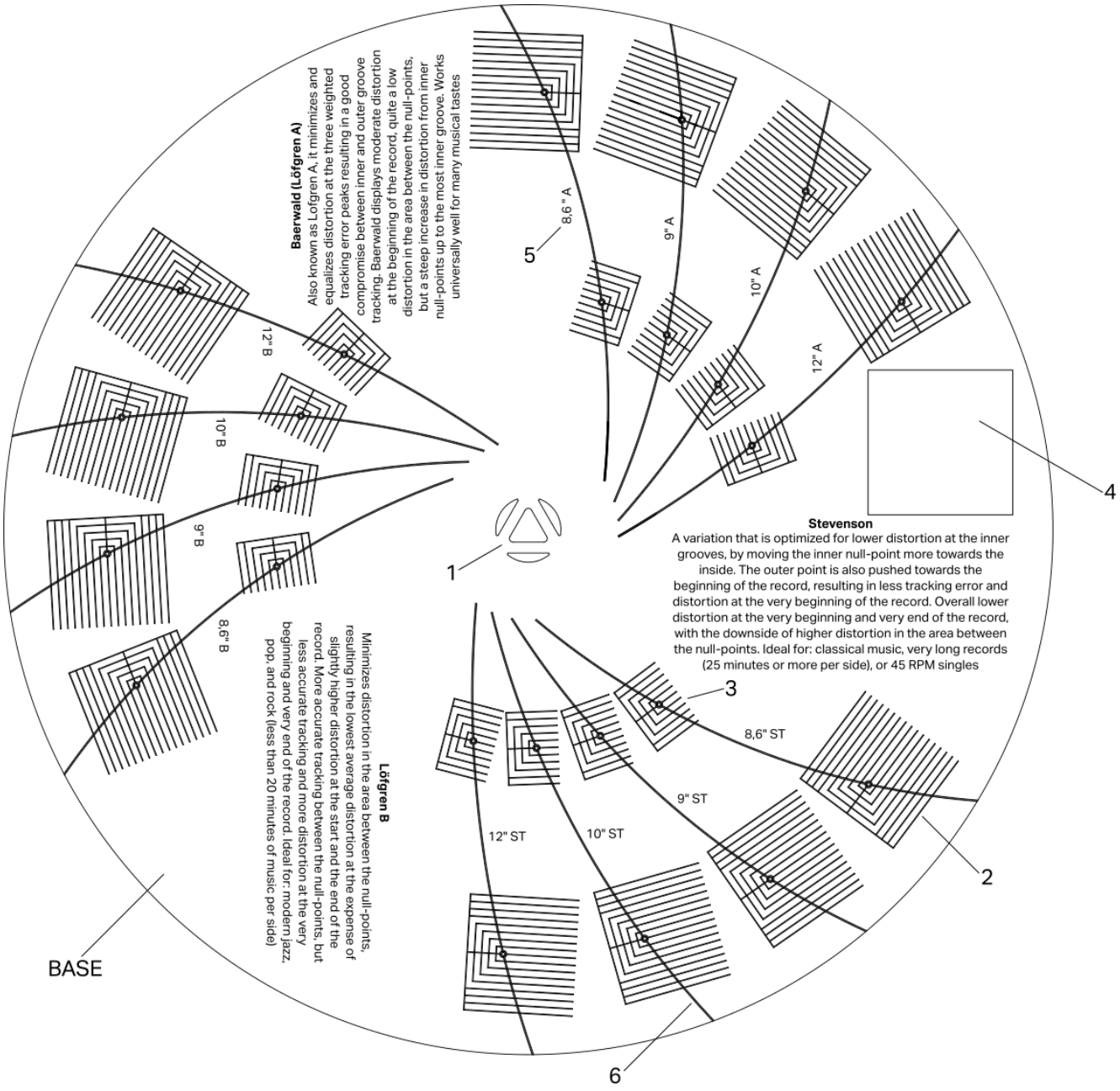
Pro-Ject
AUDIO SYSTEMS

INSTRUCTIONS FOR USE
Cartridge alignment tool
Pro-Ject Align it DS3



1- Spindle hole

2- Cartridge tangency adjustment (outer null point)

3- Cartridge tangency adjustment (inner null point)

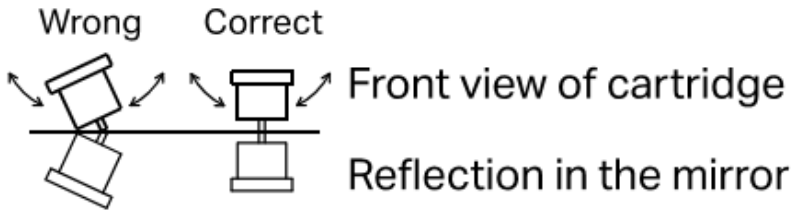
4- Mirror

5- Tonearm length for each alignment curve

6- Alignment curve

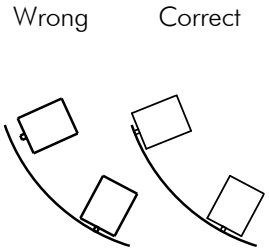
Adjust the horizontal alignment of the cartridge

Lower the cartridge down on the mirror (4) and adjust the azimuth on your tonearm (Consult your turntable manual if necessary). If the bottom body of the cartridge and its reflection are completely parallel to each other, the azimuth, or horizontal alignment, is correct.



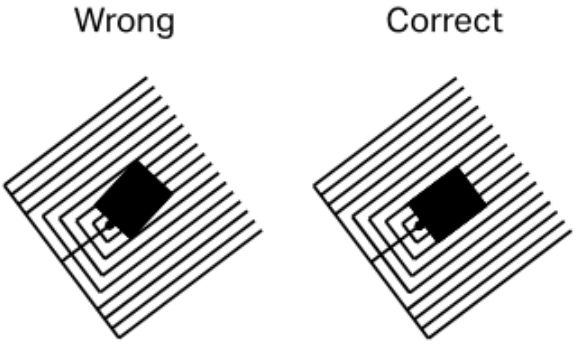
Setting the effective length

Lower the cartridge on the outer alignment point of your chosen geometry/curve and the specific length of your tonearm. For accurate alignment, keep your turntable's platter as still as possible, and do not spin it in either direction. Carefully lift the tonearm again, move it to the second inner point on the curve and lower the tonearm/cartridge down again. The effective arm length is set correctly if the cartridge sits on the second point when lowered and follows the curve. If it does not, adjust the cartridge position on the headshell. To do this, lift the tonearm, loosen the headshell screws a tiny bit, move the cartridge forwards or backward on the headshell and tighten the headshell screws again. Lower the tonearm and check the positioning at both points and the curve. Repeat the procedure until you get it right.



Cartridge tangency adjustment

An aligned cartridge is essential to ensure the most accurate reproduction of the recording, low noise, and the least amount of wear on the record and stylus. The stylus tip should remain as tangential to the record groove as possible as it travels across the record. A pivoted tonearm can achieve perfect tangency at only two points as the tonearm travels in an arc across the record. These two points are known as null points (points where there is no tracking error). With this template, you can set the correct tangency so that the cartridge is aligned to the straight lines on the template at the marked zero points (preferably the outer one).



We recommend rechecking all the previous settings once done.

This template is made for Pro-Ject tonearms or other tonearms which have the following pivot to spindle lengths:

200 mm (used on Pro-Ject 8,6" tonearms)
212 mm (used on Pro-Ject 9" tonearms)
238 mm (used on Pro-Ject 10" tonearms)
291,6 mm (used on Pro-Ject 12" tonearms)

Please consult the manual of your turntable or tonearm, should you use a different brand.

The Align it DS3 comes with 3 different alignment geometries. Each geometry is defined by a different overhang and different null-points. Baerwald has an overhang of 16,21 mm, Lofgren B has an overhang of 16,64 mm and Stevenson has an overhang of 14,44 mm. The effective length of your tonearm is the pivot to spindle length plus the overhang added together. So, each geometry will result in different effective lengths AND different null-points, which optimizes your vinyl playback for different scenarios. Feel free to choose the geometry which suits your listening habits most!

Your Pro-Ject turntable comes factory aligned with an overhang different to any of the methods that the Align it DS3 offers! For example: Debut Carbon EVO and Debut PRO come aligned with 18,5mm overhang. X2 B with 18mm overhang. Check your turntable's manual for the factory adjusted overhang, and don't worry if your factory fresh turntable doesn't align by default with the Align it DS3 and its curves. That is because the factory alignment is done using a different curve!

The effective length of your tonearm is the result of pivot to spindle distance PLUS overhang added together. For example: Pro-Ject turntables with 8,6" tonearms use a pivot to spindle distance of 200mm, add the overhang to that and you are at 216,21 mm effective length (=8.5").

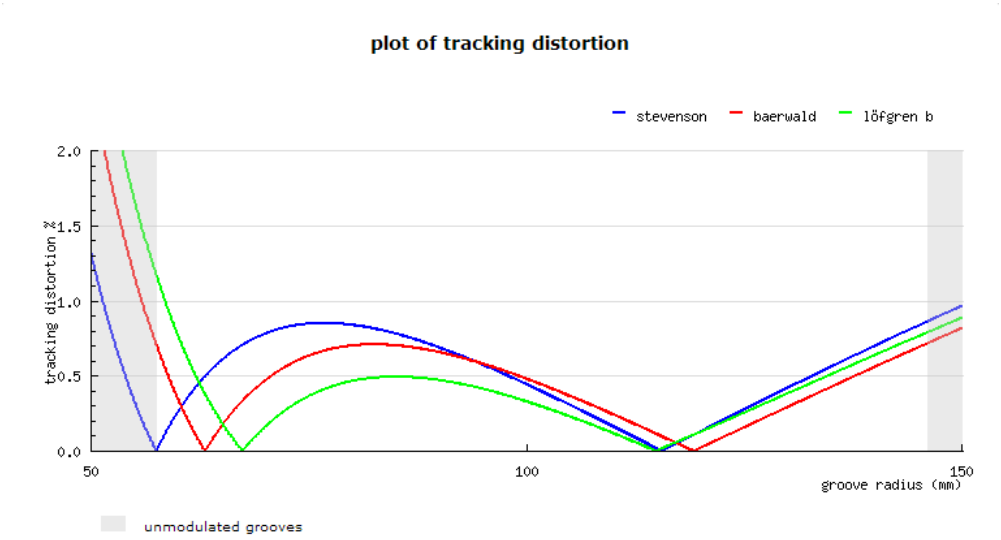
Pro-Ject 8,6" tonearms use an overhang of 18,5 mm and the above-mentioned pivot to spindle distance of 200 mm. This results in an effective length of 218,5 mm (=8,6"). A cartridge alignment protractor for the Pro-Ject standard is included with all our turntables. The Align it DS3 gives you access to 3 new alignment curves!

Technical Deep Talk: Tonearm geometry and null-points

The optimum geometry of tonearms has been the subject of several articles over the past decades. However, the earliest complete mathematical study was that of H.G. Baerwald in his paper on optimum geometry in 1941, where an analytical survey of tracking error distortion showed that optimum geometry of a tonearm of given effective length would have a corresponding offset angle and overhang. This seems obvious today, but H.G. Baerwald was the first to show these facts.

Baerwald? Lofgren? Stevenson? Which one should I use?

This is a choice you have to make. Every curve has its own strengths and weaknesses. We recommend starting with the Baerwald curve.
Here is a graph of the 3 curves, the Align it DS3 offers. You'll understand to interpret this graph correctly by reading the following pages.



Baerwald (Lofgren A)

Also known as Lofgren A, minimizes and equalizes distortion at the three weighted tracking error peaks resulting in a good compromise between inner and outer groove tracking. Baerwald displays moderate distortion at the beginning of the record, quite low distortion in the area between the null-points, but a steep increase in distortion from inner null-points up to the most inner groove. Works universally well for many musical tastes.

Lofgren B

Minimizes distortion in the area between the null-points, resulting in the lowest average distortion at the expense of slightly higher distortion at the start and the end of the record. More accurate tracking between the null-points, but less accurate tracking and more distortion at the very beginning and very end of the record. Ideal for: modern jazz, pop and rock (less than 20 minutes of music per side).

Stevenson

A variation which is optimized for lower distortion at the inner grooves, by moving the inner null-point more towards the inside. The outer point is also pushed towards the beginning of the record, resulting in less tracking error and distortion at the very beginning of the record. Overall lower distortion at the very beginning and very end of the record, with the downside of higher distortion in the area between the null-points. Ideal for: classical music, very long records (25 minutes or more per side), or 45 RPM singles.

Problems with playback in the inner grooves

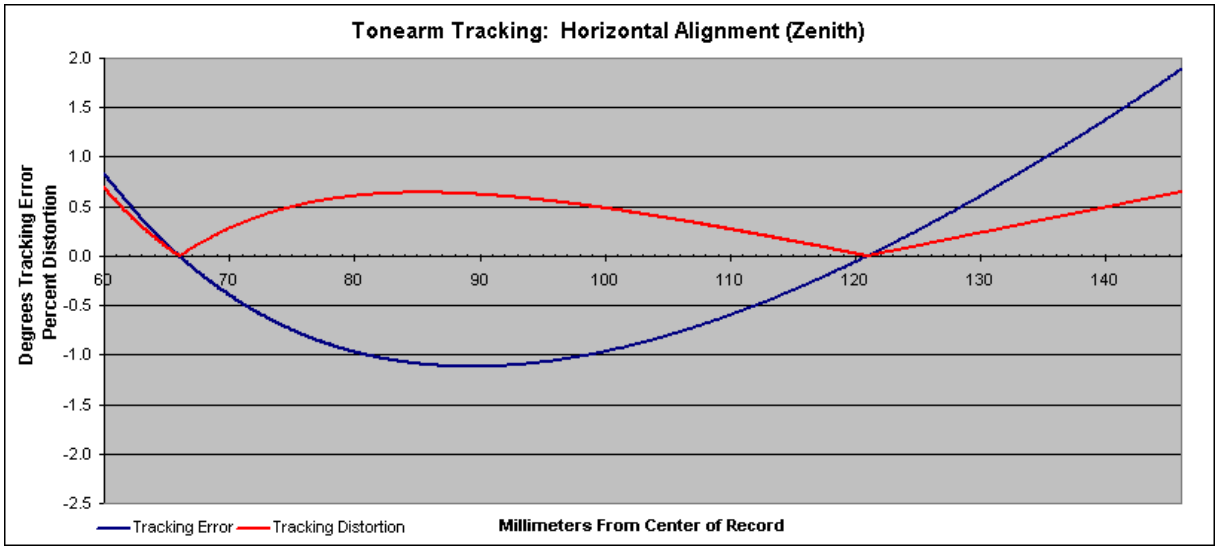
The RIAA standard for 12" (long play records) says that the "Minimum Inside Diameter of Recording" is 4 3/4", which means a diameter of 120,65mm or a better radius of 60,325mm. Stopping groove (closed concentric circle) should be on the diameter of 4 3/16" ± 1/32". This means a diameter of 106,36mm or a radius of 53,18mm. Unfortunately, today most record publishers don't follow RIAA standards for records and cut the grooves very close to the stopping track. Very often nowadays, the end of the recording is found at a radius of 55mm. This allows the record to hold more music, but on the other side, it has very serious consequences.

1. A record player has constant angular speed, but as the radius of the grooves decreases, it also decreases the linear distance the cartridge travels in the groove in a given time. On the outer groove the linear velocity is 509mm/sec. On a groove with a radius of 60,325mm the linear velocity is 210mm/sec; on a radius of 55mm, it drops to only 190mm/sec. So, if the signal of 10kHz has a "length" of 0,05mm on the outer groove, on the inner groove with radius of 60mm, it will be only 0,02mm, and on 55mm, it will be 0,018mm. This is precisely the radius of the classical spherical stylus. But also, an elliptical stylus will have the problem of playing back such signal in case it is not perfectly aligned.

2. Tracking error versus radius of the groove versus distortion:
Bearing in mind that distortion = ABS((50 x tracking error)/groove radius), we can easily calculate that a tracking error of 2 degrees will generate outer groove distortion = ABS((50 x 2)/146) = 0,684%, but the same tracking error of 2 degrees on radius of 55mm will be already = ABS((50 x 2)/55) = 1,81%. So, the same tracking error generates three times higher distortion on the radius of 55mm than on radius of 146mm.

Bearwald (null points 66,0 and 120,9 mm)

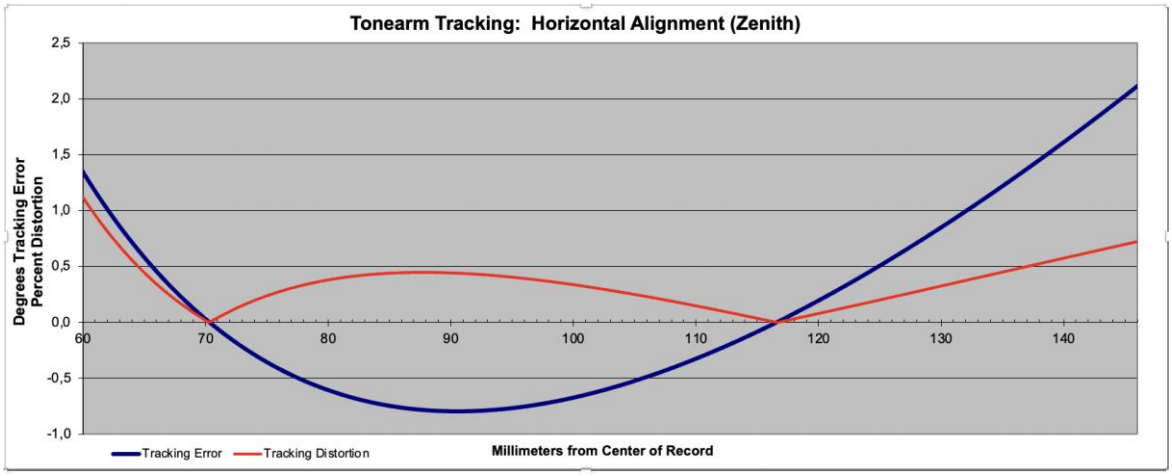
Also known as Lofgren A, minimizes and equalizes distortion at the three weighted tracking error peaks resulting in a good compromise between inner and outer groove tracking. Baerwald displays moderate distortion at the beginning of the record, quite low distortion in the area between the null-points, but a steep increase in distortion from inner null-points up to the most inner groove. An excellent starting point and works universally well for many musical tastes. Widely used in the industry, null-points at 66,0 and 120,9 mm. Here is an example of the typical Baerwald geometry with correct null points. The blue curve shows the tracking error.



From the beginning, the tracking error has a positive value, but between null-points is negative and after the inner null-point positive. That is why our formula mentioned above counts with the absolute value of tracking error. The red curve represents distortion. The Baerwald geometry works universally and equally well for many musical tastes. An excellent allrounder, which is why it is so popular.

Löfgren B (null points 70,3 and 116,6mm)

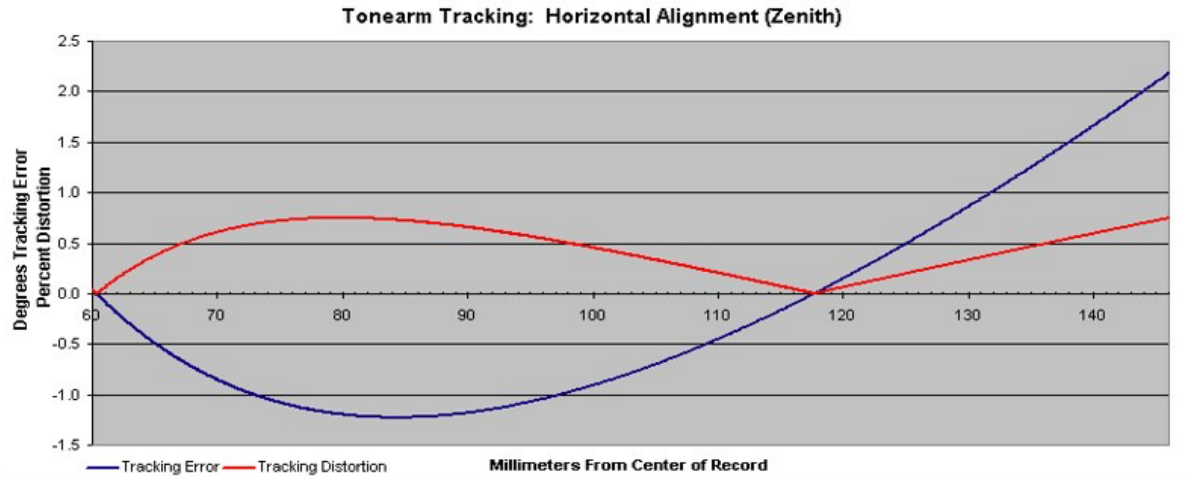
Minimizes distortion in the area between the null-points, resulting in the lowest average distortion at the expense of slightly higher distortion at the start and the end of the record. Compared to Baerwald you'll have more accurate tracking between the null-points, but less accurate tracking and more distortion at the very beginning and very end of the record. We recommend this for modern jazz, pop and rock records where there is less musical content on each side (less than 20 minutes) so only two thirds of the record are covered by grooves, and the most important songs are typically found between the null-points. Null-points at 70,3 and 116,6mm, both are shifted more towards the middle of the record to optimize this area for playback.



Here we can see the same condition as before, but the geometry is Löfgren B. Because the inner null point is shifted more from the centre, we got a more considerable tracking error at the end of the record and, with it, related distortion higher. But the integration of the distortion on the whole record will be lower than in the previous case.

Stevenson (null points 60,3 and 117,4mm)

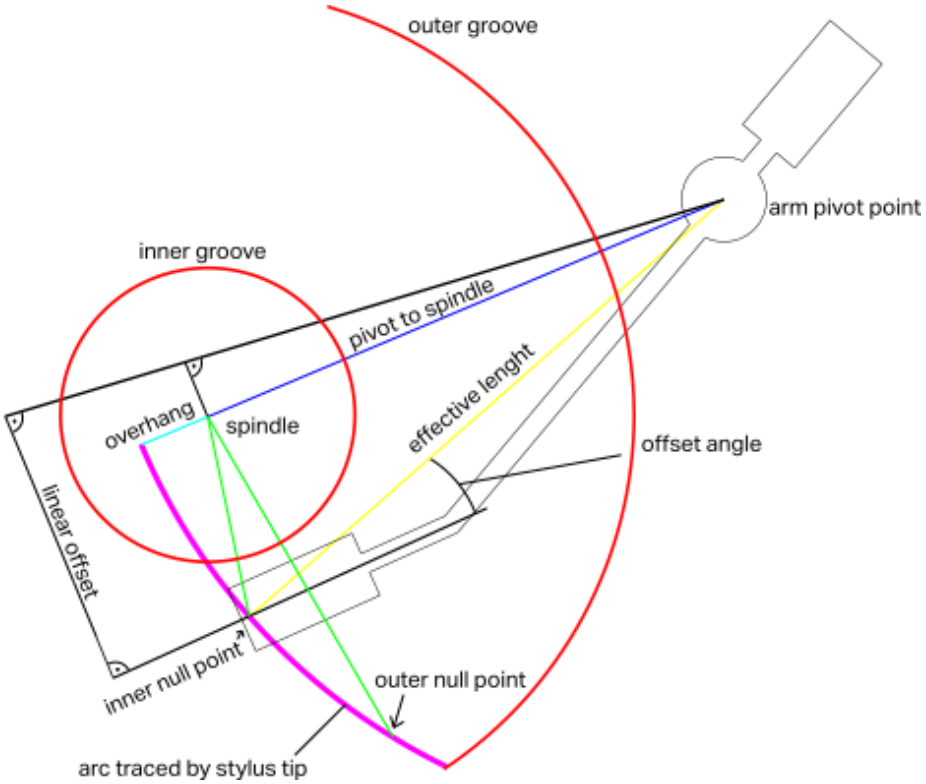
A variation which is optimized for lower distortion at the inner grooves, by moving the inner null-point more towards the inside. In classical music the closing big climaxes occur exactly while the stylus is approaching the end of the grooves (the most inner groove). This results in the biggest challenge for the cartridge, just as the playback conditions are worst. Some records are close to the theoretical maximum of 25 minutes, and if done carelessly even longer and the grooves are covering the record up to the innermost part. This is true for classical music, operas, live concerts, where a piece of music is so long that it is difficult to get it on one side and you want to avoid a cut and putting the rest on the next side. Null-points at 60,3 and 117,4 mm, meaning also the outer point is pushed outside, towards the beginning of the record, resulting in less tracking error and distortion at the very beginning of the record.



Compared to Baerwald or Lofgren B, you will get lower distortion at the very beginning and very end of the record, with the downside of higher distortion in the area between the null-points.

Null-points explanation

During playback, the stylus follows an arc on the record surface. And only at two points is the stylus tangential to the record grooves. The picture from vinylengine.com shows it exactly.
The arc path is purple in color. And on the arc lie two points where the green line (orthogonal to the axle of the cartridge) intersects precisely the center of the record. These points are called null-points. We have zero tracking error in these null points, resulting in zero distortion.



Other consequence of not correctly adjusted cartridge

If your cartridge is not aligned, there is a good chance that the cantilever will never be tangent to the groove and that the angle between the two will take exaggerated values. This can cause a lot of distortion and mechanical tension on the cantilever of your cartridge and the stylus itself and wear down the grooves of your records.

Service

Should you encounter a problem you cannot alleviate or identify despite the above information, don't hesitate to get in touch with your dealer for further advice. Only when the issue cannot be resolved there should the unit be sent to the responsible distributor in your country. Guarantee repairs will only be affected if the unit is returned correctly packaged. For this reason, we recommend keeping the original packaging.

Warranty

The manufacturer accepts no responsibility for damage caused by not adhering to these instructions for use and/or by transportation without the original packaging. Modification or change to any part of the product by unauthorized persons releases the manufacturer from any liability over and above the customer's lawful rights.

The information was correct at the time of going to press. The manufacturer reserves the right to make changes to the technical specification without prior notice as deemed necessary to uphold the ongoing technical development process.