

LINAC DESIGN FOR RADIOSURGERY WITH PRECISE 4PI DELIVERY AND FAST, INTEGRATED CT IMAGING

[Mutic, Sasa, Zhang, Tiezhi](#)

[Carter, Paul](#)

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Technology Description

This technology is a patented LINAC (linear accelerator) radiation therapy system designed to enable non-coplanar cone beams to be delivered from all angles by using a ring gantry instead of a robotic moving couch. This simple approach enables easier treatment planning and quality assurance in an instrument that could be integrated with fast CT imaging.

Radiosurgery requires radiation to be delivered from multiple angles (4p, full six-degree positioning) in order to precisely target the radiation dosage to a tumor while minimizing damage to surrounding tissue and critical organs. Currently, LINAC radiosurgery machines are not ideal for this 4p delivery due to complicated treatment planning or lack of image guidance. This technology solves that problem by delivering a cone-shaped treatment beam using a ring gantry that moves the beam around the patient instead of having the patient move on a robotic couch. This hardware is combined with planning methods that can correct rotational errors. These features reduce costs, prevent collision and speed up the treatment time. Furthermore, the system could be combined with volumetric imaging such as CT and be used for a range of tumors, including intra-cranial and extra-cranial targets. Overall, by enabling further dose escalation with reduced impact on critical organs, this 4p radiosurgery system has the potential to offer life-saving curative treatments to patients with a variety of cancer.

Stage of Research

The inventors have designed the LINAC machine and derived methods and algorithms for rotation correction and treatment planning.

Applications

- **Radiosurgery/3D conformal radiation therapy using LINAC:**
 - precisely deliver radiation dose to targets while minimizing radiation to healthy tissue
 - potential for end-user applications in intra- and extra-cranial radiosurgery including treatment for prostate, head and neck or lung tumors

Key Advantages

- **Easy 4p planning and delivery:**
 - more degrees of freedom to deliver conformal doses with less complexity
 - cone-shaped non-coplanar beams
 - no rotating couch, minimizing potential for patient collisions
 - simple design to reduce operational costs and enable easy quality assurance and maintenance
- **Robust and precise, fast CT imaging:** can be performed in seconds due to ring gantry:
 - easily integrated into machine
 - mechanically stable with faster rotation than open gantry LINAC

- **Range of applications:**

- can treat both intra- and extra-cranial targets, including relatively large targets with trajectory/aperture optimization
- could enable additional therapies from a single machine

Patents: [System and method for radiation treatment optimized for non-coplanar delivery](#) (U.S. Patent No. 10,632,326)