

## **The GSI heavy ion microbeam: A tool for the investigation of cellular response to high LET radiations**

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Since the mid 1990's, an increasing number of charged particle microbeams have been designed to deliver a preset number of ions to individual living cells with the micron resolution. These tools provide a powerful technique to investigate the cellular response to low doses of radiations. During the last years, the single ion hit facility in operation on the GSI microbeam since 1987 has been upgraded for the irradiation of individual living cells in vitro. This setup presents two main peculiarities compared to the microbeams used up to now for cell irradiation. First, the beam's micrometric size is obtained by magnetic focusing and not by a simple collimation. This allows obtaining a smaller beam spot, a better defined linear energy transfer, and a high irradiation throughput. Then, the GSI microbeam is able to focus ions from carbon to uranium with energies between 1.4 MeV/u to 11.4 MeV/u. The range of accessible linear energy transfer is thus considerably extended compared to light ions microbeam in operation today. The design of the GSI microbeam is described, including the beam control, the online cell localisation, the cell dish designed specifically for microbeam irradiation, and the cell irradiation procedures. Experimental tests performed to check the global aiming accuracy as well as the first cellular irradiations are presented.