

# Improved Laboratory Workflow with ARIES®—A Time and Motion Study

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## Abstract

**Introduction:** U.S. hospital systems and diagnostic laboratories are continuously looking for more effective management strategies to maximize productivity, improve workflow, optimize staff time, and reduce the time to deliver results back to healthcare providers.<sup>1</sup> In addition, there is a desire to shift from traditional testing methods to faster, more sensitive, and more cost-effective molecular methods. In this report, we describe a time and motion study conducted with the Luminex® ARIES® system. ARIES® is a fully integrated, automated, sample to answer platform that performs extraction of nucleic acid from clinical samples, followed by real-time PCR detection, data analysis, and results reporting.

**Materials and Methods:** This study compared the hands-on time for ARIES® and Cepheid® GeneXpert® systems. The study compared the hands-on time required to set up various numbers of samples, including data entry, patient/sample information entry, and then starting the run for both systems. The Xpert GBS LB and ARIES® HSV 1&2 assays were used for this study as the Xpert GBS LB assay does not require any pre-processing steps and is most similar to ARIES® workflow. Two different scenarios were tested for ARIES®—i) entering test order, sample, and assay information at the instrument using the barcode reader provided (standard workflow), and ii) sample and cassette scanned in advance and sent to ARIES® by LIS (LIS-enabled). The times measured include the time required for removing cassettes/cartridges from the kit box and individual pouches, adding the sample, placing cassettes in a magazine (ARIES®), and loading the tests onto the systems.

**Results:** The average time needed to load one sample was 71 secs for ARIES® standard workflow, 34 secs for ARIES® in LIS-enabled mode, and 52 secs for GeneXpert. As the number of samples increased to 16, ARIES® standard workflow required 9 mins 52 secs, ARIES® in LIS-enabled mode was 4 mins 58 secs, and GeneXpert was 10 mins 10 secs. A considerable reduction in hands-on time was realized when ARIES® was configured in the LIS-enabled mode (no additional manual scanning required). It was observed that loading 12 samples into ARIES® in LIS-enabled mode reduced the hands-on time by 45% as compared to GeneXpert.

**Conclusion:** In this time and motion study, we found that as the number of samples approached six, the set up time favored ARIES® as less hands-on time and fewer user interactions were required. This pattern repeated at each multiple of six samples, since specific steps are constant on ARIES® for groups of one to six samples. However, setting up a run for a single sample was 19 secs faster on GeneXpert. Overall, ARIES® demonstrated enhanced simplicity, reduced hands-on time, and less chance for user error as compared to the GeneXpert system.

## Introduction

In recent years, there has been a significant increase in the availability of more advanced molecular methods and technologies, often with improved ease of use. Currently, a number of FDA-cleared molecular tests are available, and diagnostic laboratories are implementing these tests and adapting the laboratory to lean methodologies. The concept of lean thinking focuses on testing products and materials in the most cost and time efficient manner. Application of lean principles in hospitals can help determine the optimal and most effective placement of frequently used instruments and supplies, which reduces hands-on time and technician costs.<sup>2</sup> The objective of this Time and Motion study was to compare the workflow efficiency of Luminex ARIES® to that of Cepheid® GeneXpert®, which serves as an example of an automated real-time PCR assay system.

## Materials and Methods

This study was designed to compare the hands-on time required to set up various numbers of samples, including any required data entry and patient/sample information, and starting the assay run for ARIES® and GeneXpert® (GX-XVI-R2). The Xpert GBS LB and ARIES® HSV 1&2 assays were used for this study. The Xpert GBS LB assay does not require any pre-processing steps and is most similar in procedure to the ARIES® HSV 1&2 Assay.

Two scenarios for ARIES® were tested:

- The first scenario involved manually entering an order, sample and assay information at the instrument using the barcode reader provided (standard workflow).
- The second scenario assumed that test orders for samples were previously created by a Laboratory Information System (LIS) or an employee responsible for sample accessioning (ARIES® LIS-enabled).

The time calculated for the study includes the time required for removing the cassettes from the kit box and individual pouches, adding the sample, to attach a secondary sample ID barcode to the cassette, placing them in a magazine, and loading them in the system. The total turnaround time required for completion of the assay (i.e., the time required for sample to result) is not included in this study. Similar testing conditions were set up for both the systems prior to the study.



Figure 1: ARIES® Workflow (ARIES® LIS-enabled\*). Same steps followed for any number of samples.

## Results

Table 1: Raw Times (min:sec)

No. of Samples	ARIES® (standard workflow)		ARIES® LIS-enabled*		GeneXpert®	
	1st	2nd	1st	2nd	1st	2nd
1	01:18	01:05	00:33	00:35	00:53	00:51
4	02:43	02:42	01:29	01:26	02:39	02:38
6	03:42	03:48	02:08	02:01	03:51	03:46
8	05:06	05:08	02:50	03:01	05:24	05:02
12	07:14	06:55	04:04	04:08	07:47	07:29
16	10:13	09:30	04:54	05:02	10:02	10:18

Table 2: Average Times (min:sec)

No. of Samples	ARIES® (standard workflow)	ARIES® LIS-enabled*	GeneXpert
1	01:11	00:34	00:52
4	02:43	01:28	02:38
6	03:45	02:05	03:49
8	05:07	02:56	05:13
12	07:04	04:06	07:38
16	09:52	04:58	10:10

- The average time needed to load one sample was 71 secs for ARIES® in standard workflow, 34 secs for ARIES® in LIS-enabled mode, and 52 secs for GeneXpert.
- As the number of samples increased to 16, ARIES® standard workflow required 9 mins 52 secs, ARIES® LIS-enabled mode was 4 mins 58 secs, and GeneXpert was 10 mins 10 secs.
- A considerable reduction in hands-on time was realized when ARIES® was configured in the LIS-enabled mode (no additional manual scanning required). It was observed that loading 12 samples into ARIES® in LIS-enabled mode reduced the hands-on time by 45% as compared to GeneXpert.

\*LIS-enabled simulates a test ordered through a Laboratory Information System (LIS) or a non-lab employee responsible for sample accessioning.

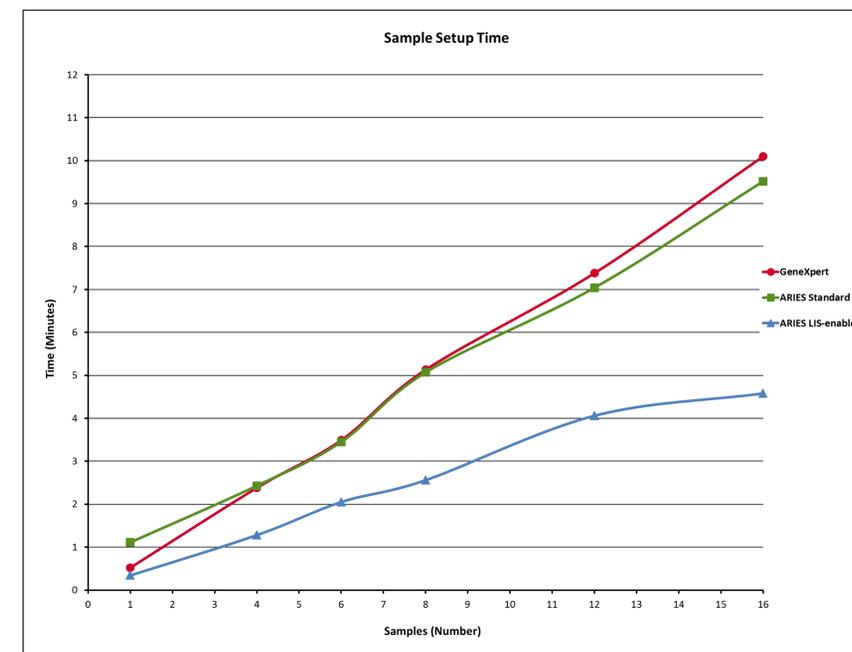


Figure 2: Sample setup time comparison of ARIES® & Cepheid GeneXpert.

## Conclusions

- It was observed that as the number of samples approached six, the set up time favored ARIES® as less hands-on time and fewer user interactions were required, although setting up a run for a single sample was faster on GeneXpert (Tables 1 & 2).
- The sample information input and placement of the cartridge into the machine were the main bottlenecks for the GeneXpert system. For every sample on GeneXpert, the user starts an order, enters a sample ID, scans the cartridge, puts it in a specific module in the instrument and starts the run.
- In ARIES®, the sample and assay information can be entered entirely with a barcode reader and the entire group of six cassettes can be placed into the instrument at one time via the magazine.
- With ARIES®, there is no need to use a mouse to click “enter” or “next” as the user can scan the icon on the screen. This reduces the number of times a user must switch between using a barcode reader, mouse or keyboard, and also the number of times the user has to alternate between adding samples to the instrument and starting the run.
- The ARIES® workflow demonstrated another major advantage over GeneXpert by eliminating the possibility of receiving incorrect results due to placement of the wrong cassette in a particular location in the instrument. With GeneXpert, there is no method to detect end user error in cartridge misplacement. In ARIES®, the assay run for a sample is independent of the position of the cassettes inside the system.
- Overall, ARIES® demonstrated enhanced simplicity, reduced hands-on time, and less chance of user error as compared to the GeneXpert system.

## Reference:

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2. Dundas NE, Ziadie MS, Revell PA, Brock E, Mitui M, Leos NK, Rogers BB. A lean laboratory: operational simplicity and cost effectiveness of the Luminex xTAG™ respiratory viral panel. J Mol Diagn 2011 Mar;13(2):175-9.