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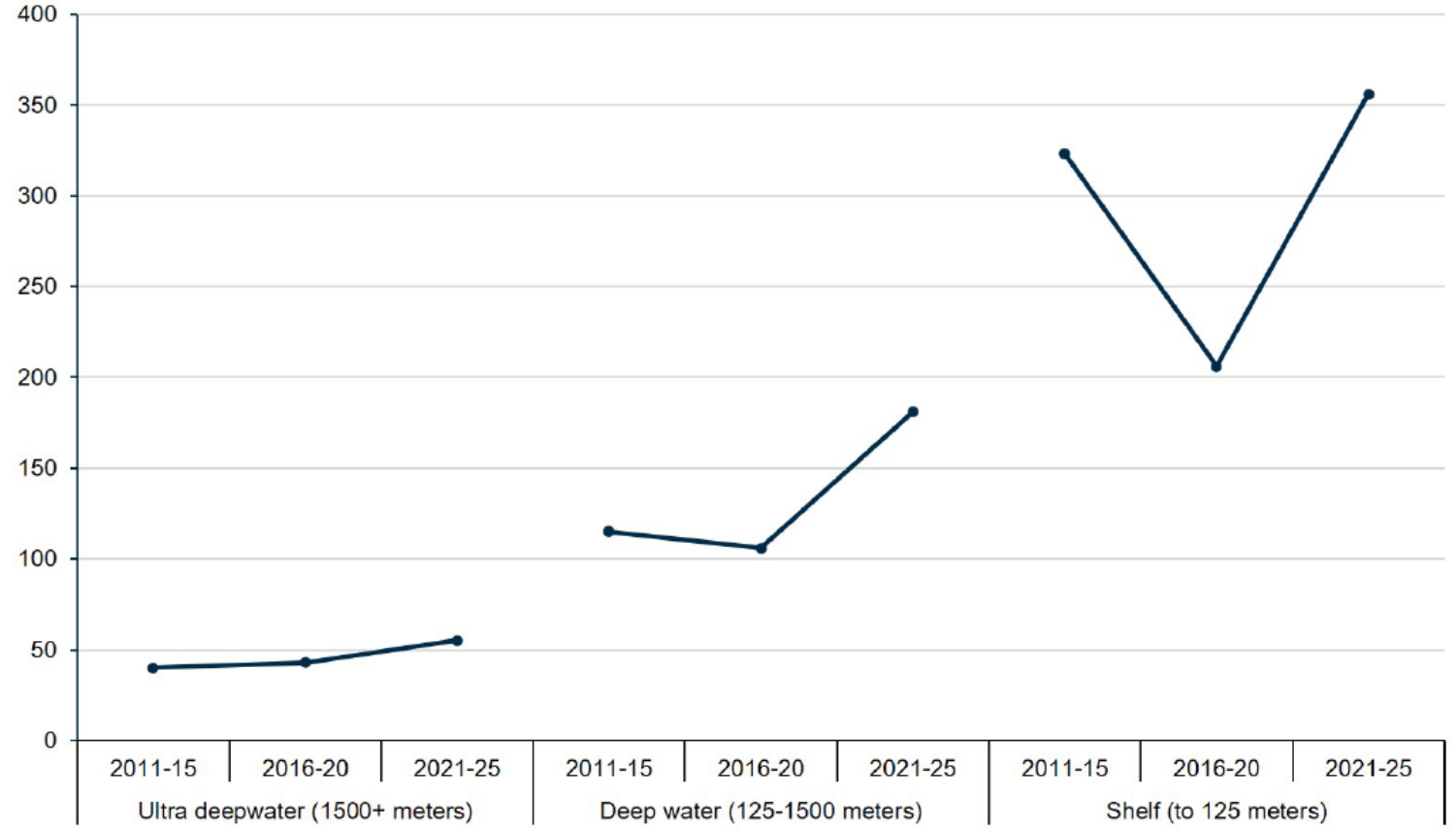
Fiber Optic Sensing of Subsea Wells

Glenn Wilson

Product Manager – Subsea Solutions

Growth in subsea developments

Figure 1: Number of offshore project commitments, split by five-year periods



Source: Rystad Energy Cost Solution, Service Demand Cube

From: Rystad Energy, 26 Feb 2021

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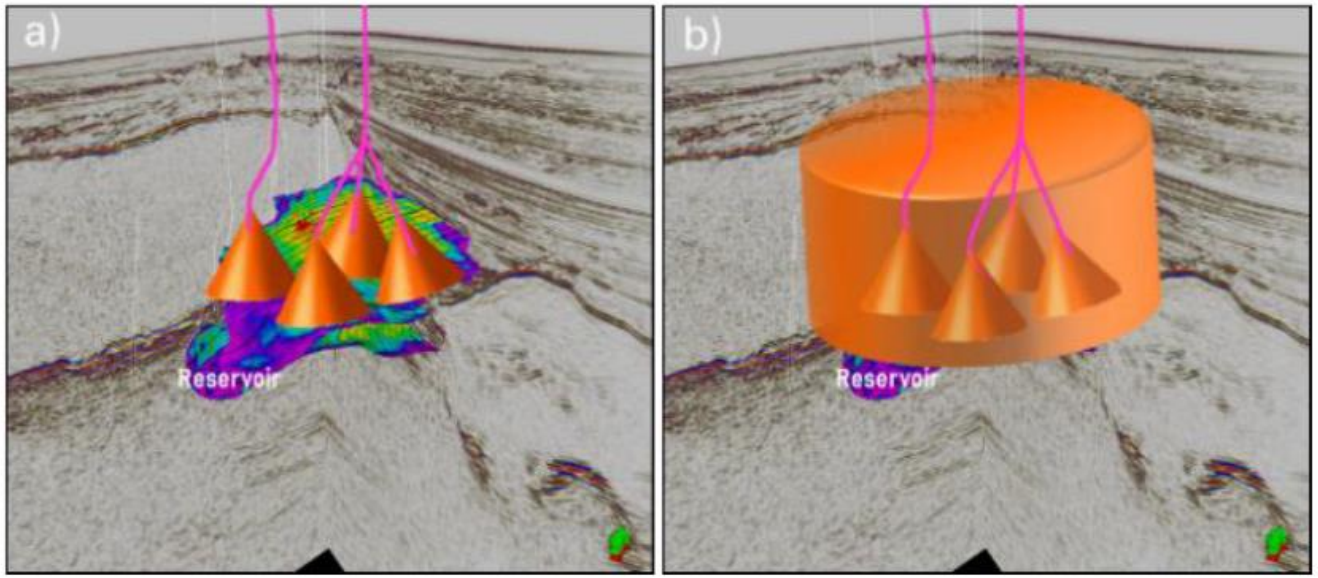
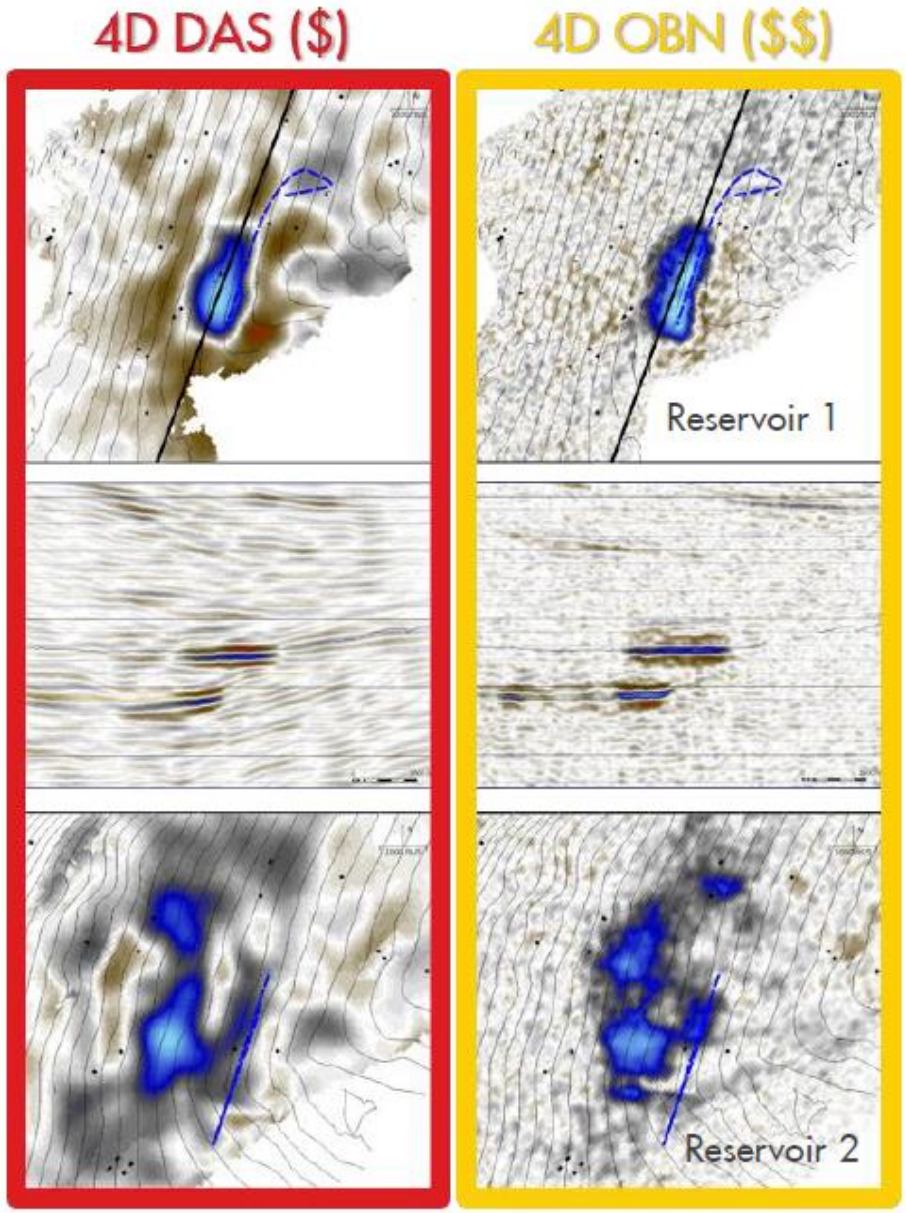
What drives interest in subsea DAS?

- Multiwell DAS VSP yields equivalent images to OBN
- Significantly lower total cost of ownership



From Zhan & Nahm (2020) SEG



From Mateeva et al. (2019) SPE

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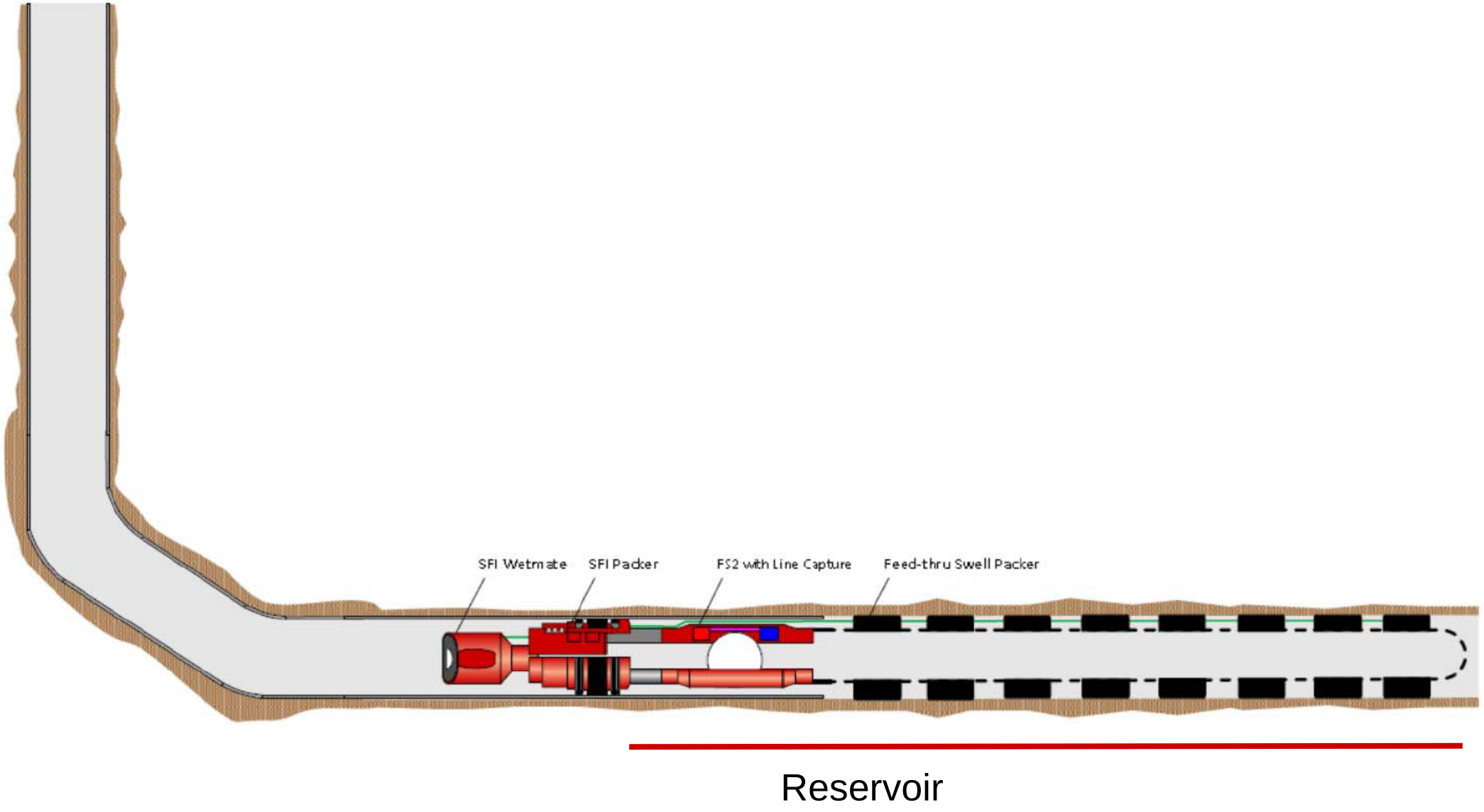
Fiber-Enabled Dual Trip Completions



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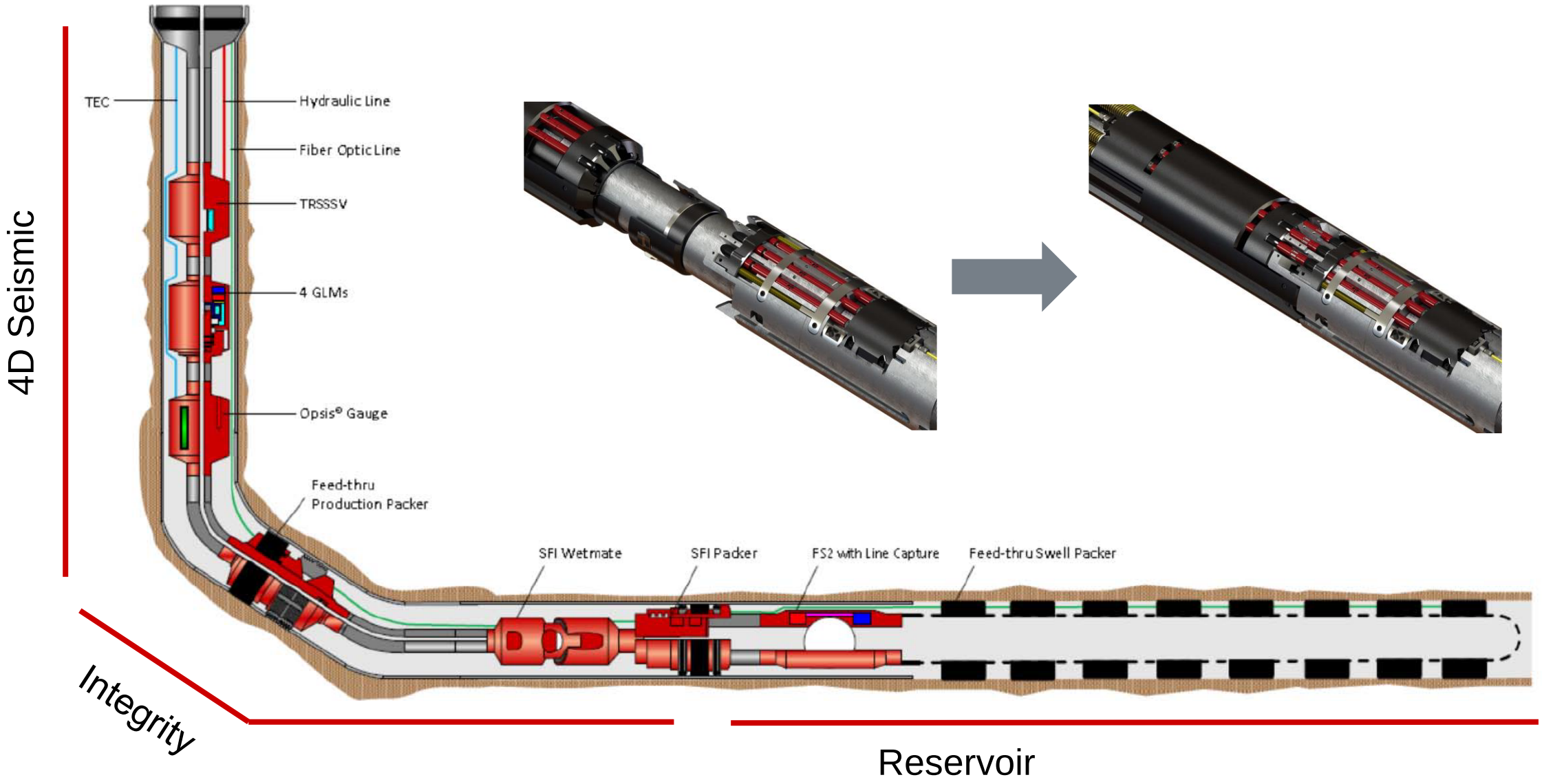
Fiber-Enabled Dual Trip Completions



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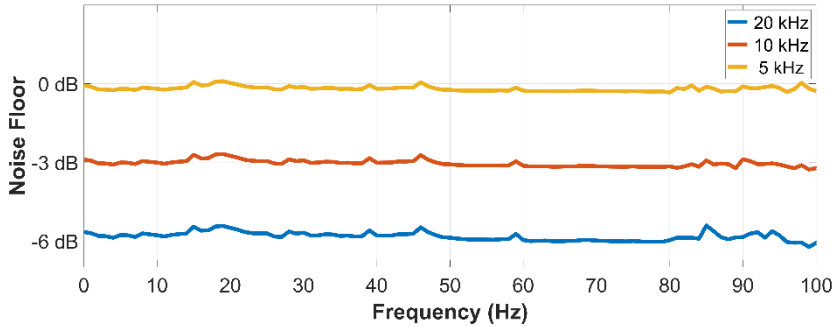
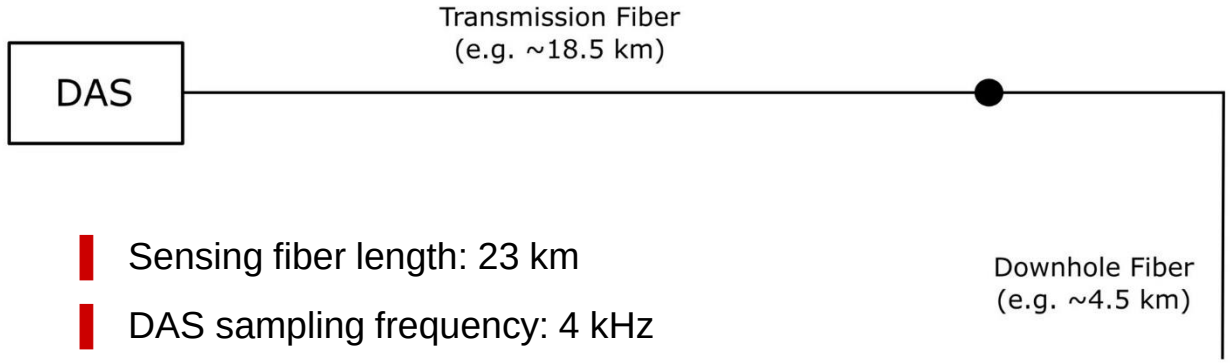
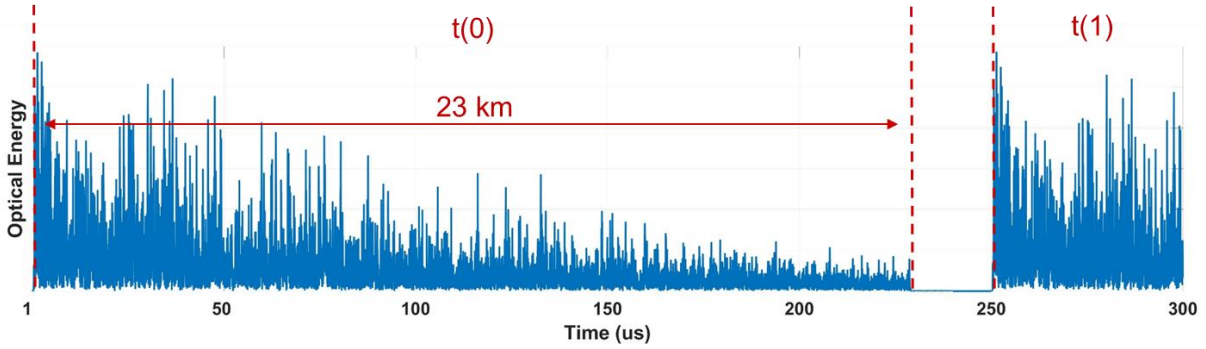
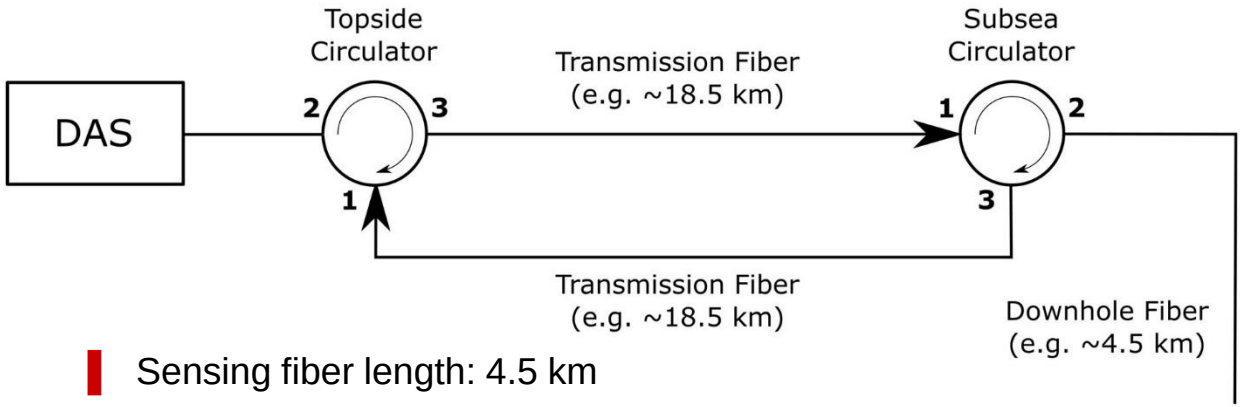
Pulse Repetition and Acoustic Bandwidth

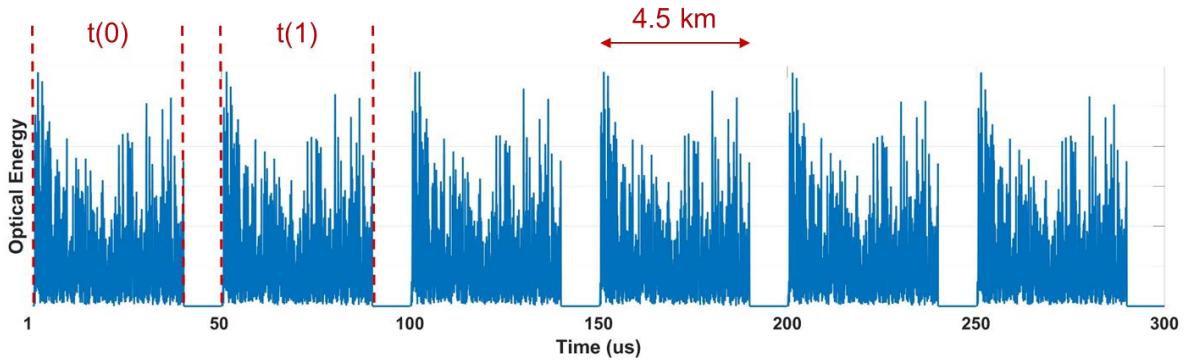






- Sensing fiber length: 23 km
- DAS sampling frequency: 4 kHz
- **Spectral Bandwidth: 0-2 kHz**





- Sensing fiber length: 4.5 km
- DAS sampling frequency: 20 kHz
- **Spectral Bandwidth: 0-10 kHz**

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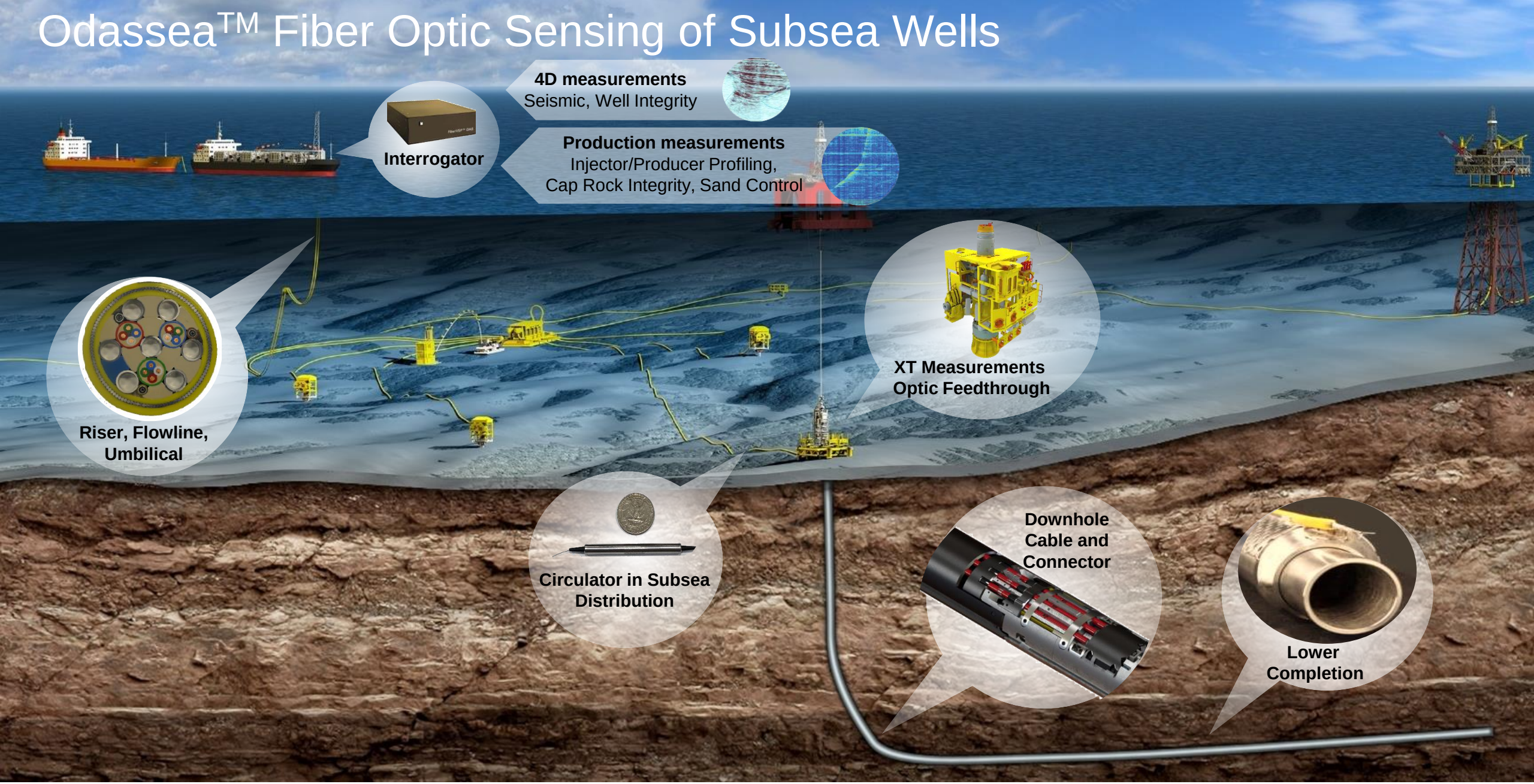
Odassea™ Fiber Optic Sensing of Subsea Wells



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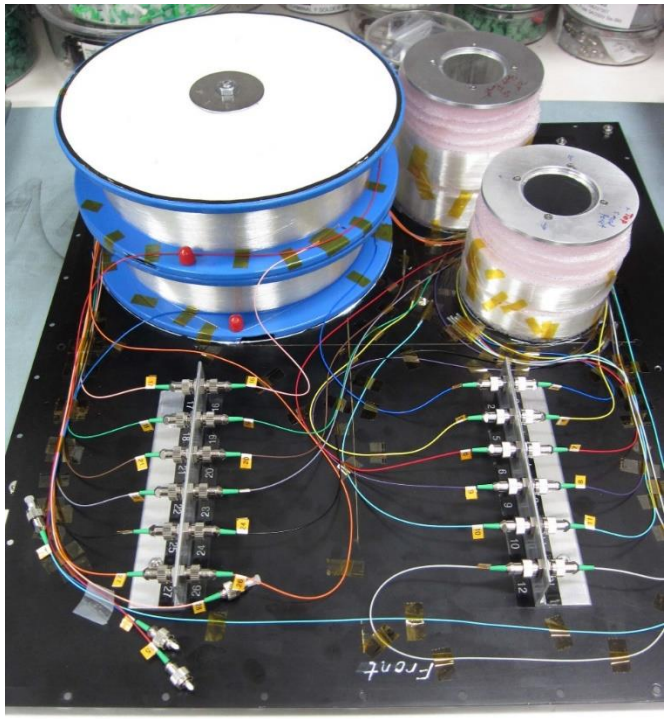
Subsea Emulator



- 6 FC/APC connector pairs with 0.2 - 0.5 dB insertion loss simulating 3 drill center nodes
- 2 FC/UPC connectors + Variable optical attenuator simulating 3.5 dB wellhead insertion loss
- Simulated step-out lengths:
  - 12 km
  - 21 km
  - 32 km
  - 52 km

From: Wilson et al. (2020) SEG
Ellmauthaler et al. (2020) TLE

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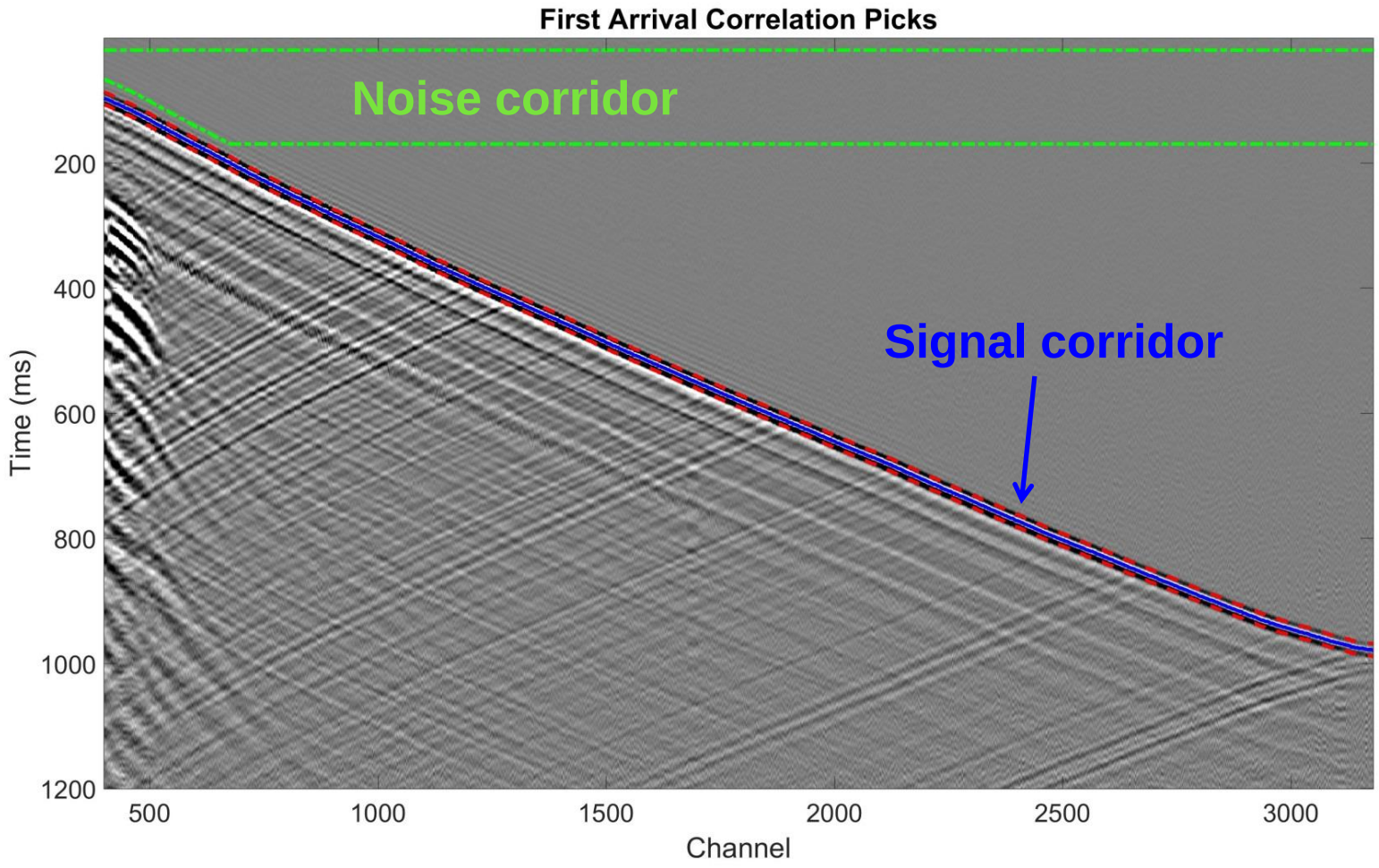
Quantifying SNR for VSP



From: Wilson et al. (2020) SEG
Ellmauthaler et al. (2020) TLE

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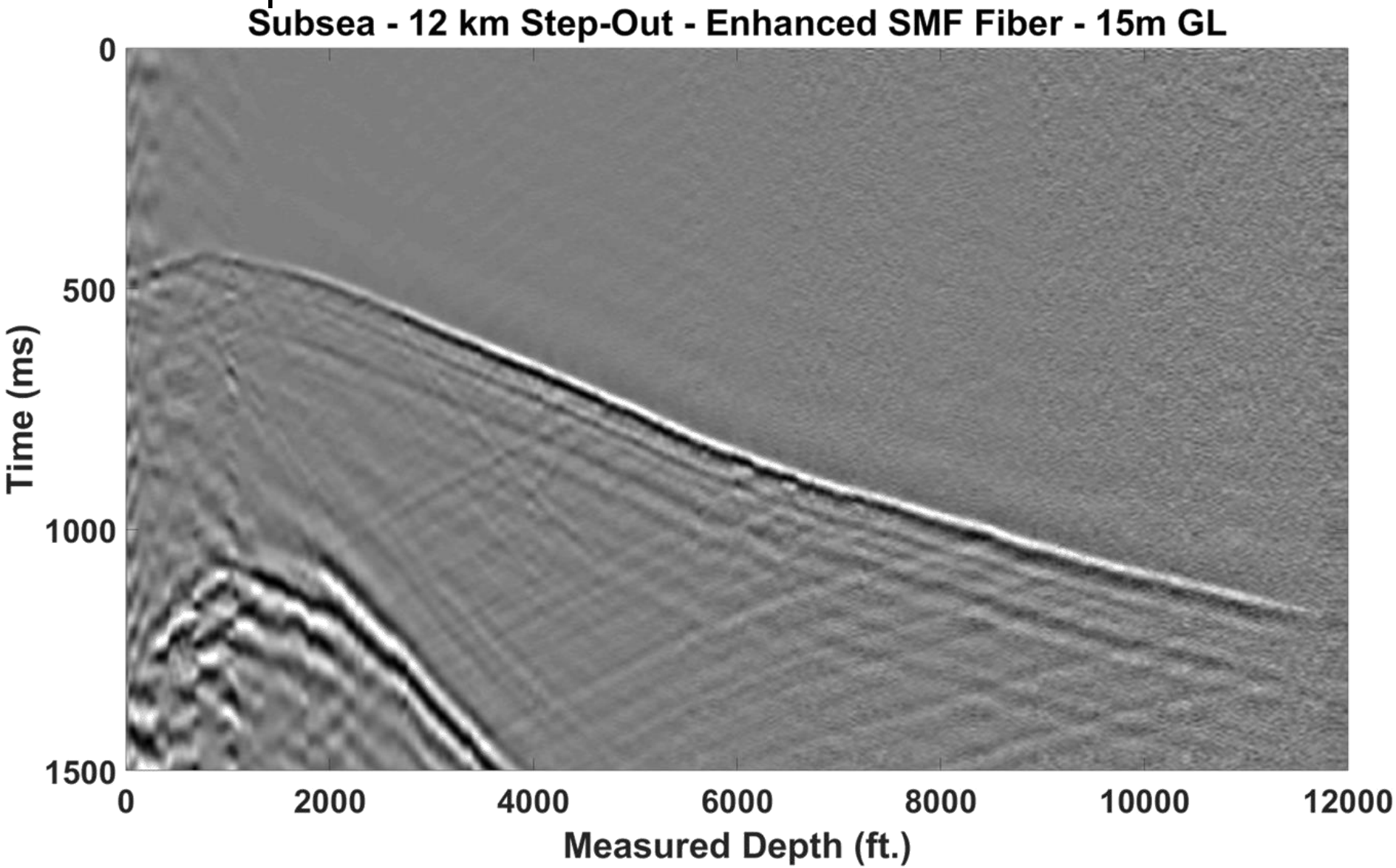
Subsea – 12 km Step-Out – 12.5 kHz



From: Wilson et al. (2020) SEG
Ellmauthaler et al. (2020) TLE

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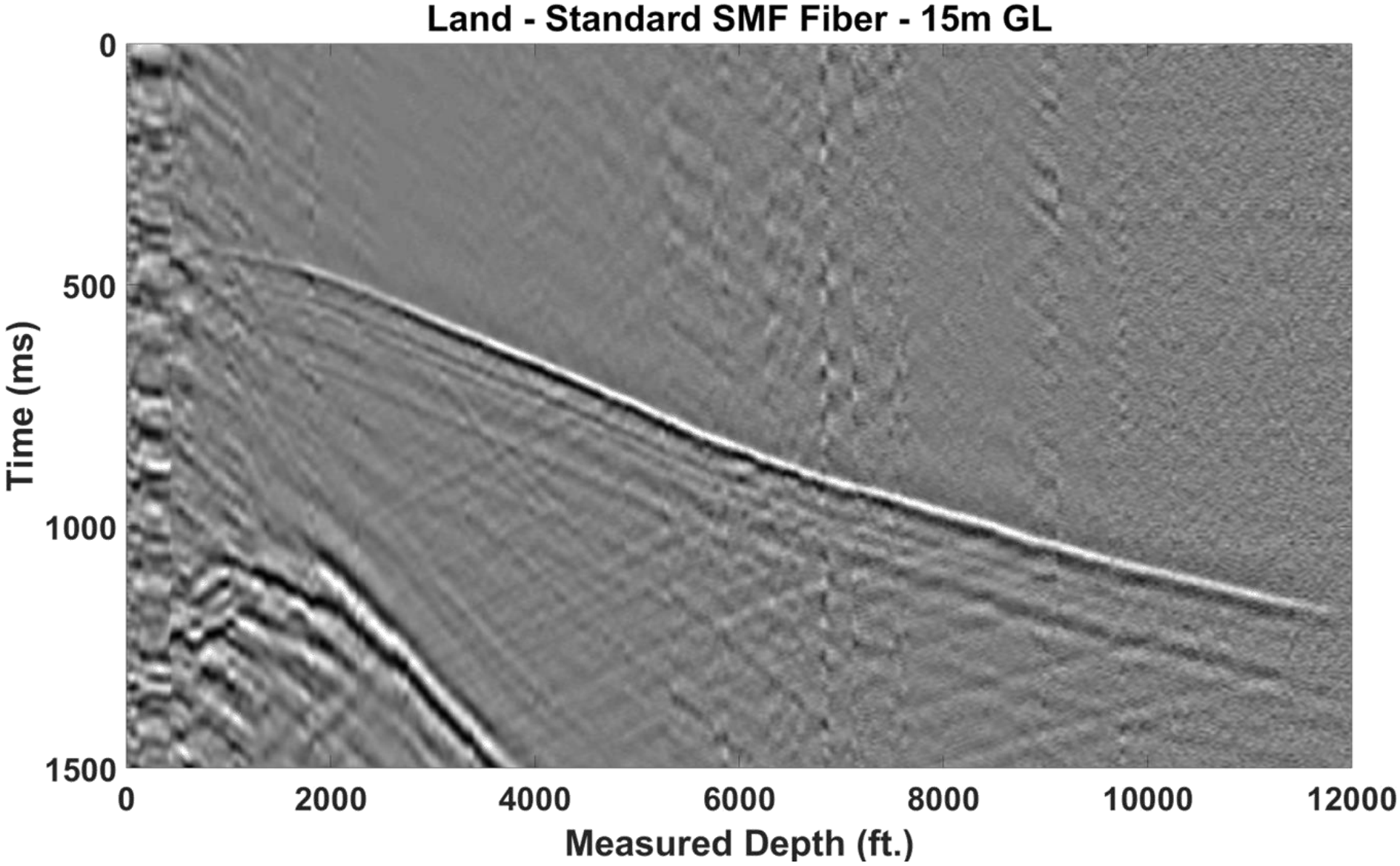
Dry-Tree – Standard SMF – 12.5 kHz



From: Wilson et al. (2020) SEG
Ellmauthaler et al. (2020) TLE

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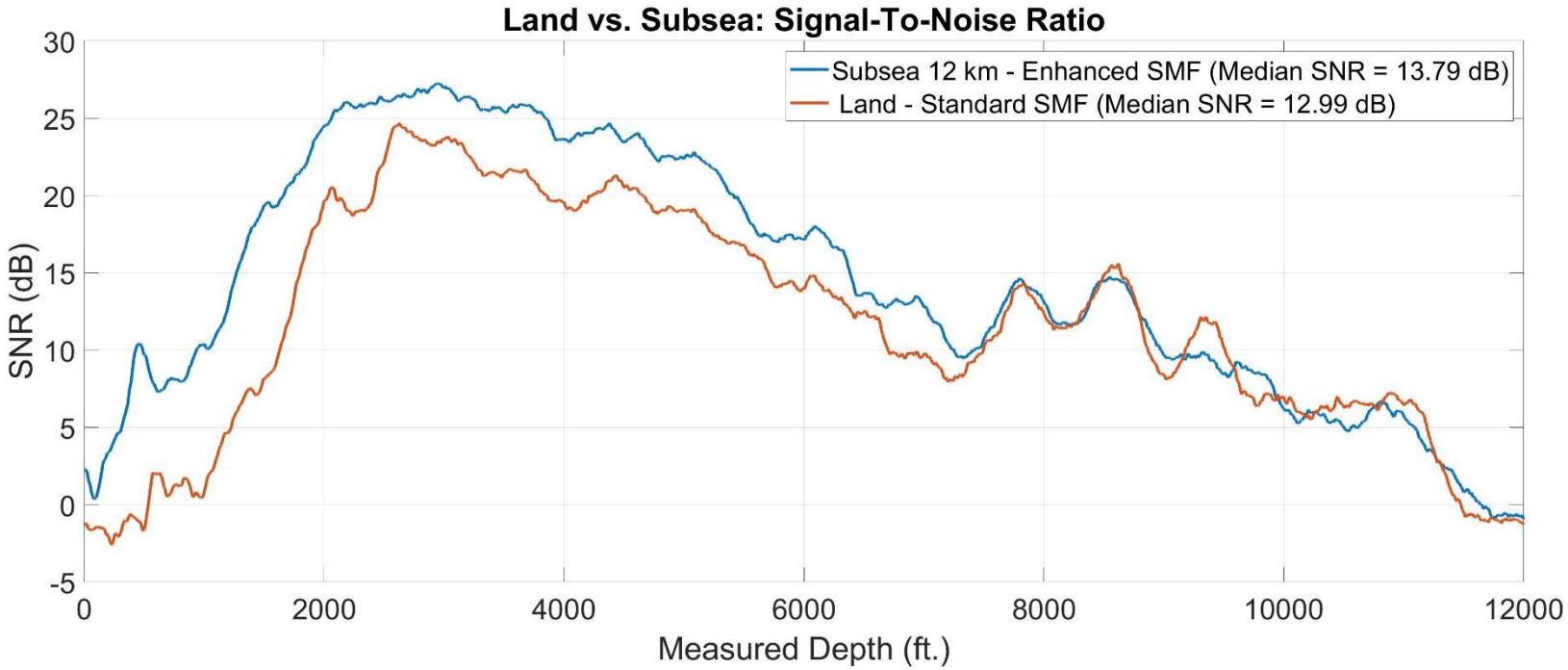
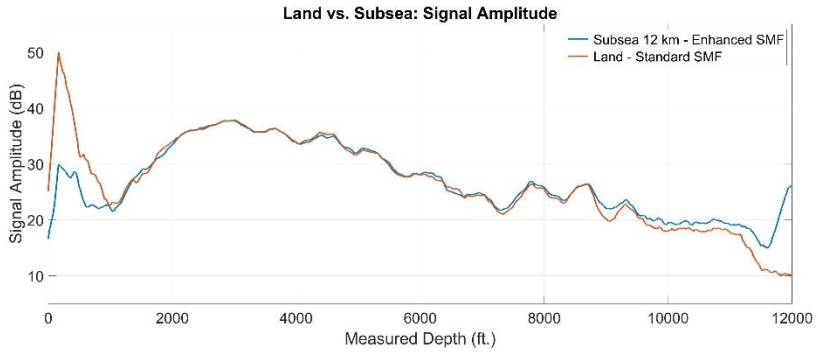
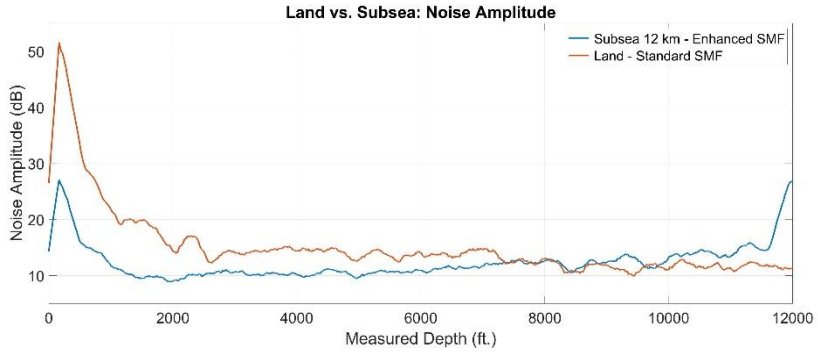
Comparison of Dry-Tree v. Subsea 12 km Step-Out: Same 12.5 kHz







From: Wilson et al. (2020) SEG
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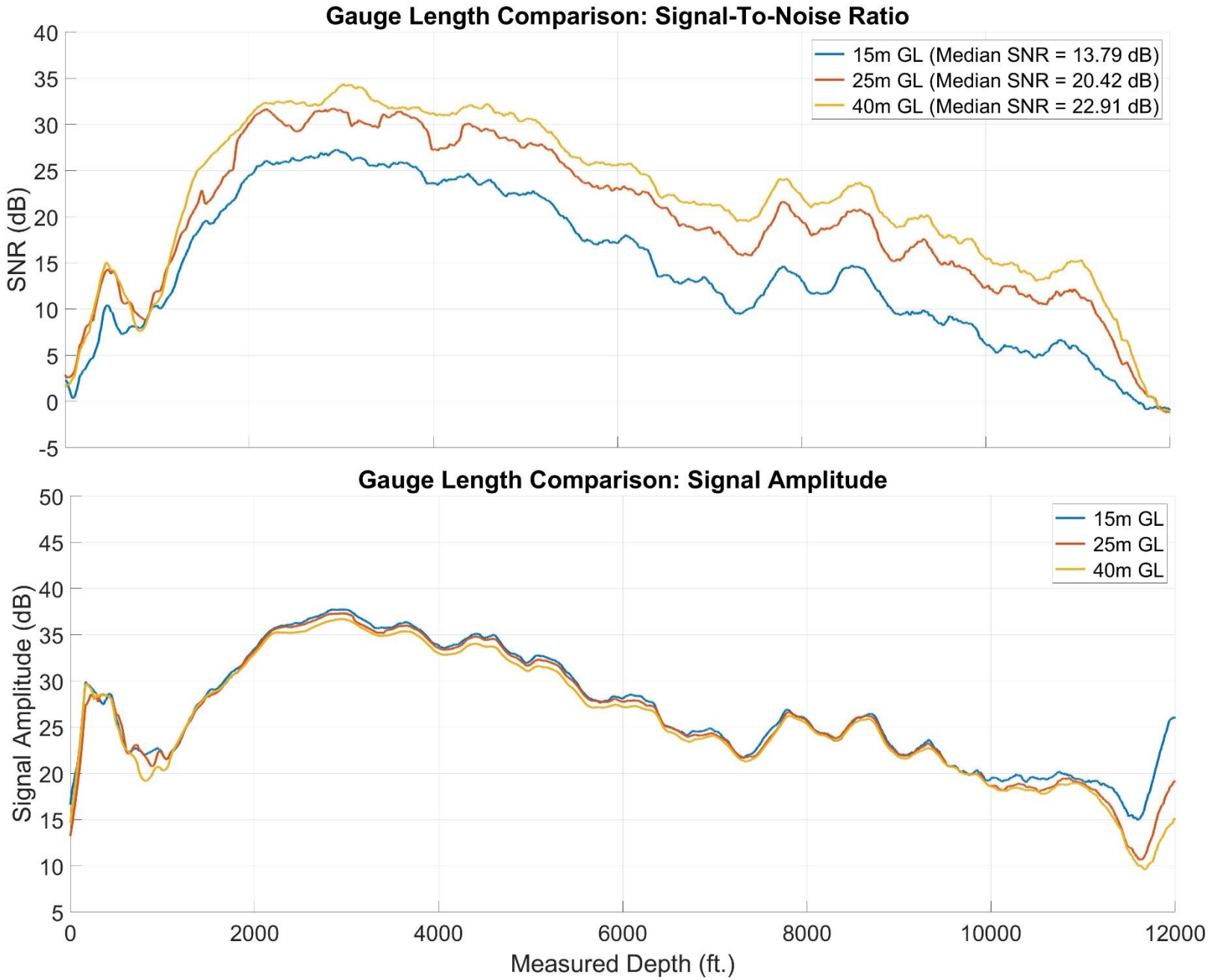

From: Wilson et al. (2020) SEG
Ellmauthaler et al. (2020) TLE

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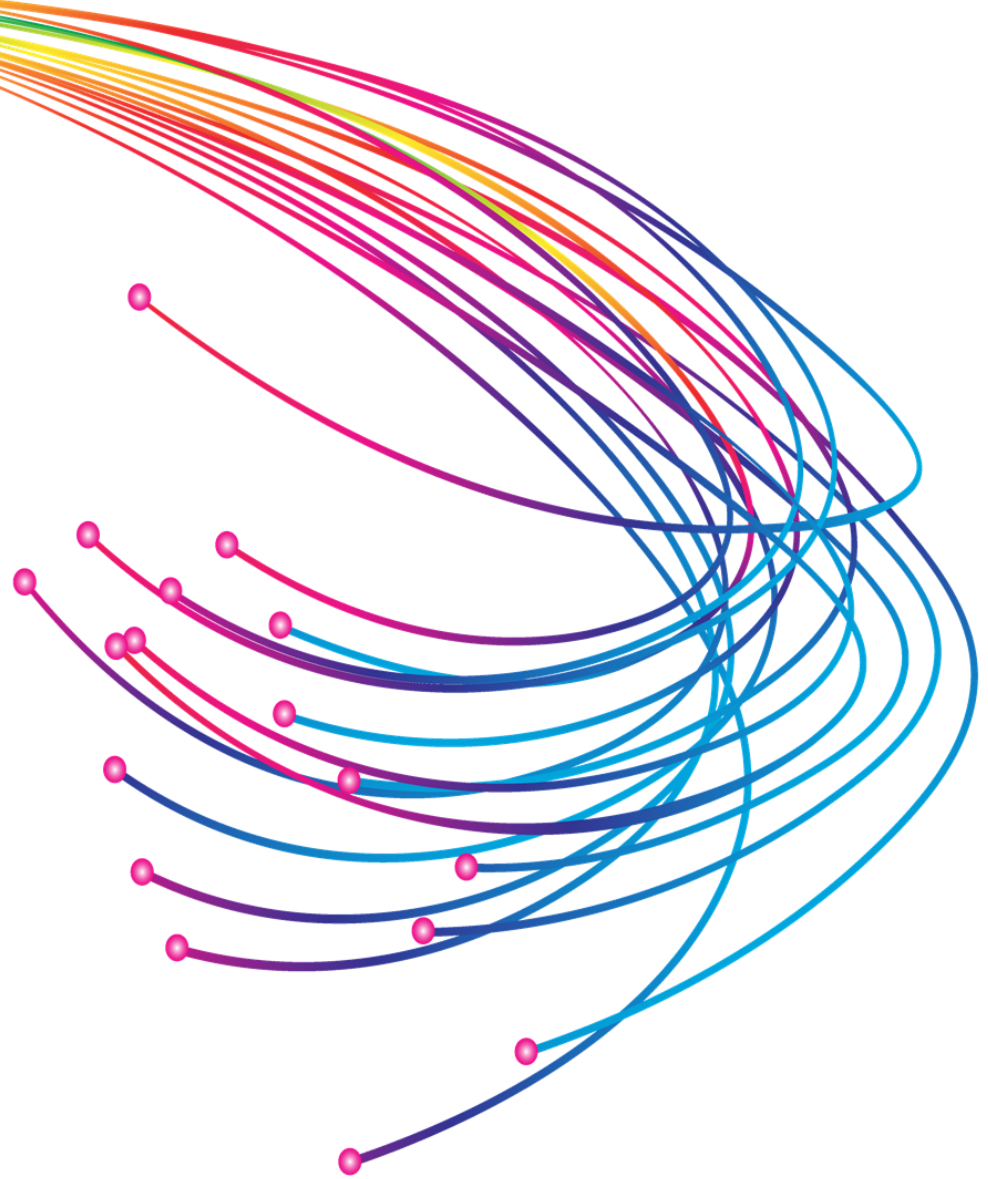
Summary

- Odassea™ subsea sensing topology able to compensate for various subsea insertion losses
- Odassea system capable of acquiring SNR equal or better than dry-tree equivalent
  - 10+ kHz acoustic bandwidth
  - Independent of tie-back distance
- Executing multiple projects from Pre-FEED to Execution



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THANK YOU