Course Contents

Course Overview

Epson Large Format Printing System.

The Epson Large Format Printing system is a tuned system. It requires specific support from media, drivers, and ink to deliver optimum performance. This course will explain the relationship between the printer, the ink, the media, and the driver.

This course will also explain the following topics:

- The tools provided to compensate for un-supported media.
- The tools provided to compensate for RIP servers that do not fully support the Epson LFP System.

Droplet Size Control

Accurate droplet control is necessary to achieve optimum print quality.

- **Uniform droplet size**
- **Multiple droplet sizes**

Uniform Droplet Size

Print Head Calibration: All print heads are tested at the factory, and the exact amount of energy required to “fire” a standard size dot is determined. Every print head requires a slightly different amount of energy to eject the same quantity of ink. The printer’s control electronics requires this information to produce a uniform dot size.

Ink Formula: The amount of energy required to “fire” a standard sized dot depends on the ink formula.
Each ink formula has a specific viscosity (thickness). All approved Epson Inks have a known viscosity. The energy applied to the print head is adjusted to compensate for the viscosity of the ink, to ensure that a standard size dot is ejected.

Temperature: The amount of energy required to eject a standard size dot, depends on temperature.
Ink changes its viscosity at different temperatures. The printer monitors the temperature of the ink in the print head, and ensures that the proper amount of energy is applied, to compensate for ink temperature variations.

Variable Droplet Sizes

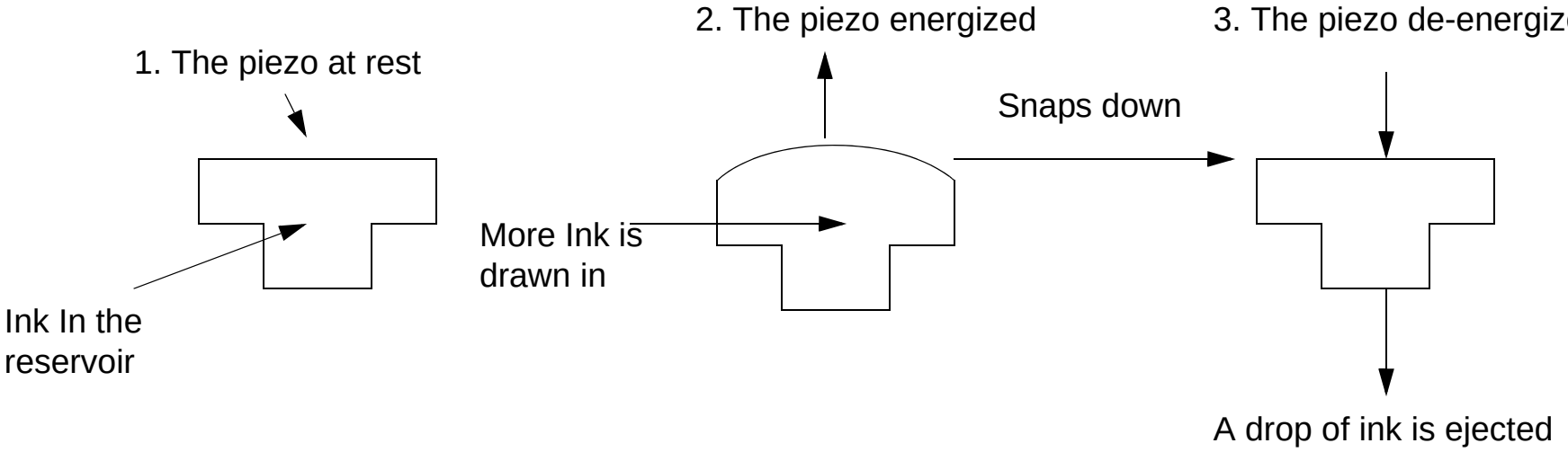
Epson ink jet printers use different droplet sizes depending on the image being printed. A small droplet is used for very fine, detail. A larger droplet is used for low detail areas.

- **Small droplet = high resolution / detail**
- **Large droplet = speed**

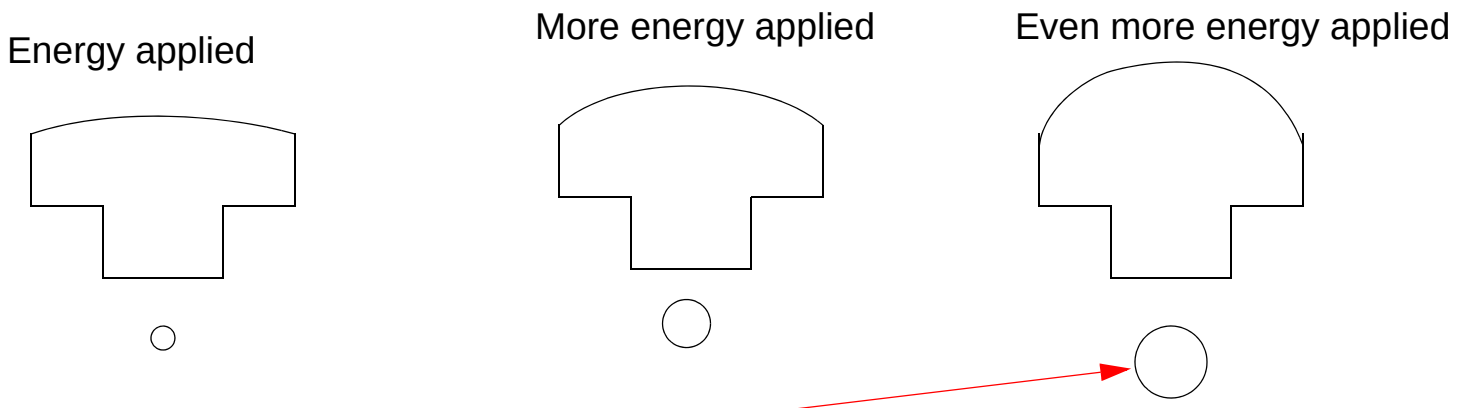
Variable droplet printing allows for fast printing, and detail printing, at the same time.

Piezo Technology / Droplet Control

•A piezo electric element is an electronic device that flexes when it is energized by an electrical current.
•Epson uses the piezo electric elements to eject ink from the print head.



•The more energy that is applied to the piezo, the more ink is ejected, the bigger the droplet.



Note: This drop travels faster that the smaller dots. Think Bow and Arrow.

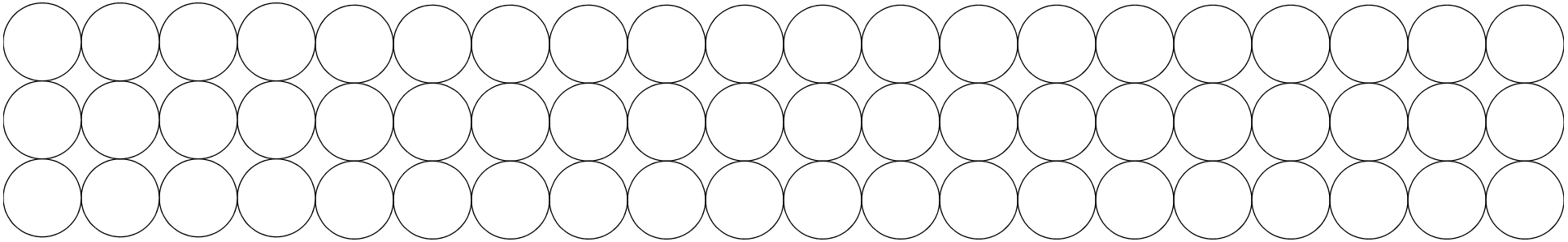
Dot Control

- **Media dot gain**
- **Droplet timing**
- **Media advance**

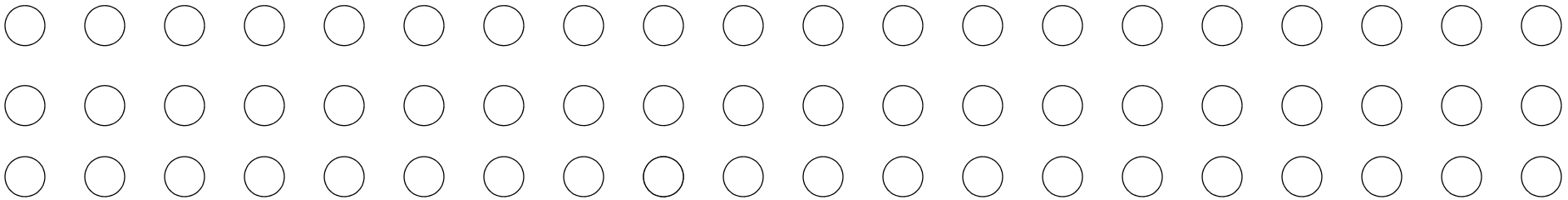
Dot Gain

- **Dot gain refers to the size a droplet of ink grows, when it is absorbed by the paper.**
- **Dot gain is a factor of the size of the ink droplet, and the properties of the media.**

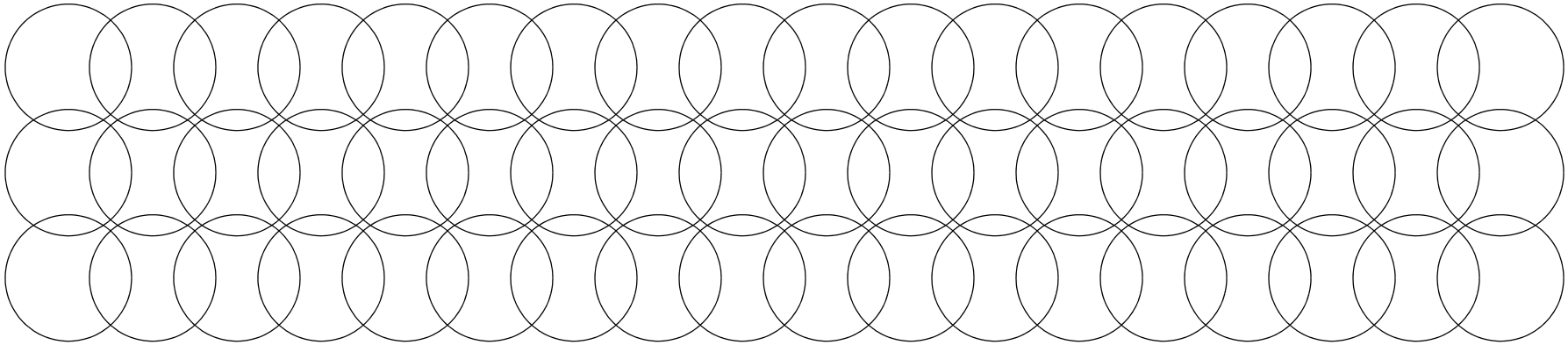
(Assuming that the print job required dots to be adjacent, but not “underlapping” or “overlapping”), the example below represents **perfect dot gain**.



(Assuming that the print job required dots to be adjacent, but not “underlapping” or “overlapping”), the example below represents **to little dot gain**.”.



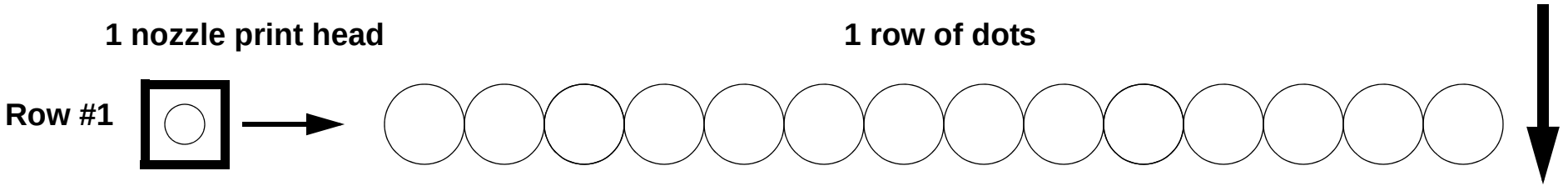
(Assuming that the print job required dots to be adjacent, but not “underlapping” or “overlapping”), the example below represents **too much dot gain**.



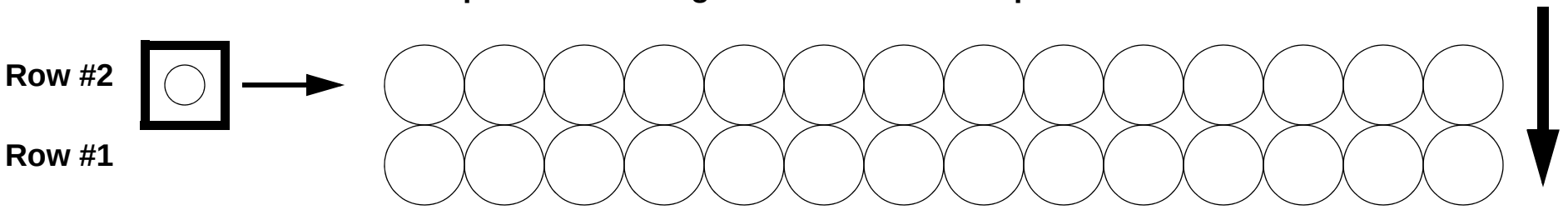
Ink jet media has a coating on it’s surface designed to control (minimize and standardize) dot gain. Dot placement on the media must be adjusted to compensate for dot gain.

Media Advance

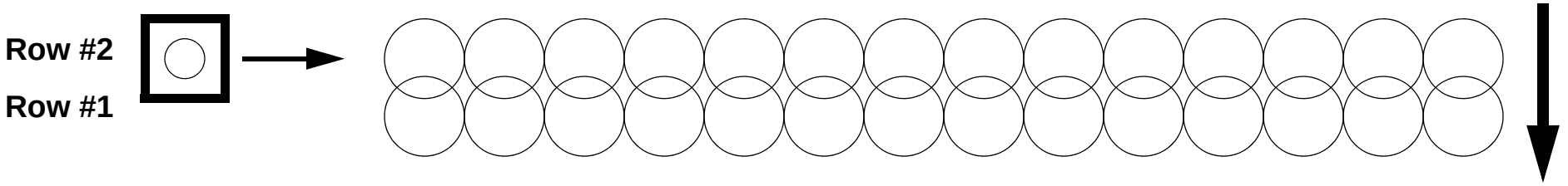
- **Media advance controls the vertical placement of the dots on the media.**
- **Media advance must be adjusted to compensate for the dot gain characteristics of the ink and media**



The media is advanced until the print head is aligned with the correct position for the next row of dots.



Incorrect media advance results in incorrect dot placement.



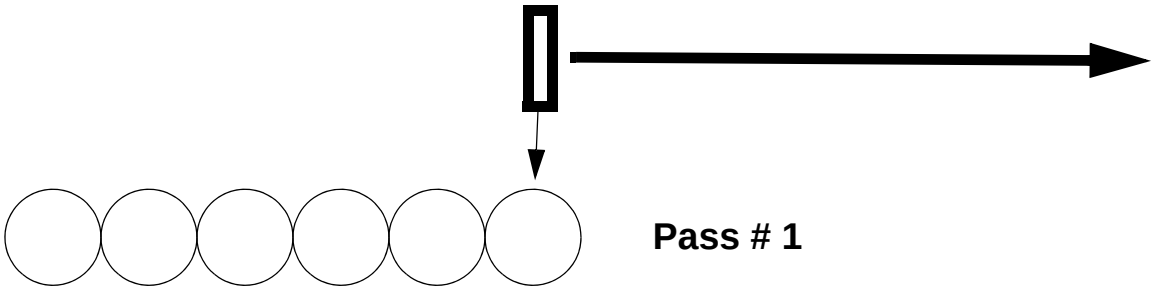
Electronic Alignments

- **Electronic alignments compensate for mechanical drift.**
- **Mechanical drift changes with age.**
- **Electronic alignments should be performed regularly to compensate for mechanical changes.**

Bi-di (Bi-directional) Alignment

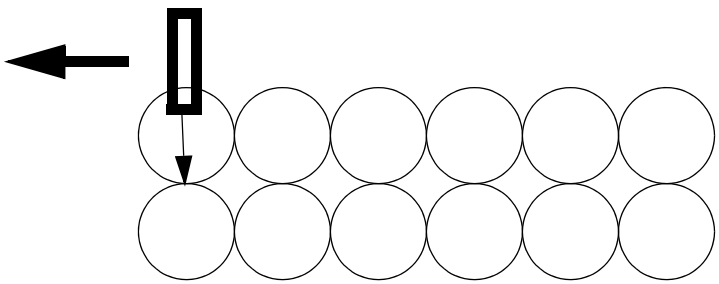
Bi-directional printing (High Speed On) is the fastest printing mode. During Bi-directional printing, the printer places dots on the media during both directions of print head movement.

Pass #1, left to right printing.

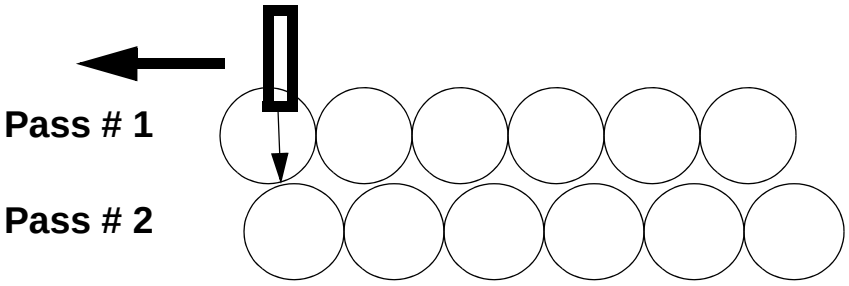


The Bi-di alignment ensures that the printer can place dots on the media accurately, regardless of print head direction.

Pass #2, right to left printing.



Good Bi-directional alignment

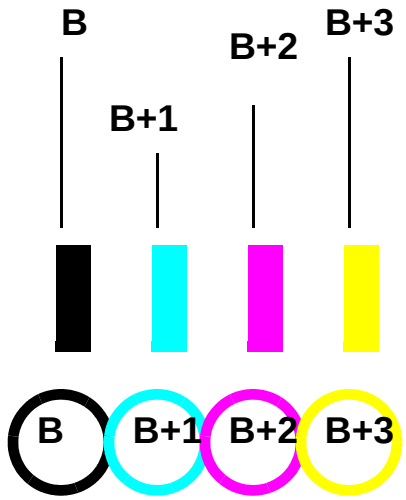


Poor Bi-directional alignment

Uni-di (Uni-directional) Alignment

- **The Uni-di alignment synchronizes dot placement between different colors (different nozzles sets).**

Each color must have a different timing for dot firing, because of it's different position on the print head.

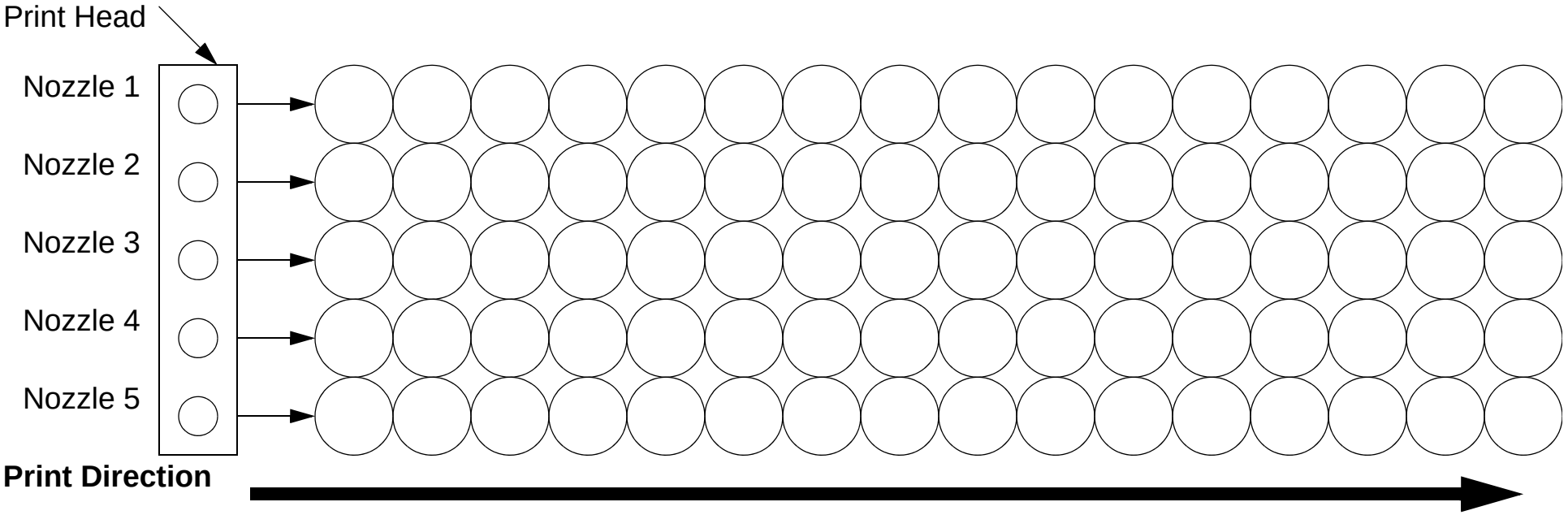


The printer uses the uni-directional alignment to measure the distance between black, and the other colors.

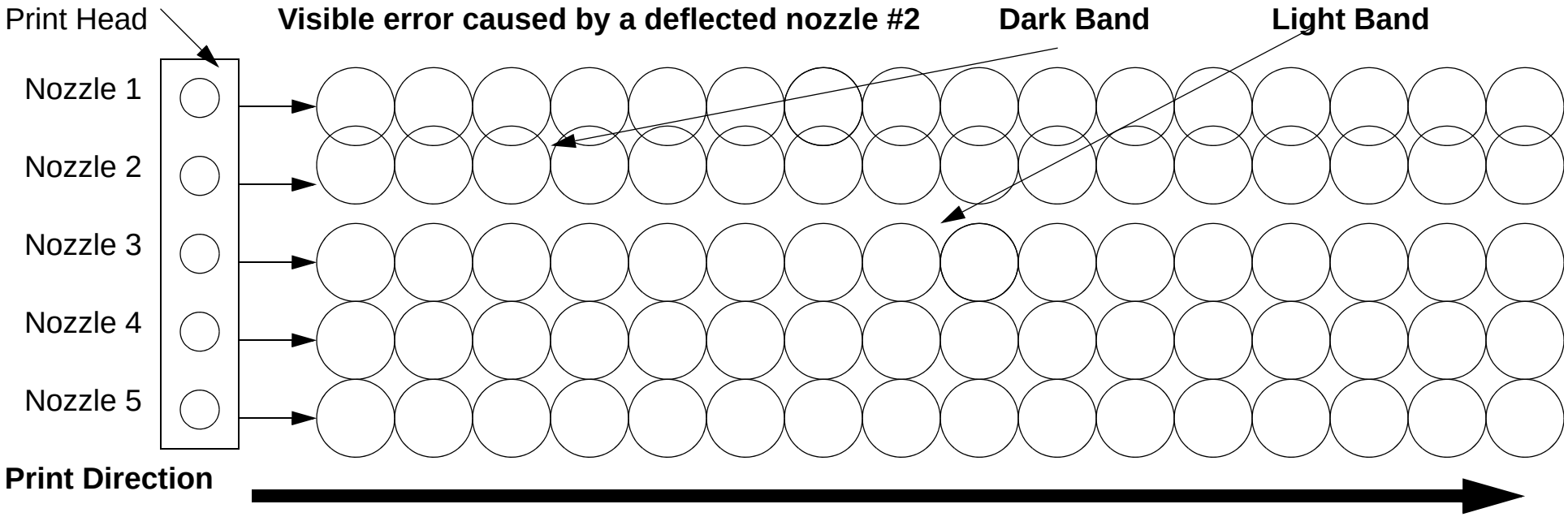
The printer needs to know the distance between black and the other colors, so that it can place each color of dot next to any other color.

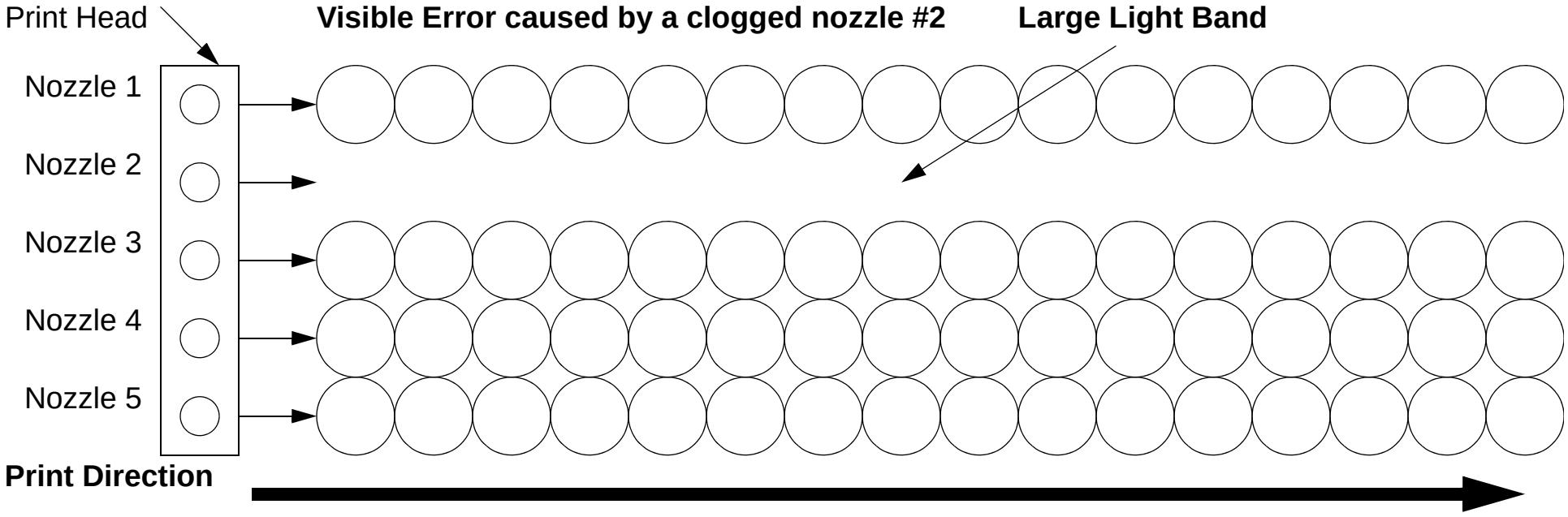
Non-MicroWeave Printing

It is possible for the Print Head to fill in the entire area under the print head in one pass, as shown below.



This type of printing is fast, but has potential for print quality issues. If any of the nozzles (1-5 shown above) mis-fire (sputter), are deflected (ricochet), or are clogged, the error will be replicated for the entire row of dots. See the Graphic on the next page.


Print Head
Visible error caused by a deflected nozzle #2
Dark Band
Light Band
Nozzle 1
Nozzle 2
Nozzle 3
Nozzle 4
Nozzle 5
Print Direction

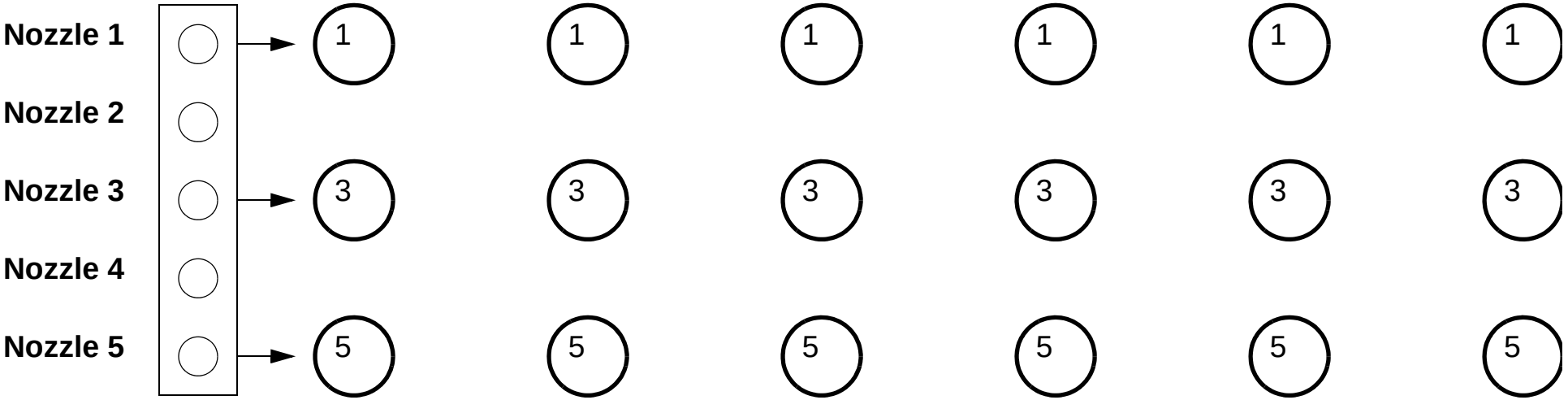

Print Head
Visible Error caused by a clogged nozzle #2
Large Light Band
Nozzle 1
Nozzle 2
Nozzle 3
Nozzle 4
Nozzle 5
Print Direction

MicroWeave Printing

- **MicroWeave Printing refers to the Epson method for ensuring that slight nozzle imperfections are masked (hidden).**
- **The MicroWeave process does not allow the same nozzle to print an entire row of dots.**

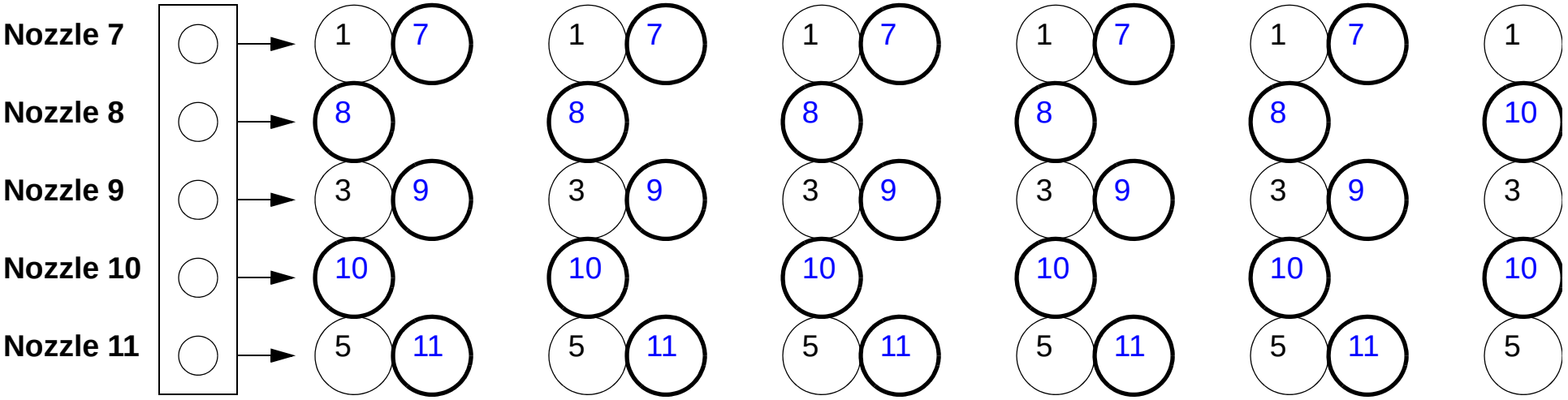
In the example shown by the next 4 graphics, it takes 4 passes from the print head to fill an area that, potentially, could be filled by 1 pass of Non-MicroWeave printing

Pass #1: using nozzles 1, 3, and 5



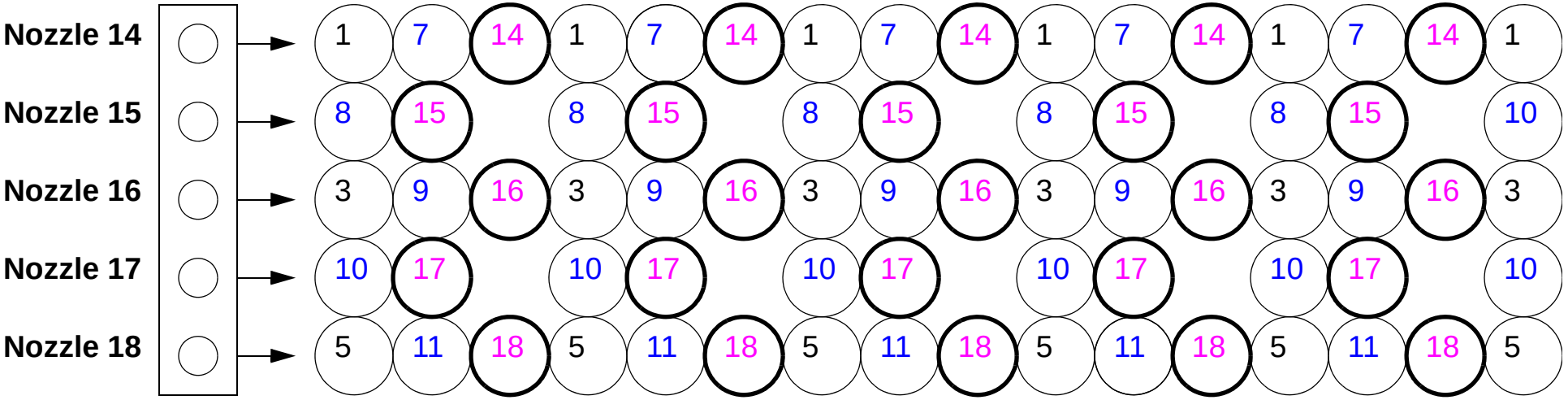
After the print head places the dots listed above on the media, the paper is advanced so that another set of nozzles is lined up with the partially printed lines (see the next graphic).

Pass #2: using nozzles 7, 8, 9, 10, and 11



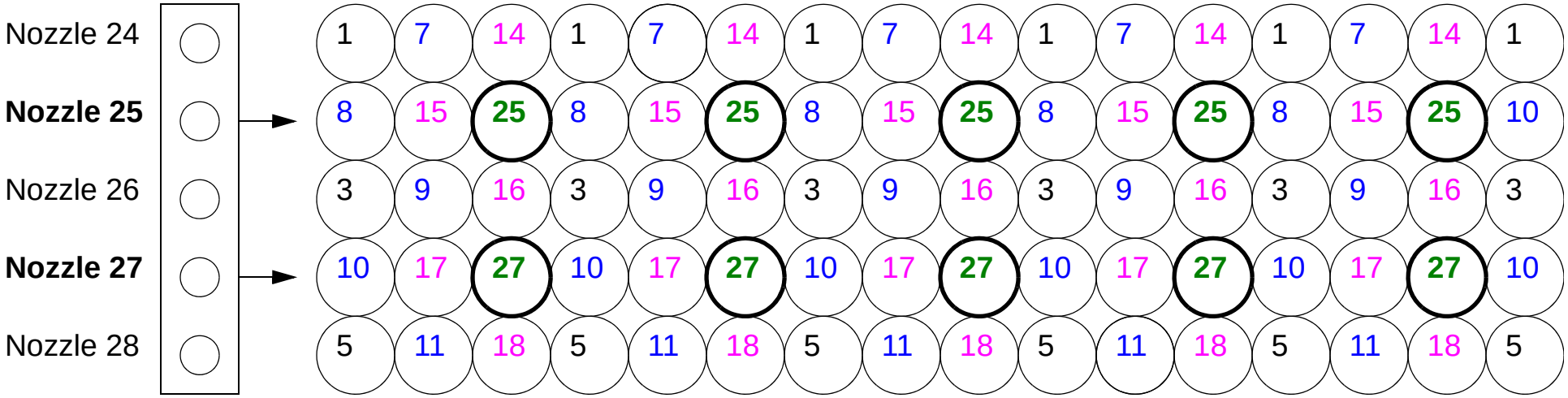
•The paper is advanced again so that another set on nozzles is lined up with the existing dots.

Pass #3: using nozzles 14, 15, 16, 17, and 18



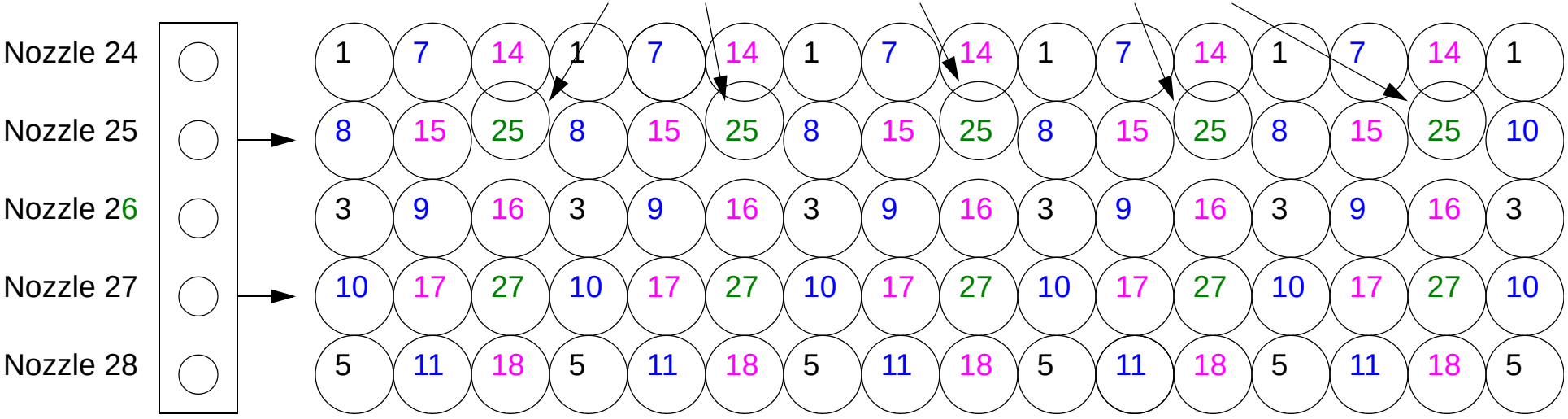
•The paper is advanced again so that another set on nozzles is lined up with the existing dots

Pass #4: using nozzles 25, and 27

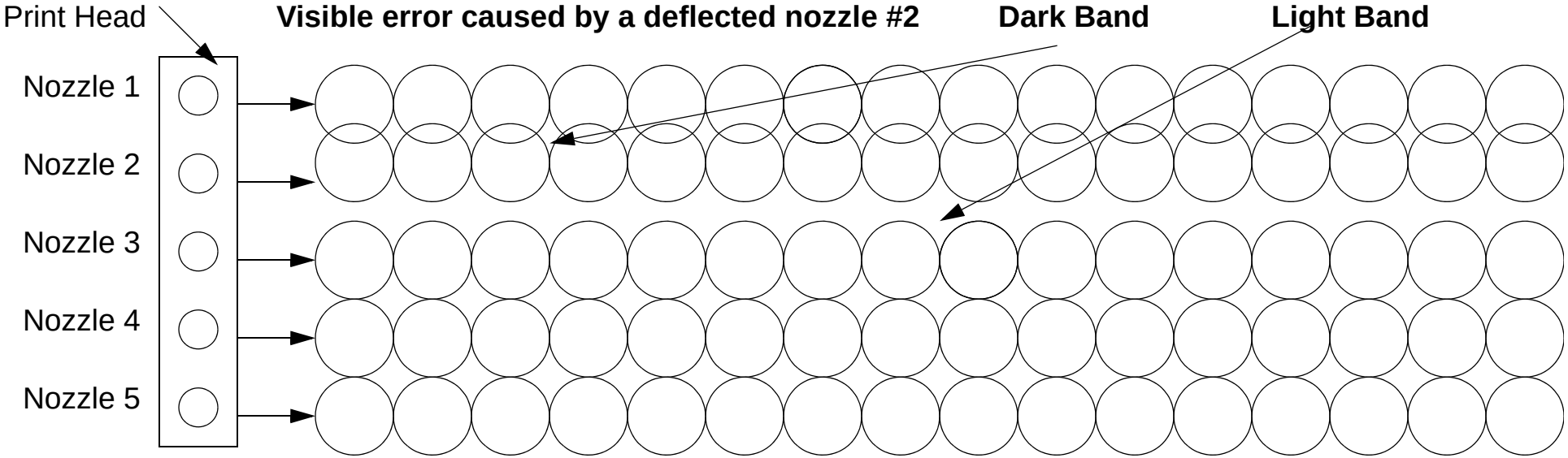


If nozzle 25 was deflected, the finished pattern would look like this.

1/3 of the dots out of place, typically imperceptible.



Non-Microweave printing with one deflected nozzle.

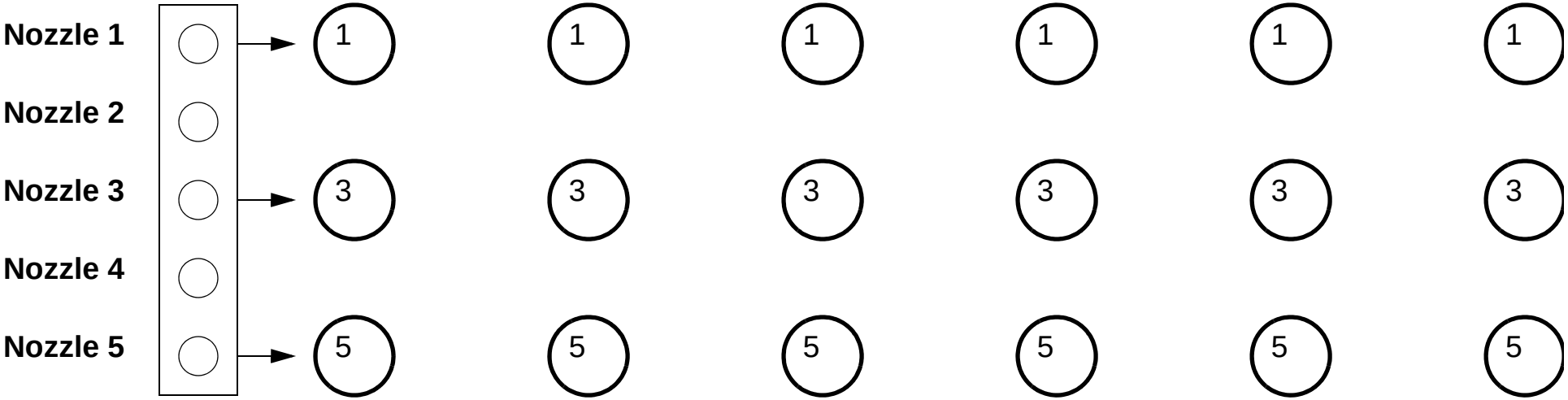


Paper Advance and Media

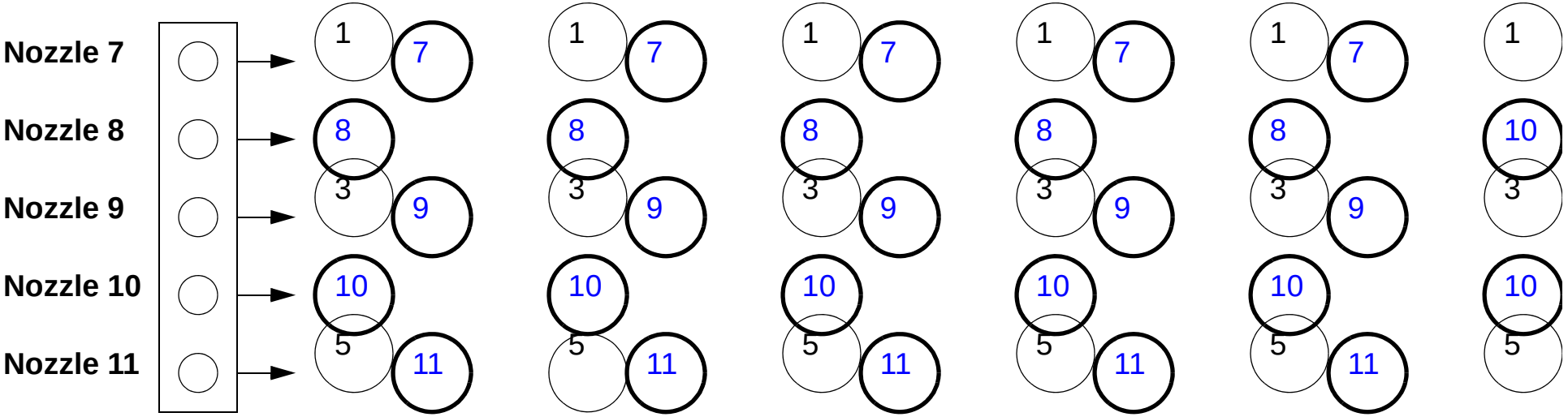
- **Every media type has a specific coefficient of friction.**
- **The printer must advance the paper in increments that compensate for the media's unique characteristics.**
- **Incorrect paper advancement equals horizontal banding.**

MicroWeave Printing with incorrect paper advancement.

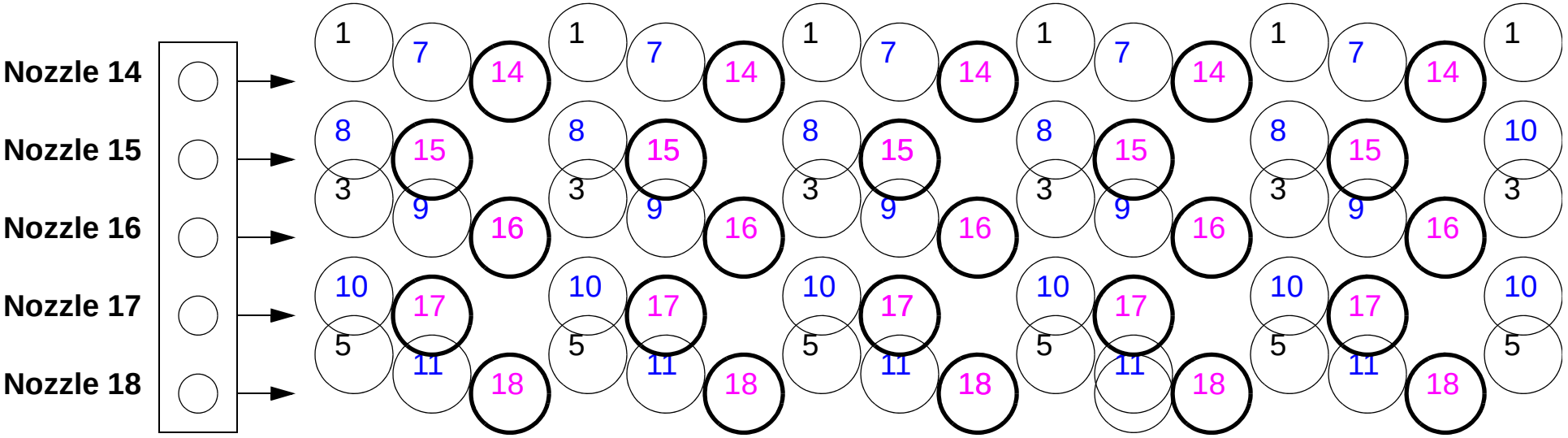
Pass #1:.



Pass #2: The media is advanced to far.

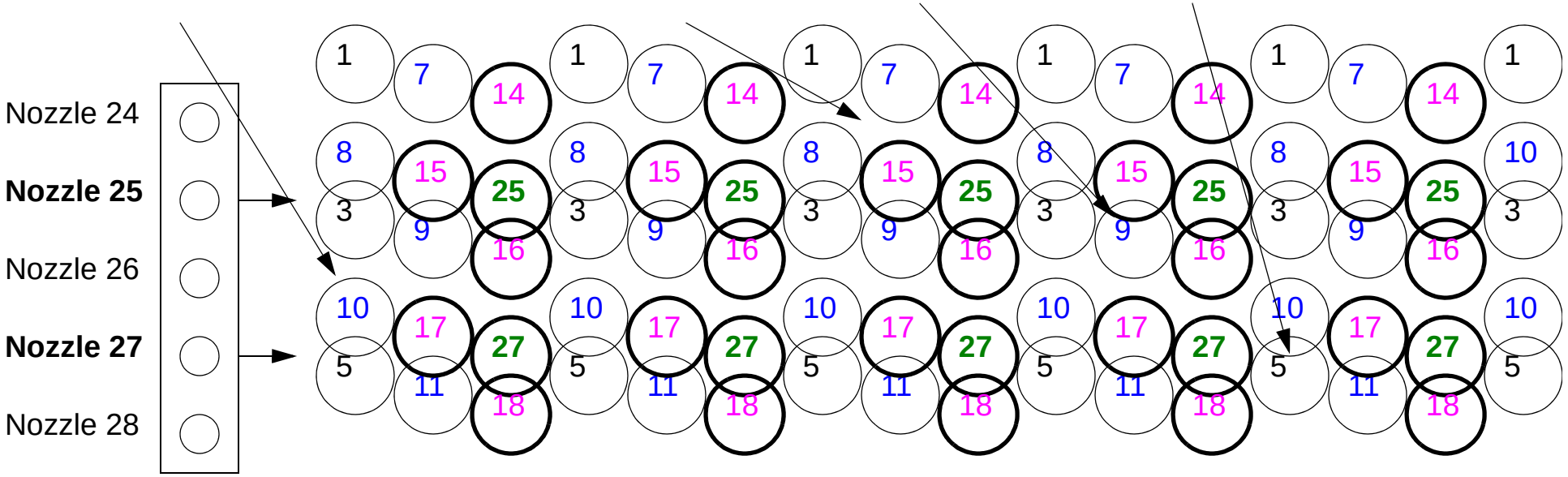


Pass 3#: The media is advanced to far, again.



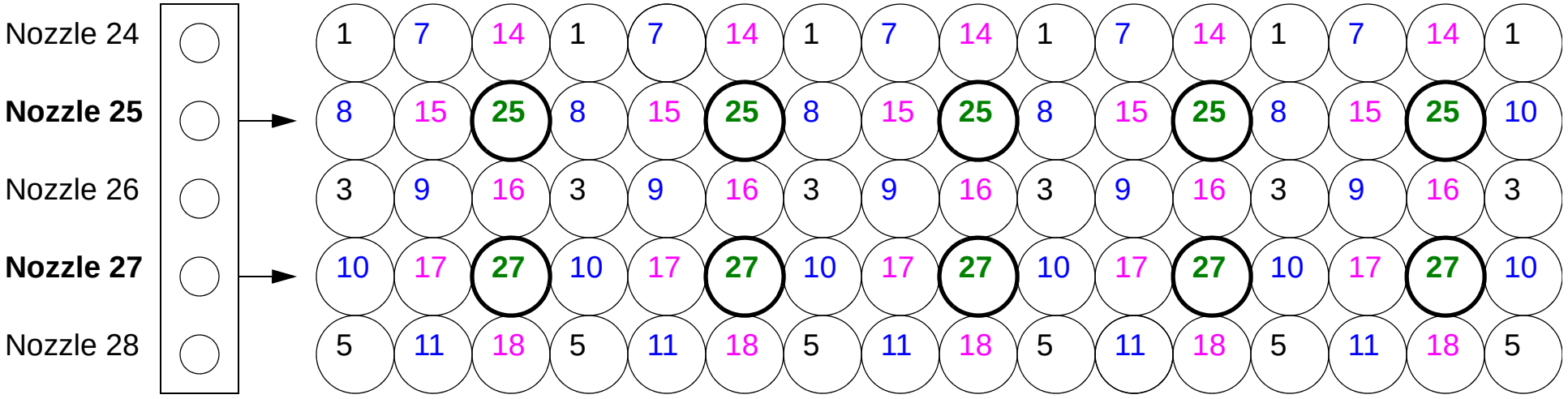
Pass #4: Once again, the media is advance to far.

These gaps will result in a horizontal light **These overlaps will result in a horizontal dark**



Example of correct dot placement

No overlaps or gaps



Epson Printer Driver

The Epson Printer Driver controls the dithering / screening (dot placement) on the media. The Epson Driver uses proprietary screening method. The Epson method for dot placement is optimized for the printer.

The Epson Printer Driver requires the following information to run the printer correctly.

- **Resolution for the job**
- **Media type for the job**
- **MicroWeave or Non-MicroWeave printing**

Print Resolution

- **The higher the resolution, the better the print quality.**
- **The higher the resolution, the slower the printing.**

Media Type

Selecting the media type allows the printer to adjust for:

- **Horizontal dot placement, to compensate for dot gain.**
- **Vertical dot placement, to compensate for dot gain and media advancement properties.**
- **Proper saturation / color for the image.**

MicroWeave Printing

- **Off**
- **On**
- **Super (more complex MicroWeaving)**

Note: The more complex the MicroWeave pattern is, the better the print quality, the slower the printing.

Non-Epson Driver

Things to look for in a Non-Epson Driver

A Non-Epson Driver should support:

- **Multiple Resolutions**
- **Multiple Media Types**
- **MicroWeave Printing**

Multiple Resolutions

Multiple resolutions are not necessary if the driver is running the printer at a resolution that meets expectations for image quality.

Multiple Media Types

If the Non-Epson driver does not allow the user to pick a media type, then the driver probably does not adjust for the media dot gain and media feed variations. Banding is very probable.

MicroWeave Printing

MicroWeave printing is necessary for optimum image quality. A Non-Epson printer driver may support MicroWeave printing without indication. MicroWeave support can be visually verified by watching the printer print. A printer that is printing in MicroWeave mode takes multiple passes to fill in the image at the leading edge of the printing.

Non-Epson Driver / RIP Support

Media Type Support

Epson has included tools to compensate for Non-Epson RIPs / Drivers that do not support media type variations.

Control Panel Custom Paper Menu

The Paper Config Menu, that is accessed through the printer's control panel, supports compensation for:

- **Media advance variations**
- **Media saturation variations**
- **Media thickness variations (printer suction variations)**

Non-Epson Media Support

Custom Paper Menu (Epson Driver)

The Paper Config Menu, that is accessed through the printer's control panel, supports compensation for:

- **Media advance variations**
- **Media saturation variations**
- **Media thickness variations (printer suction variations)**

The Paper Config Menu (Driver) works in conjunction with the Media Type information that is accessed by the driver.

Custom Paper Menu (Control Panel)

The Paper Config Menu, that is accessed through the printer's control panel, supports compensation for:

- **Media advance variations**
- **Media saturation variations**
- **Media thickness variations (printer suction variations)**

The Paper Config Menu (Control Panel) affects every job that is sent to the printer.

Print Head Cleaning Station

Purpose

- **Seal the Print Head Surface to prevent nozzle clogging.**
- **Clean the surface of the print head to prevent a build up of material that could block nozzles.**
- **Clear clogged nozzles.**

Components

Pump: The Pump supplies suction for the cleaning process.

Cap Assembly: The cap assembly seals the print head surface to prevent nozzle clogging. It also applies the suction generated by the pump mechanism to the nozzles to assist in clearing clogged nozzles.

Wiper Blade: The wiper blade is used to ”squeegee” the print head surface, to remove residual ink after cleaning.

How it works

Cleaning consists of firing the nozzles while applying suction. After clearing the nozzles, the wiper blade is passed over the print head surface to remove any residual ink or material left behind.

Why it stops working

When the cap assembly becomes dirty, the pump suction can no longer be applied to the nozzle area with its original power (suction leak caused by dirt). This greatly reduces the efficiency of the cleaning cycle. The cap assembly is designed to seal the face of the print head to protect the nozzles from clogging (drying out). When the cap assembly is dirty, it does not seal properly, resulting in a more frequent need to perform cleaning cycles.

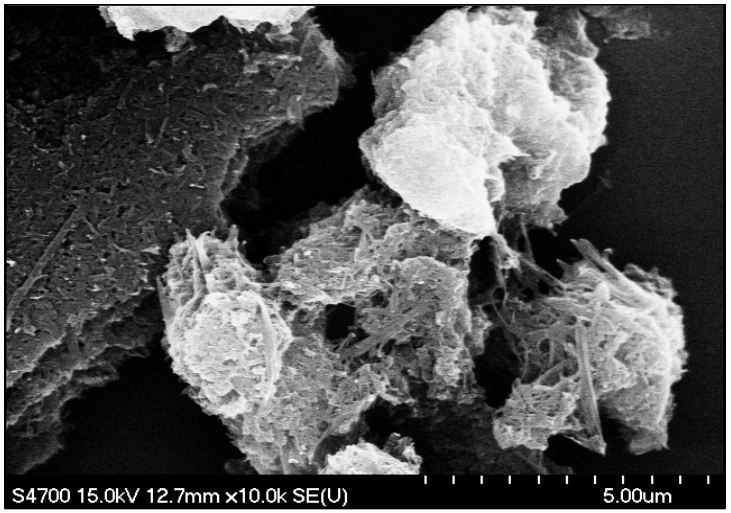
- **Dirt = More frequent need for cleaning.**
- **Dirt = Less efficient cleaning.**

Epson Ink

Epson Inks are formulated to match the unique design of Epson print heads. Pigment particle size is very important. Large particles will block (clog) the nozzles.

Conventional Pigment

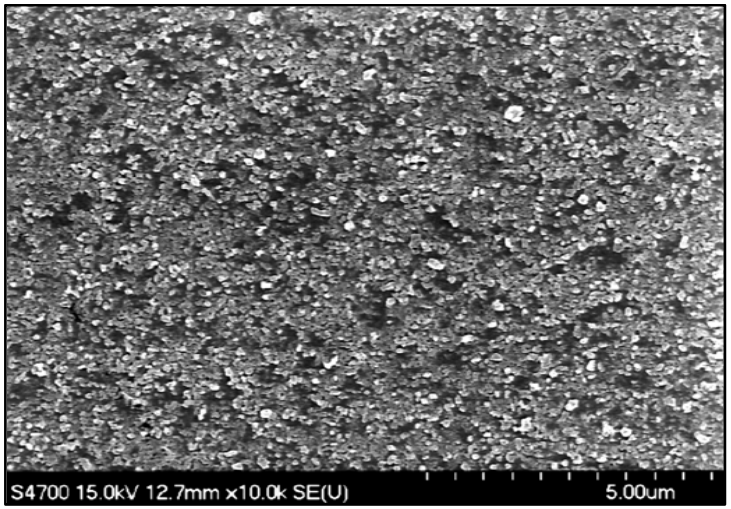
Each Pigment particle is irregular shaped and



5 microns

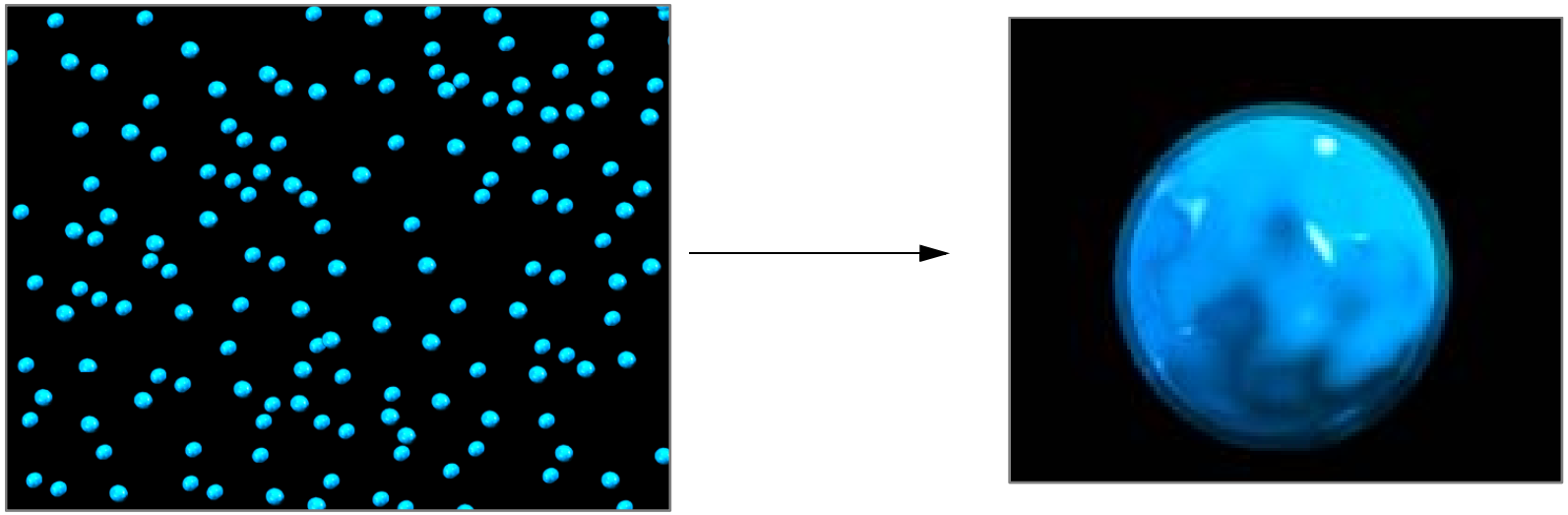
Epson Pigment

Each pigment particle is uniformly shaped and

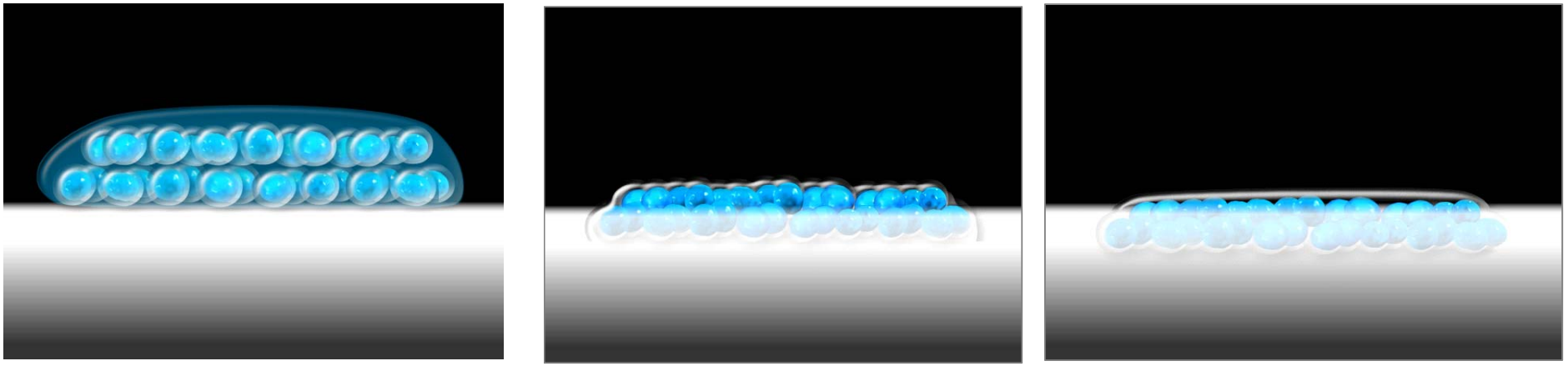


5 microns

Each pigment particle is encapsulated in resin to assist in particle dispersion. The resin helps keep the particles suspended in the ink solution. Evenly distributed pigment particles are less likely to bond with each other, reducing the chances of clumped pigment particles clogging the print head. Evenly distributed pigment particles also makes for uniform color.



The resin encapsulated pigment bonds with the media for a more durable image.



Review

Accurate droplet control is necessary to achieve optimum print quality.

- **Uniform droplet size**
- **Multiple droplet sizes**

Dot Gain

- **Dot gain refers to the size a droplet of ink grows, when it is absorbed by the paper.**
- **Dot gain is a factor of the size of the ink droplet, and the properties of the media.**

Droplet Timing

- **Droplet timing controls the horizontal placement of the dots on the media.**
- **Droplet timing must be adjusted to compensate for the dot gain characteristics of the ink and media**

Electronic Alignments

- **Electronic alignments compensate for mechanical drift.**
- **Mechanical drift, is normal with age.**
- **Electronic alignments should be performed regularly to compensate for mechanical drift.**

Bi-di (Bi-directional) Alignment

- **Bi-directional printing (High Speed On) is the fastest printing mode.**
- **Bi-directional printing places dots on the media during both directions of print head movement**
- **The Bi-directional alignment ensures accurate horizontal dot placement during both directions of printing.**

Uni-di (Uni-directional) Alignment

- **The Uni-directional alignment synchronizes dot placement between different colors (different nozzles sets).**
- **The Uni-directional alignment ensures that different colors align horizontally.**

MicroWeave Printing

- **MicroWeave Printing refers to the Epson method for ensuring that slight nozzle imperfections are masked (hidden).**
- **The MicroWeave process does not allow the same nozzle to print an entire row of dots.**
- **The more complex the MicroWeave pattern, the better the print quality, the slower the printing.**

Media Advance and Media

- **Media advance controls the vertical placement of the dots on the media.**
- **The printer must advance the paper in increments that compensate for the media's unique characteristics.**
- **Every media type has a specific coefficient of friction.**
- **Media advance must be adjusted to compensate for the coefficient of friction between the media and the feed rollers.**
- **Media advance must be adjusted to compensate for the dot gain characteristics of the ink and media**
- **Incorrect paper advancement equals horizontal banding.**

The Epson Printer Driver requires the following information

- **Resolution for the job**
- **Media type for the job**
- **MicroWeave or Non-MicroWeave printing**

A Non-Epson Driver should support:

- **Multiple Resolutions**
- **Multiple Media Types**
- **MicroWeave Printing**

Custom Paper Menu (Control Panel) (for Non-Epson Drivers / RIPs)

The Paper Config Menu, that is accessed through the printer's control panel, supports compensation for:

- **Media advance variations**
- **Media saturation variations**
- **Media thickness variations (printer suction variations)**

Custom Paper Menu (Epson Driver) (For Non-Epson Media Support)

The Paper Config Menu, that is accessed through the printer's control panel, supports compensation for:

- **Media advance variations**
- **Media saturation variations**
- **Media thickness variations (printer suction variations)**

Print Head Cleaning Station

- **Seals the Print Head Surface to prevent nozzle clogging.**
- **Cleans the surface of the print head to prevent a build up of material that could block nozzles.**
- **Clears clogged nozzles.**

Epson Ink

- **Epson Inks are formulated to match the unique design of Epson print heads.**
- **Pigment particle size is very important. Large particles will block (clog) the nozzles.**
- **Pigment particles are encapsulated in resin to ensure that the particles, do not clump before printing, and bond with the media after printing**