

DICOM Change Proposal

STATUS	In work
Date of Last Update	2026-05-28
Person Assigned	bjoern.nolte@siemens-healthineers.com
Submitter Name	Ingo.Wilkening@siemens-healthineers.com
Submission Date	2026-01-08

Change Number	CP-2603
Log Summary:	Correction of problematic UCUM
Name of Standard	PS3.16
Rationale for Change:	<p>PS3,16 contains several coded concepts for UCUM units which may be seen as “problematic”.</p> <p>1) Breaths/min</p> <p>(/min, UCUM, "breaths/min") is used in TID 3114, TID 3510, TID 3550. The CodeValue is not correct, as it does not contain "{breaths}" and therefor, it is ambitious to (/min, UCUM, "/min") used in TID 7181.</p> <p>2) CodeValue “MeV” with Quotes</p> <p>("MeV", UCUM, "Megaelectronvolt") is used in TID 15401. Here the CodeValue contains double quotes – which is not wanted. Correct is (MeV, UCUM, "Megaelectronvolt") – which is used in CID 9521, TID 15301.</p> <p>3) Electron Density</p> <p>(10*23/m^l, UCUM, "Electron Density") is used in CID 301. The CodeMeaning misses the part “per milliliter”, which is necessary to define the unit. Wikipedia article in German “Elektronendichte” (Electron density) lists Electron Density n_e for metals with a value of 10^{28} m^{-3} – which shows that the constant is influenced by the volume.</p> <p>4) Dyne vs. Newton</p> <p>These units look “weird”, and unnecessary complicated: (dyn.s.cm-5, UCUM, "dyn.s.cm-5") is used in CID 3502 (dyn.s.cm-5/m², UCUM, "dyn.s.cm-5/m²") is used in CID 3503 As 1 Dyne = 10^{-5} Newton, it should be discussed to replace it with the metric units based on Newton (N). Simplify “dyn.s.cm-5” to “N.s.cm” resp. “dyn.s.cm-5/m²” to “N.s.cm/m²”.</p> <p>Editorial note: Change of these units is a non-breaking change for existing values. TO BE DISCUSSED, as the CIDs 3502 and 3503 are non-extensible.</p>

Discuss

WG06



5) Diopters

(diop, UCUM, "diopters") is used CID 4267, while

(**[**diop**]**, UCUM, "diopters") is used in TID 2021 (5x).

The later shall be used, as it is defined in [UCUM](#) and [FHIR Example ValueSet UCUM-common](#).

6) CodeMeaning with μ -sign

CID 3045 has CodeMeanings "dB (**[** μ V**]**)" and "**[** μ V**]**".

The Greek micro sign (μ) should be avoided in CodeMeanings, as it does not exist in some character sets, like ISO IR 6 (DICOM Default), ISO IR 101 (Central European), ISO IR 110 (Nordic), ISO IR 144 (Cyrillic), ISO IR 127 (Arabic), ISO IR 166 (Thai).

See similar described for the degrees sign "°" in [PS3.16. 7.2.2 Measurement Unit](#)

7) Parts per million

CID 7181 and CID 4033 (column "Unit", 16x) have (ppm, UCUM, "ppm")

But [UCUM §29 dimensionless units](#) has code in brackets as (**[**ppm**]**, UCUM, "ppm").

8) Scores / Ranges

According to [PS3.16. 7.2.2 Measurement Unit](#),

"unitless numeric scores may use {M:N}, UCUM, "range: M:N" to specify the minimum and maximum value, for example, {0:10}, UCUM, "range: 0:10" "

These do not follow this rule:

Concept found in PS3.16	Expected Code Meaning	# used	Usage
({-1:1}, UCUM, " [-1:1] ")	range: -1:1	12	TID 1604 (6x), TID 4020 (6x)
({0:100}, UCUM, " [range:0:100] ")	range: 0:100	4	TID 2101 (3x), TID 2120
({0:2}, UCUM, " [range 0:2] ")	range: 0:2	10	TID 5009 (5x), TID 5230 (5x)
({0:4}, UCUM, " [range 0:4] ")	range: 0:4	2	TID 3114, TID 3510
({1:10}, UCUM, " [range 1:10] ")	range: 1:10	2	TID 3114, TID 3510

9) Wrong format

Table CID 4109 uses an UCUM Coded Concept in column "Units" but the parentheses are missing:

DCM	126323	IAUC180		DT (mmol/l.s, UCUM, "mmol/l.s")
DCM	126324	IAUCBN		DT {normalized}, UCUM, "normalized"
DCM	126325	IAUC60BN		DT {/AIF}, UCUM, "/AIF"
DCM	126326	IAUC90BN		DT {/AIF}, UCUM, "/AIF"
DCM	126327	IAUC180BN		DT {/AIF}, UCUM, "/AIF"
DCM	126370	Time of Peak Concentration		DT (s, UCUM, "s")

10) Negative Powers

~~(10⁻⁶.mm²/s, UCUM, "10⁻⁶.mm²/s") is used in CID 7277~~

[FHIR Example ValueSet UCUM-common](#) has negative powers of 10 written as "10⁻⁶".

Editorial: Seems to be wrong in FHIR.

Correct in DICOM, see UCUM §9 exponents: "The exponent is an integer number and is written immediately behind the unit term. Negative exponents must be preceded by a minus sign".

See UCUM "§10 nested terms", syntax in Backus Naur Form.

Change Wording:

Change PS3.16, TID 15401, delete the double-quotes around MeV, as:

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TID 15401 Real-World Quantity Definition for X-Ray Attenuation Properties

Type: Extensible
Order: Non-Significant
Root: No

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Table TID 15401. Real-World Quantity Definition for X-Ray Attenuation Properties

	NL	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		INCLUDE	DTID 15400 "Real-World Quantity Definition"	1	M		
2		NUMERIC	EV (130087, DCM, "Reference Energy")	1	MC	IF TID 15400 Row 1 Quantity value is (130086, DCM, "Relative Linear Stopping Power")	UNITS = EV (☐MeV☐, UCUM, "Megaelectronvolt")

Change PS3.16, CID 301, as:

CID 301 Multi-energy Material Unit

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Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
Keyword: MultienergyMaterialUnit
FHIR Keyword: dicom-cid-301-MultienergyMaterialUnit
Type: Extensible
Version: 20181109YYYYMMDD
UID: 1.2.840.10008.6.1.1209

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Table CID 301. Multi-energy Material Unit

Coding Scheme Designator	Code Value	Code Meaning
UCUM	mg/cm3	mg/cm^3
UCUM	[hnsfU]	Hounsfield Unit
UCUM	10*23/ml	Electron Density/ml
DCM	129320	Effective Atomic Number
DCM	129321	Modified Hounsfield Unit
UCUM	mg/ml	mg/ml
UCUM	%	Percent

Change PS3.16, CID 3045, change the μ sign to a lower-case “u”, as:

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CID 3045 Waveform Filter Lookup Table Output Magnitude Unit

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
Keyword: WaveformFilterLookupTableOutputMagnitudeUnit

30 FHIR Keyword: dicom-cid-3045-WaveformFilterLookupTableOutputMagnitudeUnit
 Type: Non-Extensible
 Version: 20220630 YYYMMDD
 UID: 1.2.840.10008.6.1.1456

Table CID 3045. Waveform Filter Lookup Table Output Magnitude Unit

Coding Scheme Designator	Code Value	Code Meaning
UCUM	dB[uV]	dB(μ V)
UCUM	dB[mV]	dB(mV)
DCM	130776	Magnitude normalized
UCUM	mV	mV
UCUM	μ V	μ V

35 **Change PS3.16, CID 4109, add parentheses, as:**

CID 4109 Model-Independent Dynamic Contrast Analysis Parameter

40 Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
 Keyword: ModelIndependentDynamicContrastAnalysisParameter
 FHIR Keyword: dicom-cid-4109-ModelIndependentDynamicContrastAnalysisParameter
 Type: Extensible
 Version: 20150916 YYYMMDD
 UID: 1.2.840.10008.6.1.994

Table CID 4109. Model-Independent Dynamic Contrast Analysis Parameter

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID	Units
DCM	126320	IAUC			DT (mmol/l.s, UCUM, "mmol/l.s")
DCM	126321	IAUC60			DT (mmol/l.s, UCUM, "mmol/l.s")
DCM	126322	IAUC90			DT (mmol/l.s, UCUM, "mmol/l.s")
DCM	126323	IAUC180			DT (mmol/l.s, UCUM, "mmol/l.s")
DCM	126324	IAUCBN			DT ({normalized}, UCUM, "normalized")
DCM	126325	IAUC60BN			DT ({/AIF}, UCUM, "/AIF")
DCM	126326	IAUC90BN			DT ({/AIF}, UCUM, "/AIF")
DCM	126327	IAUC180BN			DT ({/AIF}, UCUM, "/AIF")
[...]					

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Change PS3.16, CID 4267, change "diop" to "[diop]", as:

CID 4267 Corneal Topography Mapping Unit for Real World Value Mapping

50 Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
 Keyword: CornealTopographyMappingUnitForRealWorldValueMapping
 FHIR Keyword: dicom-cid-4267-CornealTopographyMappingUnitForRealWorldValueMapping
 Type: Extensible
 Version: 20131014.YYYYMMDD
 UID: 1.2.840.10008.6.1.965

55 **Table CID 4267. Corneal Topography Mapping Unit for Real World Value Mapping**

Coding Scheme Designator	Code Value	Code Meaning
UCUM	um	micrometer
UCUM	[diop]	diopters
UCUM	mm	mm

60 **Editorial Change PS3.16, search and replace in full text in XML source**

#	Search	Replace	Comment
1	{{-1:1}, UCUM, "{-1:1}"}	{{-1:1}, UCUM, "range: -1:1"}	12 changes
2	{{0:100}, UCUM, "range:0:100"}	{{0:100}, UCUM, "range: 0:100"}	4 changes
3	{{0:2}, UCUM, "range 0:2"}	{{0:2}, UCUM, "range: 0:2"}	10 changes
4	{{0:4}, UCUM, "range 0:4"}	{{0:4}, UCUM, "range: 0:4"}	2 changes
5	{{1:10}, UCUM, "range 1:10"}	{{1:10}, UCUM, " range: 1:10"}	2 changes
6	(ppm, UCUM, "ppm")	[ppm], UCUM, "ppm")	16 changes
7	(/min, UCUM, "breaths/min")	([breaths]/min, UCUM, "breaths/min")	3 changes

Change DICOM PS3.16, To the modified table J-1 from CP-2476, add these:

65 **Table J-1. Coded Concepts retired from DICOM use**

Retired Coding Scheme Designator	Retired Code Value	Retired Code Meaning	Replacement Coding Scheme Designator	Replacement Code Value	Replacement Code Meaning	Notes (informal)
		[...]				
UCUM	diop	diopters	UCUM	[diop]	diopters	CP2603

<u>UCUM</u>	<u>/min</u>	<u>breaths/min</u>	<u>UCUM</u>	<u>{breaths}/min</u>	<u>breaths/min</u>	<u>CP2603</u>
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