
NEAL
ANALYTICS
TRANSFORMING YOUR BUSINESS WITH DATA
Predictive Maintenance
Customer Stories

Multinational glass manufacturer: Predictive maintenance for manufacturing equipment

CHALLENGES

Experiencing equipment failures unexpected costs in production process

High machine downtime and low production availability

Managers are challenged to see through all the rapidly growing machine data volumes captured throughout the process

SOLUTIONS

Using Azure Machine Learning, Neal Analytics identified key variables that influence the failure of equipment such as pressure, current, and duty cycle

Used a classification model to predict future failures in equipment based on known failure events

Used an anomaly detection to identify outliers in sensor data that could lead to failures throughout the production process

RESULTS

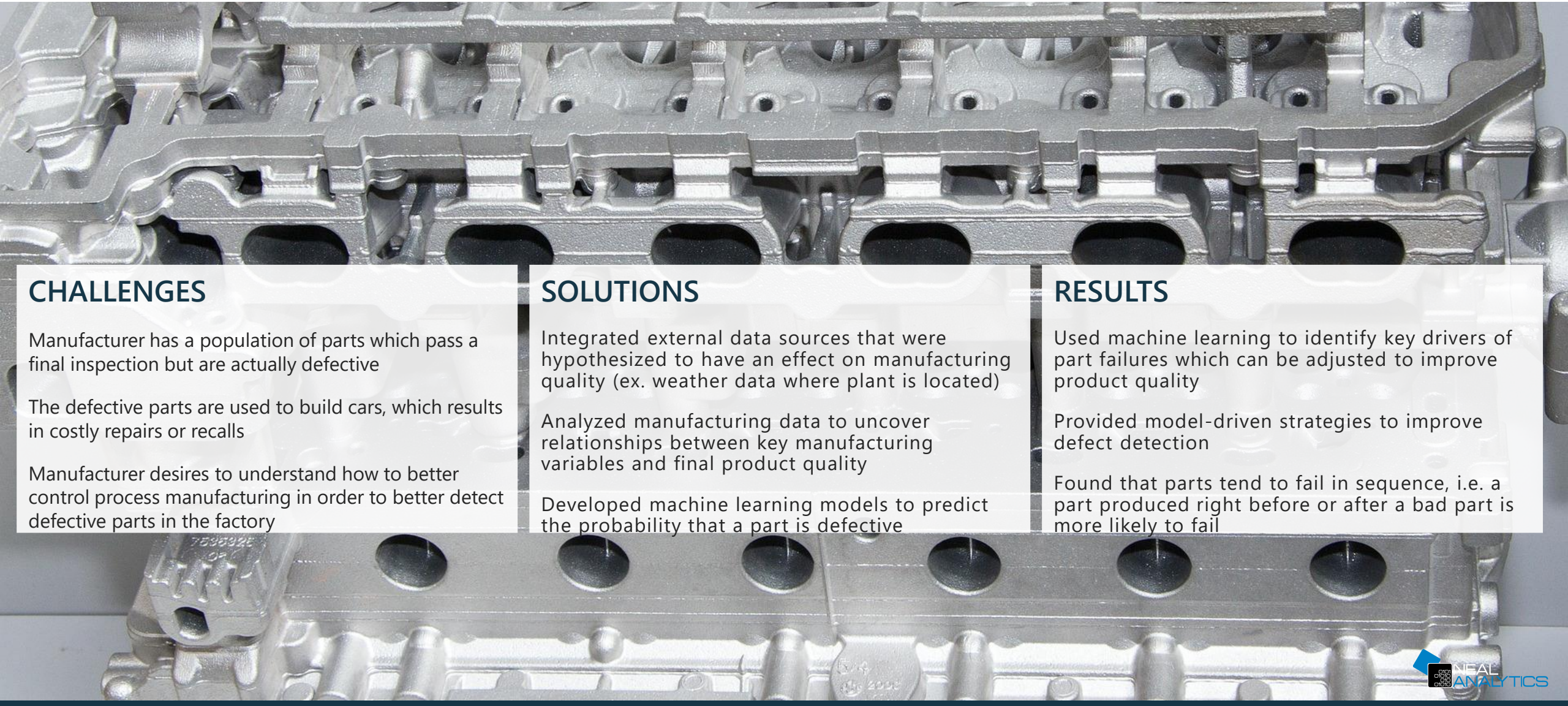
Reduce total maintenance costs through better planning of predictive maintenance programs

Able to identify potential breakdowns with 85% Precision up to two days before breakdown.

Reduce production downtime and asset utilization

Improv ning

Automotive part manufacturer: Quality prediction and driver analysis for aluminum castings



CHALLENGES

Manufacturer has a population of parts which pass a final inspection but are actually defective

The defective parts are used to build cars, which results in costly repairs or recalls

Manufacturer desires to understand how to better control process manufacturing in order to better detect defective parts in the factory

SOLUTIONS

Integrated external data sources that were hypothesized to have an effect on manufacturing quality (ex. weather data where plant is located)

Analyzed manufacturing data to uncover relationships between key manufacturing variables and final product quality

Developed machine learning models to predict the probability that a part is defective

RESULTS

Used machine learning to identify key drivers of part failures which can be adjusted to improve product quality

Provided model-driven strategies to improve defect detection

Found that parts tend to fail in sequence, i.e. a part produced right before or after a bad part is more likely to fail

Improving process control at a leading craft brewery

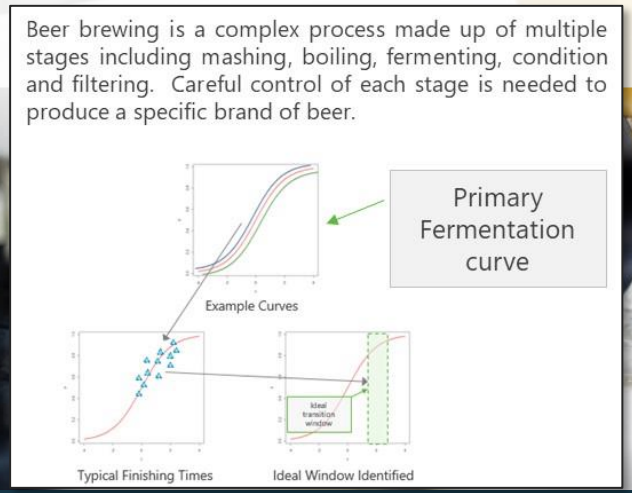
CHALLENGES

Brewery management wanted to leverage analytics to improve control of brewing process

Brewing stages proved difficult to time, leading to inefficiencies in brewing changeovers

Identifying abnormalities in brewing process were difficult to automate

Beer brewing is a complex process made up of multiple stages including mashing, boiling, fermenting, condition and filtering. Careful control of each stage is needed to produce a specific brand of beer.



SOLUTIONS

Neal Analytics developed parametric models to inform performance of key processing stages in brewing process

Neal Analytics developed a methodology for automatically identifying abnormal beer batches, improving opportunities for early intervention

Models were integrated into existing BI dashboards and Power BI to allow for improved insights and decision making on factory floor

RESULTS

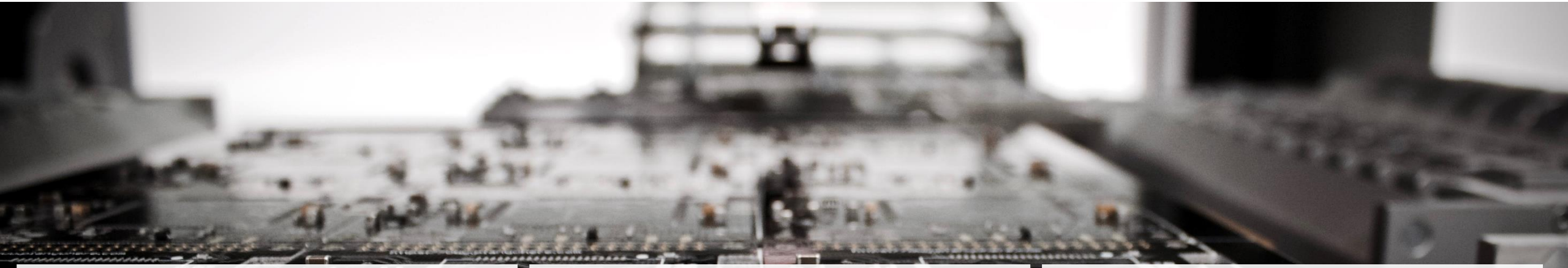
Improved visualization into core brewing stages

Enabled improved feedback and control of brewing process

Improved early identification of abnormal beer batches

NEAL ANALYTICS

Aerospace supplier: Designing an analytics data pipeline



CHALLENGES

- Variations in manufacturing process lead to quality issues in final product
- Lack of traceability of products across factory processes inhibited ability to analyze variation in product quality
- No infrastructure in place to connect disparate systems across manufacturing facilities

SOLUTIONS

- Automated movement of data from 10+ on premises systems across 5 manufacturing facilities to Azure Data Lake Store using Data Factory
- Developed USQL scripts to load data to Azure Data Lake Analytics tables and perform data transformations which eliminate gaps in traceability of products across factory process stages
- Loaded transformed data into Azure SQL Data Warehouse tables using PolyBase for downstream activities (ex. visualization, machine learning, etc.)

RESULTS

- Identified gaps in traceability of products across factory process steps
- Connected fragmented systems to provide a 360o view of the manufacturing process
- Created an automated data pipeline for continuous analysis of quality in factory

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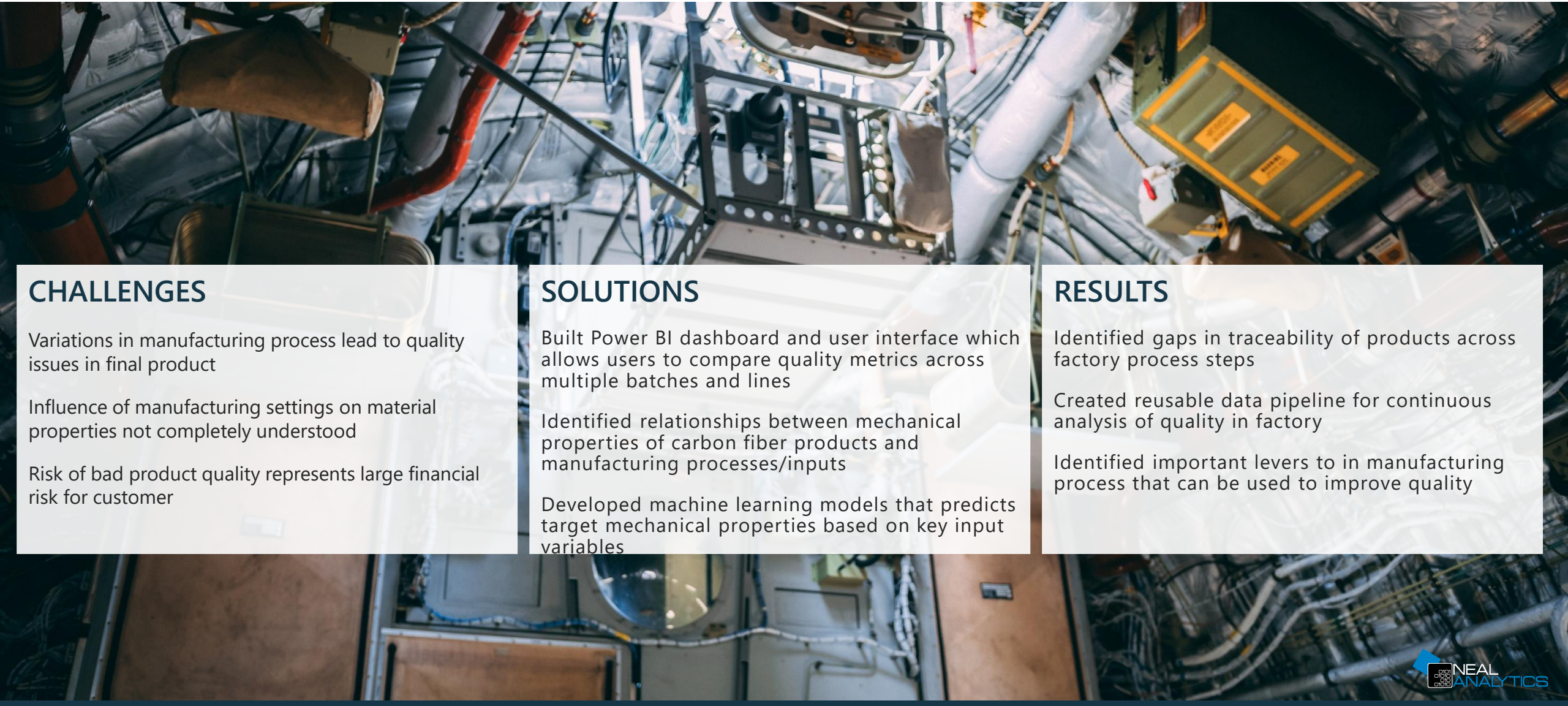
Quality prediction and driver analysis for a high-tech aerospace manufacturer



CHALLENGES

Variations in manufacturing process lead to quality issues in final product

Influence of manufacturing settings on material properties not completely understood

Risk of bad product quality represents large financial risk for customer

SOLUTIONS

Built Power BI dashboard and user interface which allows users to compare quality metrics across multiple batches and lines

Identified relationships between mechanical properties of carbon fiber products and manufacturing processes/inputs

Developed machine learning models that predicts target mechanical properties based on key input variables

RESULTS

Identified gaps in traceability of products across factory process steps

Created reusable data pipeline for continuous analysis of quality in factory

Identified important levers to in manufacturing process that can be used to improve quality

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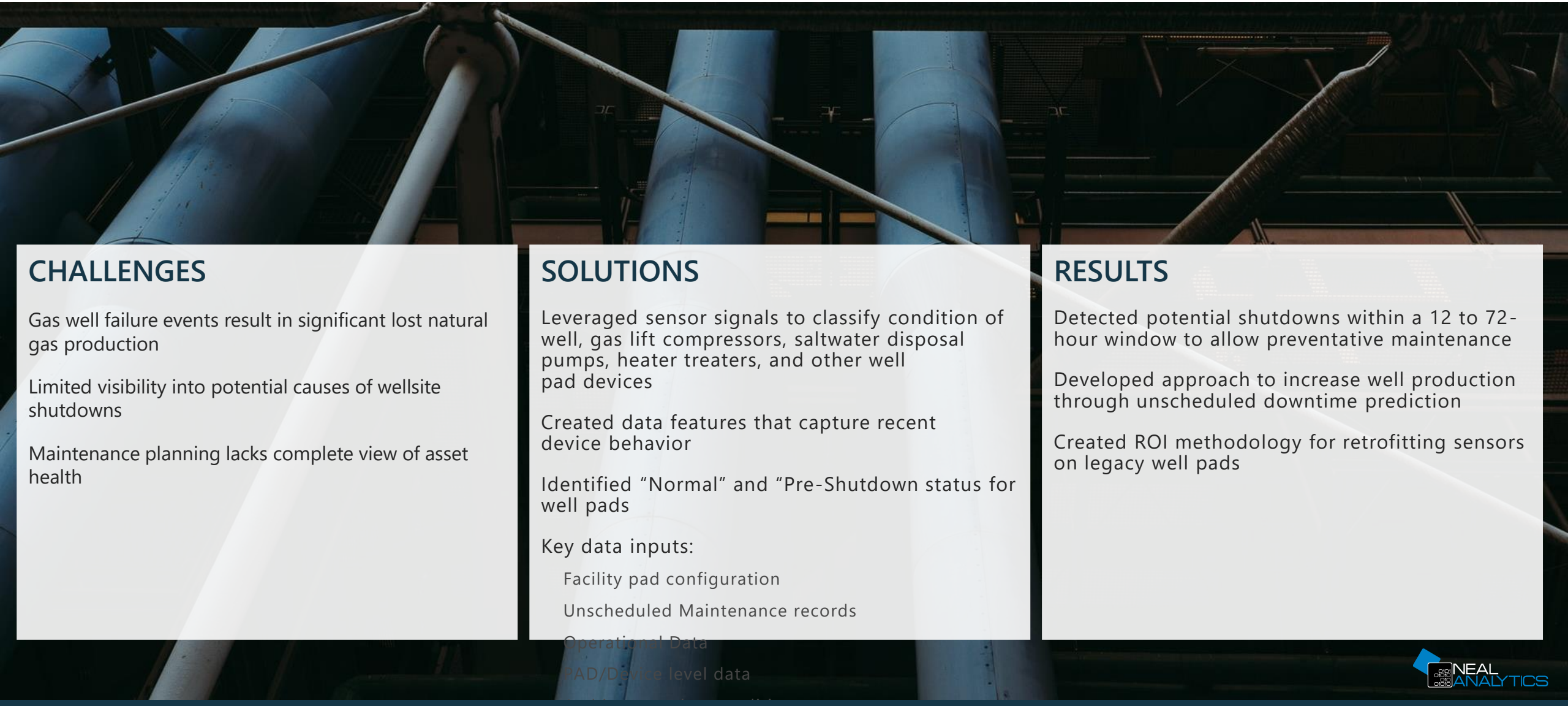
Unplanned shutdown prevention at major natural gas producer



CHALLENGES

Gas well failure events result in significant lost natural gas production

Limited visibility into potential causes of wellsite shutdowns

Maintenance planning lacks complete view of asset health

SOLUTIONS

Leveraged sensor signals to classify condition of well, gas lift compressors, saltwater disposal pumps, heater treaters, and other well pad devices

Created data features that capture recent device behavior

Identified “Normal” and “Pre-Shutdown status for well pads

Key data inputs:

- Facility pad configuration
- Unscheduled Maintenance records
- Operational Data
- PAD/Device level data

RESULTS

Detected potential shutdowns within a 12 to 72-hour window to allow preventative maintenance

Developed approach to increase well production through unscheduled downtime prediction

Created ROI methodology for retrofitting sensors on legacy well pads

NEAL ANALYTICS

Multi-national oil & gas company: Pump jack predictive maintenance

CHALLENGES

Large oil producer interested in understanding the ongoing effectiveness of their downhole pumps to lift fluid to the surface

Pump jack failures proved difficult to detect using rule based diagnostic methods and often led to expensive field failures and lost production

SOLUTIONS

Created a unified view for wells over time by combining dynamometer, operational, well maintenance, downtime and performance failure data

Using Azure Machine Learning, Neal Analytics classified failure types to identify patterns of failure occurrences and allow for remote diagnostics of pre-failure conditions

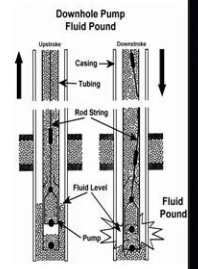
RESULTS

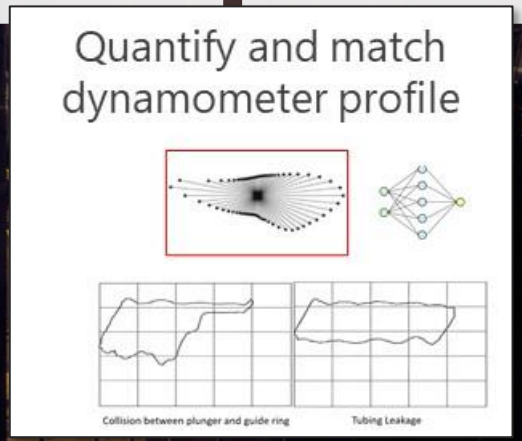
Reduced cost of nonproductive time and operations

Increased Return on Assets by avoiding severe pump jack failures

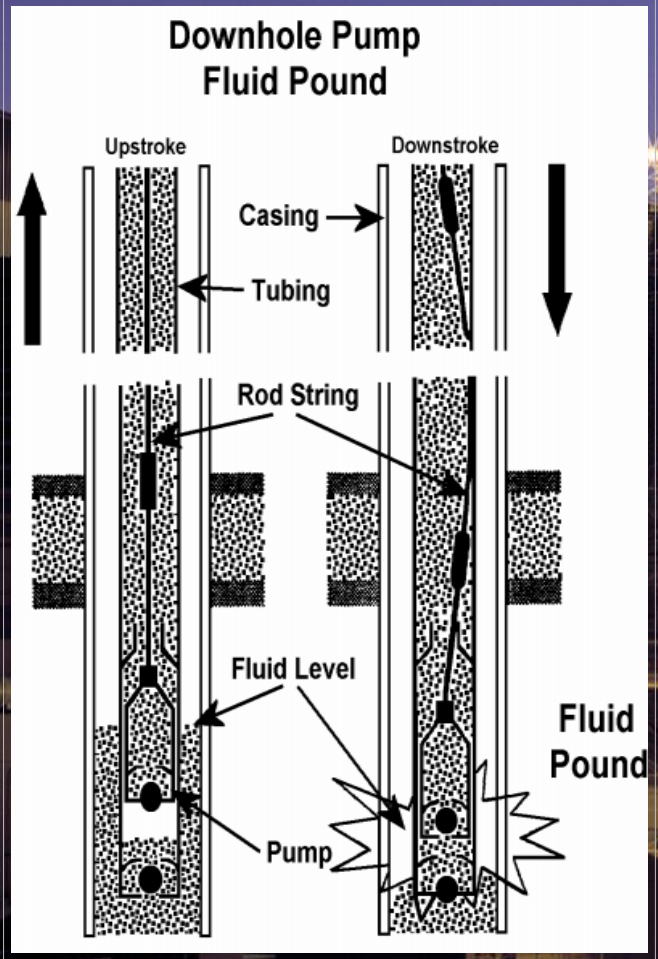
Optimized maintenance schedules based on risk probabilities

A Dynamometer is a diagnostic device used on downhole oil well pump systems to measure and plot the physical forces as the pump moves through each stroke cycle. This takes into account fluid load, rod weight, acceleration and frictional forces.

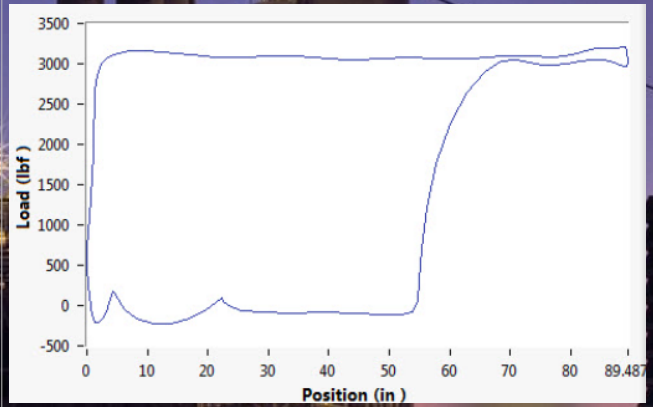




Multi-national oil & gas company: Pump jack predictive maintenance (details)

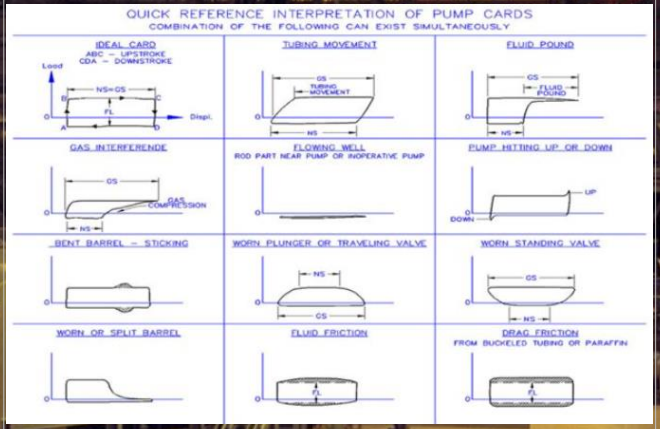


Data Visualization



Source: Sage Oil Tools

Shape Library



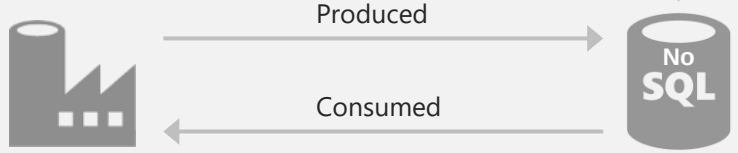
Source: Lufkin Application

Analysis Process & Diagnosis

Data

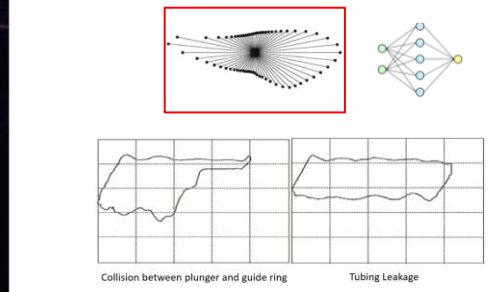
ADF consumes aggregates
returns ML results

DocumentDB



Data to Card Shapes
+ Area per shape

Quantify shape, match
to problem shapes



Machine Learning
Predictions

$Y' = b_{yx}X + a_{yx}$

Daily notifications
generated

Notifications sent to
dispatch system

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Virtual meter tuning at multinational energy services company

CHALLENGES

- Virtual Gas/Oil production flow assignments utilize complex models, which must be periodically tuned to maintain accurate readings
- Errors in models accumulate over time and can lead to incorrect allocation of large dollar values of production to producers
- Customer interested in improving tuning accuracy and automating the tuning process

SOLUTIONS

- Leveraged advanced solvers to improve fit of virtual metering models
- Created data pipeline in Azure and scripts to automate process of model tuning
- Validated results against multiple well layouts and configurations

RESULTS

- Automated tuning of virtual meter algorithms
- Improved tuning accuracy of production model

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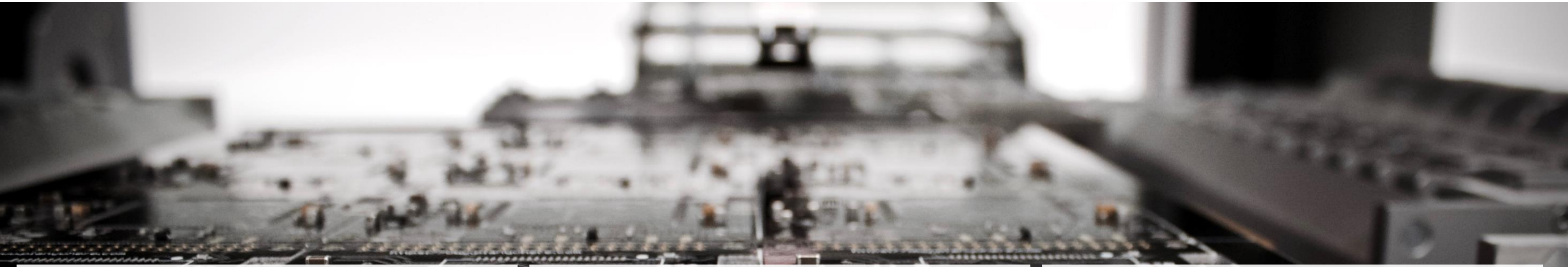
Aerospace supplier: Designing an analytics data pipeline



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