

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

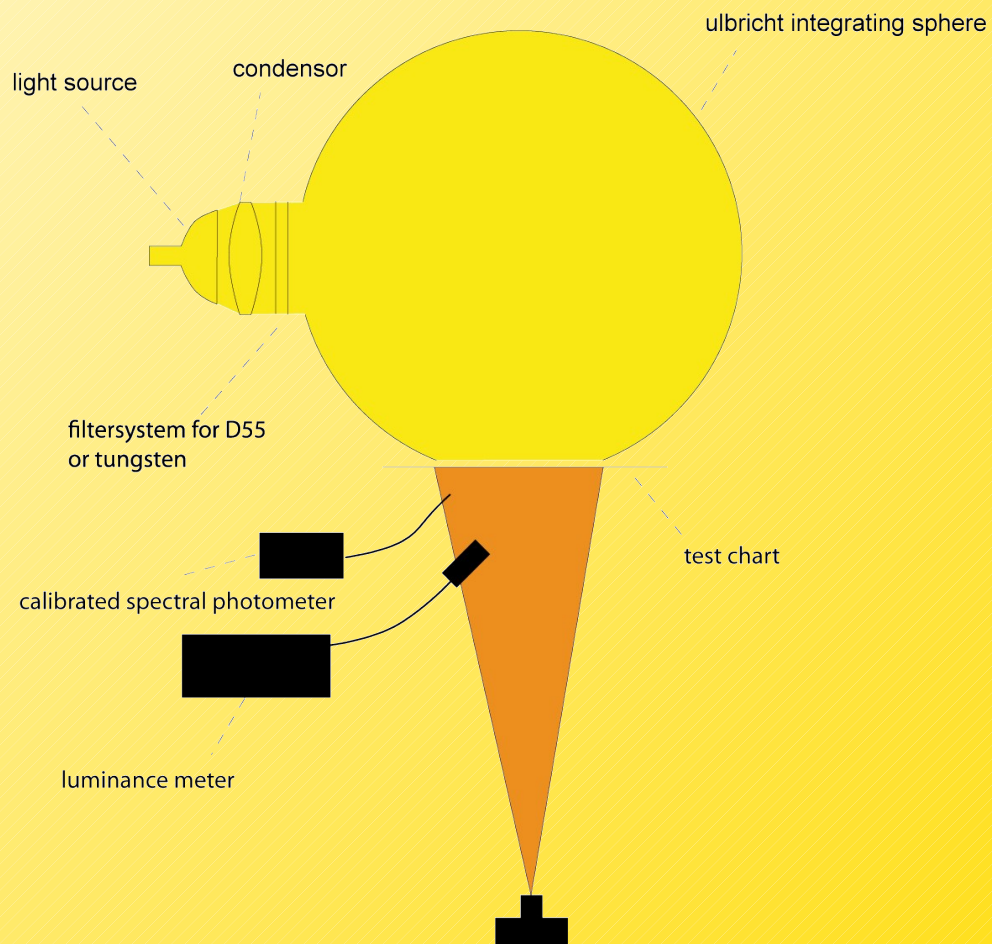
Digital Camera Tests

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?)

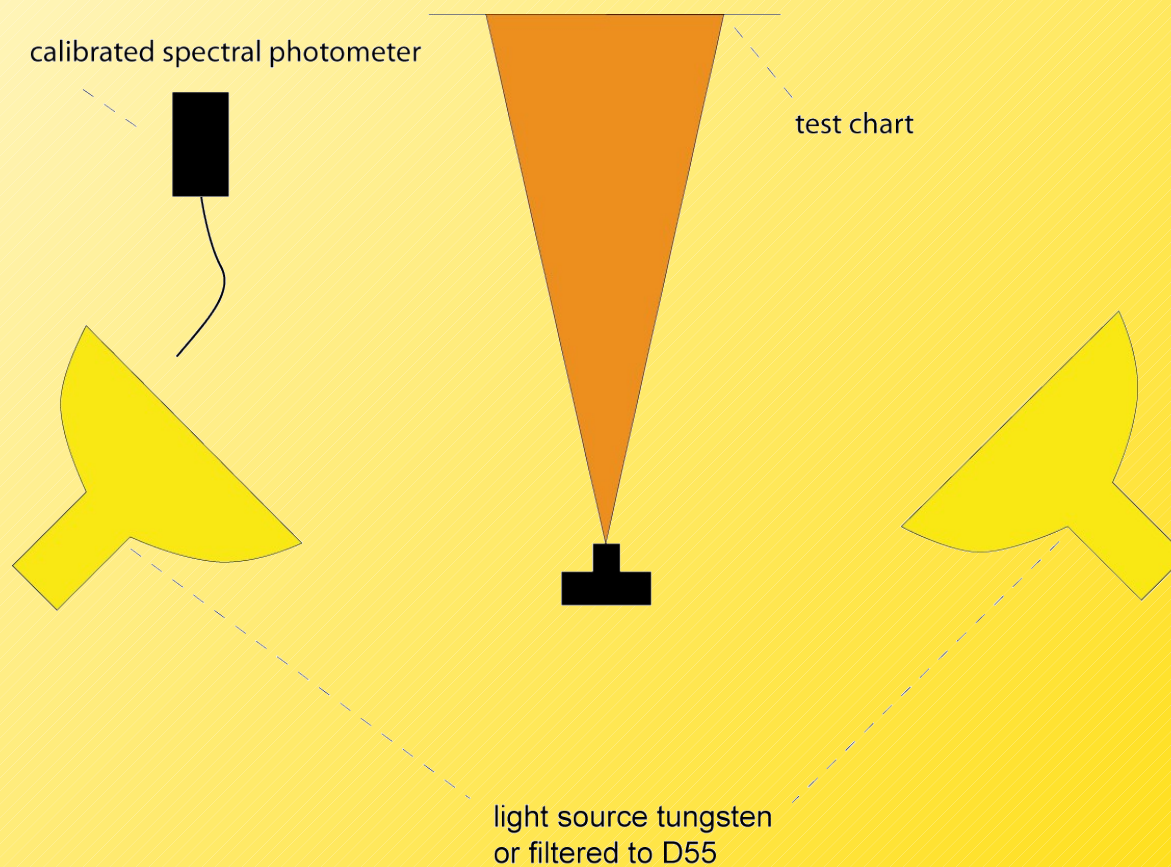
Digital Camera Tests

- Principle



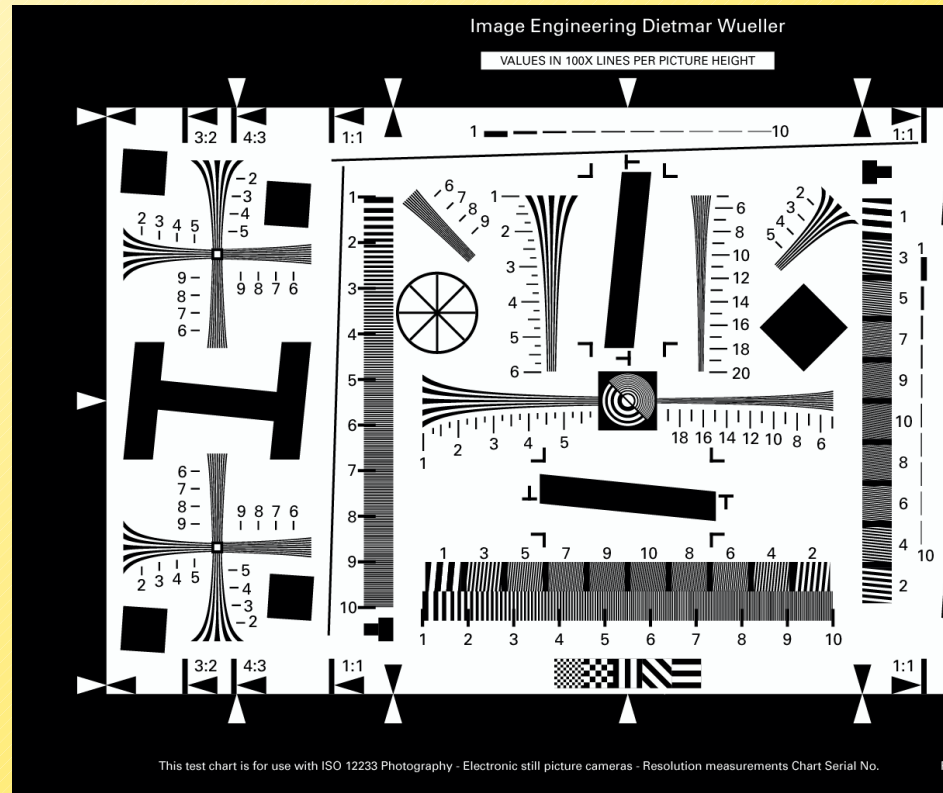
Digital Camera Tests

- Principle



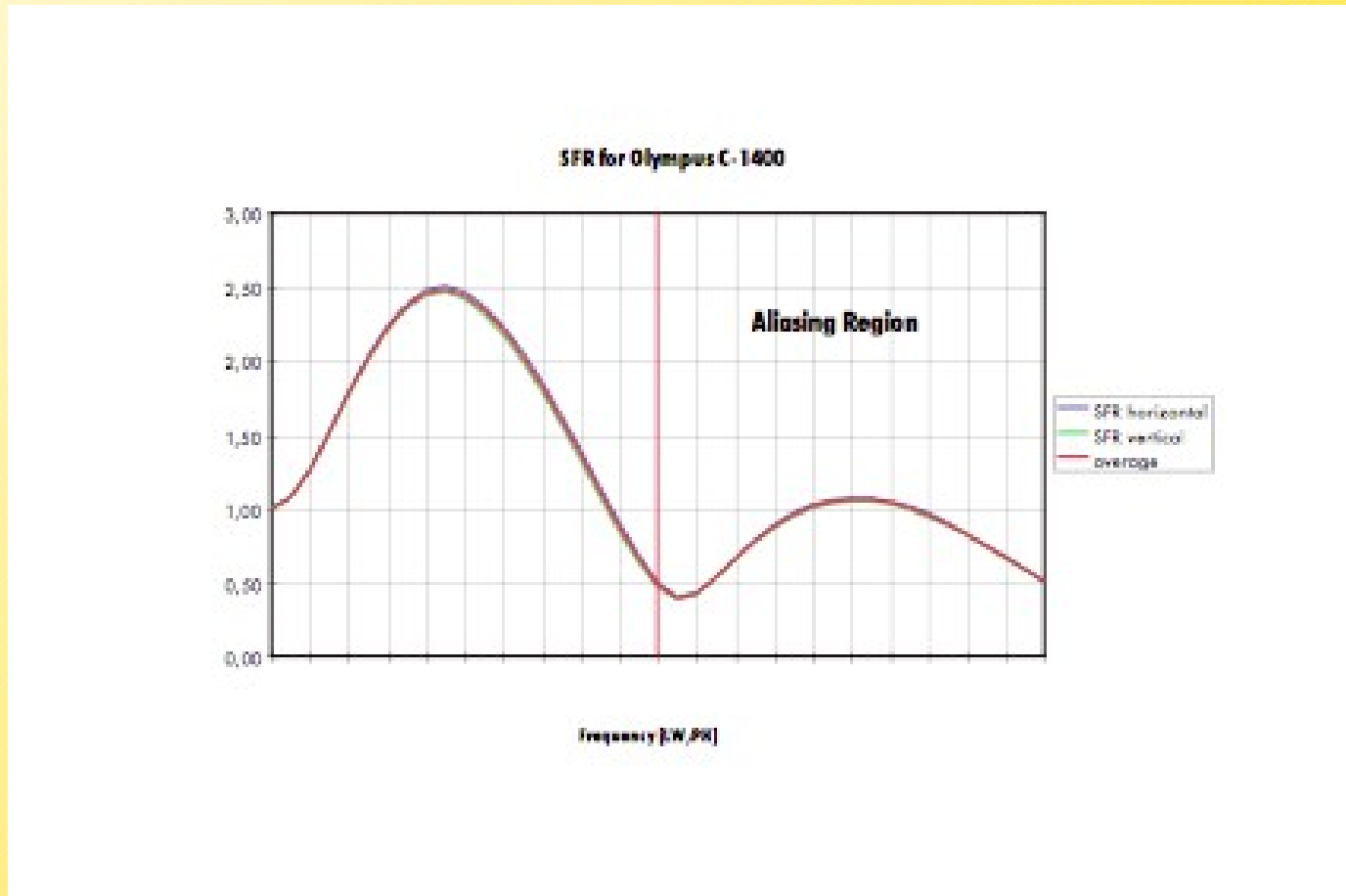
Standards are not God given

- Several problems occurred



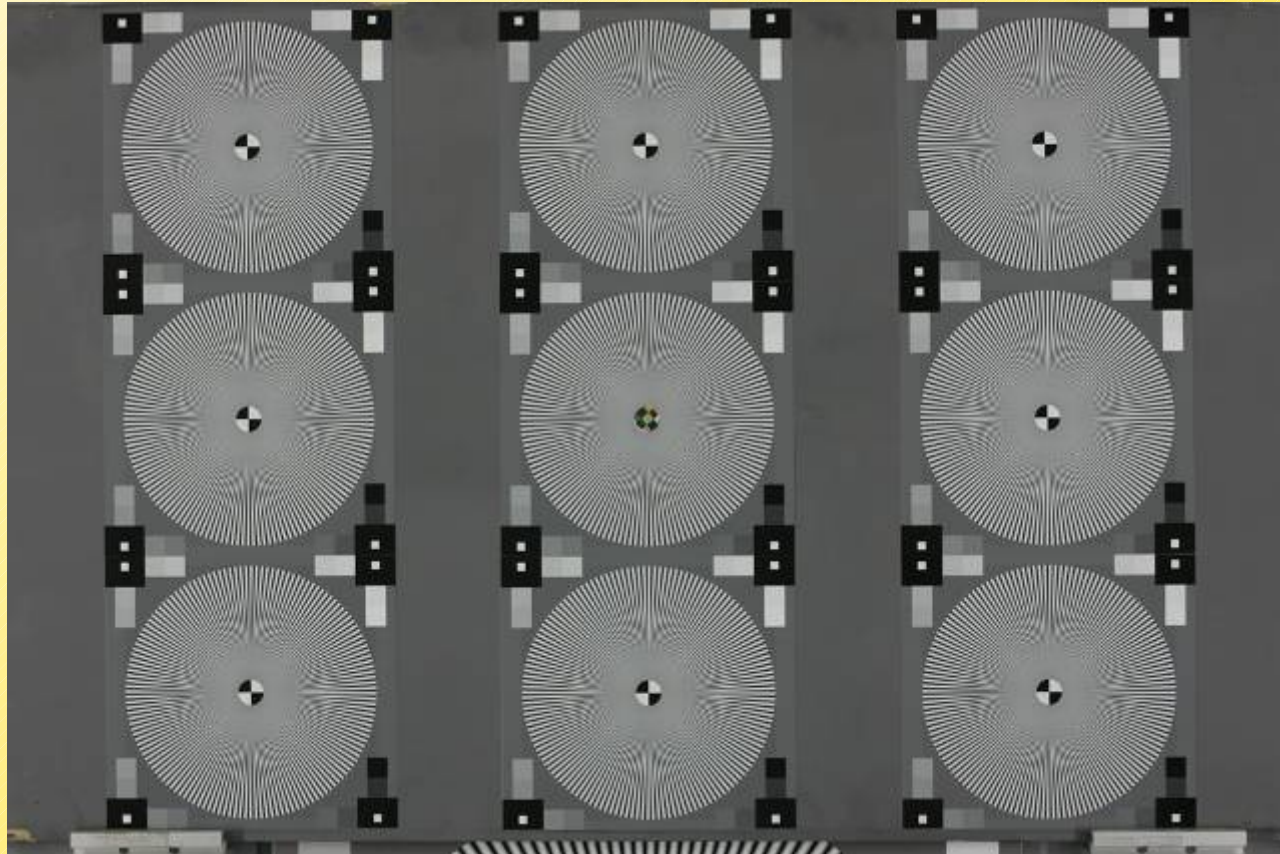
Standards are not God given

- Several problems occurred



Digital Camera Tests

- resolution measurement

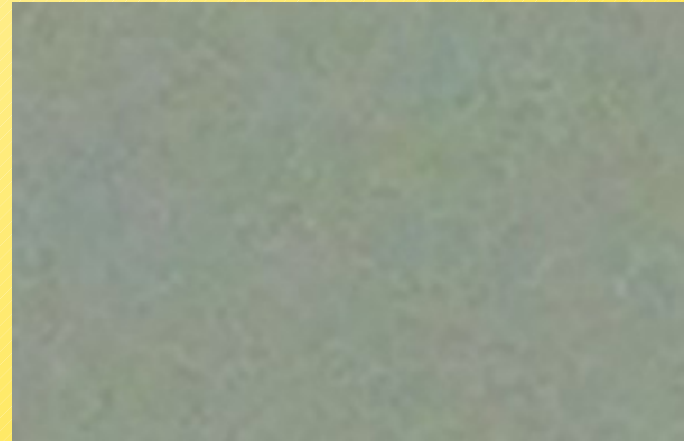


Finding new methods

- Signal to noise vs. Visual noise



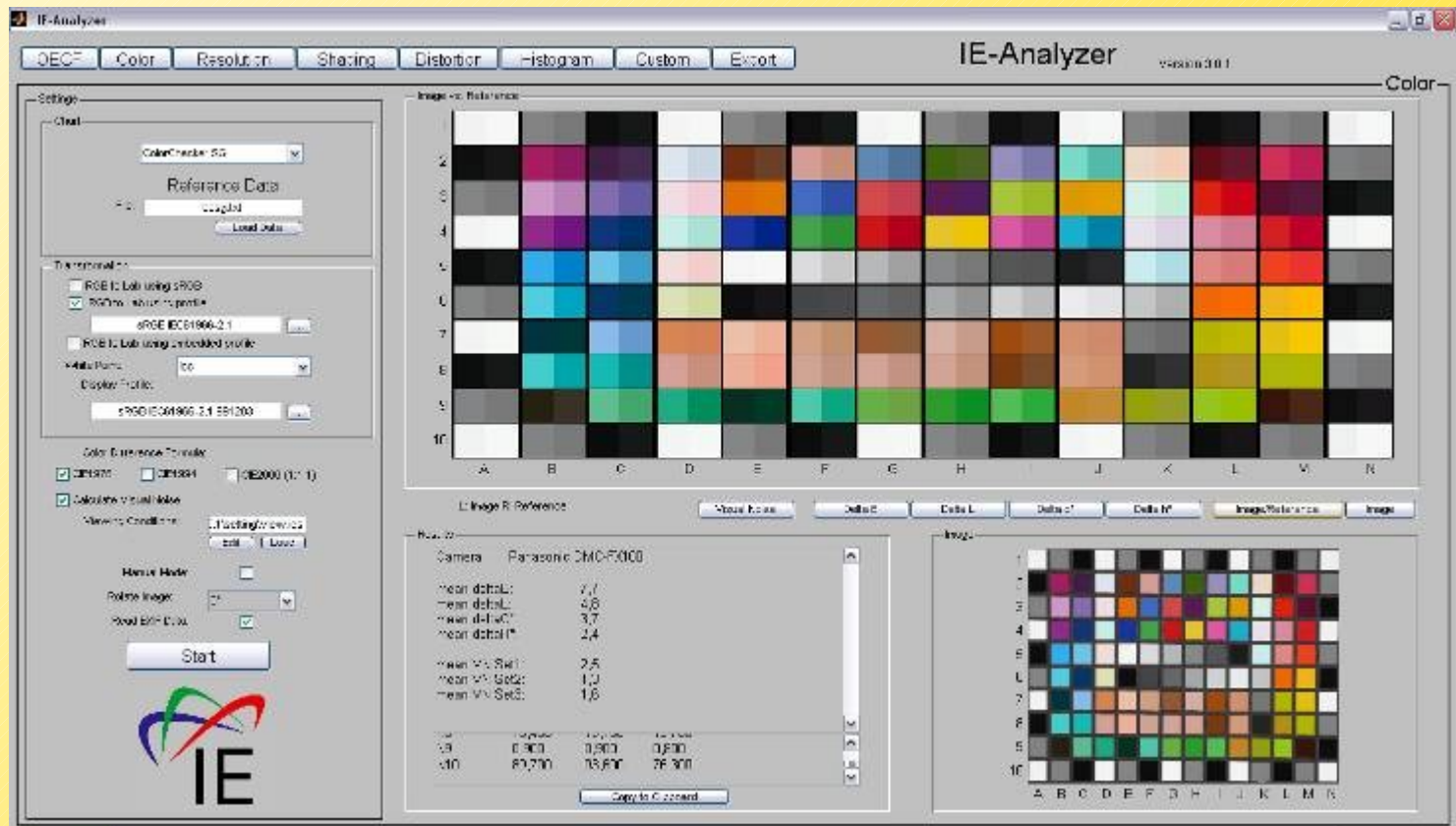
SNx= 27



SNx= 29

Digital Camera Tests

- color reproduction quality



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

The interface is divided into several sections:

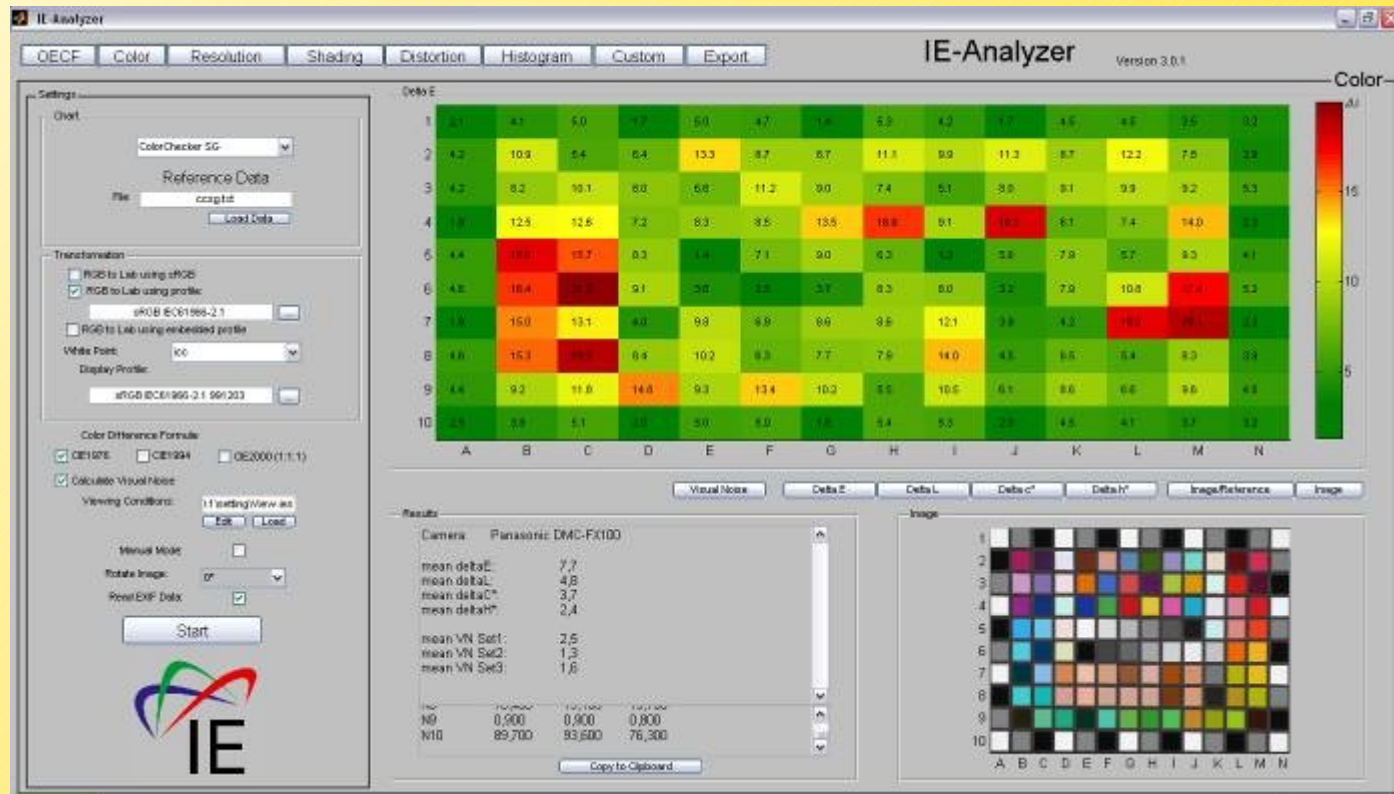
- Settings:**
 - Color:** A dropdown menu is set to "ColorChecker 50".
 - Reference Data:** A text field contains "c00g00" and a "Load Data" button is present.
 - Transmittance:**
 - Radio buttons for "RDE Lab using sRGB", "RDE Lab using sRGB", and "RDE Lab using embedded profile".
 - A text field for "sRGB ICC1996-2.1" with a "Load" button.
 - Radio buttons for "RDE Lab using embedded profile" and "RDE Lab using embedded profile".
 - A text field for "sRGB ICC1996-2.1 sRGB100" with a "Load" button.
 - Color Difference Metrics:**
 - Checkboxes for "CIE1976", "CIE1994", and "CIE2000 (1:1)".
 - Checkboxes for "Calculate virtual color" and "View in Condition".
 - A dropdown menu for "View in Condition" set to "sRGB/ColorChecker".
 - Buttons for "Load" and "Load".
 - Header Mode:** A checkbox is unchecked.
 - Roller Image:** A dropdown menu is set to "sRGB".
 - Roller B&W:** A checkbox is checked.
 - A "Stat" button is located at the bottom of the settings panel.
- Image vs. Reference:** A large grid of color patches (ColorChecker 50) is displayed, with axes labeled 1-10 and A-N.
- Image Reference:** A smaller grid of color patches is shown below the main grid.
- Camera:** A text field displays "Panasonic DMC-FX100".
- Mean Delta E:** A list of mean delta E values for different color sets:

mean delta E1	7.7
mean delta E2	4.8
mean delta E3	3.7
mean delta E4	2.4
mean V1 Set1	2.5
mean V1 Set2	1.2
mean V1 Set3	1.8
- Resolution:** A table showing resolution data:

Line	Horizontal	Vertical	Resolution
10	6,900	0,900	0,900
510	80,700	10,800	76,800
- Copy to Clipboard:** A button is located at the bottom of the resolution table.

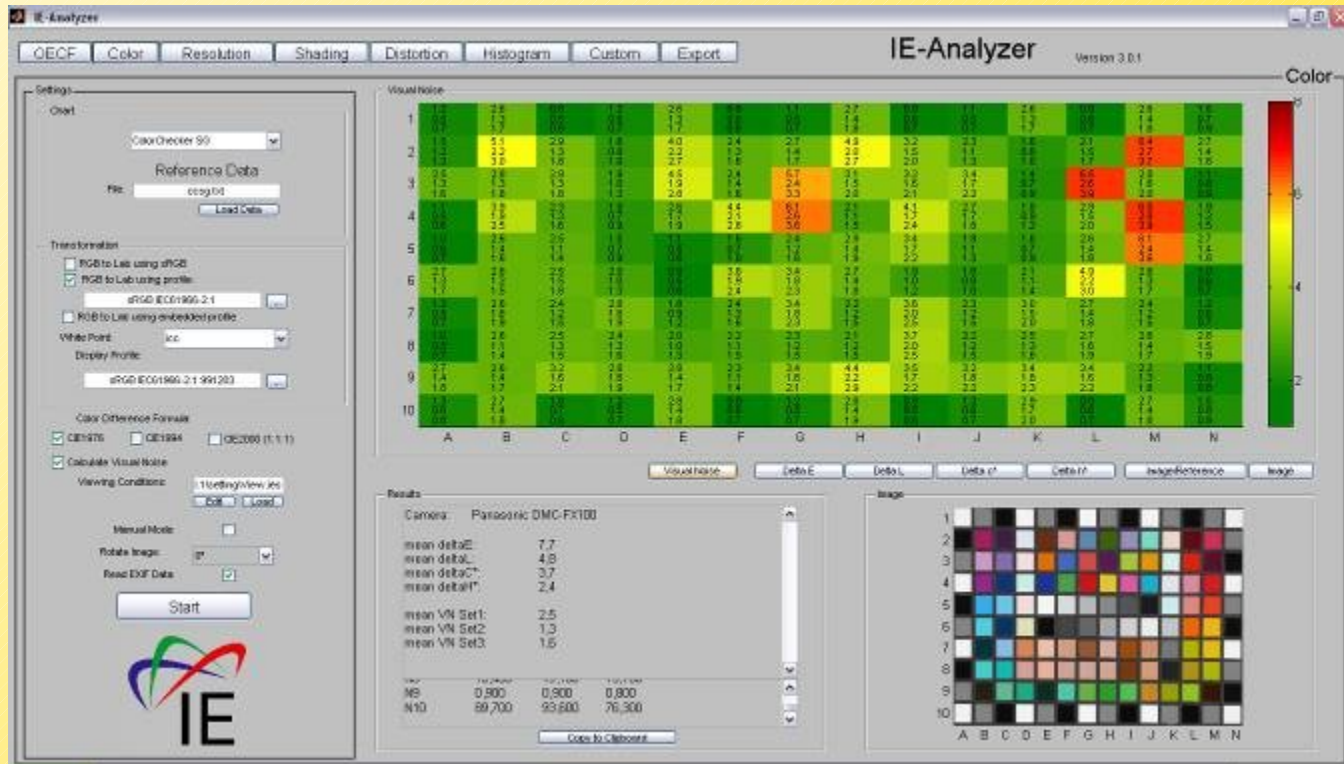
Digital Camera Tests

- color reproduction quality



Digital Camera Tests

- color reproduction quality



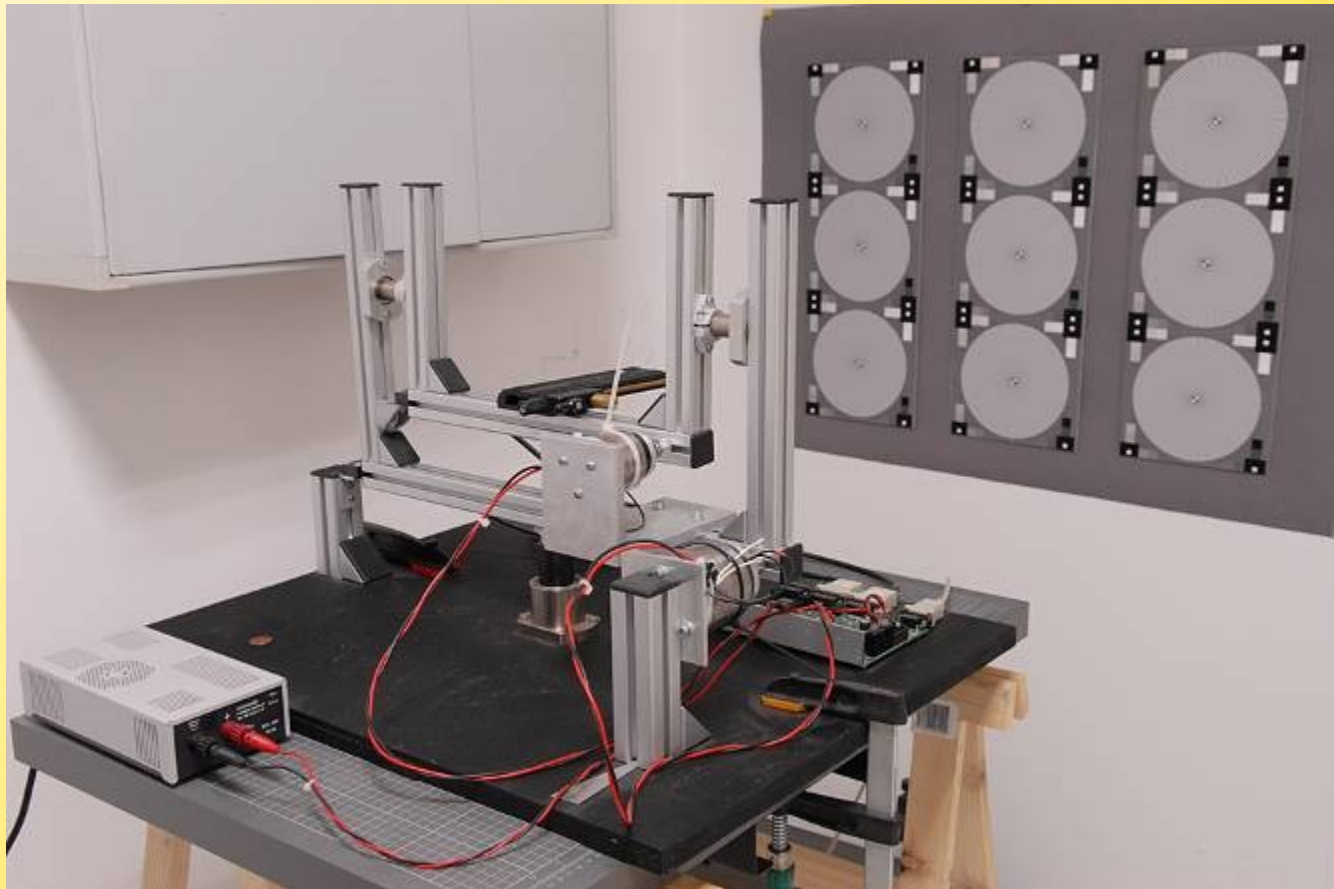
Digital Camera Tests

- shutter and shooting lag

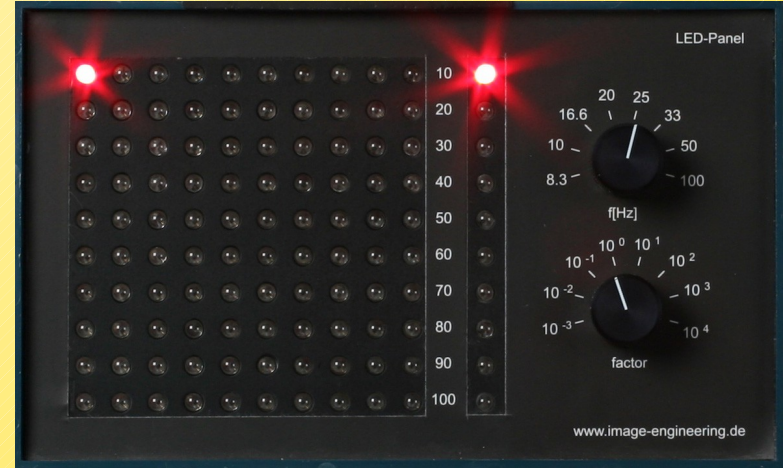


Digital Camera Tests

- Welcome: Steve (“Stabilizer Evaluation Equipment”)

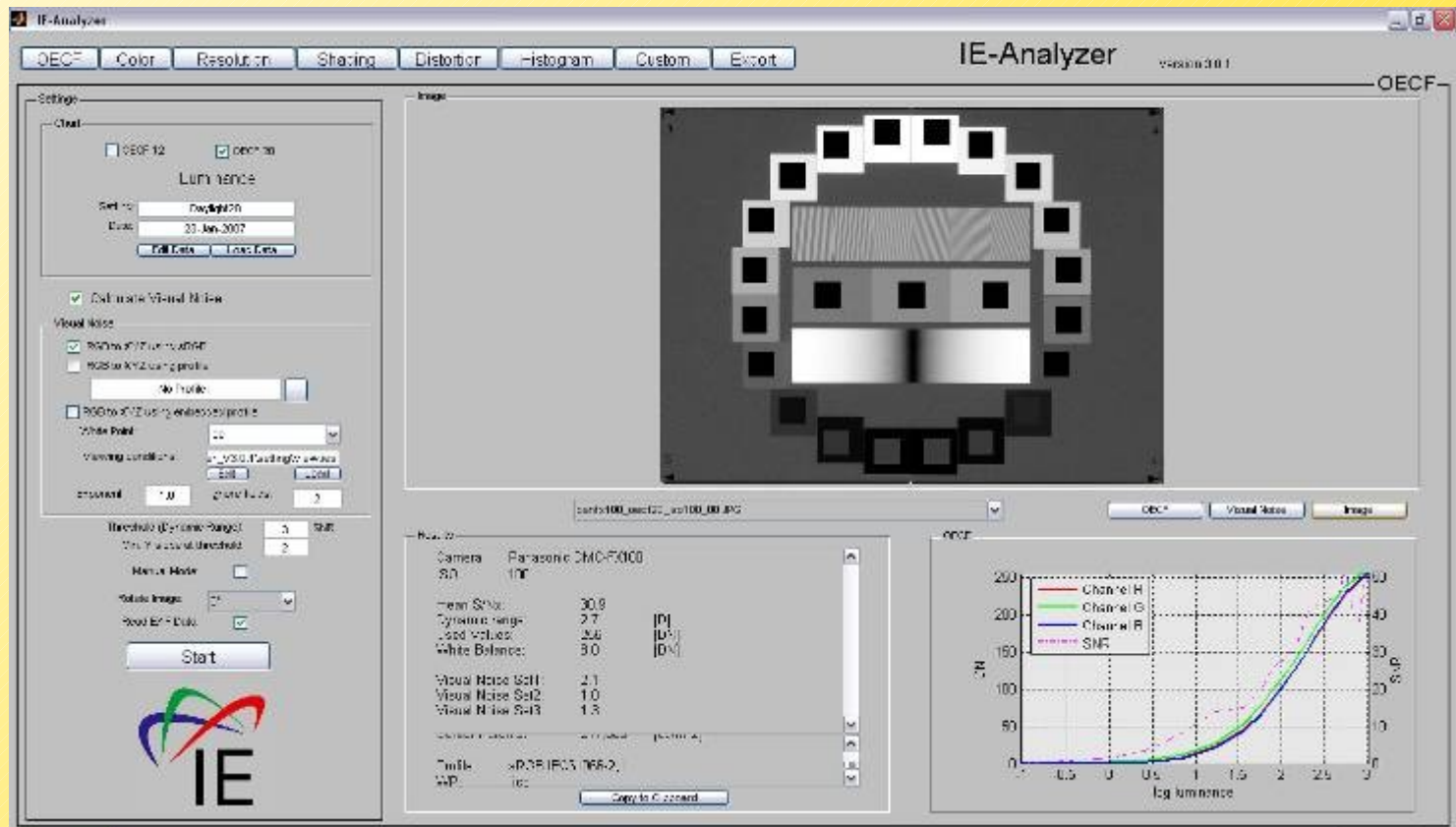


Digital Camera Tests



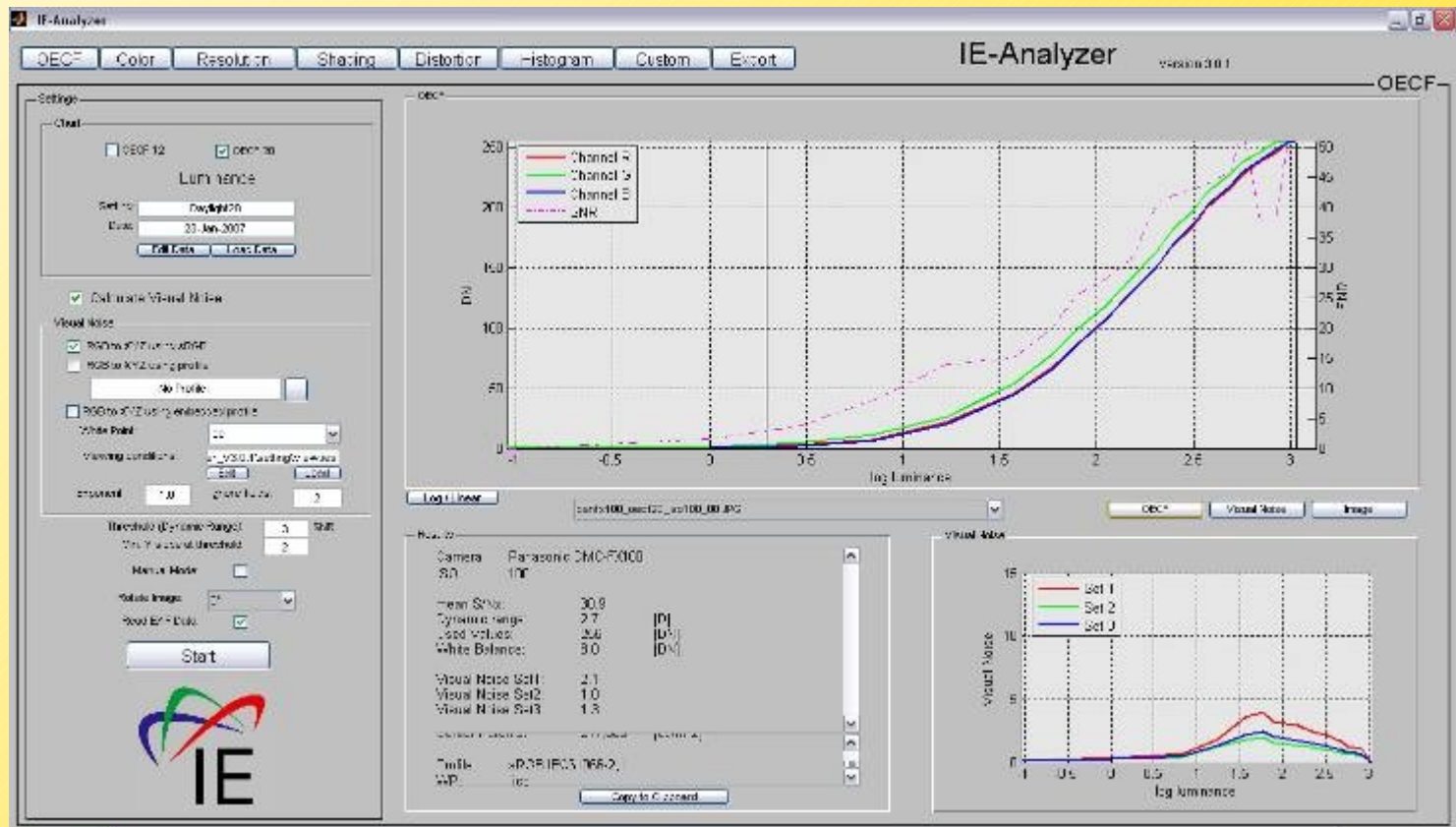
Digital Camera Tests

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



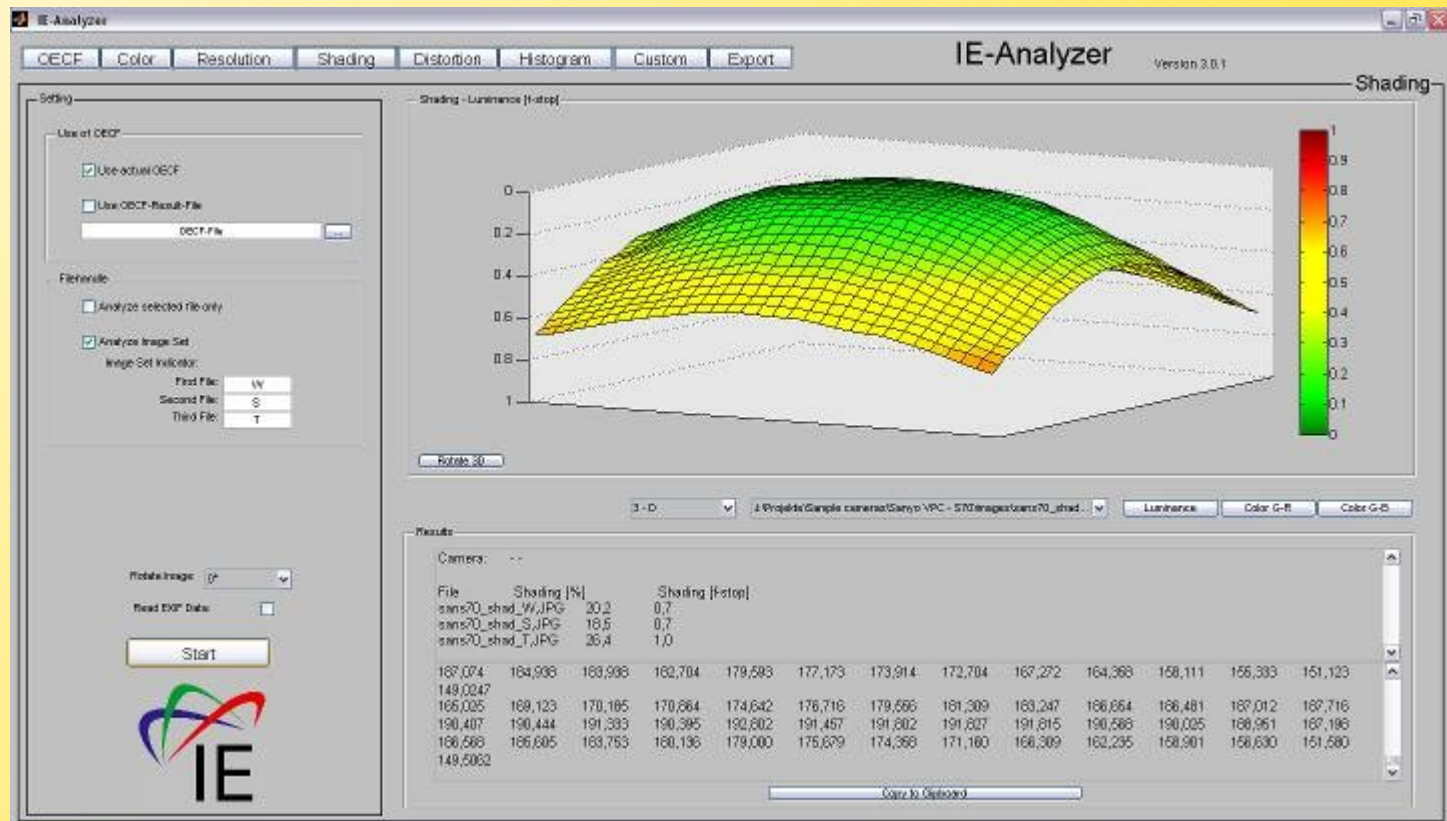
Digital Camera Tests

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



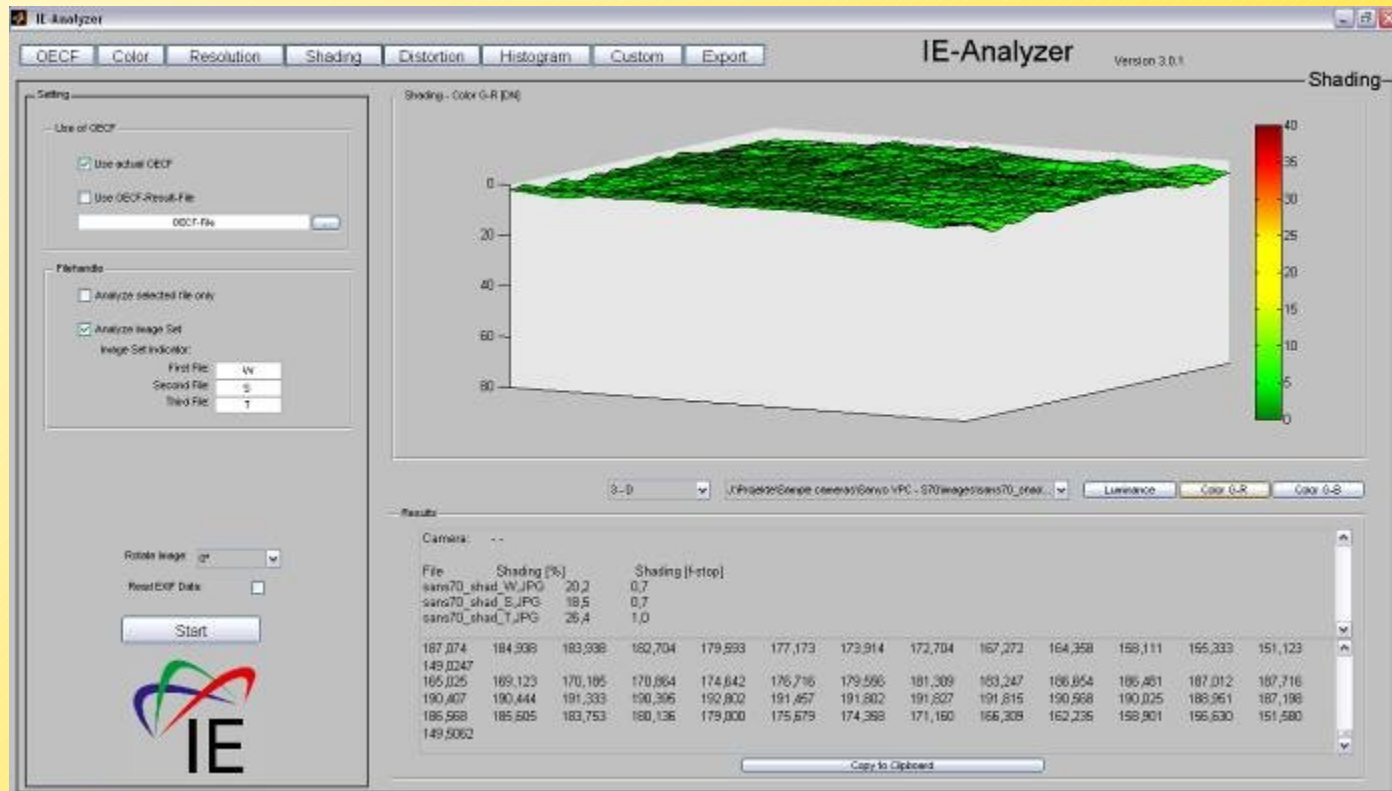
Digital Camera Tests

- vignetting / corner shading



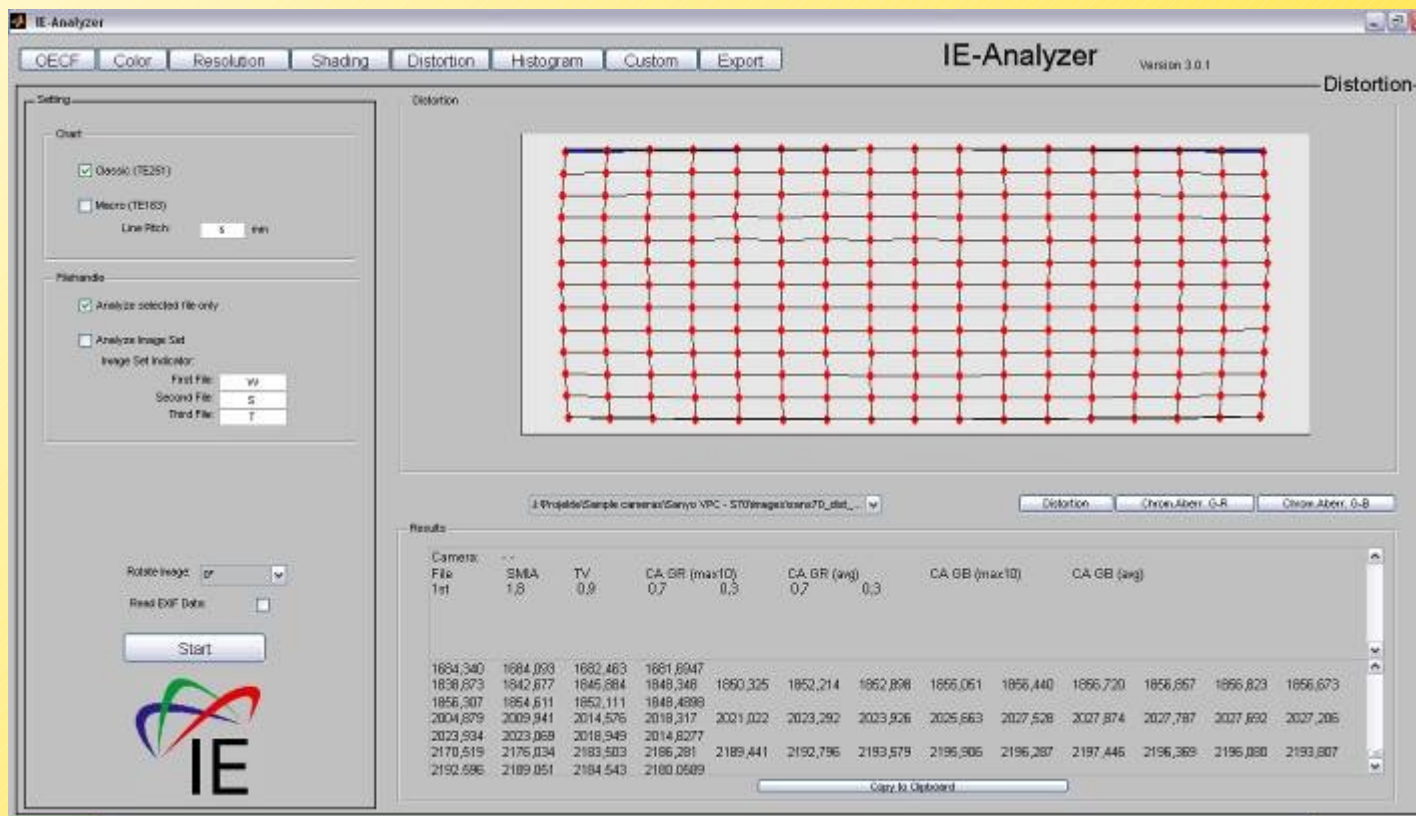
Digital Camera Tests

- vignetting / corner shading



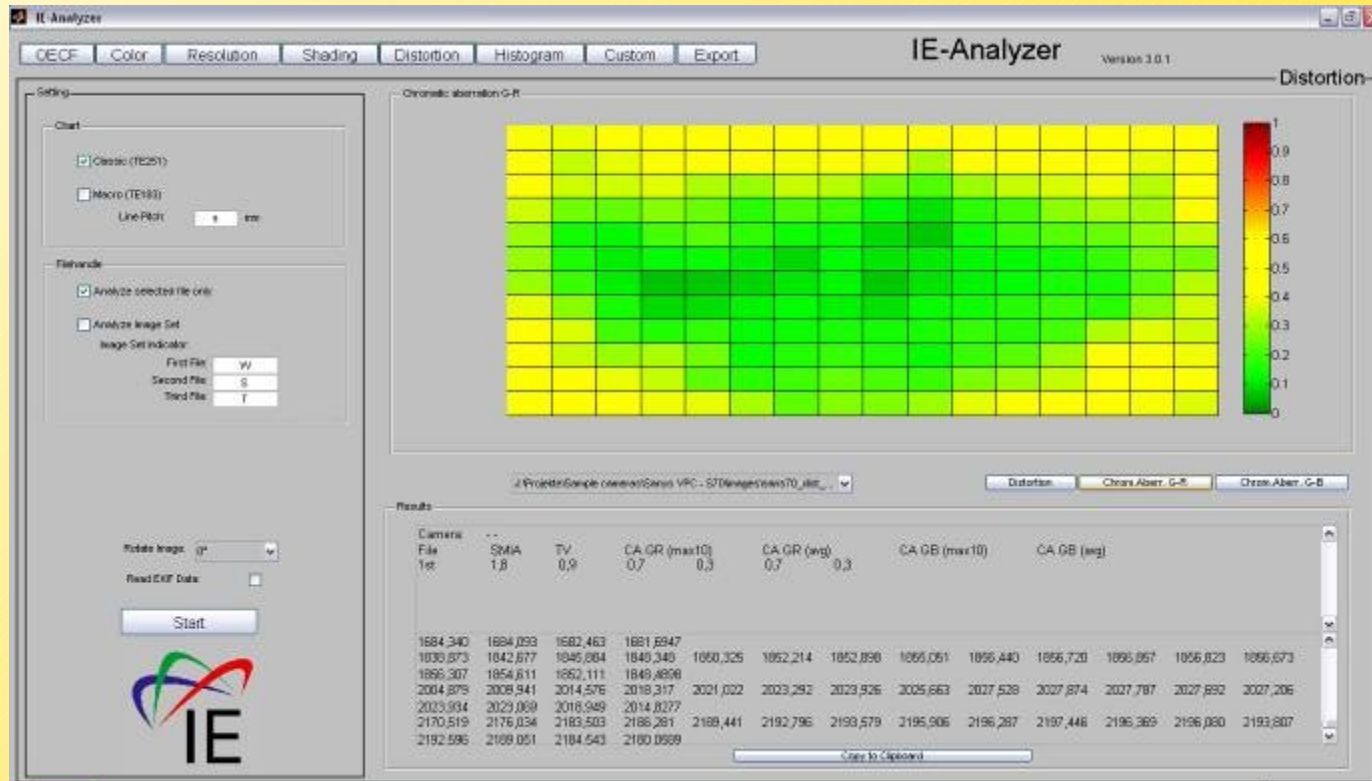
Digital Camera Tests

- distortion



Digital Camera Tests

- chromatic aberration



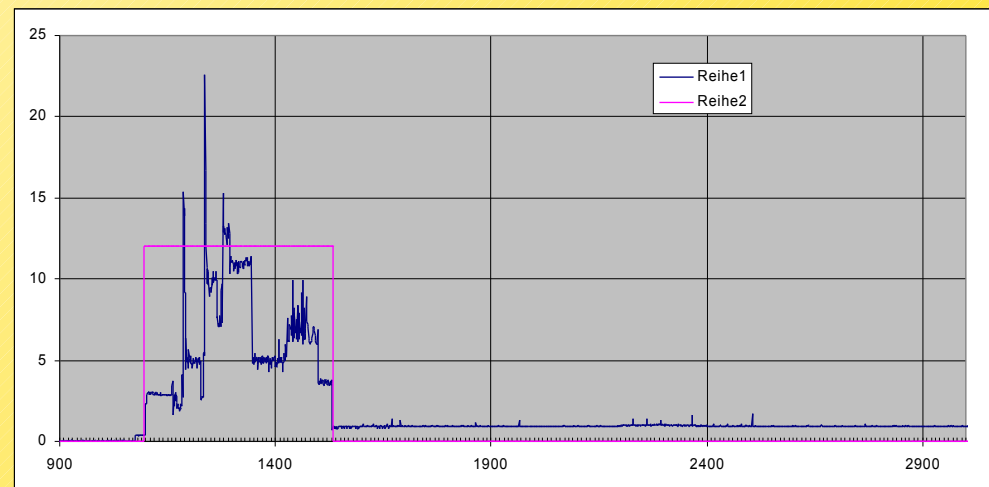
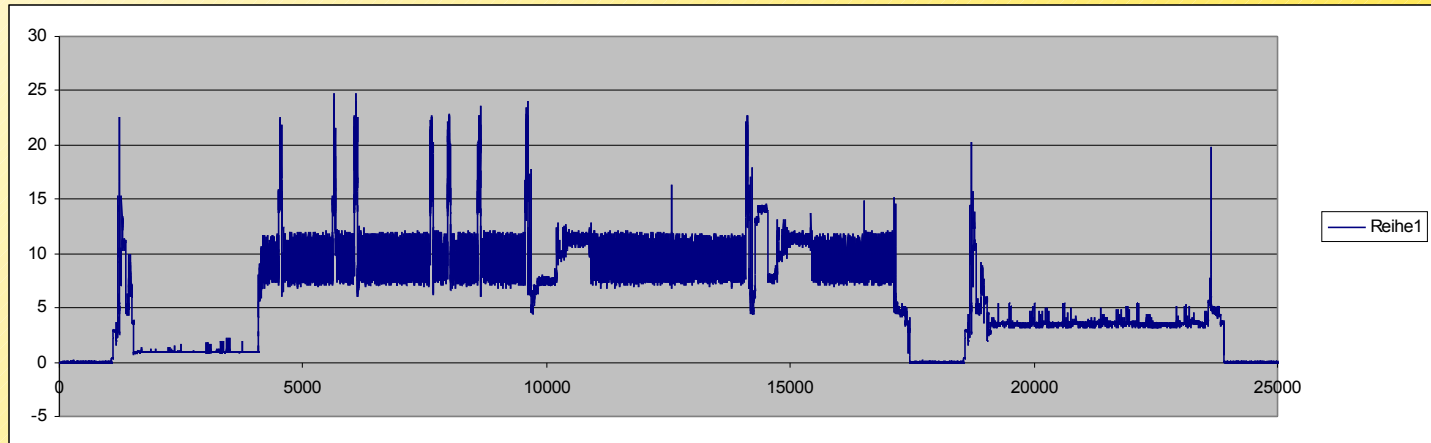
Digital Camera Tests

- power consumption test



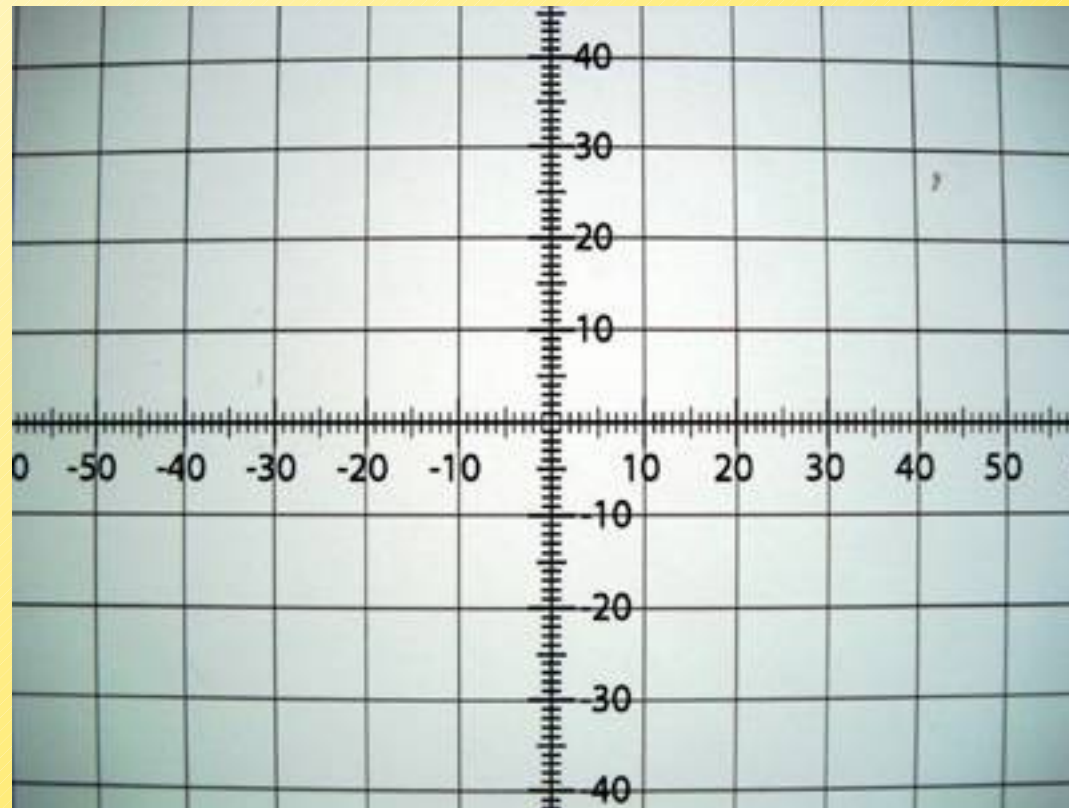
Digital Camera Tests

- power consumption and shooting rate



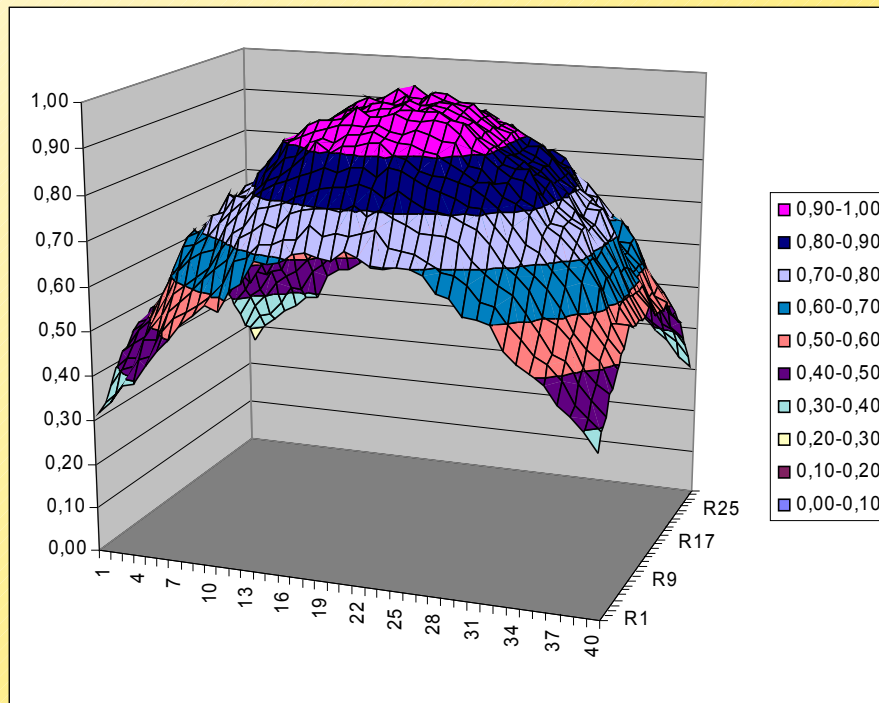
Digital Camera Tests

- max. scale



Digital Camera Tests

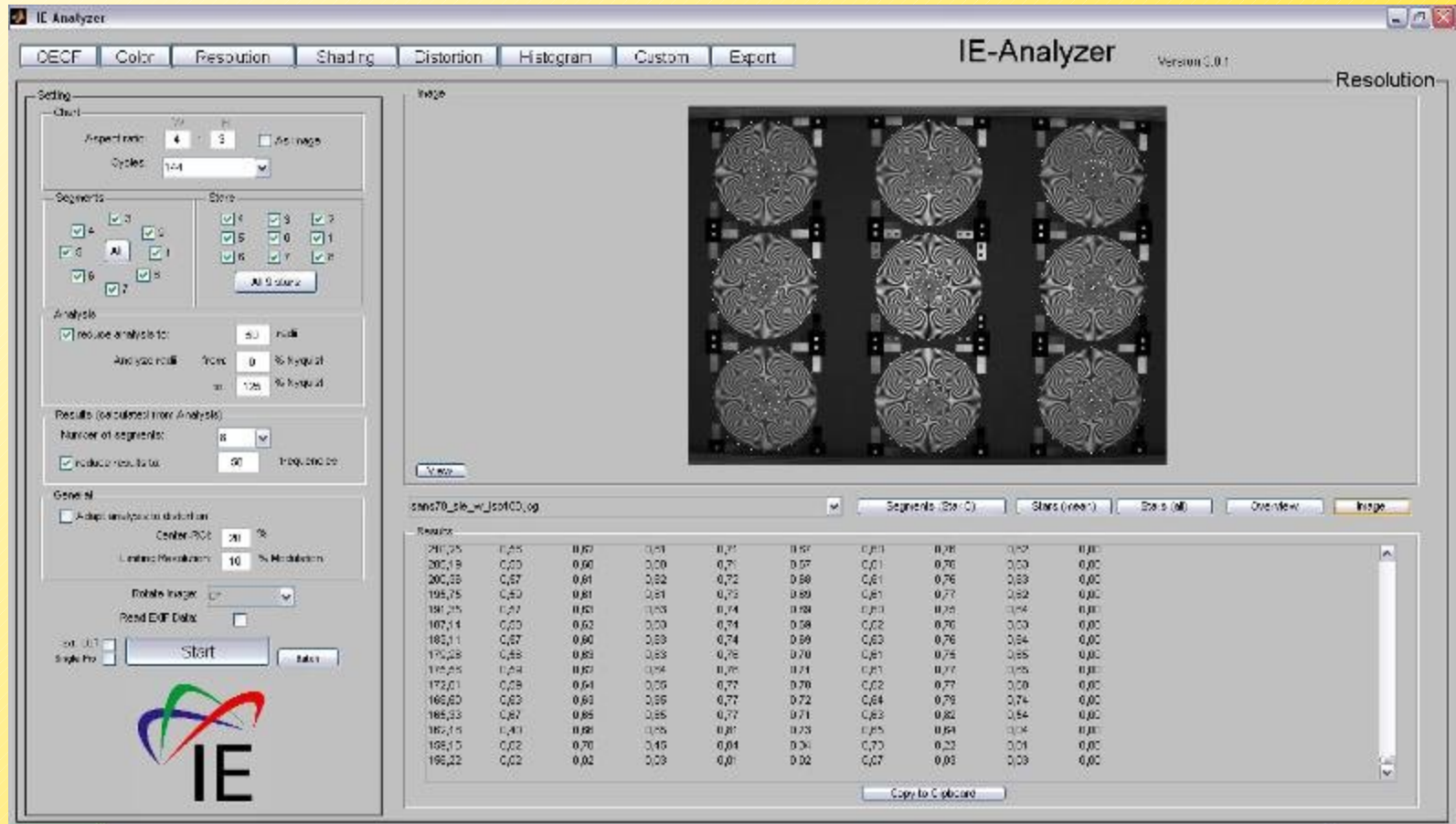
- Flash: uniformity and guide number



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

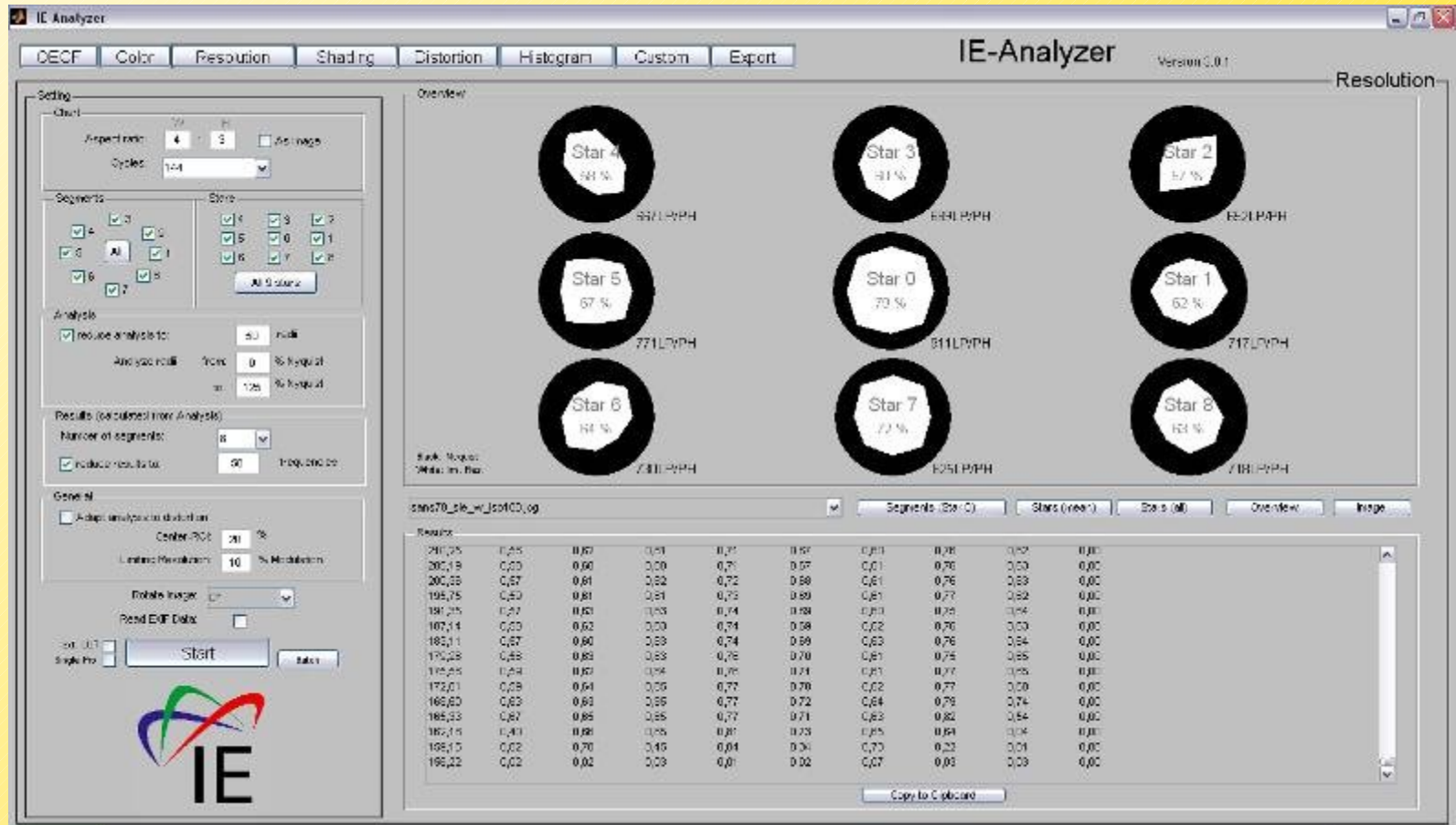


The screenshot shows the IE Analyzer software interface. The 'Resolution' tab is active, displaying a 3x3 grid of test patterns. Below the patterns is a table of results for 'std70_std_w_100102.log'. The table lists resolution values for various line numbers (191 to 196) across different segments (1-9). The values are generally high, indicating good resolution performance.

Line	1	2	3	4	5	6	7	8	9
191,25	0,25	0,07	0,01	0,21	0,07	0,01	0,26	0,07	0,01
192,19	0,20	0,00	0,00	0,21	0,07	0,01	0,26	0,07	0,01
193,09	0,07	0,01	0,02	0,22	0,08	0,01	0,26	0,07	0,01
194,75	0,40	0,01	0,01	0,23	0,09	0,01	0,27	0,08	0,01
195,25	0,27	0,01	0,03	0,24	0,09	0,01	0,28	0,08	0,01
197,14	0,20	0,02	0,00	0,24	0,08	0,02	0,26	0,07	0,01
198,11	0,07	0,00	0,03	0,24	0,09	0,02	0,26	0,08	0,01
199,28	0,48	0,03	0,03	0,26	0,10	0,01	0,28	0,08	0,01
199,28	0,24	0,07	0,04	0,26	0,11	0,01	0,27	0,08	0,01
199,01	0,09	0,04	0,05	0,27	0,10	0,02	0,27	0,09	0,01
199,00	0,03	0,03	0,05	0,27	0,12	0,04	0,28	0,10	0,01
199,33	0,07	0,05	0,05	0,27	0,11	0,03	0,28	0,09	0,01
199,15	0,01	0,00	0,05	0,28	0,13	0,05	0,29	0,10	0,01
199,10	0,02	0,00	0,05	0,28	0,14	0,04	0,29	0,11	0,01
199,22	0,02	0,02	0,09	0,28	0,12	0,07	0,29	0,10	0,01

Digital Camera Tests

- resolution measurement



The screenshot shows the IE Analyzer software interface. The 'Resolution' tab is active, displaying a grid of nine stars with their respective resolution values in L/PPH. The stars are arranged in a 3x3 grid:

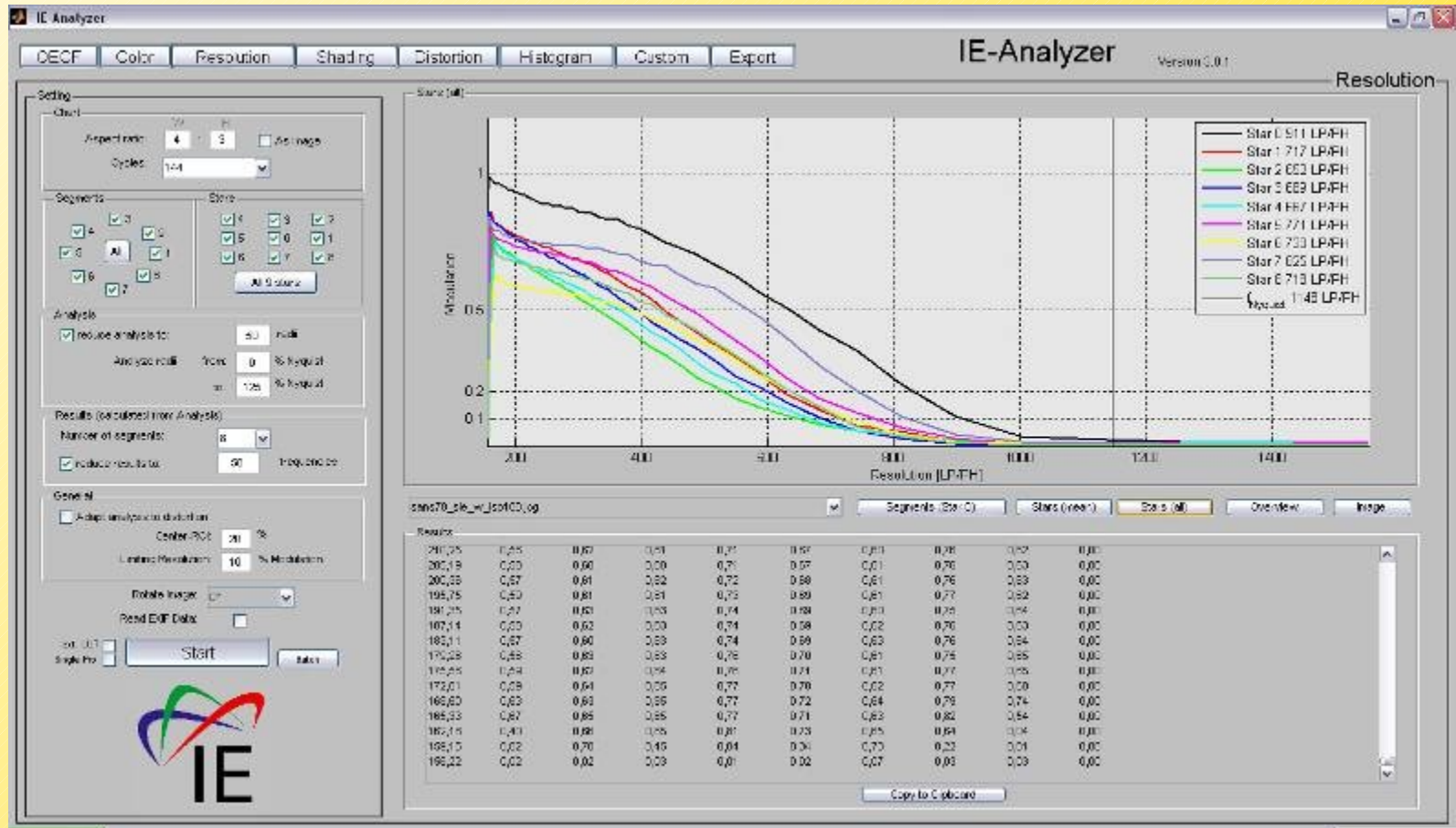
- Star 4: 64 L/PPH
- Star 3: 64 L/PPH
- Star 2: 62 L/PPH
- Star 5: 67 L/PPH
- Star 0: 70 L/PPH
- Star 1: 62 L/PPH
- Star 6: 78 L/PPH
- Star 7: 82 L/PPH
- Star 8: 78 L/PPH

Below the star grid is a table of results for the file 'star70_star_w_100102.jpg'. The table has 10 columns and 10 rows of data.

Results	0,05	0,07	0,09	0,11	0,13	0,15	0,18	0,20	0,22
200,19	0,25	0,00	0,00	0,21	0,07	0,01	0,76	0,03	0,00
200,28	0,57	0,61	0,02	0,72	0,58	0,61	0,76	0,53	0,00
195,75	0,50	0,81	0,81	0,75	0,89	0,81	0,77	0,82	0,00
181,25	0,77	0,83	0,73	0,74	0,78	0,83	0,78	0,78	0,00
187,14	0,20	0,62	0,00	0,74	0,58	0,62	0,70	0,00	0,00
185,11	0,57	0,60	0,53	0,74	0,59	0,63	0,76	0,54	0,00
170,28	0,68	0,83	0,83	0,76	0,70	0,81	0,75	0,85	0,00
175,25	0,54	0,67	0,74	0,76	0,71	0,81	0,77	0,75	0,00
172,01	0,28	0,64	0,05	0,77	0,70	0,62	0,77	0,00	0,00
165,80	0,63	0,83	0,55	0,77	0,72	0,84	0,78	0,74	0,00
165,33	0,87	0,85	0,85	0,77	0,71	0,83	0,82	0,84	0,00
167,15	0,49	0,88	0,75	0,81	0,73	0,85	0,84	0,74	0,00
198,10	0,02	0,70	0,45	0,64	0,34	0,70	0,23	0,01	0,00
195,22	0,02	0,02	0,03	0,01	0,02	0,07	0,03	0,03	0,00

Digital Camera Tests

- resolution measurement



Digital Camera Tests

- Measuring spectral sensitivities



Digital Camera Tests

- Measuring spectral sensitivities

