

*As the mining activities of open-pit mines advance to the deep, artificial tall slopes will be formed, which poses a threat to the safe production of open-pit mines. Once the slope slides, it will directly cause damage to the personnel and equipment working nearby, and cause immeasurable economic losses to the open-pit mine. Therefore, advanced monitoring methods are a powerful guarantee for mine slope prevention and control.*



## *Application of slope radar monitoring system in Mine Monitoring*

### **Project Background**

The Kizil-Tashteq Polymetallic Mine is a high-grade mega-lead-zinc polymetallic mine located 120 km north-east of Kizil, the capital of the Republic of Tuva in the Russian Federation, located at forested snow plain at an altitude of more than 1,600 metres. Since it was officially put into production in 2015, the resources of the Kizil-Tashteq polymetallic mine have been substantially depleted by open pit mining and have been gradually transitioned to underground mining. Compared with open pit mining, underground mining poses greater safety risks, as the collapse of the mining area will directly endanger the safety of personnel and equipment, cause damage to the shaft equipment, and generate air shock waves that are equally harmful. After careful consideration, the project unit decided to adopt the slope monitoring radar system with higher monitoring accuracy, easy installation and wide monitoring range to monitor the mine slope.

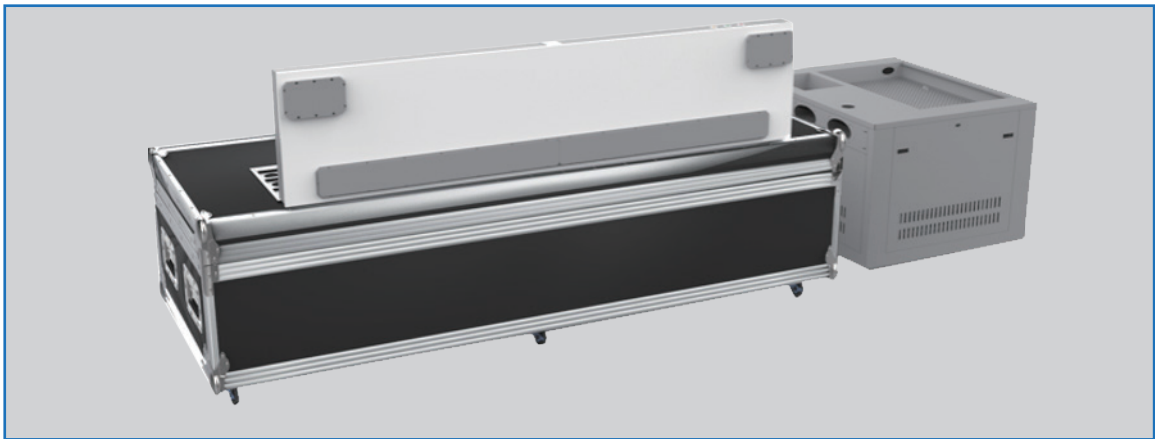
### **Pain Point Analysis**

The monitoring content of the project is mainly the real-time displacement of the mine surface. The mine is a continuous operation, and the slope condition is unstable, and landslides and collapses may occur at any time. In order to ensure the safety of operators, the contact monitoring means have certain risks.

Meanwhile, the traditional GNSS online monitoring system needs to be erected on the stable slope surface, which cannot meet the system installation conditions for the mining environment of continuous operation; the GNSS online monitoring system mostly adopts solar power supply, which is difficult to ensure sufficient solar power supply for the Kizil-Tashteq polymetallic mine located in a relatively cold climate.

## Implementation Program

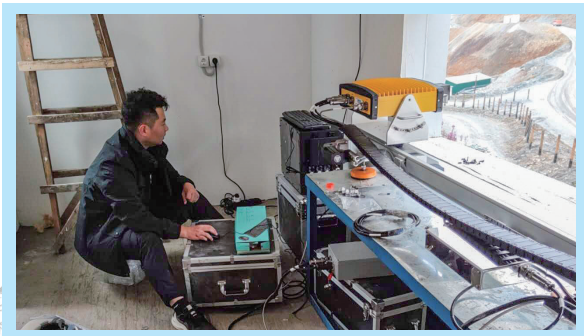
With excellent product performance and technical services, Hi-Target has become a partner of this monitoring and early warning project. The Hi-Target slope radar monitoring system is a non-contact monitoring method. It uses radar beams to conduct continuous, repeated, and large-scale measurement and scanning of the slope rock mass in the mining area all day and all day long. The millimeter-level displacement monitoring data is compared and analyzed with the previous model data to determine the degree of deformation and displacement, and then calculate the displacement change rate, so as to accurately predict the future trend of slope displacement.



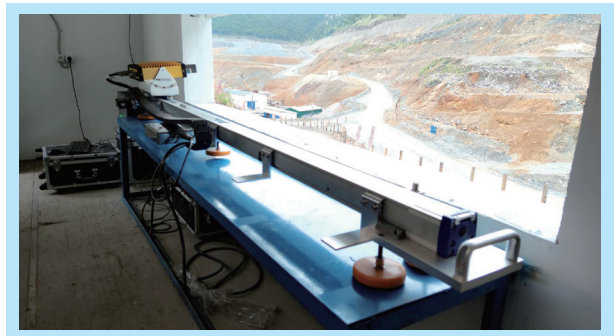
Hi-Target Slope Radar Monitoring System **FIG1**

## Workflow

After arriving at the work site with Hi-Target slope radar monitoring system, the technicians determine the installation location of the radar monitoring point through on-site survey to ensure that the radar waves could fully cover the monitoring area. After the survey, the location of the radar monitoring point is chosen in an area with stable geological structure and open sightline, meeting the requirements of radar imaging of not less than 4km, opposite to the monitoring area.

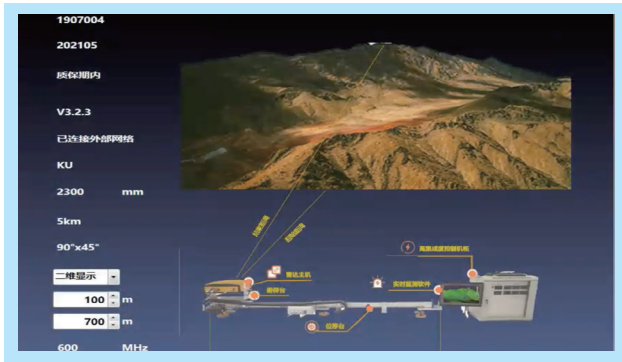


Technicians install radar mainframe **FIG2**

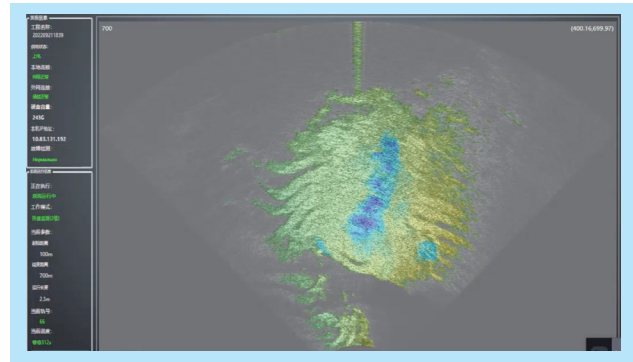


Hi-Target slope radar monitoring system after installation **FIG3**

With the assistance of the customer, the technicians build the hut to install the radar host at the monitoring point. As the radar host adopts integrated design, small volume and light weight, the technicians finish the installation of the radar host efficiently. After the radar mainframe is poared on, the technicians set the parameters of the deformation monitoring radar data acquisition software to ensure the normal operation of the Hi-Target slope radar monitoring system after startup, so as to generate a 3D model report of the monitoring area.



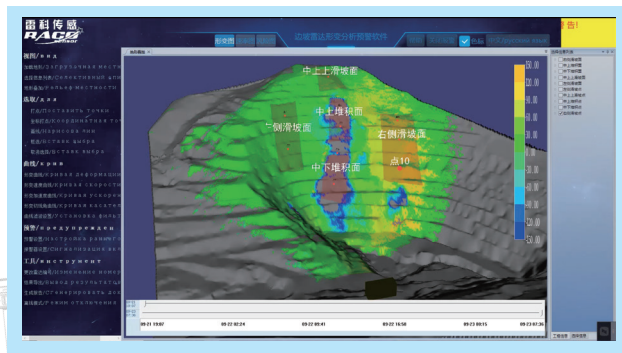
Deformation monitoring radar data acquisition software parameter setting interface FIG4



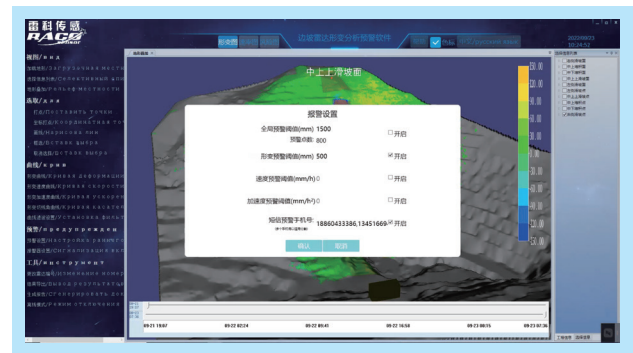
Deformation monitoring radar data acquisition software start-up monitoring map FIG5

## Result

On the generated 3D model report interface, different displacements can be displayed in different colors. The displacement values corresponding to different colors are marked on the right side of the interface. This figure intuitively shows the displacement changes of the slope. Operators can know the dynamics of slope deformation in a timely manner according to the colors. When the monitoring result reaches the color alarm threshold, the Hi-Target slope radar monitoring system will give an early warning through the software red light flashing or SMS.



Slope displacement change monitoring map FIG6



Alarm setting interface FIG7



The Hi-Target radar monitoring system can generate four types of curve reports: deformation curve, deformation rate curve, reciprocal rate curve, and deformation acceleration curve, allowing operators to accurately predict the future trend of slope displacement.



Deformation curve report FIG8

## Project Summary

By comparing traditional manual inspection and GNSS online monitoring system, Hi-Target slope radar monitoring system has unparalleled advantages.

First of all, the monitoring accuracy of Hi-Target slope radar monitoring system is high. Through electronic scanning, the system can obtain one displacement image of the observation scene every 30 seconds at the earliest, and each displacement image can obtain data of millions of monitoring points, and the monitoring accuracy can reach 0.1mm.

Secondly, the safety factor of Hi-Target slope radar monitoring system is high. The system adopts non-contact measurement and sets up radar on the opposite side of the deformation area to carry out large-scale remote scanning without any fixing objects or setting up base stations, which ensures the safety of installers and operators to the greatest extent.

Thirdly, Hi-Target slope radar monitoring system is easy to install and low cost. The system adopts integrated design, smaller volume and lighter weight, single person can complete the installation, no need to set up piles to pour the base station, saving the cost investment.

Finally, Hi-Target's slope radar monitoring system monitors around the clock. The radar technology adopted by the system is not affected by day and night, which can ensure 24-hour continuous monitoring of the system.

To sum up, Hi-Target slope radar monitoring system can be widely used in long-term monitoring and emergency monitoring of mountain, ore body, dam body and other areas, in order to achieve round-the-clock, all-weather, non-contact, high-precision remote monitoring and landslide early warning of the monitoring area, and build a safety barrier for people's lives and properties.



More information at <https://en.hi-target.com.cn/become-our-partner/>

## About Hi-Target

Established in 1999, Hi-Target is the first professional high-precision surveying and mapping instrument brand to be successfully listed in China.

Hi-Target provides a wide range of surveying equipment including GNSS receivers, CORS stations, Total Stations, 3D Laser Scanners, GIS Data Collectors, UAV/UAS, and Hydrographic products to offer complete commercial solutions for various industries.

As the leading brand in the geospatial industry, Hi-Target invests heavily in research and development, on top of collaborating with more than 100 universities globally to bring the latest positioning technology and innovation for product development.

For over 20 years, Hi-Target has approximately 2,500+ employees worldwide, with an established network of 20+ subsidiaries, 28 branches and more than 200 partners in 100+ countries / regions to service and support our customers.

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