



GE Medical Systems

Technical Publications

**Direction 5411767-100
Revision 1**

Advantage 4D 2.3 DICOM CONFORMANCE STATEMENT

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 - 若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。
- UPOZORENJE** Ovaj servisni priručnik dostupan je na engleskom jeziku.
- (HR)
- Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod.
 - Ne pokušavajte servisirati opremu ako niste u potpunosti pročitali i razumjeli ovaj servisni priručnik.
 - Zanimarite li ovo upozorenje, može doći do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehaničkih ili drugih rizika.
- VÝSTRAHA** Tento provozní návod existuje pouze v anglickém jazyce.
- (CS)
- V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka.
 - Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah.
 - V případě nedodržování této výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
- ADVARSEL** Denne servicemanual findes kun på engelsk.
- (DA)
- Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse.
 - Forsøg ikke at servicere udstyret uden at læse og forstå denne servicemanual.
 - Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikereren, operatøren eller patienten.

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- WAARSCHUWING**
(NL)
- Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar.
- Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan.
 - Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is.
 - Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
- WARNING**
(EN)
- This service manual is available in English only.
- If a customer's service provider requires a language other than english, it is the customer's responsibility to provide translation services.
 - Do not attempt to service the equipment unless this service manual has been consulted and is understood.
 - Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.
- HOIATUS**
(ET)
- See teenindusjuhend on saadaval ainult inglise keeles
- Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest.
 - Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist.
 - Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.
- VAROITUS**
(FI)
- Tämä huolto-ohje on saatavilla vain englanniksi.
- Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla.
 - Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen.
 - Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
- ATTENTION**
(FR)
- Ce manuel d'installation et de maintenance est disponible uniquement en anglais.
- Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire.
 - Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance n'a pas été consulté et compris.
 - Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.
- WARNUNG**
(DE)
- Diese Serviceanleitung existiert nur in englischer Sprache.
- Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.
 - Versuchen Sie nicht diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben.
 - Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.
- ΠΡΟΕΙΔΟΠΟΙΗΣΗ**
(EL)
- Το παρόν εγχειρίδιο σέρβις διατίθεται μόνο στα αγγλικά.
- Εάν ο τεχνικός σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει τις υπηρεσίες μετάφρασης.
 - Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό αν δεν έχετε συμβουλευτεί και κατανοήσει το παρόν εγχειρίδιο σέρβις.
 - Αν δεν προσέξετε την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στον τεχνικό σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.

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FIGYELMEZTETÉS

(HU)

Ezen karbantartási kézikönyv kizárólag angol nyelven érhető el.

- Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészítése.
- Ne próbálja elkezdni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték.
- Ezen figyelmeztetés figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.

AÐVÖRUN

(IS)

Þessi þjónustuhandbók er aðeins áanleg á ensku.

- Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálþjónustu.
- Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin.
- Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.

AVVERTENZA

(IT)

Il presente manuale di manutenzione è disponibile soltanto in lingua inglese.

- Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.
- Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto.
- Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.

警告

(JA)

このサービスマニュアルには英語版しかありません。

- サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
- このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないでください。
- この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

경고

(KO)

본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다.

고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다.

본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오.

본 경고 사항에 유의하지 않으면 전기 쇼크, 기계적 위험, 또는 기타 위험으로 인해 서비스 제공자, 사용자 또는 환자에게 부상을 입힐 수 있습니다.

BRĪDINĀJUMS
(LV)

Šī apkopes rokasgrāmata ir pieejama tikai angļu valodā.

- Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu.
- Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas.
- Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.

ĮSPĖJIMAS
(LT)

Šis eksploatavimo vadovas yra tik anglų kalba.

- Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas privalo klientas.
- Nemėginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploatavimo vadovo.
- Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų.

ADVARSEL
(NO)

Denne servicehåndboken finnes bare på engelsk.

- Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for oversettelse.
- Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått.
- Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.

OSTRZEŻENIE
(PL)

Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim.

- Jeśli serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta.
- Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go.
- Niezastosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.

AVISO
(PT-BR)

Este manual de assistência técnica encontra-se disponível unicamente em inglês.

- Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao cliente fornecer os serviços de tradução.
- Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica.
- A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.

ATENÇÃO
(PT-PT)

Este manual de assistência técnica só se encontra disponível em inglês.

- Se qualquer outro serviço de assistência técnica solicitar este manual noutra idioma, é da responsabilidade do cliente fornecer os serviços de tradução.
- Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica.
- O não cumprimento deste aviso pode colocar em perigo a segurança do técnico, do operador ou do paciente devido a choques elétricos, mecânicos ou outros.

ATENȚIE
(RO)

Acest manual de service este disponibil doar în limba engleză.

- Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere.
- Nu încercați să reparați echipamentul decât ulterior consultării și înțelegerii acestui manual de service.
- Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolului de electrocutare, mecanice sau de altă natură.

ОСТОРОЖНО!
(RU)

Данное руководство по техническому обслуживанию представлено только на английском языке.

- Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует самостоятельно обеспечить перевод.
- Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения.
- Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.

UPOZORENJE
(SR)

Ovo servisno uputstvo je dostupno samo na engleskom jeziku.

- Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge.
- Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo.
- Zanemarivanje ovog upozorenja može dovesti do povređivanja serviser, rukovoca ili pacijenta usled strujnog udara ili mehaničkih i drugih opasnosti.

UPOZORNENIE
(SK)

Tento návod na obsluhu je k dispozícii len v angličtine.

- Ak zákazník poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka.
- Nepokúšajte sa o obsluhu zariadenia, kým si neprečítate návod na obsluhu a neporozumiete mu.
- Zanedbanie tohto upozornenia môže spôsobiť zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.

ATENCIÓN
(ES)

Este manual de servicio sólo existe en inglés.

- Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual.
- No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio.
- La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

VARNING
(SV)

Den här servicehandboken finns bara tillgänglig på engelska. .

- Om en kunds servicetekniker har behov av ett annat språk än engelska, ansvarar kunden för att tillhandahålla översättningstjänster.
- Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken.
- Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.

OPOZORILO
(SL)

Ta servisni priročnik je na voljo samo v angleškem jeziku.

- Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod.
- Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli.
- Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.

DİKKAT
(TR)

Bu servis kılavuzunun sadece ingilizcesi mevcuttur.

- Eğer müşteri teknisyeni bu kılavuza ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer.
- Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz.
- Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

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CONFORMANCE STATEMENT OVERVIEW

Advantage 4D is a diagnostic application used in the preparation of a 4D CT-scanned patient for treatment by radiotherapy on the AW4.6/AWS2 platforms. This base application is a Networked Medical Imaging Console dedicated to Examination Scan, Review and Diagnosis. The workstation uses DICOM services to import acquisition images for possible further analysis or processing, and to export images and radiotherapy data to other vendors.

Advantage 4D does not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE.

Table 0.1 provides an overview of the network services supported by Advantage 4D.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
CT Image Storage	Yes	Yes

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

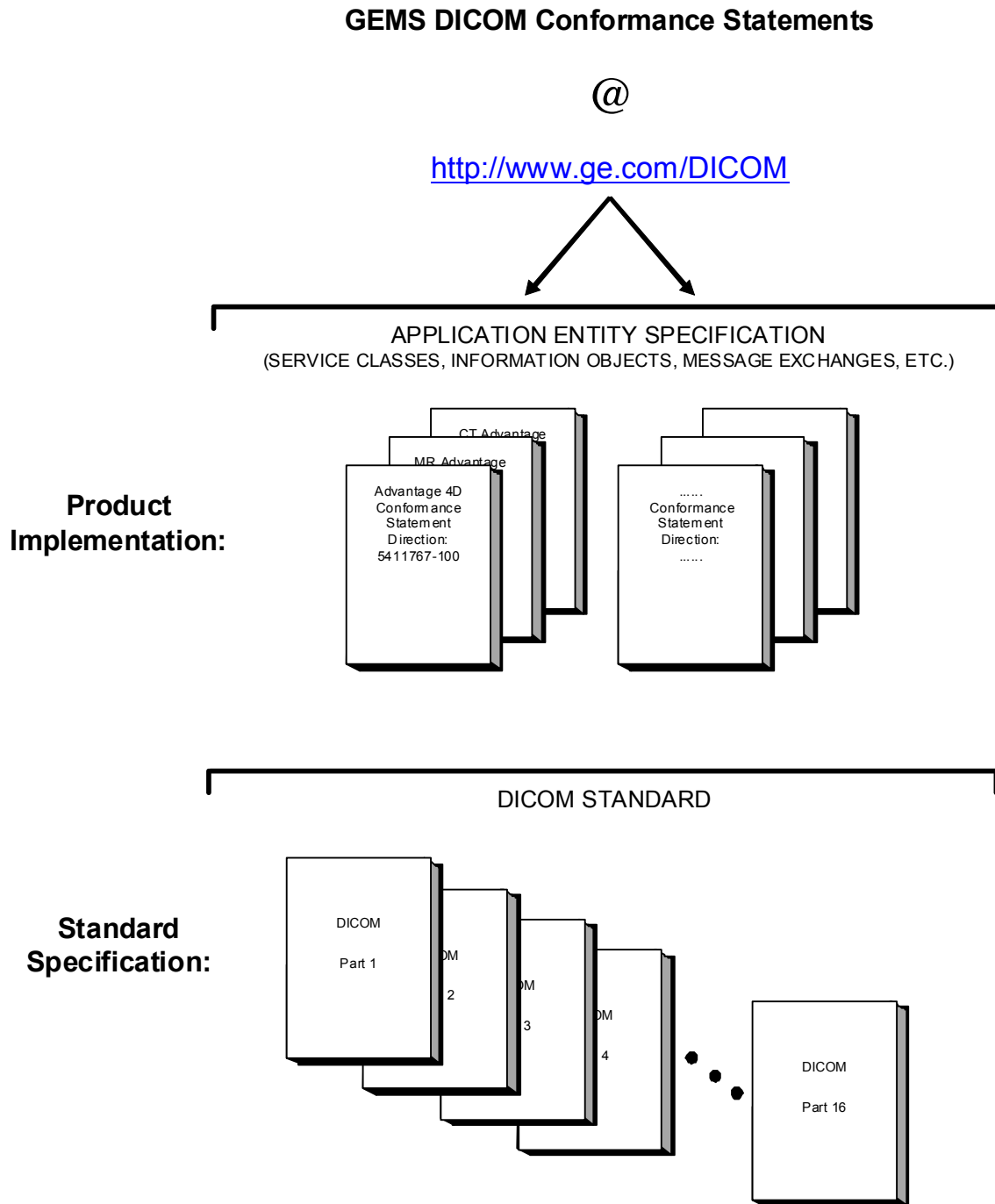
Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 4 (CT Image Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a CT Image Information Object.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEMS DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

*Advantage 4D 2.3
Conformance Statement for DICOM
Direction 5411767-100*

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEMS network interface.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1752
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be**

successful. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at <http://medical.nema.org/>

The supported platforms DICOM conformance statements are described in the following documents:

Document title	Direction
AW Server generation 2 CONFORMANCE STATEMENT for DICOM	5367884-100
Volume Share 5– Advantage Workstation	5404296-100

4.6 DICOM CONFORMANCE STATEMENT	
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1.7 DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity (Service Class User)*. Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AW	Advantage Workstation

AWS	AW Server
AWS2	AW Server generation 2
AW4.6	Volume Share 5 – Advantage Workstation 4.6
DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MR	Magnetic Resonance Imaging
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Advantage 4D compliance to DICOM requirements for **Networking** features.

Advantage 4D is a diagnostic application used in the preparation of a 4D CT-scanned patient for treatment by radiotherapy on the AW4.6/AWS2 platforms. This base application is a Networked Medical Imaging Console dedicated to Examination Review and Diagnosis. The workstation uses DICOM services to import acquisition images for possible further analysis or processing, and to export images and radiotherapy data to other vendors.

Advantage 4D does not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE. For some detailed information on DICOM features of AW4.6/AWS2 platforms, refer to the respective Conformance Statements (See References).

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

Refer to the respective Conformance Statements of the AW4.6/AWS2 platforms where Advantage 4D application is running (See References).

2.2.2 Functional Definition of AE's

Refer to the respective Conformance Statements of the AW4.6/AWS2 platforms where Advantage 4D application is running (See References).

2.2.3 Sequencing of Real-World Activities

The user can select CT Images (multiple phases), then start application from one of the AW4.6/AWS2 platforms. Perform the phase binning and then user action needs to indicate saving of phase series. Also the Advantage 4D application can be started from the Advantage 4D application, with the CT Images just created. After user request the 4D binned image series is created and saved into AW4.6/AWS2 database.

The goal of this document is to give a detailed description of the CT IMAGE DICOM IOD (1.2.840.10008.5.1.4.1.1.2) read by the application, required to reconstruct a 3-dimensional volume

2.3 AE SPECIFICATIONS

2.3.1 Advantage 4D AE Specification

The Advantage 4D Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes

2.4 SUPPORT OF EXTENDED CHARACTER SETS

The Advantage 4D supports ISO_IR 100 (Latin alphabet Number 1 supplementary set) as extended character set. The product user interface will allow the user to enter characters from the console keyboard that are within ASCII or the configured extended character set.

The character set ISO_IR 6 (ASCII) is also supported. If there is no character set defined at Specific Character Set (0008,0005) the ISO_IR 6 will be used.

Other character sets are not supported by Advantage 4D therefore, in this case the application will display the corresponding error message and will quit after the message is confirmed. (The same error message will be displayed if this DICOM field is zero-length.)

3. CT INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM CT Image IOD to represent the information included in CT Images produced and/or received by this implementation. Corresponding attributes are conveyed using the module construct.

3.2 ADVANTAGE 4D MAPPING OF DICOM ENTITIES

The Advantage 4D maps DICOM Information Entities to local Information Entities in the product’s database and user interface.

**TABLE 3-1
 MAPPING OF DICOM ENTITIES TO ADVANTAGE 4D ENTITIES**

DICOM IE	Advantage 4D Entity
Patient	Patient (AW/AWS)
Study	Exam (AW/AWS)
Series	Series (AW/AWS)
Image	Patient model reconstruction on 3D server

3.3 IOD MODULE TABLE

The Computed Tomography Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 3.5.

**TABLE 3-2
 CT IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
Series	General Series	Used	3.4.3.1
Frame of Reference	Frame of Reference	Used	3.4.4.1
Equipment	General Equipment	Used	3.4.5.1
Image	General Image	Used	3.4.6.1
	Image Plane	Used	3.4.6.2
	Image Pixel	Used	3.4.6.3
	Contrast/Bolus	Used	3.4.6.4

CT Image	Used	3.4.6.5
SOP Common	Used	3.4.6.6

3.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the CT Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported and/or expected. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance as well as what are the expected values when loading such instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

3.4.1.1 Patient Module

TABLE 3-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	SCU: Duplicated from input instances if present in those images. SCP: Used for display if provided. REQUIRED FOR SAFE PATIENT IDENTIFICATION.
Patient ID	(0010,0020)	2	SCU: Duplicated from input instances if present in those images. SCP: REQUIRED BY Advantage 4D FOR SAFE PATIENT IDENTIFICATION.
Issuer of Patient ID	(0010,0021)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
>Universal Entity ID	(0040,0032)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
>Universal Entity ID Type	(0040,0033)	1C	SCU: Duplicated from input instances if present in those images. SCP: Not used.
>All other attributes of Issuer of Patient ID Qualifiers Sequence		3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
Patient's Birth Date	(0010,0030)	2	SCU: Duplicated from input instances if present in those images. SCP: Used for display if provided.
Patient's Sex	(0010,0040)	2	SCU: Duplicated from input instances if present in those images. SCP: Used for display if provided
Other Patient IDs	(0010,1000)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
Other Patient IDs Sequence	(0010,1002)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
>Patient ID	(0010,0020)	1	SCU: Duplicated from input instances if present in those images. SCP: Not used.

>Issuer of Patient ID	(0010,0021)	3	SCU: Duplicated from input instances if present in those images. SCP: Not used.
>Type of Patient ID	(0010,0022)	1	SCU: Duplicated from input instances if present in those images. SCP: Not used.

3.4.2 Study Entity Modules

3.4.2.1 General Study Module

**TABLE 3-4
GENERAL STUDY MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	SCU: Duplicated from input instances SCP: Not used
Study Date	(0008,0020)	2	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D. Used for display
Study Time	(0008,0030)	2	SCU: Duplicated from input instances if provided. SCP: Used for display if provided.
Referring Physician's Name	(0008,0090)	2	SCU: Duplicated from input instances if provided. SCP: Used for display if provided.
Study ID	(0020,0010)	2	SCU: Duplicated from input instances if provided. SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION (MUST NOT BE ZERO-LENGTH). The values of (Study ID, Series Number) pair must uniquely identify series in AW/AWS database.
Accession Number	(0008,0050)	2	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Study Description	(0008,1030)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Name of Physician(s) Reading Study	(0008,1060)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database

TABLE 3-5
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database
Patient's Age	(0010,1010)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database
Patient's Weight	(0010,1030)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database
Additional Patient's History	(0010,21B0)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database

3.4.3 Series Entity Modules

3.4.3.1 General Series Module

TABLE 3-6
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. MUST NOT BE ZERO LENGTH. MUST be CT modality.
Series Instance UID	(0020,000E)	1	SCU: Duplicated from input instances SCP: Used internally for series identification
Series Number	(0020,0011)	2	SCU: Generated, or provided by user. SCP: REQUIRED BY Advantage 4D AND USED FOR IDENTIFICATION. REQUIRED IF MULTIPLE CT SERIES ARE TO BE REFERENCED FOR THE SAME STUDY. The values of (Study ID, Series Number) pair must uniquely identify series in AW/AWS database.
Series Date	(0008,0021)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database

Series Time	(0008,0031)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database
Performing Physicians' Name	(0008,1050)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database
Series Description	(0008,103E)	3	SCU: Generated from Advantage 4D SCP: Used if provided.
Operators' Name	(0008,1070)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Body Part Examined	(0018,0015)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Patient Position	(0018,5100)	2C	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.

3.4.4 Frame Of Reference Entity Modules

3.4.4.1 Frame Of Reference Module

TABLE 3-7
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	SCU: Duplicated from input instances SCP: not used directly, but used only to declare/store in the Image Database.
Position Reference Indicator	(0020,1040)	2	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.

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3.4.5 Equipment Entity Modules

3.4.5.1 General Equipment Module

**TABLE 3-8
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. MUST BE "GE MEDICAL SYSTEMS".
Institution Name	(0008,0080)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Station Name	(0008,1010)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Manufacturer's Model Name	(0008,1090)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Pixel Padding Value	(0028,0120)	1C	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. MUST NOT BE ZERO LENGTH.

3.4.6 Image Entity Modules

3.4.6.1 General Image Module

**TABLE 3-9
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. MUST NOT BE ZERO LENGTH.
Content Date	(0008,0023)	2C	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Content Time	(0008,0033)	2C	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Image Type	(0008,0008)	3	See 3.4.6.5.1.

Acquisition Number	(0020,0012)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Acquisition Date	(0008,0022)	3	SCU: Duplicated from input instances if provided SCP: not used directly, but used only to declare/store in the Image Database.
Acquisition Time	(0008,0032)	3	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. Must not be zero length.

3.4.6.2 Image Plane Module

TABLE 3-10
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	SCU: Duplicated from input instances Scp: Used for patient model reconstruction. PIXELS MUST BE SQUARE (i.e. X and Y values must be equal).
Image Orientation (Patient)	(0020,0037)	1	SCU: Duplicated from input instances SCP: Used for patient model reconstruction. IMAGES MUST NOT HAVE GANTRY TILT OR SWIVEL (i.e. only one of each (x, y ,z) cosine triplet can be non-zero).
Image Position (Patient)	(0020,0032)	1	SCU: Duplicated from input instances SCP: Used for patient model reconstruction.
Slice Thickness	(0018,0050)	2	SCU: Duplicated from input instances SCP: Used for patient model reconstruction.
Slice Location	(0020,1041)	3	SCU: Duplicated from input instances SCP: Required by Advantage 4D. Used by 4D to identify z coordinate.

3.4.6.3 Image Pixel Module

TABLE 3-11
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	See 3.4.6.5.
Photometric Interpretation	(0028,0004)	1	See 3.4.6.5.
Rows	(0028,0010)	1	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D. Must be 512.

Columns	(0028,0011)	1	SCU: Duplicated from input instances SCP: Required by Advantage 4D. Must be 512.
Bits Allocated	(0028,0100)	1	See 3.4.6.5.
Bits Stored	(0028,0101)	1	See 3.4.6.5.
High Bit	(0028,0102)	1	See 3.4.6.5.
Pixel Representation	(0028,0103)	1	SCU: Duplicated from input instances SCP: Used for image display
Pixel Data	(7FE0,0010)	1	SCU: Duplicated from input instances SCP: Used for image display
Smallest Image Pixel Value	(0028,0106)	3	SCU: Duplicated from input instances if present SCP: Not used
Largest Image Pixel Value	(0028,0107)	3	SCU: Duplicated from input instances if present SCP: Not used

3.4.6.4 Contrast/Bolus Module

**TABLE 3-12
CONTRAST/BOLUS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	SCU: Duplicated from input instances SCP: Not used
Contrast/Bolus Route	(0018,1040)	3	SCU: Duplicated from input instances SCP: Not used

3.4.6.5 CT Image Module

**TABLE 3-13
CT IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Image Type	(0008,0008)	1	SCU: Duplicated from input instances SCP: Must be provided
Samples per Pixel	(0028,0002)	1	SCU: Value 1 is stored SCP: Not used.
Photometric Interpretation	(0028,0004)	1	SCU: Duplicated from input instances SCP: not used directly, but used only to declare/store in the Image Database.
Bits Allocated	(0028,0100)	1	SCU: Value 16 is stored SCP: Not used.
Bits Stored	(0028,0101)	1	SCU: Value 16 is stored SCP: Not used.

High Bit	(0028,0102)	1	SCU: Value 15 is stored SCP: Not used.
Rescale Intercept	(0028, 1052)	1	SCU: Duplicated from input instances SCP: Used for display
Rescale Slope	(0028,1053)	1	SCU: Value “1” is stored SCP: Used for display.
KVP	(0018,0060)	2	SCU: Duplicated from input instances if provided SCP: Not used.
Acquisition Number	(0020,0012)	2	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION.
Scan Options	(0018,0022)	3	SCU: Duplicated from input instances SCP: REQUIRED BY Advantage 4D FOR IMAGE IDENTIFICATION. Must contain the word “CINE”.
Data Collection Diameter	(0018,0090)	3	SCU: Duplicated from input instances if provided SCP: Not used.
Reconstruction Diameter	(0018,1100)	3	SCU: Duplicated from input instances if provided SCP: Not used.
Gantry/Detector Tilt	(0018,1120)	3	SCU: Duplicated from input instances if provided SCP: Not used.
Exposure Time	(0018,1150)	3	SCU: Duplicated from input instances if provided SCP: REQUIRED BY Advantage 4D.
X-ray Tube Current	(0018,1151)	3	SCU: Duplicated from input instances if provided SCP: REQUIRED BY Advantage 4D.
Convolution Kernel	(0018,1210)	3	SCU: Duplicated from input instances if provided SCP: Not used.

3.4.6.5.1 Image Type

Advantage 4D application supports only the Image Type (0008,0008) **ORIGINAL\PRIMARY\AXIAL** for opening. Any images with other image types will be rejected with the corresponding error message

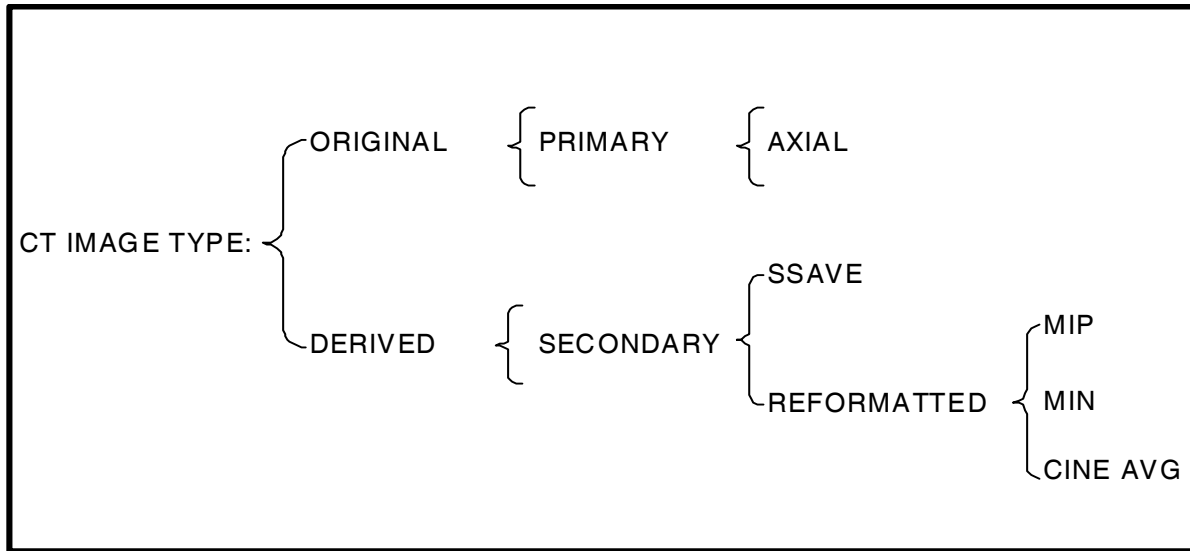
The application can create multiple types of images. These are the following.

ORIGINAL\PRIMARY\AXIAL images are created in case of saving phase series. In this case the original images are used and only some fields are modified/filled differently.

Three types of **DERIVED\SECONDARY\REFORMATTED** images can be created. These are **MIP** (Maximum Intensity Projection), **MIN**, which is used for Min-IP (Minimum Intensity Projection) and **CINE AVG**, which is used for Ave-IP (Average Intensity Projection).

Creating secondary captured images is also available to create screen captures. In this case the image type **DERIVED\SECONDARY\SSAVE** is used.

**ILLUSTRATION 3.4-1
CT IMAGE TYPE DECISION TREE**



3.4.6.6 SOP Common Module

**TABLE 3-14
SOP COMMON MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SCU: Duplicated from input instances SCP: Used by Advantage 4D to confirm image is CT Image.
SOP Instance UID	(0008,0018)	1	SCU: Generated from Advantage 4D SCP: Used by Advantage 4D for image identification.
Specific Character Set	(0008,0005)	1C	SCU: Duplicated from input instances SCP: Advantage 4D supports only the ISO_IR 100 and ISO_IR 6 character sets. (In case of this field is not specified the character set ISO_IR 6 will be used.)

3.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended CT SOP Instances as Type 3 data elements.

3.5.1 Private Group GEMS_HELIOS_01

Private Group GEMS_HELIOS_01 is modeled as part of the Series Information Entity.

**TABLE 3-15
PRIVATE GROUP GEMS_HELIOS_01**

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0045,00xx)	LO	1	GEMS_HELIOS_01
PctRpeakDelay	(0045,xx33)	CS	1	SCU: Generated, the phase information for the image is stored. SCP: Not used

3.5.2 Private Group GEMS_PETD_01

Private Group GEMS_PETD_01 is modeled as part of the Series Information Entity.

**TABLE 3-16
PRIVATE GROUP GEMS_PETD_01**

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0015,00xx)	LO	1	GEMS_PETD_01
Gating type	(0015,xx1A)	SL	1	SCU: Generated, the phase information for the image is stored. SCP: Not used
Total Number of Bins	(0015,xx1B)	SL	1	SCU: filled with total number of bins (phases). SCP: Not used.
% Phase Value	(0015,xx1C)	SL	1	SCU: filled with target respiratory phase number. This tag, therefore, contains the same information as the PctRpeakDelay (0045, 1033). SCP: Not used.