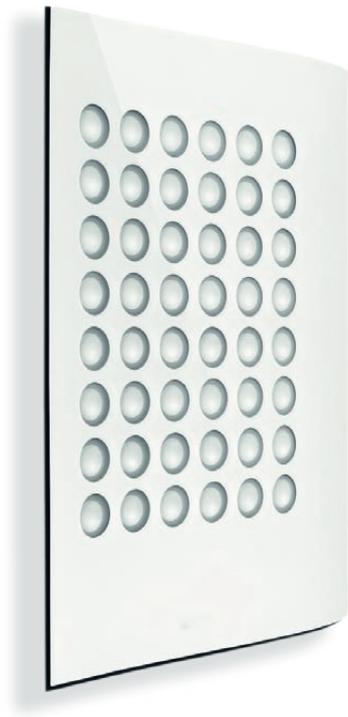
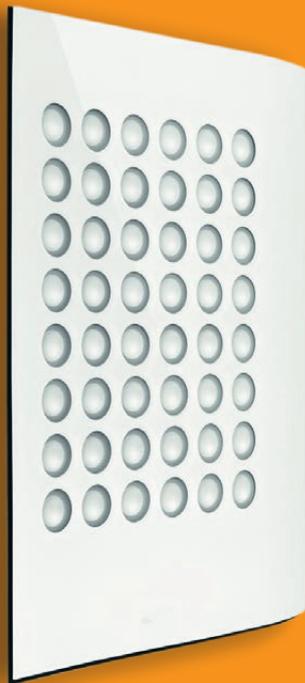


# Opalum Sound Optimization System



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## Challenge

Opalum needed a scalable sound optimization system for their tests of sound quality with the ability to protect their intellectual property.

## Solution

A turn-key solution based on National Instruments NI-DAQ™ hardware and LabVIEW™, where Opalum intellectual property is protected from being reverse engineered by using an Opalum-based cloud server for calculations.

## Introduction

Opalum is a Linköping University spin-off company that was founded in 2007. Opalum develops tools for a unique approach to audio reproduction, where cutting-edge research from fields like digital signal processing, human hearing and mechatronics is combined to create a big and clear sound from small devices. In addition to own designs, such as the speaker in the image above, Opalum also licenses their techniques to customers who want to use them in their own products, for example to make a small audio system sound bigger and more expensive.

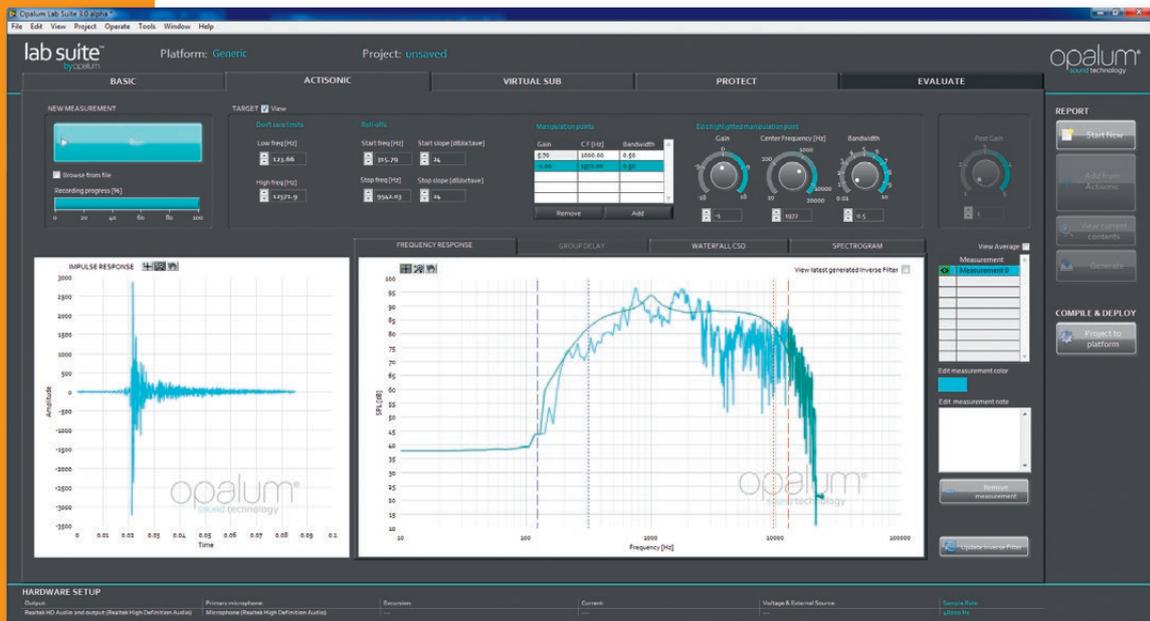
Opalum needed to provide their customers a toolkit that had an intuitive graphical user interface, with no compromises in accuracy or precision. They also needed to protect their algorithms from being reverse engineered. To solve these challenges they chose LabVIEW and Novator Solutions AB.

## About Novator Solutions

Novator Solutions excels in LabVIEW, and is highly skilled in developing test, measurement, and control systems. As a Gold Alliance Member Novator Solutions works closely with National Instruments, and has extensive experience on NI hardware and software platforms, especially LabVIEW, TestStand™, and VeriStand™. Novator Solutions consultants have more than 100 years of combined experience with these tools.

Novator Solutions works as consultants in customer projects or as suppliers of complete turn-key solutions, including mechanics, electronics, assembly, installation, maintenance, and support.

# The solution – Opalum Sound Optimization System



Main measurement and characterization view with time-domain behavior on the left and the frequency visualization on the right

**Opalum Sound Optimization System** is developed in LabVIEW, using NI USB-4431 hardware for signal acquisition. Opalum set the following requirements to the application:

- Reproducible free-field audio measurements
- Graphical plots on impulse response, frequency response and cumulative spectral decay (waterfall)
- Listening tests with real-time processing through the DAQ hardware
- Cloud-based calculation of algorithm parameters to avoid reverse engineering attempts
- Distributable to customers

The application can produce reports in Excel and PDF. A completely novel approach in audio optimization is the possibility to do measurements, listen and tune parameters within the same system. When the operator is satisfied with the listening tests, other fundamental audio properties should be

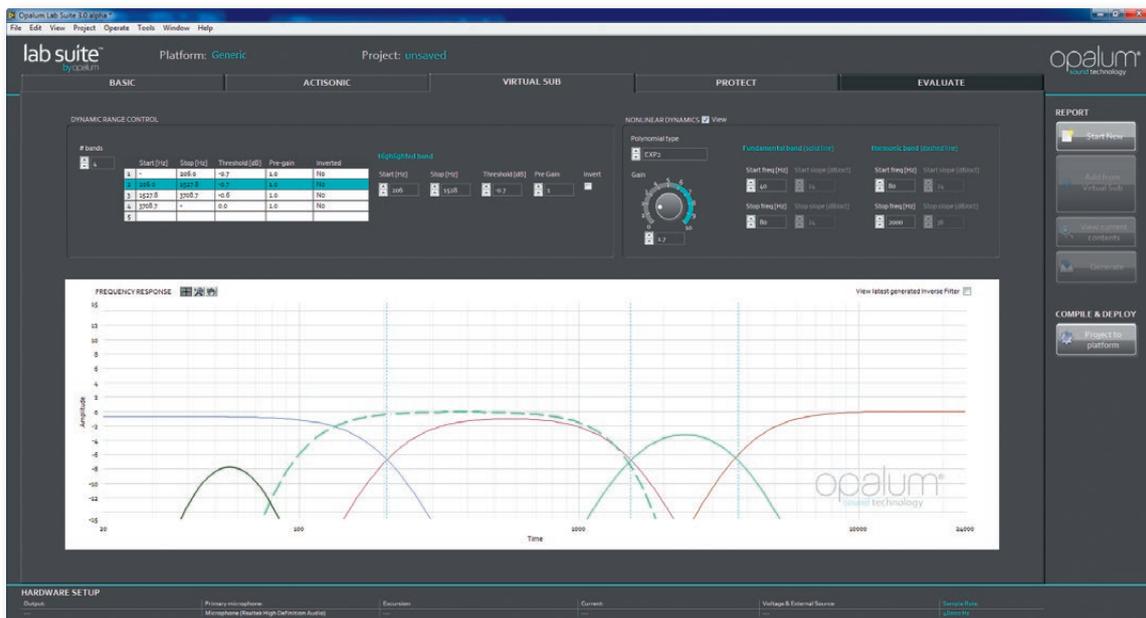
verified, such as total harmonic distortion (THD), impedance behavior, and sound pressure level (SPL). This was implemented using LabVIEW modules, saving many man-hours and increasing the accuracy of the results coming directly from NI software and hardware.

## Why LabVIEW?

Studies show that the developing time is significantly reduced using graphical programming. Novator Solutions uses an object-oriented program design, which results in very robust, modular and easily maintainable code. In this project several developers have worked concurrently on creating the system, adding to each other's code smoothly and without problems.

# Conclusion

**Developing the Sound Optimization System** on the LabVIEW platform has drastically reduced time-to-market for Opalum, and resulted in a very versatile and scalable solution. Opalum has, in cooperation with Novator Solutions, been able to leverage the highly trusted NI hardware platform already integrated with LabVIEW.



Excursion/Impedance view



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