

[← All posts](#)

JULY 6, 2023 | SEQUENCING 101

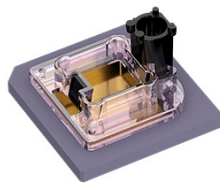
Sequencing 101: The SMRT Cell in PacBio long-read sequencing



If you have ever clicked around the PacBio website or attended a workshop or webinar discussing PacBio long-read sequencing technology, then you have probably seen or heard about SMRT (Single Molecule, Real-Time) Cells. These small but vital pieces of technology sit at the heart of HiFi (high fidelity) sequencing, one of the world's most advanced long-read genome sequencing technologies. But what is a SMRT Cell exactly, and what can it do? Let's take a look!

What is a SMRT Cell?

A SMRT Cell is a small consumable device that is roughly the size and shape of a computer chip where the chemistry of [HiFi sequencing](#) takes place on PacBio long-read sequencing instruments.



Prior to sequencing, SMRT Cells are loaded into the PacBio long-read sequencing instrument much like you would load an ink cartridge into a printer. The flat interior surface of the SMRT Cell contains numerous nanometer-scale perforations or wells called zero mode waveguides (ZMWs). Once sample DNA molecules diffuse down inside the ZMWs, sequencing begins, and the DNA is imaged in real-time using powerful, state-of-the-art optics.

Why are SMRT Cells designated "8M" or "25M"?

The "M" number designation indicates how many millions of ZMWs there are within that SMRT Cell. A SMRT Cell 8M contains 8 million ZMWs; the Revio "25M" SMRT Cell contains 25 million ZMWs, and so on. The more densely packed ZMWs are within the SMRT Cell, the more molecules that can be sequenced at once which speeds up sequencing time and drives down the cost of analyzing samples. However, the quantity of ZMWs in a SMRT Cell does not necessarily indicate the exact number of reads that can be obtained from it in a sequencing run. For example, during whole genome sequencing (WGS) the number of HiFi reads generated per SMRT Cell is sometimes less than the number of ZMWs available. At the same time, the number of reads generated using molecular concatenation kits (e.g., [MAS-Seq](#)) can be more than triple the number of ZMWs (e.g., 80 million reads from one Revio "25M" SMRT Cell). The throughput metrics presented for PacBio long-read instruments consider this data output range.

How much sequencing can I do with one *Revio* SMRT Cell?

**URL**<https://www.pacb.com/blog/smrt-cell/>**Timestamp**

Tue Jan 23 2024 08:51:49 GMT-0800 (Pacific Standard Time)

available. At the same time, the number of reads generated using molecular concatenation kits (e.g., [MAS-Seq](#)) can be more than triple the number of ZMWs (e.g., 80 million reads from one Revio "25M" SMRT Cell). The throughput metrics presented for PacBio long-read instruments consider this data output range.

How much sequencing can I do with one Revio SMRT Cell?



A technician prepares to load a tray of four Revio SMRT Cells into a Revio instrument.

Currently, the most powerful SMRT Cell in the PacBio lineup is the Revio SMRT Cell which is used exclusively on the new high-throughput Revio system. With 25 million ZMWs in the Revio SMRT Cell, you can generate game-changing long-read data for a variety of applications using just one of these powerful little pieces of technology.

The capabilities of just one Revio SMRT Cell include:

- Up to 90 Gb of total long-read sequencing data in 24 hours.†
- One phased 30x [human whole genome](#).†
- Up to 80 million full-length RNA isoforms using the [MAS-Seq single-cell kit](#).†
- Large, targeted gene panels (e.g., [Dark Gene](#)) for up to 12 samples.†
- Small, targeted gene panels (e.g., [Long-read PGx](#)) for up to 72 samples.†
- Approximately 170 high quality [metagenome](#) assembled genomes (HQ-MAGs) from a human gut microbiome sample.†*

These are just some examples of the kinds of studies that can be performed with a single Revio SMRT Cell. Bear in mind that a fully loaded Revio system can accept 8 of these new SMRT Cells at a time and can analyze up to 4 at once –so the sequencing possibilities are tremendous!

What is needed to prepare SMRT Cells for sequencing?

Nothing at all! SMRT Cells come ready to use. Simply load the SMRT Cells onto your PacBio long-read instrument following the appropriate protocols (along with pipette tips and sample plates) and you are ready to begin sequencing!

Want to learn more about PacBio long-read sequencing?

[Check out this primer on long reads](#)

[Watch how HiFi sequencing works](#)

[Explore Revio, our most powerful long-read sequencer](#)

† Expected coverage and throughput are estimates. Coverage and total reads/data may vary based on library quality and fragment lengths.

* Estimated high-quality metagenome assembly recovery for analysis of ZymoBIOMICS Fecal Reference with TruMatrix™ Technology using PacBio recommended analysis pipelines. Results may vary.

SUBSCRIBE FOR BLOG UPDATES:

Email

Subscribe

Search the blog



URL

<https://www.pacb.com/blog/smrt-cell/>

Timestamp

Tue Jan 23 2024 08:51:49 GMT-0800 (Pacific Standard Time)

Subscribe

Search the blog



FILTER BY TOPIC

Cancer research
HiFi difference
Liquid biopsy
Sequencing methods
Epigenetics
RNA sequencing
Targeted sequencing
Whole genome sequencing
Metagenomics
Gene therapy + editing
AAV
Sample + library preparation
Public health + surveillance
Immunogenomics + HLA
Biodiversity
Pharmacogenomics
Neurogenomics
Data analysis
Microbiome
Rare disease
Human genetics research
Agrigenomics
Sequencing 101
Microbial sequencing methods
Infectious disease research
Products, procedures + protocols
Plant + animal biology
Events + conferences
General
Corporate news

TALK WITH AN EXPERT

If you have a question, need to check the status of an order, or are interested in purchasing an instrument, we're here to help.

First name *

Last name *

Email *

Phone

Organization *

Country *

Area of interest *

Product interest *



URL

<https://www.pacb.com/blog/smrt-cell/>

Timestamp

Tue Jan 23 2024 08:51:49 GMT-0800 (Pacific Standard Time)

Email *

Phone

Organization *

Country *

Area of interest *

Product interest *

Questions *

Connect with a PacBio scientist

By registering on this web page, you are consenting and agreeing to collection and use of that information by PacBio in accordance with our [privacy policy](#).

PacBio

Our revolutionary sequencing technologies combine the completeness of long reads with the accuracy of short reads to provide the most comprehensive view of genomes, transcriptomes, and epigenomes.

Connect with us   

Email *

Join our mailing list

PRODUCTS

Technologies

Sequencing systems

Sequencing methods

Consumables

Compatible products

Software + bioinformatics

Purchase

Documentation

FOCUS AREAS

Human genomics

Plant + animal

Infectious disease

Microbial genomics

Cancer research

Gene therapy

ENGAGE

Blog

Webinars

Events

Case studies

Sequencing 101

Access datasets

Resources

Become a service provider

Find a service provider

Find a distributor

COMPANY

About us

Contact us

Leadership

Press releases

Investors

Sustainability

Careers

Support

Customer login

© 2024 PacBio. All rights reserved. Research use only. Not for use in diagnostic procedures. [Privacy policy](#) | [Legal + trademarks](#)



URL

https://www.pacb.com/blog/smrt-cell/

Timestamp

Tue Jan 23 2024 08:51:49 GMT-0800 (Pacific Standard Time)

Page 4 of 4