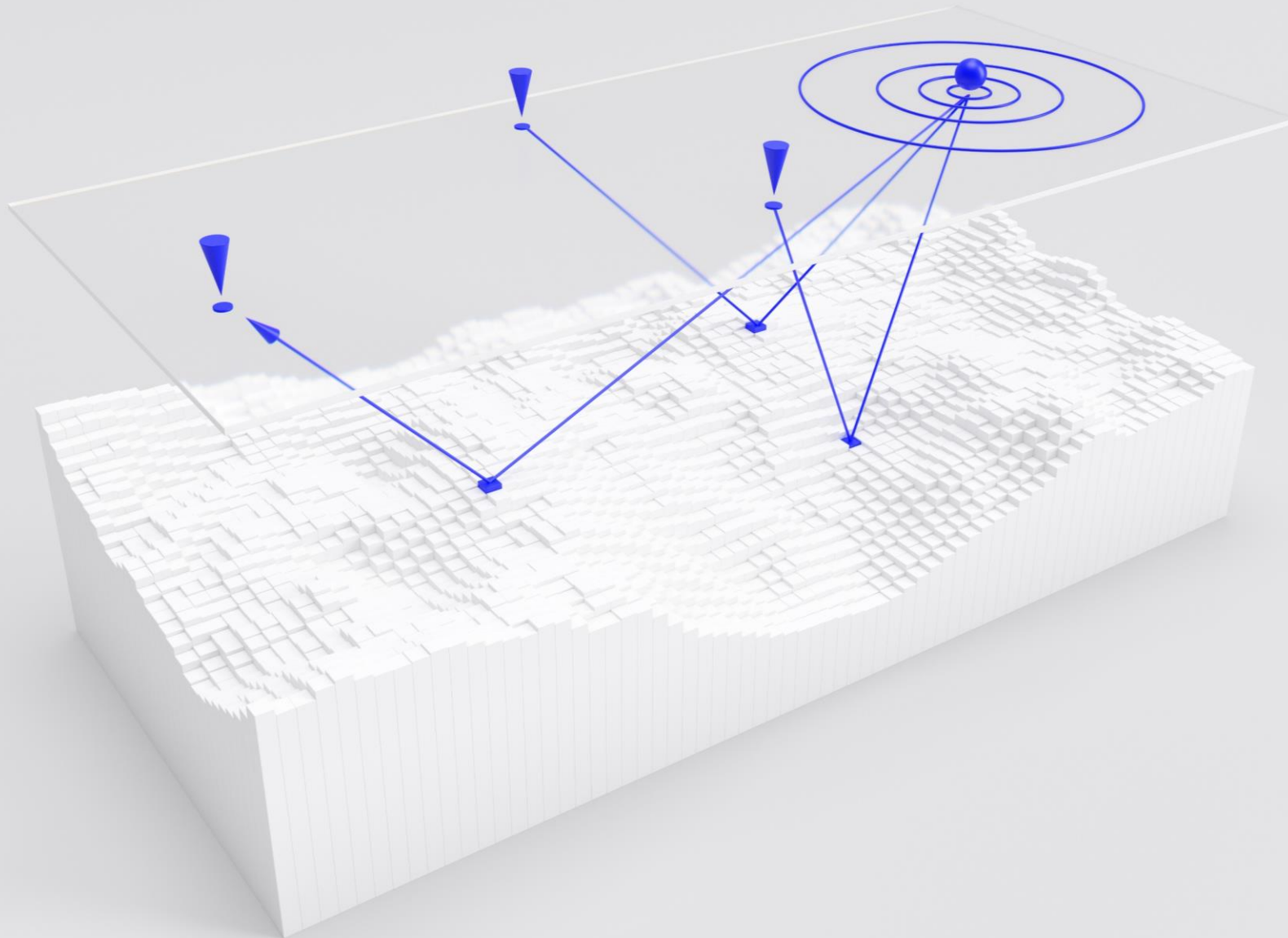




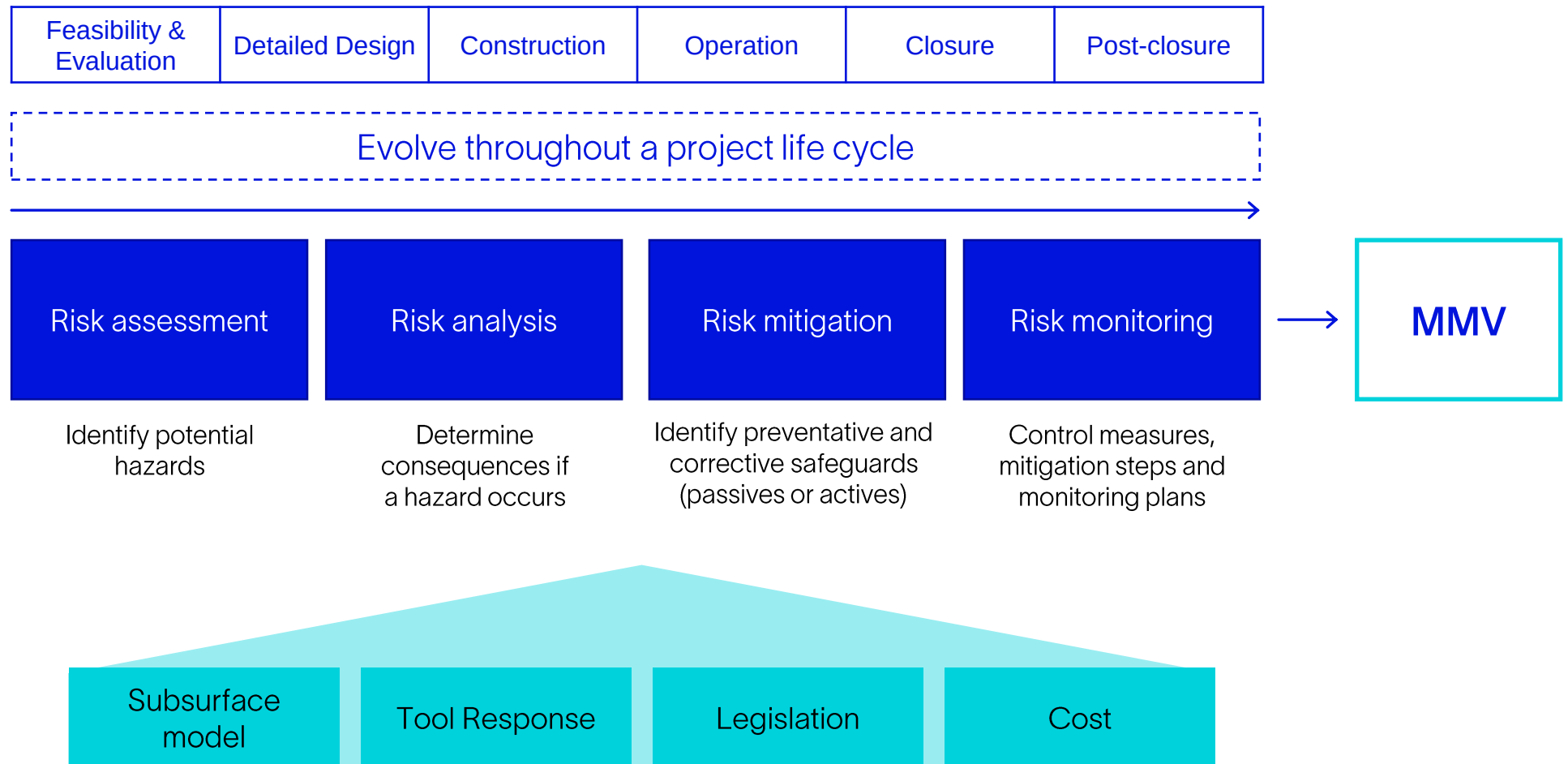
S-DAS Adaptive Monitoring System

29th October 2024

mbranston@slb.com

What is a Measurement, Monitoring and Verification (MMV) plan?

MMV
is a risk
management
plan



What if you could...



Increase monitoring frequency and reduce analysis turn around by addressing several monitoring objectives within a single system



Reduce OPEX costs associated with spatial monitoring and improve cash flow predictions through the project life



Have the choice to adapt your acquisition solution to the monitoring objective in front of you



Capture the value of seismic at a cost appropriate to CCS

Surface
DAS



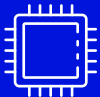
Adaptive
Monitoring



AI/ML



Edge
Computing



Evergreen
model



Traditional



S-DAS is a new seismic monitoring measurement

Proposition: S-DAS for adaptive monitoring of CO₂

- Enabled by horizontally deployed fibre optic sensors
- Change monitoring concept from full field imaging to scalable and targeted detection schemes
- Integration of passive and active source technology
- Scalable MMV Answer products
 - Fluid front
 - Pressure front
 - Seismicity detection
 - Ground motion

Tracked in an adaptive, scalable, and cost-effective manner

Digitally integrated to enable model evergreening & reporting



Industry review and recommendation of monitoring technologies with potential to reduce reliance on 4D seismic

27th February 2024

Submitted on behalf of the CTS Taskforce by the Monitoring subgroup (Elle Lashko, Ian Barron, Ben Ward, Benedetta Olivieri, Christine Yallup, Fiona Sutherland, Georgina Katzaros, Jon Tarasewicz, Kate Evans and Luis Acevedo)

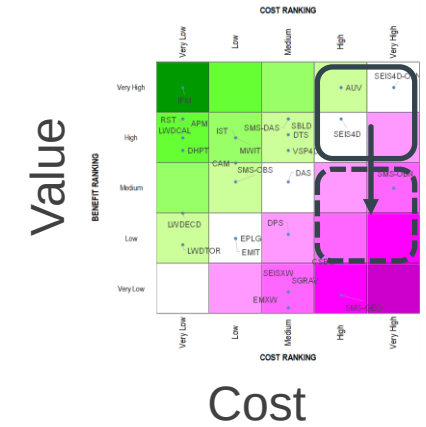


CO₂ Transportation and Storage Taskforce

The report concludes that S-DAS demonstrates potential for monitoring of CO₂ storage sites and that would benefit from site-specific field trials at UK's Track-1 & Track-2 stores.

Current time-lapse 3D – discrete monitor surveys

Current Status
3D Timelapse seismic every 3-5 years.
Cost driven.
Diminishes value.



Seismic

Baseline

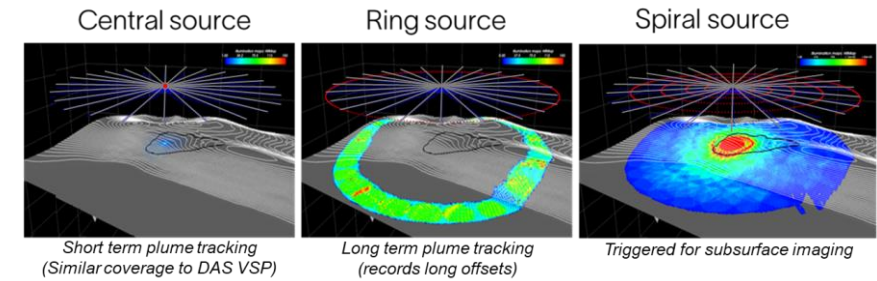
Monitor 1

Monitor 2

Monitor N

Reservoir model

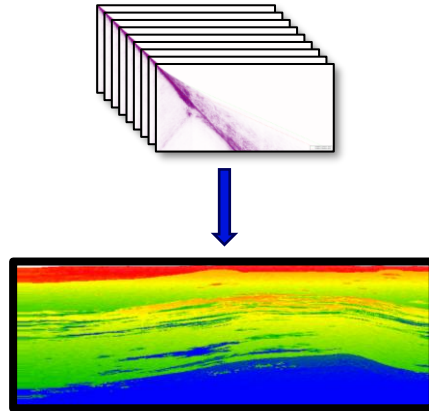
Adaptive model updates



Mike Branstons et al., A new Adaptive Monitoring Scheme..., EAGE Annual 2024

Seismic

Baseline



Reservoir model

MMV Plan



Adaptive Monitor

Passive Data

Limited active source

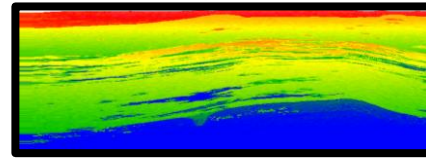
2D active source

Sparse 3D active source



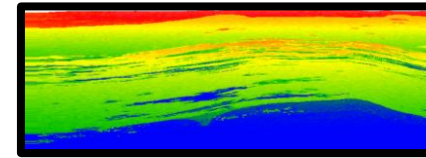
Scalable monitoring effort

Adaptive survey design



4D Objective (expected change)

Model update (evergreening)



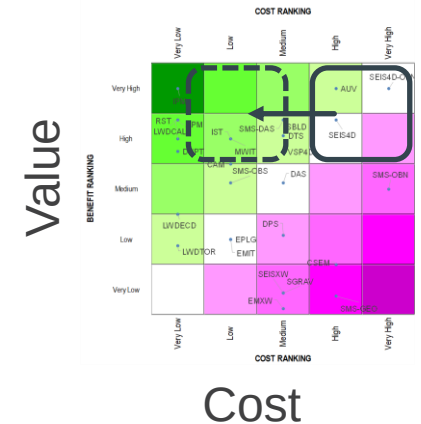
Update MMV plan

Expected change

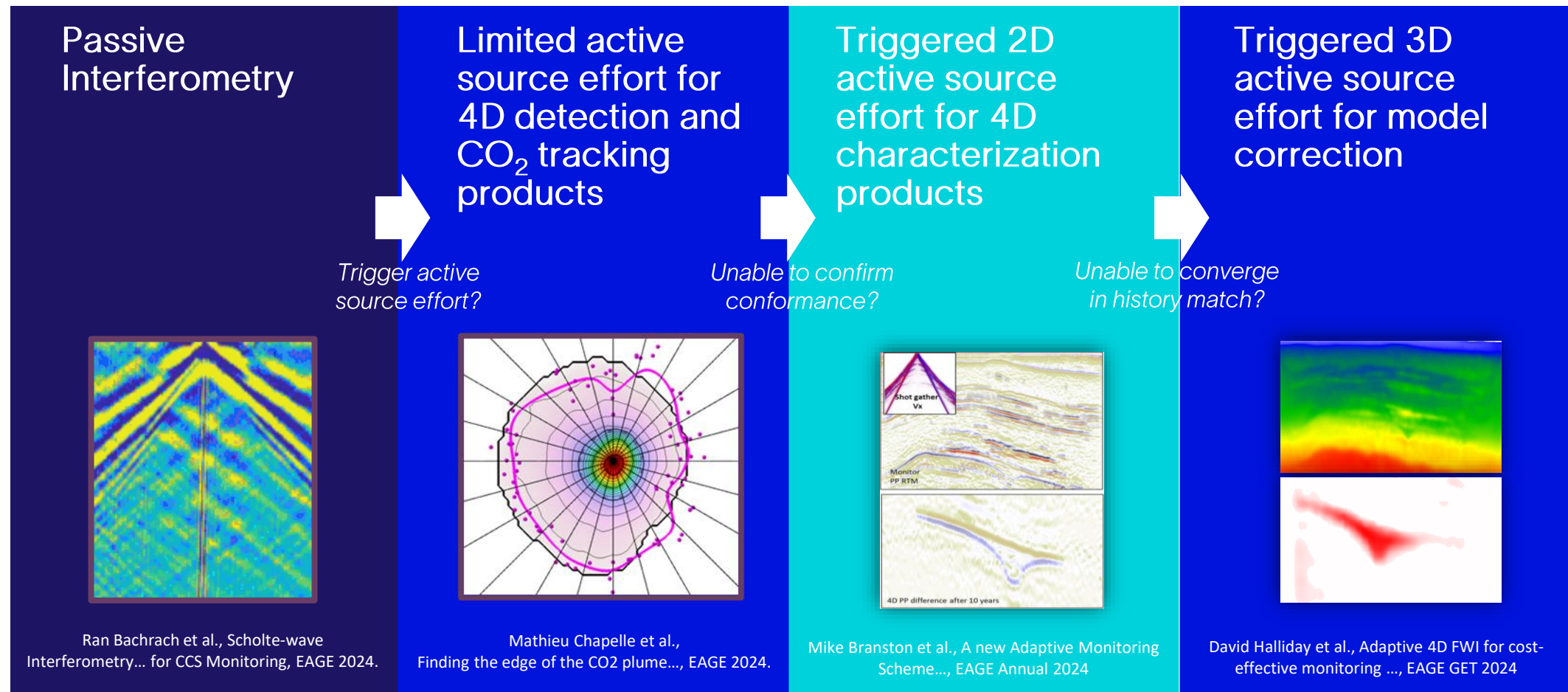
Subsurface risk 1

Subsurface risk N

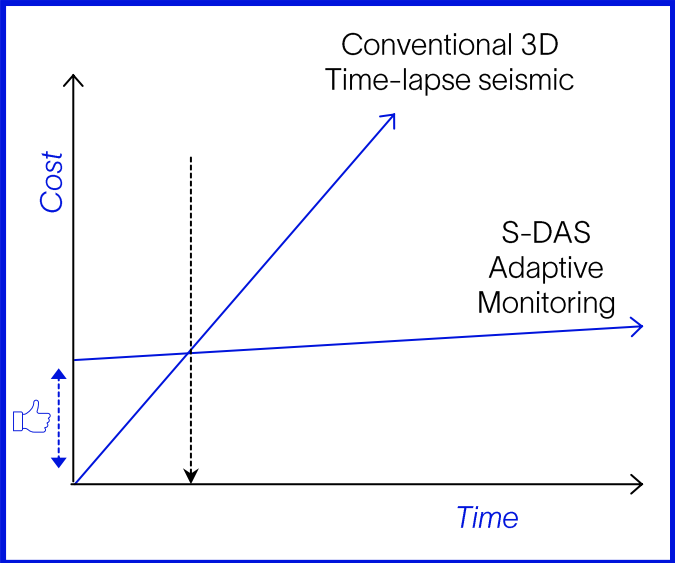
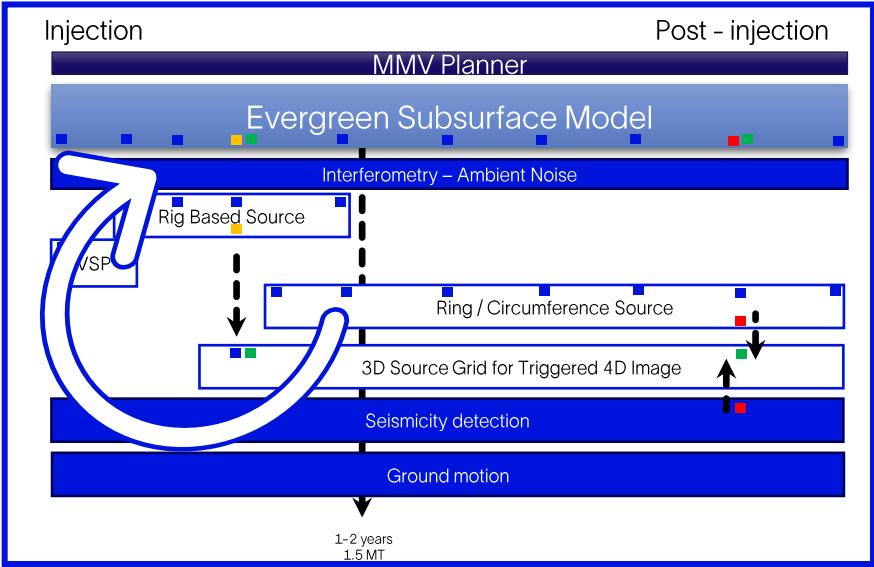
Continuous link between model and measurement for life of field



A scalable and adaptive monitoring workflow



Impact



Impact on CCS market

-  Reduced project costs
-  Increased measurements
-  Faster reporting
-  Lower barrier to entry
-  Increase in projects

Adaptive answer products

S-DAS and an adaptive monitoring effort as part of the MMV plan

Cost efficiency

Change balance of CAPEX and OPEX to better reflect the drivers in CCS

Scalability

A scalable solution designed for the technical requirements of CCS



The Road Ahead

Collaborate to
succeed...

- Looking for partners to deploy at scale
- Land / Marine
- Dynamic subsurface



Iain Martin
Technology Manager
CCUS, NZTC

"The radical approach by SLB offers a step change in continuous seismic monitoring for CCS."

Open Innovation Program (Spark 2368).



Chevron
ConocoPhillips
Oxy
Saudi Aramco

Shell
SLB
Total Energies
Woodside