

Holistic cement analysis with passive and active acoustics

Archer
VIVID[®]





Generic well construction

Overburden and reservoir

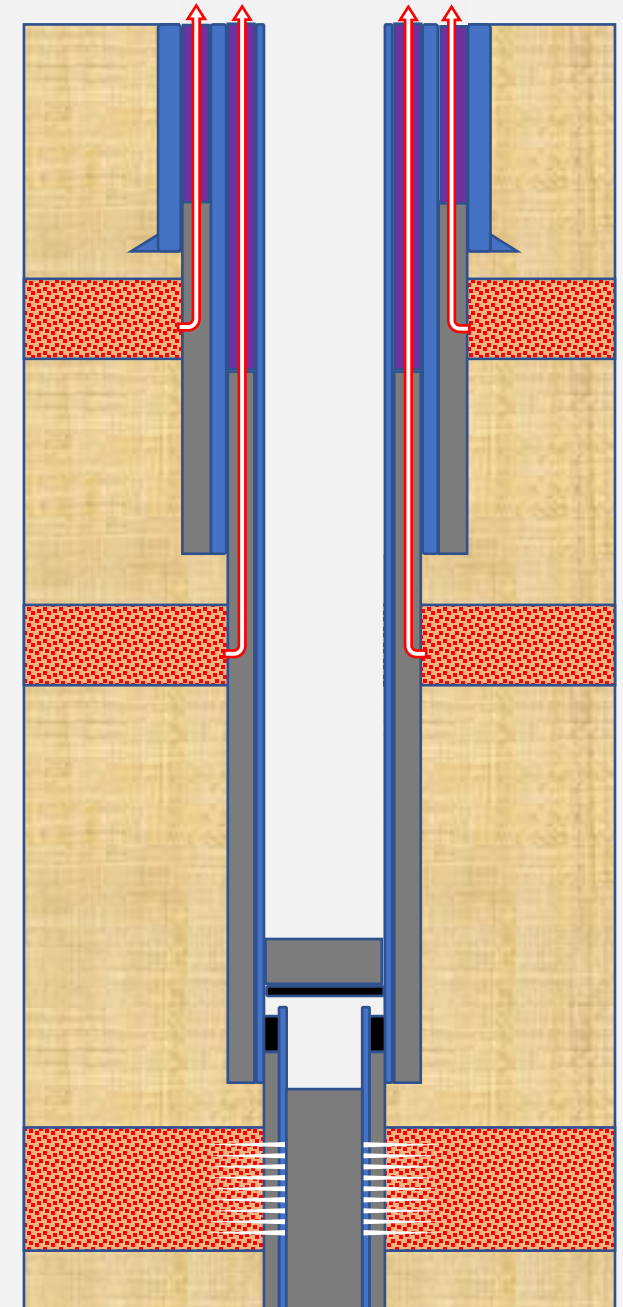
Drill and complete

SAP manageable during operations

Plugging operations

SAP reappears

Where and Why?





Acoustic logging techniques for diagnostics

Active acoustic – cement condition

First barrier

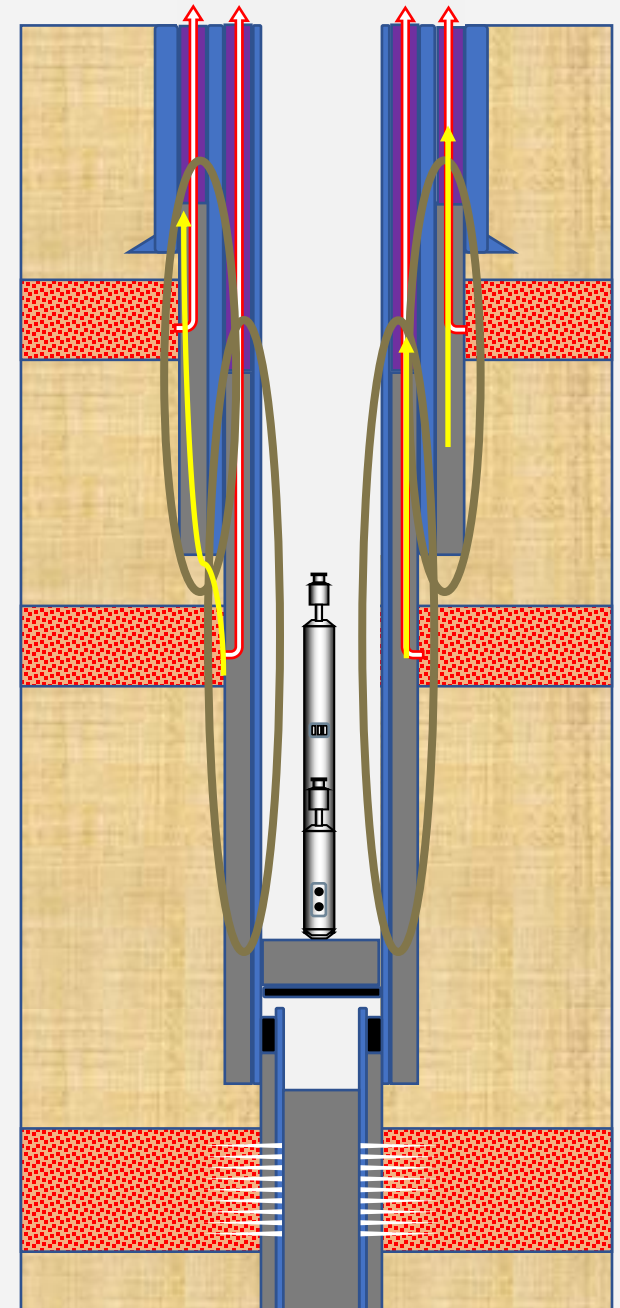
Further barriers ?

Passive acoustic – cement performance

First barrier

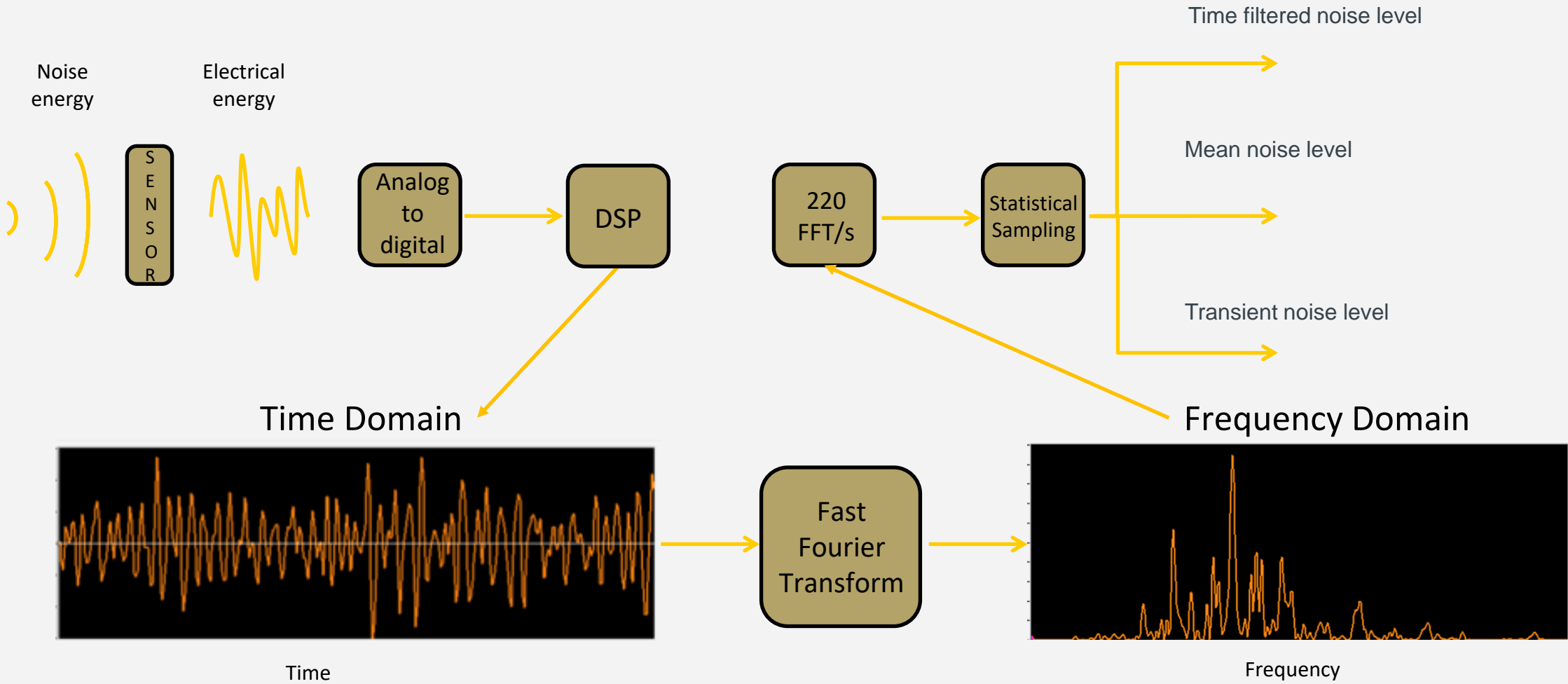
Further barriers ✓

Complex leak paths



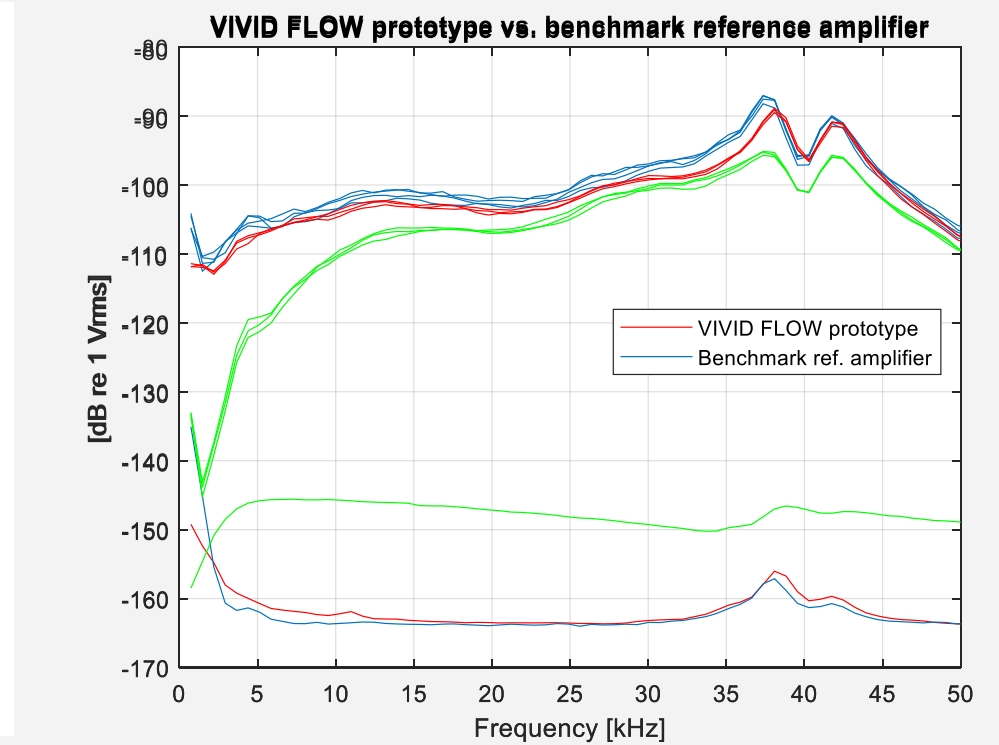
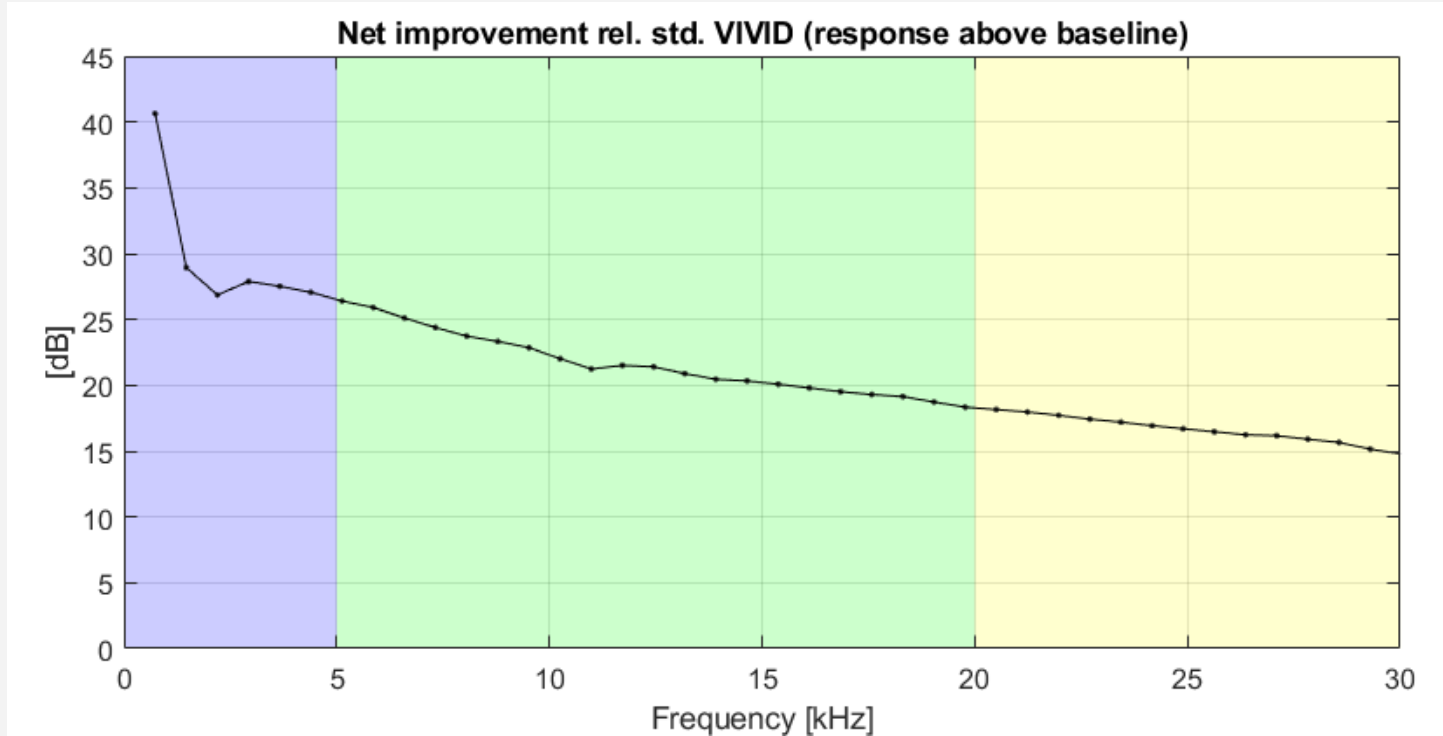


Acoustic logging techniques for diagnostics





Low energy low frequency response



Below 15kHz, net response improved by a factor of 10 or more



Field results

Low level of gas migration in cemented annulus

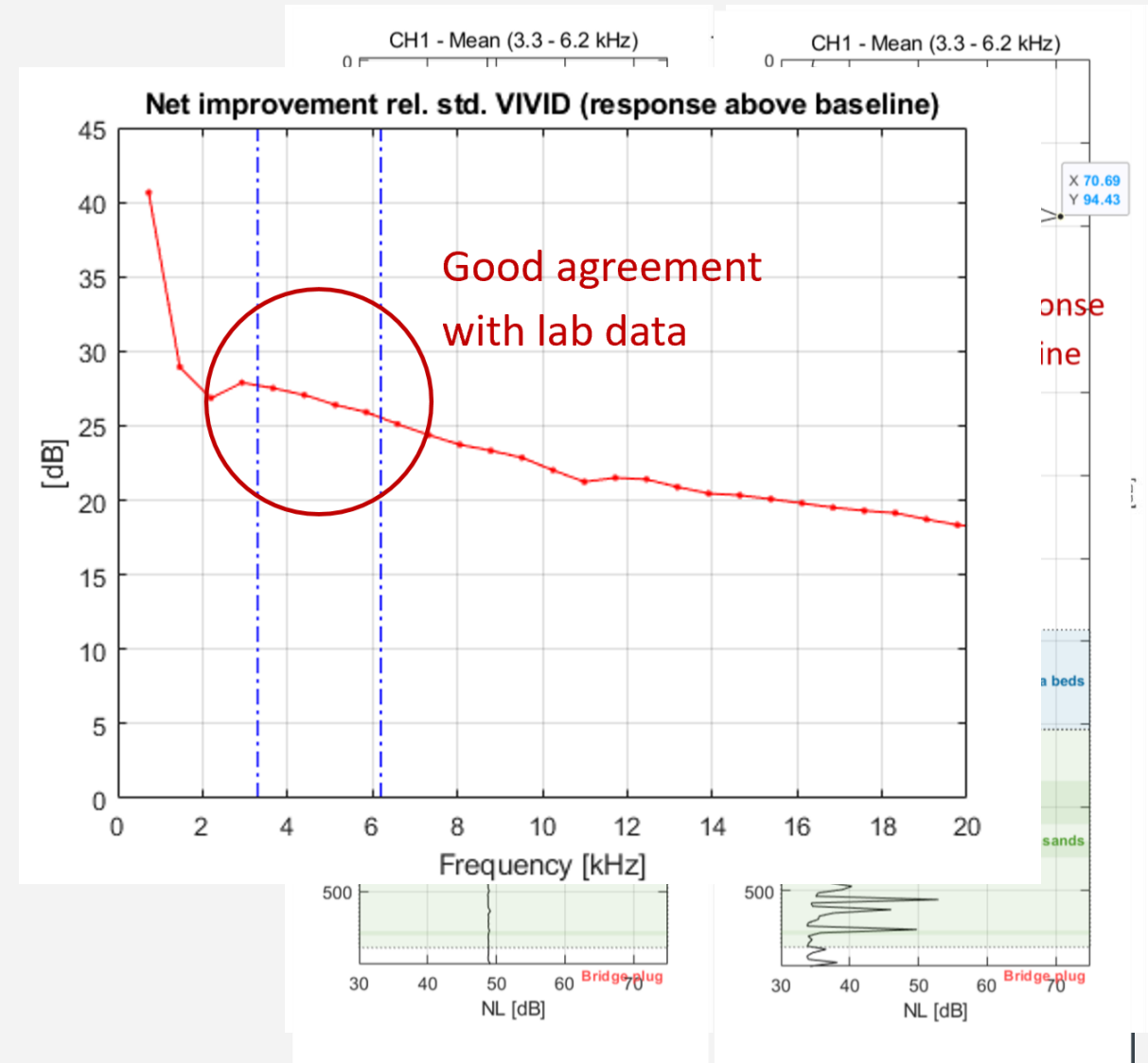
- Original tool – spectrum display
- Optimised tool – same scales

Low frequency response

- Original tool – noise level
- Optimised tool – same scales

In alignment with lab data

- More than 25 dB improvement above baseline





An actual well

Well workover

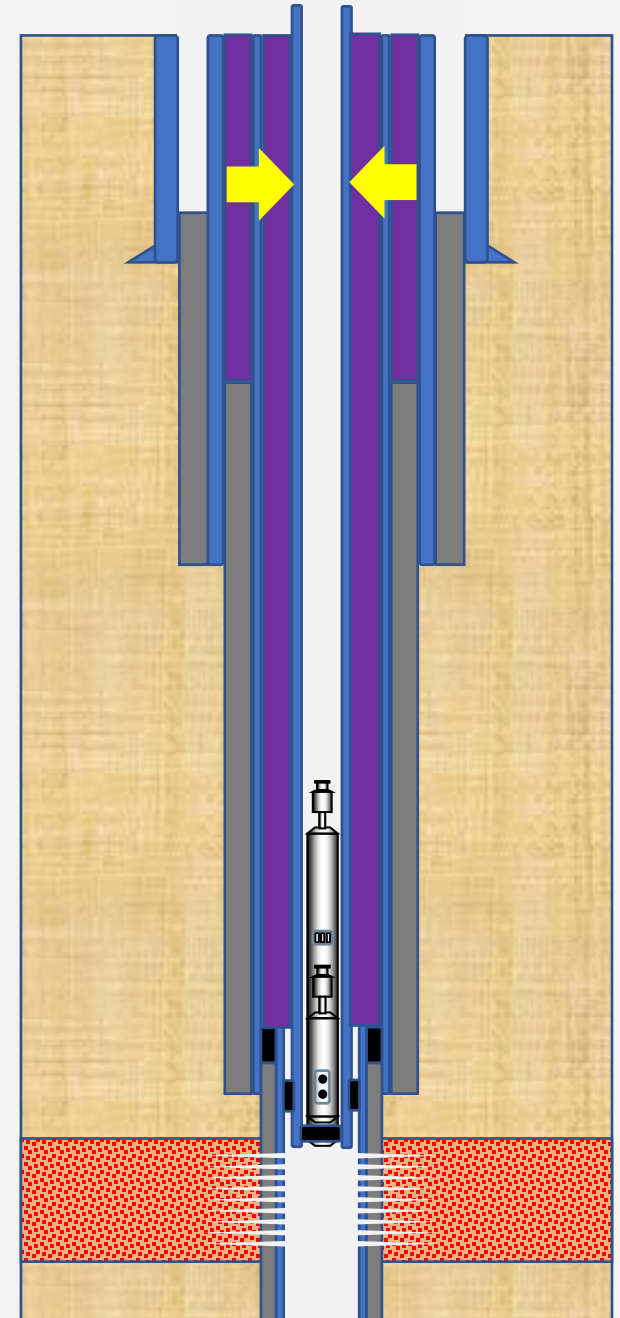
- Record bond log

Recomplete

- SAP A and B
- Communication B to A

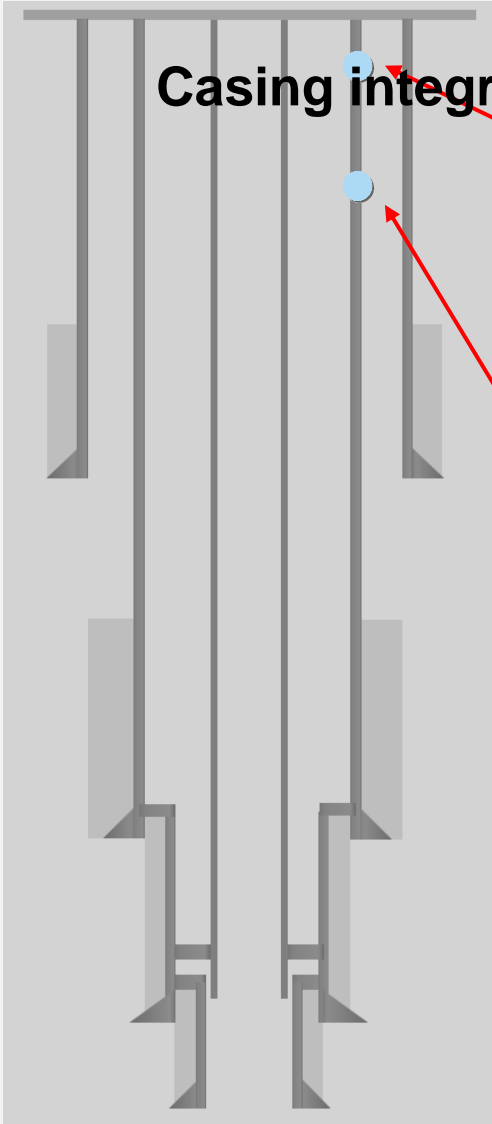
Set tubing plug and log passive acoustic

- Locate communication
- Determine source of buildup





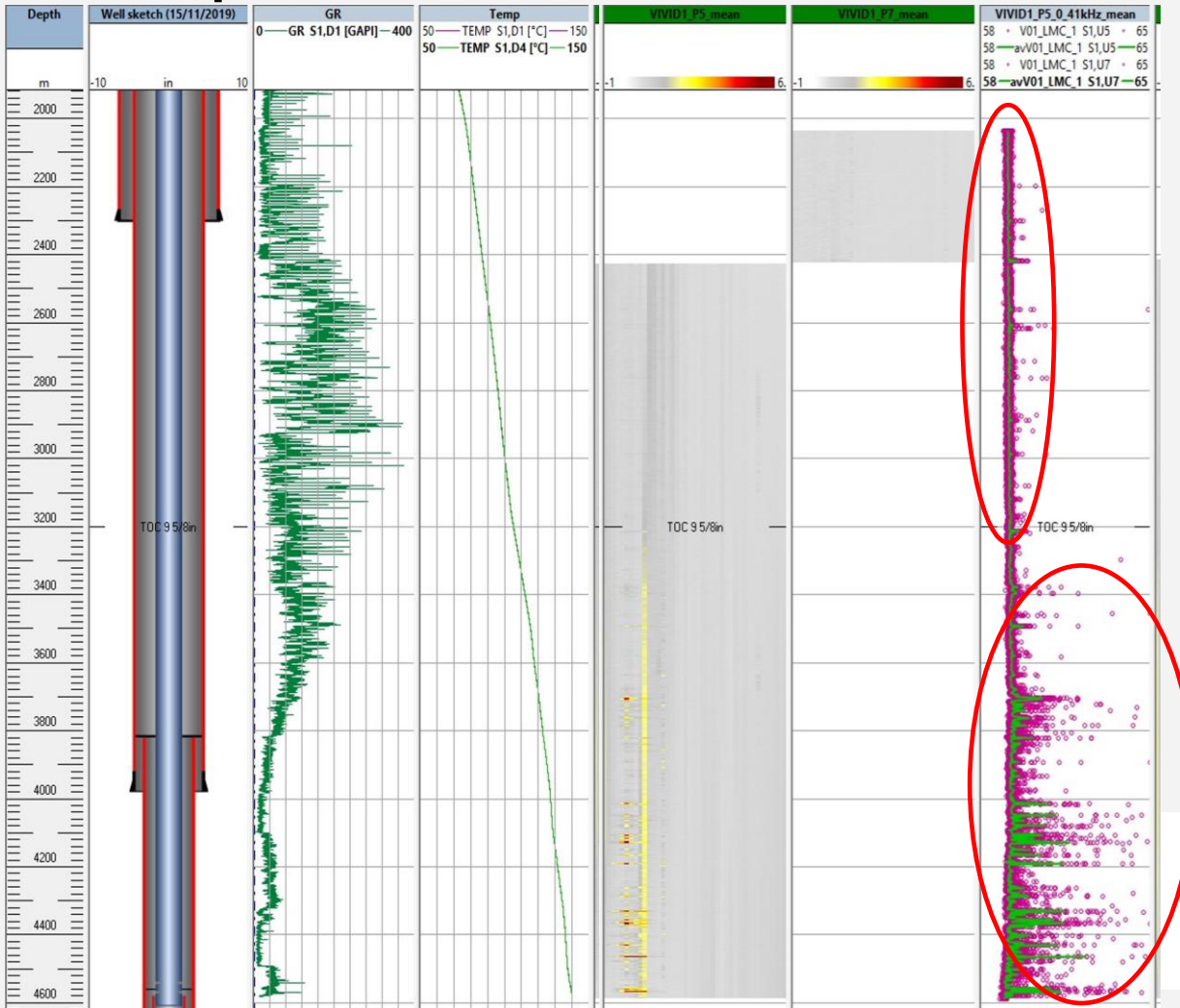
Casing integrity analysis



- Logged as a series of stations
- Clean baseline
- Large leak signature
- Smaller signature
- 2 distinct 9-5/8” casing leaks



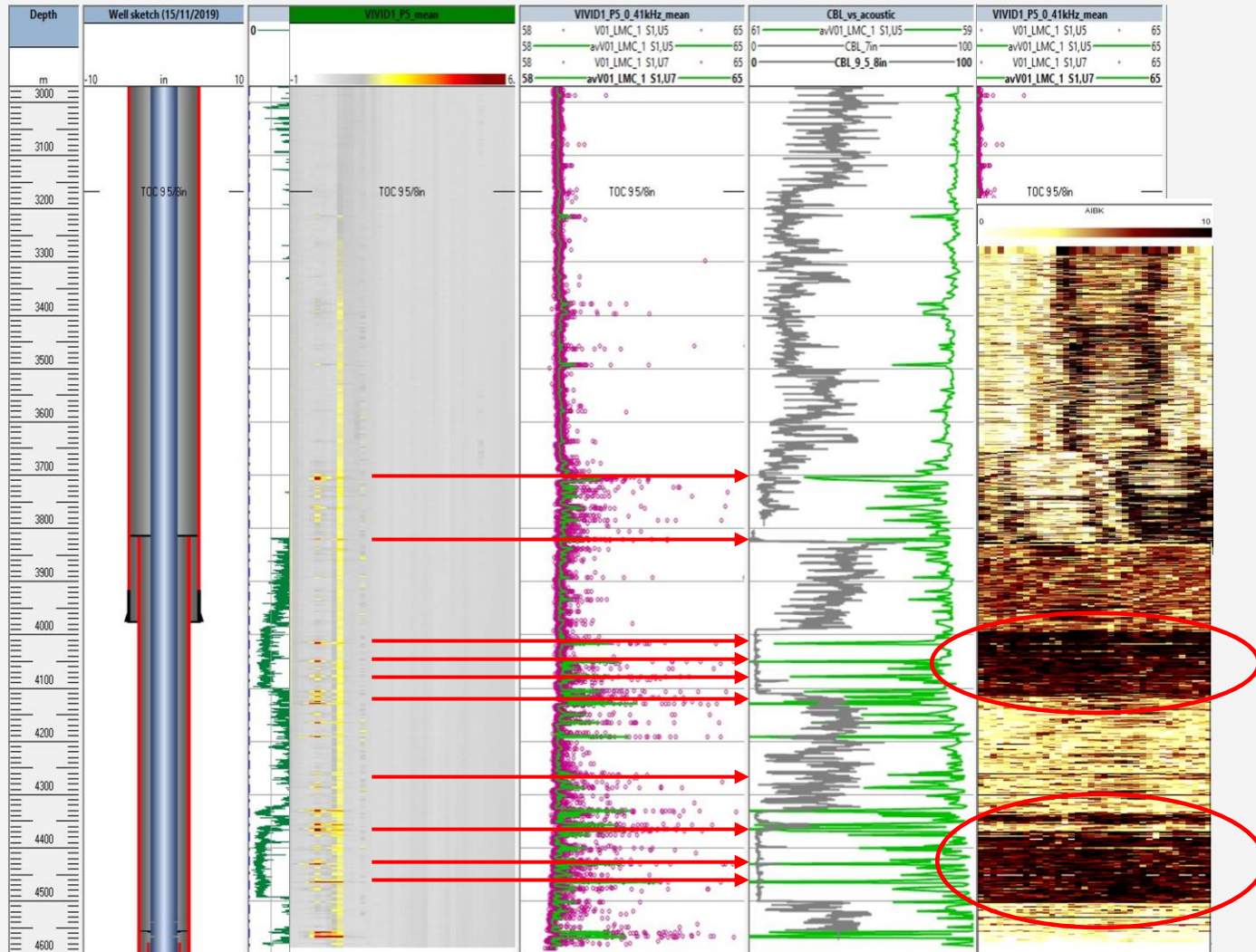
Cement performance evaluation



- Logged GR and temperature
- No indication on temperature
- Log acoustic stations
- Much lower amplitude
- Baseline noise level
- Elevated noise level



Introduce cement condition



- Zone of interest
- Acoustic
- CBL Amplitude with noise level
- Clear leak path
- Impedance map
- “Good” cement



Conclusions

Advances in passive acoustic technology

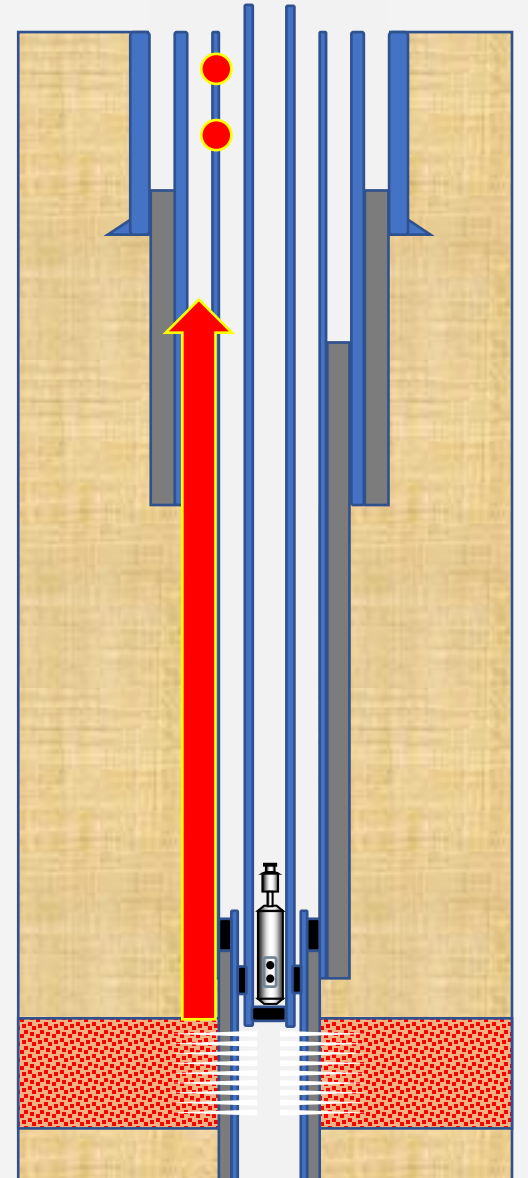
- Detect very small fluid migrations
- Evaluate through tubing

Complementary with active acoustic bond logging

- Cross validation of interpretations
- Powerful planning tool

Example well – run through tubing single run-in-hole

- Located 2 casing leaks – implications for abandonment plan
- Mapped fluid migration from reservoir to above TOC





VIVID[®] – Acoustic listening platform

- Ultra-high sensitivity acoustic technology
- Rapidly locates leaks in tubing and casing

- Can detect even small gas migration in cemented annuli
- Detects sand ingress points and confirms transported sand
- Analyses flows inside and behind casing

