SIBELCO
UK

Location

Sibelco UK
Imperial Hotel,
Park Hill Road,
Torquay, Devon

Speakers

Michael Pede, Bernd Wittenberg
TEAM GmbH,
Westerholter Str. 781,
45701 Herten

Topic

Instrumentation and automation of dredgers and plants

Torquay
24th October 2012

www.dredgertec.de

Team GmbH

Westerholter Straße 781 • 45701 Herten

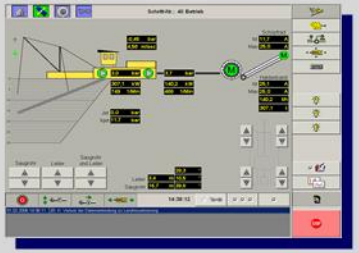
Founded: **1984**

Employees: **23**

CEOs: **Dr. Dirk Blume**
Bernd Wittenberg

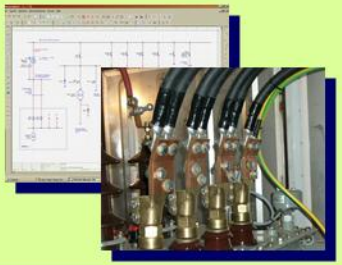
Business areas

DredgerTec
Sand and gravel industry



Software development

Electrotechnical and engineering



Hydrographics and navigation

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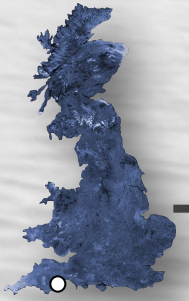
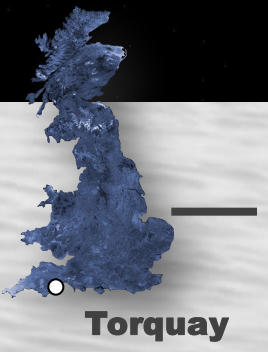


High activity

- Belgium
- Canada
- Denmark
- Germany
- Finland
- France
- India
- Netherlands
- Poland
- Russia
- Spain
- Switzerland

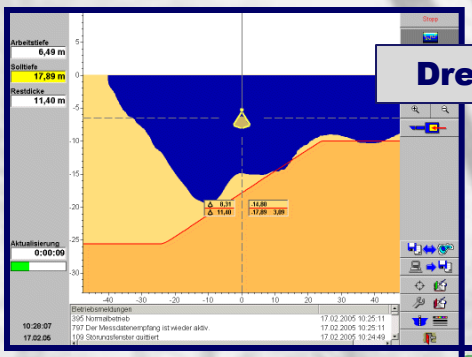
Lower activity

- Austria
- China
- Hungary
- Italy
- Mexico
- Portugal
- Romania
- Sweden

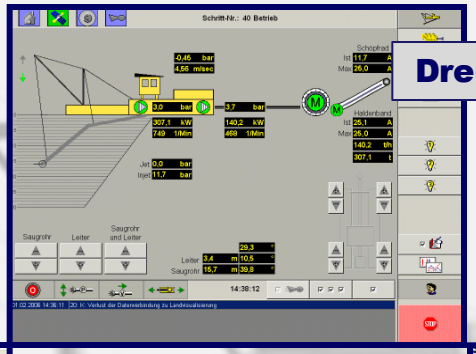


DredgerTec – Product range for the sand and gravel industry

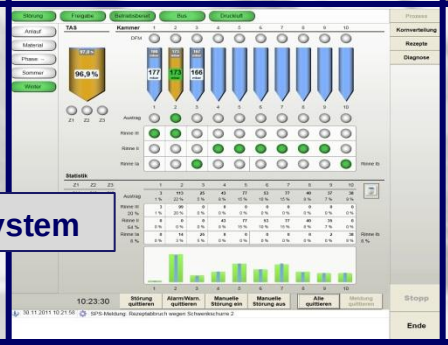
Team GmbH



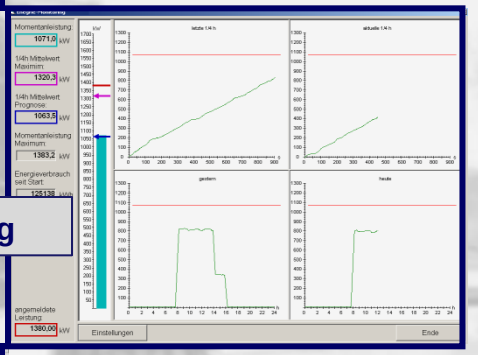
DredgerNaut



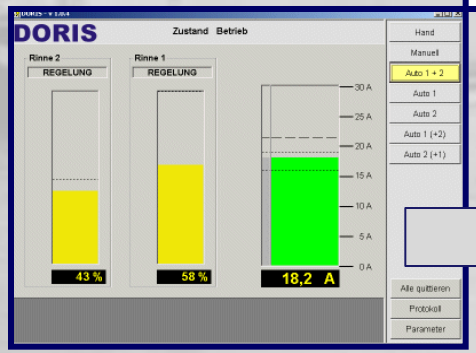
DredgerControl



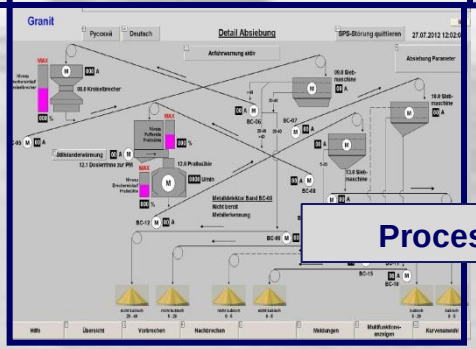
Akorel control system



Energy-monitoring



Dosing-Tube-Control



ProcessingControl

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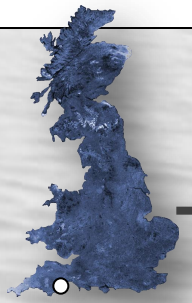
DredgerTec – over 120 systems across Europe

Team GmbH

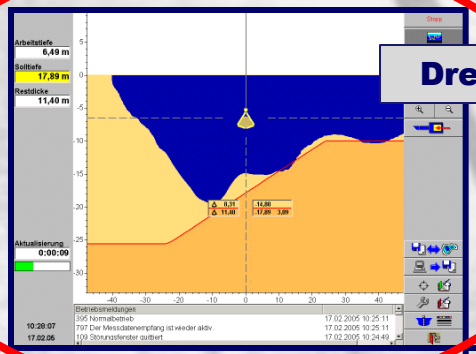
Sibelco (12 systems)

- Lommel (2x)
- Blauwe Kei
- Maasmechelen
- Donk
- Berg
- Pinken
- Heerlen (NL)
- Arija (E)
- Durance (Fr)
- MVE + Scout

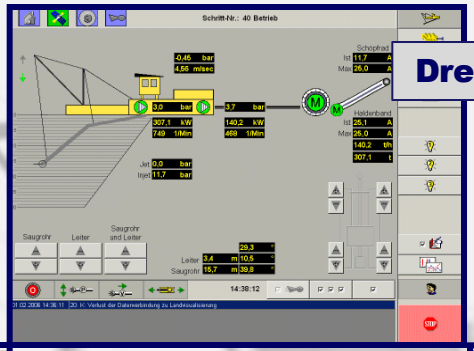


DredgerTec – DredgerNaut in detail

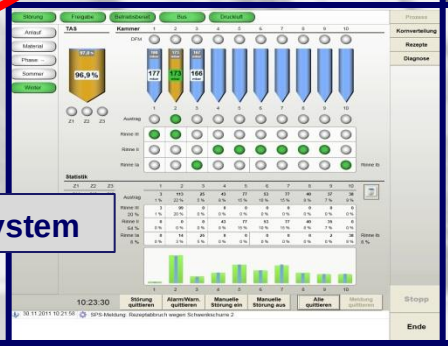
Team GmbH



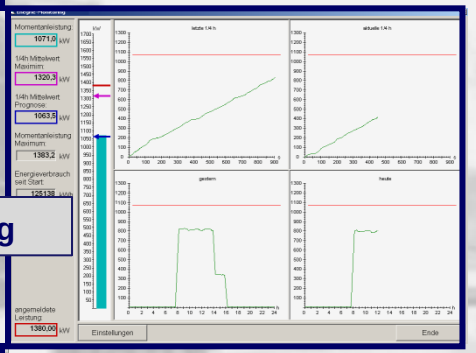
DredgerNaut



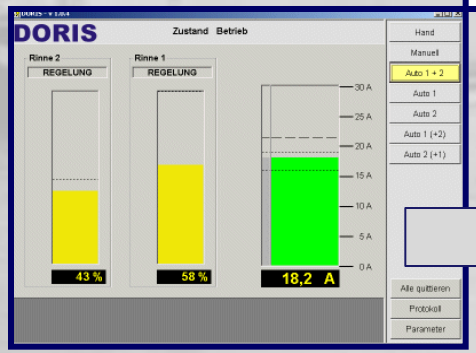
DredgerControl



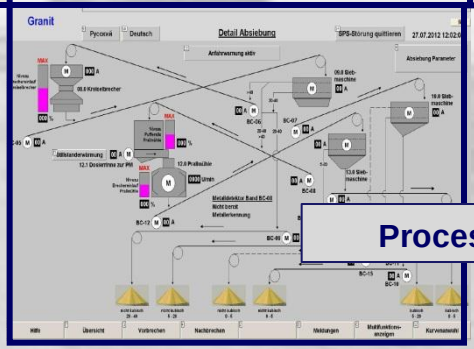
Akorel control system



Energy-monitoring



Dosing-Tube-Control



ProcessingControl

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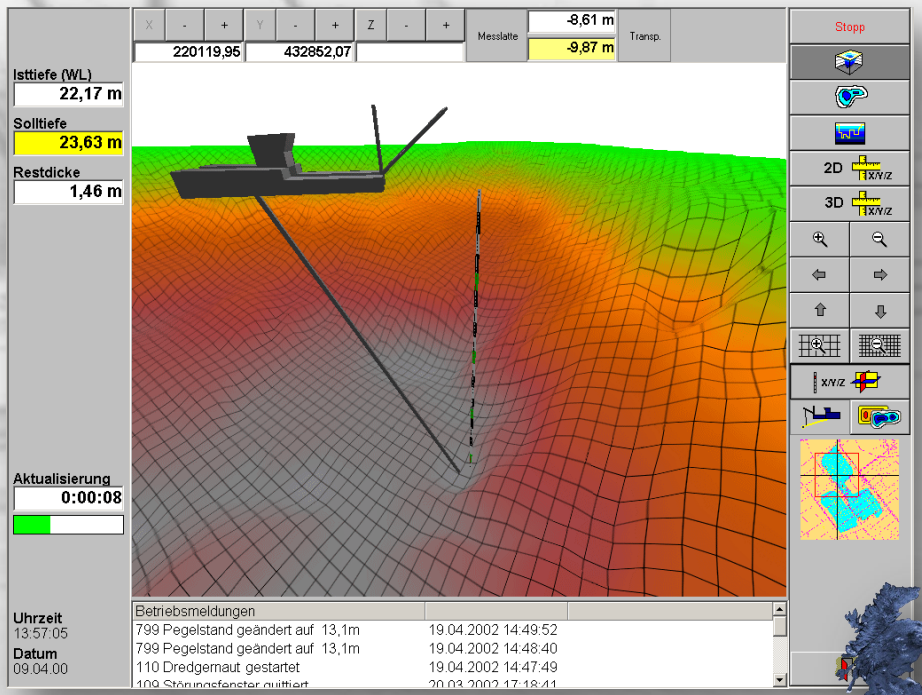
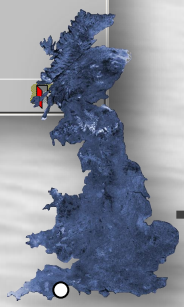
Torquay

The excavation monitoring system for the gravel- and sand-industry

DredgerNaut

- *Objective*
- *Technique*
- *Precision*
- *Functionality*





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Objective

Excavation monitoring systems are used to
- determine the exact position of the excavation device and the suction head and
- document the progress of the excavation.

Benefits
- Efficient primary extraction
- Selective secondary extraction (reworking)
- Preparation of „harmonic“ ground-areas
- Precise creation of grown embankments
- Prevention of overstepping

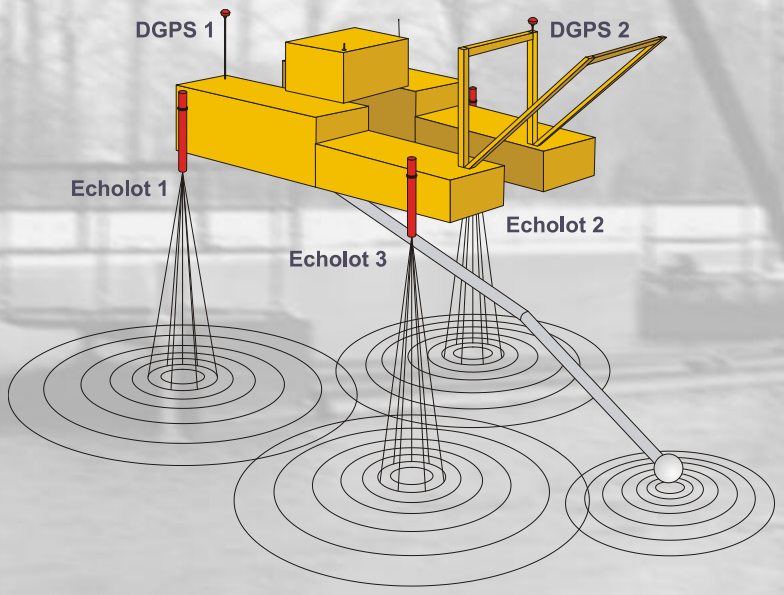
Aim

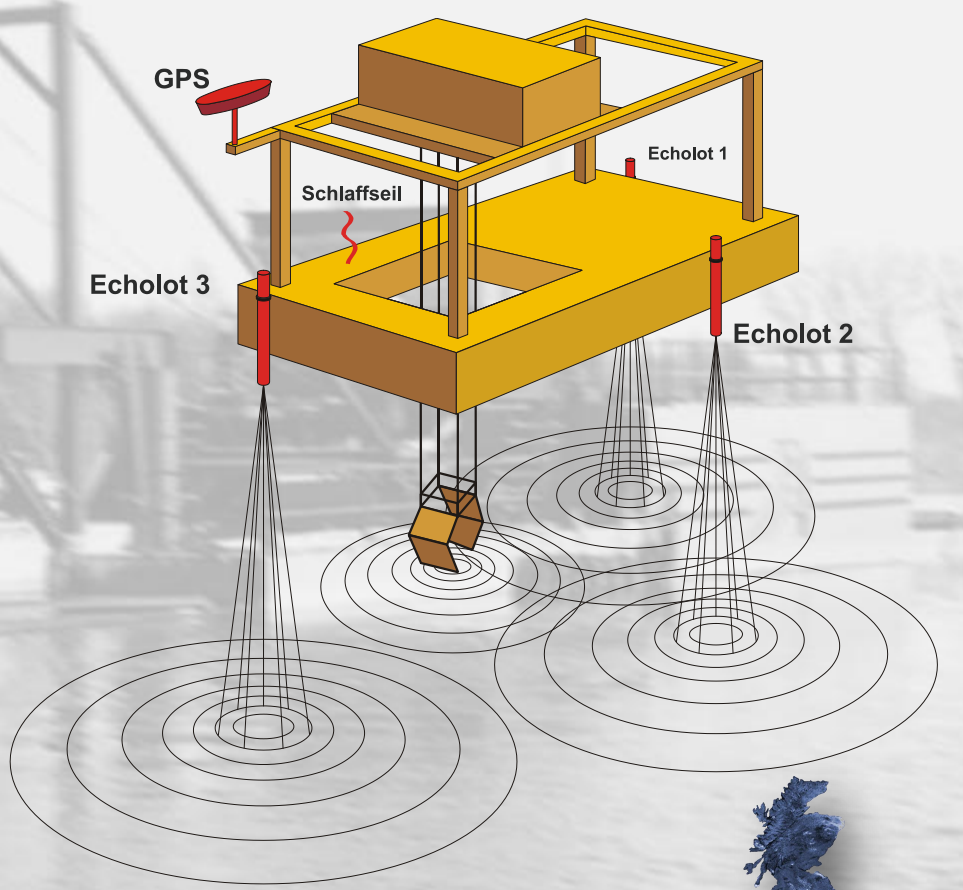
- fast and thorough extraction, while combining
- low energy consumption and wear with high efficiency

Standard equipment

The equipment of DredgerNaut systems consists basically of:

- Computer
- DGPS-Receiver(s)
- Echo-sounders





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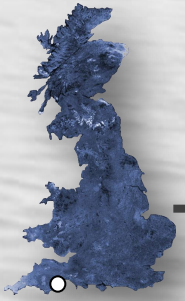
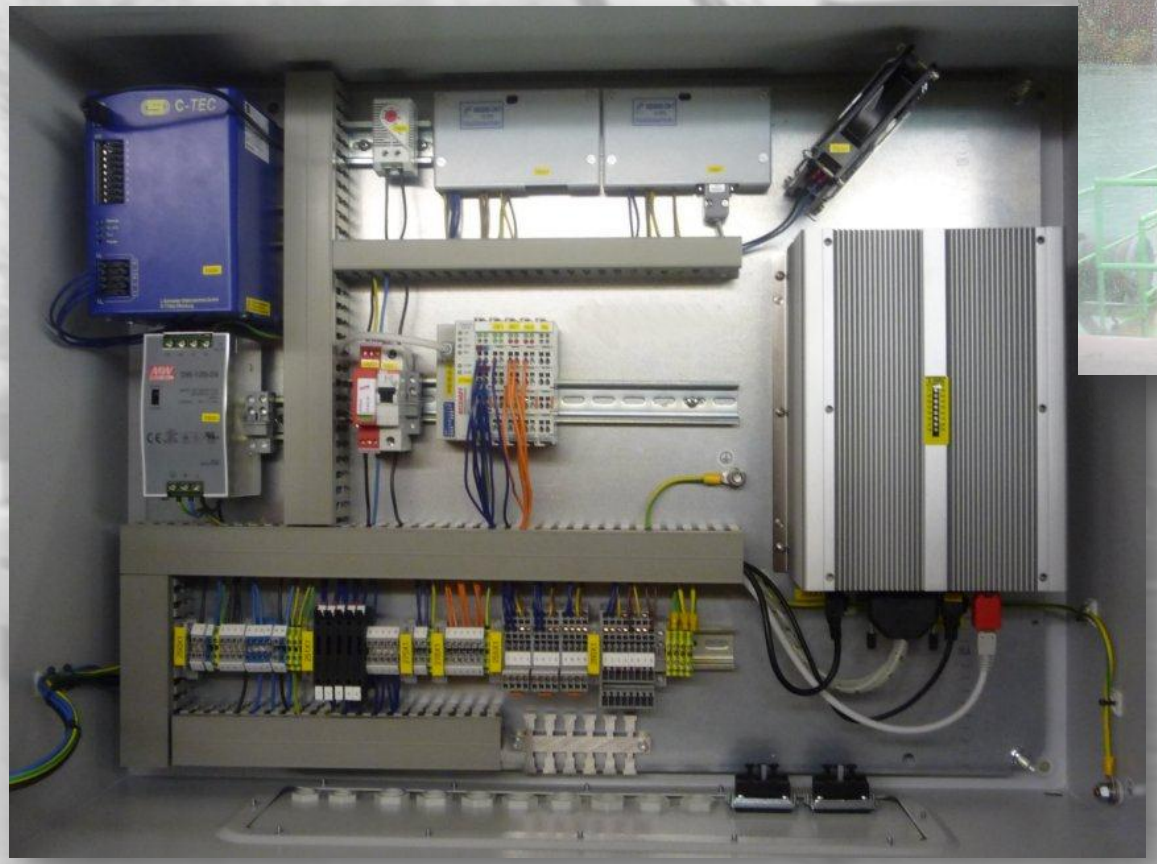


Systems engineering

Electrical cabinet



22“-Touch-display

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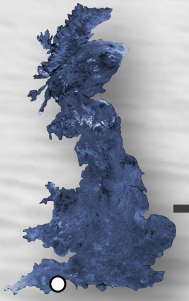
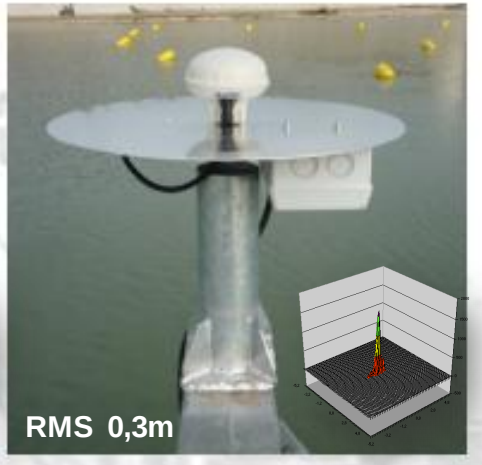


Sensors



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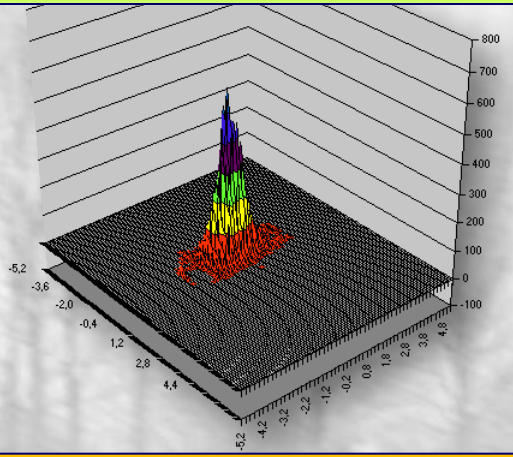
Accuray of GPS-Receivers

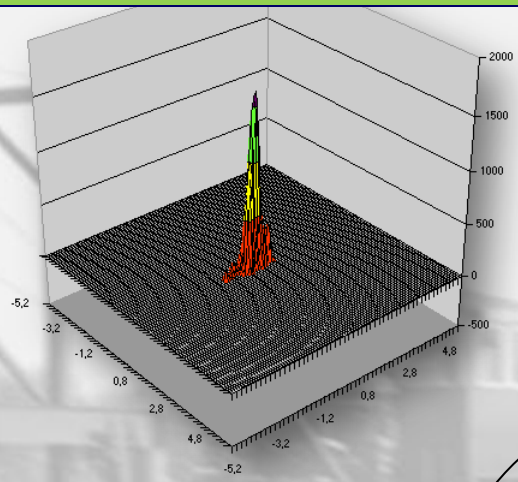
DGPS with EGNOS-correction



Mean accuracy:

RMS app. 1 meter

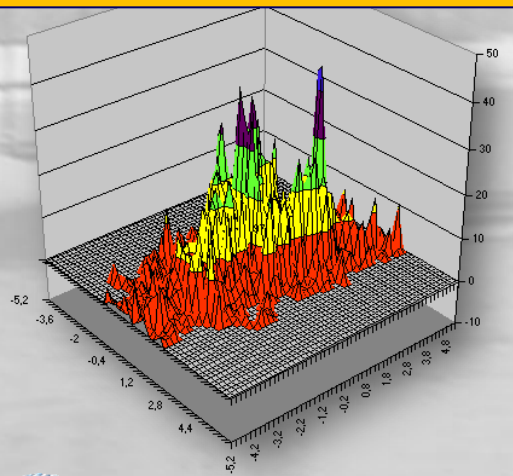
DGPS with OmniSTAR-correction



Absolute accuracy:

ca. 1 meter

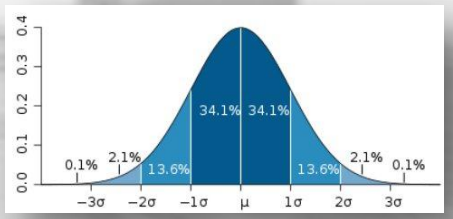
GPS without correction

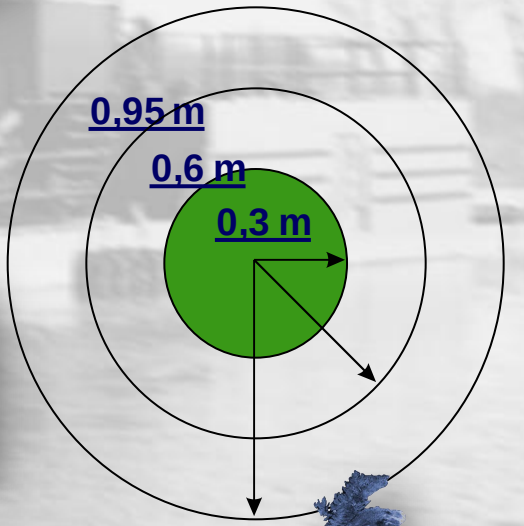


Mean accuracy:

RMS app. 5-10 meters

Deviation





Sigma 1 68,3 % < 0,95 m
Sigma 2 95,5 % < 0,6 m
Sigma 3 99,7 % < 0,3 m

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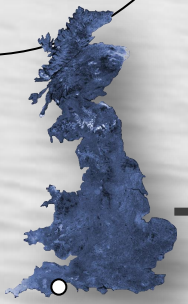
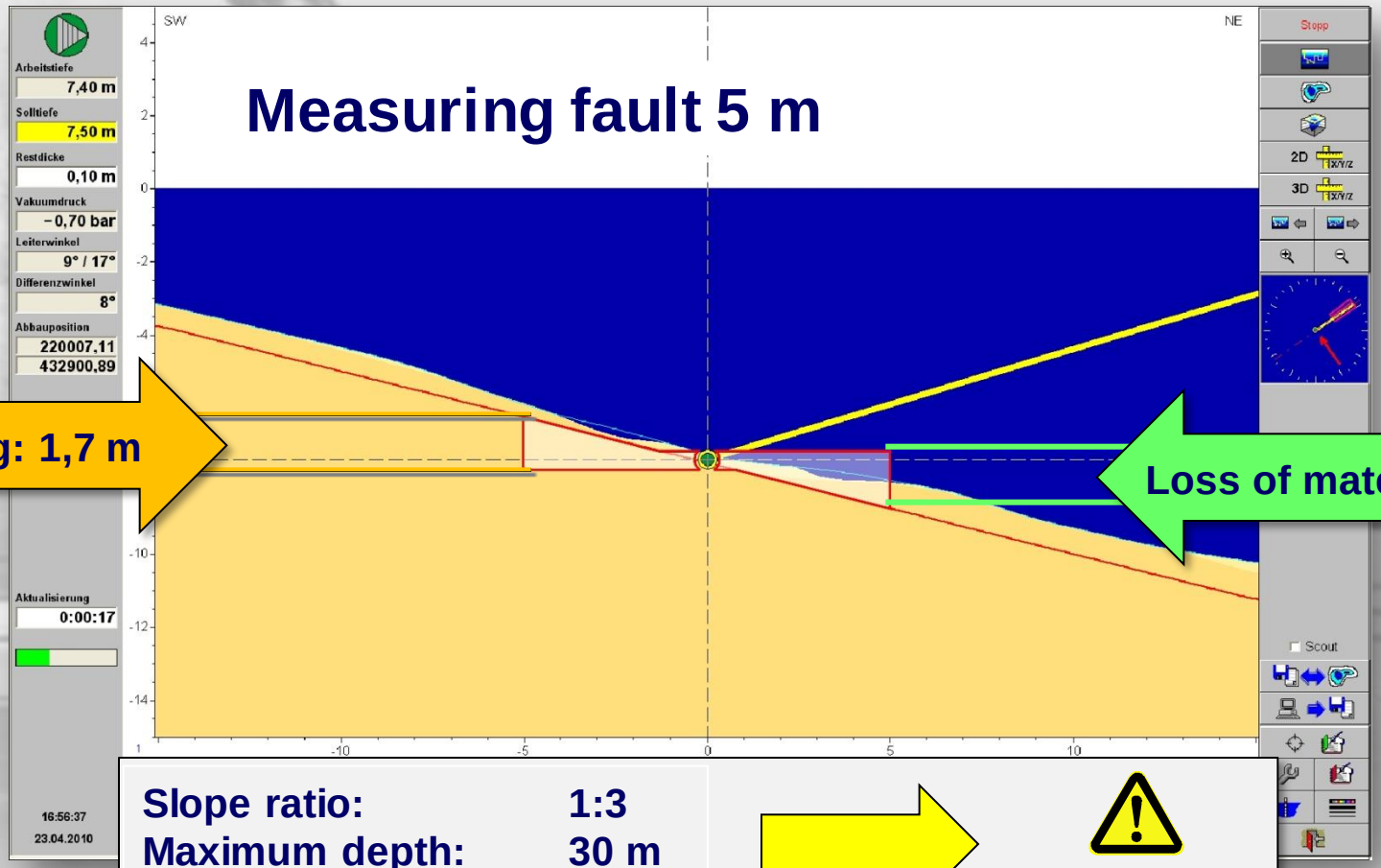


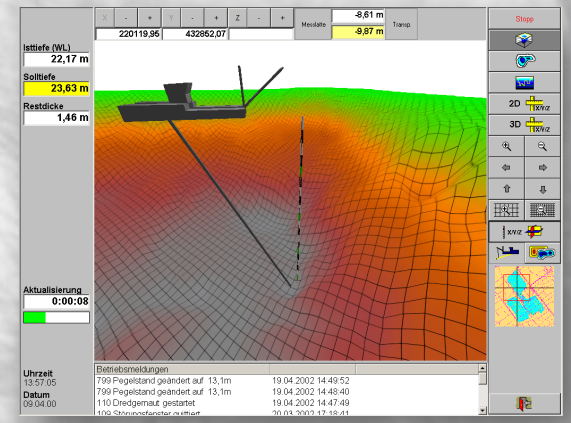
Importance of GPS-accuracy



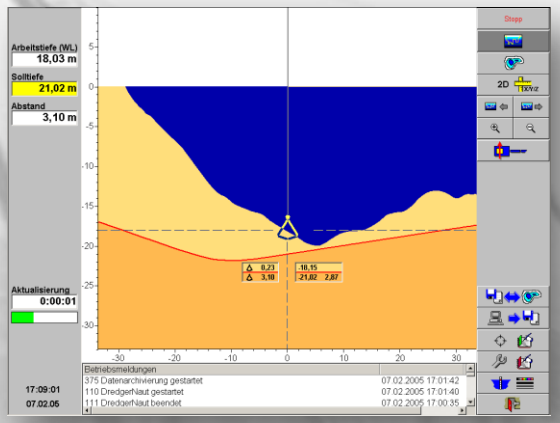
Presentation modes

Team GmbH

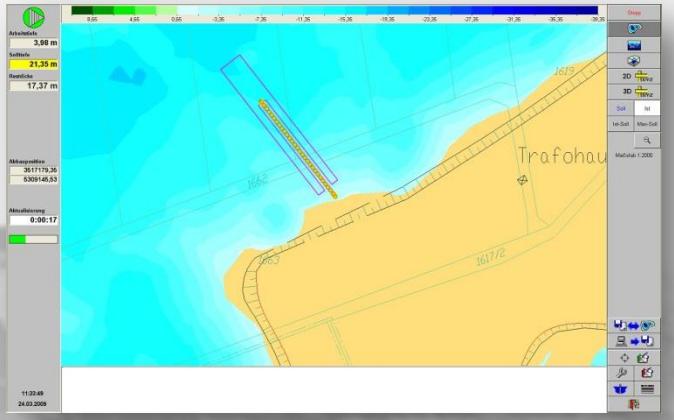
3D-presentation

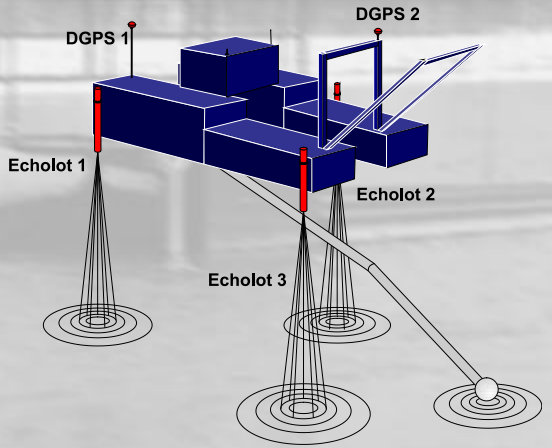


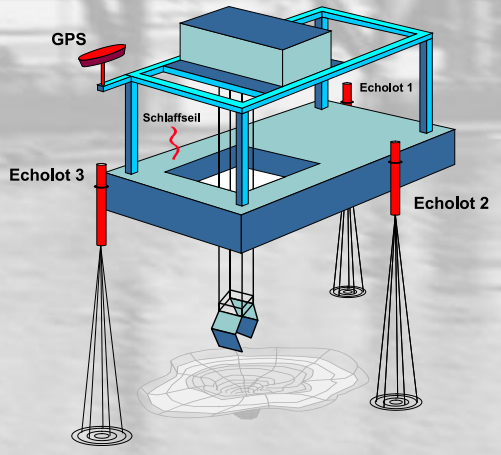
Cross-section presentation

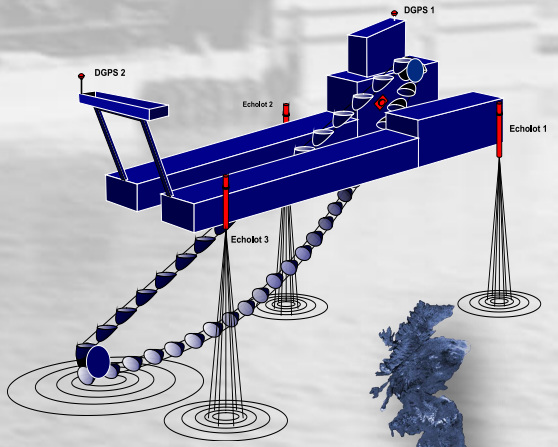


Topographical view









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Topographical view – incl. anchor-ropes

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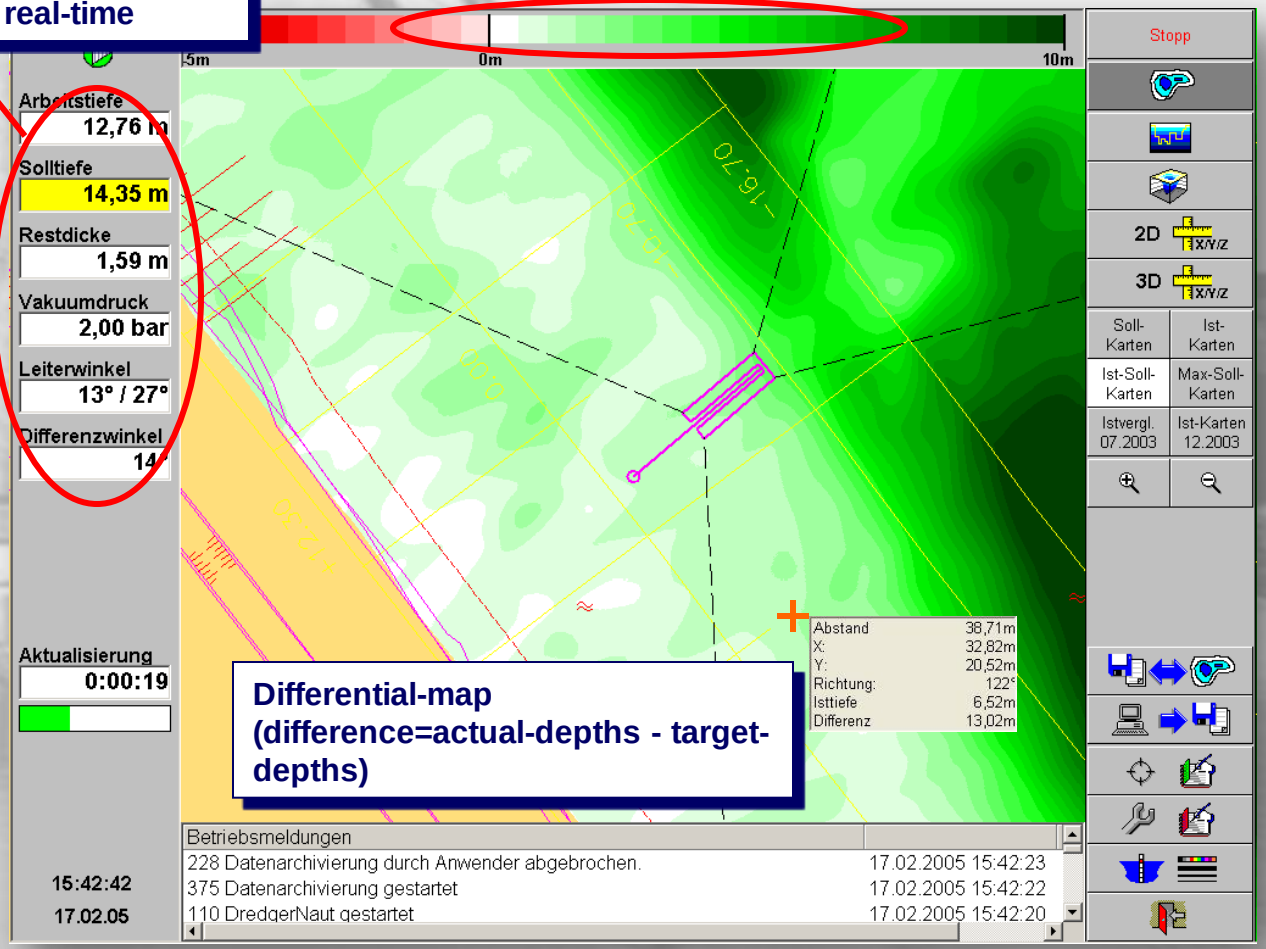
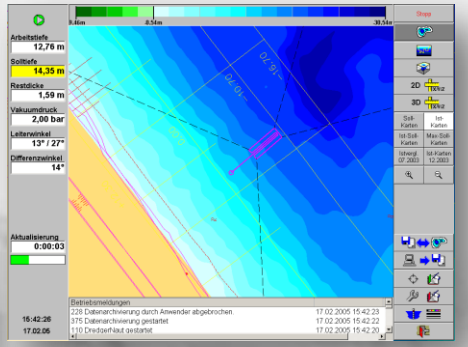
Indication of current depths in real-time

Colour-legend

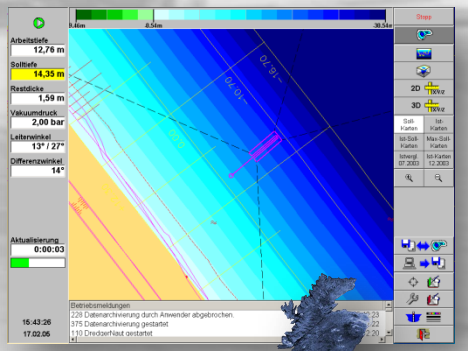


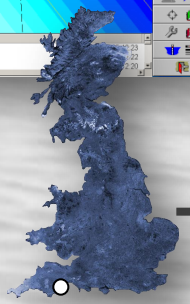
Differential-map (difference=actual-depths - target-depths)

Actual-depths map



Target-depths map





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Cross-section presentation – suction dredger

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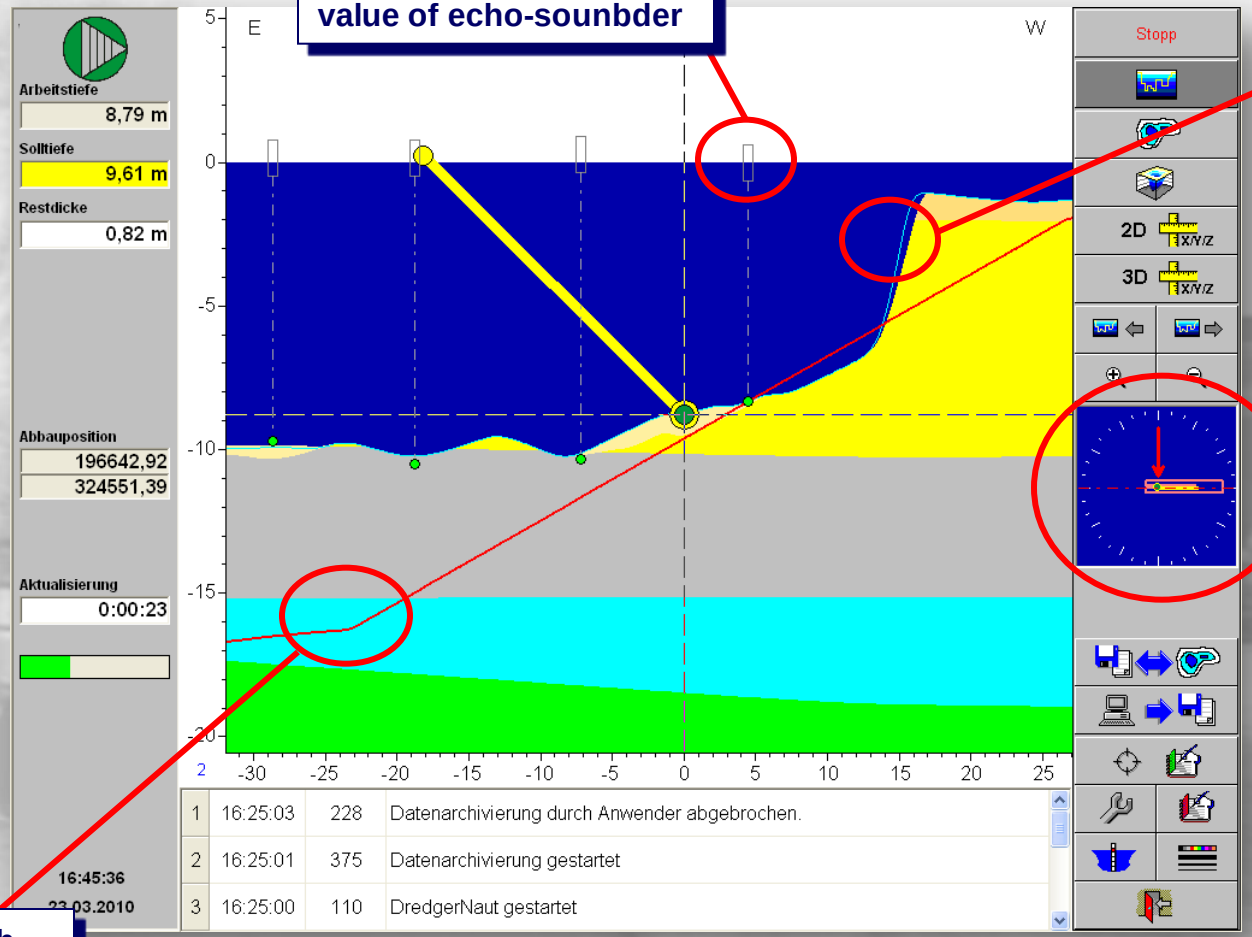

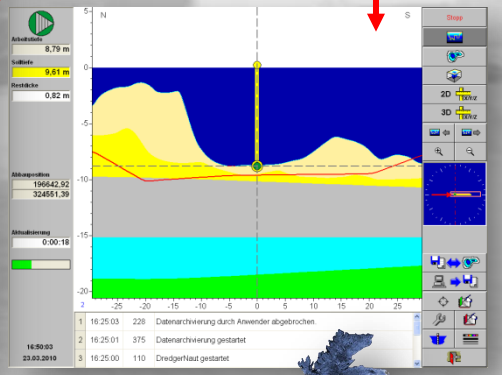

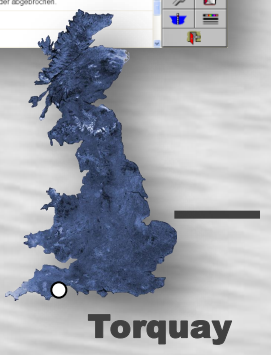

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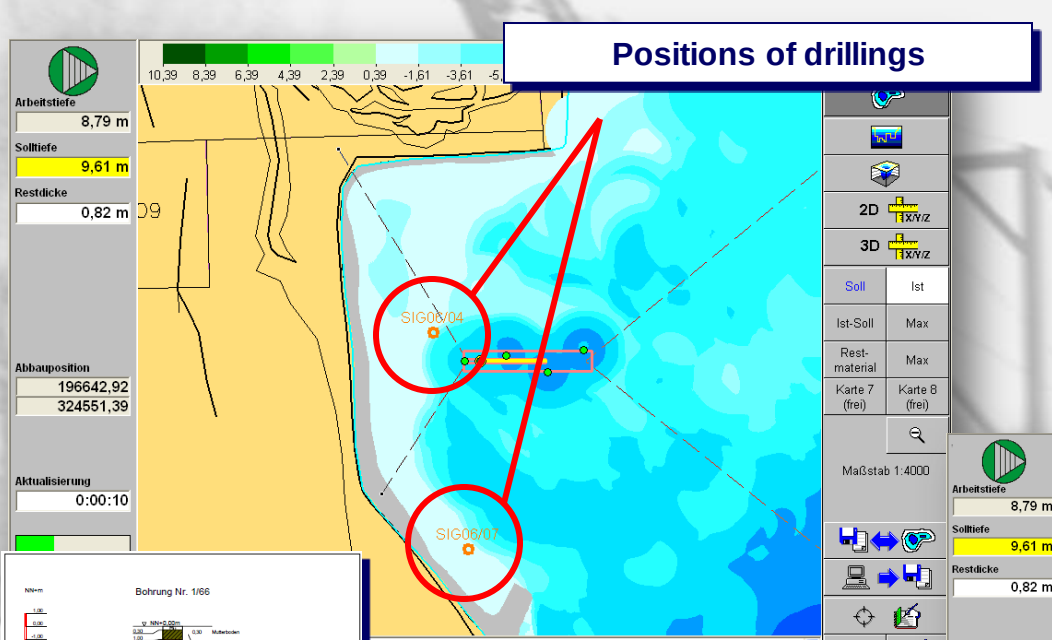
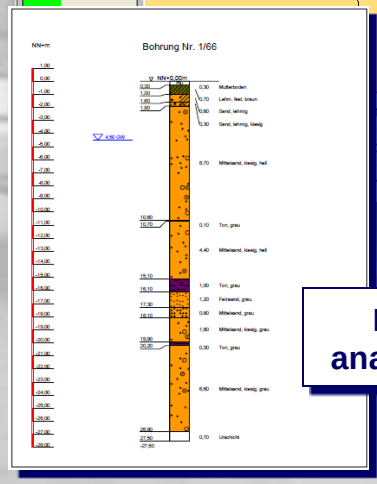
Drilling data and layers/beds

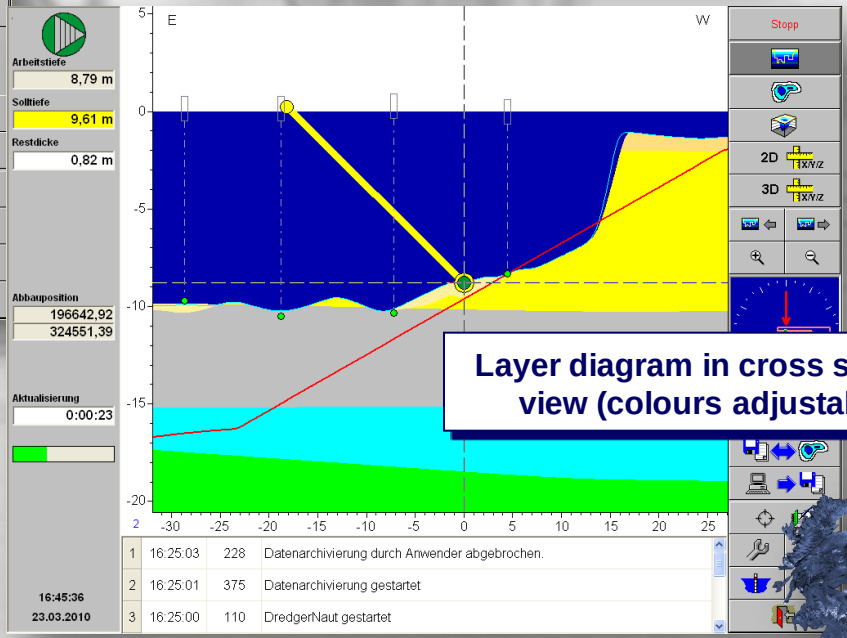
Team GmbH



Comments for the position



Results of the analysis of drillings



Layer diagram in cross section view (colours adjustable)

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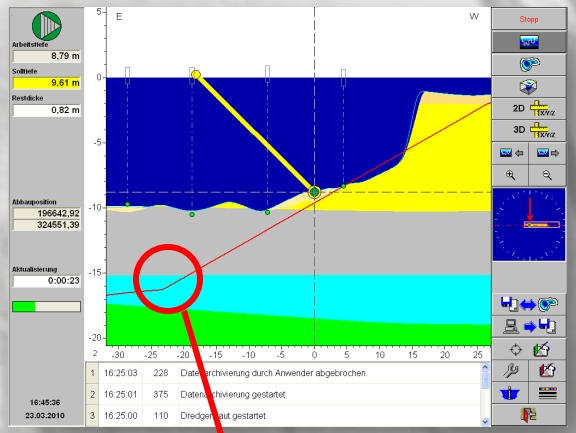
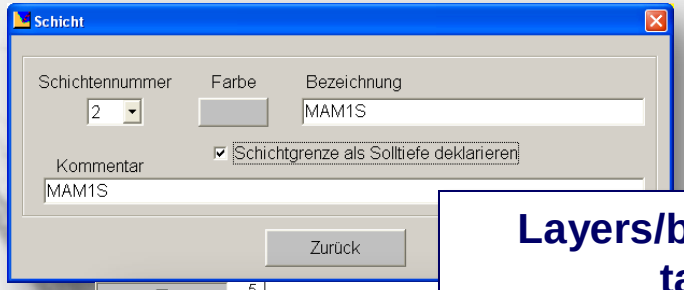
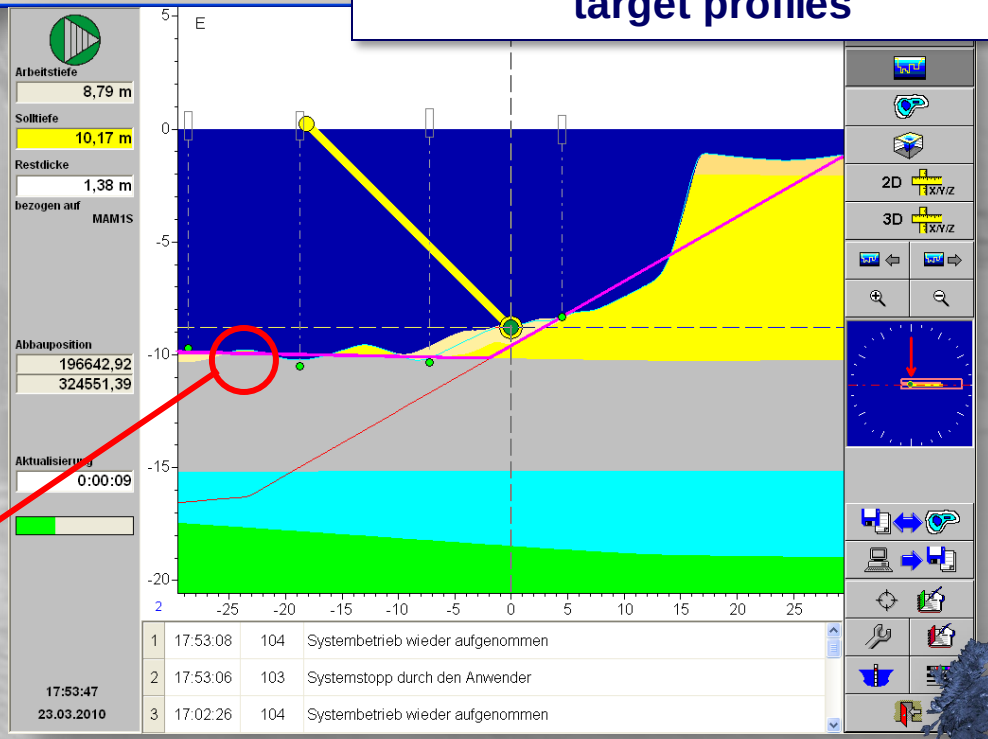
Layers/beds as target profiles



Target profile (administration)

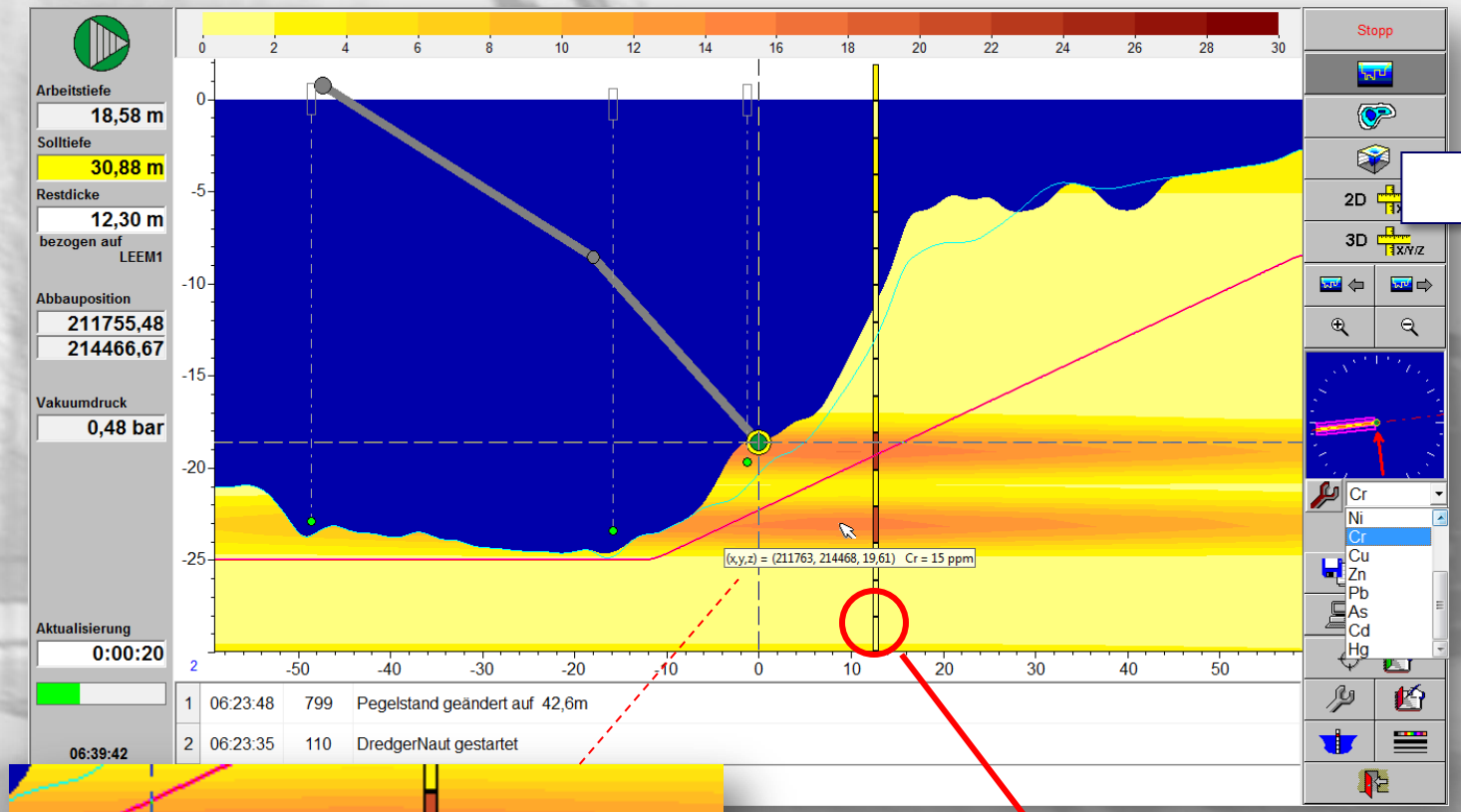


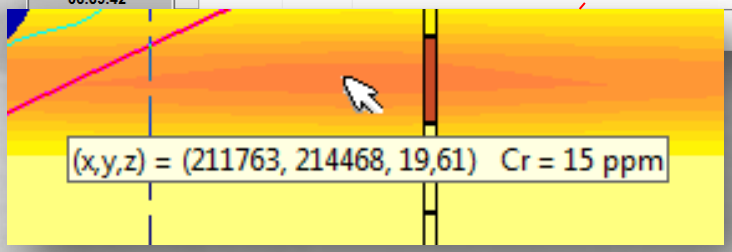
Layers/beds can be used as target profiles



Working profile

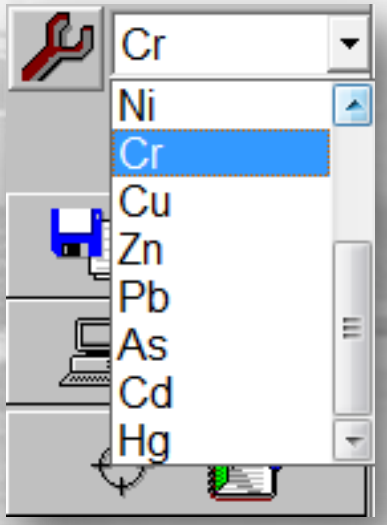
Models of contamination



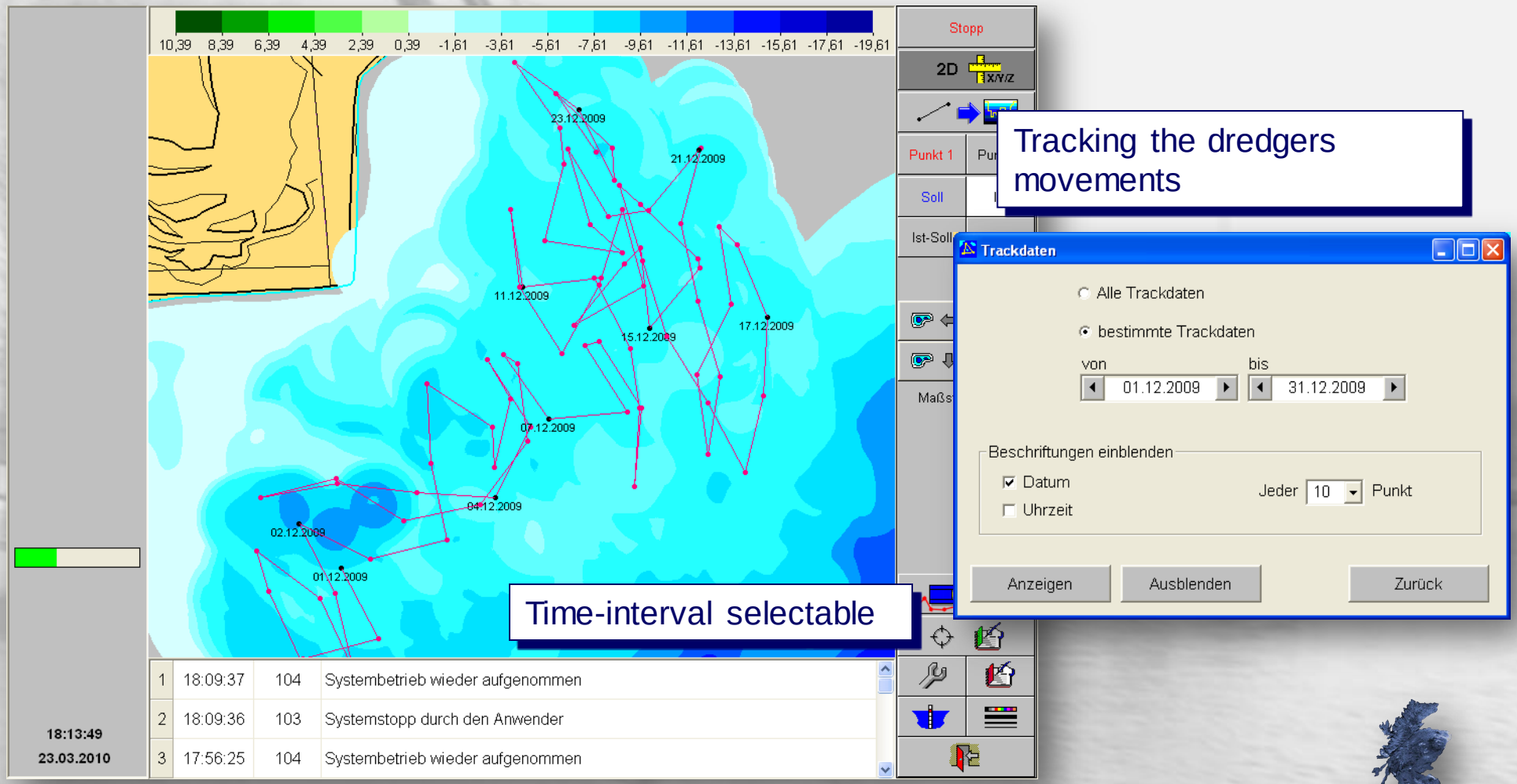


Drill

Listbox



Track-data



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Operations-protocol incl. Excel-export

Team GmbH

Material- and Operational-time

Working hours

Max. depths

Operator

Water-level logging

Position at noon

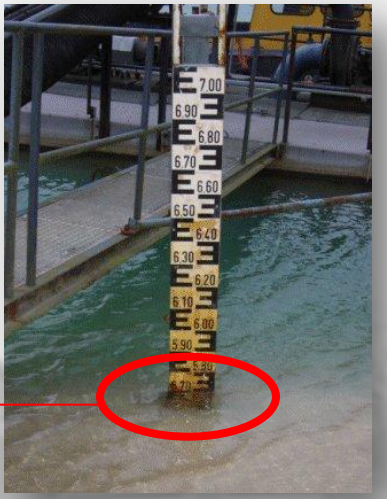
Excel-export

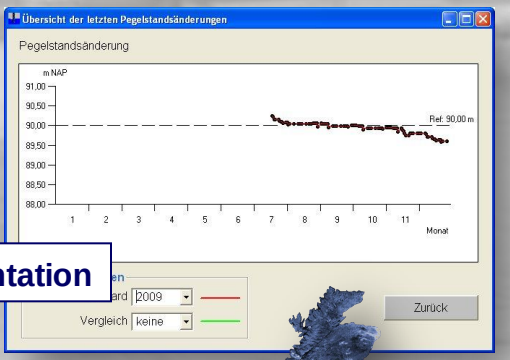
Water-level documentation

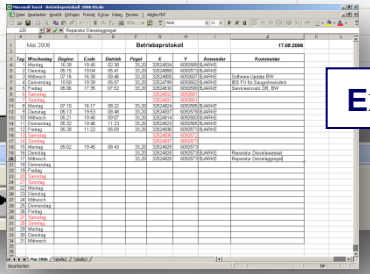
Tag	Wochentag	Beginn	Ende	Materialzeit	Betriebszeit	Pegel	X:	Y:	Tiefe	Anwender	Kommentar
1	Dienstag	07:21	21:38	12:09	14:16	89,81	196671	324518	79,94	ADMIN	
2	Mittwoch	07:16	21:38	11:39	14:20	89,81	196697	324564	79,54	ADMIN	
3	Donnerstag	07:26	21:39	11:58	14:00	89,81	196716	324570	79,86	ADMIN	
4	Freitag	07:19	21:55	11:46	14:13	89,81	196651	324565	79,63	ADMIN	
7	Montag	06:15	20:34	12:26	14:19		196725	324575			
8	Dienstag	06:11	21:01	10:34	12:51	89,81	196734	324582	80,79	ADMIN	
9	Mittwoch	06:22	20:40	13:22	14:18	89,79	196742	324599	81,48	ADMIN	
10	Donnerstag	12:25	23:59	6:46	7:22	89,71	196730	324612	81,63	ADMIN	
11	Freitag	06:15	23:59	13:01	14:29	89,71	196710	324611	81,38	ADMIN	
12	Samstag						196710	324606	86,72		
13	Sonntag						196710	324605	86,72		
14	Montag	07:32	21:38	11:47	14:03	89,71	196738	324621	80,88	ADMIN	
15	Dienstag	08:14	21:38	11:25	13:22	89,68	196744	324615			
16	Mittwoch	07:18	21:37	13:22	14:18	89,66	196751	324631			
17	Donnerstag	07:05	21:36	13:25	14:31	89,65	196768	324592			
18	Freitag	06:52	21:38	13:45	14:43	89,62	196760	324587	81,10	ADMIN	
19	Samstag										
20	Sonntag										
21	Montag	06:55	20:42	11:24	13:39	89,64	196757	324638	81,52	ADMIN	
22	Dienstag	06:21	20:39	12:28	14:16	89,64	196710	324636	81,45	ADMIN	
23	Mittwoch	06:16	20:45	10:52	13:30	89,59	196718	324665	81,83	andre	
24	Donnerstag	10:55	11:47	0:25	0:52	89,61					
25	Freitag										
26	Samstag										
27	Sonntag										
28	Montag										
29	Dienstag										
30	Mittwoch										
31	Donnerstag										

Monat 12.2009

Excel Pegelstände Zurück







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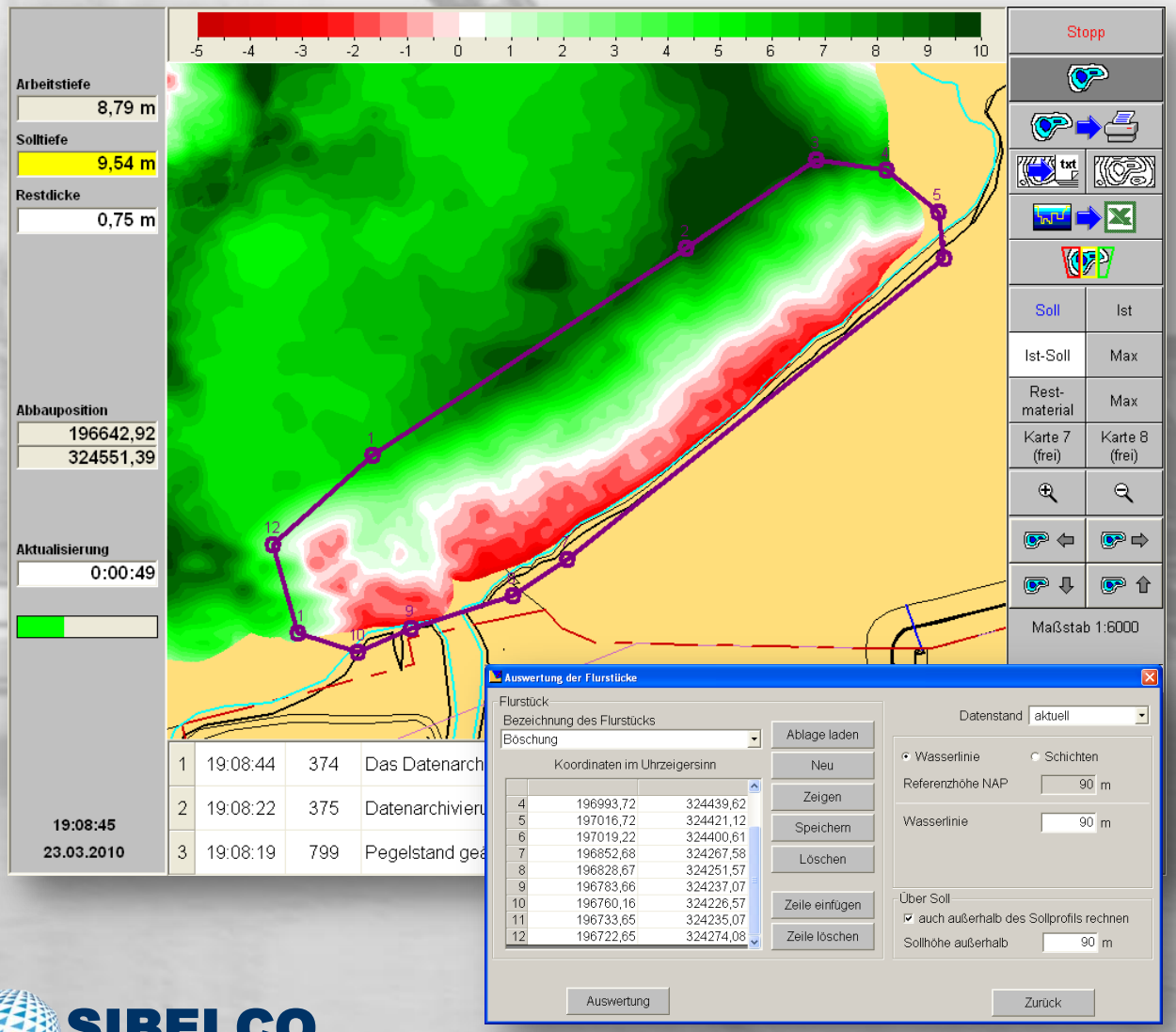
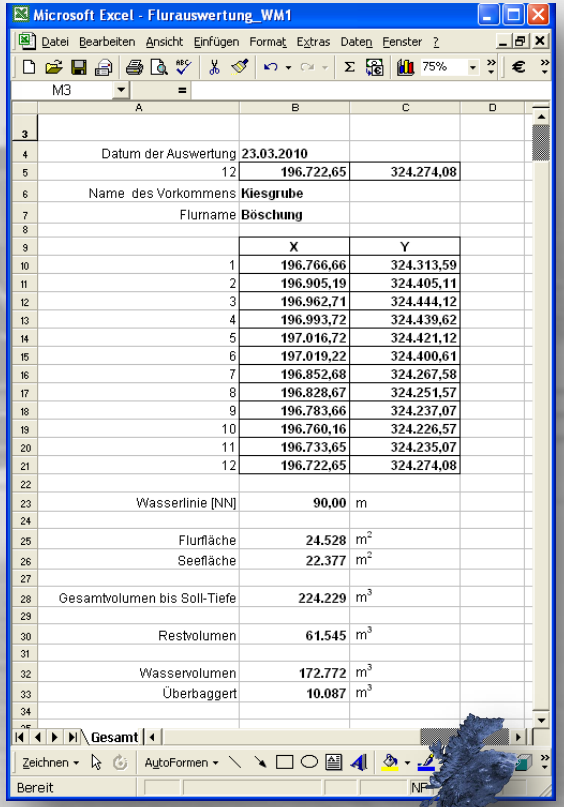
Central-station – deposit evaluation/volume calculations

Team GmbH



Data-interface to Excel



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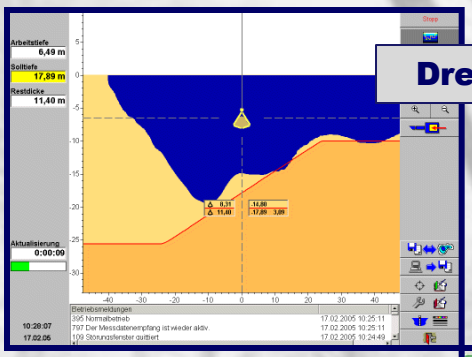
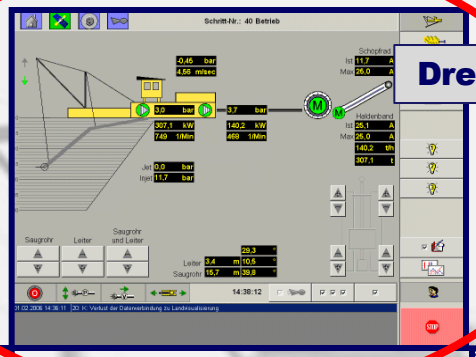
DredgerTec – DredgerControl in detail

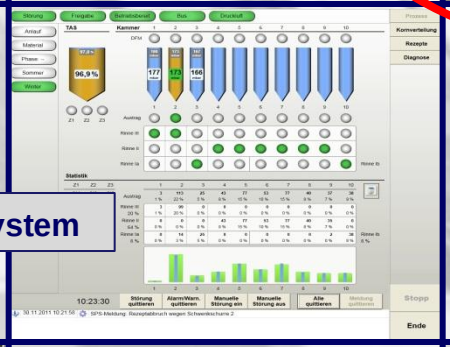
Team GmbH



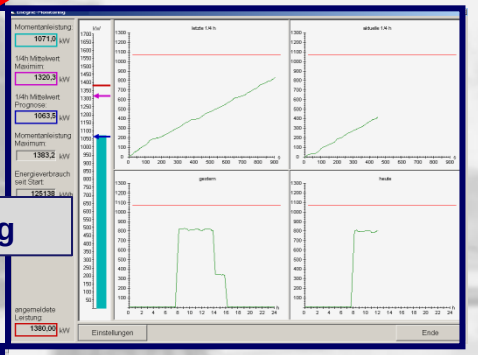
DredgerNaut



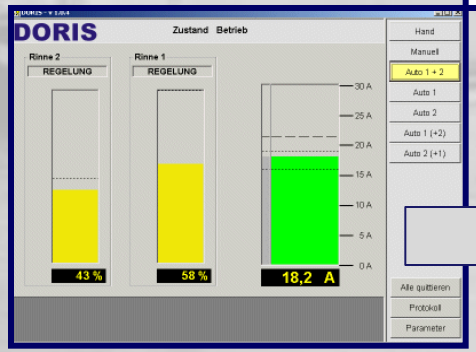
DredgerControl



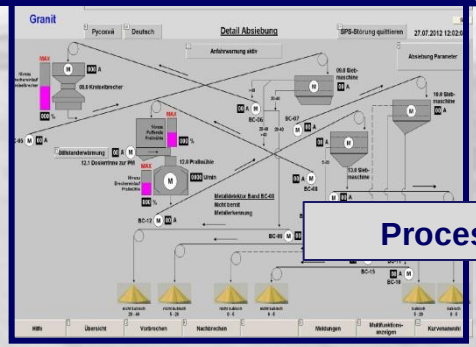
Akorel control system



Energy-monitoring



Dosing-Tube-Control



ProcessingControl

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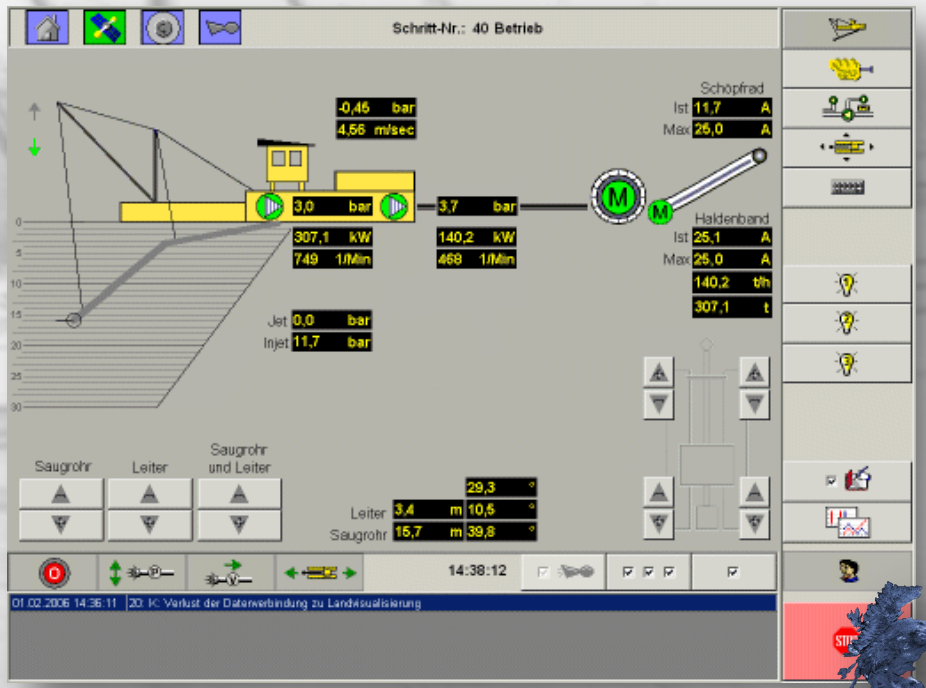
The suction-dredger control-system for the sand and gravel-industy

DredgerControl

- *Objective*
- *Technique*
- *Funktionality*
- *Data-analysis*



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Objective

Control-systems are tasked with

- Visualisation functions
- Monitoring- and signalling-functions
- Regulation functions
- Remote-control functions
- Interfaces for excavation-monitoring-systems
- Dokumentation functions

Aim

- Relief the dredger-operator
- Increase the production output
- Homogenise the flow of the material-water-mix
- Prevent disturbances/accidents
- Damage limitation during accidents
- Collect data needed to optimise the process
- Correlate and decrease energy consumption
- Detect wear
- Optimise maintenance
- Wear reduction
- Increase operator motivation by visualising the aggregate output

Schematical setup of a suction-dredger

Drives

- Sand pump
- Jet pump
- Gland pump
- Ladder winch
- Suction-tube hoist

Sensors

- Vacuum sensor
- Back pressure sensor
- Gland pressure sensor
- Jet pressure sensor
- Inclinometer ladder
- Inclinometer suction-tube

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Visualisation views

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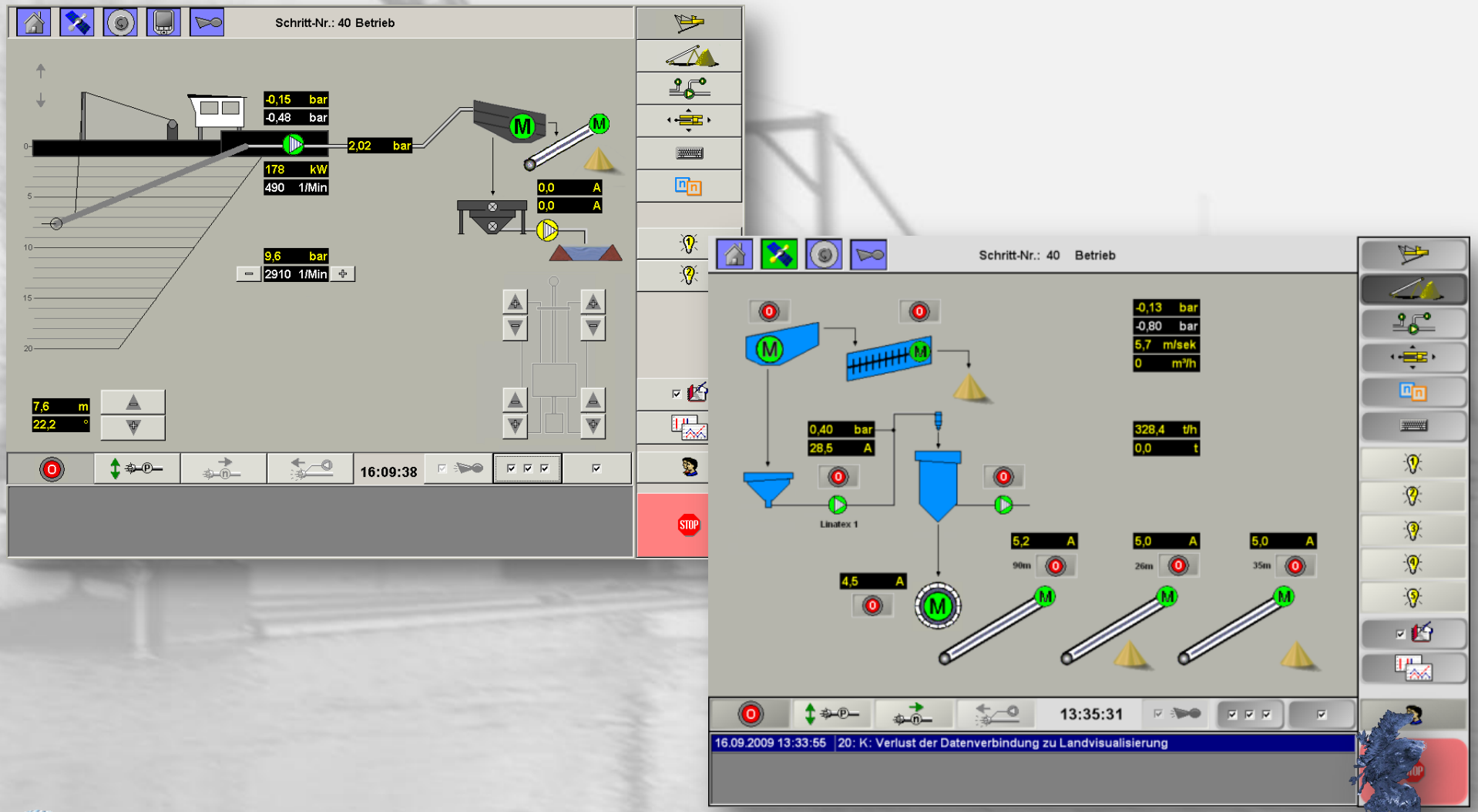

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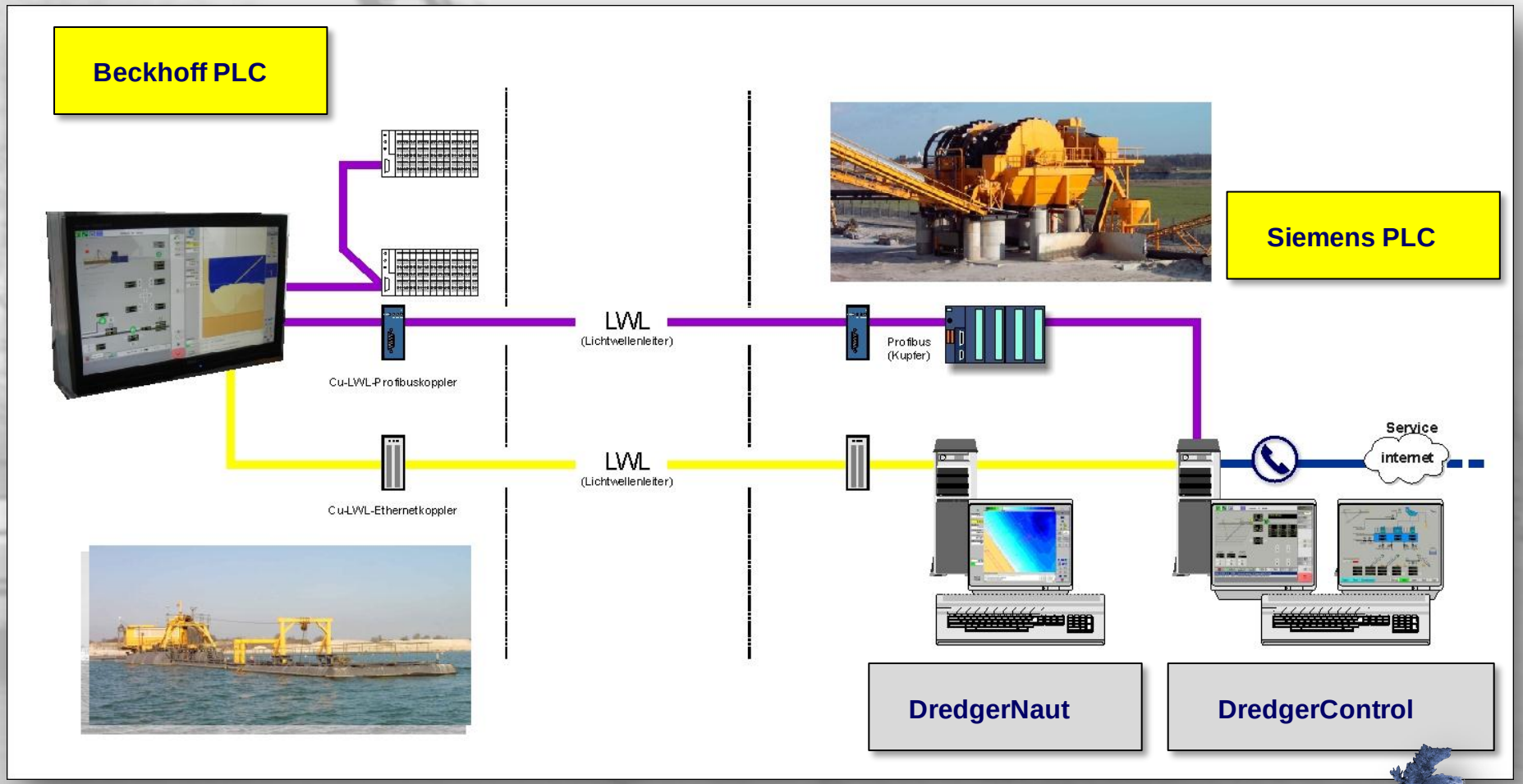
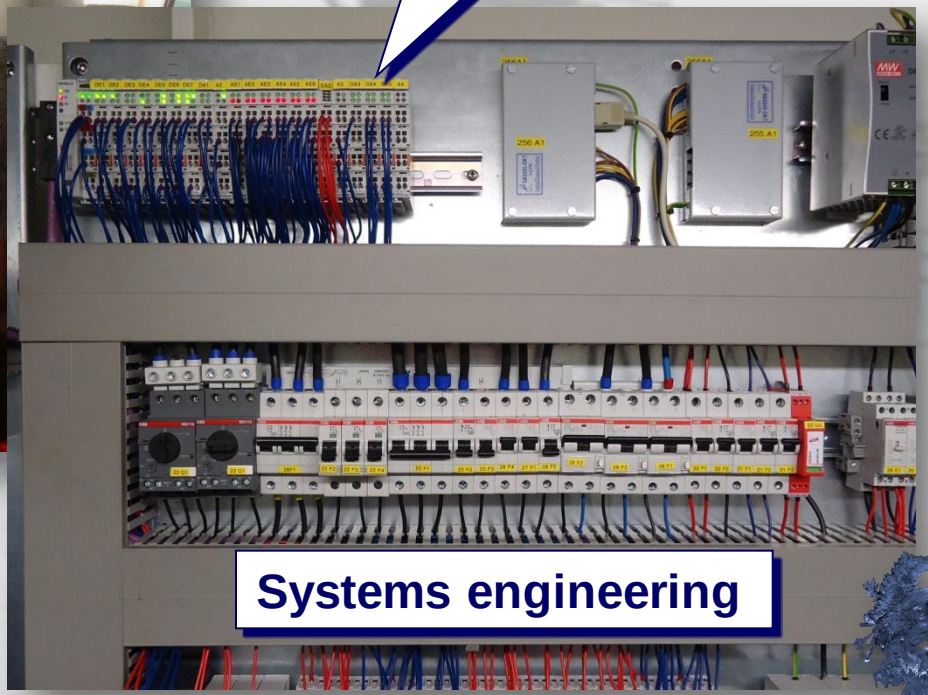
Plant structure – connection between different PLCs



Systems engineering

27“-Display

PLC control



Systems engineering

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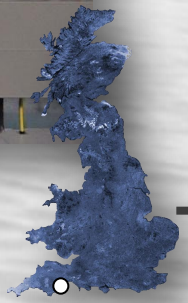

Torquay

Regulation strategies

- Vacuum regulation
- Flow-velocity regulation
- Back pressure monitoring
- Jet regulation

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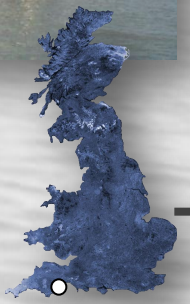
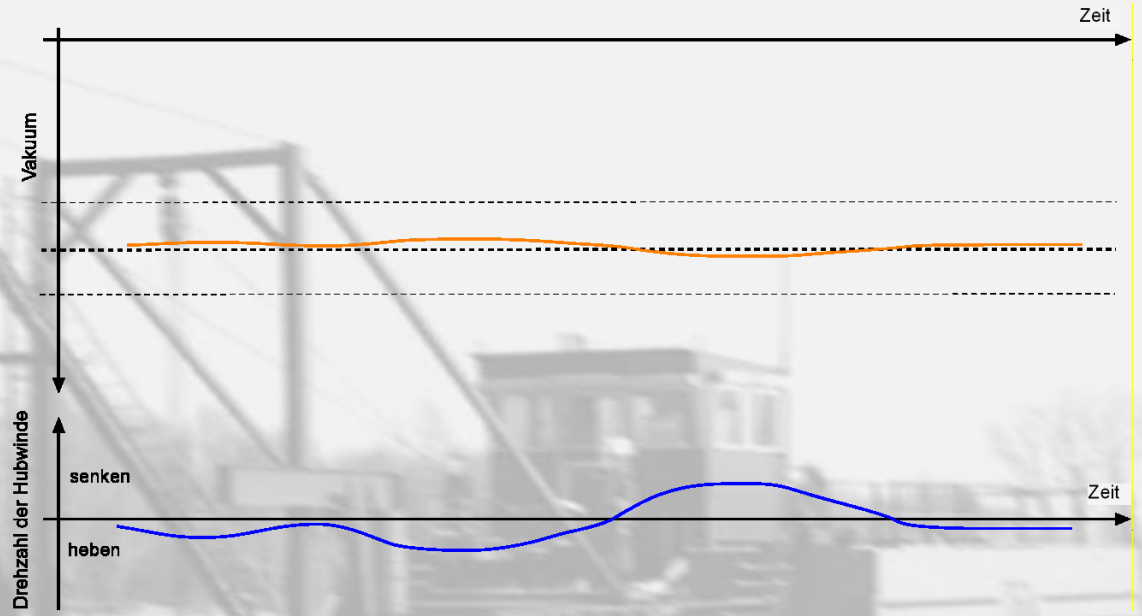


Vacuum regulation

- The actual regulation is carried out by lifting and lowering the suction tube.
- For normal operation the regulation has to be sensitive.
- But during critical situations the winch cannot react too fast.

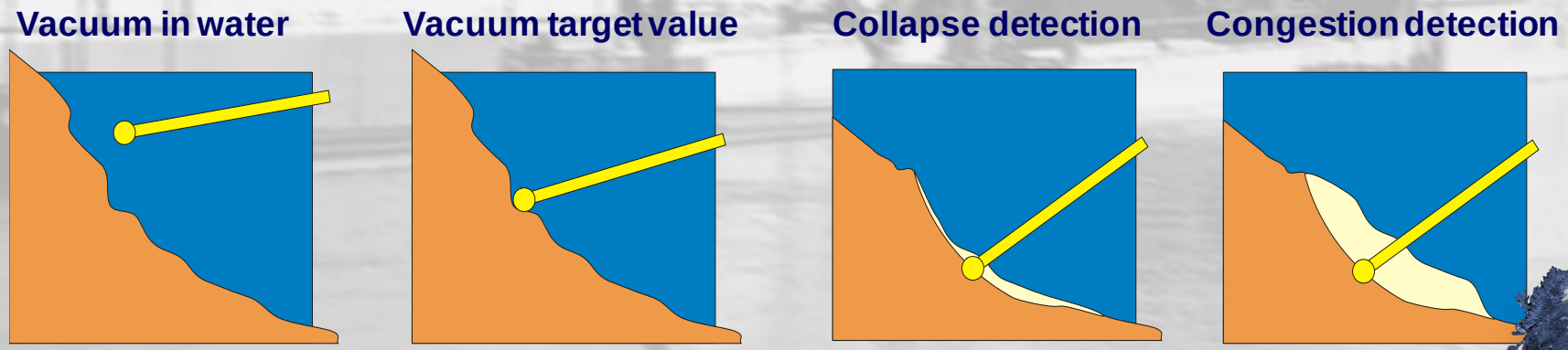


- Shown is the regulation of the hoist motor by means of a frequency drive.
- During regulation-operation there is almost no actual movement.

Vacuum regulation

Handling of disturbances is important for the operation:

- **Collapse detection**
- **Congestion detection**
- **Limitation of the lifting force**

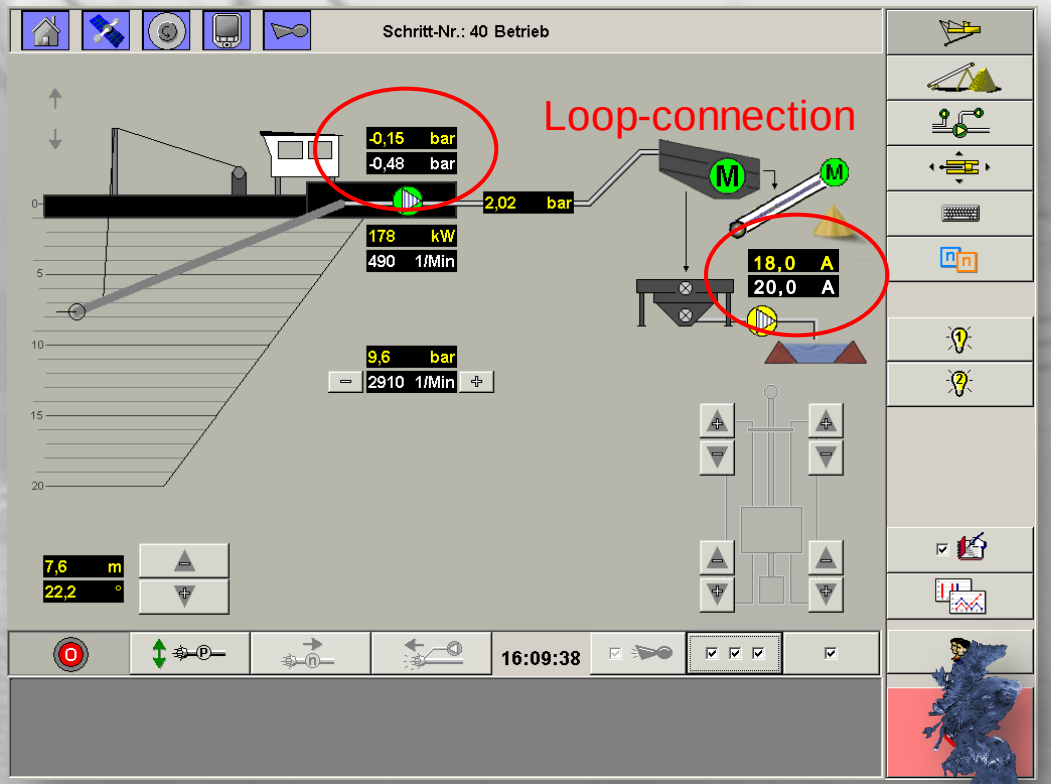


Vacuum adaption

- **Vacuum adaption adapts the vacuum target value according to the needs of the process.**
- **Vacuum adaption reacts to the working point of aggregates that may become a bottleneck in the operation.**

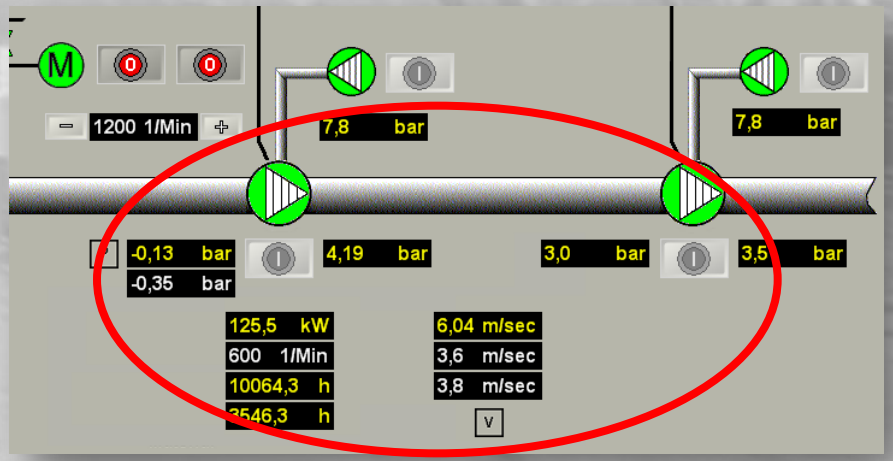
Example

If the current consumed by the belt conveyor is higher than the limit of **20 A** the vacuum target value will be decreased to prevent an overload here. As soon as the value is back inside the normal range, the vacuum target value will be increased again.



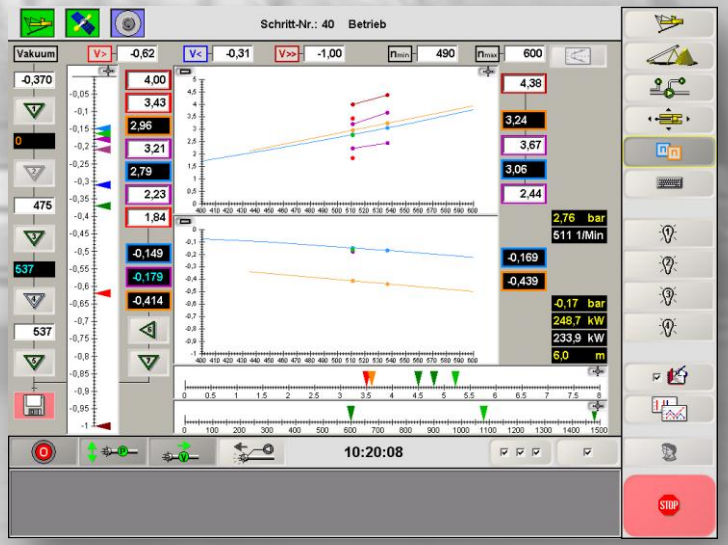
Flow-velocity regulation

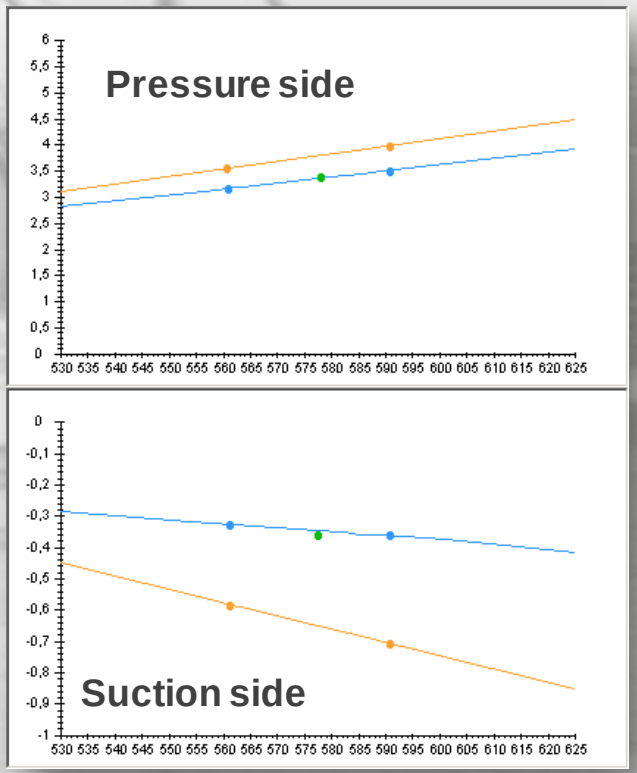
- Flow-velocity regulation influences the flow inside the pressure pipeline.
- The rotational speed of the sand pump is adjusted accordingly.
- The necessary speed is derived from the combination of material and the plant geometry.
- Flow-velocity regulation has a great impact on:
  - Energy consumption
  - Amount of wear
  - Operating reliability (danger of congestion)



Back pressure monitoring

- The pump diagrams depict the suction- and pressure-side of the pump.
- For both back pressure and vacuum the characteristic water- and material- curves are shown in graphical form.
- The parameters for the threshold- and monitoring-values are calculated automatically.





Material-curve

Water-curve

Water-curve

Material-curve

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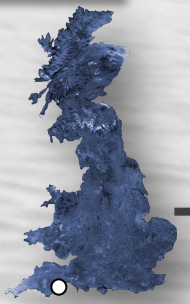
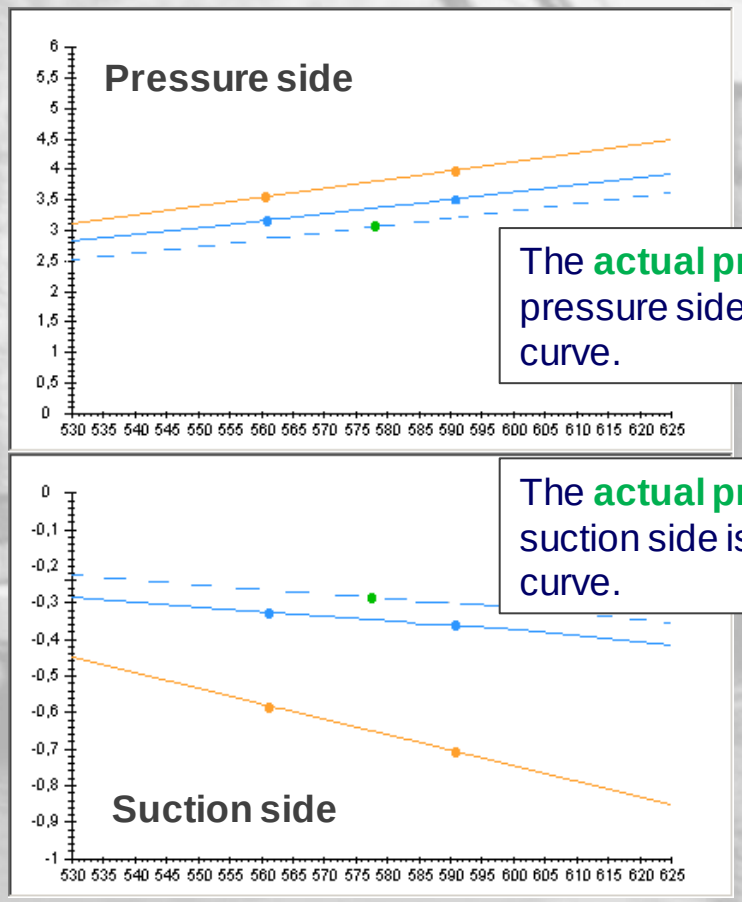


Wear detection

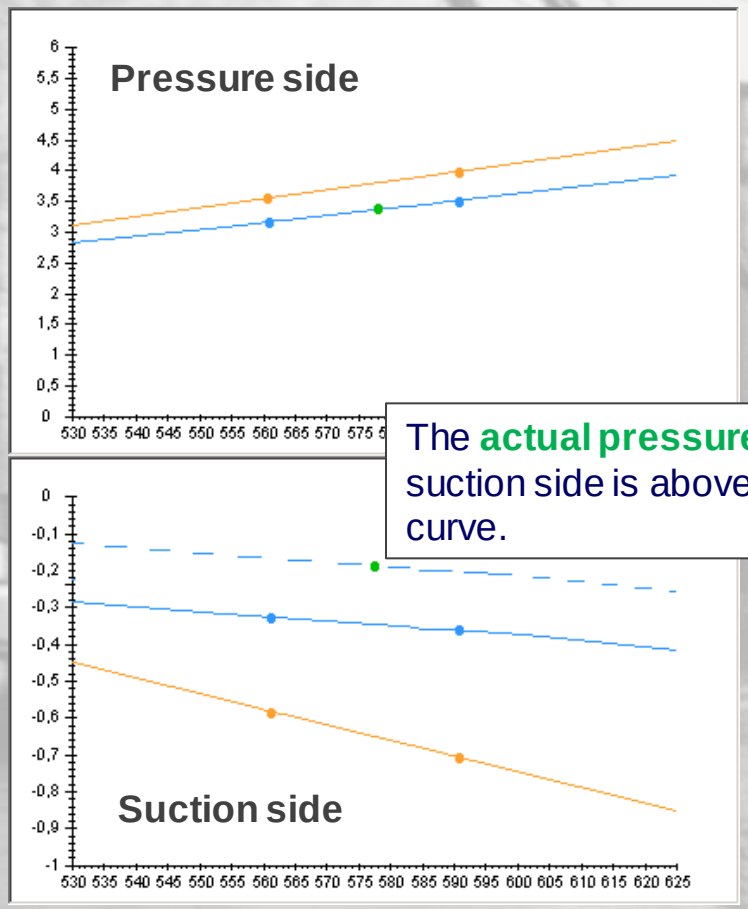


The **actual pressure point** of the pressure side is beneath the water curve.

The **actual pressure point** of the suction side is above the water curve.

General wear

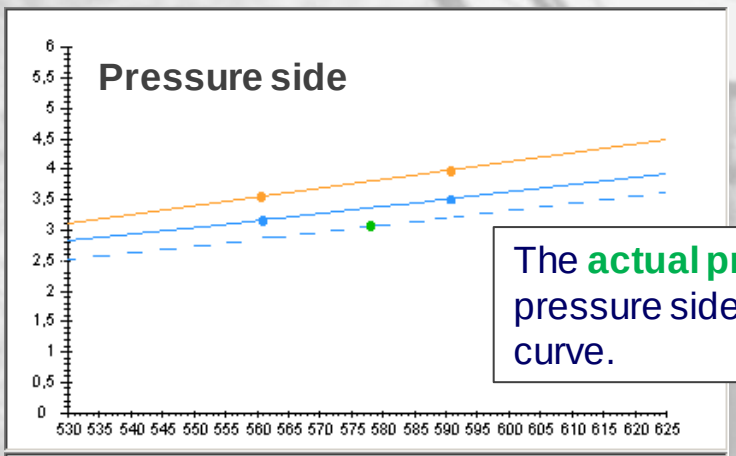
Wear detection



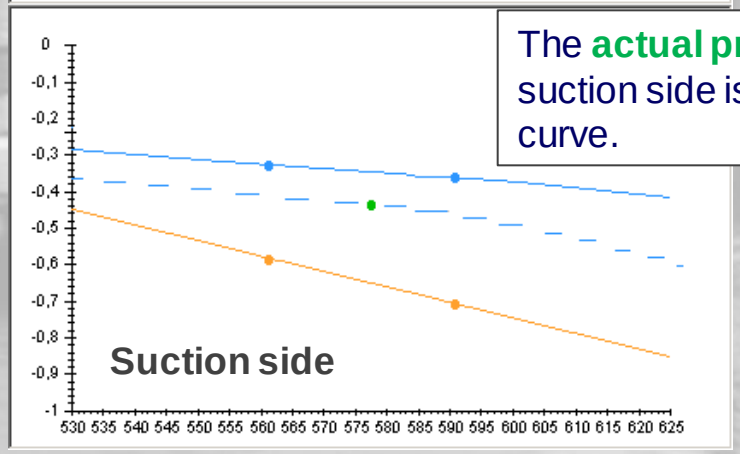
The **actual pressure point** of the suction side is above the water curve.

Leakage on the suction side

Wear detection



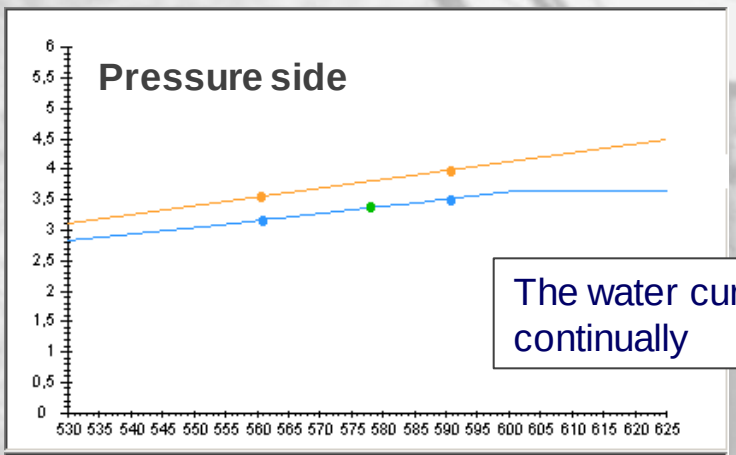
The **actual pressure point** of the pressure side is beneath the water curve.



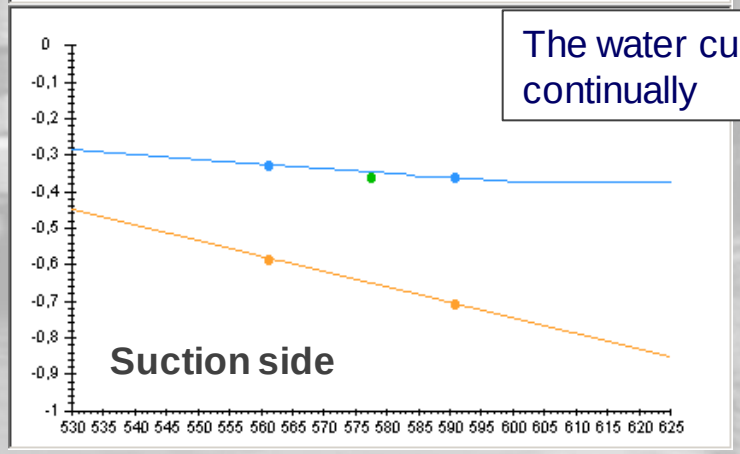
The **actual pressure point** of the suction side is beneath the water curve.

Leakage on the pressure side

Wear detection



The water curve does not ascend continually



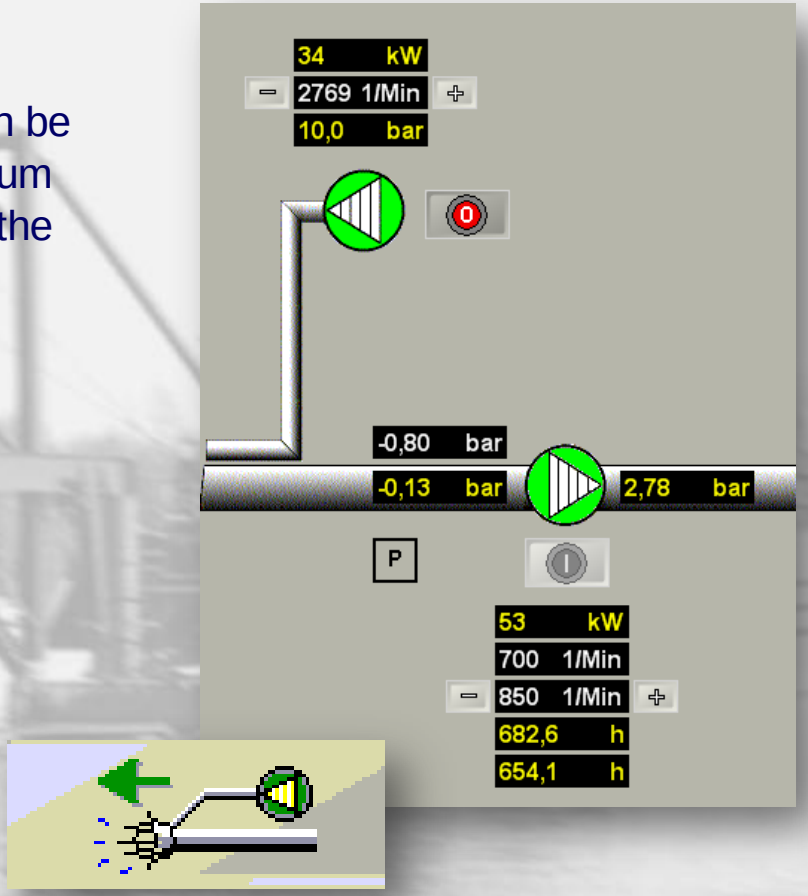
The water curve does not descend continually

Drive is going into power-limit

Rotational speed cannot be increased further

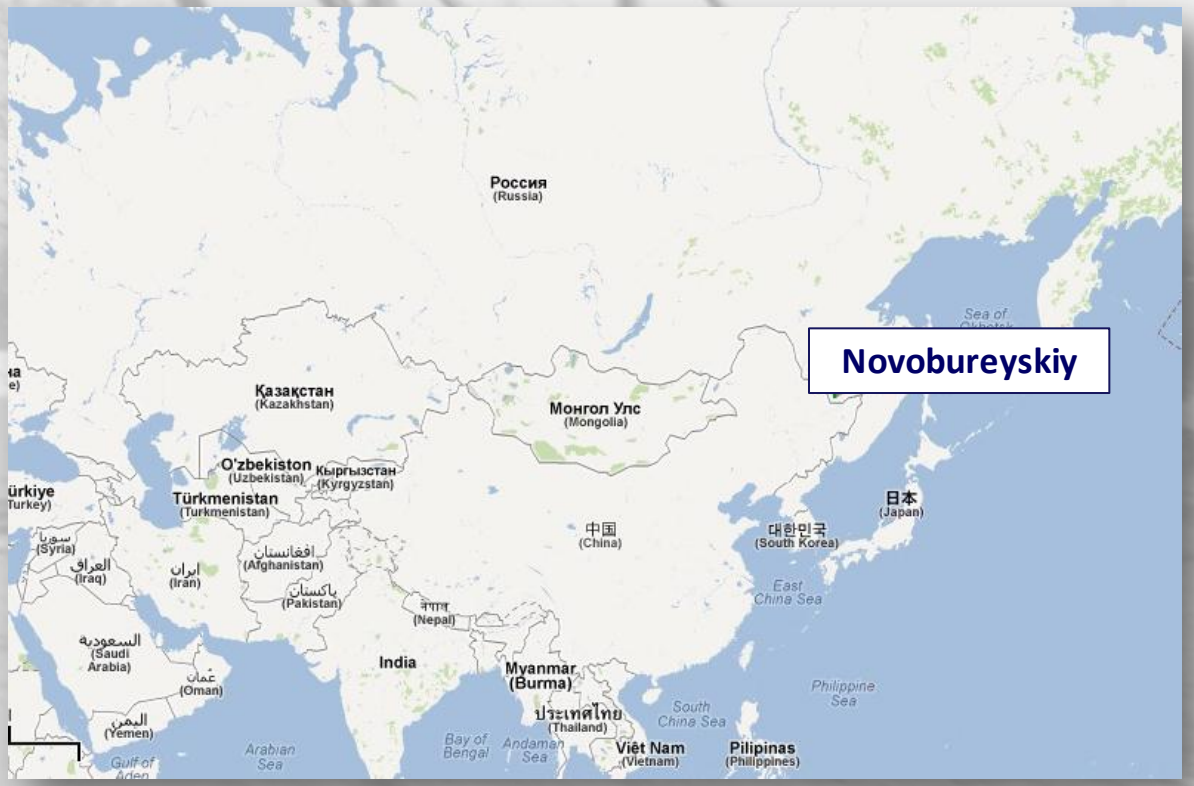
Jet regulation

If the vacuum target value is reached during extraction, the rotational speed of the jet pump can be decreased. Are there dificulties to achiev the vacuum target value, the jet pump is switched on again or the speed increased, respectively.

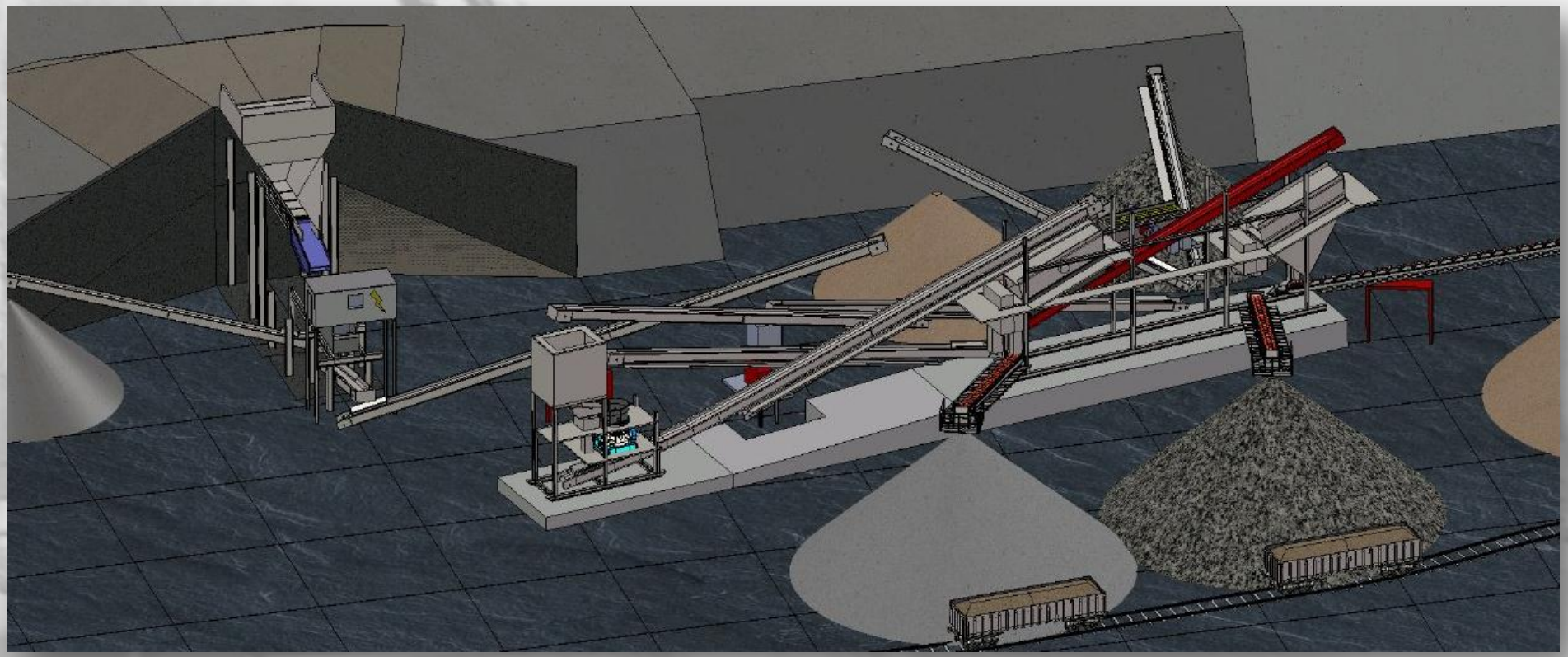


Granite plant

… for crushing and classifying of commercial granite in Siberia/Russia



Overview

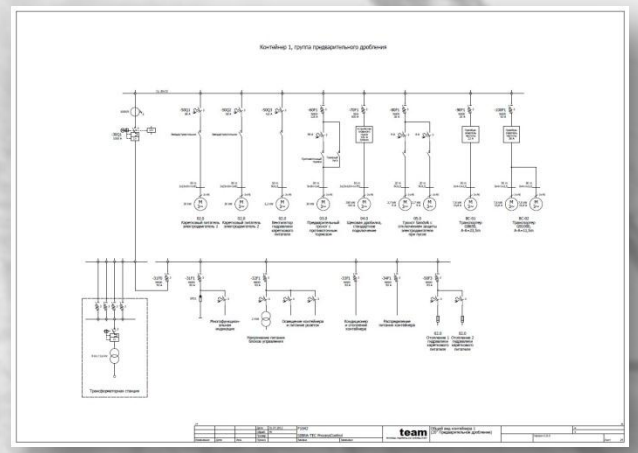


- Number of main aggregates: 31
- Installed elctrical power: app. 1 MW
- Climate conditions: +/- 50° C

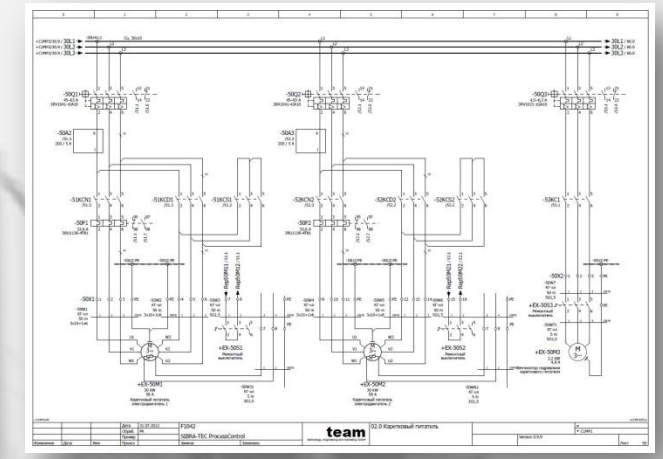
- Electrical equipment installed in three 20‘ Sea Containers
- Automation and visualisation based on Siemens technology

Electrical planning, dimensioning and drawings

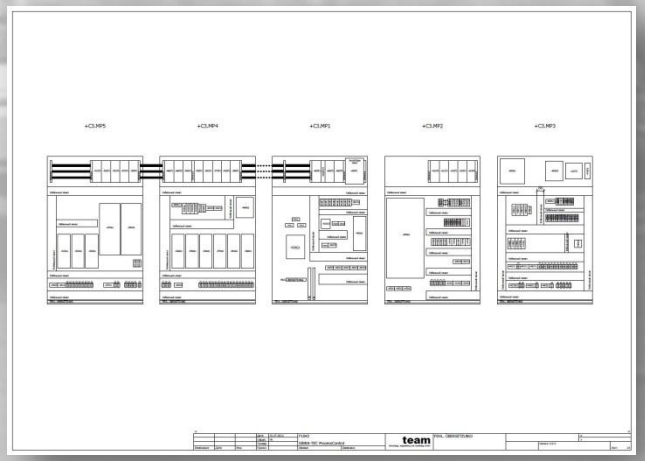
Team GmbH



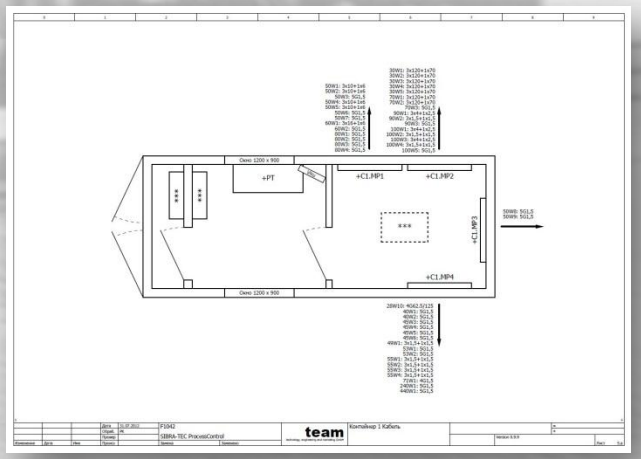
single-line-diagram



all-phase-diagram



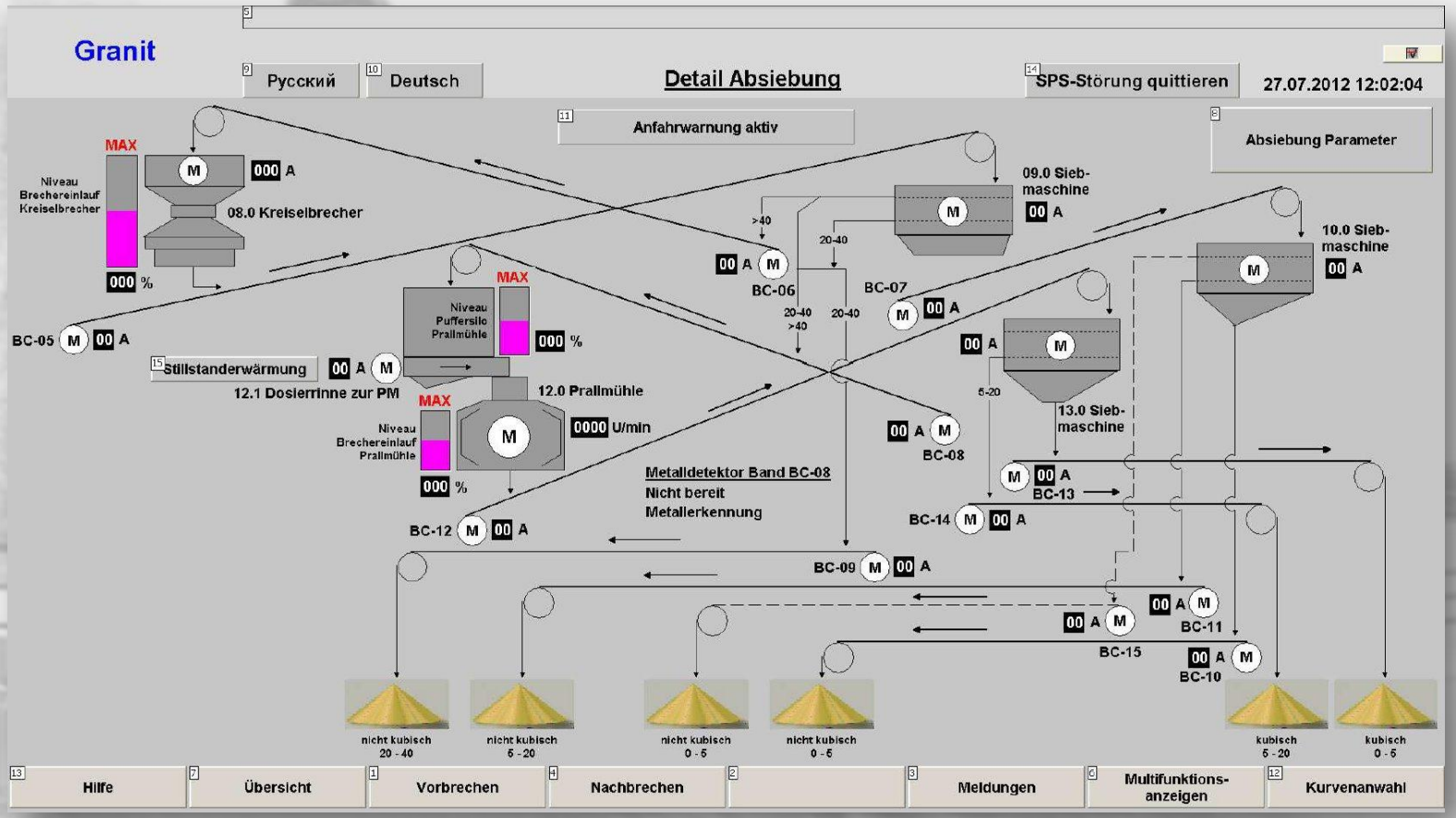
planning and construction of the mounting plates



planning and construction of the containers

Visualisation based on Siemens WinCC

Team GmbH



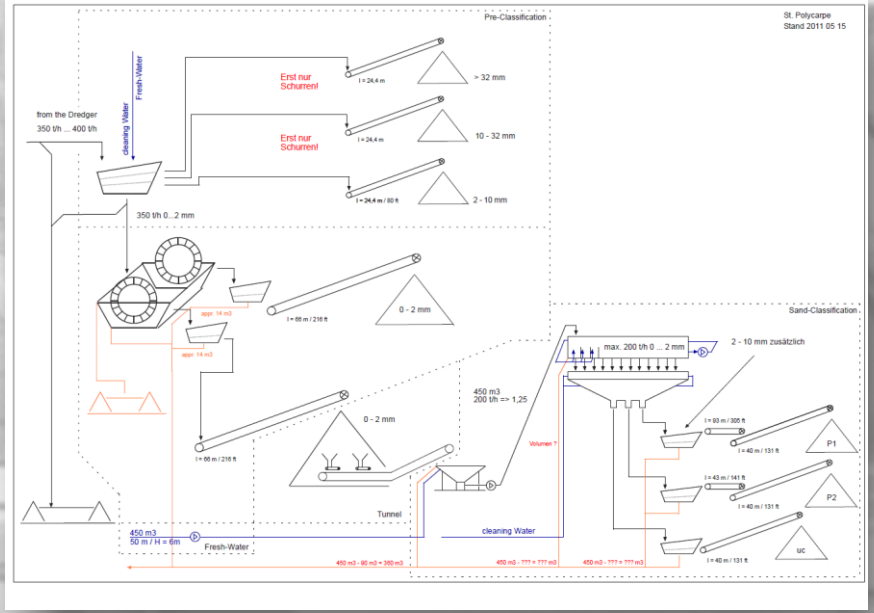
Special functions:

- **Automated cleaning and discharching of the whole system over night**
- **Monitoring of no-load and overload running of the conveyor belts**

3 containers housing the electrical equipment

Team GmbH

Current project – St. Polycarpe/Canada



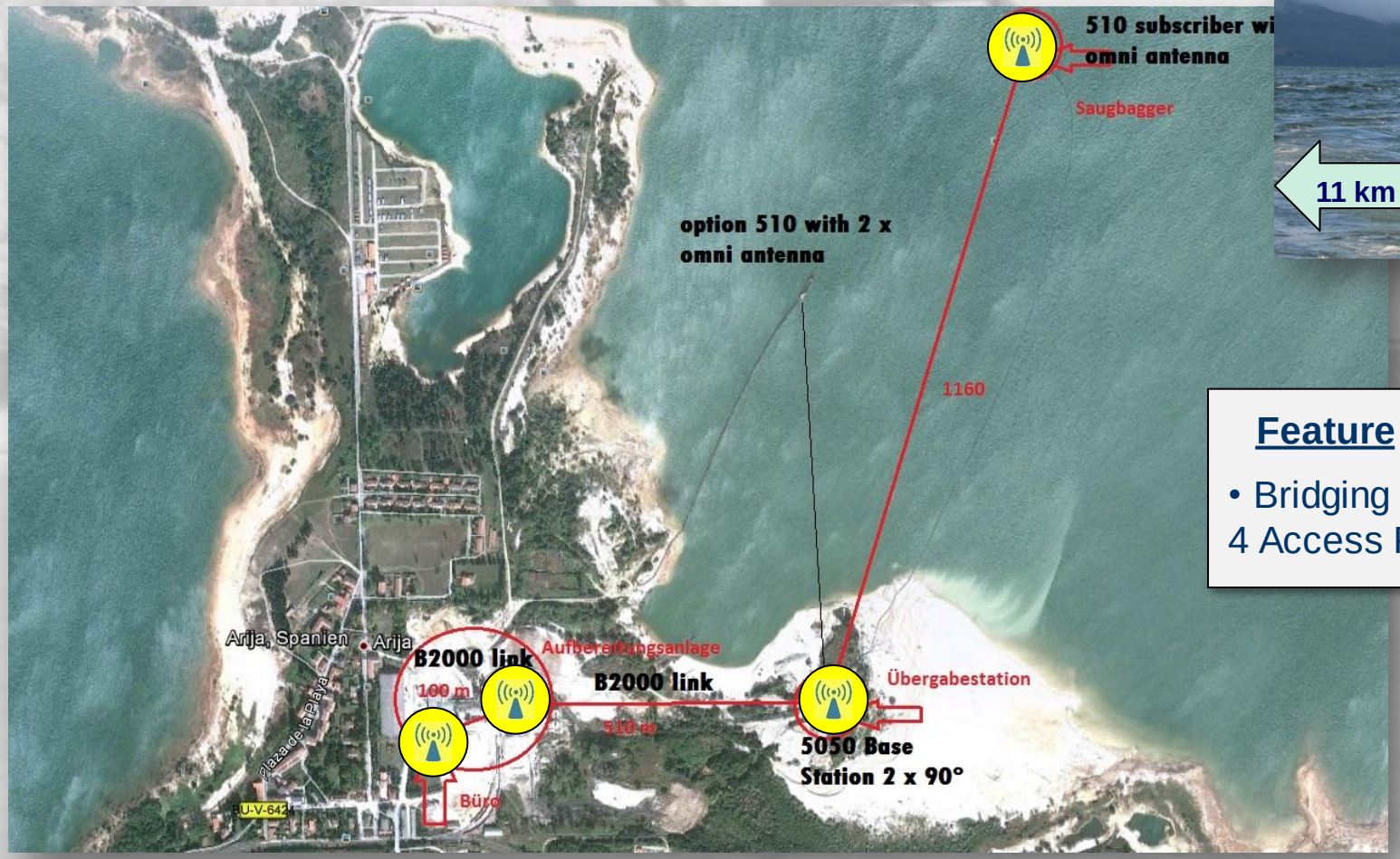
- Planning of the 25 kV energy power supply
- Electrical planning of the suction dredge and pre-classification and Akorel control-system
- Software development
- Coordination of the mounting and installation of the electrical cabinets in Canada

Suction tube dredger – Arija/Sibelco Spain

- Installation of **DredgerControl** using the ‚Assisted Automatic Mode'
  - Vacuum Regulator
  - Flow Velocity Regulator
- Installation of DredgerNaut
- Integration of additional process signals in different locations by WLAN
- Remote access from shore and service by 3G mobile network

WLAN-Connections

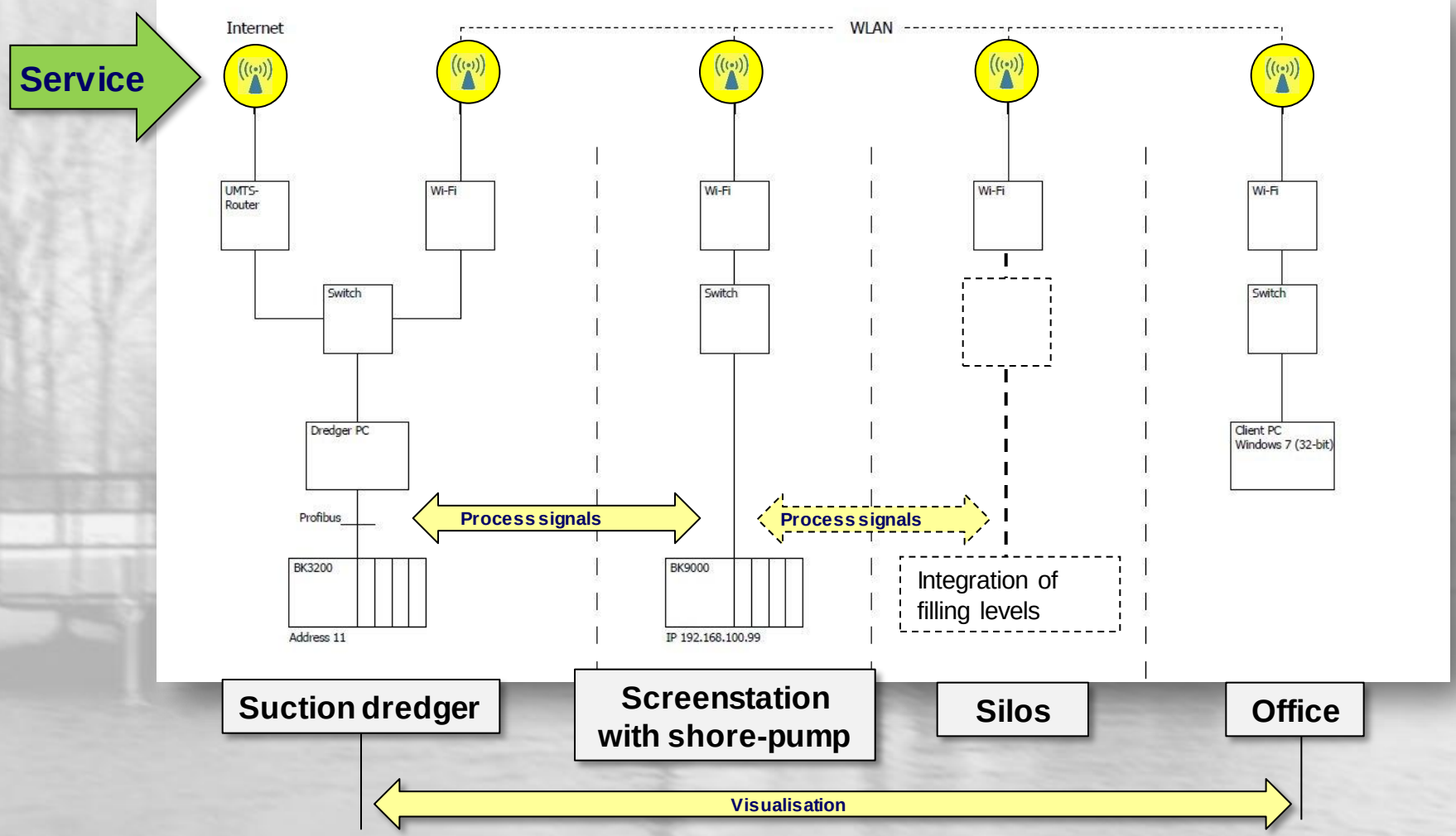
Team GmbH



Feature

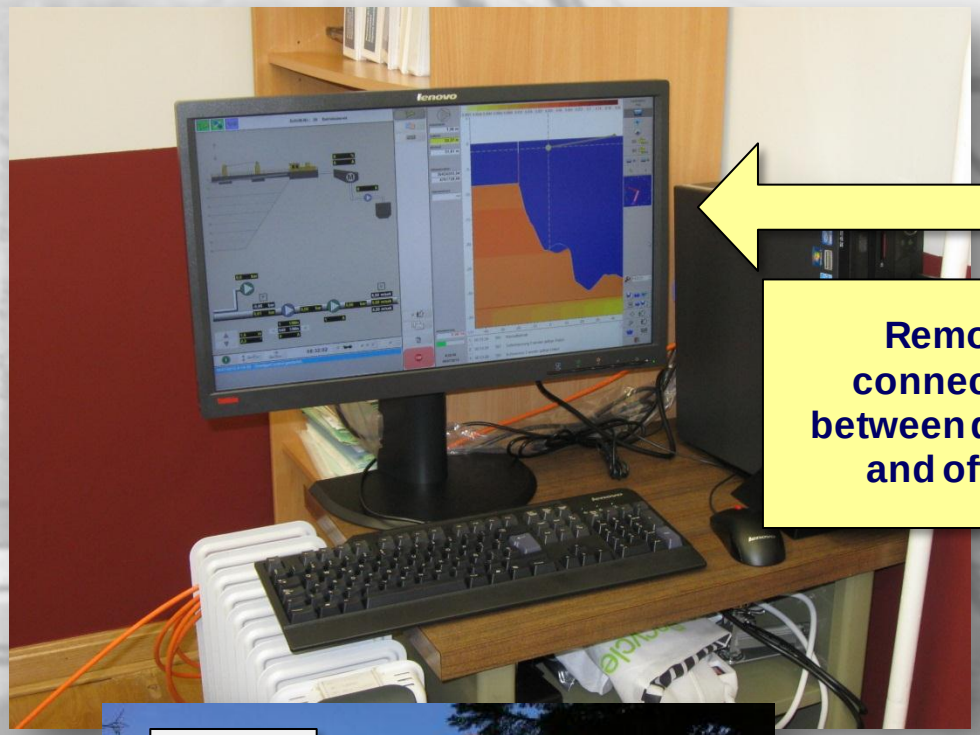
- Bridging a total of 1800 m using 4 Access Points

WLAN-Connections

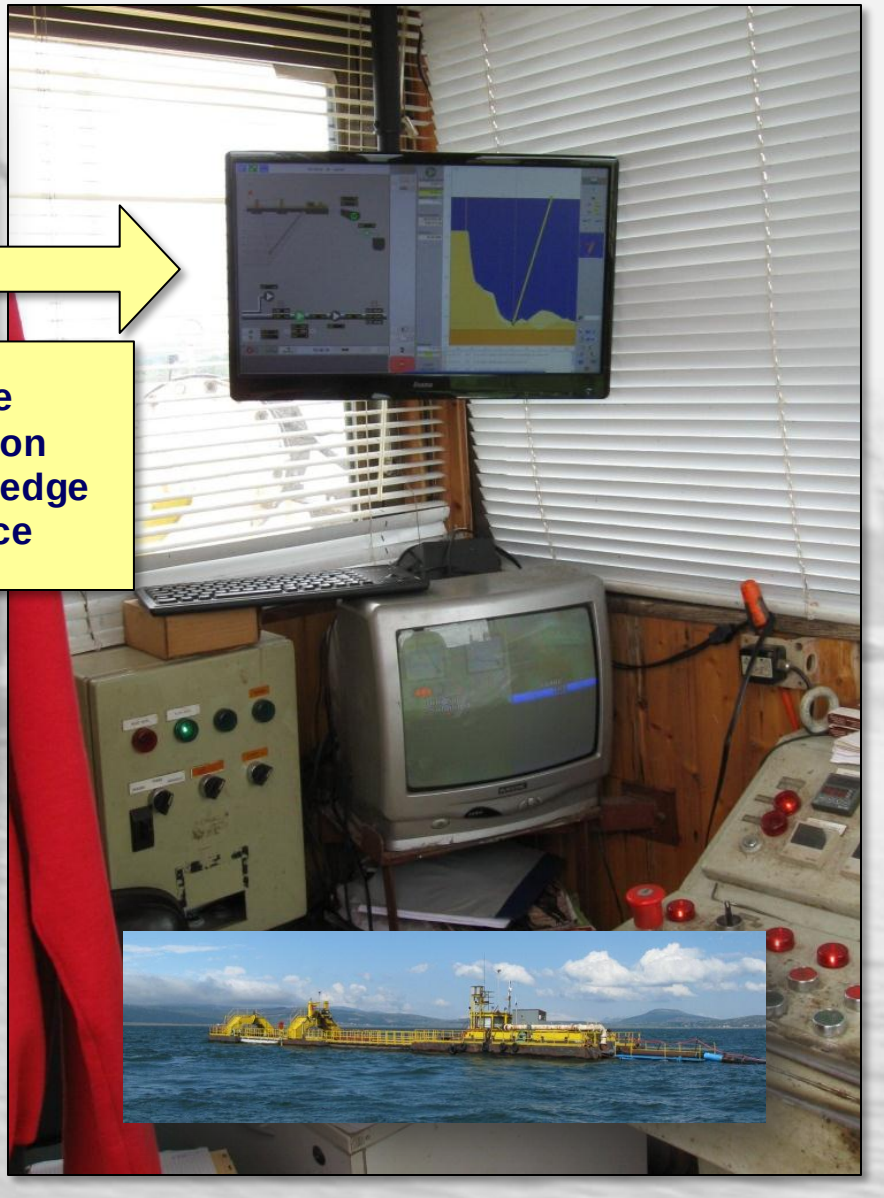


WLAN-Connections

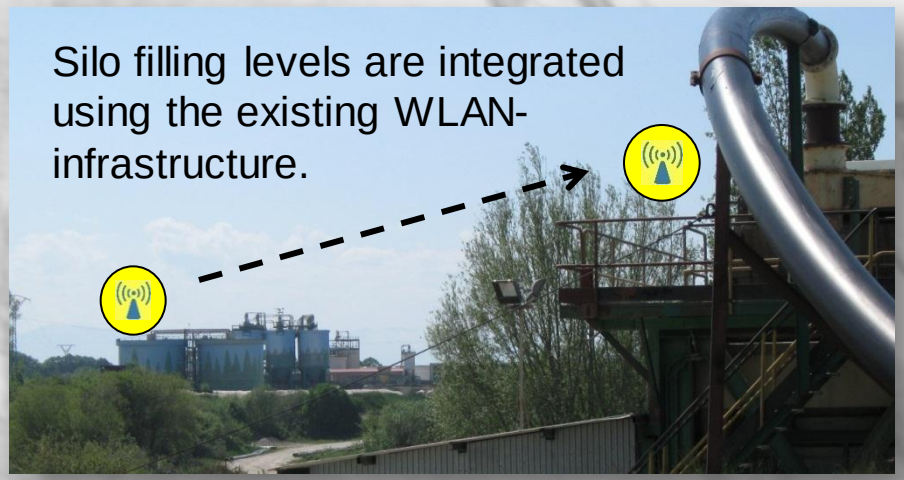
Team GmbH

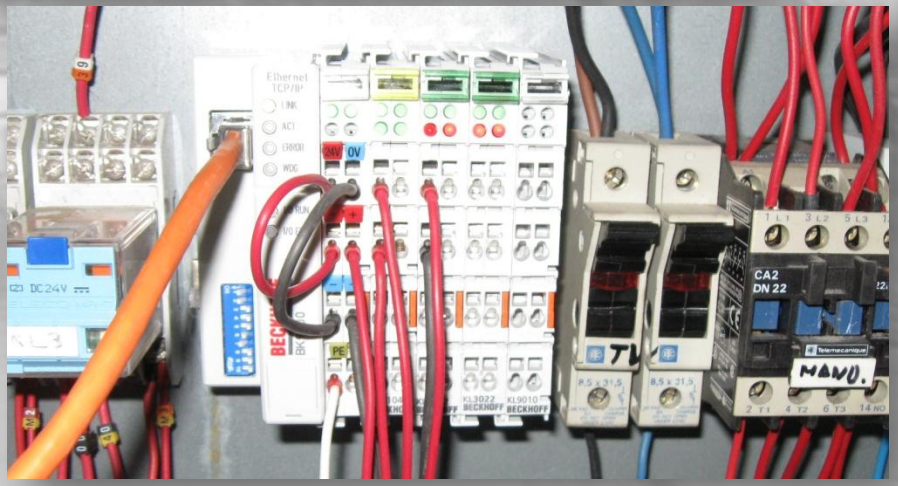


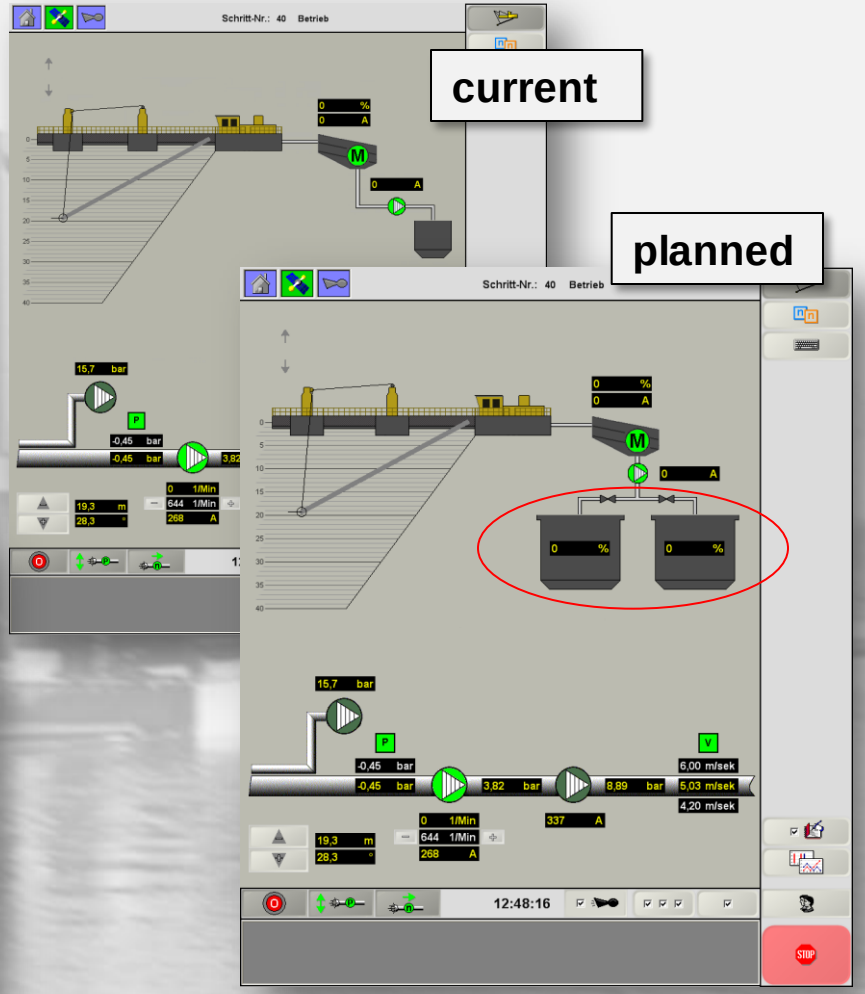
Remote connection between dredge and office



WLAN – Prozesssignale auf der Strecke







3G Remote-connection

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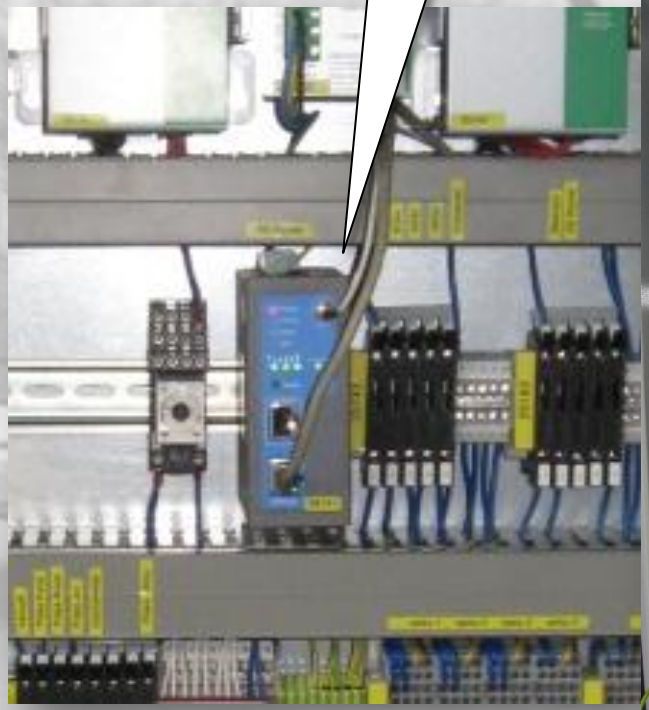

Aquisition of measures for data-analysis

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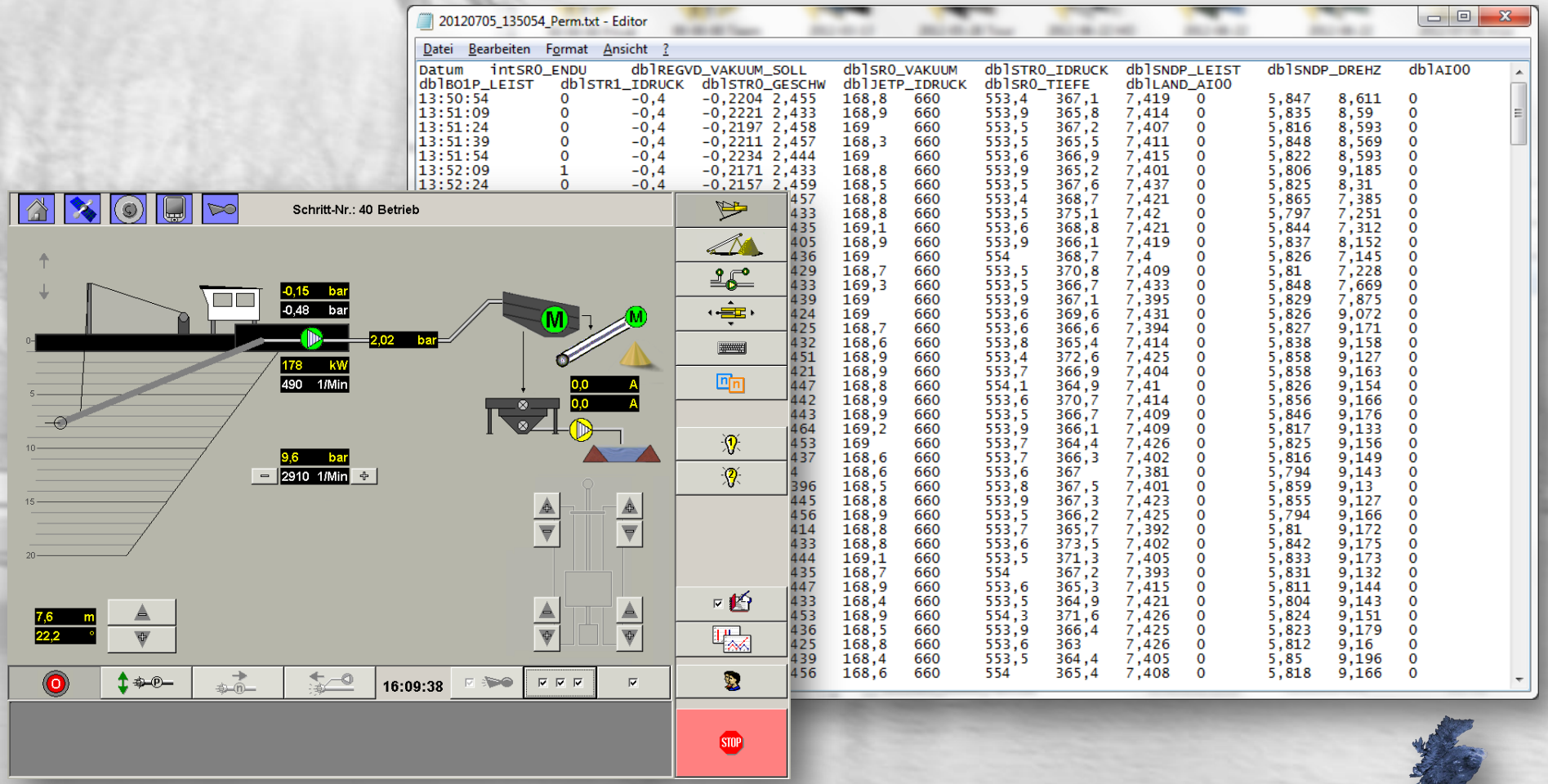
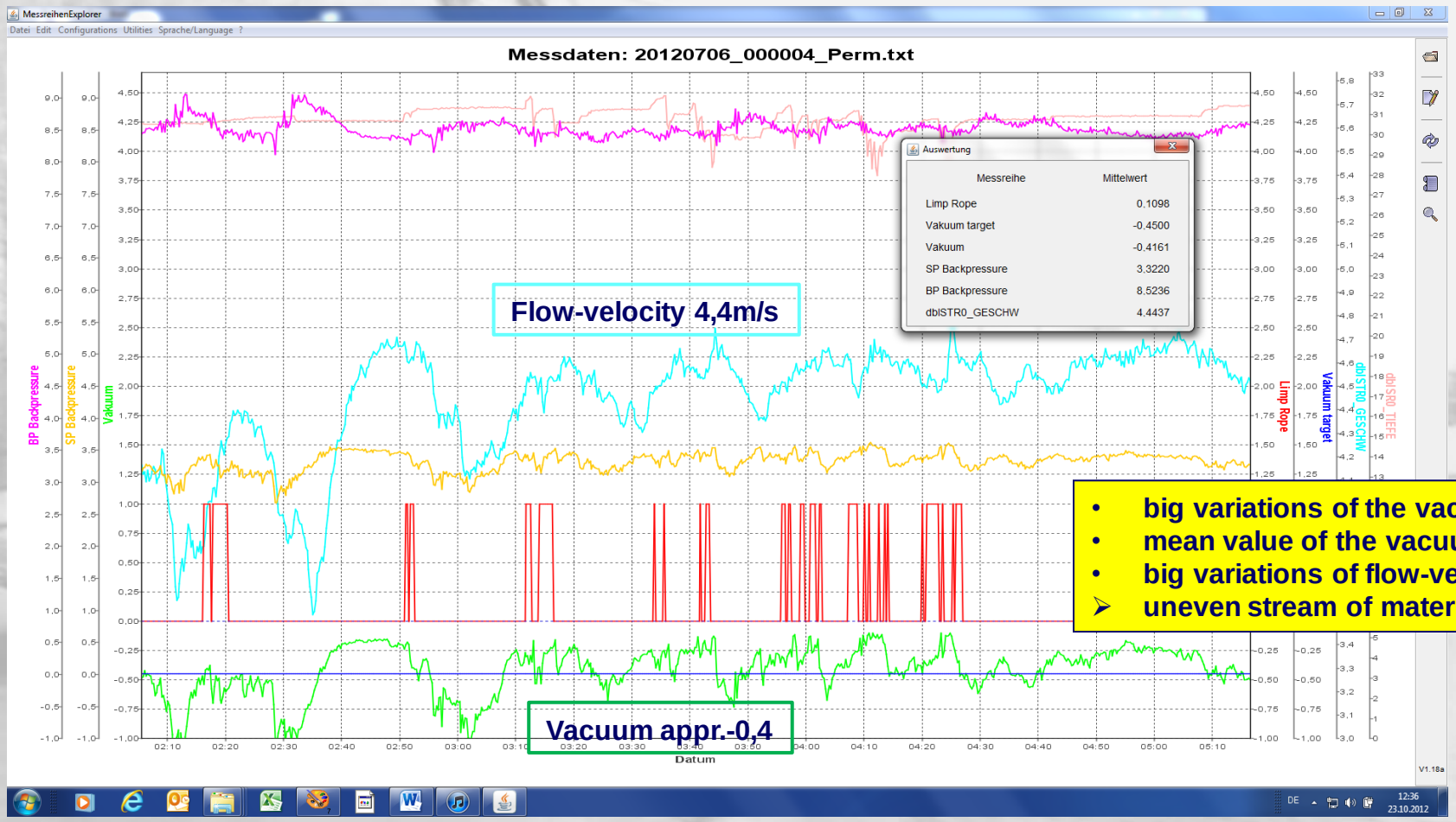


SIBELCO UK

Imperial Hotel,
Park Hill Road,
Torquay Devon

Torquay

Manual control by dredger-operator



- big variations of the vacuum
- mean value of the vacuum -0,41 bar
- big variations of flow-velocity

➢ uneven stream of material

Automatic control by **DredgerControl** system

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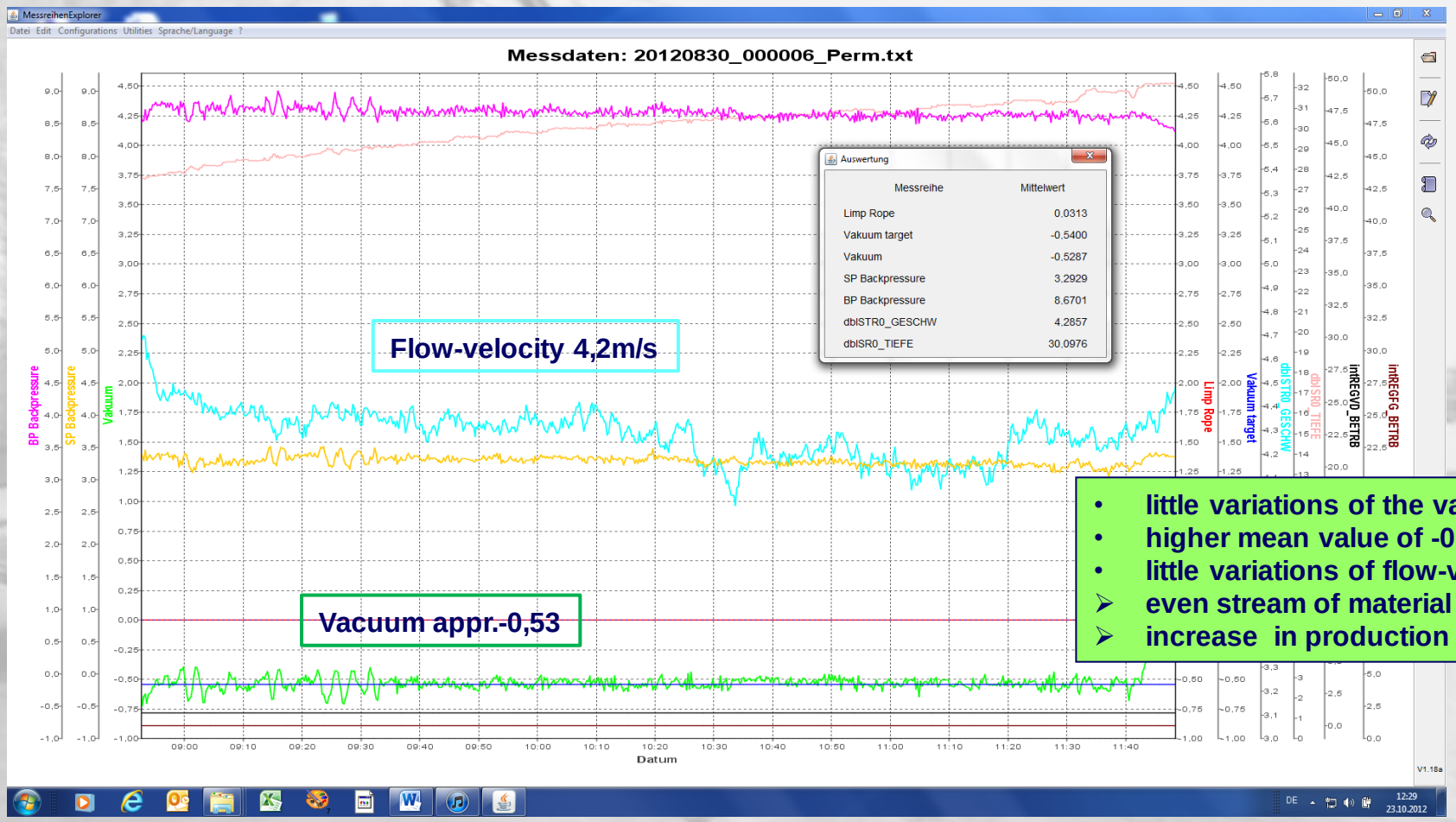
Vacuum- and flow-velocity regulation active!



- little variations of the vacuum
- higher mean value of -0,53 bar
- little variations of flow-velocity

➢ even stream of material

➢ increase in production

Arija - Flow situation with water, normal vacuum

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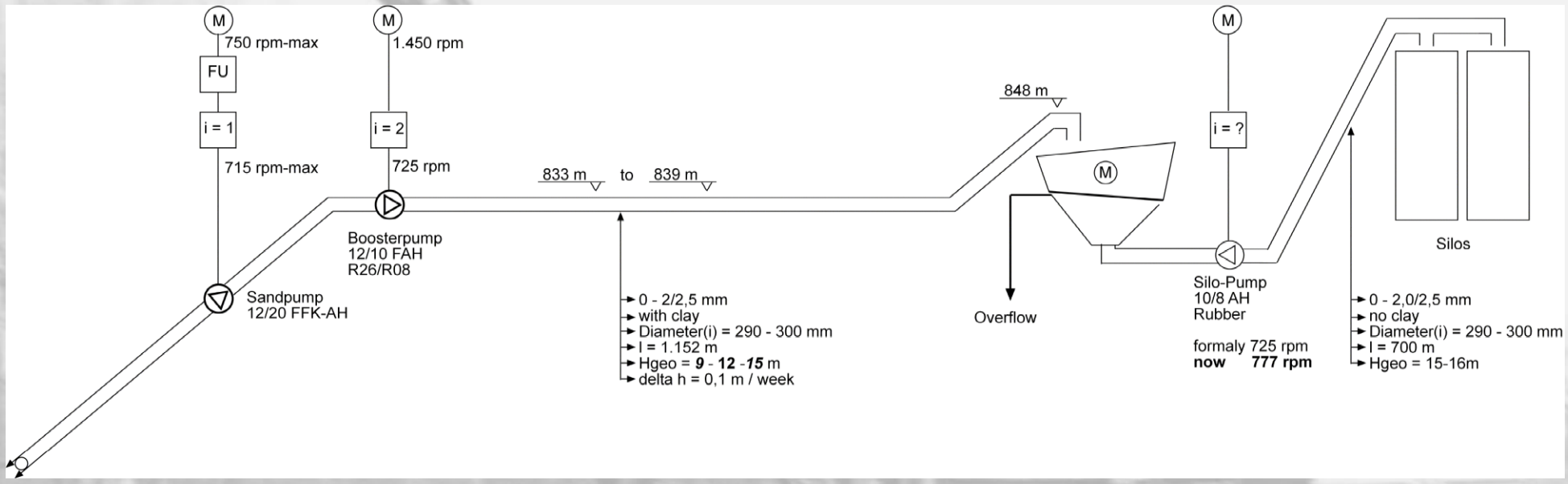
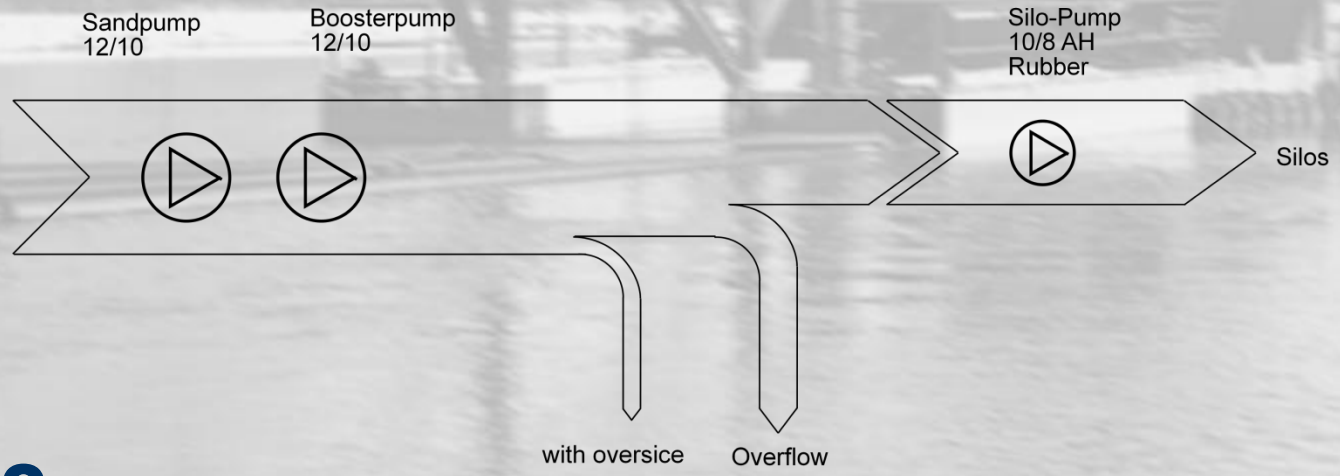
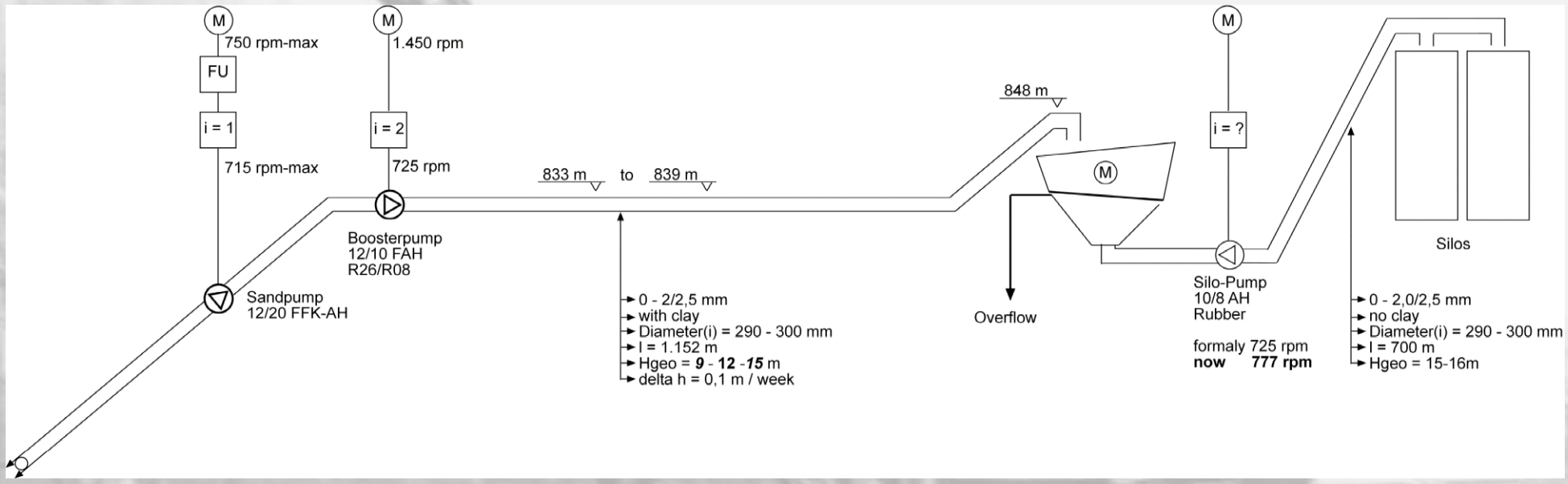
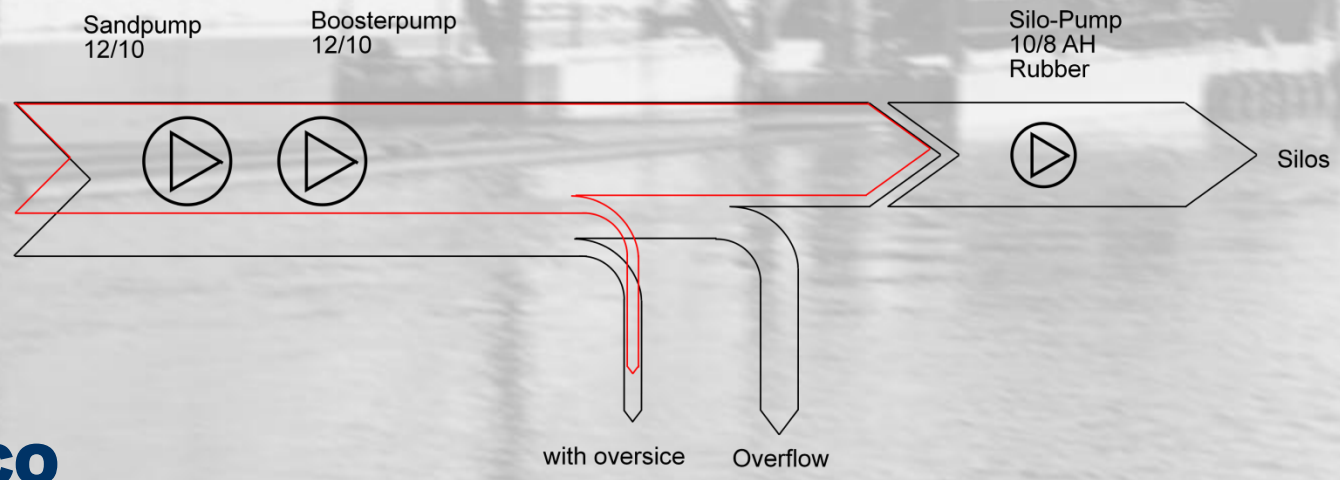




Arija - Flow situation with higher vacuum

DredgerNaut





Arija – Achievements and next steps

Achievements

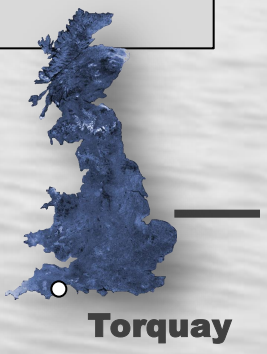
- increase in production of the dredger (due to higher density)
- relief of the operator
- even out the stream of material

Bottleneck

- transport way of material on shore into silos

Next steps

- back pressure measurement of the shore pump
- flow-velocity measurement behind shore pump
- ➢ analysis of this data results in adjustment of shore pump RPMs leading to wear minimisation and energy saving



Thank You for your attention!