



REDUCING RISKS AND UNCERTAINTIES ON CO₂ STORAGE CAPACITY

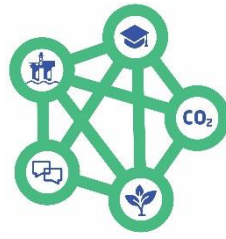
June 4th, 2024, Rungstedgaard

Nick Lee, Subsurface Manager, PGS

Birgitte D Larsen, Advisor Geoscience, DTU Offshore



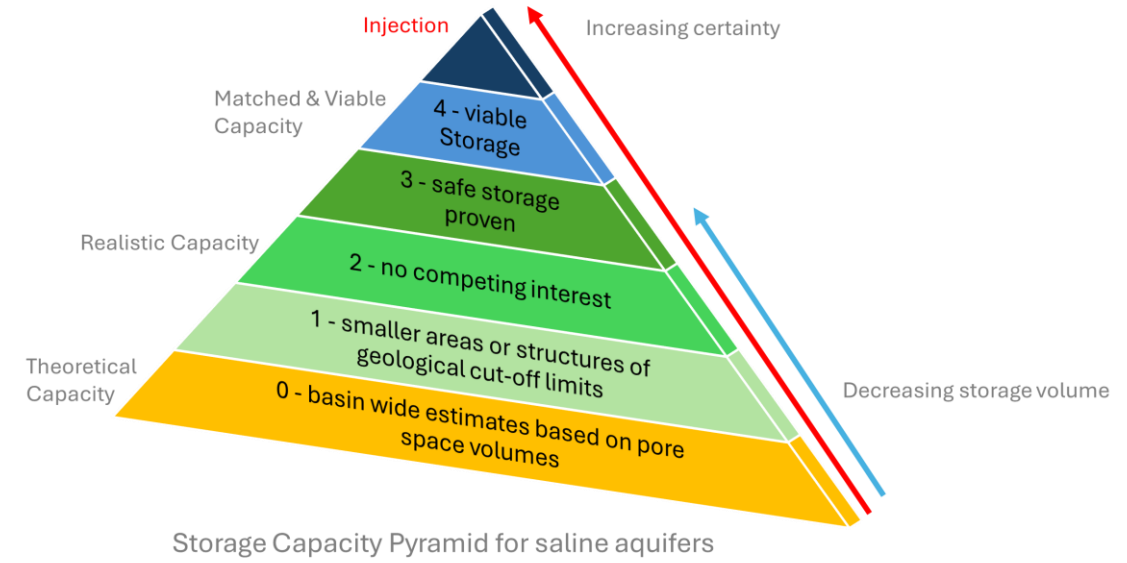
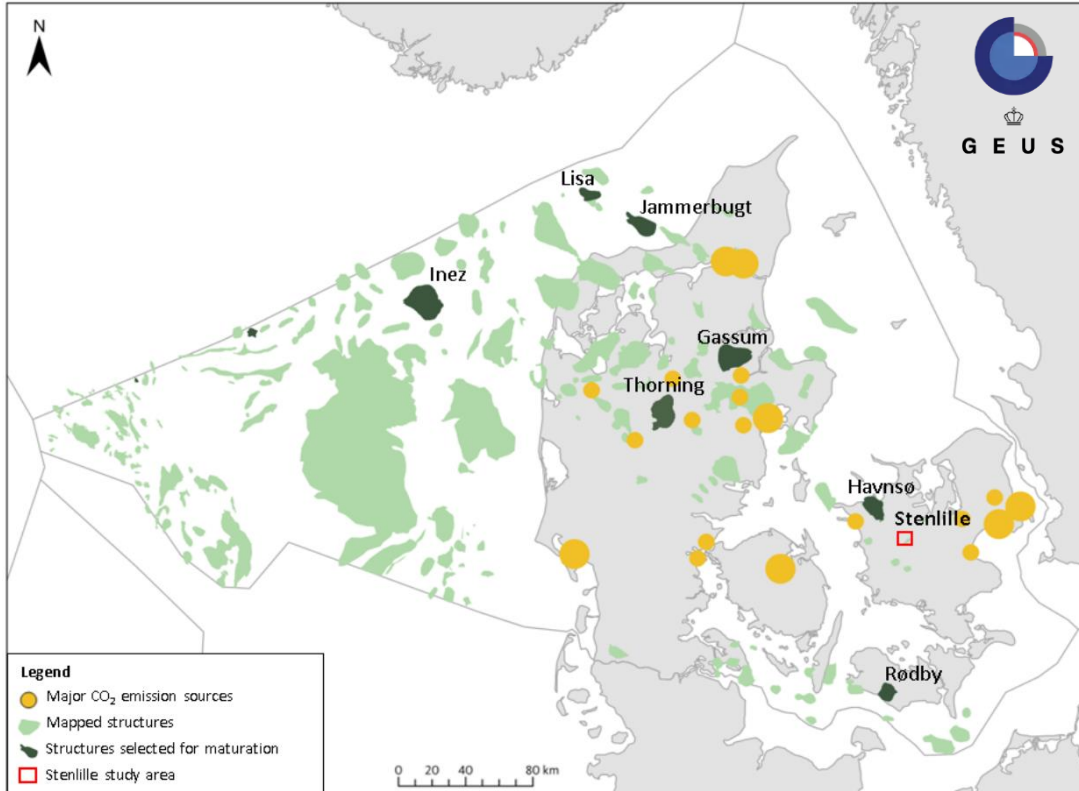
CCS offshore Denmark



Significant CO₂ storage potential has been mapped in Denmark, but this comes with significant **risk and uncertainty**, in terms of site identification and characterisation. This is in part due to the **absence of high-quality modern datasets** over the prospective areas where leads for carbon storage have been identified offshore

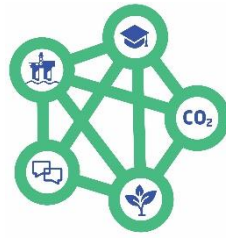
Communicated storage capacity, would currently be considered as **"Theoretical Capacity`s"** where CO₂ storage capacity has been evaluated using an "open aquifer" approach. These **estimates do not take-into account, pressure effects that result from injection of CO₂**

$$SC = \text{por volume} * \rho_{CO_2\text{reservoir}} * S(\text{Eff.})$$



*In order, to move theoretical storage capacity to **realistic storage capacity** - subsurface knowledge/data and different modelling approaches are needed*

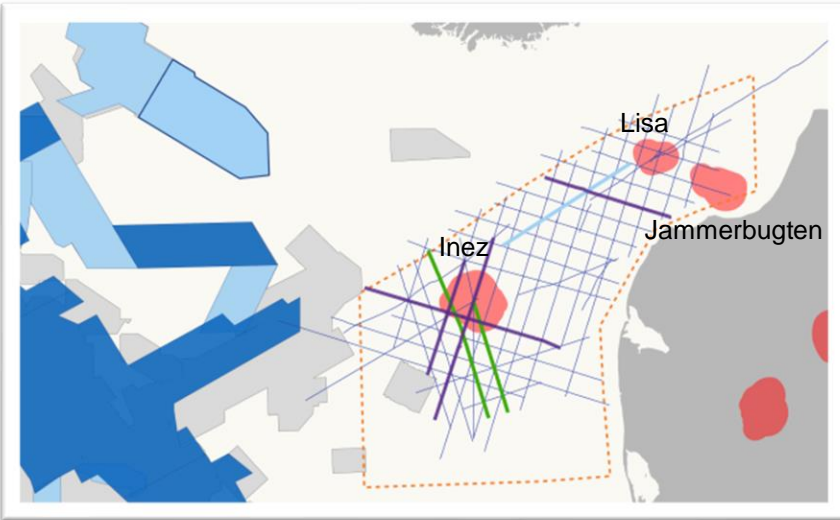
Storage characterization and capacity



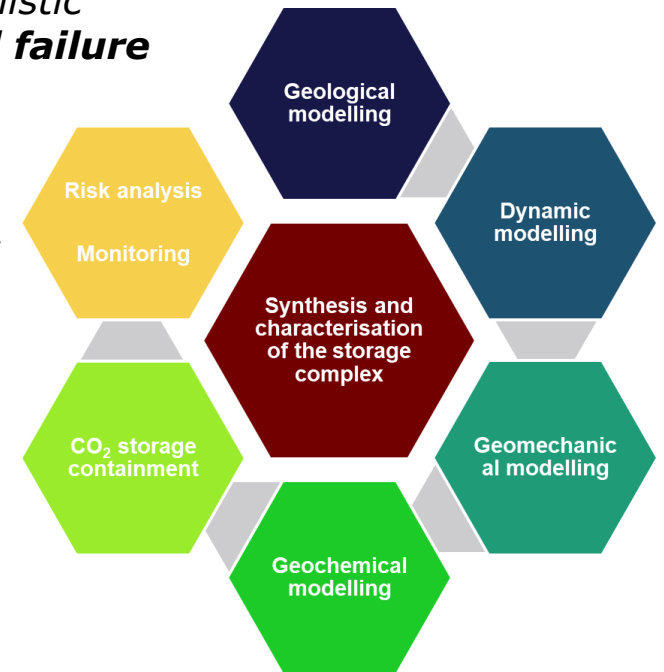
CO₂ storage nearshore/offshore in Denmark, **closed structures** are likely chosen as storage reservoirs, to ensure optimal communication of safe storage concepts in the first phase

Various approaches can be used to evaluate the CO₂ storage capacity of saline aquifer structures, resulting in a **widely conflicting results** for a given aquifer

DTU Offshore will, **based on re-juvenated seismic data by PGS** approach more realistic storage capacities accounting for pressure build-up and **review possible mechanical failure modes** for the structures Inez, Lisa and Jammerbugten



Risk assessment of the storage complex will also outline important parameters needed to be de-risked and help outline **fit for purpose work program`s**



In the second phase of CO₂ storage in Denmark could be the opportunity of **open aquifer structures**, providing **large additional storage capacity**

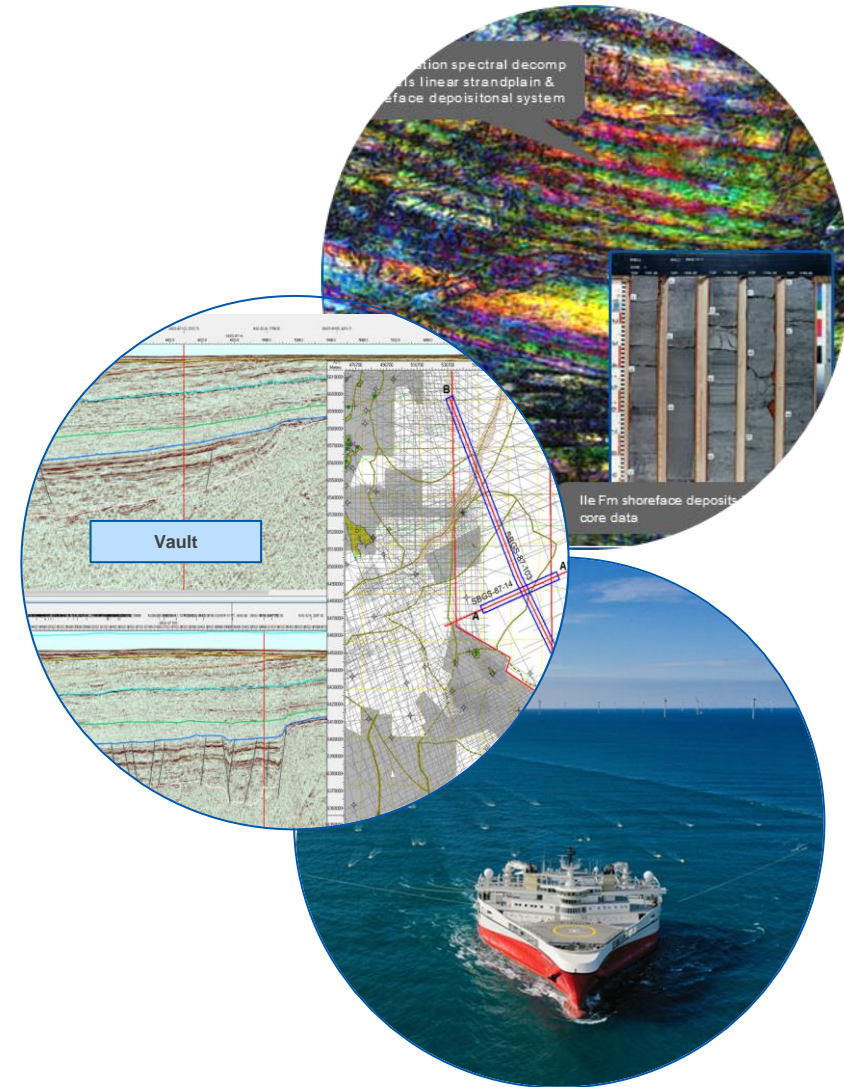
2D Rejuvenation for Danish CCS

Carbon Storage

3 Themes



- **Liberating CCS prospectivity from library 3D data**
- **Developing the multiclient opportunity**
- **Providing acquisition & processing solutions for identification, development & monitoring**

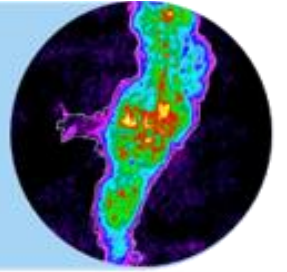


Demand is there for advanced seismic & geophysical solutions for CCS



Smeaheia
3D High Resolution
Development Survey

Snøhvit and Sleipner
Acquisition and Processing
CO₂ Monitor Surveys



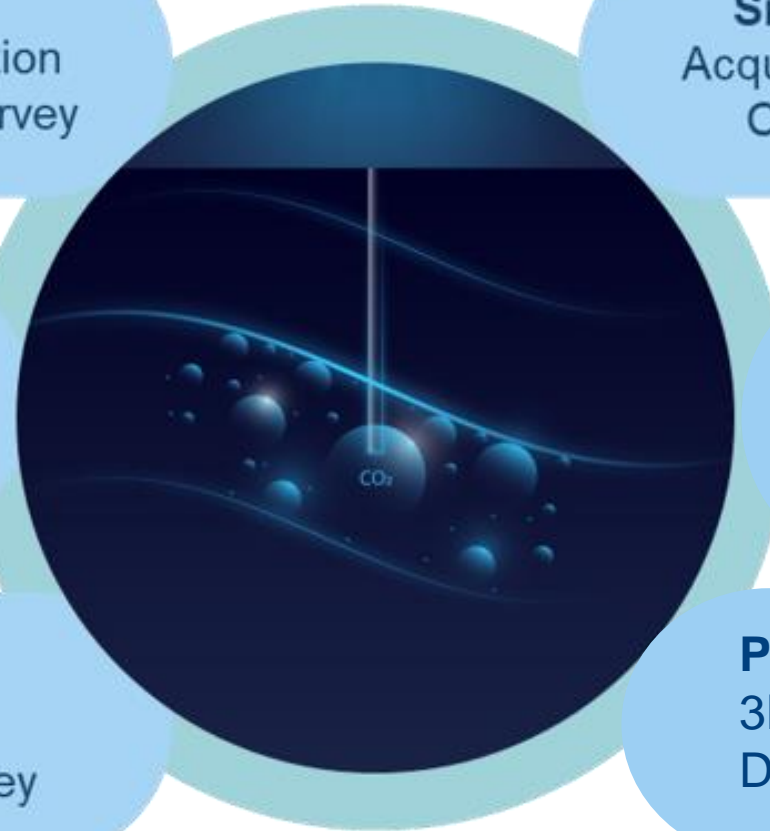
**Northern
Endurance
Partnership**
3D High Resolution
Development
Survey

Vault
MC3D High Resolution
Identification Survey

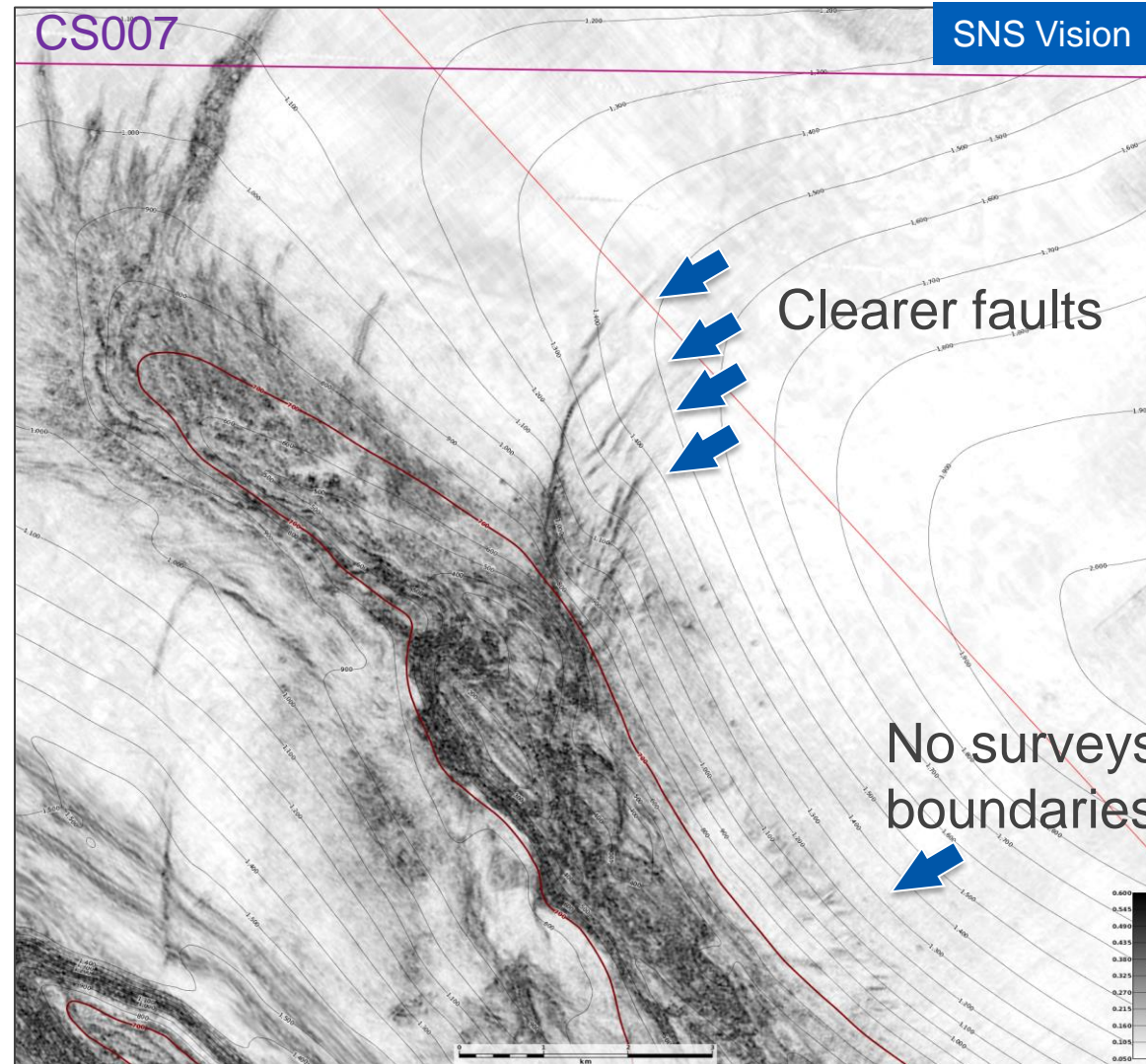
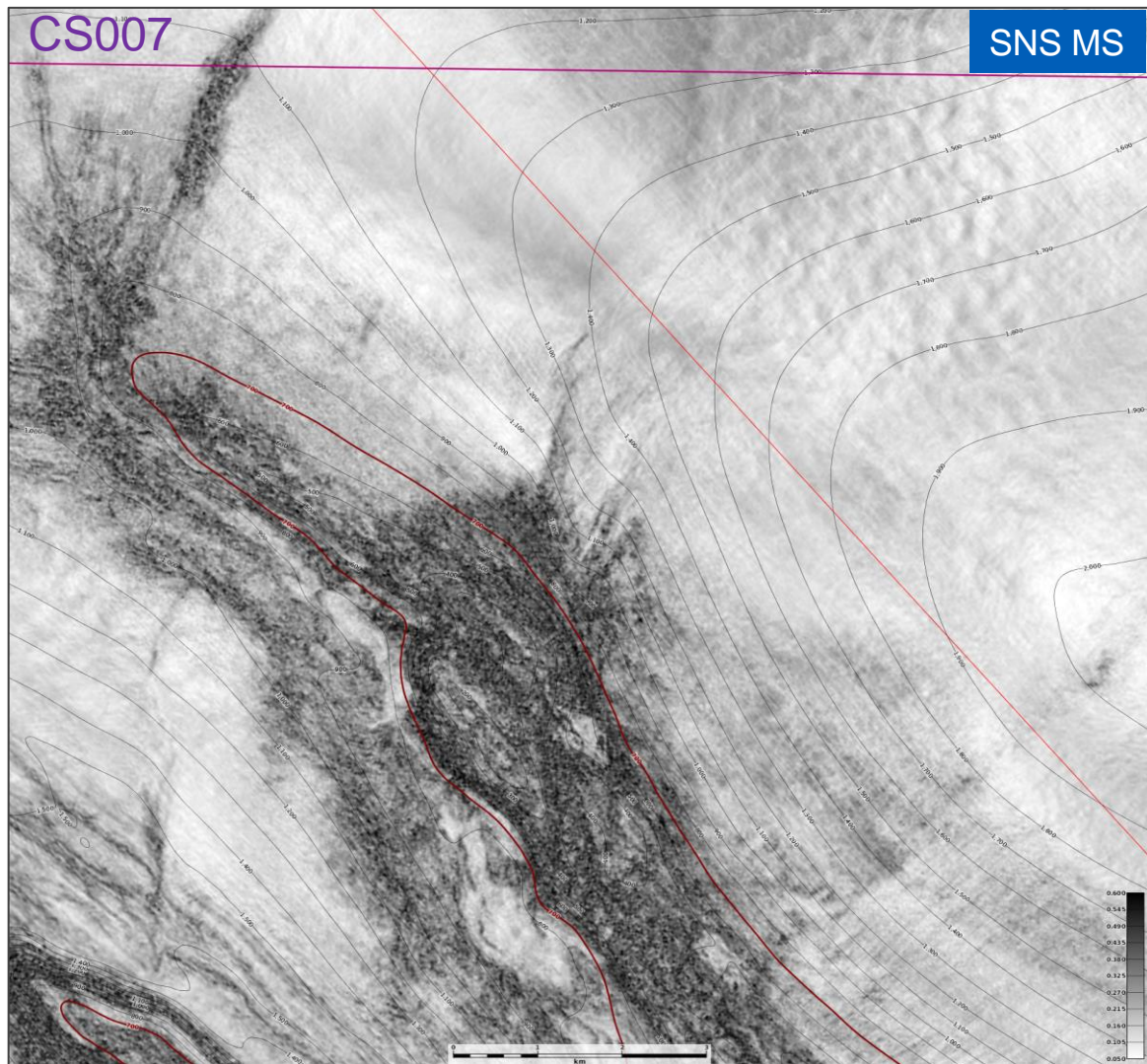


**Northern
Lights**
4D High
Resolution
Baseline Survey

Poseidon
3D High Resolution
Development Survey

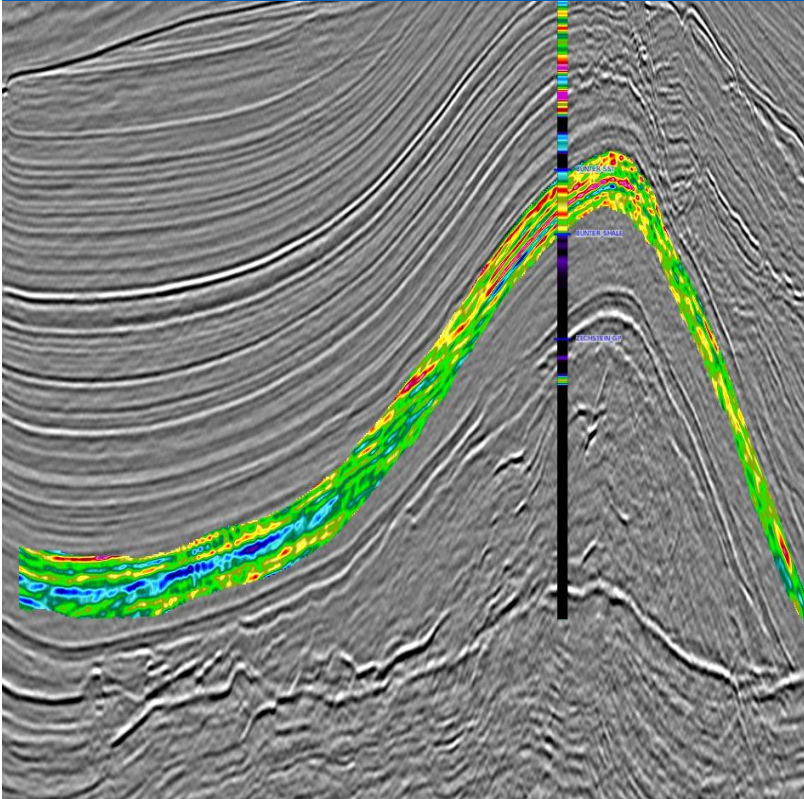


SNS Vision – rejuvenation of the Southern North Sea

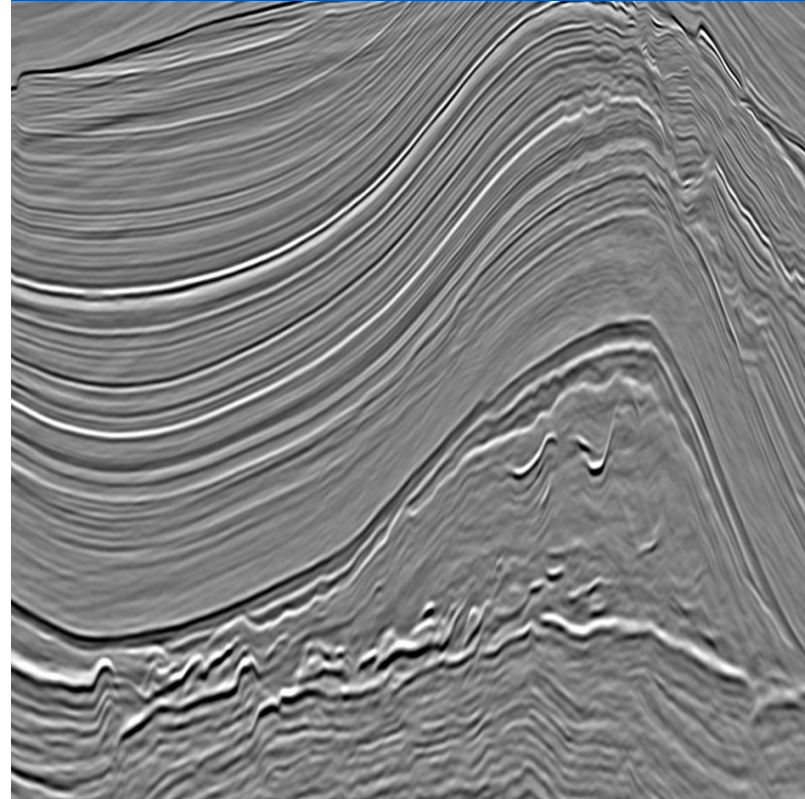


From Regional Pre-stack Time Merge to Pre-Stack Depth Migration

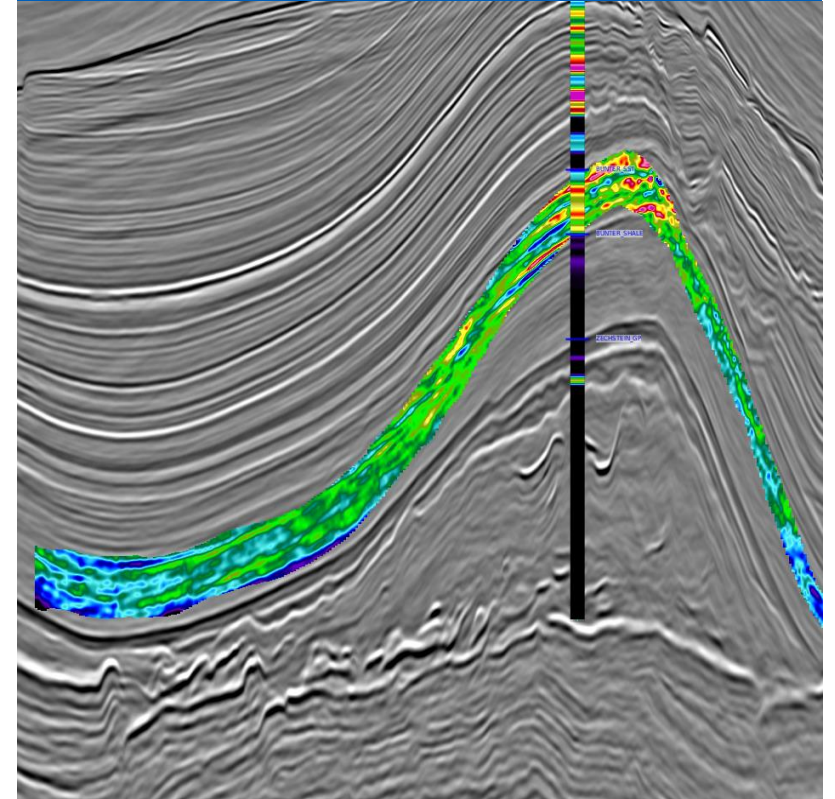
Legacy PSTM Porosity Estimation



SNS Vision PSDM



SNS Vision PSDM Porosity Estimation

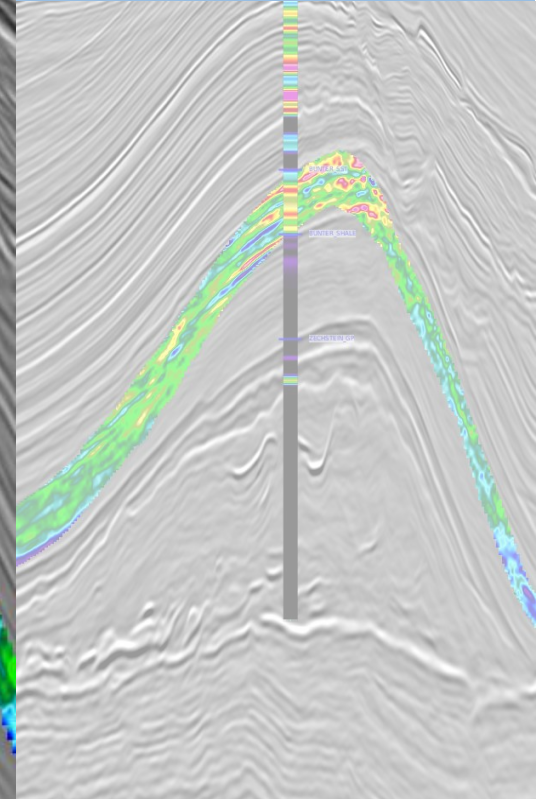
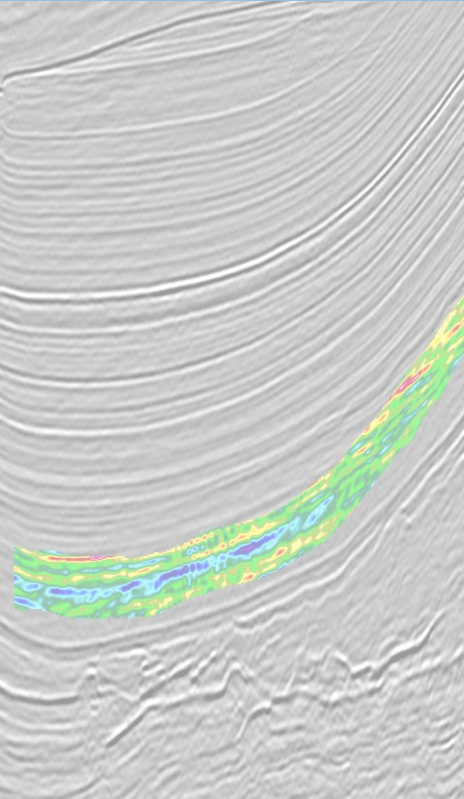
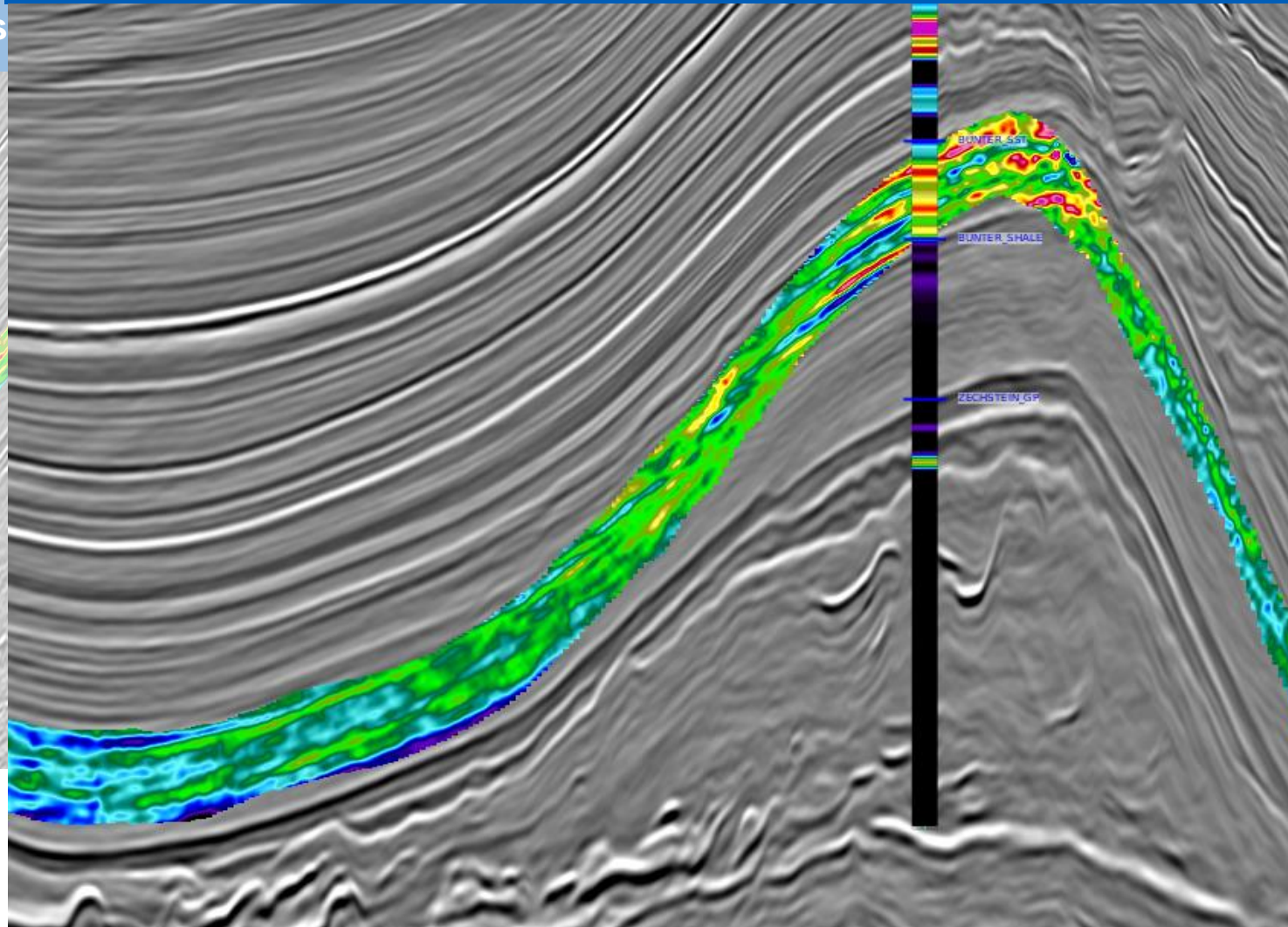


From Regional Pre-stack Time Merge to Pre-Stack Depth Migration

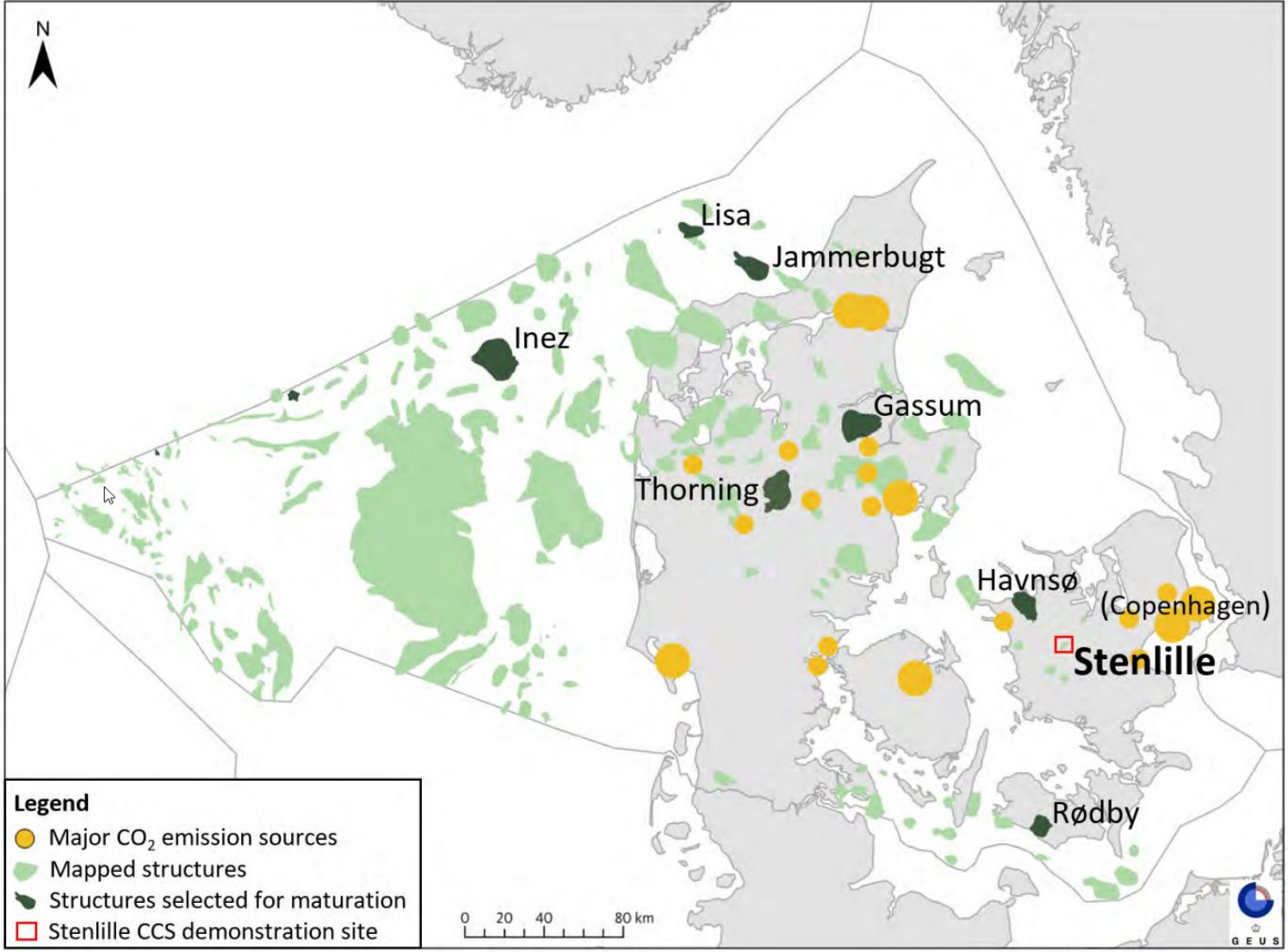
SNS Vision PSDM Porosity Estimation

Legacy PSTM Poros

SDM Porosity Estimation



PGS 2D Vision for Denmark CCS Storage Screening



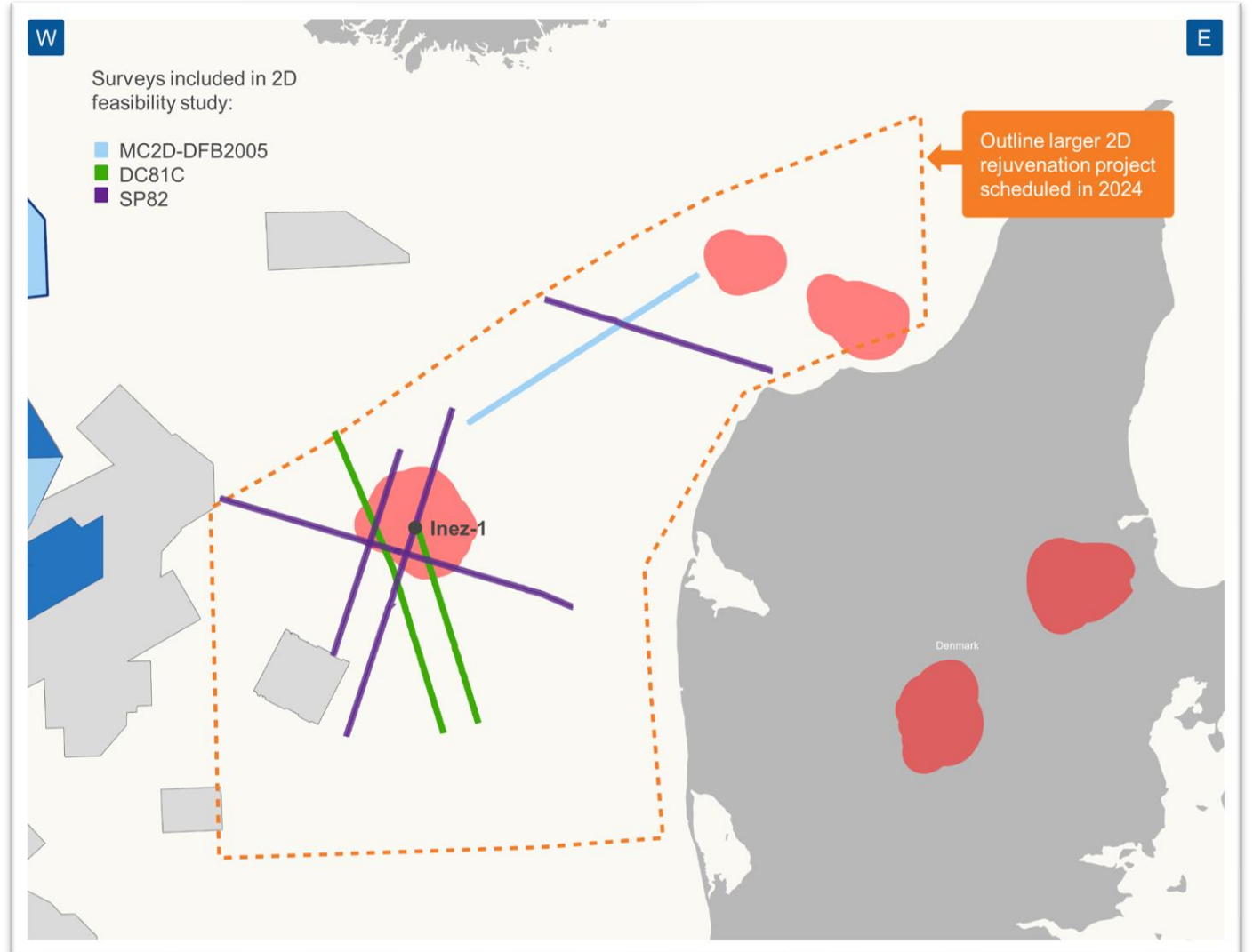
Objectives & Feasibility Study

To evaluate the potential of using 2D seismic data for regional screening for carbon storage opportunities offshore Denmark, PGS conducted a feasibility study with state-of-the-art 2D processing.

7 seismic lines were chosen over identified CCS structures

Pre-processing, tomography and final Kirchhoff PSDM processing was applied.

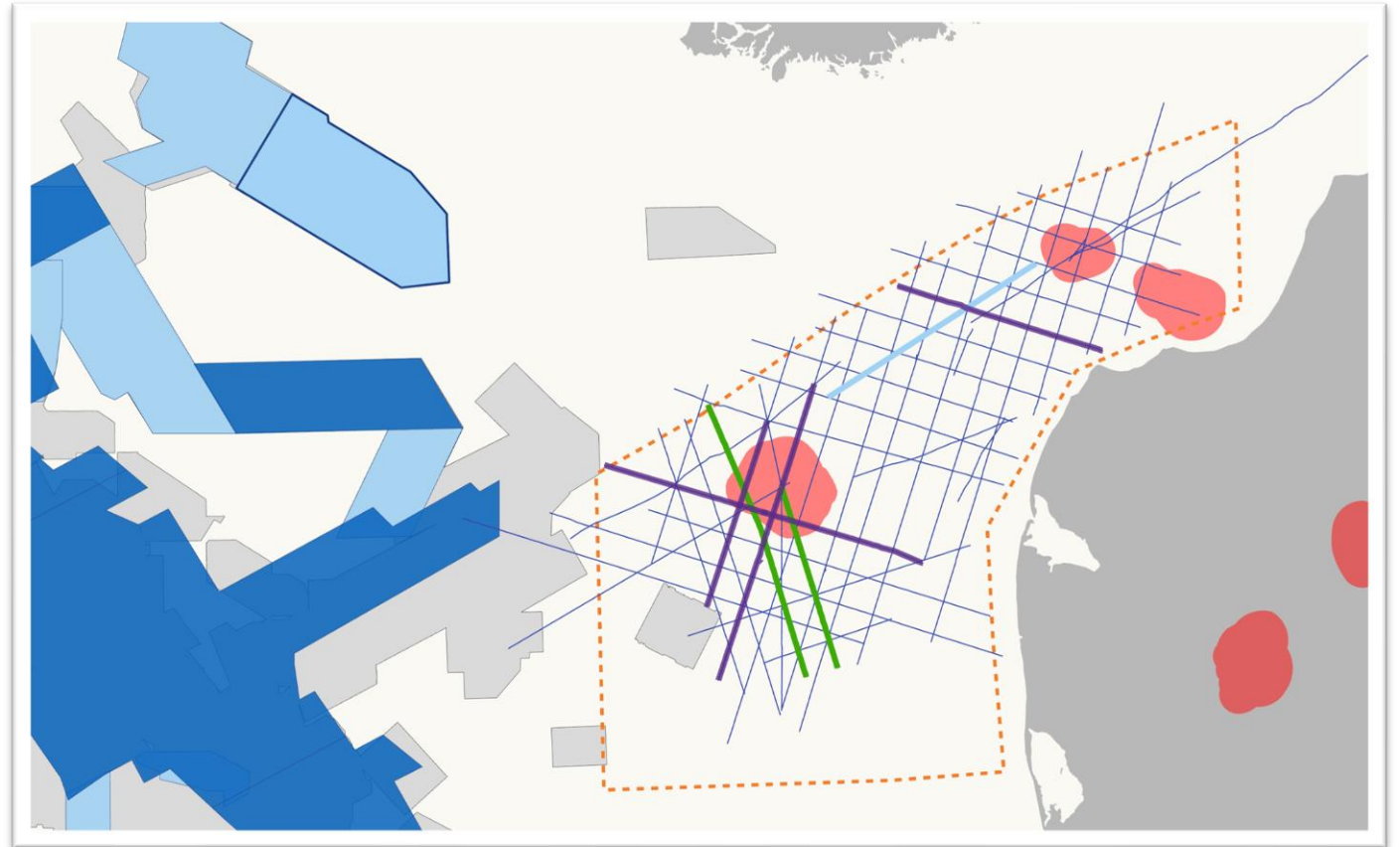
*feasibility study done with the support of Geus



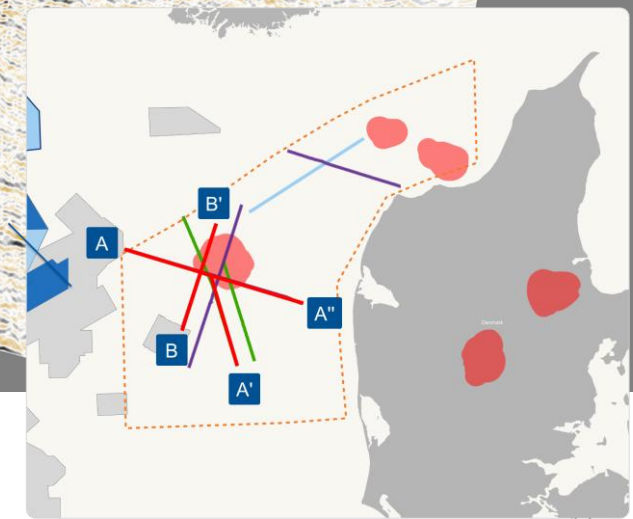
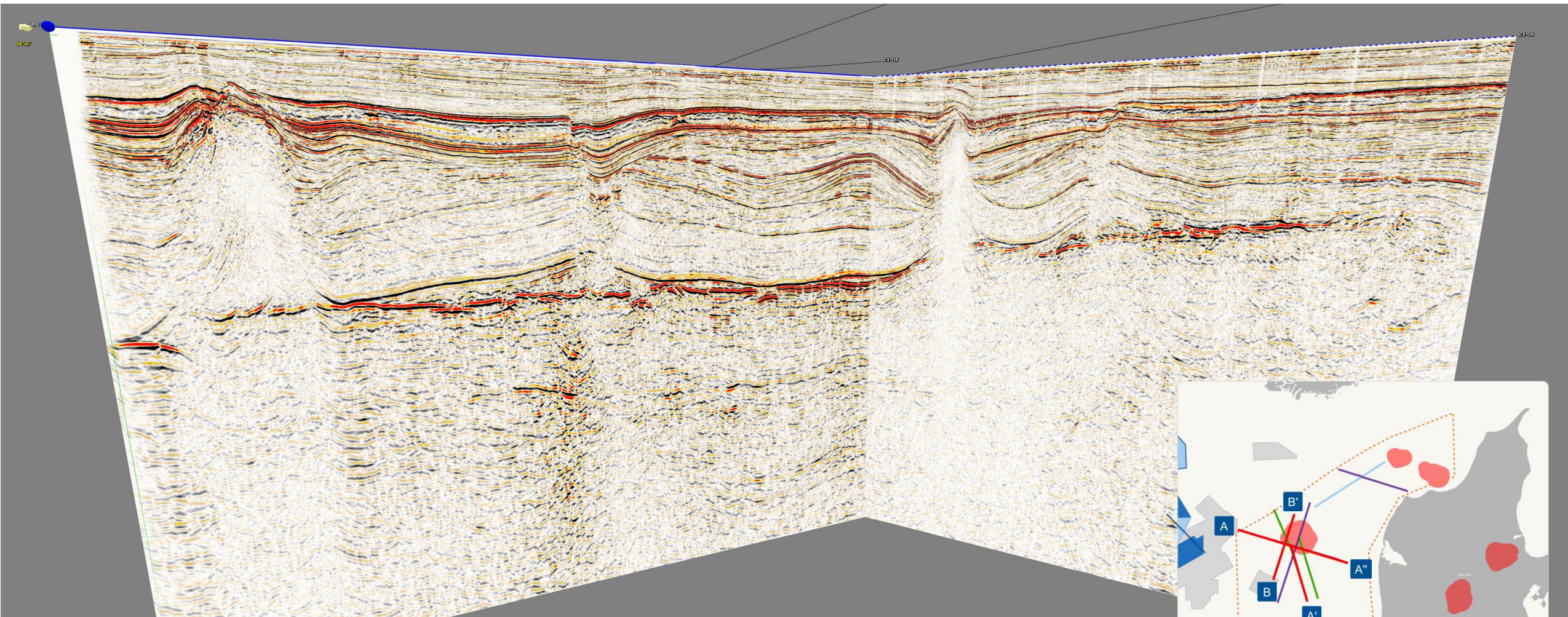
Next Steps – Commend new 2D Vision Project

The feasibility study demonstrated the uplift of the reprocessing and the next phase will be to use the same processing workflow on a further 40-50 000 line km of data in the Danish North Sea for CCS screening purposes.

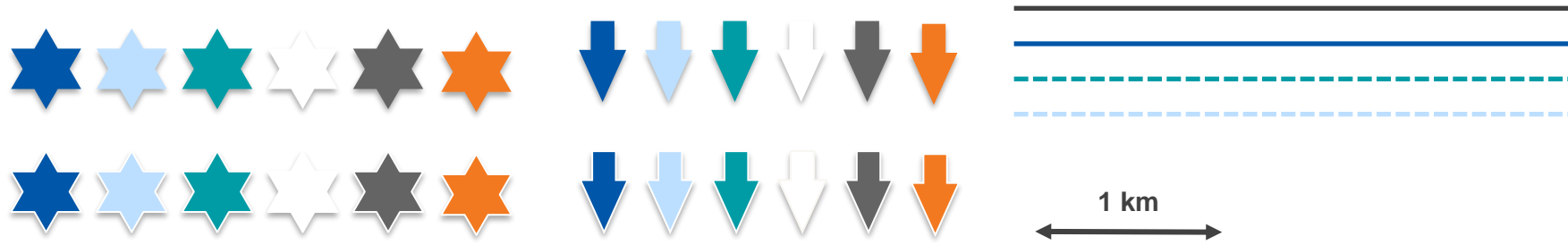
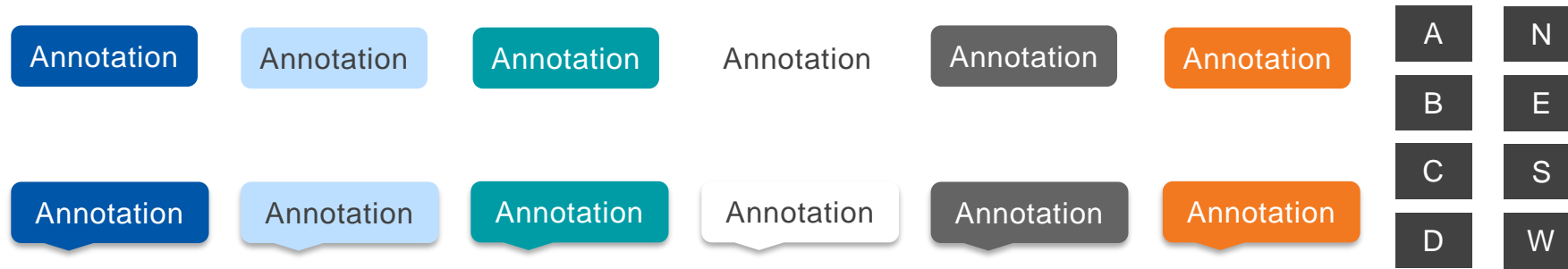
- 55 2D lines will be reprocessed for Denmark 2D Vision
- Project schedule Q2 2024
- Turn around time: 10.5 months



SP82-219 and DC81-38 intersection with Inez structure



Annotations – Choose the Right Color to Contrast the Image



Selection of examples to pick from – apply the PGS style to any shape you create – it's also easy to copy and paste from this example slide

Acknowledgements

PGS would like to thank GEUS for facilitating access to the data & DTU for technical discussions

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A Clearer Image