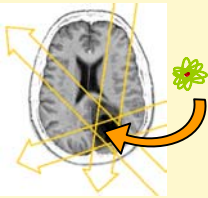


## Synchrotron Radiation Tomotherapy

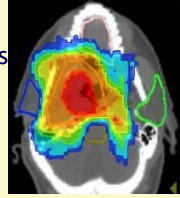
- beam fitted to the tumor size
- tumor positioned at the center of rotation
- monochromatic beam
- beam crossing: high dose deposited



⇒ **Plus**  
**dose enhancement** injection  
of Iodine (higher Z<sub>eff</sub> for tissues)  
**Or**  
**combination with chemotherapy** intra-  
tumoral injection of a platinated drug

## Dosimetry for future Clinical Trials

Treatment Planning provides a 3D dose estimate for radiotherapy



Example: map of calculated doses, the target volume defined by the physician.  
Note: a sensitive organ (green contour) is spared thanks to the geometry of the irradiation.

## Tools for 3D Dosimetry

- Simulations** Monte Carlo or deterministic methods
- Fricke Gel** chemical dosimeter, water equivalent

## Monte Carlo Dosimetry

- The Monte Carlo code samples:
- Photons: collisions from interactions cross sections
  - Electrons: scattering angles, energy loss

## inputs for calculation



❖ **anatomic geometry**  
absolute attenuation value provided by monochromatic RS tomography

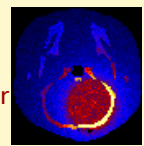
❖ **source characteristics:** energy, beam size, center of rotation



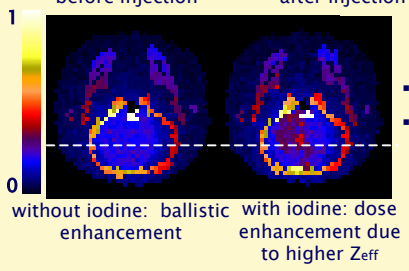
& **image segmentation** i.e. material classification (bone, muscle, air)

## outputs

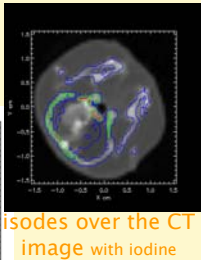
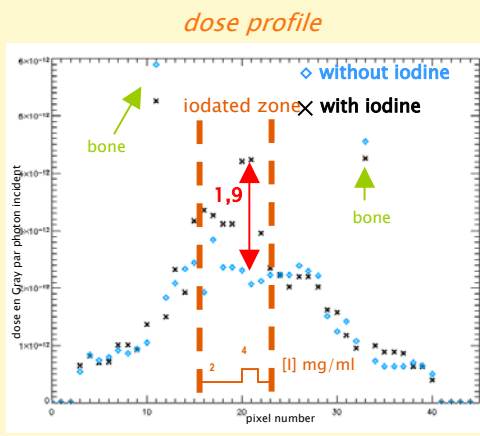
❖ **map of absorbed dose** = deposited energy per mass unit



## Dosimetry: F98 glioma bearing rats with iodine injection



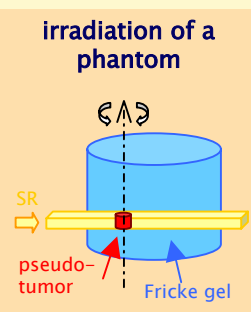
irradiation parameters:  
• energy: 50keV  
• beam: 1\*0,1 cm<sup>2</sup>



## Fricke Dosimetry

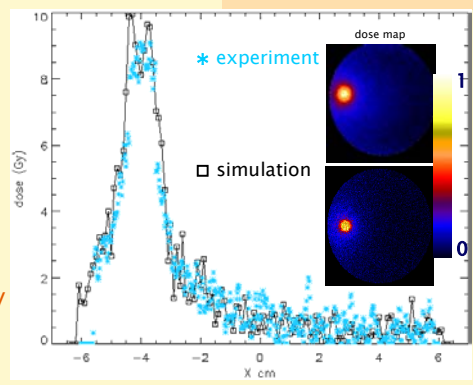
### principle

- X rays irradiation induces chemical change of ferrous ions contained in the gel ⇒ (Fe<sup>2+</sup> → Fe<sup>3+</sup>)
- visualization : Nuclear Magnetic Resonance ⇒ relaxation (1/T<sub>1</sub>) proportional to absorbed dose



irradiation parameters:  
• energy: 78,8keV  
• beam: 1\*0,1 cm<sup>2</sup>

⇒ results from simulations are in good agreement with Fricke dosimetry



## Perspectives

- Comparison with various Monte Carlo codes
- Calculation optimization (computer time)
- Implementation of algorithms for treatment planning: **clinical trials**