# Carina® 100XLog diagnoses fracture designs by quantifying well production from individual clusters

Client: RockCliff Energy, USA

## Challenge

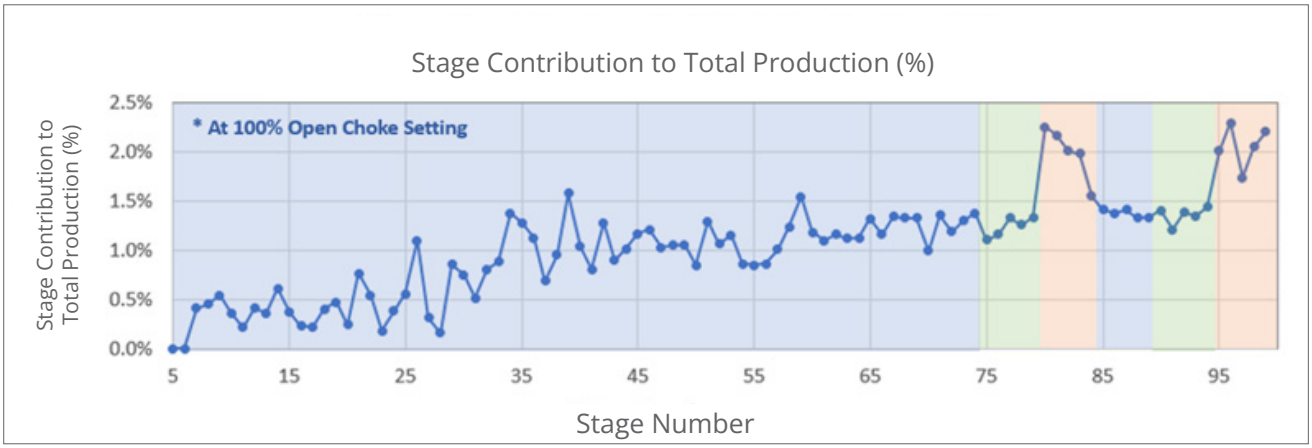
Diagnose a series of stimulation designs in a recently fractured well based on the cluster level inflow production analysis using a fiber optic wireline cable deployed on well tractor.

## Solution

Deploy Silixa's retrievable engineered fibre optic sensing-based system, Carina 100Xlog, for in-well diagnostics to compare production from each stimulation design.

## Results

Silixa's fiber optic production analysis answer product was able to identify the optimal stimulation design. The optimal design was applied by the operator on future wells and the cost for the fiber deployment and production analysis was fully re-couped on the next well in cost savings when they applied the new completions design.




Stage contribution to total production (%) using DAS allocation data highlighted by design. Toe-side stages contribute much less toward total production compared to the heel.

| | Stage length | Cluster count | Shots per foot | Cluster spacing |
|---|---|---|---|---|
| Old Design | 100 ft | 6 clusters | 6 SPF | 17 ft |
| New Design | 150 ft | 9 clusters | 4 SPF | 17 ft |

## Background Information

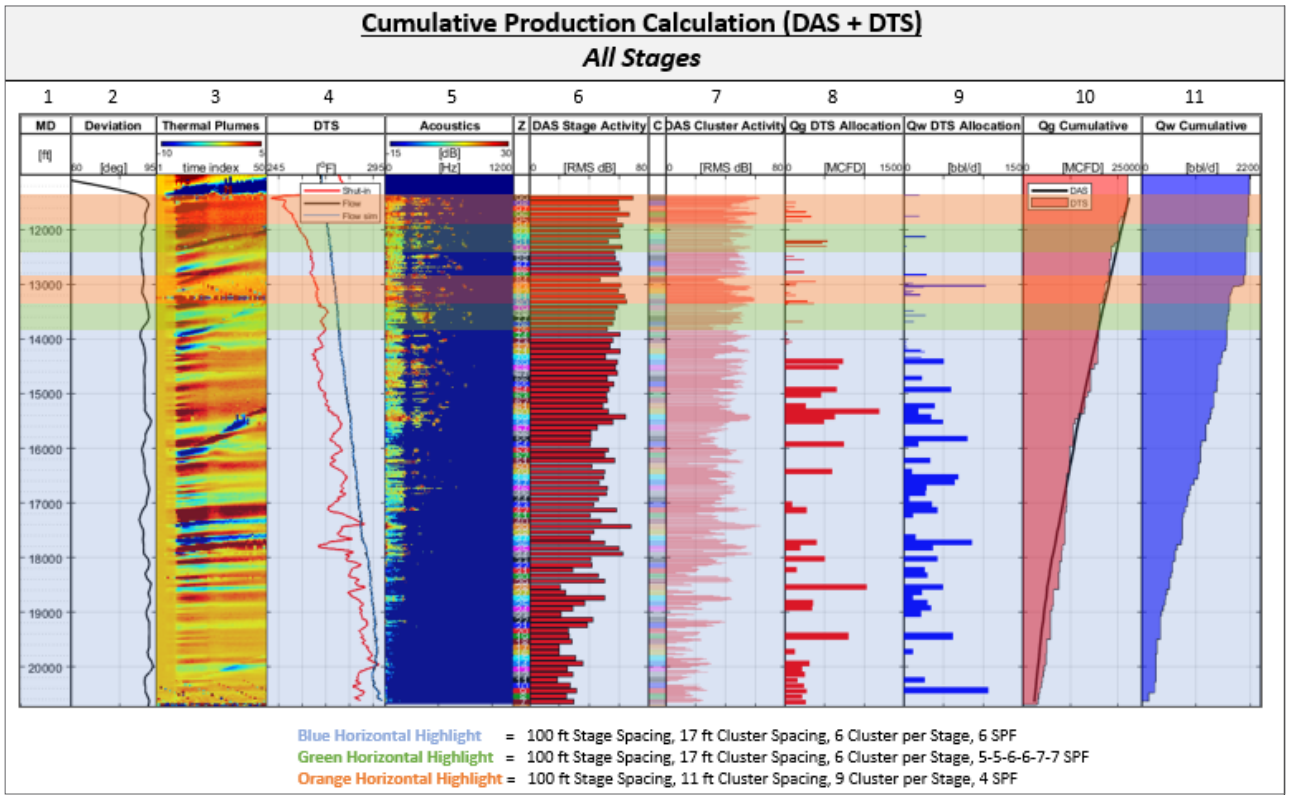
To continue the technological advancement of hydraulic fracture completions, more rigorous analysis is required to continue to optimize well treatment designs. Some of the most recent changes over the last few years have come in the form of decreasing cluster spacing and increasing lateral lengths. Quickly finding the ideal lateral length and perf cluster design for the economic conditions requires a diagnostic tool that can quickly tie those design changes back to production performance.

## Surveillance program

A well was chosen for production monitoring within the operator's large acreage position in East Texas so that the learnings from the project could be applied across their horizontal well completions program.

Production data is allocated to individual stages and clusters using fiber optic distributed acoustic sensing (DAS) and distributed temperature sensing (DTS) data. The well is landed in the high temperature (300+ degF) Haynesville Formation and has been producing for 1 month before intervention. The temporary fiber optic line was deployed using a tractor and left in the wellbore over the 2.5 day monitoring program. The program contained a series of well opening and closing sequences during which the fiber continuously measured changing wellbore conditions, which are missed when moving other types of production logging tools up and down the wellbore.

The focus of the project was to optimize the completion design in an effort to discern treatment effectiveness and effect on production.



## Value created to client

An optimal stimulation design containing increased cluster count and stage length was identified during the fiber analysis and was later applied by the operator on future wells. The cost paid by the operator for the fiber analysis was fully re-couped on the next well in the form of cost savings when they utilized the new stimulation design.

The low cost of Carina 100XLog is the result of rapid surveys, that are not only magnitudes faster than other types of production log tools, but are not even comparable because standard tools cannot obtain production measurements at all points of the wellbore at a time. This is due to having to move the standard production logging tool (spinners) up and down the wellbore to try to capture changing production conditions, something that only fiber production logging tools can obtain because of their "distributed" sensing capabilities, allowing for production measurements at all points of the wellbore simultaneously.

## Benefits of using the Carina 100XLog solution demonstrated

- The solution produced quantitative cluster level flow allocation results
- It identified the optimal stimulation design to be applied across acreage position
- The service cost paid by the operator was fully re-couped on the next well when the new stimulation design was utilized

## Why Use Carina 100XLog

- Carina 100XLog provides 100x improvement in signal-to-noise ratio (SNR). This superior sensitivity enables the system to detect ultra-low flowing clusters. The higher SNR can detect acoustic energy of flow through highly eroded perforations even though a low-pressure drop is present (less noise).

- Distributed data ensures wider coverage. Unlike traditional production logging tools that cover a single point in the well at one time, missing hanging production during well opening and closing sequences, and requiring multiple passes, Carina 100XLog captures every point in the wellbore simultaneously, replacing guesswork with high fidelity data in less time.

- Higher SNR also allows for advanced diagnostic capabilities such as the ability to identify multi-phase flow regimes using Silixa's Speed of Sound (SOS) analysis and the ability to detect low-frequency "thermal plumes" during production transient analysis.

Reference: (URTeC 5512, July 2021), Optimizing Completion Designs for the East Texas Haynesville Utilizing, Production Flow Allocations From Lower-Cost Fiber Optic Sensing DAS/DTS Systems

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