



Accuracy and Precision for the Sciclone ALH 3000

Evaluation of Second Generation Disposable Tip Accuracy and Precision for the Sciclone ALH 3000 using the Artel MVS™ Calibration Kit

Abstract

The development of a second generation of disposable tips capable of being loaded directly on the Sciclone ALH 3000 deck without the need for a separate tip attachment device required the evaluation of the accuracy and precision of the new tip and mandrel design. This study used the Artel MVS system to rapidly evaluate and compare the dispensing accuracy and precision of the 2nd generation disposable tips to the 1st generation tips. The current study shows that there is no discernable difference between either the accuracy or precision results for 1st vs. 2nd generation tips.

I. Introduction

Many liquid-handling applications require the use of disposable tips, and several of the current automated solutions require a special device or "station" where the tip loading takes place. This requirement puts a constraint on the flexibility of the system, which may decrease efficiency. Furthermore, it is impossible with many of these devices to load tips with an "offset", in order to load a single row or column of tips on a 96 or 384-channel pipetting array. The evaluation of liquid-handling precision frequently receives more attention in the automated liquid-handling community than accuracy, however we were interested in evaluating both simultaneously. We therefore used the Artel MVS system to calibrate with NIST traceable accuracy while concurrently collecting precision data. We demonstrate here that the 1st and 2nd generation tips show no discernable difference in either the accuracy or precision results respectively. Furthermore, with the use of the Artel calibration system, we were able to collect data points very rapidly.

II. Methods and Materials

MVS dyes were transferred from an open reservoir to a MVS 96-well "characterized" microtiter plate using the Sciclone ALH 3000 1st and 2nd generation 96-mandrel tip arrays (see Figure 1).

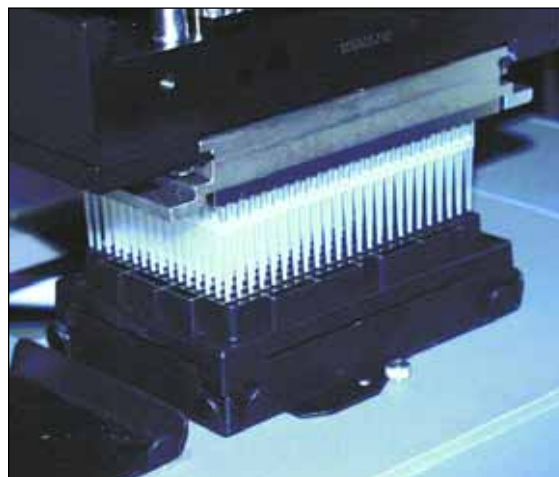


Figure 1: The same liquid transfer protocol was used for both 1st and 2nd generation calibrations. The method consisted of the following steps:

- 1) Aspirate a pre-air gap.
- 2) Aspirate the desired amount of dye from the dye reservoir.
- 3) Dispense dye into MVS characterized microtiter plate containing MVS bulk solution.
- 4) Mix.

After the method was run, the plate was manually analyzed using the Artel MVS system. For the 2nd generation tips, after the first plate was read, a correction was made in the Sciclone software to adjust the accuracy of the aspiration. Both pre- and post-calibration results are shown in Table 1. Three plates were run for each volume transferred.

Requested	1 ST GENERATION TIPS			2 ND GENERATION TIPS				
	Mean	CV	Inaccuracy pre-corr.	Mean	Inaccuracy post-corr.	Mean	CV	Inaccuracy
0.10	0.12	25.0%	20.0%	0.07	-30.00%	0.08	25.0%	-20.0%
0.15	0.15	20.0%	0.0%					
0.20	0.21	14.3%	5.0%					
0.25	0.24	8.3%	-4.0%					
0.30	0.29	6.9%	-3.3%	0.26	-13.33%	0.29	10.3%	-3.3%
0.35	0.34	5.9%	-2.9%					
0.50	0.50	6.0%	0.0%	0.48	-4.00%	0.50	6.0%	0.0%
0.70	0.72	4.2%	2.9%	0.59	-15.71%	0.72	4.2%	2.9%
0.90	0.92	3.3%	2.2%	0.75	-16.67%	0.88	3.4%	-2.2%
1.10	1.09	2.7%	0.0%					
1.30	1.29	2.3%	-0.8%					
1.50	1.48	2.7%	-0.7%	1.40	-6.67%	1.51	2.7%	0.7%
1.90	1.84	1.6%	-3.2%					

Table 1: Comparison of 1st and 2nd Generation Tip Accuracy and Precision.

This data is more easily visualized in the graphs.

In Figure 2 we see that the variation in precision results using 1st and 2nd generation tips appears nearly identical.

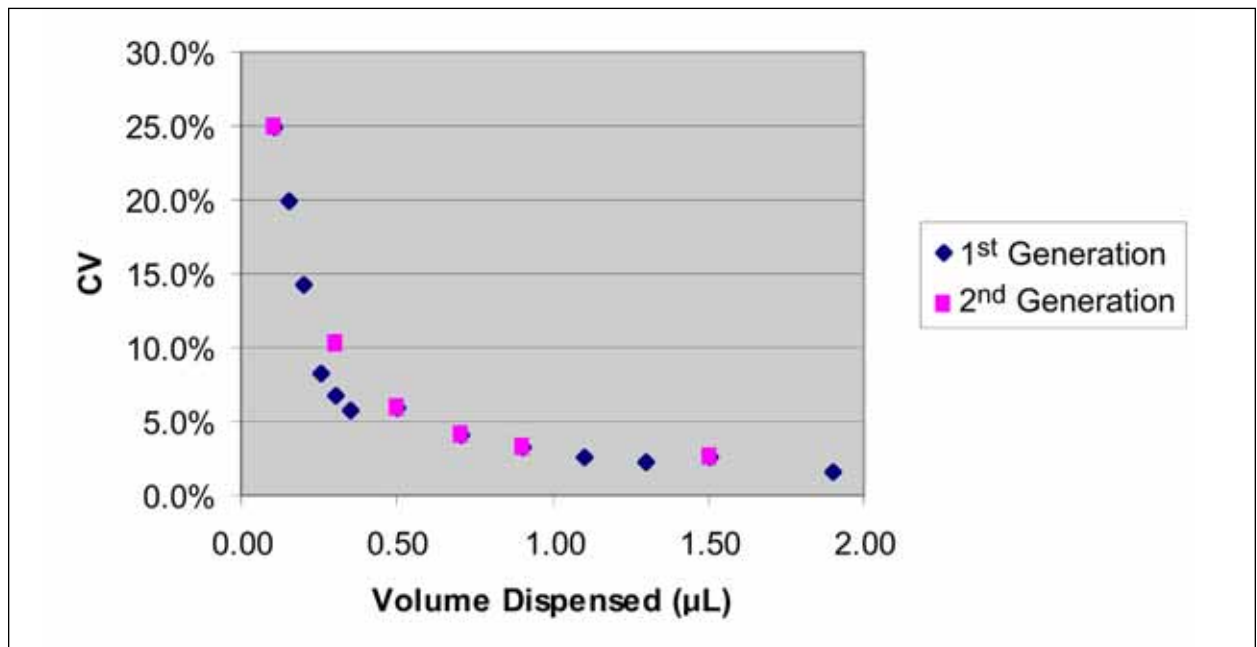


Figure 2: Comparison of 1st and 2nd Generation Tip Precision

We also get a view of "typical" precision well below the minimum operating specifications for an aqueous liquid system. The concentration of the dye may make the behavior vary somewhat from water; however, qualitatively speaking, the wetting properties appear very similar, but the surface tension appears to be a bit higher than pure water.

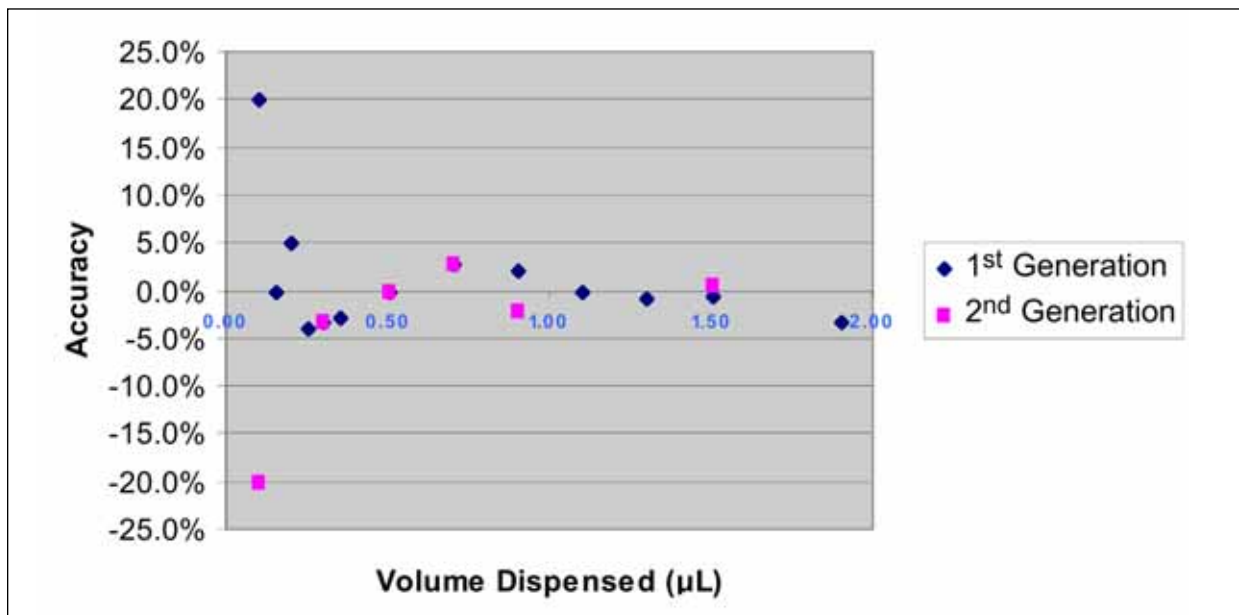


Figure 3: Comparison of 1st and 2nd Generation Tip Accuracy

In Figure 3 we again see that the 1st and 2nd generation tips are performing nearly identically, and that accuracy below 5% can be achieved down to about 0.25 µL. Using the Artel MVS system, it took only a couple of minutes to evaluate each plate for accuracy and precision and then use those results to make a correction to the accuracy, which is shown in Figure 4.

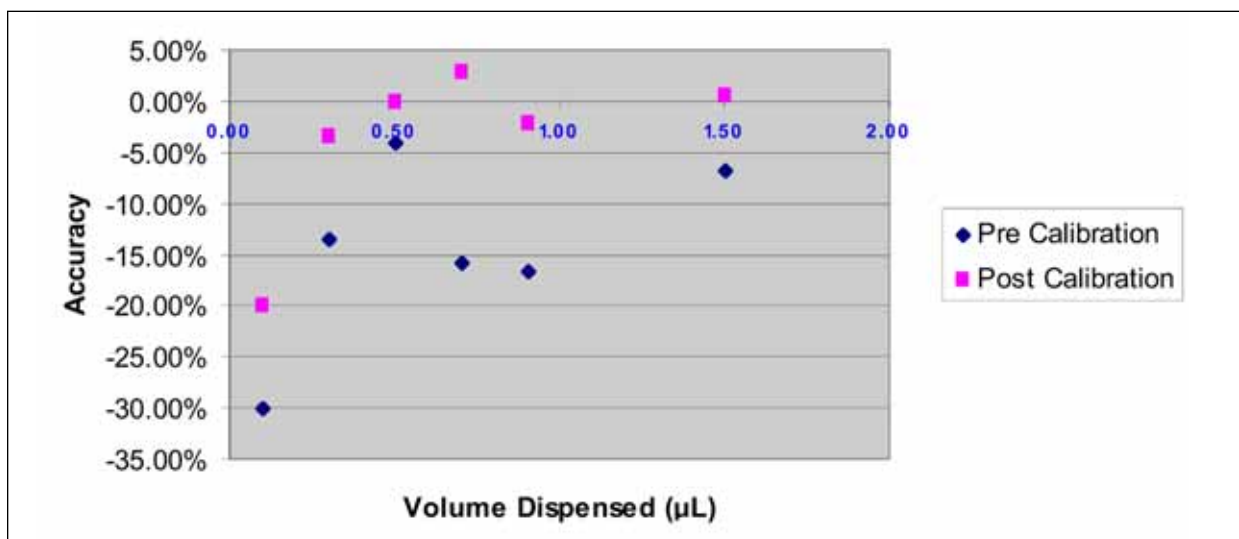


Figure 4: Accuracy Calibration using Artel's MVS Calibration Kit

Figure 4 clearly shows that the pre-calibration accuracy below 1 µL averaged about 15% low for this liquid on this particular instrument. After calibration, accuracy within 5% of the requested volume was achieved down to 0.25 µL.

Conclusion

The results of our comparison demonstrate that there is not a discernable difference in the accuracy or precision of the 2nd generation disposable tips, when compared to the 1st generation tips. The primary advantage of the 2nd generation tips is therefore the ability to load tips without the need for a tip-loading station. Furthermore, we found the use of the Artel MVS kit facilitated rapid simultaneous generation of precision and NIST traceable accuracy data. If more time was spent on the calibration of the instrument, and in establishing the optimal aspirating and dispense speeds, the precision and accuracy could be further improved. However, we believe that this quick calibration (<1day) is sufficient for many applications.

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¹Bradshaw, J.T.; Knaide, T.; Rogers, A. and Curtis, R. Multichannel Verification System (MVSTM): A Dual-Dye Ratiometric Photometry System for Performance Verification of Multichannel Liquid Delivery Devices. JALA, in press 2004.



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