

Illumina DRAGEN™ Server for NextSeq™ 550Dx Sequencing Instruments

Simplifying the setup of
diagnostic NGS testing

- Easy integration of IVDR-compliant DRAGEN NGS analysis application with NextSeq 550Dx Instruments
- Intuitive workflow incorporating proven Illumina DNA Prep with Enrichment Dx library preparation
- Efficient analysis and file generation with ORA technology that provides up to 5× lossless compression of FASTQ files



NGS analysis for diagnostic labs

Next-generation sequencing (NGS) is indispensable for comprehensive diagnostic testing, including newborn screening, genetic disease testing, and oncology testing. Diagnostic NGS protocols must comply with regulations that are designed to ensure the highest standard of care and protect patients. Illumina DRAGEN Server for NextSeq 550Dx Instruments, with IVDR-compliant consumables, simplifies the setup of diagnostic testing with a three-step targeted sequencing workflow that includes library preparation using Illumina DNA Prep with Enrichment Dx, sequencing on the NextSeq 550Dx Instrument, and secondary data analysis accelerated by intuitive DRAGEN software (Figure 1).

DRAGEN Server for NextSeq 550Dx Instruments is designed to streamline NGS operations for diagnostics laboratories with integrated run management, and efficient file handling using Original Read Archive (ORA) technology. The Illumina Run Manager interface allows users to easily configure runs and manage operations on the NextSeq 550Dx Instrument. Additionally, the server offers a secondary analysis application for Illumina DNA Prep with Enrichment Dx that complies with European Union (EU), In Vitro Diagnostics Regulation (IVDR) 2017/746, and offers highly accurate variant calling. DRAGEN Server for NextSeq 550Dx Instruments can be easily incorporated into existing NextSeq 550Dx Instruments or, in select countries, purchased as a package with new NextSeq 550Dx Instruments.

NextSeq 550Dx Instrument

The NextSeq 550Dx Instrument is a powerful benchtop sequencing system built to meet the needs of the clinical laboratory (Figure 2). The NextSeq 550Dx Instrument is an FDA-regulated and CE-marked in vitro diagnostic (IVD) system that enables diagnostic laboratories to develop and perform NGS IVD assays ranging from targeted panels to whole exomes. The NextSeq 550Dx Instrument includes dual-boot functionality that includes a diagnostic mode, or Dx Mode, and a Research Mode. These dual modes provide the flexibility to perform IVD testing, lab-developed test (LDT) development, and clinical research on a single instrument.



Figure 2: The NextSeq 550Dx Instrument—The NextSeq 550Dx Instrument delivers high-quality results for both clinical and research applications.

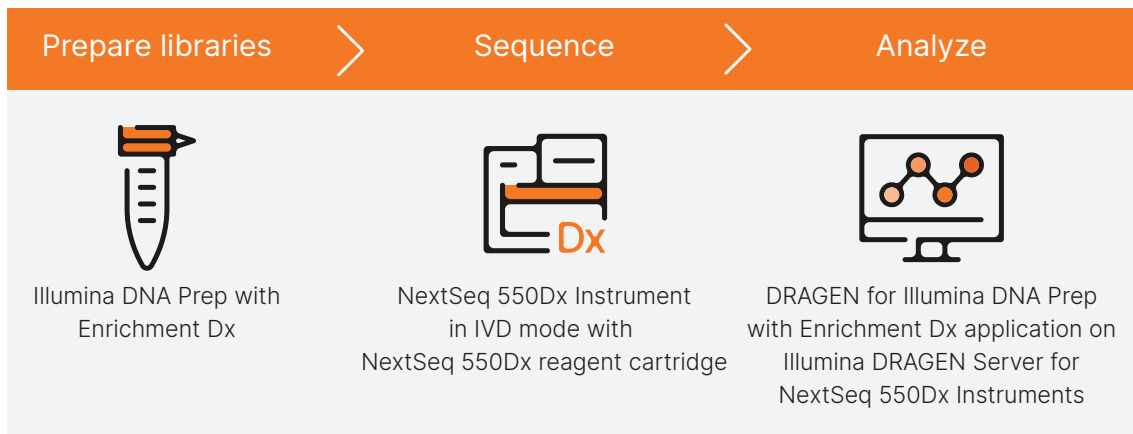


Figure 1: IVDR-compliant NGS analysis of samples on the DRAGEN Server for NextSeq 550Dx Instruments—Targeted sequencing workflow includes library preparation of extracted samples with the Illumina DNA Prep with Enrichment Dx NGS workflow, sequencing on the NextSeq 550Dx Instrument, and accurate IVDR-compliant analysis performed on the DRAGEN Server for NextSeq 550Dx Instrument.

Intuitive operation and analysis

DRAGEN Server for NextSeq 550Dx Instruments is an optional component for NextSeq 550Dx Instruments. Illumina Run Manager is the fully integrated operating system on DRAGEN Server for NextSeq 550Dx Instruments. The intuitive interface allows users to manage and run locked and validated diagnostic NGS workflows in Dx Mode on the NextSeq 550Dx Instrument. Workflows can be configured on the instrument directly or remotely. Following the sequencing run, Illumina Run Manager automatically initiates the application-specific secondary data analysis configured using the analysis module during the run setup (Figure 3).

Illumina DNA Prep with Enrichment Dx

Libraries prepared using the Illumina DNA Prep with Enrichment Dx kit can be analyzed in a simple, streamlined workflow on DRAGEN Server for NextSeq 550Dx Instruments. The Illumina DNA Prep with Enrichment Dx kit is a rapid library preparation and enrichment solution that offers an FDA-regulated and EU IVDR 2017/746-compliant solution with proven performance across Illumina IVD sequencing platforms. Illumina DNA Prep with Enrichment Dx features innovative On-Bead Tagmentation using bead-linked transposomes for a highly uniform tagmentation reaction. It supports analysis of genomic DNA (gDNA) samples derived from human

tissues, including gDNA extracted from whole blood or formalin-fixed, paraffin-embedded (FFPE) tissue. Illumina DNA Prep with Enrichment Dx is compatible with fixed and custom enrichment panels available from Illumina and other third-party suppliers, enabling clinical laboratories to add targeted sequencing to their menu of NGS diagnostic applications.

Efficient analysis

DRAGEN software is designed to give labs the analysis efficiency and accuracy they need for their NGS analysis. The efficiency of DRAGEN analysis algorithms has recently been demonstrated with two world speed records for genomic data analysis.^{1,2} DRAGEN software also includes Original Read Archive (ORA) technology that provides lossless 5× compression of FASTQ files to help labs address the substantial storage and energy demands of large NGS patient data files. The lossless compression of DRAGEN ORA is remarkably fast, requiring ~8 minutes for compression of 70 GB FASTQ files, while maintaining file integrity (Figure 4).

The highly configurable field-programmable gate array technology (FPGA) used for DRAGEN applications also allows for ultraefficient hardware-accelerated implementations of genomic analysis algorithms, such as base call (BCL) file conversion, mapping, alignment, sorting, duplicate marking, and haplotype variant calling.

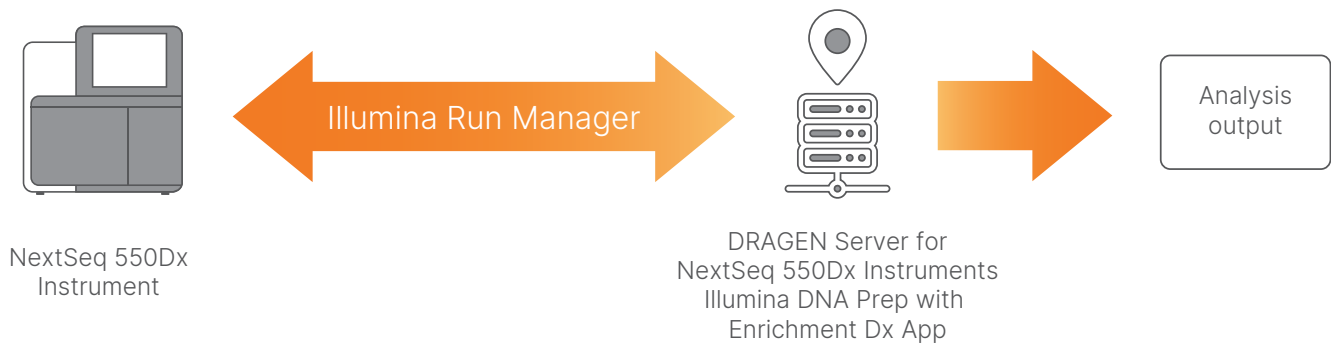


Figure 3: Illumina Run Manager on DRAGEN Server for NextSeq 550Dx Instruments—Illumina Run Manager provides intuitive run setup and automatically initiates secondary data analysis using the application selected during the run setup.

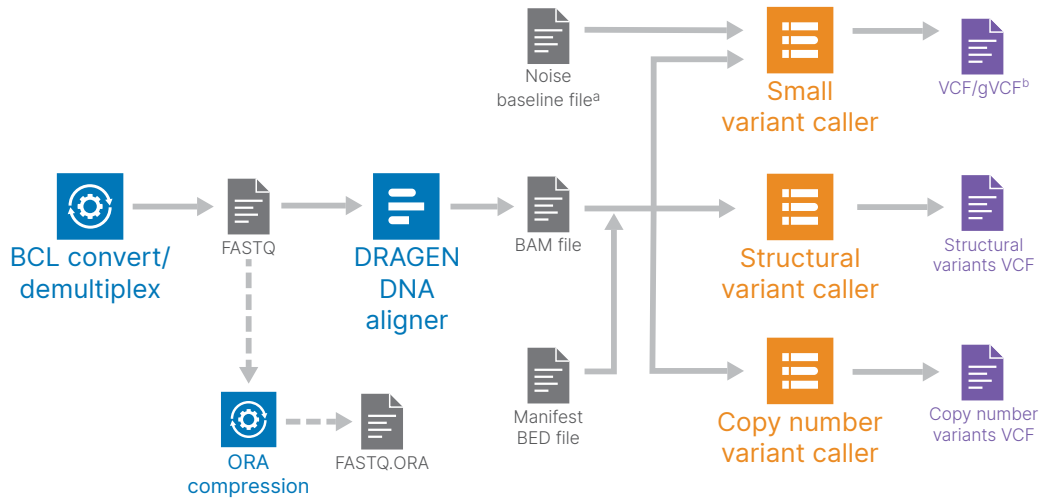


Figure 4: DRAGEN for Illumina DNA Prep with Enrichment Dx App workflow—Analysis can be configured in Illumina Run Manager to begin automatically upon sequencing run completion. The workflow supports generation of FASTQ files with somatic or germline variant callers. Exceptionally efficient ORA compression is able to generate up to 5× smaller FASTQ.ORA files.

a. The DRAGEN Baseline Builder app can be used to build an optional custom noise baseline file for use in the somatic variant mode only.
 b. gVCF files are not generated with somatic variant calling.

DRAGEN for Illumina DNA Prep with Enrichment Dx App

The DRAGEN for Illumina DNA Prep with Enrichment Dx App on the DRAGEN Server for NextSeq 550Dx Instrument delivers exceptionally accurate variant calling for both germline and somatic variants (Figure 4). For performance assessment, genomic DNA (gDNA) samples from whole blood were purchased from the Coriell institute (Catalog no. NA24631, NA24385, NA12877, and NA12878) and prepared using Illumina DNA Prep with Enrichment Dx (Catalog no. 20051354).

Results from the DRAGEN for Illumina DNA Prep with Enrichment Dx App were compared to results obtained using Burrows-Wheeler Aligner (BWA, v.0.7.17)³ and Genome Analysis Toolkit (GATK, v.4.3.0)⁴ (Table 1). Data show that the DRAGEN for Illumina DNA Prep with Enrichment Dx App produces high-quality sequencing data and sensitive detection of variants that exceeds established BWA-GATK analysis..

The highly configurable field-programmable gate array technology (FPGA) used for DRAGEN applications also allows for ultraefficient hardware-accelerated implementations of genomic analysis algorithms, such as base call (BCL) file conversion, mapping, alignment, sorting, duplicate marking, and haplotype variant calling.

Table 1: Variant calling in Dx Mode

Pipeline	SNV			Indel		
	Precision	Recall	F1	Indel precision	Indel recall	Indel F1
BWA-GATK	97.36%	93.95%	95.62%	65.29%	79.83%	71.78%
Illumina DNA Prep with Enrichment Dx app	99.14%	95.85%	97.46%	90.12%	85.43%	87.70%

Warranty and service

Illumina is committed to providing excellent customer service and support for all of our products. Your territory account manager will coordinate the installation of your DRAGEN Server for NextSeq 550Dx Instrument with the Illumina service and support team. The service and support team will provide guidance for on-site requirements ahead of installation to make sure that no delays occur during delivery and installation of your system.

After your DRAGEN Server for NextSeq 550Dx Instruments is delivered, an Illumina engineer will work with you to make sure that the instrument is running as expected. After the system is up and running, the Illumina service and support team will schedule training based on your availability and needs.

The DRAGEN Server for NextSeq 550Dx Instruments includes a comprehensive 12-month warranty that covers the hardware, accessories, and installed option packages included with each system purchase. The standard warranty includes:

- Repair parts, labor, and travel.
- Five-business-day on-site response time target
- Reagent replacement due to instrument failures
- Hardware and software updates
- Application support
- Phone and email access to Technical Support eight hours per day, Monday through Friday

Summary

DRAGEN Server for NextSeq 550Dx Instruments provides cutting-edge technology for targeted IVD NGS assays and, with the Illumina DNA Prep for Enrichment Dx application, allows clinical labs to meet the high standards of IVDR for the benefit of patient care. The NextSeq 550Dx Instrument brings high-throughput FDA-regulated and CE-marked NGS capabilities to the clinical lab for research and diagnostic applications. DRAGEN Server for NextSeq 550Dx Instruments, with IVDR-compliant consumables, simplifies implementation of NGS data analysis in IVDR applications. The DRAGEN for Illumina DNA Prep with

Enrichment Dx application on the DRAGEN Server for NextSeq 550Dx Instruments enables accurate, efficient, and streamlined secondary analysis of NGS data.

The NextSeq 550Dx Instrument and DRAGEN Server for NextSeq 550Dx Instruments are part of a growing line of Illumina IVD NGS products and solutions. As additional IVD assays continue to be developed, the menu of supported applications on DRAGEN Server for NextSeq 550Dx Instruments will also expand.

Ordering information

Product	Catalog no.
DRAGEN Server for NextSeq 550Dx Instruments	20086130
NextSeq 550Dx Instrument	20005715

Learn more

[DRAGEN Server for NextSeq 550Dx Instruments](#)

[In Vitro Diagnostic Medical Devices Regulation \(EU\) 2017/746](#)

[NextSeq 550Dx Instrument](#)

References

1. BioIT World. Children's Hospital Of Philadelphia, Edict Set World Record For Secondary Analysis Speed. [bio-itworld.com/news/2017/10/23/children-s-hospital-of-philadelphia-edico-set-world-record-for-secondary-analysis-speed](https://www.bio-itworld.com/news/2017/10/23/children-s-hospital-of-philadelphia-edico-set-world-record-for-secondary-analysis-speed). Accessed March 14, 2022.
2. San Diego Union Tribune. Rady Children's Institute sets Guinness world record. www.sandiegouniontribune.com/95899028-132.html. Published February 12, 2018. Accessed March 14, 2022.
3. Li H, Durbin R. [Fast and accurate short read alignment with Burrows-Wheeler transform](#). *Bioinformatics*. 2009;25(14):1754-1760. doi:10.1093/bioinformatics/btp324
4. McKenna A, Hanna M, Banks E, et al. [The Genome Analysis Toolkit: a MapReduce framework for analyzing next-generation DNA sequencing data](#). *Genome Res*. 2010;20(9):1297-1303. doi:10.1101/gr.107524.110

Intended use statements

Illumina DNA Prep with Enrichment Dx (CE-IVD)

The Illumina DNA Prep with Enrichment Dx Kit is a set of reagents and consumables used to prepare sample libraries from genomic DNA derived from human cells and tissue to develop in vitro diagnostic assays. User-supplied probe panels are required for the preparation of libraries targeting specific genomic regions of interest. The generated sample libraries are intended for use on Illumina sequencing systems. The Illumina DNA Prep with Enrichment Dx includes software for sequencing run setup, monitoring, and analysis.

Illumina DNA Prep with Enrichment Dx (United States)

Illumina DNA Prep with Enrichment Dx is a set of reagents and consumables used to prepare sample libraries from DNA extracted from peripheral whole blood and formalin-fixed, paraffin-embedded tissue. User-supplied probe panels are required for the preparation of libraries targeting specific genomic regions of interest. The generated sample libraries are intended for use on Illumina sequencing systems.

NextSeq 550Dx Instrument (United States)

The NextSeq 550Dx Instrument is intended for targeted sequencing of DNA libraries from human genomic DNA extracted from peripheral whole blood or formalin-fixed, paraffin-embedded (FFPE) tissue, when used for in vitro diagnostic (IVD) assays performed on the instrument. The NextSeq 550Dx instrument is not intended for whole genome or de novo sequencing. The NextSeq 550Dx instrument is to be used with registered and listed, cleared, or approved, IVD reagents and analytical software.

NextSeq 550Dx instrument (European Union/other)

The NextSeq 550Dx Instrument is intended for targeted sequencing of DNA libraries from human genomic DNA extracted from peripheral whole blood or formalin-fixed, paraffin-embedded (FFPE) tissue, when used for in vitro diagnostic (IVD) assays performed on the instrument.



1.800.809.4566 toll-free (US) | +1.858.202.4566 tel
techsupport@illumina.com | www.illumina.com

© 2023 Illumina, Inc. All rights reserved. All trademarks are the property of Illumina, Inc. or their respective owners. For specific trademark information, see www.illumina.com/company/legal.html.
M-GL-01471 v1.0