



ORIGIN, an EU project targeting real-time 3D dose imaging and source localization in brachytherapy: commissioning and first results of a 16-sensor prototype.

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SUMMARY

The ORIGIN project addresses the urgent need to deliver more precise and effective BrachyTherapy (BT) treatments for prostate and gynaecological oncology.

The project targets on the development of two innovative single point optical fibre dosimeters with inorganic scintillators on the tip.

The ORIGIN system prototype integrates an array of such sensors with an acquisition system to provide real-time patient dose imaging by signal counting, which is currently unavailable, with a spatial resolution of 0.5 mm for HDR in 0.1 s and 3 mm for LDR in 0.5 s.

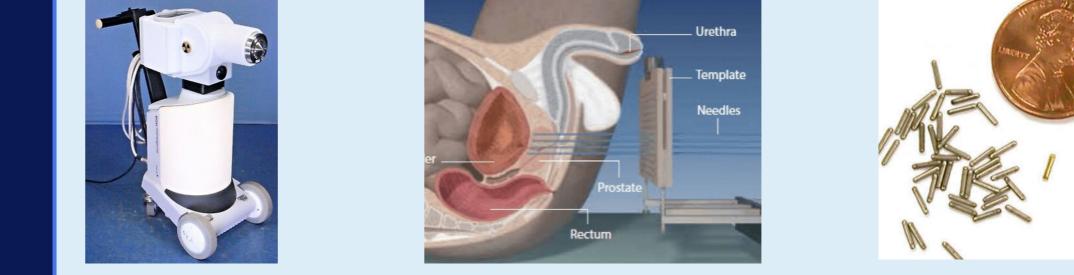


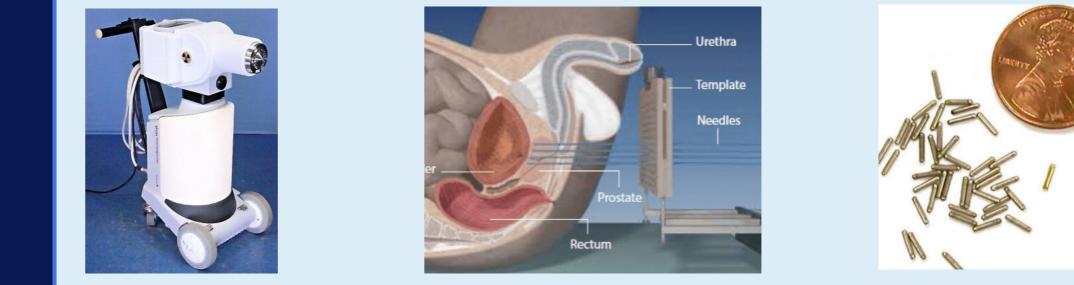
ORIGIN brings together a highly multidisciplinary consortium of

BRACHYTHERAPY

Radiotherapy makes use of ionizing radiation for cancer treatment, which is required by 50-60% of the patients. This treatment can be delivered in the form of external beam radiotherapy, using linear accelerators, or internal radioactive sources (BT).

	Source	Activity	Implantation	<Εγ>	λ@<Εγ>
LDR	¹²⁵	15 MBq	Permanent	35 keV	3 cm
HDR	¹⁹² lr	~100 GBq	Temporary	380 keV	10 cm





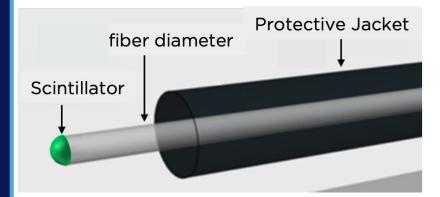


leaders in their respective

fields.

SYSTEM DEVELOPMENT & CHARATERIZATION

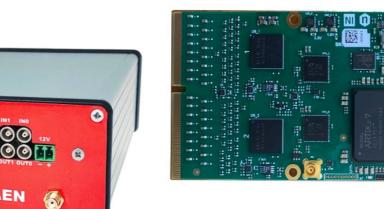
16-CHANNEL SYSTEM



16 optical fiber-based system with scintillating materials on the tip: **Gadox** for LDR and **YVO** for HDR.



16 1x1 mm² SiPM from KETEK.





Simplified Block-schema

Front-end: CAEN FERS board (DT5202) - 64 channel (2 CITIROC1A ASICs).

Among the main features: Single p.e. counting capability (Max 20MHz), SiPM bias voltage 20 – 100V, Ethernet, usb2 and optical link interface for readout (up to 6.25 Gbit/s).



EQUALIZATION PROCEDUERE

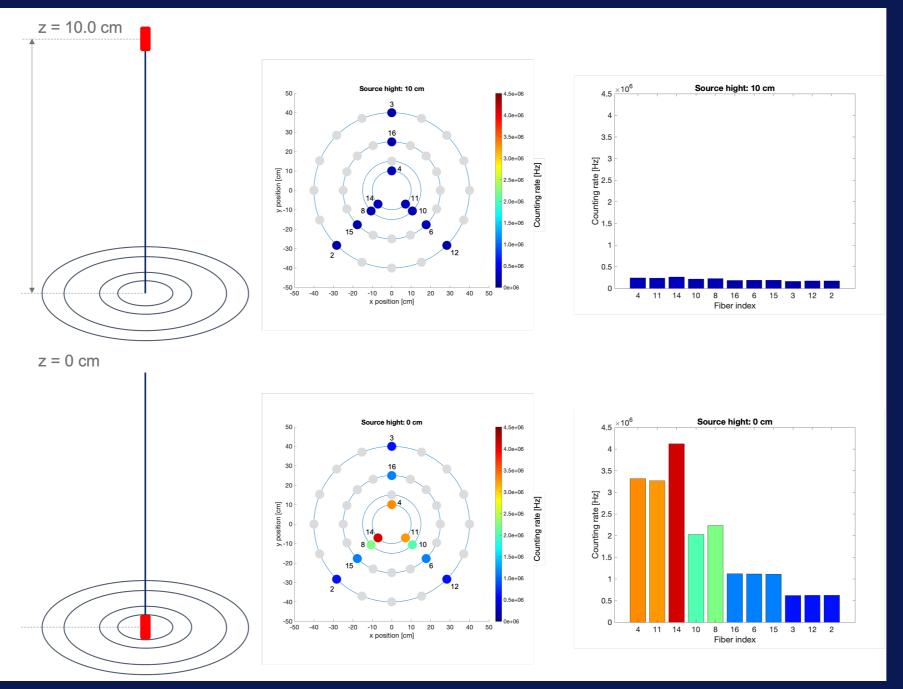
Following the equalization procedure, the

16-CHANNEL SYSTEM CLINICAL MEASUREMENT

The initial evaluation of the 16-channel system, with sensors placed around a ¹⁹²Ir radioactive source was performed at the Queen's University Hospital (Belfast, Ireland), using a phantom with a circular geometry in a water tank.

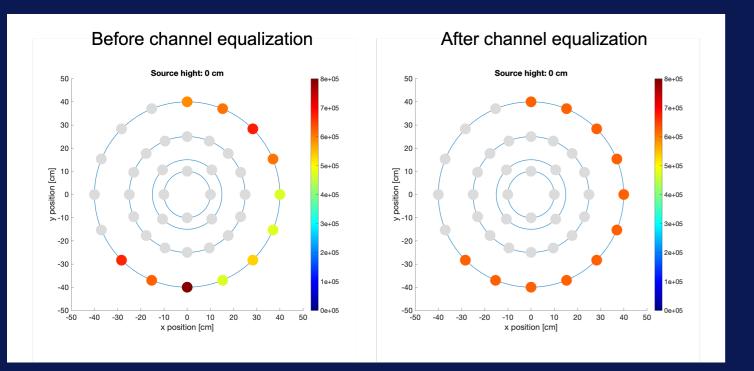
SOURCE LOCALIZATION

The source is moved from a 10 cm distance on the z axis down to the sensors plane (z=0 cm) and the corresponding counting rate as a function of distance was measured.

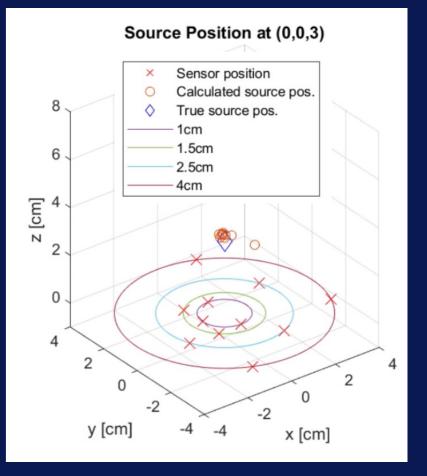


position The Source was reconstructed using triangulation algorithm based on the counting

residual systematic variation (due to the geometrical acceptance, the fiber nonuniformity and positioning) is less than 1%.



rate measured by every source.



OUTLOOK

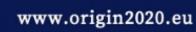
The clinical HDR characterization of the ORIGIN dosimeter shows excellent results, while the LDR characterization results are expected soon. Following a subsequent test with anatomical phantoms, the **ORIGIN** dosimeter prototype will be integrated in clinical systems.



The ORIGIN project is an initiative of the Photonics Public Private Partnership (www.photonics21.org) and has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no 871324.

More Info

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