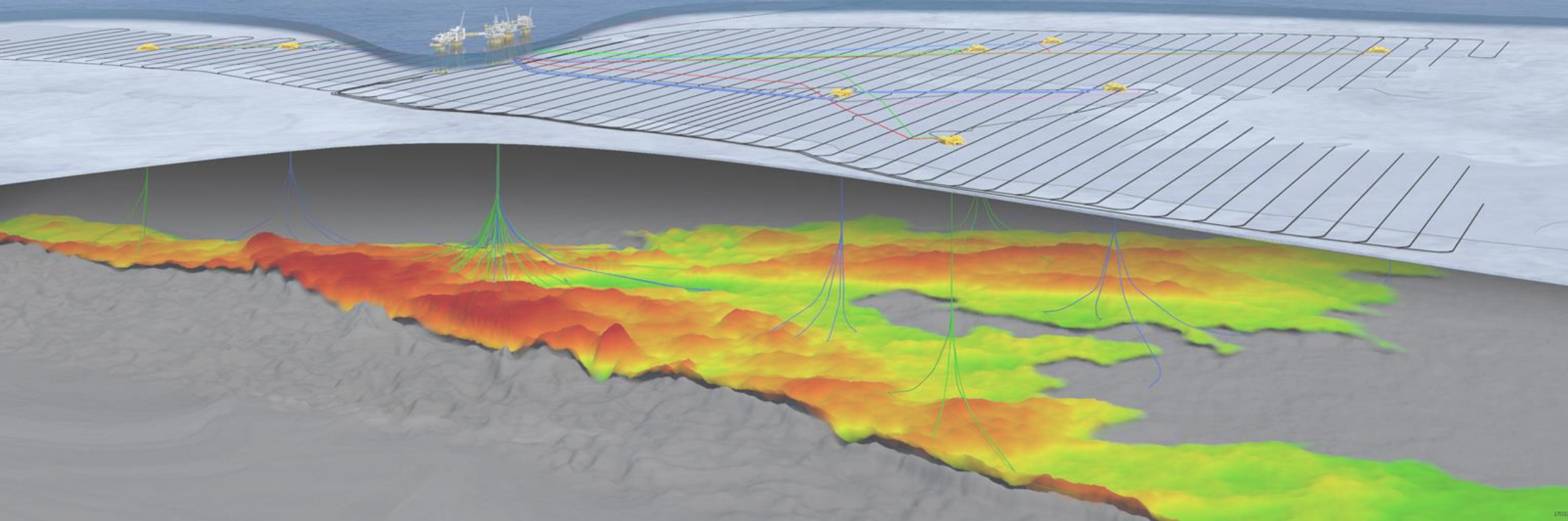
Johan Sverdrup digitalization: The subsurface of the future

Teknologidag 7.juni 2022

Sylvia Nordfjord, Equinor



Agenda

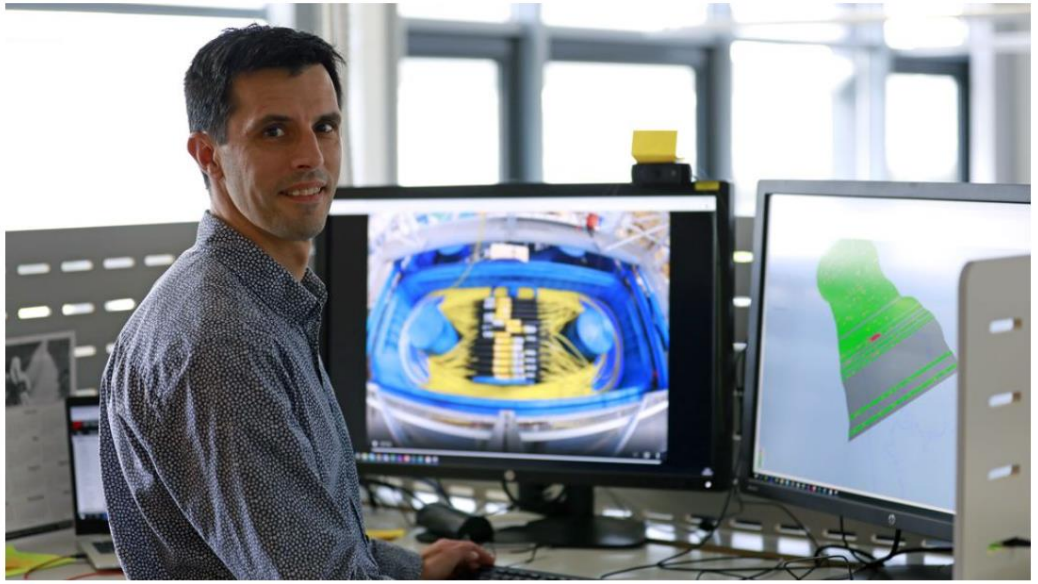
- Short intro to Johan Sverdrup field
- Johan Sverdrup digital flagship
- Description of key technologies and how we use it
    - Reservoir modelling workflows
    - PRM (Permenant Reservoir Monitoring)
    - Fiber optics
    - APO
- Summary

Take away message

- Johan Sverdrup field are using technology and digitalization to become the subsurface of the future
- JS subsurface digital front-runner is important part of enabling Equinor digital ambition and keeping us relevant
- We have a good set-up that have delivered and can continue to deliver significant business value
- Way of working and thinking is as important as subsurface technology application – DIGITAL CULTURE

Første gang et oljefelt overvåkes på denne måten fra dag én

Verdens største system ble gravd ned på havbunnen tidligere i år.



Cedric Fayemendy er geofysiker i Equinor og har ansvar for overvåkingen av reservoaret til Johan Sverdrup. (Foto: Equinor)

TU Energi 2019

JOHAN SVERDRUP OG PERMANENT RESERVOIR MONITORING

Første gang et oljefelt overvåkes på denne måten fra dag én

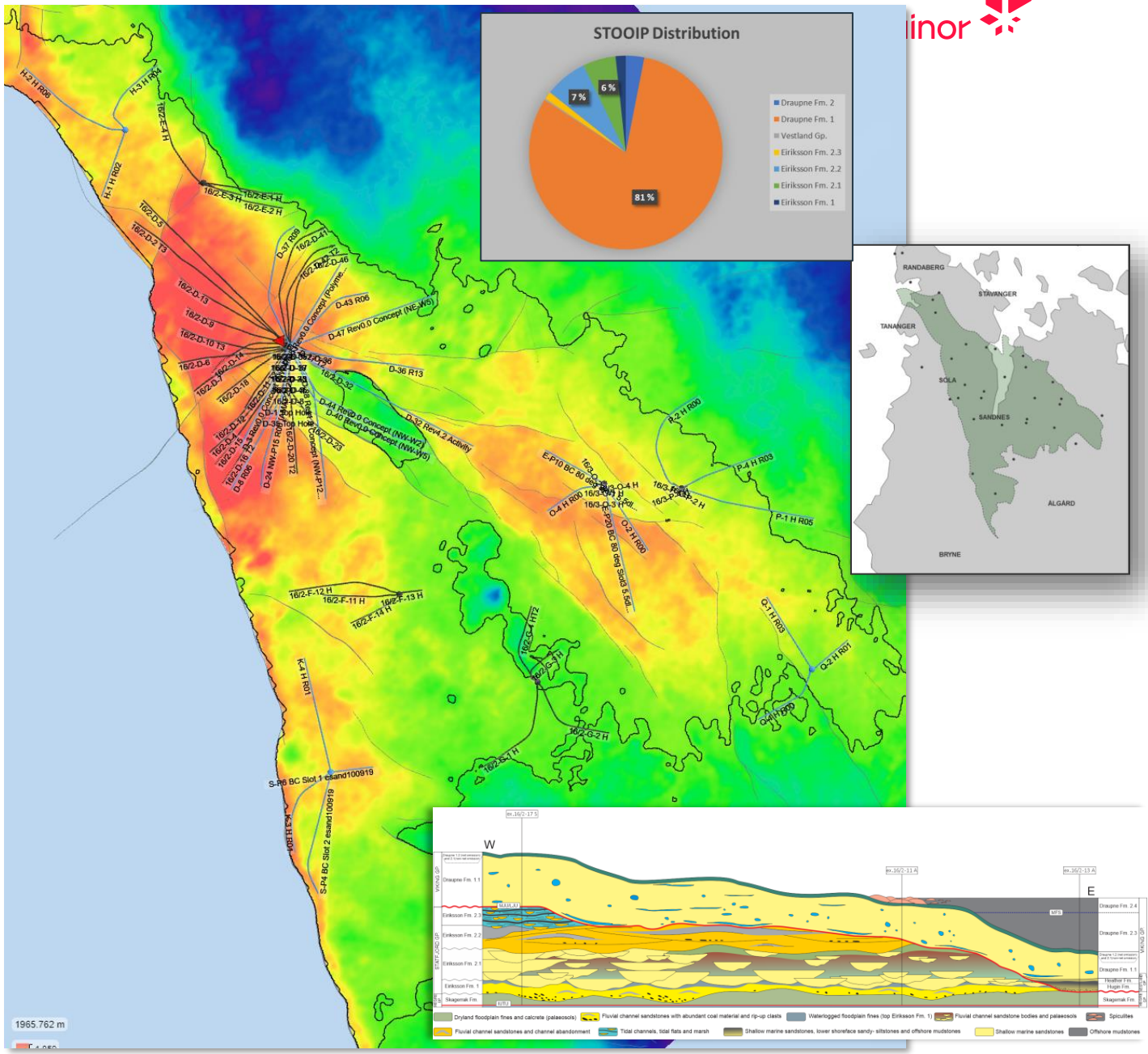
Introduction to Johan Sverdrup

General

Reservoir apex	~1800 m
Water depth	~110 m
OWC	1922 - 1934 m MSL
Pressure	Hydrostatic
Thickness	4 – 146 m (Well observation)

Reservoir Facts

Quality	25-30 % porosity, high NTG
	Multi-Darcy permeability
	No gas cap
Area/Volume	~200 km^2 area
	2.2 – 3.2 billion boe recoverable volumes
Main uncertainties	Reservoir thickness
	Relative permeability



Johan Sverdrup digital flagship – since 2017

Changing Equinor through digital innovation

OUR STRATEGIC OBJECTIVES

We want to reinvent how we work and operate a field to continuously improve safety, increase value and reduce carbon emissions.

Our ambition is to:

- Eliminate human exposure in high risk areas
- Optimise production and energy use at all times
- Predict and resolve failure before it occurs
- Make optimal decisions through data availability and analytics

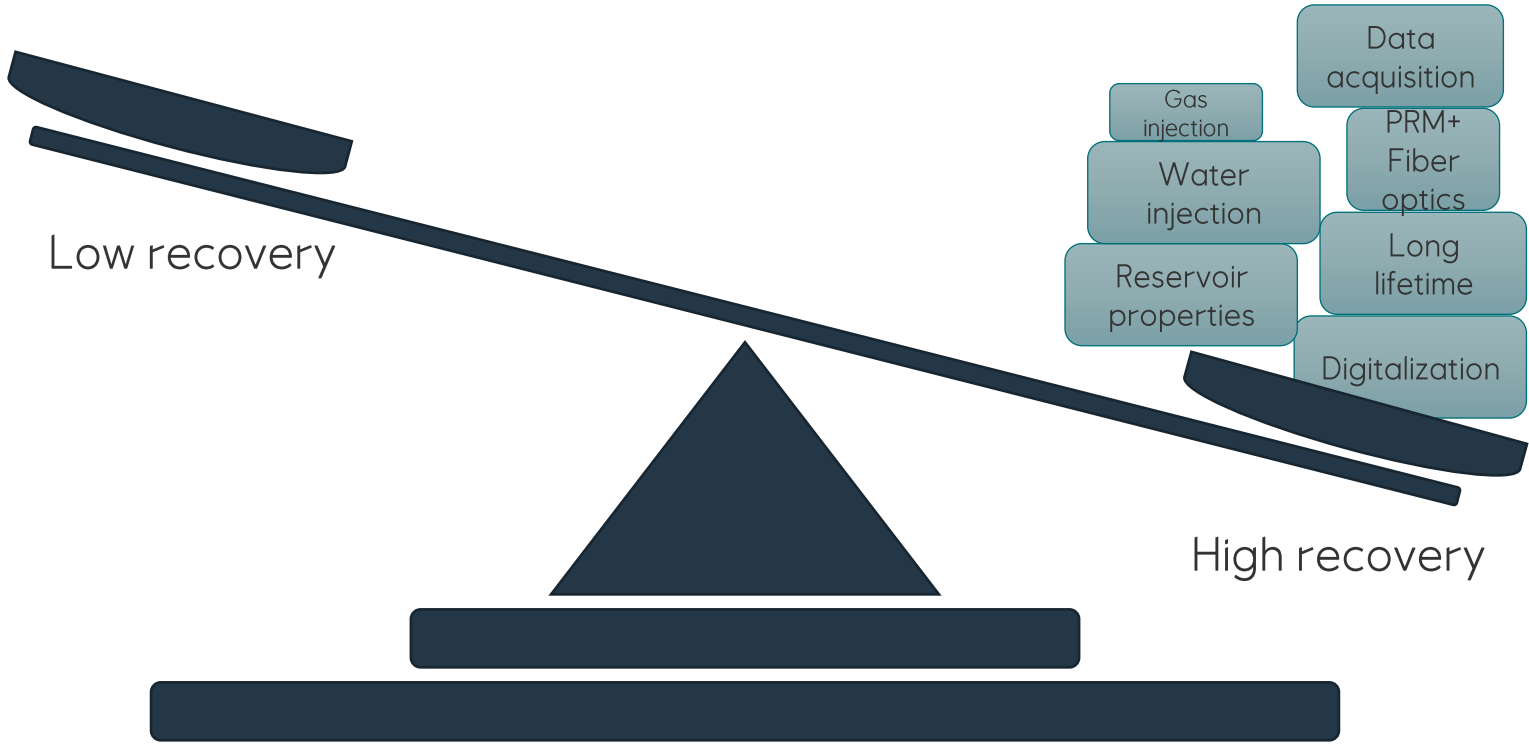
Enablers:

- Leadership & partner commitment
- Collaboration
- Digital culture & competence
- External orientation

What does digitalization and technology mean to us?

Accelerated production and world class recovery > 70%

- Next generation reservoir monitoring
  - Large investments and use of PRM and fiberoptics
  - Pressure monitoring
  - Integrated data acquisition program
- Profitable wells and targets
  - Decision-centric reservoir modelling
  - Efficient well planning and execution
- Optimized production
  - Automated production optimization (APO)
  - Optimal well design
- Maximizing IOR

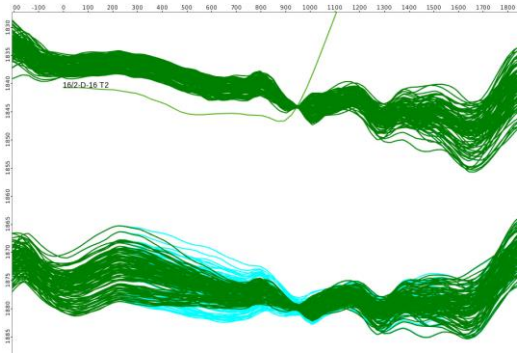


Fast Model Update (FMU)
Create the foundation – decision centric reservoir modelling

Opportunity space

- Uncertainty is visible, understood and embraced
- Improved cross-disciplinary automation

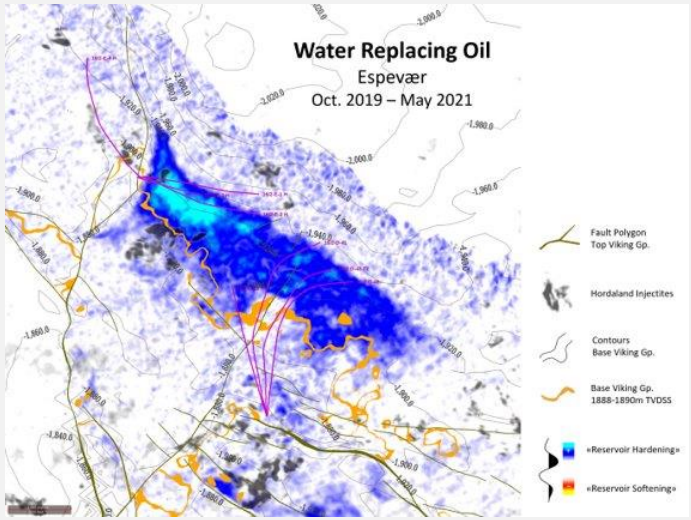
Subsurface understanding is *continuously developed*.



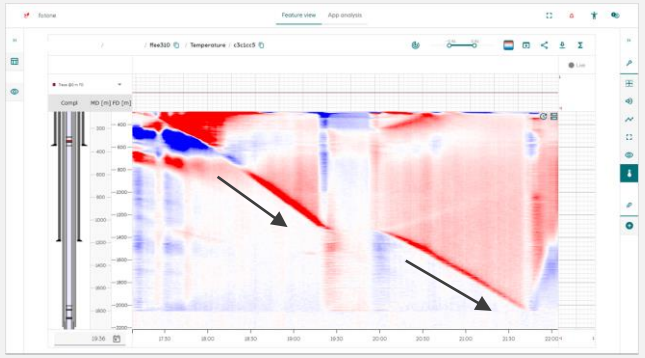
PRM

World largest Permanent Reservoir Monitoring system

Enabling us to optimize production/injection rates, well placement, etc.

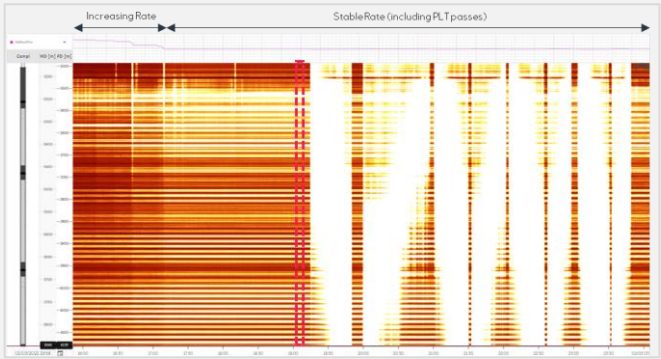


Fiber optic



New domain for wellbore monitoring – increases the opportunity space

Fiber installed down to production packer in most wells
Some wells with fiber in reservoir

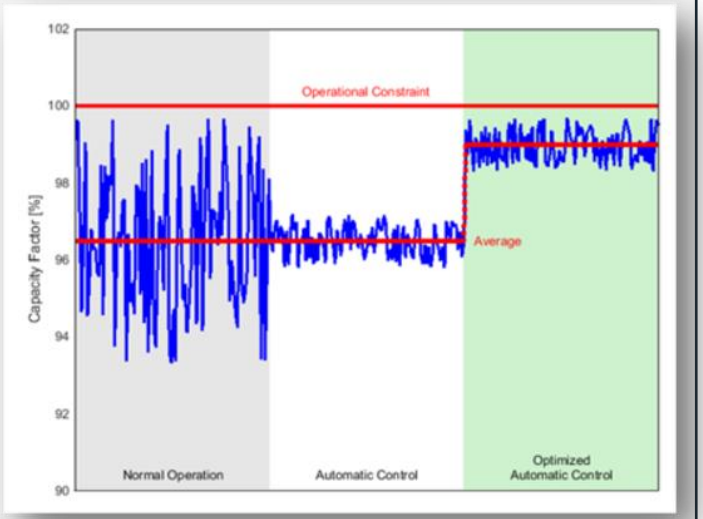


APO

Automated production optimization

Enables stable production with the use of swing producers

Industrumental to start-up

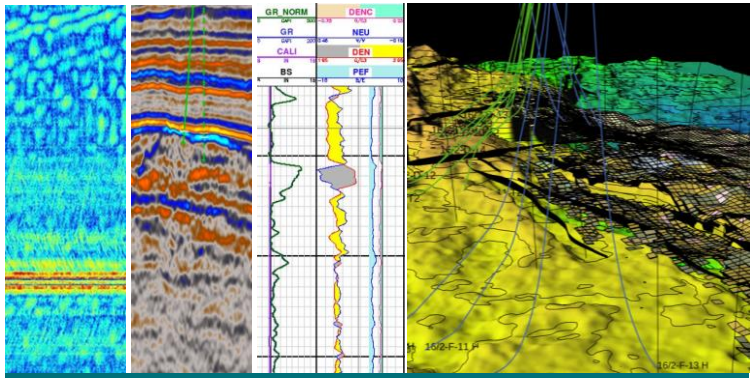


Digital culture - Working different | (some) fundamentals still the same

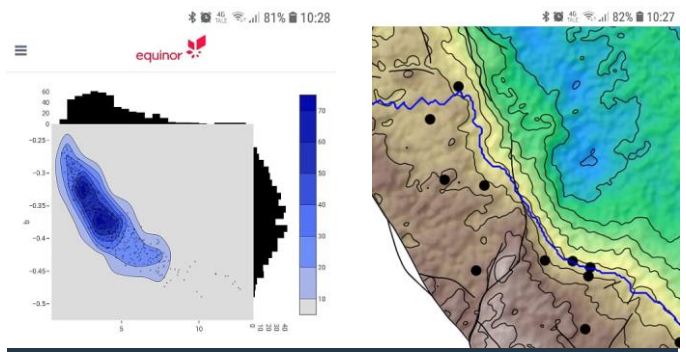
SUBSURFACE UNDERSTANDING
NUMERICALLY REPRESENTED

TRANSPARENT & COLLABORATIVE
BACKED BY GOOD TOOLS

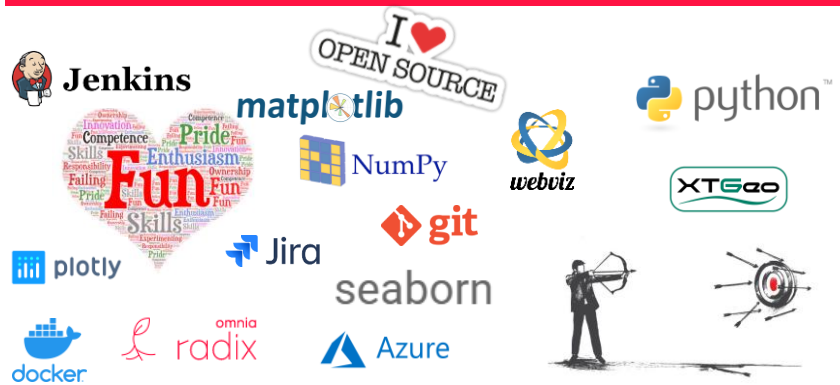
STABLE, INTEGRATED, AUTONOMOUS TEAM
ENTHUSIASM AND OWNERSHIP



UTILIZING ALL DATA
ACCURATE & EFFICIENT PREDICTIONS



VISUALISATION & SHARING
ALSO TO PARTNERS



TECH/TOOL-AGNOSTIC
EXPERIMENTAL & CURIOUS

DIGITAL COMPETENCE
...AND A DIGITAL MINDSET

Summary

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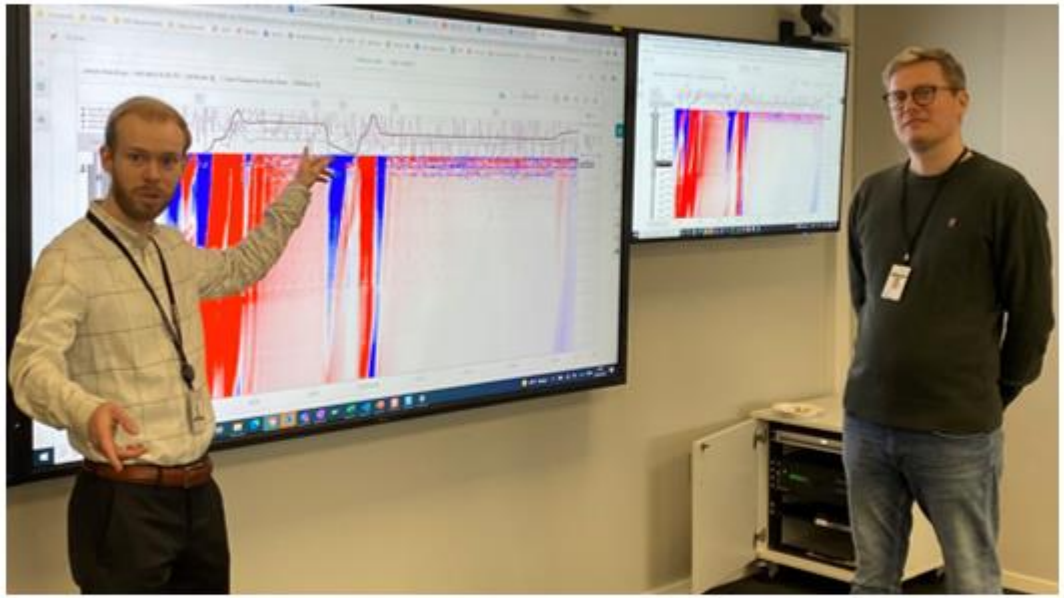
Johan Sverdrup- astronomisk verdier skapt for AS Norge ved tverrfaglig bruk av undergrunnsdata



TU Energi 2029
JOHAN SVERDRUP OG DATA UTNYTTELSE
Vanvittig verdier ifra fiberoptiske data

Første gang et oljefelt overvåkes på denne måten fra dag én

Questions?

Thanks to:

Colleagues in Johan Sverdrup Subsurface Operations, all Equinor units providing support and JSU partners for contributing to this presentation

Johan Sverdrup digitalization– subsurface of the future

Sylvia Nordfjord

Johan Sverdrup license partners: