



A novel Liquid Scintillator setup for measuring β energy spectra

Timo Ahola, Doctoral Researcher
University of Jyväskylä

MAYORANA SCHOOL
19-25.06.2025

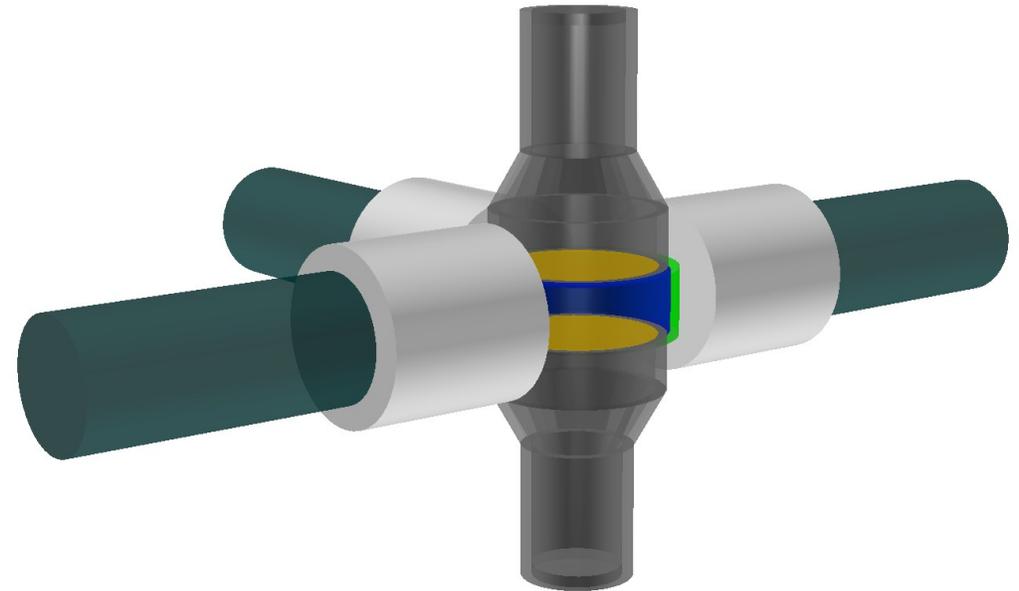
Background



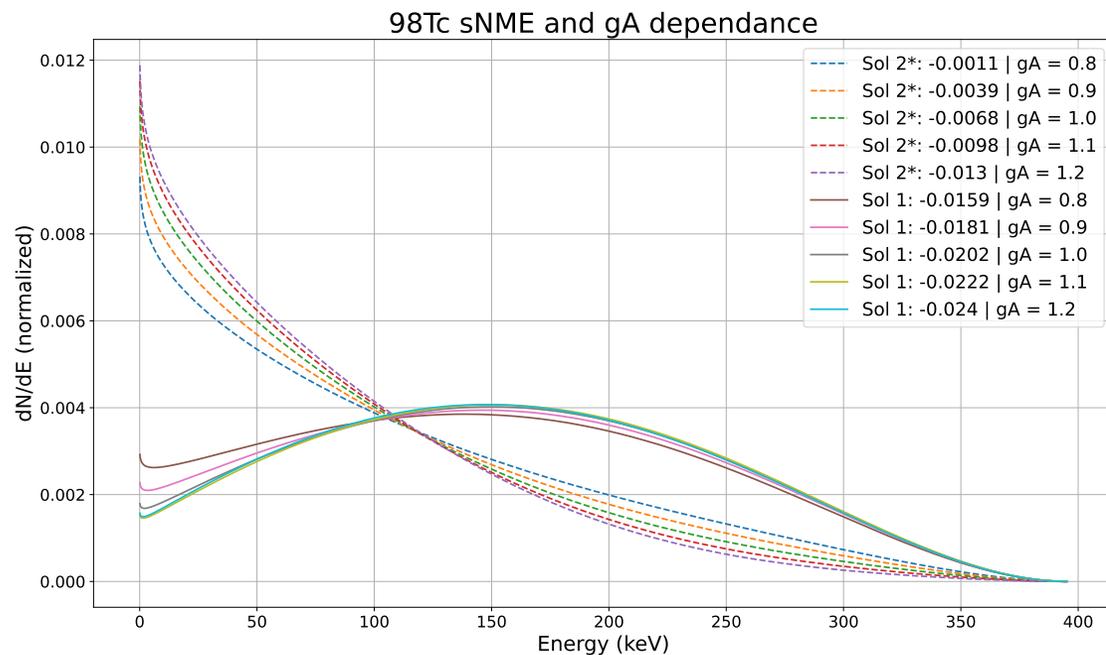
- The search for neutrinoless double beta decay ($0\nu\beta\beta$) plays a crucial role in nuclear and particle physics
- The rate at which this decay occurs is dependent on the effective weak axial vector coupling (g_A)
 - g_A also affects the beta decay spectra of some isotopes
 - This means that you can determine the value of g_A !
- The focus of previous studies has been on β^- and $2\beta^-$ spectra
- β^+ is still uncharted territory

Simulation setup

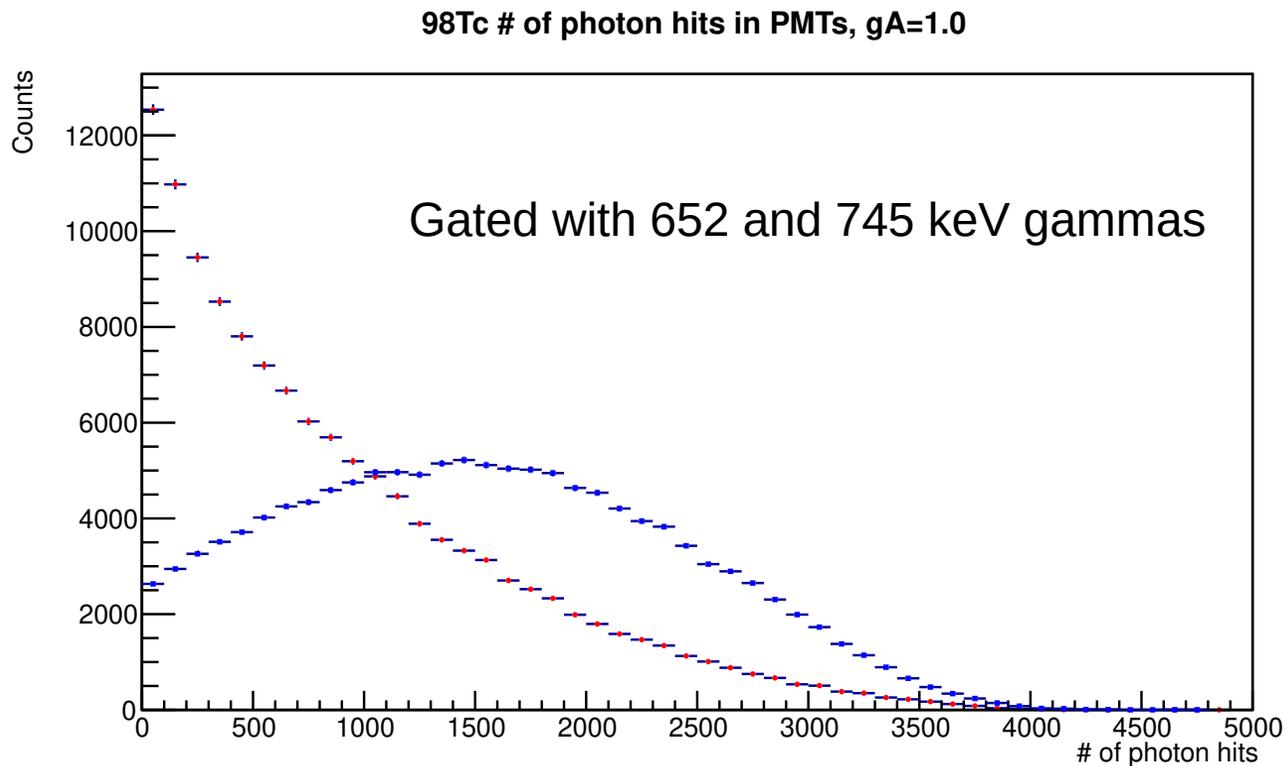
- Not build in reality
- Consists of four 3" LaBr₃ (or NaI) gamma detectors
- Two 3" photomultiplier tubes (PMT)
- An 8.8cm foil-encased PMMA LS vessel
- Gamma detectors provide opportunity for gamma tagging
- Used for testing the concept



Simulation results



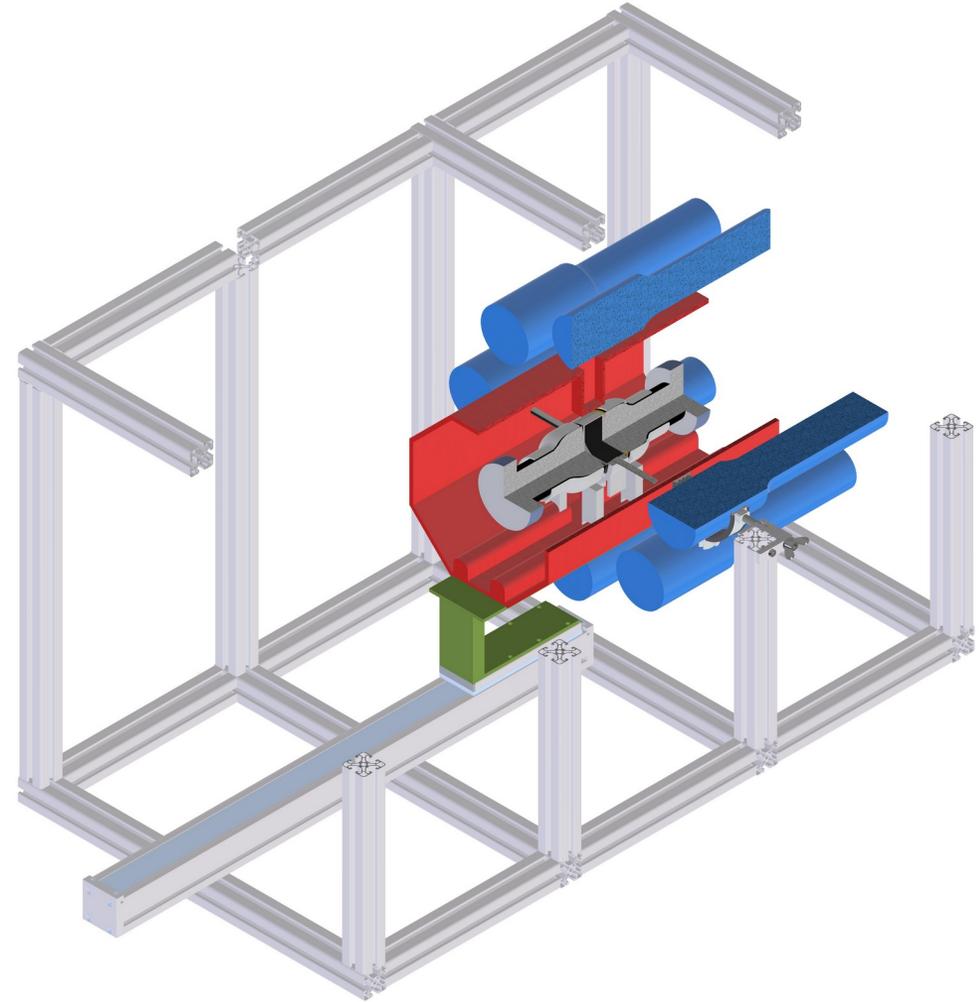
Spectral data from: M. Ramalho et. al., (2024) Front. Phys. 12:1455778.



Includes background from K40,
Th232-chain, U238-chain

Planned setup

- Consists of eight 3" LaBr₃ (or NaI) gamma detectors
- Two 3" photomultiplier tubes (PMT)
- An 8.8cm foil-encased glass LS vessel
- A dark box to house the PMTs and LS vessel
- Rail for ease of access
- To be simulated soon



Conclusions



- We propose a new LS based β -spectra measurement setup
- The purpose is to measure β -spectra and derive g_A and/or sNME from the results
- Preliminary simulations give promising results
- Some testing of the available hardware has been done
- A concept paper aimed at proving the feasibility of the setup is in the works

Thank you!



