

Controlling Ink Color during the Press Run - Solid Ink or Gray Balance

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Abstract

A series of press runs under very controlled conditions was conducted using three different types of paper and varying two variables to ascertain the benefits of two control points. A hypothesis was established and was supported – control by solid ink density results in less waste and less color variation than control by gray balance.

Hypothesis

That a lithographic printing press is more quickly brought under control and that printing conditions are more precisely controlled by using solid ink density as opposed to gray balance as the control metric. Further that this condition is true for different types of paper.

The Plan

The basic plan was to run a number of tests to take a look at the various factors that affect the control of color when using solid ink density as the primary control point or when using gray balance as the primary control point.

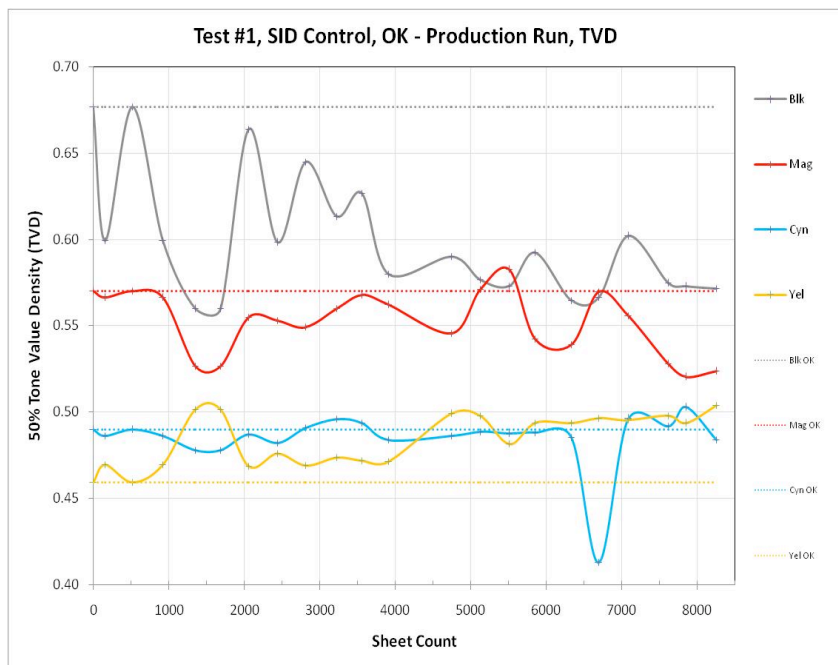
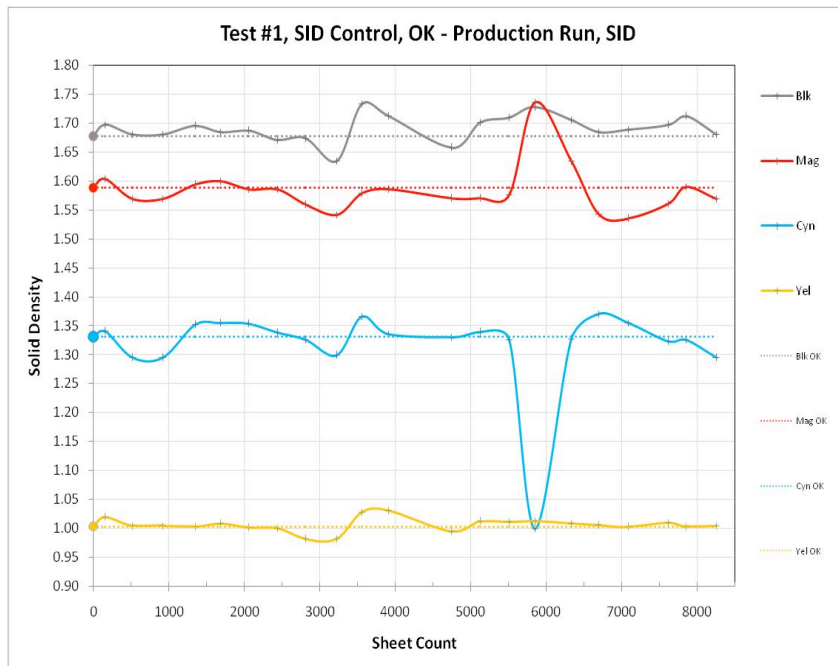
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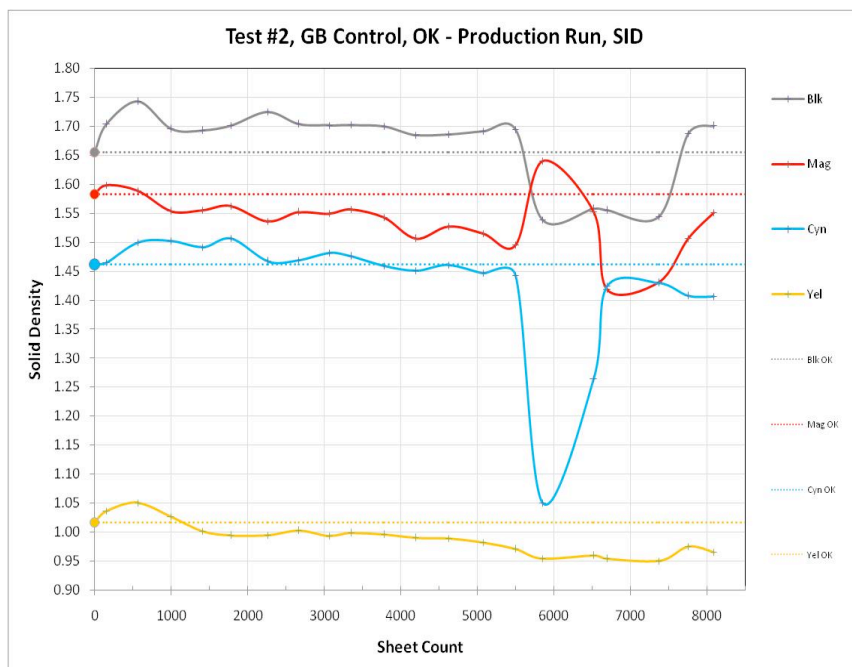
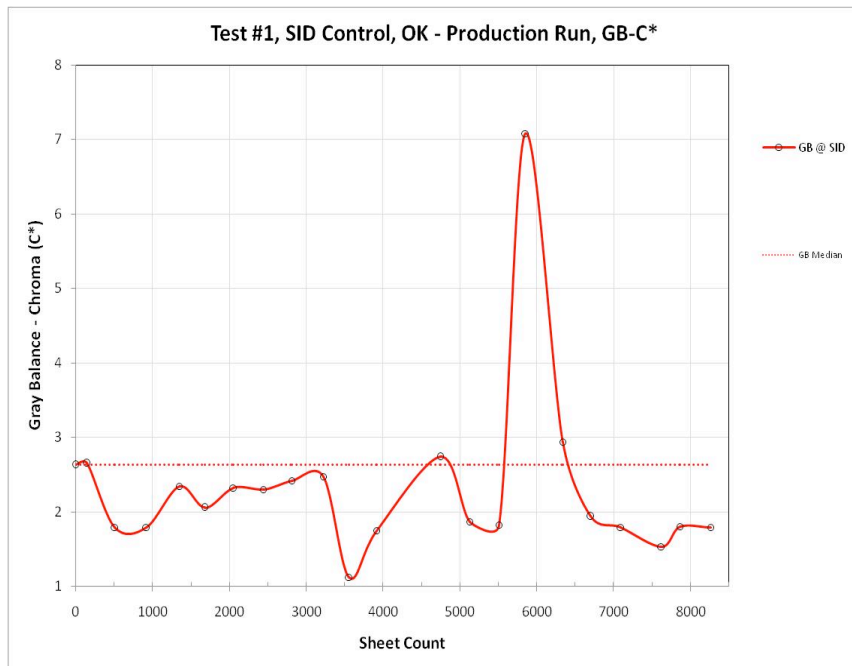
The test procedure was to use a new Heidelberg Speedmaster 105XL 6-color sheetfed press with color control, called Image-Control. The basic press was set to manufacturer's standards in terms of roller settings, packings, back cylinder pressure, etc. Fresh ink was used as well as new blankets and fresh fountain solution. A customized test form with color bars utilizing solids and gray patches in every ink zone was used for this test. The ink used for this test was Toyo HyPlus XM, which conforms to ISO 2846-1. The water-based coating is one of the more popular on the market, which is NiCoat low curl gloss. Profiles were obtained for the #1 coated stock in advance of the test itself. To evaluate the control mechanism, the press was set at top speed, which is 18,000 impressions per hour. In an effort to get as much data as possible, samples were pulled approximately every 400 sheets (about a minute interval), scanned, and data transferred. To insure that the press was at optimum print conditions, the press was warmed up by running blank stock before running the actual tests were done.

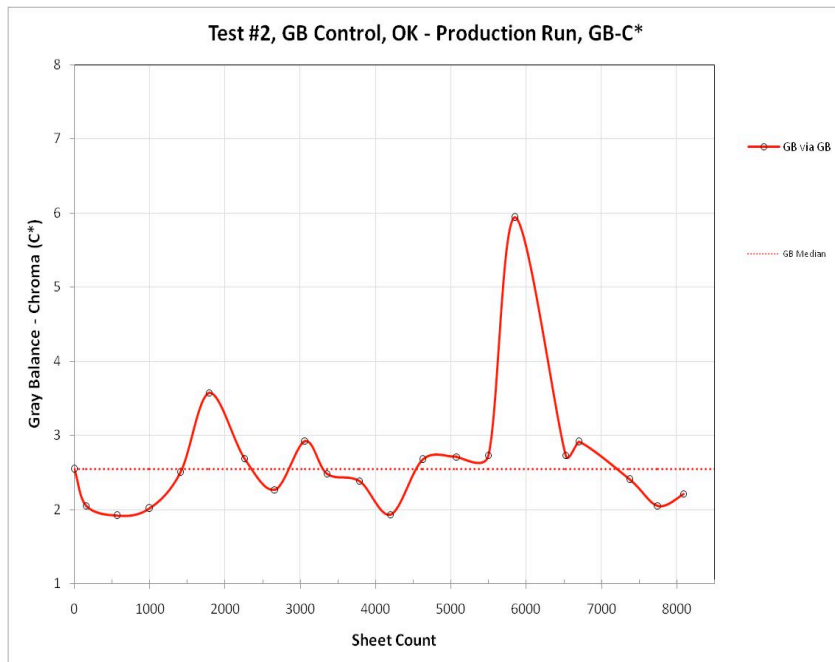
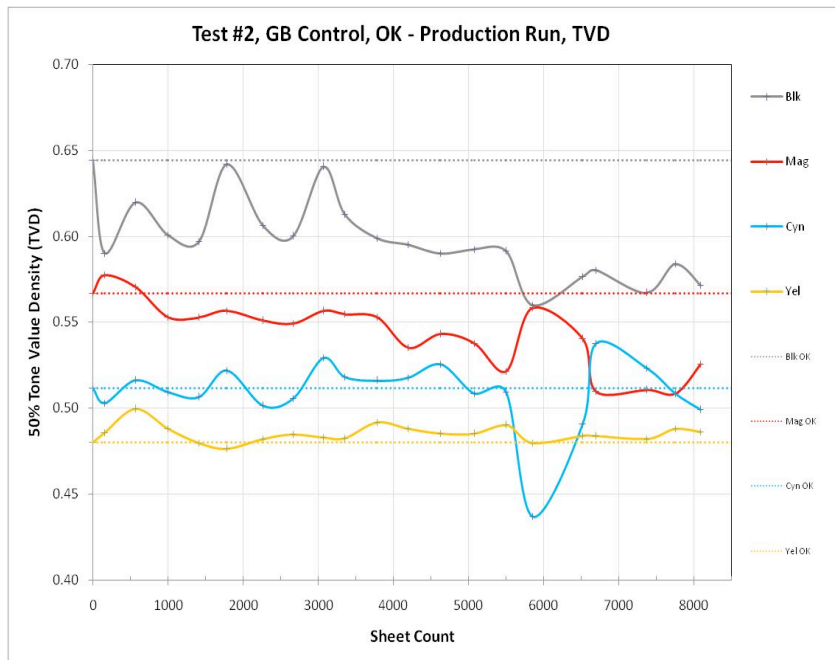
In regards to paper, three papers were chosen. First was an International Paper, 40# Accent Opaque White as an example of a quality uncoated light-weight stock. The second was SAPPI, 80# Flo Gloss with 10% post consumer waste, which is considered a quality #3 sheet. Finally was NewPage, 80# Signature True Gloss Text, which is considered a high quality #1 sheet.

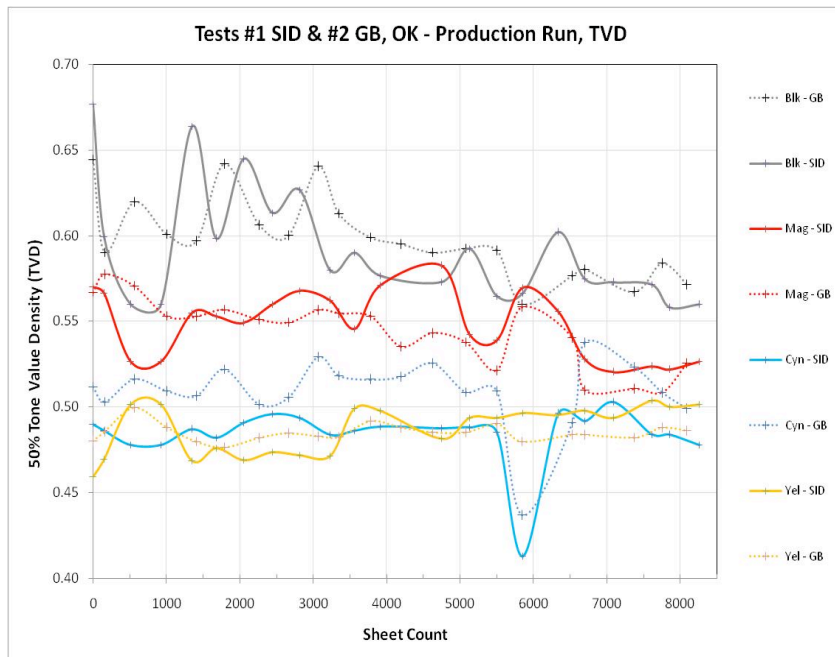
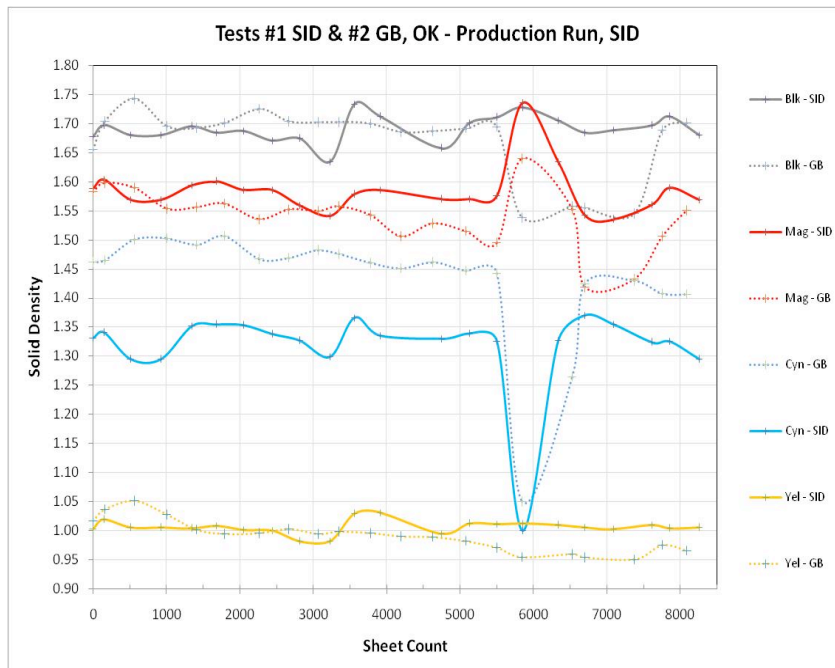
After consideration of many variables, it was decided that during the press run we would introduce an intentional change a increase in solid ink density in magenta by 0.20 points and a decrease in cyan pf 0.30 points. Then determine how each control point, namely density or gray balance, detected and then adjusted to the change. The change occurred at the approximate 5,500 sheet point. What this is doing is mimicking a press stop, which could be for a blanket wash, major trip off, blanket smash, etc.

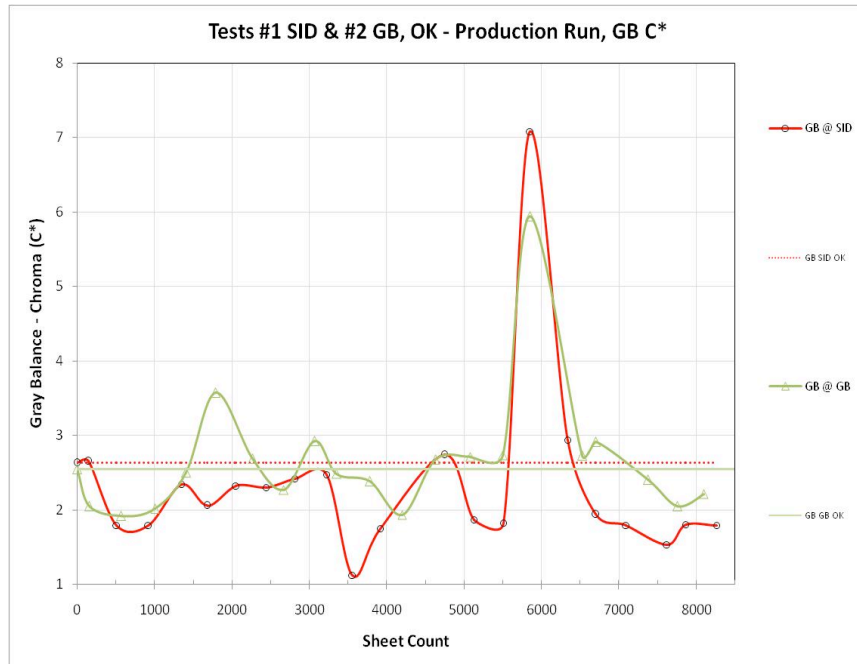
The following graphs show what happened during the production run when solid ink density was used as the control point, the effect of tone value density, how SID controlled gray GB-C*. The second series of tests used gray balance control, in measuring tone value density, control production run, Gray Balance via C* (GB-C*), and finally some comparisons of both methods in the next two or three charts.



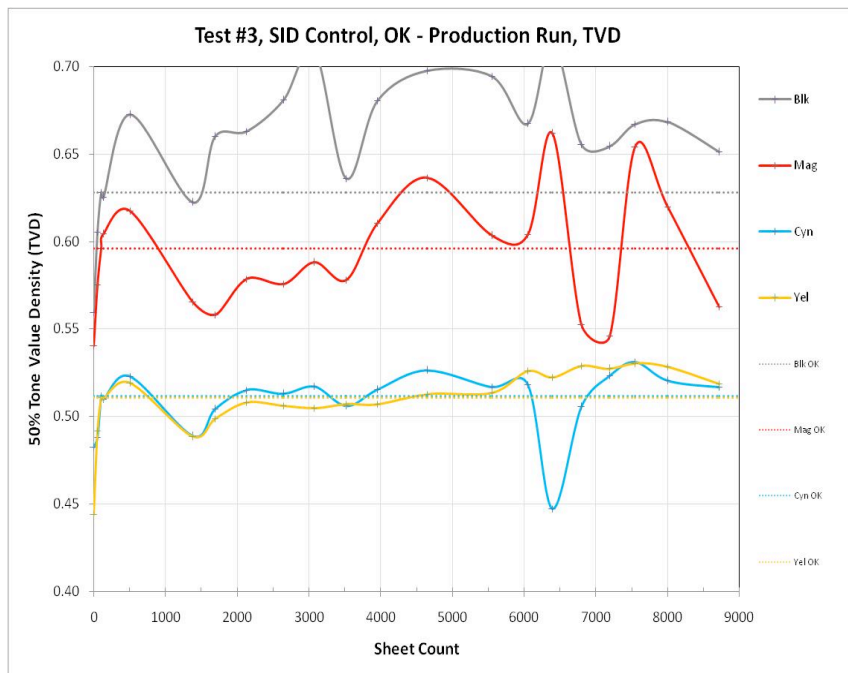


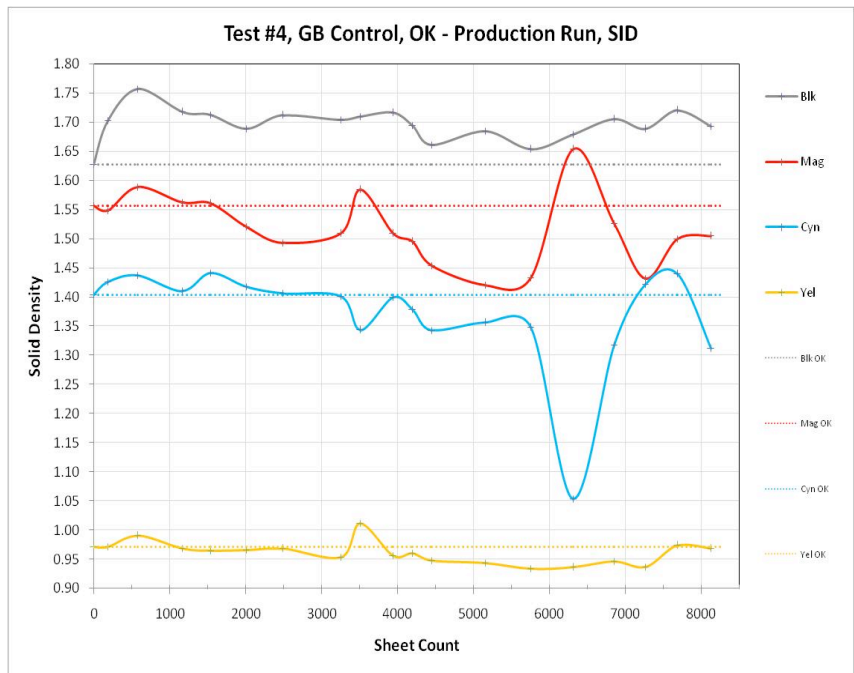
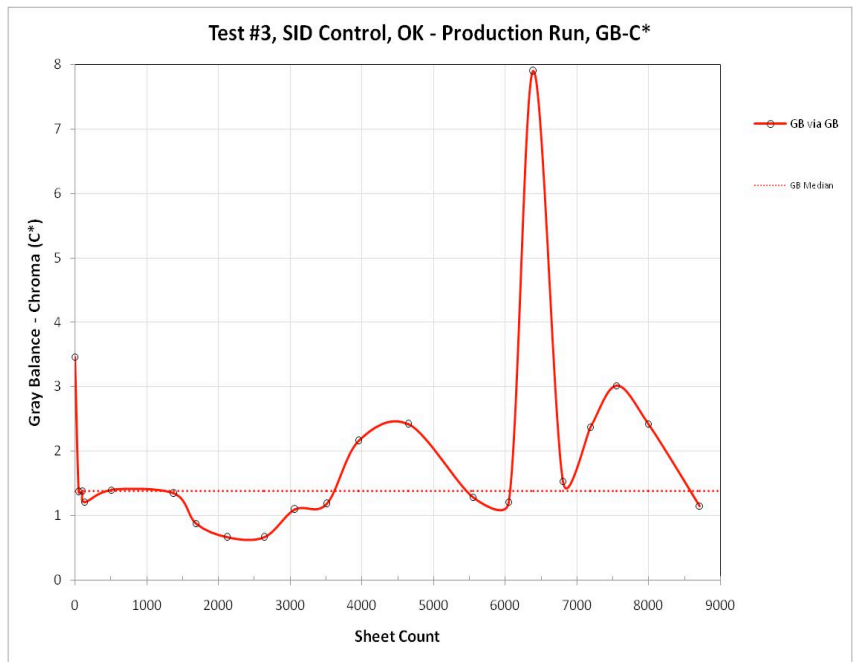


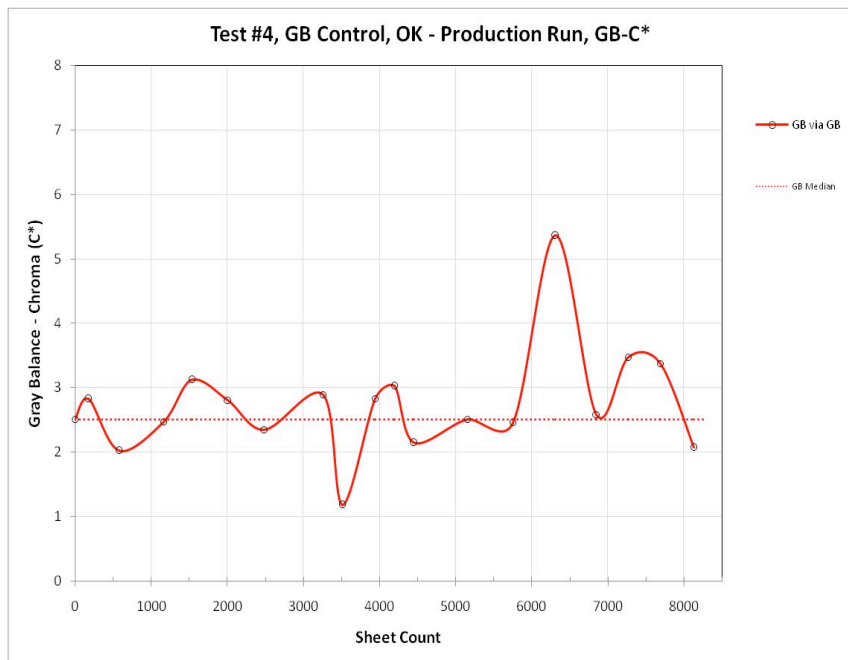
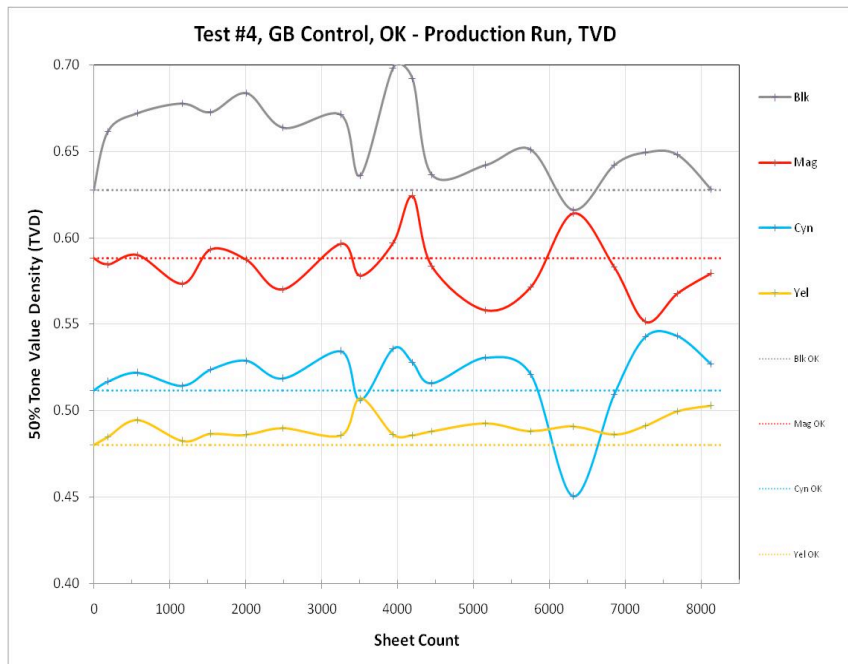


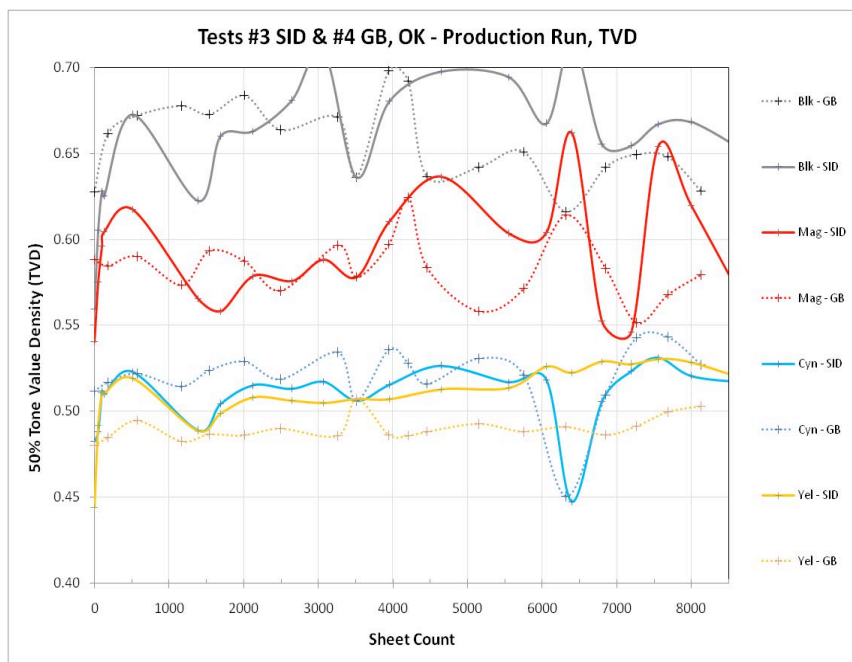
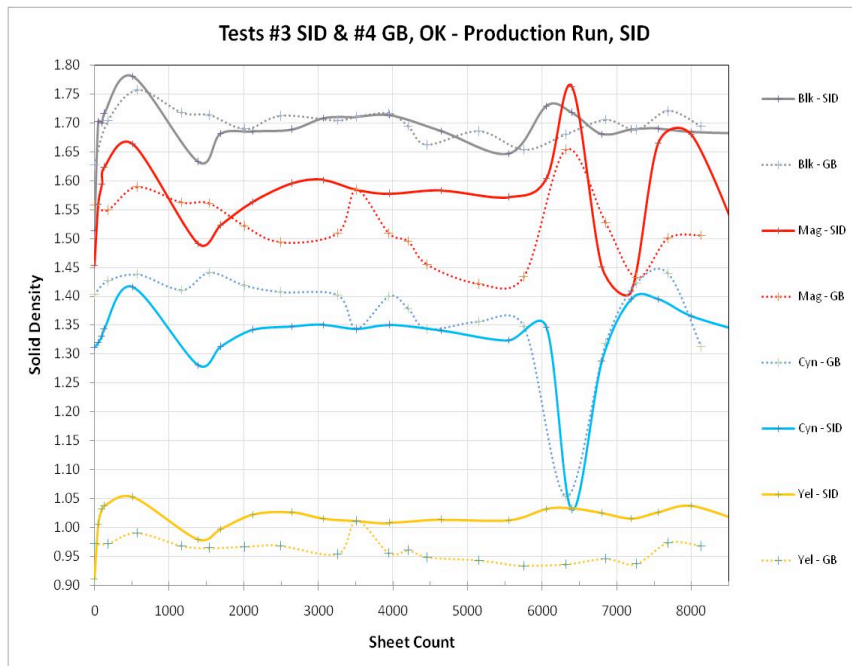


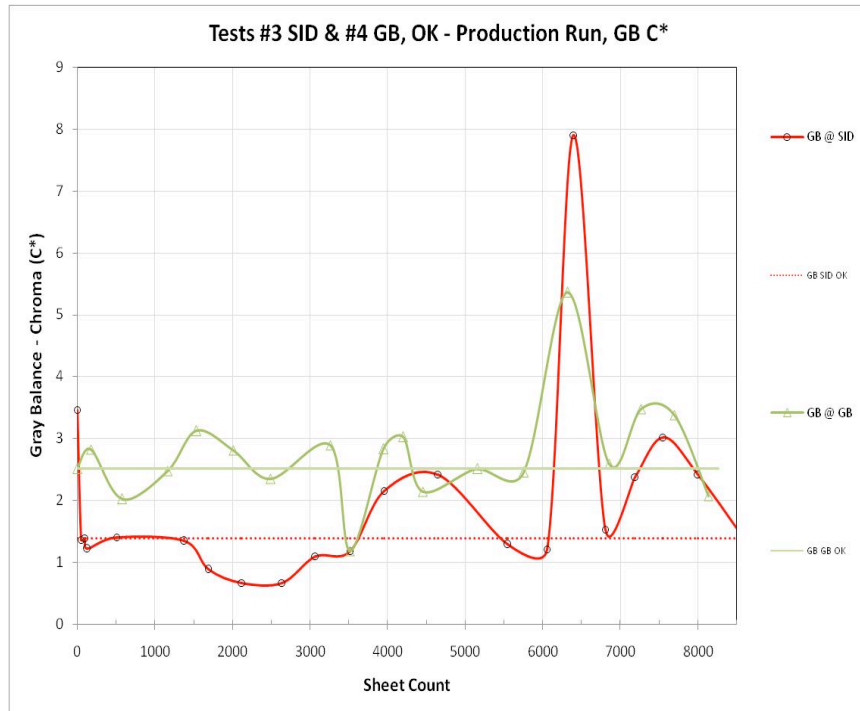
In regard to conclusions that we see from the above, as expected the solids were most sensitive to solid ink density changes. We achieved a basic control within 400 sheets, there was some slight over control, and chroma (C*) reflected solid ink density rather well. In regard to gray balance control the correction was slower, namely about 800 sheets and there were continued correction. In regard to the actual makeready itself, both methods were similar from the okay to the production run. Solid ink density obtained a faster correction when a variable was introduced. The above tests were all done with the use of a #1 coated stock. With a #3 coated stock the following charts were produced. These are represented by tests 3 and 4. Test 3 was solid ink density control and test 4 was gray balance control.











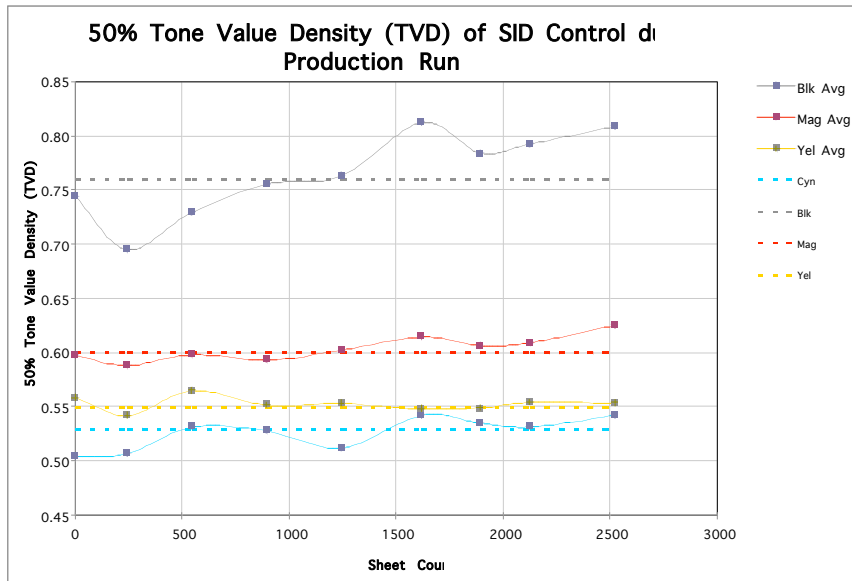
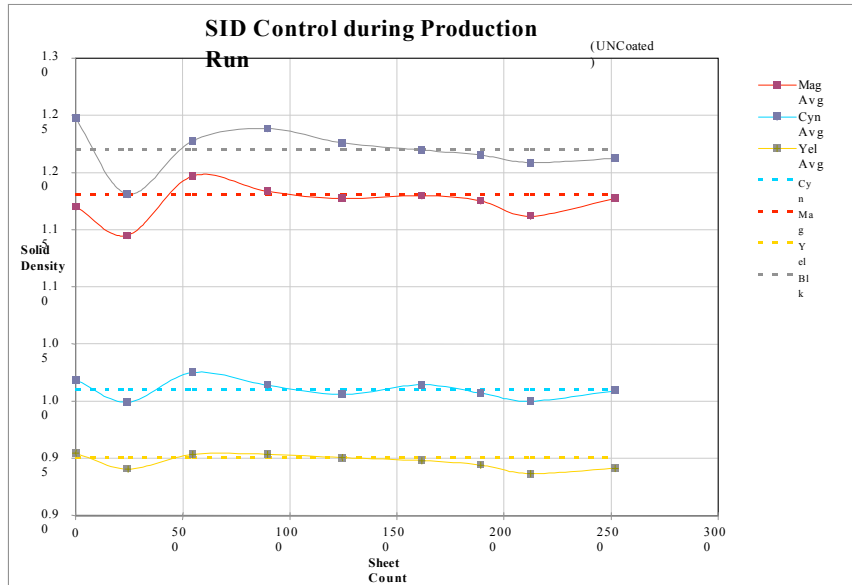
In regard to conclusions it is interesting to note that with a #3 coated stock solid ink density control, when a variable was introduced, it took 800 to 1,600 sheets to return to the desired target level. Gray balance control, when the variable was introduced, it took longer with 1,600 to 2,000 sheets to return to the desired target level.

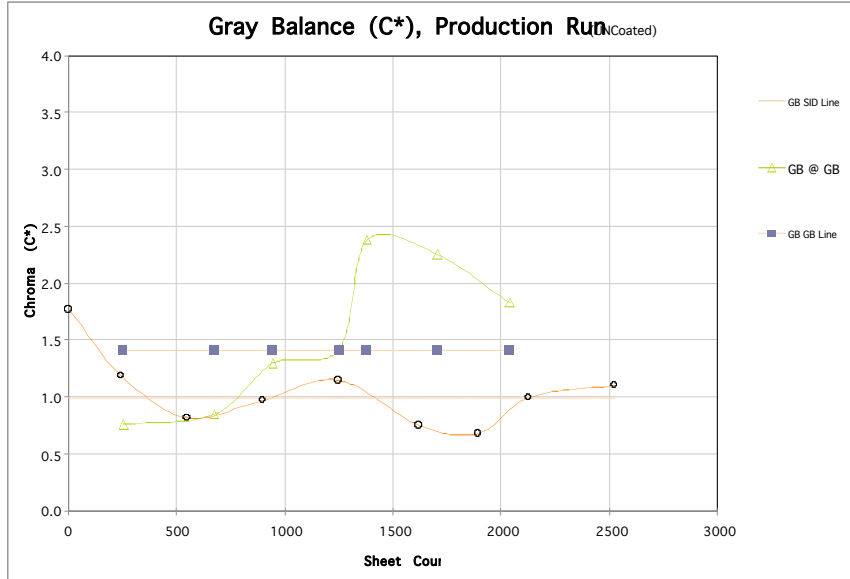
We begin looking at a comparison to see if the conclusions can be drawn from tests 1 thru 4 we find the following:

- a.) Paper makes a measureable difference in the ability to control color.
- b.) Solid ink density is a more sensitive control than gray balance for controlling color during the run when a variable is introduced.

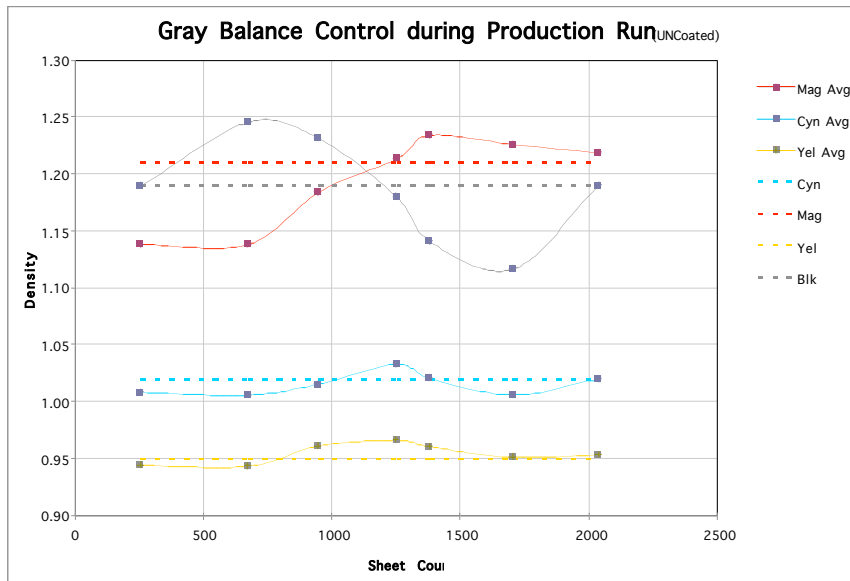
The next series of test were to take a look at utilization of uncoated stock and, once again, to look at what is the best control point solid ink density or gray balance. Please take a look at charts/graphs for tests 5 and 6.

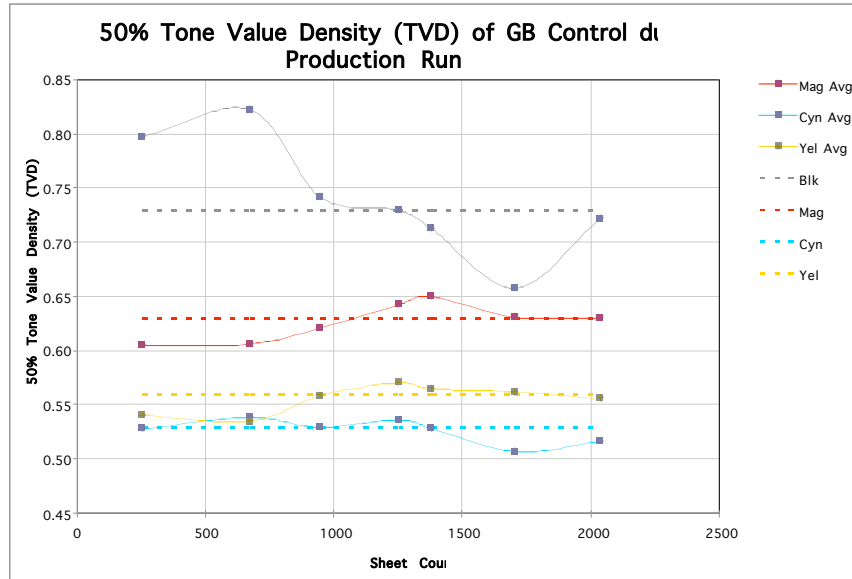
Test 5





Test 6

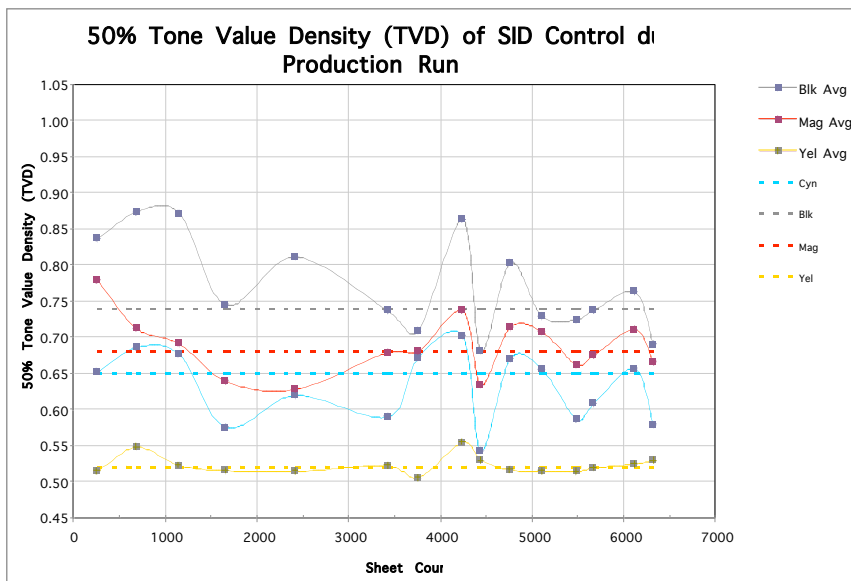
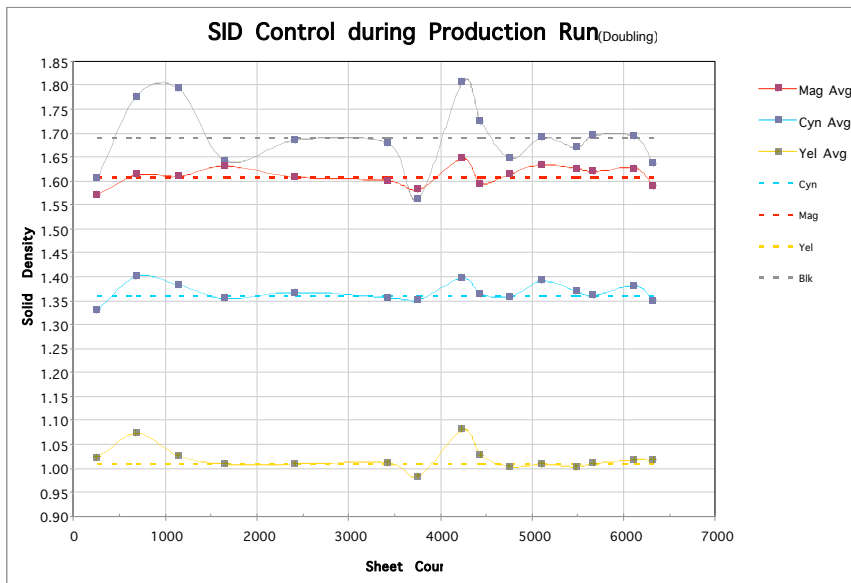


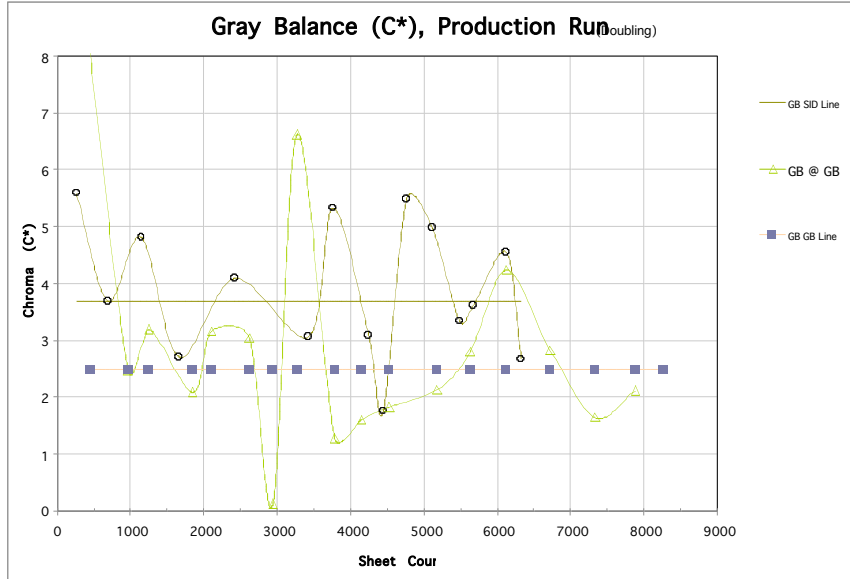


What can be noted is that the control of solid ink density in doing the production run using density control while showing slight variation and showed far less variation than in test 6 where gray balance control was used during the production run. As can be seen from tests 5 and 6 where we are comparing both tests in terms of gray balance we noticed that gray balance control produced a much more erratic result.

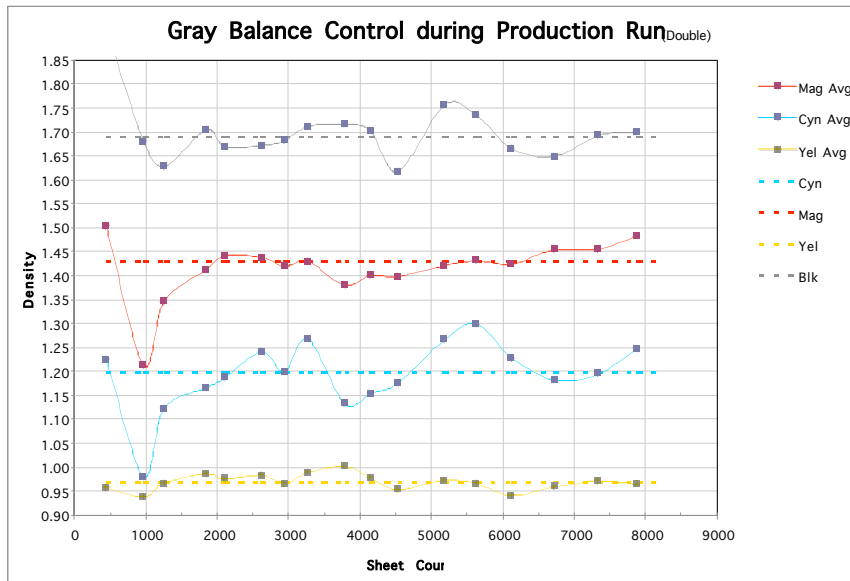
In looking at tests 7 and 8 in which we introduced a double into the press itself.

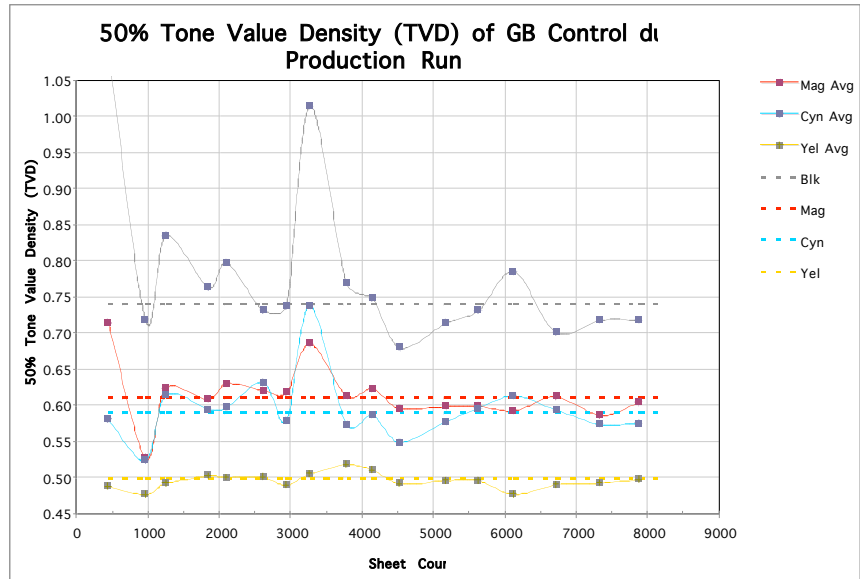
Test
7





Test 8





The double was introduced by putting a distortion into the sheet in the feeder so that it would be relatively consistent. The following five charts outline both control methods in terms of solid ink density control and gray balance control as well as what happened at the 50% tone value density.

In looking at the last graph gray balance C* production run doubling where we are comparing gray balance control to SID control we noted that there is greater variation with gray balance control. It should be pointed out in all fairness that most system of control cannot mitigate a double on a press.

Suggestions for Further Study

1. The ideal situation would be to use a press with the ability to scan automatically in the press at least every 25 sheets and save the data, such as Heidelberg's "In-Press" closed-loop color control.
2. A look at a long run of at least 60,000 sheets or longer in a production mode could yield some very important findings.

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