# PREPARATION OF THE IRRADIATION TEST AT CAVE HHD OF GSI DARMSTADT

A. Plotnikov#, E. Floch, E. Mustafin, E. Schubert, T. Seidl, I. Strasik,
GSI FAIR AT, Darmstadt, Germany
A. Smolyakov, ITEP, Moscow, Russian Federation.

*Abstract*

In the frame of the FAIR project in spring 2008 an irradiation test of superconducting magnet components was done at GSI Darmstadt. Cave HHD with the beam dump of SIS18 synchrotron was taken as the test area. The beam dump was reequipped to meet the irradiation test requirements. Thereby the first stage of preparation for the irradiation test was to investigate the radiation field around the reconstructed beam dump from the point of view of radiation safety. FLUKA simulations were performed to estimate the dose rate inside and immediate outside of the cave during the irradiation. The simulations showed safe level of the radiation field, and it was later confirmed by the measurements provided by the radiation safety group of GSI.

## MOTIVATION

The Facility for Antiproton and Ion Research (FAIR) is planned to be finished in 2015 (fig. 1). In the frame of the project among other accelerators two synchrotrons will be built: SIS100 and SIS300. The features of those machines are high intensity and energy of the proton and heavy ion beams. For SIS100 the energy is going to be 2.7 GeV/u for $U^{+28}$, and bunch compression to ~60 ns for $5 \cdot 10^{11}$ U ions. For SIS300 - 34 GeV/u for $U^{+92}$ and slow extraction of $\sim 3 \cdot 10^{11}$ U-ions per sec [1].

The prospective beam loss during slow extraction is $1.5 \cdot 10^{10}$ particles per second. Thus, the slow extraction area is the region with the highest beam loss rate in the whole tunnel, accommodating the two synchrotrons.

At the present stage of SIS100/300 facility design, it is very important to investigate the lifetime of the materials which will be used in magnets and other equipment of the new facility. Since the superconducting magnets are the most important component of the synchrotrons, it is necessary to know as precisely as possible the radiation hardness of the most radiation fragile material used in the magnets – the insulators.

## THE RADIATION TEST SET-UP

The significance of the presented irradiation test consists in the unique setup of the target. Main aim of the experiment was to reproduce the real beam-loss conditions during the operation of the synchrotron. All test samples were shielded by stainless steel plate which represented the wall of the vacuum chamber. Beams hit the surface of this plate at a tiny angle to reproduce the charge exchange losses and losses in the slow extraction area [2].

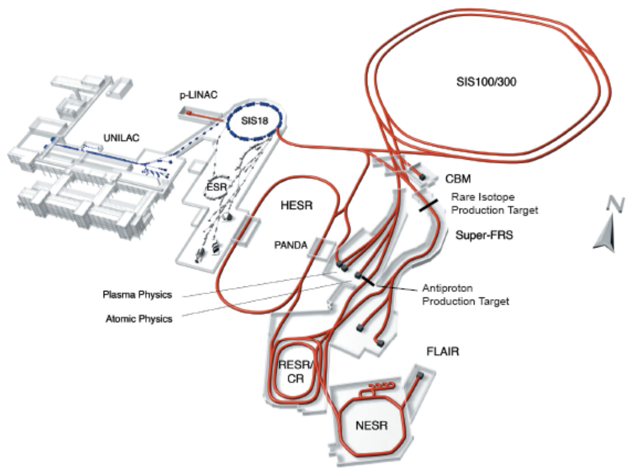


Figure.1: Schematic view on the existing GSI facility: UNILAC, SIS18, ESR (blue line) - and the planned FAIR facility on the right: the superconducting synchrotrons SIS100, SIS300, the collector ring CR, the accumulator ring RESR, the new experimental storage ring NESR, the rare isotope production target, the superconducting fragment separator Super-FRS, the proton linac, the antiproton production target, and the high energy antiproton storage ring HESR. Also shown are the experimental stations for plasma physics, relativistic nuclear collisions (CBM), radioactive ion beams (Super-FRS), atomic physics, and low-energy antiproton and ion physics (FLAIR).

### *HHD cave*

Facility of the SIS18 contains a beam dump for the emergency dump of the high energy ion beam (fig.2). The beam dump is situated in the HHD cave. It is a massive iron cube with a cavity to accept the beam. This place was taken for the needs of the experiment. Part of the vacuum line 1.5 m long was removed to let us install a special transporter. This mechanism allowed moving the target in two horizontal dimensions of freedom. Thus one can remotely drive the target left-right in order to centre it relatively to the beam axis and also push-pull it in order to get the target inside the beam dump cavity or get it outside.

#a.b.plotnikov@gsi.de