Co-Planar FMT-CT

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Fluorescence Molecular Tomography (FMT) is rapidly becoming an important biomedical research tool for in-vivo imaging of small animals, since it allows non-invasive and quantitative retrieval of the spatial distribution of fluorescence probes deep in tissue. The FMT reconstruction process involves two steps, the so called forward problem, that implies modelling the photon transport through tissues, and the inverse problem, that implies solving a system of linear equations whose coefficients are given by the solution to the forward problem. The unknowns of this equations are the fluorophore concentrations at each voxel of the volume of the digitalized sample.

In our lab we have built a non-contact FMT together with a high resolution cone beam CT scanner in the same rotating gantry achieving co-planar geometry. This type of set-up offers many new advantages. From the biomedical research point of view is obvious that the CT anatomical information is a very interesting complement to the functional information given by FMT, due to the co-planar configuration of the experimental set up, no registration has to be made to the reconstructed images. On the other hand this set up will allow to improve FMT performance in many ways. Firstly, since it is built in a rotatory gantry many geometrical projections can be made, increasing the number of source detector pairs and maximizing the information content of the FMT datasets. Furthermore, if the CT scan of the subject is made prior to the FMT scan, the spatial distribution of different kinds of tissue can be obtained, and used as “a priori” information for the FMT reconstruction process, allowing to propose more realistic forward problems or make corrections to each voxel contribution while solving the inverse problem.