



Image-guided intraoperative electron irradiation: clinical set-up and feasibility

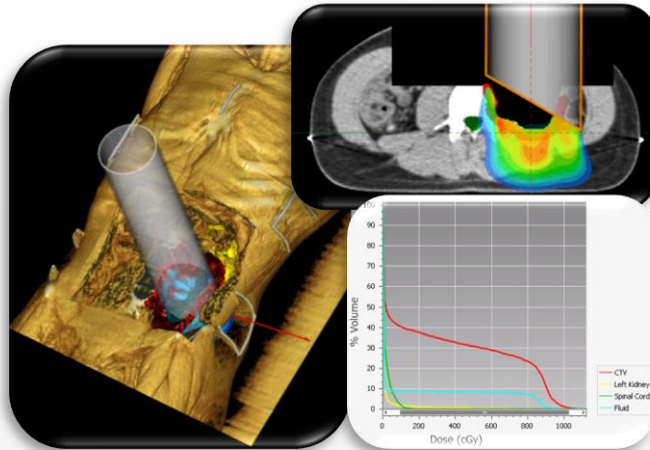
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IOERT Planning

- Radiance



- Actual treatment is manually registered
- Actual location of the applicator?



- Previous work: Feasibility of integrating a multi-camera optical tracking system in intra-operative electron radiation therapy scenarios*



Table 2. Positioning and orientation errors^a between the actual applicator and the virtual applicator

	Bevel centre (mm)	Bevel axis (°)	Longitudinal axis (°)
IOERT scenarios ^b	1.8 ± 0.5	1.6 ± 0.5	0.7 ± 0.3

^a Mean ± standard deviation.

^b Average of all data.



Physical space

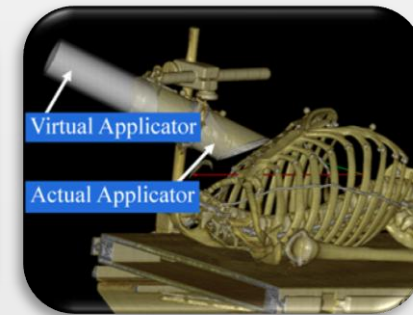


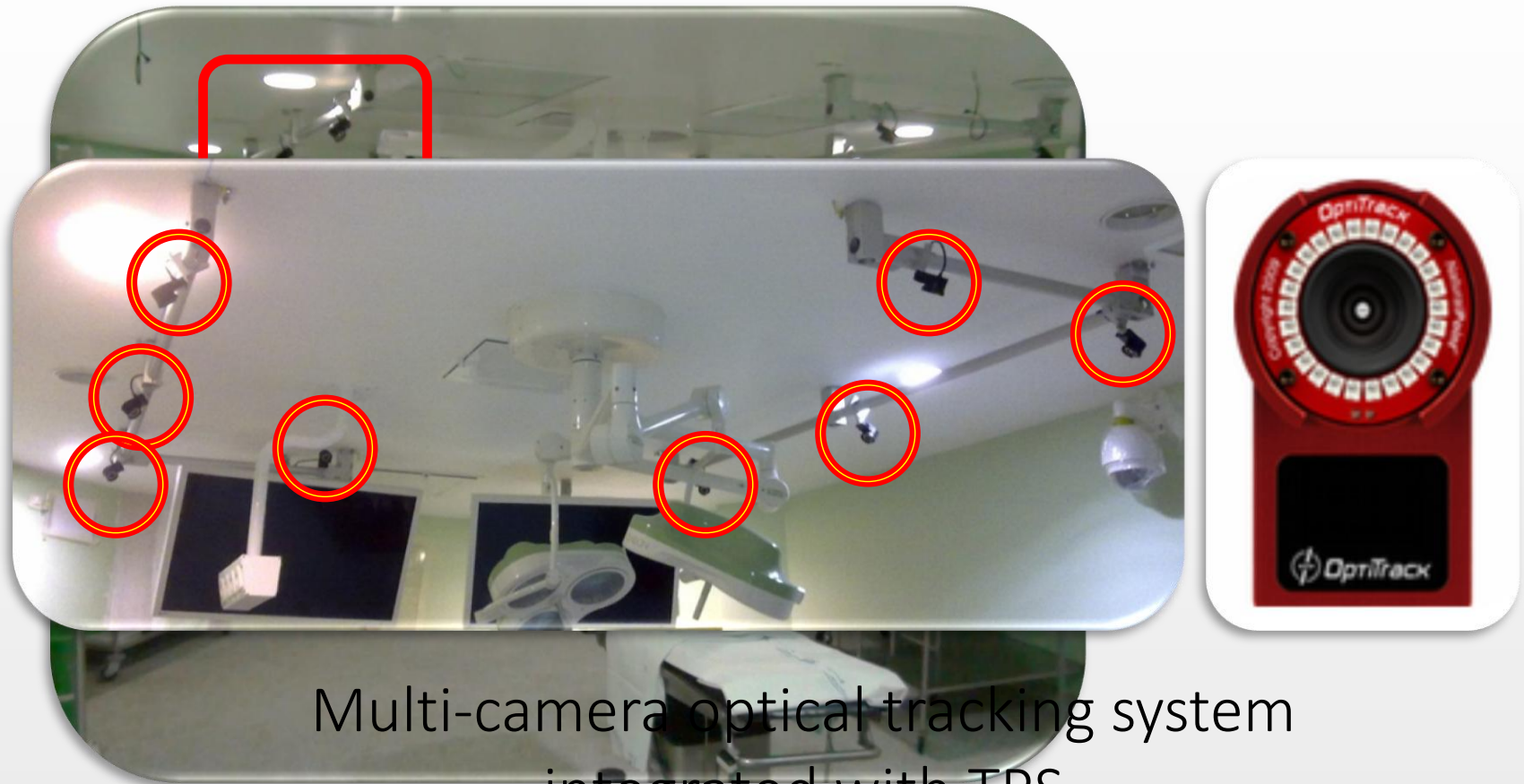
Image space

* García-Vázquez V, Marinetto E, Santos-Miranda JA, Calvo FA, Desco M, Pascau J. Physics in Medicine and Biology, 2013

Objectives

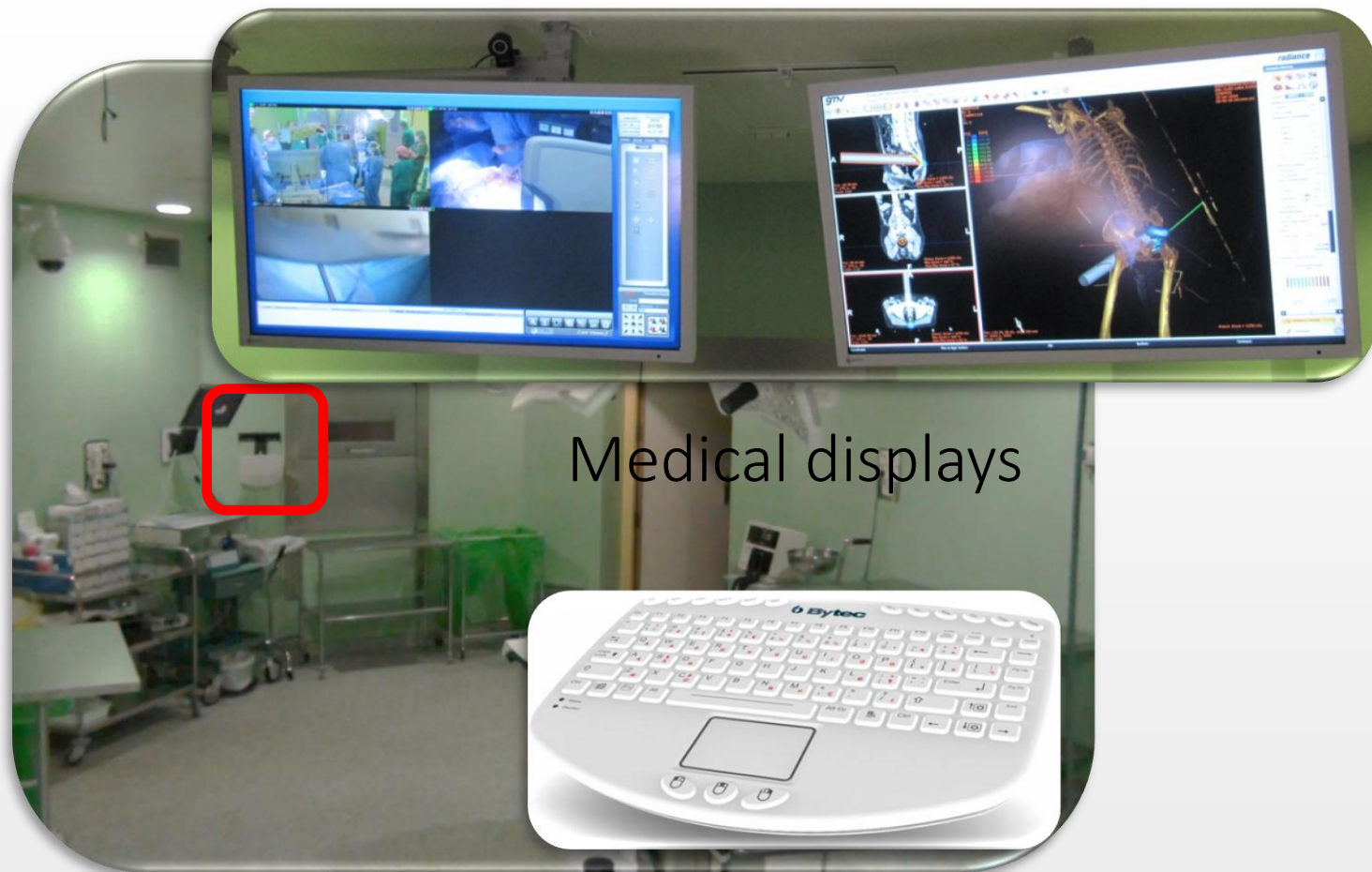
- Integration of the navigation of the IOERT applicator with the treatment planning system (TPS) **in the operating room (OR)**
 - Preoperative imaging
- Assessment of the feasibility and limitations in real cases (patients)

Surgical Room (I)



Multi-camera optical tracking system
integrated with TPS

Surgical Room (II)



Medical displays

Medical keyboard with integrated touchpad

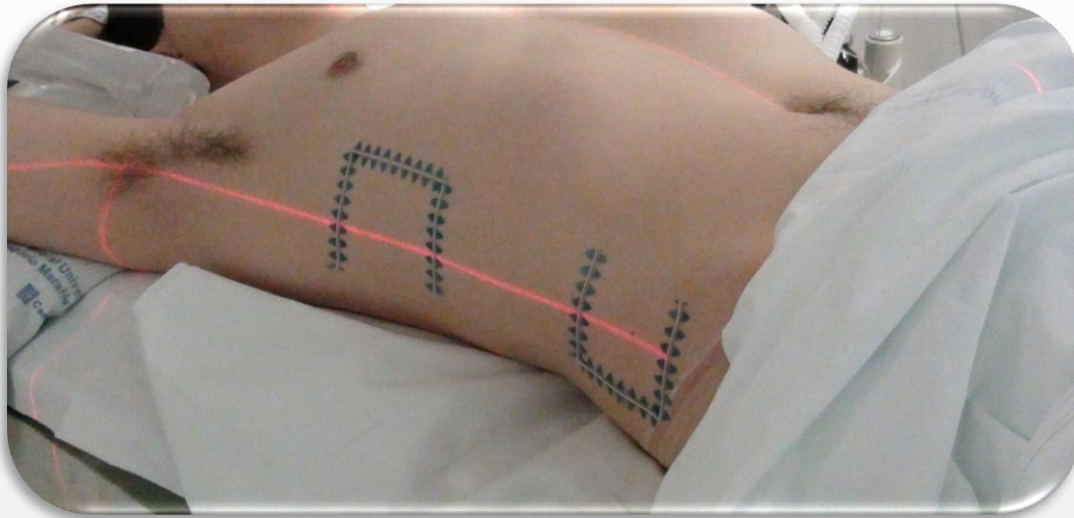
Surgical Room (III)



2 high definition remotely-managed video cameras

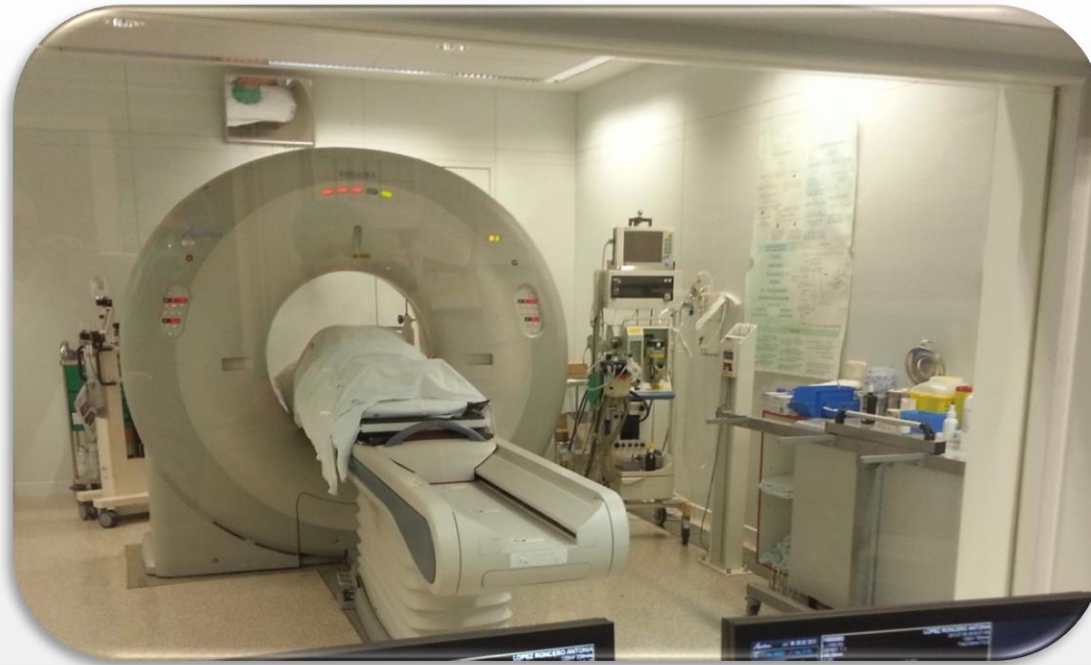
Surgical camera

Navigation workflow (I)



Landmarks on patient's skin

Navigation workflow (II)



Preoperative CT image

Navigation workflow (III)



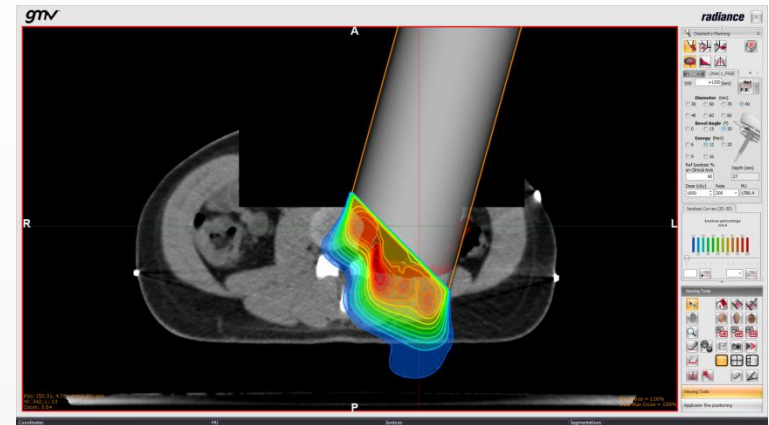
Landmarks coordinates (optical tracking system)

Physical space

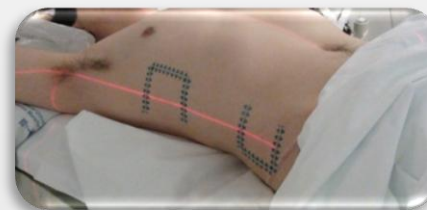
Navigation workflow (IV)



Surgical procedure



TPS (radiotherapy treatment planning)



Physical space

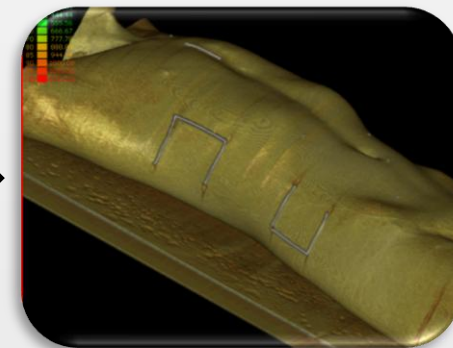
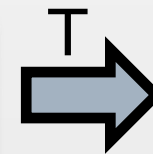


Image space

Navigation workflow (V)



After navigation, IOERT was performed under the conventional institutional protocol

Cases

- 14 patients
- Different intraoperative radiation therapy sites: breast, esophagus, intraperitoneum, retroperitoneum, rectum and sacrum
- Different patient positions: supine, lithotomy, prone and lateral
- The procedure was performed independently of the clinical treatment and **no decisions were taken based on these experimental data**

Results



Navigation of the applicator with respect to the preoperative CT in 11 cases. Surgical complications or decision not to perform IOERT prevented the navigation procedure in other three cases

Discussion

- Coordination of a multidisciplinary team
- Bed movements during surgery
- Evaluation of several error sources such as tracking system, tools design and registration
- Preoperative imaging

Conclusions

- First cases of stereotactic image-guided IOERT with patients
- Navigation is feasible and could be integrated with the conventional protocol
- Integration of the navigation of the applicator with treatment simulation opens new possibilities that would lead to improve accuracy and to optimize documentation of intraoperative radiation procedures

Acknowledgements

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