

ALSTON&BIRD LLP

TO: Eric T. Jameson
Georgia Department of Natural Resources
Radioactive Materials Program

FROM: Todd M. Hess
Attorney for Yokogawa Corporation of America

DATE: August 22, 2012

RE: Radiation Profiles for WG31B1 and WG41B1
A&B Matter No. 048546/387545

Dear Eric:

The purpose of this memorandum is to address the questions that were raised during our meeting of August 15, 2012, concerning the radiation profiles for the above-referenced beta-ray device.

Meaning of magnification factor. The magnification factor is what would be more appropriately termed a ratio between the radiation dose measured at 5 cm when the upper and lower sensor units are separated by a distance of 2 cm and the radiation dose measured at 5 cm when there is no separation between the upper and lower sensor units. We have revised the radiation profile tables to eliminate this value since the values can be compared by visual inspection.

The measured doses at 5 cm for the shutter open and the shutter closed position in the X-Y direction are the same. Due to an oversight, the profile data reported in the application for the SS&D certificate was data that had been symmetrically corrected. This data ensured substantially symmetrical curves, but in all cases was based upon the maximum measured dose for all symmetrical opposite positions in the curve were always based upon the larger of any opposing value. Additionally, to reflect a worst case exposure scenario, a corrected dose was always replaced with the higher of the corrected doses between the shutter open and the shutter closed position. (Please see attachment entitled "Correction of Measured Doses for Radiation Profile." The attachments entitled "Radiation Profile Corrected Data" provides the data reported in the application.) Thus, these series of corrections led to the reporting of exposure values that were the same in some cases.

To supplement the information available to the agency for assessment of this device, we have attached hereto the radiation profile that shows the measured data without correction. (Please see the series of sheets entitled "Radiation Profile Raw Data.")

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In some cases, the maximum dose at 5 cm is greater when the shutter is closed. In looking at the raw measurement data, there appear to be some cases in the X-Y plane when the reported measured doses are greater for the shutter closed position than those reported in the shutter open. In most cases, these differences are within the measurement error of the device used to measure the doses. Additionally, it is quite difficult to precisely match where the measurements are taken relative to the cross-section. Both of these factors lead to values that are not necessarily amenable to comparison. Notwithstanding this, there does seem to be some degree of increase in dose at the 5 cm in the X-Y plane when the shutter is closed. We note, however, that the trend is reversed at the 30 cm and the 100 cm positions.

Additionally, these differences may be due to the changed position of the direction of the beam between the shutter open and the shutter closed positions. For example, the dose measurements for the positions along the top portion of the device, as illustrated in the data shown for the <X-Z> and the <Y-Z> planes become markedly reduced. When the position of the beam shifts from being substantially vertical to the angular, shielded position the beam assumes in the shutter closed position. An increase of radiation dose proximate to the beam at the surface and 5 cm positions may sometimes be slightly higher. However, at positions further removed from the beam, for example at 30 cm and 100 cm, the scattering effect and effect of the shielding always leads to a significant reduction in measured dose.

cc: Nobuya Horiguchi-san

Enclosures

TMH:mrh

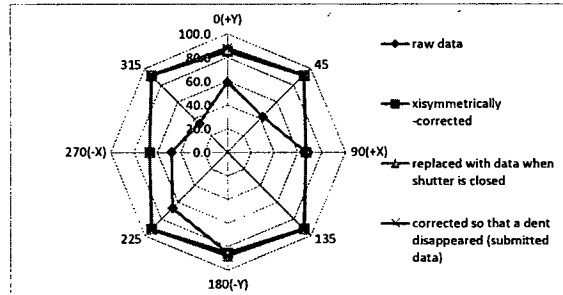
<X-Y Plane>

Shutter Open

Deep-dose equivalent [μ Sv/h]

Yellow : corrected

Angle from the positive Cross-Machine Direction (+Y Direction) [°]	process of correction			
	raw data	xisymmetrically-corrected	replaced with data when shutter is closed	corrected so that a dent disappeared (submitted data)
0(+Y)	59.4	85.2	87.8	87.8
45	42.8	91.8	92.3	92.3
90(+X)	66.7	66.7	66.7	66.7
135	91.8	91.8	92.3	92.3
180(-Y)	85.2	85.2	87.8	87.8
225	66.8	91.8	92.3	92.3
270(-X)	48.0	66.7	66.7	66.7
315	34.5	91.8	92.3	92.3

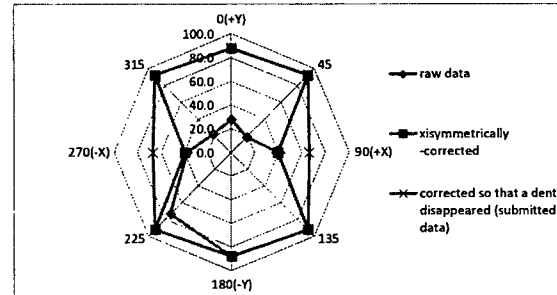


Shutter close

Deep-dose equivalent [μ Sv/h]

Yellow : corrected

Angle from the positive Cross-Machine Direction (+Y Direction) [°]	process of correction			
	raw data	xisymmetrically-corrected	replaced with data when shutter is closed	corrected so that a dent disappeared (submitted data)
0(+Y)	27.8	87.8	87.8	87.8
45	18.5	92.3	92.3	92.3
90(+X)	39.5	39.5	39.5	66.7
135	92.3	92.3	92.3	92.3
180(-Y)	87.8	87.8	87.8	87.8
225	73.5	92.3	92.3	92.3
270(-X)	37.9	39.5	39.5	66.7
315	21.8	92.3	92.3	92.3



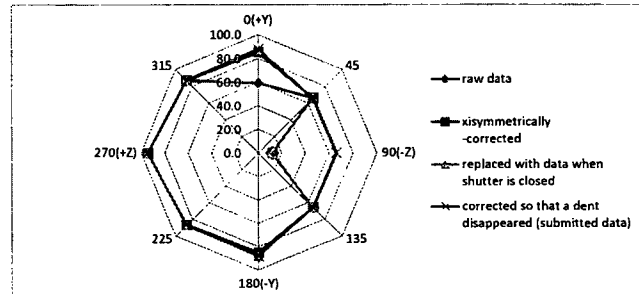
<Y-Z Plane>

Shutter Open

Deep-dose equivalent [μ Sv/h]

Yellow : corrected

Angle from the positive Cross-Machine Direction (+Y Direction) [°]	process of correction			
	raw data	xisymmetrically-corrected	replaced with data when shutter is closed	corrected so that a dent disappeared (submitted data)
0(+Y)	59.4	85.2	87.8	87.8
45	66.0	66.0	66.0	66.0
90(-Z)	12.0	12.0	12.0	66.0
135	66.0	66.0	66.0	66.0
180(-Y)	85.2	85.2	87.8	87.8
225	87.0	87.0	87.0	87.0
270(+Z)	94.5	94.5	94.5	94.5
315	87.0	87.0	87.0	87.0

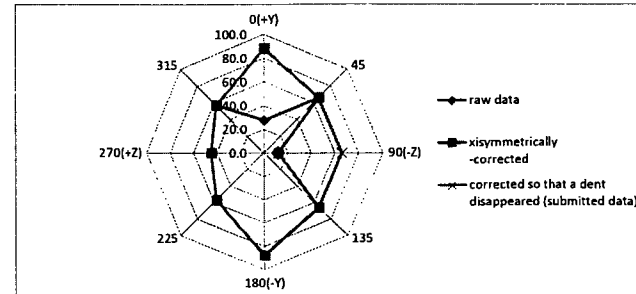


Shutter close

Deep-dose equivalent [μ Sv/h]

Yellow : corrected

Angle from the positive Cross-Machine Direction (+Y Direction) [°]	process of correction			
	raw data	xisymmetrically-corrected	replaced with data when shutter is closed	corrected so that a dent disappeared (submitted data)
0(+Y)	27.8	87.8	87.8	87.8
45	66.0	66.0	66.0	66.0
90(+X)	12.0	12.0	12.0	66.0
135	66.0	66.0	66.0	66.0
180(-Y)	87.8	87.8	87.8	87.8
225	57.0	57.0	57.0	57.0
270(-X)	45.0	45.0	45.0	45.0
315	57.0	57.0	57.0	57.0



<X-Y Plane>

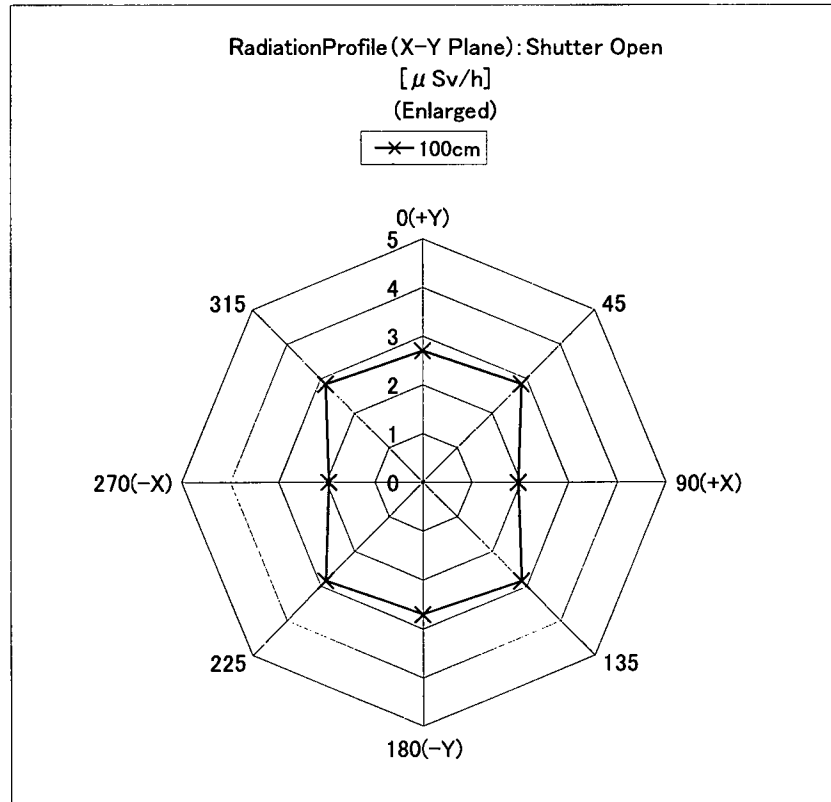
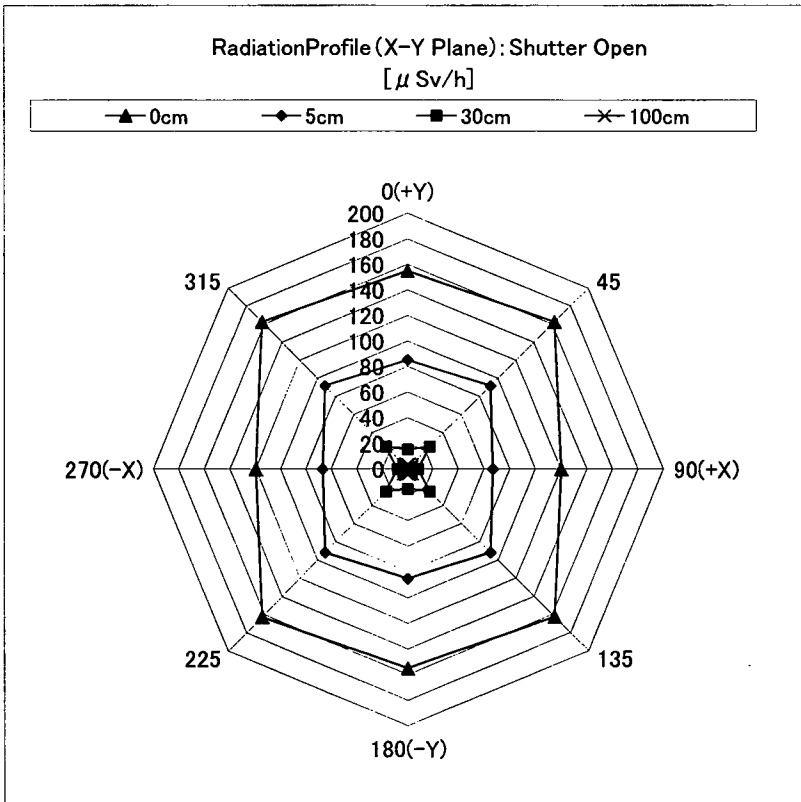
Shutter Open

Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-Machine Direction (+Y)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	154.9	85.2	15.3	2.7
45	162.6	91.8	24.8	2.9
90(+X)	120.1	66.7	8.3	2.0
135	162.6	91.8	24.8	2.9
180(-Y)	154.9	85.2	15.3	2.7
225	162.6	91.8	24.8	2.9
270(-X)	120.1	66.7	8.3	2.0
315	162.6	91.8	24.8	2.9

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm
96.0
109.5
80.0
109.5
96.0
109.5
80.0
109.5



<X-Y Plane>

Shutter Closed

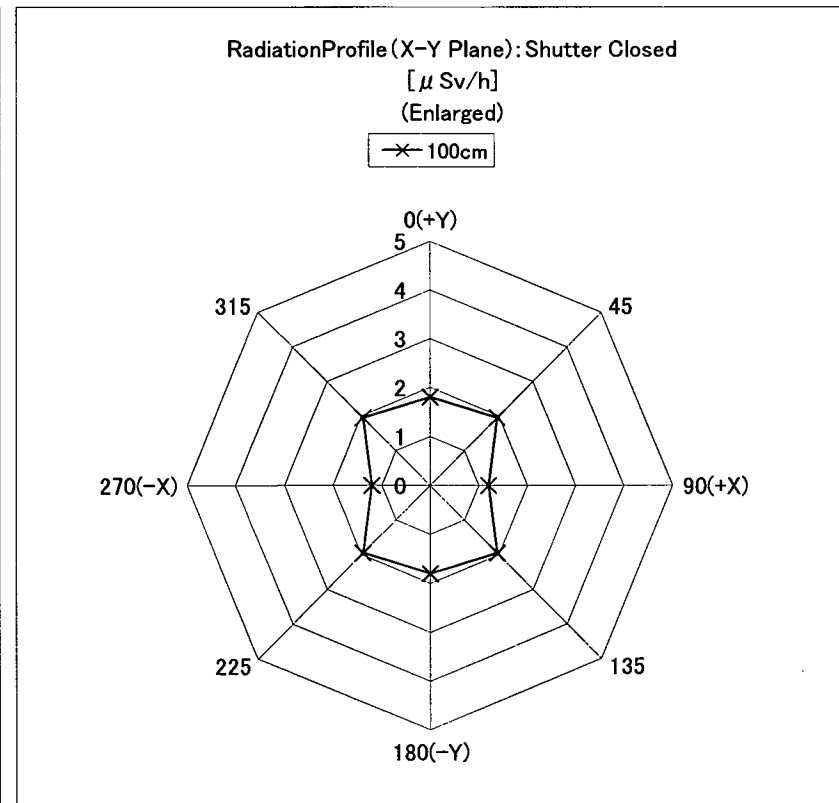
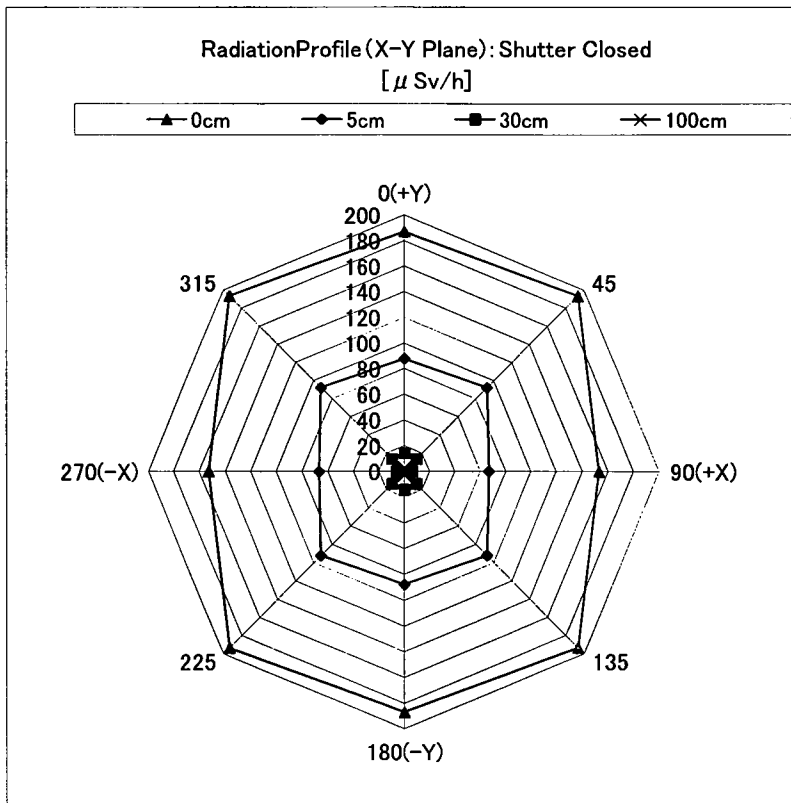
Deep-dose equivalent [$\mu\text{Sv/h}$]

Angle from the positive Cross-	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	186.9	87.8	14.1	1.8
45	193.4	92.3	13.8	2.0
90(+X)	152.9	66.7	6.3	1.2
135	193.4	92.3	13.8	2.0
180(-Y)	186.9	87.8	14.1	1.8
225	193.4	92.3	13.8	2.0
270(-X)	152.9	66.7	6.3	1.2
315	193.4	92.3	13.8	2.0

2cm Miss alignment of Upper sensor head and Lower sensor head

Deep-dose equivalent [$\mu\text{Sv/h}$]

5cm
95.1
111.7
93.3
111.7
95.1
111.7
93.3
111.7



<Y-Z Plane>

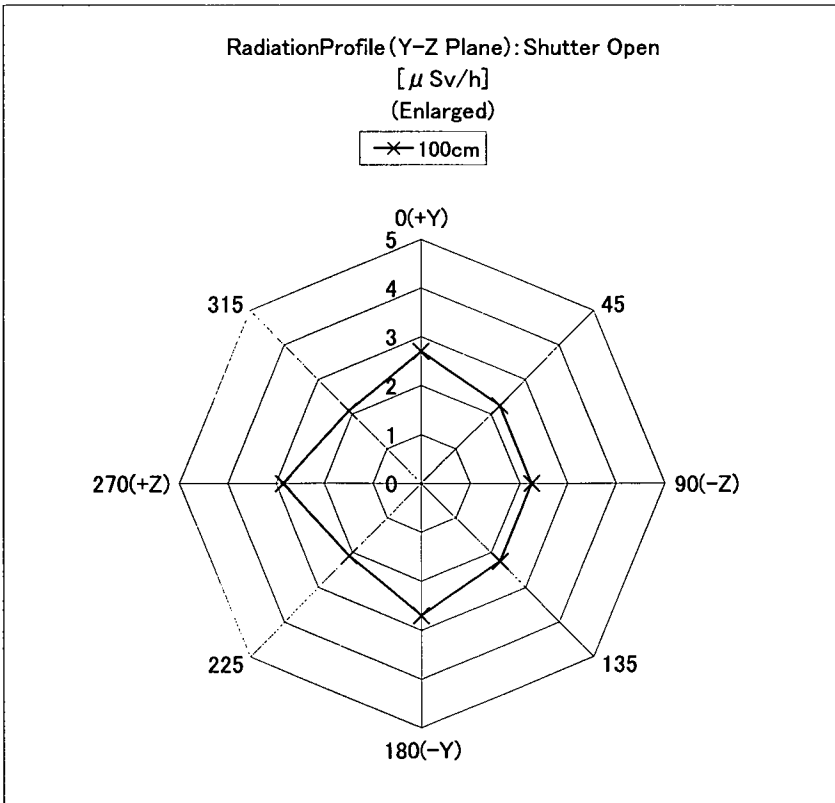
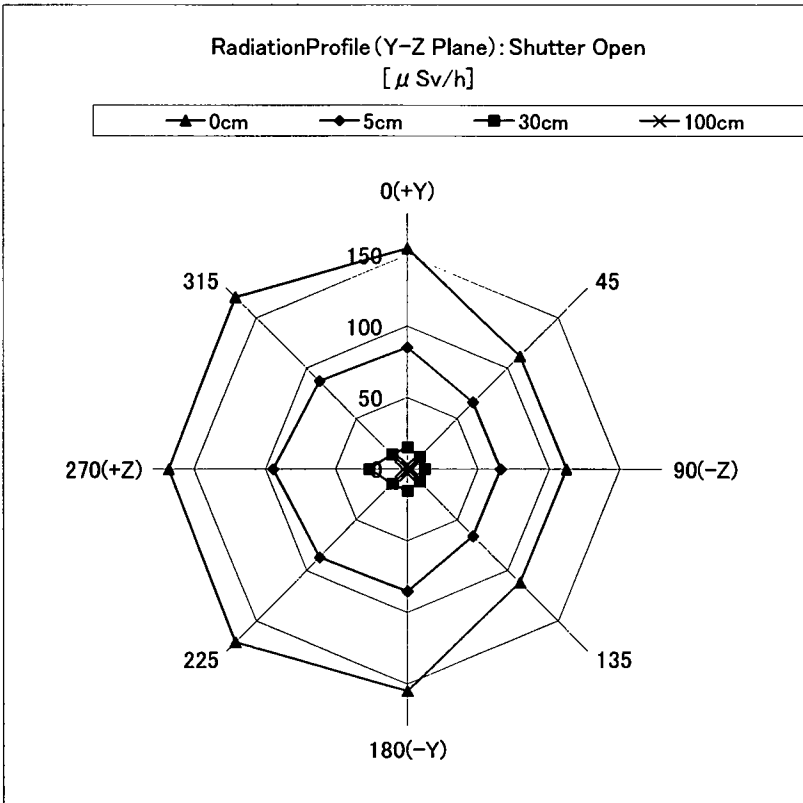
Shutter Open

Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-Machine Direction (+Y)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	154.9	85.2	15.3	2.7
45	112.0	66.0	12.0	2.3
90(-Z)	112.0	66.0	12.0	2.3
135	112.0	66.0	12.0	2.3
180(-Y)	154.9	85.2	15.3	2.7
225	170.7	87.0	14.6	2.1
270(+Z)	168.2	94.5	26.3	2.9
315	170.7	87.0	14.6	2.1

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm
96.0
85.8
72.9
85.8
96.0
105.2
97.3
105.2



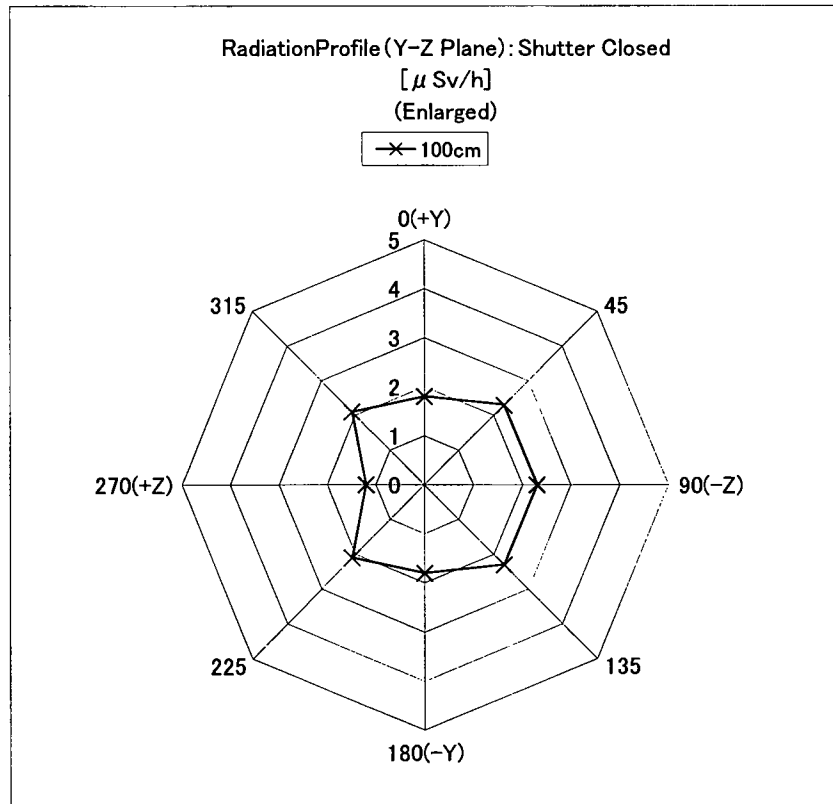
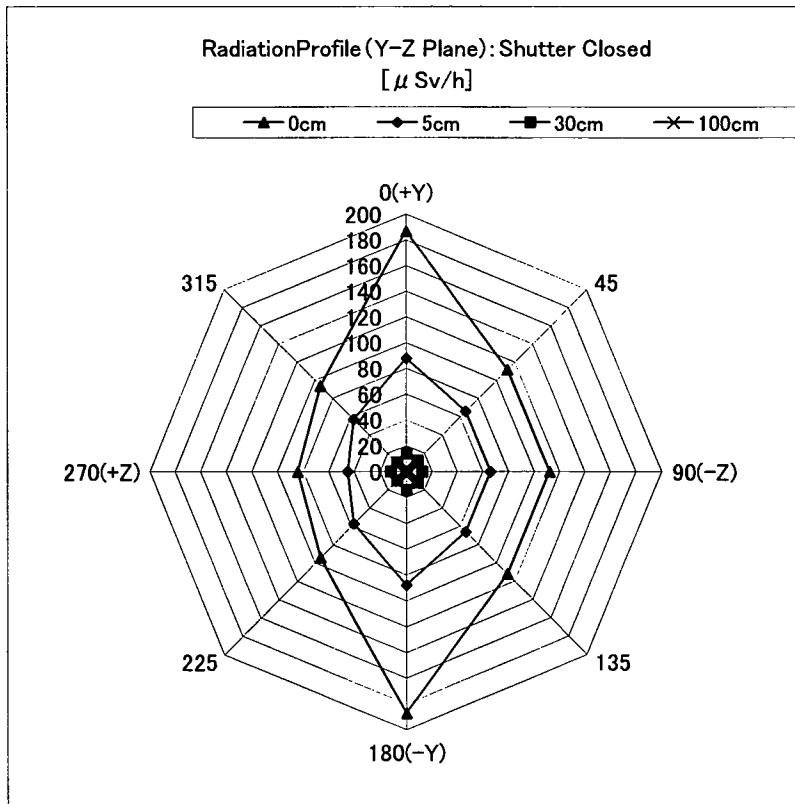
<Y-Z Plane>
Shutter Closed

Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	186.9	87.8	14.1	1.8
45	112.0	66.0	12.0	2.3
90(-Z)	112.0	66.0	12.0	2.3
135	112.0	66.0	12.0	2.3
180(-Y)	186.9	87.8	14.1	1.8
225	94.1	57.0	10.2	2.1
270(+Z)	84.4	45.0	12.0	1.2
315	94.1	57.0	10.2	2.1

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm	95.1
	81.2
	70.1
	81.2
	95.1
	67.6
	46.8
	67.6



<X-Z Plane>

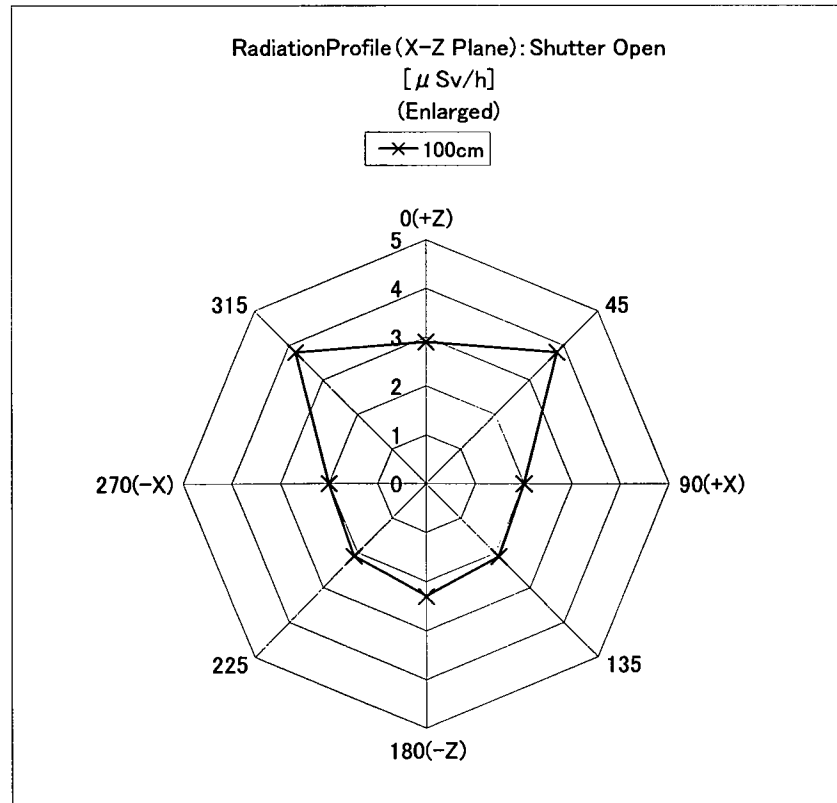
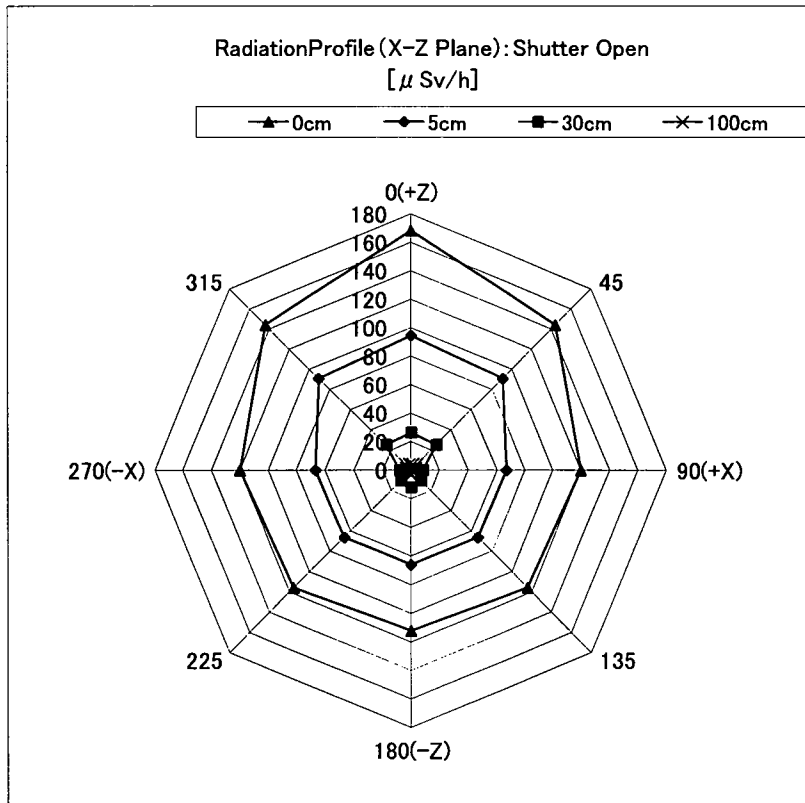
Shutter Open

Deep-dose equivalent[μ Sv/h]

Angle from the positive Vertical Direction (+Z Direction)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Z)	168.2	94.5	26.3	2.9
45	144.1	90.8	25.2	3.8
90(+X)	120.1	66.7	8.3	2.0
135	115.8	66.3	10.1	2.1
180(-Z)	112.0	66.0	12.0	2.3
225	115.8	66.3	10.1	2.1
270(-X)	120.1	66.7	8.3	2.0
315	144.1	90.8	25.2	3.8

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent[μ Sv/h]

5cm	97.3
	103.7
	80.0
	94.0
	72.9
	94.0
	80.0
	103.7



<X-Z Plane>

Shutter Closed

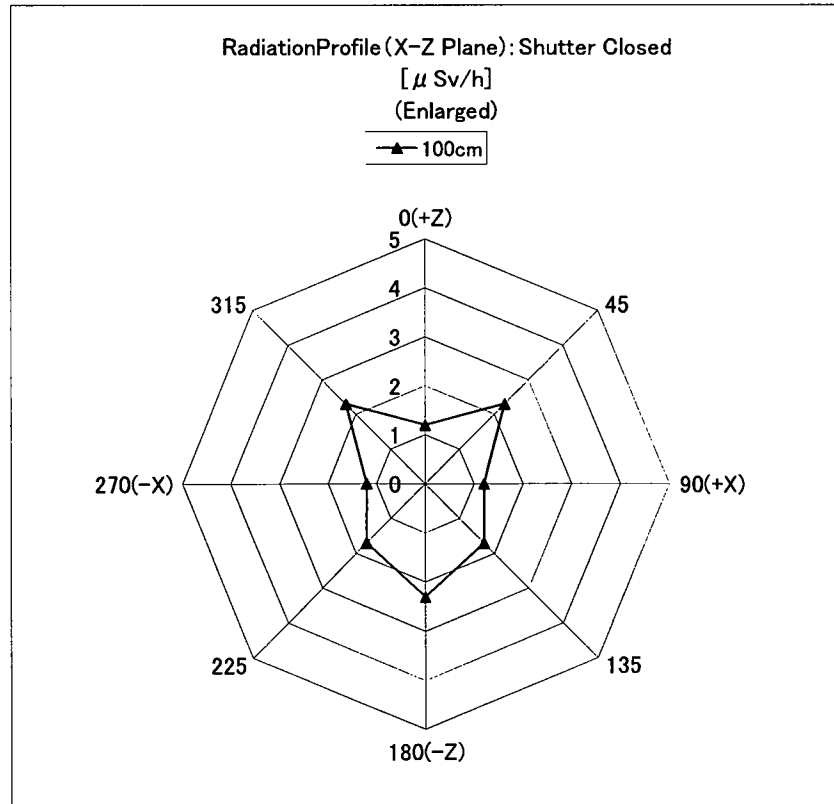
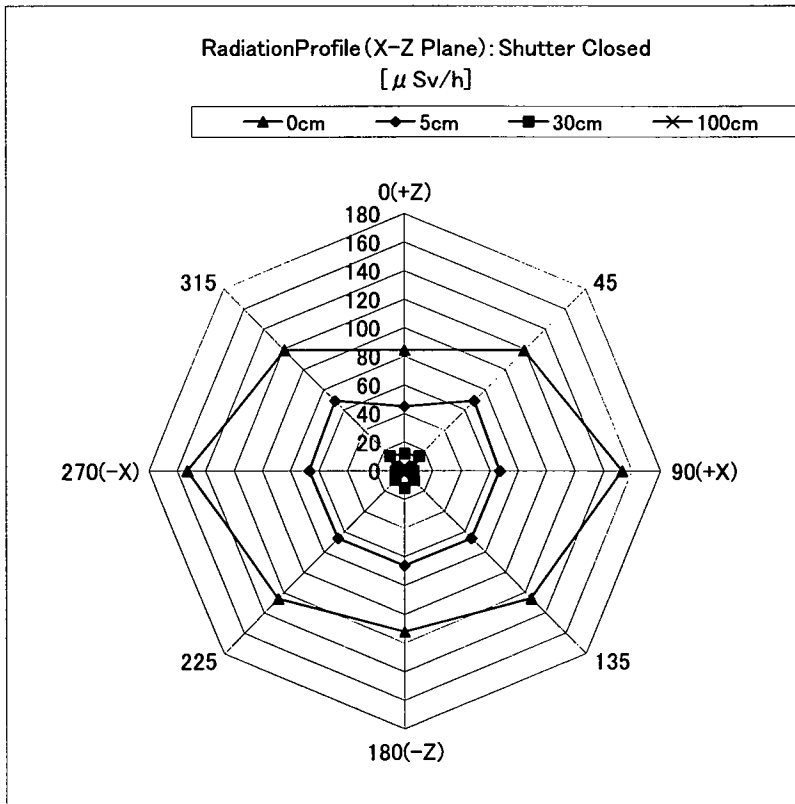
Deep-dose equivalent [$\mu\text{Sv/h}$]

Angle from the positive Vertical	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Z)	84.4	45.0	12.0	1.2
45	119.1	69.0	14.6	2.3
90(+X)	152.9	66.7	6.3	1.2
135	125.8	66.3	9.2	1.7
180(-Z)	112.0	66.0	12.0	2.3
225	125.8	66.3	9.2	1.7
270(-X)	152.9	66.7	6.3	1.2
315	119.1	69.0	14.6	2.3

2cm Miss alignment of Upper sensor head and Lower sensor head

Deep-dose equivalent [$\mu\text{Sv/h}$]

5cm
46.8
80.9
93.3
71.0
70.1
71.0
93.3
80.9



<X-Y Plane>

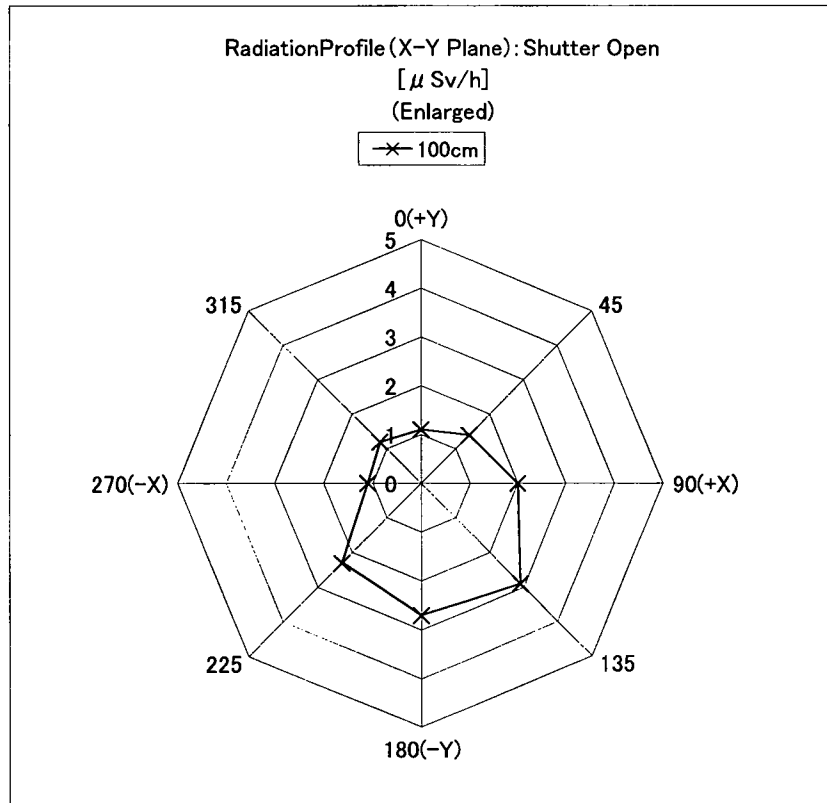
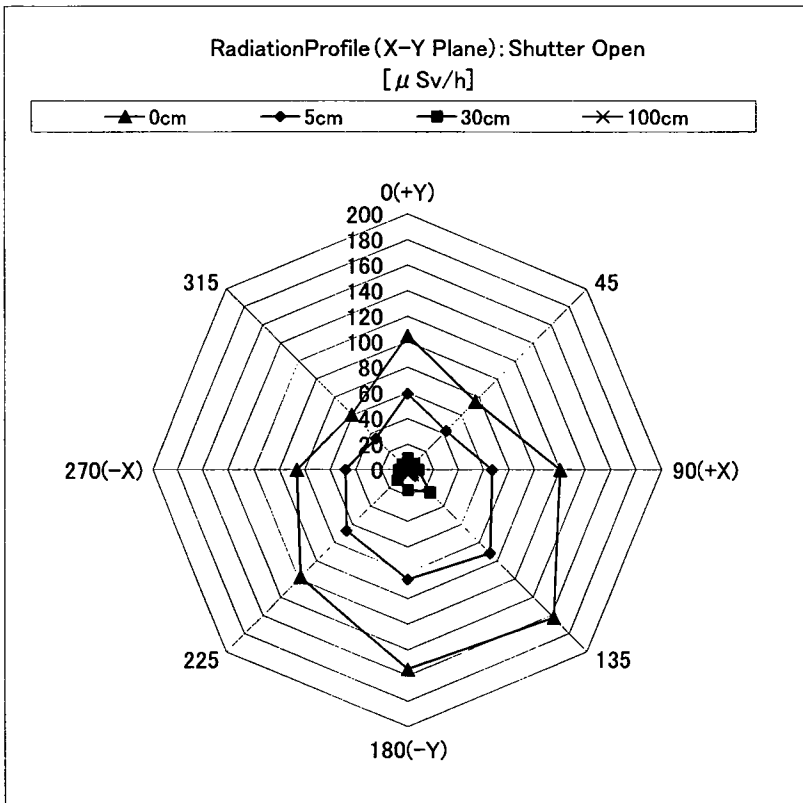
Shutter Open

Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-Machine Direction (+Y)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	104.9	59.4	9.3	1.1
45	75.4	42.8	7.1	1.4
90(+X)	120.1	66.7	8.3	2.0
135	162.6	91.8	24.8	2.9
180(-Y)	154.9	85.2	15.3	2.7
225	117.8	66.8	11.1	2.3
270(-X)	86.5	48.0	6.8	1.1
315	60.8	34.5	6.2	1.2

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm
96.0
44.5
72.4
95.0
96.0
66.8
80.0
109.5



<X-Y Plane>

Shutter Closed

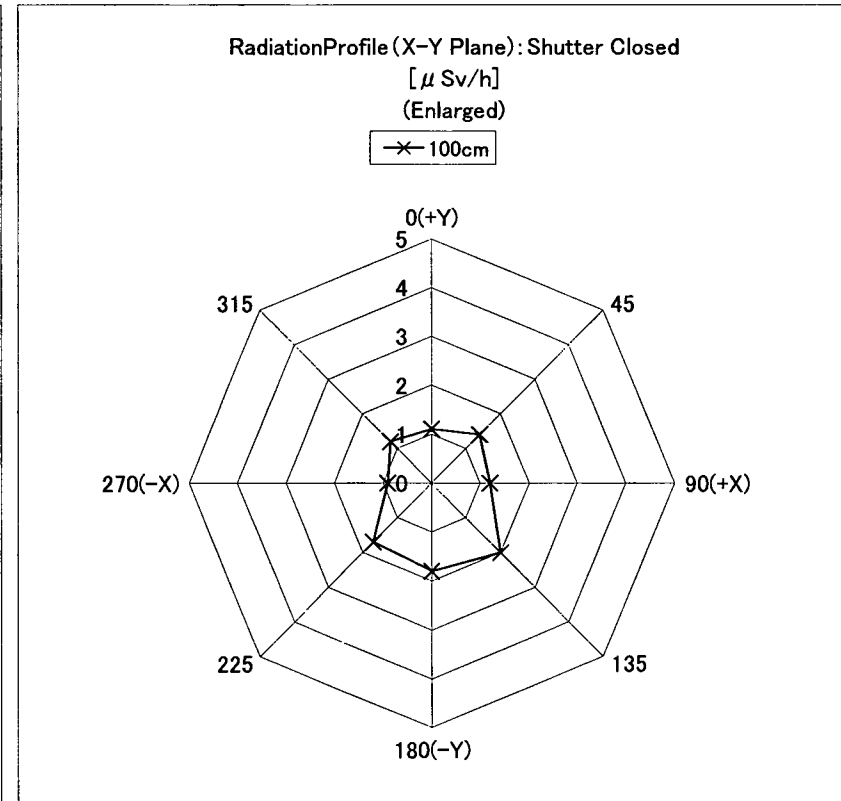
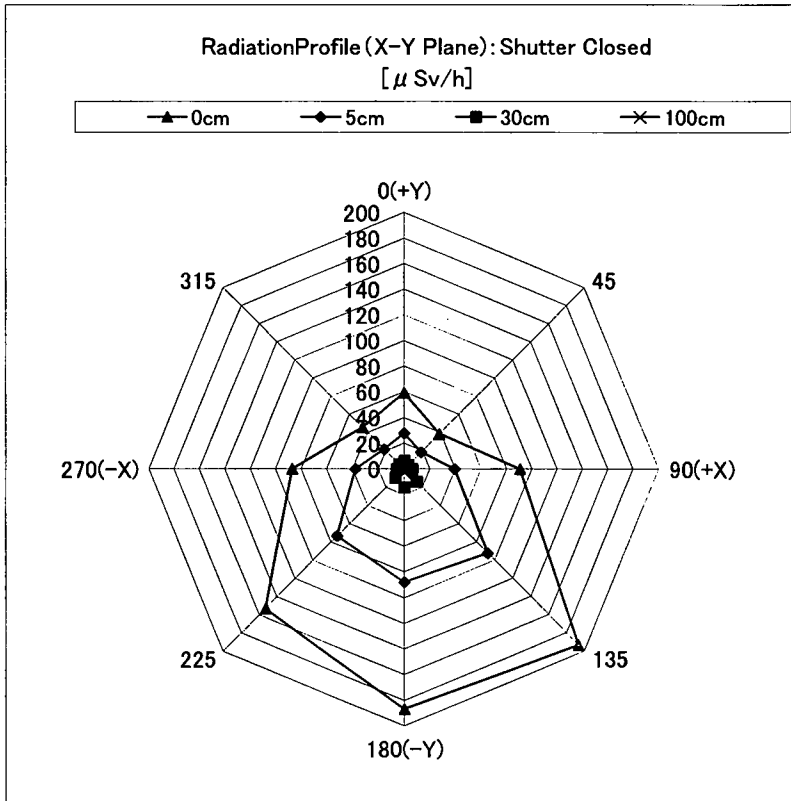
Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	59.2	27.8	6.6	1.1
45	38.8	18.5	4.1	1.4
90(+X)	90.6	39.5	6.3	1.2
135	193.4	92.3	13.8	2.0
180(-Y)	186.9	87.8	14.1	1.8
225	152.9	73.5	9.5	1.7
270(-X)	86.9	37.9	6.0	0.9
315	45.7	21.8	5.4	1.2

2cm Miss alignment of Upper sensor head and Lower sensor head

Deep-dose equivalent [μ Sv/h]

5cm
95.1
111.7
55.3
111.7
94.8
111.7
93.3
26.4



<Y-Z Plane>

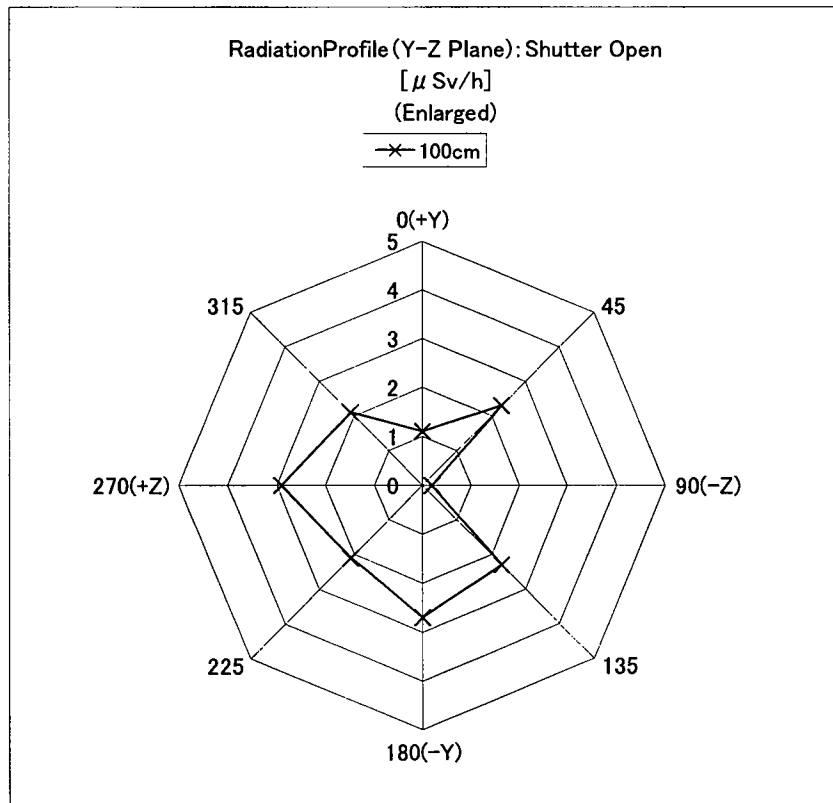
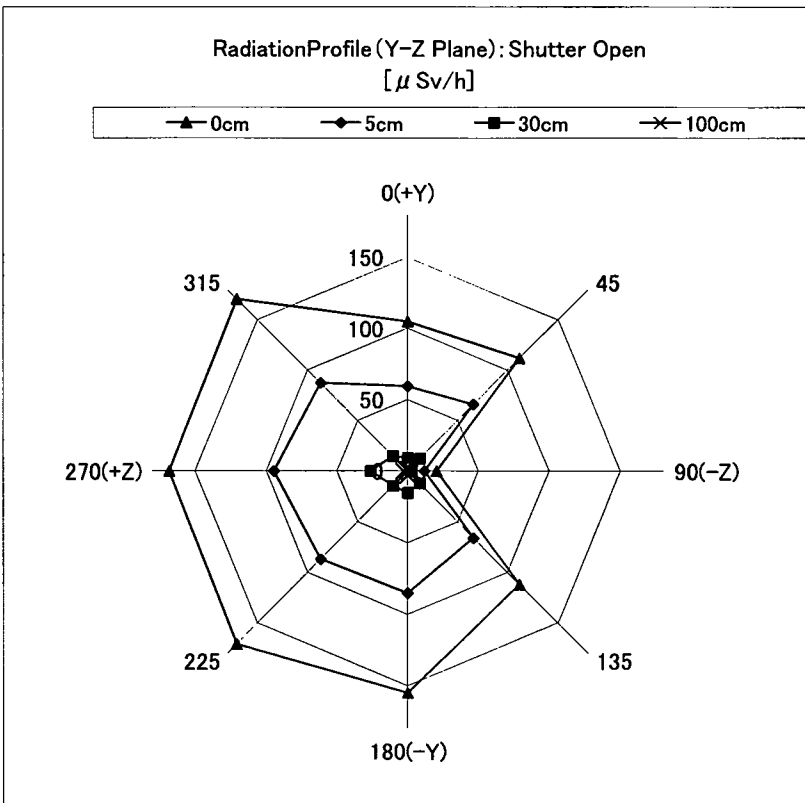
Shutter Open

Deep-dose equivalent [μ Sv/h]

Angle from the positive Cross-Machine Direction (+Y)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	104.9	59.4	9.3	1.1
45	112.0	66.0	12.0	2.3
90(-Z)	20.4	12.0	2.7	0.2
135	112.0	66.0	12.0	2.3
180(-Y)	154.9	85.2	15.3	2.7
225	170.7	87.0	14.6	2.1
270(+Z)	168.2	94.5	26.3	2.9
315	170.7	87.0	14.6	2.1

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm
61.2
75.1
72.9
85.8
96.0
105.2
97.3
105.2



<Y-Z Plane>

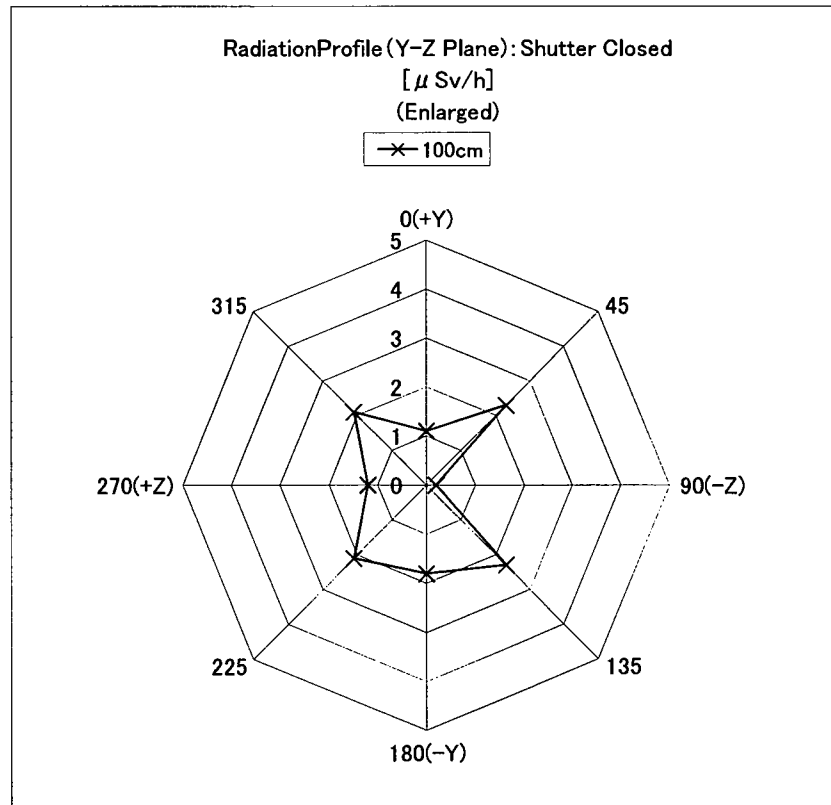
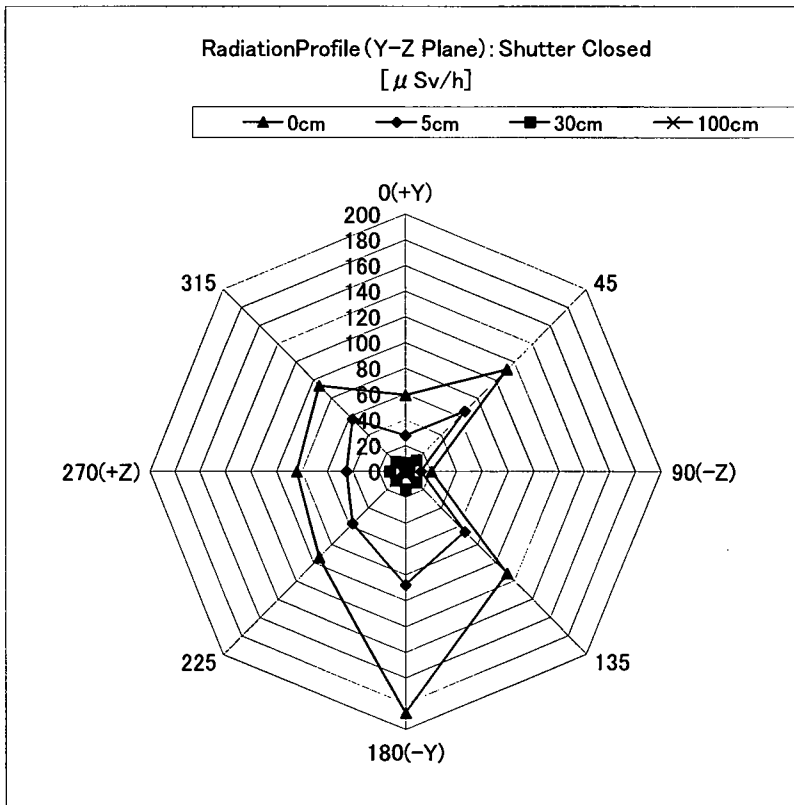
Shutter Closed

Deep-dose equivalent[μ Sv/h]

Angle from the positive Cross-	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Y)	59.2	27.8	6.6	1.1
45	112.0	66.0	12.0	2.3
90(-Z)	20.4	12.0	2.7	0.2
135	112.0	66.0	12.0	2.3
180(-Y)	186.9	87.8	14.1	1.8
225	94.1	57.0	10.2	2.1
270(+Z)	84.4	45.0	12.0	1.2
315	94.1	57.0	10.2	2.1

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent[μ Sv/h]

5cm
28.9
78.3
70.1
81.2
95.1
57.0
46.8
67.6



<X-Z Plane>

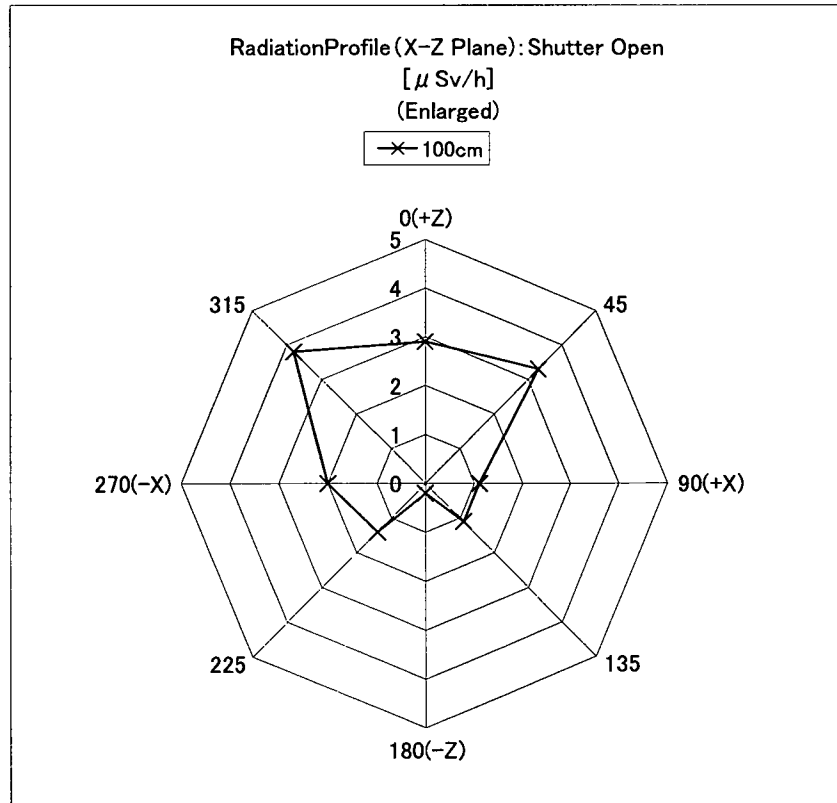
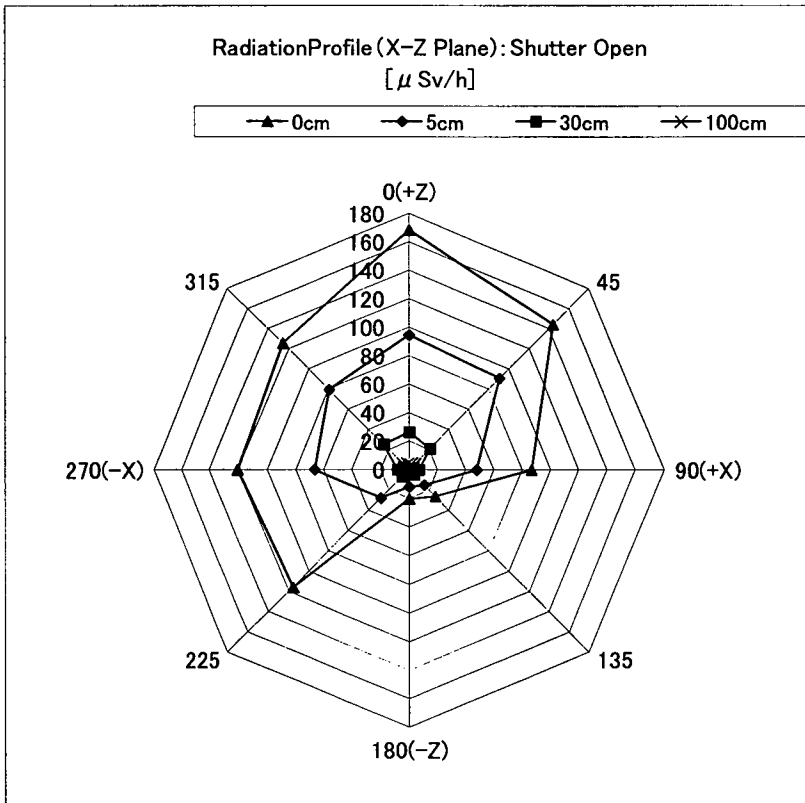
Shutter Open

Deep-dose equivalent [μ Sv/h]

Angle from the positive Vertical Direction (+Z Direction)	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Z)	168.2	94.5	26.3	2.9
45	144.1	90.8	20.7	3.3
90(+X)	86.5	48.0	6.8	1.1
135	26.2	15.0	4.8	1.1
180(-Z)	20.4	12.0	2.7	0.2
225	115.8	27.8	6.8	1.4
270(-X)	120.1	66.7	8.3	2.0
315	125.7	79.2	25.2	3.8

2cm Miss alignment of Upper sensor head and Lower sensor head
Deep-dose equivalent [μ Sv/h]

5cm
97.3
103.7
52.1
16.6
72.9
94.0
80.0
81.0



<X-Z Plane>

Shutter Closed

Deep-dose equivalent [$\mu\text{Sv/h}$]

Angle from the positive Vertical	Distance from the surface			
	0cm	5cm	30cm	100cm
0(+Z)	84.4	45.0	12.0	1.2
45	119.1	69.0	14.6	2.3
90(+X)	86.9	37.9	6.0	0.9
135	28.4	15.0	4.1	1.1
180(-Z)	20.4	12.0	2.7	0.2
225	125.8	19.5	5.3	0.8
270(-X)	152.9	39.5	6.3	1.2
315	62.1	36.0	12.3	2.0

2cm Miss alignment of Upper sensor head and Lower sensor head

Deep-dose equivalent [$\mu\text{Sv/h}$]

5cm
46.8
75.5
42.1
71.0
70.1
19.5
93.3
80.9

