

*DOES THE USE OF BLACK INK STILL
COMPRISE THE "DARKEST" ISSUE OF
CMYK PRINTING ?*

Y. Kuznetsov, M. Ermoshina

North-West Institute of Printing of the
Saint- Petersburg State University of
Technology and Design

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- Overview of K-ink functions in CMYK printing

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- *The comparative analysis of chromatic gamma for three- and four color printing: from CMY to CMYK*

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- *Providing the new chromatic colors lacking in CMY gamut*

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- *Conclusions*

The beginning of K-ink use within the CMY triad stems from the times of photoengraving, camera prepress when control facilities of black according to certain rendering intent were rather restricted.

However, the heuristically found, scanty collection of K settings is practically used until now.

Black ink functions in CMYK printing

1. The CMY achromatic share (CMYmin) replacement

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5. *Print security providing based on the K reflectance in near IR band*

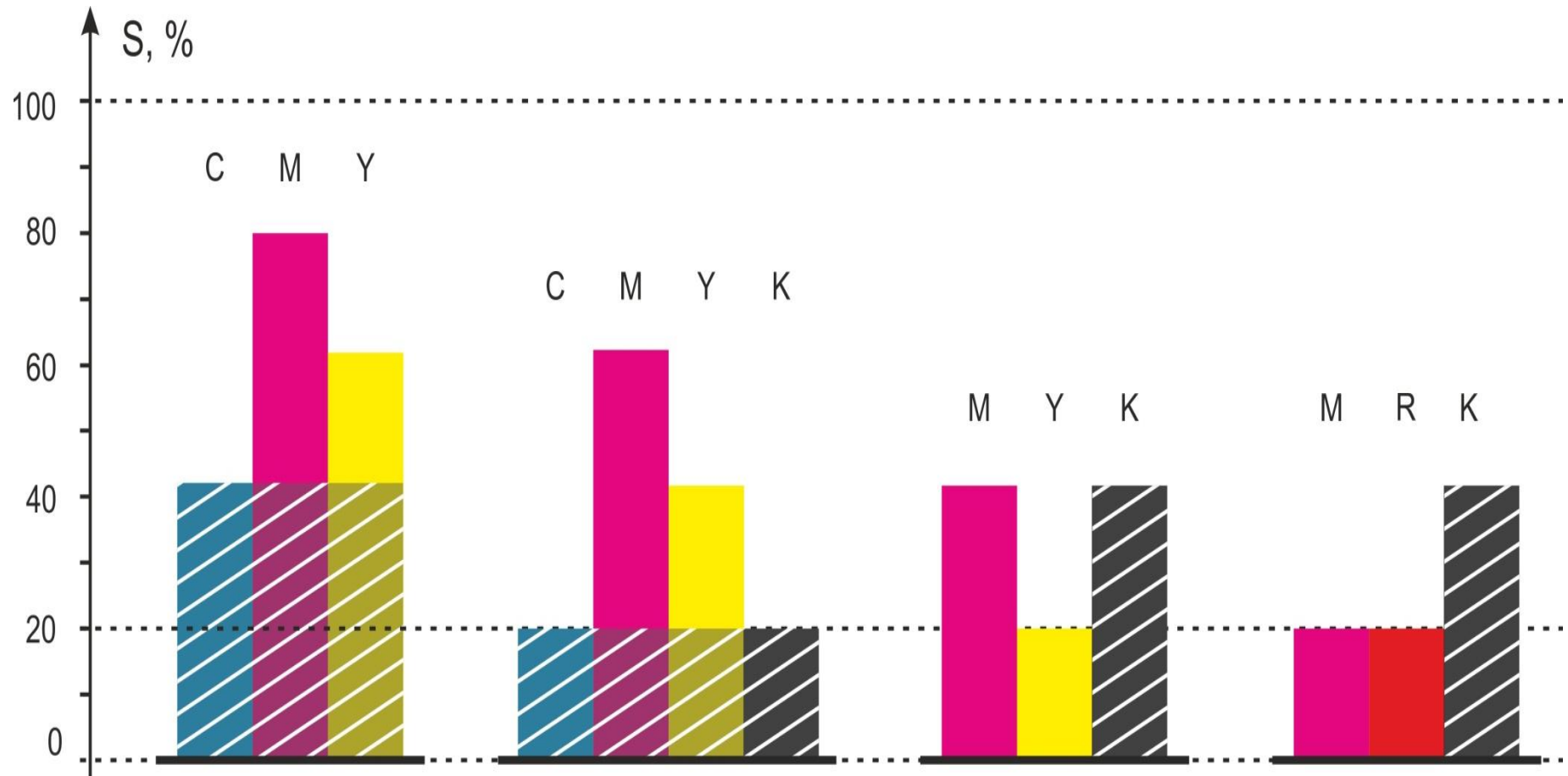
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4. Contour and fine detail reproduction
5. Print security providing based on the K reflectance in near IR band
6. *Producing the new chromatic colors lacking in CMY gamut*

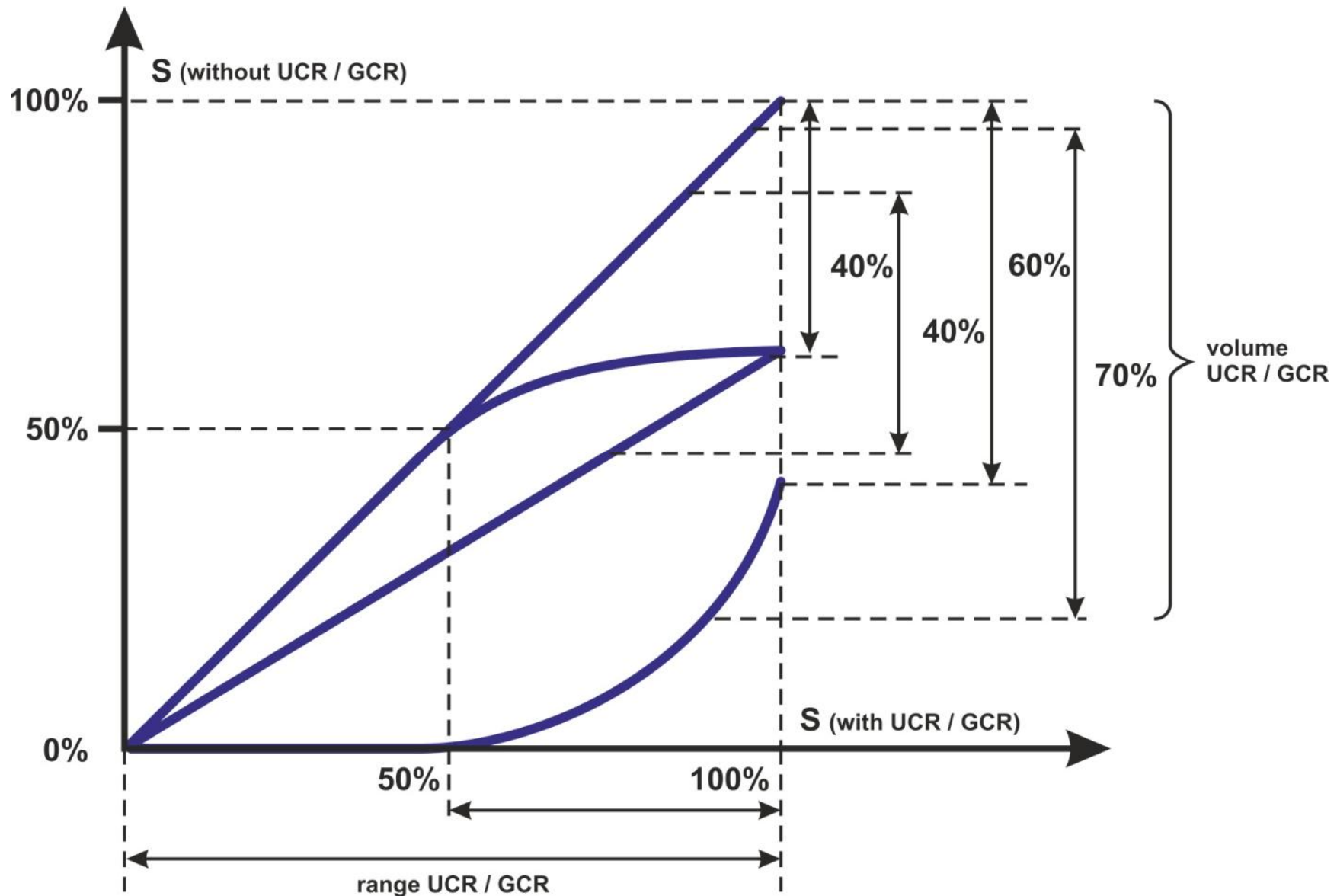
Are the so called UCR and GCR
“strategies” principally different ?

*The difference does exist but
between the two dimensions
of the same procedure!*

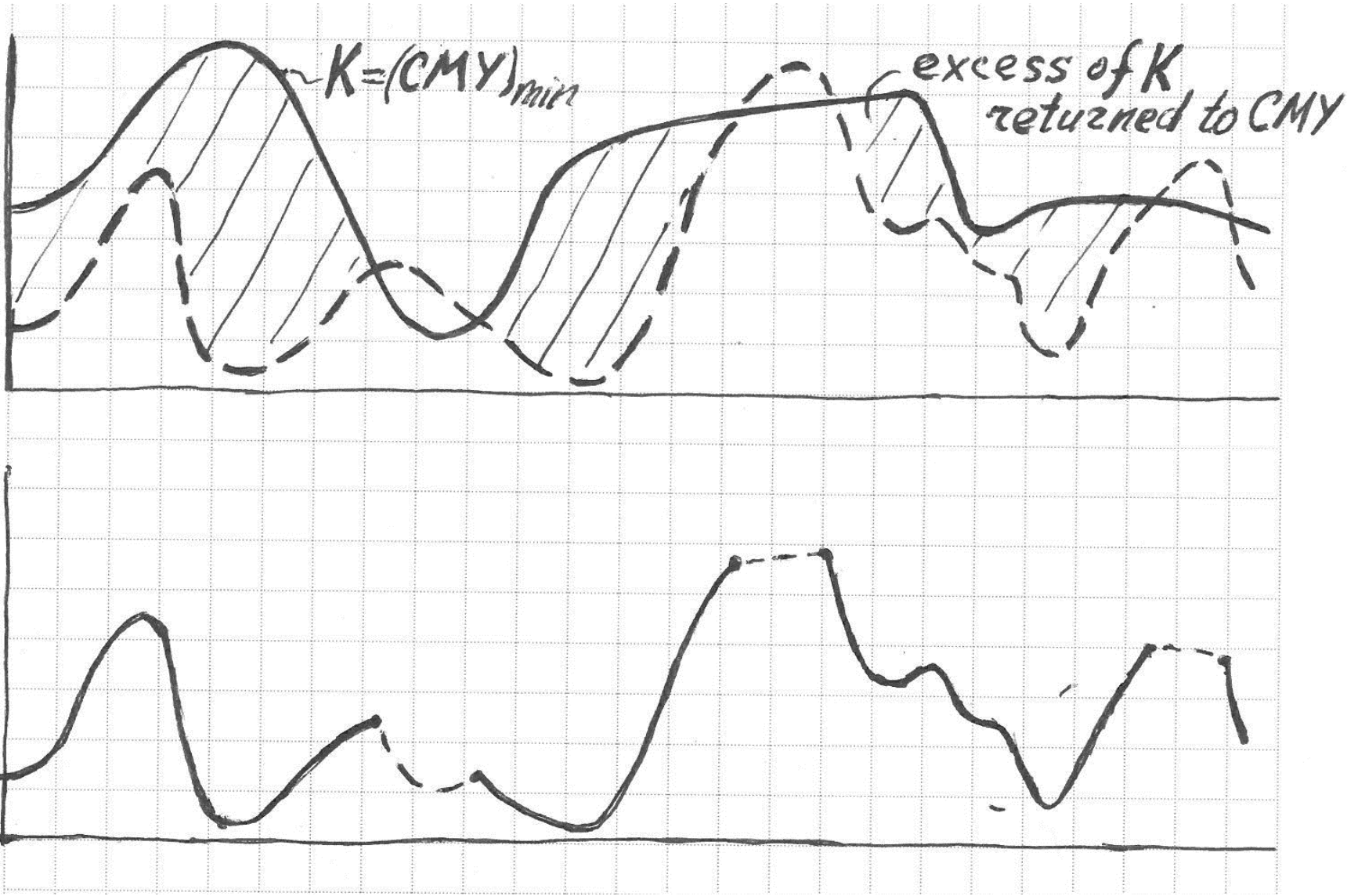
The first parameter of CMY achromatic component removal – *volume of its replacement by K*



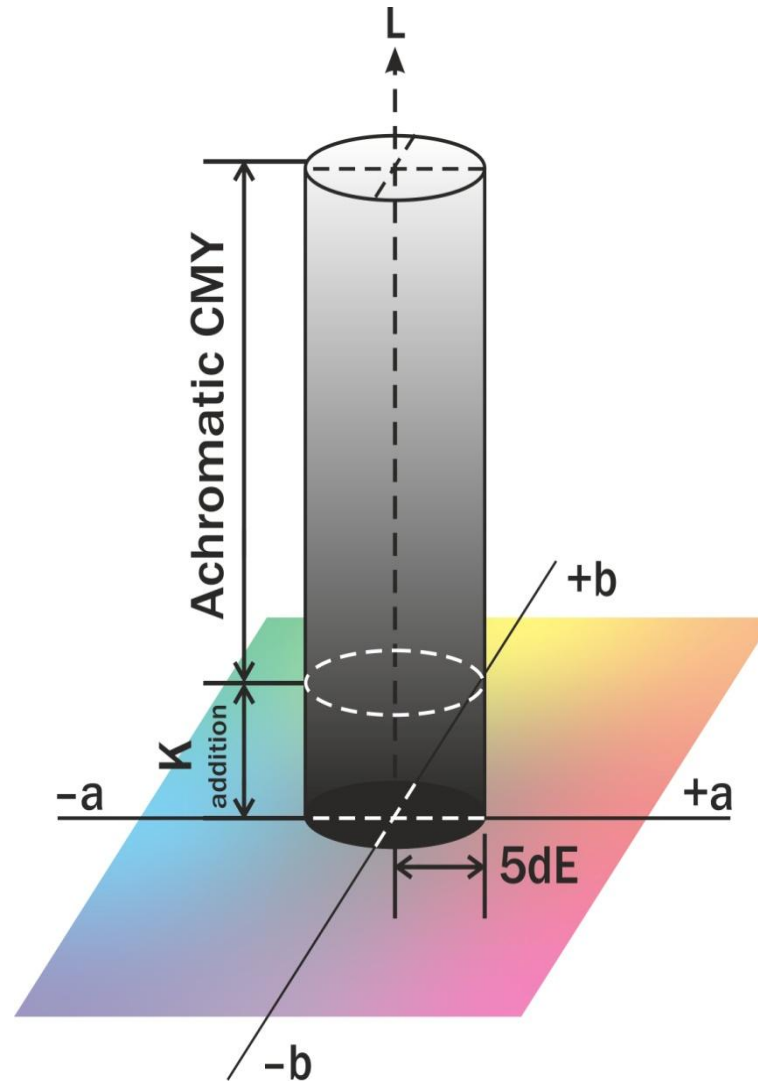
The second parameter – *distribution of (CMY)min replacement volume within the tone range*



Modulation of $K = (CMY)_{min}$ component by the concealed image appearing in near infrared light



Formal example of achromatic gamma expanding due to K addition



Equipment and substrate

Ink jet drop-on-demand printer Canon
PF8300S

RIP – FlexiSIGN Pro v8.6

HP Premium Plus Photo Paper Matt

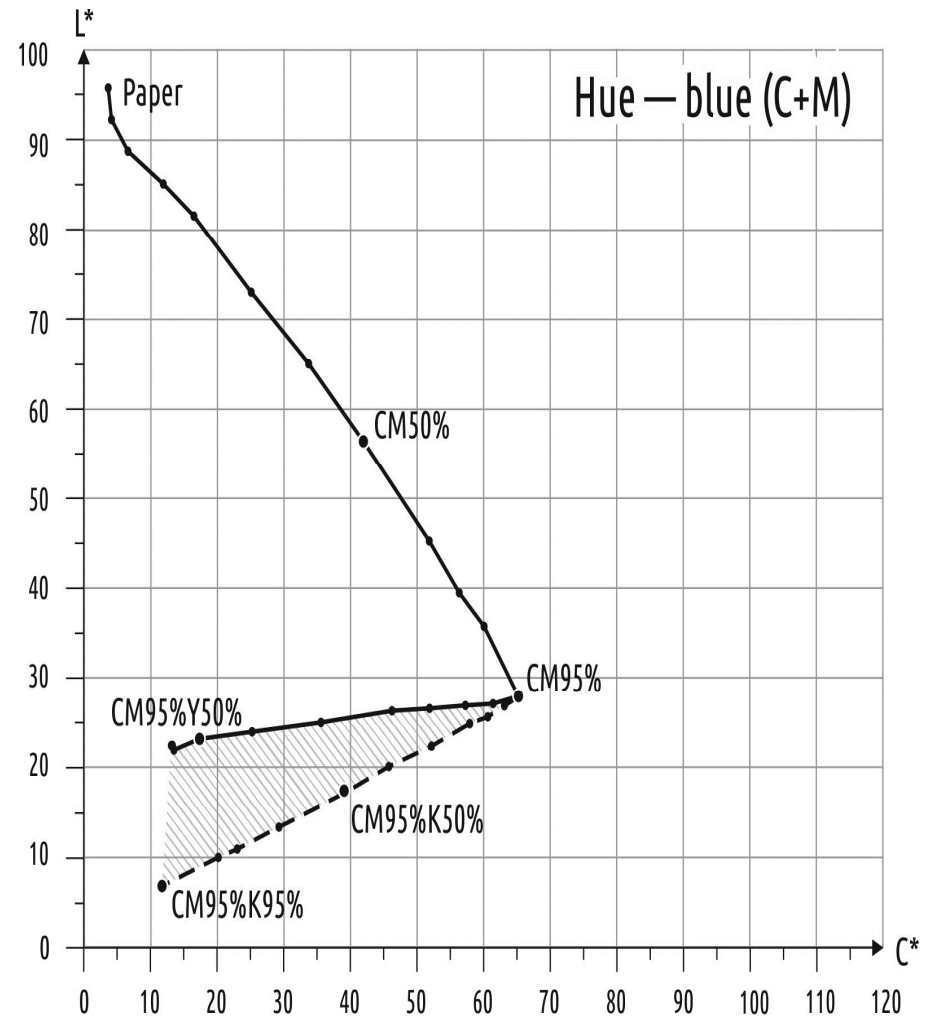
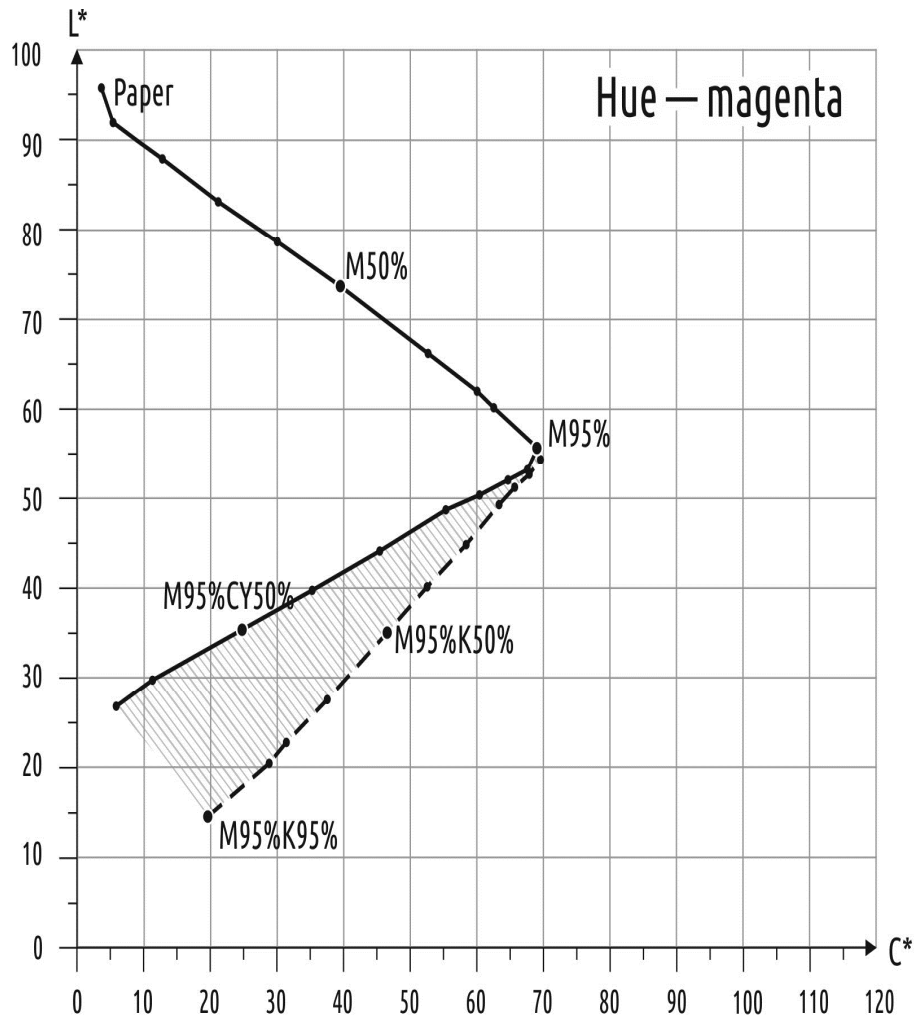
Instrument and metrics

- GretagMacbeth Eye-One Pro
- CIE Lab, CIE LCh hardcopy colorimetry (D50; two degrees; 0/45)

Test objects

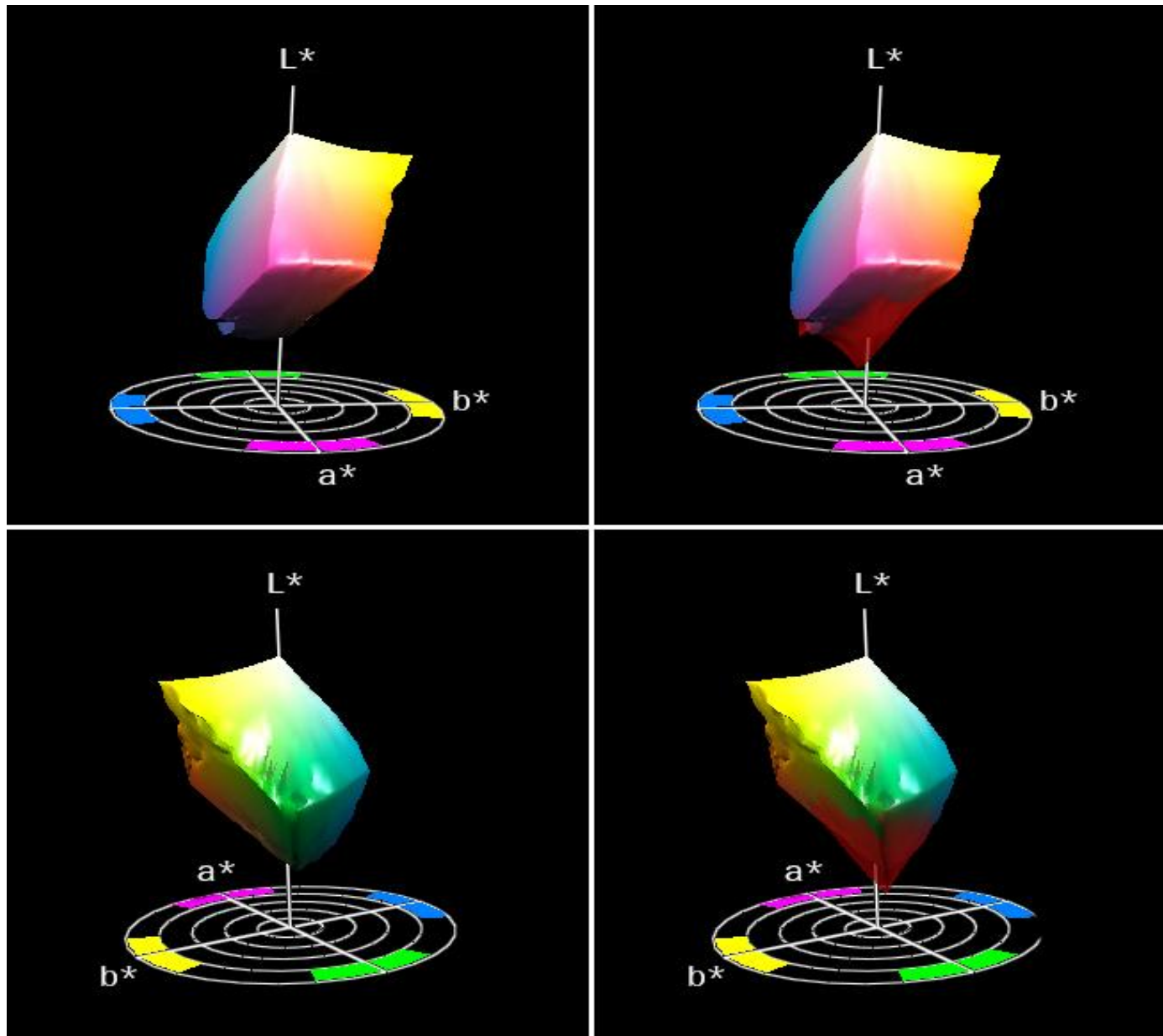
1. Atlas of chromatic colors minimization in offset printing VNII poligrafii
2. Indexed versions of C, M, Y step wedges and CM, MY, CY, CMY overprints with the stepwise K addition.
(Each one comprised of 11 patches for demonstration in meridian sections and on Ch plane of LCh space)
3. IT8-7.3 target for CMY and CMYK color gamut computation

M or C+M solids with added black ink are purer than their mixture with complementary ones (C+Y or Y)



CMY — — — — CMYK - - - -

CIE Lab views of CMY (left) and CMYK (right) gamut



Conclusions

- Addition of K to C, M, Y solids and to their overprints:
 - *provides darker colors with chroma up to 40 units greater of those produced by addition of an opposite CMY color;*
 - *expands color gamut over 10% mostly due to anew chromatic colors generating.*

The move from CMY to CMYK in 30ies of the last century can be considered as the first step to “Hi-Fi color” printing of today.

Thank you for attention