Гиперспектральные камеры ATH1010-4-17

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Datasheet

Wideband Hyperspectral Imager

ATH1010-4-17

Features

- Wavelength Range:400–1700nm.
- Hyperspectral resolution: 1.5nm at 546nm, 4.6nm at 1128nm.
- Spectral path: Holographic transmission grating. Maximum FOV: 31.7°.
- Minimum instantaneous FOV: 1.2mrad.
- Exceptional imaging performance.
- Powerful image compression algorithm.
- Compact size: 280mm × 150mm × 75mm.
- Lightweight: <1700g.
- No mechanical scanning, high reliability.

Application

- Geological exploration.
- Precision agriculture.
- Pest & disease monitoring.
- Coastline monitoring.
- Grassland monitoring.
- Lake & watershed monitoring.
- Remote sensing research.
- Meteorological studies.
- Environmental protection.
- Water & soil monitoring.

Description

The ATH1010-4-17 is a compact, lightweight wide-band hyperspectral imager compatible with various drones. It offers high spatial and spectral resolution, along with a wide imaging range. The system includes an imaging lens and a hyperspectral sensor using transmission grating technology, providing excellent aberration characteristics and clear, low-noise images with high performance CCD imaging devices. Its cylindrical design makes it ideal for multirotor drones.

This imager is ideal for real-time spectral measurement of plants, water, and soil, enabling research in plant classification and growth monitoring. The system features high spectral resolution and uses external scanning imaging, which can be paired with rotating or linear scanning platforms for independent measurements. It can also be mounted on drones for aerial remote sensing applications.

图 1ATH1010-4-17Wideband Hyperspectral Imager

1 Parameters

	Performance	Parameters
No	Model	ATH1010-4-17
1	Spectral Range	400~1700nm
2	Best Spectral Resolution	Visible/NIR: 1.4nm, SWIR: 3.5nm
3	Max Spectral Channels	Visible/NIR: 1920, SWIR: 640
4	Max Spatial Channels	Visible/NIR: 1200, SWIR: 512
5	Detector	SCMOS+InGaAs
6	Detector Native Resolution	Visible/NIR: 1920×1200, SWIR: 640×512
7	Pixel Bit Depth	Visible/NIR: 12bit, SWIR: 14bit
8	Max Frame Rate	156fps
9	Scanning Method	External scanning
9	Numerical Aperture	Visible/NIR: F/2.4, SWIR: F/2.0
10	Data Output Interface	USB3.0
11	Field of View	Visible/NIR: 11.4°@f=35mm, SWIR: 12.5°@f=35mm
12	Instantaneous Field of View	Visible/NIR: 0.167mrad@f=35mm SWIR: 0.418mrad@f=35mm
13	Focal Length	25mm, 35mm optional
14	Dimensions	280mm×150mm×75mm
15	Weight	1700g
16	Operating Temperature	-20~55°C
17	Storage Temperature	-30~70°C

2 Imaging Test of ATH1010-4-17

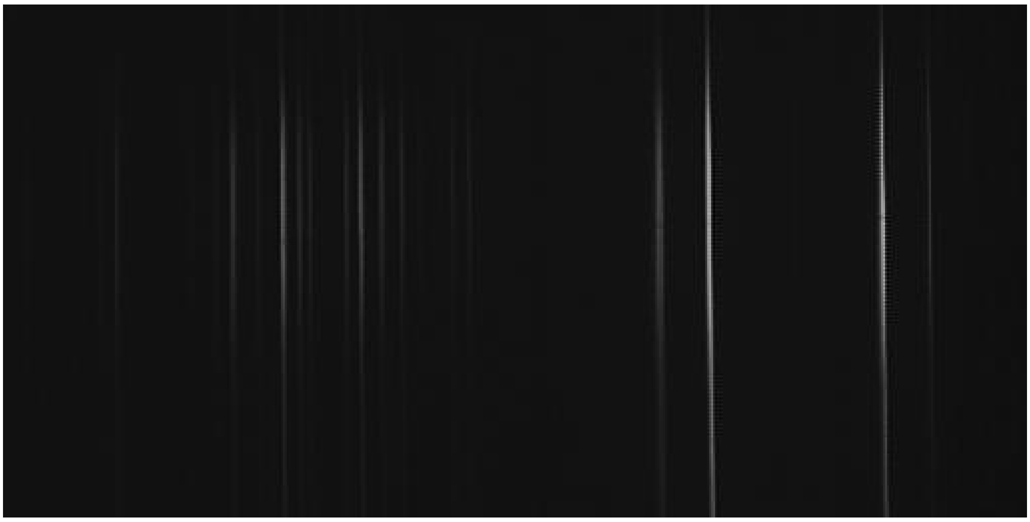

Figure 2: Spectral graph of the mercury lamp captured by ATH1010-4-17, with a resolution better than 1.5nm at 546nm and 4.6nm at 1128nm (without Binning)

3 Model and Dimension Diagram

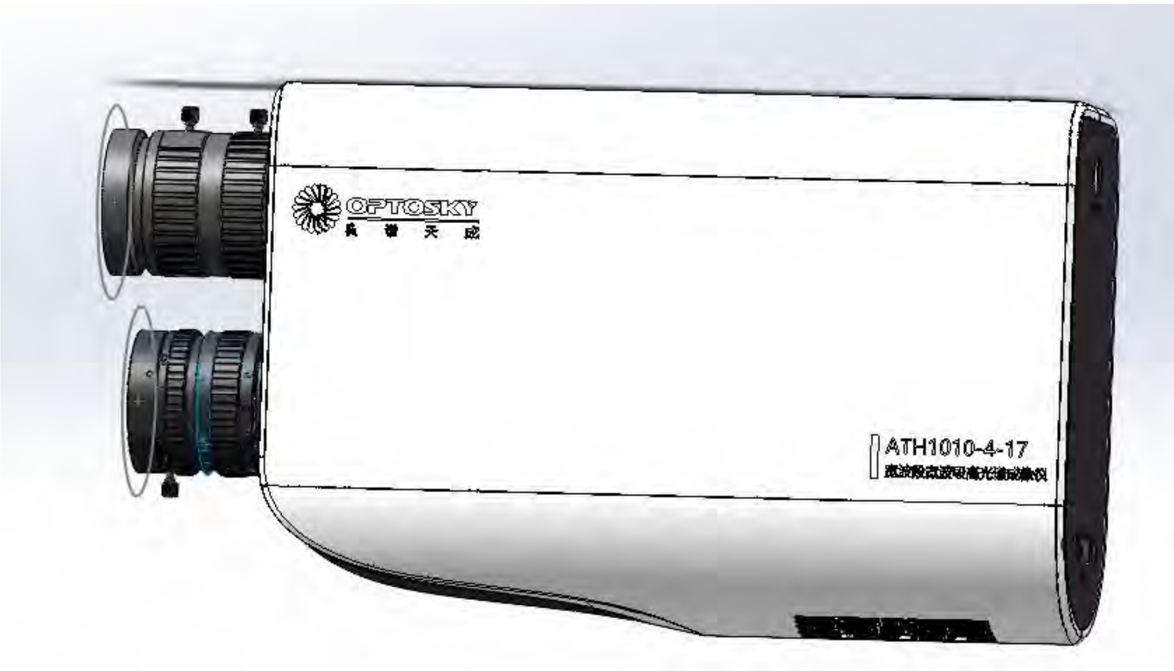

Figure 3: ATH1010-4-17 Wideband Hyperspectral Imaging Instrument

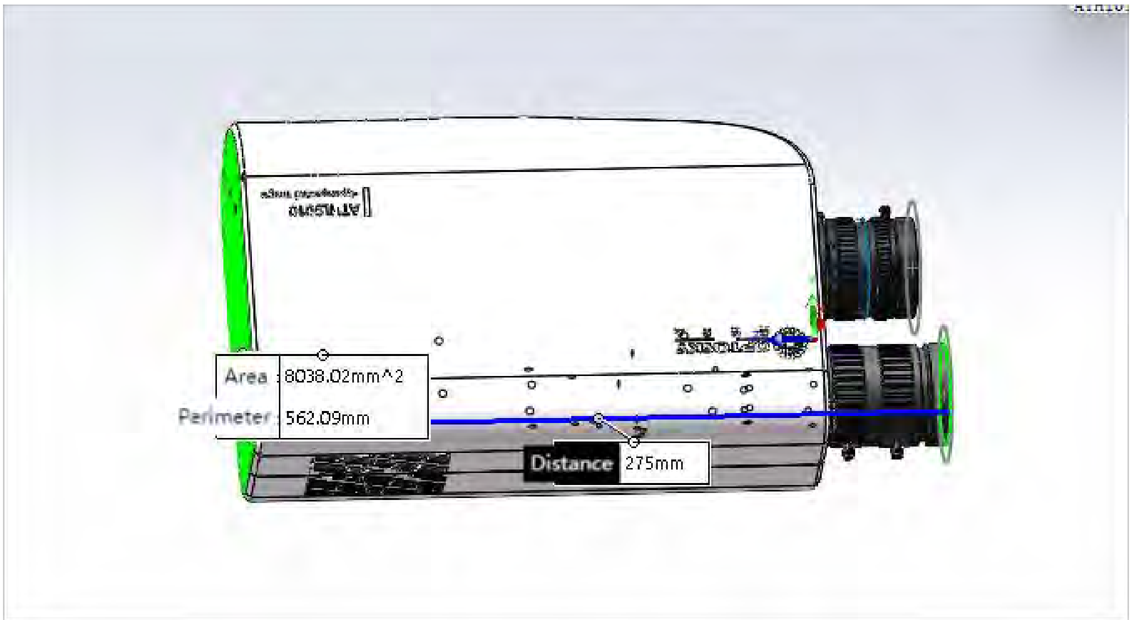

Figure 4: External dimensions of the ATH1010-OEM Hyperspectral Imaging Instrument

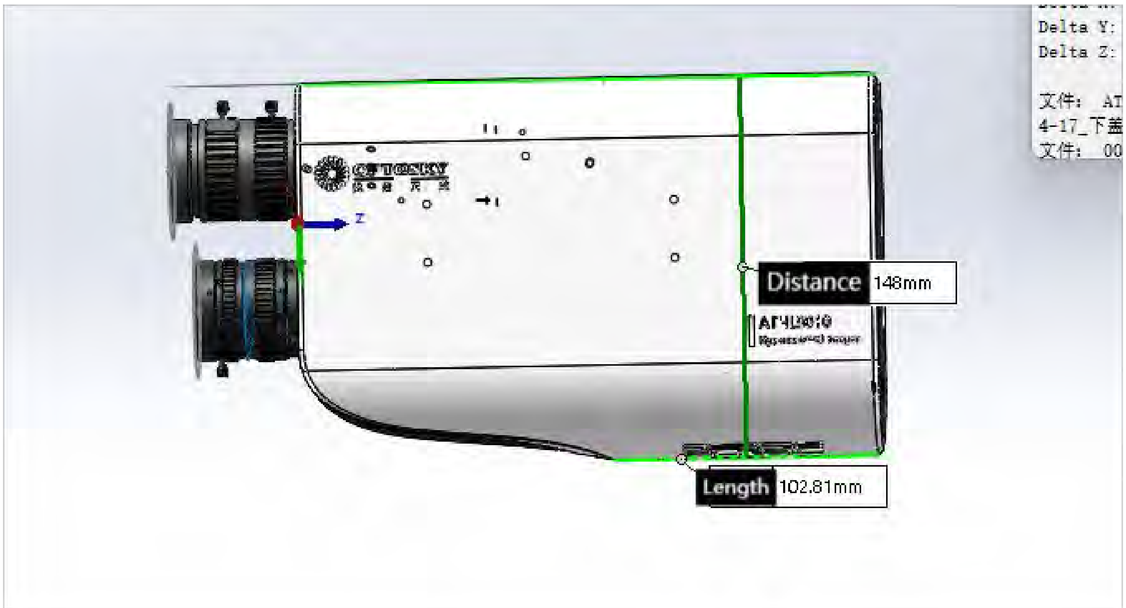

Figure 5: External dimensions of the ATH1010L-OEM Hyperspectral Imaging Instrument

4 Application Examples

Figure 14: Drone-mounted experiment

Figure 15: Field experiment scene 1

Figure 16: Field experiment scene 2

Figure 17: Field experiment scene 3

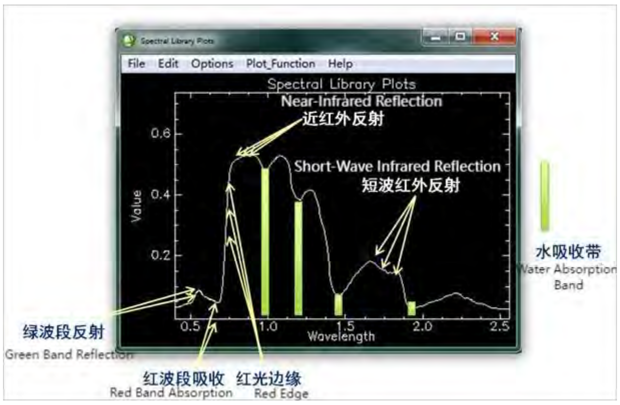

Figure 18: Spectral graph of green plants measured by the hyperspectral imaging instrument

4.1. Exploration Applications

Spectral remote sensing technology evolved from multispectral remote sensing technology represented by Landsat and took shape in the mid-1980s (Goetsetal., 1985; Tong Qingxi et al., 2006). Due to its high spectral resolution and unified spectral map, hyperspectral remote sensing technology has the ability to finely detect and analyze the surface rock and mineral composition on a large spatial scale. It not only provides macroscopic ground images but also can determine the types and abundance of minerals in geological bodies, and even the chemical composition of certain minerals at the pixel level (Wang Runsheng et al., 2010). In recent years, with the continuous development of hardware, data processing methods, and software related to imaging spectrometers, the application of hyperspectral remote sensing technology in geological surveys has been rapidly promoted. From large mining areas to medium-sized ore fields, hyperspectral remote sensing technology has played an important role in geological mapping, delineating hydrothermal alteration zones, and identifying and judging mineralization anomalies (e.g., Bierwirth et al., 2002; Lian Changyun et al., 2005; Kruse et al., 2006; Cudahy et al., 2007; Wang Runsheng et al., 2010; Liu Dechang et al., 2011; Yan Baikun et al., 2014; Yang Zian et al., 2015; Graham et al., 2017). As the theory of ore-forming systems (Wyborn et al., 1994) increasingly guides prospecting practice, thematic mineral mapping on the scale of large ore districts and mineralized belts will provide key regional material composition information for predictive mineral exploration.

The spectral wavelength range used in mineral mapping includes visible light (400-700nm), near-infrared (700-1000nm), short-wave infrared (1000-2500nm), and thermal infrared (7000-15000nm). Currently, the most widely used for mining applications is the short-wave infrared range (1000-2500nm). Because the frequency of the chemical bond vibrations in the mineral lattice is close to the co-frequency and combination frequencies, in the short-wave infrared wavelength range, minerals containing water or OH- (mainly layered silicates and clays) and certain sulfates and carbonates can be observed.

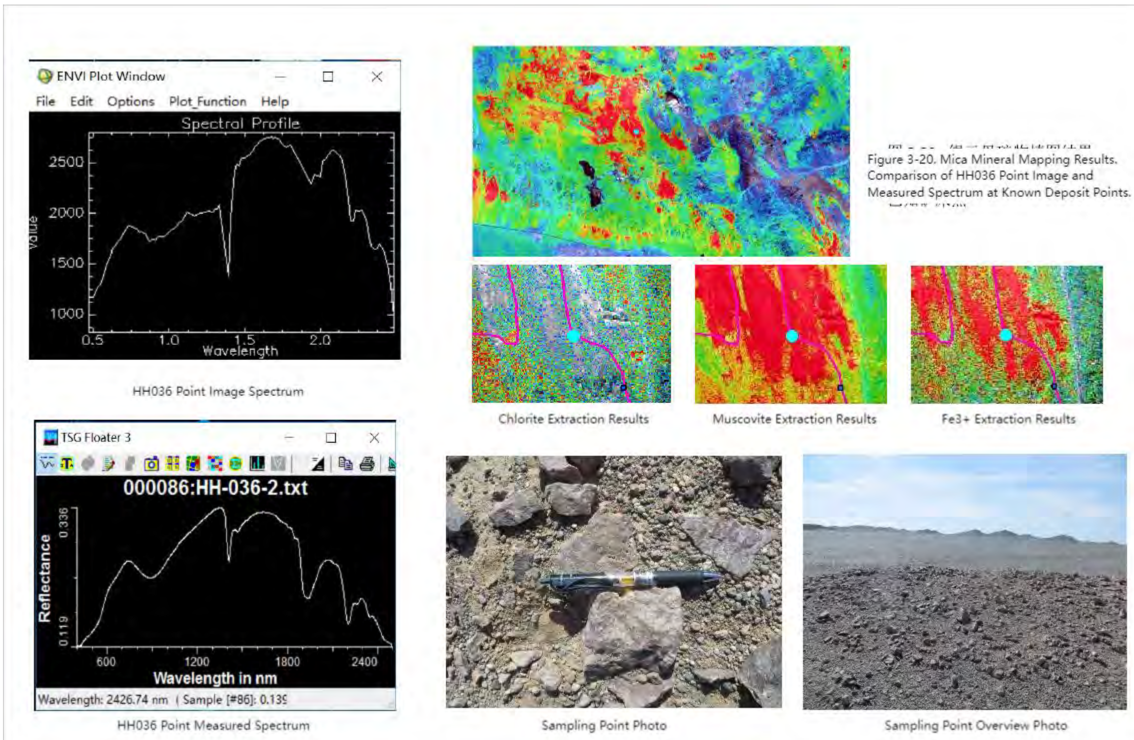

Figure 3-20. Mica Mineral Mapping Results. Comparison of HH036 Point Image and Measured Spectrum at Known Deposit Points.

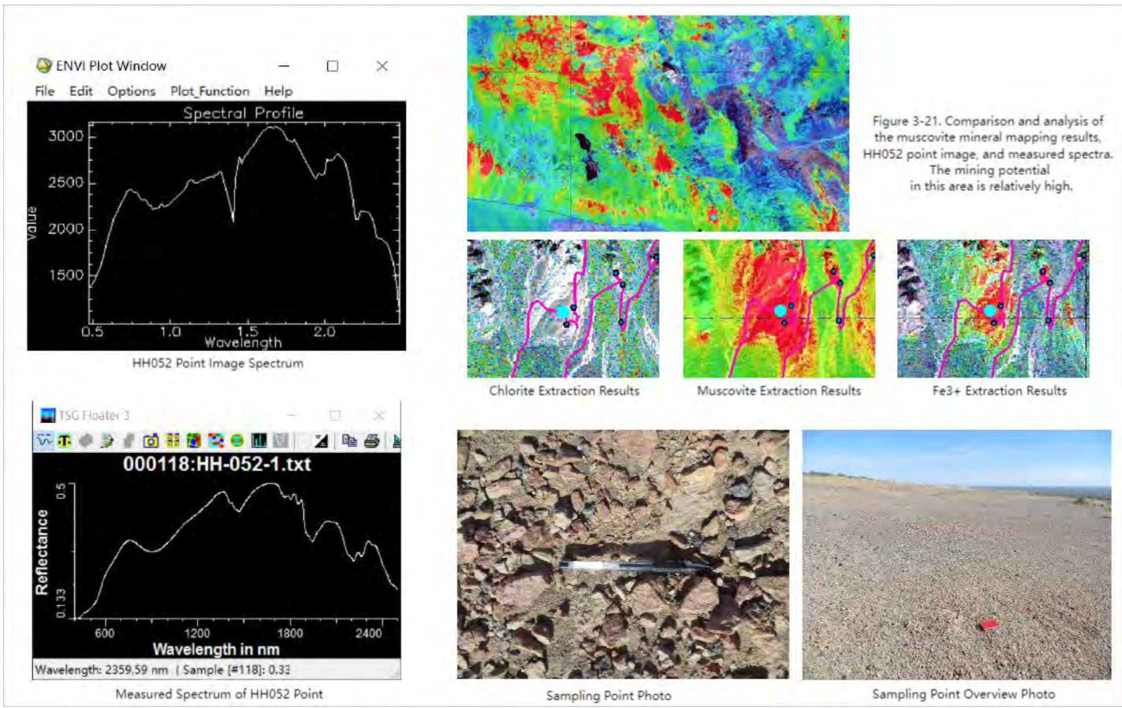

Figure 19: Application of hyperspectral imaging in exploration

Soil salinization is one of the important ecological environmental issues faced by arid and semi-arid regions. The consequences of soil salinization, such as soil hardening, reduced fertility, imbalance of pH, and land degradation, severely restrict agricultural development in China and impact the broader sustainable development strategy. Remote sensing technology, with its large scale, wide range, strong timeliness, and economic advantages, effectively compensates for the limitations of traditional salinization monitoring methods, providing a new approach for the quantitative monitoring of soil salinization.

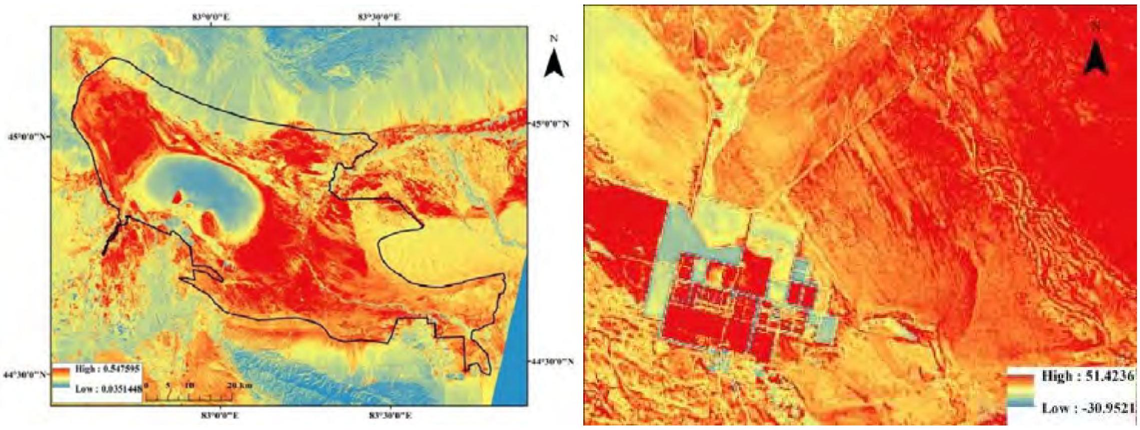

Figure 20: Surrounding area of a salt field

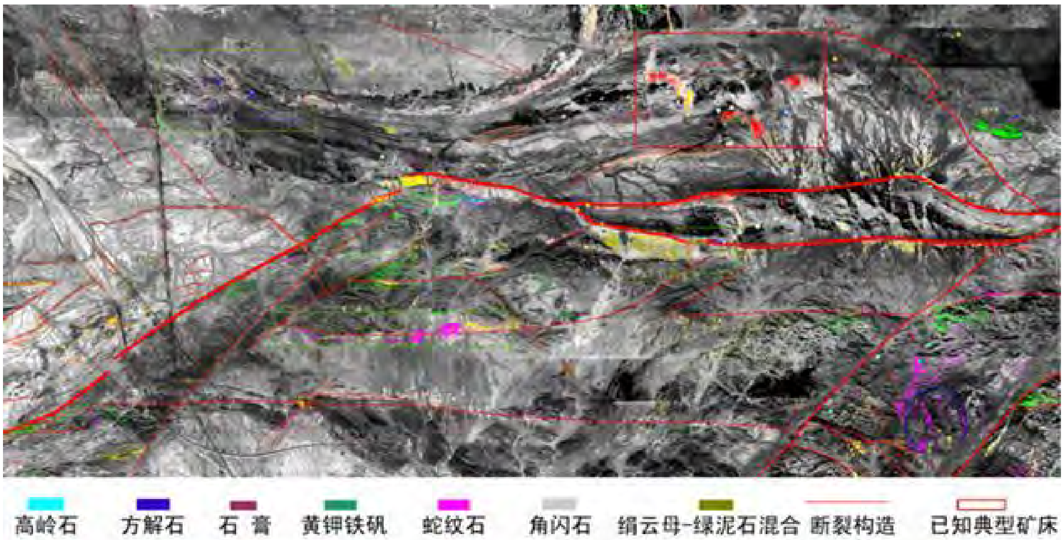

Figure 21: Measurement diagram of a mine field

4.2. Application in Vegetation Growth

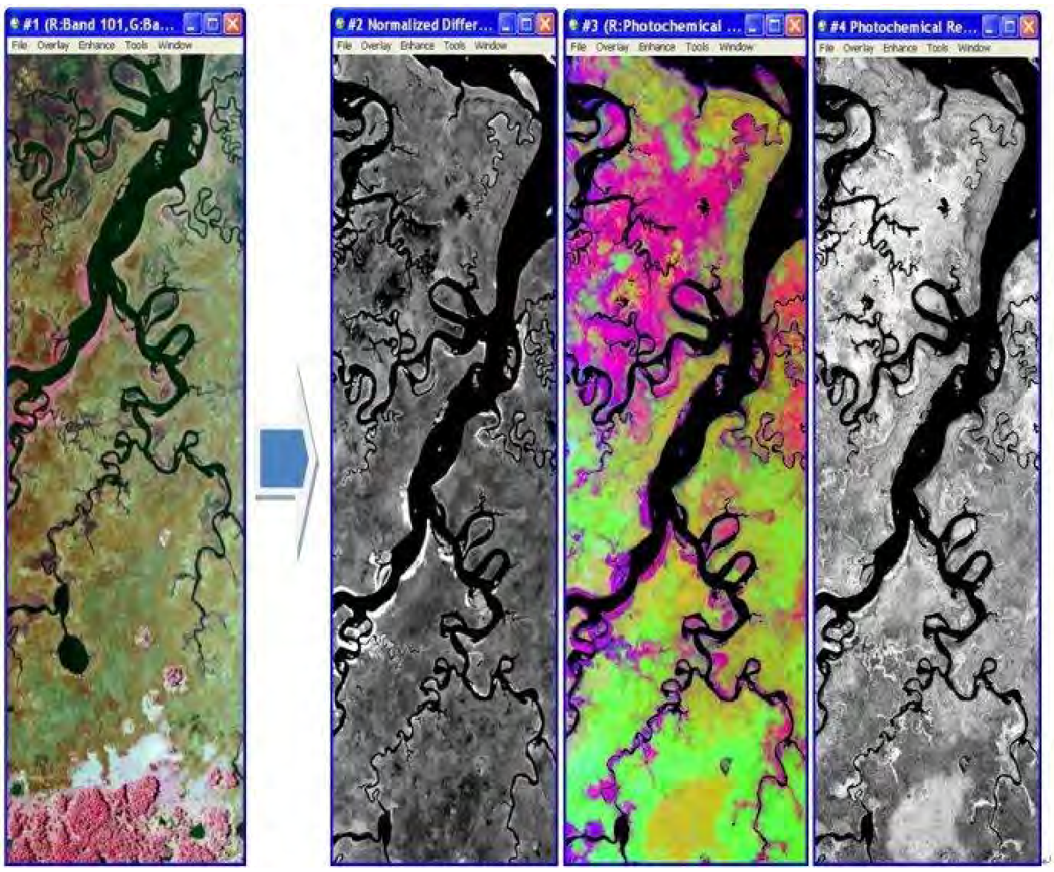

Figure 22: Hyperspectral image of plant growth

4.3. Application in Forest Health

Used for pest and disease monitoring, forest resource assessment.
Principle: Vegetation health is related to the green index, leaf area index, leaf moisture content, and light use efficiency.

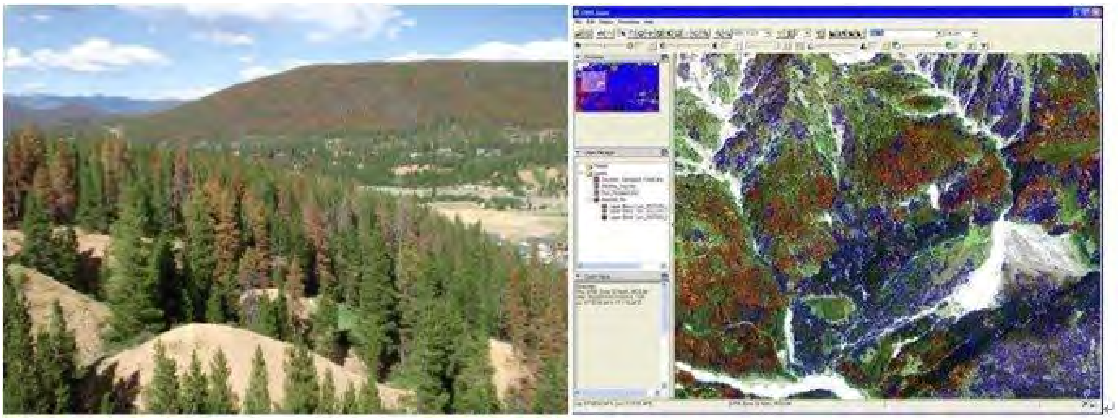

Figure 23: Hyperspectral imaging study of the health of Pinus massoniana

4.4. Application in Forest Fire Prevention

Analysis of fire possibility, distinguishing fire range and fire points.
Principle: The possibility of vegetation catching fire is related to the green index, canopy moisture content, drought, and carbon decay caused by non-photosynthetic plants.

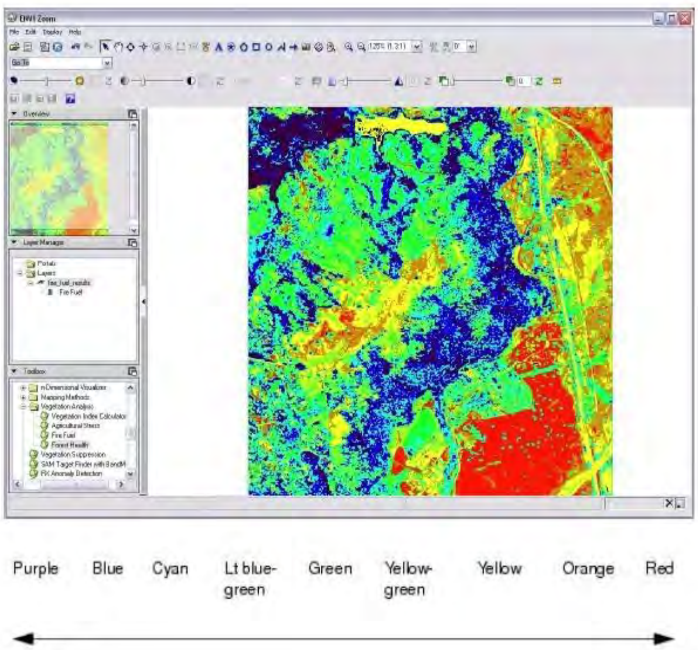

Figure 24: Application of hyperspectral in forest fire prevention

4.5. Medical Microscopic Imaging Spectrum Application

Application goal: Intraoperative online detection and navigation for tumor surgery

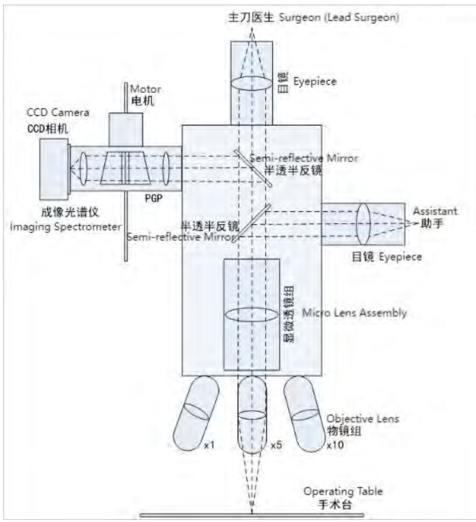

Figure 25: Schematic diagram of the optical path of a medical microscopic imaging spectrometer

The diagram shows the principle of a medical microscopic imaging spectrometer. The target to be tested on the operating table is divided into three paths after passing through the objective lens and microscopic lens group: one path for the main surgeon's visual observation, one for the assistant's visual observation, and one for detection by the imaging spectrometer. The spectrometer scans the target in space, obtains the imaging spectral information, and displays it to the doctor after data analysis and image processing.

Figure 26: Actual image of the medical microscopic imaging spectrometer

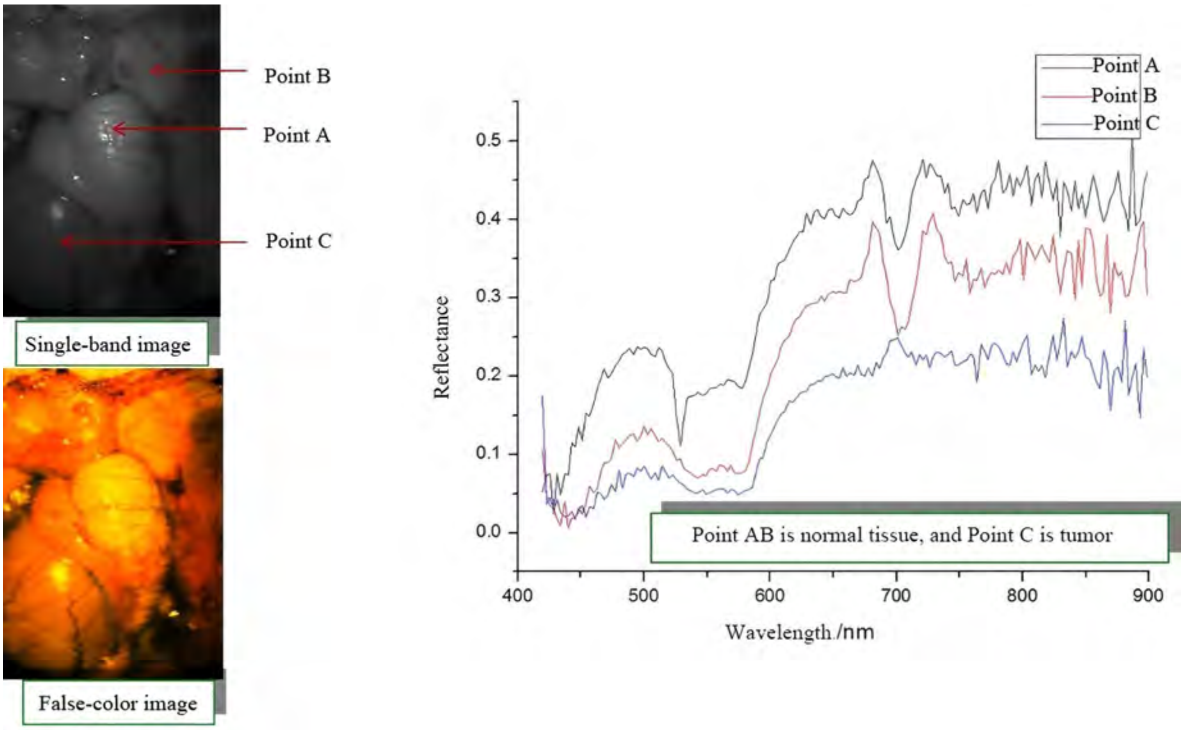

Figure 27: Data from the medical microscopic imaging spectrometer

4.6. Airborne Imaging Spectrum Application

Application goal: Airborne remote sensing

Application introduction: The airborne imaging spectrometer based on SpecVIEW-VIS is shown in the figure. The instrument consists of SpecVIEW-VIS, a stable platform, and a POS module. Figures 20 and 21 show data obtained by this instrument during a flight in Jingmen, Hubei, in December 2014. Figure 20 shows a pseudo-color image after geometric correction, flight strip stitching, and radiometric correction, while Figure 21 shows the spectral curve of a typical object.

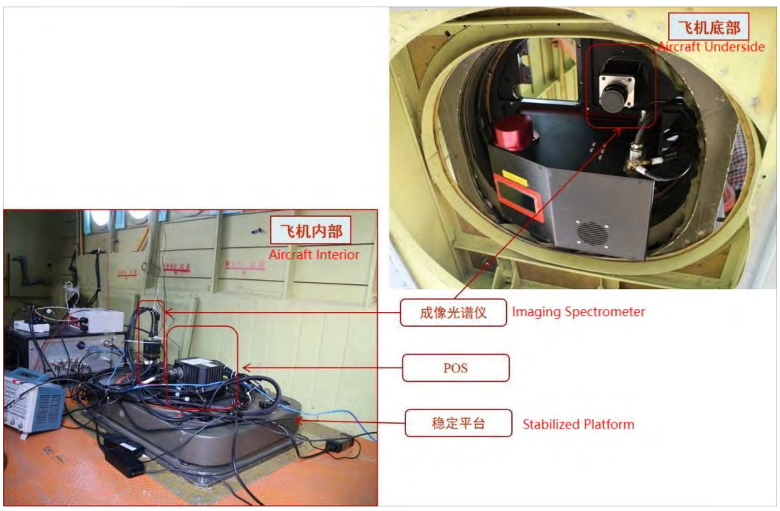

Figure 28: Airborne remote sensing application

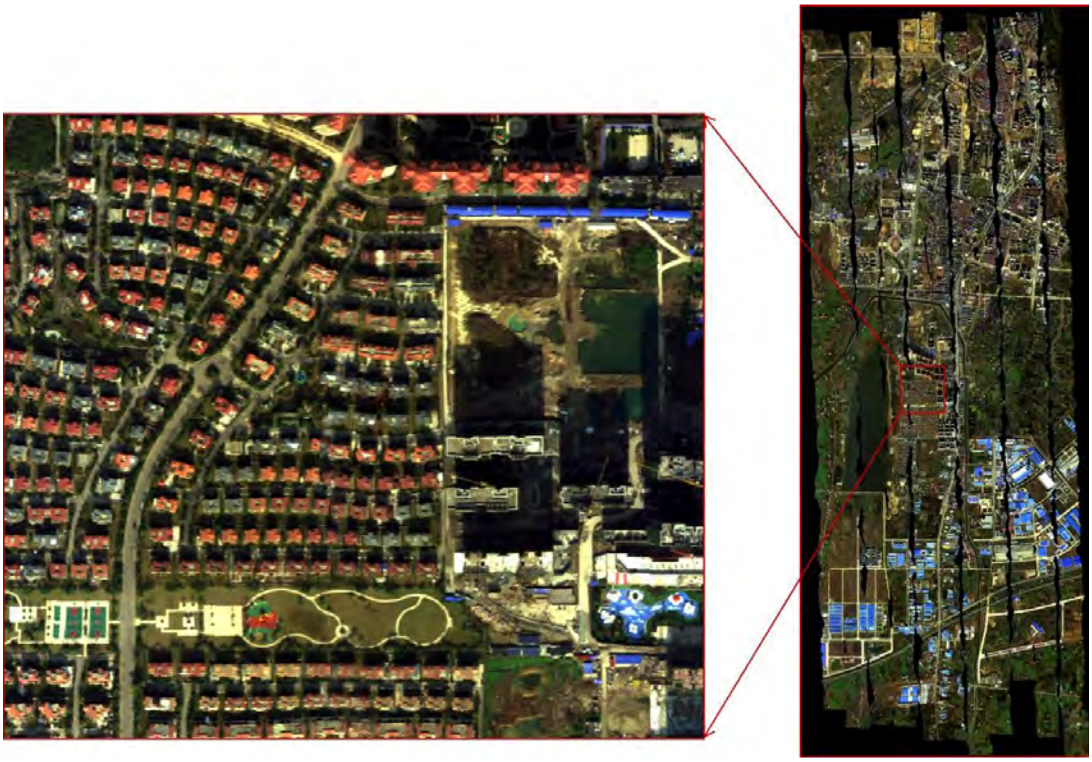

Figure 29: Airborne application data — pseudo-color image

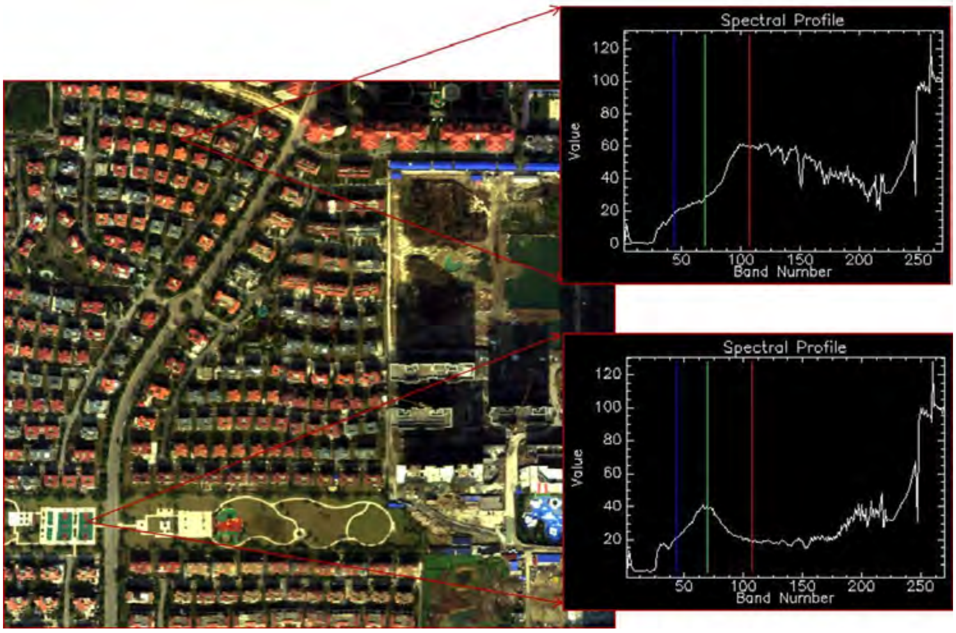

Figure 30: Airborne application data — spectral curve

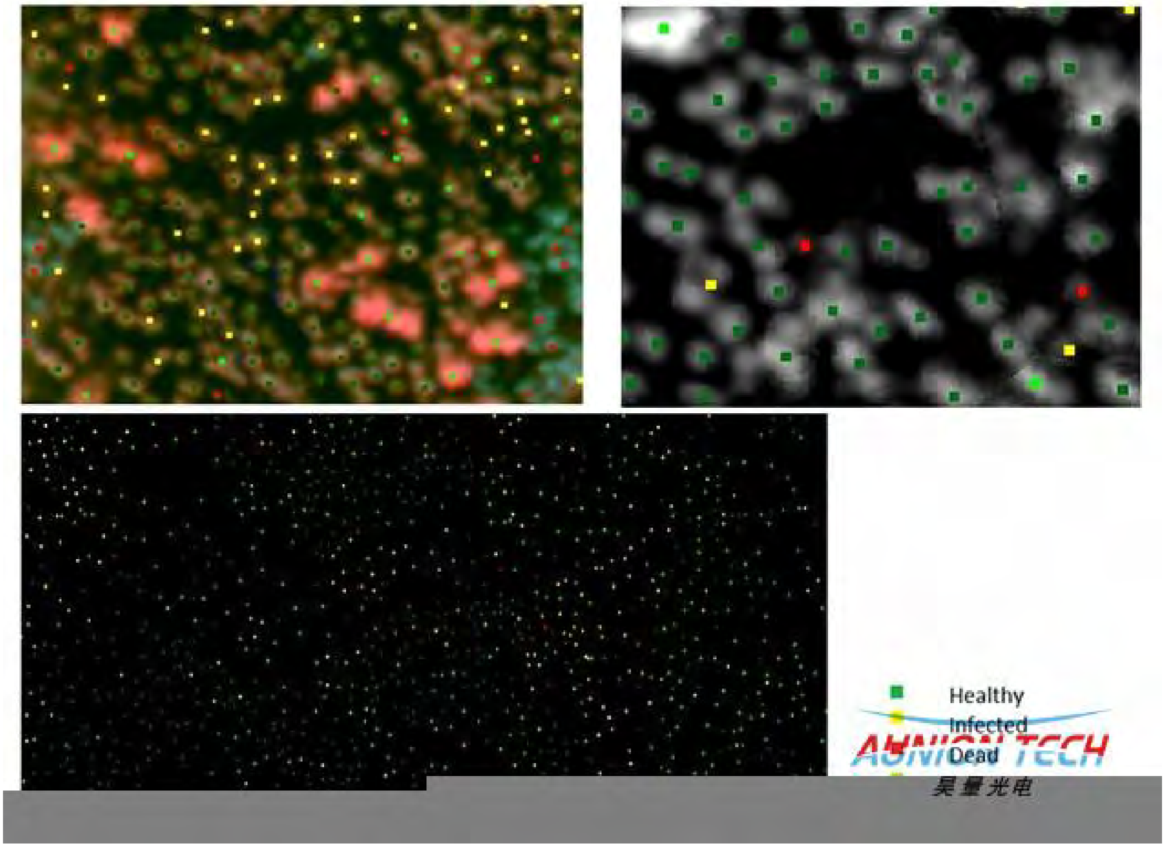

Figure 31: Forest remote sensing, airborne hyperspectral observation of forest pests and diseases

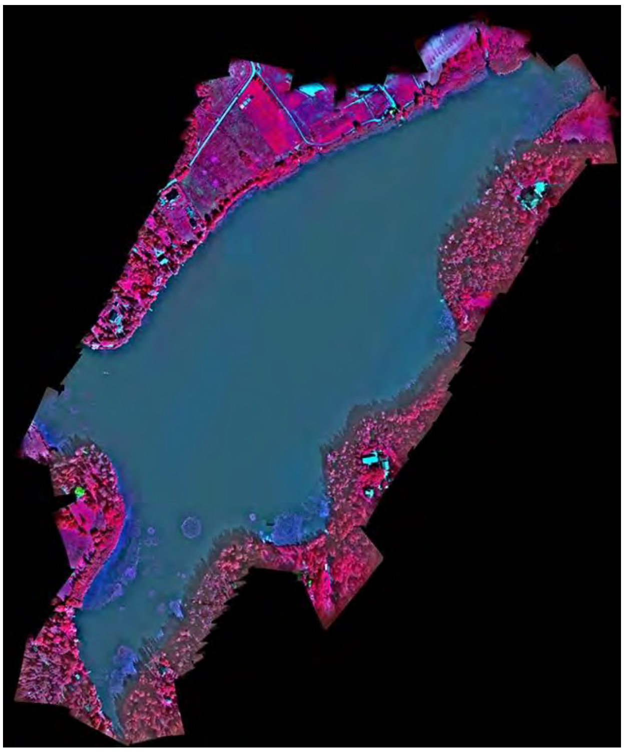

Figure 32: Water body detection (lake phytoplankton, algae, vegetation research)

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