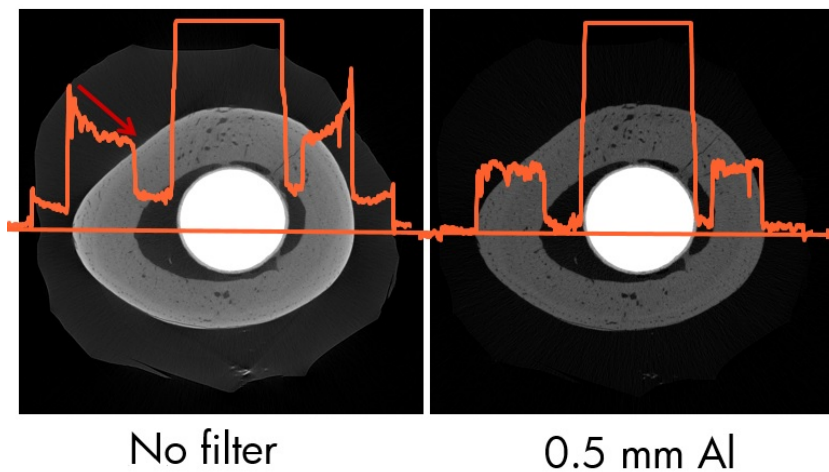


Using the right beam hardening correction

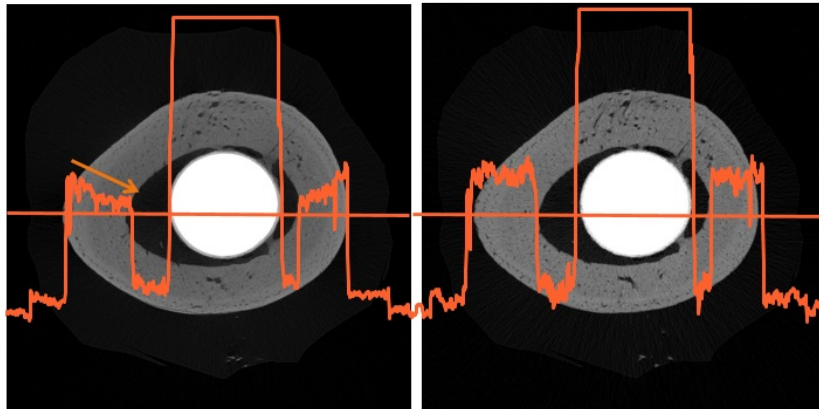
An X-ray beam contains a spectrum of different energies where the peak voltage selected in the control file setting only represents the highest energy of the spectrum. When the X-ray beam traverses a medium of a certain density and thickness, each energy gets absorbed differently which modifies the shape of the spectrum. This leads to something known as beam hardening artifacts in the image.

Beam hardening effects can be reduced by a combination of using an appropriate filter and applying beam hardening correction during the image reconstruction. The most commonly used filter is the 0.5 mm Al filter which works very well for most cases our users are confronted with. The images below show an implant (the white circle in the middle) surrounded by bone scanned with and without a filter.



In the image to the left no filter is used and you can see a gradient in the gray level values as you move from the edge of the bone. The gradient can be clearly seen in the graph that is plotting the gray level values across the orange line. When a 0.5 mm Al filter is applied this gradient disappears.

The two images above are both reconstructed using the appropriate beam hardening correction file for the reconstruction. The correction file estimates the gradient that would occur when going through a material of a certain density and compensates for it. In this case the material used for the estimation is 1200 mgHA/ccm which corresponds to the highest possible density of bone. Below you will see the difference between selecting a correction file for 1200 mgHA/ccm and PMMA. In the image to the left where PMMA has been used the gray level gradient is still present whereas it has been entirely compensated in the image to the right where 1200 mgHA/ccm has been used.



PMMA

1200 mg HA