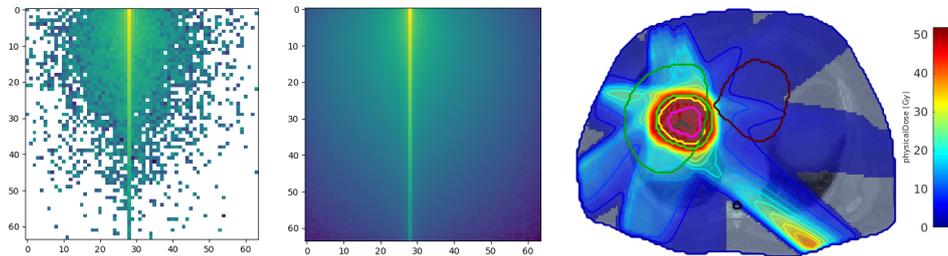


## Post-Doctoral Fellowship: Deep learning for fast dose calculation in medical applications



**Figure 1:** Numerical simulation of a photon beam in water with a fast simulation leading a low statistic (left) and a long simulation time leading to a high statistic (middle). The right image illustrates a full simulation of external beam radiotherapy for liver cancer composed of a large number of beams.

### Scientific context

Monte Carlo simulations (MCS) are using random sampling methods for solving physical and mathematical problems. They play a key role in medical applications, especially to treat cancer by radiotherapy. MCS simulate the interactions of the particles through the matter allowing to estimate the irradiation dose deposition within human tissue. Dose simulation is used to study new protocol in radiotherapy or in radiation protection.

The main drawback of MCS is the need of long time of calculation to obtain a result with a sufficient statistic. Previous works on GPU architecture and variance reduction technique have improve simulation speed but they are still limited. Recent advances in IA, especially in deep learning, show a promising solution to deeply improve the MCS in order to obtain a fast and accurate dose deposition within tissue.

### Job description and missions

The job consists in researching and developing new methods based on IA especially in deep learning for MCS. The aim is to investigate a deep learning architecture that allows producing a high statical dose map (fig 1-middle) from low statistical data (fig 1-left), in order to speed up the variance reduction of any kind of dose deposition simulations for medical applications (fig 1-right).

### Profile

Candidate with a PhD in computer sciences, image processing, computer vision or applied mathematics. Good programming skills is an important requisite, especially in python. Autonomy, open-mindedness and motivation, as well as good English speaking/writing skills, are also expected. Some experience in deep learning is appreciated. Experience in MCS is not required, since the work will be focused on the dose map which are basically 3D images.

### Position context

The postdoc will join the INSERM UMR1101 Laboratory of Medical Information Processing (LaTIM, Brest, France). Our research group is composed of 20 peoples including PhD students and other postdocs. The future recruited postdoc will work in collaboration with different academic and hospital partners within the context of MoCaMed project () funded by the French National Research Agency. The position will be for an initial duration of one year and could be renewable. Salary is about 2100 € net/month, depending on the candidate's experience. The position should start ideally October/November 2021.

### Contact and additional information

For application, a folder that contains a CV, a motivation letter, a complete list of publications, as well as letters of recommendation, have to be sent to the following e-mails:

Julien Bert ([julien.bert@univ-brest.fr](mailto:julien.bert@univ-brest.fr))