ImSimQA™ is independent quality assurance software that utilizes virtual phantoms to allow physicists to test the image data from 3rd party medical imaging and radiation therapy systems; and the imaging workflow pathway within a radiotherapy department. The product will:

- Provide a toolkit of virtual phantoms which can be manipulated by the user for testing geometric problems;
- Simulate CT/MR/PET images based on the toolkit phantoms
- Import DICOM data to allow users to generate their own virtual phantoms based on real phantom or patient data
- Display DICOM datasets;
- Import/export RT Structure sets;
- Provide contour analysis tools;
- Generate 4D datasets from virtual phantoms;
- Create deformed anatomy on imported CT/MR/PET/CBCT/MVCT images
- Create synthetic IGRT images using DICOM CT Images

ImSimQA software is unique in its ability to use virtual phantoms to test the rigid (RIR) and deformable image registration (DIR) algorithms of 3rd party medical imaging systems [1, 14, 15] and has been used by the AAPM TG132 Task Group Committee to develop and implement the recommendations of their report on the Use of Image Registration and Fusion Algorithms and Techniques in Radiotherapy [16] ImSimQA was developed due to the limitations of physical phantoms for testing modern radiation therapy and imaging software systems for complex radiotherapy techniques including atlas-based auto contouring, adaptive RT, multi-modality fusion, and 4D planning and gating.

Work with clinical partners has led to the development of an additional library of 10 original and deformed synthetic head and neck phantoms created where the deformed dataset is based on actual anatomical changes seen during the radiotherapy treatment course. From these a ground truth deformable vector field (DVF) was created for each phantom. This allows the phantoms to be used to assess the accuracy and precision of the DIR algorithm in any available system, with clinically relevant data [2, 14, 15]. ImSimQA has also been used to assess the accuracy of DIR algorithms in the pelvic and spinal regions [3, 15] and for commissioning 4DCT [4].

Despite the fact that there are many other methods to independently validate DIR methods, such as gel dosimetry [5], physical phantoms [6], qualitative analysis of contours by physicians in both single [7-8] and multi-centre studies [9] and generation of computational phantoms [10]. These are all methods which are too resource and time intensive for a typical radiotherapy centre, in particular when it has been shown that the accuracy of DIR will depend on both the treatment site and image quality of the data used [10, 14, 15, 17] making it imperative for individual centres to QA the processes they use on a frequent basis.

ImSimQA can provide the flexibility of centre specific QA without the timely processes involved in generating real phantom data [11 - 15].
References


