VisiSonics

5/64 Audio Visual Camera

Delivering a Paradigm Shift in Acoustic Analysis

Explore the latest in our audio/visual imaging tools

VisiSonics Audio/Visual Camera at a Glance:

A new way to capture, understand and reproduce sound scenes using a combined spherical microphone and camera array.

Acoustic visualization is quickly becoming the industry standard for Noise Source Identification. Akin to a heat-map, the Audio Visual Camera provides "hot spots" on a visual panorama to highlight the location and pressure level of sounds.

The VisiSonics Audio/Visual Camera consists of microphone and camera arrays distributed over the surface of an 8" aluminum sphere and internal electronics to calibrate and synchronize audio and visual data capture. The high microphone count yields extremely accurate resolution for noise source localization. Data from both arrays is transferred to a provided laptop over a *single USB 3.0 cable*. This eliminates the need for a front end, dramatically reducing setup time and increasing the portability. The system ships with a preinstalled acoustic analysis tool which is intuitive and powerful. Acoustic data is displayed in realtime and can be recorded for detailed analysis. From on-site demonstrations to customers, the Audio/Visual Camera is able to identify NVH issues in a matter of minutes that previously took weeks to diagnose.

VisiSonics Audio/Visual Camera in Detail:

The convergence of audio and video capture allows for the visualization of sound sources and their interaction with the environment to be understood in real-time. Users can capture, store, retrieve and process real-time integrated and synchronized audio and visual information.

The auditory scene can be decomposed into its spherical harmonic components up to 7th order. This allows for increased spatial isolation of acoustic sources in the environment. A resolution

of up to approximately two degrees is possible for higher frequency beams.

The microphone signals are conditioned using individualized pre-amp circuits and then digitalized by a dedicated analog to digital converter. The digitized acoustic data is sampled at 44.1 kHz per channel and collected by an internal high performance Field Programmable Gate Array (FPGA) based processor where they are managed, formatted, converted and combined with the video streams.

Five video cameras are integrated into the VisiSonics Audio/Visual Camera to facilitate a ~3K resolution panoramic scene capture. The captured video once synchronized with the audio data is sent to a laptop over a single USB 3.0 cable. Included software operating on a laptop PC with an internal NVIDIA GPU, accepts the USB data stream and performs the user selected functions in real-time.

VisiSonics RealSpace™ Acoustic Analysis Tool (VRAAT):

Included with all Audio/Visual Cameras is the intuitive VRAAT software.

With VRAAT, you have the ability to visualize and analyze your recorded data. The VRAAT console gives you instant access to an integrated audio/video panorama and breaks down the data for you in helpful graphs for both time and frequency domain analysis.

The console features versatile imaging options and a helpful frequency graph that is user-definable by way of a spectrogram. Adding to the functionality of the software, there are two powerful modules, "Order Analysis" and "Virtual Reality." (details pg. 6) Integral to the VisiSonics Audio/Visual Camera, the VRAAT tool is intuitive and powerful.

Acoustic Analysis Tool Capabilities:

- Panoramic audio/video data integration
  - Mercator Projection view allows for quick identification of sound hot-spots
- "Area of Interest" view
  - Alternative visualization mode displays sound imaging without spherical distortion
- Spectro-temporal selection window
  - Allows user to select arbitrary spectro-temporal regions to generate acoustic pressure maps
- GPU accelerated computation of acoustic image
  - Create slow motion videos with acoustic imaging at 4000 FPS
  - Enables technicians to identify sources and differentiate initial sound sources from reflections
- Virtual microphone tool with up to 7th order beamforming
  - Place virtual microphones anywhere in your audio panorama to isolate acoustic signals from a specific location, effectively creating a virtual stethoscope
- Dynamic Range Selection
  - User definable dynamic range selection tightens noise source identification

Developer's Features:

- MATLAB Integration
  - Build new features to process data captured with the camera
  - MATLAB Toolbox helps developers to easily create custom scripts and processes
- ASIO Drivers
  - Audio/Visual Camera appears as a standard 64 channel audio device to standard Digital Audio Workstations that support ASIO input
- C Language API
  - Developers can develop custom high performance real-time algorithms using the native C API
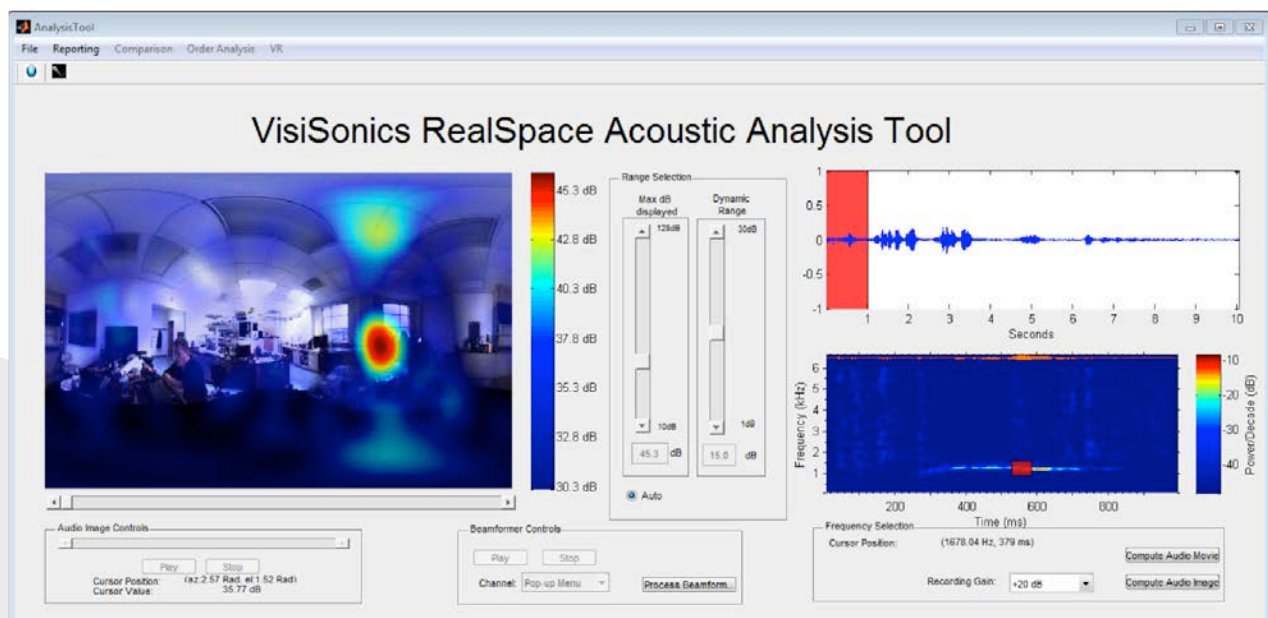
Applications:

Automotive Noise, Vibration and Harshness (NVH)

NVH issues are a significant cause of warranty returns costing the automobile industry billions of dollars a year. Identification of these problems, early in the design process, is essential. Measuring the interior (cabin) noise fields of a vehicle is a difficult and time consuming task with standard beamforming arrays. VisiSonics Audio Visual Camera excels in measuring noise fields in tight areas like cabins and identifying NVH issues on the fly. For this reason, VisiSonics is the go-to solution for many automotive industry leaders such as Tesla and others. The ability to identify and eliminate unnecessary noise increases the value of vehicles to customers by providing a better overall user experience.
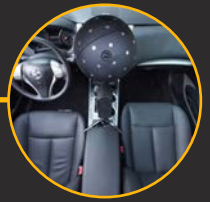
Academic Research

Universities and research institutions use audio capture equipment to perform experiments and conduct acoustics research. VisiSonics Audio/Visual Camera and the included analysis software (VRAAT) can be used in any field of acoustic analysis including but not limited to:

- Acoustic measurement techniques
- Environmental noise surveying and control
- Acoustic barriers and enclosures
- Active mechanical noise control
- Material surface coefficients
- Audio/visual object tracking
- Sound source localization
- Higher-order ambisonics
- Geometric scene reconstruction

Airport Noise

Airports are plagued by such a high degree of noise that many of them must adhere to specific noise abatement policies which limit the amount of noise permitted in public areas. VisiSonics products are able to help localize noise sources as well as their pressure levels. Using this technology, architects and policy enforcers can work together to pinpoint and fix problem areas easier than ever before.

Architectural Acoustics

VisiSonics technology gives architects the ability to visualize sound sources and reflections in critical listening spaces. With a forensic-like approach, architects can pinpoint the directionality, timing, composition and location of each sound instance in real-time. Powerful analysis software makes it possible to perform on-the-spot comprehensive spatial acoustical analysis of listening spaces for the evaluation and improvement of speech intelligibility and sound quality. In addition, it is a unique tool to aid in the accurate identification of troublesome acoustic artifacts such as noise leaks, late reflections and slapback problems. Playback through the VR Module provides your customer the best "venue" to demonstrate your company's precision tuning capabilities. Let our software and Audio/Visual Camera do the work for you. With real-time capability and post-capture data processing, figuring out the echoes and bounces in any space will help you give the best listening experience to all spectators
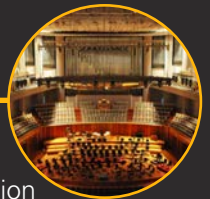
Building Acoustics

A workplace should be full of productivity and efficiency. When businesses are housed in buildings with poor acoustics, employees can become easily distracted, lowering their daily productivity. VisiSonics technology can help to mitigate unnecessary noise in any environment.

Occupational Health

Hearing loss is a huge problem in the workplace that too often goes unaddressed. If your employees are having problems with noise exposure, allow our products to help. With VisiSonics technology, primary offending noise sources are easily identified and mitigation measures can be implemented as necessary.

Urban Noise

Urban areas present an abundance of sounds. Though few realize it, the level of noise in many urban areas can have a negative effect on people's physical and psychological health. Civil engineers work hard to plan municipal construction and create zoning laws that optimize the acoustic environment for everyone. With the help of VisiSonics proprietary technology, pinpointing problem areas is easier than ever. Once identified, these challenging areas can be assessed and improvements can be made.

Environmental Noise

Construction zones and outdoor industrial facilities face unique challenges when it comes to noise identification and abatement. VisiSonics' Audio/Visual Camera is well suited for measuring sound levels from many different sources in an outdoor setting. Our technology can identify the most troublesome noise sources in any environment and provide information to abatement technicians that is crucial in the development of sound mitigation.
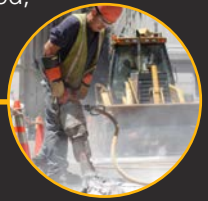
Noise Source Identification

Identifying the source of a bothersome noise can be a complicated and time-consuming procedure. With VisiSonics' Audio/Visual Camera and Acoustic Analysis Software (VRAAT), the complications disappear. Acoustic engineers are able to use the Audio/Visual Camera to identify noise issues in a matter of minutes that previously took weeks to diagnose.

> *One of the reasons I'm excited to use VisiSonics [Array Microphones] is the large number of audio channels, which will give the resolution and harmonic order necessary to produce results with the high level of accuracy and precision required for cutting-edge acoustics research.*

David Bradley
Vassar College

VisiSonics
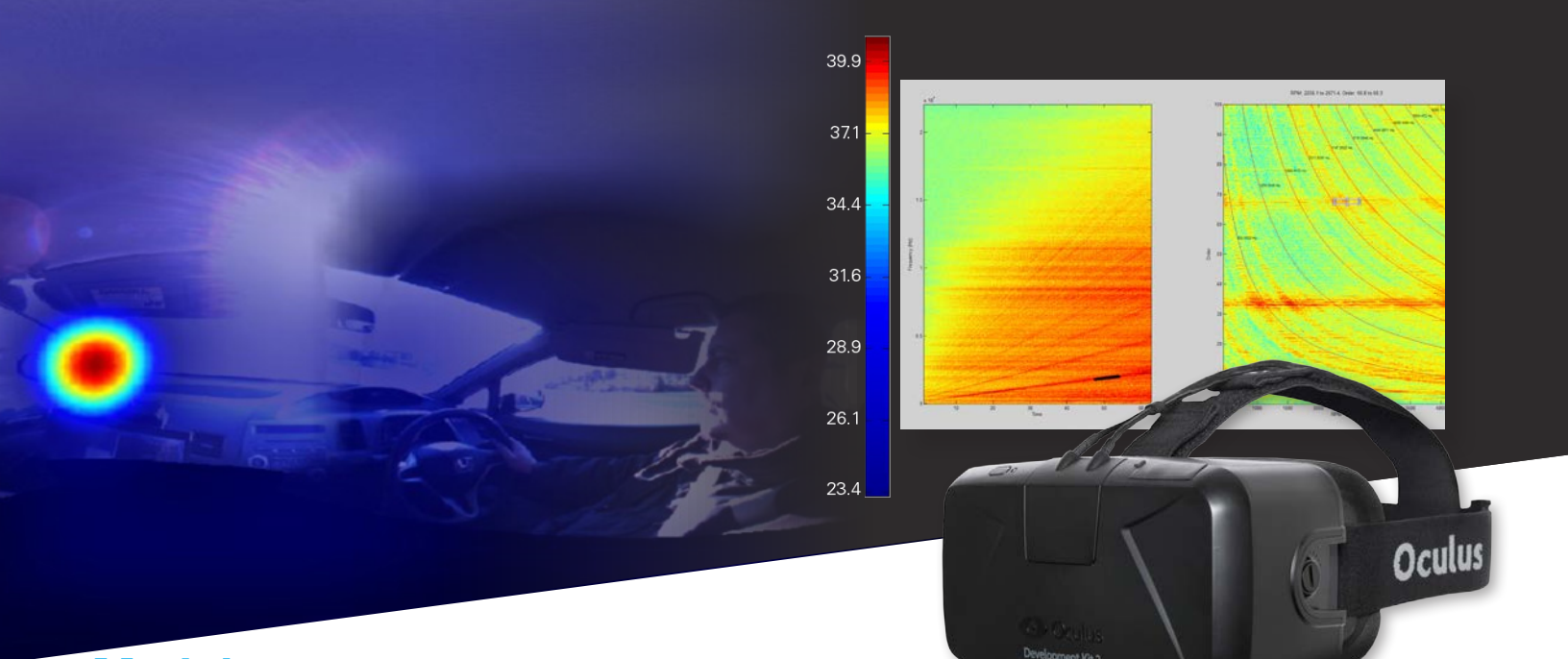
Modules

ORDER ANALYSIS

Order Analysis is one of the most popular analysis methods for detecting flaws in various fields of industry. Reliability engineers commonly use this technique for examining rotating machinery in industries such as automotive, aerospace, industrial equipment, household appliances and many others.

Order Analysis is a method to evaluate harmonic orders of rotating machine assemblies. This can be done by synchronizing the sampling of input signals to the instantaneous angular position of the machine shaft using a resampling technique. Rather than a constant number of samples per time, this results in a constant number of samples per revolution and transforms the analysis from the frequency domain to the order domain.

With the Order Analysis Module, users can capture a pulse-width modulated 5V TTL tachometer signal to view the acoustic data in the order space. The Order Analysis Module is also compatible with other acquisition systems supporting word-clock synchronization via a 5V TTL signal.

VisiSonics is the only company that allows direct acoustic imaging of harmonic orders. Custom module design for this application is available upon request.

VIRTUAL REALITY

VisiSonics' Audio/Visual Camera's powerful acoustic forensic analysis capabilities and realistic soundscape reproduction are now available as a VR experience. Many manufacturers are developing head mounted displays (HMD) for virtual reality, and VisiSonics has integrated its software output with the industry-leading DK-2 HMD from Oculus.

Virtual reality opens up a whole new world of telepresence where experts and managers need not be present at the scene of a test to experience and visualize the results.

Whether viewing a prerecorded session, or viewing the live stream, users are presented with perceptually accurate sound, meaning that sounds in the virtual scene appear to be coming from the location they actually exist in the real world. VisiSonics software also enables technicians with a "virtual stethoscope" mode where suspected noise sources/leaks can be identified by simply looking in that direction.
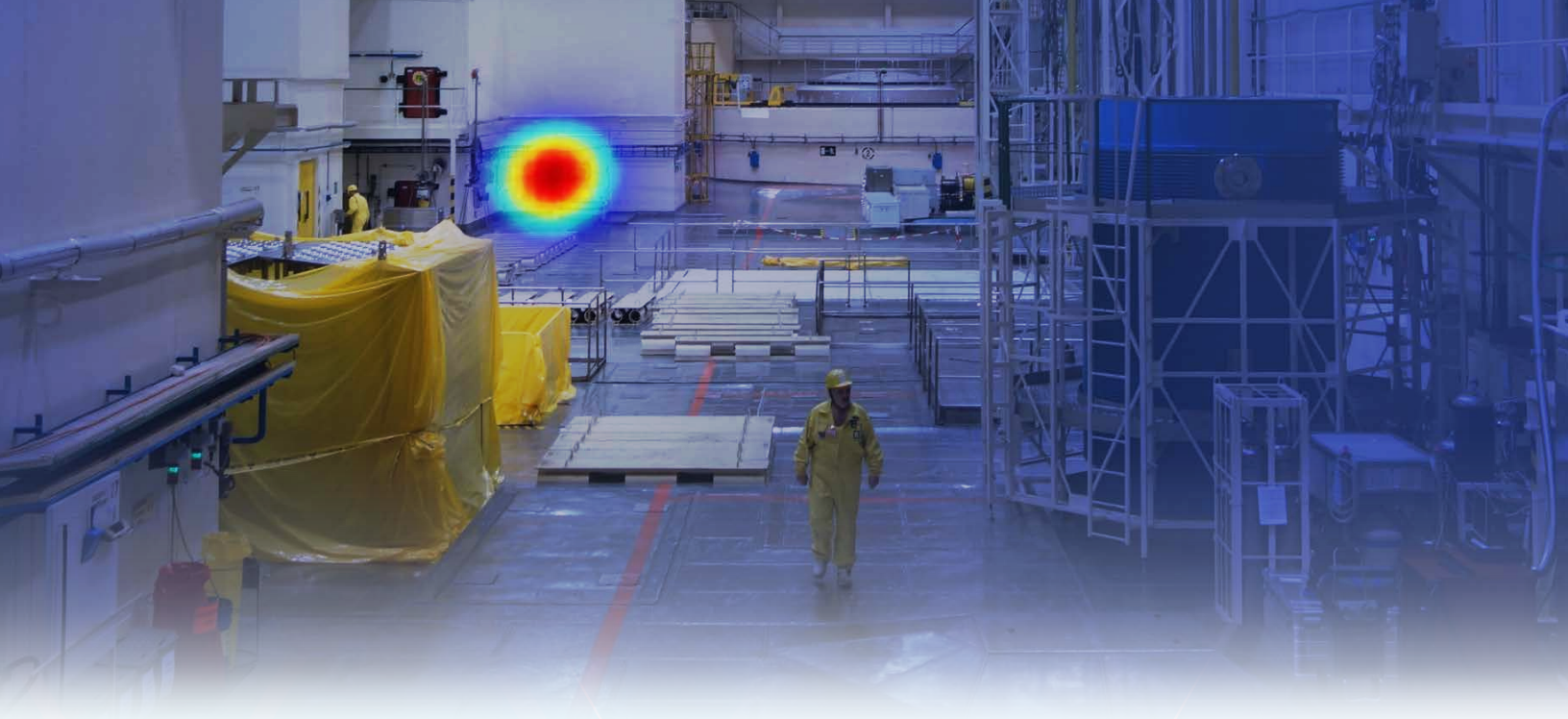
Accurately conveying identified acoustics issues to colleagues in remote offices is often a difficult task. The ability to record analysis sessions and use VR playback allows technicians to be virtually present and share entire projects with colleagues that cannot be physically present. For the first time, this allows collaborative diagnosis across physically separated groups.

Specifications

Included	• Audio/Visual Camera
	• Performance configured laptop computer containing all software and drivers with GPU subsystem
	  – Professional-class graphics card with minimum 2GB VRAM
	  – SuperSpeed USB 3.0 Port
	  – 256GB Solid State Drive
	• Custom watertight, crushproof, dust proof wheeled travel case with lifetime guarantee of excellence (from manufacturer)
	• Flyweight class tripod specifically configured for travel and fast setup
	• 90-day warranty
	• VisiSonics 3.0 Package Acoustic Analysis Tool Software
	  – Panoramic audio/video data integration
	  – Spectro-temporal selection window
	  – Accelerated audio image generation
	  – Audio movie generation for dynamic analysis
	  – Virtual microphone tool with up to 7th order beamforming
	• All required cables	

Dimensions	• 20 cm (8″) Diameter Sphere • Audio Camera: 8″x19.5″x8″ (L x H x W)	• Travel Case 24.76″ x 19.57″ x 13.9″ (L x W x D)
Video	• 5 HD Cameras at 1328x1048/Camera • Mercator/Spherical Scene Display	• Real-time High Definition Stitched Panoramic Display
Audio	• 64 Calibrated Microphones (±0.1dB) • < 1% THD • 24 bit Digitization	• 44.1 kHz Sampling Rate • 110 dB Dynamic Range • Raw Data Output SNR > 80 dB
Output Format	• 64 Track .WAV (raw Format) • Beamformer Output • ASIO Drivers	• AVI Video • Frame-synced A/V • MATLAB Integration
Software Features	• Capture Control • Recorded Session Playback • Slow Motion Playback	• Panorama Direction Control • Real-time Beamforming • Interactive Sound Isolation
Interface	• Single USB 3.0 Connection	
Optional Packages	• VR Module, Order Analysis Module (pg. 6)	

VisiSonics

VisiSonics' RealSpace™ tools, products and solutions are based on three disciplines: high performance computing using GPUs, machine vision and audio-visual algorithms. Integrating these, the company has created a real-time technology that handles the visual and audio environment as a cohesive data set, enabling users to uncover an additional dimension of meaning. Today's engineering teams have to base their decisions on correlatable data from multiple sources. The VisiSonics Audio/Visual Camera provides audio, video, and sync signals all tied together with intuitive software.

We knew the [Paramount Theater] was going to be a challenge. The venue is primarily made of brick and concrete, which leads to a highly reverberant space. VisiSonics solution had an easy setup and gave us instant, real-time feedback, allowing us to quickly identify problematic 'hot spots' and apply solutions that dramatically improved the acoustic clarity of the venue, without affecting the ambiance, environment and atmosphere of the theater.

– Ryan Beck
Maryland Sound International (MSI)

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The Next Generation of Advanced Audio/Visual Analysis