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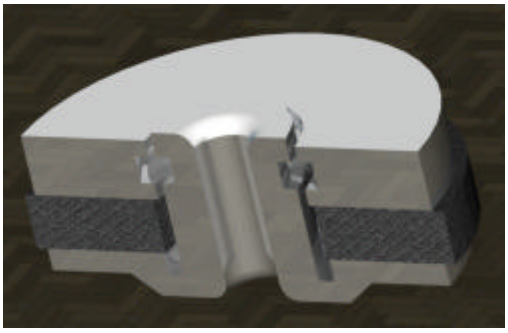
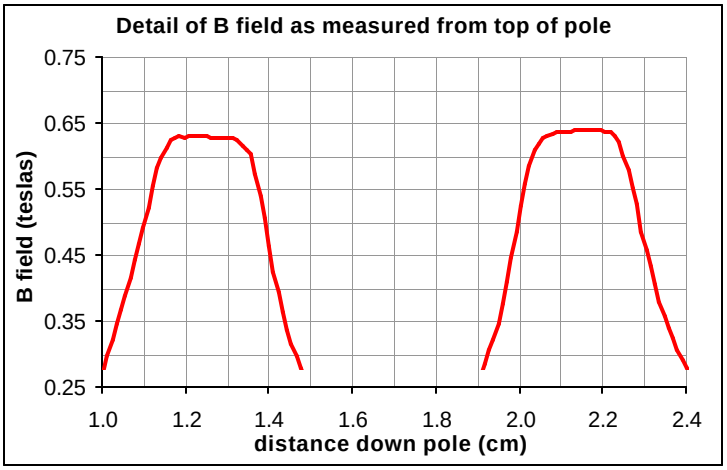
**Adire Audio has invented a new patent pending technology for improving loudspeaker drivers: eXtreme BL Linearity, or XBL² ™. Relative to other motor topologies, this new technology greatly linearizes the motor strength over the majority of the driver's usable excursion, with typically no net increase in production cost. The flatter, more linear BL curve means significantly lower distortion (see Dr. Wolfgang Klippel, et al).**

XBL² ™ motors are designed from the ground up to yield a **flat BL curve** over as wide a range of excursion as possible. In addition, other benefits of the motor topology include **low inductance** (important for faster transient response/wider bandwidth) and **low moving mass** (allowing higher efficiency). The combination of higher excursion, wider bandwidth, lower moving mass, and lower distortion is naturally suited to use in wide-bandwidth/full range drivers. **The driver has the efficiency and bandwidth required for maximum top end extension, yet because of the high excursion smaller diameter drivers can still produce high SPL levels.** Couple this to lower distortion for increased clarity and it is plainly obvious that XBL² enabled motors are of great benefit for all drivers—woofers, mids, tweeters, and fullrange. XBL² enabled drivers have been used in many applications over the last 2 years.

XBL² relies upon a motor gap design called ***SplitGap***™. SplitGap breaks the magnetic gap into more than one region. An easy and low-cost implementation of this design is shown in the 3D image to the right. This shows a cutaway of a typical XBL² motor. The top plate has one or more grooves distributed across the face of the gap. Typically, opposing grooves are cut in the pole piece as well, to create well-defined high-flux regions that correspond to the narrow portions of the total gap. **Functionally, there are two or more gaps in the motor** (see cutaway). The motor design shown here would yield a typical B field, as measured from the top of the pole to the bottom of the top-plate, as follows (much like the twin humps of a Bactrian camel):






The total package is brought together via the use of a properly-sized voice coil. **The key to the extremely flat BL curves possible with the XBL² technology is to use a voice coil of a certain length so that as it moves across the B curve it integrates a consistent amount of flux, yielding the constant BL product desired.** For the motor shown here, the typical voice coil would extend from roughly the center of the top high-flux gap to the center of the lower high-flux gap. This would correspond to points on the flux curve from roughly 1.25 cm to 2.125 cm. As the voice coil moves up or down this B curve, an equal amount of voice coil enters one high-flux gap and leaves the other high-flux gap. In this example, the resulting BL curve would be within linear limits (-3 dB loss) from 0.75 cm to 2.75 cm, or **20 mm total linear throw**. This is for a voice coil of approximately 9 mm length, and a top plate of 10 mm thickness (the peak-to-peak linear throw is twice the top plate thickness, and nearly 2.5 times the voice coil length). For complete design details of this motor, please contact Adire Audio.



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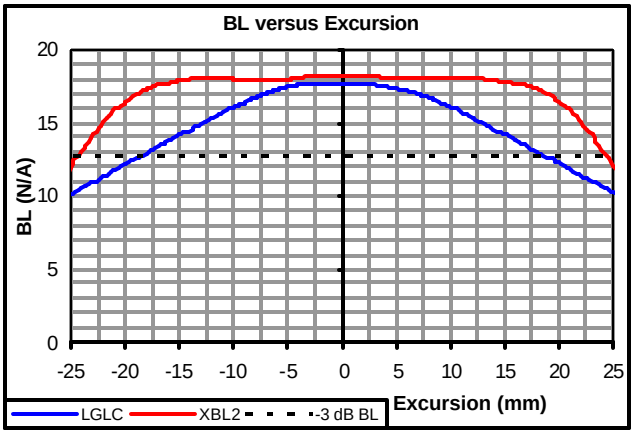
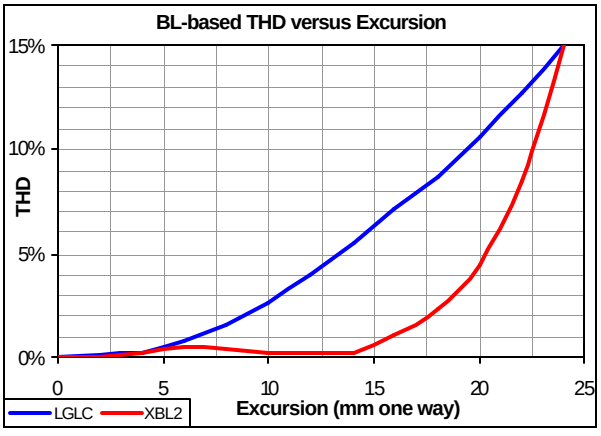
Because the voice coil is physically shorter than the top plate, many classify it as an underhung design. Yet the operation is seen to show that the voice coil is longer than the high-flux gaps, meaning it is somewhat akin to an overhung. In fact, **an XBL² enabled motor shares the best attributes of both under and overhung designs**, yet is not adequately described as either. The above example could, in fact, be considered a double-hung design. This is the basis for the claim that an XBL² enabled motor is a new topology. Neither under nor overhung, but a beneficial and unique hybrid of the two.

The cost savings of an XBL² motor as compared to a traditional long-gap overhung design comes from the much shorter voice coil. **Cutting the voice coil length in half results in cutting the voice coil cost in half**. Additionally, because the voice coil is considerably shorter, gap width/clearance issues relating to rock and scrape are greatly reduced. Narrower gaps translate to higher B strengths, meaning **smaller and lower grade magnets are required for a given target flux density**. In fact, taking the exact same motor structure and XBL² enabling it can often result in higher BL over a wider range, without an increase in either DC resistance or inductance.




Shown to the right is a comparison of the same base motor parts (same steel forgings and magnets), with one set modified to have XBL². The top-plate is 1.3" tall, and the gap width is the same for both cases. For the LGLC (Long Gap Long Coil) design, the voice coil is 2" long. For the XBL² enabled motor the voice coil is approximately 1" long. However, the **BL of the XBL² enabled version is higher at all points**, out past the linear limits of both motors (indicated with the dashed line).

One of the key benefits of the flat and extended BL curve is lower distortion. **Distortion from BL nonlinearities is the major contributor to the total THD of the driver.** This distortion increases as the BL curve changes. Keeping the BL flat results in low distortion, as shown below. In fact, in a musical (transient) situation, an XBL² enabled driver with a nominal 12mm of Xmag will have a transient distortion profile similar to a standard driver with 16mm of Xmag. **In terms of dynamic distortion performance, an XBL² enabled motor typically out-performs drivers with greater rated excursion.** Yet, as shown above, XBL² typically **adds** excursion to a given set of parts, thus leading to even lower distortion for motors based on those parts.




Overall, adding XBL² to existing motor designs is a very straightforward and affordable process. The gains in linear performance and typical cost savings are quite significant. Additionally the licensing fees for XBL² are very affordable, and **a license includes full design tools (including a custom FEA package) for use in your development of all XBL² enabled motors**.

If you would like to explore adding Adire Audio's XBL² technology to your build-house capabilities or drivers, please contact Dan Wiggins at the number listed below.



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