Tracking Sequencing Quality in Real Time: A Long-Read Dashboard

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BACKGROUND

The NIHR BioResource is conducting a flagship long-read sequencing project to sequence 22,000 participants using Oxford Nanopore technology. At this scale (>300 samples/week), monitoring throughput, quality, and anomalies is critical. A sample-tracking dashboard was developed to streamline QC, data monitoring, and operational feedback.

Objectives

The objectives of this project were to:

1. Gain a deeper understanding of ONT sequencing data visualisation.
2. Modify the database schema to include new QC and yield insights.
3. Build an interactive dashboard for sample tracking and QC monitoring.

METHODS

A relational database connected to the sequencing platform which captures run metadata, quality control metrics, mapping statistics, and yield information at the library level was the primary data source. This database linked directly to automated workflows, ensures that new sequencing data were incorporated with minimal manual handling.

A web-based dashboard using Dash (Python) with Plotly as the visualization framework was developed. The dashboard was structured into three analytical modules: throughput and capacity, quality and QC, and anomalies and efficiency. Each module contained dynamic charts and controls such as date filters, trendline toggles, and log-scale options that allowed users to interrogate the data flexibly.

Visualisation methods included scatter plots (yield vs. N50, read quality vs. length), box and violin plots (yield distributions), histograms (depth and read quality), and heatmaps (anomaly profiles). Key performance indicators such as mean quality scores, mapping efficiency, and yield gaps were automatically summarised. A searchable QC table was also incorporated to provide library-level detail and support downstream troubleshooting.

RESULTS AND DISCUSSION

The live-deployed dashboard offers real-time visibility into sequencing performance and QC metrics. On average, yield per library reached 190GB, with N50 values spanning 1k–35k kb across PromethION units

Figure 1: Live Yield vs N50 Scatter

Median Q-scores remained robust, and more than half of bases exceeded Q20

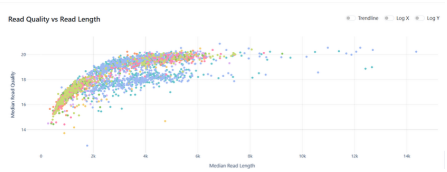

Figure 2: Quality vs Read Length Scatter

Depth and quality histograms revealed consistent read distributions, and the heatmap of interruptions flagged approximately 296 libraries as having multiple runs, typically representing early production episodes that correlated with slight drops in yield and efficiency in select PromethION units.

In practice, the dashboard platform empowers researchers and operations teams to monitor sequencing in real-time, identify outlying runs quickly, and maintain quality standards at scale. Its integration of yield, QC, and anomaly data into an interactive interface supports proactive intervention making it an indispensable tool as the long-read sequencing effort scales beyond 22,000 genomes.

CONCLUSION

The live-deployed dashboard provides seamless, real-time visibility into sequencing throughput, QC metrics, and anomalies, transforming operational oversight into an interactive and intuitive experience. Key insights, such as consistent yield performance, quality score distributions, and interruption trends are now accessible briefly, allowing quick detection of abnormalities and swift troubleshooting.

By integrating database-driven metrics with dynamic visual tools, the platform empowers teams to maintain high-quality genomics data as the project scales. Its modular design ensures adaptability for future QC layers, broader analytics, and potential remote deployment making this dashboard not just a tool, but a cornerstone of scalable, high-throughput sequencing operations.

REFERENCES

ONT long-read background / motivation
Jain M, Olsen HE, Paten B, Akeson M. *The Oxford Nanopore MinION: delivery of nanopore sequencing to the genomics community.* Nat Biotechnol. 2016;34: https://doi.org/10.1186/s13059-016-1103-0

General ONT sequencing overview
Oxford Nanopore Technologies. *Long-read sequencing: a review.* https://nanoporetech.com/platform/technology