DICOM Correction Item

Correction Number CP-434	
Log Summary: RT Dose Grid Frame Offset Vector	
Type of Modification Ambiguity	Name of Standard PS 3 2004

Rationale for Correction:

Description of the Grid Frame Offset Vector (3004,000C) in Section C.8.8.3.2 in the Multi-frame module of the RT Dose IOD states that the attribute contains an array of *n* elements indicating the plane location of the data. This statement, however, does not state the coordinate system in which the position is to be specified. As a result of this ambiguity, early implementers have interpreted this attribute as either (1) absolute axial (longitudinal) positions in the patient coordinate system, or (2) relative offsets of the dose grid frame from the point specified by the Image Position (Patient) (0020,0032) attribute.

The image coordinate system's relationship to the patient coordinate system is defined by the Image Orientation (Patient) (0020,0037) attribute, which specifies the direction cosines of the first row and the first column with respect to the patient. Interpreting the Grid Frame Offset Vector (3004, 000C) as absolute patient longitudinal coordinates, i.e., (1) above, presents difficulties in the case that the axes of the dose distribution are rotated with respect to those of the patient coordinate system. Thus, it is proposed that the language of Section C.8.8.3.2 be modified to state explicitly that values of the Grid Frame Offset Vector (3004, 000C) represent positions of dose planes with respect to the first dose plane transmitted, i.e., the point at which the Image Position (Patient) (0020,0032) attribute is defined. Thus, the first element of the Grid Frame Offset Vector (3004, 000C) will always be zero.

To support existing implementations, use of absolute patient z coordinates (i.e. where the offset of the first plane is non-zero) is supported, in the case where the dose image coordinate system is not rotated.

Sections of documents affected

PS 3.3, C.8.8.3 (RT Dose Module)

Correction Wording:

In DICOM Part 3, Section C.8.8.3 (RT Dose Module), Table C.8-35, modify the attribute description as follows:

Attribute Name	Tag	Type	Attribute Description
Grid Frame Offset Vector	(3004,000C)	1C	An array which contains the ~~**z coordinates**~~ **dose image plane offsets** (in mm) of the **dose** image frames in a multi-frame dose. Required if multi-frame pixel data are present and Frame Increment Pointer (0028,0009) points to Grid Frame Offset Vector (3004,000C). See C.8.8.3.2.

In PS 3.3, Section C.8.8.3.2, modify the text as follows:

C.8.8.3.2 Grid Frame Offset Vector

Grid Frame Offset Vector (3004,000C) shall be provided if a dose distribution is sent as a multi-frame image. ~~**This attribute contains an array of n elements indicating the place location of the data.**~~**Values of the Grid Frame Offset Vector (3004,000C) shall vary monotonically and are to be interpreted as follows:**

a. If Grid Frame Offset Vector (3004,000C) is present and its first element is zero, this attribute contains an array of *n* elements indicating the plane location of the data in

the right-handed image coordinate system, relative to the position of the first dose plane transmitted, i.e., the point at which the Image Position (Patient) (0020, 0032) attribute is defined, with positive offsets in the direction of the cross product of the row and column directions.

b. If Grid Frame Offset Vector (3004,000C) is present, its first element is equal to the third element of Image Position (Patient) (0020,0032), and Image Orientation (Patient) (0020,0037) has the value (1,0,0,0,1,0), then Grid Frame Offset Vector contains an array of n elements indicating the plane location (patient z coordinate) of the data in the patient coordinate system.

In future implementations, use of option a) is strongly recommended.

This attribute is conditional since the RT Dose module may be included even if pixel doses are not being transmitted, or the image may be a single-frame image. If the Multi-frame Module is present, Frame Increment Pointer (0028,0009) shall have the Enumerated Value of 3004000C (Grid Frame Offset Vector).

Note:

Option (a) can represent a rectangular-parallelepiped dose grid with any orientation with respect to the patient, while option (b) can only represent a rectangular-parallelepiped dose grid whose planes are in the axial patient dimension and whose x- and y-axes are parallel to the patient x- and y-axes.

Example:

Figure C.8-xxx shows an example of plane positions for a dose grid with axial planes.

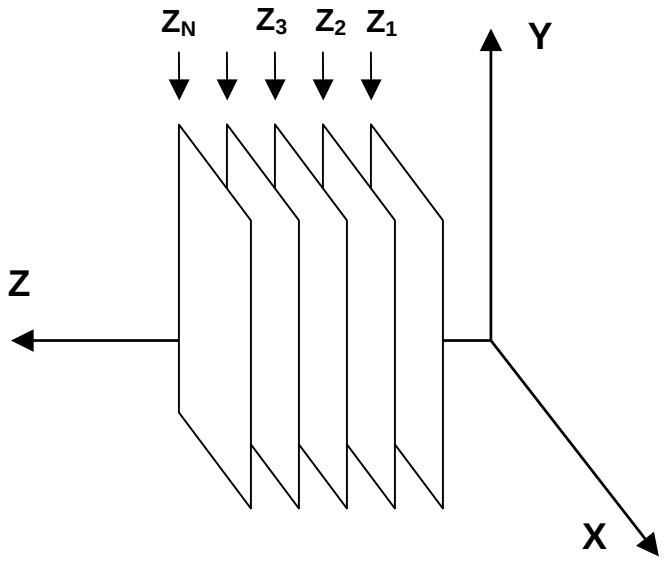

Figure C.8.xxx Dose Grid Frame Example

For this example, Table C.8.yyy gives the values of elements in the Grid Frame Offset Vector (3004,000C) for both relative (option (a)) and absolute (option (b)) interpretations, under the following conditions:

1. **The value of Image Orientation (Patient) (0020,0037) is (1,0,0,0,1,0). I.e., the dose grid is axial with x- and y-axes parallel to the patient x- and y-axes;**
2. **The value of Image Position (Patient) (0020,0032), i.e. the position of the first element of the dose grid, is (4, 5, 6); and**
3. **The spacing between adjacent dose grid planes is 2mm (uniform).**

Table C.8-yyy. Values of Dose Grid Frame Offset Vector under Relative (a) and Absolute (b) Interpretations

Grid Frame Offset Vector Element	Option (a) Relative Coordinates	Option (b) Absolute Coordinates
Z_1	0	6
Z_2	2	8
Z_3	4	10
Z_N	2(N-1)	6 + 2(N-1)