

# PICO-40L Status Update

TRISTAN SULLIVAN

CAP 2018

# Outline

- ▶ Bubble chambers for dark matter
- ▶ The PICO program
- ▶ PICO-40L
- ▶ Current status
- ▶ Future

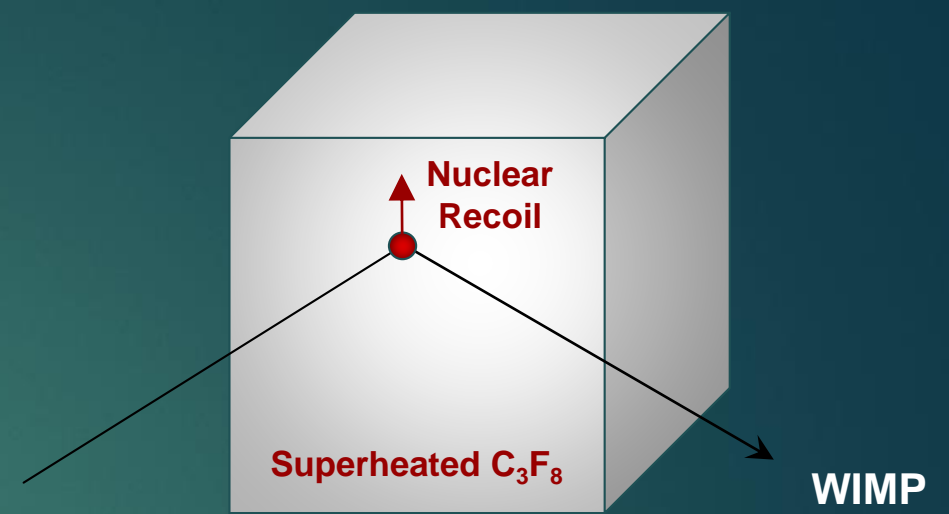
# Detection Principle

Active liquid is in a superheated state

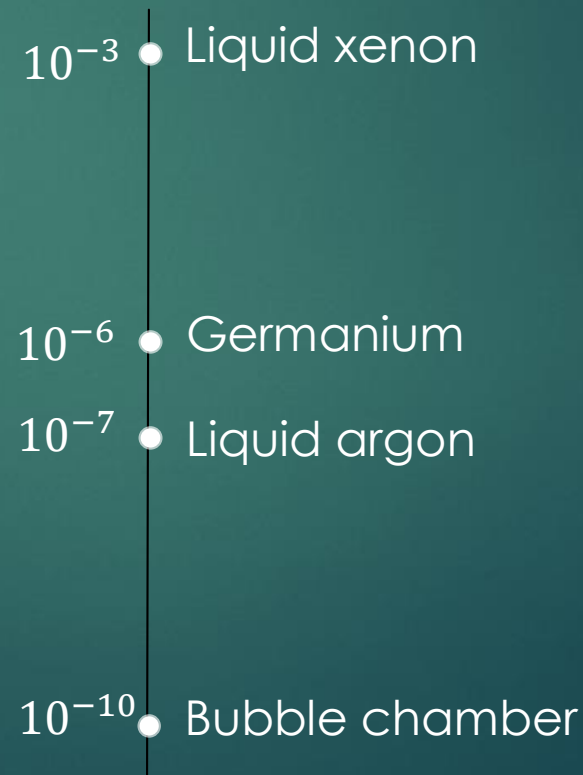
Bubble formation depends on total energy deposited and  $dE/dx$ ; threshold set by T and P

Nuclear recoils make bubbles, electron recoils don't\*

\*see plot



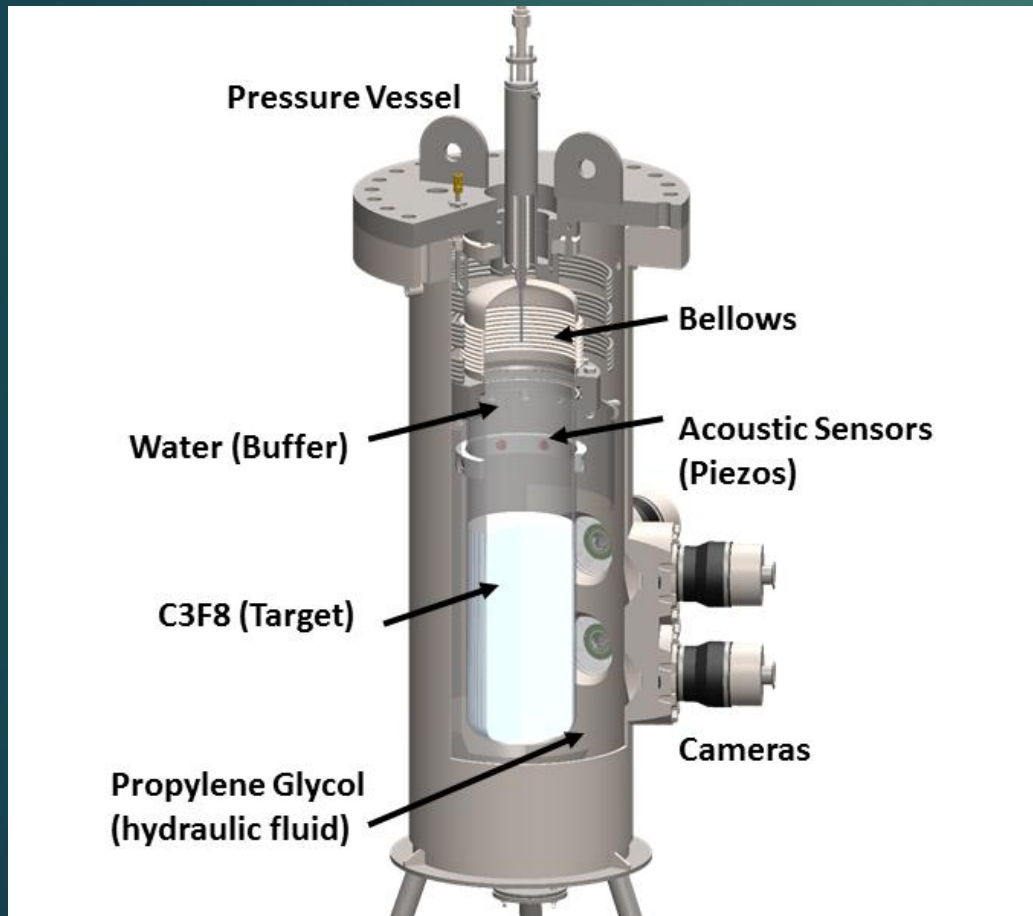
Electron recoil rejection



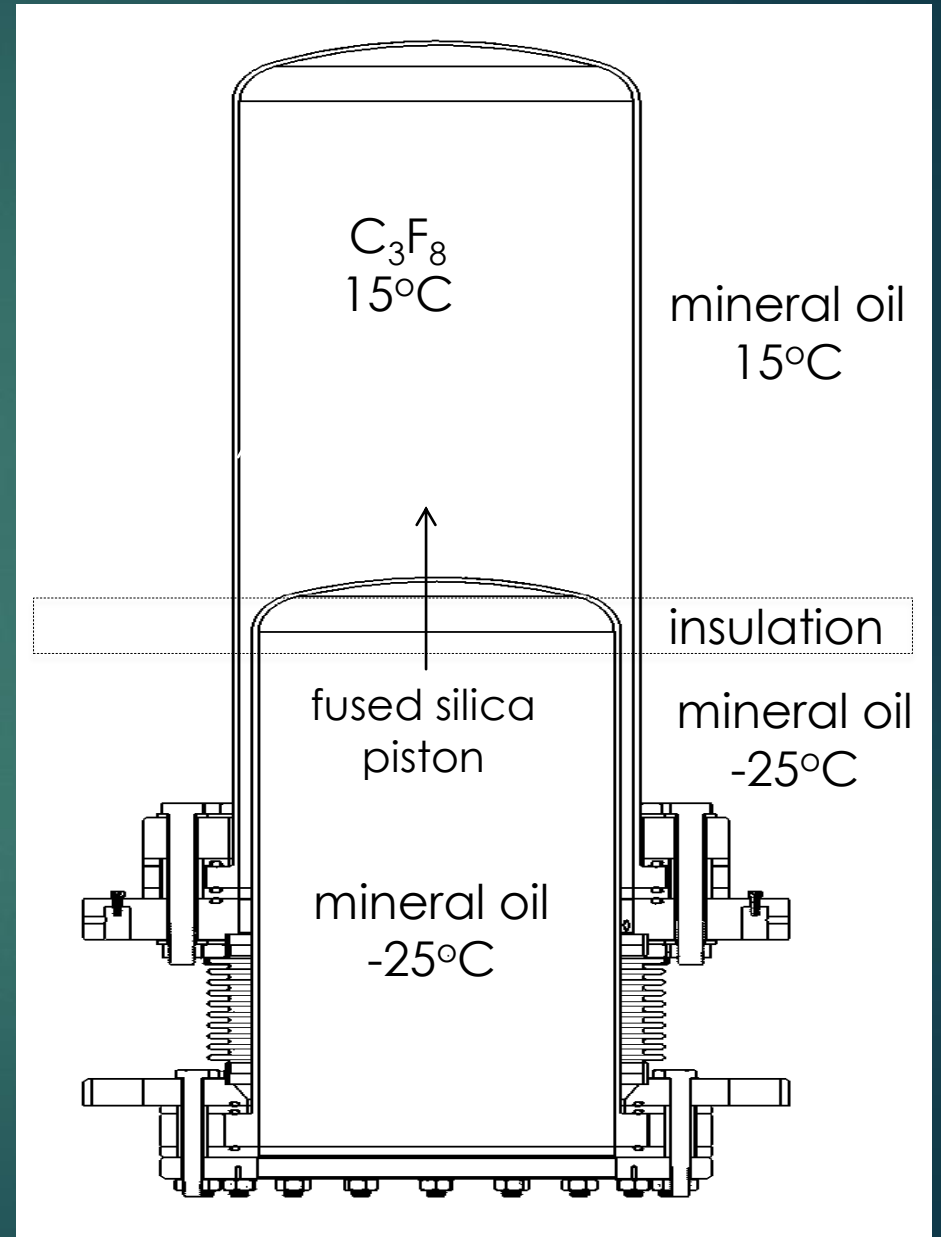
NIM A 704 (2013), 111-126  
Phys Rev D 95, 082002 (2017)  
arXiv:1707.08042v2

# PICO Past and Present

PICO-60



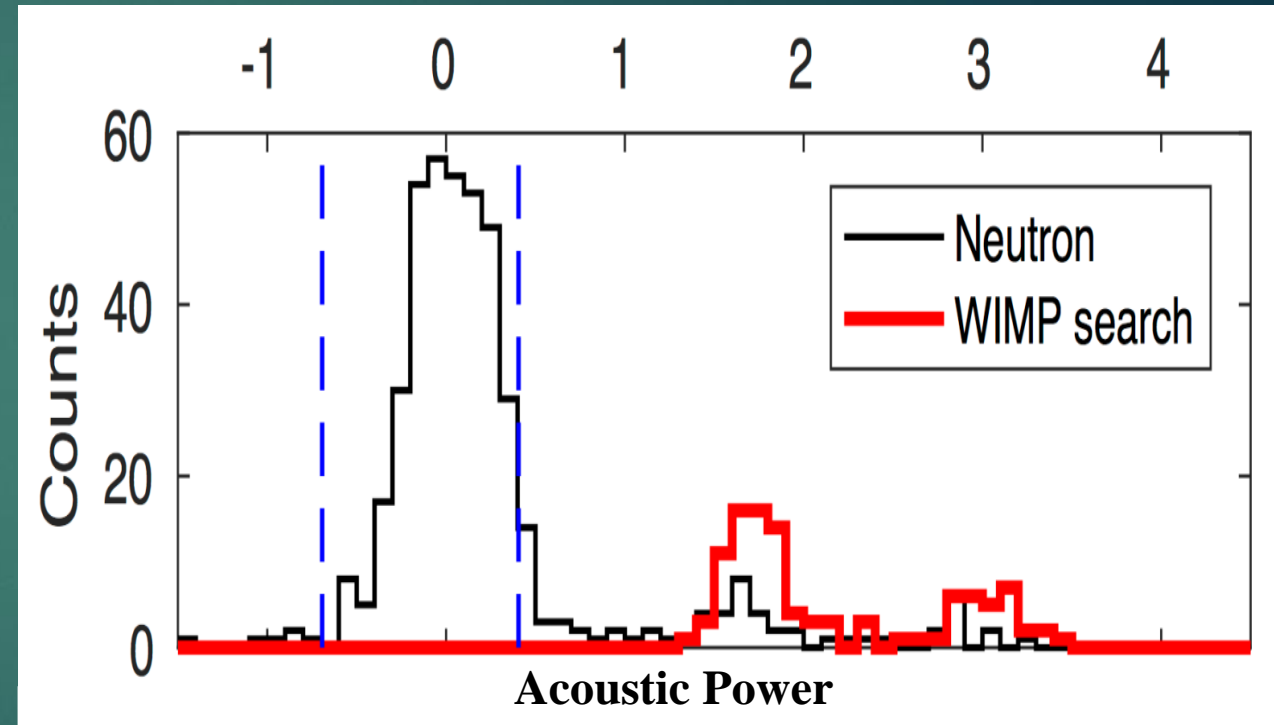
PICO-40L



# Trigger and DAQ

- ▶ Trigger signal comes from a difference between successive camera images
- ▶ When a trigger is received, the chamber compresses, preventing further boiling
- ▶ Temperature, pressure, cameras, and piezoelectric sensors are read out
- ▶ Many more temperature sensors this time
- ▶ Acoustics provide event discrimination: bubbles caused by  $\alpha$  particles are louder than nuclear recoil bubbles!

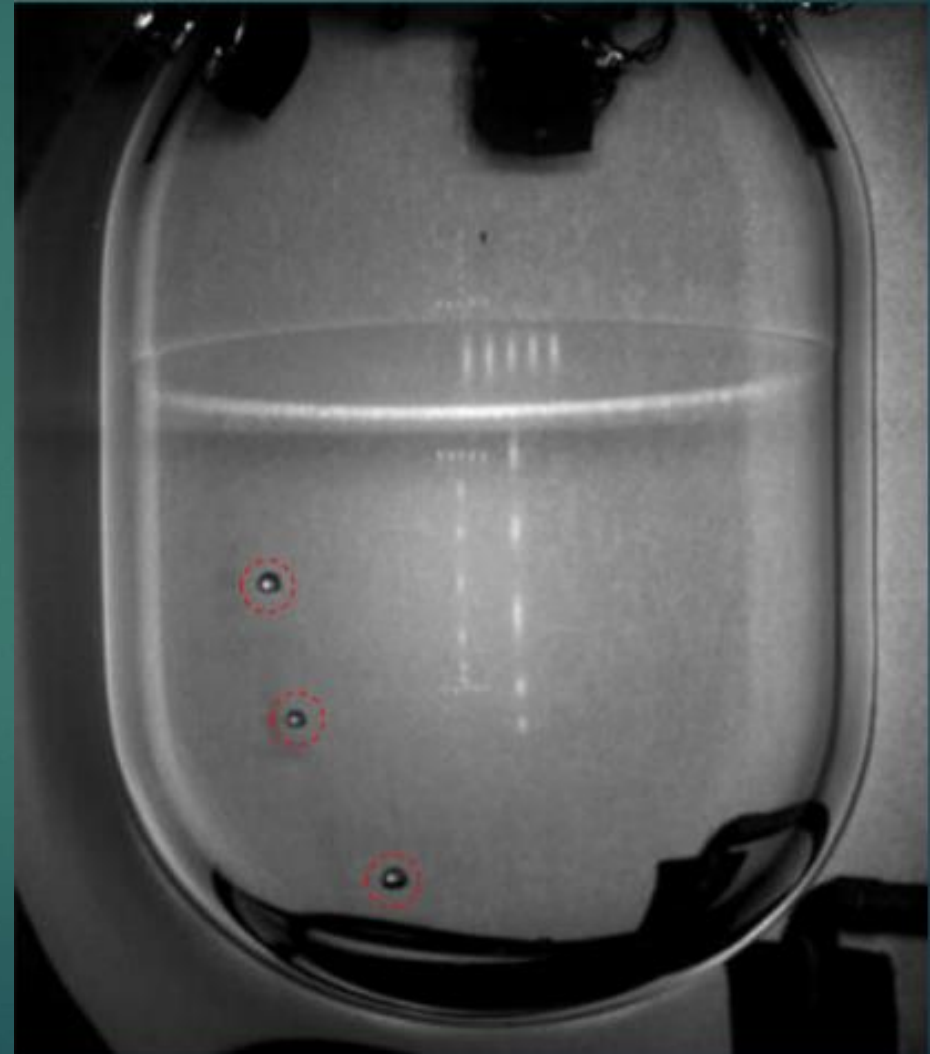
PICO-60 acoustic analysis



# Neutron background

- ▶ Neutrons that enter the active liquid can elastically scatter off nuclei, mimicking a WIMP signal
- ▶ Most neutrons scatter multiple times
- ▶ MC gives ratio of multiple bubble to single bubble events

PICO-2L multiple bubble event



# Installation Status



Water shielding tank

Camera ports

Pressure vessel

PICO-40L is currently being assembled at SNOLAB

SNOLAB is ~2 km underground, in Creighton Mine in Lively, Ontario, and is home to many low-background experiments

# Installation Status



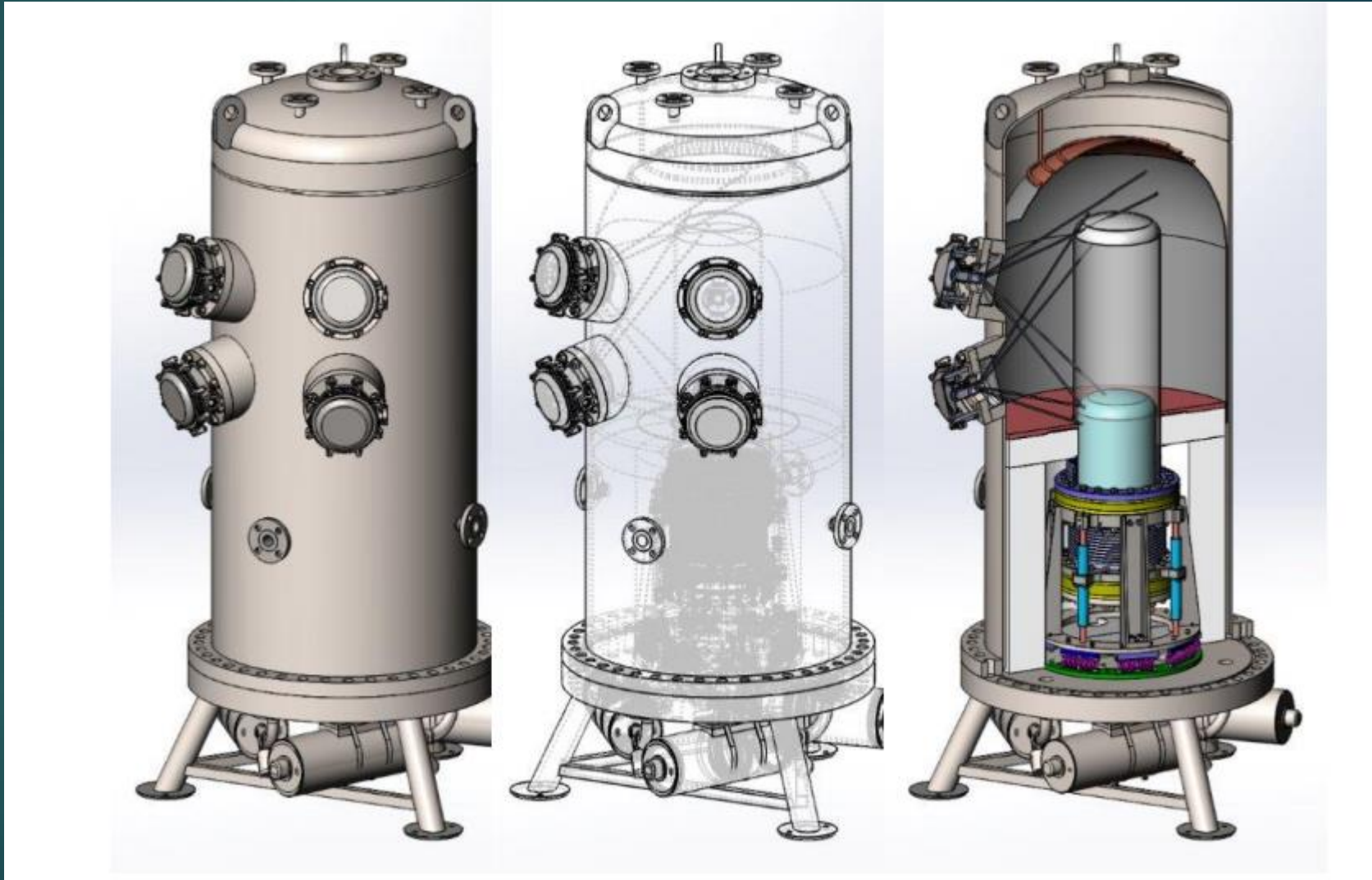
Pressure vessel base



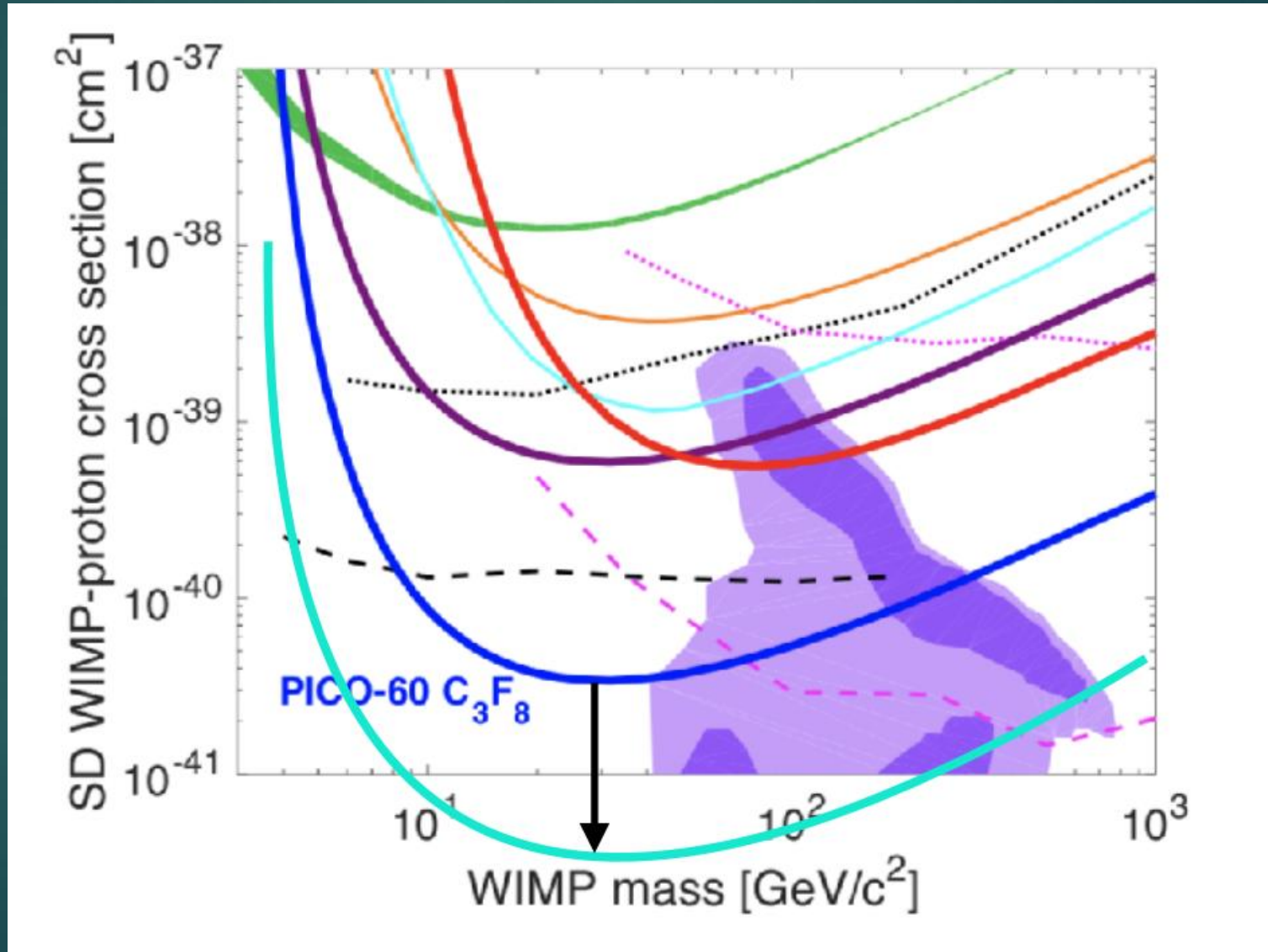
Inner jars and bellows assembly



# The Goal



# The Real Goal



# Commissioning Timeline

- ▶ June/July: assemble pressure vessel without inner jar, fill with mineral oil, test pressure system, ensure nothing leaks
- ▶ August/September: take pressure vessel apart again, insert inner jar, seal everything back up. Commission cameras, piezos, DAQ, etc.
- ▶ October/November: Chiller (finally) arrives. Commission chillers, heaters, temperature control system
- ▶ December: Take calibration data
- ▶ January: Physics data!

Thank you!

