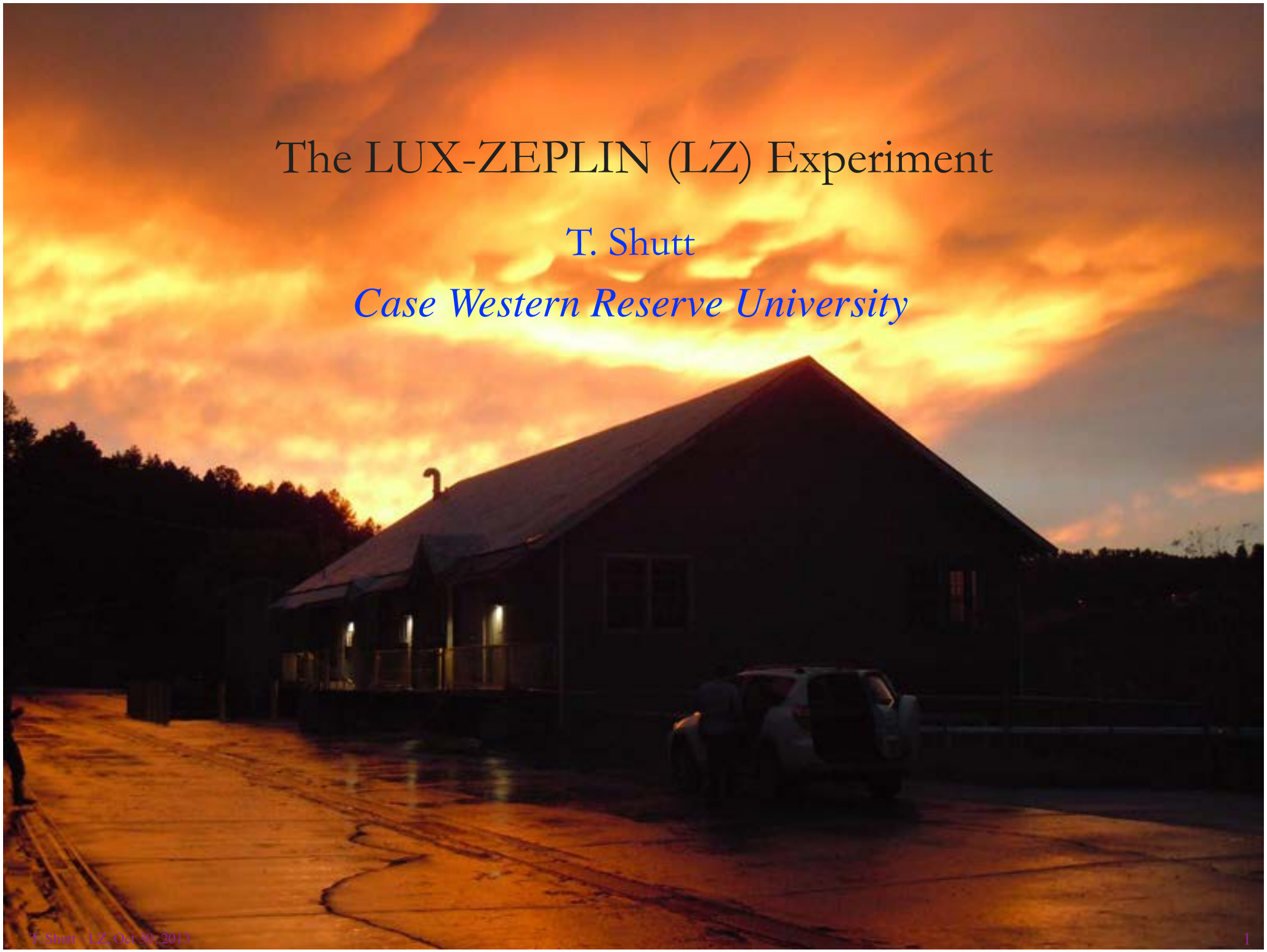
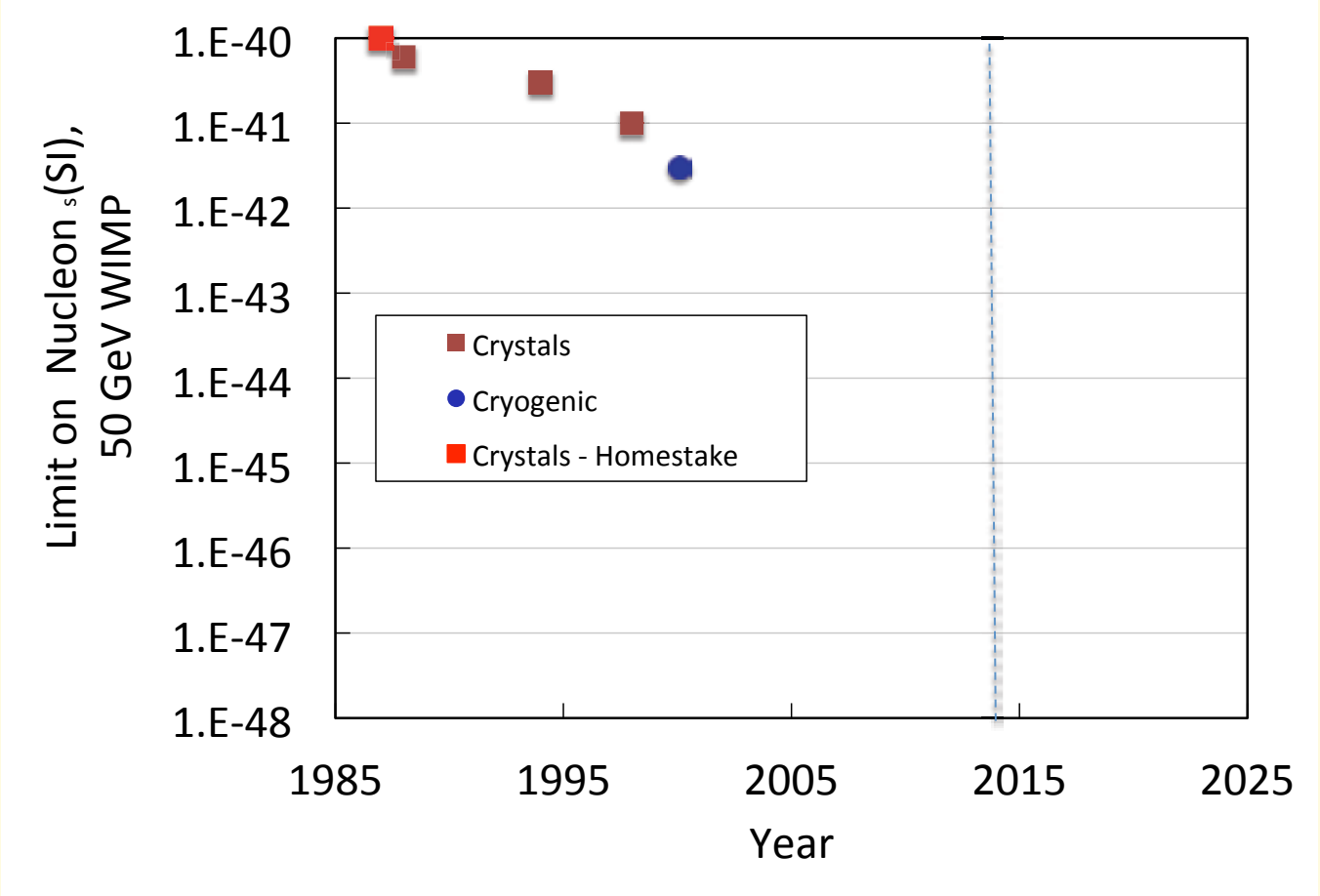
The LUX-ZEPLIN (LZ) Experiment

T. Shutt

Case Western Reserve University



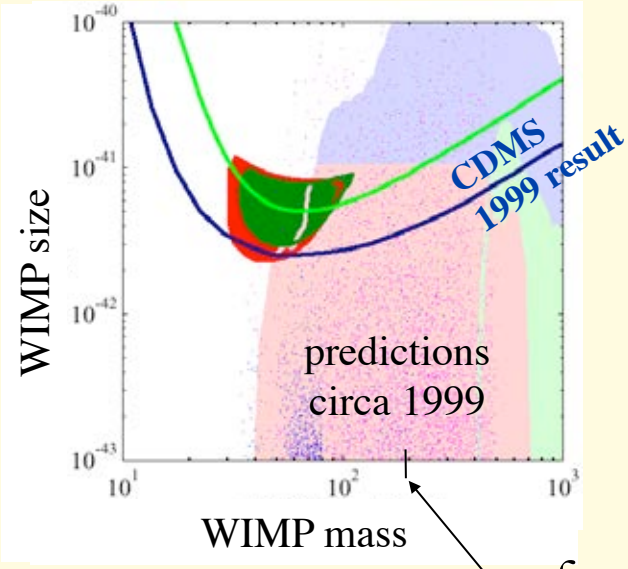
A brief history of hunting WIMPs



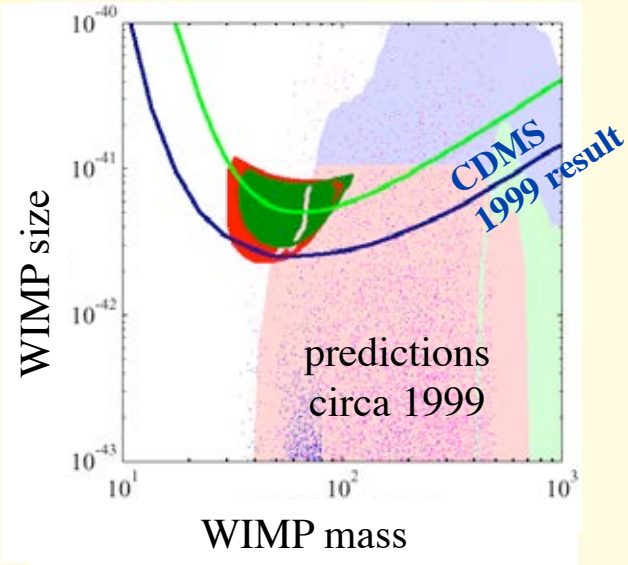
The first dark matter search was at Homestake!

Grandparent of Majorana

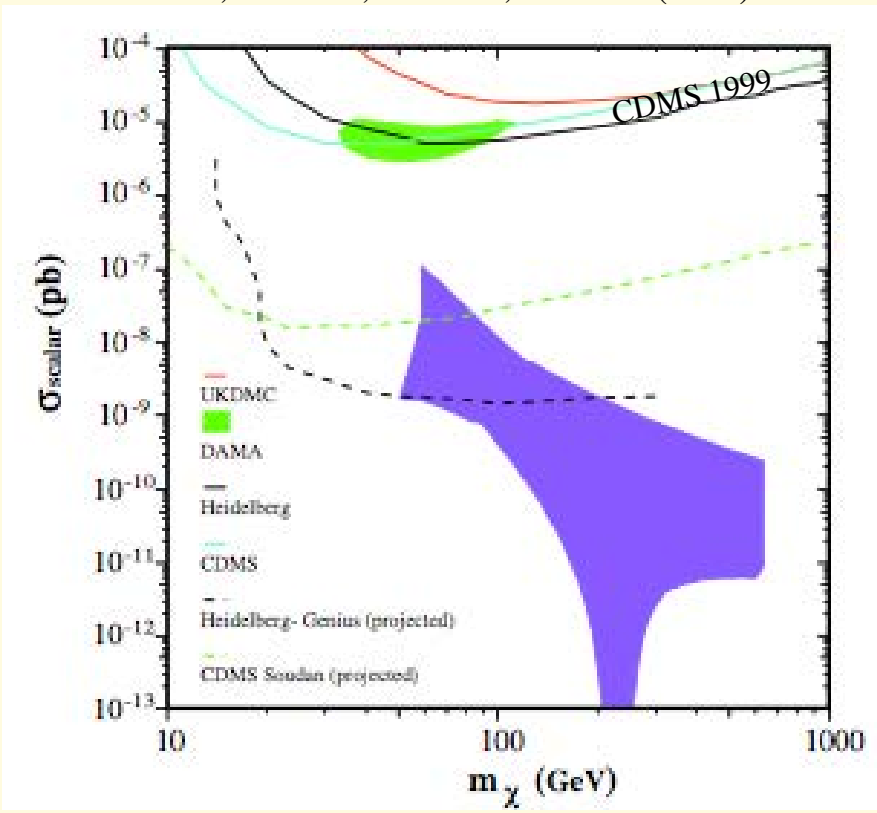
An elusive quarry



An elusive quarry



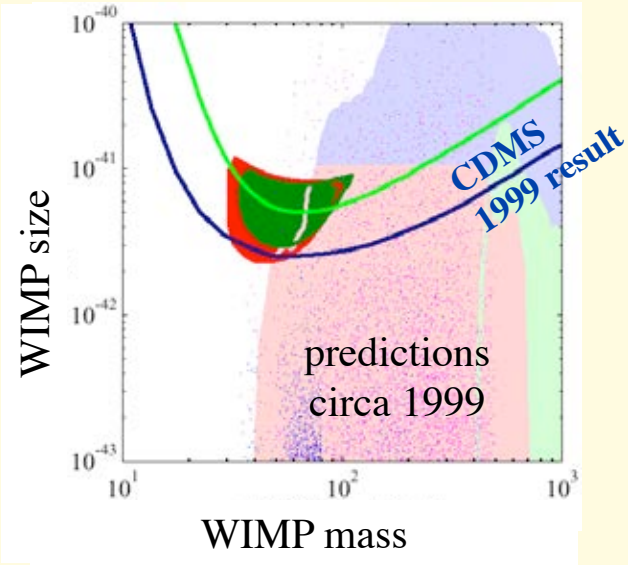
J. Ellis, A. Ferstl, K. Olive, *PLB* 481 (2000)



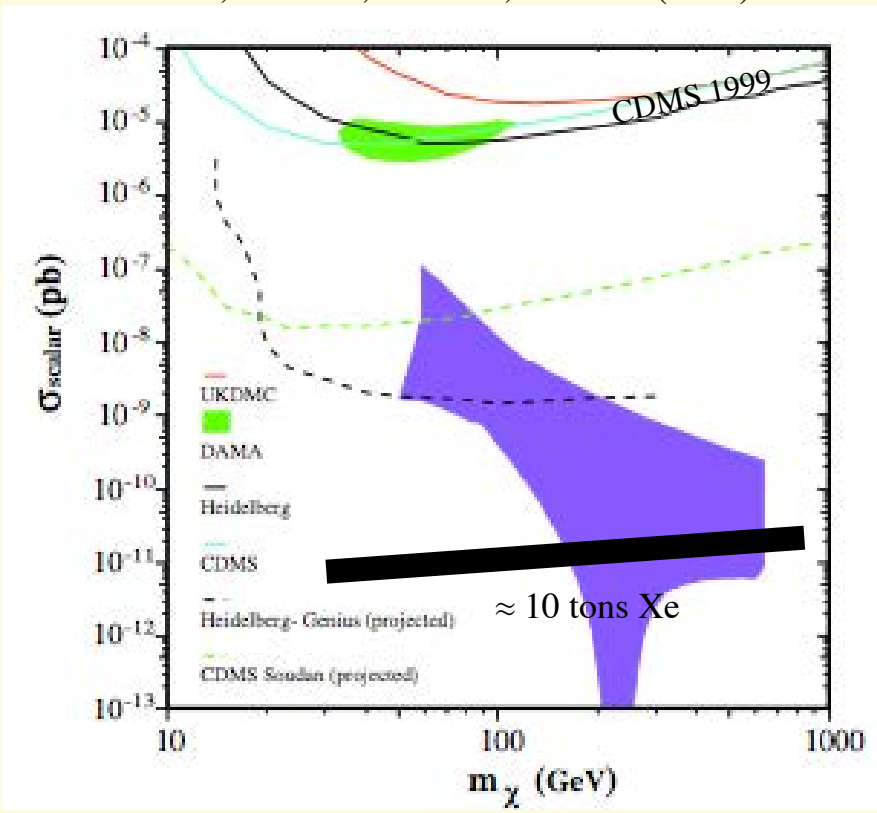
a predominant $U(1)$ gaugino (Bino) composition for the LSP. Our results fall considerably below many of the possible predictions in the literature [10], and may discourage some faint-hearted experimentalists. However, we think they provide a realistic estimate of the target

We should not want our experimental colleagues to be too downcast by the long road they appear to have to cover in order to probe the minimal universal MSSM framework utilized here. For example, there are surely some supersymmetric models that predict larger

An elusive quarry



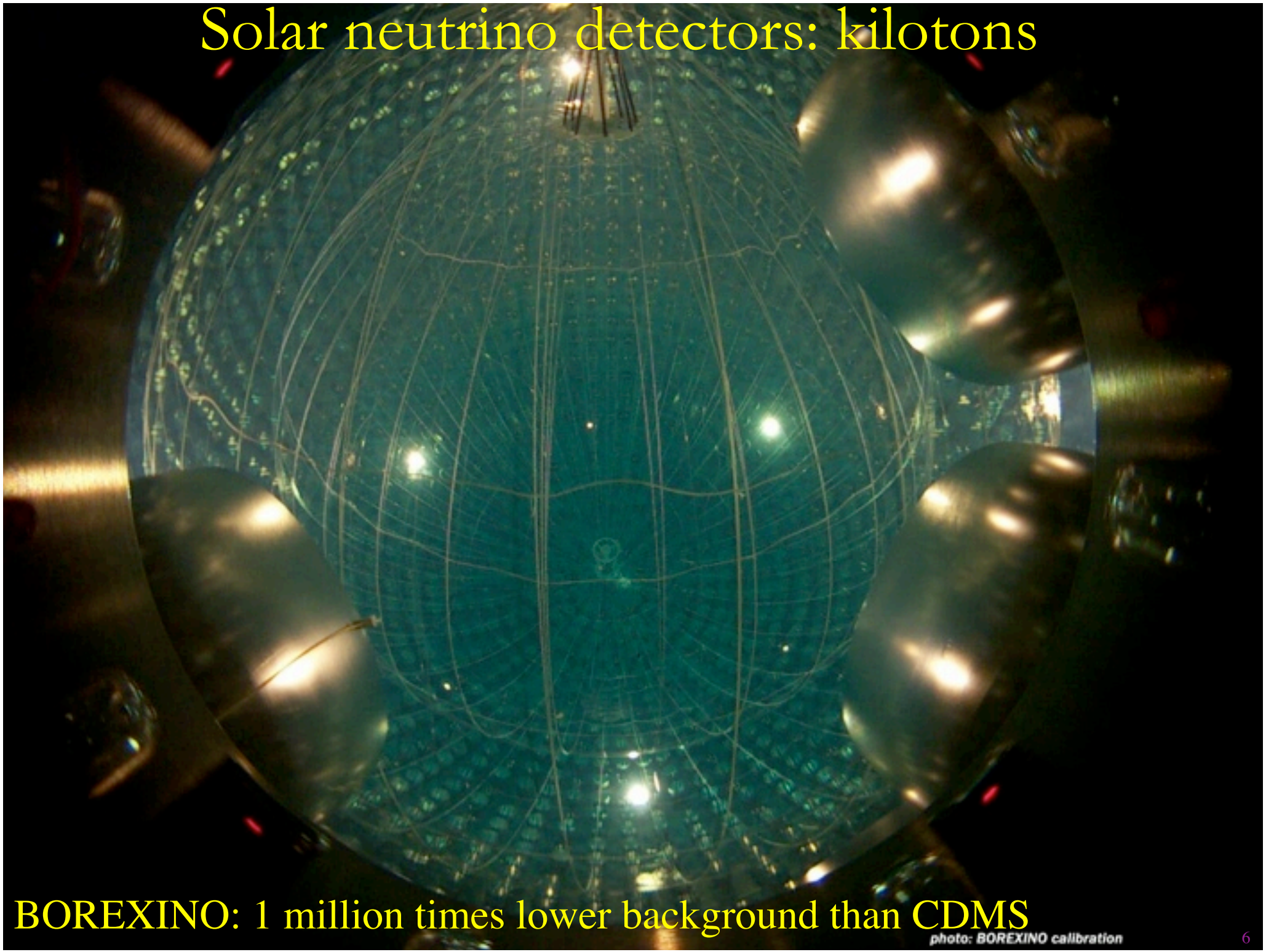
J. Ellis, A. Ferstl, K. Olive, *PLB* 481 (2000)



a predominant $U(1)$ gaugino (Bino) composition for the LSP. Our results fall considerably below many of the possible predictions in the literature [10], and may discourage some faint-hearted experimentalists. However, we think they provide a realistic estimate of the target

We should not want our experimental colleagues to be too downcast by the long road they appear to have to cover in order to probe the minimal universal MSSM framework utilized here. For example, there are surely some supersymmetric models that predict larger

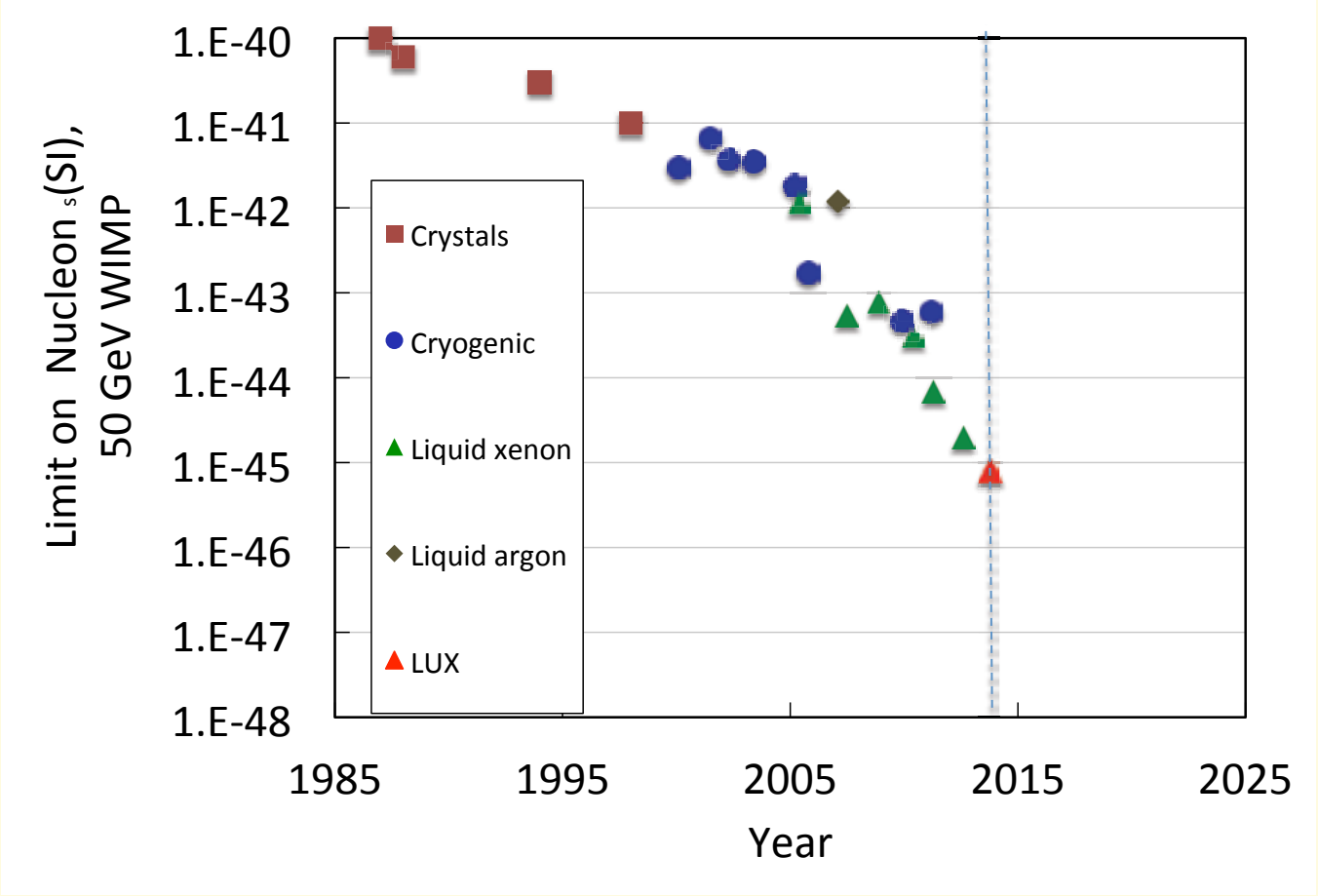
Solar neutrino detectors: kilotons



BOREXINO: 1 million times lower background than CDMS

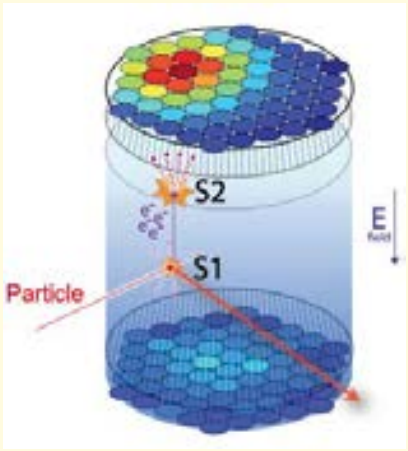
photo: BOREXINO calibration

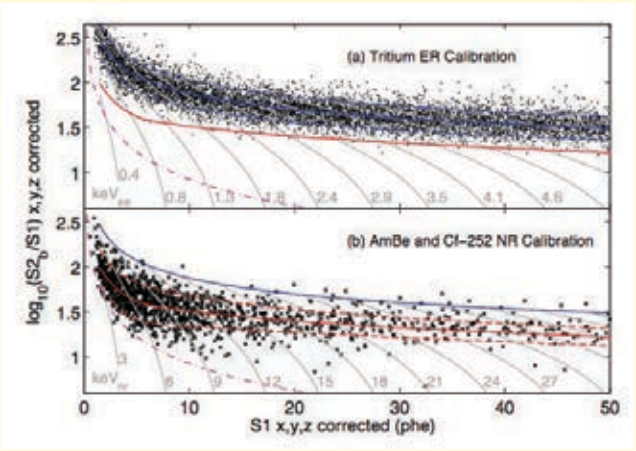
A brief history of hunting WIMPs

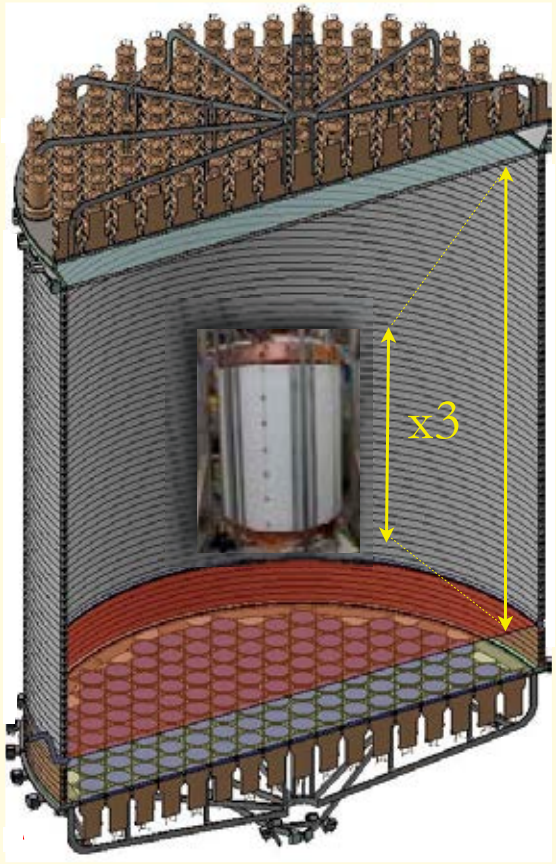


How to be massive for dark matter

Start with LUX

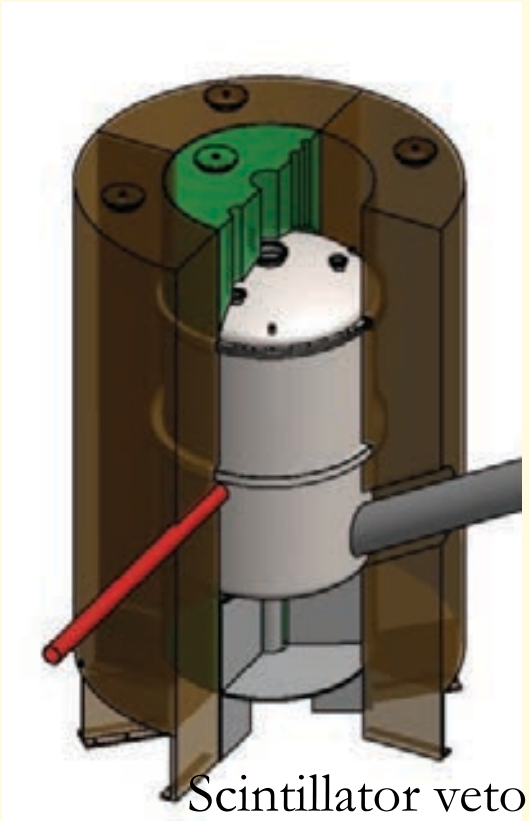




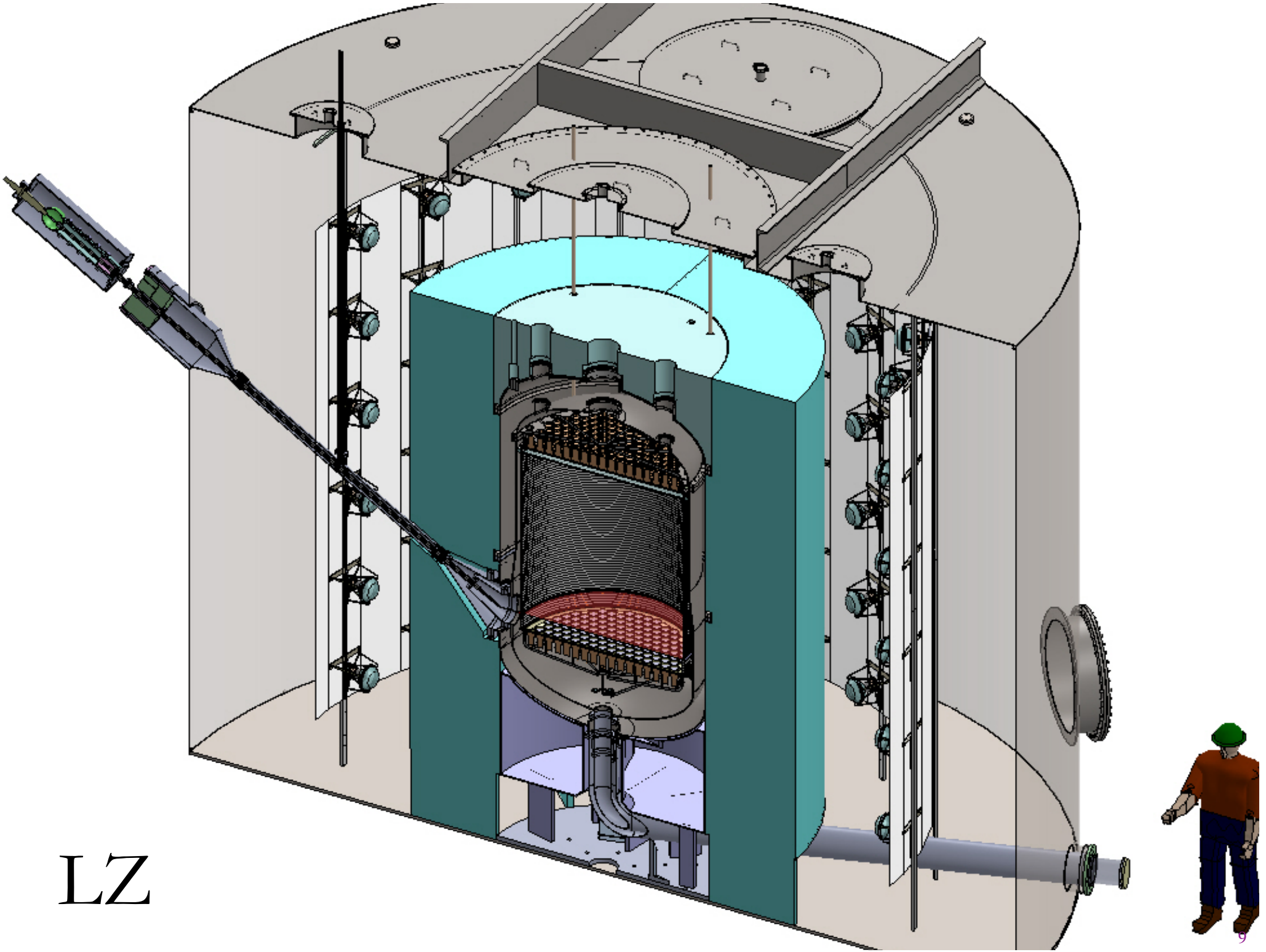


Make it 27 times bigger

Measure every bit of radioactivity



Scintillator veto


LZ

LUX was a dry run

Water tank deployment

Ti vessels

Thermosyphon cryogenics

Dual-phase heat exchanger system

Xe purity analytical systems

Kr removal to very low levels

Low background PMTs

Efficient light collection

In-situ calibrations

Electronics

Davis campus infrastructure

ZEPLIN III: background rejection at high field

Assembled a great team

LZ Collaboration

US Groups

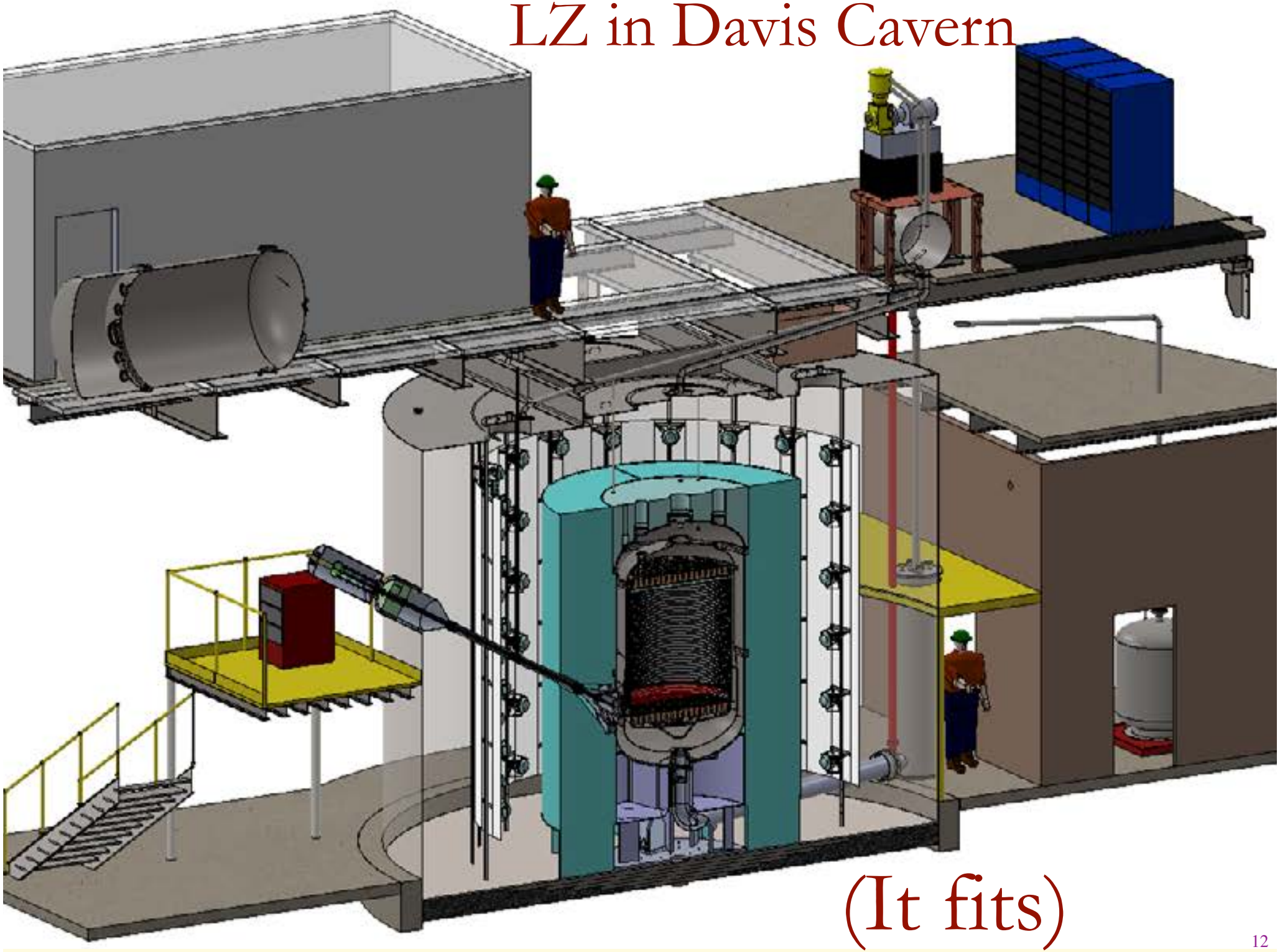
Brookhaven National Laboratory
Brown University
Case Western Reserve University
LLNL
SLAC
South Dakota School of Mines and Technology
South Dakota Science and Technology Authority
Texas A&M University
University Of Alabama
University of California, Berkeley/LBNL
University of California, Davis
University of California, Santa Barbara
University of Maryland1
University of Rochester
University of South Dakota
University of Wisconsin
Physical Sciences Laboratory, Wisconsin
Washington University
Yale University

Overseas Groups

Imperial College, London
LIP – University of Coimbra
Moscow Engineering Physics Institute
Oxford University
STFC Daresbury Laboratory
STFC Rutherford Appleton Laboratory
University College, London
University of Edinburgh
University of Sheffield

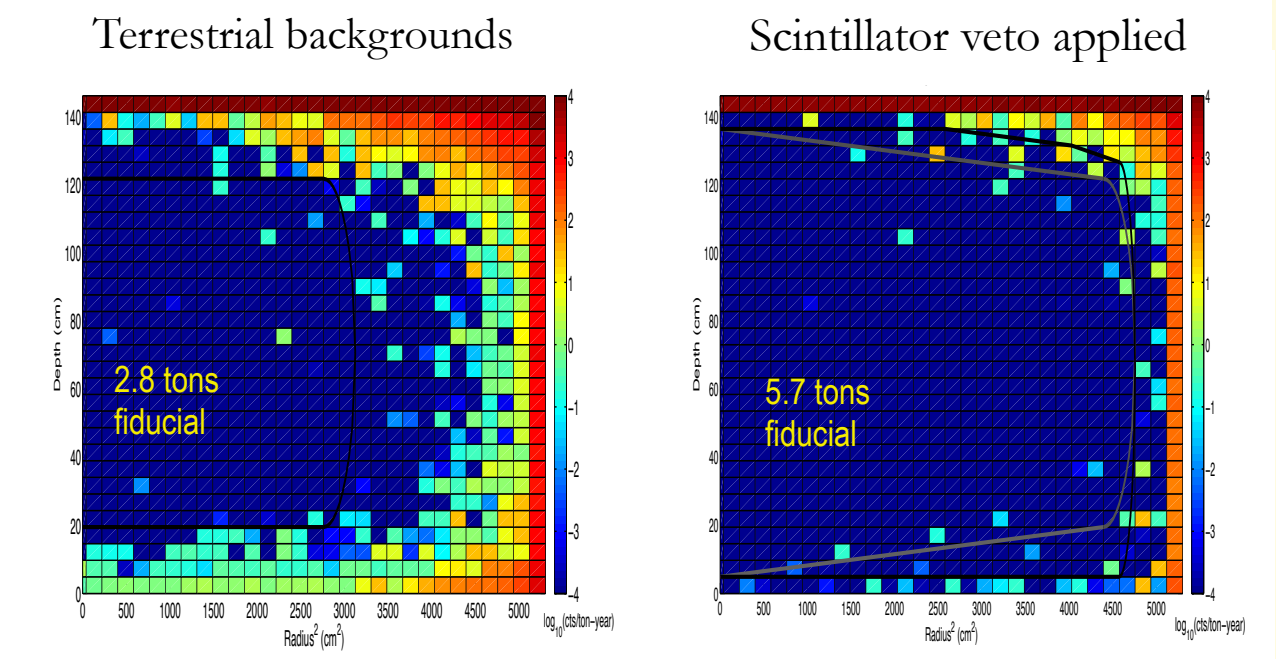
19 US and 9 International institutions

LZ in Davis Cavern



(It fits)

A neutrino-dominated background

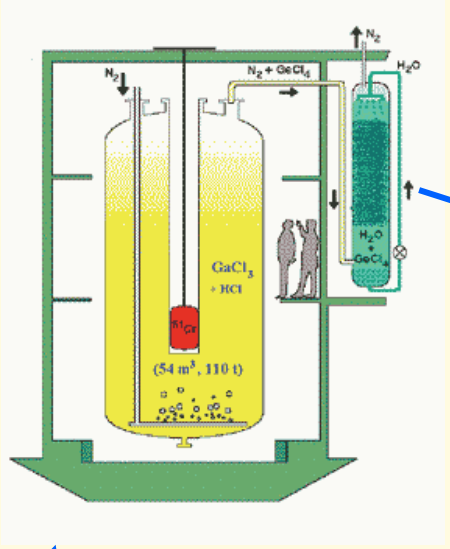


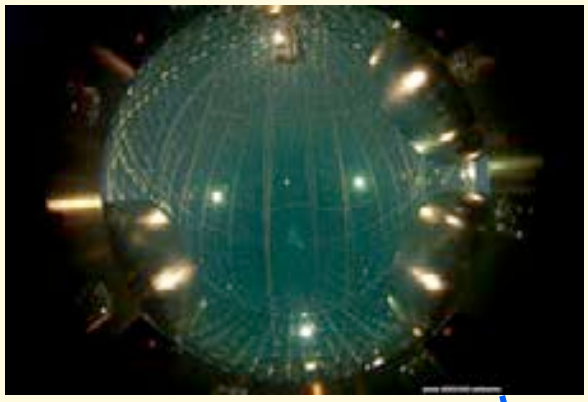
- The ultimate background to WIMP searches is astrophysical neutrinos
- LZ's dominant backgrounds are all neutrinos:
  - Sun
  - Cosmic rays on atmosphere
  - Supernovae throughout universe

} Irreducible, 0.6 events

A story about Kr removal

GALLEX (91-97)
^{71}Ge extracted
from Ga



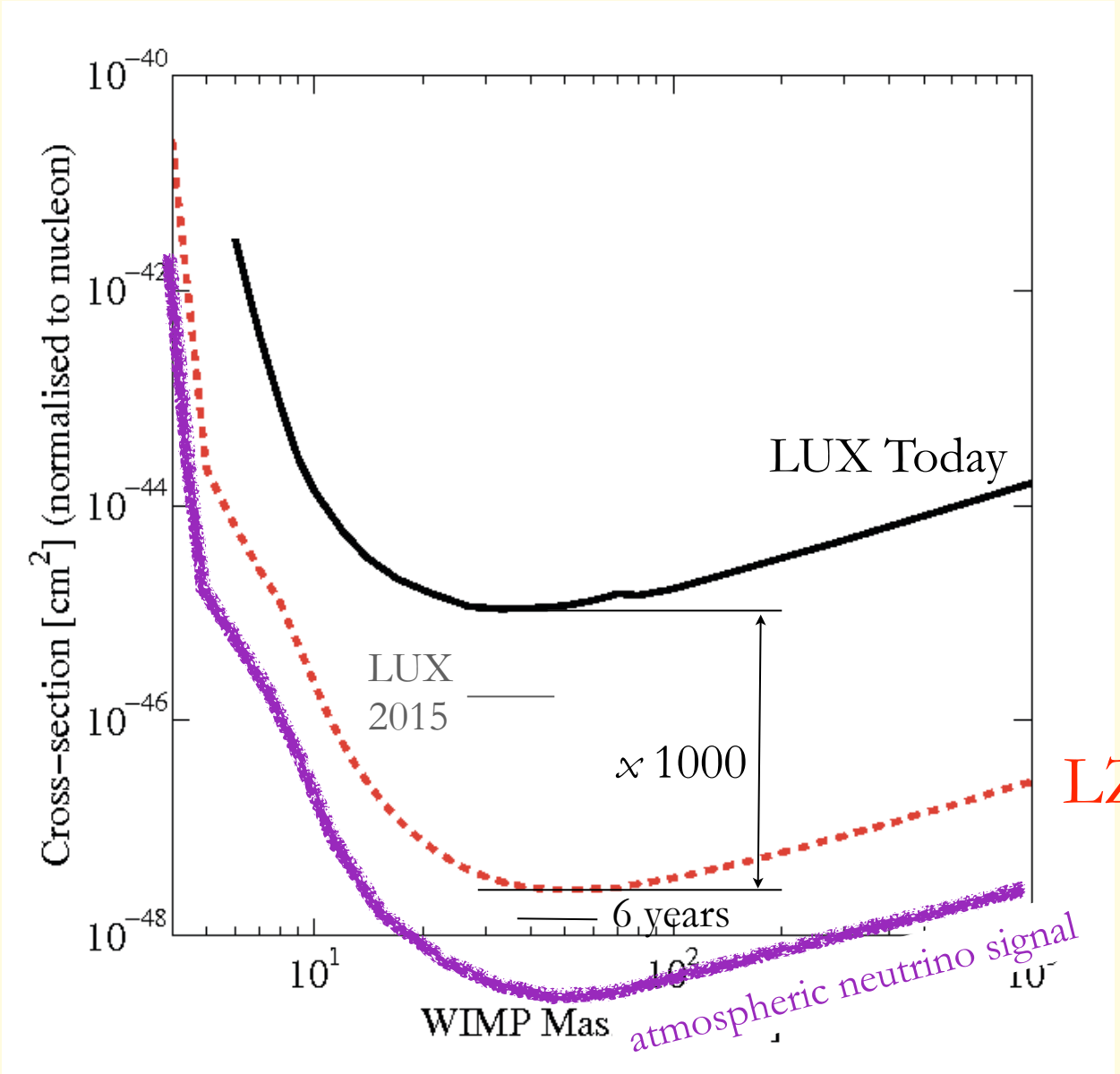


Borexino (07-13)
Rn removed
from air
2000

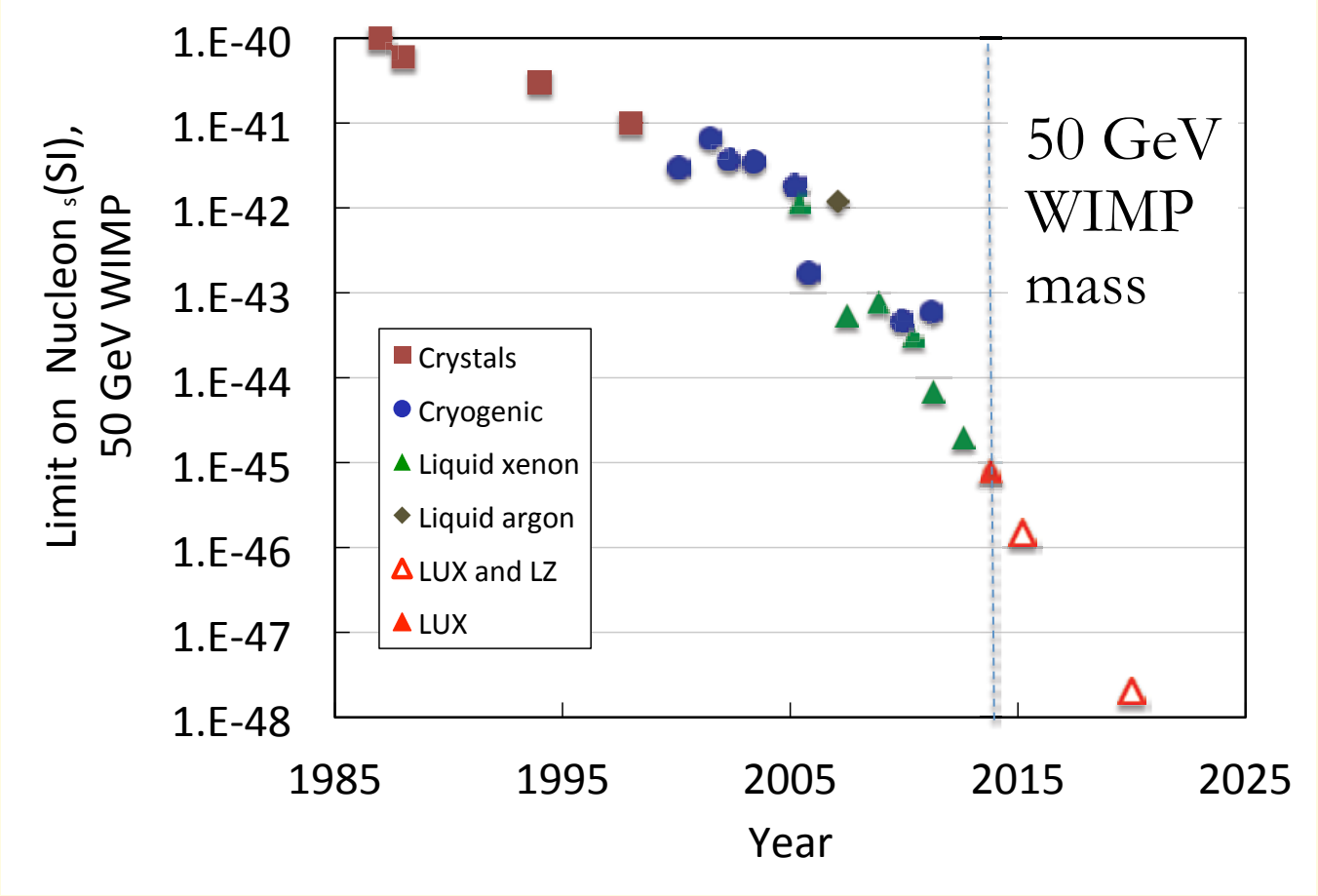
Homestake (70-94)
^{37}Ar extracted
from cleaning
fluid

LUX/LZ (13-)
Kr removed
from Rn

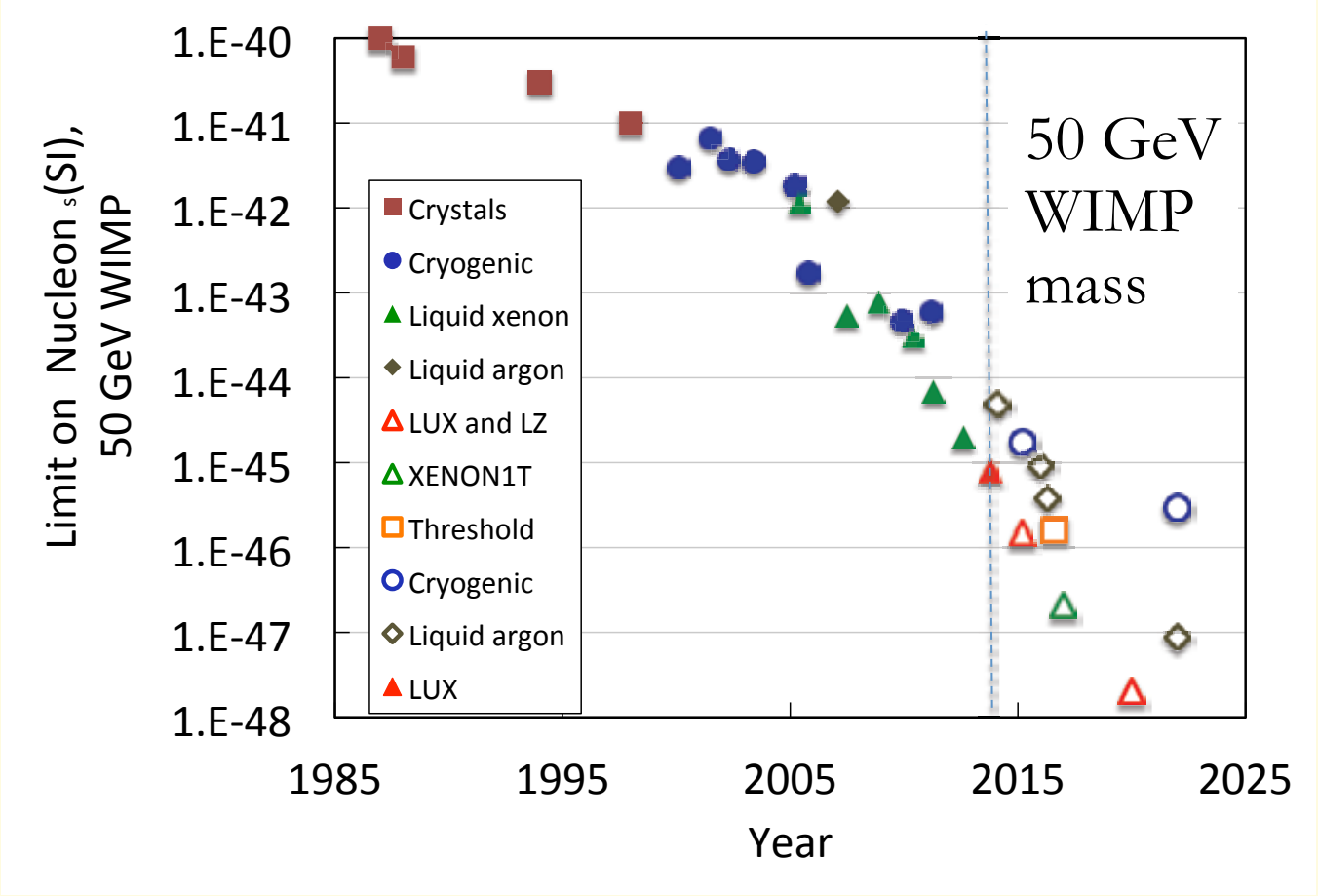
LZ sensitivity



LZ approaches the final neutrino background



- Timeline:
  - Agencies conducting a "down-select" process
  - Proposal due Nov. 26, decision expect in January.
  - Project: CD1 April 13 -> Completion March 17



- Competition to find dark matter is fierce
- We have the experiment, site, collaboration and partnership to succeed

LUX/LZ will be the experiments to beat for most of the next decade or more