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New Scale Detection Technologies For Geothermal Applications:

Advanced Virtual Pump Intake Pressure Machine Learning Models and GeoESP® Intake

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Agenda

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Introduction

Challenges

Geothermal ESP (GeoESP®):

Scale

Power consumption

Run life

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Methodology

GeoESP® Digitalization

Scale detection

Run life increase

Intelevate™

Power optimization

- Real-time diagnostics
- Virtual Pump Intake Pressure

- Data-driven decisions

- 24/7 data science-driven platform
- Machine Learning
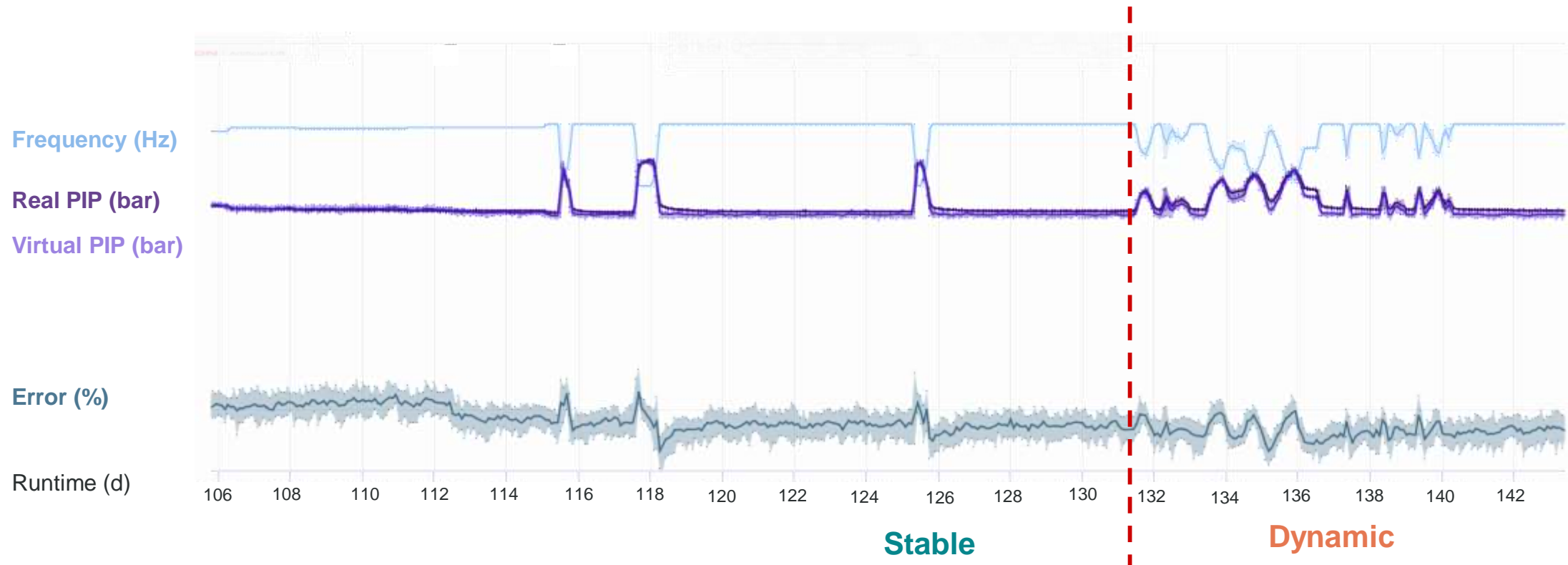
- Normalized KPIs
- GeoESP® Intake

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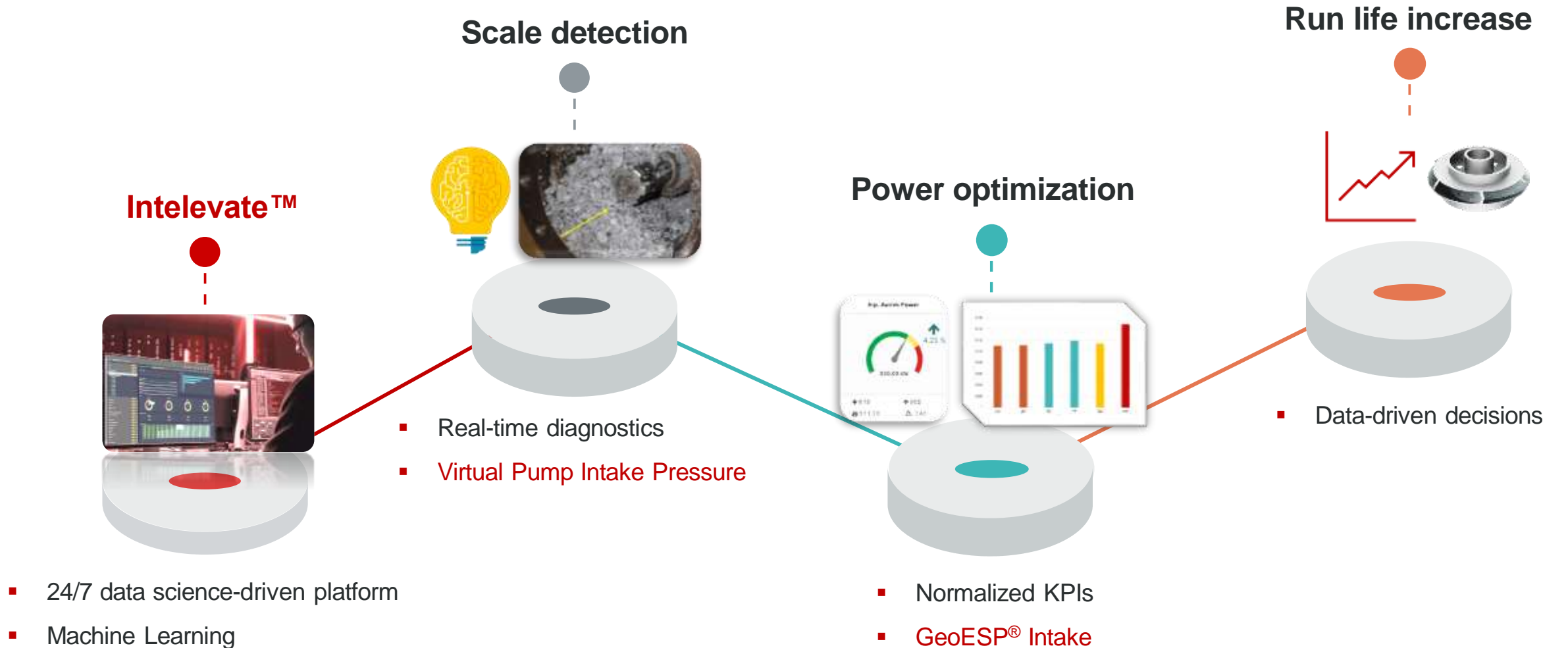
Results

Scale detection: Virtual Pump Intake Pressure

Machine Learning implementation

Real and Virtual parameters fully overlap with errors **< 3%**
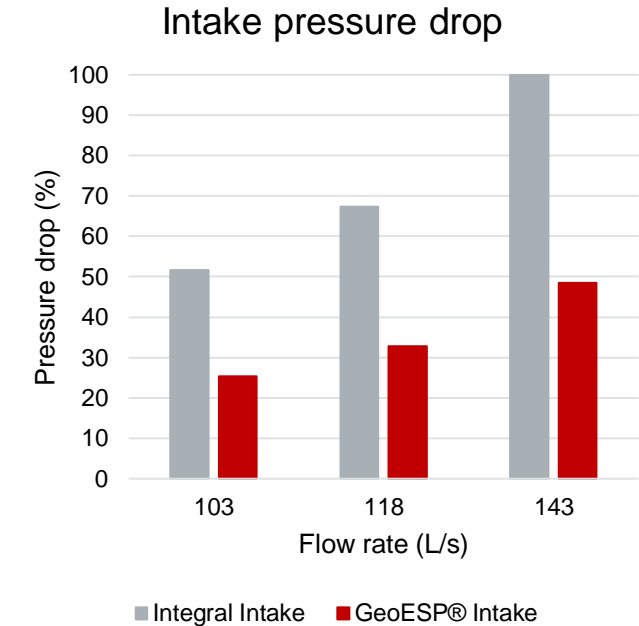
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Results

Scale detection: Virtual Pump Intake Pressure

Early detection

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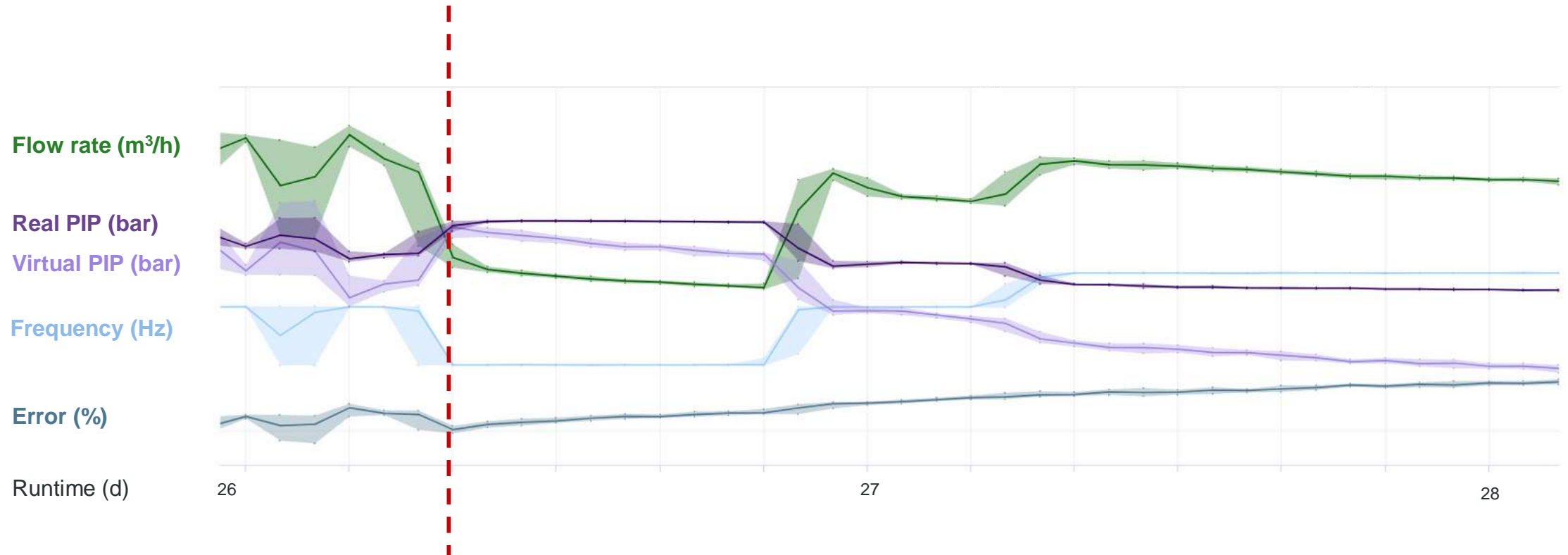
Results

Power consumption: GeoESP® Intake

Intake pressure drop

Chart legend: ▪ Integral Intake ▪ GeoESP® Intake
X-axis: Flow rate (L/s) — 103, 118, 143
Y-axis: Pressure drop (%)

- New inlet specifically designed for geothermal wells
- Prevents buildup of scale (DuraHard 3® coating)

- Perforated modular housing
- 5x increased flow area

- Reduced pressure drop by 30%
- Less power to operate (-10%)

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Results

Increase **GeoESP®** run life with **real-time digitalization**

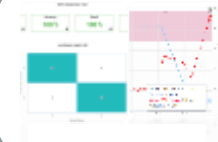**01** | **Machine learning models**
- PIP
- TDH
- Flow
- Electric

02 | **Events detection**
- Downhole
- Surface

03 | **Real-time equipment status**
- Pump
- GeoESP® Intake
- Motor

04 | **Increased system health**
- Resonance
- Unbalance
- Operating range

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Conclusion

Solution

Scale:	Power consumption:	Run life:
▪ Machine Learning	▪ GeoESP® Intake	▪ Intelevate™

12 applications and >1500 days of run life

24/7/365 continuous monitoring

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Thank you

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