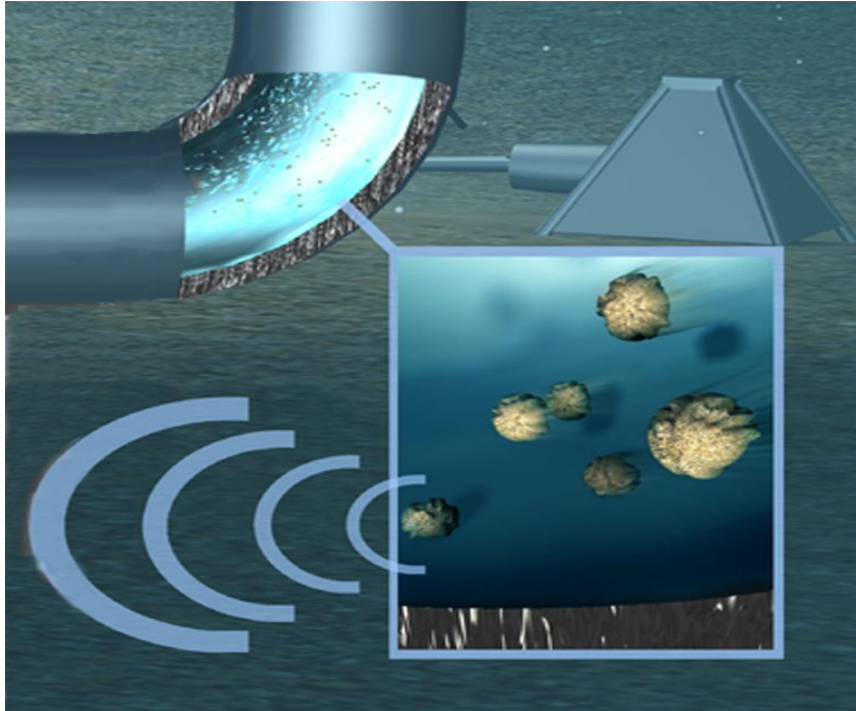


Detecting sand at
velocities below
0,5 m/sec. A
NorthSea field
case.

Torbjørn Haugsdal

Working principle

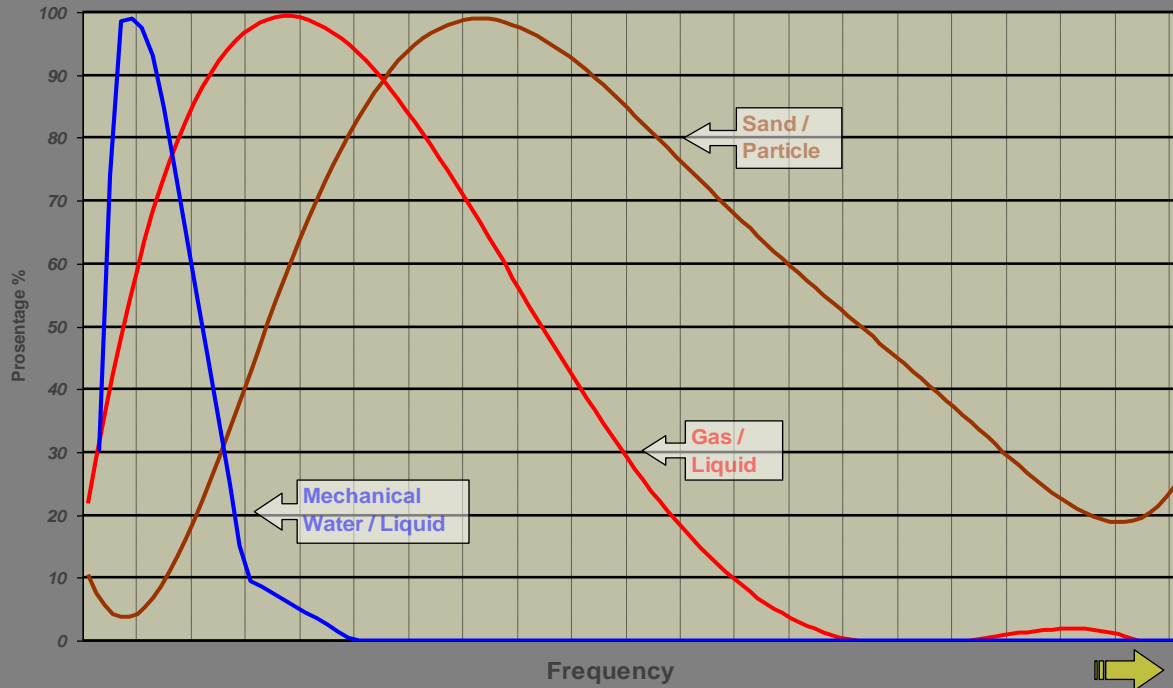


- The sensor have to be installed immediately downstream of a bend
- Particles being transported with the flow, will by gravity hit the pipe wall in a bend
- This will create ultrasonic pulses, detected by the sensor

- The principle depends on particles hitting the pipe wall.
- Low velocity, heavy oil and small particles might prevent this

ClampOn DSP Particle Monitor

Spectrum - Response from different media



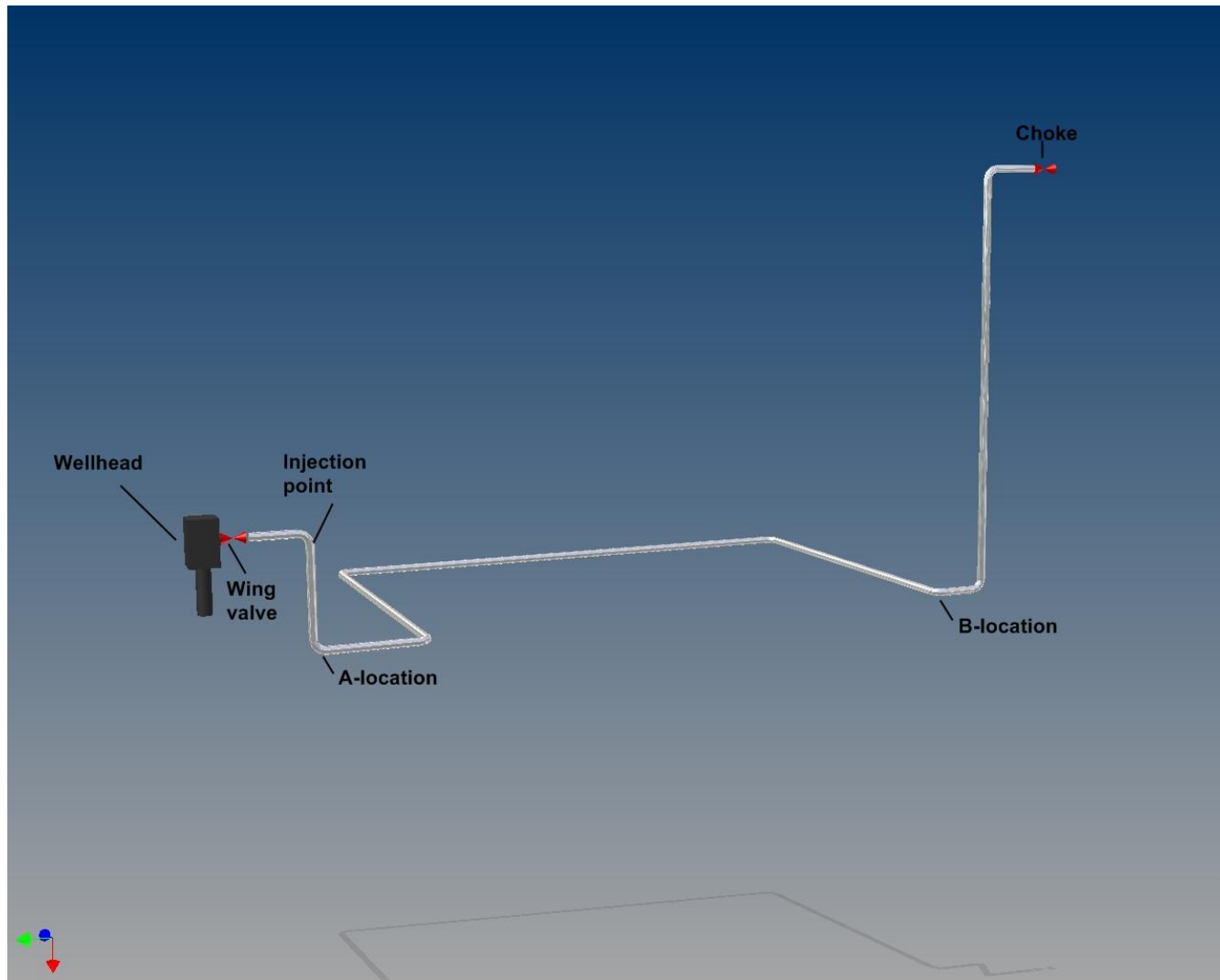
- An acoustic sand detector will normally have to be installed some distance away from sources of ultrasonic noise like a choke

ClampOn SandQ



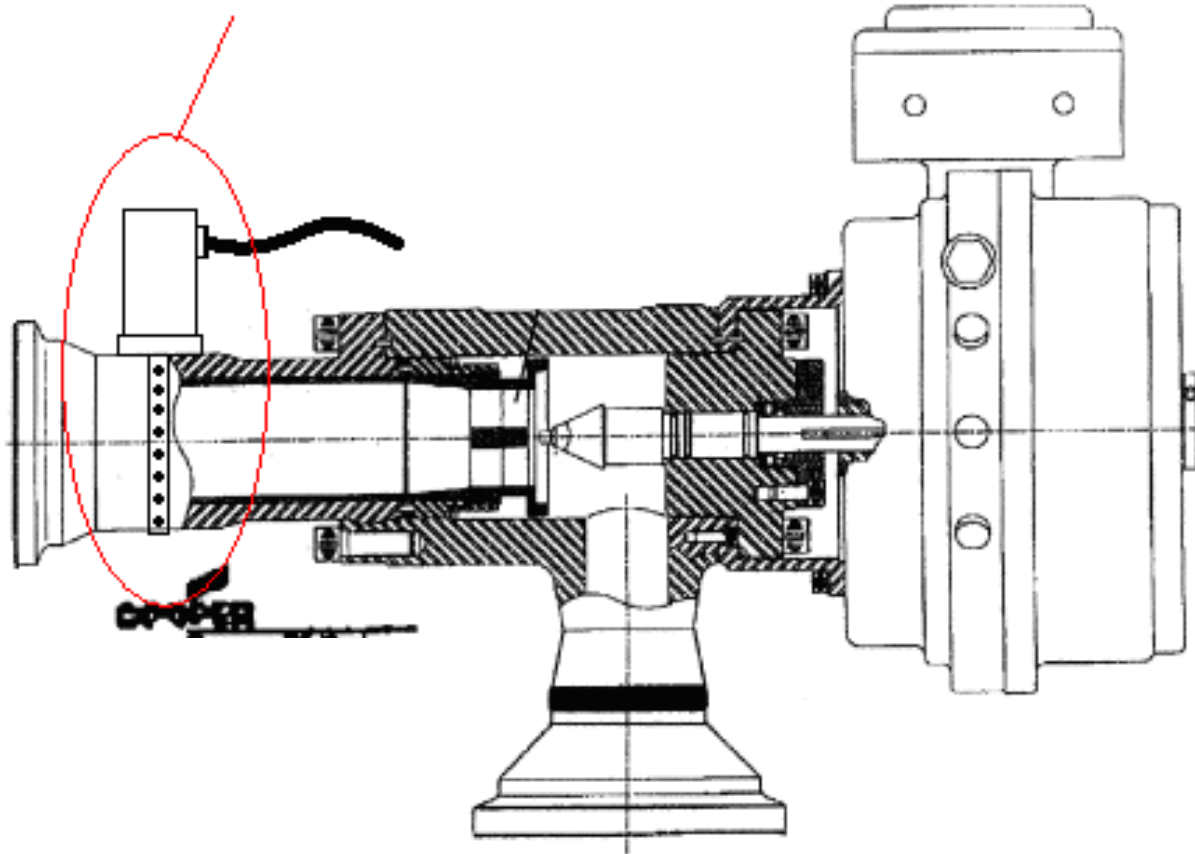
- New and more powerful processor makes a more advanced and flexible noise filtering possible, giving more flexibility with regards to the sensor location.

Pipe layout on the test location



The Choke

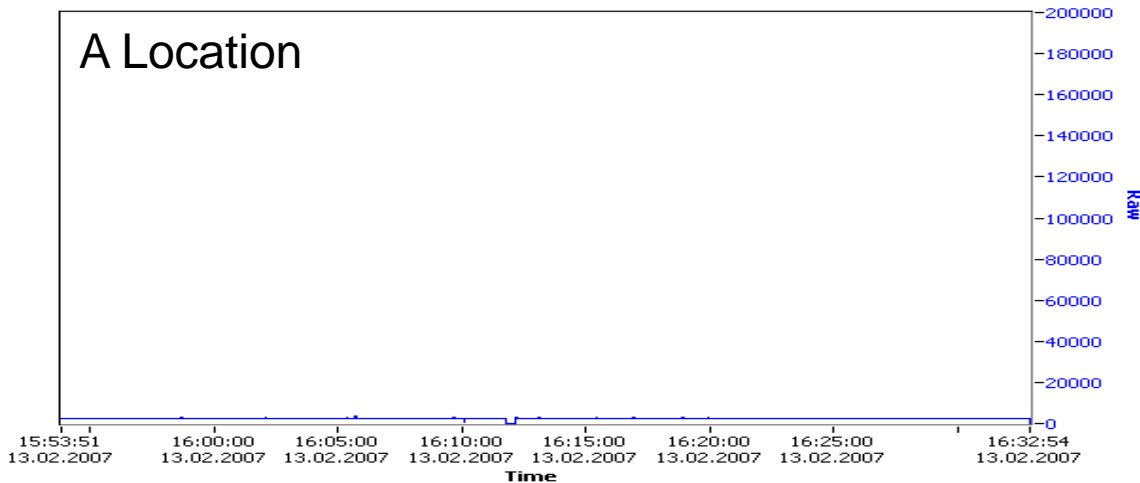
Sensor location on the choke



The test in 2007

Sensor 5185_2007_02.dat

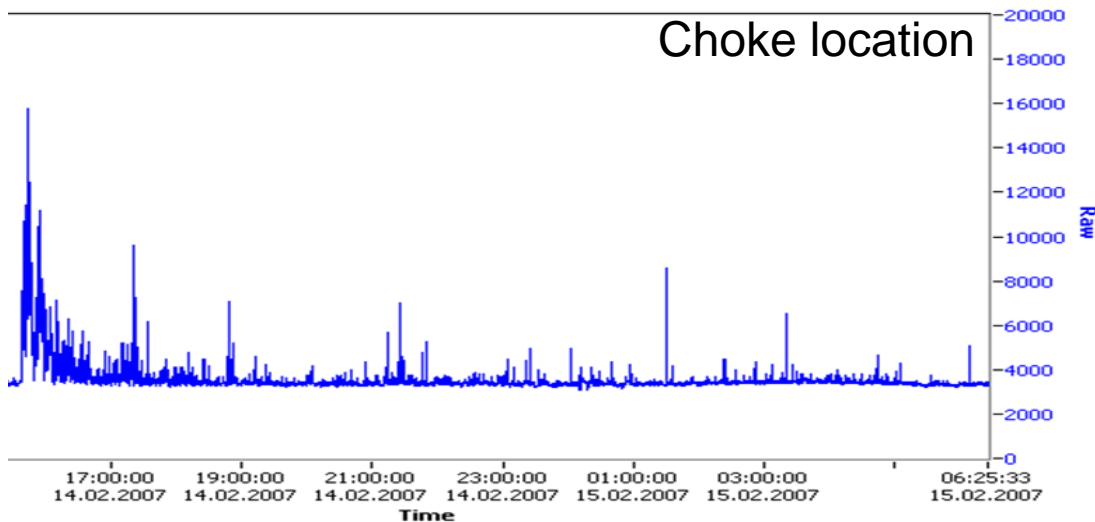
A Location



Fluid velocity: 1.2 m/s:
it took 45 minutes from start of injection to the first detection on the choke location.

Sensor 5184_2007_02.dat

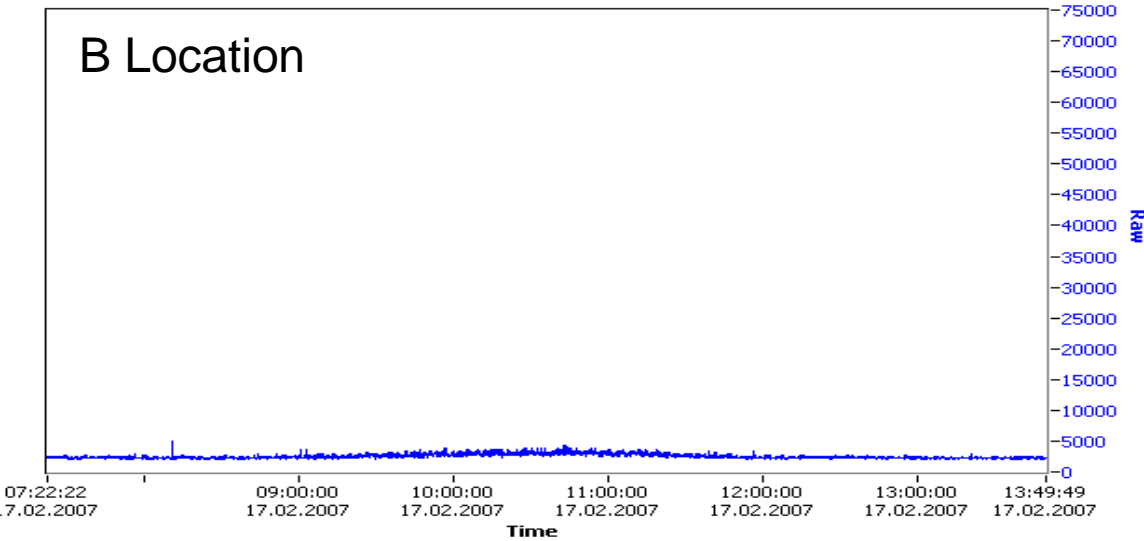
Choke location



The test in 2007

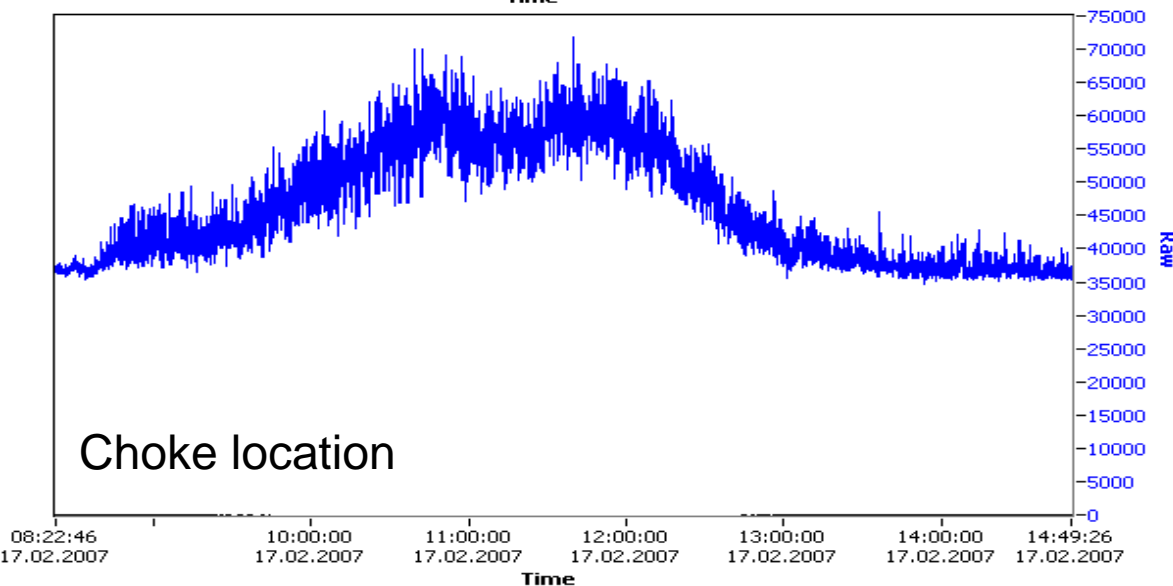
C19 B location 400g HST50.dat

B Location



Velocity 0,7 m/sec
The injection of 400 g sand
takes 10 minutes
Response at sensor location is
more than 4 hours.
This gives an average sand
rate of 0,03 g/sec

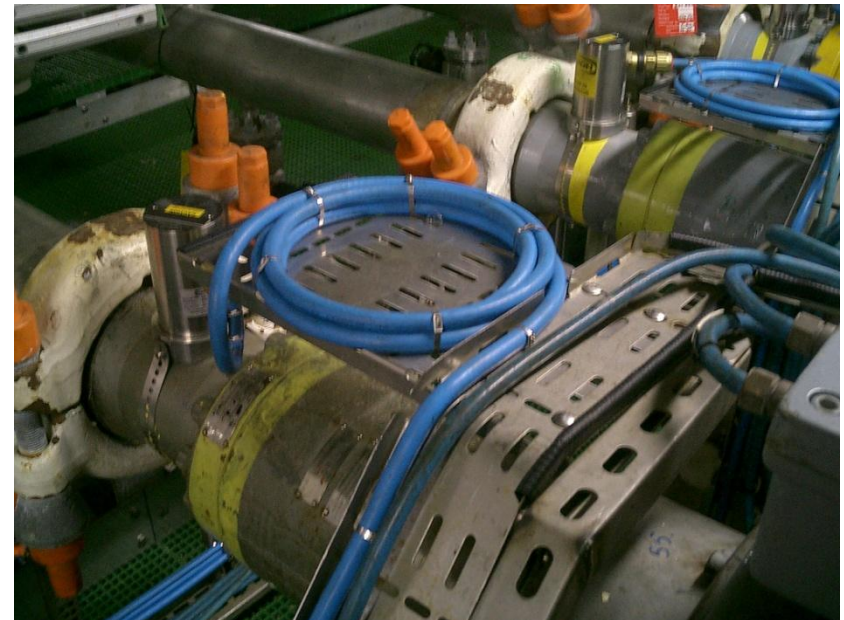
Choke location



Second face

- Based on the promising results the operator decided to start a large scale test.
- 15 sensors where installed on the choke of 15 wells known to be difficult to monitor
- Although a test, the installation was made permanent, and the data is integrated to the control system, and are made available onshore. Also ClampOn has access to real-time data from the installation.

The installation

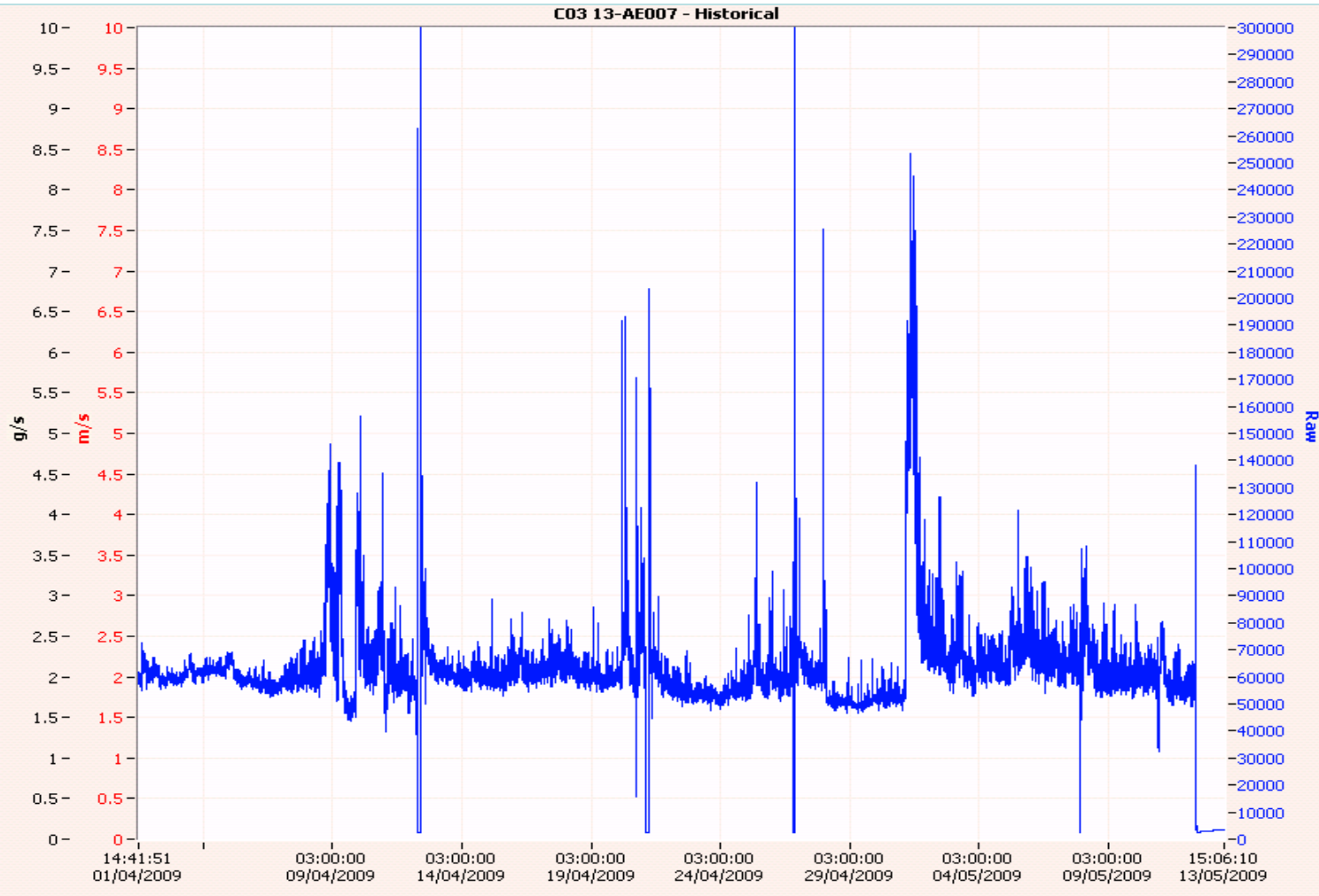


The first sand monitoring report

April 2009

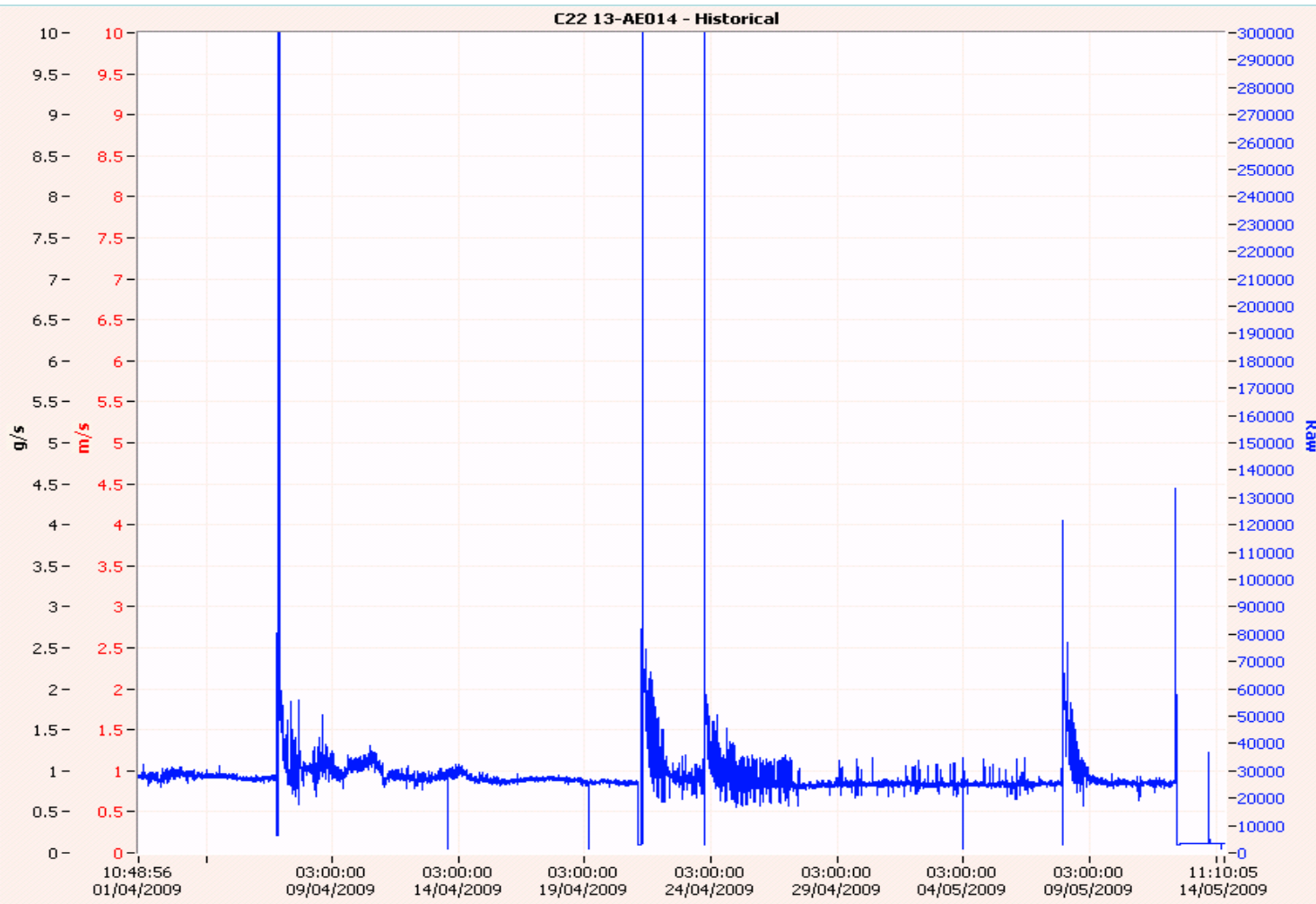
WELL	LITTLE OR NO SAND @ STABLE PRODUCTION	SAND @ START-UP/BEAN-UP	SAND @ STABLE PRODUCTION	CONTINUOUS SAND
C03		✓	✓	
C07	✓			
C08	✓	✓		
C14	✓			
C15	✓	✓		
C19				
C22	✓	✓		
C23	✓			
C25	✓			
C26	✓			
C27	✓			
C28	✓			
C29	✓			
C30	✓			
C35	✓	✓		

Sand production



C3,
Sand production
during startup
and during stable
production

Sand production

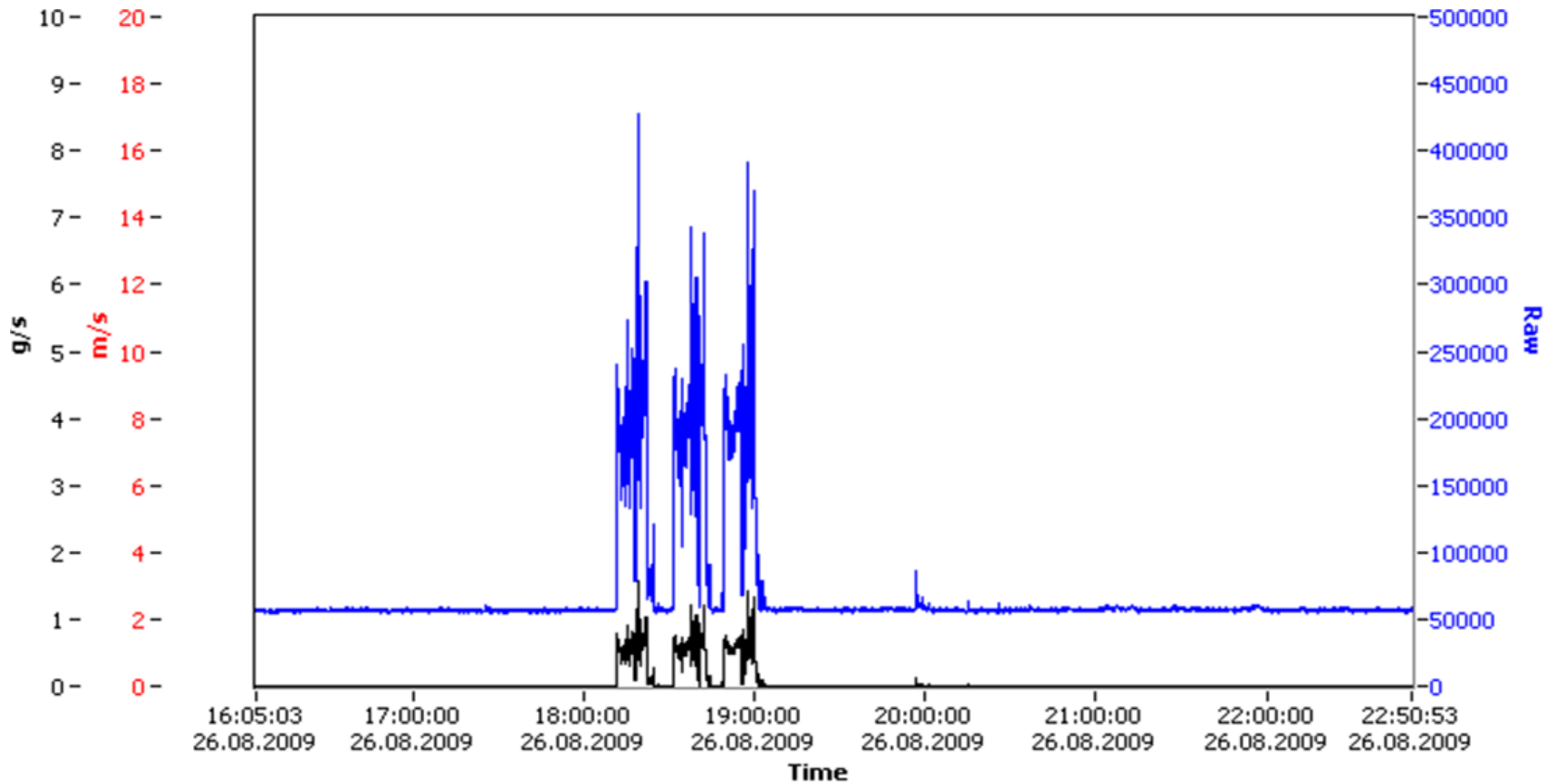


C 22,
Sand production
during startup
and during stable
production

The installation

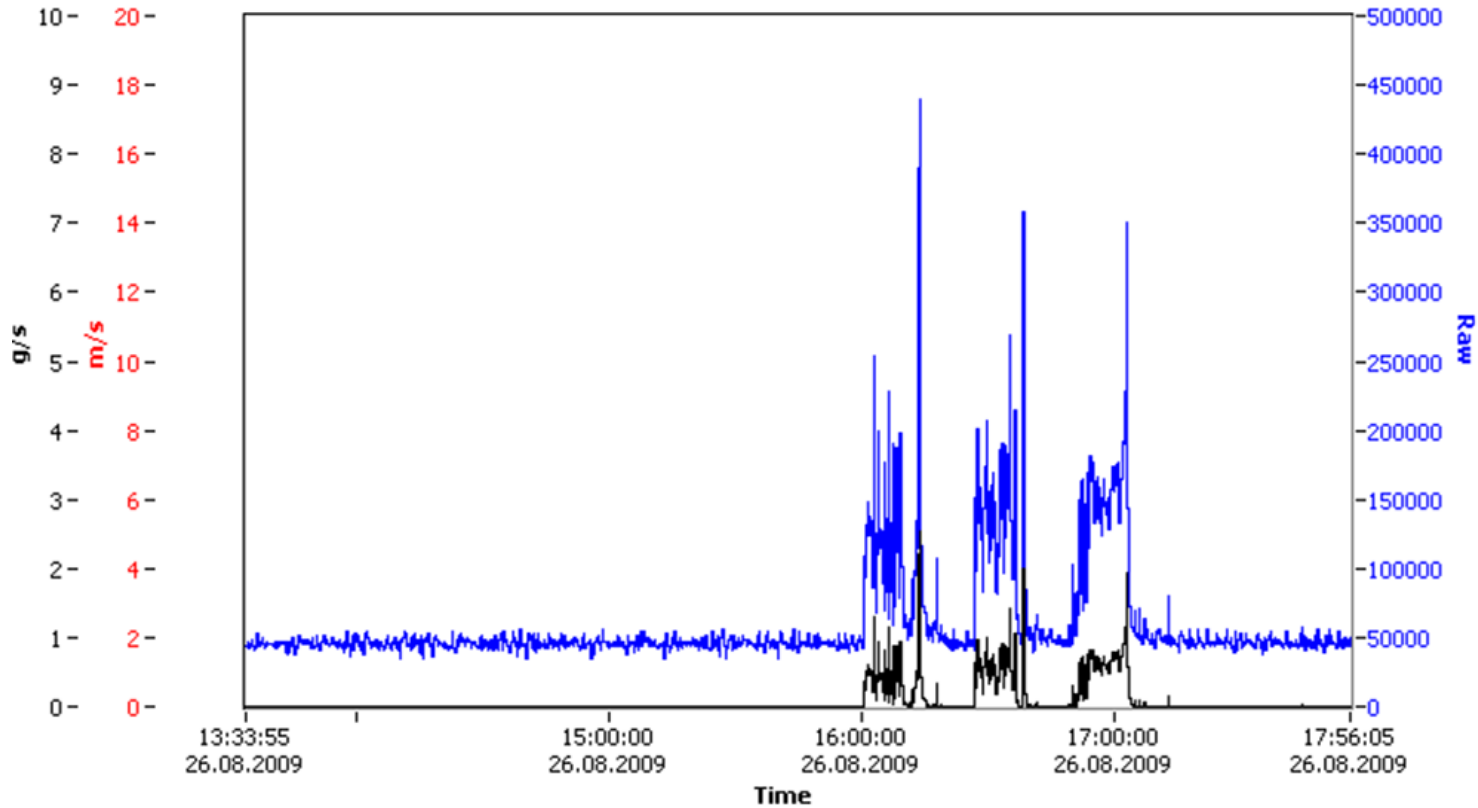
WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step	
C-3	21.08.2009	16:40	50	77	57	20	0,92	55000	112000	
C-29	22.08.2009	08:00	[Ctrl+F4]	[Ctrl+F5]	[Ctrl+F6]	56	19	0,49	30000	61000
C-22	22.08.2009	13:00	Flow velocity [m/s]	Zero	Step	57	29	0,99	125000	50000
C-23CT2	22.08.2009	15:30	1,0 ==>	2200	525	57	12	0,38	N/A	N/A
C-27	23.08.2009	10:30	2,0 ==>	2400	1500	58	15	1,35	23000	105000
C-25T2	23.08.2009	14:00	3,0 ==>	3000	2500	56	48	0,77	35000	16000
C-7	23.08.2009	16:00	4,0 ==>	3800	3200	58	8	1,96	30000	105000
C-15C	24.08.2009	09:45	6,0 ==>	5000	4800	56	26	0,49	27000	95000
C-8	24.08.2009	16:00	7,0 ==>	6000	5650	58	34	1,67	48000	104000
C-35	25.08.2009	17:15	8,0 ==>	6500	6500	58	72	0,43	170000	63000
C-26AT2	26.08.2009	17:10	10,0 ==>	8000	8500	58	29	3,65	58000	235000
C-30	27.08.2009	13:30	15,0 ==>	10000	18050	58	51	0,8	14000	85000
C-14	26.08.2009	15:00	18,0 ==>	12000	26120	16	16	1,38	55000	152000
C-14	26.08.2009	19:45	25,0 ==>	15000	48240	16	25	0,68	100000	355000
C-14	26.08.2009	19:45	30,0 ==>	18000	64980	16	25	0,68	100000	355000
C-14	27.08.2009	08:30				16	26	0,42	N/A	N/A

C 26, 3,6 m/sec



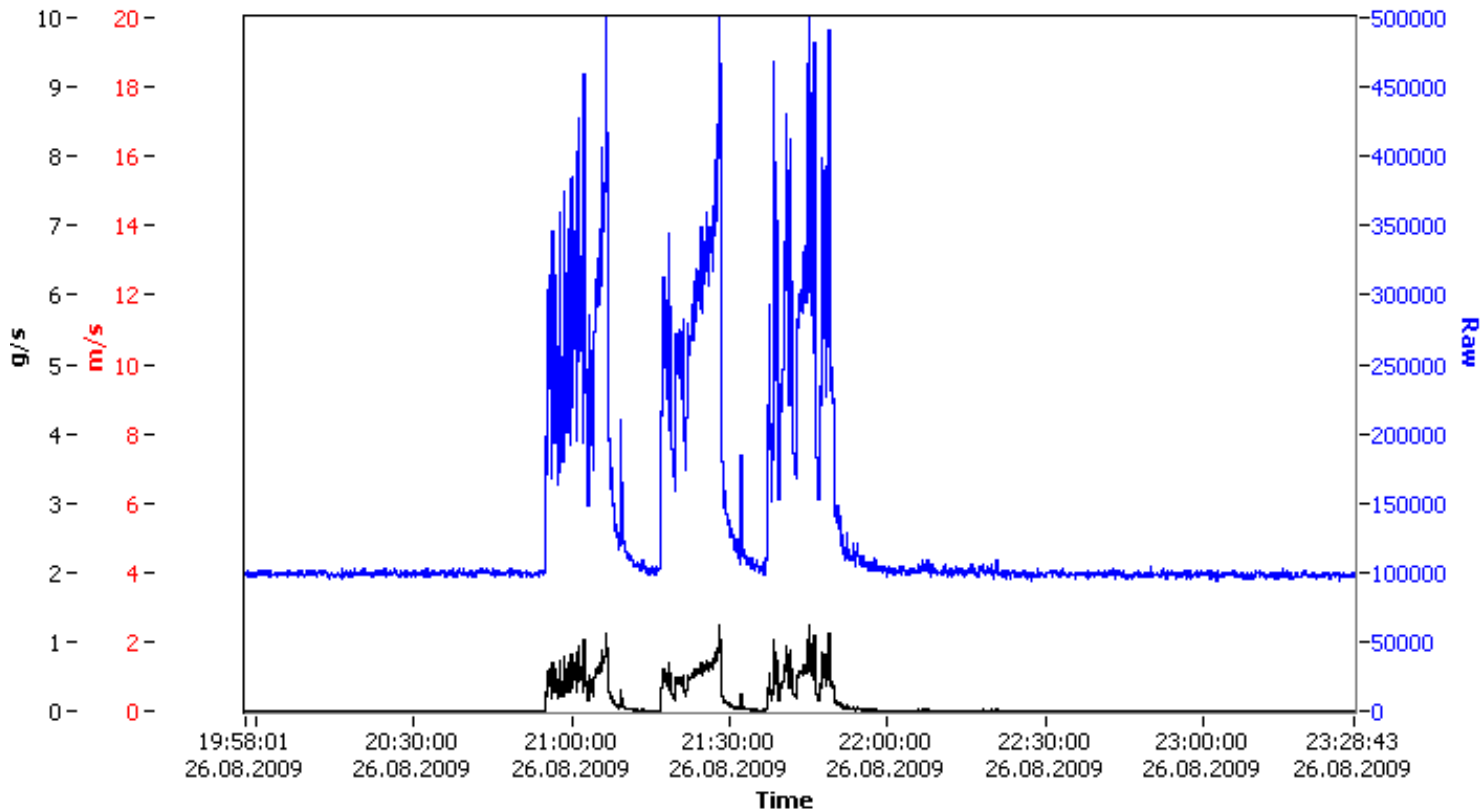
WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step
C-26AT2	26.08.2009	18:10	59	87	58	29	3,65 m/sec	58000	235000

C14 high rate



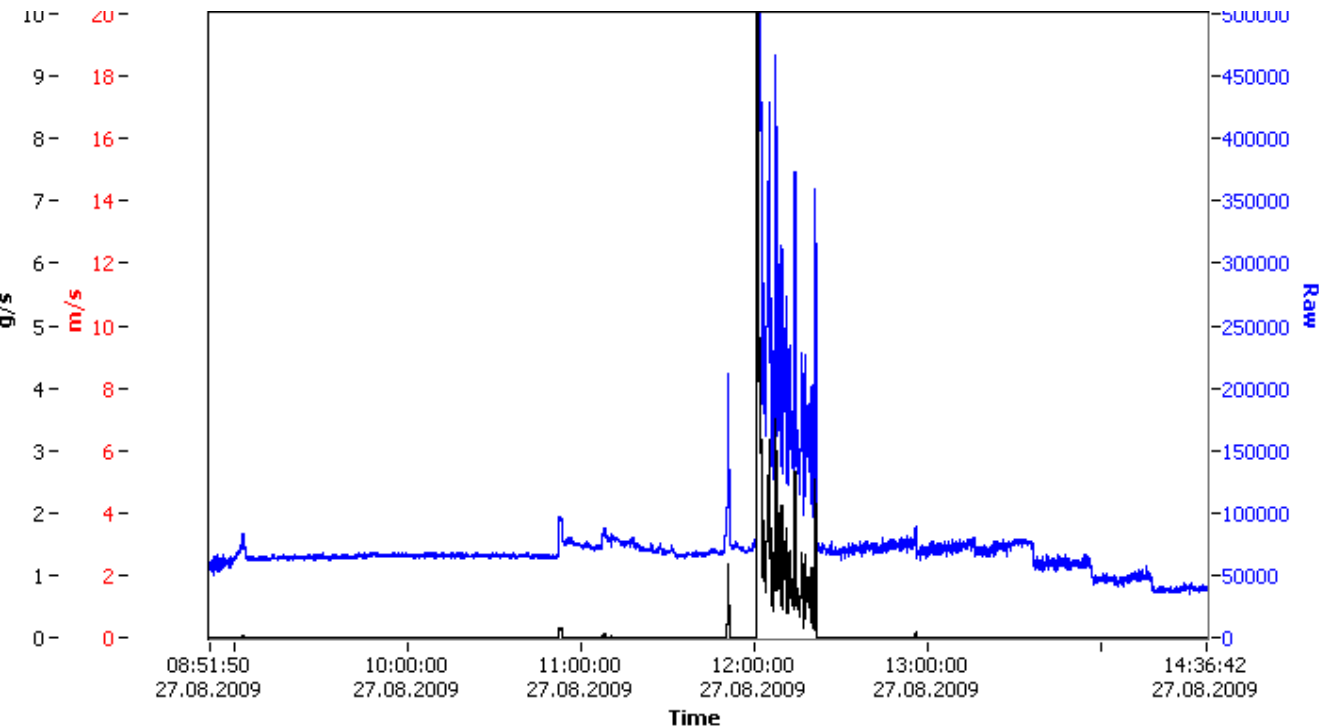
WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step
C-14	26.08.2009	15:00	73	32	16	16	1,38	55000	152000

C14 Medium rate



WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step
C-14	26.08.2009	19:45	55	41	16	25	0,68	100000	355000

The installation

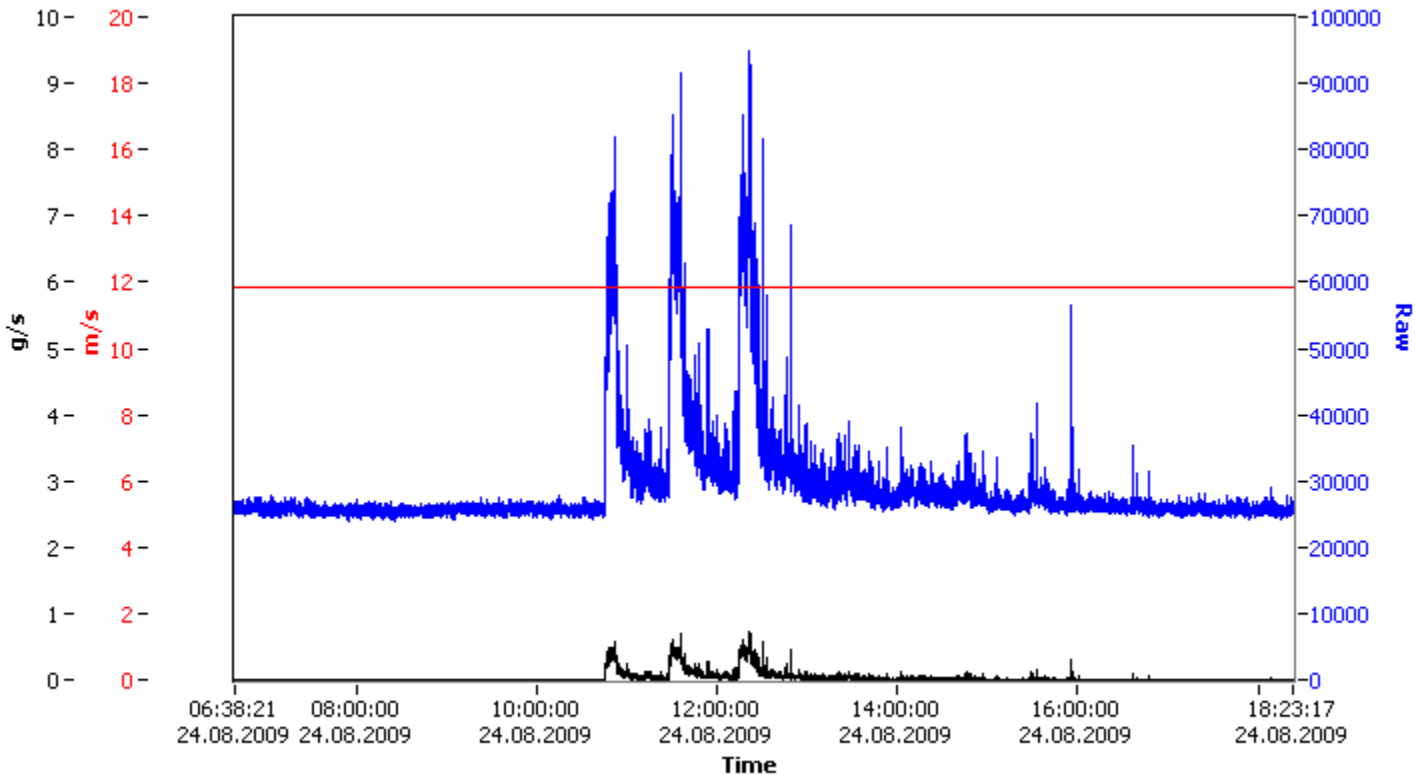


No sand detected during injections, but when the rate was increased after the test the sand came.
Conclusion: This is a sand transport issue.



WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step
C-14	27.08.2009	08:30	35	42	16	26	0,42	N/A	N/A

C15 at 0,49 m/sec



WELL_NO	Date	Time	Choke (deg)	Upstream pres	Downstream pres	DP (bar.g)	Velocity	Zero	Step
C-15C	24.08.2009	09:45	44	82	56	26	0,49	27000	95000

Next step

- This method will have to be confirmed at different conditions, different choke and different flowing media especially.
- We believe this is a perfect solution when high sensitivity is required
- A traditional installation is assumed to give an higher accuracy
- For accuracy we need to learn more about the factors affecting the signal. It will probably be different parameters than the flow velocity

Thank you for your attention