Using the SDvision 3D visualization software developed within the framework of IDL Object Graphics at CEA/IRFU, we have visualized the travel of particles within the IFMIF-LIPAC accelerator. IFMIF (Internal Fusion Materials Irradiation Facility) is a Europe-Japan joint project aiming at constructing an accelerator-based neutron source, the world’s most intense one, dedicated to study materials that must withstand the intense neutron flux coming from the fusion plasma of future Tokamaks. Tokamaks are the nuclear fusion reactors capable of producing energy in a similar way as in the Sun’s core. The needed accelerations must accelerate 2x125 mA of deuterons to an energy of 40 MeV, i.e. 2x5MW particle beams, toward a liquid Lithium target to produce the desired neutron flux. Due to the very challenging high intensity, high power that have never been achieved, a prototype called LIPAC accelerating 125 mA D+ particles to 9 MeV energy, i.e. 1.1 MW beam, is being designed and fabricated in Europe and installed in Japan.

Simulations visualized here were made with a million macroparticles. To ensure that beam losses do not exceed 1W/m in the high energy part, simulations with 4,000,000,000 particles were performed, which lasted several weeks using fifty processors in parallel.

Visualization of Particles Beam Simulations in the IFMIF Accelerator

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Some views of the beam at several stages of the progression inside the accelerator. These simulations were made with a million particles, which needs some tens of hours computing. The visualization itself takes some hours computing with the SDvision code. Visualization is needed to analyze in details the results, in each part of the accelerator. The resulting videos were shown at IFMIF international workshops. It is also a good support for outreach and is permanently shown on a 3D TV in a special showroom of our institute.

References:
- The SDvision software is developed as part of the COAST + Computational Astrophysics + Program of the Institute of Research into the Fundamental Laws of the Universe at CEA/Saclay http://irfu.cea.fr/Projets/COAST/