

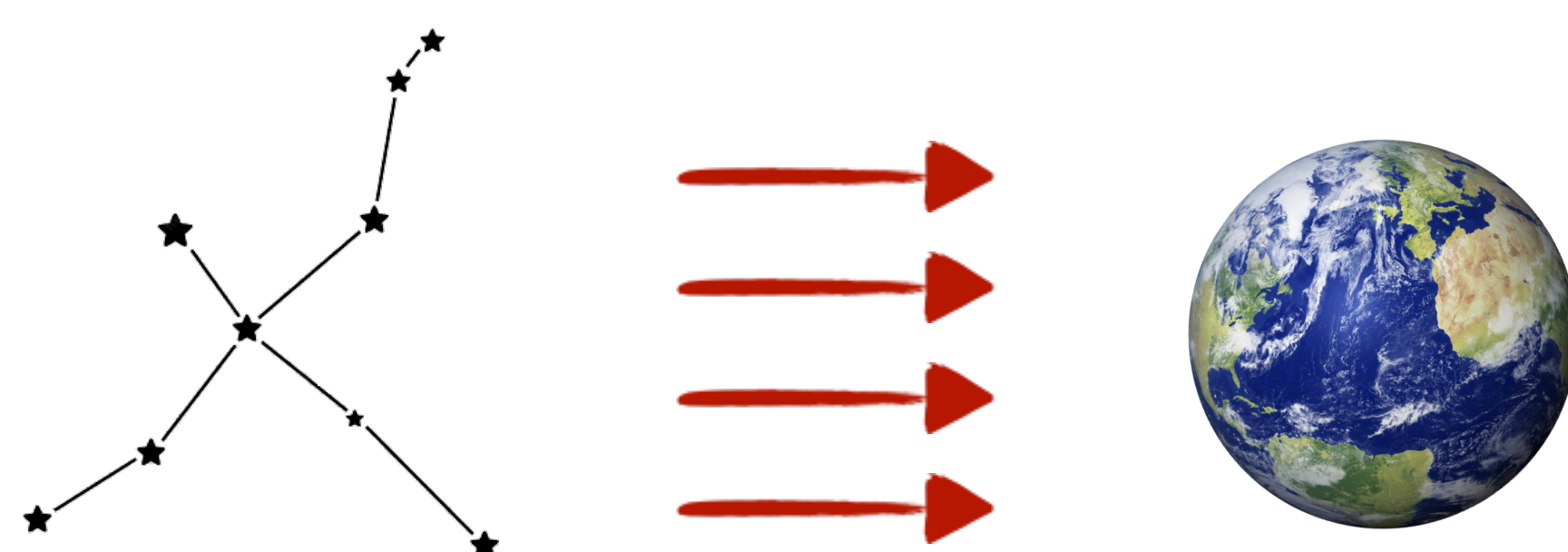


The CYGNO experiment

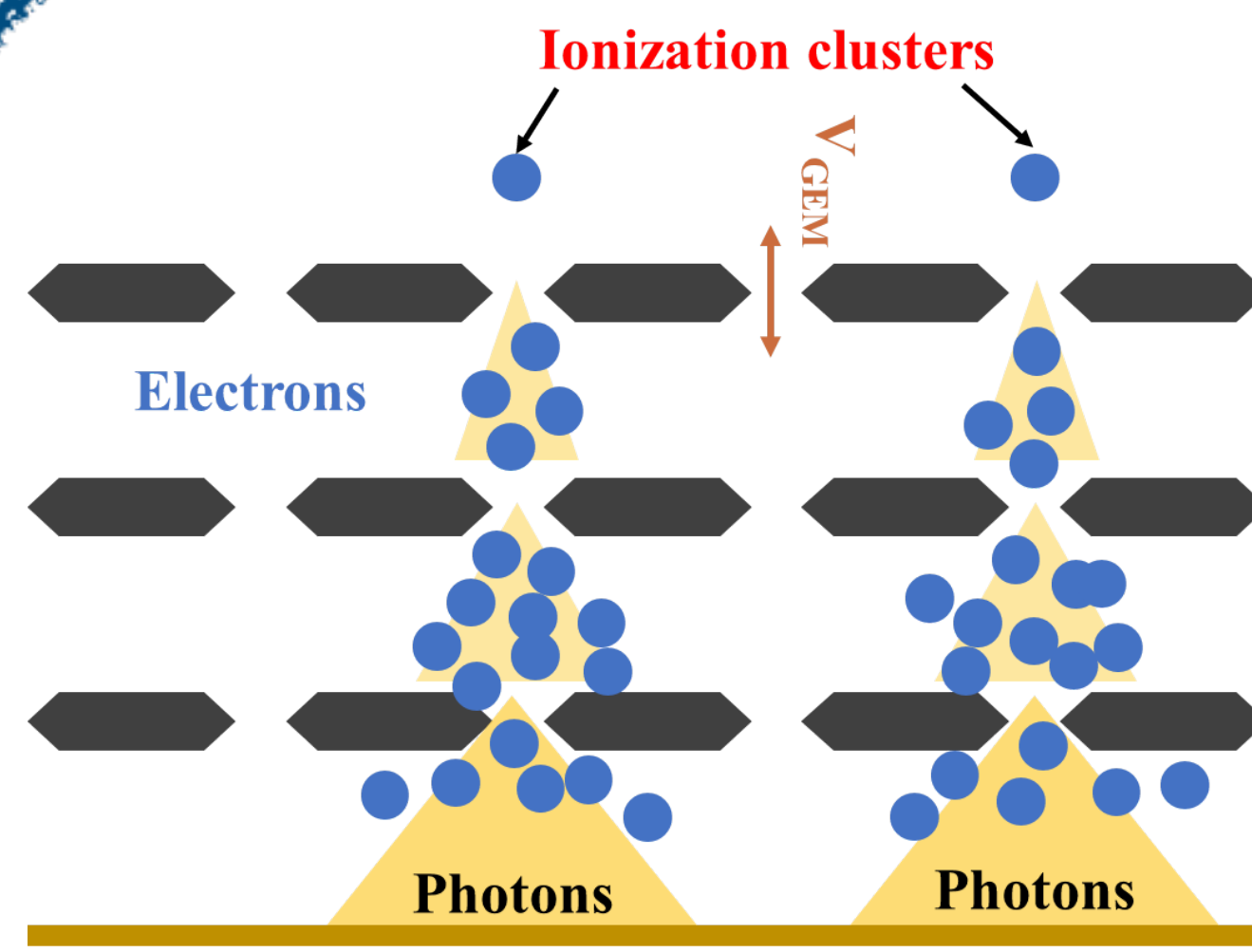
F. D. Amaro, R. Antonietti, E. Baracchini, L. Benussi, S. Bianco, F. Borra, R. Campagnola, C. Capoccia, M. Caponero, D. S. Cardoso, L. Carvalho, G. Cavoto, I. A. Costa, E. Dané, M. D'Astolfo, G. Dho, F. Di Giambattista, E. Di Marco, G. D'Imperio, J. M. F. dos Santos, R. R. M. Gregorio, D. Fiorina, M. Folcarelli, F. Iacoangeli, E. Kemp, H. P. Lima Júnior, G. Maccarrone, R. D. P. Mano, D. J. G. Marques, G. Mazzitelli, A. G. McLean, P. Meloni, A. Messina, C. M. B. Monteiro, R. A. Nobrega, I. F. Pains, E. Paoletti, L. Passamonti, F. Petrucci, S. Piacentini, D. Piccolo, D. Pierluigi, D. Pinci, A. Prajapati, F. Renga, R. C. Roque, F. Rosatelli, A. Russo, G. Saviano, P. A. O. C. Silva, N. J. C. Spooner, R. Tesauo, S. Tomassini, S. Torelli and D. Tozzi

A TPC for directional DM searches

- The CYGNO project aims for a large detector for high precision **3D tracking of low energy (1-100 keV) nuclear recoils** from rare interactions (such as WIMPs);
- A detector with **directional capabilities** will be **crucial for a positive identification** of a **Dark Matter** signal;
- **Optical readout** of a gaseous TPC with a **He:CF₄** based gas mixture operated at **atmospheric pressure**;
 - Low energy events \longrightarrow visible tracks.
 - He and F \longrightarrow sensitive to GeV DM and both spin-dependent and -independent interactions.

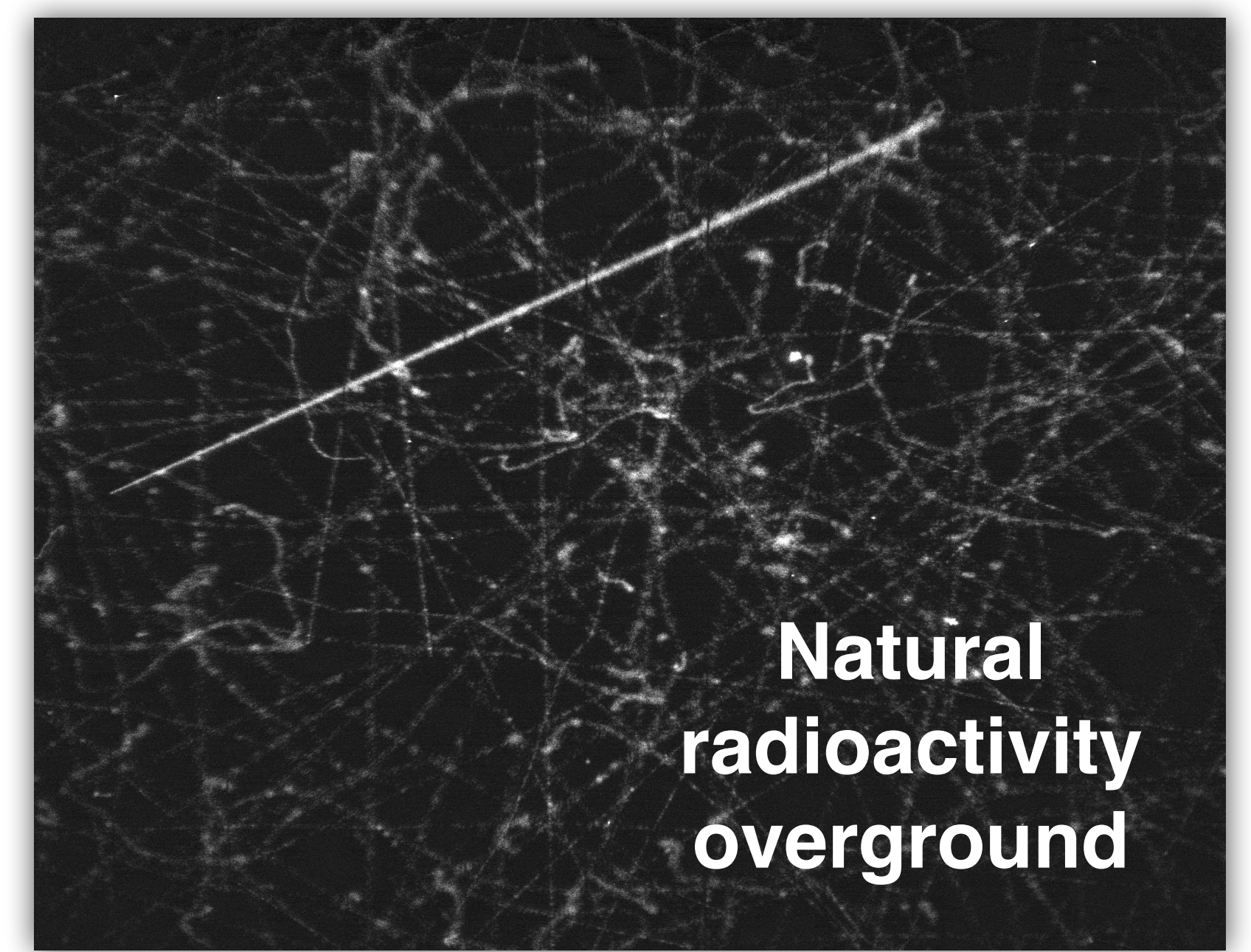
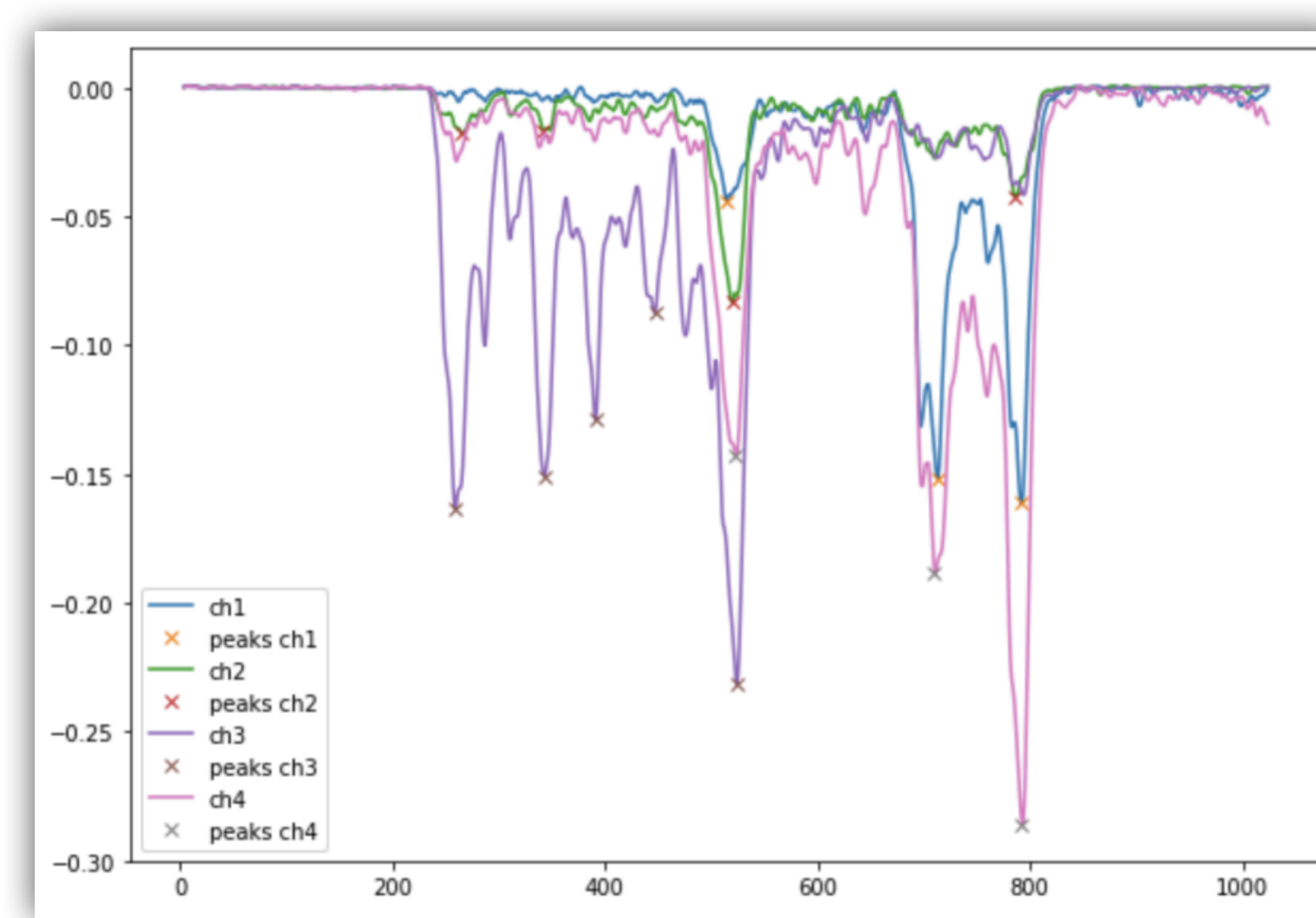


The optical readout



In the **avalanche processes CF₃*** created by electron dissociation and its de-excitation results in **light**
sCMOS camera: single photon detection; high granularity and **XY reconstruction**

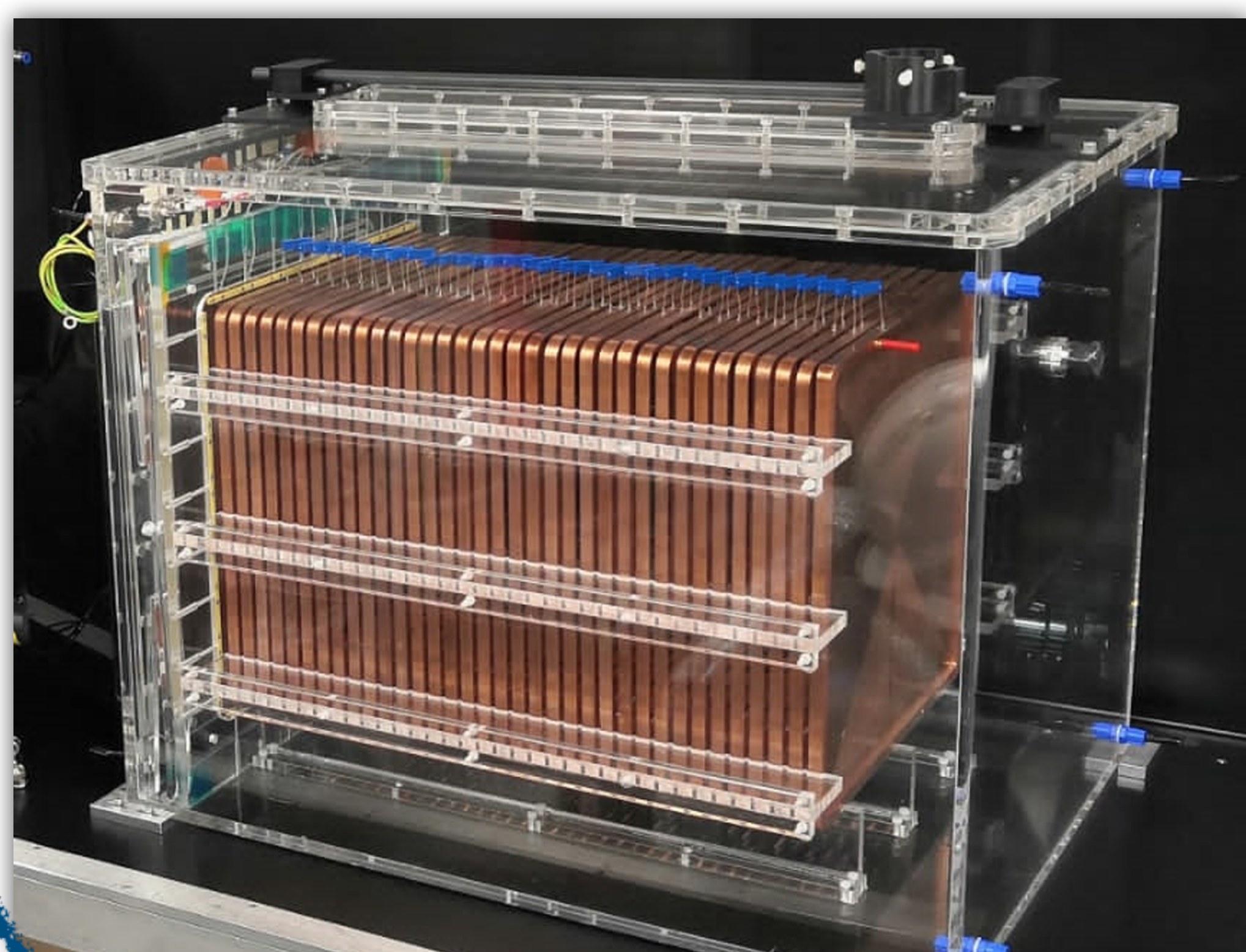
PMT provide **Z development**



The **combination** of information allows a **3D reconstruction**

The CYGNO present

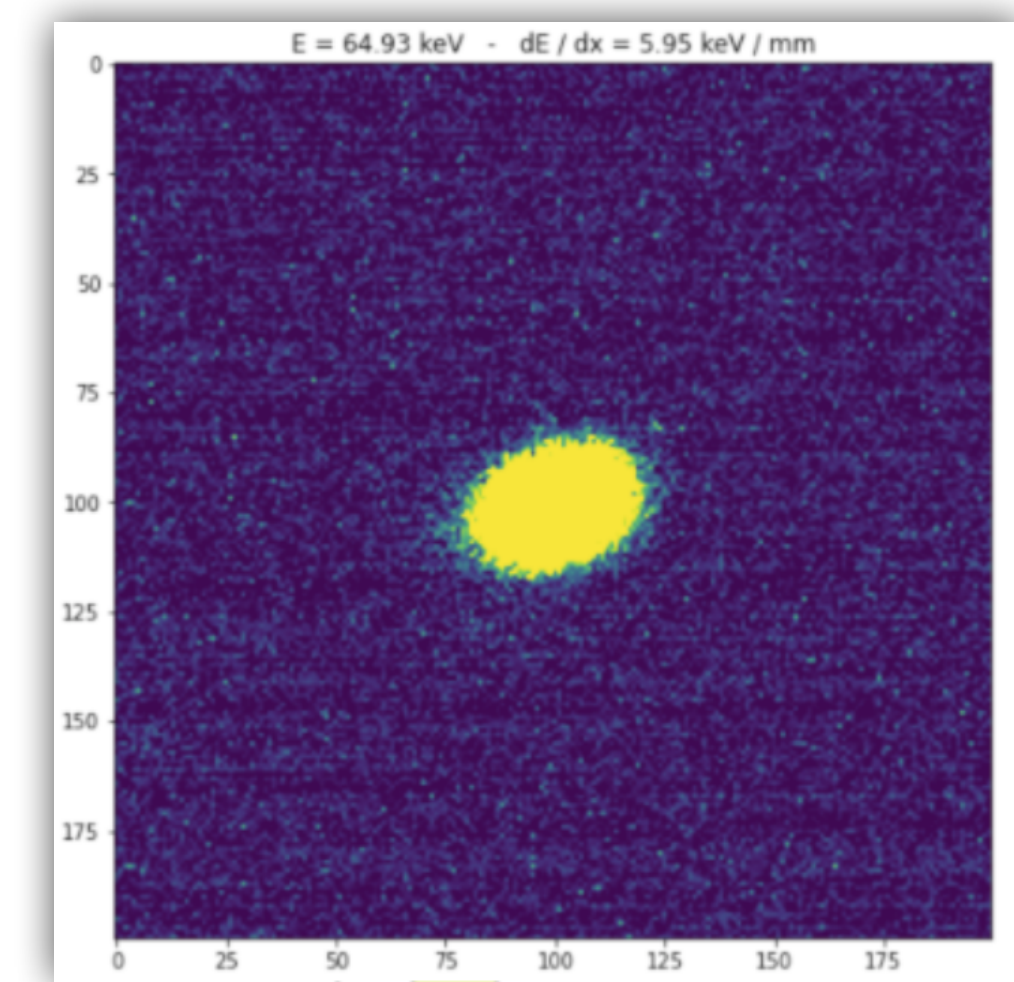
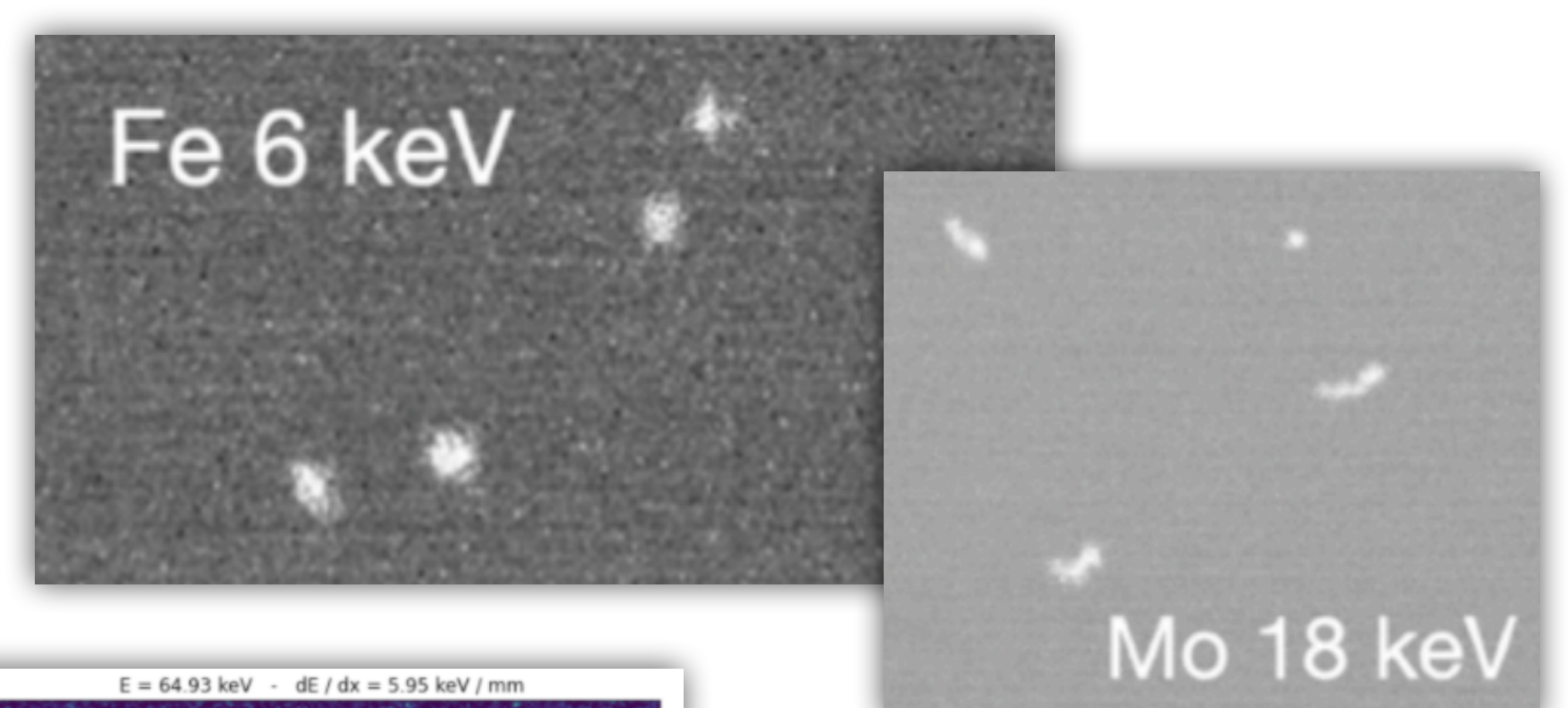
LIME
 50 litres of sensitive volume



- 50 cm drift
- 33x33 cm² GEM
- Copper ring field cage
- 1 sCMOS sensor + 4 PMTs

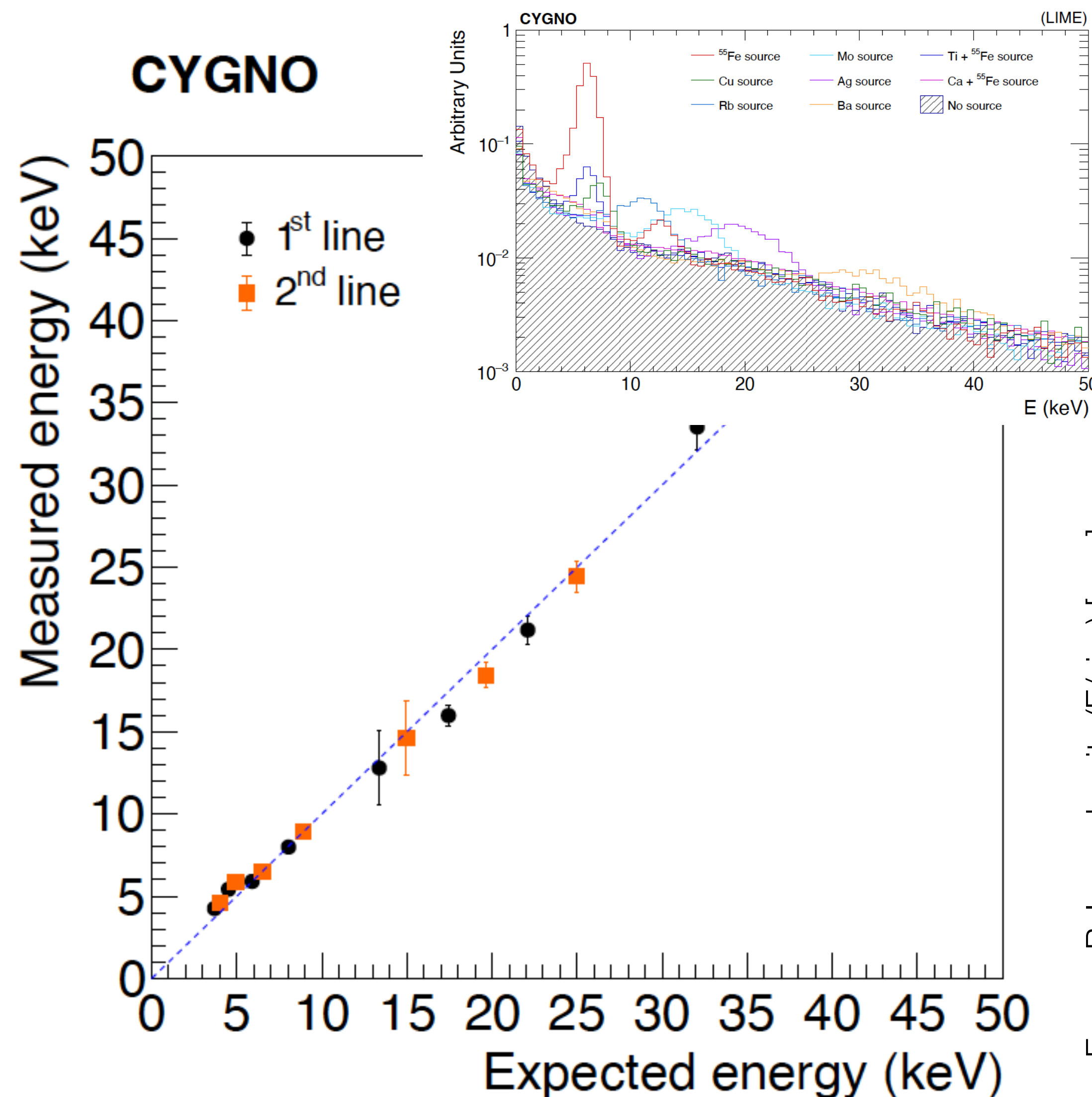
Electronic recoils (ER): produced in gas by photon interactions

Nuclear recoils (NR): induced by neutrons, neutrinos and WIMPs



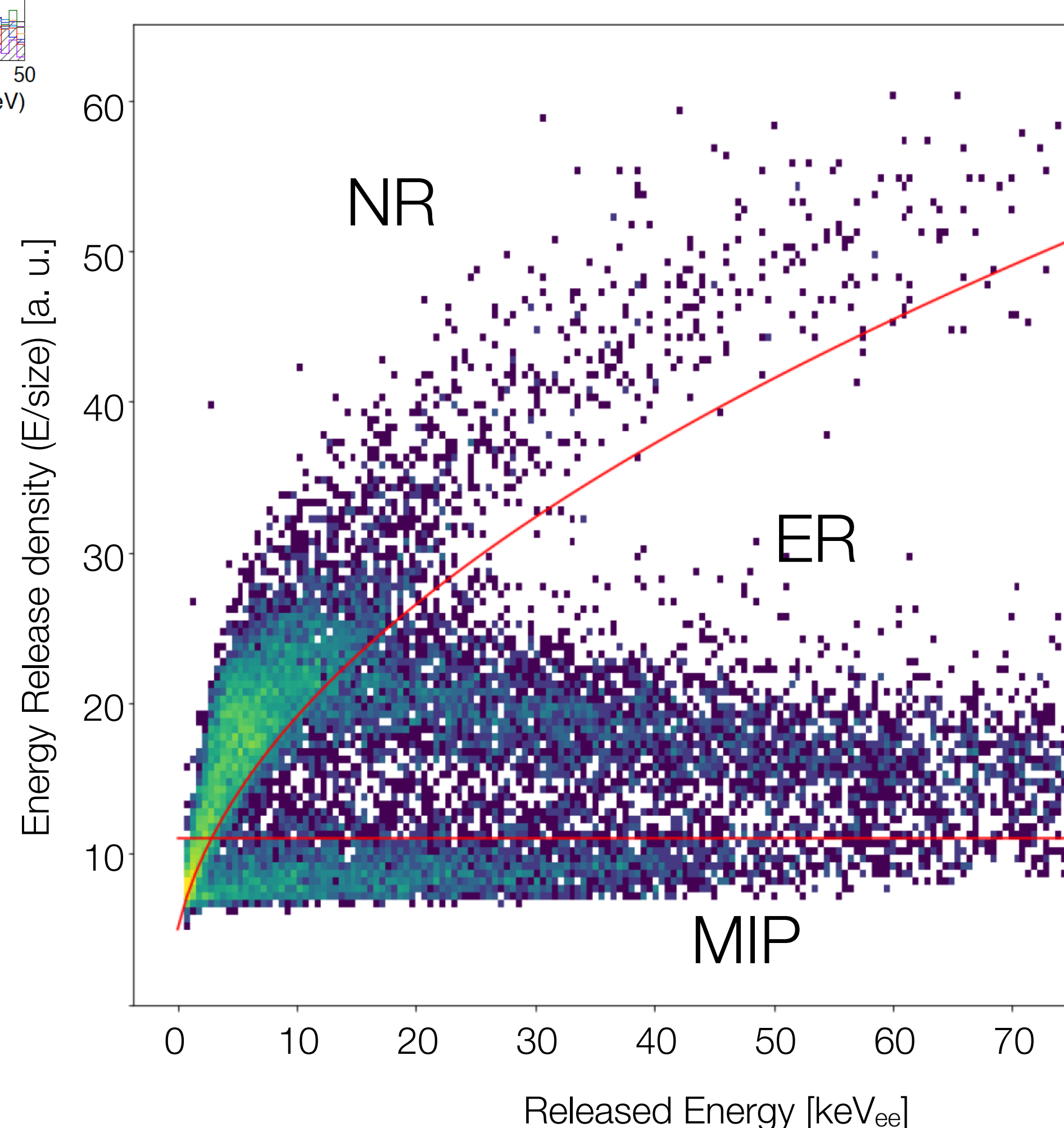
Light density and track shape strongly depend on the **particle energy and identity**

Optical readout performance



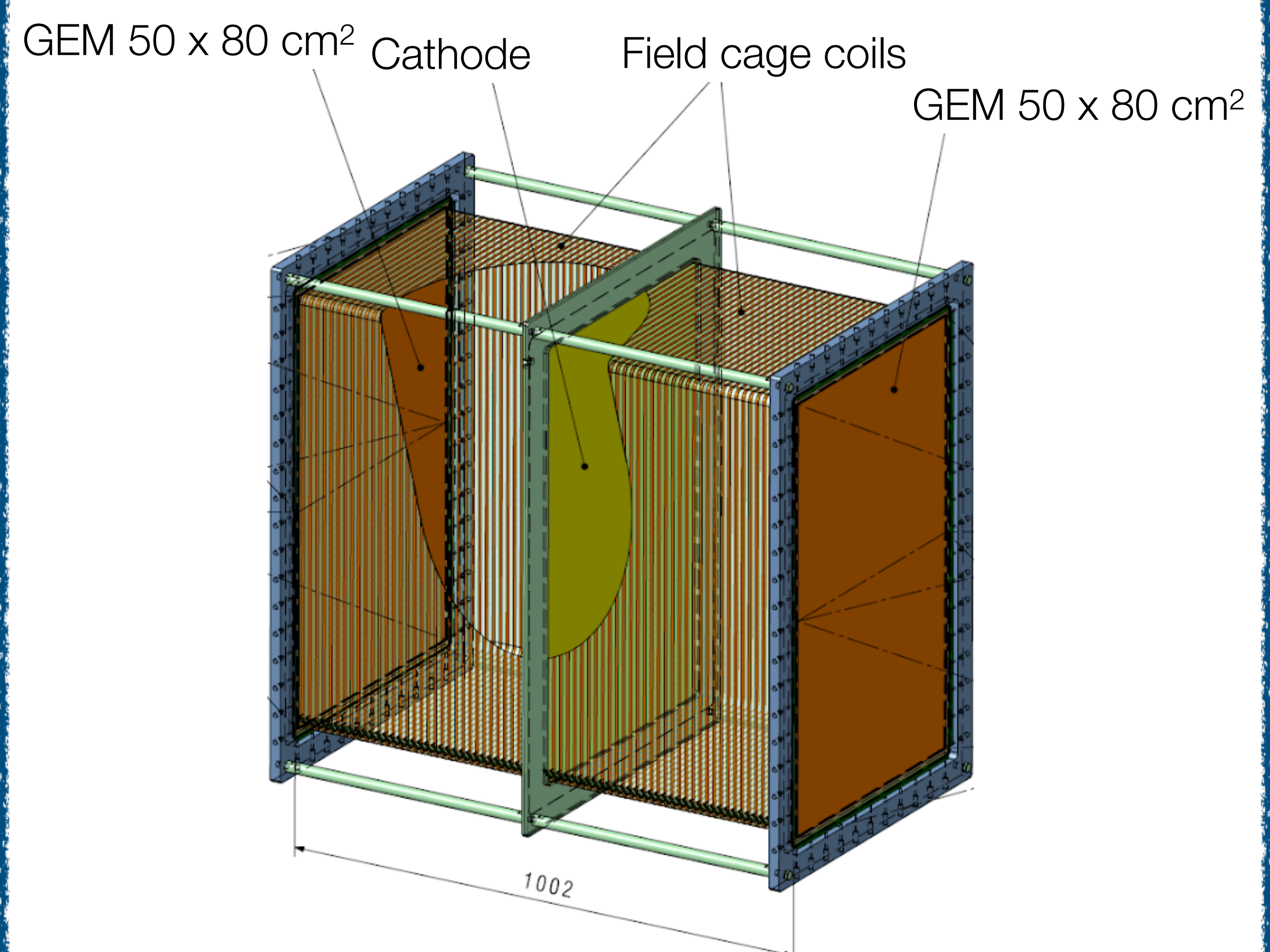
Electron Recoils (ER): good response **linearity** found in the 4-40 keV range

Nuclear Recoils: by means of the energy release density (E/size) it is possible to separate the NR from the ER and MIP tracks



The CYGNO future

CYGNO_04: 0.4 m³ demonstrator to be operative at LNGS in 2025 - 2027



CYGNO_30: O(30 - 100 m³) detector for directional DM searches in the \sim GeV/c² mass region.