

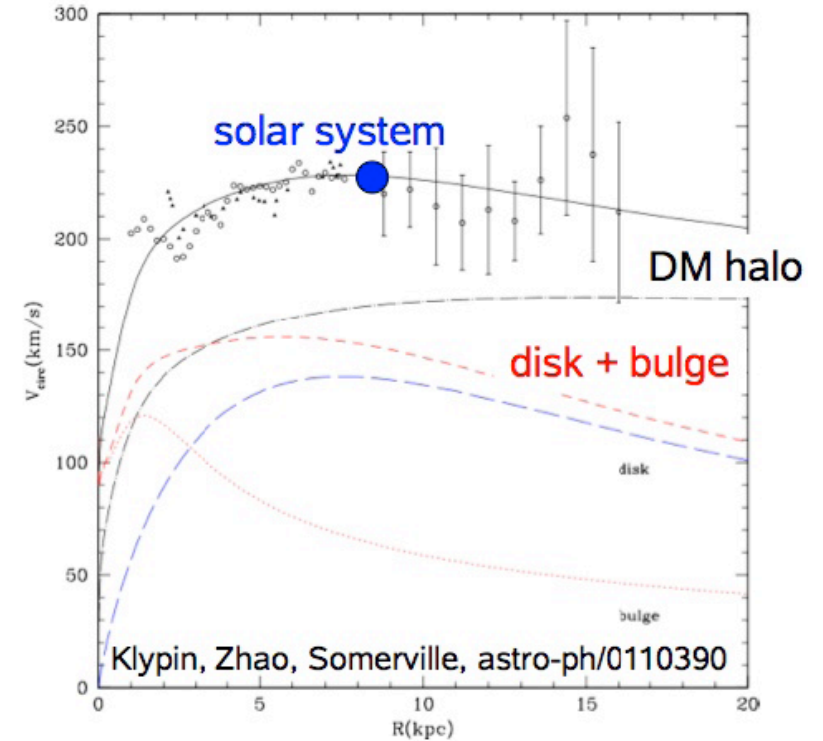
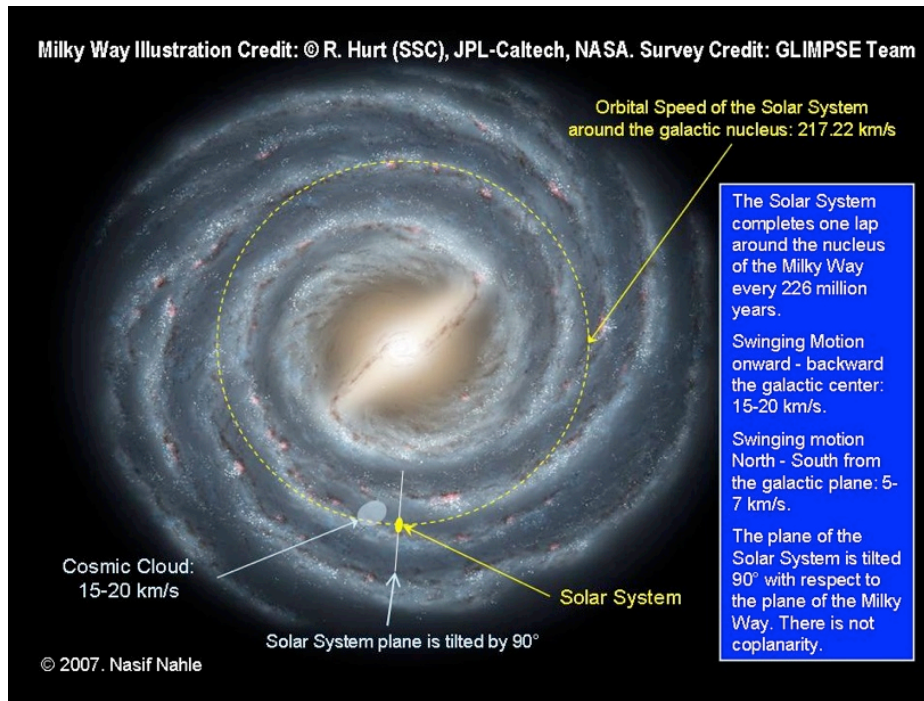


First Dark Matter Results from the XENON100 Experiment

Yuan Mei
Rice University

Pheno 2010
University of Wisconsin-Madison

Direct Detection of WIMP Dark Matter



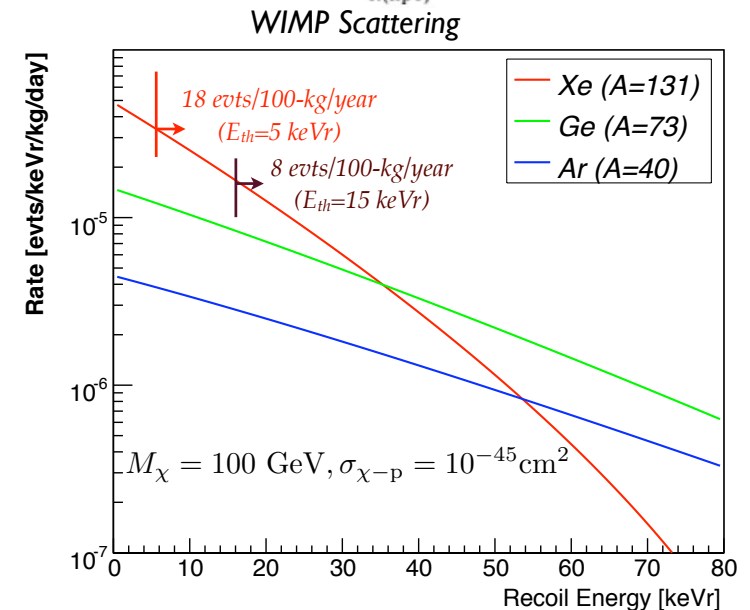
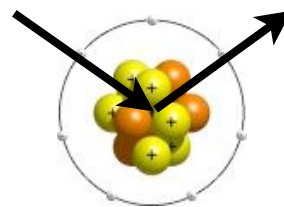
Model: ρ_χ and $f(\mathbf{v}, t)$

Measurement: $\frac{dR}{dE}$

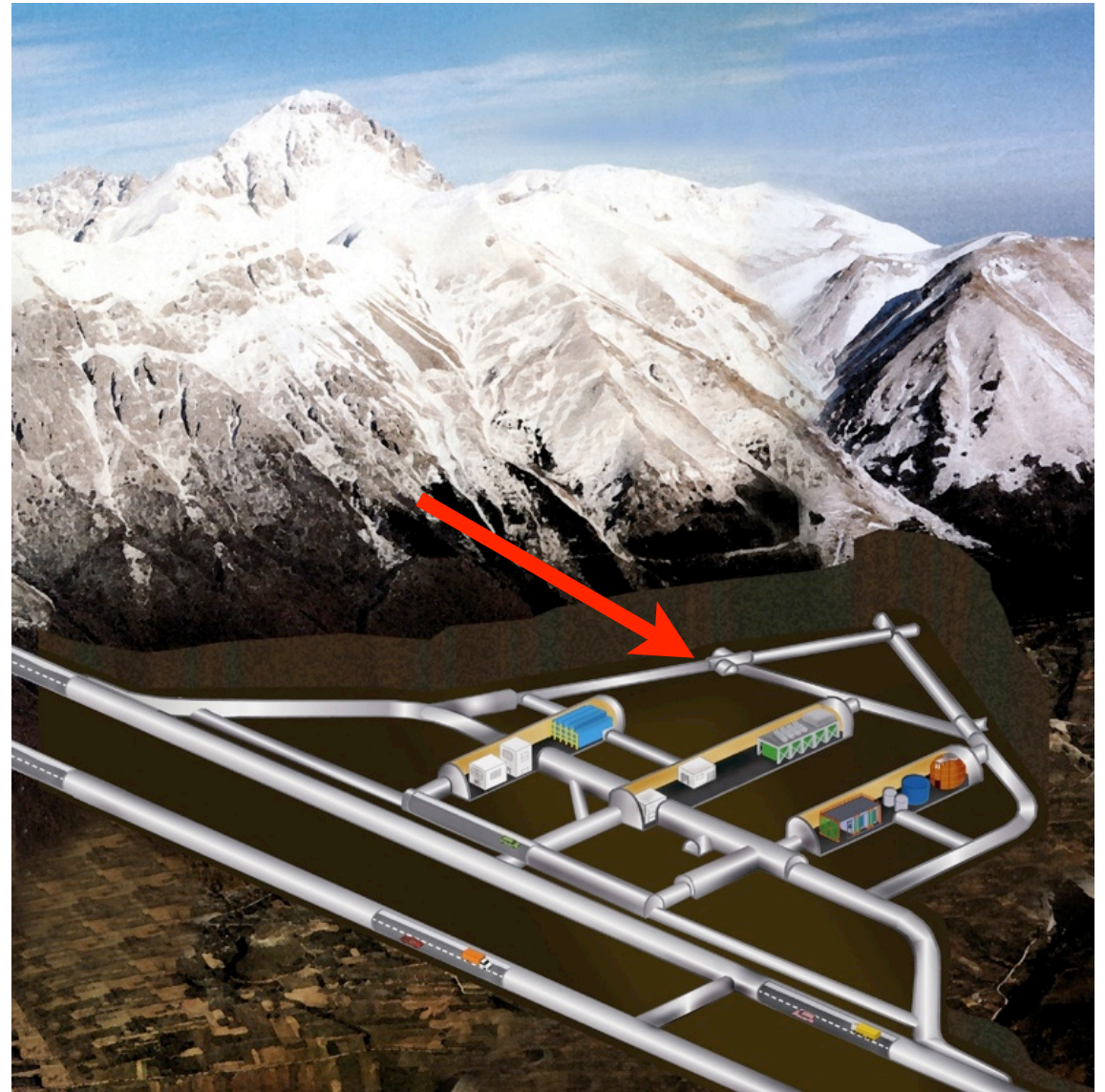
Result: $\sigma_{\chi-p} - M_\chi$

$$\frac{dR}{dE} = \frac{\rho_\chi \sigma_{\chi-p}}{2M_\chi \mu^2} |\mathbf{F}(E)|^2 \int_{v_{\min}}^{v_{\max}} \frac{f(\mathbf{v}, t)}{v} d^3v$$

$$f(\mathbf{v}, t) \propto \exp\left(\frac{-(\mathbf{v} + \mathbf{v}_\oplus(t))^2}{2\sigma^2}\right)$$



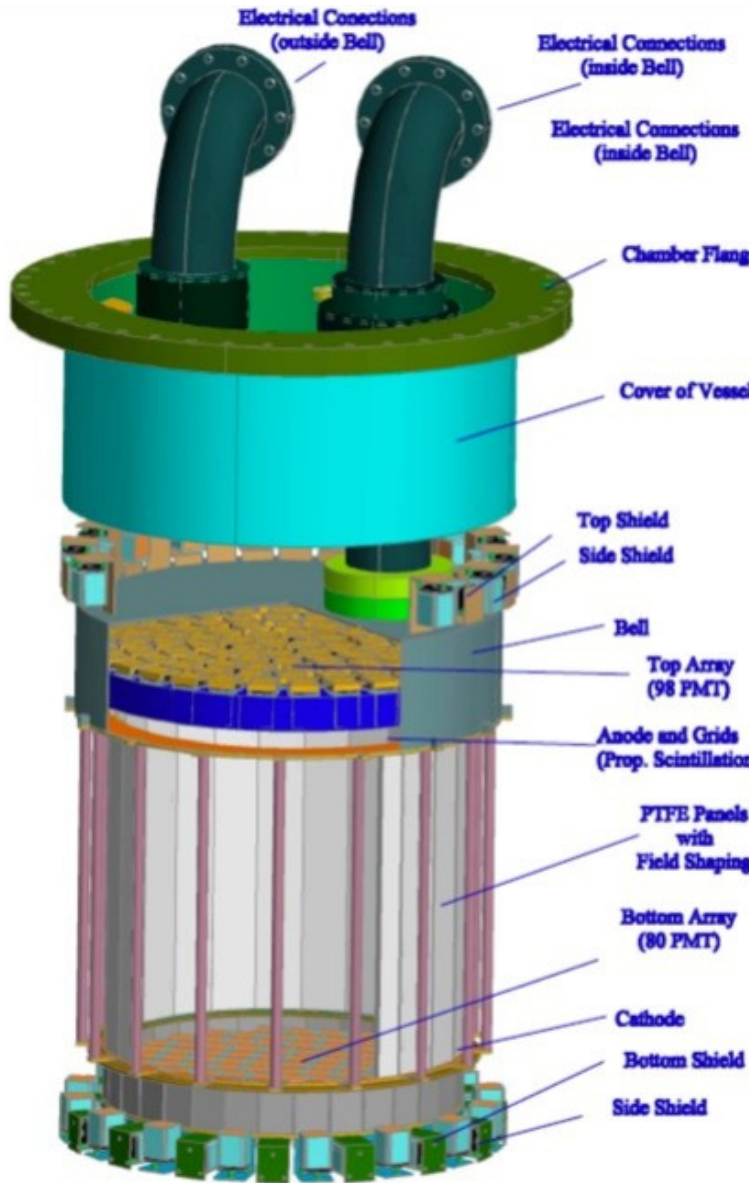
XENON100 Experiment



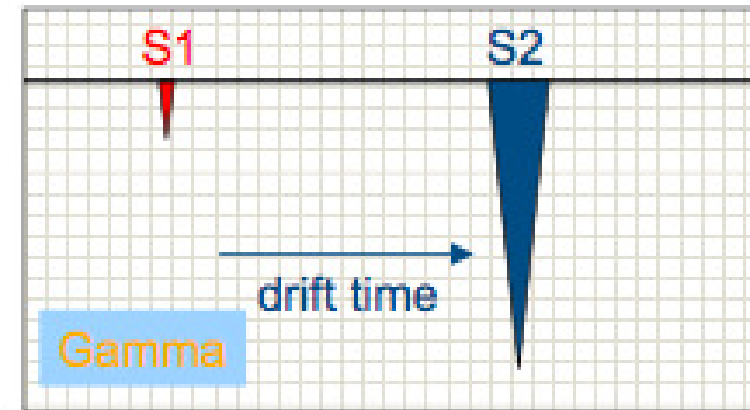
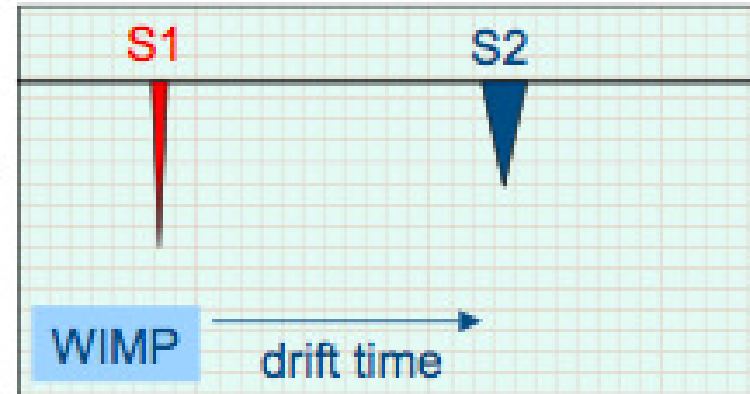
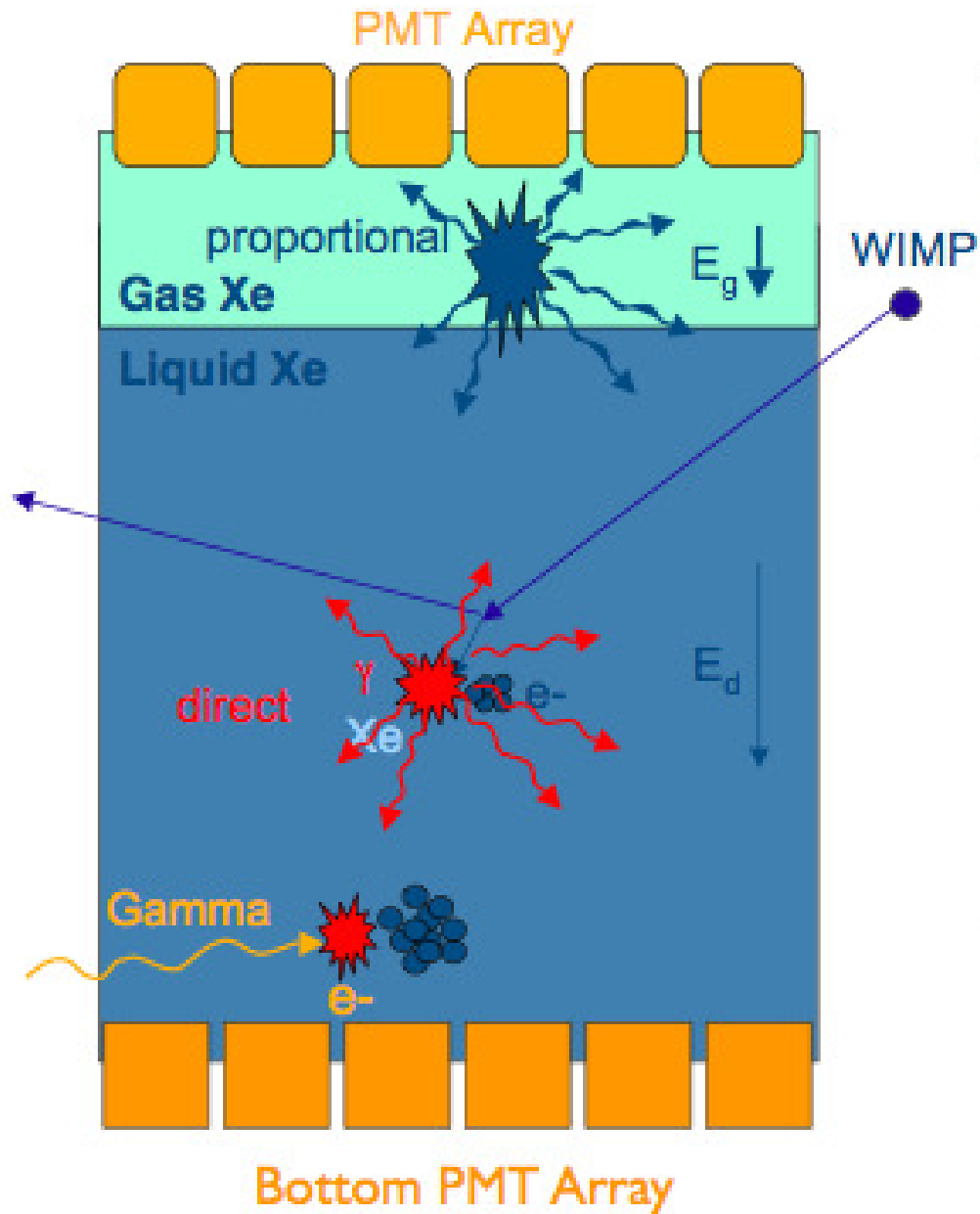
Laboratori Nazionali del Gran Sasso, Italy
Depth: 3600 meters *water equivalent*

XENON100 TPC

XENON100 TPC

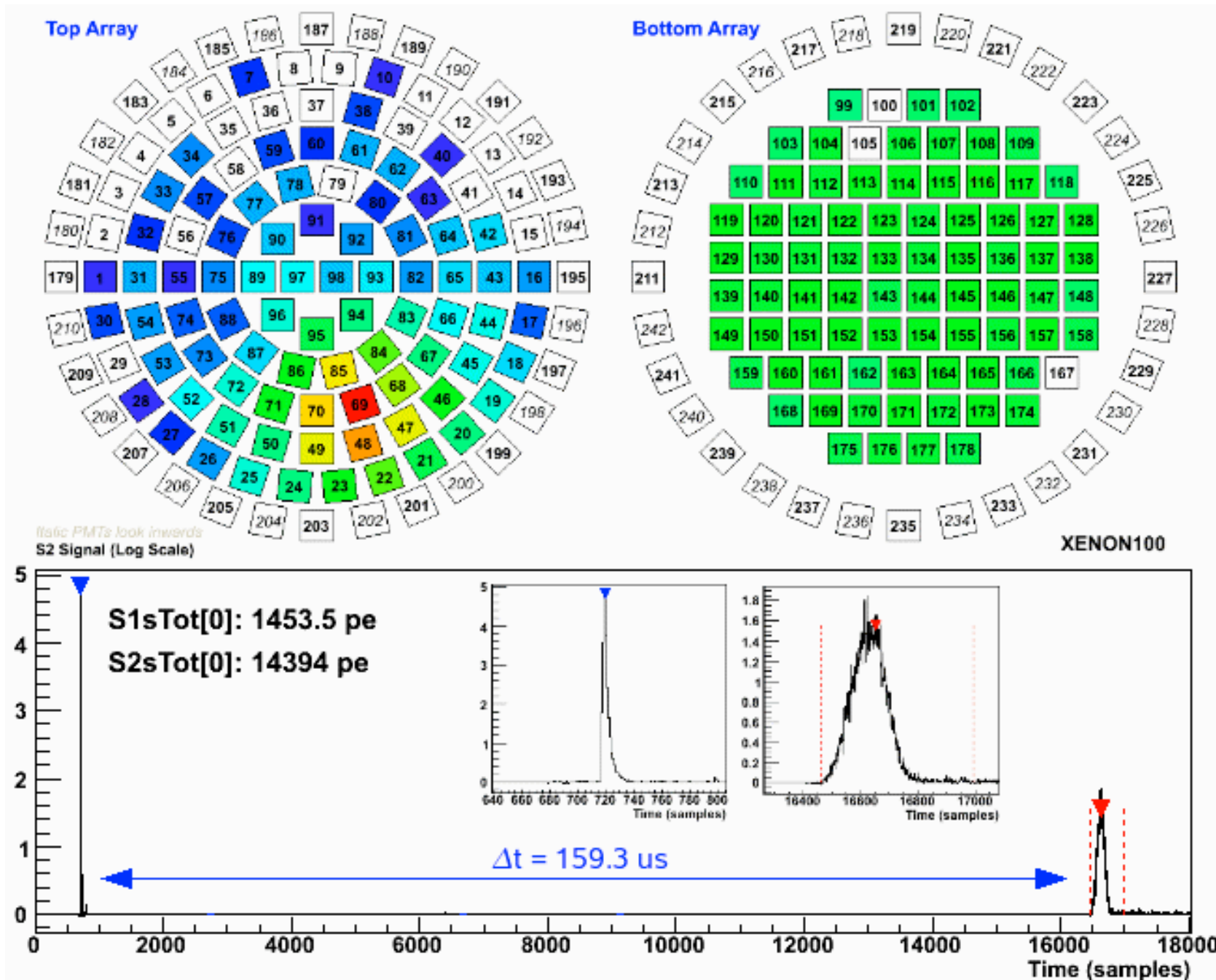


Principle of Operation

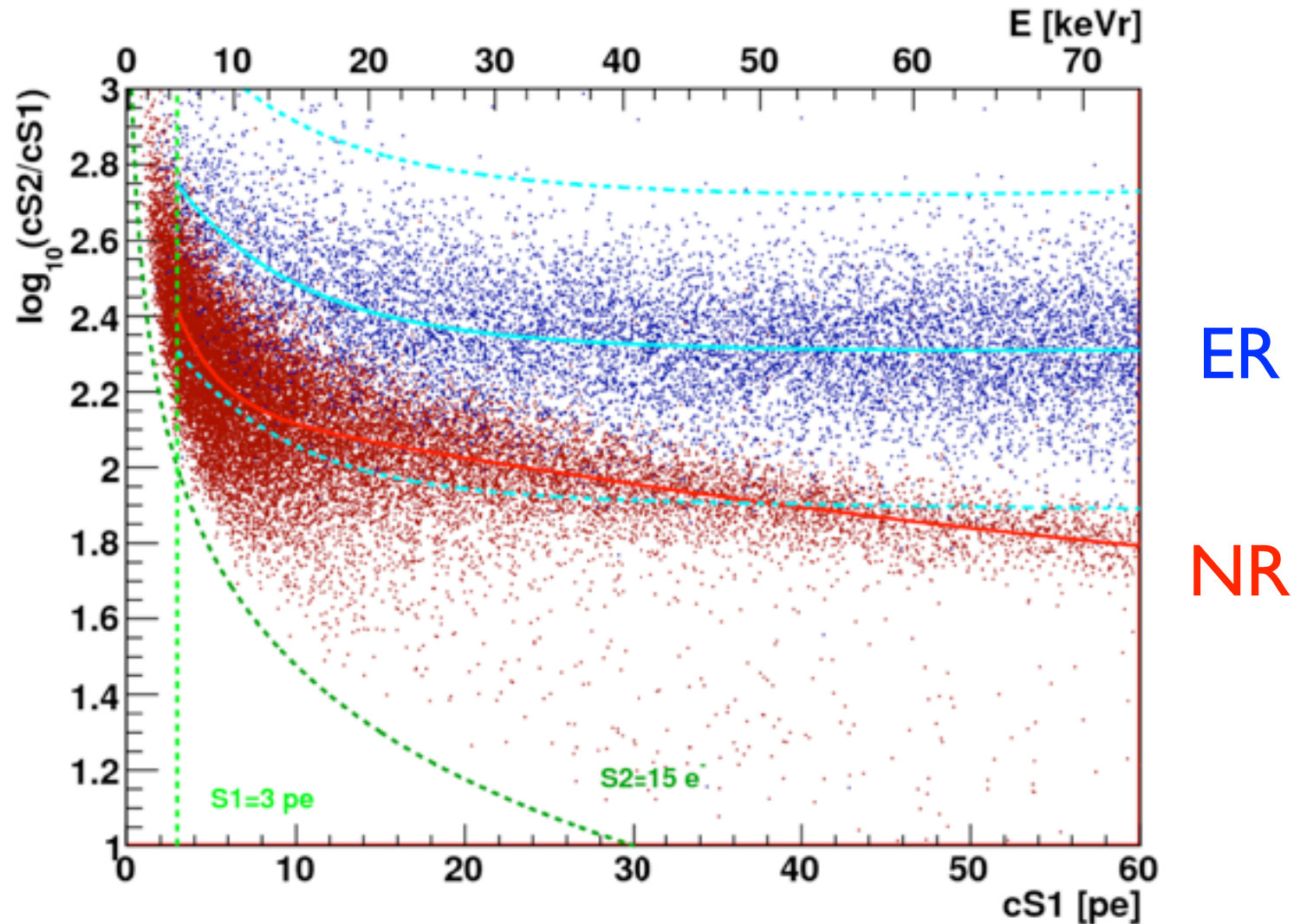


$$(S2/S1)_{wimp} \ll (S2/S1)_{gamma}$$

Event Signatures in XENON100



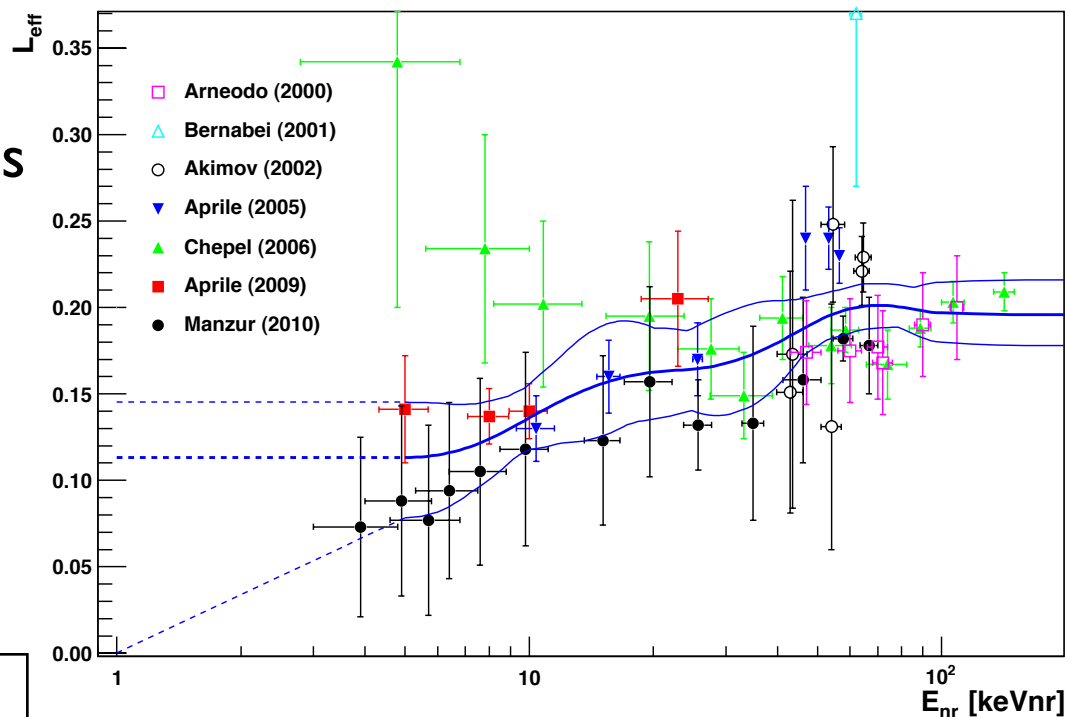
Background Discrimination



ER/NR discrimination > 99%

Energy Scale

- Electron recoil [keVee]
 - Calibrated with gamma lines
- Nuclear recoil [keVnr]
 - L_{eff}



Nuclear recoil energy [keVnr]

$$E_r = \frac{S_1}{LY} \frac{1}{L_{\text{eff}}(E_r)} \frac{S_e}{S_r}$$

SI [p.e.]

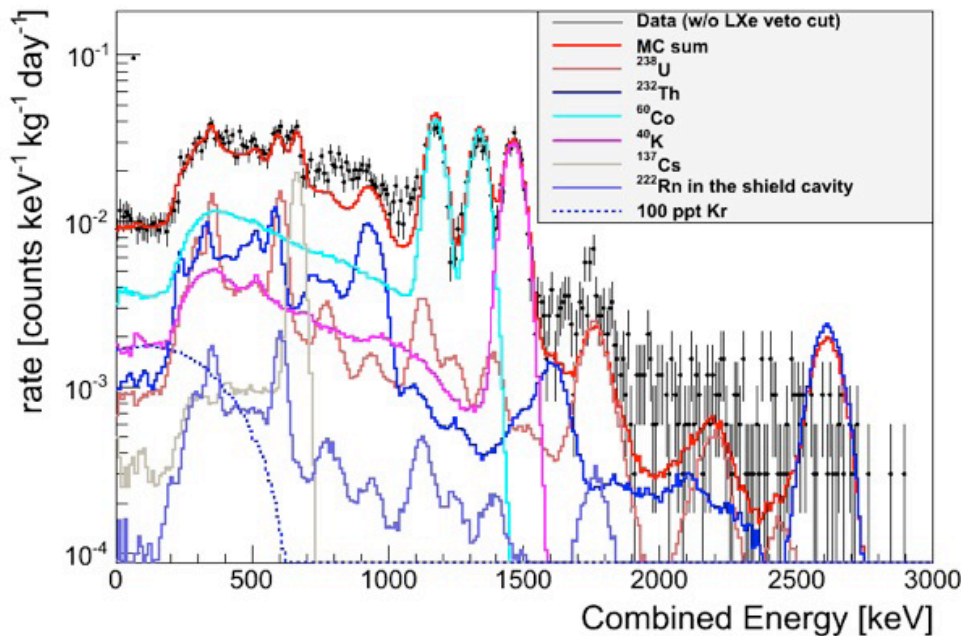
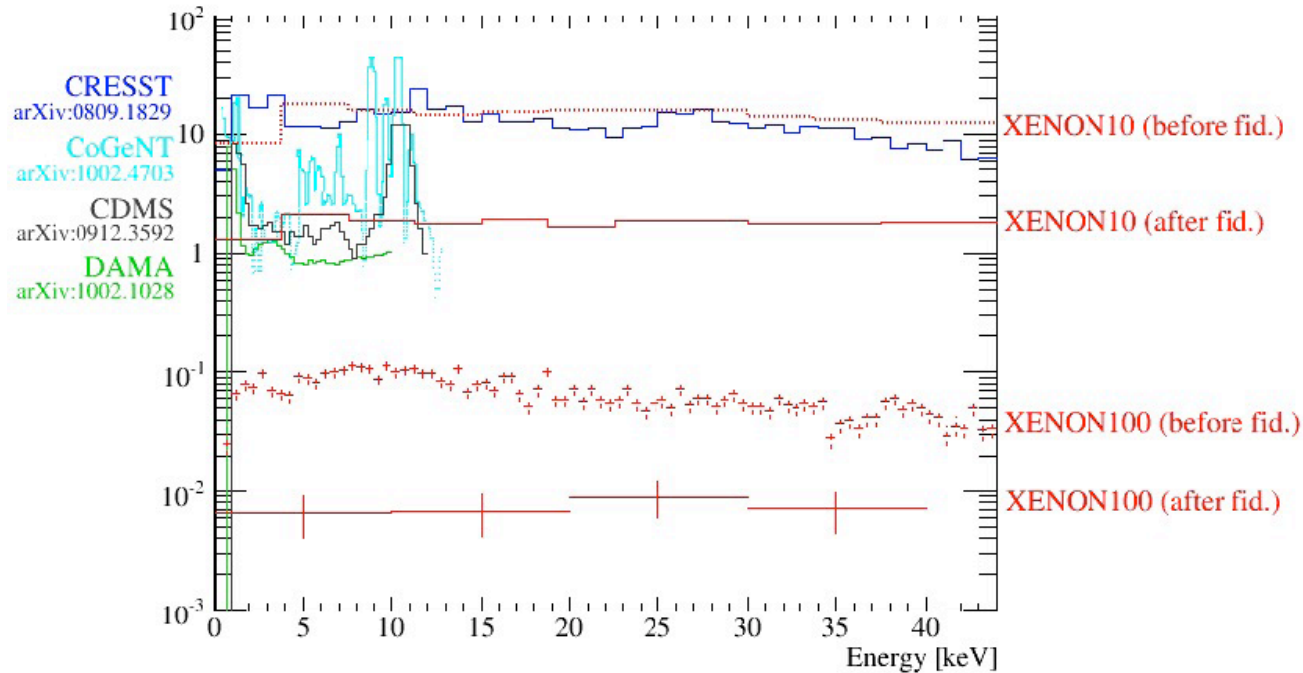
Light quenching factor for electron recoil

Light yield [p.e./keV] @ 122keVee

Light quenching factor for nuclear recoil

Lowest Background of All DM Detectors

Rate [events/keV/kg/day]



- Very low ER background
 - LXe self-shielding
- Data spectrum match with MC
 - Material screening

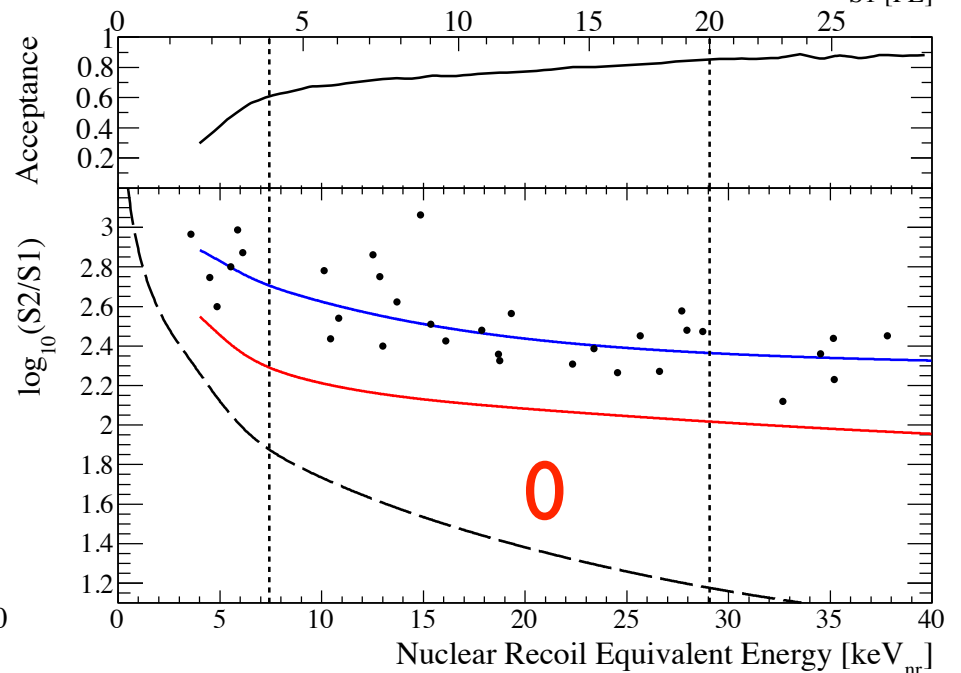
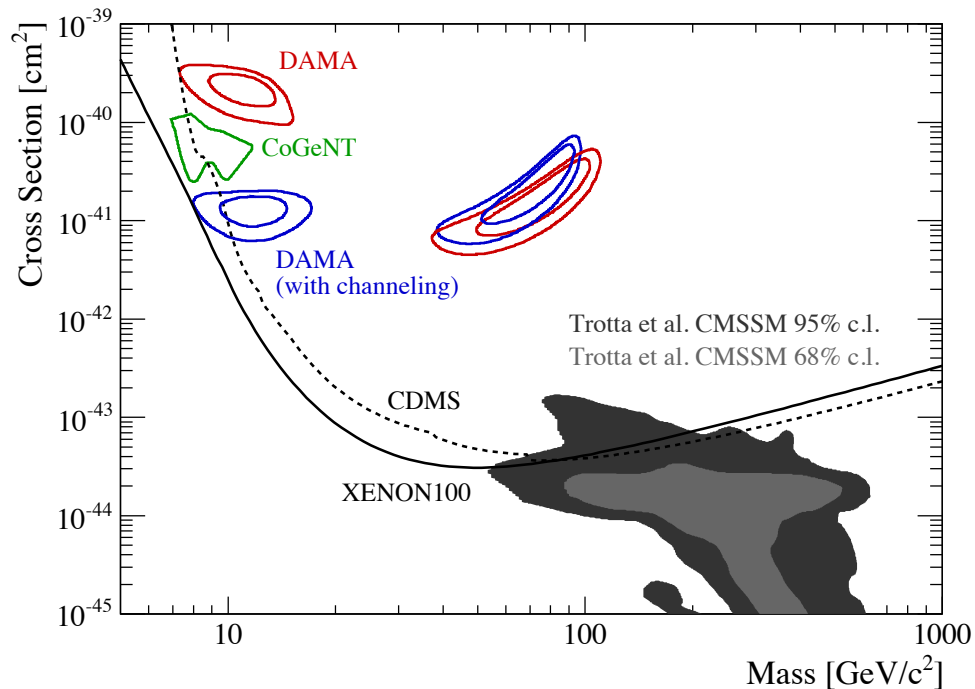
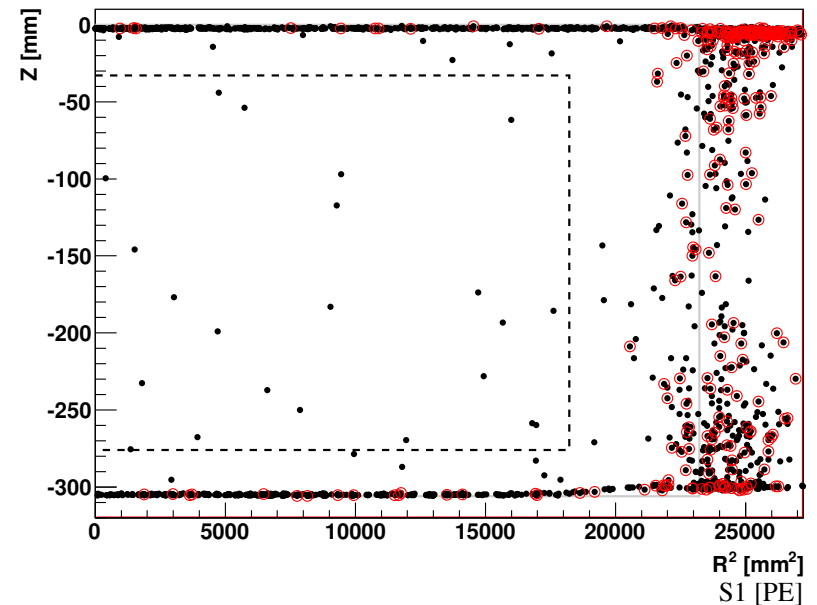
First Dark Matter Results

11.17 live days x 40kg
 (data collected Oct.2009 - Nov. 2009)

Analysis: [4-20]p.e.

0 event observed, <0.2 expected

Leff: global fit



XENON Collaboration



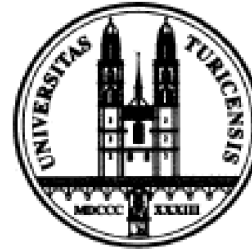
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Countries:

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- Switzerland (1)
- Portugal (1)
- Italy (1)
- Germany (2)
- China (1)
- France (1)
- ~ 50 collaborators



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D. Thers



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