



Simulating Athermal Phonons



Alessio Ludovico De Santis
alessio.desantis@gssi.it

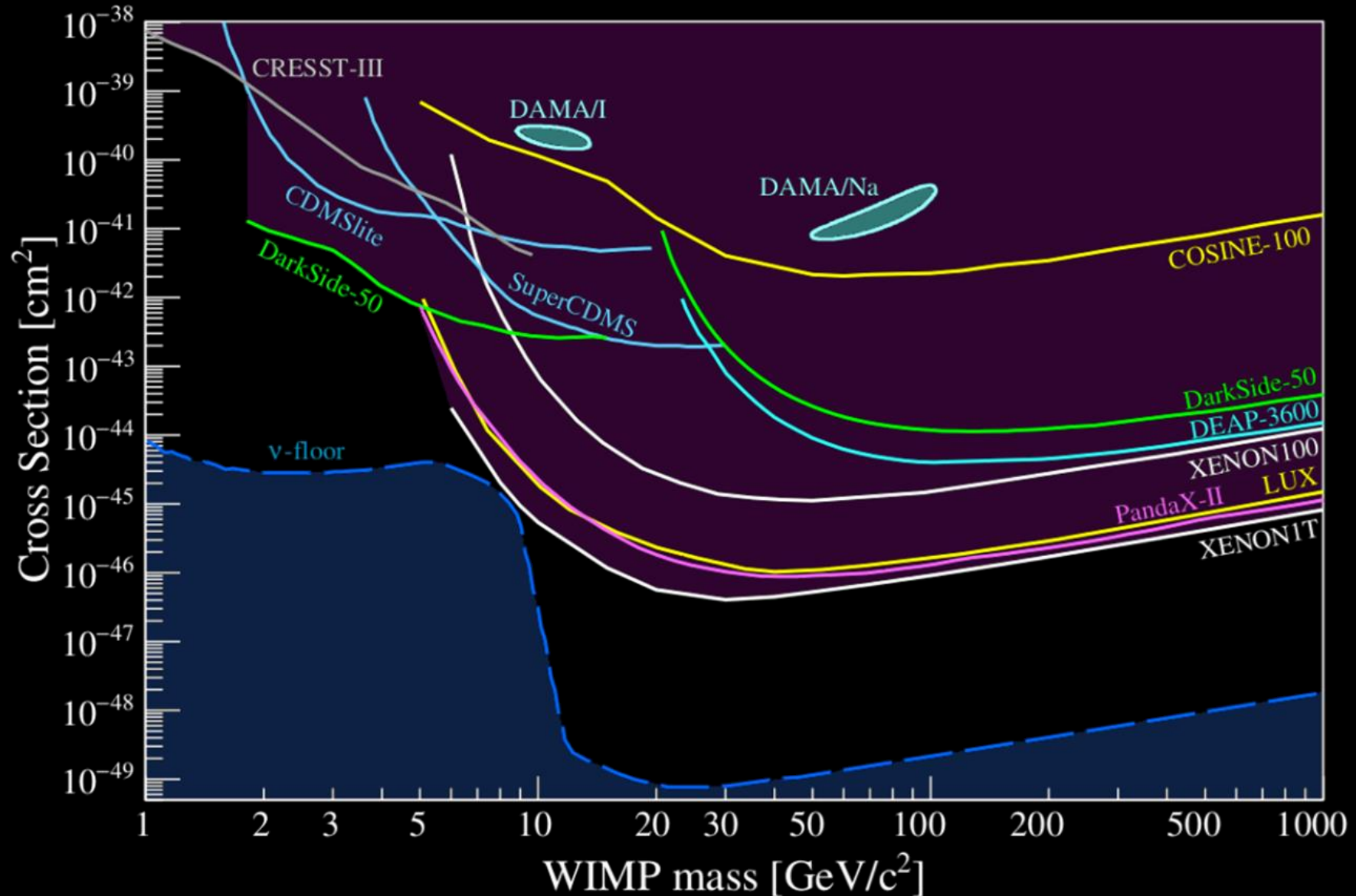
Heavily inspired from :

Simulations of athermal phonon propagation in a cryogenic
semiconducting bolometer

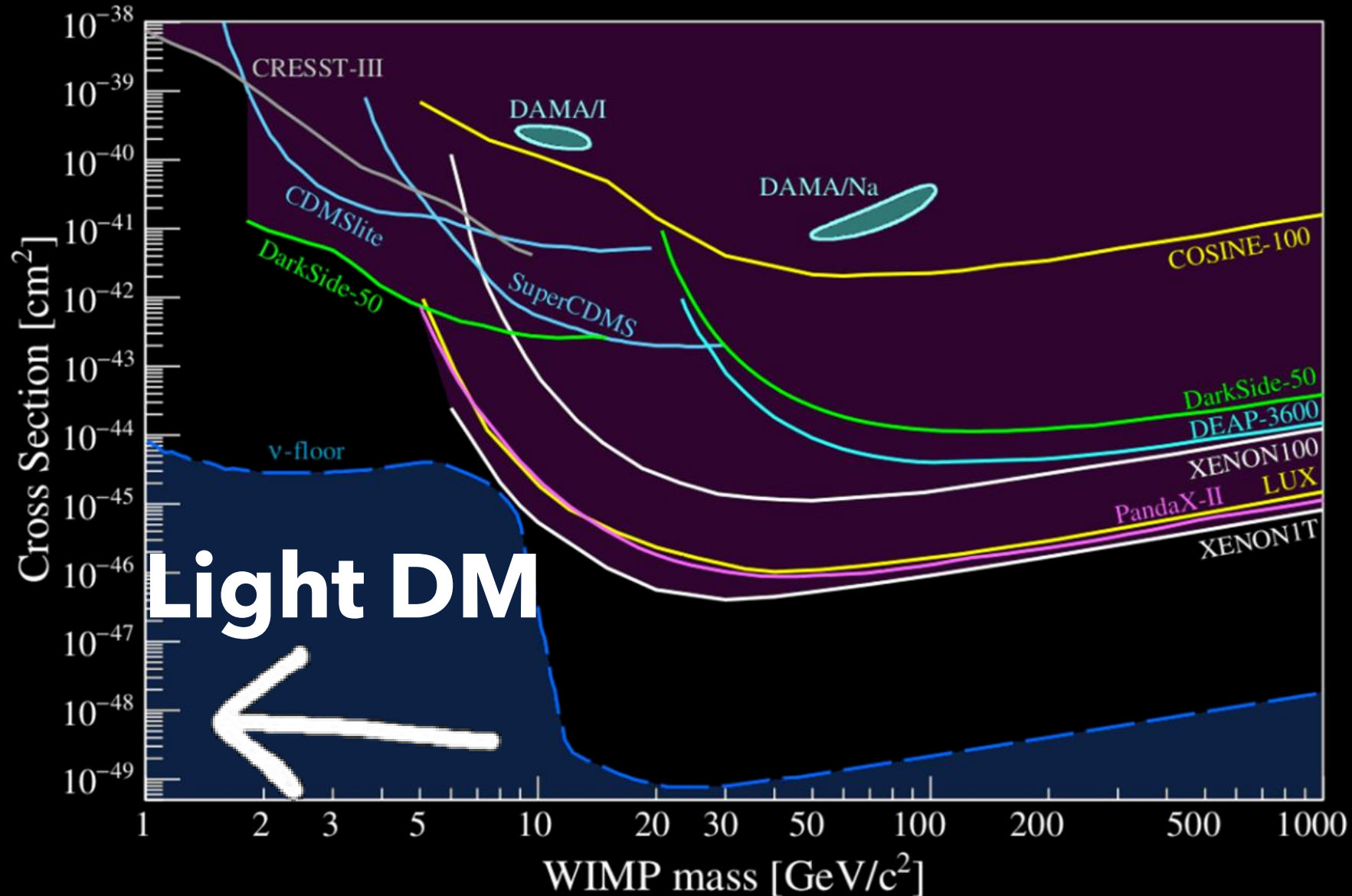
S. L. Stever^{a,b}, F. Couchot^c, and B. Maffei^d



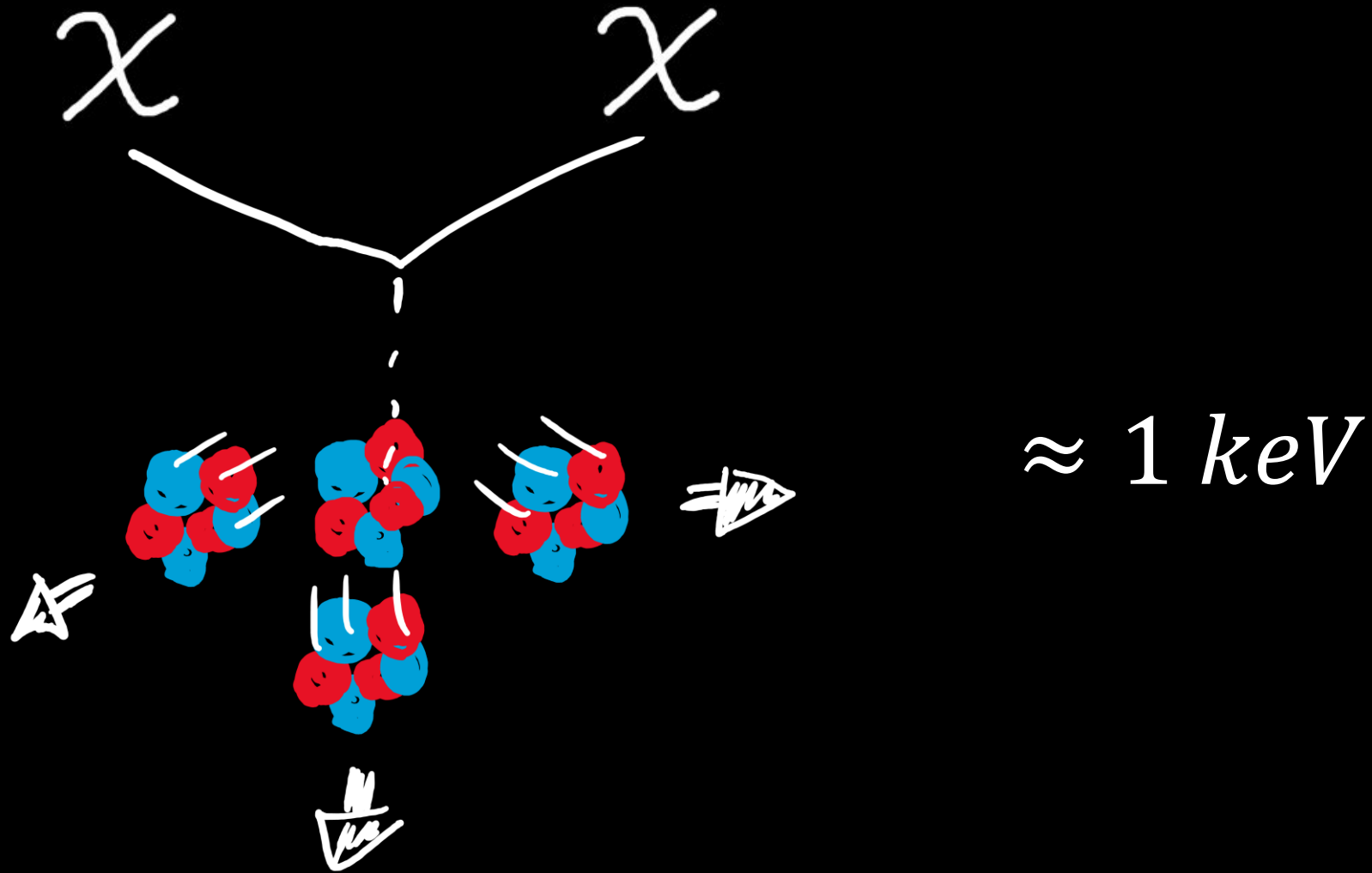
Dark Matter searches



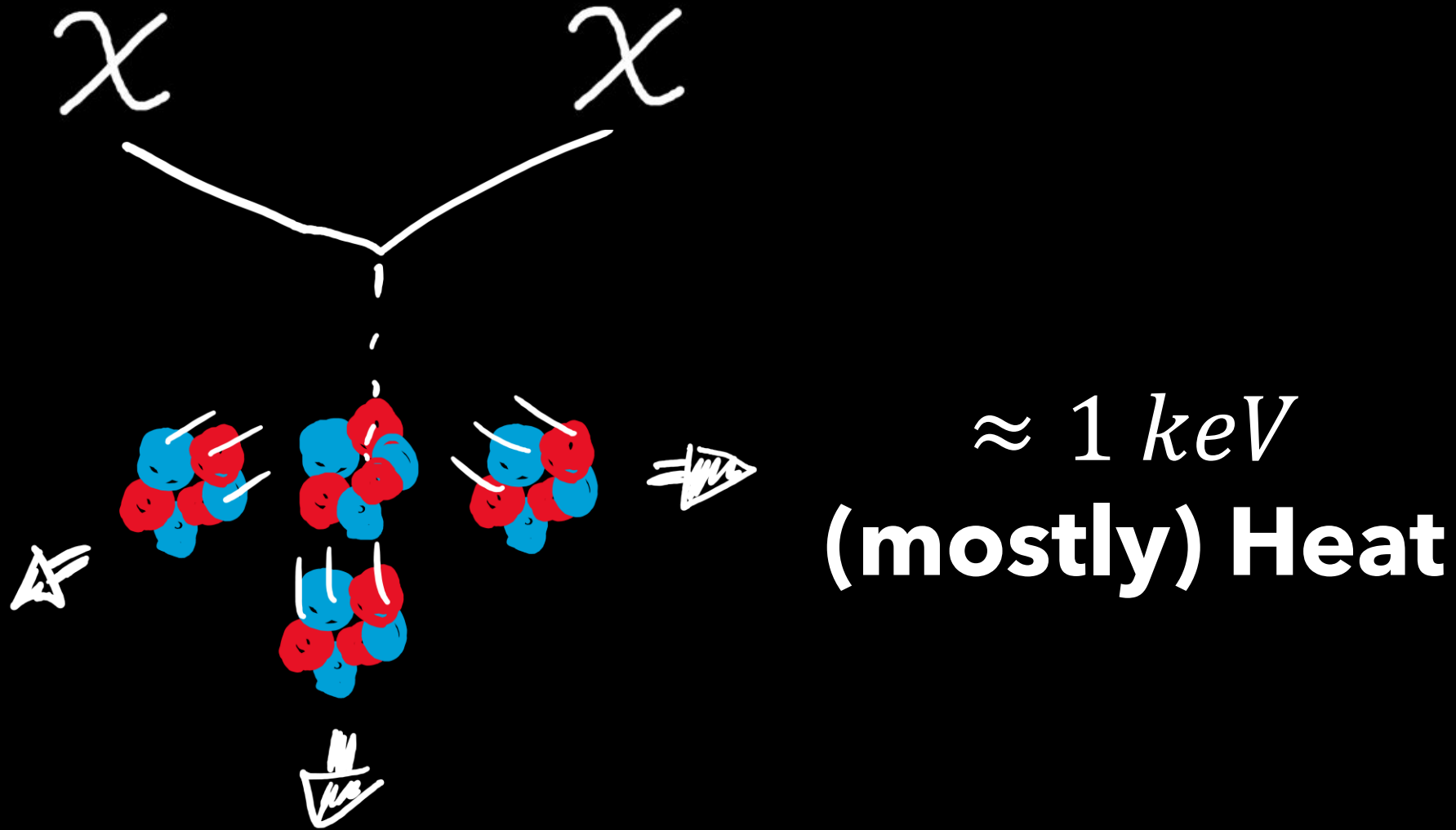
Dark Matter searches



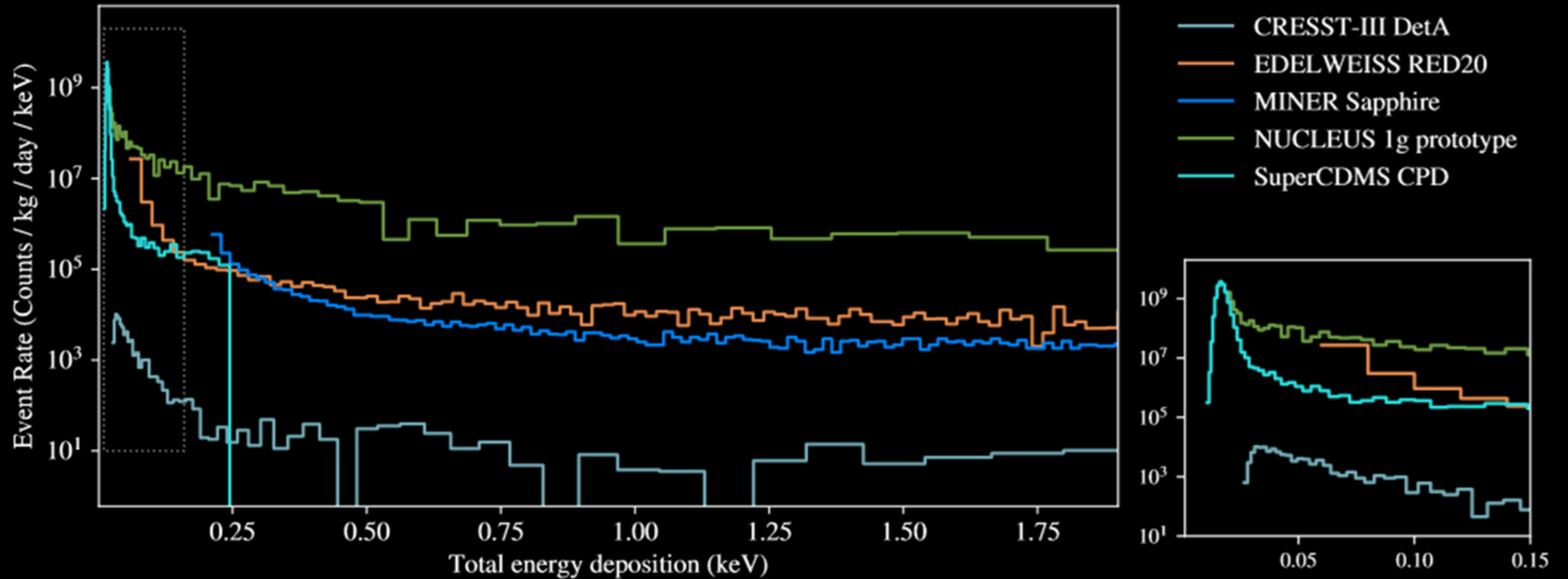
Light Dark Matter detection



Light Dark Matter detection



Low Energy Excess

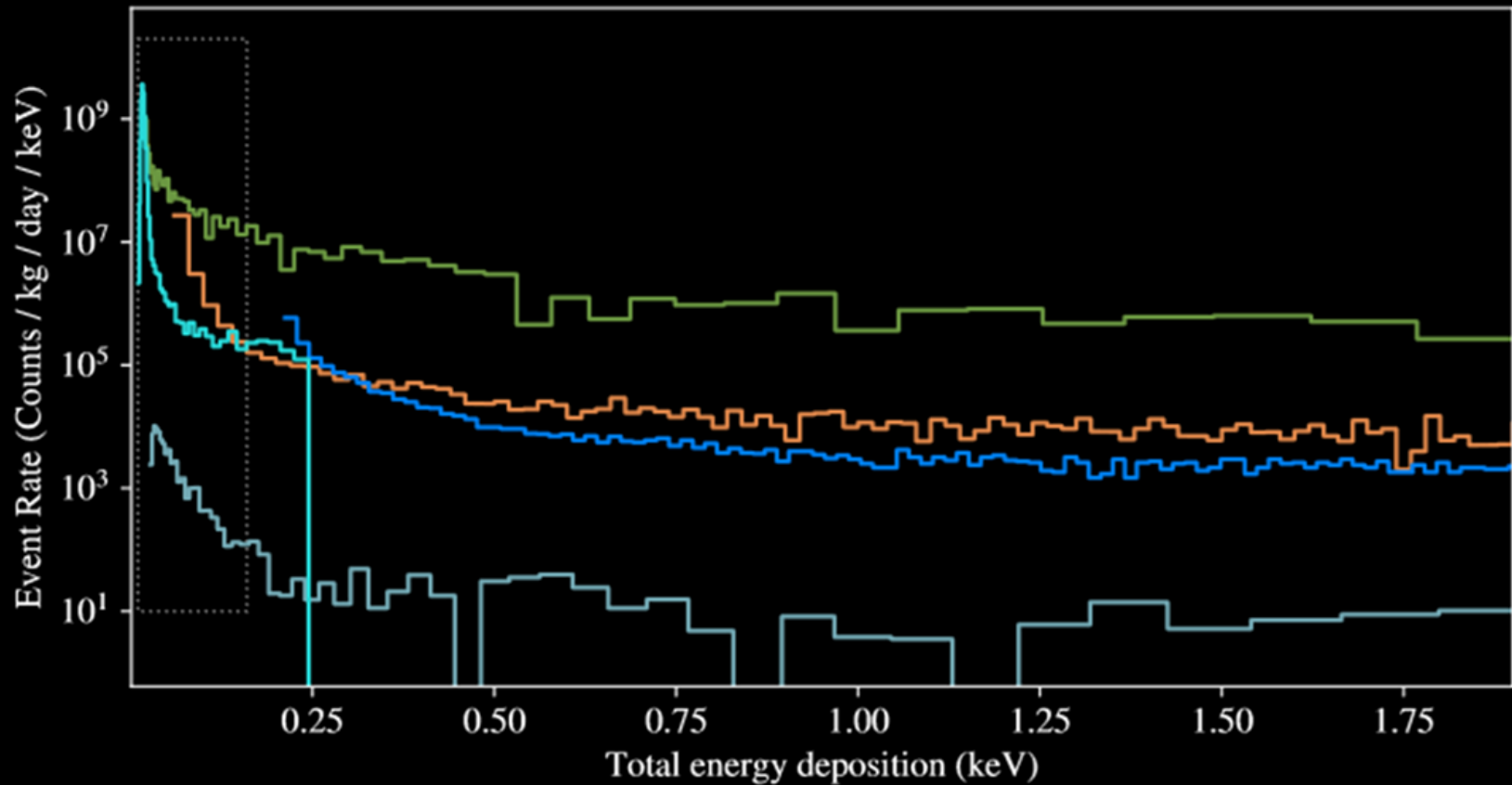


Low Energy Excess

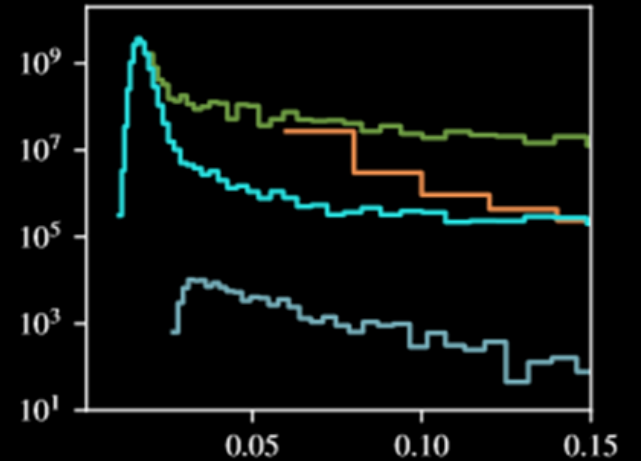


MAX-PLANCK-INSTITUT
FÜR PHYSIK

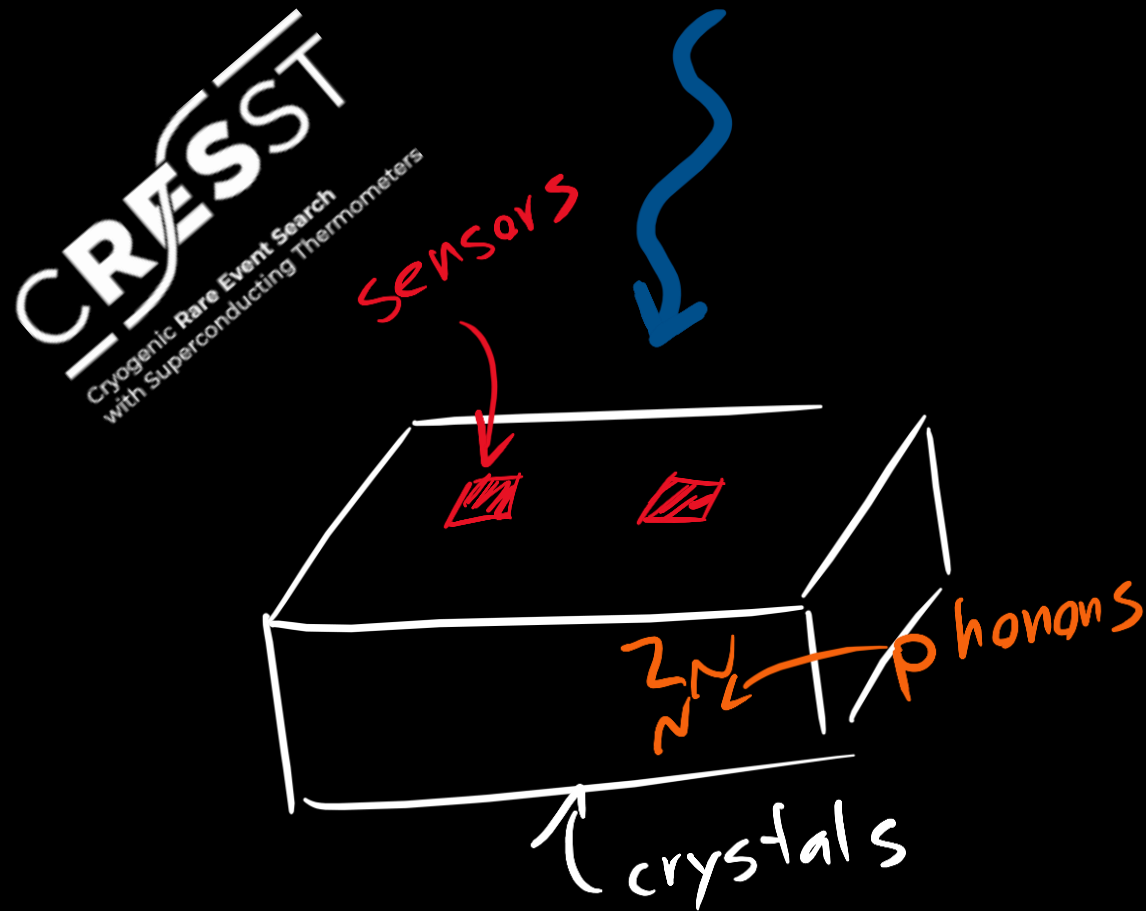
↑
~~LETES~~



- CRESST-II DetA
- EDELWEISS RED20
- MINER Sapphire
- NUCLEUS 1g prototype
- SuperCDMS CPD



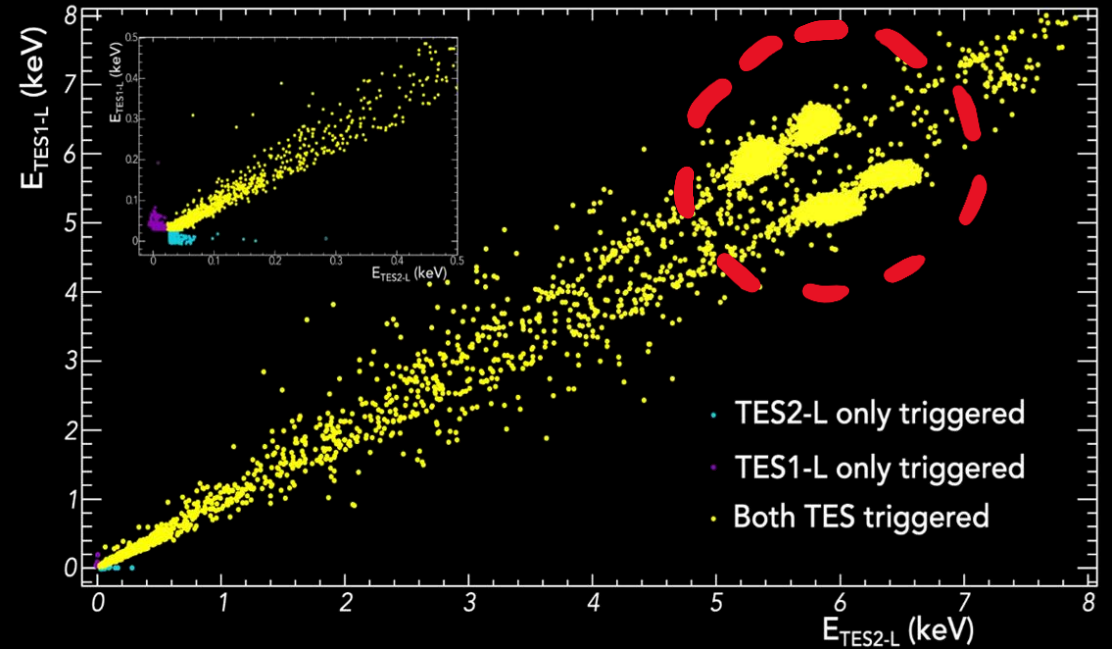
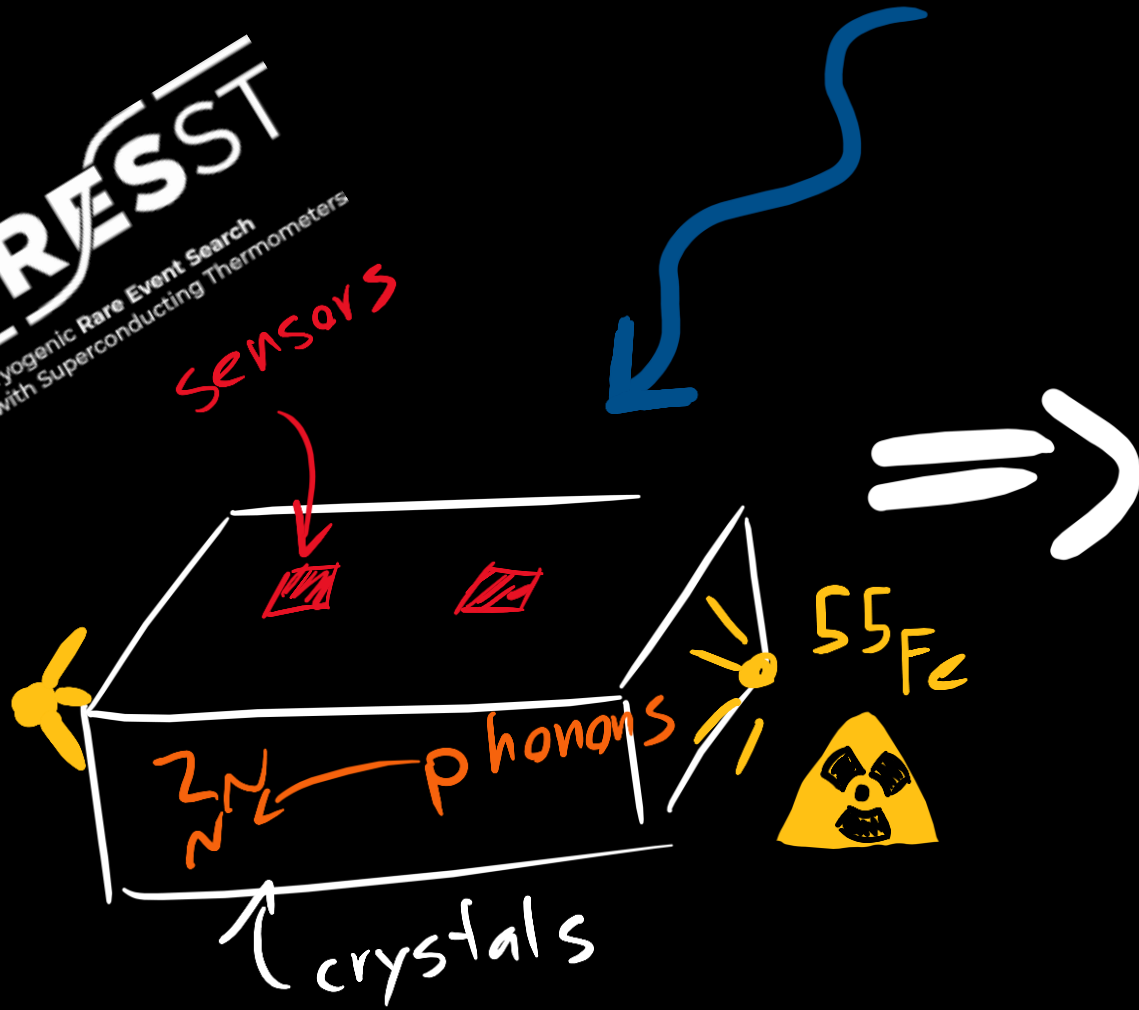
CRESST Double TES



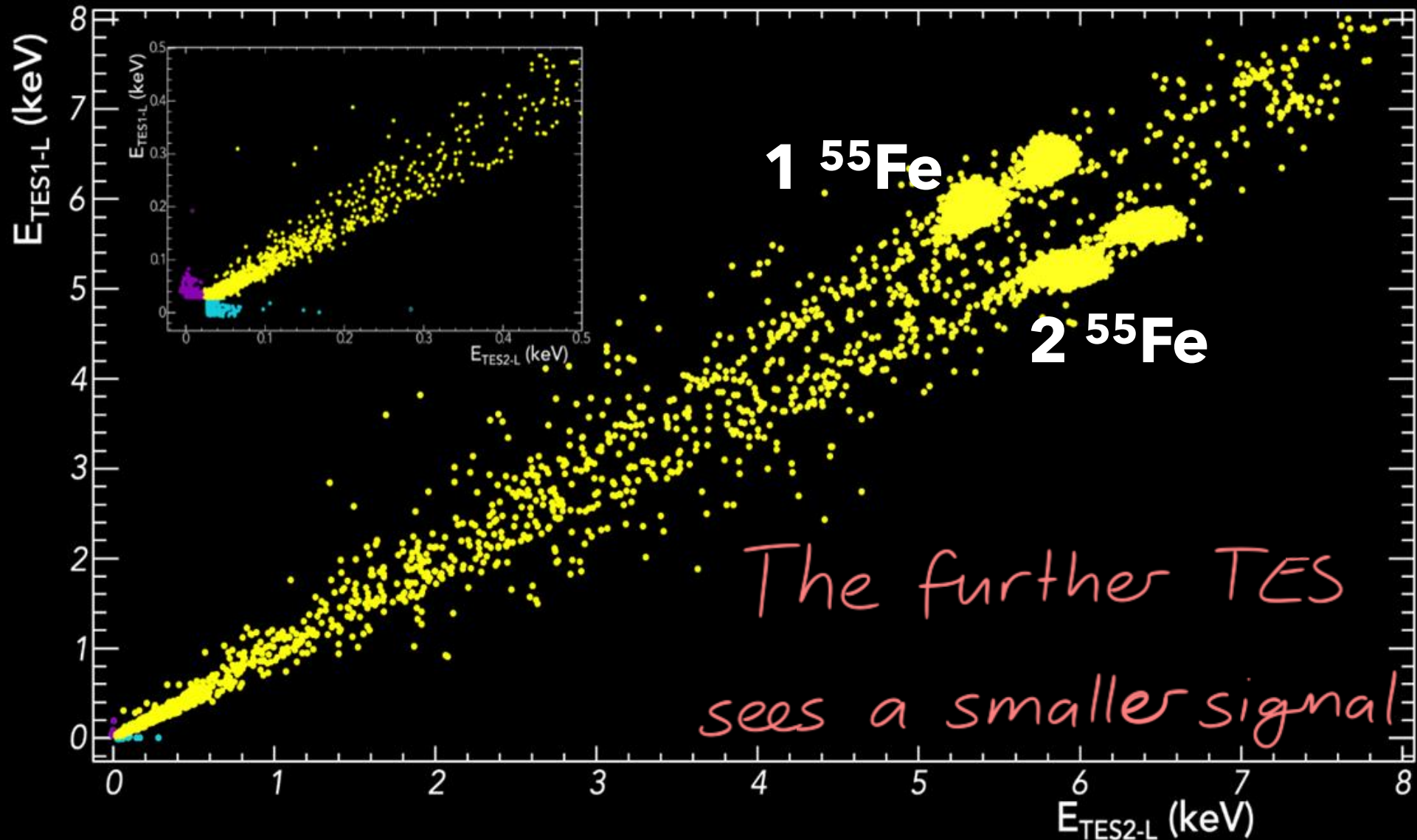
($CdWO_4$, Sapphire, Silicon, ...)

CRESST Oddities

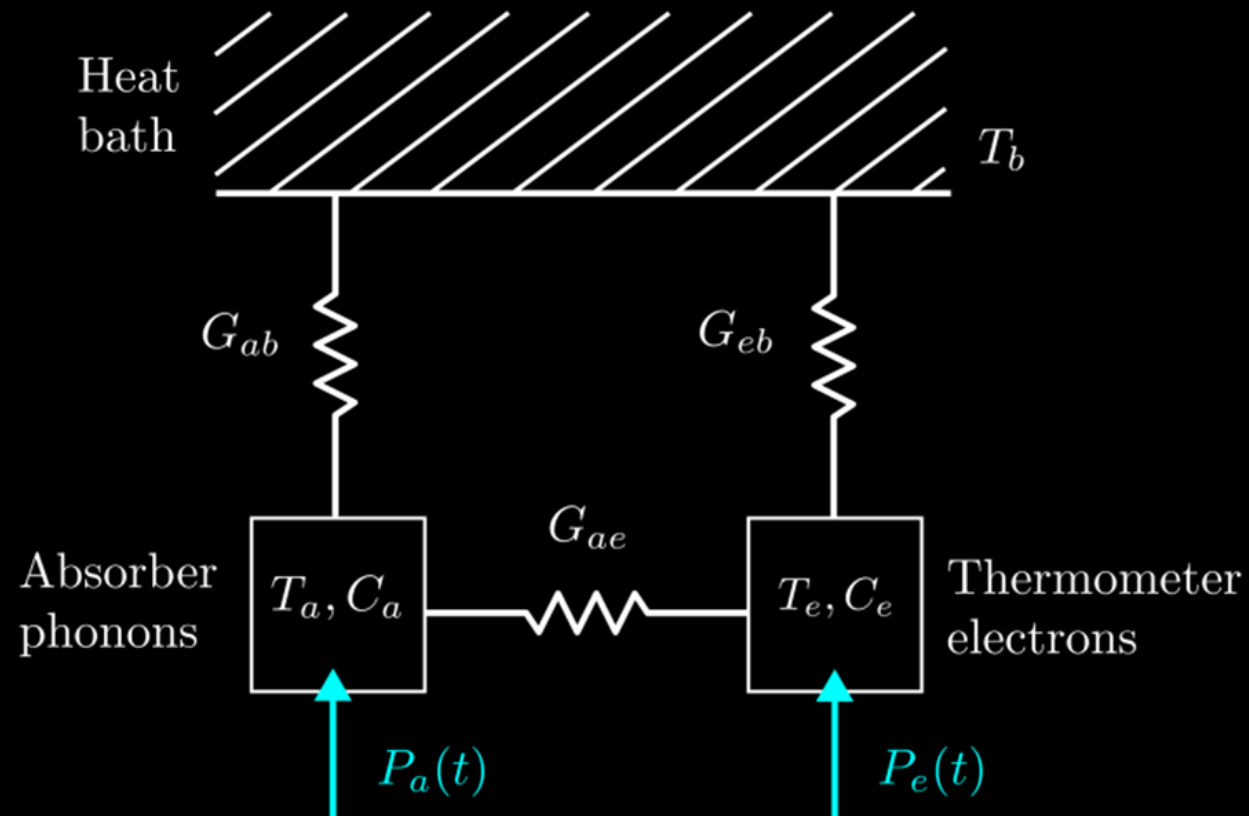
CRESST
Cryogenic Rare Event Search
with Superconducting Thermometers



Position Dependence



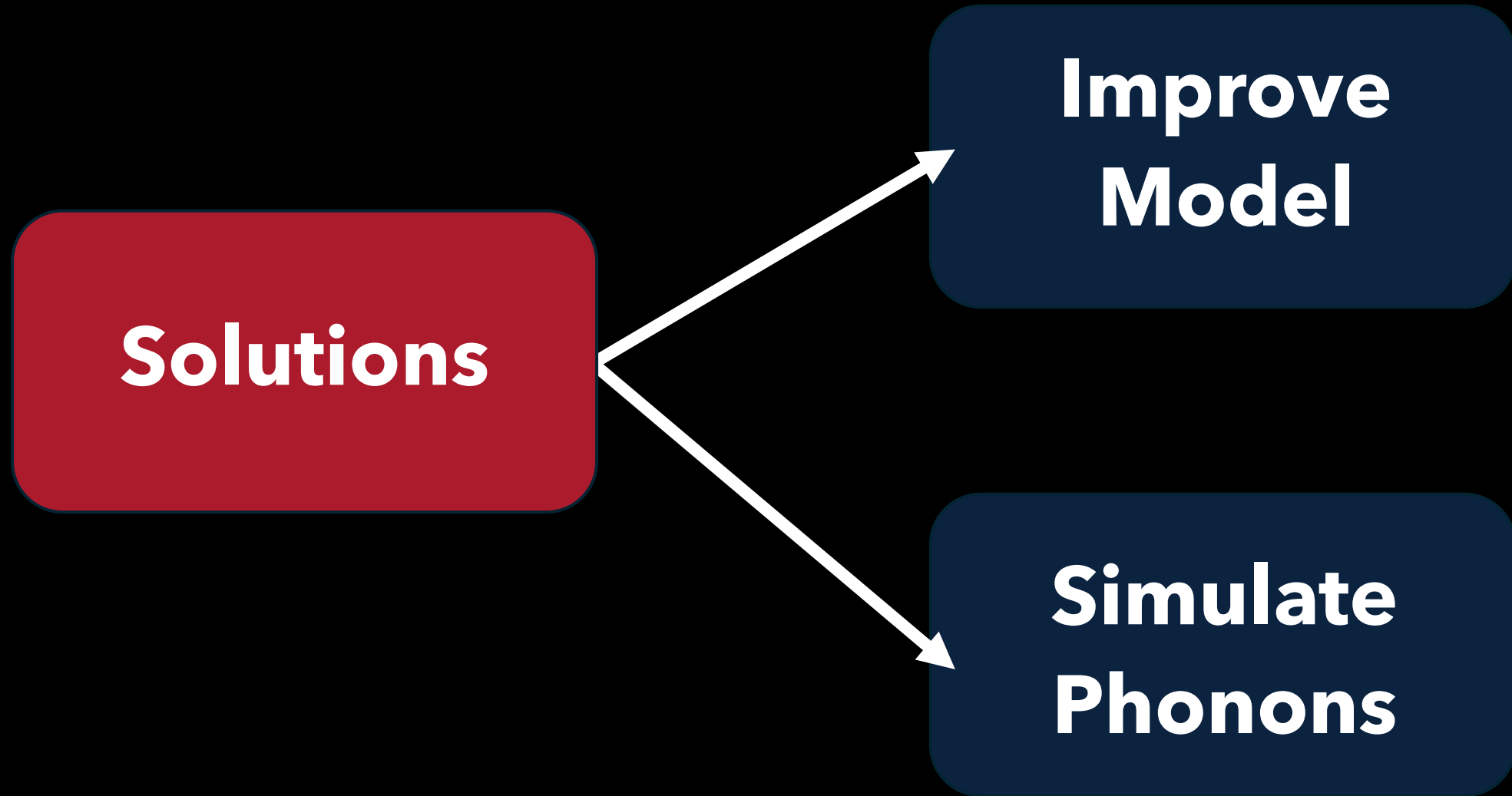
The Thermal Model



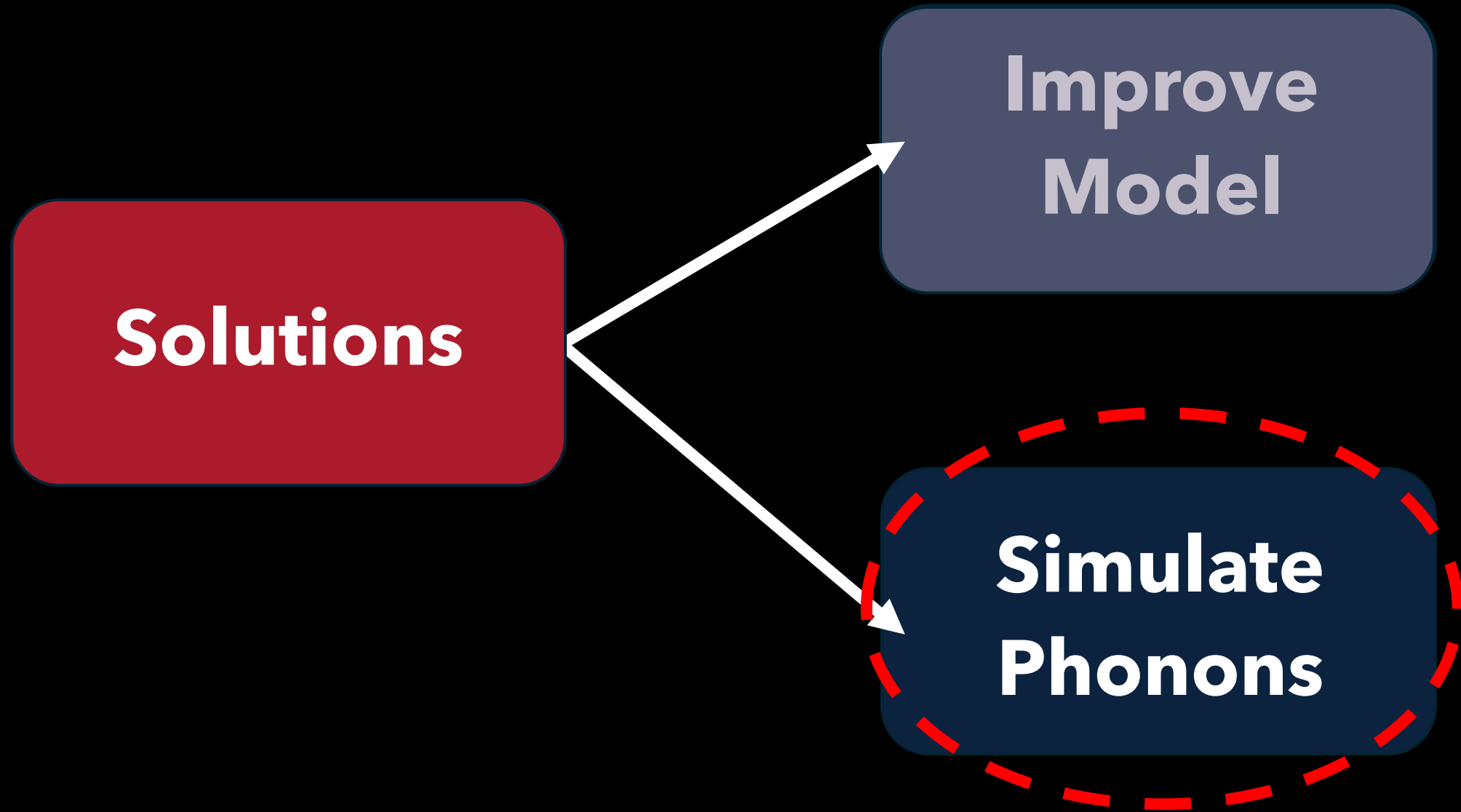
The Thermal Problem



Athermal Solution



Athermal Solution



Phonon Recap

Phonons in a substrate

Scattering

$$\tau_e = A\omega^4$$

Decay

$$\tau_a = A\omega^5$$

Phonon Recap

Phonons in a
substrate

Every decay
 $\Rightarrow 32\times$ lifetime

Scattering

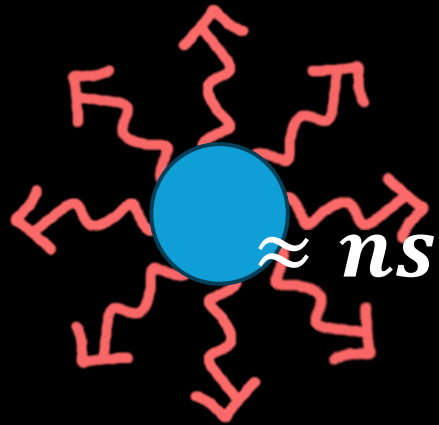
$$\tau_e = A\omega^4$$

Decay

$$\tau_a = A\omega^5$$

Phonon Simulation

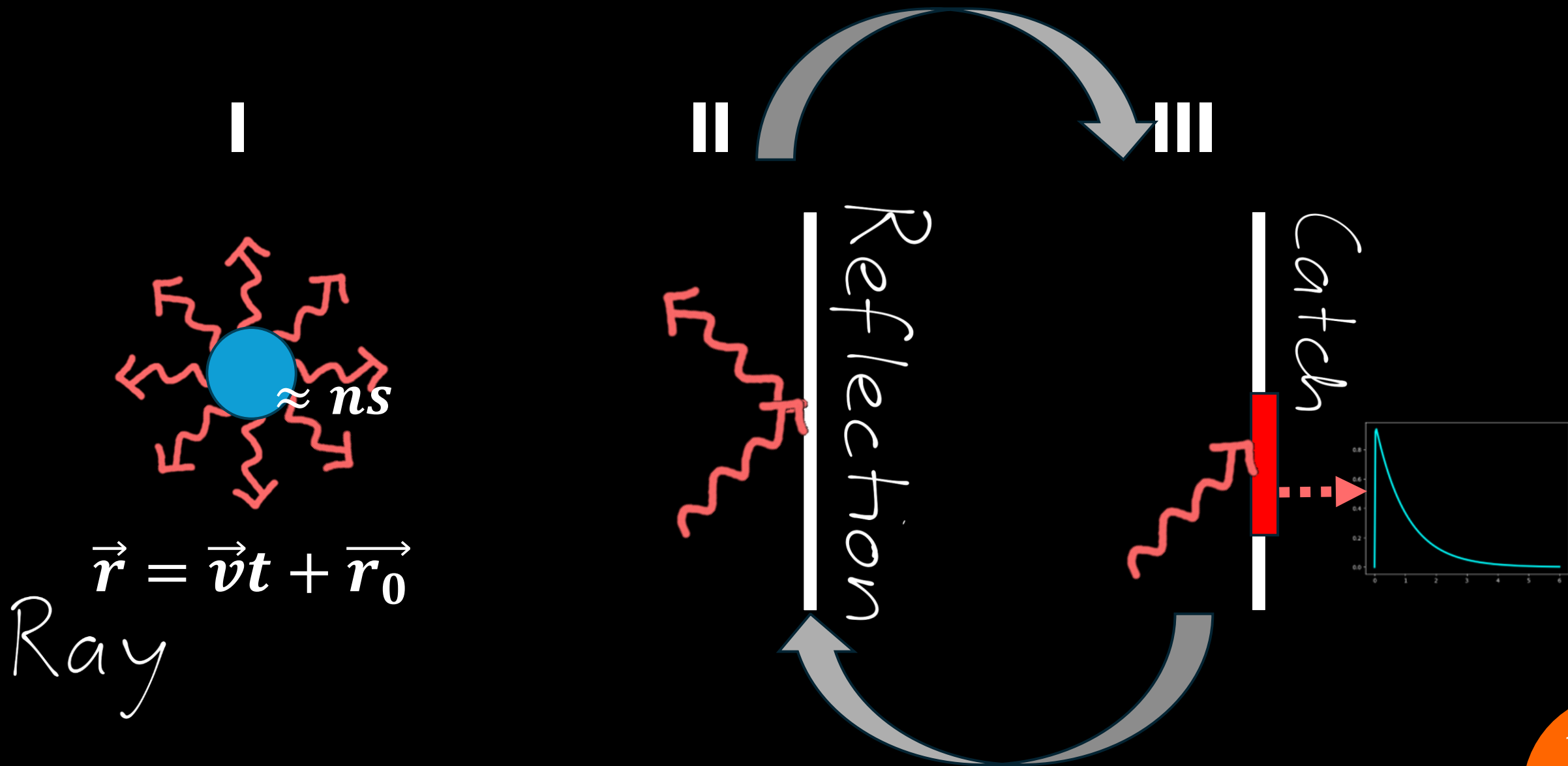
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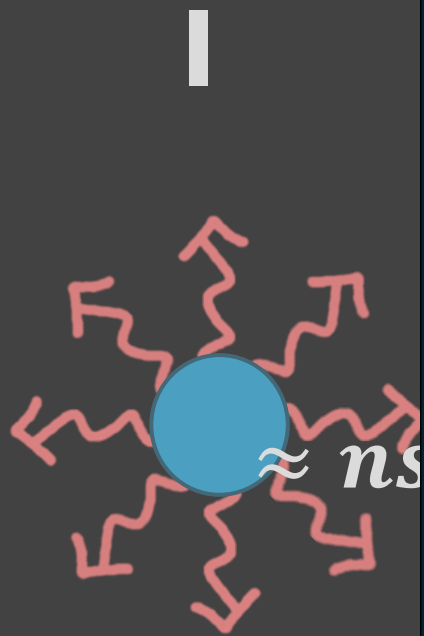
$$\vec{r} = \vec{v}t + \vec{r}_0$$

Ray

Phonon Simulation

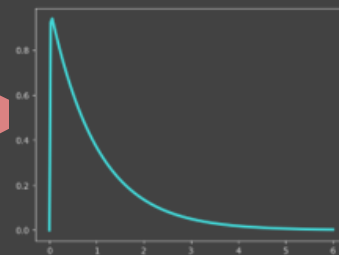
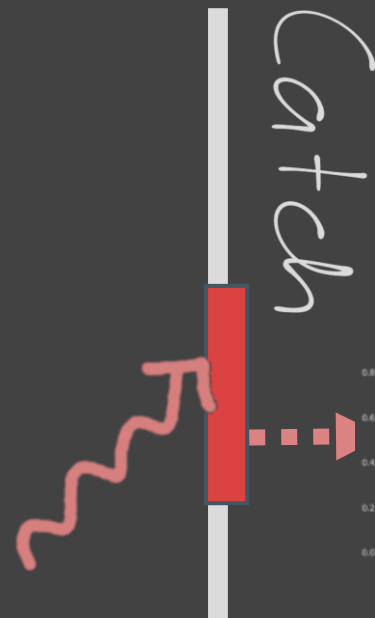
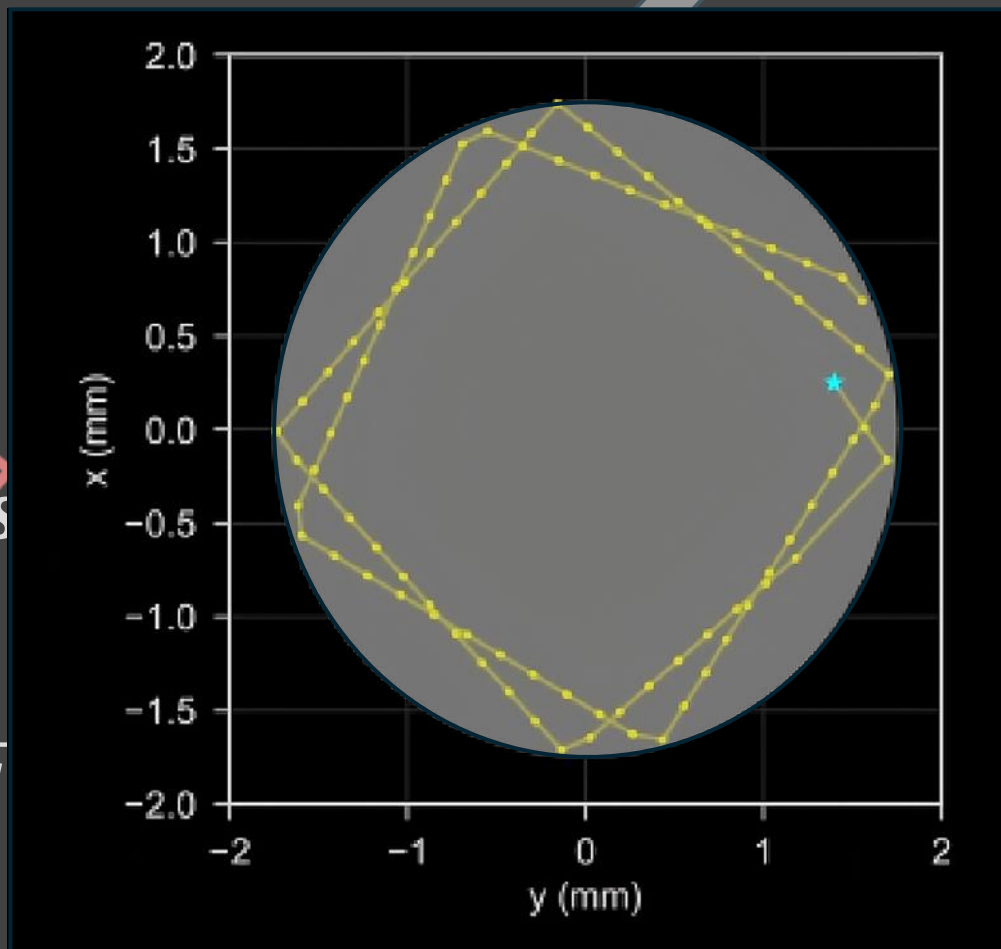


Phonon Simulation



$$\vec{r} = \vec{v}t + \vec{r}_0$$

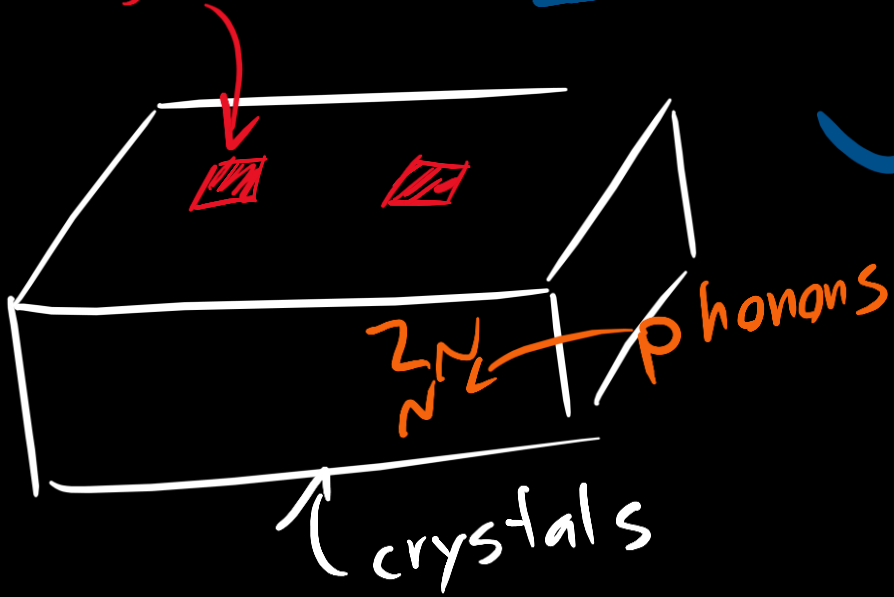
Ray



Simulations

CREST
Cryogenic Rare Event Search
with Superconducting Thermometers

sensors



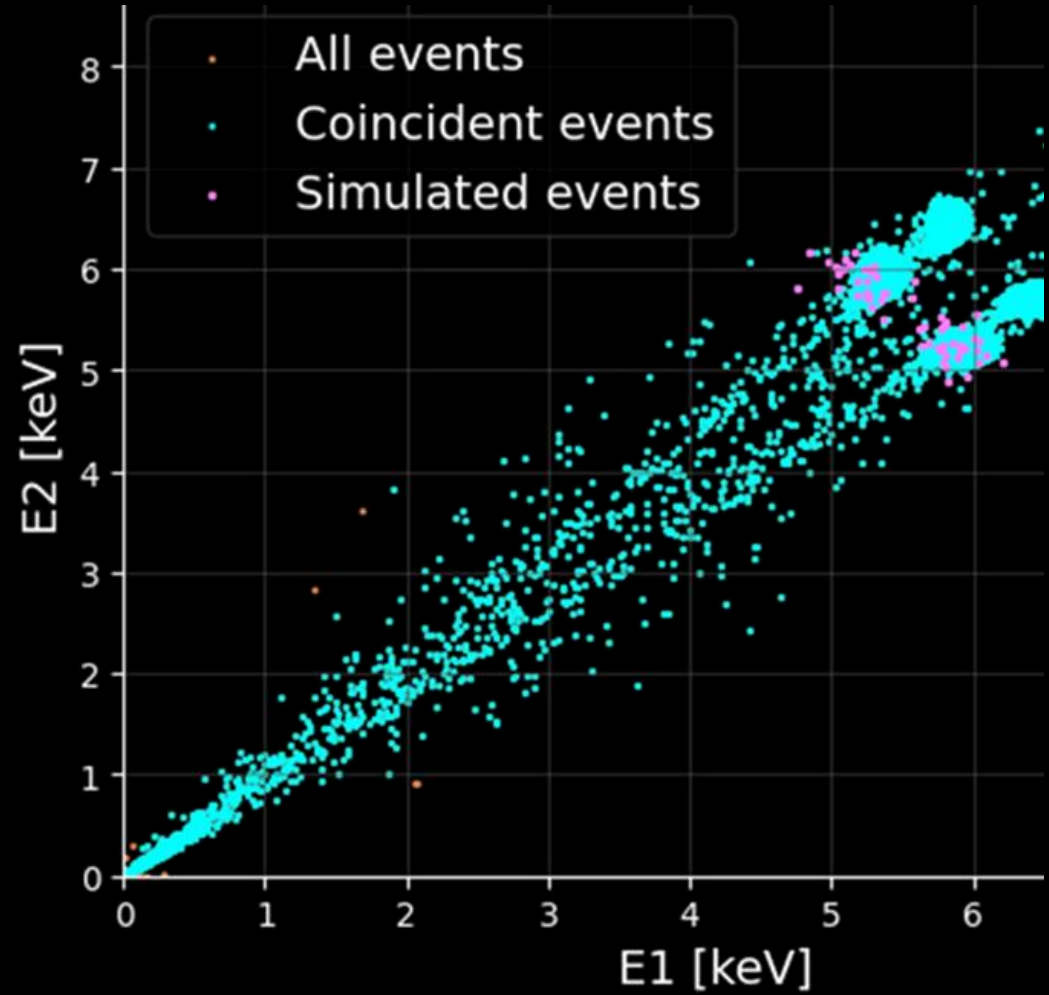
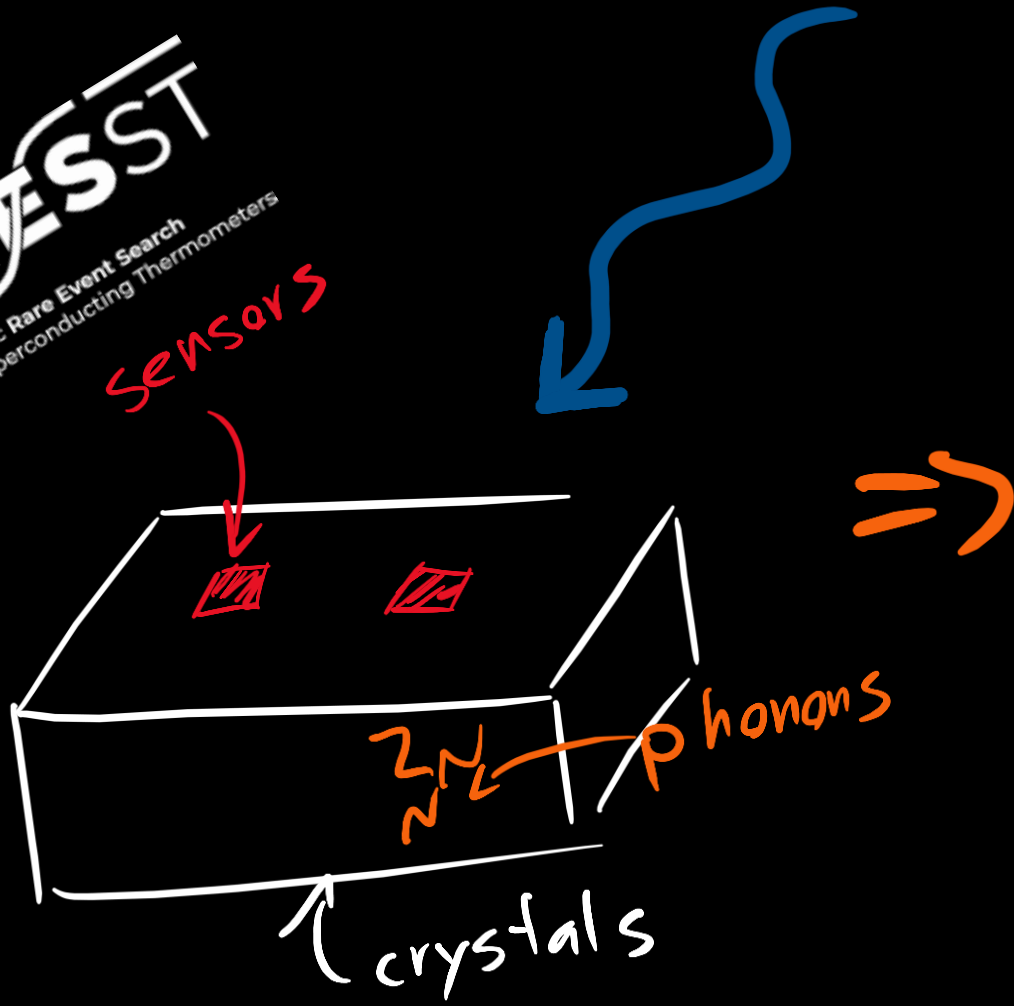
CAPIBARA



github

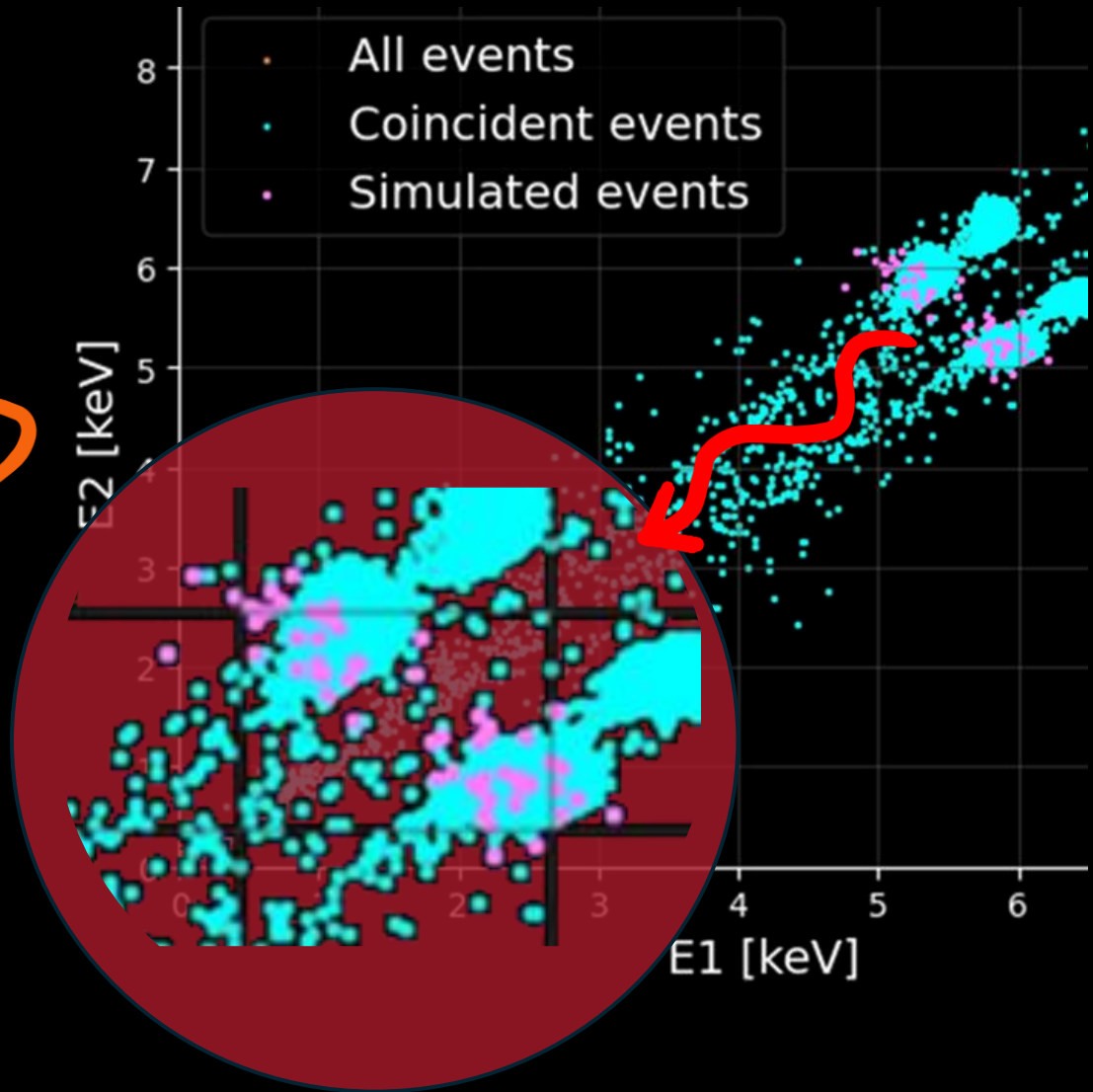
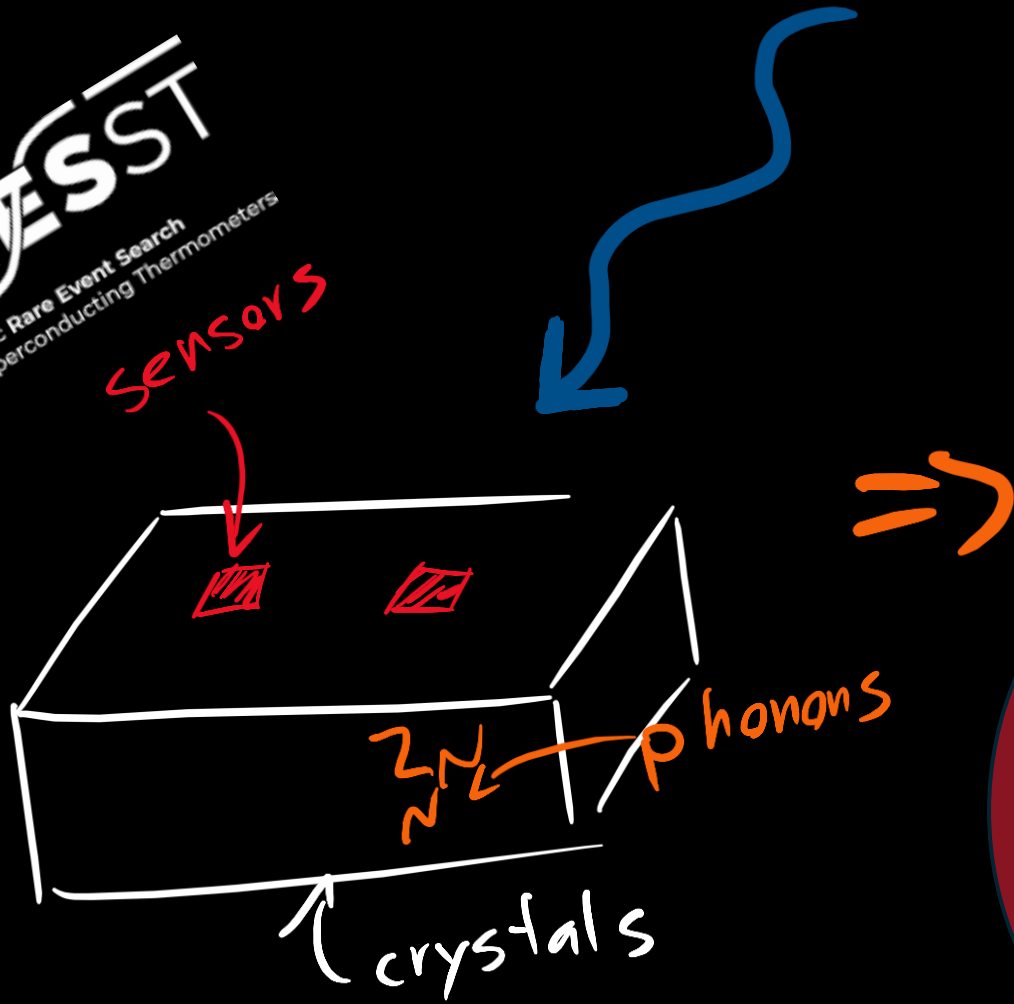
Simulations

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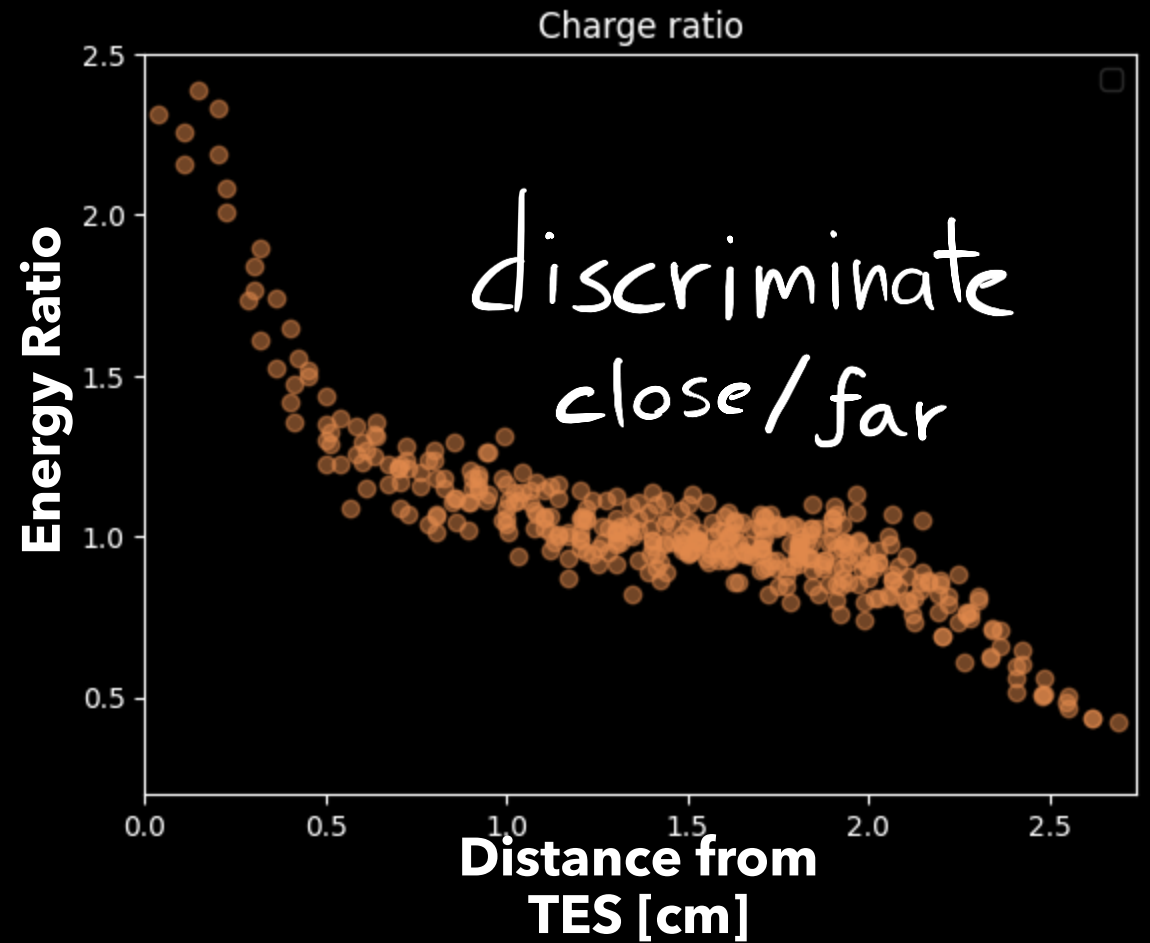
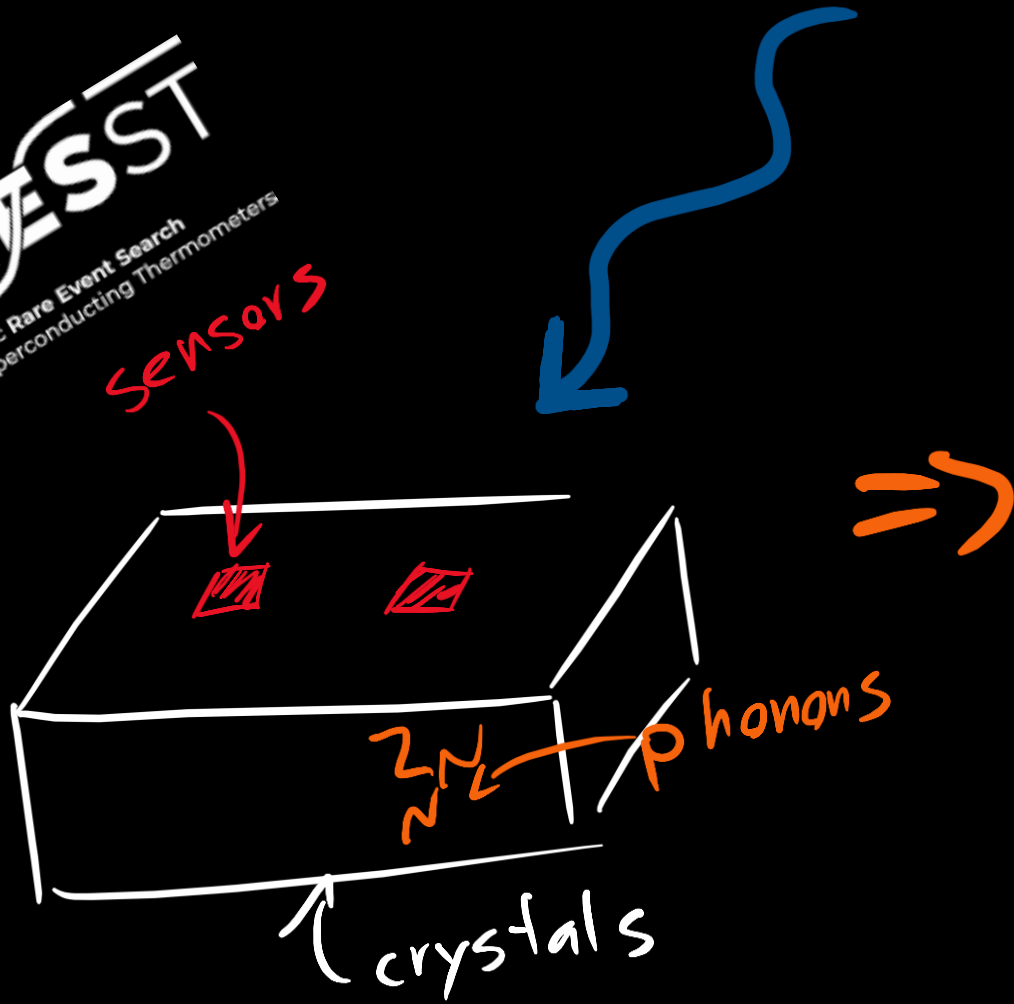
Simulations

CREST
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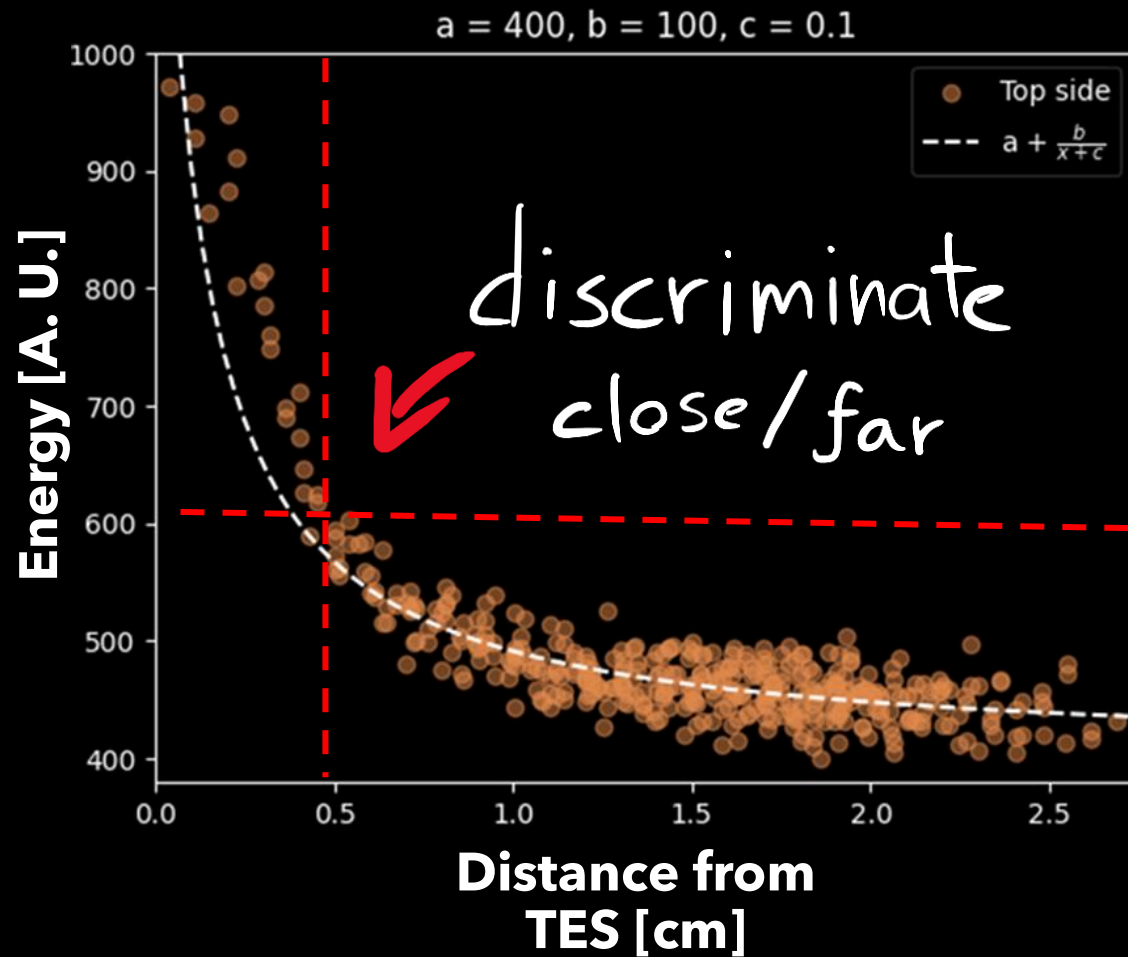


Simulations

CREST
Cryogenic Rare Event Search
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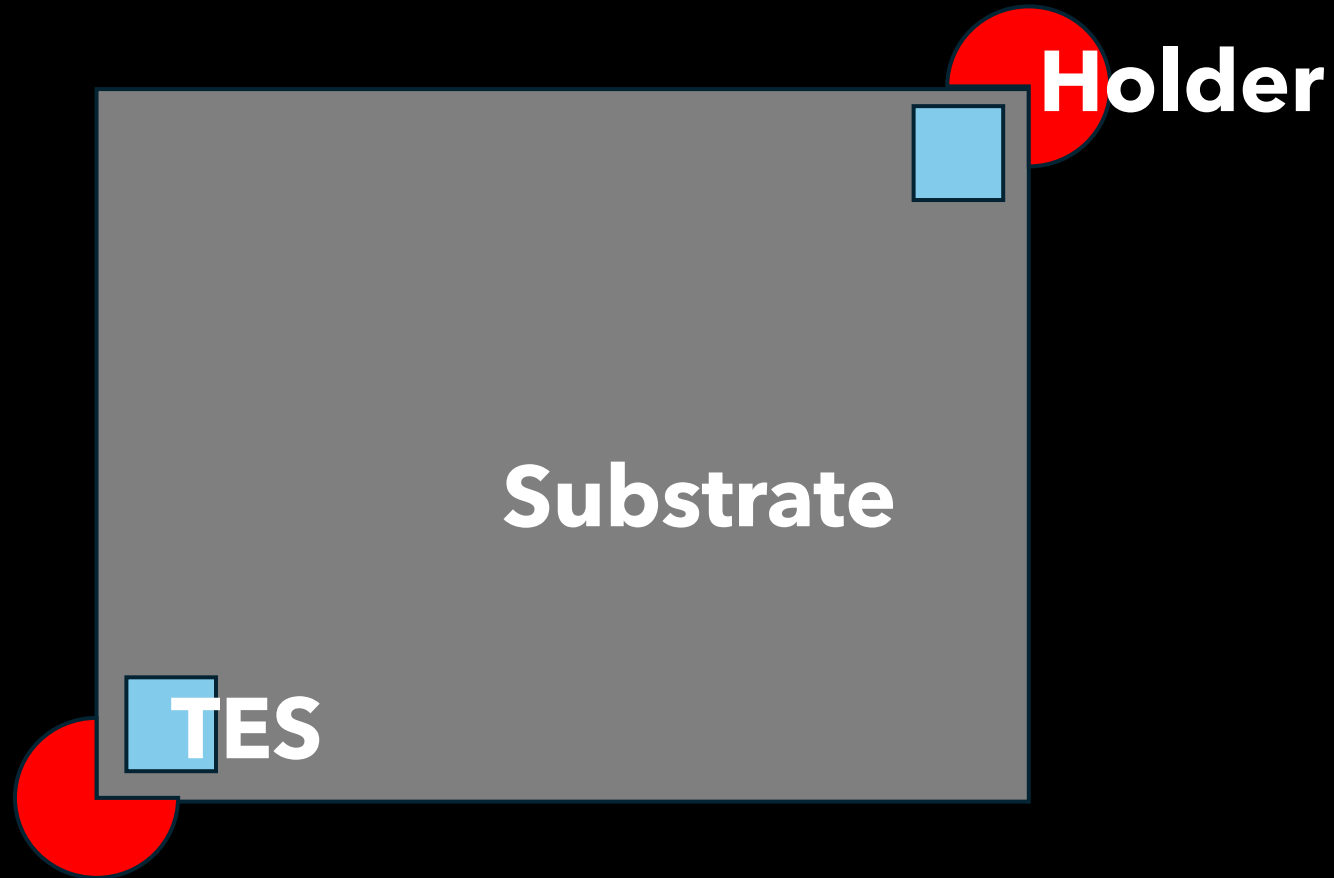
Questions



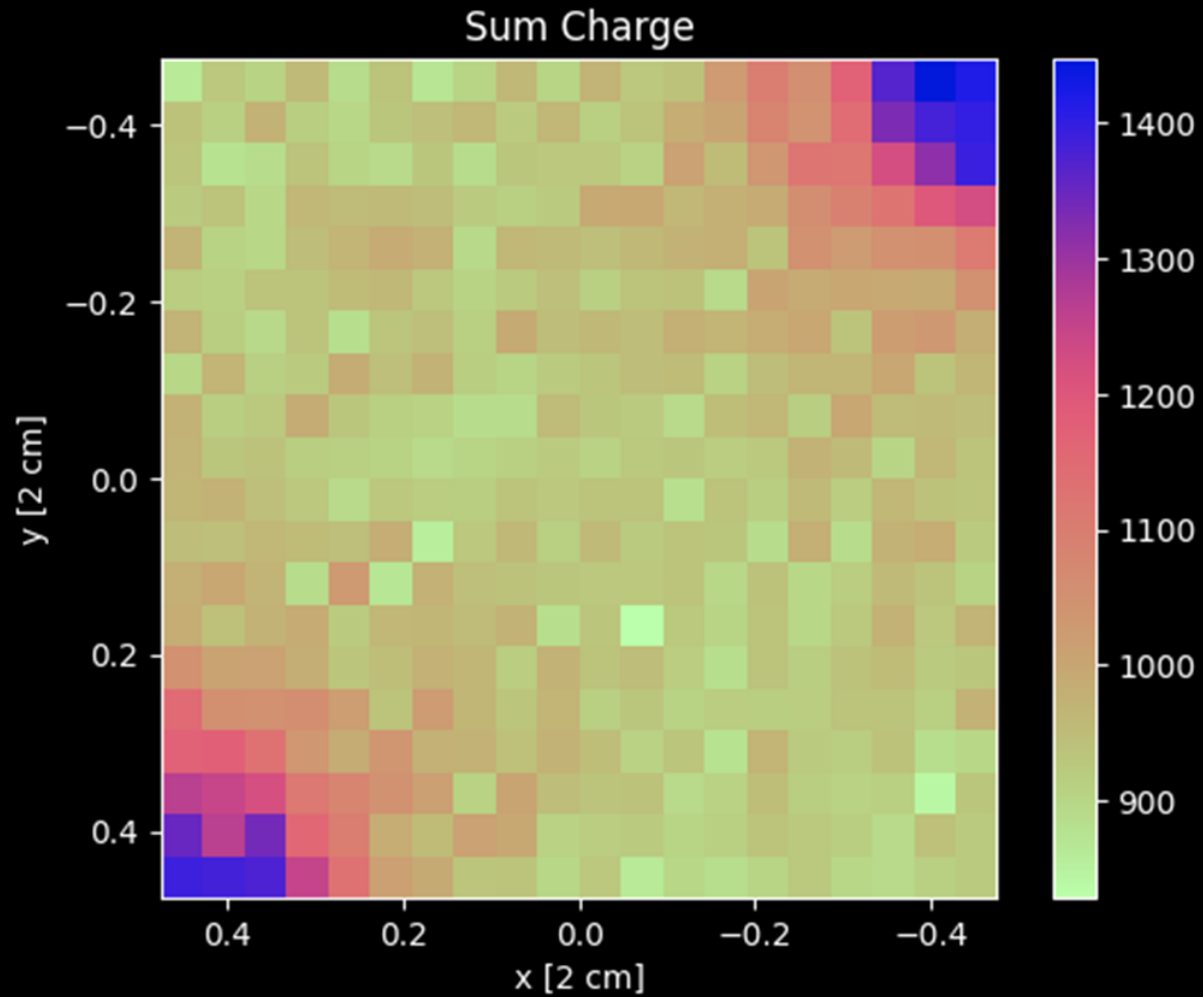
investigate

- TES source of LEE ?
- Crystal ?
- Cryostat ?

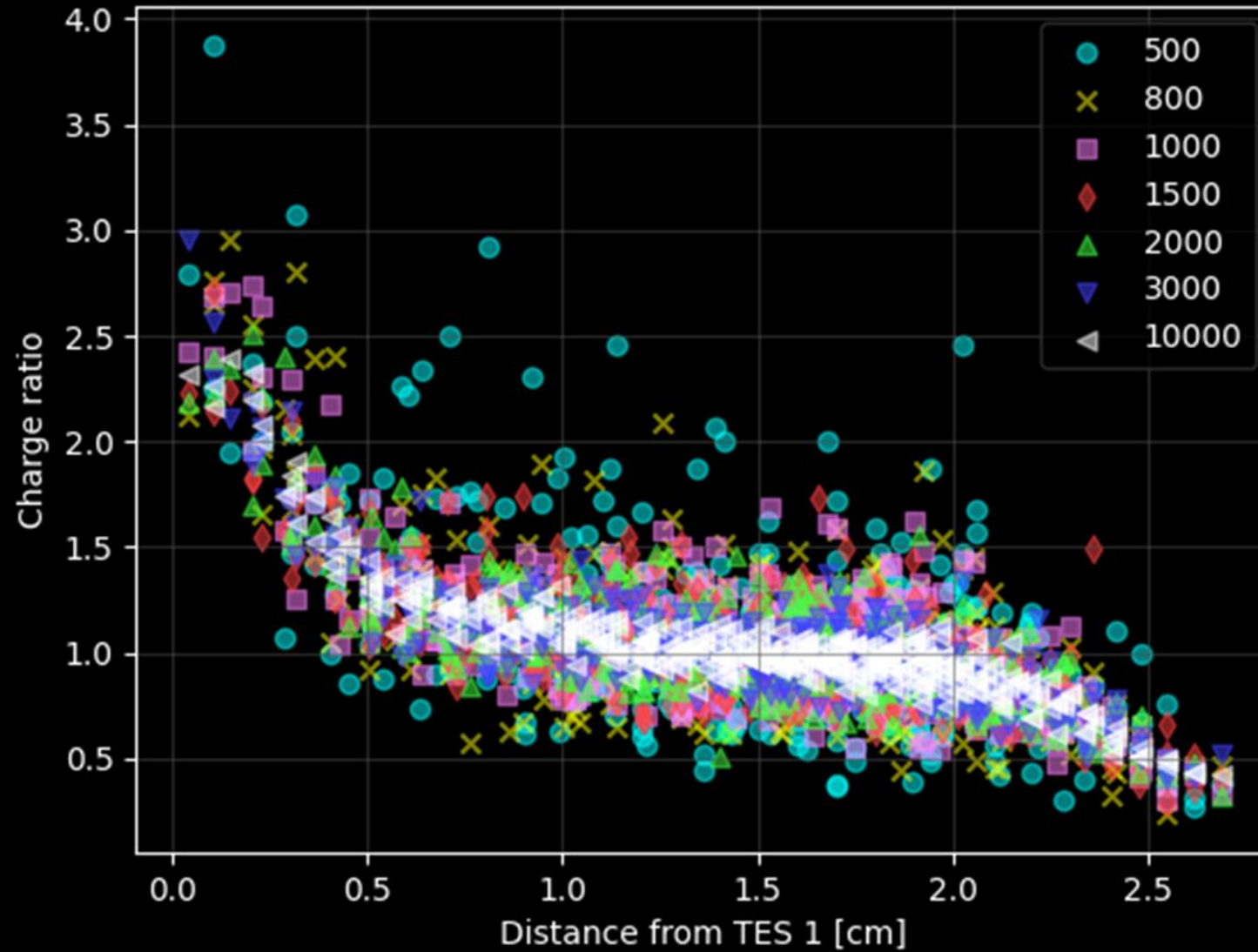
New Designs



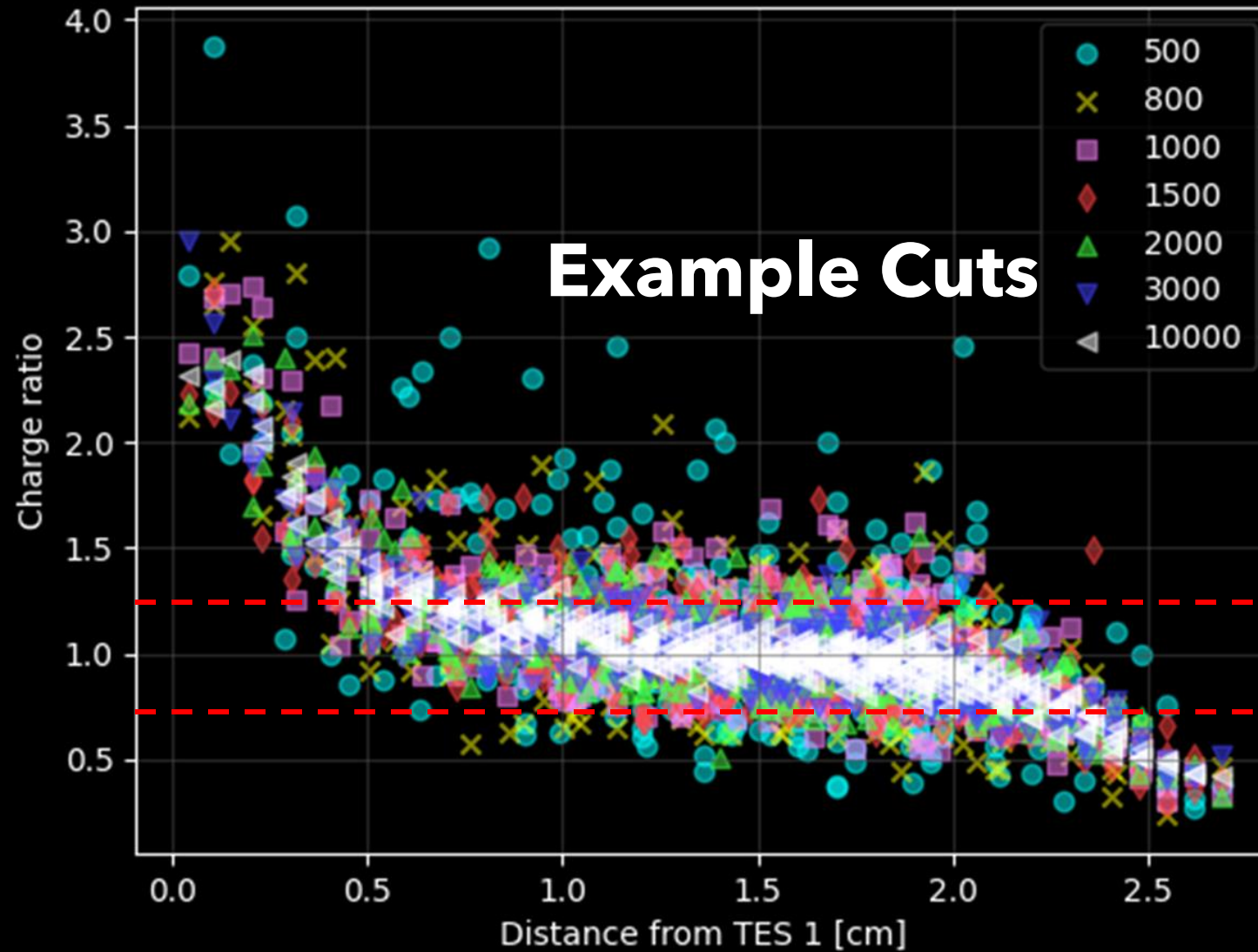
New Designs - Simulation



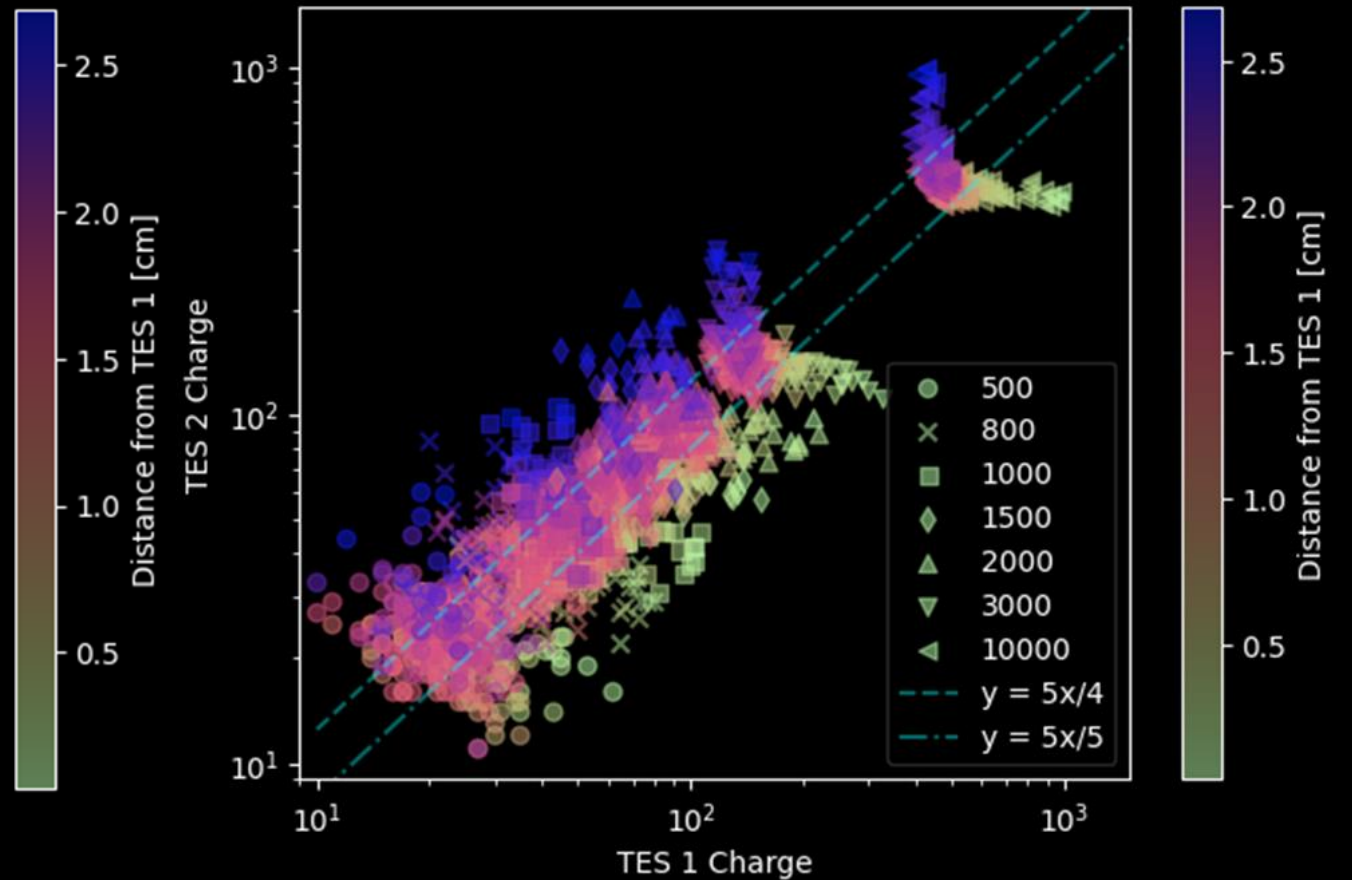
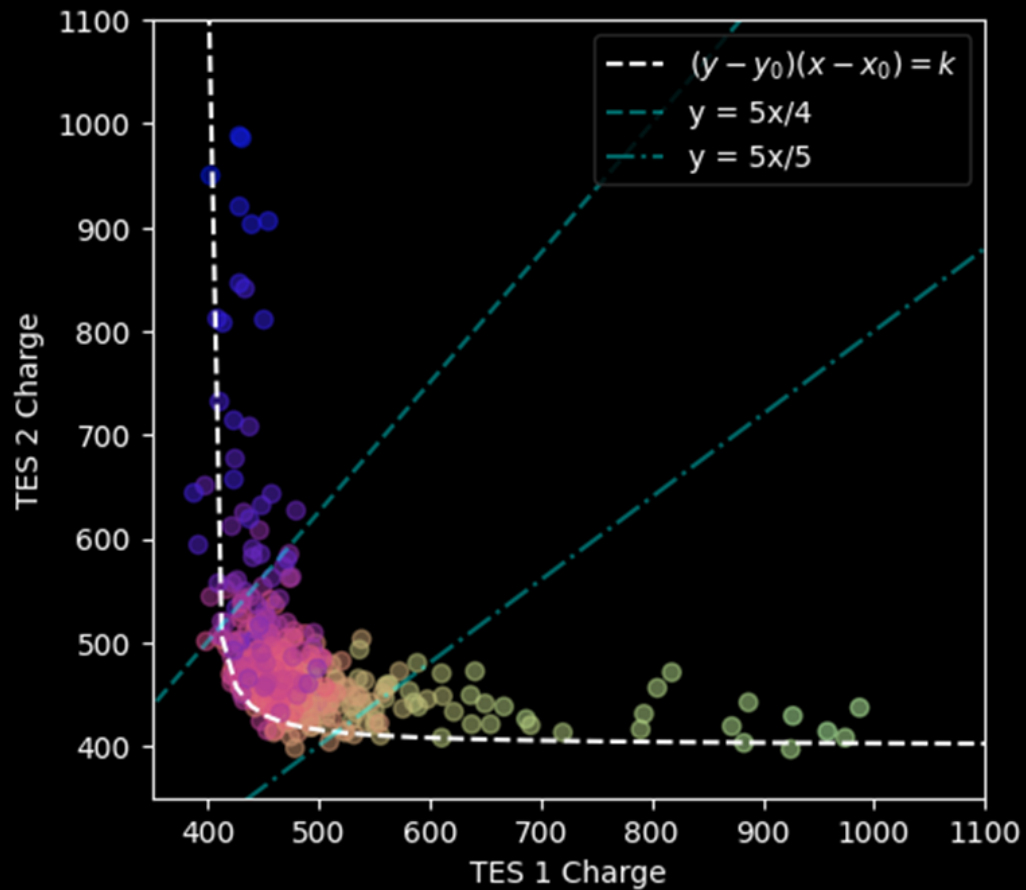
Results



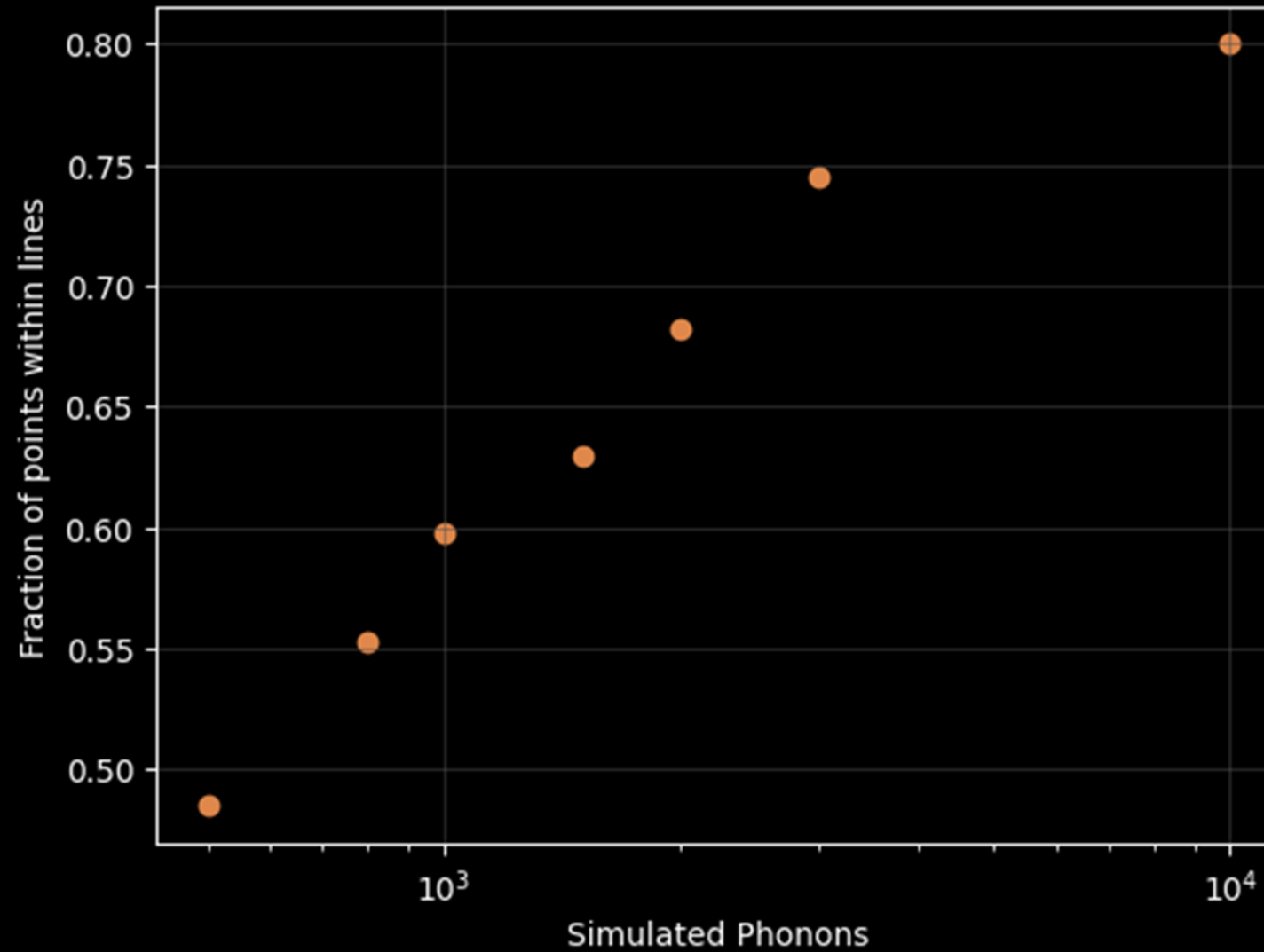
Results



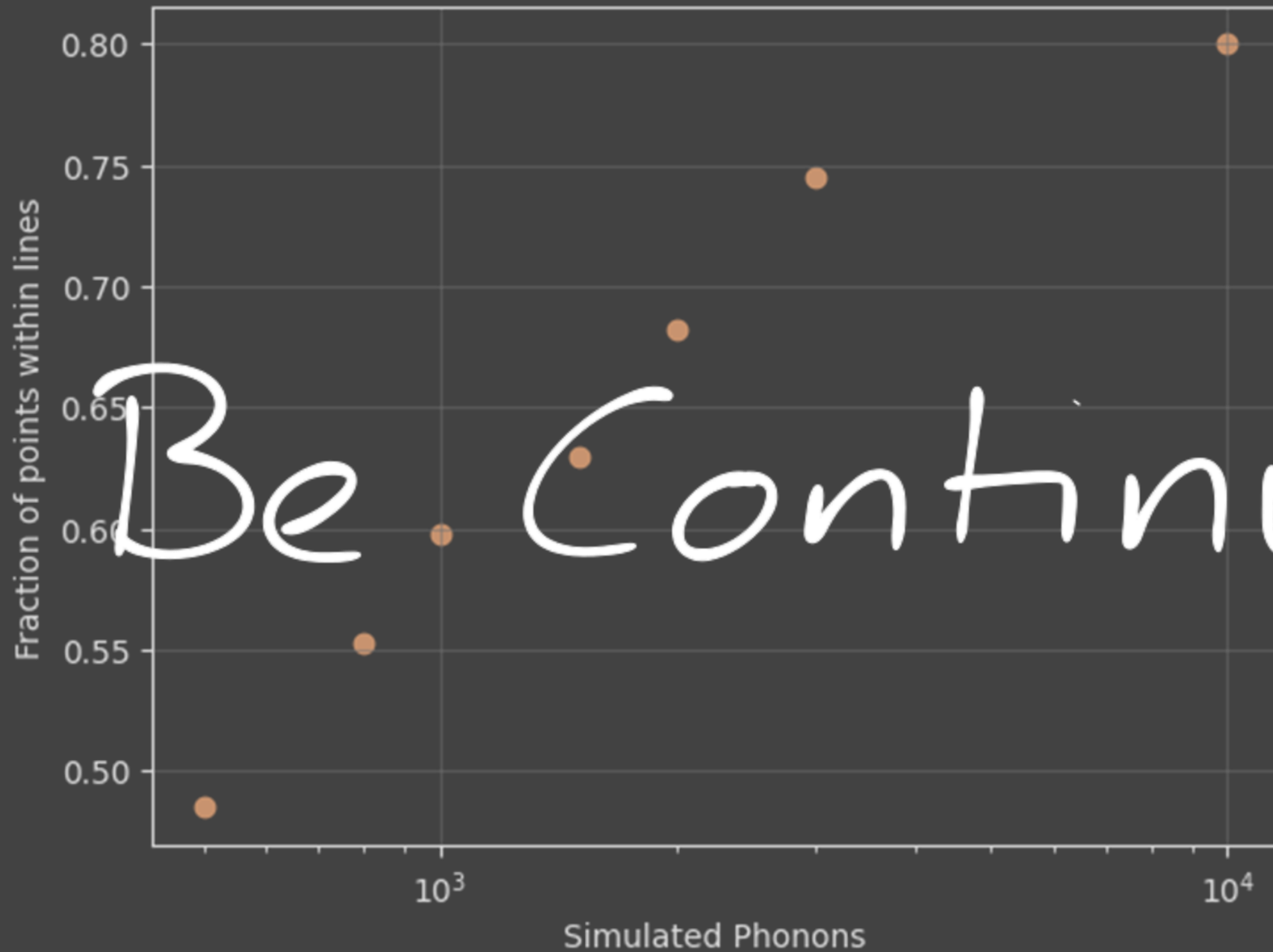
Applications



Reduce Background ?

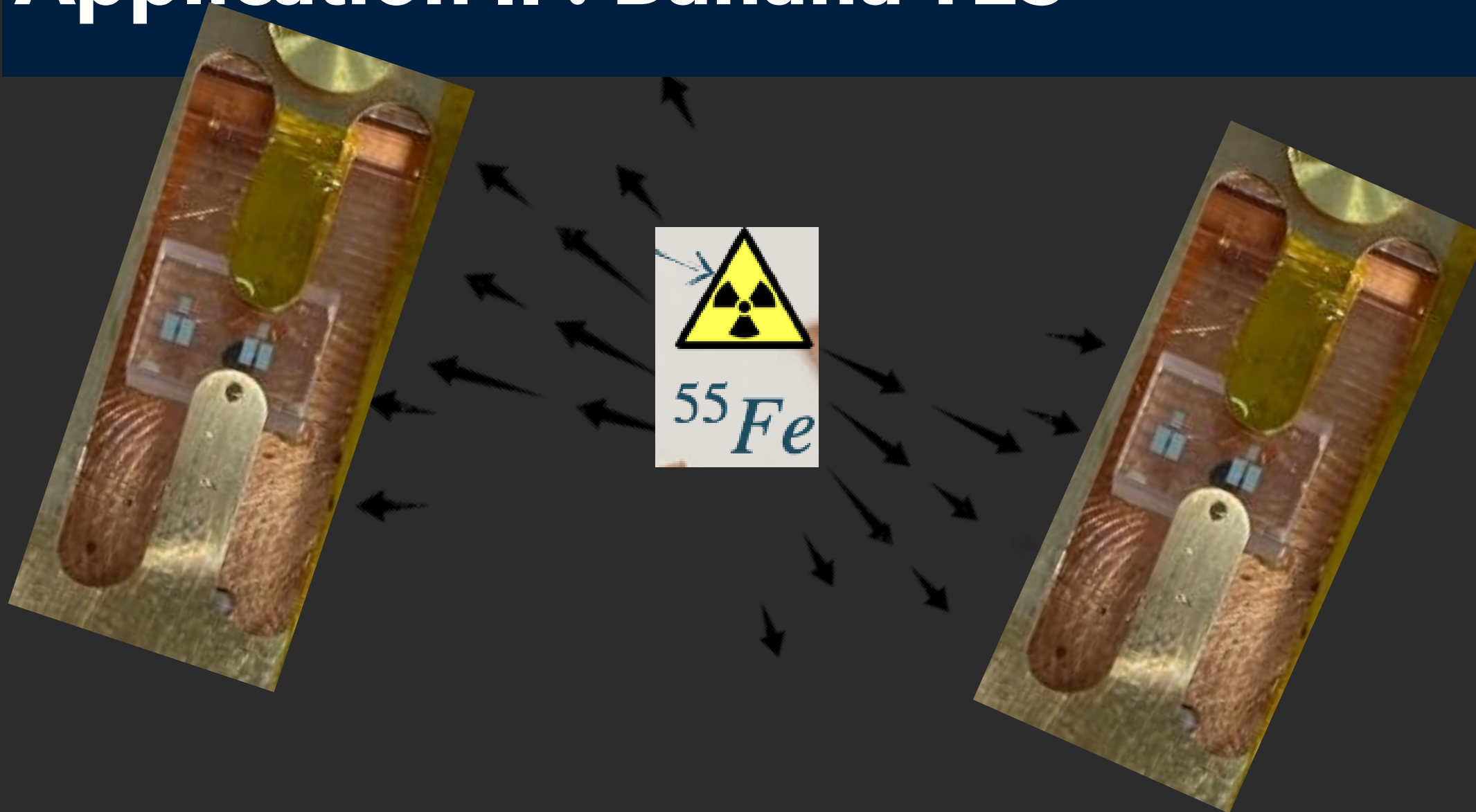


Reduce Background ?

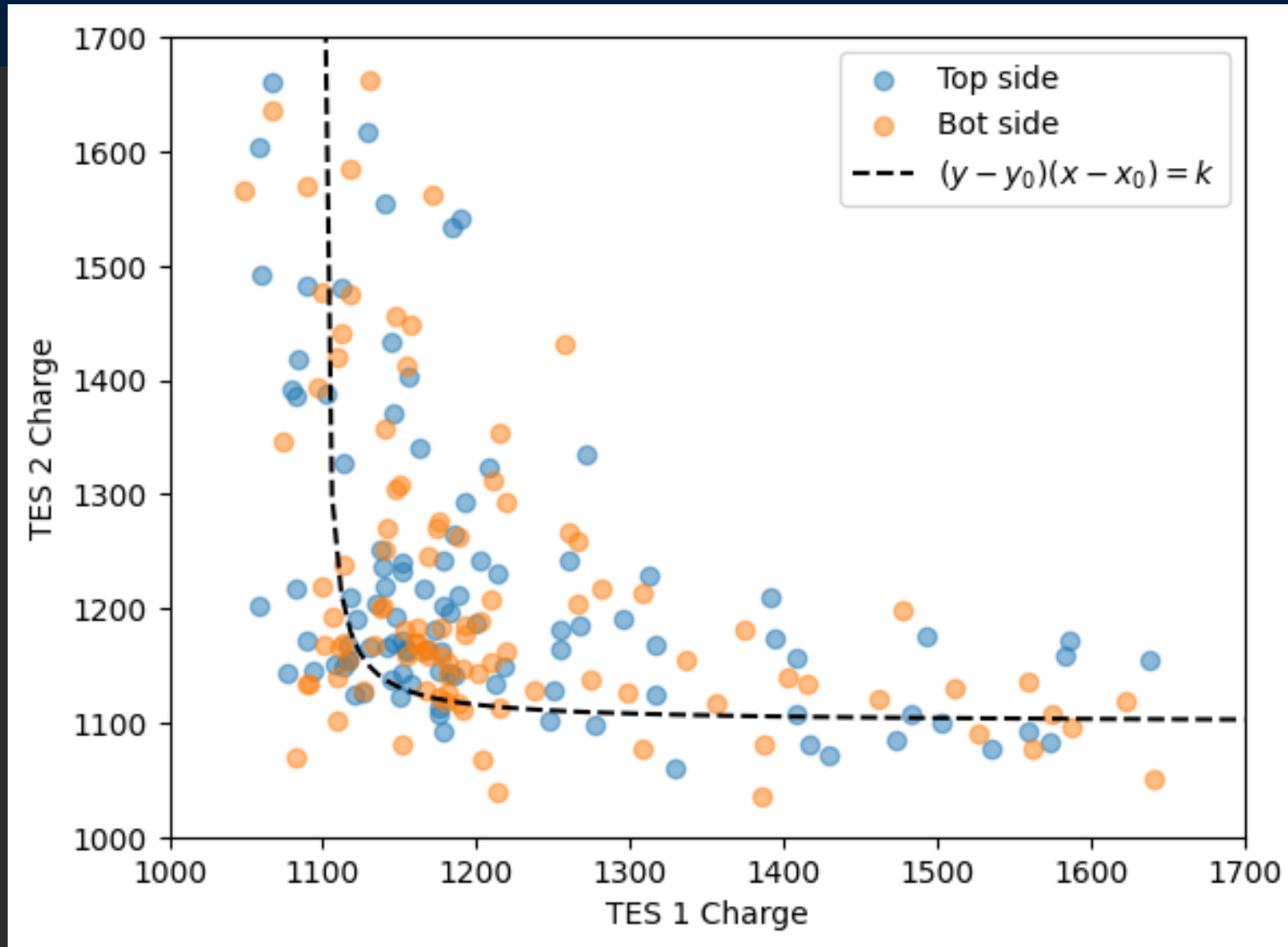


To Be Continued

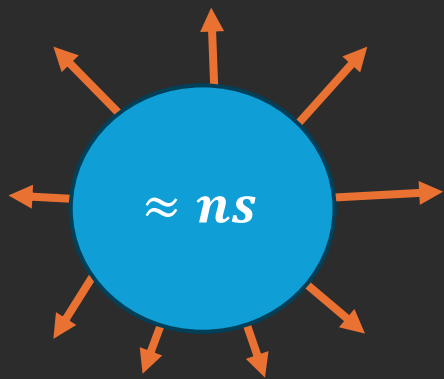
Application II : Banana TES



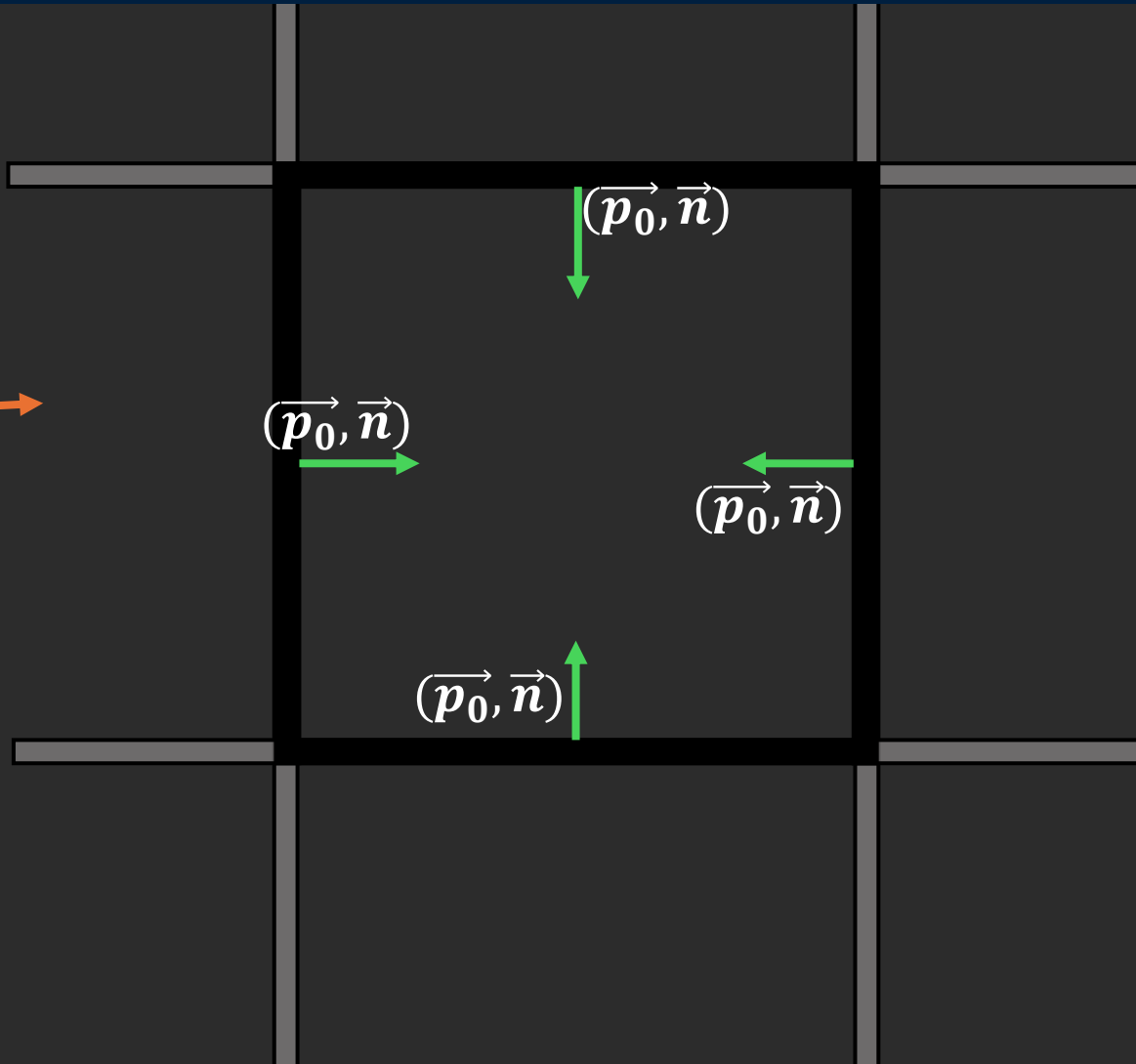
Results - Double TES



Simulation Details



$$\vec{r} = \vec{v}t + \vec{r}_0$$



$$t = \vec{n} \cdot \frac{\vec{r}_0 - \vec{p}_0}{\vec{n} \cdot \vec{v}}$$

$$\vec{v}' = \vec{v} - 2 \vec{n} \cdot \vec{v} \vec{n}$$

Other Projects & Prospects



OPOSSUM

