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DATA ANALYTICS

CLARITY™
POWERED BY PRISM

AUTOMATED COLLAR TO COLLAR MATCHING USING PRISM TIMELAPSE

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EXECUTIVE SUMMARY

In the high-stakes environment of well integrity management, the ability to accurately monitor an asset's degradation over time is the difference between proactive maintenance and catastrophic failure. Timelapse Analysis of Multi-Finger Caliper (MFC) surveys over time is the primary tool used for this monitoring. However, the industry has long been hampered by the manual, subjective process of depth-matching surveys that is laborious and time consuming.

ANSA's **PRISM suite** introduces a new workflow solution by moving away from traditional sparse manual picking and correlation by adopting a collar wise Correlation model. This allows PRISM to automate the identification and synchronization of every pipe joint within a wellbore. Utilizing the **PRISM Joint Identification** module for high-fidelity detection (>95% accuracy) and the **PRISM Timelapse** module for algorithmic pairwise matching, the software eliminates non-linear depth discrepancies caused by cable stretch and mechanical slip. This approach ensures that variations in recorded pipe radius represent true material loss rather than correlation errors, providing operators with more reliable corrosion-rate measurements.

CHALLENGES IN MONITORING

Accurate prediction of an asset's Remaining Service Life (RSL) relies on the comparison of radial measurements acquired across multiple surveys over time. By quantifying changes in the pipe's internal profile, analysts can distinguish between stable environments and active threats like accelerated corrosion or scale deposition.

Traditionally, the synchronization of multiple surveys has been a manual and labor-intensive process. Analysts align datasets using reference points such as Safety Valves (SSV), Side Pocket Mandrels (SPM), or Landing Nipples as depth anchors. While these completion items provide a basic framework for alignment, the approach presents several technical limitations:

- **Non-Linear Depth Discrepancies:** While two surveys may align at a specific nipple profile, variations in cable stretch, tool speed, and wheel slippage mean that data thousands of feet away may still be out of sync. Manual "point-to-point" shifting fails to account for the non-linear nature of depth errors.
- **Error Propagation and "Snowballing":** In mature assets where three or more surveys are being compared, any alignment error introduced between the first and second surveys is inherently carried forward into all subsequent comparisons. These compounded inaccuracies can lead to a fundamental miscalculation of the Corrosion Rate loss (mm/year).

PRISM TIMELAPSE

For timelapse data to be actionable, the process must be replicable and independent of human bias. The industry requires a solution that moves beyond "visual best-fits" toward a standardized approach that would improve reliability and replicability. Integrated within the Clarity software, the PRISM suite leverages proprietary AI-enhanced algorithms to streamline complex processing procedures. This automation minimizes human bias and eliminates manual redundancies, ensuring that both junior and senior analysts can achieve precise, data-driven conclusions with consistent accuracy.

To overcome the inherent inaccuracies of manual point-picking, ANSA has introduced a comprehensive depth-synchronization framework within the PRISM suite. The core philosophy of this solution is to transition from a sparse reference model to a collar wise correlation model. By utilizing every pipe collar as a synchronization anchor, PRISM ensures that depth discrepancies are corrected at a granular, joint-by-joint level. This is achieved through a streamlined, two-stage automated workflow:

PRISM TIMELAPSE

Stage One: Automated Collar Picking (PRISM Joint Identification)

The first hurdle in high-fidelity alignment is the identification of individual pipe joints across thousands of feet of data. Traditionally, this step is manual and proves to be quite labour intensive and time-consuming. The **PRISM Joint Identification** module utilizes a proprietary signal-processing algorithm and machine learning models to detect the radial signatures of casing/tubing collars and completion components for almost instant identification.

Stage Two: Intelligent Pairwise Correlation (PRISM Timelapse)

Once the individual joints are identified in both the baseline and the subsequent surveys, the **PRISM Timelapse** module performs the actual synchronization.

Rather than a simple linear shift, the module employs a pairwise distance matrix Matching algorithm. This mathematical approach compares the distribution of collars in Survey A against Survey B to calculate the most statistically probable joint pairs.

The Analytical Result: "True Delta" Reporting

By pinning the surveys together at every collar, PRISM eliminates the "false anomalies" caused by depth-shift artefacts. The resulting output is a clean, synchronized dataset where any remaining radial difference can be confidently attributed to actual physical changes such as corrosion, erosion, or mineral deposition rather than mechanical measurement error or analyst subjectivity.

CASE STUDY

To validate the efficiency of the **PRISM** workflow, we analysed two MFC datasets (Dataset A and B) captured from the same asset at different times. This example focuses on how automated collar matching identifies and corrects non-linear depth anomalies that would otherwise compromise the integrity analysis.

The analysis began with the **PRISM Joint Identification** module. With a single click, the model predicted all the collars within the well.

Dataset A (Reference): 255 joints identified.

Dataset B (Comparison): 256 joints identified.

At this stage, the analyst performed a rapid audit of the results, utilising the PRISM interface to refine collar tops and bottoms where scale buildup had slightly attenuated the signal, ensuring a 100% accurate joint table before proceeding to the synchronization phase.

Dataset A

Index	Joint Top	Joint Bottom	Joint Length	Collar Length	Annotation
1	43.020	51.640	8.620	1.390	Joint
2	53.030	94.430	41.400	1.450	Joint
3	95.880	109.260	13.380	1.420	Joint
4	110.680	119.050	8.370	1.420	Joint
5	120.470	160.910	40.440	1.400	Joint
6	162.310	202.570	40.260	1.400	Joint
7	203.970	243.390	39.420	1.400	Joint
8	244.790	283.660	38.870	1.350	Joint
9	285.010	325.530	40.520	1.410	Joint
10	326.940	368.670	41.730	1.370	Joint
⋮					
246	10235.300	10278.440	43.140	1.300	Joint
247	10279.740	10320.470	40.730	1.290	Joint
248	10321.760	10362.370	40.610	1.200	Joint
249	10363.570	10405.750	42.180	1.200	Joint
250	10406.950	10448.560	41.610	1.290	Joint
251	10449.850	10492.520	42.670	1.290	Joint
252	10493.810	10535.430	41.620	1.240	Joint
253	10536.670	10578.420	41.750	1.170	Joint
254	10579.590	10621.310	41.720	1.270	Joint
255	10622.580	10652.130	29.550	NaN	Joint

Delete Selected | Delete All | Export | Import | Auto Detect

Dataset B

Index	Joint Top	Joint Bottom	Joint Length	Collar Length	Annotation
1	0.000	44.965	44.965	1.000	Joint
2	45.965	51.640	5.675	1.390	Joint
3	53.030	94.430	41.400	1.450	Joint
4	95.880	109.260	13.380	1.420	Joint
5	110.680	119.050	8.370	1.420	Joint
6	120.470	160.910	40.440	1.400	Joint
7	162.310	202.570	40.260	1.400	Joint
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250	10363.570	10405.760	42.190	1.190	Joint
251	10406.950	10448.560	41.610	1.290	Joint
252	10449.850	10492.520	42.670	1.290	Joint
253	10493.810	10535.430	41.620	1.240	Joint
254	10536.670	10578.420	41.750	1.170	Joint
255	10579.590	10621.310	41.720	1.270	Joint
256	10622.580	10652.130	29.550	NaN	Joint

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CASE STUDY

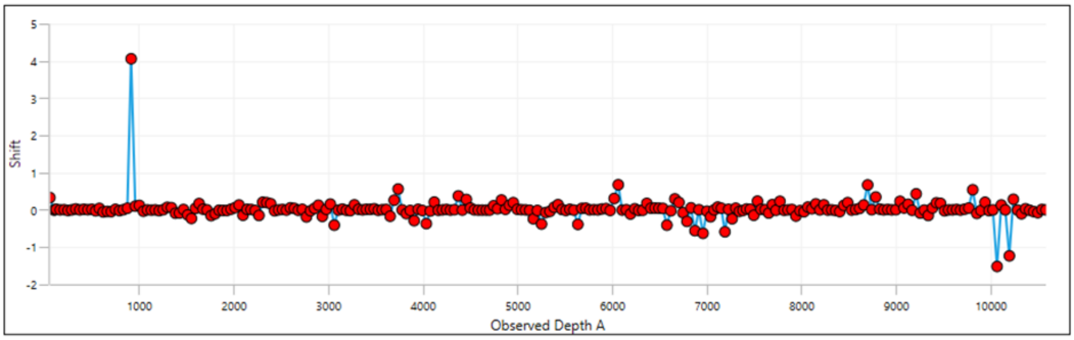
Identifying the "Anomalous Shift"

The joint tables were then processed through the **PRISM Timelapse** module. The software generated a comparative matrix presenting each joint pair alongside two critical metrics:

- **Shift:** The total depth displacement required to align each collar from Dataset A with their respective collar from Reference Dataset B.
- **Delta:** The rate of change between subsequent shifts, highlighting where "stretch" or "compression" is occurring.

Dataset	Data Node	Top Depth	Bottom Depth	Number of Joints
A	PrismCent2	52.100	10624.520	253
B	PrismCent1	43.020	10652.130	255

Dataset A Depth	Dataset B Depth	Shift	Delta	Comment A	Comment B
829.645	829.640	0.005	0.025	Joint21	Joint22
872.135	872.090	0.045	0.040	Joint22	Joint23
912.020	907.960	4.060	4.015	Joint23	Joint24
955.760	955.660	0.100	-3.960	Joint24	Joint25
998.640	998.520	0.120	0.020	Joint25	Joint26
1040.935	1040.970	-0.035	-0.155	Joint26	Joint27
1082.460	1082.460	0.000	0.035	Joint27	Joint28



The output of this module is a shift profile against depth which is a powerful visualisation tool for the analysts. In this case, it revealed a clear anomaly at 912 ft. Although the overall depth shift remained relatively stable in the upper section of the well, Dataset A exhibited a localized stretching at this depth. In traditional manual alignment, such discrepancies are often smoothed over, introducing depth-shift errors that propagate through the remainder of the survey.

CONCLUSION

The integrity of a well is a dynamic, evolving metric. To manage it effectively, the data used to calculate corrosion and scale-accumulation rates must be beyond reproach. As demonstrated in this whitepaper, the **PRISM** workflow effectively removes the technical bottlenecks and human biases that have traditionally plagued timelapse studies.
By transitioning to a collar wise asset correlation model, ANSA provides three critical advantages to well integrity analysts:

- **Mathematical Replicability:** The use of a **Pairwise Distance Matrix** ensures that the alignment is driven by objective data, allowing different teams to achieve identical, standardized results across the entire asset lifecycle.
- **Artefact Elimination:** By correcting depth at a joint-by-joint level, PRISM removes artefacts, preventing the unnecessary and costly remediation of healthy pipe.
- **Operational Efficiency:** Automating the laborious task of collar detection allows analysts of any experience to shift their focus from cleaning data to interpreting risks, reducing total analysis time.

Ultimately, the **PRISM Timelapse** module provides the consistent data foundation required for confident well integrity reporting. By anchoring every survey to the physical joints of the well, ANSA ensures that operators are making decisions based on the true physical state of their assets, supporting safer and more reliable operational decisions..