# Standardization of Offset Printing

Dipl.-Phys. J. Gemeinhardt

# Classification of Paper Types

- PT 1: 115 g/m$^2$ gloss-coated, wood-free
- PT 2: 115 g/m$^2$ matte-coated, wood-free
- PT 3: 70 g/m$^2$ LWC, web
- PT 4: 115 g/m$^2$ uncoated, white
- PT 5: 115 g/m$^2$ uncoated, slightly yellowish

# Colour of Paper and Gloss

- **Black backing (bb)**

| Paper type | L* | a* | b* | Gloss |
|---|---|---|---|---|
| **1** | 93 | 0 | -3 | 65% |
| **2** | 92 | 0 | -3 | 38% |
| **3** | 87 | -1 | 3 | 55% |
| **4** | 92 | 0 | -3 | 6% |
| **5** | 88 | 0 | 6 | 6% |
| **Tolerance** | ± 3 | ± 2 | ± 2 | ± 5% |

# Colour of Paper and Gloss

- **White backing (wb)**

| Paper type | L* | a* | b* | Gloss |
|---|---|---|---|---|
| **1** | 95 | 0 | -2 | 65% |
| **2** | 94 | 0 | -2 | 38% |
| **3** | 92 | 0 | 5 | 55% |
| **4** | 95 | 0 | -2 | 6% |
| **5** | 90 | 0 | 9 | 6% |
| **Tolerance** | ± 3 | ± 2 | ± 2 | ± 5% |

# Determination of Paper Types

- **Sheet-fed or web?**
- **Coated or uncoated?**
- **Colour of paper and gloss**
  - Colour measurement
  - (Gloss measurement)
- **Definite classification not always possible**
  - Slight deviations acceptable
  - Otherwise generation of new profiles!

# Backings for Colour Measurements

- **Practice**
  - Printed sheets
  - Desk of printing machine
  - Substrate backing
- **Black backing**
  - Matte black carton
  - Density without polarization: 1,50 ± 0,20
- **White backing**
  - Matte without optical brighteners
  - $92 < L^* < 96$
  - $C^* < 3$

# Black or White Backing?

- **Print**
  - Usually black backing
  - White backing for one-sided prints possible
  - Opaque papers (> 170 g/m$^2$) require white backing
- **Proof**
  - Must be measured on white backing
  - Simulates print run on white backing
- **Problems**
  - Show-through of back-side not considered
  - Print control according to proof on thin papers

# Aim Values for Black Backing

| Paper type | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* |
| Black | 16/0/0 | 16/0/0 | 20/0/0 | 31/1/1 | 31/1/2 |
| Cyan | 54/-36/-49 | 54/-36/-49 | 55/-36/-44 | 58/-25/-43 | 59/-27/-36 |
| Magenta | 46/72/-5 | 46/72/-5 | 46/70/-3 | 54/58/-2 | 52/57/2 |
| Yellow | 87/-6/90 | 87/-6/90 | 84/-5/88 | 86/-4/75 | 86/-3/77 |
| Red | 46/67/47 | 46/67/47 | 45/62/39 | 52/53/25 | 51/55/34 |
| Green | 49/-66/24 | 49/-66/24 | 47/-60/25 | 53/-42/13 | 49/-44/16 |
| Blue | 24/16/-45 | 24/16/-45 | 24/18/-41 | 37/8/-30 | 33/12/-29 |

Use of printing inks according to ISO 2846-1

# Aim Values for White Backing

| Paper type | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* |
| Black | 16/0/0 | 16/0/0 | 20/0/0 | 31/1/1 | 31/1/3 |
| Cyan | 55/-37/-50 | 55/-37/-50 | 58/-38/-44 | 60/-26/-44 | 60/-28/-36 |
| Magenta | 48/74/-3 | 48/74/-3 | 49/75/0 | 56/61/-1 | 54/60/4 |
| Yellow | 89/-5/93 | 89/-5/93 | 89/-4/94 | 89/-4/78 | 89/-3/81 |
| Red | 47/68/48 | 47/68/48 | 47/67/43 | 54/55/26 | 53/58/37 |
| Green | 50/-68/25 | 50/-68/25 | 50/-64/27 | 54/-44/14 | 50/-46/17 |
| Blue | 24/17/-46 | 24/17/-46 | 25/20/-44 | 38/8/-31 | 34/12/-29 |

Use of printing inks according to ISO 2846-1

# Difference Black – White

| Paper type | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* | L*/a*/b* |
| Black | -0,3/-0,3/-0,1 | -0,3/-0,3/-0,1 | -0,5/-0,3/-0,6 | -0,7/-0,1/-0,3 | -0,2/-0,1/-0,5 |
| Cyan | -1,0/0,9/0,9 | -1,0/0,9/0,9 | -2,6/2,3/0,5 | -1,5/0,7/0,9 | -1,2/1,4/-0,2 |
| Magenta | -1,8/-2,5/-1,6 | -1,8/-2,5/-1,6 | -3,4/-4,6/-2,9 | -1,6/-2,6/-1,1 | -1,5/-2,6/-1,6 |
| Yellow | -2,6/-0,7/-2,8 | -2,6/-0,7/-2,8 | -4,9/-1,4/-5,8 | .-2,8/-0,2/-3,0 | -2,7/-0,4/-3,8 |
| Red | -1,8/-2,8/-2,1 | -1,8/-2,8/-2,1 | -3,5/-5,2/-4,6 | -1,7/-2,7/-2,0 | -1,5/-2,8/-2,6 |
| Green | -1,0/1,7/-0,3 | -1,0/1,7/-0,3 | -2,6/2,6/-1,9 | -1,3/1,2/-0,8 | -1,0/1,6/-1,3 |
| Blue | -0,4/-0,3/0,7 | -0,4/-0,3/0,7 | -1,4/-0,8/0,8 | -0,8/-0,5/0,6 | -0,5/-0,2/0,3 |

# Tolerances

- **Deviation tolerance: Maximum difference between OK print and aim values**
- **Variation tolerance**
  - Maximum difference between production copies and OK print
  - Valid for at least 68 % of print run

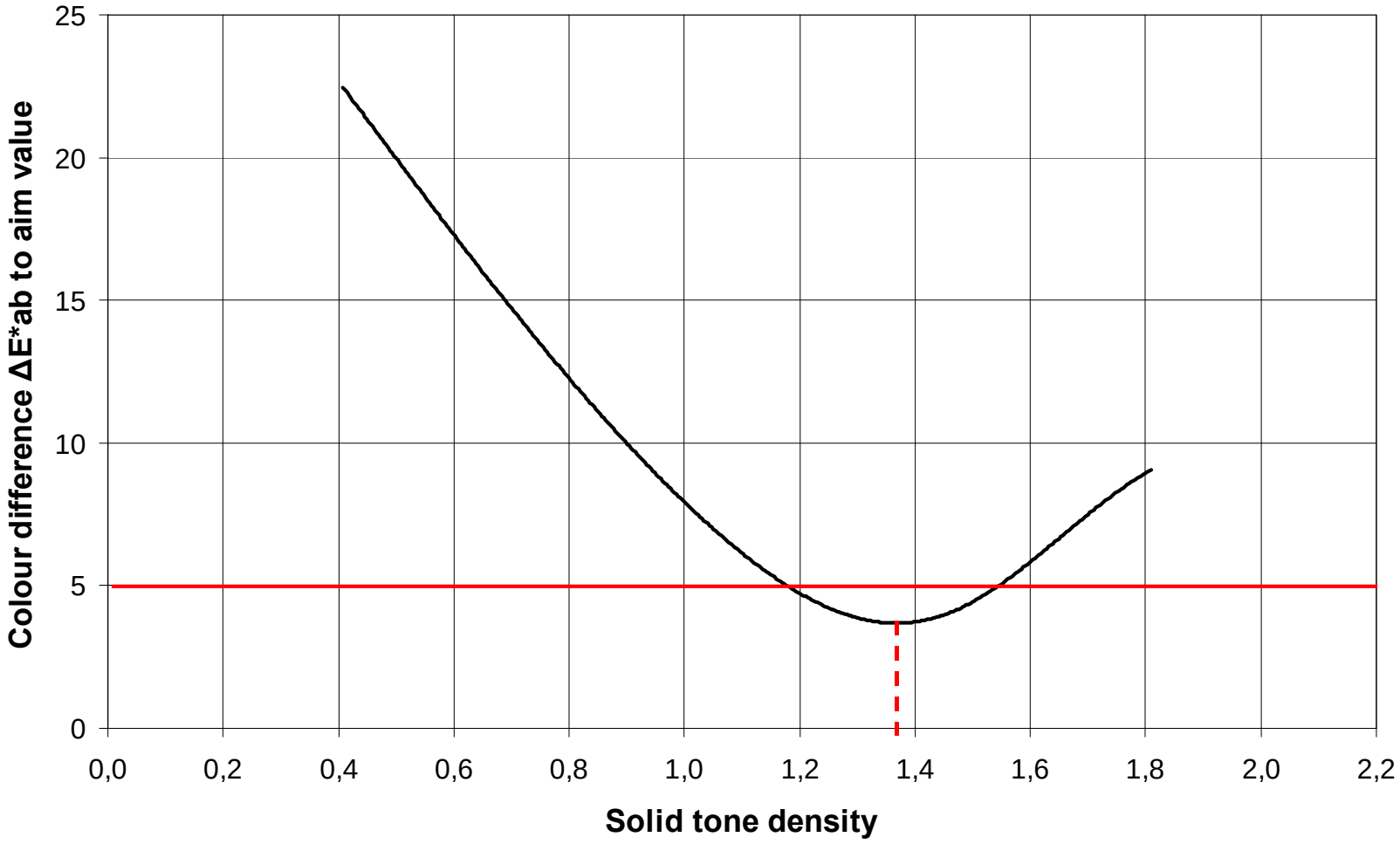
| | K | C | M | Y |
|---|---|---|---|---|
| **Deviation** | 5 | 5 | 5 | 5 |
| **Variation** | 4 (± 8% density) | 4 (± 8% density) | 4 (± 8% density) | 5 (± 8% density) |

- **No tolerances for secondaries**

# Adjusting the Printing Machine

- **With contract proof**
  - Colour difference: Proof – OK print
  - Colour measurement device
  - Visual
- **No contract proof**
  - Colour difference: Aim values – OK print
  - Colour measurement device
  - Colouring specimen
  - Individual aim densities

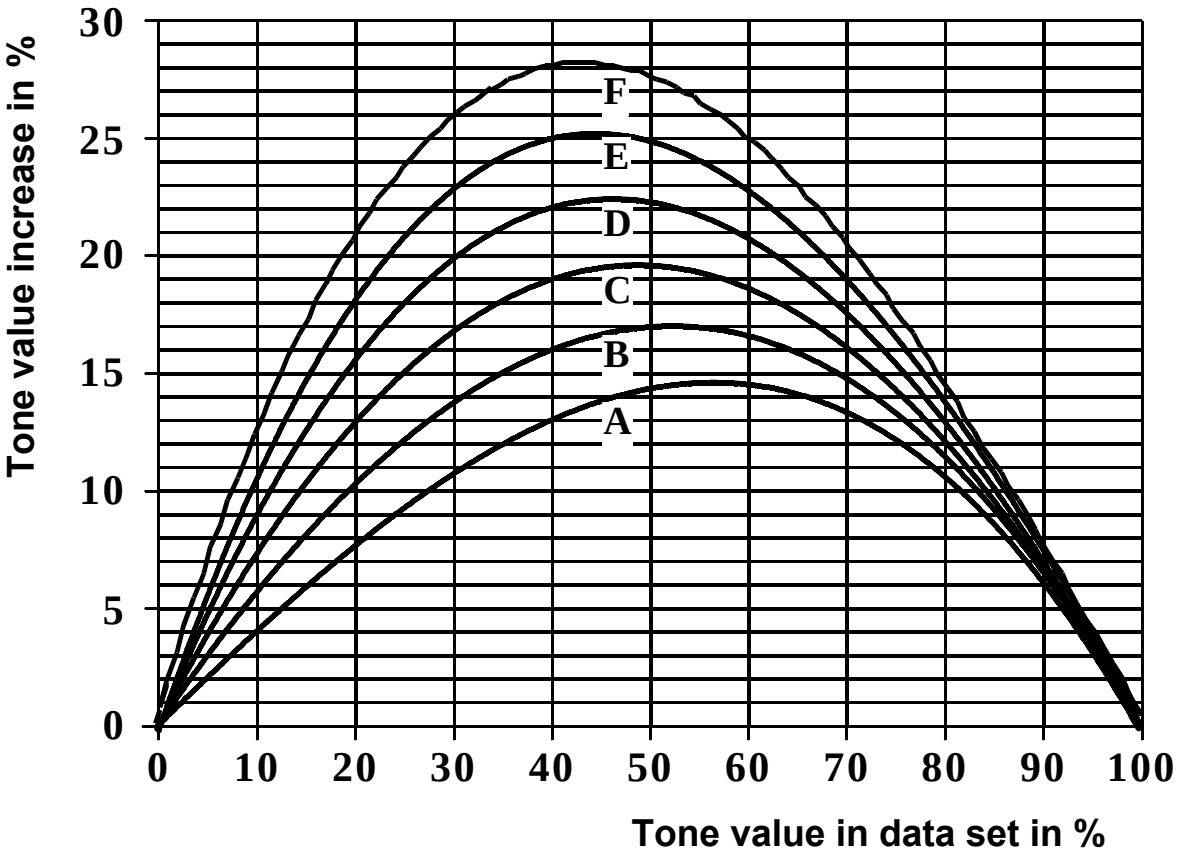
# Colouring sequence



# Controlling the Print Run

- **Colourimetric values**
  - Difficult to interpretate
  - Automatic measuring and controling devices make calculations
- **Density values can be judged easily**
- **Valuation of the print run**
  - Retained samples or reports of measuring devices
  - Random test: At least 20 – 30 specimens
  - OK print necessary
  - Separate evaluation of zones with ink taking

# Standardized Tone Value Increases



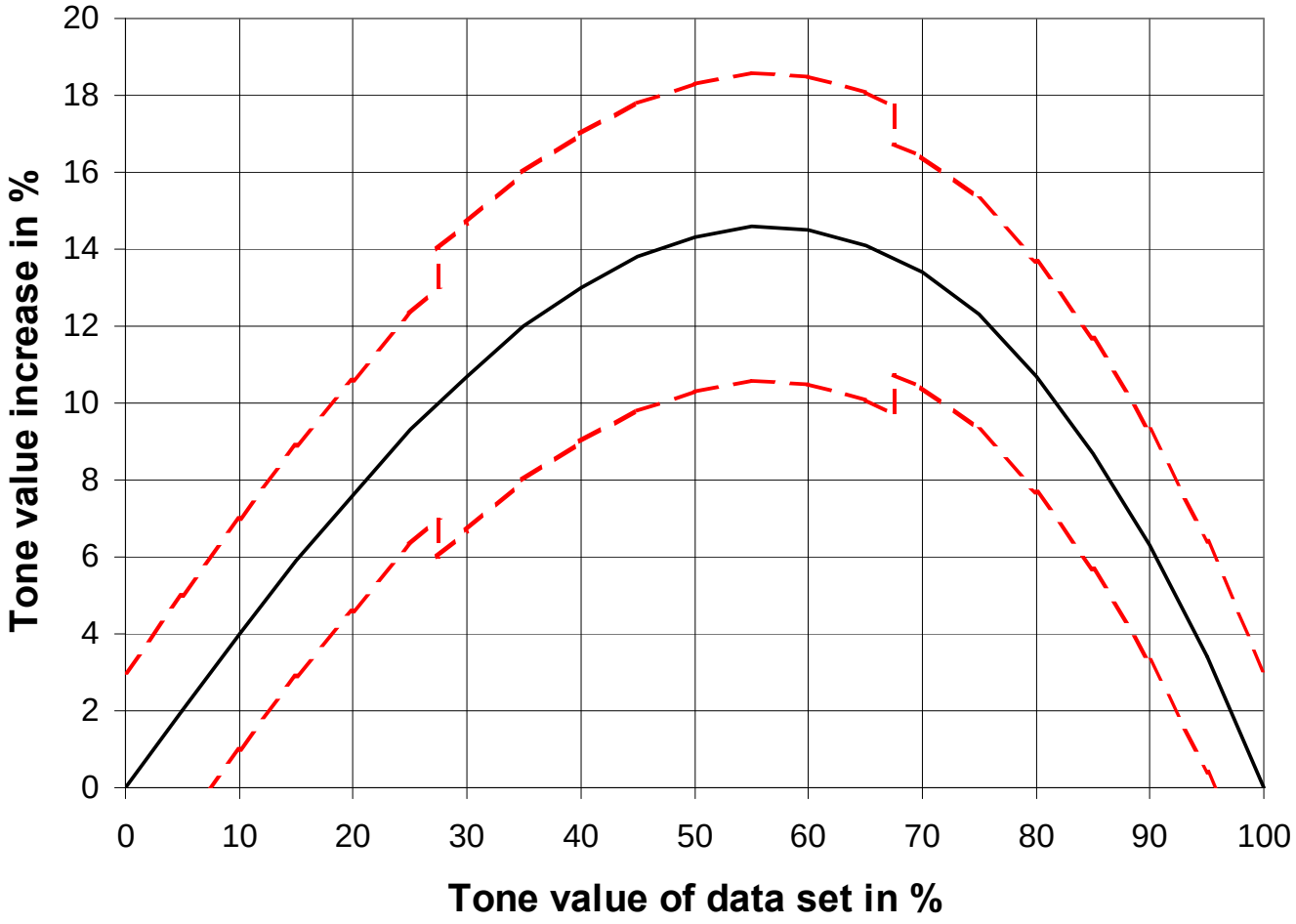

| Papier | CMY | K |
|---|---|---|
| 1/2 | A | B |
| 3 | B | C |
| 4/5 | C | D |

Complete tables in MediaStandard Print

# Tolerances for OK Print

- **Deviation tolerance**
  - Maximum difference between OK print and aim values
  - Highlight: ± 3 %
  - Midtone: ± 4 %
  - Shadow: ± 3%
- **Spread of tone value increases**
  - Maximum difference between the chromatic colours CMY: 5 %
  - Greater deviations cause colour cast

# Tolerance Range Visualized



# Tolerances for Print Run

- **Variation tolerance**
  - Maximum difference between 68 % of the production copies and OK print
  - Midtone: ± 4 %
  - Shadow: ± 3 %
- **Valuation of the print run**
  - Retained samples or reports of measuring devices
  - Random test: At least 20 – 30 specimens
  - OK print necessary
  - Separate evaluation of zones with ink taking

# Achieving the Desired Tonal Transfer

- **RIP can convert tone values in data sets with the aid of correction tables**
- **Adding or taking away of sinlge pixels**
- **Linearization of plates**

| Tone value data | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured on plate | 4,5 | 9,2 | 18,5 | 27,9 | 36,6 | 45,6 | 56,3 | 67,2 | 78,4 | 89,6 | 94,7 |

- **Prozess calibration**

| Tone value data | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured on print | 9,1 | 16,3 | 29,3 | 43,7 | 55,4 | 66,7 | 76,6 | 85,4 | 92,9 | 97,2 | 99,0 |
| Aim values print | 7,0 | 14,0 | 27,6 | 40,7 | 53,0 | 64,3 | 74,5 | 83,4 | 90,7 | 96,3 | 98,4 |

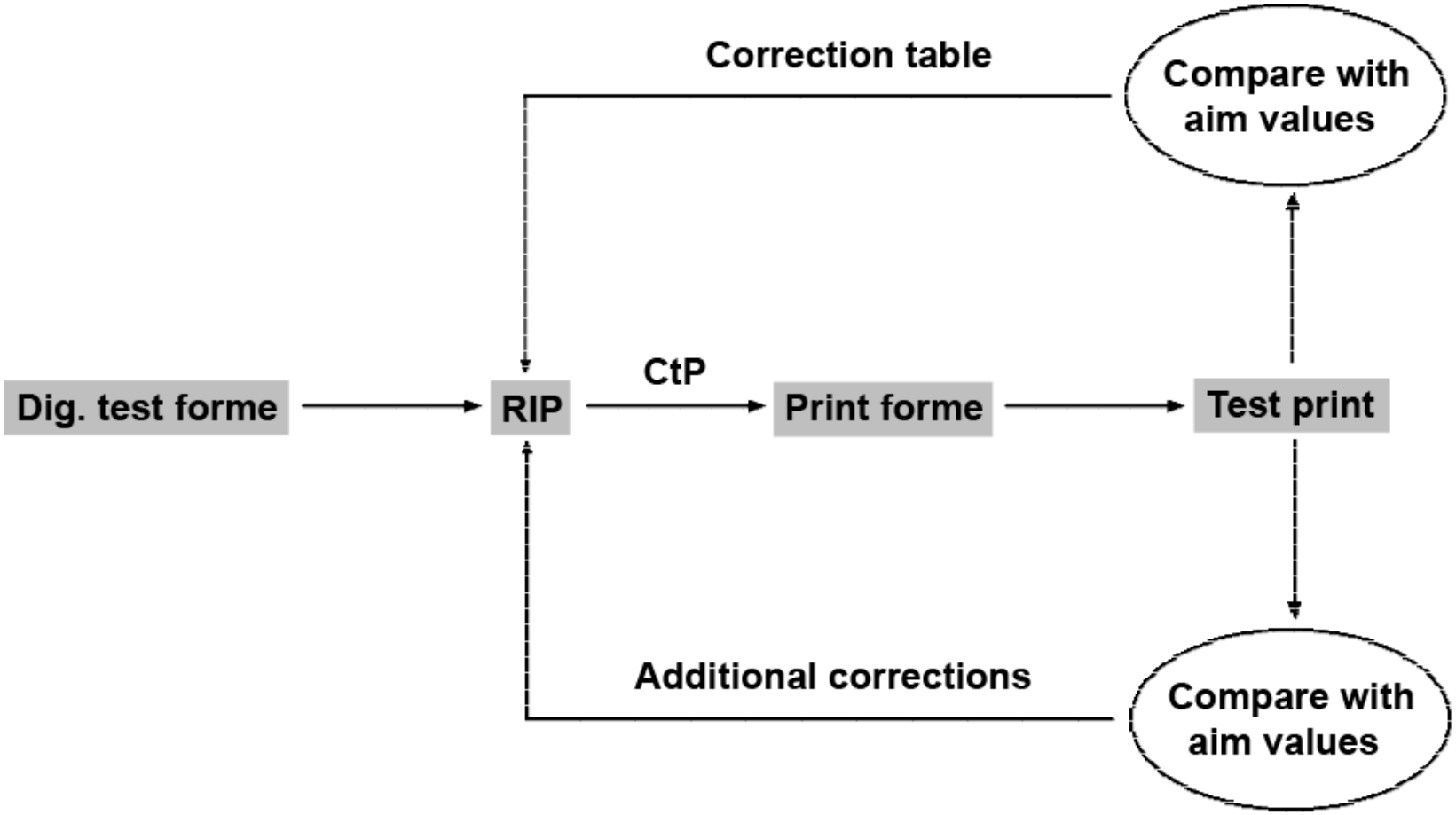
- **Usage of smoothing functions!**

# Aim Values on Print

| Tone value film/data | Tone value increase | | | | | |
|---|---|---|---|---|---|---|
| | A: 13 % | B: 16 % | C: 19 % | D: 22 % | E: 25 % | F: 28 % |
| 0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 5 | 2,0 | 3,0 | 3,9 | 4,8 | 5,7 | 6,7 |
| 10 | 4,0 | 5,6 | 7,3 | 8,9 | 10,6 | 12,3 |
| 15 | 5,9 | 8,1 | 10,3 | 12,5 | 14,7 | 17,0 |
| 20 | 7,6 | 10,2 | 12,8 | 15,5 | 18,1 | 20,8 |
| 25 | 9,3 | 12,1 | 15,0 | 17,9 | 20,8 | 23,8 |
| 30 | 10,7 | 13,7 | 16,7 | 19,8 | 22,8 | 25,9 |
| 35 | 12,0 | 15,0 | 18,1 | 21,1 | 24,2 | 27,3 |
| 40 | 13,0 | 16,0 | 19,0 | 22,0 | 25,0 | 28,0 |
| 45 | 13,8 | 16,7 | 19,5 | 22,4 | 25,2 | 28,0 |
| 50 | 14,3 | 17,0 | 19,6 | 22,3 | 24,9 | 27,5 |
| 55 | 14,6 | 17,0 | 19,4 | 21,7 | 24,1 | 26,4 |
| 60 | 14,5 | 16,6 | 18,7 | 20,8 | 22,8 | 24,8 |
| 65 | 14,1 | 15,9 | 17,7 | 19,4 | 21,1 | 22,7 |
| 70 | 13,4 | 14,9 | 16,3 | 17,6 | 19,0 | 20,3 |
| 75 | 12,3 | 13,4 | 14,5 | 15,5 | 16,5 | 17,5 |
| 80 | 10,7 | 11,5 | 12,3 | 13,0 | 13,7 | 14,4 |
| 85 | 8,7 | 9,3 | 9,8 | 10,2 | 10,7 | 11,0 |
| 90 | 6,3 | 6,6 | 6,9 | 7,1 | 7,3 | 7,5 |
| 95 | 3,4 | 3,5 | 3,6 | 3,7 | 3,8 | 3,8 |
| 100 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| PT 1 and 2 | ☐ CMY | ☐ K | ■ CMY | ■ K | | |
| PT 3 | | ☐ CMY | ☐ K | ■ CMY | ■ K | |
| PT 4 and 5 | | | ☐ CMY | ☐ K | ■ CMY | ■ K |

MediaStandard Print

# Test Print for Process Calibration



# Test Formes

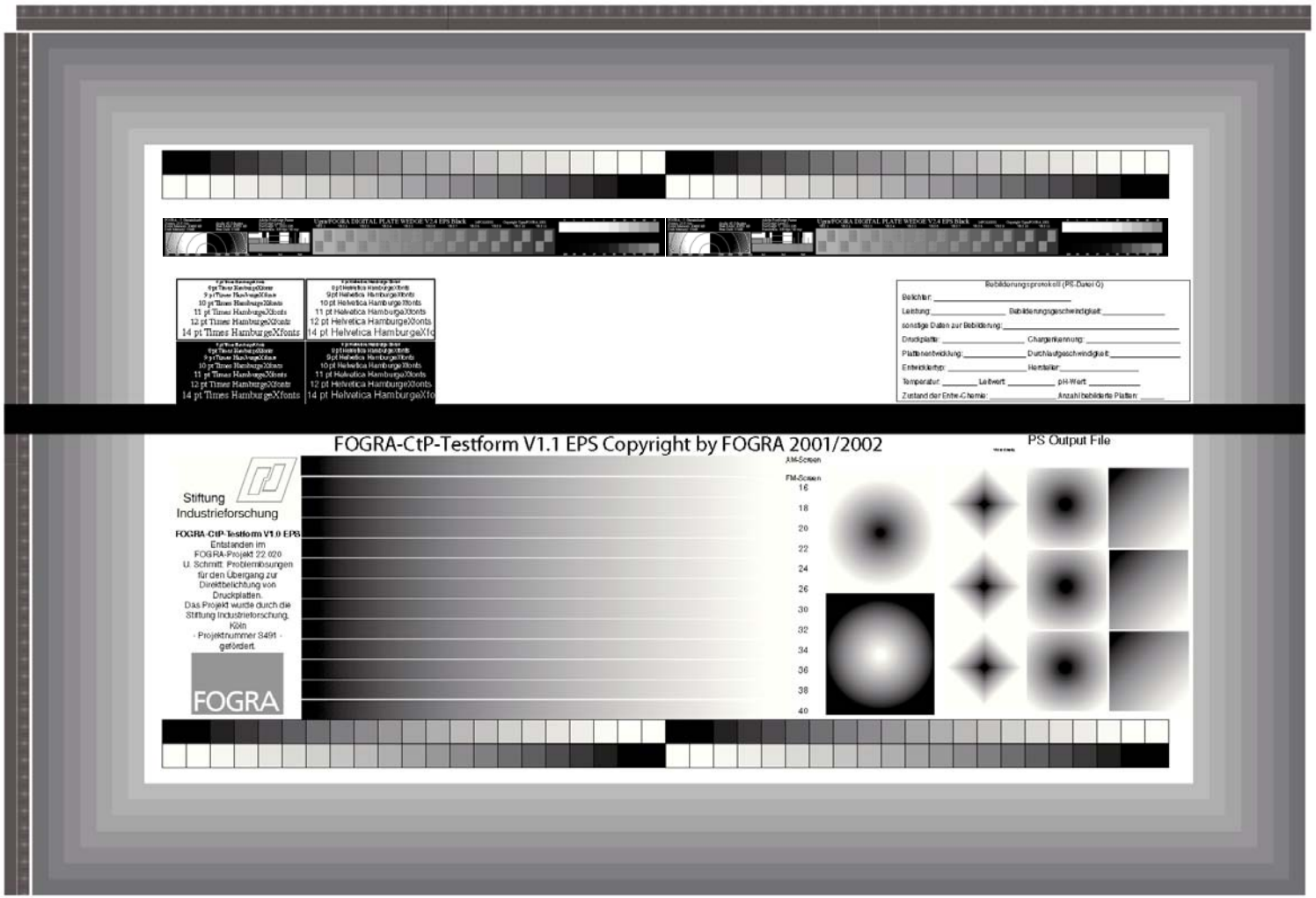
# Tonal Corrections in Practice

- **Optimal/typical adjustment of printing machine**
  - Temperature
  - Solid tone density
  - Uniform tone value reproduction across format
  - Periodical repetition
- **Formation of suitable machine groups**
  - Comparable characteristic curves of printing
  - 1 correction table for each group
  - As few correction tables as possible

# Periodical control

- **When?**
  - Every day / before start of production
  - After chemistry change
  - On new plate delivery
- **Linear output of monochromatic test forme**
- **Evaluation**
  - Visual control
  - Comparison with reference plates
  - Tone value measurements
    - Linearization (approx. < 2 %)
    - Uniformity across format (approx. < 2 %)

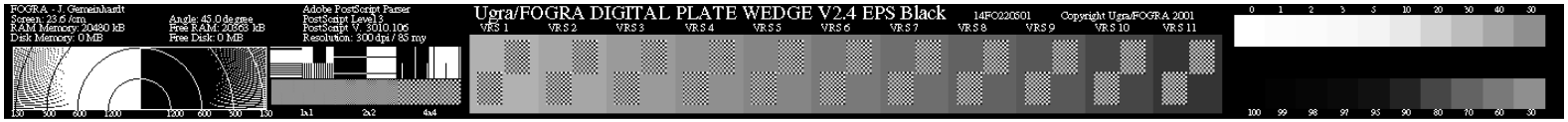
# Fogra CtP Test Forme



# Regular control

- **On every plate**
  - CtP plate wedge
  - Non-printing areas
- **Visual control**
  - Comparison with reference wedges
  - Visual reference steps change with tone value correction curve
- **Tone value measurements**
  - Comparison with reference wedges
  - Tone values change with correction curve

# Ugra/Fogra Digital Plate Wedge




- **Resolution panel**
- **Geometrical diagnostics panel**
- **Checkered panels**
- **Visuel reference steps**
- **Tint patches**
  - Tone value measurements
  - Tone value reproduction limits

# Print Control Strip

- **Control of print run**
- **Mounting accross printing direction**
- **Necessary patches**
  - Tint patches 40 % (50 %) and 80 % (70 %)
  - Solid tones of primaries and secondaries
  - Doubling/slur patches
- **Print control strips of machine producers**
  - Definite attachment to ink zones
  - Automatic measure and control units

# Miscellaneous I

- **Standardized printing sequence**
  - Conformity of secondaries
  - Black – Cyan – Magenta – Yellow (KCMY)
- **Register deviation between separated colours**
  - Reduction of detail rendering
  - White spots → spreading in data set
  - Maximum register deviation: 83 µm (< 0,10 mm)
- **Tone value reproduction limits**
  - 3 % must be rendered consistently and uniformly
  - 97 % must be open (visibly distinguishable from solid tone)

# Miscellaneous II

- **Screen angle (dots with pricipal axis)**
  - Avoiding moiré
  - 60° between C, M and K
  - Yellow separated 15° from another colour
  - Dominant colour (magenta, black) 45° or 135°
  - Default of CtP device will usually do
- **Treatment of spot colours**
  - No aim values and tolerances
  - Individual agreements
- **No varnishing and cladding**