WHITE PAPER

SlideMate Laser Achieves 100% Barcode Scannability with the Epredia E1000 Dx & the 3DHISTECH PANNORAMIC 1000 DX Digital Pathology Slide Scanners

Abstract

In pathology laboratories, the adoption and integration of digital slide scanners into the pathology workflow is becoming increasingly prevalent[1]. A factor that can impact workflow efficiencies within the digital pathology system is barcode quality and placement on the slide tab. Studies have shown the highest error rate on a whole slide imager can come from the inability to scan the barcode on the slide[2].

Inadequate barcode printing or slide label quality can lead to workflow interruptions caused by barcode reading issues. Barcodes that are smudged, printed poorly, or misaligned may not be readable by the scanner. Barcodes must be placed in specific areas of the slide for scanners to capture them correctly. If a label is misplaced, partially covered, or not in the designated area, the scanner may not be able to read it and as a result manual intervention may be required.

This can cause increased downtime, increased staff costs associated with handling and rescanning slides and delays in diagnostic reporting[3].

One way to improve the overall digital pathology workflow for laboratories may be to adopt improved labelling technologies to assist in producing high quality barcodes printed directly onto the slide to support reducing barcode reading errors issues.

Printed barcodes for slide labeling can be accomplished in a number of ways. Various technologies exist to print information directly on the slide while other options, such as printing information on a slide label and applying the slide label to the slide, are available for laboratories.

Objective

The purpose of this study was to evaluate the scannability rate of 2D barcodes generated by the Epredia SlideMate Laser slide printer that have been printed directly on SlideMate Laser PLUS slides on the Epredia E1000 Dx Digital Slide Scanner*† and the 3DHistech P1000 DX Digital Slide Scanner†.

Methods

Slide printing

1000 SlideMate Laser PLUS microscope slides (manufactured by New Erie Scientific, Epredia) were printed with 2D, data matrix barcodes and identifying text directly onto the slide using the SlideMate Laser slide printer (manufactured by Fa-Tech Diagnostics, SRL, subsidiary of PHC Group). Each barcode contained information such as sample identifier, stain name, block identifier and year. Slides were grouped by case number with 10 slides printed per case and each slide within the group containing a different stain so each slide contained a unique barcode to identify it.

Image 1:
SlideMate Laser

† IVD units not for sale in the US, and select other geographies globally. For more information, please contact your local Epredia specialist.

* E1000 Dx Digital Pathology Solution is 510k pending.

SlideMate Laser prints text and barcodes at 600dpi (dots per inch) which can enable labs to include more identifying information for the sample on the slide tab. Other printer technologies such as thermal transfer and inkjet print at <300dpi. The resolution of the print may have an effect on the scannability of downstream instrumentation.

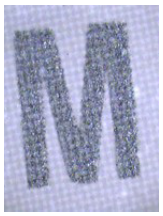
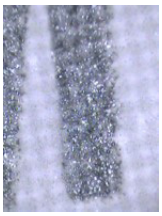
	4x magnification	10x magnification	Resolution
Thermal Transfer Printing			300 dpi
Infrared Laser Printing			>600 dpi

Table 1:
Magnified images of the letter M directly printed on a slide tab with 2 different technologies, thermal transfer and infrared laser printing. Differences in the resolution can be seen at 4x and 10x magnification

The 1000 microscope slide consisted of 200 slides of each tab colour: white, blue, pink, green, yellow.

SlideMate Laser technology uses specialty slides to produce 600dpi indelible printing directly on the slide tab. As the contrast of print may differ for each colour of slide tab, all 5 colours of available slide types were included in this testing.

Image 2:
SlideMate Laser PLUS slides with information printed directly on the slide tab with SlideMate Laser.

Staining

After slides were printed on SlideMate Laser, they were stained using the Gemini AS automated slide stainer (manufactured by Shandon Diagnostics, Epredia) with the protocol outlined in Table 2.

Staining Procedure

Station	Solution	Time
1	Xylene	3 minutes
2	Xylene	3 minutes
3	Xylene	3 minutes
4	100% Reagent Alcohol	1 minute
5	100% Reagent Alcohol	1 minute
6	100% Reagent Alcohol	1 minute
7	Running water	1 minute
8	Hematoxylin 7211	2.5 minutes
9	Running water	1 minute
10	Clarifier 2	0.5 minutes
11	Running water	1 minute
12	Bluing Reagent	1 minute
13	Running water	1 minute
14	95% Reagent Alcohol	0.5 minutes
15	Eosin-Y 7111	1 minute
16	100% Reagent Alcohol	1 minute
17	100% Reagent Alcohol	1 minute
18	100% Reagent Alcohol	1 minute
19	Xylene	1 minute
20	Xylene	1 minute
21	Xylene	1 minute

Table 2:
Protocol for Hematoxylin and Eosin staining on Gemini

Upon completion of staining, slides were dried in a fume hood, and transferred to E1000 Dx slide baskets.

Image 3:
Printed slides that have been transferred into slide baskets and loaded into E1000 Dx.

Digital Slide Scanning

- Epredia E1000 Dx Digital Slide Scanner
- 3DHISTECH PANNORAMIC 1000 DX Digital Slide Scanner

Slides baskets, each containing 20 slides, were loaded into the E1000 Dx and the scanner was set-up to scan the slide tab to capture the relevant sample information in the barcode. A scan is classified as successful when the instrument scans the barcode and the information is populated in the scanner software. The barcode scanning technology used to obtain this data is VintaSoft Barcode .NET SDK.

Image 4:
E1000 Dx Digital Slide Scanner

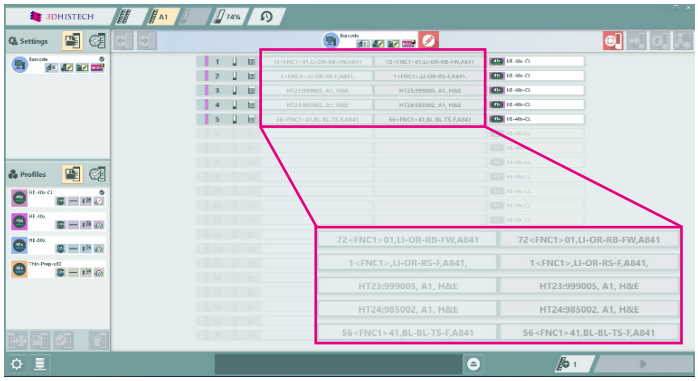


Image 5:
Example of scanning software interface demonstrating the scanner successfull picking up on barcode information. Columns 2 & 3 demonstrate barcode information has accurately been transferred from the slides directly into the scanning software platform.

If the scanner is unable to accurately scan the slide tab to identify the sample information, the software will leave the first column empty and add a date stamp (DS) to the slide placeholder in the software.

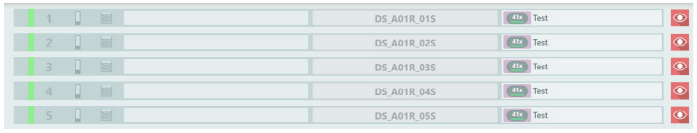


Image 6:
Example of date stamped (DS) files within scanning software.

Images of all slide tabs were reviewed on the E1000 Dx scanning software in order to confirm the accuracy of the barcode scanning.

The same test protocol was then replicated on the P1000 DX Digital Slide Scanner.

Results

For both barcode scannability tests, each microscope slide barcode was successfully scanned and the data was correctly placed into the software based on the information within the barcode. No slide tabs were unable to be read so as a result, no date stamp (DS) results were seen.

While scannability may be affected by the color of the slide tab for text printed directly onto the slide, no difference in scannability was seen on the 5 slide colors tested, white, blue, green, pink, or yellow.

As data was printed directly on the slide tab, issues such as stuck labels or destroyed slides were not seen in this study[2].

The Epredia E1000 Dx Digital Slide Scanner achieved a barcode scannability rate of 100% on the printed and stained SlideMate Laser printed slides. No barcodes were deemed inadequate or unscannable by the E1000 Dx scanner or software.

The P1000 DX Digital Slide Scanner also achieved a barcode scannability rate of 100%.

Conclusion

A barcode scannability rate of 100% was seen on the printed slides generated on the SlideMate Laser slide printer and scanned on the E1000 Dx and P1000 DX digital slide scanners. These results indicate that high quality barcode printing with a 600dpi resolution and accurate data placement on the slide tab can support digital pathology in the laboratory to enable labs to reduce the amount of manual intervention needed in one of the most error-prone parts of the digital slide scanning workflow.

References

1 Hanna, M.G., Ardon, O., Reuter, V.E. et al. Integrating digital pathology into clinical practice. Mod Pathol 35, 152–164 (2022). https://doi.org/10.1038/s41379-021-00929-0

2 Hanna, M.G., Reuter, V.E., Ardon, O. et al. Validation of a digital pathology system including remote review during the COVID-19 pandemic. Mod Pathol 33, 2115–2127 (2020). *https://doi.org/10.1038/s41379-020-0601-5*

3 Hartman DJ, Pantanowitz L, McHugh JS, Piccoli AL, OLeary MJ, Lauro GR. Enterprise Implementation of Digital Pathology: Feasibility, Challenges, and Opportunities. J Digit Imaging. 2017 Oct;30(5):555-560. doi: 10.1007/s10278-017-9946-9. PMID: 28116576; PMCID: PMC5603431.

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