Utilizing Robotics to Increase LAL Testing Efficiency

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ABSTRACT

Endotoxin testing is a regulatory requirement for biological product, drug, and medical device firms per United States Pharmacopeia (USP) Chapter <85> Bacterial Endotoxins Test. Several endotoxin testing applications are currently available in the industry and although the science behind endotoxin testing remains largely the same, the methods have improved over time. Legacy methods such as gel clot (more labor intensive) and kinetic methods (more sensitive and efficient) using plate readers are still widely used in the industry however a degree of analyst manipulation may be required which leads to greater potential for errors due to pipetting and/or assay variability. For large microbiology laboratories, high throughput with minimal analyst touch time is critical as it's more important than ever to "do more with less". The Nexus™ robotic system utilizes the Endosafe®- Multi Cartridge System (MCS) and employs the kinetic chromogenic LAL method using cartridge based technology. The system fully automates the entire LAL sample testing process as well as data entry and reporting to electronic data management systems. High sample throughput, rapid results, less analyst touch time and lower assay error rate have the potential to improve efficiencies in the laboratory, allowing for more focus on continuous improvements and analyst development.
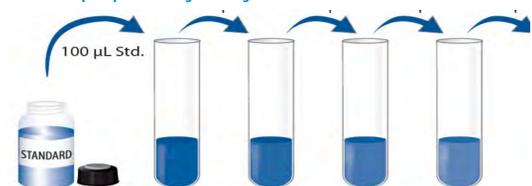
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ENDOTOXIN DETECTION
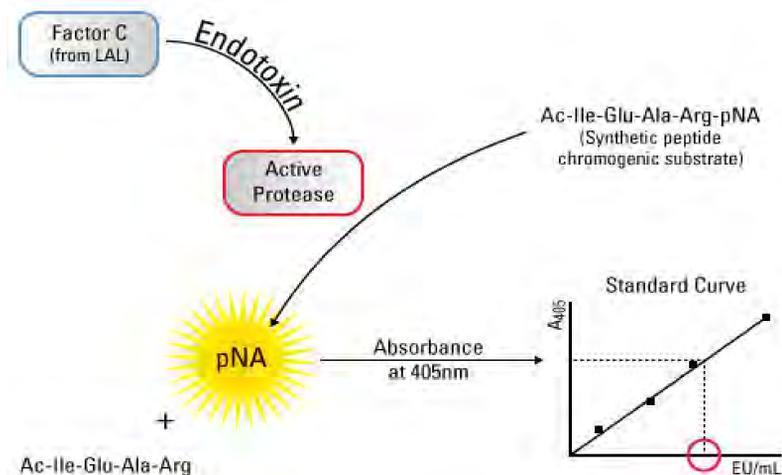
TRADITIONAL METHOD: KINETIC CHROMOGENIC

- Sample dilutions prepared by analyst:
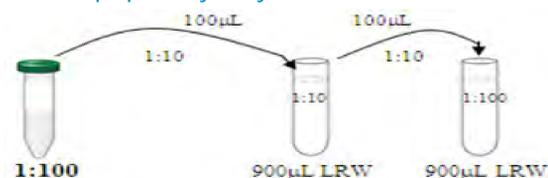
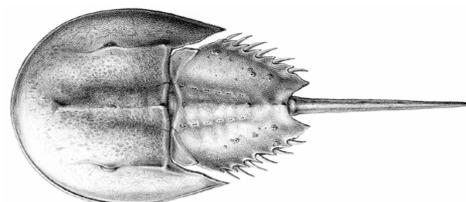
- Standard curve prepared by analyst:

- Analyst plates all samples, standard curve, and controls:

TRADITIONAL METHOD: KINETIC CHROMOGENIC CONTINUED

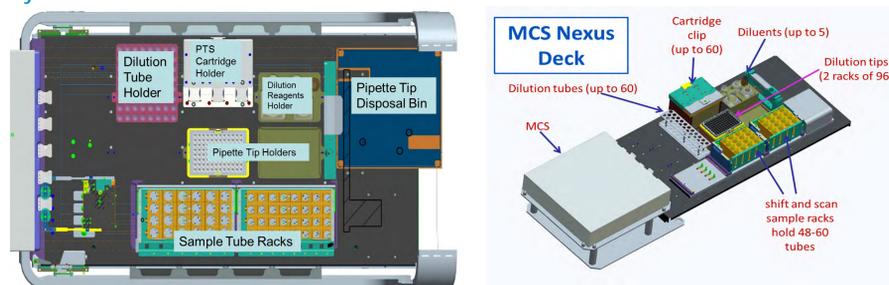- Lysate is added to the plate, all samples and controls by the analyst:

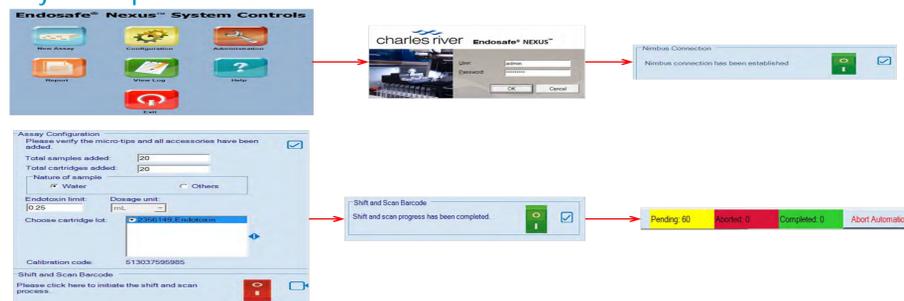- Plate placed on plate reader for approximately 1 hour:

ROBOTIC METHOD: KINETIC CHROMOGENIC CARTRIDGE BASED
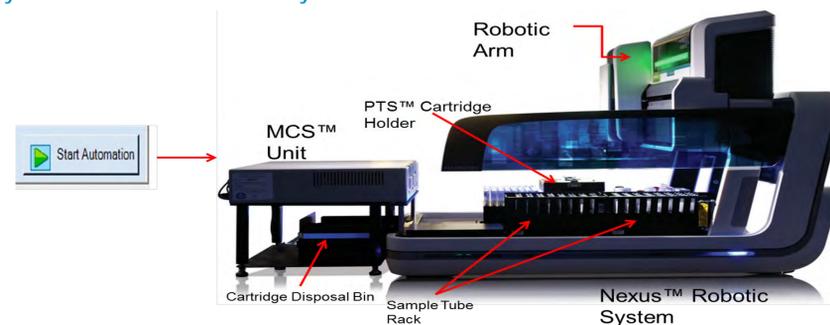
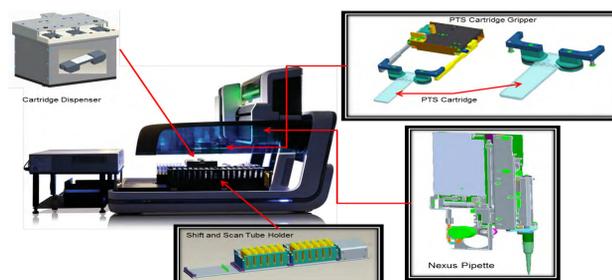- Analyst loads robotic deck:

- Analyst sets ups robotic software:

- Analyst starts robotic automation cycle:

- Nexus™ system performs dilutions, tests samples, discards cartridges, and reports results:
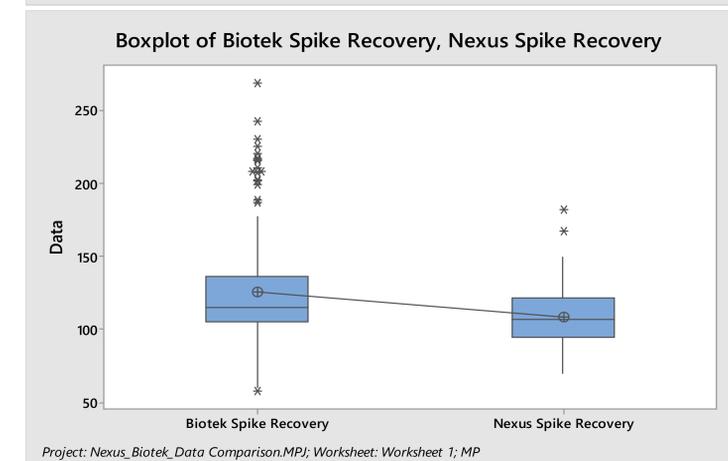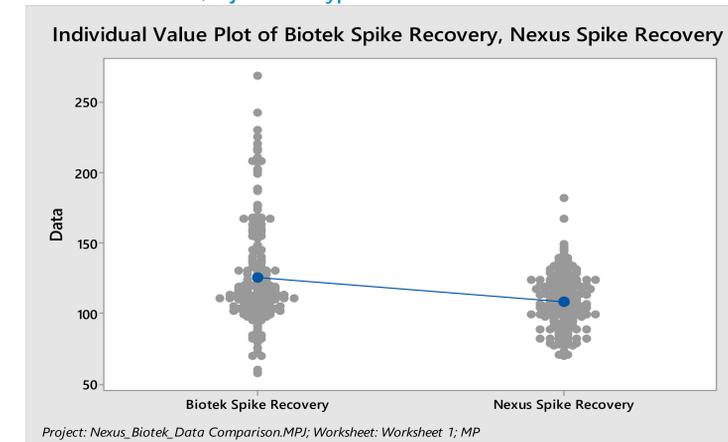

WASTE REDUCTION BENEFITS: TRADITIONAL VS ROBOTIC

The robotic method is capable of testing up to 60 samples during one robotic run. The analyst is involved in setting up the robotic deck and aliquoting samples. After that the robotic system carries out endotoxin testing on all samples from dilutions, sample addition, consumable discard, to data reporting into electronic systems.

Process Step	Traditional Method (Batch: 5-6 Samples)	Robotic Method (Batch: 60 Samples)
Assay Preparation	½ hour – 1 hour	½ hour – 1 hour
Assay Performance	Manual: 2 hours	Analyst Free: 3 hours
Assay Runtime	Plate Reader: 1 hour	
Data Reporting and Review	Manual / Paper: 2 hours	Electronic: 1 hour

REDUCING PIPETTING VARIATION: TWO SAMPLE T-TEST

- n = 200, 95% confidence, P-value = 0.000
- H_0: means of both data sets are equal, H_A: means of data sets are not equal
- P = 0.000 < 0.05, reject null hypothesis

Individual Value Plot of Biotek Spike Recovery, Nexus Spike Recovery

Project: Nexus_Biotek_Data Comparison.MPJ; Worksheet: Worksheet 1; MP

Boxplot of Biotek Spike Recovery, Nexus Spike Recovery

Project: Nexus_Biotek_Data Comparison.MPJ; Worksheet: Worksheet 1; MP

OUTCOME

Although traditional endotoxin testing platforms are robust, accurate, and proven; robotic testing systems have the potential to reduce pipetting variability, reduce analyst LAL assay hands-on time, provide costs savings on endotoxin laboratory consumables, and reduce analyst data entry and review time. This means that the endotoxin assay can be performed with reliable "right first time" metrics, allowing laboratory analysts to focus on other analyst hands-on laboratory tasks, assay validations, and continuous improvement projects.

ACKNOWLEDGMENTS