

The DMT logo is a blue square with the letters 'DMT' in white, bold, sans-serif font. The background of the entire slide is a high-angle, low-light photograph of a large industrial structure, possibly a dam or bridge, with a complex network of steel beams and concrete. Two workers in orange safety gear are visible in the lower right corner, providing a sense of scale. A thin red horizontal line is positioned near the top right of the image.

DMT

DMT SAFEGUARD

MONITORING SOLUTIONS

DMT part of TÜV NORD GROUP | DMT SAFEGUARD

Engineering Performance

Agenda

01. DMT at a Glance

02. DMT SAFEGUARD Monitoring Platform

03. Markets & Projects

DMT as part of the TÜV NORD GROUP

TÜV NORD GROUP

Headquarters in Hannover, Germany

Industrial Service,
Mobility, Education

TÜVNORD

Engineering and
Natural Resources

DMT

Aerospace

ALTER

Information
Technology

TÜVIT

Facts and Figures

We create **sustainable value** for our customers through **quality-assured, specialized and innovative services in engineering and consulting.**



We provide independent services in the areas of **civil engineering and infrastructure, industrial plant engineering, natural resources, plant & product safety.**

DMT's roots date back to **1737**



Approx. **1,100** employees mainly with academic background

DMT comprises **13** operational engineering and consulting companies and more than **30** branches worldwide



DMT's attitude is dedicated to **excellence, responsibility & innovation**

Approx. **€130 million** turnover



Today DMT is a **core brand** of **TÜV NORD GROUP**

Locations and Availability

Branch Offices throughout Germany

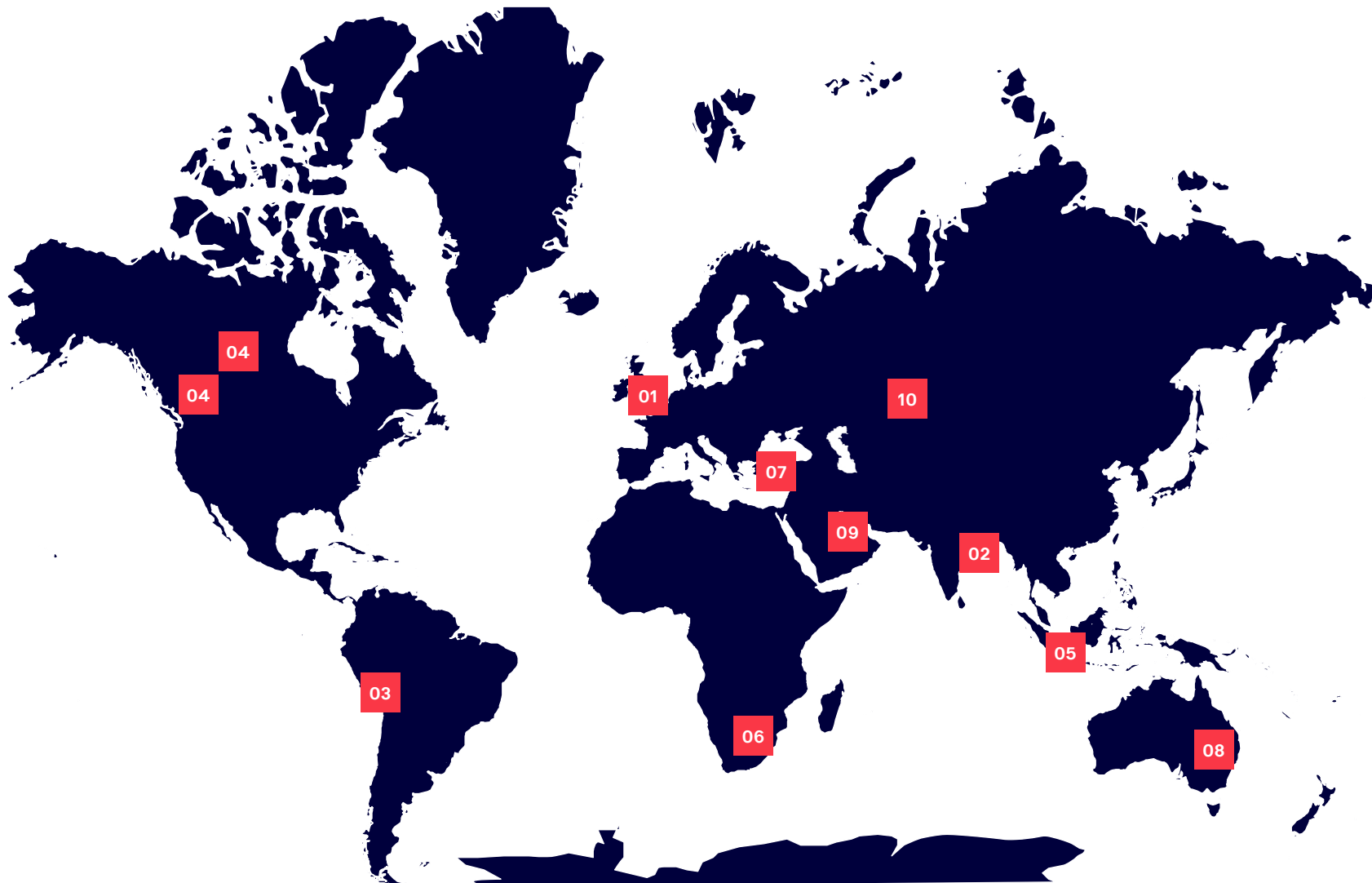


Locations and Availability

International Presence

Local representations

- | | |
|------------------|-----------------|
| 01. UK | 07. Turkey |
| 02. India | 08. Australia |
| 03. Peru | 09. Middle East |
| 04. Canada | 10. Kazakhstan |
| 05. Indonesia | |
| 06. South Africa | |



Focus Markets

Plant Engineering & Process Engineering



Civil Engineering & Infrastructure



Mining



Energy



The campaign “Engineering Performance”

Electromobility



Water



Monitoring



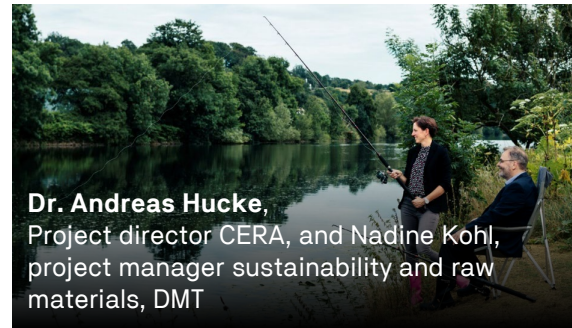
Operator Responsibility Management



Industrial Engineering



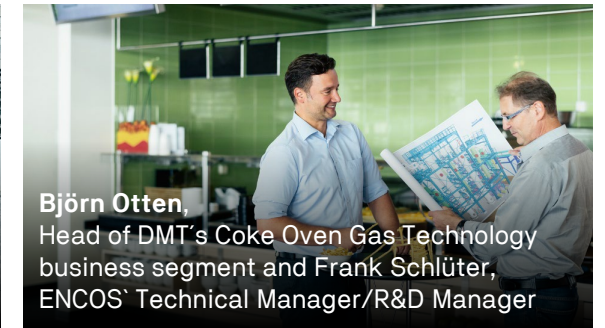
Sustainability



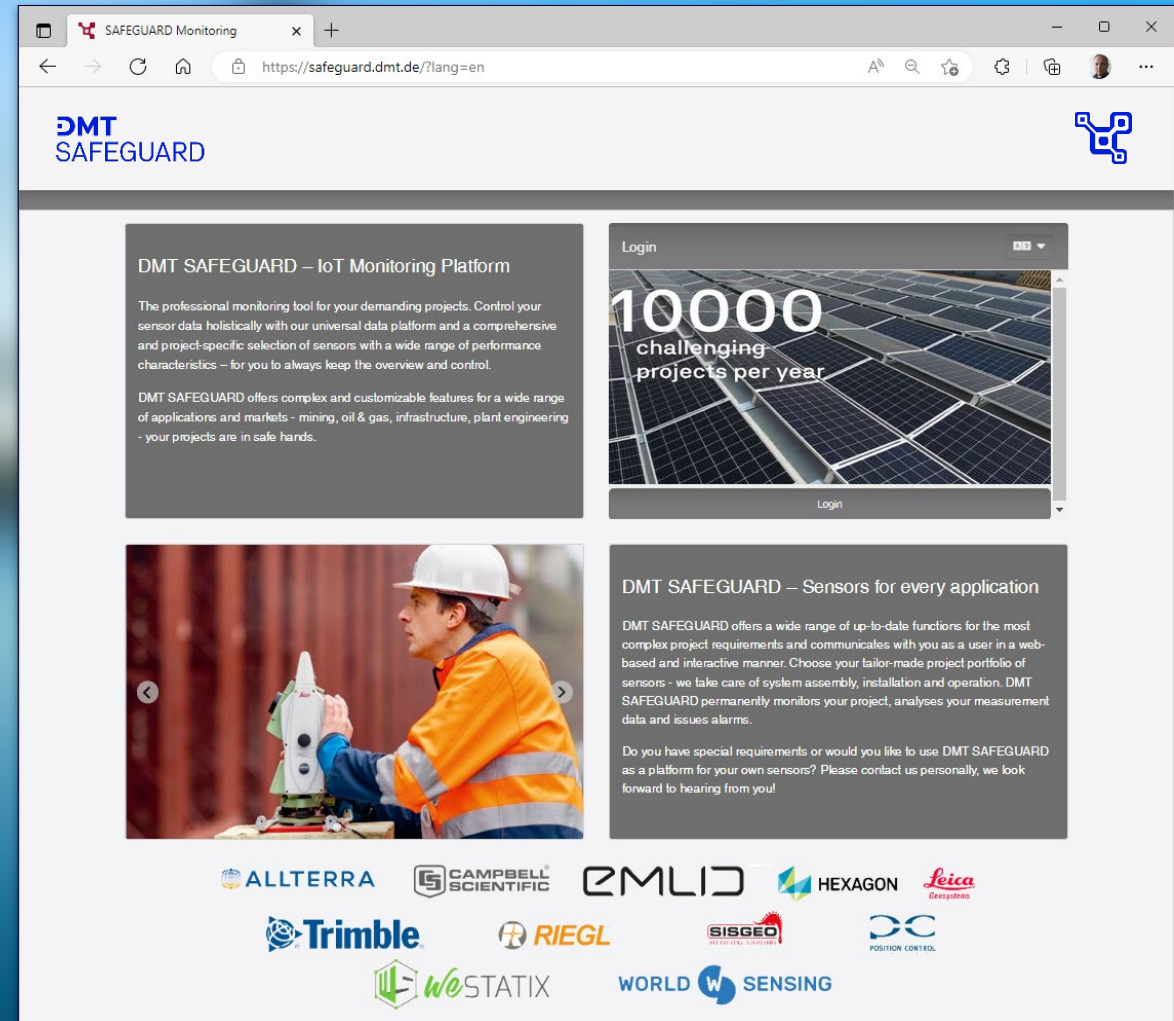
Electromobility



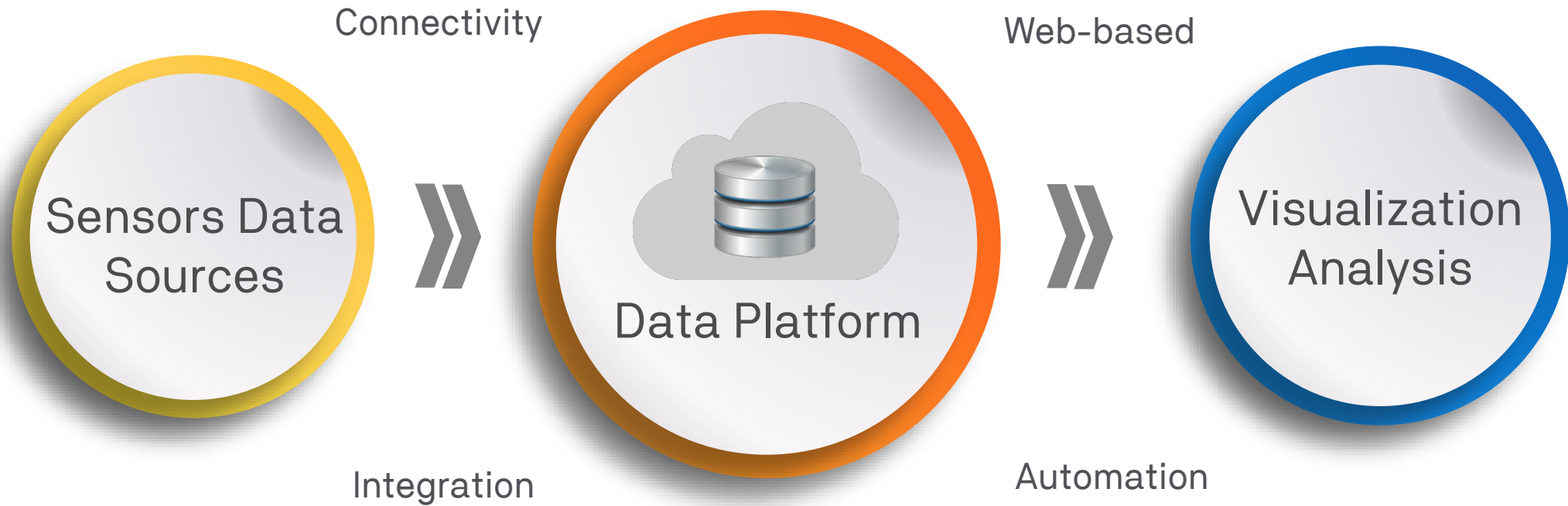
Industrial Engineering



02. DMT SAFEGUARD

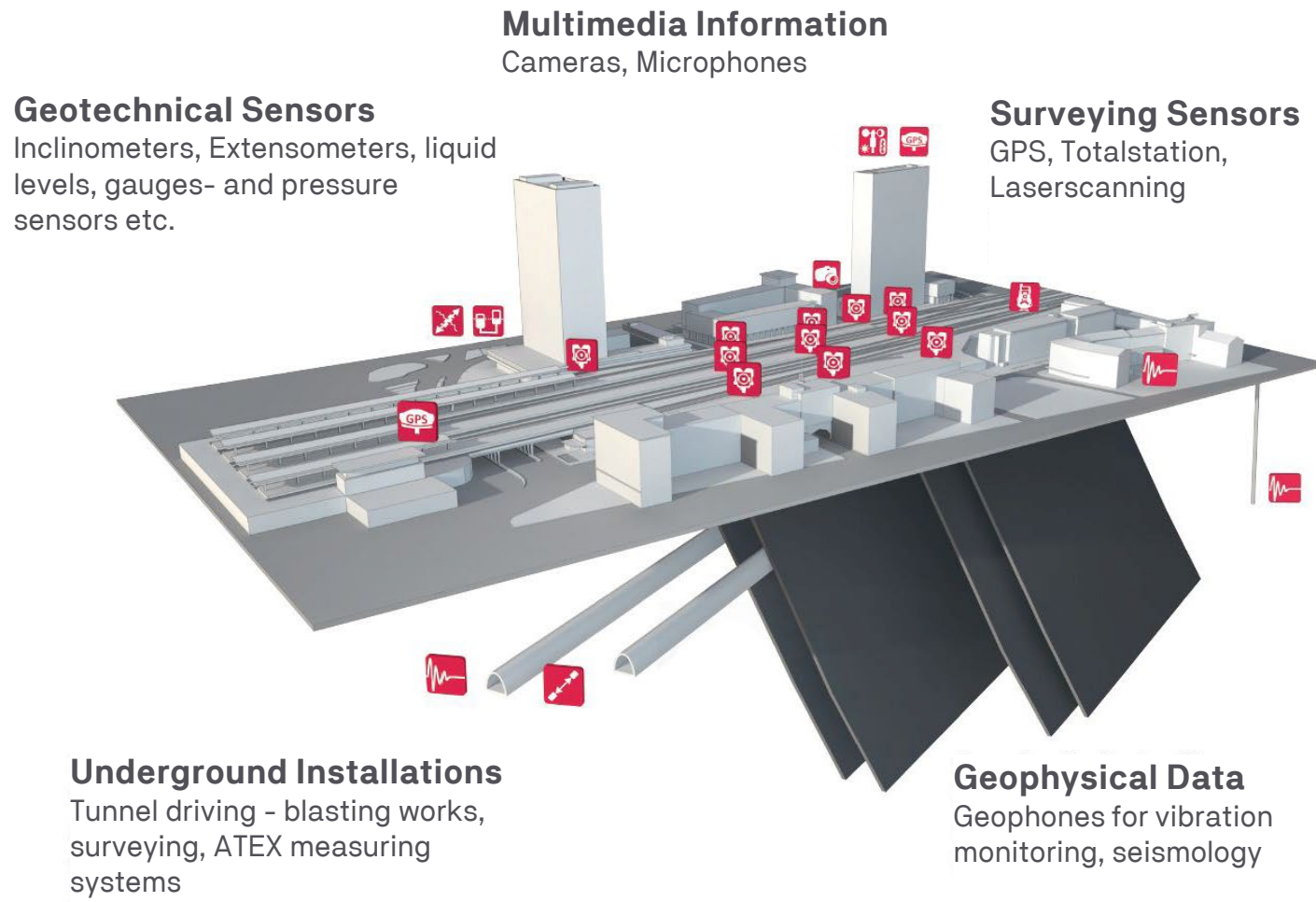


System Introduction





System Introduction



System Introduction



Data-Platform



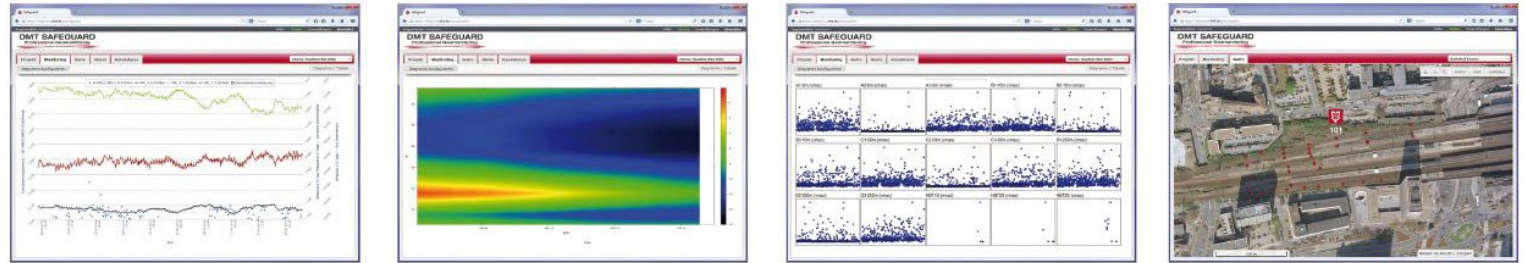
Visualization
Analysis



Flexible data integration (format, type, manufacturer)



Data storage and management



Online - Visualization

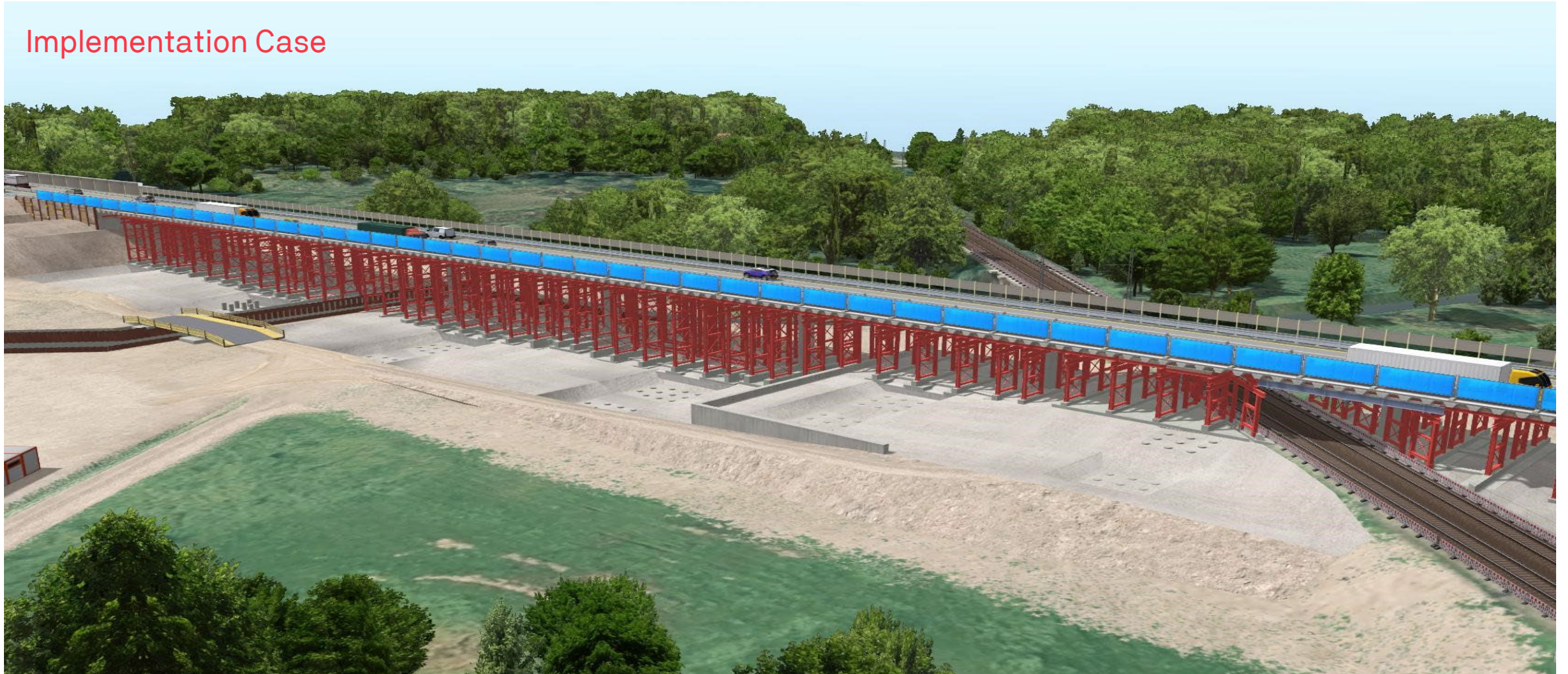


Alarming and Support

System Introduction



Implementation Case



System Introduction

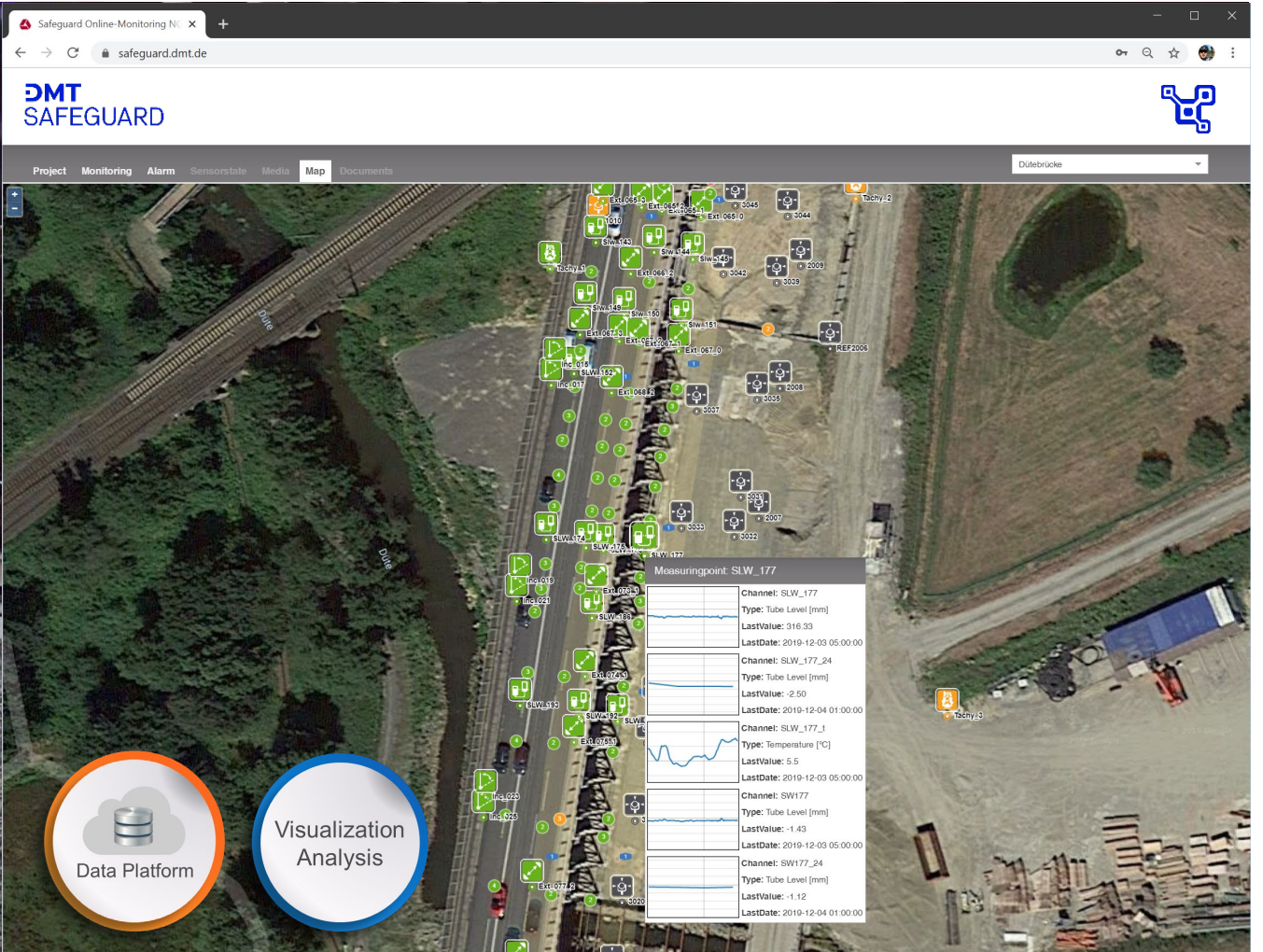

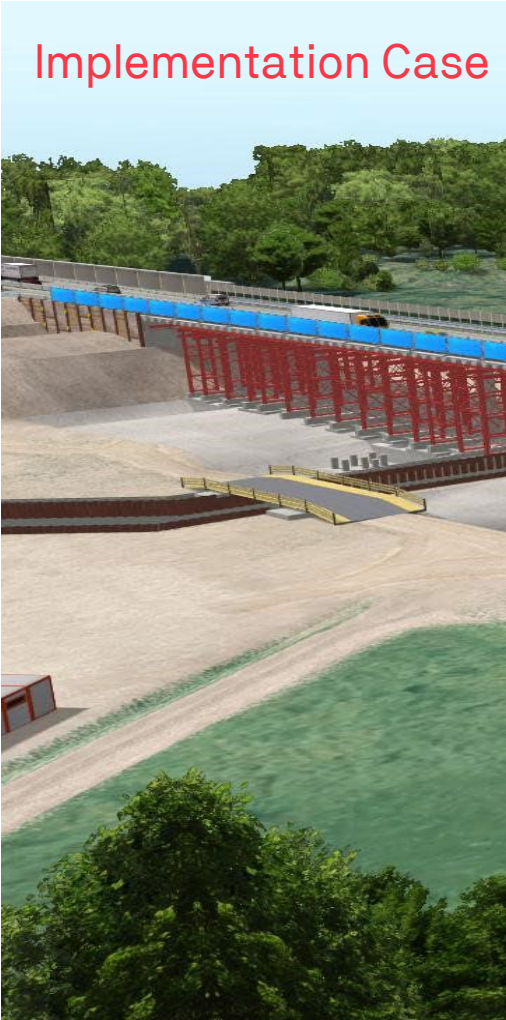


Sensors
Data
Sources

System Introduction



Implementation Case



Sensors Data Sources

Data Platform

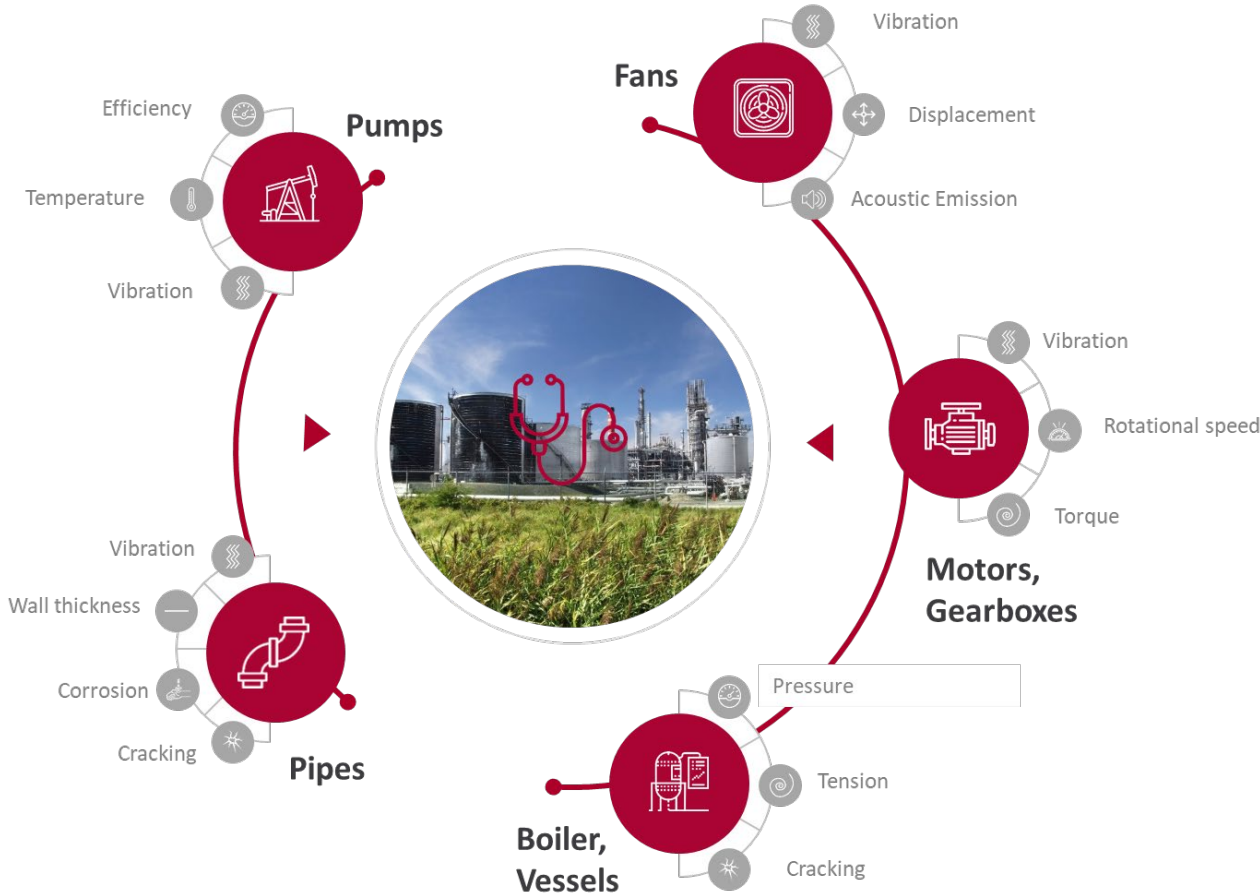
Visualization Analysis

| Channel | Type | LastValue | LastDate |
|---------------------|------------------------|-------------------|-------------------------------|
| Channel: SLW_177 | Type: Tube Level [mm] | LastValue: 316.33 | LastDate: 2019-12-03 05:00:00 |
| Channel: SLW_177_24 | Type: Tube Level [mm] | LastValue: -2.50 | LastDate: 2019-12-04 01:00:00 |
| Channel: SLW_177_1 | Type: Temperature [°C] | LastValue: 5.5 | LastDate: 2019-12-03 05:00:00 |
| Channel: SW177 | Type: Tube Level [mm] | LastValue: -1.43 | LastDate: 2019-12-05 05:00:00 |
| Channel: SW177_24 | Type: Tube Level [mm] | LastValue: -1.12 | LastDate: 2019-12-04 01:00:00 |

System Introduction



Condition monitoring application case
Surveillance of industrial plant operations



Generation of testing data

- Increase in plant and operational safety
- Recurring inspections
- Lifetime extension

Optimization of operations

- Optimization of maintenance (material, personnel)
- Avoidance / early detection of damages
- Extension of inspection intervals

1. Status Quo assessment

2. Computation / Simulation

3. Condition assessment + prediction

4. Remaining lifetime + testing concept

System Introduction



Platform Technology – Webserver, API, Data Base



- NGINX: Web Server, Reverse Proxy, Load Balancer
- MSSQL and PostgreSQL in various application scenarios
- PostgreSQL with Timescale and PostGIS Extension
- ExpressJS flexible Node.js web framework in conjunction with Sequelize
- Restful API secured with Keycloak

Key Functions



Connectivity

Advanced device management control, diagnostics and analysis for distributed sensor networks



Maps & Geolocation

Sensor data in geospatial context, direct integration of GIS services



Data Visualization

Powerful visualizations with customized time series, bar charts, distribution graphs etc.



Reporting & Tables

Create data tables that are available from raw and calculated metrics for easy viewing, comparison, export and reporting. Comprehensive AUTO-Report functionality.



Analytics & Alerting

User-defined, multi-level threshold values and notifications (text message, e-mail, push)



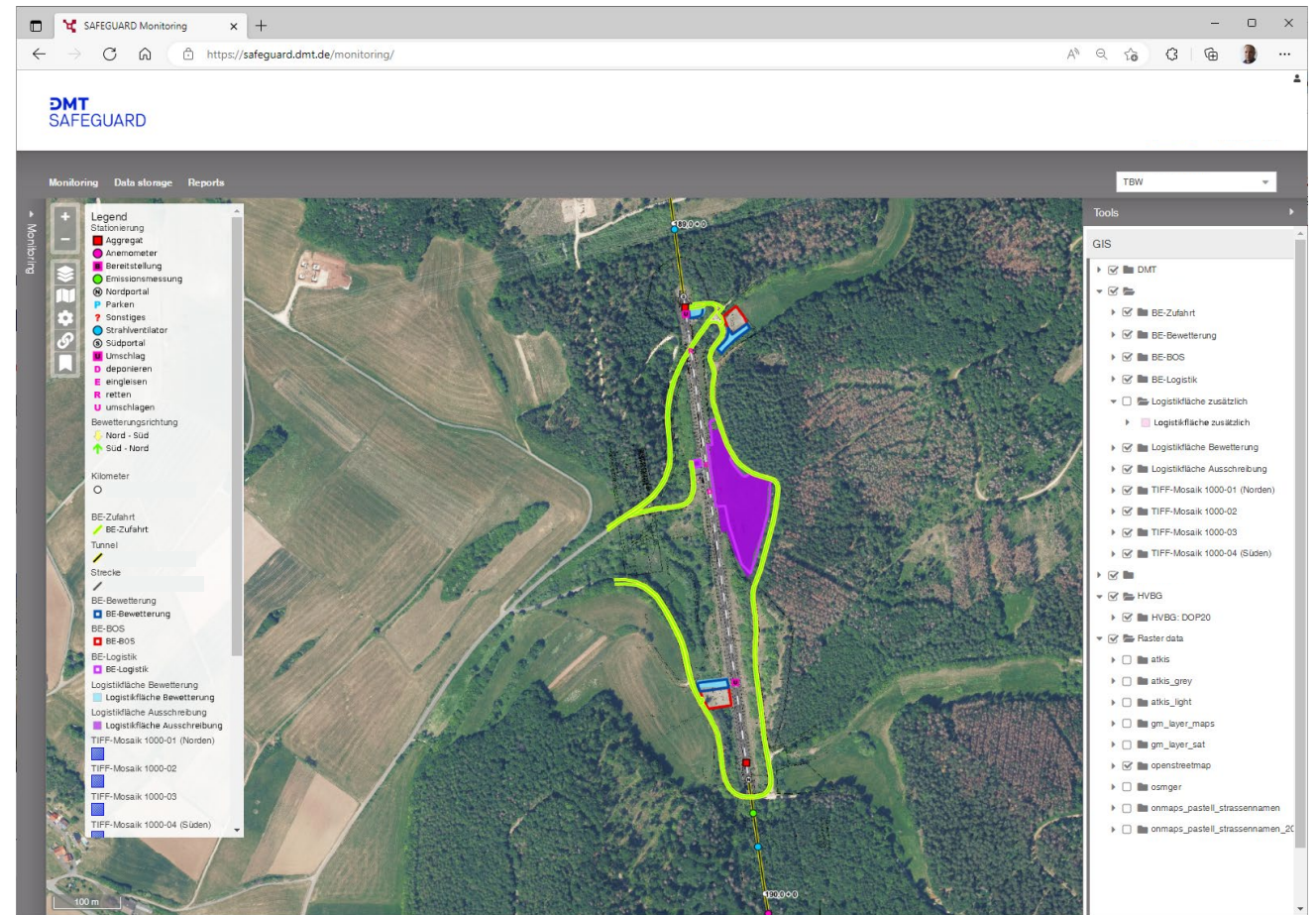
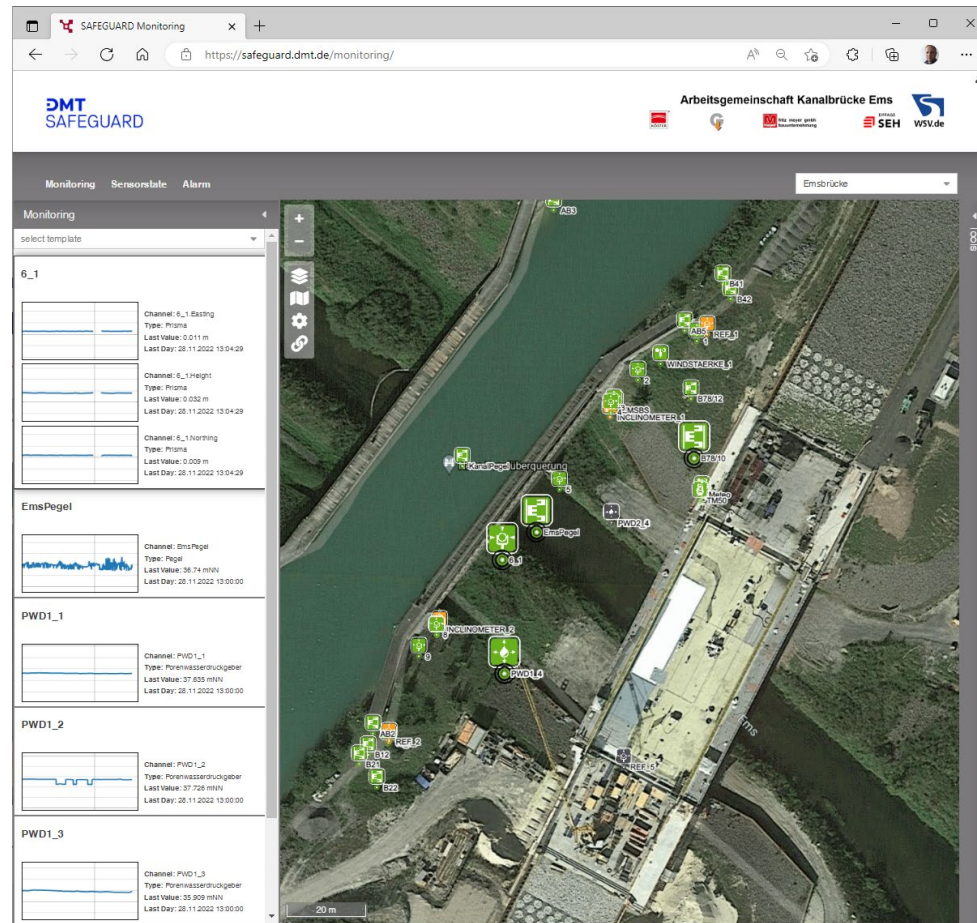
Documents & Wiki

Import of critical documents, photos, inspection records and event data to demonstrate project progress and performance.

Key Functions



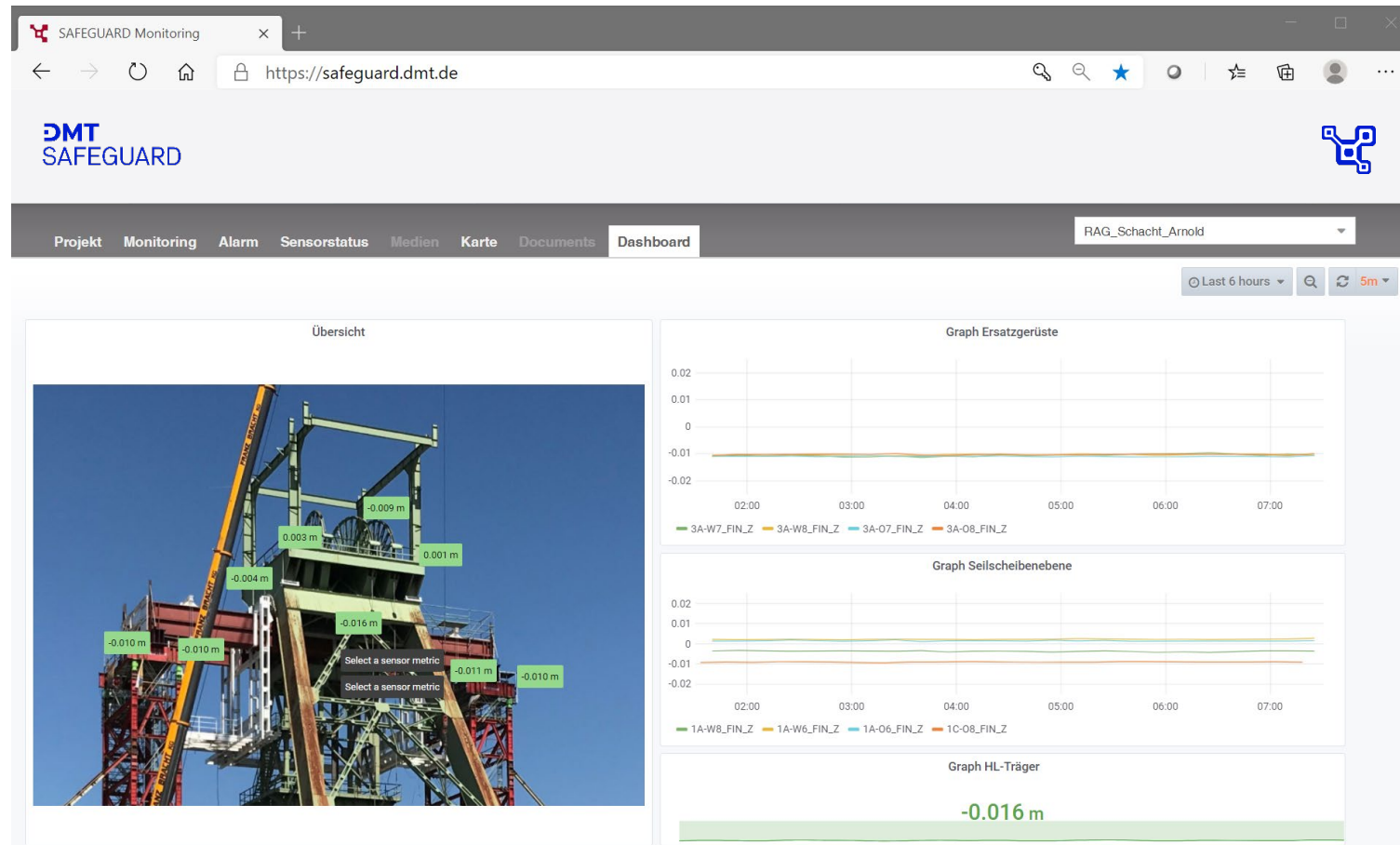
Sensor Data & GIS Integration – Highly Customizable



Key Functions



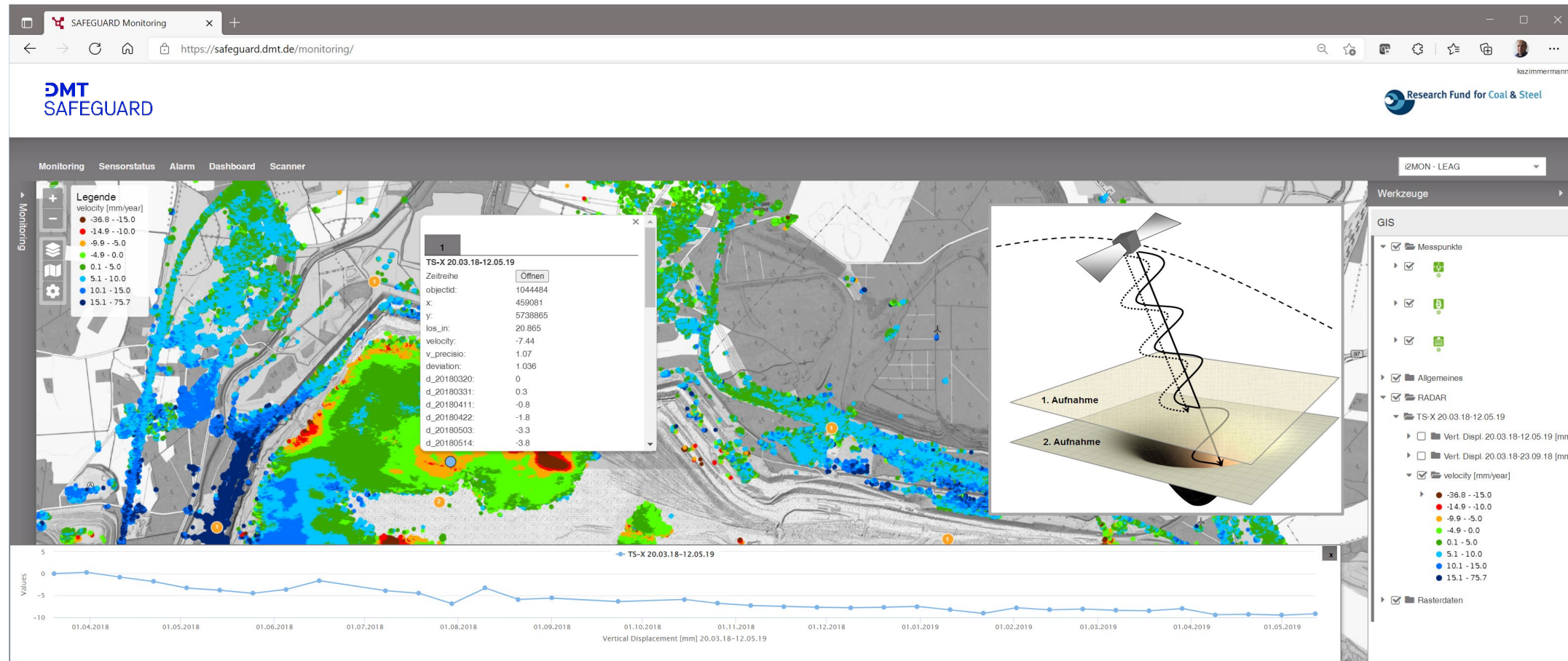
Data Dashboard Integration – Highly Customizable



Key Functions



GIS - Remote Sensing/InSAR Integration - Interactive



Key Functions

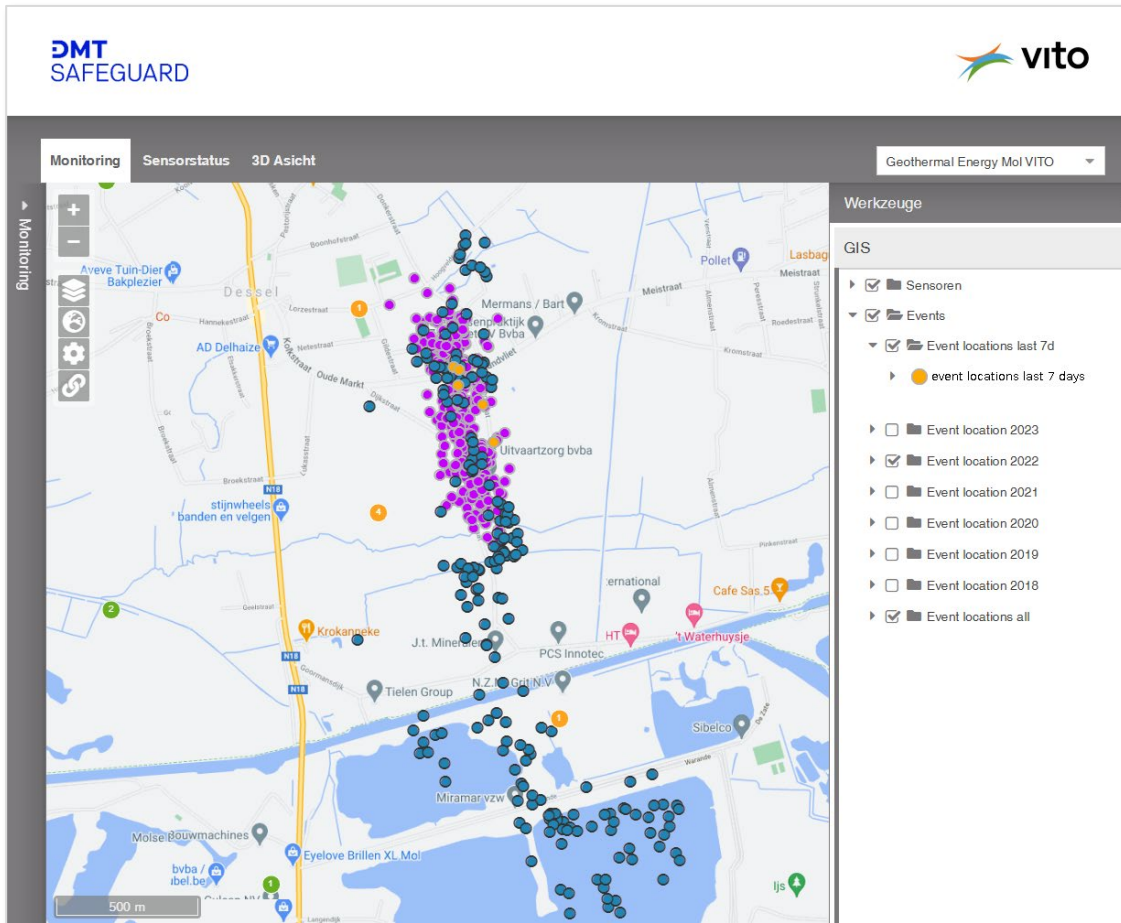


LiDAR Long-Range Laserscanning Integration - Interactive

The screenshot displays the DMT SAFEGUARD Monitoring Platform interface. The main view shows a 3D LiDAR scan of a mountain slope, with different colors representing different elevations and features. The interface includes a navigation menu with options like 'Monitoring', 'Dashboard', 'Scanner', and 'Info'. A 'Web View Monitoring' dropdown is visible. The top right corner features logos for 'SCANEXPERIMENT VALS in collaboration with: RIEGL' and 'LAND TIROL'. A mobile app interface is overlaid on the right side, showing a similar 3D scan view. The bottom of the interface has a 'REFERENCE' section with two scan dates: '10.05.2021 13:00:31' and '17.06.2021 07:00:05'. A 'COMPARE' section is also present. The bottom right corner contains a 'Scanner Orientation Adjustment' section with a 'Changes' toggle and a color scale for 'Below Reference (m)' and 'Above Reference (m)'. The color scale ranges from -0.5 to 0.5 meters, with a '0.003' marker. The 'Opacity' is set to 100%.

Key Functions

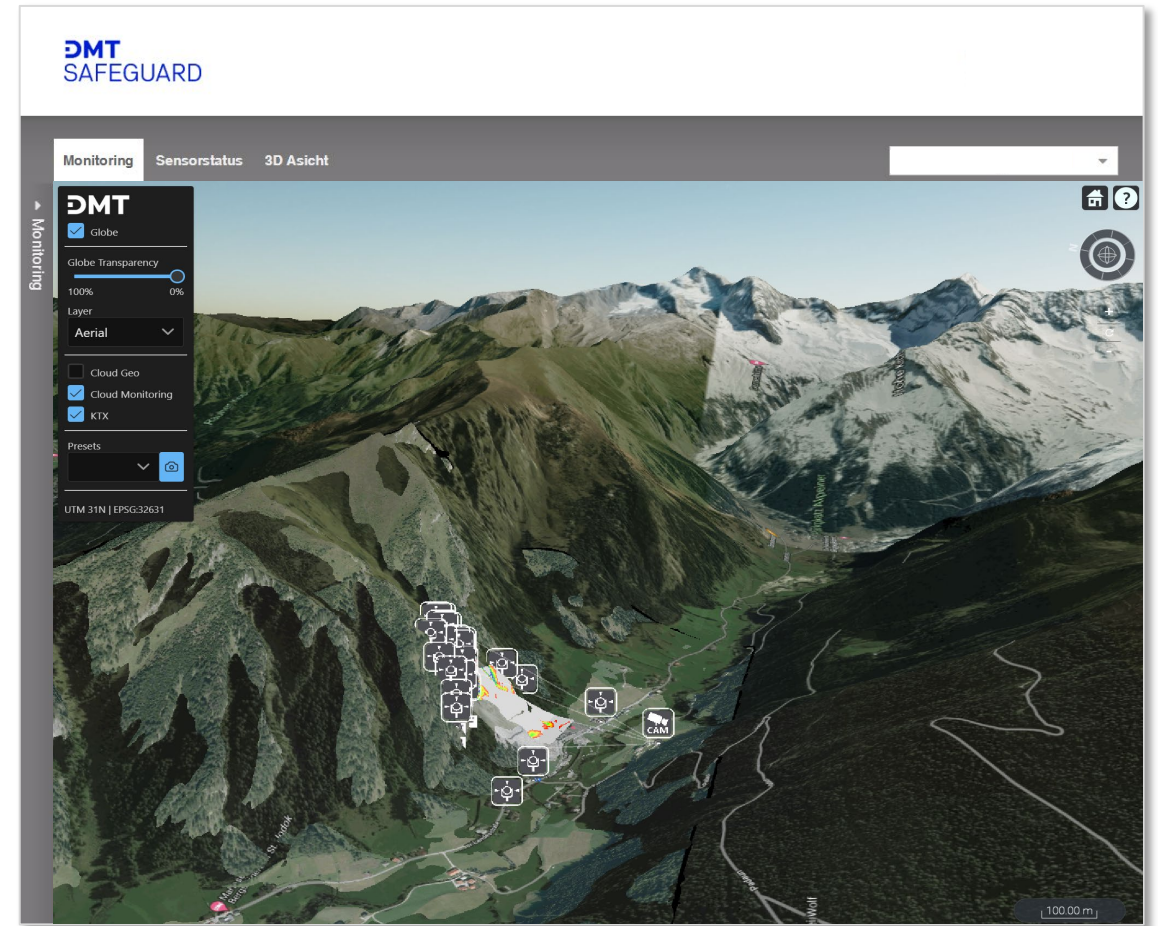
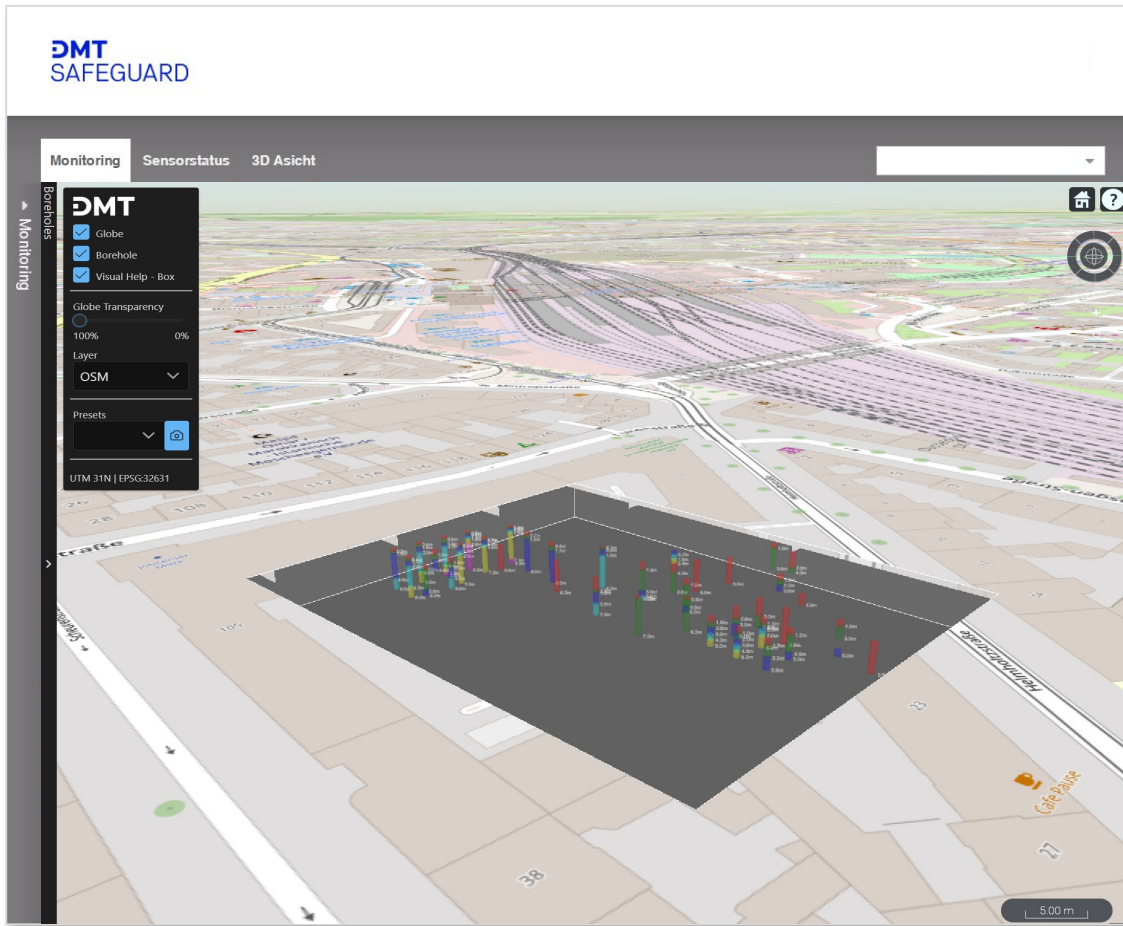
3D Data Management & Visualization - Interactive



Key Functions



3D Data Management & Visualization – Interactive <> Import/Export to BIM



Key Functions

Mobile Applications



SENSOR INVENTORY
with QR-code scanner

SMARTPHONE APP
for Android and iOS

SITE OBSERVATION LOG
with location, photo and
observation notes

DMT SAFEGUARD

Monitoring Project

Sensor: 07U

2020-08-26 2020-08-31

DMT SAFEGUARD

MOBILE ACCESS
to monitoring data and
system status

ORIENTATION ON SITE
with location-based
sensor lists

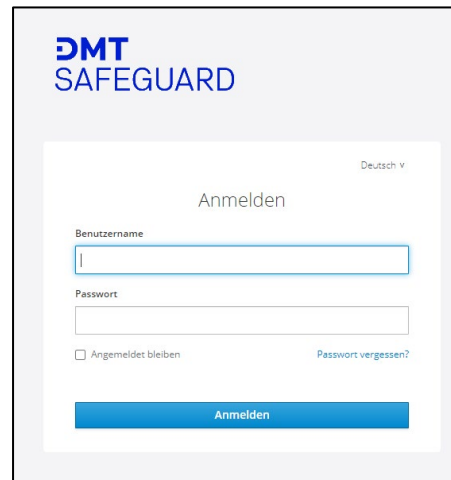
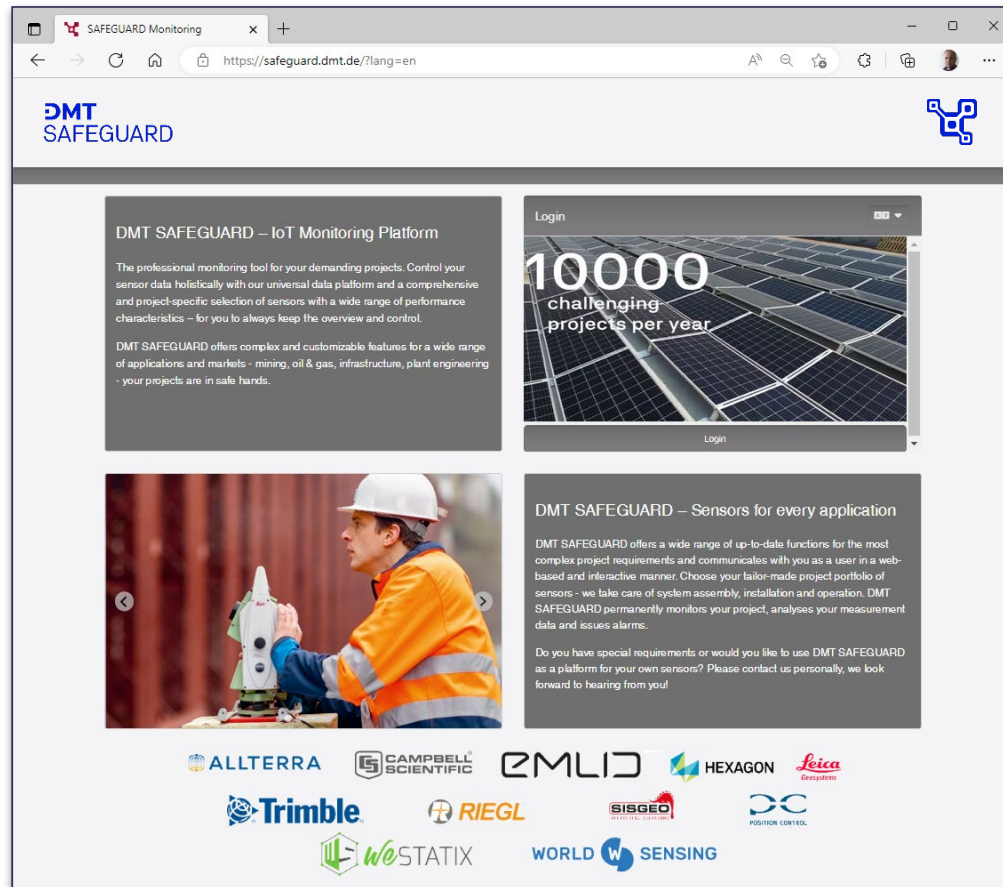
INSTANT ALERTS
with push-notifications

Key Functions

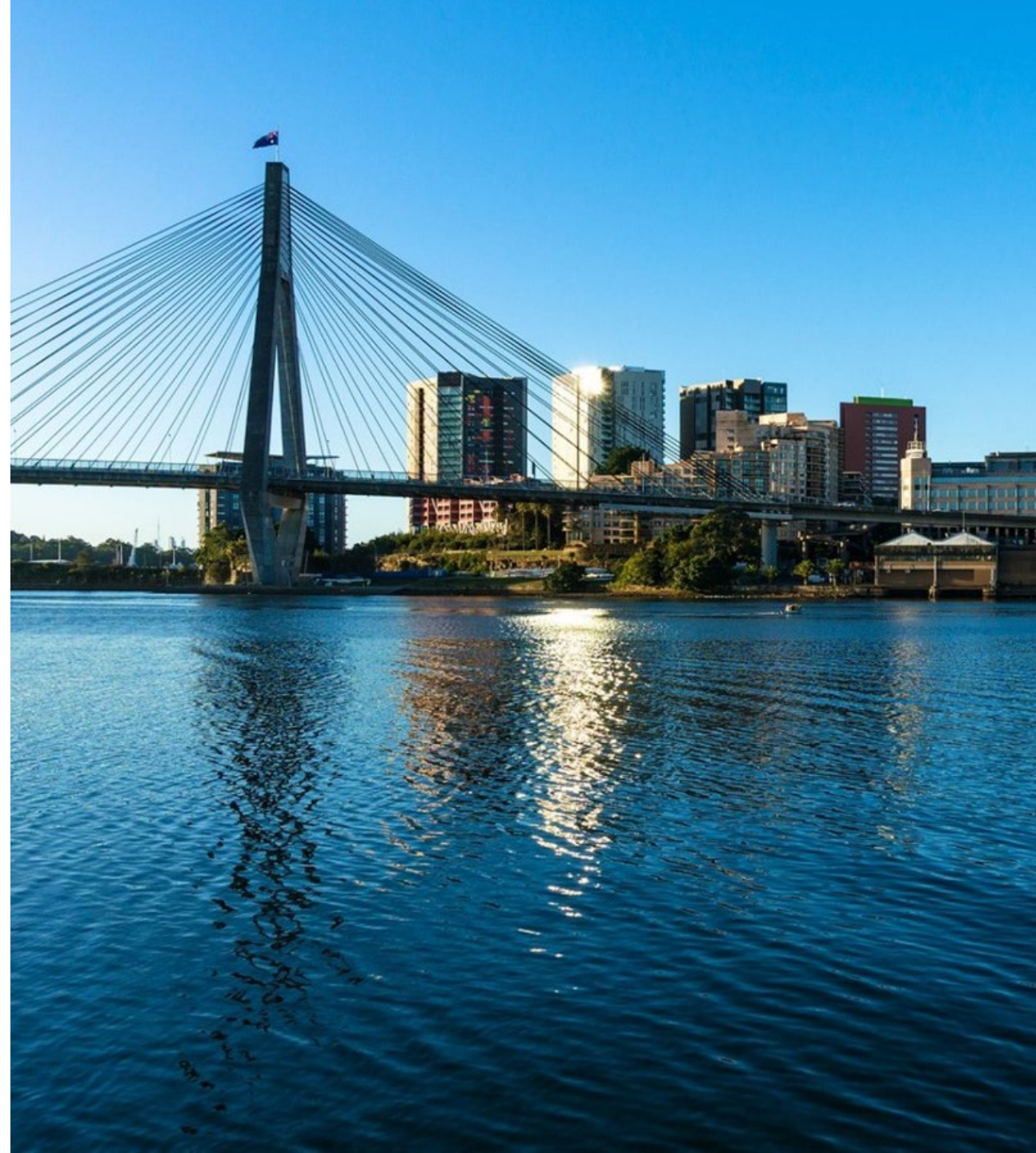
Identity and Access Management



- Single Sign-On
- User Federation Enterprise AD / LDAP
- OpenID Connect, OAuth 2.0 and SAML
- Account-Management
- Client-Adapter



03. Markets & Projects



Fields of Application

- Mining (subsidence, stability, deformation)
- Tunneling (convergence, ventilation, blasting vibrations)
- Infrastructure (excavation pits, bridge monitoring)
- Hydraulic engineering (groundwater, filling levels)
- Natural hazards (slopes, seismicity)
- Industry plant surveillance (cranes, power plants, refineries)



Fields of Application

DMT - ONE STOP SERVICE

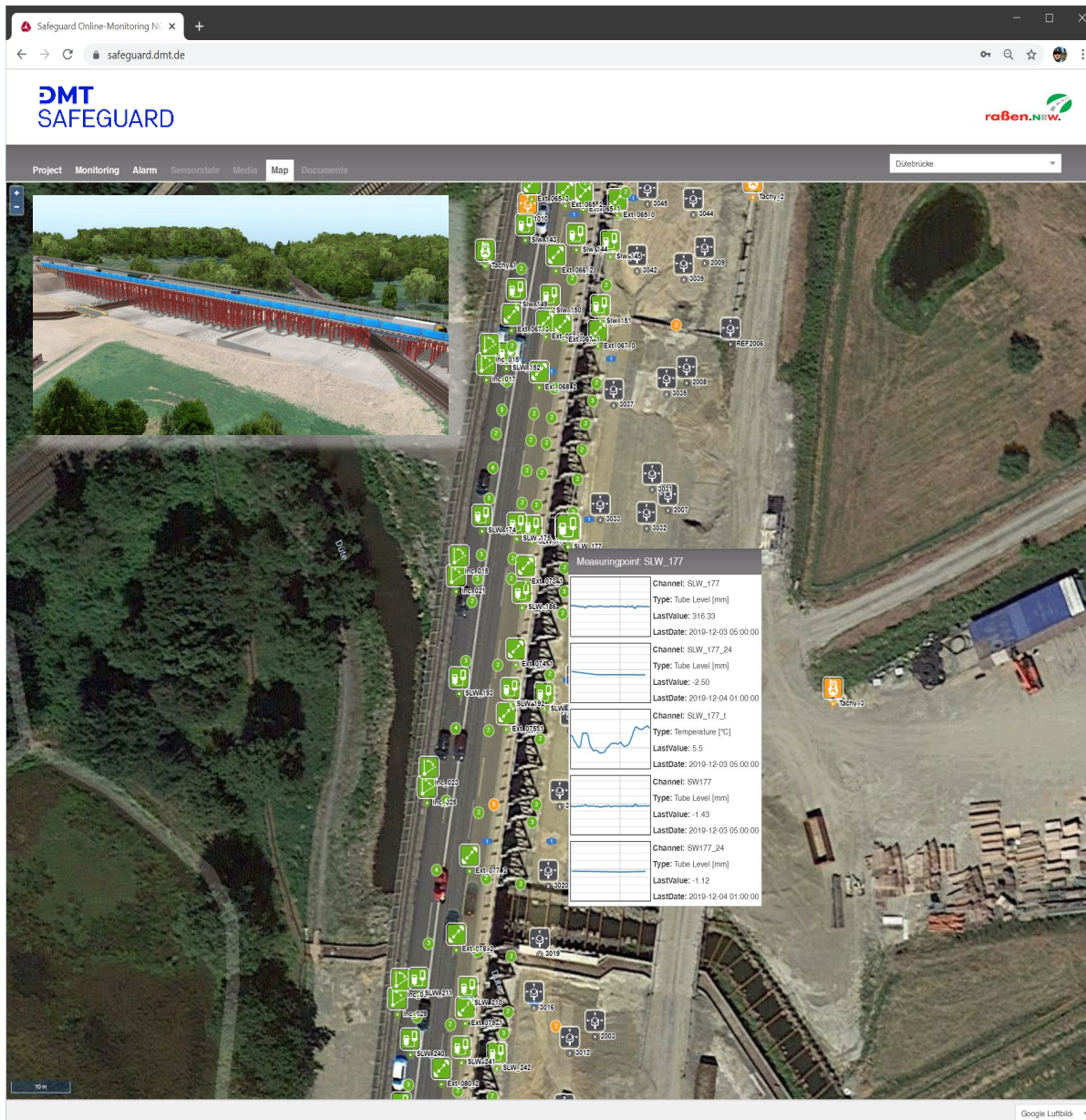
DMT uses the platform as part of its own monitoring projects



PLATFORM AS A SERVICE

CUSTOMERS use the platform as part of their own monitoring projects





03 MARKETS & PROJECTS

Infrastructure Civil Engineering

Bridge Monitoring – Dütebrücke Autobahn A1 near Osnabrück, Germany

PORR Bauunternehmen, Straßen NRW



- Permanent monitoring of the movement and deformations of bridge and auxiliary structures
 - Provision of information for the assessment of structural stability and planning specifications
-
- Engineering of the system > 500 sensors
 - Provision of measurement technology, installation
 - All sensors are networked and operated online
 - Data management and web-based client access via DMT SAFEGUARD Monitoring Platform
 - Automated notification (text-message, E-Mail) when threshold values are exceeded

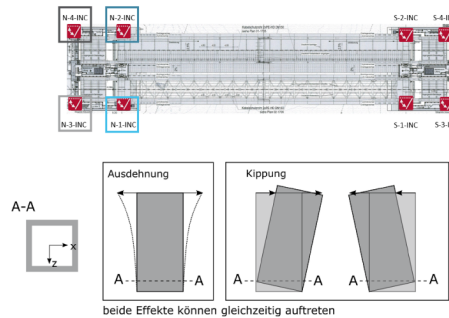
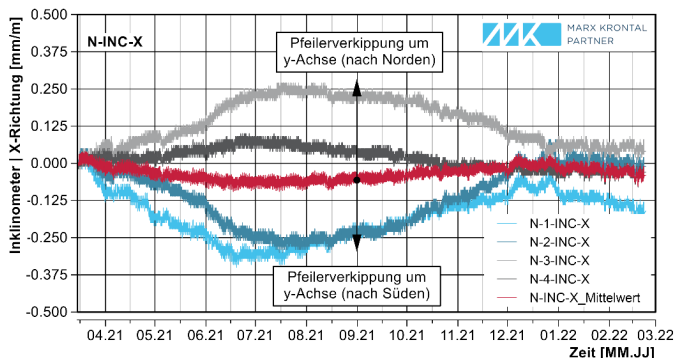
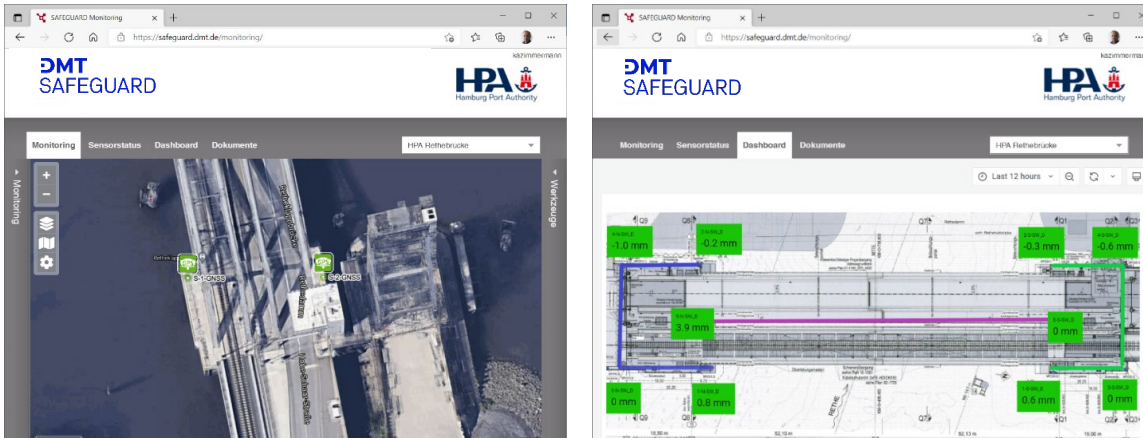


03 MARKETS & PROJECTS

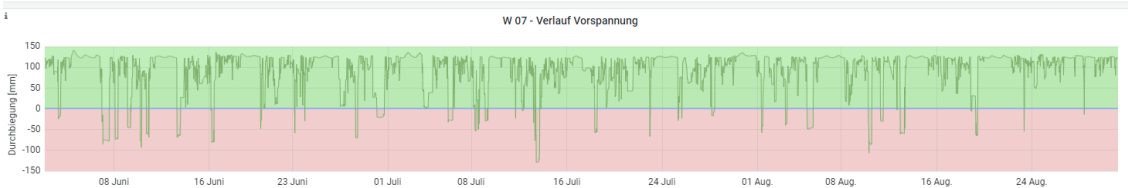
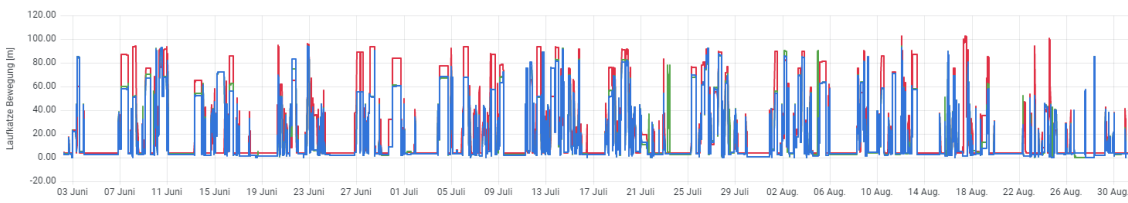
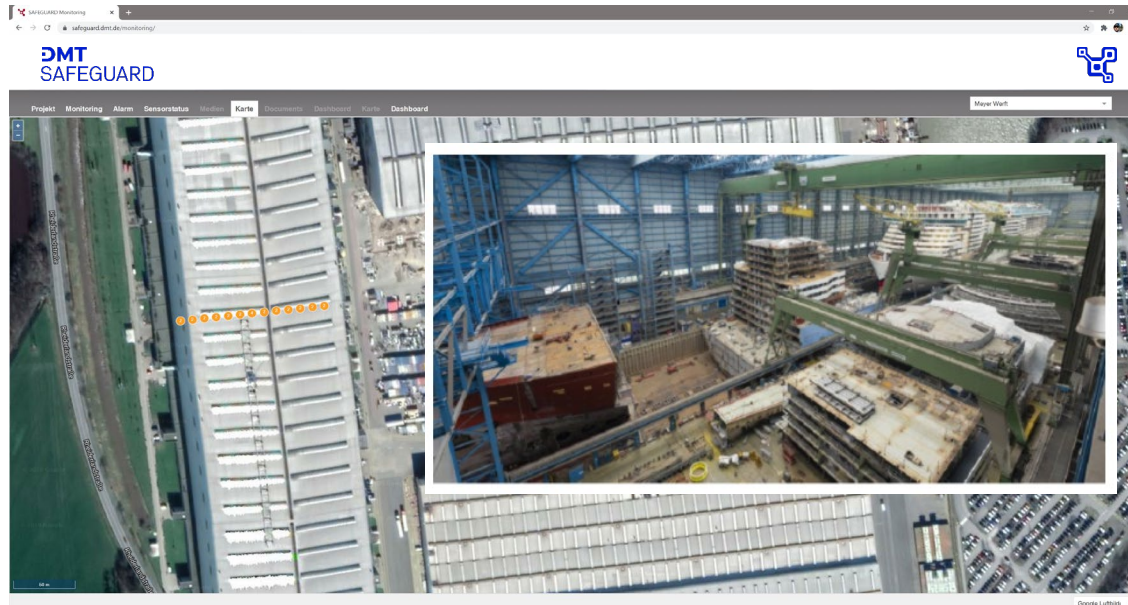
Infrastructure Civil Engineering

Bridge Monitoring – Rethebrücke Hamburg, Germany

Hamburg Port Authority



- Permanent monitoring of the movement and deformations of bridge and auxiliary structures
 - Provision of information for the assessment of structural stability, load-bearing capacity, serviceability and durability
-
- Engineering of the system: liquid level gauges, laser distance sensors, inclination sensors, ultrasonic distance sensors, total stations, GPS, meteo stations, water level gauge, partly SPS - controlled
 - Provision of measurement technology, installation
 - All sensors are networked and operated online
 - Data management and web-based client access via DMT SAFEGUARD Monitoring Platform
 - Automated notification (text-message, E-Mail) when threshold values are exceeded



03 MARKETS & PROJECTS

Industry Large Components

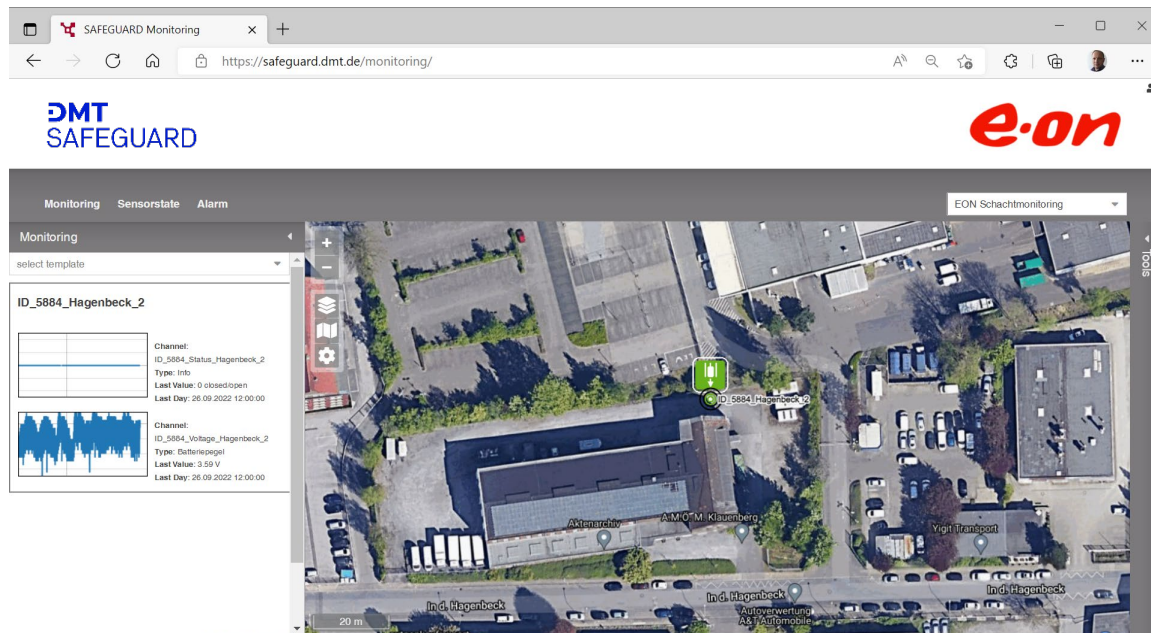
Crane beam monitoring – Meyer Werft Papenburg, Germany

Meyer Werft



- Monitoring to determine the deflection of an 800t gantry overhead beam crane during operation
- Provision of information for the assessment of plant condition, operation and optimization

- Engineering of the system > liquid level gauges
- Provision of measurement technology, installation
- All sensors are networked and operated online
- Data management and web-based client access via DMT SAFEGUARD Monitoring Platform
- Automated notification (text-message, E-Mail) when threshold values are exceeded



03 MARKETS & PROJECTS

Mining Abandoned Shafts

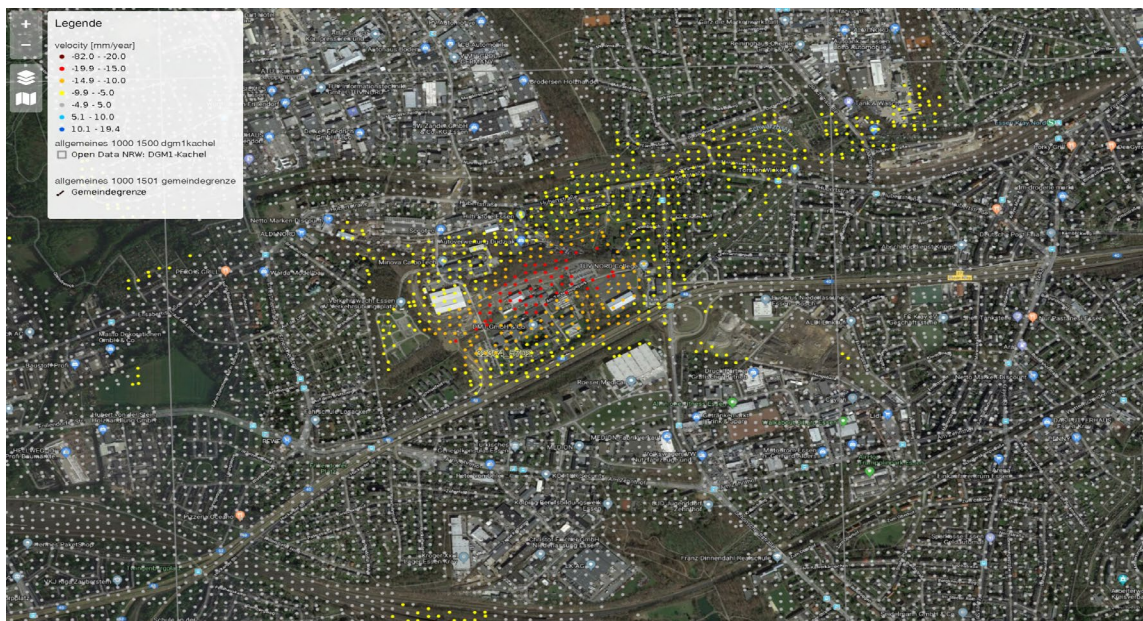
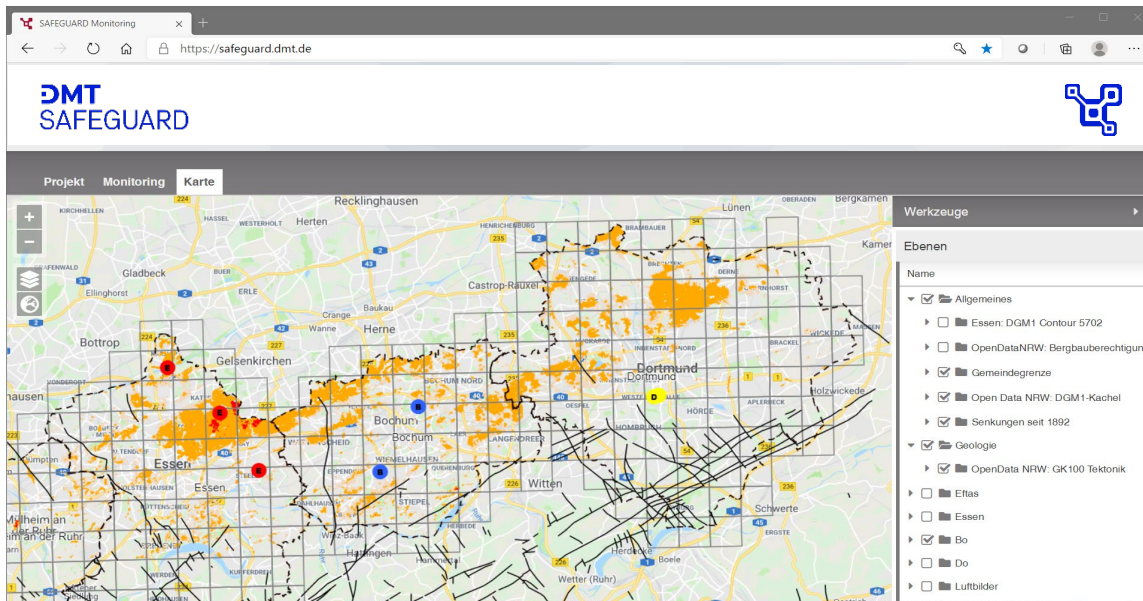
DMT SAFEGUARD SCM Sensor + Mine Shaft Column Monitoring

E.ON



- Monitoring the integrity of shaft filling columns is of great importance worldwide. When monitoring, it must be taken into account that methane gas can escape at the shaft, so explosion protection (Ex-protection) guidelines apply
- In close cooperation with E.ON, DMT has developed a special monitoring system with hydraulic switching that is unique on the market
- Battery-powered data transmission, self-sufficient for several years
- System protection by utility model (DPMA)
- Installation and operation of SCM at 11 shafts with automated data acquisition, data transfer, storage and web visualization with DMT SAFEGUARD, alarm





Infrastructure Platform as a Service

Monitoring Data Infrastructure - Ruhr Area, Germany



Network of the Ruhr cities

- Central management and presentation of monitoring data and relevant geoinformation as a cloud service model
 - Surveillance of potential ground movements of the surface at public buildings, structures and construction projects
-
- Provision of DMT SAFEGUARD as a platform
 - Continuous monitoring of the surface in given spatial areas by satellite based radar interferometry
 - Engineering, installation and operation of ground sensors
 - Integration of further geoinformation relevant to post-mining (e.g. risk map of old mining areas) and technical expertise

Critical Infrastructure Civil Engineering

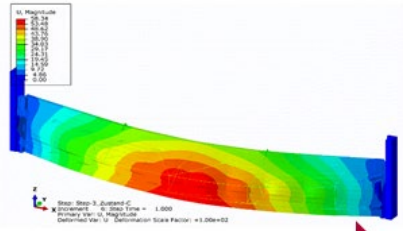
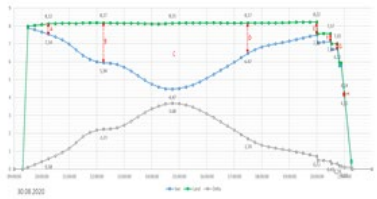
Tailor-made measurement solution for the monitoring of the lift gate of a tidal barrier

- Emssperrwerk, Gandersum, Lower-Saxony

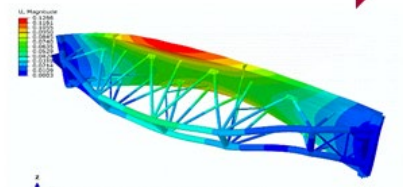
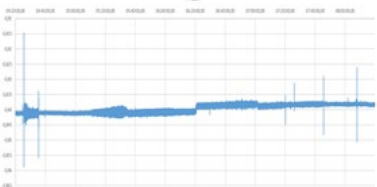


NLWKN

- Cooperation of TÜV NORD and DMT at the engineering of a suitable measurement solution
- Engineering and installation of a sensor network for the surveillance of pressure, temperature and vibration
- Online database for the visualization of results
- Simulation and computation of a fatigue verification by TÜV NORD to proof the successful operation of the system



| Sensor | | Value | |
|----------|---------|----------|---------|
| CTM 1677 | 32 mbar | CTM 1682 | 21 mbar |
| CTM 1678 | 16 mbar | CTM 1683 | 8 mbar |
| CTM 1679 | 15 mbar | CTM 1684 | 1 mbar |
| CTM 1680 | 3 mbar | CTM 1685 | 1 mbar |
| CTM 1681 | 4 mbar | CTM 1686 | 1 mbar |
| CTM 1682 | 2 mbar | CTM 1687 | 1 mbar |
| CTM 1683 | 1 mbar | CTM 1688 | 1 mbar |
| CTM 1684 | 1 mbar | CTM 1689 | 1 mbar |
| CTM 1685 | 1 mbar | CTM 1690 | 1 mbar |
| CTM 1686 | 1 mbar | CTM 1691 | 1 mbar |
| CTM 1687 | 1 mbar | CTM 1692 | 1 mbar |
| CTM 1688 | 1 mbar | CTM 1693 | 1 mbar |
| CTM 1689 | 1 mbar | CTM 1694 | 1 mbar |
| CTM 1690 | 1 mbar | CTM 1695 | 1 mbar |
| CTM 1691 | 1 mbar | CTM 1696 | 1 mbar |
| CTM 1692 | 1 mbar | CTM 1697 | 1 mbar |
| CTM 1693 | 1 mbar | CTM 1698 | 1 mbar |
| CTM 1694 | 1 mbar | CTM 1699 | 1 mbar |
| CTM 1695 | 1 mbar | CTM 1700 | 1 mbar |
| CTM 1696 | 1 mbar | CTM 1701 | 1 mbar |
| CTM 1697 | 1 mbar | CTM 1702 | 1 mbar |
| CTM 1698 | 1 mbar | CTM 1703 | 1 mbar |
| CTM 1699 | 1 mbar | CTM 1704 | 1 mbar |
| CTM 1700 | 1 mbar | CTM 1705 | 1 mbar |
| CTM 1701 | 1 mbar | CTM 1706 | 1 mbar |
| CTM 1702 | 1 mbar | CTM 1707 | 1 mbar |
| CTM 1703 | 1 mbar | CTM 1708 | 1 mbar |
| CTM 1704 | 1 mbar | CTM 1709 | 1 mbar |
| CTM 1705 | 1 mbar | CTM 1710 | 1 mbar |
| CTM 1706 | 1 mbar | CTM 1711 | 1 mbar |
| CTM 1707 | 1 mbar | CTM 1712 | 1 mbar |
| CTM 1708 | 1 mbar | CTM 1713 | 1 mbar |
| CTM 1709 | 1 mbar | CTM 1714 | 1 mbar |
| CTM 1710 | 1 mbar | CTM 1715 | 1 mbar |
| CTM 1711 | 1 mbar | CTM 1716 | 1 mbar |
| CTM 1712 | 1 mbar | CTM 1717 | 1 mbar |
| CTM 1713 | 1 mbar | CTM 1718 | 1 mbar |
| CTM 1714 | 1 mbar | CTM 1719 | 1 mbar |
| CTM 1715 | 1 mbar | CTM 1720 | 1 mbar |
| CTM 1716 | 1 mbar | CTM 1721 | 1 mbar |
| CTM 1717 | 1 mbar | CTM 1722 | 1 mbar |
| CTM 1718 | 1 mbar | CTM 1723 | 1 mbar |
| CTM 1719 | 1 mbar | CTM 1724 | 1 mbar |
| CTM 1720 | 1 mbar | CTM 1725 | 1 mbar |
| CTM 1721 | 1 mbar | CTM 1726 | 1 mbar |
| CTM 1722 | 1 mbar | CTM 1727 | 1 mbar |
| CTM 1723 | 1 mbar | CTM 1728 | 1 mbar |
| CTM 1724 | 1 mbar | CTM 1729 | 1 mbar |
| CTM 1725 | 1 mbar | CTM 1730 | 1 mbar |
| CTM 1726 | 1 mbar | CTM 1731 | 1 mbar |
| CTM 1727 | 1 mbar | CTM 1732 | 1 mbar |
| CTM 1728 | 1 mbar | CTM 1733 | 1 mbar |
| CTM 1729 | 1 mbar | CTM 1734 | 1 mbar |
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| CTM 1734 | 1 mbar | CTM 1739 | 1 mbar |
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| CTM 1736 | 1 mbar | CTM 1741 | 1 mbar |
| CTM 1737 | 1 mbar | CTM 1742 | 1 mbar |
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| CTM 1741 | 1 mbar | CTM 1746 | 1 mbar |
| CTM 1742 | 1 mbar | CTM 1747 | 1 mbar |
| CTM 1743 | 1 mbar | CTM 1748 | 1 mbar |
| CTM 1744 | 1 mbar | CTM 1749 | 1 mbar |
| CTM 1745 | 1 mbar | CTM 1750 | 1 mbar |
| CTM 1746 | 1 mbar | CTM 1751 | 1 mbar |
| CTM 1747 | 1 mbar | CTM 1752 | 1 mbar |
| CTM 1748 | 1 mbar | CTM 1753 | 1 mbar |
| CTM 1749 | 1 mbar | CTM 1754 | 1 mbar |
| CTM 1750 | 1 mbar | CTM 1755 | 1 mbar |
| CTM 1751 | 1 mbar | CTM 1756 | 1 mbar |
| CTM 1752 | 1 mbar | CTM 1757 | 1 mbar |
| CTM 1753 | 1 mbar | CTM 1758 | 1 mbar |
| CTM 1754 | 1 mbar | CTM 1759 | 1 mbar |
| CTM 1755 | 1 mbar | CTM 1760 | 1 mbar |
| CTM 1756 | 1 mbar | CTM 1761 | 1 mbar |
| CTM 1757 | 1 mbar | CTM 1762 | 1 mbar |
| CTM 1758 | 1 mbar | CTM 1763 | 1 mbar |
| CTM 1759 | 1 mbar | CTM 1764 | 1 mbar |
| CTM 1760 | 1 mbar | CTM 1765 | 1 mbar |
| CTM 1761 | 1 mbar | CTM 1766 | 1 mbar |
| CTM 1762 | 1 mbar | CTM 1767 | 1 mbar |
| CTM 1763 | 1 mbar | CTM 1768 | 1 mbar |
| CTM 1764 | 1 mbar | CTM 1769 | 1 mbar |
| CTM 1765 | 1 mbar | CTM 1770 | 1 mbar |
| CTM 1766 | 1 mbar | CTM 1771 | 1 mbar |
| CTM 1767 | 1 mbar | CTM 1772 | 1 mbar |
| CTM 1768 | 1 mbar | CTM 1773 | 1 mbar |
| CTM 1769 | 1 mbar | CTM 1774 | 1 mbar |
| CTM 1770 | 1 mbar | CTM 1775 | 1 mbar |
| CTM 1771 | 1 mbar | CTM 1776 | 1 mbar |
| CTM 1772 | 1 mbar | CTM 1777 | 1 mbar |
| CTM 1773 | 1 mbar | CTM 1778 | 1 mbar |
| CTM 1774 | 1 mbar | CTM 1779 | 1 mbar |
| CTM 1775 | 1 mbar | CTM 1780 | 1 mbar |
| CTM 1776 | 1 mbar | CTM 1781 | 1 mbar |
| CTM 1777 | 1 mbar | CTM 1782 | 1 mbar |
| CTM 1778 | 1 mbar | CTM 1783 | 1 mbar |
| CTM 1779 | 1 mbar | CTM 1784 | 1 mbar |
| CTM 1780 | 1 mbar | CTM 1785 | 1 mbar |
| CTM 1781 | 1 mbar | CTM 1786 | 1 mbar |
| CTM 1782 | 1 mbar | CTM 1787 | 1 mbar |
| CTM 1783 | 1 mbar | CTM 1788 | 1 mbar |
| CTM 1784 | 1 mbar | CTM 1789 | 1 mbar |
| CTM 1785 | 1 mbar | CTM 1790 | 1 mbar |
| CTM 1786 | 1 mbar | CTM 1791 | 1 mbar |
| CTM 1787 | 1 mbar | CTM 1792 | 1 mbar |
| CTM 1788 | 1 mbar | CTM 1793 | 1 mbar |
| CTM 1789 | 1 mbar | CTM 1794 | 1 mbar |
| CTM 1790 | 1 mbar | CTM 1795 | 1 mbar |
| CTM 1791 | 1 mbar | CTM 1796 | 1 mbar |
| CTM 1792 | 1 mbar | CTM 1797 | 1 mbar |
| CTM 1793 | 1 mbar | CTM 1798 | 1 mbar |
| CTM 1794 | 1 mbar | CTM 1799 | 1 mbar |
| CTM 1795 | 1 mbar | CTM 1800 | 1 mbar |



Energy Wind Turbine Vibration

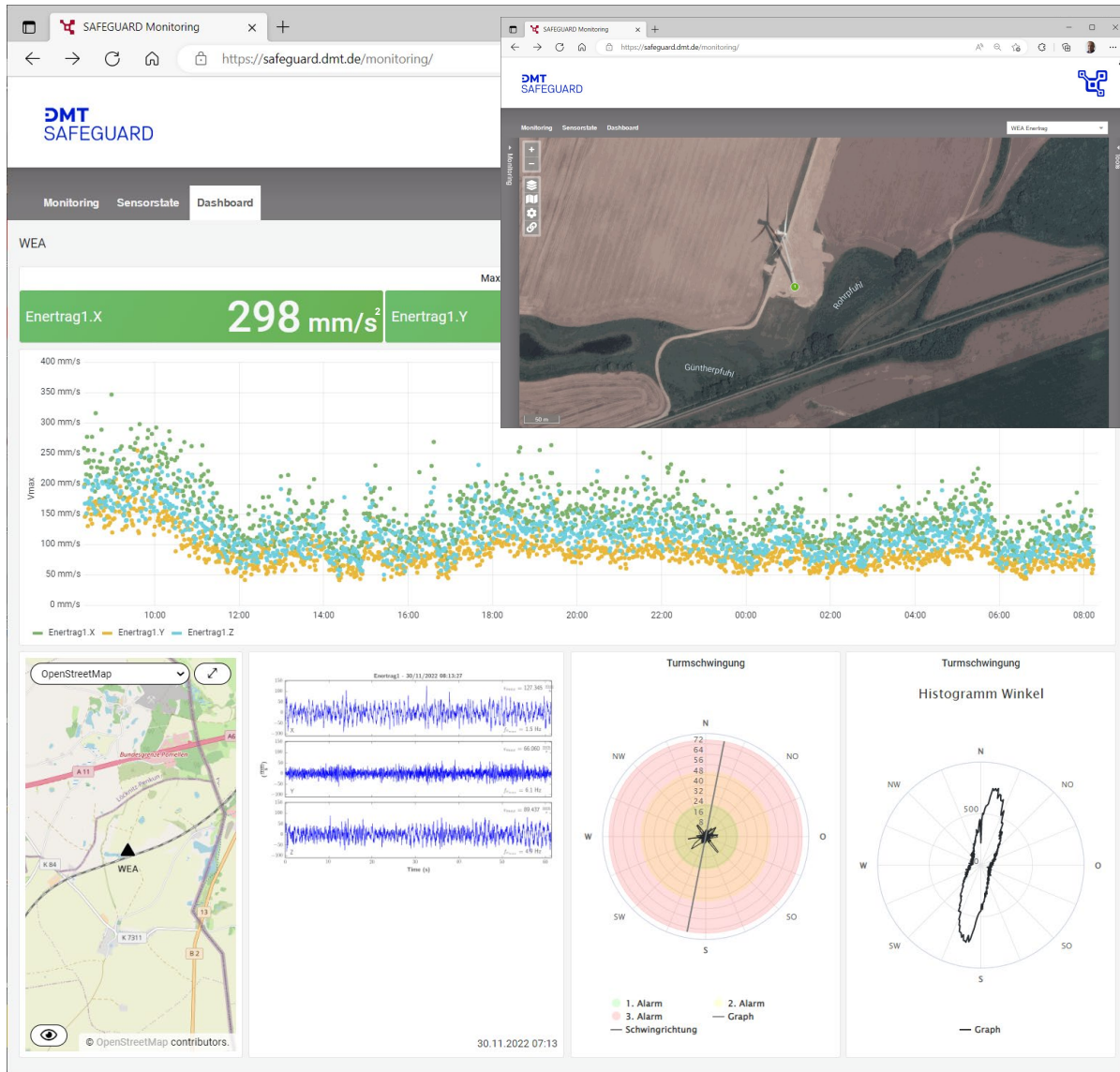
Wind Turbine Monitoring - Germany

ENERTRAG



- Monitoring of wind turbines regarding vibrations
- Provision of crucial information for turbine operation and safety

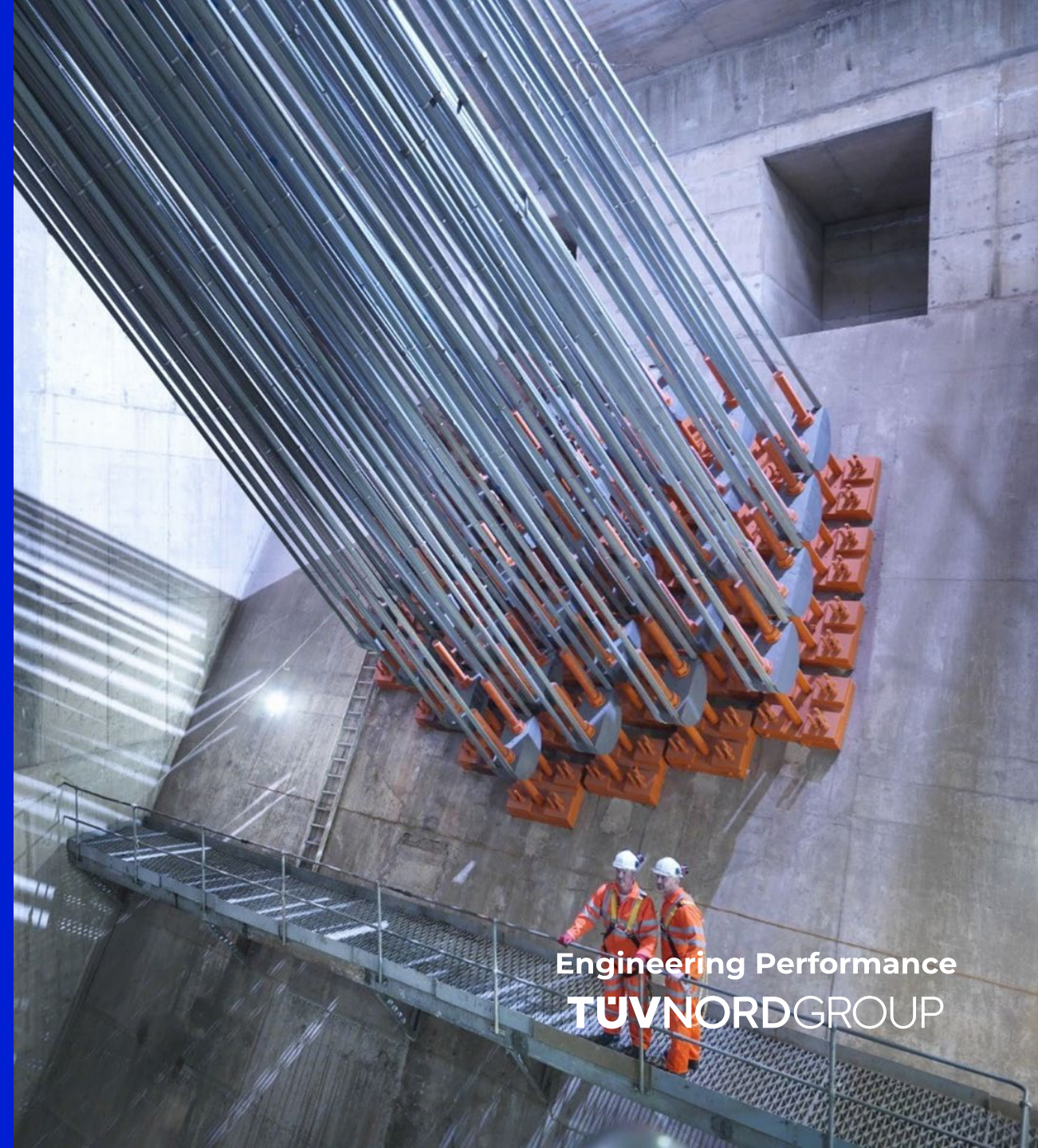
- Engineering of the vibration monitoring system
- Provision of measurement technology, installation
- All sensors are networked and operated online
- Data analytics regarding vibration amplitudes and directions
- Data management and web-based client access via DMT SAFEGUARD Monitoring Platform
- Automated notification (text-message, E-Mail) when threshold values are exceeded



Thank you for your attention

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