



-A web-based CT dose calculator-

## WAZA-ARI v2 USER MANUAL

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National Institutes for Quantum and Radiological Science and Technology  
National Institute of Radiological Sciences  
Center for Radiation Protection Knowledge

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# 1. Preface

## 1.1. Preface

This manual is a user manual of WAZA-ARI v2, the web system for evaluating exposure dose from CT. The instruction, calculation algorithm and parameters for WAZA-ARI v2 are summarized in this manual. And it was edited by the following members who developed WAZA-ARI v2.

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## **1.2. Background of the development of WAZA-ARIv2**

Recently, CT scan has been widely used in medical institutions while exposure dose from CT scan is much higher than that from radiography. Therefore, the International Atomic Energy Agency IAEA has called for more attention to exposure dose by radiography in early childhood and repeated radiography for the same patients. Japanese medical-related societies have also begun to manage exposure doses caused by medical behavior during the patient's life in order to prevent excessive exposure. Japan had a relatively large number of CT scanners per million population. According to the survey in 2005, more than 20.7 million scans per year was recorded. Nevertheless, the system for managing total medical exposure of patients has not been constructed in Japan.

To solve the above-mentioned problems, Japan's National Institutes for Quantum and Radiological Science and Technology (QST), Japan Atomic Energy Development Agency (JAEA), and the Oita University of Nursing and Health Sciences (Oita Pref. Nursing) renewed the WAZA-ARI system which was developed in 2012. The renewal system WAZA-ARI v2 can evaluate patient dose from CT scans and officially started to serve in January 2015 under the management of QST. [1][2]

## **1.3. Features of WAZA-ARIv2**

WAZA-ARI is the second highest score a fighter can achieve in a Japanese martial arts ippon or waza-ari contest such as judo. The CT dose evaluation system WAZA-ARIv2 shares the same features with WAZA-ARI, which has served from Dec. 2012.

### **[Web-based system]**

WAZA-ARIv2 was developed to be a web-based system so that installation and maintenance will never be a burden to users. After accessing the web site, users can calculate dose from CT by entering information such as the model of CT scanner, the scanning range, the age, body shape, and gender of the patient. The result will display immediately after the scanning conditions are set.

WAZA-ARIv2 has the following new functions

### **[Dose calculation for patients of various body shapes and ages]**

The previous version of WAZA-ARI only calculates organ doses for the average Japanese adults. On the other hand, WAZA-ARIv2 calculates not only standard body shape but also fat and thin people so that most Japanese can be covered. Besides, dose calculation is supported for underage patients with the age of 0, 1, 5, 10, or 15. Dose calculation was mainly performed by simulation code developed by JAEA, and the phantoms used for calculation include the newly developed Japanese adult phantoms and the child phantoms developed by the University of Florida and the National Cancer Institute of the US.

### **[Construction of registered dose data statistically for CT scanning condition optimization]**

After registration, users can calculate organ dose by entering required information and register the data on the QST server. WAZA-ARIv2 server, on the other hand, can collect dose data of each institution and estimate the distribution of dose from CT in Japan. Users can compare the dose level between their own institutions and the dose level of the registered data in WAZA-ARIv2 and use it to optimize CT scanning conditions to prevent overexposure of patients.

Calculation results are modified to display on the right side of the window for setting the scanning conditions in WAZA-ARIv2. In addition, the layout has been changed so that users can see the scanning conditions and the calculation results at the same time. Functions of registering calculation results and frequently used scanning conditions are also added for convenience.

## 2. Registration

ID registration is required to use WAZA-ARIV2 for dose calculation, dose registration, and dose distribution confirmation. The registration contents include name, email address, occupation, number of beds, number of annual CT tests, name of medical institution, etc.

### 2.1. User registration page

Press the "ID registration" button on the login page of WAZA-ARIV2 to go to ID registration page. After entering the required information, press the "Confirm" button for confirmation.

ID registration	
Name	<input type="text"/> Required
E-mail address	<input type="text"/> Required
Occupation	<input type="text"/> Doctor <span style="color:red;">Required</span>
Nation	<input type="text"/> Japan <span style="color:red;">Required</span>
Fiscal year	<input type="text"/> 2019 <span style="color:red;">Required</span>
Number of beds	<input type="text"/> Required
Annual number of CT exams	<input type="text"/> Required
Kind of facility	<input type="text"/> All <span style="color:red;">Required</span>
Name of medical organization	<input type="text"/> Required

**Confirm**

Fig. 2-1. Page for user ID registration

## 2.2. Confirmation of registered content for user ID

Please check if the registered information is correct and read the terms of use for this site. Tick the checkbox and press "Register" button if you agree with the terms of us. Press "Revise" button to return to the input page and revise it if there is any mistake.

The screenshot shows a confirmation page for user ID registration. At the top left is the Waza-ari logo with the tagline "- A web-based CT dose calculator -". At the top right is a "Back" button. The main title is "Confirmation of user ID registration". Below the title is a message: "Please click the \"Register\" button if you would like to register the data shown below. If you would like to revise your data to be registered, please click \"Revise\" button. If you would like to cancel the registration, please click \"Cancel\" button." The registration data is listed in a table:

Name	QST
E-mail address	qst@qst.go.jp
Occupation	Doctor
Nation	Japan
Fiscal year	2019
Number of beds	100
Annual number of CT exams	1000
Kind of facility	Hospital(Public)
Name of medical organization	National Institute of Radiological Sciences

Below the data is a section titled "Privacy Policy" which includes "Conditions of use" and "Copyright". The "Conditions of use" text states: "The contents of the WAZA-ARIV2 website are provided by National Institute of Radiological Sciences (hereinafter "NIRS") with the following conditions of use. It is assumed that all the users visiting this website have agreed to the Site Policy." The "Copyright" text states: "The copyright (or intellectual property rights) of all texts, graphical". At the bottom is a checkbox: " I have read and understand the sitepolicy described above and agree to all of its terms and conditions." Below the checkbox are three buttons: "Register", "Revise", and "Cancel".

Fig. 2-2. Confirmation page for the registered content of user ID

## 2.3. Confirmation of the user ID registration

You will receive a registration completion email as shown below (Japanese only). The "User ID" and "Temporary Password" are included in this e-mail. Password can be changed after WAZA-ARI v2 login

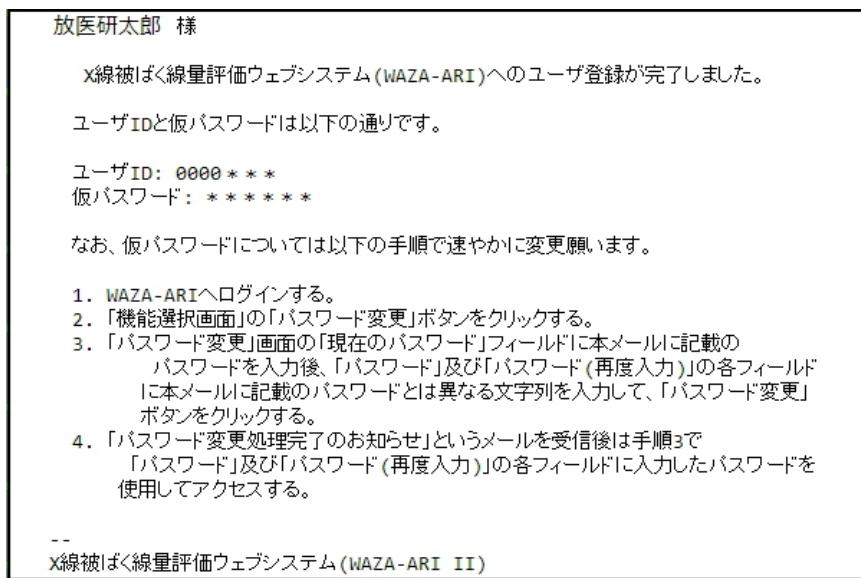


Fig. 2-3. Sample of the registration completion email

# 3.Dose calculation

## 3.1. Setting of the condition for dose calculation

After login, press "Calculation of the X-ray CT exposures" button on the Main menu page (Fig. 3.1) to go to dose calculation page(Fig. 3.2).

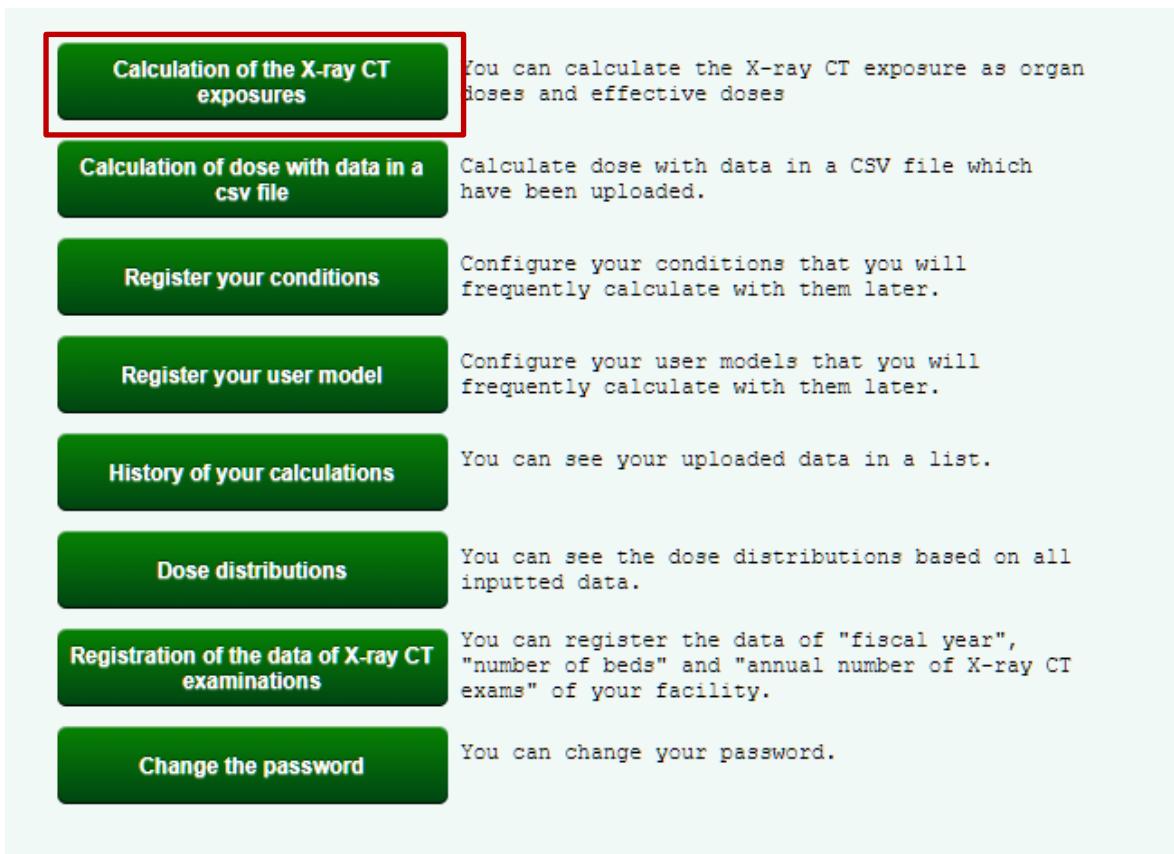


Fig. 3-1. Main menu (dose calculation)

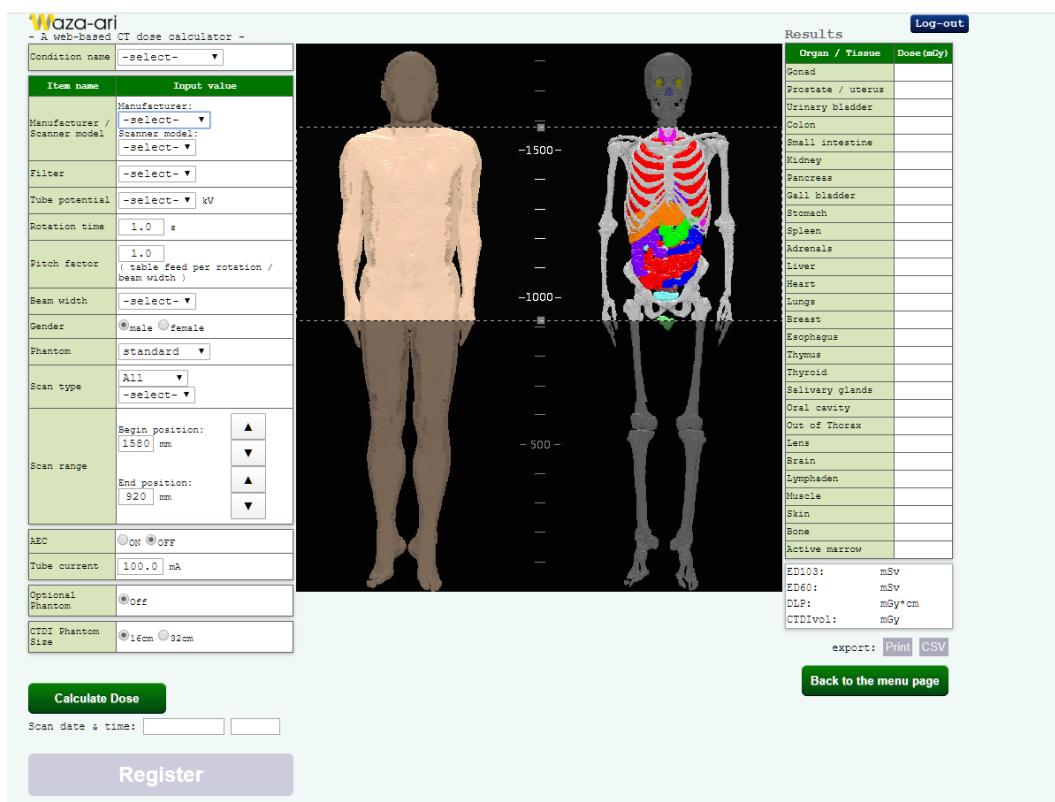


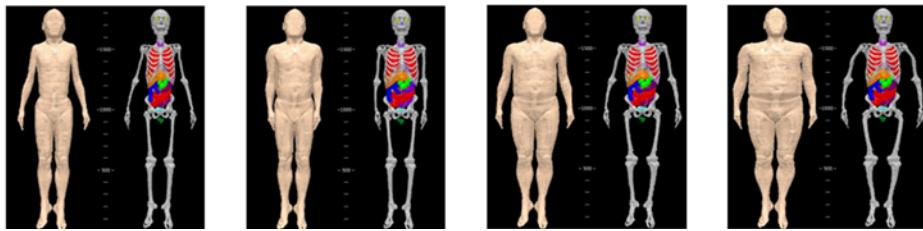
Fig. 3-2. Page for calculation of the X-ray CT exposures

Scanning conditions for dose calculation are set in the left column on dose calculation page. Detail of the scanning condition items are shown in Table 3-1 and detail of the available phantoms are shown in Table 3-2 and Fig. 3-3. Height, weight and BMI for each phantom are shown in Table 3-2.

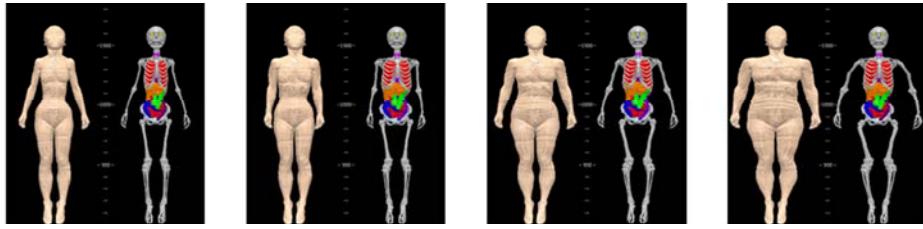
Two new functions of (1) BMI-based organ dose calculation and (2) SSDE calculation are added in Feb 2021. If you select Adult optional phantom in the phantom item, body shape correction function (optional phantom) will be turned on and columns of height and weight display (Fig. 3-4). Using BMI estimated by the entered height and weight, it has potential to calculate the organ dose closer to the body shape of the subject. Phantom displayed on the calculation screen does not change with the entered height and weight. In WAZA-ARIv2, SSDE is calculated using CTDI<sub>vol</sub> and the conversion factors proposed in AAPM TG 204, and the conversion factor is a function of effective diameter (AP: anterior-posterior dimension, LAT: lateral dimension). Fig. 3-5 shows the calculation screen when SSDE is turned on.

Table 3-1. Scanning condition item for dose calculation

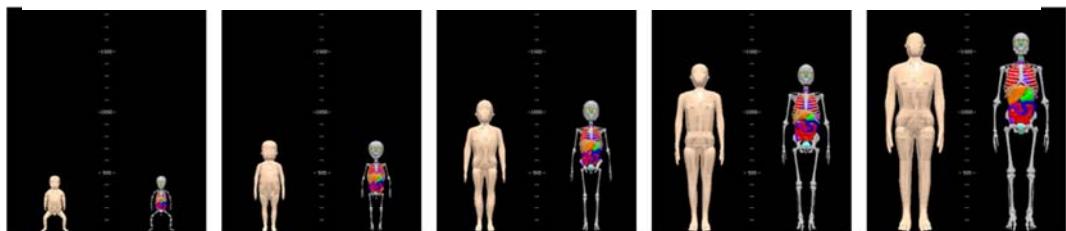
Item	Description
<b>Manufacturer</b>	Vender of CT machine
<b>Scanner model</b>	Name of the CT scanner model
<b>Filter</b>	Name of the Bow-tie filter that depends on the of FOV
<b>Tube potential</b>	Tube Voltage [kV]
<b>Rotation time</b>	Time required for one rotation of the tube [s]
<b>Pitch factor</b>	Pitch for helical scan mode. (Movement of the table for one rotation of tube) / (beam width)
<b>Beam width</b>	Collimation range in the direction of body axis
<b>Gender</b>	Gender
<b>Phantom</b>	Select a phantom according to the body type and age. Adult: Standard, Fat(+2SD), Fat(+5SD) and Thin(-2SD) Child: age:0~15 Adult optional phantom
<b>Scan type</b>	Scan type (region of body)
<b>Scan range</b>	Enter the scanning range. The scanning range can also be set by dragging the <input type="checkbox"/> part on the center phantom image
<b>AEC (Option)</b>	"On" to enable dose calculation for the case of AEC (Auto Exposure Control) is applied. Setting the tube current for the specific slice is necessary.
<b>Tube Current</b>	Tube Current
<b>Optional Phantom</b>	The function of body shape correction is planned to be implemented in the future.
<b>SSDE(Option)</b>	"On" to enable calculation of SSDE (Size Specific Dose Estimates). P.S. Since SSDE is estimated using effective diameter, information of anterior-posterior dimension and lateral dimension are necessary.
<b>CTDI phantom size</b>	CTDI phantom size for calculating CTDI <sub>vol</sub> and DLP



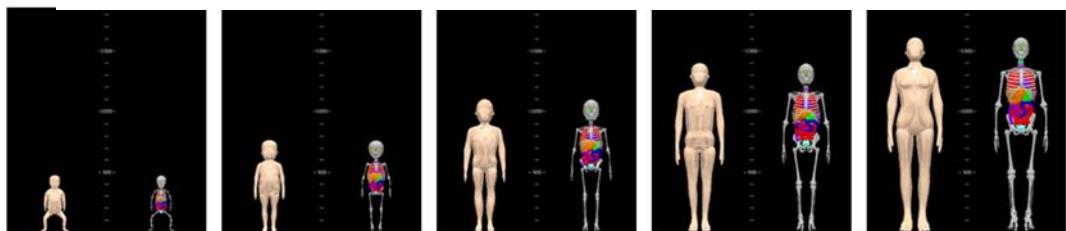
Adult Male (from left to right): thin ( $-2\sigma$ ), standard, fat ( $+2\sigma$ ), obese ( $+5\sigma$ )



Adult Female (from left to right): thin ( $-2\sigma$ ), standard, fat ( $+2\sigma$ ), obese ( $+5\sigma$ )



Boy (from left to right): 0-yr-old, 1-yr-old, 5-yr-old, 10-yr-old, 15-yr-old



Girl (from left to right): 0-yr-old, 1-yr-old, 5-yr-old, 10-yr-old, 15-yr-old

Fig. 3-3. Available phantom types

Optional Phantom	<input checked="" type="radio"/> ON
Height	<input type="text"/> cm
Weight	<input type="text"/> kg

Fig. 3-4. Columns of Height and Weight display when Adult optional phantom is chosen.

Zd	206.0 mA (z=1150.5mm)
Ze	259.0 mA (z=987.5mm)
End position	254.0 mA (z=920mm)
Optional Phantom	<input checked="" type="radio"/> OFF
CTDI Phantom Size	<input type="radio"/> 16cm <input checked="" type="radio"/> 32cm
SSDE	<input checked="" type="radio"/> ON <input type="radio"/> OFF
AP	[ ] cm
Lateral	[ ] cm

**Calculate Dose**

Scan date & time: [ ] [ ]

Fig. 3-5. Columns of AP and Lateral display when SSDE is set "on".

Table 3-2. Height, weight and BMI for each phantom used in WAZA-ARI[3][4]

	Male			Female		
	height[cm]	weight[kg]	BMI*	height[cm]	weight[kg]	BMI*
<b>Standard</b>	171	65.1	22.3	155	52	21.6
<b>+2σ : Fat(+2SD)</b>	171	82.2	28.1	155	66.9	27.8
<b>+5σ : Fat(+5SD)</b>	171	118.1	40.4	155	89.5	37.3
<b>-2σ : Thin(-2SD)</b>	171	54.1	18.5	155	43	17.9
<b>age:0</b>	47.5	3.5	15.5	47.5	3.5	15.5
<b>age:1</b>	76.4	10.2	17.5	76.4	10.3	17.6
<b>age:5</b>	110.2	19.7	16.2	110.2	19.7	16.2
<b>age:10</b>	139.8	34.3	17.6	139.8	34.3	17.6
<b>age:15</b>	165.7	59.9	21.8	161.1	56.6	21.8

\* BMI = (Weight[kg])/Height[m])<sup>2</sup>

### 3.2. Confirmation of dose calculation results

After setting the appropriate conditions, press “Calculation dose” button to start dose calculation, and the dose calculation result will display. In addition to absorbed dose [mGy] to each organ, the effective dose (ED103, ED60) [mSv], DLP and CTDIvol are also displayed.

#### Absorbed dose · Equivalent dose · Effective dose

Equivalent dose  $H_T$  [mSv] of each organ is obtained by using the radiation weighting factor  $w_R$  and the absorbed dose  $D_{TR}$  [mGy] as follows.

$$H_T = w_R \times D_{TR}$$

Since  $w_R$  for X-ray is 1,  $D_{TR}$  [mGy] of each organ is equal to  $H_T$  [mSv]. Effective dose  $E$  is then calculated by summing the product of the tissue weighting factor  $w_T$  of each organ and [mSv]  $H_T$  for all organs.

$$E = \sum_T w_T H_T$$

Since the definition of  $w_T$  for each organ is different between ICRP103[5] and ICRP60[6], ED103 and ED60 are both displayed in the calculation result of WAZA-ARI.

It is worth to mention that WAZAARIv2 calculates  $E$  using Japanese phantom which is different from the phantom defined by ICRP. Therefore, strictly speaking, it is not proper to compare  $E$  calculated by WAZA-ARIv2 with that by other calculation software.

### 3.3. Registration of calculation results

You can browse statistical information of the registered data and compare with data registered in WAZA-ARIv2 with the statistical information of the radiation dose of your facility by registering the calculation results on the QST server. Press “Register” button to confirm your data for registration (Fig. 3-6).

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**Confirmation of your dose data to be registered**

Please click the "Register" button if you would like to register your data shown below. If you would like to revise your data to be registered, please click "Revise" button. If you would like to cancel the registration, please click "Cancel" button.

Condition		Results	
Item name	Input value	Organ / Tissue	Dose(mGy)
Date and Time	2020/02/07 17:03	Gonad	20.05
Scan type	Chest(Chest-Pelvis (1-phase))	Prostate / uterus	24.45
Manufacturers / Scanner model	Manufacturer: Canon Scanner model: Alexion	Urinary bladder	32.17
Filter	Medium	Colon	33.26
Tube potential	120 kV	Small intestine	34.31
Rotation time	0.5 s	Kidney	30.91
Pitch factor	1.0	Pancreas	32.07
Beam width	10mm(2x5mm)	Gall bladder	31.06
Gender	male	Stomach	34.68
Phantom	standard	Spleen	31.09
Scan range	Begin position: 1580 mm End position: 920 mm	Adrenals	26.98
AEC	OFF	Liver	31.71
Tube current	300.0 mA	Heart	33.18
Optional Phantom	OFF	Lungs	30.55
CTDI Phantom Size	32cm	Breast	21.22
ED103: 27.14 mSv ED60: 27.81 mSv DLP: 1233.10 mGy*cm CIDIVol: 19.59 mGy			

**Register**    **Revise**    **Cancel**

Fig. 3-6. Page for confirming the registered dose information

# 4.Dose calculation・registration using csv file

WAZA-ARIv2 can calculate and register multiple cases with different scanning condition by using a list file of csv format. Selecting “Calculation of dose with data in a csv file” on the Main menu (Fig. 4-1), the page for dose calculation and registration from csv file can will be shown as Fig. 4-2.

## 4.1. Dose calculation・registration using csv file

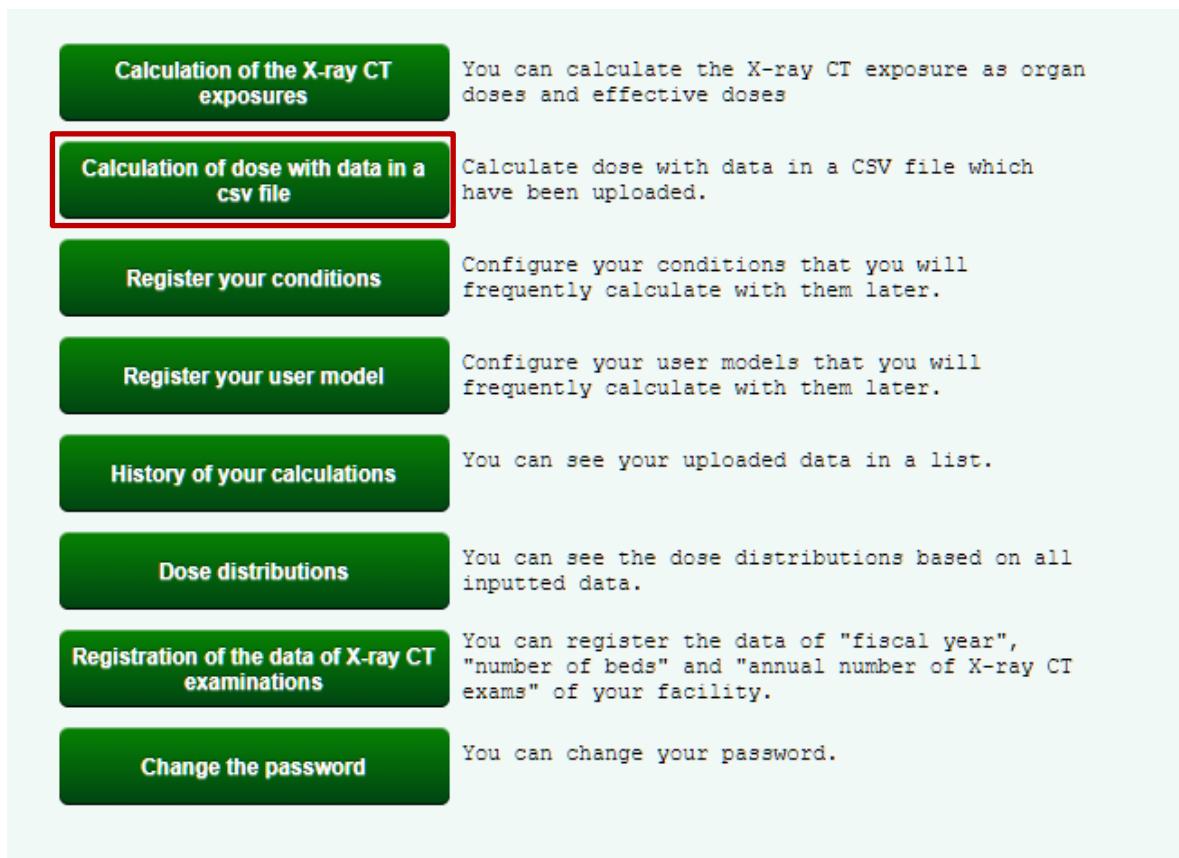


Fig. 4-1. Main menu (Calculation of dose with data in a csv file)

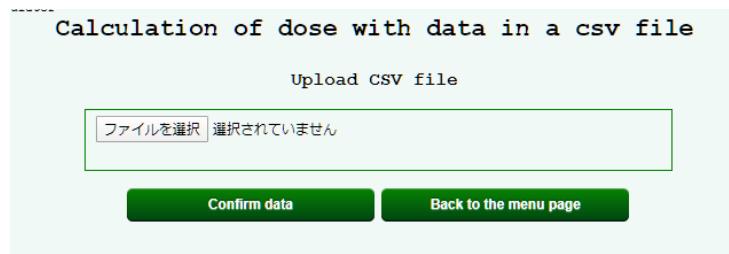


Fig. 4-2. Page for calculation of dose with data in a csv file

Press [ファイルを選択] to select the csv file and then press "Confirm data" button to check the content of upload data as it shown in Fig. 4-3. If any improper condition is included in the csv file, a warning message as shown in Fig. 4-4 will display and the upload process will stop.

Condition	Date and Number	Time	Scan type	Manufacturer	Scanner model	Filter	potential	Tube	Rotation	Pitch	time factor	Beam width	Gender	Phantom	Scan begin position	Scan end position	AEC current	Tube current	Beam Position current
1	2019/4/1 0:00		Chest(Chest-Pelvis (1-phase))	Siemens	Sensation 64	(Body)	120 kV	1 s	1	15mm		male	Thin (-2SD)	1580mm	820mm	ON		198 mA	149 mA
2	2019/4/1 0:00		Head(Head-Neck (1-phase))	GE	Revolution CT	(Head)	120 kV	1.5 s	1.2	286x0.625mm		female	Fat (+2SD)	1825mm	1510mm	OFF	200 mA		
3	2019/4/1 0:00		Neck(Neck-Pelvis (1-phase))	Canon	Aquilion ONE GENESIS	(Body)	120 kV	1 s	1.2	220x0.5mm(Volume)	male	age:15	1525mm	790mm	OFF	180 mA			

Fig. 4-3. Confirmation of the registered dose information

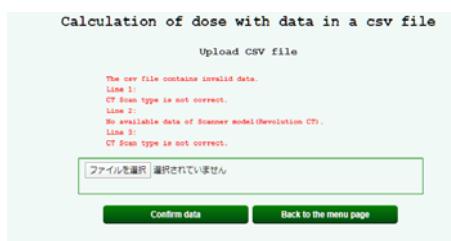


Fig. 4-4. Screenshot for confirmation of improperly registered scanning condition

## 4.2. List file of scanning condition

You can download a sample list file (csv file and Excel file) on the lower part of the Description section on the homepage for reference and create a scanning condition list file by yourself. The scanning condition list file is a csv format file which is separated by commas in the following order. It is recommended to create a csv file using the example of the Excel file.

(Order of the scanning condition items)	Description
<<Date and Time>>,	: scan time (Ex : 2015/7/6 14:03)
<<CT scan type>>,	: scan type
<<Manufacturer>>,	: Manufacturer of CT scanner
<<Scanner model>>,	: Name of the CTs scanner
<<Filter>>,	: Filter corresponding to the size of FOV
<<Tube potential>>,	: Tube Voltage[kV]
<<Rotation time>>,	: Tube rotation time[s]
<<Pitch factor>>,	: Pitch factor
<<Beam width>>,	: Beam width
<<Gender>>,	: Gender (male or female)
<<Phantom>>,	: Type of phantom
<<Scan range Begin position>>,	: Scan range Begin position [mm]
<< Scan range Begin position >>,	: Scan range Begin position [mm]
<<AEC>>,	: ON or OFF
<<Tube current>>,	: Input when AEC OFF
<<Begin position>>,	: Input when AEC ON
<<Za>>,<<Zb>>,<<Zc'>>,	: Input when AEC ON (Not necessary for Zc')
<<Zc>>,<<Zd>>,<<Ze>>,	: Input when AEC ON
<<End position>>,	: Input when AEC ON
<<Optional Phantom>>,	: ON or OFF
<<Height>>,<<Weight>>,	: N/A
<<AP>>,<<Lateral>>	: N/A
<<CTDI Phantom Size>>	: Phantom Size used for calculating dose index (16 or 32)
<<SSDE>>,	: ON or OFF

# 5.The setting of user scanning condition

Five frequently used scanning conditions are allowed to registered for each user in WAZA-ARI.

## 5.1. The setting of user scanning condition

After clicking "Register your conditions" button on the Main menu (Fig. 5-1), page for condition registration as shown in Fig. 5-2 will be displayed.

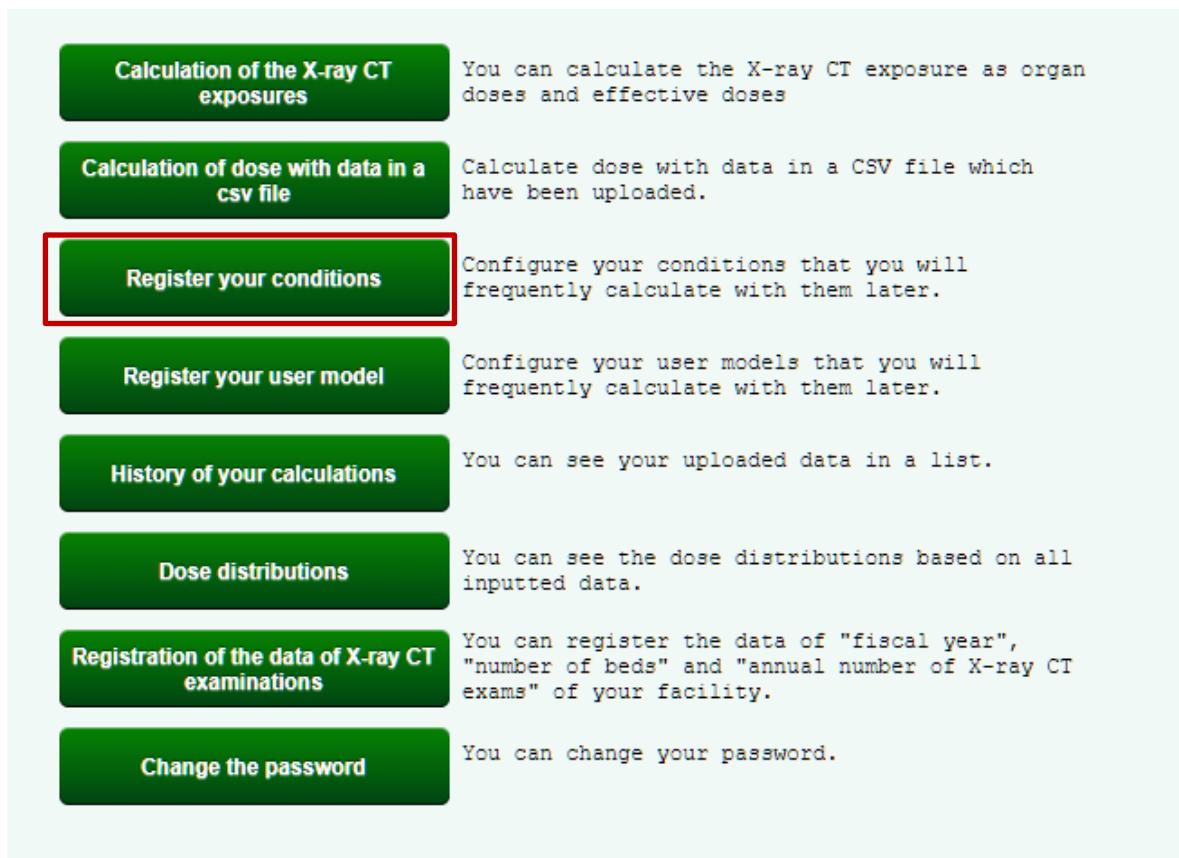


Fig. 5-1. Main menu (Register your conditions)

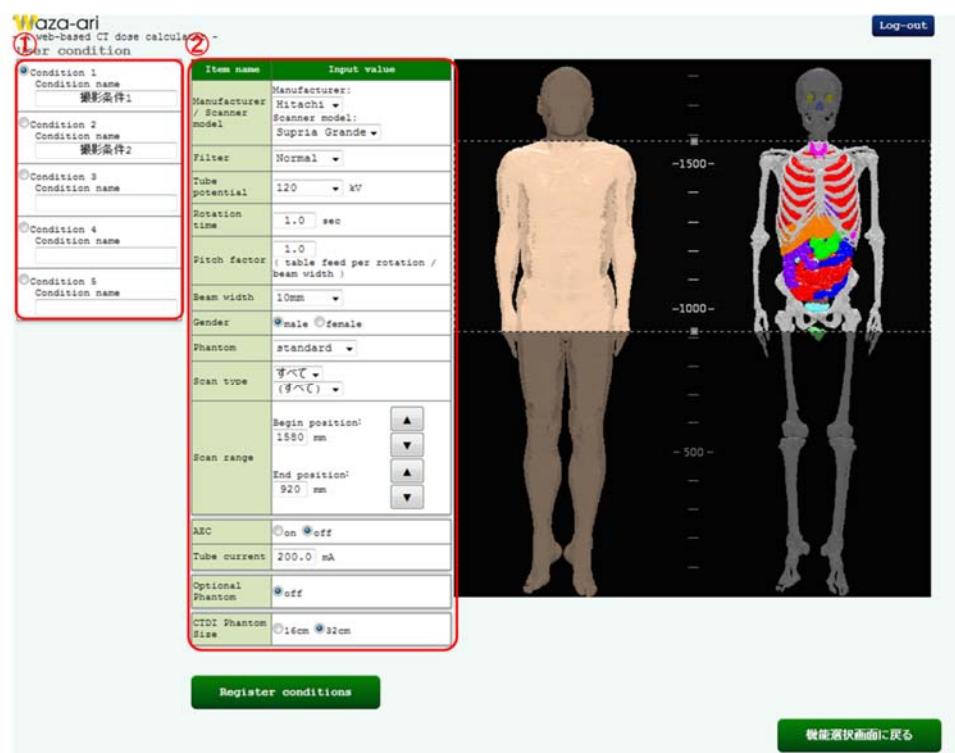


Fig. 5-2. Page for registering user scanning condition

Select the number of the scanning condition from the box ① shown in Fig. 5-2. Name of the scanning condition is required information. Fill the selected scanning condition shown in the box ②. All items are required item. After setting the scanning conditions, press “Register conditions” button and the window for confirmation will be displayed. Press the “Register” button to register if the conditions are correct.

## 5.2. Application of user scanning conditions

Choose the name of the scanning condition from the drop down list of “Condition name” in the upper left of Fig. 3-2 to apply the registered user scanning conditions for dose calculation.

# 6. Merge of dose calculation and calculation results

You can search, delete, merge, print, and export the dose calculation results in csv format in WAZA-ARIV2.

## 6.1. Search, print and delete of dose calculation history

### 6.1.1. Search of dose result from the history of your calculation

(1) Press "History of your calculation" button on the Main menu to go to the page of history of your calculations.

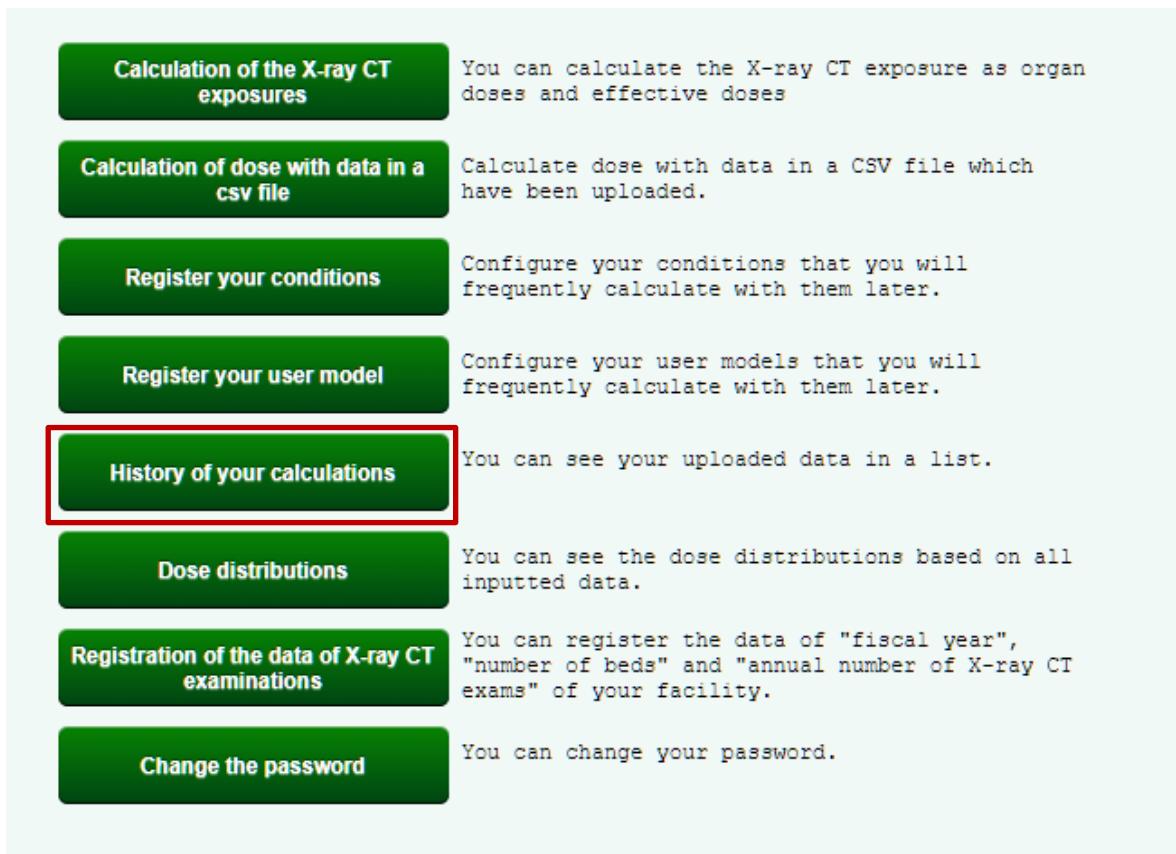


Fig. 6-1. Main menu (History of your calculation)

On the page of history of your calculation, ten cases of calculation results are displayed on each page. It is also possible to display the results for a limited period by specifying the date registered from "Period specified". You can delete, combine, and print only the selected result by ticking the check box on the left of each calculation result.

The screenshot shows the 'History of your calculations' page of the Waza-ari web-based CT dose calculator. The page includes a search bar for 'Period' and 'Study ID', and buttons for 'Search', 'Back to the menu page', and navigation arrows ('<>First', '<Previous 10 cases', 'Next 10 cases>', 'Last>'). A table lists 10 calculated cases with columns for Date and Time, Study ID, Series ID, Scan type, Manufacturer, Scanner model, Filter, Tube potential, Rotation time, Pitch factor, Beam width, Gender, Phantom, Scan Begin position, Scan End position, AEC, Tube current, and Position. Below the table are buttons for 'Delete the marked data' and 'Merge selected data', and an 'export' section with 'Print(by selection)', 'Print', and 'CSV' options.

Select for deletion	Date and Time	Study ID	Series ID	Scan type	Manufacturer	Scanner model	Filter	Tube potential	Rotation time	Pitch factor	Beam width	Gender	Phantom	Scan Begin position	Scan End position	AEC	Tube current	Position
<input type="checkbox"/>	2015/12/06 15:12	00093160	00085251	Pelvis [Pelvis]	GE	LightSpeed VCT	Small	120.0 kV	0.8 s	1.0	20mm	male	age:5	640mm	480mm	OFF	400.0 mA	
<input type="checkbox"/>	2015/12/10 14:50	00093178	00085269	Chest [Chest-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	0.8 s	1.0	16x0.625mm	male	standard	1449mm	789mm	OFF	300.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094215	00087146	Head[Head-Neck (1-phase)]	Siemens	Definition Flash (tube A)	Standard	80.0 kV	1.0 s	1.0	64x0.6mm(128x0.6)	male	standard	1600mm	1200mm	ON	198.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094216	00087145	Chest [Chest-Pelvis (1-phase)]	Siemens	Definition Flash (tube A)	Wide	120.0 kV	1.5 s	1.2	12x1.2mm	female	Thin(-2SD)	1600mm	1200mm	OFF	200.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094217	00087146	Neck [Neck-Pelvis (1-phase)]	GE	LightSpeed 16	Large	120.0 kV	1.0 s	1.2	20mm	male	age:10	1600mm	1200mm	OFF	201.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094227	00087170	Head[Head-Neck (1-phase)]	Siemens	Definition Flash (tube A)	Wide	100.0 kV	1.0 s	1.0	62x0.6mm(64x0.6)	male	standard	1600mm	1200mm	ON	198.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094228	00087171	Neck [Neck-Pelvis (1-phase)]	Canon	Aquilion ONE (Trix-S 60)	Large	120.0 kV	1.8 s	1.2	2mmx0.6mm(Conventional)	female	Thin(-2SD)	1600mm	1200mm	OFF	200.0 mA	
<input type="checkbox"/>	2014/10/30 15:46	00094229	00087172	Neck [Neck-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	1.0 s	1.2	32x0.625mm	male	age:15	1600mm	1200mm	OFF	201.0 mA	
<input type="checkbox"/>	2015/04/01 00:00	00136271	00139820	Chest [Chest-Pelvis (1-phase)]	Siemens	Sensation 64	[Body]	120.0 kV	1.0 s	1.0	18mm	male	Thin(-2SD)	1580mm	920mm	ON	198.0 mA	
<input type="checkbox"/>	2015/04/01 00:00	00136272	00139824	Head[Head-Neck (1-phase)]	GE	Revolution CT	[Head]	120.0 kV	1.5 s	1.2	256x0.625mm	female	Fat(+2SD)	1585mm	1510mm	OFF	200.0 mA	

Fig. 6-2. Page of history of your calculation

### 6.1.2. Print

The registered dose information can be printed for preservation or distribution.

(1) To print only the selected calculation results, check the check box and select "Print (by selection)". Select "Print" to print all the search results displayed.

(2) The "scanning conditions", "Phantom simulation range", "Absorbed dose to organ" and "Effective dose" input to WAZA-ARI are printed as shown below.

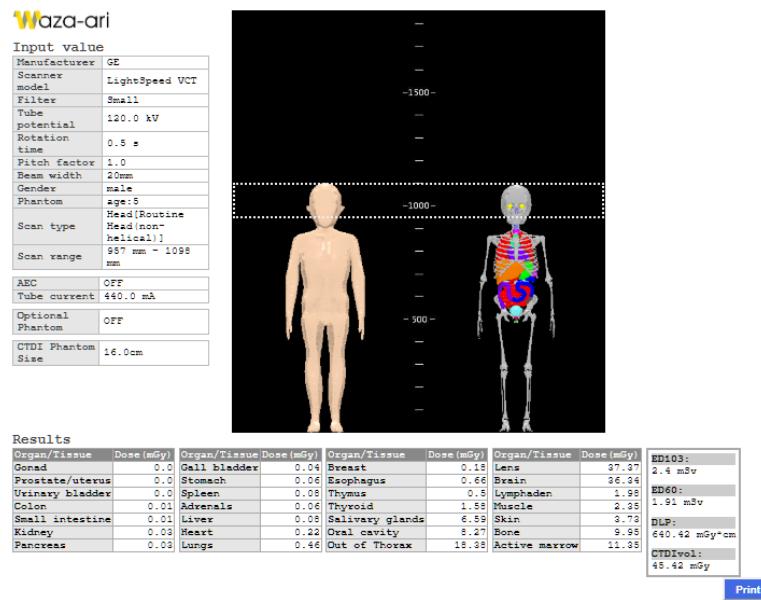


Fig. 6-3. Preview of the print of dose calculation result

(3) After confirming the printed page, click " for printing.

### 6.1.3. Export data in CSV format

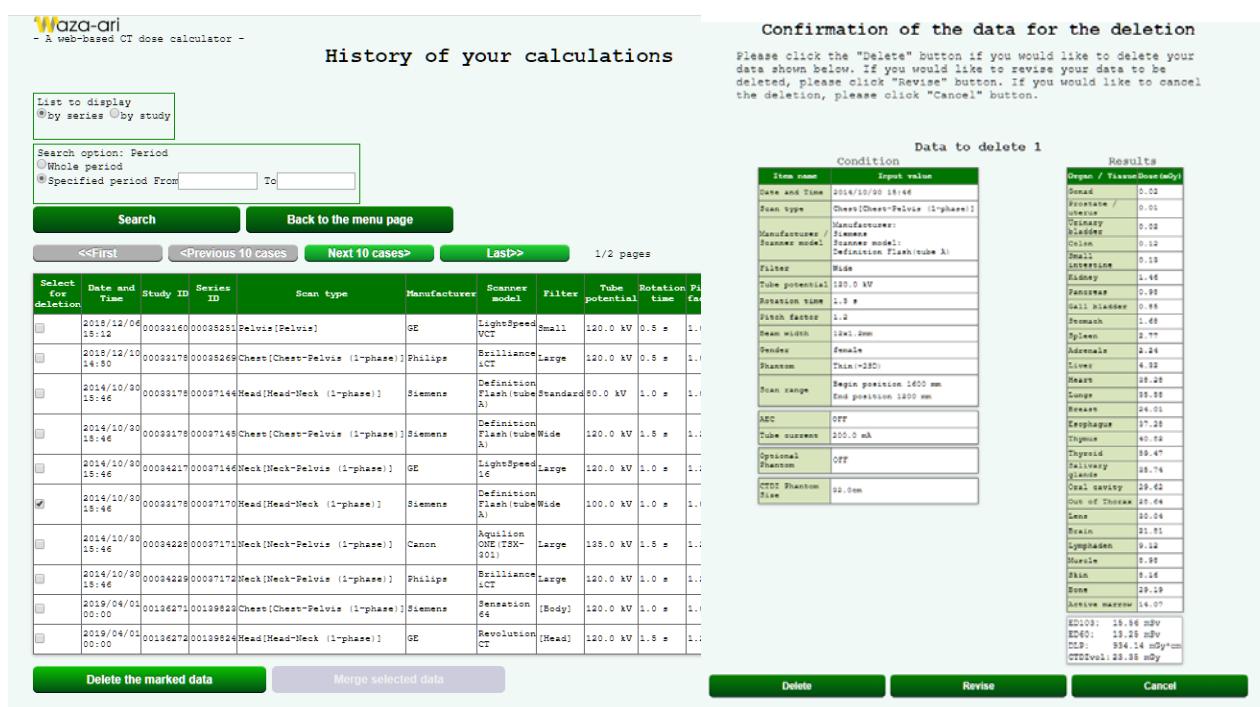
The registered dose information can be used for detailed analysis with spreadsheet software such as excel. 

Press on the page of History of your calculation and specify the save destination for saving.

### 6.1.4. Delete dose calculation results

"Delete the marked data" button is not activated in the beginning.

(1) Tick the box "☒" on the left edge of the table and press "Delete the marked data" button to forward to the confirmation page.



The screenshot shows two overlapping windows from the Waza-ari software:

- Left Window (History of your calculations):**
  - Header: "Waza-ari - A web-based CT dose calculator -"
  - Section: "History of your calculations"
  - Search options: "List to display" (radio buttons for "by series" and "by study"), "Search option: Period" (radio buttons for "Whole period" and "Specified period From [ ] To [ ]"), and a "Search" button.
  - Table: Shows a list of dose calculation entries with columns: Date and Time, Study ID, Series ID, Scan type, Manufacturer, Scanner model, Filter, Tube potential, Rotation time, and FA.
  - Buttons at the bottom: "Delete the marked data", "Merge selected data", "Delete", "Revise", and "Cancel".
- Right Window (Confirmation of the data for the deletion):**
  - Header: "Confirmation of the data for the deletion"
  - Text: "Please click the "Delete" button if you would like to delete your data shown below. If you would like to revise your data to be deleted, please click "Revise" button. If you would like to cancel the deletion, please click "Cancel" button."
  - Table: "Data to delete 1" showing detailed parameters for the selected entry.
  - Table: "Results" showing organ/tissue doses in mGy for various organs.
  - Buttons at the bottom: "Delete", "Revise", and "Cancel".

Fig. 6-4. Page of "History of your calculations" and "Confirmation of the data for deletion"

- (2) Press "Delete" button to delete the data after confirmation.
- (3) Press "Revise" to return to "History of your calculation".
- (4) Press "Cancel" button to return to Main menu.

**\* Note: Deleted data cannot be recovered.**

## 6.2. Merge of the dose calculation result and dose evaluation for the same protocol

Study ID and Series ID are automatically assigned to the registered dose calculation results. Data for the same patient can be merged to the same Study ID and evaluated in WAZA-ARIv2.

### 6.2.1. Merge of the calculation results

Tick the box of the dose calculation result that you want to merge as shown in Fig. 6-5. The "Merge selected data" button will be active when more than one box was ticked. Press "Merge selected data" button to go to the confirmation page as shown in Fig. 6.6. Press "Merge" button and the Study ID of the selected dose calculation results will be unified as shown in Fig. 6-7.

Select for deletion	Date and Time	Study ID	Series ID	Scan type	Manufacturer	Scanner model	Filter	Tube potential	Rotation time	Pitch factor	B
<input type="checkbox"/>	2018/12/06 15:12	00033160	00035251	Pelvis[Pelvis]	GE	LightSpeed VCT	Small	120.0 kV	0.5 s	1.0	20mm
<input type="checkbox"/>	2018/12/10 14:50	00033178	00035269	Chest[Chest-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	0.5 s	1.0	16x0.6
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034215	00037144	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Standard	80.0 kV	1.0 s	1.0	64x0.6
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034216	00037145	Chest[Chest-Pelvis (1-phase)]	Siemens	Definition Flash(tube A)	Wide	120.0 kV	1.5 s	1.2	12x1.2
<input type="checkbox"/>	2014/10/30 15:46	00034217	00037146	Neck[Neck-Pelvis (1-phase)]	GE	LightSpeed 16	Large	120.0 kV	1.0 s	1.2	20mm
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034227	00037170	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Wide	100.0 kV	1.0 s	1.0	32x0.6
<input type="checkbox"/>	2014/10/30 15:46	00034228	00037171	Neck[Neck-Pelvis (1-phase)]	Canon	Aquilion ONE(TSX-301)	Large	135.0 kV	1.5 s	1.2	2mmx4 (
<input type="checkbox"/>	2014/10/30 15:46	00034229	00037172	Neck[Neck-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	1.0 s	1.2	32x0.6
<input type="checkbox"/>	2019/04/01 00:00	00136271	00139823	Chest[Chest-Pelvis (1-phase)]	Siemens	Sensation 64	[Body]	120.0 kV	1.0 s	1.0	18mm
<input type="checkbox"/>	2019/04/01 00:00	00136272	00139824	Head[Head-Neck (1-phase)]	GE	Revolution CT	[Head]	120.0 kV	1.5 s	1.2	256x0.

[Delete the marked data](#)    [Merge selected data](#)

Fig. 6-5. Page of history of your calculation (merge of the calculation results)

**Waza-ori**  
A web-based CT dose calculator

Log-out

**Confirmation of the data for the merge**

Please click the "Merge" button if you would like to merge your data shown below. If you would like to revise your data to be merged, please click "Revise" button. If you would like to cancel the merge, please click "Cancel" button.

Data to merge 1		Results	
Item name	Input value	Organ / Tissue Dose (mGy)	
Date and Time	2014/10/01 15:44	Genital	0.0
Scan type	Head/Neck-Chest (i-phase)	Prostate / Uterus	0.55
Scanning time	1.0 s	Urinary	0.03
Pitch factor	1.0	Colon	1.29
Beam width	16x1.6mm(128x1.6)	Intestine	0.8
Gender	male	Bladder	0.02
Phantom	standard	Gallbladder	4.78
Scan range	Begin position: 1400 mm End position: 1200 mm	Stomach	1.13
ADC	ON	Spleen	0.11
Optimal Phantom	OFF	Adrenals	0.27
CTSI Phantom	12.0cm	Liver	0.29
Site		Heart	0.48

ED100: 1.00 mGy  
ED200: 1.41 mGy  
CLB: 153.45 mGy\*cm  
CTSIvol:1.24 mGy

Data to merge 2		Results	
Item name	Input value	Organ / Tissue Dose (mGy)	
Date and Time	2014/10/01 15:44	Genital	0.02
Scan type	Chest/Chest-Pelvis (i-phase)	Prostate / Uterus	0.51
Scanning time	1.0 s	Urinary	0.02
Pitch factor	1.0	Colon	0.12
Beam width	16x1.6mm	Intestine	0.18
Gender	male	Bladder	1.44
Phantom	Chin-2FD	Gallbladder	3.86
Scan range	Begin position: 1400 mm End position: 1200 mm	Stomach	1.49
ADC	OFF	Spleen	2.77
Tube current	200.0 mA	Adrenals	2.12
Optimal Phantom	OFF	Liver	4.12
CTSI Phantom	12.0cm	Heart	14.28
Site		Large intestine	18.88

ED100: 15.54 mGy  
ED200: 15.21 mGy  
CLB: 834.14 mGy\*cm  
CTSIvol:12.25 mGy

Data to merge 3		Results	
Item name	Input value	Organ / Tissue Dose (mGy)	
Date and Time	2014/10/01 15:44	Genital	0.0
Scan type	Head/Neck-Chest (i-phase)	Prostate / Uterus	0.54
Scanning time	1.0 s	Urinary	0.02
Pitch factor	1.0	Colon	1.29
Beam width	16x1.6mm(128x1.6)	Intestine	0.8
Gender	male	Bladder	0.02
Phantom	standard	Gallbladder	14.04
Scan range	Begin position: 1400 mm End position: 1200 mm	Stomach	18.99
ADC	ON	Spleen	18.99
Optimal Phantom	OFF	Adrenals	18.48
CTSI Phantom	12.0cm	Liver	18.24
Site		Heart	14.73

ED100: 8.38 mGy  
ED200: 8.07 mGy  
CLB: 451.44 mGy\*cm  
CTSIvol:11.39 mGy

**Merge**      **Revise**      **Cancel**

Fig. 6-6. Page for confirming the merged data

Select for deletion	Date and Time	Study ID	Series ID	Scan type	Manufacturer	Scanner model	Filter	Tube potential	Rotation time	Pitch factor	
<input type="checkbox"/>	2018/12/06 15:12	00033160	00035251	Pelvis[Pelvis]	GE	LightSpeed VCT	Small	120.0 kV	0.5 s	1.0	20ms
<input type="checkbox"/>	2018/12/10 14:50	00033178	00035269	Chest[Chest-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	0.5 s	1.0	16x1
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034215	00037144	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Standard	80.0 kV	1.0 s	1.0	64x1
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034216	00037145	Chest[Chest-Pelvis (1-phase)]	Siemens	Definition Flash(tube A)	Wide	120.0 kV	1.5 s	1.2	12x1
<input type="checkbox"/>	2014/10/30 15:46	00034217	00037146	Neck[Neck-Pelvis (1-phase)]	GE	LightSpeed 16	Large	120.0 kV	1.0 s	1.2	20ms
<input checked="" type="checkbox"/>	2014/10/30 15:46	00034227	00037170	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Wide	100.0 kV	1.0 s	1.0	32x1
<input type="checkbox"/>	2014/10/30 15:46	00034228	00037171	Neck[Neck-Pelvis (1-phase)]	Canon	Aquilion ONE(TSX-301)	Large	135.0 kV	1.5 s	1.2	2mm
<input type="checkbox"/>	2014/10/30 15:46	00034229	00037172	Neck[Neck-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	1.0 s	1.2	32x1
<input type="checkbox"/>	2019/04/01 00:00	00136271	00139823	Chest[Chest-Pelvis (1-phase)]	Siemens	Sensation 64	[Body]	120.0 kV	1.0 s	1.0	18ms
<input type="checkbox"/>	2019/04/01 00:00	00136272	00139824	Head[Head-Neck (1-phase)]	GE	Revolution CT	[Head]	120.0 kV	1.5 s	1.2	256



Select for deletion	Date and Time	Study ID	Series ID	Scan type	Manufacturer	Scanner model	Filter	Tube potential	Rotation time	Pitch factor	
<input type="checkbox"/>	2018/12/06 15:12	00033160	00035251	Pelvis[Pelvis]	GE	LightSpeed VCT	Small	120.0 kV	0.5 s	1.0	20ms
<input type="checkbox"/>	2018/12/10 14:50	00033178	00035269	Chest[Chest-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	0.5 s	1.0	16x1
<input checked="" type="checkbox"/>	2014/10/30 15:46	00033178	00037144	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Standard	80.0 kV	1.0 s	1.0	64x1
<input checked="" type="checkbox"/>	2014/10/30 15:46	00033178	00037145	Chest[Chest-Pelvis (1-phase)]	Siemens	Definition Flash(tube A)	Wide	120.0 kV	1.5 s	1.2	12x1
<input type="checkbox"/>	2014/10/30 15:46	00034217	00037146	Neck[Neck-Pelvis (1-phase)]	GE	LightSpeed 16	Large	120.0 kV	1.0 s	1.2	20ms
<input checked="" type="checkbox"/>	2014/10/30 15:46	00033178	00037170	Head[Head-Neck (1-phase)]	Siemens	Definition Flash(tube A)	Wide	100.0 kV	1.0 s	1.0	32x1
<input type="checkbox"/>	2014/10/30 15:46	00034228	00037171	Neck[Neck-Pelvis (1-phase)]	Canon	Aquilion ONE(TSX-301)	Large	135.0 kV	1.5 s	1.2	2mm
<input type="checkbox"/>	2014/10/30 15:46	00034229	00037172	Neck[Neck-Pelvis (1-phase)]	Philips	Brilliance iCT	Large	120.0 kV	1.0 s	1.2	32x1
<input type="checkbox"/>	2019/04/01 00:00	00136271	00139823	Chest[Chest-Pelvis (1-phase)]	Siemens	Sensation 64	[Body]	120.0 kV	1.0 s	1.0	18ms
<input type="checkbox"/>	2019/04/01 00:00	00136272	00139824	Head[Head-Neck (1-phase)]	GE	Revolution CT	[Head]	120.0 kV	1.5 s	1.2	256

Fig. 6-7. Change of the Study ID after merging data

## 6.2.2. Dose evaluation for the same study (patient)

You can search dose data in the history of your calculations and have the results displayed with the unit of Study ID by choosing list to display “by study” as it shown in Fig. 6-8. In that case, the organ dose for the same ID will be summed automatically for evaluation and the column of the scanning conditions will not be displayed.

The screenshot shows the 'History of your calculations' page of the Waza-ari web-based CT dose calculator. The page includes a header with the logo and a 'Log-out' button. Below the header is a search section with options for 'List to display' (radio buttons for 'by series' and 'by study'), 'Search option: Period' (radio buttons for 'Whole period' and 'Specified period'), and a date range from 'From 2014/09/08' to 'To 2020/02/11'. There are buttons for 'Search', 'Back to the menu page', and navigation links like '<<First', '<Previous 10 cases', 'Next 10 cases>', and '>>Last'. The main content is a table with columns for Date and Time, Study ID, Series ID, and various organ doses. One row for study ID 00084217 is highlighted with a red box around its entire row, showing a dose of 0.0 for all organs listed.

Date and Time	Study ID	Series ID	Dose <sup>a</sup>	Prostate	Urinary	Colon	Small intestine	Kidney	Pancreas	Gall bladder	Stomach	Spleen	Adrenals	Liver	Heart	Lungs	Breast	Esophagus	Thymus	Thyroid	Salivary glands	Ovaries	Cervix
2018/12/06 15:12	00033160	00036261	45.13	42.2	42.3	28.27	30.18	4.39	3.68	3.45	1.78	1.11	1.05	1.45	0.34	0.19	0.15	0.22	0.1	0.04	0.01	0.01	
2014/10/30 15:46	00084217	00036269	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
2014/10/30 15:46	00084218	00037170	29.87	19.82	13.5	23.6	28.06	37.49	43.01	42.79	48.55	46.78	39.87	48.2	79.55	71.66	53.66	68.99	72.27	89.71	88.29	31.0	
2014/10/30 15:46	00084218	00037171	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
2014/10/30 15:46	00084218	00037172	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
2019/04/01 00:00	00136271	00139823	19.01	19.22	23.94	28.94	28.98	29.95	30.42	29.83	31.65	31.92	26.87	30.16	28.01	27.08	19.88	23.88	25.33	27.9	1.97	0.88	
2019/04/01 00:00	00136272	00139824	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.01	0.02	0.01	0.02	0.08	0.12	0.08	0.17	0.11	0.8	17.04	8.7	
2019/04/01 00:00	00136279	00139825	12.01	10.17	10.99	12.63	11.93	11.97	11.14	11.56	12.18	11.42	11.1	12.06	12.4	11.65	9.83	11.59	12.98	18.83	14.53	15.1	
2019/10/04 07:00	00137100	00140482	6.94	9.55	11.89	11.17	11.94	9.76	9.66	9.65	10.29	9.7	8.04	9.34	8.72	8.41	6.1	7.59	8.2	11.9	0.6	0.98	
2019/10/04 07:01	00137101	00140483	6.68	9.47	12.06	14.26	14.71	14.61	14.56	14.21	15.2	14.8	12.7	14.47	14.46	14.04	10.18	12.67	13.45	17.14	0.79	0.5	

Buttons at the bottom include 'Delete the marked data', 'Merge selected data', and export options: 'Print(by selection)', 'Print', and 'CSV'.

Fig. 6-8. Page for history of your calculation (displayed with history for the same study ID)

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## 7. User model

Under construction

## 8. Confirmation of dose distribution

You can review all registered calculation results using this function. Accordingly, print, delete and exportation of the registered data are also available. Pressing "Dose distributions" button on the Main menu (Fig. 8-1) to go to the page of "Register the number of X-ray CT examination".

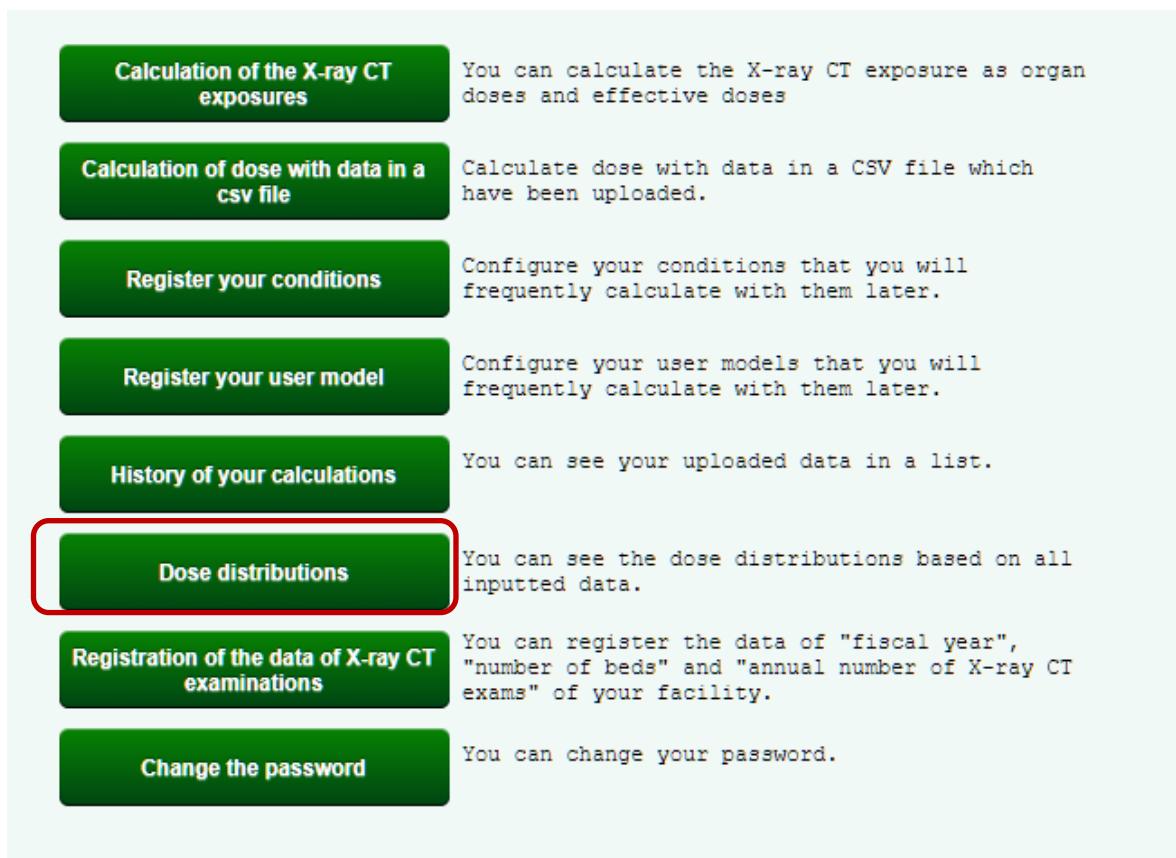


Fig. 8-1 Main menu (Dose distributions)

Specify each condition on the page for displaying in dose distribution (Fig. 8-2) and press "Show the graph" button to check browse dose distribution of registered data as a histogram. (Fig. 8-3andFig. 8-4).

If you choose "All facilities" for the data for the search you will see light green and dark green in your graph and the meaning is as follows,

Light green: All the dose data in the WAZA-ARIv2

Dark green: Dose data registered by your institution

Accordingly, median of each data is displayed as the statistical level value of the histogram.

You can specify the tissue types and CT examination type of dose information to display. If you want to specify more than one type, press "Ctrl" on the keyboard while you select.

The screenshot shows the 'Dose distributions' page of the Waza-ari web-based CT dose calculator. The page has a header with the logo and a 'Log-out' button. The main area is titled 'Specify range of display?' and contains several input fields:

- List to display:** Radio buttons for 'by series' and 'by study'.
- Fiscal year:** A dropdown menu set to '2019'.  
**Nation:** A dropdown menu set to 'Japan'.
- Data for the search:**
  - Facility type:** Radio buttons for 'All facilities' (selected) and 'Limit type to:' followed by a dropdown menu with 'All', 'Hospital (National)', and 'Hospital (Public)'.
  - Phantom:** Radio buttons for 'All facilities' (selected) and 'Limit type to:' followed by a dropdown menu with 'Type' and '-select-'.
- Item name of dose data:** A dropdown menu set to 'ED103'.  
**Type of CT exams:** A dropdown menu with 'All [All]', 'Head [Face/Orbits/Sinus]', and 'Head [Head-Neck CTA]'.
- Search option:**
  - No**
  - Yes**
  - Absolute**
  - Relative**With input fields for 'Minimum', 'Maximum', and 'Step'.

At the bottom are two buttons: 'Show the graph' and 'Back to the menu page'.

Fig. 8-2 Page for specifying the information of dose distribution

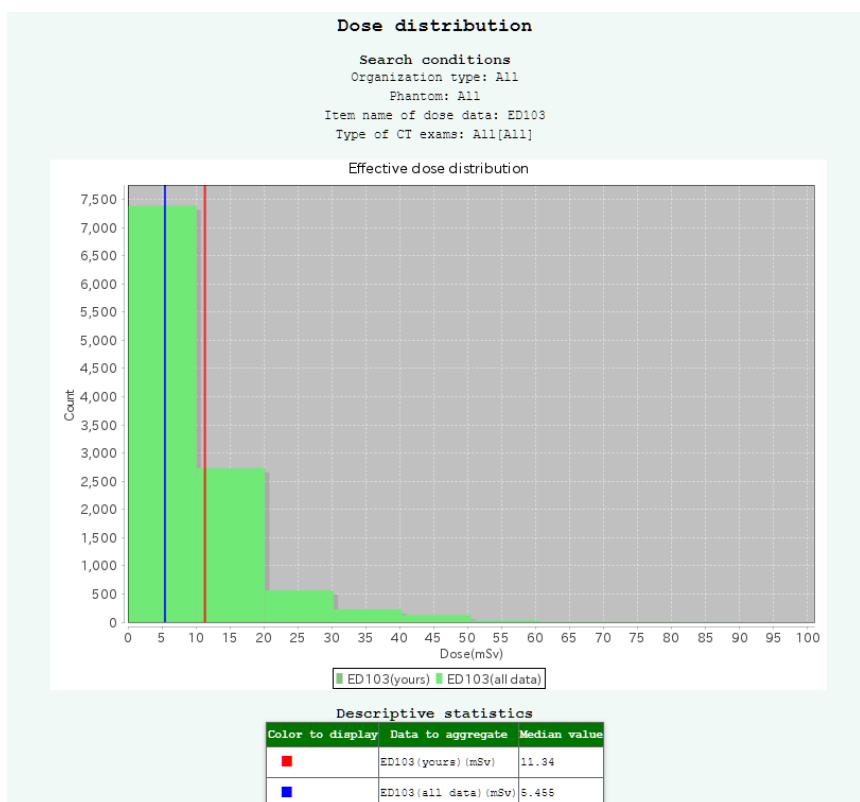


Fig. 8-3 Histogram of dose distribution (Absolute)

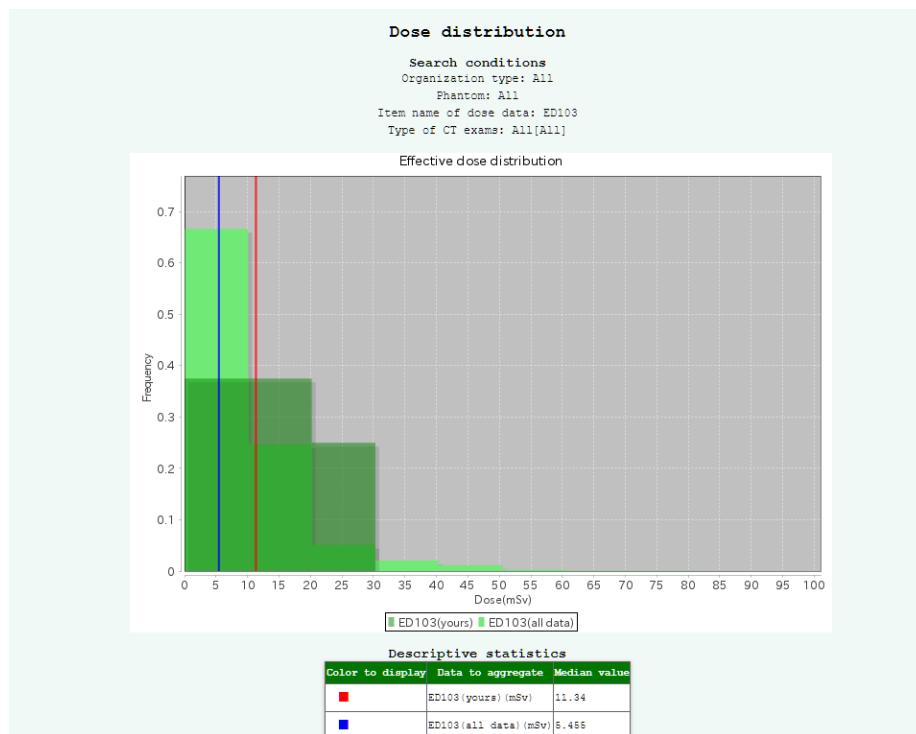


Fig. 8-4 Histogram of dose distribution (Relative)

# 9. Dose calculation method

## 9.1. Construction of organ dose database for each CT source data

WAZA-ARI calculates exposure dose using organ dose database for each CT model, tube voltage, Bow-tie filter, and phantom. This organ dose database is constructed using general-purpose particle / heavy ion transport calculation codes PHITS developed by the JAEA and various human Voxel phantoms.

After measuring source data (such as HVL and dose distribution) for each CT model, tube voltage, Bow-tie filter and collimation X-ray energy spectrum and generation distribution are modeled based on the measurement, and the model is implemented into PHITS as an X-ray source. Accordingly, using PHITS and the human body voxel phantom to calculate dose to each organ for each slice of phantom. [1,2]

In PHITS, absorbed dose to organ  $T$  per generated photon at slice  $k$   $qD(T, k)$  [mGy / photon] and air kerma at the center of rotation per generated photon  $qK_{air}$  [mGy / photon] ( $=CTDI_{free\ air}$  per generated photon) are calculated for each CT model, tube voltage, Bow-tie filter, and phantom and implemented in WAZA-ARI system as described above. Absorbed dose to organ  $T$  at  $k$ -th slice  $nD(T, k)$  [mGy / mGy] per  $CTDI_{free\ air}$  is then calculated by

$$nD(T, k) = \frac{qD(T, k)}{qK_{air}}.$$

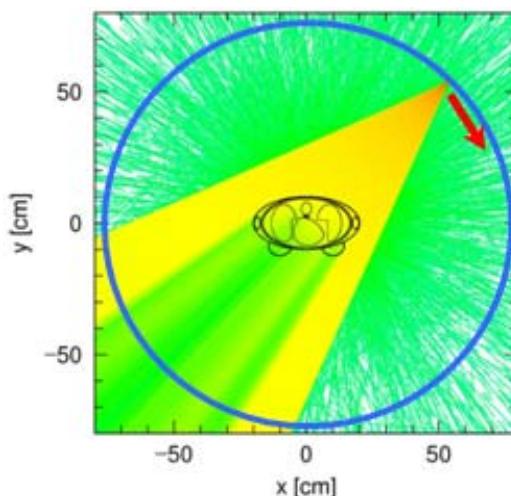


Fig. 9-1. Example of how X-ray emitted from CT device using PHITS

In WAZA-ARI, CT models with similar beam quality and dose distribution are calculated using the same source data while dose information such as  $CTDI_w$  and  $CTDI_{free\ air}$  are referring the nominal values of each model.

## 9.2. Organ dose database and the computable range

Organ dose database is the calculated radiation dose data for each organ within an interval of 5 mm (= 1 slice). Table 9-1 shows the content of organ dose database.

Table 9-1 Content of organ dose database

Phantom	Male	Female
<b>standard</b>		
<b>Fat(+2SD)</b>	0 – 1835 (367 slice)	0 – 1666 (334 slice)
<b>Fat(+5SD)</b>		
<b>Thin(-2SD)</b>		
<b>age:0</b>	0 - 475 mm (95 slice)	0 - 475 mm (95 slice)
<b>age:1</b>	0 - 765 mm (153 slice)	0 - 765 mm (153 slice)
<b>age:5</b>	0 - 1105 mm (221 slice)	0 - 1105 mm (221 slice)
<b>age:10</b>	0 – 1400 mm (280 slice)	0 – 1400 mm (280 slice)
<b>age:15</b>	0 – 1660 mm (332 slice)	0 – 1615 mm (323 slice)

### 9.3. Parameter and data for dose calculation

Organ dose calculation for each scanning condition needs the following parameter.

**Beginning position  $z_{start}$  [mm] and the end position  $z_{end}$  [mm] of scan**

**Tube current  $I$  [mA]**

**Rotation time  $t$  [s]**

**Beam pitch  $pit$  [-]**

**normalized CTDI free air  $nCTDI_{free\ air}$  [mGy/mAs]**

$nCTDI_{free\ air}$  means CTDI free air per mAs which varies with tube current, Bow-tie filter and beam width.

**normalized Weighted CTDI  $nCTDI_w$  [mGy/mAs]**

$CTDI_w$  is the summation of weighted central dose in CTDI phantom (16 cm $\phi$  for head and 32 cm $\phi$  for body)  $CTDI_{center}$  and the peripheral dose in CTDI phantom  $CTDI_{peripheral}$ .

$$CTDI_w = \frac{1}{3} CTDI_{center} + \frac{2}{3} CTDI_{peripheral} \quad (1)$$

$nCTDI_w$  is  $CTDI_w$  per mAs and it varies with tube voltage and beam width.

## 9.4. Calculation of organ dose

### AEC (Auto Exposure Control) : off

Couch movement during one rotation of the beam is  $w \cdot pit$ , and irradiated area is equal to the beam width  $w$  during one rotation. Therefore, percentage of the body surface with incident of primary X-rays can be expressed as follows.

$$\frac{w}{w \cdot pit} = \frac{1}{pit}$$

$\frac{1}{pit} > 1$  means that this part is multiple irradiations.

Irradiation of  $k$ th slice results in dose for the organ  $TD(T, k)$  [mGy] is as follows

$$D(T, k)[\text{mGy}] = {}_n D(T, k)[\text{mGy}/\text{mGy}] \cdot {}_n CTDI_{free air}[\text{mGy}/\text{mAs}] \cdot \frac{I \cdot t}{pit} [\text{mAs}] \quad (2)$$

${}_n D(T, k)$  is pre-calculated for different CT scanner, tube voltage, Bow-tie filter and phantom with an interval  $\Delta s = 5 \text{ mm}$ .

As shown in Fig 9-2, absorbed dose  $D$  to tissue  $T$   $D(T)$  that located in scanning range of  $z_{start} \sim z_{end}$  ( $z_{start} < z_{end}$ ) [mm] is calculated as follows.

$$D(T) = \int_{z_{start}}^{z_{end}} \frac{D(T, k)}{\Delta s} dz = \frac{z_{i+1} - z_{start}}{\Delta s} D(T, i) + \sum_{k=i+1}^{j-1} D(T, k) + \frac{z_{end} - z_j}{\Delta s} D(T, i) \quad (3)$$

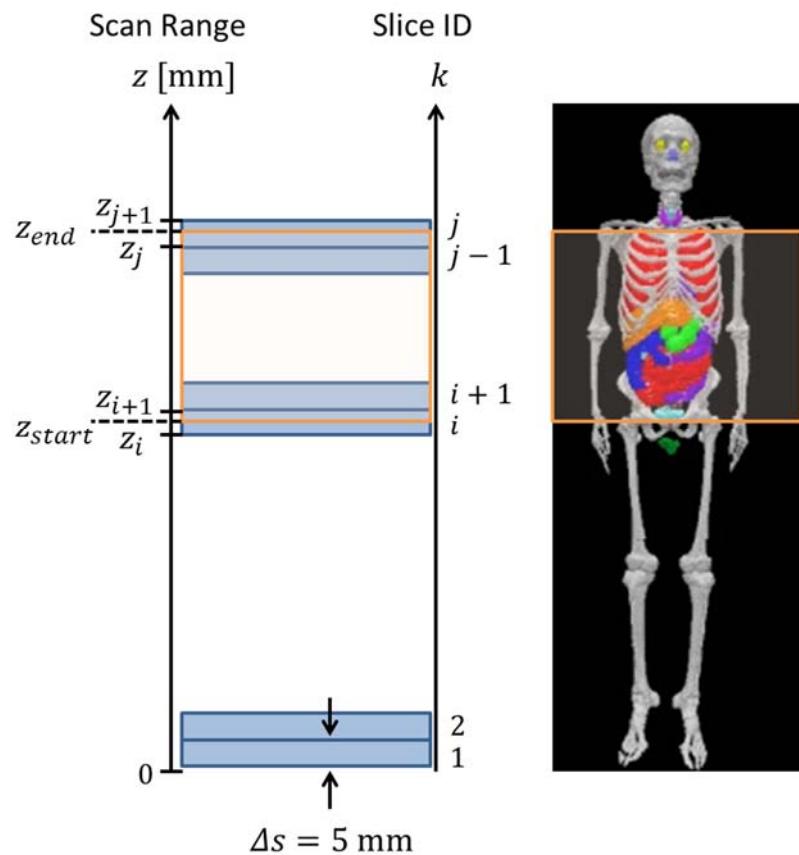


Fig 9-2. Relationship between the scanning range of  $z_{start} \sim z_{end}$  and organ dose data for  $k$ th slice

### AEC (Auto Exposure Control) : on

When AEC function is on, it is assumed that tube current  $I$  [mA] changes according to z-coordinate of the irradiation position as shown in Fig. 9-3. Tube current values  $I_{start}, I_{end}, I_a, I_b, I_c (= I_b), I_c, I_d, I_e$  corresponding to the beginning/end position of scanning  $z_{start}, z_{end}$  and boundary position  $z_a, z_b, z_c, z_d, z_e$  can be specified by the user. Tube current at the center of each slice  $I_k$  ( $\Delta s = 5$  mm) within the scanning range is calculated based on the tube voltage. Boundary positions are shown in Table 9-2 and Table 9-3.

When the coordinates  $z_k + \frac{\Delta s}{2}$  of the center of the k-th slice are between adjacent boundary positions  $z_l, z_m$ , tube current  $I_k$  is expressed by linear interpolation as shown in the following formula.

$$I_k = I_l + \frac{I_m - I_l}{z_m - z_l} \left( z_k + \frac{\Delta s}{2} - z_l \right) \quad \left( z_l < z_k + \frac{\Delta s}{2} < z_m \right) \quad (4)$$

On the assumption that  $I_k$  is constant within each slice, absorbed dose  $D$  to organ  $T$  from the irradiation of the  $k$ th slice  $D(T, k)$  is calculated as follows.

$$D(T, k)[\text{mGy}] = n D(T, k)[\text{mGy}/\text{mGy}] \cdot n CTDI_{free air}[\text{mGy}/\text{mAs}] \cdot \frac{I_k \cdot t}{pit} [\text{mAs}] \quad (5)$$

Absorbed dose to tissue  $T$   $D(T)$  within the scan area is calculated by Eq. (6).

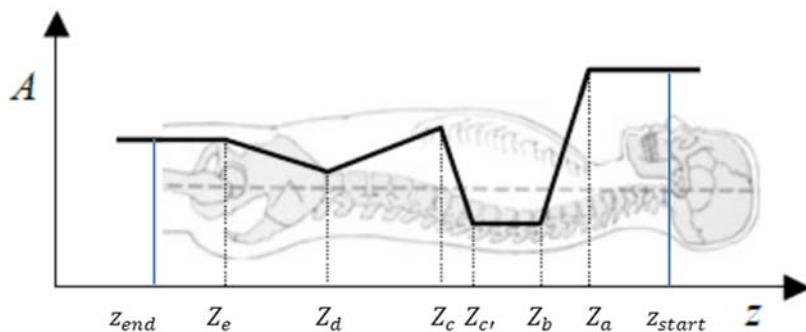


Fig. 9-3. Change of tube current when AEC is on

Table 9-2 Boundary for male phantom when using AEC calculation

z	Anatomical definition	Adult	0-year-	1-year-	5-year-	10-year-	15-year-
		male [mm]	old boy [mm]				
$Z_a$	First slice of lung apex	1542.5	337.5	575.5	885.5	1156.5	1394.5
$Z_b$	Trachea	1452.5	319.5	550.5	843.5	1100.5	1324.5
$Z_{c'}$		1322.5	297.5	493.5	774.5	1019.5	1190.5
$(Z_{c'} - Z_c)$		(50)	(20)	(20)	(20)	(20)	(20)
Hepatic portal section							
$Z_c$	(Last slice for left lung field)	1272.5	277.5	473.5	754.5	999.5	1170.5
$Z_d$	Upper margin of iliac	1150.5	200.5	377.5	614.5	823.5	1010.5
$Z_e$	Upper margin of pubis	987.5	164.5	306.5	517.5	686.5	849.5

Table 9-3 Boundary for male phantom when using AEC calculation

z	Anatomical definition	Adult	0-year-	1-year-	5-year-	10-year-	15-year-
		female [mm]	old girl [mm]				
$Z_a$	First slice of lung apex	1404.5	337.5	575.5	885.5	1156.5	1345.5
$Z_b$	Trachea	1311.5	319.5	550.5	843.5	1100.5	1269.5
$Z_{c'}$		1181.5	297.5	493.5	774.5	1019.5	1164.5
$(Z_{c'} - Z_c)$		(50)	(20)	(20)	(20)	(20)	(20)
Hepatic portal section							
$Z_c$	(Last slice for left lung field)	1131.5	277.5	473.5	754.5	999.5	1144.5
$Z_d$	Upper margin of iliac	1028.5	200.5	377.5	614.5	823.5	975.5
$Z_e$	Upper margin of pubis	861.5	164.5	306.5	517.5	686.5	818.5

## 9.5. Calculation of dose index

WAZA-ARI calculates DLP (Dose Length Product) and averaged  $CTDI_{vol}$  for the scanning area as dose indexes.

### AEC (Auto Exposure Control) : off

$$CTDI_{vol}[\text{mGy}] = {}_nCTDI_w \cdot \frac{I \cdot t}{pit}$$

$$DLP[\text{mGy} \cdot \text{cm}] = CTDI_{vol}[\text{mGy}] \cdot (z_{end} - z_{start}) [\text{mm}] \cdot \frac{1}{10} [\frac{\text{cm}}{\text{mm}}]$$

### AEC (Auto Exposure Control) : on

$CTDI_{vol}$  for  $k$ th slice  $CTDI_{vol}(k)$  is expressed as:

$$CTDI_{vol}(k)[\text{mGy}] = Rel\_CTDI \cdot {}_nCTDI_w \cdot \frac{I_k \cdot t}{pit}$$

When the scanning range is between  $z_{start} \sim z_{end}$  ( $z_{start} < z_{end}$ ) shown in Fig 9-2,  $DLP$  [ $\text{mGy} \cdot \text{cm}$ ] can be expressed as

$$DLP[\text{mGy} \cdot \text{cm}] = \left\{ (z_{i+1} - z_{start}) \cdot CTDI_{vol}(i) + \Delta s \cdot \sum_{k=i+1}^{j-1} CTDI_{vol}(k) + (z_{end} - z_j) \cdot CTDI_{vol}(j) \right\} [\text{mGy} \cdot \text{mm}] \cdot \frac{1}{10} [\text{cm/mm}]$$

Averaged  $CTDI_{vol}$  [ $\text{mGy}$ ] can be expressed as:

$$CTDI_{vol}[\text{mGy}] = \frac{DLP[\text{mGy} \cdot \text{cm}]}{(z_{end} - z_{start})[\text{mm}]} \cdot 10[\text{mm/cm}]$$

### SSDE (Size-specific Dose Estimates) : on

SSDE is a dose index proposed to correct the uncertainty of  $CTDI_{vol}$ . WAZA-ARIv2 calculates SSDE by using the conversion factors, i.e.  $f_{size}^{16}$  or  $f_{size}^{32}$ , and the following formula proposed in AAPM report TG204 [7].

If  $CTDI_{vol}$  was calculated based on a 32 cm CTDI phantom:

$$SSDE = f_{size}^{32} \times CTDI_{vol}^{32} [\text{mGy}]$$

If  $CTDI_{vol}$  was calculated based on a 16 cm CTDI phantom:

$$SSDE = f_{size}^{16} \times CTDI_{vol}^{16} [\text{mGy}]$$

Table 9-4 Conversion factor  $f_{size}^{32}$  as a function of effective diameter

Effective diameter	Conversion factor	Effective diameter	Conversion factor	Effective diameter	Conversion factor
8	2.76	21	1.71	34	1.06
9	2.66	22	1.65	35	1.02
10	2.57	23	1.59	36	0.99
11	2.47	24	1.53	37	0.95
12	2.38	25	1.48	38	0.92
13	2.30	26	1.43	39	0.88
14	2.22	27	1.37	40	0.85
15	2.14	28	1.32	41	0.82
16	2.06	29	1.28	42	0.79
17	1.98	30	1.23	43	0.76
18	1.91	31	1.19	44	0.74
19	1.84	32	1.14	45	0.71
20	1.78	33	1.10		

Table 9-5 Conversion factor  $f_{size}^{16}$  as a function of effective diameter

Effective diameter [cm]	Conversion factor	Effective diameter [cm]	Conversion factor	Effective diameter [cm]	Conversion factor
6	1.49	23	0.77	40	0.40
7	1.43	24	0.74	41	0.38
8	1.38	25	0.71	42	0.37
9	1.32	26	0.69	43	0.35
10	1.27	27	0.66	44	0.34
11	1.22	28	0.63	45	0.33
12	1.18	29	0.61	46	0.32
13	1.13	30	0.59	47	0.30
14	1.09	31	0.56	48	0.29
15	1.05	32	0.54	49	0.28
16	1.01	33	0.52	50	0.27
17	0.97	34	0.50	51	0.26
18	0.93	35	0.48	52	0.25
19	0.90	36	0.47	53	0.24
20	0.86	37	0.45	54	0.23
21	0.83	38	0.43	55	0.22
22	0.80	39	0.41		

# 10. Registered parameters

Table 10-1. Supported CT scanner model, Bow-tie filter and tube voltage. (Feb. 2021)

Scanner Model	Bow-tie Filter Name or Size	Tube Voltage [kV]
<b>GE</b>		
LightSpeed 16	Large, Small	80, 100, 120
LightSpeed RT	Large, Small	80, 100, 120
LightSpeed Ultra	Large, Small	80, 100, 120
LightSpeed VCT	Large, Medium, Small	80, 120
BrightSpeed Elite	Large, Small	80, 100, 120, 140
Discovery CT750HD	Large, Medium, Small	80, 100, 120, 140
Revolution HD	Large, Medium, Small	80, 100, 120, 140
Optima CT660	Large, Small	80, 100, 120, 140
Revolution EVO	Large, Small	80, 100, 120, 140
Revolution GSI	Large, Medium, Small	80, 100, 120, 140
Revolution CT	Large, Medium, Small	70, 80, 100, 120, 140
<b>Siemens</b>		
Sensation 16	Standard	80, 120
Sensation 64	Standard	80, 100, 120
Emotion 6	Standard	80, 110, 130
Emotion 16	Standard	80, 110, 130
Perspective	Standard	80, 110, 130
Scope	Standard	80, 110, 130
Definition Flash	Standard, Wide	80, 100, 120, 140
Definition Edge	Standard	70, 80, 100, 120, 140
Definition AS	Standard	70, 80, 100, 120, 140
Definition AS+	Standard	70, 80, 100, 120, 140
Force	Standard	70, 80, 90, 100, 110, 120, 130, 140, 150
<b>Canon (Toshiba)</b>		
Aquilion 16	Large, Small	80, 100, 120, 135
Aquilion 64	Large, Small	80, 100, 120, 135
Aquilion CX	Large, Small	80, 100, 120, 135
Aquilion CXL	Large, Small	80, 100, 120, 135
Aquilion LB	Large, Small	80, 100, 120, 135
Alexion	Medium	80, 100, 120, 135
Alexion Access	Medium	80, 100, 120, 135

Aquilion Lightning	Large, Small	80, 100, 120, 135
Aquilion PRIME Beyond	Large, Medium, Small	80, 100, 120, 135
Aquilion PRIME Focus	Large, Medium, Small	80, 100, 120, 135
Aquilion Prime SP	Large, Small	80, 100, 120, 135
Aquilion ONE ViSION	Large, Medium, Small	80, 100, 120, 135
Aquilion ONE GENESIS	Large, Medium	80, 100, 120, 135
Aquilion ONE NATURE	Large, Medium	80, 100, 120, 135
Aquilion Precision	Large1, Large2, Medium	80, 100, 120, 140

### **Hitachi**

Eclos 4	Normal	100, 120
Eclos 8	Normal	100, 120
Eclos 16	Normal	100, 120
SCENARIA	Normal, Small	80, 100, 120, 140
SCENARIA EX	Normal, Small	80, 100, 120, 140
SCENARIA View	Normal, Small	80, 100, 120, 140
Supria	Normal	80, 100, 120, 140
Supria Grande	Normal	80, 100, 120, 140
Supria Grande Advance	Normal	80, 100, 120, 140
Supria Advance	Normal	80, 100, 120, 140
Supria Grande Premium	Normal	80, 100, 120, 140

### **Philips**

Brilliance 64	Large	80, 120
Brilliance iCT	Large, Small	80, 120
Ingenuity	Large	80, 120
IQon Spectral CT	Medium	80, 100, 120, 140

Table 10-2. Parameters related to dose index for GE Light Speed 16

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120	120kV-L-101	20 mm	20	0.252	ND	0.100
			15 mm	15	0.276	ND	0.109
			10 mm	10	0.293	ND	0.116
			5 mm	5	0.370	ND	0.146
			1.25 mm	1.25	0.384	ND	0.152
<b>Large</b>	100	100kV-L-101	20 mm	20	0.171	ND	0.058
			15 mm	15	0.187	ND	0.064
			10 mm	10	0.199	ND	0.068
			5 mm	5	0.251	ND	0.086
			1.25 mm	1.25	0.261	ND	0.089
<b>Large</b>	80	80kV-L-101	20 mm	20	0.092	ND	0.027
			15 mm	15	0.101	ND	0.029
			10 mm	10	0.107	ND	0.031
			5 mm	5	0.135	ND	0.039
			1.25 mm	1.25	0.141	ND	0.041
<b>Small</b>	120	120kV-S-101	20 mm	20	0.277	0.180	ND
			15 mm	15	0.302	0.197	ND
			10 mm	10	0.322	0.209	ND
			5 mm	5	0.405	0.264	ND
			1.25 mm	1.25	0.421	0.274	ND
<b>Small</b>	100	100kV-S-101	20 mm	20	0.189	0.117	ND
			15 mm	15	0.206	0.128	ND
			10 mm	10	0.219	0.136	ND
			5 mm	5	0.276	0.171	ND
			1.25 mm	1.25	0.287	0.178	ND
<b>Small</b>	80	80kV-S-101	20 mm	20	0.112	0.064	ND
			15 mm	15	0.122	0.070	ND
			10 mm	10	0.130	0.074	ND
			5 mm	5	0.164	0.093	ND
			1.25 mm	1.25	0.171	0.097	ND

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-3. Parameters related to dose index for GE Light Speed RT

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120		20 mm	20	0.206	ND	0.085
			15 mm	15	0.223	ND	0.092
			10 mm	10	0.239	ND	0.099
			5 mm	5	0.295	ND	0.122
			2 x 0.63 mm	1.26	0.305	ND	0.127
			1 x 1.25 mm	1.25	0.582	ND	0.241
<b>Large</b>	100		20 mm	20	0.137	ND	0.054
			15 mm	15	0.148	ND	0.059
			10 mm	10	0.159	ND	0.063
			5 mm	5	0.196	ND	0.078
			2 x 0.63 mm	1.26	0.203	ND	0.081
			1 x 1.25 mm	1.25	0.387	ND	0.154
<b>Large</b>	80		20 mm	20	0.079	ND	0.029
			15 mm	15	0.085	ND	0.031
			10 mm	10	0.092	ND	0.034
			5 mm	5	0.113	ND	0.042
			2 x 0.63 mm	1.26	0.117	ND	0.043
			1 x 1.25 mm	1.25	0.259	0.170	ND
<b>Small</b>	120		20 mm	20	0.281	0.184	ND
			15 mm	15	0.302	0.198	ND
			10 mm	10	0.373	0.245	ND
			5 mm	5	0.385	0.253	ND
			2 x 0.63 mm	1.26	0.735	0.482	ND
			1 x 1.25 mm	1.25	0.259	0.170	ND
<b>Small</b>	100		20 mm	20	0.182	0.114	ND
			15 mm	15	0.197	0.123	ND
			10 mm	10	0.211	0.132	ND
			5 mm	5	0.261	0.163	ND
			2 x 0.63 mm	1.26	0.270	0.169	ND
			1 x 1.25 mm	1.25	0.514	0.322	ND
<b>Small</b>	80		20 mm	20	0.113	0.065	ND
			15 mm	15	0.123	0.071	ND
			10 mm	10	0.132	0.076	ND
			5 mm	5	0.163	0.094	ND
			2 x 0.63 mm	1.26	0.168	0.097	ND
			1 x 1.25 mm	1.25	0.321	0.185	ND

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-4. Parameters related to dose index for GE Light Speed Ultra

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120	120kV-L-101	20 mm	20	0.252	ND	0.100
			15 mm	15	0.293	ND	0.116
			10 mm	10	0.290	ND	0.115
			5 mm	5	0.359	ND	0.143
			1 x 1.25 mm	1.25	0.614	ND	0.244
			2 x 0.63 mm	1.26	0.368	ND	0.146
<b>Large</b>	100	100kV-L-101	20 mm	20	0.165	ND	0.060
			15 mm	15	0.191	ND	0.070
			10 mm	10	0.189	ND	0.070
			5 mm	5	0.234	ND	0.086
			1 x 1.25 mm	1.25	0.401	ND	0.147
			2 x 0.63 mm	1.26	0.240	ND	0.088
<b>Large</b>	80	80kV-L-101	20 mm	20	0.092	ND	0.031
			15 mm	15	0.106	ND	0.036
			10 mm	10	0.105	ND	0.036
			5 mm	5	0.131	ND	0.044
			1 x 1.25 mm	1.25	0.223	ND	0.076
			2 x 0.63 mm	1.26	0.134	ND	0.046
<b>Small</b>	120	120kV-S-101	20 mm	20	0.304	0.195	ND
			15 mm	15	0.353	0.226	ND
			10 mm	10	0.350	0.224	ND
			5 mm	5	0.433	0.278	ND
			1 x 1.25 mm	1.25	0.741	0.475	ND
			2 x 0.63 mm	1.26	0.444	0.285	ND
<b>Small</b>	100	100kV-S-101	20 mm	20	0.207	0.127	ND
			15 mm	15	0.241	0.148	ND
			10 mm	10	0.238	0.146	ND
			5 mm	5	0.296	0.181	ND
			1 x 1.25 mm	1.25	0.505	0.310	ND
			2 x 0.63 mm	1.26	0.303	0.186	ND
<b>Small</b>	80	80kV-S-101	20 mm	20	0.124	0.070	ND
			15 mm	15	0.144	0.082	ND
			10 mm	10	0.142	0.081	ND
			5 mm	5	0.177	0.100	ND
			1 x 1.25 mm	1.25	0.302	0.171	ND
			2 x 0.63 mm	1.26	0.181	0.102	ND

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-5. Parameters related to dose index for GE Light Speed VCT

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120	80kV-L-102	40 mm	40	0.240	ND	0.093
			20 mm	20	0.257	ND	0.100
			10 mm	10	0.307	ND	0.120
			1.25 mm	1.25	0.407	ND	0.159
<b>Large</b>	80	80kV-L-102	40 mm	40	0.090	ND	0.030
			20 mm	20	0.096	ND	0.033
			10 mm	10	0.115	ND	0.039
			1.25 mm	1.25	0.152	ND	0.052
<b>Medium</b>	120	120kV-M-102	40 mm	40	0.301	0.217	0.095
			20 mm	20	0.322	0.233	0.102
			10 mm	10	0.385	0.278	0.122
			1.25 mm	1.25	0.511	0.369	0.162
<b>Medium</b>	80	80kV-M-102	40 mm	40	0.128	0.081	0.034
			20 mm	20	0.136	0.086	0.036
			10 mm	10	0.163	0.103	0.043
			1.25 mm	1.25	0.216	0.137	0.058
<b>Small</b>	120	120kV-S-102	40 mm	40	0.300	0.193	ND
			20 mm	20	0.321	0.206	ND
			10 mm	10	0.383	0.247	ND
			1.25 mm	1.25	0.509	0.328	ND
<b>Small</b>	80	80kV-S-102	40 mm	40	0.127	0.071	ND
			20 mm	20	0.136	0.076	ND
			10 mm	10	0.163	0.090	ND
			1.25 mm	1.25	0.216	0.120	ND

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-6. Parameters related to dose index for GE Discovery CT750HD/Revolution HD

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	140		64 x 0.625 mm	40	0.318	ND	0.114
			32 x 0.625 mm	20	0.353	ND	0.127
			16 x 0.625 mm	10	0.400	ND	0.144
			8 x 0.625 mm	5	0.483	ND	0.174
			4 x 0.625 mm	2.5	0.499	ND	0.180
			2 x 0.625 mm	1.25	0.676	ND	0.243
<b>Large</b>	120	120kV-L-103	64 x 0.625 mm	40	0.222	ND	0.080
			32 x 0.625 mm	20	0.247	ND	0.089
			16 x 0.625 mm	10	0.279	ND	0.101
			8 x 0.625 mm	5	0.338	ND	0.122
			4 x 0.625 mm	2.5	0.349	ND	0.126
			2 x 0.625 mm	1.25	0.473	ND	0.171
<b>Large</b>	100	100kV-L-103	64 x 0.625 mm	40	0.148	ND	0.051
			32 x 0.625 mm	20	0.165	ND	0.056
			16 x 0.625 mm	10	0.186	ND	0.064
			8 x 0.625 mm	5	0.225	ND	0.077
			4 x 0.625 mm	2.5	0.233	ND	0.079
			2 x 0.625 mm	1.25	0.316	ND	0.108
<b>Large</b>	80	80kV-L-103	64 x 0.625 mm	40	0.084	ND	0.027
			32 x 0.625 mm	20	0.093	ND	0.030
			16 x 0.625 mm	10	0.105	ND	0.034
			8 x 0.625 mm	5	0.127	ND	0.041
			4 x 0.625 mm	2.5	0.131	ND	0.042
			2 x 0.625 mm	1.25	0.178	ND	0.058
<b>Medium</b>	140		64 x 0.625 mm	40	0.378	0.254	0.118
			32 x 0.625 mm	20	0.420	0.282	0.132
			16 x 0.625 mm	10	0.475	0.319	0.149
			8 x 0.625 mm	5	0.574	0.385	0.180
			4 x 0.625 mm	2.5	0.593	0.398	0.186
			2 x 0.625 mm	1.25	0.804	0.539	0.252
<b>Medium</b>	120	120kV-M-103	64 x 0.625 mm	40	0.280	0.182	0.083
			32 x 0.625 mm	20	0.311	0.202	0.092
			16 x 0.625 mm	10	0.352	0.228	0.104
			8 x 0.625 mm	5	0.426	0.276	0.126
			4 x 0.625 mm	2.5	0.440	0.285	0.130
			2 x 0.625 mm	1.25	0.596	0.386	0.177
<b>Medium</b>	100	100kV-M-103	64 x 0.625 mm	40	0.191	0.119	0.052
			32 x 0.625 mm	20	0.212	0.132	0.058
			16 x 0.625 mm	10	0.240	0.149	0.066
			8 x 0.625 mm	5	0.290	0.180	0.080
			4 x 0.625 mm	2.5	0.299	0.186	0.082
			2 x 0.625 mm	1.25	0.406	0.253	0.111
<b>Medium</b>	80	80kV-M-103	64 x 0.625 mm	40	0.115	0.066	0.028
			32 x 0.625 mm	20	0.128	0.073	0.031
			16 x 0.625 mm	10	0.145	0.082	0.035
			8 x 0.625 mm	5	0.175	0.100	0.042
			4 x 0.625 mm	2.5	0.181	0.103	0.044
			2 x 0.625 mm	1.25	0.245	0.139	0.059
<b>Small</b>	140		64 x 0.625 mm	40	0.380	0.226	0.100
			32 x 0.625 mm	20	0.422	0.251	0.111
			16 x 0.625 mm	10	0.478	0.284	0.126
			8 x 0.625 mm	5	0.578	0.343	0.152
			4 x 0.625 mm	2.5	0.597	0.355	0.157
			2 x 0.625 mm	1.25	0.809	0.481	0.213
<b>Small</b>	120	120kV-S-103	64 x 0.625 mm	40	0.280	0.162	0.070
			32 x 0.625 mm	20	0.311	0.180	0.078
			16 x 0.625 mm	10	0.352	0.203	0.088
			8 x 0.625 mm	5	0.426	0.246	0.107
			4 x 0.625 mm	2.5	0.440	0.254	0.110
			2 x 0.625 mm	1.25	0.596	0.344	0.149
<b>Small</b>	100	100kV-S-103	64 x 0.625 mm	40	0.192	0.106	0.044
			32 x 0.625 mm	20	0.213	0.117	0.049
			16 x 0.625 mm	10	0.241	0.133	0.055
			8 x 0.625 mm	5	0.291	0.161	0.067
			4 x 0.625 mm	2.5	0.301	0.166	0.069
			2 x 0.625 mm	1.25	0.408	0.225	0.094

<b>Small</b>	80	80kV-S-103	64 x 0.625 mm	40	0.117	0.058	0.024
			32 x 0.625 mm	20	0.129	0.065	0.026
			16 x 0.625 mm	10	0.146	0.073	0.030
			8 x 0.625 mm	5	0.177	0.089	0.036
			4 x 0.625 mm	2.5	0.183	0.092	0.037
			2 x 0.625 mm	1.25	0.248	0.124	0.050

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using GE Healthcare Discovery CT750HD Technical Reference Manual

Table 10-7. Parameters related to dose index for GE OptimaCT660

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	140		64 x 0.625 mm	40	0.338	ND	0.127
			32 x 0.625 mm	20	0.360	ND	0.135
			16 x 0.625 mm	10	0.420	ND	0.157
			8 x 0.625 mm	5	0.524	ND	0.196
			4 x 0.625 mm	2.5	0.551	ND	0.206
			2 x 0.625 mm	1.25	0.748	ND	0.280
<b>Large</b>	120	120kV-L-103	64 x 0.625 mm	40	0.238	ND	0.087
			32 x 0.625 mm	20	0.254	ND	0.093
			16 x 0.625 mm	10	0.296	ND	0.108
			8 x 0.625 mm	5	0.369	ND	0.135
			4 x 0.625 mm	2.5	0.388	ND	0.142
			2 x 0.625 mm	1.25	0.527	ND	0.192
<b>Large</b>	100	100kV-L-103	64 x 0.625 mm	40	0.154	ND	0.054
			32 x 0.625 mm	20	0.164	ND	0.057
			16 x 0.625 mm	10	0.191	ND	0.067
			8 x 0.625 mm	5	0.238	ND	0.084
			4 x 0.625 mm	2.5	0.251	ND	0.088
			2 x 0.625 mm	1.25	0.340	ND	0.119
<b>Large</b>	80	80kV-L-103	64 x 0.625 mm	40	0.085	ND	0.028
			32 x 0.625 mm	20	0.090	ND	0.029
			16 x 0.625 mm	10	0.105	ND	0.034
			8 x 0.625 mm	5	0.131	ND	0.043
			4 x 0.625 mm	2.5	0.138	ND	0.045
			2 x 0.625 mm	1.25	0.187	ND	0.061
<b>Small</b>	140		64 x 0.625 mm	40	0.385	0.237	0.108
			32 x 0.625 mm	20	0.409	0.252	0.115
			16 x 0.625 mm	10	0.478	0.294	0.135
			8 x 0.625 mm	5	0.596	0.366	0.168
			4 x 0.625 mm	2.5	0.627	0.385	0.177
			2 x 0.625 mm	1.25	0.850	0.523	0.240
<b>Small</b>	120	120kV-S-103	64 x 0.625 mm	40	0.271	0.167	0.076
			32 x 0.625 mm	20	0.288	0.178	0.081
			16 x 0.625 mm	10	0.337	0.208	0.095
			8 x 0.625 mm	5	0.420	0.259	0.118
			4 x 0.625 mm	2.5	0.441	0.273	0.124
			2 x 0.625 mm	1.25	0.599	0.370	0.168
<b>Small</b>	100	100kV-S-103	64 x 0.625 mm	40	0.175	0.108	0.048
			32 x 0.625 mm	20	0.186	0.115	0.051
			16 x 0.625 mm	10	0.217	0.134	0.060
			8 x 0.625 mm	5	0.271	0.168	0.074
			4 x 0.625 mm	2.5	0.285	0.176	0.078
			2 x 0.625 mm	1.25	0.386	0.239	0.106
<b>Small</b>	80	80kV-S-103	64 x 0.625 mm	40	0.096	0.059	0.025
			32 x 0.625 mm	20	0.102	0.063	0.027
			16 x 0.625 mm	10	0.119	0.073	0.032
			8 x 0.625 mm	5	0.149	0.092	0.039
			4 x 0.625 mm	2.5	0.157	0.096	0.042
			2 x 0.625 mm	1.25	0.212	0.131	0.056

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using GE Healthcare Optima CT660 Technical Reference Manual

Table 10-8. Parameters related to dose index for GE RevolutionEVO

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	140		8 x 5 mm	40	0.338	ND	0.127
			4 x 5 mm	20	0.360	ND	0.135
			2 x 5 mm	10	0.420	ND	0.157
			1 x 5 mm	5	0.524	ND	0.196
			1 x 2.5 mm	2.5	0.551	ND	0.206
			1 x 1.25 mm	1.25	0.748	ND	0.280
<b>Large</b>	120		8 x 5 mm	40	0.238	ND	0.087
			4 x 5 mm	20	0.254	ND	0.093
			2 x 5 mm	10	0.296	ND	0.108
			1 x 5 mm	5	0.369	ND	0.135
			1 x 2.5 mm	2.5	0.388	ND	0.142
			1 x 1.25 mm	1.25	0.527	ND	0.192
<b>Large</b>	100		8 x 5 mm	40	40	0.154	ND
			4 x 5 mm	20	20	0.164	ND
			2 x 5 mm	10	10	0.191	ND
			1 x 5 mm	5	5	0.238	ND
			1 x 2.5 mm	2.5	2.5	0.251	ND
			1 x 1.25 mm	1.25	1.25	0.340	ND
<b>Large</b>	80		8 x 5 mm	40	0.090	ND	0.029
			4 x 5 mm	20	0.105	ND	0.034
			2 x 5 mm	10	0.131	ND	0.043
			1 x 5 mm	5	0.138	ND	0.045
			1 x 2.5 mm	2.5	0.187	ND	0.061
			1 x 1.25 mm	1.25	0.085	ND	0.028
<b>Small</b>	140		8 x 5 mm	40	40	0.385	0.237
			4 x 5 mm	20	20	0.409	0.252
			2 x 5 mm	10	10	0.478	0.294
			1 x 5 mm	5	5	0.596	0.366
			1 x 2.5 mm	2.5	2.5	0.627	0.385
			1 x 1.25 mm	1.25	1.25	0.850	0.523
<b>Small</b>	120		8 x 5 mm	40	0.271	0.167	0.076
			4 x 5 mm	20	0.288	0.178	0.081
			2 x 5 mm	10	0.337	0.208	0.095
			1 x 5 mm	5	0.420	0.259	0.118
			1 x 2.5 mm	2.5	0.441	0.273	0.124
			1 x 1.25 mm	1.25	0.599	0.370	0.168
<b>Small</b>	100		8 x 5 mm	40	40	0.175	0.108
			4 x 5 mm	20	20	0.186	0.115
			2 x 5 mm	10	10	0.217	0.134
			1 x 5 mm	5	5	0.271	0.168
			1 x 2.5 mm	2.5	2.5	0.285	0.176
			1 x 1.25 mm	1.25	1.25	0.386	0.239
<b>Small</b>	80		8 x 5 mm	40	0.096	0.059	0.025
			4 x 5 mm	20	0.102	0.063	0.027
			2 x 5 mm	10	0.119	0.073	0.032
			1 x 5 mm	5	0.149	0.092	0.039
			1 x 2.5 mm	2.5	0.157	0.096	0.042
			1 x 1.25 mm	1.25	0.212	0.131	0.056

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using RevolutionEVO Technical Reference Manual

Table 10-9. Parameters related to dose index for Siemens Sensation 16

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	120		24 mm	24	0.169	ND	0.076
			18 mm	18	0.172	ND	0.077
			12 mm	12	0.185	ND	0.083
			10 mm	10	0.153	ND	0.068
			9 mm	9	0.197	ND	0.088
			2 mm	2	0.168	ND	0.075
			1.2 mm	1.2	0.237	ND	0.106
<b>Standard</b>	80		24 mm	24	0.058	ND	0.023
			18 mm	18	0.059	ND	0.024
			12 mm	12	0.063	ND	0.026
			10 mm	10	0.052	ND	0.021
			9 mm	9	0.068	ND	0.027
			2 mm	2	0.058	ND	0.023
			1.2 mm	1.2	0.081	ND	0.033

\*  $nCTDI_{free\ air}$ ,  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-10. Parameters related to dose index for Siemens Sensation 64

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	120	120kV-M-202	28.8 mm	28.8	0.181	0.134	0.065
			19.2 mm	19.2	0.195	0.145	0.070
			18 mm	18	0.192	0.142	0.069
			10 mm	10	0.161	0.120	0.058
			6 mm	6	0.170	0.126	0.061
			5 mm	5	0.160	0.118	0.058
<b>Standard</b>	100	100kV-M-202	28.8 mm	28.8	0.111	0.081	0.038
			19.2 mm	19.2	0.120	0.087	0.041
			18 mm	18	0.118	0.086	0.040
			10 mm	10	0.099	0.072	0.034
			6 mm	6	0.104	0.076	0.035
			5 mm	5	0.098	0.071	0.033
<b>Standard</b>	80	80kV-M-202	28.8 mm	28.8	0.055	0.134	0.065
			19.2 mm	19.2	0.060	0.145	0.070
			18 mm	18	0.059	0.142	0.069
			10 mm	10	0.049	0.120	0.058
			6 mm	6	0.052	0.126	0.061
			5 mm	5	0.049	0.118	0.058

\*  $nCTDI_{free\ air}$ ,  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-11. Parameters related to dose index for Siemens Emotion 6

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	130	130kV-M-203	6 x 3 mm	18	0.287	0.204	0.101
			6 x 2 mm	12	0.306	0.217	0.107
			2 x 5 mm	10	0.266	0.189	0.093
			6 x 1 mm	6	0.359	0.255	0.126
			6 x 0.5 mm	3	0.354	0.251	0.124
			1 x 1 mm	1	0.266	0.189	0.093
<b>Standard</b>	110		6 x 3 mm	18	0.214	0.147	0.067
			6 x 2 mm	12	0.228	0.157	0.071
			2 x 5 mm	10	0.199	0.137	0.062
			6 x 1 mm	6	0.267	0.183	0.083
			6 x 0.5 mm	3	0.268	0.184	0.083
			1 x 1 mm	1	0.213	0.146	0.066
<b>Standard</b>	80		6 x 3 mm	18	0.106	0.065	0.027
			6 x 2 mm	12	0.113	0.069	0.028
			2 x 5 mm	10	0.098	0.060	0.025
			6 x 1 mm	6	0.132	0.081	0.033
			6 x 0.5 mm	3	0.132	0.081	0.033
			1 x 1 mm	1	0.105	0.064	0.027

\*  $nCTDI_{free\ air}$ ,  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-12. Parameters related to dose index for Siemens Emotion 16

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	130	130kV-M-203	16 x 1.2 mm	19.2	0.340	0.242	0.114
			2 x 8 mm	16	0.300	0.214	0.101
			12 x 1.2 mm	14.4	0.334	0.238	0.112
			2 x 5 mm	10	0.303	0.216	0.102
			16 x 0.6 mm	9.6	0.376	0.268	0.126
			12 x 0.6 mm	7.2	0.425	0.303	0.143
<b>Standard</b>	110		4 x 0.6 mm	2.4	0.416	0.296	0.140
			16 x 1.2 mm	19.2	0.233	0.160	0.072
			2 x 8 mm	16	0.205	0.141	0.064
			12 x 1.2 mm	14.4	0.228	0.157	0.071
			2 x 5 mm	10	0.209	0.144	0.065
			16 x 0.6 mm	9.6	0.257	0.177	0.080
<b>Standard</b>	80		12 x 0.6 mm	7.2	0.290	0.200	0.090
			4 x 0.6 mm	2.4	0.286	0.197	0.088
			16 x 1.2 mm	19.2	0.114	0.069	0.029
			2 x 8 mm	16	0.101	0.061	0.025
			12 x 1.2 mm	14.4	0.112	0.067	0.028
			2 x 5 mm	10	0.103	0.062	0.026
			16 x 0.6 mm	9.6	0.126	0.076	0.032
			12 x 0.6 mm	7.2	0.142	0.086	0.035
			4 x 0.6 mm	2.4	0.140	0.085	0.035

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens Emotion 16

Table 10-13. Parameters related to dose index for Siemens Perspective

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	130	130kV-M-203	2 x 1.0 mm	2	0.578	0.399	0.190
			4 x 0.6 mm	2.4	0.483	0.333	0.159
			12 x 0.6 mm	7.2	0.434	0.299	0.143
			2 x 5 mm	10	0.310	0.214	0.102
			32 x 0.6 mm	19.2	0.352	0.243	0.116
			32 x 1.2 mm	38.4	0.335	0.231	0.110
<b>Standard</b>	110		2 x 1.0 mm	2	0.415	0.278	0.128
			4 x 0.6 mm	2.4	0.347	0.232	0.107
			12 x 0.6 mm	7.2	0.311	0.208	0.096
			2 x 5 mm	10	0.223	0.149	0.069
			32 x 0.6 mm	19.2	0.253	0.169	0.078
			32 x 1.2 mm	38.4	0.240	0.161	0.074
<b>Standard</b>	80		2 x 1.0 mm	2	0.191	0.113	0.048
			4 x 0.6 mm	2.4	0.159	0.094	0.040
			12 x 0.6 mm	7.2	0.143	0.085	0.036
			2 x 5 mm	10	0.102	0.061	0.026
			32 x 0.6 mm	19.2	0.116	0.069	0.029
			32 x 1.2 mm	38.4	0.110	0.065	0.028

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens Perspective

Table 10-14. Parameters related to dose index for Siemens Definition Flash

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	140	140kV-M-204	64 x 0.6 mm (128x0.6)	38.4	0.271	0.202	0.099
			32 x 1.2 mm	38.4	0.276	0.206	0.100
			32 x 0.6 mm (64x0.6)	19.2	0.310	0.231	0.113
			32 x 0.6 mm	19.2	0.303	0.226	0.110
			12 x 1.2 mm	14.4	0.315	0.235	0.115
			30 x 0.6 mm (40x0.6)	12	0.335	0.250	0.122
			1 x 10 mm	10	0.246	0.184	0.090
			8 x 0.6mm (16x0.6)	4.8	0.473	0.353	0.172
			8 x 0.6 mm (16x0.3)	4.8	0.473	0.353	0.172
			10 x 0.6 mm (20x0.6)	6	0.327	0.244	0.119
			6 x 0.6 mm	3.6	0.443	0.331	0.161
			1 x 5 mm	5	0.246	0.184	0.090
			2 x 1 mm	2	0.273	0.204	0.100
			64 x 0.6 mm (128x0.6)	38.4	0.192	0.139	0.067
			32 x 1.2 mm	38.4	0.195	0.142	0.069
<b>Standard</b>	120	120kV-M-204	32 x 0.6 mm (64x0.6)	19.2	0.220	0.159	0.077
			32 x 0.6 mm	19.2	0.214	0.156	0.075
			12 x 1.2 mm	14.4	0.223	0.162	0.078
			30 x 0.6 mm (40x0.6)	12	0.237	0.172	0.083
			1 x 10 mm	10	0.174	0.127	0.061
			8 x 0.6mm (16x0.6)	4.8	0.335	0.243	0.118
			8 x 0.6 mm (16x0.3)	4.8	0.335	0.243	0.118
			10 x 0.6 mm (20x0.6)	6	0.232	0.168	0.082
			6 x 0.6 mm	3.6	0.314	0.228	0.110
			1 x 5 mm	5	0.174	0.127	0.061
			2 x 1 mm	2	0.193	0.141	0.068
			64 x 0.6 mm (128x0.6)	38.4	0.123	0.086	0.042
			32 x 1.2 mm	38.4	0.125	0.088	0.043
			32 x 0.6 mm (64x0.6)	19.2	0.141	0.099	0.048
			32 x 0.6 mm	19.2	0.138	0.096	0.047
<b>Standard</b>	100	100kV-M-204	12 x 1.2 mm	14.4	0.143	0.100	0.049
			30 x 0.6 mm (40x0.6)	12	0.152	0.107	0.052
			1 x 10 mm	10	0.112	0.078	0.038
			8 x 0.6mm (16x0.6)	4.8	0.215	0.150	0.073
			8 x 0.6 mm (16x0.3)	4.8	0.215	0.150	0.073
			10 x 0.6 mm (20x0.6)	6	0.149	0.104	0.051
			6 x 0.6 mm	3.6	0.201	0.141	0.068
			1 x 5 mm	5	0.112	0.078	0.038
			2 x 1 mm	2	0.124	0.087	0.042
			64 x 0.6 mm (128x0.6)	38.4	0.064	0.043	0.020
			32 x 1.2 mm	38.4	0.066	0.044	0.020
			32 x 0.6 mm (64x0.6)	19.2	0.074	0.050	0.023
			32 x 0.6 mm	19.2	0.072	0.048	0.022
			12 x 1.2 mm	14.4	0.075	0.050	0.023
<b>Standard</b>	80	80kV-M-204	30 x 0.6 mm (40x0.6)	12	0.080	0.054	0.024
			1 x 10 mm	10	0.059	0.039	0.018
			8 x 0.6mm (16x0.6)	4.8	0.112	0.076	0.035
			8 x 0.6 mm (16x0.3)	4.8	0.112	0.076	0.035
			10 x 0.6 mm (20x0.6)	6	0.078	0.052	0.024
			6 x 0.6 mm	3.6	0.105	0.071	0.032
			1 x 5 mm	5	0.059	0.039	0.018
			2 x 1 mm	2	0.065	0.044	0.020
			64 x 0.6 mm (128x0.6)	38.4	0.297	0.226	0.123
			32 x 1.2 mm	38.4	0.302	0.230	0.125
			32 x 0.6 mm (64x0.6)	19.2	0.340	0.259	0.140
			32 x 0.6 mm	19.2	0.332	0.253	0.137
			12 x 1.2 mm	14.4	0.346	0.263	0.143
<b>Wide</b>	140	140kV-S-204	30 x 0.6 mm (40x0.6)	12	0.367	0.280	0.152
			1 x 10 mm	10	0.270	0.206	0.111
			8 x 0.6mm (16x0.6)	4.8	0.518	0.395	0.214
			8 x 0.6 mm (16x0.3)	4.8	0.518	0.395	0.214
			10 x 0.6 mm (20x0.6)	6	0.359	0.274	0.148
			6 x 0.6 mm	3.6	0.486	0.370	0.201
			1 x 5 mm	5	0.270	0.206	0.111
			2 x 1 mm	2	0.300	0.228	0.124

<b>Wide</b>	120	120kV-S-204	64 x 0.6 mm (128x0.6)	38.4	0.199	0.150	0.080
			32 x 1.2 mm	38.4	0.203	0.152	0.082
			32 x 0.6 mm (64x0.6)	19.2	0.228	0.171	0.092
			32 x 0.6 mm	19.2	0.223	0.167	0.090
			12 x 1.2 mm	14.4	0.232	0.174	0.093
			30 x 0.6 mm (40x0.6)	12	0.246	0.185	0.099
			1 x 10 mm	10	0.181	0.136	0.073
			8 x 0.6mm (16x0.6)	4.8	0.348	0.261	0.140
			8 x 0.6 mm (16x0.3)	4.8	0.348	0.261	0.140
			10 x 0.6 mm (20x0.6)	6	0.241	0.181	0.097
			6 x 0.6 mm	3.6	0.326	0.245	0.131
			1 x 5 mm	5	0.181	0.136	0.073
			2 x 1 mm	2	0.201	0.151	0.081
<b>Wide</b>	100	100kV-S-204	64 x 0.6 mm (128x0.6)	38.4	0.139	0.097	0.051
			32 x 1.2 mm	38.4	0.142	0.099	0.052
			32 x 0.6 mm (64x0.6)	19.2	0.160	0.111	0.058
			32 x 0.6 mm	19.2	0.156	0.108	0.057
			12 x 1.2 mm	14.4	0.162	0.113	0.059
			30 x 0.6 mm (40x0.6)	12	0.172	0.120	0.063
			1 x 10 mm	10	0.127	0.088	0.046
			8 x 0.6mm (16x0.6)	4.8	0.243	0.169	0.089
			8 x 0.6 mm (16x0.3)	4.8	0.243	0.169	0.089
			10 x 0.6 mm (20x0.6)	6	0.168	0.117	0.061
			6 x 0.6 mm	3.6	0.228	0.158	0.083
			1 x 5 mm	5	0.127	0.088	0.046
			2 x 1 mm	2	0.141	0.098	0.051
<b>Wide</b>	80	80kV-S-204	64 x 0.6 mm (128x0.6)	38.4	0.071	0.050	0.026
			32 x 1.2 mm	38.4	0.073	0.050	0.027
			32 x 0.6 mm (64x0.6)	19.2	0.082	0.057	0.030
			32 x 0.6 mm	19.2	0.080	0.055	0.029
			12 x 1.2 mm	14.4	0.083	0.058	0.030
			30 x 0.6 mm (40x0.6)	12	0.088	0.061	0.032
			1 x 10 mm	10	0.065	0.045	0.024
			8 x 0.6mm (16x0.6)	4.8	0.124	0.086	0.046
			8 x 0.6 mm (16x0.3)	4.8	0.124	0.086	0.046
			10 x 0.6 mm (20x0.6)	6	0.086	0.060	0.032
			6 x 0.6 mm	3.6	0.117	0.081	0.043
			1 x 5 mm	5	0.065	0.045	0.024
			2 x 1 mm	2	0.072	0.050	0.026

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens

Definition Flash

Table 10-15. Parameters related to dose index for Siemens Definition Edge

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	120		64 x 0.6 mm (128x0.6)	38.4	0.201438	0.144324	0.067602
			32 x 1.2 mm	38.4	0.197904	0.141792	0.066416
			12 x 1.2 mm	14.4	0.226176	0.162048	0.075904
			20 x 0.6 mm (40x0.6)	12.0	0.243846	0.174708	0.081834
			1 x 10 mm	10.0	0.1767	0.1266	0.0593
			6 x 1.2 mm	7.2	0.254448	0.182304	0.085392
			10 x 0.6 mm (20x0.6)	6.0	0.238545	0.17091	0.080055
			1 x 5 mm	5.0	0.1767	0.1266	0.0593
			8 x 0.6 mm (16x0.6)	4.8	0.344565	0.24687	0.115635
			8 x 0.6 mm (16x0.3)	4.8	0.344565	0.24687	0.115635
			6 x 0.6 mm	4.8	0.293322	0.210156	0.098438
			2 x 1 mm	3.6	0.319827	0.229146	0.107333
			64 x 0.6 mm (128x0.6)	38.4	0.128	0.088	0.040
			32 x 1.2 mm	38.4	0.126	0.087	0.039
			12 x 1.2 mm	14.4	0.144	0.099	0.045
<b>Standard</b>	100		20 x 0.6 mm (40x0.6)	12.0	0.155	0.107	0.048
			1 x 10 mm	10.0	0.113	0.078	0.035
			6 x 1.2 mm	7.2	0.162	0.112	0.050
			10 x 0.6 mm (20x0.6)	6.0	0.152	0.105	0.047
			1 x 5 mm	5.0	0.113	0.078	0.035
			8 x 0.6 mm (16x0.6)	4.8	0.220	0.151	0.068
			8 x 0.6 mm (16x0.3)	4.8	0.220	0.151	0.068
			6 x 0.6 mm	4.8	0.187	0.129	0.058
			2 x 1 mm	3.6	0.204	0.140	0.063
			64 x 0.6 mm (128x0.6)	38.4	0.070	0.045	0.019
			32 x 1.2 mm	38.4	0.068	0.044	0.019
			12 x 1.2 mm	14.4	0.078	0.050	0.021
			20 x 0.6 mm (40x0.6)	12.0	0.084	0.054	0.023
			1 x 10 mm	10.0	0.061	0.039	0.017
			6 x 1.2 mm	7.2	0.088	0.056	0.024
			10 x 0.6 mm (20x0.6)	6.0	0.082	0.053	0.023
			1 x 5 mm	5.0	0.061	0.039	0.017
			8 x 0.6 mm (16x0.6)	4.8	0.119	0.076	0.033
			8 x 0.6 mm (16x0.3)	4.8	0.119	0.076	0.033

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens

Definition AS

Table 10-16. Parameters related to dose index for Siemens Definition AS

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	120	120kV-M-204	16x1.2mm	19.2	0.217	0.156	0.073
			32x0.6mm(64x0.6)	19.2	0.228	0.163	0.076
			12x1.2mm	14.4	0.226	0.162	0.076
			20x0.6mm(40x0.6)	12	0.244	0.175	0.082
			1x10mm	10	0.177	0.127	0.059
			6x1.2mm	7.2	0.254	0.182	0.085
			10x0.6mm(20x0.6)	6	0.239	0.171	0.080
			1x5mm	5	0.177	0.127	0.059
			8x0.6mm(16x0.6)	4.8	0.345	0.247	0.116
			8x0.6mm	4.8	0.293	0.210	0.098
			6x0.6mm	3.6	0.320	0.229	0.107
			2x1mm	2	0.196	0.141	0.066
			16x1.2mm	19.2	0.138	0.095	0.043
			32x0.6mm(64x0.6)	19.2	0.145	0.100	0.045
<b>Standard</b>	100	100kV-M-204	12x1.2mm	14.4	0.144	0.099	0.045
			20x0.6mm(40x0.6)	12	0.155	0.107	0.048
			1x10mm	10	0.113	0.078	0.035
			6x1.2mm	7.2	0.162	0.112	0.050
			10x0.6mm(20x0.6)	6	0.152	0.105	0.047
			1x5mm	5	0.113	0.078	0.035
			8x0.6mm(16x0.6)	4.8	0.220	0.151	0.068
			8x0.6mm	4.8	0.187	0.129	0.058
			6x0.6mm	3.6	0.204	0.140	0.063
			2x1mm	2	0.125	0.086	0.039
			16x1.2mm	19.2	0.075	0.048	0.021
			32x0.6mm(64x0.6)	19.2	0.079	0.050	0.022
			12x1.2mm	14.4	0.078	0.050	0.021
			20x0.6mm(40x0.6)	12	0.084	0.054	0.023
<b>Standard</b>	80	80kV-M-204	1x10mm	10	0.061	0.039	0.017
			6x1.2mm	7.2	0.088	0.056	0.024
			10x0.6mm(20x0.6)	6	0.082	0.053	0.023
			1x5mm	5	0.061	0.039	0.017
			8x0.6mm(16x0.6)	4.8	0.119	0.076	0.033
			8x0.6mm	4.8	0.101	0.065	0.028

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens Definition AS

Table 10-17. Parameters related to dose index for Siemens Force

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Standard</b>	150		2 x 1 mm(2x1mm)	2	0.284	0.211	0.103
			6 x 0.6 mm(6x0.6mm)	3.6	0.479	0.356	0.174
			1 x 5 mm(1x5mm)	5	0.284	0.211	0.103
			1 x 10 mm(1x10mm)	10	0.281	0.208	0.102
			12 x 1.2 mm(12x1.2mm)	14.4	0.407	0.302	0.147
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.325	0.241	0.118
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.341	0.253	0.123
			32 x 0.6 mm(64x0.6mm)	19.2	0.388	0.288	0.141
			48 x 0.6 mm(96x0.6mm)	28.8	0.353	0.262	0.128
			64 x 0.6 mm(128x0.6mm)	38.4	0.334	0.248	0.121
			96 x 0.6 mm(192x0.6mm)	57.6	0.315	0.234	0.114
			24 x 1.2 mm(24x1.2mm)	28.8	0.353	0.262	0.128
			48 x 1.2 mm(48x1.2mm)	57.6	0.315	0.234	0.114
<b>Standard</b>	140		2 x 1 mm(2x1mm)	2	0.247	0.182	0.088
			6 x 0.6 mm(6x0.6mm)	3.6	0.417	0.307	0.148
			1 x 5 mm(1x5mm)	5	0.247	0.182	0.088
			1 x 10 mm(1x10mm)	10	0.244	0.180	0.087
			12 x 1.2 mm(12x1.2mm)	14.4	0.354	0.261	0.126
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.283	0.208	0.100
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.296	0.218	0.105
			32 x 0.6 mm(64x0.6mm)	19.2	0.337	0.249	0.120
			48 x 0.6 mm(96x0.6mm)	28.8	0.307	0.226	0.109
			64 x 0.6 mm(128x0.6mm)	38.4	0.291	0.214	0.103
			96 x 0.6 mm(192x0.6mm)	57.6	0.274	0.202	0.098
			24 x 1.2 mm(24x1.2mm)	28.8	0.307	0.226	0.109
			48 x 1.2 mm(48x1.2mm)	57.6	0.274	0.202	0.098
<b>Standard</b>	130		2 x 1 mm(2x1mm)	2	0.211	0.154	0.073
			6 x 0.6 mm(6x0.6mm)	3.6	0.357	0.261	0.124
			1 x 5 mm(1x5mm)	5	0.211	0.154	0.073
			1 x 10 mm(1x10mm)	10	0.209	0.153	0.073
			12 x 1.2 mm(12x1.2mm)	14.4	0.303	0.221	0.105
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.242	0.177	0.084
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.254	0.185	0.088
			32 x 0.6 mm(64x0.6mm)	19.2	0.289	0.211	0.100
			48 x 0.6 mm(96x0.6mm)	28.8	0.263	0.192	0.091
			64 x 0.6 mm(128x0.6mm)	38.4	0.249	0.182	0.087
			96 x 0.6 mm(192x0.6mm)	57.6	0.235	0.172	0.082
			24 x 1.2 mm(24x1.2mm)	28.8	0.263	0.192	0.091
			48 x 1.2 mm(48x1.2mm)	57.6	0.235	0.172	0.082
<b>Standard</b>	120	120kV-M-204	2 x 1 mm(2x1mm)	2	0.178	0.128	0.060
			6 x 0.6 mm(6x0.6mm)	3.6	0.301	0.217	0.102
			1 x 5 mm(1x5mm)	5	0.178	0.128	0.060
			1 x 10 mm(1x10mm)	10	0.176	0.127	0.059
			12 x 1.2 mm(12x1.2mm)	14.4	0.255	0.184	0.086
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.204	0.147	0.069
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.214	0.154	0.072
			32 x 0.6 mm(64x0.6mm)	19.2	0.243	0.175	0.082
			48 x 0.6 mm(96x0.6mm)	28.8	0.222	0.160	0.075
			64 x 0.6 mm(128x0.6mm)	38.4	0.210	0.151	0.071
			96 x 0.6 mm(192x0.6mm)	57.6	0.198	0.143	0.067
			24 x 1.2 mm(24x1.2mm)	28.8	0.222	0.160	0.075
			48 x 1.2 mm(48x1.2mm)	57.6	0.198	0.143	0.067
<b>Standard</b>	110		2 x 1 mm(2x1mm)	2	0.145	0.103	0.047
			6 x 0.6 mm(6x0.6mm)	3.6	0.245	0.174	0.079
			1 x 5 mm(1x5mm)	5	0.145	0.103	0.047
			1 x 10 mm(1x10mm)	10	0.143	0.102	0.046
			12 x 1.2 mm(12x1.2mm)	14.4	0.208	0.148	0.067
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.166	0.118	0.054
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.174	0.124	0.056
			32 x 0.6 mm(64x0.6mm)	19.2	0.198	0.141	0.064
			48 x 0.6 mm(96x0.6mm)	28.8	0.180	0.128	0.058
			64 x 0.6 mm(128x0.6mm)	38.4	0.171	0.121	0.055
			96 x 0.6 mm(192x0.6mm)	57.6	0.161	0.114	0.052
			24 x 1.2 mm(24x1.2mm)	28.8	0.180	0.128	0.058
			48 x 1.2 mm(48x1.2mm)	57.6	0.161	0.114	0.052

<b>Standard</b>	100	100kV-M-204	2 x 1 mm(2x1mm)	2	0.115	0.080	0.036
			6 x 0.6 mm(6x0.6mm)	3.6	0.195	0.135	0.061
			1 x 5 mm(1x5mm)	5	0.115	0.080	0.036
			1 x 10 mm(1x10mm)	10	0.114	0.079	0.036
			12 x 1.2 mm(12x1.2mm)	14.4	0.165	0.114	0.052
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.132	0.091	0.041
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.138	0.096	0.043
			32 x 0.6 mm(64x0.6mm)	19.2	0.157	0.109	0.049
			48 x 0.6 mm(96x0.6mm)	28.8	0.143	0.099	0.045
			64 x 0.6 mm(128x0.6mm)	38.4	0.136	0.094	0.043
			96 x 0.6 mm(192x0.6mm)	57.6	0.128	0.089	0.040
			24 x 1.2 mm(24x1.2mm)	28.8	0.143	0.099	0.045
			48 x 1.2 mm(48x1.2mm)	57.6	0.128	0.089	0.040
<b>Standard</b>	90		2 x 1 mm(2x1mm)	2	0.088	0.059	0.026
			6 x 0.6 mm(6x0.6mm)	3.6	0.149	0.100	0.044
			1 x 5 mm(1x5mm)	5	0.088	0.059	0.026
			1 x 10 mm(1x10mm)	10	0.087	0.058	0.026
			12 x 1.2 mm(12x1.2mm)	14.4	0.126	0.084	0.037
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.101	0.067	0.030
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.106	0.071	0.031
			32 x 0.6 mm(64x0.6mm)	19.2	0.120	0.081	0.036
			48 x 0.6 mm(96x0.6mm)	28.8	0.110	0.073	0.032
			64 x 0.6 mm(128x0.6mm)	38.4	0.104	0.069	0.031
			96 x 0.6 mm(192x0.6mm)	57.6	0.098	0.066	0.029
			24 x 1.2 mm(24x1.2mm)	28.8	0.110	0.073	0.032
			48 x 1.2 mm(48x1.2mm)	57.6	0.098	0.066	0.029
<b>Standard</b>	80	80kV-M-204	2 x 1 mm(2x1mm)	2	0.064	0.041	0.017
			6 x 0.6 mm(6x0.6mm)	3.6	0.107	0.068	0.029
			1 x 5 mm(1x5mm)	5	0.064	0.041	0.017
			1 x 10 mm(1x10mm)	10	0.063	0.040	0.017
			12 x 1.2 mm(12x1.2mm)	14.4	0.091	0.058	0.025
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.073	0.046	0.020
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.076	0.049	0.021
			32 x 0.6 mm(64x0.6mm)	19.2	0.087	0.055	0.024
			48 x 0.6 mm(96x0.6mm)	28.8	0.079	0.050	0.022
			64 x 0.6 mm(128x0.6mm)	38.4	0.075	0.048	0.020
			96 x 0.6 mm(192x0.6mm)	57.6	0.071	0.045	0.019
			24 x 1.2 mm(24x1.2mm)	28.8	0.079	0.050	0.022
			48 x 1.2 mm(48x1.2mm)	57.6	0.071	0.045	0.019
<b>Standard</b>	70		2 x 1 mm(2x1mm)	2	0.043	0.026	0.011
			6 x 0.6 mm(6x0.6mm)	3.6	0.073	0.043	0.018
			1 x 5 mm(1x5mm)	5	0.043	0.026	0.011
			1 x 10 mm(1x10mm)	10	0.043	0.025	0.010
			12 x 1.2 mm(12x1.2mm)	14.4	0.062	0.037	0.015
			32 x 0.6 mm(32x0.6mm)UHR	19.2	0.050	0.029	0.012
			32 x 0.6 mm(64x0.6mm)sUHR	19.2	0.052	0.031	0.013
			32 x 0.6 mm(64x0.6mm)	19.2	0.059	0.035	0.014
			48 x 0.6 mm(96x0.6mm)	28.8	0.054	0.032	0.013
			64 x 0.6 mm(128x0.6mm)	38.4	0.051	0.030	0.012
			96 x 0.6 mm(192x0.6mm)	57.6	0.048	0.029	0.012
			24 x 1.2 mm(24x1.2mm)	28.8	0.054	0.032	0.013
			48 x 1.2 mm(48x1.2mm)	57.6	0.048	0.029	0.012

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using the report of dose and image quality for Siemens

Definition Force

Table 10-18. Parameters related to dose index for Toshiba Aquilion 16

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	135	120kV-M-301	32 mm(4x8mm)	32	0.472	ND	0.160
			32 mm(16x2mm)	32	0.477	ND	0.162
			24 mm	24	0.466	ND	0.158
			16 mm(4x4mm)	16	0.483	ND	0.164
			16 mm(16x1mm)	16	0.522	ND	0.177
			12 mm	12	0.477	ND	0.162
			8 mm(1x8mm)	8	0.522	ND	0.177
			8 mm(4x2mm)	8	0.561	ND	0.190
			8 mm(16x0.5mm)	8	0.618	ND	0.210
			6 mm	6	0.528	ND	0.179
			4 mm(1x4mm)	4	0.691	ND	0.234
			4 mm(4x1mm)	4	0.775	ND	0.263
			2 mm(1x2mm)	2	1.084	ND	0.368
			2 mm(4x0.5mm)	2	1.162	ND	0.394
			1 mm	1	1.842	ND	0.625
<b>Large</b>	120	120kV-M-301	32 mm(4x8mm)	32	0.385	ND	0.120
			32 mm(16x2mm)	32	0.389	ND	0.121
			24 mm	24	0.380	ND	0.119
			16 mm(4x4mm)	16	0.394	ND	0.123
			16 mm(16x1mm)	16	0.426	ND	0.133
			12 mm	12	0.389	ND	0.121
			8 mm(1x8mm)	8	0.426	ND	0.133
			8 mm(4x2mm)	8	0.458	ND	0.143
			8 mm(16x0.5mm)	8	0.504	ND	0.157
			6 mm	6	0.431	ND	0.134
			4 mm(1x4mm)	4	0.563	ND	0.176
			4 mm(4x1mm)	4	0.632	ND	0.197
			2 mm(1x2mm)	2	0.884	ND	0.276
			2 mm(4x0.5mm)	2	0.948	ND	0.296
			1 mm	1	1.502	ND	0.468
<b>Large</b>	100	120kV-M-301	32 mm(4x8mm)	32	0.279	ND	0.079
			32 mm(16x2mm)	32	0.282	ND	0.080
			24 mm	24	0.276	ND	0.078
			16 mm(4x4mm)	16	0.286	ND	0.081
			16 mm(16x1mm)	16	0.309	ND	0.087
			12 mm	12	0.282	ND	0.080
			8 mm(1x8mm)	8	0.309	ND	0.087
			8 mm(4x2mm)	8	0.332	ND	0.094
			8 mm(16x0.5mm)	8	0.365	ND	0.103
			6 mm	6	0.312	ND	0.088
			4 mm(1x4mm)	4	0.408	ND	0.115
			4 mm(4x1mm)	4	0.458	ND	0.129
			2 mm(1x2mm)	2	0.641	ND	0.181
			2 mm(4x0.5mm)	2	0.687	ND	0.194
			1 mm	1	1.089	ND	0.308
<b>Large</b>	80	80kV-M-301	32 mm(4x8mm)	32	0.184	ND	0.044
			32 mm(16x2mm)	32	0.186	ND	0.044
			24 mm	24	0.182	ND	0.043
			16 mm(4x4mm)	16	0.189	ND	0.045
			16 mm(16x1mm)	16	0.204	ND	0.048
			12 mm	12	0.186	ND	0.044
			8 mm(1x8mm)	8	0.204	ND	0.048
			8 mm(4x2mm)	8	0.219	ND	0.052
			8 mm(16x0.5mm)	8	0.241	ND	0.057
			6 mm	6	0.206	ND	0.049
			4 mm(1x4mm)	4	0.270	ND	0.064
			4 mm(4x1mm)	4	0.303	ND	0.072
			2 mm(1x2mm)	2	0.423	ND	0.101
			2 mm(4x0.5mm)	2	0.454	ND	0.108
			1 mm	1	0.719	ND	0.171
<b>Small</b>	135		32 mm(4x8mm)	32	0.382	0.287	ND
			32 mm(16x2mm)	32	0.386	0.290	ND
			24 mm	24	0.377	0.283	ND
			16 mm(4x4mm)	16	0.391	0.293	ND
			16 mm(16x1mm)	16	0.422	0.317	ND
			12 mm	12	0.386	0.290	ND

			8 mm(1x8mm)	8	0.422	0.317	ND
			8 mm(4x2mm)	8	0.454	0.341	ND
			8 mm(16x0.5mm)	8	0.500	0.375	ND
			6 mm	6	0.427	0.321	ND
			4 mm(1x4mm)	4	0.559	0.420	ND
			4 mm(4x1mm)	4	0.627	0.471	ND
			2 mm(1x2mm)	2	0.877	0.658	ND
			2 mm(4x0.5mm)	2	0.940	0.706	ND
			1 mm	1	1.490	1.119	ND
<b>Small</b>	120	120kV-S-301	32 mm(4x8mm)	32	0.304	0.218	ND
			32 mm(16x2mm)	32	0.307	0.220	ND
			24 mm	24	0.300	0.215	ND
			16 mm(4x4mm)	16	0.311	0.223	ND
			16 mm(16x1mm)	16	0.336	0.241	ND
			12 mm	12	0.307	0.220	ND
			8 mm(1x8mm)	8	0.336	0.241	ND
			8 mm(4x2mm)	8	0.362	0.259	ND
			8 mm(16x0.5mm)	8	0.398	0.285	ND
			6 mm	6	0.340	0.244	ND
			4 mm(1x4mm)	4	0.445	0.319	ND
			4 mm(4x1mm)	4	0.499	0.358	ND
			2 mm(1x2mm)	2	0.698	0.500	ND
			2 mm(4x0.5mm)	2	0.748	0.536	ND
			1 mm	1	1.186	0.850	ND
<b>Small</b>	100		32 mm(4x8mm)	32	0.212	0.141	ND
			32 mm(16x2mm)	32	0.215	0.143	ND
			24 mm	24	0.210	0.139	ND
			16 mm(4x4mm)	16	0.217	0.144	ND
			16 mm(16x1mm)	16	0.235	0.156	ND
			12 mm	12	0.215	0.143	ND
			8 mm(1x8mm)	8	0.235	0.156	ND
			8 mm(4x2mm)	8	0.253	0.168	ND
			8 mm(16x0.5mm)	8	0.278	0.184	ND
			6 mm	6	0.238	0.158	ND
			4 mm(1x4mm)	4	0.311	0.206	ND
			4 mm(4x1mm)	4	0.349	0.231	ND
			2 mm(1x2mm)	2	0.488	0.324	ND
			2 mm(4x0.5mm)	2	0.523	0.347	ND
			1 mm	1	0.829	0.550	ND
<b>Small</b>	80	80kV-S-301	32 mm(4x8mm)	32	0.134	0.079	ND
			32 mm(16x2mm)	32	0.135	0.080	ND
			24 mm	24	0.132	0.079	ND
			16 mm(4x4mm)	16	0.137	0.081	ND
			16 mm(16x1mm)	16	0.148	0.088	ND
			12 mm	12	0.135	0.080	ND
			8 mm(1x8mm)	8	0.148	0.088	ND
			8 mm(4x2mm)	8	0.159	0.095	ND
			8 mm(16x0.5mm)	8	0.175	0.104	ND
			6 mm	6	0.150	0.089	ND
			4 mm(1x4mm)	4	0.196	0.116	ND
			4 mm(4x1mm)	4	0.220	0.131	ND
			2 mm(1x2mm)	2	0.307	0.183	ND
			2 mm(4x0.5mm)	2	0.329	0.196	ND
			1 mm	1	0.522	0.310	ND

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated using ImPACT 1.04

Table 10-19. Parameters related to dose index for Toshiba Aquilion 64

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	80	80kV-M-301	64 x 0.5 mm	32	0.199	0.087	0.043
			32 x 0.5 mm	16	0.213	0.093	0.046
			32 x 1.0 mm	32	0.196	0.086	0.042
			16 x 0.5 mm	8	0.222	0.097	0.048
			16 x 1.0 mm	16	0.186	0.081	0.040
			16 x 2.0 mm	32	0.169	0.074	0.037
			4 x 8.0 mm	32	0.191	0.084	0.042
			4 x 6.0 mm	24	0.193	0.085	0.042
			4 x 4.0 mm	16	0.197	0.086	0.043
			4 x 3.0 mm	12	0.217	0.095	0.047
			4 x 2.0 mm	8	0.219	0.096	0.048
			4 x 1.0 mm	4	0.296	0.129	0.064
			4 x 0.5 mm	2	0.440	0.192	0.095
			64 x 0.5 mm	32	0.317	0.157	0.077
			32 x 0.5 mm	16	0.338	0.167	0.082
<b>Large</b>	100	100kV-M-301	32 x 1.0 mm	32	0.311	0.154	0.076
			16 x 0.5 mm	8	0.353	0.174	0.086
			16 x 1.0 mm	16	0.296	0.146	0.072
			16 x 2.0 mm	32	0.269	0.133	0.065
			4 x 8.0 mm	32	0.304	0.150	0.074
			4 x 6.0 mm	24	0.308	0.152	0.075
			4 x 4.0 mm	16	0.314	0.155	0.076
			4 x 3.0 mm	12	0.345	0.171	0.084
			4 x 2.0 mm	8	0.348	0.172	0.085
			4 x 1.0 mm	4	0.471	0.233	0.114
			4 x 0.5 mm	2	0.700	0.346	0.170
			64 x 0.5 mm	32	0.421	0.240	0.126
			32 x 0.5 mm	16	0.449	0.256	0.134
			32 x 1.0 mm	32	0.413	0.235	0.124
<b>Large</b>	120	120kV-M-301	16 x 0.5 mm	8	0.468	0.267	0.140
			16 x 1.0 mm	16	0.393	0.224	0.118
			16 x 2.0 mm	32	0.358	0.204	0.107
			4 x 8.0 mm	32	0.404	0.230	0.121
			4 x 6.0 mm	24	0.408	0.232	0.122
			4 x 4.0 mm	16	0.416	0.237	0.125
			4 x 3.0 mm	12	0.458	0.261	0.137
			4 x 2.0 mm	8	0.462	0.263	0.138
			4 x 1.0 mm	4	0.625	0.356	0.187
			4 x 0.5 mm	2	0.929	0.529	0.278
			64 x 0.5 mm	32	0.530	0.312	0.154
			32 x 0.5 mm	16	0.565	0.333	0.164
			32 x 1.0 mm	32	0.520	0.306	0.151
<b>Large</b>	135	135kV-M-301	16 x 0.5 mm	8	0.590	0.347	0.171
			16 x 1.0 mm	16	0.495	0.292	0.144
			16 x 2.0 mm	32	0.450	0.265	0.131
			4 x 8.0 mm	32	0.509	0.300	0.148
			4 x 6.0 mm	24	0.514	0.303	0.150
			4 x 4.0 mm	16	0.525	0.309	0.152
			4 x 3.0 mm	12	0.577	0.340	0.168
			4 x 2.0 mm	8	0.582	0.343	0.169
			4 x 1.0 mm	4	0.787	0.464	0.229
			4 x 0.5 mm	2	1.169	0.689	0.340
			64 x 0.5 mm	32	0.151	0.073	0.033
			32 x 0.5 mm	16	0.162	0.078	0.035
			32 x 1.0 mm	32	0.149	0.072	0.033
<b>Small</b>	80	80kV-S-301	16 x 0.5 mm	8	0.169	0.082	0.037
			16 x 1.0 mm	16	0.142	0.069	0.031
			16 x 2.0 mm	32	0.129	0.062	0.028
			4 x 8.0 mm	32	0.145	0.070	0.032
			4 x 6.0 mm	24	0.147	0.071	0.032
			4 x 4.0 mm	16	0.150	0.073	0.033
			4 x 3.0 mm	12	0.165	0.080	0.036
			4 x 2.0 mm	8	0.166	0.081	0.037
			4 x 1.0 mm	4	0.225	0.109	0.049
			4 x 0.5 mm	2	0.334	0.162	0.073
			64 x 0.5 mm	32	0.241	0.132	0.059

			32 x 0.5 mm	16	0.257	0.141	0.063
			32 x 1.0 mm	32	0.236	0.129	0.058
			16 x 0.5 mm	8	0.268	0.147	0.066
			16 x 1.0 mm	16	0.225	0.123	0.056
			16 x 2.0 mm	32	0.205	0.112	0.050
			4 x 8.0 mm	32	0.231	0.127	0.057
			4 x 6.0 mm	24	0.234	0.128	0.058
			4 x 4.0 mm	16	0.239	0.131	0.059
			4 x 3.0 mm	12	0.262	0.144	0.065
			4 x 2.0 mm	8	0.265	0.145	0.065
			4 x 1.0 mm	4	0.358	0.196	0.088
			4 x 0.5 mm	2	0.532	0.291	0.131
<b>Small</b>	120	120kV-S-301	64 x 0.5 mm	32	0.330	0.202	0.091
			32 x 0.5 mm	16	0.352	0.215	0.098
			32 x 1.0 mm	32	0.324	0.198	0.090
			16 x 0.5 mm	8	0.367	0.224	0.102
			16 x 1.0 mm	16	0.309	0.188	0.085
			16 x 2.0 mm	32	0.281	0.171	0.078
			4 x 8.0 mm	32	0.317	0.194	0.088
			4 x 6.0 mm	24	0.320	0.196	0.089
			4 x 4.0 mm	16	0.327	0.200	0.091
			4 x 3.0 mm	12	0.359	0.220	0.100
			4 x 2.0 mm	8	0.363	0.222	0.100
			4 x 1.0 mm	4	0.490	0.300	0.136
			4 x 0.5 mm	2	0.729	0.445	0.202
<b>Small</b>	135	135kV-S-301	64 x 0.5 mm	32	0.403	0.263	0.119
			32 x 0.5 mm	16	0.430	0.280	0.127
			32 x 1.0 mm	32	0.395	0.258	0.117
			16 x 0.5 mm	8	0.448	0.293	0.133
			16 x 1.0 mm	16	0.376	0.246	0.111
			16 x 2.0 mm	32	0.342	0.223	0.101
			4 x 8.0 mm	32	0.387	0.252	0.114
			4 x 6.0 mm	24	0.391	0.255	0.116
			4 x 4.0 mm	16	0.399	0.260	0.118
			4 x 3.0 mm	12	0.438	0.286	0.130
			4 x 2.0 mm	8	0.443	0.289	0.131
			4 x 1.0 mm	4	0.598	0.390	0.177
			4 x 0.5 mm	2	0.889	0.580	0.263

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion CXL. Dose ratio for each collimation are calculated based on the measured value from Kasahara in chiba university hospital.

Table 10-20. Parameters related to dose index for Toshiba Alexion

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Medium</b>	120	120kV-M-302	4 mm(1mmx4)	4	0.755	0.440	0.191
			8 mm(2mmx4)	8	0.551	0.321	0.140
			12 mm(3mmx4)	12	0.484	0.282	0.123
			16 mm(4mmx4)	16	0.444	0.259	0.113
			10 mm(5mmx2)	10	0.515	0.300	0.131
			16 mm(8mmx2)	16	0.444	0.259	0.113
			2 mm(2mmx1)	2	1.177	0.686	0.298
			4 mm(4mmx1)	4	0.755	0.440	0.191
			6 mm(6mmx1)	6	0.622	0.363	0.158
			16 mm(1mmx16)	16	0.444	0.259	0.113
<b>Medium</b>	100		4 mm(1mmx4)	4	0.559	0.303	0.127
			8 mm(2mmx4)	8	0.407	0.221	0.093
			12 mm(3mmx4)	12	0.358	0.194	0.082
			16 mm(4mmx4)	16	0.329	0.178	0.075
			10 mm(5mmx2)	10	0.381	0.207	0.087
			16 mm(8mmx2)	16	0.329	0.178	0.075
			2 mm(2mmx1)	2	0.871	0.472	0.199
			4 mm(4mmx1)	4	0.559	0.303	0.127
			6 mm(6mmx1)	6	0.460	0.249	0.105
			16 mm(1mmx16)	16	0.329	0.178	0.075
<b>Medium</b>	80	80kV-M-302	4 mm(1mmx4)	4	0.370	0.168	0.070
			8 mm(2mmx4)	8	0.270	0.122	0.051
			12 mm(3mmx4)	12	0.237	0.108	0.045
			16 mm(4mmx4)	16	0.218	0.099	0.041
			10 mm(5mmx2)	10	0.252	0.115	0.048
			16 mm(8mmx2)	16	0.218	0.099	0.041
			2 mm(2mmx1)	2	0.577	0.262	0.109
			4 mm(4mmx1)	4	0.370	0.168	0.070
			6 mm(6mmx1)	6	0.305	0.138	0.058
			16 mm(1mmx16)	16	0.218	0.099	0.041

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion Alexion

Table 10-21. Parameters related to dose index for Toshiba Alexion Access

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Medium</b>	120	120kV-M-302	4 mm(4x1mm)	4	0.678	0.394	0.174
			8 mm(4x2mm)	8	0.489	0.284	0.126
			12 mm(4x4mm)	12	0.418	0.243	0.107
			16 mm(4x4mm)	16	0.377	0.219	0.097
<b>Medium</b>	100		4 mm(4x1mm)	4	0.491	0.266	0.112
			8 mm(4x2mm)	8	0.355	0.192	0.081
			12 mm(4x4mm)	12	0.303	0.164	0.069
			16 mm(4x4mm)	16	0.273	0.148	0.062
<b>Medium</b>	80	80kV-M-302	4 mm(4x1mm)	4	0.325	0.146	0.058
			8 mm(4x2mm)	8	0.235	0.105	0.042
			12 mm(4x4mm)	12	0.201	0.090	0.036
			16 mm(4x4mm)	16	0.181	0.081	0.032

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion Alexion Access

Table 10-22. Parameters related to dose index for Toshiba Aquilion Prime

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120	120kV-L-303	1 mm	1	1.637	0.969	0.539
			2 mm	2	0.907	0.537	0.299
			4 mm	4	0.603	0.357	0.198
			8 mm	8	0.427	0.253	0.141
			10 mm	10	0.379	0.224	0.125
			12 mm	12	0.374	0.221	0.123
			16 mm	16	0.343	0.203	0.113
			20 mm	20	0.336	0.199	0.111
			32 mm	32	0.297	0.176	0.098
			40 mm	40	0.294	0.174	0.097
<b>Large</b>	80	80kV-L-303	1 mm	1	0.658	0.362	0.156
			2 mm	2	0.365	0.201	0.087
			4 mm	4	0.242	0.133	0.058
			8 mm	8	0.172	0.094	0.041
			10 mm	10	0.152	0.084	0.036
			12 mm	12	0.150	0.083	0.036
			16 mm	16	0.138	0.076	0.033
			20 mm	20	0.135	0.074	0.032
			32 mm	32	0.119	0.066	0.028
			40 mm	40	0.118	0.065	0.028
<b>Medium</b>	120	120kV-M-303	1 mm	1	1.619	0.969	0.475
			2 mm	2	0.897	0.537	0.263
			4 mm	4	0.596	0.357	0.175
			8 mm	8	0.423	0.253	0.124
			10 mm	10	0.375	0.224	0.110
			12 mm	12	0.370	0.221	0.108
			16 mm	16	0.340	0.203	0.100
			20 mm	20	0.332	0.199	0.097
			32 mm	32	0.293	0.176	0.086
			40 mm	40	0.291	0.174	0.085
<b>Medium</b>	80	80kV-M-303	1 mm	1	0.651	0.362	0.137
			2 mm	2	0.361	0.201	0.076
			4 mm	4	0.240	0.133	0.051
			8 mm	8	0.170	0.094	0.036
			10 mm	10	0.151	0.084	0.032
			12 mm	12	0.149	0.083	0.031
			16 mm	16	0.137	0.076	0.029
			20 mm	20	0.134	0.074	0.028
			32 mm	32	0.118	0.066	0.025
			40 mm	40	0.117	0.065	0.025
<b>Small</b>	120	120kV-S-303	1 mm	1	1.868	1.061	0.516
			2 mm	2	1.035	0.588	0.286
			4 mm	4	0.688	0.391	0.190
			8 mm	8	0.488	0.277	0.135
			10 mm	10	0.433	0.246	0.119
			12 mm	12	0.427	0.242	0.118
			16 mm	16	0.392	0.223	0.108
			20 mm	20	0.384	0.218	0.106
			32 mm	32	0.338	0.192	0.093
			40 mm	40	0.335	0.190	0.093
<b>Small</b>	80	80kV-S-303	1 mm	1	0.751	0.396	0.149
			2 mm	2	0.416	0.220	0.083
			4 mm	4	0.277	0.146	0.055
			8 mm	8	0.196	0.104	0.039
			10 mm	10	0.174	0.092	0.035
			12 mm	12	0.172	0.091	0.034
			16 mm	16	0.158	0.083	0.031
			20 mm	20	0.154	0.081	0.031
			32 mm	32	0.136	0.072	0.027
			40 mm	40	0.135	0.071	0.027

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion Prime and the measured data from Kasahara in Chiba university hospital and Nishijima in Oita prefecture hospital.

Table 10-23. Parameters related to dose index for Toshiba Aquilion ONE(TSX-301)

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	135		0.5 mm x 4(Conventional)	2	1.182	0.797	0.402
			1 mm x 4(Conventional)	4	0.751	0.506	0.255
			2 mm x 4(Conventional)	8	0.533	0.360	0.181
			3 mm x 4(Conventional)	12	0.465	0.314	0.158
			4 mm x 4(Conventional)	16	0.427	0.288	0.145
			5 mm x 4(Conventional)	20	0.405	0.273	0.138
			8 mm x 4(Conventional)	32	0.367	0.247	0.125
			1 mm x 1(Conventional)	1	2.044	1.378	0.695
			0.5 mm x 40(Volume)	20	0.439	0.296	0.149
			0.5 mm x 80(Volume)	40	0.371	0.250	0.126
			0.5 mm x 120(Volume)	60	0.350	0.236	0.119
			0.5 mm x 160(Volume)	80	0.354	0.239	0.120
			0.5 mm x 200(Volume)	100	0.346	0.233	0.118
			0.5 mm x 240(Volume)	120	0.341	0.230	0.116
			0.5 mm x 256(Volume)	128	0.337	0.227	0.115
			0.5 mm x 280(Volume)	140	0.333	0.224	0.113
			0.5 mm x 320(Volume)	160	0.329	0.222	0.112
			1 mm x 120(Volume)	120	0.341	0.230	0.116
			1 mm x 140(Volume)	140	0.333	0.224	0.113
			1 mm x 160(Volume)	160	0.329	0.222	0.112
			0.5 mm x 8(SURE)	4	0.777	0.524	0.264
			2 mm x 1(CTF)	2	1.126	0.760	0.383
			4 mm x 1(CTF)	4	0.695	0.469	0.237
			6 mm x 1(CTF)	6	0.589	0.397	0.200
			8 mm x 1(CTF)	8	0.533	0.360	0.181
			2 mm x 3(CTF)	6	0.589	0.397	0.200
			4 mm x 3(CTF)	12	0.444	0.299	0.151
			6 mm x 3(CTF)	18	0.397	0.268	0.135
			8 mm x 3(CTF)	24	0.371	0.250	0.126
			0.5 mm x 16(Helical)	8	0.559	0.377	0.190
			0.5 mm x 32(Helical)	16	0.461	0.311	0.157
			0.5 mm x 64(Helical)	32	0.414	0.279	0.141
			0.5 mm x 80(Helical)	40	0.371	0.250	0.126
			0.5 mm x 100(Helical)	50	0.388	0.262	0.132
			0.5 mm x 128(Helical)	64	0.358	0.242	0.122
			0.5 mm x 160(Helical)	80	0.354	0.239	0.120
			1 mm x 16(Helical)	16	0.461	0.311	0.157
			1 mm x 32(Helical)	32	0.410	0.276	0.139
			1 mm x 40(Helical)	40	0.367	0.247	0.125
<b>Large</b>	120	120kV-L-303	0.5 mm x 4(Conventional)	2	0.923	0.612	0.302
			1 mm x 4(Conventional)	4	0.587	0.389	0.192
			2 mm x 4(Conventional)	8	0.417	0.276	0.136
			3 mm x 4(Conventional)	12	0.363	0.241	0.119
			4 mm x 4(Conventional)	16	0.333	0.221	0.109
			5 mm x 4(Conventional)	20	0.317	0.210	0.104
			8 mm x 4(Conventional)	32	0.287	0.190	0.094
			1 mm x 1(Conventional)	1	1.597	1.058	0.523
			0.5 mm x 40(Volume)	20	0.343	0.227	0.112
			0.5 mm x 80(Volume)	40	0.290	0.192	0.095
			0.5 mm x 120(Volume)	60	0.273	0.181	0.089
			0.5 mm x 160(Volume)	80	0.277	0.183	0.091
			0.5 mm x 200(Volume)	100	0.270	0.179	0.088
			0.5 mm x 240(Volume)	120	0.267	0.177	0.087
			0.5 mm x 256(Volume)	128	0.263	0.174	0.086
			0.5 mm x 280(Volume)	140	0.260	0.172	0.085
			0.5 mm x 320(Volume)	160	0.257	0.170	0.084
			1 mm x 120(Volume)	120	0.267	0.177	0.087
			1 mm x 140(Volume)	140	0.260	0.172	0.085
			1 mm x 160(Volume)	160	0.257	0.170	0.084
			0.5 mm x 8(SURE)	4	0.607	0.402	0.199
			2 mm x 1(CTF)	2	0.880	0.583	0.288
			4 mm x 1(CTF)	4	0.543	0.360	0.178
			6 mm x 1(CTF)	6	0.460	0.305	0.151
			8 mm x 1(CTF)	8	0.417	0.276	0.136
			2 mm x 3(CTF)	6	0.460	0.305	0.151
			4 mm x 3(CTF)	12	0.347	0.230	0.113
			6 mm x 3(CTF)	18	0.310	0.205	0.101

			8 mm x 3(CTF)	24	0.290	0.192	0.095
			0.5 mm x 16(Helical)	8	0.437	0.289	0.143
			0.5 mm x 32(Helical)	16	0.360	0.238	0.118
			0.5 mm x 64(Helical)	32	0.323	0.214	0.106
			0.5 mm x 80(Helical)	40	0.290	0.192	0.095
			0.5 mm x 100(Helical)	50	0.303	0.201	0.099
			0.5 mm x 128(Helical)	64	0.280	0.185	0.092
			0.5 mm x 160(Helical)	80	0.277	0.183	0.091
			1 mm x 16(Helical)	16	0.360	0.238	0.118
			1 mm x 32(Helical)	32	0.320	0.212	0.105
			1 mm x 40(Helical)	40	0.287	0.190	0.094
<b>Large</b>	100		0.5 mm x 4(Conventional)	2	0.619	0.400	0.185
			1 mm x 4(Conventional)	4	0.393	0.254	0.117
			2 mm x 4(Conventional)	8	0.279	0.180	0.083
			3 mm x 4(Conventional)	12	0.243	0.157	0.073
			4 mm x 4(Conventional)	16	0.223	0.144	0.067
			5 mm x 4(Conventional)	20	0.212	0.137	0.063
			8 mm x 4(Conventional)	32	0.192	0.124	0.057
			1 mm x 1(Conventional)	1	1.070	0.691	0.320
			0.5 mm x 40(Volume)	20	0.230	0.149	0.069
			0.5 mm x 80(Volume)	40	0.194	0.126	0.058
			0.5 mm x 120(Volume)	60	0.183	0.118	0.055
			0.5 mm x 160(Volume)	80	0.185	0.120	0.055
			0.5 mm x 200(Volume)	100	0.181	0.117	0.054
			0.5 mm x 240(Volume)	120	0.179	0.115	0.053
			0.5 mm x 256(Volume)	128	0.176	0.114	0.053
			0.5 mm x 280(Volume)	140	0.174	0.113	0.052
			0.5 mm x 320(Volume)	160	0.172	0.111	0.051
			1 mm x 120(Volume)	120	0.179	0.115	0.053
			1 mm x 140(Volume)	140	0.174	0.113	0.052
			1 mm x 160(Volume)	160	0.172	0.111	0.051
			0.5 mm x 8(SURE)	4	0.406	0.263	0.122
			2 mm x 1(CTF)	2	0.590	0.381	0.176
			4 mm x 1(CTF)	4	0.364	0.235	0.109
			6 mm x 1(CTF)	6	0.308	0.199	0.092
			8 mm x 1(CTF)	8	0.279	0.180	0.083
			2 mm x 3(CTF)	6	0.308	0.199	0.092
			4 mm x 3(CTF)	12	0.232	0.150	0.069
			6 mm x 3(CTF)	18	0.208	0.134	0.062
			8 mm x 3(CTF)	24	0.194	0.126	0.058
			0.5 mm x 16(Helical)	8	0.293	0.189	0.087
			0.5 mm x 32(Helical)	16	0.241	0.156	0.072
			0.5 mm x 64(Helical)	32	0.217	0.140	0.065
			0.5 mm x 80(Helical)	40	0.194	0.126	0.058
			0.5 mm x 100(Helical)	50	0.203	0.131	0.061
			0.5 mm x 128(Helical)	64	0.188	0.121	0.056
			0.5 mm x 160(Helical)	80	0.185	0.120	0.055
			1 mm x 16(Helical)	16	0.241	0.156	0.072
			1 mm x 32(Helical)	32	0.214	0.139	0.064
			1 mm x 40(Helical)	40	0.192	0.124	0.057
<b>Large</b>	80	80kV-L-303	0.5 mm x 4(Conventional)	2	0.360	0.220	0.105
			1 mm x 4(Conventional)	4	0.229	0.140	0.067
			2 mm x 4(Conventional)	8	0.163	0.099	0.047
			3 mm x 4(Conventional)	12	0.142	0.087	0.041
			4 mm x 4(Conventional)	16	0.130	0.080	0.038
			5 mm x 4(Conventional)	20	0.124	0.076	0.036
			8 mm x 4(Conventional)	32	0.112	0.068	0.033
			1 mm x 1(Conventional)	1	0.623	0.381	0.182
			0.5 mm x 40(Volume)	20	0.134	0.082	0.039
			0.5 mm x 80(Volume)	40	0.113	0.069	0.033
			0.5 mm x 120(Volume)	60	0.107	0.065	0.031
			0.5 mm x 160(Volume)	80	0.108	0.066	0.031
			0.5 mm x 200(Volume)	100	0.105	0.064	0.031
			0.5 mm x 240(Volume)	120	0.104	0.064	0.030
			0.5 mm x 256(Volume)	128	0.103	0.063	0.030
			0.5 mm x 280(Volume)	140	0.101	0.062	0.030
			0.5 mm x 320(Volume)	160	0.100	0.061	0.029
			1 mm x 120(Volume)	120	0.104	0.064	0.030
			1 mm x 140(Volume)	140	0.101	0.062	0.030
			1 mm x 160(Volume)	160	0.100	0.061	0.029
			0.5 mm x 8(SURE)	4	0.237	0.145	0.069

			2 mm x 1(CTF)	2	0.343	0.210	0.100
			4 mm x 1(CTF)	4	0.212	0.130	0.062
			6 mm x 1(CTF)	6	0.179	0.110	0.052
			8 mm x 1(CTF)	8	0.163	0.099	0.047
			2 mm x 3(CTF)	6	0.179	0.110	0.052
			4 mm x 3(CTF)	12	0.135	0.083	0.039
			6 mm x 3(CTF)	18	0.121	0.074	0.035
			8 mm x 3(CTF)	24	0.113	0.069	0.033
			0.5 mm x 16(Helical)	8	0.170	0.104	0.050
			0.5 mm x 32(Helical)	16	0.140	0.086	0.041
			0.5 mm x 64(Helical)	32	0.126	0.077	0.037
			0.5 mm x 80(Helical)	40	0.113	0.069	0.033
			0.5 mm x 100(Helical)	50	0.118	0.072	0.035
			0.5 mm x 128(Helical)	64	0.109	0.067	0.032
			0.5 mm x 160(Helical)	80	0.108	0.066	0.031
			1 mm x 16(Helical)	16	0.140	0.086	0.041
			1 mm x 32(Helical)	32	0.125	0.076	0.036
			1 mm x 40(Helical)	40	0.112	0.068	0.033
<b>Medium</b>	<b>135</b>		0.5 mm x 4(Conventional)	2	1.182	0.788	0.361
			1 mm x 4(Conventional)	4	0.751	0.501	0.230
			2 mm x 4(Conventional)	8	0.533	0.356	0.163
			3 mm x 4(Conventional)	12	0.465	0.310	0.142
			4 mm x 4(Conventional)	16	0.427	0.285	0.130
			5 mm x 4(Conventional)	20	0.405	0.270	0.124
			8 mm x 4(Conventional)	32	0.367	0.245	0.112
			1 mm x 1(Conventional)	1	2.044	1.363	0.625
			0.5 mm x 40(Volume)	20	0.439	0.293	0.134
			0.5 mm x 80(Volume)	40	0.371	0.248	0.114
			0.5 mm x 120(Volume)	60	0.350	0.233	0.107
			0.5 mm x 160(Volume)	80	0.354	0.236	0.108
			0.5 mm x 200(Volume)	100	0.346	0.231	0.106
			0.5 mm x 240(Volume)	120	0.341	0.228	0.104
			0.5 mm x 256(Volume)	128	0.337	0.225	0.103
			0.5 mm x 280(Volume)	140	0.333	0.222	0.102
			0.5 mm x 320(Volume)	160	0.329	0.219	0.100
			1 mm x 120(Volume)	120	0.341	0.228	0.104
			1 mm x 140(Volume)	140	0.333	0.222	0.102
			1 mm x 160(Volume)	160	0.329	0.219	0.100
			0.5 mm x 8(SURE)	4	0.777	0.518	0.237
			2 mm x 1(CTF)	2	1.126	0.751	0.344
			4 mm x 1(CTF)	4	0.695	0.464	0.213
			6 mm x 1(CTF)	6	0.589	0.393	0.180
			8 mm x 1(CTF)	8	0.533	0.356	0.163
			2 mm x 3(CTF)	6	0.589	0.393	0.180
			4 mm x 3(CTF)	12	0.444	0.296	0.136
			6 mm x 3(CTF)	18	0.397	0.265	0.121
			8 mm x 3(CTF)	24	0.371	0.248	0.114
			0.5 mm x 16(Helical)	8	0.559	0.373	0.171
			0.5 mm x 32(Helical)	16	0.461	0.307	0.141
			0.5 mm x 64(Helical)	32	0.414	0.276	0.127
			0.5 mm x 80(Helical)	40	0.371	0.248	0.114
			0.5 mm x 100(Helical)	50	0.388	0.259	0.119
			0.5 mm x 128(Helical)	64	0.358	0.239	0.110
			0.5 mm x 160(Helical)	80	0.354	0.236	0.108
			1 mm x 16(Helical)	16	0.461	0.307	0.141
			1 mm x 32(Helical)	32	0.410	0.273	0.125
			1 mm x 40(Helical)	40	0.367	0.245	0.112
<b>Medium</b>	<b>120</b>	<b>120kV-M-303</b>	0.5 mm x 4(Conventional)	2	0.923	0.605	0.272
			1 mm x 4(Conventional)	4	0.587	0.384	0.173
			2 mm x 4(Conventional)	8	0.417	0.273	0.123
			3 mm x 4(Conventional)	12	0.363	0.238	0.107
			4 mm x 4(Conventional)	16	0.333	0.218	0.098
			5 mm x 4(Conventional)	20	0.317	0.207	0.093
			8 mm x 4(Conventional)	32	0.287	0.188	0.084
			1 mm x 1(Conventional)	1	1.597	1.046	0.470
			0.5 mm x 40(Volume)	20	0.343	0.225	0.101
			0.5 mm x 80(Volume)	40	0.290	0.190	0.085
			0.5 mm x 120(Volume)	60	0.273	0.179	0.080
			0.5 mm x 160(Volume)	80	0.277	0.181	0.081
			0.5 mm x 200(Volume)	100	0.270	0.177	0.079
			0.5 mm x 240(Volume)	120	0.267	0.175	0.078

			0.5 mm x 256(Volume)	128	0.263	0.173	0.077
			0.5 mm x 280(Volume)	140	0.260	0.170	0.076
			0.5 mm x 320(Volume)	160	0.257	0.168	0.075
			1 mm x 120(Volume)	120	0.267	0.175	0.078
			1 mm x 140(Volume)	140	0.260	0.170	0.076
			1 mm x 160(Volume)	160	0.257	0.168	0.075
			0.5 mm x 8(SURE)	4	0.607	0.397	0.178
			2 mm x 1(CTF)	2	0.880	0.577	0.259
			4 mm x 1(CTF)	4	0.543	0.356	0.160
			6 mm x 1(CTF)	6	0.460	0.301	0.135
			8 mm x 1(CTF)	8	0.417	0.273	0.123
			2 mm x 3(CTF)	6	0.460	0.301	0.135
			4 mm x 3(CTF)	12	0.347	0.227	0.102
			6 mm x 3(CTF)	18	0.310	0.203	0.091
			8 mm x 3(CTF)	24	0.290	0.190	0.085
			0.5 mm x 16(Helical)	8	0.437	0.286	0.128
			0.5 mm x 32(Helical)	16	0.360	0.236	0.106
			0.5 mm x 64(Helical)	32	0.323	0.212	0.095
			0.5 mm x 80(Helical)	40	0.290	0.190	0.085
			0.5 mm x 100(Helical)	50	0.303	0.199	0.089
			0.5 mm x 128(Helical)	64	0.280	0.183	0.082
			0.5 mm x 160(Helical)	80	0.277	0.181	0.081
			1 mm x 16(Helical)	16	0.360	0.236	0.106
			1 mm x 32(Helical)	32	0.320	0.210	0.094
			1 mm x 40(Helical)	40	0.287	0.188	0.084
<b>Medium</b>	100		0.5 mm x 4(Conventional)	2	0.619	0.395	0.166
			1 mm x 4(Conventional)	4	0.393	0.251	0.105
			2 mm x 4(Conventional)	8	0.279	0.178	0.075
			3 mm x 4(Conventional)	12	0.243	0.156	0.065
			4 mm x 4(Conventional)	16	0.223	0.143	0.060
			5 mm x 4(Conventional)	20	0.212	0.136	0.057
			8 mm x 4(Conventional)	32	0.192	0.123	0.052
			1 mm x 1(Conventional)	1	1.070	0.684	0.287
			0.5 mm x 40(Volume)	20	0.230	0.147	0.062
			0.5 mm x 80(Volume)	40	0.194	0.124	0.052
			0.5 mm x 120(Volume)	60	0.183	0.117	0.049
			0.5 mm x 160(Volume)	80	0.185	0.118	0.050
			0.5 mm x 200(Volume)	100	0.181	0.116	0.049
			0.5 mm x 240(Volume)	120	0.179	0.114	0.048
			0.5 mm x 256(Volume)	128	0.176	0.113	0.047
			0.5 mm x 280(Volume)	140	0.174	0.111	0.047
			0.5 mm x 320(Volume)	160	0.172	0.110	0.046
			1 mm x 120(Volume)	120	0.179	0.114	0.048
			1 mm x 140(Volume)	140	0.174	0.111	0.047
			1 mm x 160(Volume)	160	0.172	0.110	0.046
			0.5 mm x 8(SURE)	4	0.406	0.260	0.109
			2 mm x 1(CTF)	2	0.590	0.377	0.158
			4 mm x 1(CTF)	4	0.364	0.233	0.098
			6 mm x 1(CTF)	6	0.308	0.197	0.083
			8 mm x 1(CTF)	8	0.279	0.178	0.075
			2 mm x 3(CTF)	6	0.308	0.197	0.083
			4 mm x 3(CTF)	12	0.232	0.148	0.062
			6 mm x 3(CTF)	18	0.208	0.133	0.056
			8 mm x 3(CTF)	24	0.194	0.124	0.052
			0.5 mm x 16(Helical)	8	0.293	0.187	0.078
			0.5 mm x 32(Helical)	16	0.241	0.154	0.065
			0.5 mm x 64(Helical)	32	0.217	0.138	0.058
			0.5 mm x 80(Helical)	40	0.194	0.124	0.052
			0.5 mm x 100(Helical)	50	0.203	0.130	0.055
			0.5 mm x 128(Helical)	64	0.188	0.120	0.050
			0.5 mm x 160(Helical)	80	0.185	0.118	0.050
			1 mm x 16(Helical)	16	0.241	0.154	0.065
			1 mm x 32(Helical)	32	0.214	0.137	0.058
			1 mm x 40(Helical)	40	0.192	0.123	0.052
<b>Medium</b>	80	80kV-M-303	0.5 mm x 4(Conventional)	2	0.360	0.218	0.094
			1 mm x 4(Conventional)	4	0.229	0.139	0.060
			2 mm x 4(Conventional)	8	0.163	0.098	0.042
			3 mm x 4(Conventional)	12	0.142	0.086	0.037
			4 mm x 4(Conventional)	16	0.130	0.079	0.034
			5 mm x 4(Conventional)	20	0.124	0.075	0.032
			8 mm x 4(Conventional)	32	0.112	0.068	0.029

		1 mm x 1(Conventional)	1	0.623	0.377	0.163
		0.5 mm x 40(Volume)	20	0.134	0.081	0.035
		0.5 mm x 80(Volume)	40	0.113	0.068	0.030
		0.5 mm x 120(Volume)	60	0.107	0.065	0.028
		0.5 mm x 160(Volume)	80	0.108	0.065	0.028
		0.5 mm x 200(Volume)	100	0.105	0.064	0.028
		0.5 mm x 240(Volume)	120	0.104	0.063	0.027
		0.5 mm x 256(Volume)	128	0.103	0.062	0.027
		0.5 mm x 280(Volume)	140	0.101	0.061	0.027
		0.5 mm x 320(Volume)	160	0.100	0.061	0.026
		1 mm x 120(Volume)	120	0.104	0.063	0.027
		1 mm x 140(Volume)	140	0.101	0.061	0.027
		1 mm x 160(Volume)	160	0.100	0.061	0.026
		0.5 mm x 8(SURE)	4	0.237	0.143	0.062
		2 mm x 1(CTF)	2	0.343	0.208	0.090
		4 mm x 1(CTF)	4	0.212	0.128	0.055
		6 mm x 1(CTF)	6	0.179	0.109	0.047
		8 mm x 1(CTF)	8	0.163	0.098	0.042
		2 mm x 3(CTF)	6	0.179	0.109	0.047
		4 mm x 3(CTF)	12	0.135	0.082	0.035
		6 mm x 3(CTF)	18	0.121	0.073	0.032
		8 mm x 3(CTF)	24	0.113	0.068	0.030
		0.5 mm x 16(Helical)	8	0.170	0.103	0.045
		0.5 mm x 32(Helical)	16	0.140	0.085	0.037
		0.5 mm x 64(Helical)	32	0.126	0.076	0.033
		0.5 mm x 80(Helical)	40	0.113	0.068	0.030
		0.5 mm x 100(Helical)	50	0.118	0.072	0.031
		0.5 mm x 128(Helical)	64	0.109	0.066	0.029
		0.5 mm x 160(Helical)	80	0.108	0.065	0.028
		1 mm x 16(Helical)	16	0.140	0.085	0.037
		1 mm x 32(Helical)	32	0.125	0.076	0.033
		1 mm x 40(Helical)	40	0.112	0.068	0.029
<b>Small</b>	135	0.5 mm x 4(Conventional)	2	1.359	0.866	0.391
		1 mm x 4(Conventional)	4	0.864	0.550	0.248
		2 mm x 4(Conventional)	8	0.613	0.391	0.176
		3 mm x 4(Conventional)	12	0.535	0.341	0.154
		4 mm x 4(Conventional)	16	0.491	0.313	0.141
		5 mm x 4(Conventional)	20	0.466	0.297	0.134
		8 mm x 4(Conventional)	32	0.422	0.269	0.121
		1 mm x 1(Conventional)	1	2.350	1.498	0.676
		0.5 mm x 40(Volume)	20	0.505	0.322	0.145
		0.5 mm x 80(Volume)	40	0.427	0.272	0.123
		0.5 mm x 120(Volume)	60	0.402	0.256	0.116
		0.5 mm x 160(Volume)	80	0.407	0.260	0.117
		0.5 mm x 200(Volume)	100	0.397	0.253	0.114
		0.5 mm x 240(Volume)	120	0.393	0.250	0.113
		0.5 mm x 256(Volume)	128	0.388	0.247	0.112
		0.5 mm x 280(Volume)	140	0.383	0.244	0.110
		0.5 mm x 320(Volume)	160	0.378	0.241	0.109
		1 mm x 120(Volume)	120	0.393	0.250	0.113
		1 mm x 140(Volume)	140	0.383	0.244	0.110
		1 mm x 160(Volume)	160	0.378	0.241	0.109
		0.5 mm x 8(SURE)	4	0.893	0.569	0.257
		2 mm x 1(CTF)	2	1.295	0.826	0.373
		4 mm x 1(CTF)	4	0.800	0.510	0.230
		6 mm x 1(CTF)	6	0.677	0.432	0.195
		8 mm x 1(CTF)	8	0.613	0.391	0.176
		2 mm x 3(CTF)	6	0.677	0.432	0.195
		4 mm x 3(CTF)	12	0.510	0.325	0.147
		6 mm x 3(CTF)	18	0.456	0.291	0.131
		8 mm x 3(CTF)	24	0.427	0.272	0.123
		0.5 mm x 16(Helical)	8	0.643	0.410	0.185
		0.5 mm x 32(Helical)	16	0.530	0.338	0.152
		0.5 mm x 64(Helical)	32	0.476	0.303	0.137
		0.5 mm x 80(Helical)	40	0.427	0.272	0.123
		0.5 mm x 100(Helical)	50	0.447	0.285	0.128
		0.5 mm x 128(Helical)	64	0.412	0.263	0.119
		0.5 mm x 160(Helical)	80	0.407	0.260	0.117
		1 mm x 16(Helical)	16	0.530	0.338	0.152
		1 mm x 32(Helical)	32	0.471	0.300	0.136
		1 mm x 40(Helical)	40	0.422	0.269	0.121

<b>Small</b>	120		0.5 mm x 4(Conventional)	2	1.062	0.665	0.294
			1 mm x 4(Conventional)	4	0.675	0.422	0.187
			2 mm x 4(Conventional)	8	0.479	0.300	0.133
			3 mm x 4(Conventional)	12	0.418	0.262	0.116
			4 mm x 4(Conventional)	16	0.383	0.240	0.106
			5 mm x 4(Conventional)	20	0.364	0.228	0.101
			8 mm x 4(Conventional)	32	0.330	0.206	0.091
			1 mm x 1(Conventional)	1	1.836	1.150	0.508
			0.5 mm x 40(Volume)	20	0.395	0.247	0.109
			0.5 mm x 80(Volume)	40	0.334	0.209	0.092
			0.5 mm x 120(Volume)	60	0.314	0.197	0.087
			0.5 mm x 160(Volume)	80	0.318	0.199	0.088
			0.5 mm x 200(Volume)	100	0.311	0.194	0.086
			0.5 mm x 240(Volume)	120	0.307	0.192	0.085
			0.5 mm x 256(Volume)	128	0.303	0.190	0.084
			0.5 mm x 280(Volume)	140	0.299	0.187	0.083
			0.5 mm x 320(Volume)	160	0.295	0.185	0.082
			1 mm x 120(Volume)	120	0.307	0.192	0.085
			1 mm x 140(Volume)	140	0.299	0.187	0.083
			1 mm x 160(Volume)	160	0.295	0.185	0.082
			0.5 mm x 8(SURE)	4	0.698	0.437	0.193
			2 mm x 1(CTF)	2	1.012	0.634	0.280
			4 mm x 1(CTF)	4	0.625	0.391	0.173
			6 mm x 1(CTF)	6	0.529	0.331	0.146
			8 mm x 1(CTF)	8	0.479	0.300	0.133
			2 mm x 3(CTF)	6	0.529	0.331	0.146
			4 mm x 3(CTF)	12	0.399	0.250	0.110
			6 mm x 3(CTF)	18	0.357	0.223	0.099
			8 mm x 3(CTF)	24	0.334	0.209	0.092
			0.5 mm x 16(Helical)	8	0.502	0.314	0.139
			0.5 mm x 32(Helical)	16	0.414	0.259	0.115
			0.5 mm x 64(Helical)	32	0.372	0.233	0.103
			0.5 mm x 80(Helical)	40	0.334	0.209	0.092
			0.5 mm x 100(Helical)	50	0.349	0.218	0.097
			0.5 mm x 128(Helical)	64	0.322	0.202	0.089
			0.5 mm x 160(Helical)	80	0.318	0.199	0.088
			1 mm x 16(Helical)	16	0.414	0.259	0.115
			1 mm x 32(Helical)	32	0.368	0.230	0.102
			1 mm x 40(Helical)	40	0.330	0.206	0.091
<b>Small</b>	100		0.5 mm x 4(Conventional)	2	0.711	0.435	0.180
			1 mm x 4(Conventional)	4	0.452	0.276	0.114
			2 mm x 4(Conventional)	8	0.321	0.196	0.081
			3 mm x 4(Conventional)	12	0.280	0.171	0.071
			4 mm x 4(Conventional)	16	0.257	0.157	0.065
			5 mm x 4(Conventional)	20	0.244	0.149	0.062
			8 mm x 4(Conventional)	32	0.221	0.135	0.056
			1 mm x 1(Conventional)	1	1.230	0.751	0.311
			0.5 mm x 40(Volume)	20	0.265	0.162	0.067
			0.5 mm x 80(Volume)	40	0.223	0.136	0.056
			0.5 mm x 120(Volume)	60	0.211	0.129	0.053
			0.5 mm x 160(Volume)	80	0.213	0.130	0.054
			0.5 mm x 200(Volume)	100	0.208	0.127	0.053
			0.5 mm x 240(Volume)	120	0.205	0.126	0.052
			0.5 mm x 256(Volume)	128	0.203	0.124	0.051
			0.5 mm x 280(Volume)	140	0.200	0.122	0.051
			0.5 mm x 320(Volume)	160	0.198	0.121	0.050
			1 mm x 120(Volume)	120	0.205	0.126	0.052
			1 mm x 140(Volume)	140	0.200	0.122	0.051
			1 mm x 160(Volume)	160	0.198	0.121	0.050
			0.5 mm x 8(SURE)	4	0.467	0.286	0.118
			2 mm x 1(CTF)	2	0.678	0.414	0.171
			4 mm x 1(CTF)	4	0.419	0.256	0.106
			6 mm x 1(CTF)	6	0.354	0.216	0.090
			8 mm x 1(CTF)	8	0.321	0.196	0.081
			2 mm x 3(CTF)	6	0.354	0.216	0.090
			4 mm x 3(CTF)	12	0.267	0.163	0.067
			6 mm x 3(CTF)	18	0.239	0.146	0.060
			8 mm x 3(CTF)	24	0.223	0.136	0.056
			0.5 mm x 16(Helical)	8	0.336	0.206	0.085
			0.5 mm x 32(Helical)	16	0.277	0.169	0.070
			0.5 mm x 64(Helical)	32	0.249	0.152	0.063

		0.5 mm x 80(Helical)	40	0.223	0.136	0.056
		0.5 mm x 100(Helical)	50	0.234	0.143	0.059
		0.5 mm x 128(Helical)	64	0.216	0.132	0.054
		0.5 mm x 160(Helical)	80	0.213	0.130	0.054
		1 mm x 16(Helical)	16	0.277	0.169	0.070
		1 mm x 32(Helical)	32	0.247	0.151	0.062
		1 mm x 40(Helical)	40	0.221	0.135	0.056
<b>Small</b>	80	0.5 mm x 4(Conventional)	2	0.414	0.240	0.102
		1 mm x 4(Conventional)	4	0.263	0.152	0.065
		2 mm x 4(Conventional)	8	0.187	0.108	0.046
		3 mm x 4(Conventional)	12	0.163	0.094	0.040
		4 mm x 4(Conventional)	16	0.150	0.087	0.037
		5 mm x 4(Conventional)	20	0.142	0.082	0.035
		8 mm x 4(Conventional)	32	0.129	0.074	0.032
		1 mm x 1(Conventional)	1	0.716	0.414	0.176
		0.5 mm x 40(Volume)	20	0.154	0.089	0.038
		0.5 mm x 80(Volume)	40	0.130	0.075	0.032
		0.5 mm x 120(Volume)	60	0.123	0.071	0.030
		0.5 mm x 160(Volume)	80	0.124	0.072	0.031
		0.5 mm x 200(Volume)	100	0.121	0.070	0.030
		0.5 mm x 240(Volume)	120	0.120	0.069	0.029
		0.5 mm x 256(Volume)	128	0.118	0.068	0.029
		0.5 mm x 280(Volume)	140	0.117	0.067	0.029
		0.5 mm x 320(Volume)	160	0.115	0.067	0.028
		1 mm x 120(Volume)	120	0.120	0.069	0.029
		1 mm x 140(Volume)	140	0.117	0.067	0.029
		1 mm x 160(Volume)	160	0.115	0.067	0.028
		0.5 mm x 8(SURE)	4	0.272	0.157	0.067
		2 mm x 1(CTF)	2	0.395	0.228	0.097
		4 mm x 1(CTF)	4	0.244	0.141	0.060
		6 mm x 1(CTF)	6	0.206	0.119	0.051
		8 mm x 1(CTF)	8	0.187	0.108	0.046
		2 mm x 3(CTF)	6	0.206	0.119	0.051
		4 mm x 3(CTF)	12	0.155	0.090	0.038
		6 mm x 3(CTF)	18	0.139	0.080	0.034
		8 mm x 3(CTF)	24	0.130	0.075	0.032
		0.5 mm x 16(Helical)	8	0.196	0.113	0.048
		0.5 mm x 32(Helical)	16	0.161	0.093	0.040
		0.5 mm x 64(Helical)	32	0.145	0.084	0.036
		0.5 mm x 80(Helical)	40	0.130	0.075	0.032
		0.5 mm x 100(Helical)	50	0.136	0.079	0.034
		0.5 mm x 128(Helical)	64	0.126	0.073	0.031
		0.5 mm x 160(Helical)	80	0.124	0.072	0.031
		1 mm x 16(Helical)	16	0.161	0.093	0.040
		1 mm x 32(Helical)	32	0.144	0.083	0.035
		1 mm x 40(Helical)	40	0.129	0.074	0.032

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion ONE(TSX201)

Table 10-24. Parameters related to dose index for Toshiba Aquilion CXL

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	135	120kV-M-301	1 mmx1	1	2.046	1.205	0.595
			0.5 mmx4	2	1.280	0.754	0.372
			4 mmx4	16	0.525	0.309	0.153
			8 mmx4	32	0.483	0.284	0.140
			1 mmx32	32	0.504	0.297	0.146
<b>Large</b>	120	120kV-M-301	1 mmx1	1	1.677	0.925	0.457
			0.5 mmx4	2	1.049	0.579	0.286
			4 mmx4	16	0.430	0.237	0.117
			8 mmx4	32	0.396	0.218	0.108
			1 mmx32	32	0.413	0.228	0.113
<b>Large</b>	100	80kV-M-301	1 mmx1	1	1.224	0.605	0.298
			0.5 mmx4	2	0.766	0.378	0.186
			4 mmx4	16	0.314	0.155	0.076
			8 mmx4	32	0.289	0.143	0.070
			1 mmx32	32	0.301	0.149	0.073
<b>Large</b>	80	80kV-M-301	1 mmx1	1	0.769	0.337	0.167
			0.5 mmx4	2	0.481	0.211	0.104
			4 mmx4	16	0.197	0.086	0.043
			8 mmx4	32	0.181	0.079	0.039
			1 mmx32	32	0.189	0.083	0.041
<b>Small</b>	135	120kV-S-301	1 mmx1	1	1.555	1.015	0.460
			0.5 mmx4	2	0.973	0.635	0.288
			4 mmx4	16	0.399	0.260	0.118
			8 mmx4	32	0.367	0.239	0.108
			1 mmx32	32	0.383	0.250	0.113
<b>Small</b>	120	120kV-S-301	1 mmx1	1	1.275	0.779	0.353
			0.5 mmx4	2	0.797	0.487	0.221
			4 mmx4	16	0.327	0.200	0.091
			8 mmx4	32	0.301	0.184	0.083
			1 mmx32	32	0.314	0.192	0.087
<b>Small</b>	100	80kV-S-301	1 mmx1	1	0.930	0.509	0.229
			0.5 mmx4	2	0.582	0.319	0.143
			4 mmx4	16	0.239	0.131	0.059
			8 mmx4	32	0.219	0.120	0.054
			1 mmx32	32	0.229	0.125	0.056
<b>Small</b>	80	80kV-S-301	1 mmx1	1	0.585	0.283	0.128
			0.5 mmx4	2	0.366	0.177	0.080
			4 mmx4	16	0.150	0.073	0.033
			8 mmx4	32	0.138	0.067	0.030
			1 mmx32	32	0.144	0.070	0.032

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are based on the user manual of Toshiba Aquilion CXL

Table 10-25. Parameters related to dose index for Hitachi Eclos series (Eclos 4, Eclos8, Eclos16)

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Normal</b>	120	120kV-M-401	20 mm	20	0.235	0.163	0.085
			15 mm	15	0.257	0.179	0.094
			10 mm	10	0.286	0.199	0.104
			5 mm	5	0.320	0.223	0.116
			2.5 mm	2.5	0.360	0.250	0.131
<b>Normal</b>	100	100kV-M-401	20 mm	20	0.157	0.109	0.054
			15 mm	15	0.172	0.119	0.059
			10 mm	10	0.191	0.132	0.065
			5 mm	5	0.214	0.148	0.073
			2.5 mm	2.5	0.241	0.167	0.082

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated based on data offered by HITACHI.

Table 10-26. Parameters related to dose index for Hitachi Supria series (Supria, Supria Advance, Supria Grande, Supria Grande Advance)

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Normal</b>	140		40 mm	40	0.307	0.223	0.120
			20 mm	20	0.311	0.226	0.121
			15 mm	15	0.342	0.248	0.133
			10 mm	10	0.384	0.278	0.150
			5 mm	5	0.395	0.287	0.154
			1.25 mm	1.25	0.649	0.470	0.253
<b>Normal</b>	120	120kV-M-401	20 mm	20	0.222	0.158	0.081
			15 mm	15	0.244	0.174	0.089
			10 mm	10	0.274	0.195	0.101
			5 mm	5	0.282	0.201	0.104
			1.25 mm	1.25	0.463	0.330	0.170
<b>Normal</b>	100	100kV-M-401	20 mm	20	0.148	0.101	0.050
			15 mm	15	0.163	0.111	0.055
			10 mm	10	0.183	0.124	0.062
			5 mm	5	0.188	0.128	0.064
			1.25 mm	1.25	0.309	0.210	0.105
<b>Normal</b>	80	80kV-M-401	20 mm	20	0.086	0.054	0.025
			15 mm	15	0.094	0.059	0.028
			10 mm	10	0.106	0.067	0.031
			5 mm	5	0.109	0.068	0.032
			1.25 mm	1.25	0.179	0.112	0.053

\*  $nCTDI_{free\ air}$  and  $nCTDI_w$  are calculated based on data offered by HITACHI.

Table 10-27. Parameters related to dose index for Hitachi Scenaria

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Normal</b>	140	140kV-M-401	40 mm	40	0.333	0.252	0.131
			20 mm	20	0.358	0.271	0.141
			15 mm	15	0.375	0.284	0.148
			10 mm	10	0.422	0.319	0.166
			5 mm	5	0.540	0.408	0.213
			1.25 mm	1.25	0.885	0.669	0.349
<b>Normal</b>	120	120kV-M-401	40 mm	40	0.244	0.179	0.091
			20 mm	20	0.263	0.192	0.097
			15 mm	15	0.275	0.201	0.102
			10 mm	10	0.309	0.226	0.115
			5 mm	5	0.396	0.289	0.147
			1.25 mm	1.25	0.649	0.475	0.241
<b>Normal</b>	100	100kV-M-401	40 mm	40	0.164	0.115	0.057
			20 mm	20	0.176	0.124	0.061
			15 mm	15	0.185	0.130	0.064
			10 mm	10	0.208	0.146	0.072
			5 mm	5	0.266	0.187	0.092
			1.25 mm	1.25	0.436	0.307	0.151
<b>Normal</b>	80	80kV-M-401	40 mm	40	0.096	0.063	0.029
			20 mm	20	0.103	0.068	0.032
			15 mm	15	0.108	0.071	0.033
			10 mm	10	0.122	0.079	0.037
			5 mm	5	0.156	0.102	0.048
			1.25 mm	1.25	0.255	0.167	0.078
<b>Small</b>	140	140kV-S-401	40 mm	40	0.332	0.230	0.098
			20 mm	20	0.358	0.248	0.105
			15 mm	15	0.379	0.262	0.112
			10 mm	10	0.426	0.295	0.126
			5 mm	5	0.545	0.377	0.161
			1.25 mm	1.25	0.894	0.619	0.264
<b>Small</b>	120	120kV-S-401	40 mm	40	0.239	0.163	0.069
			20 mm	20	0.258	0.176	0.074
			15 mm	15	0.273	0.184	0.078
			10 mm	10	0.307	0.207	0.087
			5 mm	5	0.393	0.265	0.112
			1.25 mm	1.25	0.645	0.434	0.183
<b>Small</b>	100	100kV-S-401	40 mm	40	0.164	0.105	0.043
			20 mm	20	0.177	0.113	0.046
			15 mm	15	0.187	0.119	0.048
			10 mm	10	0.210	0.133	0.054
			5 mm	5	0.269	0.170	0.070
			1.25 mm	1.25	0.442	0.280	0.114
<b>Small</b>	80	80kV-S-401	40 mm	40	0.096	0.056	0.022
			20 mm	20	0.103	0.060	0.023
			15 mm	15	0.110	0.063	0.024
			10 mm	10	0.123	0.071	0.027
			5 mm	5	0.158	0.091	0.035
			1.25 mm	1.25	0.258	0.149	0.058

\*  $nCTDI_{free\ air}$ ,  $nCTDI_w$  are calculated based on data offered by HITACHI.

Table 10-28. Parameters related to dose index for Philips Brilliance 64

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120		12 x 0.625 mm	7.5	0.225	0.171	0.087
			12 x 1.25 mm	15	0.191	0.146	0.074
			16 x 0.625 mm	10	0.208	0.159	0.081
			16 x 2.5 mm	40	0.169	0.129	0.066
			20 x 0.625 mm(UHR)	12.5	0.198	0.151	0.077
			2 x 0.5 mm(HR)	1	0.409	0.312	0.159
			2 x 0.625 mm(UHR)	1.25	0.326	0.249	0.127
			32 x 1.25 mm	40	0.169	0.129	0.066
			40 x 0.625 mm	25	0.176	0.134	0.068
			64 x 0.625 mm	40	0.169	0.129	0.066
<b>Large</b>	80		12 x 0.625 mm	7.5	0.074	0.052	0.025
			12 x 1.25 mm	15	0.063	0.044	0.021
			16 x 0.625 mm	10	0.068	0.048	0.023
			16 x 2.5 mm	40	0.055	0.039	0.019
			20 x 0.625 mm(UHR)	12.5	0.065	0.046	0.022
			2 x 0.5 mm(HR)	1	0.134	0.095	0.046
			2 x 0.625 mm(UHR)	1.25	0.107	0.076	0.037
			32 x 1.25 mm	40	0.055	0.039	0.019
			40 x 0.625 mm	25	0.058	0.041	0.020
			64 x 0.625 mm	40	0.055	0.039	0.019

Table 10-29. Parameters related to dose index for Philips Brilliance iCT

Filter Size	Potential [kV]	Source Name	Collimation Name	Total Collimation Width [mm]	$nCTDI_{free\ air}$ [mGy/mAs]	$nCTDI_w$ (16 cm) [mGy/mAs]	$nCTDI_w$ (32 cm) [mGy/mAs]
<b>Large</b>	120		4 x 0.625 mm	2.5	0.261	0.200	0.102
			8 x 0.625 mm	5	0.278	0.213	0.109
			16 x 0.625 mm	10	0.240	0.184	0.094
			32 x 0.625 mm	20	0.207	0.159	0.081
			64 x 0.625 mm	40	0.180	0.138	0.071
			96 x 0.625 mm	60	0.173	0.133	0.068
			112 x 0.625 mm	70	0.170	0.130	0.066
			128 x 0.625 mm	80	0.167	0.128	0.065
			4 x 0.625 mm	2.5	0.085	0.061	0.030
			8 x 0.625 mm	5	0.091	0.065	0.032
<b>Large</b>	80		16 x 0.625 mm	10	0.079	0.056	0.027
			32 x 0.625 mm	20	0.068	0.048	0.024
			64 x 0.625 mm	40	0.059	0.042	0.020
			96 x 0.625 mm	60	0.057	0.040	0.020
			112 x 0.625 mm	70	0.056	0.039	0.019
			128 x 0.625 mm	80	0.055	0.039	0.019
			4 x 0.625 mm	2.5	0.350	ND	0.099
			8 x 0.625 mm	5	0.373	ND	0.106
			16 x 0.625 mm	10	0.322	ND	0.091
			32 x 0.625 mm	20	0.278	ND	0.079
<b>Small</b>	120		64 x 0.625 mm	40	0.242	ND	0.068
			96 x 0.625 mm	60	0.232	ND	0.066
			112 x 0.625 mm	70	0.228	ND	0.064
			128 x 0.625 mm	80	0.224	ND	0.063
			4 x 0.625 mm	2.5	0.115	ND	0.032
			8 x 0.625 mm	5	0.122	ND	0.034
			16 x 0.625 mm	10	0.105	ND	0.030
			32 x 0.625 mm	20	0.091	ND	0.026
			64 x 0.625 mm	40	0.079	ND	0.022
			96 x 0.625 mm	60	0.076	ND	0.021
<b>Small</b>	80		112 x 0.625 mm	70	0.075	ND	0.021
			128 x 0.625 mm	80	0.073	ND	0.021

Table 10-30 Scan position and range for each scan type: Age-0 M/F

<b>Body region</b>	<b>Scan parameter</b>	<b>Begin</b>	<b>End</b>	<b>Range (mm)</b>
<b>Head</b>	Routine Head (non-helical)	475	390	85
	Routine Head (helical)	475	390	85
	Head-Neck (1-phase)	475	330	145
	Head CTA	475	355	120
	Head-Neck CTA	475	330	145
	Face/Orbits/Sinus	440	355	85
<b>Neck</b>	Routine Neck (1-phase)	390	345	45
	Neck-Chest (1-phase)	390	260	130
	Neck-Abdomen (1-phase)	390	220	170
	Neck-Pelvis (1-phase)	390	140	250
<b>Chest</b>	Routine Chest (1-Phase)	370	260	110
	HRCT	370	260	110
	Chest-upper Abdomen (1-phase)	370	220	150
	Chest-Pelvis (1-phase)	370	140	230
	Lung nodule (1-phase)	370	260	110
<b>Abdomen</b>	Upper Abdomen (1-phase)	300	220	80
	Abdomen-Pelvis (1-phase)	300	140	160
	Multi-phase Liver	300	215	85
<b>Pelvis</b>	Pelvis	240	140	100
	Lower Abdomen	240	140	100
	Hip	195	145	50
<b>Spine</b>	C-spine	395	345	50
	T-spine	370	240	130
	L-spine	280	190	90
<b>Cardiac</b>	Coronary CTA	330	280	50

Table 10-31 Scan position and range for each scan type: Age-1 M/F

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	765	650	115
	Routine Head (helical)	765	650	115
	Head-Neck (1-phase)	765	555	210
	Head CTA	765	600	165
	Head-Neck CTA	765	555	210
	Face/Orbits/Sinus	720	600	120
Neck	Routine Neck (1-phase)	650	565	85
	Neck-Chest (1-phase)	650	425	225
	Neck-Abdomen (1-phase)	650	380	270
	Neck-Pelvis (1-phase)	650	280	370
Chest	Routine Chest (1-Phase)	600	425	175
	HRCT	600	425	175
	Chest-upper Abdomen (1-phase)	600	380	220
	Chest-Pelvis (1-phase)	600	280	320
Abdomen	Lung nodule (1-phase)	600	425	175
	Upper Abdomen (1-phase)	495	380	115
	Abdomen-Pelvis (1-phase)	495	280	215
Pelvis	Multi-phase Liver	495	375	120
	Pelvis	405	280	125
	Lower Abdomen	405	280	125
Spine	Hip	345	285	60
	C-spine	655	565	90
	T-spine	600	410	190
Cardiac	L-spine	470	350	120
	Coronary CTA	550	470	80

Table 10-32 Scan position and range for each scan type: Age-5 M/F

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1100	975	125
	Routine Head (helical)	1400	1270	130
	Head-Neck (1-phase)	1400	1135	265
	Head CTA	1400	1200	200
	Head-Neck CTA	1400	1135	265
Neck	Face/Orbits/Sinus	1350	1200	150
	Routine Neck (1-phase)	1270	1140	130
	Neck-Chest (1-phase)	1270	920	350
	Neck-Abdomen (1-phase)	1270	860	410
	Neck-Pelvis (1-phase)	1270	635	635
Chest	Routine Chest (1-Phase)	1180	920	260
	HRCT	1180	920	260
	Chest-upper Abdomen (1-phase)	1180	860	320
	Chest-Pelvis (1-phase)	1180	635	545
	Lung nodule (1-phase)	1180	920	260
Abdomen	Upper Abdomen (1-phase)	1020	860	160
	Abdomen-Pelvis (1-phase)	1020	635	385
	Multi-phase Liver	1020	865	155
Pelvis	Pelvis	860	635	225
	Lower Abdomen	860	635	225
	Hip	740	650	90
Spine	C-spine	1280	1140	140
	T-spine	1180	900	280
	L-spine	950	745	205
Cardiac	Coronary CTA	1120	990	130

Table 10-33 Scan position and range for each scan type: Age-10 M/F

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1400	1270	130
	Routine Head (helical)	1400	1270	130
	Head-Neck (1-phase)	1400	1135	265
	Head CTA	1400	1200	200
	Head-Neck CTA	1400	1135	265
Neck	Face/Orbits/Sinus	1350	1200	150
	Routine Neck (1-phase)	1270	1140	130
	Neck-Chest (1-phase)	1270	920	350
	Neck-Abdomen (1-phase)	1270	860	410
	Neck-Pelvis (1-phase)	1270	635	635
Chest	Routine Chest (1-Phase)	1180	920	260
	HRCT	1180	920	260
	Chest-upper Abdomen (1-phase)	1180	860	320
	Chest-Pelvis (1-phase)	1180	635	545
	Lung nodule (1-phase)	1180	920	260
Abdomen	Upper Abdomen (1-phase)	1020	860	160
	Abdomen-Pelvis (1-phase)	1020	635	385
	Multi-phase Liver	1020	865	155
Pelvis	Pelvis	860	635	225
	Lower Abdomen	860	635	225
	Hip	740	650	90
Spine	C-spine	1280	1140	140
	T-spine	1180	900	280
	L-spine	950	745	205
Cardiac	Coronary CTA	1120	990	130

Table 10-34 Scan position and range for each scan type: Age-15 Male

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1660	1530	130
	Routine Head (helical)	1660	1530	130
	Head-Neck (1-phase)	1660	1370	290
	Head CTA	1660	1445	215
	Head-Neck CTA	1660	1370	290
Neck	Face/Orbits/Sinus	1620	1445	175
	Routine Neck (1-phase)	1525	1365	160
	Neck-Chest (1-phase)	1525	1140	385
	Neck-Abdomen (1-phase)	1525	1010	515
	Neck-Pelvis (1-phase)	1525	790	735
Chest	Routine Chest (1-Phase)	1420	1140	280
	HRCT	1420	1140	280
	Chest-upper Abdomen (1-phase)	1420	1010	410
	Chest-Pelvis (1-phase)	1420	790	630
	Lung nodule (1-phase)	1420	1140	280
Abdomen	Upper Abdomen (1-phase)	1215	1010	205
	Abdomen-Pelvis (1-phase)	1215	790	425
	Multi-phase Liver	1215	1015	200
Pelvis	Pelvis	1050	790	260
	Lower Abdomen	1050	790	260
	Hip	910	790	120
Spine	C-spine	1540	1365	175
	T-spine	1420	1100	320
	L-spine	1200	920	280
Cardiac	Coronary CTA	1360	1185	175

Table 10-35 Scan position and range for each scan type: Age-15 Female

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1600	1485	115
	Routine Head (helical)	1600	1485	115
	Head-Neck (1-phase)	1600	1320	280
	Head CTA	1600	1405	195
	Head-Neck CTA	1600	1320	280
Neck	Face/Orbits/Sinus	1550	1405	145
	Routine Neck (1-phase)	1480	1325	155
	Neck-Chest (1-phase)	1480	1080	400
	Neck-Abdomen (1-phase)	1480	1015	465
	Neck-Pelvis (1-phase)	1480	770	710
Chest	Routine Chest (1-Phase)	1370	1080	290
	HRCT	1370	1080	290
	Chest-upper Abdomen (1-phase)	1370	1015	355
	Chest-Pelvis (1-phase)	1370	770	600
	Lung nodule (1-phase)	1370	1080	290
Abdomen	Upper Abdomen (1-phase)	1190	1015	175
	Abdomen-Pelvis (1-phase)	1190	770	420
	Multi-phase Liver	1190	800	390
Pelvis	Pelvis	1000	770	230
	Lower Abdomen	1000	770	230
	Hip	880	770	110
Spine	C-spine	1490	1325	165
	T-spine	1370	1050	320
	L-spine	1160	900	260
Cardiac	Coronary CTA	1310	1145	165

Table 10-36 Scan position and range for each scan type: Adult Male

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1835	1700	135
	Routine Head (helical)	1835	1700	135
	Head-Neck (1-phase)	1835	1510	325
	Head CTA	1835	1600	235
	Head-Neck CTA	1835	1510	325
Neck	Face/Orbits/Sinus	1785	1600	185
	Routine Neck (1-phase)	1700	1525	175
	Neck-Chest (1-phase)	1700	1230	470
	Neck-Abdomen (1-phase)	1700	1150	550
Chest	Neck-Pelvis (1-phase)	1700	920	780
	Routine Chest (1-Phase)	1580	1230	350
	HRCT	1580	1230	350
	Chest-upper Abdomen (1-phase)	1580	1150	430
Abdomen	Chest-Pelvis (1-phase)	1580	920	660
	Lung nodule (1-phase)	1580	1230	350
	Upper Abdomen (1-phase)	1350	1150	200
Pelvis	Abdomen-Pelvis (1-phase)	1350	920	430
	Multi-phase Liver	1350	1165	185
	Pelvis	1180	920	260
Spine	Lower Abdomen	1180	920	260
	Hip	1080	910	170
Cardiac	C-spine	1700	1525	175
	T-spine	1580	1190	390
	L-spine	1340	1060	280
Coronary CTA		1450	1265	185

Table 10-37 Scan position and range for each scan type: Adult Female

Body region	Scan parameter	Begin	End	Range (mm)
Head	Routine Head (non-helical)	1665	1550	115
	Routine Head (helical)	1665	1550	115
	Head-Neck (1-phase)	1665	1380	285
	Head CTA	1665	1445	220
	Head-Neck CTA	1665	1380	285
	Face/Orbits/Sinus	1625	1455	170
Neck	Routine Neck (1-phase)	1540	1370	170
	Neck-Chest (1-phase)	1540	1110	430
	Neck-Abdomen (1-phase)	1540	1010	530
	Neck-Pelvis (1-phase)	1540	820	720
Chest	Routine Chest (1-Phase)	1435	1110	325
	HRCT	1435	1110	325
	Chest-upper Abdomen (1-phase)	1435	1010	425
	Chest-Pelvis (1-phase)	1435	820	615
	Lung nodule (1-phase)	1435	1110	325
Abdomen	Upper Abdomen (1-phase)	1200	1010	190
	Abdomen-Pelvis (1-phase)	1200	820	380
	Multi-phase Liver	1200	1015	185
Pelvis	Pelvis	1050	820	230
	Lower Abdomen	1050	820	230
	Hip	930	810	120
Spine	C-spine	1545	1370	175
	T-spine	1435	1090	345
	L-spine	1200	930	270
Cardiac	Coronary CTA	1300	1140	160

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