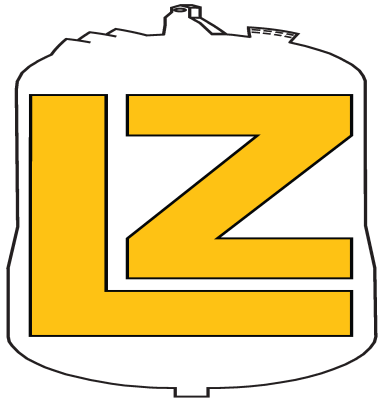
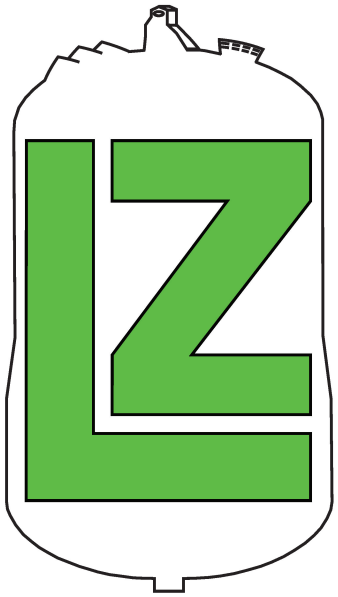
The LZ Dark Matter Detector



Bhawna Gomber, University Of Wisconsin
(On behalf of LZ Collaboration)

LZ = LUX + ZEPLIN



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Lawrence Livermore National Laboratory
University of Maryland
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University of South Dakota
South Dakota School of Mines & Technology
South Dakota Science and Technology Authority
SLAC National Accelerator Laboratory
Texas A&M
Washington University
University of Wisconsin
Yale University

LIP Coimbra (Portugal)
MEPhI (Russia)
Edinburgh University (UK)
University of Liverpool (UK)
Imperial College London (UK)
University College London (UK)
University of Oxford (UK)
STFC Rutherford Appleton Laboratories (UK)
Shanghai Jiao Tong University (China)
University of Sheffield (UK)

Scale Up ~50x in fiducial mass

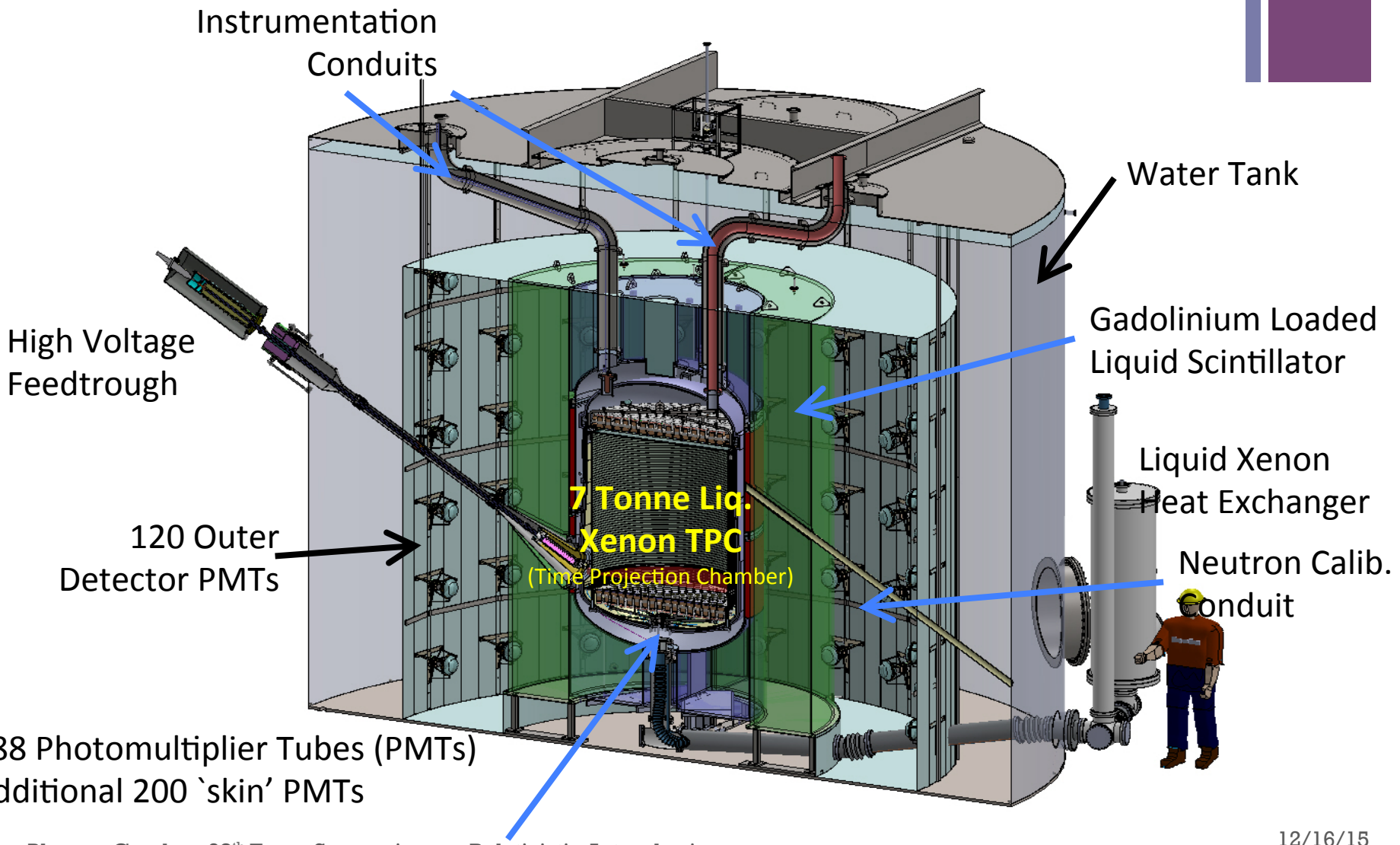
LZ

Total mass – 10 T
Active Mass – 7 T
Fiducial Mass – 5.6 T

Gain ~400X in sensitivity

LUX

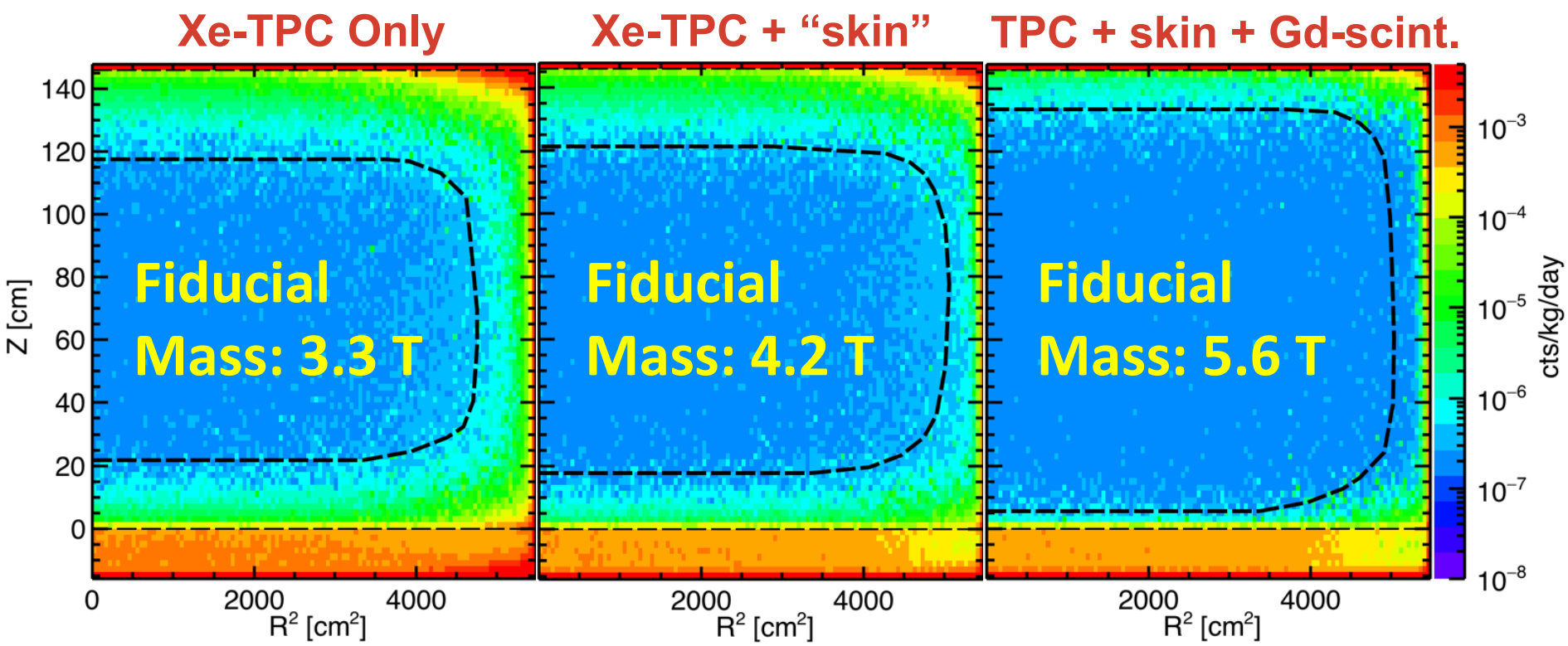
LZ Overview


Instrumentation Conduits
Water Tank
High Voltage Feedtrough
Gadolinium Loaded Liquid Scintillator
Liquid Xenon Heat Exchanger
7 Tonne Liq. Xenon TPC
(Time Projection Chamber)
120 Outer Detector PMTs
Neutron Calib. Conduit
488 Photomultiplier Tubes (PMTs)
Additional 200 `skin' PMTs

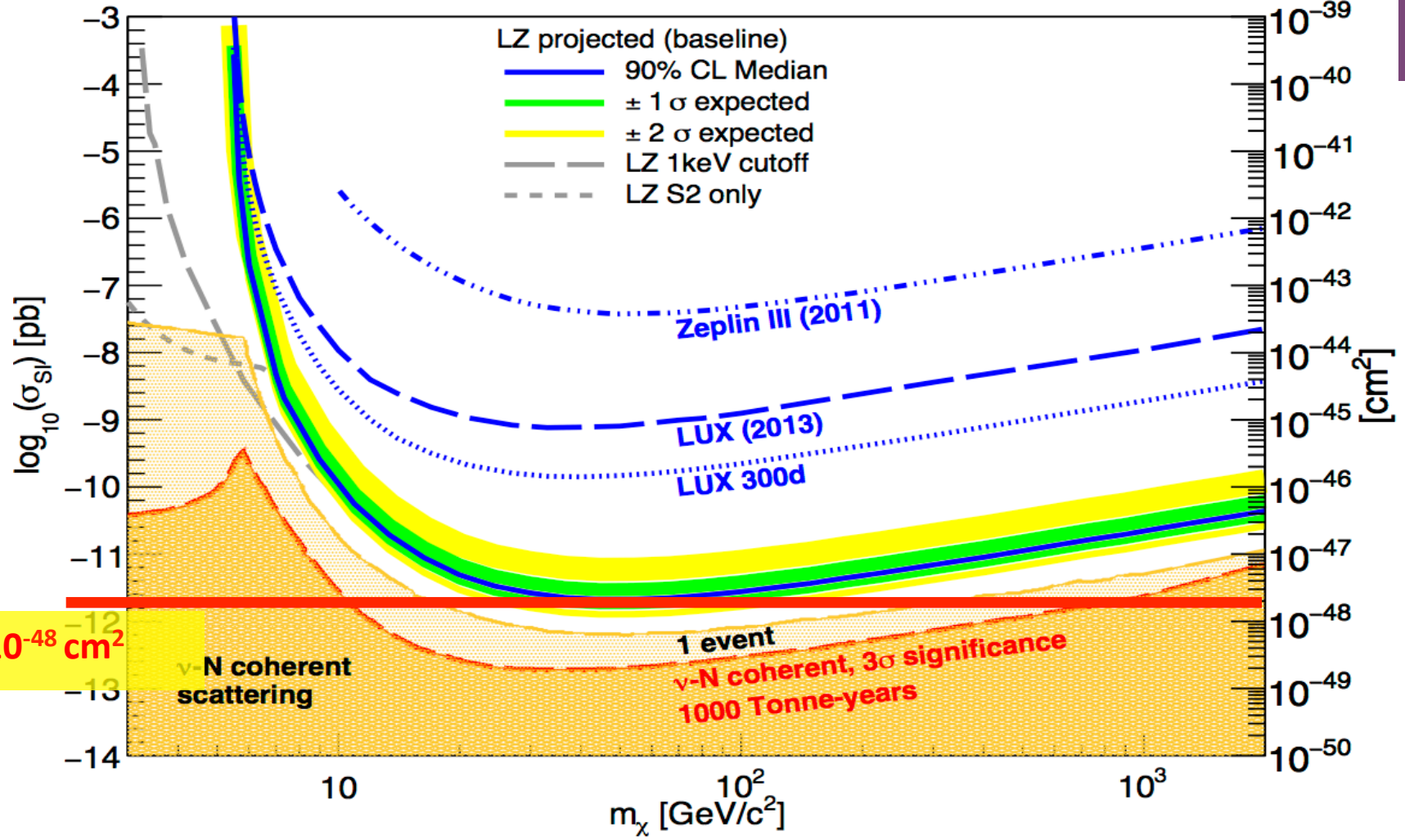
How to maximize the WIMP target mass?

- Two-component outer detector:
  - 0.75 m thick Gd-loaded scintillator
  - instrumented Xenon "skin"
  - tag neutrons and gammas

***in-situ* monitoring of residual backgrounds!!!**



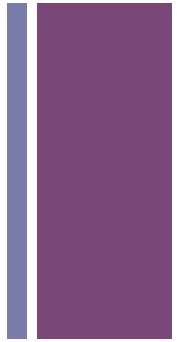
Projected Sensitivity – Spin Independent
(LZ 5.6 Tonnes, 1000 live days)



Summary

- LUX has provided the most stringent limit on the WIMP-nucleon spin-independent interaction cross-section, and pioneered techniques with internal calibration sources.
- LZ holds the promise to be the ultimate WIMP search experiment. Limited by neutrino-induced `background'.
- LZ Project well underway. Procurement of Xe, PMTs and cryostat vessels started. Extensive prototyping program.
- Projected commissioning in 2019.

Backup



Backgrounds

Expected backgrounds for 5.6 T fiducial - 1,000 days

Item	Mass kg	U mBq/kg	Th mBq/kg	^{60}Co mBq/kg	^{40}K mBq/kg	n/yr	ER cts	NR cts
R11410 PMTs	93.7	2.7	2.0	3.9	62.1	373	1.24	0.20
R11410 bases	2.7	74.6	29.1	3.6	109.2	77	0.17	0.03
Cryostat vessels	2,140	0.09	0.23	≈0	0.54	213	0.86	0.02
OD PMTs	122	1,507	1,065	≈0	3,900	20,850	0.08	0.02
Other components	-	-	-	-	-	602	9.5	0.05
Total components							11.9	0.32
Dispersed radionuclides (Rn, Kr, Ar)							54.8	-
^{136}Xe 2νββ							53.8	-
Neutrinos (ν-e, ν-A)							271	0.5
Total events							391.5	0.82
WIMP background events (99.5% ER discrimination, 50% NR acceptance)							1.96	0.41
Total ER+NR background events							2.37	