• This talk is an Instance. It is not unique, but the object referencing it is. It is but one of many Instances which are part of a Series of Instances, and, I quote “which series contains Instances that are referenced elsewhere in this Instance”.

• The Content Label, defined in the Presentation State Module, is:

  Image Registration and DICOM – when two worlds collide.

• Please pay careful attention as I may make reference to theReferenced Frame of Reference a few times though not all Instances of the references will reference the Frame of Reference – and they will not be unique.
DICOM Objects

- **Main image modalities**
  - CT
  - MR (multiple flavors)
  - PET/ NM
  - Ultrasound
  - SC etc

- **Main RT Objects**
  - Structure Set
  - Plan/ Brachy Plan
  - RT Image
  - Dose
  - Treatment Record
Clinical Applications

• CT/MR(S), CT/CT, MR/MR, CT/PET, CT/ Ultrasound etc
  – target localization pre- and post- treatment
  – Boost planning
  – Rigid and Deformable methods

• Functional imaging
  – Special requirements e.g. SUV, filters etc.
  – Slope/intercept problem?

• Tomotherapy
• Cone-Beam CT
• Daily Ultrasound localization
• Combined external and brachytherapy planning
Clinical Applications

- 4D Planning
  - Time series
  - 3D dose distributions
- Respiratory Gating
- Port film verification
  - Port/ simulator films
  - DRR
  - EDIP
  - patient imaging systems etc
- IMRT QA
  - Film
  - EPID
  - 2D Dose Planes – calculated/ measured
• Traditionally we have transformed MR(S)/CT/PET etc. to coordinate system of treatment planning CT
• Future we need to transform target and other volumes defined in primary (initial planning CT) coordinate system to secondary (subsequent treatment imaging modality) – could be u/s, cone-beam CT, traditional CT etc.
  – This is the most commonly requested feature CMS receives
Data Storage

- 4x4 transformation matrices
- Multiple references and cross-references
  - Inverse transforms?
- Transformation method
  - Fiducial points, correlation, MI
  - Rigid/deformable
- Mechanism to identify transformed data (not the original that is referenced by the transformation matrix).
Does the proposed supplement fulfill the preceding clinical requirements?

- Hard to tell - the basics appear to be covered in the inimitable (read – confusing, ambiguous) DICOM manner.
  - Massive sledgehammer to crack the proverbial nut!
  - Document is clearly a works-in-progress
  - Why two separate IODs – Spatial Registration and Spatial Fiducials?
    - Arguably existing contour objects could be utilized for fiducials.
    - I may have calculated the transformation via fiducials and want to transmit both to compliant systems
- Not clear (to me) if appropriate cross (back) references are covered?
Does the proposed supplement fulfill the preceding clinical requirements?

• There seems unhealthy emphasis on Fiducials
  – Fiducial matching is known to be the least reliable
  – Contour matching is also problematic
  – Why would anyone want to know the coordinates of the fiducials used in the matching process???

• If fiducial parameters are covered, why not include algorithmic parameters related to the more commonly used volumetric methods of registration e.g. MI, cross-correlation etc.