An Improved Loudspeaker Frequency Response by Using a Structure of Rigid Absorptive Panels in a Vented Cabinet

R. Balistreri
Community Light & Sound Inc., Chester, PA, USA

Introduction: Loudspeakers often have to deal with irregular frequency response due to standing waves. Placing rigid absorptive panel in strategic places improves efficiently their reduction smoothing the loudspeaker frequency response.

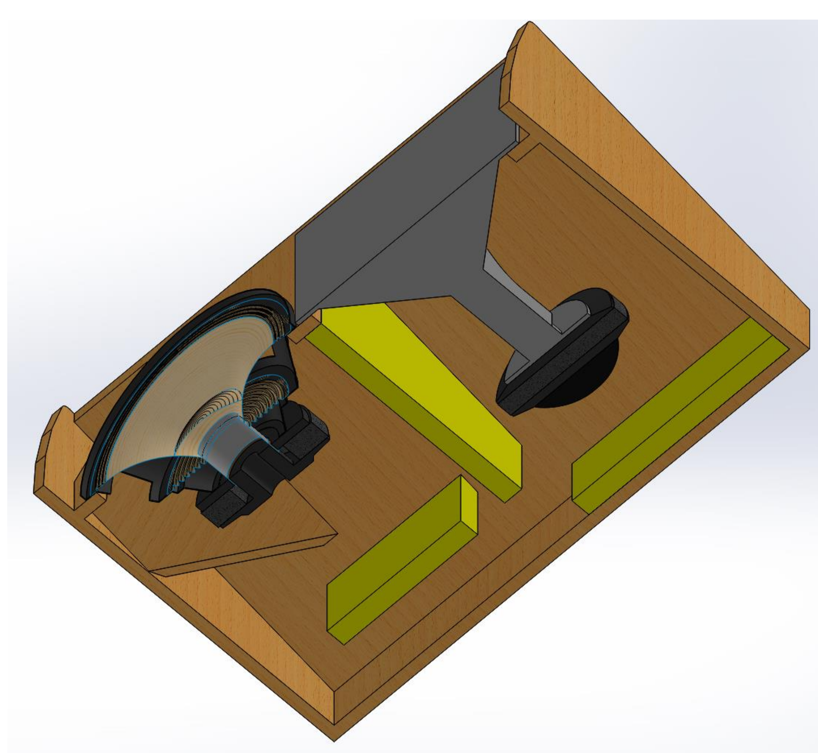


Figure 1. Section of speaker cabinet

Computational Methods: Two physics were applied to simulate the case in the frequency domain, Acoustic-Shell Interaction and Pressure Acoustics. Equations involved are for the pressure:

$$\nabla \cdot \left(-\frac{\nabla p}{\rho_c}\right) - \frac{\omega^2 p}{c_c^2 \rho_c} = 0$$

With the use of Poroelastic material glass fiber panel of apparent density of 48kg/m^3 giving a flow resistance of Rf=11.8k (kg/m^{3}s). While for the wave equation

$$\frac{1}{\rho_0 c^2}\frac{\partial^2 p}{\partial t^2} + \nabla \cdot \left(-\frac{1}{\rho_0}(\nabla p - \mathbf{q})\right) = Q$$

in the acoustic shell interaction governs the propagation of waves generated by the moving diaphragm which in turn has a force proportional to the current passing in the wire of length l immersed in a magnetic flux B. As the current can be derived by the blocked coil inductance Zb and the driving voltage the Force from the electrical domain can be written as:

$$F_e = \frac{BLV_0}{Z_b} - v\frac{(BL)^2}{Z_b}$$

Results: The simulated Frequency response brings to investigation the behavior i.e in the range of 800Hz.

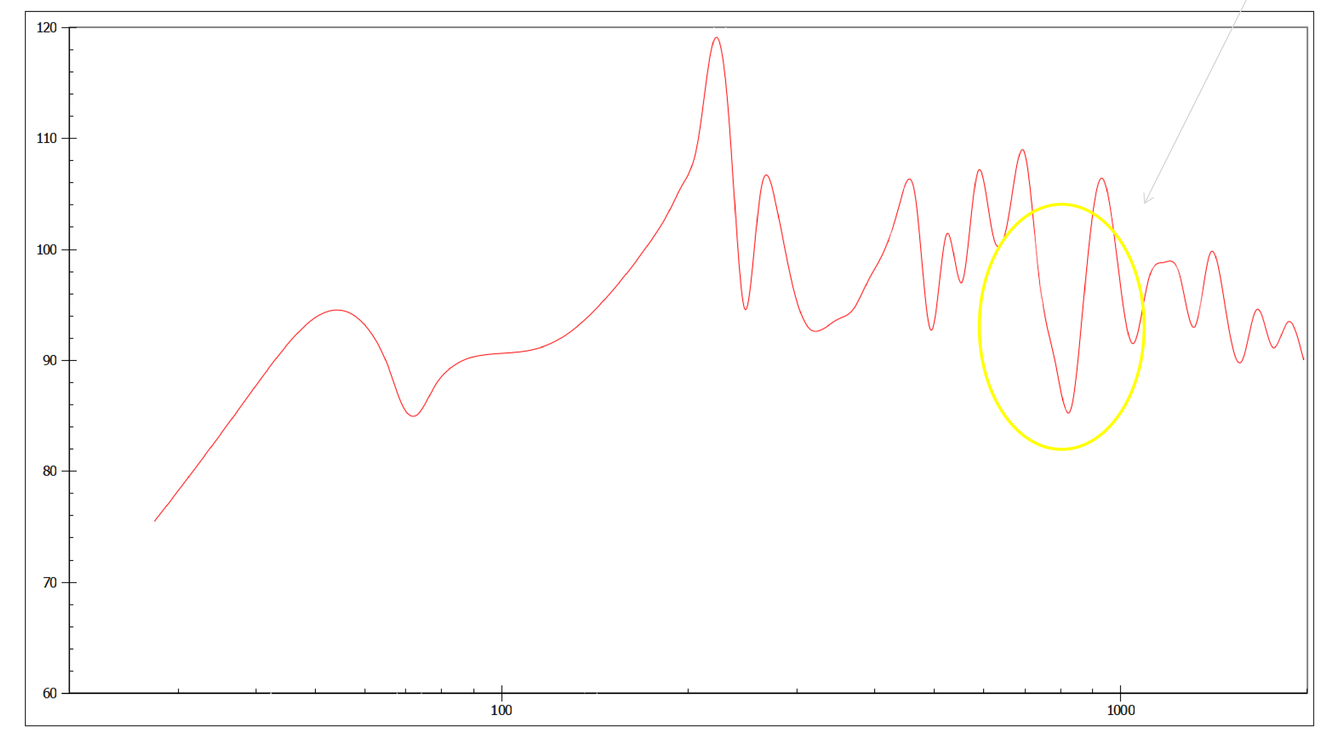


Figure 2. Simulated response without panels

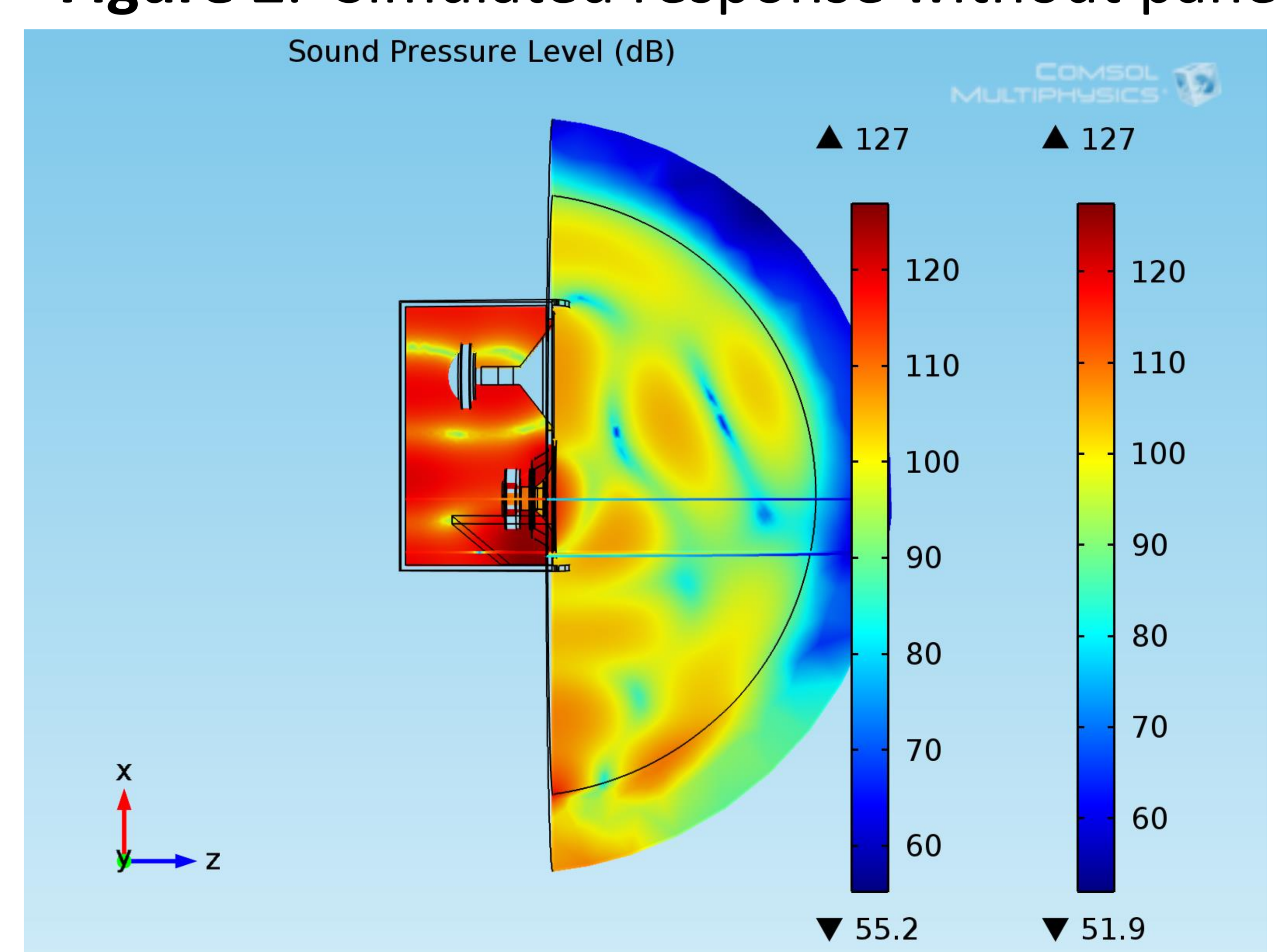
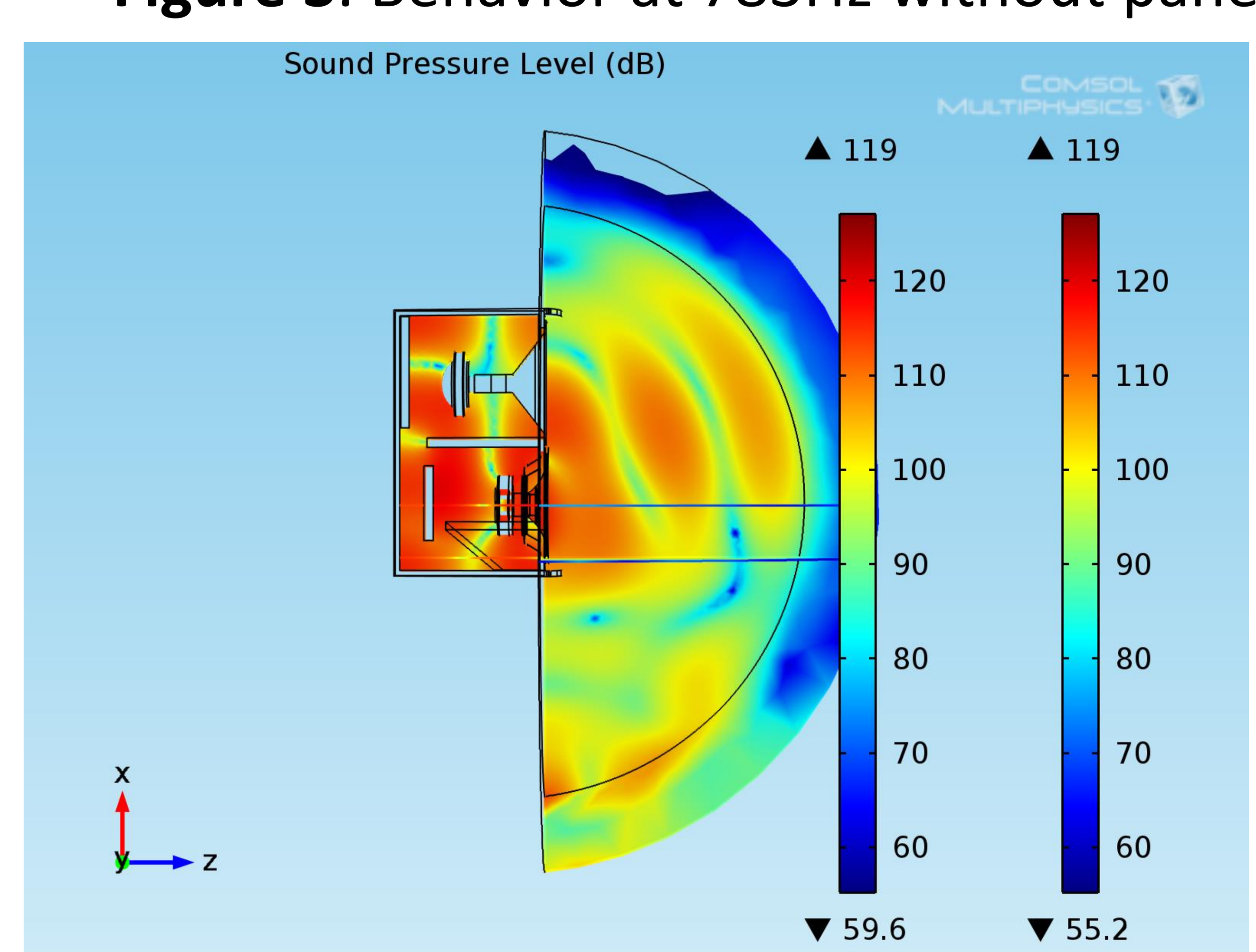
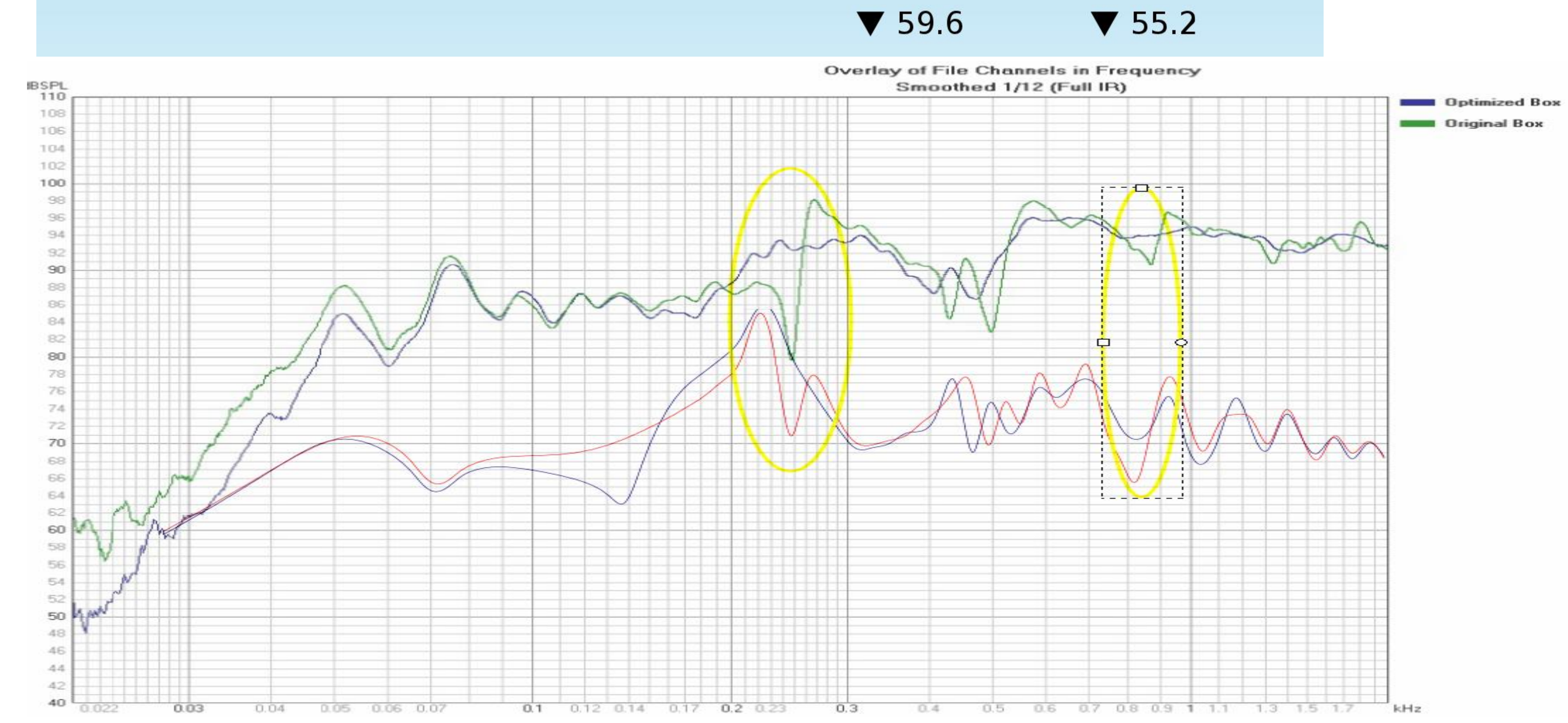


Figure 3. Behavior at 783Hz without panels





Conclusions: Simulated SPL with panels shows improvements in few regions and such corresponding measurement do confirm the improvements.