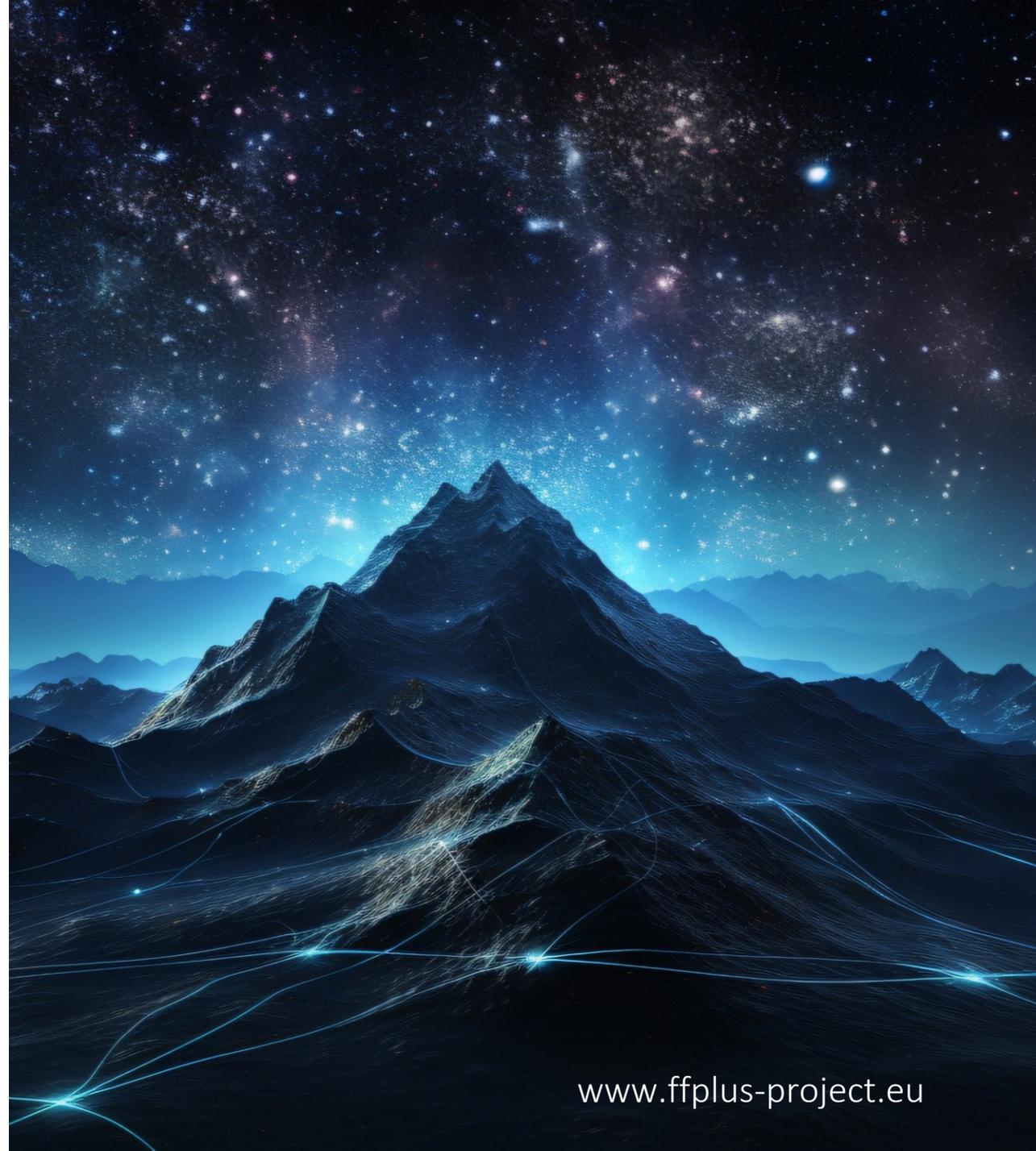# 1204 - ΔosimetrEYE:
A GenAI-based tool for 3D preclinical dosimetry from 2D dynamic imaging

Sub-projects' review – 12 February 2025 (online)

Panagiotis Papadimitroulas
Co-Founder & SW Advisor
BIOEMTECH

11 February 2026

Consortium & Roles

Panagiotis Papadimitroulas, BIOEMTECH

<u>Partners</u>

BIOEMTECH: End-user & Main Applicant
GRNET: HPC Expert (Greek NCC)
ALETHIA: XAI Expert

<u>BIOEMTECH Coordinator:</u> ***Dr. Panagiotis Papadimitroulas***
<u>Deputy coordinator:</u> ***Dr. Valentina Paneta***
<u>ALETHIA representative:</u> ***Dr. Neo Christopher Chung***
<u>GRNET representative:</u> ***Dr. Ilias Hatzakis***

<u>Roles & expertise required in the project:</u>
Technicians, Imaging Scientists, Bioinformatics, Physicists, SW Engineers, AI - MC experts

About BIOEMTECH

Panagiotis Papadimitroulas, BIOEMTECH

BIOEMTECH develops and offers innovative solutions in pharmaceutical and medical physics and biotechnology research

We focus on **molecular imaging, dosimetry & biomedical engineering**:

➢ Design and construction of screening imaging systems, the *eyesᵀᴹ*

➢ Preclinical CRO for testing new radiolabelled compounds

➢ Computational tools for medical imaging and dosimetry

Courtesy of BIOEMTECH
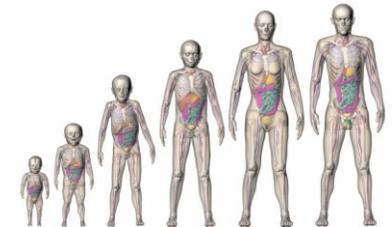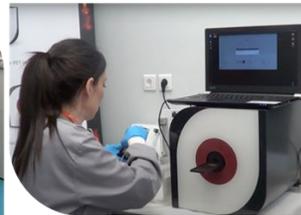
Business Problem
Panagiotis Papadimitroulas, BIOEMTECH

Annually **115 million animals** are sacrificed **in biomedical experiments**.
Small animal imaging and dosimetry prediction tools can enable the effective **reduction of over 80%** animal sacrifice and **drastically speed** up the assessment of drug delivery studies.

- **Dosimetry assessment** currently is based on **rough estimations.**

- **MC simulations** provide the ground truth but **are time consuming.**

- **Anatomical variations** are important in preclinical dosimetry and can lead to **significant lack of accuracy (appropriate for drug discovery).**

The goal is to utilize the ground truth dosimetry (MC simulations) with GenAI and HPC resources to develop a prediction tool for 3D dose assessment based on 2D preclinical imaging.

Solution Approach
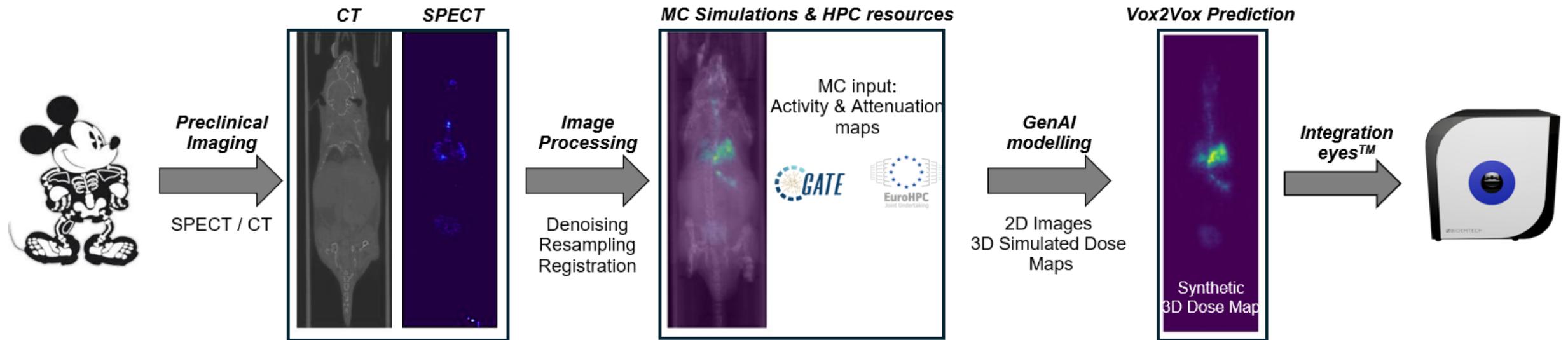
Panagiotis Papadimitroulas, BIOEMTECH

Our innovative approach is based on the deep knowledge of
MC simulations, image processing tools, GenAI algorithms and XAI methods.

To develop a prediction dosimetry SW tool for our imaging devices, we need to:

i. **Collect & harmonise imaging data** from different systems (3D SPECT/CT/2D planar).

ii. **Execute highly demanding MC simulations (HPC use)** with the use of pairs (SPECT/CT) to extract the 3D dose maps (dosimetry per organ).

iii. **Develop the final GenAI model to generate the 3D Dose Map (HPC use)**, providing as input the pairs 2D planar/3D dose maps.

iv. **Apply XAI methods** for analysing the parameters most contribute to the generation of the dose maps for increasing their robustness/trustworthiness.

Solution Approach - Methodology

Panagiotis Papadimitroulas, BIOEMTECH

HPC-Access
Panagiotis Papadimitroulas, BIOEMTECH

EuroHPC JU Access:
AI and Data-Intensive Applications

Project Duration:
Jan. 2025 – Jan. 2026

Resources allocation:
50000 node hours on Leonardo Booster (CINECA, Italy)

Usage:
Execution of both MC simulations & GenAI models
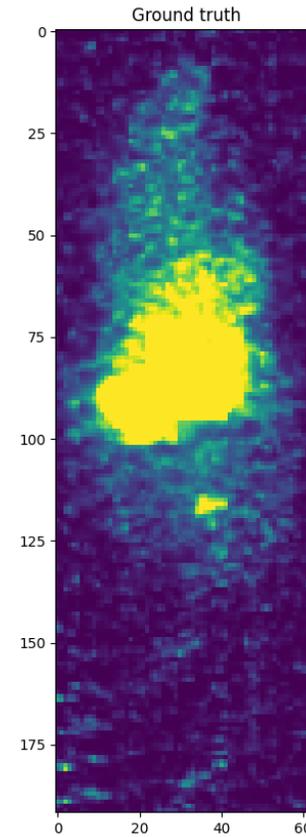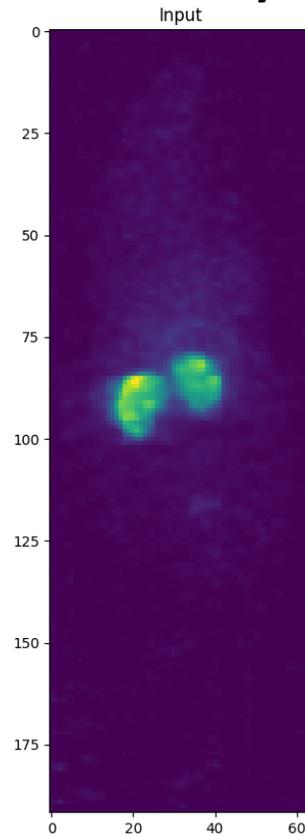
Main Achievements

Panagiotis Papadimitroulas, BIOEMTECH

- ✓ Creation of a comprehensive preclinical dosimetry database

- ✓ Development of the first GenAI-based model for 3D dose prediction

- ✓ Integration of Explainable AI and quality-control mechanisms

- ✓ Demonstration of HPC-enabled scalability and efficiency

- ✓ Establishment of a sustainable AI-driven business model for preclinical imaging

- ✓ Reduction of animal use and promotion of ethical research

- ✓ Active dissemination and international visibility

- ✓ Strengthened collaboration and capacity building among partners

Main Achievements – The Tool

Panagiotis Papadimitroulas, BIOEMTECH

Perform **GenAI Dosimetry** in parallel with **in vivo Imaging**!!!
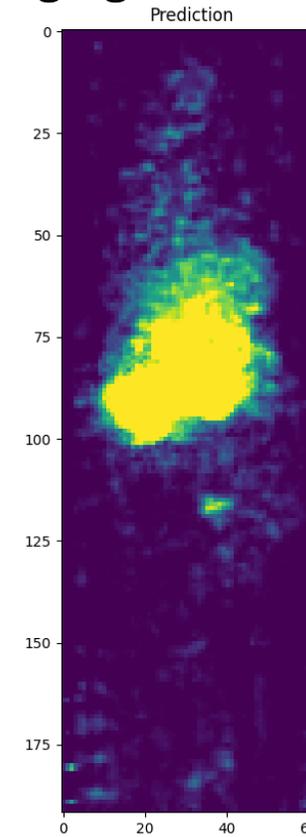
Main Achievements - Dissemination

Panagiotis Papadimitroulas, BIOEMTECH

- ✓ **3 Presentations** (invited talks)

- ✓ **3 International Conference** (oral/poster presentations)

- ✓ **1 Publication** (proceedings)

- ✓ **Social Media, Blog post, Interview by FFPlus**

- ✓ **1 Industrial Exhibition**

Business Impact

Panagiotis Papadimitroulas, BIOEMTECH

✓ **Product Innovation & Differentiation**:

Development of **δ-eye** for 3D preclinical dosimetry based on 2D imaging, significantly reduces animal models usage.

✓ **Commercial Expansion**:

The company's **product portfolio can now include AI-enhanced dosimetry**, appealing to pharmaceutical, CRO, and clinical customers worldwide.

✓ **Strategic Collaborations**:

HPC competency served as a magnet for **further collaborations and EU funding proposals**.

✓ **Efficiency & ROI:**

Faster simulation times and increased automation led to **reduced product development cycles**.

Simultaneous preclinical imaging and dosimetry **improves research throughput**, minimizing experimental time and cost.

A Polish start-up establishing its XAI platform (SaaS) on real healthcare use –cases.

Exploit their HPC expertise in industrial sector – real business case for NCC.

Business Impact - Benefit
Panagiotis Papadimitroulas, BIOEMTECH

The **GenAI dosimetry tool** reduces computation time from 5–10 hours per MC simulation to under 20 seconds, a >99% reduction in processing time. Expected to increase CRO service efficiency by up to 60%, shorten client delivery times by 3 times, and open new market opportunities. With an annual volume of ~200 dosimetry studies, this equates to **yearly savings of about 120k€ and an additional 200–250k€ of extra service revenue due to higher throughput**.

XAI & QC mechanisms make **DosimetrEYE** suitable for regulatory and industrial environments, strengthening customer confidence and aligning the product with EU AI Act requirements for transparency and accountability. The XAI tools are now ready for deployment in other regulated AI projects across healthcare and industrial applications. The expected licensing and consulting revenue is estimated **at 80–100k€ per year.**

Challenges

Panagiotis Papadimitroulas, BIOEMTECH

- **Collection of large experimental preclinical imaging data**.
  Retrospective data utilized.

- **Generalization to other radiopharmaceuticals**.
  Within the study GenAI dosimetry applied for In-111, while we aim to generalize the tool.

- **Time limitation for further optimization and evaluation.**
  Tool development and integration to the imaging devices for routine evaluation.

Outlook & Next Steps

Panagiotis Papadimitroulas, BIOEMTECH

✓ Generalization of the tool for multiple radioisotopes (Lu-177, Ga-68, F-18, Tc-99m, I-131)

✓ Fully integration of **DosimetrEYE** GenAI dosimetry model into ***eyes*™** preclinical imaging systems.

END-USERS: Preclinical imaging labs, CROs, pharma companies, and academic researchers performing radiopharmaceutical development or toxicity evaluation.

✓ Data inspection modules by **ALETHIA** will be further validated within **DosimetrEYE** pipeline.

✓ ***ALETHIA*** will continue enhancing its **Obz AI** platform by integrating XAI, interpretability features and outlier-detection modules, expanding their use in other healthcare and industrial AI applications

END-USERS: AI developers, regulators, and biomedical SMEs integrating AI tools under EU AI Act or ISO 27001 frameworks.

Thank you!

Panagiotis Papadimitroulas

Software Advisor & Co-Founder
BIOEMTECH
panpap@bioemtech.com
www.bioemtech.com

www.ffplus-project.eu