3D³

A Simple, Reliable, Low Cost Particle Dosimetry for Cancer Therapy using 3D printing and Geant4 simulation

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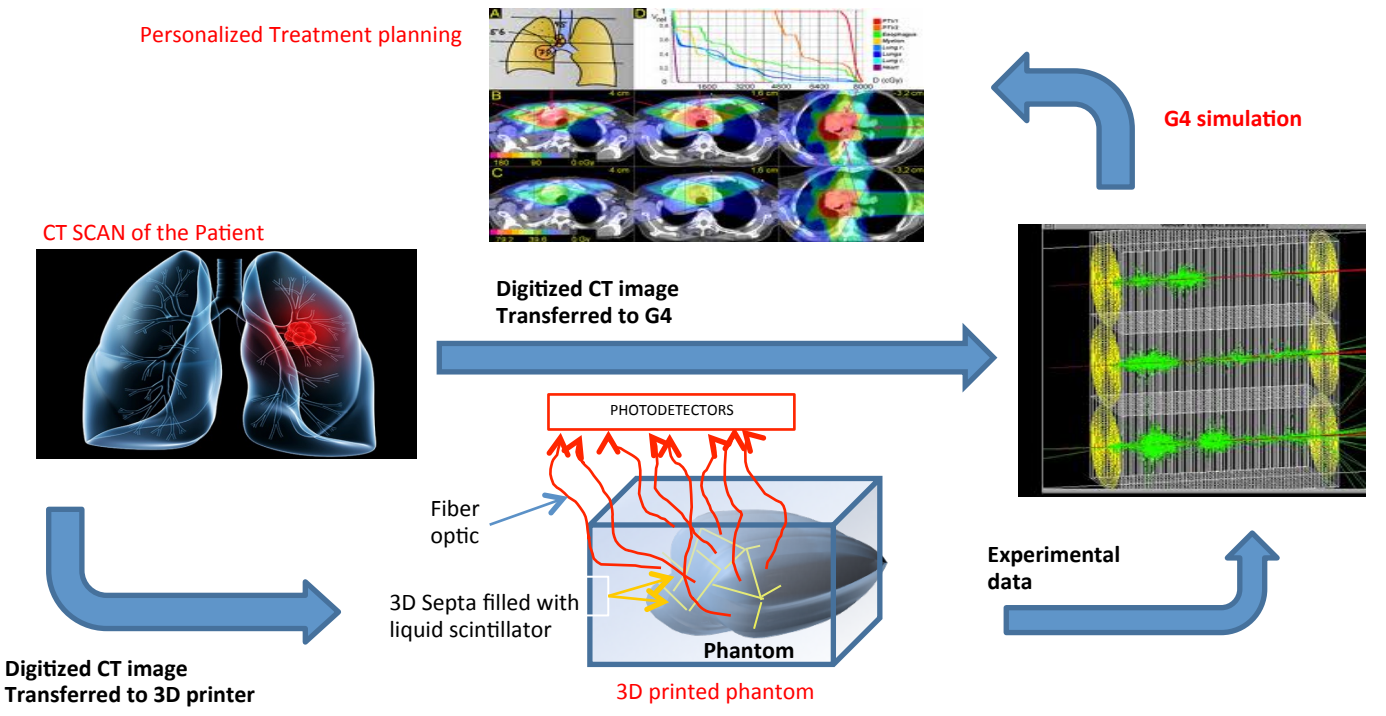
Introduction

The precise knowledge of the correct dose distribution delivered to the patient during cancer treatment is essential for a correct radiation treatment planning. This is particularly true in PEDIATRIC TREATMENTS where dose deposition in healthy cells could be catastrophic for the life expectancy of the patient. This information needs to be FAST,RELIABLE, REDUNDANT and LOW COST. At the moment precise dosimetry is a key open question in particle therapy.

The idea

The idea is that CT scanning is the tool used to detect tumors. The CT outcome is a digitized file which can be fed AT THE SAME TIME into a 3D printer and a simulation tool like Geant4 producing a true, tissue equivalent 3-dimensional replica of the organ,the tumor and its simulation object. For precise 3-dimensional energy deposition information, the 3D-printed tumor-replica and its neighborhood can be divided into "voxels" filled with tissue equivalent liquid scintillator each read out separately by transmission fibers and silicon-photo-multipliers and exposed to the treatment beam. The same can be done in the G4 object. These combined "physical" and "simulated" energy deposition tests can help to get a precise definition of the beam energy required for effective treatment and the dosimetry on the tumoral and the neighbor healthy tissues regions in preparation to the treatment planning with moderate cost and time delay. Repetition of the tests with a new tumor-replica and G4 simulation is possible at any stage due to the rapidity and moderate cost of the process.



Potential Impact

The potential impact is to revolutionize in time and precision cancer treatment planning with low cost and personalized devices