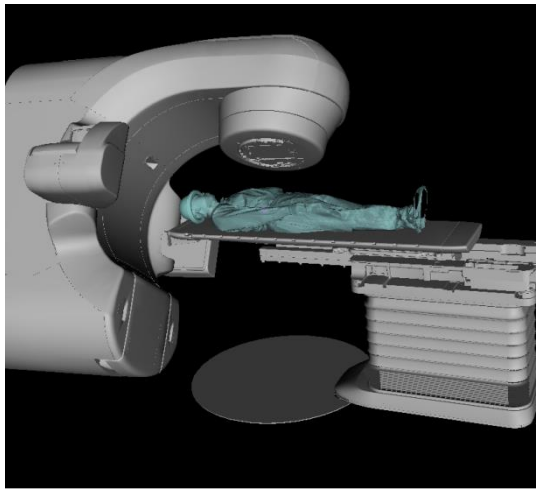
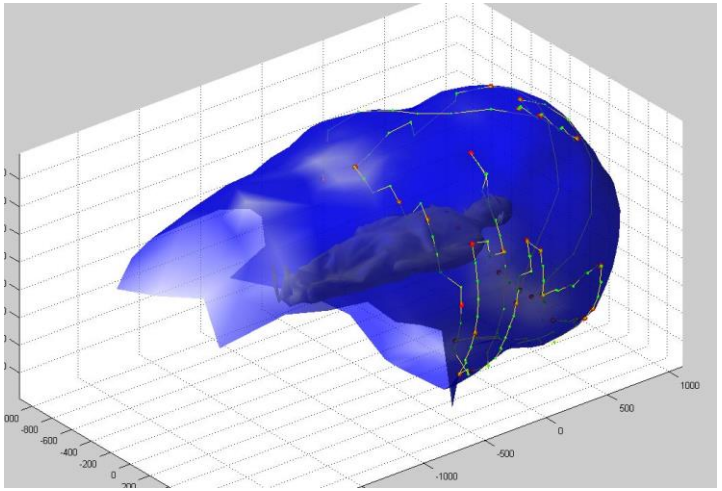
Evidence suggests that dose conformality can be substantially improved using a large number of non-coplanar beams but implementing such strategy on widely available C-arm accelerators is challenging. Risk of collision, delivery efficiency and optimization in an enormous solution space are the main difficulties. Solving these problems requires approach involving 3D visualization of the delivery space, automated navigation and an efficient optimization algorithm. These problems can be reformulated as a robotics navigation problem and solved accordingly. In such approach, an individualized delivery surface is constructed from the machine CAD model and 3D optical images of the patient. 3D optical imaging further provides quantitative visual feedback during the treatment so deviation from plans can be managed. The dose optimization problem is solved on the non-isocentric delivery surface, maximizing the collision free solution space yet minimizing the total optimization problem size. Lastly, the delivery surface provides a map for robotic navigation so an optimized plan can be efficiently and safely delivered.

How to deliver a highly non-coplanar and non-isocentric plan on available C-arm linac

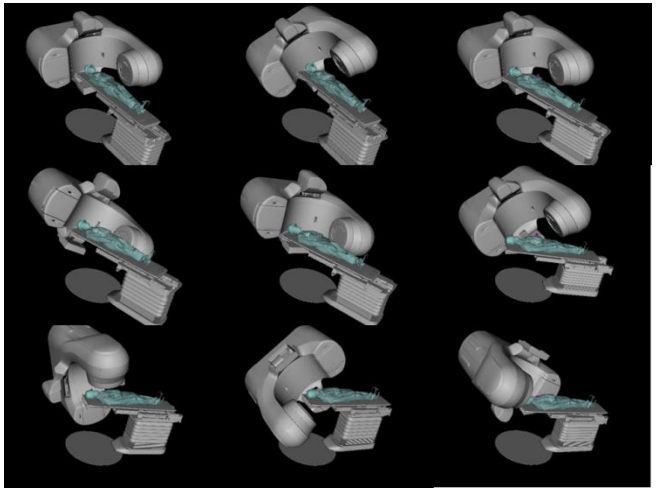
3D camera capture



CAD model

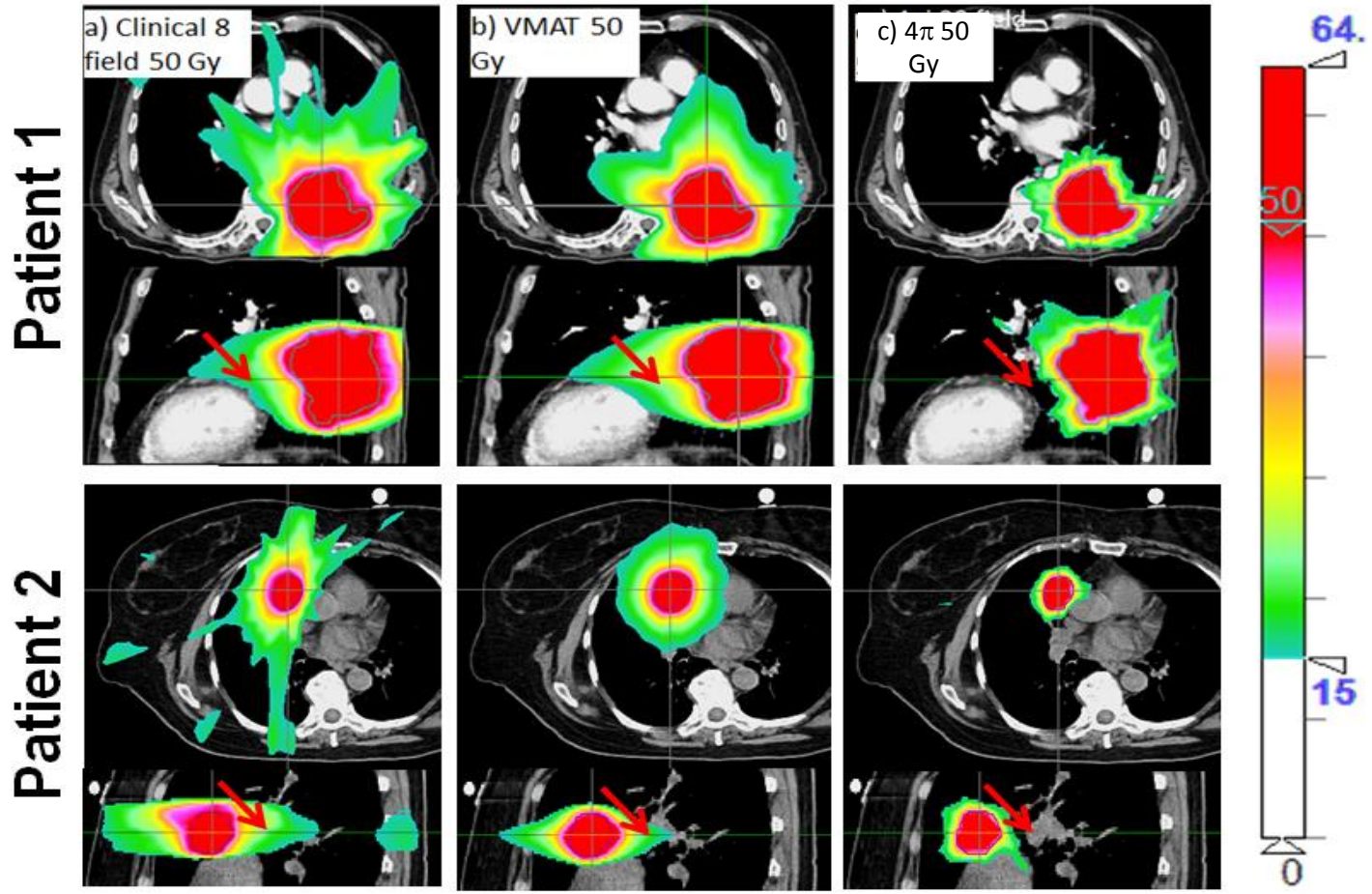


BGSS

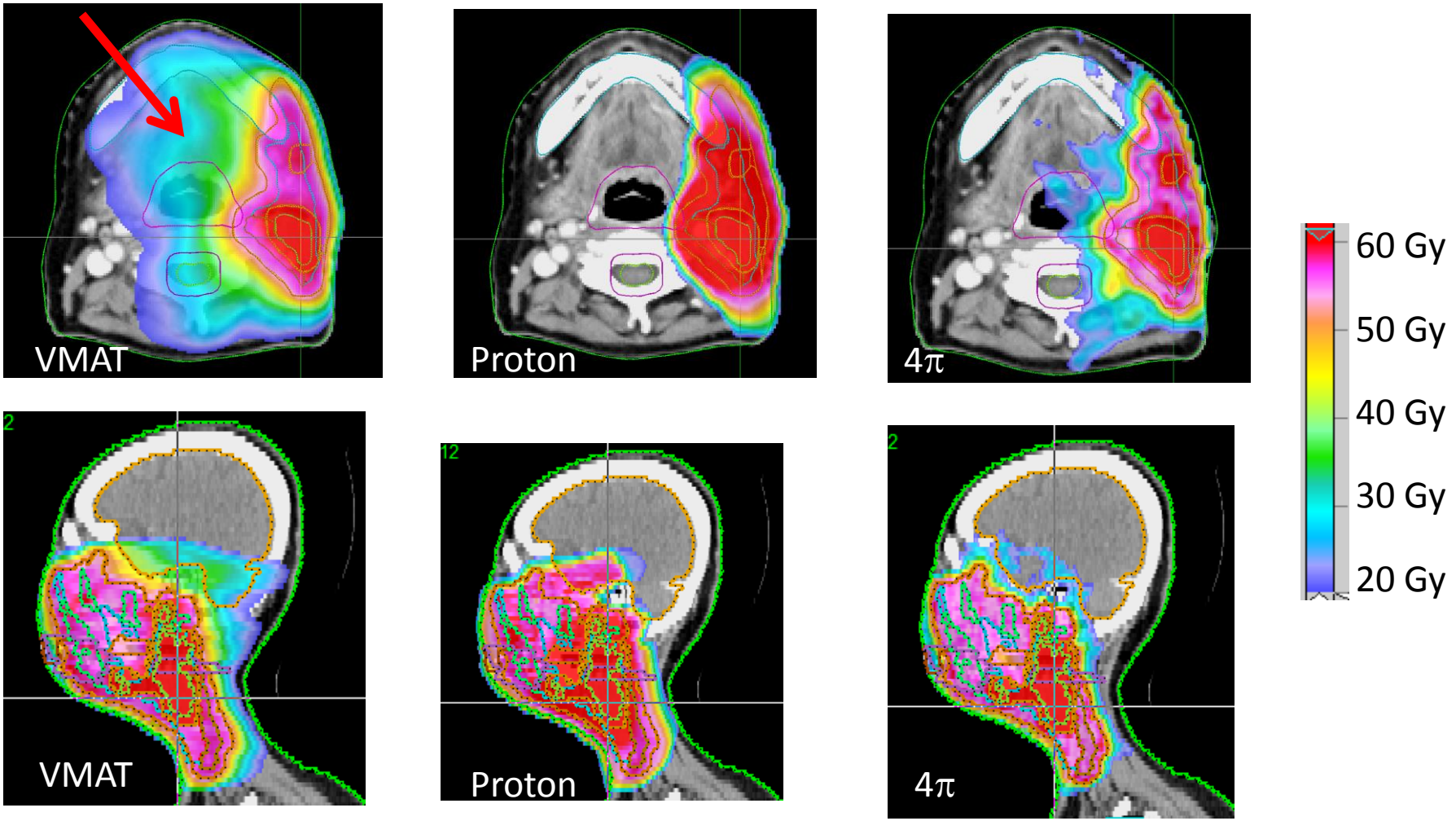


Collision free couch and gantry positions

4π radiotherapy is a significant step forward in IMRT



Head and neck dosimetric comparison



Reduction in the normal tissue dose spillage is evident