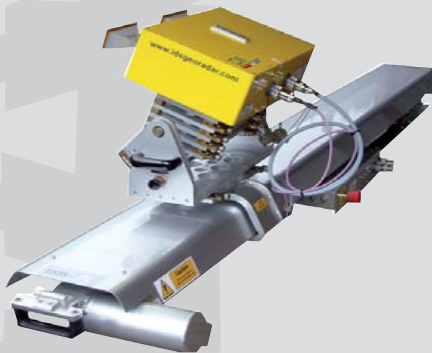




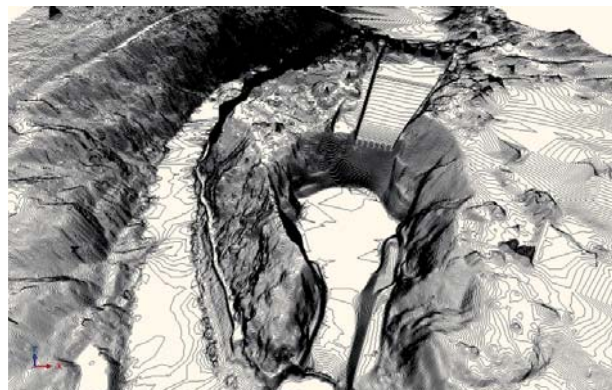
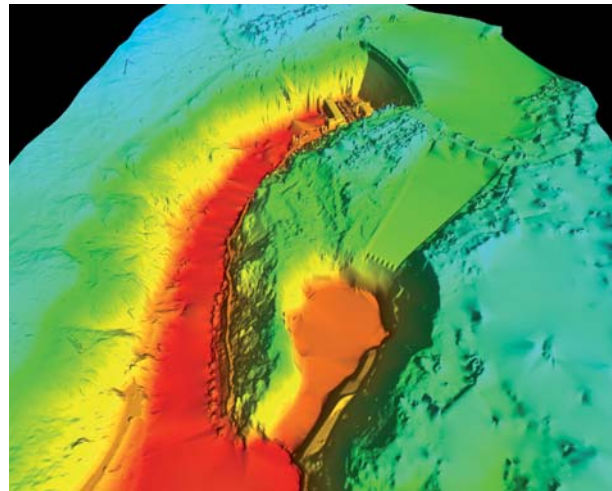
## Engineering Geology

### Terrestrial LiDAR & InSAR Technologies



## Terrestrial LiDAR

Our terrestrial LiDAR (Light Detection and Ranging) system RIEGL LMS-Z620 consists of a high performance long-range 3D laser scanner and a calibrated and accurately oriented high-resolution digital camera. The system provides 3D survey data to generate products such as textured triangulated surfaces and undistorted high resolution panorama images, as a basis for geotechnical and geomechanical analysis. Modern LiDAR technology offers a unique and unrivalled combination of a wide field-of-view, high maximum range, and rapid data acquisition.



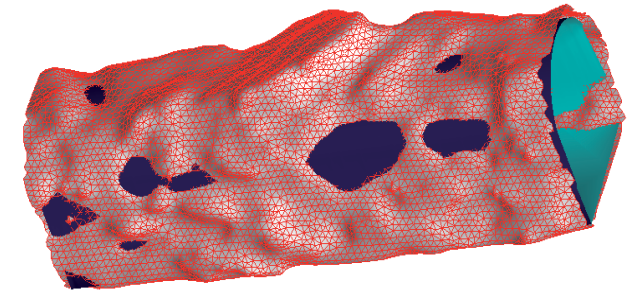
*LiDAR generated false-color elevation model and topographic map of the Ricobayo Dam and Spillway, Zamora, Spain.*

### Key Specifications

- Measurement range 2 - 2000 m
- Accuracy 10 mm
- Minimum angle step width 0.004°

### Products

Raw survey data is presented in the form of 3D point clouds, and post processing services are offered for developing triangulated surface models, orthophotos, contour maps, and a variety of other 2D and 3D products. Raw and processed data can be formatted for direct input to computer aided design programs such as AutoCAD and MicroStation.



*Volumetric LiDAR model of tunnel indicating areas of tunnel underbreak (lining encroachment).*



*LiDAR survey of ground failure caused by the 2009 L'Aquila Italy earthquake*

### Applications

- Slope stability analysis
- Tunnel documentation/claims management
- Quantification of volume change and surface deformation
- Digital terrain model generation
- Accurate remote measurement of structural geologic features
- Forensic engineering
- Cultural heritage restoration

# Ground Based InSAR

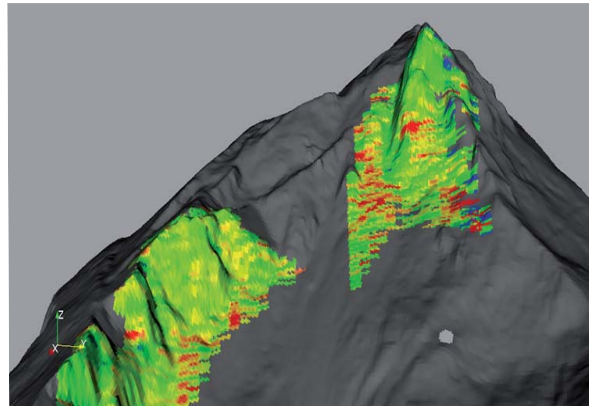
Interferometric Synthetic Aperture Radar (InSAR) technology permits the real-time remote monitoring of structural or terrain deformations with sub-millimeter accuracy. Our IBIS-FL InSAR equipment can remotely measure the simultaneous displacement of thousands of points over large areas (e.g. natural geologic reflectors comprising a hillside), without the need for physically accessing the survey area. The IBIS-FL provides displacement time series for each reflector with an accuracy of up to 0.1 mm. Automatic acquisition and processing of data enables the device to provide early warning of dangerous landslide movements based on user- specified displacement and velocity thresholds.



*InSAR deployment in Reutte, Tyrol for the remote (2.2 km) measurement of rock wall deformation.*

## Key Specifications

- Real time remote measurements at up to 4 km range
- Displacement accuracy in the sub-millimeter range
- Real time 3D map of displacements/ velocities over areas of several square kilometers
- Operates day & night in most weather conditions
- Scan times of less than 6 minutes



*InSAR displacement map of the Hornberg, Reutte, Tyrol.*

## Products

- InSAR displacement and velocity maps, projected onto a digital terrain model
- Time history data (displacement, velocity, and inverse velocity) for select monitoring points and areas
- Derivative GIS-based maps for visualizing layers of geology and deformation simultaneously

## Applications

- Slope stability analysis
- Monitoring of deep excavations
- Geologic hazards assessment
- Emergency response (civil defense)
- Monitoring of ground subsidence and heave
- Monitoring of civil structures: dams, bridges, towers

## Additional Information

In situations where detailed information regarding active ground deformation is essential, LiDAR and InSAR offer complementary state-of-the-art technologies. InSAR provides unprecedented displacement field information, as LiDAR provides the digital terrain model and an accurate photo-realistic 3D model of surface geologic conditions. Survey control with real time kinematic GPS technology ensures accurate geo-referenced results and facilitates data integration with GIS platforms.

SCIENCE • PASSION • TECHNOLOGY



## Terrestrial LiDAR & InSAR Services

For further information regarding LiDAR and InSAR technologies and their potential application for your project, please contact:

Univ.-Prof. Dr. Scott Kieffer, P.E., C.E.G.  
Professor of Engineering Geology  
Institute of Applied Geosciences  
Graz University of Technology  
Rechbauerstraße 12  
8010 Graz, Austria

Tel: +43 316 873 6370  
Mobile: +43 664 60 873 6370  
E-mail: [kieffer@tugraz.at](mailto:kieffer@tugraz.at)  
Homepage: [www.egam.tugraz.at](http://www.egam.tugraz.at)

