sciDROP NANO
Versatile and Precise Nanoliter Dispensing for GENSPEED's Multiplex Point of Care Testing System

SCIENION's sciDROP PICO technology is well established for precise low volume dispensing in the picoliter range. sciFLEXARRAYER enables precise printing on all kinds of supports (flat or three-dimensional – such as slides, biosensors, microwells, microtiter plates or micro fluidic cartridges) thanks to its x-, y-, z-robust axis system and its drop volume control software.
In some applications though dispensing a larger volume (nanoliters, microliters) is required, when e.g. larger areas on sensors need to be covered, filled with larger sample volumes or printed with lines.

To cover applications demanding large volume dispensing, SCIENION recently launched sciDROP NANO technology. sciDROP NANO has a solenoid valve technology to generate droplets in the nL volume range. Print samples can be water-based solutions and organic solvents with surface tensions up to 28 mN/m. Viscosity of the samples can be as high as 22 mPa*s. They can be dispensed as bulk from 1, 5, 10 or 50 mL reservoirs or with aspirate-dispense mode. The sciDROP NANO technology is available as stand-alone printer in SCIENION's S3, S12, and SX systems with a maximum of 8 channels and also in combination with sciDROP PICO printing technology.

GENSPEED Biotech is an Austrian company, that develops, produces and distributes IVD-CE certified rapid testing solutions based on a patented combination of microfluidics, miniaturized opto-electronics and automation. The GENSPEED technology can be applied to both nucleic acid (DNA/RNA) based detection of pathogens and protein-based analytics of biomarkers, respectively. GENSPEED allows concentration measurements of up to 8 biomarkers in just one drop of blood and in only 15 minutes. The CE-IVD certified GENSPEED xPOC Immuno Multiplex technology enables the next step towards personalized medicine. Available test-panels include rapid tests for detection of hospital acquired infections and tests for identification of pathogens associated with periodontitis.

Figure 1. 8 sciDROP NANO Dispensing Channels System.

Figure 2. GENSPEED xPOC Multiplex System for parallel detection of up to 8 analytes.

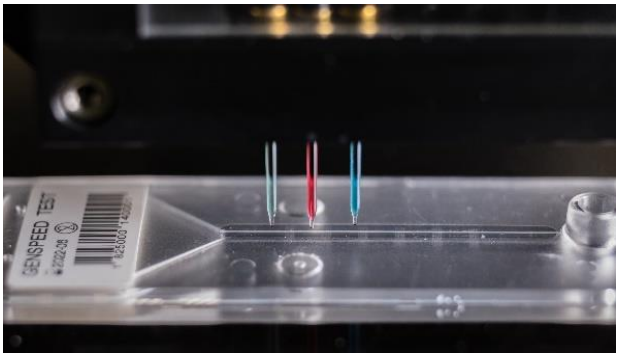

Figure 3. Illustration of simultaneous spotting of three lines of capture probes with sciFLEXARRAYER onto GENSPEED's microfluidic chip.

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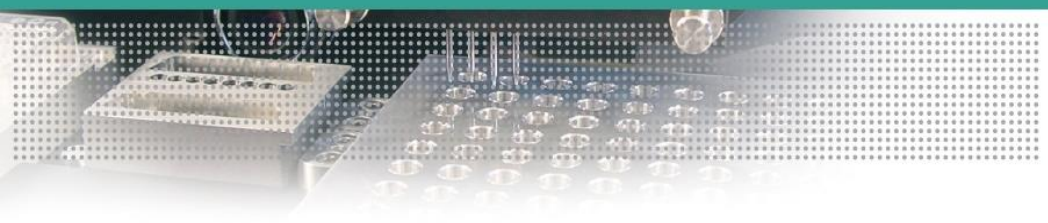

Application of sciDROP NANO printing technology for capture probe deposition onto GENSPEED chips

A key step in the manufacturing process of the GENSPEED microfluidic chips is the printing of the capture probes. In the current production process lines of the capture probes are printed on a polymer foil using a capillary printer. The foil is then bonded to the chip with the microfluidic channels. sciDROP NANO printing technology was used to optimize the probe deposition process. This technology allows printing of full lines as well as line segments. GENSPEED qualitative MRSA test was used as the test system to evaluate the sciDROP NANO technology. The printing parameters like speed, line thickness and volume were adjusted to reach the required specifications. Table 1 shows sciDROP NANO print parameters in comparison to a capillary printing technology.

Table 1. Overview of printing parameters.

	Capillary printer	sciDROP NANO (full)	sciDROP NANO (segment)
Speed	20 mm/s	20 mm/s	20 mm/s
Thickness	1 mm	1 mm	1 mm
Volume	150 nL/cm	512 nL/cm	512 nL/cm
Print Volume	4.1 µL	13.8 µL	2.2 µL

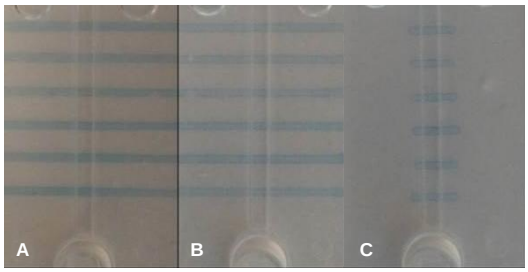

Figure 4. sciDROP NANO Head Camera Images of printed full lines by capillary printer (A) and sciDROP NANO (B), which also allows printing line segments (C).

The results of the chemiluminescence MRSA measurements on chips using both printing technologies are summarized in Figure 5. The results indicate a similar chip performance.
sciDROP NANO technology allows also printing of line segments instead of whole lines to **reduce consumption of print samples**, as illustrated in Figure 4. This way 83% sample materials could be saved. Especially when printing costly antibodies, this procedure is an advantage. Printing line segments only requires 16.3% of the sample amount compared to full line printing with sciDROP NANO.

In addition, sciDROP NANO can be used to print array of spots on any kind of support material, Figure 6.

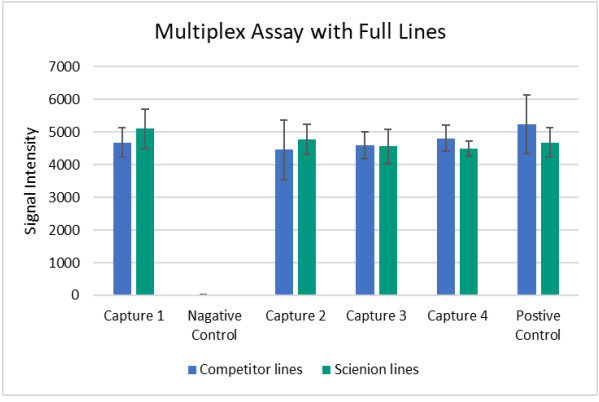

Figure 5. Comparison of signal intensities of printed full line printing between capillary printer (blue) and sciDROP NANO (green).

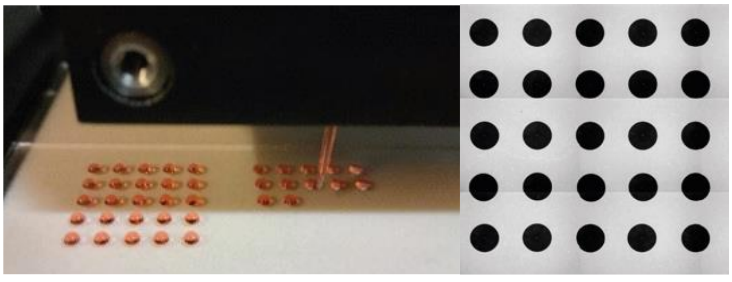

Figure 6. Printing of spot patterns using sciDROP NANO. 1 µL per spot results in 1.4 mm spot diameter.

Conclusion

The sciDROP NANO is a versatile nanoliter dispenser providing precise volume deposition (CV of less than 5% in volume dispensing and less than 10 µm for spot positioning). In respect to the required application, sciDROP NANO provides flexibility to choose array, line segment or full line printing. In this way optimal production settings can be found for each individual application. sciDROP NANO printing technology was successfully applied for oligonucleotide printing in the loading of the GENSPEED microfluidic chips. The sciDROP NANO printing technology can be seamlessly integrated in sciFLEXARRAYER S100 high throughput production lines.

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