

XENON collaboration



180 SCIENTISTS
27 INSTITUTIONS
12 COUNTRIES

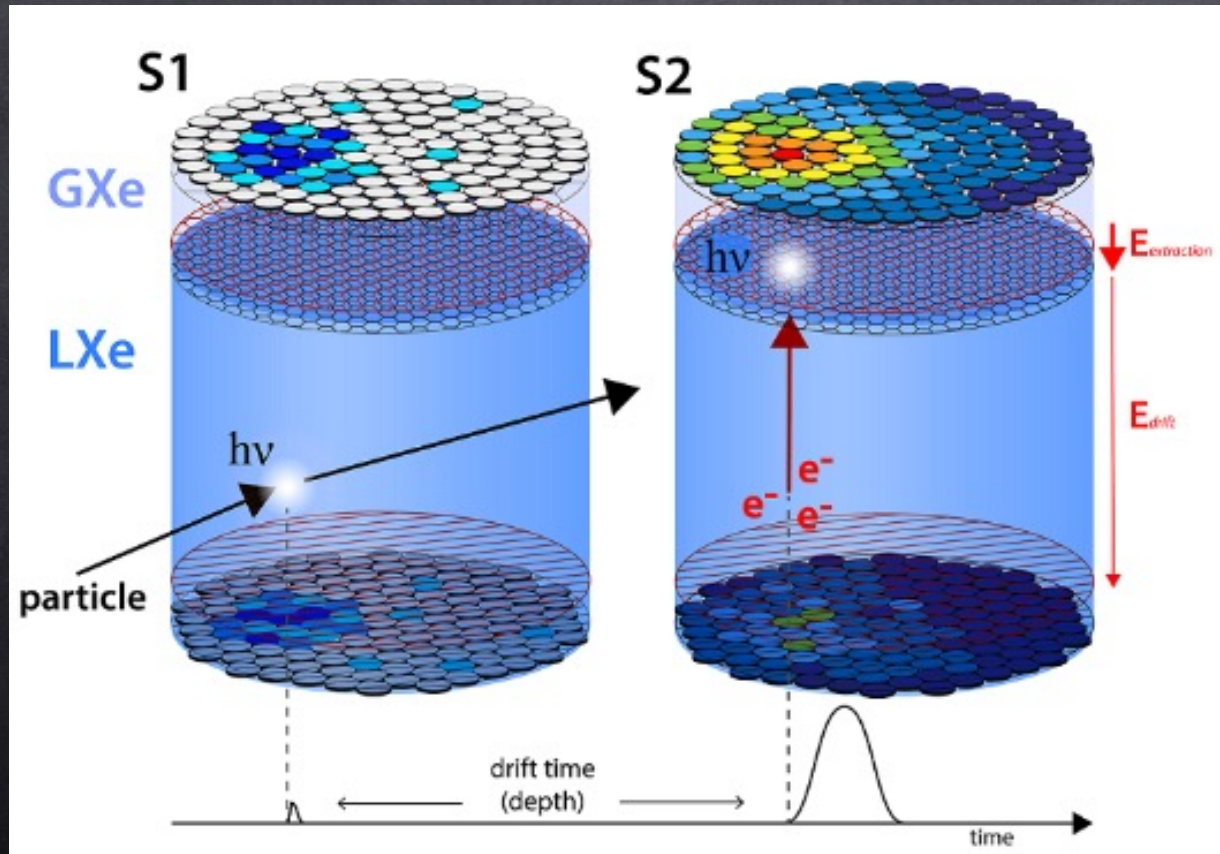
Sezioni INFN:

- BO
- LNGS
- NA
- TO
- FE-DTZ

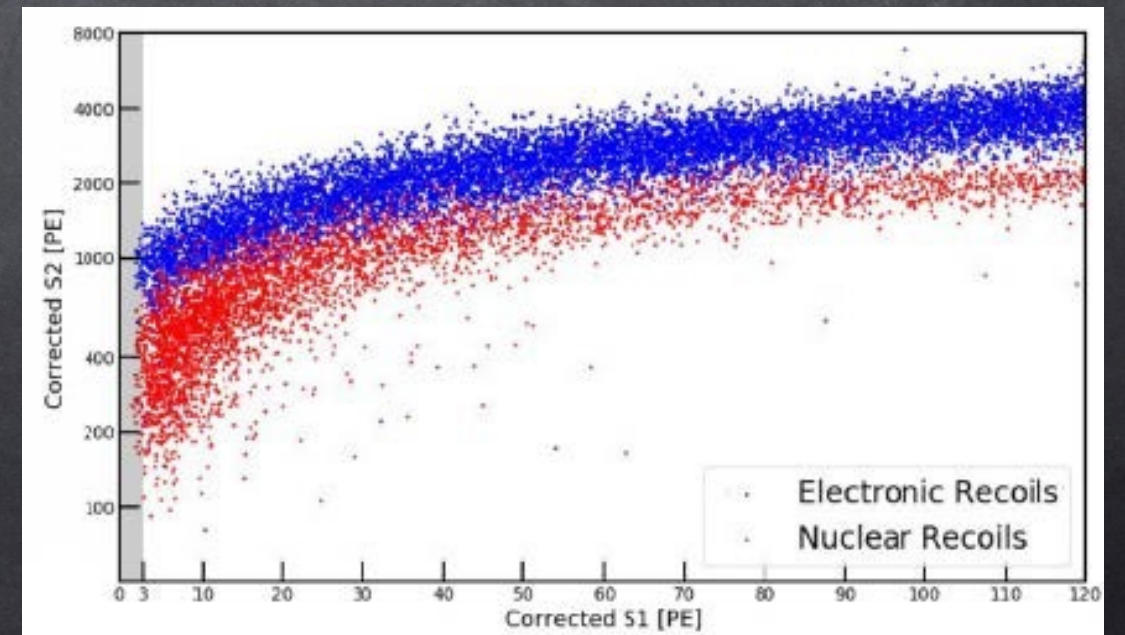
Rivelazione diretta

Time projection chamber in xenon a doppia fase

- Ricostruzione 3D degli eventi
- Discriminazione rinculo nucleare – rinculo elettronico
- Self shielding
- Grossi volumi: 1 T e più

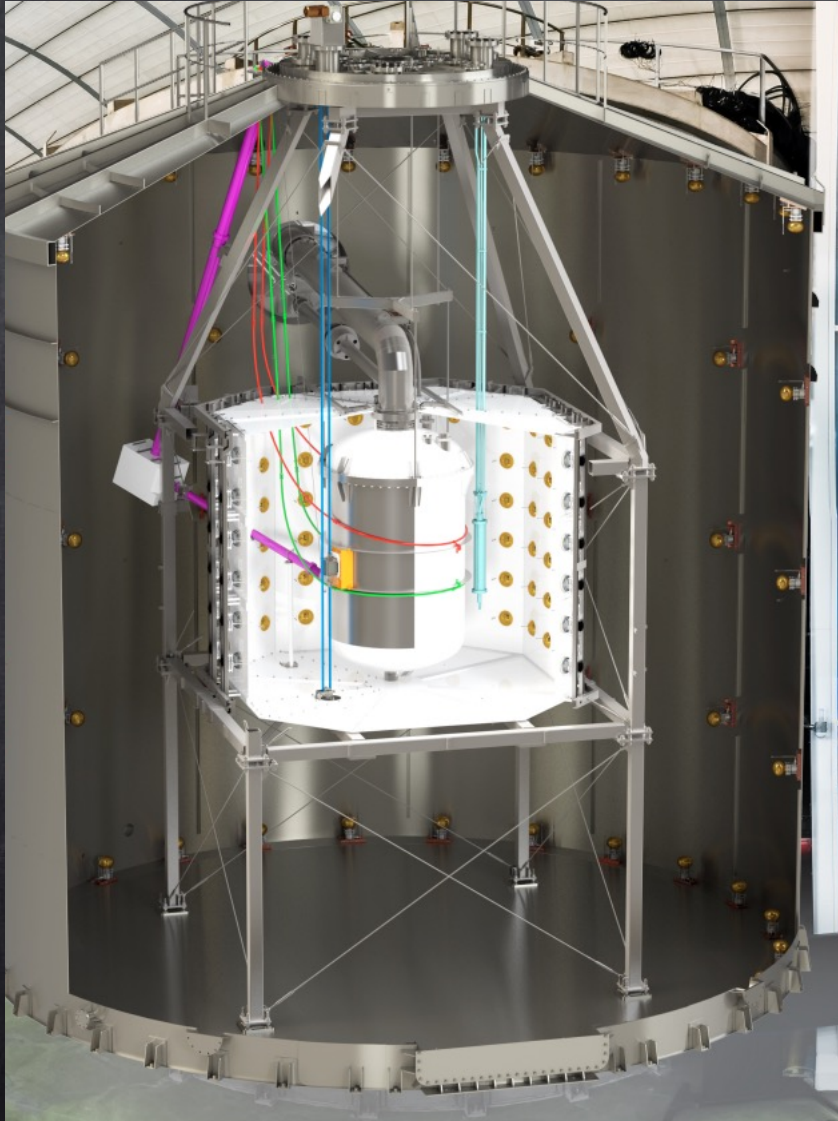


Distribuzione rinculi elettronici (blu) e rinculi nucleari (red).



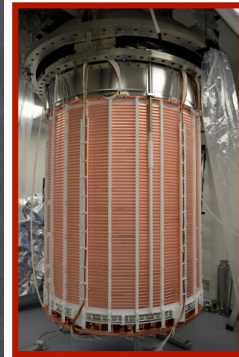
XENONnT: Sr0 completed, SR1 running

L'aumento di massa ha comportato dei miglioramenti per ridurre il fondo



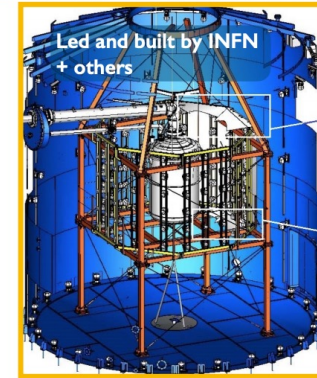
Contributo di Ferrara al Neutron Veto:

- studio delle prestazioni e calibrazioni
- modellizzazione della risposta dei fotomoltiplicatori



Larger TPC

- Total 8.4 t LXe
- 5.9 t in TPC
- ~ 4 t fiducial
- 248 → 494 PMTs



Neutron veto

- Inner region of existing muon veto
- optically separate
- 120 additional PMTs
- Gd in the water tank
- 0.5 % $Gd_2(SO_4)_3$



^{222}Rn distillation

- Reduce Rn (^{214}Pb) from pipes, cables, cryogenic system
- New system, PoP in XENON1T



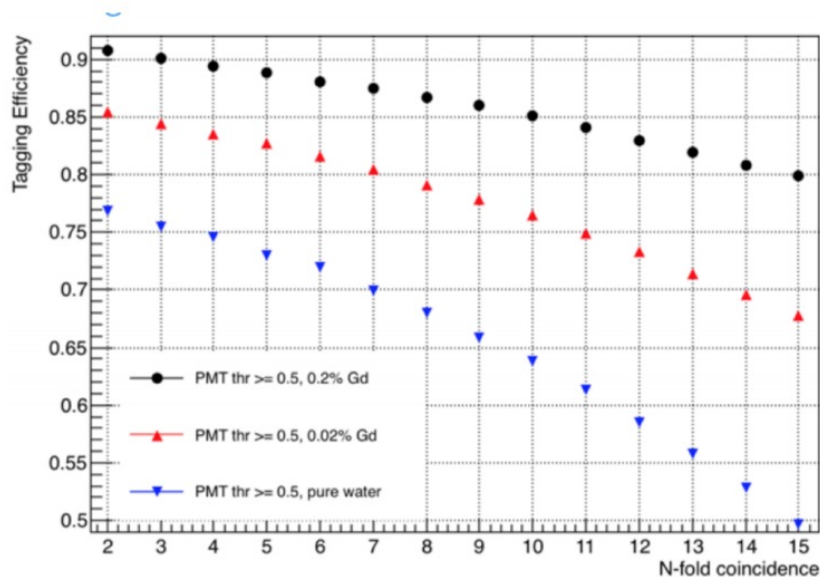
LXe purification

- Faster xenon cleaning
- 5 L/min LXe (2500 slpm)
- XENON1T ~ 100 slpm

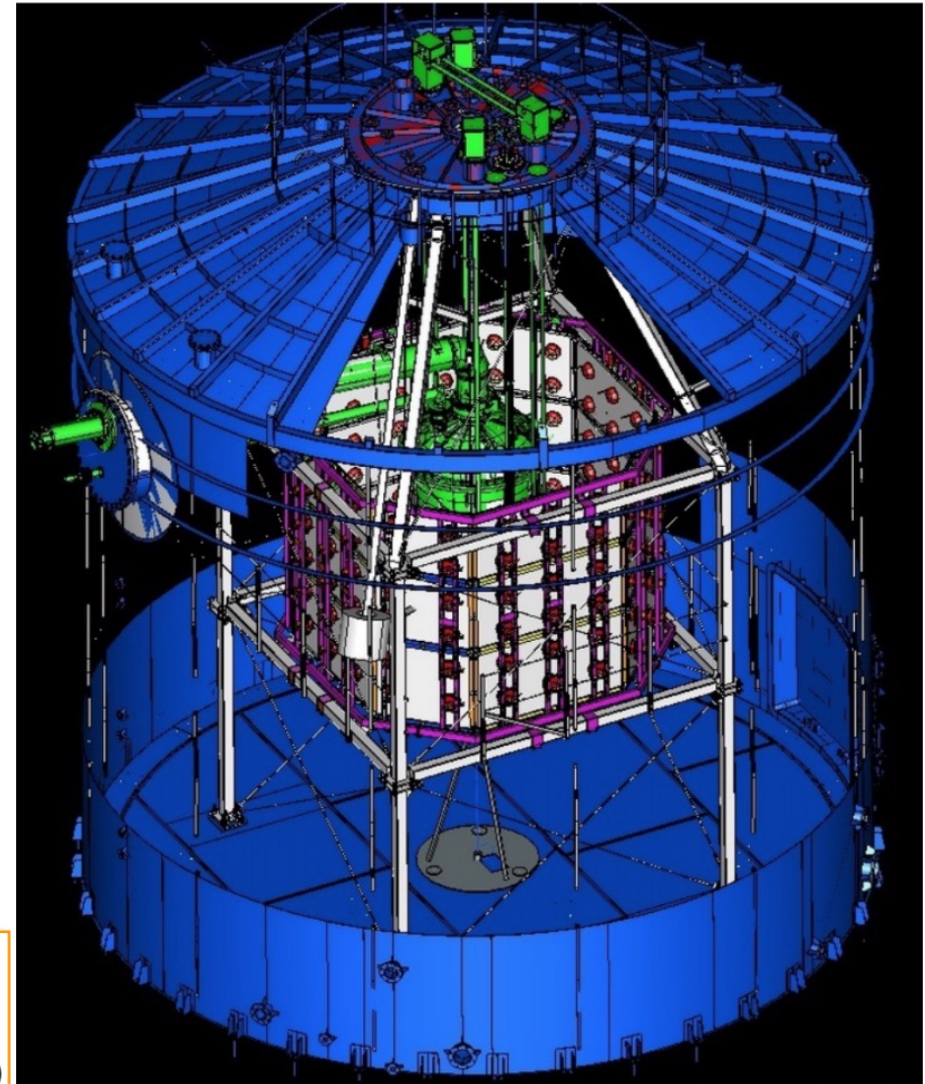
XENONnT: neutron Veto

- Gd-loaded Water: 0.2% of Gd in mass
-> 3.4 t of Gd-sulphate-octahydrate;
(technology from EGADS-SK colleagues)
- Cerenkov light is seen by additional 120 8" PMTs placed in water around the cryostat;
- high-reflectivity foil to confine an inner nVeto region with high light collection efficiency.

XENONnT nVeto



Neutron tagging efficiency:
85% with 0.2% Gd,
65% with pure water
(requiring a threshold of 10 PMTs in coincidence)

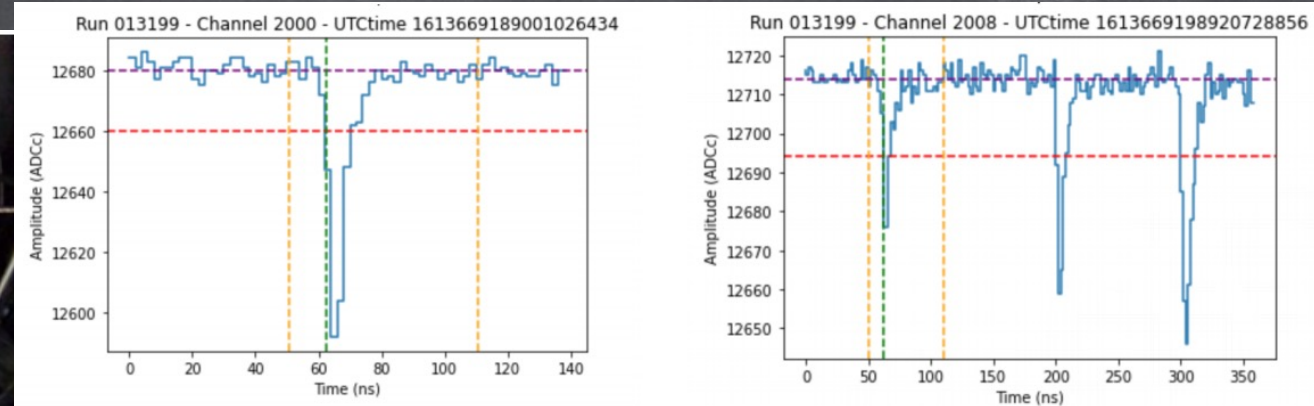


XENONnT

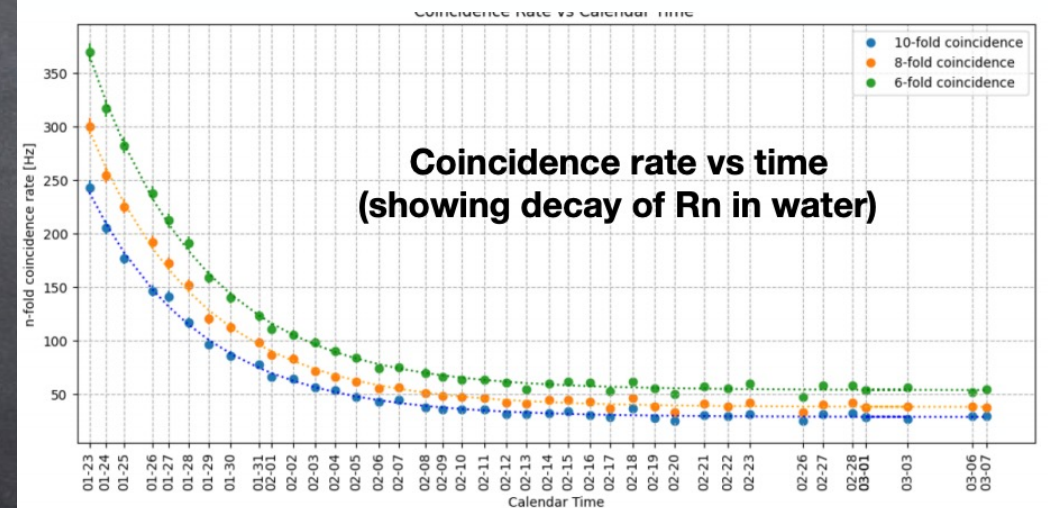


Foto del nVeto da sotto (senza chiusura inferior)

Primo run concluso



Decadimento del ^{222}Rn presente nell'acqua



Very small background rate: 30 Hz at 10-fold PMT coincidence

**Preliminary detection efficiency of the ^{208}Tl 2.6 MeV gamma
in the middle of the nVeto: 70-80%**

Richieste per 2023 (XENON-DTZ)

G. Zavattini 40% Resp. Locale (OK per regole CSNII)
S. Vecchi 30%

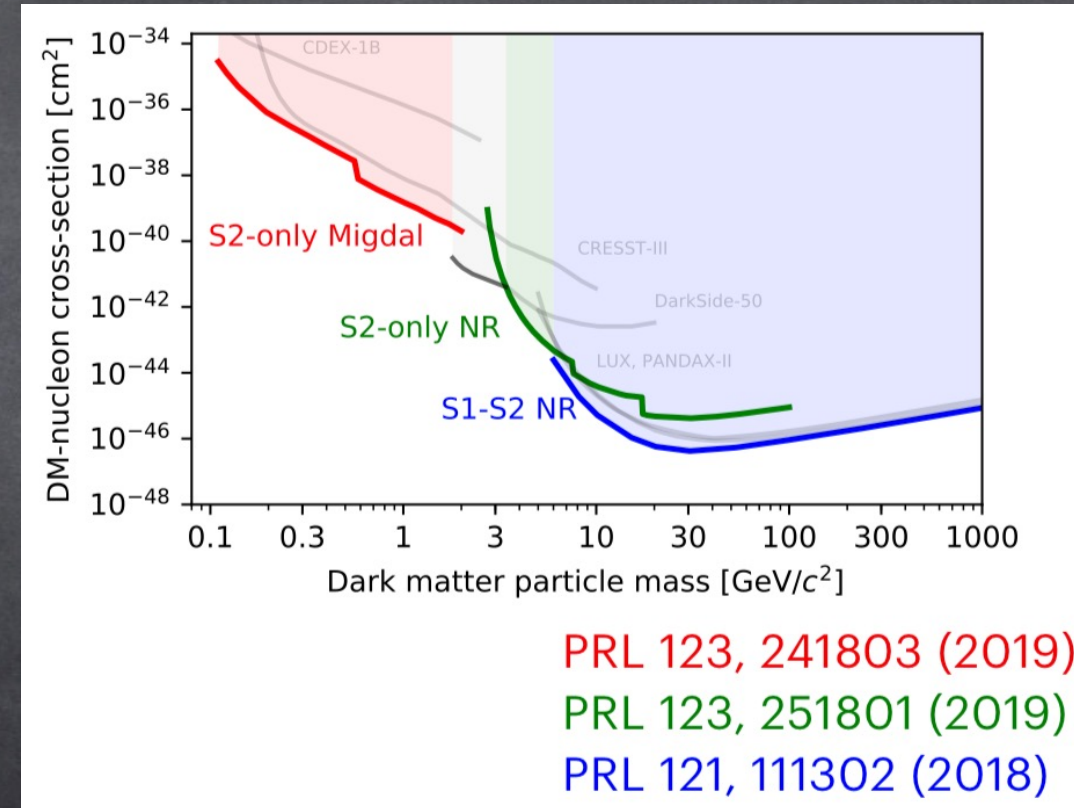
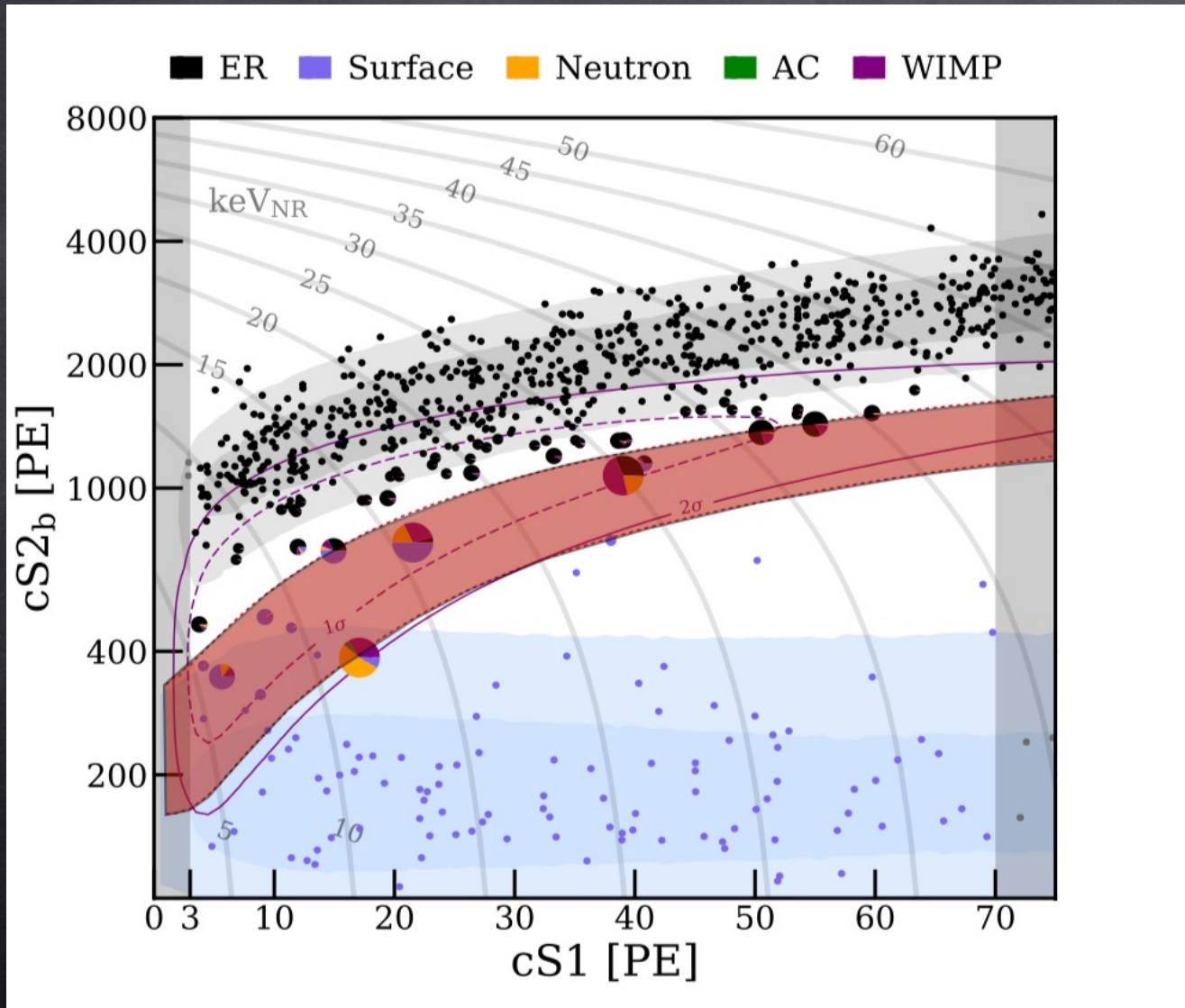
Tot FTE Xenon Italia: 18.7

	MI	Cons	Manu	App	Tot
FE	7	2			9

Richieste di consumo sono per un o più termometro da inserire nel nVeto

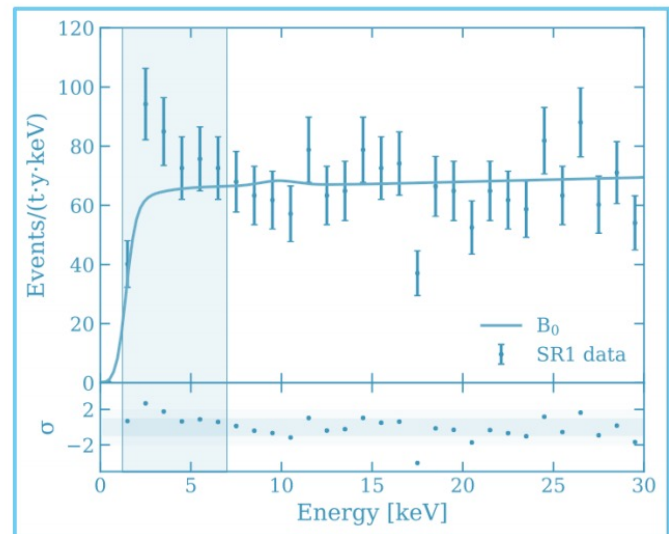
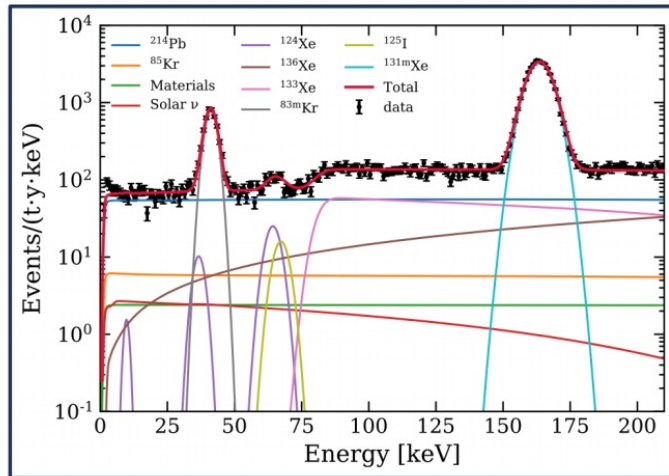
Rivelazione diretta: risultati XENON1T - NR

Per un'esposizione 1.0 t·yr: **nessun eccesso di eventi di rinculo nucleare**



Rivelazione diretta: risultati - ER

Esposizione 0.65 t · yr: C'è un eccesso. **Varie ipotesi da verificare con XENONnT**



NEW PHYSICS OR UNEXPECTED BACKGROUND?

[Phys. Rev. D 102, 072004](https://arxiv.org/abs/1907.072004)



3.2σ TRITIUM BACKGROUND

- ⊗ Fitted concentration: $(6.2 \pm 2.0) \times 10^{-25}$ mol/mol $^3\text{H}/\text{Xe}$
- ⊗ We don't expect that much ^3H from liquid purity
- ⊗ Very difficult to confirm or exclude such a tiny abundance



3.4σ SOLAR AXIONS

- ⊗ Non-null coupling to electrons \rightarrow ABC and/or Primakoff
- ⊗ Strong tension with astrophysical constraints
- ⊗ Axions+ ^3H favoured over ^3H -only at 2.1 σ



3.2σ NEUTRINO MAGNETIC MOMENT μ_ν

- ⊗ $\mu_\nu = [1.4, 2.9] \times 10^{-11} \mu_B$
- ⊗ $\mu_\nu > 10^{-15}$ would imply neutrinos to be Majorana fermions
- ⊗ Tension with astrophysical constraints



3.0σ BOSONIC DARK MATTER

- ⊗ Including pseudo-scalar (ALPS) and vector (dark photons) bosons
- ⊗ Most restrictive constraints to date set

Solar axions + (unconstrained) ^3H fit

