β-eye": A low cost, portable coincidence camera for whole-body mouse dynamic imaging

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Introduction

- "β-eye", is a dedicated planar coincidence camera suitable for *in vivo* molecular imaging of biomolecules and nanoparticles.
- β-eye is a unique benchtop system for whole-body mouse imaging. Its 5×10 cm^2 field-of-view (FOV) allows static and fast dynamic studies.
- β-eye is the only truly portable planar coincidence system, offered in a safe suitcase with all components and ready for immediate use.
- β-eye fulfil the gap between *ex vivo* biodistributions and advanced multimodal imaging systems.
- Have a full biodistribution dataset, for all time points post injection, non-invasively, using only one animal.
- Obtain whole body images easily, right from the first second post injection.
- Speed up ex-vivo biodistributions by imaging all organs in a single view.
- Provide semi-quantitative planar images of signficantly higher resolution, with no penetration depth limit at a much lower cost compared to optical imaging.
- Optimize imaging protocols.

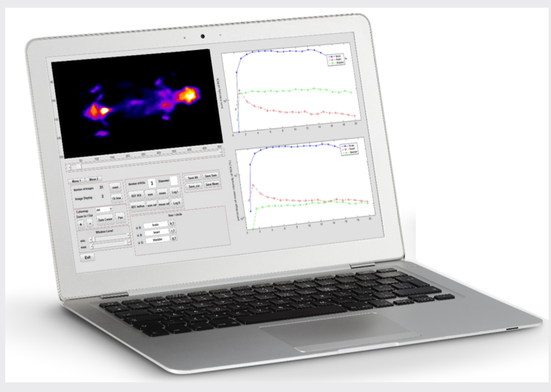
System's Characteristics

Hardware

- "β-eye" camera
  - Dimensions: $40(L) \times 35(W) \times 30(H)$ cm^3
- Scintillation detection: pixellated BGO
  - FOV: 5×10 cm^2
  - 22×44 elements
  - $2 \times 2 \times 5$ mm^3 pixel size and septa 0.25 mm
- Photodetection: H12700A PSPMTs (Hamamatsu, Japan)
  - 1×2 arrangement - 5×10 cm^2 FOV
- Number of detectors: 2
  - Separation distance: 6 cm
- FPGA electronics for data acquisition and processing
- Standard laptop

Software

- Fully comprehensive, user-friendly software
  - Real-time imaging
  - Database archive
  - Post-processing analysis
  - Reporting tool
  - DICOM export format



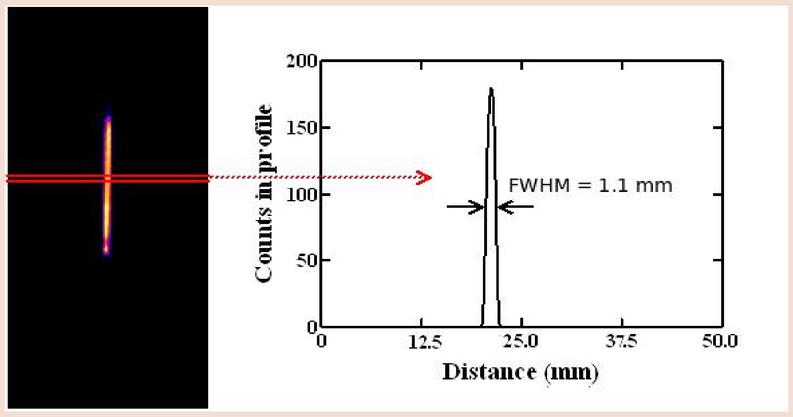
Packaging The system is delivered in a portable suitcase where all components are stored (mouse beds, phantoms, cables, laptop, power supply). The suitcase is safe for transportation by all means (airplane, bus, train) considered as standard luggage.

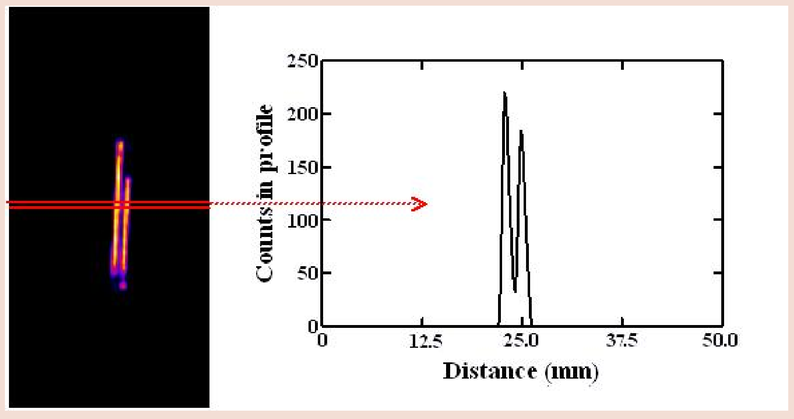
System's Performance

Table 1: Performance parameters

PARAMETER	350-700keV energy window
Spatial resolution	1.1 mm (CFOV)
Energy resolution	17 % @511 keV
System sensitivity	14 kcps/MBq
Timing resolution	2.2 nsec

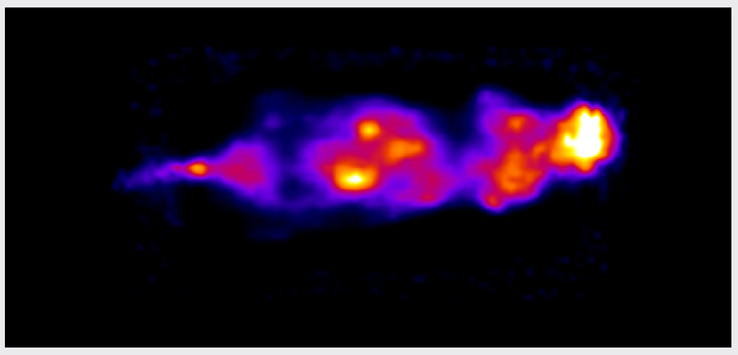
Capillary (60 mm long, 0.6 mm diameter) filled with FDG 2 capillaries filled with FDG; Separation distance: 3 mm



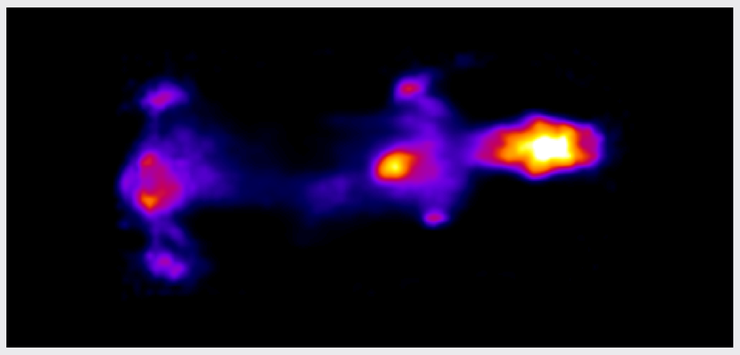


Animal imaging

Mouse injected with 30 uCi FDG; 10 min post injection image



Mouse injected with 30 uCi FDG; 1 hour post injection image



Why "β-eye" is the right choise

Technology

- Low-cost benchtop system
- Easy versatile transportation
- Robust technology
- Semi-quantitative information
- Long-term operational system
- No special room requirements
- No need for technical staff
- User friendly software

Applications

- Whole-body dynamic studies
- Fast screening of promising biomolecules before detailed studies
- Dynamic studies for determining best biodistribution time-points
- Quality control imaging prior to *ex vivo* biodistributions
- Quality control pre-screening before multimodal imaging

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