Conception of a numerical simulation tool for the deployable expert team CReDO (Operational Dose Reconstruction Cell)

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Résumé

Introduction:
In the context of a nuclear or radiological accident involving high doses of ionizing radiation, the treatment of the victims faces two different situations:
- For contaminated patients, the priority goes to the treatment, which can often be "blindly" administered to reduce the committed dose as the main molecules don't engage any harmful side effects. This therapeutic must take place early, before and during a precise assessment of the involved radionuclides;
- For irradiated patients, priority goes to the diagnosis because it is essential to know how the dose is distributed among the organs in order to sort the victims according to the severity of the exposure. The victims can consequently be lead to the most appropriate health structures.
At present there is yet only very few field techniques that are capable of rapidly characterizing an external radiation exposure in case of an accident involving a large amount of victims. Nevertheless scientific, industrial and military applications as well as terrorist menace generate a significant probability of such an event.
Materials and methods:
The dosimetric reconstruction tool currently in development uses the Geant4 and the GATE Monte Carlo codes to provide dose maps in the area of an irradiation accident. An important feature of the simulation device is to be able to operate in highly degraded situations. As it is integrated in a militarized and hardened case, it can be freed from any link to a remote computer cluster thanks to a powerful multicore calculator that allows performing dose simulations with total autonomy.
Results:
Using a simple and intuitive graphical user interface, trained users will be able to quickly design the whole scene of the accident using mostly the mouse and navigate in this 3D virtual world with a first person camera. This simulation tool is also compatible to work with

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libraries of sources, voxel phantoms and shielding materials that can be quickly integrated into the modeled scene of the radiation accident. Numerical filters are currently in development to target the most exposed areas to help medical teams to guide victims through appropriate medical care management solutions.
Conclusion:
This numerical simulation tool based on modern technologies for dose calculation is aimed to strengthen the current diagnostic arsenal by meeting the need of on-field dosimetric triage for radiation-exposed victims. Through a validation phase on standardized scenarios the relevance of this dosimetric solution is currently being tested for different type of possible external exposure situations. 1 French defense radiation protection service
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