Seisflix: Cloud-based seismic express interpretation on demand

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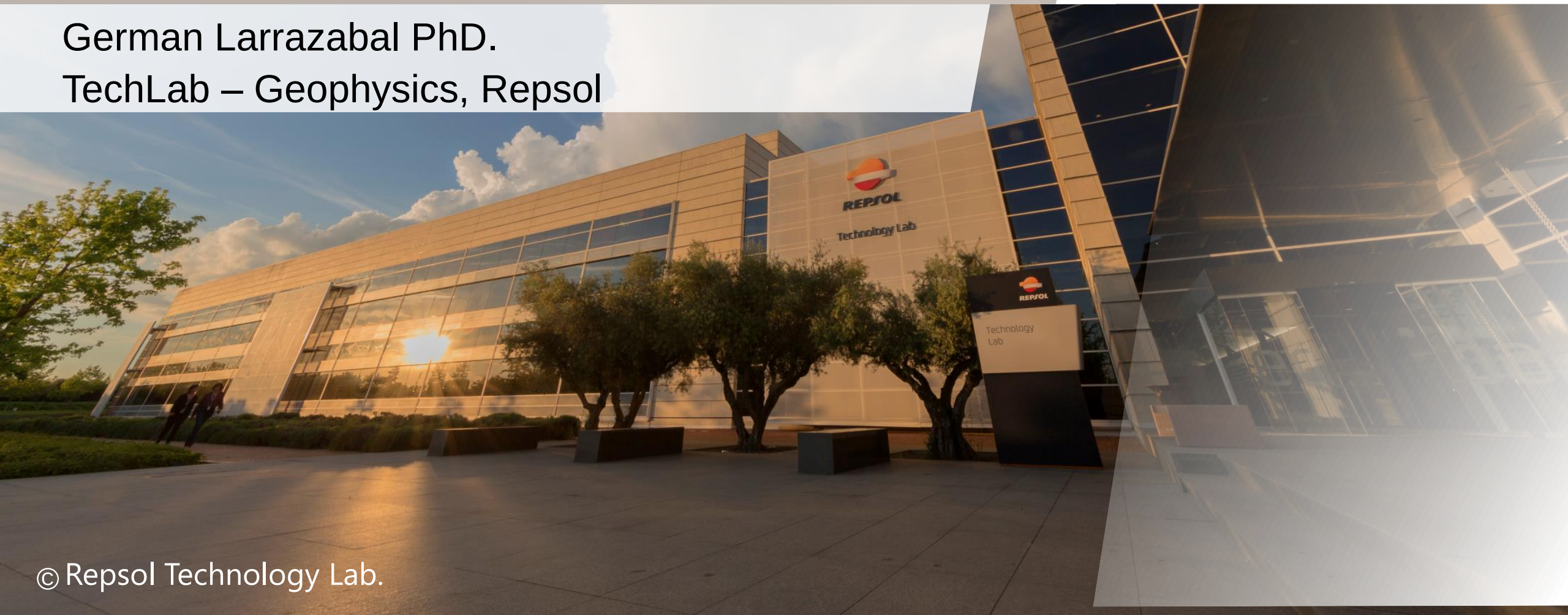
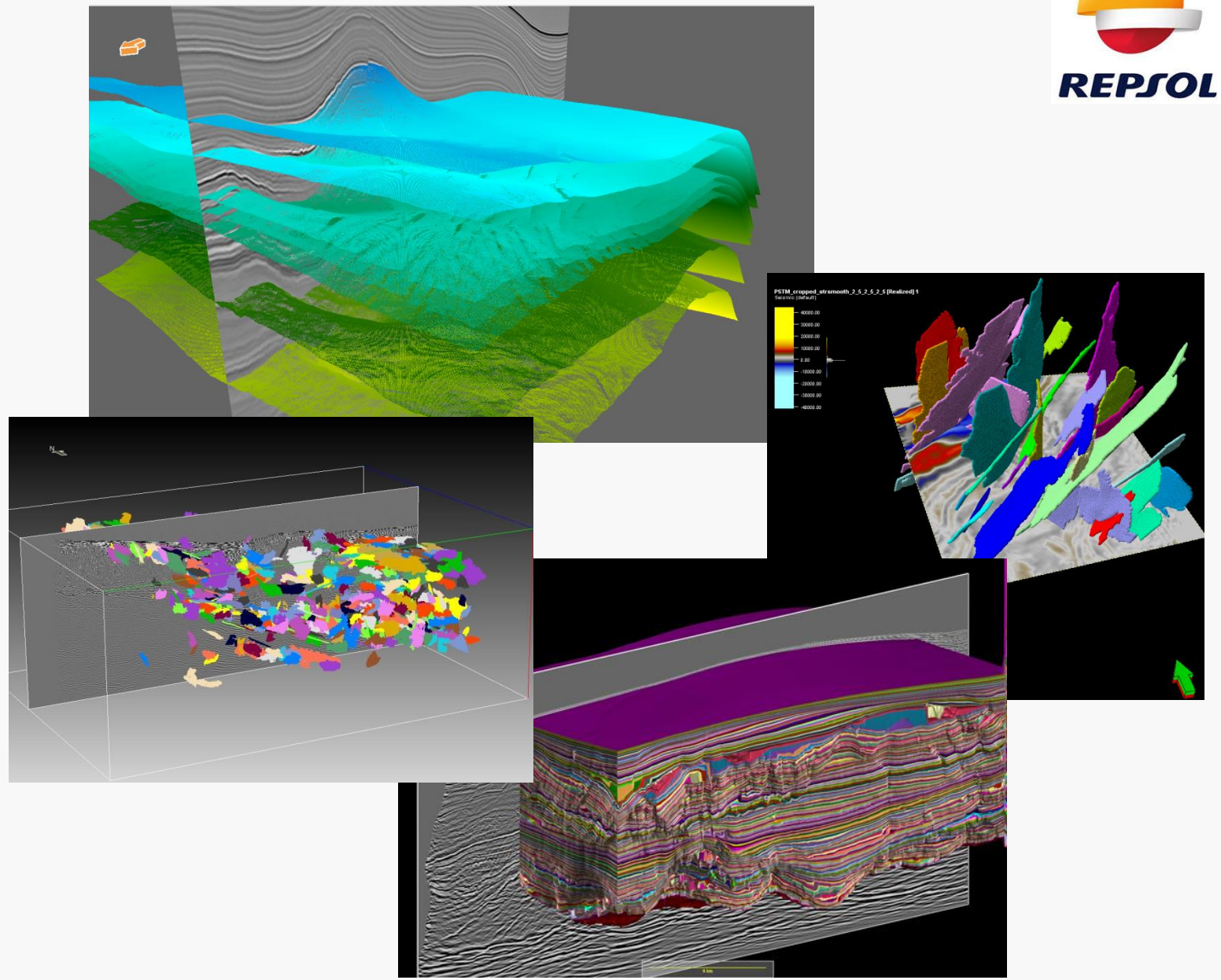


Agenda

- Motivations
- Seismic interpretation task
- Cloud platform
- Applications and results



Motivation

"Reduce the time cycle in all exploration projects since a block is acquired until the first well is drilled"

-> accelerate the seismic interpretation task <-

Motivation

Scenario:

- Repsol's has ~ 300 Interpreters worldwide
- Different countries with data regulated by law
- Interpretation task takes months

Goal:

- Automate simple decisions and guide harder ones
- Reduce the human bias
- Allow interpreters to be focused on geology and geophysics

Motivation

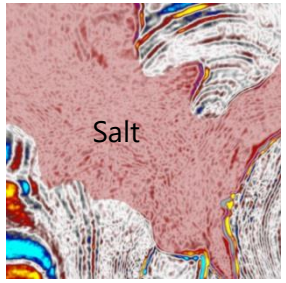
How we can do that as part of the Digital Transformation?

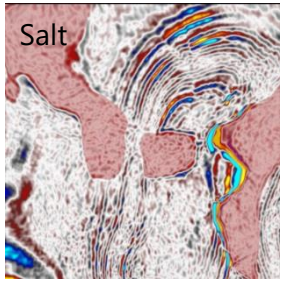
- Democratization of the technology -> HPC Cloud & Empowering

- Volumes, Variety and data transfer speed -> Big Data (Oil & Gas)
- New workflows and hybrid-algorithms -> Data Science (Machine Learning)

Our Contribution

Automatic Segmentation of Seismic Data





Automatic Geobody Detection Using Multi-class Sparse Representation. In *76th EAGE Conference and Exhibition 2014*, Amsterdam, Netherlands.

Salt body detection from seismic data via sparse representation. *Geophysical Prospecting***,** Volume 64, No 2, pp 335-347, 2016. (**Cited by 25**)

A Novel Salt Body Detection Workflow, In *77th EAGE Conference and Exhibition 2015*, Madrid, Spain.

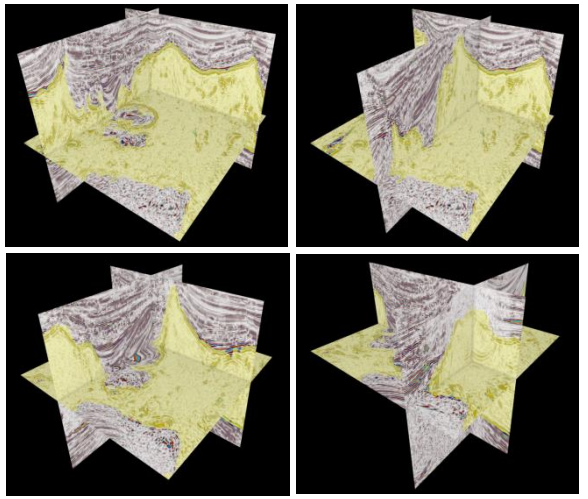
Detecting salt bodies with minimum manual intervention: An effort towards automated workflow. *Congreso Mexicano del Petroleo 2015*, Guadalajara, Mexico.

Detecting salt body using texture classification, *14th International Congress of the Brazilian Geophysical Society,* Rio de Janeiro, Brazil, August 3-6, 2015.

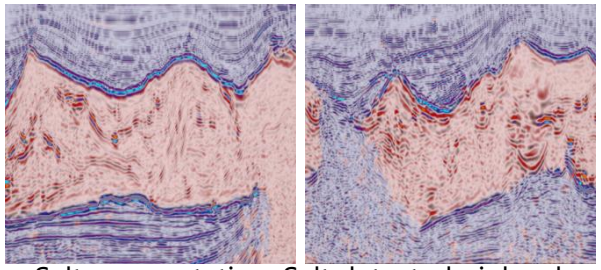
Supervised learning to detect salt body, in *SEG 2015 International Exposition and 85th Annual Meeting*, New Orleans, Louisiana, USA.

Machine Learning: a Deep Learning approach for seismic structural evaluation, in SEG 2019 International Exposition 89th Annual Meeting, San Antonio TX.

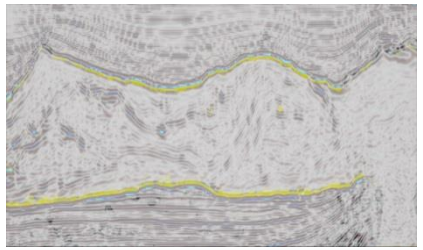
Automated Salt top interpretation, Rice Data Science Conference, October 15, 2019, Houston, TX.



Salt segmentation of GOM.

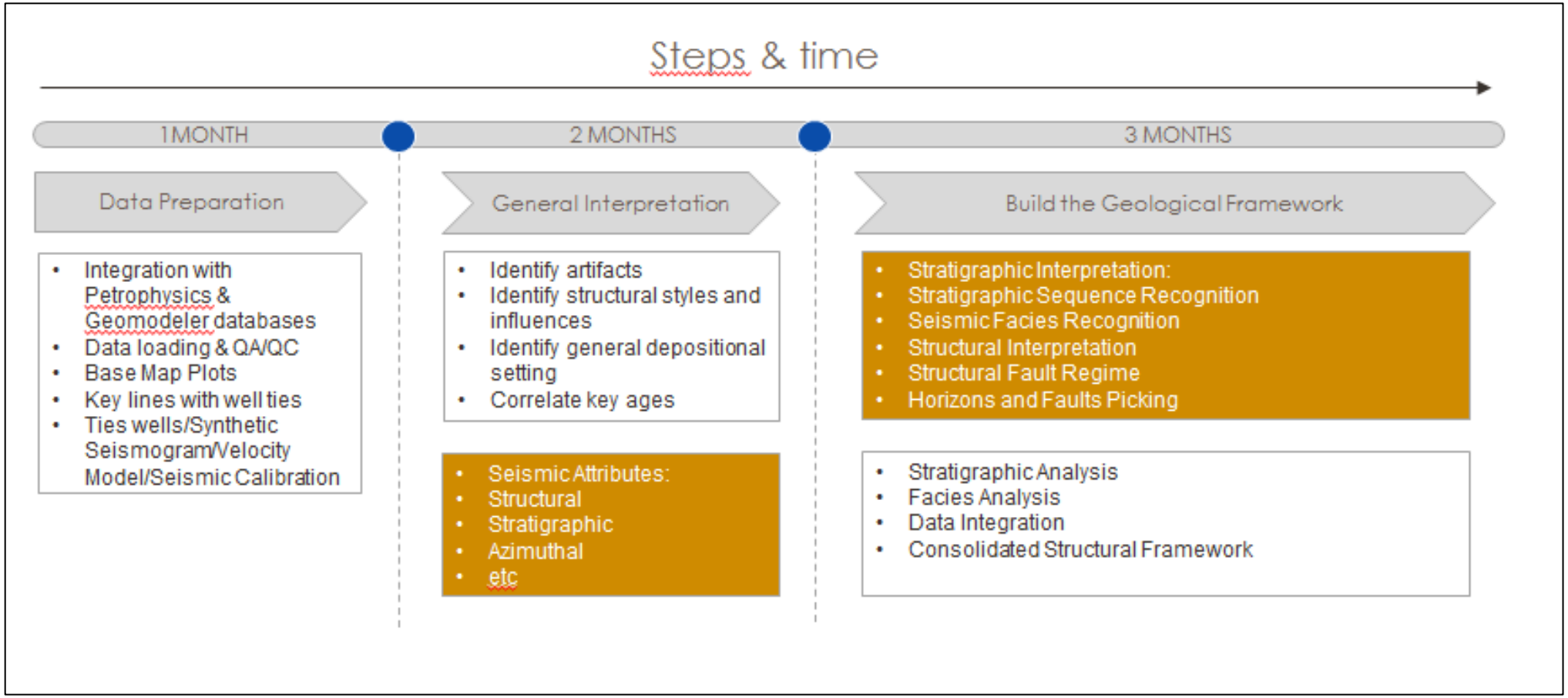


Salt segmentation. Salt detected pink color



Salt segmentation. Error 5 – 12 samples.

Seismic Interpretation task



How we can enhance and accelerate the interpretation task, using maximum detail from a seismic volume ?

Repsol's proprietary tool

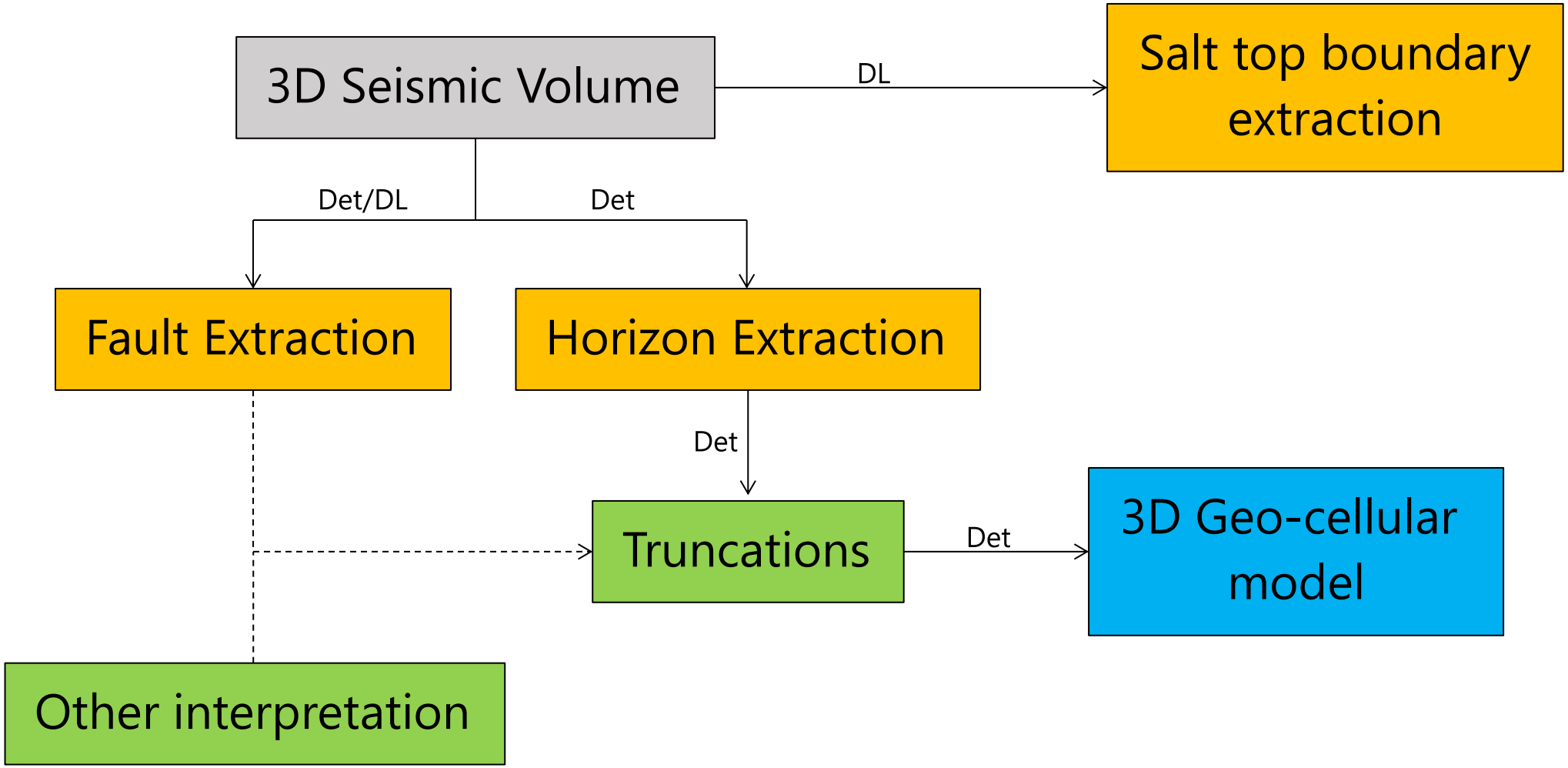
Cloud-based Accelerated Seismic Interpretation platform:

- Fault planes -> thousands in ~2 hours !!
- Horizon surfaces -> thousands in ~1.5 hours
- Truncation surfaces -> seconds !!
- Salt top boundaries -> seconds !!!!

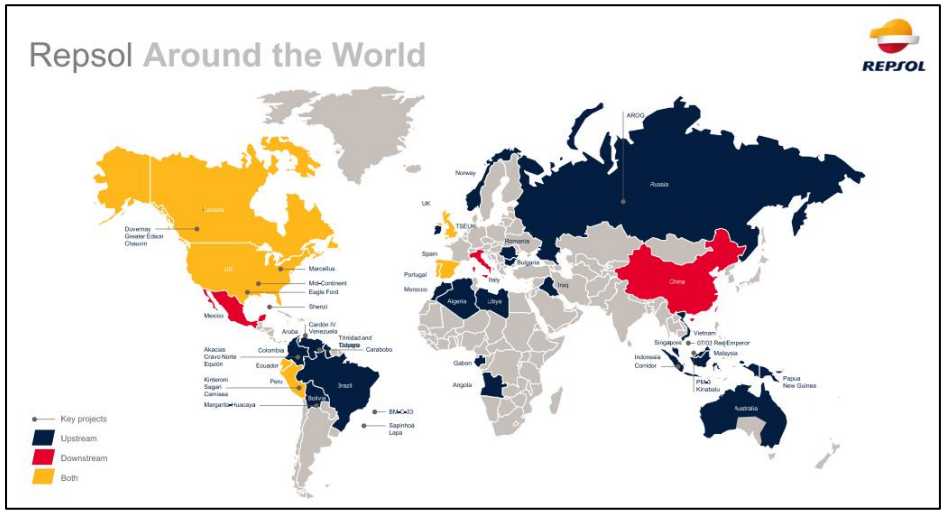
Seismic Interpretation on Demand !!!

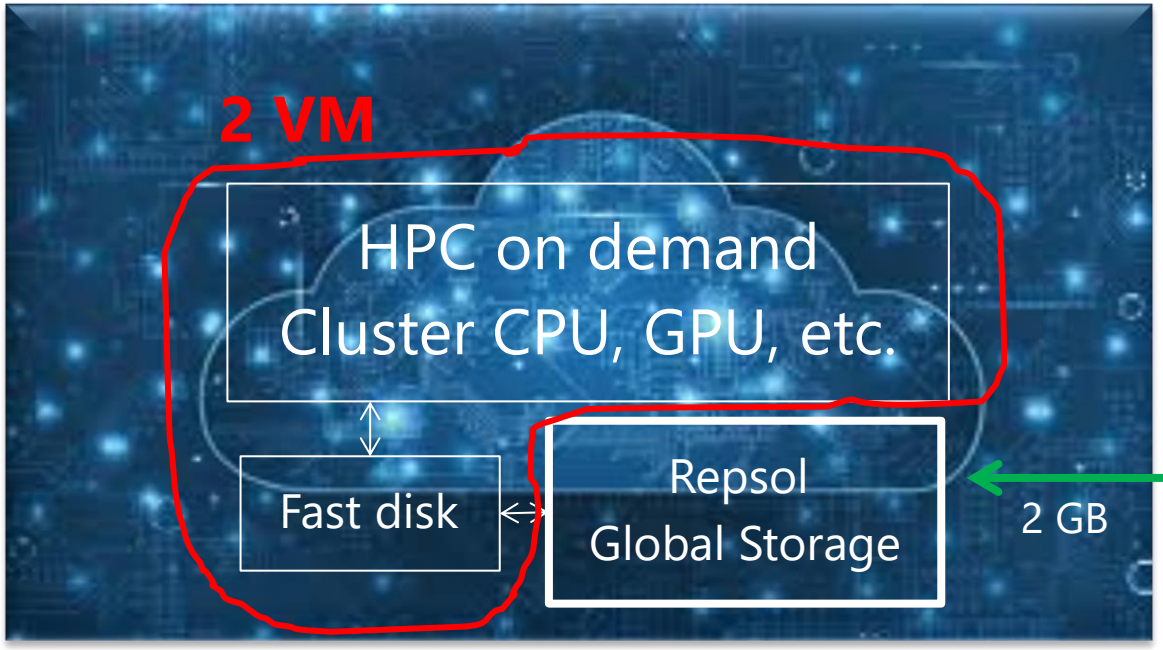
SeisFLIX

Repsol's proprietary tool



HPC Azure Cloud by Region





3D Compression
32 bits

Interpreter 1

Interpreter n

Exploration
Server

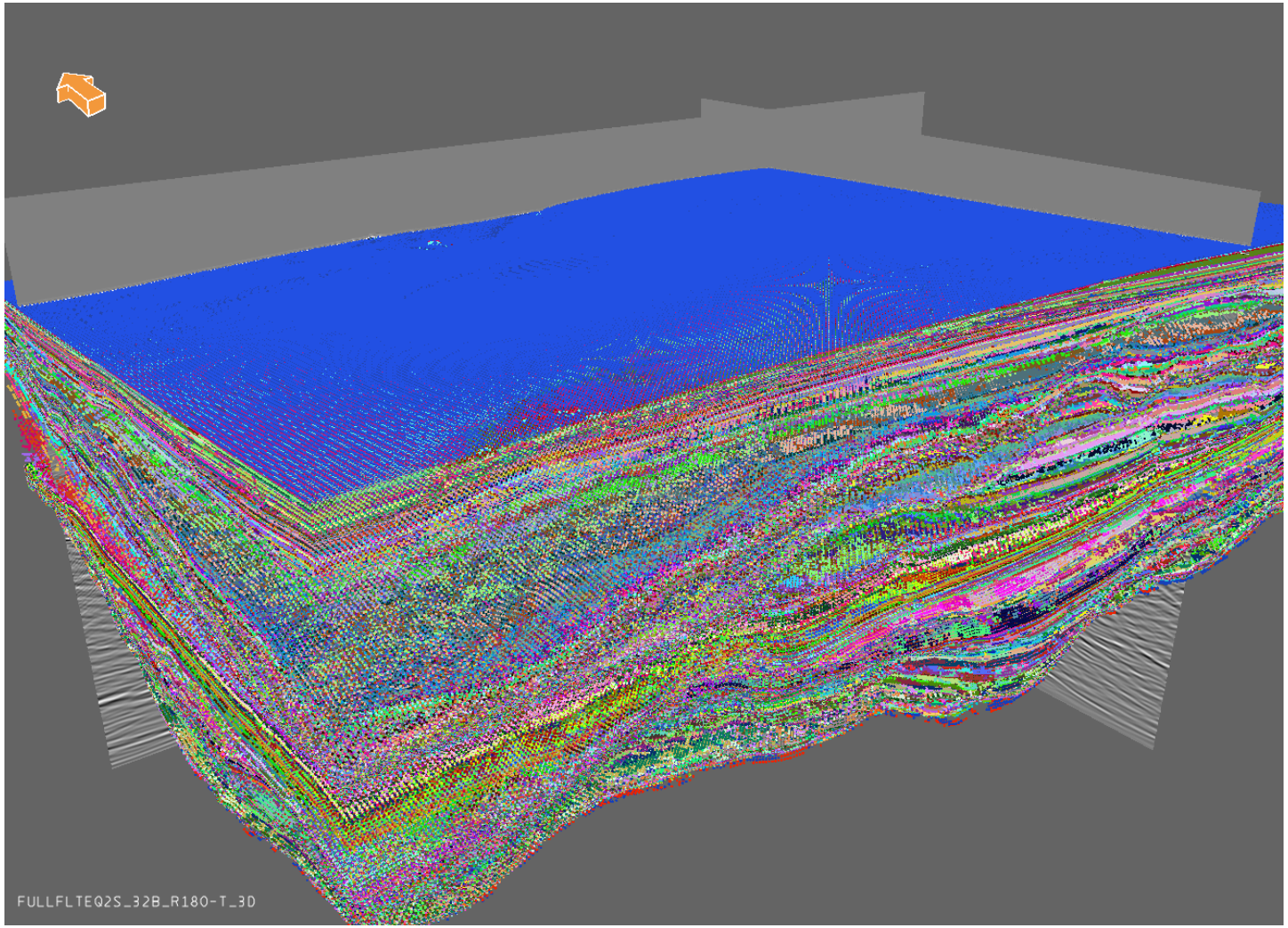
30 GB

Microsoft Azure

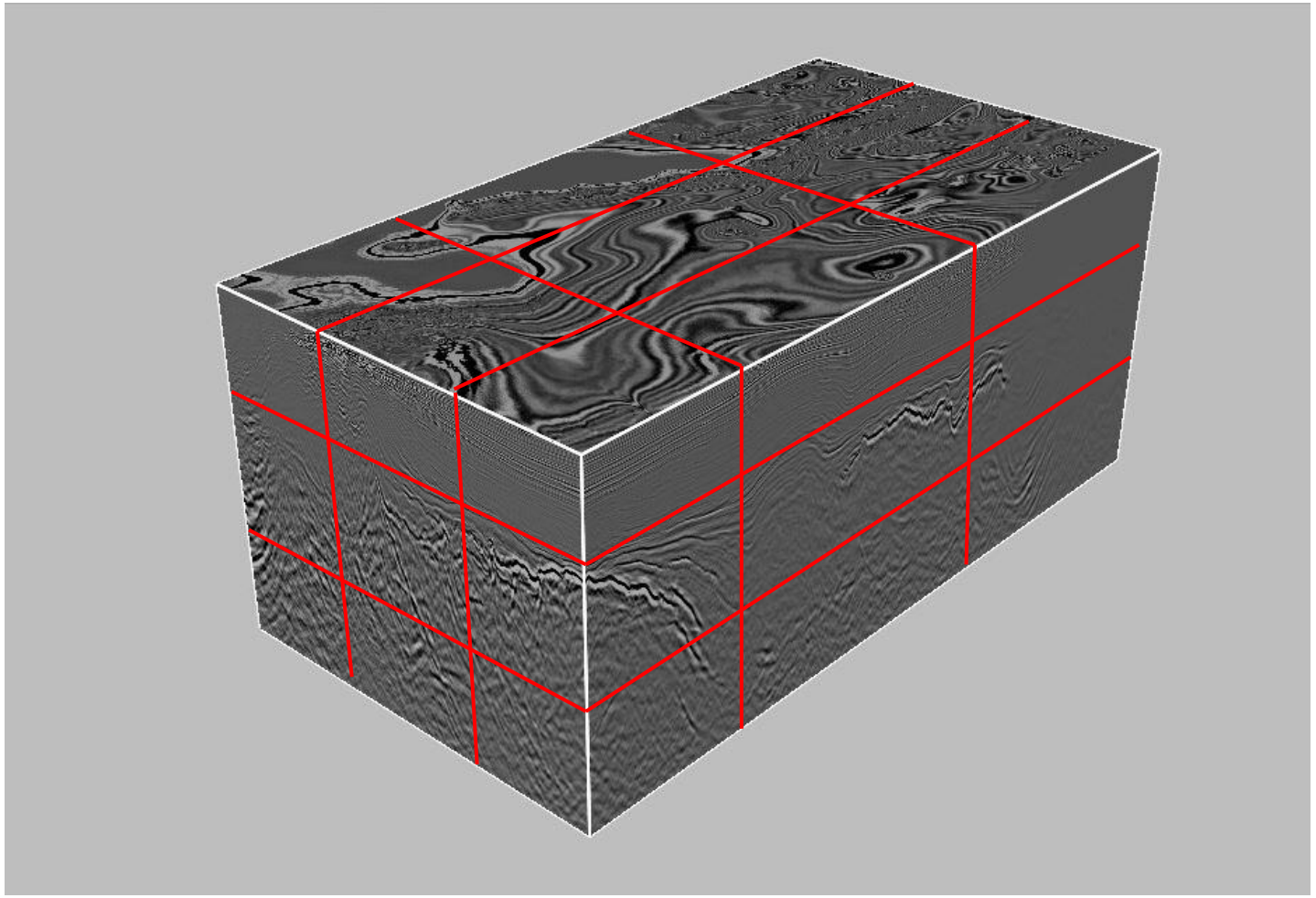
Cluster
NVIDIA V100

Horizons

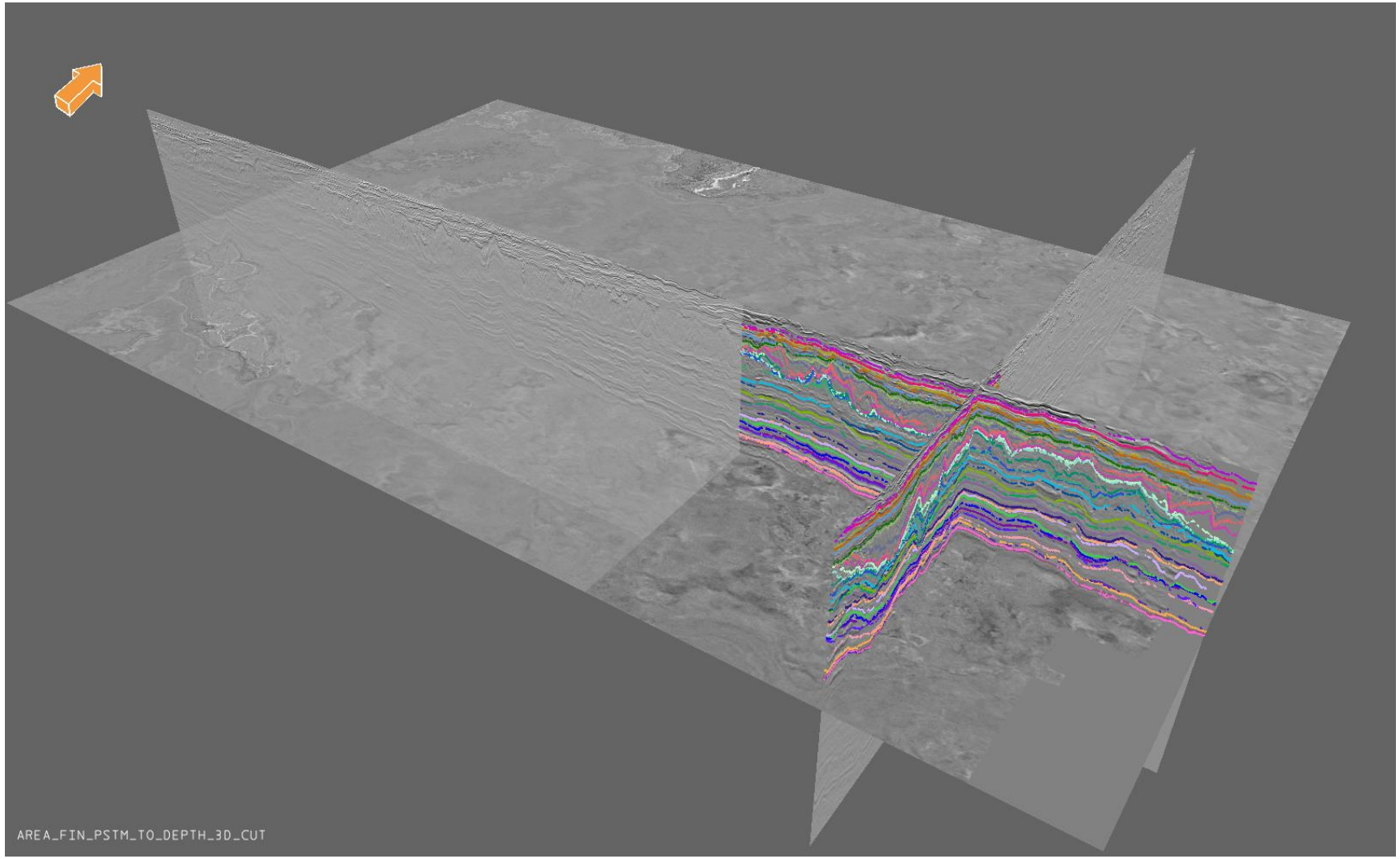
~114 GB, 1000 km2 – 576 horizons: 2.8 hours -> $ 9.00



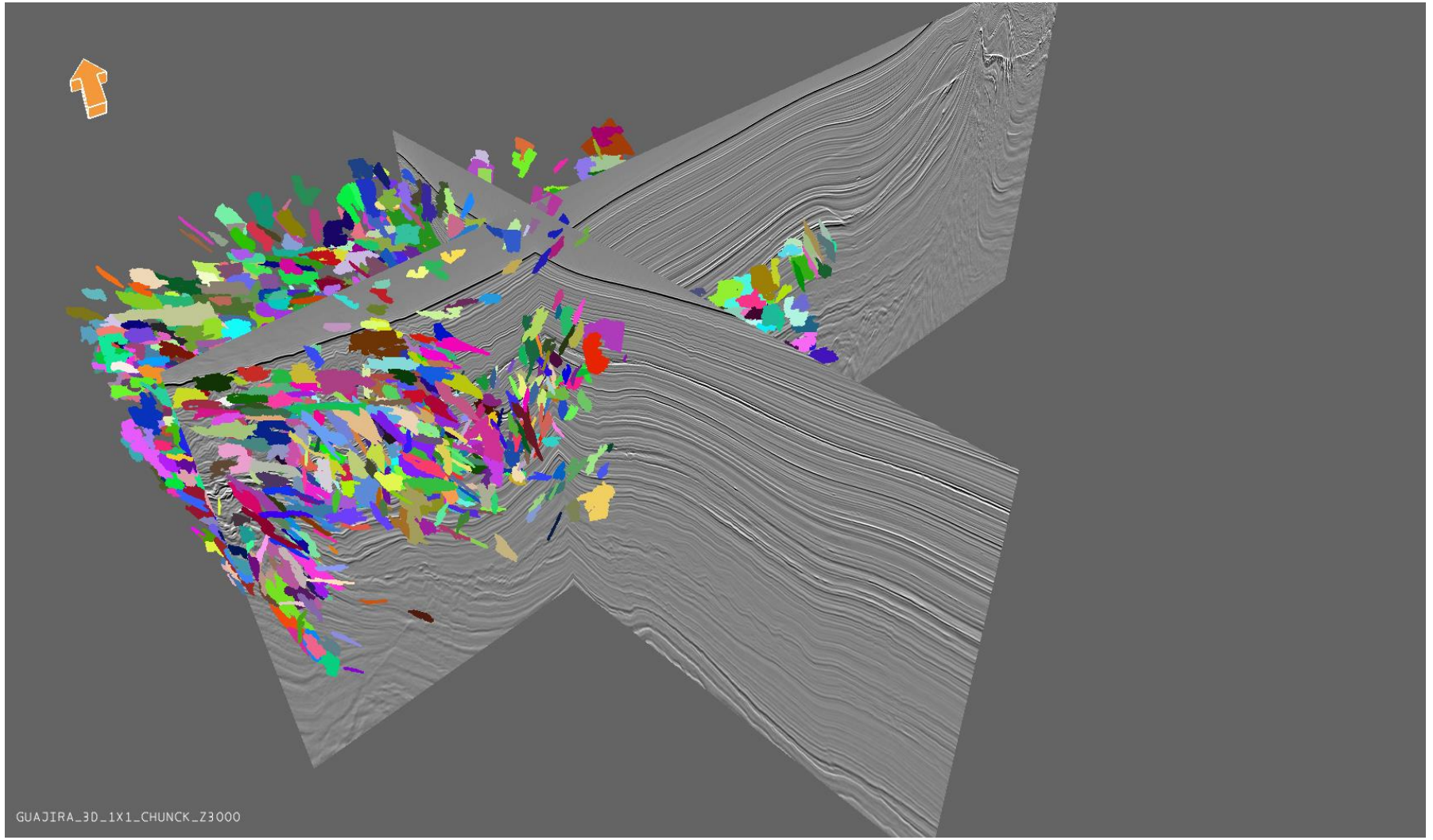
Domain Decomposition



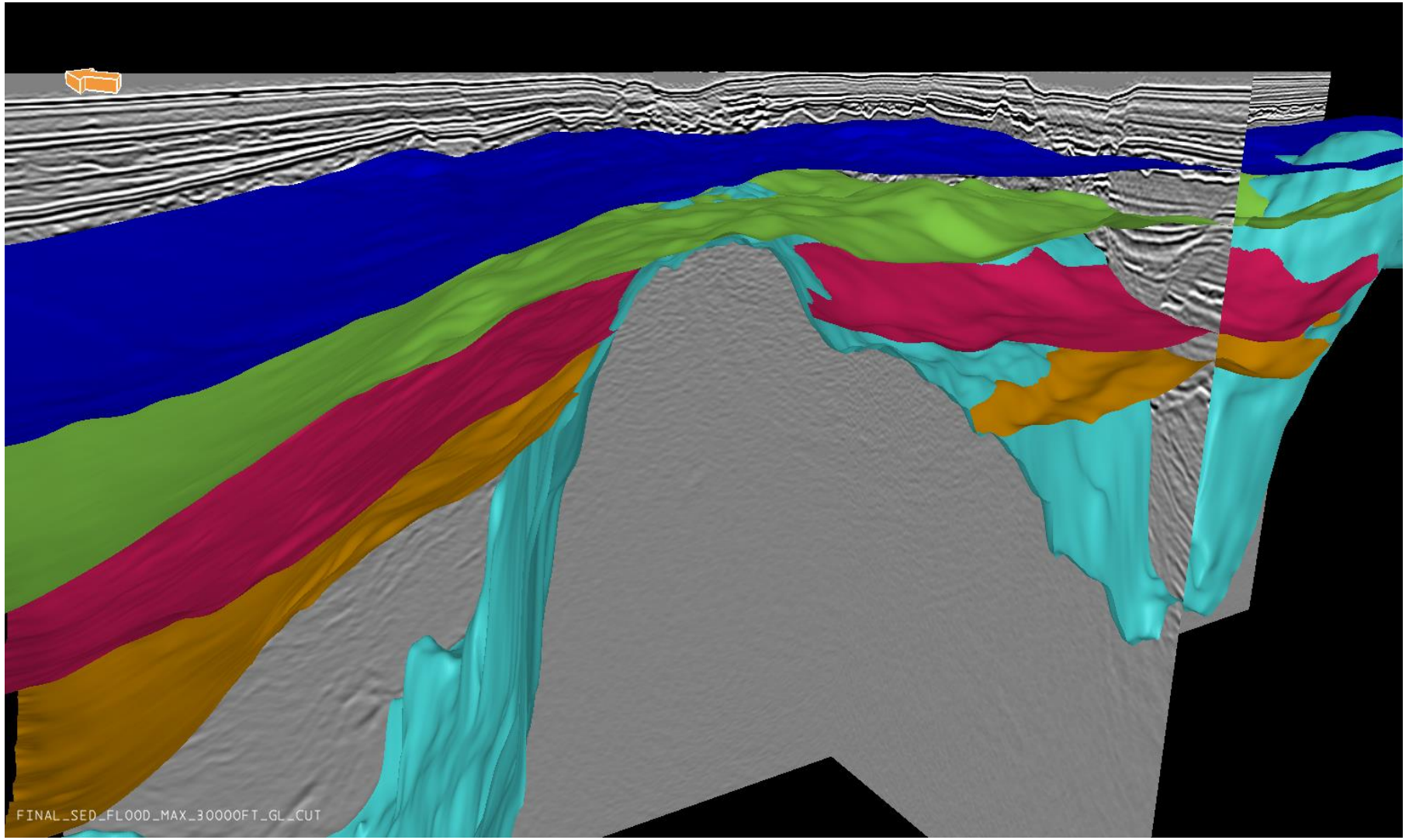
Horizons



Faults



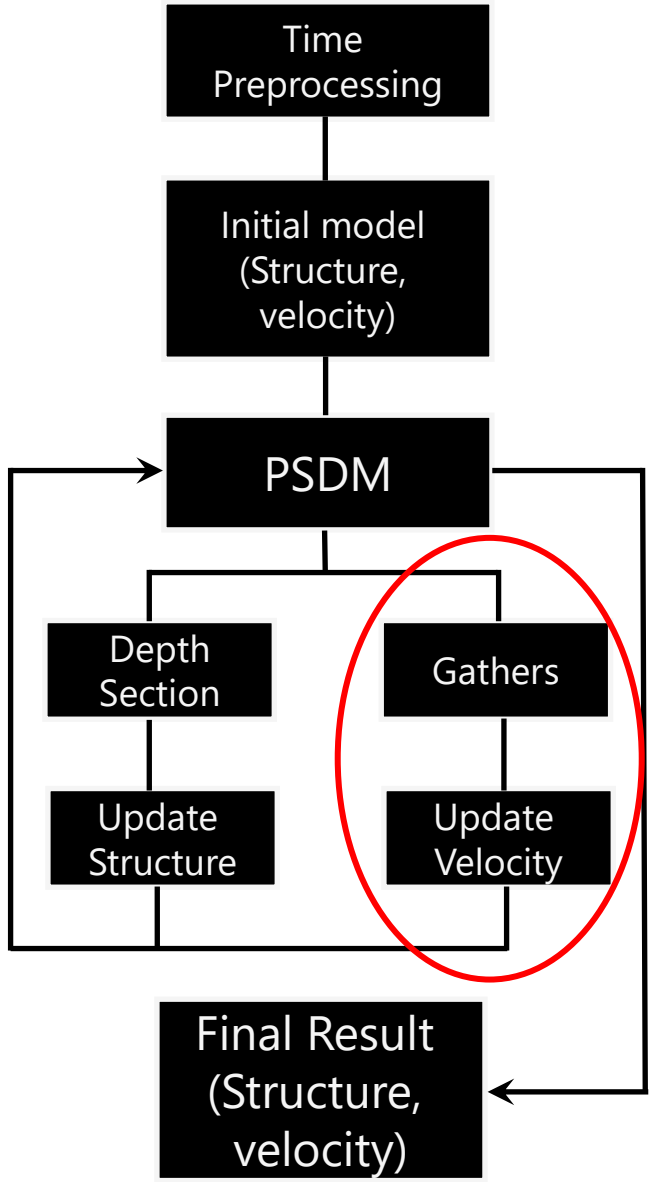
Truncations



Salt environment
Deep Learning approach

"The difference between the success and failure of a model is in the design"

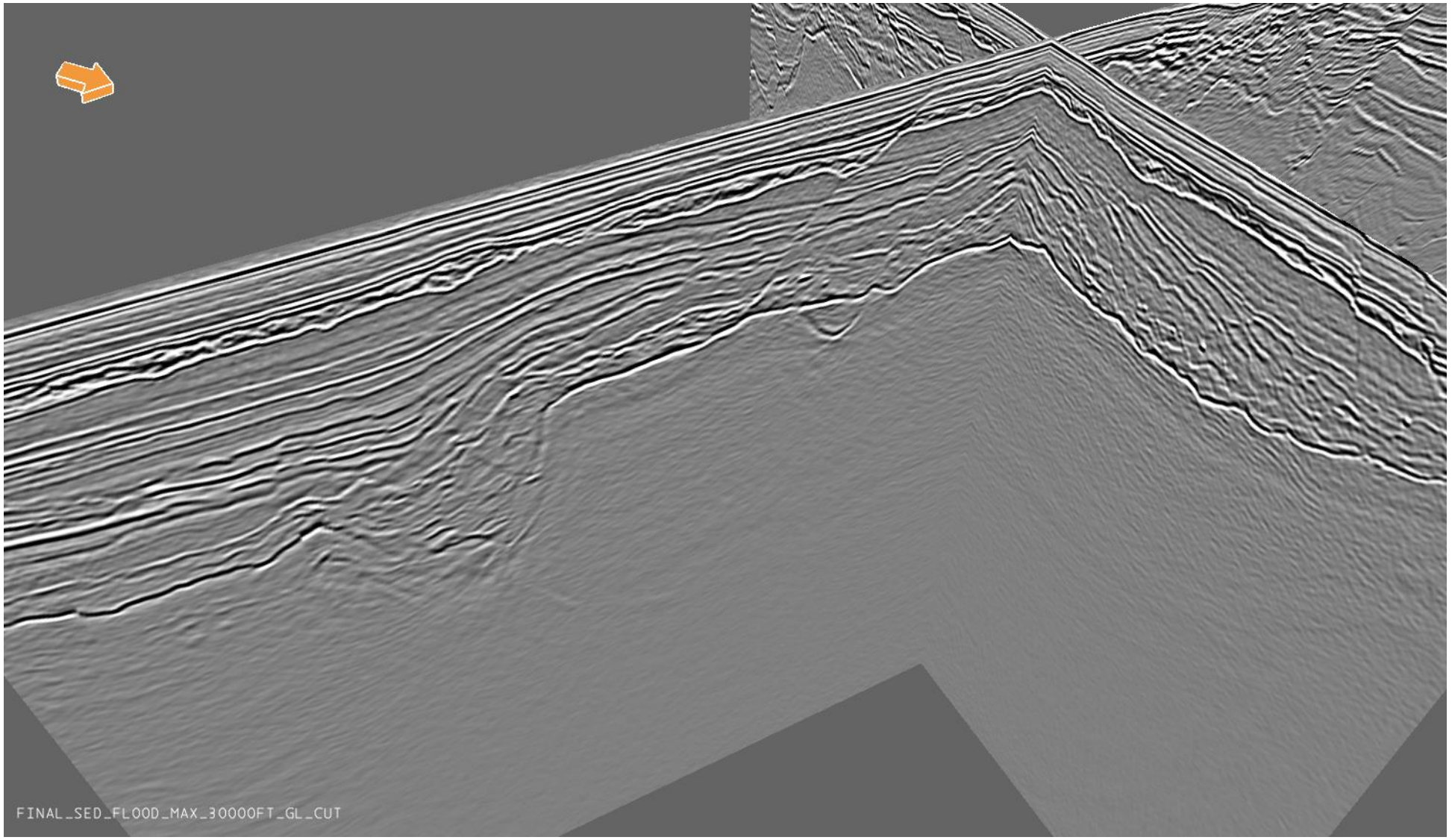
Depth Imaging



After 1-3 iterations
Sediment flood image is generated and interpreter needs to pick the salt top (~ 2 weeks)

Tomography process
V1 = Vo + deltaV

Salt Top Boundaries (Top 1) - Volume 2



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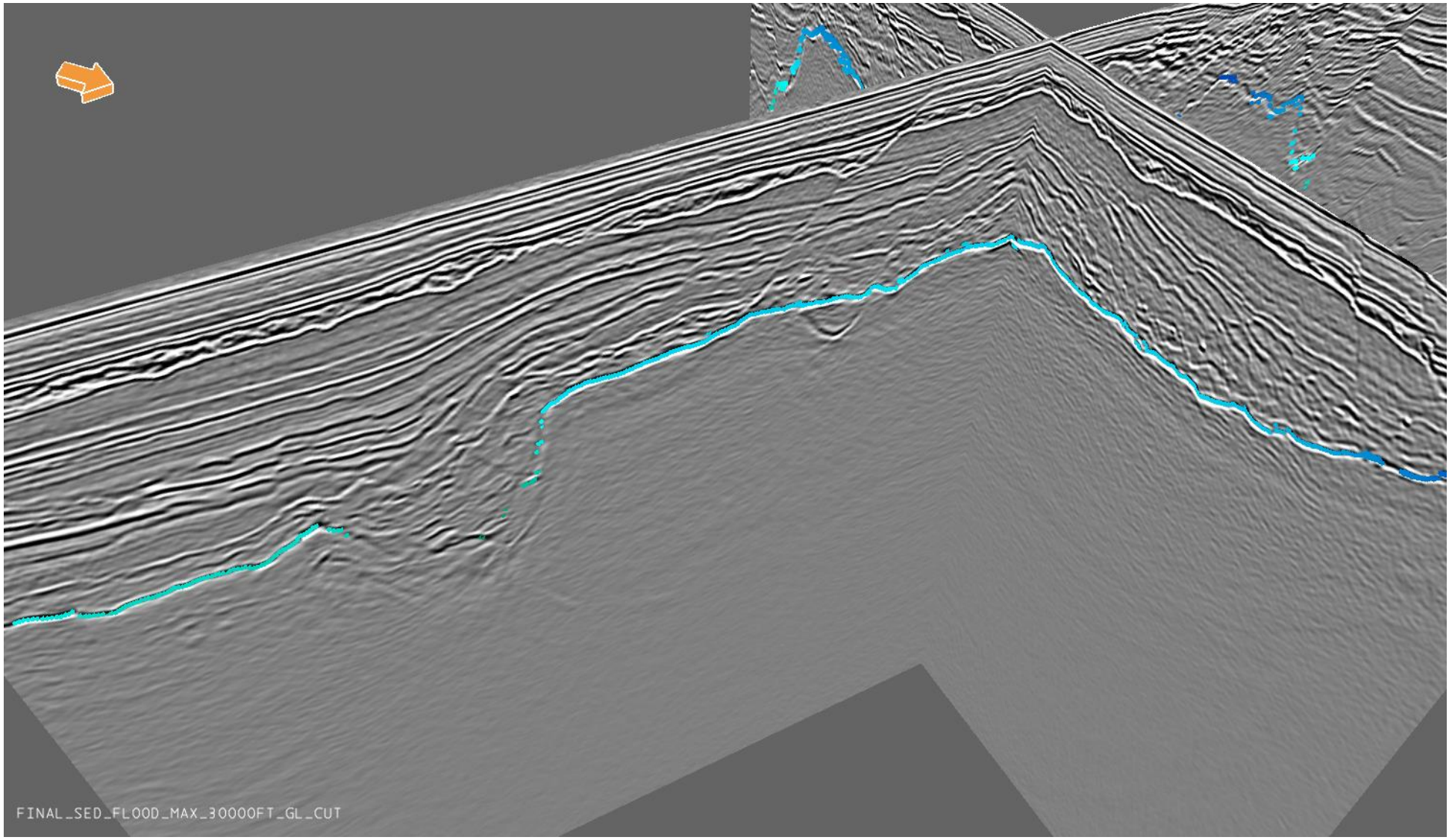

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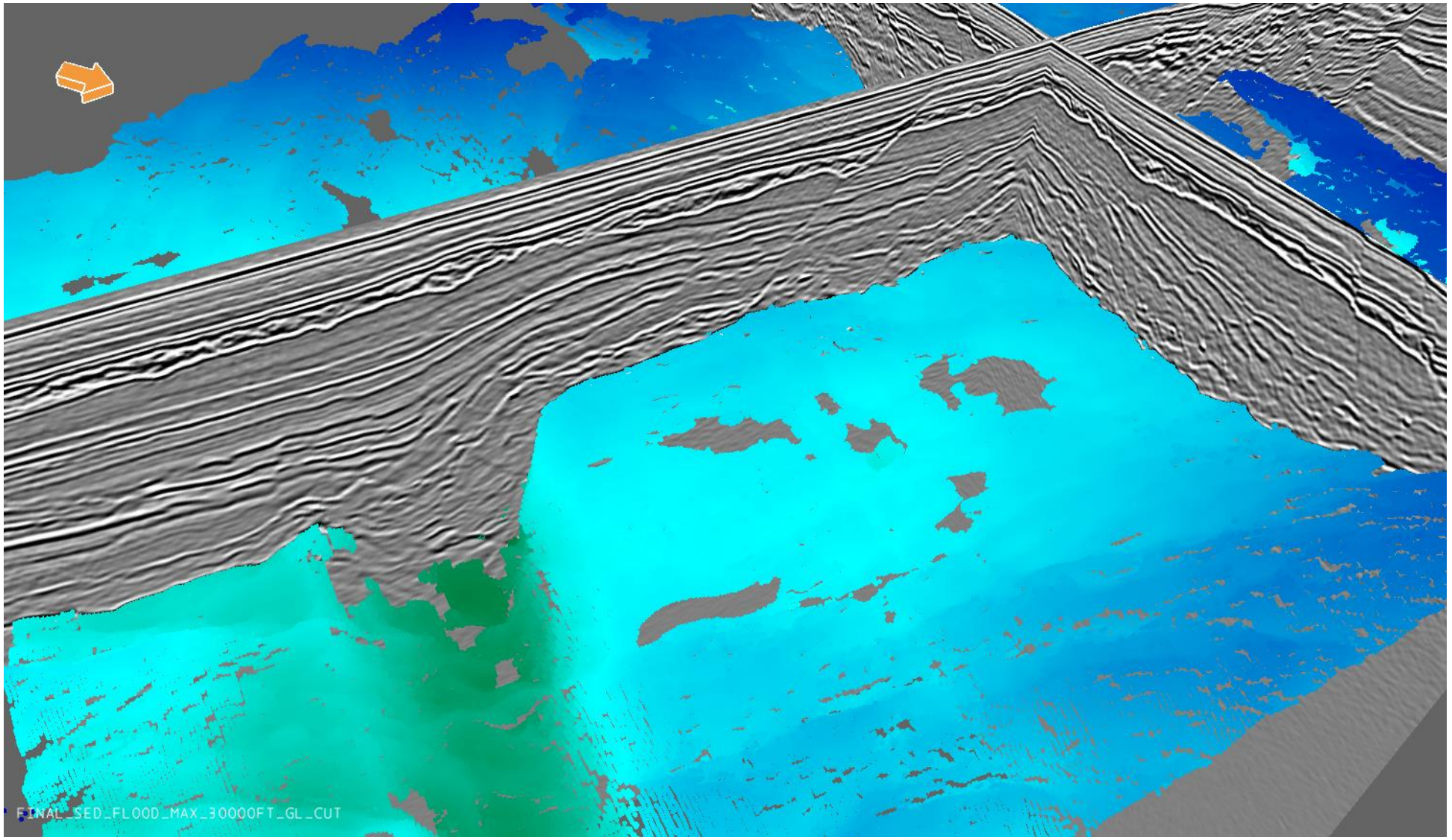


REPSOL