N.V. International Medical Products S.A.

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LumiraDx™
FastLab Solutions

qSTAR Technology

A Rapid and Innovative Nucleic Acid Amplification

INTRODUCTION

Nucleic acid amplification technologies are the primary methods for detecting and analyzing specific nucleic acid sequences. Polymerase chain reaction (PCR) is the most widely used nucleic acid amplification technology. However, in the past few decades we have seen novel nucleic acid amplification techniques come to the forefront in the detection and identification of infectious diseases, genetic disorders, and other research purposes. Available NAATs for SARS-CoV-2 include reverse transcription polymerase chain reaction (RT-PCR), reverse transcription loop-mediated isothermal amplification (RT-LAMP), transcription-mediated amplification (TMA), nicking enzyme amplification reaction (NEAR), helicase-dependent amplification (HDA), Recombinase Polymerase Amplification (RPA) and Quantitative Selective Temperature Amplification Reaction (qSTAR).

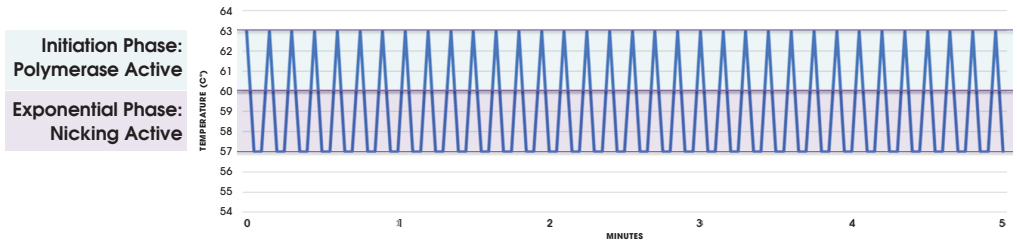
During this COVID-19 pandemic we have lived and adapted to shortages in testing capacity and supply chain restrictions which has placed strain on laboratory facilities and staffing. The turnaround time for common molecular laboratory tests can take several days, creating a backlog of testing in many laboratories across the globe. For these reasons, the LumiraDx team sought to apply the novel nucleic acid amplification technology qSTAR to rapidly speed up the testing on existing open molecular systems already found in the field.

TECHNOLOGY OVERVIEW

The LumiraDx qSTAR technology leverages "temperature gating" to control enzyme activity and optimize the kinetics of the reaction.

ADVANTAGES

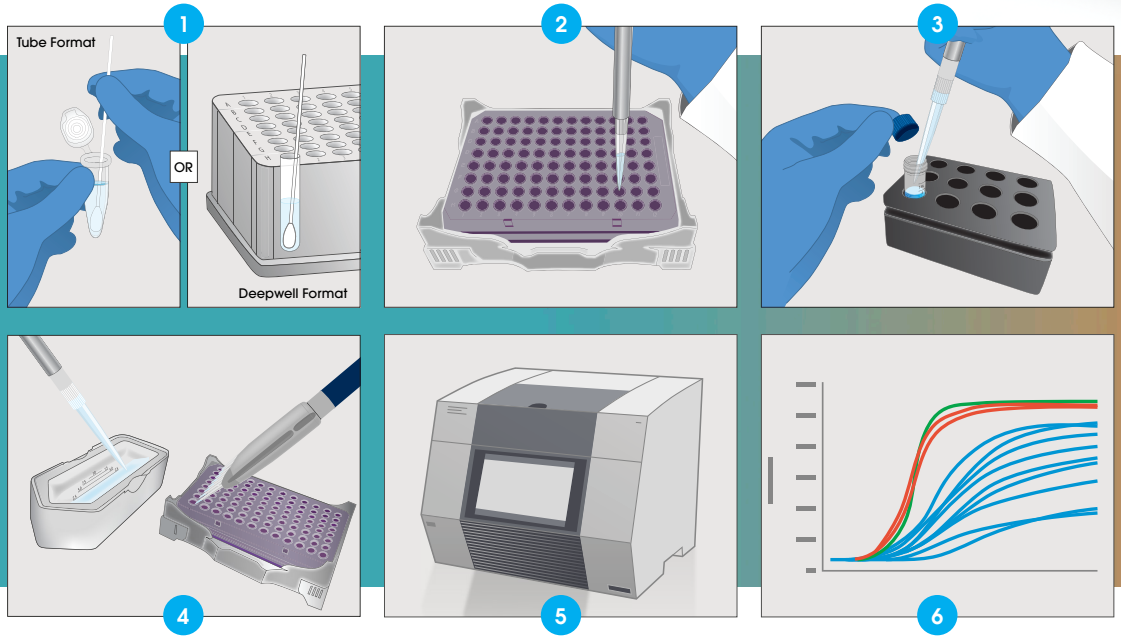
qSTAR EXAMPLE TEMPERATURE PROFILE



By optimizing and controlling peak enzyme activity, qSTAR technology allows for a rapid amplification of the target, allowing the amplification time to be reduced to minutes, not hours, thereby increasing the through-put in open molecular systems. This novel technology has been applied to the development of the LumiraDx RNA STAR SARS-CoV-2 and RNA STAR Complete SARS-CoV-2.

SAMPLE PREPARATION

The RNA STAR Complete workflow and principle of the test is shown below. The test utilizes a direct amplification method that combines lysis and amplification into a single step within minutes (not hours) along with eliminating the need for any upfront automated purification instrumentation.



1. Sample Preparation
2. Sample Plate Preparation
3. qSTAR Reagent Preparation
4. Reaction Mix Added to Plate
5. Lysis/Amplification
6. Analysis/Report

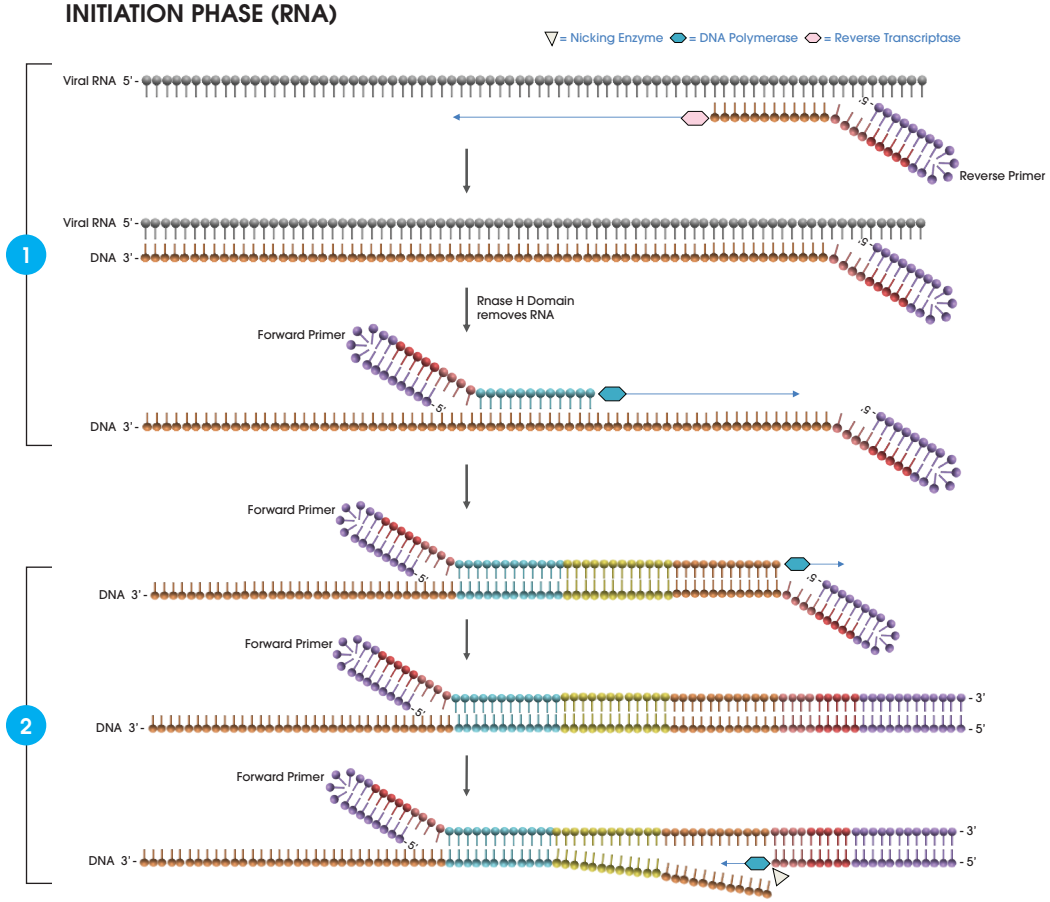
AMPLIFICATION

1. The sample is lysed by detergents in the extraction buffer and the nucleic acids are amplified by qSTAR. If the target is RNA, it is initially reversed transcribed into cDNA as shown in the figure right.

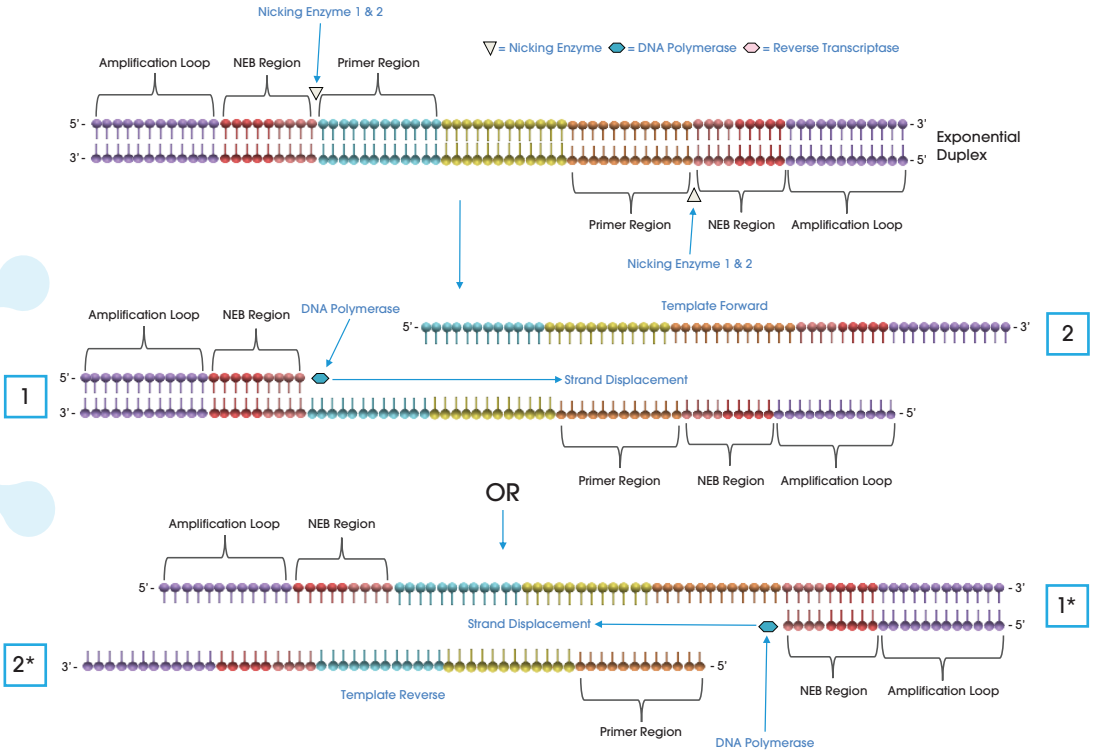
2. The cDNA (or gDNA) is then subsequently amplified by qSTAR using primers to a highly conserved target region to generate an exponential amplification duplex.

3. Rapid amplification from the exponential duplexes occurs via “temperature gating”, which leads to regeneration of exponential duplexes which increases amplification speed (not shown).

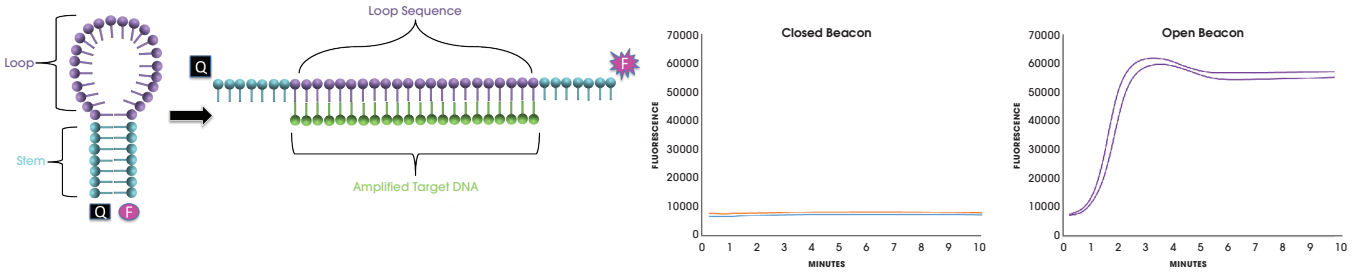
INITIATION PHASE (RNA)



EXPONENTIAL PHASE: BI-DIRECTIONAL AMPLIFICATION (SINGLE NICK)



STAR DETECTION



4. Detection - The amplicons are specifically detected with molecular beacons.

The qSTAR technology provides several distinct technological and laboratory benefits compared to other nucleic acid amplification technologies. The most notable include:

- **Reliability of Detection** By targeting small (30-50 bp) regions, qSTAR can amplify highly conserved regions which are less prone to mutations.
- **Speed** By "temperature gating", qSTAR enzymes can complete amplification in under five minutes whereas PCR often takes over an hour for reaction completion.
- **Robust** Highly optimized enzymes provide improved resistance and tolerance of inherent impurities often found in diagnostic samples, without the need for additional purification. Optimized primer design further limits background amplification and the generation of nonspecific amplified products common to isothermal amplification techniques.

In conjunction with the above technology benefits the laboratory benefits include:

- **Accessible** Technology allows for laboratories to utilize existing instrumentation, specimen types, and infrastructure to provide quick implementation.
- **Rapid** A simple workflow in combination with the rapid amplification provides a fast result in hours not days.
- **Efficiency** Provides approximately a 2- to 4- fold increase of testing throughput over common open molecular systems.

CONCLUSION

The qSTAR technology brings high-quality molecular diagnostics from the point of care to the laboratory. LumiraDx will continue to expand the testing menu with this innovative technology to areas and populations of the world that need them most.

If you are ready to expand your molecular testing capabilities with qSTAR give one of our representatives a call at 1-888-586-4721 or email us at CustomerServices@lumiradx.com.

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This test has not been FDA cleared or approved but has been authorized by FDA for emergency use under an EUA for use by authorized laboratories; this test has been authorized only for the detection of nucleic acid from SARS-CoV-2, not for any other viruses or pathogens; and the emergency use of this test is only authorized for the duration of the declaration that circumstances exist justifying the authorization of emergency use of in vitro diagnostics for detection and/or diagnosis of COVID-19 under Section 564(b)(1) of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 360bbb-3(b)(1), unless the declaration is terminated or authorization is revoked sooner.

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