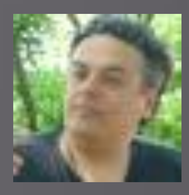
γ Dose Rate Evaluation at a Radioactive Ion Beam Facility



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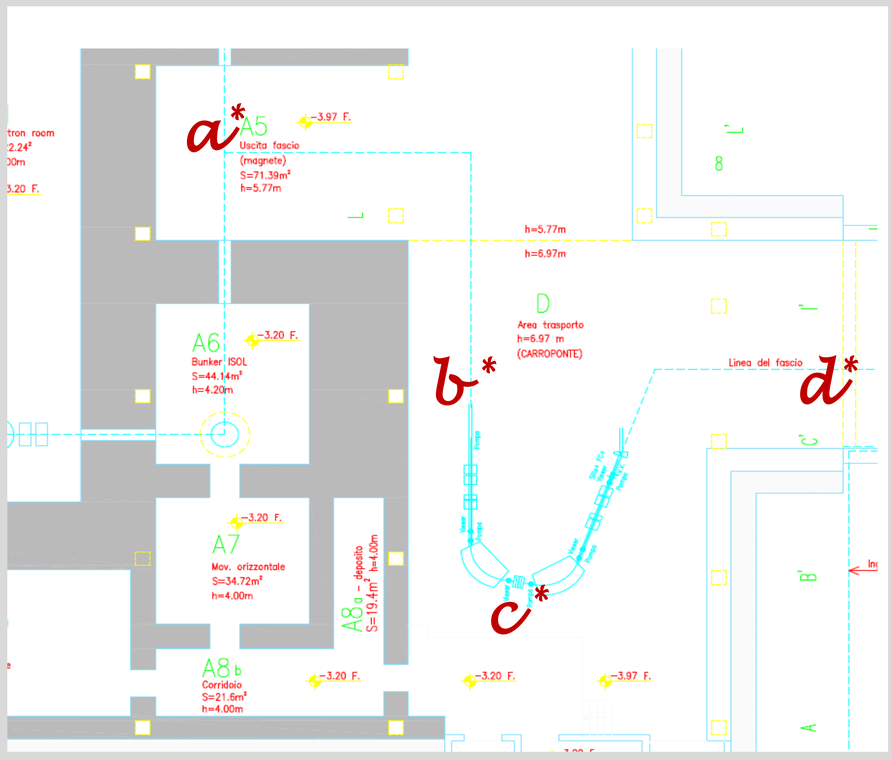
1. Introduction

SPES (Study for the Production of Exotic Species) is a project of the Laboratori Nazionali di Legnaro (INFN) in Italy for the study of exotic neutron-rich ion beams.

The beams are obtained through direct **fission** of a UCx target with a proton beam at 40 MeV energy and 200 uA current.

The **radioactive ion beam** considered, ^{132}Sn, is extracted from the target and processed in order to obtain an accelerated beam. The processing consists in the selection of the desired mass number and the isolation of the mentioned isotope. Successively it is brought to a charge state suitable for the injection in the super-conductive Linac.



a*: selection magnet
b*: beam cooler
c*: HRMS
d*: charge breeder

Figure 1

Gamma dose rates produced during irradiation at the target and along the extraction beam line up to the charge breeder, are evaluated.

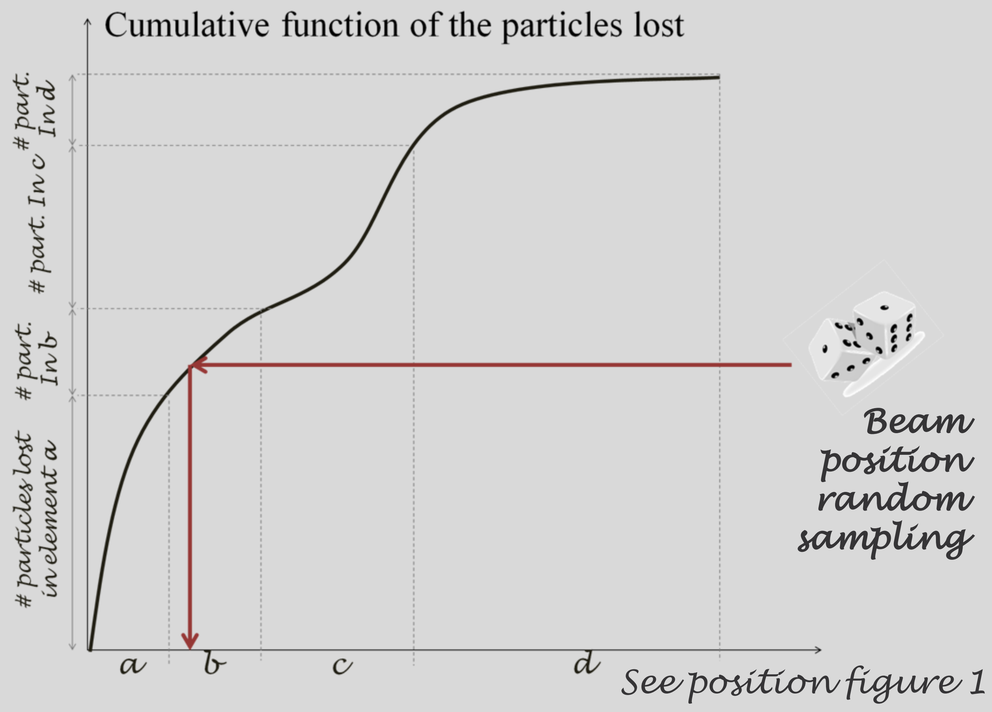
2. Objectives

The objective of this work is the evaluation of the residual γ dose rate due to the transport of the radioactive ion beam from the production target to the re-acceleration site.

The main objective is to consider all the isotopes involved and all the elements of the transport line in a all-in-one run, trying not to split the calculation in more simulations.

3. Methods

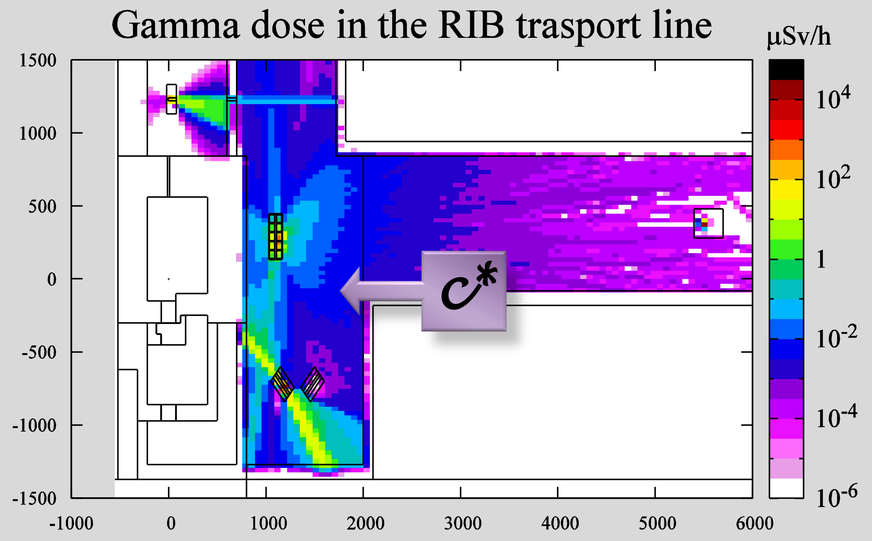
The study has been done using a Monte Carlo approach. The **FLUKA** standard executable routine has been linked to a routine specifically written to take into account the exact position where the beam has been.



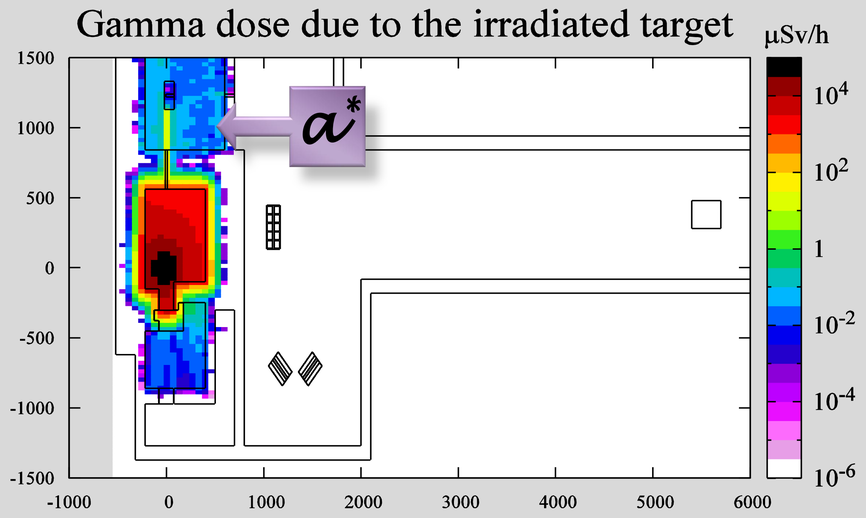
In the picture can be seen a graphical representation of the method used to sample the particles position in the simulation.

The method consists of a **sampling on the probability** that a certain isotope – considered as a point source – stops in one of the elements of the selection/transport line.

4. Results



The γ dose map obtained with the Monte Carlo simulation shows that the dose rate at the end of 2 irradiation weeks is maximum 10 μSv/h in well defined areas close to the beam cooler and the mass spectrometer (**c***). In the selection magnet area the contribution from the irradiated target is comparable to the dumped RIB (**a***).



6. Conclusions

The editing of a dedicated source routine linked to the transport code FLUKA is essential in order to calculate the dose rate in the areas where the radioactive beam is selected and transported. The routine includes a probability sampling according to the current and type of isotopes dumping in each transport line element. Results indicate the presence of a gamma dose rate easy to manage.

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