DR. DOT'S HALF-DOZEN

- DOLLARS
- DESCRIBING FUNCTIONS
- DATA
- DISTRIBUTION OF DATA
- DOT FIDELITY
- DECISIONS

DOLLARS

Do you know how much dollar opportunity is available if you make productivity improvements in your printing operations?

DESCRIBING FUNCTIONS

Printing presses are designed to make a uniformly thick film of ink available to an imaged plate.

Control of the printing process requires control of the ink-film thickness,

but you cannot directly measure that thickness.

DESCRIBING FUNCTIONS

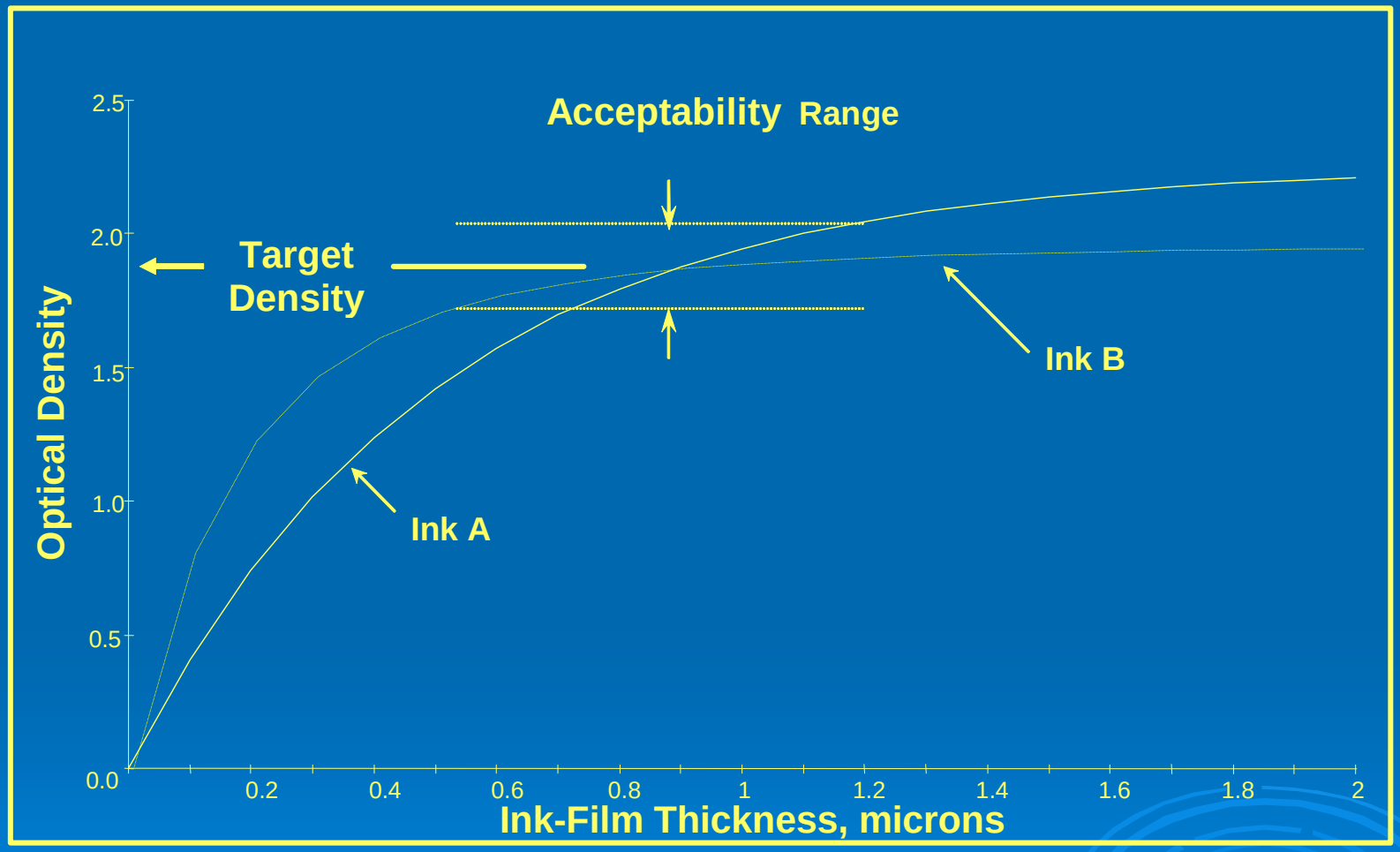
You can make measurements of the light absorbing properties of the ink film after it has been transferred to the substrate.

Describing Functions

are what quantify the relationship between the measurements of the light absorbing properties of an ink film and

the ink-film thickness itself.

Optical Density Function



DESCRIBING FUNCTIONS

Knowing the *Describing Functions* enables you to decide what the thickness of each ink film should be for optimum control sensitivity.

Do you know the

Describing Functions

for the inks you use in your presses?

DATA

Control of ink-film thickness during production involves making judgments about data taken to indicate what each ink-film thickness is.

Do you know the best way to set ink keys to ensure that a uniformly thick film of ink is presented to the plate?

Do you know what to do if the measured data reveal that the ink-film thickness presented to the plate is not uniform?

DATA

V_{in}/unit time = V_{out}/unit time

V_{out}/unit time = Printed area coverage
X Ink-film thickness
X Sheets per unit time

V_{in}/unit time is not spatially uniform, but that's okay.

Setting ink keys in relation to printed area coverage is not necessary, but it is convenient and provides consistency.

DATA

If the data indicate that the thickness of an ink film is not uniform,

- Is it because the start-up transient is still underway?

or

- Because the image is causing ink starvation?

or

- What?

DISTRIBUTION OF DATA

The larger process of printing consists of many smaller processes,

each of which is characterized by small random variations.

The consequence of this is that

THE OUTCOME IS STOCHASTIC.

DISTRIBUTION OF DATA

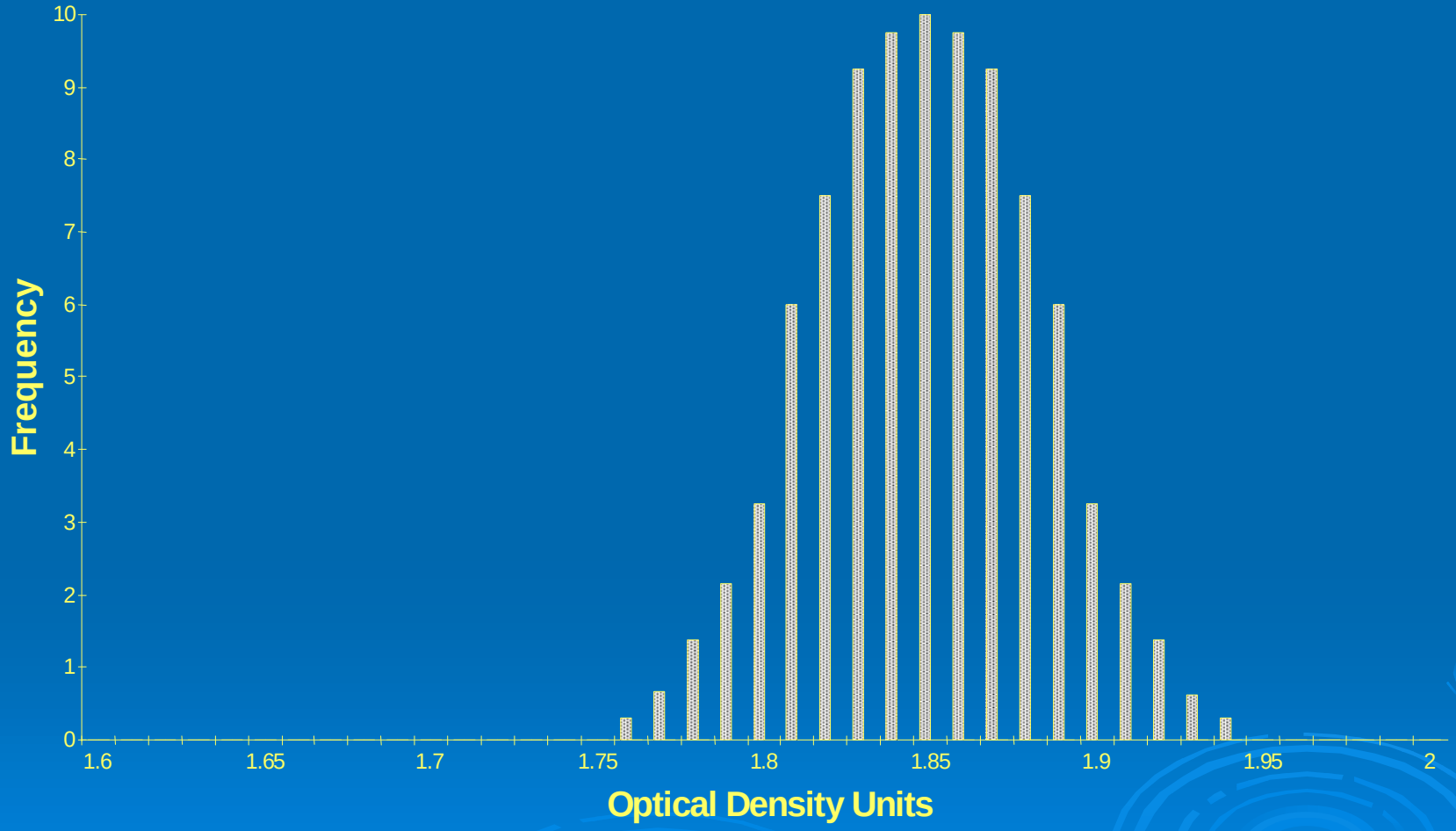
Measurements taken from consecutively printed samples are normally distributed.

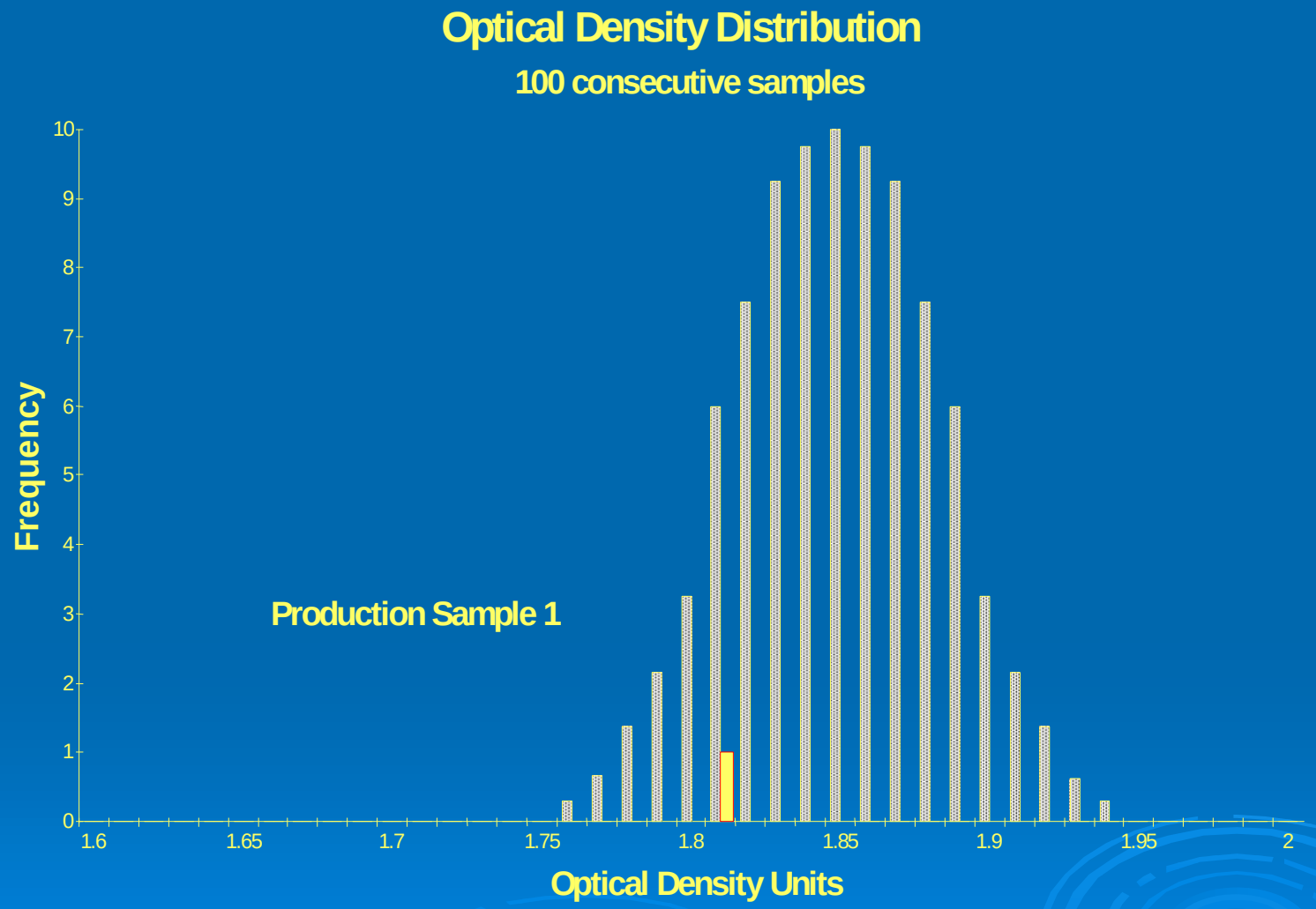
The distributions of these measured data are characterized by

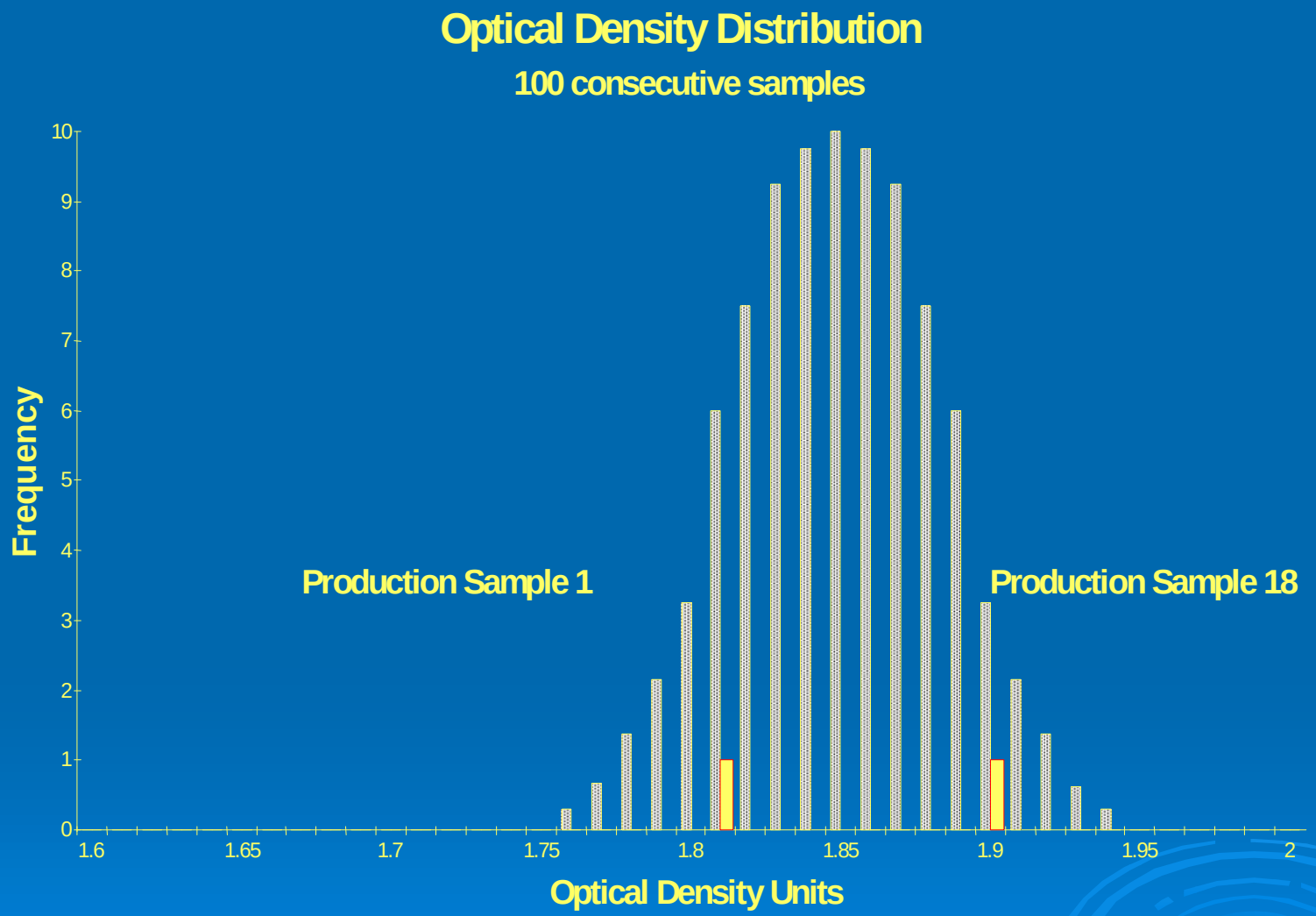
- **Mean values, and**
- **Standard deviations.**

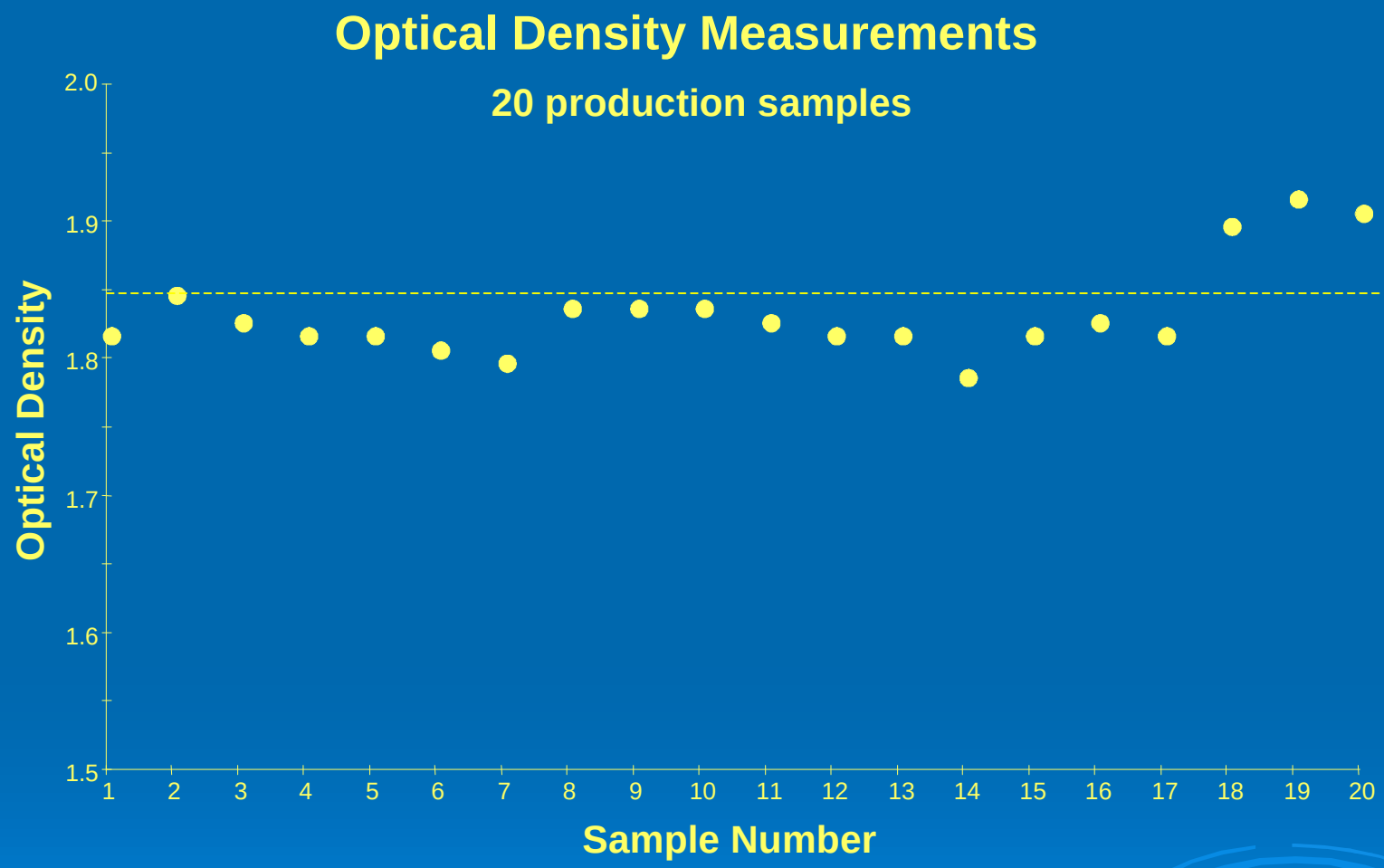
Optical Density Distribution

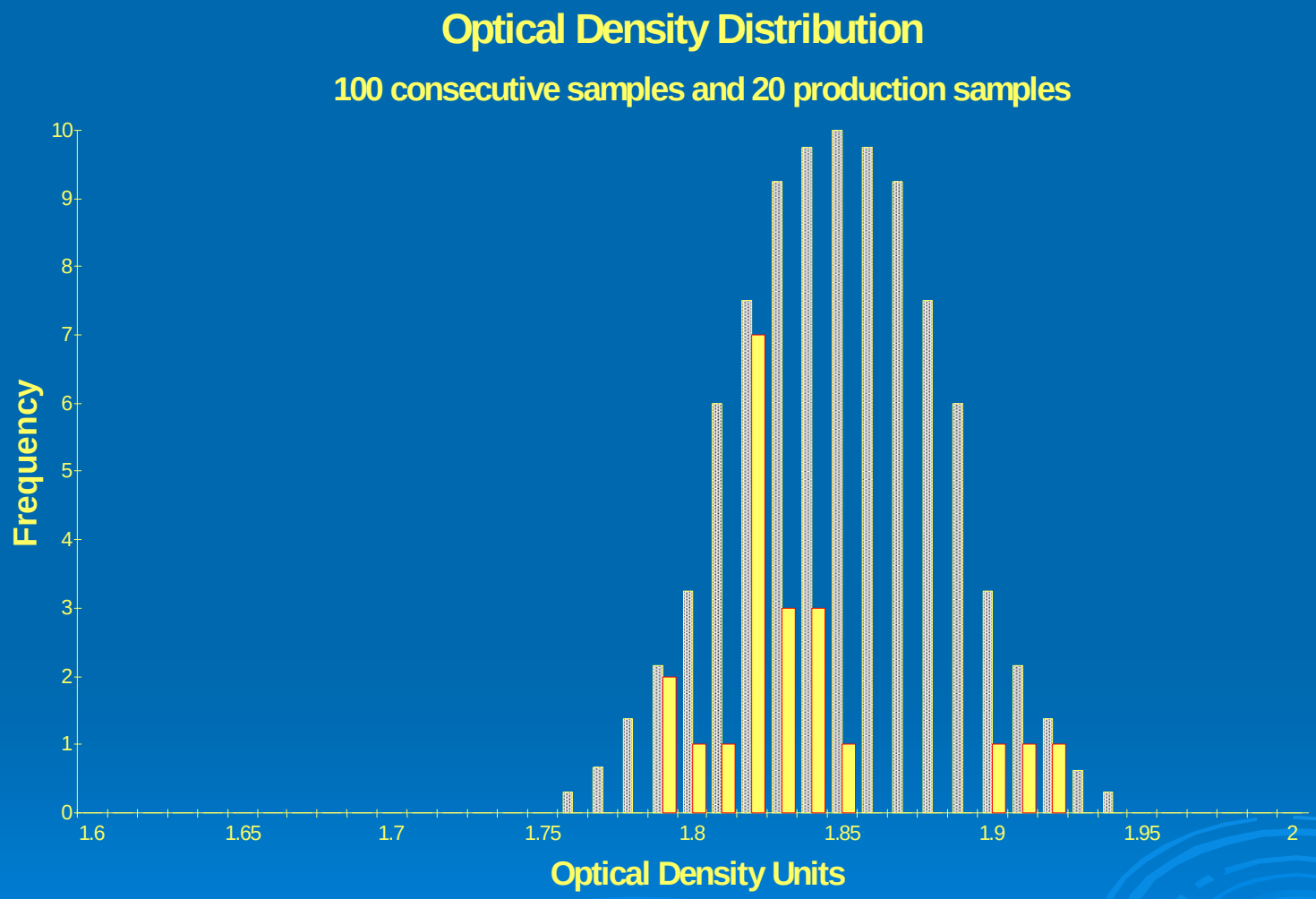
100 consecutive samples




Optical Density Distribution
100 consecutive samples
Frequency
10
9
8
7
6
5
4
3
2
1
0
Production Sample 1
1.6
1.65
1.7
1.75
1.8
1.85
1.9
1.95
2
Optical Density Units


Optical Density Distribution
100 consecutive samples
Frequency
10
9
8
7
6
5
4
3
2
1
0
Production Sample 1
Production Sample 18
1.6
1.65
1.7
1.75
1.8
1.85
1.9
1.95
2
Optical Density Units


Optical Density Measurements
20 production samples
Optical Density
2.0
1.9
1.8
1.7
1.6
1.5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Sample Number


Optical Density Distribution
100 consecutive samples and 20 production samples
Frequency
10
9
8
7
6
5
4
3
2
1
0
1.6
1.65
1.7
1.75
1.8
1.85
1.9
1.95
2
Optical Density Units

DISTRIBUTION OF DATA

The standards your process is expected to meet are characterized by

- **Target values, and**
- **Acceptance tolerances.**

Do you know what the standard deviations of your process data are compared to the acceptance tolerances?

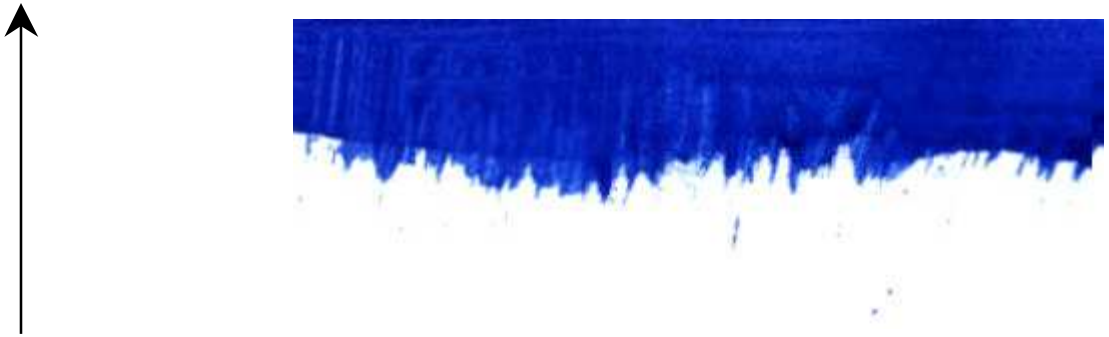
DOT FIDELITY

Measurements and control of ink-film thickness are carried out in relation to areas of coverage we call solids, but a substantial part of the value of printed materials derives from the presence of what we call half-tones or dots, alpha-numeric characters, and end-user tools like bar codes.

These elements of the final product can become problematic if they are *distorted*.

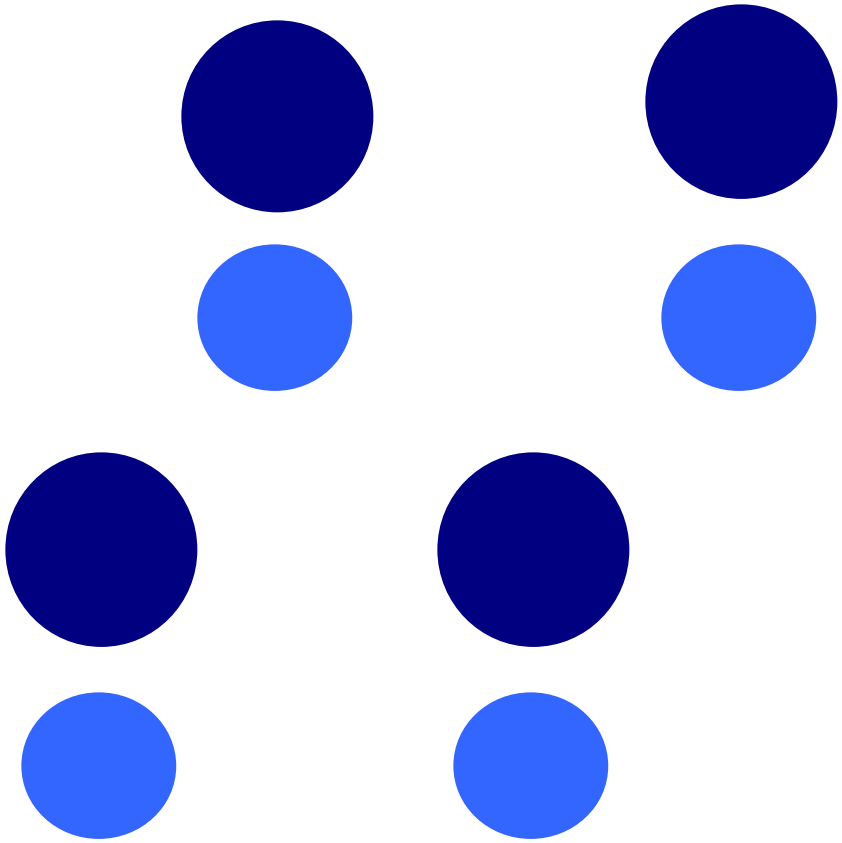
DOT DISTORTION

Direction of sheet travel

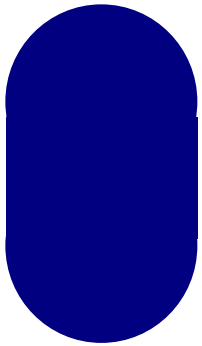


DISTORTION CAUSED BY INK-WATER IMBALANCE

DOT DISTORTION



BACKTRAP DOUBLING



SLUR

Dot Fidelity

Instruments that measure the indicators of ink-film thickness can alert press crews to the possible presence of dot distortion, but they are of little or no use in diagnosing the character of and the cause of dot distortion.

A press operator needs to have access to a microscope.

DOT FIDELITY

Can you identify and characterize dot distortion that arises from

- **Ink-water imbalance?**
- **Slur?**
- **Backtrap doubling?**

If dot distortion is confused with dot-gain, something that ain't broke might get fixed.

DECISIONS

Who will decide

What parameters will be measured and used to characterize the process?

What values of these parameters to use for product acceptance?

What effort to invest to quantify the relationship between these parameters and the parameters you can directly control?

DECISIONS

Who will decide how to

Acquire and read measured data?

Quantify the stochastic parameters?

Deal with dot fidelity issues?

Use all of the above to capitalize on the dollar opportunity available in your metal decorating operations?