KaVo Kerr Group

OP300 Maxio

Scatter radiation

CHANGE HISTORY:

REV.	*AUTHOR*	*DATE*	*DESCRIPTION*
1	*Pasi Turusenaho*	*15.8.2014*	*Initial revision*
2	*Jarkko Aivelo*	*28.1.2016*	*Added calculated 13x15 program values.*

AUTHOR:

28.1.2016

Jarkko Aivelo

APPROVED BY:

Jarmo Suni

This document consists of the scatter radiation test results for OP300 Maxio system. Because of identical operation of the x-ray generator unit on these systems, the results from platform test unit can be considered valid for all these systems.

1. TEST ARRANGEMENTS

Device under test: OP300 Maxio unit SN: IE1402320

Test Instruments:

Radcal, X-ray monitor model 9015, S/N: 91-1160

Sensors: 10x5-6, S/N 17580, 10x5-180, S/N 18682

VacuTec, DAP –meter VacuDAP 2000, 157 00 85

Tested by:	P Turusenaho	7.8.2014 (Panoramic)
	J Vuorijärvi	10.3.2011 (Cephalometric)
	P Turusenaho	15.8.2014 (3D, DAP)

The scatter radiation was measured around the anthropomorphic skull phantom with the test instrument 10x5-180 chamber. Measurements were performed with adult panoramic program, cephalometric full lateral program and FOV size 5x5, 6x8, 8x8 and 8x15 of 3D programs. The height of the test instrument was altered to define the maximum scatter radiation direction.

The measurements in panoramic program were performed with the normal movements of panoramic programs. Exposure values were 90kV, 13mA and 16 sec. Reference measurement was measured first just in front of the beam source to define the maximum radiation level hitting the skull.

The measurements in cephalometric program were performed with the normal movements of ceph programs. Exposure values were 90kV, 13mA and 10 sec. Reference measurement was measured first just in front of the skull to define the radiation hitting the skull.

The measurements in 3D programs were performed with the normal movements of 3D programs. Exposure values were 90kV, 13mA and 2,3 sec (standard resolution with max. exposure values) with FOV sizes 5x5, 6x8 and 8x8. 90kV, 10mA, 4,5s for 8x15 FOV size.

Values for the 13x15 table were calculated from 8x15 measurements, since 13x15 program consists effectively of two 8x15 scans.

DAP (Dose-Area Product) was measured from the front of the tube head.

Scatter radiation is calculated for workload of 10 and 50 scans per week.

In this document, unit Roentgen is used with definition of 1 C/kg = 3876 R.

2. SCATTER IN PANORAMIC PROGRAM

Exposure values 90kV, 13mA,16sec were used. Measured DAP was 292mGycm²

Test instrument was placed at 100 cm distance from the skull to measure the scattered radiation. The maximum radiation was found at 225˚, -15cm below the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level:

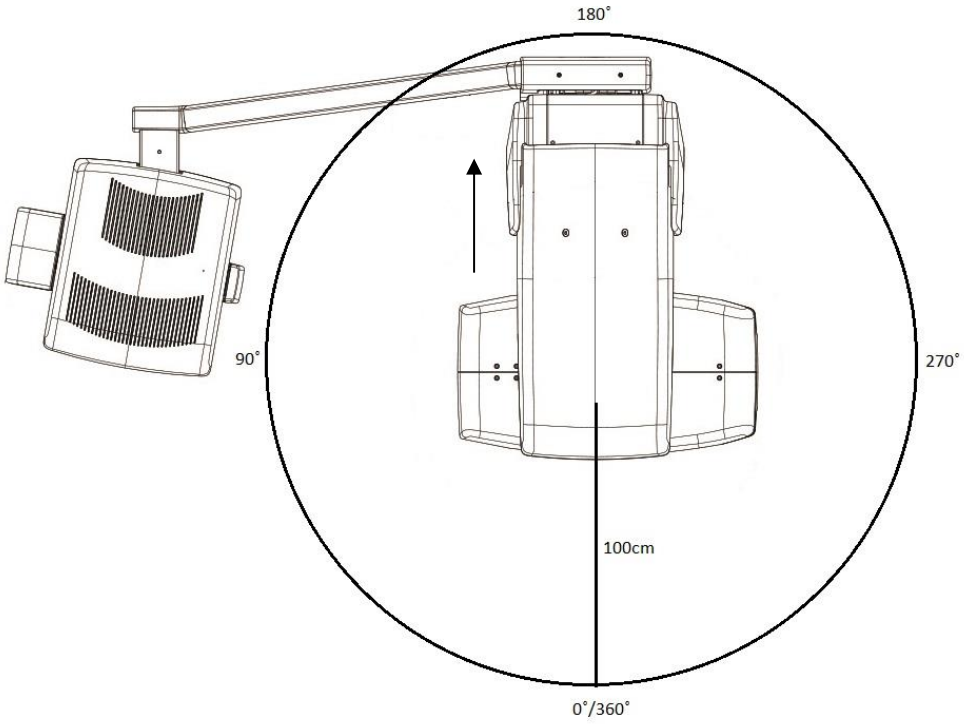
Angle	Dose - µR/16s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	93,6	0,936	4,68
45˚	111,2	1,112	5,56
90˚	101,4	1,014	5,07
135˚	113,2	1,132	5,66
180˚	6,5	0,065	0,325
225˚	114,5	1,145	5,725
270˚	130,8	1,308	6,54
315˚	113,3	1,133	5,665

0 -level +15cm:

Angle	Dose - µR/16s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	80,7	0,807	4,035
45˚	93,7	0,937	4,685
90˚	103,5	1,035	5,175
135˚	101,5	1,015	5,075
180˚	5,9	0,059	0,295
225˚	113,2	1,132	5,66
270˚	101,5	1,015	5,075
315˚	93,7	0,937	4,685

0 -level -15cm:

Angle	Dose - µR/16s	10 scans/wk mR/wk	50 scans/wk mR/wk
45˚	127,2	1,272	6,36
90˚	100,7	1,007	5,035
135˚	108,5	1,085	5,425
180˚	7,8	0,078	0,39
225˚	146,6	1,466	7,33
270˚	103,5	1,035	5,175
315˚	131,9	1,319	6,595



Picture 1. Measurement procedure of the panoramic program.

3. SCATTER RADIATION IN CEPH PROGRAM

Ceph head was in ceph-PIO position (beam hitting the secondary collimator, ear posts and image sensor). DAP at technique factors 90kV, 13mA, 10sec was measured to be 53mGycm^2.

Scatter radiation was measured during the scanning of the ceph head. Full lateral ceph images were taken with 90kV, 13mA, 10sec scanning/exposure time and scatter radiation was measured at 50 cm distance from the head. The maximum radiation was found at 270˚, +15cm above the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 90˚ = Left ear side, 270˚ = Right ear side

0 -level:

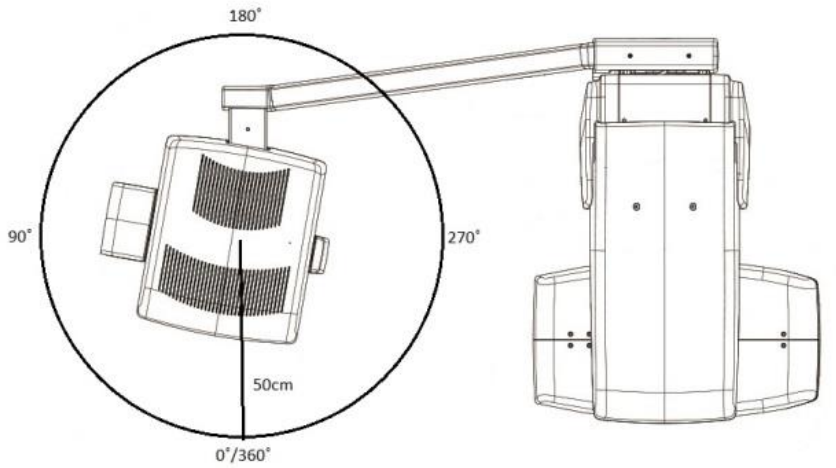
Angle	Dose - µR/10,0s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	34	0,34	1,7
90˚	25	0,25	1,25
270˚	66	0,66	3,3

0 -level +15cm:

Angle	Dose - µR/10,0s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	29	0,29	1,45
90˚	38	0,38	1,9
270˚	81	0,81	4,05

0 -level -15cm:

Angle	Dose - µR/10,0s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	22	0,22	1,1
90˚	21	0,21	1,05
270˚	59	0,59	2,95



Picture 2. Measurement procedure of the cephalometric program.

4. SCATTER IN FOV SIZE 5X5 3D PROGRAM

Exposure values 90kV, 13mA, 2.3sec were used. Measured DAP was 286mGycm²

Test instrument was placed at 100 cm distance from the skull to measure the scattered radiation. The maximum radiation was found at 135˚, -15cm below the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	74,4	0,744	3,72
45˚	104,1	1,041	5,205
90˚	115,1	1,151	5,755
135˚	125,5	1,255	6,275
180˚	7,1	0,071	0,355
225˚	137,2	1,372	6,86
270˚	110,6	1,106	5,53
315˚	110,7	1,107	5,535

0 -level +15cm

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	78,3	0,783	3,915
45˚	91,3	0,913	4,565
90˚	108,7	1,087	5,435
135˚	108,1	1,081	5,405
180˚	0	0	0
225˚	109,4	1,094	5,47
270˚	101	1,01	5,05
315˚	92	0,92	4,6

0 -level -15cm

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	97,8	0,978	4,89
45˚	114,6	1,146	5,73
90˚	136,1	1,361	6,805
135˚	148,3	1,483	7,415
180˚	6,5	0,065	0,325
225˚	145,8	1,458	7,29
270˚	141,9	1,419	7,095
315˚	110,7	1,107	5,535

5. SCATTER IN FOV SIZE 6X8 3D PROGRAM

Exposure values 90kV, 13mA, 2.3sec were used. Measured DAP was 473mGycm²

Test instrument was placed at 100 cm distance from the skull to measure the scattered radiation. The maximum radiation was found at 225˚, -15cm below the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	145,1	1,451	7,255
45˚	158,6	1,586	7,93
90˚	175,5	1,755	8,775
135˚	200,2	2,002	10,01
180˚	9,1	0,091	0,455
225˚	226	2,26	11,3
270˚	188,5	1,885	9,425
315˚	170,5	1,705	8,525

0 -level +15cm

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	110,2	1,102	5,51
45˚	139,4	1,394	6,97
90˚	159,3	1,593	7,965
135˚	175,7	1,757	8,785
180˚	7,8	0,078	0,39
225˚	195,1	1,951	9,755
270˚	181,5	1,815	9,075
315˚	148,5	1,485	7,425

0 -level -15cm

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	150,6	1,506	7,53
45˚	158,2	1,582	7,91
90˚	197,9	1,979	9,895
135˚	223,9	2,239	11,195
180˚	9,1	0,091	0,455
225˚	241,5	2,415	12,075
270˚	216,1	2,161	10,805
315˚	179,1	1,791	8,955

6. SCATTER IN FOV SIZE 8X8 3D PROGRAM

Exposure values 90kV, 13mA, 2.3sec were used. Measured DAP was 573mGycm²

Test instrument was placed at 100 cm distance from the skull to measure the scattered radiation. The maximum radiation was found at 90˚, on the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	214,2	2,142	10,71
45˚	243,9	2,439	12,195
90˚	285,7	2,857	14,285
135˚	225,9	2,259	11,295
180˚	4,5	0,045	0,225
225˚	256,9	2,569	12,845
270˚	204,9	2,049	10,245
315˚	192,7	1,927	9,635

0 -level +15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	126,6	1,266	6,33
45˚	163,5	1,635	8,175
90˚	191,9	1,919	9,595
135˚	221,8	2,218	11,09
180˚	4,5	0,045	0,225
225˚	223,2	2,232	11,16
270˚	168,2	1,682	8,41
315˚	137,8	1,378	6,89

0 -level -15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	160,1	1,601	8,005
45˚	201,6	2,016	10,08
90˚	243,1	2,431	12,155
135˚	265,8	2,658	13,29
180˚	7,8	0,078	0,39
225˚	250,6	2,506	12,53
270˚	217,4	2,174	10,87
315˚	164,2	1,642	8,21

7. SCATTER IN FOV SIZE 8X15 3D PROGRAM

Exposure values 90kV, 10mA, 4.5sec were used. Measured DAP was 882mGycm²

Test instrument was placed at 100 cm distance from the skull to measure the scattered radiation. The maximum radiation was found at 135˚, -15cm below the vertical level of the primary beam.

Measurement results:

0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	125,7	1,257	6,285
45˚	254,9	2,549	12,745
90˚	321,5	3,215	16,075
135˚	365,4	3,654	18,27
180˚	7,8	0,078	0,39
225˚	366,7	3,667	18,335
270˚	278,3	2,783	13,915
315˚	252	2,52	12,6

0 -level +15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	217,3	2,173	10,865
45˚	253,8	2,538	12,69
90˚	297,8	2,978	14,89
135˚	353,8	3,538	17,69
180˚	11,7	0,117	0,585
225˚	365,7	3,657	18,285
270˚	266,8	2,668	13,34
315˚	240,8	2,408	12,04

0 -level -15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	212,8	2,128	10,64
45˚	263,1	2,631	13,155
90˚	337,5	3,375	16,875
135˚	419	4,19	20,95
180˚	9,7	0,097	0,485
225˚	398,9	3,989	19,945
270˚	297	2,97	14,85
315˚	251,6	2,516	12,58

8. SCATTER IN FOV SIZE 13X15 3D PROGRAM

Exposure values 90kV, 10mA, 9sec.

Results are calculated from 8x15 program values, since 13x15 program consists effectively of two 8x15 scans.

Scatter radiation data for 13x15 program:
0˚ = Behind the skull, 180˚ = The nose side of the skull

0 -level:

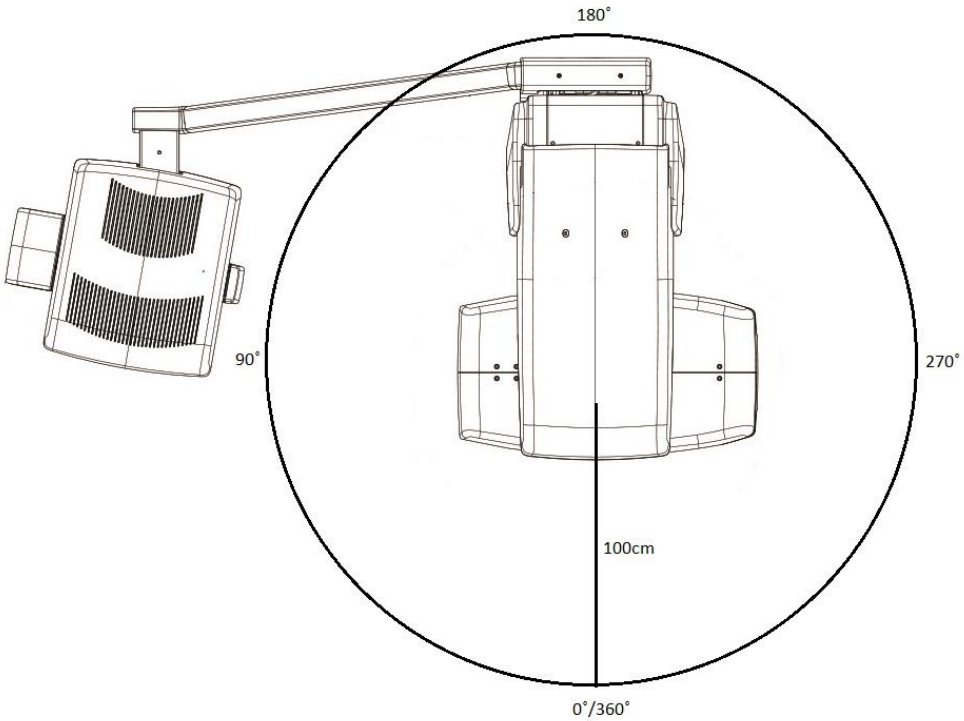
Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	251,4	2,514	12,57
45˚	509,8	5,098	25,49
90˚	643	6,43	32,15
135˚	730,8	7,308	36,54
180˚	15,6	0,156	0,78
225˚	733,4	7,334	36,67
270˚	556,6	5,566	27,83
315˚	504	5,04	25,2

0 -level +15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	434,6	4,346	21,73
45˚	507,6	5,076	25,38
90˚	595,6	5,956	29,78
135˚	707,6	7,076	35,38
180˚	23,4	0,234	1,17
225˚	731,4	7,314	36,57
270˚	533,6	5,336	26,68
315˚	481,6	4,816	24,08

0 -level -15cm:

Angle	Dose - µR/2,3s	10 scans/wk mR/wk	50 scans/wk mR/wk
0˚/360˚	425,6	4,256	21,28
45˚	526,2	5,262	26,31
90˚	675	6,75	33,75
135˚	838	8,38	41,9
180˚	19,4	0,194	0,97
225˚	797,8	7,978	39,89
270˚	594	5,94	29,7
315˚	503,2	5,032	25,16



Picture 3. Measurement procedure of the 3D programs.