Digital Imaging and Communications in Medicine (DICOM)

SUPPLEMENT 15: Visible Light Image for Endoscopy, Microscopy, and Photography

Prepared by:

DICOM Standards Committee, Working Group 13

1300 N. 17th Street

Rosslyn, Virginia 22209 USA

VERSION: Final Text (2 July 1999)

Table of Contents

Foreword

The ANSI HISPP MSDS (American National Standards Institute, Healthcare Informatics Standards Planning Panel, Message Standards Developers Subcommittee) Joint Working Group for Diagnostic Image Communication organized the Endoscopic Image Exchange Ad Hoc Committee in September, 1993, to extend the DICOM Standard (for Digital Imaging and Communications in Medicine) initially developed by the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) to support (color) Visible Light Imaging Modalities. The American Society for Gastrointestinal Endoscopy (ASGE) formed the Endoscopic Image Exchange Committee in 1993. The College of American Pathologists (CAP) organized the CAP Image Exchange Committee in 1994 to develop extensions of the DICOM Standard for Pathology imaging modalities in conjunction with ACR and NEMA. The American Dental Association (ADA), the European Society for Gastrointestinal Endoscopy (ESGE), the Organisation Mondiale d'Endoscopie Digestive (OMED), and the American Academy of Ophthalmology (AAO) joined DICOM WG13 in 1996. The American Academy of Dermatology (AAD) joined DICOM WG13 in 1998.

The AAOMR (American Association of Oral and Maxillofacial Radiologists), ACG (American College of Gastroenterology), ACS (American College of Surgeons), IADMFR (International Association of Dento-Maxillofacial Radiology) SAGES (Society of American Gastrointestinal Endoscopic Surgeons), AGA (American Gastroenterological Association), ACCP (American College of Chest Physicians), and the AUA (American Urological Association) also participated at some point in the development of this Standard. This Supplement to the DICOM Standard was developed according to NEMA Procedures.

This Supplement to the Standard is developed in liaison with other Standards Organizations including ISO/TC215, CEN/TC251/WG3 and WG4 in Europe and MEDIS-DC and JIRA in Japan, with review also by other organizations who are members of the ANSI Healthcare Informatics Standards Board (HISB).

The DICOM standard is structured as a multi-part document using the guidelines established in the following document: ISO/IEC Directives, 1989 Part 3 - Drafting and Presentation of International Standards.

This document is a Supplement to the DICOM Standard. It is an extension of PS 3.3, 3.4, and 3.6 of the published DICOM Standard which consists of the following parts:

PS3.1	Introduction and Overview
PS3.2	Conformance
PS3.3	Information Object Definitions
PS3.4	Service Class Specifications
PS3.5	Data Structures and Encoding
PS3.6	Data Dictionary
PS3.7	Message Exchange
PS3.8	Network Communication Support for Message Exchange
PS3.9	Point-to-Point Communication Support for Message Exchange

PS3.10	Media Storage and File Format
PS3.11	Media Storage Application Profiles
PS3.12	Media Formats and Physical Media
PS3.13	Print Management - Point-to-point Communication Support
PS3.14	Grayscale Standard Display Function

These Parts are independent but related documents.

This Supplement includes the definition of the Visible Light (VL) Image IODs and of the corresponding Network and Media Storage SOP Classes.

Scope and Field of Application

This Supplement defines a VL Single-frame Image IOD to serve as a template for specialized VL Single-frame Image IODs. No SOP Classes are specified for the generic VL Image IODs.

This Supplement also defines Single-frame VL Modality IODs and Storage SOP Classes derived from the generic VL Image IOD for each of four VL Modalities: Endoscopy (ES), Microscopy (GM), Automated-Stage Microscopy (SM), and Photography (XC).

The scope of the VL IODs is to support Visible Light color Images or monochrome Images produced by endoscopes, microscopes, or photographic cameras.

Since this document proposes changes to existing Parts of DICOM the reader should have a working understanding of the Standard. This proposed Supplement includes a number of Addenda to existing Parts of DICOM:

1. PS3.3 Addenda (Annex A and Annex C)
2. PS3.4 Addenda (Annex B)
3. PS3.6 Addenda (Section 6 and Annex A)

Acknowledgment

Support for the development of this Standard was provided in part by the United States National Library of Medicine, Duke University, the American College of Radiology, the College of American Pathologists, the American Society for Gastrointestinal Endoscopy, the American Dental Association, the American Academy of Ophthalmology, the American Academy of Dermatology, the participating companies of the National Electrical Manufacturers Association, and the non-NEMA corporate members of the Endoscopic Image Exchange Committee and Pathology Image Exchange Committee.

Add the following IODs to PS3.3 Annex A

A.X VISIBLE LIGHT IMAGE INFORMATION OBJECT DEFINITIONS

A.X.1 VL Endoscopic Image Information Object Definition

A.X.1.1 VL Endoscopic Image IOD Description

The VL Endoscopic Image IOD specifies the Attributes of Single-frame VL Endoscopic Images.

A.X.1.2 VL Endoscopic Image IOD Entity-Relationship Model

The E-R Model in Section A.1.2 of this Part depicts those components of the DICOM Information Model which directly reference the VL Endoscopic Image IOD, with exception of the Curve, VOI LUT, Frame of Reference and Modality LUT entities which are not used. Additionally, Image in figure A.1.2 of PS3.3 represents a Single Frame image. A frame denotes a two-dimensional organization of pixels recorded as a single exposure. Table A.X.1-2 specifies the Modules of the VL Endoscopic Image IOD.

Notes: 1. An endoscopic procedure might include multiple series of single frame endoscopic images as well as one or more additional series of related diagnostic images. The procedure might involve multiple Performed Procedure Steps, multiple endoscopes, and multiple anatomic regions and might be supervised, performed, and/or interpreted by one or more individuals.

2. Several distinct diagnostic or therapeutic processes might occur during an endoscopic procedure. For example: Endoscopic examination of duodenal mucosa, biopsy, lavage, or biliary stone removal.

Table A.X.1-2
VL ENDOSCOPIC IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M
	Image Pixel	C.7.6.3	M
	Acquisition Context	C.7.6.x	M
	VL Image	C.x.x.1	M
	Overlay Plane	C.9.2	U
	SOP Common	C.12.1	M

A.X.1.3 VL Endoscopic Image IOD Content Constraints

A.X.1.3.1 Modality

The value of Modality (0008,0060) shall be ES.

A.X.1.3.2 Acquisition Context Module

The Baseline Template for Acquisition Context Sequence (0040,0555) is: TID 2.

The Baseline Context Groups for Concept-name Code Sequence (0040,A043) are: CID 211 (Anatomic frame of reference); and CID 212 (Image-acquisition context).

Baseline Context Groups for Concept Code Sequence (0040,A168) are specified in Tables: C.7.6.x.1.2-4 (Anatomic frame of reference); and C.7.6.x.1.2-2 (Image-acquisition context).

A.X.2 VL Microscopic Image Information Object Definition

A.X.2.1 VL Microscopic Image IOD Description

The VL Microscopic Image IOD specifies the Attributes of Single-frame VL Microscopic Images. Slide Coordinates shall not be encoded with this IOD.

A.X.2.2 VL Microscopic Image IOD Entity-Relationship Model

The E-R Model in Section A.1.2 of this Part depicts those components of the DICOM Information Model which directly reference the VL Microscopic Image IOD, with exception of the Curve, VOI LUT, Frame of Reference and Modality LUT entities which are not used. Additionally, Image in figure A.1.2 of PS3.3 represents a Single Frame image. A frame denotes a two-dimensional organization of pixels recorded as a single exposure. Table A.X.1-3 specifies the Modules of the VL Microscopic Image IOD.

Notes: 1. A microscopy procedure might include multiple series of single frame VL Microscopic Images as well as one or more additional series of related diagnostic images. The procedure might involve multiple Performed Procedure Steps, multiple microscopes, and multiple anatomic regions and might be supervised, performed, and/or interpreted by one or more individuals.

2. Several distinct diagnostic or therapeutic processes might occur during a single procedure. For example: Histologic staining of the same section with multiple special stains.

Table A.X.1-3
VL MICROSCOPIC IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Specimen Identification	C.7.1.2	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M
	Image Pixel	C.7.6.3	M
	Acquisition Context	C.7.6.x	M
	VL Image	C.x.x.1	M
	Overlay Plane	C.9.2	U
	SOP Common	C.12.1	M

A.X.2.3 VL Microscopic Image IOD Content Constraints

A.X.2.3.1 Modality

The value of Modality (0008,0060) shall be GM.

A.X.1.3.2 Acquisition Context Module

The Baseline Template for Acquisition Context Sequence (0040,0555) is: TID 2.

The Baseline Context Groups for Concept-name Code Sequence (0040,A043) are: CID 203 (Specimen-acquisition and specimen-processing properties); CID 207 (Illumination); and CID 209 (Magnification).

Baseline Context Groups for Concept Code Sequence (0040,A168) are specified by Tables: C.7.1.2.1.4-1 (Specimen-acquisition and specimen-processing), C.7.6.x.1.2-3 (Illumination);.and C.7.6.x.1.2-4 (Magnification).

A.X.3 VL Slide-Coordinates Microscopic Image Information Object Definition

A.X.3.1 VL Slide-Coordinates Microscopic Image IOD Description

The VL Slide-Coordinates Microscopic Image IOD specifies the Attributes of VL Single-frame Slide-Coordinates Microscopic Images.

A.X.3.2 VL Slide-Coordinates Microscopic Image IOD Entity-Relationship Model

The E-R Model in Section A.1.2 of this Part depicts those components of the DICOM Information Model which directly reference the VL Slide-Coordinates Microscopic Image IOD, with exception of the Curve, VOI LUT and Modality LUT entities which are not used. Additionally, Image in figure A.1.2 of PS3.3 represents a Single Frame image. A frame denotes a two-dimensional organization of pixels recorded as a single exposure. Table A.X.1-3 specifies the Modules of the VL Slide-Coordinates Microscopic Image IOD.

Notes: 1. A microscopic imaging procedure might include multiple series of single frame Microscopic Images as well as one or more additional series of related diagnostic images and might involve multiple Performed Procedure Steps, multiple Microscopes, and multiple anatomic regions. The procedure might be supervised, performed, and/or interpreted by one or more individuals.

2. Several distinct diagnostic or therapeutic processes might occur during a single procedure. For example: Histologic staining of the same section with multiple special stains.

Table A.X.1-3
VL SLIDE-COORDINATES MICROSCOPIC IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Specimen Identification	C.7.1.2	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
	Frame of Reference	C.7.4.1	M
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M
	Image Pixel	C.7.6.3	M
	Acquisition Context	C.7.6.x	M
	VL Image	C.x.x.1	M
	Slide Coordinates	C.x.x.2	M

Overlay Plane	C.9.2	U
SOP Common	C.12.1	M

A.X.3.3 VL Slide-Coordinates Microscopic Image IOD Content Constraints

A.X.3.3.1 Modality

The value of Modality (0008,0060) shall be SM.

A.X.3.3.2 Acquisition Context Module

The Baseline Template for Acquisition Context Sequence (0040,0555) is: TID 2.

The Baseline Context Groups for Concept-name Code Sequence (0040,A043) are: CID 203 (Specimen-acquisition and specimen-processing properties); CID 207 (Illumination); and CID 209 (Magnification).

Baseline Context Groups for Concept Code Sequence (0040,A168) are specified by Tables: C.7.1.2.1.4-1 (Specimen-acquisition and specimen-processing), C.7.6.x.1.2-3 (Illumination);.and C.7.6.x.1.2-4 (Magnification).

A.X.4 VL Photographic Image Information Object Definition

A.X.4.1 VL Photographic Image IOD Description

The VL Photographic Image IOD specifies the attributes of VL Single-frame photographic Images.

A.X.4.2 VL Photographic Image IOD Entity-Relationship Model

The E-R Model in Section A.1.2 of this Part depicts those components of the DICOM Information Model which directly reference the VL Photographic Image IOD, with exception of the Curve, VOI LUT, Frame of Reference and Modality LUT entities which are not used. Additionally, Image in figure A.1.2 of PS3.3 represents a Single Frame image. A frame denotes a two-dimensional organization of pixels recorded as a single exposure. Table A.X.4-1 specifies the Modules of the VL Photographic Image IOD.

Notes: 1. A VL photographic imaging procedure might include multiple series of single frame VL Photographic images as well as one or more additional series of related diagnostic images. The procedure might involve multiple Performed Procedure Steps, multiple cameras, and multiple anatomic regions and might be supervised, performed, and/or interpreted by one or more individuals.

2. Several distinct diagnostic or therapeutic processes might occur during a single procedure.

Table A.X.4-1
VL PHOTOGRAPHIC IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Specimen Identification	C.7.1.2	C - Required if the Imaging Subject is a Specimen
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M

Image Pixel	C.7.6.3	M
Acquisition Context	C.7.6.x	M
VL Image	C.x.x.1	M
Overlay Plane	C.9.2	U
SOP Common	C.12.1	M

A.X.4.3 VL Photographic Image IOD Content Constraints

A.X.4.3.1 Modality

The value of Modality (0008,0060) shall be XC.

A.X.4.3.2 Acquisition Context Module

The Baseline Template for Acquisition Context Sequence (0040,0555) is: TID 2.

The Baseline Context Groups for Concept-name Code Sequence (0040,A043) are: CID 207 (Illumination); CID 211 (Anatomic frame of reference); and CID 212 (Image-acquisition context).

Baseline Context Groups for Concept Code Sequence (0040,A168) are specified in Tables: C.7.6.x.1.2-3 (Illumination); C.7.6.x.1.2-4 (Anatomic frame of reference); and C.7.6.x.1.2-2 (Image-acquisition context).

Retire the following Defined Terms from PS3.3, Section C.7.3.1.1.1

AS = Angioscopy

CS = Cystoscopy

EC = Echocardiography

FA = Fluorescein angiography

LP = Laparoscopy

CP = Culposcopy

DM = Digital microscopy

FS = Fundoscopy

Add the following Defined Terms to PS 3.3, Section C.7.3.1.1.1

GM = General Microscopy

SM = Slide Microscopy

XC = External-camera Photography

Add the Visible Light Image Module to PS3.3 Annex C

166 ### C.x.x.1 VL Image Module

167 Table C.x.x.1-1 specifies the Attributes that describe a VL Image produced by Endoscopy (ES), General
168 Microscopy (GM), Automated-Stage Microscopy (SM), External-camera Photography (XC), or other VL
169 imaging Modalities.

170 **Table C.x.x.1-1**
171 **VL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Image identification characteristics. See C.x.x.1.1.6 for specialization.
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.x.x.1.1.1 for specialization of this Attribute.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. See C.x.x.1.1.2 for specialization of this Attribute. See PS 3.5 for further explanation.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. See C.x.x.1.1.2 for specialization of this Attribute. See PS 3.5 for further explanation.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. See C.x.x.1.1.2 for specialization of this Attribute. See PS 3.5 for further explanation.
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. See Section C.x.x.1.1.3 for specialization of this Attribute.
Samples per Pixel	(0028,0002)	1	Number of samples (planes) per image. See C.x.x.1.1.4 for specialization of this Attribute.
Planar Configuration	(0028,0006)	1C	Indicates whether the pixel data are sent color-by-plane or color-by-pixel. Required if Samples per Pixel (0028,0002) has a value greater than 1. See C.x.x.1.1.5 for specialization of this Attribute.
Image Time	(0008,0033)	1C	The time the image pixel data creation started. Required if the Image is part of a series in which the images are temporally related.
Lossy Image Compression	(0028,2110)	2	Specifies whether an Image has undergone lossy compression. See C.7.6.1.1.5. Enumerated Values: 00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression.
Referenced Image Sequence	(0008,1140)	1C	A sequence which provides reference to a set of Image SOP Class/Instance identifying other images significantly related to this image. Shall be used to relate each of a stereo pair to the other member of the pair. Required if Image Type (0008,0008) Value 3 is present and has a value of "STEREO L" or "STEREO R". May also be

			present otherwise. Encoded as a sequence of items: (0008,1150) and (0008,1155). When used to relate members of a stereo pair, only a single item shall be present.
> Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Image Sequence (0008,1140) is present.
> Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Image Sequence (0008,1140) is present.

C.x.x.1.1 VL Image Module Attribute Descriptions

C.x.x.1.1.1 Photometric Interpretation

The Enumerated Values of Photometric Interpretation (0028,0004) shall:

MONOCHROME2
RGB
YBR_FULL_422

C.x.x.1.1.2 Bits Allocated, Bits Stored, and High Bit

The Enumerated Value of Bits Allocated (0028,0100) shall be 8; the Enumerated Value of Bits Stored (0028,0101) shall be 8; and the Enumerated Value of High Bit (0028,0102) shall be 7.

C.x.x.1.1.3 Pixel Representation

The Enumerated Value of Pixel Representation (0028,0103) shall be 0000H.

Note: A value of 0000H signifies an unsigned integer value.

C.x.x.1.1.4 Samples per Pixel

The Enumerated Values of Samples per Pixel (0028,0002) shall be as follows: If the value of Photometric Interpretation (0028,0004) is MONOCHROME2, then the Enumerated Value of Samples per Pixel (0028,0002) shall be one (1). If the value of Photometric Interpretation (0028,0004) is RGB or YBR_FULL_422, then the Enumerated Value of Samples per Pixel (0028,0002) shall be three (3).

C.x.x.1.1.5 Planar Configuration

If present, the Enumerated Value of Planar Configuration (0028,0006) shall be 0000H. This value shall be present if Samples per Pixel (0028,0002) has a value greater than 1.

C.x.x.1.1.6 Image Type

The Image Type attribute identifies important image characteristics in a multiple valued data element. For Visible Light, Image Type is specialized as follows:

a. Value 1 shall identify the Pixel Data Characteristics in accordance with Section C.7.6.1.1.2; Enumerated Values are: ORIGINAL and DERIVED;

b. Value 2 shall identify the Patient Examination Characteristics in accordance with Section C.7.6.1.1.2; Enumerated Values are: PRIMARY and SECONDARY.

c. Value 3 may be absent, but if present shall identify the members of a stereo pair, in which case Referenced Image Sequence (0008,1140) is used to identify the other member of the pair. If present, the Enumerated Values are:

STEREO L	Image is the left image (relative to the observer's left) of a stereo pair acquisition;
STEREO R	Image is the right image (relative to the observer's right) of a stereo pair acquisition.

d. Other Values are implementation specific (optional).

Add the Slide Coordinates Module to PS3.3 Annex C

C.x.x.2 Slide Coordinates Module

The table in this Section contains Attributes that describe Slide Coordinates. Slide Coordinates provide a means to position a robotic Microscope Stage reproduceably with respect to the pixel plane of the digital Microscope.

Note: There is no a priori correspondence of pixels to Slide Coordinates. Therefore, the geometrical symmetry point through the pixel plane of the digital microscope may not correspond to the center of a pixel. The geometrical symmetry point could be between pixels.

Table C.x.x.2-1
Slide Coordinates Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Center Point Coordinates Sequence	(0040,071A)	2C	The coordinates of the center point of the Image in the Slide Coordinate System Frame of Reference. This sequence shall contain exactly one item. See Section C.x.x.2.1.1 of this Part for further explanation. Required if the value of Modality (0008,0060) is SM.
>X Offset in Slide Coordinate System	(0040,072A)	1C	The X offset in millimeters from the Origin of the Slide Coordinate System. See Figure C.x.x.2.1.1-1. Required if a sequence item is present.
>Y Offset in Slide Coordinate System	(0040,073A)	1C	The Y offset in millimeters from the Origin of the Slide Coordinate System. See Figure C.x.x.2.1.1-1. Required if a sequence item is present.
>Z Offset in Slide Coordinate System	(0040,074A)	2C	The Z offset in microns from the image substrate reference plane (i.e. utilized surface of a glass slide). Required if a sequence item is present.
Pixel Spacing Sequence	(0040,08D8)	3	Physical distance in the Imaging Subject, i.e. Patient or Specimen, between the center of each pixel along specified axes. One or more items may be present. May be present only if Modality (0008,0060) is SM.

>Coordinate System Axis Code Sequence	(0040,08DA)	1C	Axis of a coordinate system. This sequence shall contain exactly one item.
>>Include 'Code Sequence Macro' Table 8.8-1			*Baseline Context ID is 95.*
>Numeric Value	(0040,A30A)	1C	The distance between the center-points of adjacent pixels along the axis specified by Coordinate System Axis Code Sequence (0040,08DA). Required if a sequence item is present.
>Measurement Units Code Sequence	(0040,08EA)	1C	Units of the measurement. This sequence shall contain exactly one item. Required if a sequence item is present.
>>Include 'Code Sequence Macro' Table 8.8-1			*Baseline Context ID is 82.*

C.x.x.2.1 VL Slide Coordinates Attribute Descriptions

C.x.x.2.1.1 Image Center Point Coordinates Sequence

This Section defines the Slide Coordinate System and specifies the Attributes that shall be used to describe the location of the center point of the Image pixel plane (as captured through a microscope) in the Slide Coordinate System Frame of Reference. The Slide Coordinate System shall be defined if and only if the value of Modality (0008,0060) = SM.

Note: In Slide Microscopy (SM), the Microscope is equipped with a moveable Stage and position sensors that enable storage of the location of the center point of the displayed image with respect to the examined Specimen.

The Stage is the part of the Microscope to which the Slide is attached for viewing. The Objective Lens is the lens that is closest to the Specimen. The Top Surface of the Slide is the surface of the Slide on which the Specimen in Mounted. The Bottom Surface of the Slide is the opposite surface. This Specification presumes that: 1) the Slide is rectangular; 2) the Top Surface of the Slide is oriented toward the Objective Lens of the Microscope; and 3) the Bottom Surface of the Slide is in perfect contact with the Microscope Stage when the Slide is attached to the Stage for viewing.

Notes: 1. The Label of the Slide is presumed to be mounted-on or written-on the Top Surface of the Slide.

2. Specification of the mechanical form, function, or tolerances of the Microscope are outside the scope of this Standard.

Figure C.x.x.2.1.1-1 depicts the Top Surface of the Slide on the Microscope Stage from the perspective of the Objective Lens. This is Reference Slide Orientation. The X, Y, and Z axes of the Slide Coordinate System in Reference Slide Orientation are defined as follows. The Y-axis is a line that includes the Left Edge of the Slide. The X-axis is a line that is orthogonal to the Y-axis and includes at least one point of the Specimen Edge of the Slide. The Z-axis is a line that passes through the intersection of the X-axis and Y-axis and is orthogonal to the Microscope Stage. The Origin (0,0,0) of the Slide Coordinate System is the point of intersection of the X, Y, and Z axes.

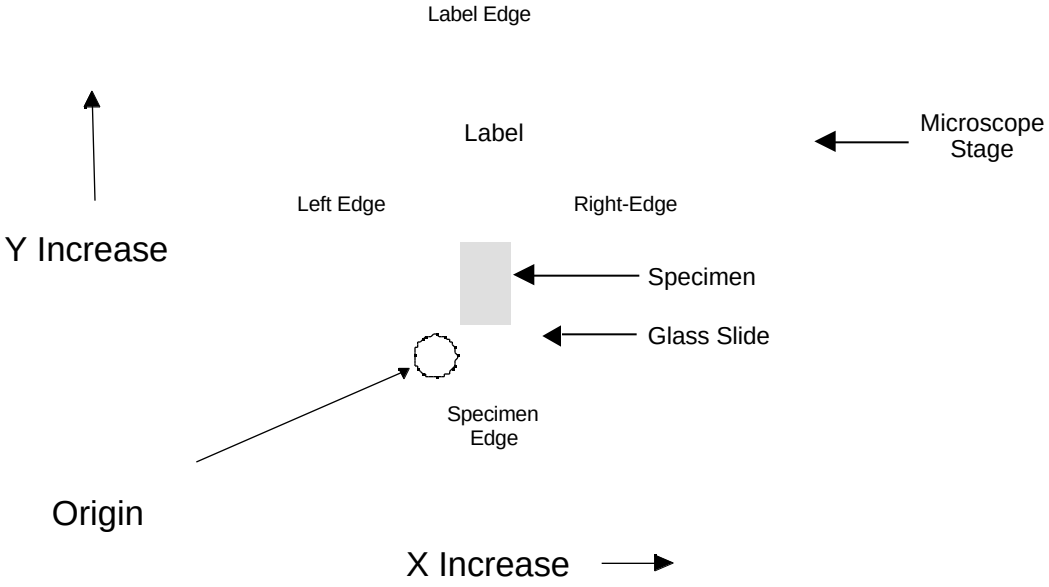

Figure C.x.x.2.1.1-1
REFERENCE SLIDE ORIENTATION

Notes: 1. An improperly-placed coverslip or Specimen that overlaps an Edge of a Slide is not considered part of the Edge a Slide for purposes of defining the Slide Coordinate System. However, such objects may cause inaccurate positioning of the Slide on the Stage.

2. If the Left Edge and Specimen Edge of the Slide are not orthogonal (e.g. the Slide is damaged or defective or the Specimen Edge is curvilinear), then the lower left-hand corner of the Slide may not be located at the Origin.

3. The definitions of X, Y, and Z axes are the same for inverted microscopes, with the Top Surface of the Slide (i.e. Specimen side of the Slide) still being closest to the Objective Lens.

Figure C.x.x.2.1.1-2 depicts the Z-axis center point location. The X-axis value of Image Center Point Location (0040,073A) shall increase from the Origin toward the Right Edge in Reference Slide Orientation. The Y-axis value of Image Center Point Location (0040,073A) shall increase from the Origin toward the Label Edge in Reference Slide Orientation. The Z-axis value of Image Center Point Location (0040,073A) shall be referenced as zero at the image substrate reference plane (i.e. utilized surface of a glass slide) and shall increase in a positive fashion coincident with increased distance from the substrate surface.

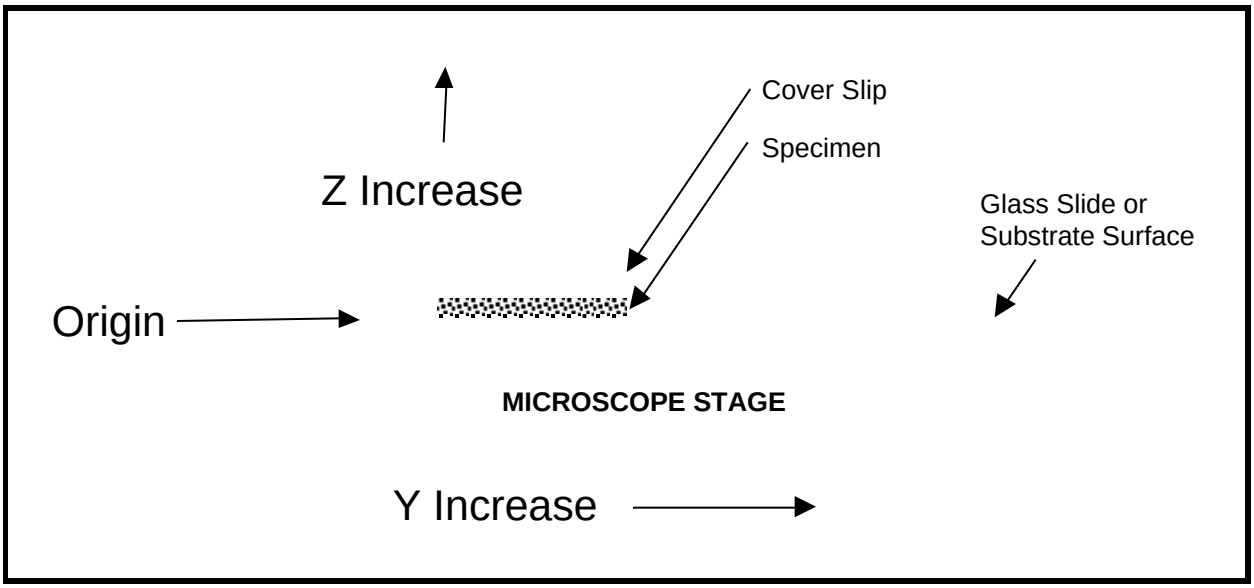

Figure C.x.x.2.1.1-2
Z-AXIS CENTER POINT LOCATION, VIEW FROM RIGHT EDGE OF SLIDE

Amend section C.7.6.14 Acquisition Context Module to include additional descriptors of acquisition context shown in bold underlined text:

C.7.6.14.1 Acquisition Context Module Attribute Descriptions

C.7.6.14.1.1 Concept-name Code Sequence

Table C.7.6.14.1.1-1 specifies the SNOMED DICOM Microglossary Templates and Context Groups that define the Defined Terms for Code Value (0008,0100) of the Concept-name Code Sequence (0040,A043) for naming the Attributes of Image-Acquisition Context**, Specimen-acquisition and Specimen-processing**. The Baseline Context Groups provide suggested Value Sets. The Baseline Templates provide suggested Properties and corresponding Value Sets. See clinical data interchange guidelines published by professional specialty societies for recommendations in specific clinical or operational contexts.

Table C.7.6.14.1.1-1 - ATTRIBUTES OF ACQUISITION CONTEXT

Concept Type	Description	Baseline CID	Baseline TID

Context Group names, SDM	Names of the SNOMED DICOM Microglossary Context Groups	291	
Image-Acquisition Context	General-purpose template of clinically-significant procedure-description concepts. Contains other Templates by reference (i.e TID 5, TID 6, TID 7, and TID 14).	212	2
Chemical agent administration	Concepts describing the delivery (administration) of radiographic contrast agent or other chemical agent.	213	14
Specimen-acquisition and Specimen-processing properties.		**203**	**4**
Illumination	**For Slide Microscopy**	**207**	**5**
Magnification	**For Slide Microscopy**	**209**	**6**
Anatomic frame of reference	**For description of anatomic location relative to an anatomic structure, space, or region rather than in terms of a gantry-based frame of reference**	**211**	**7**

C.7.6.14.1.2 Concept Code Sequence

Table C.7.6.14.1.2-1 specifies the SNOMED DICOM Microglossary Context Groups that provide the Defined Terms for Code Value (0008,0100) of the Concept Code Sequence (0040,A168) for description of Image-Acquisition Context**, and the acquisition and processing of Specimens**. See clinical data interchange guidelines published by professional specialty societies for recommendations in specific clinical or operational contexts. See the SNOMED DICOM Microglossary for subset Context Groups indexed by clinically-significant factors, such as specialty, imaging modality, or anatomic region.

Note: Each SDM Template provides a detailed specification of the semantic network that describes a complex concept. TID 2 describes Image-Acquisition Context; TID 5 describes Illumination; TID 6 describes Magnification; TID 7 describes Anatomic frame of reference; and TID 14 describes Chemical agent administration.

Table C.7.6.14.1.2-1 - DESCRIPTORS OF ACQUISITION CONTEXT

Concept Type	Examples	Baseline TID	Baseline CID	Modality Constraint
IMAGE ACQUISITION CONTEXT FOR DIGITAL X-RAY				
Functional condition present during image acquisition	breathing, phonation	2	91	
Image labels used commonly to indicate acquisition context (or the role of the image in a procedure)	post-void, I+, C, non-contrast, flexion, neutral, scout	2	171	

Interventional drug	epinephrine	2	10	
Physical agent used to apply the physical force during image acquisition	compression paddle, knee brace	2	86	
Physical force applied during image acquisition	distraction, valgus stress	2	89	
Radiographic contrast agent	barium sulfate, meglumine diatrizoate	2	12	
IMAGE ACQUISITION CONTEXT FOR VISIBLE LIGHT				
Anatomic region or structure examined	**retina, antrum**	**2**	**1**	
Functional condition present during image acquisition	**breathing, phonation**	**2**	**91**	
Geometric projection	**antero-posterior, lateral**	**2**	**22**	
Geometric projection, cranio-caudad angulation modifier	**craniad, caudal**	**2**	**23**	
Image labels used commonly to indicate acquisition context (or the role of the image in a procedure)	**post-void, I+, C, non-contrast, flexion, neutral, scout**	**2**	**171**	
Imaging subject orientation with respect to gravity	**erect, recumbent**	**2**	**19**	
Imaging subject orientation with respect to gravity, modifier of	**standing, prone**	**2**	**20**	
Interventional drug	**epinephrine**	**2**	**10**	
Physical agent used to apply the physical force during image acquisition	**compression paddle, knee brace**	**2**	**86**	
Physical force applied during image acquisition	**distraction, valgus stress**	**2**	**89**	
Radiographic contrast agent	**barium sulfate, meglumine diatrizoate**	**2**	**12**	
Radiopharmaceutical	**gallium^67^ citrate**	**2**	**25**	

Vital stain	**methylene blue, fluorescein**	**2**	**168**	
CHEMICAL AGENT ADMINISTRATION				
Active ingredient	barium sulfate	14	56	
Administration route	intravenous, oral	14	11	
Carrier ingredient	normal saline	14	56	
SPECIMEN ACQUISITION AND PROCESSING				
Anatomic region or structure, source of Specimen			**1**	
Chemical agent used during specimen processing			**223**	
Functional condition existing during specimen acquisition			**219**	
Hybridization Amplification			**43**	
Physical agent used for specimen acquisition			**220**	
Physical force applied during specimen acquisition			**221**	
Physical process used during specimen processing			**222**	
Radiographic contrast agent			**12**	
Radiopharmaceutical			**25**	
Specimen artifacts, cytology			**216**	
Specimen artifacts, gross examination			**218**	
Specimen artifacts, histology			**217**	
Specimen Collection Procedure			**35**	
Specimen Counter-Stain			**40**	
Specimen Extraction			**41**	
Specimen Fixation			**38**	
Specimen Handling Precautions			**214**	

Specimen Handling Special Requirements			**215**	
Specimen Hybridization			**42**	
Specimen Processing Procedure			**36**	
Specimen Stain			**39**	
Specimen Type			**37**	
Vital stain			**168**	
ILLUMINATION				
Collected Light Type	**transmitted, emitted, scattered**	**5**	**197**	**SM**
Correction Filter		**5**	**47**	**SM**
Emission Filter		**5**	**49**	**SM**
Excitation Filter		**5**	**48**	**SM**
Illumination Methodology		**5**	**50**	**SM**
Light Source		**5**	**46**	**SM**
Polarization	**polarized, non-polarized**	**5**	**196**	**SM**
MAGNIFICATION				
Condenser immersion media	**air, oil, water**	**6**	**251**	**SM**
Objective immersion media	**air, oil, water**	**6**	**251**	**SM**
Secondary-condenser immersion media	**air, oil, water**	**6**	**251**	**SM**
Secondary-objective immersion media	**air, oil, water**	**6**	**251**	**SM**
ANATOMIC FRAME OF REFERENCE				
Anatomic Approach Direction	**antegrade**	**7**	**32**	
Anatomic Location of Examining Instrument	**suprapatellar bursa**	**7**	**44**	
Anatomic location of examining instrument, modifier of	**distal**	**7**	**2**	
Anatomic Portal of Entrance	**stoma**	**7**	**45**	
Anatomic portal of entrance, modifier of	**inferior**	**7**	**2**	
Anatomic Site	**pylorus**	**7**	**1**	

Anatomic Site Modifier	**proximal**	**7**	**2**	
Aspect of the target that is visible	**anterior, posterior**	**7**	**31**	
Orientation of the image collection point of the examining instrument	**lateral**	**7**	**32**	
Anatomic View Perspective	**medial, anterior**	**7**	**31**	

298

299

300

301 *Add the following to Section B.5 of PS3.4:*

SOP Class Name	SOP Class UID	IOD Specification
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image

302

303

304 *Add the following to Section I.4 of PS3.4:*

SOP Class Name	SOP Class UID	IOD Specification
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image

305

306

307 *Add the following Data Elements to the Registry of Data Elements in PS3.6, Section 6:*

308

Tag	Name	VR	VM
(0040,06FA)	Slide Identifier	LO	1
(0040,071A)	Image Center Point Coordinates Sequence	SQ	1

(0040,072A)	X offset in Slide Coordinate System	DS	1
(0040,073A)	Y offset in Slide Coordinate System	DS	1
(0040,074A)	Z offset in Slide Coordinate System	DS	1
(0040,08D8)	Pixel Spacing Sequence	SQ	1
(0040,08DA)	Coordinate System Axis Code Sequence	SQ	1

309

310

311 *Add the following UID's to PS3.6, Annex A:*

312

UID Value	SOP Class NAME	UID TYPE	Part
1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image Storage	SOP Class	PS3.4
1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image Storage	SOP Class	PS3.4
1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image Storage	SOP Class	PS3.4
1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image Storage	SOP Class	PS3.4

313

314