High-Energy Irradiation Facility for Biophysics and Materials Research

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for the BIOMAT-Collaboration

The BIOMAT collaboration, formed by the biophysics and materials research groups at GSI and 29 international user groups, is planning a high-energy irradiatioin facility for experiments in biophysics, space research, and materials science. The facility will be part of the FAIR High-Energy Cave which is shared by the SPARC-Collaboration and will provide unique experimental conditions for irradiations with heavy ions covering the energy range from 100 MeV/u up to 10 GeV/u.

Solar and cosmic radiation represents a major hazard in all space explorations. The interactions and transport properties of cosmic radiation should be known as precisely as possible in order to reduce shielding to the necessary minimum. Moreover, shielding of humans and spacecraft is difficult and costly in space. At the new facility, irradiation experiments will simulate cosmic rays exploiting shielding properties and radiation stability of materials such as the spacecraft hull and electronic equipment. Materials research activities will primarily focus on modifications of solids induced by relativistic ions. The large range of the projectiles will allow the exposure of samples embedded in high-pressure anvil cells.

Experiments in both fields require high flexibility concerning irradiation conditions and target area. Access to a broad range of beams (protons up to uranium) and ion energies from the SIS18 as well as the SIS100 synchrotron is therefore mandatory.

To allow high-quality irradiations of large sample areas, a magnetic beam scanner will be installed. Additionally, a passive scattering system will be provided. The main target station will comprise various flexible set-ups such as a remote-controlled moving belt for positioning of smaller samples and larger devices (e.g. detectors, space devices) together with a robotic system for automatic handling of biological samples. Irradiation experiments on samples exposed to extreme pressure conditions will be performed in a large-volume multi-anvil device. Finally, for basic studies allowing in-situ und on-line monitoring of ion-induced processes, a multi-purpose UHV-chamber is planned. An additional target set-up in close vicinity of the beam dump will allow experiments with extreme beam conditions with respect to fluence and beam energy.

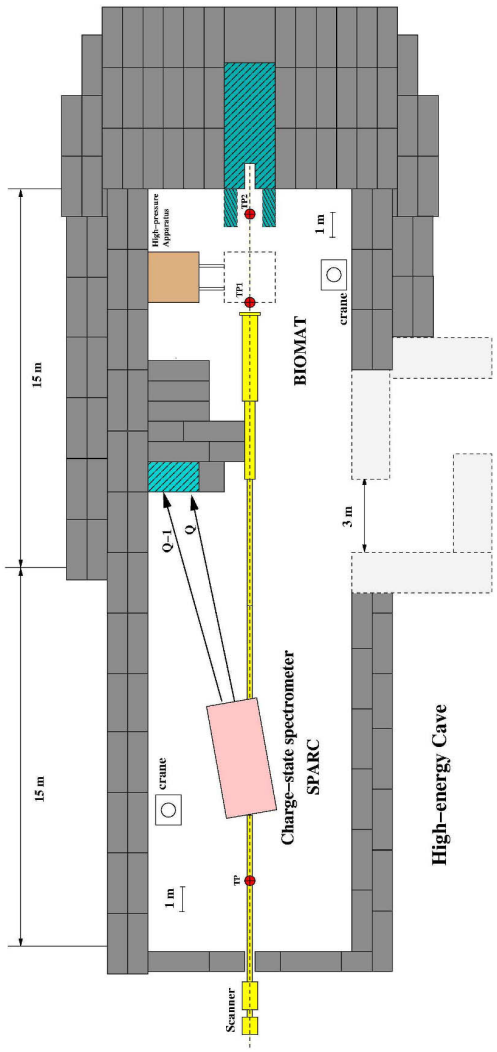

Figure 1: *Schematic layout of the planned High-Energy Cave shared by the SPARC and BIOMAT collaborations.*