WEIZMANN INSTITUTE OF SCIENCE

Hear me out

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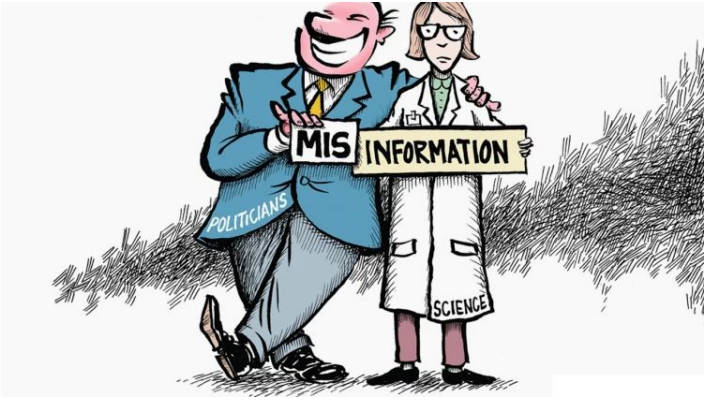
PAZY
EXCELLING IN SCIENCE

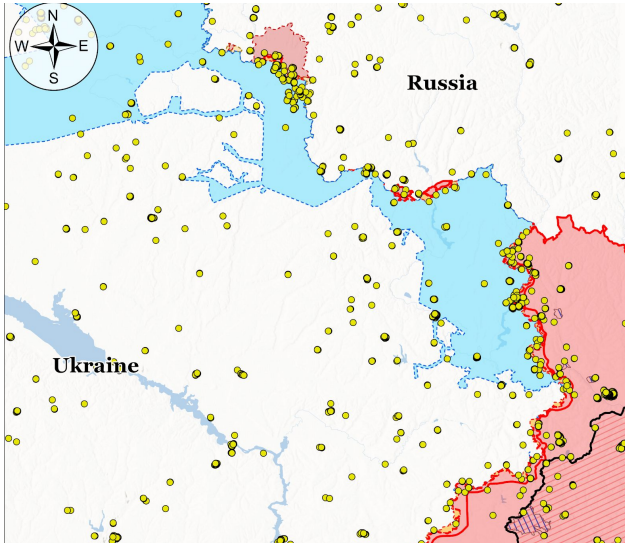
Our situation

- War on science



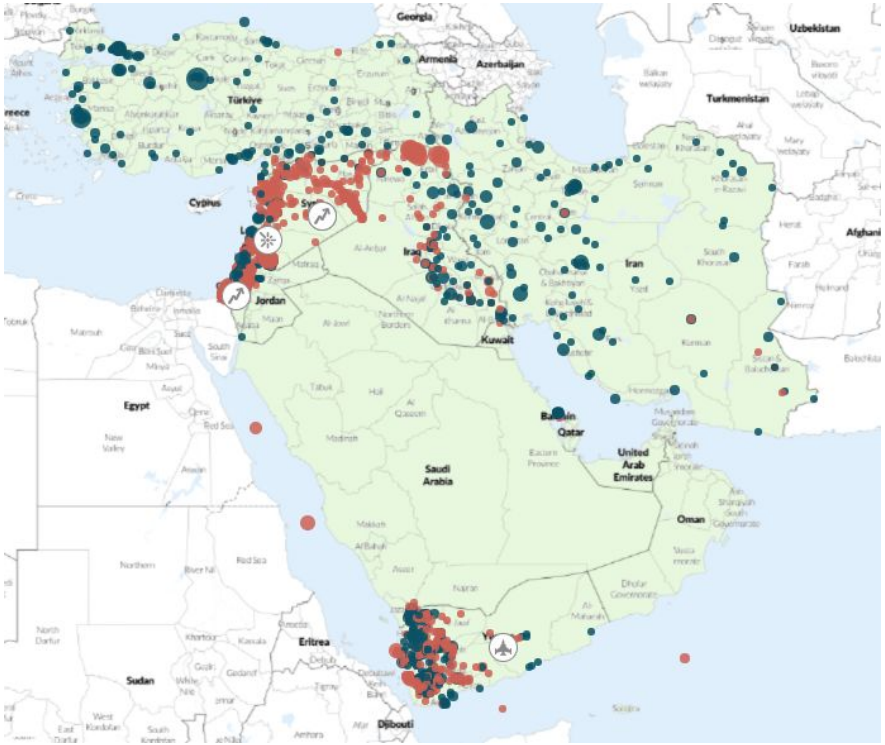
Our situation

- War on science
- War in Europe



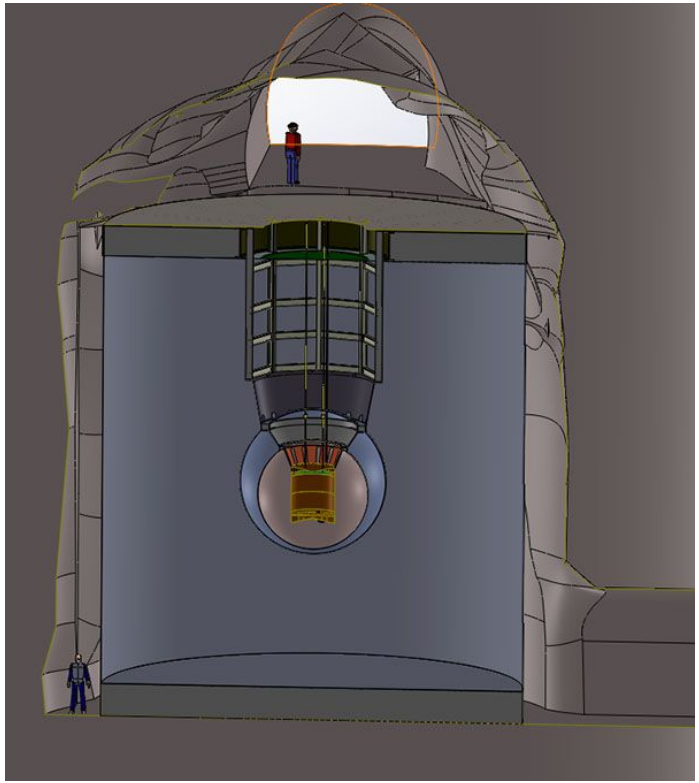
Our situation

- War on science
- War in Europe
- War in the Middle East



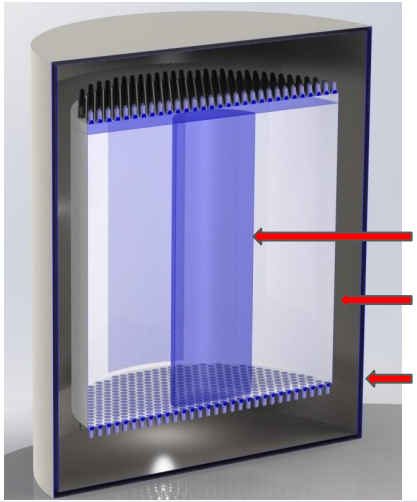
Our situation

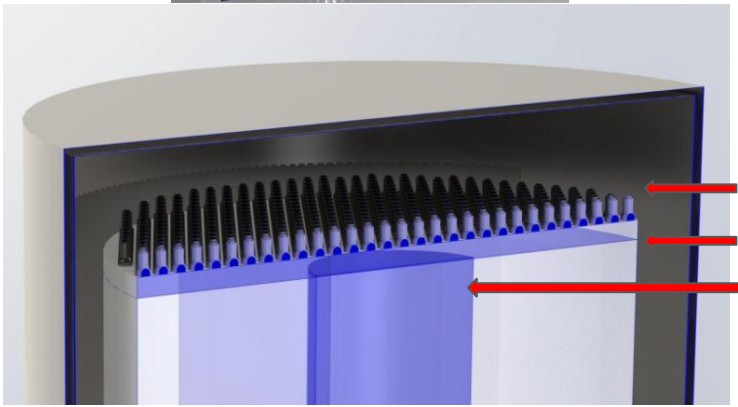
- War on science
- War in Europe
- War in the Middle East
- nEXO got shut down



We have an idea

- The classic "2 for 1":
  - A ~4.5 t ^{136}Xe in a transparent cylinder, end-to end TPC for 0ν2β (~90 cm diameter)
  - Embedded inside a 60 t LXe (depleted) TPC for DM
  - Embedded inside…
- The inner TPC is fully functional on its own: Cathode to Anode
  - **S2**s produced inside, **S1** photons leaving freely through the transparent wall.
- The outer TPC sets the drift field, good for all DM purposes
- Shields the inner TPC





Similar ideas:
- Arisaka: Astropart. Phys. 31 (2009) 63 [0808.3968].
- J.J.: JCAP 02 (2012) 037 [1110.6133]

Why is it interesting?

- DBD can be done with **less** enriched Xe - getting nEXO goal
  - +Significant Rn and chemical impurities reduction
- The DM shield is eliminating all materials γ from large R
- DM is not strongly affected *
- DM **can benefit** from depletion (no 2ν2β ER)
- Combination is enriching for both sides, can attract **funding** agencies

- It is FUN

* FV may decrease by <10%;

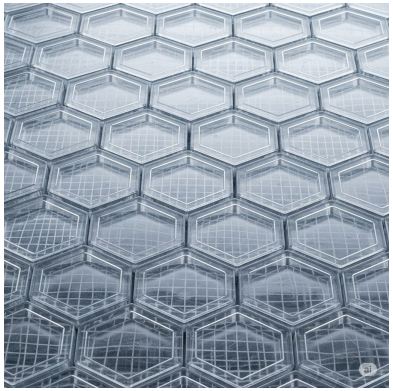
How can it be done?

Inner part is transparent (Sapphire, High purity fused silica, quartz, ?) brazed with metallic connections

Top stack: Anode should be segmented, deposited (gold?) on a transparent material
Gate suspended inside cylinder

Cylinder itself: no vertical metals!
Horizontal metallic parts allowed *

Bottom: Cathode deposited on the transparent material



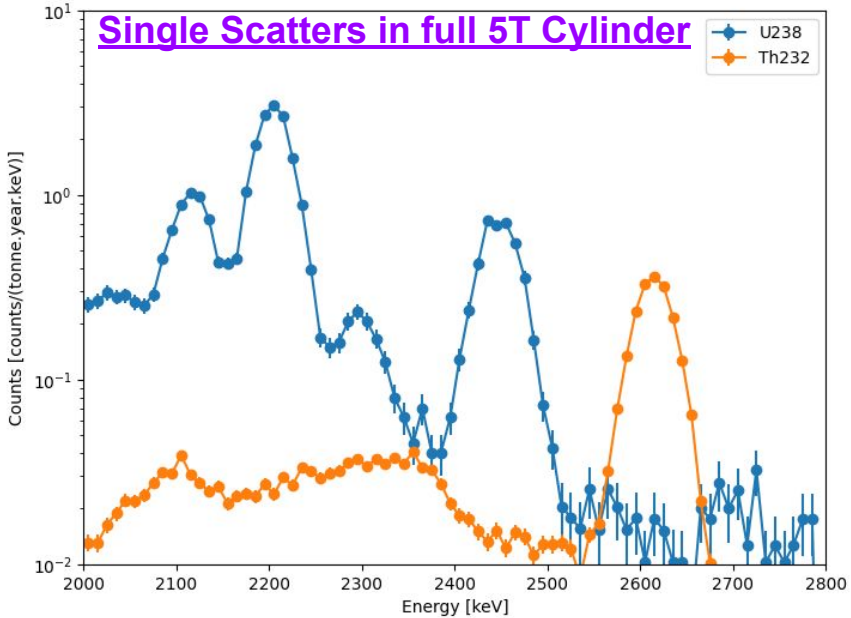
* Actually needed, for gate and voltage transfer to anode and cathode

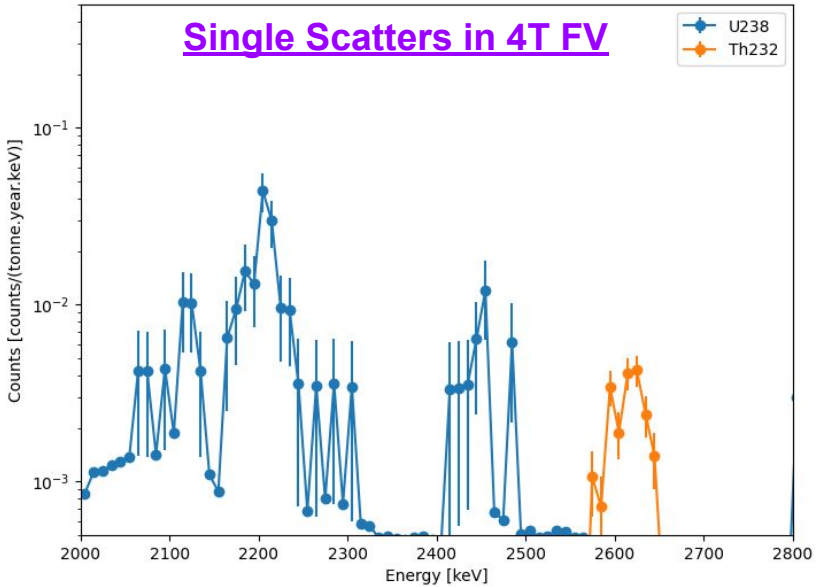
R&D and partial technologies:

- Eur. Phys. J. C 83, (2023) 9, arXiv:2209.00362
- PTEP, (2020) 113H02, arXiv:1910.13831
- JINST 16, (2021) P01018, arXiv:2007.16194

Simulated Background In RoI

- Energy resolution taken from XENON1T high energy search
- PTFE, PMT and Cryostats simulated (XENONnT levels)
- Sapphire (3mm) radioactivity assumptions (NEXT samples):
  - U238: 0.09 mBq/kg
  - Th232: 0.06 mBq/Kg
- Define 4.0 T FV by excluding top and bottom 30cm, SS to MS Δz>5 mm
- Inner volume background dominated by PMTs





What is missing

Technology

- Grids: transparency, mechanics, HV behavior, segmentation - in progress @WIS
- How to make a transparent cylinder that large?
- Pressure control
- Level control
- Level meters
- Mechanical stability
- General demonstration…

Faith

Funding (?)

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Talk to us!

Jacques, Hagar, Ranny