

Quantum-Si Cloud: A Scalable Informatics Platform for Protein Sequence Data Analysis

SUMMARY

Quantum-Si's innovative Platinum™ system provides a platform for next-generation, single-molecule protein sequencing across millions of individual peptides on its proprietary semiconductor chip. Each Platinum instrument is directly connected to the Quantum-Si Cloud, providing an integrated and user-friendly solution to streamline data analysis. The Cloud platform allows users to create and customize experiments for user-specific applications, automate data analysis through community and custom workflows, visualize experimental results, and share data with colleagues simply and securely. The platform scales to the users' research and workflow needs. This tech note describes the key features and benefits of the Cloud platform to maximize instrument utilization and transform protein sequencing data into actionable insights.



2.0

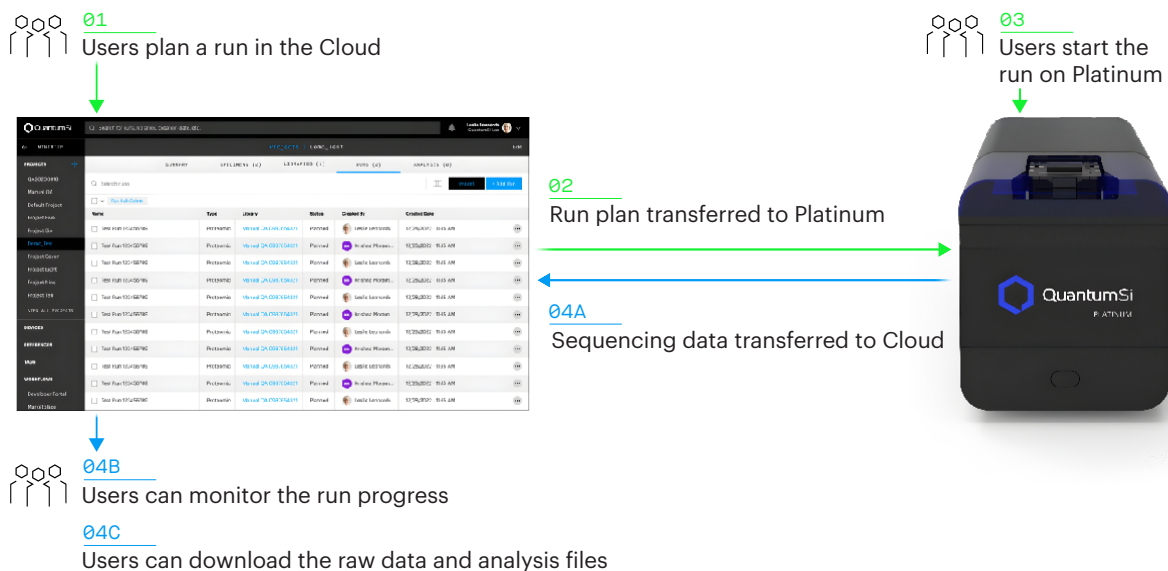
Introduction to Quantum-Si Cloud

Quantum-Si's Cloud solution will accelerate proteomic research and reduce the data analysis burden through efficient data processing, storage, access, and sequence analysis. Users can set up and control experiments from start to end, verify instrument status, and visualize real-time data on-site or remotely using the Cloud. Real-time data enables analyses of gathered data points to determine if they meet quality requirements even before a sequencing run is completed.

RUN PLANNING AND INSTRUMENT MANAGEMENT

Users can set up experimental runs ahead of time with configurable settings, minimizing in-lab set up time and streamlining the workflow. Cloud offers a list view of previously scheduled runs as well as the option to easily replicate past experiments with the same run parameters.

FIG. 1



A schematic of the interface and workflow between Platinum and Cloud. The Cloud provides the interface for planning the sequencing run. Once the sample is loaded into Platinum, users can start a run, which then streams data directly to the Cloud, enabling downstream data analysis and real-time status updates.



Additionally, the Cloud provides an interface for users to perform instrument diagnostics and download software updates, ensuring consistent high-quality data and streaming performance.

REAL-TIME QUALITY METRICS

Cloud's continuous display of real-time metrics, alerts, and instructions keeps users informed about data quality scores throughout the sequencing run. There are a variety of metrics generated and reported, including information related to each step and the status of the sequencing run progress, chip loading metrics, and total number of sequencing read counts. At every step of the workflow, the Cloud provides users with metrics and tools to visualize run quality and accuracy, providing confidence in the sequencing run.

DATA MANAGEMENT & SCALABLE COMPUTE AND STORAGE RESOURCES

The Cloud platform provides users with flexible scaling of compute and memory resources based on data needs, all while eliminating upfront or on-site data infrastructure costs. In addition, the Cloud optimizes data storage and simplifies at scale data management. Powered by **Amazon Web Services**, Cloud handles all the logistics related to data management so the researchers can focus on their primary objective—generating meaningful insights from their proteomic data analysis.

FIG. 2

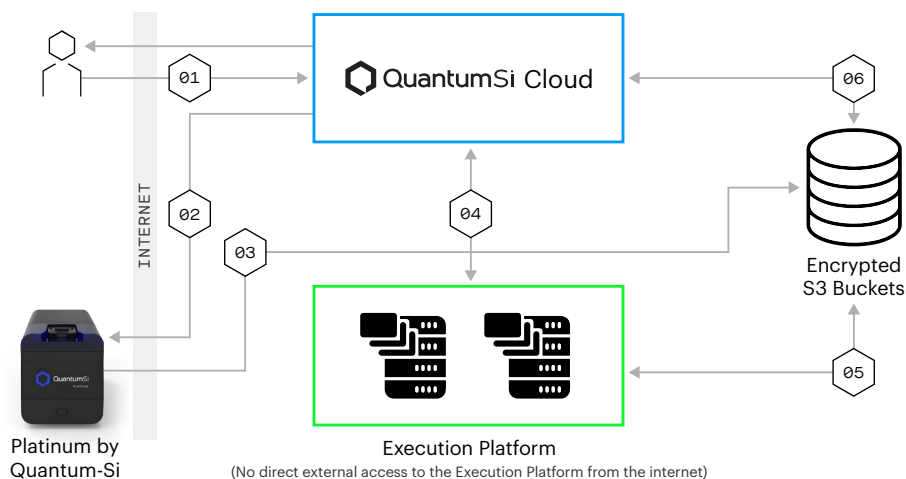


FIG. 2
QUANTUM-SI CLOUD DATA FLOW

1. Users access Cloud platform via HTTP communication using short-lived access tokens.
2. All data transfers to the instrument from Cloud is encrypted.
3. Instrument stores the sequencing data on the encrypted AWS S3 buckets.
4. Cloud web front platform accesses the Execution Platform when computation is required. This access is role-based.
5. Execution Platform accesses the data from the S3 buckets and transfers the data as needed for processing analysis.
6. Cloud accesses the analysis data from the S3 buckets. This transfer is encrypted.



DATA SECURITY

One of the primary objectives of the Cloud platform is to always ensure the security of the users' data. The data generated from the Platinum sequencing instrument and analysis output remains encrypted throughout the data generation, transfer, and analysis process. Cloud encrypts data volumes using AES 256, while all file transfers and platform services communicate through encrypted SSL channels. These safeguards ensure data security from beginning to end, giving users and collaborators peace of mind.

PORTABLE WORKFLOWS AND CUSTOMIZABLE VISUALIZATIONS

The ability to develop, test, and run common workflow language (CWL) based workflows on the Cloud offers significant advantages to any laboratory setting. CWL is a bioinformatics community standard and Quantum-Si recognizes the importance of integrating this standard into its technology.¹ Users can develop their own tools and workflows on their local computers and then port them to the Cloud platform to access Quantum-Si's computing infrastructure and data repositories. The ability to integrate in-house CWL workflows into the Cloud allows users to address application-specific needs and customize graphs and visualizations to interpret data.

INTEGRATED SUPPORT

The integrated support of Cloud provides users with easy access to the customer service team. Users can submit support tickets for sequencing runs, analysis, library creation, and other items. This integrated support serves as a one-stop-shop for all customer support needs, giving users complete visibility into ticket progress and alerting them to resolution status. This allows users to get a rapid response to any problems they may have while using the Platinum sequencing instrument and Cloud.

COLLABORATION

Cloud provides users with the ability to collaborate with researchers across the globe allowing joint analysis of their sequencing runs and downstream analyses without providing access to the underlying data. Using sharing functionality, Cloud users can share the results with their partners through interactive HTML reports. This enables users to have complete control of their data while securely sharing the results, graphs, and reports pertaining to runs and analyses.

¹ Get more information about CWL at www.commonwl.org



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Conclusion

Quantum-Si's Cloud is a scalable informatics platform that maximizes the capabilities of Platinum's single-molecule resolution sequencing. The Cloud provides a host of functionalities and features which speed up lab workflows, enable dynamic and scalable data analysis and storage, and promote collaboration throughout research projects.