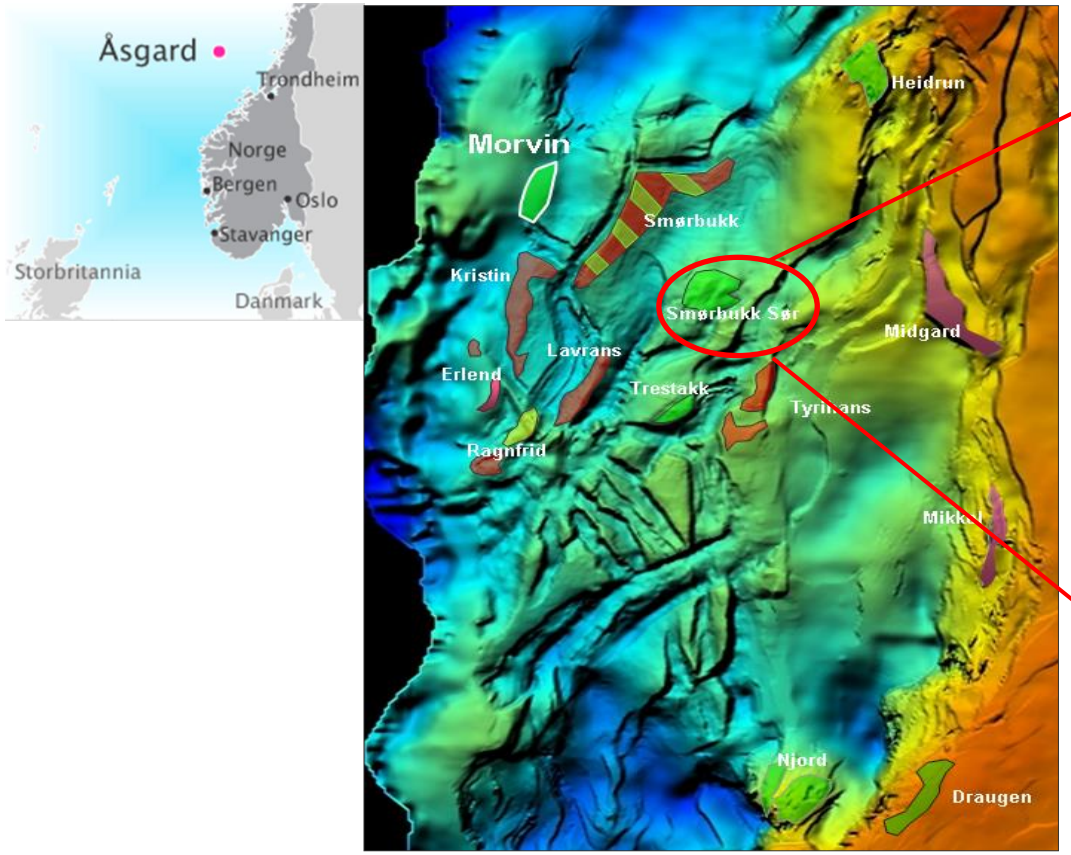
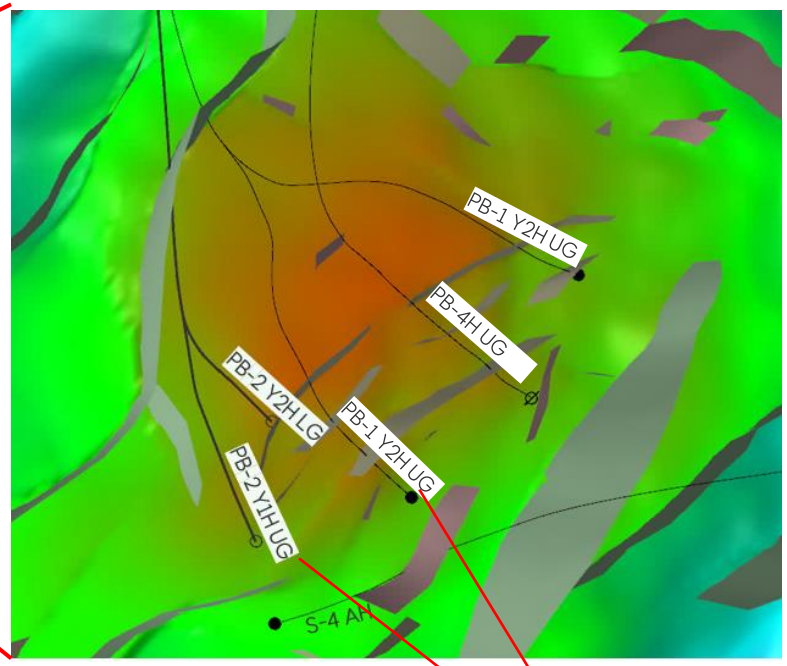




Økt utvinning med Fishbones kompletteringsteknologi – erfaringer og potensiale i Åsgardområdet

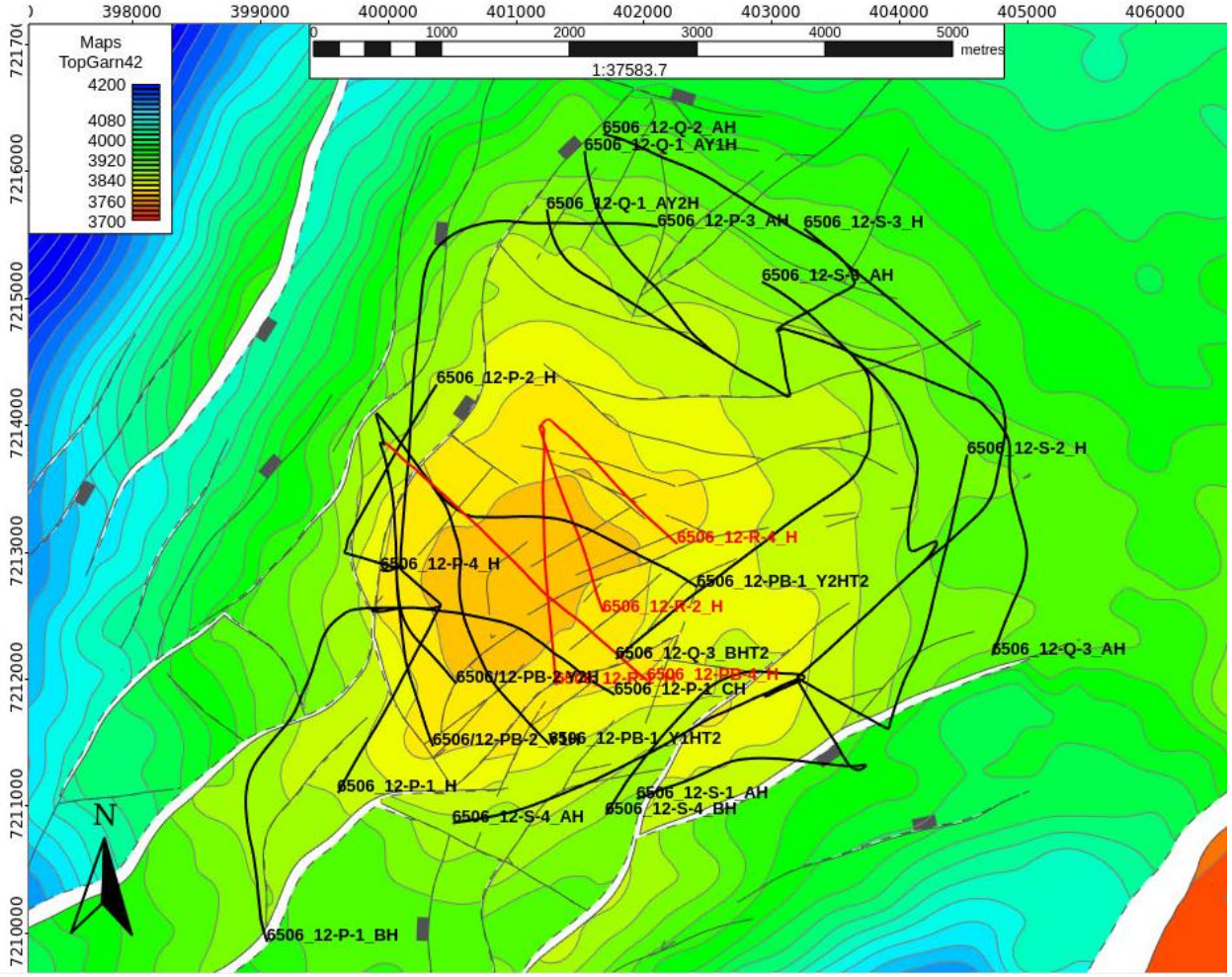
Bård Haukland – Reservoarrådgiver Equinor
7 Juni, 2022

Outline

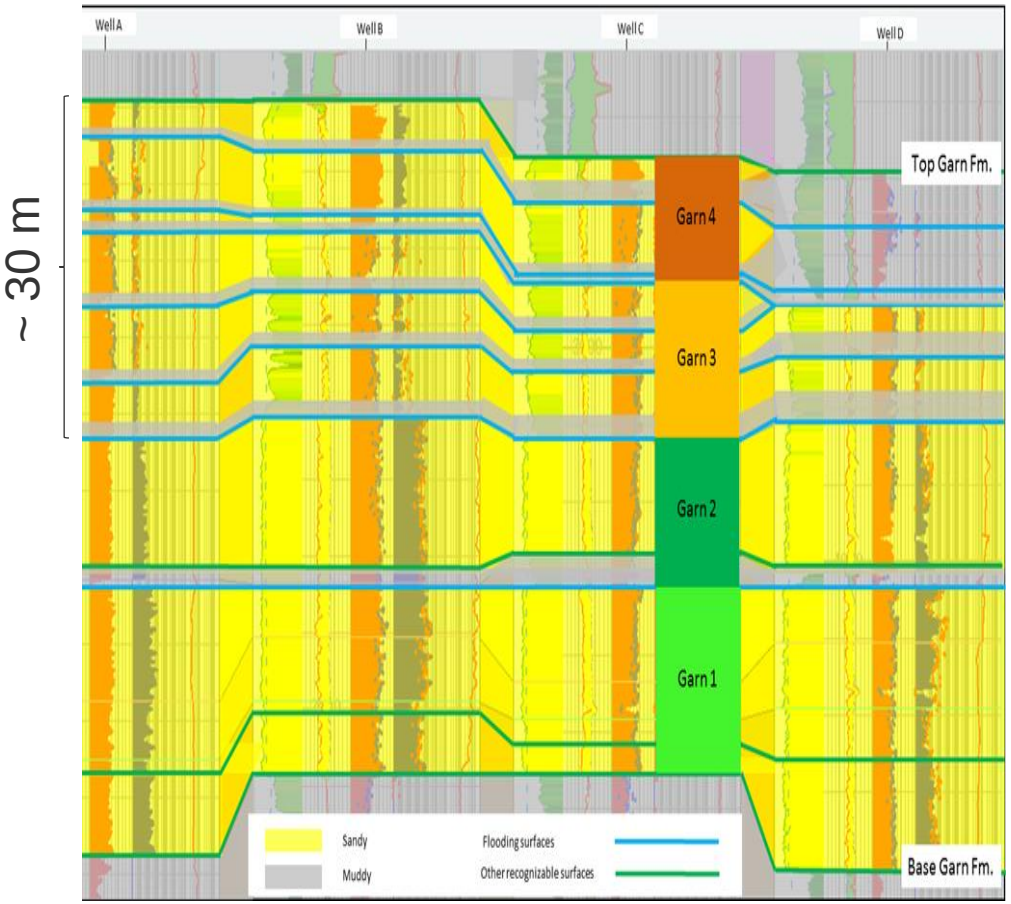
- Introduction to Smørbukk Sør
- Fishbones wells
- Production experience
- Summary

Smørbukk Sør

- **History**
  - Production started 19.05.1999 from Lower Garn
  - 5 subsea templates, 1 available slot
  - Production from the Garn, Ile, and Tilje reservoirs
  - Drainage strategy: Initially gas injection from R- and PB-templates, now mostly depletion. Currently planning the next step of the blowdown phase
  - Drainage of the Ile started in 2006, Lower Tilje in 2007
  - Marginal facies development started in 2015 with the first dedicated well into the Upper Garn. Fishbones qualification and first use in Equinor



Motivation for use of Fishbones in Upper Garn on Smørbukk Sør



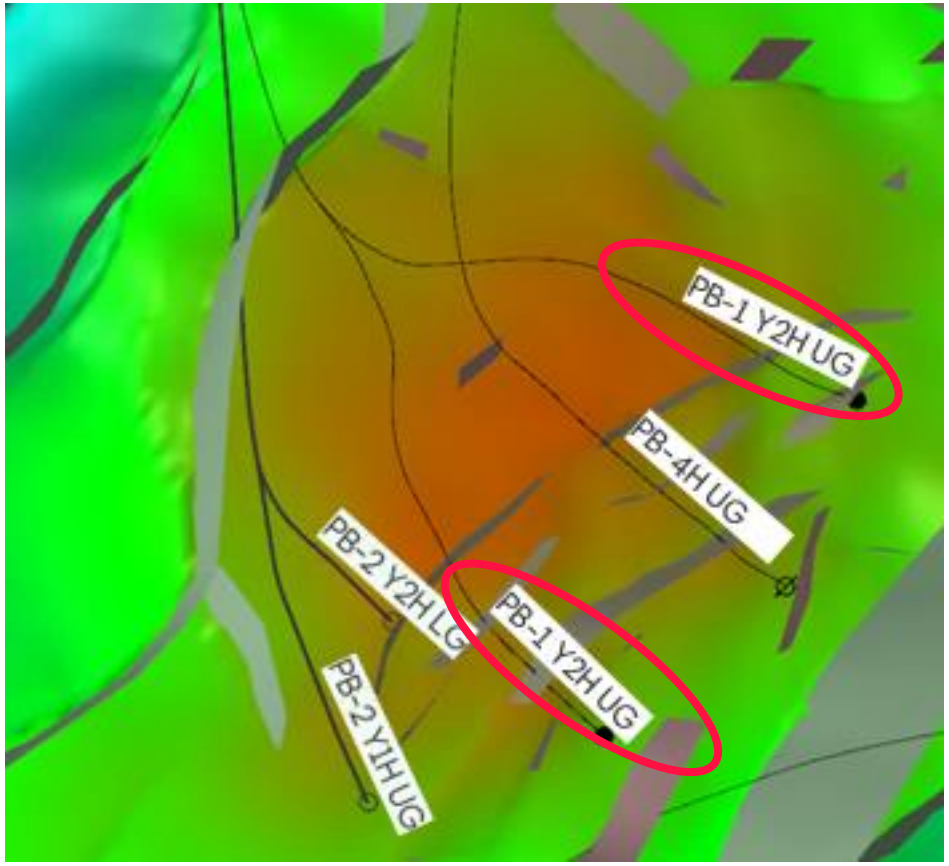
- Low permeability, less than 10 mD
- Fracture length – Underlying reservoir is gas filled with lower pressure. Risk of fracturing into underlying reservoir with conventional fracturing
- Internal barriers – Within the reservoir there are internal barriers that needs to be penetrated for increased reservoir exposure
- Sand strength – Competent and consolidated sandstone requiring no sand control

Fits well with Fishbones technology

PB-1 Y1H / Y2H Well objective

- First well from the PB-template on Smørbukk Sør (2015)
- Planned as a multilateral well with two long horizontal reservoir sections

- Mainbore (Y1): targeting oil in Upper Garn Fm. 3 and 4
  - ~2200m horizontal section
  - 5 ½" liner and Fishbones
- Lateral (Y2): targeting oil in Upper Garn Fm. 3 and 4
  - OH sidetrack
  - ~2000m horizontal section
  - 5 ½" pre-drilled liner, blanks and swell packers



PB-2 Y1H / Y2H Well objective

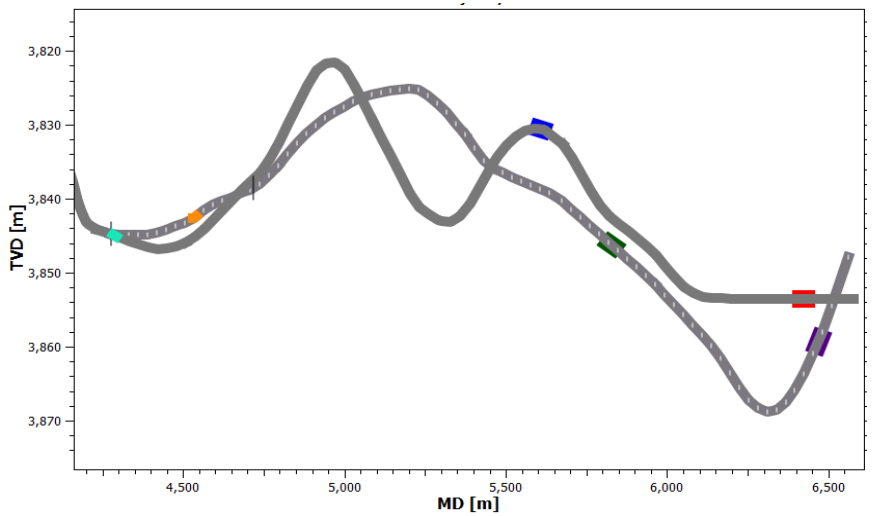
- New well from the PB template on Smørbukk Sør (2021)
- Planned as a multilateral well with two long horizontal reservoir sections

- Mainbore (Y1): targeting oil in Upper Garn Fm. 3 and 4
  - ~1500m horizontal section
  - 5 ½" liner and Fishbones
- Lateral (Y2): targeting gas in Lower Garn Fm. 2
  - OH sidetrack
  - ~1000m horizontal section
  - 5 ½" pre-drilled liner, blanks and swell packers
  - Pre-installed plug to seal off Y2H during clean-up

Interpretation of production performance PB-1 H

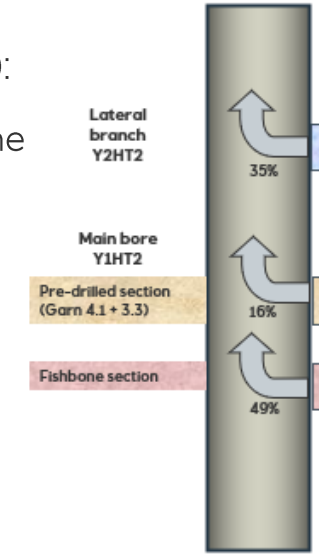
Inflow tracer interpretation (2015):

- Mainbore (w/Fishbones completion) produces with a higher rate than the lateral
- Higher productivity in zones where Fishbones completion is installed



Equinor interpretation of production log (2017):

- The majority of the production is originating from the mainbore (Fishbones branch)
- Equinor's interpretation is that ~50% of production is coming from the Fishbones completion



Expected Fishbone performance (2015):

- Interpretation of open hole logs* and zonal pressures** indicate roughly same contribution from both branches (+/- 5%)
- Computational Fluid Dynamics (CFD) analysis indicates branch rate increase of 10-20% by installing Fishbones completion

* Including both open hole sidetracks
** Measured and estimated

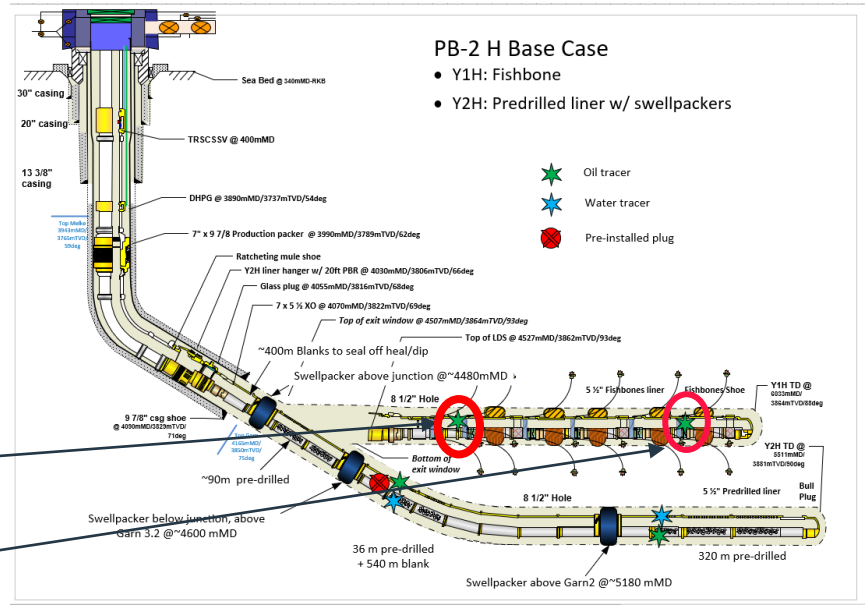
Interpretation of production performance PB-2 H

Production start-up (2022):

- Due to lower pressures and shallower lower completion in lateral, well did not start-up at first attempt in September 2021
- New attempt made in January 2022, bull heading of gas, slightly higher pressure and with mud cake more disintegrated, well started up

Inflow tracer interpretation (2022):

- Low response/concentration from heel tracer in the Fishbones branch
- High response/saturation from toe tracer in the Fishbones branch



Production performance (2022):

- The majority of the production is originating from the lateral (LG) as it has much higher PI and mostly gas is produced
- Equinor's interpretation is that Fishbones branch is performing as expected ~ 200 Sm^3/d oil rate

Expected Fishbones performance (2021):

- Based on simulation using ResInsight software to model Fishbones, an additional recovery of ~25% is expected compared to a predrilled liner from Upper Garn

Summary

- The Fishbones technology is well suited for the Smørbukk Sør Upper Garn reservoir. It has a solid business case with a low cost and no apparent downside risk

- Operational learnings
  - The installation and pumping job for Fishbones went according to plan on both PB-1 & PB-2 wells
  - Clean-up of wells with low PI needs time and pressure for a successful operation
  - Ensure good hole cleaning and stable hole conditions for running of completion as OD's are large

- Interpretation using tracers & PLT for PB-1 H indicate higher productivity in zones completed with Fishbones, compared to expectations based on interpreted reservoir properties and measured pressures

- Based on experience and evaluation, Equinor believe that Fishbones stimulation can add value to reservoirs with permeabilities in the range ~ 1-100 mD. Further use of the Fishbones is being evaluated on wells fitting above mentioned criteria

SPE-180390-MS

First Installation of Multilateral Drilling Stimulation Technology in Tight Sandstone Formation (S. Torvund, K. Stene and H. Jensaas, Statoil ASA; E. Renli, J. K. Rice and T. Jørgensen, Fishbones AS)

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- Note that conclusions presented are based on Equinor's assessment of the results without verification from Åsgard license partners

- The author would also like to thank Fishbones for excellent co-operation before, during and after installation

Questions?