

Cosmic rays contaminants on data streams of bolometers for the QUBIC instrument

Annual Meeting of DDAp/DDEIT and HIRSAP 2025

Lic. Iván Queirolo

Instituto Sábato, UNSAM / Sapienza, Università di Roma

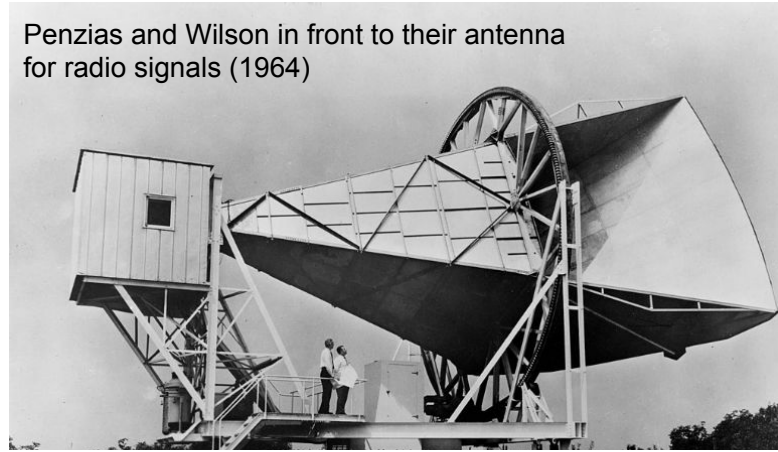
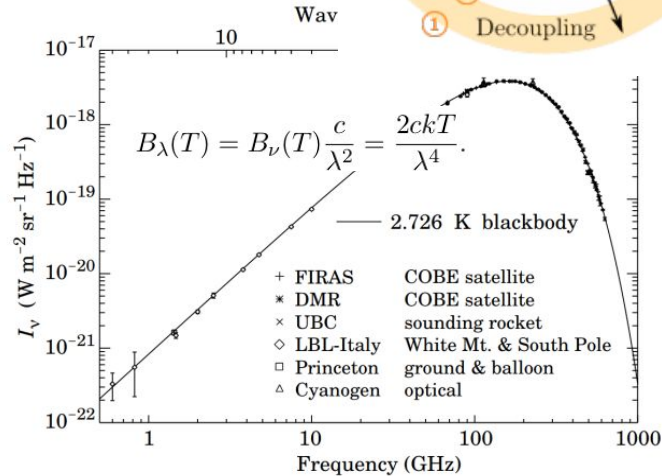
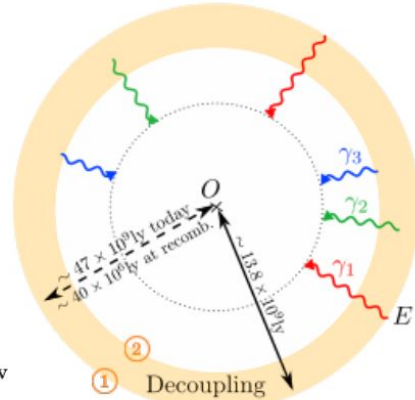
Dir.: Dr. Diego Gabriel Melo

Instituto en Tecnologías de detección de astropartículas (ITeDA), CNEA

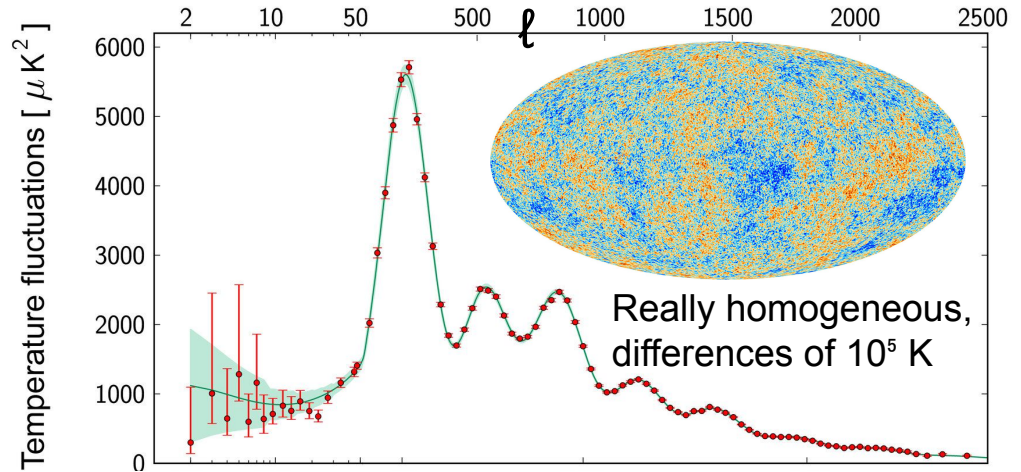


ITeDA

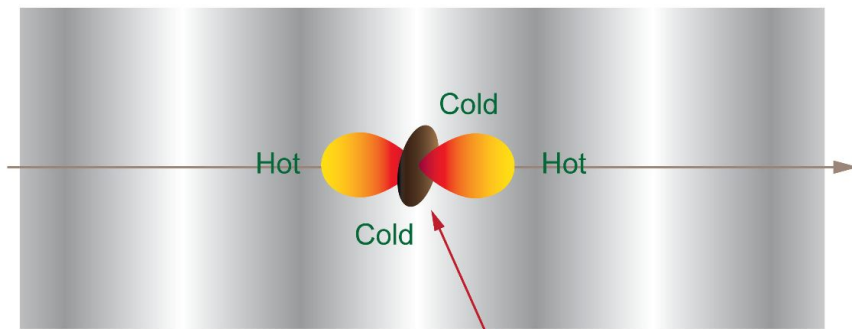
Big bang model and CMB



Penzias and Wilson in front to their antenna for radio signals (1964)

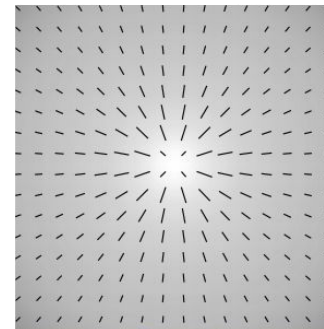
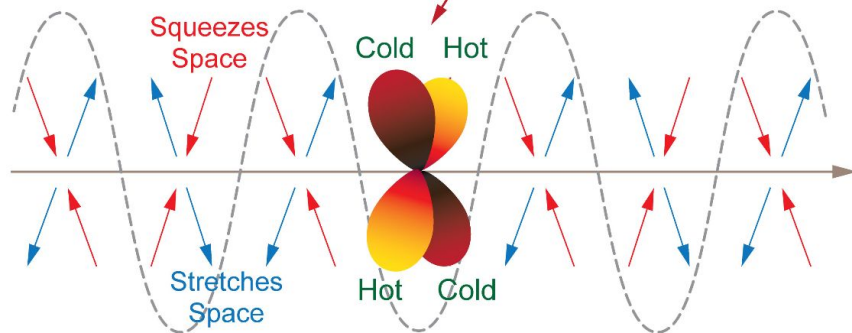


Density Wave



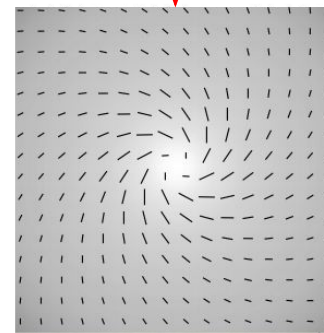
<http://bicepkeck.org/visuals.html>

Gravitational Wave



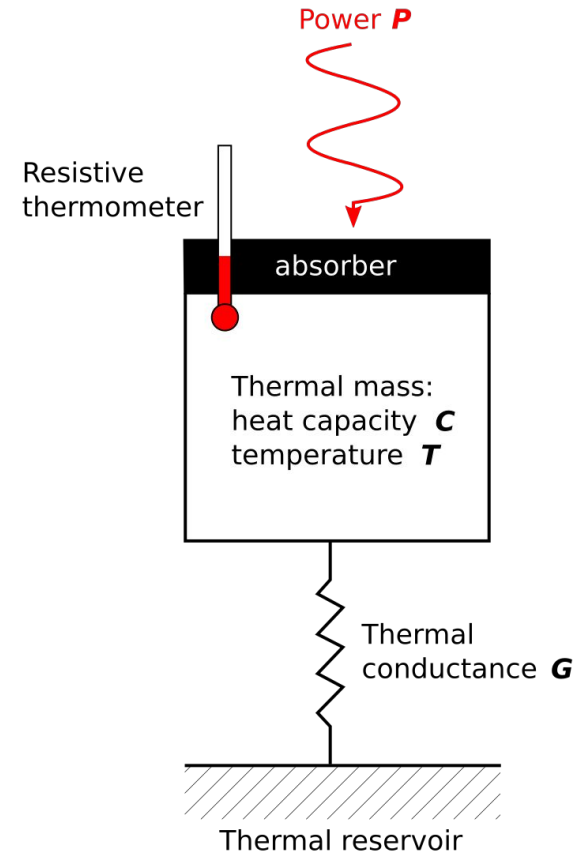
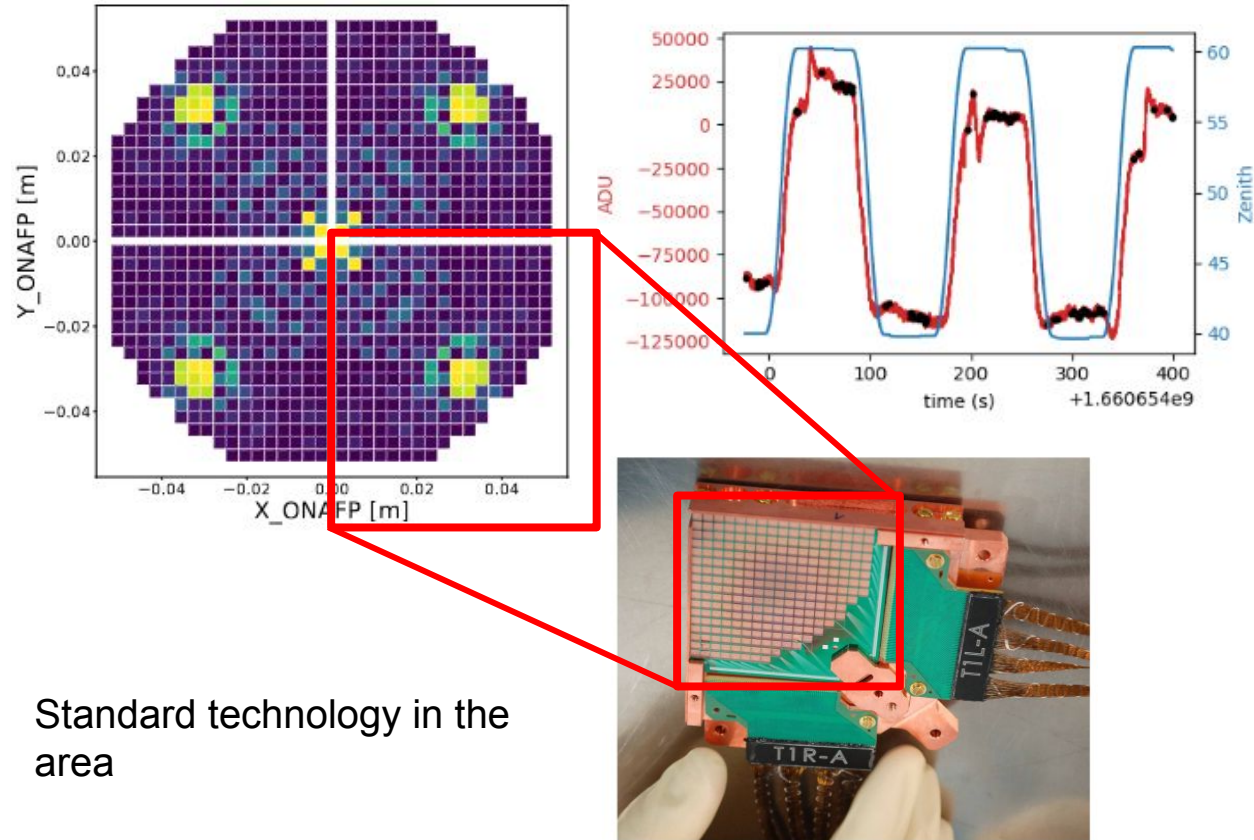
E-mode

Accounting for many waves we get these patterns in the sky

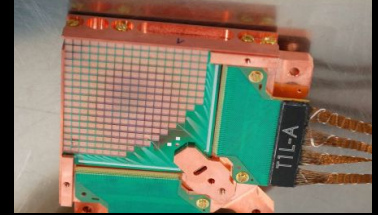
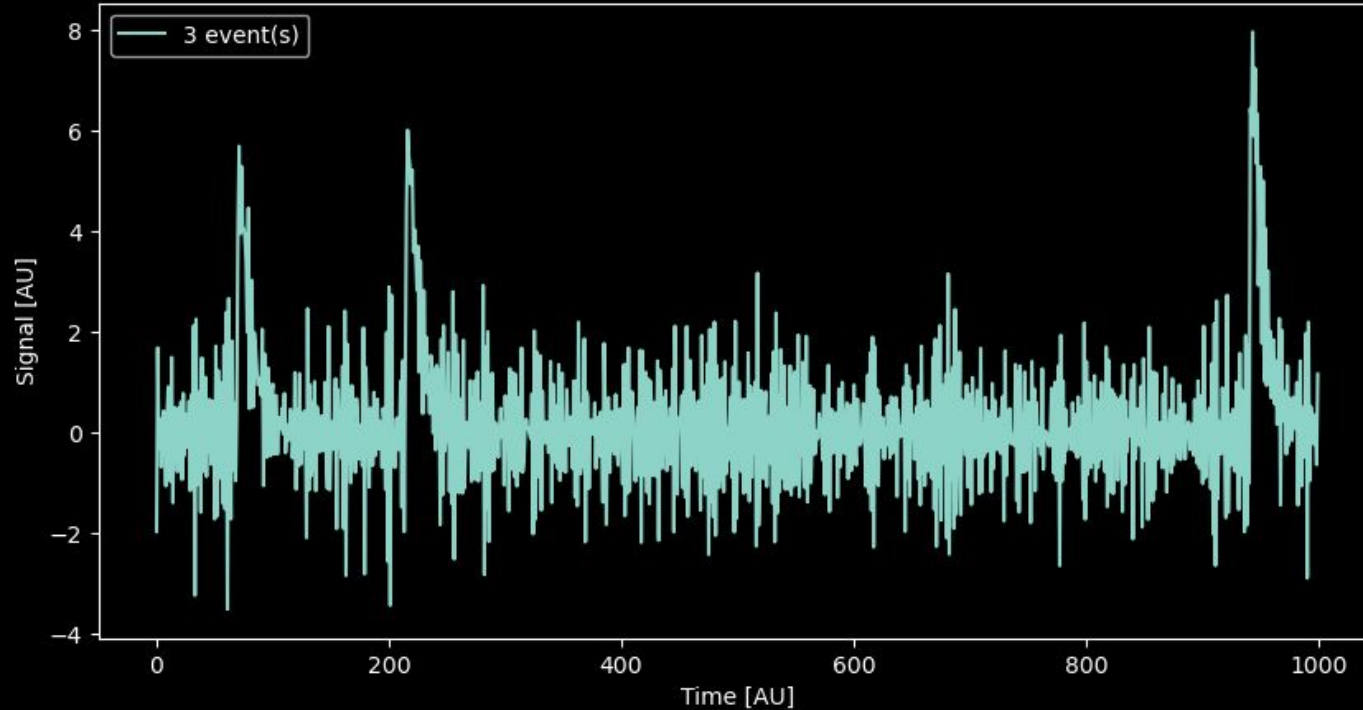


B-mode

Bolometers: array of Transition-Edge Sensors (TES)

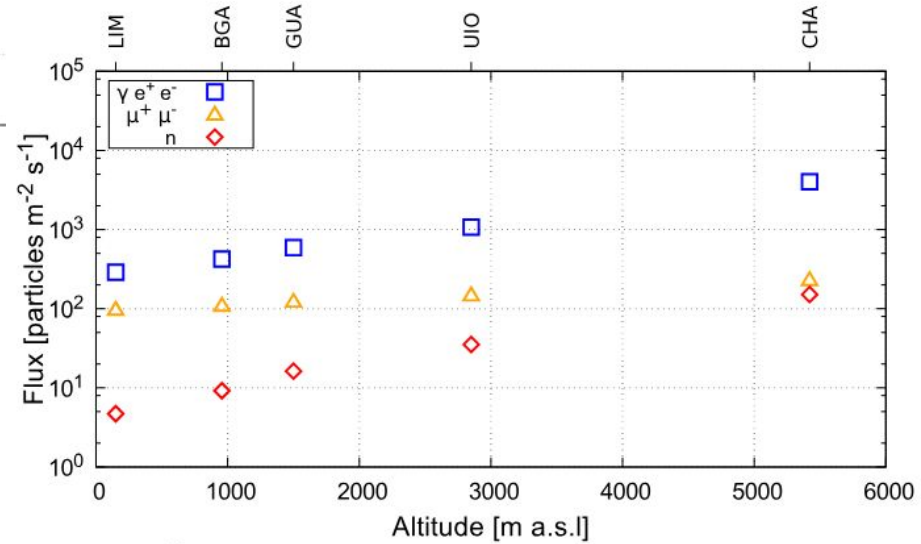
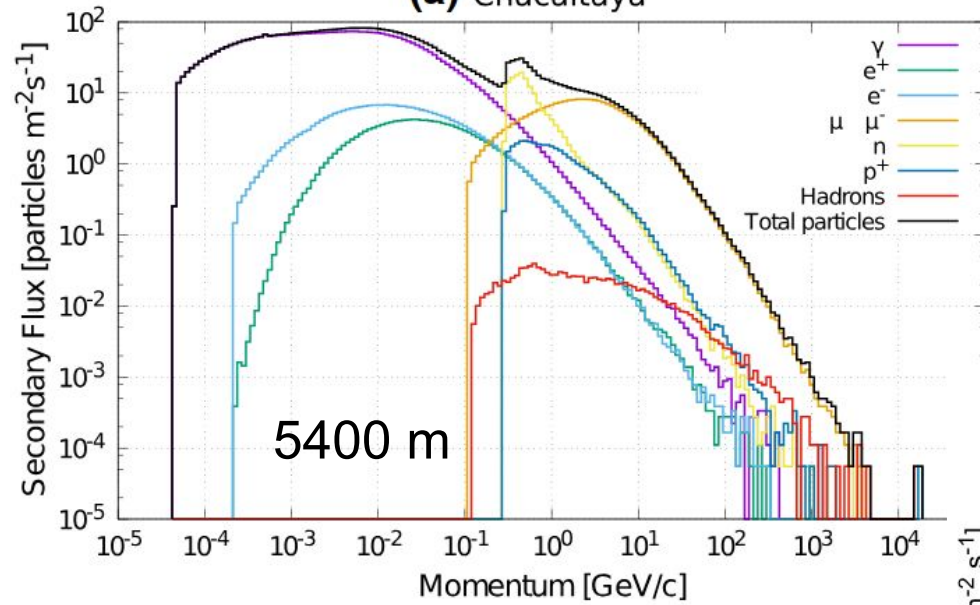


Objective

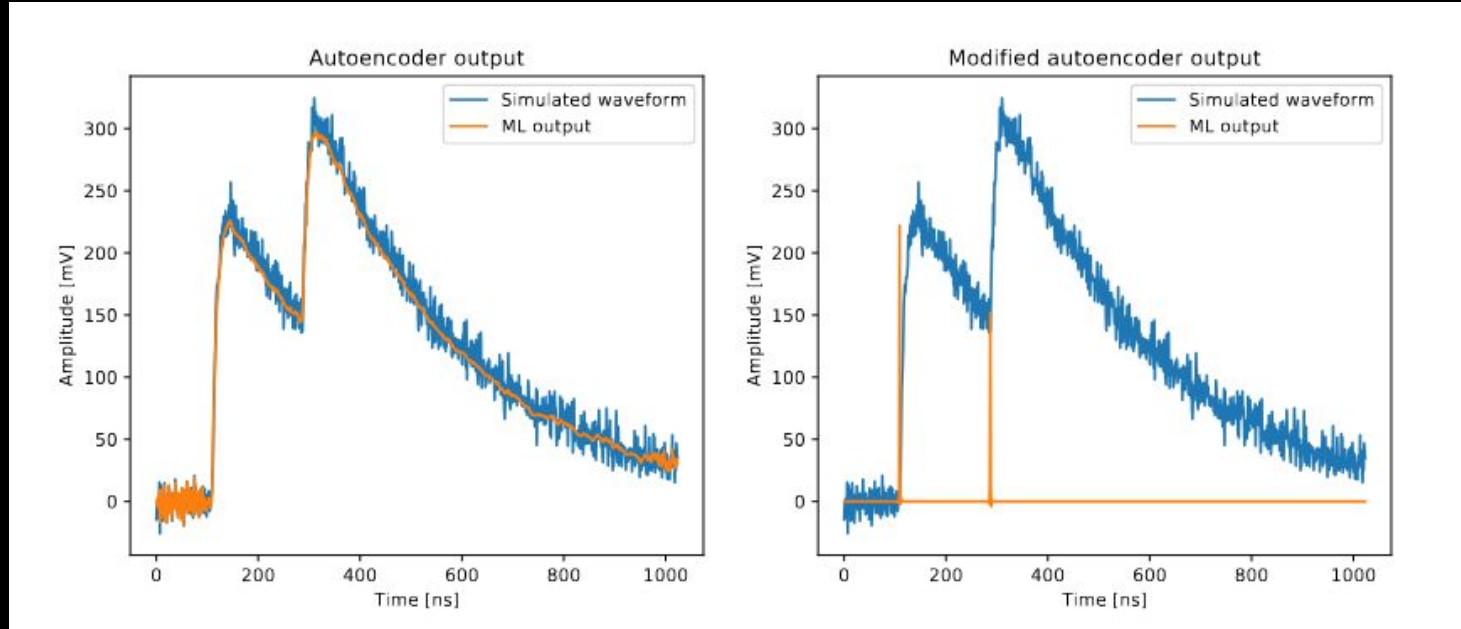


- Is there any event?
→ Binary
- How many?
- Where? → t
- How big are they?
→ A

(a) Chacaltaya

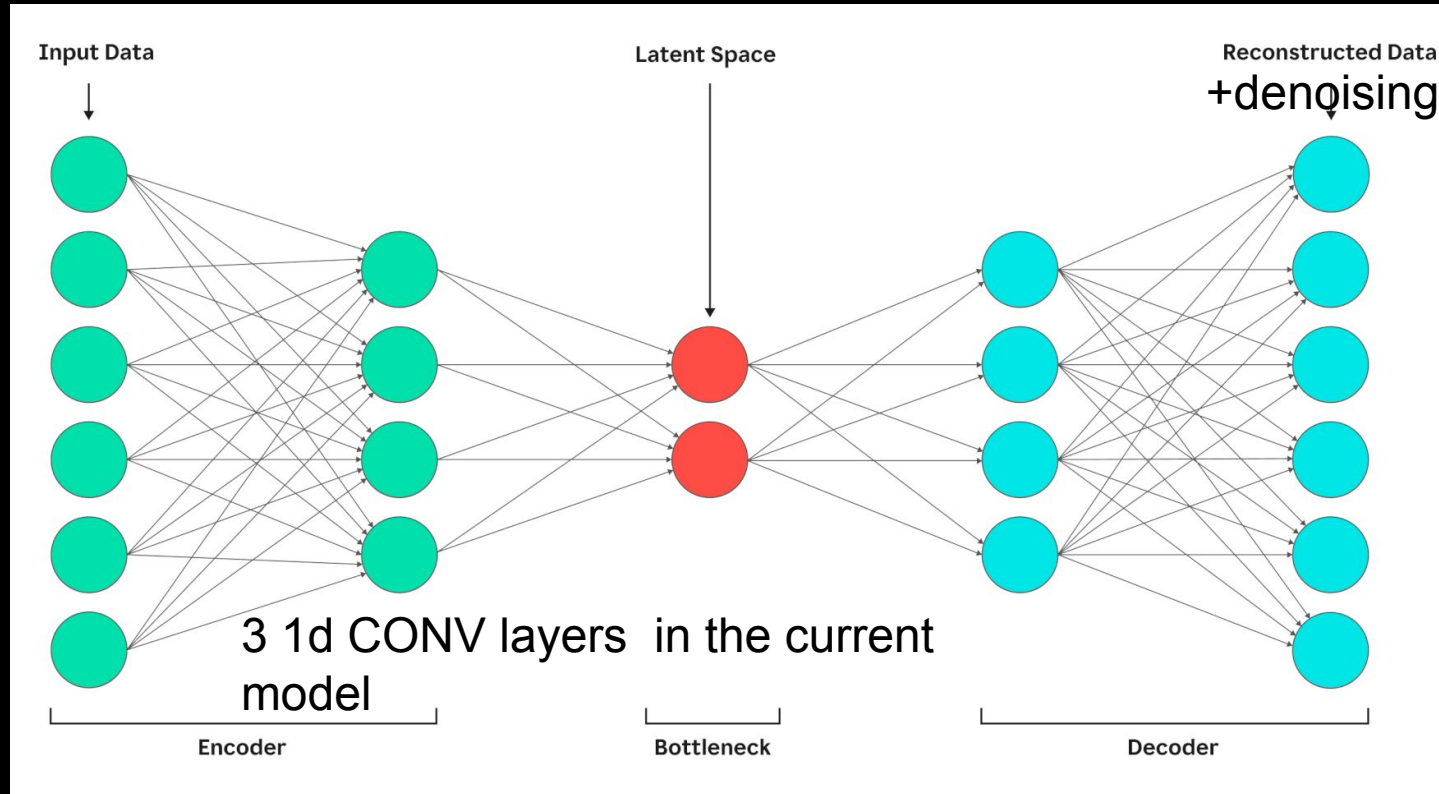


Autoencoder structure

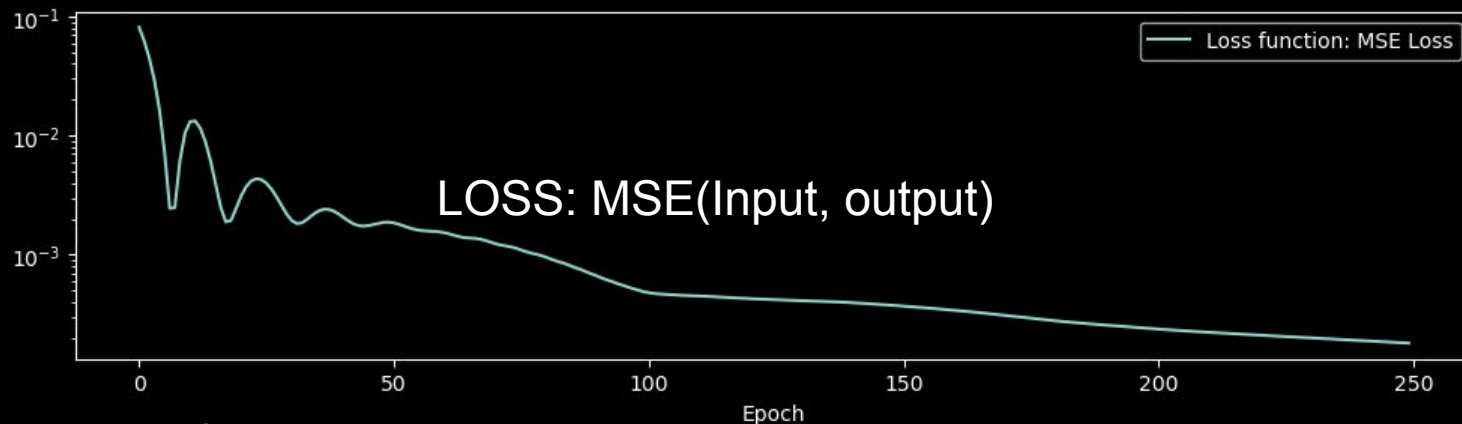


Buchakchiev, V., Dimitrova, K., Georgiev, G., Georgieva, G., & Kozhuharov, V. (2023). Pattern recognition and signal parameters extraction using machine learning methods. *Journal of Physics: Conference Series*, 2668(1), Article 012001. <https://doi.org/10.1088/1742-6596/2668/1/012001>

Autoencoder structure

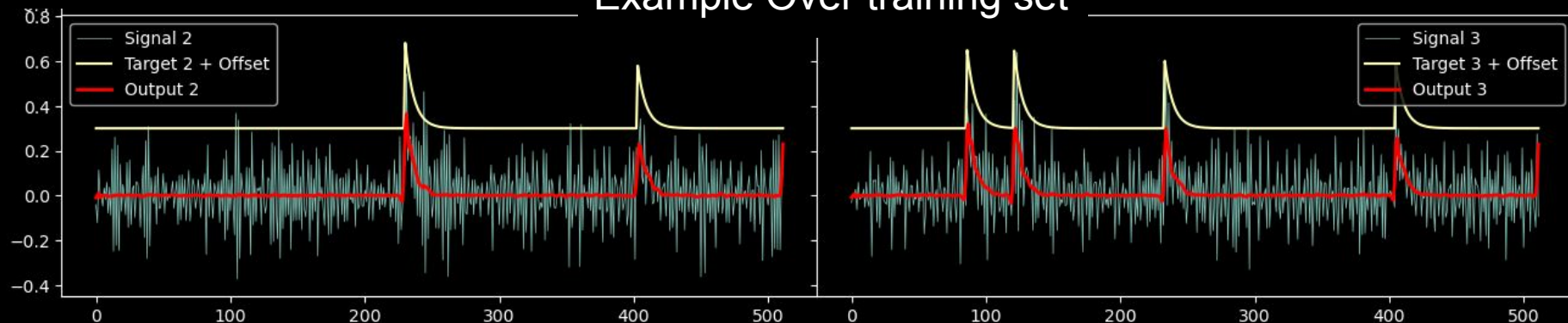


Autoencoder

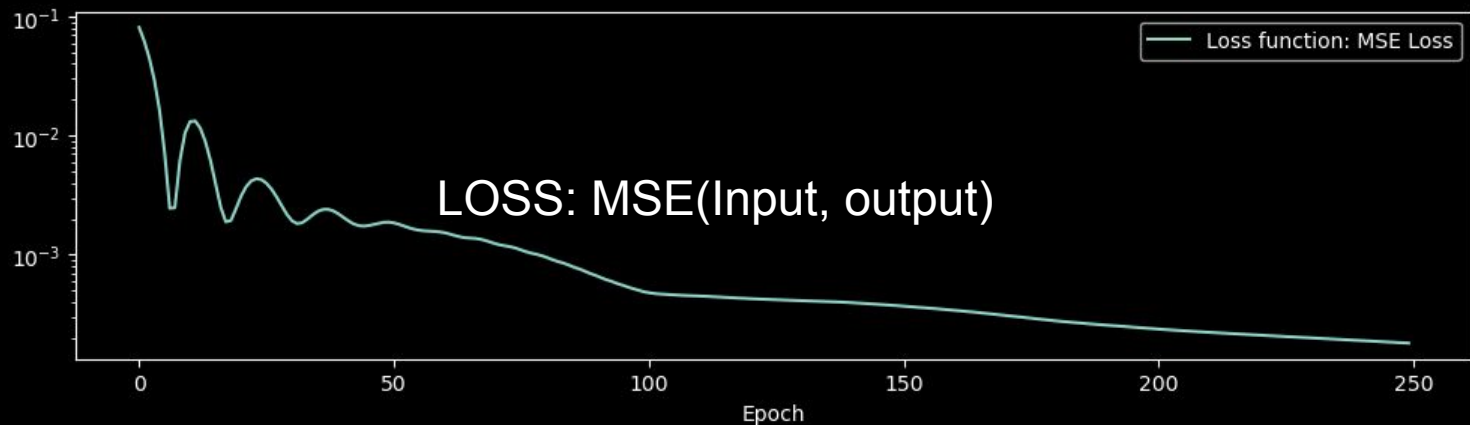


4000 parameters for $I=256$

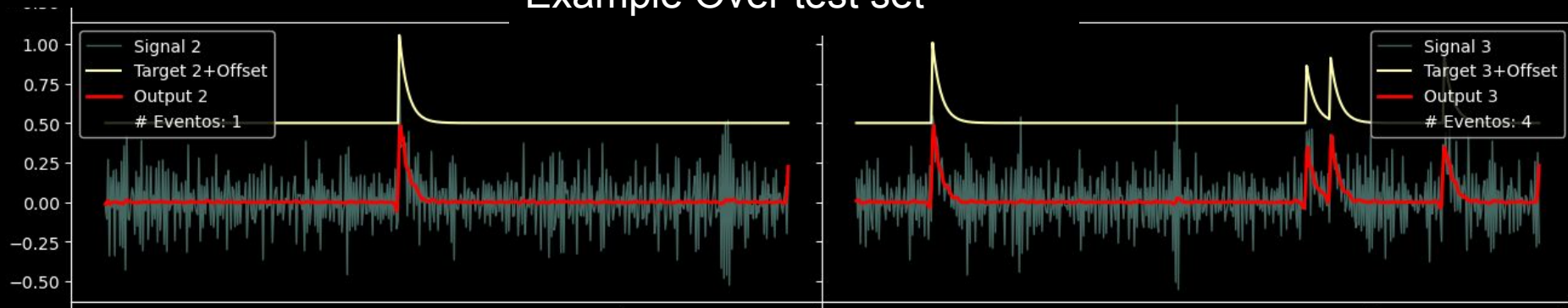
Example Over training set



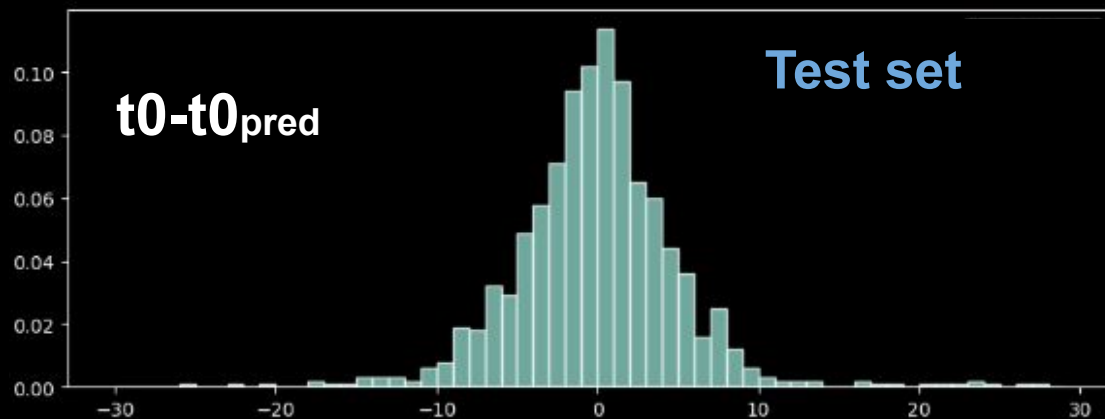
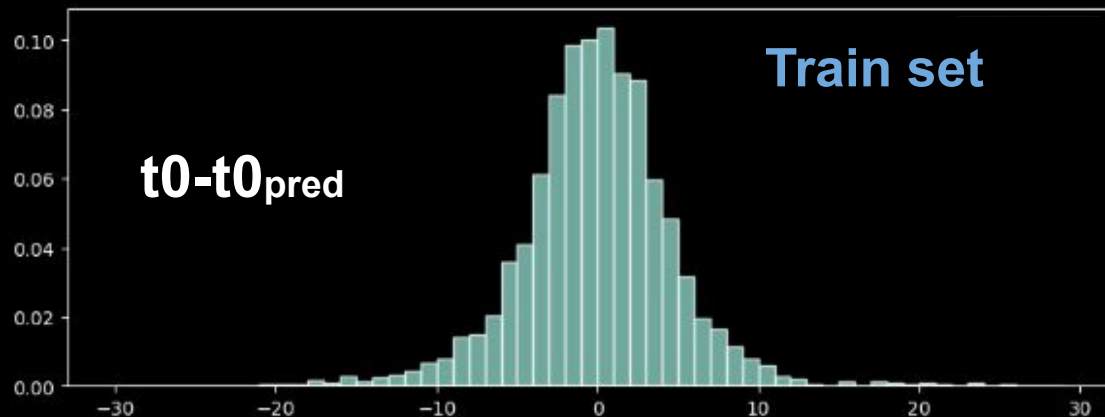
Autoencoder

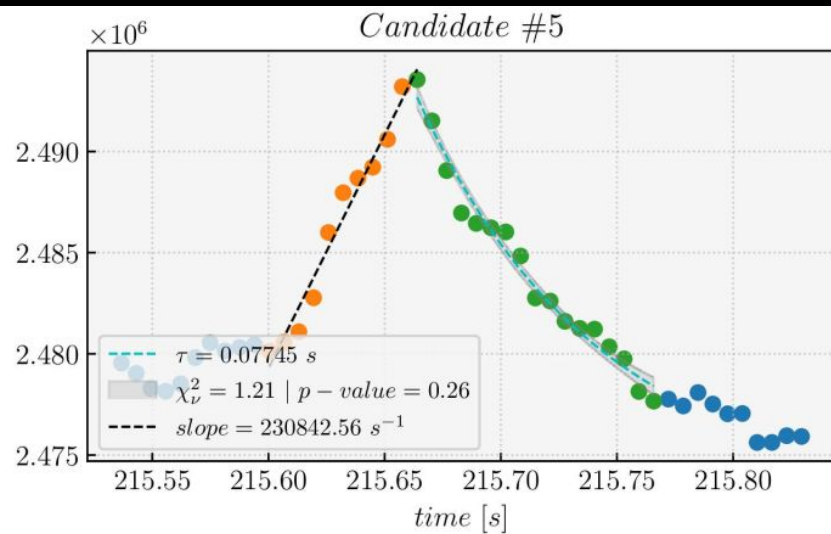
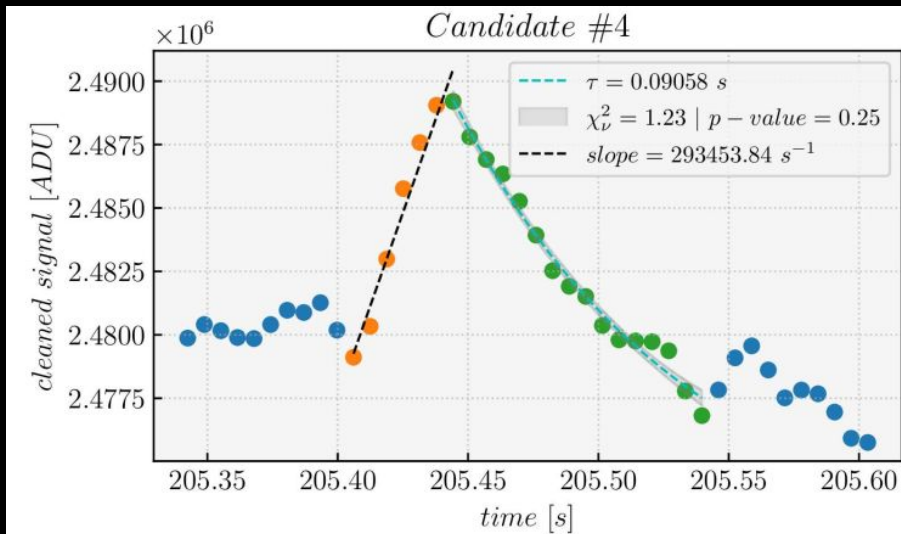


Example Over test set

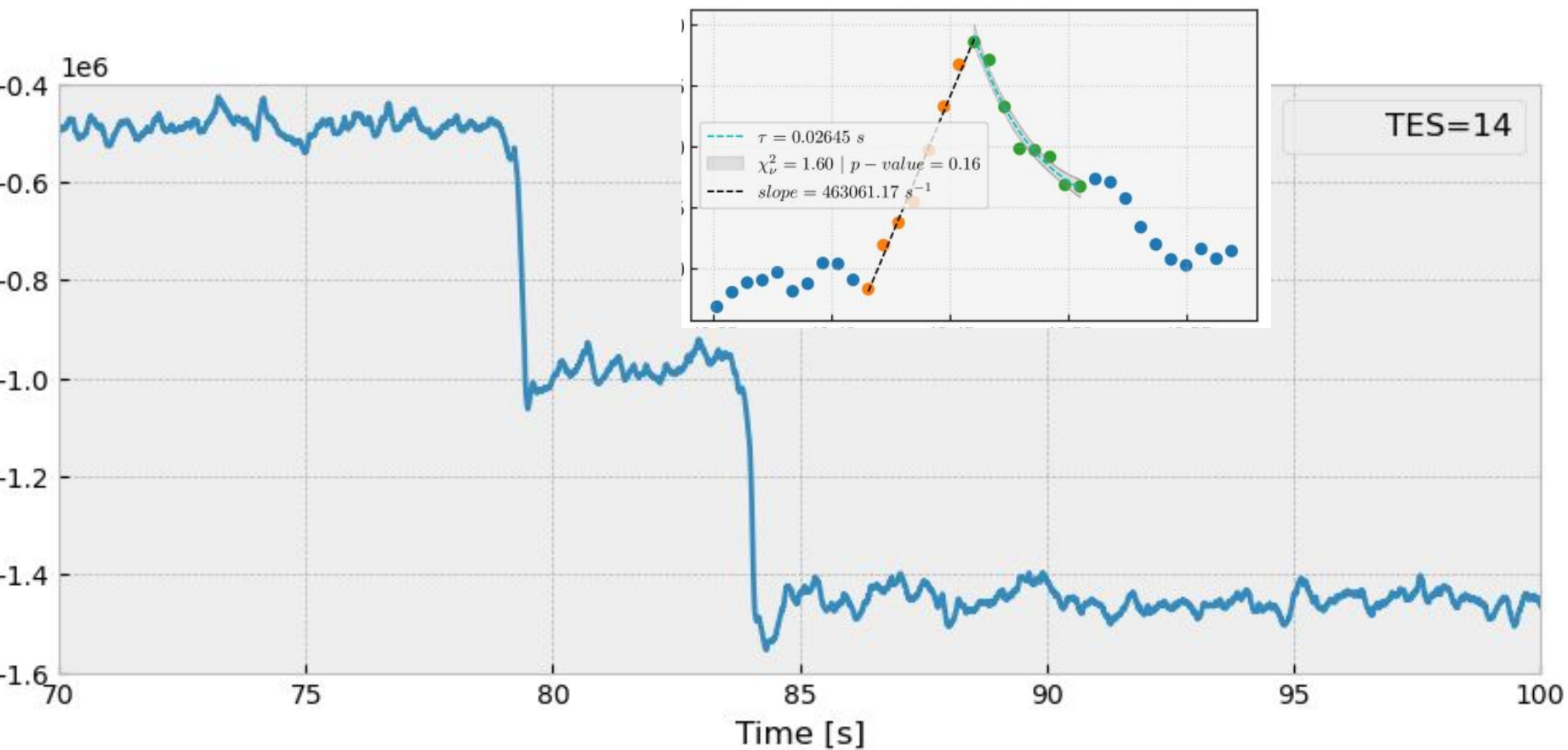


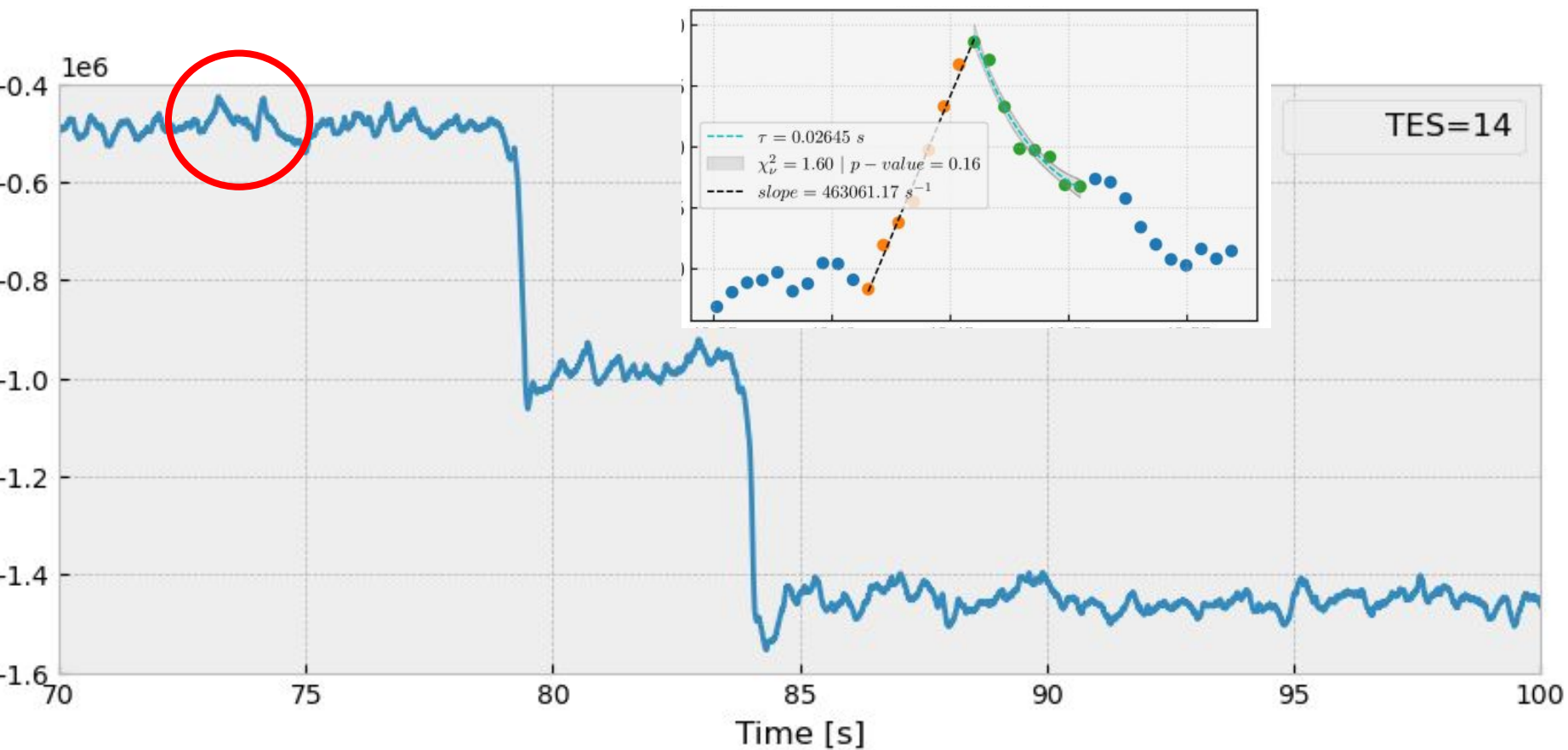
Identification on time-stamp of events

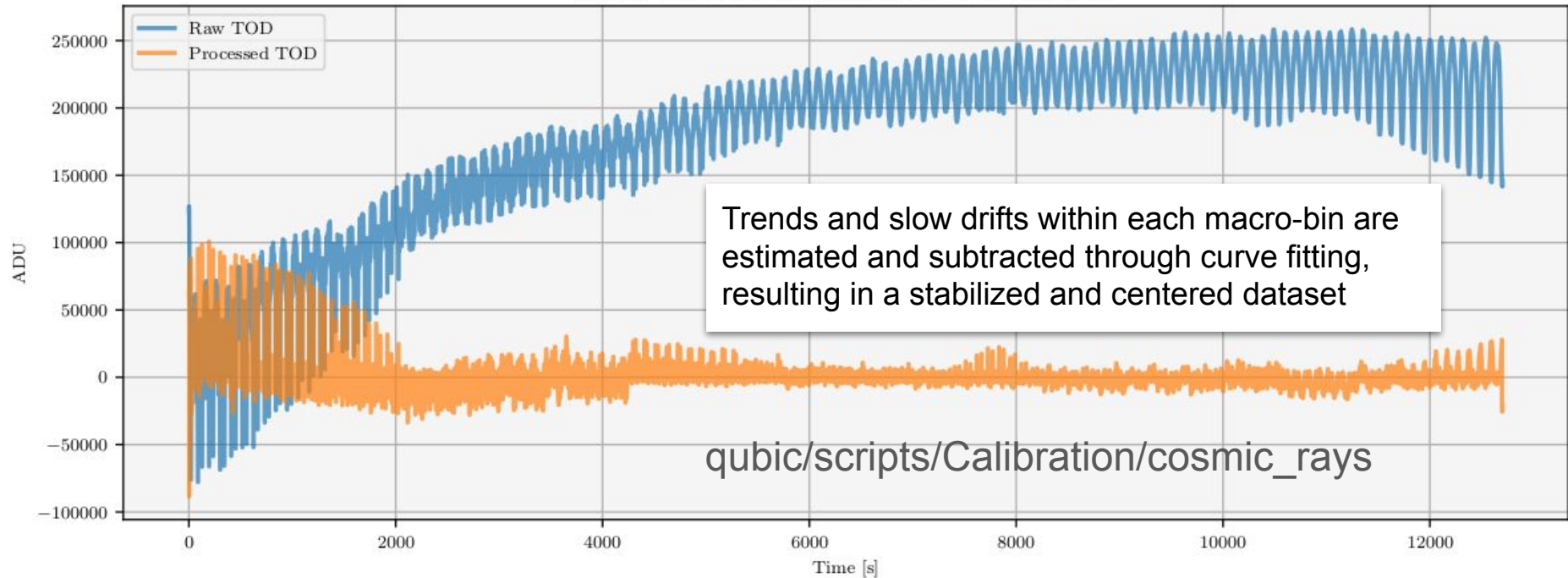




Ferazzoli, S., Battistelli, E. S., Masi, S., Coppolecchia, A., Costanza, B., De Bernardis, P., De Gasperis, G., Hamilton, J-Chr., Miron Granese, N., O'Sullivan, C., Scóccola, C., & Torchinsky, S. A. (n.d.). *QUBIC: An algorithm for detecting cosmic rays*.







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New line of work– How does the noise at detector affect the noise at map-level?

