

1	Status	Final Text
2	Date of Last Update	2025/01/22
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7	Submission Date	2024/04/23

8	Correction Number CP-2412	
9	Log Summary: Add flag to whole slide microscopy images indicating tiles are nonoverlapping	
10	Name of Standard	
11	PS3.3, PS3.6 2024e	
12	Rationale for Correction:	
13	Tiles may theoretically overlap, and some scanners acquire them in that manner.	
14	This is challenging for some image consumers and it would be helpful to flag this before having to analyze the position of every tile.	
15	This is not applicable to the TILED_FULL pattern or encoding, which already prohibits overlapping.	
16	Correction Wording:	

Amend DICOM PS3.3 as follows (changes to existing text are bold and **underlined** for additions and **~~struckthrough~~** for removals):

C.8.12.14 Microscope Slide Layer Tile Organization Module

Table C.8.12.14-1 specifies the Attributes of the Microscope Slide Layer Tile Organization Module, which describe the logical and physical organization of the tiles within a single resolution layer encoded as a tiled Image, such as that of a Multi-Resolution Pyramid.

Table C.8.12.14-1. Microscope Slide Layer Tile Organization Module Attributes

Attribute Name	Tag	Type	Attribute Description
Total Pixel Matrix Columns	(0048,0006)	1	Total number of columns in pixel matrix; i.e., width of total imaged volume in pixels. ...
...			
Image Orientation (Slide)	(0048,0102)	1C	The direction cosines of the first row and the first column of the total pixel matrix with respect to the Slide Coordinate System Frame of Reference. ... Required if Plane Position (Slide) Sequence (0048,021A) is present within a Functional Group Sequence or Dimension Organization Type (0020,9311) is present with a value of TILED_FULL. May be present otherwise. Note This condition will always be satisfied when this Module is included in the Whole Slide Microscopy Image IOD.
<u>Tiles Overlap</u>	<u>(0048,0304)</u>	<u>3</u>	<u>Whether or not tiles in this Instance overlap with one or more adjacent tiles in the same Instance.</u> <u>Enumerated Values:</u> <u>ALL</u> <u>All tiles overlap with at least one adjacent tile</u> <u>SOME</u> <u>Some tiles overlap with at least one adjacent tile</u> <u>UNDEFINED</u> <u>Some tiles might overlap</u> <u>NONE</u> <u>No tiles overlap</u> <u>Shall be NONE if this Attribute is present and Dimension Organization Type (0020,9311) is present with a value of TILED_FULL.</u> Note <u>If the value is NONE, then a receiving application to which this matters does not need to check the position of every tile in this respect, since it can be assured that no tiles overlap. If the value is UNDEFINED or SOME or ALL, or the Attribute is absent, then a receiving application might need to check the position of every tile.</u>

C.7.6.17 Multi-frame Dimension Module

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Table C.7.6.17-1. Multi-frame Dimension Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			...

Attribute Name	Tag	Type	Attribute Description
Dimension Organization Type	(0020,9311)	3	Dimension organization of the Instance. Defined Terms: 3D Spatial Multi-frame image of equally spaced parallel planes (3D volume set) 3D_TEMPORAL Temporal loop of equally spaced parallel-plane 3D volume sets. TILED_FULL Tiled image in which each frame represents a single tile and the positions of the tiles are implicitly defined as per Section C.7.6.17.3. TILED_SPARSE Tiled image in which each frame represents a single tile and the positions of tiles are explicitly defined by per-frame Functional Group Macro entries.
...			

C.7.6.17.3 Spatial Location and Optical Path of Tiled Images

If Dimension Organization Type (0020,9311) is present with a value of TILED_FULL, then the Per-Frame Functional Group Macros that would otherwise describe the spatial location of each tile explicitly (e.g., the X, Y and Z offsets from the origin in the Slide Coordinate System Plane Position (Slide)), and the optical path or segment, may be omitted.

A value of TILED_FULL indicates that the frames across all Instances of a Concatenation, or a single Instance in the absence of a Concatenation, comprise a non-sparse non-overlapping representation of an entire rectangular region, and are sequentially encoded as successive frames in Pixel Data (7FE0,0010) in an implicit order varying:

- first along the row direction from left to right, where the row direction is defined in the Slide Coordinate System by the first three values of Image Orientation (Slide) (0048,0102),
- then along the column direction from top to bottom, where the column direction is defined in the Slide Coordinate System by the second three values of Image Orientation (Slide) (0048,0102),
- then along the depth direction from the glass slide towards the coverslip, where the depth direction is defined in the Slide Coordinate System from zero to positive,
- then along optical paths, if applicable, where the direction is defined by successive Items of the Optical Path Sequence (0048,0105) in the order in which they are listed in that Sequence,
- then along the segments, if applicable, where the direction is defined by ascending numeric values of Segment Number (0062,0004) as defined in the Segment Sequence (0062,0002).

If Dimension Organization Type (0020,9311) is absent or has a value of TILED_SPARSE, then the location of each tile is explicitly encoded using information in the Per-Frame Functional Groups Sequence, and the recipient shall not make any assumption about the spatial position or optical path or segment or order of the encoded frames, **and whether or not any tiles overlap.** but shall rely on the values of the relevant Per-Frame Functional Group Macro.

Note

Images with an Image Type (0008,0008) Value 3 of THUMBNAIL, LABEL or OVERVIEW are single frame and may have a spatial extent that is not the same as the Total Pixel Matrix, so Dimension Organization Type (0020,9311) is not applicable.

The same previously applied to images with an Image Type (0008,0008) Value 3 of LOCALIZER, which has been retired. See PS3.3-2021c.

For reference unchanged DICOM PS3.3 :

C.8.20.2 Segmentation Image Module

Table C.8.20-2. Segmentation Image Module Attributes

Segments Overlap	(0062,0013)	3	<p>Whether or not any segments in this Instance overlap. I.e., whether or not any pixel is or might be in more than one segment.</p> <p>Enumerated Values:</p> <p>YES Some segments overlap UNDEFINED Some segments might overlap NO No segments overlap</p> <p>See Section C.8.20.2.3.</p> <p>Note</p> <p>If the value is NO, then a receiving application to which this matters can be assured that no segments overlap and does not need to check every pixel. If the value is UNDEFINED or YES, or the Attribute is absent, then a receiving application might need to check every pixel in every segment.</p>
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C.8.20.2.3 Segmentation Type, Segmentation Fractional Type and Segments Overlap

A Segmentation Type (0062,0001) of BINARY indicates the segmented property is present with a value of 1 and absent with a value of 0.

For a Segmentation Type (0062,0001) of FRACTIONAL the segmented property is defined as a value from zero to the Maximum Fractional Value (0062,000E). A FRACTIONAL segmentation shall be further specified via Segmentation Fractional Type (0062,0010).

Enumerated Values of Segmentation Fractional Type (0062,0010):

PROBABILITY Defines the probability, as a ratio of the pixel value to the Maximum Fractional Value, that the segmented property occupies the spatial area defined by the voxel.

OCCUPANCY Defines the proportion of the pixel volume occupied by the segmented property as the ratio of the pixel value to the Maximum Fractional Value.

Note

Binary Segmentation Instances may be transformed into or from "label maps", in which each pixel contains a coded value that indicates the segment, rather than the Segmentation IOD representation that encodes separate bit planes for each segment. This conversion is facilitated by knowing whether or not any segment biplanes overlap. A Segments Overlap (0062,0013) value of NO indicates they can be converted into (or may have been converted from) a label map representation without the need to check every pixel.

Amend DICOM PS3.6 as follows (changes to existing text are bold and **underlined** for additions and **~~struckthrough~~** for removals):

6 Registry of DICOM Data Elements

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM
<u>(0048,0304)</u>	<u>Tiles Overlap</u>	<u>TilesOverlap</u>	<u>CS</u>	<u>1</u>