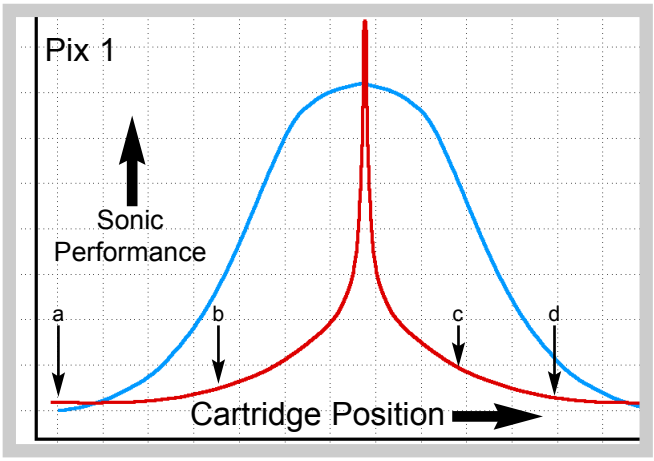
VACUUM STATE

Cartridge Alignment Guide.

This information is a distillation of the huge amount of work done and publish over years and years by many of the heavies in this field, but has the additions of a few key points from myself, my *Guru* (the late Rowan McCombe), and *Dice 45,* a past associate who posted some of this information on the *Vinyl Asylum Forum* several years ago—but without offering any acknowledgments to the other sources... <http://www.audioasylum.com/audio/vinyl/messages/45126.html>

Key Aspects

1/ These adjustments are to a *very* large degree, interactive. So when you change one, the others may go out of what was (before) a near optimum setting. This is the stuff of madness, but with patience, and more patience, a wonderful result can be obtained!



2/ The adjustments are very easy to misinterpret. Tweakers may expect easily heard sonic differences from every cartridge position change they make, assuming a "movement to result" curve as shown by the blue line in Pix 1 with steadily sloping sides and a wide flatish optimum. But the reality is that the actual curve is far more like the peaked red line, and this make the job a tad more tricky…

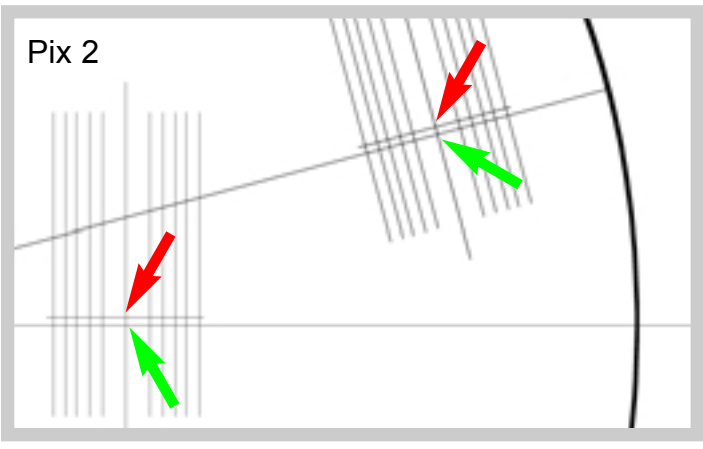
3/ The red curve explains why, when the position is far from correct, even a large adjustment (say from a to b) may make very little sonic difference—and even if heard as a change may not be able to be *clearly* distinguished as an improvement or a worsening.

4/ It also explains why, when the adjustment steps are too large, one may jump from one side of the peak (b) to the other (c), completely miss the very sharp performance optimum in the middle, maybe even never know it's there! As (c) is fractionally better than (b), and (d) is worse, then (c) may be taken as an optimum sonic point—which it clearly is not! And as the positional difference between (b) and (c) may be only 1mm (!!), or a fraction of a gram change in antiskating weight, this real peak is easily skipped over!

The Alignment Protractor

There are many commercial devices on the market such as the *GeoDisk* or *Dennison Alignment Tool*, all which certainly help you get the cartridge into a reasonable *starting* position on the tone arm. But they are not the be all & end all in this game. as I had proven to me around 1980. I had read the seminal set-up articles by *Mitch Cotter* as published in *Audio Critic Magazine* and even had some protractors made up in stainless steel by a toolmaker to his precise dimensions. Then I got a new TT/arm/cartridge combo, and not having the time available to do the full *by ear extremo* set-up myself, entrusted it to *The Guru*. When it came back it was singing as I never had heard before, but when the *Cotter* protractor was placed under the cartridge to compare, they were not in agreement, and in fact the *Guru's* positioning made no logical sense. At the time there was a small group of *Guru* devotees in and around Sydney, Australia who had all learnt TT setup from him, so one weekend, with the *Cotter* protractor in hand, I made a tour and checked out their set-ups—all of which had been aligned *only* by ear, and which all were singing wonderfully! And wonders of wonders, all had the same physical alignment as my new *Guru'd* TT—even though not one of these system had the same cart/arm/TT combination!

This *Guru* position is shown on the *Vacuum State* protractor, as per Pix 2, and the complete protractor drawing can be downloaded as either a TIFF or PDF file from our site at www.vacuumstate.com—for printing on your printer using the material of your choice.



Our recommendation would be to use a material that does not change it's size with temperature or relative humidity, which suggests a plastic OH transparency sheet rather than regular paper or card.

The intersections of the two long radial lines with the central line of the two parallel clusters (Green arrows) are the classic *Cotter* intersection points at 66.0 and 120.9 mm from the center spindle. But 0.05" (1.27mm) *behind* the *Cotter* points are the *Guru* points (Red arrows) and these, which are not on any exact radial line from the center, are the alignment points we suggest for the diamond to rest and the cartridge then be twisted and/or moved back and forward so it aligns with the parallels at *both* red arrowed intersection points.

I cannot offer any logic for this positioning, just strongly suggest you try it. If you don't like the result, then it's no real work to revert to the regular settings, and you now have those markings also!

LOCK THE TURNTABLE'S PLATTER AGAINST POSSIBLE ROTATION FOR THESE NEXT ADJUSTMENTS

a/ Use the *Guru* protractor to set the overhang, arm length and offset angle to PRECISELY fit the protractor dimensions.

b/ Set the tracking weight midway between the cartridge manufacturer's suggested range of tracking weights.

c/ Set the skating compensation to zero, for the moment.

d/ Place a good *flat* record on the platter

e/ Set the VTA to approximate having the cartridge's top surface parallel to the record surface with the arm lowered onto a record, so that the tracking force compresses the cantilever the expected amount.

f/ If there is an azimuth adjustment possible with your tonearm, adjust it so the cartridge is exactly vertical to the record surface, with the cartridge resting on the record surface with the tracking force applied.

NOW YOU CAN UNLOCK THE PLATTER (if it wasn't locked with the diamond resting on the protractor, or a record, any reverse rotation could have bent back the cantilever and *destroyed* your cartridge!) and set the antiskating to the arm makers instructions.

f/ Take a listen to a few discs to get a sense of how it performs now, which is now already better aligned than most TT's out there.

Tweak Adjustments–Stage 1

VTA

There are many thousands of words written about setting VTA and they all pretty much say the same thing: Using a record with good female vocals and clear high frequency sounds such as cymbals, raise and lower the arm with relation to the horizontal position to find the points where the voice and the cymbals becomes obviously peaky/excessive (too high at the arm pivot) and when the bass becomes inflated and imprecise (too low at the arm pivot). Do not expect these to have the arm parallel to the record surface!

You may be able to find a really nice position where the voice and cymbals sound just right, but without some of the other adjustments optimised it may not be possible to get an ideal setting. If not, set it between these two extremes for the moment.

Anti Skating

This is new and vital information, never before seen in print from other sources, and totally creditable to the *Guru* (*Rowan McCombe)*, who taught it to me back in the mid/late 70's. (And I in turn taught it to *Dice 45* circa 2000).

a/ Select a premium stereo recording with a wide even spread of texture across the whole stereo picture. A live well spread out choral recording is perhaps the best for this, particularly if recorded in a large naturally reverberant space, but a.studio recording with a huge background reverberation can also be used if nothing else is available (I have used Al Stewart's 70's *"Year of the Cat"*).

b/ With the antiskating force at *zero*, listen to the dynamics & microdynamics of the stereo picture. Not the tonality or anything else, just the macro/microdynamics, but more specifically, what we call the *Downward Dynamic Range* (DDR), which is *"What microdynamics can you hear in the presence of macrodynamics?"* A live recording of a large choir is a perfect disc for this purpose.

With no antiskating force dialed in, the left channel will show more DDR than the right channel, it will seem more alive than the numb flat sounding right channel, which may almost sound as if it's been switched off.

c/ Now increase the antiskating force step by step by *small* step. Maybe nothing happens for quite a while (you are still down on the "flat" region of the Pix 1 red curve) but sooner or later you will sense the right channel (Pix 3 blue line) slowly coming to life more and more, but the left channel (Pix 3 green line) sounds pretty much OK and unchanged.

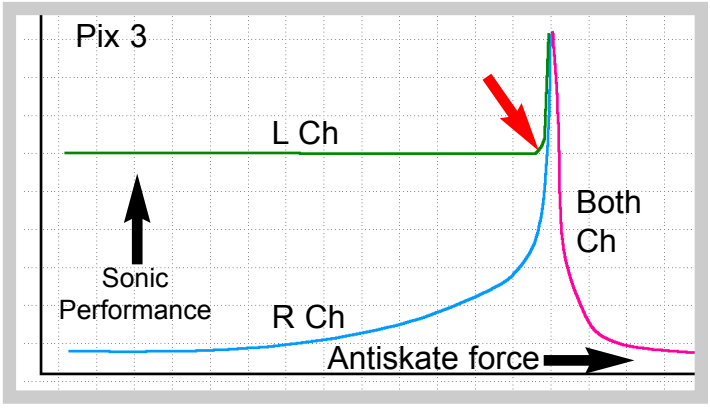
d/ Continue to increase the antiskating compensation by *very* small steps until you reach a point (Pix 3 Red arrow) where the right channel has improved to the point it now matches the left, so they both sound equally dynamic and you have a wonderfully balanced stereo picture. *This point you should mark/document carefully, as you may need to come back to it if you get lost further on.*

e/ Then you further increase in *extremely* small steps and *both* channels will grow more alive together. This shows that the diamond is now almost perfectly "floating" in the groove, with identical pressure & response on each side of the diamond (= each channel).

But one step too far and *both* channels loose their dynamics dramatically and the magic just vanishes. This is because the curve (Pix 3) associated with antiskating is even more extreme than the red curve of Pix 1, and the sonics drop like a stone once past the peak!

Obviously you have gone too far, so sneak it back a fraction and verify BOTH channels are now dynamic and naturally singing beyond what you have heard before..

Don't expect this antiskating setting to be anything like that marked on the arm's scale—it could be less or more— trust your ears!



Tracking force interacts with VTA to some degree. When the tracking force is increased the cantilever will recess further into the cartridge body, which will cause the front of the arm to sit lower to the record surface, which would appear to create a similar effect as if the rear of the arm was raised. Actually the effect is the opposite, as the cantilver is much shorter than the arm and it will have *less* VTA angle with an increase in tracking weight. But varying the tracking force is important because there will be a sweet spot of tracking weight for a given cartridge, and this is found by listening for the best dynamics and micro dynamics and most believable sound colours. This optimum also is very narrow—and of course the antiskating had to be set pretty close to ideal to be able to hear the small but important changes in dynamics from this adjustment..

Azimuth

If there is an azimuth adjustment possible with your tonearm, and you have a test disc & some test equipment available, optimise the azimuth by measuring the crosstalk between left and right channel and adjust it so that the crosstalk from L to R is *EQUAL* to the R to L crosstalk. If you can find the Ortofon Test Record 0002, you can do this by ear by following the instructions given with the disc..

Tweak Adjustments–Stage 2

Cartridge location Stage 2

Using the our protractor (and we are assuming you used it with *extreme* precision and care) gets the cartridge into what we have found to be the best location—*but if and only if*—the cartridge has been manufactured perfectly. If the diamond isn't mounted *exactly* square with respect to the cantilever, and the cantilever not aligned aligned *perfectly* to the cartridge body, your $$ diamond (which most likely has an extreme *line contact* profile) has little chance of perfectly (that word again) sitting in the record groove square and central.

Play a disc that you are certain has the performers remaining located on the same place in the stereo picture for the whole side. If the diamond is square, then the image should not seem to "rotate" as you play the whole record side. But if one of the performers seem to get closer as the side progresses, or if it seems that you are changing your seat at the concert, then you will need to *carefully* and *microscopically* change the angle of the cartridge in the headshell until you get the image stable across the whole album side.

VTA Stage 2

This extremo technique comes from *Dice 45,* and he is fully acknowledged for such a wild but useful contribution....

1/ Select a mono recording with female voice (dynamic!!) and a lot happening around. Relax and concentrate. (he used an old Maria Callas recording when he was demonstrating to me).

2/. Wrong VTA lets her voice go wider and wider as she sings louder. Real wrong VTA lets her voice go cinemascope from left to right speaker.

3/ Adjust VTA so that the voice has the maximum focus (minimum size and maximum shape of virtual sound sources). The louder she sings/screams the smaller her mouth has to appear; this is clearly audible at the right VTA position. This optimum is very narrow: within 2/100 of a millimetre of vertical tonearm position. (That figure is not a misprint!)

Note that this requires a MONO recording—I have no idea what happens if you try to use a stereo disc, but I doubt if it would work..

Antiskate Stage 2

Nothing new here, but with the cartridge position optimised and also the VTA perfected, you maybe able to find the peak with more success and/or accuracy than before.

Tracking Weight Stage 2

Same as antiskating, the previous adjustments may have made your Stage 1 tracking weight adjustment no longer perfect, so just do it again, aiming for a higher and higher sonic result and this may then require a further tweak of the VTA...

These are the steps, the number of times you want to go around the loop is up to you. I suggest you do NOT try to do it all in one afternoon—you may end up frazzled and a nervous wreak—and in thatstate rip the cantilever right out of your prized cartridge...

I tend to do one loop at a time, with maybe a week of just letting the music flow before going through it again.

Sometimes patience is a virtue!

But a key final step is to *very* accurately measure and record all the parameters you possibly can, just so you can come back to this very hard won position if/when circumstances require the arm or cartridge to be changed. And a ruler is no way good enough for this—professional digital readout calipers would be the minimum suggested. And later on you'll be thankful you did note it down, I am...

Good hunting,

Allen

Rowan McCombe aka The Guru

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