Nanotom®
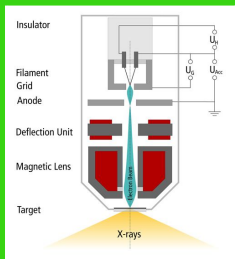
Definition:
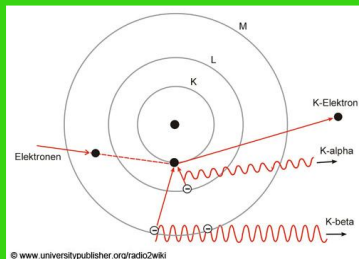
The nanotom® is a nanofocus computed-tomography (nano c-t) system tailored to non-destructive inspections of samples. It is based on the interaction of the scanning probe and x-rays, adressing its adsorbtion/ or attenuation characteristics of the probe. While the sample rotates, several c-t images are made. Later those single images are processed to a 3D data set allowing many different ways of analyses.
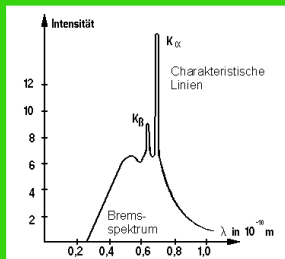
X-Ray source:

Insulator

Filament
Grid
Anode

Deflection Unit

Magnetic Lens

Target

X-rays

Scheme of the x-ray tube

M

L

K

K-Elektron

Elektronen

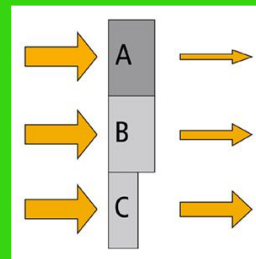K-alpha

K-beta

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Source of the x-ray at the target

With a maximal output of 15 W electrons are released at the filament due to the generated heat. Within the x-ray tube the electrons are intensified to form an electron beam which is focused to the target. Velocity and direction are determined by the magnetic field which is adjustable up to 180 kV. The electron beam hits the target and therefore creates x-rays as electrons of the outer atomic shell are released from the target. The spectra of x-rays depends on the used target material.
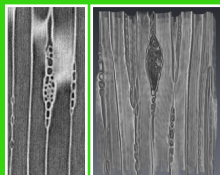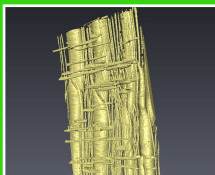
The x-rays are recorded at the detector. An object that is located between the target and the detector changes the x-rays intensities due to adsorbtion or attenuation. The intensity of the attenuation depends on the material and its density. The higher the atomic number or density, the higher the attenuation of the x-rays.

The nanotom® is well suited to scan samples with the hight of 15 cm and a diameter of 12cm. The voxel resolution depends on the object size and reaches maximum 500 nm.
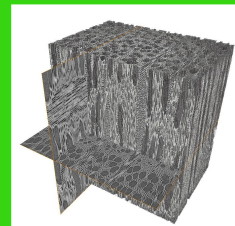

Intensität

K_α

Charakteristische Linien

K_β

Brems-spektrum

λ in 10^{-10} m

0,2 0,4 0,6 0,8 1,0

X-ray spectra of a molybden target

A

B

C

Attenuation of the x-rays

Reconstructions:

After scanning the sample the pixels of the single images of the 360° scans are converted to three-dimensional voxels. This leads to a 3D data set, ready to be handled by the software Avizo® Fire. A lot of different analyzing possibilities are available.
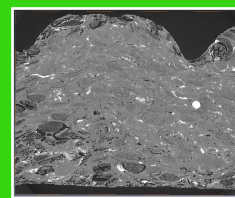
Left: 2D ray in Scots pine Right: 3D ray in thermo treated Pine

Demonstration of air filled areas in a beech sample

Beech wood

Application fields:

- Material separation
- Evaluation of trapped air
- Non destructive detection of anatomical defects
- Detection of chemicals
- Analysis of air-ducts
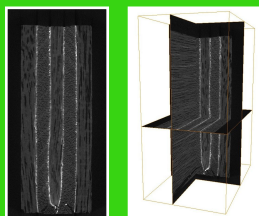
Reconstructed 3D volume created with the software Avizo® Fire

Weathered WPC sample

HOLZ