DICOM Change Proposal

STATUS	Assigned
Date of Last Update	2025-04-13
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Submission Date	2025-03-18

Change Number	CP-2529
Log Summary: Clarify definition of Pixel Aspect Ratio and Presentation Pixel Aspect Ratio	
Name of Standard PS3.3	
Rationale for Change: The definition of the Attributes Pixel Aspect Ratio (0028,0034) and Presentation Pixel Aspect Ratio (0070,0102) states that "the first value is the vertical pixel size, and the second value is the horizontal pixel size", which is not correct as the aspect ratio is not about pixel sizes. It is, therefore, proposed to improve this definition. Furthermore, it is proposed to explicitly state that a pixel aspect ratio of "0\0" and also negative values are not allowed. *Editorial changes (not included in the following changes):* • Various tables in PS3.3 refer to the Image Pixel Module for a detailed description of particular Attributes, e.g. Table C.13-5 refers to Section C.7.6.3 for Rows, Columns, Pixel Aspect Ratio, and so on. However, the referenced section does not list these Attributes (any more, i.e., directly), since they have been moved to Section C.7.6.3.3 "Image Pixel Description Macro". This could confuse at least unexperienced readers of the DICOM Standard, so it is proposed to update these references (if appropriate).	
Change Wording:	

> **For reference PS3.3 Section 10.7.1.3 (unchanged)**

10.7.1.3 Pixel Spacing Value Order and Valid Values

All pixel spacing related Attributes are encoded as the physical distance between the centers of each two-dimensional pixel, specified by two numeric values.

The first value is the row spacing in mm, that is the spacing between the centers of adjacent rows, or vertical spacing.

The second value is the column spacing in mm, that is the spacing between the centers of adjacent columns, or horizontal spacing.

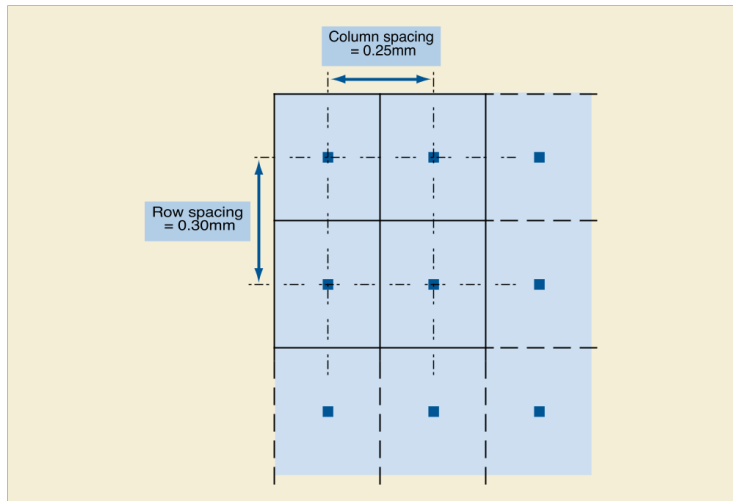To illustrate, consider the example shown in Figure 10.7.1.3-1.

Figure 10.7.1.3-1. Example of Pixel Spacing Value Order

Pixel Spacing = Row Spacing \ Column Spacing = 0.30\0.25.

All pixel spacing related Attributes shall have positive non-zero values, except when there is only a single row or column of pixel of data present, in which case the corresponding value may be zero.

Note

A single row or column or "pixel" may occur in MR Spectroscopy Instances. If the value is non-zero, its purpose may be to convey the dimensions of a single row or column or pixel, such as in single voxel MR Spectroscopy; there is no other mechanism for conveying this.

This description applies to:

- Pixel Spacing (0028,0030)

- Imager Pixel Spacing (0018,1164)

- Nominal Scanned Pixel Spacing (0018,2010)

- Image Plane Pixel Spacing (3002,0011)

- Compensator Pixel Spacing (300A,00E9)

- Detector Element Spacing (0018,7022)

- Presentation Pixel Spacing (0070,0101)

- Printer Pixel Spacing (2010,0376)

- Object Pixel Spacing in Center of Beam (0018,9404)

Modify PS3.3 Section C.7.6.3.1.7 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.7.6.3.1.7 Pixel Aspect Ratio

The pixel aspect ratio is the ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value **is****refers to** the vertical **pixel size****extension of a pixel**, and the second value

~~is~~**refers to** the horizontal ~~pixel size~~**extension of a pixel**. To illustrate, consider the example pixel size shown in Figure C.7.6.3.1.7-1**.**
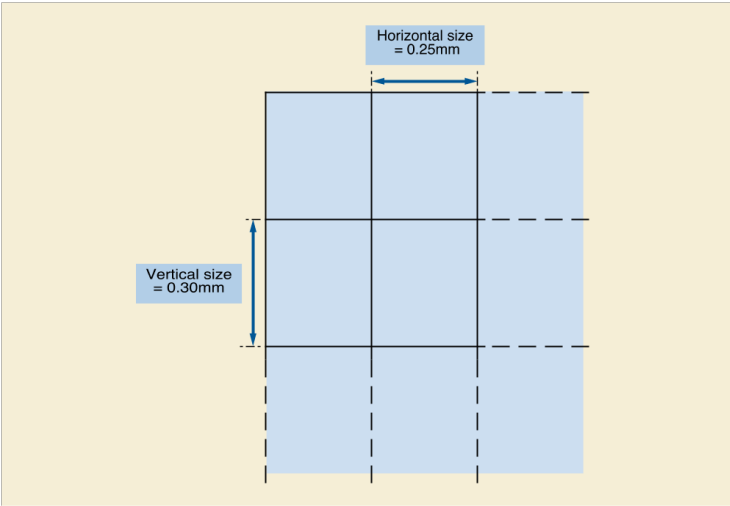
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Figure C.7.6.3.1.7-1. Example of Pixel Size and Aspect Ratio

In the example, the ~~Pixel Aspect Ratio = V~~**v**ertical **pixel S**~~s~~ize **is 0.30 mm** **and the** ~~H~~**h**orizontal **pixel S**~~s~~ize ~~= 0.30 mm~~**is** ~~\~~0.25 mm. Thus**,** the **Value of** Pixel Aspect Ratio **(0028,0034)** could be represented as the multi-valued ~~i~~**I**nteger ~~s~~**S**tring "6\5", "60\50", or any equivalent integer ratio. **Both integer values shall be greater than 0.**

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Note

<mark>Unlike for pixel spacing related Attributes, there is no exception to the requirement to use only positive non-zero values, i.e., even when there is only a single row or column or pixel of data present (see Section 10.7.1.3), a Value of "0" in Pixel Aspect Ratio (0028,0034) is not used, and in such cases the Attribute will be absent.</mark>

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Modify PS3.3 Section C.7.6.3.3 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.7.6.3.3 Image Pixel Description Macro

55 Table C.7-11c specifies the Attributes of the Section C.7.6.3.3 Image Pixel Description Macro, which are the common Attributes that describe the pixel data of the image.

Table C.7-11c. Image Pixel Description Macro Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Pixel Aspect Ratio	(0028,0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value ~~is~~**refers to** the vertical ~~pixel size~~**extension of a pixel**, and the second value ~~is~~**refers to** the horizontal ~~pixel~~

Attribute Name	Tag	Type	Attribute Description
			~~size~~**extension** of a pixel. Required if the aspect ratio values do not have a ratio of 1:1**, there is more than one row and one column of pixel data present,** and the physical pixel spacing is not specified by Pixel Spacing (0028,0030), or Imager Pixel Spacing (0018,1164) or Nominal Scanned Pixel Spacing (0018,2010), either for the entire Image or per-frame in a Functional Group Macro. See Section C.7.6.3.1.7.
…			

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Modify PS3.3 Section C.7.6.24 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.7.6.24 Floating Point Image Pixel Module

Table C.7.6.24-1 specifies the Attributes of the Floating Point Image Pixel Module. This Module differs from the Section C.7.6.3 Image Pixel Module in that:

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• instead of integer stored pixel values, float stored pixel values are used

• Bits Stored (0028,0101) and High Bit (0028,0102) are not used because the stored pixel values always occupy the entire word

• Pixel Representation (0028,0103) is not used because the stored pixel values are always signed

• Photometric Interpretation is constrained

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• Pixel Data Provider URL (0028,7FE0) is not used

Table C.7.6.24-1. Floating Point Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Pixel Aspect Ratio	(0028,0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value ~~is~~**refers to** the vertical ~~pixel size~~**extension of a pixel**, and the second value ~~is~~**refers to** the horizontal ~~pixel size~~**extension of a pixel**. Required if the aspect ratio values do not have a ratio of 1:1**, there is more than one row and one column of pixel data present,** and the physical pixel spacing is not specified by Pixel Spacing (0028,0030), or Imager Pixel Spacing (0018,1164) or Nominal Scanned Pixel Spacing (0018,2010), either for the entire Image or per-frame in a Functional Group Macro. See Section C.7.6.3.1.7.
…			

Modify PS3.3 Section C.7.6.25 as indicated

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(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.7.6.25 Double Floating Point Image Pixel Module

Table C.7.6.25-1 specifies the Attributes of the Double Floating Point Image Pixel Module. This Module differs from the Section C.7.6.3 Image Pixel Module in that:

- instead of integer stored pixel values, double float stored pixel values are used

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- Bits Stored (0028,0101) and High Bit (0028,0102) are not used because the stored pixel values always occupy the entire word

- Pixel Representation (0028,0103) is not used because the stored pixel values are always signed

- Photometric Interpretation is constrained

- color palette tables are not used

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- Pixel Data Provider URL (0028,7FE0) is not used

Table C.7.6.25-1. Double Floating Point Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Pixel Aspect Ratio	(0028,0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value **is**~~refers to~~ the vertical **pixel size**~~extension of a pixel~~, and the second value **is**~~refers to~~ the horizontal **pixel size**~~extension of a pixel~~. Required if the aspect ratio values do not have a ratio of 1:1**, there is more than one row and one column of pixel data present,** and the physical pixel spacing is not specified by Pixel Spacing (0028,0030), or Imager Pixel Spacing (0018,1164) or Nominal Scanned Pixel Spacing (0018,2010), either for the entire Image or per-frame in a Functional Group Macro. See Section C.7.6.3.1.7.
…			

Modify PS3.3 Section C.8.28.2 as indicated

90   *(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):*

C.8.28.2 Ophthalmic Thickness Map Module

Table C.8.28.2-1 specifies the Attributes of the Ophthalmic Thickness Map Module, which describe an Image produced by ophthalmic thickness mapping devices.

Table C.8.28.2-1. Ophthalmic Thickness Map Module Attributes

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Attribute Name	Tag	Type	Attribute Description
…			
Pixel Aspect Ratio	(0028,0034)	1	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value **is**~~refers to~~ the vertical **pixel size**~~extension of a pixel~~, and the second value **is**~~refers to~~ the horizontal **pixel size**~~extension of a pixel~~. **See Section C.7.6.3.1.7.**
…			

Modify PS3.3 Section C.8.30.2 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.8.30.2 Corneal Topography Map Image Module

Table C.8.30.2-1 specifies the Attributes of the Corneal Topography Map Image Module, which describe an Image produced by corneal topography mapping devices.

Table C.8.30.2-1. Corneal Topography Map Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Pixel Aspect Ratio	(0028,0034)	1	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value **is**__refers to__ the vertical ~~pixel size~~**extension of a pixel**, and the second value **is**__refers to__ the horizontal ~~pixel size~~**extension of a pixel**. **See Section C.7.6.3.1.7.**
…			

Modify PS3.3 Section C.10.4 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

C.10.4 Displayed Area Module

This Module describes Attributes required to define a Specified Displayed Area space.

The Specified Displayed Area is that portion of the image displayed on the device.

If Presentation Size Mode (0070,0100) is specified as SCALE TO FIT, then the specified area shall be displayed as large as possible within the available area on the display or window, i.e., magnified or minified if necessary to fit the display or window space available.

If Presentation Size Mode (0070,0100) is specified as TRUE SIZE, then the physical size of the rendered image pixels shall be the same on the screen as specified in Presentation Pixel Spacing (0070,0101).

If Presentation Size Mode (0070,0100) is specified as MAGNIFY, then the factor that shall be used to spatially interpolate image pixels to create pixels on the display is defined.

Note

If this factor is specified as 1.0, then one image pixel will correspond to one displayed pixel, and if the Specified Displayed Area is the entire image, and it fits on the display, then the number of displayed pixels will equal the number of image pixels.

In all modes, the actual area rendered on a display device may be greater than the Specified Display Area, if the ratio of rows and columns of the Specified Display Area differs from the ratio of rows and columns of the display device or window. The Displayed Area relative annotations specified in Section C.10.5 Graphic Annotation Module are rendered relative to the Specified Displayed Area, not the actual rendered displayed area.

Note

1. The content of a display outside the Specified Display Area is not defined. In particular no padding value (such as black) is specified.

2. In the TRUE SIZE and MAGNIFY modes, if the entire Specified Displayed Area is not visible, then display relative graphic annotations may be obscured.

This Module explicitly specifies the aspect ratio to be used to display the image, even if it is 1:1, and it may be different from that specified in the referenced image.

Note

1. Depending on the mode, the aspect ratio is either specified using the Presentation Pixel Aspect Ratio (0070,0102), or derived from the Presentation Pixel Spacing (0070,0101).

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2. This explicit definition of aspect ratio implies that graphic objects that are specified relative to the Specified Display Area will not change their shape regardless of the size or shape of the presentation device (e.g., whether a landscape or portrait monitor is used).

3. The mechanism of interpolation, if necessary, is not specified.

4. The image may need to be cropped and scroll bars or a panning mechanism provided in order to provide access to sections of the image that do not fit within the available area on the display or window.

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Table C.10-4. Displayed Area Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
>Presentation Pixel Aspect Ratio	(0070,0102)	1C	Ratio of the vertical size and the horizontal size of the pixels in the referenced image, to be used to display the referenced image, specified by a pair of integer values where the first value ~~is~~refers to the vertical ~~pixel size~~extension of a pixel, and the second value ~~is~~refers to the horizontal ~~pixel size~~extension of a pixel. See Section C.7.6.3.1.7. Required if Presentation Pixel Spacing (0070,0101) is not present. Note 1. This value may be different from the aspect ratio specified by Pixel Aspect Ratio (0028,0034) in the referenced image, or implied by the values of Pixel Spacing (0028,0030) or Imager Pixel Spacing (0018,1164) specified in the referenced image, which are ignored. 2. This value must be specified even if the aspect ratio is 1:1.
…			

Commented [JR2]: Strictly speaking, the referenced section only covers the Pixel Aspect Ratio (0028,0034) Attribute.