

OR-Imaging

1. Ortho CT (Orthogonal Computed Tomography for X-Ray Therapy)
2. O-PGI (Orthogonal Prompt-Gamma Imaging for Proton Therapy)
3. TPPT (In-Beam TOF-PET for Proton Therapy)

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Francisco Miguéis^{1,2}, Andrey Morozov¹, Jorge Sampaio^{1,4}, João Silva¹, Hugo Simões¹,
J. Miguel Venâncio^{1,3}, Patrícia Gonçalves^{1,3}**

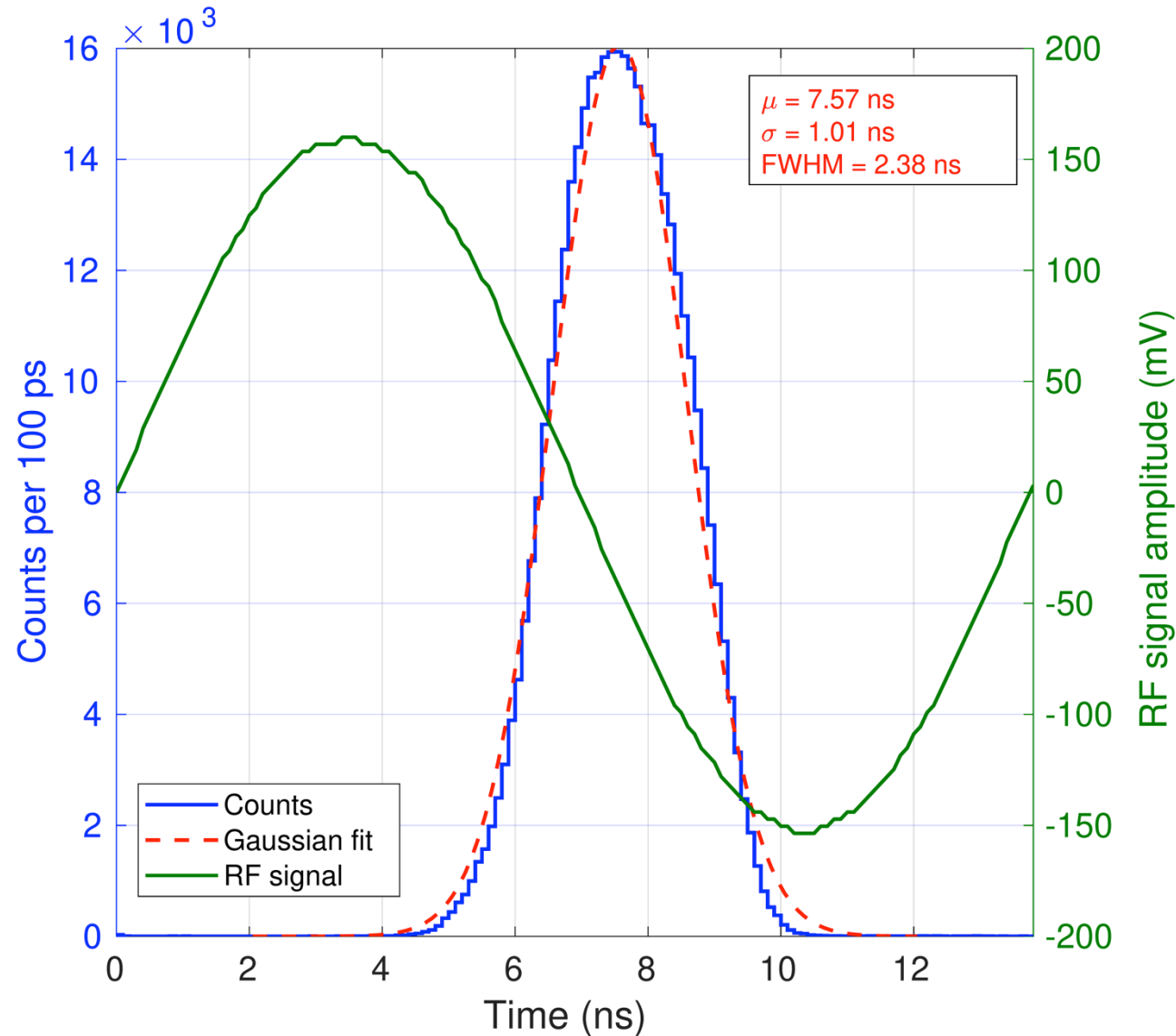


LIP

Meeting with LIP's Advisory Committee – April 19, 2024

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OR Imaging: first beam test results at HollandPTC



- RF occupancy ~ 10 %
($I = 1.3$ pA)
- First RF synchronization with proton arrival for a VARIAN medical proton cyclotron (4 D's configuration)

OR Imaging: OrthoCT experimental results

Multi-slit gamma camera for external beam radiotherapy monitoring: experimental OrthoCT proof-of-concept

In internal review

Hugo Simões,^{a,1} Paulo J.B.M. Rachinhas,^b Others??,^{a,c} and Paulo Crespo^{a,c}

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OR Imaging: OPGI for monitoring pelvic irradiation

Simulation of a multi-slat prompt-gamma camera for 200 MeV proton beam distal edge determination

In internal review

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OR Imaging: new project within the group (TMS)

Multiple Coils Immersed in a Conducting Liquid for Whole-Brain or One-Hemisphere Deep Transcranial Magnetic Stimulation: A Simulation Study

Nuno Saraiva Santos, Sónia C. P. Sousa, Hugo Simões,
Paulo Fonte, Paulo Crespo, *Senior Member, IEEE*

In internal review

OR Imaging: SWOT analysis

Strengths

The group relies of strong expertise in the development of full system Geant4 simulations for health applications. In particular it dominates the technique of including CT-based (computed tomography) data into the simulations so that real treatment plans may also be simulated, with and without pertinent patient simulated modifications. The group is based in Coimbra with easy access to the LIP mechanical workshop and detectors laboratory, enabling a agile interface for the development of prototypes. The group has strongly invested in the study an application of the OrthoCT and OPGI, which are techniques with undeniable applicability strengths, given their rotation-free and low-dose imaging capability. The imaging capability of both techniques have been proven by experiment (OrthoCT) and detailed simulation (O-PGI) in real therapeutic scenarios. O-PGI competes with in-beam time-of-flight PET, the latter highly suffering from biological washout of the produced beta+ activity, which does not affect OPGI.

Weaknesses

The group has a low number of FTE from senior researchers. In particular, the Group PI, Paulo Crespo, is a Professor at Coimbra University, with part of his time dedicated to classes and academic duties and Hugo Simões, the senior researcher with highest FTE available for the group activities does not yet have a stable position either at LIP or at the University and his work has been funded by fixed term contracts in the framework of the group projects.

The applicability weaknesses of the the OrthoCT and OPGI techniques are the need to detect gammas which can be suffer from the contamination of neutrons and also require some positioning complexity, given the high out-of-field particle fluxes and required heavy shielding.

Opportunities

Potential future collaborations with ICNAS the "Institute of Nuclear Sciences Applied to Health", also located in Coimbra, in Coimbra University Hospital Centre.

Exploration of Synergies with the LIP RADART group, which already proved to be an excellent strategy in the context of two successful CERN fund calls for projects, in 2019 and 2021.

Potential collaborations with Spanish Universities and Research centres given the foreseen installation of more than ten Charged Particle Therapy facilities in Spain in the next 3 to 5 years.

Funding opportunities for continuing the development of the group applied work should be sought, namely in the framework of Spanish La Caixa calls or PT2030 funding programme.

Threats

Lack of senior FTEs in the project due to senior researcher teaching and potential low funding levels.

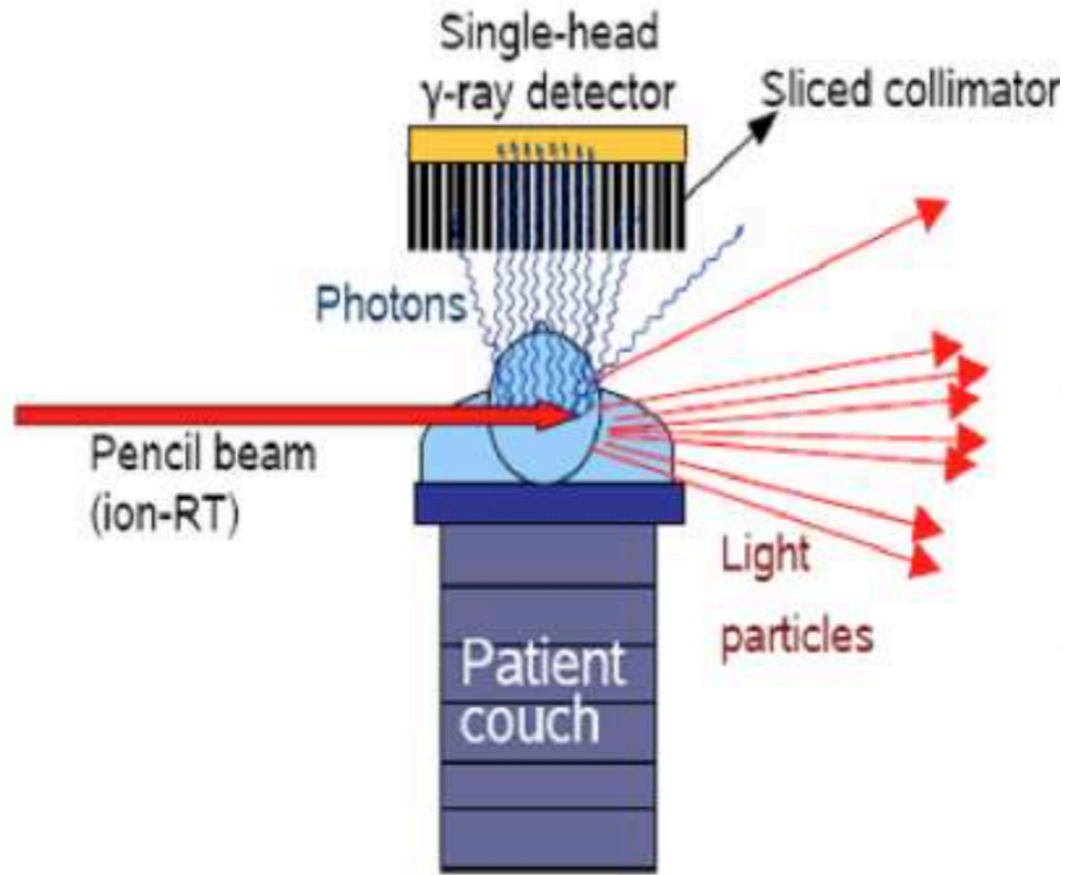
The ongoing projects are being finalised and no new funding opportunities for the next years were successful so far.

There is yet no funding secured for Hugo Simões, the researcher with larger FTE in the group for the last 4 months of 2024.

The investment of clinical sites in other IGRT (image-guided radiation therapy) techniques may makes investment in the three pursued techniques – OrthoCT, OPGI and TPPT - difficult for such sites, at least before the return on previous investment(s) is achieved.

OR Imaging: the concepts

OrthoCT and O-PGI:



TPPT:

