Gooch & Housego

HSi-300-NIR Hyperspectral Imaging System

Gooch and Housego's patented acousto-optic tunable filter (AOTF) imaging module fulfills the promise of multispectral and hyperspectral imaging through unmatched spectral flexibility and switching speed.

The performance capabilities of this technology make it ideally suited for high-content, high-throughput fluorescence studies as well as spectral transmission and reflectance imaging. Potential applications range from live cell and whole animal studies to stand off detection.

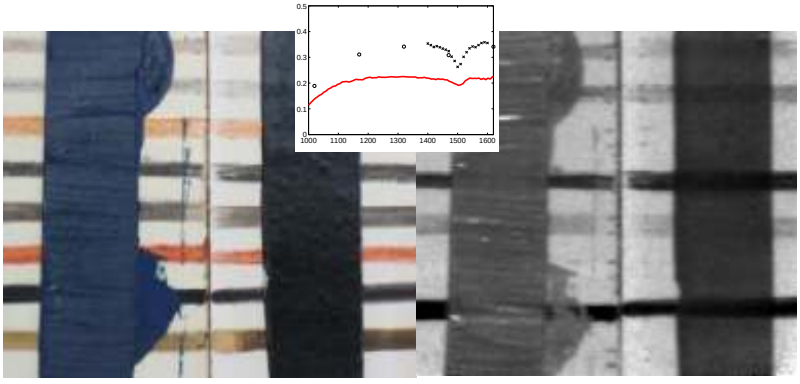
Multispectral and Hyperspectral Imaging

In multispectral and hyperspectral imaging, a series of images of an object are acquired at many different wavelengths so that the complete spectrum of each pixel is available, which is represented as an image cube. Coupled with transmission and fluorescence microscopy techniques, hyperspectral imaging enables fast and quantitative image analysis.

What is an acousto-optic tunable filter (AOTF)?

Our patented AOTF is a high-speed, high-throughput random-access solid-state optical filter with an adjustable optical passband and exceptionally high rejected light levels. Gooch & Housego's proprietary AOTF technology delivers diffraction-limited image quality with variable bandwidth resolution down to within 6 nm. Wavelength switching time, including computer control overhead, is a few hundred microseconds.

Gooch and Housego's HSi-300-NIR Hyperspectral Imaging System features an AOTF-based spectral filter system, instrument driver control and control module, and a powerful, intuitive image capture and hyperspectral analysis software suite. The HSi-300-NIR features μ-Manager plug-ins, a free and open source application software platform for imaging and control of automated microscopes on multiple operating systems (Windows, Mac, and Linux). μ-Manager offers a flexible and powerful image capture and processing package at no cost to the user. The HSi-300-NIR is integrated with the Xenics XEVA family of scientific cameras.



Left-Right: Azurite in linseed oil 50 microns thick over different underdrawings. Prussian blue in linseed oil 100 microns thick. Both objects observed at 1620 nm with AOTF & Xenics InGaAs camera. Images courtesy of Haida Liang, Nottingham Trent University.

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As part of our policy of continuous product improvement, we reserve the right to change specifications at any time

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Applications

Powerful image capture and hyperspectral analysis tools facilitate both research tasks and dedicated process applications development.

Biological Research

A number of fluorescence microscopy research techniques benefit from the speed and resolution of Gooch and Housego's hyperspectral imaging technology.

Medical Diagnostics

Gooch and Housego's technology has the potential to take high-content/ -throughput analysis to a new level.

Additional Applications

Hyperspectral imaging techniques have been successfully implemented in an ever-growing number of diverse applications including:

- Standoff detection of hazardous materials
- Agricultural processing
- Art conservation

AOTF versus Other Spectral Imaging Techniques

While liquid crystal tunable filters (LCTFs) have broad tuning capabilities, their bandwidth is fixed and switching times are typically more that 50 milliseconds with significantly lower throughput that AOTFs.

In Fournier transform imaging spectroscopy (FTIS), an interferometer is used to acquire imaging data at a variety of settings, and the resulting data transformed to provide a spectral image set. With FTIS, the choice of wavelengths and bandwidths cannot be changed and all wavelengths have to be captured regardless of application interest, a process that typically takes tens of seconds.

In tomographic imaging, light is bounced off of a diffraction grating, separated, and captured on a single CCD chip for subsequent processing and extraction of the spectral information, a slow and computationally intense procedure with limited imaging resolution.

Unlike these techniques, AOTFs allow wavelength and bandwidth to be changed at will. It takes less than 100 microseconds to change settings, capabilities that are ideal for high-throughput multiprobe imaging.

PRELIMINARY SPECIFCATIONS

Tuning	900 – 1623 nm
Bandwidth	6 nm (@ 900 nm), 15 nm (@ 1600 nm) variable (1 to 16x) at each center wavelength
Accuracy	± 1 nm (est temperature variance ± 5° C)
Repeatability	± 0.5 nm
Out-of-band rejection	$1{:}10^{-3}$
Optical output polarization	linearly polarized
Total device efficiency	~ 30% across tuning range
Switching speed	< 100 µs
Image quality	diffraction-limited
Control interface	PC-USB
Application software	Image capture and Hyperspectral Image Analysis Suite
Operating system	Windows XP®
Operating temperature	15°C to 35°C
Weight (w/o camera)	10.0 lbs (4.53 kg)
Weight (w/ camera)	14.0 lbs (6.35 kg)
Dimensions (including Xenics XEVA camera)	8.00 in (W) x 5.50 (H) in x 14.45 in (D) 20.3 cm (W) x 14.0 cm (H) x 36.7 cm (D)
Reliability (est for AO devices in general, based on Q-Switch Devices)	> 100,000 hrs MTBF

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