CHANCE - Robotic Assisted Brachytherapy, an Innovative Approach of Inoperable Cancers

National partnership project of type PCCA no. 173/2012

Director: Prof. Dr.-Ing. Plitea Nicolae Nicolae.Plitea@mep.utcluj.ro (2012-2016)

Project team: Prof. Nicolae Plitea, Prof. Doina Pisla, Dr.-Ing. Calin Vaida

Dr.-Ing. Bogdan Gherman, PhD student Dragos Cocorean,

PhD student Bogdan Galdau, PhD student Florin Covaciu

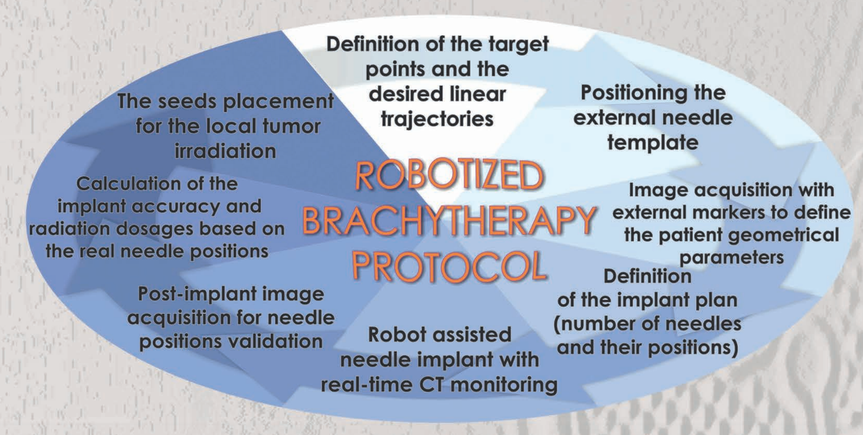
Objectives:

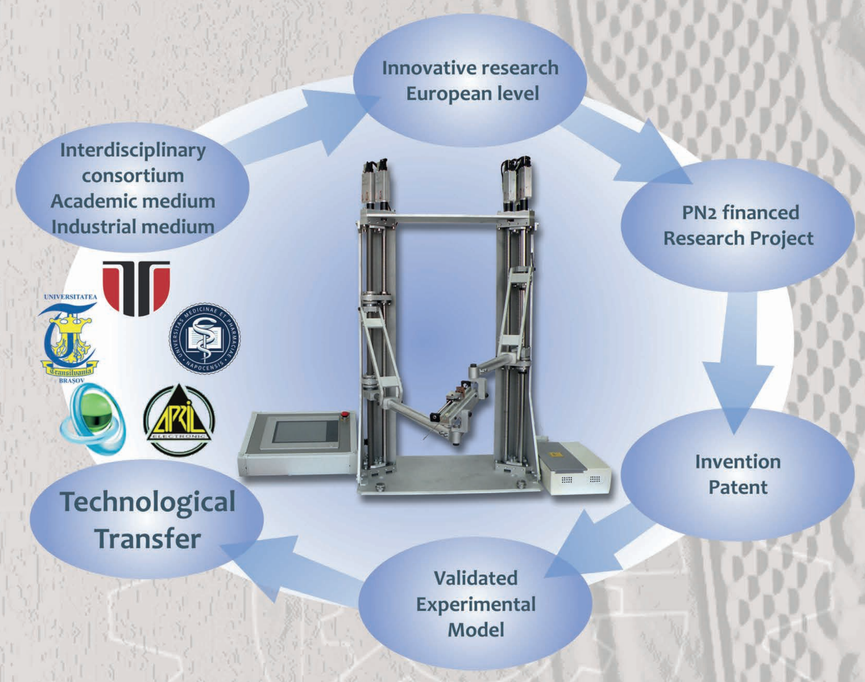
The development of a robotic system capable of positioning the specific brachytherapy devices in the tumors in a minimally invasive way;

The design of an advanced simulation software for brachytherapy;

The development of an advanced guiding system based on radiological patient data;

Validation of a fully functional solution in the experimental stage.





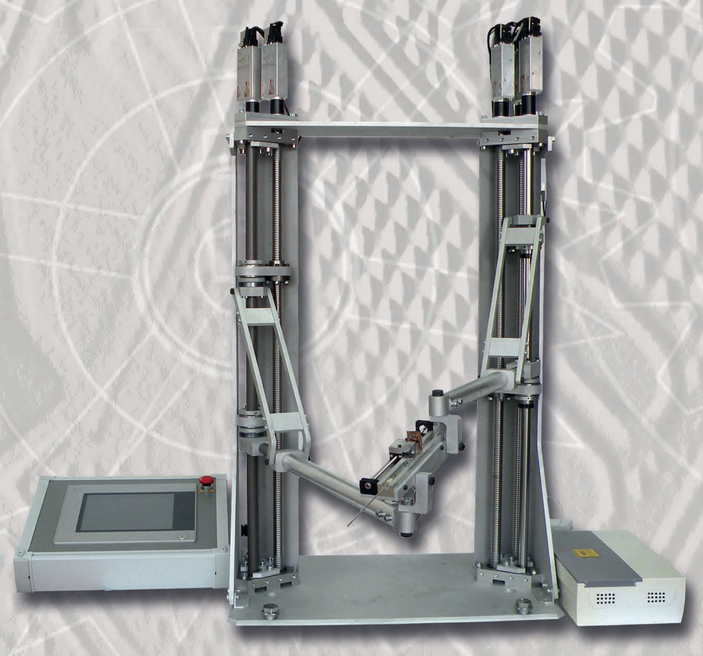
Achievements:

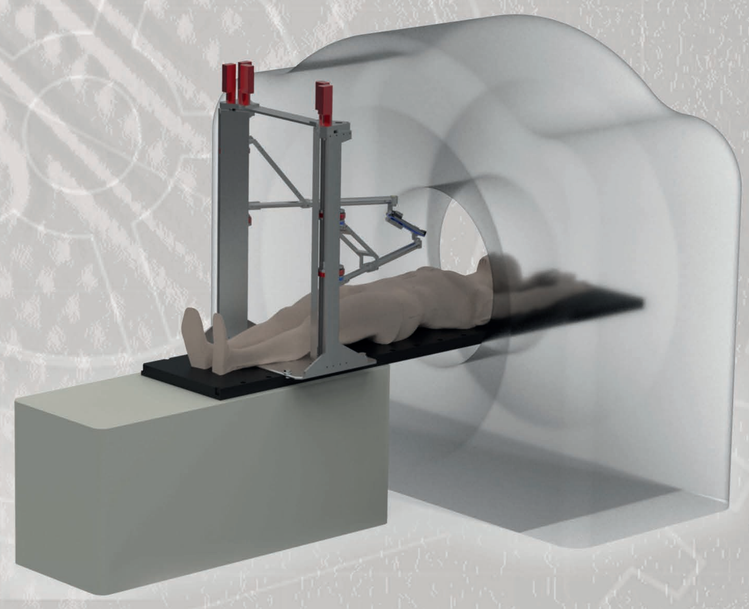
Brachytherapy, also known as internal radiotherapy, is a form of minimally invasive treatment where the radiation source is placed into the body directly to the area in need of treatment. The essential condition for the success of the procedure is to place the catheters through which the radiotherapy sources are inserted as accurately as possible, as the dose of radiation decreases rapidly from the base and improper positioning leads to the necrosis of healthy tissue surrounding the tumor without actually affecting the tumor.

Robotic assisted brachytherapy provides a high precision and a robust control of the entire procedure, achieved using computer tomography (CT) for those cases where the use of ultrasound probe is insufficient.

The global deficit regarding robotic systems for general brachytherapy (primarily for thoracic and abdominal areas) and hence the use of brachytherapy for the tumors situated in these locations leads to the need of developing a solution that eliminates these disadvantages.

To achieve the aspirations of the project, a family of optimized parallel robots to perform the tasks required by the brachytherapy procedure has been developed. Kinematic and dynamic study of these structures led to their validation and the proposal of an experimental model found in the testing phase. A virtual platform to optimize the brachytherapy needles trajectories has been developed, based on the medical oncologists' indications. Modeling and simulation of the virtual work environment led to the validation of the entire system.





Application fields:

The proposed robotic system proposed is for the brachytherapy cancer treatment, addressing especially the medical units offering curative or palliative treatment for cancer, but can be easily adapted to other procedures involving the insertion of needles, such as biopsy.

The system can be used for general brachytherapy procedures, from prostate, breast, cervical and the treatment of cancer located in the abdomen and chest areas. It was designed to work with visual inspection using both the ultrasound probe, but especially computer tomography (CT), which imposes significant restrictions for the space that the robot can occupy in the medical environment, so that the needle can be tracked by the CT.

The control system architecture has been designed and built to suit the requirements of the oncologists, using both visual inspection and force feedback that provides additional information and safety in use.