SDI/CDI Interface Supplementary Document to DICOS v03

Abstract: This document represents the process for standardized data collection that uses the DICOS v03 data format using modules and Original Equipment Manufacturers (OEM) defined modules for the Sensor Data Interface (SDI) and Corrected Data Interface (CDI). The data will be uniform across any Explosive Detection Systems (EDSs) or checkpoint CTs, eliminating any need to develop anything unique, for collecting raw X-ray detector data. In addition, this format will allow third-party development pre-processing data methods and alternate reconstruction algorithms. Using the defined DICOS v03 formats, each third-party investigator will be able to read the X-ray detector data from any Explosive Detection System (EDS) or Checkpoint CT without having to develop unique software.
The SDI/CDI interface is that process nexus between the OEMs and third-party developers where necessary and sufficient data can be obtained by third-parties to empower their independent algorithm development while protecting the proprietary property of OEMs who are collecting such data. The SDI/CDI Interface document which accompanies the DICOS v03 standard defines the necessary data elements, tags, and formats by which the important objective of empowering third-party developers in the security domain may be advanced through a consistent data "handoff" between OEMs and third parties.

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TSA DICOS v03 Draft Sensor Data Interface (SDI) and Corrected Data Interface (CDI) Information Object Definition (IOD) Modules Proposal to TWG-2

Engineering Analysis Report

Section 15

DICOS v03 Draft Sensor Data Interface (SDI) and Corrected Data Interface (CDI) IOD Modules

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Revision History

Date	Rev.	Description	Author
2018-10-24	0.1	Draft	S. Skrzypkowiak
2018-11-06	0.2	Added general comment tag attribute Added CDI subsection Add SOPs, which will need to be included in the main section. Added CDI to the SDI tag attributes	S. Skrzypkowiak
2018-12-29	0.3	We have added missing tag attribute numbers as we were unsuccessful in contacting NEMA to determine the proper numbering system.	S. Skrzypkowiak
2021-07-01	0.4	Completed Document Revision	S. Skrzypkowiak
2021-10-14	0.5	Revised to accommodate files and new modules	S. Skrzypkowiak
2021-11-02	0.6	Update document to reflect Geometry Mapping File and its relationship to the other required files.	S. Skrzypkowiak
2021-11-18	0.7	Add text input to GMF to describe how the data is formatted within the file. Then, combine the DX and CT position and detector modules, and remove the X-ray fault module.	S. Skrzypkowiak
2021-12-2	0.8	Corrections to GMF, move FOV and image origin to GMF, Remove Figure 8	S. Skrzypkowiak
2022-01-03	0.9	Moved modules to separate file and defined SOP	S. Skrzypkowiak

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OVERVIEW

Presently, raw data is collected from Explosive Detection Systems (EDSs) to improve the image reconstruction process and develop new reconstruction techniques by third parties. Previously, primary detector data was gathered according to a format established by the OEM or the data gathering agency. This made the distribution of data to third parties for enhanced development difficult since each OEM had its own unique data structure, which needed to be decoded, and specific software to be developed. However, even when such software was developed, it could not be used universally since each OEM had its own unique format.

DICOS v03 is a standardized data collection format that uses the data format using modules and OEM defined modules for the Sensor Data Interface (SDI) and Corrected Data Interface (CDI). These data will be uniform across all EDSs for collecting raw X-ray detector data. In addition, this format will allow third-party development pre-processing data methods and alternate reconstruction algorithms. Using the defined DICOS v03 formats, each third-party investigator will be able to read the X-ray detector data from any EDS without having to develop unique software.

As preliminarily defined by DICOS v02A, the plain X-ray data is shown in Figure 1 based on the DICOM transmission. As historically defined by DICOS v02A, the X-ray detector raw data is shown in Figure 1 and is based on the DICOM transmission model. For DICOM, there is usually an image transmitted every 20 minutes. From Figure 1, each image would require the addition of the following data: X-ray Detector Read Format, X-ray Detector Geometry File, Bad Detector Map, and Air/Offset Tables. The TSA has an image transfer rate of 600 bags per hour and will continue to increase as the number of passengers increases yearly. The DICOS v02A model is efficient for a large file, high-volume image transfer over a network.

Consequently, the DICOS v03 Technical Working Group proposed and adopted the model shown in Figure 2. In this model, the Geometry Map, X-ray Detector Read Format, X-ray Detector Geometry File, Bad Detector Map, Air/Offset Tables and CT IOD Modules do not change between images and would be indexed through a file pointer that contains the necessary data. This model is tailored for the security industry and dramatically reduces or eliminates the amount of redundant data that needs to be transferred for each bag image file, between 10 to 15% over the DICOS v02A implementation.

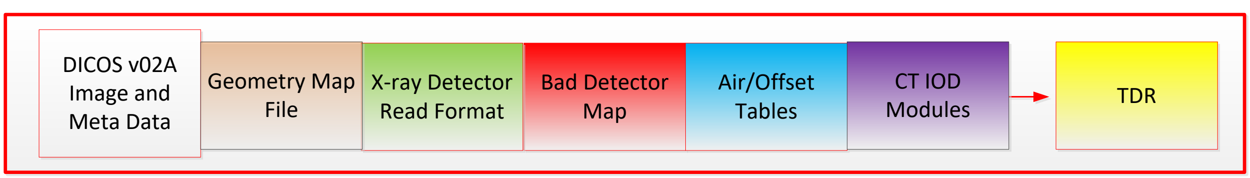

Figure 1. Historical DICOS v02A implementation of transmitting raw X-ray detector data.

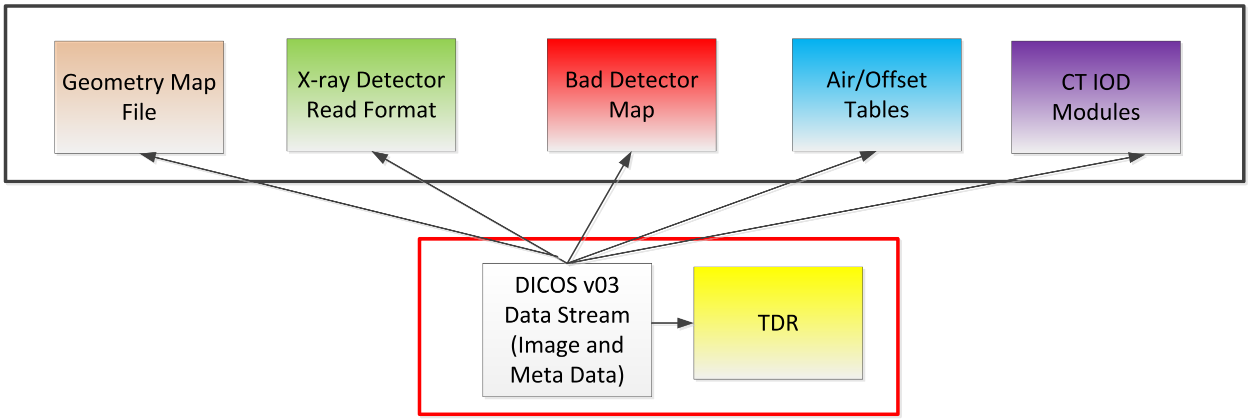

Figure 2. Draft DICOS v03 implementation of transmitting raw X-ray detector data. The first file that must be named or pointed to is the Geometry Map File. The order of the other files may be random.

The flow, modules, and tag attributes presented in this document are not meant as a final implementation but a first draft of obtaining the final format. Technical discussions will be required to validate the draft tag attributes, and additional tag attributes will be added to make the formatting and data gathering process more efficient and accurate.

A draft data flow is presented in Figure 2. Figure 2 shows the files and file pointers that will be leveraged from the original DICOS standard and those needing development. The files and modules that will need to be considered by the Technical Working Group (TWG) will be:

1. Renaming/expanding some of the present Digital X-ray modules so that they can be used in the Computed Tomography (CT) series
2. Development of Geometry Mapping File (GMF) which not only lays out the mapping of the X-ray detectors to the X-ray source(s) but identifies how the X-ray detectors are indexed for the following additional files, for example, but not limited to:
    a. X-ray Detector Read Format
    b. Offset Calibration
    c. Air Calibration
    d. Bad Detector
    e. CT IOD Modules

The purpose of the SDI and CDI modules is to make them general enough so that no private tags need to be used by the OEM yet specific enough to meet all the formatting needs of the data.

Again, this is a draft for the starting point consideration and will be further refined/enhanced through the DICOS v03 TWG discussions.

SENSOR DATA INTERFACE (SDI) AND CORRECTED DATA INTERFACE (CDI) IOD MODULE

This section is concerned with data collection at the Sensor Data Interface (SDI) and Corrected Data Interface (CDI) levels. This is further explained in detail in the current Digital Imaging and Communications in Security (DICOS) v03 Standard, and it is also included in Section 15.5 of this document.

Sensor Data Interface (SDI)

This section describes how X-ray detector (sensor) and corrected data are formatted from the X-ray scanning devices. Sensor data are the X-ray detector readings (output) directly from the sensors used to interrogate suspicious objects in the scanner. At this point, the X-ray detector values have not been processed (or have had limited processing). Instead, a Data Acquisition System (DAS) sends the X-ray detector data to a reconstruction computer. (Note: the DAS itself may pre-process the X-ray detector data by transforming the detector read-outs into logarithmic numbers.) When X-rays are used in the scanner, X-ray detectors measure the X-ray photons (either through time integration or energy level counting) that reach the X-ray detectors from the X-ray source as they pass through the Field of View (FOV). Sensor data may also include readings from other sensors required to reconstruct the images. These additional sensors may combine temperature, High Voltage Power Supply (HVPS) status, X-ray source, detector status, and mechanical gantry information.

Corrected Data Interface (CDI)

The CDI results from SDI data being corrected for the Explosive Detection System (EDS). Scanner geometric, X-ray detector calibration (air and dark current), and other signal processing (high and low-pass filtering) performed by the Original Equipment Manufacturer (OEM) to obtain data that can be reconstructed into a viewable image. Once the data is placed into the CDI form, many available reconstruction algorithms can be rebuilt into a viewable image.

Service-Object Pair

Service Object Pair (SOP), listed in the DICOM Standard section 6.5 is defined as:

a. A Service-Object Pair (SOP) is defined by the combination of the service classes[1] and information objects[2], which form the functional units of DICOM. Information objects define the core contents of medical imaging, and service classes define what to do with those contents.

   The selection of SOP Classes[3] is used by Application Entities to establish an

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[1] A service class is a collection of SOP Classes and/or Meta SOP Classes that are related in that they are described together to accomplish a single application.

[2] An Information Object Definition (IOD) is an object-oriented abstract data model used to specify information about Real-World Objects. An IOD provides communicating Application Entities with a common view of the information to be exchanged.

[3] **Service-Object Pair (SOP) Class** is the union of a specific set of DIMSE Services and one related Information Object Definition (as specified by a Service Class Definition) that completely defines a precise context for communication of operations on such an object or notifications about its state.

agreed set of capabilities to support their interaction. This negotiation is performed at Association establishment time as described in PS3.7. An extended negotiation allows Application Entities to further agree on specific options within a SOP Class.

The SDI-CDI module can be implemented as a standalone SOP. Still, it is recommended that the Transformed Data Interface (TDI), the reconstructed image made by the OEM, also be referenced. This will provide an initial representation of what the sensor data generates when reconstructed by the OEM.

There is an SOP for each of the SDI and CDI data formats. These will be added to the SOPs listed in the current DICOS v02A Standard upon acceptance.

Table 15.1 lists the Files used to construct an SDI module from the SDI-CDI IOD. Table 15.2 lists the Files used to build a CDI module from the SDI-CDI IOD.

Table 1a. Computed Tomography (CT) Raw Sensor Data Interface Files used for Data Gathering

IE	Files	Reference	Usage
SDI	Geometry Map File	Section 15.1.1	M
	X-ray Detector Data File	Section 15.1.2	M
	X-ray Static Bad Detector Map File	Section 15.1.3	M
	Offset Table File	Section 15.1.4	M
	Air Table File	Section 15.1.5	M
IOD	CT IOD Module	Section 15.1.6	M

Table 2b. Computed Tomography (CT) IOD Modules Used for Generating the Raw Sensor Data Interface

IE	Module	Reference	Usage
Owner	Owner	Section 3.1	U
	OOI	Section 4	M
	Itinerary	Section 4.2	U
Scan	General Scan	Section 5	M
Series	General Series	Section 6	M
	X-ray Position	Section 8.2.2.4	M
	X-ray Detector	Section 8.2.2.3	M
	CT Series	Section 7.4.1	M
Frame of Reference	Frame of Reference	Section 12.15	M
Equipment	General Equipment	Section 12.1.1	M
Note: M is Mandatory, C is Conditional, and U is User-Defined.			

Table 3a. Computed Tomography (CT) Corrected Sensor Data Interface Files used for Data Gathering

IE	Files	Reference	Usage
CDI	**Geometry Map File**	**Section 15.1.1**	**M**
	X-ray Detector Data File	**Section 15.1.2**	**M**
	X-ray Static Bad Detector Map File	**Section 15.1.3**	**M**
	Offset Table File	**Section 15.1.4**	**M**
	Air Table File	**Section 15.1.5**	**M**
IOD	**CT IOD Module**	**Section 15.1.6**	**M**

Table 4b. CT Corrected Data Interface (CDI) IOD Modules

IE	Module	Reference	Usage
Owner	Owner	Section 3.1	U
	OOI	Section 4	M
	Itinerary	Section 4.2	U
Scan	General Scan	Section 5	M
Series	General Series	Section 6	M
	X-ray Position	Section 8.2.2.4	M
	X-ray Detector	Section 8.2.2.3	M
	CT Series	Section 7.4.1	M
Frame of Reference	Frame of Reference	Section 12.15	M
Equipment	General Equipment	Section 12.1.1	M

IE	Module	Reference	Usage
Note: M is Mandatory, C is Conditional, and U is User-Defined.			

The other modules related to the SDI-CDI IOD module are referenced in Tables 1 and 2. A majority of these are already referenced in the DICOS v02A Standard. Changes to some existing DX modules to make them compatible with the required CT modules are required and are addressed in Section 15.2.

15.1 ADDITION OF GENERAL SUPPORT FILES REQUIRED TO SUPPORT SDI/CDI DATA COLLECTION

To implement the SDI/CDI data collection, the following files and modules are defined in DICOS v03.

The changes required to the DICOS v03 standard for collecting SDI/CDI data will be presented in this document. This will include the addition of dedicated files and modules for this effort. This will also have the referencing of these files within the DICOS v03 stream. To increase transmission efficiency, the following files will not be transmitted with each DICOS v03 image but will be referenced by a file pointer. The following files will need to be defined only once during bag image transmission and will not change from the bag-to-bag image. This is:

a. X-ray Detector Geometry File

The following files are stable and will only need to be updated as a result of X-ray detector temperature change, or the EDS goes in and out of SCAN state:

a. X-ray Detector Read Format
b. Offset Calibration
c. Air Calibration
d. Bad Detector
e. CT IOD Modules

The file that will be required will be the projection/image X-ray Detector Read that will be associated with each bag image. In addition, the DICOS stream will have the names or pointers of the associated files used when the bag image is obtained off the X-ray Detectors.

When the bag image DICOS files are downloaded for daily storage or forensic purposes, the General Support Files will also be downloaded.

15.1.1 Geometry Map File

The Geometry Map File defines the relation of each X-ray detector to its associated X-ray source/emitter. This mapping will not change for the EDS once defined, as shown in Table 3. The transmission of this information would be redundant for each bag image and will be identified in the DICOS v03 stream by a pointer or file name to the Geometry Map File location.

The identification of each X-ray detector to its X-ray source in the GMF will be the order for which the X-ray detector data is read from the X-ray array. This is true for the projection, air/offset, and bad detector maps.

There will be a text file within the GMF that will define how the data is stored in the format and any other information required to decode the information in the GMF.

Table 3. Geometry Map File. This X-ray detector orientation to an associated source will not change once established for the EDS. This mapping includes stationary, multi-plane, and rotating EDS geometries.

	Stationary	Rotation	Multi planes	Description
Text File Description				
Type of System	Non-rotating	Rotating	Non-rotating	
Detector Set Position(s)	(position, x,y,z) or (angle, distance)	(position, x,y,z) or (angle, distance)	(position, x,y,z) or (angle, distance)	Absolute position of all detectors in sequence stored
Source Set Position(s)	(position, x,y,z) (projection angle, angle) (central detector position, index) (projection length, length)	(position, x,y,z) (projection angle, angle) (central detector position, index) (projection length, length)	(position, x,y,z) (projection angle, angle) (central detector position, index) (projection length, length)	Array of source position(s), rotation angle, central detector position and projection length. One or more sources is acceptable.
Isocenter for Rotation	N/A	(position, x,y)	N/A	Needed to help determine point where rotation angle occurs. Only needs x,y since z axis will be the assumed axis of rotation
Geometry File ID	N/A	N/A	0, 1, 2, 3...	Identifies which geometry file is used to address multiple planes of detection
Header Length per Projection	(header length, length)	(header length, length)	(header length, length)	
Footer Length per Projection	(footer length, length)	(footer length, length)	(footer length, length)	
Number of Bits per Detector Word	(number of bits, integer)	(number of bits, integer)	(number of bits, integer)	
Offset to First Projection	(offset, integer)	(offset, integer)	(offset, integer)	
Endian	(big, little)	(big, little)	(big, little)	
Detector Size	(dx,dy,dz)	(dx,dy,dz)	(dx,dy,dz)	The detector dimensions (without this, I think the detectors are assumed to be in a continous and contiguous geometry)

A Text File will be provided at the start of the GMF. This file explains what is contained in the file and how the tag attributes are defined. This text file will also include the coordinates for the image origin (0,0) within the Field of View (FOV) system. In addition, the GMF will have the position of the X-ray detector to the X-ray source placed in the order that the X-ray detectors would be read from the X-ray modules. This X-ray detector read order would not only account for the projection reading but would be the same order used to generate the following files:

15.1.1.3 Isocenter for Rotation

Determine the point where rotation angle occurs. It only needs x, y since the z-axis will be the assumed axis of rotation. The reference will be provided from the conveyor belt.

15.1.2 X-ray Detector Read File for a bag image

The *X-ray Detector Read File is X-ray Detector data* read from the detectors in the order defined by the GMF. This raw X-ray detector data will then provide all the raw data for a single bag.

15.1.3 X-ray Static Bad Detector Map File

The *X-ray Static Bad Detector Map File* will follow the same read format described in the GMF. The bad detector would be marked as a “1” for bad and “0” for good

The transmission of this information would be redundant for each bag image and will be identified in the DICOS v03 stream by a filename or pointer to the file location.

15.1.4 Offset Table File

The *Offset Table File* will follow the same indexing and read format described in the GMF.

The transmission of this information would be redundant for each bag image and will be identified in the DICOS v03 stream by a filename or pointer to the file location. This file will be updated and pointed to within the DICOS v03 as required.

15.1.5 Air Table File

The *Air Table File* will follow the same indexing and read format described in the GMF.

The transmission of this information would be redundant for each bag image and will be identified in the DICOS v03 stream by a filename or pointer to the file location. This file will be updated and pointed to within the DICOS v03 as required.

15.1.6 CT IOD Module File

In order to reduce redundancy, the modules which make up the CT IOD Module as shown in Section 8 (Table 1b and Table 2B) will also be placed into a file and referenced by the DICOS stream either by name or pointer.

15.2 CHANGES TO CT IOD ADDITIONAL MODULES

To successfully collect the CT X-ray detector raw data, there need to be minor changes and tag attributes additional to the DX modules to account for required information which is not present in the DX module standard. Instead of repeating the meta data for both the DX and CT modules, it is recommended that the DX name to be changed to X-Ray and the minor changes made to the DX to accommodate the CT IOD.

15.2.1 X-RAY POSITIONING MODULE ATTRIBUTES

In Table 4, below are the *DX Positioning Module (Table 34, page 82 of DICOS)* Tag Attributes, required for the CT series but are not related to the CT modules. These tag attributes can either be placed into the new CT Image Module or the name of the DX Positioning module can be changed to include the CT series. For example, change the name to *X-ray Positioning Module* and have this module applied both to the Digital X-ray (DX) and Computed Tomography (CT) series.

Table 4. (DICOS Table 34), X-ray Positioning Module Attributes

Belt Speed	(0018,9309)	1	FD	1	The velocity of the belt is in millimeters per second.
Belt Height	(4010,1062)	1	FL	1	The y-coordinate of the belt is in millimeters relative to the origin in the coordinate system.

Detector Geometry Sequence	(4010,0004)	3	SQ	1	Defines a sequence of detector positioning module attributes only for DX.
Distance Source to Detector	(0018,1110)	3	DS	1	Distance in millimeters from the X-ray source to detector center. Only for DX.
Source Orientation	(4010,1060)	3	FL	3	Directional cosines of the X-ray beam in the coordinate system in degrees relative to gravity. Only for DX
Source Position	(4010,1061)	3	FL	3	The coordinates (x, y, z) of the X-ray source in millimeters relative to the origin of the coordinate system. Only for DX.

15.2.2 X-ray Detector Module Attributes

Table 5 (DICOS Table 33, page 76) contains the tag attributes describing the X-ray detectors for DX and CT-based screening systems. This module is originally named the *DX Detector* change the *Module Attributes*. These tag attributes can either be placed into the new CT Image Module or the name of the DX Detector module could be changed to include the CT series. For example, change the name to *X-ray Detector Module Attributes* and have this module applied both to the Digital X-ray (DX) and Computed Tomography (CT) series. This module is only required for SDI data (This is based on the Digital X-ray (DX) module and will need to be updated to reflect the CT X-ray detector qualities.).

Table 5. (Table 33, DICOS), X-ray Detector Module Attributes

Attribute Name	Tag	Type	VR	VM	Attribute Description
Detector Type	(0018,7104)	2	CS	1	The type of X-ray detector used the screening device. Enumerated Values Are: • DIRECT = x-ray photoconductor • SCINTILLATOR = Phosphor used • OTHER
Detector Configuration	(0018,7106)	3	CS	1	Configuration of the detectors. Enumerated Values Are: • SANDWICH • SIDE BY SIDE • CHECKERBOARD • UNKNOWN
Detector Description	(0018,7106)	3	LT	1	Free text description of detector.
Detector Mode	(0018,7008)	3	LT	1	Text description of the operating mode of the detector (implementation-specific).
Detector ID	(0018,700A)	3	SH	1	The ID or the detector's serial number is used to acquire this image.
Exposures on Detector Since Last Calibration	(0018,7010)	3	IS	1	The total number of X-ray exposures that have been made on the detector used to acquire this image as identified in Detector ID (0018,700A) since it was calibrated.

Attribute Name	Tag	Type	VR	VM	Attribute Description
Exposures on Detector Since Manufactured	(0018,7011)	3	IS	1	The total number of X-ray exposures that have been made on the detector used to acquire this image as identified in Detector ID (0018,700A) since it was manufactured.
Detector Time Since Last Exposure	(0018,7012)	3	DS	1	Time in seconds since exposure was last made on this detector before acquiring this image.
Detector Binning	(0018,701A)	3	DS	2	The number of active detectors used to generate a single pixel. They were specified as the number of row detectors per pixel then column.
Detector Manufacturer Name	(0018,702A)	3	LO	1	Name of the manufacturer of the detector component of the acquisition system.
Detector Manufacturer's Model Name	(0018,702B)	3	LO	1	The model's name of the detector component of the acquisition system.
Detector Conditions Nominal Flag	(0018,7000)	3	CS	1	Whether or not the detector operates within normal tolerances during this image acquisition. Enumerated Values are: • YES • NO Note: This flag is intended to indicate whether or not there may have been some compromise of the quality of the image due to some condition such as over-temperature, etc.

Attribute Name	Tag	Type	VR	VM	Attribute Description
Detector Temperature	(0018,7001)	3	DS	1	Detector temperature during exposure in degrees Celsius.
Sensitivity	(0018,6000)	3	DS	1	Detector sensitivity in manufacturer-specific units. Note: This value is intended to provide a single location where manufacturer-specific information can be found for annotation on display with meaning to a knowledgeable observer.
Detector Element Physical Size	(0018,7020)	3	DS	2	Each detector element’s physical dimensions that comprise each detector element’s physical dimensions include the detector matrix, in mm, expressed as a row dimension followed by a column. Note: This may not be the same as Detector Element Spacing (0018,7022) due to the presence of spacing material between detector elements.

Attribute Name	Tag	Type	VR	VM	Attribute Description
Detector Element Spacing	(0018,7022)	3	DS	2	The physical distance between the centers of each detector element, specified by a numeric pair-row spacing value (delimiter) column spacing value in millimeters. Note: This may not be the same as the Imager Pixel Spacing (0018,1164), and should not be assumed to describe the stored image.
Low Energy Detectors	(4010,0001)	3	CS	1	Low Energy detector type: Defined Terms include: INTEGRATING PHOTON_COUNTING
High Energy Detectors	(4010,0002)	3	CS	1	High Energy detector type: Defined Terms include: INTEGRATING PHOTON_COUNTING
Bin Number	(4010,0003)	1C	CS	1C	The bin number within the energy histogram is used to reconstruct the image.
Higher Energy	(4010,0004)	1C	CS	1C	The higher energy of the energy histogram bins is used to reconstruct the high-energy image.
Lower Energy	(4010,0005)	1C	CS	1C	The lower energy of the energy histogram bins is used to reconstruct the low-energy image.
Energy Resolution	(4010,0006)	1C	CS	1C	The energy bin width is used to place to produce the energy histogram.

15.3 SDI DATA MODULE

The Sensor Data Interface (SDI) module with tag attributes is shown in Table 6. This data is as close to the detectors as possible with limited correction.

Table 6. The Source Detector Interface (SDI) Module

Attribute Name	Tag	Type	VR	VM	Attribute Description
SDI Data Type	(0008,0012)	3	CS	1	Identify that the data in this module refers to the information required for SDI data.

15.3.1 COORDINATE REFERENCE

The GMF text file shown in Table 3 will also include the coordinates for the image origin (0,0,0) within the system's Field of View (FOV).

15.4 CDI DATA MODULE

The Corrected Data Interface (CDI) module, shown in Table 7, results from the raw detector data being corrected for poor detector map, offset, and air calibration. As a result of these corrections, the associated detector values are unnecessary. This data is corrected at this point. The actual scatter detector values are not required.

Table 7. CDI Module

Attribute Name	Tag	Type	VR	VM	Attribute Description
CDI Data Type	(0008,0012)	3	CS	1	Identify that the data in this module referring to the Air Calibration Detector map

15.5 SOP ADDITIONS TO THE DICOS STANDARD

In addition, the following SOPs (shown in red) would have to be added to Table 8 (Table 111, page 233) of the DICOS v02A Standard.

Table 8. (Table 111, DICOS) Standard Storage SOP Classes

DICOS SOP Class Name	DICOS SOP Class UID	DICOS IOD Specification
DICOS CT image Storage – 16-bit	1.2.840.10008.5.1.4.1.1.501 .1	DICOS CT Image
DICOS CT Raw Sensor Data Storage – 16-bit	12.840.10008.5.1.4.1.1.501. 1.2	DICOS CT Raw Sensor Data (See Sec. xxxxx)
DICOS CT Corrected Sensor Data Storage – 16-bit	1.2.840.10008.5.1.4.1.1.501 .1.3	DICOS CT Corrected Sensor Data (See Sec. yyyy)
DICOS CT image Storage – 32-bit	1.2.840.10008.5.1.4.1.1.501 .1.1	DICOS CT Image, (See Sec. 14.1.3)
DICOS CT Raw Sensor Data Storage – 32-bit	1.2.840.10008.5.1.4.1.1.501 .1.1.2	DICOS CT Raw Sensor Data (See Sec. xxxxx)
DICOS CT Corrected Sensor Data Storage – 32-bit	1.2.840.10008.5.1.4.1.1.501 .1.1.3	DICOS CT Corrected Sensor Data (See Sec. yyyy)
DICOS CT image Storage – 64-bit	1.2.840.10008.5.1.4.1.1.501 .1.2	DICOS CT Image, (See Sec. 14.1.3)
DICOS CT Raw Sensor Data Storage – 64-bit	1.2.840.10008.5.1.4.1.1.501 .1.2.2	DICOS CT Raw Sensor Data (See Sec. xxxxx)
DICOS CT Corrected Sensor Data Storage – 64-bit	1.2.840.10008.5.1.4.1.1.501 .1.2.3	DICOS CT Corrected Sensor Data (See Sec. yyyy)
DICOS CT image Storage – float-bit	1.2.840.10008.5.1.4.1.1.501 .1.3	DICOS CT Image, (See Sec. 14.1.3)
DICOS CT Raw Sensor Data Storage – float-bit	1.2.840.10008.5.1.4.1.1.501 .1.3.2	DICOS CT Raw Sensor Data (See Sec. xxxxx)
DICOS CT Corrected Sensor Data Storage – float-bit	1.2.840.10008.5.1.4.1.1.501 .1.3.3	DICOS CT Corrected Sensor Data (See Sec. yyyy)

15.6 OVERVIEW OF DATA FLOW THROUGH THE PROCESS

Figure 15.6 illustrates the various processes associated with data transit across identified interfaces. Also shown is the data processing within the screening device for each sub-section.

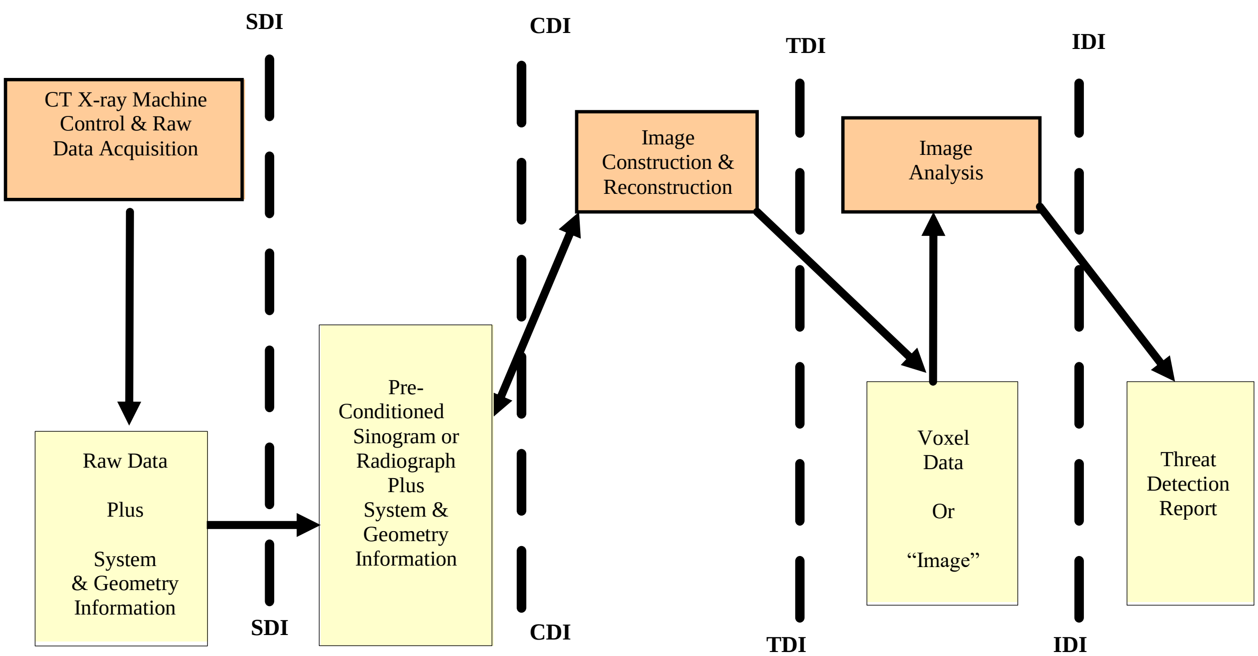
The interfaces identified in Figure 15.6 are:

a) SDI—communicating sensor data, along with calibration data;

b) CDI—sharing corrected data;

c) TDI—transmitting transformed data (reconstructed images, in the case of CT scanners);

d) Inspection Data Interface (IDI)—displaying the inspection results (Threat Detection Report).



1. Data Acquisition
2. Detector Correction

1. Sinogram
2. (Material Correction Artifacts)

1. Reconstruction
2. (Correction for Beam Hardening, etc.)

1. Segmentation
2. Classification
3. Image Production (Display)

Figure 3. Data Interfaces for Digital Information-Based Devices or Systems Along with Data Processing

REFERENCES AND SOURCES

1. DICOS Standard v02, NEMA
2. DICOS Standard v02A 2021, NEMA

ACRONYM LIST

CDI	Corrected Data Interface
CS	Code String
CT	Computer Tomography
DA	Date
DAS	Data Acquisition System
DICOS	Digital Imaging and Communications in Security
DS	Decimal String
DX	Digital X-ray
EDS	Explosive Detection System
E-R	Entity-Relationship model
FD	Floating Point Double
FL	Floating Point Single
FOV	Field of View
HVPS	High Voltage Power Supply
IDI	Inspection Data Interface
IOD	Information Object Definition
IS	Integer String
LO	Long String
LT	Long Text
OEM	Original Equipment Manufacturer
OOI	Object of Inspection
SDI	Sensor Data Interface
SH	Short String

SOP	Service-Object Pair
SS	Signed Short
SQ	Sequence of Terms
TDI	Transformed Data Interface
TM	Time
UL	Unsigned Long
US	Unsigned Short
VM	Value Multiplicity
VR	Value Representation