Updates to the ACR CT Manual

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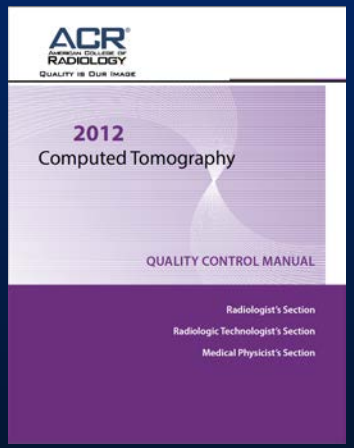
AAPM Spring Clinical
March 30, 2017



Disclosures

- Chair, ACR CT Physics Subcommittee
- Senior Reviewer, ACR CT Accreditation Program
- Vice President, Medical Physicist, Alliance Medical Physics, LLC

Disclaimer

- The revision of the 2012 ACR CT QC Manual is a work in progress.
- The CT QC manual currently available on the ACR website remains in effect until the revised manual is published.
- Some items in the presentation are still under discussion and subject to change.

ACR CT Physics Subcommittee

Current Members:

Will Breeden, MS
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Dustin Gress, MS
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ACR Staff:

Cynthia Davidson
Dina Hernandez

Outline

- Current ACR CT Program Statistics
- Changes to the ACR Accreditation Program
- Changes to the ACR CT Quality Control Manual
- New/Recent ACR FAQs
- Common Reasons for Failure of Submissions

Outline

- **Current ACR CT Program Statistics**
- Changes to the ACR Accreditation Program
- Changes to the ACR CT Quality Control Manual
- New/Recent ACR FAQs
- Common Reasons for Failure of Submissions

Current ACR CT Accreditation Program Statistics

- As of February 1, 2017

	Sites	CT Units
Accredited	7082	9475
Active (Accredited & In Process)	7201	9872

- 2016 Pass/Fail Rate: 87% (13% Fail)

Outline

- Current ACR CT Program Statistics
- **Recent changes to the ACR Accreditation Program**
- Changes to the ACR CT Quality Control Manual
- New/Recent ACR FAQs
- Common Reasons for Failure of Submissions

Recent changes to the ACR Accreditation Program

- QC Manual changes ongoing for more than a year, but preempted
- December 2016
  - Added the option to determine the pediatric abdomen CTDI with a 32 cm phantom (if applicable)
  - Added/Revised/Removed fields from:
    - Phantom Site Scanning Data Form
    - CTDI Calculations Forms

Updated Pediatric Abdomen Reference Values and Pass/Fail Criteria

Examination	Reference Value $CTDI_{vol}$ (mGy)	Pass/Fail Criteria $CTDI_{vol}$ (mGy)
Adult Head	75	80
Adult Abdomen	25	30
Pediatric Head (1 year old)	35	40
Pediatric Abdomen (40-50 lb.) -16 cm phantom	15	20
Pediatric Abdomen (40-50 lb.) - 32 cm phantom	7.5	10

Form Changes

- Fields Revised
  - Numerous decimal fixes
    - Report to the ACR if values do not fit
  - N and T have been reversed on all forms

- Fields Removed
  - Available Slice Thicknesses
  - Effective Dose

Fields Added: Phantom Site Scanning Data Form

- Dose Notification Value (mGy) (XR-25/XR-29)
  - Goal is to encourage using this feature
  - Optional
  - Not Scored
  - XR-29 compliance is not a requirement of ACR CT accreditation

Computed Tomography Accreditation Program
Phantom Site Scanning Data Form

CTAP#

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Manufacturer: Philips

Model: BRILLIANCE ICT 256

Geometry:
- (•) Rotate/Rotate (3rd generation)
- ( ) Rotate/Stationary (4th generation)
- ( ) Other

Spiral Helical Capability: (•) Yes ( ) No

Multi Slice Capability: (•) Yes ( ) No

Nmax: Maximum number of axial images able to be acquired simultaneously in one rotation (Nmax): 128.00

Minimum tube rotation time: 0.33 Sec

Available beam energies in kV:

- [ ] 70 kV
- [ ] 90 kV
- [ ] 110 kV
- [ ] 130 kV
- [x] 140 kV
- [x] 80 kV
- [x] 100 kV
- [x] 120 kV
- [ ] 135 kV
- [ ] Other

Types of Dose Reduction Options Available: DoseRight, Z-DOM, iD

Serial number of ACR CT Accreditation Phantom: 804740-1617

Name of person providing this data: Chad M. Dillon, MS, D

For this section, use techniques used on an average patient or calculate an average technique from several patient images. DO NOT ENTER AUTOMATIC TECHNIQUES.	Adult Head (cerebrum technique)	Adult Abdomen (mid-liver technique)	Pediatric Head (cerebrum technique) (1 year old)	Pediatric Abdomen (mid-liver technique) (40-50 lb)
kV	120	120	120	100
mA	136	458	156	208
Time per rotation (s)	0.75	0.40	0.50	0.50
mAs (calculated by the System)	102.00	183.20	78.00	104.00
Effective mAs (or mAs per slice) as displayed by scanner	260.0	200.0	200.0	105.0
Scan FOV (cm)	50	50	50	50
Display FOV (cm)	25.00	35.00	20.00	35.00
Reconstruction Algorithm	Brain Sharp (UC), iDos	Standard (B), iDose = 1	Brain Sharp (UC), iDos	Standard (B), iDose = 2
~~Axial (A) or~~ Helical (H)	Helical	Helical	Helical	Helical
# Data Channels used in a single rotation (N)	64	128	64	128
Z-axis width of each data channel (T) in mm	0.625	0.625	0.625	0.625
Table ~~increment (I); Axial Scans~~ (mm) or Helical Table Speed (mm/rotation)	15.68	73.20	15.64	79.44
IEC definition for this protocol (Pitch = I / N • T) (calculated by the System)	0.39	0.92	0.39	0.99
Reconstructed Image Width (mm)	3.000	3.000	3.000	3.000
Reconstructed Image Interval (mm)	3.000	3.000	3.000	3.000
Dose Reduction Technique(s) used in routine patient scanning for these protocols (DO NOT scan the ACR phantom or the CTDI phantoms with dose reduction techniques other than iterative reconstruction)	N/A	DoseRight, Z-DOM	N/A	DoseRight, Z-DOM
Dose Notification Value (mGy) as described in XR-29 (leave blank if not applicable)				

Save

Fields Added: CTDI Calculation Forms

- Size Specific Dose Estimate (SSDE) in mGy
  - Adult Abdomen (35 cm Effective Diameter)
  - Pediatric Abdomen (18.5 cm Effective Diameter)
  - Automatically calculated
  - Refer to AAPM Report TG204 for further information

- Scanner Reported $CTDI_{vol}$
  - Should be less than 20% per the ACR CT QC manual (must be for The Joint Commission)
  - Optional Field
  - Not Scored

Computed Tomography Accreditation Program
Dose Calculator Spreadsheet (Exposure)
Radiation Dosimetry (Pediatric Abdomen) (40-50 lb)

CTAP#

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Note: For pediatric (40-50 pounds) abdomen protocols, some CT scanners report CTDIvol using the 16 cm phantom, while others use the 32 cm phantom. The physicist should select the phantom (16 or 32 cm) that is used by the scanner to report CTDIvol.

CTDI Phantom (16-cm or 32-cm diameter PMMA Phantom)	Measured	Calculated
Size of phantom the scanner uses to report CTDIvol for routine pediatric abdomen protocol (40-50 lb)	32 cm	
kV	100	
mA	208	
Exposure time per rotation (s)	0.50	
# data channels used (N)	128	
Z-axis collimation (T) in mm	0.625	
Axial (A): Table increment (mm) = (I) OR Helical (H): Table Speed (mm/rot) = (I)	79.44	
Active Chamber Length (mm)	100	
Chamber correction factor	1.0000	
Center		
Measurement 1 (mR)	206.8	
Measurement 2 (mR)	208.6	
Measurement 3 (mR)	206.8	
Average of above 3 measurements (mR)		207.40
Ped Body CTDI at isocenter in phantom (mGy)		2.26
12 o'clock position		
Measurement 1 (mR)	463.6	
Measurement 2 (mR)	451.1	
Measurement 3 (mR)	452.3	
Average of above 3 measurements (mR)		455.67
Ped Body CTDI at 12 o'clock position in phantom (mGy)		4.96
CTDIw (mGy)		4.06
Clinical exam dose estimates (using measured CTDIw and site's Pediatric Abdomen Protocol (40-50 lb) from Site Scanning Data Form)		
CTDIvol (mGy)	=CTDIw*N*T/I	4.09
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form	4.50	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		9.11
Dose Notification Value (mGy) as described in XR-29		
DLP (mGy-cm)	=CTDIvol*15	61.33
SSDE for 18.5 cm water equivalent diameter (mGy)	=SSDE(18.5cm)	7.68

Save

Clinical exam dose estimates (using measured CTDIw and site's Pediatric Abdomen Protocol (40-50 lb) from Site Scanning Data Form)		
CTDIvol (mGy)	=CTDIw*N*T/I	8.76
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form	4.50	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		21.78
Dose Notification Value (mGy) as described in XR-29		
DLP (mGy-cm)	=CTDIvol*15	131.42
SSDE for 18.5 cm water equivalent diameter (mGy)	=SSDE(18.5cm)	16.45

Warning: 7.5 mGy is a reference level and 10 mGy is pass/fail criteria. Recommend consulting with your qualified medical physicist before submitting.

Save

Outline

- Current ACR CT Program Statistics
- Changes to the ACR Accreditation Program
- **Changes to the ACR CT Quality Control Manual**
- New/Recent ACR FAQs
- Common Reasons for Failure of Submissions

General Changes

- No major additions
- Updated to reflect ACR accreditation program changes since the first revision in 2012
- Wordsmithing/Revisions for clarification or emphasis of various points
- Various References were updated to more current versions, i.e. Practice Parameters

Radiologist Section

Radiologist Section – Introduction

- QMP is responsible to determine additional testing

"Facilities should refer to their state and local regulations to remain in compliance when these are more restrictive. The determination of additional QC testing to be performed to comply with state and local regulations should be determined by a qualified medical physicist."

Radiologist Section – Definition of Quality Assurance

- Quality Assurance Committee expanded to include
  - A supervisory, lead or senior CT technologist”

Radiologist Section – Definition of Equipment Quality Control

"Acceptance testing should take place before a patient is scanned and after major repairs."

Radiologist Section – Radiologist Responsibilities

"Provide the appropriate training, test equipment and materials necessary for the technologist to perform the QC tests."

- Note that this is in collaboration with the Qualified Medical Physicist

Radiologist Section – Responsibilities of the QMP
Purchase Specifications and Acceptance Testing

- Revised to a more objective statement:

"Many manufacturers sell CT systems with a large variety of features. Due to its complexity, a CT system's quality under all scan conditions may be difficult to discern before purchase."

Radiologist Section – Purchase Specifications and Acceptance Testing

"The purchase should be made contingent on satisfactory performance during acceptance testing. The purpose of acceptance testing is primarily to determine if the CT equipment performs according to the manufacturer's specifications as stated in the documentation received from the manufacturer. Acceptance testing should be conducted by an experienced QMP. The manufacturer specified phantoms and tests procedures must be used when comparing measured performance values to those specified by the manufacturer, which must be compliant with FDA and IEC standards. The description of acceptance testing procedures and limits is outside the scope of this document; however, testing performed during acceptance testing provides an opportunity to establish baseline values that will serve as the basis for comparison for ongoing QC testing."

Radiologist Section – Purchase Specifications and Acceptance Testing

"The QC program described in this manual is intended to document consistency of performance after the unit has been accepted and put into service. Therefore, the Qualified Medical Physicist should consider using the results of these acceptance tests wherever possible as part of an initial set of baseline tests for the ongoing QC program. The QMP may also consider performing additional tests (that is, tests that are not determining whether the scanner meets the manufacturer's specifications) but that can serve as the initial testing of a condition that will be evaluated at a later time; essentially performing the baseline test which will be used as a comparison for the daily, weekly, quarterly or annual tests described in this manual."

Radiologist Section – CT QC Technologist's Responsibilities

- Added:

"The QC technologist is also a key member of the team that is developing and reviewing all new or modified CT protocol settings to ensure that both image quality and radiation dose are appropriate."

Technologist Section

Technologist Section – Important Points – Quality Control Records

- Recommendation for keeping records updated
  - QC Documentation - 3 years
  - QC Images – 3 months

"QC records for an individual scanner should be kept for 3 years or in compliance with local regulations and accreditation mandates. QC images should be maintained for 3 months or until reviewed by the qualified medical physicist."

Technologist Section – Important Points – Action Limits

- Added:

"Keep in mind that manufacturers might only initiate service if their standards (e.g. manufacturer specified testing procedures with specified phantom and action limits) are not met. It is important for the facility, the qualified medical physicist, and the service engineer to maintain a close working relationship."

Technologist Section – Important Points - Scanner Repairs

"QC testing should be completed after major repairs and ideally prior to the first clinical scan after the repair. However, if, this is not feasible, then the water phantom testing should be completed at a minimum and complete testing may be postponed until the first feasible opportunity to complete it."

Technologist's Section - Daily CT Quality Control

- Water CT Number and Standard Deviation:

"Images of the water phantom are acquired in either the axial or helical scan modes (or both) using predetermined scan techniques."

Technologist Section – Water CT Number and Standard Deviation (Noise) – Test Procedure

- Water mean and standard deviation values must be monitored in either the axial or helical scan mode and may be monitored in both modes; that is, the qualified medical physicist should assist the QC technologist to establish (and ideally pre-program) the desired scan in one of these modes. If the QMP desires, then they can assist the QC technologist in establishing (and again, ideally pre-program) the desired scan for the other mode, which will typically be performed less frequently.

Technologist Section – Water CT Number and Standard Deviation (Noise) – Test Procedure

- Removed:

"Repeat the above measurement for an image that is either at the leading or trailing edge of the fan beam during the acquisition (ie, an image at the beginning or end of the stack). Repeat the measurements of Step 1."

Technologist Section - Water CT Number and Standard Deviation (Noise) – Data Interpretation and Corrective Action

- Expanded upon baseline setup:

"Note that the baseline value might be different on some scanners and should be established by the qualified medical physicist. The qualified medical physicist may establish limit criteria for noise (standard deviation) for either axial or helical modes (or both) after consulting manufacturer's recommendations. Due to scanner and setup fluctuations, it may be advisable to perform a 10 day (or more) average of standard deviation data when establishing baselines."

Technologist Section - Water CT Number and Standard Deviation (Noise) – Data Interpretation and Corrective Action

- Updated corrective action:

"If either the mean CT number or the noise (standard deviation) is not within the criteria established by the QMP, the phantom, phantom positioning, phantom image used, ROI placement, and protocol used should be double checked. Additionally, air calibrations (if recommended by the manufacturer) should be run. The test should then be repeated. If the test is still failing, consult the QMP for guidance. The QMP should assist in determining whether or not service should be contacted, and, if necessary, if the service should be done prior to clinical imaging."

Technologist Section - Artifact Evaluation – Test Procedure

- Manufacturer's are not necessarily providing large phantoms.
- 32 cm CTDI phantom can be used
- "Please also note that an alternative method involving air scans is described in the ACR CT Accreditation Program FAQ pages."
- FAQ to be developed

Technologist Section – Artifact Evaluation – Data Interpretation and Corrective Action

"Some other artifacts, such as lines or streaks, can be caused by contrast material that has spilt onto the gantry. If these types of artifacts are present, inspect the gantry window and clean off any contrast material that may be present. This can be a quick and effective fix of an artifact source and can avoid downtime and a visit from the service provider. Make sure to repeat the scan to confirm that the artifact in no longer present on the images."

Technologist Section –
Artifact Evaluation –
Data Interpretation and Corrective Action

"After the QC technologist has viewed many artifact images, he or she may begin to recognize subtle artifacts that are very unlikely to be visible in a patient scan. The QC team should consider developing criteria to use with each scanner to avoid overreacting to subtle artifacts that cause unnecessary downtime. For example, the QC team might require a difference greater than 3 HU between the artifact mean CT number (within the ring or circle) and the unaffected background mean prior to arranging for service to address the artifact."

Technologist Section – Visual Checklist

- Removed:
  - High-voltage cable/other cables safely attached (and not frayed)
  - Display window width/level
  - Door interlocks functioning
- Added:
  - X-ray on indicator functioning (At the console)

Technologist Section – Visual Checklist

- Edited:
  - Service records maintained/accessible to the facility
  - As opposed to “present”
- Items that do not pass the visual checklist should be replaced or corrected immediately if they are related to patient or worker safety; and should be replaced or corrected within 30 days otherwise.

Technologist Monthly Quality Control – SMPTE Pattern

- Added to grey scale procedure:

"(note that there are 2 adjacent squares that are both labelled as 50% which should appear to be equivalent)"

- Description of how to review SMPTE

"As part of the preventative maintenance program of the CT scanner, the display monitors of the CT scanner should be checked at least annually."

Technologist Section – Appendix

- New consolidated QC form
  - One Month of all QC on one form
- Can still use old or custom forms

CT EQUIPMENT QUALITY CONTROL DATA FORM

Facility Name: _____

Month: _____ Year: _____ CT Scanner: _____

Day	Warm Up	Air Cals	Mode	CT_{water} (HU)	Noise (SD)	Artifacts	P/F	Initials
1			Axial					
2			Helical					
3			Axial					
4			Helical					
5			Axial					
6			Helical					
7			Axial					
8			Helical					
9			Axial					
10			Helical					
11			Axial					
12			Helical					
13			Axial					
14			Helical					
15			Axial					
16			Helical					
17			Axial					
18			Helical					
19			Axial					
20			Helical					
21			Axial					
22			Helical					
23			Axial					
24			Helical					
25			Axial					
26			Helical					
27			Axial					
28			Helical					
29			Axial					
30			Helical					
31			Axial					
Action Limits:			CT_{water} = 0 ± 5 HU		Noise: A ≤		H ≤	

Comments/Corrective Action

Monthly Visual Checklist

GANTRY	Table height indicator	
	Table position indicator	
	Angulation indicator	
	Laser localization light	
	Smoothness of table motion	
	X-Ray on indicator	
CONTROL CONSOLE	Exposure switch	
	Panel switches/lights/meters	
	X-Ray on indicator	
	Warning labels	
	Intercom system	
OTHER	Postings	
	Service records maintained/accessible	

Monthly Acqusition Display Monitor

SMPTE PATTERN	0%-5% contrast is discernible	
	95%-100% contrast is discernible	
	Distinct gray level steps	
	Alphanumerics discernible	
	High contrast patterns visible	
	Low contrast patterns visible	
	No artifacts (distortion, burn-in, blur, etc.)	

Window: Level:

Monthly Large Artifact Check

If available, scan manufacturer's large phantom

Results/Artifacts:

Date of Monthly QA: **Initials:**

PASS = P or ✓ FAIL = F NOT APPLICABLE = NA

Notes:
Air Calibration frequency is per manufacturer recommendation.
Continue Comments/Corrective action on back of sheet, if needed.

Qualified Medical Physicist Reviewer

Date of Review

Medical Physicist's Section

Medical Physicist Section – Introduction

Regarding the role of the Qualified Medical Physicist:

"Although equipment service engineers ensure the system is performing to within manufacturer's specifications and technologists perform specified calibrations and QC, the QMP is uniquely qualified to perform certain tests and then analyze the data to determine which sets of specifications are relevant to a particular imaging problem. The QMP is able to bridge the gap between the technical aspects and clinical image quality of the system. The QMP testing allows the QMP to recognize equipment failures before they unacceptably degrade clinical images."

Medical Physicist Section – Introduction

"Communicating test results and recommending corrective action are areas that should be given focused attention, as this is a vital interface between the technical assessment and the clinical practice."

- Regarding suggested acceptable limit criteria:

"In some cases, the manufacturer's testing conditions (phantom, protocol) and specifications may take into account specific capabilities and functions of the scanner and therefore may be preferred."

Medical Physicist Section - QMP Annual Quality Control

"It should be noted that there is great diversity in scanner technology, phantoms, testing procedures and tolerances. The primary intent of the ACR CT QC manual is to establish a QC program and a secondary goal is to provide a reasonably uniform approach to testing. However, there may be instances where the QC manual's described tests may not be appropriate for a specific test on a specific scanner (for some existing examples, see the ACR CT Accreditation program FAQ and specifically pages 4-7. Use of the manufacturer's phantom, testing procedure and specifications, especially in these situations, is appropriate and encouraged.

In instances where a scanner does not pass a specification recommended by the ACR in their QC manual or a specification that the medical physicist designed, the following steps should be followed before issuing a call to the manufacturer's service engineer. First, the test should be repeated to confirm the result. Next, the manufacturer's Technical Manual should be consulted. If the same type of test is provided in the manufacturer's technical manual, then that test should be performed as specified by the manufacturer and applying the manufacturer's specification. If the manufacturer's specification is passing and the clinical images do not have a clinically significant image quality issue, corrective action is likely not needed. If the manufacturer-provided test result is outside the manufacturer's specification, or there is believed to be a clinically significant degradation of image quality on the images used for diagnosis, service should be contacted. "

Medical Physicist Section - QMP Annual Quality Control

"Communication is key in these instances. The QMP should not just perform a test and inform the site that a service call is required; the QMP has a responsibility to provide clear communication regarding the following:

- The specific metric/issue under discussion
- The specific tests have been performed, including test objects
- The observed/measured results
- The specifications (e.g. manufacturer's specifications) not being met

The site has the responsibility to ensure that effective and timely corrective action is performed and documented and that any comments or recommendations for quality improvement are addressed.

If the manufacturer does not provide specifications for a particular test, then the ACR or medical physicist's test result should be benchmarked and monitored over time. Please note additional testing outside of the manufacturer specifications may not be supported by the manufacturer. "

Medical Physicist Section - Review of Clinical Protocols

- Under Development
- General Consensus
  - Physicist is an integral part of the CT Protocol Review Team
  - Physicist should accessible to the Team for their meetings
    - Does not have to be on site

Medical Physicist Section - Review of Clinical Protocols

- With respect to developing dose thresholds:

"This may include dose notification values (XR-25/XR-29), dose thresholds for the facility's enterprise radiation dose monitoring systems, and/or other thresholds required to satisfy state and/or other accreditation body standards."

Medical Physicist Section - Review of Clinical Protocols

- Precautions and Caveats
  - Responsible Technologist should make any changes recommended by the QMP
  - QMP should provide assistance if necessary

Medical Physicist Section - Review of Clinical Protocols

- Added:

"The review should be consistent with the AAPM Medical Physics Practice Guideline 1.a.: AAPM CT Protocol Management and Review Practice Guideline [4]"

Medical Physicist Section – Radiation Beam Width

"Each unique N × T product that is used clinically should be measured, adjusting table position as appropriate for the detector being used"

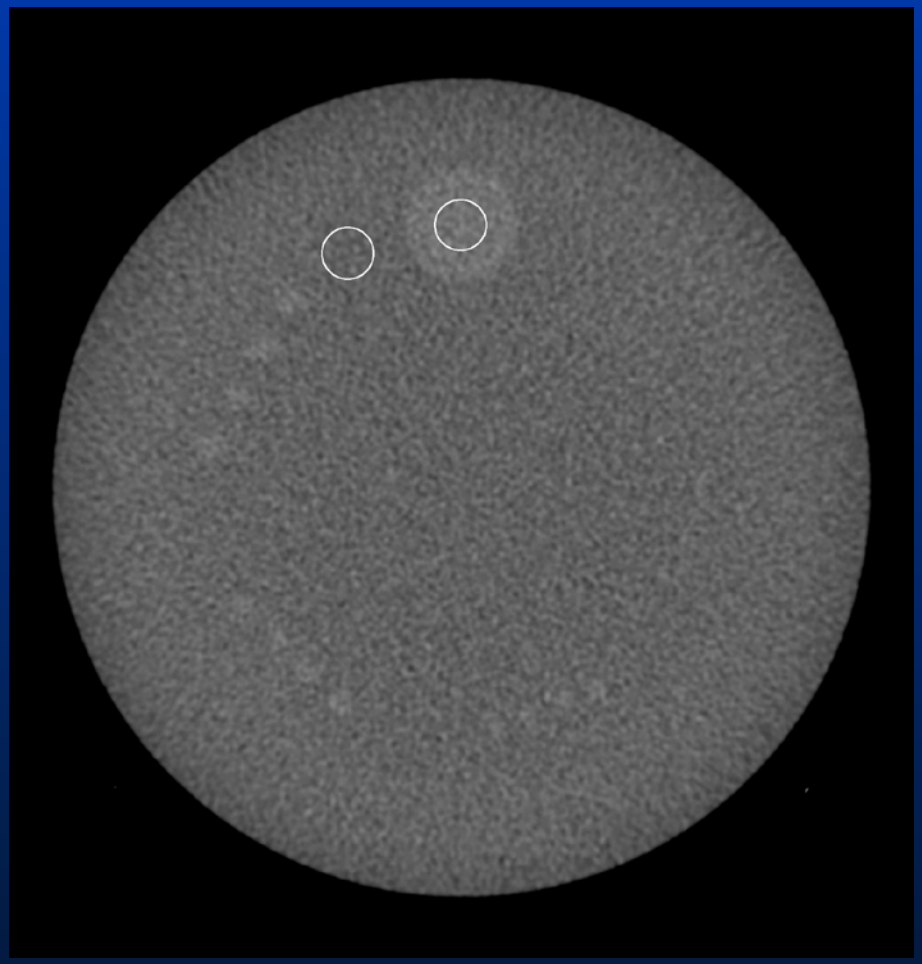
Criteria:

"You may use the manufacturer's specifications as the performance criteria. These specifications can usually be found in the manufacturer's technical specifications documentation. If the radiation beam width is outside of manufacturer's specifications using their specified procedure, service should be contacted for corrective action."

"However, if these specifications are not readily available, then the measured radiation beam width should be accurate to within 3 mm or 30% of the total nominal collimated beam width (N × T), whichever is greater. If the radiation beam width does not meet this criteria, an effort should be made to obtain the specifications from the manufacturer. If these are not able to be obtained, then service should be notified to evaluate the radiation beam width."

Medical Physicist Section - Low-Contrast Performance

- Updated to indicate area ROI 100 mm^2
- New image with appropriate ROI size and location
- Removed visual analysis



Medical Physicist Section - Low Contrast Performance

Previous Limits

Scan protocol	CNR
Adult Head	1.0
Pediatric Head	1.0
Adult Abdomen	1.0
Pediatric Abdomen	0.5

Updated Limits

Scan protocol	CNR
Adult Head	1.0
Pediatric Head	0.7
Adult Abdomen	1.0
Pediatric Abdomen	0.4

- Corrective action time frame:

"As soon as feasible upon determination of suboptimal performance."

Medical Physicist Section - CT Number Accuracy

"Perform scans of the CT number accuracy section of the phantom with each kV setting available on the scanner for one protocol (i.e. it is not required to test all CT number accuracies at each kV for each protocol)."

Medical Physicist Section
CT Number Accuracy - Criteria

"If measured values fall outside of the specified ranges, scanner calibrations should be run (if the manufacturer provides such user calibrations) and the test repeated. If the values remain outside the ranges, then the manufacturer's technical manual should be consulted and the manufacturer's tests should be performed. If the results of these tests are outside the manufacturer's specifications, then service should be contacted. If it has been verified that the scanner is properly calibrated and the numbers remain outside of the ranges, then the QMP should establish new baseline values and acceptable ranges."

Medical Physicist Section - Artifact Check - Required Equipment

"It is recommended that a large diameter phantom also be used, if available, to evaluate artifacts that may occur outside the reconstructed field of view of the ACR CT Phantom, which is limited to 20 cm. If a large diameter phantom is not available from the scanner manufacturer, the CTDI phantom (32cm) may be used. In addition, the ACR FAQ's describe an alternative method in which air scans are used in lieu of a large phantom."

Medical Physicist Section – Artifact Check - Precautions and Caveats

- Some scanners will demonstrate a noticeable bright ring just inside the phantom border. **This is sometimes from the automatic corrections a scanner makes when a "routine head" scan protocol is performed and the scanner anticipates a skull will be present.** This artifact may be excluded from consideration.

Medical Physicist Section – Dosimetry – Test Procedure

Note: For pediatric (40-50 pounds) abdomen protocols, some CT scanners report CTDIvol using the 16 cm phantom, while others use the 32 cm phantom. The physicist should select the phantom (16 or 32 cm) that is used by the scanner to report CTDIvol.

Medical Physicist Section – Dosimetry – Data Interpretation and Analysis

"For pediatric body scans performed on some scanners, the 32-cm dosimetry phantom is used in reporting CTDIvol, while others use the 16-cm dosimetry phantom for reporting. (Since the physicist should use the use the CTDI phantom (16 or 32 cm) that is used by the scanner to report CTDIvol, the measured CTDIvol value is directly comparable to the reported value.)"

Medical Physicist Section – Dosimetry

"Measured values not within 20% of the values reported by the scanner should be investigated further. In some cases, or under certain scan conditions, the manufacturer's specifications allow larger deviations between measured and displayed value (up to +/- 30 or 40%). In these cases, the testing should be repeated under the manufacturer's specified conditions and using the manufacturer's specified tolerances. If these are exceeded, then service may be called."

Medical Physicist Section – Dosimetry – Timeframe for Corrective Action

"For $CTDI_{vol}$ values exceeding ACR CTAP limits, efforts to reduce dose by modifying protocol settings should begin as soon as possible, in consultation with the technologist and the radiologist."

CT Scanner Display Calibration – Test Procedure

Added:

"In the scan room displays used for interventional/biopsy procedures must provide good low-contrast visualization in typically bright room conditions. Consider repeating the above on all CT image acquisition displays."

Revised:

"The maximum brightness should be greater than or equal to 100 cd/m^2, and the luminance ratio should be greater than equal to 100."

CT Scanner Display Calibration – Test Procedure

"If after corrective action is attempted and the monitor does not meet these specifications, additional action should be determined by the lead interpreting physician in consultation with a qualified medical physicist. If the monitor is exclusively used for image acquisition and localization and not for clinical image interpretation, then it may be determined that it is acceptable to continue to use it based on this consultation."

Medical Physicist Section

- Removed:
  - Image Thickness Section

Caution!

- This is still required by:
  - The Joint Commission
  - IAC
  - Possibly State/Local Regulations

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- Changes to the ACR CT Quality Control Manual
- **New/Recent ACR FAQs**
- Common Reasons for Failure of Submissions

New FAQ – Axial Wide Beam

Q. Our scanner has several protocols that are done in a single gantry rotation, with no table movement, and which use collimations greater than 100mm, i.e. the length of my ion chamber. How do I calculate the dose for these protocols?

New FAQ – Axial Wide Beam

A. For single rotation protocols with clinical collimations greater than 100mm, e.g. 320 x 0.5mm, make the physical dose measurement in the same way you ordinarily would by centering the phantom/ion chamber and performing an axial rotation using the actual clinical technique and collimation. In this situation the X-ray beam will exceed the length of the chamber but this will be taken in account in the CTDI field on the dose form in your online testing package (and the generic excel form available on the ACR CT Accreditation Testing and QC forms webpage) to avoid an inaccurately low CTDIvol. For collimations that equal or exceed 100mm, the dose index should be determined by using 100mm in lieu of NxT in the calculation. When filling out the CTDI calculation form, any N and T that give a product of 100 would be acceptable, i.e. N =1 and T = 100mm. The table increment should also be set 100mm.

New FAQ – Helical Wide Beam

Q. Our scanner has helical protocols which use collimations greater than 100mm, i.e. the length of my ion chamber. How do I calculate the dose for these protocols?

New FAQ – Helical Wide Beam

A. For helical protocols with clinical collimations greater than 100mm, e.g. 256 x 0.625mm, make the physical dose measurement in the same way you ordinarily would by centering the phantom/ion chamber and performing an axial rotation using the axial equivalent of the clinical helical technique and collimation. In this situation the X-ray beam will exceed the length of the chamber but this will be taken in account in the CTDI field on the dose form in your online testing package (and the generic excel form available on the ACR CT Accreditation Testing and QC forms webpage) to avoid an inaccurately low CTDIvol. For collimations that equal or exceed 100mm, the dose index should be determined by using 100mm in lieu of NxT in the calculation. The table speed (I) should be changed to yield the same pitch value used clinically. For example, if the helical scan uses N = 256, T = 0.625mm, and pitch = 0.75, the following should be input into the CTDI calculation form: N = 1, T = 100, and I = N x T x pitch = 1 x 100 x 0.75 = 75 mm/rotation.

Recent FAQ – Scan FOV

Q. For the pediatric body CTDI measurement, if a site's clinical protocol dictates the use of the 32 cm phantom with a Scan Field of View (SFOV) that limits the Display Field of View (DFOV) such that the entire phantom is not visualized, is that acceptable?

A. Images of the 32 cm phantom at these small SFOVs may be cut off and that is acceptable.

- This can be an issue on
  - Toshiba (24 cm SFOV)
  - GE (32 cm SFOV)

Recent FAQ – Scan FOV

Example: For the pediatric body protocol on scanner A, the clinical protocol uses the small body SFOV. For this SFOV, the scanner reports CTDIvol using the 32 cm phantom (in accordance with IEC standards). However, when the phantom is scanned, the maximum DFOV is only 24 cm and the outer portion of the phantom is cutoff, leaving only the central 24 cm (and central hole) of the phantom visualized. Because the site is making the measurement using the correct clinical protocol (including the correct bowtie filter as dictated by the SFOV), the measurement will be correct and will also match what the manufacturer is using to report CTDIvol. Not visualizing the full phantom is acceptable.

Example: For the pediatric body protocol on scanner B, the clinical protocol uses the small body SFOV. However, for this scanner and this SFOV, the scanner reports CTDIvol using the 16 cm phantom. Therefore, the site uses the 16 cm phantom for its measurement and the entire phantom should be visualized. Again, because the site is making the measurement using the correct clinical protocol (including the correct bowtie filter as dictated by the SFOV) and the phantom size that matches what the manufacturer is using to report CTDIvol, the measurement will be correct and will also match that of the manufacturer. In this case, the entire phantom should be visualized and is acceptable.

Outline

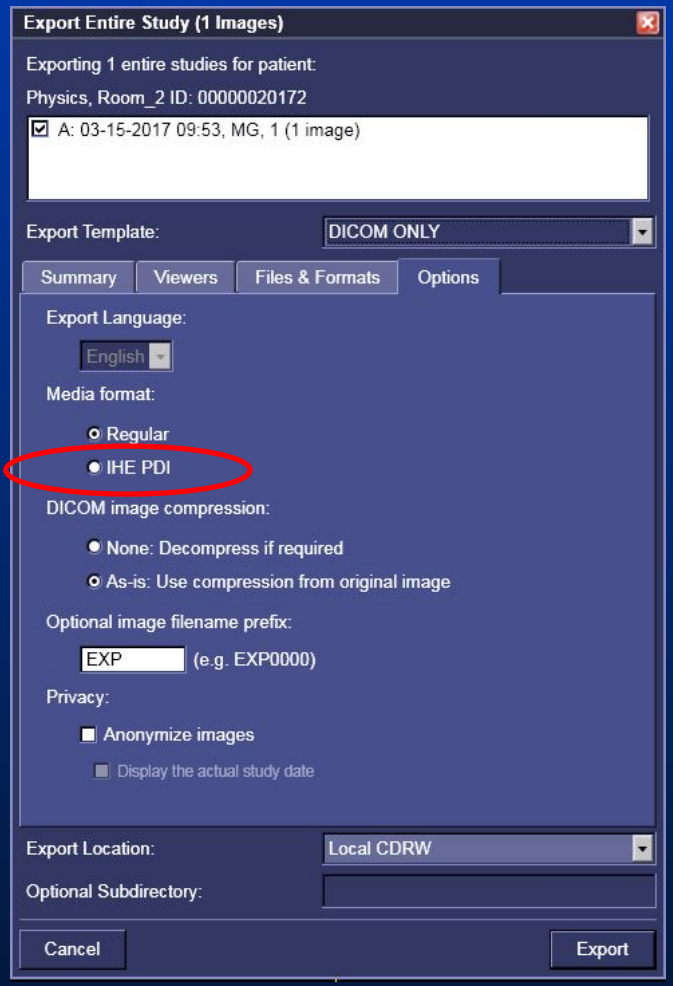
- Current ACR CT Program Statistics
- Changes to the ACR Accreditation Program
- Changes to the ACR CT Quality Control Manual
- New/Recent ACR FAQs
- **Common Reasons for Failure of Submissions**

Common Reasons for Failure

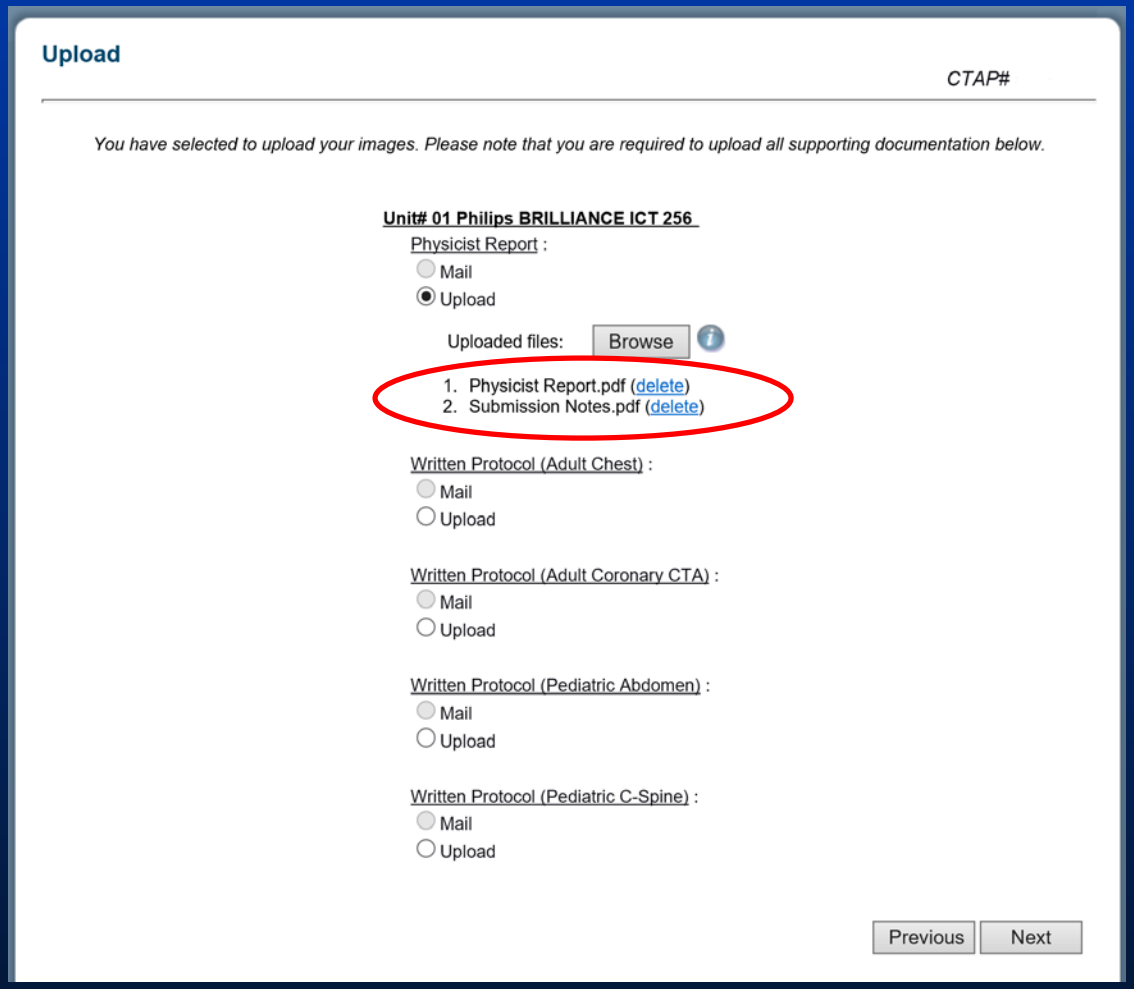
- Missing Images
- Unable to open images
- Forms do not agree with Images
  - Effective mAs (mAs per Slice) vs mAs and mA
  - Inconsistent kVp and slice thickness
  - Typos
- Artifacts

Tip: Unable to Open Images

- Tip for McKesson PACS
- Select “IHE PDI” to burn images that will open with ClearCanvas



Tip: Include Additional Documentation



Tip: Effective mAs

The terms **Effective mAs**, **mAs/slice** and **mAs per slice** are equivalent.

To calculate effective mAs:

$$effective\ mAs = \frac{mAs}{pitch} \qquad \text{(Eq. 1)}$$

To calculate mAs:

$$mAs = effective\ mAs \times pitch \qquad \text{(Eq. 2)}$$

To calculate mA:

$$mA = \frac{effective\ mAs \times pitch}{time\ per\ rotation\,(\text{sec})} \qquad \text{(Eq. 3)}$$

Further Tips

- Don’t submit excess images, i.e. all annual survey images
- Fill out the Phantom Data Forms and CTDI Calculation forms, and upload images yourself
- Double check that your Phantom Data Forms and CTDI forms match
- Check to make sure images open with ClearCanvas and that they are actually on the CD.

Questions?