



REal Time Image REconstruction for 3- γ Xenon camera

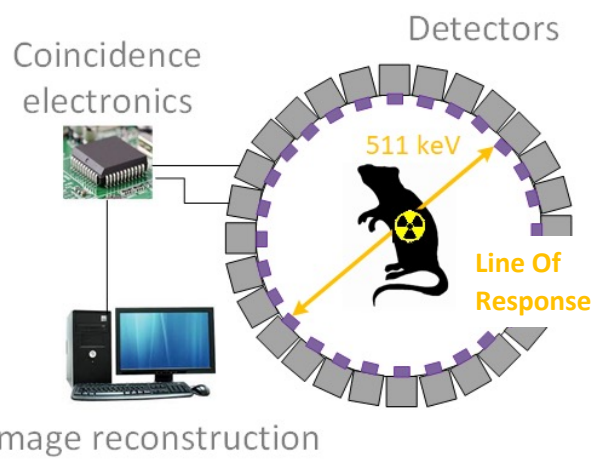
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Nuclear medical imaging context

- Main tool: Positron Emission Tomography (PET)
- Injection of **radioactive tracer** ^{18}F (fluorooxyglucose).
- Nuclear disintegrations create 511keV back-to-back gamma photons detected by **scintillation**.
- Push to **reduce injected dose** of radiotracer
- Image quality = f(injected dose, duration)



Improvements in PET scan

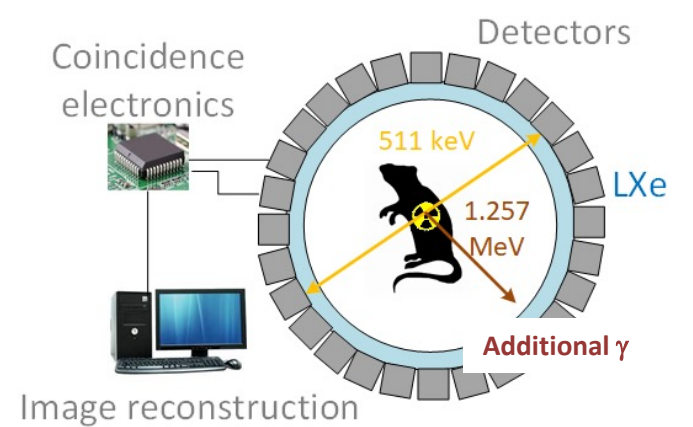
- Photon Time-of-Flight (TOF).
- Rare earth LYSO crystal as scintillator coupled with SiPMs.
- **High time resolution** (100s of ps)
- Long axial field of view (**LAFOV**) systems to increase sensitivity .
- **Power hungry**
- Cost: **more than 4x traditional PET**
- Huge amount of data: **not real-time**

Not compatible with routine clinical usage

New imaging tool: 3- γ Xenon camera by

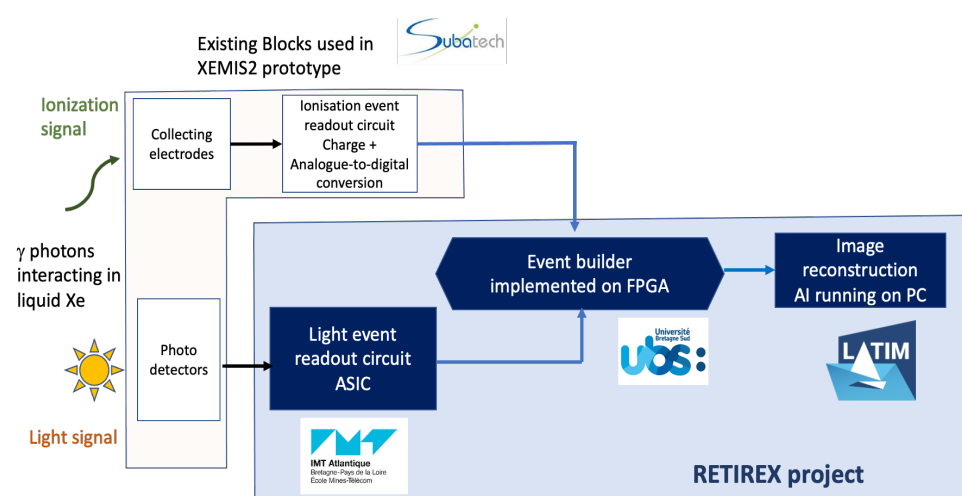
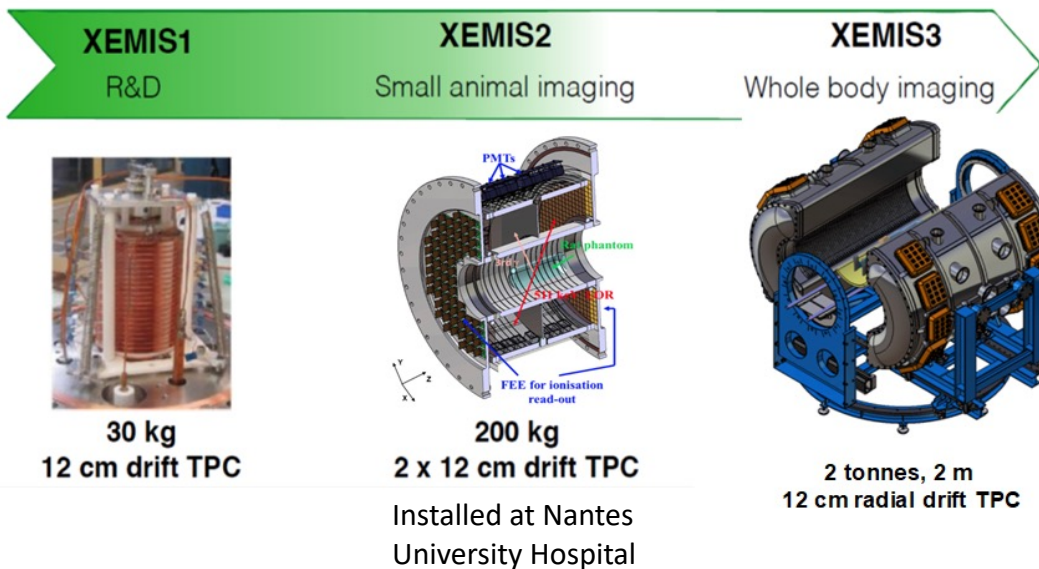


- Use of a (β^+ , γ) emitter, e.g. Scandium 44 (^{44}Sc).
- **3 γ photons = Additional spatial information**
- **Fewer disintegration needed**
- Scintillator: **liquid Xenon (LXe)**.
- **Reduce the injected radiotracer dose**
- **Reduce acquisition times**
- **Localise accurately the disintegration**
- **Achieve real-time dynamic quantitative imaging**



RETIREX: from XEMIS2 prototype to XEMIS3 prototype

RETIREX works



Light-read out circuit

Event builder

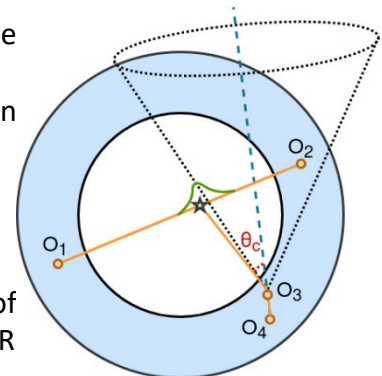
Image reconstruction

- Charge on PMT = f(light received)
- Improving charge reconstruction : MTOT

- Exploring optimized sorting network architecture for synchronisation of light and charge events
- Creation of the alpha version of a synthesis tool for automatic generation of the Event Builder architecture

$O_{1,2}$: photons of the annihilation process
 $O_{3,4}$: γ interactions in the detector.

Origine = intersection of Compton cone and LOR



- Determining origine (Gaussian).
- Determining photon interaction sequence.

Use artificial intelligence

