

DIGITALIZATION IN AL OPTIMIZATION: status and challenges ahead

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INA



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Agenda

- Introduction
- Where are we now:
 - SRP
 - LRP
 - ESP
 - IPM
- What we aspire: **Digital Oilfield**
- Conclusion

CHALLENGE

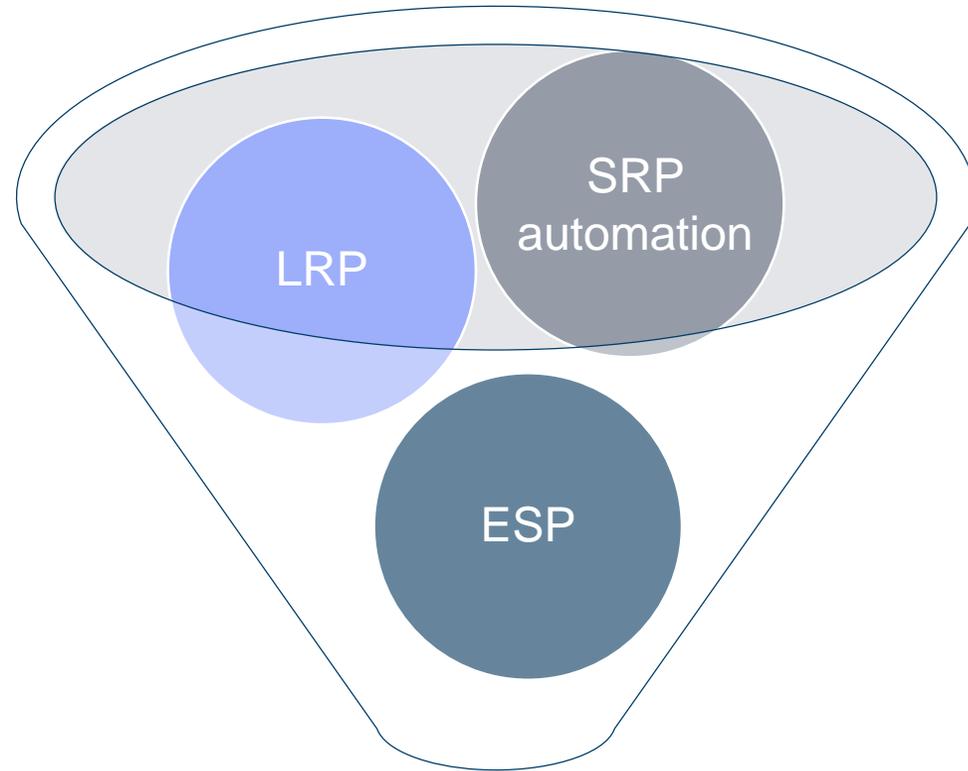
Improving efficiency
(Q_{HC} , \$)



SOLUTION

Continuous monitoring of relevant well parameters in order to determine optimal production regime and decrease operation cost

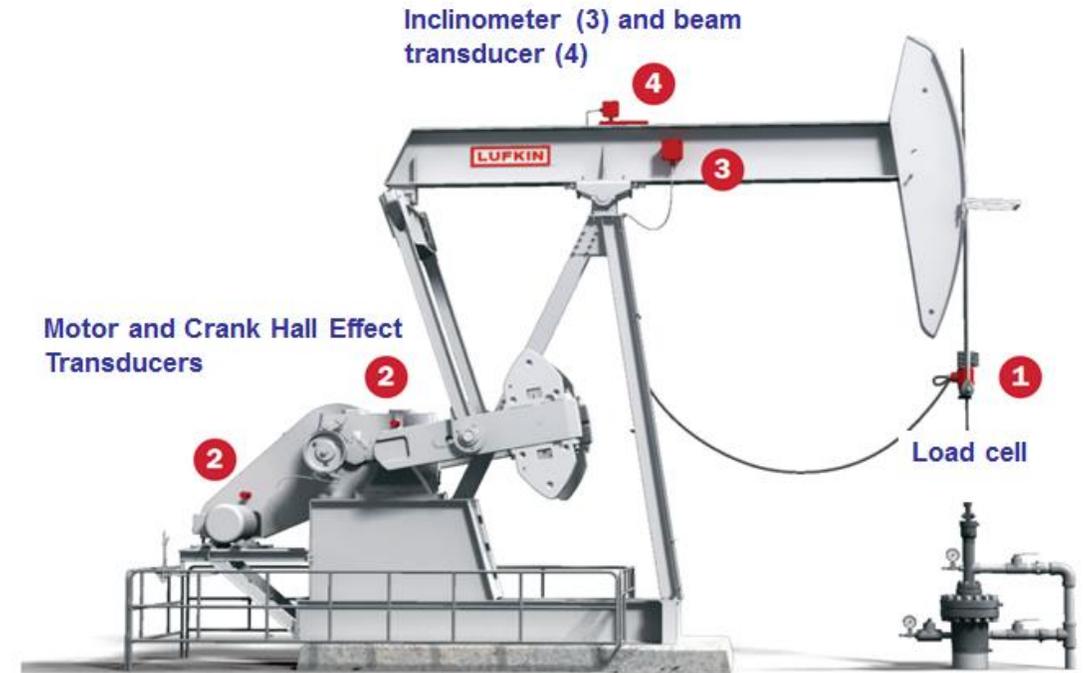
- Integrated Production Modelling
- SRP well automation - 2015
- LRP implementation - 2016
- Installation of ESP production equipment - 2018



INTEGRATED PRODUCTION
MODELLING

Sucker Rod Pump (SRP) well automation

- Autonomous well control to maintain optimal production and increase well uptime
- Decrease in energy consumption and equipment maintenance cost
- Reduction of well measurement and well visit cost (real time monitoring)
- 47 wells, additional 20 planned
- 18.7% fluid production increase; 18.6% gas production increase
- 20% less workovers, 30% less cost of workovers



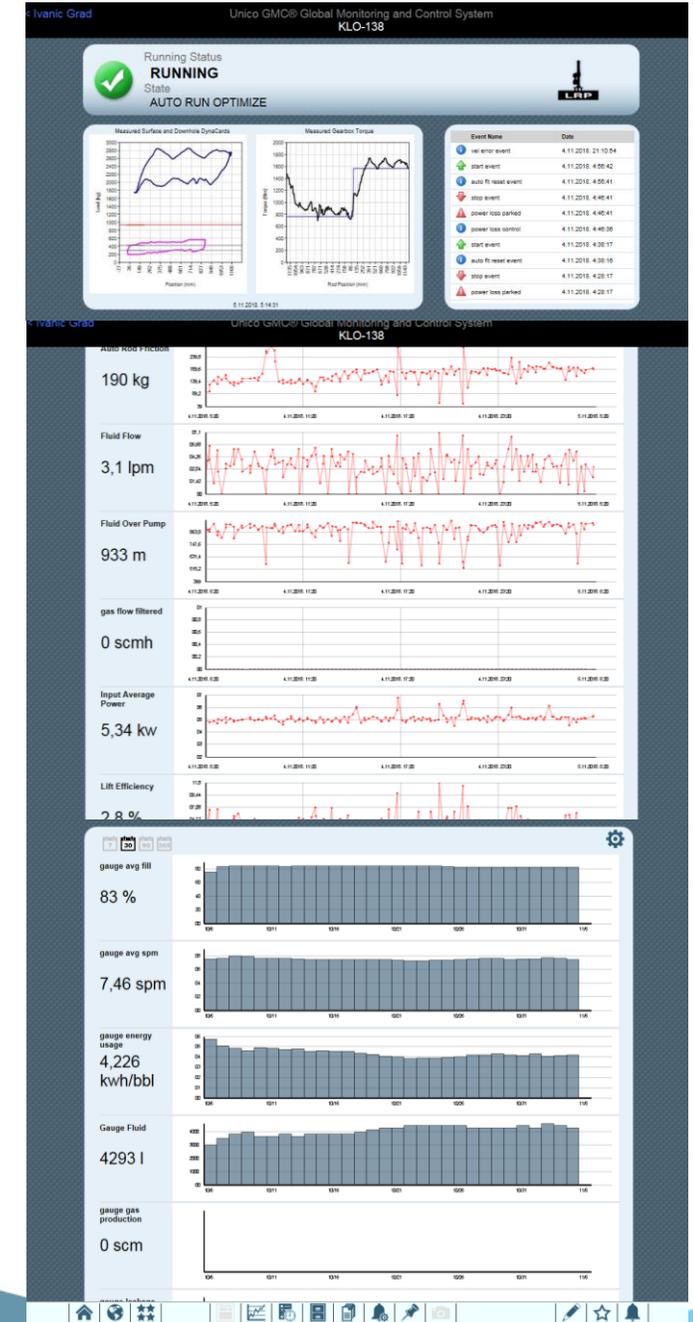
Linear Rod Pump® (LRP)

- 13 wells, 10 additional in plan
- Automated stroke speed based on pump fillage (min 1 spm)
- Decreased cost of installation and maintenance
- SCADA
- Surface pressure and temperature transmitter



LRP unit

Monitoring well operation
with SCADA



Electrical Submersible Pump (ESP)

- ESP recompletion on 25 wells
- Downhole sensor: communication to surface via ESP cable
- Pump intake pressure and temperature, motor winding temperature, vibration, leakage, pump discharge pressure in real time
- Surface pressure and temperature transmitter
- SCADA



Flowline pressure and temperature transmitter

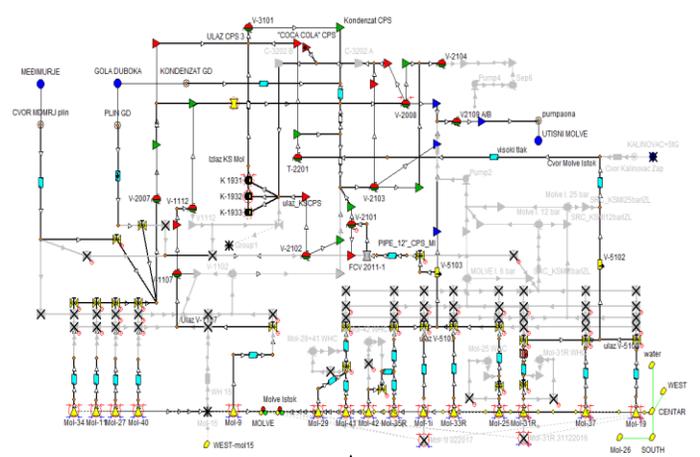


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Digital Oilfield

Integrated production modelling

- Development of on-line integrated production modelling
- Defining user variables for production optimization process and target range
- Engineering and operations support system



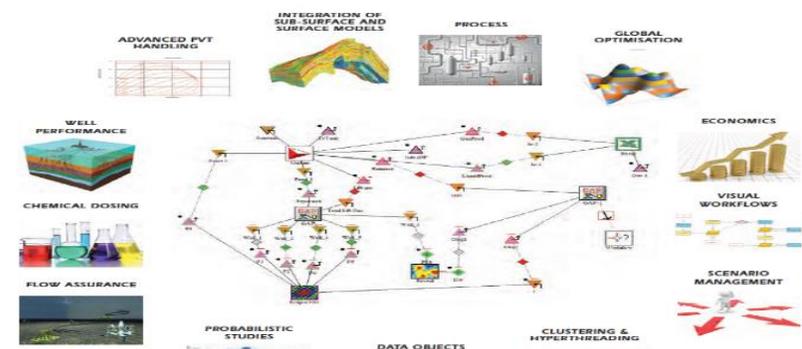
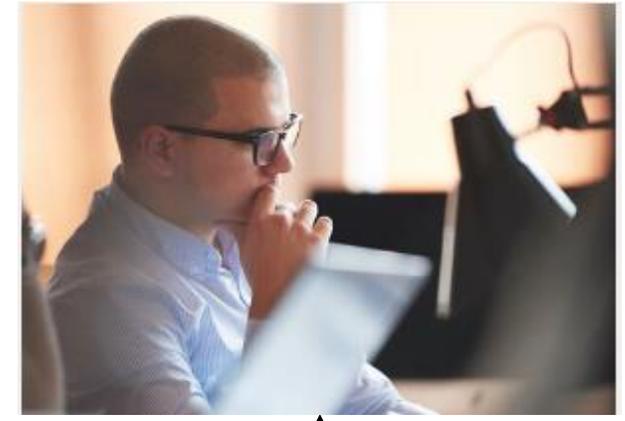
SCADA System

- Providing real time data for IPM
- Digital and visual output
- Remote controlling of production processing
- Alarming and reporting



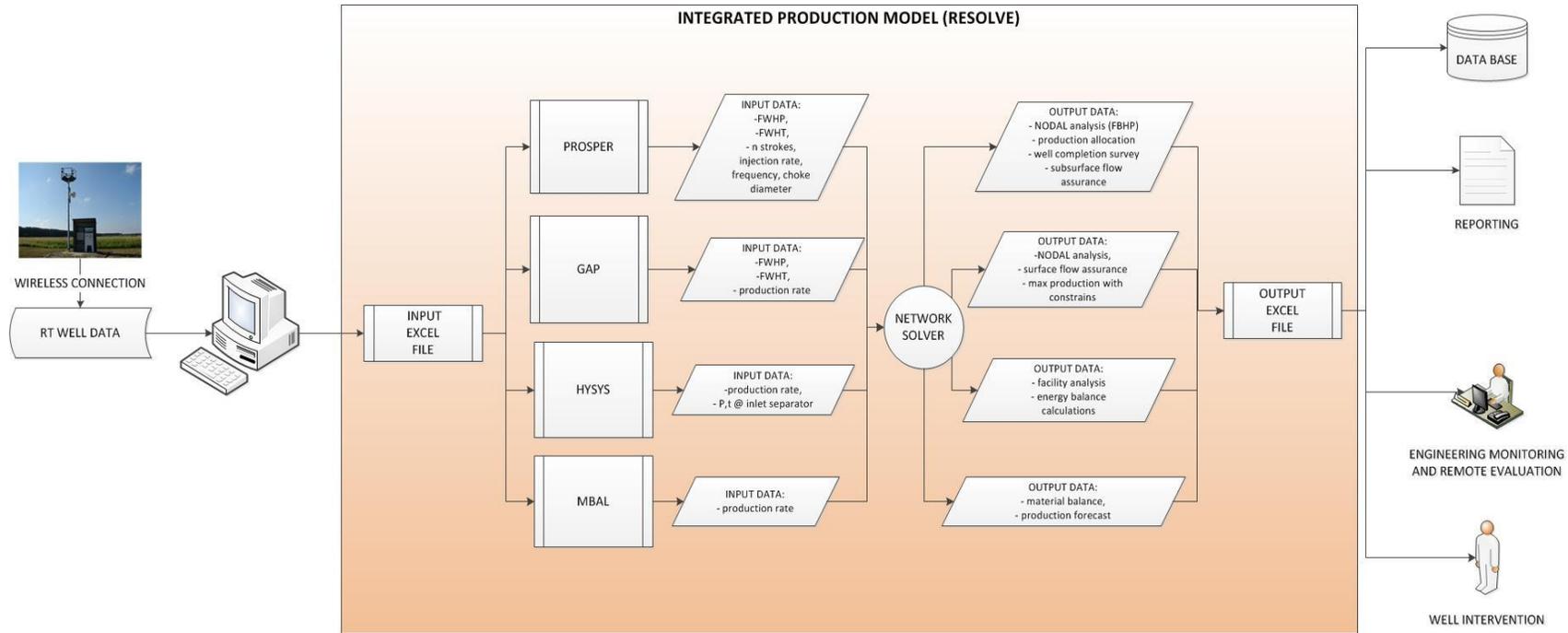
Engineering evaluation and monitoring/Data mining

- Increased efficiency of engineering in field troubleshooting and finding new opportunities
- Allocated from field and able to monitor several fields
- Data historian
- Data handling



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What is next?



CURRENT STATUS:

- IPM models updating and upgrading
- RT on-line well data providing to operation service desk
- Debugging of modules calculations

CHALLENGES AHEAD:

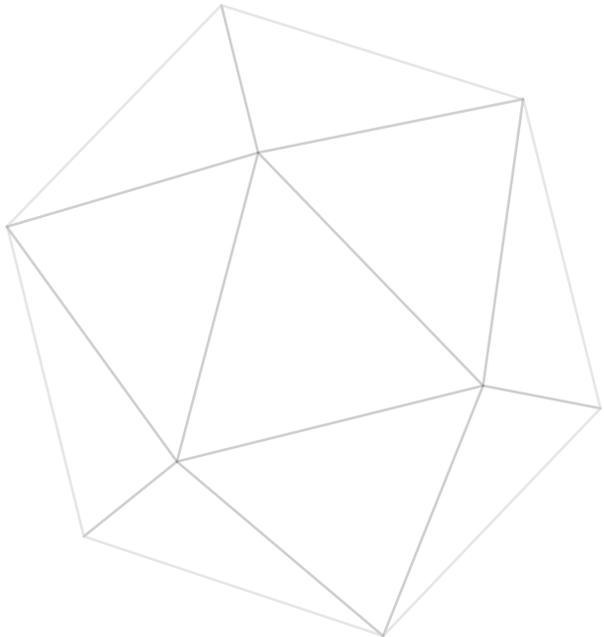
- Defining and implementation of Integrated Operation workflow and system
- Computing power requirements
- Improving engineering efficiency in evaluation and monitoring from dislocated center



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Thank you!





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DIGITALIZATION IN AI OPTIMIZATION: Backup slides

Polished rod
load cell



Beam transducers

Motor and crank
position indicator



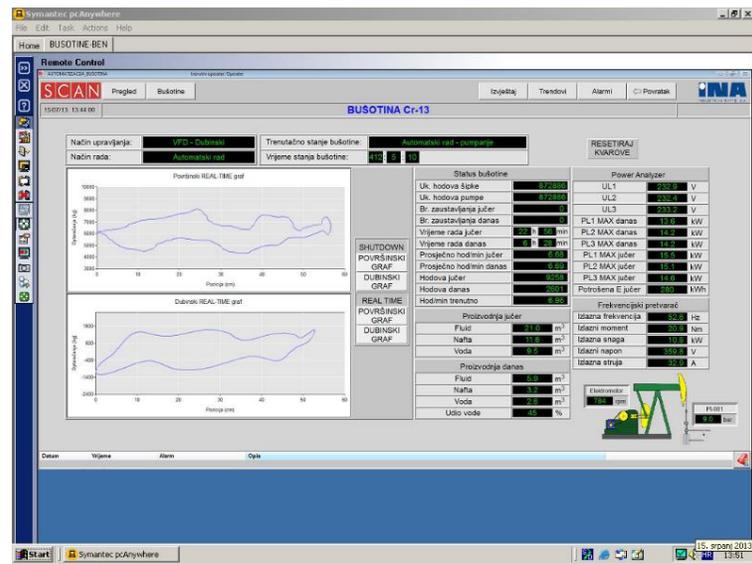
Flowline pressure
transmitter

Rod Pump Control (RPC) unit



RPC and digital microwave radio link equipment

Monitoring well operation at SCADA system



- SCADA (*Supervisory control and data acquisition*) monitoring on gathering stations
- Flowline pressure transmitter
- Real-time downhole and surface dynamometer card
- Data on well production, downhole pressure, loads etc.

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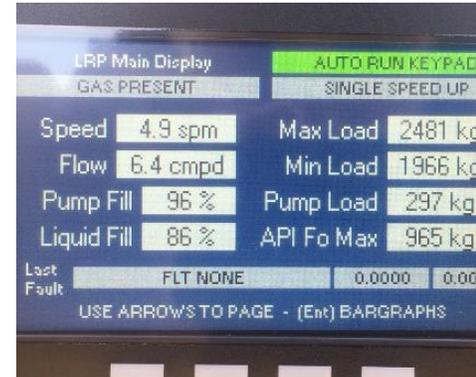


LRP unit and flowline pressure and temperature transmitter



Variable-speed drive (VSD) unit

MAIN



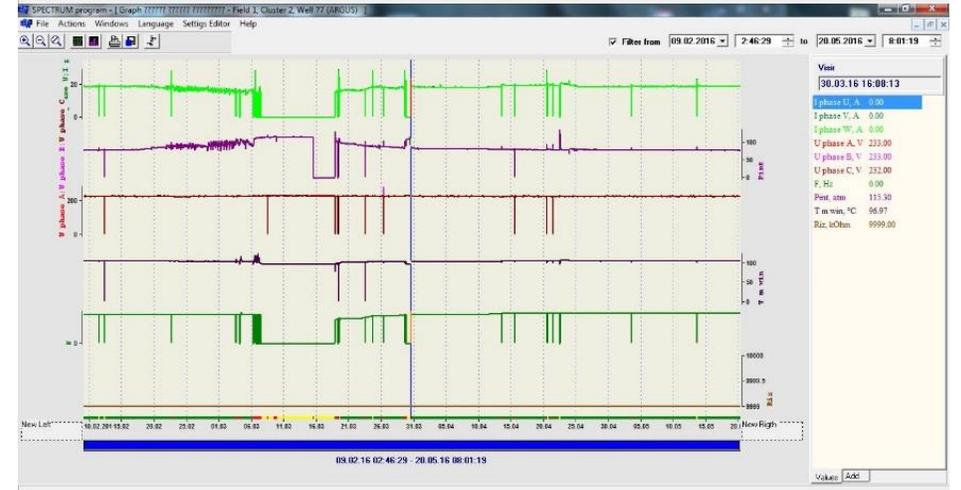
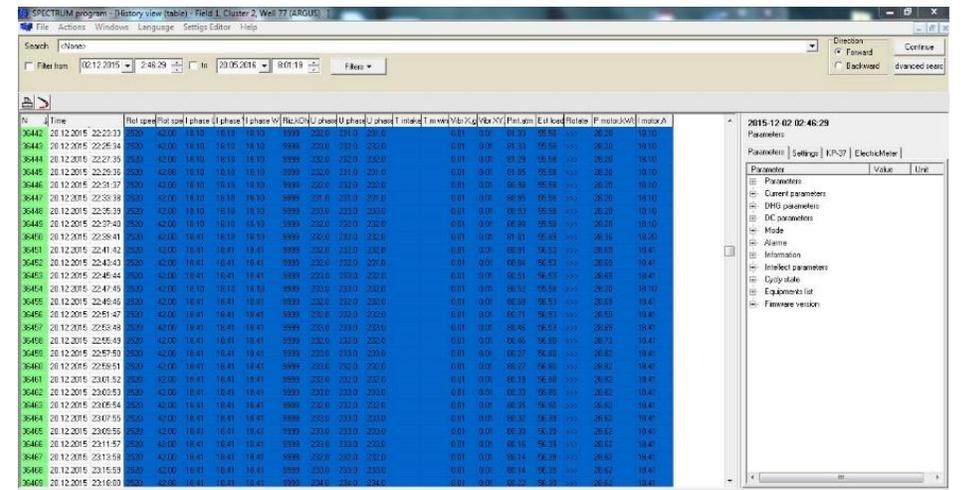
Real-time production data on surface control unit



Surface Telemetry Unit (STU)



Variable-speed drive (VSD) unit



Monitoring well operation and motor performance data in SPECTRUM program

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