1.1. Project 1: Tumor Radiation Planning

1.1.1. Motivation

Some brain tumors are inoperable and radiation is the only viable treatment. This means that very large radiation doses are required this will also damage the healthy brain tissue. To minimize the damage to the healthy parts of the brain multiple radiation sources directed towards the tumor, thus attacking the tumor from many angles. The assignment is a simplified treatment planning for such radiation. The simplification consists of two things, first of all we work only in 2D and secondly that the modeling of energy absorption in the tissue is based only on the density of the brain matter.

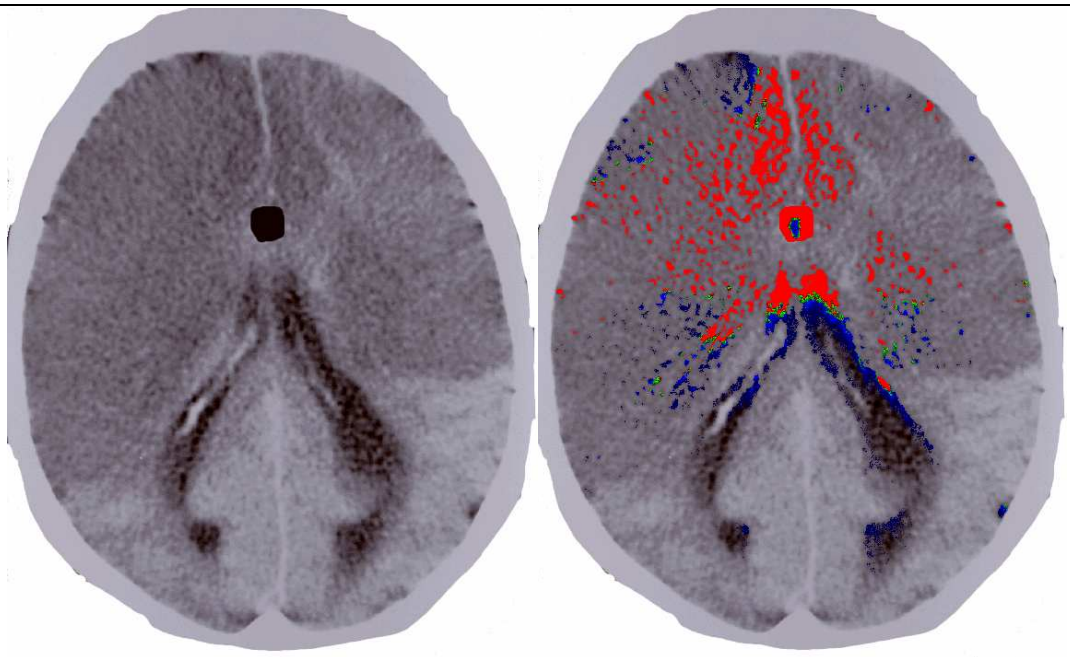

Figure 1 The map of the dessert, first the initial map and then the final zoom

1.1.2. Considerations on the parallel version

The parallel version of the radiation planning belongs to the class of embarrassingly parallel applications, just as the Monte Carlo Pi program. In the case of this application we can simulate each particle independently of the others, which gives us a large degree of freedom in the choice of defining the grain-size for the parallel version.

1.1.3. Programming Task

Write two parallel versions of the code, you may use the sequential version as provided as a core. Both parallel versions should be based on a multithreaded shared memory model and execute on a multiprocessor with physical shared memory. One version should use a static orchestration approach, where orchestration can be defined either at compile-time or initially at run-time. The other solution should be based on a producer-consumer approach, which should define the number of workers either at compile-time or run-time.

Your report should identify the various choices that have been made as well as individual techniques that have been applied to improve performance, and the impact of each should be documented. Your parallel version should do the same as the sequential version, and our report should include speedup numbers for both versions and you should try to explain the results.