

DICOM Correction Item

Correction Number: CP-1084	
Log Summary: Clarify Spatial Registration Description	
Type of Modification Modify	Name of Standard PS 3.3 – 2009
Rationale for Correction When reading the definition of the Spatial Registration Module and comparing the information to the examples in PS 3.17 Annex O it was not clear, how to interpret the definitions.	
Sections of documents affected PS 3.3, Section C.20.2	
Correction Wording: n.a.	

Modify PS 3.3, C.20.2

C.20.2 Spatial Registration Module

Table C.20.2-1 defines the general Attributes of the Spatial Registration Module.

**Table C.20.2-1
 SPATIAL REGISTRATION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Content Date	(0008,0023)	1	The date the content creation started.
Content Time	(0008,0033)	1	The time the content creation started.
<i>Include Content Identification Macro Table 10-12</i>			
Registration Sequence	(0070,0308)	1	A sequence of one or more registration items. Each item defines a spatial registration <u>of the images referenced in that item to the Registered RCS established by this SOP instance to the referenced images in that item.</u> All referenced images are in the same spatial frame of reference or atlas.
>Frame of Reference UID	(0020,0052)	1C	Identifies <u>the a</u> Frame of Reference <u>of the referenced data,</u> that may or may not be an image set (e.g. atlas or physical space). See C.7.4.1.1.1 for further explanation. Required if Referenced Image Sequence (0008,1140) is absent. May be present otherwise.

>Referenced Image Sequence	(0008,1140)	1C	Identifies the set of images of the referenced data , registered in this sequence item. One or more items shall be present. Required if Frame of Reference UID (0020,0052) is absent. May be present otherwise.
<i>>>Include 'Image SOP Instance Reference Macro' Table 10-3</i>			
>Matrix Registration Sequence	(0070,0309)	1	A sequence that specifies one spatial registration. Exactly one item shall be present
>>Frame of Reference Transformation Comment	(3006,00C8)	3	User description or comments about the registration.
>>Registration Type Code Sequence	(0070,030D)	2	Describes the information input into the registration process. Zero or one Items may be present in this Sequence.
<i>>>>Include 'Code Sequence Macro' Table 8.8-1</i>			<i>Baseline CID 7100</i>
>>Matrix Sequence	(0070,030A)	1	One or more items shall be present. <u>Specifies one transformation, that registers the Source RCS/images to the Registered RCS. It is expressible as multiple matrices, each in a separate item of the sequence. Each item specifies a transformation.</u> –The item order is significant and corresponds to matrix multiplication order. See C.20.2.1.1.
>>>Frame of Reference Transformation Matrix	(3006,00C6)	1	A 4x4 homogeneous transformation matrix that registers <u>a coordinate system A to B the referenced images to the local RCS.</u> Matrix elements shall be listed in row-major order. See C.20.2.1.1.
>>>Frame of Reference Transformation Matrix Type	(0070,030C)	1	Type of Frame of Reference Transformation Matrix (3006,00C6). Defined terms: RIGID RIGID_SCALE AFFINE See C.20.2.1.2

Modify PS 3.3, C.20.2.1.1

C.20.2.1 Registration Module Attribute Descriptions

C.20.2.1.1 Frame of Reference Transformation Matrix

The Frame of Reference Transformation Matrix (3006,00C6) ${}^A M_B$ describes how to transform a point $({}^B x, {}^B y, {}^B z)$ with respect to RCS_B into $({}^A x, {}^A y, {}^A z)$ with respect to RCS_A according to the equation below.

$$\begin{bmatrix} {}^A x \\ {}^A y \\ {}^A z \\ 1 \end{bmatrix} = \begin{bmatrix} M_{11} & M_{12} & M_{13} & T_x \\ M_{21} & M_{22} & M_{23} & T_y \\ M_{31} & M_{32} & M_{33} & T_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} {}^B x \\ {}^B y \\ {}^B z \\ 1 \end{bmatrix}$$

The **Frame of Reference Transformation Matrix Registration** is expressible as multiple matrices, each in a separate item of the Matrix Sequence (0070,030A). The equation below specifies the order of the matrix multiplication where **M₁**, **M₂** and **M₃** are the first, second and third items in the sequence.

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