



GigaBREAD

An Overview

Maja Benning | 14. January 2026

Outline

BREAD

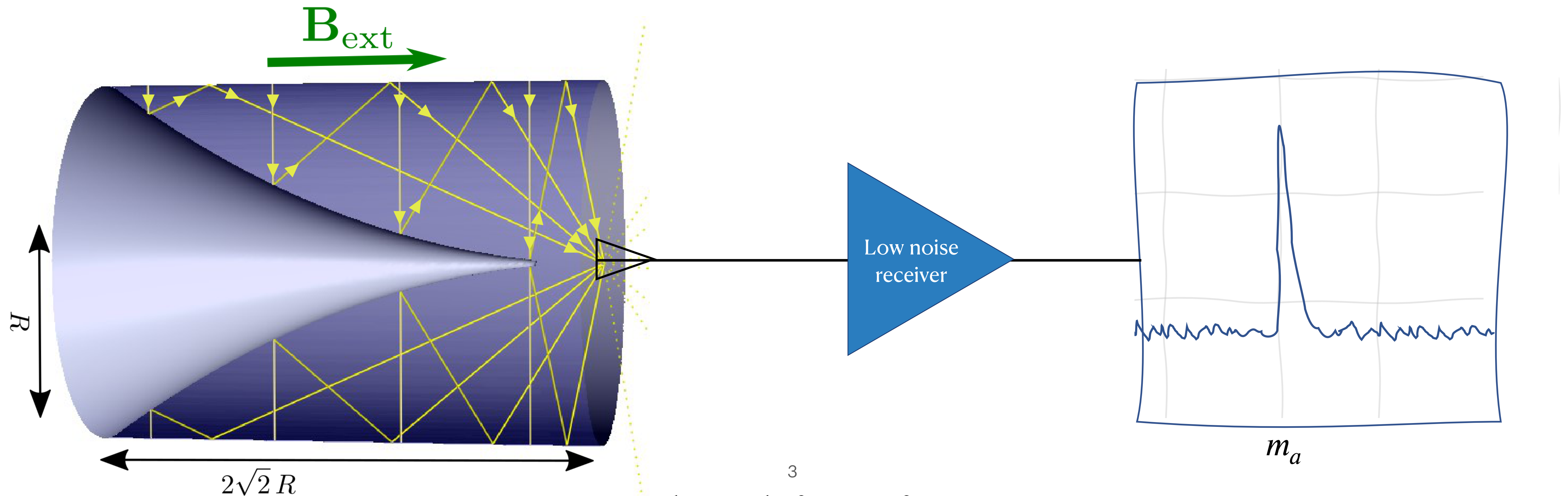
GigaBREAD in the past

GigaBREAD now



Broadband Reflector Experiment for Axion Detection

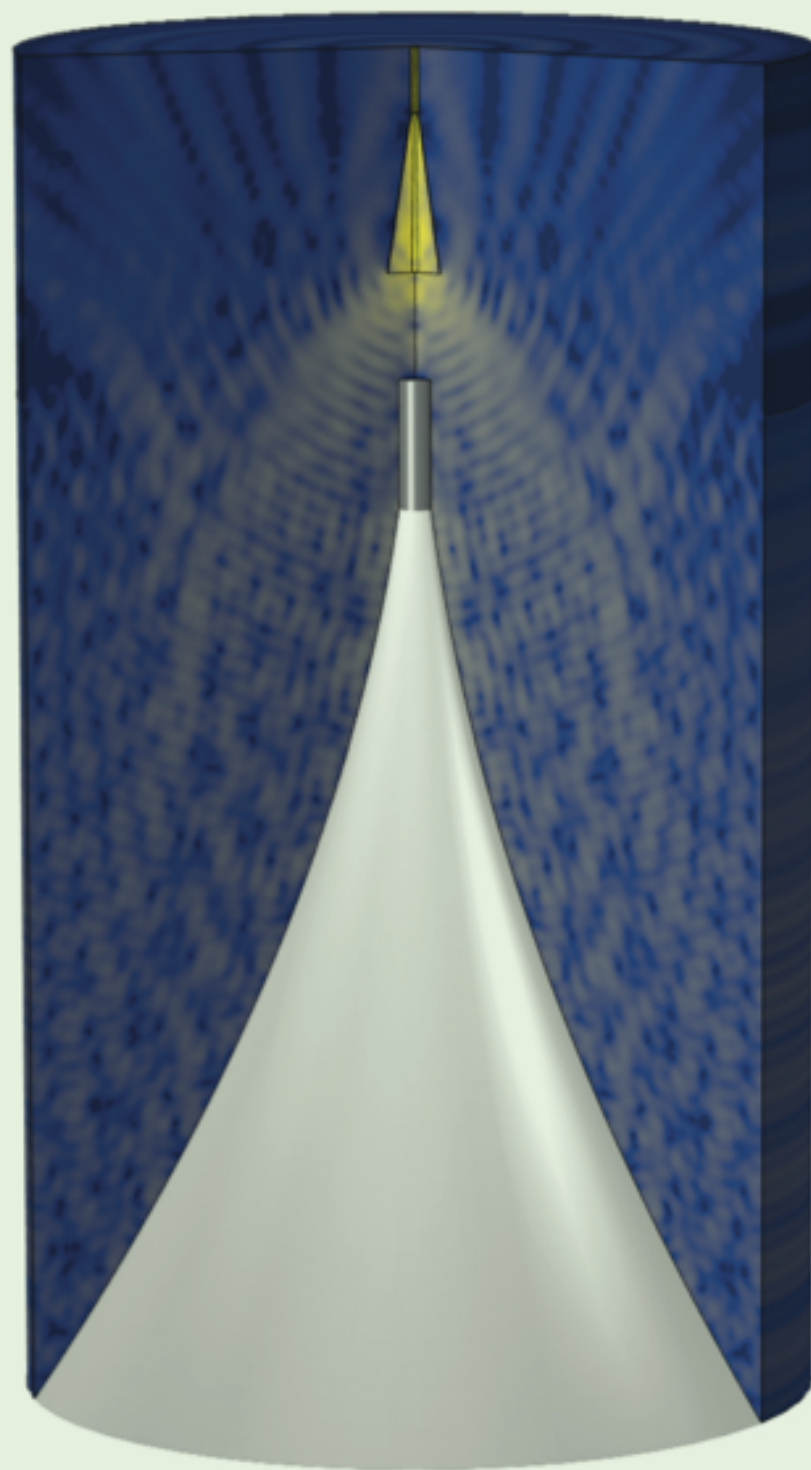
$$P_{sig} = 1.2 \times 10^{-25} \text{ W} \left(\frac{A}{10 \text{ m}^2} \right) \left(\frac{B_{\parallel}}{10 \text{ T}} \right)^2 \left(\frac{\rho_{DM}}{0.45 \text{ GeV cm}^{-3}} \right) \left(\frac{g_{a\gamma\gamma}}{3.9 \times 10^{-16} \text{ GeV}^{-1}} \right)^2 \left(\frac{1 \mu\text{eV}}{m_a} \right)^2$$



PHYSICAL REVIEW LETTERS

Published week ending

1 APRIL 2022

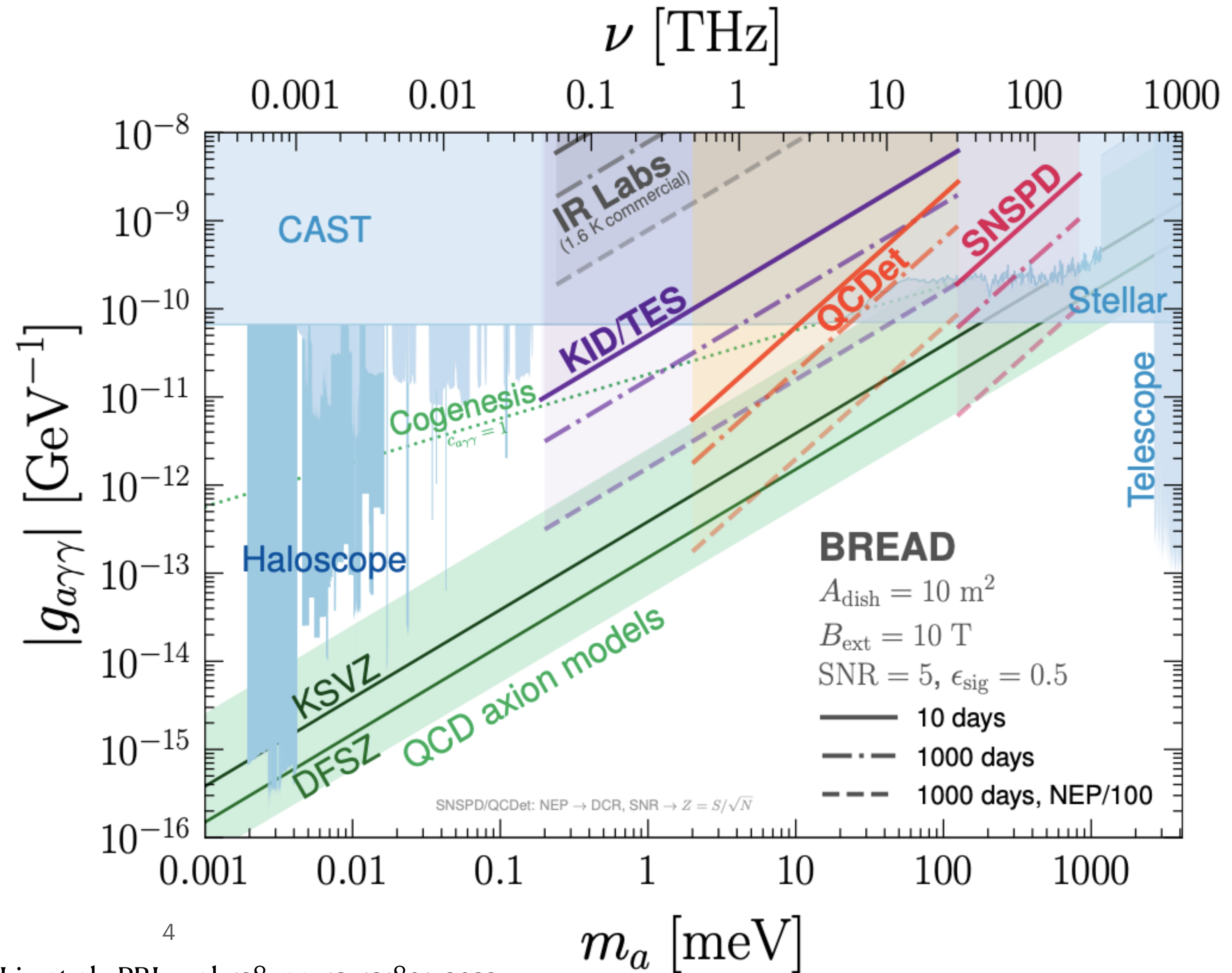


Published by
American Physical Society

APS
physics

Volume 128, Number 13

Sensitivity



GigaBREAD: *Dark Photon* Run

- 
- The logo for BREAD Collaboration. The word "BREAD" is in a large, bold, black sans-serif font. The letter "A" is replaced by a stylized graphic of a blue arch with a yellow dot in the center, resembling a stylized "A" or a bridge. Below "BREAD" is the word "COLLABORATION" in a smaller, black, sans-serif font.



Motor

Absorber

Coaxial horn

Dark Photon

40 cm

40 cm

RF shielded room

Amplifier chain +60 dB

+28 dB

$T_N \approx 120K$

-3 dB

Injected signal generator

FFT (Xilinx)

IF (0-2 GHz)

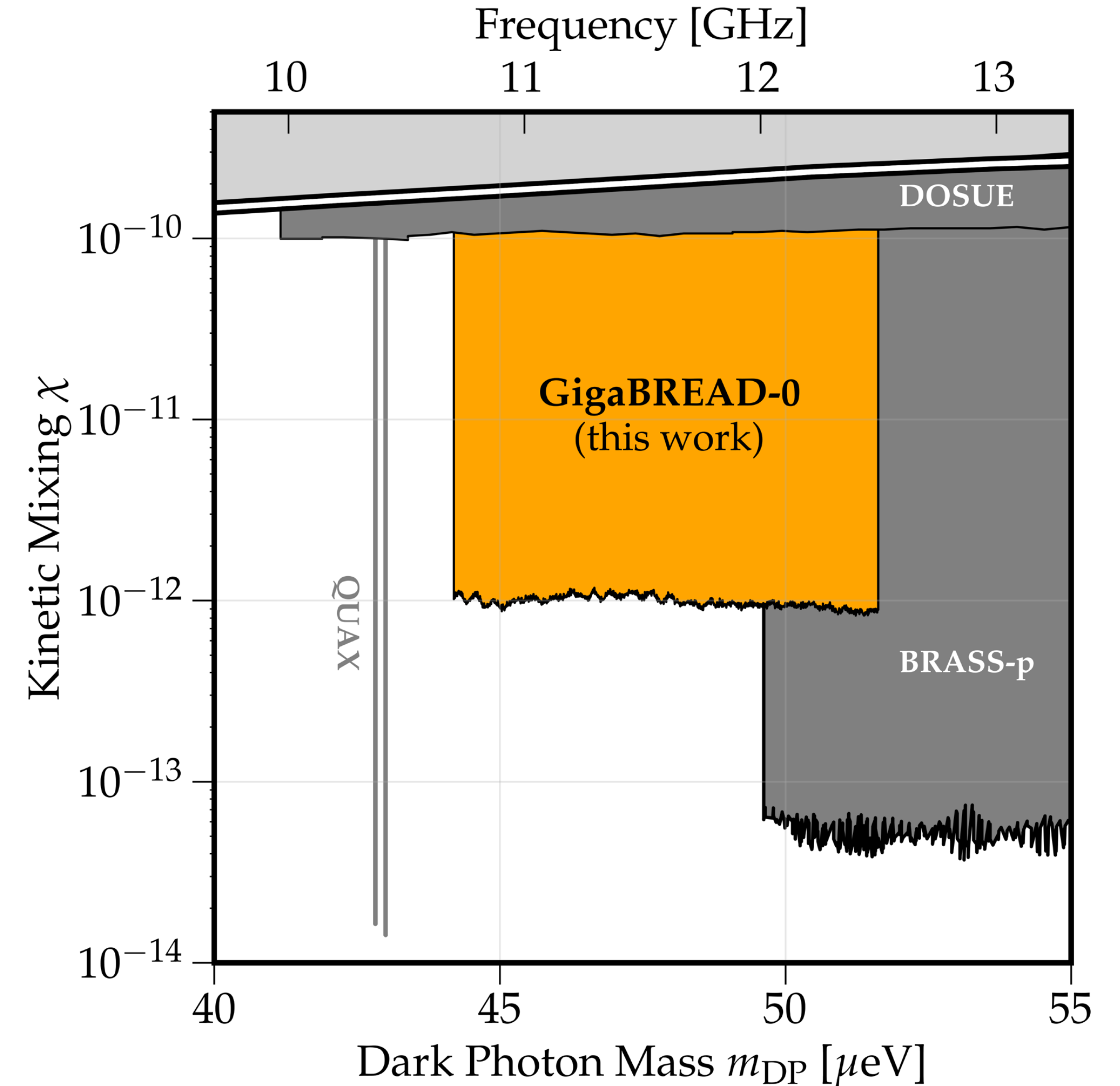
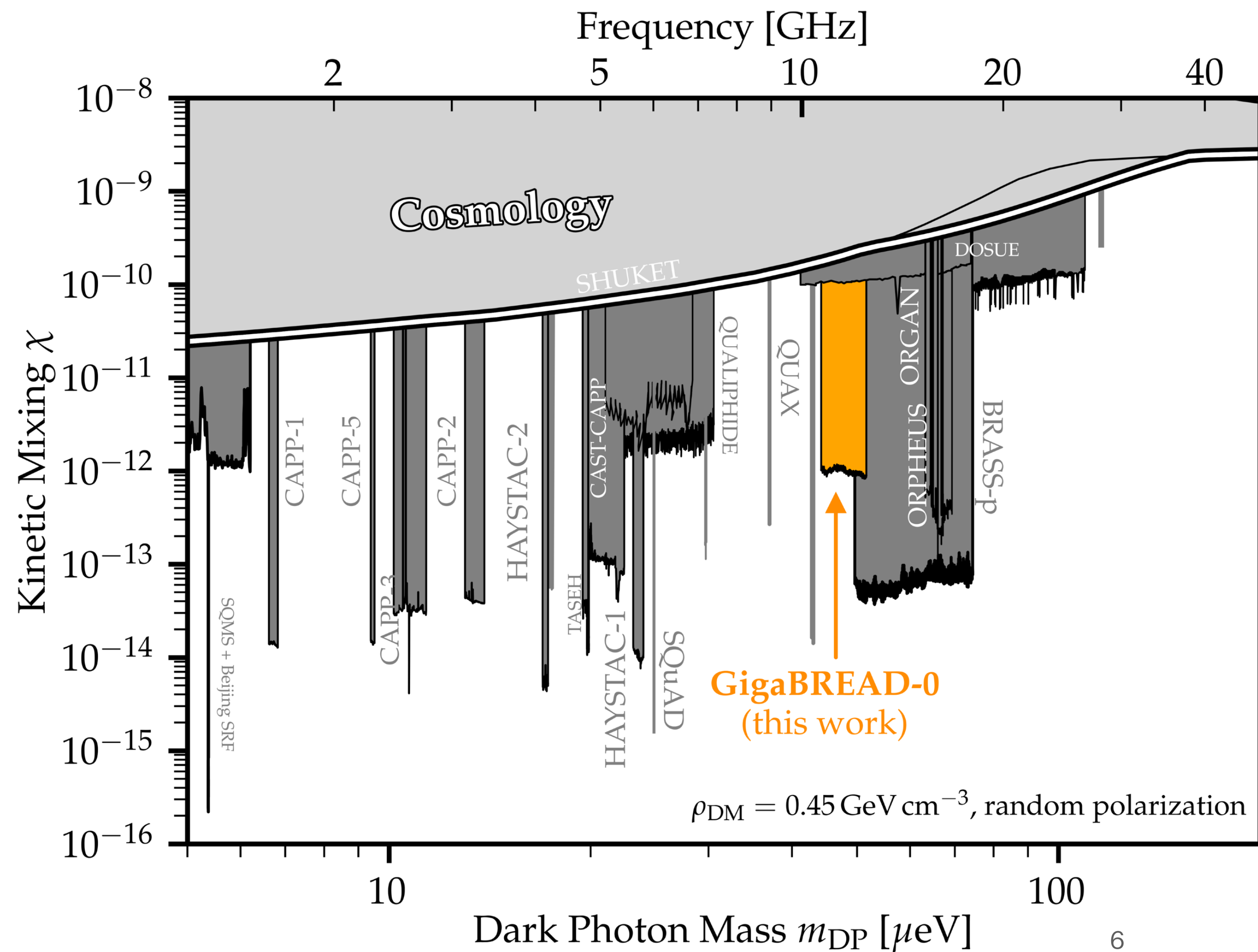
L.O. (~10.6 GHz)

RF (10.7-12.7 GHz)

-16 dB

Result - Exclusion Limits

Dark Photon Run — Room Temperature & No Magnet

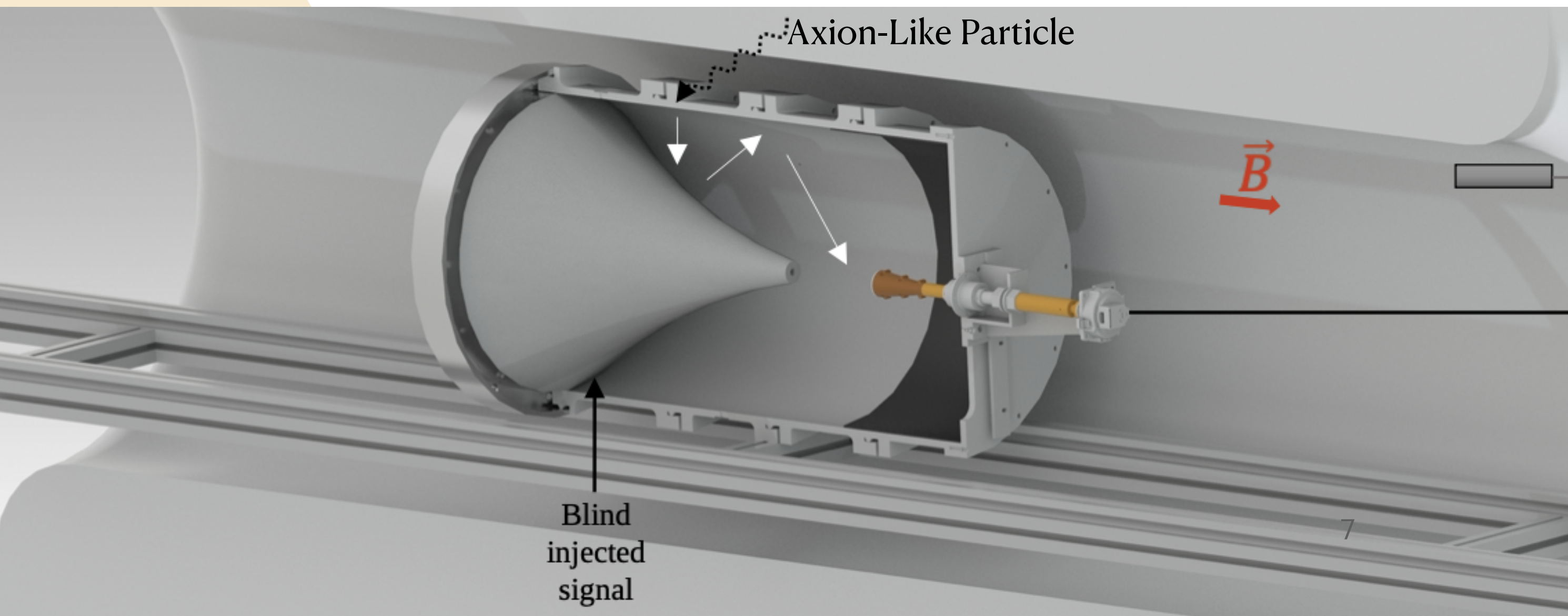


GigaBREAD: Axion-Like *Particle Run*

Summer
2024

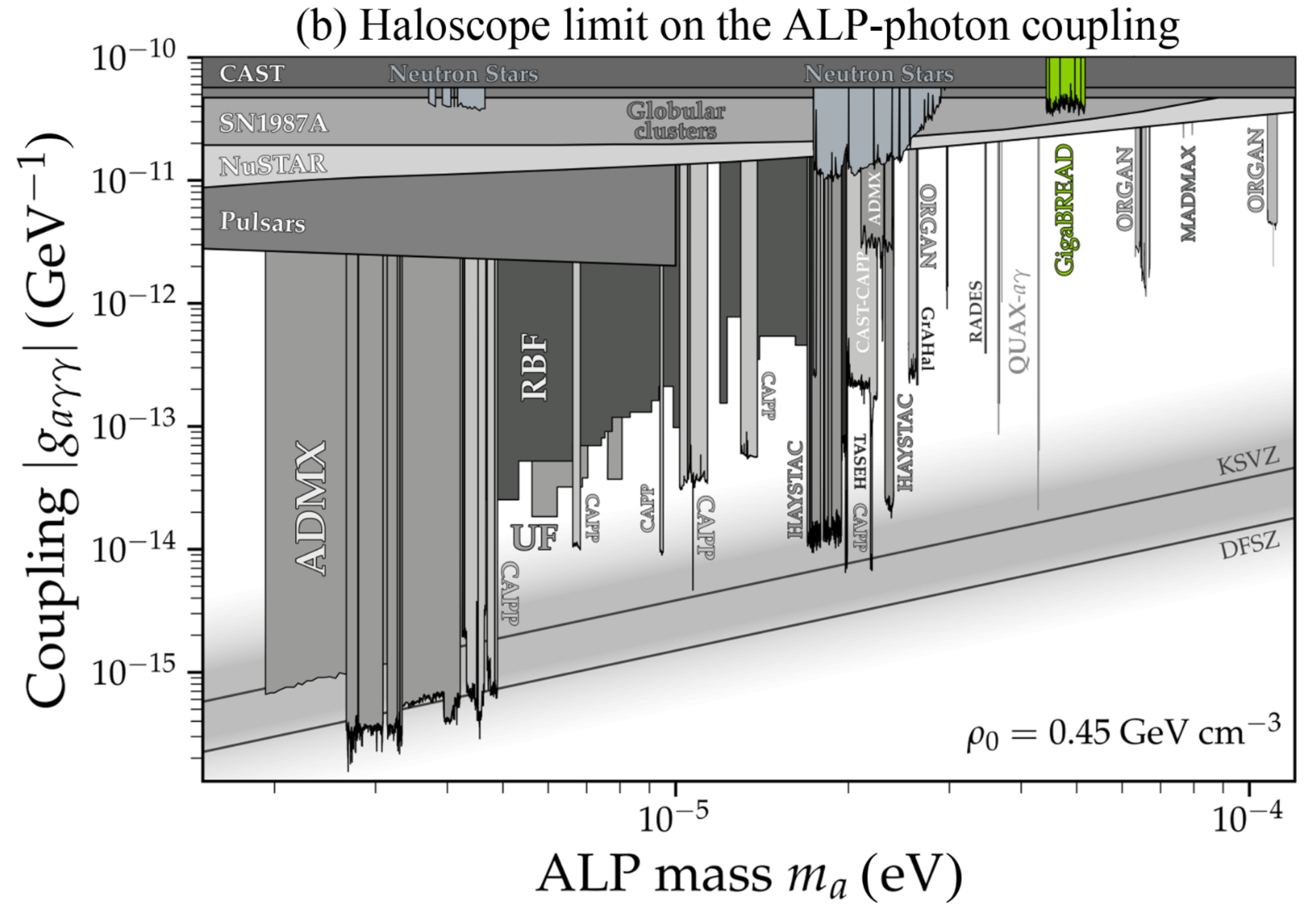
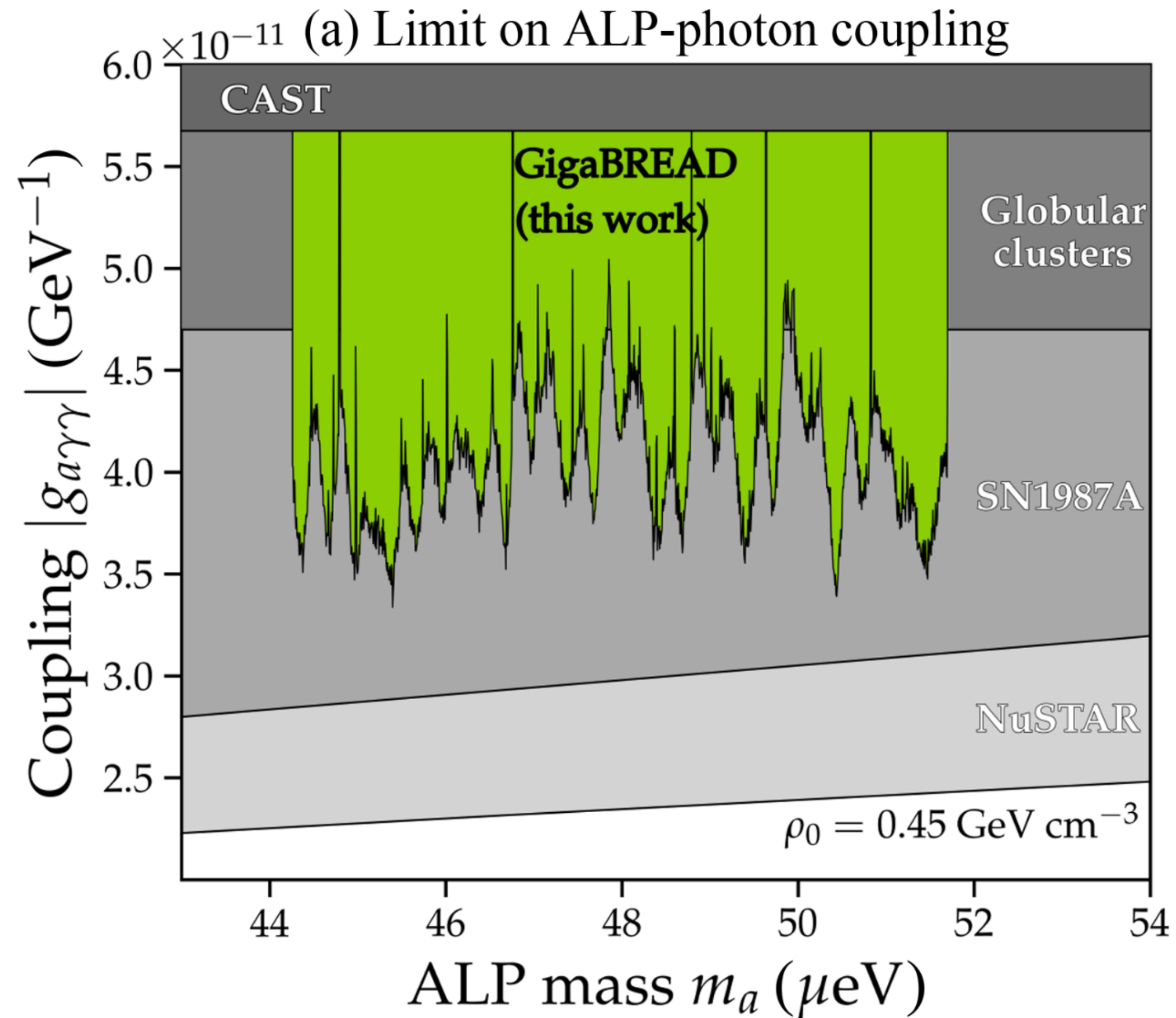
- Room Temperature
- 4T MRI Magnet @ Argonne National Lab
- 44 – 52 μeV (10.7 – 12.5 GHz)

Hoshino et al., PRL vol. 134, no. 17, 171002, 2025



Result - Exclusion Limits

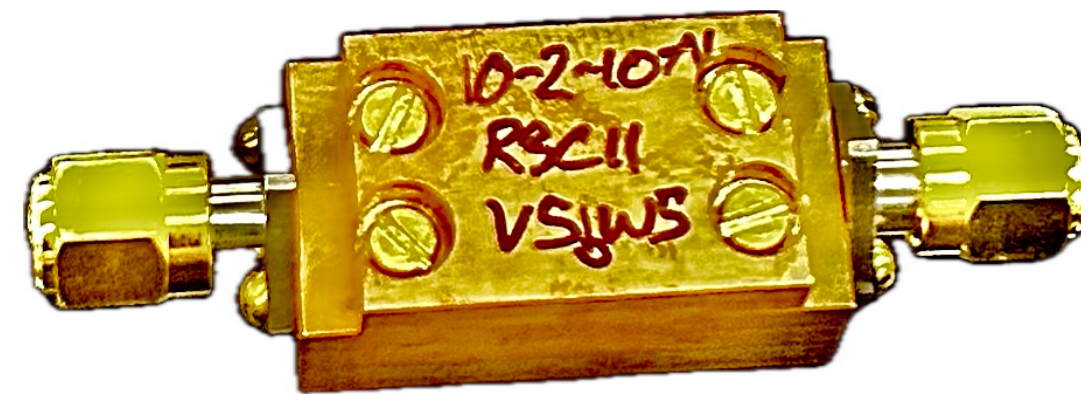
Axion-Like Particle Run — 4T MRI Magnet @ Room Temperature



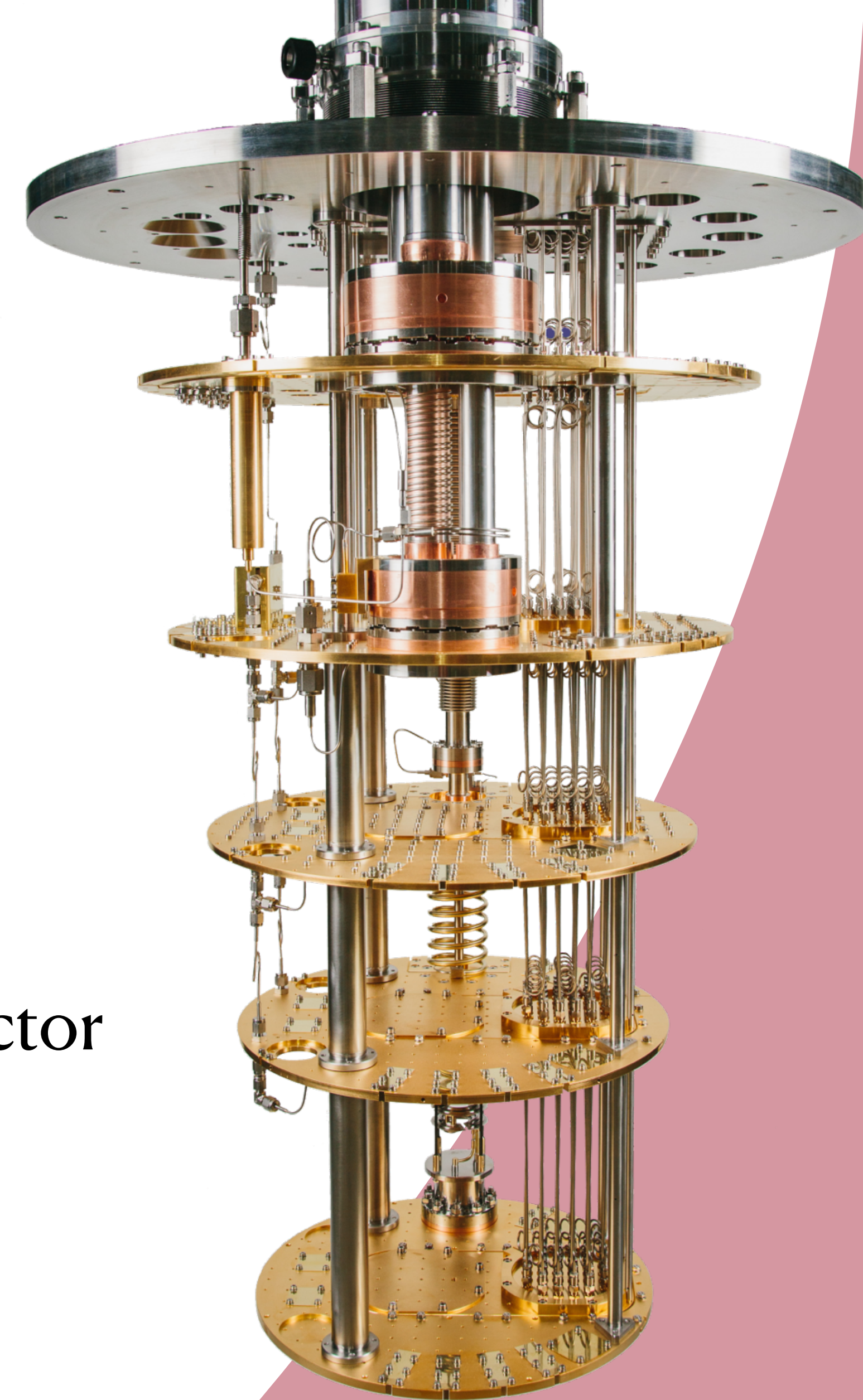
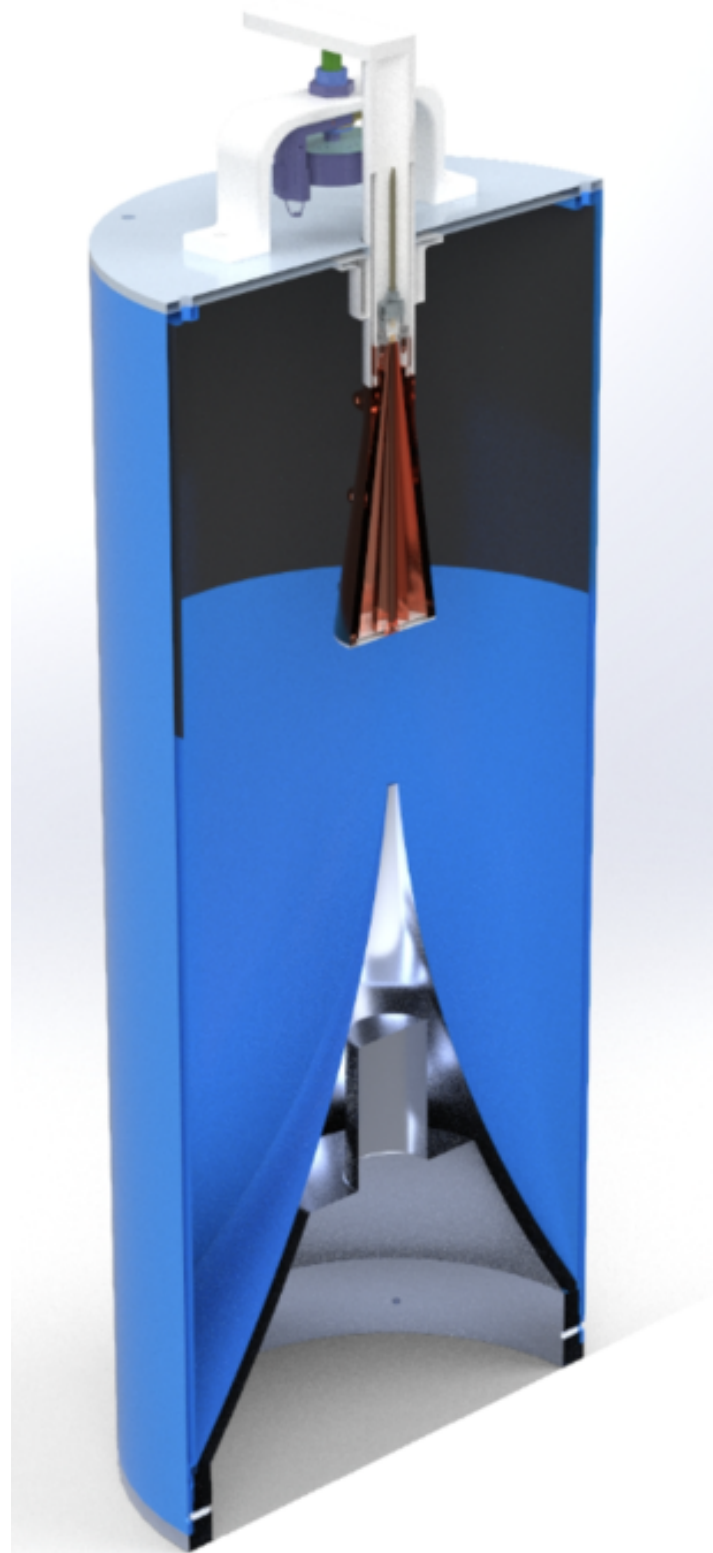
Harvard Setup

Current Research

- Reproducing the receiver + amplification chain of old runs
- KI-TWPA integration

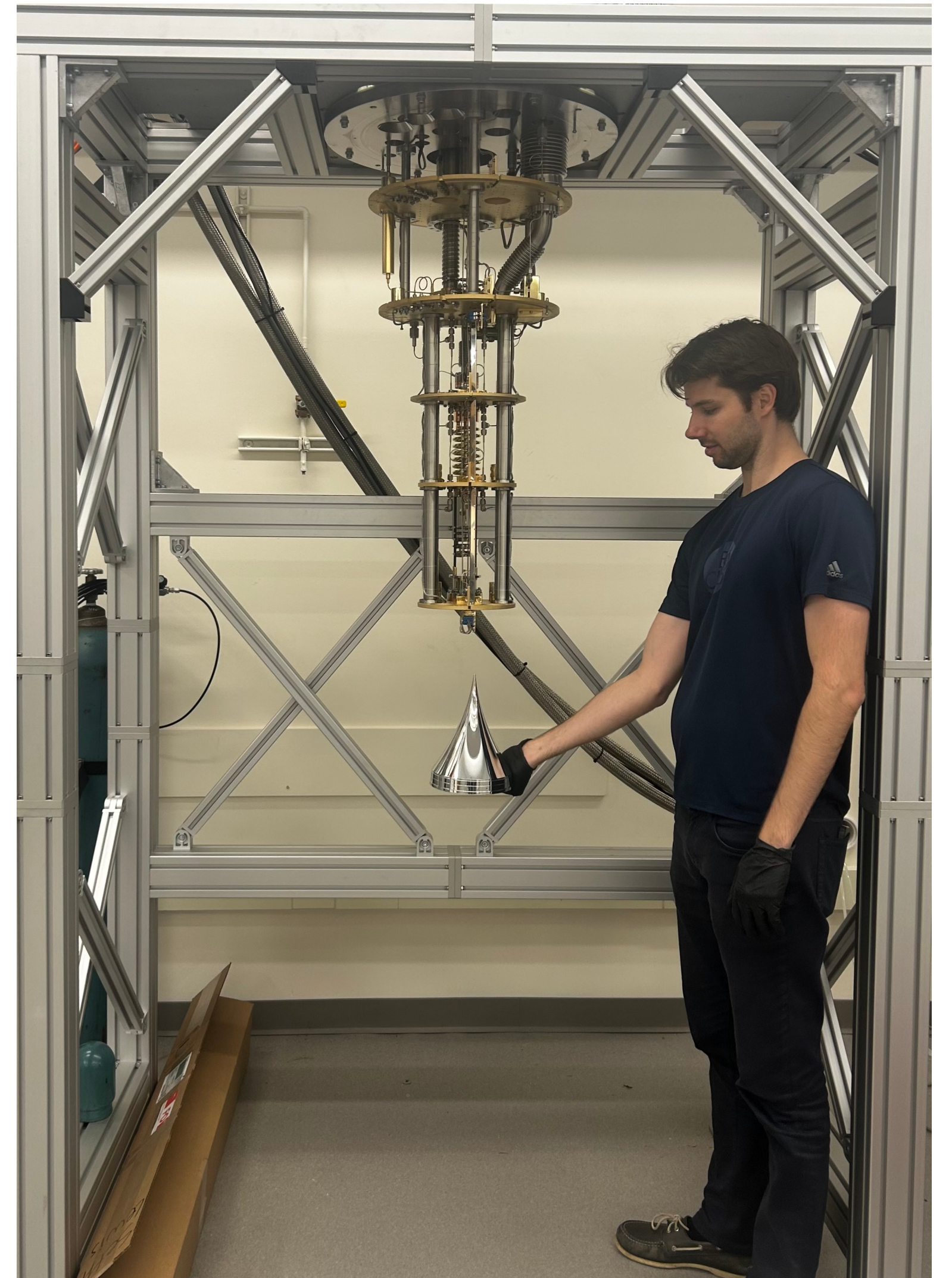
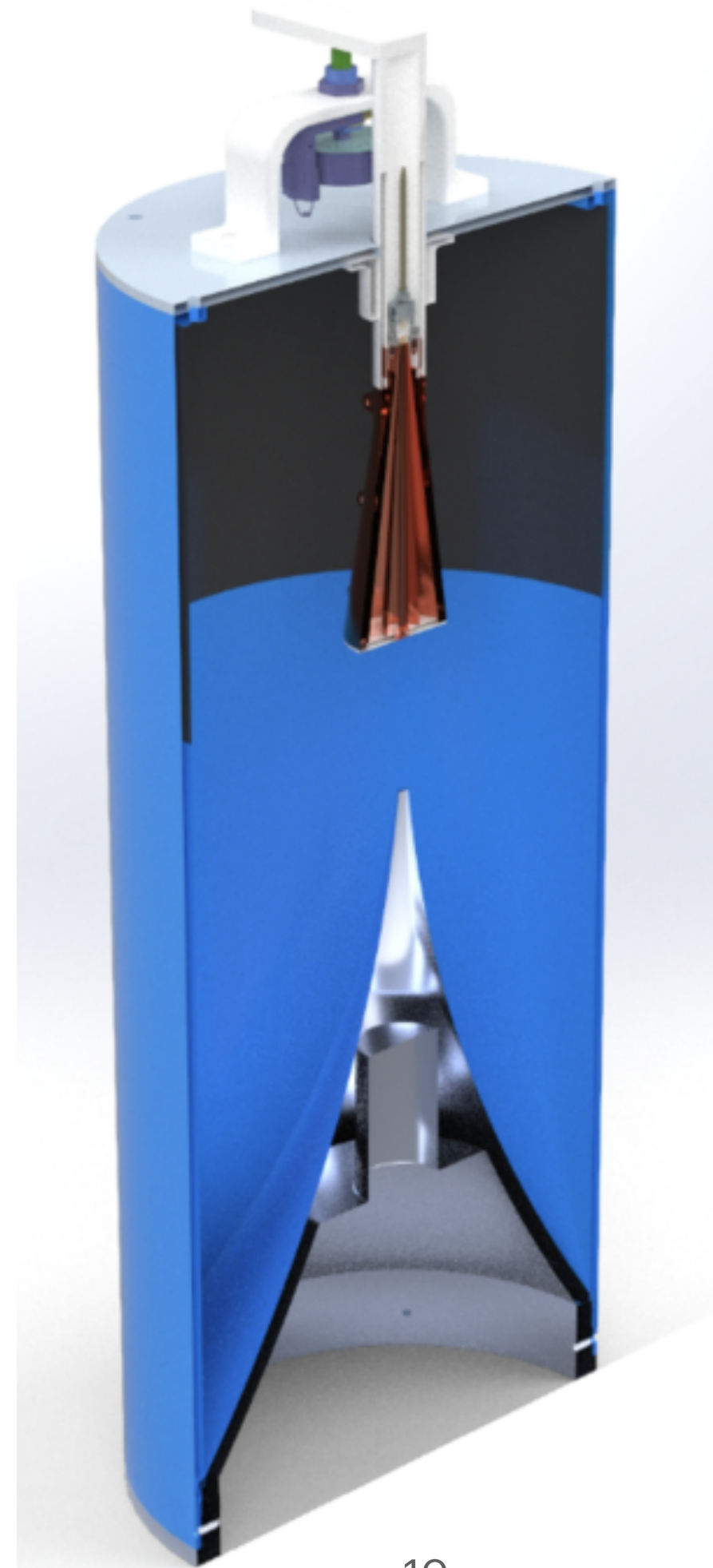
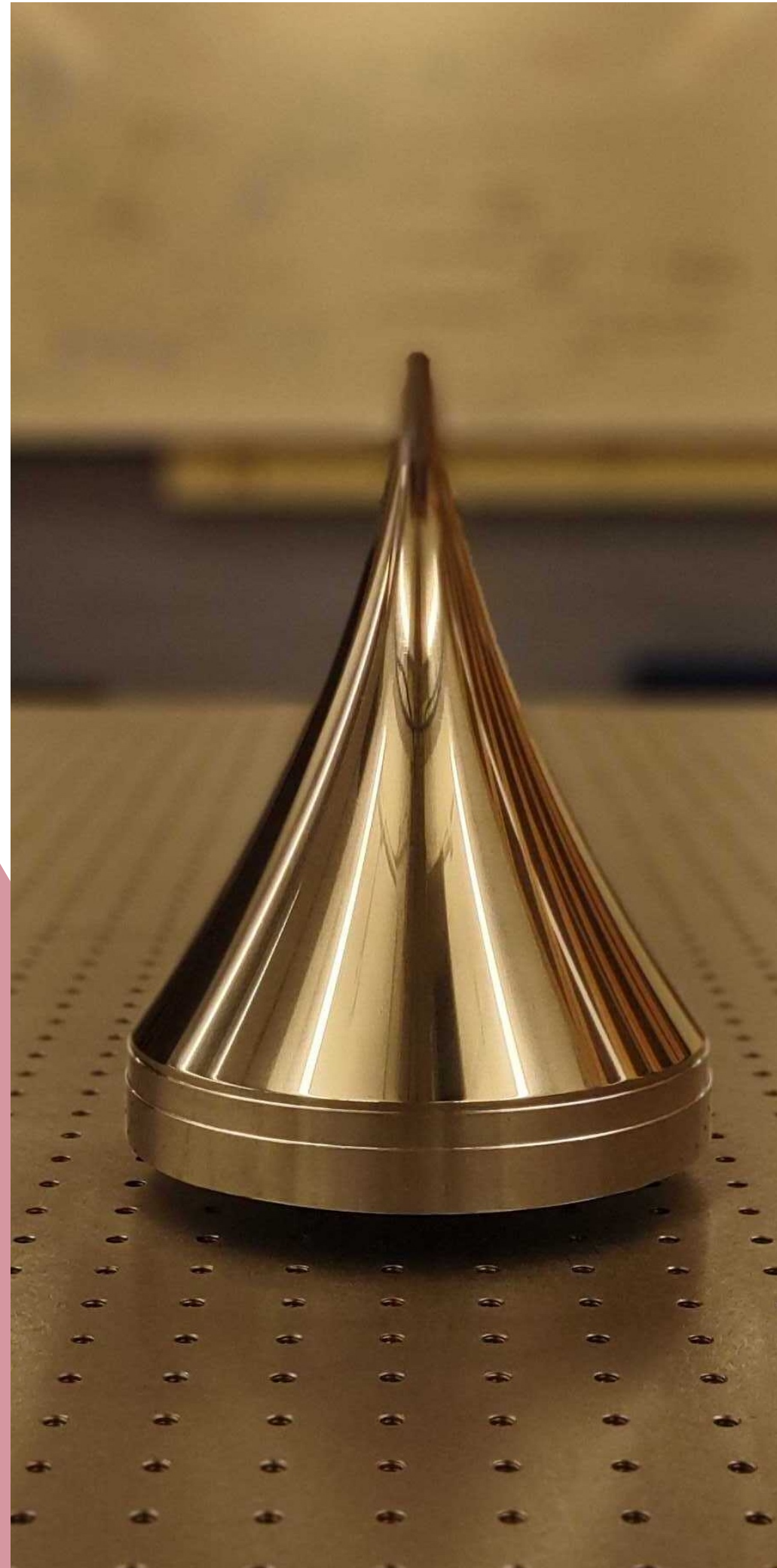


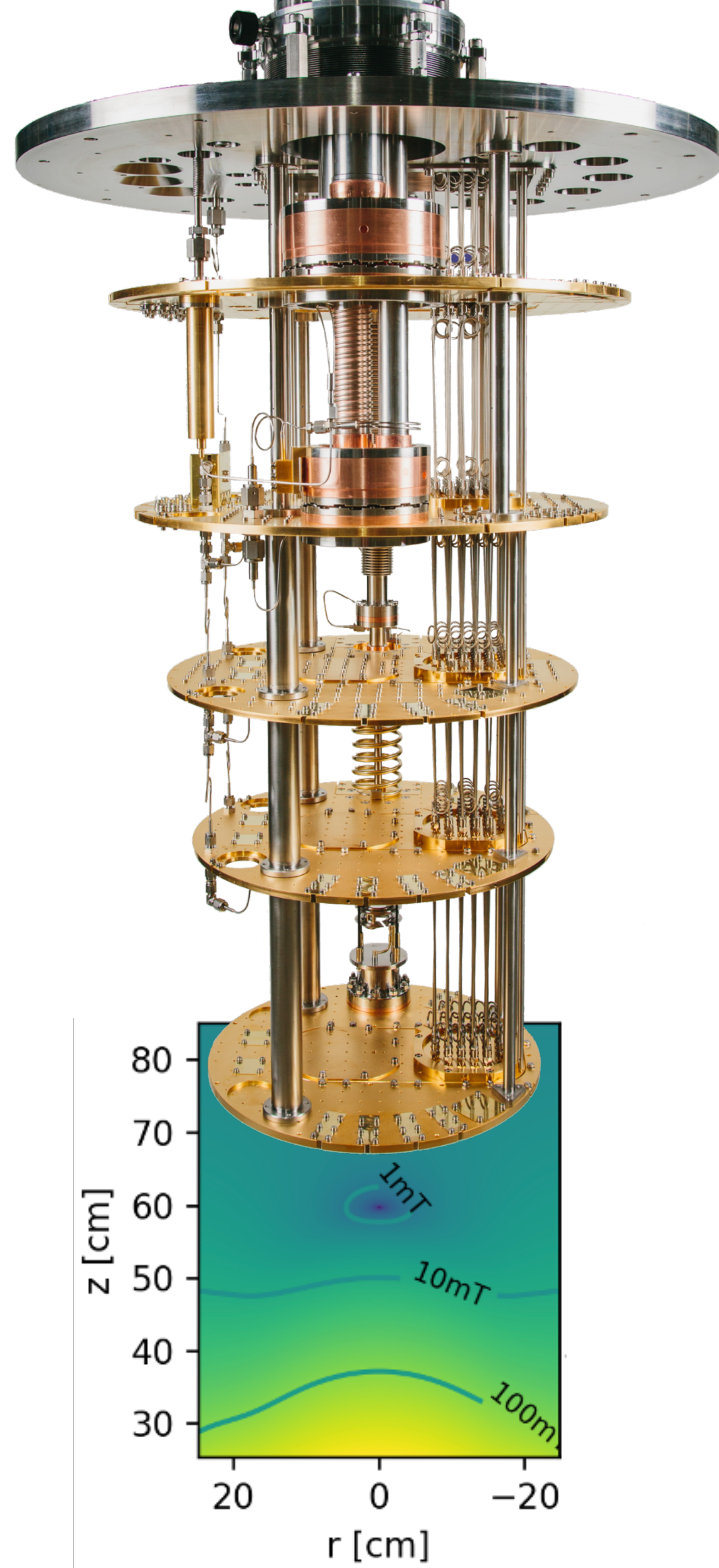
- New mechanical design — with smaller reflector
- Other BREAD variants: SlicedBREAD, TeraBREAD, InfraBREAD etc.



New Reflector

Diameter = 178 mm

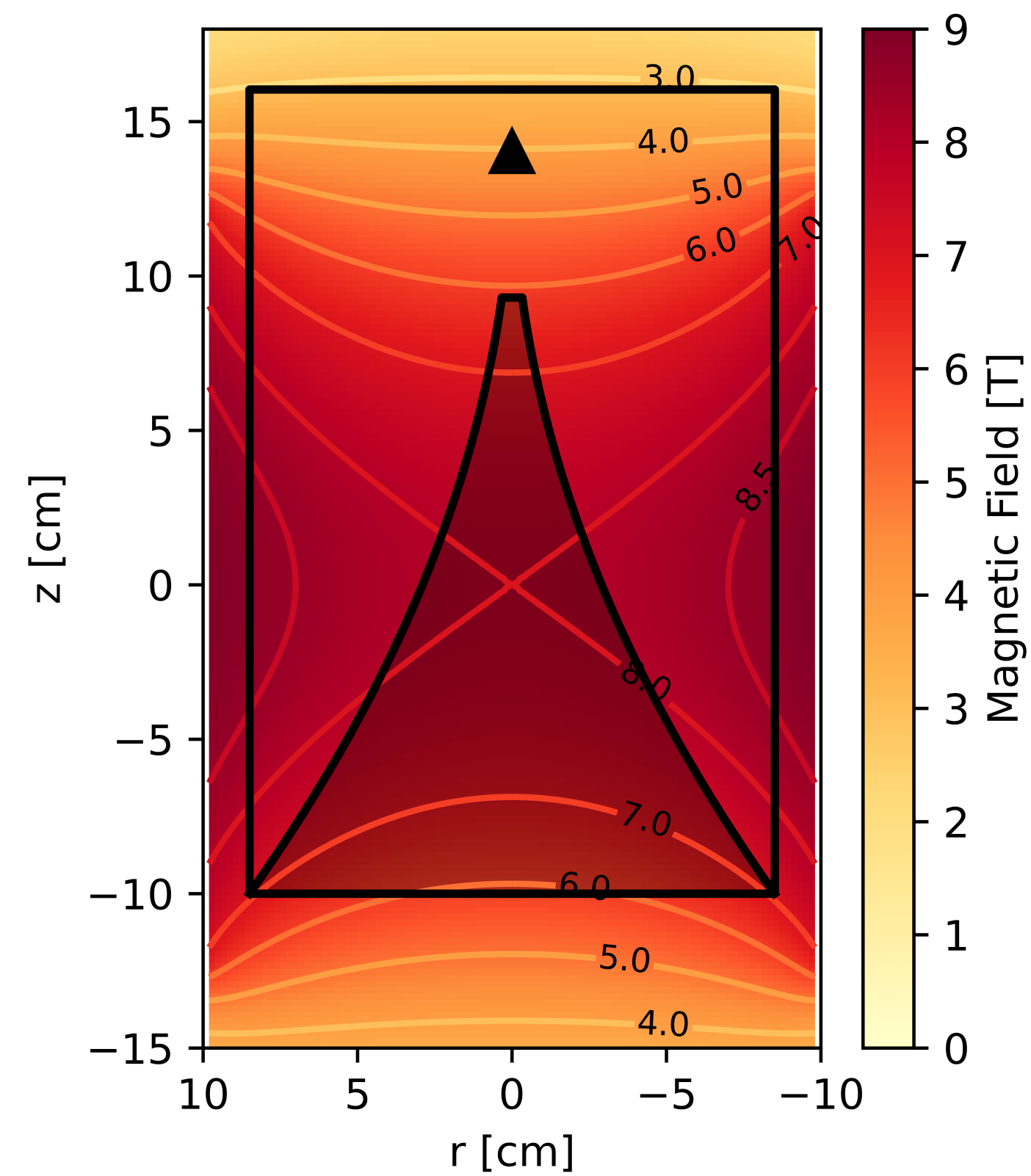




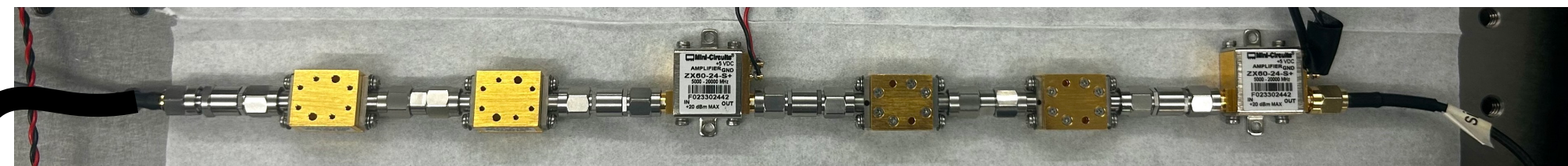
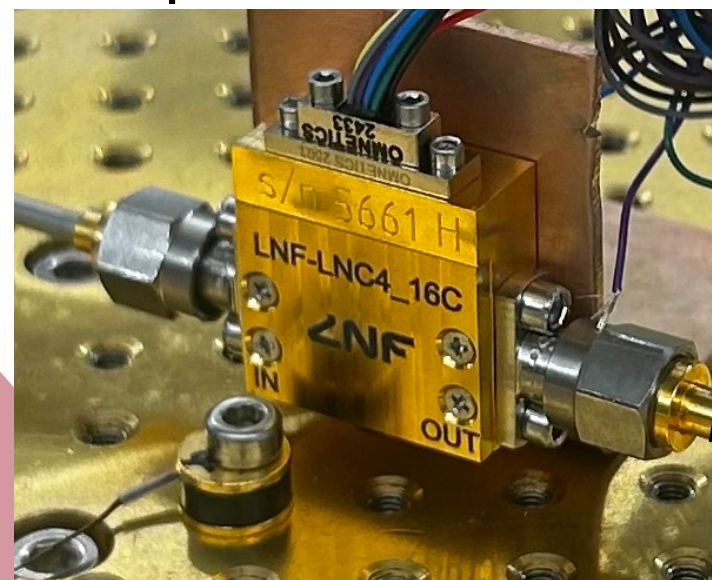
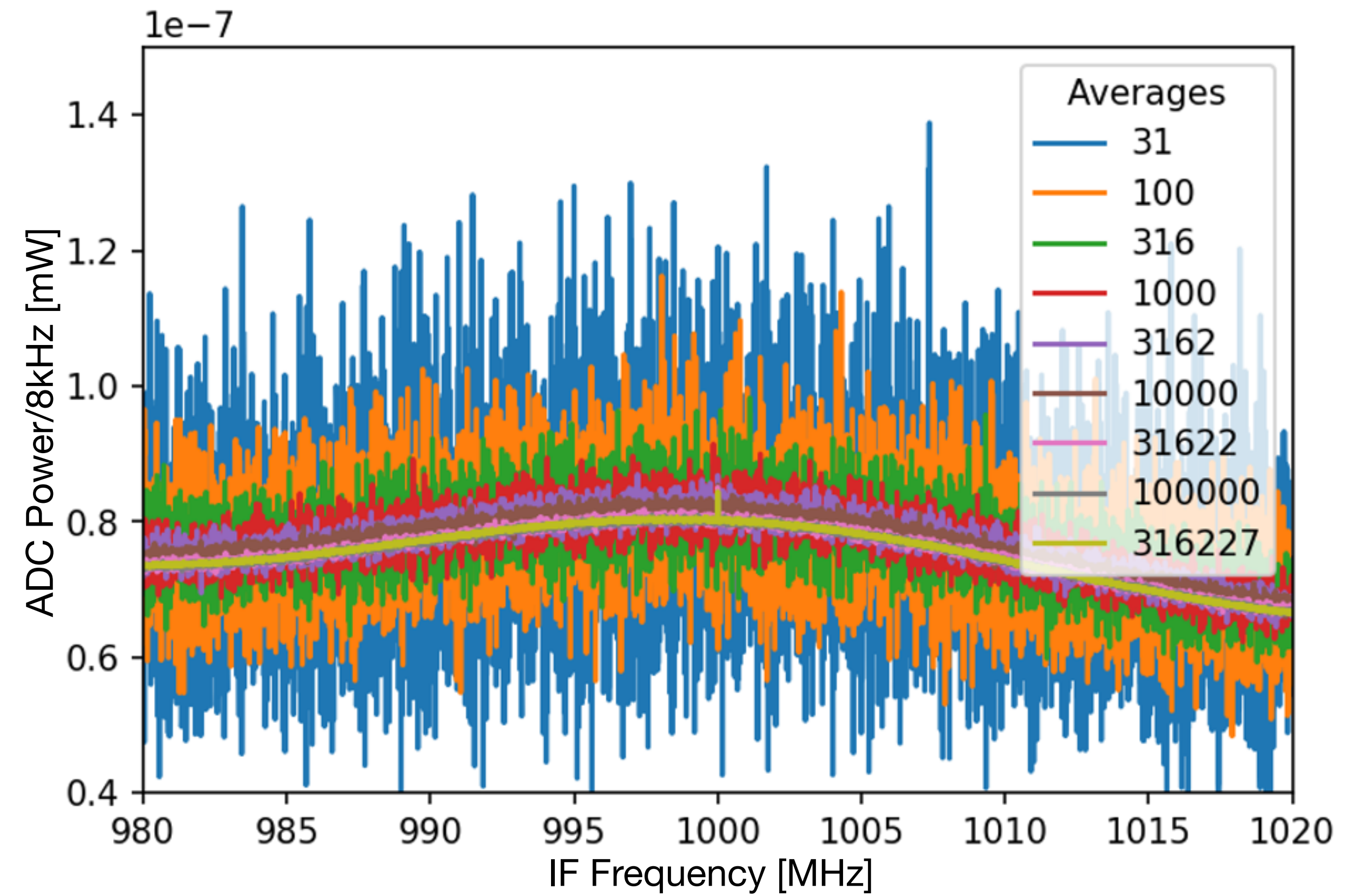
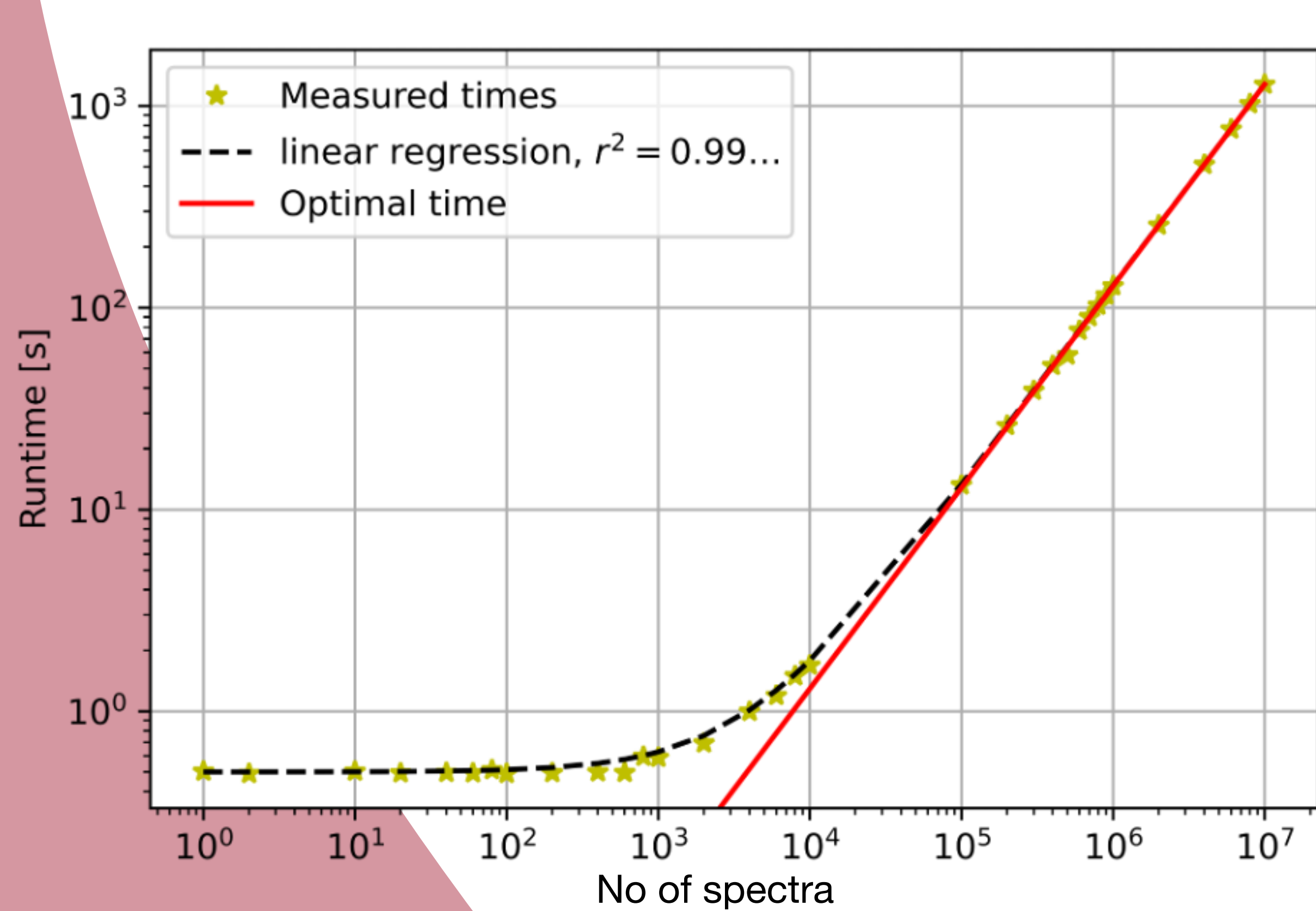
8T Magnet

@ Harvard

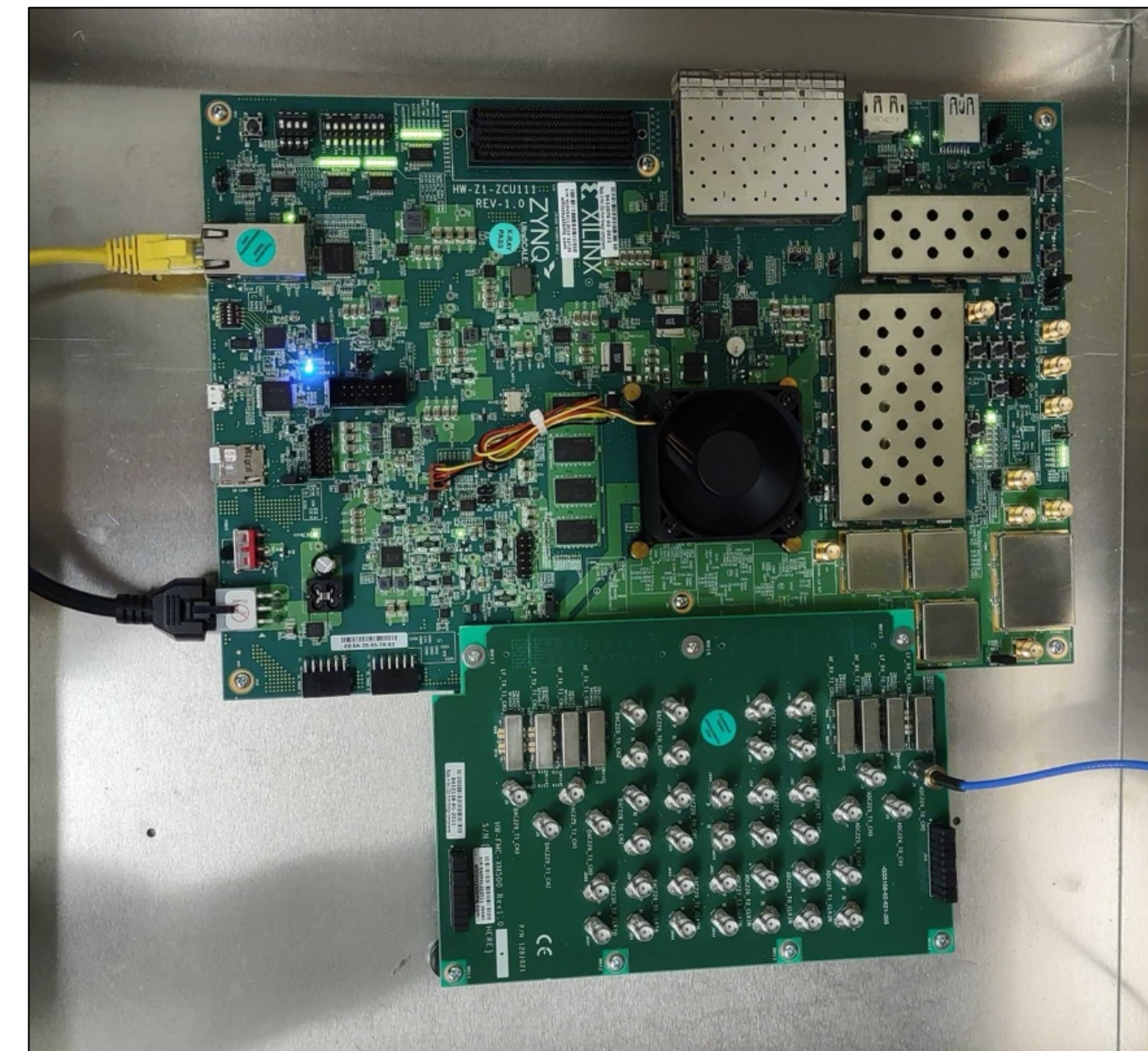
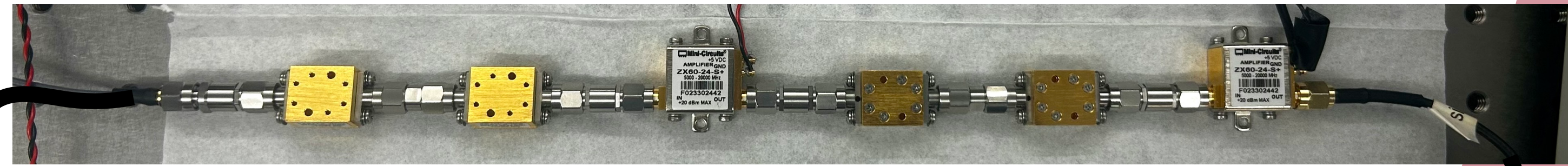
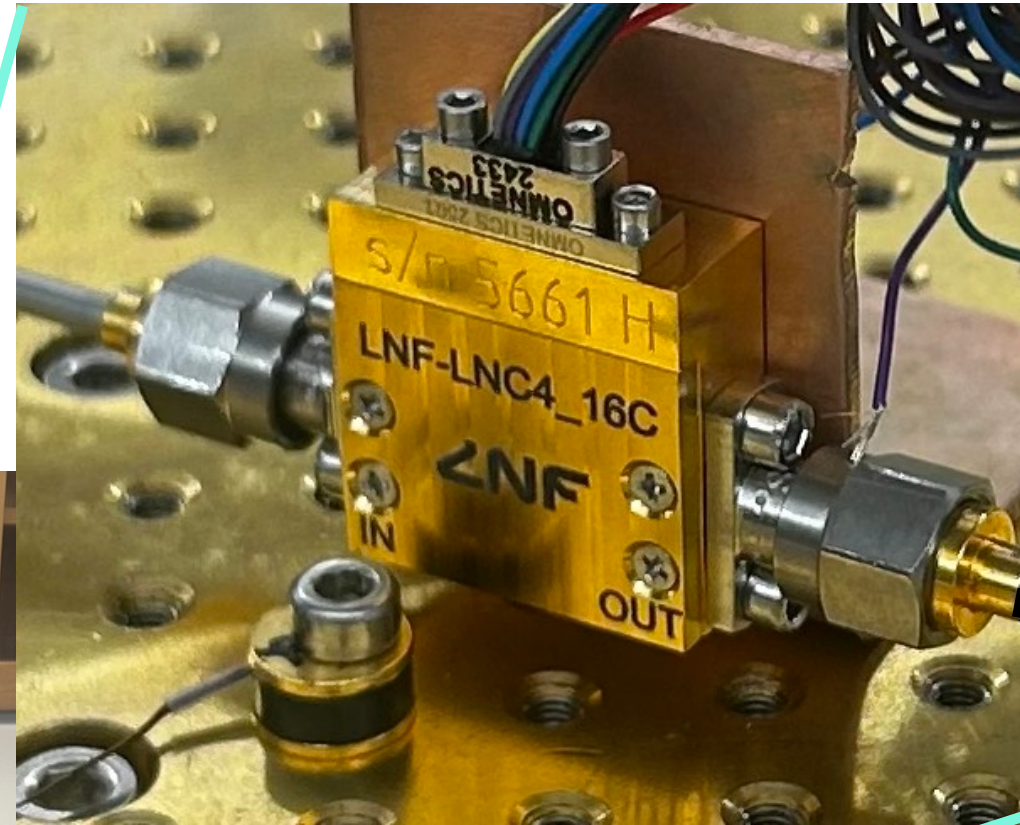
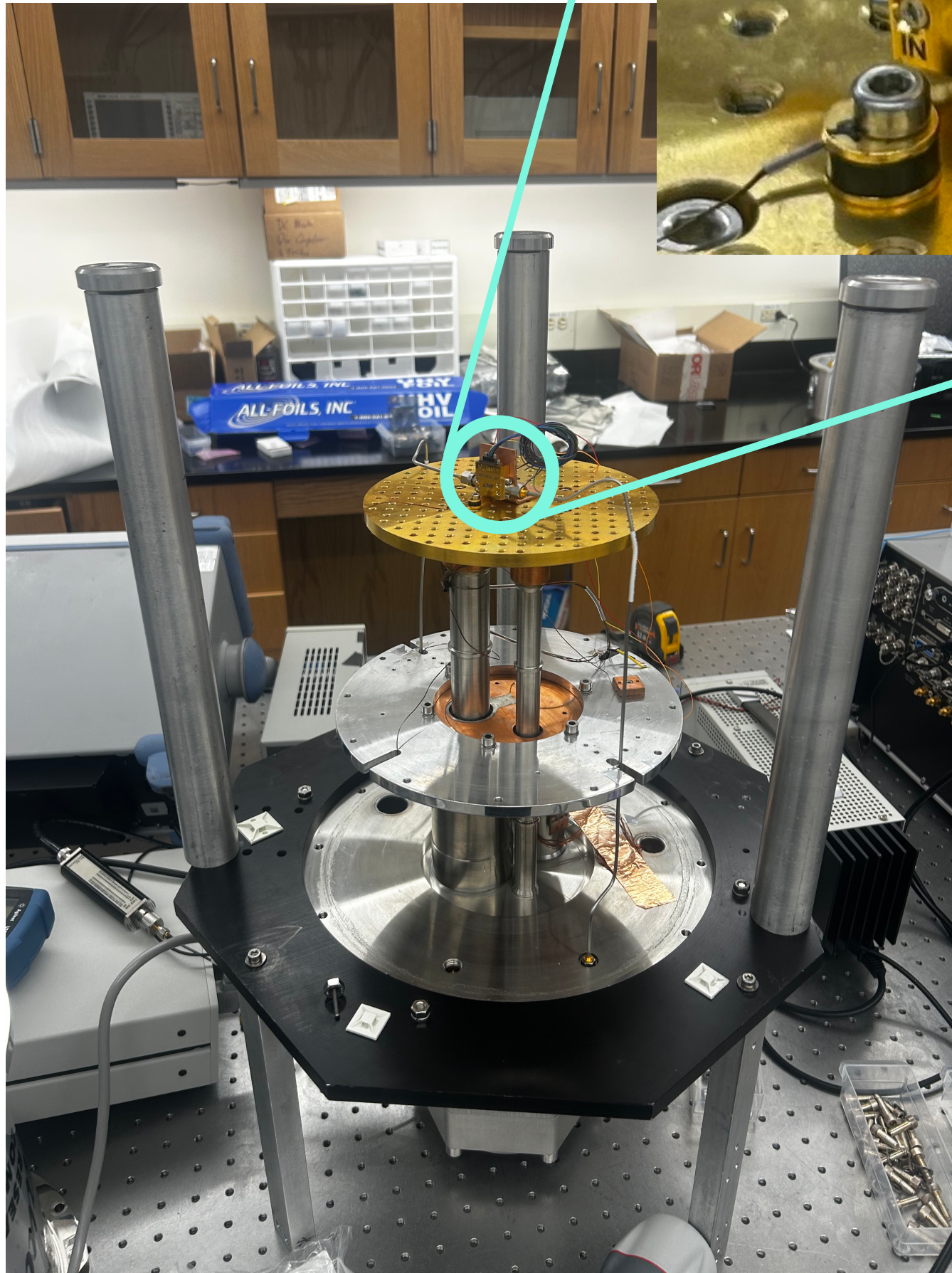
Arrives in the
summer



Receiver Chain



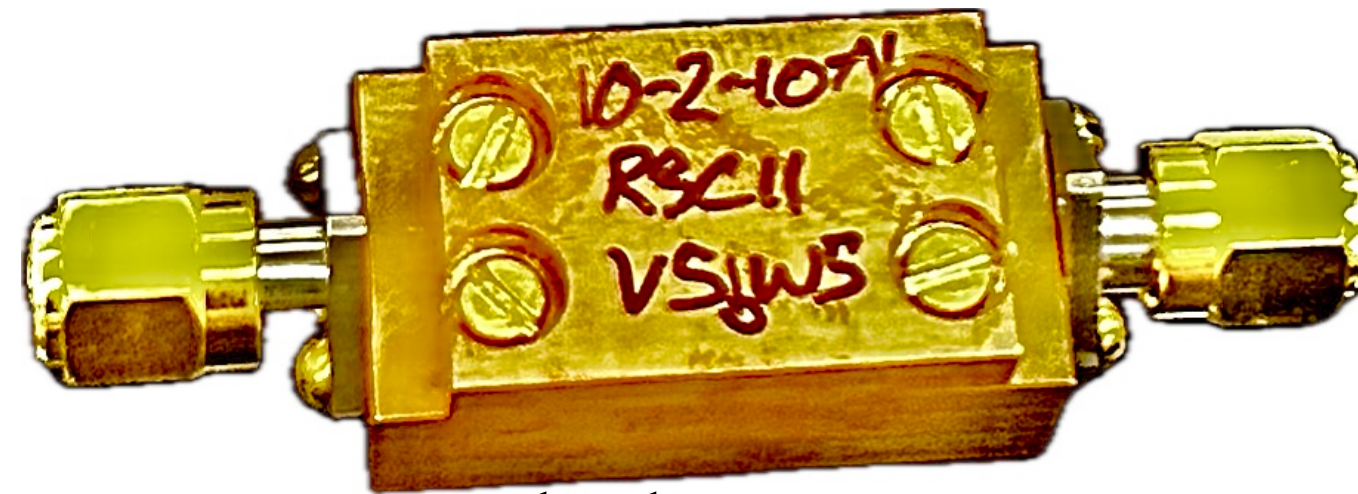
Receiver Chain



TWPA

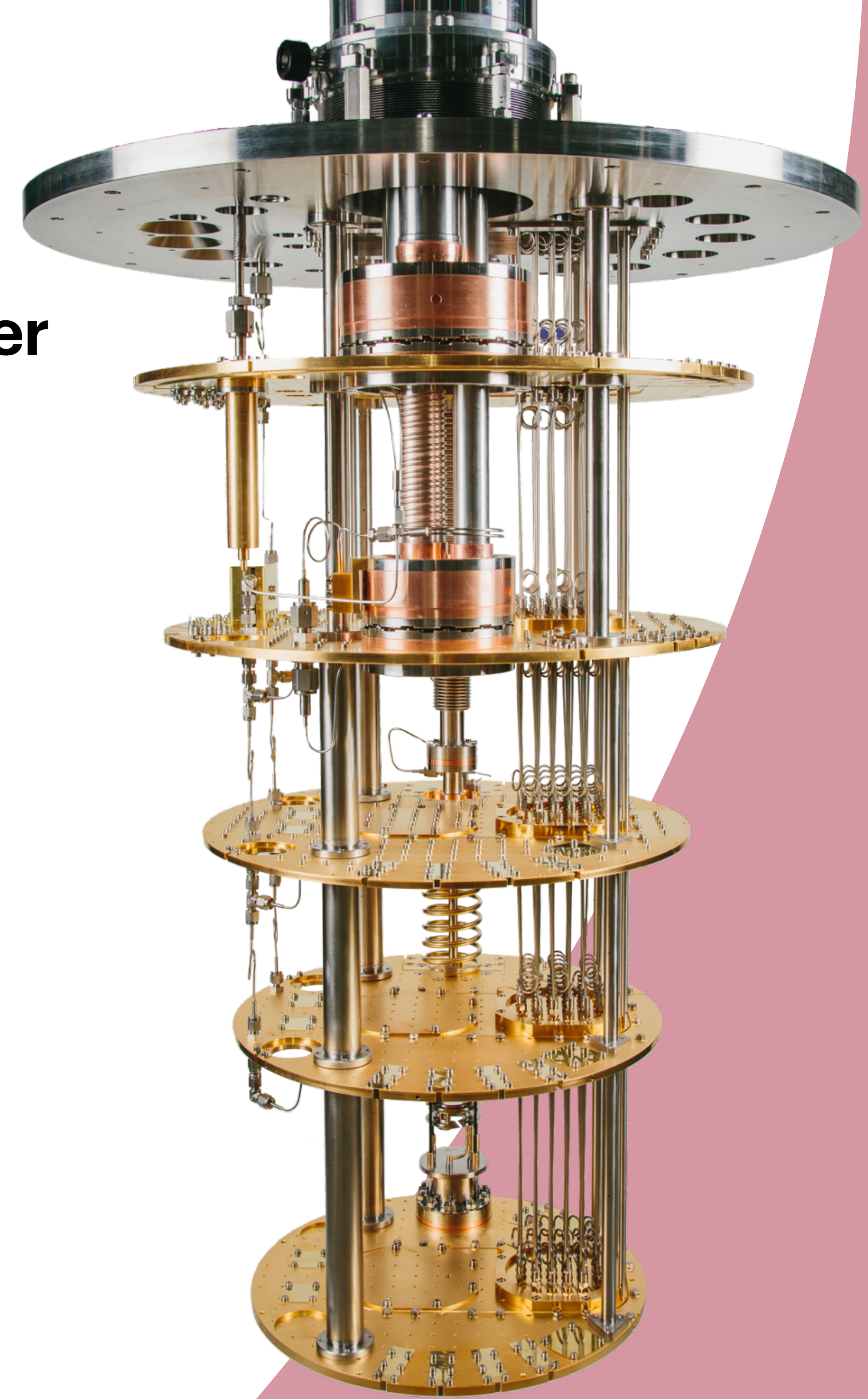
Traveling-Wave Parametric Amplifier

- Broadband
- Noise near the SQL

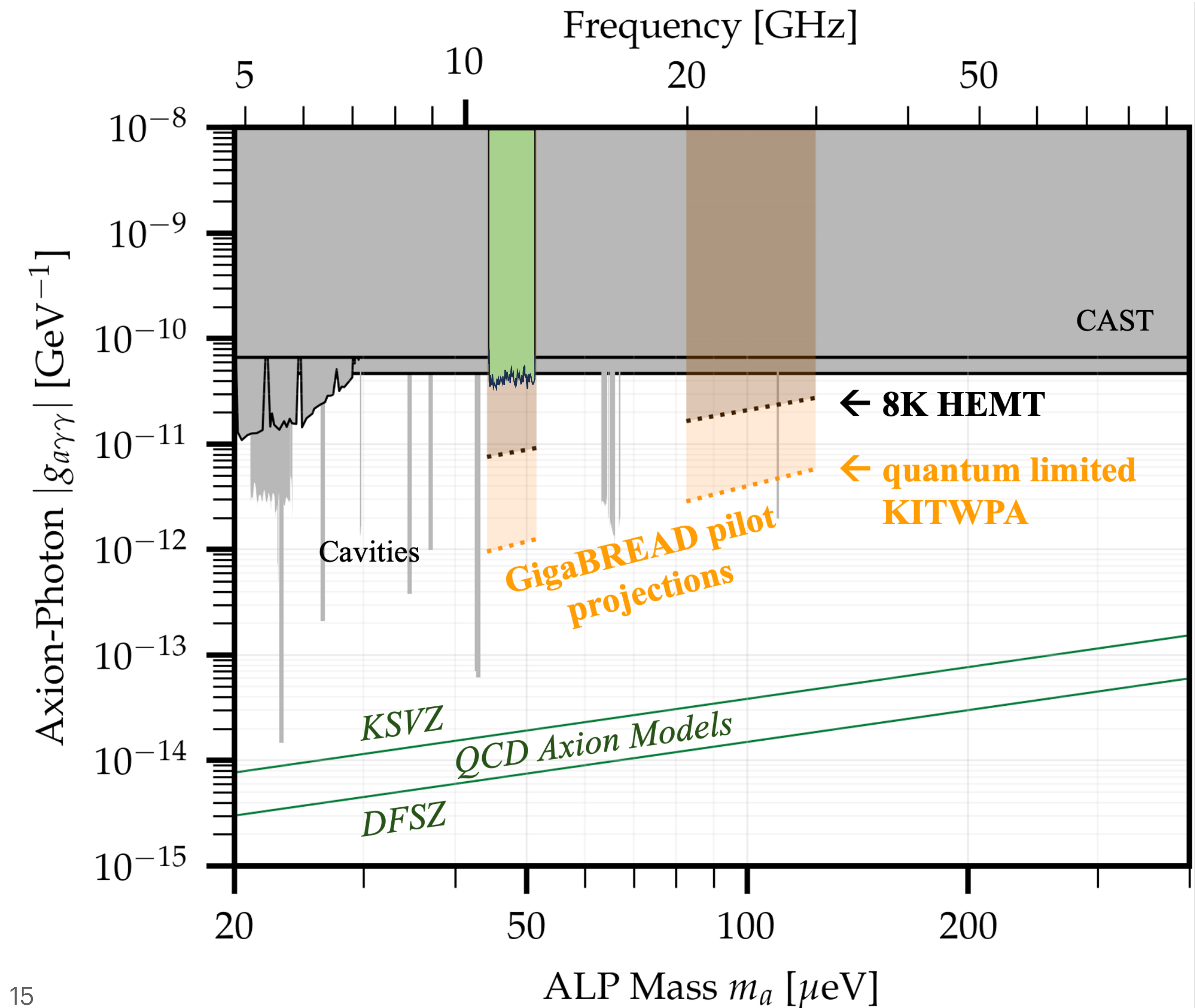
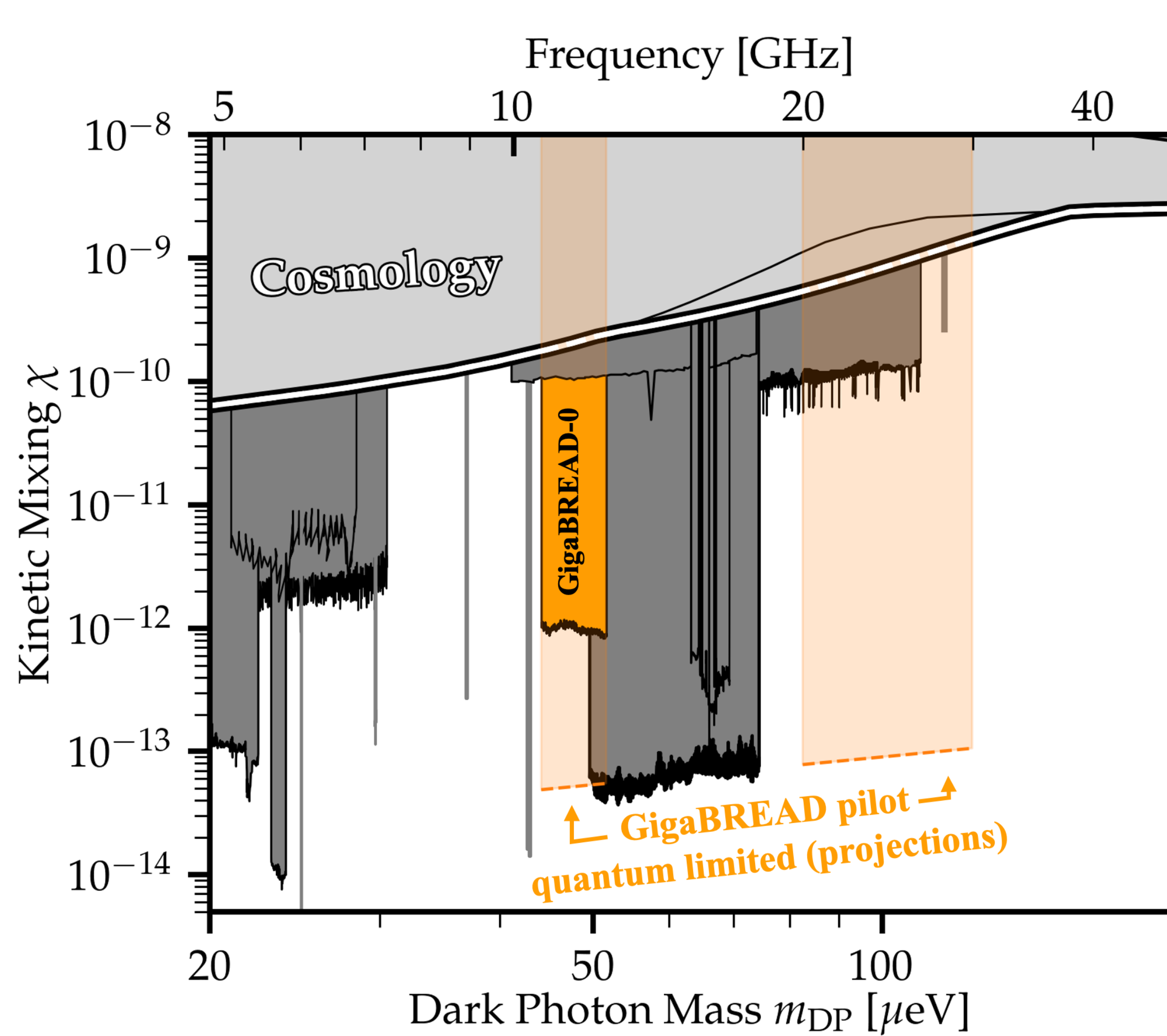


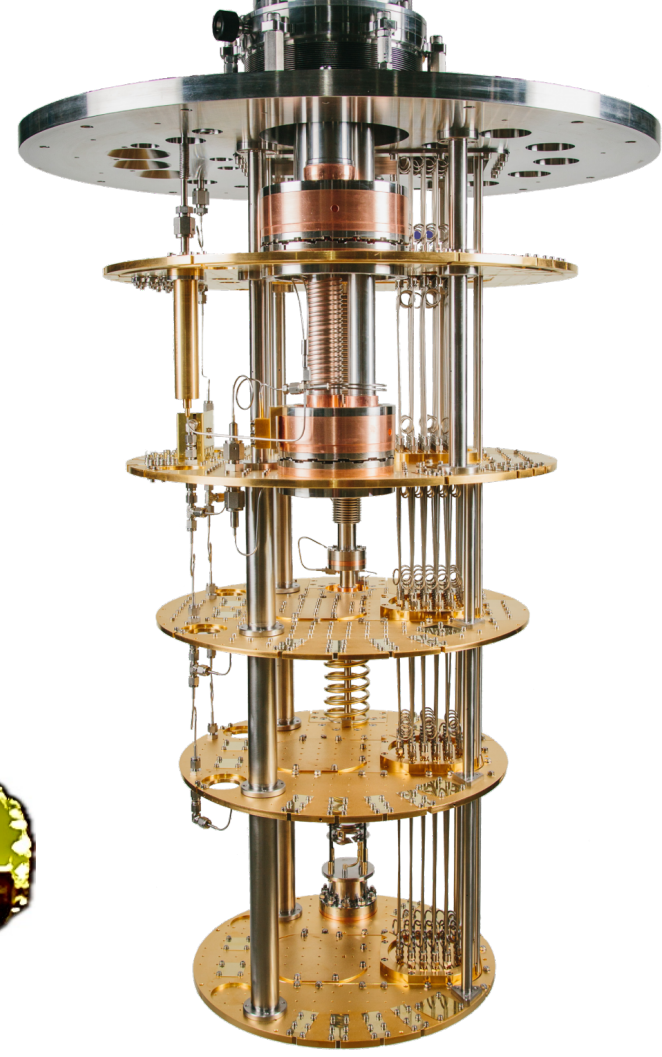
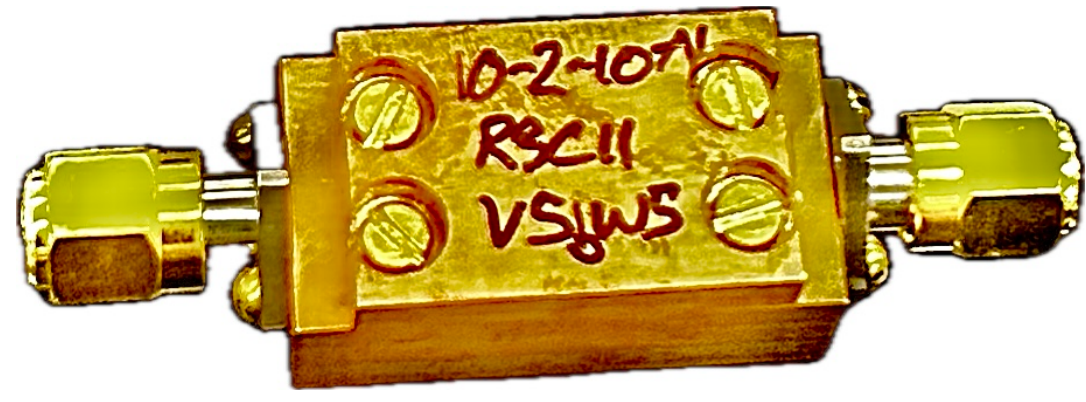
Thank you Corwin

- **KI-TWPA** (Kinetic Inductance Traveling-Wave Amplifier)
- **JTWPA** (Josephson TWPA)



Sensitivity Estimate





Thank you :)

