Why Acoustic Sand Detectors don’t work?
“The well is shut-in yet we keep getting indications of sand production!”

Operator issues #1
“We know we are producing sand as we keep filling up our separator but the sand detector shows zero sand production.”
“The CRO’s were getting flooded with so many sand alarms we had no choice but to turn the system off”
Why acoustic detectors don’t work

“Why is it that for many operators their acoustic monitoring systems simply don’t work”
Detector fundamentals

- Passive microphone transducer
- Detects noise of particles impacting on pipe wall
- Also detects flow noise and mechanical noise
- Filter used to ensure noise is predominantly due to sand impacts.
- Not possible to completely isolate sand noise
Sand Rate

- Quantify each well's sand production
- Predict sand deposition in vessels
- Estimate erosion
Calibration

- Velocity
- Flow rates: Oil, Gas, Water
- Pressure & Temperature
- Static Inputs

☑ Real time process data
• Flow well at different rates

• Establish background noise at each rate

• Determine background noise curve / zero values

\[
y = 3x^3 - 40x^2 + 533x + 2000
\]

<table>
<thead>
<tr>
<th>Velocity [m/s]</th>
<th>Signal [100nV]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 m/s</td>
<td>2000</td>
</tr>
<tr>
<td>5 m/s</td>
<td>4000</td>
</tr>
<tr>
<td>10 m/s</td>
<td>6000</td>
</tr>
<tr>
<td>15 m/s</td>
<td>10000</td>
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</tbody>
</table>
Sand noise / Step

- Flow well at different rates
- Inject known quantities of sand at each rate
- Determine sand curve / step values

Velocity Signal [100nV]

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<td>5 m/s</td>
<td>13 000</td>
</tr>
<tr>
<td>10 m/s</td>
<td>22 000</td>
</tr>
<tr>
<td>15 m/s</td>
<td>35 000</td>
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</tbody>
</table>

Sand curve [1g/s]

\[ y = 11x^3 - 240x^2 + 3533x - 0 \]
Sand Rate

- Calculate sand rate

\[
\text{Sand rate} = \frac{\text{Raw data} - \text{Background noise}}{\text{Sand Noise}}
\]

- Production availability
- Accurate particle sampling data
Velocity = 11 m/s  
Reading = 21 040 [100nV]

Background noise = $3 \cdot 11^3 - 40 \cdot 11^2 + 533 \cdot 11 + 2000$

= 7016 [100nV]

Sand noise [1g/s] = $-11 \cdot 11^3 - 240 \cdot 11^2 + 3533 \cdot 8 + 0$

= 24463 [100nV]

Sand rate = $\frac{\text{Reading} - \text{Background noise}}{\text{Sand noise}}$

= $\frac{21040 - 7016}{24463}$

= 0.57 g/s
Re-calibration

• Every 6 – 12 months

• Change in the well flowing conditions

☑ Stable process flow
☑ POB capacity
Sand Quantification criteria

- Real time process data
- Production availability
- Accurate particle sampling data
- Stable process flow
- POB capacity
Raw signal interpretation

You are the experts on your sand production!
Data Interpretation

Acoustic Data – Sand Event?
Data Interpretation

Acoustic data & erosion probe data– Sand Event - Yes
Data Interpretation

Acoustic data, erosion probe data, pressure & temperature – Sand Event - Yes
- Determine sand producing wells
- Understand how process operations affect sand production
- Estimate erosion – if used in conjunction with sampling data.
Case Study

Surfactant treatment and Pressure reduction
Case Study (cont.)

- Surfactant treatment
- Platform Trip during pressure reduction
- Well cycled
1. Well flowing normally

2. Well cycled closed for 9 hours

3. Noise signal consistent with sand production

4. Well begins to ‘clean-up’
Outcome:

- Surfactant treatment successful
- Staged pressure reduction successful
- Sand production following well start-ups
- Requirement for ‘hard’ bean-up
Sand Monitoring Services

http://www.sand-monitoring.co.uk

Questions?