TAGA NextGen

Measuring Metallic Appearance

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Why is this research necessary?

Why metallics?

- Project luxury
- Metallics stand out
- Glint moves – attracts attention
- Brands pay a premium

Lighting direction matters

Diffuse lighting

Directional lighting

Some prior research

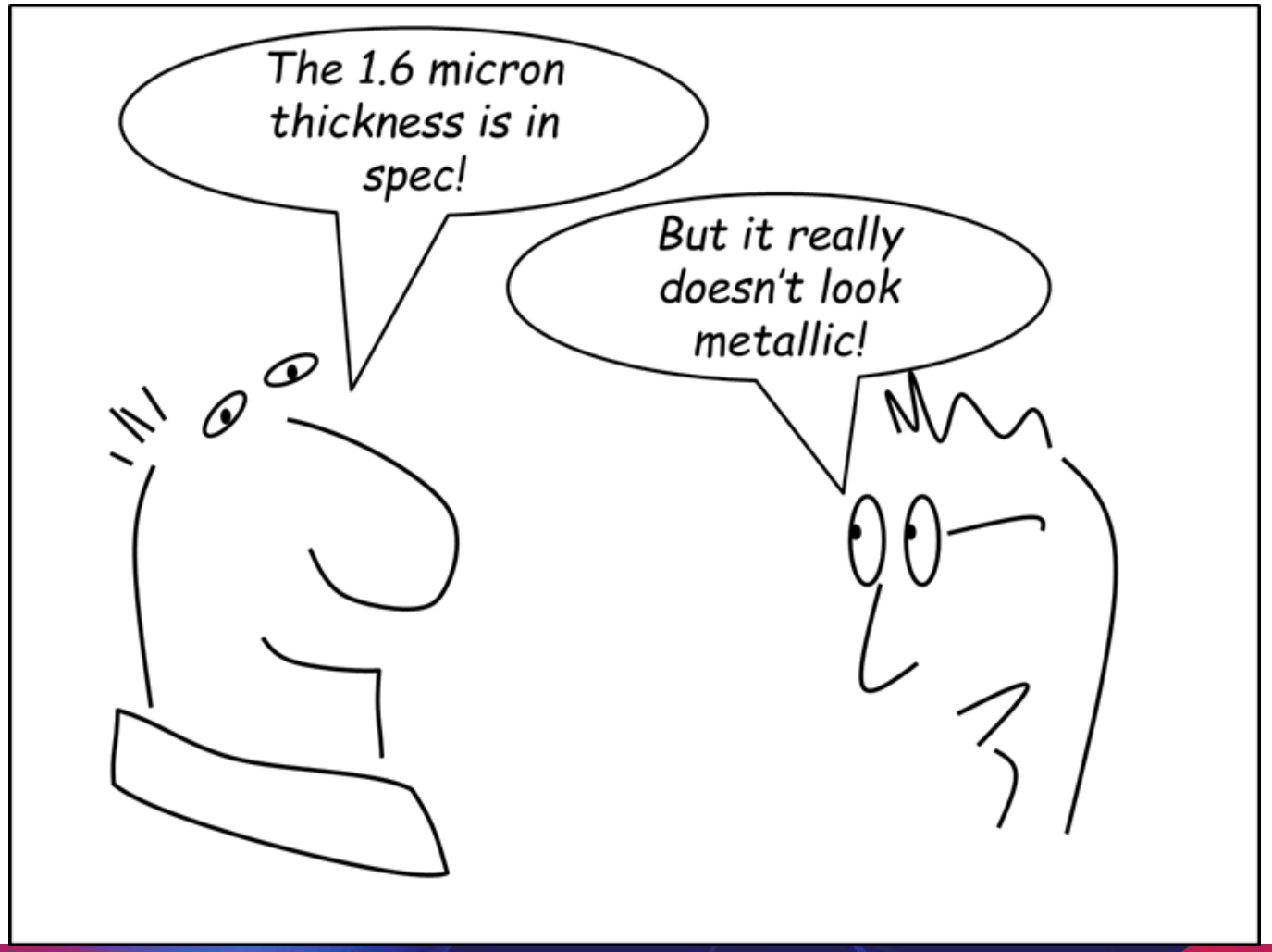
- Four previous papers investigated *process control* of metallic ink
    - Jorg Mannig and Ray Verderber, Improving Metallic Ink Printing through Polarized Densitometry, TAGA 2002
    - Martin Habekost and A. Andino, Metallic ink measurement using the M3 mode, TAGA 2016
    - Martin Habekost and Xiaoying Ma, M3 is for controlling metallics, TAGA 2017
    - Martin Habekost and Xiaoying Ma, Visual and Numerical Evaluation of Metallic Inks and How They Compare to Numerical Colour Differences, TAGA 2018

Summary – selected research

- Conclusion from these four papers
- You should use 45:0 or 0:45 with cross-polarized filters
- Filters eliminate gloss
- M3 mode
- Measurements correlate well with *ink film thickness*


OMG! That ink film thickness is **absolutely gorgeous**!!
...said no customer ever in the known universe!

Process control vs Quality conformance



Clue about how to measure metallic appearance

Another TAGA paper

MEASUREMENT AND VISUAL EVALUATION OF METALLIC GLOSS OF PRINTS.

Artur P. Rosenberg*

Keywords: Metallic gloss, printing inks, gonio-spectro-photometry

Abstract: Metallic gloss is increasingly used for simulating high quality of a product. Since the methods used for producing metallic gloss widely differ, e. g. bronzing, offset, gravure and flexo-printing, they also effect a different appearence. Therefore it is desirable to have a measuring technique at hand the

Artur Rosenberg, Measurement and Visual Evaluation of Metallic Gloss of Prints, TAGA 2001

What is that???!?!?

- *Gonio* – means angle
- *Spectrophotometer* – we know what that is
- Measures spectral reflectance at different angles

Used a *goniospectrophotometer*

Goniospectrophotometer

A gonio-spectrophotometer (Fig. 1) was used for the measurement of metallic lustre. This fibre optic equipped device enables the reflexion spectrum of the samples to be measured across a broad range of angles of illumination and measurement. The samples were each illuminated at angles of 30°, 45° and 60°, and the spectral values were measured and recorded at angles between 0° and 75° in steps of 5° (Fif. 2).

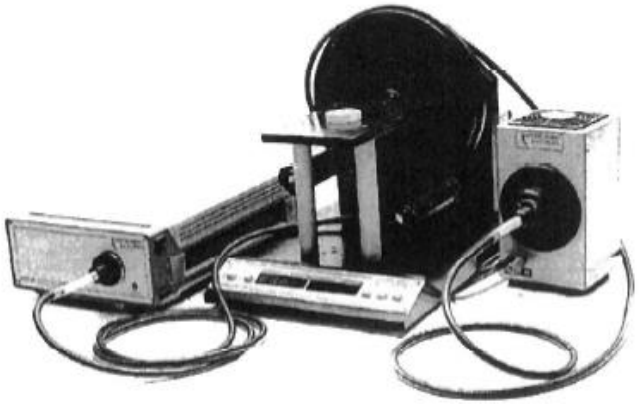


Figure 1: Gonio-spectrophotometer (Instrument systems Inc.)

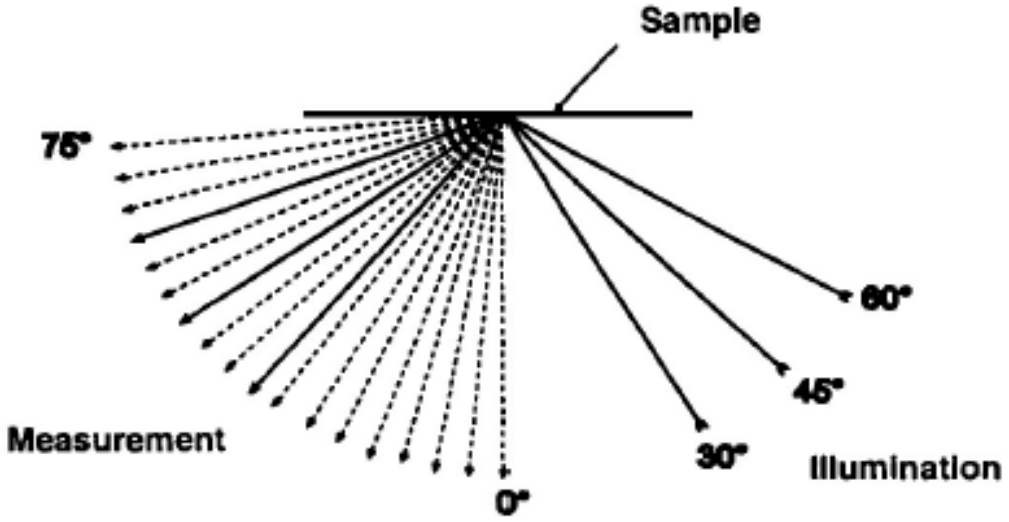


Figure 2: Illumination and measurement geometry of the gonio-spectrophotometer

Used a *goniospectrophotometer*

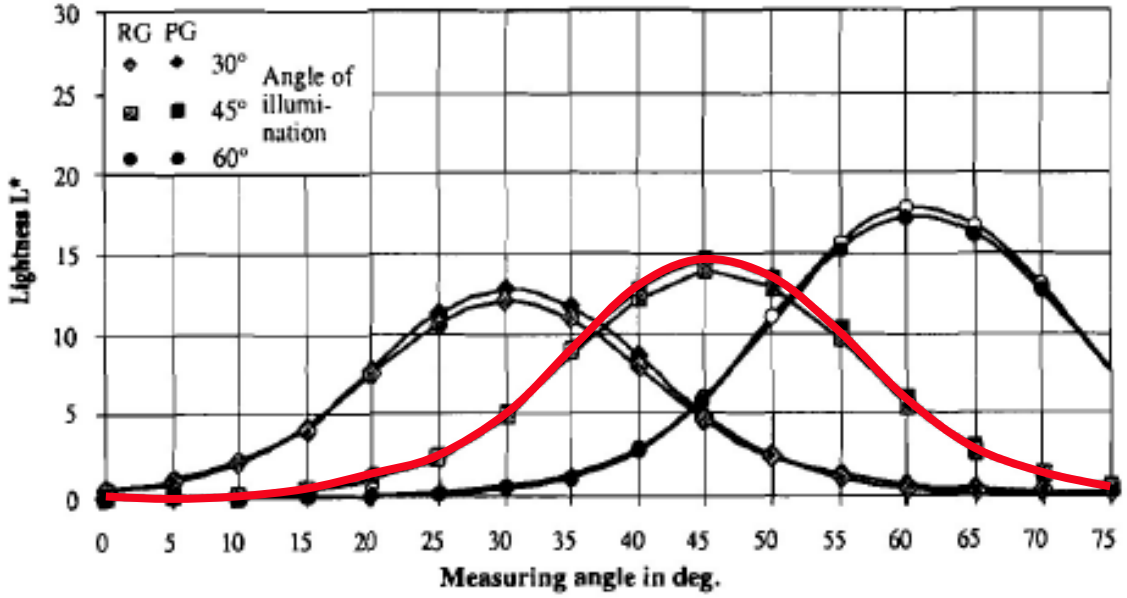


Figure 5: Lustre curves (lightness L*) for bronzed rich gold (RG) and pale gold (PG) prints at different illumination angles

- Measured L* of bronzed rich gold
- Illumination at -45º
- Measured at 0º, 5º, 10º, … 75º
- Detector moved to 16 positions for each illumination angle

Important observation

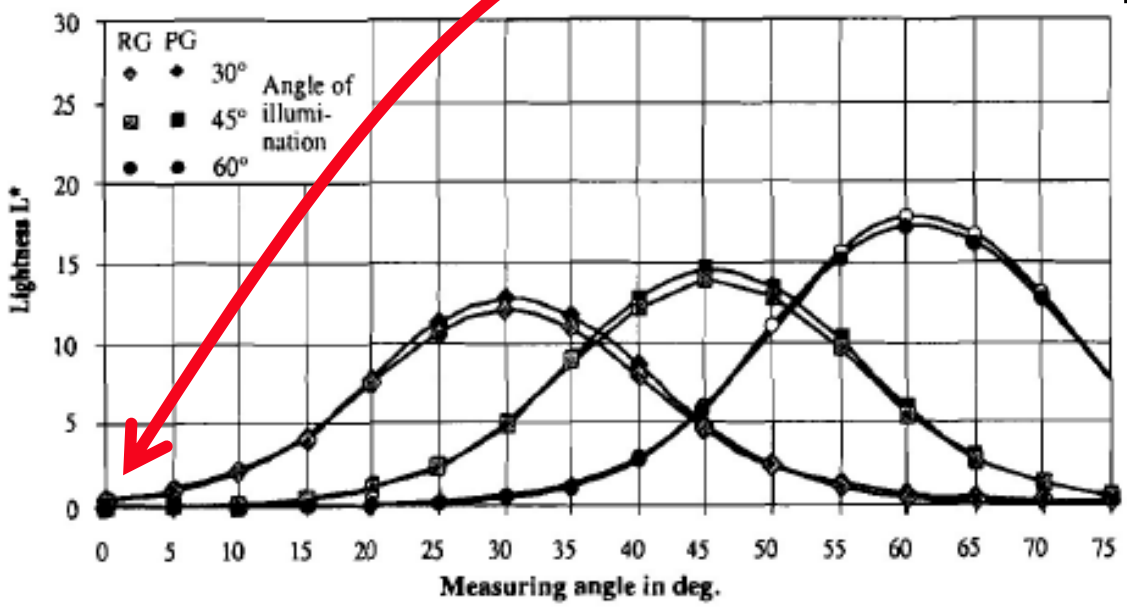


Figure 5: Lustre curves (lightness L*) for bronzed rich gold (RG) and pale gold (PG) prints at different illumination angles

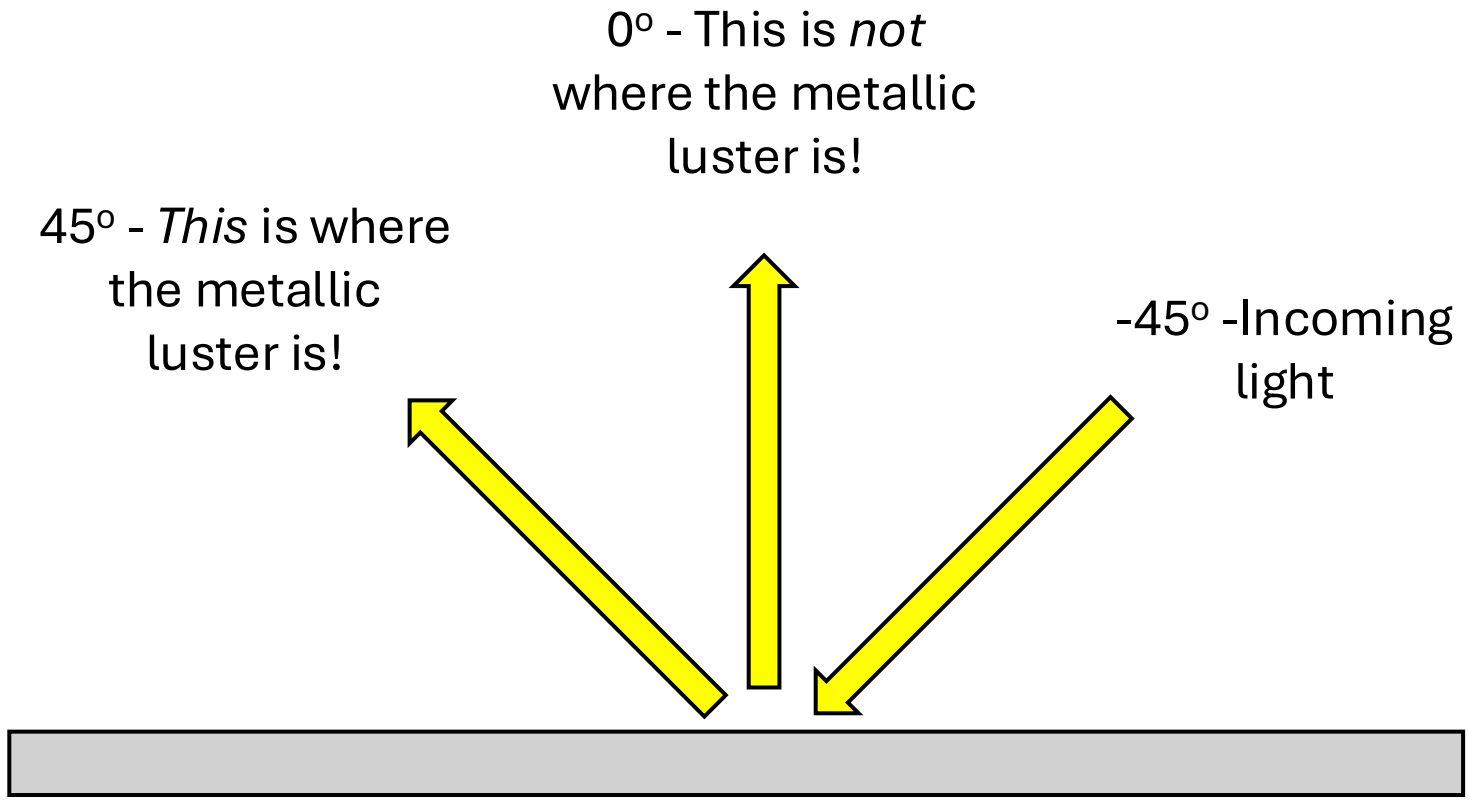
With 45° illumination, there is minimal light at 0°!!

45:0 won't measure appearance!

Metallic luster info is somewhere else

Three rules for metallic appearance

Lighting direction matters



First rule

Metallic *appearance*
must be measured
around
the gloss angle!

A look at aluminum foil

The matte side does not

The polished side looks metallic

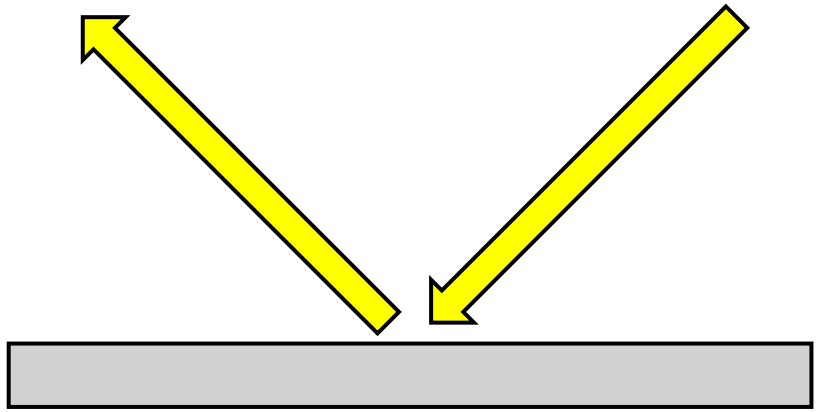
Second rule

The surface must be glossy for it to look metallic

Just being glossy isn’t enough!

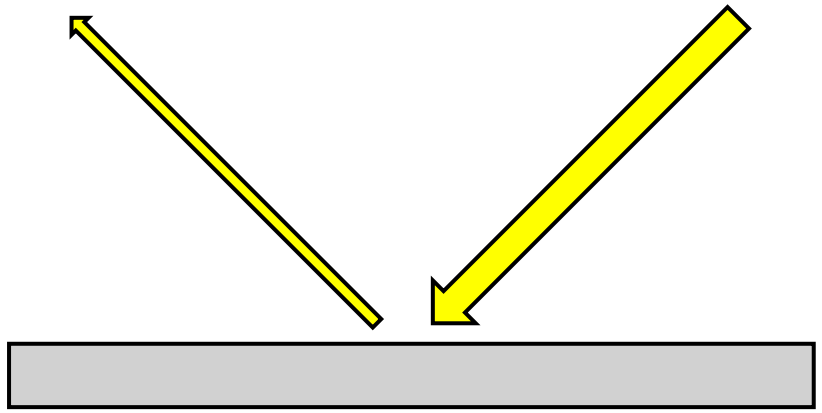
Fresnel’s law

80% to 90%



Metals

< 10%



Non-metals

Third rule

The surface must reflect more than 70% of incoming light

My guess

Seymour’s rules for metallic appearance

1. Metallic appearance must be measured around the gloss angle.
2. The surface reflection must not scatter very much.
3. The surface reflection must be more than 70%.

We need …

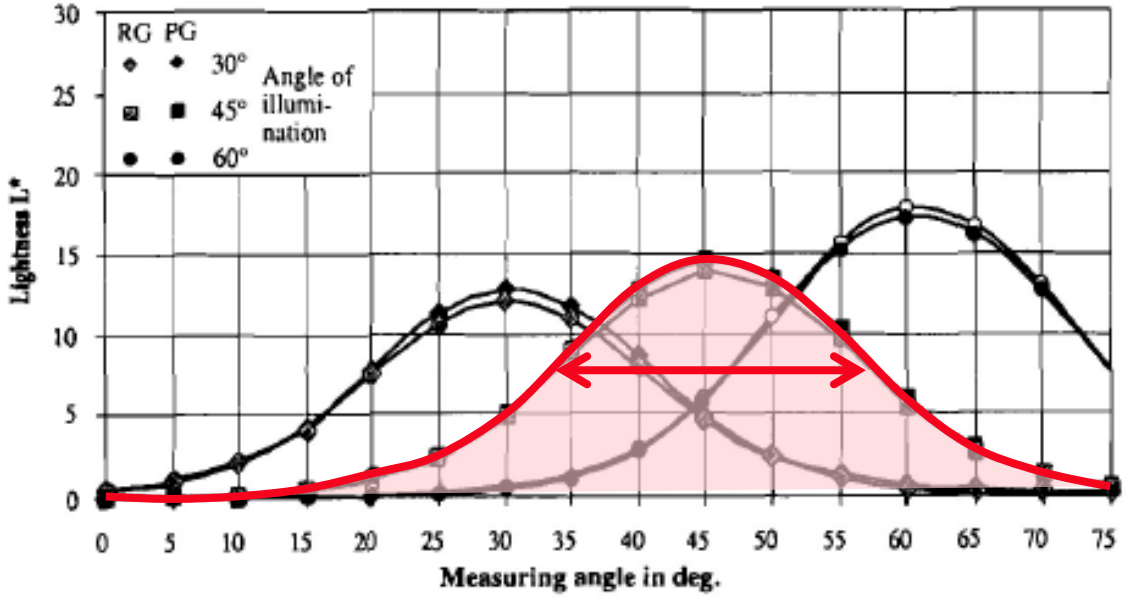


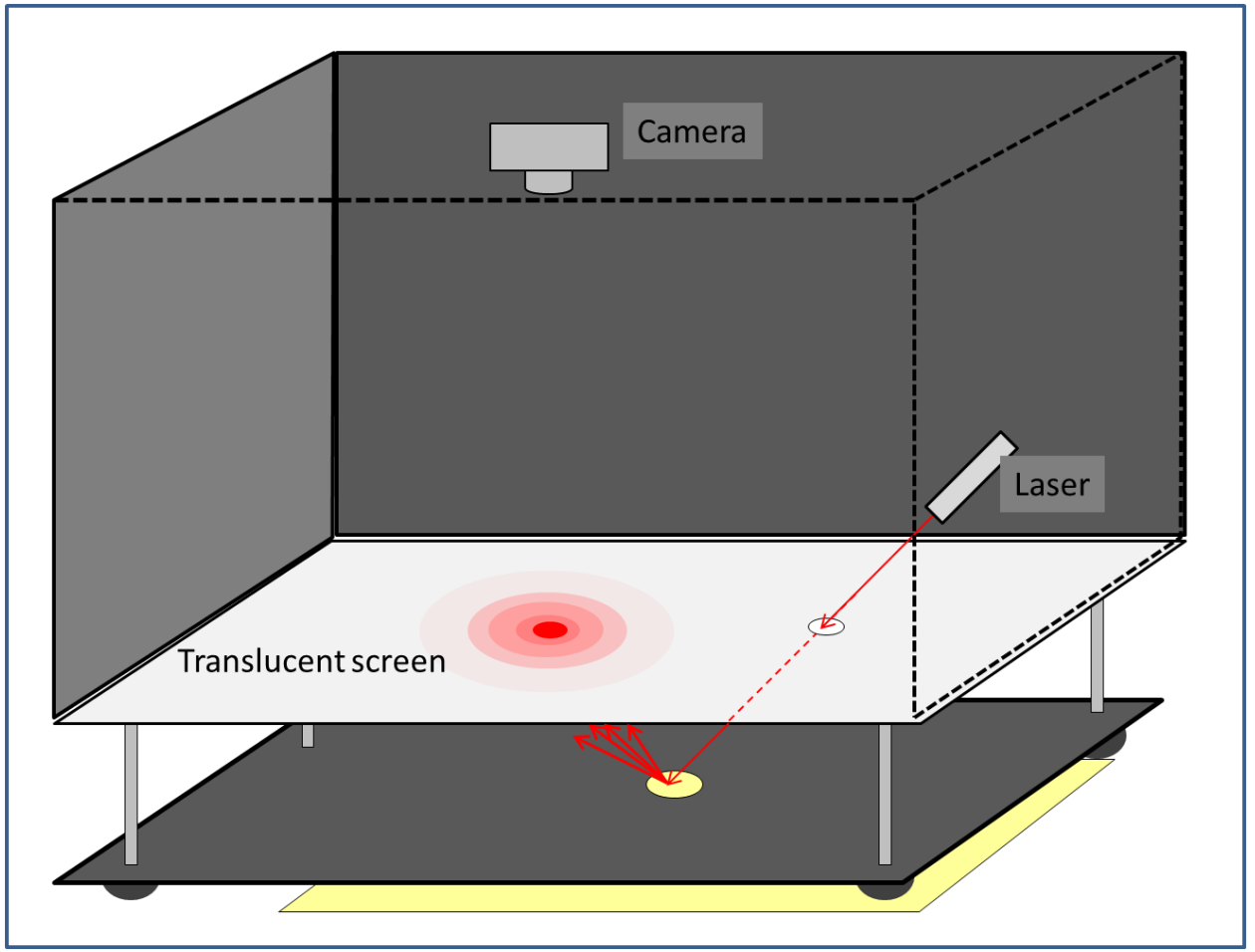
Figure 5: Lustre curves (lightness L*) for bronzed rich gold (RG) and pale gold (PG) prints at different illumination angles

- Area under the curve
- Width of the curve

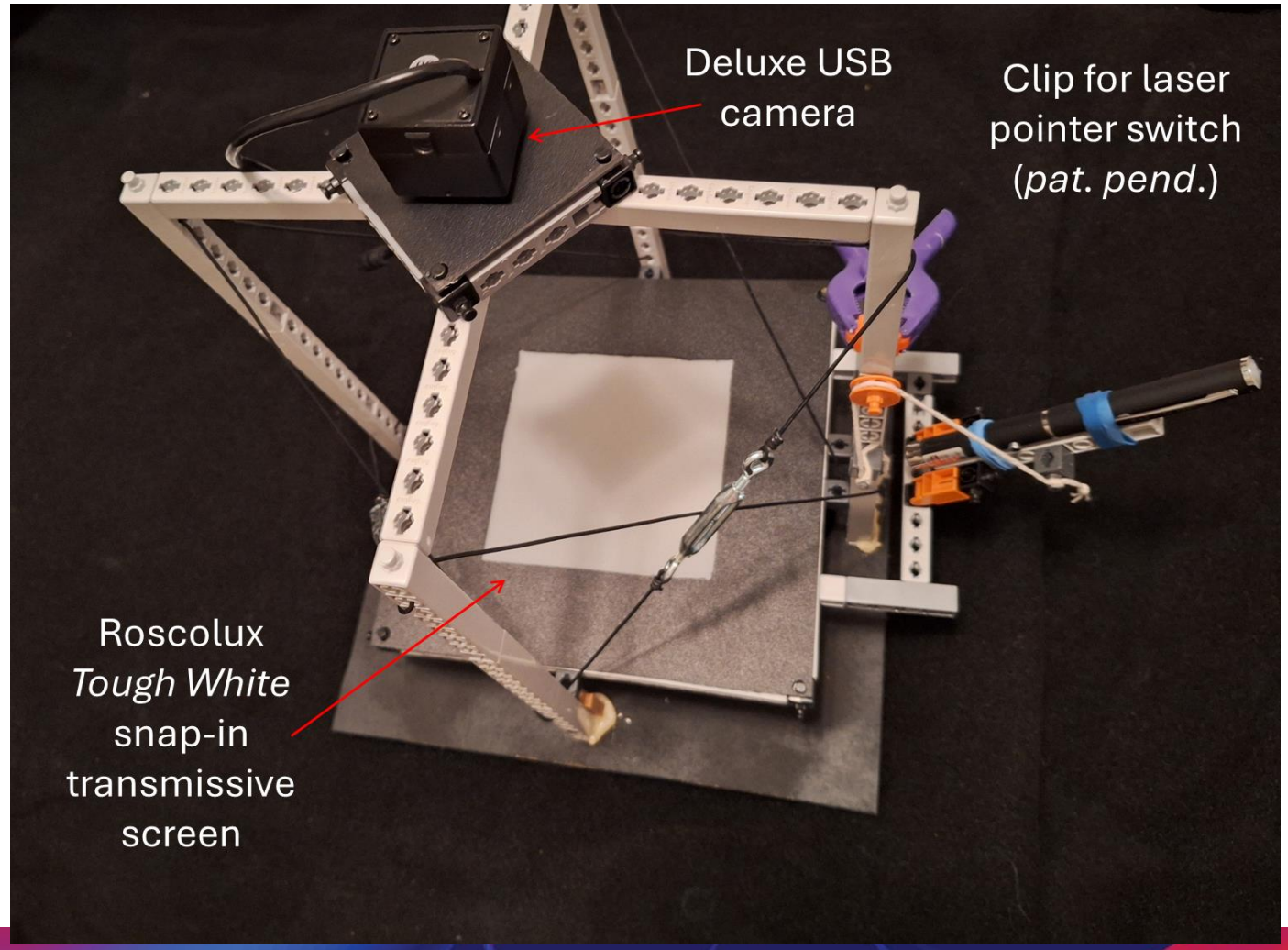
How to measure this?

Quickly and cheaply!

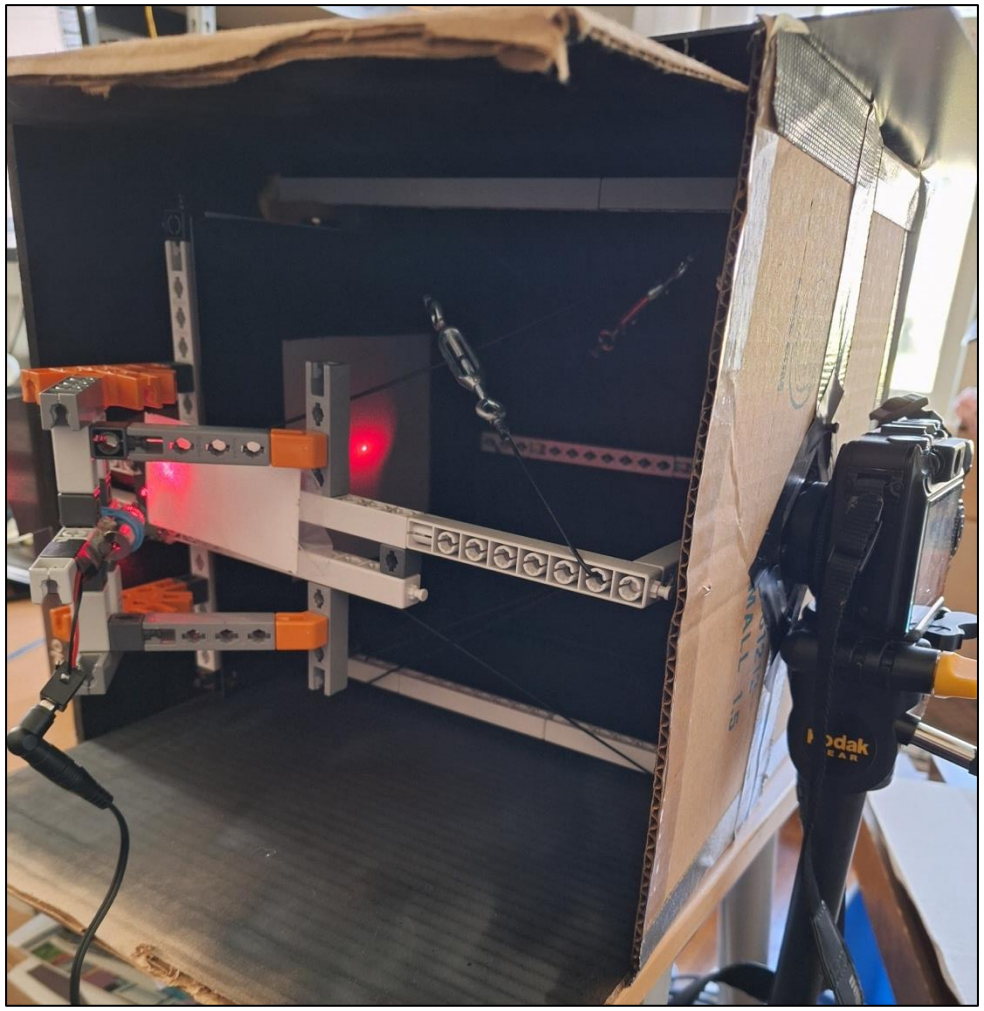
Gonio*scope* concept (~2014)



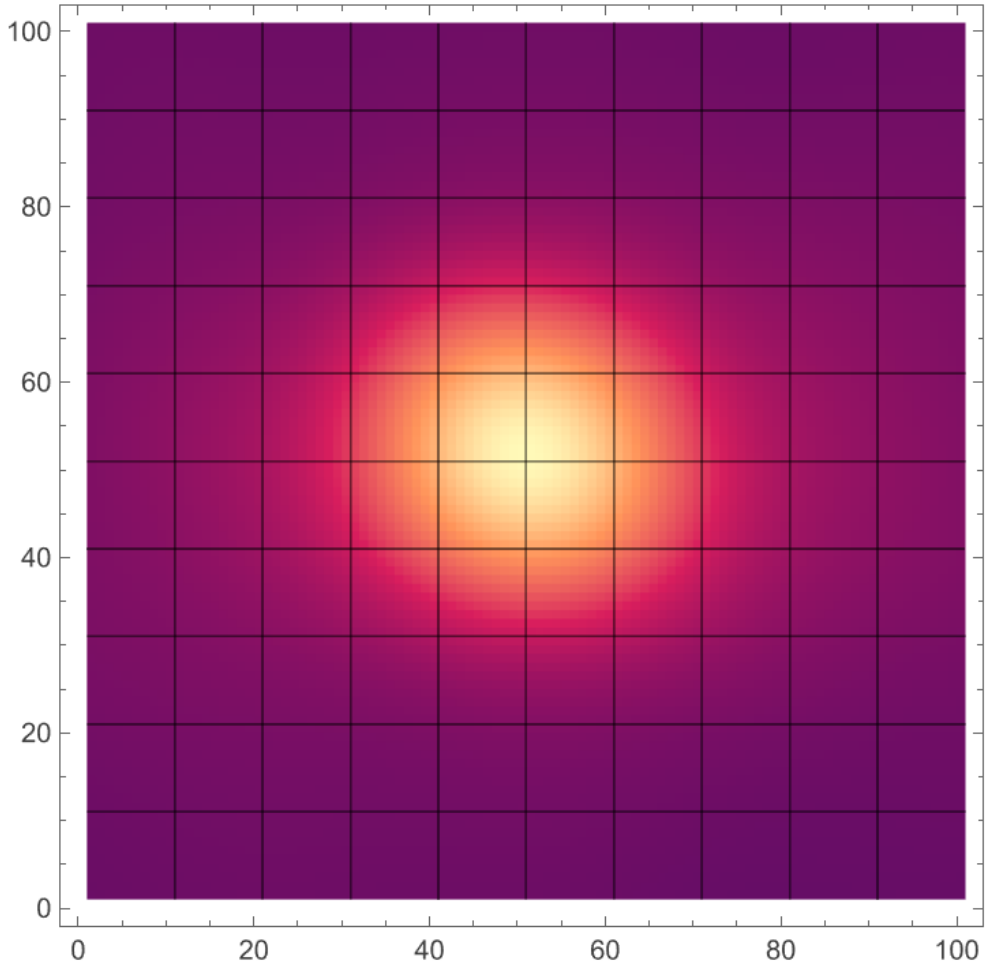
2nd iteration (Aug 2025)



3rd iteration gonio*photometer* (Mar 2026)

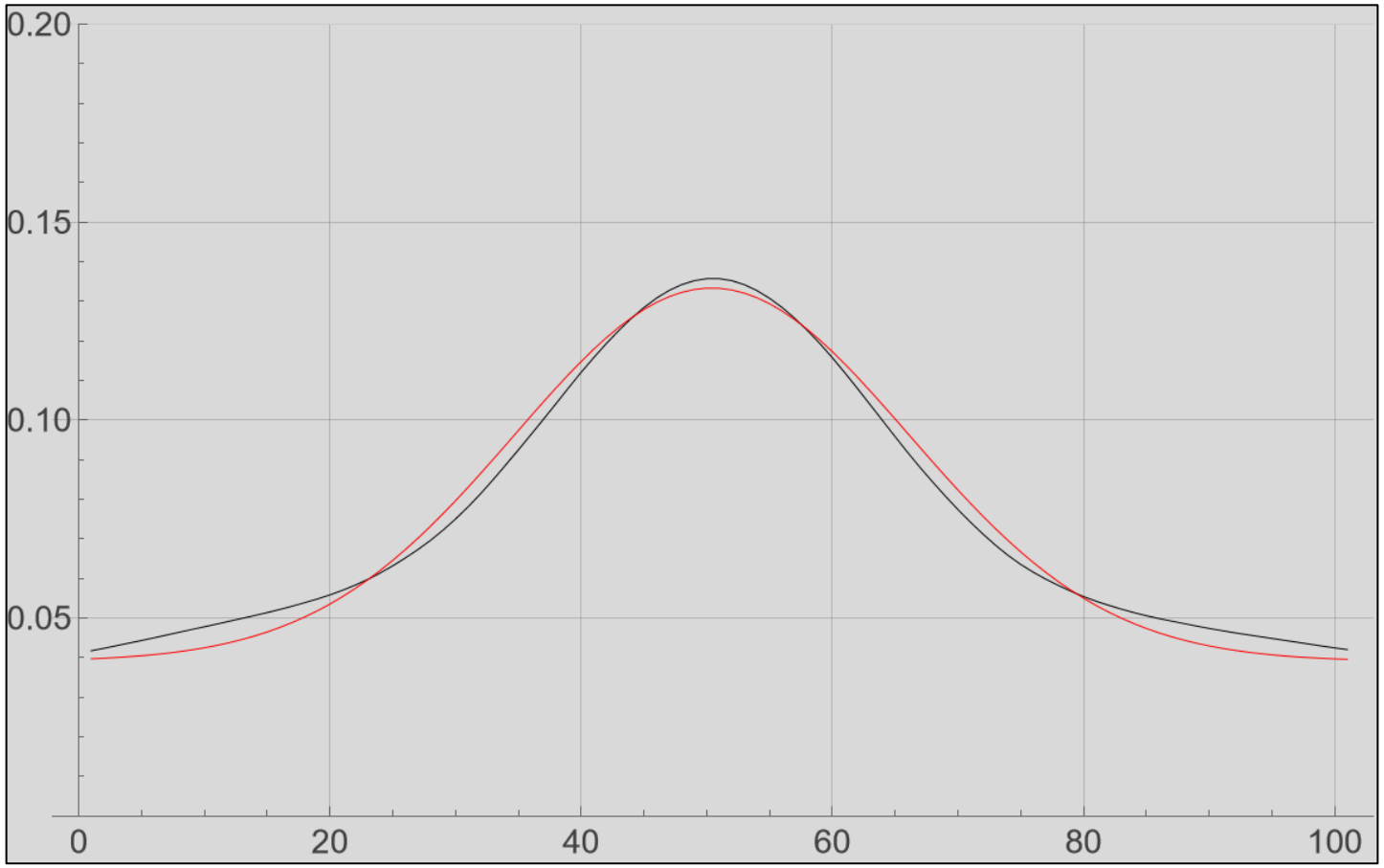


Gonioscope image-25% metallic on PET

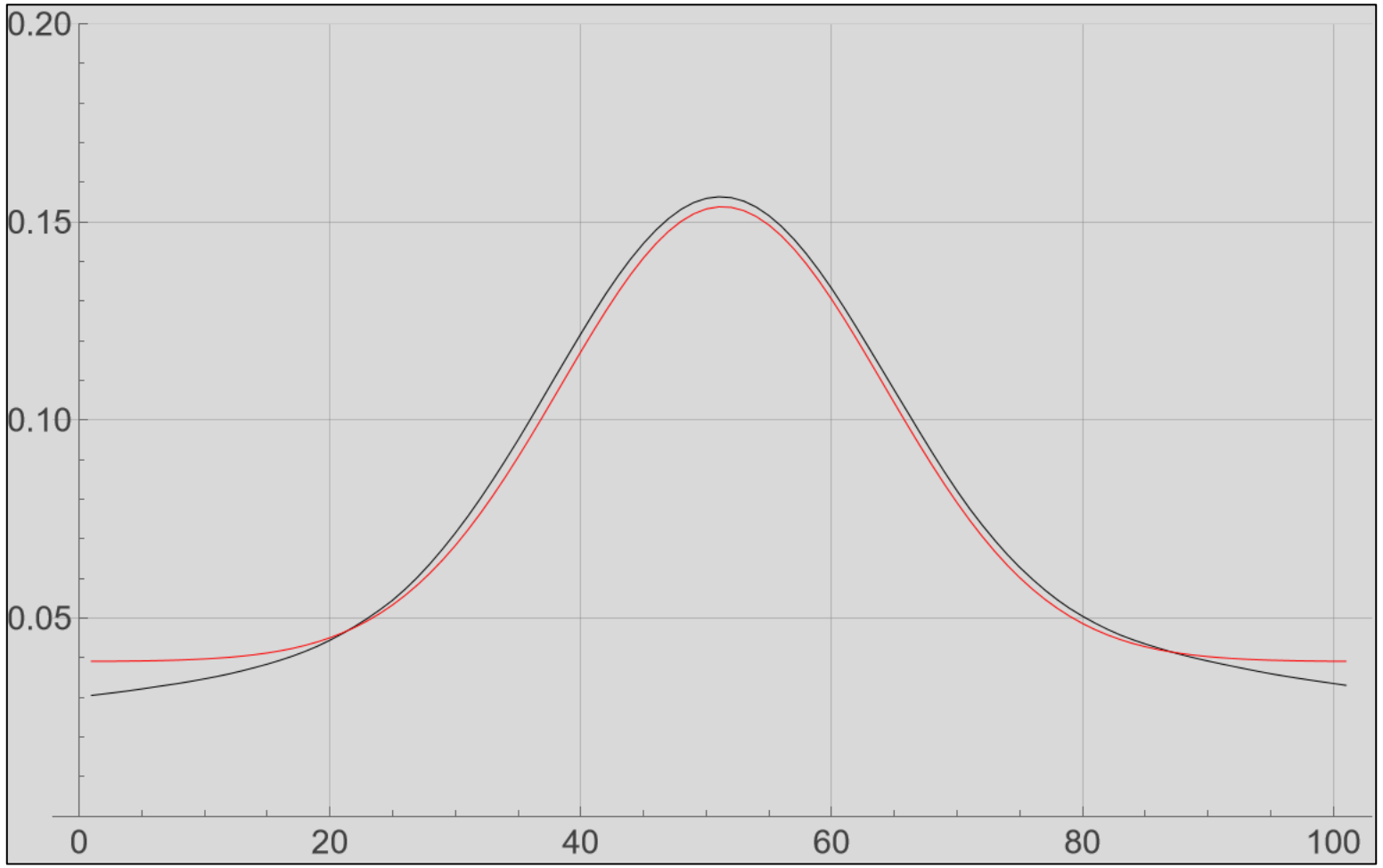


I fit a Gaussian to this 2D data

Column ave (black) vs Gaussian (red)



Row ave (black) vs Gaussian (red)



Current status

- This is a work in progress
- I have drawdowns of two percentages on three substrates
- I have gonioscope images
- I need to optimize my analysis code

- Look for more results in the paper

One relatively inexpensive potential device

Rhopoint IQ 20/60/85 Gloss Haze DOI Meter

This is a goniophotometer that measures at a high resolution around the correct angles.

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