ANALOG CORNER

BY MICHAEL FREMER

THIS ISSUE: DVIV Laboratory's Rigid Float tonearm upsets apple carts.

A Challenge to Tonearm Dogma

At the 2013 High End Show, in Munich, a tonearm designer displayed a *pivoting* tangential tracker. A nearly invisible length of monofilament wrapped around the arm's perimeter controlled the pivoting headshell of the box-girder–like arm.

It may very well have worked as promised, but was it practical? And with so many tiny moving parts, would it sound any good? I don't know—it was a silent display—and inquisitive attendees kept bumping the difficult-to-see monofilament, dislodging it from its track.

The odds weren't good that this contraption, however well intended, would ever get past the prototype stage, though I was going to look for it at the 2014 Munich show, in May. Sometimes, designers obsessed with one particular performance parameter lose sight of the forest for the trees.

The designer of ViV Lab's Rigid Float tonearm, Koichiro Akimoto, also had in mind an unusual design goal, based on his belief that the geometry of pivoted tonearms, as we know it, is wrong.

What we know, or think we know, of that geometry all goes back to work begun in 1924 by Percy Wilson, technical editor of *The Gramophone*. You can read in detail about Wilson's work in Keith Howard's "Arc Angles: Optimizing Tonearm Geometry," in the March 2010 *Stereophile*.[1] Basically, when a lacquer is cut, the cutter head describes a radius—a straight line—across the lacquer's surface. But most tonearms swing on a pivot: as the stylus traces the groove, it describes an arc across the record surface (fig.1 on p. 24).

In theory, at least, a linear- or tangential- or straight-line–tracking tonearm allows the stylus of the phono cartridge to maintain optimal tangency with both groove walls by reproducing, as closely as possible, the motion of the cutter-head's stylus across the lacquer. Because it does not maintain this optimal tangency, a pivoted tonearm produces lateral tracking error (LTE). But as Keith Howard points out, because a record's groove is a spiral, absolute tangency is *never* possible—but for our purposes, we can assume that it is.

Wilson's great contribution to modern tonearm design was his realization that to minimize LTE, the radius of the arc described by the playback stylus had to exceed the distance between the tonearm pivot and the platter spindle. The difference between those two distances is called the *overhang*: literally, how far past the spindle the stylus is when it is placed directly over the spindle. The overhang plus the pivot-to-spindle distance is called the arm's effective length. If your tonearm permits such motion, place it directly over the spindle and note the amount of overhang.

Wilson also calculated that minimizing LTE required that the stylus be set at an angle to the pivot point. This *offset angle* can be achieved either by bending the tonearm in an S shape or by angling the headshell. When this is done, two positions along the arc described by the stylus as it traces the groove, called the null points, produce perfect groove tangency, and LTE and the distortion it causes are minimized throughout the arc (fig.2 on p. 24).

However, Wilson's actual geometric calculations were incorrect: he didn't take into account that the groove's linear velocity is constantly slowing, from outer groove to inner groove. Eric Löfgren was the first to recognize and correct for the fact that LTE distortion is inversely proportional to linear groove speed, which, on a 12" LP, varies by a factor

This story is about Koichiro Akimoto's obsession with skating and antiskating.

1 www.stereophile.com/features/arc_angles_optimizing_tonearm_geometry




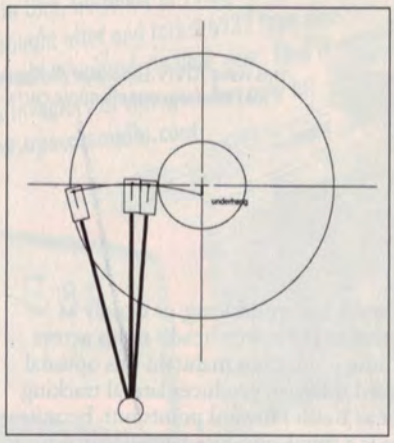

Fig.1 A straight arm/headshell means that the cantilever is perpendicular to the groove at just one radius. (After ViV Laboratory.)

of 2.5 from outermost to innermost groove; in other words, in the same amount of time, the stylus travels 2.5 times as far in one revolution of the outermost groove as it does in one revolution of the innermost groove.

But that's [*ahem*] tangential to what this story is really about: Koichiro Akimoto's obsession with skating and antiskating, for which Percy Wilson is to blame. It was Wilson who devised the offset angle, and it is the offset angle that produces the vector force that causes a tonearm to "skate" toward the center of the record. Skating is *not* caused by centrifugal or centripetal force as the groove spiral shrinks (although you'll still find that explanation throughout the Internet).

In theory, absent the offset angle, there would be little or no skating. But play a record, and there's friction between the stylus and the groove—how much friction will depend on how heavily modulated the groove, the vinyl formulation (some vinyls are stickier than others), where on the record surface the stylus is, the vertical tracking force (VTF), and, of course, the stylus profile. A pivoted tonearm's inherent LTE itself also produces some friction, though very little.

Were there no offset angle, the drag produced by this friction would be in line with the arm pivot, which would be directly behind and in line with the stylus's cantilever, so the drag would be straight back. But when you add the offset angle, that imaginary line goes through the position of an imaginary pivot—the actual pivot remains over in left field.

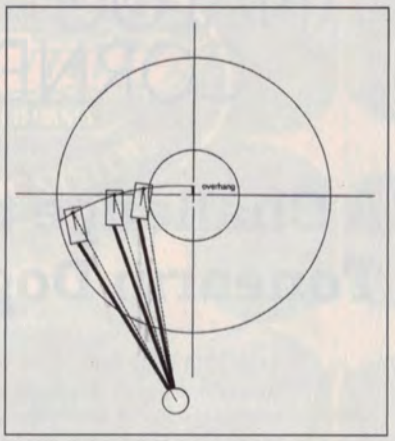

Fig.2 Overhang and an angled headshell minimizes lateral tracking error across the groove area. (After ViV Laboratory.)

Because of that distance between the imaginary and the actual pivot points, there is a vector force that causes the arm to skate toward the center of the record. The longer the tonearm, the less the offset angle, and the less the offset angle, the lower the skating force—but even a 12" tonearm produces measurable skating.

If you don't compensate for this sideways force, the stylus will ride the

inside wall of the groove across the record. If you overcompensate, the stylus will ride the groove's outside wall. If your compensation is precisely accurate, the stylus will sit centered in the groove, where it belongs—but how likely are you to get it precisely accurate? Not all that likely across the entire side, though more likely with tonearms whose antiskating devices precisely vary the side-force compensation across the record surface. In short, antiskating compensation, like most attempts to play LPs perfectly, isn't.

As best I could decipher Viv Lab's poorly translated documentation, Akimoto also believes that the skating force does more than bias the stylus toward the groove's inner wall. He believes that it also displaces the cantilever the stylus is attached to, and exerts a force that de-centers the position of the coil or magnet inside the cartridge.

He also believes—and this is key to his work—that the skating produced by the offset angle results in more objectionable distortion than that caused by LTE. The gist of his calculations is that, at either the minimum or maximum LTE positions along the arc, *uncompensated-for* skating produces a condition in which almost half of the frictional force in the groove pushes the stylus against the sidewall.

Akimoto's point is that, even though it will have higher LTE, a tonearm with a non-offset headshell will produce only a tiny amount of side-force, hence distortion—and so, he concludes, a non-offset arm is preferable, all things considered. Once he'd concluded that an unangled arm was the way to go, he had to invent his own geometry, which resulted in cartridge *underhang*. The stylus of a cartridge mounted in the Rigid Float arm describes an arc that never extends past the spindle—in fact, at the beginning and end of its travel, it falls well short of the spindle.

Akimoto claims that his arm has zero tracking error at the arc's apex, which he's set to be in the center of the groove area, slightly closer to the label—probably to partly compensate for the greater inner-groove distortion inherent in vinyl playback.

So he built three . . .

There are three models of ViV Lab's Rigid Float tonearm: the 7, 9, and 13, respectively "about" 7", 10", and 13" long. Because there's no offset or overhang, length isn't critical, which begs the question: Why three lengths? Simply to more easily accommodate a wide variety of turntables. I got a sample of the Rigid Float 9 ($4500).

As its name hints, the Rigid Float's geometry isn't its only unique aspect. The arm lacks a conventional bearing. Instead, the pivot floats on a dark, magnetic, light-viscosity, ferrofluid-like oil that you inject into a large opening at the front of the pivot housing. Before you do, the arm is too stiff to pivot; afterward, it smoothly glides on what appears to be a bubble of oil without visible means of support. According to inventor Akimoto, inside the pivot, a small ball floats on a "slimy rubber swimming ring that regulates the arc motion of the wand."

There must be a cup-like structure inside that holds the oil, and a vertical rod—the pivot point—that is somehow steadied by but floats within the oil. I couldn't pull the arm to and fro, and yet it floated freely. Very ingenious, however it works!

The arm is housed in a heavy, truncated-conical base of brass; on its

flat bottom are small, hard button feet. The arm is simply placed in position, not screwed or bolted down in the usual way.

If you have an unusually tall platter or prefer a spiked interface, you can attach three small, threaded feet. You can also adjust the cartridge's vertical tracking angle (VTA) and stylus rake angle (SRA) by loosening a large, knurled grub screw and raising the pivot housing by up to ¾" (18mm).

It's not the most convenient way to adjust VTA, or the most rigid—and if you (wrongly) feel the need to adjust a tonearm's height for every thickness of record, the Rigid Float will not be for you. But I found that when I set the SRA to 92° and left it there, the Rigid Float's system, though somewhat cumbersome, was workable. (When you've chosen a starting height, it's best to mark the pivot tower with a Sharpie so you can use that height as a reference and return to it as needed.) Azimuth is easily adjusted by loosening a grub screw on the arm's underside and rotating the arm tube.

Nelson Hold headshell and Setting Underhang

The Rigid Float 9 is fitted with an old-school, collet-type, bayonet headshell mount that's not the last word in rigidity—and, of course, it adds a break in the signal wiring. ViV Lab includes a Nelson Hold headshell, internally wired with silk-insulated wire of 99.99%-pure silver. The name derives from wrestling's full nelson hold, in which you clasp your hands behind your opponent's neck and press his or her head forward.

The headshell has a thin, almost tubular mount to which you affix a small aluminum crosspiece, to which the cartridge is secured with the standard mounting holes, nuts, and bolts. The crosspiece attaches to the headshell via a large knurled screw. The tighter you make that screw, the greater the pressure exerted on the cartridge body, and thus the greater rigidity of the mount. Caution: Irrational exuberance with this screw can deform a cartridge's body, particularly those made of hard plastic.

Since you position the Rigid Float's base on the plinth *after* you've installed the cartridge in the arm, underhang positioning is not a consideration. Still, to make the Rigid Float more compatible with a variety of turntables, the headshell has three closely spaced, threaded holes in which to anchor the cross piece.

The Nelson Hold's finger lift is an inline extension of the headshell that, unusually, is at the same height above the record surface as the rest of the arm. Unless you have skinny fingers and a deft touch, this makes use of the cueing mechanism mandatory.

Mechanical Ground or Mechanical Isolation?

One of the Rigid Float 9's claimed benefits is its mechanical isolation. Because the arm floats in oil, it's mechanically isolated from the turntable as well as from ground-borne vibrations. Energy generated at the interface of groove and stylus will be dissipated in the oil, not fed back to the interface. The same theory is implemented in the Well Tempered Arm, which floats a golf-ball-sized bearing in a pool of silicone.

Another way to remove energy from the system is to ground it, as in Allen Perkins's Immedia RPM 2 tonearm, which I wrote about in my review of VPI's Classic Direct turntable in the May and June issues: A post containing the bearing cup bolts directly to the armboard. The bearing point rests in this cup, making a direct mechanical connection between arm and armboard, so that energy from the groove/stylus interface has a direct path to mechanical ground. Of course, this means that energy also has a clear path to travel the other way, up *into* the arm—but that's easily handled with an isolation stand.

Setting Up the Viv Labs Rigid Float

Though the one-sheet accompanying the Rigid Float 9 says "just put it anywhere," that's not quite true. The tonearm comes with an L-shaped alignment jig that you put over the spindle (the hole is too big and the fit is sloppy). As with SME's alignment system, you line up the straight arm tube directly over the jig, but instead of sliding the arm along a track to set overhang, you set *under*hang by manually moving the base until the stylus sits in a tiny, almost invisible circle near the end of the L jig. Also as with the SME system, more than a bit of subjectivity is involved in outlining the armtube against the jig below.

The arm base's considerable weight makes it unsuitable for spring-suspended turntables. At worst, the weight will collapse many spring suspensions; at best, it will de-level the plinth and require the sort of adjustment of spring compensation that causes Linn owners, for instance, mental breakdowns—unless you can mount the arm on an external pod. A perfectly level pod is required for proper operation; a large bubble level is set into this one's top.

I set up the Rigid Float 9 on three turntables: the VPI Classic Direct Drive, the Continuum Audio Labs Caliburn, and the Music Hall MMF 11.1. Cartridges used were the Lyra Helikon SL and Titan *i*, and the Transfiguration Phoenix.

Once I'd installed the cartridge, approximated the VTF, correctly positioned the arm, and set the underhang, it was time to fine-tune the VTF. Here is where I ran into the first problem with the Rigid Float: setting precise VTF proved very difficult. First, the counterweight "system" consists of two weights that fit very loosely on a threaded rod extending from the back of the arm. If you could use both weights, you could snug one up against the other to tighten them; however, balancing each of the three cartridges I tried required only one weight.

At first, I quickly set the Phoenix to about 1.75gm. When I re-checked it after positioning the arm and saw that the VTF was now over 2.2gm, I figured I'd bumped the counterweight, or that it sat so loosely on its threaded shaft that it had rotated on its own. But when I took more time and care in setting VTF, I discovered the problem: the Rigid Float 9 has a very long settling time. I set the VTF to 1.8gm; it appeared to have settled—the tiny circle on the gauge that indicates "settled" had appeared—but instead of removing the gauge, I watched and waited. Over the next 90 seconds, the gauge went from 1.8 to 2.52gm.

I reset VTF so that, when the ViV Lab arm was finished settling, the gauge read 1.8gm. But the Rigid Float really never fully settled—and this was on the unsuspended VPI 'table sitting on a rock-stable HRS base. I took that VTF reading near the outer edge of the platter. When I measured near the inner-groove area, I found a 0.25gm discrepancy. I then raised the gauge about ½" and observed a drop of 0.25gm, which indicated that the arm was, like the Kuzma 4Point, negatively balanced. Unless you play a lot of seriously warped records, that will not be a serious problem, in my opinion.

The RF tonearm sits on a massive base that will unbalance sprung-subchassis turntables.

The RF tonearm is set up with the supplied jig to give underhang.

My other observations do indicate serious problems, and they made me re-read the manual, where I found this: "Often the recommended tracking force is not the best because of various conditions. We strongly recommend to try to find the best tracking force *frequently*." (My italics.)

Sound

Multiple variables were at work, so it was difficult to determine what was producing the Viv Lab Rigid Float 9's consistent sound quality. However, the three cartridges all sounded more lush, more full bodied, more richly textured than they do in more traditional tonearms.

I don't know about you, but the sound produced by my turntable and tonearm using the Löfgren A offset geometry and carefully set antiskating has never produced obvious unwanted sonic artifacts. In fact, ever since I got really serious about turntable setup—using a precision overhang gauge, a digital microscope, and a WallySkater or a track from Telarc's *Omnidisc* test LP—and began setting azimuth electronically, whether with Dr. Feickert Analogue software, a digital oscilloscope, or the most primitive but still efficacious voltmeter at the speaker outputs (as described on my turntable-setup DVD), the absence of audible distortion, shifting images, or other unwanted artifacts has always impressed and amazed me. Other than the lifelike sound only vinyl provides, you aren't aware that you're playing vinyl.

So I can't be sure whether the sonic characteristics produced by the Rigid Float 9 resulted from its unique bearing system, its underhung geometry, or both.

I played dozens of LPs with the Rigid Float. Some, like Cécile McLorin Salvant's highly recommended *Woman Child* (Mack Avenue 1072LP), sounded gorgeous. Classical and jazz fared best; rock sounded too thick and rich for me, but I know people who will absolutely love this sound. Overall attack was somewhat softened, sustain prolonged, and decay significantly shortchanged.

The main event sounded enriched, while the context—the space around the instruments, as well as the space in which all of them were played—was significantly diminished. It was almost as if my system's electronics had been swapped out for warm, rolled-off-sounding tube gear. Instruments and voices were full-bodied, round, and solid. Harmonics were intensified, but transient attack was only slightly softened, which was impressive.

Some people absolutely crave this kind of sound. In my experience, it's the sound produced by, say, Audio Note and Shindo tubed electronics, whose advocates claim that these products "make music" to the exclusion of everything else, while detractors claim that they produce a distinct set of colorations that enhance most recordings, which are inherently imperfect.

In any case, I could still hear the negative sonic effects that Koichiro Akimoto believes are produced by skating, an offset headshell, and Löfgren's overhang geometry. But I'd like to hear a controlled experiment in which the only variable is the geometry.

Preliminary Conclusions

I thoroughly enjoyed spending time with ViV Lab's Rigid Float 9 tonearm. Clearly a result of a designer thinking outside the box, it represents some original thinking, and produced a sound that many will appreciate. But I was seriously troubled by the arm's drifting VTF, which no amount of fiddling seemed to fully resolve. Correct, consistent, repeatable VTF across a record's surface, and quick, nearly instantaneous settling time strike me as crucial, and these were things the Rigid Float seemed incapable of providing.

Upsetting apple carts

Defective products aren't often encountereded in *Stereophile* reviews. Products found to be defective are returned for working samples, though the fact that the sample was defective is still noted in the review. That standard operating procedure was tripped up by the ViV Laboratory Rigid Float tonearm's unorthodox design and poorly translated instruction manual.

The manual states something unusual: "Often the recommended tracking force is not the best because of various conditions. We strongly recommend to try to find the best tracking force *frequently*." (My italics.) So I assumed that the difficulties I experienced in finding the right vertical tracking force (VTF) were *normal*.

Also, the instructions don't mention a small, knurled aluminum nut that's used to secure the counterweight. So after removing all of the pieces mentioned in the manual, I closed the box and got to work setting up the arm.

I submitted my review, and a copy was sent to ViV Laboratory and their importer for comment. ViV claimed that the behavior I described in the review was not normal, nor were the words used in the manual meant to imply that it was "frequently" necessary to "try to find the best

PHOTOS: MICHAEL FREMER

tracking force."

Editor John Atkinson decided to postpone the review while we investigated the matter, resulting in the absence from *Stereophile* of "Analog Corner" for the first time in 19 years.

As it turned out, the review sample was *not* defective per se, but behaved as if it were because the amount of magnetic fluid specified by the manual to be injected into its bearing cup—this was the amount I'd injected—was incorrect. Nothing in the manual suggested circumstances under which additional fluid should be added. What's more, the importer said that Rigid Floats had originally been shipped with fluid already injected because, usually, the fluid didn't leak. But because it had leaked in a few instance, Viv Lab decided to ship the fluid separately, in a syringe.

The importer sent me two additional arms, in lengths of 7" and 9", both with fluid already injected. When I opened their boxes, it was clear that neither reservoir had leaked. And once set up, both arms behaved very differently from the first arm.

While the first arm was indeed "rigid" and, as described in my original review, could not be moved fore or aft, the 7" and 9" arms were easily moved along that axis. More important, both quickly and consistently retained a reliable VTF setting. In other words, despite the Rigid Float's unusual design, the two additional arms behaved as claimed.

The designer, Koichiro Akimoto, at first claimed that the "slop" in the "underhang" gauge's spindle hole was deliberate, to accommodate the large spindles of Garrard and other vintage turntables. That seems backward to me. Better to make the hole the correct size and let Garrard owners enlarge it. Apparently, that's how the gauge will be shipped in future.

The manual, too, will be changed to indicate the minimum clearance that must be achieved for proper operation, and how much additional fluid should be injected should be the initial, prescribed amount prove insufficient.

Underhung Sound

The 7" and 9" Rigid Float arms had sonic personalities that seemed to go along with their increased freedom of movement They sounded more open, airy, and extended on top than the first, longer, sample, while the midrange of each was gloriously smooth, and images were rock-solidly three-dimensional. Bass was meaty and full bodied, yet well controlled. Tonally, these arms sounded like Miyajima Labs cartridges, though with less soundstage depth than those cartridges produce.

I recently received a copy of *No Place to Fall* (LP, Monsoon MS 204), an album superbly recorded, live in the studio, by West Coast singer-songwriter Kathleen Grace. Grace has three previous albums to her credit; in this one, she "plants her jazz roots in the soil of classic country music."

If that sounds like Norah Jones, so does the very talented Grace—with a bit of Kathleen Edwards thrown in. If you hear this album, I'm sure you'll find the comparison unavoidable, and no doubt the production team had Jones's superbly recorded output in their ears, and they've done an excellent job of creating a sonic landscape similar to that of Jones's *Come Away With Me*. "No Place to Fall," a Townes Van Zandt tune, has it all—air, space, image dimensionality, sparkling brushwork, etc.—as does one of Grace's own songs, the atmospheric "Fine Young Woman."

I'd played *No Place to Fall* numerous times using the Transfiguration Proteus cartridge mounted on the Continuum Audio Labs Cobra tonearm, preparing for a review of the album for AnalogPlanet.com. When the 7" Rigid Float arrived, I set up the Helikon SL cartridge—and, later, the Transfiguration Proteus—and listened again. Despite its unique, floating "non-bearing" system, the Rigid Float proved to be a fine groove tracker, within the greater amount of tracking-error distortion acknowledged by the designer (never heard as "distortion" per se).

I'd heard *No Place to Fall* through four different cartridges in four different rigs: Zorin Audio TP-S3 turntable, Zorin PUS-12 arm, Lyra Titan *i* cartridge; Music Hall MMF-11.1 turntable-arm with Goldring Elite cartridge; Continuum Caliburn turntable, Kuzma 4Point arm, and Lyra Etna; and Continuum Caliburn, Continuum Cobra arm, and Transfiguration Proteus. With all of those, Grace's voice had a bit of edge, but the air and sense of space were obvious; cymbals, snare, and brushes were naturally sharp and shimmering; and with the guitars, plenty of clean pick on string was audible.

Through the ViV Lab arm, the three-dimensional picture—though not the images themselves—were flattened, obscuring the front-to-back layering of images; the air evacuated the room; and the shimmer and overall transient "crack" and definition, were somewhat blunted. However, Grace's voice became 100% natural and convincing. What I'm fairly certain are recording artifacts were artfully carved away, leaving a relaxed, "cushiony" reproduction of Grace's voice.

Final conclusion

The first review sample's tonal presentation was generally similar to these two newer samples, but was far more closed down, obviously colored, and almost claustrophobic. The two correctly functioning samples produced a far better-balanced sound that I'm sure will appeal to some listeners—particularly those of the "vintage gear persuasion." As I wrote about my experience with the first sample of this tonearm, if you love to the exclusion of most everything else the romantic, vintage, midrangey sound that some people insist is "music," the ViV Laboratory Rigid Float is made for you.

Assuming the tonearm's sound is a result of its geometry and not its "floating" technology, are the other four arms producing additive sonic effects due to skating issues? My take is that the Rigid Float—either because of its underhung geometry, or its non-grounded bearing system, or both—has a singularly smooth, lush sound that some listeners will instantly crave. Those folks should drop a ViV Lab Rigid Float into their system ASAP and find out for themselves. ■

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