Status of the Shielding Design for the Super-FRS

E. Kozlova[1], G. Fehrenbacher[1], T. Radon[1], H. Weick[1] and M. Winkler[1]

[1]GSI, Darmstadt, Germany

Introduction

The first calculations of the shielding thickness for the Super-FRS [1-3] in most cases were done without including of channels for the supplies, cryo-lines, ventilation ducts and etc. To make the shielding design more realistic it is obligatory to perform some detailed calculations. In this paper a short overview of such calculations is presented. All calculations were done with the Monte Carlo code FLUKA [4].

Prompt dose rates

The first investigated case is the prompt dose in the pre-separator area including a ventilation duct. The results are shown in Fig.1, where the selected ^{131}Pd interacts with the aluminium degrader at FPF2. The dose rate above the duct is in agreement with the design goal (0.5 µSv/h).

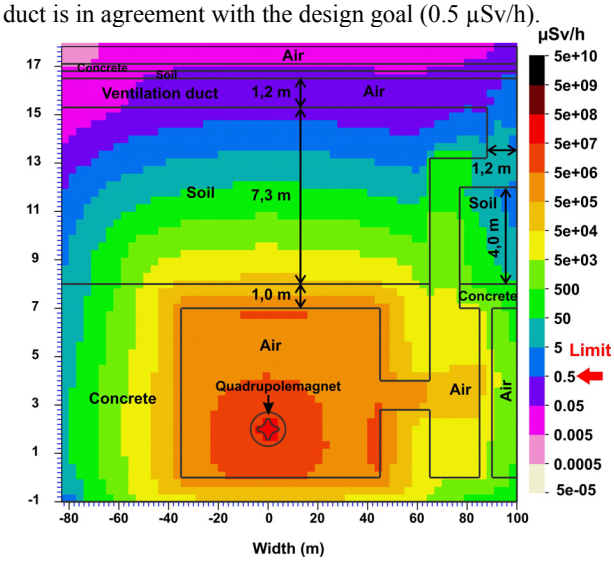

Fig. 1: Front view of the prompt dose rate distributions in the pre-separator area of Tunnel 103. The Pd beam (1.3 GeV/u, 3E10/s) interacts with the Al degrader (10 g/cm^2).

The next case is the detailed simulation of the labyrinth from Tunnel 103 to the Building 006a (Fig. 2). The results of this calculation helped to define the position of the cryo-line. The labyrinth connects to the branch area of the Super-FRS, where several beam losses appear: at the degrader, at the slits and the dipoles. For the dose rates calculations the most conservative case was taken. It is a beam loss at the high-energy branch (FHF1). The best position for the cryo-line exit is marked in Fig. 2.

In Fig. 3 also the branch area is presented, but the losses take place at the second degrader (FMF2). It is shown how the dose rates are distributed between the Tunnel 103 and Building 17.2. The channels for cryo-line and supplies are included in the shielding design. The calculations demonstrate that the dose rates in Building 17.2 are below 0.5 µSv/h.

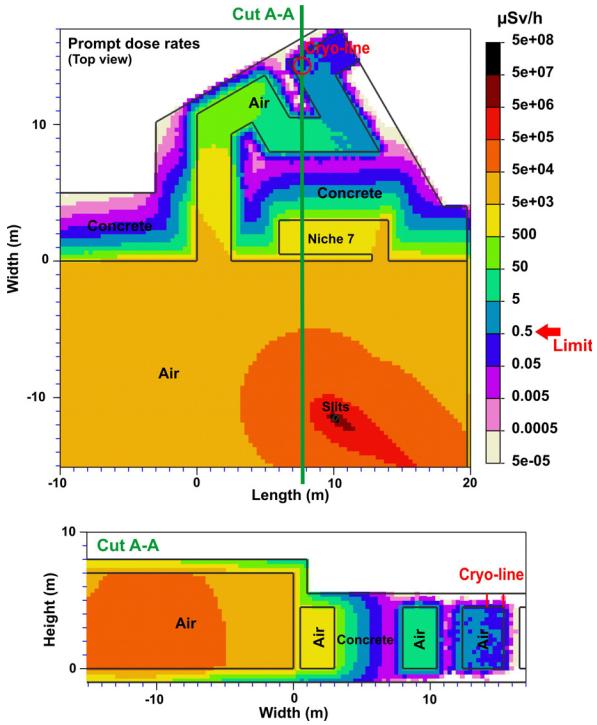

Fig.2: Horizontal and front views of the prompt dose rate distributions in the labyrinth from Tunnel 103 to the Building 006a. 50% of the uranium beam (1GeV/u, 1E9/s) is stopped at the slits.

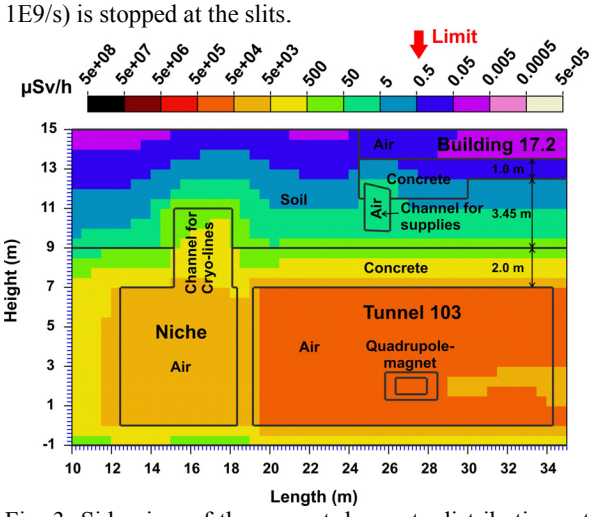

Fig. 3: Side view of the prompt dose rate distributions at the branch area of the Super-FRS. The antimony beam (1GeV/u, 8E9/s) interacts with the aluminium degrader (10 g/cm^2).

References

[1] E. Kozlova et al. GSI-Report 2008-1 (2008), p 247.
[2] A. Plotnikov et al. GSI-Report 2011-1 (2011), p 322.
[3] E. Kozlova et al. GSI-Report 2012-1 (2012), p 356.
[4] www. fluka.org