

Welcome to the

DarkSide Masterclass

Part Two



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Istituto Istruzione Superiore Luigi Einaudi, Siracusa, March 17th, 2025

How can we detect WIMPs ?

The DarkSide experiment solution: a direct detection

WIMP-nucleus elastic collisions revealed by
a **Liquid** (radiopure) **Argon detector**
capable of unambiguously identifying a small
number of **nuclear recoils**



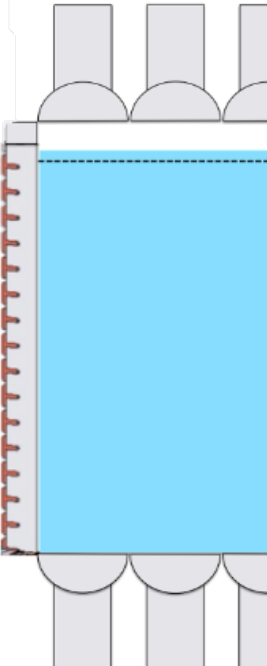
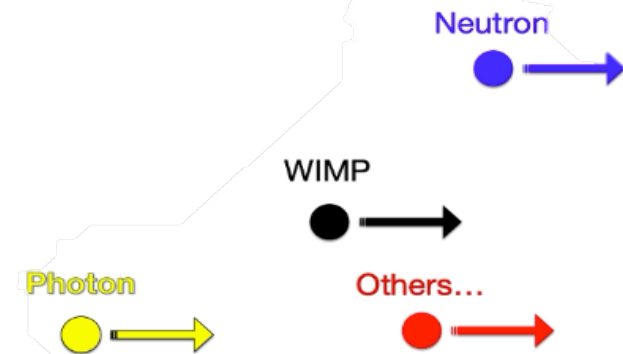
Liquid Argon used as:

- Target: to interact with WIMP
- Detector: in a double phase state (liquid + gas) to measure the WIMP energy and position





Detecting dark matter is very challenging mainly due to **background particles**.

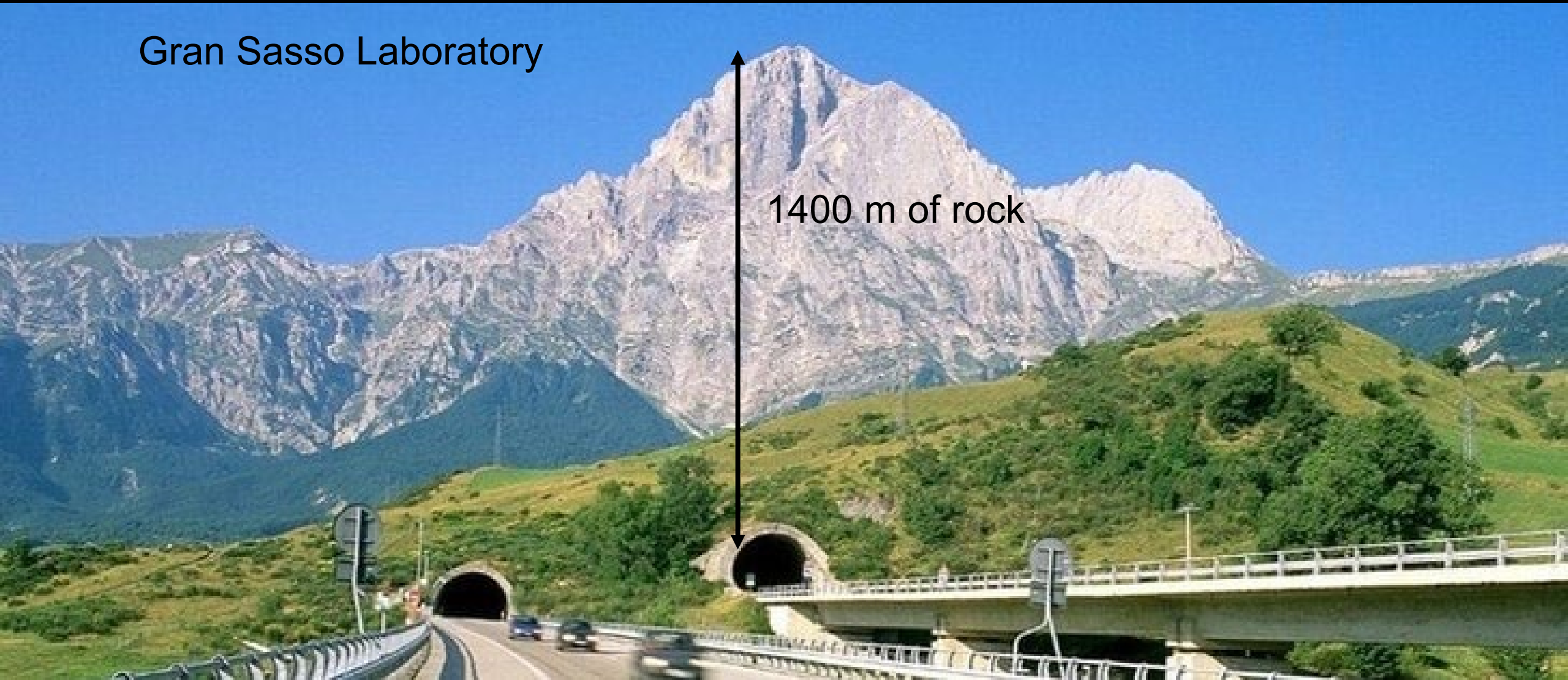


How can we reduce the background?

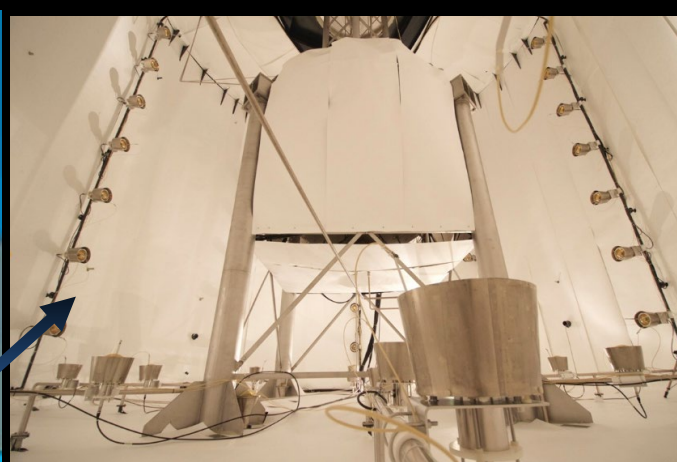
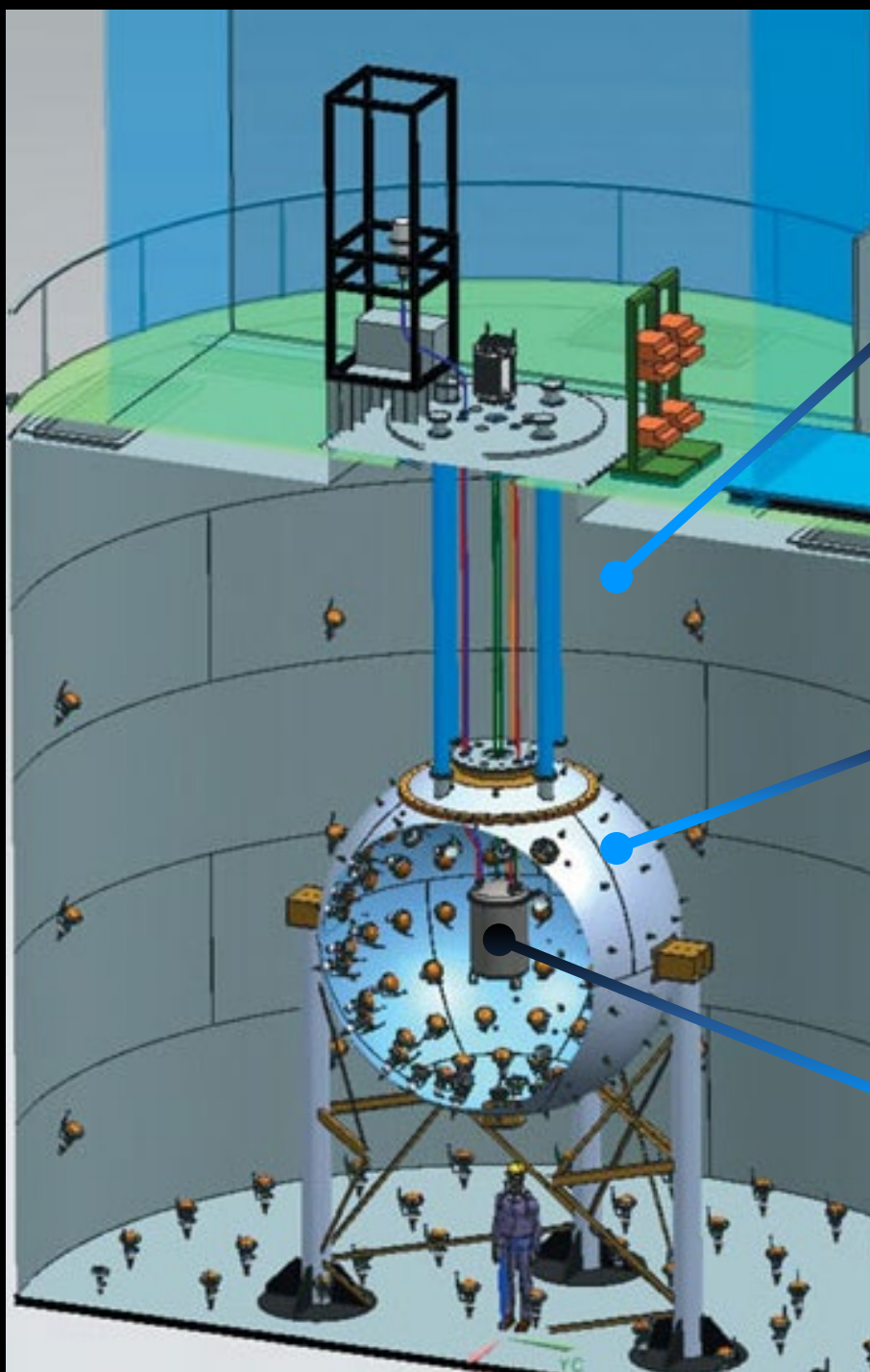
And how to identify a WIMP?

- Going underground
- All the materials are as radiopure as possible

Gran Sasso Laboratory





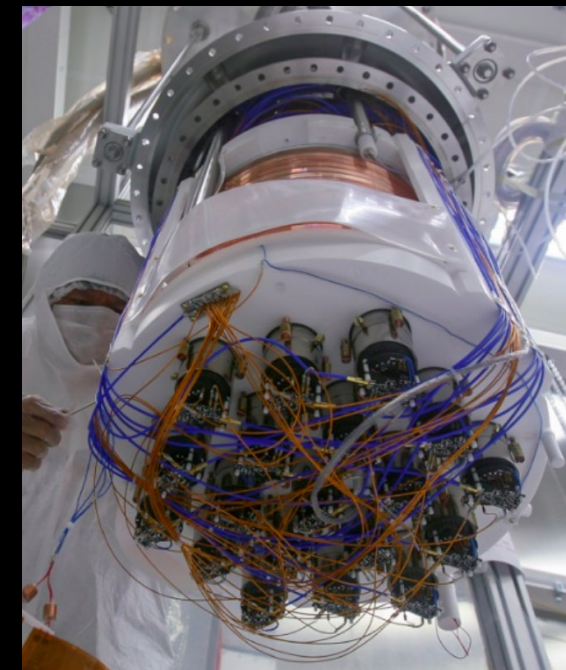


Cosmic-ray veto:
1 kton ultra pure Water
Cherenkov



Neutron veto:
30 ton Borated Liquid
Scintillator

Dark Matter Detector:
TPC 50 kg Liquid Argon from
underground source depleted in ^{39}Ar

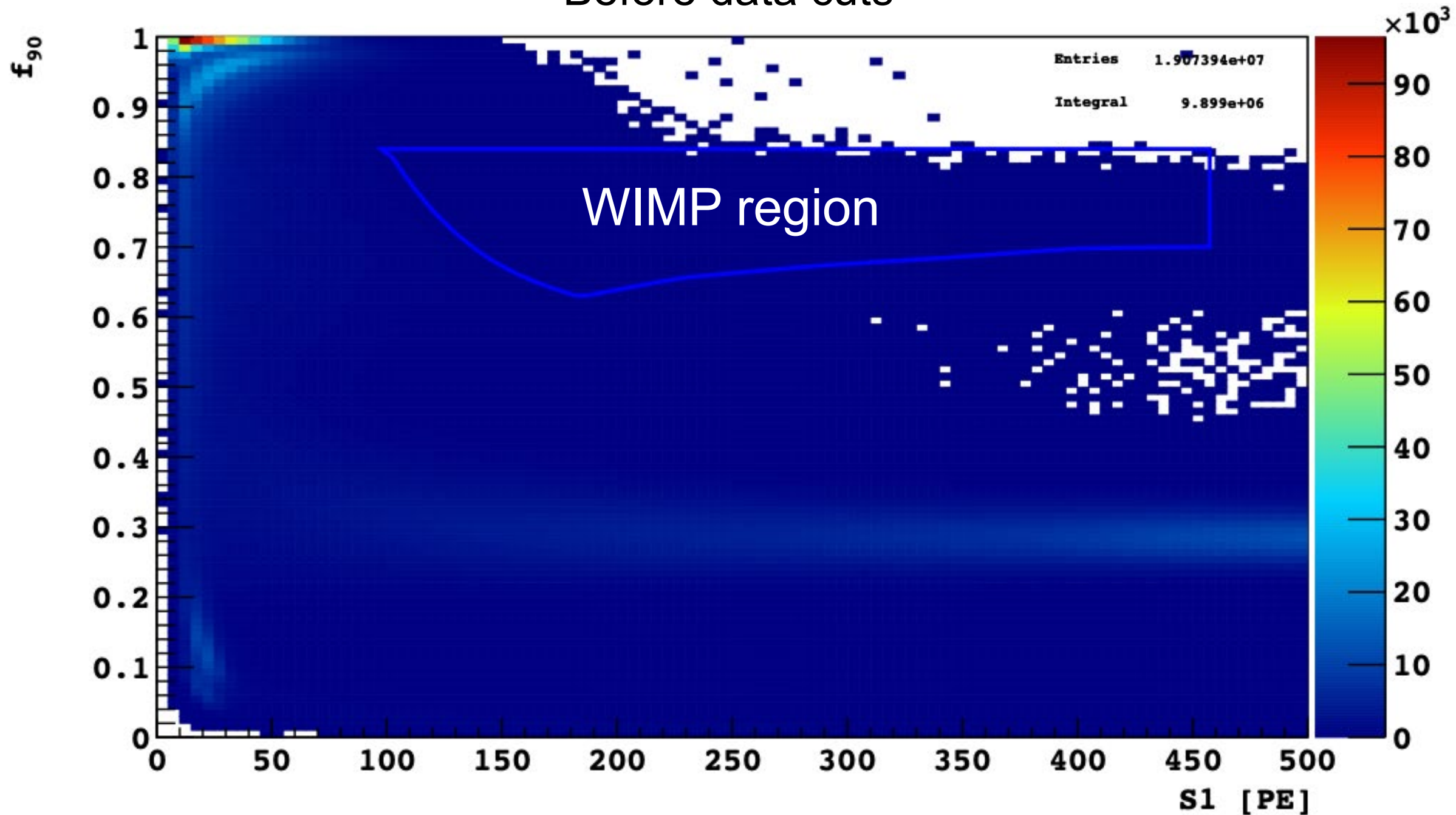




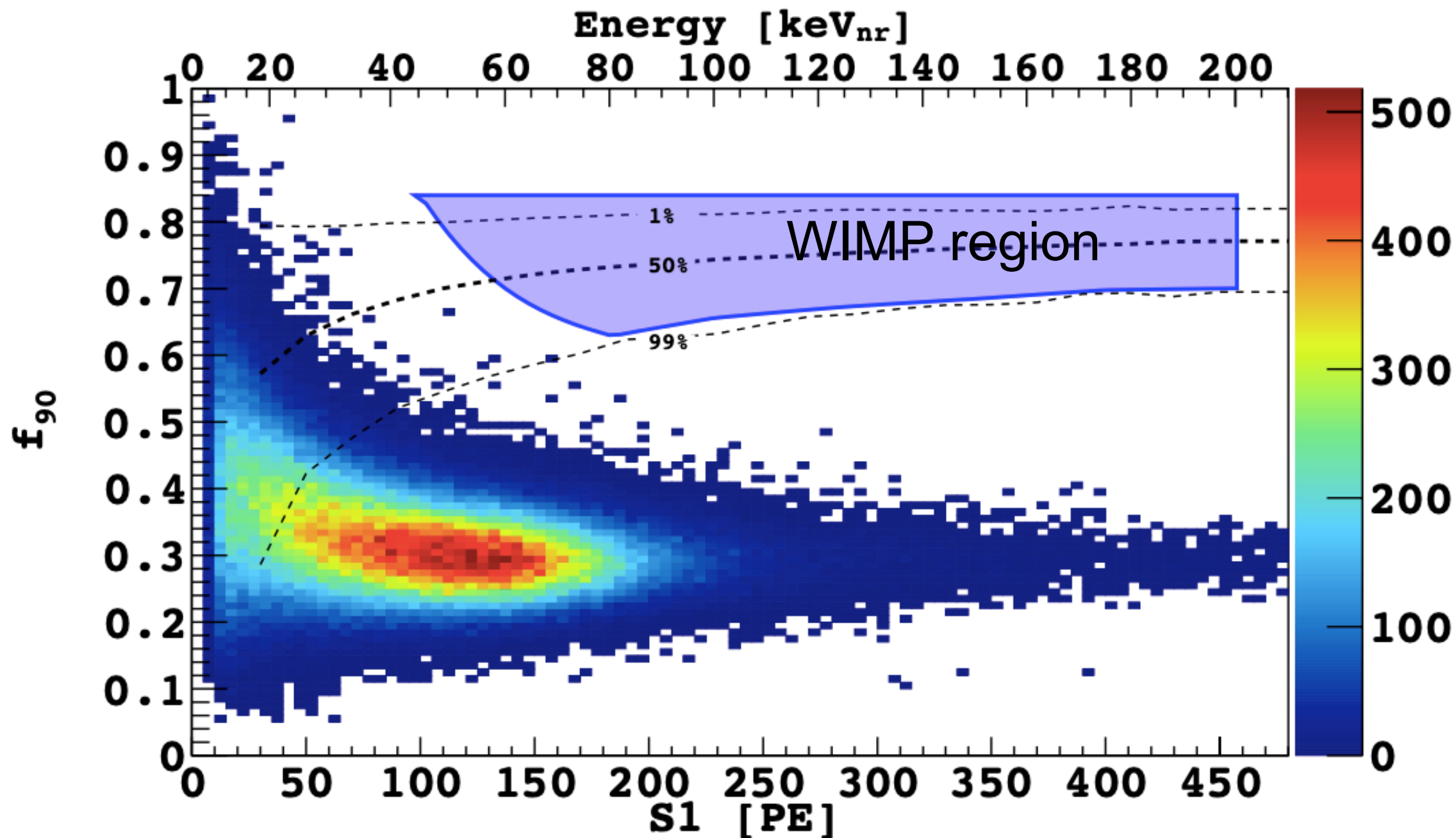


Before data cuts

f_{90} = fraction of S1 light detected in the first 90 ns of a signal
= prompt light

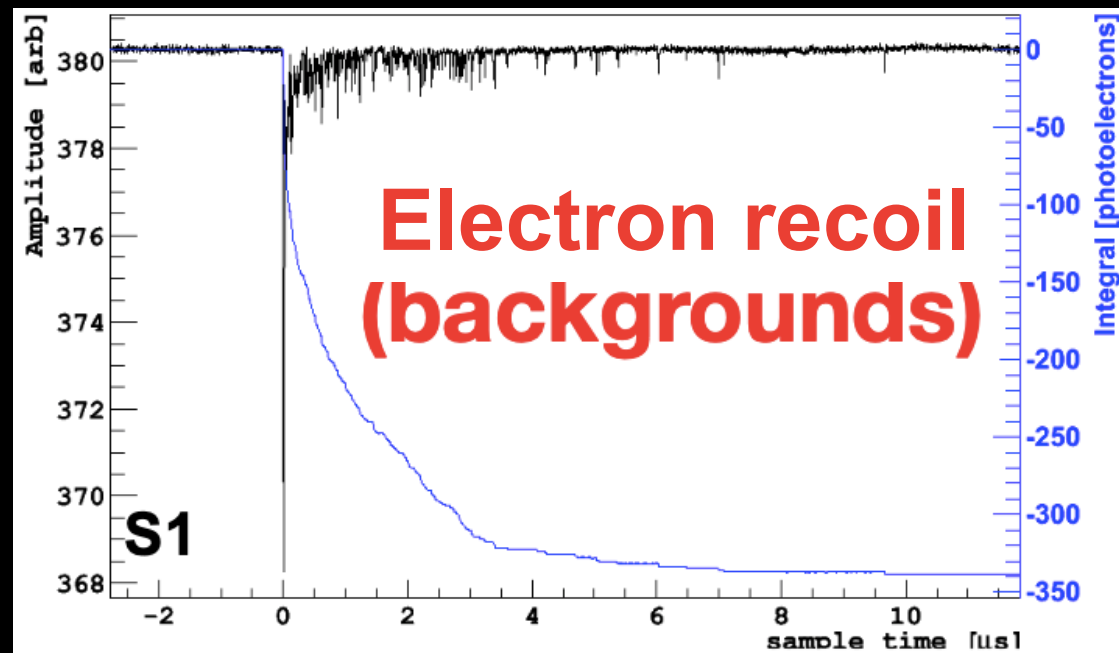
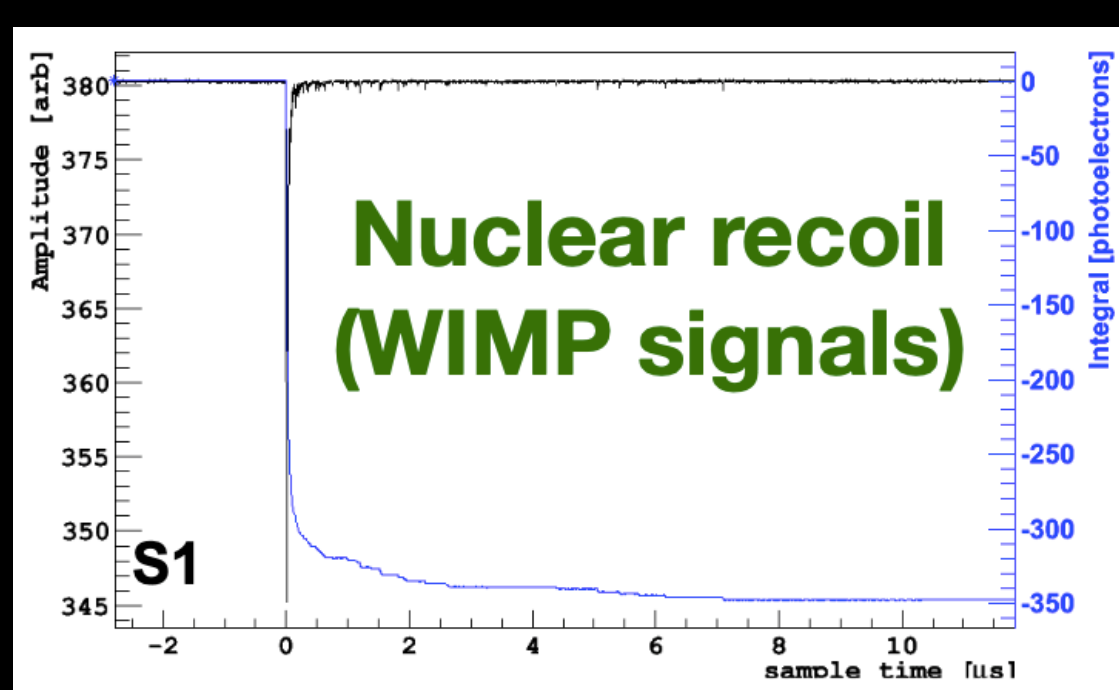


and after cuts





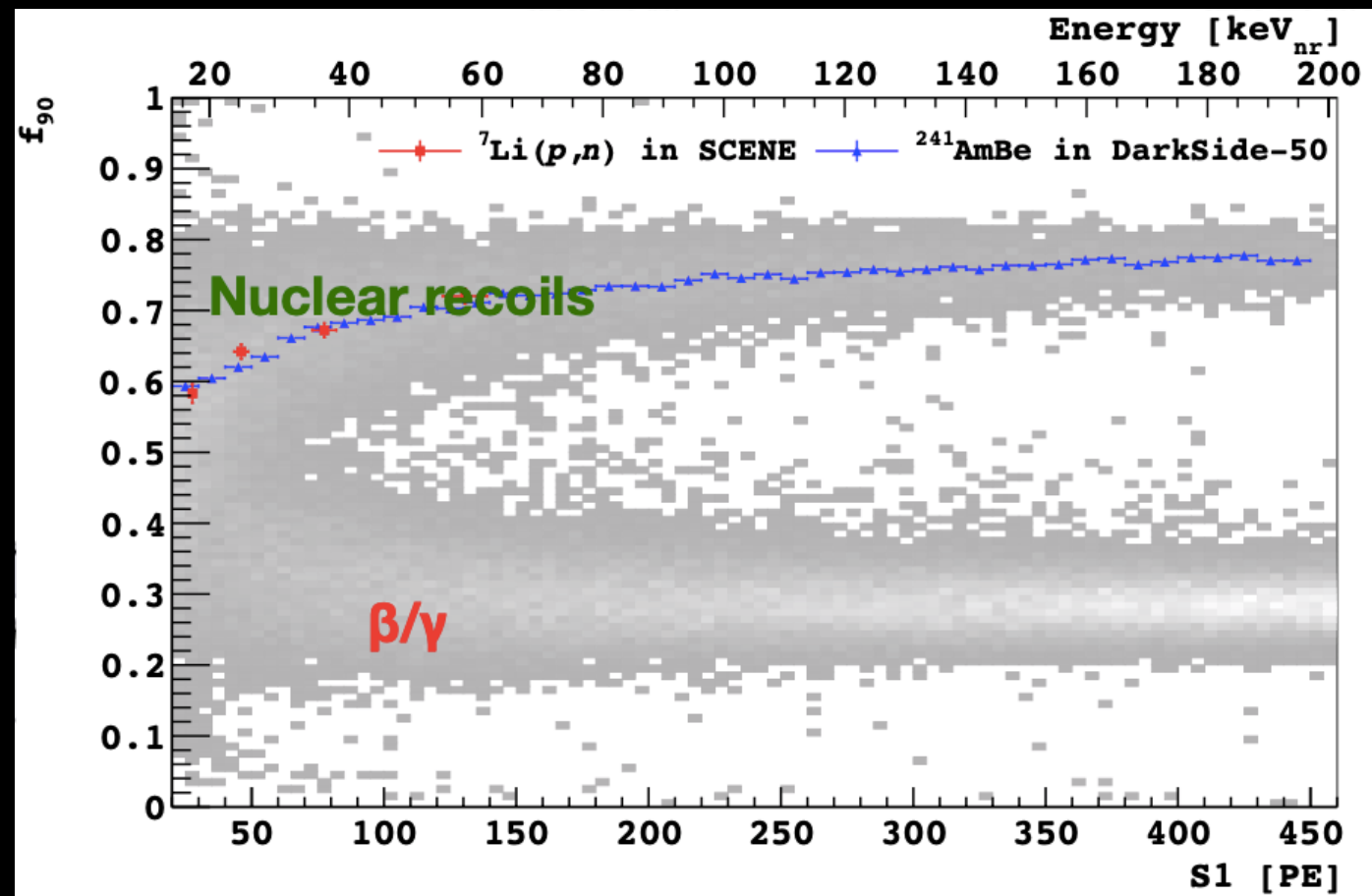
Backup

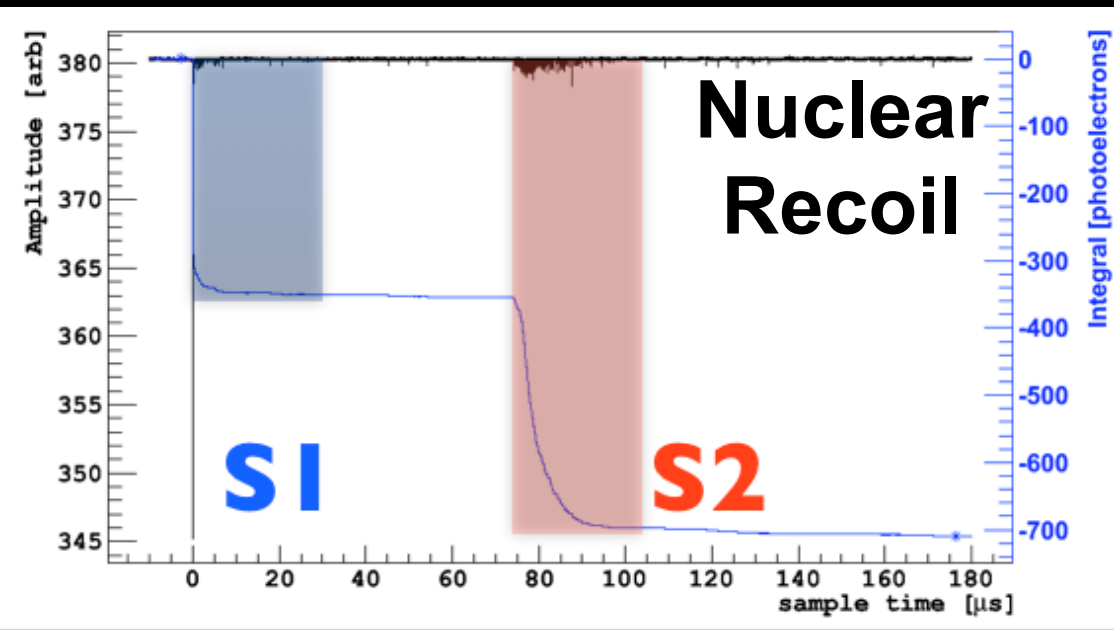


NR/ER, PSD on S1

Nuclear recoil: $f_{90} \sim 0.7$

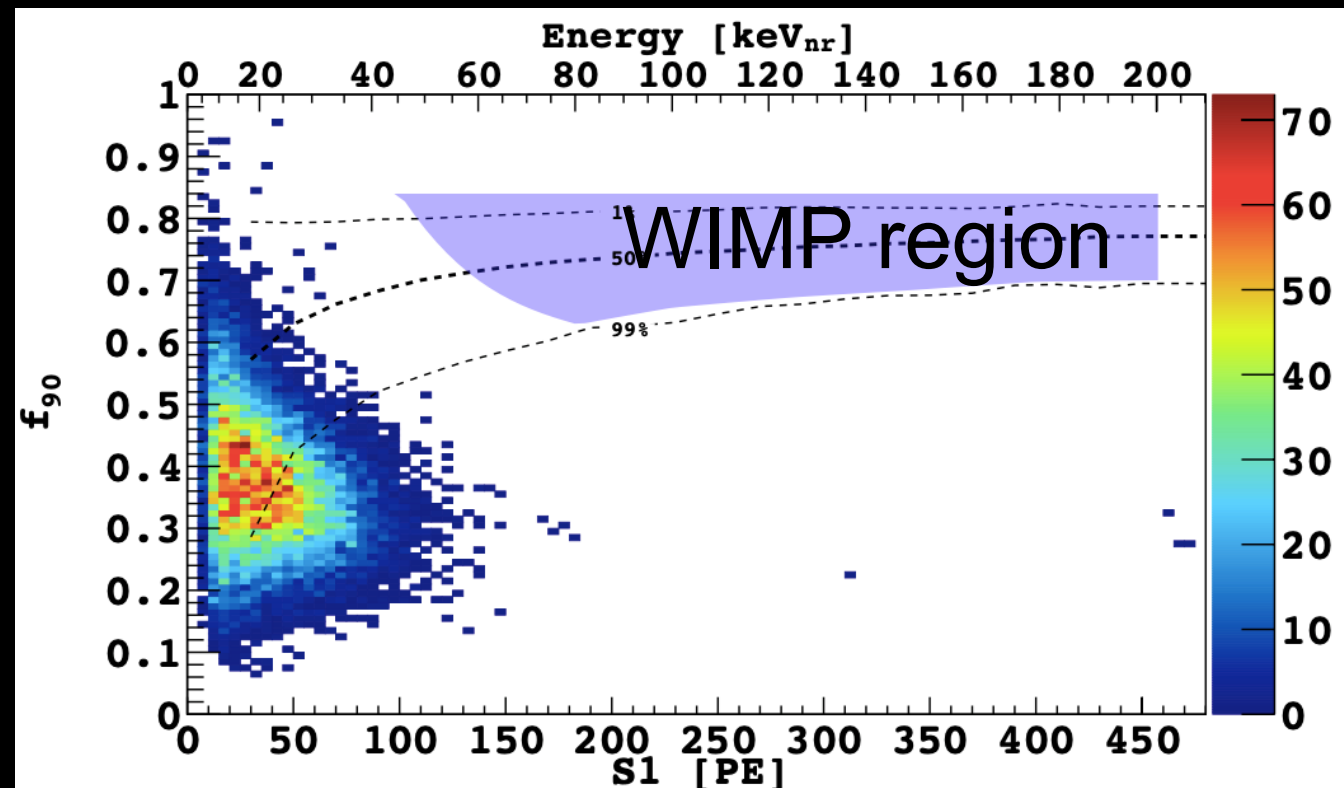
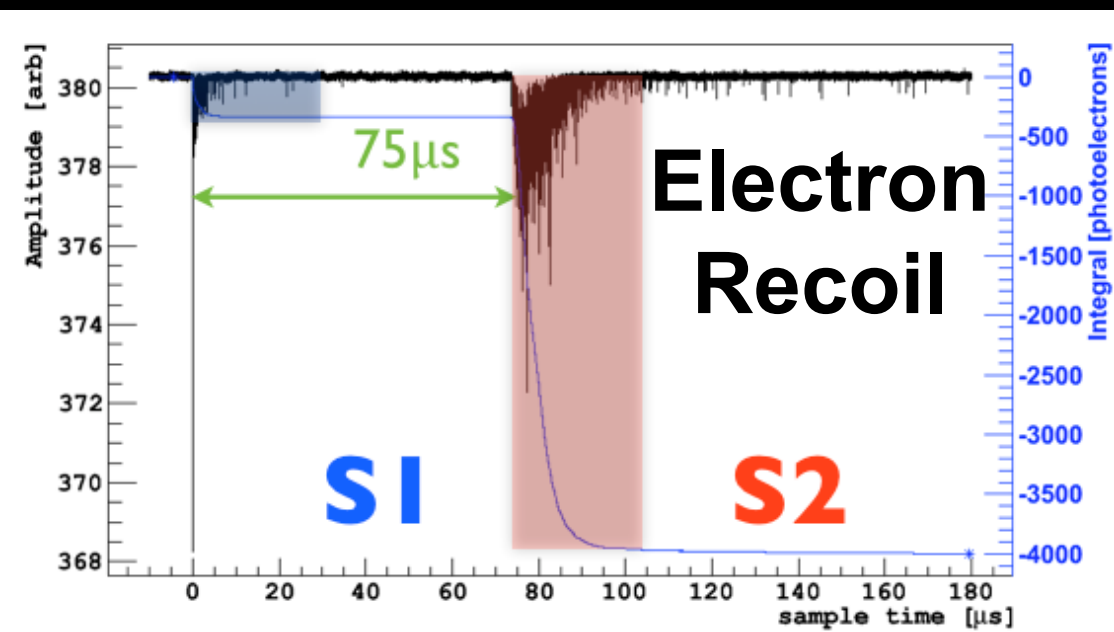
Electron recoil: $f_{90} \sim 0.3$





S2/S1
S2/S1 (NR) $\ll$ S2/S1 (ER)

S2/S1 + tightened radial cuts



Exclusion Plot

