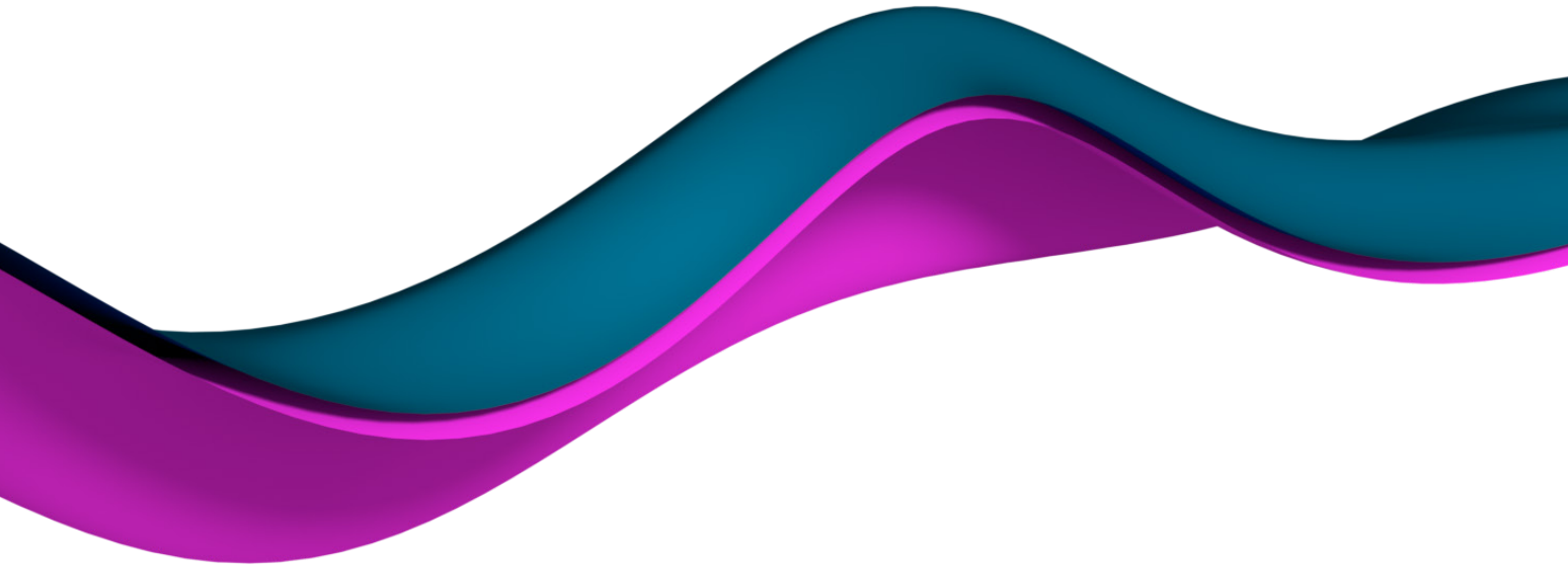


Catch the **next wave** in completions

PulseEight™

Dynamic Downhole Reservoir Management System

TAQA


The best way to deal
with complexity
is to balance it with
simplicity

It's time to replace intelligent completions dictated by the constraints of downhole technology with a more agile completions approach, shaped by the dynamics of the reservoir

Introducing the world's first re-deployable wireless completion

PulseEight gives you the opportunity to achieve greater recovery gains from any well.

Our PulseEight dynamic downhole reservoir management system is the world's first re-deployable wireless completion with control, power, monitoring and communications already on board.

In contrast to a fixed intelligent completion, operators can deploy PulseEight systems on wireline in any well at any depth, programme it to dynamically manage drainage with infinite variability, then pull, re-programme and re-deploy elsewhere.

Putting the PulseEight systems' suite of tools to work as intelligent assets represent a more agile completions approach, providing systems that respond to the changing dynamics of the reservoir during production.

To make this approach possible, we pioneered Fluid Harmonics production telemetry, the only downhole system designed for two-way cable-free communication by harnessing live production fluids.

Intelligent completions make way for the next wave: **intelligent assets**

In contrast to installing a fixed intelligent completion, operators can deploy a Dynamic Monitoring and Control insert anywhere on wireline, use it to dynamically manage drainage, then pull, re-programme and re-deploy.

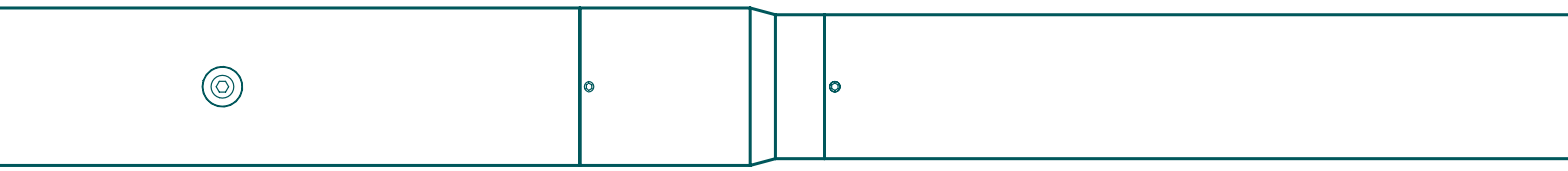
Our PulseEight systems provide a versatile wireless alternative to existing data transfer and actuation methods within both production and injection wells.

Downhole, the flow regime is diverted through an infinitely variable choke system which permits the manipulation of the available flow area with which to create a pressure response that can be observed at surface. These communication waves can be received and decoded by surface software examining the amplitude, duration and interval of the waves to deliver meaningful data from the tool.

A similar effect can be achieved at surface using a production choke for the reversal of the communication route. As this communication wave is contained within the normal flow stream, it is possible to achieve this level of communication without the need for additional downhole 'jewellery', such as signal boosters or repeater systems.

This provides the ability for the entire system to have an elegantly compact configuration with limited downhole footprint.

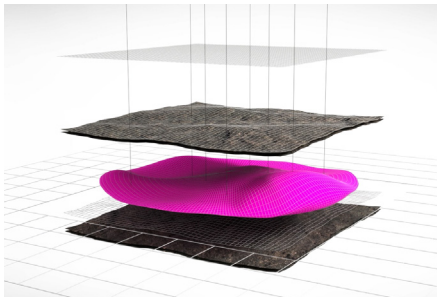
Additionally, surface equipment requirements can be reduced to almost zero by utilising existing pressure monitoring already in place which enables an easy to install solution.



PulseEight™ allows operators to be smart about how much they invest, how they manage pressure and outflow to keep a well economical, and when it's time to deploy elsewhere.

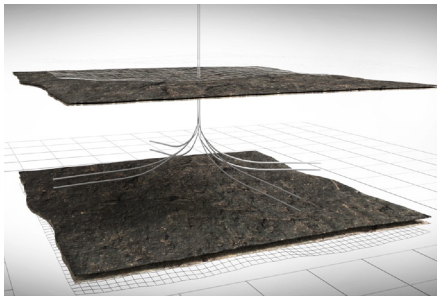
Adds value in **any** scenario

From marginal fields to multilateral wells, putting an intelligent asset to work provides the most direct way to reduce lifting costs, improve economic viability, extend productive life and increase overall recovery rates.



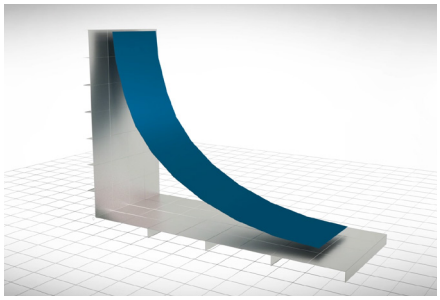
Reduce lifting costs in mature fields

With more oil and less water and gas breakthrough, PulseEight's intervention allows operators to design optimal wells, balance cash flow, achieve drive in reducing lifting costs, balance reservoir complexity with simplicity of completion, and it's your intelligent asset – use it again and again. Low risk solution with the target of reducing costs and extending production.



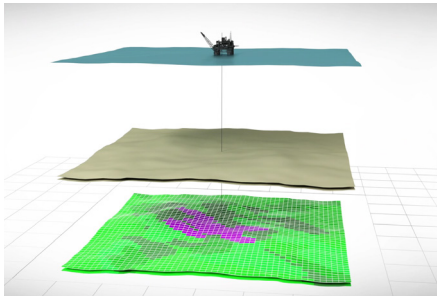
Simplify junction control in multilaterals

In multilateral completions, there is a tendency for one lateral to dominate. Cables and control junction lines struggle to overcome the complexity of multilateral completions. Multilaterals are easily within the capabilities of well design and drilling, but limited by completion technology today. PulseEight bridges this completion technology gap.



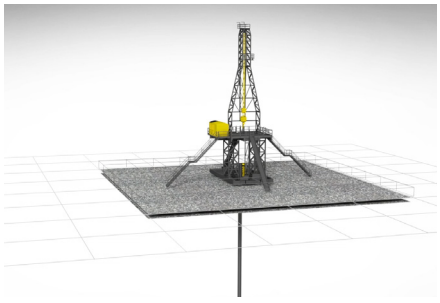
Improve marginal field economics

PulseEight systems allow changes to the economics of a marginal field. The well can be drilled and perforated as required allowing it to be simply and quickly brought on production – with PulseEight permitting future completion control later. This reduces exposure to market price volatility and overall completion costs. PulseEight improves NPV by allowing first oil sooner and can delay cessation of production by improving decline curves.



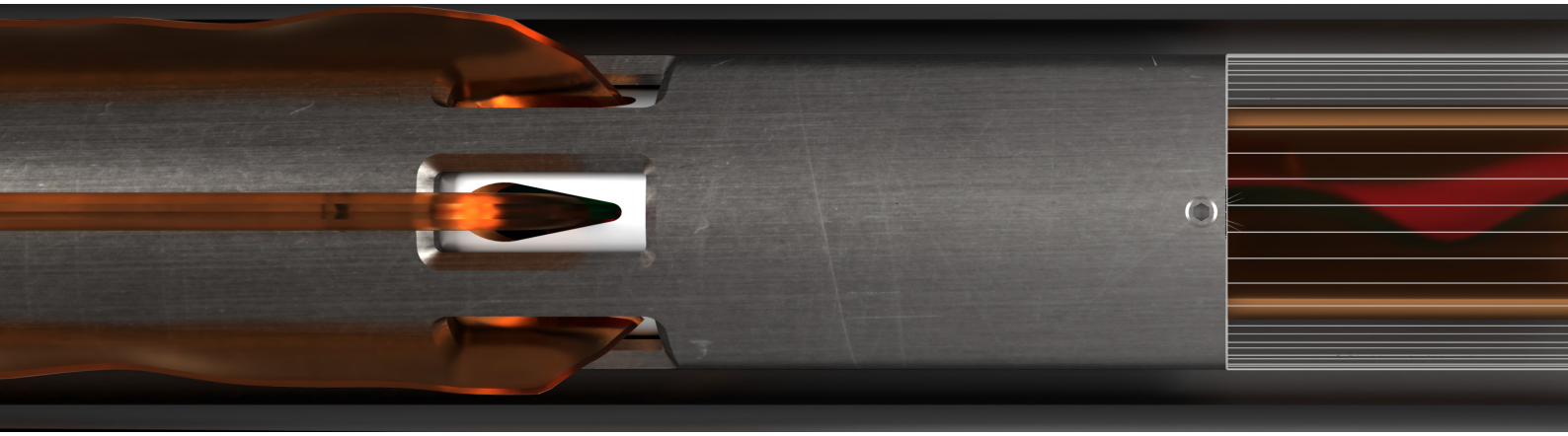
Maintain safety, address integrity issues and support compliance

The elimination of traditional hydraulic or electric control lines reduces overall system costs whilst delivering an improved design from a safety aspect. The truly intelligent capability of modern tooling sees the absolute need of surface data analysis for key trigger points in the well lifecycle to be mitigated, leaving engineering time to focus on more complex aspects of the reservoir's production potential.



Drive down capex in new deals

Traditional systems incur significant CAPEX for initial deployment and increased risk due to possible damage of control lines. PulseEight eliminates that need.



A more **fluid** approach

PulseEight employs Fluid Harmonics, TAQA's proprietary wireless production telemetry that puts produced fluids to work as a two-way channel for data and tool commands.

The early development of PulseEight focused on the need to address the significant challenges associated with ensuring Fluid Harmonics telemetry could be achieved in not only liquid flow but also gas, and all three phases of flow.

Tool responses have been designed such that they can autonomously optimise the pressure response created downhole to illicit a robust surface signal. This has been demonstrated to be possible even within the changeable characteristics of 'steady state' flow regimes associated with any hydrocarbon production stream.

The **PulseEight Monitor** was first applied to a retrofit downhole pressure and temperature monitoring system. This significantly expanded upon the limited functionality of the traditional industry memory gauge by providing real-time data to surface. This has facilitated the capability of existing reservoir models to be simultaneously updated with the latest data in a timeframe that is unhindered by the need for well interventions to retrieve memory gauges to surface for download.

These benefits, coupled with the flexibility of the retrofit design, were exemplified over multiple deployments over the last few years. This permitted valuable pressure and temperature monitoring to be regained in wells which had experienced a failure of their permanent downhole gauge systems and in wells which were never designed for gauge inclusion in the first place.

In one example, declining reservoir pressure in a field had resulted in the requirement for more surface compression capability to drive production. It was therefore crucial that there was an accurate understanding of reservoir pressure and decline to meet contractual gas deliveries and achieve recovery targets. A long-term deployment of the PulseEight Monitor system secured the requisite information to facilitate these needs.

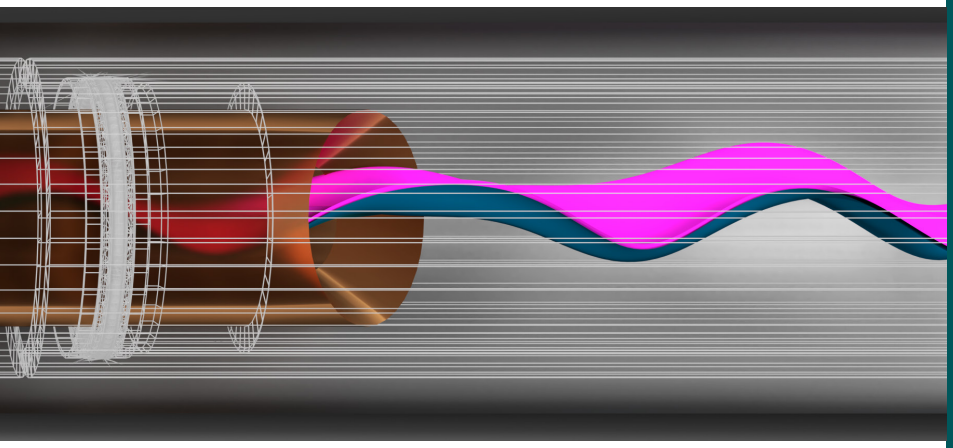
The communication system capability has been further expanded to offer true cable-free access to wellbore data. A recent deployment of a **PulseEight Control** in an onshore well demonstrated the ability of the system to send data wirelessly from the tool all the way to a smartphone app.

In what is believed to be a world first, this wireless 'reservoir to smartphone' communication enabled easy access in almost any global location with either cell phone or satellite link connectivity.

Despite the obvious benefit of ease of access, this opens up a new data route capability for challenging wells and/or remote locations that would otherwise be unattainable.

The system's additional ability to function autonomously in reaction to specific wellbore events, without the need of surface instruction, opens a new chapter in the digital oilfield delivery.

The **PulseEight Secure** is the first tool in the range which utilises this autonomy. It conducts downhole shut-ins in response to conditional flow changes associated with losses of surface containment or emergency shut-down events in producing wells. These first steps now brings aspects of data analysis downhole to elicit responses in a timeframe unachievable by traditional human analysis and action alone. Allowing for future more rapid production optimisation from the PulseEight suite.



As produced fluids travel through the tool, infinitely variable ports are used to briefly manipulate the flow regime with precision

Information is embedded within the amplitude, duration and interval of the resulting communication wave

Proprietary software running in the surface acquisition unit identifies and decodes the received signal

By manipulating surface chokes, tool commands can also be transmitted from the surface and decoded downhole by PulseEight™'s onboard software

Wireless communications like no other

Robust without repeater

Proven in gas, liquids and multiphase fluids

Unconstrained by casing/tubing design

Subsea compatible

Simple surface integration

PulseEight™ Specifications

Secure your well

PulseEight Secure

PulseEight Secure is a retrofittable, wireless, cable-free subsurface safety valve that enables production in dynnamic environments. Qualified under API 14A, the intelligent safety valve ofers a fully autonomous self-powered system.

The valve is equipped with pressure and temperature sensors upstream and downstream of choke ports, providing accurate surveillance of well events and ease of opening via TAQA's proprietary fluid harmonic communication. In additon, the tool is self-monitoring and will communicate a "Vitality Pulse" to surface providing valuable information associated with tool integrity and battery life.

Improve Recovery with Control

PulseEight Control

PulseEight Control is a wireless, cable free downhole flow management system that replaces conventional Inflow Control Valves. From deployment onward, it provides continuous downhole surveillance transmitting real-time data (traditionally gathered via PLTs) to surface. Offering zonal control for both production and injection, the system can be integrated during completion or retrofitted into existing wells, enabling remote isolation or modulation of individual intervals without the need for control lines.

Monitoring Where it Matters

PulseEight Monitor

PulseEight Monitor is a wireless, cable-free downhole monitoring solution that provides continuous pressure and temperature surveillance without the need for dedicated control lines or costly workovers. Using proprietary fluids and records high-frequency PBU data to onboard memory.

SPECIFICATIONS

	Verified	Tubing Size inches	OD inches	Max Flow Area, Ports inches²	Flow Area, ID Bore inches²	Maximum Rate bbls/day	Body Pressure psi	Static Seal from below psi	Differential Pressure psi	Temp °F	Length Min-Max ft
SECURE	API 14A	3.5-5.5	2.5	2.26	1.88	10,000	10,000	7,500	1,500	230	17.12-30.86
SECURE	API 14A V2-R	7	5	9.65	8.04	30,000	6,000	6,000	1,500	230	18.66
CONTROL	N/A	3.5-5.5	2.5	2.26	1.88	10,000	10,000	7,500	1,500	230	17.12-30.86
MONITOR	N/A	3.5-5.5	2.5	2.26	1.88	10,000	7,500	N/A	N/A	230	17.89-31.63

*All tools have Dual Quartz sensors
** All tools Metallurgy - Inc718 (NACE MR0175/ISO 15156 compliant)

PulseEight™ Secure
Success Story
PulseEight Restores well integrity with significant increase in well production
Alaska

10x
INCREASE IN OIL PRODUCTION

5
DAYS TIME SAVING TO REOPEN

89%
REDUCTION IN FLOWING WELL-HEAD PRESSURE

PulseEight Secure wireless completion is a simple retrofit solution to safely restore production or injection in wells with a failed downhole safety valve, by autonomously responding to change in a well's flow or a critical safety event.

THE CHALLENGE

An operator in Prudhoe Bay had a well which had been shut-in for some time due to high water cut in low oil production. The well was previously operated with ~950psi flowing well head pressure required to maintain the Back Pressure Valve (BPV) in the open position and for it to close in an emergency.

THE SOLUTION

A self-contained, self-powered 3.5" PulseEight was successfully deployed and commissioned, and the State Regulator, Alaska Oil & Gas Conservation Commission (AOGCC), witnessed multiple commissioning tests of the new technology, approving the well to be put into full production.

THE RESULT

Initial testing and subsequent well clean-ups established flowing well head pressure with the PulseEight Secure installed is ~200psi. As a direct result, the customer witnessed a three-fold increase in total fluids but the associated reduction in water cut (WC) associated with this drawdown saw a near ten-fold increase in oil. Longer term, it is expected that the WC will continue to reduce delivering more incremental oil.

WELL DATA

- Location: Prudoe Bay, Alaska
- Well Type: Oil Producer
- Tubing size: 5.5inch
- Setting Temp: 95°C

PulseEight™ Secure
Success Story

PulseEight Secure enables return to production in a previously shut in offshore North Sea well

UK

100%
ROI
WITHIN 6 DAYS

300+
DAYS
OPERATIONAL

$$$
WORKOVER
COST SAVINGS

PulseEight Secure wireless completion is a simple retrofit solution to safely restore production or injection in wells with a failed downhole safety valve, by autonomously responding to change in a well's flow or a critical safety event.

THE CHALLENGE

An operator in the UK had a cyclic gas-producing well with a control line leak rendering the Tubing Retrievable Sub-Surface Safety Valve (TRSSSV) inoperable and no option to run an Insert Safety Valve (ISSV). The well had been shut in since 2021 and the operator needed a safe solution that was not dependent on control line.

THE SOLUTION

In March 2023, a 3.5" PulseEight Secure wireless completion was installed just above the existing TRSSSV using a retrievable packer, enabling the operator to bring the well back on to production safely without having to pull the tubing. The tool was run in closed to allow the packer to be inflow tested against the maximum anticipated pressure.

WELL DATA

- Location: Offshore, UK
- Well Type: Gas Producer
- Tubing size: 5.5inch
- Setting Temp: 95°C

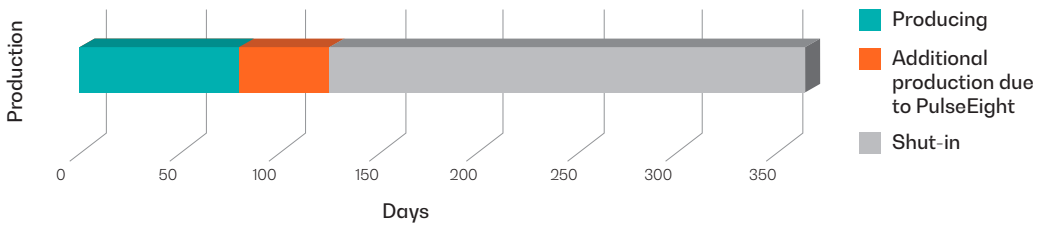
THE RESULT

The installation of PulseEight Secure enabled over 50% additional days production, significantly improving recovery and therefor the economics of the well.

Our daily Vitality Pulse provided continuous visibility into the tool's functionality, thus adding an additional level of safety assurance over other barrier solutions. The unique Vitality Pulse has no negative impact on productivity, is fully automatic and provides a daily tool status, unlike other barrier solutions that require periodic testing.

The operator was able to eliminate multiple yearly interventions, allowing them to optimize the overall production from the cyclic well, compared to the previous operational model.

The deployment of PulseEight Secure created significant value for our customer, by improving production time and setting a standard for managing future well operations.



**Example of expected increase in production time using PulseEight Secure*

PulseEight™ Monitor
Success Story

Retrofittable wireless gauge installed via slickline in 6hrs, and reservoir data transmitted to surface in less than 24 hours.

Middle East

< 6hrs
INSTALLATION

< 24hr
RE-INSTATED RESERVOIR MONITORING

$$$
NO NEED FOR WORKOVER

Hydraulically operated tool, deployed in the tubing string, adds a continuous monitoring capability to any well via intervention rather than a costly workover. PulseEight Monitor uses fluid perturbation to transmit regular pressure and temperature data through live produced fluids.

THE CHALLENGE

Trial well, permanent downhole gauge monitoring in place, results from PulseEight Monitor used as a comparison against existing Downhole Gauge.

We were able to set PulseEight Monitor at desired setting depth. Target with tool is to reinstate reservoir monitoring where clients either have no gauges or failed gauges that required workover and time to replace.

THE SOLUTION

Retrofitted PulseEight Monitor in less than 6 hours, set on lock mandrel avoiding the requirement for workover of multiple piece systems.

WELL DATA

- Location: Middle East
- Well Type: Oil
- Tubing size: 4 1/2"
- Well Temp: 110°C
- Deployment Year: 2023

THE RESULT

Daily pressure and temperature data to surface in less than 24 hours. Daily data from tool also included tool status information valuable for tool integrity and longevity monitoring. Additional benefits of the tool presented data image below; is the tools ability to recognise a well shut-in and activating and enhanced logging frequency to ensure pressure build up is recorded on the tool memory for added value on recovery.

The first telegram delivered from the tool upon-reopening after a shut-in is the max shut-in pressure recorded during the well closure period.

Tubing head pressure at surface was decoded to provide valuable daily data points, providing data from reservoir to desktop wirelessly.

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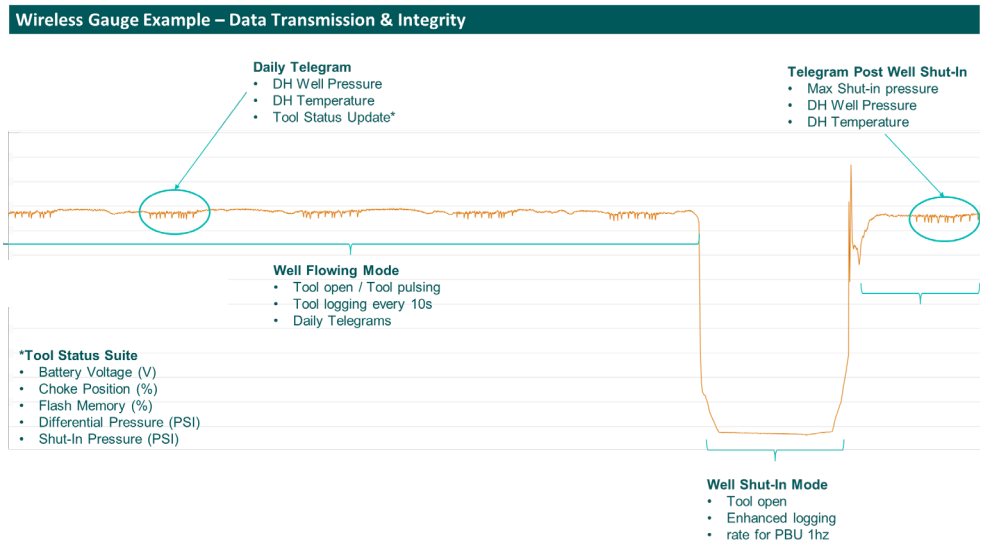

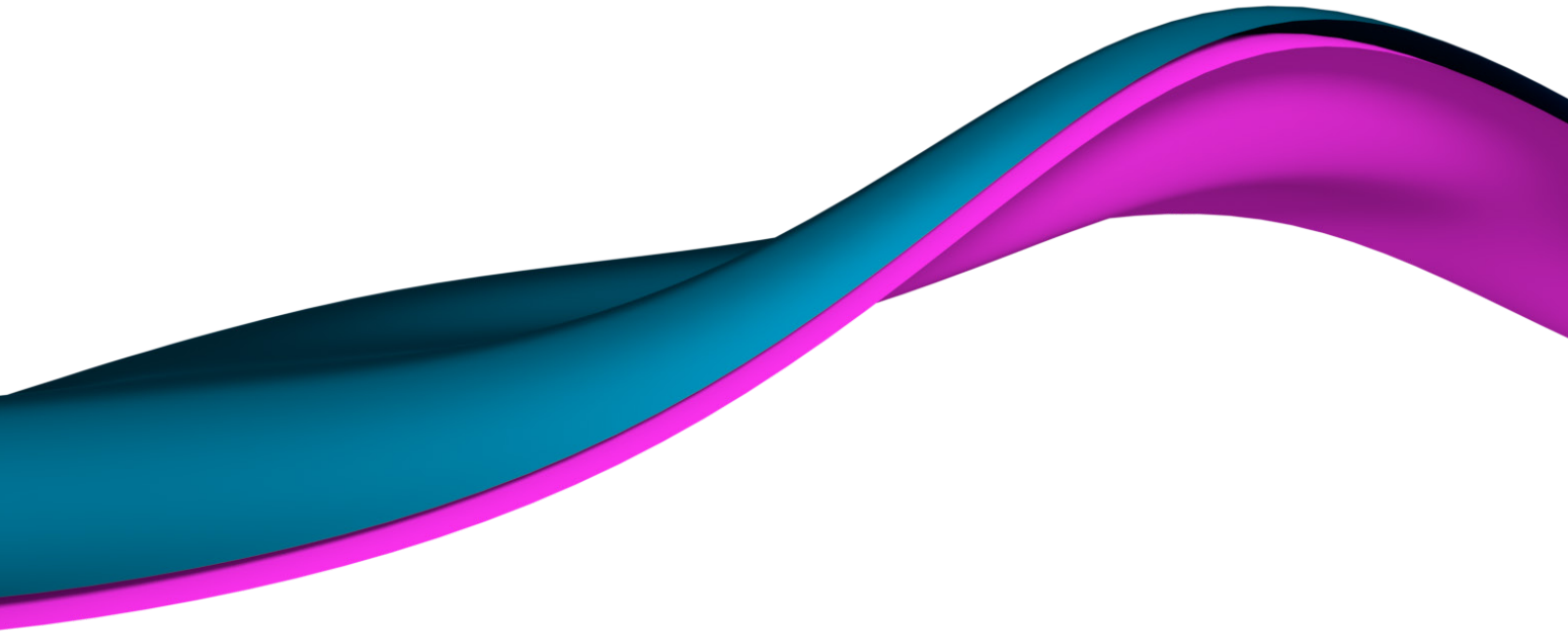

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