NeuViz 16 Calibration

Nicholas Luan
International Service Department

Neusoft

Agenda

➢ Calibrations

➢ Phantoms

➢ Some characteristics
- Display calibration result On-line & Off-line
- Once for all when positioning phantom

➢ Each calibration
- Purpose
- Phantom
- Key process
- Calibration result

➢ Notice

Calibrations

1. Grid Voltage Initialization
2. Rotor Balancing
3. Filament Pre-adjustment
4. Tube Seasoning
5. Filament Calibration
6. A-Plane Preadjustment
7. Tube Mechanical Alignment
8. A-Plane Calibration
9. SFS Calibration
10. DFS Calibration
11. Nonlinearity Calibration
12. Crosstalk Calibration
13. Beam Hardening Calibration
14. HCOR Calibration
15. Laser Marker Calibration
16. Air Calibration

Phantoms

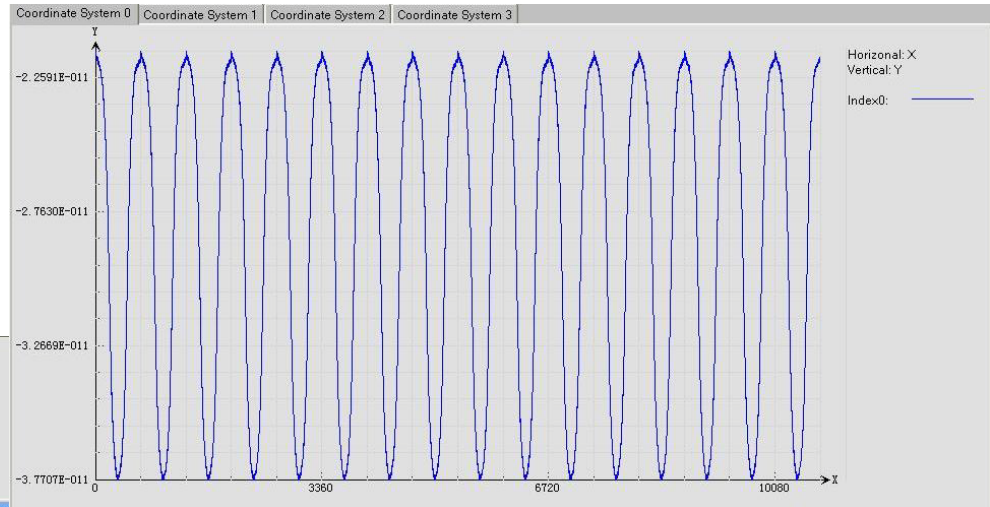Two-layer step phantom

Combination phantom

Some characteristics - Display calibration result On-line & Off-line

Curve

Table

ShowCortbl

Some characteristics - Once for all when positioning phantom

- After the first time to position a phantom successfully, software will record the current horizontal position and vertical position.

- Later, when positioning the phantom again, the couch will go to the recorded position automatically.

- The user only need to confirm the phantom's exact position.
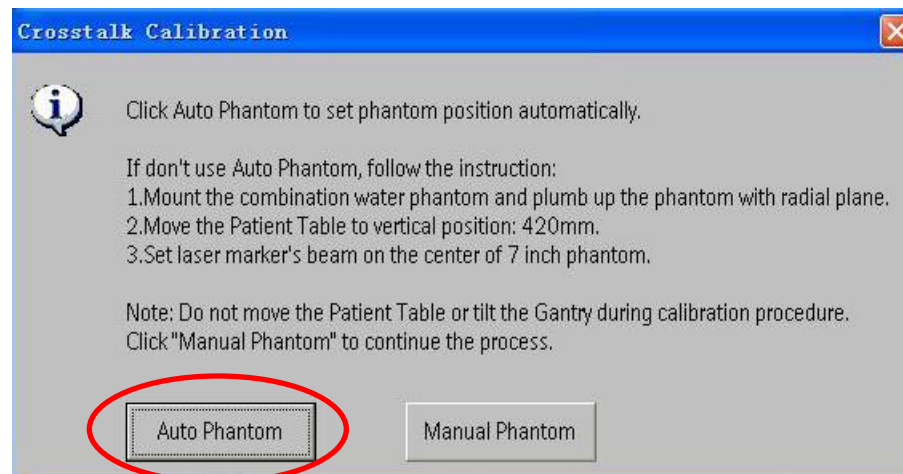
Grid Voltage Initialization

- Purpose: Input the initial value of grid voltage
- Phantom: None
- Key process: Next page

Grid Voltage Initialization

Grid Voltage Initialization

Grid Voltage Initialization

- Calibration result:

TubeInfo			DMS
SerialNumber	**TubeType**	**InstallDate**	**DFSPhaseDelay**
37035	CTR2150	01-Jan-2007	0

GridVoltage					
KV	**FSSize**	**FSPos**	**GV1**	**GV2**	**CenterChannel**
90	Large	FSU	710	710	336.6346
90	Large	FSQ	647	887	336.751
90	Large	FS0	1071	469	336.375
90	Large	FS1	491	1023	336.876
90	Small	FSU	1060	1060	336.6365
90	Small	FSQ	932	1188	336.751
90	Small	FS0	1381	739	336.377
90	Small	FS1	760	1328	336.878
120	Large	FSU	974	974	336.6372
120	Large	FSQ	817	1131	336.752
120	Large	FS0	1378	601	336.376
120	Large	FS1	635	1320	336.875
120	Small	FSU	1420	1420	336.6362
120	Small	FSQ	1250	1590	336.751

Rotor Balancing

- Purpose: Stabilize the gantry's rotation
- Phantom: None
- Key process: Next page
- Calibration result: None

Rotor Balancing
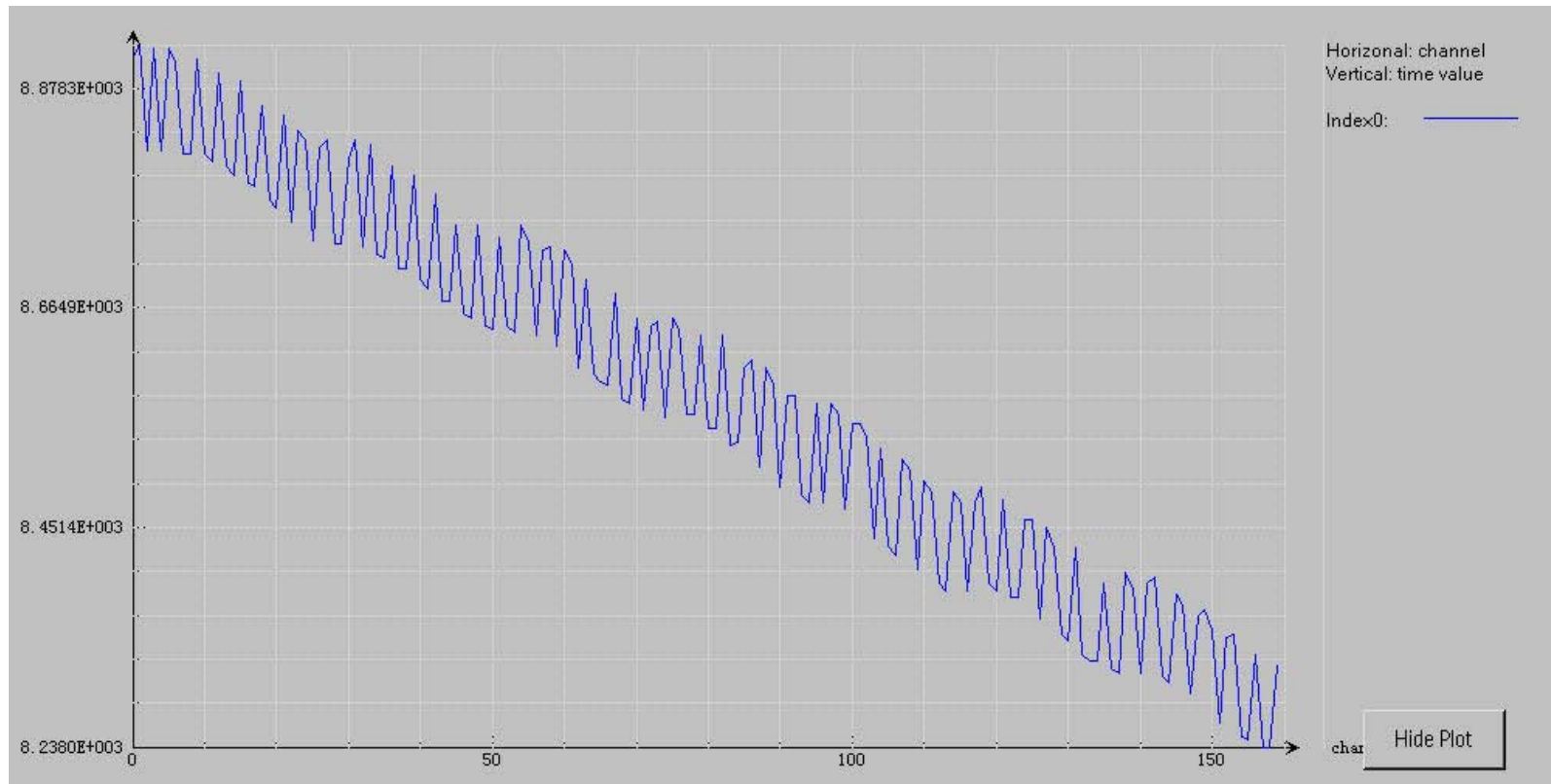
The speed track of gantry during its going to stabilization

Horizontal axis: *Sample number*. 160 point (One point per 100ms, and 16s in all.)

Vertical axis: *Rotation time per view (125ns)*. Equivalent to time channel in Chorus16(next page).

Rotor Balancing

Time channel of four rotation

Horizontal axis: *View number*. 2320 * 4 = 9280

Vertical axis: *Rotation time per view (125ns)*

Filament Preadjustment

- Purpose: Initialize the baseline of the following Filament Calibration
- Phantom: None
- Key process: None
- Calibration result:

TubeInfo

SerialNumber	TubeType	InstallDate
37035	CTR2150	01-Jan-2007

FilamentCurrent

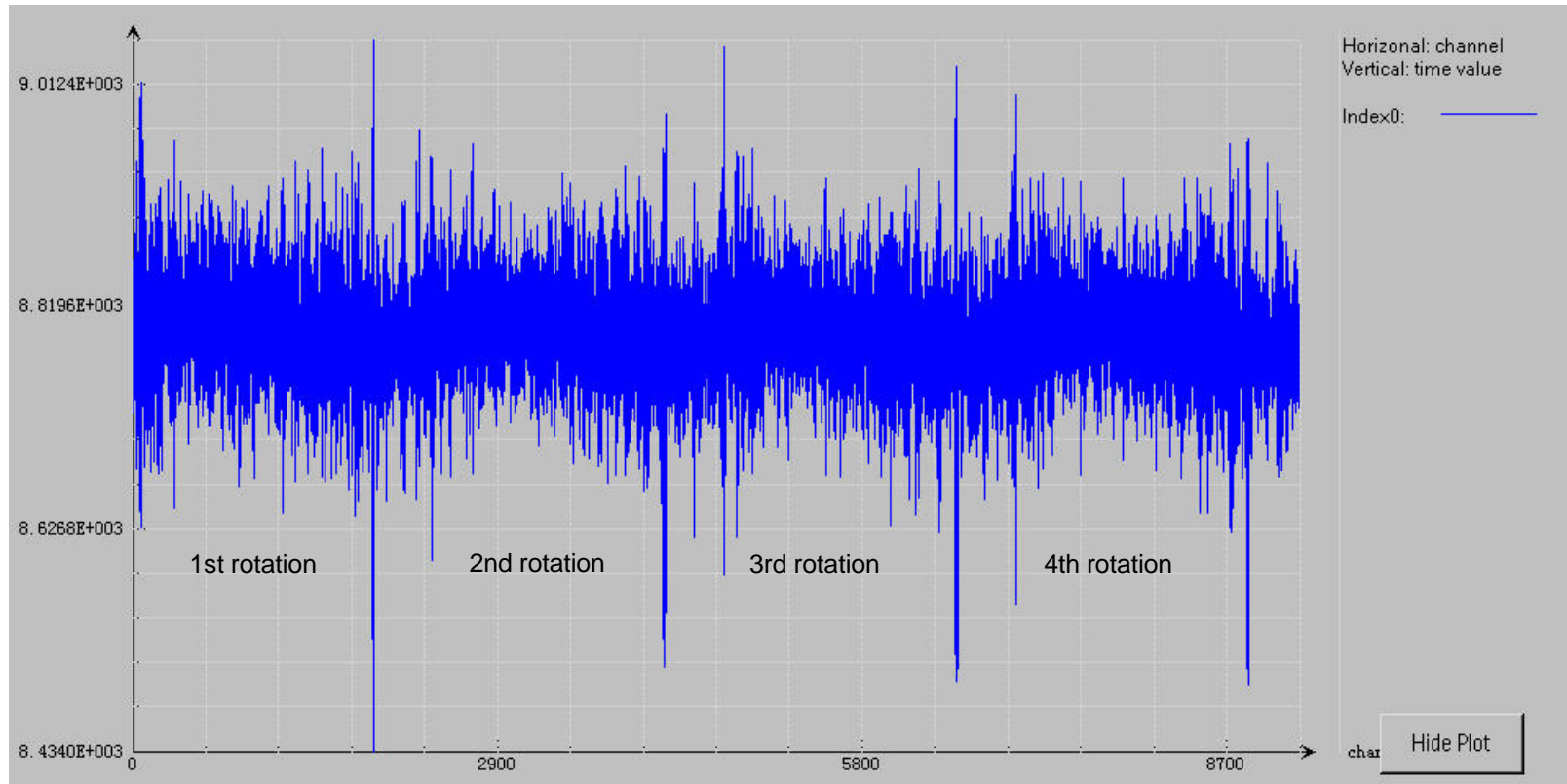| FSSize	Voltage (kV)	Current (mA)	FilamentCurrent (A)	FSSize	Voltage (kV)	Current (mA)	FilamentCurrent (A)	FSSize	Voltage (kV)	Current (mA)	Filam
Large	90	30	3.40	Large	120	30	3.38	Large	140	30	3.37
Large	90	35	3.44	Large	120	35	3.42	Large	140	35	3.41
Large	90	40	3.47	Large	120	40	3.46	Large	140	40	3.44
Large	90	45	3.50	Large	120	45	3.49	Large	140	45	3.47
Large	90	50	3.53	Large	120	50	3.51	Large	140	50	3.50
Large	90	55	3.56	Large	120	55	3.54	Large	140	55	3.53
Large	90	60	3.58	Large	120	60	3.57	Large	140	60	3.55
Large	90	65	3.60	Large	120	65	3.59	Large	140	65	3.57
Large	90	70	3.62	Large	120	70	3.61	Large	140	70	3.60
Large	90	75	3.64	Large	120	75	3.63	Large	140	75	3.62

Tube Conditioning

- Purpose: Remove the released gas in a tube that is not used for a long time, avoiding ARC during its working.
- Phantom: None
- Key process: None
- Calibration result: None

Filament Calibration

- Purpose: Find the optimum filament current
- Phantom: None
- Key process: None
- Calibration result:

TubeInfo

SerialNumber	TubeType	InstallDate
37035	CTR2150	01-Jan-2007

FilamentCurrent

FSSize	Voltage (kV)	Current (mA)	FilamentCurrent (A)	FSSize	Voltage (kV)	Current (mA)	FilamentCurrent (A)	FSSize	Voltage (kV)	Current (mA)	Filam
Large	90	30	3.40	Large	120	30	3.38	Large	140	30	3.37
Large	90	35	3.44	Large	120	35	3.42	Large	140	35	3.41
Large	90	40	3.47	Large	120	40	3.46	Large	140	40	3.44
Large	90	45	3.50	Large	120	45	3.49	Large	140	45	3.47
Large	90	50	3.53	Large	120	50	3.51	Large	140	50	3.50
Large	90	55	3.56	Large	120	55	3.54	Large	140	55	3.53
Large	90	60	3.58	Large	120	60	3.57	Large	140	60	3.55
Large	90	65	3.60	Large	120	65	3.59	Large	140	65	3.57
Large	90	70	3.62	Large	120	70	3.61	Large	140	70	3.60
Large	90	75	3.64	Large	120	75	3.63	Large	140	75	3.62

A-Plane Preadjustment

- Purpose: Get the coarse value of A-Plane in Z-direction
- Phantom: None
- Key process: None
- Calibration result: Next page

A-Plane Preadjustment

- Calibration result:

APlaneInfo

APLinearCoefk	APLinearCoefb	Zero
4.97	5.13	1256

CAmap

Collimation	CAmap
0	0
2*0.75	1219
4*0.75	1472
8*0.75	1979
10*0.75	2232
12*0.75	2486
16*0.75	2993
10*1.5	3499
12*1.5	4006
14*1.5	4536

14*1.5	4536
16*1.5	5025

Small

Collimation	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffse
2*0.75	0.5	1344	0.6	1344	0.75	1344	1.0	1344	1.5	1344	2.0	1344
4*0.75	0.5	1370	0.6	1370	0.75	1370	1.0	1370	1.5	1370	2.0	1370
8*0.75	0.5	1421	0.6	1421	0.75	1421	1.0	1421	1.5	1421	2.0	1421
10*0.75	0.5	1446	0.6	1446	0.75	1446	1.0	1446	1.5	1446	2.0	1446
12*0.75	0.5	1472	0.6	1472	0.75	1472	1.0	1472	1.5	1472	2.0	1472
16*0.75	0.5	1523	0.6	1523	0.75	1523	1.0	1523	1.5	1523	2.0	1523
10*1.5	0.5	1574	0.6	1574	0.75	1574	1.0	1574	1.5	1574	2.0	1574
12*1.5	0.5	1625	0.6	1625	0.75	1625	1.0	1625	1.5	1625	2.0	1625
14*1.5	0.5	1654	0.6	1654	0.75	1654	1.0	1654	1.5	1654	2.0	1654
16*1.5	0.5	1727	0.6	1727	0.75	1727	1.0	1727	1.5	1727	2.0	1727

Large

coarse value

An introduction before the following calibrations
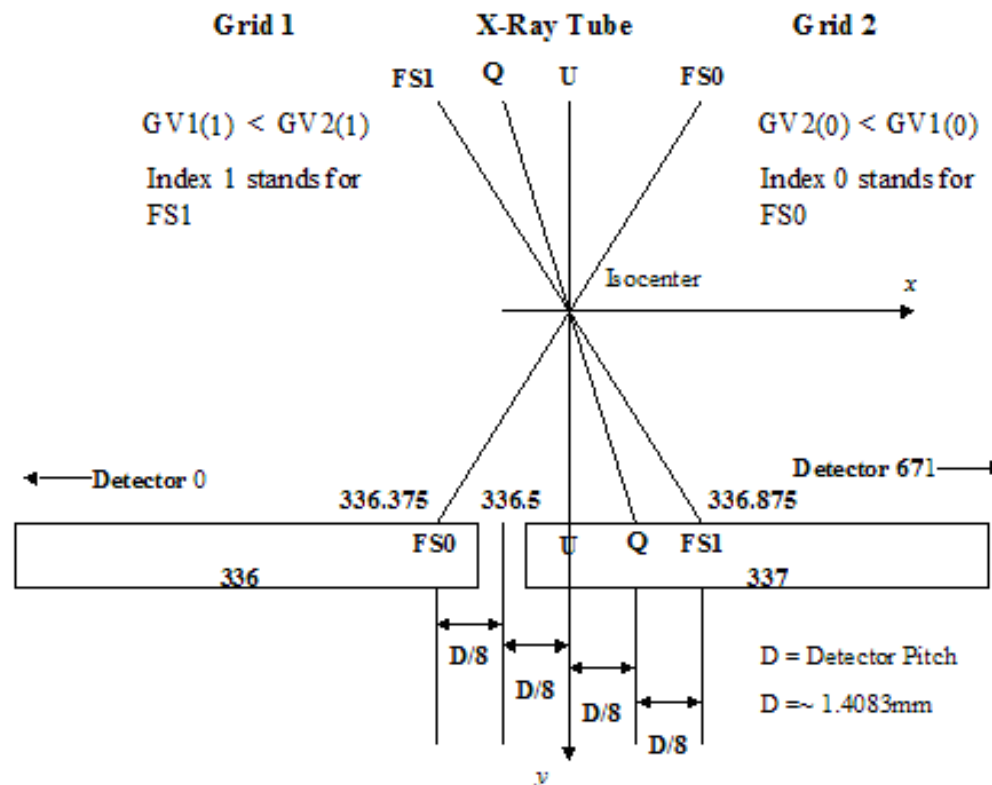
Tube Mechanical Alignment

- Purpose: Adjust the tube in X-direction and Z-direction, and get the center channel of DMS when FS (Focal Spot) is in FSU.

- Phantom: Pin (on Combination phantom)

- Key process: Next page

Tube Mechanical Alignment

The pin (off-center) track during gantry's rotation

Horizontal axis: *View number*

Vertical axis: *Channel*

Tube Mechanical Alignment

- Calibration result:
- ☞ Small FS: 336.595~336.655 (336.625 ± 0.03)
- ☞ Large FS: Small FS ± 0.03

TubeInfo			DMS
SerialNumber	**TubeType**	**InstallDate**	**DFSPhaseDelay**
37035	CTR2150	01-Jan-2007	0

GridVoltage					
KV	**FSSize**	**FSPos**	**GV1**	**GV2**	**CenterChannel**
90	Large	FSU	710	710	336.6346
90	Large	FSQ	647	887	336.751
90	Large	FS0	1071	469	336.375
90	Large	FS1	491	1023	336.876
90	Small	FSU	1060	1060	336.6365
90	Small	FSQ	932	1188	336.751
90	Small	FS0	1381	739	336.377
90	Small	FS1	760	1328	336.878
120	Large	FSU	974	974	336.6372
120	Large	FSQ	817	1131	336.752
120	Large	FS0	1378	601	336.376
120	Large	FS1	635	1320	336.875
120	Small	FSU	1420	1420	336.6362
120	Small	FSQ	1250	1590	336.751

A-Plane Calibration

- Purpose: Get the refined value of A-Plane in Z-direction
- Phantom: None
- Key process: None
- Calibration result:

| 14*1.5 | 4536 |
| 16*1.5 | 5025 |

refined value

Small

Collimation	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffset	R.Speed	Zoffse
2*0.75	0.5	1344	0.6	1344	0.75	1344	1.0	1344	1.5	1344	2.0	1344
4*0.75	0.5	1370	0.6	1370	0.75	1370	1.0	1370	1.5	1370	2.0	1370
8*0.75	0.5	1421	0.6	1421	0.75	1421	1.0	1421	1.5	1421	2.0	1421
10*0.75	0.5	1446	0.6	1446	0.75	1446	1.0	1446	1.5	1446	2.0	1446
12*0.75	0.5	1472	0.6	1472	0.75	1472	1.0	1472	1.5	1472	2.0	1472
16*0.75	0.5	1523	0.6	1523	0.75	1523	1.0	1523	1.5	1523	2.0	1523
10*1.5	0.5	1574	0.6	1574	0.75	1574	1.0	1574	1.5	1574	2.0	1574
12*1.5	0.5	1625	0.6	1625	0.75	1625	1.0	1625	1.5	1625	2.0	1625
14*1.5	0.5	1654	0.6	1654	0.75	1654	1.0	1654	1.5	1654	2.0	1654
16*1.5	0.5	1727	0.6	1727	0.75	1727	1.0	1727	1.5	1727	2.0	1727

Large

SFS Calibration

- Purpose: Get the grid voltage and corresponding center channel of DMS when FS is in FSQ
- Phantom: Pin (on Combination phantom)
- Key process: None
- Calibration result:
☞ 336.747~336.765(336.75-0.003,336.75+0.015)

TubeInfo					DMS
SerialNumber		**TubeType**		**InstallDate**	**DFSPhaseDelay**
37035		CTR2150		01-Jan-2007	0

GridVoltage					
KV	**FSSize**	**FSPos**	**GV1**	**GV2**	**CenterChannel**
90	Large	FSU	710	710	336.6346
90	Large	FSQ	647	887	336.751
90	Large	FS0	1071	469	336.375
90	Large	FS1	491	1023	336.876
90	Small	FSU	1060	1060	336.6365
90	Small	FSQ	932	1188	336.751
90	Small	FS0	1381	739	336.377
90	Small	FS1	760	1328	336.878
120	Large	FSU	974	974	336.6372
120	Large	FSQ	817	1131	336.752
120	Large	FS0	1378	601	336.376
120	Large	FS1	635	1320	336.875
120	Small	FSU	1420	1420	336.6362
120	Small	FSQ	1250	1590	336.751

DFS Calibration

- Purpose: Get the grid voltage and corresponding center channel of DMS when FS is in FS0 and FS1 respectively.
- Phantom: Pin (on Combination phantom)
- Key process: None
- Calibration result:
☞ FS0:336.360~336.378(336.375-0.015,336.375+0.003)
☞ FS1:336.872~336.890(336.875-0.003,336.875+0.015)

| TubeInfo				DMS	
SerialNumber		**TubeType**	**InstallDate**	**DFSPhaseDelay**	
37035		CTR2150	01-Jan-2007	0	

GridVoltage					
KV	**FSSize**	**FSPos**	**GV1**	**GV2**	**CenterChannel**
90	Large	FSU	710	710	336.6346
90	Large	FSQ	647	887	336.751
90	Large	FS0	1071	469	336.375
90	Large	FS1	491	1023	336.876
90	Small	FSU	1060	1060	336.6365
90	Small	FSQ	932	1188	336.751
90	Small	FS0	1381	739	336.377
90	Small	FS1	760	1328	336.878
120	Large	FSU	974	974	336.6372
120	Large	FSQ	817	1131	336.752
120	Large	FS0	1378	601	336.376
120	Large	FS1	635	1320	336.875
120	Small	FSU	1420	1420	336.6362
120	Small	FSQ	1250	1590	336.751

Nonlinearity Calibration

- Purpose: Reduce rings on images as a result of the non-linear spectral response of detectors and Front End Electronics (FEE) for various values of current and beam intensity
- Phantom: Two-layer step phantom
- Key process: Next page

Nonlinearity Calibration
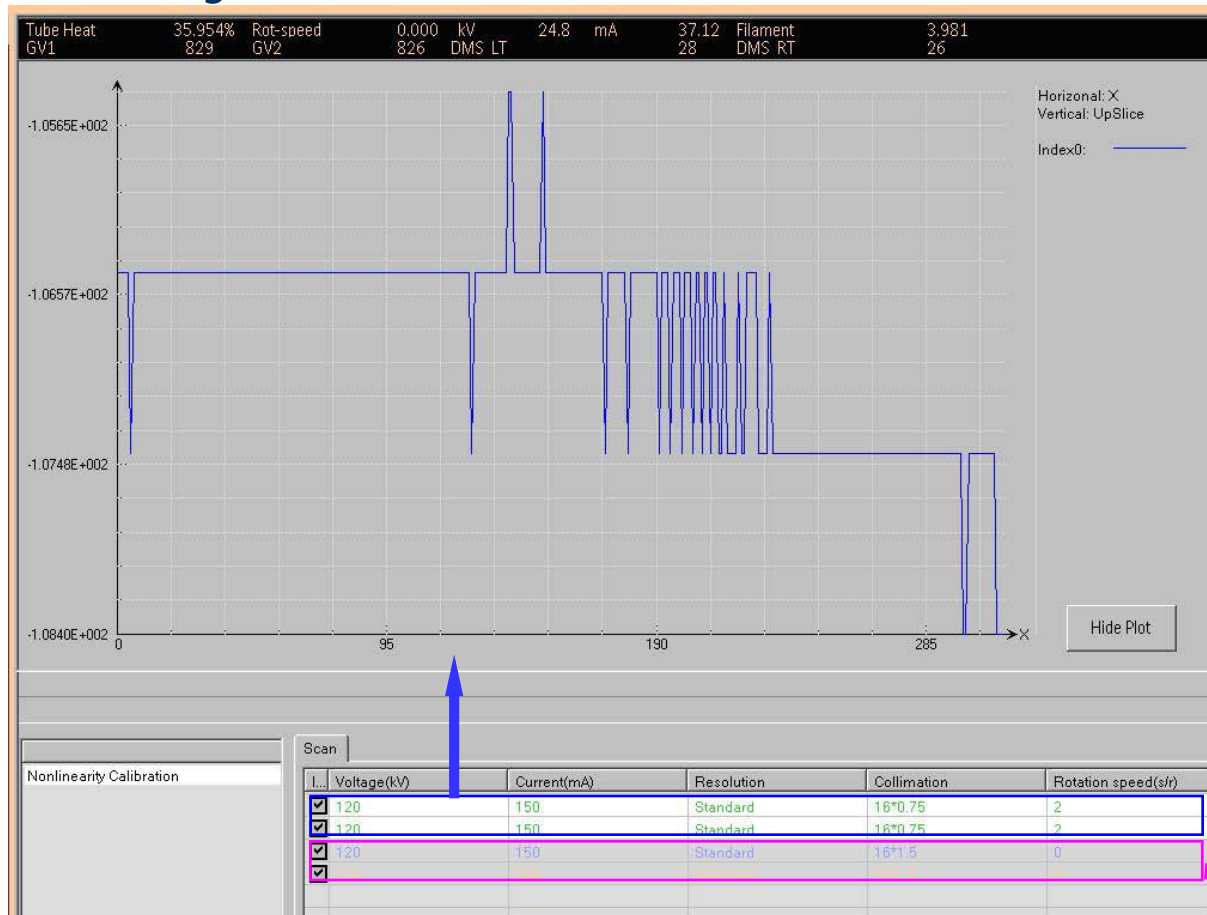
The distance between top surface of step phantom and ISO surface in Y-direction

Horizontal axis: *Phantom width (mm)*
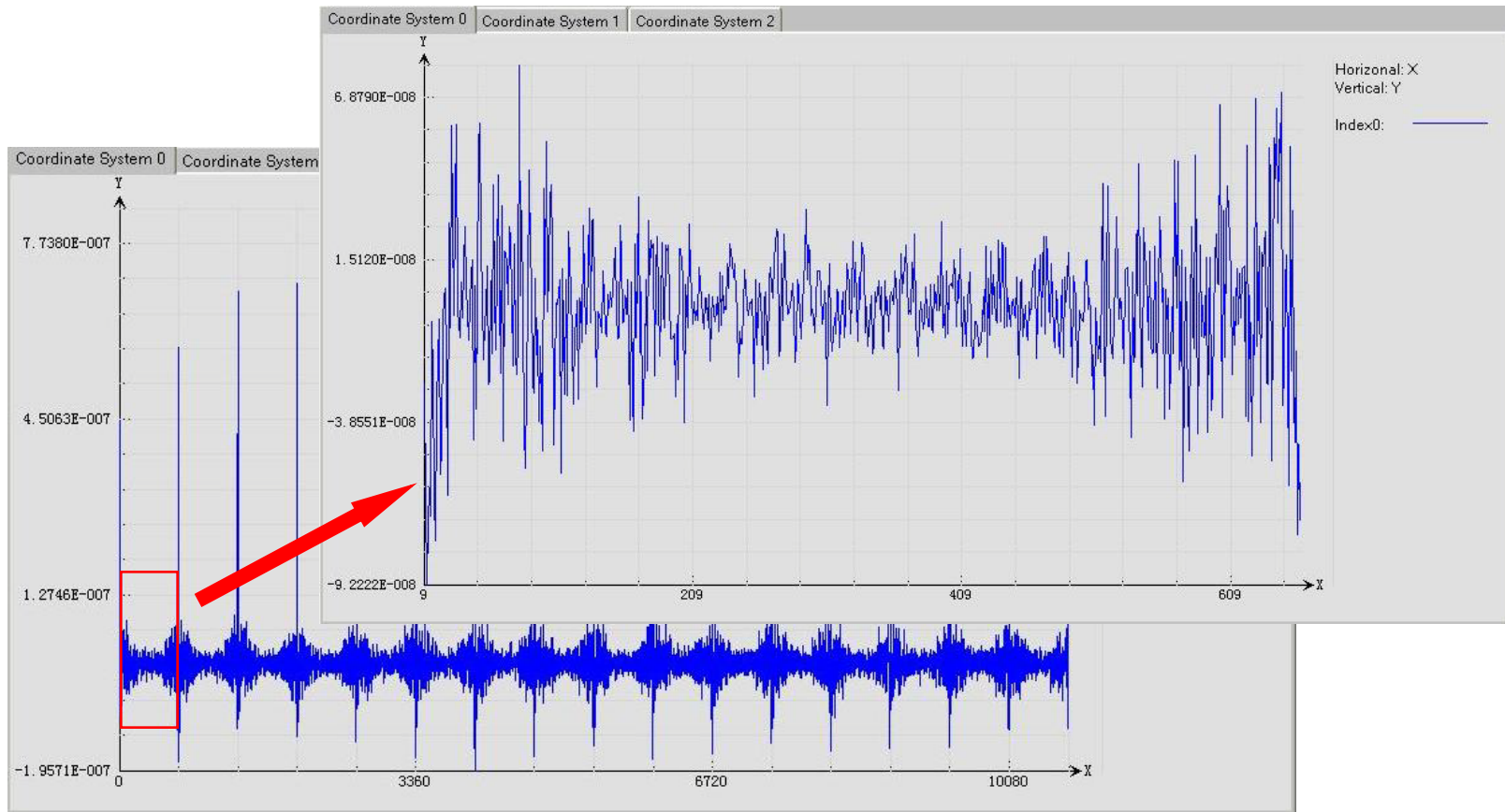
Vertical axis: *Y-Distance (mm)*

Nonlinearity Calibration
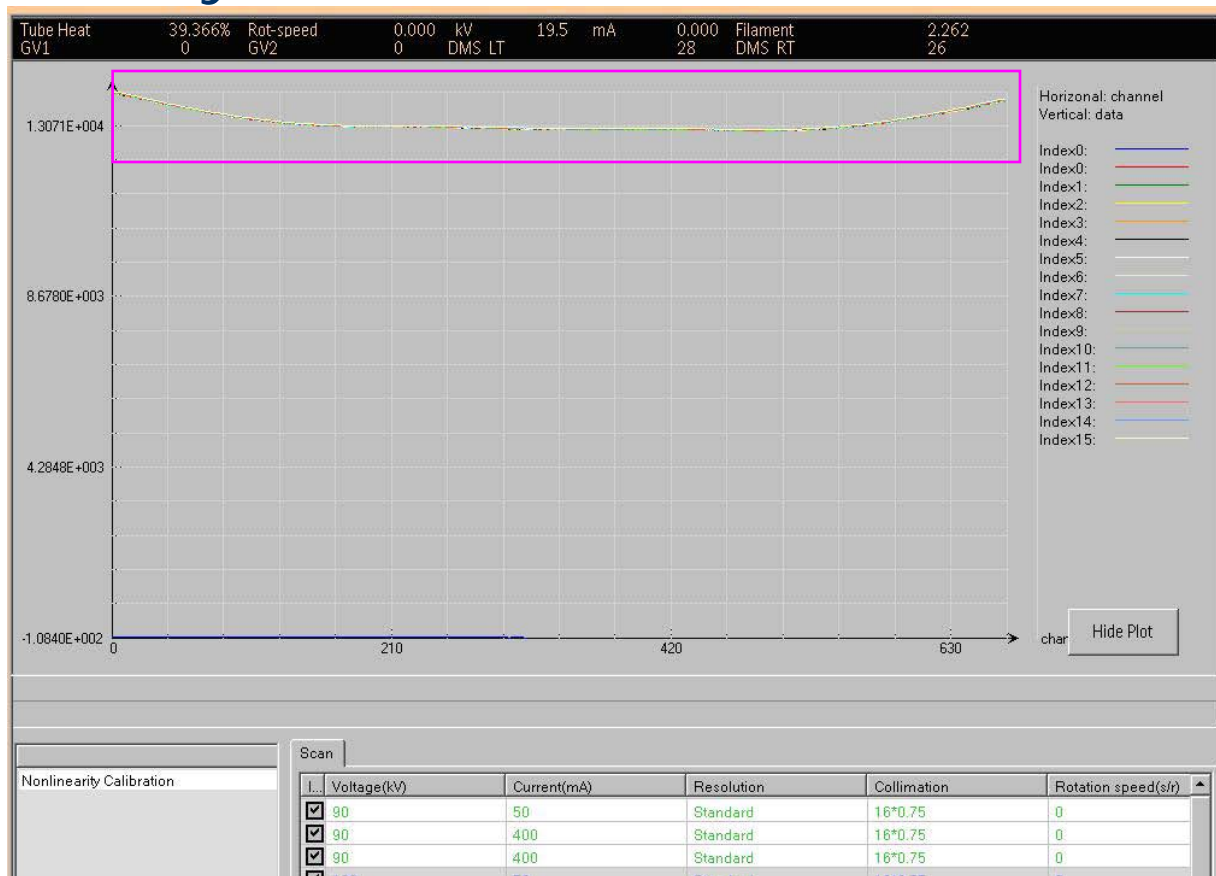
Whether all the X-RAY pass through the step phantom

Horizontal axis: *Channel*

Vertical axis: *Attenuation*

Nonlinearity Calibration

- Calibration result: Curve

Nonlinearity Calibration
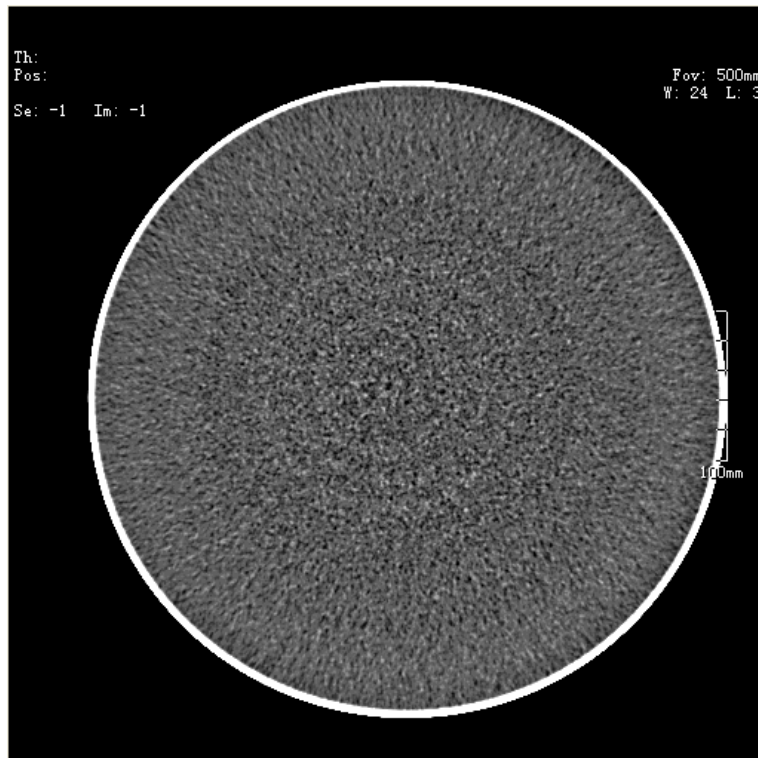
- Nonlinearity Calibration
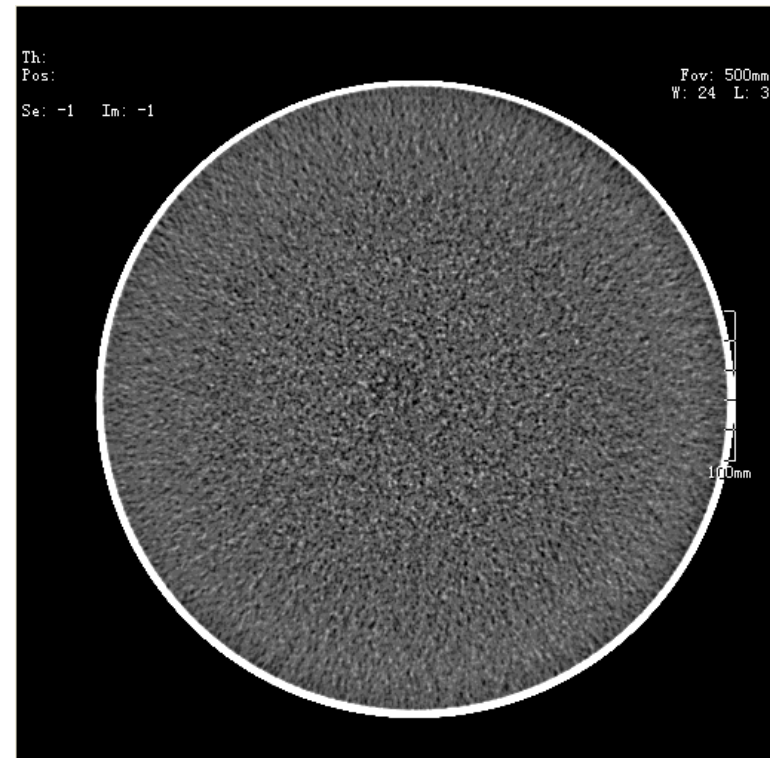
+ Nonlinearity Calibration

Crosstalk Calibration

- Purpose: Correct the crosstalk between the adjacent channels
- Phantom: 7 inch Phantom (on Combination Phantom)
- Key process: None
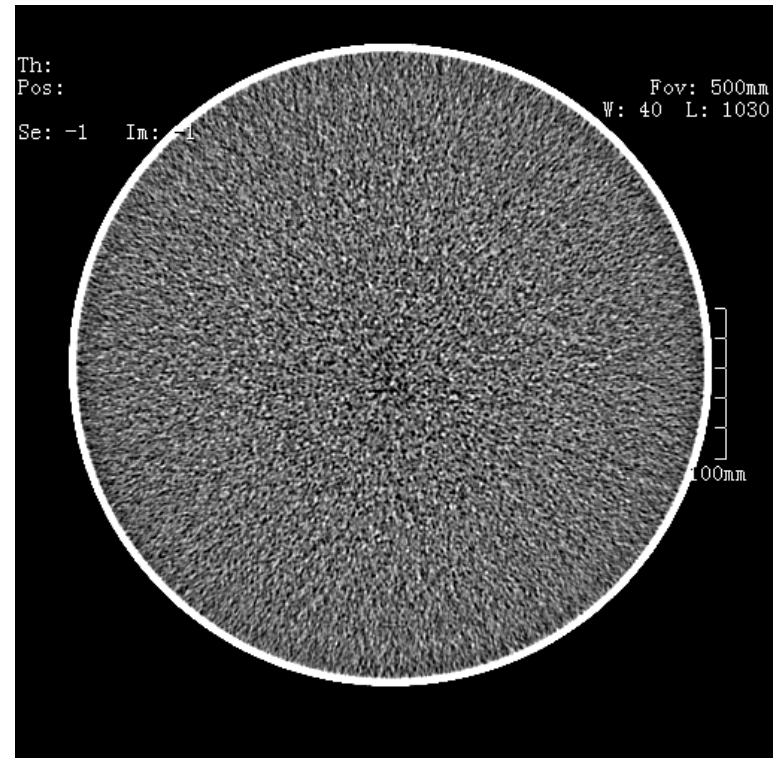- Calibration result: Next page

Crosstalk Calibration

- Calibration result: Curve
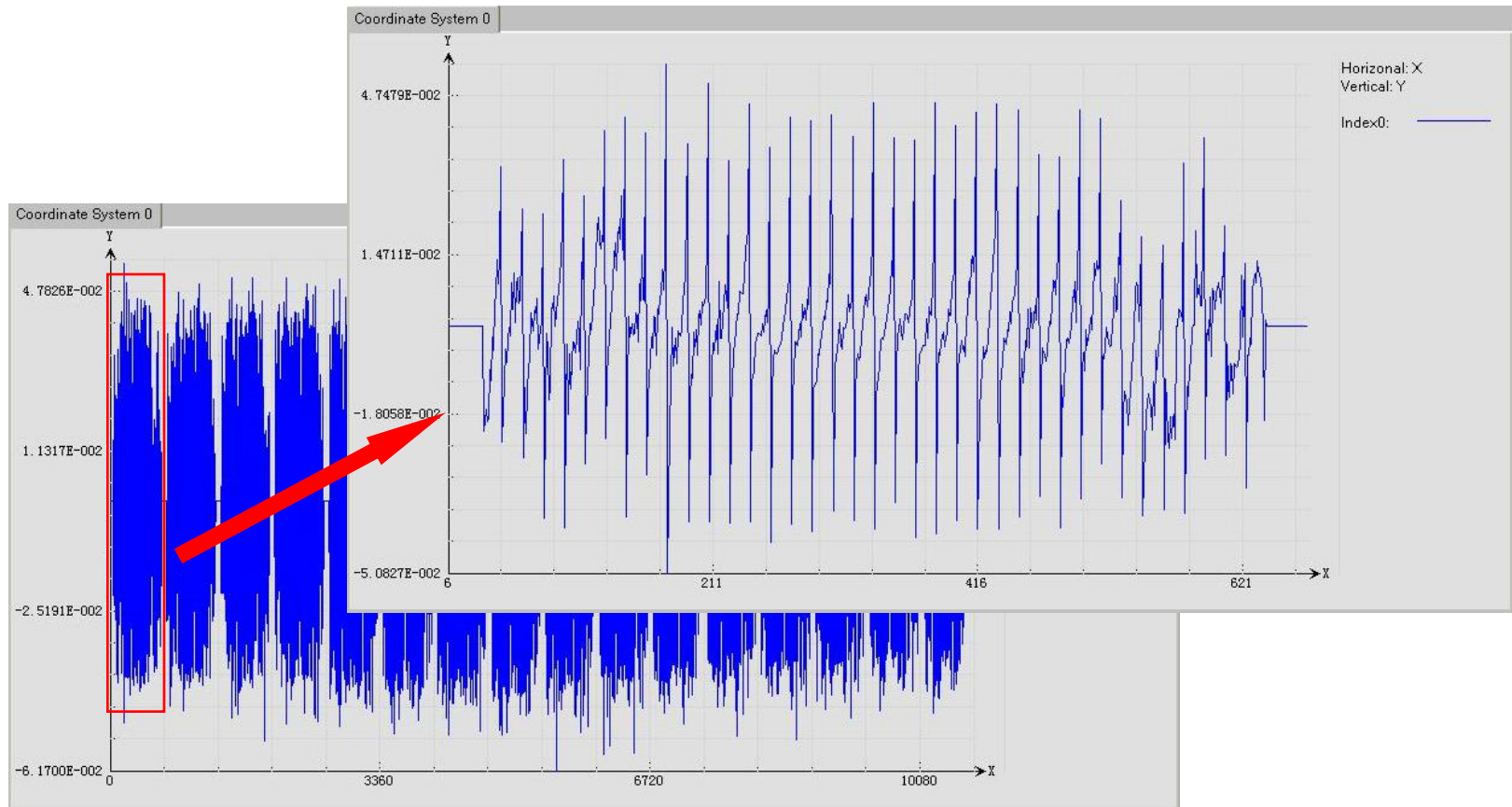
Crosstalk Calibration
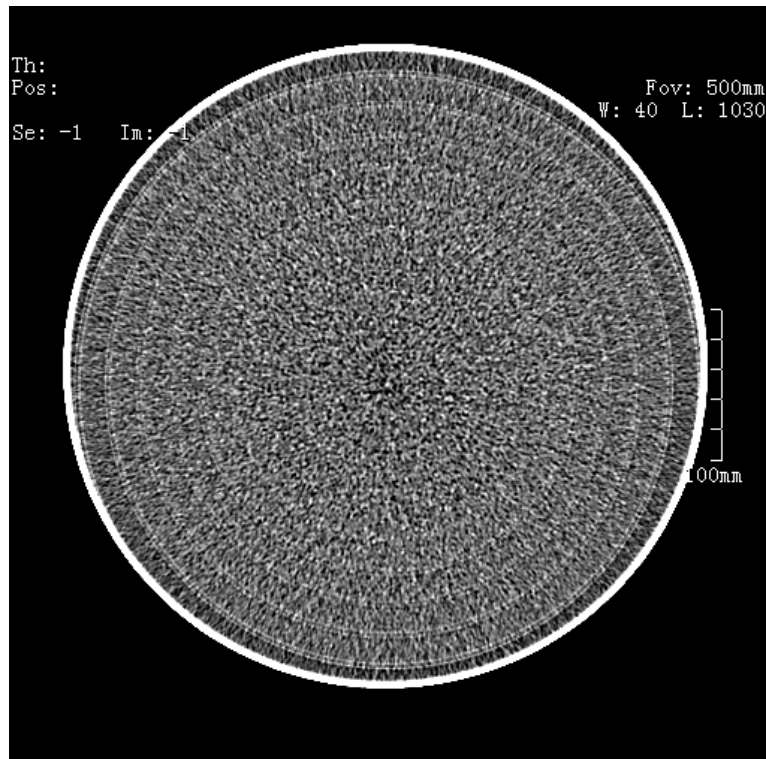
- Crosstalk Calibration
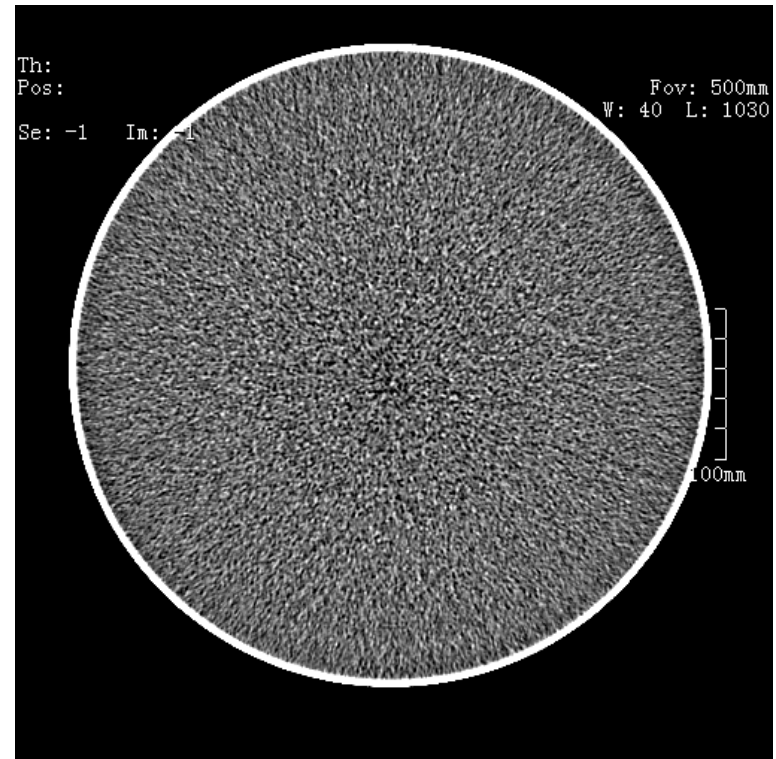
+ Crosstalk Calibration

Beam Hardening Calibration

- Purpose: Correct the multi-spectrum of X-Ray
- Phantom: 7 inch Phantom (on Combination Phantom)
- Key process: None
- Calibration result: Next page

# Beam Hardening Calibration

- Calibration result: Curve
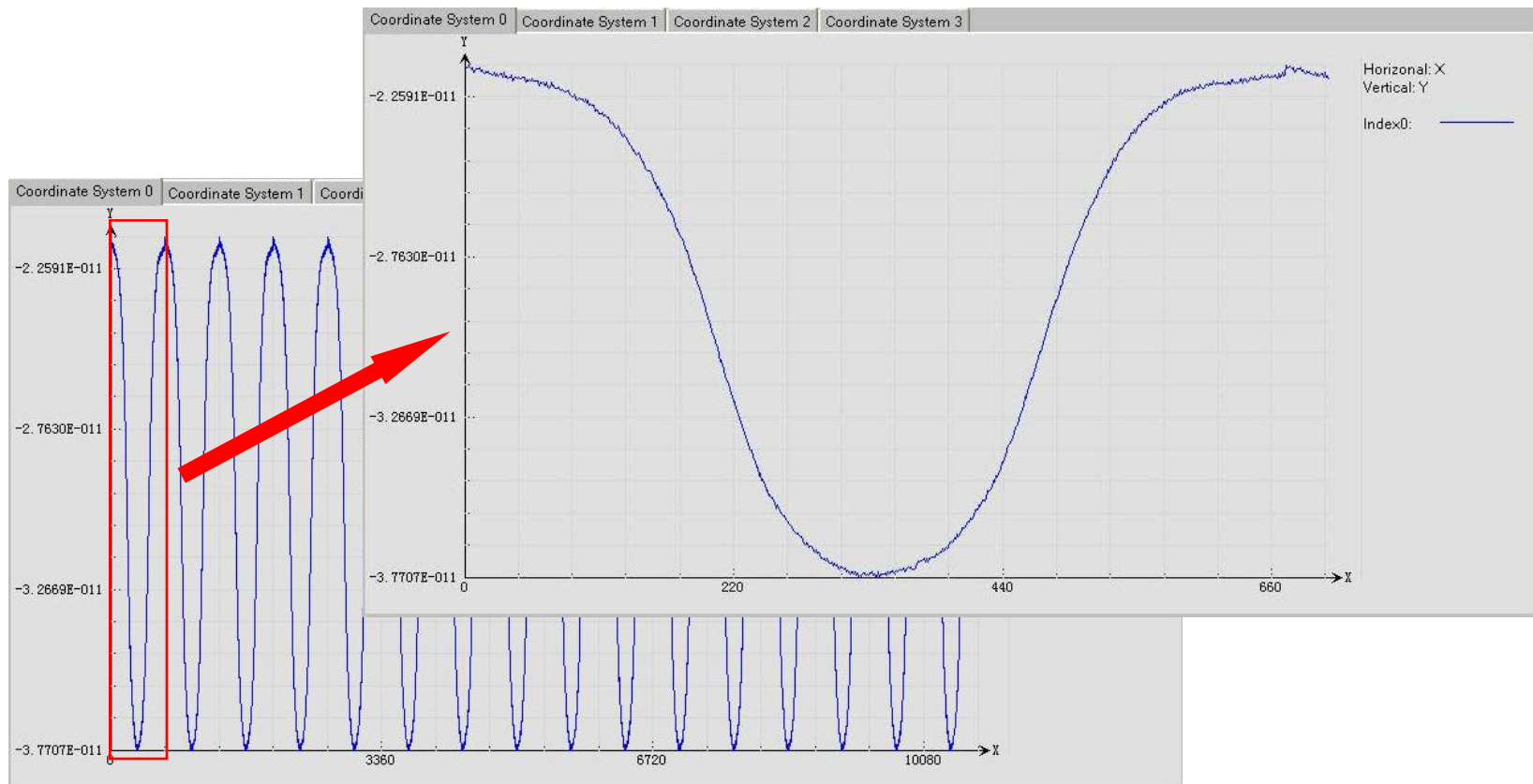
Beam Hardening Calibration
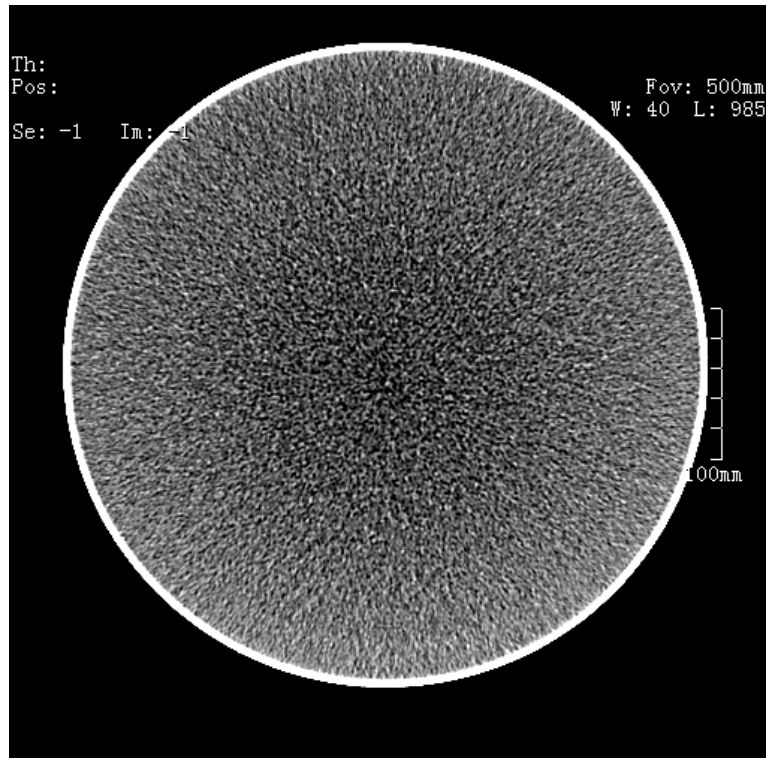
- Beam Hardening Calibration

+ Beam Hardening Calibration

HCOR Calibration

- Purpose: Normalize the CT number among different materials
- Phantom: 10 inch Phantom (on Combination Phantom)
- Key process: None
- Calibration result: Next page

HCOR Calibration

- Calibration result: Curve
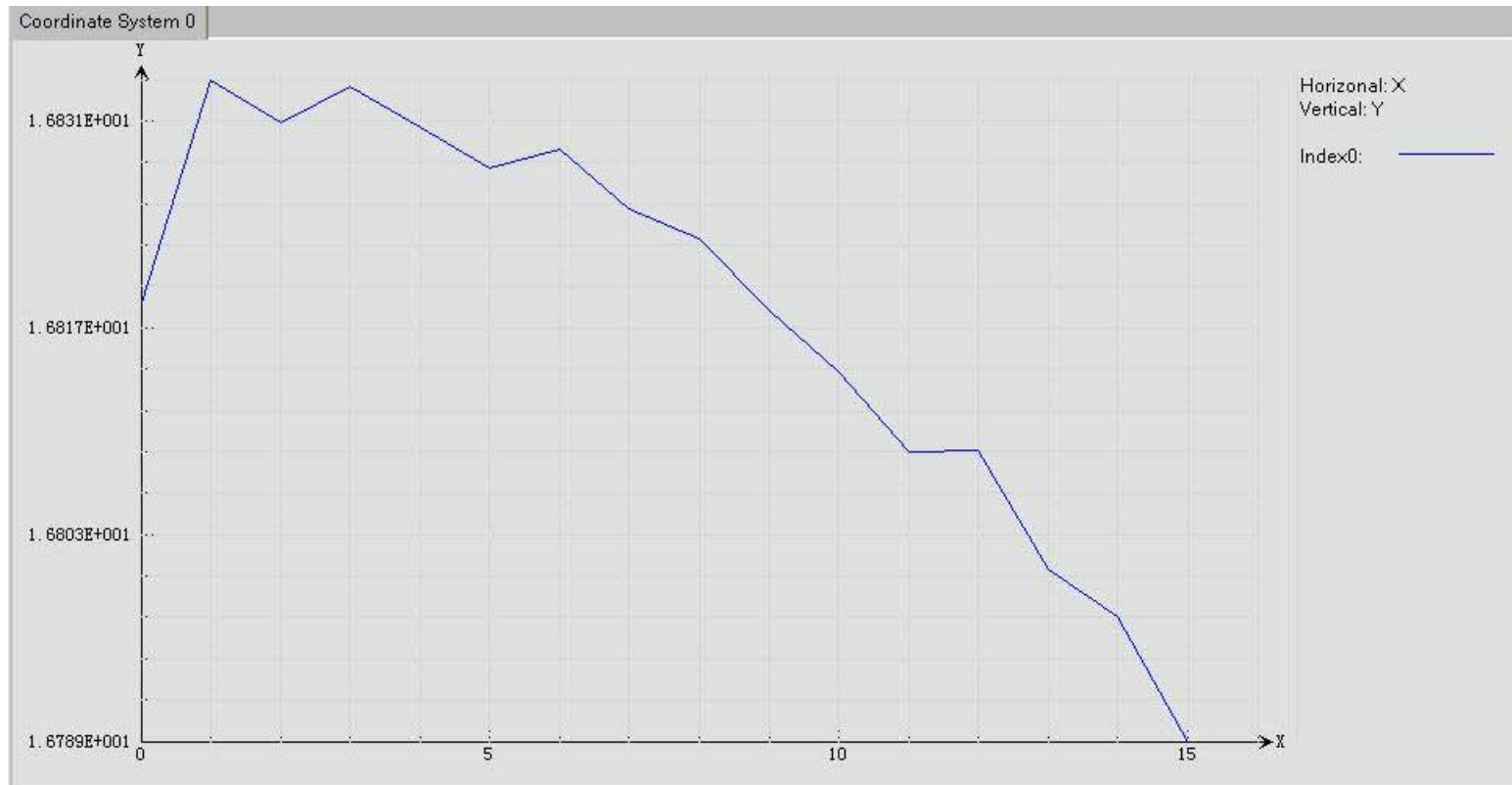
HCOR Calibration

- HCOR Calibration   + HCOR Calibration

Laser Marker Calibration

- Purpose: Adjust the laser marker
- Phantom: Combination Phantom
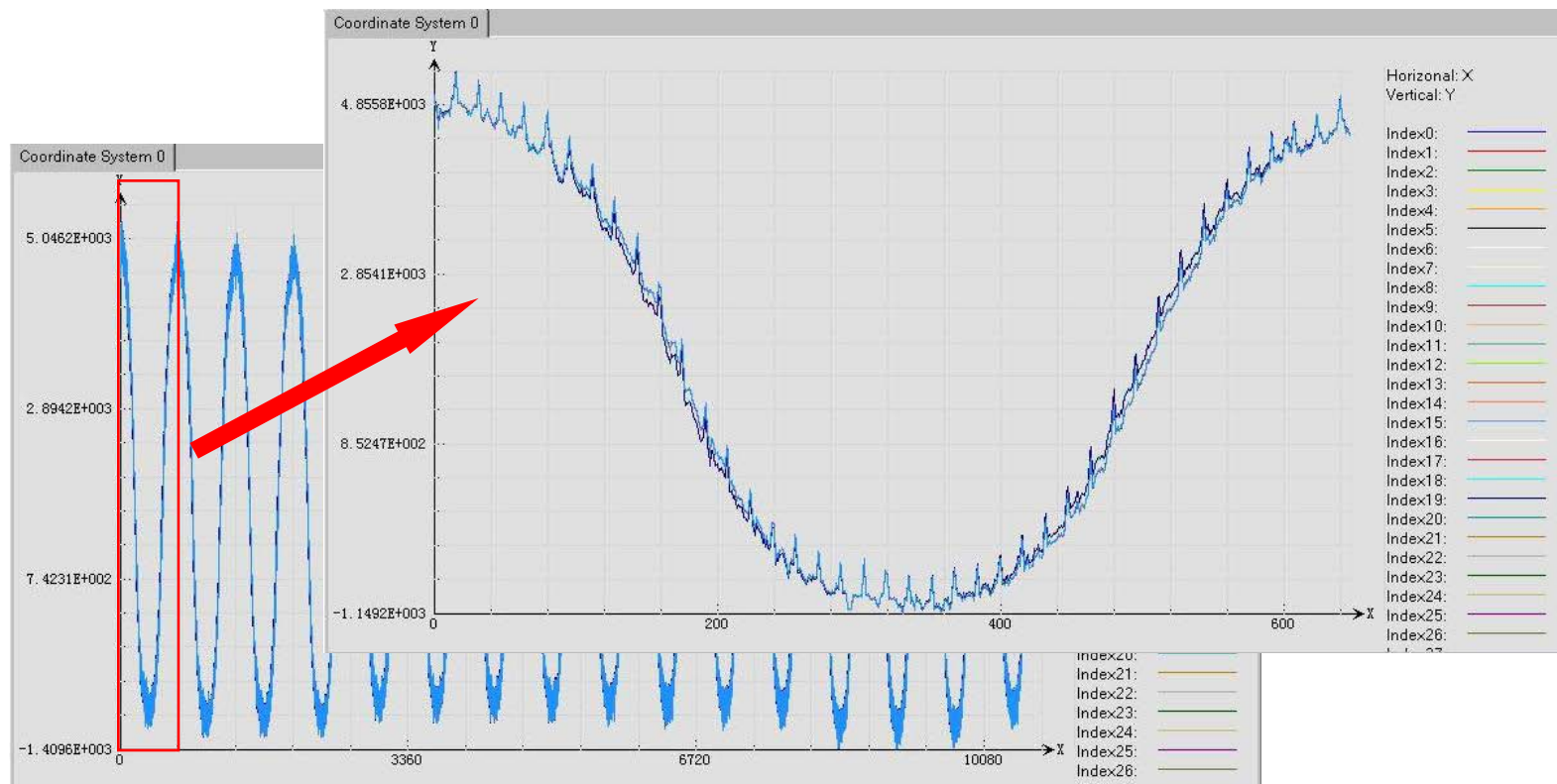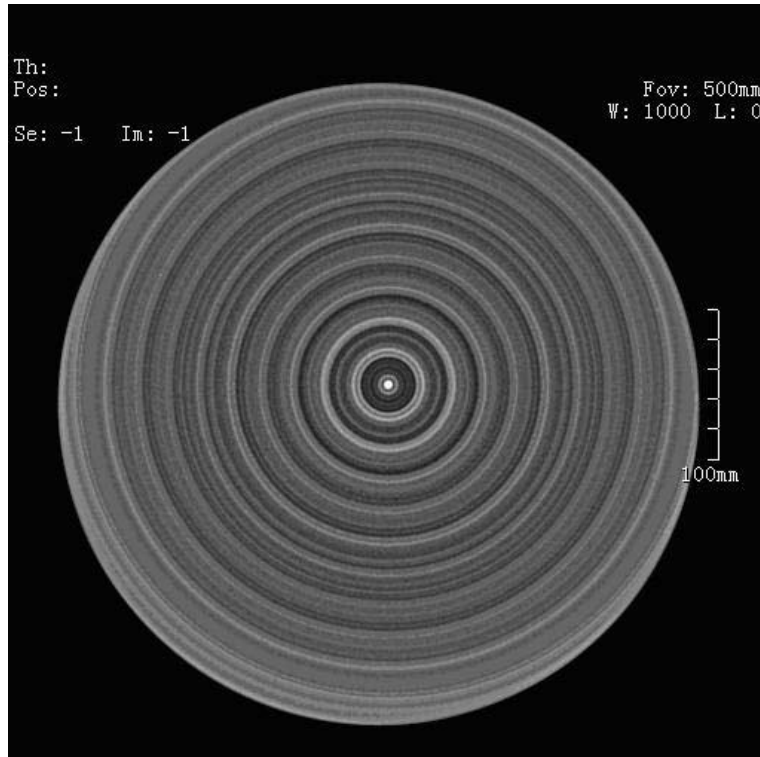- Key process: None
- Calibration result: None
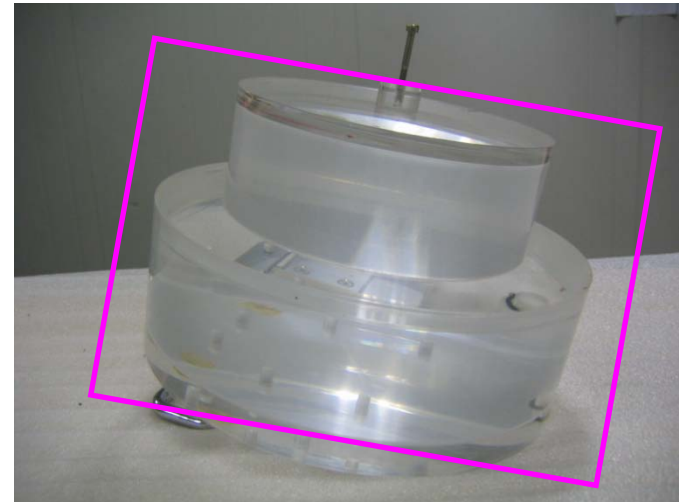
Air Calibration

- Purpose: Remove the influence of air on detectors
- Phantom: None
- Key process: None
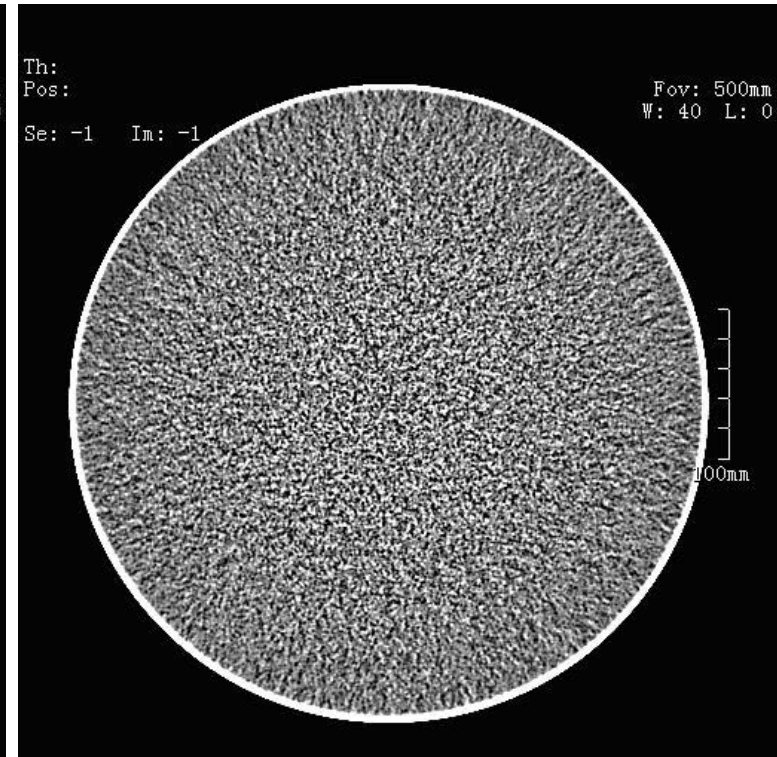- Calibration result: Next page

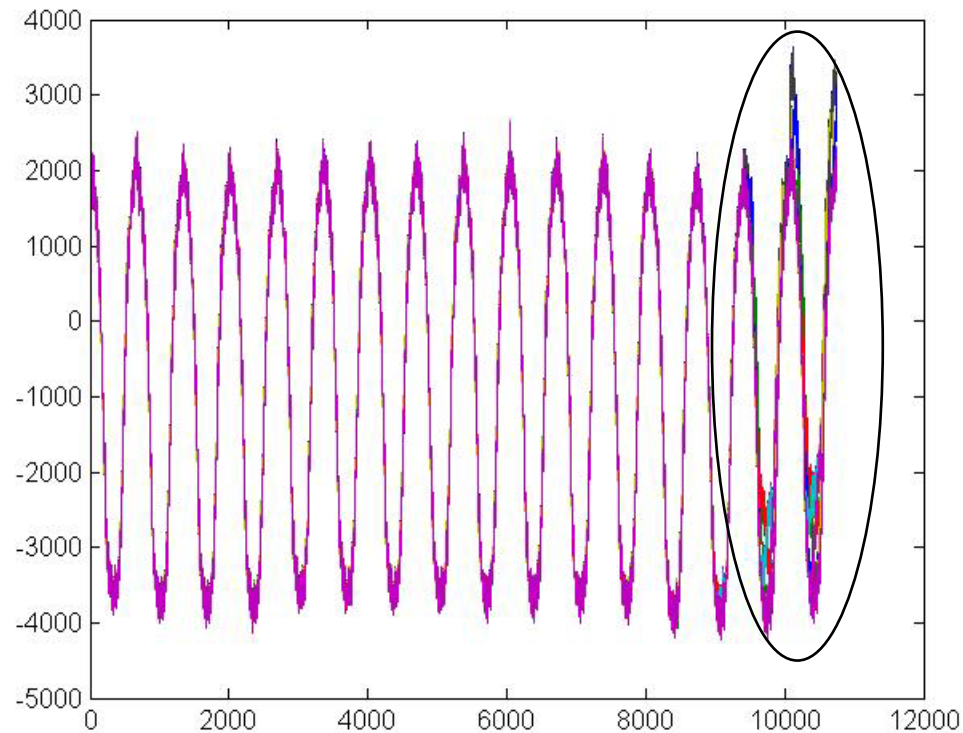# Air Calibration

- Calibration result: Curve

Air Calibration

- Air Calibration

+ Air Calibration

Notice

- The Mylar may block the X-Ray.

A bad air calibration example caused by the Mylar's blocking X-Ray