

## DICOM Correction Proposal

STATUS	Assigned
Date of Last Update	2017/03/24
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Submission Date	2016/07/22

Correction Number	CP-1657
Log Summary:	Consolidate Brachytherapy Applicator Geometry Definitions
Name of Standard	PS 3.3 2016e
Rationale for Correction:	<p>Currently there are different implementations of RT Plans for Brachytherapy in use to specify the dwell positions relative to the physical applicator interior length because of ambiguous definition of several RT Plan attributes. Adding two new attributes to the channel specification (Channel Effective Length and Channel Inner Length) solves this issue and allows verification of the source positions relative to the applicator tip (see Figure C.8.8.15-1).</p> <p>Mapping of the afterloader channels and the applicator channels, which do not necessarily have the same channel number, is not addressed in the current RT Brachy Application Setup Module Attributes. Some implementations use the transfer tube number for that mapping, which is technically not correct, because the transfer tube has two connectors: on the afterloader and on the applicator side. The transfer tube connectors, therefore, cannot be unambiguously described by a single number. Adding a new attribute for the afterloader channel ID solves this issue and allows unambiguous assignment of the applicator channels to the afterloader channels (channel mapping, see Figure C.8.8.15-2).</p> <p>Source applicator tip length parameter has been requested by the BRAPHYQS group of GEC-ESTRO committee in order to specify the external tip of an applicator, which can be identified on the images and used for applicator reconstruction and QA.</p>
Correction Wording:	

In PS3.3 modify and extend Section C.8.8.15 RT Brachy Application Setups Module as follows:

**C.8.8.15 RT Brachy Application Setups Module**

...

**Table C.8-51. RT Brachy Application Setups Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Brachy Treatment Technique	(300A,0200)	1	Type of brachytherapy treatment technique. Enumerated Values: <b>INTRALUMENARY</b> <b>INTRACAVITARY</b> <b>INTERSTITIAL</b> <b>CONTACT</b> <b>INTRAVASCULAR</b> <b>PERMANENT</b> See Section C.8.8.15.1.
...			
Application Setup Sequence	(300A,0230)	1	Sequence of Application Setups for current RT Plan. One or more Items shall be included in this Sequence.
...			
>Application Setup Number	(300A,0234)	1	Identification number of the Application Setup. The value of Application Setup Number (300A,0234) shall be unique within the RT Plan in which it is created.
>...			
>Channel Sequence	(300A,0280)	1	Sequence of Channels for current Application Setup. One or more Items shall be included in this Sequence.
>>Channel Number	(300A,0282)	1	Identification number of the Channel. The value of Channel Number (300A,0282) shall be unique within the Application Setup in which it is created.
>>Channel Length	(300A,0284)	2	Length of Channel (mm). See Section C.8.8.15.3.
...			
>>Source Applicator Number	(300A,0290)	3	Identification number of the Source Applicator. The value of Source Applicator Number (300A,0290) shall be unique within the Channel in which it is created.
...			
>>Source Applicator Length	(300A,0296)	1C	Length of Source Applicator (mm), defined as the distance between the connector of the applicator and the distal-most position of the source. Required if Source Applicator Number (300A,0290) is sent.
...			
>>Transfer Tube Number	(300A,02A2)	2	Identification number of the Transfer Tube. The value of Transfer Tube Number (300A,02A2) shall be unique within the Channel in which it is created.
>>Transfer Tube Length	(300A,02A4)	2C	Length of Transfer Tube of current afterloading Channel (mm). Required if value Transfer Tube Number (300A,02A2) is non-null.
<b>&gt;&gt;Channel Effective Length</b>	<b>(xxxx,yyy1)</b>	<b>3</b>	<b><u>Length of Channel (in mm) defined as the distance between the connector on the afterloader and the center of the distal-most possible position of the source.</u></b> <b><u>See C.8.8.15.16.</u></b>

Attribute Name	Tag	Type	Attribute Description
<b>&gt;&gt;Channel Inner Length</b>	<b>(xxxx,yyy2)</b>	<b>2C</b>	<b>The total physical inner length of channel (in mm). Specifies the distance between the connector on the afterloader and the end of the channel. Required if Channel Effective Length (xxxx,yyy1) is present. See C.8.8.15.16.1.</b>
<b>&gt;&gt;Afterloader Channel ID</b>	<b>(xxxx,yyy3)</b>	<b>3</b>	<b>Identification of the Channel connection on the afterloader. See C.8.8.15.16.2.</b>
>>...			
>>Source Applicator Number	(300A,0290)	3	Identification number of the Source Applicator. The value of Source Applicator Number (300A,0290) shall be unique within the Channel in which it is created.
>>Source Applicator ID	(300A,0291)	2C	User or machine supplied identifier for Source Applicator. Required if Source Applicator Number (300A,0290) is sent.
>>Source Applicator Type	(300A,0292)	1C	Type of Source Applicator. Required if Source Applicator Number (300A,0290) is sent. Defined Terms: <b>FLEXIBLE</b> <b>RIGID</b>
>>Source Applicator Name	(300A,0294)	3	User-defined name for Source Applicator.
>>Source Applicator Length	(300A,0296)	1C	Length of Source Applicator (mm), defined as the distance between the connector of the applicator and the distal-most position of the source. Required if Source Applicator Number (300A,0290) is sent.
<b>&gt;&gt;Source Applicator Tip Length</b>	<b>(xxxx,yyy4)</b>	<b>2C</b>	<b>Length of Source Applicator Tip (in mm), defined as the distance between the outer tip of the applicator and the center of the distal-most possible position of the source. Required if Channel Effective Length (xxxx,yyy1) is present. See C.8.8.15.16.</b>
>>...			
>>Brachy Control Point Sequence	(300A,02D0)	1	Sequence of machine configurations describing this Channel. The number of Items in this Sequence shall equal the value of Number of Control Points (300A,0110). See Section C.8.8.15.7.
>>>Cumulative Time Weight	(300A,02D6)	2	Cumulative time weight to current Control Point (where the weighting is proportional to time values delivered). Cumulative Time Weight for first item in Brachy Control Point Sequence (300A,02D0) is always zero. See Section C.8.8.15.6 and Section C.8.8.15.8.
>>>...			
>>>Control Point Relative Position	(300A,02D2)	1	Distance between current Control Point Position and <b>the center of</b> the distal-most possible Source position in current Channel (mm). See Section C.8.8.15.9.

### C.8.8.15.1 Permanent Implants

...

### C.8.8.15.3 Channel Length

If specified, Channel Length (300A,0284) shall be the sum of the Source Applicator Length (300A,0296) and Transfer Tube Length(300A,02A4).

...

### C.8.8.15.9 Control Point Relative Position

Control Point Relative Position (300A,02D2) shall describe where **the center of** a given source in a channel is located with respect to the end of the channel, **i.e. to the center of the distal-most possible dwell position in the channel. This position shall correspond to the end of the afterloader catheter, not the "safe position".**

...

### C.8.8.15.16 Geometric parameters

**A Channel is the combination of the Transfer Tube and the Source Applicator. A Channel is physically connected to one of the connection sockets of the afterloader. Afterloader Channel ID (xxxx,yyy3) unambiguously identifies the afterloader channel to which the applicator is connected, see C.8.8.15.16.2. Both Afterloader Channel ID and Source Applicator ID describe the connection between the afterloader and the applicator (so called channel mapping). Channel Number (300A,0282) is used to index the items within the Channel Sequence (300A,0280) and does not serve as the identification of the channel socket at the afterloader.**

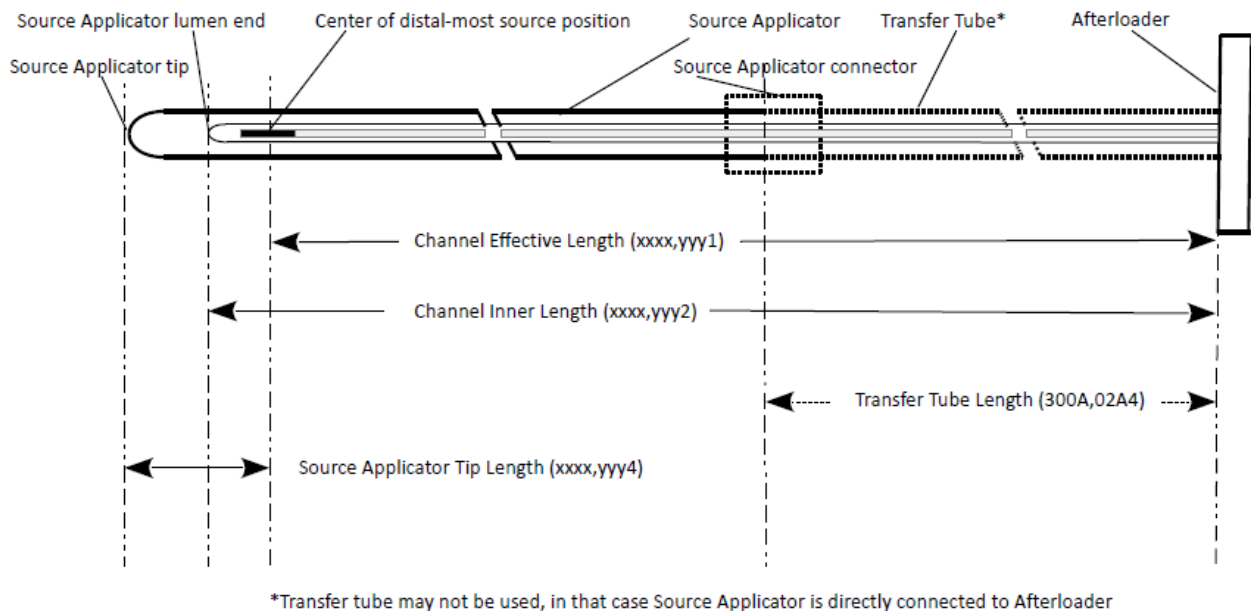


Figure C.8.8.15-1 — RT Brachy Channel Geometric Parameters

**Notes: Channel Length (300A,0284) have been interpreted in different ways. Channel Effective Length (xxxx,yyy1) should be used instead, as the distance from the afterloader to the center of the distal-most possible dwell position following the definition in the Figure C.8.8.15-1.**

**Additionally, the Transfer Tube Length (300A,02A4) may be specified. If Transfer Tube Length is absent or has no value, the distance from the Source Applicator connector to the center of the distal-most possible dwell position is equal to the value of the Channel Effective Length. If Transfer Tube Length has a value, the distance from the Source Applicator connector to the center of the distal-most possible dwell position is equal to the Channel Effective Length minus the Transfer Tube Length. The concept of Source Applicator Length (300A,0296) should not be used any longer.**

### C.8.8.15.16.1 Channel Inner Length

**The Channel Inner Length (xxxx,yyy2) is the measurable physical inner length of channel. Specifies the distance between the connector on the afterloader and the inner end of the channel. In the RT Brachy Session Record Module it shall be specified as the measured or verified length.**

### C.8.8.15.16.2 Afterloader Channel ID

**The Afterloader Channel ID (xxxx,yyy3) is the connector socket identification on the afterloader where the channel is connected.**

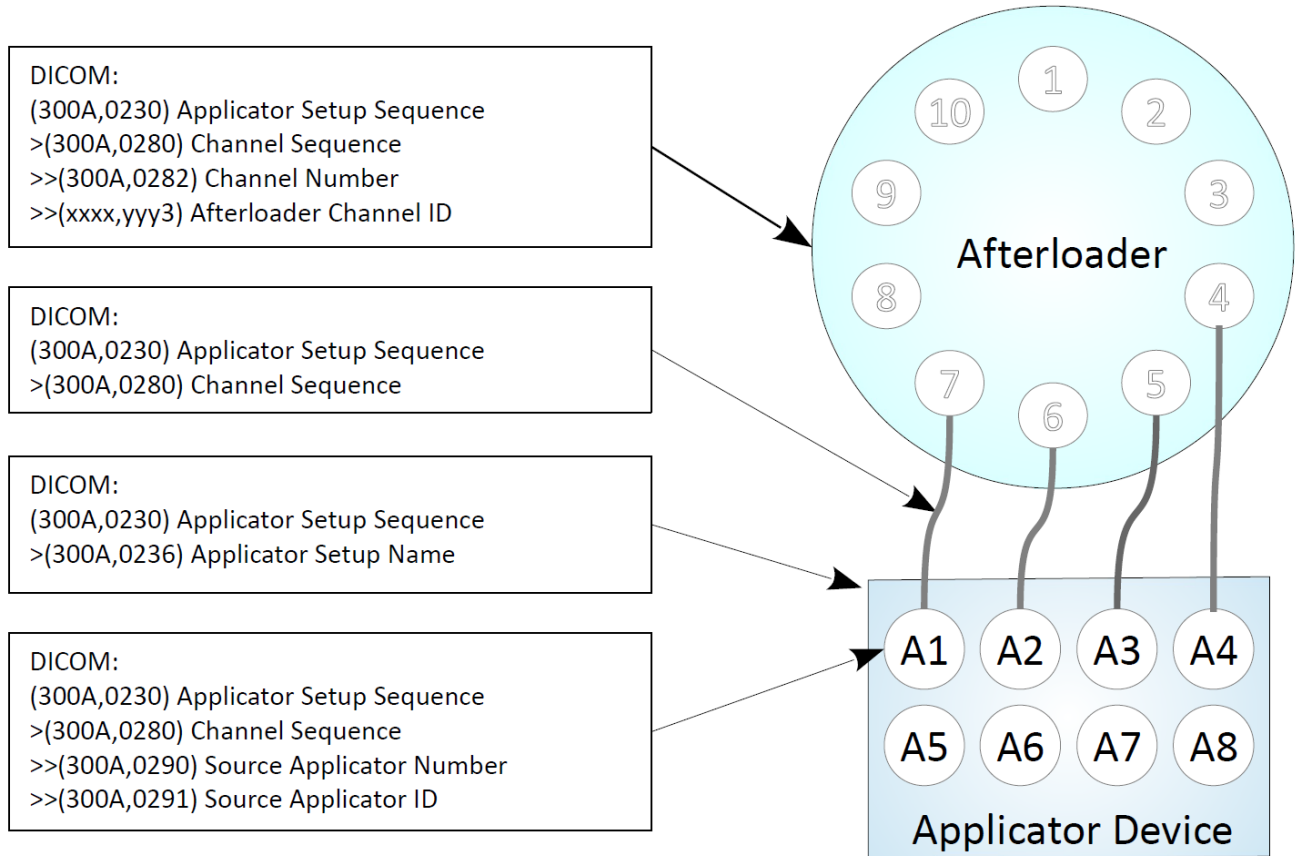


Figure C.8.8.15-2 — RT Brachy Channel and Applicator IDs

In PS3.3 modify and extend Section C.8.8.22 RT Brachy Session Record Module as follows:

**C.8.8.22 RT Brachy Session Record Module**

**Table C.8-58. RT Brachy Session Record Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Referenced Fraction Group Number	(300C,0022)	3	Identifier of Fraction Group within referenced RT Plan.
...			
Treatment Session Application Setup Sequence	(3008,0110)	1	Sequence of Application Setups for RT Treatment Record for current RT Plan. One or more Items shall be included in this Sequence.
>...			
>Referenced Brachy Application Setup Number	(300C,000C)	3	References application setup specified by Application Setup Number (300A,0234) in Application Setup Sequence (300A,0230) in RT Brachy Application Setups Module within referenced RT Plan.
>...			
>Recorded Channel Sequence	(3008,0130)	1	Sequence of Channels for current Application Setup. One or more Items shall be included in this Sequence.
>>Channel Number	(300A,0282)	1	Identification number of the Channel. The value of Channel Number (300A,0282) shall be unique within the Application Setup in which it is created.
<b>&gt;&gt;Referenced Channel Number</b>	<b>(0074,1406)</b>	<b>3</b>	<b><u>The channel to be delivered, specified by the value of Channel Number (300A,0282) in referenced RT Plan.</u></b>
>>Channel Length	(300A,0284)	2	Length of Channel (mm). See also RT Plan IOD.
<b>&gt;&gt;Channel Effective Length</b>	<b>(xxxx,yyy1)</b>	<b>3</b>	<b><u>Length of Channel (in mm) defined as the distance between the connector on the afterloader and the center of the distal-most possible position of the source.</u></b> <b><u>See C.8.8.15.16.</u></b>
<b>&gt;&gt;Channel Inner Length</b>	<b>(xxxx,yyy2)</b>	<b>2C</b>	<b><u>The total physical inner length of channel (in mm). Specifies the distance between the connector on the afterloader and the end of the channel.</u></b> <b><u>Required if Channel Effective Length (xxxx,yyy1) is present.</u></b> <b><u>See C.8.8.15.16.1.</u></b>
<b>&gt;&gt;Afterloader Channel ID</b>	<b>(xxxx,yyy3)</b>	<b>3</b>	<b><u>Identification of the channel connection on the afterloader.</u></b> <b><u>See C.8.8.15.16.2.</u></b>
>>Specified Channel Total Time	(3008,0132)	1	Total amount of time in seconds, scaled for the current source delivery strength and other delivery factors, specified to be delivered at the time of treatment between the first Control Point and the final Control Point for the current Channel.  In the case of resuming a partially delivered treatment, the Specified Channel Total time will only include the remainder to be treated.  See Section C.8.8.22.2.
>>Delivered Channel Total Time	(3008,0134)	1	Total amount of time in seconds actually delivered between Control Point 0 and final Control Point of the Brachy Control Point Delivered Sequence (3008,0160) for current Channel.

Attribute Name	Tag	Type	Attribute Description
>>...			
>>Recorded Source Applicator Sequence	(3008,0140)	3	Sequence of recorded Source Applicators. One or more Items are permitted in this Sequence.
>>>Referenced Source Applicator Number	(3008,0142)	3	Identification number of the Source Applicator. The value of Source Applicator Number (300A,0290) shall be unique within the Channel in which it is created.
>>>Source Applicator ID	(300A,0291)	2C	User or machine supplied identifier for Source Applicator. Required if Source Applicator Number (300A,0290) is sent.
>>>Source Applicator Type	(300A,0292)	1C	Type of Source Applicator. Required if Source Applicator Number (300A,0290) is sent. Defined Terms: <b>FLEXIBLE</b> <b>RIGID</b>
>>>Source Applicator Name	(300A,0294)	3	User-defined name for Source Applicator.
>>>Source Applicator Length	(300A,0296)	1	Length of Source Applicator (mm), defined as the distance between the connector of the applicator and the distal-most position of the source.
<b>&gt;&gt;&gt;Source Applicator Tip Length</b>	<b>(xxxx,yyy4)</b>	<b>2C</b>	<b><u>Length of Source Applicator Tip (in mm), defined as the distance between the outer tip of the applicator and the center of the distal-most possible position of the source. Required if Channel Effective Length (xxxx,yyy1) is present. See C.8.8.15.16.</u></b>
>>>...			
>>Transfer Tube Number	(300A,02A2)	2	Identification number of the Transfer Tube. The value of Transfer Tube Number (300A,02A2) shall be unique within the Channel in which it is created.
>>Transfer Tube Length	(300A,02A4)	2C	Length of Transfer Tube of current afterloading Channel (mm). Required if value Transfer Tube Number (300A,02A2) is non-null.
>>...			
>>Brachy Control Point Delivered Sequence	(3008,0160)	1	Sequence of machine configurations describing this Channel. The number of Items in this Sequence shall equal the value of Number of Control Points (300A,0110). See RT Plan IOD and Section C.8.8.22.1 for description of Brachy Control Point Delivered Sequence.
>>> Referenced Control Point Index	(300C,00F0)	3	Index of current Control Point, starting at 0 for first Control Point.
>>>...			
>>>Control Point Relative Position	(300A,02D2)	1	Distance between current Control Point Position and <b>the center of</b> the distal-most possible Source position in current Channel (mm). See Section C.8.8.15.9.
>>Pulse Specific Brachy Control Point Delivered Sequence	(3008,0171)	3	Brachy Control Point Delivered Sequence for each PDR treatment pulse. Number of items in the sequence shall be equal to the Delivered Number of Pulses (3008,0138).
>>>Pulse Number	(3008,0172)	1	Identification Number of this delivered Pulse. The pulse numbers for a treatment start at 1 and increase monotonically by 1. A given SOP instance might only contain

Attribute Name	Tag	Type	Attribute Description
			some of the pulses of the given treatment.
>>>...			
>>>Brachy Pulse Control Point Delivered Sequence	(3008,0173)	1	List of control points for this pulse. See Section C.8.8.22.1.
>>>>Referenced Control Point Index	(300C,00F0)	1	Index of current Control Point, starting at 0 for first Control Point in this Sequence.
>>>>...			
>>>>Control Point Relative Position	(300A,02D2)	1	Distance in mm between current Control Point Position and <b>the center of</b> the distal-most possible Source position in current Channel. See Section C.8.8.15.9.

In PS 3.6, Section 6, add the following attributes:

Tag	Name	Keyword	VR	VM	
<u>(xxx,yyy1)</u>	<u>Channel Effective Length</u>	<u>ChannelEffectiveLength</u>	<u>DS</u>	<u>1</u>	
<u>(xxx,yyy2)</u>	<u>Channel Inner Length</u>	<u>ChannelInnerLength</u>	<u>DS</u>	<u>1</u>	
<u>(xxx,yyy3)</u>	<u>Afterloader Channel ID</u>	<u>AfterloaderChannelID</u>	<u>SH</u>	<u>1</u>	
<u>(xxx,yyy4)</u>	<u>Source Applicator Tip Length</u>	<u>SourceApplicatorTipLength</u>	<u>DS</u>	<u>1</u>	