

Dark Matter – XENON, DARWIN

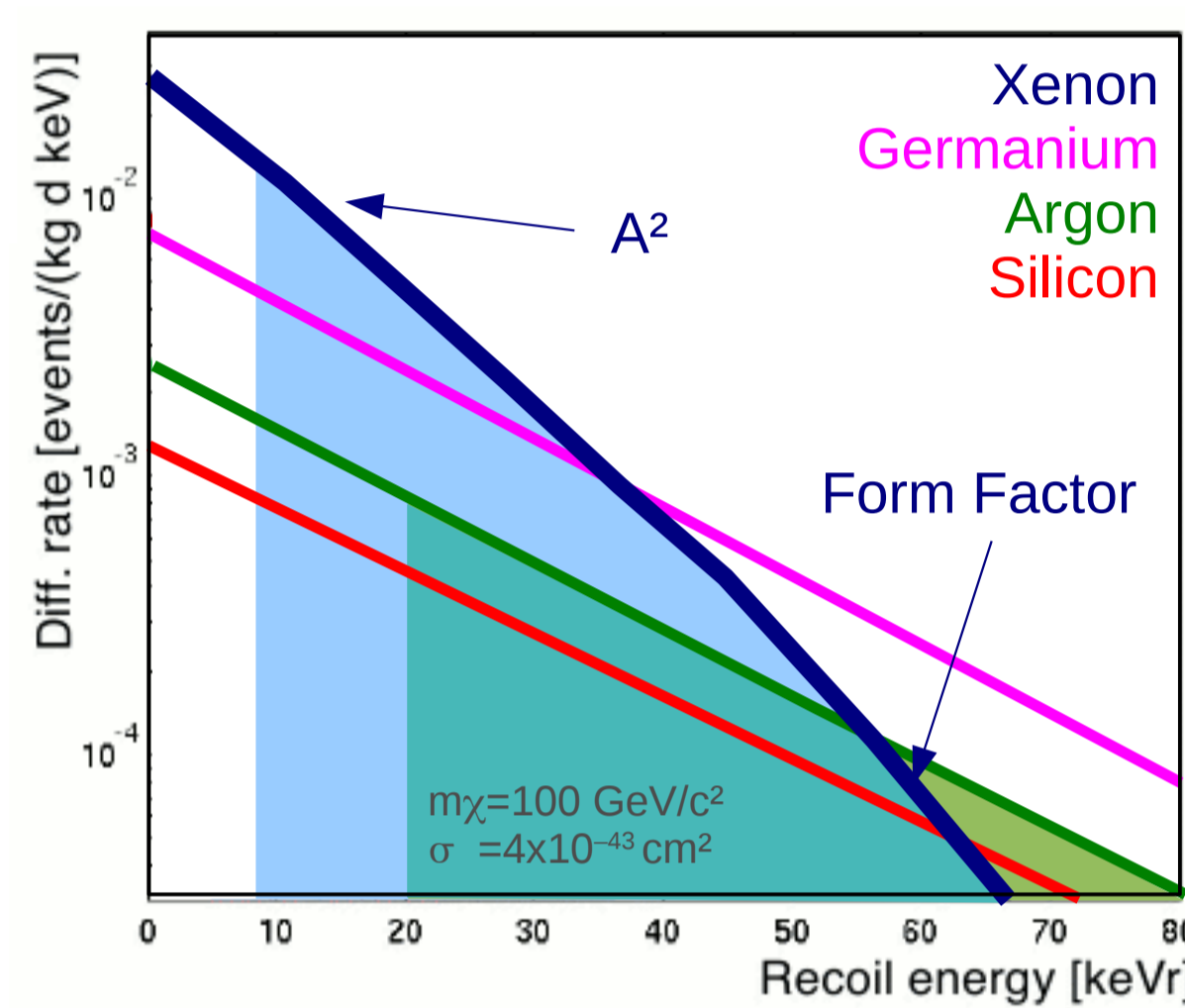
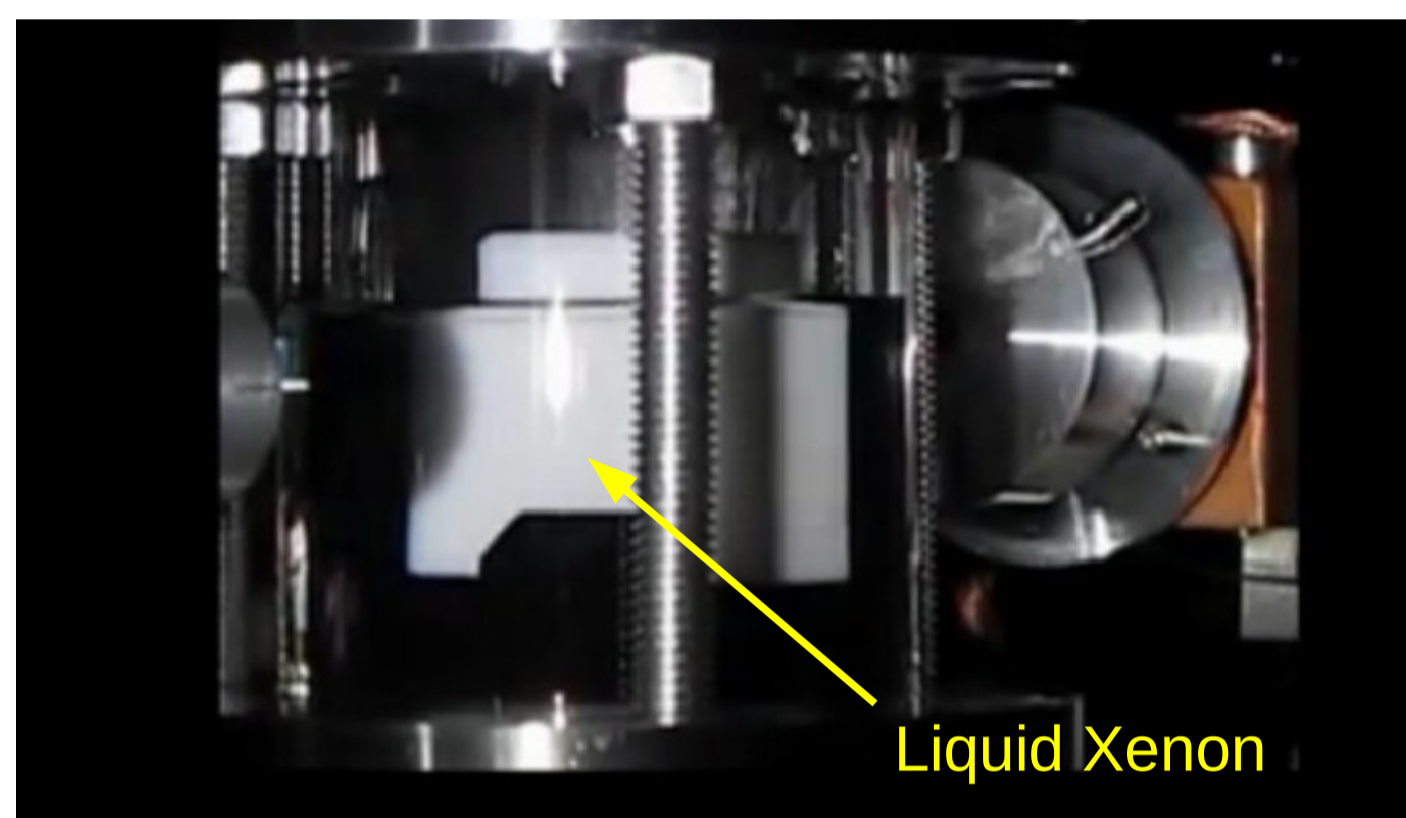


The AG Schumann participates in two international projects searching for dark matter in form of weakly interacting massive particles (WIMPs): XENON und DARWIN. XENON1T installed at LNGS (Italy) led to the worlds-strongest WIMP constraints to date. XENONnT will increase the sensitivity by an order of magnitude. DARWIN's sensitivity will only be limited by irreducible neutrino backgrounds.

Xenon as Dark Matter Target

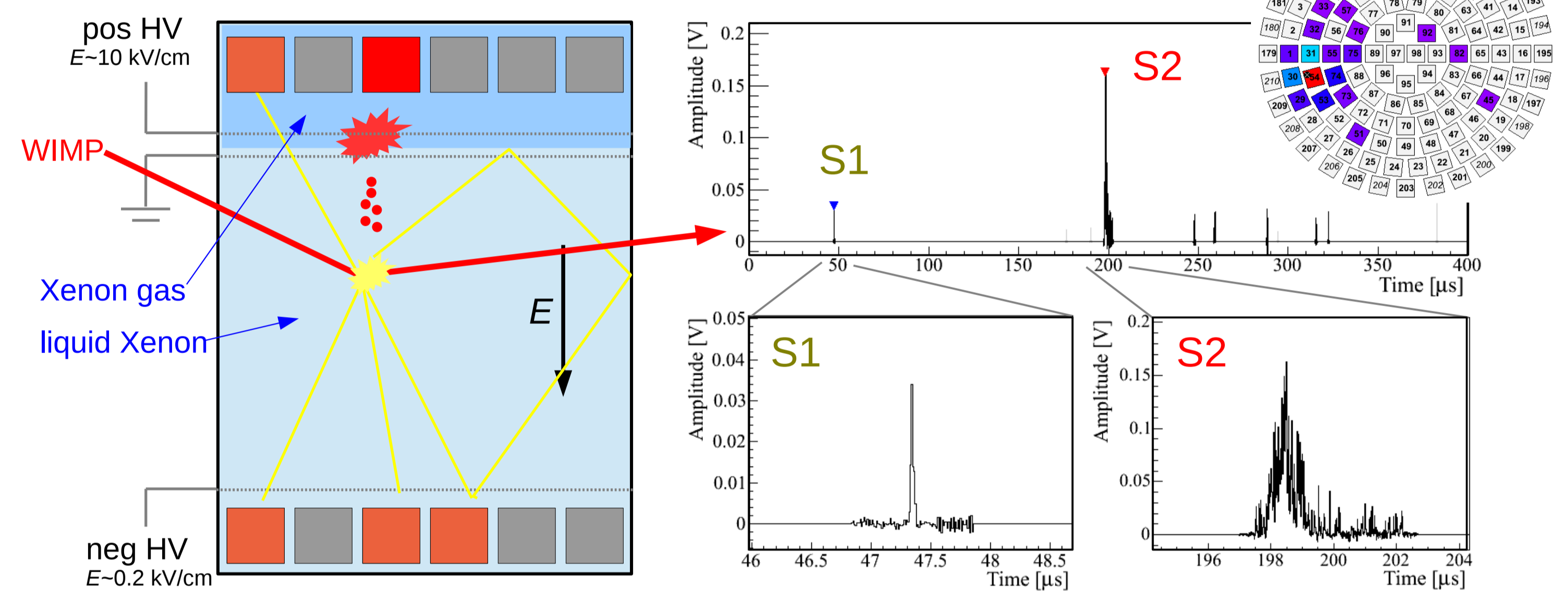
The noble gas xenon in liquid form (-95°C) is ideal for the direct detection of WIMP dark matter

- heavy nucleus ($A\sim 131$): good for self-shielding and WIMP-nucleon cross section ($\sigma \propto A^2$)
- Scintillator: Target = Detector
- no long-lived Isotope
- Detectors are scalable



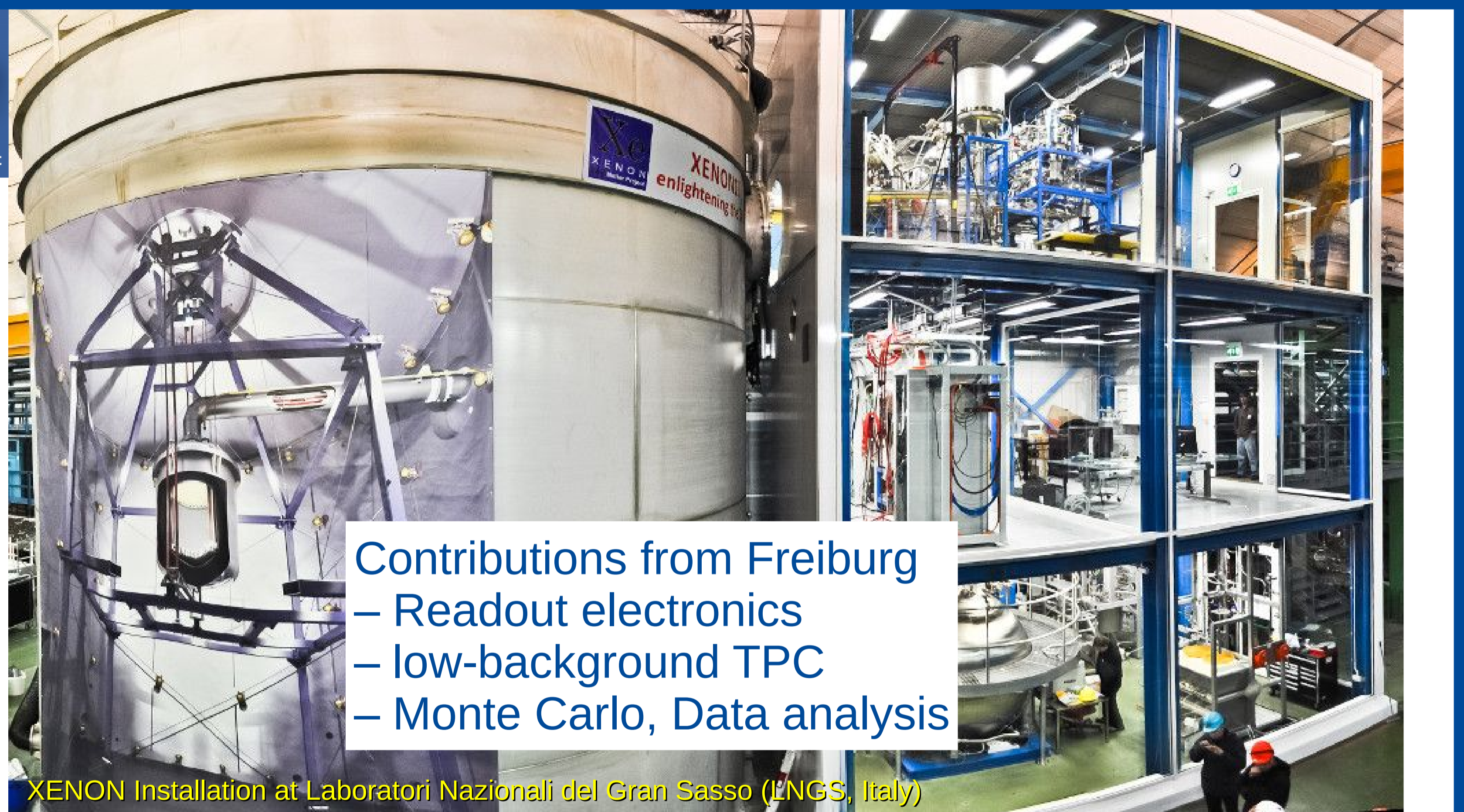
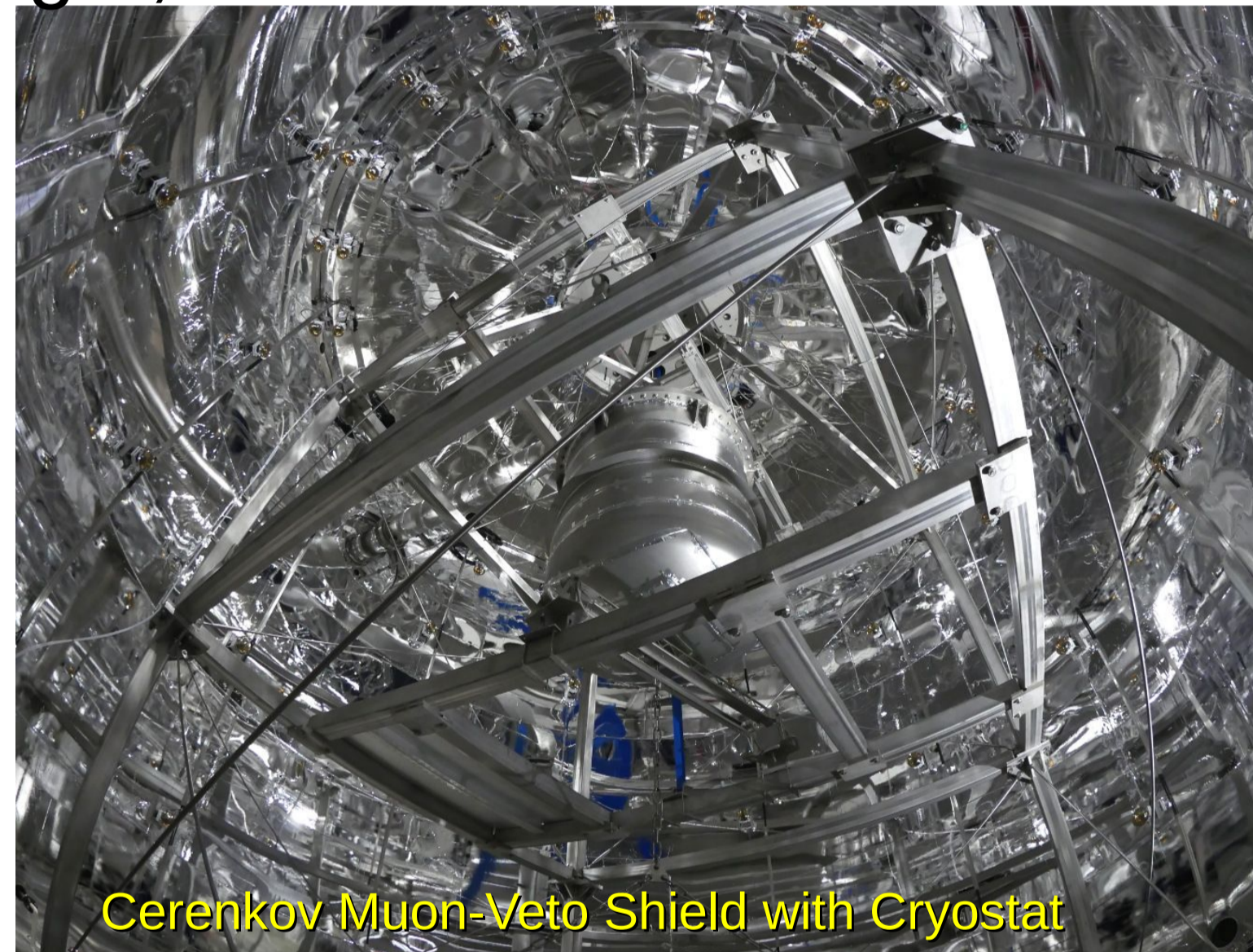
Detector: Time Projection Chamber (TPC)

- two phases: liquid (LXe) and gaseous xenon
- Light detection with photomultiplier tubes (PMT): scintillation (S1) and charge (S2, via proportional scintillation)
- 3D position reconstruction



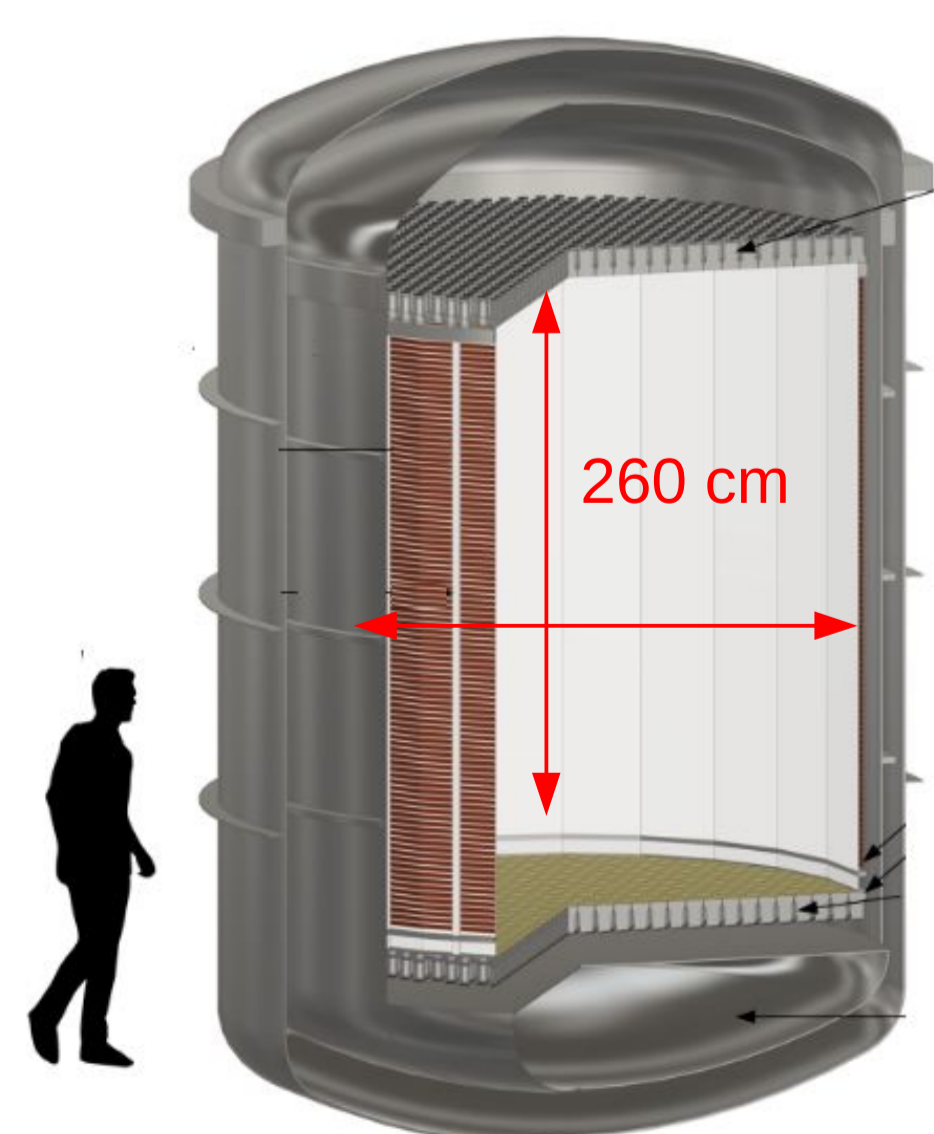
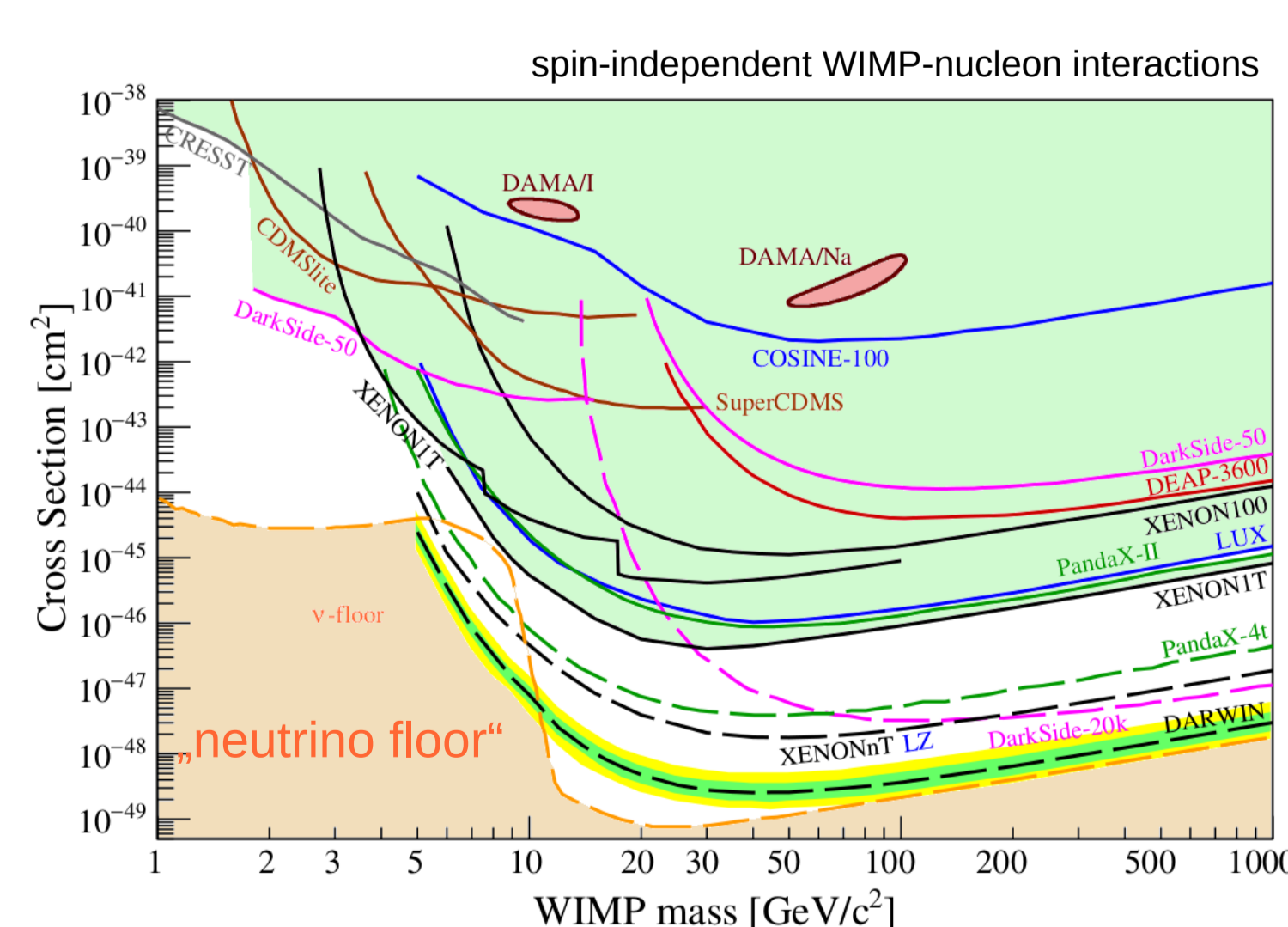
XENON @ LNGS

- XENON1T: still world leading results
2.0t active Xe target; 248 PMTs
- XENONnT (2020 – 2024+)
5.9t active Xe target; 494 PMTs



DARWIN: The ultimate Detector

- Neutrinos are the ultimate background for the direct dark matter search
- DARWIN: 40t xenon detector to reach maximal sensitivity

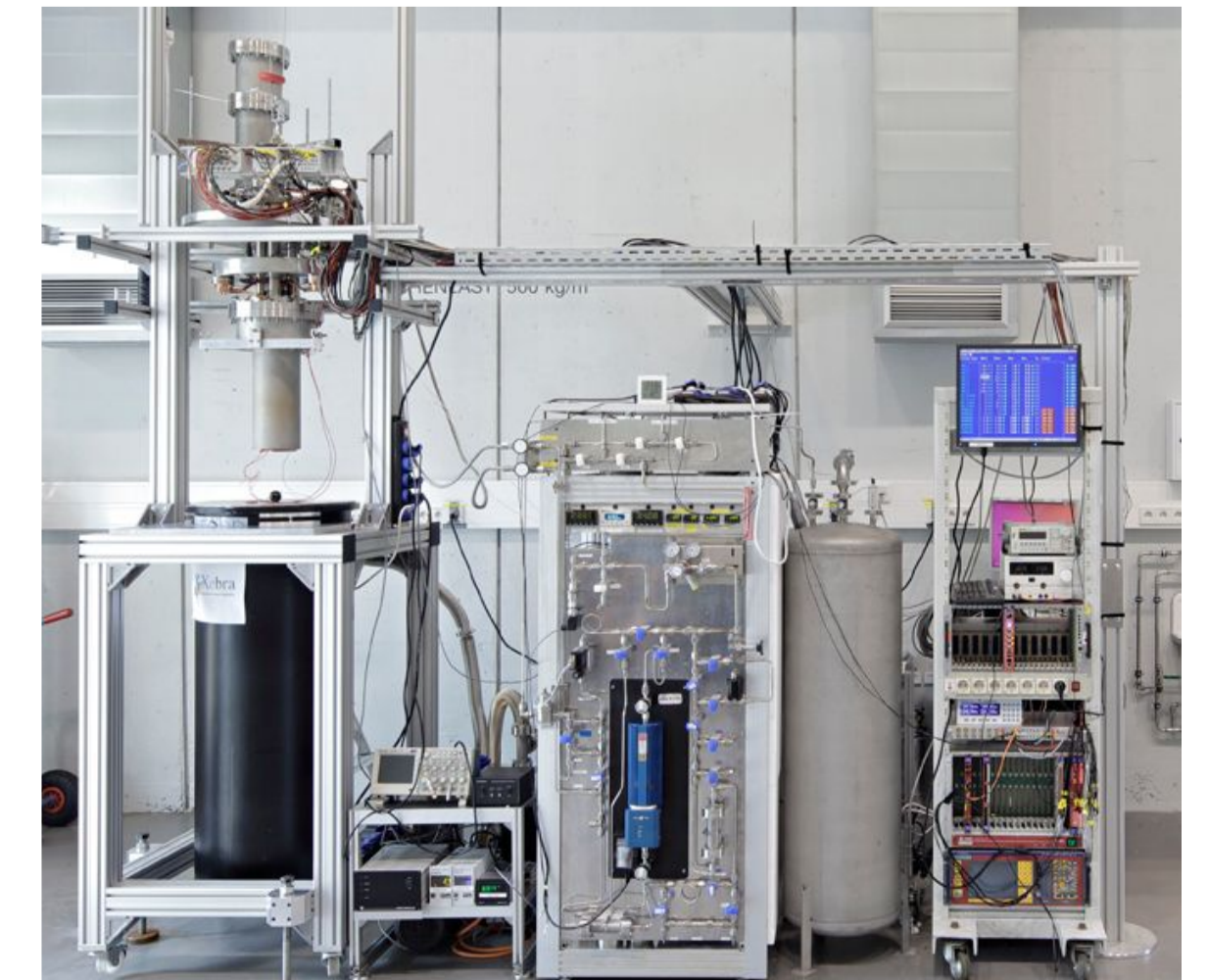
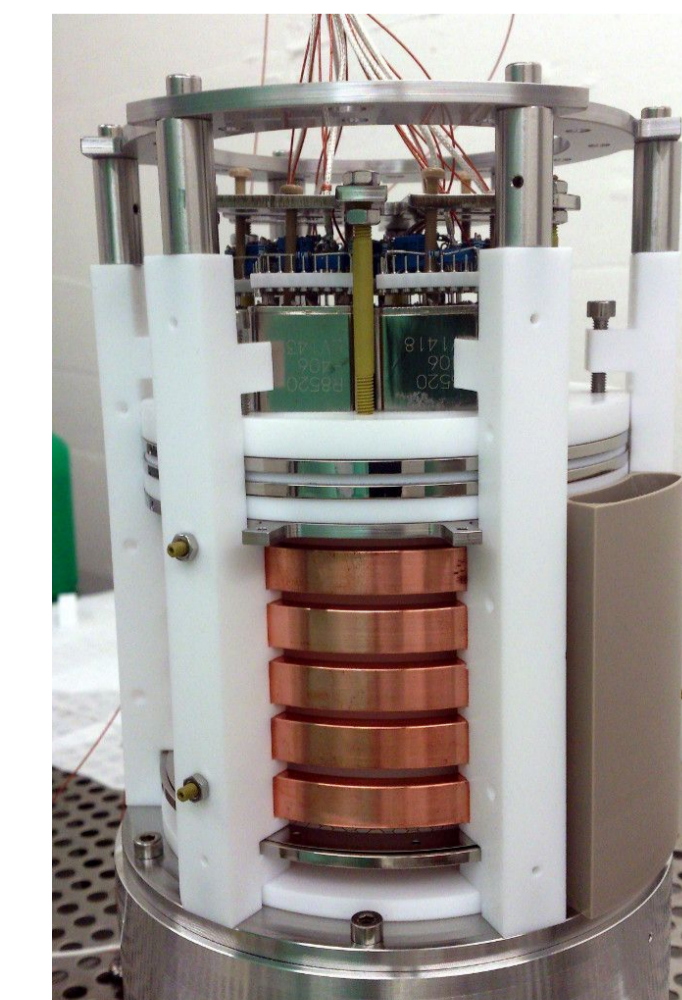
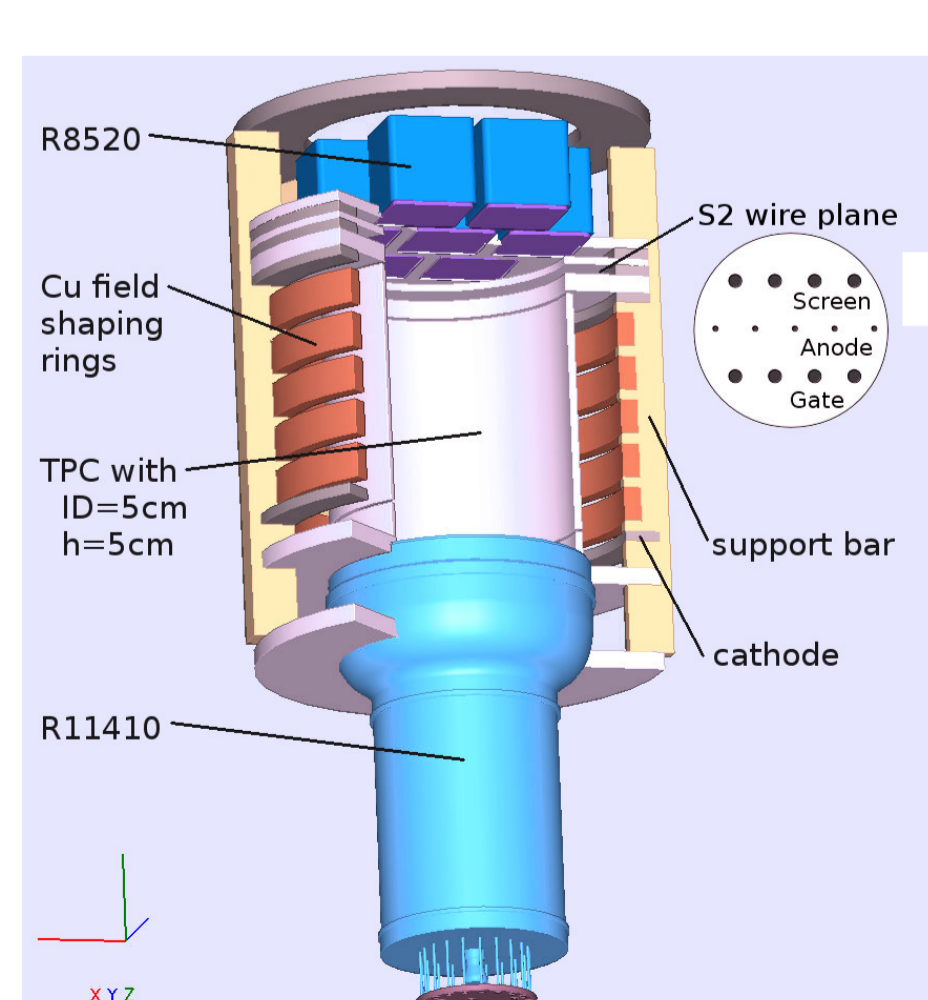


ULTIMATE: R&D for DARWIN in Freiburg

- EU-project to prepare DARWIN
- Reduction: ^{222}Rn and (α, n) -background
- new ideas to measure the charge signal
- Science & Sensitivity



→ many projects for BSc and MSc thesis



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