

TUnIS.pipelight and MultiStation: Assistance systems for automated control measurements.

- ▣ **Tunnel alignment design:** new, unexpected possibilities
- ▣ **Reduction of downtimes:** Control measurements within a few minutes
- ▣ **Decrease in cost** for services of surveying experts
- ▣ **Improved Quality:** Control measurements can be carried out anytime
- ▣ **Increased accuracy** for long distance and curved drives

TUnIS.pipelight

TUnIS.pipelight, a camera-based assistance system for carrying out automated control surveys improves the precision of gyro-based navigation systems for pipe jacking and Direct Pipe projects in small and even non-accessible diameter areas.

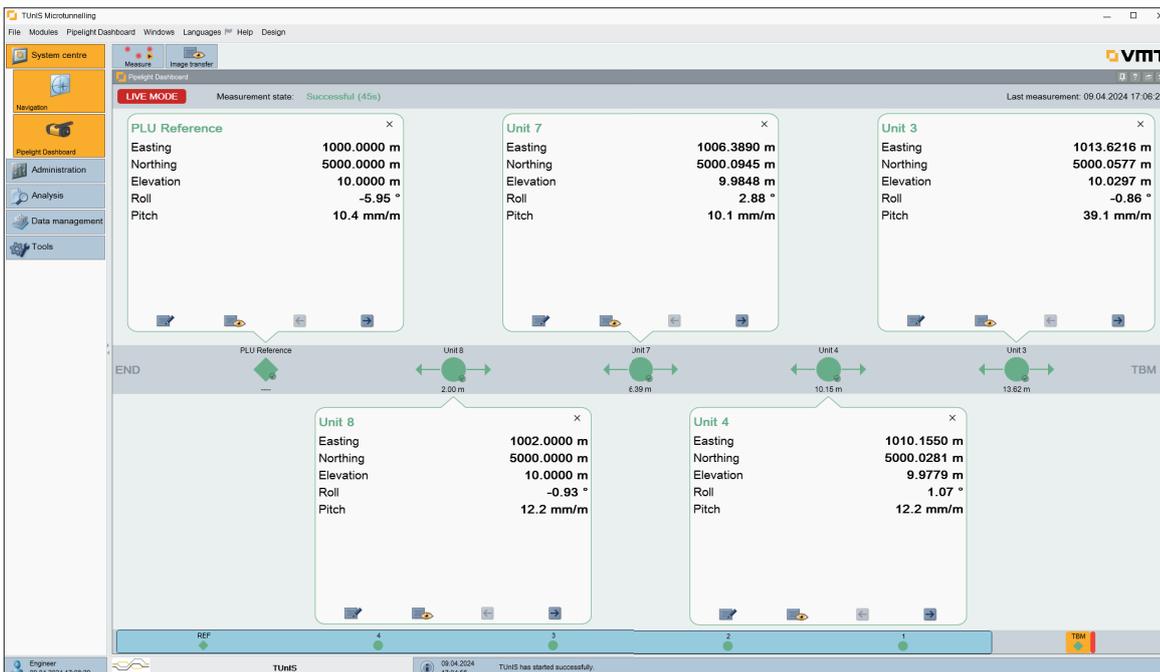


The assistance system acts as automated traverse measurement that determines the actual position of the tunnelling machine and therefore enables the calibration of the gyro navigation system without any significant interruption to the tunnelling process. The system's mode of operation is based on a completely innovative technology using compact camera sensors. These sensors are suitable for very small pipes and pipeline diameters (<1,200 mm). This enables complex alignment geometries to be realised with adequate accuracy.



Benefits

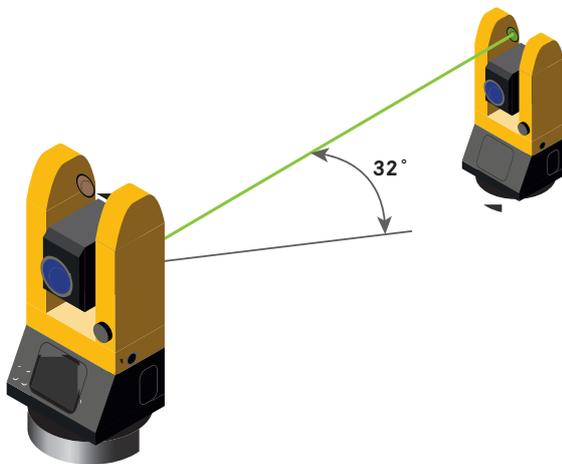
- ▣ **A new era in microtunnelling:**
For the first time, TUnIS.pipelight makes it possible to carry out control surveys in non-accessible curved drives
- ▣ **Significant reduction in costs and construction time:**
For small, non-accessible pipe jacking, the number of intermediate shafts can be significantly reduced thanks to TUnIS.pipelight
- ▣ **Considerable decrease in downtime for accessible direct pipe jobs:**
Automated control measurements take a maximum of 30 minutes instead of several hours.
- ▣ **Increased daily output:**
Significant savings in costs for energy, personnel and rental equipment over the entire project duration.
- ▣ **Maximum occupational safety:**
Thanks to TUnIS.pipelight, no surveyor needs to go into the tunnel; no elaborate safety concepts necessary for measurement services in direct pipe drives.
- ▣ **High flexibility:**
Because of the modular system design, TUnIS.pipelight can be flexibly adapted to the project requirements and, for example, only installed in certain sections of the pipe string.



MultiStation

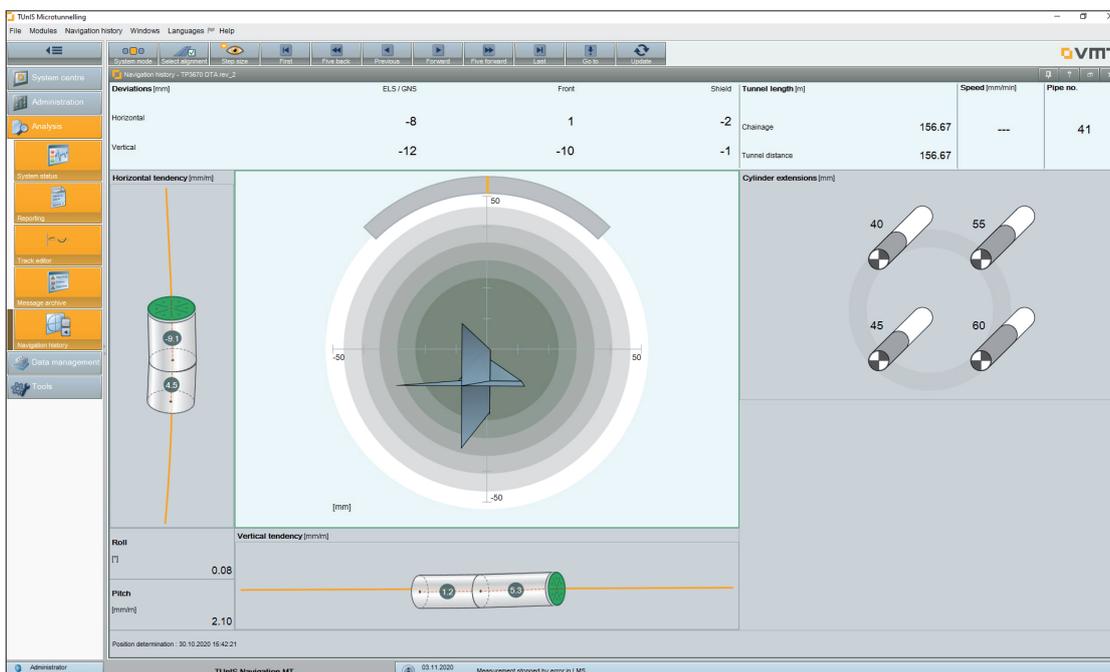
The MultiStation system consists of a chain of total stations installed in the pipeline with a defined spacing. Starting from a fixed station in the launch shaft, the system measures an automated traverse whose end point is a reference point installed on the tunnelling machine..

Due to the fixed station in the launch shaft, the traverse is integrated into the local survey network and determines the actual situation of the tunnelling machine at the measurement time using that network. This result is then transferred to the navigation system and used to readjust it.



Benefits

- ▣ **Reduction of downtimes for control measurements to a few minutes:**
Downtimes of several hours are no longer necessary, as is the case with manual control surveys. The duration for a control measurement is shortened to such an extent that it is no longer perceived as an interruption in the tunnelling process.
- ▣ **Automation equals cost reduction:**
By automating the control measurements, there is no longer any need for a surveyor to be on site. This reduces the costs for services of surveying experts.
- ▣ **Higher frequency, more flexibility, better quality:**
Control surveys can be carried out at shorter intervals, at any time. This avoids larger deviations, reduces corrective steering to the minimum necessary and minimises both jacking forces and pipe loads: The quality of the pipeline is significantly improved.
- ▣ **Assured quality even for small diameter pipe jacking:**
Control measurements can also be carried out for smaller diameters (down to DN 1200) – this means for pipes that cannot be entered. Thus, even long-distance and curved drives in these diameters can be excavated with high accuracy, resulting in considerable cost advantages during construction.

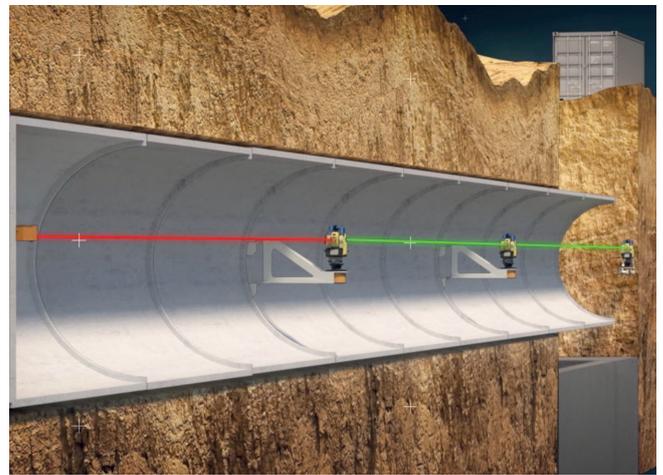
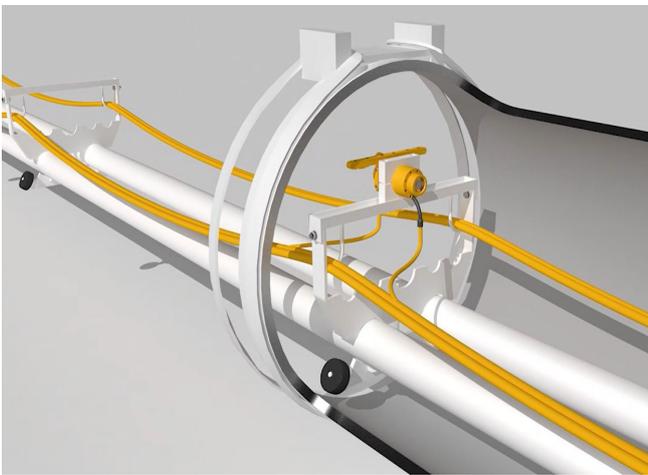


New solutions for automated control measurements

Two assistance systems for automated control measurements herald a new era for the planning and execution of microtunnelling projects.

Until now, the use of navigation systems for curved and long-distance tunnelling (gyro-based or based on laser total stations) required manual control measurements to ensure the accuracy of the tunnelling. At the same time, the need for longer tunnelling with critical diameters of $\leq 1,200$ mm is continuously increasing in the fields of microtunnelling and direct pipe tunnelling worldwide, where personnel access to the pipeline is difficult or even not allowed.

Pipe jacking or direct pipe projects with pipe or pipeline diameters $\leq 1,200$ mm and challenging alignments (straight lines >400 m or curved routes) can only be navigated with a gyro system. Manual control measurements, which are essential for the calibration of the gyro system and thus for the required accuracy, are very time-consuming. Access to the pipeline by surveying personnel may require special safety concepts or men-entry may be prohibited at all for occupational safety reasons due to the small diameter of the pipelines.



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