QA solutions for cone beam and computed tomography
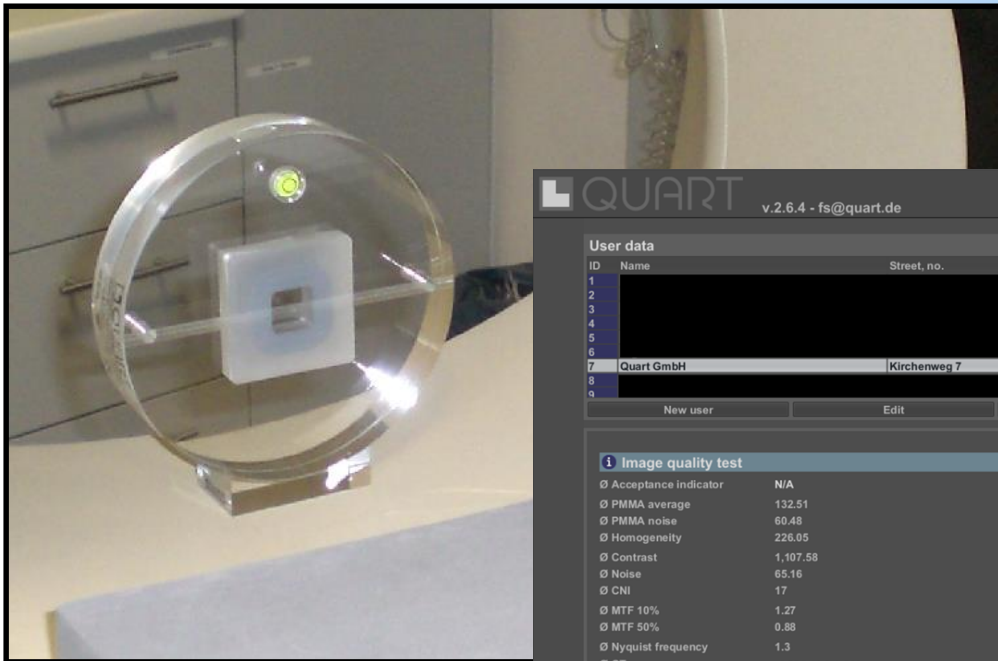
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QUART
Quality Assurance in Radiological Technologies

2020 JULY 12–16 VIRTUAL EASTERN TIME [GMT-4]
JOINT AAPM | COMP MEETING
Improving Health QUALITY. Increasing Global IMPACT.

CTtec - Imaging Performance Test

Standard Phantom

DIN6868-161&15 IEC 61223-3-7

Standard Software

Dose

Geometric data

Distance of the focal spot from the centre of rotation (mm)	50
Distance of the focal spot from the detector (mm)	80
Horizontal diameter of scanned volume (mm)	20
Horizontal diameter of radiation field at detector (mm)	30

Dosemeter

Manufacturer	Quart, Zorneding, Germany
Model	didoNeo
Serial number	0001

Dose measurements

Dose 1 (mGy)	7
Dose 2 (mGy)	6
Dose 3 (mGy)	8
Dose mean (mGy)	6.5
Dose maximum deviation (%)	7.692
Dose at the isocentre (mGy)	15.6

Dose at the isocentre is within tolerance (<50mGy)

Imaging: Preparation

Test images used

Axial slice
1_resolution_image_i0016_0000b.dcm

Edit path to test image

DICOM image readable

Homogeneity slice
2_homogeneity_image_i0040_000

Edit path to test image

Water slice
3_Water_i0009_0000b.dcm

Sagittal slice
4_Sagittal_DCT0205_original.dcm

Serial no. of the test-phantom used

Test-phantom serial no. 0001

Conventional tests

Image display (monitor)	● OK	○ Not OK
Radiation output: tube potential, leakage, filtration, repeatability, reproducibility	● OK	○ Not OK
Beam collimation and alignment	● OK	○ Not OK
Artefacts	● OK	○ Not OK
Operator protection (report from radiation protection expert is provided)	● OK	○ Not OK

Imaging: Evaluation
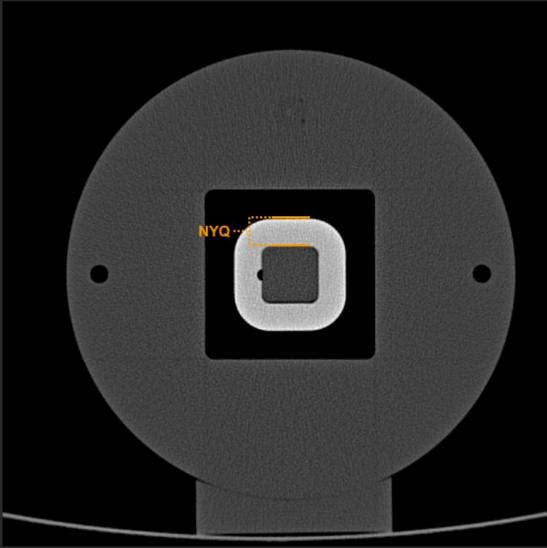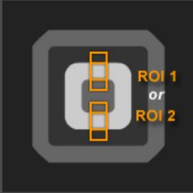
Imaging: Evaluation

dataset
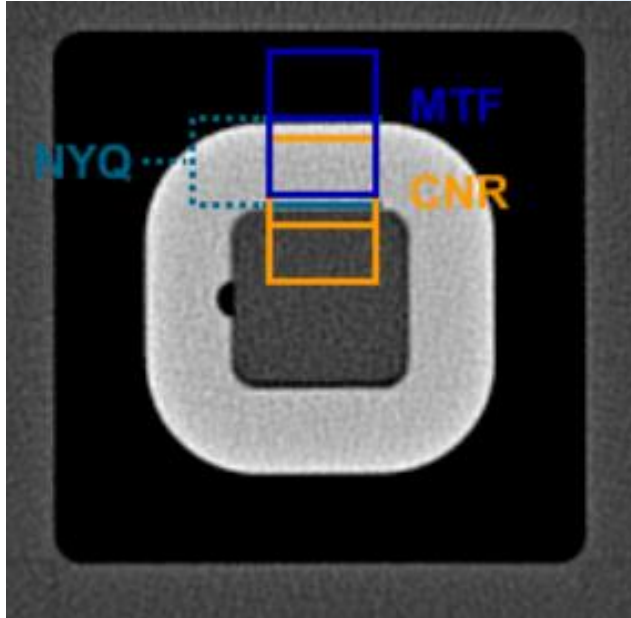
guidance

result
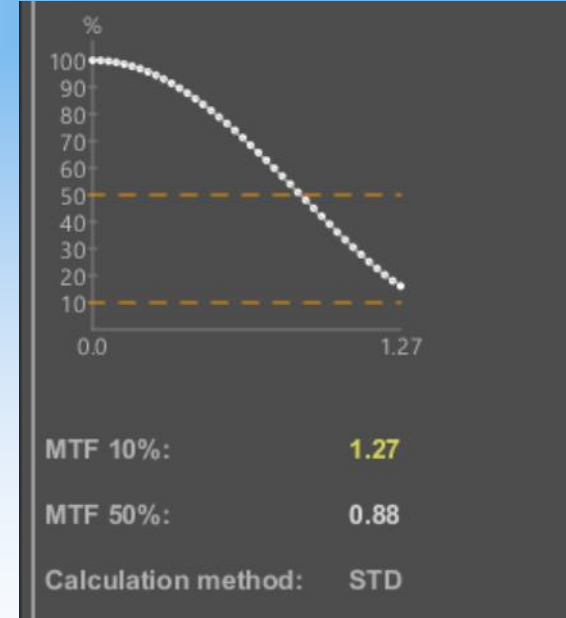
Reporting

Parameter	Run 1
Monitor	Ok
Functional testing	Ok
Alignment	Ok
Artefacts	Ok
Radiation protection	Ok
Acceptance indicator	311.63
PMMA average	132.51
PMMA noise	60.48
Homogeneity	226.05
Contrast	1,107.58
Noise	65.16
CNI	17.00
MTF 10%	1.27 [3]
MTF 50%	0.88
Nyquist frequency	1.30
CT_{air}	-1,021.46
CT_{PMMA}	162.09
CT_{PVC}	1,291.85
CT_{water}	8.60
$Contrast_z$	1,831.73
$Noise_z$	100.41
CNI_z	18.24
MTF_z 10%	2.00 [2]
MTF_z 50%	0.72
$Nyquist\ frequency_z$	2.40

NYQ

CT air

NYQ_z

CNR

CT PMMA

CNR_z

HOM

CT PVC

MTF_z pre

MTF std

CT water

Reporting

CT-Quality control test
created on Jul 16, 2020

Controller:
Dr. Felix H. Schöfer   ceo

User data:
Quart GmbH
Kirchenweg 7
85604 Zorneding

Tel.:   +498106249118
Fax: +498106249119
Email: info@quart.biz

X-ray device:

Manufacturer:	Manufacturer
Model:	Model
Serial no. x-ray device:	Serial no.
Active size of detector:	20 x 20 cm²
Imaged volume:	r10cm h5cm
Entrance dose rate:	1mGy/s
Maximum scan time:	12 sec
kV/mA settings:	100kV, 100mA
Selected mode:	pulsed
Test-phantom serial no.:	0001

Test program:

Software:	CTtec 2.6.4
Manufacturer:	Quart GmbH (www.quart.de)
Dosemeter:	Quart, Zorneding, Germany didoNeo
Serial number:	0001

Compliant with the EFOMP-ESTRO-IAEA guideline

Test results

Parameter	TOL	Run 1	Run 2	Run 3	Average
Acceptance indicator	--	311.63	--	--	311.63
Homogeneity	--	226.05	--	--	226.05
CNI	--	17.00	--	--	17.00
MTF 10%	--	1.27 [3]	--	--	1.27
MTF 50%	--	0.88	--	--	0.88
Nyquist frequency	--	1.30	--	--	1.30
CT_{air}	--	-1,021.46	--	--	-1,021.46
CT_{PMMA}	--	162.09	--	--	162.09
CT_{PVC}	--	1,291.85	--	--	1,291.85
CT_{water}	--	8.60	--	--	8.60
CNI_z	--	18.24	--	--	18.24
MTF_z 10%	--	2.00 [2]	--	--	2.00
MTF_z 50%	--	0.72	--	--	0.72
Nyquist frequency$_z$	--	2.40	--	--	2.40

MTF-Calculation method: [1] 161 [2] PRE [3] STD   /   All results are within tolerance.

Image display (monitor)	Ok ☒ / Not ok ☐
Radiation output: tube potential, leakage, filtration, repeatability, reproducibility	Ok ☒ / Not ok ☐
Beam collimation and alignment	Ok ☒ / Not ok ☐
Artefacts	Ok ☒ / Not ok ☐
Operator protection (report from radiation protection expert is provided)	Ok ☒ / Not ok ☐

Exposure: Dose 1: 7mGy   Dose 2: 6mGy   Dose 3: 8mGy
The maximum deviation of the dose measurements from the dose mean (7mGy) is: 14.29%
Dose at the isocentre: 16.8mGy is within tolerance (<50mGy and less than 40% deviation from the reference value)

Test result: Acceptable

Registered to: fs@quart.de

_____
Date, signature

| Parameter	TOL	Run 1	Run 2
Acceptance indicator	--	311.63	--
Homogeneity	--	226.05	--
CNI	--	17.00	--
MTF 10%	--	1.27 [3]	--
MTF 50%	--	0.88	--
Nyquist frequency	--	1.30	--
CT_{air}	--	-1,021.46	--
CT_{PMMA}	--	162.09	--
CT_{PVC}	--	1,291.85	--
CT_{water}	--	8.60	--
CNI_z	--	18.24	--
MTF_z 10%	--	2.00 [2]	--
MTF_z 50%	--	0.72	--
Nyquist frequency$_z$	--	2.40	--

MTF-Calculation method: [1] 161 [2] PRE [3] STD   /   All results are within tolerance.

Reporting

MTF (Run 1)

0.88 at 50% modulation
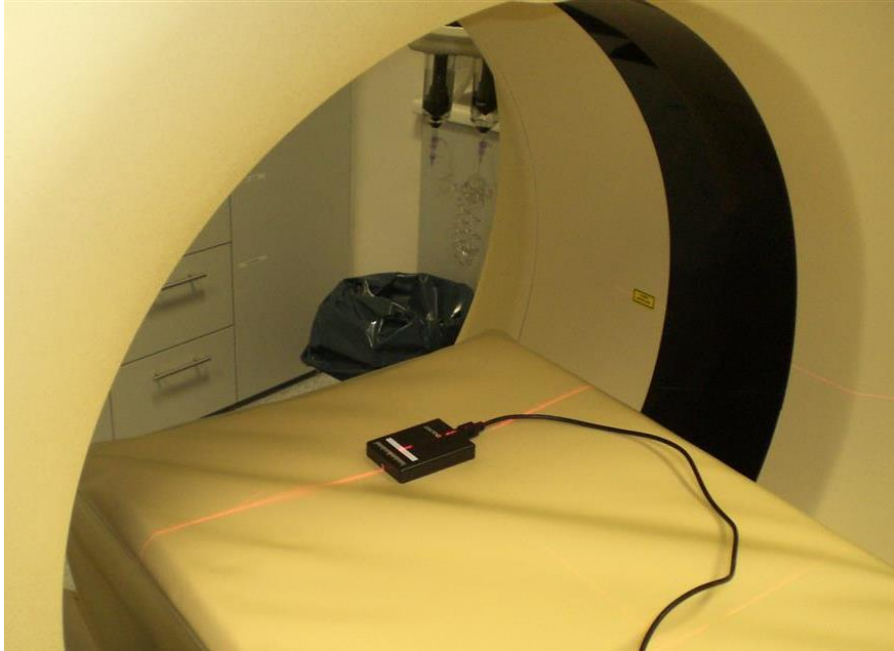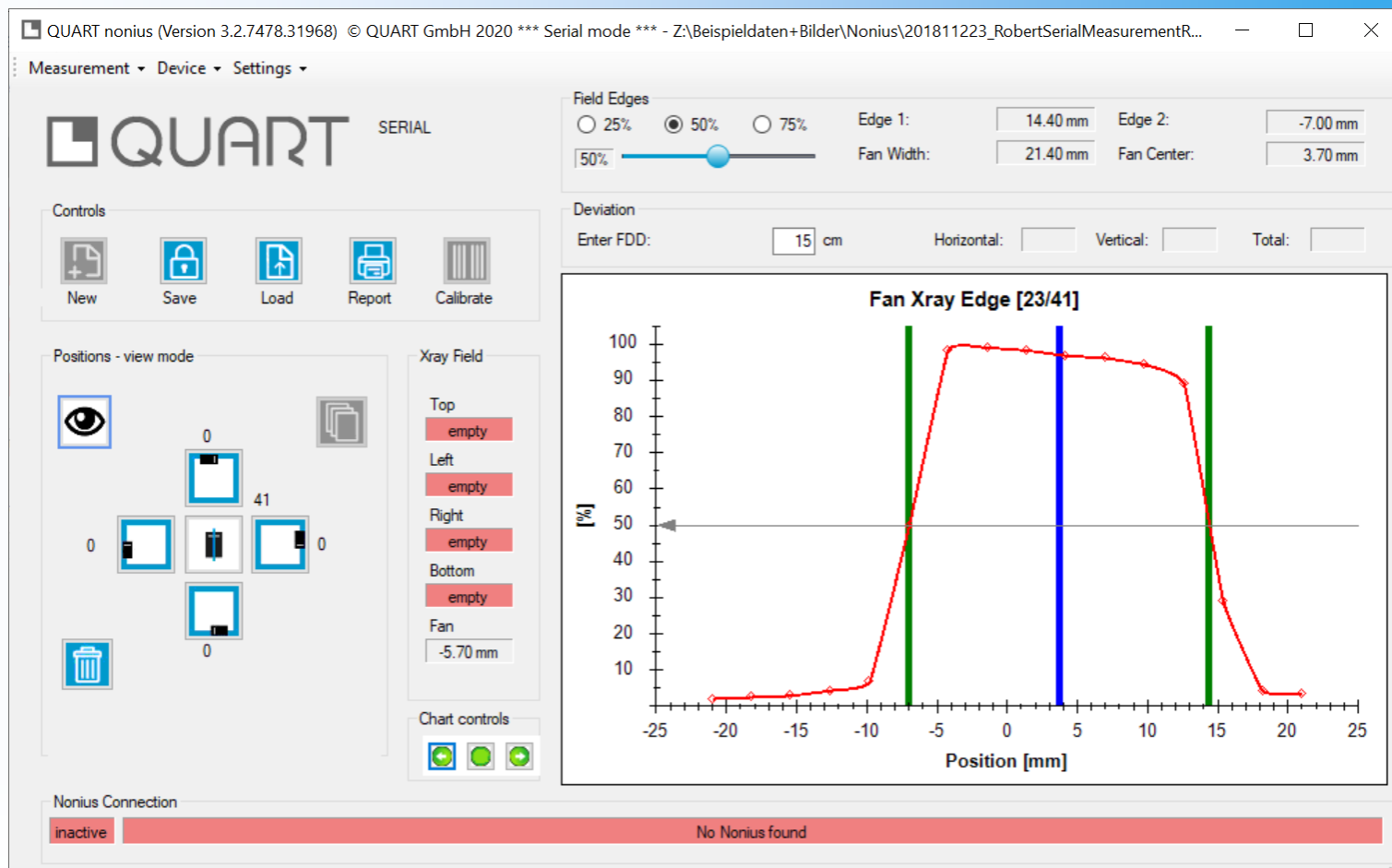
1.27 at 10% modulation
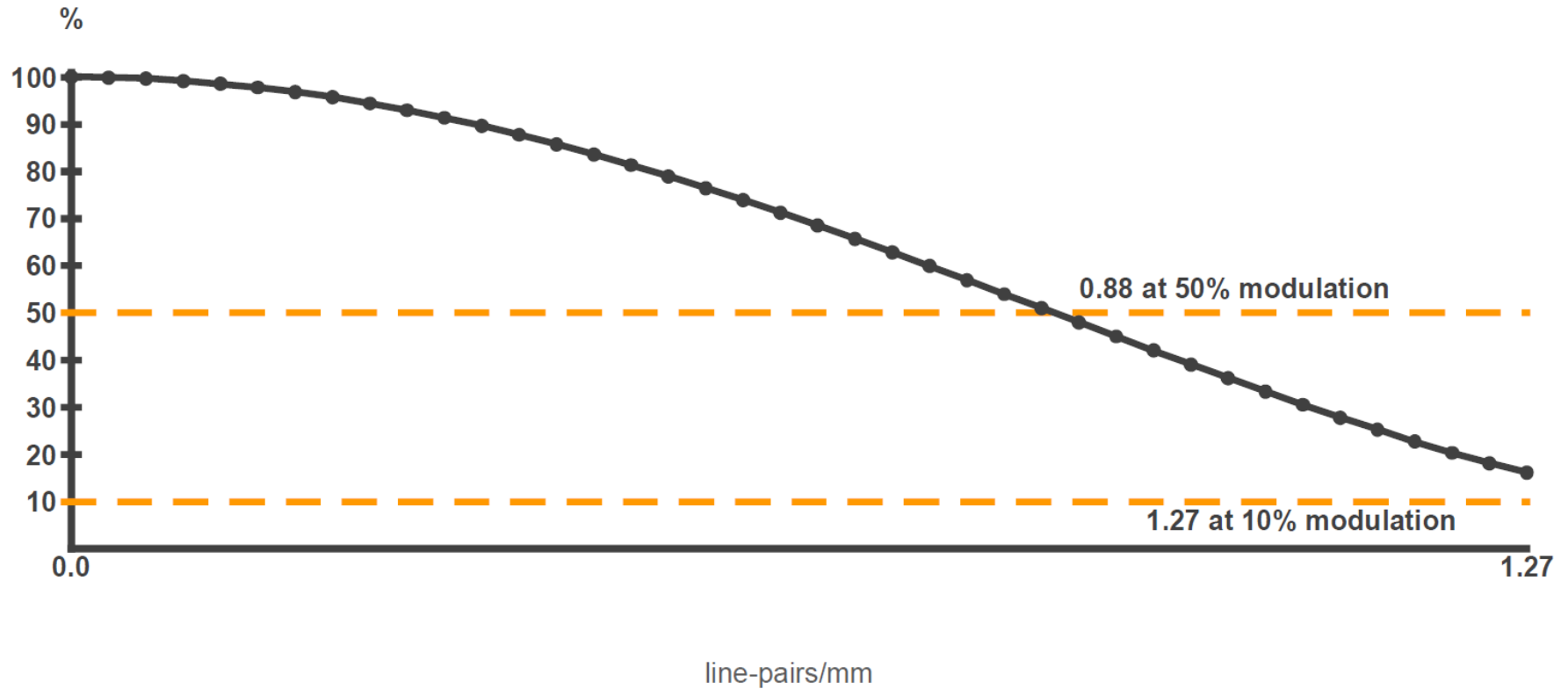
Nonius - Collimation Test
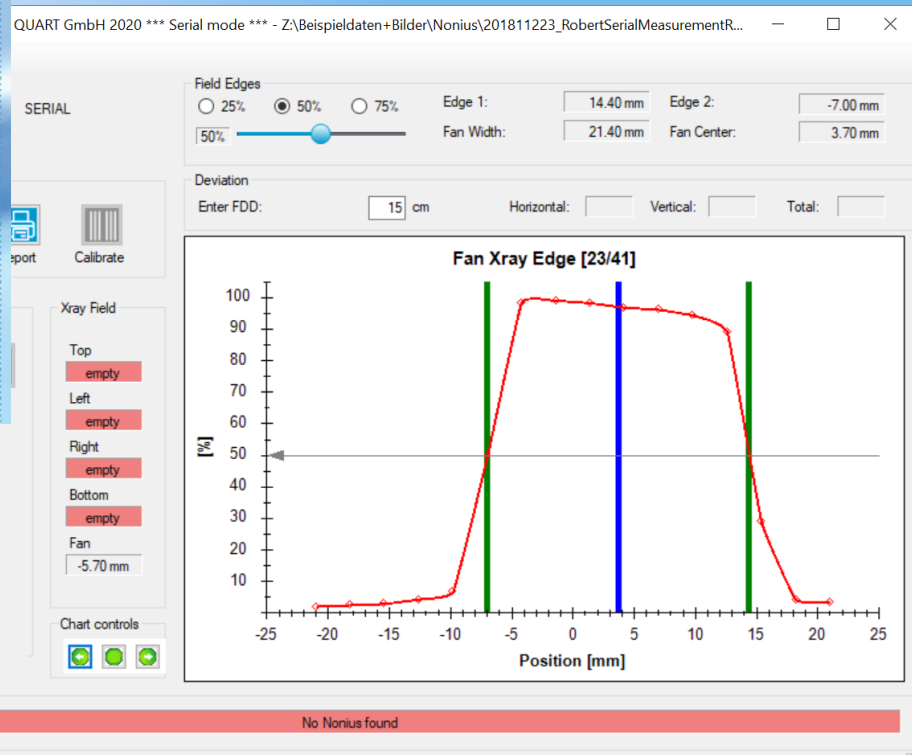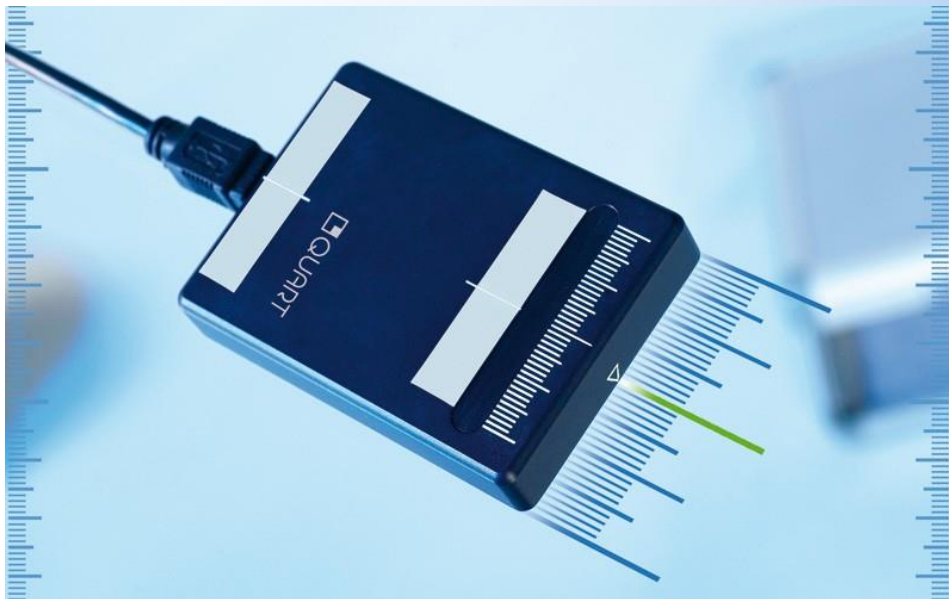
Position accuracy test: Nonius is positioned in the **isocenter** and **aligned** with the positioning lights

Nonius - collimation test

Nonius - collimation test