

How International Standards affect Camera Testing

October 2008

In the beginning

- When I started testing cameras in 1997 I sat there and asked myself: how the hell shall I do that?



The unlimited number of standards

Isn't there a standard method how to test cameras?

There are several:

ISO 12231: Terminology

ISO 12232: Determination of ISO speed

ISO 12233: Resolution measurements

ISO 12234: Removable memory -

Part 1: Basic removable memory reference model

Part 2: Image data format - TIFF/EP

ISO 14524: Methods for measuring opto-electronic conversion functions (OECF)

ISO 15739: Noise measurements

ISO 15740: Picture Transfer Protocol (PTP)
for Digital Still Photography Devices

The unlimited number of standards

ISO 15781: Measuring shooting time lag, shutter release time lag, shooting rate, and start-up time

ISO 17321: Graphic technology and photography
Colour characterisation of digital still cameras
Part 1: Stimuli, metrology, and test procedures

ISO 20462: Psychophysical experimental method
to estimate image quality
Part 1: Overview of psychophysical elements
Part 2: Triplet comparison method
Part 3: Quality ruler method

ISO 22028 Extended colour encodings for digital image storage,
manipulation and interchange
Part 1: Architecture and requirements
Part 2: ROMM RGB
Part 3: RIMM RGB
Part 4: ECI RGB

The unlimited number of standards

Standardisation committees:

- International Organization for Standardization (ISO)
Technical Committee (TC) 42, Working Group 18
- Cell Phone Image Quality Group organized by
International Imaging Industry Association (I3A)
- International Electrotechnical Commission (IEC)
Technical Committee (TC) 100
- Related Organisations: ICC, CIE, SMPTE

Digital Camera Tests

Values which can be measured:

- Resolution (s)
- Dynamic Range (s)
- Used digital values (s)
- Noise (s)
- Color Reproduction (s)
- White Balance (s)
- Vignetting (s)
- Distortion (s)
- Power consumption
- Dead Pixels

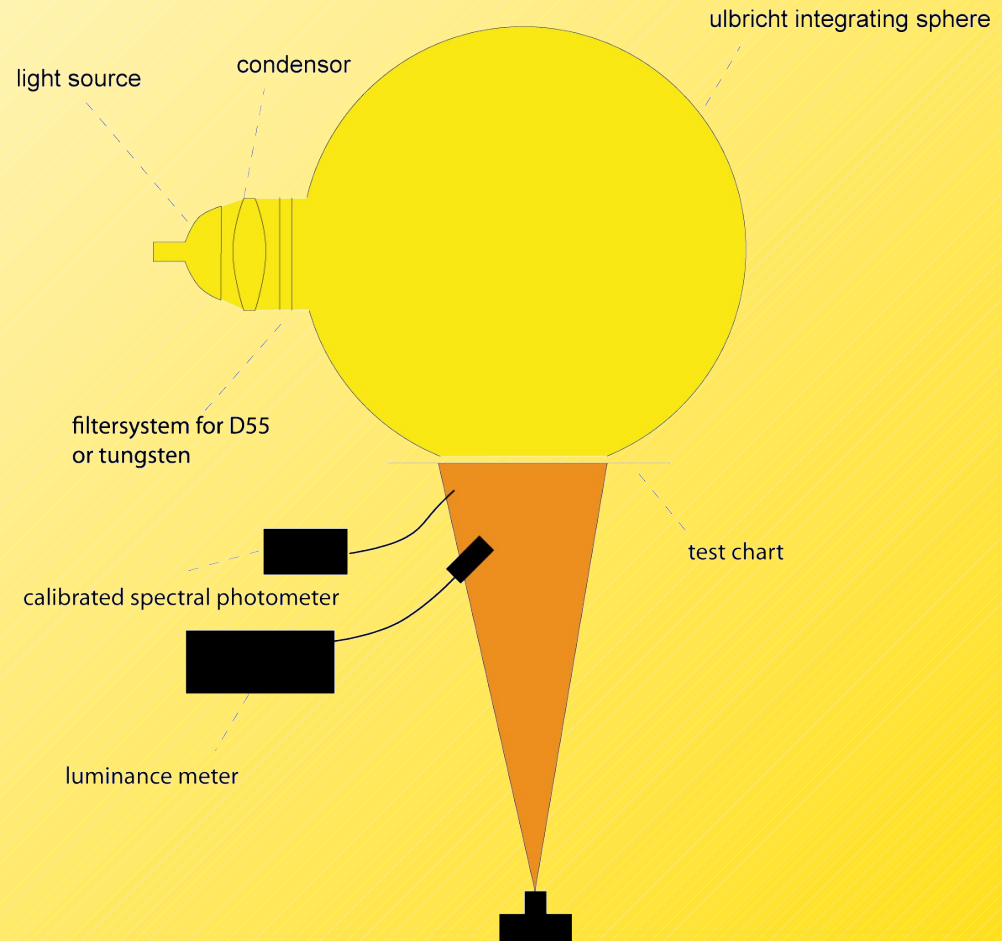
Digital Camera Tests

Values which can be measured:

- Max. scaling
- Flash uniformity and guide number
- Lateral chromatic aberration (s)
- Color shading
- Noise based on human perception (s?)
- Shutter and shooting lag (s?)
- Startup time and shooting rate (s?)
- Image stabilization (s?)

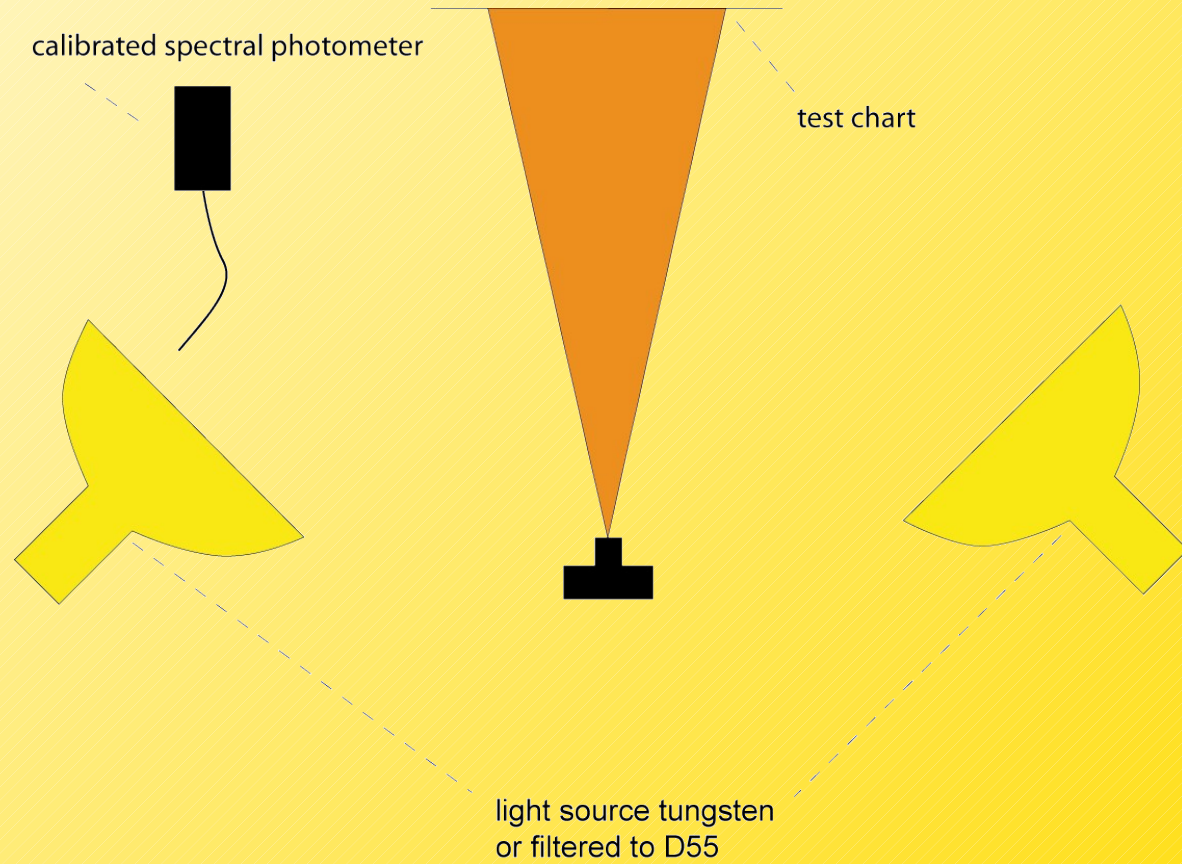
Digital Camera Tests

- Principle



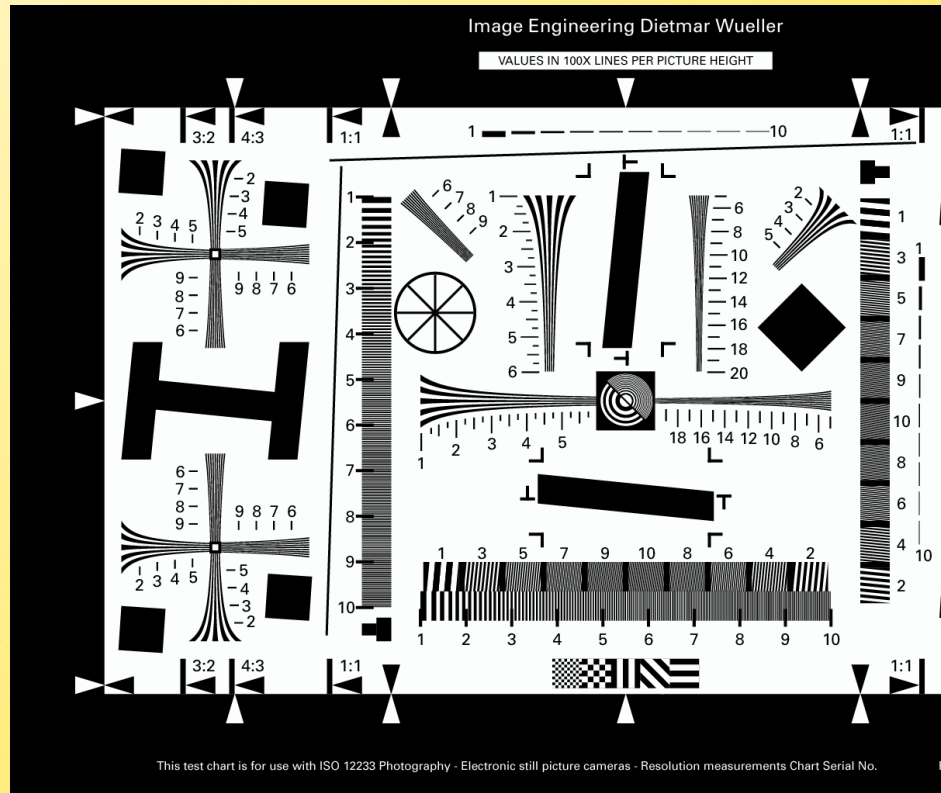
Digital Camera Tests

- Principle



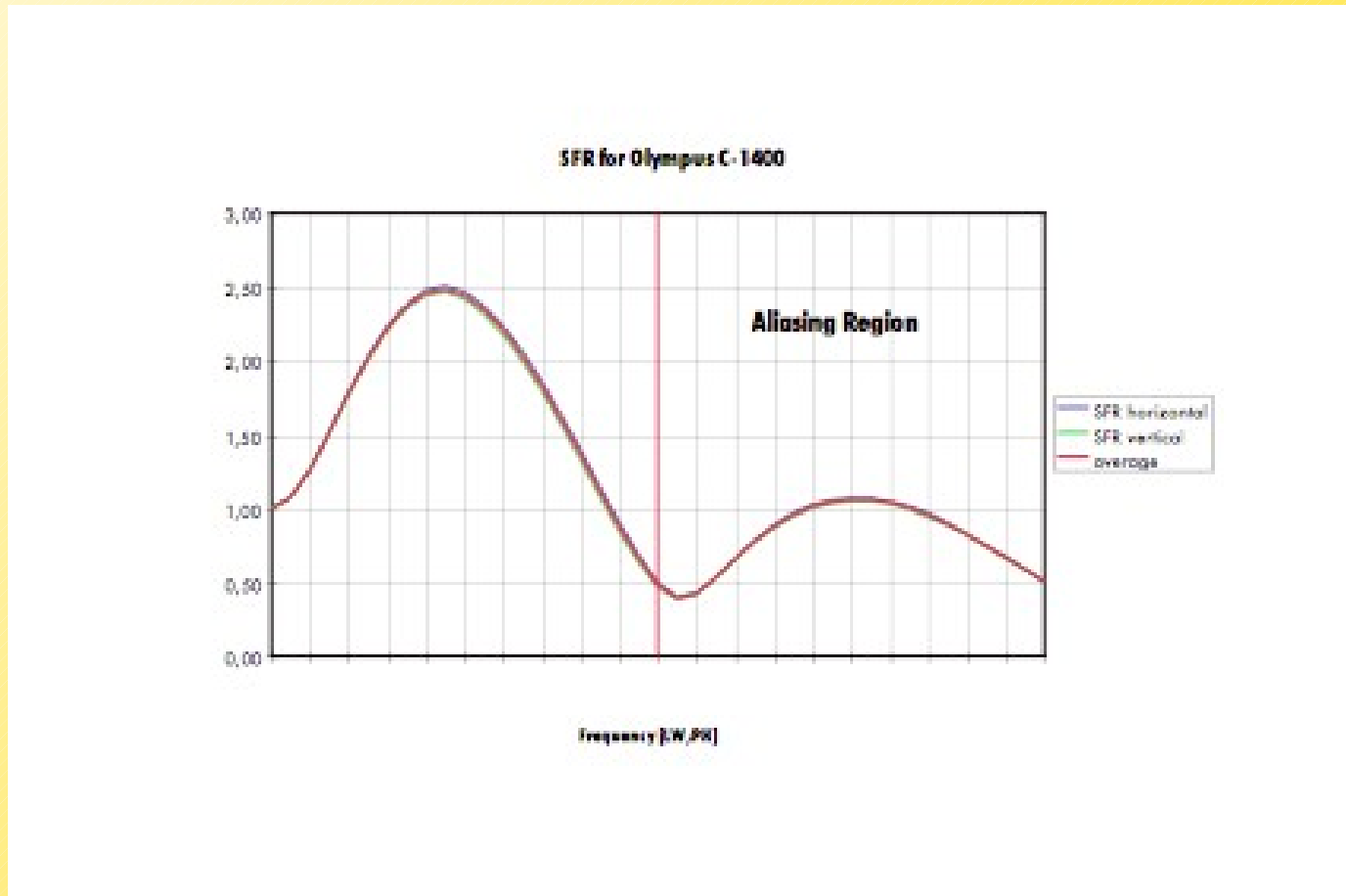
Standards are not God given

- Several problems occurred



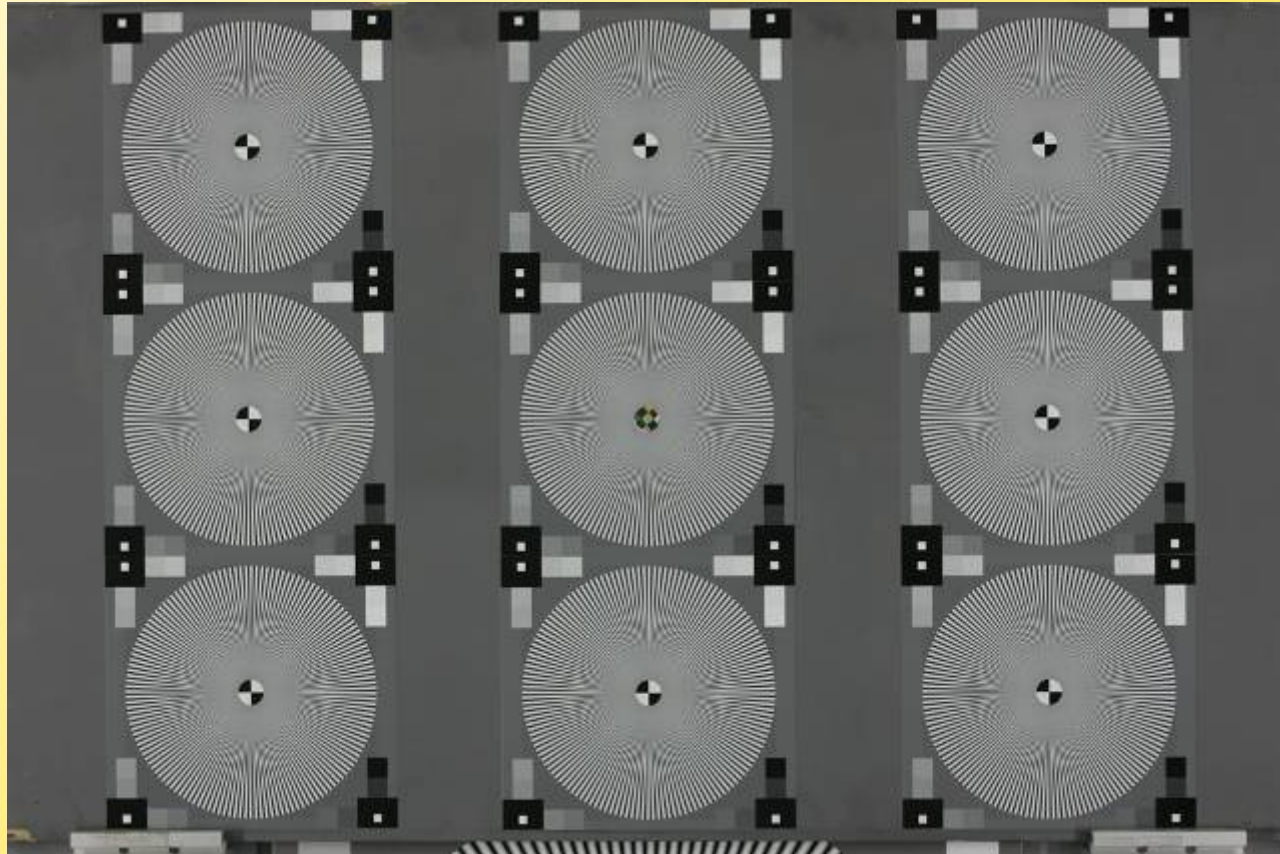
Standards are not God given

- Several problems occurred



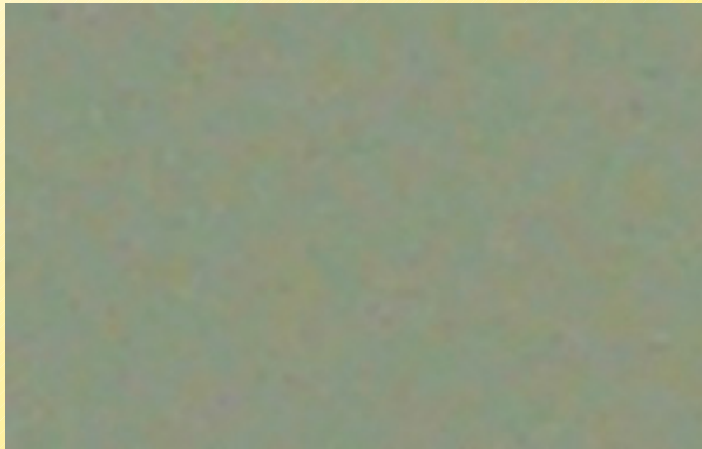
Digital Camera Tests

- resolution measurement

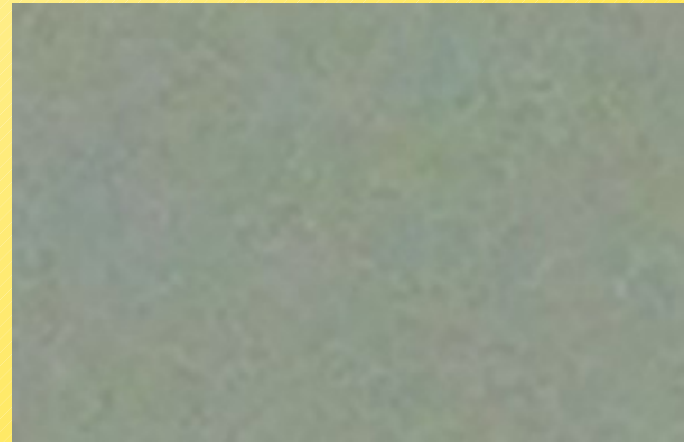


Finding new methods

- Signal to noise vs. Visual noise



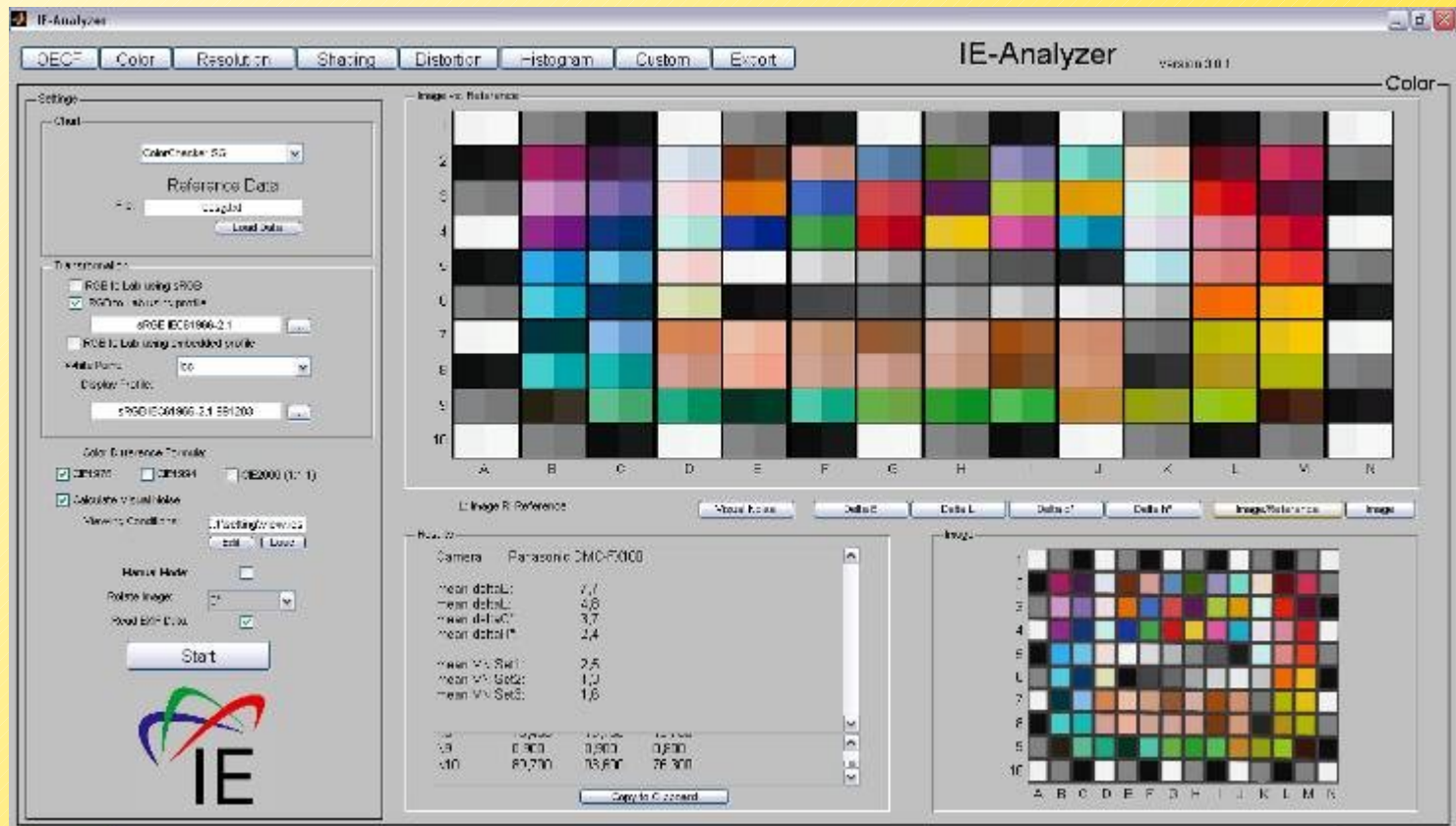
SNx= 27



SNx= 29

Digital Camera Tests

- color reproduction quality



The screenshot shows the IE-Analyzer software interface. The main window is titled "IE-Analyzer" and has a menu bar with options: DECF, Color, Resolution, Shading, Distortion, Histogram, Custom, and Export. The version number "version 3.0.1" is visible in the top right corner.

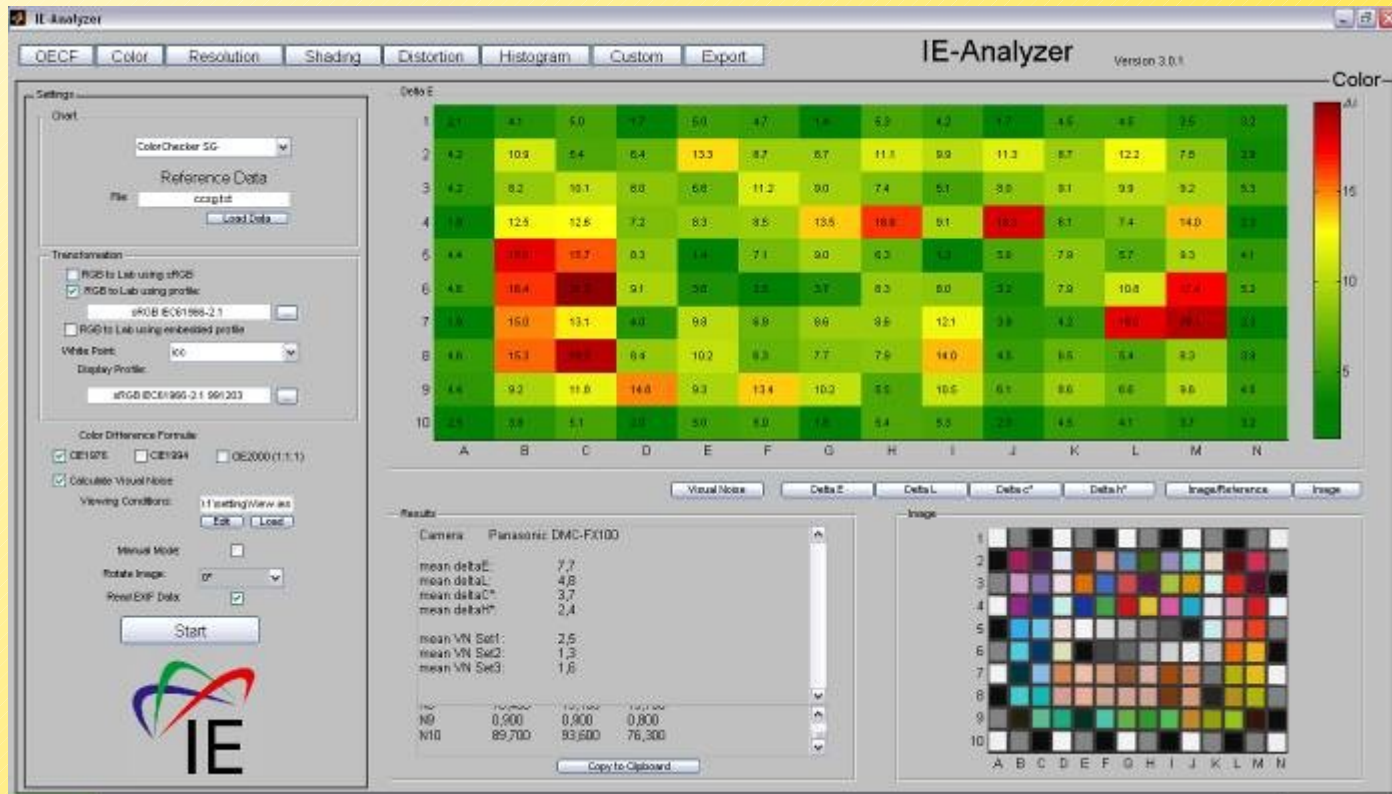
The interface is divided into several sections:

- Settings:**
 - Color:** ColorChecker: 50, Reference Data: C00000, Load Data button.
 - Transmittance:**
 - RDE Lab using sRGB
 - RDE Lab using profile
 - Profile: sRGB (ICC1998-2.1) [Browse]
 - RDE Lab using embedded profile
 - Matrix Name: CC [Browse]
 - Display Profile: sRGB (ICC1998-2.1) [Browse]
 - Color Difference Metrics:**
 - dE1976
 - dE1994
 - dE2000 (1:1)
 - Calculate virtual index
 - Viewing Condition: D50 (2 degree observer) [edit] [Load]
 - Header Mode:**
 - Rotate Image:** 0° [v]
 - Read EXIF Data:**
 - Stat button
- Image vs. Reference:** A large grid of color patches (A-N, 1-10) showing the difference between the captured image and the reference. The grid is labeled "Image vs. Reference" and "Image Reference".
- Image Reference:** A smaller grid of color patches (A-N, 1-10) showing the reference image. The grid is labeled "Image Reference" and "Image".
- Raw Data:**
 - Camera: Panasonic DMC-FX100
 - mean dE1976: 7.7
 - mean dE1994: 4.8
 - mean dE1976: 3.7
 - mean dE1976: 2.4
 - mean M1 Set1: 2.5
 - mean M1 Set2: 1.2
 - mean M1 Set3: 1.8
- Table:**

Color	Original	Camera	Delta E	Delta L
58	0.903	0.903	0.000	0.000
110	80.700	78.600	2.100	26.300

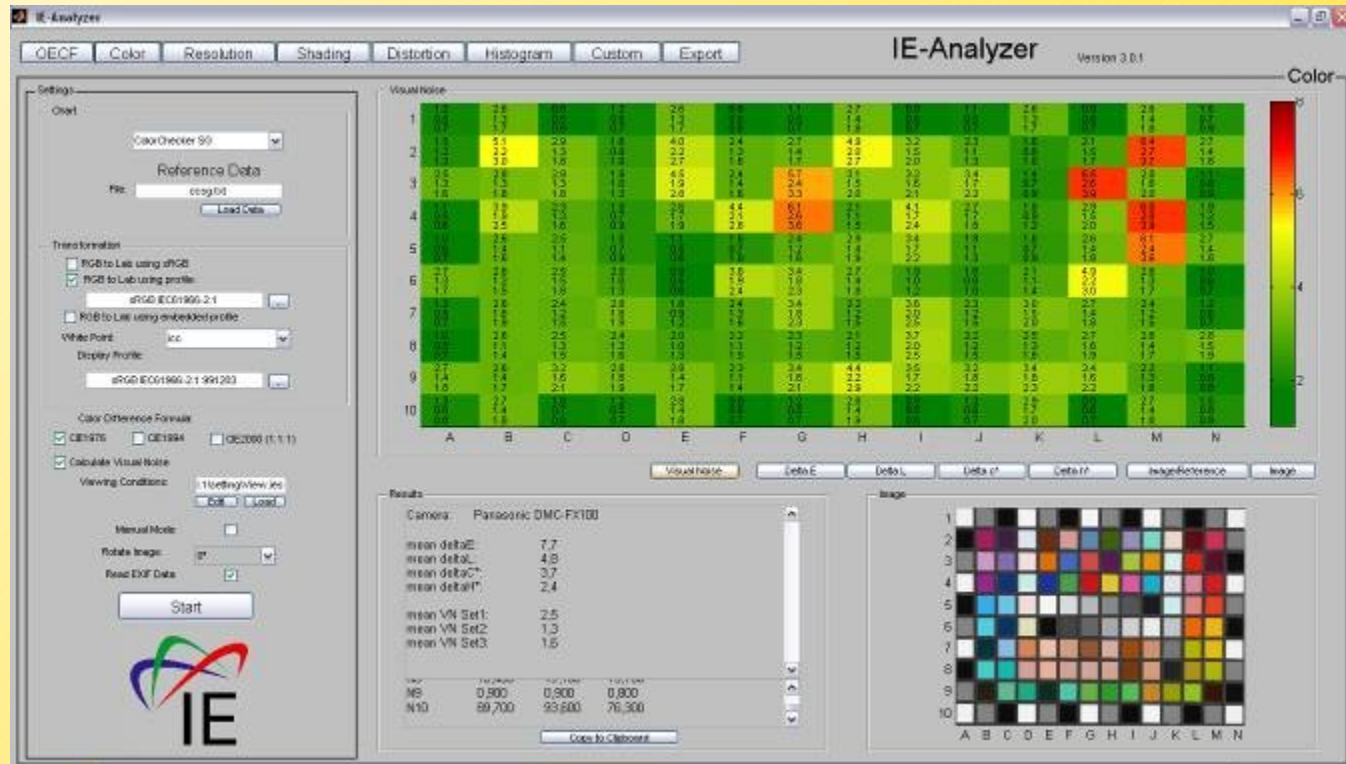
Digital Camera Tests

- color reproduction quality



Digital Camera Tests

- color reproduction quality



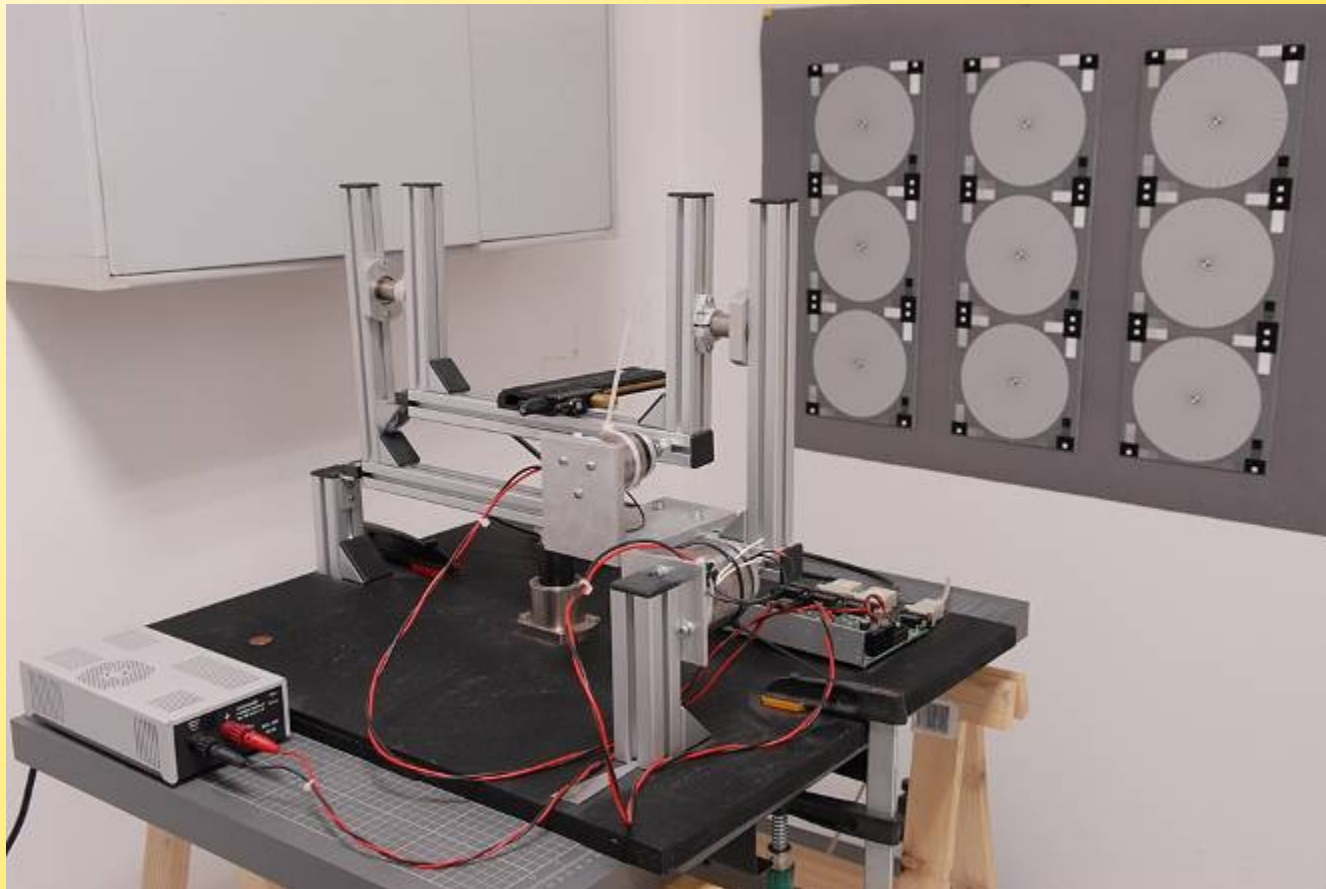
Digital Camera Tests

- shutter and shooting lag

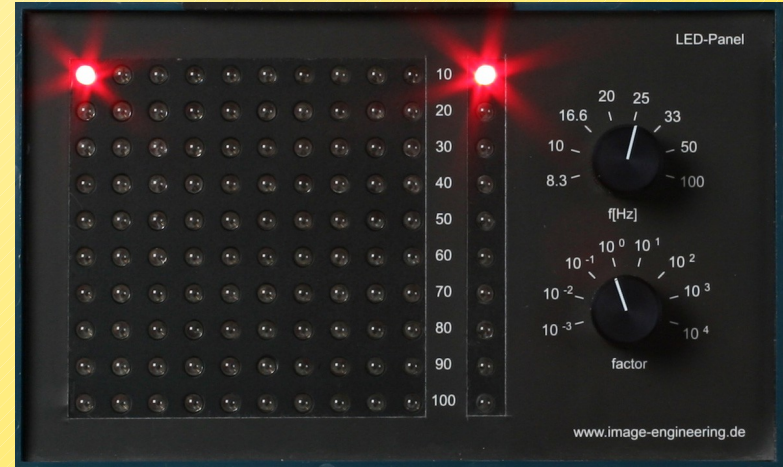


Digital Camera Tests

- Welcome: Steve (“Stabilizer Evaluation Equipment”)

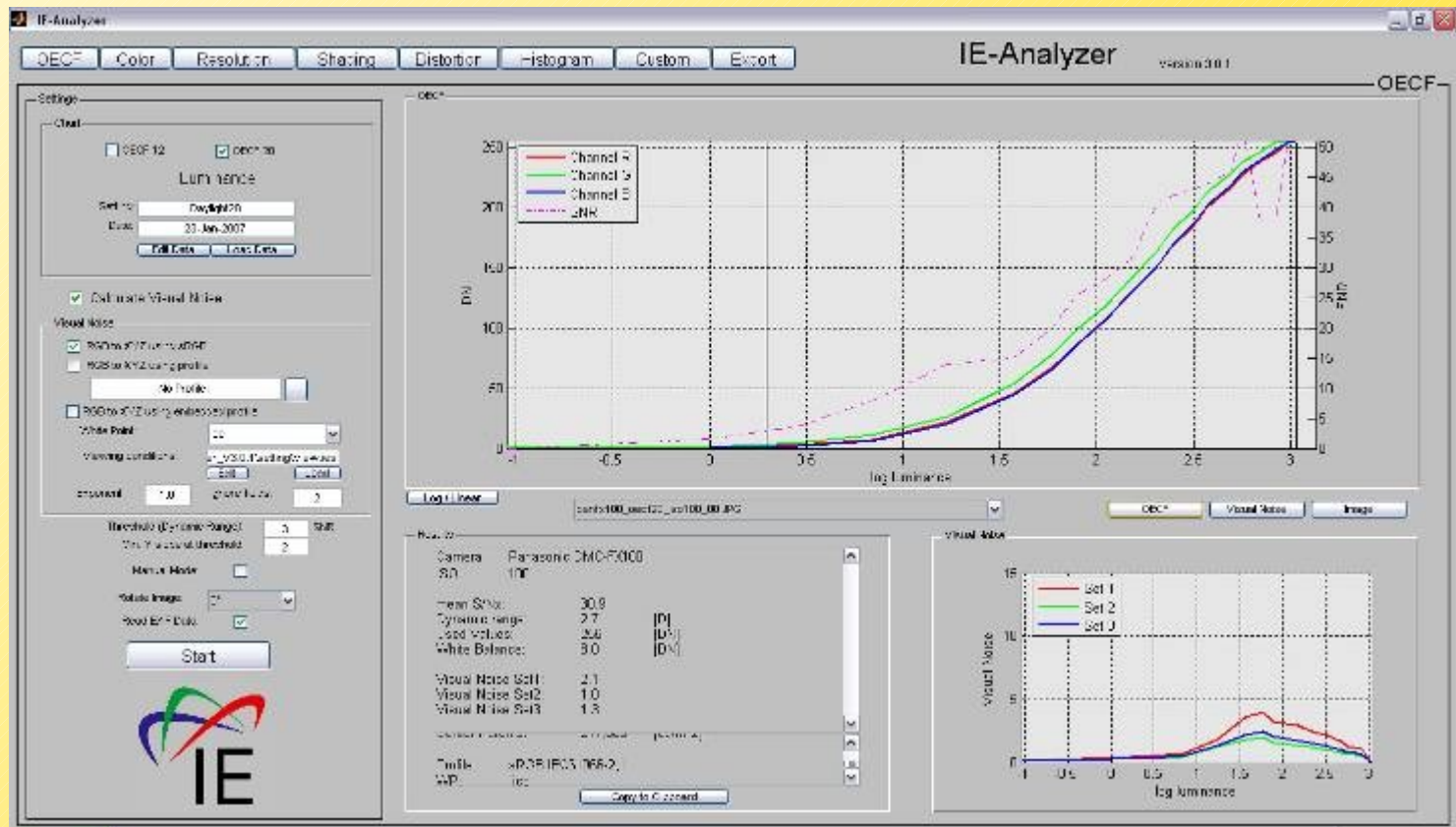


Digital Camera Tests



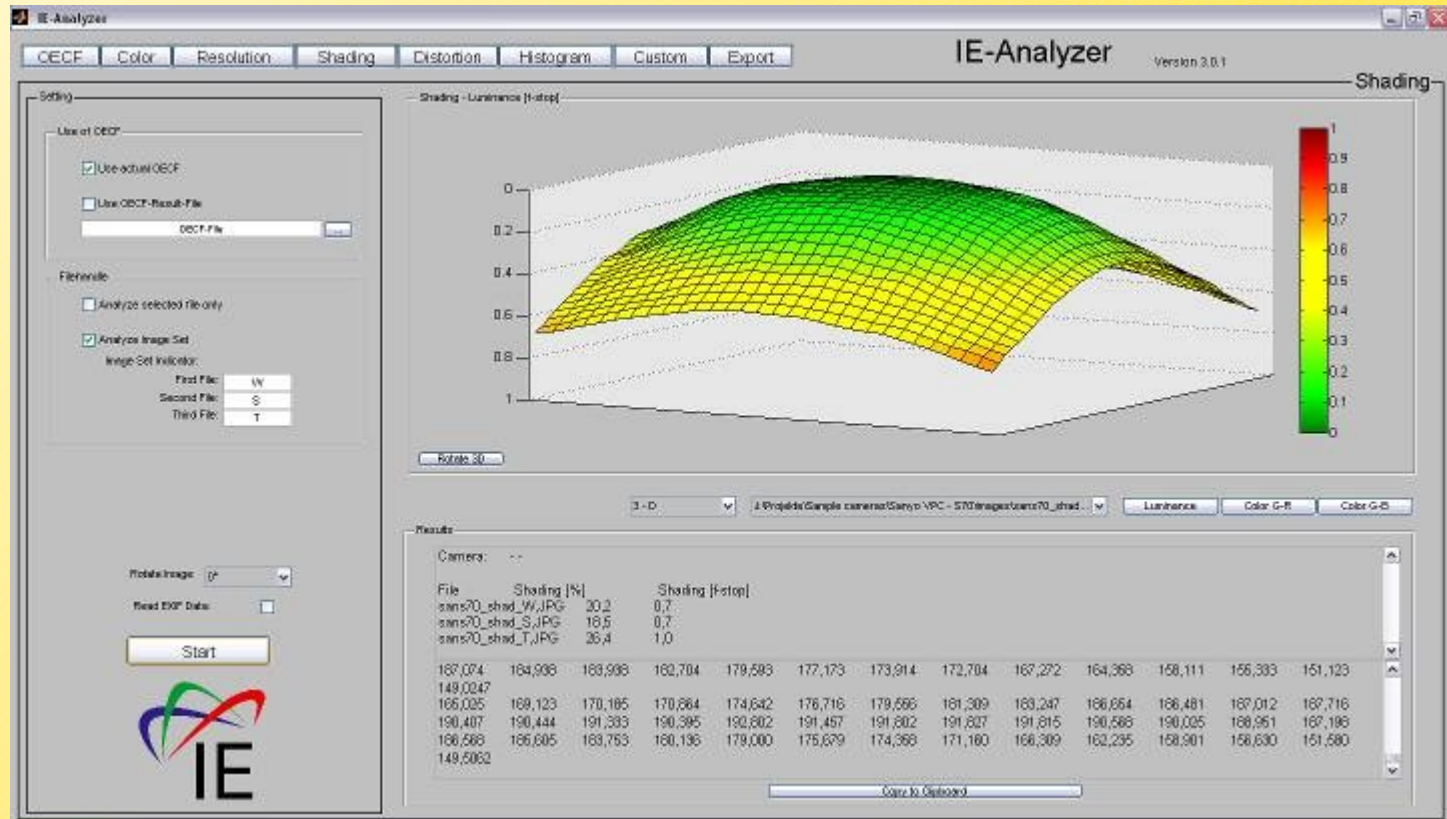
Digital Camera Tests

- OECF, Speed, and Noise (ISO 14524, 15739)



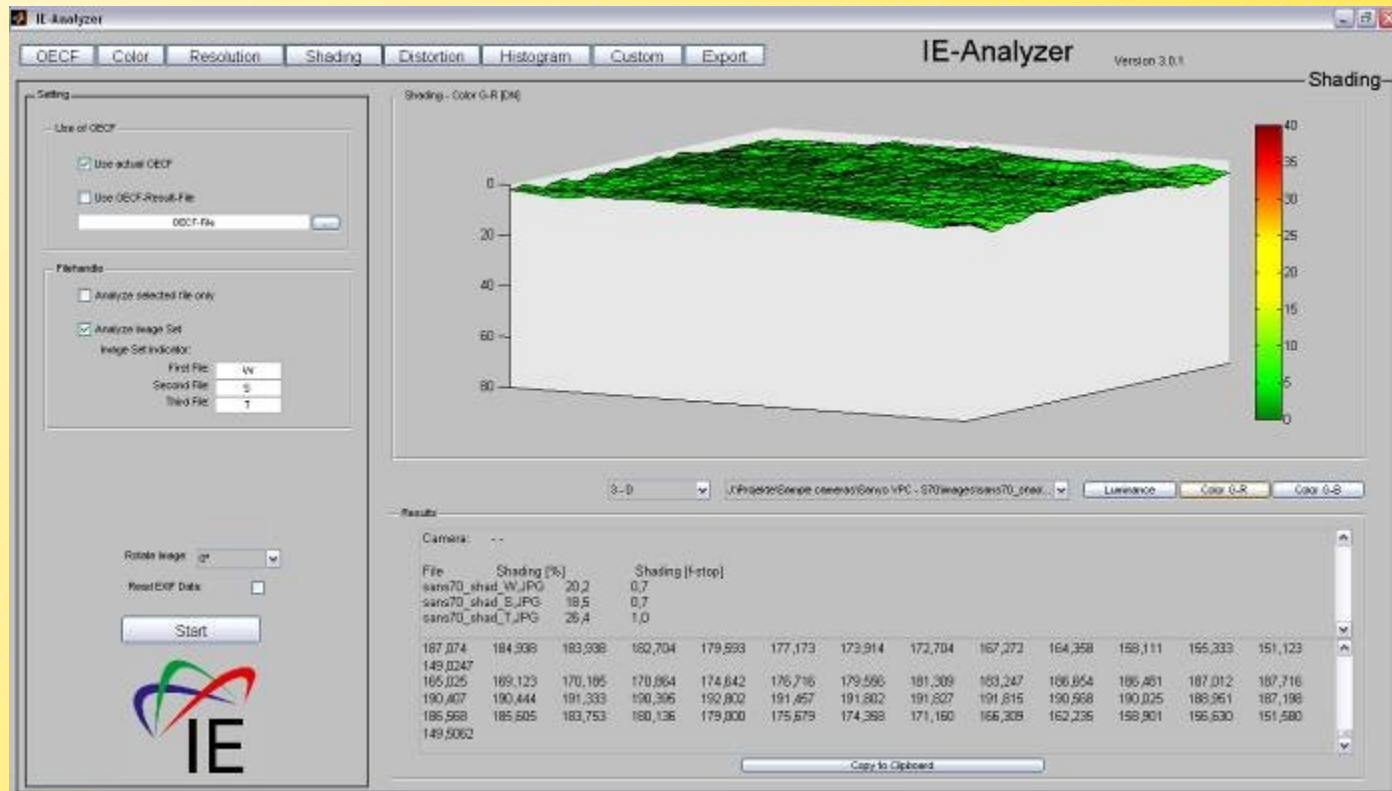
Digital Camera Tests

- vignetting / corner shading



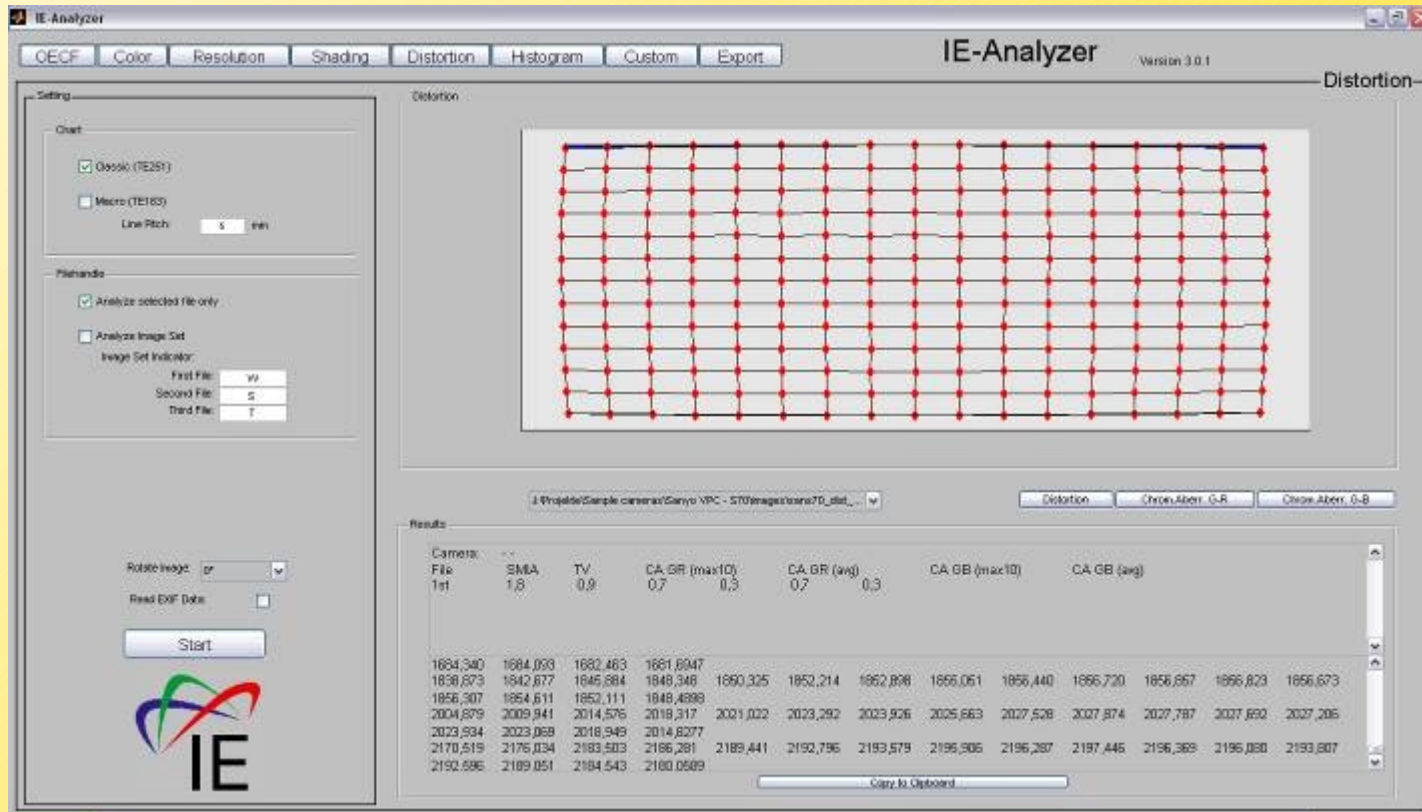
Digital Camera Tests

- vignetting / corner shading



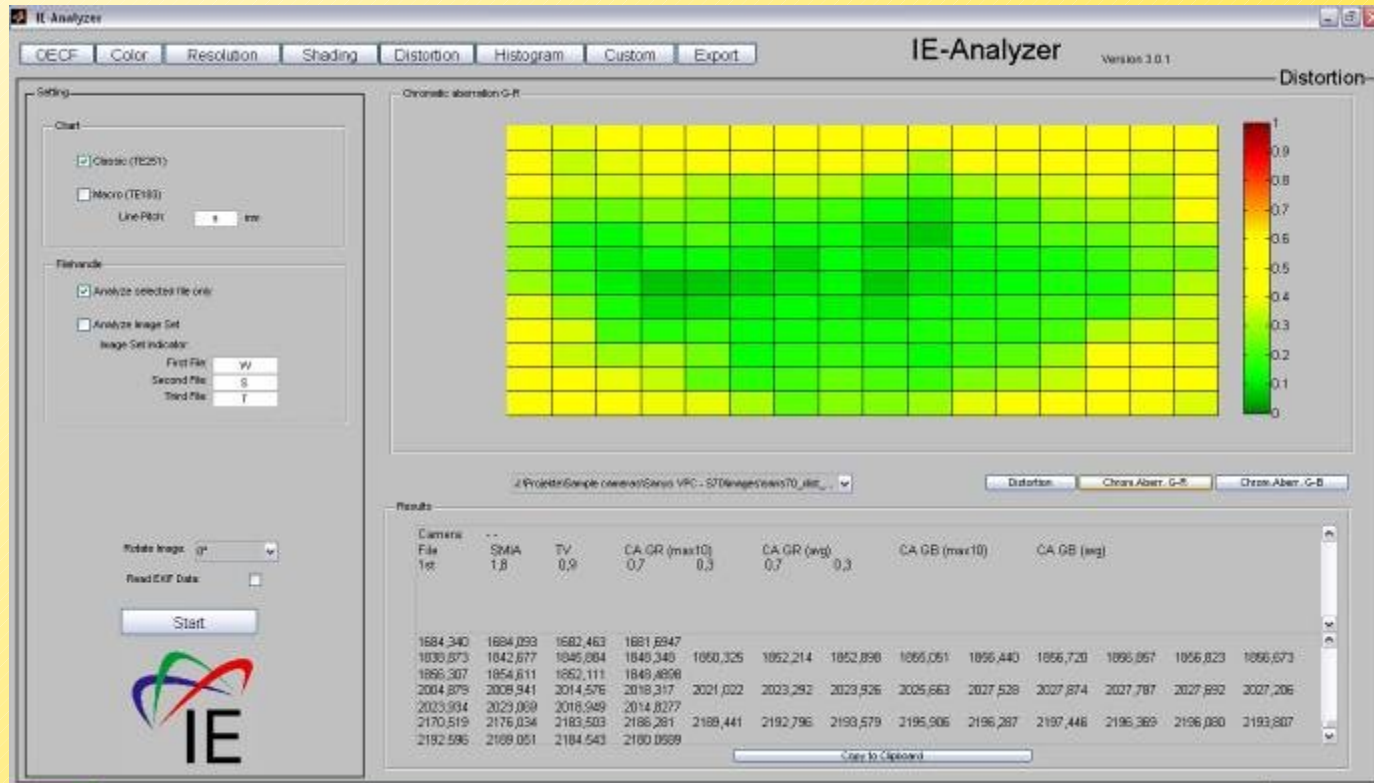
Digital Camera Tests

- distortion



Digital Camera Tests

- chromatic aberration



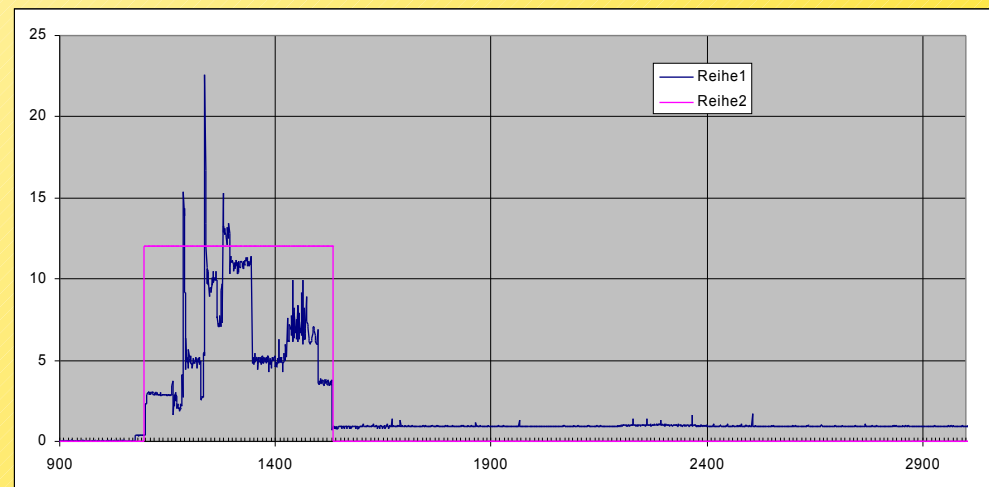
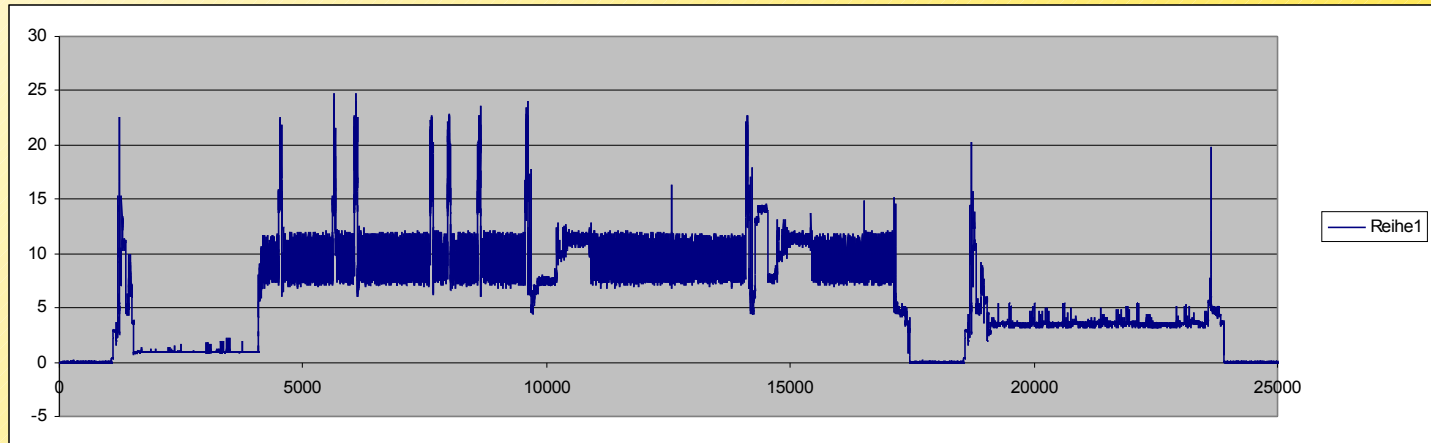
Digital Camera Tests

- power consumption test



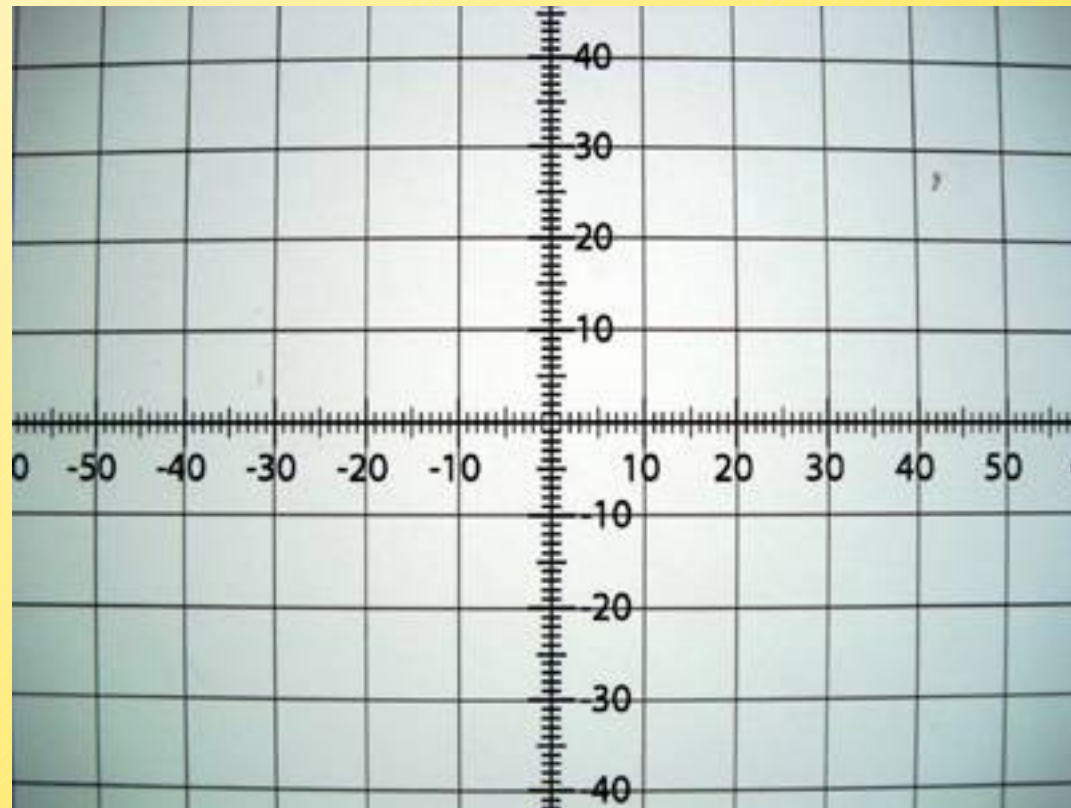
Digital Camera Tests

- power consumption and shooting rate



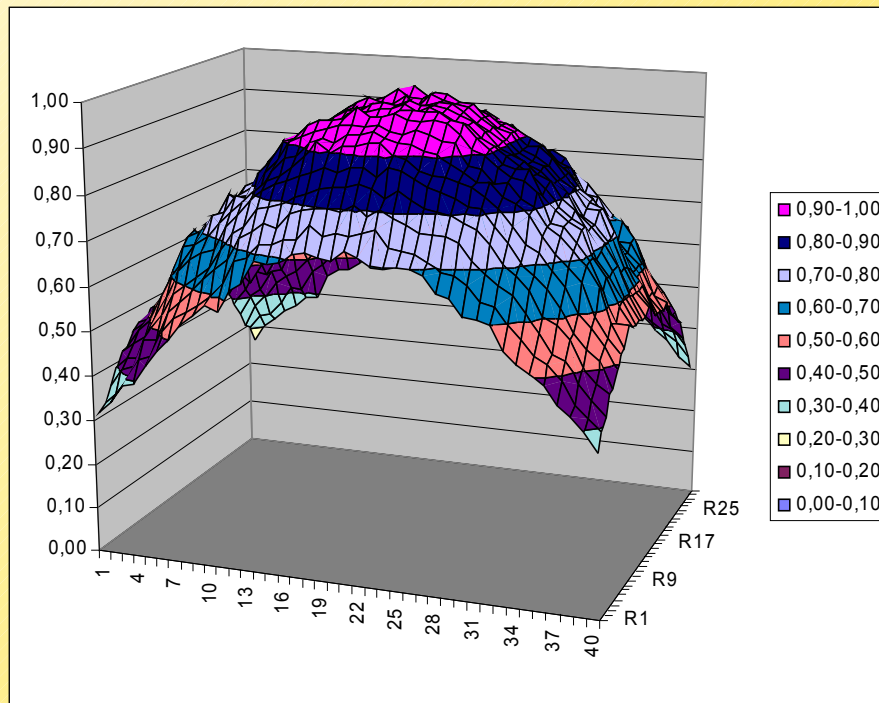
Digital Camera Tests

- max. scale



Digital Camera Tests

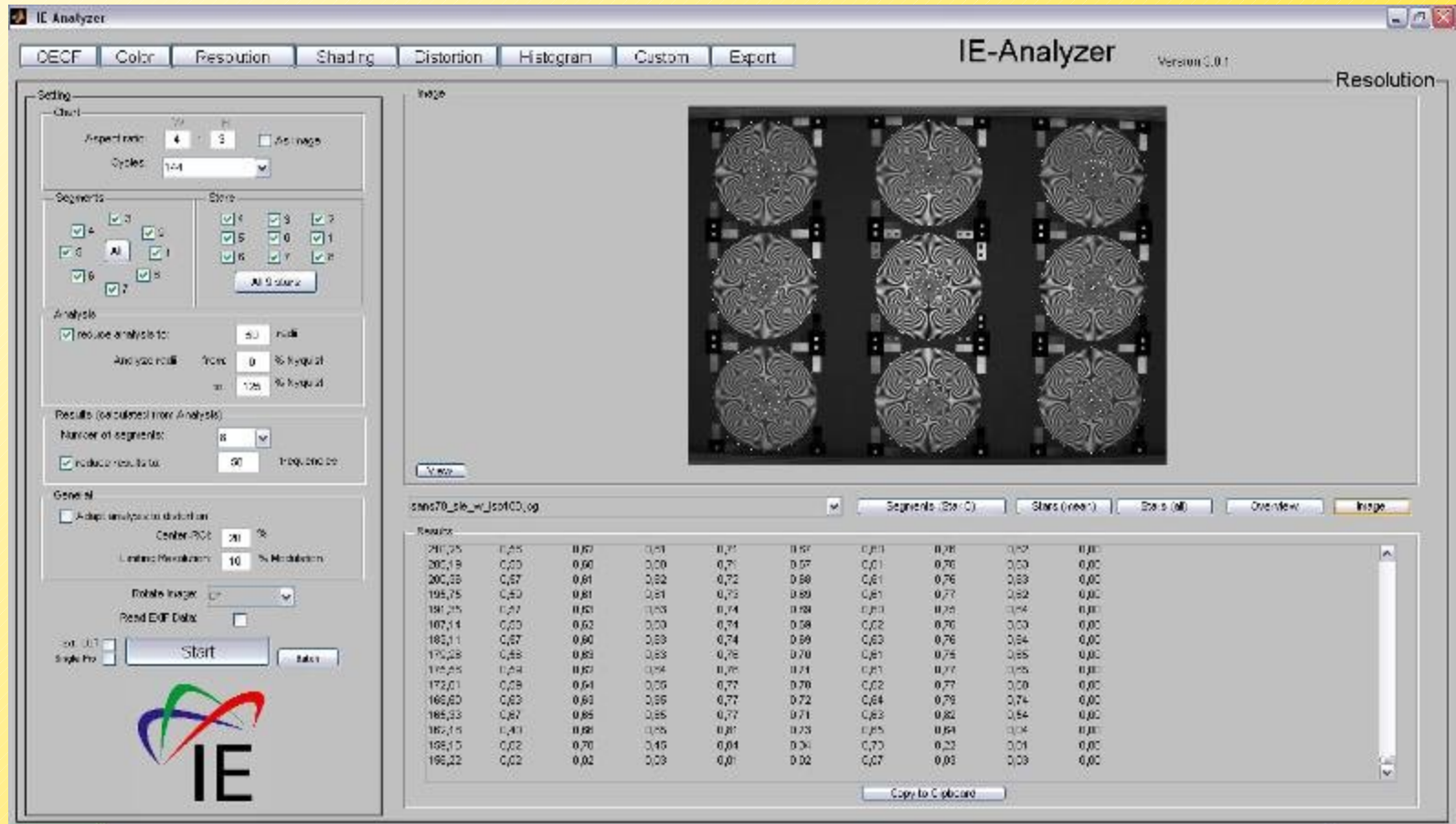
- Flash: uniformity and guide number



Zeile	Log Luminanz	y	Log Luminanz
3	0,67	11	1,08
4	1,46	42	
5	1,92	93	1,97
6	2,16	132	
Differenz Blendenstufen			2,97

Digital Camera Tests

- resolution measurement

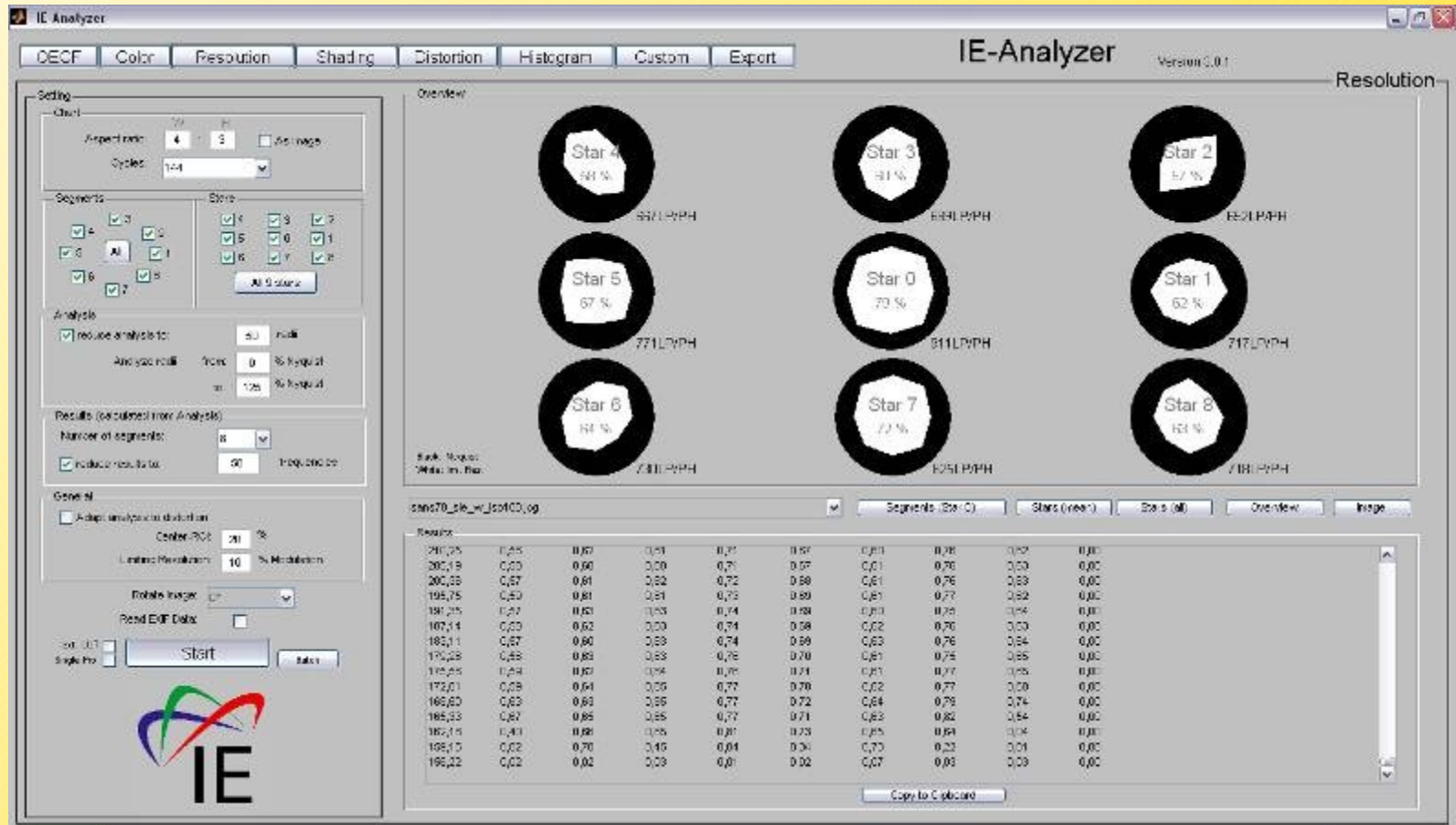


The screenshot shows the IE Analyzer software interface. The 'Resolution' tab is active, displaying a 3x3 grid of test patterns. Below the patterns is a table of results for 'std70_std_w_100102.log'. The table lists resolution values for various line numbers (200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900) across 10 different segments. The values are consistently high, indicating good resolution performance.

Line	0	1	2	3	4	5	6	7	8	9
200,25	0,25	0,67	0,51	0,71	0,57	0,61	0,78	0,50	0,60	0,60
200,49	0,20	0,60	0,50	0,71	0,57	0,61	0,76	0,50	0,60	0,60
200,73	0,27	0,61	0,62	0,72	0,58	0,61	0,76	0,53	0,63	0,60
199,75	0,50	0,81	0,61	0,75	0,69	0,61	0,77	0,62	0,60	0,60
199,25	0,27	0,61	0,63	0,74	0,64	0,61	0,78	0,54	0,64	0,60
187,14	0,20	0,62	0,50	0,74	0,58	0,62	0,76	0,50	0,60	0,60
185,11	0,27	0,60	0,59	0,74	0,59	0,63	0,76	0,54	0,64	0,60
170,28	0,58	0,83	0,68	0,76	0,70	0,61	0,75	0,65	0,60	0,60
175,25	0,24	0,67	0,54	0,76	0,71	0,61	0,77	0,55	0,60	0,60
172,01	0,28	0,64	0,56	0,77	0,70	0,62	0,77	0,50	0,60	0,60
166,00	0,23	0,63	0,56	0,77	0,72	0,64	0,78	0,74	0,60	0,60
165,33	0,27	0,65	0,55	0,77	0,71	0,63	0,82	0,54	0,60	0,60
162,15	0,40	0,86	0,75	0,81	0,73	0,65	0,84	0,64	0,60	0,60
158,10	0,22	0,70	0,45	0,64	0,74	0,70	0,73	0,51	0,60	0,60
156,22	0,22	0,62	0,59	0,61	0,62	0,67	0,83	0,53	0,60	0,60

Digital Camera Tests

- resolution measurement



The screenshot shows the IE Analyzer software interface. The 'Resolution' tab is active, displaying a grid of nine stars (Star 0 to Star 8) with their respective resolution values in L/PPH. The 'Results' table at the bottom provides a detailed view of the data for each star.

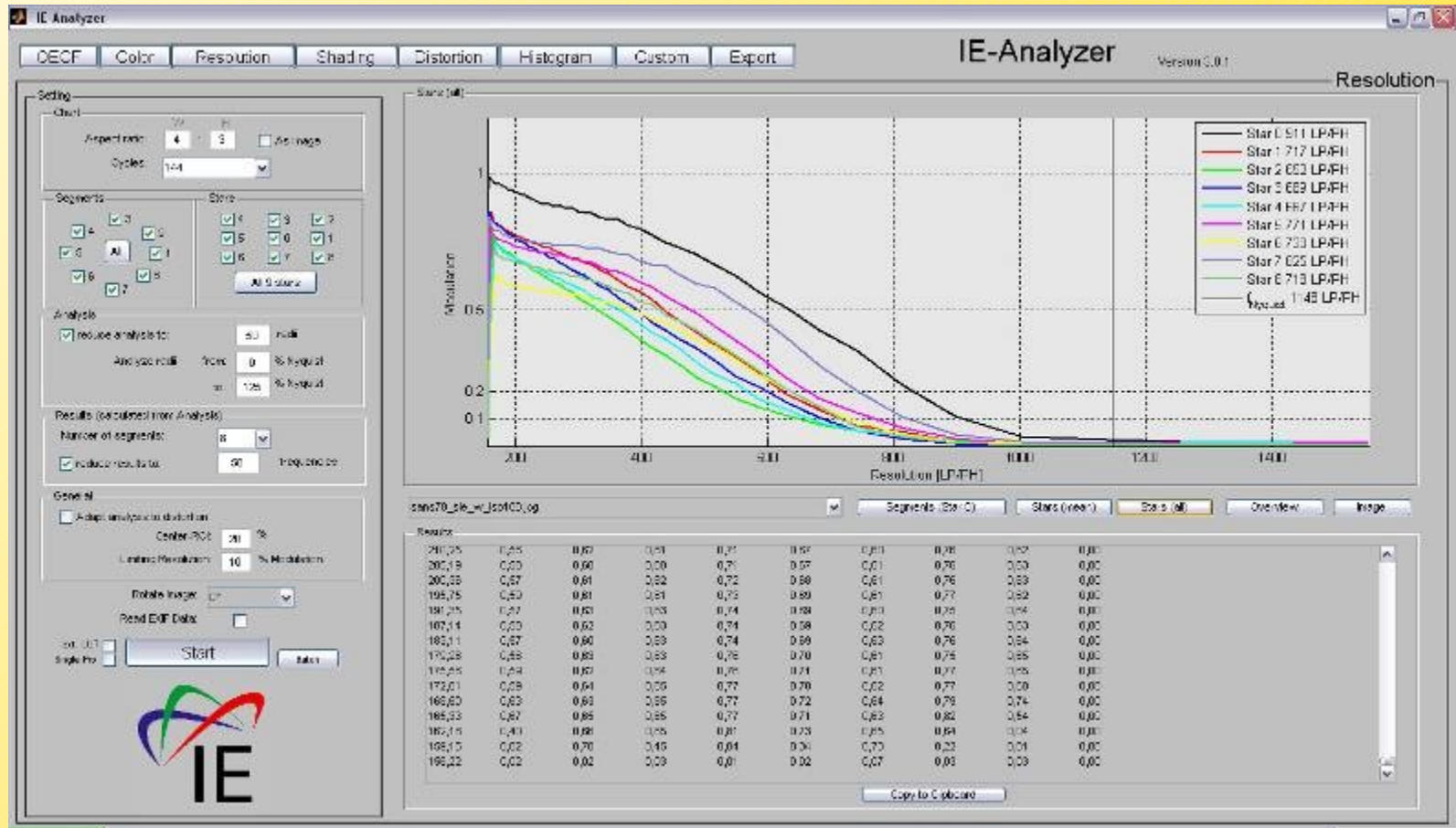
Star	Resolution (L/PPH)
Star 4	641
Star 3	644
Star 2	621
Star 5	771
Star 0	811
Star 1	717
Star 6	781
Star 7	825
Star 8	718

The 'Results' table contains the following data:

Results	0.05	0.07	0.09	0.11	0.13	0.15	0.18	0.20	0.22	0.25
200.19	0.05	0.06	0.09	0.11	0.13	0.15	0.18	0.20	0.22	0.25
200.28	0.07	0.09	0.12	0.14	0.16	0.18	0.21	0.23	0.25	0.28
195.75	0.10	0.12	0.15	0.17	0.19	0.21	0.24	0.26	0.28	0.31
181.25	0.13	0.15	0.18	0.20	0.22	0.24	0.27	0.29	0.31	0.34
167.14	0.16	0.18	0.21	0.23	0.25	0.27	0.30	0.32	0.34	0.37
153.11	0.19	0.21	0.24	0.26	0.28	0.30	0.33	0.35	0.37	0.40
139.28	0.22	0.24	0.27	0.29	0.31	0.33	0.36	0.38	0.40	0.43
125.65	0.25	0.27	0.30	0.32	0.34	0.36	0.39	0.41	0.43	0.46
112.21	0.28	0.30	0.33	0.35	0.37	0.39	0.42	0.44	0.46	0.49
98.80	0.31	0.33	0.36	0.38	0.40	0.42	0.45	0.47	0.49	0.52
85.53	0.34	0.36	0.39	0.41	0.43	0.45	0.48	0.50	0.52	0.55
72.41	0.37	0.39	0.42	0.44	0.46	0.48	0.51	0.53	0.55	0.58
59.45	0.40	0.42	0.45	0.47	0.49	0.51	0.54	0.56	0.58	0.61
46.65	0.43	0.45	0.48	0.50	0.52	0.54	0.57	0.59	0.61	0.64
34.00	0.46	0.48	0.51	0.53	0.55	0.57	0.60	0.62	0.64	0.67
21.50	0.49	0.51	0.54	0.56	0.58	0.60	0.63	0.65	0.67	0.70
9.15	0.52	0.54	0.57	0.59	0.61	0.63	0.66	0.68	0.70	0.73
1.82	0.55	0.57	0.60	0.62	0.64	0.66	0.69	0.71	0.73	0.76

Digital Camera Tests

- resolution measurement



Digital Camera Tests

- Measuring spectral sensitivities



Digital Camera Tests

- Measuring spectral sensitivities

