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**NATIONWIDE EVALUATION
OF X-RAY TRENDS (NEXT)**

**PROTOCOL FOR
2005 SURVEY OF COMPUTED TOMOGRAPHY**

July 2008

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**Nationwide Evaluation of X-ray Trends (NEXT)
Protocol for
2005 Survey of Computed Tomography**

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Food and Drug Administration (FDA)
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in association with

Conference of Radiation Control Program Directors, Inc.'s
Committee on Nationwide Evaluation of X-ray Trends (H-4)

and

American College of Radiology

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FOREWORD

The Conference of Radiation Control Program Directors, Inc. (CRCPD) is an organization made up of the radiation control programs in each of the 50 States, the District of Columbia, and Puerto Rico, and of individuals, regardless of employer affiliation, with an interest in radiation protection. The primary purpose and goal of CRCPD is to assist its members in their efforts to protect the public, radiation workers, and patients from unnecessary radiation exposure. CRCPD also provides a forum for centralized communication on radiation protection matters between the States and the Federal government, and between the individual States.

One method of providing assistance to the States, as well as to other interested parties, is through technical and administrative publications. Most technical publications of CRCPD are written by various committees, task forces or special working groups. Most administrative publications are written by staff of the Office of Executive Director (OED).

CRCPD's mission is "to promote consistency in addressing and resolving radiation protection issues, to encourage high standards of quality in radiation protection programs, and to provide leadership in radiation safety and education."

This particular publication, *Nationwide Evaluation of X-ray Trends (NEXT) Protocol for 2005 Survey of Computed Tomography*, contains the survey procedures developed to collect information for a population-representative reference database documenting general CT practice and indicators of patient dose, and characterizing the impact of new technologies and clinical applications.



John P. Winston, Chairperson
Conference of Radiation Control
Program Directors, Inc.

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PREFACE

This document contains the survey procedures developed to collect information for a population-representative reference database documenting general CT practice and indicators of patient dose, and characterizing the impact of new technologies and clinical applications. The 2005 NEXT CT survey consisted of a site visit by trained state radiation personnel, and a facility questionnaire.

Surveyors were requested to elicit responses to the [Facility Questionnaire](#) from facility staff that are familiar with the site's practice of computed tomography. Surveyors recorded data gathered during their site visit on the [Surveyor Data Form](#). Both of these forms are available in printed form at the end of this document, and the *facility questionnaire* and *surveyor data form* above are hyperlinked to the *Microsoft Excel* files. The questionnaire provides instructions to those persons contributing responses.

This CRCPD publication of the *2005 NEXT Protocol for Survey of Computed Tomography (CT)* is a minor revision of the version that was distributed to all survey participants. The document underwent only minor formatting, and no changes have been made to survey procedures.

The FDA Center for Devices and Radiological Health and the Conference of Radiation Control Program Directors H-4 Committee on NEXT, with support from the American College of Radiology, provided training in April and May, 2005, to representatives of the following 39 States and to observers from Canada:

Alabama	Louisiana	Ohio
Alaska	Maine	Oklahoma
Arizona	Massachusetts	Oregon
Arkansas	Michigan	Pennsylvania
California	Mississippi	Rhode Island
Connecticut	Missouri	South Carolina
Florida	Nebraska	South Dakota
Hawaii	Nevada	Tennessee
Idaho	New Hampshire	Texas
Illinois	New Jersey	Virginia
Iowa	New York	Washington
Kansas	North Carolina	West Virginia
Kentucky	North Dakota	Wisconsin

We recognize the voluntary nature of participation in this survey by the various state radiation control programs, and we appreciate these efforts.

The NEXT CT body phantom must be used with this survey protocol in order to compare acquired CT radiation data with existing NEXT survey results.



David C. Spelic
Food and Drug Administration
Division of Mammography Quality and Radiation Programs



Warren Freier, R.T., Chairperson
Committee on Nationwide Evaluation
of X-ray Trends

ABSTRACT

Spelic, David C., Stern, Stanley H., Kaczmarek, Richard, CRCPD Committee on Nationwide Evaluation of X-ray Trends, *Nationwide Evaluation of X-ray Trends (NEXT) Protocol for 2005 Survey of Computed Tomography*, CRCPD Publication #E-08-2, July 2008, 54 pp.

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The surveyors were provided with Excel spreadsheets, which are available for downloading:

 Facility Questionnaire http://www.crcpd.org/pubs/NEXT_Protocols/2005CT_FacilityQuestionnaire.xls

 Survey Form http://www.crcpd.org/pubs/NEXT_Protocols/2005CT_SurveyForm.xls

Note: The material in the Excel spreadsheets has been inserted in this published version of the document.

Acrobat PDF  Version of Excel Worksheets

[Note: These pages were inserted in the publication version of the Protocol]

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INTRODUCTION

This survey seeks information regarding the practice of computed tomography (CT) in clinical facilities. The survey protocol describes procedures that will be used to collect information for a reference database documenting general CT practice, measuring radiation-emission indicators of patient dose, and characterizing the impact of new technologies and clinical applications. Based on a random sampling of clinical sites, the results can be used to analyze and understand population exposure trends in the practice of CT in the United States.

Traditionally, NEXT surveys have focused on one selected diagnostic x-ray examination. Computed tomography, however, is an imaging modality that is used for an increasingly diverse array of clinical examinations. This survey will collect dosimetric and exam workload data for adult and pediatric CT examinations of the head, chest, abdomen, and pelvis.

Recent advances in CT include the use of technologies that attempt to reduce dose delivered to the patient by modulating the x-ray tube current during the scanning sequence. To assess the impact of such technologies, this protocol includes procedures using a specially designed phantom that simulates the x-ray attenuation properties of an average-sized adult patient during examinations of the chest, abdomen, and pelvis. Additionally, the 2005 survey seeks to quantify the increased use of multi-row-detector CT imaging (MDCT) in routine CT practice as well as a number of new clinical applications including 3-D virtual exams and CT angiography.

The 2005 NEXT CT survey is comprised of three distinct components:

1. Collection of particular facility information about their routine diagnostic CT examinations of the adult and pediatric head, chest, abdomen, and pelvis through interviews of facility personnel, and measurements of exposure on the CT unit most frequently used for these routine examinations.
2. A questionnaire to be completed by one or more facility staff that captures CT exam protocol information, technique factors and exam workload frequencies, and quality-assurance and quality-control procedures.
3. Collection and examination of the most recent physics survey report available on the CT unit being assessed in the 2005 NEXT survey. Obtaining head and body computed tomography dose-index (CTDI) data from the physics report avoids the need to make those measurements during the NEXT survey.

The following sections discuss basic procedures for performing the survey, communicating with the facility, and ensuring the integrity of collected data.

GENERAL INSTRUCTIONS

This section provides an overview of the survey procedures and provides contact information for obtaining assistance with various survey components.

The quality of collected data is critical to the success of this survey. Quality *may* be compromised *if*, for example, the data are:

- Incomplete or contain values well outside expected ranges
- Not representative of the facility's practice of CT (for example, the wrong CT unit is mistakenly surveyed, or the responses on the facility questionnaire are not for the same CT unit the surveyor examines)
- Gathered using procedures other than those prescribed in this protocol
- Come from a facility that is not on the list of randomly selected sites.

In order to avoid the possibility of compromising collected data, **READ THIS SECTION CAREFULLY**. For assistance with various aspects of the survey, please contact the following persons:

For questions regarding	Please contact
Survey procedures, phantom-related questions, facility sample listing issues, or questions regarding Excel data entry	David Spelic ph: 240-276-3312 e-mail: david.spelic@fda.hhs.gov or Stanley Stern ph: 240-276-3319 e-mail: stanley.stern@fda.hhs.gov
MDH meter and CT probe calibration	Jannita Ridgell ph: 301-796-2573 e-mail: jannita.ridgell@fda.hhs.gov
Surveyor training-related issues	Stephanie Belella ph: 240-276-3256 e-mail: stephanie.belella@fda.hhs.gov

You should be provided everything you need to perform these surveys. If you are missing any items, contact the appropriate person prior to beginning surveys. Please note that extra copies of either the data form or the facility questionnaire can be made by printing out the template Excel form you received on disk. Extra copies can also be obtained from FDA.

The provided list of facilities to survey is developed by randomly sampling from the known population of all sites in your respective state known to have at least one CT unit. The list is composed of two groups of sites: primary sites and alternate sites. For each primary site there is listed one or more alternate sites in the event a primary site does not wish to participate. Please contact any facility on the alternate-site list only if a primary-site facility does not wish to or cannot participate in the 2005 NEXT CT survey.

DO NOT substitute for a primary facility any site not on the alternate list. Doing so may compromise the random nature of the survey population. **If you have difficulty with your facility sample, please contact FDA staff for assistance.**

The surveyor is asked to enter the collected data into a computer spreadsheet in Microsoft Excel format. Electronic entry will greatly speed the processes of data verification and analysis done by FDA staff.

It is recommended that you submit a completed survey package to FDA staff for review after performing one survey. Quick submittal of the first results will preclude the potentially erroneous subsequent completion of data forms. Your first submitted survey package will be evaluated, and you will be provided feedback from FDA. **Submittal of first-completed forms is an important step in ensuring the integrity and quality of collected data.**

Please make a copy of all documents for your records prior to mailing a survey package to FDA. This will avoid a potential disaster in the event your package is never received.

Initiating a survey request with a facility on your sample listing

It is recommended that you initiate a survey request several weeks in advance to permit the facility adequate time to reserve the CT unit. The following items should be addressed during the initial conversation:

1. Inform the facility that this is a voluntary survey and they have been randomly selected for participation as part of a national program administered by the Conference of Radiation Control Program Directors in a cooperative agreement with the Food and Drug Administration.
2. Request access to the CT unit used most frequently for routine examinations of the head and body.
3. Inform the facility that you will need a copy of the most recent medical physics report for the unit to be surveyed, and
4. That they will be requested to complete a questionnaire regarding their general CT practice.

Attempt to identify a contact person for future reference—it is desirable that this be someone who is familiar with their CT practice, such as the CT technologist. Mail the facility a cover letter (a sample will be provided) with the questionnaire, and any available trifolds.

What types of CT units should NOT be surveyed?

You should **NOT** perform a survey on these types of CT units: Any CT unit that is not the most frequently used CT unit of a facility. If a CT unit is dedicated exclusively for pediatric patients, it

should be noted as such in the surveyor remarks section of the data form, and it should be surveyed for its pediatric techniques.

If you are unsure whether the CT unit at a facility is appropriate for this survey, contact FDA staff prior to proceeding.

IMPORTANT

It is **imperative** that your survey data, facility questionnaire, and physics survey report refer to the same CT unit. Please make efforts to verify this before performing the on-site survey.

Instructions for the Facility Questionnaire

Approximately two weeks prior to your onsite visit, mail a paper copy of the Facility Questionnaire to the department contact person. The first page of the questionnaire serves as a cover letter and explains to the facility the intent of this survey.

For the most part the *facility questionnaire* is a self-explanatory, self-contained package ([Appendix E](#)). At the facility, a paper copy of the questionnaire should be completed by (1) the radiologic technologist responsible for the CT unit and assisting with the on-site survey *and/or* (2) the medical physicist or other facility staff able to address the questions posed.

Facility staff may need clarification of some points in the questionnaire, and surveyors are encouraged to help the staff should there be difficulties in filling out the form. Surveyors should feel free to contact David Spelic (301-594-3525), Stanley Stern (301-827-0014), or Rick Kaczmarek (301-594-0865) at CDRH when there are problems that the surveyors may not feel comfortable addressing. If the facility can complete the questionnaire by the survey date, the surveyor can pick it up from them at that time.

The Medical Physics Survey Report

You are asked to collect a copy of the most recent physics survey report performed on the CT unit you will survey. The facility may or may not have this available on-site, depending on whether the person who performed the physics survey is on-site. [Appendix A](#) gives a discussion of the procedures you should follow regarding the medical physics survey. If the facility does not have a medical physics survey done on its most frequently used CT unit, or if the medical physics survey has been done and the report is not available, make a note of either case and **proceed** with the NEXT survey of that facility and its most frequently used CT unit.

The On-Site Survey

Before departing for your visit, contact the facility and verify your appointment. CT equipment is typically operated throughout the day, and often times facilities may unexpectedly need to use the CT unit for clinically-related purposes.

Bring with you the following items for a survey:

- Calibrated MDH model 1015 (or 1515) with CT probe, model no. 10X5-3CT
- **CHECK ITS OPERATION
PRIOR TO DEPARTING FOR THE FACILITY!**
- Ring-stand kit
- CT phantom
- Survey protocol
- Surveyor data form
- Extra copy of facility questionnaire and trifold brochures
- Calculator

IMPORTANT

TAKE THE PROTOCOL WITH YOU.

Do NOT rely on just the data form to guide you through the survey. Doing so may result in collection of inaccurate data and possibly a wasted effort by both you and the facility staff assisting you.

1. Retrieve the completed questionnaire and **confirm that the CT unit they provided responses for is the same unit you intend to survey—the CT unit most frequently for routine examinations.** This can be confirmed by examining the room number of the CT unit they entered into the questionnaire (item XX on page Y). If they cannot locate the questionnaire, or if it has not been completed yet, proceed with your survey.
2. Perform the on-site survey. Review your data to ensure that reasonable values are obtained. This check will avoid a potential revisit or worse, the misrepresentation of how the facility performs CT examinations.
3. Prior to leaving try to retrieve any items you still need, namely the medical physics survey/report for the CT unit you surveyed.

Always thank the facility for their participation, and provide them with any available trifold brochures as a means of informing the facility about the NEXT survey program and where they can obtain further information on NEXT.

Post-Survey Data Entry: Excel Computer Files for the Surveyor Data Form and Facility Questionnaire

You are provided with two template Excel spreadsheets with which to record your survey responses for the surveyor data form and for the facility questionnaire. Each time you begin data entry for a survey, start with a completely blank spreadsheet. It is suggested you copy the blank files contained on the computer disk to your computer. Each time you begin data entry for a completed survey, open the blank template file, and immediately save it using the following format:

STATE CODE + FACILITY NAME + SURVEYOR or FACILITY.xls

For example, files for a survey conducted in Florida at Southwest General Hospital would be saved as follows.

For the surveyor data form: **FL Southwest General SURVEYOR.xls**

For the facility questionnaire: **FL Southwest General FACILITY.xls**

These formats will allow us to easily identify your particular surveys among the many Excel forms we receive and archive.

IMPORTANT

Please do NOT use an Excel spreadsheet you completed earlier as a template for subsequent surveys by merely changing the responses—this may cause entries from the prior survey to remain intact for the subsequent surveys if you don't change all of the data values. Always start with an empty spreadsheet file.

If you have difficulty with the Excel files or cannot access them from the floppy disk provided, contact FDA staff for assistance. Finally, if it is not feasible or convenient for you to work with computer files, then you can submit to CDRH just the original, handwritten paper versions of the data forms and facility questionnaires as they are completed.

Please make photocopies of the original filled-in paper forms for backup in the event these items are never received by FDA.

Putting Your Survey Package Together for Submission

The following items are part of a completed survey package:

1. One filled-in surveyor data form. This form should be the original paper, handwritten version you completed at the facility.

2. One electronic version (Excel spreadsheet file) of the completed survey data form formatted as an Excel spreadsheet. This electronic file can be submitted either on a computed disk or as an email attachment.
 3. One paper version of the completed facility questionnaire.
 4. One electronic version (Excel spreadsheet) of the completed facility questionnaire.
 5. One paper copy of the medical physics survey report you obtained from the facility.
- NOTE: There is no Excel spreadsheet for electronic data entry of the physics survey report.

Send your complete survey package to:

David Spelic
FDA/DMQRP
1350 Piccard Drive HFZ-240
Rockville, MD 20850

We appreciate your efforts!

SURVEYOR, SURVEY, AND FACILITY IDENTIFICATION

Instructions for the Surveyor Worksheet

Whenever any piece of information pertinent to an entry is not known or cannot be confirmed, enter **UNKN** in the worksheet cell. This will avoid the problem of trying to determine whether the cell was left blank because the data value did not apply to the facility or because the surveyor unintentionally missed this data value.

Surveyor, Survey, and Facility Identification (entries 1-11)

1) Surveyor name, 2) telephone number, 3) e-mail:

Enter your name, telephone number, and electronic-mail address in the respective shaded spaces.

4) Survey date:

Enter the date on which the on-site survey was done, e.g., **6/21/05**.

5) Facility name:

Enter the name of the hospital, medical group, or corporation at which the x-ray CT system is located. If the CT system is located in a private practice, enter the name of the private practice.

6) Facility i.d. no.:

Enter the unique number assigned to the facility by your State program. Letters or numbers may be used in any combination.

EXAMPLE

23456B7C32

Facility i.d. no.

7) State/Agency code:

Enter the appropriate two-letter or two-digit code for your state.

State/Agency code

EXAMPLE

VA

8) Facility-type code:

Determine the type of facility from the list below and enter the corresponding code. **8a) If code 99** ("other") is used, please explicitly describe the facility type in the space provided on the surveyor worksheet directly to the right of facility-type code 99.

Facility-type code

EXAMPLE

01

The following codes and definitions apply to Facility Type:

Codes for Facility Type Item

01 = Private Practice: An individual practitioner or a group of practitioners engaged in the same specialty, for example, radiology. This category includes groups of general practitioners, and it also includes free-standing imaging centers.

04 = Mobile Unit: A CT system transported by motor vehicle. If the van is not permanently affixed to the facility, e.g., it is located at a hospital temporarily while a permanent system is being installed, the Facility type should be coded "04" rather than "02."

02 = Hospital: A facility that has beds for overnight care of patients. This category includes mobile units that are permanently stationed at a hospital.

99 = Other: A facility whose type does not aptly correspond to any of the preceding categories. Please explicitly describe the facility type yourself in the space provided on the surveyor worksheet directly to the right of "8a) If code 99."

03 = Multiple Specialty Practice: A group of practitioners having different specialties. This category includes school infirmaries and outpatient clinics that may be associated with hospitals.

9) Practice-specialty code:

If entry **8) Facility-type code** is "01" (Private Practice), determine the area of specialization of the private practice from the **Practice-specialty code** list provided below, and enter the appropriate code.

If entry **8) Facility-type code** is "02" (Hospital), enter the **Practice-specialty code** of the hospital *department* housing the CT unit being surveyed (e.g., **04** for RADIOLOGY, **25** for ONCOLOGY treatment planning for radiation therapy, **30** for EMERGENCY/SHOCK/TRAUMA, etc.)

If entry **8) Facility-type code** is "03" or "04," enter **XX** for **9) Practice-specialty code**.

9a) If entry **9)** is "99" (Other), please explicitly describe the practice specialty in the space provided on the surveyor worksheet directly to the right of practice-type code 99.

Practice-specialty code

EXAMPLE

04

Codes for Practice Specialty Item

XX = Multiple Specialty Practice <i>or</i> Mobile Unit	16 = Electrophysiology
01 = Dental (except orthodontics)	17 = Endocrinology
02 = Orthodontics	18 = Geriatrics
03 = Medical General Practice	19 = Hematology
04 = Radiology	20 = Immunology
05 = Internal Medicine	21 = Infectious Diseases
06 = Surgery	22 = Nephrology
07 = Urology	23 = Neurology
08 = Pediatrics	24 = Nuclear Medicine
09 = Orthopedics	25 = Oncology (including Radiation Therapy)
10 = Gastroenterology	26 = Ophthalmology
11 = Chiropractic	27 = Otolaryngology
12 = Podiatry	28 = Physical Medicine
13 = Osteopathy	29 = Pulmonary Medicine
14 = Obstetrics/Gynecology	30 = Emergency/Shock/Trauma Medicine
15 = Cardiology	99 = Other

10) Interviewee name & Title/Position:

Enter the name and title/position of all the facility staff persons providing information or other assistance to you during the on-site interview and measurements.

11) Total number of CT units at the facility

Enter the total number of clinical CT units that reside at the facility. Include mobile CT units that perform off-site exams as part of a program of patient care provided by the facility. Do NOT include any off-site units that are part of an independent clinical or radiological practice that provide intermittent CT support to the facility.

Total number of CT units

EXAMPLE

2

X-RAY CT UNIT IDENTIFICATION AND CAPABILITIES

X-ray CT Unit Identification and Capabilities (entries 12-23)

- 12) Room Number and Location:** Enter the room number and a brief description of the location for the CT unit you will survey. If the room has no number, inquire with facility staff if the room/area has an alternate means of identifying the unit.

	<u>Room number</u>	<u>Location</u>
<u>EXAMPLE</u>	<u>CT-1</u>	<u>Radiology dept</u>

- 13) Manufacturer:** Enter the name and corresponding 4-character code of the manufacturer specified on the certification and identification label located on the *gantry* of the CT unit. A list of known CT equipment manufacturers is provided in [Appendix B, page 41](#).

	<u>CT Unit Manufacturer</u>	<u>Code</u>
<u>EXAMPLE</u>	<u>General Electric Medical Systems</u>	<u>GEMS</u>

- 14) Model name:** Determine the model of the CT unit, and enter the model's trade name in the space provided. The trade name of the model may be comprised of a "generic" part, such as *Synerview* (made by Picker) or *Somatom* (made by Siemens), followed by an alphanumeric qualifier, e.g., *Synerview 1200SX*, or *Somatom Plus*, or *Somatom Plus 4*. (Note that the *Somatom Plus 4* model introduced in 1994 is different from the *Somatom Plus* model that was introduced in 1987.) Please enter the *entire* trade name (generic part plus qualifier) by which the model is commonly known.

	<u>CT unit Model Name</u>
<u>EXAMPLE</u>	<u>LightSpeed Pro16</u>

*The following items are listed on the certification and identification label located most frequently on the back of the CT gantry: **serial number, model number, and date of manufacture***

- 15) Serial number:** Enter the serial number specified on the *gantry* of the CT unit. Attempt to reproduce it exactly as it appears—letters, numbers, hyphens, and leading blanks or zeros may be used in any combination. If there is more than one serial number on the gantry

(referring, for example, to several components contained therein), then enter *any one* of those serial numbers into the worksheet, and note this circumstance in the section of the worksheet dedicated to surveyor remarks.

Serial number

EXAMPLE

2B-85

16) CT Model number:

There may be an alphanumeric number used by the manufacturer as a unique identifier to distinguish this particular product from others made by the manufacturer. It is typically specified near the serial number on the certification and identification label located on the *gantry* of the CT unit. This model number may be different from the commonly known model trade name. If you can identify a unique number associated with the model that may be different than the model trade name, enter the model number in the worksheet. If you cannot identify a unique model number, enter UNKN in the space provided for **Model number**.

Model number

EXAMPLE

174550-A

17) Date of manufacture

Enter the month and year, e.g., March 97, that the CT *gantry* was manufactured as specified on the certification and identification label located on the *gantry* of the CT unit.

Note: In the section of the surveyor worksheet reserved for remarks, please record what (if any) major *options* the model comes with, what major *upgrades* have been made to the system, and when such major upgrades were installed. Examples of major options or upgrades are (1) slip ring to allow helical scanning (in what might have been an axial scanner only), (2) solid-state detectors as an improvement over xenon (gas) detectors, (3) multi-slice capability, (4) CT fluoroscopy capability.

Helical scanning, tube current modulation (generally referred to as “automatic exposure control,” abbreviated “AEC”), and CT fluoroscopy capability of CT unit to be surveyed

Survey items 18 through 24 refer to equipment features that may or may not be available on the specific CT unit you will survey.

18) Helical scanning available on this unit?

Enter **Yes** if the CT unit is **capable** of doing helical (also called "spiral") scanning.

Enter **No** if the unit is not capable of doing helical scanning. This question refers to the **availability** of a helical scanning modality, not to whether helical scanning is actually used for specific examinations.

19) Maximum number of simultaneous slices

Ask the technologist for the maximum number of simultaneous slices the unit is capable of scanning. Currently, commercial multi-detector CT units can capture 2, 4, 8, 16, 32, 40, and 64 simultaneous image slices.

If the unit is only capable of scanning a single slice at a time, enter "1."

Maximum number of simultaneous slices

EXAMPLE

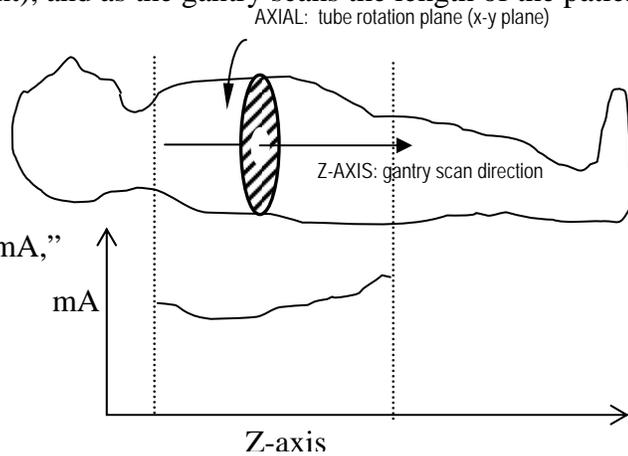
16

Items 20-21 refer to CT technologies that vary the tube current dynamically during the exam, according to anatomical attenuation presented by each individual patient. For simplicity this protocol will refer to such technologies as "AEC." Refer to the technical note below for a more complete discussion of this technology.

What is tube current modulation (referred to here as “AEC”)?

All manufacturers now produce CT equipment that reduces the dose to the patient by varying the tube current while the exam proceeds. Typically AEC is done by analyzing one or more scout-view scans of the patient and then using this information subsequently to adjust the tube current dynamically as CT data are acquired. Note that this feature can be multi-dimensional: tube current can be adjusted AXIALLY in the x-y plane (i.e., as the x-ray tube rotates about the patient), and as the gantry scans the length of the patient (Z-AXIS direction).

The various manufacturers have different names for this feature, such as “SmartDose,” “SmartScan,” “CAREDose,” “Auto-mA,” “Smart-mA,” etc. The diagram at the right illustrates how the tube current might vary along the length of the patient during the scanning sequence.



20) AEC technology available on this unit?

Enter Yes if the CT unit has some mode of AEC, that is, if the unit is **capable** of adjusting the tube current **during** the scanning sequence, based on anatomical features specific to the patient being examined.

Enter No **only** if the CT unit is not equipped with any means of AEC. If you answered ‘No’ to this item, skip to item 22 below.

21) Console display for AEC

With the assistance of the technologist, locate the console display item for AEC feature routinely used on the CT unit. The various manufacturers have such expressions for their specific AEC technology such as “Auto mA,” “Smart mA,” “Smart Scan,” “Sure Exposure,” “CAREDose,” “CAREDose4D,” “DOM,” etc. Record this descriptor as it is displayed on the console. **NOTE:** Do not confuse this with particular settings that are selected for the AEC feature as part of a specific CT exam protocol.

EXAMPLE: A manufacturer might refer to their AEC *feature* as "Auto-mA." A *specific setting* for the "Auto-mA" feature might be "low-dose," or "low-noise," depending on the exam to be performed.

Console display for AEC

EXAMPLE **Auto mA**

22) Is "CT fluoroscopy" available on this unit?

IMPORTANT: This question refers to whether the CT unit is **capable** of "CT fluoroscopy," **not** to whether such scanning is actually used routinely.

Enter **Yes** if the CT unit being surveyed is **capable** of scanning *any* part of the body in a mode variously referred to as "CT fluoroscopy," or "dynamic scanning," or "continuous scanning," or some other terminology defined by the manufacturer.

Enter **No** if the CT unit being surveyed is **not** capable of operating in a "fluoroscopic" mode.

What is CT fluoroscopy?

In this mode of CT operation, the source/detector array within the gantry rotates continuously around the patient multiple times (in some systems up to 200 revolutions of 360° each depending on the exam). In this mode, table movement is not automated, but is controlled by the operator. Low-resolution CT images are acquired nearly in real time, at rates of 6 to 8 frames per second, and they are continuously reconstructed and displayed on a monitor typically located near the patient table. This mode is typically used to visualize interventional procedures involving biopsies or drainage. *In this mode there may also be added or special filtration as well as particular values of kVp and mA.*

23) Hard-copy output code

Enter one of the following *codes* for the kind of multi-format camera/printing system used with the CT unit being surveyed to produce *hard-copy films* of images. (If none of the following systems apply, enter the code **OTHR**, and describe the hard-copy output system in the section of the surveyor worksheet dedicated to remarks).

<u>Hard-copy output system</u>	<u>Code</u>
laser-based camera/automated chemical processor	LCHM
laser-based camera/dry printing	LAPR
video-based camera/automated chemical processor	VCHM
OTHER	OTHR

24) Image display/interpretation code:

For routine adult CT examinations, enter one of the following codes for **the most common way** that images produced by the CT unit being surveyed are interpreted by radiologists. (If there is no single display method that predominates for interpretation, enter code letter **B**. If some other method is used that doesn't really fit as HC or SC, enter the code **OTHR**, and in the section of the surveyor worksheet dedicated to remarks, describe the most common way head images are displayed for interpretation). **Note:** Video monitor as well as film display and interpretation may occur at a remote location, for example in a radiology reading room, and perhaps not in the CT room.

<u>Image display/interpretation</u>	<u>Code</u>
hard-copy films reviewed with light-box	HC
video-monitor display (with or without cine-interactive) review	SC
both video-monitor display and films	B
OTHER (<i>please describe in remarks</i>)	OTHR

RADIOLOGICAL PROTOCOLS FOR ROUTINE DIAGNOSTIC CT EXAMINATIONS OF THE ADULT HEAD AND BODY

Radiological Protocols for Routine Diagnostic CT Examinations of the Adult Head and Body (entries 25 A and B)

The following items concern the technical factors the facility uses for conducting two routine diagnostic examinations: (1) **adult head (i.e., brain)** and (2) **adult abdomen + pelvis**, where the abdominal and pelvic regions are scanned in a single interval of table movement (start to stop, during which it is possible that some of the technique factors may change). In this section you will perform the following procedures:

- Document clinical protocols for routine CT exams of the adult head (brain) and of the abdomen + pelvis
- Perform free-in-air measurements of exposure at the iso-center.
- Gather data using the CT phantom when the facility reports that it typically uses AEC technology for at least one of these routine exams.

25) Clinical protocols for the routine, diagnostic adult head (brain) exam and for the routine, diagnostic, adult abdomen + pelvis exam:

Have the technologist retrieve at the console of the CT unit the exam protocols routinely used for exams of the adult head (brain) and of the abdomen + pelvis.

Record the console settings in Table A for the abdomen + pelvis exam, and Table B for the head exam. There may be more than one protocol for these anatomical regions. If this is the case, for each of these two exams tell the technologist to use the protocol which is most frequently used for routine diagnostic procedures.

Keep these points in mind while completing the tables in item 25:

1. **“SEQUENCE” refers to any set of CT scans that are acquired with the same factors.** A column in Table A or Table B should be completed:
 - For each different phase of the exam, e.g. one phase without contrast, and one phase with contrast.
 - For each section of an exam, one or more parameters is changed, such as different pitch, different table feed, different mA, different kVp, or different slice thickness.

2. The tables do not have to be completely filled in. Most facilities will have one or two sequences for an exam (one sequence without contrast, one sequence with contrast, for example).

If a value is not provided for a particular item (for instance, if the CT console does not display a value for pitch), record 'N/A' on the data form for this item.

3. **There may be multiple sets of techniques or sequences associated with each of these exams, especially the routine head exam.** For example, in a routine head exam, many facilities use axial scanning to cover the region of the head from the foramen magnum through the posterior fossa with 5-mm slice thicknesses and the region from the posterior fossa to the apex with 10-mm slice thicknesses. They may even change kVp, mA, or other technique parameters between these two regions. Also, facilities will often cover a particular region without any contrast medium, and then they will repeat the same coverage in another sequence with contrast medium injected. To account for the possibility of multiple sets of techniques associated with a particular exam, item 25 of the surveyor data form uses multiple columns for each exam, where the columns are labeled "sequence 1," "sequence 2," etc. If there is only one set of techniques used, just fill in the "sequence 1" column.
4. **Many systems may not provide values for every item in the table.** For instance, some helical scanning systems may provide a value for "table **increment** per rotation" (in mm), but not "table **speed**" (mm per second). Also, on many systems it is not possible to obtain directly a value for pitch.

EXAMPLES FOR EACH TABLE FOLLOW THE ITEM DESCRIPTIONS.

Descriptions of the clinical scanning protocols for routine, diagnostic examinations of (1) the adult head (brain) and (2) routine adult abdomen + pelvis (item 25).

Examples are provided on pages [22](#) and [23](#).

Data item	Description
Helical Mode or Axial Mode?	Enter "H" if the facility routinely performs the exam using a helical scanning mode. Enter "A" if the facility routinely uses an axial scanning mode for the exam.
Manual mode / AEC mode	Enter "M" if the facility does NOT use any form of AEC during the sequence of the exam under consideration. Enter "A" if the facility uses this mode of operation during the sequence of the exam under consideration. (You may encounter other, vendor-specific terminology referring to AEC operation: "Auto mA," "Smart mA," "CareDose," etc.)
AEC mode selected (AEC exams only)	Enter the menu item selected at the console that indicates a particular mode of AEC operation. If the facility uses some form of AEC for the sequence of the exam under consideration, ask whether they select a particular mode of AEC. You may observe AEC mode indicators such as "Normal," "Max-ma," or "Low-dose." Write the complete expression <u>exactly</u> as it is displayed on the console.
Tube potential, kVp	Enter the peak tube potential (kVp) typically selected by the facility for the sequence of the exam under consideration. (Expected values are 120 kV or 140 kV, but the facility might typically use some other value.)
Tube current, mA <i>Record this value for both Manual and AEC modes</i>	IF the facility selects a tube current at the console for the sequence of the exam under consideration, record this value. If the facility performs the exam in AEC mode, record the mA displayed at the console- this is typically a default value indicated as a reference value or starting point for the AEC feature.
mAs per gantry rotation	IF the facility selects a mAs value (per gantry rotation) at the console for the sequence of the exam under consideration, record this value.
Time (seconds) per single gantry rotation	Enter the selected time in seconds for one complete rotation (typically 360 degrees) of the x-ray tube gantry for the sequence of the exam under consideration. Typical values for gantry rotation time range from less than one second to 2 seconds or more.

Scan field-of-view (SFOV)	Enter the selected console display value for the diameter of the scan field-of-view (SFOV) for the sequence of the exam under consideration. This item refers to the breadth of the fan beam through the isocenter in the scanning plane. A narrower beam is typically selected for smaller body regions. You may encounter numerical values such as “50 cm” or simple descriptors such as “Body” instead of the actual diameter value. For numerical values provide the units, e.g. “50 cm.”
Contrast used for sequence?	Enter “Y” if contrast is injected into the patient for this sequence of the exam. Enter “N” if there is no contrast associated with this sequence of the exam.
Individual slice thickness acquired (mm)	Enter the width (mm) of each slice acquired during the sequence of the exam under consideration. (NOTE: the slice thickness entered here should not be confused with the reconstructed slice thickness, where the end-user can use reconstruct tomographic sections of thickness different from the acquired slice thickness. This situation predominantly applies to helical scanning rather than axial scanning.) Refer to figure 1, pg 24.
Number of simultaneous slices acquired per gantry rotation	Enter the number of slices per gantry rotation that are simultaneously acquired during a single rotation of the gantry for the sequence of the exam under consideration. Note: Multi-row detector CT units may have 2, 4, 16, 32, or as many as 64 slices simultaneously acquired during each rotation of the gantry. Do not confuse this value with the number of slices that comprise a <i>complete</i> exam. Refer to figure 1, pg 24.
Total number of slices acquired during the sequence	Enter the number of tomographic slices acquired for the sequence of the exam under consideration. This value may not be a selectable parameter at the CT console. If a single value cannot be identified, request a min-max range. If this cannot be determined, enter “UNKN.”
Number of gantry rotations during the sequence	Enter the number of gantry rotations that occur during the sequence of the exam under consideration. If it is difficult to identify a single value, request a minimum-maximum range of values.
Scanning length (mm) or anatomical landmarks.	Enter the distance (mm) along the patient’s length which is scanned during the sequence of the exam under consideration. This length may or may not be a selectable item at the console, but it may be displayed after other exam protocol parameters are configured. If you cannot determine this, enter the anatomical features marking the boundaries where scanning starts and stops. For example, for the

	abdomen + pelvis exam, if scanning is done in a single sequence, the length might extend from the “top of the liver” or “dome of the diaphragm” or “xiphoid process” down to the “symphysis pubis.”
Table increment (mm) per gantry rotation (HELICAL) or per axial scan (AXIAL)	Enter the distance (mm) the table travels during each complete gantry rotation (HELICAL mode) or each axial scan (AXIAL mode). This parameter may also be referred to as “table feed.” For helical scanning, the table continuously travels as the gantry rotates during the exam, and the technologist may be able to select the travel distance per gantry rotation. For axial scanning the table increments between axial scans. If table increment is not indicated on the console, enter “XX.” Refer to figure 1, pg 24.
Table speed during scanning (mm per second) (HELICAL only)	Enter the table speed (in millimeters per second, mm/s) selected for the sequence of the exam under consideration. If this parameter is not indicated, enter “XX.”
Pitch (HELICAL only)	Enter the pitch factor displayed on the console after the exam protocol has been configured. Some manufacturers may not display a value of pitch, but rather may indirectly indicate a pre-configured pitch mode through display indicators such as “HQ” (an abbreviation for “high quality” mode using lower pitch), or “HS” (an abbreviation for “high speed” mode using higher pitch.). Ask the technologist for assistance in identifying the actual pitch factor or indicators as discussed above. If you cannot locate any indication of the pitch, enter “XX.”
Rotation angle per axial scan (AXIAL only)	Enter the number of degrees the gantry revolves through during a single scan acquisition. Typical values may be 360 deg, 270 deg, 379 deg. (Note: The rotation angle is NOT the tilt angle of the gantry for specific applications such as imaging the orbits during an exam of the head.)

Figures 1 and 2 (page 24) illustrate some of the data items from tables A and B for helical and axial scanning.

Examples for item 25:

Table A. Scanning protocols for the Adult Abdomen + Pelvis exam

Table A represents the parameters recorded for the facility’s typical adult abdomen + pelvis exam. Their typical exam consists of three sequences: a “no-contrast” sequence followed by a second and third sequence where a contrast medium is injected, and a larger region is scanned using two different slice thicknesses. (Note: If there is only one sequence to this exam, then only the “Sequence 1” column would be filled in, with “Yes” (9th data element down the table) if contrast is used or “No” if there is no contrast for that single sequence; the remaining “sequence” columns would be left blank for a single-sequence exam.)

Abdomen + Pelvis	Sequence 1	Sequence 2	Sequence 3	Sequence 4
Helical mode or Axial mode? (H / A)	H	H	H	
Manual mode / AEC mode (M / A)	A	A	A	
AEC mode selected (AEC exams only)	Normal	Normal	Normal	
Tube potential, kVp	140	140	140	
Tube current, mA	250	250	250	
mAs per gantry rotation	N/A	N/A	N/A	
Time (seconds) per single gantry rotation	1.0	1.0	1.0	
Scan field-of-view	LARGE	LARGE	LARGE	
Contrast used during sequence? (Y / N)	N	Y	Y	
Individual slice thickness acquired (mm)	5.0	7.0	5.0	
Number of simultaneous slices acquired per gantry rotation	2	2	2	
Total number of slices acquired during sequence	N/A	N/A	N/A	
Number of gantry rotations during sequence	N/A	N/A	N/A	
Scanning length (mm) during sequence	Top of diaphragm to iliac crest	Top of diaphragm to iliac crest	Iliac crest to symphysis pubis	
Table increment (mm) per gantry rotation (Helical mode) or per axial scan (Axial mode).	10.0	14.0	10.0	
Table speed (mm per second) (HELICAL only)	N/A	N/A	N/A	
Pitch (HELICAL only)	1.0	1.0	1.0	
Rotation angle (degrees) per axial scan (AXIAL only) <i>(this is not related to gantry tilt)</i>	N/A	N/A	N/A	

Table B. Scanning protocols for the Adult Head

Table B represents the parameters recorded for the facility’s typical adult head exam. Their typical exam has two “sequences:” A no-contrast “sequence” where 5-mm slices cover the region from the foramen magnum to the posterior fossa. The exam continues without contrast in a second “sequence” where 10-mm slices to cover the remaining part of the head, from the posterior fossa to the apex. (Note: If there is only one sequence to this exam, then only the “Sequence 1” column would be filled in with “Yes” (9th data element down the table) if contrast is used or “No” if there is no contrast for that single sequence; the remaining “sequence” columns would be left blank for a single-sequence exam.)

Head	Sequence 1	Sequence 2	Sequence 3	Sequence 4
Helical mode or Axial mode? (H / A)	A	A		
Manual mode / AEC mode (M / A)	M	M		
AEC mode selected (AEC exams only)				
Tube potential, kVp	120	120		
Tube current, mA	200	200		
mAs per gantry rotation	200	200		
Time (seconds) per single gantry rotation	1.0	1.0		
Scan field-of-view	HEAD	HEAD		
Contrast used during sequence? (Y / N)	N	N		
Individual slice thickness acquired (mm)	5.0	10.0		
Number of simultaneous slices acquired per gantry rotation	1	1		
Total number of slices acquired during sequence	11	8		
Number of gantry rotations during sequence	N/A	N/A		
Scanning length (mm) during sequence	Foramen magnum through posterior fossa	Posterior fossa to apex		
Table increment (mm) per gantry rotation (Helical mode) or per axial scan (Axial mode).	5.0	10.0		
Table speed (mm per second) (HELICAL only)	N/A	N/A		
Pitch (HELICAL only)	N/A	N/A		
Rotation angle (degrees) per axial scan (AXIAL only) <i>(this is not related to gantry tilt)</i>	360	360		

Figure 1. Helical multi-row detector geometry illustrating:

- Acquisition slice width
- Number of simultaneous slices acquired per rotation (4)
- table increment per gantry rotation

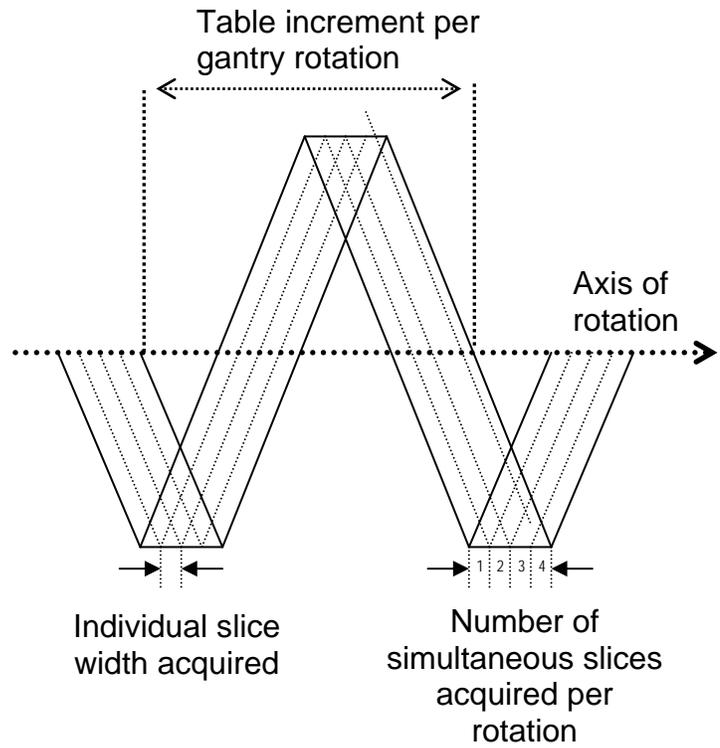
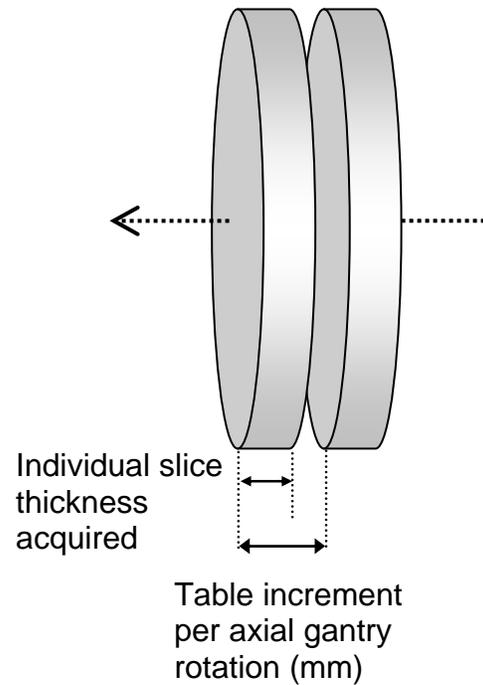


Figure 2. Axial single-slice scanning geometry illustrating:

- Individual slice thickness acquired
- Table increment per axial slice acquisition



EXPOSURE-MEASUREMENT SERIES, FREE-IN-AIR ON AXIS-OF-ROTATION

Exposure-measurement series, free-in-air on axis-of-rotation (items 26-31)

Through measurements of exposure free-in-air on the CT axis of rotation, you will characterize the radiation emissions for a reference configuration of this CT unit. You will NOT be using a phantom for this procedure.

During these measurements:

1. The ring-stand and CT probe are aligned on the central axis of the CT unit.
2. The CT system is configured as follows:
 - manual mode
 - single axial scan
 - 5-mm slice width
 - 150 mA
 - 1-sec rotation time
 - acquiring 1 slice per rotation
 - abdomen filter and scan field of view

With this configuration, you will measure and record the exposure for four different tube potentials: 80, 100, 120, and 140 kVp.

3. The patient support table is set so that it will NOT move during the scans. The center of the CT probe should remain stationary with respect to the scan plane.

A. Set-up Procedure

26) MDH model and CT ionization chamber model

1. Enter the model numbers for the MDH radiation meter and CT ionization chamber you are using for this survey.

MDH model no. CT Probe model no..
EXAMPLE 101510X5-3CT

2. Set up the lab stand on the patient table by assembling the rod into the base and fixing the 3-prong extension clamp to the rod with the clamp holder. A suggested method for configuring the ring stand and CT probe is illustrated below in [figure 3](#).
3. **Remove the plastic sleeve from the CT pencil chamber.** Secure the *base* of the pencil ionization-chamber probe in the 3-prong clamp, and make sure that the cables

are kept out of the scan plane. Do **NOT** close the jaws of the clamp on the actual chamber- the chamber can be easily damaged.

4. With the assistance of the technologist, use the CT unit's alignment system to position the probe within the CT gantry so that
 - its **length lies on the CT axis-of-rotation** and
 - the **center** of the active volume (marked by a red line around the circumference in the middle of the probe) would be cut by a single tomographic slice at the scan plane. Refer again to the illustrations below.

CAUTION

Watch the ring-stand as you align it within the gantry, and pay special attention to its height as you raise the table.

Raising it too much may cause it to collide within the gantry ring!

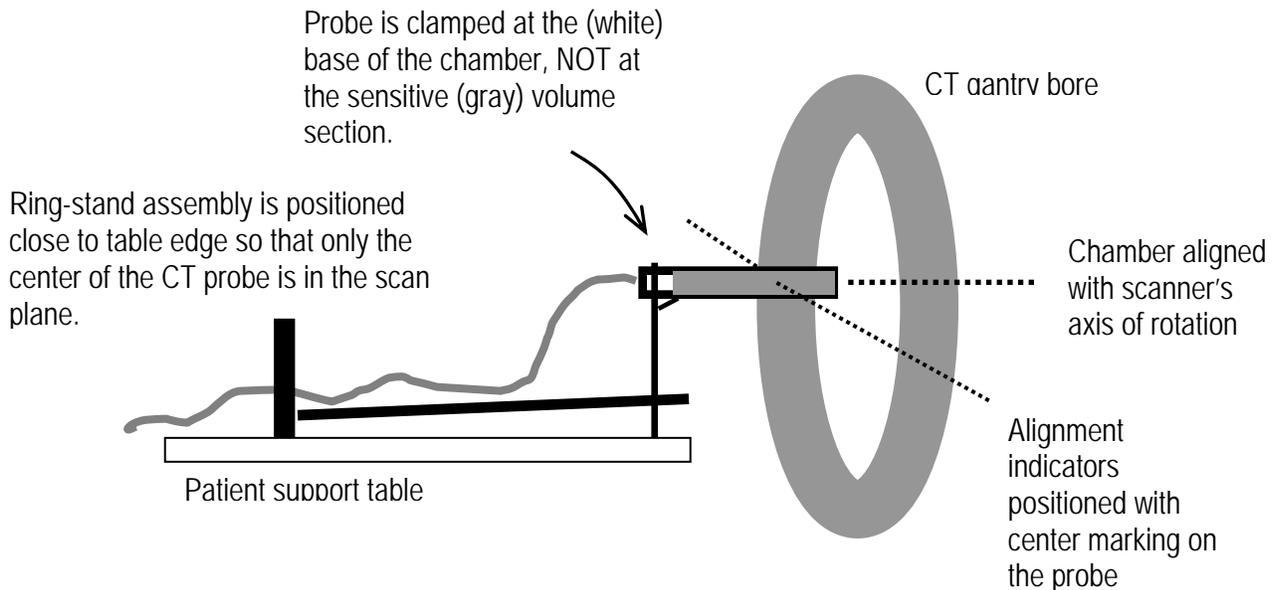


Figure 3. The ring stand is positioned on its side with probe mounted into the clamp assembly such that **ONLY** the center marking of the probe is in the scan plane. Watch the ring stand as the table is adjusted to ensure that the ring stand will not collide with the gantry.

B. Procedure for exposure measurements:

1. Do not disturb the ring stand set up for the remainder of the exposure measurements.
2. Inform the technologist that you wish to conduct a series of **AXIAL** scans on the probe with **NO table increment or movement during or between scans.**

Ask the technologist to configure the CT unit using the parameters indicated in the table below.

IMPORTANT: If the technologist cannot configure one or more parameters (eg the technologist cannot select 150 mA, 5mm slice thickness, or one or more kVp values), ask the technologist to select the closest value **and record this on the data form.**

-
- manual mode (that is, no AEC)
 - single **AXIAL** scan
 - 5-mm slice width
 - 150 mA
 - 1-second gantry rotation time
 - acquiring 1 slice per rotation
 - abdomen filter and abdomen scan field of view
 - 80 kVp (first set);
 - 100 kVp (second set);
 - 120 kVp (third set);
 - 140 kVp (fourth set)
-

VERIFY the console settings before proceeding.

NOTE: Some facilities may tilt the gantry slightly during an examination of the patient. Inform the technologist that **the gantry should NOT be tilted** for these measurements.

3. Prepare the MDH for exposures: switch the function selector to "MEASURE" and switch the mode selector to "PULSE EXPOSURE." The threshold level should be set at 0.5.
4. **NOTE:** PULSE EXPOSURE is the preferred mode of operation for these measurements. However, if you suspect that the MDH is not operating properly in this mode (primarily because of anomalous triggering), switch the mode selector to "EXPOSURE." You will not be able to record exposure times in this mode because "PULSE EXPOSURE" and "PULSE DURATION" operate as a single mode in the MDH meter. You will also need

to RESET the meter between consecutive exposures because this mode retains and adds subsequent exposures until the meter is reset. To reset the meter, switch the function selector to “HOLD”, and then back to “MEASURE”.

5. After you have verified all technique factors, ask the technologist to make a single axial scan. The first set of three scans should be for 80 kVp.
6. Record the MDH reading in *milliroentgens (mR)* (item 27a). Switch the mode selector to PULSE DURATION and record the time in *seconds* (item 27b).
7. **VERIFY** the protocol at the console to ensure that all factors in step 2 above have not changed before proceeding with the next scan.
8. **VERIFY** that the table has not moved after the first scan: check the position of the CT probe/ring-stand assembly.
9. Have the technologist **make two additional scans** at 80 kVp. After each scan record the MDH reading in *milliroentgens (items 27c and 27e)*. For each scan also record the exposure time in *seconds (items 27d and 27f)*.
10. Leave the ring-stand and CT probe undisturbed for the next series of exposure measurements.
11. Repeat the exposure- and duration-measurement sets for the remaining kVp values (*items 28, 29, and 30*). Each time a kVp value is configured, verify that all other console settings have not changed.

SURVEY PROCEDURES USING THE CT PHANTOM ON A UNIT EQUIPPED WITH AEC

Survey procedures using the CT phantom on a unit equipped with AEC (items 31-58)

This section describes survey procedures for a CT unit that is equipped with AEC technology and that is used clinically for one or more exams being surveyed.

Before proceeding, answer the following question through referral to your data [tables A and B](#) or through discussion with the assisting technologist:

*Does the facility **typically** use some mode of AEC for at least one body exam, for example, for the chest, or abdomen, or pelvis?*

If your answer is	Then you should
NO	STOP HERE. You are done with data collection on the CT unit.
YES	Complete the procedures in this section.

The purpose of the following procedures is to gather data regarding how a CT system equipped with AEC will respond to the CT phantom. You will perform TWO scans of the phantom.

- One scan of the phantom with the AEC feature turned ON.
- One scan of the phantom with the AEC feature turned OFF.

For this section you will need:

- The CT AEC phantom
- The MDH 1015 or 1515 meter with the CT ionization chamber, model no 10X5-3CT.

A. Setup and procedure

1. With assistance from the technologist, determine for which routine CT exams AEC is typically used, and record your answer on the data form (*item 31*).

Example:

	Chest	Abdomen	Pelvis
AEC typically used?	Yes	Yes	Yes

2. Disassemble the CT probe / ring-stand setup **AFTER** the technologist has repositioned the patient support table clear of the CT gantry.
3. With the assistance of the technologist position the CT phantom on the patient support table. The smallest section is representative of the adult chest, and the largest section is representative of the adult pelvis. *Be certain to orient the phantom as an adult patient would be oriented on the table.*

IMPORTANT: It is possible to position the phantom UPSIDE-DOWN. You should be able to see THREE notches on the top edge of EACH phantom section.

4. Using the CT scanner's visual (typically laser) alignment indicators, have the technologist assist you to align the phantom so that it is:
 - a. Centered vertically: use the notches on either side of the phantom to assist with this.
 - b. Centered across the support table (left to right): use the center notch on the top of the phantom to assist with this.
 - c. Positioned along the z-axis (i.e., along the length of the support table) so that the outer edge of the pelvis (largest) section is aligned with the scan plane indicator.

REFER TO THE DIAGRAMS BELOW (FIGURES 4a and 4b) TO ASSIST WITH THE ALIGNMENT PROCEDURE

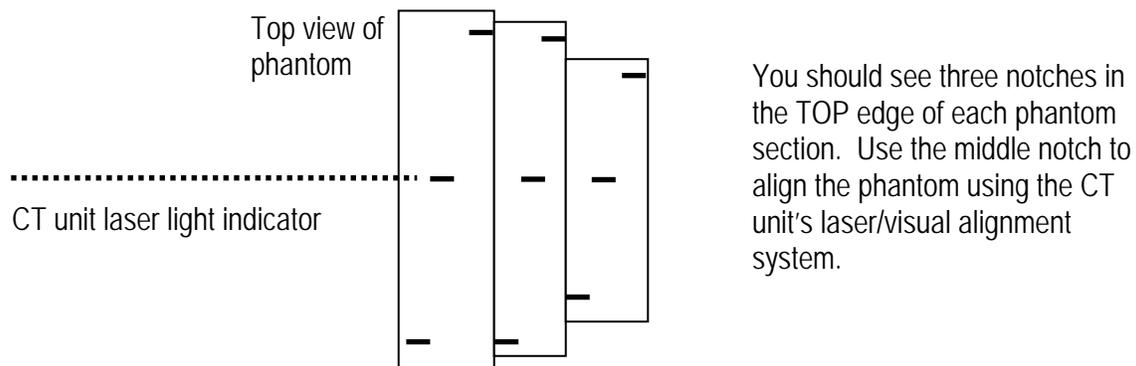


Figure 4a. Illustration of phantom orientation and transverse (left-right) alignment.

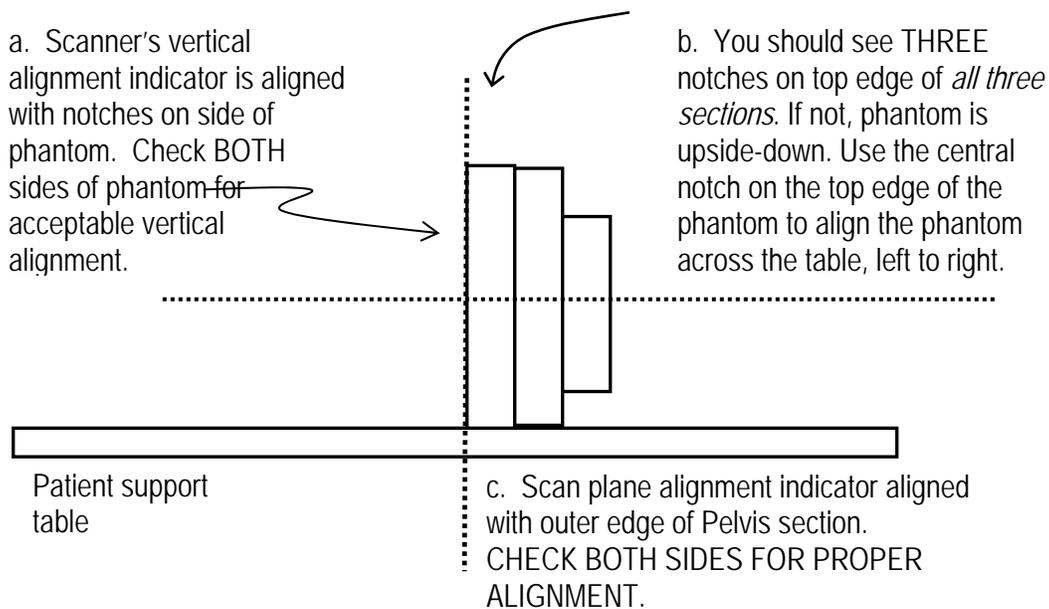


Figure 4b. Illustration of phantom alignment with CT visual indicators.

5. Insert the CT probe **WITHOUT THE CLEAR ADAPTER SLEEVE** into the center hole in the phantom until the probe stops. You may need to tape the probe's wire lead so that the probe remains in this position during the measurements. Check also that you have sufficient cable length between the probe and the MDH meter so that any table motion will not pull on the chamber.
6. Prepare the MDH for exposures: switch the function selector to "**MEASURE**" and switch the mode selector to "**EXPOSURE.**" The threshold level should be set at 0.5.

7. NOTE: **EXPOSURE** is the preferred mode of operation for these measurements because of the potential for multiple triggering of the MDH if the ‘PULSE EXPOSURE’ mode is selected during certain CT scans where the beam pulses on and off during scanning.

Part I. Phantom scanning sequence with AEC feature turned ON.

8. Have the technologist configure the CT unit for a **routine exam of the adult abdomen + pelvis**. This first scan sequence will be with the AEC feature turned **ON**.

Check your data form item 25, Table A, and confirm that the console technique factors agree with your recorded values, specifically:

-
- kVp
-
- AEC mode- set to mode indicated in Table 25 A
 - Tube current (mA) starting point
Some systems will display a value for mA as a starting point for the exam when AEC is activated
 - Scan field-of-view (SFOV)
-

Some CT protocols are configured so that during the scanning sequence, one or more scanning parameters changes. For instance, the pitch or slice thickness may change as the scanner proceeds from the chest into the abdomen.

The **ONLY** parameter that should change during the scanning sequence of the phantom is the tube current.
All other parameters should remain fixed during the scans.

Protocol parameter	Set the parameter to this value
gantry rotation time (Helical mode) or time per single axial scan (Axial mode)	Fixed at 1.0 seconds
acquisition slice thickness	Fixed at 5.0 mm, single-slice acquisition
table feed (or table speed)	Fixed at 5.0 mm per rotation (5.0 mm per second) NOTE: Some single-slice helical units may not directly indicate table feed, but may display a pitch factor. Setting the pitch = 1 will give a table feed identical to the slice thickness of 5 mm.

9. Ask the technologist to *modify the protocol* so that the following input parameters are **FIXED** at the specified values for the *entire* scanning sequence.

IMPORTANT: IF the technologist cannot configure one or more parameters to the stated values, ask the technologist to select values close to specified value. (For instance they may be able to select a gantry rotation time of 0.8 sec but not 1.0 seconds).

10. **RECORD ON THE DATA FORM** (items 32-35) your values for:
- tube current (mA) starting point (if displayed)
 - gantry rotation time
 - slice thickness
 - table speed (or table feed)
11. **IMPORTANT:** Have the technologist perform any necessary pre-scans, referred to as “scout views” (GE), “topograms” (Siemens), “Pilots” (Philips), or “scanograms” (Toshiba). The pre-scanning region should cover the *entire* phantom, from one end to the other along its length on the table.
12. Have the technologist configure the range of scanning (referred to here as the “region of interest,” abbreviated “ROI”) to that of the length of the phantom along the z-axis. If a pre-scan series was taken, then typically the technologist can set the scanning range at the console ([see figure 5 below](#)).

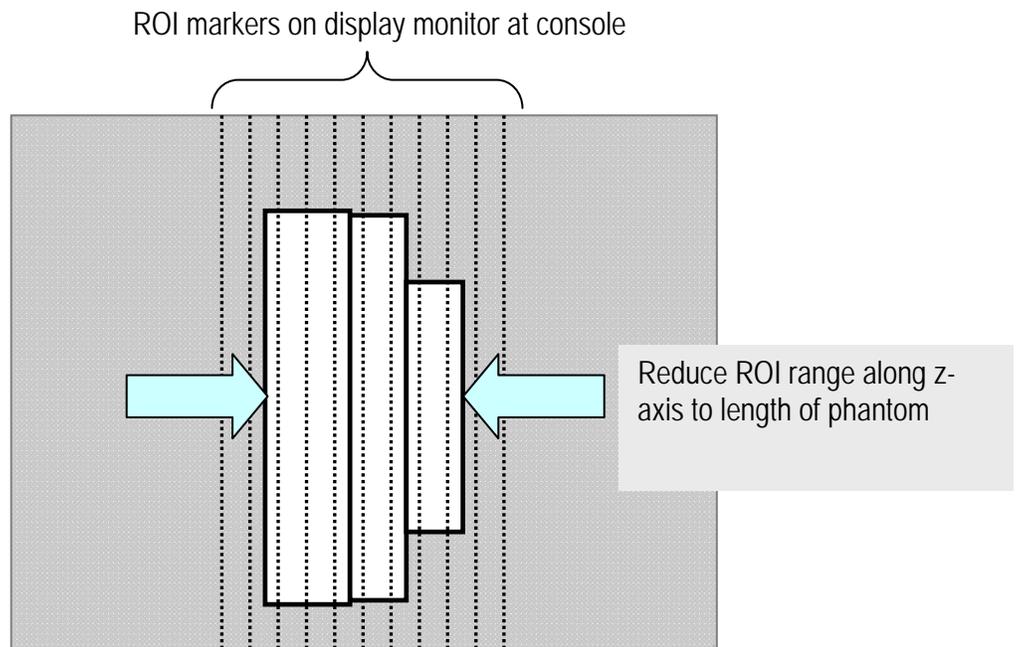


Figure 5. Diagram illustrating the adjustment of the scanning ROI to exactly cover the full length of the phantom.

13. **Pre-scan console display of CT dose indices (items 36-39).** After the CT system has been configured to scan the phantom, and before scanning commences, record the label and numerical value of each index of CT dose displayed at the console (refer to the examples below).

(Note: “CTDI” is an abbreviation for “computed tomography dose index.”)

Dose Index	What you might see displayed at the console Label	Units
Volume CTDI	<i>CTDI_{vol}, volume CTDI</i>	mGy
Weighted CTDI	<i>weighted CTDI, CTDI_w</i>	mGy
Dose-Length Product	<i>dose-length product, DLP</i>	mGy-cm

If you cannot identify any display for dose indices, ask the technologist for assistance. (Note: The oldest CT systems do not display dose indices; models from the early 2000’s may display *CTDI_w* and *DLP*; the most recent models display *CTDI_{vol}* and *DLP*.) Record on the data form the **EXACT** expression displayed along with the value and units. If the console does not display any value of dose index, enter “XX” in the appropriate spaces

on the data form. BE CERTAIN to include the units that are associated with the values you record!

IMPORTANT: There are several possible dose indices that newer CT units are now displaying on the console. The table below illustrates what could be displayed on the console for each CT dose index.

Example: Pre-scan dose quantities displayed, AEC feature ON

Dose Index	Value displayed	Units displayed
Volume CTDI (CTDI _{vol})	22.5	mGy
Weighted CTDI (CTDI _w)		
Dose-Length Product	338	mGy-cm
Other: _____		

14. Reset the MDH by briefly switching the function selector to **HOLD**, and then back to **MEASURE**. This will delete any exposure reading captured by the MDH during the scout preview scans.
15. **Proceed to scan the phantom.** When scanning is complete, record on the data form (*item 40*) the MDH meter reading in *milliroentgens (mR)*. Reset the MDH after you have recorded your reading by briefly switching the function selector to **HOLD**, and then back to **MEASURE**.
16. Retrieve from the console values displayed **post-exposure** for **CTDI** and **Dose-Length Product** (*items 41-44*). Record these values on the data form including the units. **IMPORTANT:** These post-exposure values must be recorded soon after scanning because they are NOT stored as part of the CT exam record.

CT x-ray tube current (mA) for the chest, abdomen, and pelvis phantom sections (items 45-47)

In the following procedure you will view the series of slices for the phantom on the display monitor, and record tube current (mA) and mAs values for each of the three phantom sections (pelvis, abdomen, and chest) separately.

1. Ask the technologist to display the series of tomographic slices for the phantom that were acquired with the AEC feature ON.
2. Locate the **PELVIS** section of the phantom. Refer to the diagrams below to assist you in identifying this section using the identifier notches inscribed on the phantom.

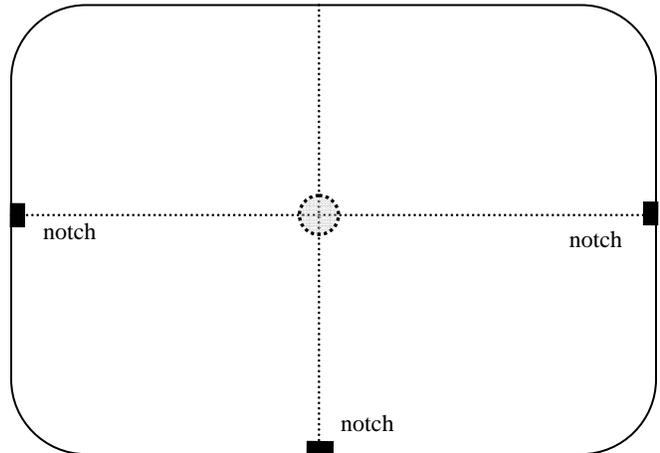
Phantom section identifiers

Figure 6. Each section of the phantom (pelvis, abdomen, and chest) has a unique series of notches inscribed into one or more edges to aid in identifying a particular section on an image.

PELVIS section

Largest phantom section has **THREE** identifier notches that can be visualized on CT images:

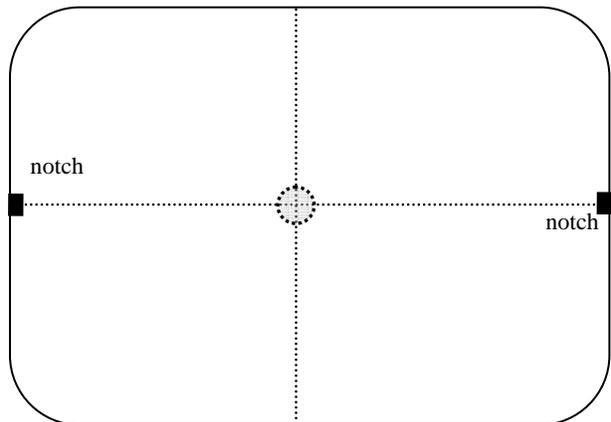
1. LEFT edge, vertically centered
2. RIGHT edge, vertically centered
3. Bottom edge, centered LEFT to RIGHT.



ABDOMEN section

Middle section, has **TWO** identifier notches that can be visualized on CT images:

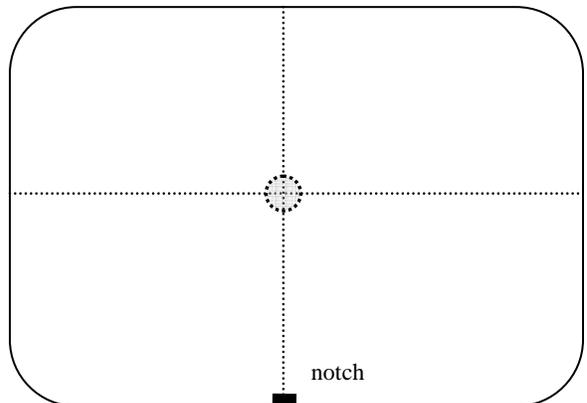
1. LEFT edge, vertically centered
2. RIGHT edge, vertically centered



CHEST section

Smallest phantom section, has **ONE** identifier notches that can be visualized on CT images:

Bottom edge, centered LEFT to RIGHT.



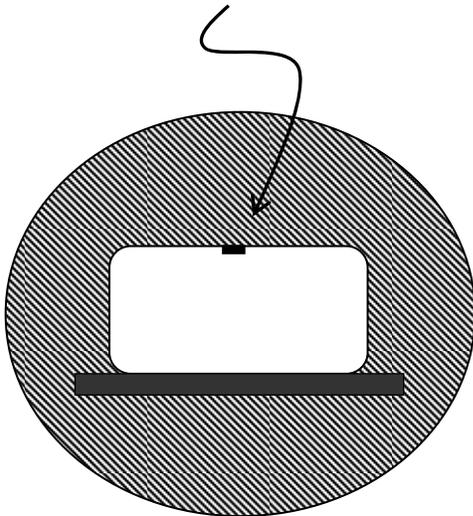
- For the **PELVIS** section locate a tomographic slice that is near the **CENTER** of the section. The central region of each phantom section can be identified on CT images by a notch in the upper edge of the phantom, centered **LEFT** to **RIGHT**. Refer to the diagram below to assist you. When you have located the central region for the **PELVIS** section, record (*item 45*) the tube current (mA) and mAs (if retrievable) displayed in the header data associated with the slice image.

Example: CT phantom Scan, AEC feature ON: post-exposure mA and mAs

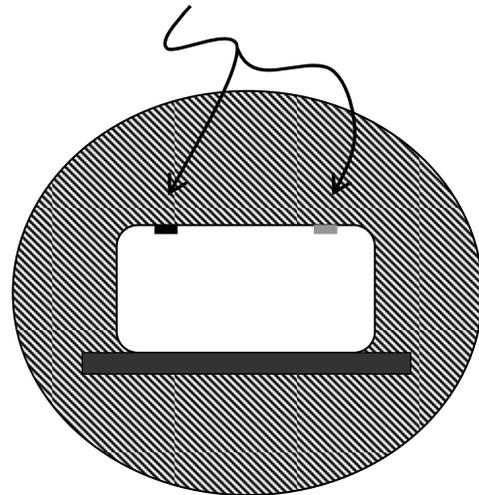
	a) Tube current (mA)	b) mAs
Pelvis	95	76
Abdomen		
Chest		

Figure 7. Locating the central region of each phantom section. Each of the three phantom sections has a series of three notches on the TOP of the section to assist in locating the central region of the phantom.

Tomographic slices of the central part of each phantom section are indicated by a notch in the



Tomographic slices that are **NOT** near the central part of each phantom section are indicated by a notch in the TOP of the phantom, **off-centered** to



4. Repeat steps 2 and 3 above for the remaining two phantom sections: **ABDOMEN** and **CHEST**. For each section, locate a slice near the center of the section and record on the data form the tube current and mAs displayed.
Phantom scanning sequence with AEC feature OFF (items 48-58).
5. Inform the technologist that you wish to repeat the scanning sequence for the routine adult abdomen + pelvis exam, but with the AEC feature now turned **OFF**, so that a manual tube current must be selected. **It is important that all other scanning parameters remain EXACTLY the same as before, when the AEC feature was activated.**
6. Ask the technologist to select a value for tube current (mA) that is typical of what would be selected for the exam of the abdomen + pelvis. **Record this value for mA** on the data form (item 48).
7. Inform the technologist that the scanning range should again be set to the *entire* length of the phantom, as was done previously with the AEC feature ON. (The technologist may need to perform a pre-scan scout-view sequence to again limit the scanning range.)
8. Record on the data form the console display values for the pre-scan dose indices ($CTDI_w$ or $CTDI_{vol}$ and *dose-length product*) (items 49-52).
9. Confirm that the MDH meter is operational.
10. Have the technologist do the scanning sequence.
11. After the scanning is complete, Record in *milliroentgens (mR)* the MDH meter reading on the data form (item 53). Reset the MDH after you have recorded your measurement.
12. Observe the console display for post-scan dose indices and record these values on the data form (items 54-57).
NOTE: Because this scanning sequence was done using a fixed mA, the post-scan display values for the dose indices will typically be very close to, or exactly agree with the pre-scan dose index values.
13. Ask the technologist to retrieve a value for mAs per slice. This value may be displayed either on the console along with other scanning parameters or as a header/footer value on images of the phantom displayed on the computer monitor. Record this value on the data form (item 58).

You are finished with this section of the protocol. Have the technologist withdraw the table from the CT gantry, and carefully disassemble and pack the CT phantom.

APPENDIX A

PROCEDURES FOR THE MEDICAL PHYSICS SURVEY

You are asked to acquire a copy of the report of the most recent physics survey conducted on the CT unit you collected data for. Ideally a medical physics survey would have been conducted on the CT unit within the past 12 months. If the physics survey report provided to you is more than 12 months old, inquire whether there is a more current report.

The following page is also provided as the last page on the Surveyor Data form. Remove that page and complete the checklist after you have received the medical physics survey report. Attach the checklist to the front of the survey report and submit the checklist and report to FDA along with the remaining survey items.

We appreciate your efforts with this survey!

Medical Physics Survey Report Checklist

Instructions

1. Obtain a copy of the report of the most recent medical physics survey for the CT unit you surveyed.
2. If possible prior to leaving the facility, review the report using the guidance items below. You may need to consult with facility staff in order confirm items, such as whether the unit had any major service (such as tube replacement) since the survey was conducted.
3. Fill in the items below and staple this form to the front of the physics report.

Surveyor Name _____ State _____

Facility Name _____ Survey Date _____

The facility name and address should be identified on the report.	<i>The address is important in cases where a large health provider might provide some radiological services off-site.</i>
The person/company who provided the service should be identified.	
The date the medical physics survey was performed (as distinguished from the date the report was prepared/submitted) should be within 1 year of the NEXT survey.	<i>If the medical physics survey was conducted more than a year ago, inquire with facility staff whether a more recent survey was performed.</i>
The medical physics survey report should identify the CT unit- location/room number, manufacturer, and model number. VERIFY that this is the same unit you surveyed.	
The medical physics survey report should include a determination of CTDI values for the head phantom and the body phantom. The phantom used for these CTDI measurements will typically be included.	<i>The report may refer to the "16-cm phantom" for the head CTDI measurements, and the "32-cm" phantom for the body CTDI measurements. Other references to a phantom may include the "FDA compliance" phantom, or just "head phantom" or "body phantom."</i>
Has the CT unit undergone any major upgrades or service since the survey was completed? If so, please describe below. Upgrades/service:	<i>Inquire with the facility whether the unit was serviced (such as tube replacement) or upgraded (major feature installation, software upgrade).</i>

APPENDIX B

List of CT equipment manufacturers and codes for data entry

Manufacturer	Code	Manufacturer	Code
Acoma (Aka Kram)	ACOM	Odelco	ODEL
Adtek	ADTK	Ohmic Ltd.	OHML
American Medical Imports Inc	AMII	Orion Corp	OTIC
Amrad Inc	AMRA	Philips Medical Systems Inc	PHMS
AR Custom Med. Products, Ltd.	AREM	Picker Corp	PICO
Ausonics Corp	AUSC	Planmeca	MECA
Bennett X-Ray Corp	BEXR	Planomed	PLAN
Belmont	BELM	Porta-Ray Inc	PORT
Berkley	BKLY	Profexray (Litton)	PROF
Castle	CSTL	Pfizer	PFIZ
CGR Medical Corp	CGRM	Radiation Sciences	RADS
Continental X-Ray Corp	CONX	Raytheon Medical Services	RAYT
Corometrics	CORO	Ritter	MORI
Del Medical Systems	DELM	Frank Scholz X-Ray Corp	FSXC
Diagnostic Inc	DIAG	Sankyo	SANK
Elscint Inc	ELSC	Shimadzu Co	SHIM
Elema-Schonander	ESCH	Siemens Medical Systems	SIEC
Fiad	FIAD	Spectrascan Inc	SPEC
Fischer Imaging Corp	HGFC	Soredex (A.k.a. Philips)	SORX
Franklin	FRNK	Standard X-Ray Corp	STAN
Gendex	GEND	Sybron	MORI
General Electric Medical systems	GEMS	Technomed	TECH
General X-Ray	GENX	Tokyo Emix Corp	TOEC
Giotto Ims (Mammo)	IMSE	Toshiba Corp	TOSE
Imaging Dynamics	IMAD	Transworld X-Ray Corp	TWXR
Italiensk Generay	ITAL	Thompson-CGR Medical Corp	TEGR
International Med. Systems Inc	IMSI	Trophy	TROP
Instrumentarium	INRU	TREX Medical Corp.	TREX
Keleket	KELE	TXR Tingle X-Ray Products	TXRI
Keystone	KYST	Unknown	UNKN
Kramex Corp	KRAM	Universal	UNIV
Litton Industries	LITT	Valmet	VALM
Lumix	LUMX	Varo Inc	VARE
Lorad Med. Systems Inc	LRAD	Velmet	VAIN
Machlett Laboratories Inc.	MALA	Versaview	MORI
Mattern	MATT	Weber	WEB R
Medicor Works Inc	MECO	Westinghouse	WEST
Midwest	MERI	S.S. White (A.k.a. Keystone)	WHCO
Min X-Ray Inc	MINX	Xerox Corp	XERO
J. Morita (A.k.a. Panex-E, Pan-Oral,		Xonics	XONI
Ora Tronix)	MORI	XRC Inc	XRCI
Moti Enterprises International	MOTI	Yoshida Co. (Distr. By Kaycor)	YOSH
Muller	MULL		

APPENDIX C

Description and set-up for the CT body phantom

Newer computed tomography equipment is now capable of varying the tube current during the scanning sequence in response to the x-ray attenuation presented by the patient. The NEXT CT body phantom is designed to invoke the response of CT systems having such technology. The phantom consists of three sections: chest, abdomen, and pelvis. Unlike projection x-ray exams where a single image is based on the patient's attenuation in one direction, the CT system collects attenuation data from a large number of projections as the gantry rotates around the patient. Therefore the NEXT CT AEC phantom is designed such that the total axial attenuation presented by each phantom section is similar to that for a typical adult human.

Assembly

The phantom does not require any assembly. The pelvis and abdomen sections should maintain the phantom upright without any additional support. (figure 8). The access hole into the pelvis section accepts the Radcal MDH CT probe model 10X5-3CT (figure 9).

Features

The phantom contains several features that permit alignment and isolation of specific regions in the phantom.

- Vertically centered notches in the left and right sides of the abdomen and pelvis sections permit vertical alignment of the phantom.
- Notches centered left to right across the top edge of all three sections permit alignment of the phantom left to right.
- Each phantom section has a unique combination of notches to permit its identification on tomographic images. Refer to figure 10 below.
- Two notches in the upper edge of each phantom section that are off-centered can be used along with the centered notch to identify specific regions in each section along the Z-axis.



Figure 8

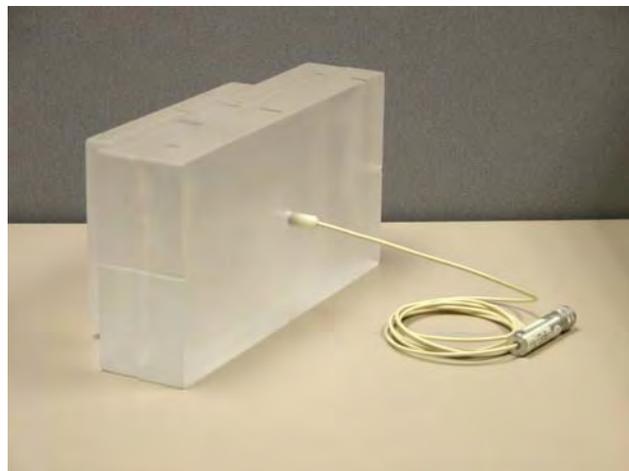


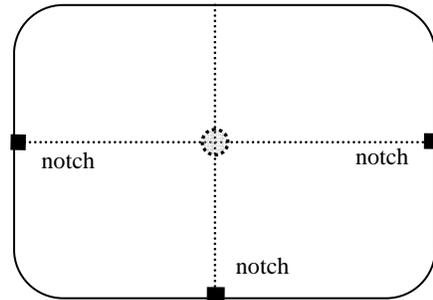
Figure 9

Figure 10. Illustration showing the unique identifiers (notches) for left, right, and bottom edges of each phantom section.

PELVIS section

Largest phantom section, has **THREE** identifier notches that can be visualized on CT images:

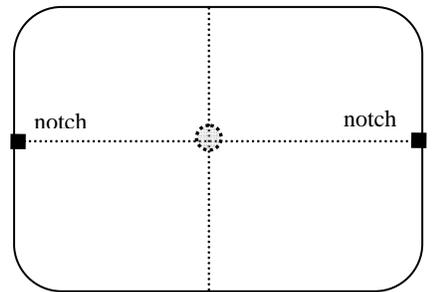
1. LEFT edge, vertically centered
2. RIGHT edge, vertically centered
3. Bottom edge, centered



ABDOMEN section

Middle section, has **TWO** identifier notches that can be visualized on CT images:

1. LEFT edge, vertically centered
2. RIGHT edge, vertically centered



CHEST section

Smallest phantom section, has **ONE** identifier notches that can be visualized on CT images:

Bottom edge, centered LEFT to RIGHT.

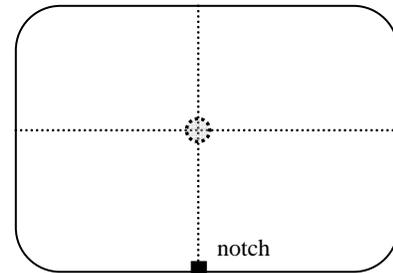
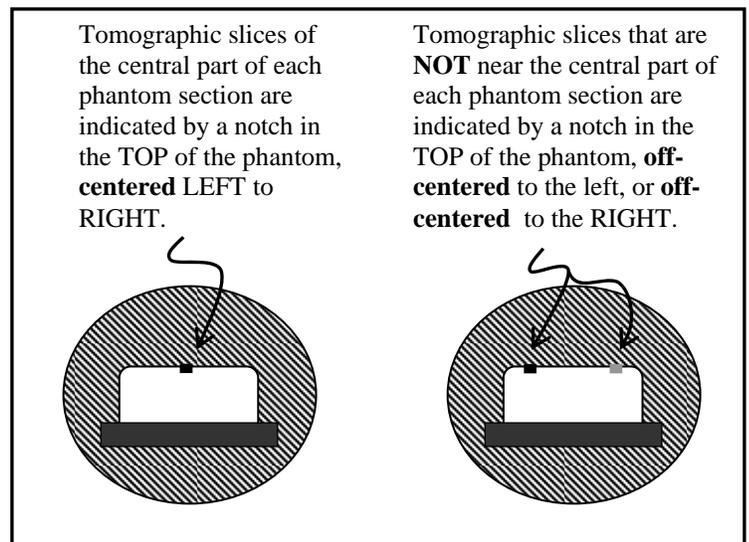


Figure 11. Illustration of the patterns of notches in the upper edge of each section visible on tomographic images for various locations along the Z-axis. Tomographic images with Z positions near the outer edges of a section will have a notch visible in either the left or right upper corner. Tomographic images with Z positions near the center of a section will have a notch visible on the upper edge, centered left to right.



Nationwide Evaluation of X-ray Trends
2005 Computed Tomography Survey
FACILITY QUESTIONNAIRE ON CT PRACTICE
Instructions

This questionnaire seeks information about the scanning protocols and typical weekly numbers of patients undergoing various routine computed tomography (CT) examinations of the head and body at your facility. The information will be used as part of the *Nationwide Evaluation of X-Ray Trends (NEXT)* survey to characterize CT practice and dose trends. Your facility was randomly selected for survey, and your participation is voluntary. **All data that you provide will be treated confidentially and will be cited anonymously.**

What you should expect to happen during the survey. This survey has three components:

- 1) A NEXT surveyor will visit your facility to collect various data regarding the practice of CT at your facility. The surveyor will request access to the CT unit used *most frequently at your facility for routine CT examinations of the head and body.*
- 2) Your facility is asked to complete a questionnaire that captures detailed information on CT protocols for particular adult and pediatric CT examinations.
- 3) The surveyor will request a copy of the most recent physics survey report performed on the CT unit being studied for the survey.

How to complete this questionnaire. This form contains a series of questions regarding the general practice of CT at your facility, followed by a table for the entry of CT exam protocol items for selected CT exams **on the particular CT unit the NEXT surveyor will study.** We recommend that a radiologic technologist who is thoroughly familiar with the practice of CT at your facility complete this survey, with assistance from the medical physicist, radiologist(s), or other staff as needed. *The questions are not intended to burden you with searching your facility's records in order to answer!* You can respond to most items with a good estimate.

The table may require a staff member to review the protocols at the CT scanner console. Some items refer to categories or terminologies that may not correspond precisely to those of your facility's practice. Please use the comments section to clarify any of your responses, and make a photocopy of the completed form for your records.

How to get assistance with this form. You should contact the NEXT surveyor for assistance with items on this form.

How to find out more about the NEXT survey program. Your NEXT surveyor can provide you additional information on NEXT including brief summary results of past surveys. Additionally, you can find information on NEXT at the following websites: <http://www.fda.gov/cdrh/radhth/next.html> and <http://www.crcpd.org>

Your time and effort to complete this form are greatly appreciated.

Facility Questionnaire on CT Practice Questions

Facility Name State

Person(s) completing this questionnaire:

1 Name Title/position

2 Name Title/position

3 Name Title/position

NEXT surveyor name Survey Date (MM/DD/YY)

1. What is the total number of CT units currently in use at your facility?

2. How many of the total number of CT units at your facility are:

a) non-helical, single-slice units

d) electron-beam CT (EBCT) units

b) helical, single-slice units

e) PET-CT combinations

c) helical, multi-slice units

3. Please indicate the number of CT units in use at the locations listed below.

Number of CT units

radiology or diagnostic imaging department

specialized imaging area such as cardiac/interventional

emergency/trauma

radiation therapy

mobile unit that routinely performs exams for hospital-based patient care

other (briefly describe):

4. On average, what is the approximate TOTAL number of ALL CT examinations, studies, or procedures performed at your facility each week on ALL CT units? Please indicate the totals for **adult AND pediatric** exams separately. (An exact number is not needed- a good estimate is sufficient.)

4a) Facility total number of **ADULT** CT exams per week

4b) Facility total number of **PEDIATRIC (under 18 yrs)** CT exams per week

5. Does your facility perform any CT examinations as a SCREENING procedure of asymptomatic patients?

(Y / N):

Please indicate the approximate number of screening exams performed each week.

Whole body

virtual colonoscopy

lung

cardiac

Other (description and weekly workload):

6. The American College of Radiology (ACR) currently offers accreditation to facilities in the area of computed tomography. Please indicate in the space to the right which of the following options best describes your facility's position or status with respect to this accreditation program.

- a) Currently have no plans to pursue ACR accreditation for CT.
- b) We plan to begin the accreditation process for CT within the next year.
- c) We are currently in the process of ACR accreditation for CT.
- d) We are currently accredited by ACR for CT.

The following questions refer SPECIFICALLY to the CT unit the NEXT surveyor will evaluate

This should be the CT unit most frequently used for routine head and body examinations.

7. CT unit manufacturer: Model name: Room no. or location:

8. When was this unit installed at your facility? month Year

9. For a typical week, what is the TOTAL number of ALL CT exams and procedures performed **on THIS CT UNIT** for:

a) Adults? b) Pediatric patients (under 18 yrs)?

10. Indicate how frequently routine service/maintenance is provided for this unit.

M) monthly **Q**) quarterly **S**) semi-annually **A**) annually **N**) as needed **O**) Other (specify)

11. Indicate how frequently the CT unit undergoes a medical physics survey.

M) monthly **Q**) quarterly **S**) semi-annually **A**) annually **O**) Other (specify:)

2005 NEXT Facility Questionnaire on CT Practice Guidance

This page provides guidance for answering specific items on the following table.

Generally, we seek data on what is most routinely done on the CT unit that is most frequently used at your facility. ***It is very important that you provide responses in the table for the same CT unit the NEXT surveyor will survey.***

The term "**phase**" refers to the scanning that occurs between the anatomical landmarks designating the start and stop of table movement. A single exam might entail two or more phases when, for example, scanning is done without contrast in one phase and then scanning is repeated after contrast is added in a second phase.

Do any parameters change during scanning? If so, please indicate different values for a table item separated by a slash. For example, if the adult head is scanned partly with 5 mm slices, and partly with 10 mm slices, indicate this in the appropriate cell as "5/10". [Refer to the example provided in the table.](#)

Weekly No. of Exams. For each exam category, enter the approximate number of exams, studies, and procedures your facility performs each week on the CT unit to be surveyed. Please consider each exam category as unique and independent of all other listed categories. Therefore workloads you report for one exam category should not be included with any other category. For example, the weekly number of exams you report for 'Adult Chest' CT exams should not be included in the number of exams you report for the category 'Adult Chest+Abdomen+Pelvis'.

AEC mode used? The term '**AEC**' on this form refers to CT technology that varies the tube current during scanning. Vendors may refer to their respective technologies in various manners, such as 'Smart-Dose', 'Smart-mA', 'Care-Dose', etc. If the CT scanner considered in this survey is equipped with such technology, please indicate in this column ("Yes" or "No") whether your facility **USES** this mode of operation *during the indicated exams*. If you are not certain whether the CT unit is equipped with such technology, please consult with other staff or your medical physicist.

Scanning field-of-view (SFOV). This item refers to the diameter representing the breadth of the x-ray beam at the isocenter during scanning. Do not confuse this with the field-of-view option when viewing reconstructed slices. The scanning field-of-view diameter may be expressed by a number (typically in centimeters) or may be a phrase such as 'HEAD'.

"Acquisition slice thickness" refers to the slice thickness set up for scanning. It is not necessarily the reconstruction slice thickness.

% of Exams with NO Contrast, % of exams exclusively with contrast, and % of exams with a contrast phase and a non-contrast phase (Last three columns on both tables.)

Please indicate approximately what percentage of exams are performed for each category, noting that the total of these three cells should add to 100% FOR EACH ROW. See the example provided on the table.

Pediatric Exams. A pediatric patient is considered to be under the age of 18 years. On the following table, "**infant**" refers to a patient who is 1 year old or younger, and "**child**" refers to a patient who is approximately 5 to 6 years old.

NEXT 2005 CT SCANNING PROTOCOLS FOR ROUTINE EXAMS, STUDIES, AND PROCEDURES

← Each ROW should add to 100% →

Exam category	Weekly no. of exams	No. of scout views before exam	Helical or Axial scan? (H/A)	AEC mode used? (mA varies during scan) (Y/N)	Scanning field-of-view (SFOV)	kVp	mA	Brief description of anatomical range scanned	Time per rotation (seconds)	No. of slices acquired per rotation	No. of slices per phase	Acquisition slice thickness (mm)	Table FEED per rotation (mm)	% of exams with NO contrast	% of exams exclusively with contrast	% of exams with a no-contrast phase AND a contrast phase
<i>EXAMPLE</i> Adult Head (brain)	35	1	A	Y	HEAD	120	200	Foramen magnum to apex	1	1	12/8	5/10	5/10	35%	0%	65%
Adult Head (brain)																
Adult temporal bones, or sinus, or orbits																
Adult chest																
Adult abdomen																
Adult abdomen + pelvis																
Adult chest + abdomen + pelvis																
Adult cervical spine, or thoracic spine, or lumbar spine																
Adult colon																
Adult coronary angiography																
Pediatric routine head	infant child															
Pediatric thoracic survey	infant child															
Pediatric abdm + pelvis survey	infant child															
Other*:																

*Please use the additional space 'Other' to provide a protocol for an additional exam FREQUENTLY performed on the CT unit that is not listed above.

Comments:

2005 CT SURVEY DATA FORM

Surveyor Information (items 1-4) [page 8](#)

1) Surveyor name 2) telephone number
3) Email address 4) Survey date
(MM/DD/YY)

Facility Information (items 5-11) [page 8](#)

5) Facility Name
6) Facility ID number 7) State/Agency code
8) Facility type code 8a)
9) Practice specialty code 9a)
10a) Interviewee name (1) Title
10b) Interviewee name (2) Title
11) Total number of CT units at facility (Refer to protocol for instructions on completing item 11.)

X-ray Unit Identification and Capabilities (items 12-17) [page 11](#)

Complete this section AFTER you have located the CT unit that is typically used for routine diagnostic CT exam. Refer to the protocol for discussion on what NOT to survey

12) Room number Location
(e.g. 'radiology dept' or 'emergency dept')

13) CT unit manufacturer: name code
list of manufacturer codes is on pg 41 of the protocol

14) CT unit model name 15) Serial number
16) CT model number 17) Date of manufacture

Features available on the CT unit being surveyed (items 18-24) [page 13](#)

18) Helical scanning? (Y/N)

19) Maximum no. of simultaneous slices

20) AEC technology on CT unit? (Y/N)

21) Console display for AEC

22) CT Fluoroscopy available: (Y/N)

23) Hard-copy code

24) Image display/interpretation code

Comments

25) Clinical protocols for the routine, diagnostic adult abdomen+pelvis exam and the adult head exam

IMPORTANT: You may not have data in all four columns. Enter data into more than one column ONLY IF the facility changes one or more protocol parameters during the scan (e.g. uses a different slice thickness for the abdomen and pelvis sections, or make two scans, one without contrast and one with contrast)

Table A. Scanning Protocols for the adult abdomen + pelvis exam

	Sequence 1	Sequence 2	Sequence 3	Sequence 4
Helical mode or Axial mode? (enter 'H' or 'A')				
Manual Mode / AEC mode (enter 'M' or 'A')				
AEC mode selected (AEC exams only)				
Tube potential, kVp				
Tube current, mA				
mAs per gantry rotation				
Time per gantry rotation (seconds)				
Scan field of view				
Contrast used during sequence? (enter 'Y' or 'N')				
Individual slice thickness acquired (mm)				
Number of simultaneous slices acquired per gantry rotation				
Total number of slices acquired during sequence				
Number of gantry rotations during sequence				
Scanning length during sequence enter length(mm) or brief description				
Table increment (mm) per gantry rotation (Helical mode) or per axial scan (Axial mode)				
Table speed (mm per second) (Helical only)				
Pitch (Helical only)				
Rotation angle (degrees) per axial scan (Axial only) <i>(this is NOT related to gantry tilt angle)</i>				

Comments

25) Clinical protocols for the routine, diagnostic adult abdomen+pelvis exam and the adult head exam

IMPORTANT: You may not have data in all four columns. Enter data into more than one column ONLY IF the facility changes one or more protocol parameters during the scan (e.g. uses a different slice thickness for the abdomen and pelvis sections, or make two scans, one without contrast and one with contrast)

Table B. Scanning Protocols for the adult head exam

	Sequence 1	Sequence 2	Sequence 3	Sequence 4
Helical mode or Axial mode? (enter 'H' or 'A')				
Manual Mode / AEC mode (enter 'M' or 'A')				
AEC mode selected (AEC exams only)				
Tube potential, kVp				
Tube current, mA				
mAs per gantry rotation				
Time per gantry rotation (seconds)				
Scan field of view				
Contrast used during sequence? (enter 'Y' or 'N')				
Individual slice thickness acquired (mm)				
Number of simultaneous slices acquired per gantry rotation				
Total number of slices acquired during sequence				
Number of gantry rotations during sequence				
Scanning length during sequence enter length(mm) or brief description				
Table increment (mm) per gantry rotation (Helical mode) or per axial scan (Axial mode)				
Table speed (mm per second) (Helical only)				
Pitch (Helical only)				
Rotation angle (degrees) per axial scan (Axial only) <i>(this is NOT related to gantry tilt angle)</i>				

Comments

26) MDH model and CT ionization chamber model numbers

MDH model number
(e.g. '1015')

CT chamber model number
(e.g. '10X5-3CT')

MDH exposure and MDH time - NO phantom, free-in-air

Are you scanning the CT probe with DIFFERENT settings than 150 mA AND 5mm slice width AND 1 second rotation time?
If so provide your settings in the spaces below.

mA (if not 150 mA):

Slice width (if not 5mm):

Rotation time (if not 1 second):

If you are using kVp's other than 80, 100, 120, and 140 kV, indicate the kV's below

		Scan 1		Scan 2		Scan 3	
		MDH exposure (mR)	MDH time (seconds)	MDH exposure (mR)	MDH time (seconds)	MDH exposure (mR)	MDH time (seconds)
27) 80 kVp or <input type="text"/>	→	<input type="text"/>					
28) 100 kVp or <input type="text"/>	→	<input type="text"/>					
29) 120 kVp or <input type="text"/>	→	<input type="text"/>					
30) 140 kVp or <input type="text"/>	→	<input type="text"/>					

CT Phantom procedures: Routine Adult Abdomen + Pelvis Exam (items 31-58)

31) Is AEC technology used? (Y/N)

Adult Chest

Adult Abdomen

Adult Pelvis

AEC feature ON: Pre-scan technique factors page 31

32) Tube current (mA)

33) Gantry rotation time (s)

34) Slice thickness (mm)

35) Table speed(mm/sec)
OR Table feed (mm/rot)

include units!

Did you verify that kVp, scan field of view, and AEC mode are properly configured according to Table 25 A?

PRE-SCAN CT Dose quantity displayed, AEC ON

	a) Number displayed	b) Units displayed
36) Volume CTDI (CTDIvol)	<input type="text"/>	<input type="text"/>
37) Weighted CTDI (CTDIw)	<input type="text"/>	<input type="text"/>
38) Dose-Length Product (DLP)	<input type="text"/>	<input type="text"/>
39) Other : <input type="text"/>	<input type="text"/>	<input type="text"/>

40) Post-scan MDH reading for exposure, AEC ON [page 35](#)

a) Exposure (mR)

mR

Remember to RESET the MDH after recording your exposure reading!

Post-scan dose display, AEC ON.

a) Number displayed

b) Units displayed

41) Volume CTDI (CTDIvol)

42) Weighted CTDI (CTDIw)

43) Dose-Length Product (DLP)

44) Other:

Post-scan CT tube current (mA) values for the pelvis, abdomen, and chest phantom sections [page 35](#)

a) Tube current (mA)

b) mAs

45) Pelvis

46) Abdomen

47) Chest

Note: Not all CT systems will provide a post-scan display of mAs- consult with the technologist.

AEC feature OFF: Pre-scan tube current (mA) [page 38](#)

48) Pre-scan tube current, AEC feature OFF. mA

Did you verify that ALL console settings have NOT changed?

Pre-scan dose display, AEC feature OFF.

a) Number displayed

b) Units displayed

49) Volume CTDI (CTDIvol)

50) Weighted CTDI (CTDIw)

51) Dose-Length Product (DLP)

52) Other:

Post-scan MDH reading for exposure, AEC OFF

a) Exposure (mR)

53) mR

Post-scan dose display, AEC OFF

a) Number displayed

b) Units displayed

54) Volume CTDI (CTDIvol)

55) Weighted CTDI (CTDIw)

56) Dose-Length Product (DLP)

57) Other:

58) Post-scan display for mAs: mAs