OR-Imag

1. OrthoCT (Orthogonal Computed Tomography for Megavoltage X-Ray Therapy)
2. OPGI (Orthogonal Prompt-Gamma Imaging for Proton Therapy)
   2.1 Coaxial detector for detection of forward particles for monitoring proton therapy
3. TPPT (In-Beam TOF-PET for Proton Therapy)
4. TMS (Deep and Whole-Brain Transcranial Magnetic Stimulation)

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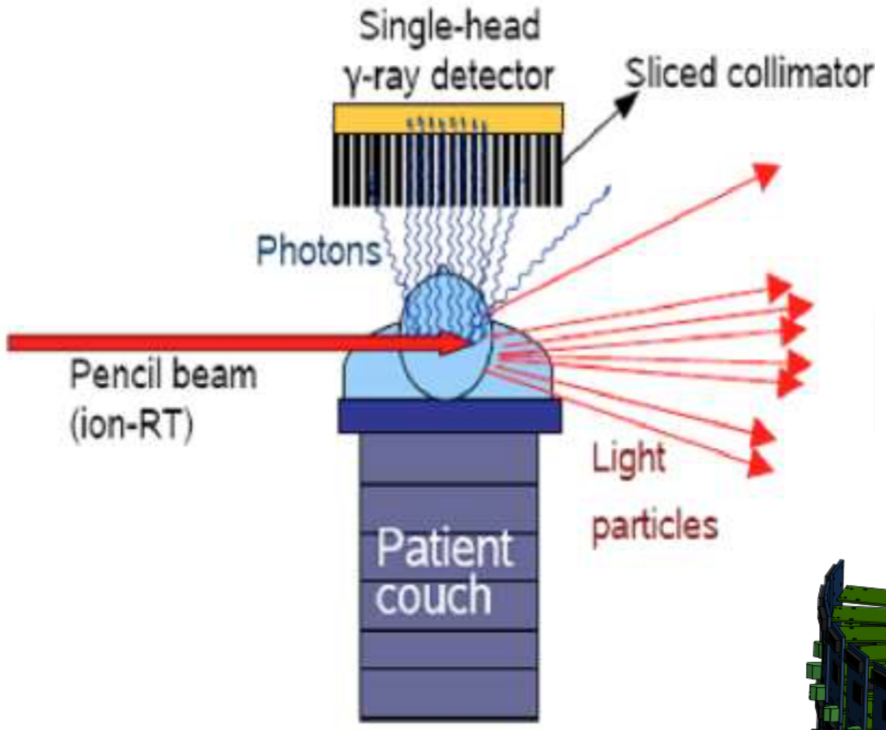
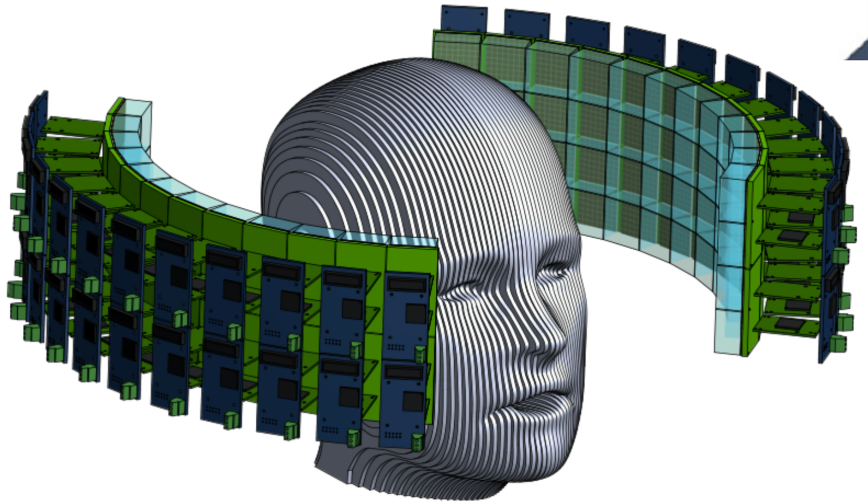
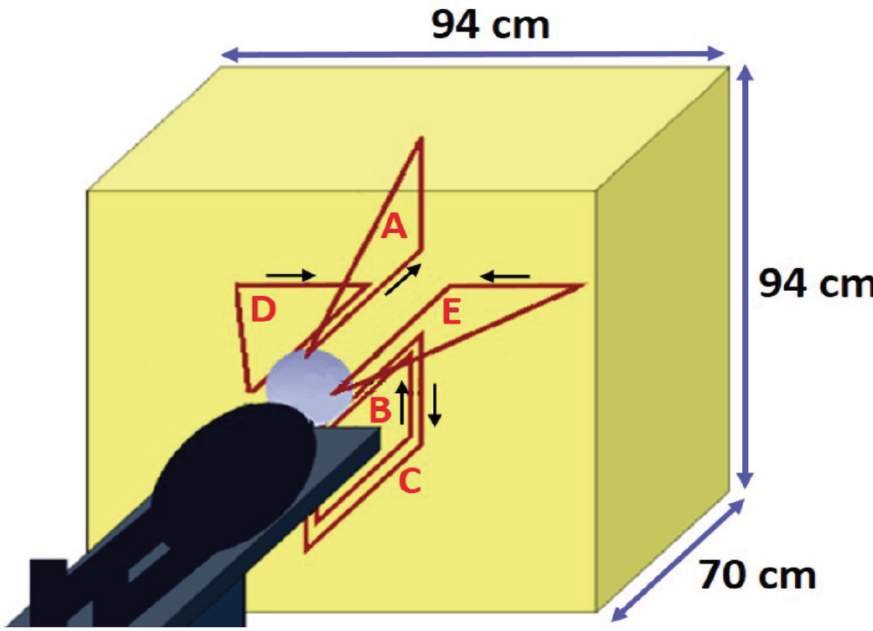
OR Imag: the concepts



OrthoCT and OPGI

TPPT





TMS

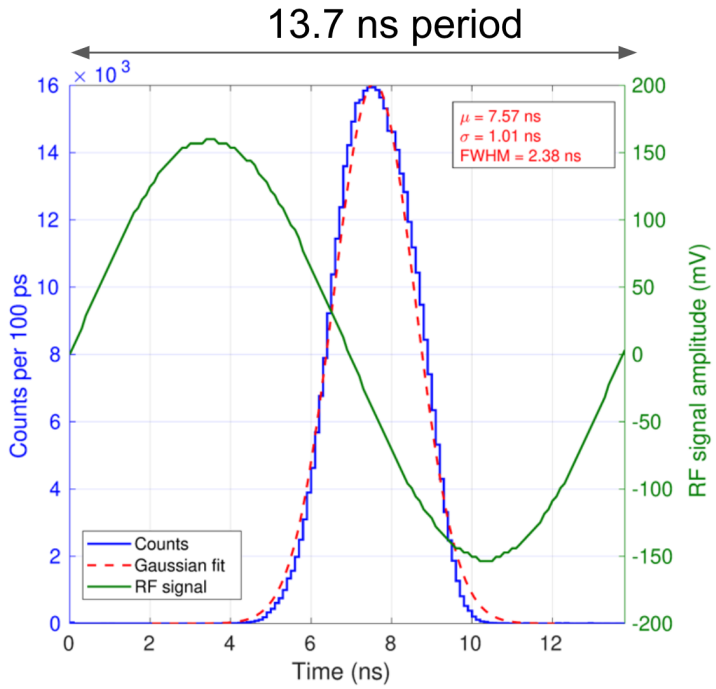
OR Imag: small-scale detector for OrthoCT and OPGI

Small-scale OPGI detector (3 scintillator slices, interleaved with 4 tungsten blades) already **tested in-beam** (proton therapy facility at HollandPTC, Delft, The Netherlands).

- Result: lack of shielding due to **contamination** of particles **from the beam window: inconclusive Bragg peak** profile.
- To be **repeated after new**, ongoing **Monte Carlo** is finished (including beam line and its **shielding**)

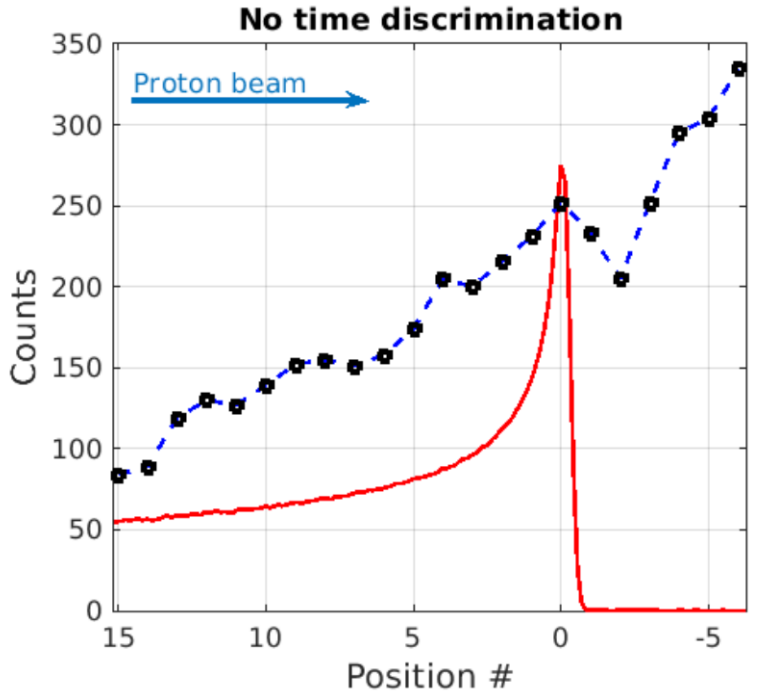
- Completed master/degree theses:

- Gegimma José, 2025
- Maria Coelho, 2025
- José Freitas, 2025
- David Mendes, 2025



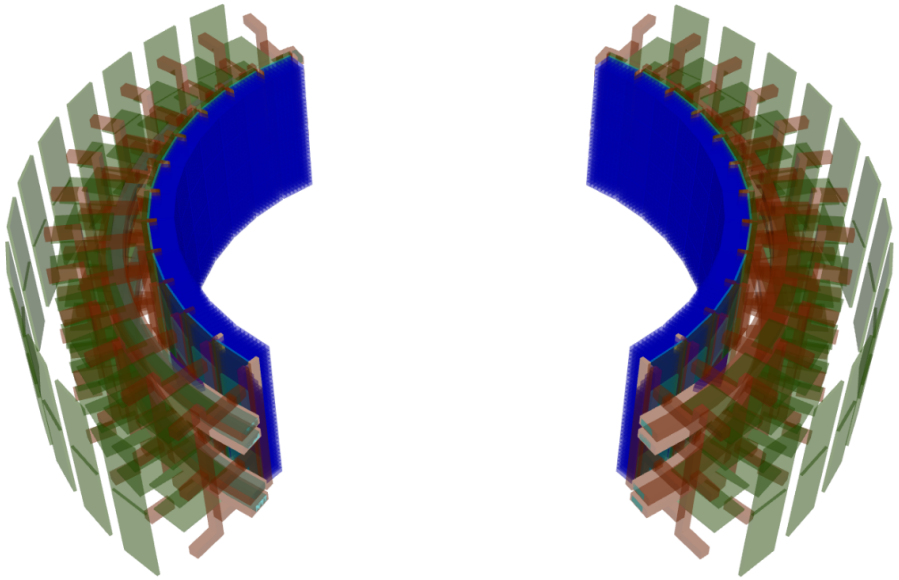
Bunch time spread: 2.38 ns FWHM

New information even for HollandPTC staff



OR Imag: TPPT

- **TPPT scanner constructed and tested at the MD Anderson Cancer Center (TX, USA)**
  - Characterisation results are being processed (paper to be submitted soon)
  - Our group is in charge of all Monte Carlo simulations
- **Ongoing activities (MC simulations):**
  - Design of an **in-beam PET / PGI** system based on TPPT scanner (startup company is involved)
  - Design of a **flat-panel PET** scanner
  - Optimization of **DoI reconstruction** + experimental validation
- Completed Master thesis:
  Marta Simões, 2025



Recent highlights:

- Geant4's UNIFIED model correction suggested:

A. Morozov JINST 20 **2025** P05021

- Ants3 official release:

A. Morozov et al, Comp Phys Comm 318 **2026** 109869

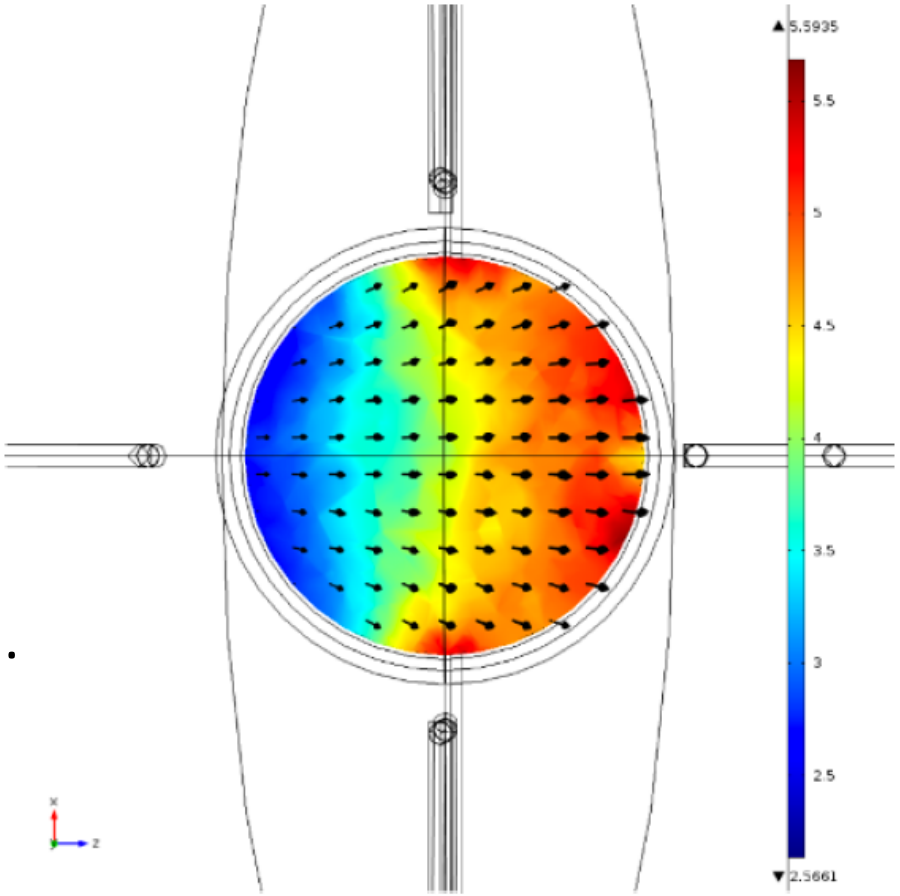
OR Imag: Deep- and Whole-Brain TMS

- **Transcranial magnetic stimulation (TMS)** with **first-time** achievement of **71% relative induction** at **brain center**, according to simulations with COMSOL Multiphysics AC/DC.

- Plethora of **applications in neurology** (paper to be published under internal revision). Team of epilepsy at Coimbra University Hospitals already contacted and acknowledged potential usefulness in their field.

- Exploratory project **funding applied**, aiming at the construction of an experimental demonstrator.

- Patent to be requested.



(a) Axial view: Max $\vec{J} = 5.59$ A/m^2. Min $\vec{J} = 2.57$ A/m^2.

OR Imaging: SWOT analysis

Strengths
- Deep understanding and practical knowledge of Monte Carlo simulation methods
- Strong expertise in simulations for health applications
- Well developed suit of custom software tools for simulation, optimization and data processing
- Access to the LIP workshop and detector lab for prototype development

Weaknesses
- Small team with little of the FTE of the senior staff allocated for research
- Lack of PhD students
- Absence of a Proton Therapy facility in Portugal or in close vicinity in Spain

Opportunities
- More than ten Charged Particle Therapy facilities to be constructed in Spain in the next 3 to 5 years (**patients 2027**)
- The first Proton Therapy center in Portugal (IPO-Porto) is under construction (**patients 2029**)
- Potential synergies to exploit with other LIP groups (e.g. RADART)

Threats
- Fixed time work contract of one of the key researchers
- Lack of consecutive funding