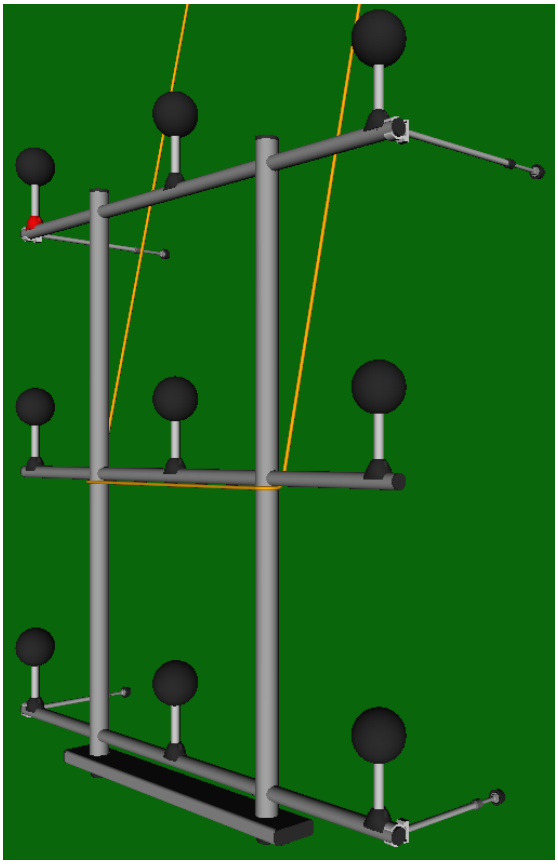
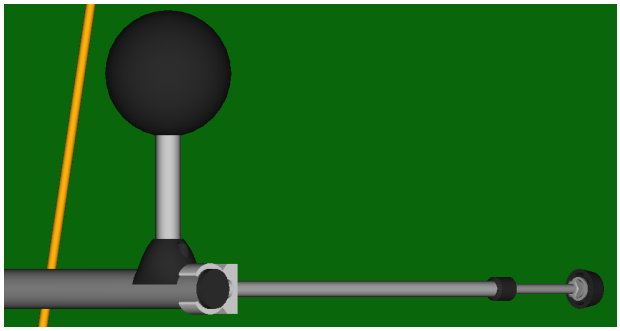
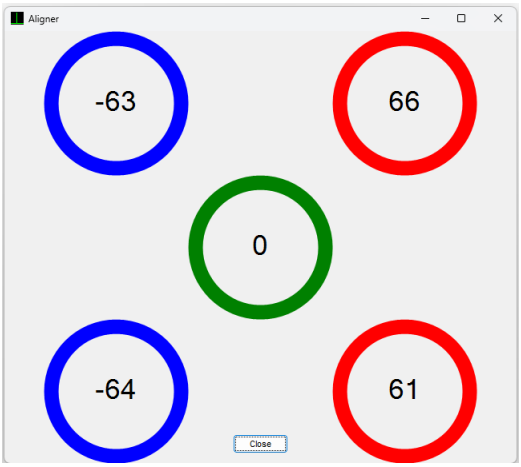
Technical Note

Zircon Alignment

Practical Problems and Solutions







Version 1.4

May 2024

1 Introduction

According to the standards EN 1793 and EN 16272 (-5/-6), the sound source and measurement grid should be aligned, mutually and with the NRD. To this end, the Zircon system is provided with several means to simplify these alignments. These will be described hereafter.

2 Aligning the MA24 with the Noise Reducing Device

2.1 MA24 placed on a tripod

The distance between **MA24** microphone 5 and the reference plane of a noise reducing device (NRD) shall be 0.25 m. Under certain conditions, this can be accomplished by placing the **MA24** on a tripod in front of the NRD, where the tripod is also used for the reference measurements. Suitable conditions are, for example, that the NRD consists of a vertical flat plane on top of flat ground, while the required height is not much more than 2 m (Figure 1).

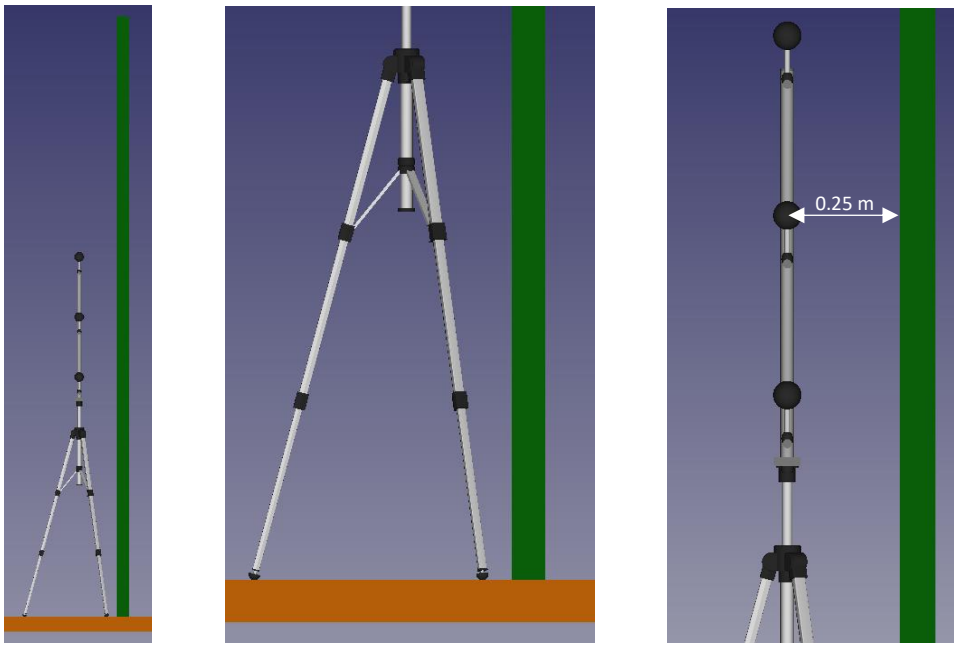


Figure 1. Placing the microphone grid on flat floor in front of a flat vertical NRD

Under these circumstances, adjusting the **MA24**, to obtain the proper microphone-NRD distance for each microphone, may take some time, but is doable.

Unfortunately, conditions are generally not that ideal, as the NRD or the terrain in front may have a slope, or the **MA24** must be placed at a height that for safe operation would require the tripod legs to be spread too wide to fit 0.25 m in front of the NRD. These conditions may also complicate getting the **MA24** properly positioned. In such situations, positioning the microphone grid requires a different solution.

2.2 MA24 hanging on a rope

A method to get the **MA24** microphone array at the correct position, is to provide it with **SP24** spacers and hang it on a centrally attached rope, thereby lightly pulling it to the proper position against the NRD. Figure 2 shows the **MA24**, provided with 4 spacers and hanging on a rope over an inclined NRD. In this case, the upper two spacers are longer than the lower spacers.

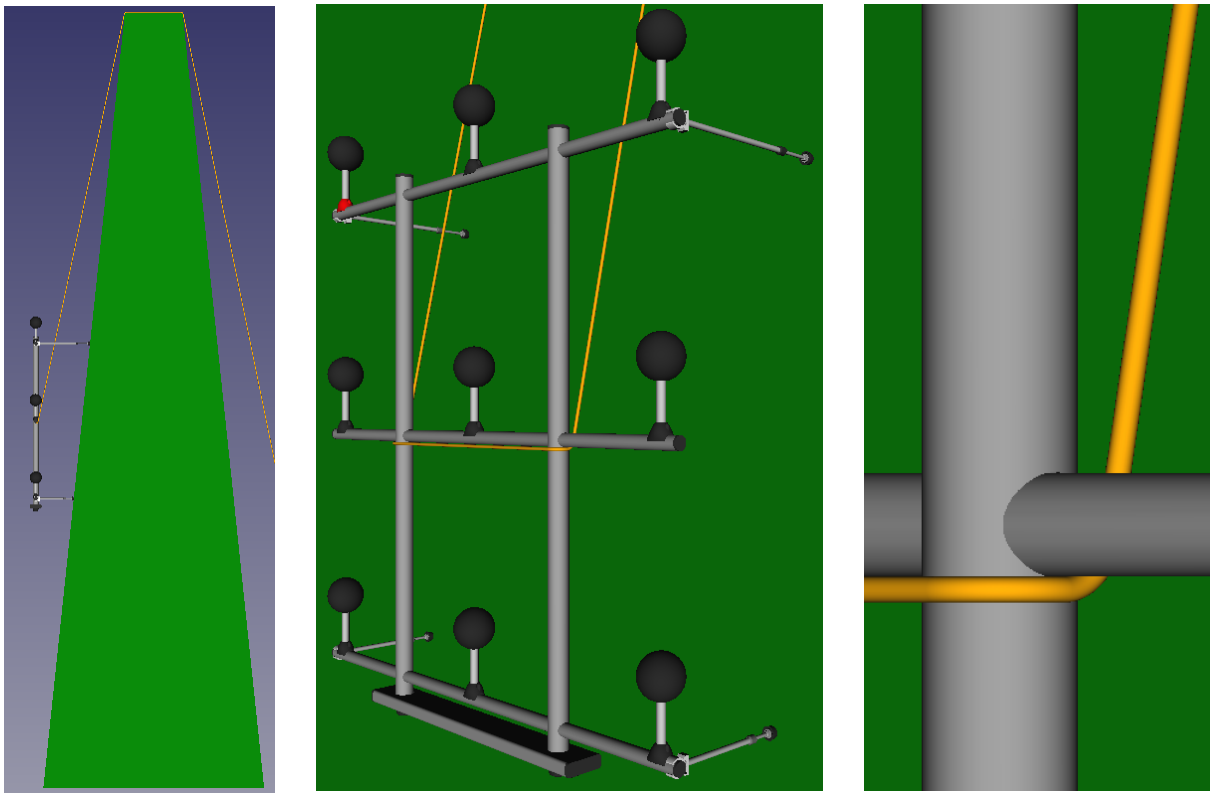


Figure 2. Hanging a microphone grid with spacers, on a rope over a sloping NRD

2.2.1 Procedure

While moving the **MA24** into the proper position, care should be taken that the microphones never touch the NRD. Note that, although the friction will normally keep the spacers in place, they would rotate when touching the NRD during lifting. Therefore, it is recommended to consider the following steps:

1. Put the **MA24** on its tripod.
2. Determine and set the proper length of each spacer.
3. Set the upper spacers a bit upward.
4. Braid the rope through the frame, coil the ends and throw the coil over the NRD. A very high NRD may require a ladder to bring the coil up and drop it down the other side. Depending on the NRD, some sliding provision on top may be needed to prevent rapid wear of the rope.

5. Take the **MA24** off its tripod and keep it away from the NRD, while lifting it to approximately its final height. A very high NRD may require the use of a ladder next to the **MA24**, or two ladders placed on either side of it.
6. Place the **MA24** gently against the NRD, thereby rotating the upper spacers to a more horizontal position.
7. Fine-adjust the **MA24** height and spacer lengths to get the proper microphone distances to the NRD.

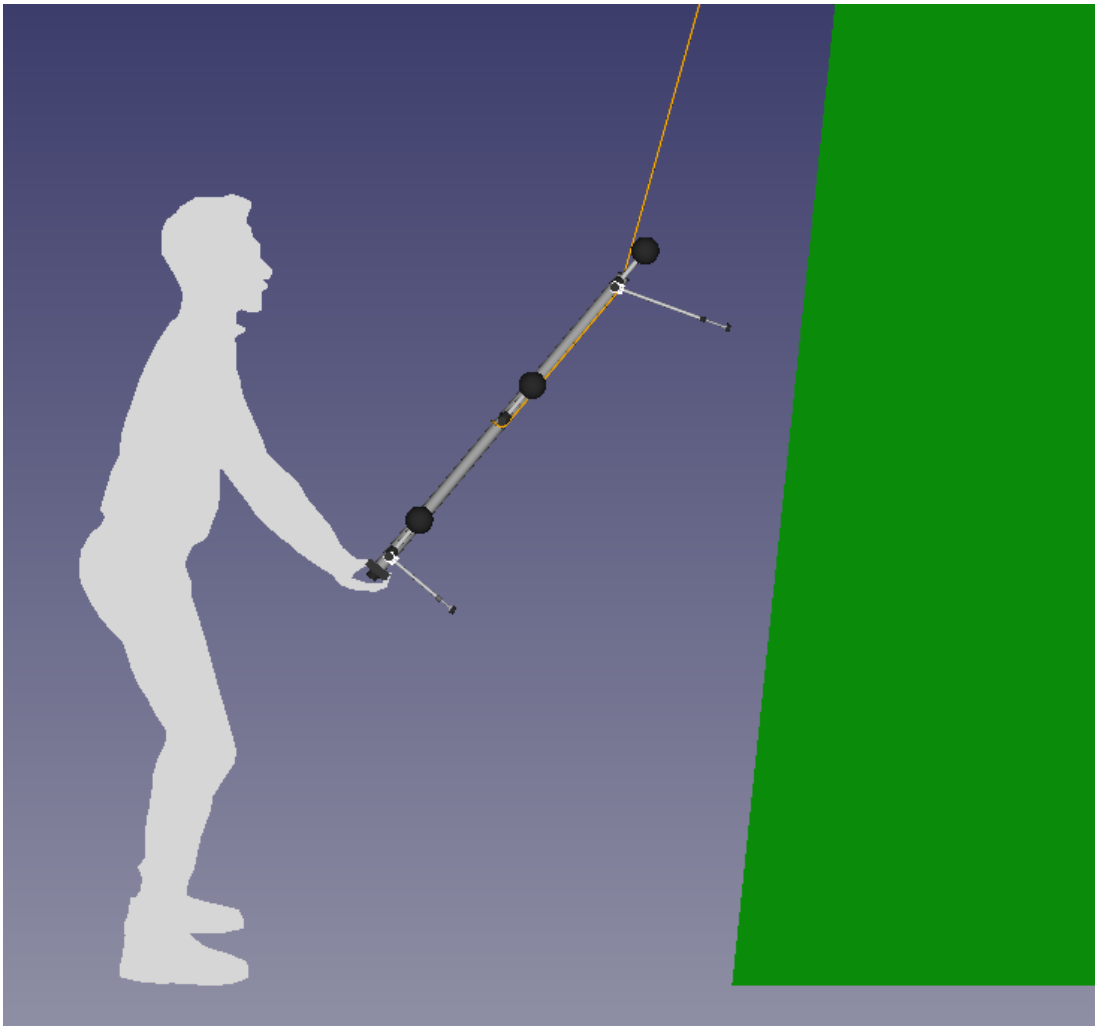


Figure 3. Keeping the microphones away from the NRD during lifting.

2.2.2 Spacers

The **SP24** spacers are attached to the **MA24** upper and lower horizontal tube ends, next to the corner microphones, and adjustable in length. An example is depicted in Figure 4.

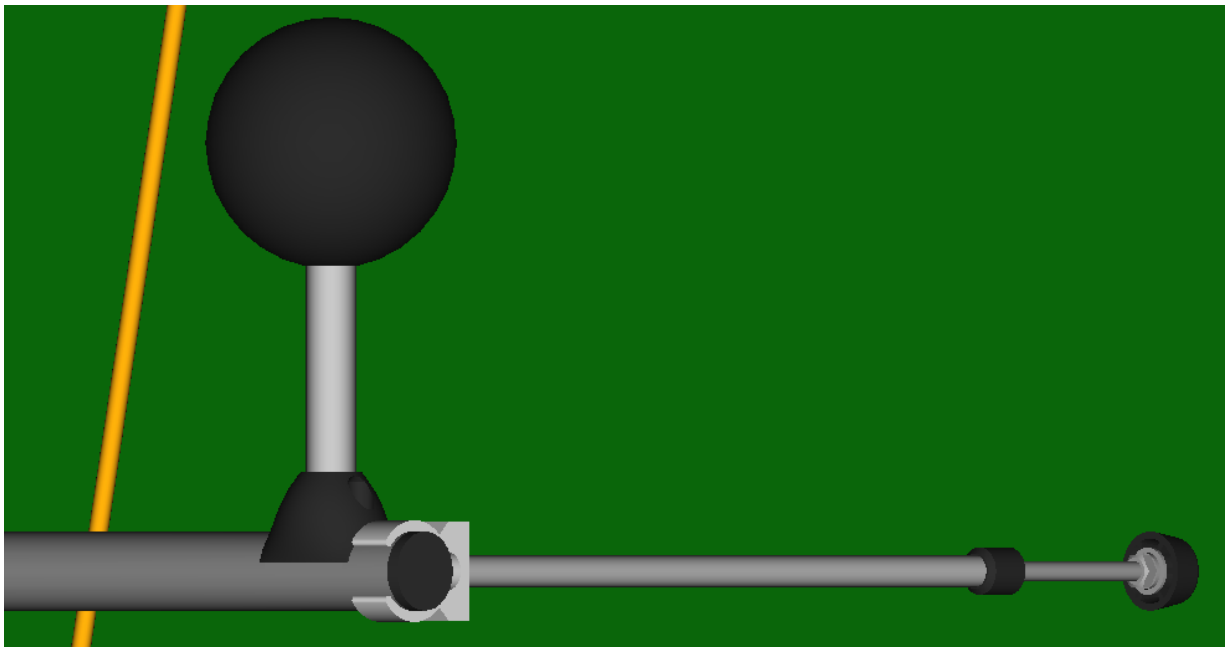


Figure 4. SP24 adjustable spacer.

To protect the lacquer and increase the friction, the tube ends are wrapped with 2 layers of 12.5 mm reinforced adhesive tape. For maintenance, this tape is widely available on 25 mm rolls.

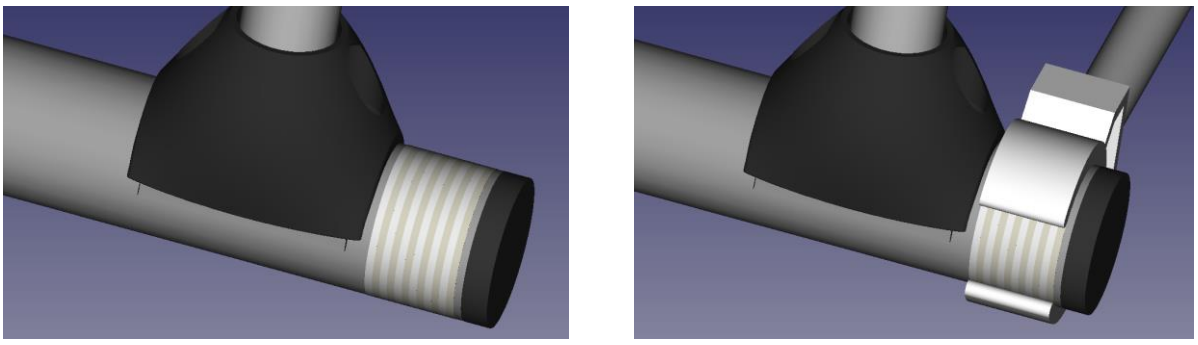


Figure 5. Protecting the lacquer and fixing the position using reinforced adhesive tape.

A standard set of 4 spacers contains 2 short and 2 long types, the length range of both of which includes 0.25 m for use on vertical NRD's. The length ranges per type are shown in Table 1 and enable placement of the **MA24** against NRD's with inclinations of up to 11° from the vertical. For longer or shorter spacers, please contact Acoustics Engineering (AE).

Table 1. Standard spacer length ranges

Spacer	Type number	Minimum length [mm]	Maximum length [mm]
Short	**SP24-S**	174	260
Long	**SP24-L**	240	392

2.2.3 Rope

Type

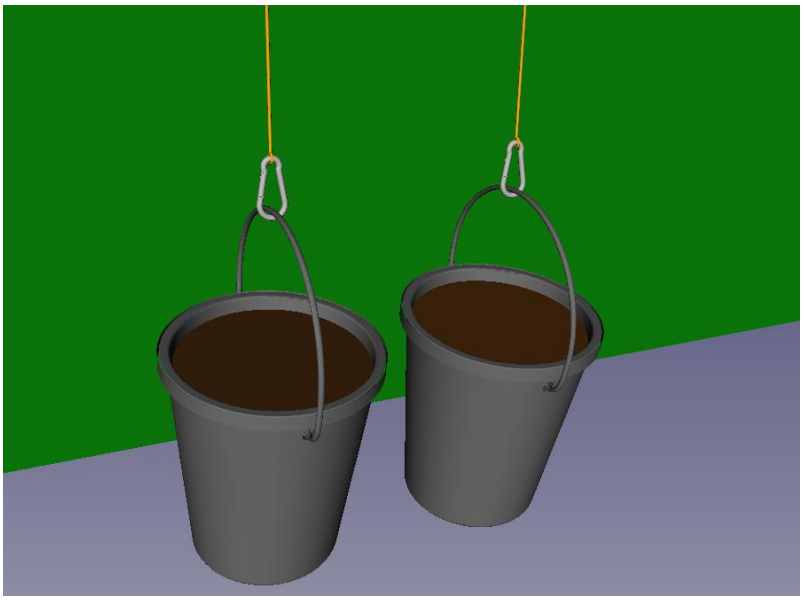
To lift the microphone grid, for example a 5 mm diameter polyester cord can be used (also orderable from AE per 100 m, under type number **RP24**). The average break load of such a rope exceeds the minimum required by a factor of hundreds, but this enables discovery of wear well before breaking, thereby preventing damage to the microphone grid.

Attachment to MA24

The rope can be braided through the frame in one piece or hooked on the frame in two pieces. In the latter case, at the positions where the hooks are attached, a piece of reinforced adhesive tape around the tubes will protect the lacquer. The advantage of a 1-piece rope is that the **MA24** horizontal angle can be adjusted simply by rotating it. The advantage of 2 independent rope pieces is that the **MA24** would not drop should one of them break.

Fixation

On the other side of the NRD, the rope ends could for instance be secured using counterweights, for instance in the form of sand buckets, or tent pegs.



A counterweight can be chosen to be in balance with the **MA24** weight, or to exceed it, which is equivalent to securing the ropes to fixed points on the ground like tent pegs.

In case of balancing, the optimum weight depends on the array height because of the amount of multi-cable pulling on it. This method enables height adjustment simply by moving the **MA24**, but its position is not completely fixed.

In case of applying overweight or tent pegs, the height can be adjusted by shifting the counterweight(s) or using guy line adjusters.

3 Aligning the LS24 with the MA24

The **LS24** loudspeaker source shall be directed perpendicularly to the **MA24**, with the centerline going through microphone 5. Its loudspeaker mounting plane shall have a distance of 1.25 m from **MA24** microphone 5 (with in situ reflection measurements) or 1 m from the NRD reference plane (with in situ insulation measurements).

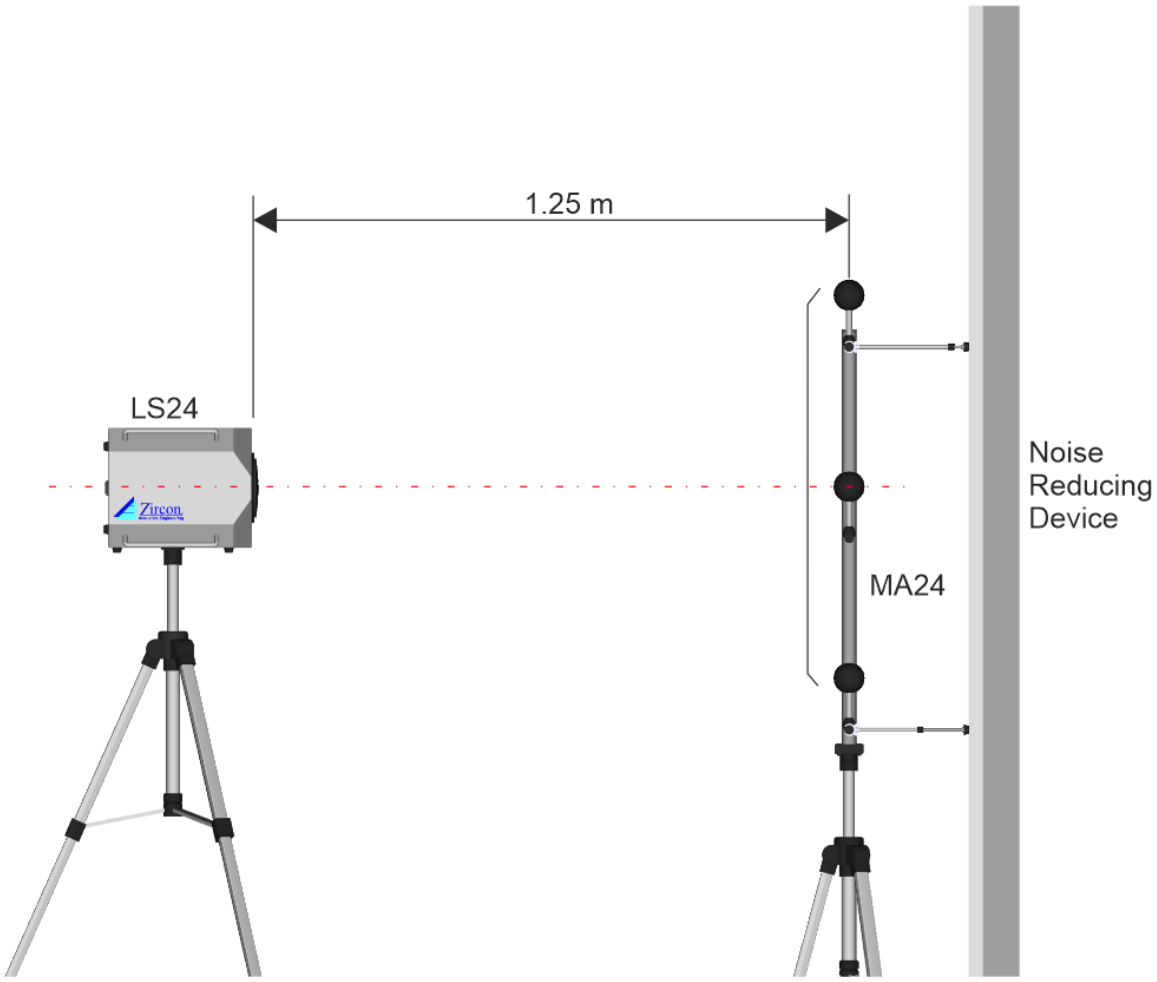


Figure 6. Side view of in situ reflection measurement setup.

If the **MA24** microphones receive sufficient signal to obtain impulse responses, you can use the alignment function in the Measurement window of the **DIRAC** software. For instance with in situ reflection measurements, the procedure is as follows:

1. Place the **LS24** visually perpendicular to the **MA24** such that the loudspeaker grille center has a distance of roughly 1.25 m to the center **MA24** microphone (#5) capsule. In this example, the LS24 is aligned with microphone 5, but not yet positioned perpendicularly with the MA24

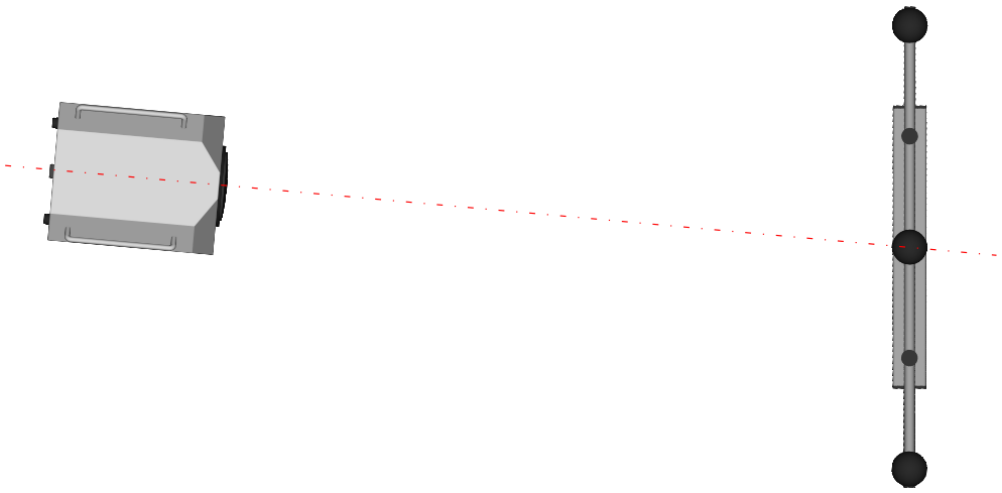
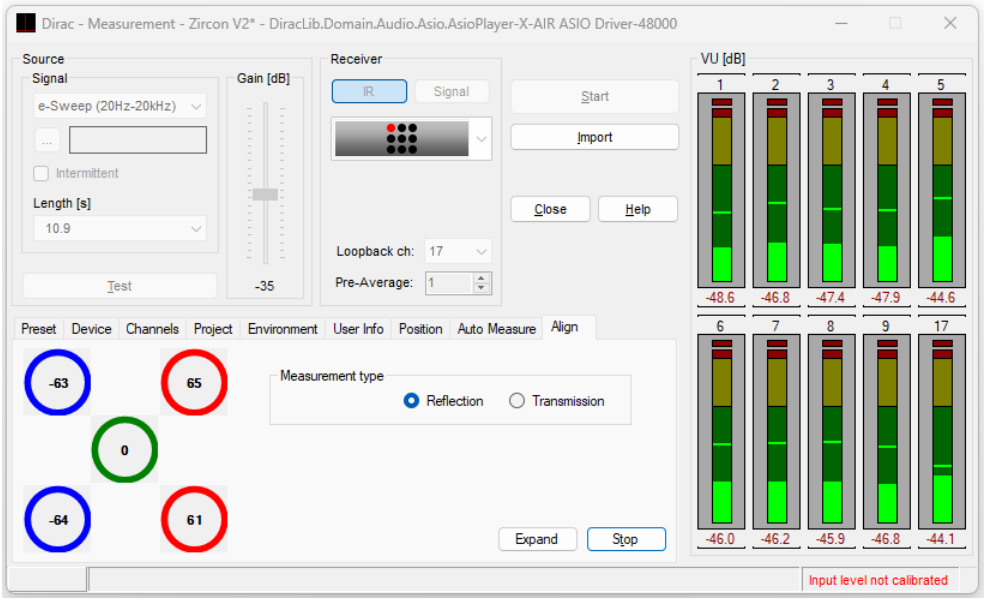
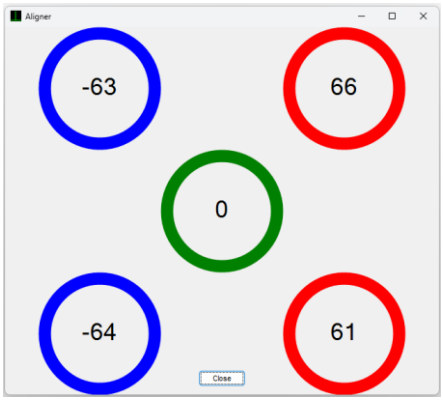


*Figure 7. Top view example of **LS24** in front of **MA24**: too close to left mics, too far from right mics.*

2. In the Receiver area of the Measurement window, select  (Array) from the Microphone Configuration drop down menu.
3. If preferred (less annoyance), temporarily set the Gain to a lower level, e.g. -30 dB.
4. On the Align tab, select Measurement type **Reflection**, and click the Run button.
5. A repetitive short sweep is heard, and the distance errors in mm between the **LS24** and the **MA24** center and corner microphones are shown in color-coded circles.



6. To maximize the circles for a better view, click the Expand button, and then maximize the Aligner window.



RED = too far away (error positive)

GREEN = OK (within ±25 mm)

BLUE = too close (error negative).

1. Adjust the **LS24** position and angle such that all 5 circles are green.
2. Click the Stop button.

Now the whole Zircon system is aligned and ready for measuring.

Acoustics Engineering develops systems for the prediction and measurement of acoustical parameters, resulting in user-friendly tools that enable you to perform fast and accurate acoustical measurements and calculations.

For information on our products, please contact

Acoustics Engineering	Email:	info@acoustics-engineering.com
	Phone:	+31 485 520996
	Mail:	Acoustics Engineering Groenling 43-45 5831 MZ Boxmeer The Netherlands
	Website:	www.acoustics-engineering.com

Hottinger Brüel & Kjær A/S is the sole worldwide distributor of DIRAC. For information on DIRAC, please contact your local B&K representative or the HBK headquarters in Denmark:

Hottinger Brüel & Kjær A/S	Email:	info@hbkworld.com
	Phone:	+45 77 412000
	Mail:	Hottinger Brüel & Kjær A/S Teknikerbyen 28 - 40 2830 Virum Denmark
	Website:	www.bksv.com