

RESONANT AND BROADBAND HALOSCOPE SEARCHES FOR HIDDEN PHOTON DARK MATTER USING THE HERA RESONANT CAVITY AT FREQUENCIES BELOW 500 MHz.

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1. HIDDEN PHOTON DARK MATTER SEARCH USING RESONANT CAVITY

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} - \frac{1}{4}X_{\mu\nu}X^{\mu\nu} - \frac{\chi}{2}F_{\mu\nu}X^{\mu\nu} + \frac{m_X^2}{2}X_\mu X^\mu + e j_\mu A^\mu.$$

χ :kinetic mixing constant.

X_μ :U(1) hidden field.

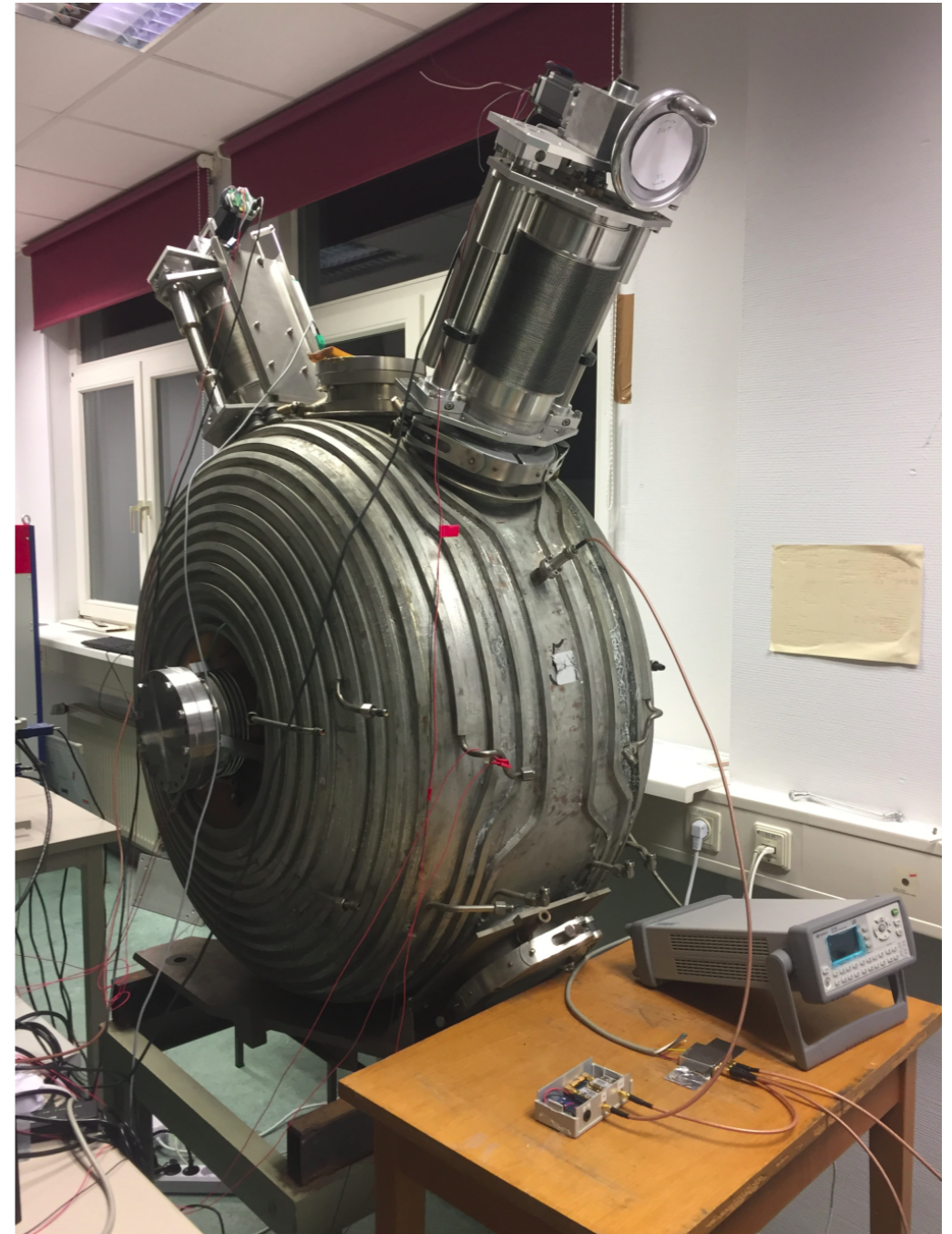
Ref: Jaeckel 2013, arXiv:1303.182

WISPD χ : **W**eakly **I**nteracting
Slim **P**article **D**ark **M**atter
Experiment.

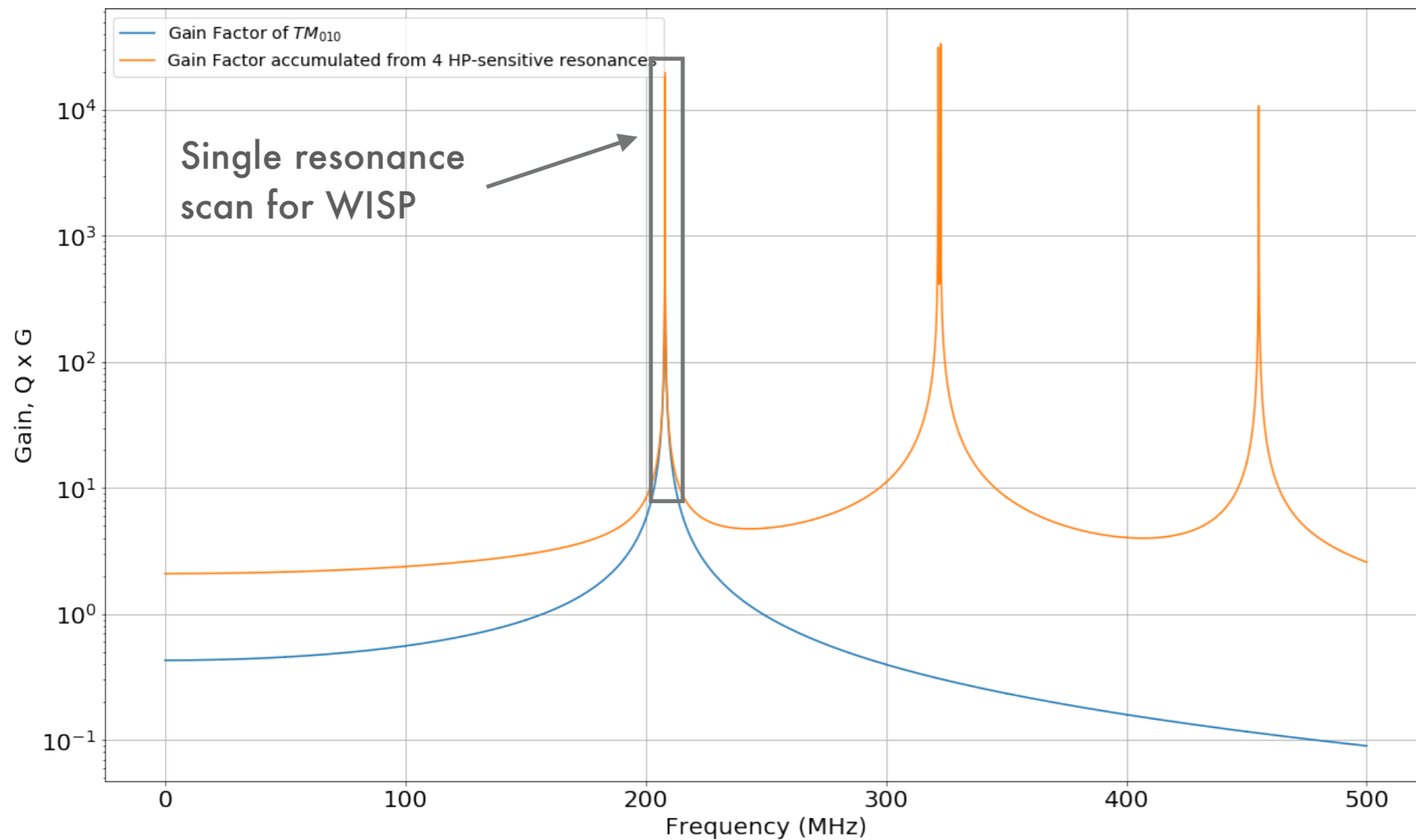
Located in building 68 room 11,
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HH.

$$P = \kappa \chi^2 m_{\gamma'} \rho_{\text{CDM}} Q V \mathcal{G}$$

$$\mathcal{G} = \frac{|\int dV \mathbf{A}(\mathbf{x}) \cdot \hat{\mathbf{n}}|^2}{V \int d^3\mathbf{x} |\mathbf{A}(\mathbf{x})|^2}.$$



2. BROADBAND SEARCH USING RESONANT CAVITY

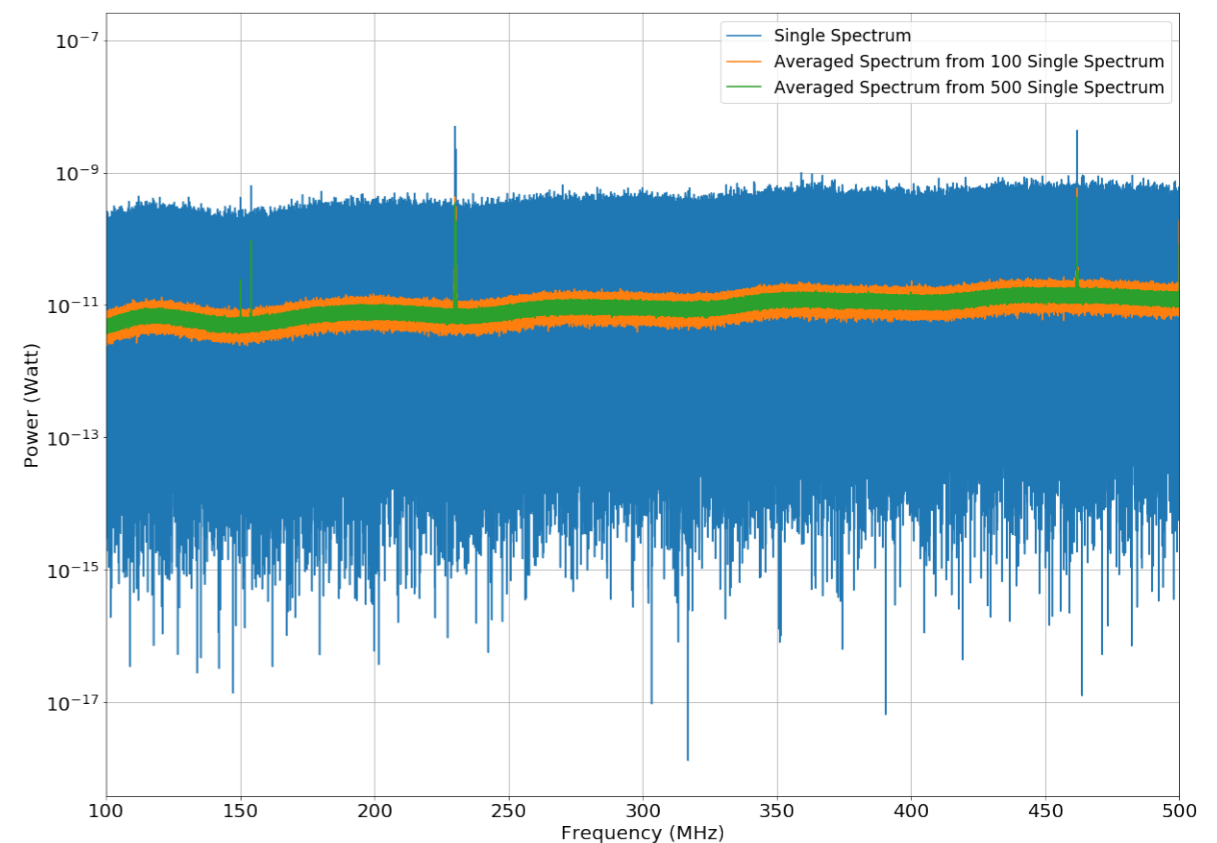
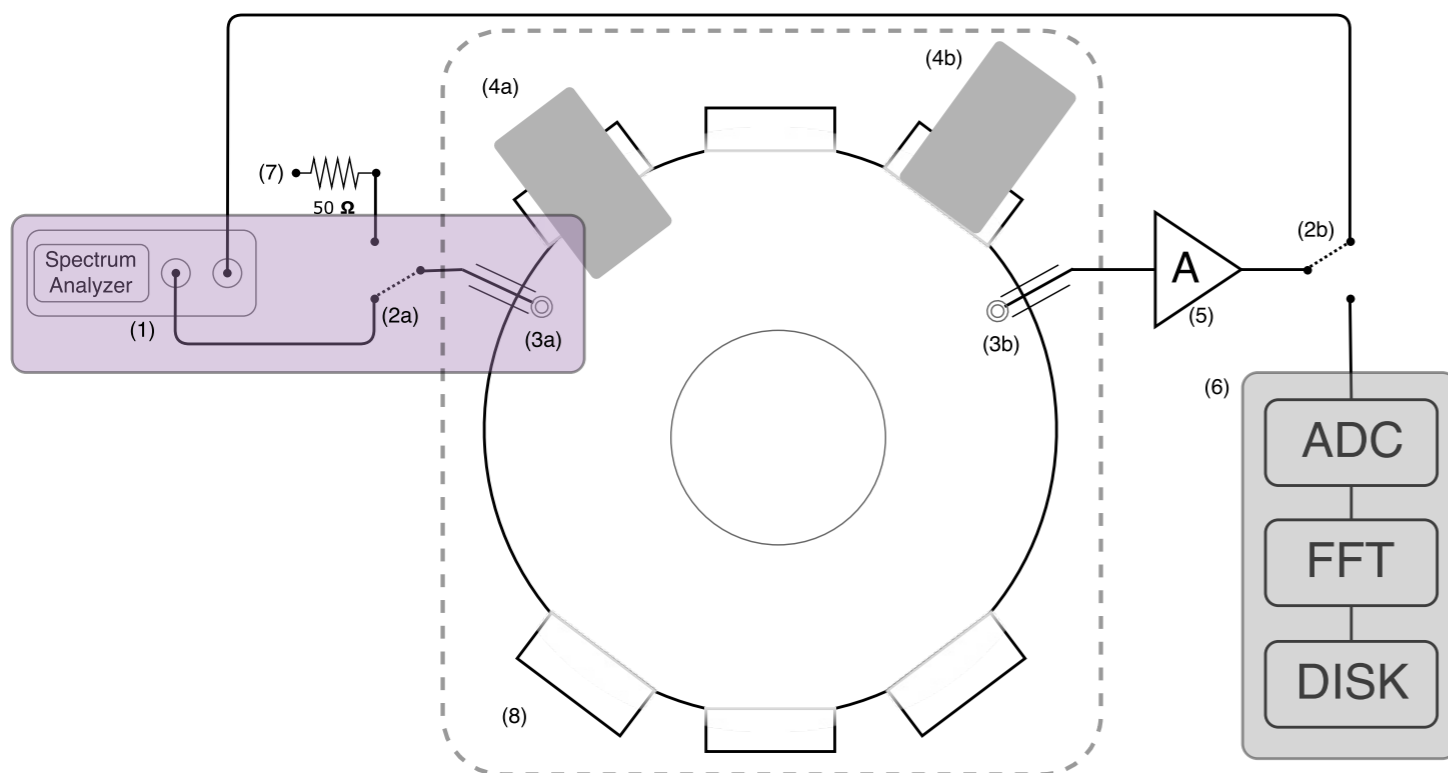


- Off-resonance region is still sensitive to HP dark matter.
- Broadband search cover a wide mass range (!)

$$m_{\gamma'} = \frac{f}{500 \text{ MHz}} 2.07 \mu\text{ev}$$

3. DEVELOPMENTS OF WISPDMMX

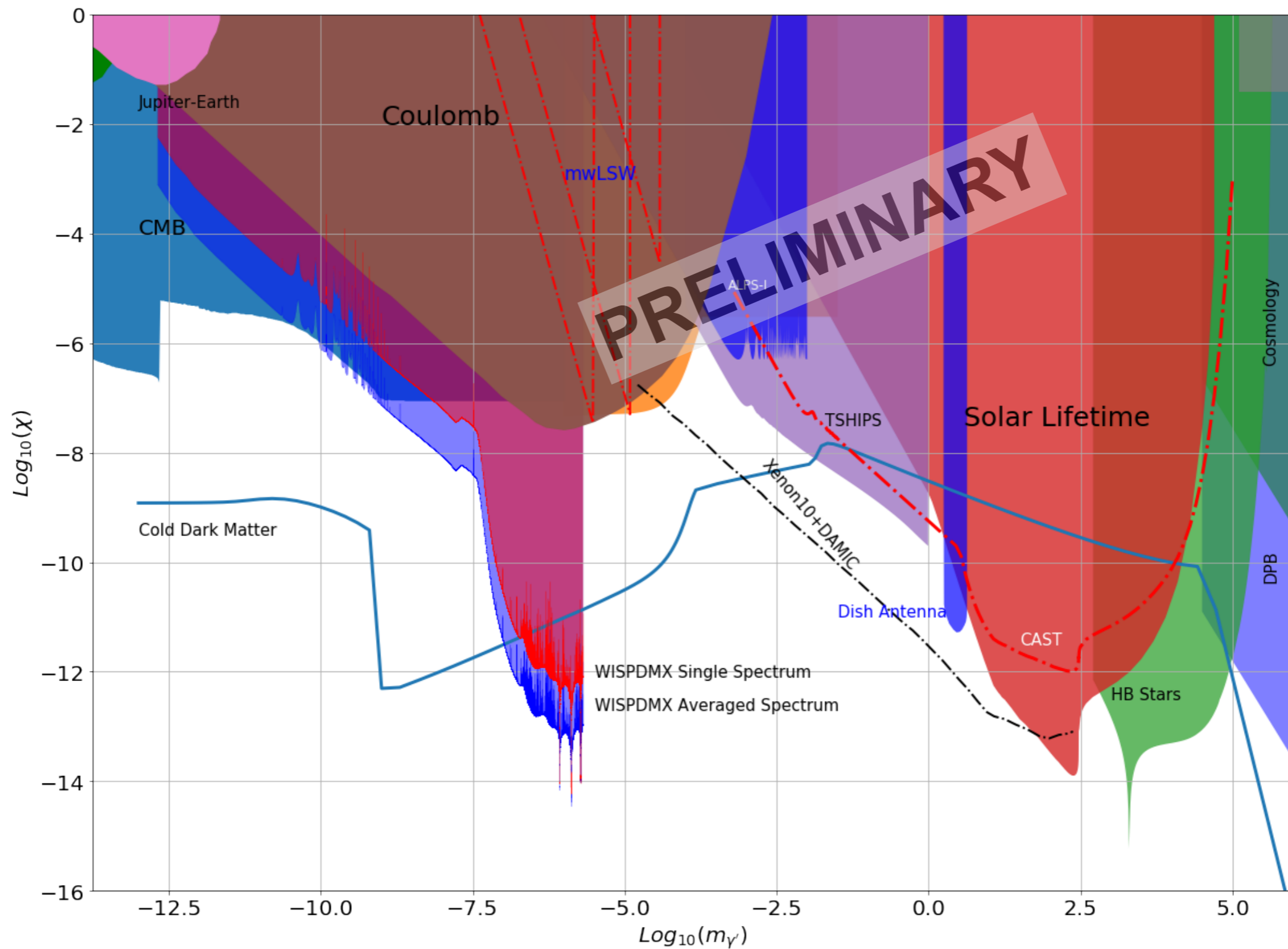
- A high-efficiency broadband acquisition covers 500 MHz at the resolution of 50 Hz.
- The fast frequency calibration tracks the resonance.
- The signal search over the high-resolution spectrum is supported by the study on light dark matter signal profile.



5. PRELIMINARY RESULT FROM THE FIRST SCIENCE RUN

- First Science Run: 23rd October 2017 to 2nd November 2017, 61.1 hours of data.
- Lowest detectable power is at the level of 10^{-18} Watt .
- Preliminary result: We found no signal which could emerge from the hidden photon dark matter in the 500 MHz broadband spectrum.

5. PRELIMINARY RESULT FROM THE FIRST SCIENCE RUN



Thanks you for attention.