

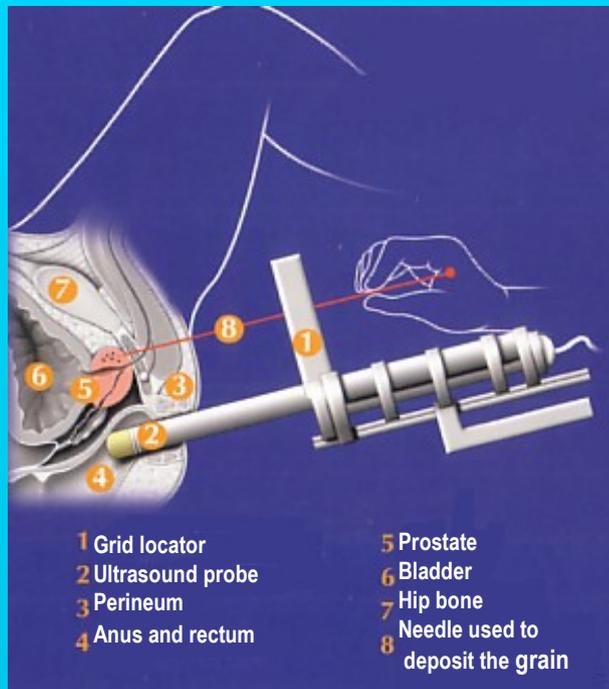
On-Line Supervision of Robotized Brachytherapy of the prostate.



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Introduction

Brachytherapy : Implantation of radioactives seeds in organs through ultrasound control



Brachytherapy of the prostate

CI-ROB : Ciblage-ROBotisé, Developing automatic system and robot in cancerology

Objectifs of the thesis :

1. On-line robotized brachytherapy of the prostate by coupling a robot with ultrasound image data.
2. Accurate robot movements' control for insertion and/or extraction of needle.
3. Monitoring of the image-guided robot for brachytherapy of the prostate.

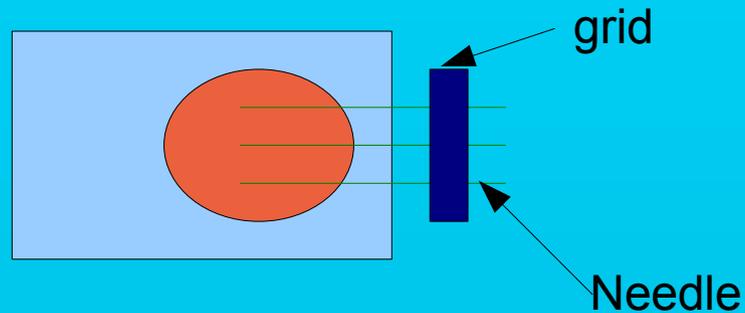
Why using a robot?

1. Accuracy

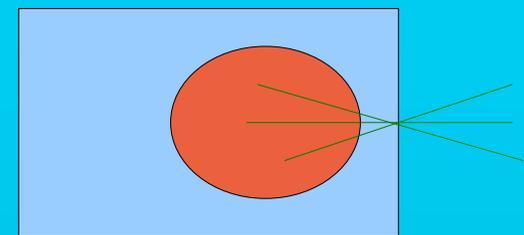
2. Repeatability

Important to respect dosimetry planning. (insertion of about 100 seed using 20-25 needles)

3. Robot can insert needle with different angle of incidence



Manual brachytherapy

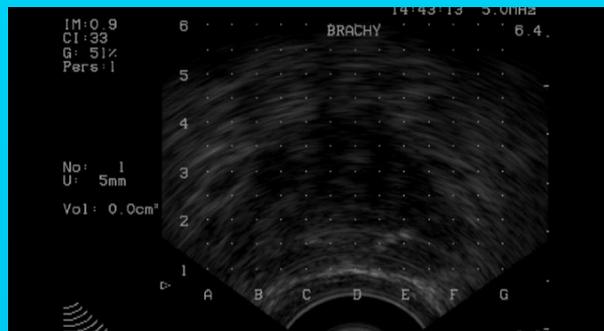


Possible incidence
insertion with a robot

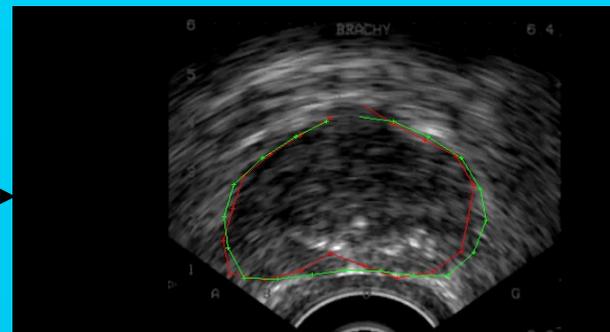
Robotization of Brachytherapy

First Step:

1. Robot and ultrasound coupling :
Identification of prostate contour, other organs and targets =>
3D reconstruction.



Original image



Segmentation of prostate and urethra in image

**Contour detection:
Active Contour Model
Algorithm**



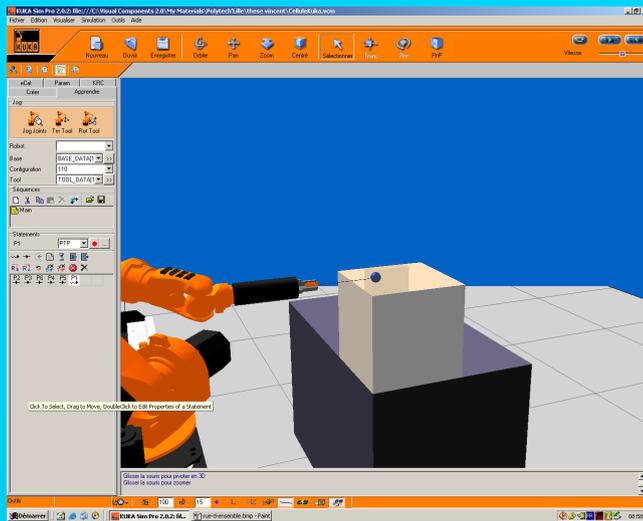
Original image



Segmentation of prostate and urethra in image

Robotization of Brachytherapy

2. Automatic needle insertion using a 6 dof arm robot



Test on virtual simulator



Test on phantom

3. Conception of an intelligent gripper to have feedback information on the insertion task

Robotization of Brachytherapy

Next Step:

1. Compensate movements of the prostate during needle insertion
2. program simulation of the system including robot and patient in order to test our algorithms.
3. Monitoring the system to detect errors during the operation and act in consequence
 - Base on : - sensor redundancy
 - model of the robot

Conclusion

- First results on image processing are encouraging, next step is to validate our algorithm with on-line acquired ultrasound images .
- Design of specialized simulator in order to implement a supervision system.

