Eastman Kodak Company
343 State Street
Rochester, NY 14650-0238
USA

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White Paper

A comparison of Computer-to-Plate architectures

It starts with the optical system

After twenty years there are more Computer-to-Plate (CtP) systems to choose from than ever before - consolidation and departures of the "originals" have been offset by newcomers; it is now a "me-too" market where it is difficult to differentiate products based on specification sheets. Compounding this is the lack of third party reviewers to provide any insight on important items such as customer satisfaction, reliability, or image quality. As engineers immersed in this technology we believe the differences should be quite obvious. After looking around we realize that with the dearth of information, a few connections need to be made to for the general audience.

If you look beyond specification sheets and at the different architectures offered, we begin to see that there are very different approaches taken to achieve the same imaging goal. These architectural differences result in key advantages and disadvantages. The system architecture of each product is in large part dictated by the choice of optical system – so that is where we will begin.

CtP optical systems can be roughly broken down into three categories:

1) High power individually addressable laser arrays
2) Low power individually addressable laser arrays
3) Single laser light modulator systems

Kodak, in its various incarnations, has designed, manufactured and supported all three architectures. From this experience, Kodak made a decision in the mid 2000's to consolidate onto what we believe is the superior architecture for our customers and for our business. This white paper will outline why.

High power individually addressable laser arrays

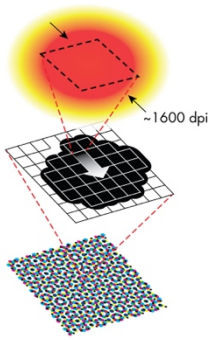
This is one of the more common imaging architectures. It begins with high power individual laser diodes (1/2 to 1W per diode) directly reimaged to the plate with or without fibre optics. The array is usually limited to 32 or 64 channels for reasons of cost and complexity. The system is relatively straightforward to develop and the "go-to" choice for manufacturers first entering the CtP market (Cron, Amsky, Screen, etc)

The spot size (resolution) of this system is its primary weakness; it images a round, fuzzy, 15um spot (FWHM) that varies dramatically with exposure. Remembering that this spot is what is used to write 2400 dpi (10.6um!) features the image sharpness limitations are clear.

Optical System Choice and Implications

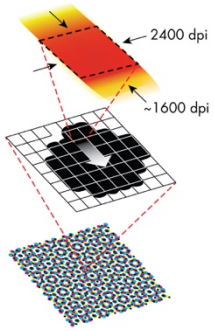
The choice of optical system directly affects image quality (resolution, power uniformity and geometric accuracy) and indirectly affects the overall plate handling system (drum speed, plate loading, plate holding, and debris management). The optical systems and the effect on the overall systems are as follows:

GAUSSIAN
TECHNOLOGY



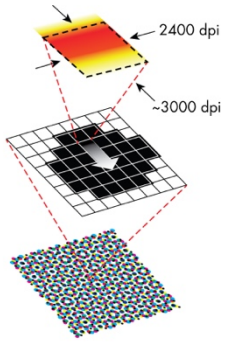
Violet, Thermal, CtCP
Tonal stability - LOW
Exposure uniformity - LOW

GLV
TECHNOLOGY



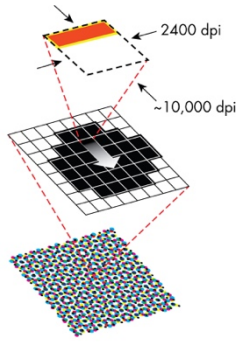
Thermal
Tonal stability - MEDIUM
Exposure uniformity - LOW

ACHIEVE (TH5)
TECHNOLOGY



Thermal
Tonal stability - MED to HIGH
Exposure uniformity - HIGH

SQUARESPOT
TECHNOLOGY



Thermal
Tonal stability - HIGH
Exposure uniformity - HIGH

The secondary weaknesses are often overlooked. Due to the low number of channels and high power per channel, the drum must rotate at very high speed to meet throughput requirements. The centripetal force on a rotating plate increases by the square of drum surface velocity driving the need for dynamic balancing, plate vacuum systems, and complex plate clamping mechanisms. These systems lead to reliability issues and image artefacts and also consume considerable amounts of power.

$$Exposure = \frac{Intensity}{Velocity}$$

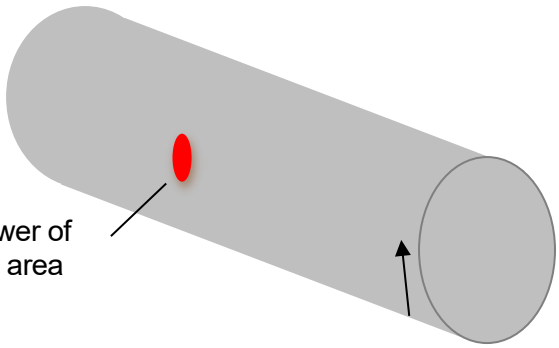
$$\therefore Velocity \propto Intensity$$

$$Force_{centripetal} = \frac{Mass * Velocity^2}{Radius}$$

$$Force_{centripetal} \propto Velocity^2$$

$$Force_{centripetal} \propto Intensity^2$$

High intensity write lasers require a high plate velocity for any given exposure. The centripetal force experienced by the plate increases exponentially with the velocity (and thus the intensity).



Intensity = power of beam per unit area (mW/cm2)

Velocity = surface velocity of plate on drum (m/s)

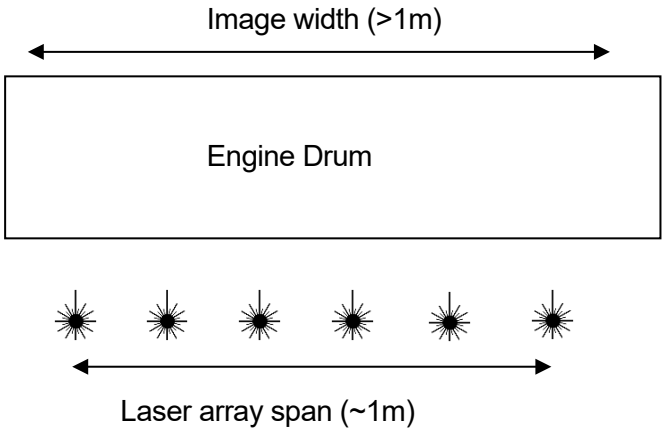
Exposure = plate sensitivity or energy per unit area required to convert plate chemistry (mJ/cm2)

Low power individually addressable laser arrays or modules

This architecture choice that has a mixed history. It consists of a wide array of laser diodes or modules spanning the length of the imaging drum where each unit is responsible for imaging a section of plate (Screen Niagara, Heidelberg Suprasetter, and Panasonic News machines). Again, the optical system is a simple re-imaging of each diode – so the same image quality limitations of the aforementioned system apply. Plate handling issues may or may not be an issue depending on the number of lasers and power.

The Achilles heel of this system is the wide span of the imaging lasers. On this scale, thermal expansion becomes a very real and significant problem. On a 1m wide offset plate the thermal expansion is ~20um per degree C. Over an operating span of 10C this is 200um or ~19x 2400 dpi pixels! Unless the laser assembly is thermally and materially matched to the plate, geometric problems between jobs or colours become very real and will result in image problems. Manufacturers who have attempted this architecture have gone to great lengths to address this problem and in some cases no longer produce the units. (Screen Niagara).

A secondary issue is the fact that each laser is responsible for a relatively large sector. The human eye is very good at detecting minute differences in tint particularly between large (cm scale) areas. Because of this the laser spot size and power must be very well calibrated and stable in order to avoid "lawn mower" artefacts.



$$\Delta Length = \alpha * \Delta Temp * Length_0$$

Assume that best case the laser array and plate are materially matched (aluminum).

If there is as little as a 1C difference in temp between the plate and laser assembly, the image size will vary by

$$\Delta Length = 22.2(10^{-6})m/(mK) * 1K * 1m$$

$$\Delta Length = 22.2\mu m$$

This is enough to cause artefacts in a four color job or when remaking one color for a pre-existing job.

Single laser light modulator systems

In Spatial Light Modulator (SLM) based systems, the laser is only a light source – it is not responsible for switching light. Pixels are created by "gating" light at the light modulator. The light modulator is then reimaged to the plate. The advantages of this system are numerous:

- The pixel resolution is not limited by the light source but instead the light modulator.
- The pixel is formed via diffraction pattern making for a non-Gaussian top-hat pixel ("Square") in subscan (a 2400 dpi pixel is truly 10.6um in Kodak CtP systems and 2um in mainscan!)

- The number of pixels is not limited by the number of lasers
- The power per pixel is based on the SLM and can be customized to suit the system

The system is quite flexible and lends itself to both high quality 1200/2400 dpi applications and very high resolution applications with up to 2um (12,800 dpi) addressability.

The system advantages are a further benefit. The large number of low power pixels minimizes drum speeds making for a simple plate handling system – a classic KODAK TRENDSETTER Q800 Platesetter system requires no vacuum systems for plate handling and uses simple magnetic clamps. All Kodak CtP systems have temperature compensation automatically scaling the carriage travel with temperature to ensure that the image size always matches any geometric changes in the plate due to temperature. The KODAK TRENDSETTER Q800 Platesetter system consistently sets the benchmark for image quality, reliability, and energy consumption.

The advanced technology used in this design requires advanced knowledge and manufacturing capability which is why very few competitors have followed Kodak down this design path. A simplified version of this unique design is also leveraged in newer versions of Kodak CTP such as the Kodak's Achieve CTP systems.

Talk to us about the benefits of SQUAREspot

We, in the Kodak product engineering group, are a bit biased but hopefully this document helps you see why we think the way we do. Image quality, reliability and affordability are important to us and what we continuously improve. We feel we offer the best architecture and we know this architecture the best.

Kodak is the largest manufacturer of SLM type systems – we have the manufacturing scale and pricing to be able to offer this as our standard technology. Kodak also has a worldwide IP portfolio covering this technology. Next time you're shopping for a CtP, take a look under the hood and take a close look at the plate. We think you'll agree with us.

About Kodak

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