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# Robot-Assisted Mouse Positioning System (RAMPS) for Preclinical Conformal FLASH Radiotherapy

Stanford researchers have developed a robot-assisted mouse positioning system (RAMPS) that enables conformal, pluridirectional FLASH radiotherapy studies in small animals.

FLASH radiotherapy delivers radiation at ultra-high dose rates and has shown potential to maintain tumor control while reducing damage to surrounding healthy tissue. Clinical radiotherapy achieves conformal tumor targeting by rotating the treatment beam around the patient, but reproducing this geometry under FLASH conditions requires the rotation to occur within the ultra-short delivery window. No current machine can do this, and no system exists for investigating conformal or pluridirectional FLASH in small animals. Off-the-shelf linear and rotary stages and commercial robot arms individually lack either the required rotational speed or the ability to reposition the rotational axis of a mounted body.

RAMPS pairs a six-axis industrial robot arm with a custom end-effector–mounted mechanism that executes rapid rotation, translation, and rotational-axis repositioning, moving a mouse through a stationary beam for precise image-guided conformal irradiation of tumors in vivo. A custom user interface controls the system and programs desired movement sequences. The platform is compatible with a range of radiotherapy machines and linear accelerators and can also be used alongside diagnostic and calibration tools.

## Applications

- Preclinical conformal and pluridirectional FLASH radiotherapy studies in small animals

- Image-guided tumor targeting in rodent models across radiotherapy modalities
- Dosimetry, calibration, and quality assurance workflows for radiotherapy and imaging systems
- Radiation physics and linear accelerator experiments requiring precise dynamic positioning
- Research platform for investigating biological effects of energy exposure during controlled motion

## Advantages

- Enables conformal FLASH delivery in small animals, a capability no existing system provides
- Combines rapid rotation, translation, and rotational-axis repositioning in a single mechanism
- Rotational speeds compatible with ultra-high dose rate delivery, unlike commercial stages or stock robot arms
- Compatible with a range of radiotherapy machines and linear accelerators
- Custom user interface for programming experiment-specific motion sequences
- Built around a commercially available industrial robot arm, supporting reproducible deployment

## Innovators

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