Update on ATC DICOM WG7 and IHE-RO Efforts

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ATC Meeting

March 27, 2008

Saint Louis, MO

Integrating the Healthcare Enterprise (IHE)

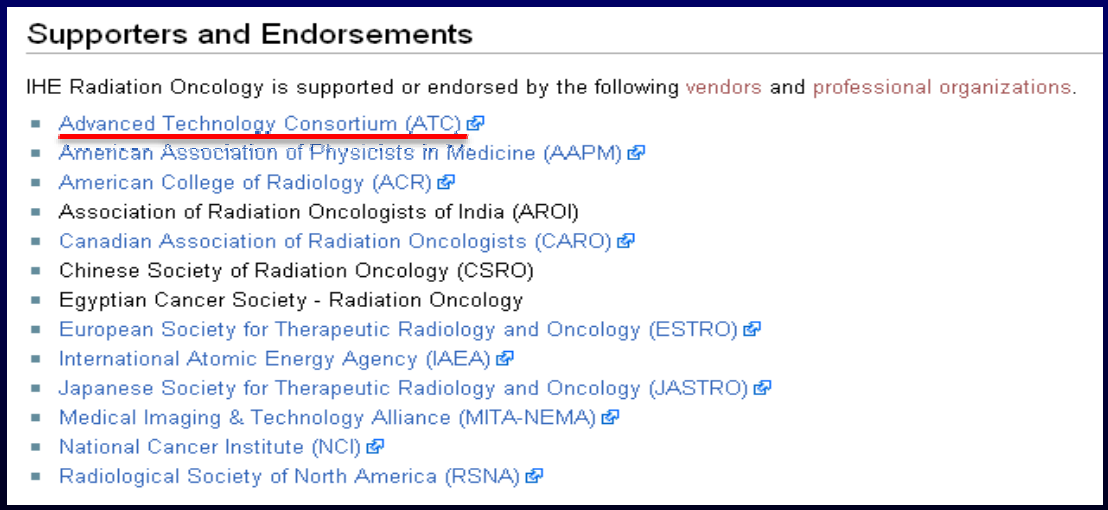
- IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information.
- IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care.

IHE Domains

- Cardiology
- Eye Care
- IT Infrastructure
- Laboratory
- Pathology
- Patient Care Coordination
- Patient Care Devices
- Quality
- Radiation Oncology (2004)
- Radiology

ATC Participation in IHE-RO

- ATC remains fully committed to supporting the mission and vision of IHE in Radiation Oncology.
- IHE International is working toward non-profit incorporation in Mar 2008
  - Principles of Governance adopted Oct. 2007
  - ATC was approved as an **Organizational Member of the International Integrating the Healthcare Enterprise** (IHE) as of March 6, 2008.



Supporters and Endorsements

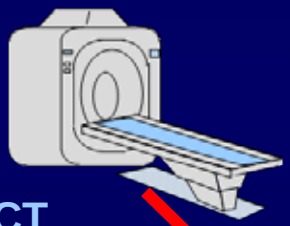
IHE Radiation Oncology is supported or endorsed by the following vendors and professional organizations.

- Advanced Technology Consortium (ATC)
- American Association of Physicists in Medicine (AAPM)
- American College of Radiology (ACR)
- Association of Radiation Oncologists of India (AROI)
- Canadian Association of Radiation Oncologists (CARO)
- Chinese Society of Radiation Oncology (CSRO)
- Egyptian Cancer Society - Radiation Oncology
- European Society for Therapeutic Radiology and Oncology (ESTRO)
- International Atomic Energy Agency (IAEA)
- Japanese Society for Therapeutic Radiology and Oncology (JASTRO)
- Medical Imaging & Technology Alliance (MITA-NEMA)
- National Cancer Institute (NCI)
- Radiological Society of North America (RSNA)

See "Radiation Oncology Domain" at http://wiki.ihe.net

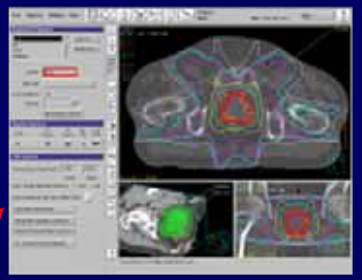
IHE-RO 2007 Profile
Normal Treatment Planning – Simple

- "Normal flow" of clinical data from CT scan through plan review for 3D conformal, external-beam RT
- Actors – abstract functions (products may implement one or more)

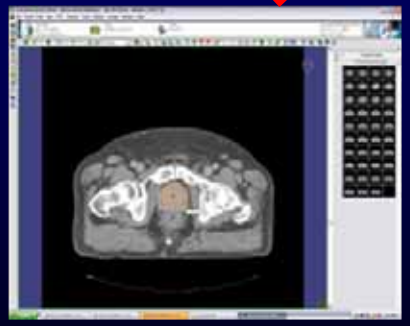


CT Scanner

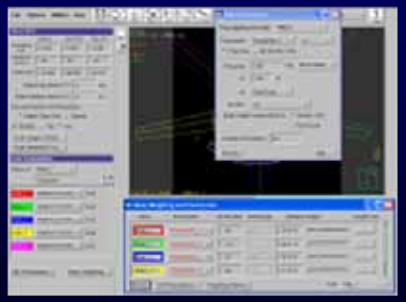
Geometric Planner



Dose Displayer



Contourer



Dosimetric Planner

IHE-RO 2007 Formal Connectathon
Aug. 27-31, 2007, at ASTRO HQ

- Pre-testing (offline) with test tools and test data to qualify for participation in connectathon
- Formal connectathon (private) to qualify for public demonstration
- Public demonstration at ASTRO for systems able to interoperate with 3+ others

Demonstration of Interoperability

- Six vendors demonstrated interoperability of one or more actors and were invited to participate in the IHE-RO Demonstration at ASTRO 2007
- Right: example dosimetric plan data generated on Tomotherapy TPS – CT images, structure contours, and dose viewed on Elekta (upper) and Varian (lower)

2007-8 Development Cycle

- **Image Registration Integration Profile**
  - DICOM Registration Information Object, resampled images
  - Supports CT, MR, PET
  - Actors: Registrator, Registered Display, Registered Contourer, Registered Dose Display

- **Treatment Delivery Workflow Profiles**
  - Discrete Positioning and Delivery Profile
    - Patient Positioning Systems acquires positioning images/data, performs registration of acquired data with desired position, adjusts patient position accordingly
    - Treatment Delivery Device performs delivery and internal verification
  - Integrated Positioning and Delivery Profile
    - Single system Patient Positioning and Delivery System acquires images/data, performs registration, adjusts position, delivers treatment

IHE-RO Domain Testing, March 3-6, 2008 BrainLab HQ, Munich, Germany

- 22 individuals representing Tomotherapy, Philips, CMS, Nucletron, Siemens, Varian, BrainLab, Elekta/IMPAC, SEFM and ASTRO
- Manufacturers tested/debugged implementations of the 2008 IHE-RO Spatial Registration and Treatment Delivery Worklist Profiles involving several DICOM objects that are new to the RO domain:
  - Spatial Registration
  - RT Beams Delivery Instruction
  - Treatment Workflow Unified Procedure Step instructions
- ATC SFTP server used to exchange Spatial Registration objects prior to testing

Results of IHE-RO Testing, March 2008

- Large number of bug fixes
- Clarification of Profile documents – required vs. optional specifications
- Consistent interpretation of DICOM standard
- Common problems/issues identified
- Several test data sets appear to have been handled correctly across multiple vendors.
- Siemens and Tomotherapy machine emulators tested by retrieving plan information from two Treatment Management Systems.

IHE-RO Technical Committee Meeting
March 7-12, 2008, BrainLab, Munich, Germany

- Multimodalitiy Registration Profile to be tested at Aug 2008 Connectathon in Houston and demonstrated at ASTRO 2008
- RT Worklist Profile is not yet ready for Connectathon
- ATC Server to be used for distributed IHE-RO Test Tools and Test Cases for 2007 and 2008 Profiles
- 2009 IHE-RO Profiles
  - Advanced Plan Integration – Electrons, Dynamic plans, Compensators, Bolus, Dose compositing
  - Extended Objects / Actors – New imaging modalities
  - Enterprise User Authentication

IHE-RO Timeline

- Dec 2004 (RSNA) – Organizational Meeting
- Jan 2005 (NEMA) – Identify Use Cases
- Apr 2005 (NEMA) – Identify Actors
- Aug 2005 (IMPAC) – Define Transactions
- Oct 2005 (ASTRO) – Joint PC/TC Meeting
- Jan 2006 (AAPM) – Review Transactions Document
- Apr 2006 (ITC) – 2006 Demo, 2007 Use Cases
- Aug 2006 (AAPM-HQ) – Connectathon Planning
- Sep 2006 (ASTRO-HQ) – 2006 Informal Testing
- Jan 2007 (IMPAC) – Identify 2008 Actors, Transactions
- Apr 2007 (Madison, WI) – Draft 2008 Reg, Workflow profiles
- Jul 2007 (AAPM) – Finish 2008 Profile drafts
- Aug 2007 (ASTRO-HQ) – 2007 Formal Connectathon
- Sep 2007 (ASTRO) – Joint PC/TC Meeting
- Mar 2008 (Munich) – Informal testing, begin work on 2009 TF
- Jul 2008 (Houston) – 2008 Formal Connectathon

DICOM: 2nd Generation RT Objects

- Some limitations of current DICOM RT objects
  - Complex referential structure means changes in one object may necessitate changes in others objects just to maintain referential integrity.
  - Difficulty in retrieving a collection of RT objects for a given phase of a patient's treatment
  - New DICOM objects offer better representation for image segmentation
  - Multiple uses of RT Plan for prescription, plan development, approval, delivery.
  - Complex conditions of a common RT Plan object used in multiple contexts, many optional attributes

DICOM WG-7 Activities

- New RT objects (larger number of smaller objects)
  - Workflow instructions
  - Physician Intent, RT Planning Prescription objects
  - RT Course (“container”) object – support for unmanaged workflow, clinical trials submissions
  - Use new DICOM segmentation (surface, volume) and registration (rigid, deformable) objects
  - Radiation Set (fraction group)
  - Separate radiation delivery objects per treatment modality: C-arm Photon Beam, C-arm Electron Beam, C-arm Ion Beam, Tomotherapeutic Photon beam, Non-isocentric Photon Beam

DICOM WG-7 Meeting Schedule

- 2007 meetings addressing the design of 2nd - generation DICOM RT objects
  - Los Angeles (ASTRO) - Oct 30 – Nov 2, 2007
  - Las Vegas - Dec 10-14, 2007
- WG-7 Meetings Scheduled for 2008
  - April 22-25, 2008 – NEMA HQ
  - June 16-19, 2008 – Albuquerque
  - Oct. 21-24, 2008 – Tampa