

Supernova Neutrinos in XENON1T

Shayne Reichard

SNEWS Meeting at
NEUTRINO 2016

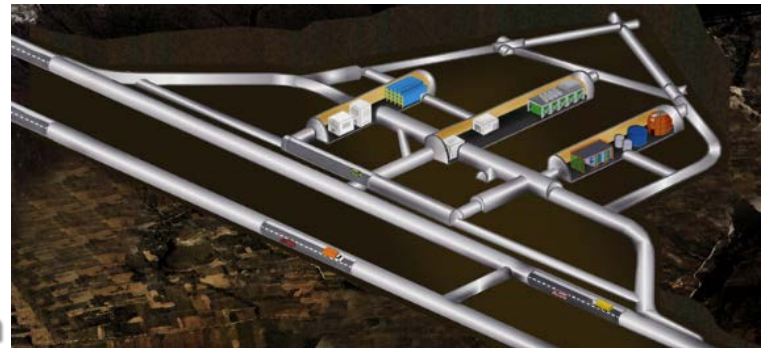
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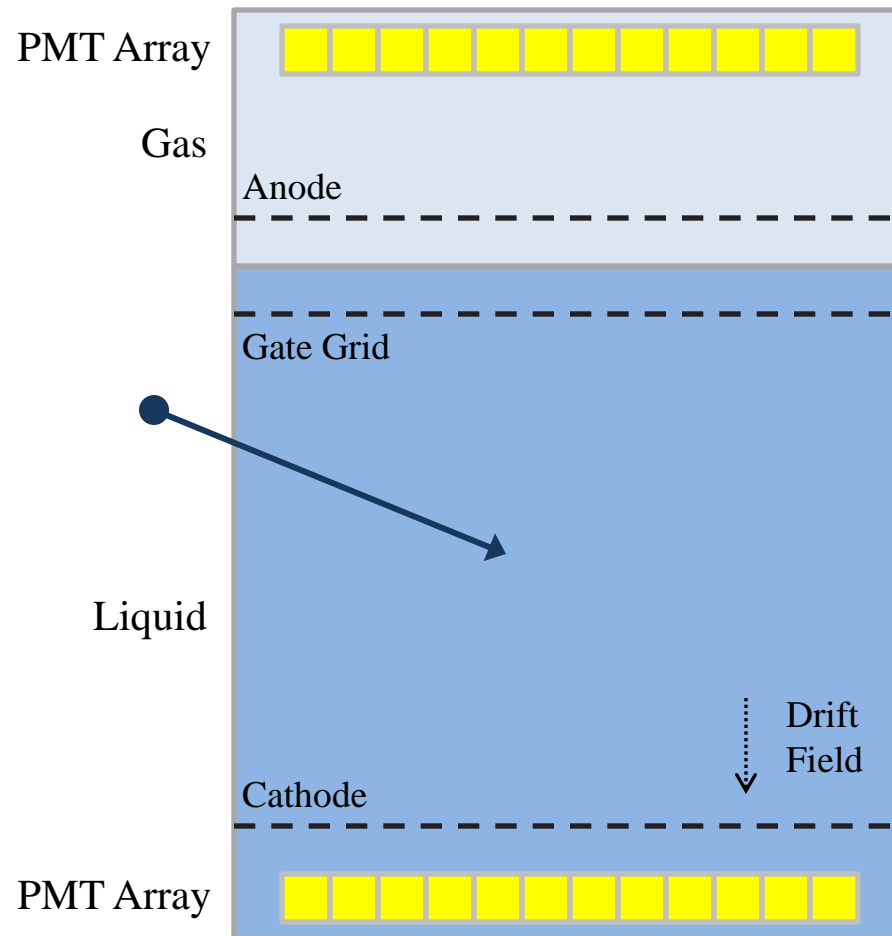
The XENON1T Experiment

- Dual-Phase Time Projection Chamber
- Xenon Target
- Dark Matter (WIMPs)
- Nuclear Scatters
- Up and Running

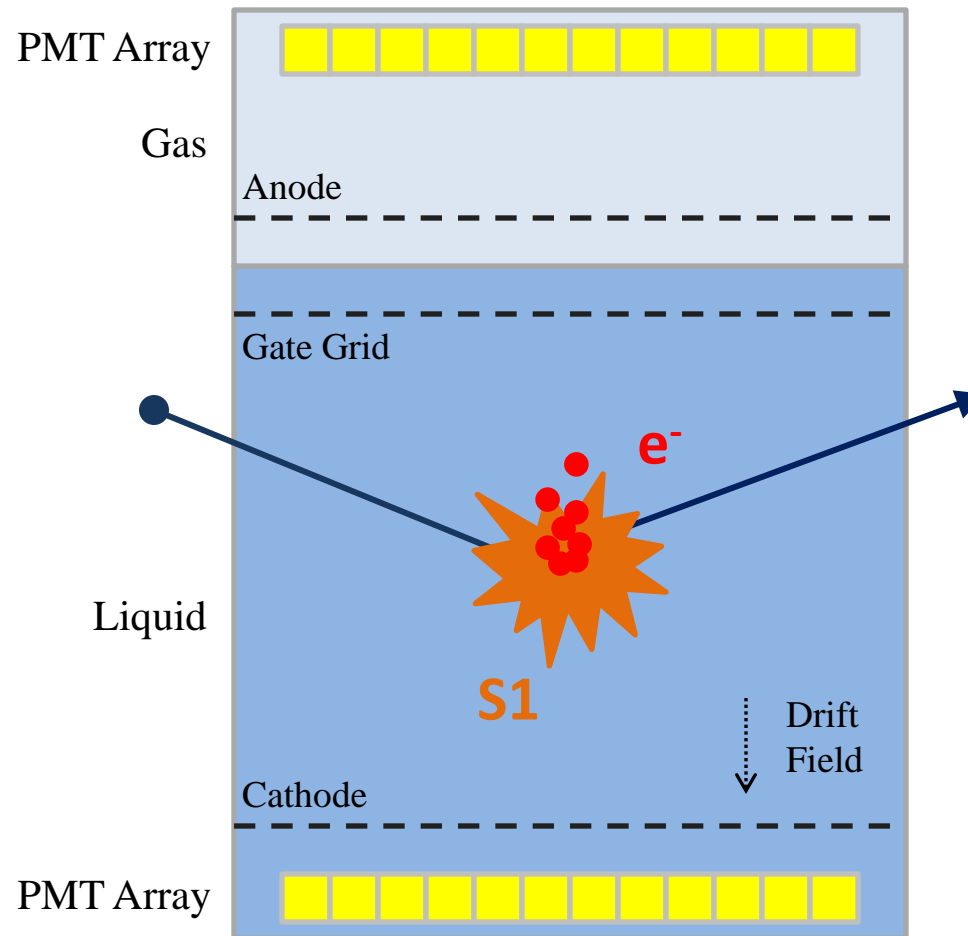


**Laboratori Nazionali
Del Gran Sasso, Italia**

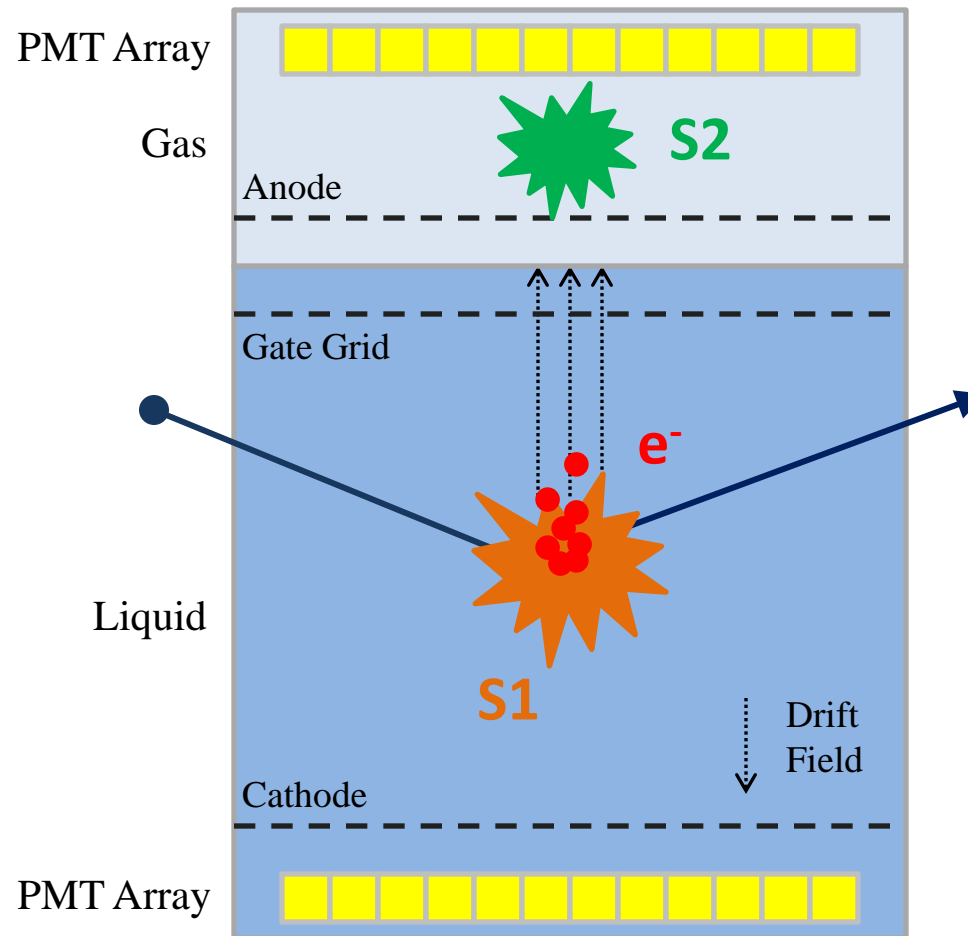
Time Projection Chamber



Time Projection Chamber

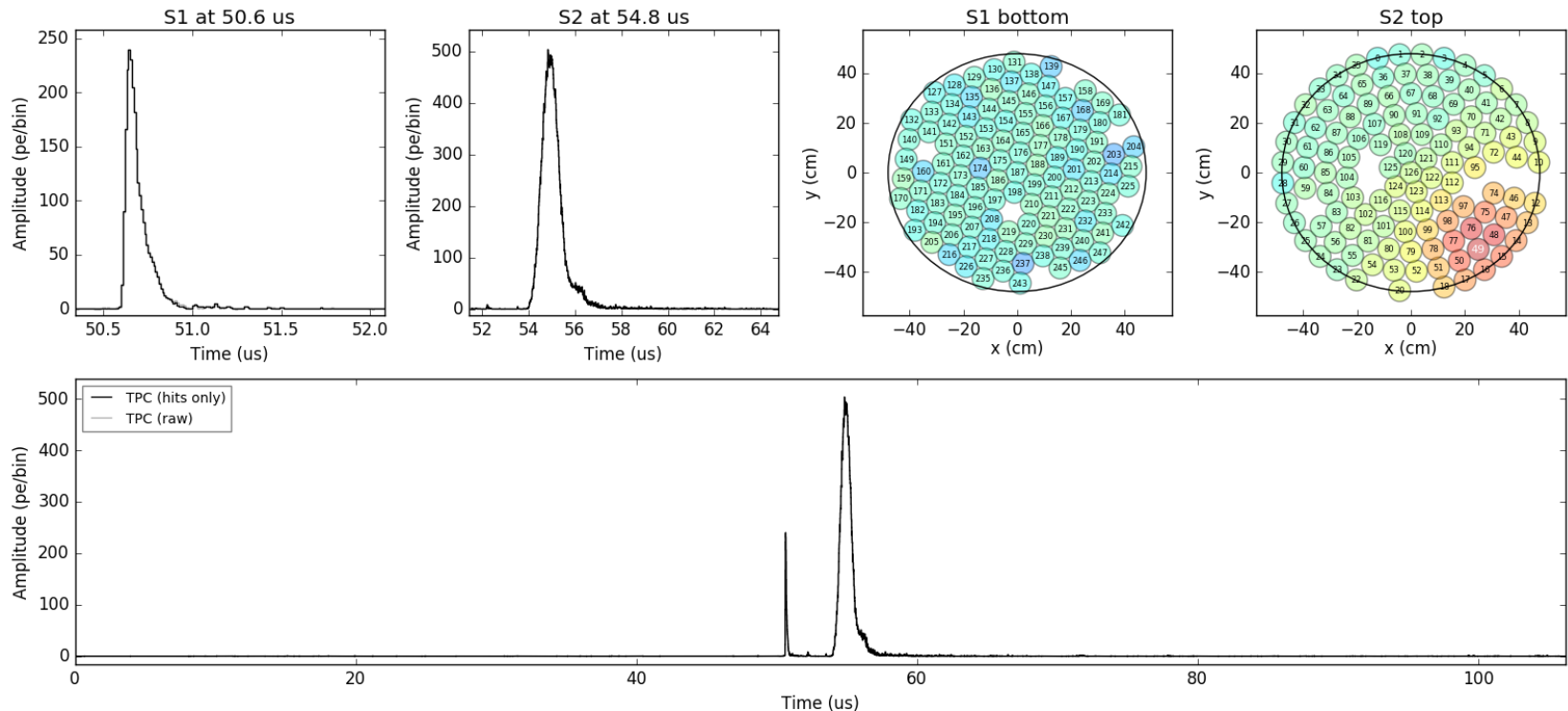


Time Projection Chamber



XENON1T is Operational

- First light from our prompt scintillation signal (S1)
- Successfully drifted electrons for our proportional scintillation signal (S2)



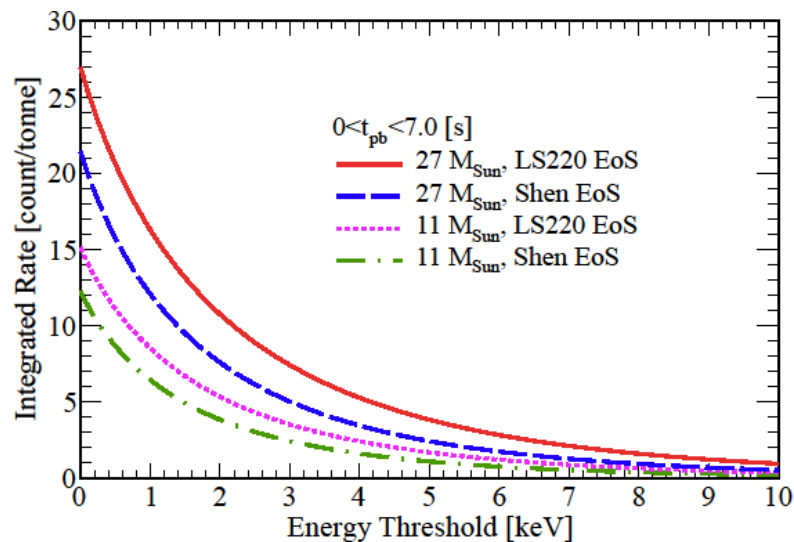
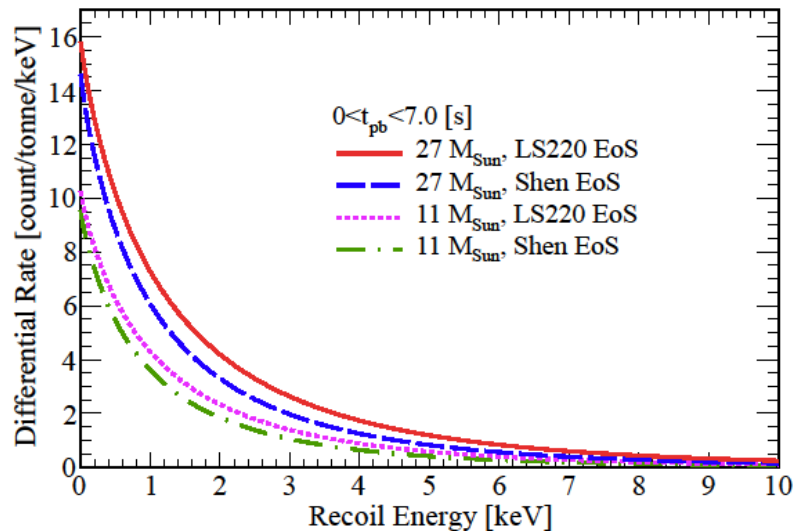
Sensitivity to a SN: Coherence

- Tonne Scale
- Coherent Elastic Neutrino-Nucleus Scattering
 - Event rate scales with target mass

$$\frac{dR}{dE_R} \sim \frac{d\sigma}{dE_R} \sim Am_N$$

- With xenon ($A \approx 131$)
- A 2-tonne detector with coherence is akin to a 200-tonne detector without coherence.

Analysis Mode



- Large rate at low energies
- Lower energy threshold
- Relinquish the requirement that an S1 is generated (S2-only analysis mode)
- Expect ~20-40 events in the 2-tonne active region of XENON1T, assuming...
 - SN at 10 kpc
 - 0.7-keV recoil threshold
 - 60-PE S2 threshold

Integrating XENON1T into SNEWS

- Negligible background (based on XENON10/100)
- Detection significance better than 5σ up to ~ 24 kpc
- Implementing capability to receive SNEWS trigger
- Measure background (also during calibration campaigns) to establish whether we can provide an alarm to SNEWS

○ Further Reading

R. F. Lang, C. McCabe, S. Reichard, M. Selvi, and I. Tamborra, 2016, arXiv:1606.09243, submitted to PRD