Neutron doses in the experimental halls TR, EX, TH

T. Radon[1], G. Fehrenbacher[1], Ch. Pöppe[1], J. Sauer[1], and M. Wengenroth[1]
[1]GSI, Darmstadt, Germany

Introduction

Ionising radiation is produced during the operation of heavy ion accelerators especially when substantial beam loss occurs. In order to protect persons from exposure to ionising radiation the efficiency of the shielding installations has to be checked by various measurements. The total dose outside the shielding of the accelerators and exp. areas comprises at GSI in most cases a major neutron component and a small photon component. We mainly focus here on the measurement of the neutron doses by a passive detection system. This detector system is based on thermoluminescence which makes it a reliable tool for dose measurements even for beams with complex spill-structures [1].

Annual doses in 2008, comparison with 2007

Figure 1 depicts the heavy ion synchrotron SIS and the adjacent experimental areas together with the positions of the neutron detectors. Similar to the previous years [2] it can be seen that the dose values are largest in the vicinity of the SIS extraction area. Due to an increase in the intensity of the ion beams leaving the SIS it was several times necessary to install (temporarily) controlled areas on top of the shielding near the SIS extraction, the FRS target and the beam dump HHD, because the measured dose rates were higher then 3 μSv/h which is the upper limit for uncontrolled areas. An analysis of the doses of the last two years shows that the overall integrated measured neutron-dose outside the shielding is more than 3.5 times larger in 2008, see Table 1. It should be noted that the detector with the highest dose value shown (40 mSv) is located inside a permanently controlled area, see Fig. 1. In addition another dose value is shown which is located inside of a cave (5 mSv). If these two values are removed from the list of doses, then still in 2008 a dose of more than a factor of 2 higher compared to 2007 was measured. If further on, all the values of the SIS and the FRS are subtracted from the total dose the dose-ratio between 2008 and 2007 is unity. As there were no major changes in the shielding, obviously a large intensity-upgrade has taken place in the last year. There is also an active method to detect the dose-rate providing the possibility to read the levels on an hour-base. The overall agreement between the measurements with active devices [3] and the TLD-based system is in the order of 10 to 30 % here, which is a good value for operational radiation protection.

Table 1: Measured neutron doses in the experimental halls outside the shielding, see Fig. 1 for explan. of * and **

position neutron-doses	2007	2008	fac.
total	19 mSv	70 mSv	3.6
total w/o * and **	11mSv	24 mSv	2.2
total w/o *, **, SIS, FRS	4 mSv	4 mSv	1.0

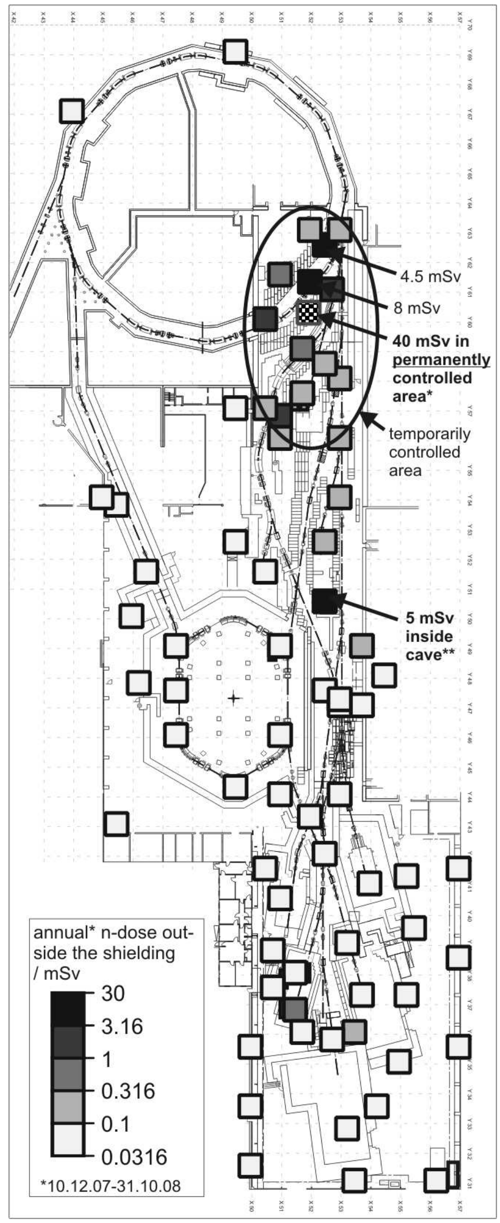

Figure 1: Measurement positions of the neutron doses (2008) in the experimental halls and their dose values.

References

[1] G. Fehrenbacher, F. Gutermuth, E. Kozlova, T. Radon, and D. Schardt, GSI-report 2005-1, p. 238.
[2] T. Radon, G. Fehrenbacher, S. Grosam, and Ch. Pöppe, GSI-report 2007, p. 248.
[3] F. Gutermuth, T. Radon, G. Fehrenbacher, and J.G. Festag, Kerntechnik (2003), 68, 4, pp. 172-179.