SIA Software Company, Inc.

One Main Street • Whitinsville, MA 01588 USA • www.siasoft.com

SIA-Smaart® Pro CASE STUDY #9

Interaction of Low Frequency Drivers and Subwoofers in Dance Systems

By Sam Berkow, SIA Software Company, Inc.

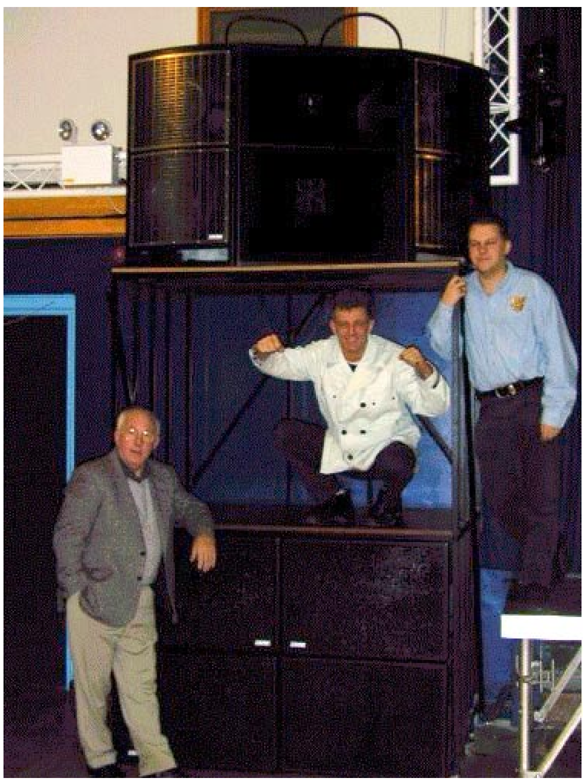

Figure #1: An Avalon stack (house left), with the house facilities engineer (standing left), Fin Bar (the house operation director) squatting on the SB1000 sub-woofers and Steve "the lad" Badham of EAW's UK distributor firm Sound Department on the right.

I was asked to help optimize a dance sound system. The system is installed in The MATRIX dance club in England. This is a new club, featuring a 1000 person dance floor. The club owner wanted a system that would get loud, but provide clean, punchy sound. An EAW AVALON system was installed.

The initial impression of the Avalon System was very favorable. The high frequencies are amazingly clean and distortion free. The mids punchy, even over a set of four SB1000 subwoofers per side. However there was some question about making the low end tighter as the sound at low frequencies (125 Hz and below) was a bit muddy and coverage of the room seemed uneven. It was assumed that this muddiness and the uneven coverage were results of the acoustics of the room. However our analysis found something different.

In measuring the transfer function of the system, we found that the system was very flat above 125 Hz (see figure #2 next page).

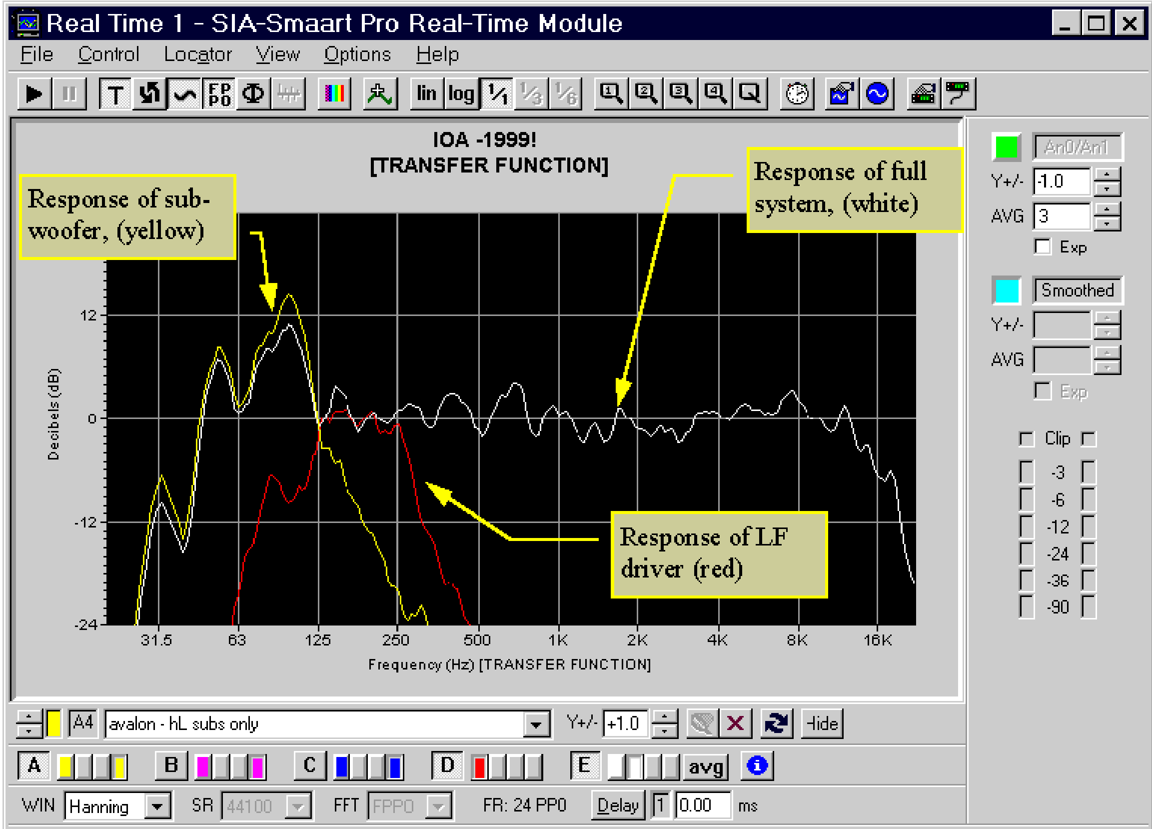

Figure #2: You can see the transfer function of the entire system, the LF drivers and the subwoofers measured separately.

In the measured results shown in Figure #2 above you can see that the subwoofers are being run about 10 dB hotter than the rest of the system. This is not uncommon in dance clubs where the beat (and the thump of the subs) is a key part of the experience.

In looking at the system, listening and reviewing our measurements we noticed that the low frequency drivers and the subwoofers were overlapping in the 70 to 150 Hz region. This would normally be appropriate for an installation employing wide physical separation between woofers and subs. However, given that these two sets of speakers are set apart only by several feet (see figure #1, previous page), we decide to reduce the amount of overlap. In this case we decided to raise the crossover point of the LF drivers.

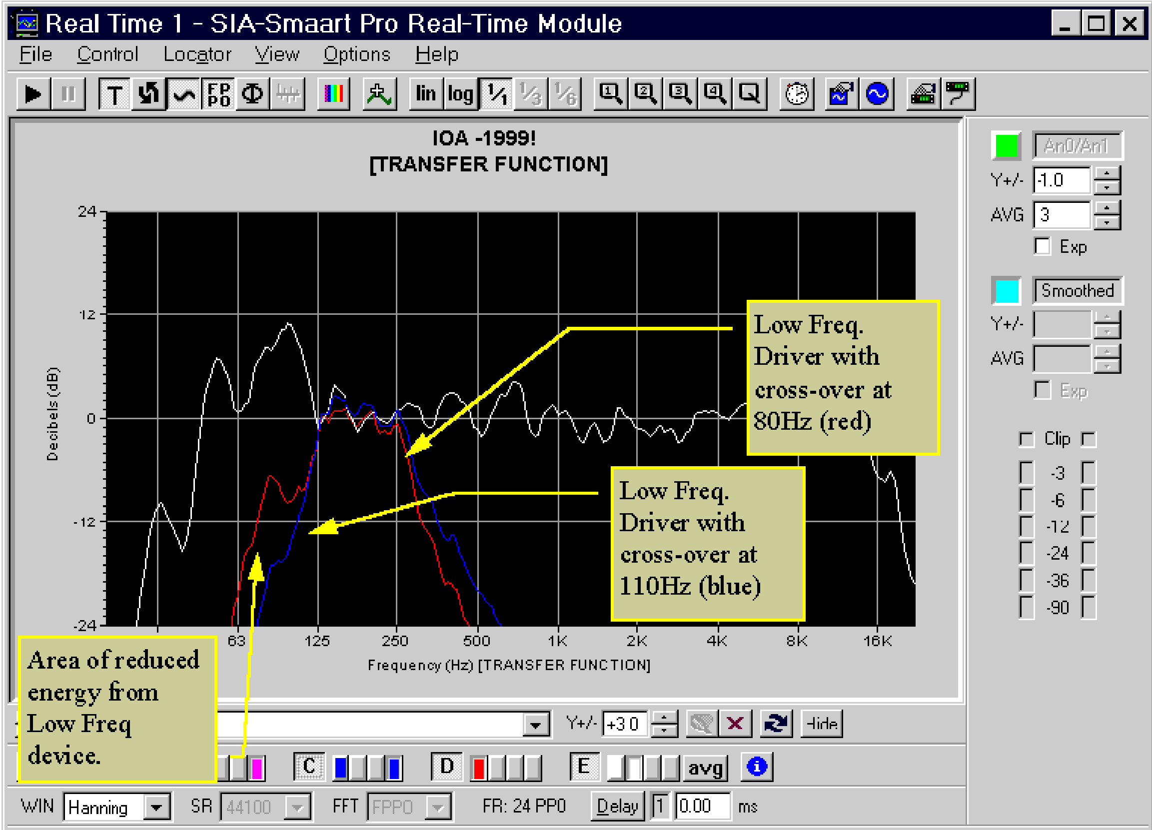

Figure #3: the full system measurement and two measurements of the LF drivers in the AVALON system. Because the subwoofers are being run at a 10 dB boost, moving the high-pass crossover point of the LF device from 80 Hz to 110 Hertz reduced the overlap between the LF and subwoofers. Less overlap is desirable when the woofers and subwoofers are in close proximity.

The results achieved by reducing the interaction between the LF driver and the subwoofer was impressive. In fact three results were immediately noticeable:

1. The LF response of the system sounded much "tighter" and "punchier."
2. The LF coverage was improved, as the LF and sub-woofers were now interacting much less.
3. The vocal region seemed much clearer as there was less "mud" in the sound.

In summary, when running subwoofers much hotter than the LF part of the system, the selection of crossover frequencies for the electronic processor might not give an accurate depiction of the true (acoustical) crossover point. Furthermore, subwoofers located in close proximity to woofers can exacerbate this, as minimal overlap is desired for this type of installation. In this case, reducing the amount of interaction between the sub and LF can help make the system sound much tighter.