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Digital Imaging and Communications in Medicine (DICOM)

Supplement 126: Colon Computer-Aided Detection SR SOP Class

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22 *Prepared by:*

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28 Developed pursuant to DICOM Work Item Number 2005-12-C

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Table of Contents

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136 <h1 align="center">Scope and Field of Application</h1>

138 This supplement to the DICOM standard introduces the DICOM format for the results of computer-aided detection (CAD) of potential malignancies in colon radiographs. The supplement provides the means for encoding a CAD system's colon analysis. This includes such basic information as:

140 • Lesion type, e.g., colon polyp
• Bounding regions of lesions, as given by a rectangle, ellipse or polyline

142 The supplement does not define a DICOM format for advanced colon findings more commonly associated with computer-aided diagnosis. Examples of such findings include the interpretations of inferred pathology
144 and disease for the colon radiograph. The existing structure will be extensible, such that inclusion of computer-aided diagnosis information may be added when these results and the most clinically
146 appropriate reporting structure are better understood.

148 This supplement to the DICOM standard only defines how the results of a computer's colon analysis should be encoded. It does not define or describe inputs to the colon CAD system other than use of colon CAD output (e.g. prior report) as input to subsequent temporal analyses; nor does it describe output for
150 studies other than colon radiographs. Note that the input may be comprised of digitized or digitally acquired X-ray images, CT slices or other germane colon images. Some of the information described is
152 beyond that which current colon CAD systems can produce. However, the DICOM committee includes it because it is expected to become relevant.

154 The colon CAD output is in the form of a DICOM Structured Report. The report can be used on its own, for example for displaying the detected polyps on a monitor or printer. It can be used within a larger Structured
156 Report document, e.g., as part of a comprehensive colon imaging report. It can even be used as input to a colon CAD system, for example to provide information on detections in prior colon radiography procedures.
158 In all cases, the output is a Structured Report (SR), so readers should become familiar with the Comprehensive SR IOD and corresponding SOP class. In addition, provision has been made to allow
160 description of the colon CAD output using common colon terminology and nomenclature (see additions to PS 3.16, Normative References).

162 This document specifies the Colon CAD SR IOD and the corresponding Colon CAD SR Storage SOP class. It is modeled after the DICOM Chest CAD SR IOD and its corresponding Chest CAD SR Storage
164 SOP class.

166 The Colon CAD SR IOD is designed to allow minimal content, depending on the capabilities of the colon CAD system producing this object. Since the content tree defined in this document can incorporate many of the same interpretations a human observer would make, it is not a requirement that colon CAD systems
168 be able to encode fully all content items in the content tree templates. Instead, colon CAD systems may populate optional content items as they see fit, to meet the requirements of the user; different colon CAD
170 systems may produce different content.

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Changes to NEMA Standards Publication PS 3.2-2008

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Digital Imaging and Communications in Medicine (DICOM)

Part 2: Conformance

182

182 **_Add new SOP Classes in Table A.1-2_**

Table A.1-2
184 **UID VALUES**

UID Value	UID NAME	Category
…		
1.2.840.10008.5.1.4.1.1.88.69	**Colon CAD SR**	**Transfer**
…		

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192

Changes to NEMA Standards Publication PS 3.3-2008

194 **Digital Imaging and Communications in Medicine (DICOM)**

Part 3: Information Object Definitions

196

196 | **Add the following to PS 3.3 Section 4 Symbols and Abbreviations**

Colon CAD   Computer-Aided Detection and/or Computer-Aided Diagnosis for colon radiography

198

Add the following to PS 3.3 Annex A

200 | **Update the Composite Module Table A. 1-2 to include Colon CAD SR IOD and Modules**

IODs Modules	Colon CAD SR
Patient	**M**
Clinical Trial Subject	**U**
General Study	**M**
Patient Study	**U**
Clinical Trial Study	**U**
SR Document Series	**M**
Clinical Trial Series	**U**
General Equipment	**M**
Enhanced General Equipment	**M**
SR Document General	**M**
SR Document Content	**M**
SOP Common	**M**

202 **A.35 STRUCTURED REPORT DOCUMENT INFORMATION OBJECT DEFINITIONS**

A.35.X Colon CAD SR Information Object Definition

204 **A.35.X.1 Colon CAD SR Information Object Description**

The Colon CAD SR IOD is used to convey the detection and analysis results of a colon CAD device. The
206 content may include textual and a variety of coded information, numeric measurement values, references
to the SOP Instances, and spatial regions of interest within such SOP Instances. Relationships by-
208 reference are enabled between Content Items.

A.35.X.2 Colon CAD SR IOD Entity-Relationship Model

210 The E-R Model in Section A.1.2 of this Part applies to the Colon CAD SR IOD. The Frame of Reference IE, and the IEs at the level of the Image IE in Section A.1.2 are not components of the Colon CAD SR IOD.

212 Table A.35.X-1 specifies the Modules of the Colon CAD SR IOD.

A.35.X.3 Colon CAD SR IOD Module Table

214 Table A.35.X-1 specifies the Modules of the Colon CAD SR IOD.

Table A.35.X-1
216 **COLON CAD SR IOD MODULES**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	SR Document Series	C.17.1	M
	Clinical Trial Series	C.7.3.2	U
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Document	SR Document General	C.17.2	M
	SR Document Content	C.17.3	M
	SOP Common	C.12.1	M

218 **A.35.X.3.1   Colon CAD SR IOD Content Constraints**

A.35.X.3.1.1   Template Constraints

220 The document shall be constructed from TID 4120 Colon CAD Document Root invoked at the root node.

Note: All Template and Context Group definitions are located in PS 3.16, Content Mapping Resource, in the
222   Annexes titled Structured Reporting Templates and DCMR Context Groups, respectively.

224 **A.35.X.3.1.2   Value Type**

Value Type (0040,A040) in the Content Sequence (0040,A730) of the SR Document Content Module is
226 constrained to the following Enumerated Values (see Table C.17.3-7 for Value Type definitions):

TEXT
228   CODE
NUM
230   DATE
TIME
232   PNAME
SCOORD
234   COMPOSITE
IMAGE
236   CONTAINER
UIDREF
238   SCOORD3D

240 **A.35.X.3.1.3   Relationship Constraints**

The Colon CAD SR IOD makes use of by-reference INFERRED FROM and by-reference HAS ACQ
242 CONTEXT relationships. Other relationships by-reference are forbidden. Table A.35.X-2 specifies the
relationship constraints of this IOD. See Table C.17.3-8 for Relationship Type definitions.

244   **Table A.35.X-2**
RELATIONSHIP CONTENT CONSTRAINTS FOR COLON CAD SR IOD

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	CODE, NUM, IMAGE[1], CONTAINER, UIDREF, DATE, TIME.
TEXT, CODE, NUM, CONTAINER	HAS OBS CONTEXT	TEXT, CODE, NUM, DATE, TIME, PNAME, UIDREF, COMPOSITE[1].
IMAGE	HAS ACQ CONTEXT	TEXT, CODE, DATE, TIME, NUM, CONTAINER.
CONTAINER, CODE, COMPOSITE, NUM	HAS CONCEPT MOD	TEXT, CODE[2].
TEXT, CODE, NUM	HAS PROPERTIES	CONTAINER, TEXT, CODE, NUM, DATE, IMAGE[1], SCOORD, SCOORD3D, UIDREF.
CODE, NUM	INFERRED FROM	CODE, NUM, IMAGE[1], SCOORD, SCOORD3D, CONTAINER, TEXT.
SCOORD	SELECTED FROM	IMAGE[1].

246

Notes: 1. Which SOP Classes the IMAGE or COMPOSITE Value Type may refer to, is documented in the
248   Conformance Statement for an application (see PS 3.2 and PS 3.4).

2. The HAS CONCEPT MOD relationship is used to modify the meaning of the Concept Name of
250   a Source Content Item, for example to provide a more descriptive explanation, a different
            language translation, or to define a post-coordinated concept.

252

Update the following in the SR Document Content Module in Table C.17-5

---

254 **C.17.3 SR Document Content Module**

   …

256   **Table C.17-5**
DOCUMENT CONTENT MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Value Type	(0040,A040)	1	The type of the value encoded in this Content Item. Defined Terms: TEXT NUM CODE DATETIME DATE

			TIME UIDREF PNAME COMPOSITE IMAGE WAVEFORM SCOORD TCOORD CONTAINER **SCOORD3D** See C.17.3.2.1 for further explanation.
Concept Name Code Sequence	(0040,A043)	1C	Code describing the concept represented by this Content Item. Also conveys the value of Document Title and section headings in documents. Only a single Item shall be permitted in this sequence. Required if Value Type (0040,A040) is TEXT, ~~or~~ NUM, ~~or~~ CODE, ~~or~~ DATETIME, ~~or~~ DATE, ~~or~~ TIME, ~~or~~ UIDREF, or PNAME. Required if Value Type (0040,A040) is CONTAINER and a heading is present, or this is the Root Content Item. Note: That is, containers without headings do not require Concept Name Code Sequence Required if Value Type (0040,A040) is COMPOSITE, IMAGE, WAVEFORM, SCOORD, ~~or~~ TCOORD**, or SCOORD3D**, and the Purpose of Reference is conveyed in the Concept Name. See C.17.3.2.2 for further explanation.
…			
Include '3D Spatial Coordinates Macro' Table C.18.y-1 if and only if Value Type (0040,A040) is SCOORD3D.			

258

Add the following value type definition to Table C.17.3-7

260 **C.17.3.2.1 Content Item Value Type**

…

262

Table C.17.3-7
VALUE TYPE DEFINITIONS

Value Type	Concept Name	Concept Value	Description
…			

SCOORD3D	Purpose of reference	Listing of spatial 3D coordinates	3D spatial coordinates (x,y,z) of a geometric region of interest in a Reference Coordinate System.

264

> ***Add the following 3D Spatial Coordinates macro attributes to PS 3.3 Section 18***

266 **C.18.y 3D Spatial Coordinates Macro**

Table C.18.y-1 specifies the Attributes that convey 3D Spatial Coordinates in an SCOORD3D Content
268 Item.

Table C.18.y-1
270 **3D SPATIAL COORDINATES MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Referenced Frame of Reference UID	(3006,0024)	1	Uniquely identifies the Frame of Reference within which the coordinates are defined.
Graphic Data	(0070,0022)	1	An ordered set of (x,y,z) triplets (in mm and may be negative) that define a region of interest in the patient-relative Reference Coordinate System defined by Referenced Frame of Reference UID (3006,0024). See Section 3.17.1. See C.18.y.1.1 for further explanation.
Graphic Type	(0070,0023)	1	See C.18.y.1.2 for Enumerated Values.
Fiducial UID	(0070,031A)	3	The globally unique identifier for this fiducial item. Note: The fiducial UID can be used to associate this set of graphics with other Content Items.

272 **C.18.y.1 3D Spatial Coordinates Macro Attribute Descriptions**

C.18.y.1.1 Graphic Data

274 Graphic Data may be used to associate an anatomic or spatial Concept with a defined set of patient
relative 3D locations in a defined frame of reference, independent of any image. Graphic Data may be
276 defined explicitly as a single point (i.e. to denote the epicenter of an anatomic site or lesion) or more than
one point (i.e. representing a set of points or an open or closed polygon).

278

C.18.y.1.2 Graphic Type

280 This attribute defines the type of geometry of the region of interest. The following Enumerated Values are
specified for 3D spatial coordinate geometries:

282   POINT = a single location denoted by a single (x,y,z) triplet.

    MULTIPOINT = multiple locations each denoted by an (x,y,z) triplet; the points need not be coplanar.

284   POLYLINE = a series of connected line segments with ordered vertices denoted by (x,y,z) triplets; the
        points need not be coplanar.

286   POLYGON = a series of connected line segments with ordered vertices denoted by (x,y,z) triplets, where the first and last vertices shall be the same forming a polygon; the points shall be coplanar.

288   ELLIPSE = an ellipse defined by four (x,y,z) triplets, the first two triplets specifying the endpoints of the major axis and the second two triplets specifying the endpoints of the minor axis.

290   ELLIPSOID = A three-dimensional geometric surface whose plane sections are either ellipses or circles and contains three intersecting orthogonal axes, "a", "b", and "c". The ellipsoid is defined
292   by six (x,y,z) triplets, the first and second triplets specifying the endpoints of axis "a", the third and fourth triplets specifying the endpoints of axis "b", and the fifth and sixth triplets specifying the
294   endpoints of axis "c".

296   Notes: 1. A circle is a special case of ELLIPSE where the major and minor axis points are equidistant from the center.
298   2. Coplanar is in the mathematical sense and is not necessarily related to a specific image instance.

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Changes to NEMA Standards Publication PS 3.4-2008

Digital Imaging and Communications in Medicine (DICOM)

Part 4: Service Class Specifications

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310

310 | ***Add the following to PS 3.4 Section 4 Symbols and Abbreviations***

Colon CAD Computer-Aided Detection and/or Computer-Aided Diagnosis for colon radiography

312 | ***Update Annex B and I SOP Class tables***

Add Colon CAD SR Storage SOP Class to Table B.5-1

314   **B.5 STANDARD SOP CLASSES**

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
Colon CAD SR	**1.2.840.10008.5.1.4.1.1.88.69**	**Colon CAD SR IOD**

316   **B.5.1.5 Structured Reporting Storage SOP Classes**

The requirements of Annex O apply to the following SOP Classes:

318   •   …

   •   **Colon CAD SR**

320 | ***Add Colon CAD SR Storage Media Storage SOP Classes to Table I.4-1***

I.4 MEDIA STANDARD STORAGE SOP CLASSES

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
Colon CAD SR	**1.2.840.10008.5.1.4.1.1.88.69**	**Colon CAD SR IOD**

322

I.4.1.2 Structured Reporting Storage SOP Classes

324   The requirements of Annex O apply to the following SOP Classes:

   •   …

326   •   **Colon CAD SR**

| ***Update Annex O***

328

O.2   **BEHAVIOR**

330   **O.2.1**   **Behavior of an SCU**

O.2.1.1   ~~**Mammography and Chest**~~ **CAD SR SOP Classes**

332   Rendering Intent concept modifiers in the Mammography CAD SR~~**, and**~~ Chest CAD SR**, and Colon CAD SR** objects shall be consistent. Content items marked "For Presentation" shall not be subordinate to

334   content items marked "Not for Presentation" or "Presentation Optional" in the content tree. Similarly,

336 content items marked "Presentation Optional" shall not be subordinate to content items marked "Not for Presentation" in the content tree.

338 Content items referenced from another SR object instance, such as a prior Mammography CAD SR ~~or~~, Chest CAD SR**, or Colon CAD SR**, shall be inserted by-value in the new SR object instance, with appropriate original source observation context. It is necessary to update Rendering Intent, and
340 referenced content item identifiers for by-reference relationships, within content items paraphrased from another source.

342

O.2.2 Behavior of an SCP

344 **…**

O.2.2.1 ~~Mammography CAD SR and Chest~~ CAD SR SOP Classes

346 The Mammography CAD SR ~~and~~, Chest CAD SR**, and Colon CAD SR** objects contain data not only for presentation to the clinician, but also data solely for use in subsequent CAD analyses.

348 The SCU provides rendering guidelines via "Rendering Intent" concept modifiers associated with "Individual Impression/Recommendation", "Composite Feature" and "Single Image Finding" content items.
350 The full meaning of the SR is provided if all content items marked "Presentation Required" are rendered down to the first instance of "Not for Presentation" or "Presentation Optional" for each branch of the tree.
352 Use of the SCU's Conformance Statement is recommended if further enhancement of the meaning of the SR can be accomplished by rendering some or all of the data marked "Presentation Optional". Data
354 marked "Not for Presentation" should not be rendered by the SCP; it is embedded in the SR content tree as input to subsequent ~~Mammography~~ CAD analysis work steps.

356 ### O.4 CONFORMANCE

…

358 ### O.4.1 Conformance Statement for an SCU

…

360 ### O.4.1.1 ~~Mammography CAD SR and Chest~~ CAD SR SOP Classes

The following shall be documented in the Conformance Statement of any implementation claiming
362 conformance to the Mammography CAD SR SOP Class as an SCU:

- Which types of detections and/or analyses the device is capable of performing:

364
  - From detections listed in Context Group 6014 Mammography Single Image Finding

  - From analyses listed in Context Group 6043 Types of Mammography CAD Analysis

366 The following shall be documented in the Conformance Statement of any implementation claiming conformance to the Chest CAD SR SOP Class as an SCU:

368 - Which types of detections and/or analyses the device is capable of performing:

  - From detections listed in Context ID 6101 Chest Finding or Feature Category, or Context ID
370   6102 Chest Finding or Feature

  - From analyses listed in Context ID 6137 Types of ~~Chest~~ CAD Analysis

372 **The following shall be documented in the Conformance Statement of any implementation claiming conformance to the Colon CAD SR SOP Class as an SCU:**

374 • **Which types of detections and/or analyses the device is capable of performing:**

• **From detections listed in Context ID 6201 Colon Finding or Feature**

376 • **From analyses listed in Context ID 6137 Types of CAD Analysis**

The following shall be documented in the Conformance Statement of any implementation claiming
378 conformance to the Mammography CAD SR ~~or,~~ Chest CAD SR**, or Colon CAD SR** SOP Class**es** as an SCU that creates instances:

380 • Which optional content items are supported

• Conditions under which content items are assigned Rendering Intent of "Presentation Optional", and
382 whether a CAD Operating Point value will be included with each Single Image Finding that has Rendering Intent of "Presentation Optional"

384 • Recommendations for the conditions under which content items with Rendering Intent of "Presentation Optional" should be rendered, based on CAD Operating Point or otherwise

386 • Conditions under which content items are assigned Rendering Intent of "Not for Presentation"

O.4.2   Conformance Statement for an SCP

388 **…**

O.4.2.1   ~~Mammography CAD SR and Chest~~ CAD SR SOP Classes

390 The following shall be documented in the Conformance Statement of any implementation claiming conformance to the Mammography CAD SR ~~or,~~ Chest CAD SR**, or Colon CAD SR** SOP Class**es** as an
392 SCP:

• Conditions under which the SCP will render content items with Rendering Intent concept modifier set to
394 "Presentation Optional"

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Changes to NEMA Standards Publication PS 3.6-2008

Digital Imaging and Communications in Medicine (DICOM)

Part 6: Data Dictionary

ANNEX A (NORMATIVE): REGISTRY OF DICOM UNIQUE IDENTIFIERS (UID)

408 *Add the following UID to Part 6 Annex A Table A-1:*

UID Value	UID NAME	UID TYPE	Part
1.2.840.10008.5.1.4.1.1.88.69	**Colon CAD SR**	**SOP Class**	**3.4**

410

Add and correct the following UIDs to Part 6 Annex A Table A-3:

412

Table A-3
414 **CONTEXT GROUP UID VALUES**

Context UID	Context Identifier	Context Group Name
…		
1.2.840.10008.6.1.454	6134	~~Chest~~ Qualitative Temporal Difference Type
1.2.840.10008.6.1.455	6135	~~Chest~~ Image Quality Finding
1.2.840.10008.6.1.456	6136	Chest Types of Quality Control Standard
1.2.840.10008.6.1.457	6137	Types of ~~Chest~~ CAD Analysis
…		
1.2.840.10008.6.1.787	**6200**	**Colon Overall Assessment**
1.2.840.10008.6.1.788	**6201**	**Colon Finding or Feature**
1.2.840.10008.6.1.789	**6202**	**Colon Finding or Feature Modifier**
1.2.840.10008.6.1.790	**6203**	**Colon Non-Lesion Object Type**
1.2.840.10008.6.1.791	**6204**	**Anatomic Non-Colon Findings**
1.2.840.10008.6.1.792	**6205**	**Clockface Location for Colon**
1.2.840.10008.6.1.793	**6206**	**Recumbent Patient Orientation for Colon**
1.2.840.10008.6.1.794	**6207**	**Colon Quantitative Temporal Difference Type**
1.2.840.10008.6.1.795	**6208**	**Colon Types of Quality Control Standard**
1.2.840.10008.6.1.796	**6209**	**Colon Morphology Descriptor**
1.2.840.10008.6.1.797	**6210**	**Location in Intestinal Tract**
1.2.840.10008.6.1.798	**6211**	**Attenuation Coefficient Descriptors**
1.2.840.10008.6.1.799	**6212**	**Calculated Value for Colon Findings**

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Changes to NEMA Standards Publication PS 3.16-2008

Digital Imaging and Communications in Medicine (DICOM)

Part 16: Content Mapping Resource

426

428

428 | **_Add the following to PS 3.16 Section 2 Normative References_**

C-RADS   **CT Colonography Reporting and Data System**

430 Based on "CT Colonography Reporting and Data System: A Consensus Proposal", <u>Radiology</u> July 2005; 236:3-9.

432 | **_Add the following to PS 3.16 Section 4 Symbols and Abbreviations_**

Colon CAD   Computer-Aided Detection and/or Computer-Aided Diagnosis for colon radiography

434 | **_Add the following Templates to Part 16 Annex A Structured Reporting Templates (Normative):_**

TID 1406   **3D Linear Measurement Template**

436   **TID 1406**
3D LINEAR MEASUREMENT
438   **Type: Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	DCID (7470) Linear Measurements	1	M		UNITS = DCID (7460) Units of Linear Measurement
2	>	INFERRED FROM	SCOORD3D	EV (121055,DCM, "Path")	1	M		GRAPHIC TYPE = {POLYLINE, ELLIPSE, POLYGON}

440 **Content Item Descriptions**

Row 2 "Path"   Path shall represent the measured path in a reference coordinate space. The Graphic Type (0070,0023) of the Path SCOORD3D shall be:

- an open POLYLINE with two or more different (x,y,z) triplets (to measure length, diameter, distance, proximity, etc.),

- an ELLIPSE (to measure circumference) or

- A closed POLYGON to measure perimeter, where the (x,y,z) triplets are coplanar.

442

COLON CAD SR IOD TEMPLATES

444 The templates that comprise the Colon CAD SR IOD are interconnected as in Figure A-X. In Figure A-X, '• • •' indicates possible recursive application of subordinate templates.
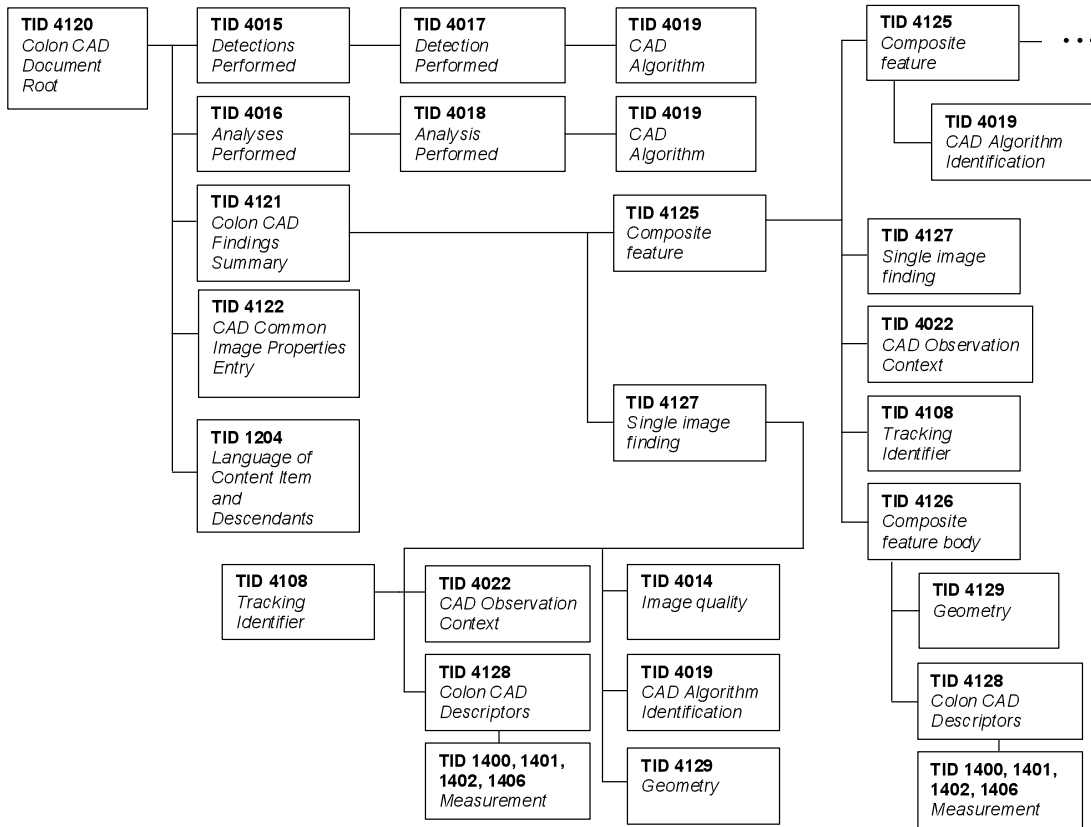
446

Figure A-X: Colon CAD SR IOD Template Structure

448

TID 4120   Colon CAD Document Root Template

450 This template forms the top of a content tree that allows a colon CAD device to describe the results of detection and analysis of colon evidence. This template, together with its subordinate templates,

452 describes both the results for presentation to radiologists and partial product results for consumption by colon CAD devices in subsequent colon CAD reports.

454 This template defines a Container that contains the CAD results and summaries of the detection and analysis algorithms performed.

456 The atomic CAD results of Single Image Findings and Composite Features are described in the Colon CAD Findings Summary sub-tree.

458 The Summary of Detections and Summary of Analyses sub-trees gather lists of algorithms attempted, grouped by success/failure status. Algorithms not attempted are not mentioned in these sub-trees. This

460 information forms the basis for understanding why a colon CAD report may produce no (or fewer than anticipated) results. Colon CAD results are constructed bottom-up, starting from Single Image Findings

462 (see TID 4127), associated as Composite Features (see TID 4125).

See the figure entitled "Top Levels of Colon CAD SR Content Tree" in the "Colon CAD" Annex of PS 3.17.

464 **TID 4120**
COLON CAD DOCUMENT ROOT
466 **Type: Non-Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (112220, DCM, "Colon CAD Report")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	DTID (1204) Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	DTID (4122) CAD Common Image Properties Entry	1-n	M		
4	>	CONTAINS	INCLUDE	DTID (4121) Colon CAD Findings Summary	1	M		
5	>	CONTAINS	CODE	EV (111064, DCM, "Summary of Detections")	1	M		DCID (6042) Status of Results
6	>>	INFERRED FROM	INCLUDE	DTID (4015) CAD Detections Performed	1	MC	Shall be present unless the value of row 5 is (111225, DCM, "Not Attempted")	$DetectionCode = DCID (6201) Colon Finding or Feature
7	>	CONTAINS	CODE	EV (111065, DCM, "Summary of Analyses")	1	M		DCID (6042) Status of Results
8	>>	INFERRED FROM	INCLUDE	DTID (4016) CAD Analyses Performed	1	MC	Shall be present unless the value of row 7 is (111225, DCM, "Not Attempted")	$AnalysisCode = DCID (6137) Types of CAD Analysis

468 **Content Item Descriptions**

Detections Performed	The "Detections Performed" and "Analyses Performed" sections of the Content Tree (TID 4120, rows 6 and 8) together shall reference all Image SOP Instances included in the Current Requested Procedure Evidence Sequence (0040,A375) attribute of the SR Document General module.
Analyses Performed	

470 **TID 4121   Colon CAD Findings Summary Template**

The contents of this template describe the findings and aggregate features that the colon CAD device
472 detected for the colon evidence presented. This template forms the colon CAD results sub-tree of the
Colon CAD Document Root (TID 4120). The data from which the details are inferred are expressed in the
474 Composite Features (see TID 4125) and/or Single Image Findings (see TID 4127), of which there may be
several.

476 The sub-tree headed by this template is illustrated in the figure entitled "Example of CAD Processing and
Findings Summary sub-tree of Colon CAD SR Content Tree" in the "Colon CAD" Annex of PS 3.17.

478 **TID 4121**
COLON CAD FINDINGS SUMMARY
480 **Type: Non-Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (111017, DCM, "CAD Processing and Findings Summary")	1	M		DCID (6047) CAD Processing and Findings Summary
2	>	HAS PROPERTIES	CODE	EV (112222, DCM, "Colon Overall Assessment")	1	U		DCID (6200) Colon Overall Assessment
3	>	INFERRED FROM	INCLUDE	DTID (4125) Colon CAD Composite Feature	1-n	U		
4	>	INFERRED FROM	INCLUDE	DTID (4127) Colon CAD Single Image Finding	1-n	U		

482 **Content Item Descriptions**

CAD Processing and Findings Summary	This code value is used to express if and why the Colon CAD Findings Summary sub-tree is empty. The Summary of Detections and Summary of Analyses sub-trees of the Document Root node contain detail about which (if any) algorithms succeeded or failed.
	If the code value indicates that there were no findings, then the code value can be used to determine whether colon CAD processing occurred successfully, without parsing the Summary of Detections and Summary of Analyses sub-trees.

484

484

TID 4122   CAD Common Image Properties Entry Template

486 Each instance of the CAD Common Image Properties Entry template contains selected attributes for a set
of parallel contiguous equally spaced slices (with identical properties) from which CAD findings are
488 derived.

TID 4122
490 **CAD COMMON IMAGE PROPERTIES ENTRY**
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (112224, DCM, "Image Set Properties")	1	M		
2	>	CONTAINS	UIDREF	EV (112227, DCM, "Frame of Reference UID")	1	M		
3	>	CONTAINS	UIDREF	EV (110180, DCM, "Study Instance UID")	1	M		
4	>	CONTAINS	DATE	EV (111060, DCM, "Study Date")	1	M		Shall be taken from Study Date (0008,0020) in the Image Instances.
5	>	CONTAINS	TIME	EV (111061, DCM, "Study Time")	1	M		Shall be taken from Study Time (0008,0030) in the Image Instances.
6	>	CONTAINS	CODE	EV (121139, DCM, "Modality")	1	M		Shall be taken from Modality (0008,0060) in the Image Instances.
7	>	CONTAINS	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	M		Shall be taken from value 1 of Pixel Spacing (0028,0030) in the Image Instances. UNITS = EV (mm/{pixel}, UCUM, "millimeters per pixel")
8	>	CONTAINS	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	M		Shall be taken from value 2 of Pixel Spacing (0028,0030) in the Image Instances. UNITS = EV (mm/{pixel}, UCUM, "millimeters per pixel")
9	>	CONTAINS	NUM	EV (112225, DCM, "Slice Thickness")	1	M		Shall be taken from Slice Thickness (0018,0050) in the Image Instances. UNITS = EV (mm, UCUM, "millimeter")
10	>	CONTAINS	CODE	EV (112226, DCM, "Spacing between slices")	1	M		Shall be computed from the Image Position (Patient) (0020,0032) projected onto the normal to the Image Orientation (Patient) (0020,0037); may or may not be the same as the Spacing Between Slices (0018,0088) if present. UNITS = EV (mm, UCUM, "millimeter")
11	>	CONTAINS	CODE	EV (112228, SRT, "Recumbent Patient Position	1	MC	Required if Patient Position (0018,5100) is present in the	Shall be derived from Patient Position (0018,5100) in the

NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
			with respect to gravity")			image instances and has a value.	Image Instances. DCID (6206) Recumbent Patient Orientation for Colon CAD

492

492

TID 4125   Colon CAD Composite Feature Template

494 This template collects a composite feature for a lesion, non-lesion object, or correlation of related objects (see TID 4121). The details of the composition are expressed in the Colon CAD Composite Feature Body
496 (see TID 4126). The data from which the details are inferred, are expressed in the Composite Features (see TID 4125) and/or Single Image Findings (see TID 4127), of which there may be several.

498

TID 4125
COLON CAD COMPOSITE FEATURE

500 **Type: Non-Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (111015, DCM, "Composite Feature")	1	M		DCID (6201) Colon Finding or Feature
2	>	HAS CONCEPT MOD	CODE	EV (112023, DCM, "Composite Feature Modifier")	1	U		DCID (6202) Colon Finding or Feature Modifier
3	>	HAS CONCEPT MOD	CODE	EV (111056, DCM, "Rendering Intent")	1	M		DCID (6034) Intended Use of CAD Output
4	>>	HAS PROPERTIES	NUM	EV (111071, DCM, "CAD Operating Point")	1	UC	IFF value of row 3 is (111151, DCM, "Presentation Optional") and row 1 of TID 4023 is present for the feature identified in row 1.	UNITS = DT ({1:n}, UCUM, "range: 1:n"), where n is the maximum specified in Row 1 of TID 4023 for the feature identified in row 1. Value is restricted to being an integer.
5	>	HAS OBS CONTEXT	INCLUDE	DTID (4108) Tracking Identifier	1	U		
6	>	HAS OBS CONTEXT	INCLUDE	DTID (4022) CAD Observation Context	1	MC	Shall be present IFF this feature is duplicated from a different report than its parent.	
7	>	HAS OBS CONTEXT	INCLUDE	DTID (4019) CAD Algorithm Identification	1	M		
8	>	HAS PROPERTIES	INCLUDE	DTID (4126) Colon CAD Composite Feature Body	1	M		
9	>	INFERRED FROM	INCLUDE	DTID (4125) Colon CAD Composite Feature	1-n	U		
10	>	INFERRED FROM	INCLUDE	DTID (4127) Colon CAD Single Image Finding	1-n	U		

502 **Content Item Descriptions**

Rendering Intent	This content item constrains the SCP receiving the Colon CAD SR IOD in its use of the contents of this template and its target content items. Colon CAD devices may opt to use data marked "Not for Presentation" or "Presentation Optional" as input to subsequent colon CAD processing steps. Refer to PS 3.4, Annex O Structured Reporting Standard SOP Classes for SCU and SCP Behavior.

504

TID 4126   Colon CAD Composite Feature Body Template

506 The details of a composite feature are expressed in this template. It is applied to Colon CAD Composite
Feature (TID 4125).

508

TID 4126
COLON CAD COMPOSITE FEATURE BODY

510 **Type: Non-Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (111016, DCM, "Composite type")	1	M		DCID (6035) Composite Feature Relations
2			CODE	EV (111057, DCM, "Scope of Feature")	1	M		DCID (6036) Scope of Feature
3			NUM	EV (111011, DCM, "Certainty of feature")	1	U		UNITS = EV (%, UCUM, "Percent") Value = 0 – 100
4			INCLUDE	DTID (4129) Colon CAD Geometry	1	U		
5			INCLUDE	DTID (4128) Colon CAD Descriptors	1	U		
6			NUM	DCID (6207) Colon Quantitative Temporal Difference Type	1-n	UC	May be present IFF the value of row 1 is (111153, DCM, "Target content items are related temporally")	
7	>	R-INFERRED FROM	NUM		2	U		The referenced numeric values shall have the same Concept Name. Their UNITS shall be the same as row 6
8			CODE	EV (111049, DCM, "Qualitative Difference")	1-n	UC	May be present only if the value of row 1 is (111153, DCM, "Target content items are related temporally")	DCID (6134) Qualitative Temporal Difference Type
9	>	HAS PROPERTIES	TEXT	EV (111021, DCM, "Description of Change")	1	U		
10	>	R-INFERRED FROM	CODE		2	M		The referenced content items shall have the same Concept Name and their code values shall be from the same context group.

512 **Content Item Descriptions**

Certainty of Feature	The CAD device's certainty that the feature analyzed and classified by the CODE, as specified in the Composite Feature parent template is, in fact, that type of feature.
Row 6	Values ≤ 0 are allowed. The two referenced numeric values are target content items of the first generation Composite Feature or Single Image Finding children of this composite feature. Given the equation, A – B, the value representing A shall be referenced first.

Qualitative Difference	The two referenced code values are target content items of the first generation Composite Feature or Single Image Finding children of this composite feature.

514 **TID 4127   Colon CAD Single Image Finding Template**

This template describes a single image finding for a lesion or other object. The details of the finding are
516 expressed in this template and/or more specific templates.

TID 4127
518 **COLON CAD SINGLE IMAGE FINDING**
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (111059, DCM, "Single Image Finding")	1	M		DCID (6201) Colon Finding or Feature
2	>	HAS CONCEPT MOD	CODE	EV (112024, DCM, "Single Image Finding Modifier")	1	U		DCID (6202) Colon Finding or Feature Modifier
3	>	HAS CONCEPT MOD	CODE	EV (111056, DCM, "Rendering Intent")	1	M		DCID (6034) Intended Use of CAD Output
4	>>	HAS PROPERTIES	NUM	EV (111071, DCM, "CAD Operating Point")	1	UC	IFF value of row 3 is (111151, DCM, "Presentation Optional") and row 1 of TID 4023 is present for the finding identified in row 1	UNITS = DT ({1:n}, UCUM, "range: 1:n"), where n is the maximum specified in Row 1 of TID 4023 for the finding identified in row 1. Value is restricted to being an integer.
5	>	HAS OBS CONTEXT	INCLUDE	DTID (4108) Tracking Identifier	1	U		
6	>	HAS OBS CONTEXT	INCLUDE	DTID (4022) CAD Observation Context	1	MC	Shall be present IFF this finding is duplicated from a different report than its parent.	
7	>	HAS OBS CONTEXT	INCLUDE	DTID (4019) CAD Algorithm Identification	1	M		
8	>	HAS PROPERTIES	NUM	EV (111012, DCM, "Certainty of Finding")	1	U		UNITS = EV (%, UCUM, "Percent") Value = 0 – 100
9	>	HAS PROPERTIES	TEXT	EV (111058, DCM, "Selected Region Description")	1	MC	Shall be present IFF value of row 1 is (111099, DCM, "Selected region")	
10	>	HAS PROPERTIES	INCLUDE	DTID (4129) Colon CAD Geometry	1	MC	Shall be present unless value of row 1 is (111101, DCM, "Image quality")	
11	>	HAS PROPERTIES	INCLUDE	DTID (4128) Colon CAD Descriptors	1	U		
12	>	INFERRED FROM	IMAGE		1	MC	Shall be present IFF value of row 1 is (111101, DCM, "Image quality") and row 13 is not present	
13	>	INFERRED FROM	SCOORD	EV (111030, DCM, "Image Region")	1-n	MC	Shall be present IFF value of row 1 is (111101, DCM, "Image quality") and row 12 is not present	

NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
14 >>	SELECTED FROM	IMAGE		1	M		All the row 13 content items in a single invocation of this template shall reference the same IMAGE
15 >	HAS PROPERTIES	INCLUDE	DTID (4014) CAD Image Quality	1	MC	Shall be present IFF value of row 1 is (111101, DCM, "Image quality")	$QualityFinding = DCID (6135) Image Quality Finding $QualityStandard = DCID (6208) Colon Types of Quality Control Standard

520

Content Item Descriptions

Rendering Intent	This content item constrains the SCP receiving the Colon CAD SR IOD in its use of the contents of this template and its target content items. Colon CAD devices may opt to use data marked "Not for Presentation" or "Presentation Optional" as input to subsequent colon CAD processing steps. Refer to PS 3.4 section on Structured Reporting Storage SOP Classes for SCU and SCP Behavior.
CAD Operating Point	Additional information to use when Rendering Intent is "Presentational Optional". A CAD Operating Point of zero is not sent, and is encoded as a Rendering Intent of "Presentation Required". See PS 3.4 section on Structured Reporting Storage SOP Classes for SCU and SCP Behavior and PS 3.17 annex on Mammography.
Certainty of Finding	The certainty of the CAD device that the finding detected and classified by the Single Image Finding CODE specified is in fact that type of finding.

522

TID 4128   Colon CAD Descriptors

524 This template provides qualitative detail for a Single Image Finding or Composite Feature. It is applied to Colon CAD Composite Feature (TID 4125) and Colon CAD Single Image Finding (TID 4127).

526
**TID 4128
COLON CAD DESCRIPTORS**

528
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (G-C504, SRT, "Associated Morphology")	1-n	U		DCID (6209) Colon Morphology Descriptor
2			CODE	EV (G-C036, SRT, "Finding Site")	1	U		DCID (6210) Location in Intestinal Tract
3			CODE	EV (111014, DCM, "Clockface or region")	1	U		DCID (6205) Clockface Location for Colon
4		CONTAINS	INCLUDE	DTID (300) Measurement	1-n	U		$Measurement = DCID (6212) Calculated Value for Colon Findings $Derivation = DCID (6140) Calculation Methods $DerivationParameter = EV (112032, DCM, "Threshold Attenuation Coefficient") $DerivationParameterUnits = EV ([hnsf'U], UCUM, "Hounsfield unit")
5			INCLUDE	DTID (1400) Linear Measurement	1-n	U		
6			INCLUDE	DTID (1401) Area Measurement	1-n	U		
7			INCLUDE	DTID (1402) Volume Measurement	1-n	U		
8			INCLUDE	DTID (1406) 3D Linear Measurement	1-n	U		
9			NUM	DCID (6141) Attenuation Coefficient Measurements	1-n	U		UNITS = EV ([hnsf'U], UCUM, "Hounsfield unit")
10	>	HAS PROPERTIES	CODE	EV (112009, DCM, "Type of Content")	1	U		DCID (6211) Colon CAD Material Description

530 **Content Item Descriptions**

Row 3	12 o'clock position is the anterior direction of the patient regardless of the positioning with respect to gravity; clockwise is from the point of view of an observer located closer to the anus than the finding being observed.

532

532

TID 4129   Colon CAD Geometry Template

534 All geometry template invocations require specification of either the location of the center of the object, the outline, or both. Geometry is a property of single image findings (see TID 4127) and composite features
536 (see TID 4125).

TID 4129
538 **COLON CAD GEOMETRY**
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			SCOORD	EV (111010, DCM, "Center")	1	MC	At least one of rows 1, 3, 4, 6 or 11 shall be present.	GRAPHIC TYPE = {POINT}
2	>	SELECTED FROM	IMAGE		1	M		
3			SCOORD3D	EV (111010, DCM, "Center")	1	MC	At least one of rows 1, 3, 4, 6 or 11 shall be present.	GRAPHIC TYPE = {POINT}
4			SCOORD	EV (111041, DCM, "Outline")	1	MC	At least one of rows 1, 3, 4, 6 or 11 shall be present.	
5	>	SELECTED FROM	IMAGE		1	M		
6			SCOORD3D	EV (111041, DCM, "Outline")	1	MC	At least one of rows 1, 3, 4, 6 or 11 shall be present.	
7			SCOORD	DCID (6166) CAD Geometry Secondary Graphical Representation	1-n	U		
8	>	SELECTED FROM	IMAGE		1	M		
9			SCOORD3D	DCID (6166) CAD Geometry Secondary Graphical Representation	1-n	U		
10			IMAGE	EV (112229, DCM, "Identifying Segment")	1	MC	At least one of rows 1, 3, 4, 6 or 11 shall be present.	Referenced image shall be a Segmentation and the content item shall include Referenced Segment Number (0062,000B)

540

540

> ***Modify the following Templates in Part 16 Annex A Structured Reporting Templates (Normative):***

542

TID 300   Measurement

544 This Template provides a general structure for a numeric measurement, together with evaluations of its normality and/or significance, and the inference source(s) for its value. This structure is instantiated by
546 inclusion of this Template with specific contextual parameters from a parent Template.

TID 300 Parameters

Parameter Name	Parameter Usage
$Measurement	Coded term or Context Group for Concept Name of measurement
$Units	Units of Measurement
$ModType	Modifier Name for Concept Name of measurement
$ModValue	Modifier Value for Concept Name of measurement
$Method	Value for Measurement Method
$Derivation	Value for Measurement Derivation
$TargetSite	Value for Anatomic Location of measurement
$TargetSiteMod	ModifierValue for Anatomic Location of measurement
$Equation	Coded term or Context Group for the equation or table from which the measurement was derived or computed
$ImagePurpose	Purpose of Reference for an image used as a source of the measurement
$WavePurpose	Purpose of Reference for a waveform used as a source of the measurement
$RefAuthority	Bibliographic reference or authority for statistical properties of a reference population
$RangeAuthority	Bibliographic reference or authority for the normal range of the measurement
$DerivationParameter	**Coded term or Context Group for Concept Name of a derivation parameter**
$DerivationParameter Units	**Units of derivation parameter**

548

TID 300
550 **Measurement**
Type: Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	$Measurement	1	M		Units = $Units
2	>	HAS CONCEPT MOD	CODE	$ModType	1-n	U		$ModValue
3	>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	U		$Method
4	>	HAS CONCEPT MOD	CODE	EV (121401, DCM, "Derivation")	1	U		$Derivation
5	>	HAS CONCEPT MOD	CODE	EV (G-C0E3, SRT, "Finding Site")	1	U		$TargetSite

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
6	>>	HAS CONCEPT MOD	CODE	EV (G-C171, SRT, "Laterality")	1	U		DCID (244) Laterality
7	>>	HAS CONCEPT MOD	CODE	DT (G-A1F8, SRT, "Topographical modifier")	1	U		$TargetSiteMod
8	>	HAS PROPERTIES	INCLUDE	DTID (310) Measurement Properties	1	U		$RefAuthority = $RefAuthority $RangeAuthority = $RangeAuthority
9	>	INFERRED FROM	NUM	**$DerivationParameter**	1-n	U**C**	**XOR Row 10**	**$DerivationParameter Units**
10	>	R-INFERRED FROM	NUM	**$DerivationParameter**	1-n	U**C**	**XOR Row 9**	**$DerivationParameter Units**
11	>	INFERRED FROM	INCLUDE	DTID (315) Equation or Table	1	UC	XOR Row 12	$Equation = $Equation
12	>	INFERRED FROM	TEXT	DCID (228) Equation or Table	1	UC	XOR Row 11	
13	>		INCLUDE	DTID (320) Image or Spatial Coordinates	1-n	U		$Purpose = $ImagePurpose
14	>		INCLUDE	DTID (321) Waveform or Temporal Coordinates	1-n	U		$Purpose = $WavePurpose
15	>		INCLUDE	DTID (1000) Quotation	1	U		

552

Content Item Descriptions

554 Rows 2, 3, 4, 5 - The HAS CONCEPT MOD items allow the explicit definition of terms for post-coordination of the measurement concept name. Additional post-coordinated modifier terms may be included in a SOP
556 Instance based on this template, in accordance with section 6.2.4.

Rows 9, 10 - The INFERRED FROM items allow the specification (by-value or by-reference) of numeric
558 values that were used in the derivation of the numeric measurement of Row 1. The nature of the inference is not explicitly conveyed; it may be implicit in the Concept Names of the measurements. Inference by-
560 reference is valid only in SOP Classes that permit the INFERRED FROM relationship by-reference.

562

562 **TID 4017   CAD DETECTION PERFORMED**

…

564 **Content Item Descriptions**

CAD Algorithm Identification	If more than one detection algorithm has the same "Detection Performed" code value (e.g., CID 6014) then the "CAD Algorithm Identification" shall unambiguously distinguish between algorithms.
Rows 3 - 6	**Mammography CAD SR:** When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, thus only row 4 and/or row 6 shall be present. **Chest CAD SR:** When this template is invoked for the Chest CAD SR, the Image Library is optional, thus any combination of rows 3, 4, 5 and 6 may be present. **Colon CAD SR: When this template is invoked for the Colon CAD SR, the Image Library does not exist, thus rows 3, 5, and/or 6 may be present and row 4 shall not be present.**
Rows 7 - 8	**Mammography CAD SR:** When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, thus only row 8 shall be present. **Chest CAD SR:** When this template is invoked for the Chest CAD SR, the Image Library is optional, thus row 7 or 8 may be present. **Colon CAD SR: When this template is invoked for the Colon CAD SR, the Image Library does not exist, thus only row 7 may be present.**

566

568 **TID 4018   CAD ANALYSIS PERFORMED**

570   **TID 4018**
                       CAD ANALYSIS PERFORMED
572   **Type: Non-Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (111004, DCM, "Analysis Performed")	1	M		$AnalysisCode
2	>	HAS PROPERTIES	INCLUDE	DTID (4019) "CAD Algorithm Identification"	1	M		
3	>	HAS PROPERTIES	IMAGE		1-n	MC	At least one of row 3, 4, 5 or 6 shall be present	

4	>	R-HAS PROPERTIES	IMAGE		1-n	MC	At least one of row 3, 4, 5 or 6 shall be present	Shall reference IMAGE content item(s) in the (111028, DCM, "Image Library")
5	>	HAS PROPERTIES	UIDREF	EV (112002,DCM,"Series Instance UID")	1-n	MC	At least one of row 3, 4, 5 or 6 shall be present	
6	>	HAS PROPERTIES	SCOORD	EV (111030, DCM, "Image Region")	1-n	MC	At least one of row 3, 4, 5 or 6 shall be present	
7	>>	SELECTED FROM	IMAGE		1	MC	XOR Row 8	
8	>>	R-SELECTED FROM	IMAGE		1	MC	XOR Row 7	Shall reference an IMAGE content item in the (111028, DCM, "Image Library")
9	**≥**		**INCLUDE**	**DTID (4023) CAD Operating Points**	**1**	**U**		

574 **Content Item Descriptions**

CAD Algorithm Identification	If more than one analysis algorithm has the same "Analysis Performed" code value (e.g., CID 6043) then the "CAD Algorithm Identification" shall unambiguously distinguish between algorithms.
Rows 3 - 6	**Mammography CAD SR:** When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, and a total of at least two instances of row 4 or row 6 shall be present. **Chest CAD SR:** When this template is invoked for the Chest CAD SR, the Image Library is optional, thus any combination of rows 3, 4, 5 and 6 may be present. **Colon CAD SR: When this template is invoked for the Colon CAD SR, the Image Library does not exist, thus rows 3, 5 and/or 6 may be present and row 4 shall not be present.**
Rows 7 - 8	**Mammography CAD SR:** When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, thus only row 8 shall be present. **Chest CAD SR:** When this template is invoked for the Chest CAD SR, the Image Library is optional, thus row 7 or 8 may be present. **Colon CAD SR: When this template is invoked for the Colon CAD SR, the Image Library does not exist, thus only row 7 may be present.**

576

576

TID 4100   CHEST CAD DOCUMENT ROOT

578
**TID 4100
CHEST CAD DOCUMENT ROOT**
580
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
…								
9	>>	INFERRED FROM	INCLUDE	DTID (4016) CAD Analyses Performed	1	MC	Shall be present unless the value of row 8 is (111225, DCM, "Not Attempted")	$AnalysisCode = DCID (6137) Types of ~~Chest~~ CAD Analysis

582

TID 4103   CHEST CAD COMPOSITE FEATURE BODY

584
**TID 4103
CHEST CAD COMPOSITE FEATURE BODY**
586
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
…								
11			CODE	EV (111049, DCM, "Qualitative Difference")	1-n	UC	May be present only if the value of row 1 is (111153, DCM, "Target content items are related temporally")	DCID (6134) ~~Chest~~ Qualitative Temporal Difference Type
…								

588

TID 4104   CHEST CAD SINGLE IMAGE FINDING

590
**TID 4104
CHEST CAD SINGLE IMAGE FINDING**
592
Type: Non-Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
…								
7	>>	HAS PROPERTIES	NUM	(111071, DCM, "CAD Operating Point")	1	UC	IFF value of row 6 is (111151, DCM, "Presentation Optional") and row ~~9~~1 of TID 40~~17~~23 is present **for the finding identified in row 1**	UNITS = DT ({1:n}, UCUM, "range: 1:n"), where n is the maximum specified in Row ~~9~~1 of TID 40~~17~~23 **for the finding identified in row 1**. Value is restricted to being an intege**r.**
…								
24	>	HAS PROPERTIES	INCLUDE	DTID (4014) CAD Image Quality	1	MC	Shall be present IFF value of row 1 is (111101, DCM, "Image quality")	$QualityFinding = DCID (6135) ~~Chest~~ Image Quality Finding $QualityStandard = DCID (6136) Chest Types of Quality Control Standard

594

594   **Add the following Context Groups to Part 16 Annex B DCMR Context Groups (Normative):**

596   **CID 6200 Colon Overall Assessment**

Context ID 6200

598   **Colon Overall Assessment**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	112240	C0 - Inadequate Study/Awaiting Prior Comparisons
DCM	112241	C1 - Normal Colon or Benign Lesion
DCM	112242	C2 - Intermediate Polyp or Indeterminate Finding
DCM	112243	C3 - Polyp, Possibly Advanced Adenoma
DCM	112244	C4 - Colonic Mass, Likely Malignant

600

CID 6201 Colon Finding or Feature

602   **Context ID 6201**

Colon Finding or Feature

604   **Type: Extensible   Version: 20090402**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	111101	Image quality
DCM	111099	Selected region
SRT	D5-41170	Polyp of colon
SRT	D5-F131F	Tumor of colon
SRT	F-54005	Rectal mass
SRT	M-32700	Diverticulum
SRT	T-59345	Colonic haustra
SRT	T-59666	Feces
SRT	M-88500	Lipoma
SRT	T-50153	Intraluminal fluid
SRT	F-61D54	Contrast media
SRT	T-58650	Ileocecal valve
SRT	M-32704	Inverted diverticulum
SRT	M-18000	Operative Site

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	111102	Non-lesion
DCM	112238	Anatomic non-colon

606 **CID 6202 Colon Finding or Feature Modifier**

Context ID 6202

608 **Colon Finding or Feature Modifier**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include Context ID 6203		
Include Context ID 6204		

610

CID 6203 Colon Non-Lesion Object Type

612 **Context ID 6203**

Colon Non-Lesion Object Type

614 **Type: Extensible   Version: 20090402**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	A-32110	Bullet
SRT	A-13600	Staple
SRT	A-13510	Suture material
SRT	M-78060	Scar tissue
SRT	A-26800	Catheter
DCM	112173	Chest tube
SRT	A-14611	Vena cava filter
SRT	A-04000	Prosthesis
SRT	A-26434	Jejunostomy tube
DCM	112175	Kidney stent
SRT	A-11C08	Ureteral stent
DCM	112176	Pancreatic stent
SRT	A-61000	Jewelry
DCM	112178	Coin

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	A-12024	Pin
SRT	A-30360	Needle
DCM	112171	Fiducial mark
DCM	111176	Unspecified
SRT	A-120DD	Colostomy set
SRT	A-10DBC	Colostomy bag
SRT	A-1009E	Ileostomy set
SRT	A-10029	Ileostomy bag
SRT	A-10703	Urostomy set
SRT	A-105E3	Urostomy bag
SRT	A-26440	Rectal tube
SRT	A-26864	Urethral catheter

616 **CID 6204 Anatomic Non-Colon Findings**

Context ID 6204

618 **Anatomic Non-Colon Findings**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	T-62000	Liver
SRT	T-C3000	Spleen
SRT	T-71000	Kidney
SRT	T-B3000	Adrenal gland
SRT	T-42000	Aorta
SRT	T-48710	Inferior vena cava
SRT	T-28000	Lung
SRT	T-D016E	Bone
SRT	T-94000	Testis
SRT	T-83000	Uterus
SRT	T-87000	Ovary
SRT	T-83200	Cervix
SRT	T-92000	Prostate
SRT	T-93000	Seminal Vesicle

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	T-59600	Rectum
SRT	T-74000	Bladder
SRT	T-13001	Muscle
SRT	T-40000	Blood Vessel
SRT	T-59200	Appendix
SRT	T-D0874	Appendiceal stump

620

CID 6205 Clockface Location for Colon

622

Context ID 6205

Clockface Location for Colon

624

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	F-01781	1 o'clock position
SRT	F-01782	2 o'clock position
SRT	F-01783	3 o'clock position
SRT	F-01784	4 o'clock position
SRT	F-01785	5 o'clock position
SRT	F-01786	6 o'clock position
SRT	F-01787	7 o'clock position
SRT	F-01788	8 o'clock position
SRT	F-01789	9 o'clock position
SRT	F-0178A	10 o'clock position
SRT	F-0178B	11 o'clock position
SRT	F-0178C	12 o'clock position

626 **CID 6206 Recumbent Patient Orientation for Colon**

Context ID 6206

628 **Recumbent Patient Orientation for Colon**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	F-10310	Prone
SRT	F-10340	Supine
SRT	F-10317	right lateral decubitus
SRT	F-10319	left lateral decubitus

630

632

CID 6207 Colon Quantitative Temporal Difference Type

634 **Context ID 6207**

Colon Quantitative Temporal Difference Type

636 **Type: Extensible   Version: 20090717**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	F-05173	Difference in size
SRT	F-05179	Difference in location
SRT	F-0516E	Difference in attenuation

638 **CID 6208 Colon Types of Quality Control Standard**

Context ID 6208

640 **Colon Types of Quality Control Standard**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	112036	ACR Position Statement
DCM	111240	Institutionally defined quality control standard
DCM	112248	ACR Guideline, Performance of Adult CT Colonography

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	112249	ACR Standard, CT medical physics performance monitoring

642

CID 6209 Colon Morphology Descriptor

644   **Context ID 6209**

Colon Morphology Descriptor

646   **Type: Extensible   Version: 20090402**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	G-A530	Sessile
SRT	G-A477	Pedunculated
SRT	G-A485	Flat
SRT	R-404F0	Circumferential
SRT	M-38000	Ulcer

648 ### CID 6210 Location in Intestinal Tract

Context ID 6210

650   **Location in Intestinal Tract**

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	T-59600	Rectum
SRT	T-59470	Sigmoid colon
SRT	T-59460	Descending colon
SRT	T-59440	Transverse colon
SRT	T-59420	Ascending colon
SRT	T-59100	Cecum
SRT	T-59442	Splenic flexure of colon
SRT	T-59438	Hepatic flexure of colon

652

CID 6211 Colon CAD Material Description

654

Context ID 6211

Colon CAD Material Description

656

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	112144	Soft tissue
SRT	T-D008A	Fat
SRT	A-80230	Air
SRT	T-11034	Bone matrix

658 **CID 6212 Calculated Value for Colon Findings**

Context ID 6212

660

Calculated Value for Colon Findings

Type: Extensible   Version: 20090402

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	R-0045B	Polyp stalk length
SRT	R-00286	Polyp size, largest dimension
DCM	112232	Polyp stalk width
DCM	112233	Distance from anus

662

664 ***Modify the following Context Groups of Part 16 Annex B DCMR Context Groups (Normative):***

666

CID 6134   ~~Chest~~ Qualitative Temporal Difference Type

668   **Context ID 6134**

~~Chest~~ Qualitative Temporal Difference Type

670   **Type: Extensible   Version: ~~20030108~~20090717**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
~~DCM~~SRT	~~112165~~ F-0517E	Difference in border shape

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
~~DCM~~SRT	~~112166~~ F-05166	Difference in border definition
~~DCM~~SRT	~~112167~~ F-0516C	Difference in distribution
~~DCM~~SRT	~~112168~~ F-05170	Difference in site involvement
~~DCM~~SRT	~~112169~~ F-05167	Difference in ~~Type of Content~~ substance
~~DCM~~SRT	~~112170~~ F-0516A	Difference in texture
SRT	F-01722	Finding partially removed
SRT	F-01723	No significant changes in the finding
SRT	M-02520	Increase in size
SRT	M-02530	Decrease in size
SRT	F-01728	Less defined
SRT	F-01729	More defined

672 **CID 6135** ~~Chest~~ **Image Quality Finding**

Context ID 6135

674 ~~Chest~~ **Image Quality Finding**

Type: Extensible **Version: ~~20030108~~20090402**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	111208	Grid artifact(s)
DCM	111209	Positioning
DCM	111210	Motion blur
DCM	111211	Under exposed
DCM	111212	Over exposed
DCM	111213	No image
DCM	111214	Detector artifact(s)
DCM	111215	Artifact(s) other than grid or detector artifact
DCM	111216	Mechanical failure
DCM	111217	Electrical failure
DCM	111218	Software failure
DCM	111219	Inappropriate image processing
DCM	111220	Other failure
DCM	111221	Unknown failure
RADLEX	**RID11327**	**Beam-hardening artifact**

676

CID 6137   Types of ~~Chest~~ CAD Analysis

678   **Context ID 6137**

Types of ~~Chest~~ CAD Analysis

680   **Type: Extensible   Version: 20030108**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	
SRT	P5-B3402	Spatial collocation analysis	See Note 1
SRT	P5-B3404	Spatial proximity analysis	See Note 2
SRT	P5-B3406	Temporal correlation	
SRT	P5-B3408	Image quality analysis	

682 _____

Notes: 1. Spatial Collocation Analysis is used to identify features that are the same or located in the same
684 place.
        2. Spatial Proximity Analysis is used to identify different features that are related spatially.

686

686

> **Modify the following definitions to Part 16 Annex D DICOM Controlled Terminology Definitions**
688 | **(Normative):**

Annex D   DICOM Controlled Terminology Definitions (Normative)

690 This Annex specifies the meanings of codes defined in DICOM, either explicitly or by reference to another part of DICOM or an external reference document or standard.

692 **DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")**

Code Value	Code Meaning	Definition	Notes
112036	ACR Position Statement	American College of Radiology. ACR Position Statement **for Quality Control and Improvement, Safety, Infection Control, and Patient Concerns. In:** *Practice Guidelines and Technical Standards*. Reston, Va: 2001:iv	
…			
112165	*Difference in border shape*	*A change in the shape formed by the boundary or edges of a finding or feature.*	***Retired. Replaced with (F-0517E, SRT, "Difference in border shape")***
112166	*Difference in border definition*	*A change in the clarity of the boundary or edges of a finding or feature.*	***Retired. Replaced with (F-05166, SRT, "Difference in border definition")***
112167	*Difference in distribution*	*A change in the extent of spreading of a finding or feature.*	***Retired. Replaced with (F-0516C, SRT, "Difference in distribution")***
112168	*Difference in site involvement*	*A change in the part(s) of the anatomy affected or encompassed by a finding or feature.*	***Retired. Replaced with (F-05170, SRT, "Difference in site involvement")***
112169	*Difference in Type of Content*	*A change in the matter or substance within a finding or feature.*	***Retired. Replaced with (F-05167, SRT, "Difference in substance")***

Code Value	Code Meaning	Definition	Notes
112170	*Difference in Texture*	*A change in the surface or consistency of a finding or feature.*	***Retired. Replaced with (F-0516A, SRT, "Difference in texture")***

694 | **Add the following definitions to Part 16 Annex D DICOM Controlled Terminology Definitions (Normative):**

Annex D DICOM Controlled Terminology Definitions (Normative)

696 This Annex specifies the meanings of codes defined in DICOM, either explicitly or by reference to another part of DICOM or an external reference document or standard.

698 **DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")**

Code Value	Code Meaning	Definition
112220	Colon CAD Report	A structured report containing the results of computer-aided detection or diagnosis applied to colon imaging and associated clinical information.
112222	Colon Overall Assessment	Overall interpretation of the colon using C-RADS categorization system.
112224	Image Set Properties	Characteristics of a set of images.
112225	Slice Thickness	Nominal slice thickness, in mm.
112226	Spacing between slices	Distance between contiguous images, measured from the center-to-center of each image.
112227	Frame of Reference UID	Uniquely identifies groups of composite instances that have the same coordinate system that conveys spatial and/or temporal information.
112228	Recumbent Patient Position with respect to gravity	Patient orientation with respect to downward direction (gravity).
112229	Identifying Segment	Distinguishes a part of a segmentation.
112232	Polyp stalk width	The diameter of a polyp stalk measured perpendicular to the axis of the stalk.
112233	Distance from anus	The length of the path following the centerline of the colon from the anus to the area of interest.
112238	Anatomic non-colon	A location in the body that is outside the colon.
112240	C0 - Inadequate Study/Awaiting Prior Comparisons	An inadequate study or a study that is awaiting prior comparisons. The study may have inadequate preparation and cannot exclude lesions greater than or equal to ten millimeters owing to presence of fluid or feces. The study may have inadequate insufflation where one or more colonic segments collapsed on both views. Based on "CT Colonography Reporting and Data System: A Consensus Proposal", Radiology July 2005; 236:3-9.

Code Value	Code Meaning	Definition
112241	C1 - Normal Colon or Benign Lesion	The study has a normal colon or benign lesion, with the recommendation to continue routine screening. The study has no visible abnormalities of the colon. The study has no polyps greater than six millimeters. The study may have lipoma, inverted diverticulum, or nonneoplastic findings, for example colonic diverticula. Based on "CT Colonography Reporting and Data System: A Consensus Proposal", Radiology July 2005; 236:3-9.
112242	C2 - Intermediate Polyp or Indeterminate Finding	The study has an intermediate polyp or indeterminate finding and surveillance or colonoscopy is recommended. There may be intermediate polyps between six and nine millimeters and there are less than three in number. The study may have an intermediate finding and cannot exclude a polyp that is greater than or equal to six millimeters in a technically adequate exam. Based on "CT Colonography Reporting and Data System: A Consensus Proposal", Radiology July 2005; 236:3-9.
112243	C3 - Polyp, Possibly Advanced Adenoma	The study has a polyp, possibly advanced adenoma, and a follow-up colonoscopy is recommended. The study has a polyp greater than or equal to ten millimeters or the study has three or more polyps that are each between six to nine millimeters. Based on "CT Colonography Reporting and Data System: A Consensus Proposal", Radiology July 2005; 236:3-9.
112244	C4 - Colonic Mass, Likely Malignant	The study has a colonic mass, likely malignant, and surgical consultation is recommended. The lesion compromises bowel lumen and demonstrates extracolonic invasion. Based on "CT Colonography Reporting and Data System: A Consensus Proposal", Radiology July 2005; 236:3-9.
112248	ACR Guideline, Performance of Adult CT Colonography	American College of Radiology Practice Guideline for the Performance of Computed Tomography (CT) Colonography in Adults. In: *Practice Guidelines and Technical Standards.* Reston, Va: American College of Radiology;2006:371-376.

Code Value	Code Meaning	Definition
112249	ACR Standard, CT medical physics performance monitoring	American College of Radiology Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment. In: *Practice Guidelines and Technical Standards.* Reston, Va: American College of Radiology;2006:945-948.

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702

704

706

Changes to NEMA Standards Publication PS 3.17-2008

Digital Imaging and Communications in Medicine (DICOM)

708

## Part 17: Explanatory Information

710

710

Add the following to PS 3.17

712   **ANNEX X Colon CAD (INFORMATIVE)**

X.1 Colon CAD SR Content Tree Structure

714   The templates for the Colon CAD SR IOD are defined in PS 3.16, Annex A, DCMR Templates. All
relationships defined in the Colon CAD SR IOD templates are by-value. Content items referenced from
716   another SR object instance, such as a prior Colon CAD SR, are inserted by-value in the new SR object
instance, with appropriate original source observation context. It is necessary to update Rendering Intent,
718   and referenced content item identifiers for by-reference relationships, within content items paraphrased
from another source.
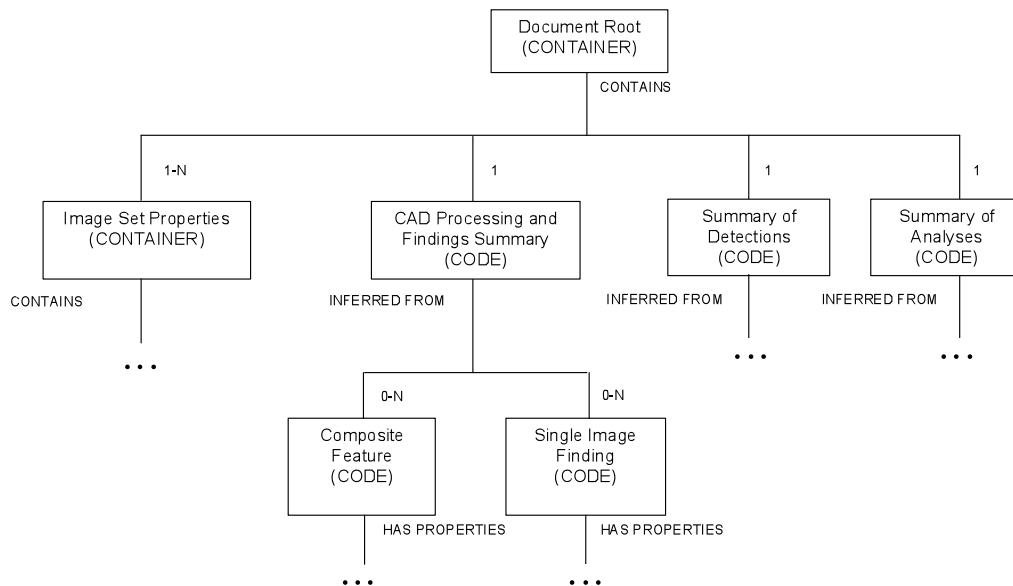
720
Figure X.1-1: Top Levels of Colon CAD SR Content Tree

722   The Document Root, Image Set Properties, CAD Processing and Findings Summary, and Summaries of
Detections and Analyses sub-trees together form the content tree of the Colon CAD SR IOD. See Annex
724   E, Mammography CAD SR Content Tree Structure, for additional explanation of the Summaries of
Detections and Analyses sub-trees.

726

728   The identification of a polyp within an image set is considered to be a Detection.The temporal correlation of
a polyp in two image sets taken at different times is considered Analysis. This distinction is used in
730   determining whether to place algorithm identification information in the Summary of Detections or
Summary of Analyses sub-trees.

732 Once a Single Image Finding or Composite Feature has been instantiated, it may be referenced by any number of Composite Features higher in the CAD Processing and Findings Summary sub-tree.

734 **X.2 Colon CAD SR Observation Context Encoding**

Any content item in the Content tree that has been inserted (i.e., duplicated) from another SR object
736 instance has a HAS OBS CONTEXT relationship to one or more content items that describe the context of the SR object instance from which it originated. This mechanism may be used to combine reports (e.g.,
738 Colon CAD SR 1, Colon CAD SR 2, Human).

The CAD Processing and Findings Summary section of the SR Document Content tree of a Colon CAD SR
740 IOD may contain a mixture of current and prior single image findings and composite features. The content items from current and prior contexts are target content items that have a by-value INFERRED FROM
742 relationship to a Composite Feature content item. Content items that come from a context other than the Initial Observation Context have a HAS OBS CONTEXT relationship to target content items that describe
744 the context of the source document.

In Figure X.2-1, Composite Feature and Single Image Finding are current, and Single Image Finding (from
746 Prior) is duplicated from a prior document.
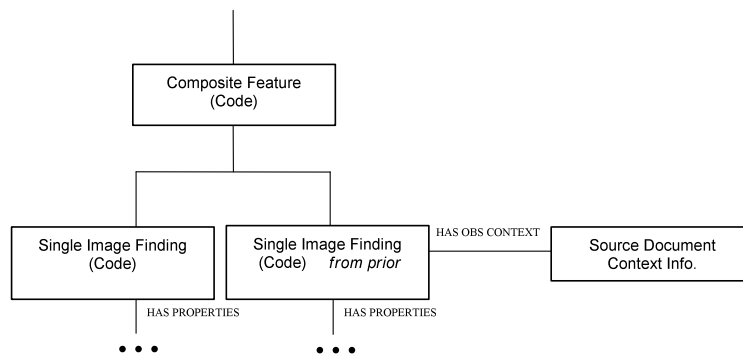
748 **Figure X.2-1: Example of Use of Observation Context**

X.3 Colon CAD SR Examples

750 The following is a simple and non-comprehensive illustration of an encoding of the Colon CAD SR IOD for colon computer aided detection results. For brevity, some mandatory content items are not included.

752 **X.3.1 Example 1: Colon Polyp Detection with No Findings**

A colon CAD device processes a typical screening colon case, i.e., there are several hundred images and
754 no polyp findings. Colon CAD runs polyp detection successfully and finds nothing.

The colon radiograph resembles:

Colon CT Slice

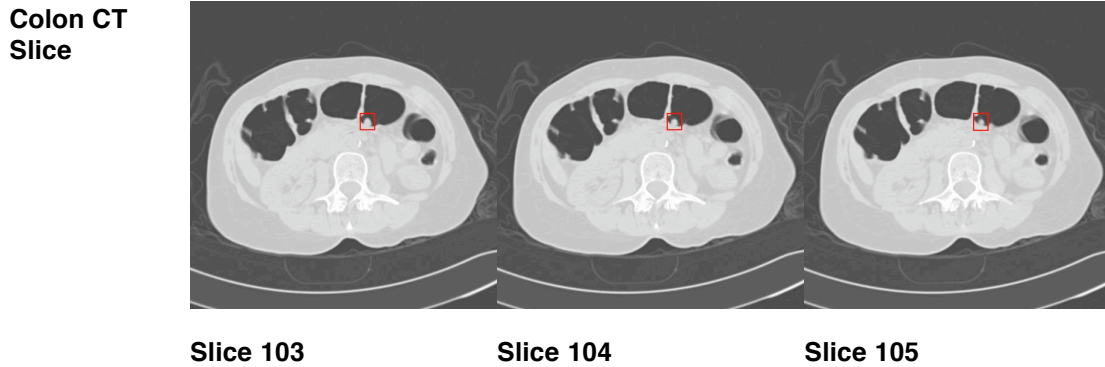756   **Figure X.3-1: Colon radiograph as Described in Example 1**

The content tree structure would resemble:

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1	Colon CAD Report		4120
1.1	Language of Content Item and Descendants	English	1204
1.2	Image Set Properties		4122
1.2.1	Frame of Reference UID	1.2.840.114191.123	4122
1.2.2	Study Instance UID	1.2.840.114191.456	4122
1.2.3	Study Date	20060924	4122
1.2.4	Study Time	090807	4122
1.2.5	Modality	CT	4122
1.2.6	Horizontal Pixel Spacing	0.80 mm	4122
1.2.7	Vertical Pixel Spacing	0.80 mm	4122
1.2.8	Slice Thickness	2.5 mm	4122
1.2.9	Spacing between slices	1.5 mm	4122
1.2.10	Recumbent Patient Position with respect to gravity	Prone	4122
1.3	CAD Processing and Findings Summary	All algorithms succeeded; without findings	4121
1.4	Summary of Detections	Succeeded	4120
1.4.1	Successful Detections		4015
1.4.1.1	Detection Performed	Nodule	4017
1.4.1.1.1	Algorithm Name	"Colon Polyp Detector"	4019
1.4.1.1.2	Algorithm Version	"V1.3"	4019
1.4.1.1.3	Series Instance UID	1.2.840.114191.789	4017
1.5	Summary of Analyses	Not Attempted	4120

758

X.3.2 Example 2: Colon Polyp Detection with Findings

760 A colon CAD device processes a screening colon case with several hundred images, and a colon polyp detected. The colon radiograph resembles:

Colon CT Slice

Slice 103   **Slice 104**   **Slice 105**

762 **Figure X.3-2: Colon radiograph as Described in Example 2**

764 The content tree structure in this example is complex. Structural illustrations of portions of the content tree are placed within the content tree table to show the relationships of data within the tree. Some content items are duplicated (and shown in boldface) to facilitate use of the diagrams.

766
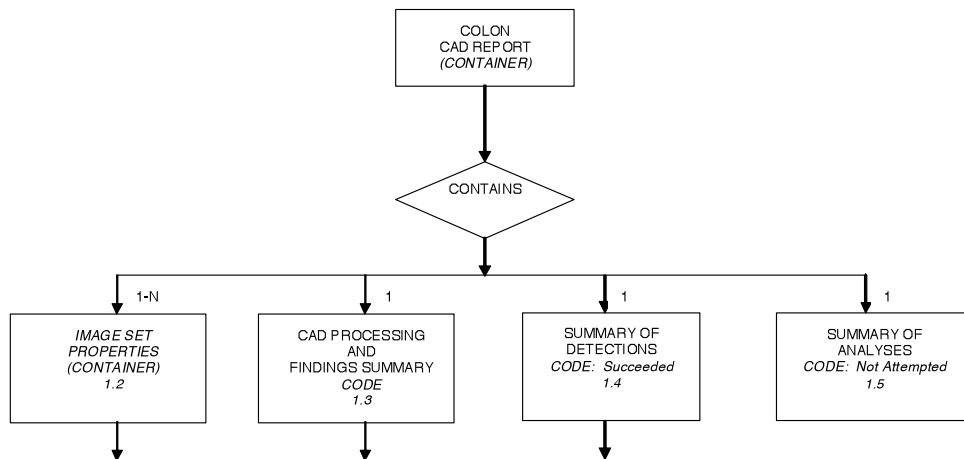
768

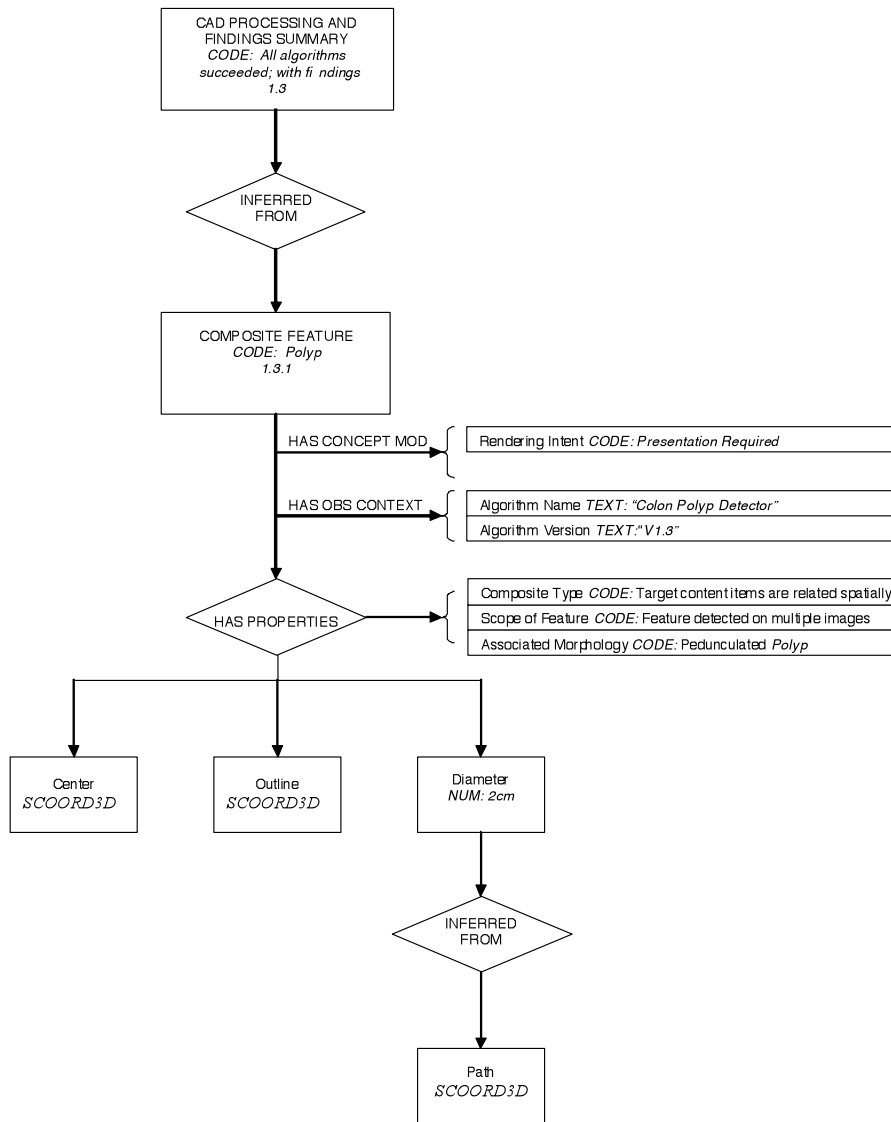**Figure X.3-3: Content Tree Root of Example 2 Content Tree**

770 The content tree structure would resemble:

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1	Colon CAD Report		4120
1.1	Language of Content Item and Descendants	English	1204

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.2	Image Set Properties		4122
1.3	CAD Processing and Findings Summary	All algorithms succeeded; with findings	4121
1.4	Summary of Detections	Succeeded	4120
1.5	Summary of Analyses	Not Attempted	4120

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.2	Image Set Properties		4122
1.2.1	Frame of Reference UID	1.2.840.114191.1122	4122
1.2.2	Study Instance UID	1.2.840.114191.3344	4122
1.2.3	Study Date	20070924	4122
1.2.4	Study Time	090807	4122
1.2.5	Modality	CT	4122
1.2.6	Horizontal Pixel Spacing	0.80 mm	4122
1.2.7	Vertical Pixel Spacing	0.80 mm	4122
1.2.8	Slice Thickness	2.5 mm	4122
1.2.9	Spacing between slices	1.5 mm	4122
1.2.10	Recumbent Patient Position with respect to gravity	Prone	4122

772

774

Figure X.3-4: CAD Processing and Findings Summary Portion of Example 2 Content Tree

776

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.3	CAD Processing and Findings Summary	All algorithms succeeded; with findings	4121
1.3.1	Composite Feature	Polyp	4125
1.3.1.1	Rendering Intent	Presentation Required:...	4125
1.3.1.2	Algorithm Name	"Colon Polyp Detector"	4019
1.3.1.3	Algorithm Version	"V1.3"	4019

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.3.1.4	Composite Type	Target content items are related spatially	4126
1.3.1.5	Scope of Feature	Feature detected on multiple images	4126
1.3.1.6	Center	SCOORD3D POINT	4129
1.3.1.7	Outline	SCOORD3D ELLIPSOID	4129
1.3.1.8	Associated Morphology	Pedunculated	4128
1.3.1.9	Diameter	20 mm	1406
1.3.1.9.1	Path	SCOORD3D POLYLINE	1406
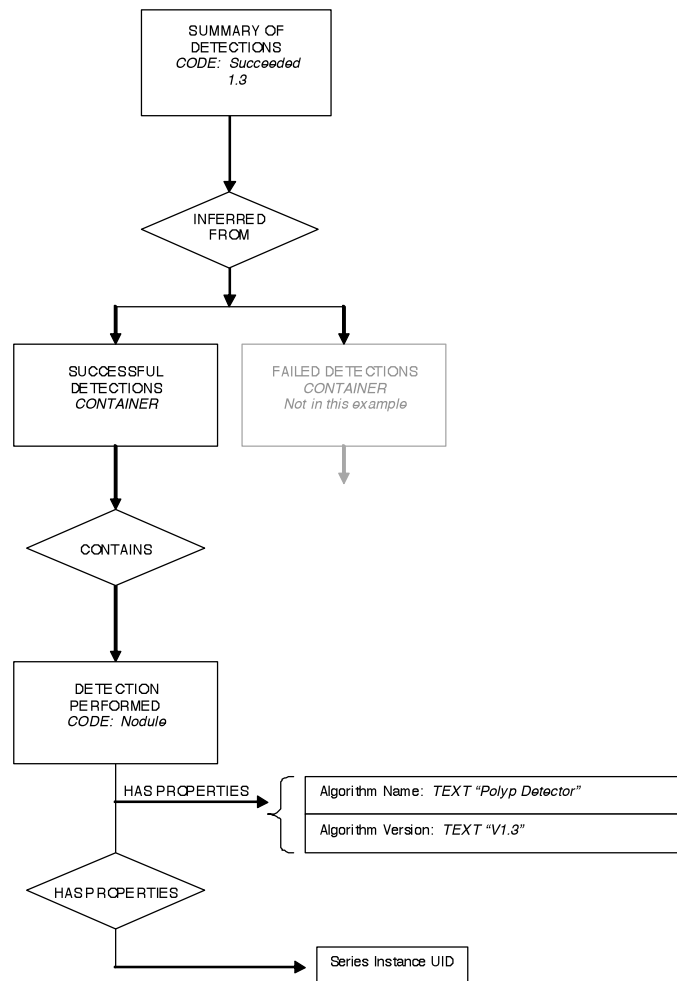
778

Figure X.3-5: Summary of Detections Portion of Example 2 Content Tree

780

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.4	Summary of Detections	Succeeded	4120
1.4.1	Successful Detections		4015
1.4.1.1	Detection Performed	Polyp	4017
1.4.1.1.1	Algorithm Name	"Colon Polyp Detector"	4019
1.4.1.1.2	Algorithm Version	"V1.3"	4019
1.4.1.1.3	Series Instance UID	1.2.840.114191.111222	4017

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.5	Summary of Analyses	Not Attempted	4120

782

X.3.3 Example 3: Colon Polyp Detection, Temporal Differencing with Findings

The patient in Example 2 returns for another colon radiograph. A more comprehensive colon CAD device processes the current colon radiograph, and analyses are performed that determine some temporally related content items for Composite Features. Portions of the prior colon CAD report (Example 2) are incorporated into this report. In the current colon radiograph the colon polyp has increased in size.

PRIOR COLON CT SLICE
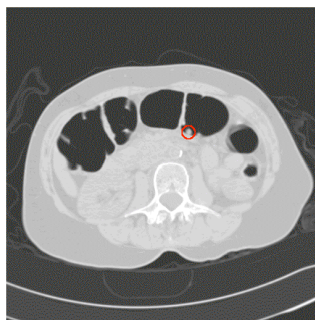
CURRENT COLON CT SLICE

790 **Figure X.3-7: Colon radiographs as Described in Example 3**

792

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1	Colon CAD Report		4120
1.1	Language of Content Item and Descendants	English	1204
1.2	Image Set Properties		4122
1.2.1	Frame of Reference UID	1.2.840.114191.5577	4122
1.2.2	Study Instance UID	1.2.840.114191.7788	4122
1.2.3	Study Date	20080924	4122
1.2.4	Study Time	101827	4122
1.2.5	Modality	CT	4122
1.2.6	Horizontal Pixel Spacing	0.80 mm	4122
1.2.7	Vertical Pixel Spacing	0.80 mm	4122
1.2.8	Slice Thickness	2.5 mm	4122
1.2.9	Spacing between slices	1.5 mm	4122
1.2.10	Recumbent Patient Position with respect to gravity	Prone	4122
1.3	Image Set Properties		4122
1.3.1	Frame of Reference UID	1.2.840.114191.1122	4122
1.3.2	Study Instance UID	1.2.840.114191.3344	4122
1.3.3	Study Date	20070924	4122
1.3.4	Study Time	090807	4122
1.3.5	Modality	CT	4122
1.3.6	Horizontal Pixel Spacing	0.80 mm	4122
1.3.7	Vertical Pixel Spacing	0.80 mm	4122
1.3.8	Slice Thickness	2.5 mm	4122
1.3.9	Spacing between slices	1.5 mm	4122
1.3.10	Recumbent Patient Position with respect to gravity	Prone	4122

794 The CAD processing and findings consist of one composite feature, comprised of single image findings, one from each year. The temporal relationship allows a quantitative temporal difference to be calculated:

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.4	CAD Processing and Findings Summary	All algorithms succeeded; with findings	4121

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.4.1	Composite Feature	Polyp	4125
1.4.1.1	Rendering Intent	Presentation Required: …	4125
1.4.1.2	Algorithm Name	"Polyp Change"	4019
1.4.1.3	Algorithm Version	"V2.3"	4019
1.4.1.4	Composite Type	Target content items are related temporally	4126
1.4.1.5	Scope of Feature	Feature detected on multiple images	4126
1.4.1.6	Certainty of Feature	85%	4126
1.4.1.7	Associated Morphology	Pedunculated	4128
1.4.1.8	Difference in size	2 mm	4126
1.4.1.8.1		Reference to Node 1.4.1.9.10	4126
1.4.1.8.2		Reference to Node 1.4.1.10.10	4126
1.4.1.9	Composite Feature	Polyp	4125
1.4.1.9.1	Rendering Intent	Presentation Required: …	4125
1.4.1.9.2	Tracking Identifier	"Watchlist #1"	4108
1.4.1.9.3	Algorithm Name	"Colon Polyp Detector"	4019
1.4.1.9.4	Algorithm Version	"V1.3"	4019
1.4.1.9.5	Composite Type	Target content items are related spatially	4126
1.4.1.9.6	Scope of Feature	Feature detected on multiple images	4126
1.4.1.9.7	Center	SCOORD3D POINT	4129
1.4.1.9.8	Outline	SCOORD3D ELLIPSE	4129
1.4.1.9.9	Associated Morphology	Pedunculated	4128
1.4.1.9.10	Diameter	4 mm	1406
1.4.1.9.10.1	Path	SCOORD3D POLYLINE	1406
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1.4.1.10.1	Rendering Intent	Presentation Required: …	4125
1.4.1.10.2	[Observation Context content items]		4022
1.4.1.10.3	Algorithm Name	"Colon Polyp Detector"	4019
1.4.1.10.4	Algorithm Version	"V1.3"	4019
1.4.1.10.5	Composite Type	Target content items are related spatially	4126
1.4.1.10.6	Scope of Feature	Feature detected on multiple images	4126

Node	Code Meaning of Concept Name	Code Meaning or Example Value	TID
1.4.1.10.7	Center	SCOORD3D POINT	4129
1.4.1.10.8	Outline	SCOORD3D ELLIPSE	4129
1.4.1.10.9	Associated Morphology	Pedunculated	4128
1.4.1.10.10	Diameter	2 mm	1406
1.4.1.10.10.1	Path	SCOORD3D POLYLINE	1406
1.5	Summary of Detections	Succeeded	4120
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1.5.1.1	Detection Performed	Polyp	4017
1.5.1.1.1	Algorithm Name	"Colon Polyp Detector"	4019
1.5.1.1.2	Algorithm Version	"V1.3"	4019
1.5.1.1.3	Series Instance UID	1.2.840.114191.555666	4017
1.6	Summary of Analyses	Succeeded	4120
1.6.1	Successful Analyses		4016
1.6.1.1	Analysis Performed	"Temporal correlation"	4018
1.6.1.1.1	Algorithm Name	"Polyp Change"	4019
1.6.1.1.2	Algorithm Version	"V2.3"	4019
1.6.1.1.3	Series Instance UID	1.2.840.114191.111222	4018
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