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# PACE Discussion



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Ph.D.  
24/10/2022

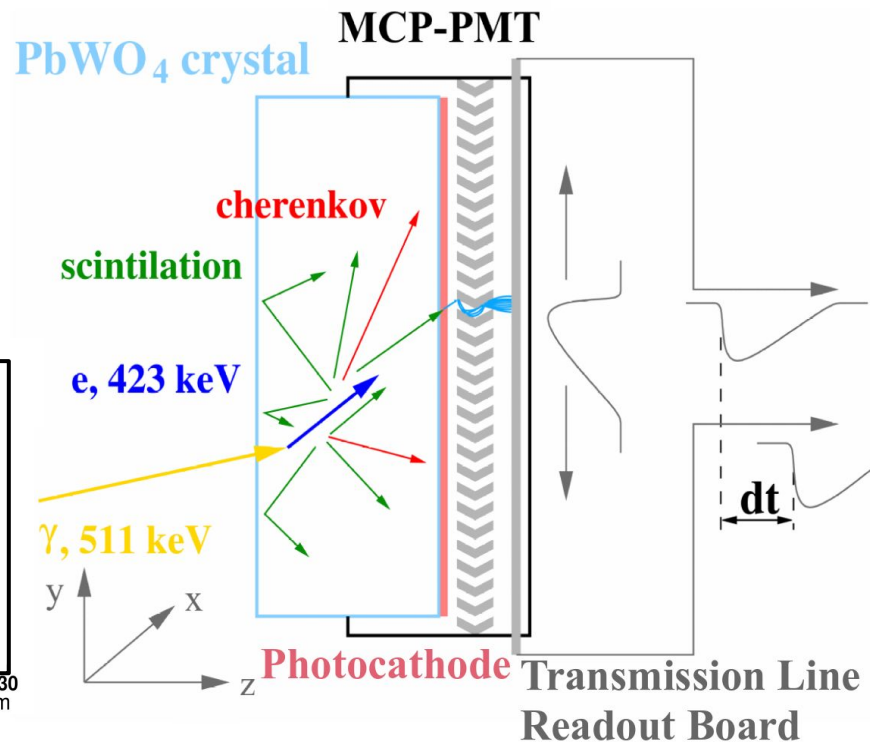
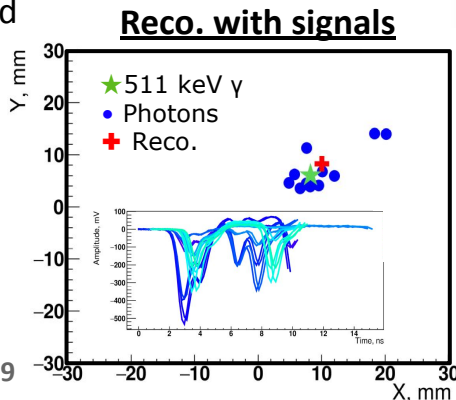
- Ph.D. work
- Post-doc proposal

## Objectives:

- Fast detector for TOF-PET:
  - Coincidence time resolution: **<100 ps** (FWHM)
  - 511-keV  $\gamma$ -ray interaction 3D resolution: **a few mm**

### Detect efficiently **Cherenkov** and scintillation lights

- Detector with **monolithic, large surface,  $\text{PbWO}_4$**  crystal as the optical window of the **MCP-PMT**
- **Direct deposition** of the photocathode
- **Transmission line** readout board
- **SAMPIC** digitization module



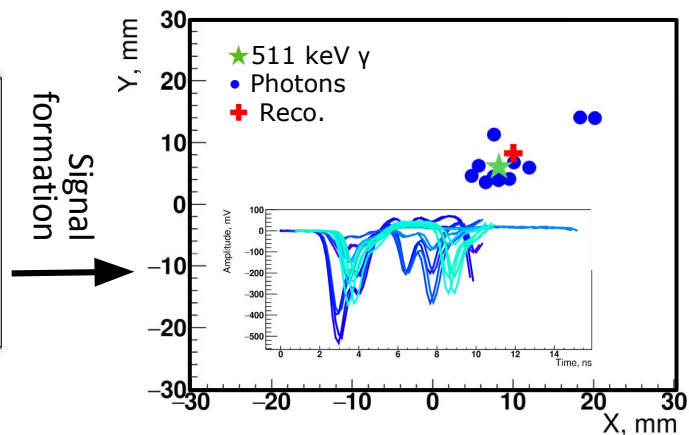
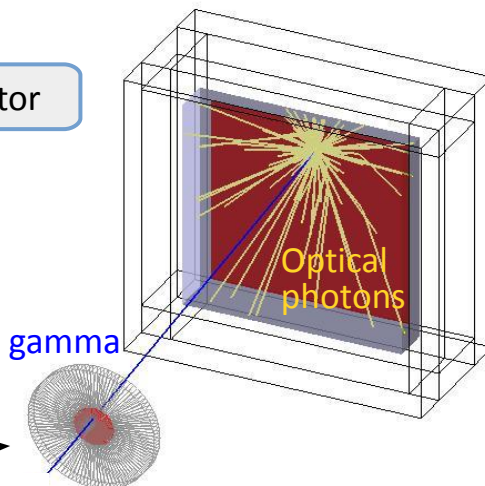
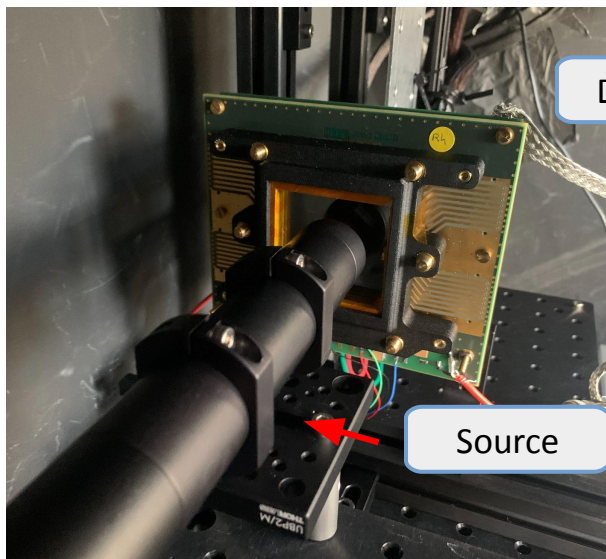
– D. Yvon *et al.*, 2020, JINST 15 P07029

– M. Follin *et al.*, 2021, NIM A, 1027, p. 166092

Measurement

Simulation

AI Event Reconstruction



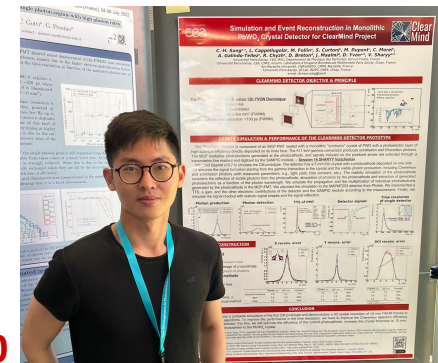
Sung et al. (2022) arxiv:2209.11587  
[physics.ins-det]

## Publication

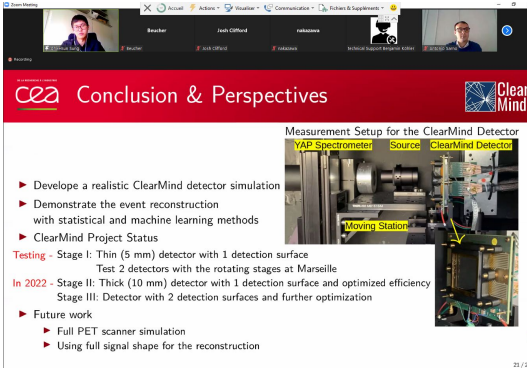
- "Detailed simulation for the ClearMind prototype detection module and event reconstruction using artificial intelligence", (Submitted to Nuclear Instruments and Methods in Physics Research, Section A), 2022, <https://doi.org/10.48550/arXiv.2209.11587>.

## Conferences

- "Machine Learning Algorithms for the Gamma Conversion Reconstruction in the ClearMind Project", IN2P3/IRFU Machine Learning Workshop 2022, Paris, September, 2022.
- "Geant4 Simulation for the ClearMind Project and Reconstruction of the Gamma Conversion", NDIP, Troyes, July, 2022.
- "Geant4 Simulation for the ClearMind Project and Reconstruction of the Gamma Conversion", The 9th French-Ukrainian workshop on the instrumentation developments for HEP, Orsay, October, 2021.
- "Geant4 Simulation for the ClearMind Project and Reconstruction of the Gamma Conversion", 2021 VIRTUAL IEEE NUCLEAR SCIENCE SYMPOSIUM AND MEDICAL IMAGING CONFERENCE 28th International Symposium on Room-Temperature Semiconductor Detectors, October 2021



**NDIP2020**



**Conclusion & Perspectives**

Measurement Setup for the ClearMind Detector

YAP Spectrometer Source ClearMind Detector

Moving Stations

- Develop a realistic ClearMind detector simulation
- Demonstrate the event reconstruction with statistical and machine learning methods
- ClearMind Project Status

Testing - Stage I: Thin (5 mm) detector with 1 detection surface  
Test 2 detectors with the rotating stages at Marseille

In 2022 - Stage II: Thick (10 mm) detector with 1 detection surface and optimized efficiency  
Stage III: Detector with 2 detection surfaces and further optimization

- Future work
  - Full PET scanner simulation
  - Using full signal shape for the reconstruction

**IEEE2021**

## Lab visit to EPFL (Switzerland)

Professor: Edoardo Charbon

Host researcher: Emanuele Ripiccini

Topic: Innovative SiPM/SPAD development for high resolution medical imaging.

Aim: 10 ps time resolution photon detector development.

The EPFL logo is rendered in a bold, red, sans-serif font. The letters are blocky and closely spaced, with the 'E' and 'P' being particularly prominent.