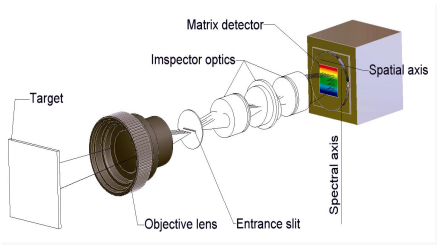
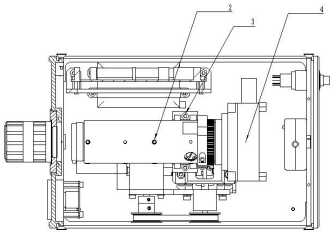
# GaiaField-Pro Hyperspectral Imaging Camera






GaiaField-Pro (GFP) camera provide extremely high resolution images by scanning and taking multiple images to construct a hyperspectral datacube. Hyperspectral imaging devices (GFP) for spatial (slit) scanning obtain slit spectra by projecting a strip of the scene onto a slit and dispersing the slit image with a prism or a grating. In spatial (slit) scanning, each two-dimensional (2-D) sensor output represents a full slit spectrum (x,λ). The NUC integrated into the system to control system operation ,data acquisition, and analyze, so the spatial dimension is collected through the scanning motor movement . The line-scan systems are particularly common in remote sensing, so it is sensible to use mobile platforms. The system can keep working by internal battery about 4 hours and user can use ipad or phone to connect the camera by internal Wifi.

## GaiaField Pro System Function:

- Auto exposure time;
- Auto focusing;
- Auto match scanning speed;
- Auxiliary camera (user can observe you want );
- Data analysis (reflectance /radiometric/uniformity/lens/area calibration)
- Spectra /imaging view and export;
- Spectral Angle matching
- NDVI(advance custom)
- PCA
- Supervised classification
- Support lens change
- Standard  type data (support envi/envice/matlab)
- Support Ipad or phone control

## GaiaField Pro System Parameters

Table:1

| Instrument model | | GaiaField-Pro-V10 | GaiaField-Pro-V10E |
|---|---|---|---|
| Spectral Region(nm) | | 400-1000 | 400-1000 |
| Spectral resolution(nm) | | 3±0.5 (with 30 μ m slit) | 2.8 ± 0.2 (with 30 μ m slit) |
| Slit Length(mm) | | 9.6 | 14.2 |
| Slit Width(μm) | | 30 | 30 |
| Numerical Aperture | | F/2.8 | F/2.4 |
| Light Transmission | | >50% | |
| Spectral Bands | | 720(2X Binning) | 720(2X Binning) |
| Lens | Model | HSIA-OLE23 | |
| | Focal Distance(mm) | 23 | |
| | Work Distance(mm) | 100-∞ | |
| | Field Angle (°) | 21.5 (CCD 2/3″) | |
| CCD Pixels | | 1936×1456 | |
| Pixel Size(μm) | | 4.54×4.54 | |
| Digital OutPut(bits) | | 8 & 12 | |
| Dynamic Range(dB) | | >66 | |
| Exposure Time Range(ms) | | 0.0035-1200000 | |
| Lens Connector | | C-Mount | |
| Power | | DC 16.8V | |
| Power Consumption(W) | | 45 | |
| Storage Temperature(℃) | | -20～+50 | |
| Running Temperature (℃) | | +5～+40 | |

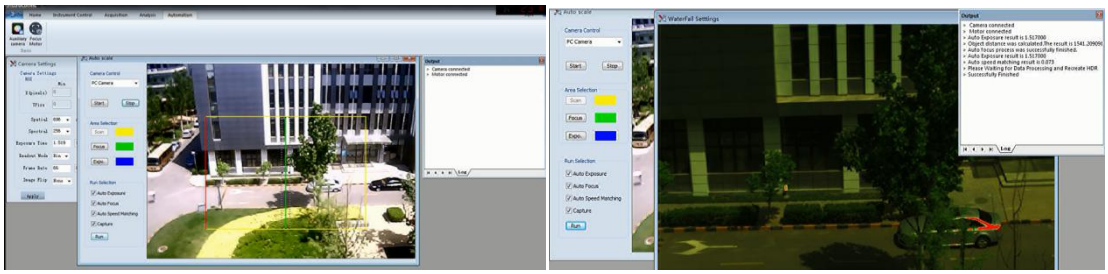
Table:2

| Instrument model | | GaiaField-Pro-N17E-N3 | GaiaField-Pro-N17E-HR |
|---|---|---|---|
| Spectral Region(nm) | | 900-1700 | 900-1700 |
| Spectral resolution(nm) | | 4(with 30 μ m slit) | 4(with 30 μ m slit) |
| Slit Length(mm) | | 14.2 | 14.2 |
| Slit Width(μm) | | 30 | 30 |
| Numerical Aperture | | F/2.0 | F/2.0 |
| Light Transmission | | >50% | >50% |
| Spectral Bands | | 100-200 | 200-300 |
| Lens | Model | HSIA-OLES30 | HSIA-OLES30 |
| | Focal Distance(mm) | 30 | 30 |
| | Work Distance(mm) | 100-∞ | 100-∞ |
| Pixels | | 320x256 | 640×512 |
| Pixel Size(μm) | | 30mm×30mm | 20umx20um |
| Digital OutPut(bits) | | 12 | 14 |
| Frame Number（fps） | | 100 | 100 |
| Exposure Time Range(ms) | | 5us-1s | 1us-40ms in high gain mode |

| | | |
|---|---|---|
| Gain Mode | High/Low | High/Low |
| Signal Connector | Ethernet port/USB | USB2.0 |
| Lens Connector | C-Mount | C-Mount |
| Power | +12V(-0%/+5%) | 12VDC |
| Power Consumption(W) | 36 | 60 |
| Storage Temperature(℃) | -45～+85 | |
| Operating Temperature (℃) | -40～+70 | |

## GaiaField Pro System Software:

- Camera settings;
- Motor settings;
- Control scanning motor;
- Control focusing motor;
- Data collect;
- Data calibration/ analysis and view;
- Saving path settings;
- Output inf and so on;



**Fig：Specview**

## GaiaField Pro System Apply:

There are many applications which can take advantage of GFP hyperspectral imaging.

- Atmosphere: water vapor, cloud properties, aerosols;
- Ecology: chlorophyll, leaf water, cellulose, pigmemts, lignin;
- Geology: mineral and soil types;
- Coastal Waters: chlorophyll,dissolved organic materials, suspended sediments;
- Snow/Ice: snow cover fraction, grainsize, melting;
- Biomass Burning: subpixel temperatures, smoke;
- Commercial: mineral exploration, agriculture and forest production

## GaiaField Pro System Apply:

### Agriculture:

Although the cost of acquiring hyperspectral images is typically high, for specific crops and in specific climates, hyperspectral remote sensing use is increasing for monitoring the development and health of crops.Work is under way to use imaging spectrometers to detect grape variety and develop an early warning system for disease outbreaks. Furthermore, work is underway to use hyperspectral data to detect the chemical composition of plants, which can be used to detect the nutrient and water status of wheat in irrigated systems.

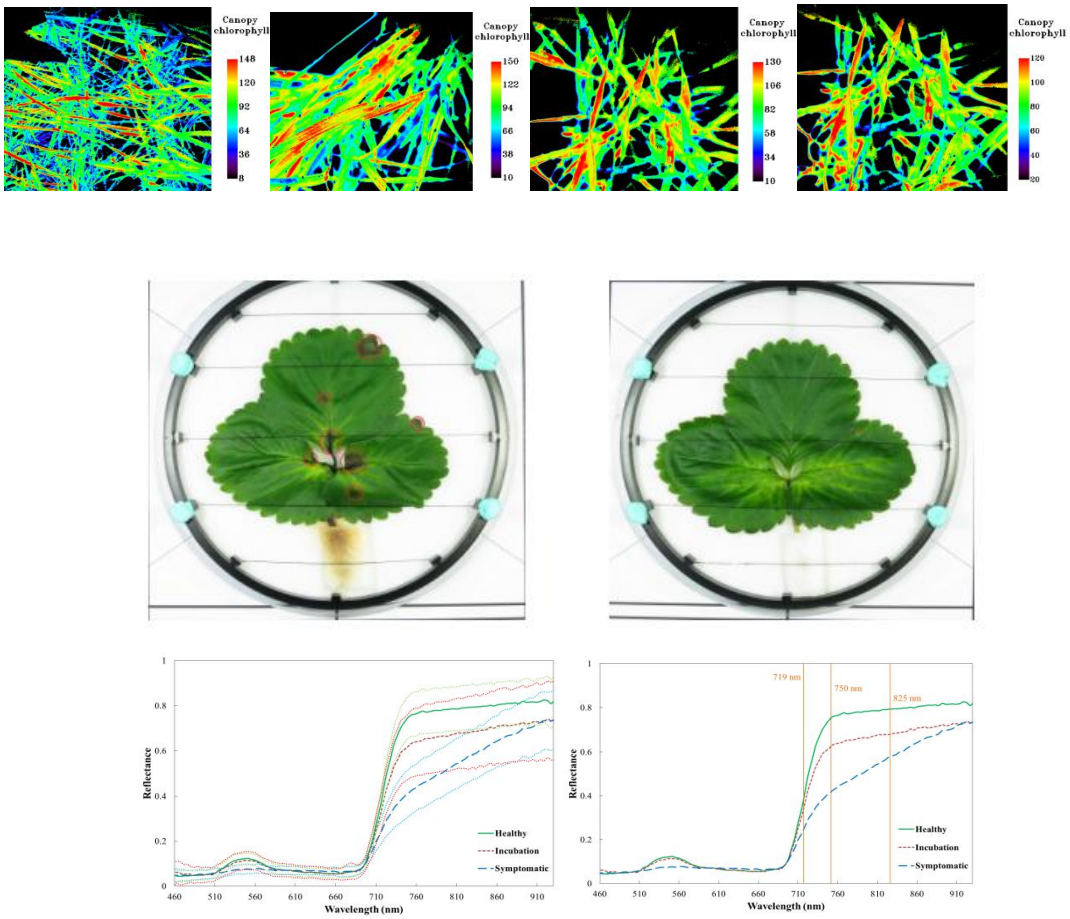



Fig . Characteristic spectrum of vegetation

## Medicine Care:

Researchers are working with Photon etc. and Optina Diagnostics to test the use of hyperspectral photography in the diagnosis of retinopathy and macular edema before damage to the eye occurs. The metabolic hyperspectral camera will detect a drop in oxygen consumption in the retina, which indicates potential disease. An ophthalmologist will then be able to treat the retina with injections to prevent any potential damage.

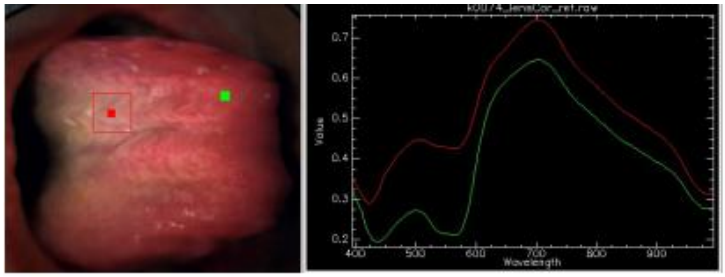


Fig .Characteristic spectrum of coating on the tongue of patients with kidney disease

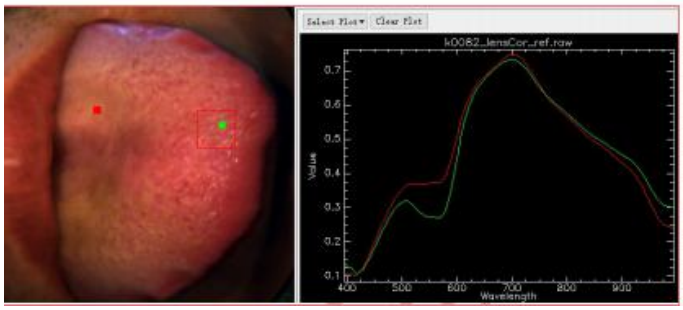


Fig .Characteristic spectrum of coating on the tongue of patients with liver disease

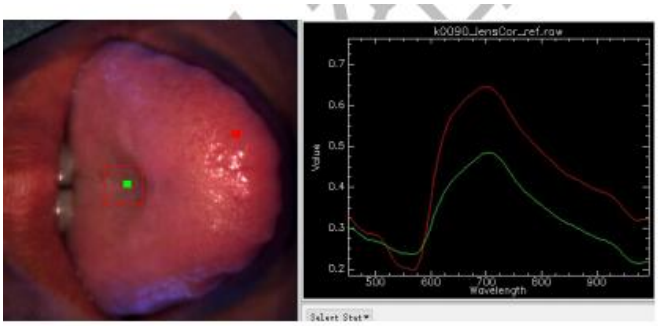


Fig .Characteristic spectrum of coating on the tongue of patients with normal

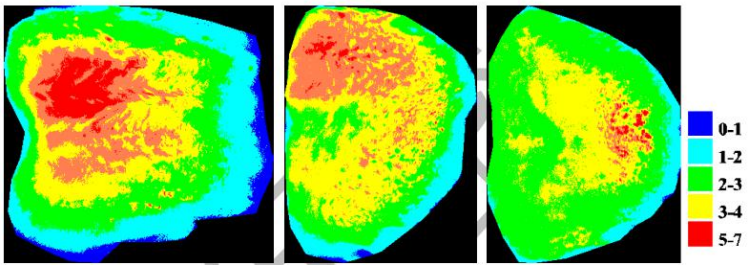



Fig .Characteristic imaging of kidney/ liver /normal tongue

**Food Processing:**

In the food processing industry, hyperspectral imaging, combined with intelligent software, enables digital sorters (also called optical sorters) to identify and remove defects and foreign material (FM) that are invisible to traditional camera and laser sorters. By improving the accuracy of defect and FM removal, the food processor's objective is to enhance product quality and increase yields.

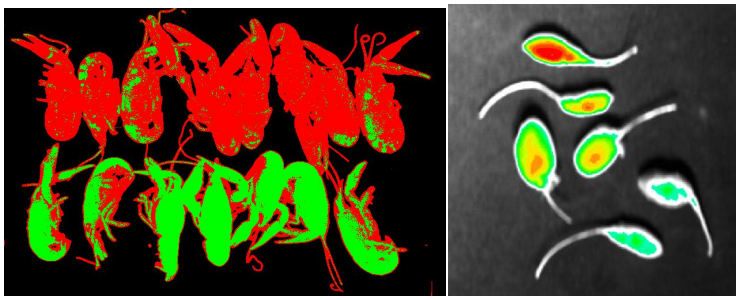


Fig :(left :lobster  right:lycium barbarum)

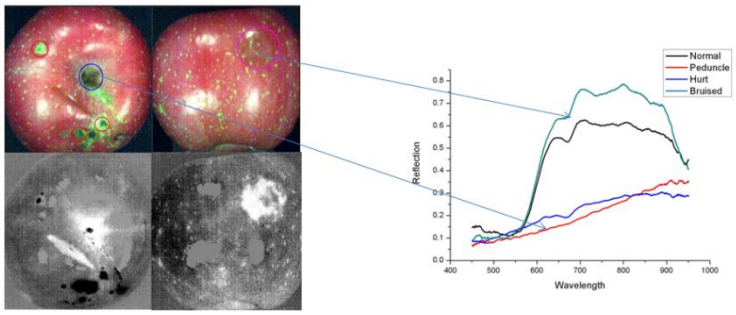



Fig: Apple quality

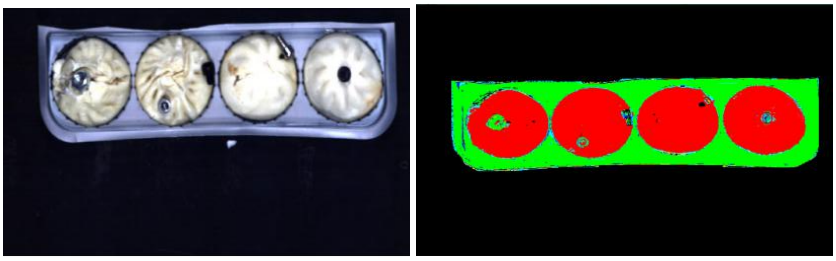
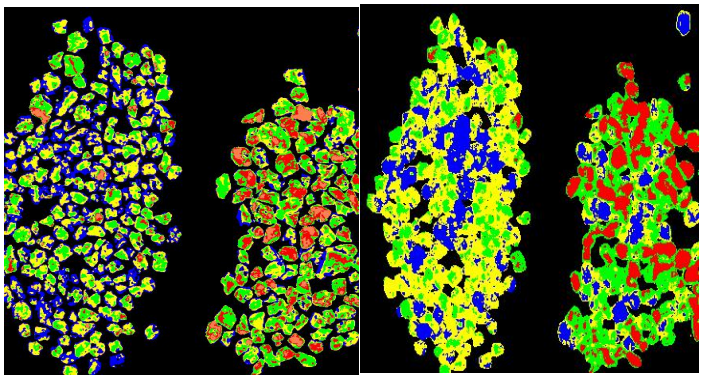


Fig: Steamed Buns

**Mineralogy:**

Geological samples, such as drill cores, can be rapidly mapped for nearly all minerals of commercial interest with hyperspectral imaging.



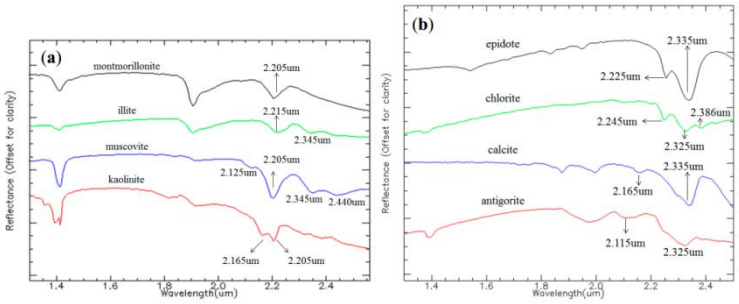



Fig: rock spectrum

**Micro imaging:**

Combined with blood cells morphological characteristics and the existing method of blood cell analysis, researchers research the data of the normal blood / leukemia blood of hyperspectral imaging.The characteristics of red blood cells, lymphocytes,leukemia cells were analyzed by microscopic hyperspectral imaging, and the implementation of the diseased cells segmentation and morphological parameter quantitative calculation.

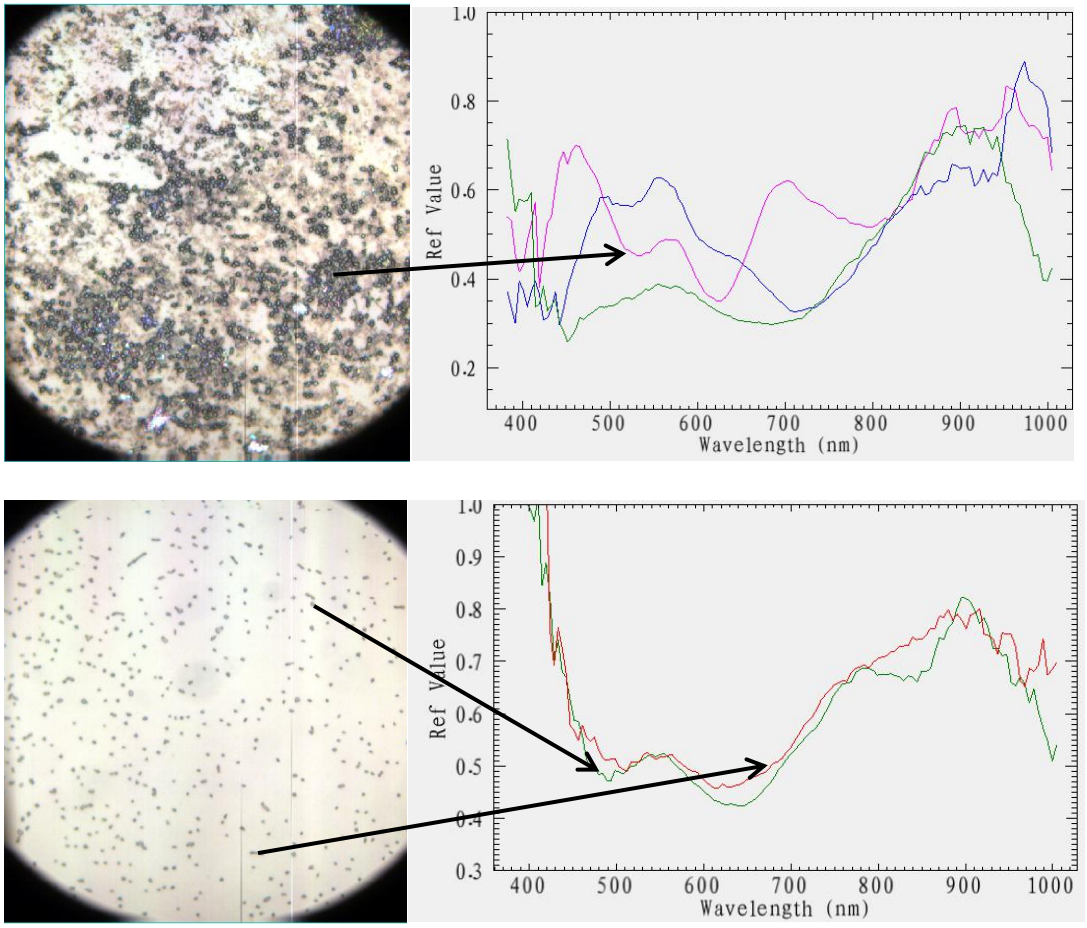



Fig: Vis-Nri Microscopic hyperspectral imaging and spectral of bacillus cell