

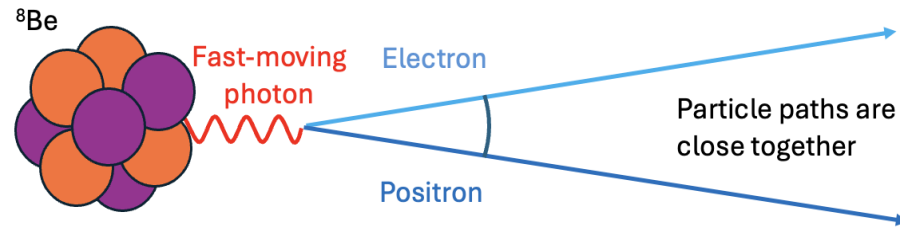
X17: an update

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n_TOF 29-04-2025

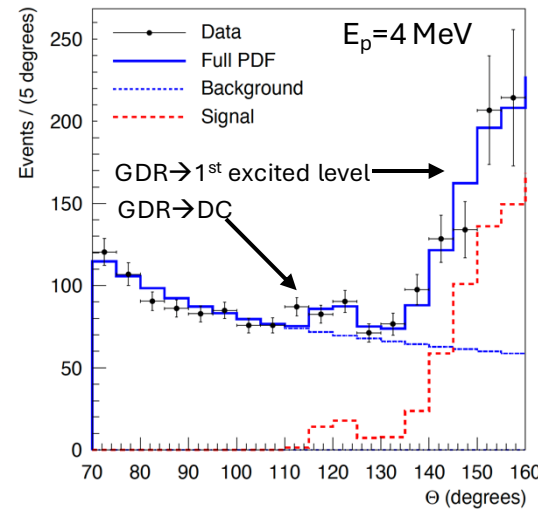
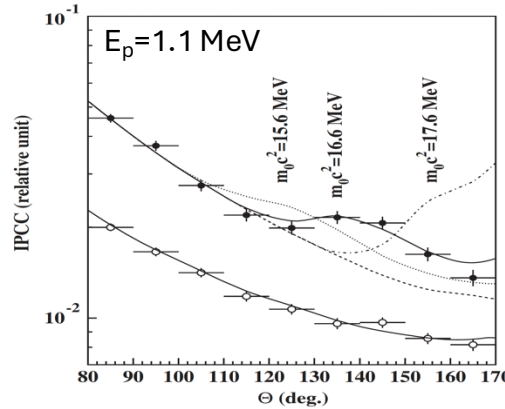
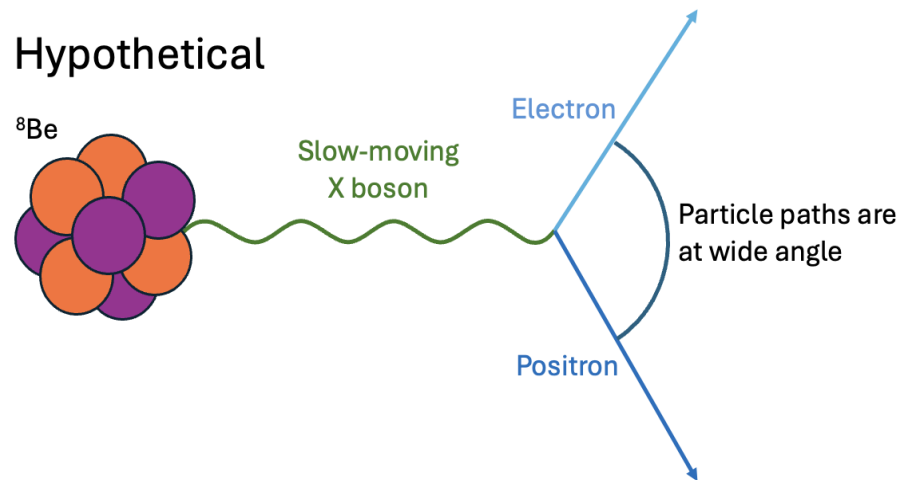
The X17 anomaly

The ATOMKI group observed an excess of e^-e^+ pairs emitted at large relative angle in the ${}^3\text{H}(p,e^-e^+){}^4\text{He}$, ${}^7\text{Li}(p,e^-e^+){}^8\text{Be}$, ${}^{11}\text{B}(p,e^-e^+){}^{12}\text{C}$ nuclear reactions. This excess can be explained with the creation (and decay into e^-e^+ pairs) of a new particle with mass ~ 17 MeV, called **X17 boson**.

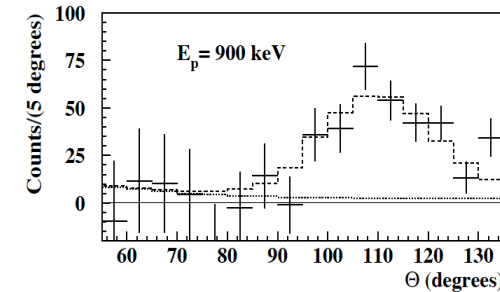
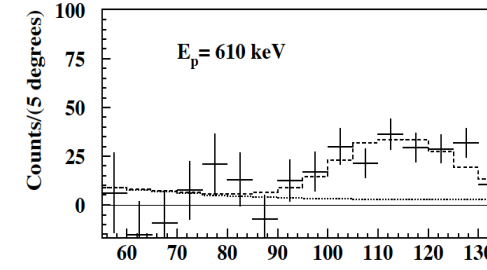
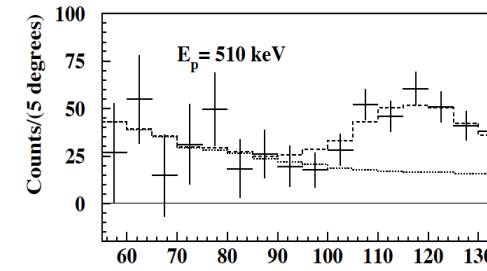
Expected ${}^8\text{Be}$ Transition



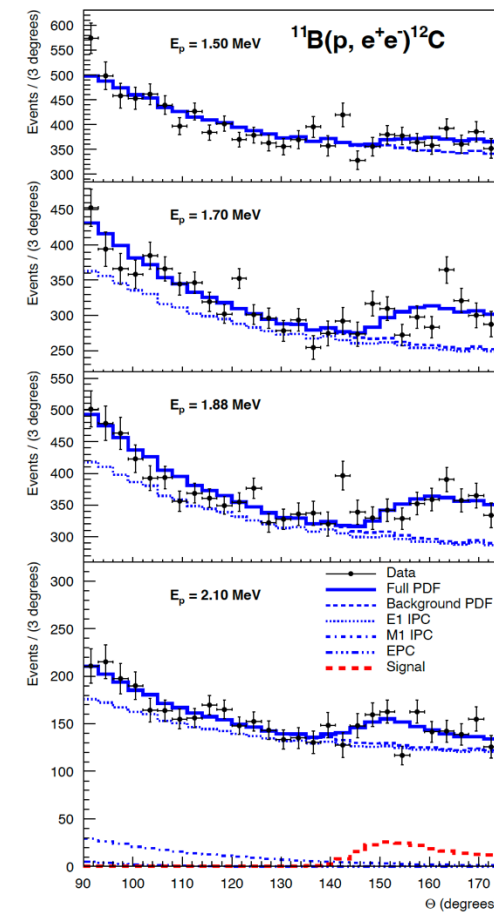
Hypothetical



${}^7\text{Li}(p,e^-e^+){}^8\text{Be}$



${}^3\text{H}(p,e^-e^+){}^4\text{He}$



${}^{11}\text{B}(p,e^-e^+){}^{12}\text{C}$

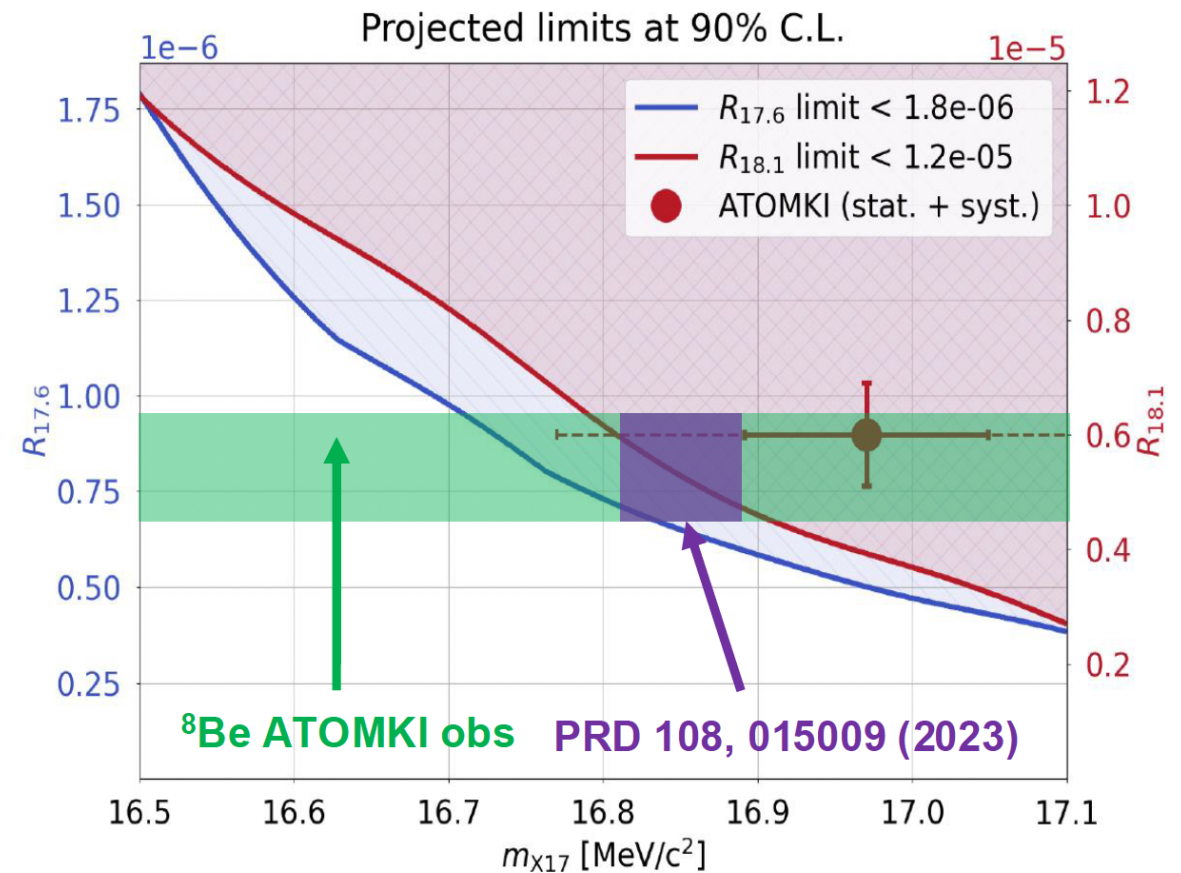
The X17 anomaly (taken from Spataro Seminar)

Recent result from MEG II, arXiv:2411.07994 still to be published

Measurement on Li7 target to reproduce Be8 ATOMKI result, no signal found

ULs on $BR(Be8^* \rightarrow Be8 ee, \text{anomaly})/BR(Be8^* \rightarrow Be8 \gamma)$ for 17.6, 18.1 MeV transitions

The MEG-II result remains compatible
[Barducci, et al. ,HEP 04 (2025) 035] with the
ATOMKI combination $M_X = 16.85(4)$ MeV
[Denton, Gehrlein PRD108, 015009 (2023)]



Can PADME help clarifying?

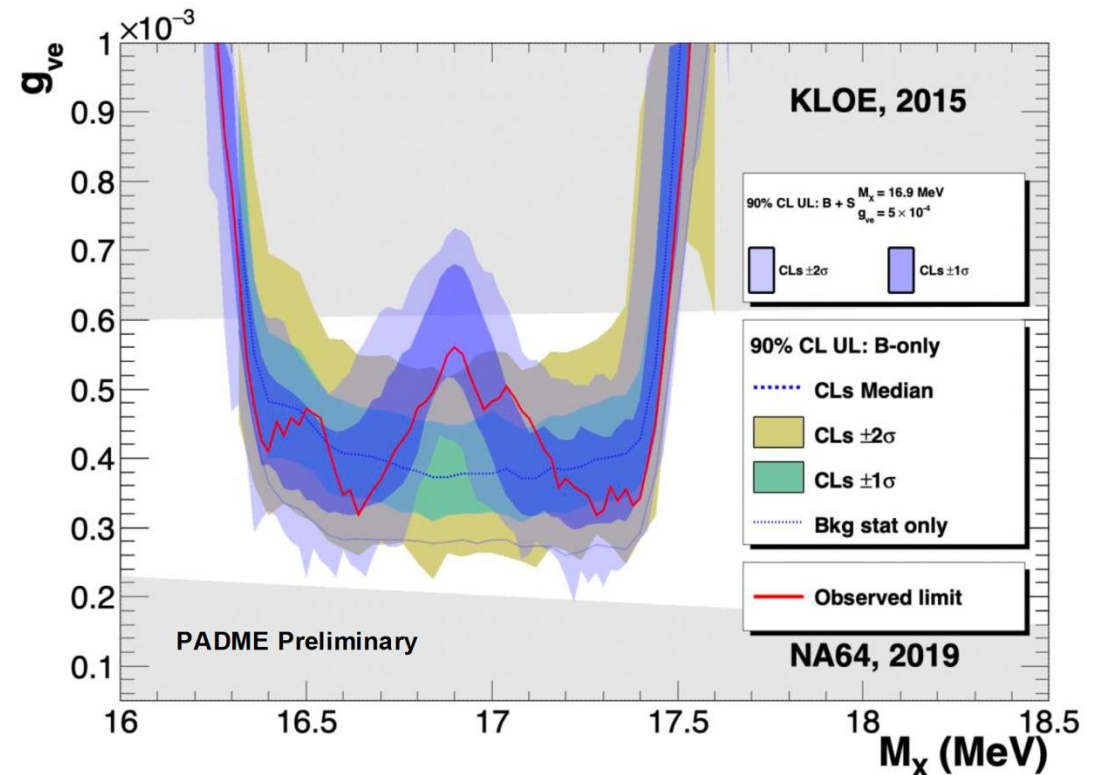
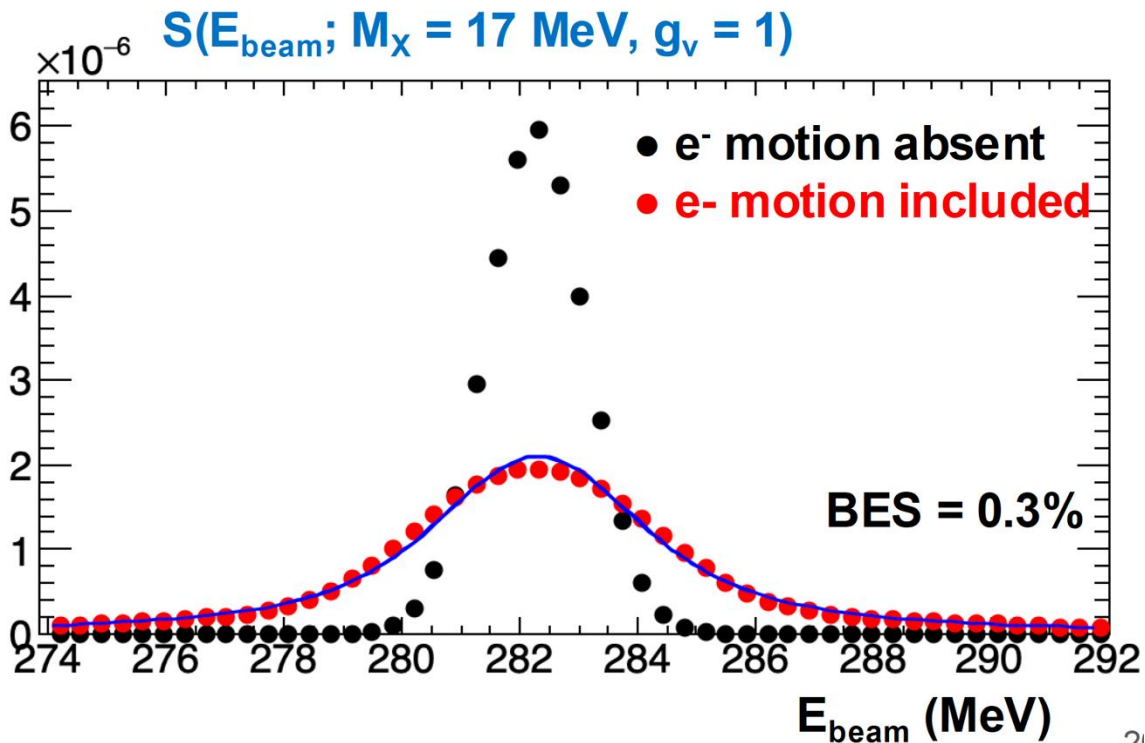
The X17 anomaly (taken from Spataro Seminar)

No indications of X17 well beyond two-sigma-equivalent global p-values

An excess has been observed, with global p-value equivalent to $1.77(15) \sigma$

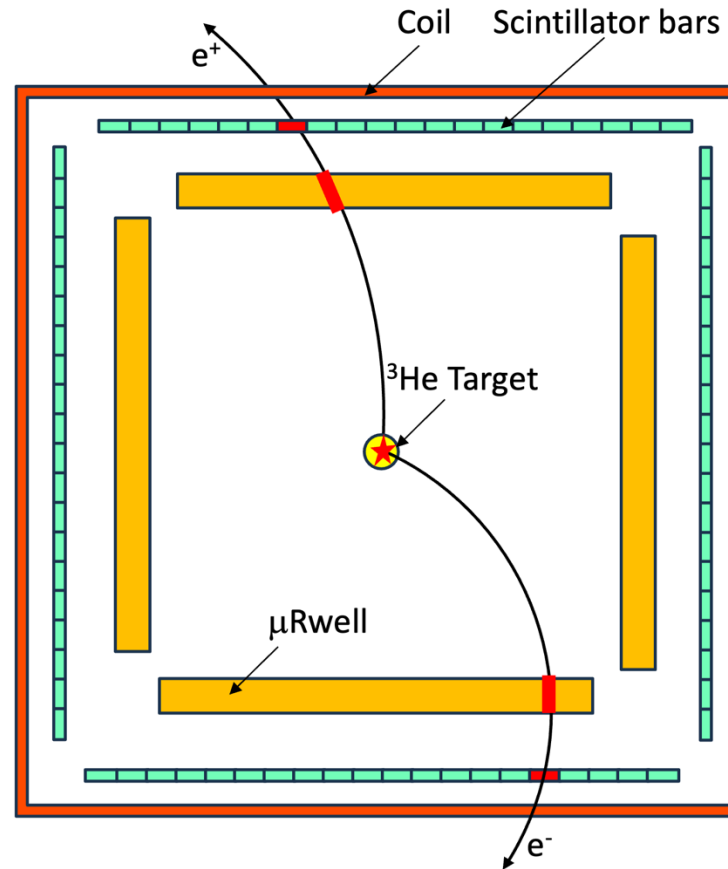
New data to be acquired to better clarify:

- we are commissioning a new detector for Run IV
- a new micromegas-based tracker to separately measure the absolute cross sections of $ee/\gamma\gamma$ thus allowing a combined analysis

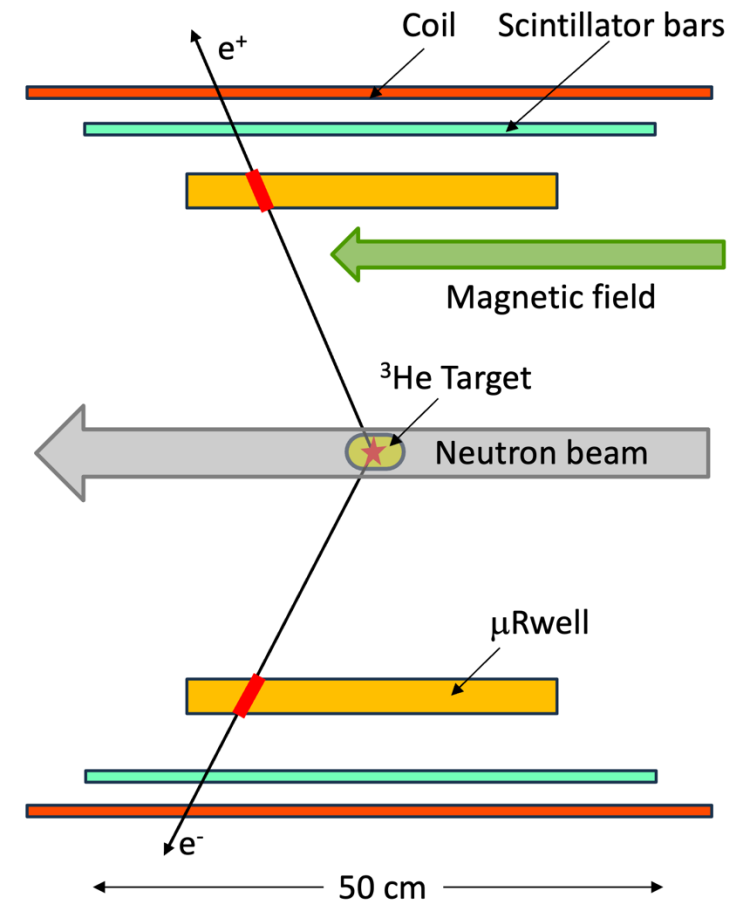


SETUP

- Pressurized ^3He (Target)
- MPGD detector (3D tracking)
- Scintillator bars (Trigger and ToF)
- Magnet (Charge and energies of ejectiles)

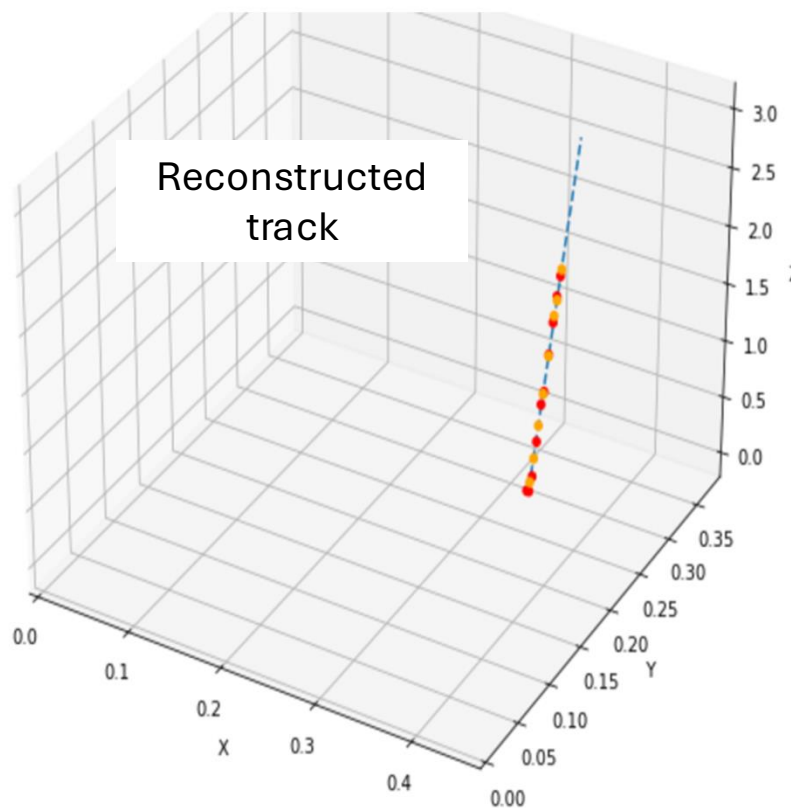
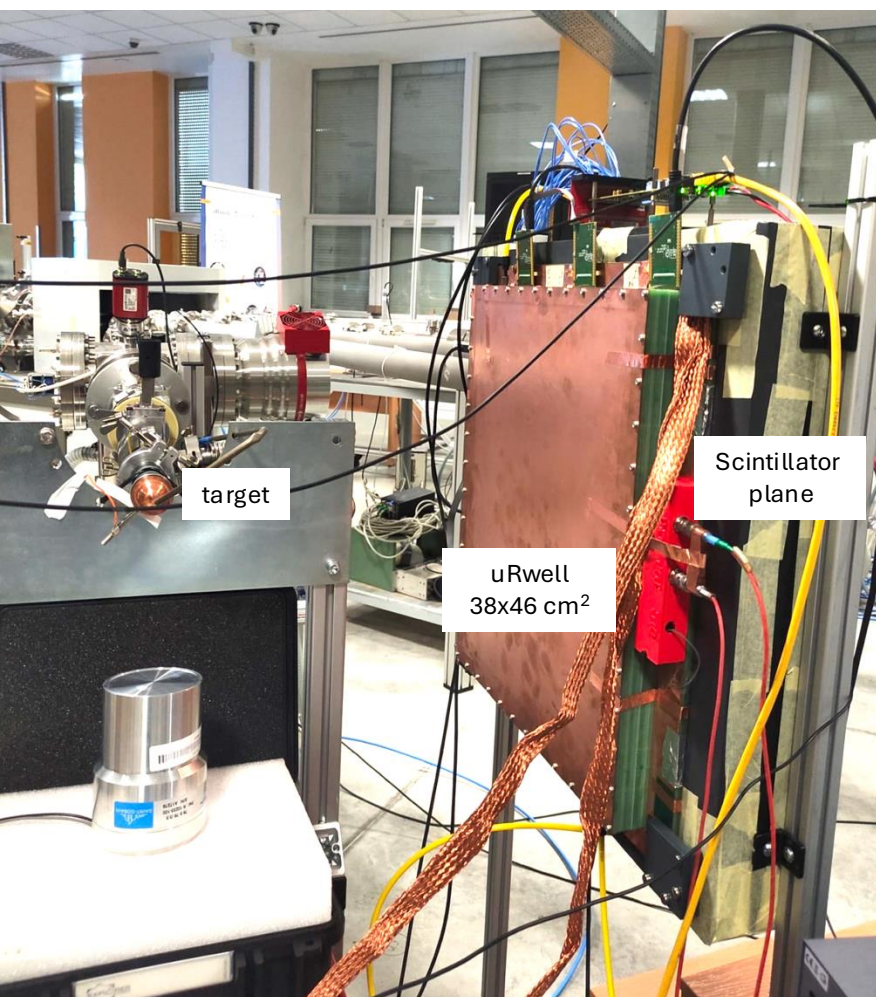


FRONT

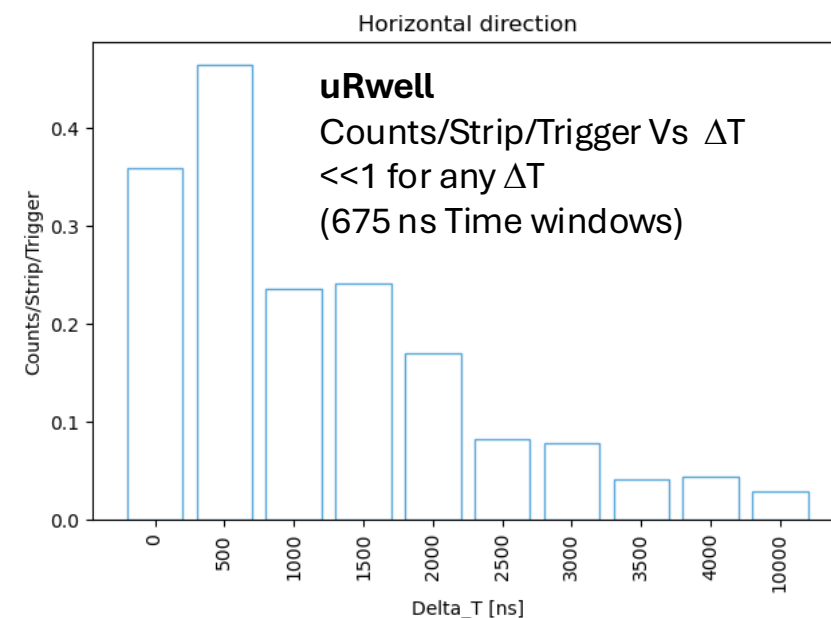
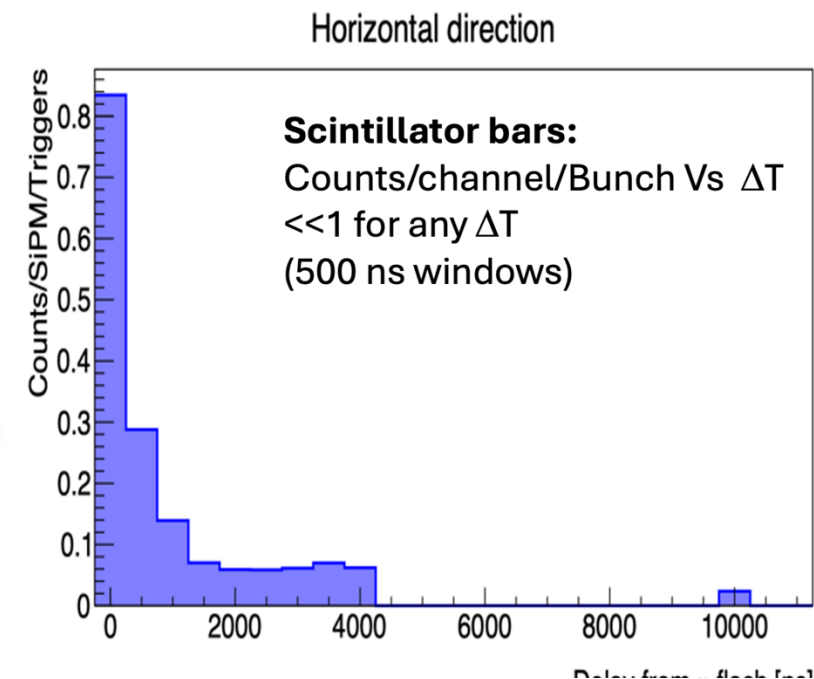


SIDE

TESTS @ EAR2 and ATOMKI



- Good tracking
- Low background (including g-flash) in the EAR2 area



Simulations

Assuming:

- 20% detector efficiency for e+e- pairs
- 5×10^{18} pot (EAR2 area)

→ 7 σ excess expected, for pairs with a large angular aperture

