Monte Carlo simulation of the CUPID array

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CUPID experiment

- Proposed $0\nu\beta\beta$ search using bolometric array of 1596 lithium molybdate crystals, deployed in the CUORE[1] cryostat.
- Aims to eliminate dominant background of alpha particles present in CUORE.

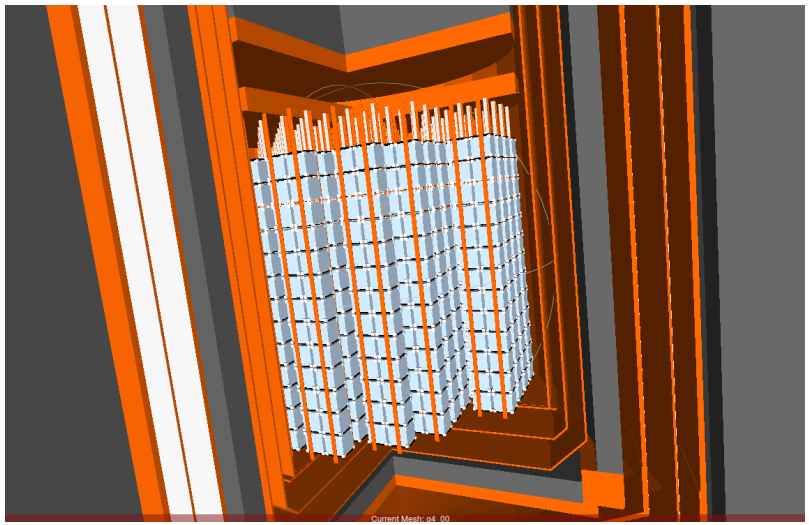


Figure: rendering of proposed CUPID array of Li_2MoO_4 crystals

[1] Clarke and Braginski 2004.

lithium molybdate

- Li_2MoO_4 crystals allow for discrimination of α backgrounds from $\beta\beta$ events (Q=3034keV) via high-light yield scintillation signals.
- relatively high isotopic abundance of ^{100}Mo (10%)
- enrichment above 95% already demonstrated in CUPID-Mo

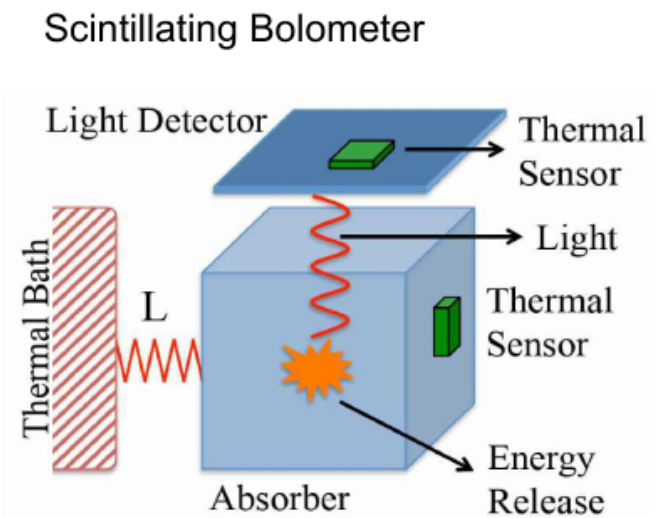
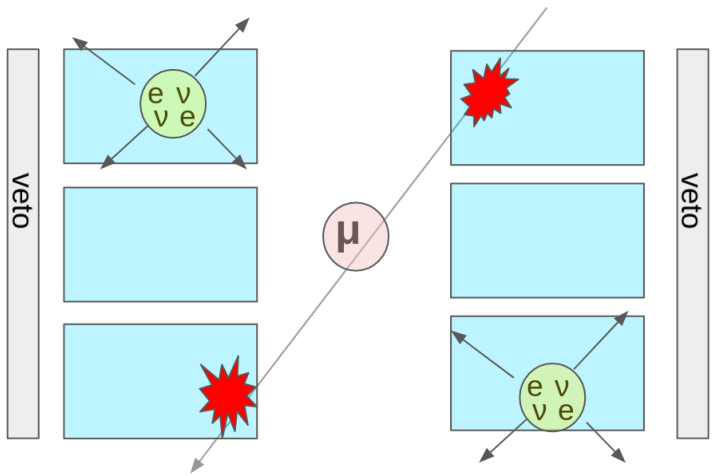


Figure: CUPID bolometer and rejection scheme

2ν events and muons

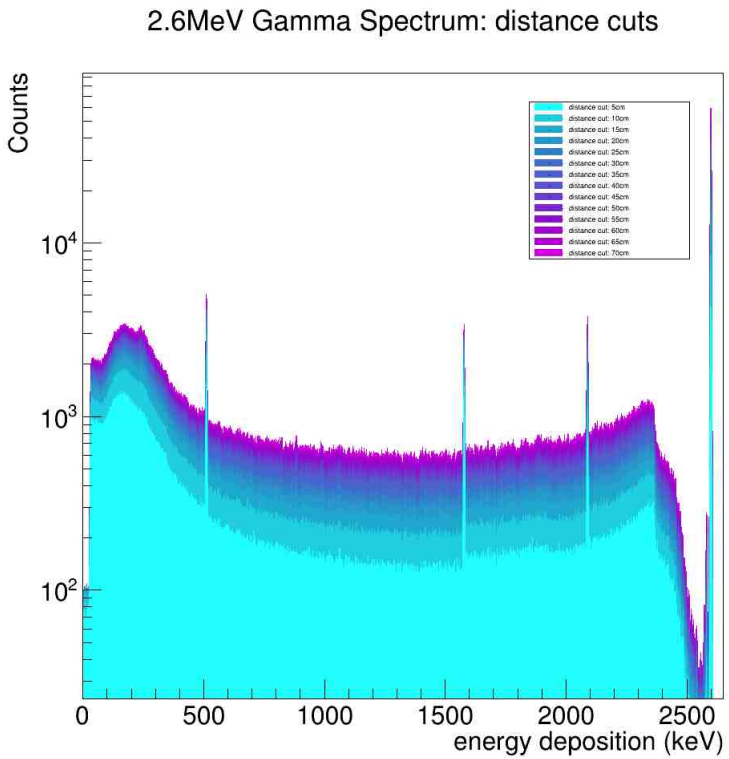
- With respect to coincidences, the rate of $2\nu\beta\beta$ events is not negligible in CUPID array (calculate this)[2]
- Minimizing the distance cut helps avoid mis-labelling random $2\nu\beta\beta$ coincidences as multiplicity 2.
- Assuming a simple muon veto geometry, increasing the distance cut rejects more muon events.



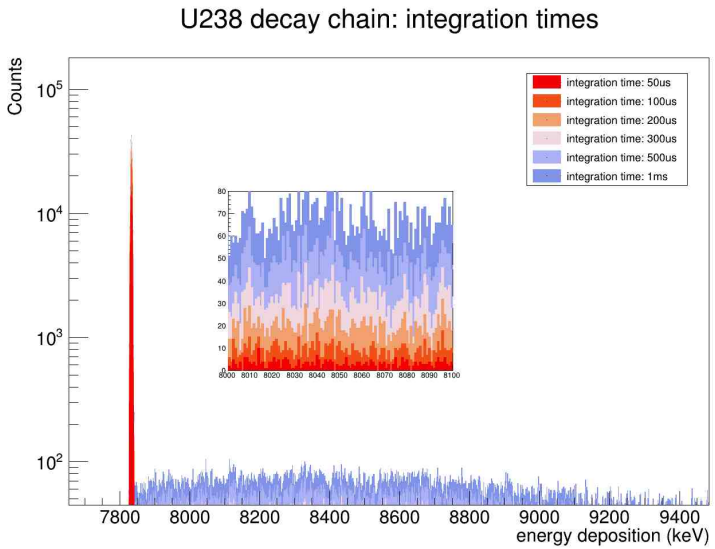
[2] **chernyak**.

distance cut in the CUPID array

- events within a trigger time window that are also within the specified distance cut are rejected
- man
- dude

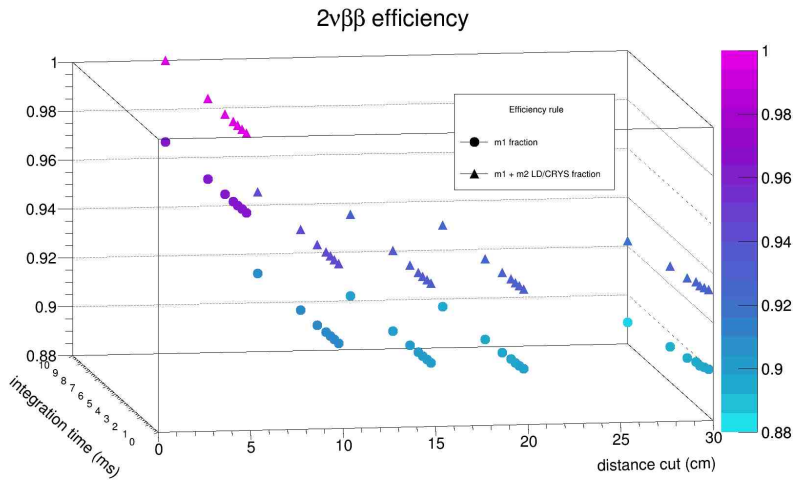


integration time in the CUPID array



$2\nu\beta\beta$ efficiency simulation

- sensitivity studies expect on the order of 90
- large distance cut, random coincidences (more variation with integration time)
- is there a paper i can cite. 0vbb expect closer to 80
- find operating point relative to muon background, parameter of interest -¿ at which distance cut do random coincidences play role in integration time



muon background

- muon flux LNGS
- planned muon veto , 90
- muon track + showers induced by the muon. muon background suppression vs efficiency

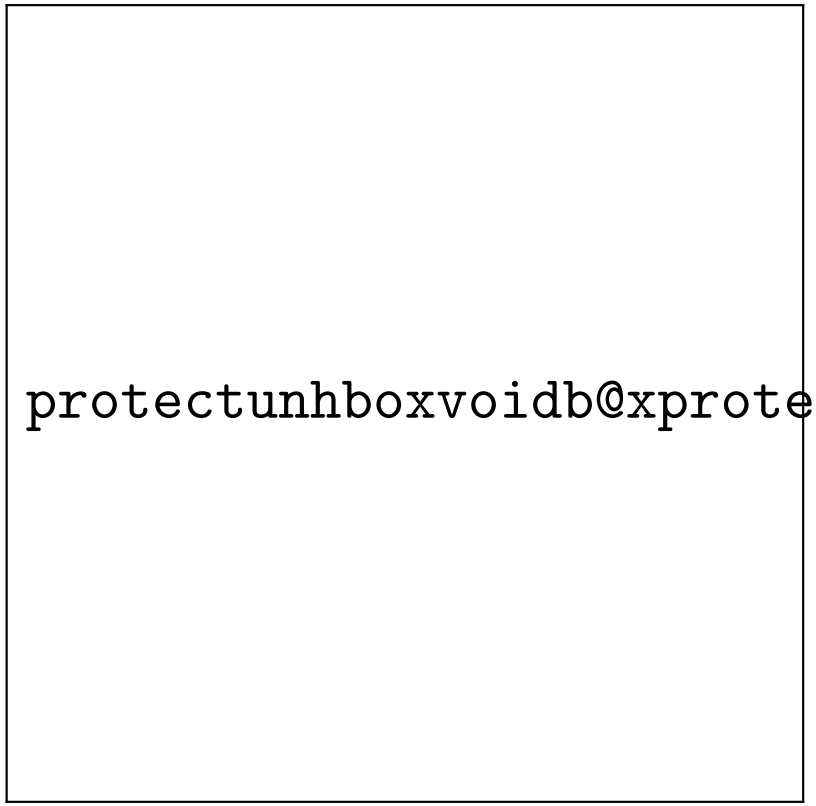


Figure: gnarly