Development of EGS4 user codes for IMAGINE

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We are developing the EGS4 user codes to calculate dose distributions in human body for IMAGINE, a project to develop a reference calculation system for treatment planning in radiotherapy with remotely connected high performance computers.

At first, we developed a prototype user code named UCRTP to calculate dose distribution for treatment planning with voxel geometries. The UCRTP was used to investigate an acceleration efficiency of dose calculations with high-performance parallel computing system on the ITBL (IT-based laboratory). It showed good acceleration performance, linearly increasing of its speed with the number of processors.

BEAMnrc user code originally developed at nrcc was modified and used for the simulation of photons come from a head of linac. Positions, directions and energies of photon sources will be calculated with BEAMnrc and be stored in "Radiation source data base" for each accelerator and its operating conditions.

We are now developing a user code named UCCTRTx for CTRTx, a tomotherapy system using CT as radiation source. UCCTRTx is tuned up to simulate transport of low-energy electrons and photons efficiently and has a interface for "Human body modeling system" which create a voxel model of a patient from CT data.

In next step, we will develop the user code for radiotherapy with linacs including IMRT. The user code calculates the dose distribution in human body with direct and scattered photons from multi leaf collimators.

All developed user codes will be tuned up to show best performance with parallel computers. They will be implanted in IMAGINE system and connected with other modules, such as the radiation source data base, the human body modeling system, an user interface with an ability of launching dose calculations and obtaining the results remotely, and commercial treatment planning systems such as FOCUS^{TM} within two or three years.