



Real-Time Analytics

FIBER-OPTIC FRACTURE MONITORING

HALLIBURTON

From understanding fracture performance, to monitoring cross-well interactions and production flow, distributed fiber optic sensing (DFOS) is one of the most trusted fracture monitoring technologies on the market.

However, the amount of data to digest and interpret can be overwhelming and time consuming.

Real-Time Actionable Insights

Halliburton fiber-optic fracture monitoring services include an analytics platform that provides real-time, actionable subsurface insights to make confident design adjustments to improve fracture performance.

Whether you are monitoring fracture performance and flow or looking to understand cross-well interference, our advanced real-time fiber analytics platform will keep you connected to fracture behavior taking place downhole during stimulation.

Our real-time analytics platform offers enhanced analysis and visualization services, including fracture, cross-well and production monitoring.

ANALYTICS CAPABILITIES

StimWatch® Fracture Monitoring

This service allows you to monitor conditions at the perforation level along the wellbore, to better understand where stimulation fluids are flowing and whether the entire targeted interval has been stimulated. The StimWatch service has many benefits that cannot be obtained using other monitoring system, such as:

Cluster Efficiency – Fiber-optics allow operators to qualify and quantify fluid distribution, helping you understand how to improve completion efficiency and treatment designs.

Improved Economics – Provides an accurate understanding of where fracture initiation is occurring, which allows you to change a treatment design in real-time, such as diverting fluid into understimulated parts of the reservoir.

Risk Mitigation – Real-time information allows operators to detect malfunctioning packers, plugs or casing lines.

CrossWatch™ Cross Well Monitoring

This service uses real-time distributed fiber optic sensing data to decipher subsurface measurements in real-time. This provides actionable insights that help you understand fracture growth in time to prevent communication and improve capital efficiency.

The CrossWatch analytics service allows you to pinpoint of cross well interference in real-time by using strain and

temperature measurements, while accurately converting strain into microseismic. Analytics include treatment volumes, growth over time, and azimuth for a detailed picture of how and when connection of offset well are established.

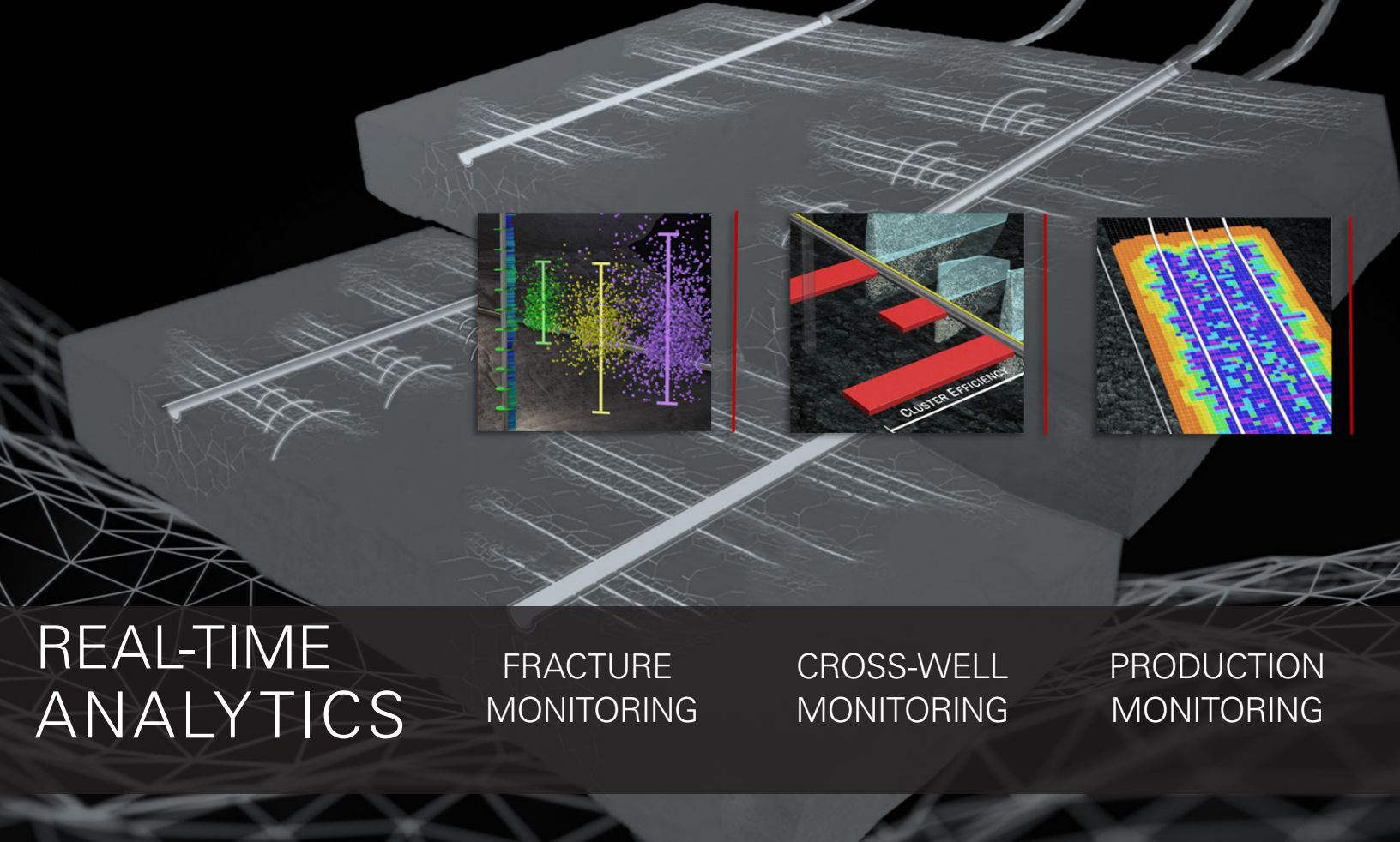
With a single sensor detecting multiple measurements, you now have the ability to understand how fracture uniformity is impacting offset wells. CrossWatch also confirms communication across different benches, allowing you to monitor the frequency and severity of communication across multiple intervals.

Having multiple measurements from the same sensor provides not only provides an accurate understanding of fracture geometry, it helps to improve economics, by allowing you to optimize completion design based on well spacing, to drive uniform depletion. By having a better understanding of near-wellbore fracture placement, you are placing sand more uniformly—and this means you are putting capital into the well the way you designed it.

FlowWatch™ Production Flow Monitoring

This monitoring and diagnostics service uses DAS to monitor dynamic wellbore conditions during production. It helps operators understand well performance by identifying zonal contribution, monitoring artificial lift systems, and identifying scaling or deposit build-up inside tubing.

With FlowWatch, you can accurately correlate downhole



REAL-TIME ANALYTICS

FRACTURE MONITORING

CROSS-WELL MONITORING

PRODUCTION MONITORING

temperature and acoustic changes with the location and volumes of liquids and gas exiting each zone. This provides a solid foundation for operators regarding critical decisions about well performance, completion effectiveness, and reservoir quality.

The FlowWatch service allows you to:

Identify Zonal Contribution – Understanding how each interval contributes to the overall production after well completion enables operators to relate this information back to treatment designs, geology and reservoir properties.

Improve Economics – Fiber-optic cables may be inserted inside tubing to acquire production profiling information. Using retrievable services, an operator can deploy a fiber-optic cable without the need for a workover rig, dramatically lowering the overall cost to obtain a production log.

Understand Production Decline Over Time – Such as how production changes as the reservoir depletes, or when the well is put on artificial lift systems. With distributed monitoring, an operator can also determine how flow dynamics, zonal contribution, and fluid phase change during the production life of a well.

Want to know what’s happening down hole while fracturing?

Halliburton has engineered high cost and complexity out of fiber installation, making it a practical option for routine fracture monitoring on more wells across your asset.

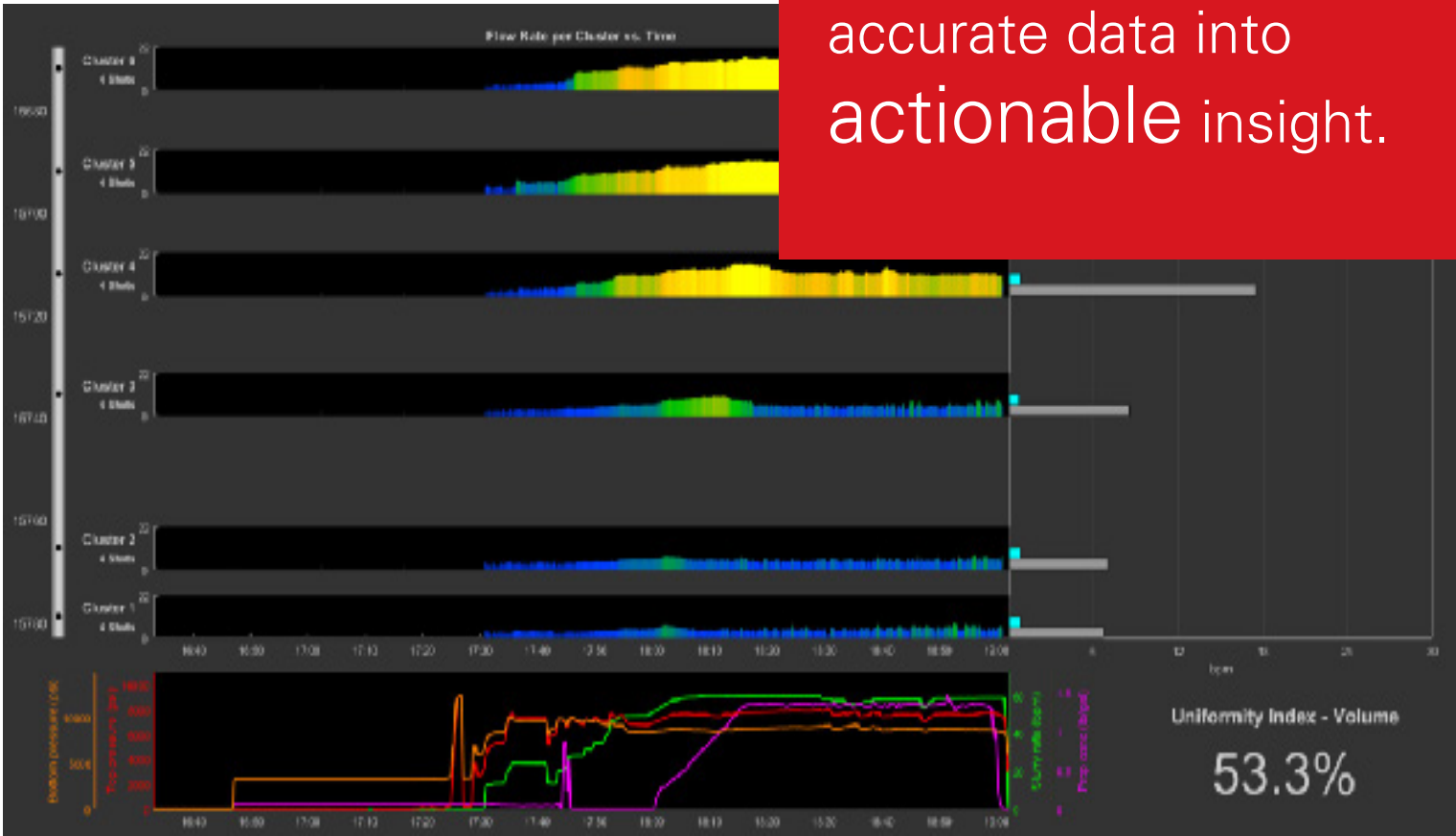
Enhanced Visualization Platform

What makes this analytics platform unique its the flexibility, algorithms, quality of data insight and the digital delivery of data.

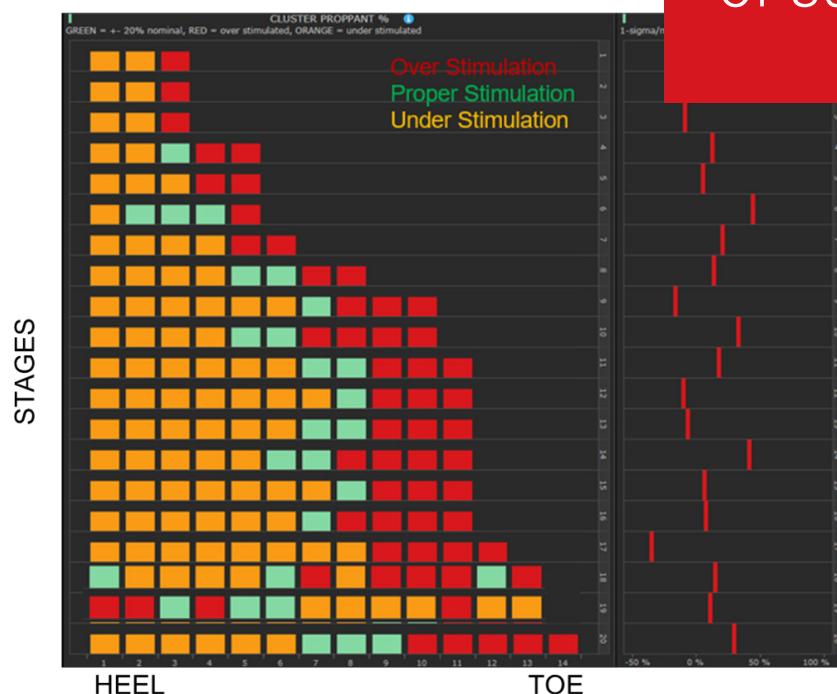
FLEXIBLE, OPEN-SOURCE PLATFORM

This fiber analytics platform is flexible, in that its open-source structure allows you to easily transforms accurate data into actionable insight. With a few clicks, you can easily analyze the volume and time it took for the cross-well interaction to happen. Quickly and seamlessly import and explore your own data, such as logs and rock-type overlays, to evaluate how completion performance changes over time. Our analytics platform even lets you code your own displays tailored to fit your unique needs and preferences.

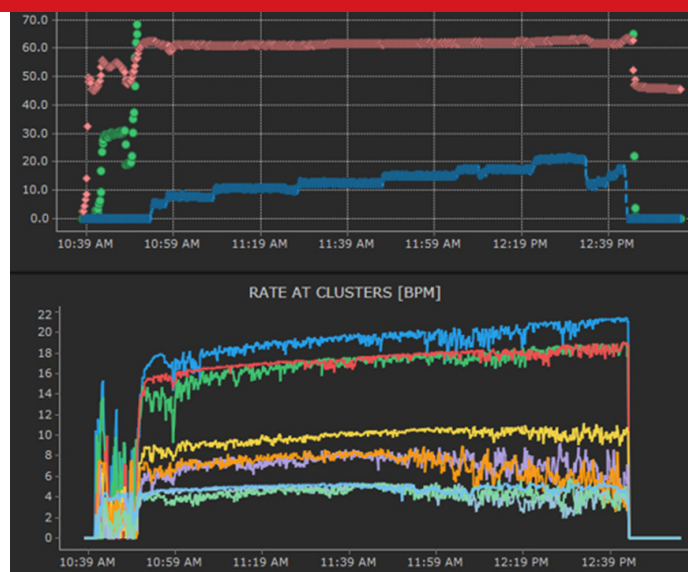
Easily transform
accurate data into
actionable insight.



Rely on quantitative data for
a direct measurement
of subsurface performance.



Well Assessment



Single Stage

UNIQUE ALGORITHMS WITH DIRECT MEASUREMENT

Our ability to deliver these benefits is rooted in our unique algorithms, which have undergone flow loop evaluation. This means our real-time analytics service delivers accurate, proven measurements of flow and empirical data, instead of theoretical models, to provide real-time insights of fracture activity downhole.

Other fiber-optic monitoring and analytics services on the market apply purely analytical models and use acoustic amplitude, which doesn't account for erosion—resulting in inaccurate and underestimated results. Our fiber optic monitoring and analytics provide flow loop evaluation that delivers quantitative data for a direct measurement of subsurface performance.

QUALITY DATA AND FASTER VALIDATION

Our platform leverages an advanced interrogator unit that offers an improved signal to noise ratio, allowing you to see the signal, while detecting microseismic and strain. This unit allows provides quality data on a standard fiber, and with our scalable fiber solution, it's now an affordable option you can scale across your asset for real-time fracture monitoring.

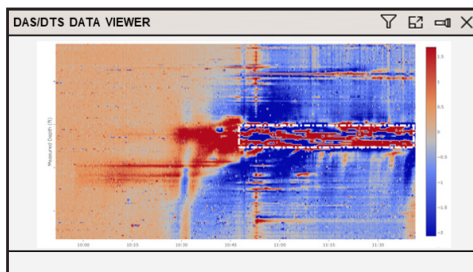
Acquiring data in real time is important, but even more valuable is having access to real-time actionable insight to respond and adjust while stimulating. Historically, it takes monitoring the entirety of a well to test and compare fiber data. This means waiting up to 90 days to validate data and to make a changes to the fracture designs. Our real-time analytics lets you validate what takes place downhole—so you can make design adjustments between stages and optimize future fracture designs much faster.

Validate data
and make changes
faster.



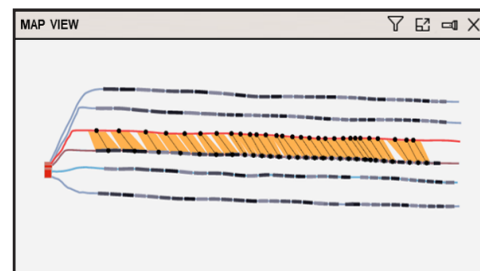
Summary Plots

Analyze your complete database and keep track of what matters the most in your project. From bar graphs to scatter plots



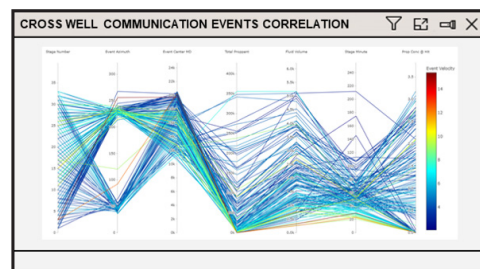
DAS/DTS Viewer

Overview the stage DAS and DTS data without the need of paid software.



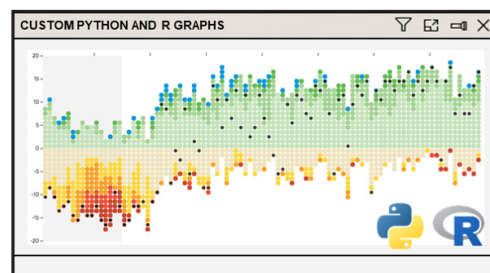
Map View

Display wells completion along with the cross well communication results. Filter by stage, event type, and well.



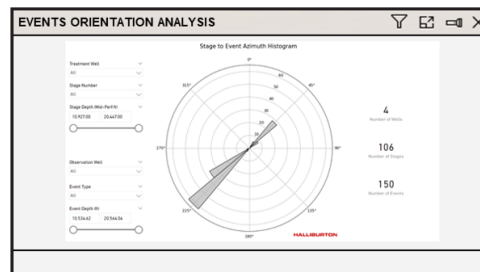
Events Correlation

Organize your data as line plots to identify where your results are clustered.



Custom Python and R Graphs

Explore further options by integrating custom Python and R graphs into your dashboard.



Events Orientation Analysis

Analyze the predominant azimuth of the cross well communication events. Filter by depth, stage, event type, and well.



Put insight
into action
quickly and easily.

ACCESS YOUR DATA EASILY AND DIGITALLY

With fiber, you consume a substantial amount of data. Sifting through files and interpreting this data is time consuming. Our data analytics platform improves how you receive and access your insights, so you can put insight into action quickly and easily.

Gone are the days of delivering PDF and PowerPoint data files. We offer prebuilt charts, plots and visuals that help you bypass the manual and cumbersome work of cleaning and importing data. We also offer the flexibility to customize how you see and interact with the data.

We offer more than just waterfalls, with features that include:

- » **Trend Analysis:** Evaluate multiple fiber projects quickly and understand trends across wells to make design adjustments.
- » **Holistic 360 Degree View:** Our open-source platform lets you build on to existing data gathered across all your assets, for a holistic view and accurate analysis of subsurface activity, such as well interactions, in real time.
- » **Detailed Data Viewer:** Allows operators, specifically reservoir engineers and geoscientists, to analyze raw data quickly and easily.

Trying to understand what's happening downhole while fracturing is complicated. The solution shouldn't be.

**LEARN MORE ABOUT
OUR REAL-TIME FIBER
ANALYTICS SERVICES BY
CONTACTING US TODAY.**

Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.

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