

## INTRODUCTION TO IMAGE GUIDED RADIOTHERAPY (IGRT)

The use of radiotherapy for the management of cancer relies on the accurate definition of a clinical treatment target. This is usually drawn by the clinician onto a CT dataset using 3D simulation software such as ProSoma (MedCom GmbH, Darmstadt). Definition of the treatment target is subjective yet forms the basis of all subsequent computerised treatment planning for that patient. The target itself may move due to various reasons, for example breathing in the case of lung tumours or shrinkage of the gross tumour itself during the course of treatment. The very basis of radiotherapy is founded upon reproducibility. Over the course of treatment which could last up to 5 weeks, the patient must be treated in the same position for each daily fraction. Therefore, patient set-up must be very accurate to ensure the target remains at the isocentre (the focus of the treatment beams). The concept of IGRT aims to improve the probability of treatment accuracy and thus enhance the management of the clinical disease.

The concept of IGRT is not new but it is only recently that technological advances in clinical linear accelerators (linac) have made it possible to implement. The approach uses a combination of imaging and radiation modalities on the same linac. Kilovoltage imaging using “on board imagers” (figure 1) combined with an amorphous silicon flat-panel X-ray image detector offers the possibility to confirm the location of the clinical target immediately prior and during the patient’s treatment. The image detector can track anatomic motion and thus provide doctors with a clear indication of exactly how a tumour will move during treatment due to respiration or other normal physiological processes. A choice of imaging modalities is available on the Varian system, including 2D radiographic, fluoroscopic, or 3D cone-beam CT imaging. The use of kV imaging can result in lower patient dose and better image quality than megavoltage imaging. This helps medical staff to optimise the accuracy and precision of the treatment. This can be done by adjusting the radiation beam based on the position of the clinical target while the patient is on the treatment table.



**Figure 1: Varian Trilogy with On Board Imager**

The advantage of IGRT is that given the greater certainty in locating the clinical target, a higher dose may be prescribed while keeping the dose to the surrounding healthy tissue to a minimum.