AbstractID: 4582 Title: Will protons become cheaper some day

Given the physical advantages of protons and light ions in target dose conformity and normal tissue sparing over commonly used photon and electron beams, why is proton or ion beam therapy only offered at a few facilities worldwide? The answer is high cost. Conventional proton or ion facilities are either cyclotron- or synchrotron-based. The cost of the accelerator, treatment gantries and the building increases the total capital cost to about $100million for a proton facility and it can cost 2-3 times more for an ion facility. In this presentation we will look at alternative solutions that may provide more cost-effective proton and light ion beams for radiation therapy. We will review recent developments in compact accelerator designs using superconductors and advances in particle acceleration using laser-induced plasmas. Take laser-proton acceleration as an example, theoretical studies show that at a laser intensity of 10^{21}-10^{22} Wcm^{-2} protons may be accelerated up to 300MeV with a spectrum and angular distribution. Experimental facilities dedicated to laser-proton acceleration for cancer treatment have recently been established in the US, Japan and France. Because of the small acceleration distance a laser-proton/ion accelerator is expected to be much more compact than conventional cyclotrons or synchrotrons and once developed may be the best candidate accelerator for particle therapy.

Educational objectives:

1. Review existing accelerator designs and alternative compact accelerator designs
2. Review recent advances in laser technology and laser-ion acceleration
3. Discuss potential applications of laser-accelerated protons for radiation therapy