AbstractID: 4570 Title: A Carbon Nanotube Based low LET Multi-Microbeam Array Singel Cell Iradiation System

Purpose: Our long-term objective is to develop innovative carbon nanotube (CNT) based multi-pixel microbeam array system for single cell irradiation at small temporal scales and under direct microscope observation. The electron microbeam has an adjustable energy (20-60 keV) and dose rate. The microbeam l array can simultaneously irradiate a large number of individually selected cells *in vitro*, instead of sequentially irradiating cells one at a time using a single radiation source. From its 2,500 or more individually controllable microbeam pixels, the device offers flexibility in irradiation pattern that can be spatially discrete or uniform and temporally continuous or pulsed. Together with new advances in biosensors and cellular imaging, the proposed device can play an important role in understanding critical signaling events for both short and long term radiation effects occurring in cellular level immediately after irradiation.

Method and Materials: The CNT single cell irradiation systems utilizes the unique field emission property of CNT, a quantum process that electrons escape from the metal surface under an external field. Each microbeam is generated by an individually controllable CNT pixel. The microbeam size is controlled by the Si_3Ni_4 electron/vacuum window and the dose rate is controlled by the external field.

Results: We have fabricated the CNT field emission electron pixels, Si_3Ni_4 electron/vacuum windows, and a prototype single pixel CNT microbeam device. We have performed Monte Carlo (MC) simulation on the microbeam dosimetry and the effect of the Si_3Ni_4 window on the electron microbeam. Initial dosimetry measurement of the CNT microbeam irradiation using GARCHROMIC film and compared with the MC result. The prototype CNT system delivered a microbeam size of 20 micron and dose rate of ~5Gy/sec.

Conclusion: Our preliminary data demonstrated that the CNT-based low LET microbeam system is feasible to deliver large dose rate and single cell (10-20 micron) microbeam irradiation.