GERMAN CANCER RESEARCH CENTER
IN THE HELMHOLTZ ASSOCIATION

Research for a Life without Cancer

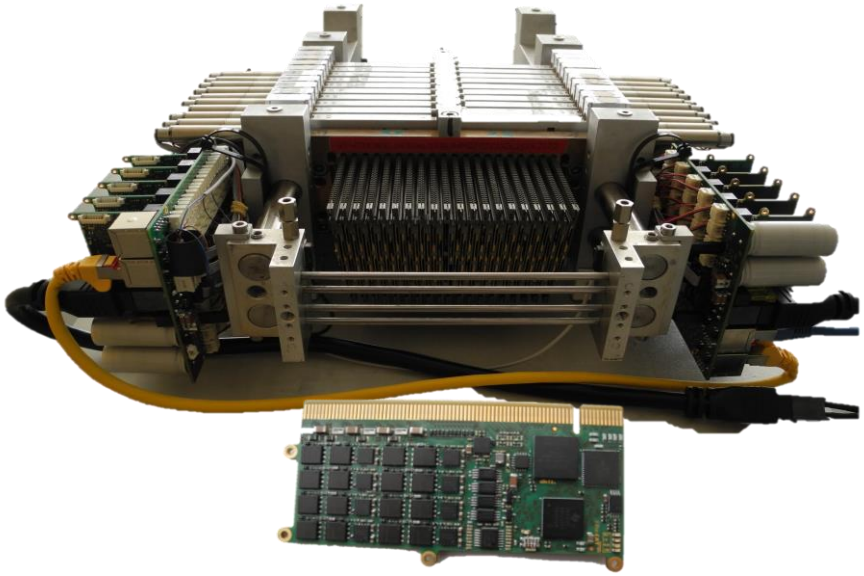
TECHNOLOGY OFFERS

Control device for controlling at least one collimator (P-1365)

Controlling collimator device to achieve high precision in radiotherapy treatment delivery.

EXECUTIVE SUMMARY

The integration of various imaging techniques into the daily practice of radiotherapy directly on the linear accelerator have made it possible to improve the management of inter- and intra-fractional variations. One of the biggest challenges in radiotherapy today is the treatment of moving tumours while delivering minimal dose to healthy tissues.
Multileaf Collimators (MLC) have been the main tool to accurately transform the radiation beam into the complex tumour shapes. Dynamically tracking these moving shapes via a MLC in real-time is particularly difficult in terms of control and precise synchronization of the various subsystems. Nonetheless, this new system architectures based on already industrial standardized components and methods is optimized for multi-subsystem control, avoiding third party vendor custom solutions, which are difficult to maintain and integrate.



Caption / Copyright

Category	Indication	Development stage	Seeking
Method	Solid cancer	Initial tests completed	Licensing, Development partner

BENEFITS

- *This intends to improve the high speed movement of leaves of multi-leaf collimator which is important for advanced radiotherapy techniques such as IGRT and adaptive radiotherapy.*
- *This predicts the tumor movements when the treatment is going on, which is very helpful to deliver dose with accuracy.*
- *Complexity of the components will be reduced as this makes the system compact.*
- *Updating the technology without redesigning the device.*
- *Real- time control system to allow new radiation treatment forms e.g. tumor tracking*.

TECHNOLOGY BACKGROUND

The control system comprises of a Programmable Logic Controller (PLC), acting as the main controller for the MLC, handling position commands, collision detection and error handling for the whole system, being a master for all the MLC high level decisions. The system consists also of multiple controllers/drivers, responsible for the fast control algorithms and driving of the leaves, acting as slaves to the PLC. All components are connected via a real-time fieldbus supporting a cycle rate of up to 8kHz. The PLC is adapted to provide static target or a dynamic target positions, algorithms to prevent collisions or following prediction curves as breathing patterns to establish MLC tumor tracking and compensating body and organ movements.

DEVELOPMENT STAGE

A prototype of the MLC architecture has been successfully tested in real-time having 80 leaves with a commercially available PLC and industry standardized motor drivers. These are capable of accurately driving the leaves at a speed of 10 cm/s (mechanically), having synchronization between them of less than 100 ns, resulting in a deterministic movement.
Initial irradiation tests have been performed and are currently in the process of being published.

APPLICATIONS

MLC leaves control system with high movement speed in real time supervision and control. High dynamic drive control which is especially needed for the advanced treatments such as adaptive radiotherapy, IGRT. Which are needed for real time tumor racking and organ movement during radiotherapy.

INTELLECTUAL PROPERTY

A priority patent application “Control device for controlling at least one collimator” was filed April 11th, 2018 as EP18166774.2, which was published as EP3552663A1. An international PCT-application has been filed as PCT/EP2019/059030, which was published as WO2019197440A1.

PUBLICATIONS & REFERENCES

- P-996 (EP 11 175 776.1, WO 2013/014260, EP 2736597, US 2014/0288349 A1) „Therapeutic device for treating a predefined body part of a patient with rays“ - PLC Control
- P-959 (EP 2500909, WO 2012/123093, EP 2686852, US 2014/0010355 A1) „Position sensoring method and system for a multi-leaf collimator (magnetic stripe)“ - Magnet-Encoder
- P-1044 (EP 13160589.1, WO 2014/147046) "Drive Concept leaves by using Linear Servo motor" - Linear Motor

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ABOUT THE DKFZ Innovation Management

Working at the interface of research and industry, the Innovation Management of the German Cancer Research Center (DKFZ) helps to get new cancer drug candidates, diagnostic tests, and research instruments onto the market as quickly as possible.

The DKFZ with its more than 3,000 employees is the largest biomedical research institution in Germany. At the Center more than 1,300 scientists investigate how cancer develops, identify cancer risk factors and endeavor to find new strategies to prevent people from getting cancer. They develop novel approaches to make tumor diagnosis more precise and treatment of cancer patients more successful. DKFZ is a member of the Helmholtz Association of National Research Centers, with ninety percent of its funding coming from the German Federal Ministry of Education and Research and the remaining ten percent from the State of Baden-Württemberg.