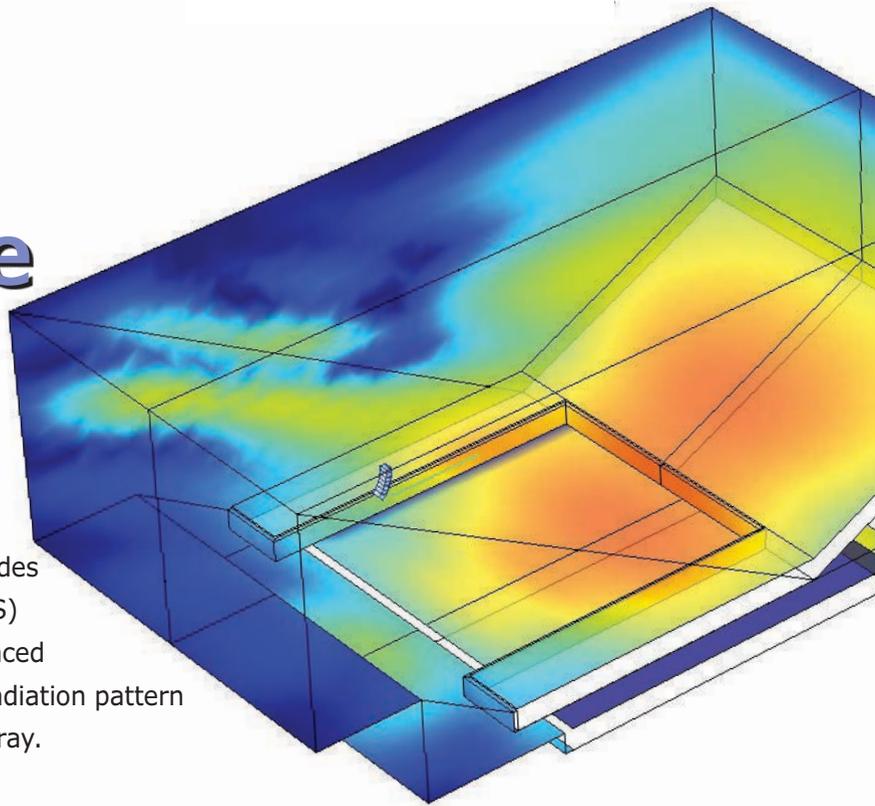




Duran Audio DDA Software

Duran Audio's Digital Directivity Analysis (DDA) software was written by Dr. Evert Start in 2000. DDA was designed to help sound system consultants and designers simulate and optimize the directional behavior of Duran Audio's Intellivox and Target products. It provides access to the Digital Directivity Synthesis (DDS) technology, which is Duran Audio/JBL's* advanced beam-shaping technology, enabling any 3-D radiation pattern to be synthesized for any suitably-equipped array.



By **Richard Honeycutt**
(United States)

DDA is a 32-bit Windows-compatible program that provides geometric modeling, direct sound prediction, statistical room acoustics prediction, graphic visualization, radiation pattern optimization and generation of output filter files for uploading to DSP units using the WinControl software. DDA can analyze semi-open or closed spaces. The current release of DDA accommodates common loudspeaker format (CLF) speaker data, permitting the software to be used in the design of sound systems that have speakers by manufacturers other than Duran/JBL.

For consistency with the other software reviews published in this column, the DDA features specific to line array systems will not be discussed. Instead, we will focus on the more general acoustical and

electroacoustical functions including 3-D room acoustics modeling, direct sound aiming support, and statistical acoustical prediction. Although high-school-level knowledge in physics and math is helpful for most effectively using DDA, it is not essential.

DDA Models

Models can be created in DDA by writing the necessary text files in the proprietary format or by using the built-in click-and-drag interactive 2-D geometry builder. Models can be imported from ODEON or CATT-Acoustic, in the .CAD format; from EASE, as EASE export (.xfc) file; or from SketchUp, via SU2DDA and SU4AC utilities freely available from Duran Audio. Material properties for planes can be

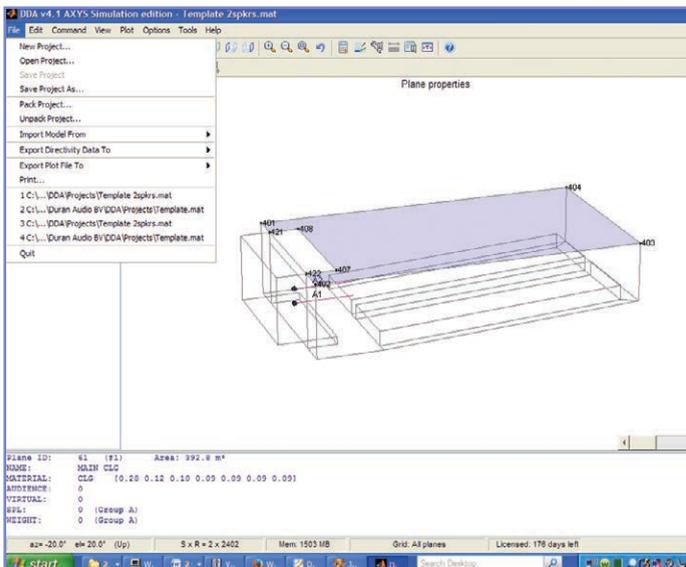


Photo 1: The DDA desktop displays various plots.

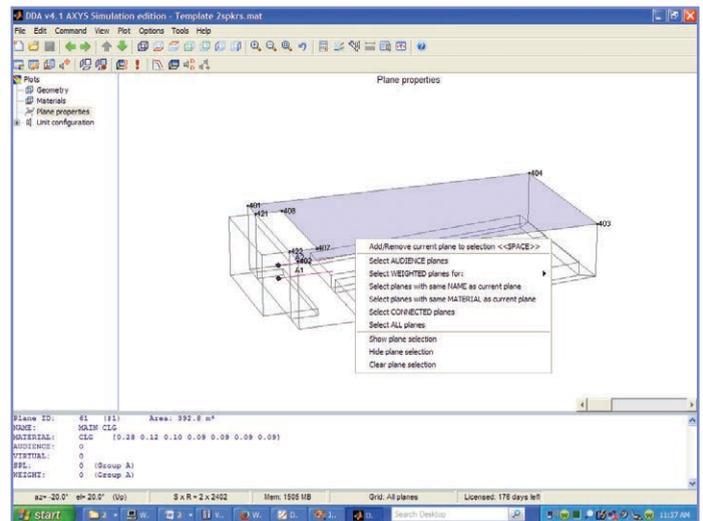


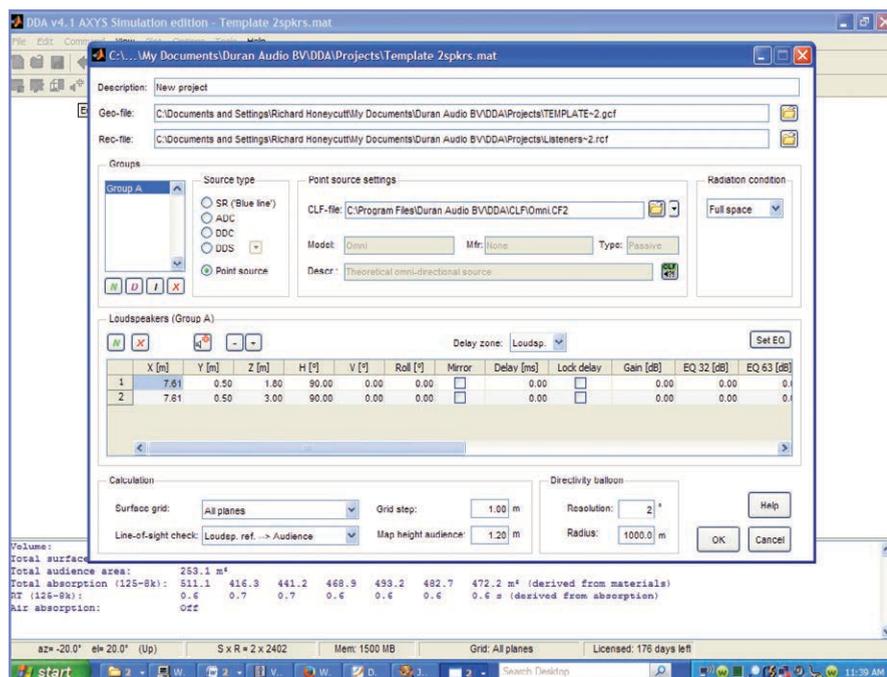
Photo 2: On the DDA desktop, and at certain other places in the displays, right-clicking brings up a context menu.

selected from the minimal built-in materials library (one "audience" and one "hard wall" material), or can be user-entered.

Duran Audio speakers using analog directivity control (ADC), digital directivity control (DDC), or direct digital synthesis (DDS) are supported, as are any speakers from other manufacturers for which CLF data is available. DDA can export directivity data to CATT-Acoustic, ODEON, or EASE. Graphics can be exported in JPEG, EMF, or bitmap form to various applications. DDA is a free download, but must be licensed (also free). The license is time-limited but can be extended. The install includes help files and a full Adobe Acrobat user manual.

Users familiar with other modeling software (e.g., EASE and CATT-Acoustic) may be aware that these programs recommend different approaches to modeling audience seating areas. However, because of its use of statistical analysis rather than ray/cone tracing or image-source methods, DDA will achieve results of equivalent accuracy using either approach. It is not necessary to tweak models created in other software before analyzing in DDA.

Once a model has been loaded, the desktop can display the geometry, material data, properties of a selected plane, or speaker configuration. All the dimensions are in the International System of Units (SI) units. **Photo 1** shows the plane properties for the main ceiling of the example project. The inside of the selected plane is displayed in blue; the outside, in red. The properties are listed at the bottom of the screen. In addition to name and material, the plane can be designated as an audience plane (displayed value of 1), or not (value



of 0). Designation of a plane as an audience plane actually causes DDA to create a plane above the selected plane. The height of the audience plane can be user-selected. This new plane can be real (i.e., casting sound shadows) or virtual. A plane can be "weighted" if so chosen for DDS analysis, and a target sound pressure level (SPL) can be specified. These items can be changed by the Plane Properties dialog, accessed via the Edit Plane Properties button on the taskbar. Right-clicking on the DDA desktop brings up a context menu (See **Photo 2**).

Photo 3 shows the Project Settings dialog box. In addition to the locations of critical files and folders, it shows locations and aiming information for two omnidirectional speakers (the CLF data is included with DDA), one mounted 1.2 m above the other. The locations of files containing

Photo 3: Loudspeaker location, aiming, and directional data can be entered in the Project Settings dialog.

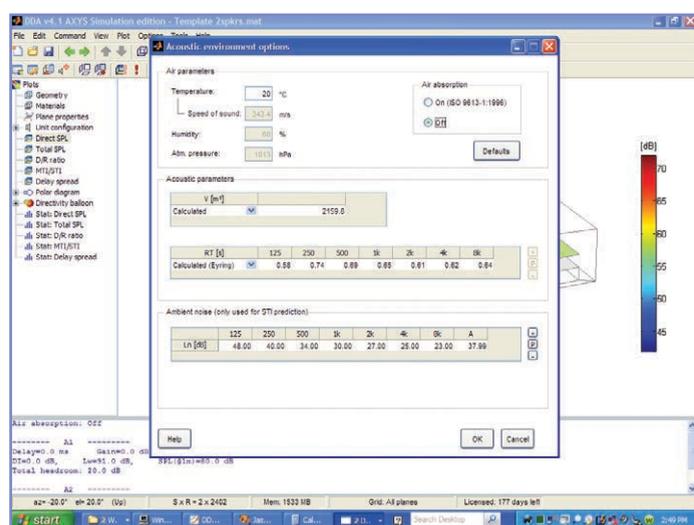


Photo 4: The desired acoustical environment can be specified in this dialog box.

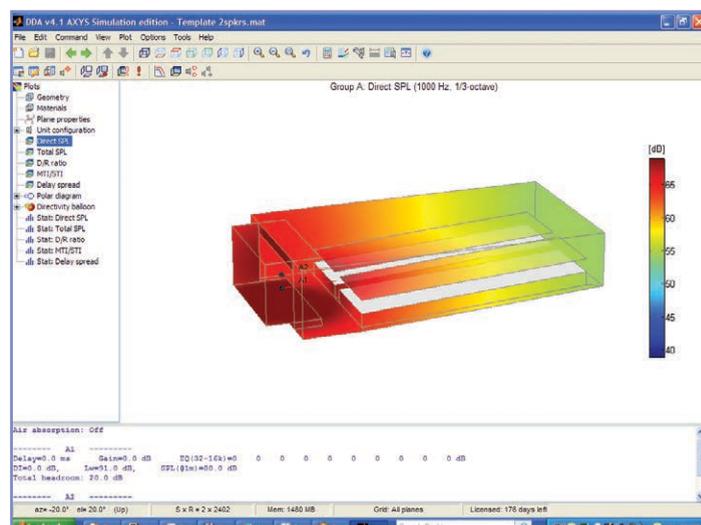


Photo 5: The Trial Run creates basic mapping.

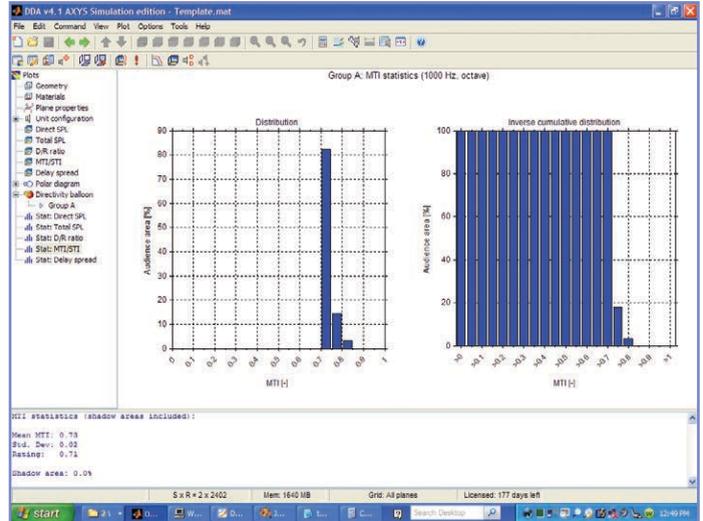
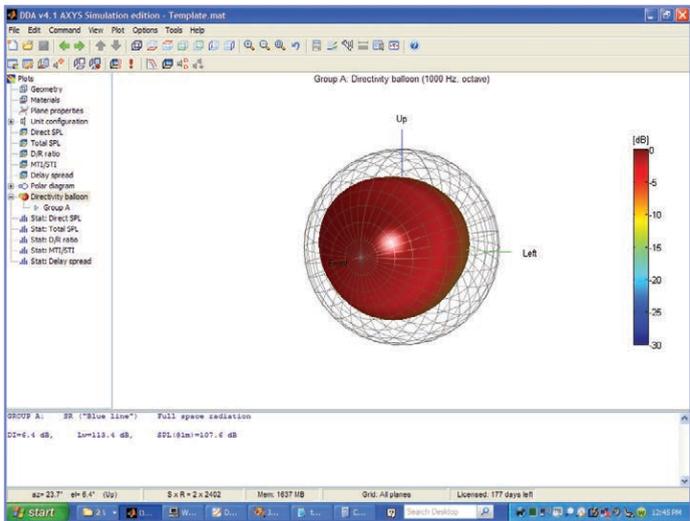


Photo 6: The Trial Run window can display the source directivity balloon, in this case, the balloon of a single speaker.

Photo 7: The intelligibility can be examined by viewing the distribution of modulation transmission index/speech transmission index (MTI/STI).

directional information for the two speakers are also designated in the dialog box. One or more identical loudspeakers or arrays can be defined as a group, and the output filters and delays are set separately or for each group. Octave-band equalization can be user-specified for each loudspeaker. The radiation condition for the loudspeakers can be set for full-space or half-space. If it is set for half-space, the user will be prompted to specify whether a plane is to be attached below or behind the speaker or array.

The Options menu on the toolbar includes calculation options, plotting options, and a dialog for specifying the acoustical environment (temperature, humidity, air pressure, etc.). Calculation options

include: analysis bandwidth (sine wave, 1/3-octave, full octave, three-octave, or five-octave); a choice of energy or complex summation for the outputs of multiple loudspeakers, and "classical" (Eyring) or "revised" acoustical analysis; and line-of-sight-check options. The "revised" analysis is based on the work of Mike Barron and L. J. Lee, which takes into account the decrease in level of reverberant energy at large distances from the source (see Resources). The line-of-sight check uses a geometrical algorithm to detect acoustical shadowing, and diffraction is not taken into account. The line-of-sight check can investigate the path from each driver to the audience, from each driver to all planes, or from the array reference point

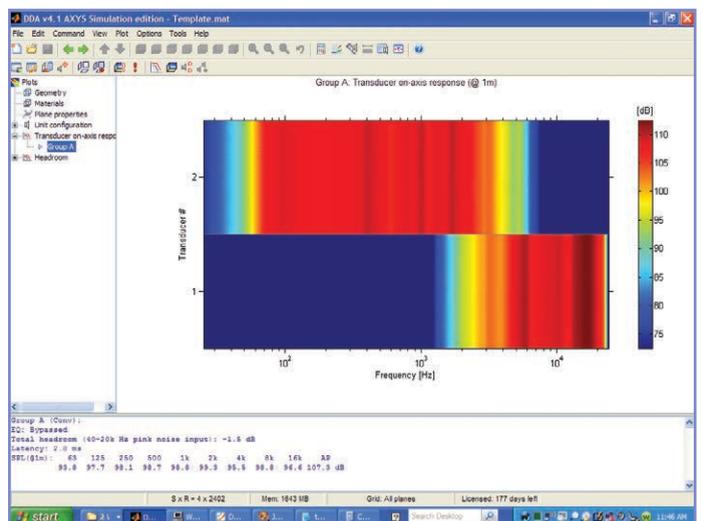
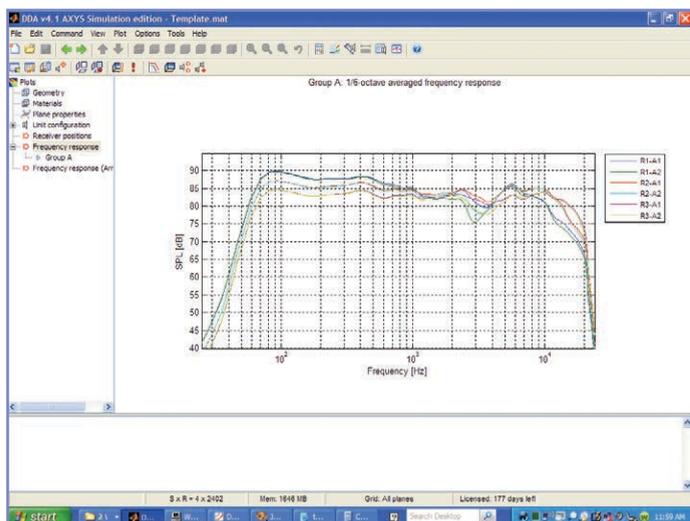


Photo 8: A display showing the frequency response from each loudspeaker or array in the group at each receiver position is available after a Full Run is performed.

Photo 9: The Full Run window offers a display of the transducer frequency response for each driver in the loudspeaker.

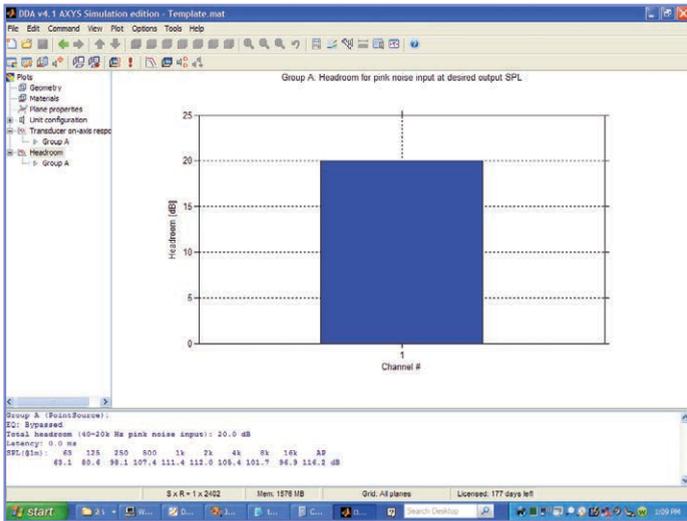


Photo 10: Loudspeaker headroom is plotted as part of the Full Run.

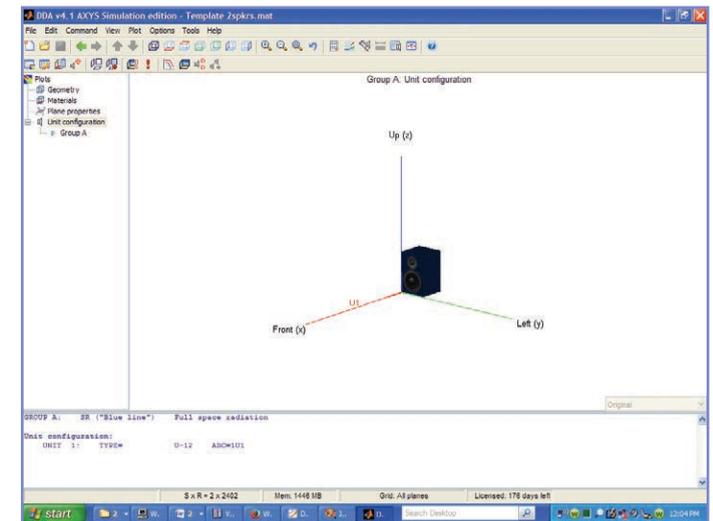


Photo 11: The user can view a graphic of the loudspeaker aiming.

to either the audience or all planes. **Photo 4** shows the acoustical environment options dialog, which also includes the calculated octave-band RT.

At this point, the user is ready to do a Trial Run. Upon clicking the button, the user will see a dialog box in which the center frequency for the analysis can be specified. (The parameters calculated during a Trial Run are not plottable vs. frequency: a separate Trial Run must be performed for each frequency band to be investigated.) Then there will be an option to map only audience planes. After the user okays the selection, the Trial Run is completed in seconds. **Photo 5** shows the display for direct SPL mapping on all planes. From the displayed list in the left-hand pane, the user can select a map of Total SPL, Direct/Reverberant (D/R) Ratio, modulation transmission index/speech transmission index (MTI/STI), or Delay. The source's polar diagram can also be viewed, as can the directivity balloon. **Photo 6** shows a single driver's directivity balloon. Statistical distributions of calculated parameters can also be selected for viewing from the Trial Run window. These include Direct SPL, Total SPL, D/R ratio, MTI/STI, and Delay spread. **Photo 7** shows the MTI/STI distribution. Both the distribution and the inverse cumulative distribution are plotted.

Receivers' (i.e., listeners') locations are specified by a user-created Receiver Configuration File. Once this file has been created, a Full Run can be performed. This requires only about twice as much time as the trial run. Then, the frequency response at each receiver position can be viewed. **Photo 8** shows the frequency response of each loudspeaker (or array if DDC, ADC, or DDS is selected) in group 1 at various receiver positions. **Photo 9** shows the frequency response at 1 m for each element in the group. (The speaker configuration used for **Photo 8** and **Photo 9** is an omnidirectional speaker with a Duran U-12 mounted 1.2 m above it.) The system's

headroom when producing the displayed SPL can be seen by selecting the appropriate option in the Full Run window. **Photo 10** illustrates a headroom display for a single speaker.

To clarify the loudspeaker aiming, the user can select Unit Configuration from either the Trial Run or the Full Run window. **Photo 11** shows the display that will appear.

In addition to these features, DDA includes a calculator, a delay optimizer, and an array builder. There is also a distance-measurement tool (usable on 2-D displays only). Delay optimization is used to time-align multiple loudspeakers or groups in order to improve speech intelligibility by reducing delayed sound contributions from secondary speakers.

While DDA does not include the sophisticated ray/cone-tracing and image-source algorithms that are used by full-fledged acoustical modeling software, it goes well beyond the simple loudspeaker-aiming programs offered by some other manufacturers. It is intended for use in sound-system design and configuration, not for acoustical design of venues. (It is also true that many users do not take advantage of the sophisticated tools available in their modeling software, but use only the statistically-based features, and for such users, DDA provides equivalent analysis at no cost). Even the simplest aiming software provides more reliable results than the looks about right (LAR) approach used by the less-competent sound contractors. DDA also provides tools to take the design a step further, providing improved coverage, naturalness, and intelligibility. DDA can be a valuable asset especially for projects in which no budget is available for an acoustical consultant or there is no option for making acoustical improvements in the venue. 

**Author's Note: Duran Audio was acquired by HARMAN International in October 2013.*