



When to Use Which Instrument

45/0, 0/45, D8, SPIN, SPEX, Spot, Scan, UV, no UV

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When to Use Which Instrument??

Agenda

- ◆ Printing devices are imaging on all types of materials today:
 - ◆ Paper, Plastic, Acrylic, Fabrics, Leather, Velour, Metal, Aluminum,
 - ◆ Many with different textures, depth, gloss, sheen and weaves
- ◆ Each combination influences how eye perceives resultant color
 - ◆ Challenge is to measure sample and capture what eye perceives
 - ◆ Very challenging, hence industry has provided a lot of options
- ◆ This Overview provides methodology to qualify instrument choice

- ◆ You will not find this information any where else, we will be reserving this content for ChromaChecker users only

CC Nano Instrument



Unique Instrument: Measures Texture/Appearance

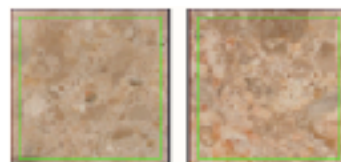
- ◆ It is not a Spectrophotometer, but a Colorimeter and Gogliometer
- ◆ Color Match for Average and Dominant Color:



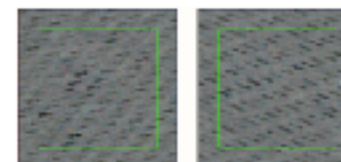
- ◆ Surface Match for texture/pattern



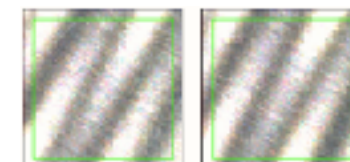
Wood 85%



Marble 89%



Textile 92%

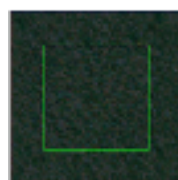


Aluminum 82%

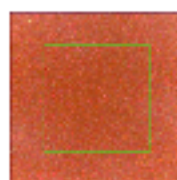
- ◆ Uniformity of patch values



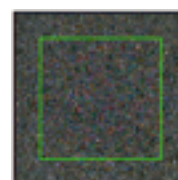
U=0.6



U=3.0



U=6.0



U=7.7



U=11.2



U=13.2

Instrument Choices: Spectrophotometers

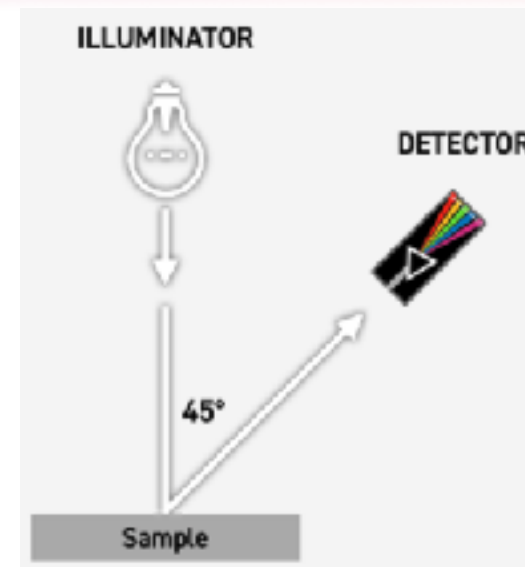
Options for Color Measurement Devices

- ◆ Geometry: $45^\circ/0^\circ$, $0^\circ/45^\circ$, $d/0^\circ$, $d/8^\circ$ (Sphere), or MultiAngle
- ◆ Illumination Methods: Annular Ring, Single/Multiple Points, Diffuse
- ◆ Automation: Single, Manual Scan, Auto Scan
- ◆ Measurement Modes: M0, M1, M2, M3, SPIN, SPEX with or w/o UV
- ◆ Aperture Size related to screen ruling of print quality, patch size

Geometry Instrument Choices: $45^\circ/0^\circ$

$45^\circ/0^\circ$ and $0^\circ/45^\circ$ Application

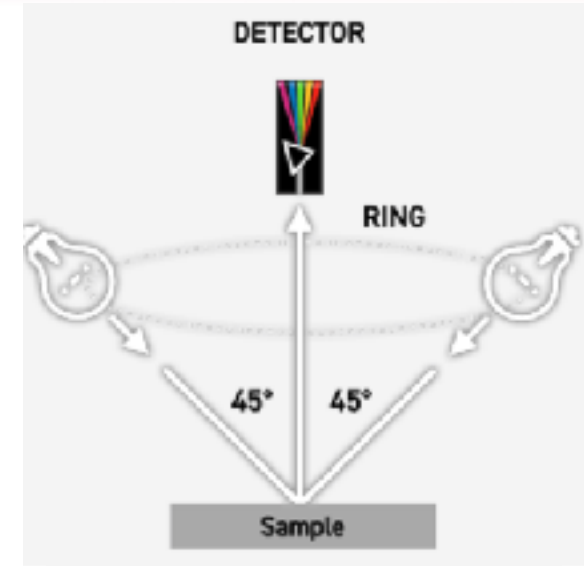
- ◆ Measuring ink on paper- Flat, regular surface
 - ◆ $45^\circ/0^\circ$ Light is from 45° and receptor is 0°



Geometry Instrument Choices: $45^\circ/0^\circ$

$45^\circ/0^\circ$ and $0^\circ/45^\circ$ Application

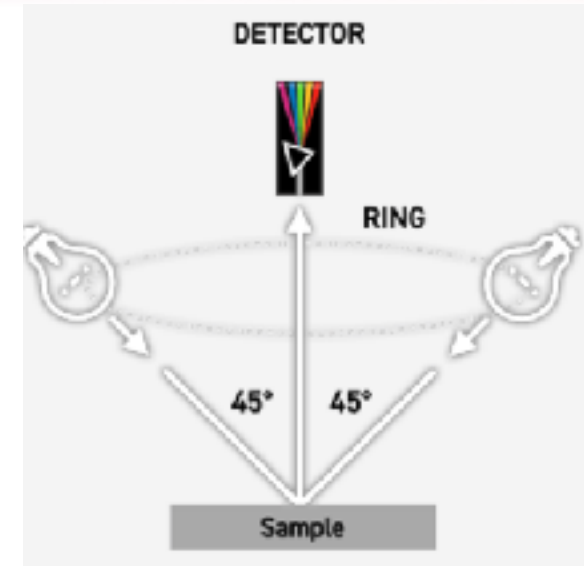
- ◆ Measuring ink on paper- Flat, regular surface
 - ◆ $45^\circ/0^\circ$ Light is from 45° and receptor is 0°
 - ◆ $0^\circ/45^\circ$ Light is from 0° and receptor is 45°
 - ◆ $45^\circ/0^\circ$ Light is Annular



Geometry Instrument Choices: $45^\circ/0^\circ$

$45^\circ/0^\circ$ and $0^\circ/45^\circ$ Application

- ◆ Measuring ink on paper- Flat, regular surface
 - ◆ $45^\circ/0^\circ$ Light is from 45° and receptor is 0°
 - ◆ $0^\circ/45^\circ$ Light is from 0° and receptor is 45°
 - ◆ $45^\circ/0^\circ$ Light is Annular
 - ◆ Options may include:
 - ◆ M0- Undefined illuminant
 - ◆ M1- D50 illuminant with UV
 - ◆ M2- D50 illuminant cutting off UV light
 - ◆ M3- Polarizing filter, cuts sheen, requires more light
 - ◆ Aperture size variable based on instrument



Geometry Instrument Choices: $d/0^\circ$ Sphere

$d/0^\circ$ Instrument Application- Spectro 1

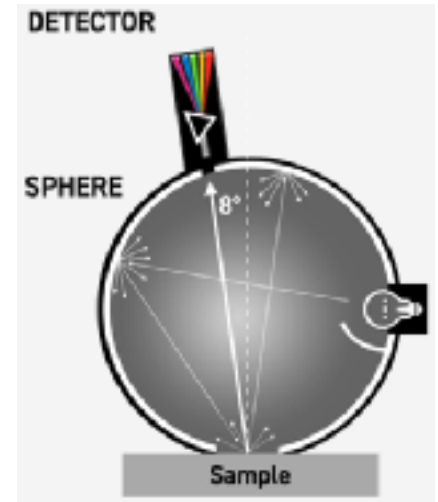
- ◆ Measuring uneven surfaces
 - ◆ Surface has unpredictable reflection of Light
 - ◆ Light reflected around sphere to sensor
 - ◆ Two Models, Pro and Regular:
 - ◆ Specular Included SPIN- surface independent measurement
 - ◆ Doesn't consider surface texture or gloss
 - ◆ Specular Excluded SPEX- surface dependent measurement
 - ◆ Considers visual affect of surface and gloss
- ◆ Aperture Size options



Geometry Instrument Choices: $d/8^\circ$ Sphere

$d/8^\circ$ Sphere Application

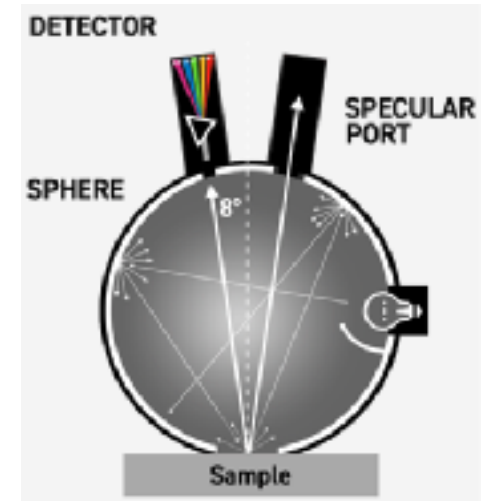
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Geometry Instrument Choices: $d/8^\circ$ Sphere

$d/8^\circ$ Sphere Application

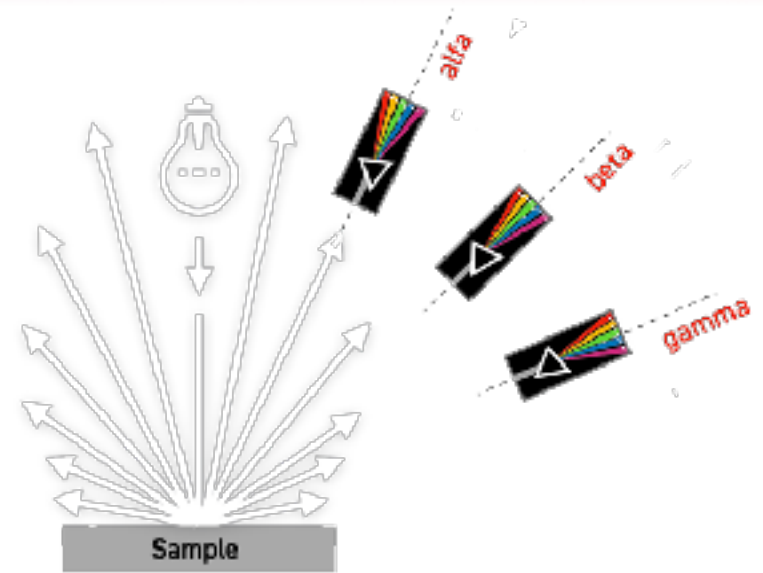
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Geometry Instrument Choices: Multi-Angle

Multi-Angle Application

- ◆ Measuring Unpredictable surfaces
 - ◆ Metallic flakes, lenses
 - ◆ One Light source, six angles
 - ◆ Very proprietary
 - ◆ Very expensive
 - ◆ Very unique, typically automotive paints



General Rules

Aperture Size

- ◆ Size versus line screen

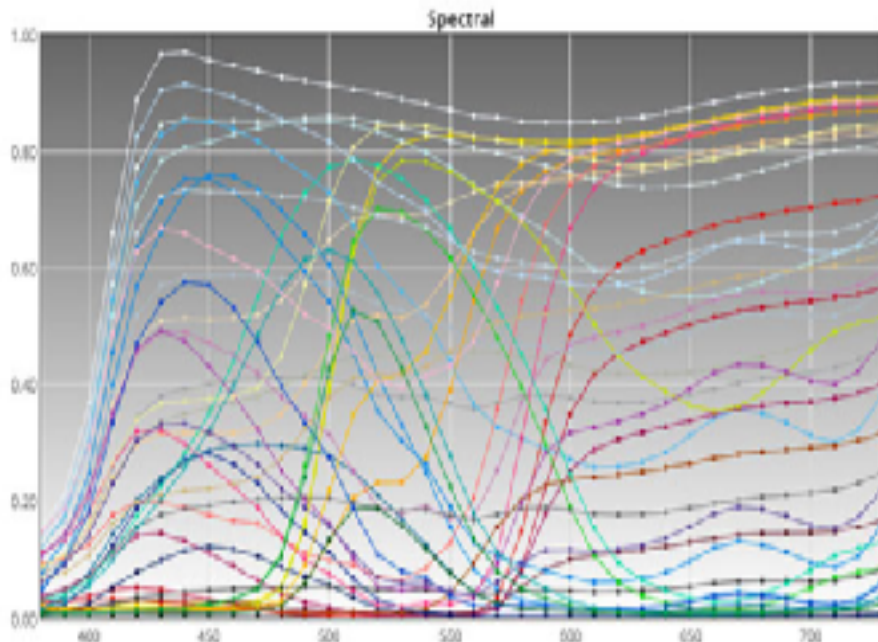
Aperture Specifications

Aperture Size	Measurement area size	Opening in target window**	Opening in scan chassis target window	Screening Range
1.5mm	1.5mm	3.5mm	4.0mm	175 lines/inch or 69 lines/cm or above
2mm	2.0mm	4.0mm	4.5mm	133 lines/inch or 52 lines/cm or above
4mm	4.0mm	6.0mm	6.5mm	65 lines/inch or 26 lines/cm or above
5mm	6.0mm	8.0mm	8.5mm	

General Rules- Baseline Instrument

Instrument Inspector

- ◆ Know instrument is consistent and accurate to factory specifications
- ◆ Use CC Capture with T42 target and measure at least 5 times
- ◆ Ensure the E-Factor is within your Expectations for Color Matching



Instruments Measuring Fluorescents Differently

Check for Optical Brighteners or Fluorescents

- ◆ Measuring same sample with different instruments

Instrument	OBA Index	Fluorescence Index	M1-M2 Spectral Δ @ 430 nm	M1-M2 ΔE_{00}
il Pro 3	8.8	9.5	0.24 @ 430 nm	8.71
il Pro 2	7.2	7.4	0.21 @ 430 nm	7.24
eXact M1 Part 2 export on	5.8	5.8	0.16 @ 430 nm	5.77
eXact M1 Part 2 export off	6.2	5.9	0.15 @ 430 nm	6.08
Techkon SpectroDens	7.9	7.4	0.16 @ 440 nm	7.25

- ◆ Much of difference due to different algorithms attempting to interpolate actual fluorescent sample.

General Rules Related to Sample

Check for Optical Brighteners or Fluorescents

- ◆ How to Check
- ◆ If Material is flat and consistent measure with 45°/0°
 - ◆ Use Variation and measure in all M Conditions available
- ◆ If substrate is contoured or uneven- measure with Spherical
 - ◆ Measure in all four conditions at same time,
 - ◆ SPEX, SPEX w/UV, SPIN, SPIN w/UV
 - ◆ Compare the difference to determine if fluorescence in sample

General Rules

Measurement Mode- 45°/0° Instruments

- ◆ Ideally measure M1 condition the majority of time
- ◆ If the “b” value in the Lab number is more than -8, may consider M2
- ◆ If failing Step 1 attempt to measure with a different M condition
- ◆ If using i1Pro3Plus, you can try Polarized mode (M3)

Sample Classification: Determine Instrument

First determine if sample falls into which category

- ◆ Flat, matte, uniform color- Ink, Paint on flat even surface
 - ◆ Use 45°/0° Instrument, check for fluorescence

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First determine if sample falls into which category

- ◆ Flat, matte, uniform color- Ink, Paint on flat even surface
 - ◆ Use 45°/0° Instrument, check for fluorescence
- ◆ Flat, High Gloss
- ◆ Textured surfaces, shadows, roughness- Fabrics, natural fibers
- ◆ Offset surfaces, multi-layered depth- Acrylic, print bottom glass
 - ◆ Test 45°/0° if fail, test Spherical

Sample Classification: Determine Instrument

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- ◆ Offset surfaces, multi-layered depth- Acrylic, print bottom glass
 - ◆ Test 45°/0° if fail, test Spherical
- ◆ Mirrored materials- Silver, Gold, Foil, Aluminum, Metal
 - ◆ Test Spherical

Sample Classification: Determine Instrument

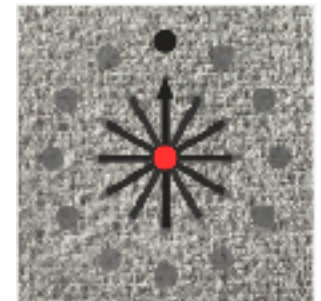
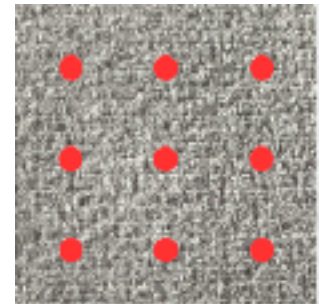
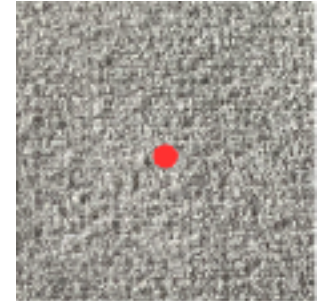
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 - ◆ Test 45°/0° if fail, test Spherical
- ◆ Mirrored materials- Silver, Gold, Foil, Aluminum, Metal
 - ◆ Test Spherical
- ◆ Metallic, Pearl colors
 - ◆ Test Spherical if fail test Multi Angle

Methodology to Test Appropriate Instrument

Simple 3 Step Process using CC Capture Variation

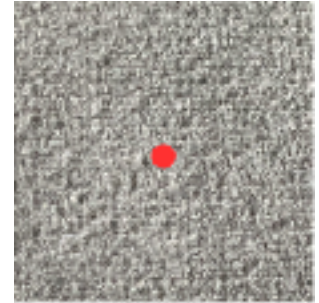
- ◆ Step 1- Measure the same spot 12-15 times, not moving instrument at all, use software to trigger measurement
- ◆ Step 2- Measure 9 different locations on sample offset by at least 0.5”
- ◆ Step 3- Measure same spot 12 times rotating instrument around the same spot



Methodology to Test Appropriate Instrument

Simple 3 Step Process using CC Capture Variation

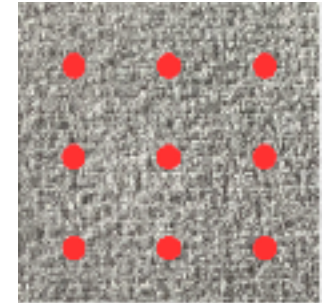
- ◆ Step 1- Measure the same spot 12-15 times, not moving instrument at all, use software to trigger measurement
- ◆ How to know if measurement fails to measure the sample within expectations?
- ◆ Try different options, modes, settings on same instrument
- ◆ Try different instruments to see if any can pass, if not- buy new



Methodology to Test Appropriate Instrument

Simple 3 Step Process using CC Capture Variation

- ◆ Step 2- Measure 9 different locations on sample offset by at least 0.5”

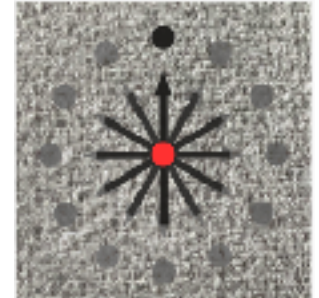


- ◆ How to know if measurement fails to measure the sample within expectations?

Methodology to Test Appropriate Instrument

Simple 3 Step Process using CC Capture Variation

- ◆ Step 3- Measure same spot 12 times rotating instrument around the same spot
- ◆ Determine if result fails outside of expectations?



Qualify the Substrates

Understand: make up of Substrate will affect results

- ◆ Substrates can have different structures that affect measurement
- ◆ Substrates can be uniform when raw, but nonuniform when printed
- ◆ Need to qualify both raw and printed substrates
- ◆ Show Video of Step 3

Summary

Simple 3 Step Process using CC Capture Variation

- ◆ Many variables related to printing on uneven, structured substrate
- ◆ This is the beginning of education to understand the process
- ◆ We will be adding additional results, applying the three steps
- ◆ Understand better when to use geometry/aperture/UV