

REPLACING MICROPLATE-BASED TECHNOLOGY WITH ARRAY TAPE: A TUTORIAL

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The motivation to maximize laboratory automation is as powerful as it is simple — laboratories must produce more high quality data — faster and cheaper. Today, most envision high throughput (HTP) automation as a robotically-driven integration of individual instruments that process and score samples in microplates. In this paradigm, increasing throughput means increasing the number of individual instruments and robotic plate handlers. Very quickly, these HTP systems become large, expensive and complex.

The Array Tape™ Platform dramatically shifts this paradigm by replacing microplates with Array Tape, a continuous plastic strip embossed with assay wells in customized shapes, sizes and formats. Array Tape is thin and flexible, allowing 200 microplate equivalents to be spooled onto

a reel 90 mm wide by 560 mm in diameter for storage or large batch thermal cycling.

Array Tape is used with instruments included in the Array Tape Platform: multi-well liquid handling and sealing (Nexar), fluorescence scanning (Araya) and high capacity thermal cycling (Soellex). (Figure 1) The innovative designs of Array Tape and inline instrumentation virtually eliminate robotics required to transfer microplates, providing a level of hands-free automation and throughput that transforms the workflow of HTP laboratories.

Several of the world's largest and most technologically-advanced HTP plant genotyping laboratories have replaced microplate-based technology with Array Tape automation for low density genotyping. In this tutorial, their experience is highlighted to illustrate the potential of Array Tape automation to

provide high quality data, faster and cheaper than microplate-based technology.

HIGH-QUALITY DATA

Laboratory automation must provide data quality similar to or better than existing labor intensive processes. The simplified workflow with Array Tape automation reduces manual handling of analytical material and may contribute to higher data quality. For example, studies show Array Tape automation outperforms microplate-based technology by increasing data return and decreasing rework. (Figure 2)

THROUGHPUT

Laboratory automation must support current and future throughput goals. Therefore, it is imperative to choose a solution that has the scalability to meet increased throughput demands as well as the flexibility to support additional processes and applications.

The design of Array Tape and the supporting platform dramatically increases throughput by providing: 1) continuous, inline automation of liquid handling, sealing, and fluorescence scanning and 2) large capacity thermal cycling.

Continuous inline automation for liquid handling (Nexar) and fluorescence scanning (Araya)

Workflow Solutions



FIGURE 1. Array Tape Platform.

Indexing holes running along each edge of Array Tape allow spooled assay wells to be unwound and accurately guided through inline modules for continuous, flexible, automated processing. This efficiency translates into optimized workflow that increases throughput and the relative data point return on investment in capital by 1.8 times and labor by 2.2 times compared to microplate-based systems.

When capacity requirements increase quickly, the scalability of the Array Tape Platform allows laboratories to rapidly increase throughput and minimize turnaround time. Using SNP genotyping as an example, 76,800 reactions wells (one reel of Array Tape) can be processed, sealed, thermal cycled and scanned in a single eight-hour workday. To accommodate a large influx of samples, this throughput can be doubled to 153,600 wells/day with workflow optimization schedules over several days. To meet even greater and more consistent sample demands, throughput can be tripled (230,400 wells/day) with the addition of a second, four-tip dispense jet module.

LARGE CAPACITY THERMAL CYCLING

Three reels of sealed and spooled Array Tape (230,400 assay wells) may be processed simultaneously in the Soellix, three-chambered water bath. The thin plastic walls of Array Tape

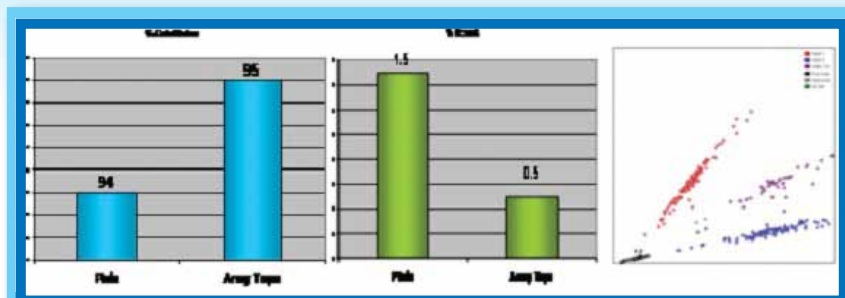


FIGURE 2. Data quality in Array Tape Platform compared to microplate-based technology.

cycling and sharper temperature transitions compared to microplates, which would require 18 water baths (32 microplate capacity) or 150 (4 microplate capacity) block heaters to process a similar number of reaction wells in the same amount of time.

ECONOMIC INCENTIVES

The economic incentive for increasing automation is a balance between cost savings and capital investment. Savings in the most costly areas of HTP processing—consumables, reagents and direct labor—is critical. Multiple HTP laboratories have reported an ROI for Array Tape automation in six months or less due to savings in these key areas (Figure 3).

ECONOMICAL ARRAY TAPE CONSUMABLE

Array Tape and cover seal cost approximately half

plastic and uses a less expensive manufacturing process than microplates. For laboratories that require flexibility in the design and configuration of assay wells, this cost savings is augmented by the ability to inexpensively customize the size, shape and density of wells in Array Tape.

ASSAY MINIATURIZATION

Array Tape assay wells are miniaturized (1µl), saving up to 80 percent in reagent costs compared to “low volume” microtiter plates (5µL). The Nexar liquid handling system supports low volume dispensing (800nL, ≤5% CV) required for these miniaturized reaction assemblies.

ELIMINATE MANUAL AND ROBOTIC HANDLING

Efficient, automated movement of assay wells between process points is cost effective on two levels. First, inline automation frees highly-trained technicians from tedious laboratory tasks prone to human error. Second, large, complex and expensive robotic microplate handlers are eliminated from HTP workflow, reducing laboratory footprint, process complexity and capital expense.

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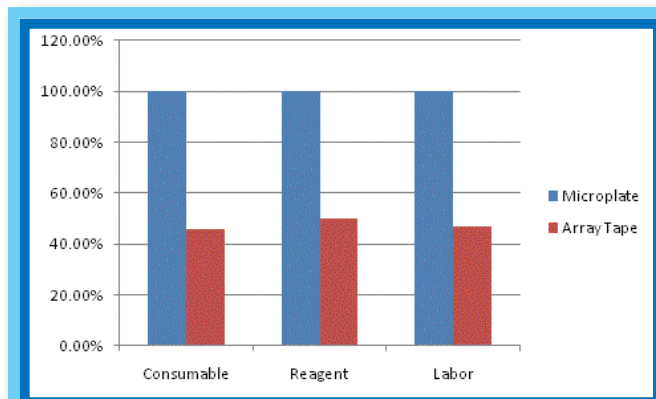


FIGURE 3. Percent cost reduction for genotyping.

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