



Verein Deutscher Druckingenieure e.V.

VDD-Seminarreihe, „Effektfarbmessung“

Darmstadt 2008

Effektfarbmessung – Quo vadis ?

Dr. Peter Gabel / GAL-Pigmente / Gernsheim

Merck KGaA - Pigments worldwide

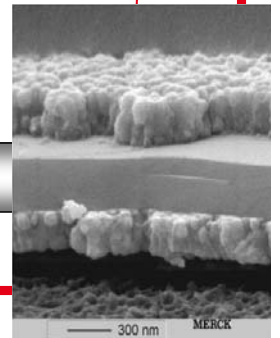
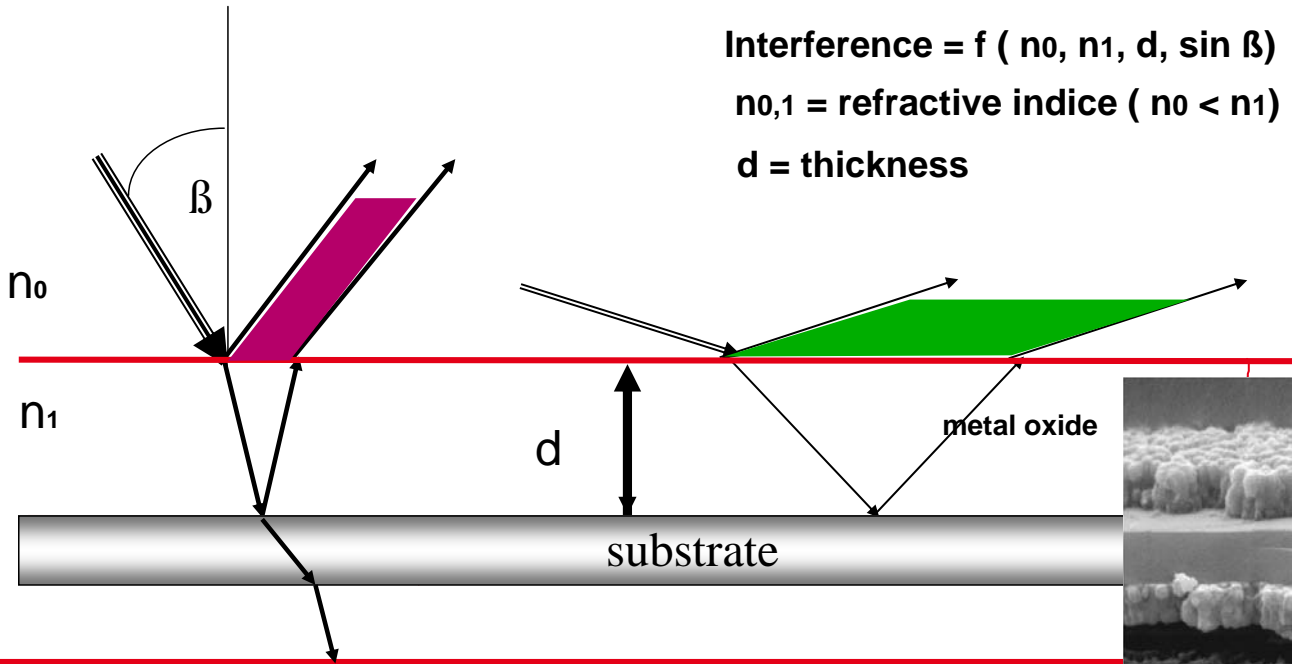


Interference - Optical Principles

Color Travel by different Observation-Points

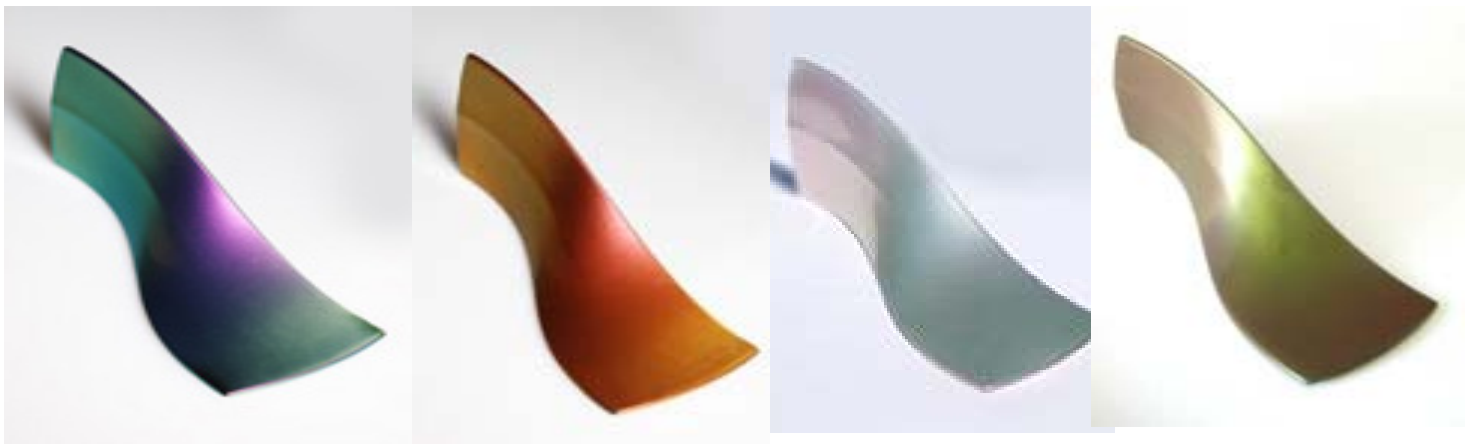


Interference = f (n_0 , n_1 , d , $\sin \beta$)
 $n_{0,1}$ = refractive indice ($n_0 < n_1$)
 d = thickness



G.Pfaff, P.Reynders, Angle-Dependent Optical Effects Deriving from Submicron Structures of Films and Pigments, Chem.Rev.1999,99,1063

colorstream®



Colorstream® T20-04 WNT Lapis Sunlight
 TiO₂ / SiO₂
 gold / silver / green / blue

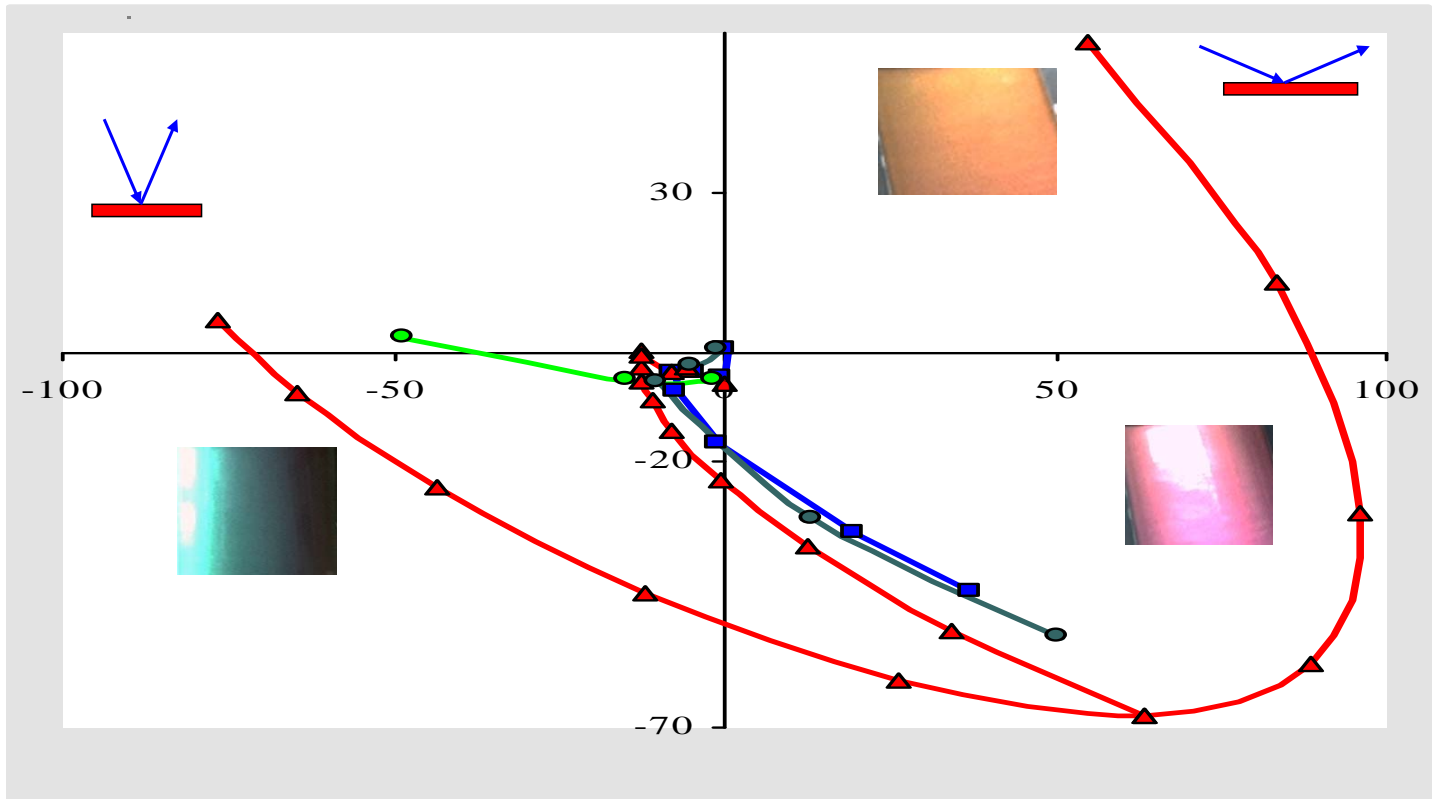
Colorstream® F20-00 WNT Autumn Mystery
 Fe₂O₃ / SiO₂
 red / gold / bronze / green

Colorstream® T20-01 WNT Viola Fantasy
 TiO₂ / SiO₂
 lilac / silver / green / blue

Colorstream® T20-03 WNT Tropic Sunrise
 TiO₂ / SiO₂
 green / silver / red / orange

ChromaFlair 190 Black Background

█ ZEISS GKM 311/ M █ OPTRONIK Multi Flash
█ MINOLTA CM 512m3 █ X-RITE MA 68 II

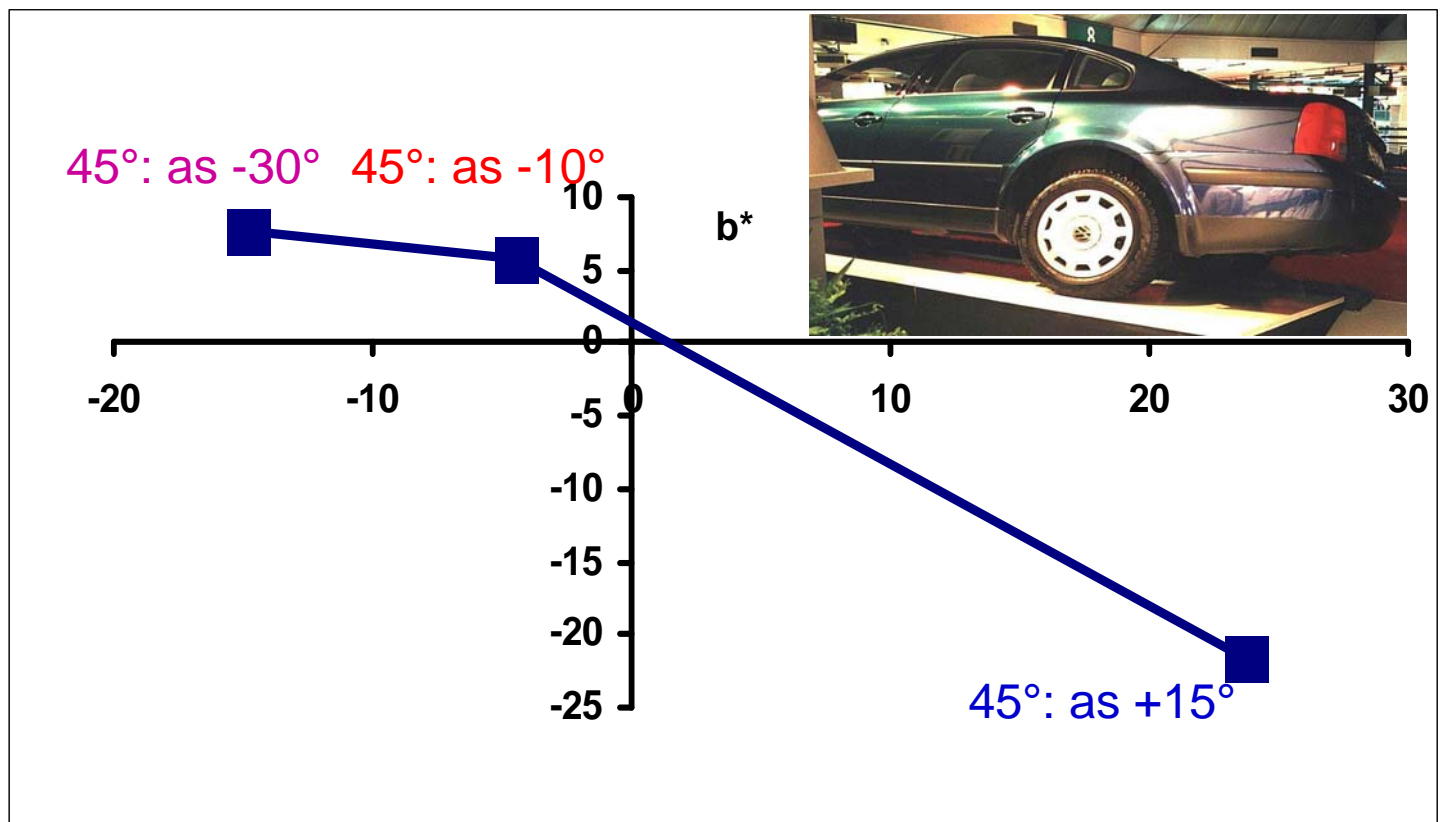


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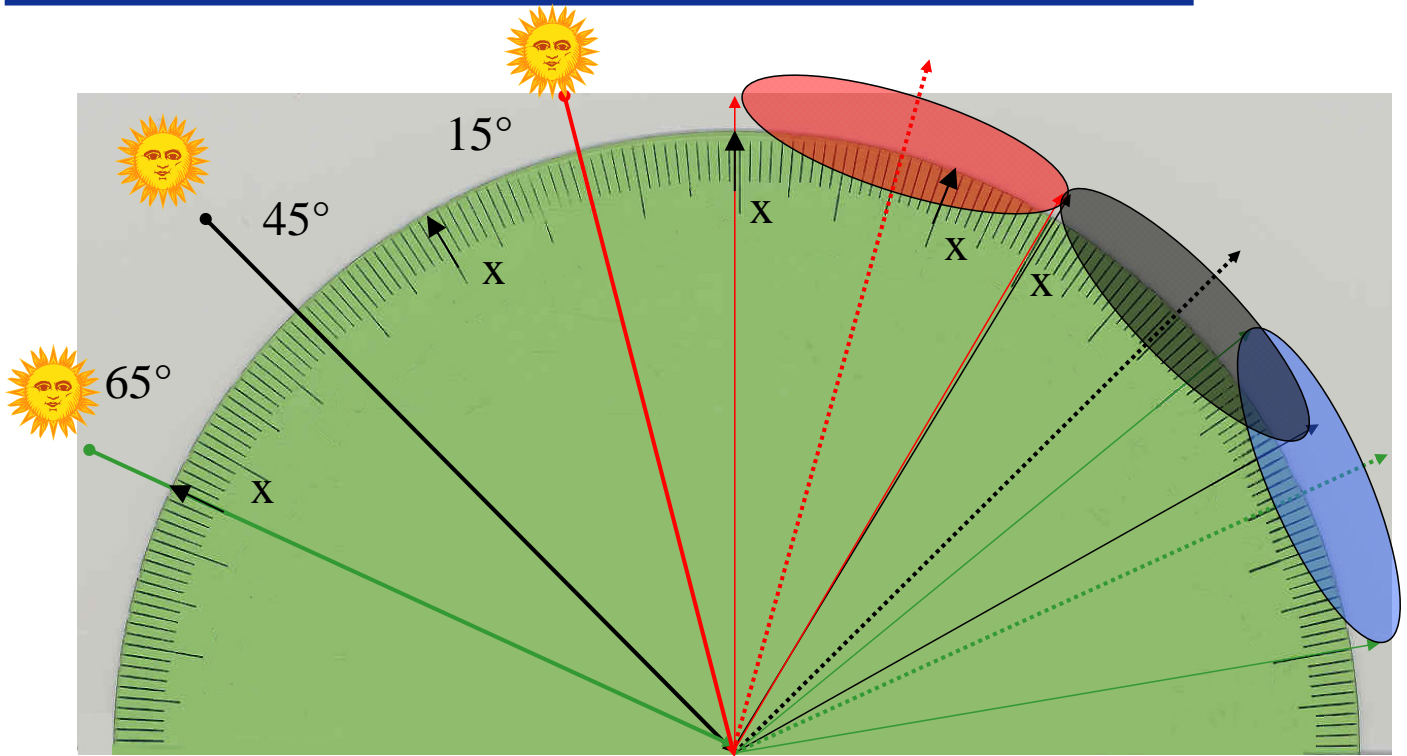
Ti - Type



Fixed 45° illumination



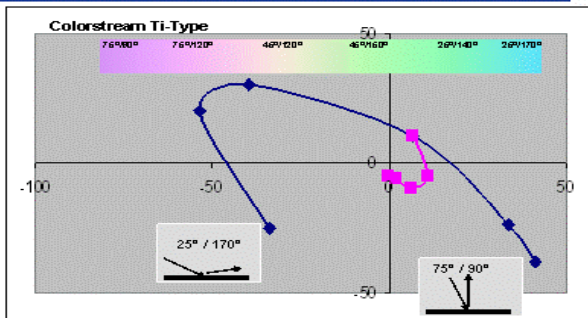
Measuring Geometry for Effect Pigments ASTM E2539-08



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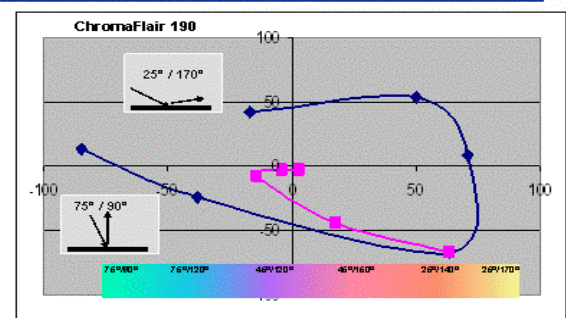


Measuring Geometry for Effect Pigments
ASTM E2539-08



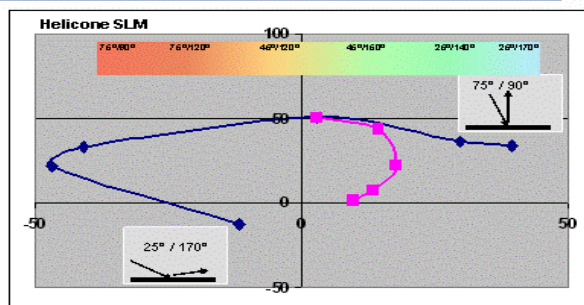
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Measuring Geometry for Effect Pigments
ASTM E2539-08



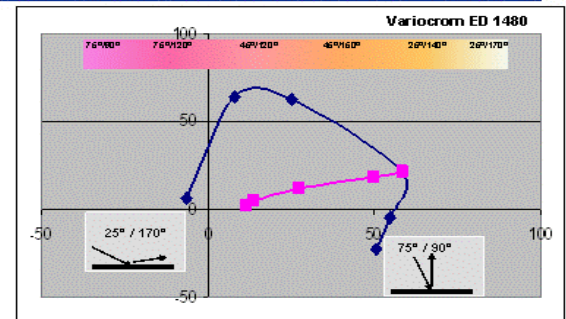
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Measuring Geometry for Effect Pigments
ASTM E2539-08



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Measuring Geometry for Effect Pigments
ASTM E2539-08



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Comparison Chart of Geometries Designations



Method Number	METHOD 1	METHOD 2**	METHOD 3	METHOD 4
Designation	Traditional CIE Convention	Aspecular angle	New Proposal	New Proposal Protractor method
Illuminator Geometry	Anormal Illuminators	(Single) Anormal Illuminator	Anormal Illuminators	Protractor Illuminators
Viewer Geometry	Anormal Viewing	Aspecular Viewing	Aspecular Viewing	Protractor Viewing
Standard	E 2175	E 2194	-	-
<i>Classical metallic geometries (ASTM E 2194, DIN 6175-2)- 1st Generation Gonioapparent</i>	45°:-30°	15°	45°:as 15°	P45°:120°
	45°:-20°	25°	45°:as 25°	P45°:110°
	45°:0°	45°	45°:as 45°	P45°:90°
	45°:30°	75°	45°:as 75°	P45°:60°
	45°:65°*	110°	45°:as 110°	P45°:25°*
<i>New interference geometries (under discussion)-2nd Generation Gonioapparent</i>	15°: 0°	15°	15°:as 15°	P75°:90°
	15°:-30°	-15°	15°:as -15°	P75°:120°
	45°:-60°	-15°	45°:as -15°	P45°:150°
	65°*:-50°	15°	65°:as 15°	P25°*:140°
* 65°:as15° illumination is in conflict with 45°:as110° viewing direction				
** The notation for this method does not accommodate multiple illuminators/multiple viewers				

New ASTM International Standard Covers Latest Wave of Gonioapparent Colorants



First generation gonioapparent colorants are materials pigmented with metal flakes that change lightness as illumination angles change. Used heavily in automotive coatings, the first generation of gonioapparent materials was covered by ASTM International standard [E2194](#), Practice for Multiangle Color Measurement of Metal Flake Pigmented Materials, first published in 2003.

Now, a second generation of gonioapparent colorants that change color with varying illumination and viewing angles has led to the development of a new standard, [E2539](#), Practice for Multiangle Color Measurement of Interference Pigments.

Both ASTM E2194 and E2539 are under the jurisdiction of Subcommittee E12.12 on Gonioapparent Color, part of ASTM International Committee [E12](#) on Color and Appearance.

Multi-Angle Color Measurement and Flake Characterization



Multi-angle Color Measurement *BYK-mac*

- Illumination: 45°
- Detection: 6-angles
-15°, 15°, 25°, 45°, 75°, 110°

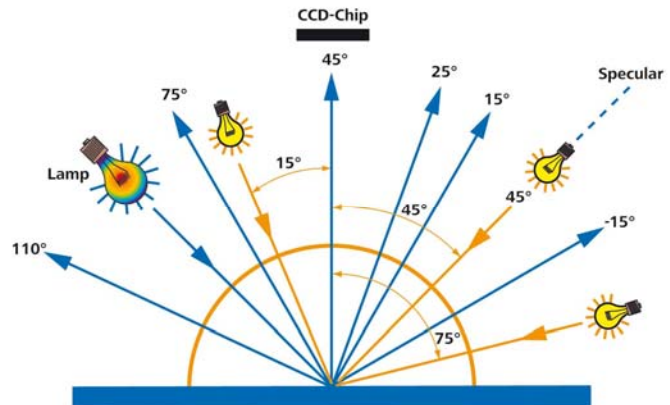


Sparkle Characterization

- Direct illumination: 15°, 75°, 45° from perpendicular
- Camera detection: 0°

Graininess Characterization

- Diffused illumination
- Camera detection: 0°



G. Kiegle-Boeckler, ECS 2007 Nürnberg, Total Color Measurement of Effect Finishes

Visual Effect - Evaluation

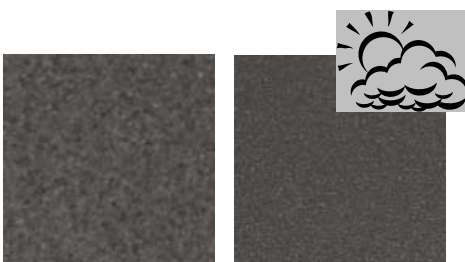


Appearance of effect finishes depends on illumination conditions:



Sunny sky: Direct illumination

- Color starts to sparkle



Cloudy sky: Diffused illumination

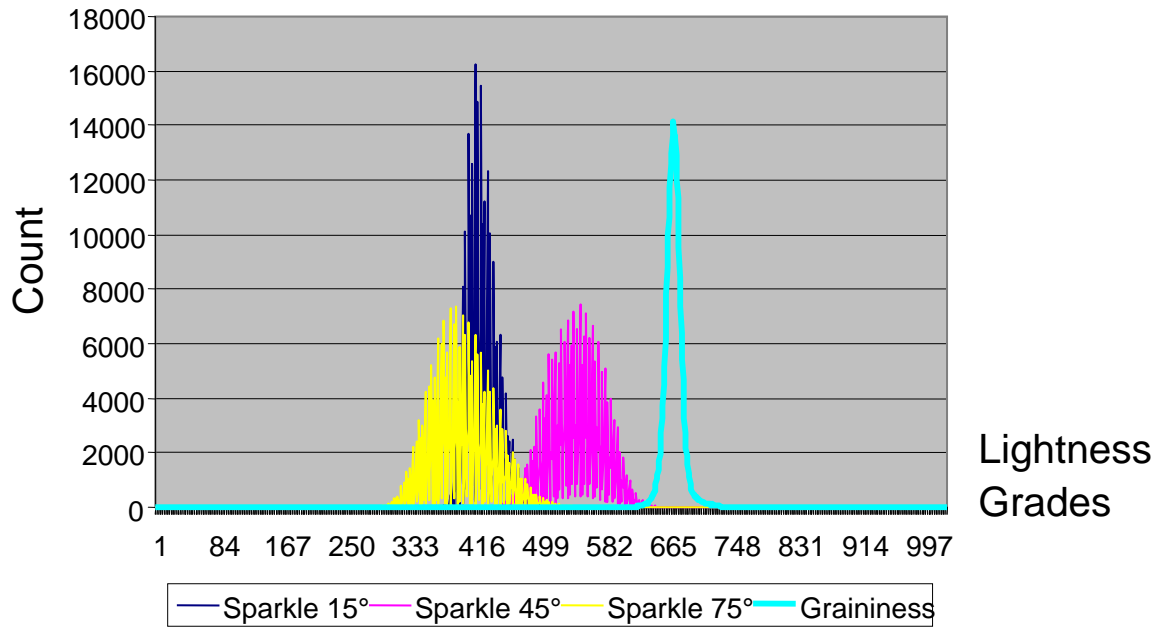
- Fine versus grainy pattern

G. Kiegle-Boeckler, ECS 2007 Nürnberg, Total Color Measurement of Effect Finishes

Calculation of Sparkle and Graininess Values



Analysis of the histograms



G. Kiegle-Boeckler, ECS 2007 Nürnberg, Total Color Measurement of Effect Finishes

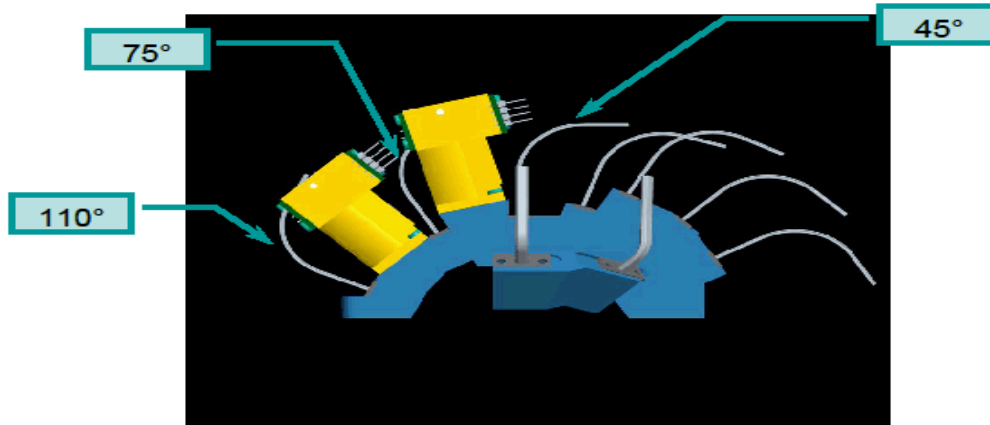
X-Rite MA xx



X-Rite MA xx



Geometry



Company Confidential
Industrial Color and Appearance

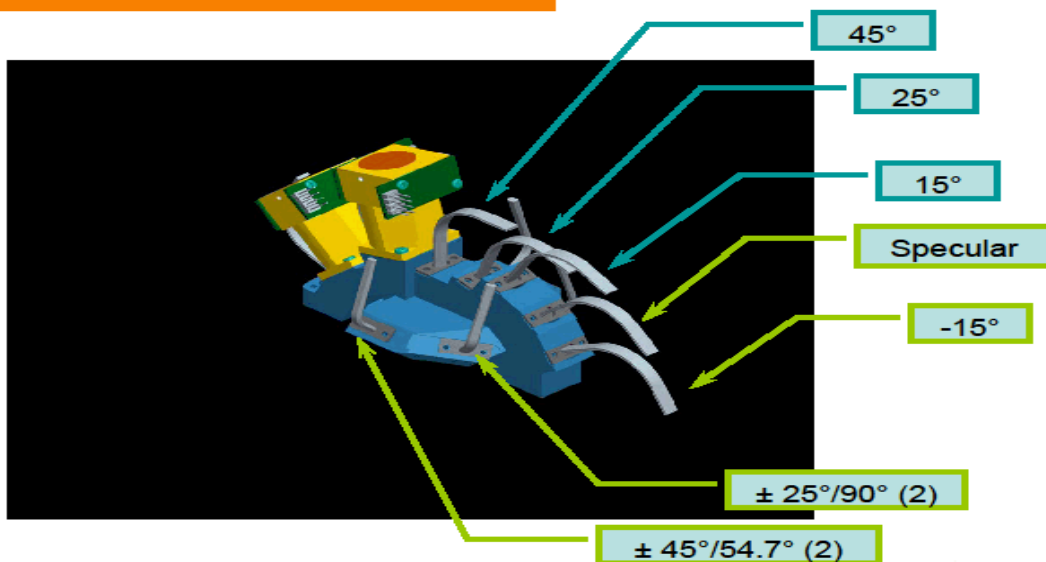
Nisper, J., American Coatings Conference, 2008



X-Rite MA xx



Geometry



Company Confidential
Industrial Color and Appearance

Nisper, J., American Coatings Conference, 2008



M.R.F. Kuntz, F. Daumard, M. Rösler, A. Huber, G. Pfaff, A New Interference Color Space Concept for Coatings, CPMA Conference MAY 13 – 15, 2008, Lincolnshire, IL.

A. Huber, M. Rösler, G. Pfaff, KAROSSERIELACKIERUNG 2020, 19. – 20. November 2007, Bad Nauheim

TEANEY, S., PFAFF, G., NITTA, K., New Effect Pigments using Innovative Substrates, ECJ (1999) 4, 434

SHARROCK, S.R., SCHUEL, N., New Effect Pigments based on SiO₂ and Al₂O₃ Flakes, ECJ (2000) 1-2, 105

M.Rösler, F.J. Maile: Local Gloss and Sparkle caused by Effect Pigments:

Psychophysics, Measurements and Simulations

Color Styling for Rinse-off Products



Vielen Dank