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P09 - The FUDAN proton microbeam for sub-cellular irradiation

Friday, 11 July 2014 13:00 (1 hour)

Biological proton microbeam for sub-cellular irradiation is constructed in Fudan University, on a 2×3MV tandem accelerator (NEC-9SDH2). With a 14 meters beam line (8.6m horizontal and 4.5m vertical), energetic protons is chosen by a 30°magnet analyzer and bended vertically up by a 90°bending magnet, and finally focused and pre-collimated to the beam exit at the endstation. To produce an external proton beam down to a sub-cellular size, a capillary collimator of 1.5μm ID and 1mm length is used, though which a collimated proton beam of 3MeV (FWHM<40keV) can be acquired with a spatial resolution <2.2μm in air. The precise detection of the protons are performed by a scintillation detector using a 13μm scintillator film (BC400) at the beam exit together with a photomultiplier (Hamamatsu R7400U) mounted above the target living cells cultured on a 3μm Mylar dish. The counting signals from the photomultiplier is discriminated by NIM electronics and counted by a computer-based counter, which sending the feedback signal to a fast beam deflector on the horizontal beam line for a fast beam cutting in 1μs, when preset number of protons is delivered to target cells. Imaging system are also set up with a cooled CCD camera mounted to Olympus microscope (BHT), and the image processing and cell irradiation steps are automatically performed by a central computer with home-developed program. The current performance of the Fudan microbeam is summarized as: external proton beam (3MeV, FWHM<40keV) produced by capillary collimator, with a beam size of 2.2μm in air; CR39 tracking method has demonstrated a single-hitting precision >95% and a targeting discrepancy within ±2μm.

Primary author: Prof. WANG, Xufei (Fudan University, China)

Co-authors: Prof. SHAO, Chunlin (Fudan University, China); Mr WANG, Jianzhong (Fudan University, China); Mr LI, Jiaqing (Fudan University, China); Mr ZHANG, Jiexiong (Fudan University, China); Prof. SHI, Liqun (Fudan University, China); Dr ZHANG, Wei (Fudan University, China)

Presenter: Prof. WANG, Xufei (Fudan University, China)

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