

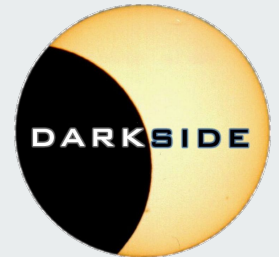


Direct Dark Matter Search with DarkSide-20k Experiment

Biennale APC 2026

David Cavalcante

04/06/2026



What is Dark Matter?

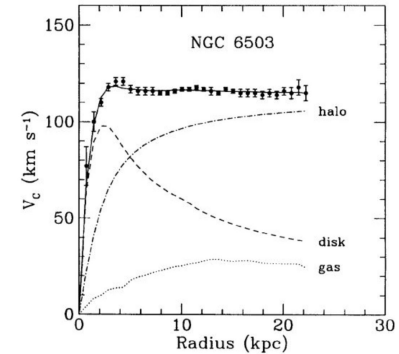


- Matter that does not interact electromagnetically or strongly;
- So how do we know it exists?

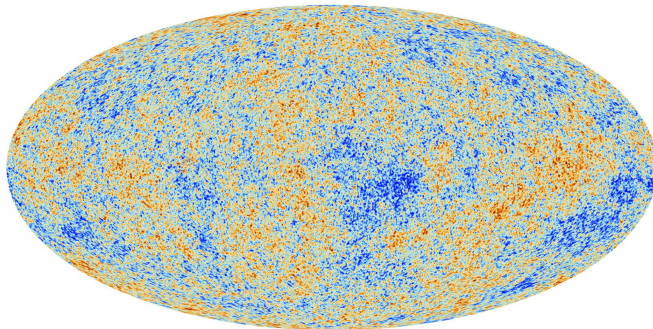
What is Dark Matter?

- Matter that does not interact electromagnetically or strongly;
- So how do we know it exists? → Strong gravitational and cosmological evidences:
 - Gravitational ⇒ Missing mass
 - Flat rotation curve in spiral galaxies;
 - Cosmology:
 - CMB anisotropies ⇒ large scale structure formation;

<https://ned.ipac.caltech.edu/level5/Sept17/Freese/Freese2.html>



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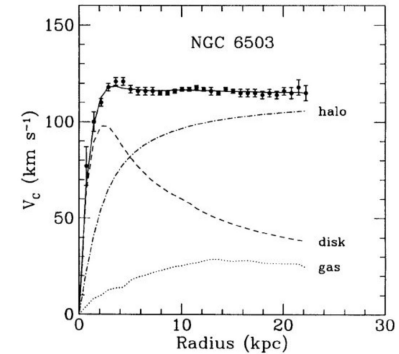


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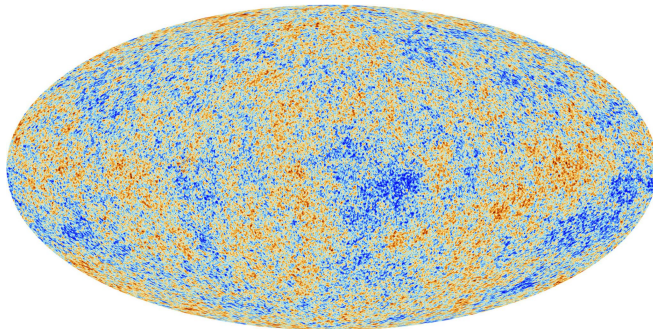
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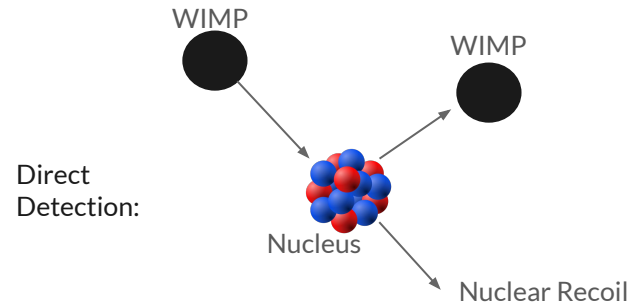


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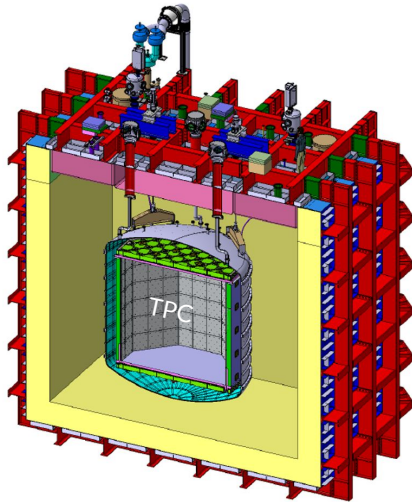
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Promising candidate: WIMPs (Weakly Interacting Massive Particles)



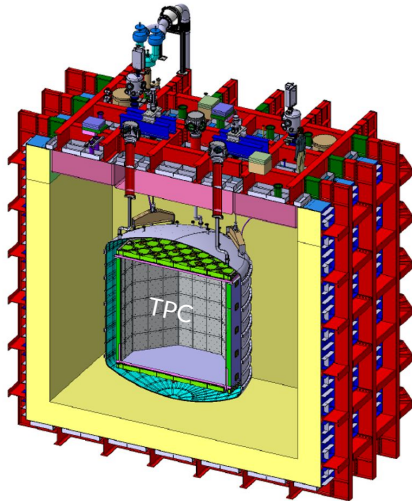
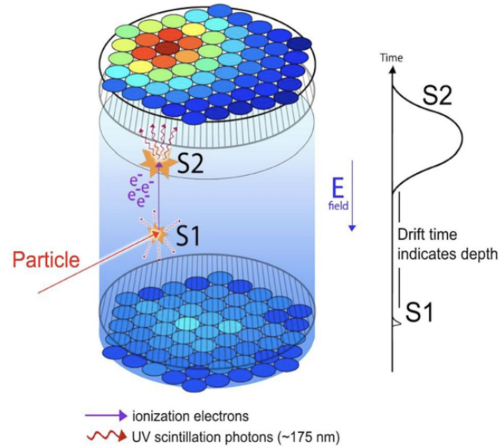
DarkSide-20k Experiment

- Located 1.4 km underground at LNGS, Italy;
- Dual-phase TPC with **50 tons** of underground liquid Argon;
- Inner and outer veto in a cryostat.



DarkSide-20k Experiment

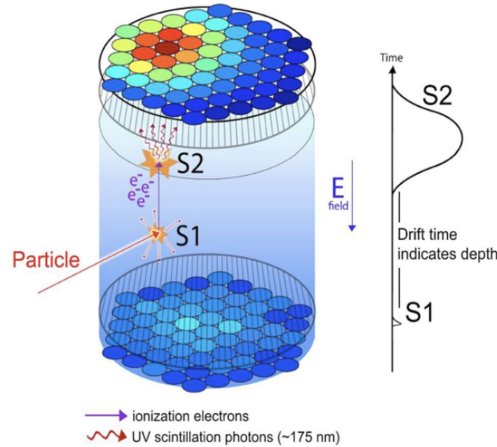
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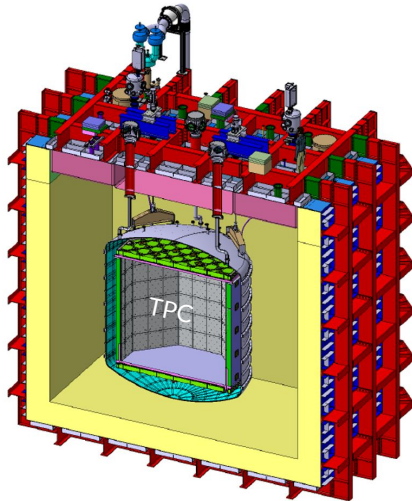


Main Backgrounds

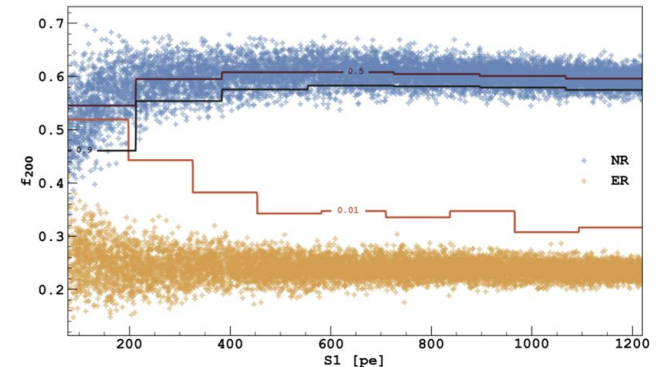
- NR: cosmogenics and radiogenics neutrons and α ;
- ER: β decays and γ radiation.

Background Rejection → PSD

- ★ Very good separation of ER and NR events in LAr → singlet/triplet de-excitation time



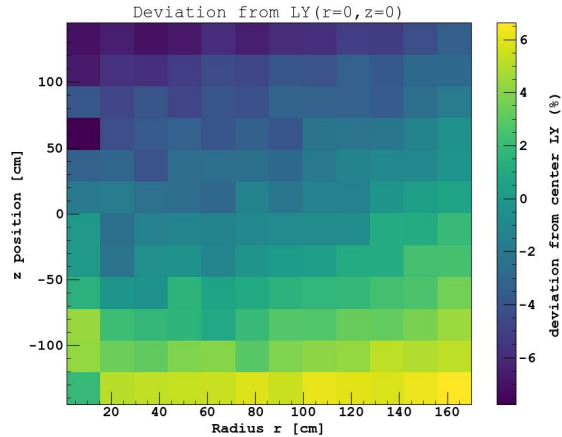
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PSD Improvements

Study elements that can spoil the PSD:

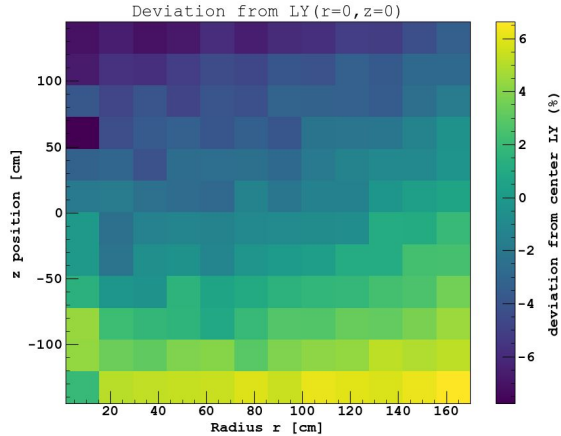
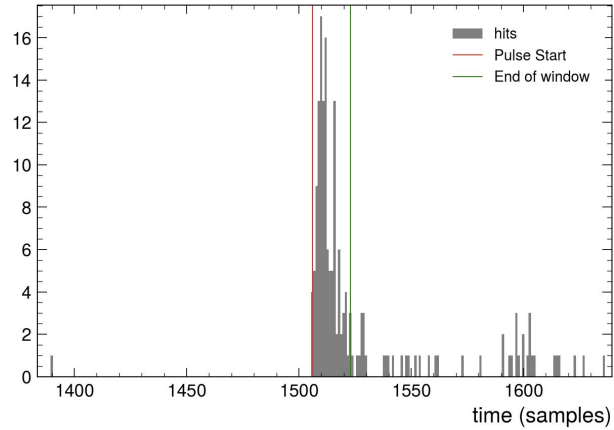
- Position dependence of the light-yield inside the TPC;



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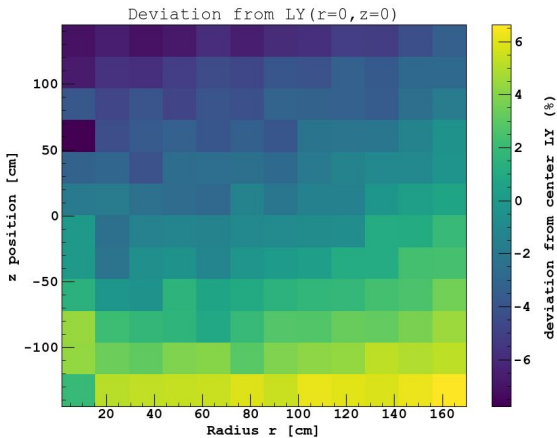
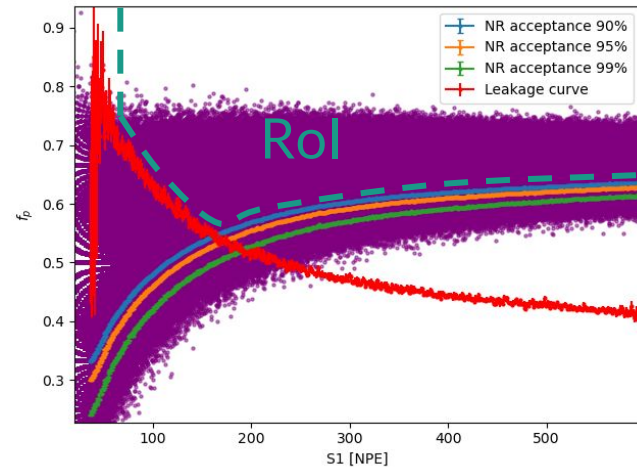
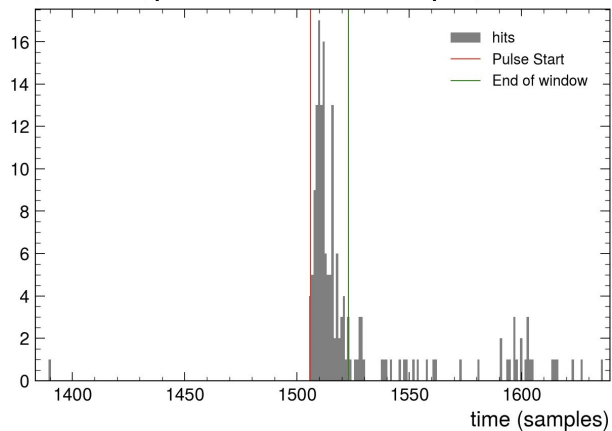
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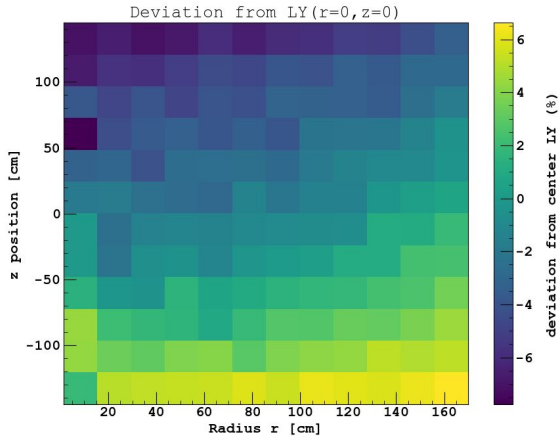
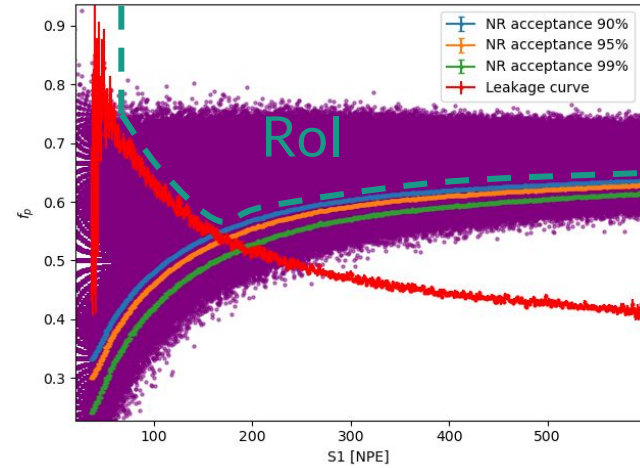
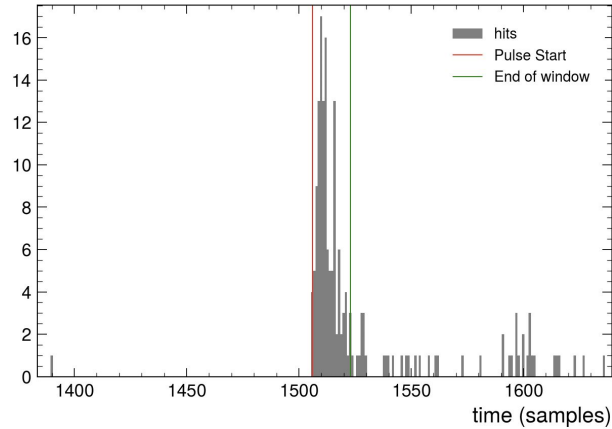


- Define the WIMP search Region of Interest (RoI);

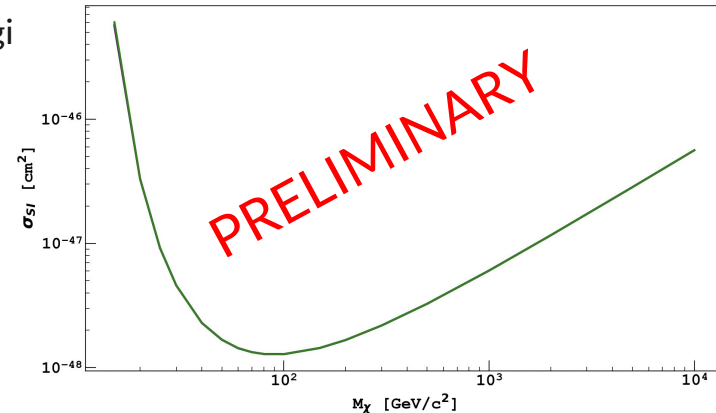
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- Define the WIMP search Regi of Interest (RoI);
- Assess the impact of these elements on the experiment sensitivity;





THANK YOU!!