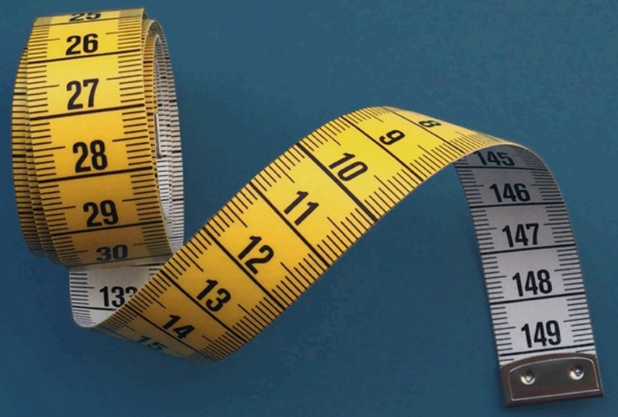
VOLUMENTAL

FOOT

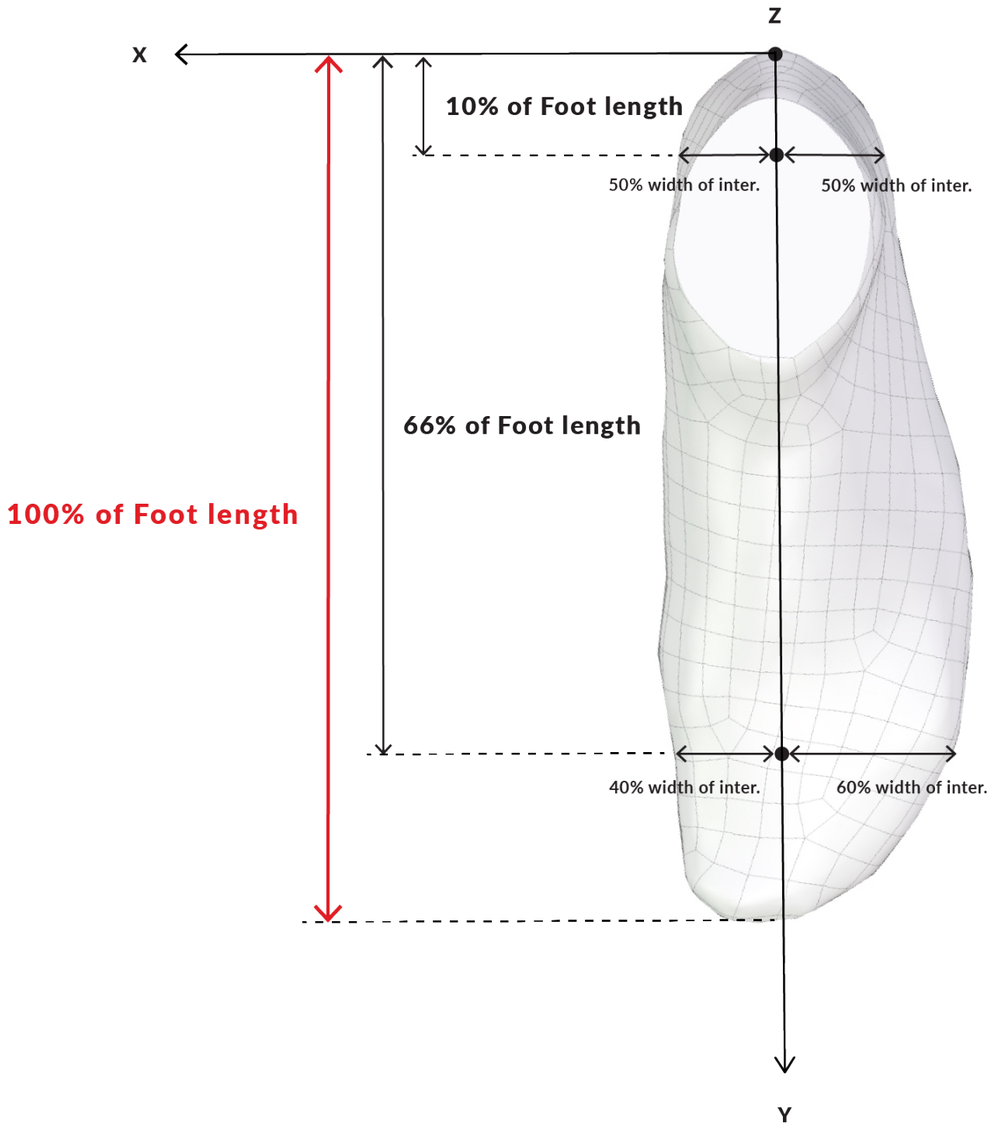
MEASUREMENTS

Definitions of measurements used for VANDRA foot scanning.



FOOT LENGTH

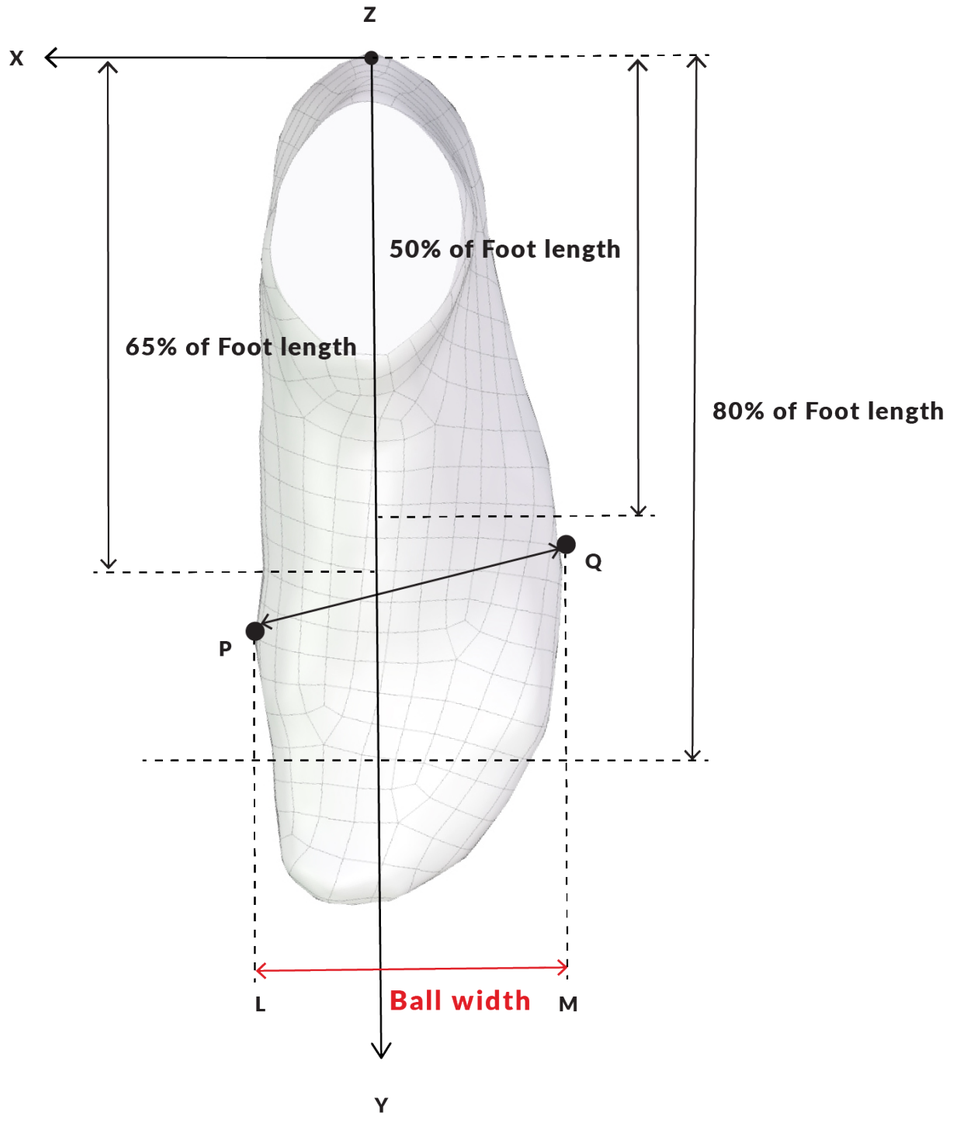
It is important to use a consistent foot orientation to get repeatable foot measurements. We orient the foot as seen in this figure. The origin of the coordinate system is at the heel, the z-axis points up and the y-axis points forward. We measure the length of the foot along the y-axis.



BALL WIDTH

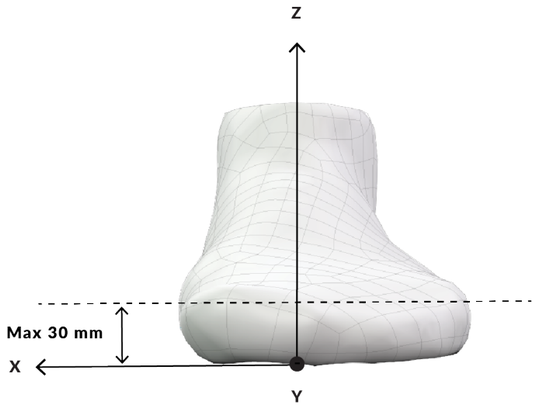
To measure ball width we first find the points P and Q. The point P is the utmost point of the medial part of the foot, in the region between 65% and 80% of the foot length. The point Q is the utmost point of the lateral part of foot, in the region between 50% and 80% of the foot length.

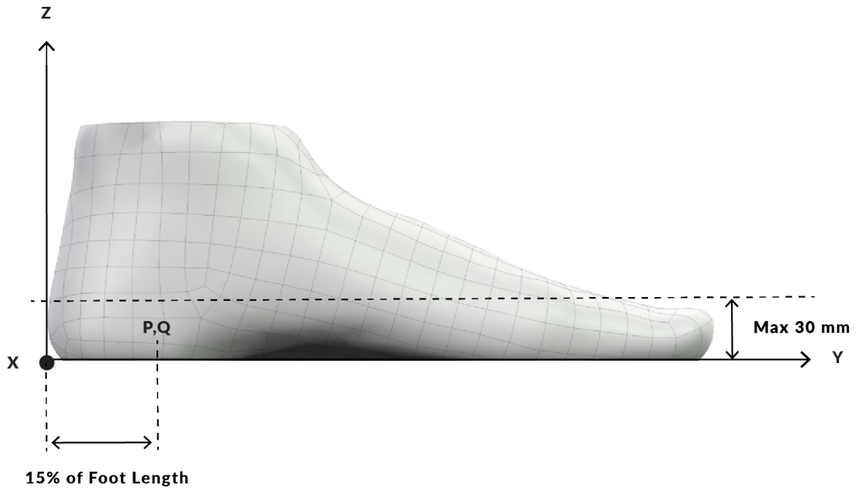
We do not directly measure the distance between the actual points P and Q, since then a small variation in angle could cause a large difference in distance. To get a more robust measurement we instead align a line L with P and another line M with Q. The ball width is measured as the distance between the lines L and M.

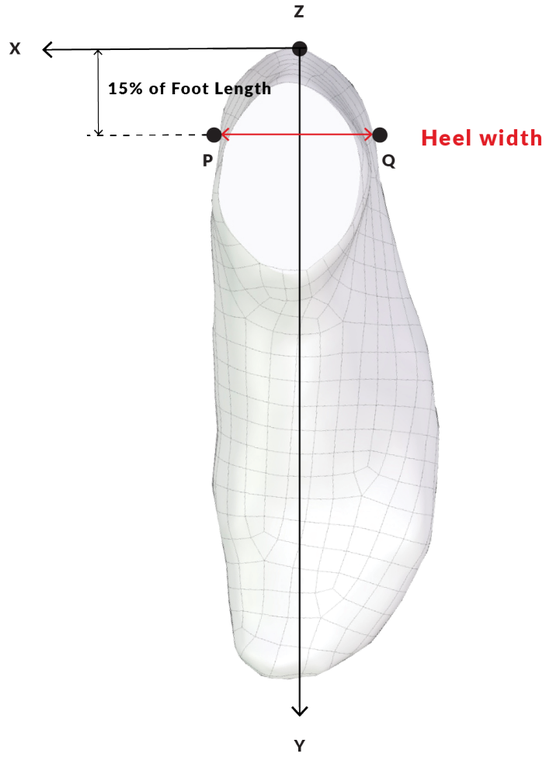


HEEL WIDTH

The heel width is determined as the distance in x-direction between the two utmost points P and Q. Both points are defined at y = 15% of foot length and up to 30 mm high in z-direction. By limiting the distance in z-direction, we exclude ankles and calf from measurement.

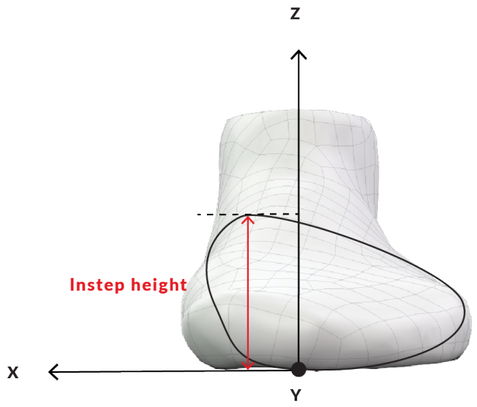


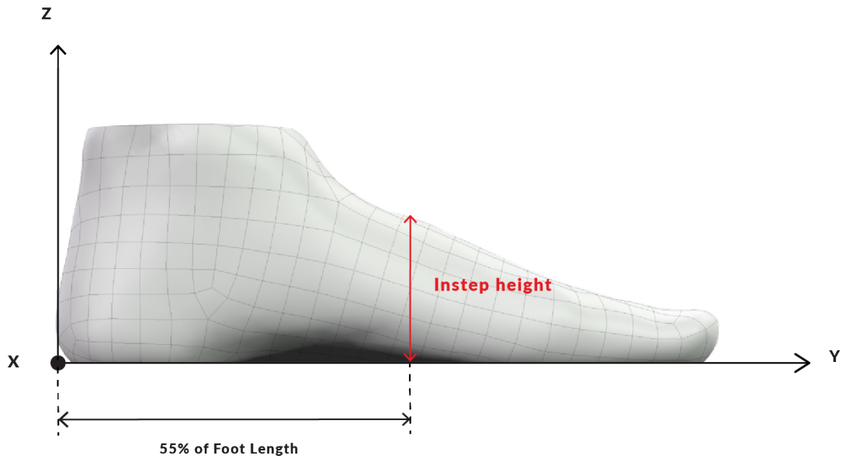


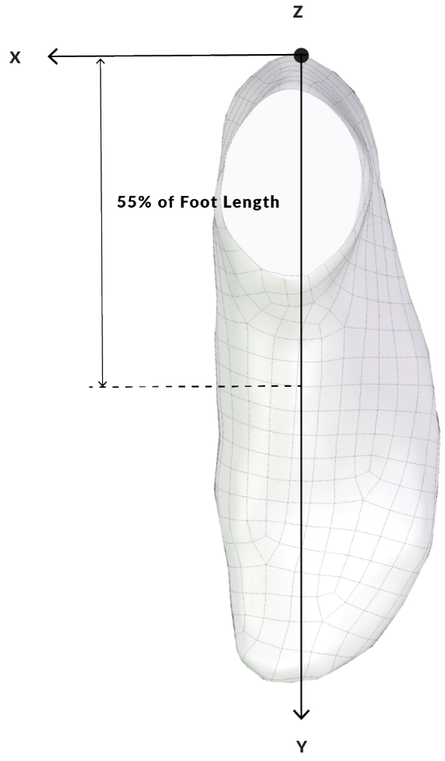


INSTEP HEIGHT

We measure the instep height at 55% of the foot length.

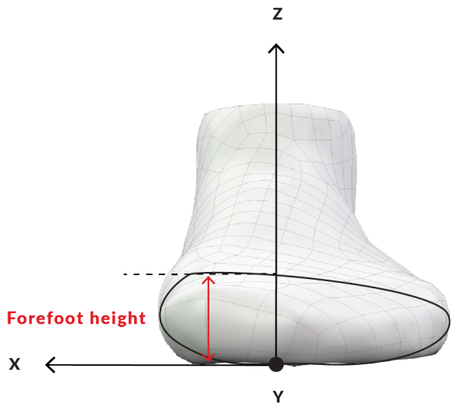


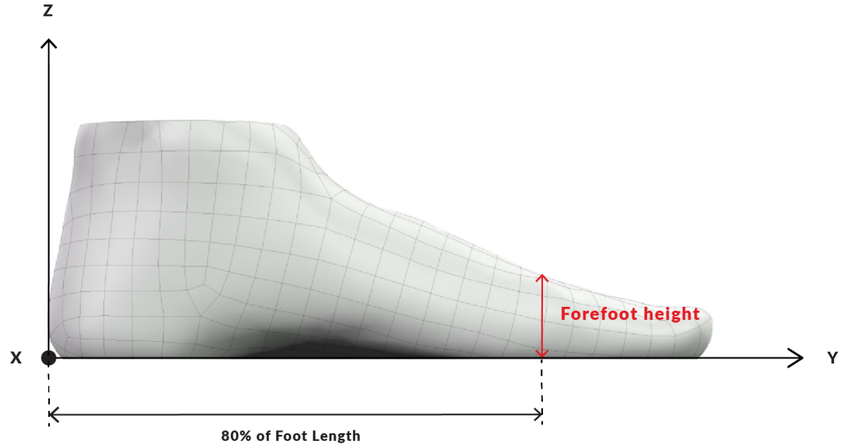


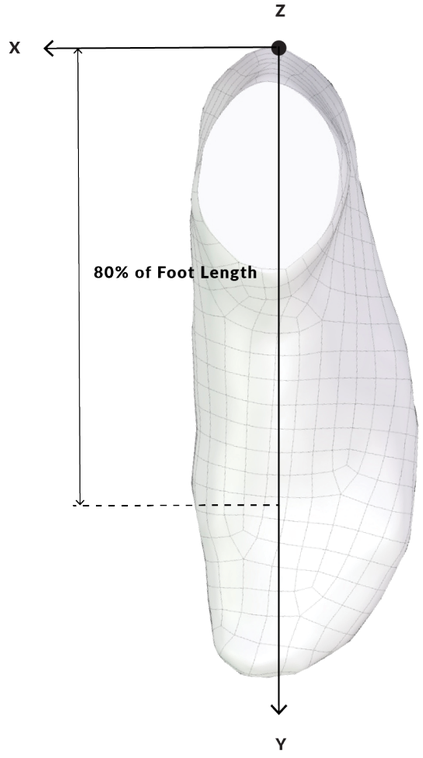


FOREFOOT HEIGHT

We measure forefoot height at 80% of the foot length.

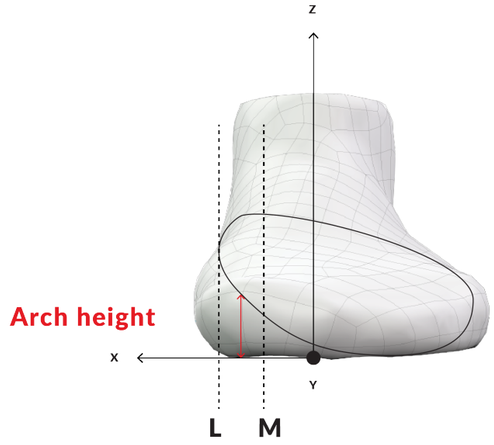


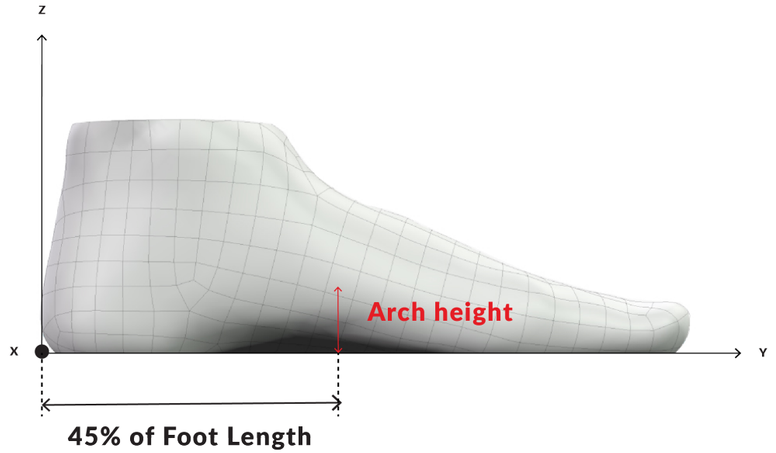


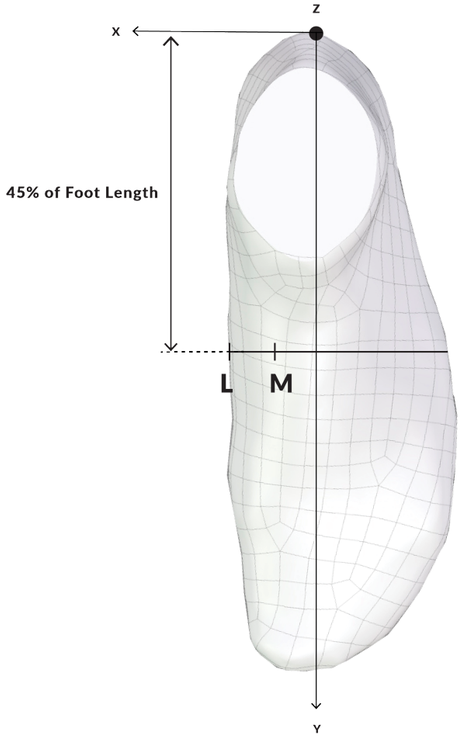


ARCH HEIGHT

To measure arch height we look at a cross section of the foot at y = 45% of foot length. This cross section of the foot is seen in the top left figure. We then align a line L with the innermost point of the foot in this cross section. We then put another line M half way between L and Z. The arch height is measured as the average vertical distance between the ground and the foot, in the arch region between L and M.

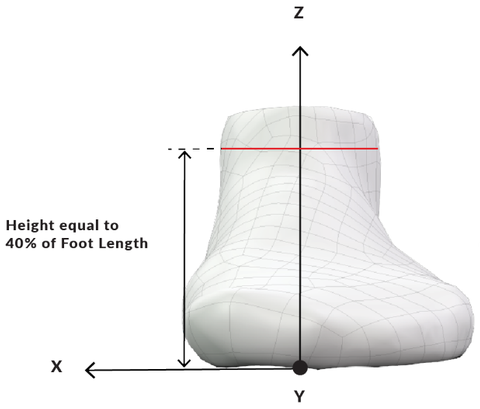


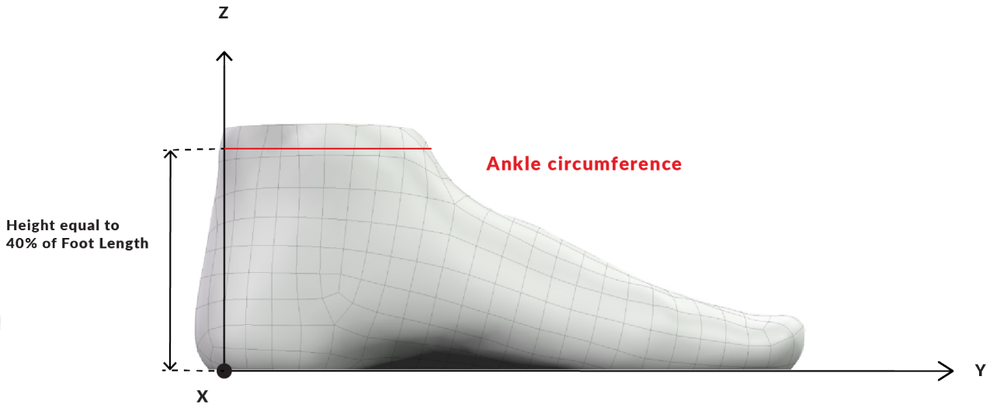


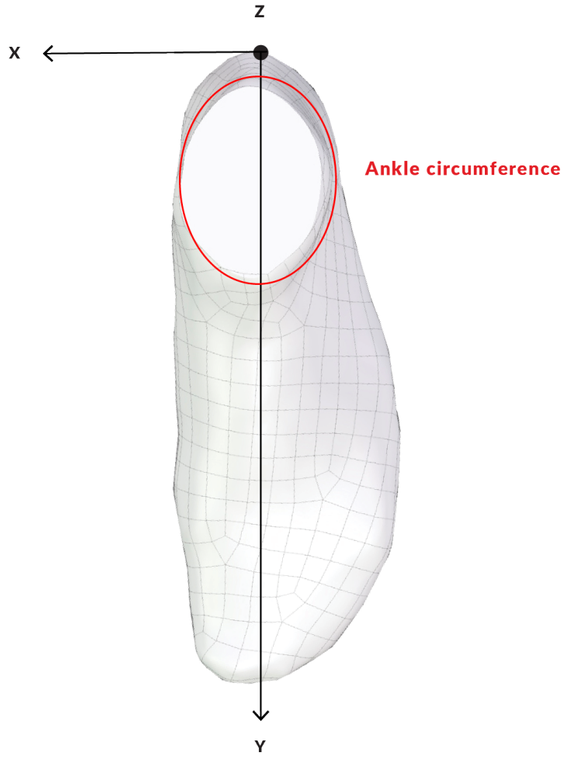


ANKLE CIRCUMFERENCE

We measure ankle circumference at the height equal to 40% of the foot length.

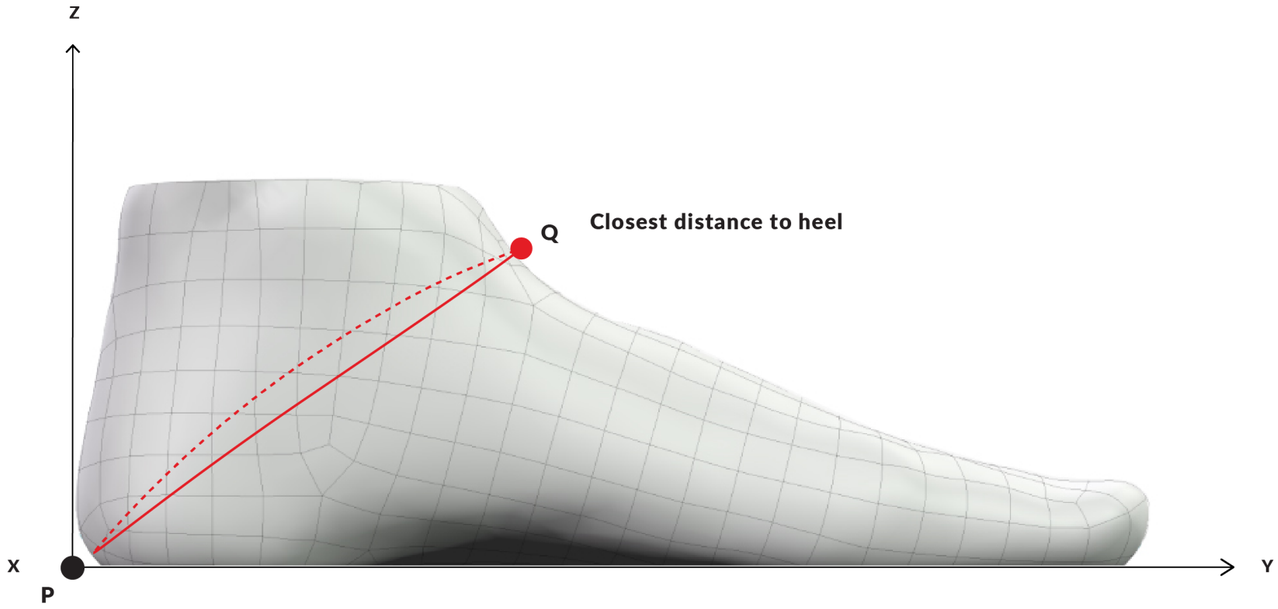






SHORT HEEL GIRTH

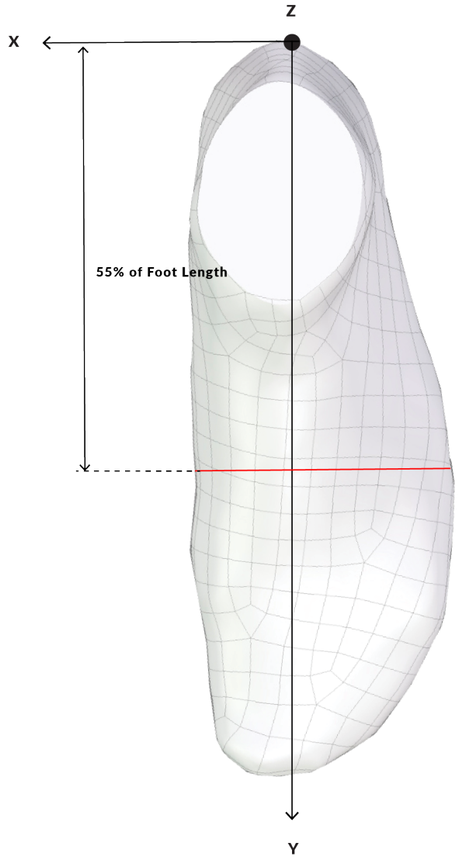
Short heel girth is measured around the heel and the point on the upper side of the foot, that gives the smallest possible circumference.

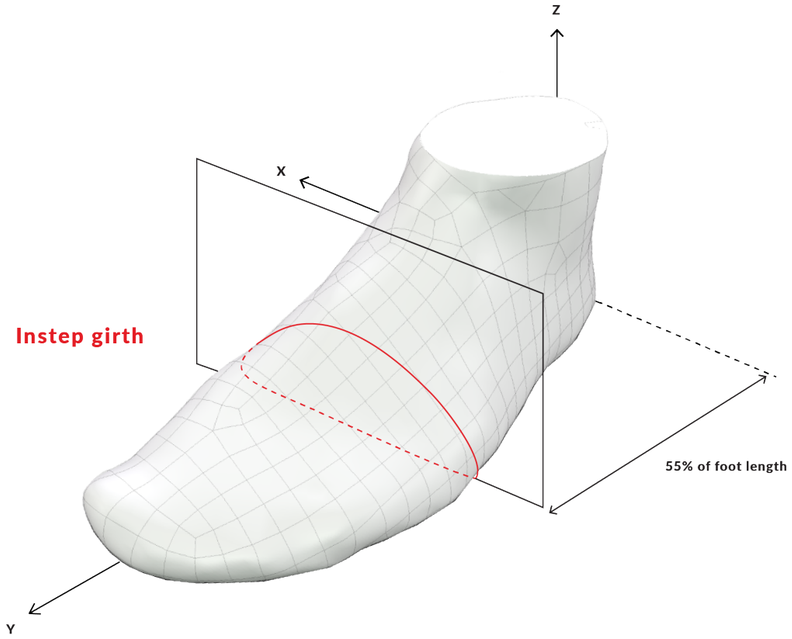


Short heel girth

INSTEP GIRTH

Instep girth is measured in the cross section that you get if you intersect the foot with a plane at y = 55% of the foot length. The instep girth is the circumference of the foot in this cross section.





BALL GIRTH

The ball girth is also known as the metatarsal girth. It is measured in the cross section that you get if you intersect the foot with a plane. The plane passes through the point x = 0, y = 69% of foot length, z = 0 and is rotated around the z-axis by 16 degrees. The result is the girth passing over first and fifth metatarsal heads, i.e. the 2 extreme bones, as seen in this figure. The ball girth is the circumference of the foot in this cross section.

This way of positioning a plane was determined empirically based on a large number of tests. In our experience this is more reliable than other methods for finding the metatarsal intersection position, including manual positioning.