

We are developing a quasi-nonisocentric external-beam radiotherapy system with a precise initial setup capability and a real-time tracking & shooting capability. The system can be used for not only a conventional static treatment with a precise initial setup, but also a real-time tracking radiotherapy by means of the following architecture: an ultra-light X-ray head is mounted on gimbals which provide quick pan and tilt motions. The gimbals are mounted on an O-shaped ring that can rotate in 360 degrees around a couch axis and the axis of the O-shaped ring can be skewed by ± 55 degrees to the couch axis. The pan and tilt motions provide a capability for real-time aiming at any arbitrary point designated with the absolute coordinates around an isocenter. The motions of the O-shaped ring provide portal selections for non-coplanar beam delivery without any couch movement. The structural rigidity of the O-shaped ring also ensures the overall accuracy of the present system. The X-ray head is composed of a compact C-band 6MV accelerator and a miniature MLC. The system has two sets of built-in kV X-ray imaging subsystem for real-time fluoroscopic imaging and tumor tracking. We are preparing for initial clinical tests on the static irradiation basis. The application of real-time imaging and tumor tracking requires further developments and pre-clinical and clinical evaluations.