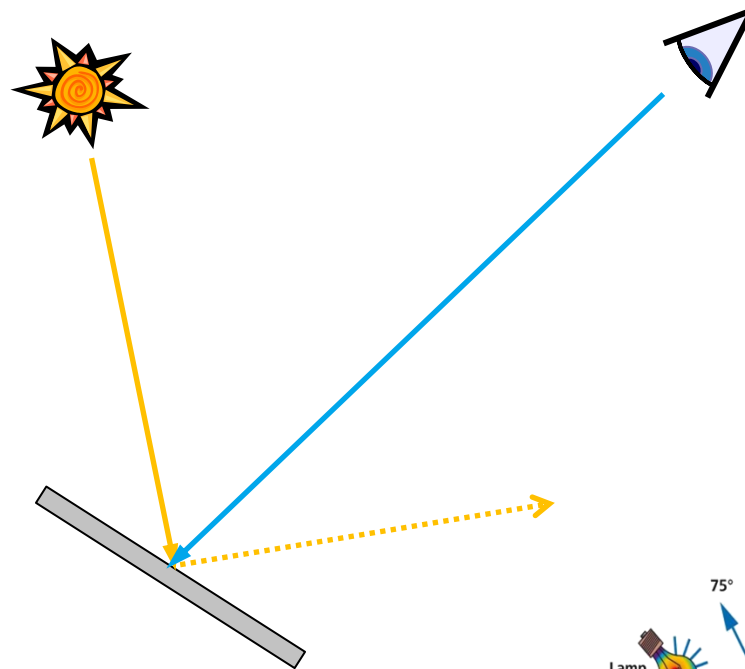
# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



# Visual Evaluation of Effect Finishes – What is used?

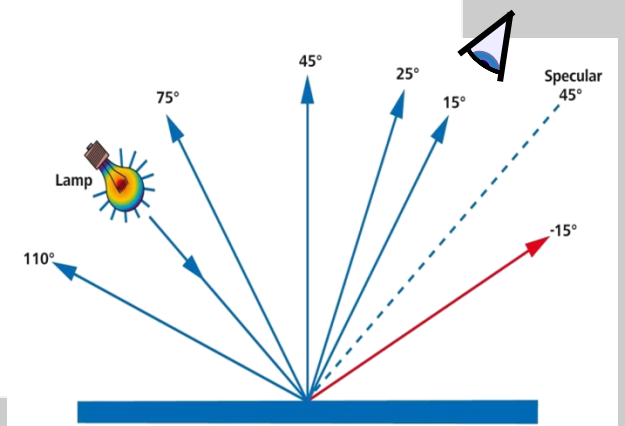
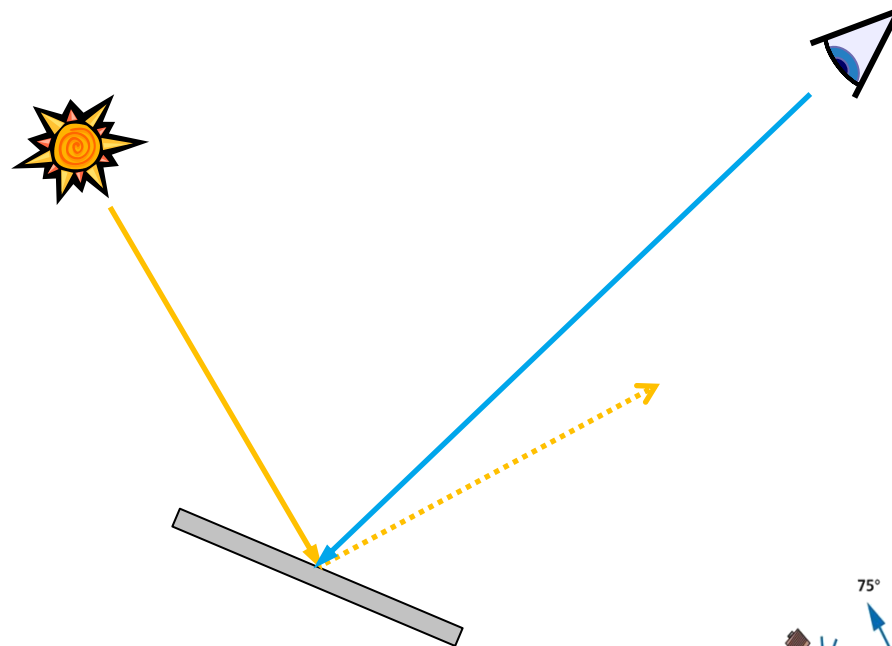
## Light Booth - byko-spectra *effect*





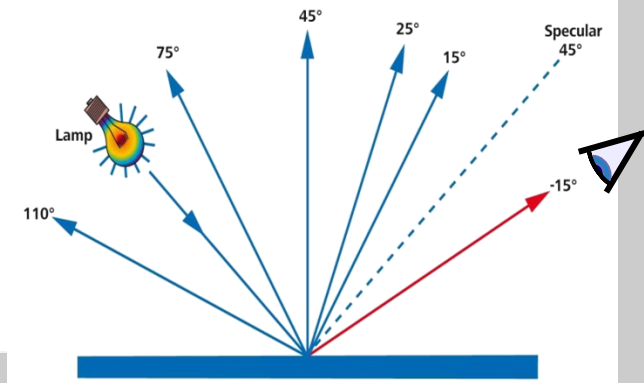
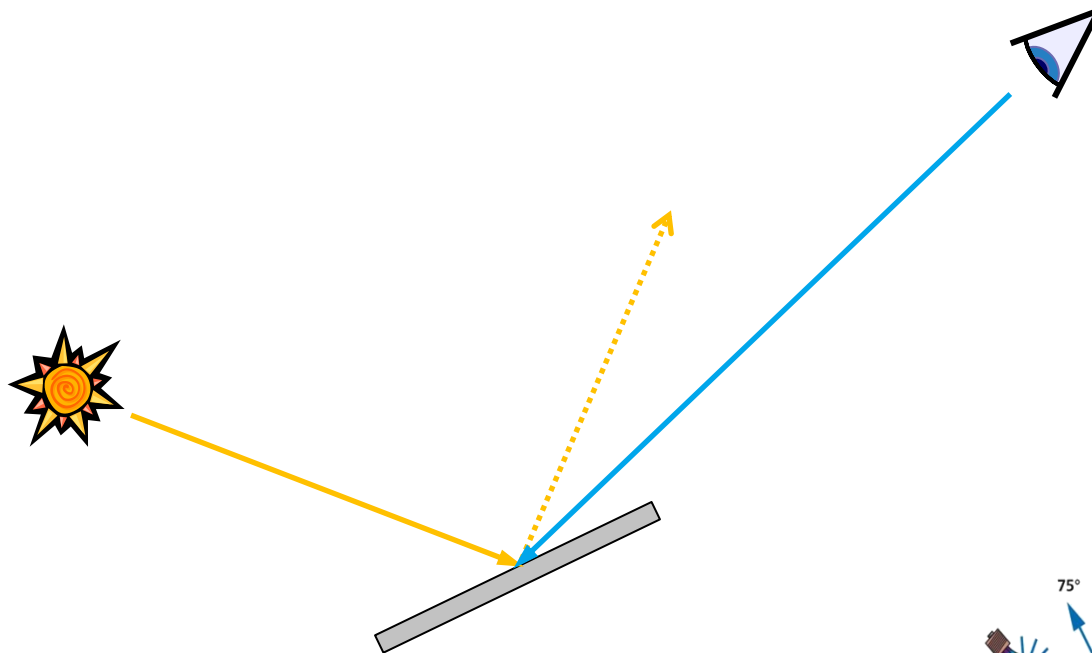
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## Light Booth - byko-spectra *effect*



# Visual Evaluation of Effect Finishes – What is used?

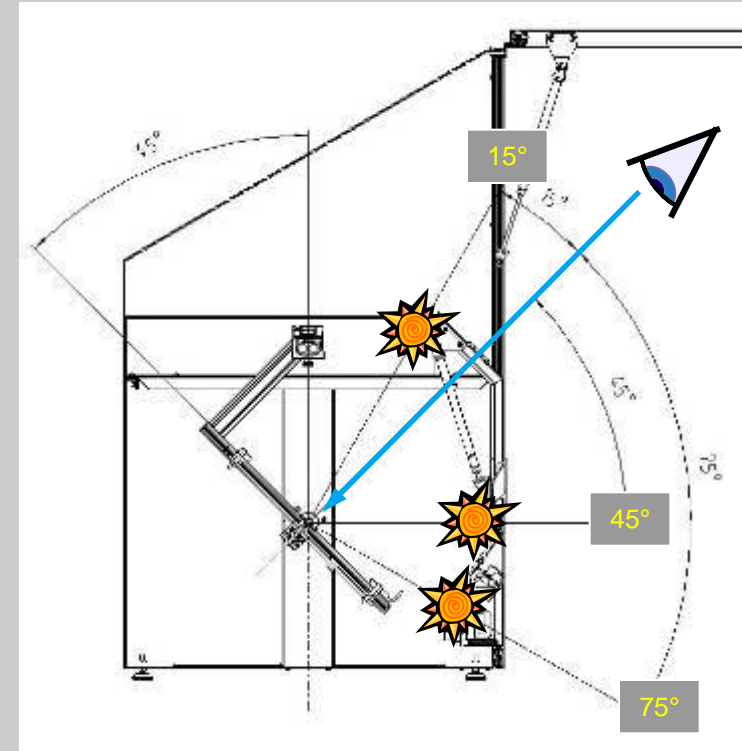
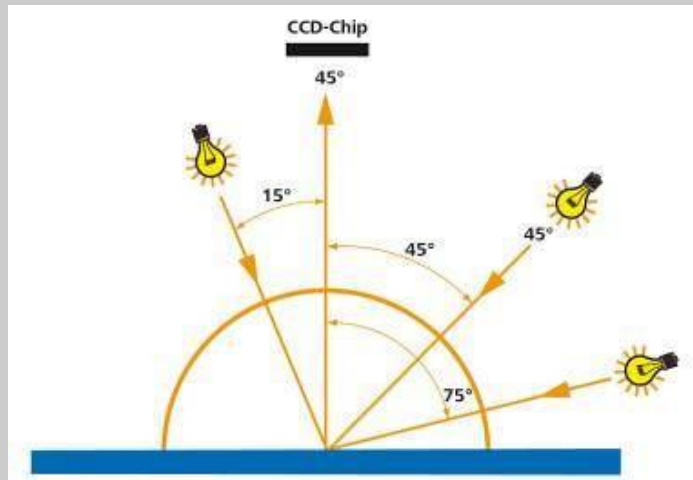
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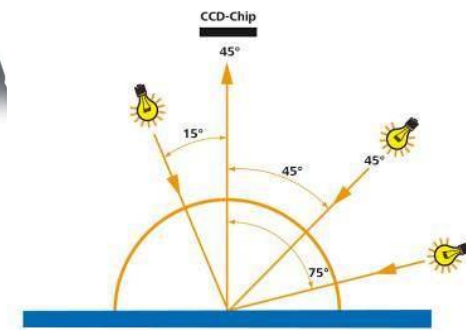
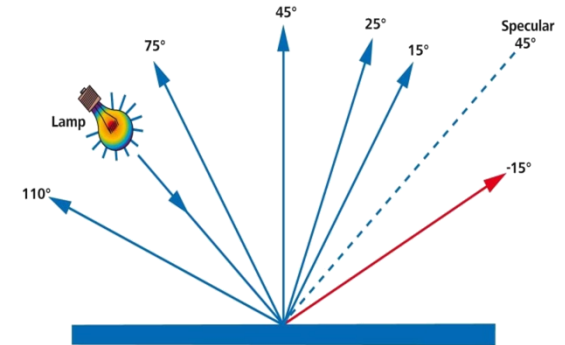
## Light Booth - byko-spectra *effect*

- 3-illumination angles: 15°, 45°, 75°
  - Very bright LEDs simulate the impression of direct sunlight
- Excellent agreement with instrument's geometry



# Visual Evaluation of Effect Finishes – What is used?

## Light Booth - byko-spectra *effect*



# How to correlate visual and instrumental evaluation of effect finishes?

Aligned in painting direction?



Direction of Illumination?



Arrow: Direction of instrument illumination

Measure what you see.



# Thank you for your attention.