ChromaChecker™

NANO

...more than color

COLORIX

ChromaChecker™

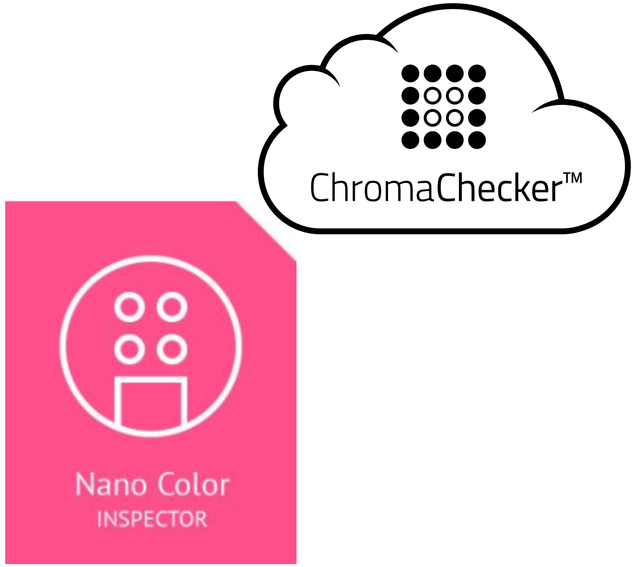
ChromaChecker Nano

CC Nano

Hardware, Software, Cloud

COLORCATCH NANO

CC NANO iOS APP



CENTRAL REPOSITORY

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Click on the link to watch the video

https://vimeo.com/500394533

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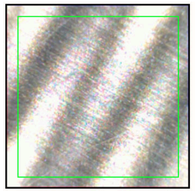
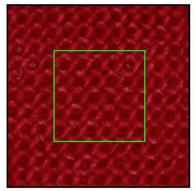
Color & Appearance Matching: Unique features

- Ultra-small aperture: 0.3 mm – 6.18mm — the fast and easy way to measure very small objects.
- Dominant Color algorithm — the unique technology to measure some complex object by extracting dominant color from the image. Can be combined with a small aperture to measure objects smaller than 0.3 mm
- Unique surface analysis including sparkling and other effect detection
- Reference image for the operator for visual comparison
- Fast, easy, user-friendly iOS App for efficient data capturing

The best way to measure objects hard to measure with other instruments:
Brushed or grained metal;
Textured surfaces like calendared plastics, textiles, fabric;
Natural materials like: stone, wood, leather, skin;
Surfaces with special effects (pearl, metallic, sparkles…)





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Technology benefits

- Central cloud-based data repository
- Global operations and reporting
- Proof of measurement — picture + timestamp + operator ID – the operator has can reject measurement, but once accepted can’t be deleted.
- Accountability management (privileges related to the type of account)
- Expert-level measurement reports (ChromaChecker website)
- Multi-level tolerances

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Selected areas of application

Industry

- Automotive
- Printing
- Plastics
- Fabrics
- Paints
- Cosmetics
- Carpentering

Design

- Interior Design
- Color Design
- Architecture
- Graphic Design

Quality Control

- Brand Colors
- Coatings
- Finishings

Other

- Cloud-based Samplers
- Color Communication
- Color Reproduction
- Surface Analysis
- Museology
- Archeology
- Criminology
- Restoration of works of art

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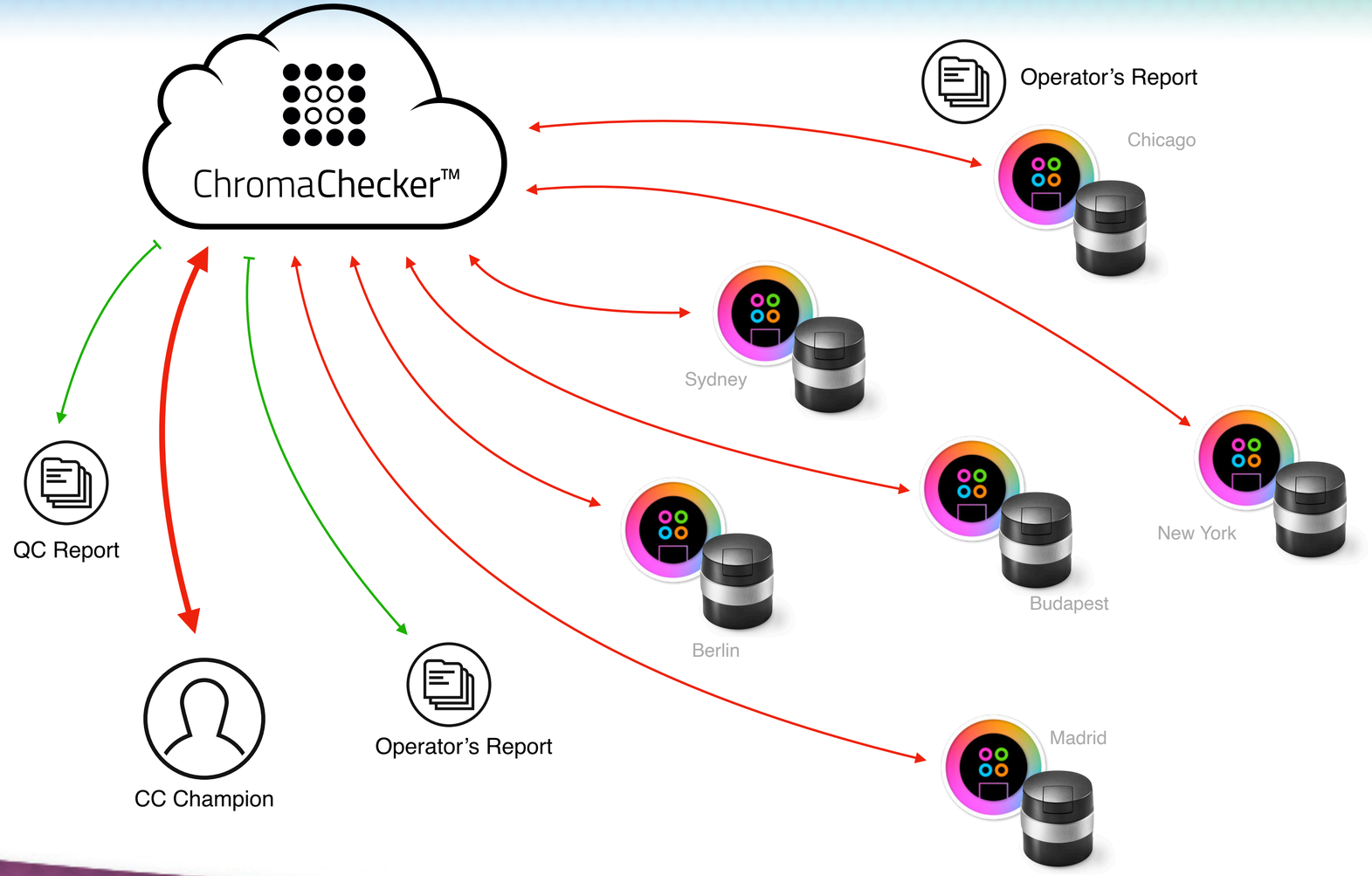
Central Repository



- Any global location with Internet access
- Simple App for data capturing
- Advanced reporting for experts
- Globally managed References
- Unlimited number of operators
- Real-time system update

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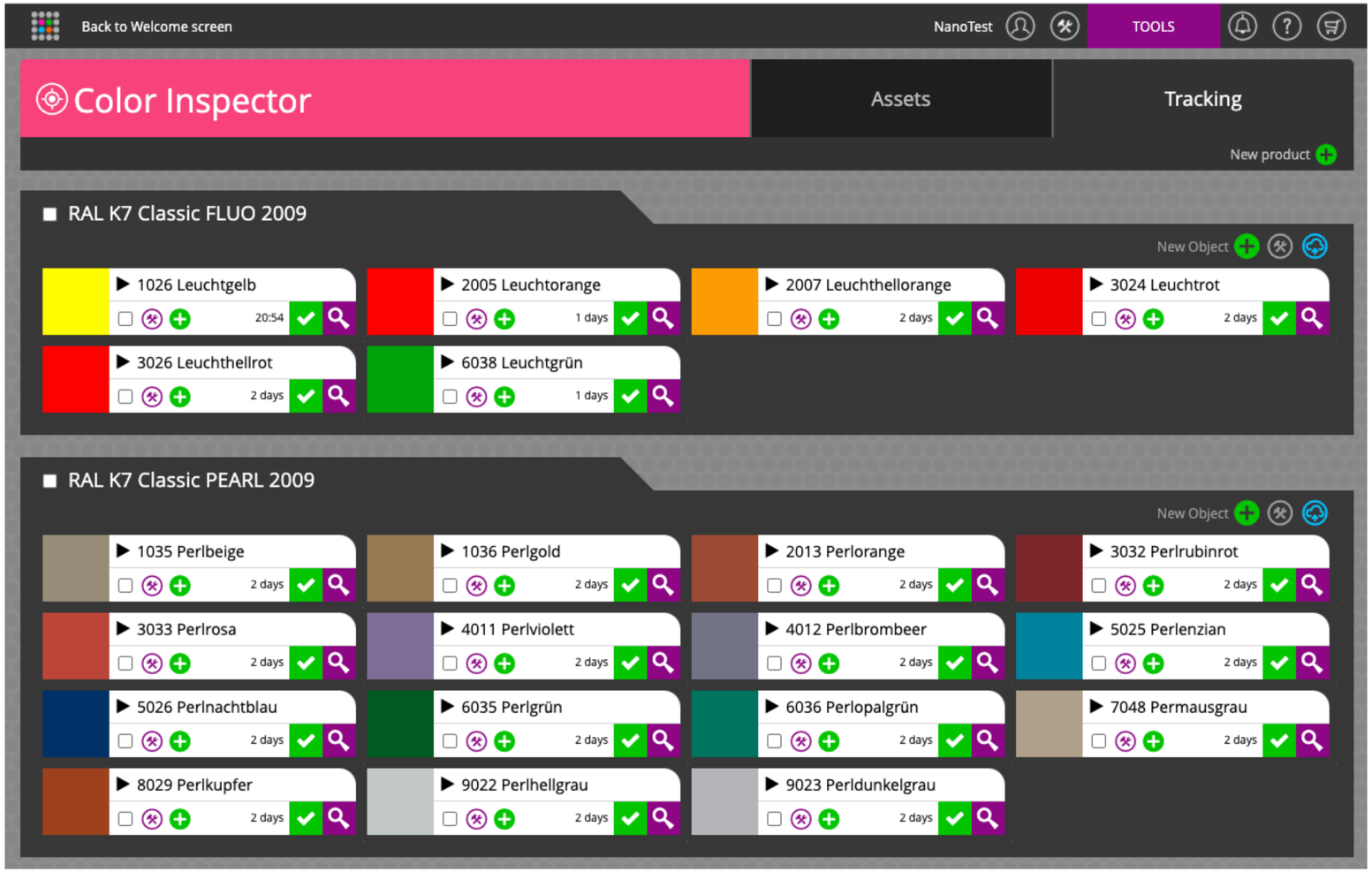
Database: 3 to 5 Level Structure

Hierarchy: Group, Product, Object, Track if one Instrument; If multiple, tracks accommodate instruments



Depending on the needs of the user, the vertical structure can be more oriented on the type of object or its color.

The user decides how to organize samples.

If measuring with all colors with one instrument, the color diversity occurs at the track level

If measuring with multiple types of instruments, then the instrument diversity occurs at track level, and color diversity happens at Object level-

**this allows brand to track “same color” and let suppliers use different instruments with difference configurations and still be confident that color will match to expectations.

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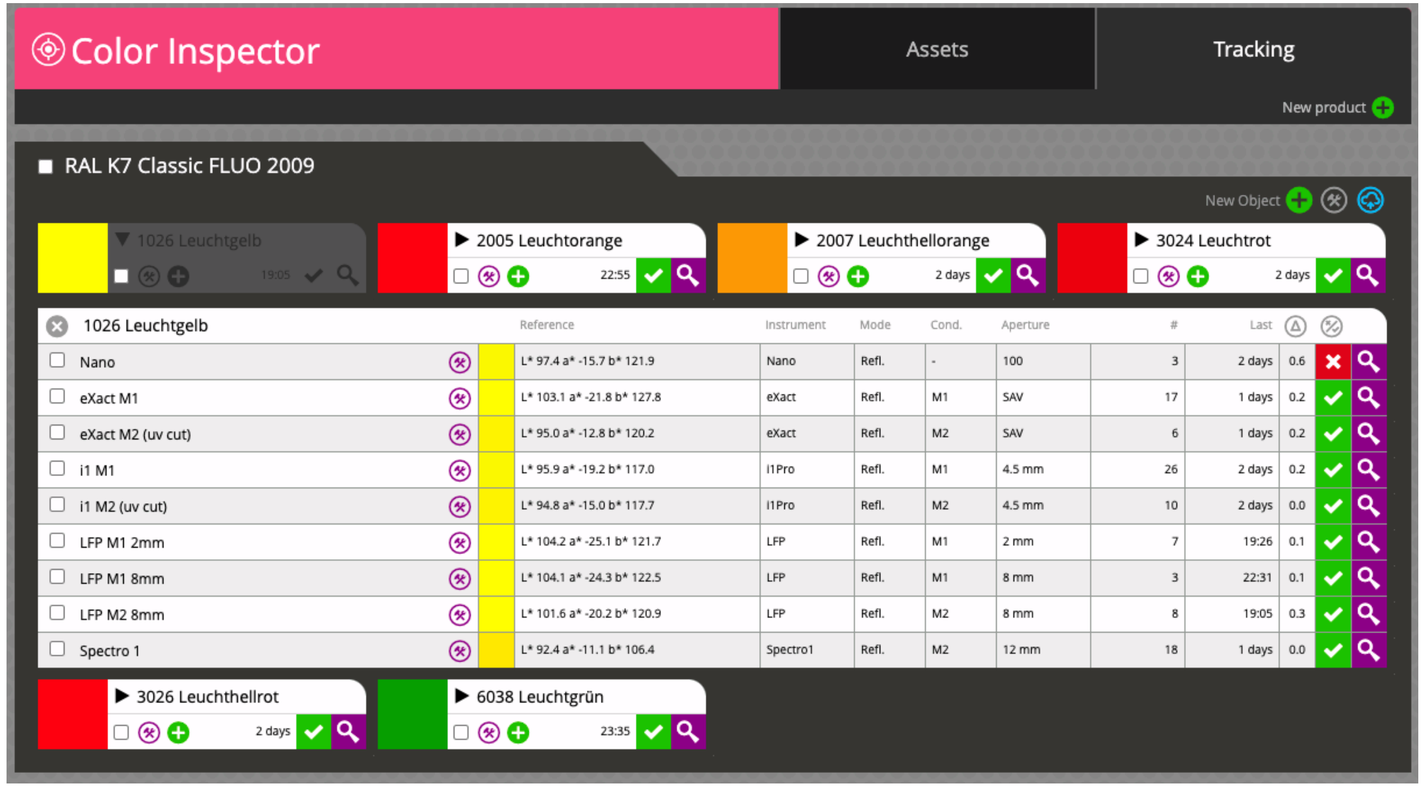
Accommodates Inter-Instrument differences

Vertical hierarchy: Product, Object, Track



In this example color is associated with the object - tracks are intended to describe the same sample with various instruments or instruments settings (M-condition, aperture…).

Use this type of data structure if more than one instrument or instrument settings are required to be tracked.

The additional advantage is a compact view of the whole product with elements that can be expanded into tracks. It makes navigation fast and easy.

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Multi-level Tolerances

1. Average - Traditional: an average of all pixels that are inside Measurement Field
   Returned value - Lab coordinates

2. Dominant Color - The dedicated algorithm is selecting dominant color and make an average of all pixels classified as dominant.
   Returned value - Lab coordinates

3. Surface Properties - a series of unique parameters are calculated as a results of pixel distribution analysis. The software is not comparing shapes but specific statistical parameters related to the pixel variations.

   Returned values:
   U - Uniformity Index
   V - Color Vibrance Index
   M - Match Index [%] - index that qualifies potential surface match
   A, B, C, D, H, L, - additional indexes that build sample surface “fingerprint”

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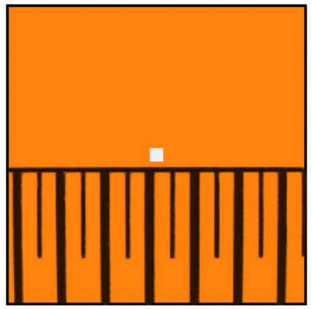
Aperture (Measurement field)

The Aperture (measurement field) is user definable. When you create a reference, the default value of 100 by 100 pixels can be reduced or enlarged to match specific task requirements

Max: 204px = 6.18 mm

Min: 10px = 0.30 mm



Areas marked with orange will be excluded from calculations

- square shape
- size range:
  max 204px = 6.18 mm
  min 10px = 0.30 mm
- recorded image size 224px
- post converted to sRGB space

The operator has no privileges to change aperture for existing reference.

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Multi-level Tolerances

ChromaChecker™ Champion can create custom multi-level tolerances that capture color expectations

Current list of parameters consist of 25 appearance and colorimetric values grouped in three sections

Tolerances

	Average			Dominant	
	Tolerance	Measured		Tolerance	Measured
ΔE 2000	3	0.1	✓		0.1
ΔE 1994		0.1			0.1
ΔE 1976		0.1			0.1
ΔE CMC (1:1)		0.1			0.1
ΔE CMC (2:1)		0.1			0.1
ΔL		0.1			0.1
Δa		0.0			0.0
Δb		0.0			0.0
ΔC		-0.0			-0.0
Δh		0.1			-0.1
ΔH		0.0			0.0

	Tolerance	Measured	
Surface Uniformity		1.34	
Color Vibrance		7.4	
Surface Match	> 80	97%	✓

User chooses critical parameters that have to meet criteria

In addition, there are eight **surface compliance** factors that help to understand a nature of the sample

Surface compliance

	A	B	C	D	H	L	U	V
Measurement	1.47	1.25	1.17	0.12	31.25	1.30	1.34	7.40
Reference	1.44	1.24	1.15	0.12	30.03	1.31	1.33	7.17
%	-2	-0	-2	0	-4	0	-1	-3

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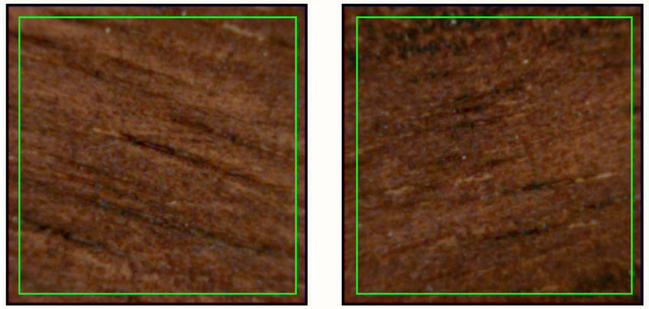
M - Surface Match Parameter

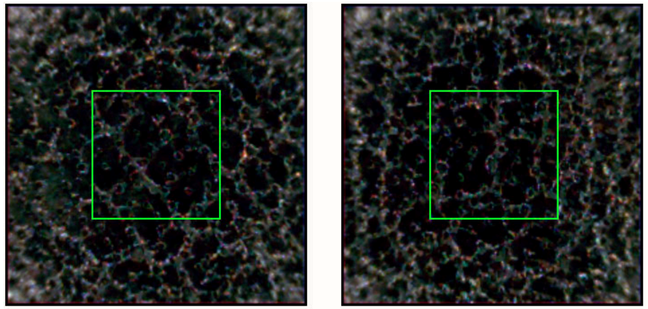
Different measurements from the same natural material

Wood (raw)



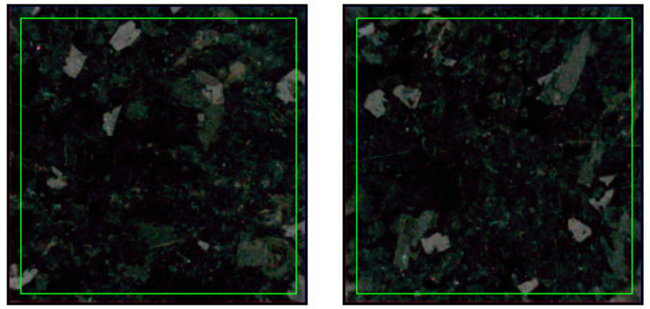
M= 87%

Patent leather



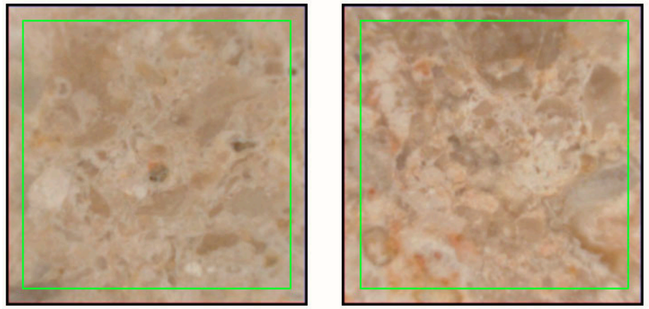
M=89%

Polished granite



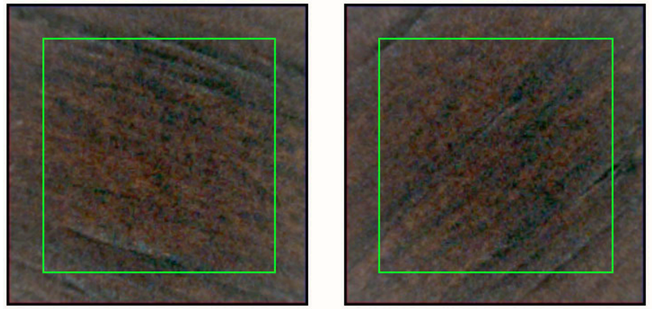
M=95%

Polished marble



M= 69%

Satin varnished wood



M=61%

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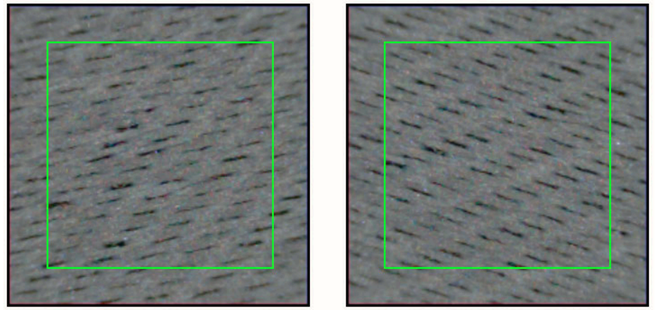
M - Surface Match Parameter

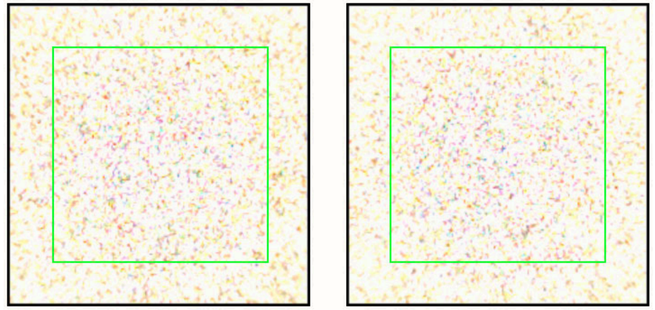
The same material (artificial, industrial products)

Textile



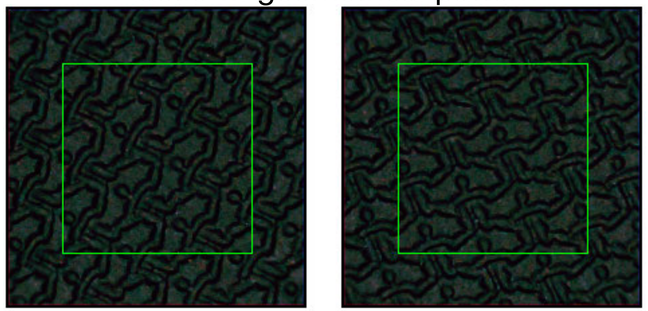
M= 94%

Anodized aluminum



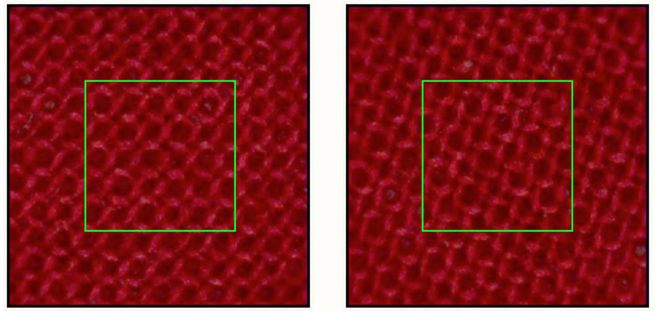
M=95%

Plastic w. geometrical pattern



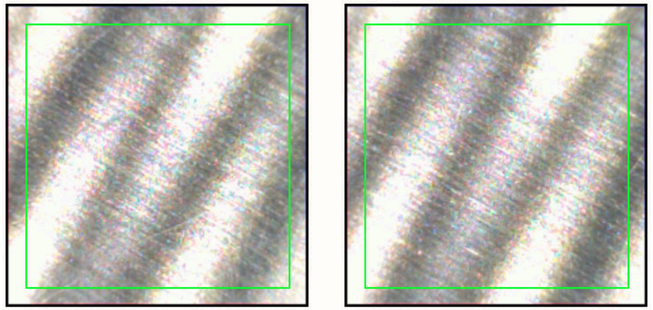
M=99%

Textile



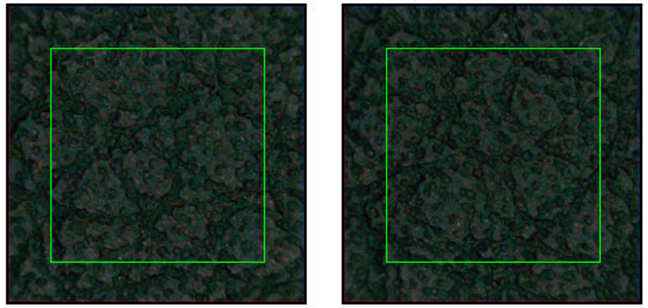
M= 89%

Brushed stainless steel



M= 97%

Plastic w. Random pattern



M=96%

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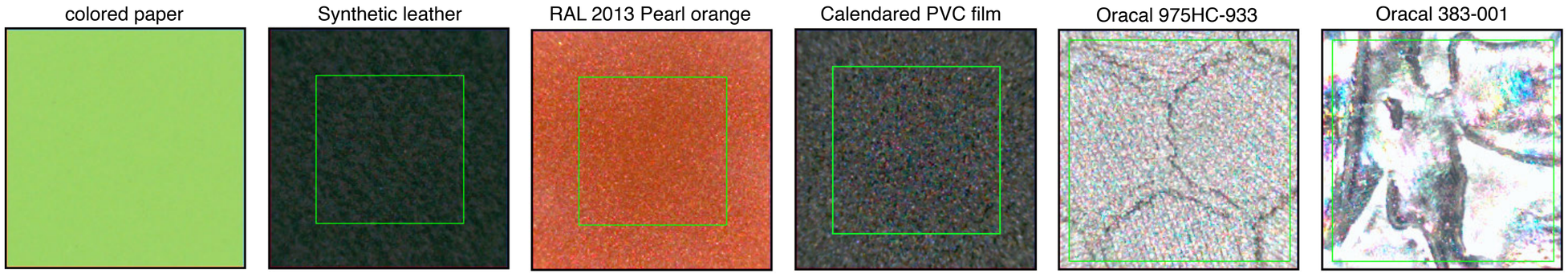
U - Uniformity Index Parameter

The parameter, that describes object surface complexity (pixel variations)



U=0.6 U=3.0 U=6.0 U=7.7 U=11.2 U=13.4

Absolutely uniform surface has value 0 but it is very rare to find sample that has this kind of uniformity (built-in Nano calibration white has it if no dust!)

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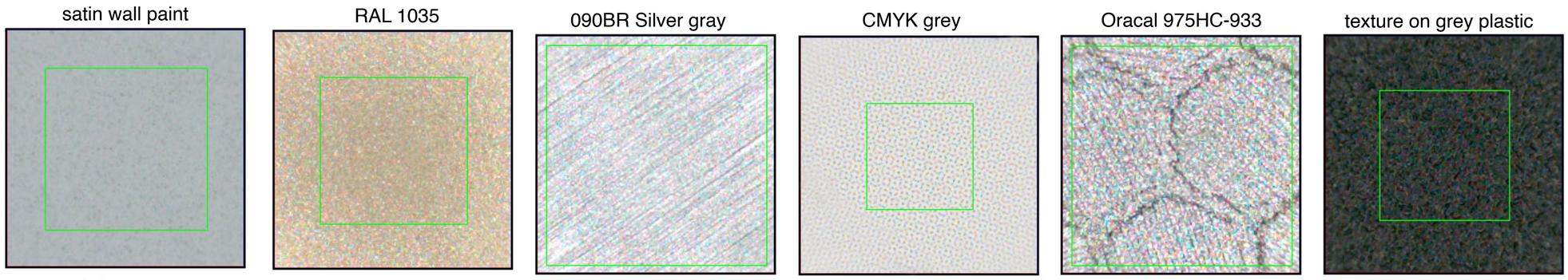
V - Color Vibrance Index Parameter

Vibrance index, quantifies objects that have multi-colored points materials.



V=3.7 V=5.4 V=8.2 V= 9.0 V=11.2 V= 12.3

Multi-colored points are characteristic of some plastics and metallic surfaces, but also exist in process printing (C,M,Y, K dots).
Light falling on some surfaces undergoes micro-fission. As a result, multi-colored surface cracks appear. Such clusters can be seen on plastics which have been given a fine-grained surface structure. This phenomenon is very clearly visible in metallic varnishes and anodized aluminum.

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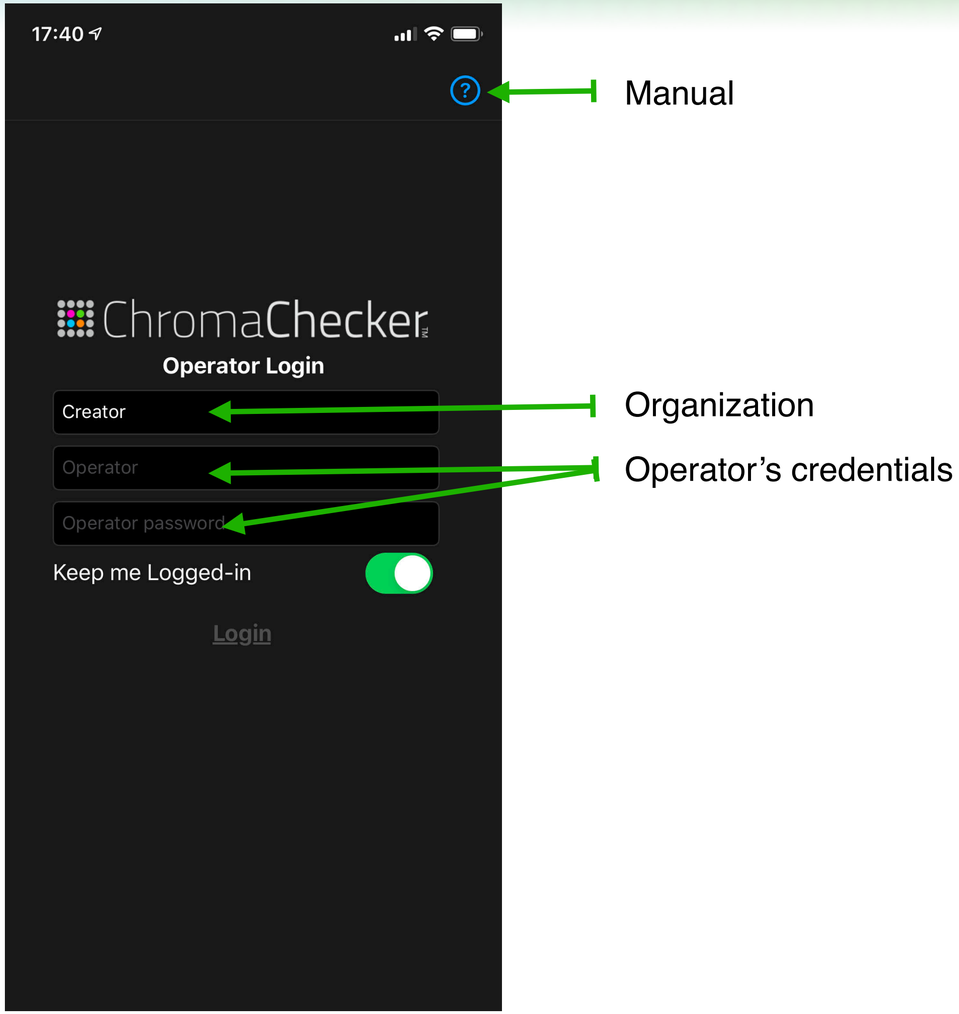
Login Simplicity

To start app: The user enters Organization name, operator name and pw

Operators of the system need to be defined within Organizations “Accountability Inspector.”

As many operators can be defined as required, and each operator can be set to “Basic, Intermediate, or Advanced.” Operator with “Basic” level can only measure samples for comparisons. Operators designated as “Intermediate or Advanced” can create new References.



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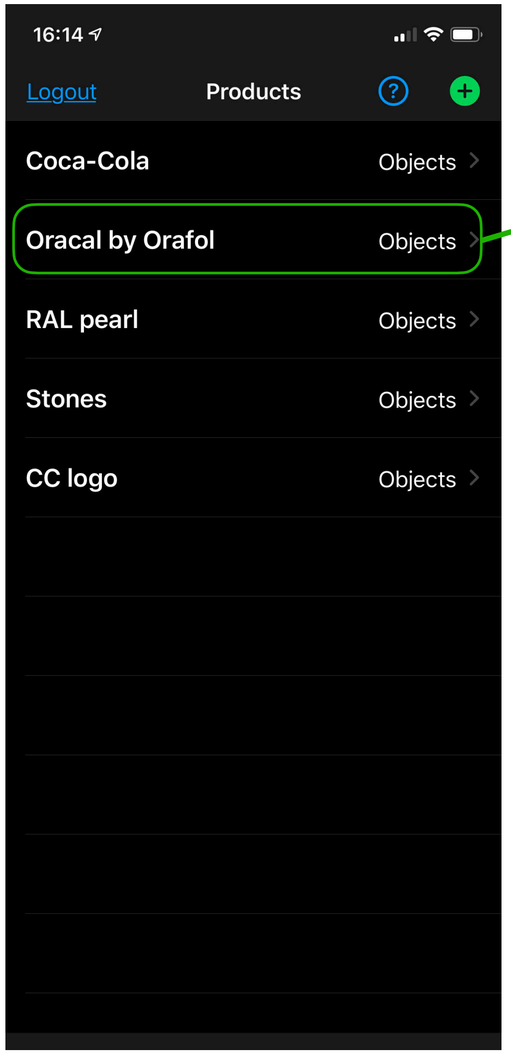
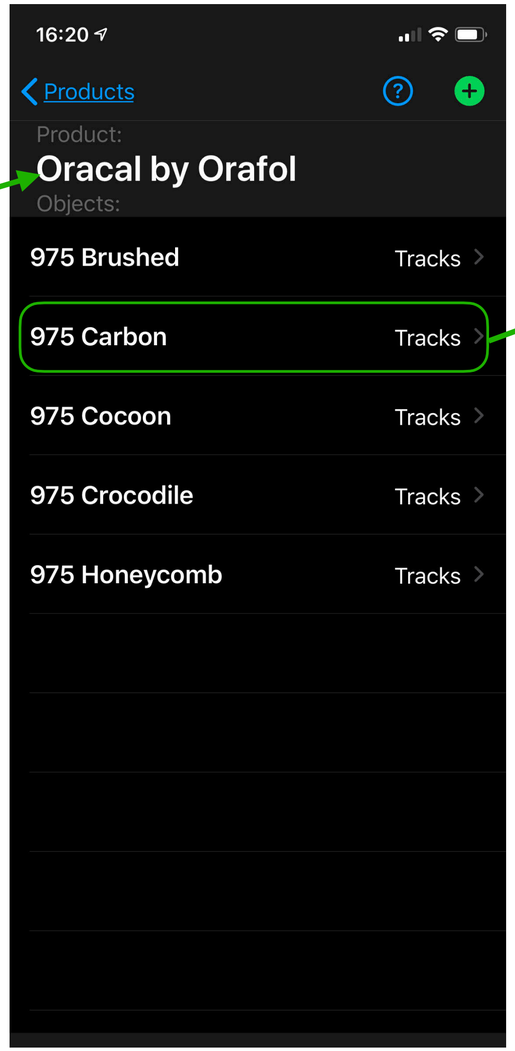
3-level Data Structure: Selecting Sample

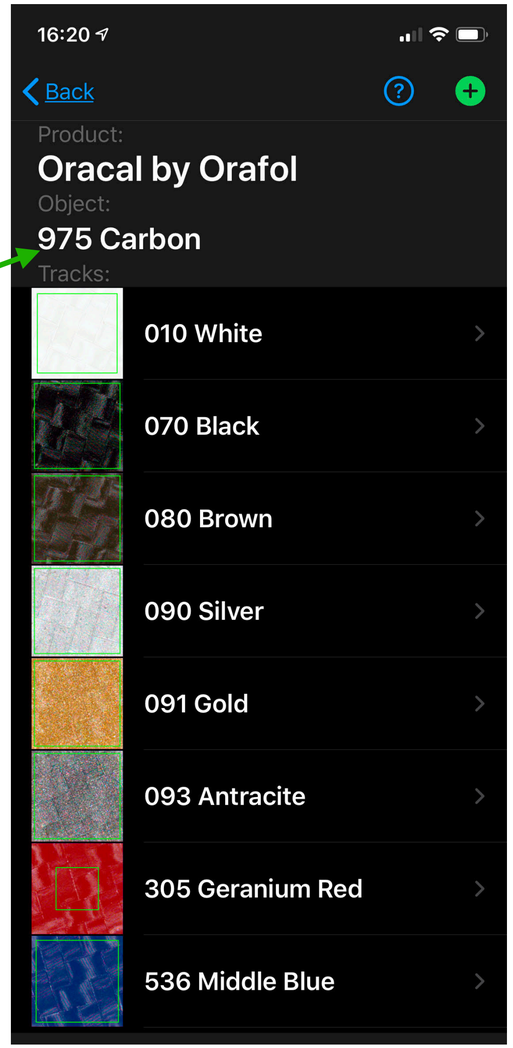
1. Select Product



2. Select Object



3. Select Track



The color is related to the track while the element is related to the subgroup of samples - in this case the surface structure (Brushed, Carbon, Cocoon…).

Relate to Object

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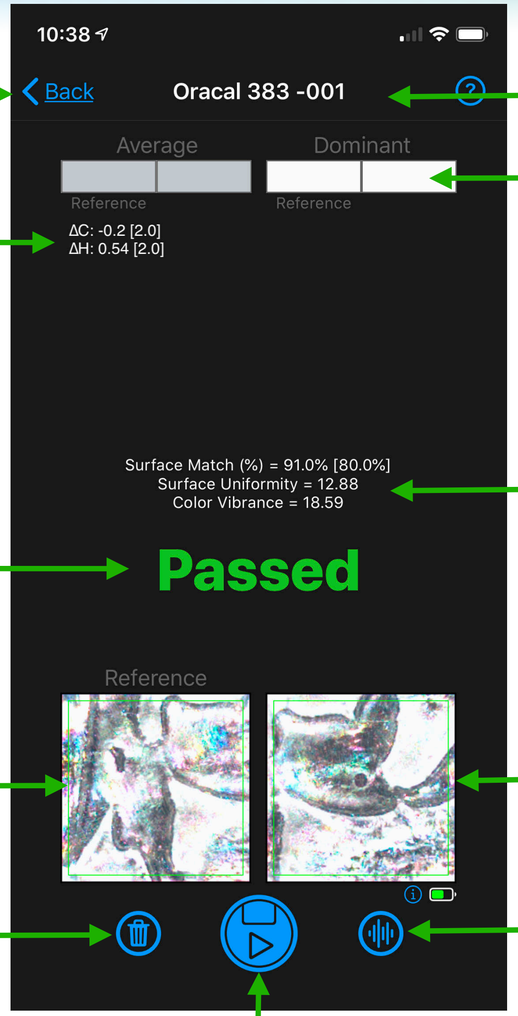
Measurements



Go back to Product/Object selection

Track Name

Visual color simulation of reference to measurement comparison for both methods: Average and Dominant

Tolerances
(separate for both methods: Average and Dominant)
values come from CC Cloud repository

Surface evaluation:
Match, Uniformity, Vibrance

Pass/Fail examination result

Reference image
comes from CC Cloud repository

Live camera view of measured object
(when measure button pressed - still image)

Delete current measurement

Calibration button

Measure/Accept button

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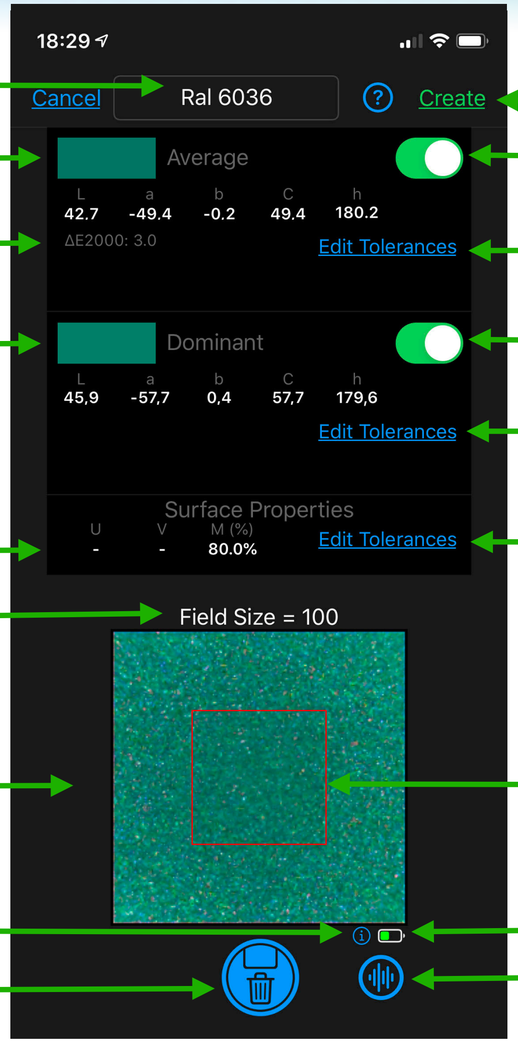
Creating Track Reference



Track name

Average color simulation and colorimetric coordinates

Colorimetric Tolerances

Dominant color simulation and colorimetric coordinates

Surface Tolerances

Aperture size [px]

Reference image (to be uploaded CC Cloud repository)

Device info (s/n and versions)

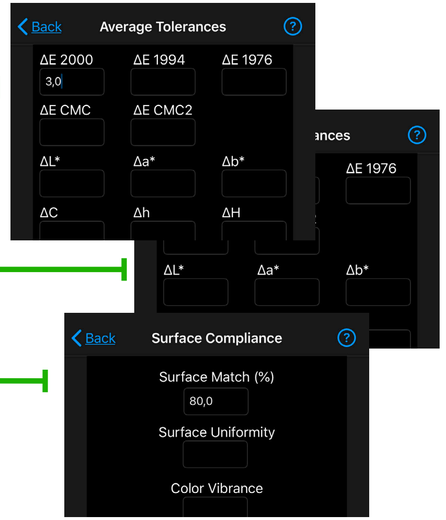
Measure/Remeasure button

Create (save)

Average enabled

Dominant enabled

Tolerances sub-windows



Adjustable Aperture size (two-fingers

Nano battery status

Calibration button

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Tracking Report

	Operator	Created	Average L*	Average a*	Average b*	Average ΔE_{00}	Average ΔL	Average ΔC	Average ΔH	Dominant L*	Dominant a*	Dominant b*	Uniformity	Vibrance	Match
	Tom Brown	2020-07-24 02:56	86.43	-0.41	-2.14	0.22	0.23	0.15	0.05	90.62	-3.11	-0.38	6.0	8.3	86%
	Tom Brown	2020-07-23 00:42	86.17	-0.87	-1.91	0.82	0.49	0.07	0.53	90.65	-3.38	-0.18	6.5	8.4	96%
	Tom Brown	2020-07-23 00:42	86.20	-0.72	-2.16	0.63	0.46	0.24	0.33	90.11	-1.09	-1.87	6.3	8.7	92%
	Tom Brown	2020-07-23 00:42	86.16	-0.79	-1.97	0.73	0.50	0.09	0.45	90.12	0.74	-0.06	6.4	8.5	95%
	Tom Brown	2020-07-23 00:42	86.00	-0.66	-1.97	0.63	0.66	0.05	0.32	89.50	-0.71	-1.39	6.8	8.5	95%
	Tom Brown	2020-07-23 00:42	85.79	-0.73	-1.62	0.88	0.86	-0.26	0.49	90.20	-2.41	-1.74	6.7	8.0	87%
	Tom Brown	2020-07-23 00:42	86.38	-0.78	-2.03	0.66	0.28	0.14	0.43	90.79	-0.37	-1.74	6.2	8.4	90%
	Tom Brown	2020-07-23 00:42	86.25	-0.68	-2.21	0.58	0.41	0.28	0.28	90.88	-1.19	-1.92	6.4	8.7	95%

Parameters defined as tolerances are displayed within each track with timelines and in tabular form.

Statistic distribution helps CC Champion adjust tolerances based on real production.

Time range / Operator filtering enables additional evaluation.

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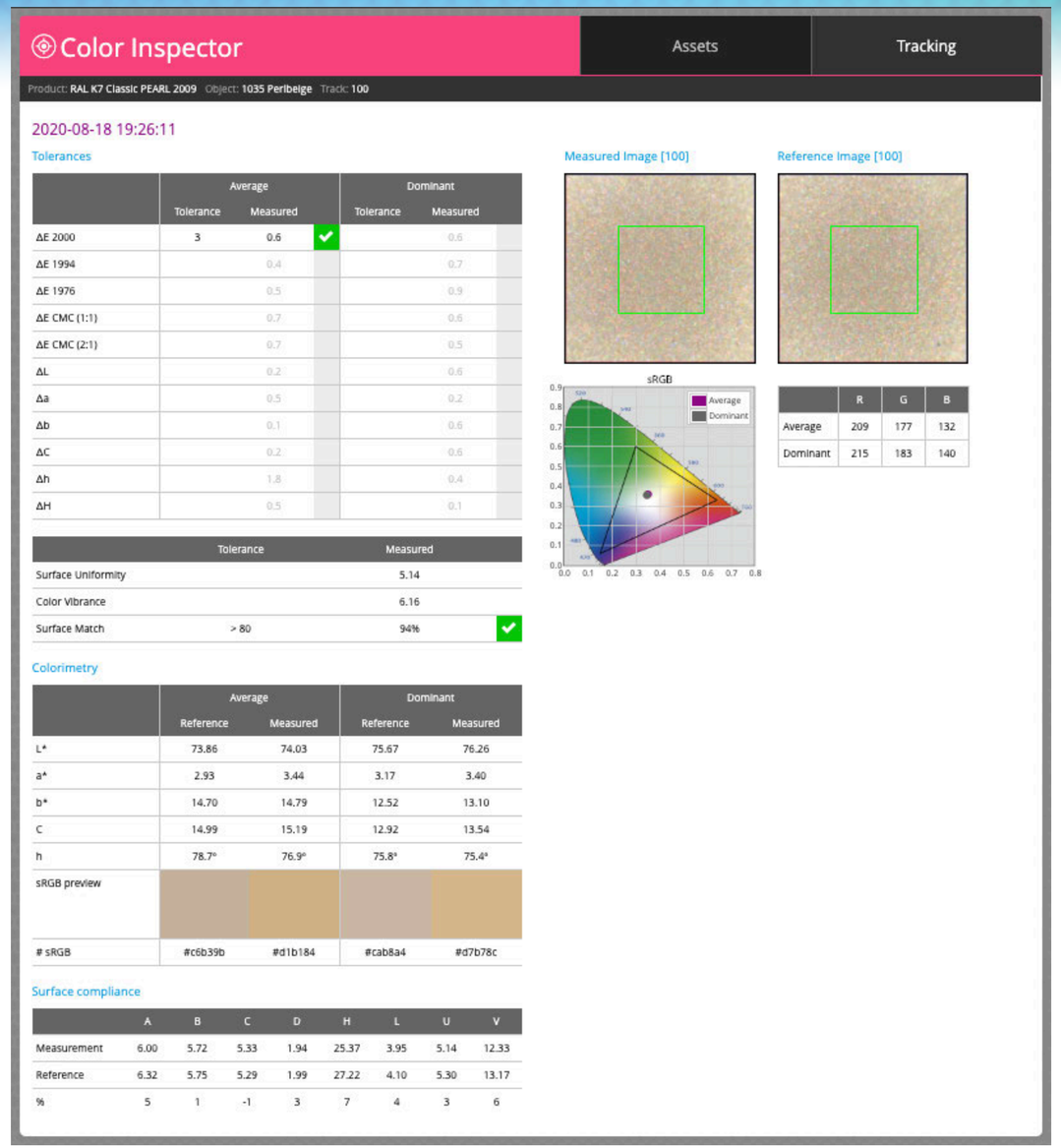
Measurement Report



Color Inspector | Assets | Tracking

Product: RAL K7 Classic PEARL 2009 Object: 1035 Perlbeige Track: 100

2020-08-18 19:26:11

Tolerances

	Average			Dominant	
	Tolerance	Measured		Tolerance	Measured
ΔE 2000	3	0.6	✔		0.6
ΔE 1994		0.4			0.7
ΔE 1976		0.5			0.9
ΔE CMC (1:1)		0.7			0.6
ΔE CMC (2:1)		0.7			0.5
ΔL		0.2			0.6
Δa		0.5			0.2
Δb		0.1			0.6
ΔC		0.2			0.6
Δh		1.8			0.4
ΔH		0.5			0.1

	Tolerance	Measured	
Surface Uniformity		5.14	
Color Vibrance		6.16	
Surface Match	> 80	94%	✔

Colorimetry

	Average		Dominant	
	Reference	Measured	Reference	Measured
L*	73.86	74.03	75.67	76.26
a*	2.93	3.44	3.17	3.40
b*	14.70	14.79	12.52	13.10
C	14.99	15.19	12.92	13.54
h	78.7°	76.9°	75.8°	75.4°
sRGB preview				
# sRGB	#c6b39b	#d1b184	#cab8a4	#d7b78c

Surface compliance

	A	B	C	D	H	L	U	V
Measurement	6.00	5.72	5.33	1.94	25.37	3.95	5.14	12.33
Reference	6.32	5.75	5.29	1.99	27.22	4.10	5.30	13.17
%	5	1	-1	3	7	4	3	6

Measured Image [100]

Reference Image [100]

sRGB

Average

Dominant

	R	G	B
Average	209	177	132
Dominant	215	183	140

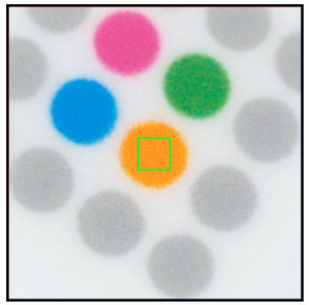
CC Champion can see details of each measurement file. Even parameters not specified in tolerances section are reported (gray table cells)

It is possible to change tolerances for existing measurements - “Recalculate” button updates pass/fail evaluation (on demand)

ChromaChecker

Application: Printing Industry

Case study: Measurements of the very small objects
Task: Measure orange dot from printed ChromaChecker logo



Aperture: 24 px = 0.72 mm

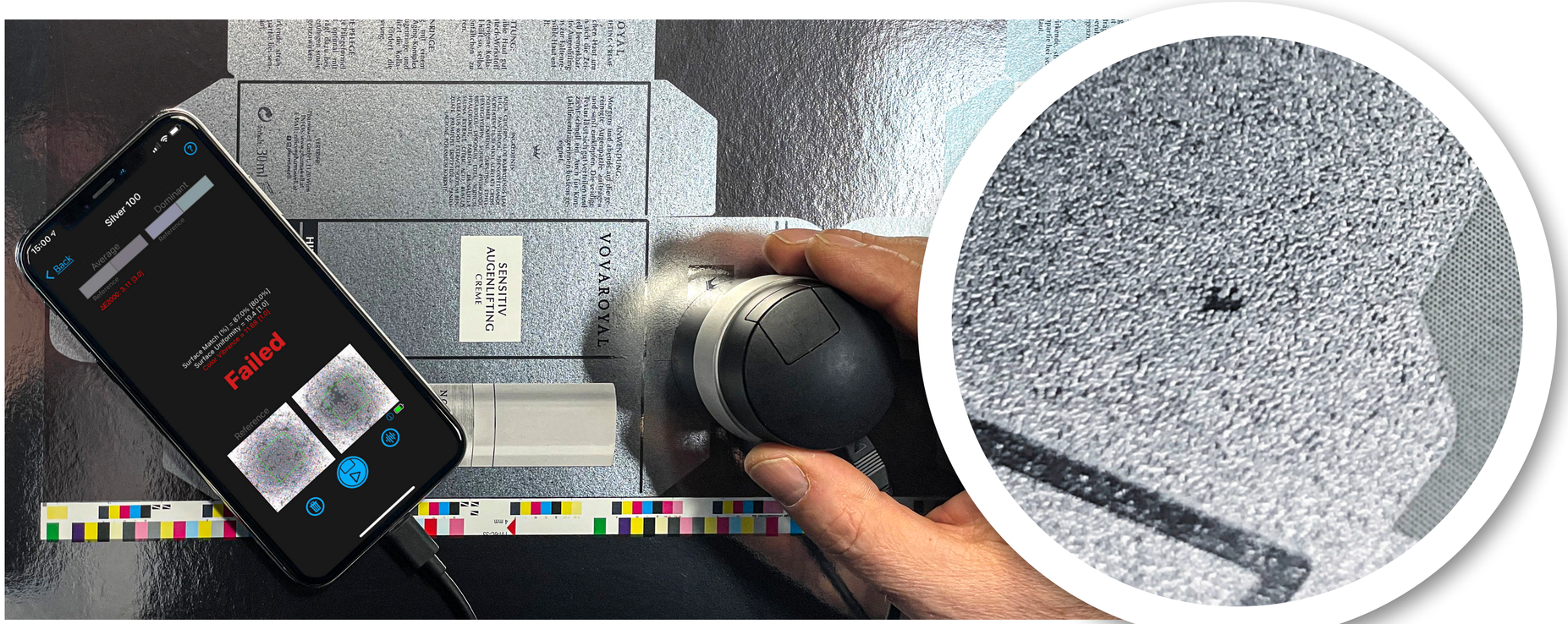
In this example measurement field is 2.4 times bigger than minimal available - we recommend to use largest possible aperture to get as many sampled pixels as possible for averaging

24x24 px = 576

CC Nano

Application: Printing Industry

Case study: Quality control of the structural hybrid varnish
Task: Document and qualify defect.



Eliminate subjectivity by measuring defects of structural varnishes even on metalized silver paper using a quantitative process.

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Application: Printing Industry

Case study: Identical color substrate with 13 different embossed patterns recognizable by the Nano.

Color Inspector

Assets | Tracking

Product: arjowiggings Object: Embossing Track: Buckram

2021-01-06 17:52:48

Tolerances

	Average			Dominant	
	Tolerance	Measured		Tolerance	Measured
ΔE 2000	2	0.1	✓		0.3
ΔE 1994		0.2			0.3
ΔE 1976		0.2			0.4
ΔE CMC (1:1)		0.2			0.3
ΔE CMC (2:1)		0.1			0.3
ΔL		0.2			0.2
Δa		0.0			0.1
Δb		0.1			0.3
ΔC		0.1			-0.3
Δh	1.8	-0.3	✓		0.6
ΔH		0.0			0.1

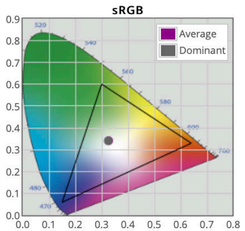
	Tolerance	Measured	
Surface Uniformity	± 0.5	1.01	✓
Color Vibrance	± 0.5	1.41	✓
Surface Match	> 93	97%	✓

Colorimetry

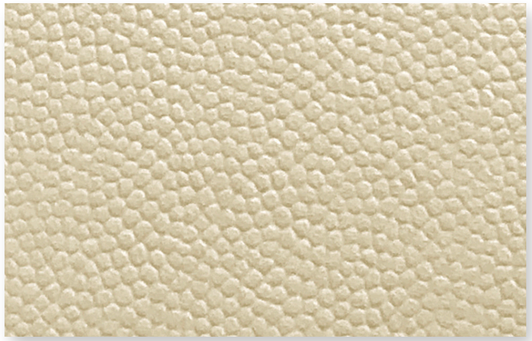
	Average		Dominant	
	Reference	Measured	Reference	Measured
L*	94.13	93.96	95.37	95.19
a*	0.72	0.70	0.43	0.49
b*	7.00	7.11	6.79	6.48
C	7.03	7.15	6.81	6.50
h	84.1°	84.4°	86.3°	85.7°

Measured Image [204]

Reference Image [204]



	R	G	B
Average	255	234	193
Dominant	255	238	197



ChromaChecker

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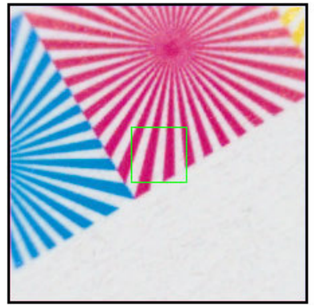
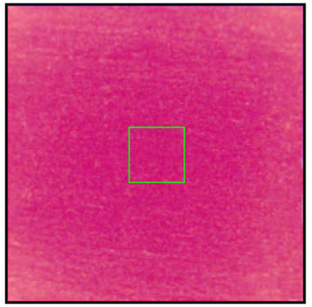
Application: Printing Industry

Case study: Measurement of ultra small objects

Task: Measure color of complex object - extract dominant color

The Measurement field size is 40 px - 1.2mm - but measured element due to dominant color extraction can be smaller - the only condition is: dominant color (magenta in this case) area have to be bigger than white. For the reference a solid sample is defined (solid magenta).





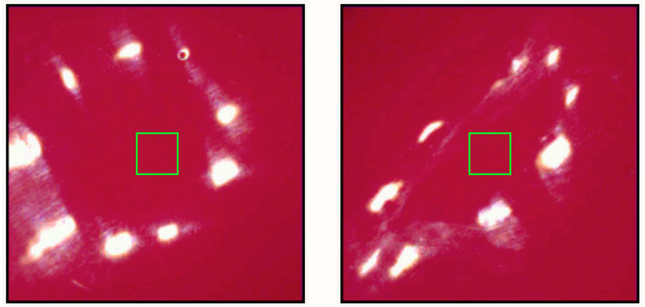
Tolerances

	Average			Dominant		
	Tolerance	Measured		Tolerance	Measured	
ΔE 2000	2	21.6	✗	2	1.1	✓
sRGB preview						

CC Nano

Application: Cosmetics Industry

Case study: Nail polish on the convex nail surface.



	Average			Dominant	
	Tolerance	Measured		Tolerance	Measured
ΔE 2000	3	0.5	✓		0.2

The convex glossy surface will cause internal LED reflections - the measuring field must be reduced to eliminate them.

For uniform varnishes (here U = 1) the use of the Dominant color can eliminate scratches and reflections - Do not use for pearl or metallic varnishes.

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Applications: Automotive Industry

The interior of the car is a classic example of a scenario in which a lot of materials with different technical parameters must co-create a harmonious design. Evaluation of the interior is one of the key elements of the purchase decision, so the competition of manufacturers in this field is very high.

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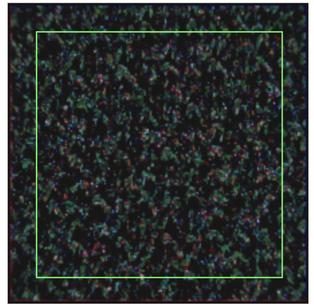
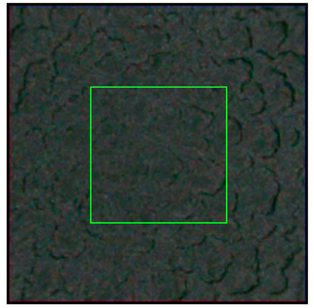
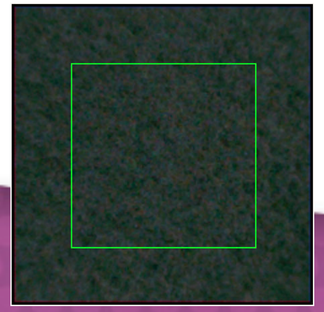
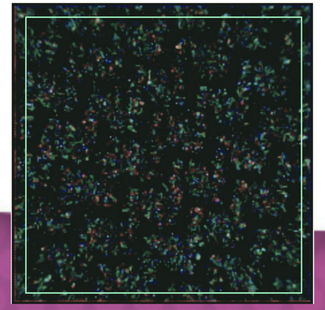
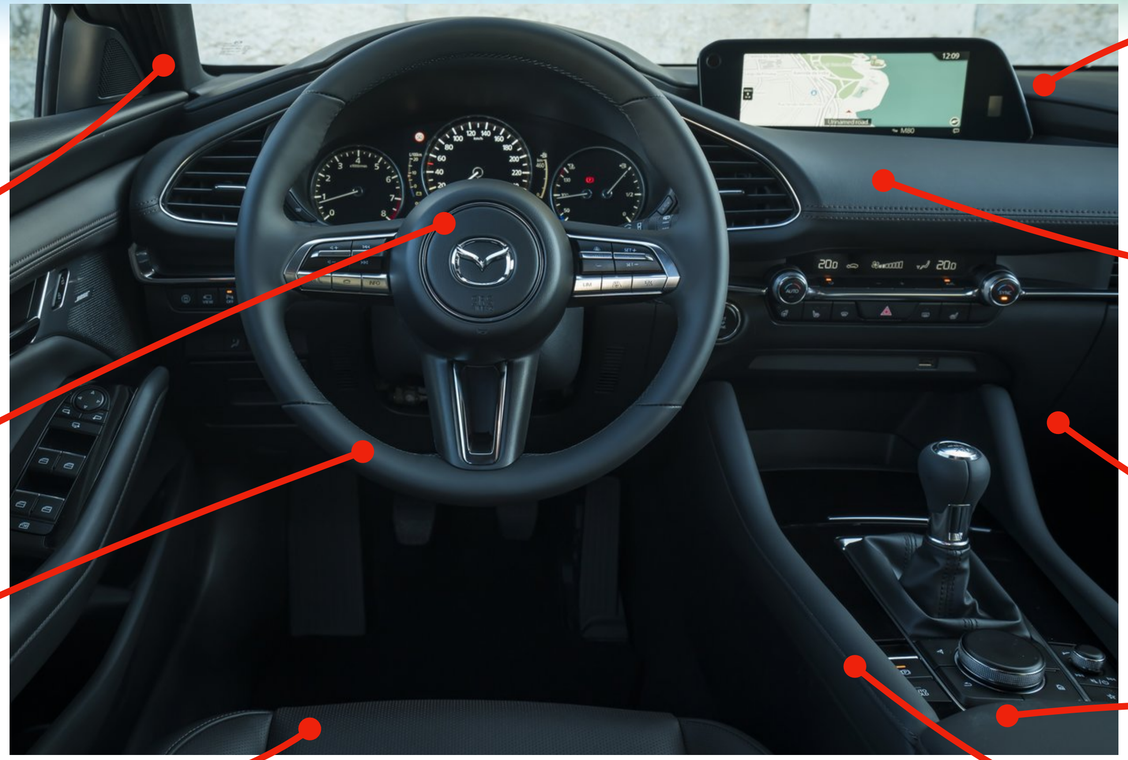
Applications: Automotive Industry

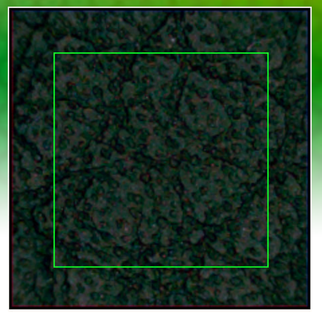


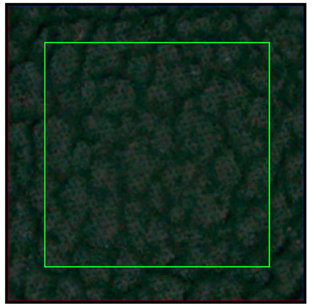


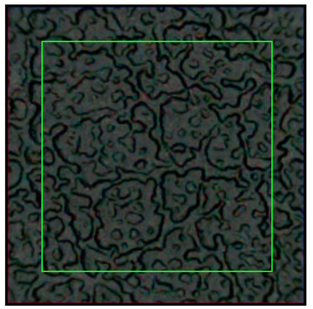


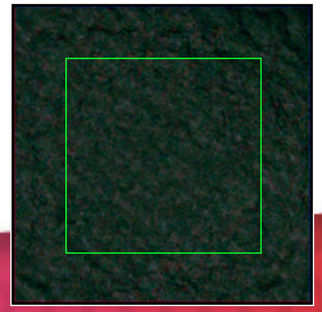


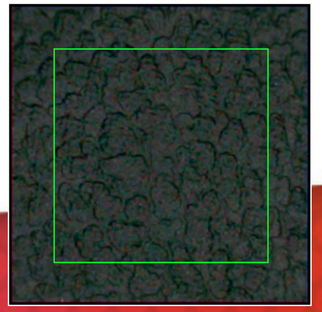












The real scenario:
A huge variety of gray shades. In a few minutes, you can easily report dozens of different surfaces and structures.

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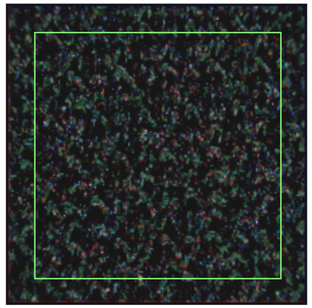
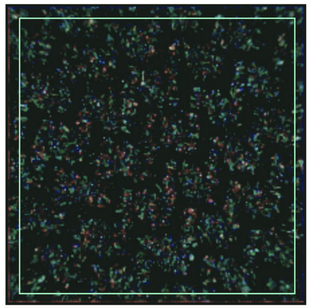
Applications: Automotive Industry

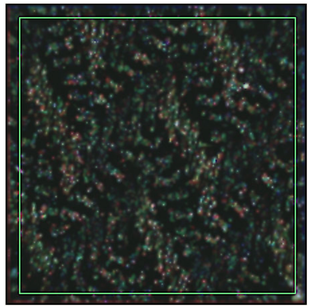
TEXTILES



U=8.1 V=10.2 M>82

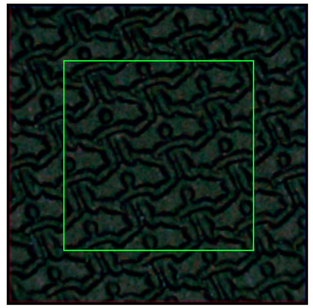


U=6.5 V=8.5 M>90

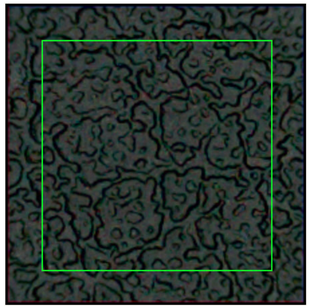


U=7.1 V=8.1 M>92

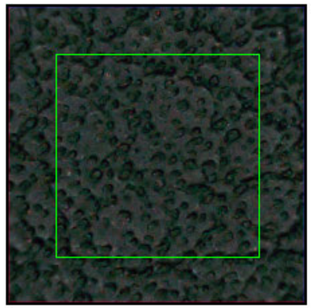
HARD PLASTICS



U=5.4 V=9.9 M>95

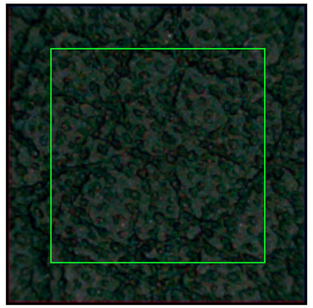


U=6.7 V=10.2 M>88

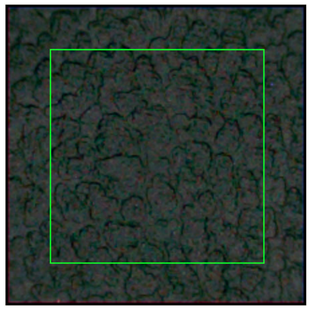


U=4.6 V=9.6 M>85

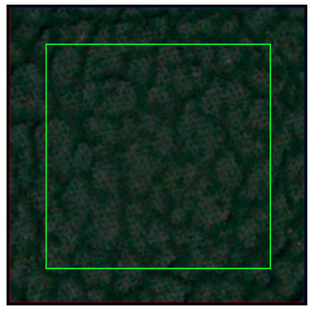
SOFT PLASTICS



U=4.1 V=9.2 M>82

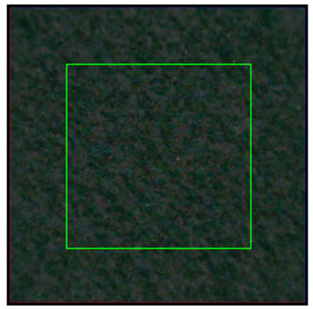


U=5.9 V=6.1 M>90

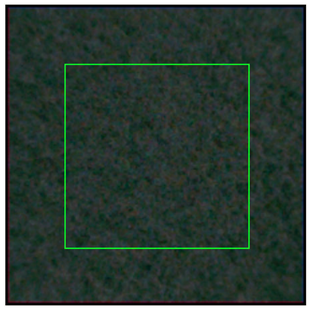


U=3.8 V=7.7 M>85

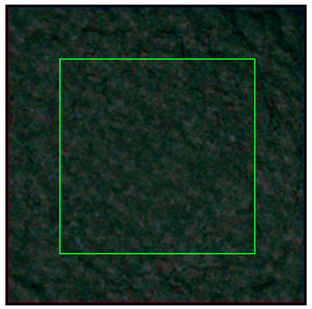
SYNTHETIC LEATHER



U=3.0 V=7.7 M>90



U=3.7 V=9.3 M>90



U=5.0 V=10.0 M>90

ChromaChecker™

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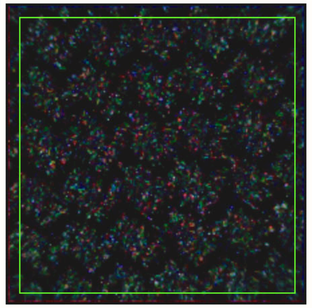
Applications: Automotive Industry

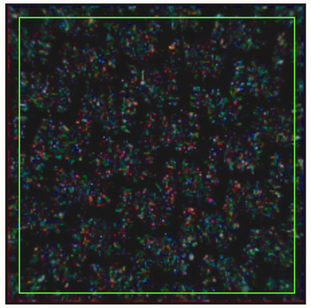
Sample:

Upholstery fabric used in the door.

A series of measurements indicated that most measurements are within 0.5 ΔE tolerance, and the Match parameter is very high - the vast majority of measurements were above 90% regardless of the angle of the pattern.

Presented example: M = 97%





	Tolerance	Measured
Surface Uniformity		6.76
Color Vibrance		16.96
Surface Match	> 80	97%

Tolerances

	Average		Dominant	
	Tolerance	Measured	Tolerance	Measured
ΔE 2000	3	0.1		2.2
ΔE 1994		0.2		1.7
ΔE 1976		0.2		2.2
ΔE CMC (1:1)		0.3		2.4
ΔE CMC (2:1)		0.2		2.1
ΔL		0.1		0.7
Δa		0.0		2.0
Δb		0.1		0.6
ΔC		0.0		2.1
Δh		1.8		-0.2
ΔH		0.1		0.0

Colorimetry

	Average		Dominant	
	Reference	Measured	Reference	Measured
L*	3.23	3.37	1.71	2.36
a*	-2.07	-2.08	-5.01	-7.04
b*	0.38	0.45	1.44	2.00
C	2.11	2.12	5.21	7.32
h	169.6°	167.8°	163.9°	164.1°
sRGB preview				
# sRGB	#070d0b	#090d08	#000a02	#000d02

Surface compliance

	A	B	C	D	H	L	U	V
Measurement	8.66	6.11	8.65	5.82	85.32	5.85	6.76	16.96
Reference	8.37	5.95	8.44	3.76	85.12	5.81	6.62	16.85
%	-3	-3	-2	-55	-0	-1	-2	-1

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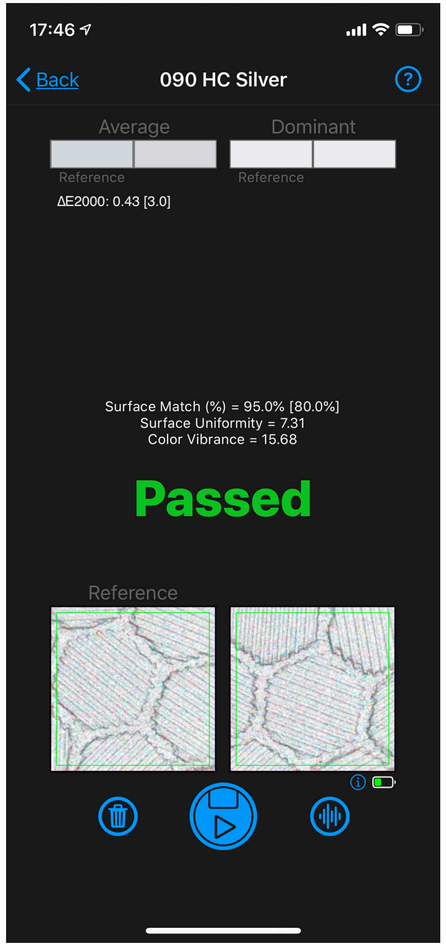
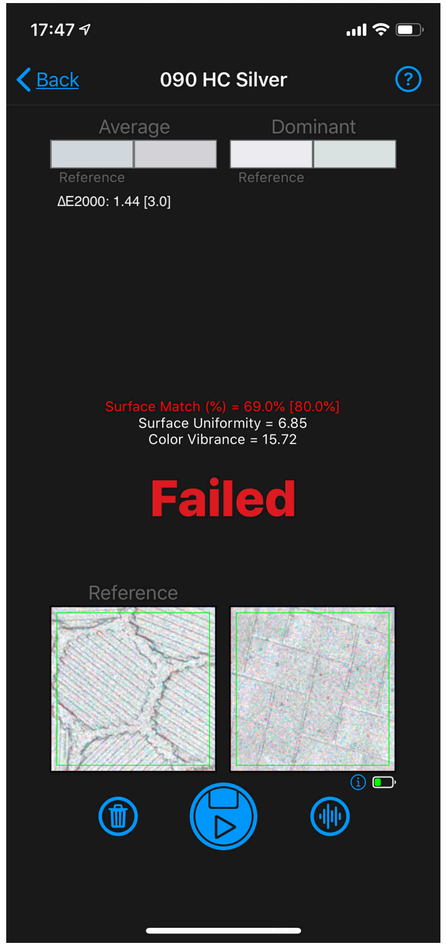
Applications: Cloud-based Product Sampler

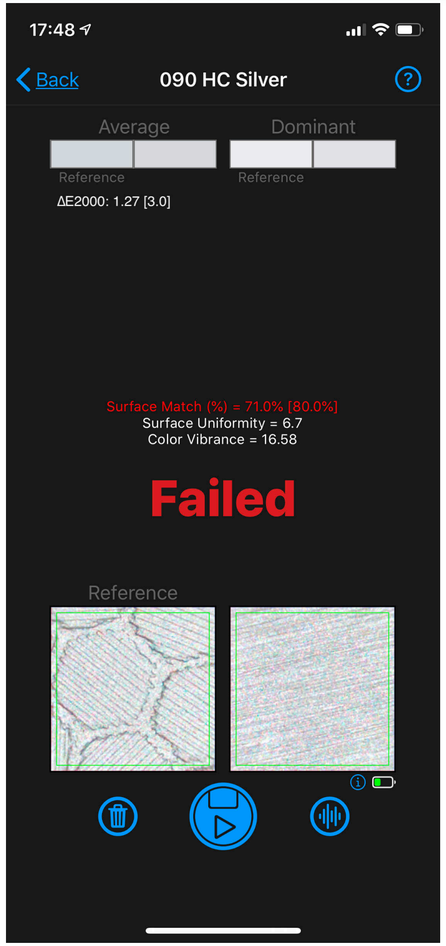
Same Color, Same Structure



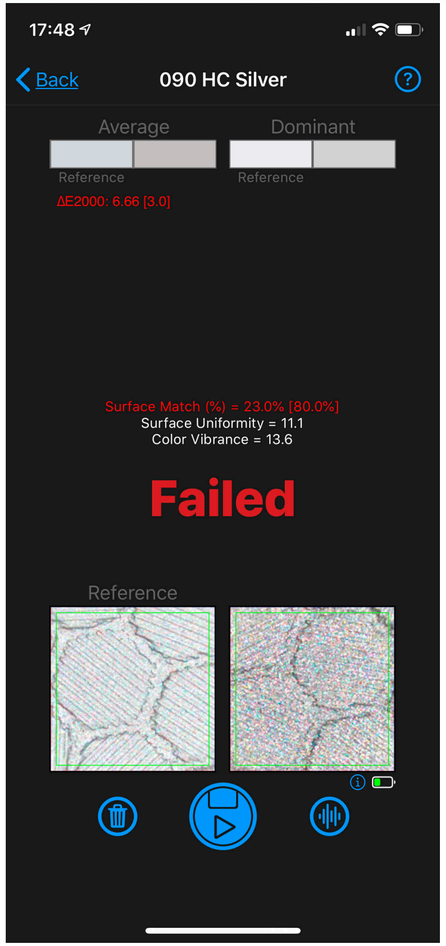
Same Color, Different Structure



Same Color, Different Structure



Same Structure, Different Color



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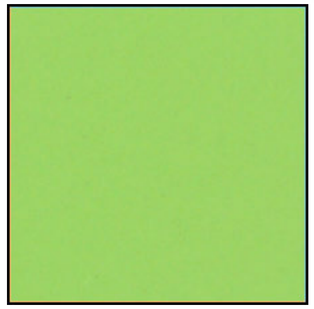
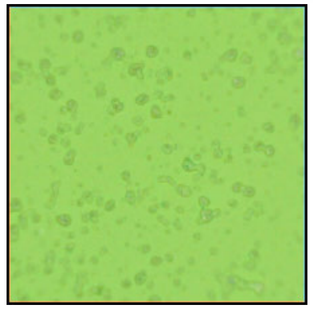
Applications: Print Substrate: Dominant Color

Sample:

The same ink
applied to a different surfaces

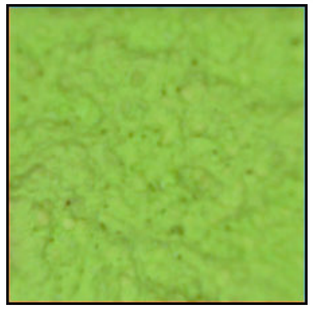


U= 0.9 V= 0.7

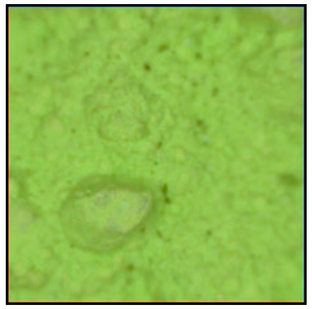


U=1.6 V= 0.8

U= 3.1 V= 1.7



U=3.4 V= 1.7

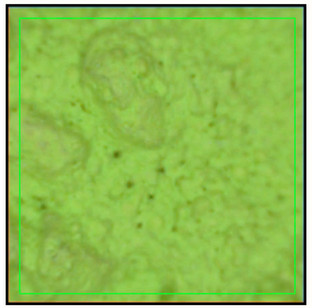


U=3.4 V= 1.7

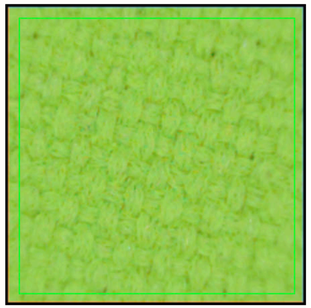
The algorithm for detecting the dominant color allows you to omit the shadows that the surface structure introduces into the analyzed image.

The use of this technology gives a radical reduction in the measurement error of the Average method.

Measured Image [204]



Reference Image [204]



Tolerances

	Average			Dominant		
	Tolerance	Measured		Tolerance	Measured	
ΔE 2000	3	2.5	✓	3	0.6	✓

ChromaChecker

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Applications: Special effects

Sample:

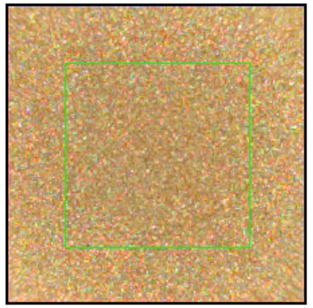
Different kind of effects

The parameter M comes from an experimental series of measurements.

The presented values may differ even for very similar materials and the user must carry out his own procedure.

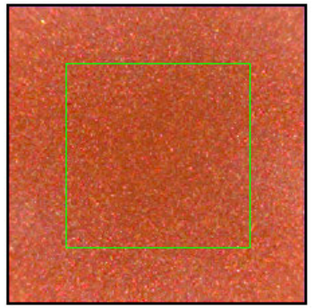
It is always recommended to repeat the measurements to assess how to effectively determine the parameters of the reference sample and the appropriate tolerances that will best illustrate the visual acceptance threshold for differences.

RAL 1036 Pearlgold



U=7.3 V=4.3 M>92

RAL 2013 Pearl orange

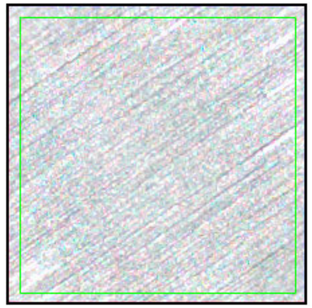


U=6.0 V=2.3 M>92

Oracal 383-001

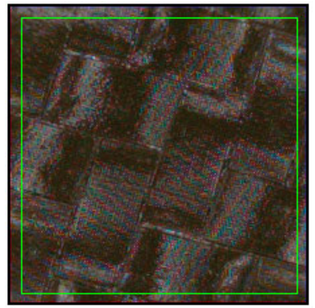
U=13.4 V=9.8 M>70*

Oracal 975BR-090



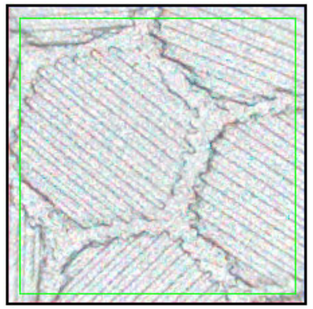
U=7 V=8.2 M>95

Oracal 975CA-080



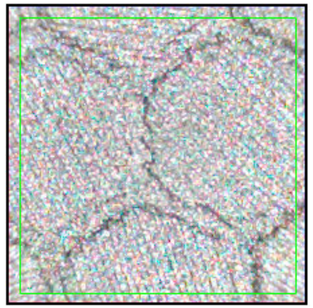
U=9 V=12.4 M>93

Oracal 975HC-090



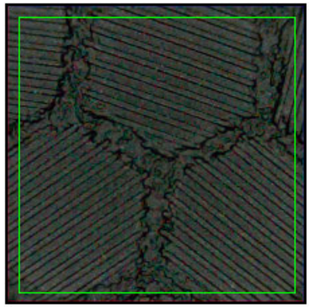
U=7.0 V=7.5 M>92

Oracal 975HC-933



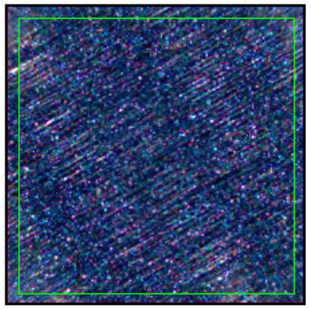
U=11.2 V=5.2 M>92

Oracal 975HC-070



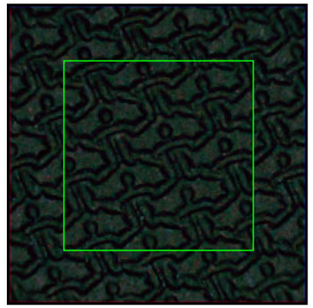
U=7.3 V=6.1 M>92

Oracal 975BR-192



U=14.8 V=9.9 M>95

Hard plastic



U=5.4 V=9.9 M>95

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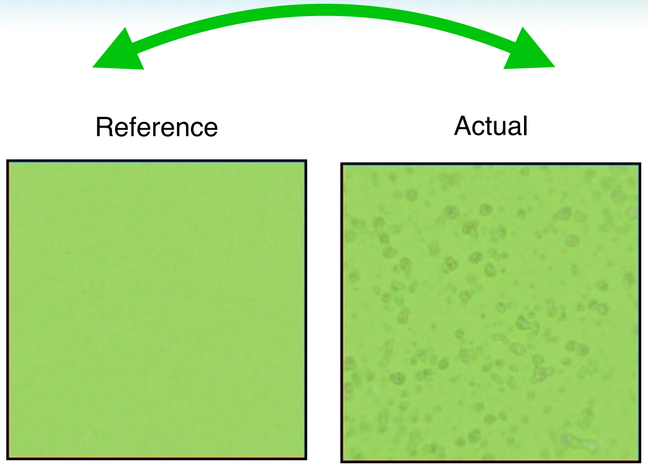
Purpose of Defining Appearance Match?

Visual impression



Objective numbers

Δ = ?

Not Only "Color Match"— Surface characteristics, metallics, raw materials and other variables can greatly affect the "Appearance Match": Requires additional metrics

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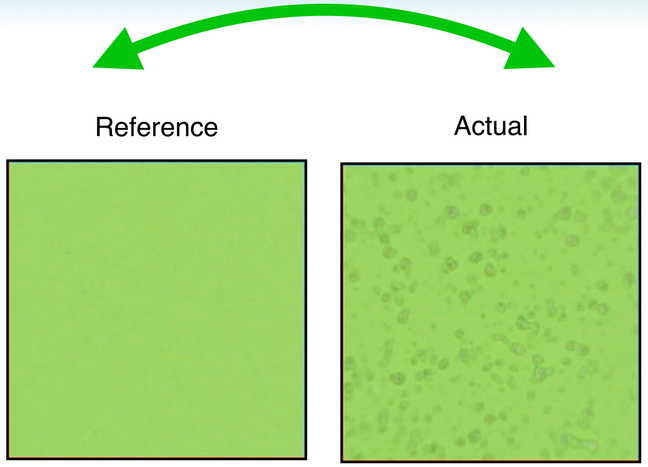
Purpose of Defining Appearance Match?

Visual impression



Objective numbers

$\Delta = ?$

Eliminate human subjectivity and replace with metrics that determines expectations met

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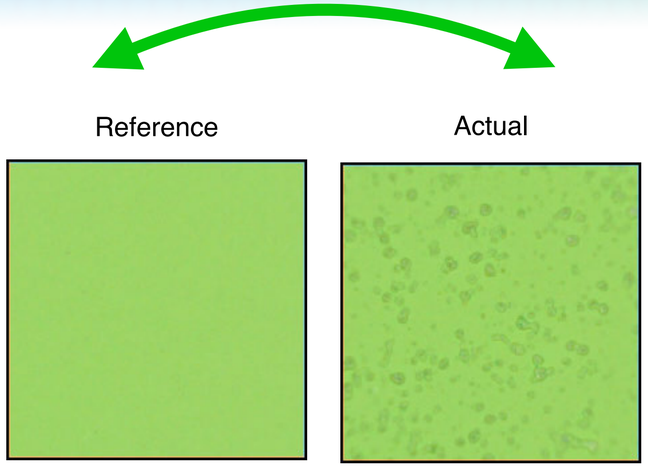
Purpose of Defining Appearance Match?

Visual impression



Objective numbers

Δ = ?

Eliminate human subjectivity and replace with metrics that determines expectations met

Requires Defining Companies Expectations for:

1) **Color- Average**
2) **Color- Dominant** ✅
3) **Surface Match = 23%** ❌
4) **Uniformity = .91**
5) **Vibrancy = .4**

Dominant ΔE= .3

Average ΔE= 1.0

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What and how we measure today?

Instruments

Colorimeters

Colorimetric coordinates.

Inexpensive, fast, but mostly low to medium accuracy.

Spectrophotometers

Spectral curves.

Beyond the human eye's ability to see sensitivity across wavelengths. Record that offers color analysis for many phenomena such as metamerism or fluorescence (may require complex measurements).

Glossmeters

Gloss units / various standards

An instrument which is used to measure specular reflection gloss of a surface. Gloss is determined by projecting a beam of light at a fixed intensity and angle onto a surface and measuring the amount of reflected light at an equal but opposite angle.

Roughness meters

Many different parameters (15)

An instruments that measure the smoothness (degree of roughness) of the surface of a target.
Roughness, is a component of surface texture.

Surface analysis (Gonio appearance)

Some modern instruments are capable of measuring parameters that describe the special effects of an object's surface. Metallic, pearly or iridescent surfaces now describe additional parameters.

In many cases, a single instrument might be not enough to fully describe the sample.

CC Color Inspector is designed to support multi-measurement tracking technology.

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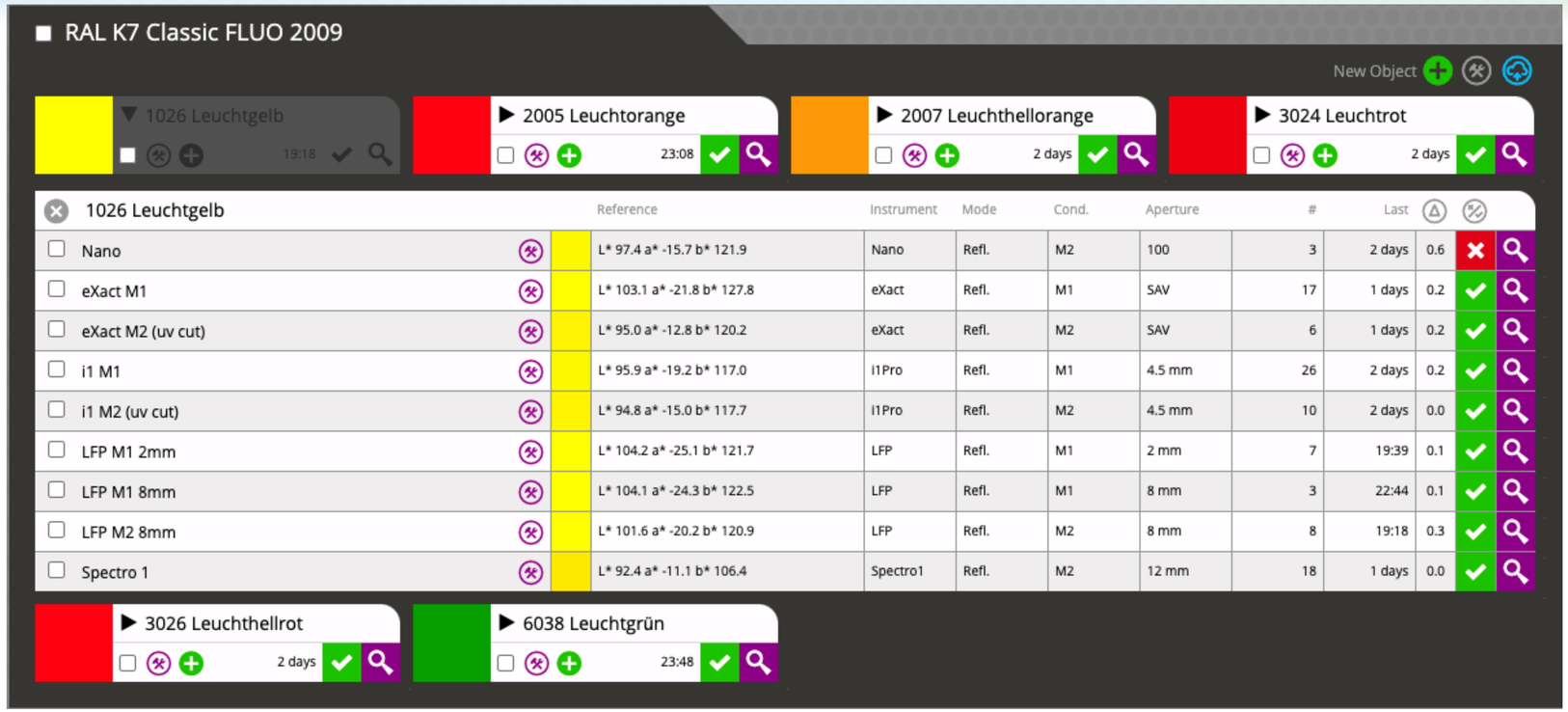
No single objective measurement method…



1026 Leuchtgelb	Reference	Instrument	Mode	Cond.	Aperture	#	Last	Δ	%
Nano	L* 97.4 a* -15.7 b* 121.9	Nano	Refl.	M2	100	3	2 days	0.6	✗
eXact M1	L* 103.1 a* -21.8 b* 127.8	eXact	Refl.	M1	SAV	17	1 days	0.2	✓
eXact M2 (uv cut)	L* 95.0 a* -12.8 b* 120.2	eXact	Refl.	M2	SAV	6	1 days	0.2	✓
i1 M1	L* 95.9 a* -19.2 b* 117.0	i1Pro	Refl.	M1	4.5 mm	26	2 days	0.2	✓
i1 M2 (uv cut)	L* 94.8 a* -15.0 b* 117.7	i1Pro	Refl.	M2	4.5 mm	10	2 days	0.0	✓
LFP M1 2mm	L* 104.2 a* -25.1 b* 121.7	LFP	Refl.	M1	2 mm	7	19:39	0.1	✓
LFP M1 8mm	L* 104.1 a* -24.3 b* 122.5	LFP	Refl.	M1	8 mm	3	22:44	0.1	✓
LFP M2 8mm	L* 101.6 a* -20.2 b* 120.9	LFP	Refl.	M2	8 mm	8	19:18	0.3	✓
Spectro 1	L* 92.4 a* -11.1 b* 106.4	Spectro1	Refl.	M2	12 mm	18	1 days	0.0	✓

Same sample measured with: Nano, eXact, i1Pro 3, Barbieri LFP and Spectro1, under different M-conditions and apertures.

Surface characteristics can vary widely and can be deceiving such as this yellow fluorescent paint sample. Effects like fluorescence, metallic, textured surface, special effect, matt or glossy finish - all influence the ***visual*** and ***numeric*** result.

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Pricing

ColorCatch
Nano Test Drive

$600 DEPOSIT

No obligation trial period. Users may try ChromaChecker Nano for testing purposes for 14 days.*

*deposit will be returned, the user pays only shipping fee

ChromaChecker™

…much more than color

ChromaChecker Nano

Appearance Matching- ***Redefined***

Dominant Color Algorithm

Surface Match Metrics

Replaces / Supplement Multiple Instruments

Affordable, Easy and Fast to Use…

Call us today for a “no risk” Test Drive

ChromaChecker™