

Development of spectrometer for WISP DM searches

デッドタイムフリーな暗黒物質探索用スペクトロメータdSpecの開発研究

Dark matter spectroscopy

- Cold axion / dark photon leaves spike at

$$\omega = m_{(a, \gamma')}$$

in spectrometer.

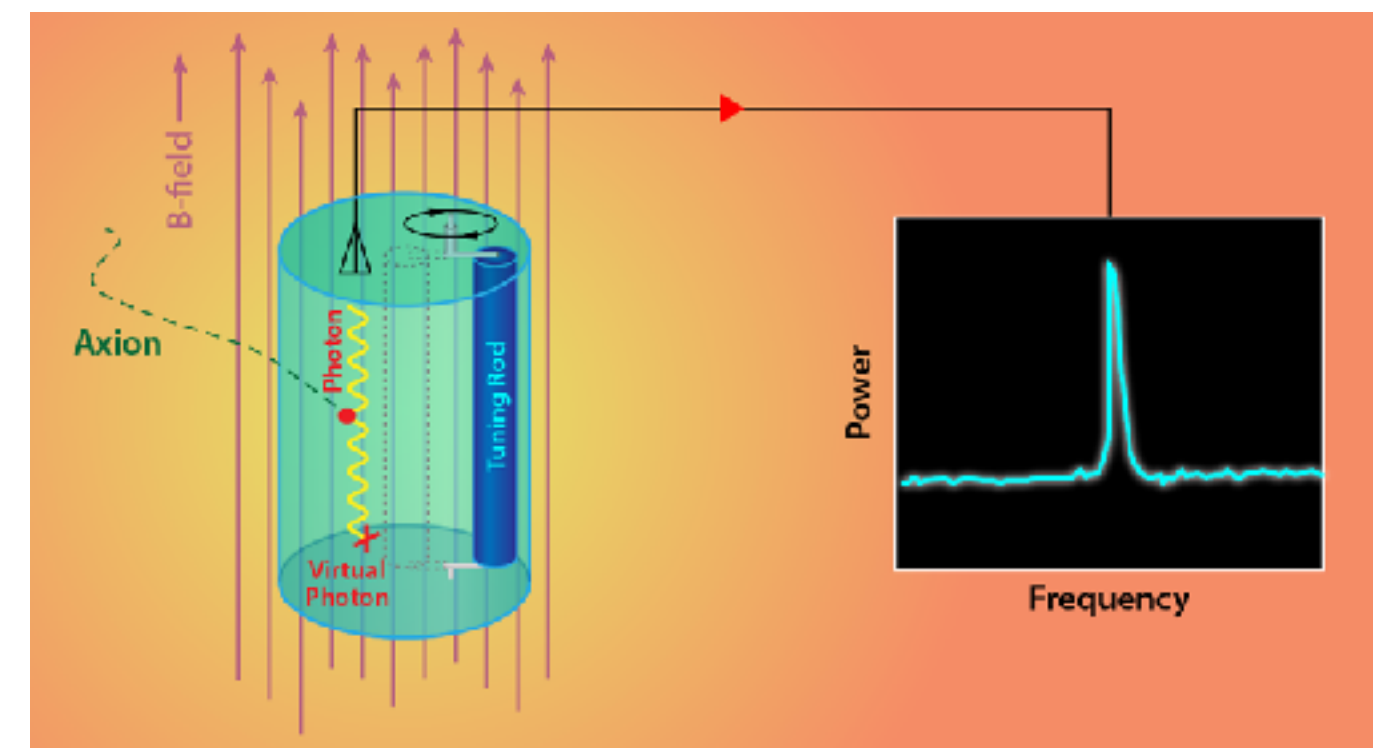
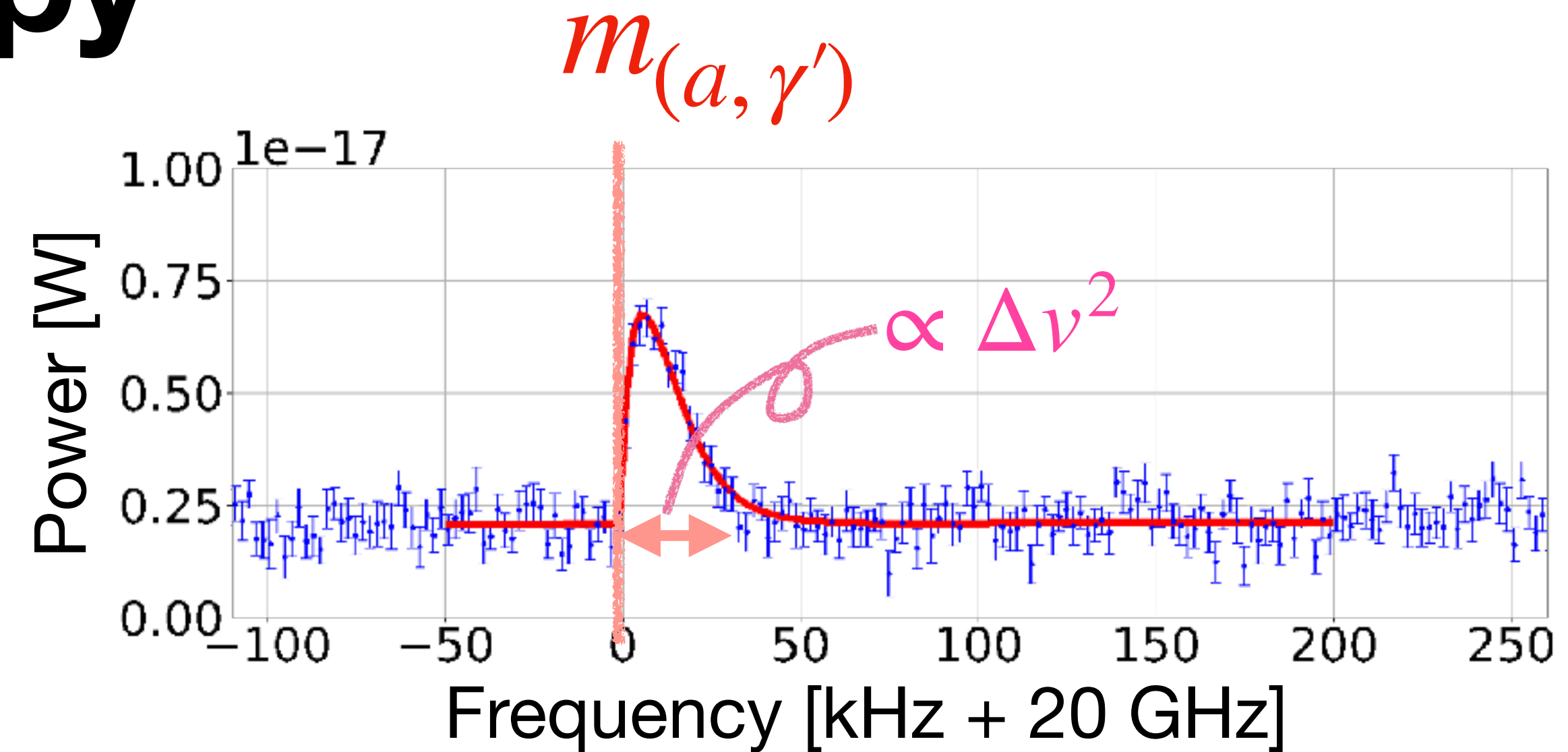
- Cavity experiment:

- High Q cavity
 \Leftrightarrow Narrow mass region coverage

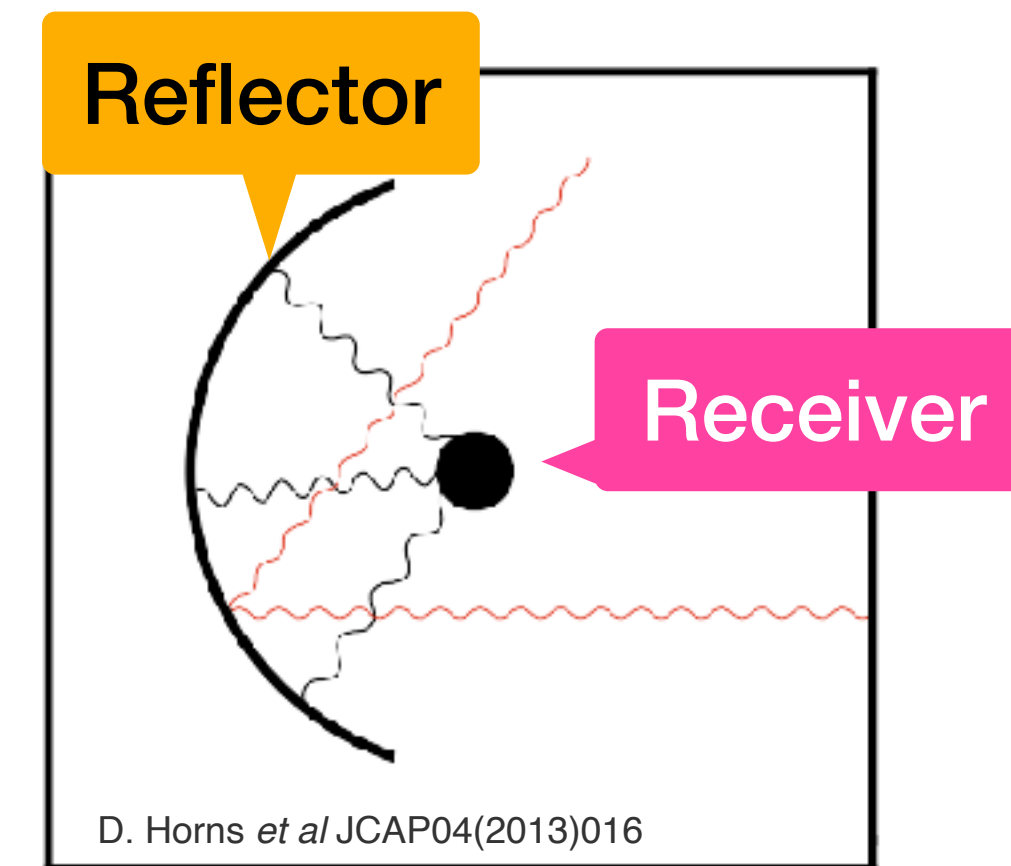
- Dish type search

- Wide search in principle

- Wide bandwidth spectrometer needed



C. Boutan/Pacific Northwest National Laboratory; adapted by APS/Alan Stonebraker



D. Horns et al JCAP04(2013)016

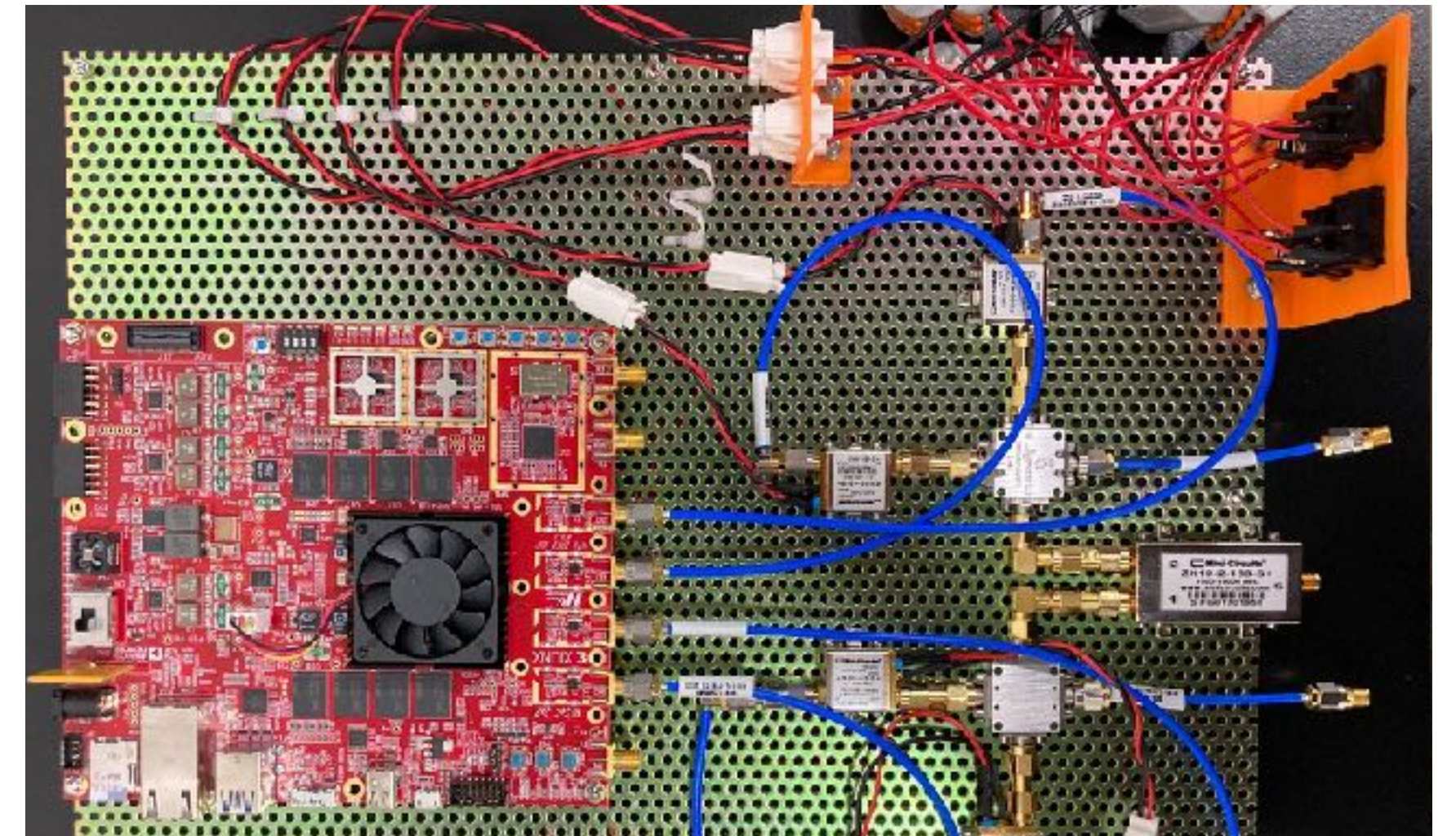
← **dSpec project**

Spectrum/signal analyzer

Commercially available SPA/SA



dSpec

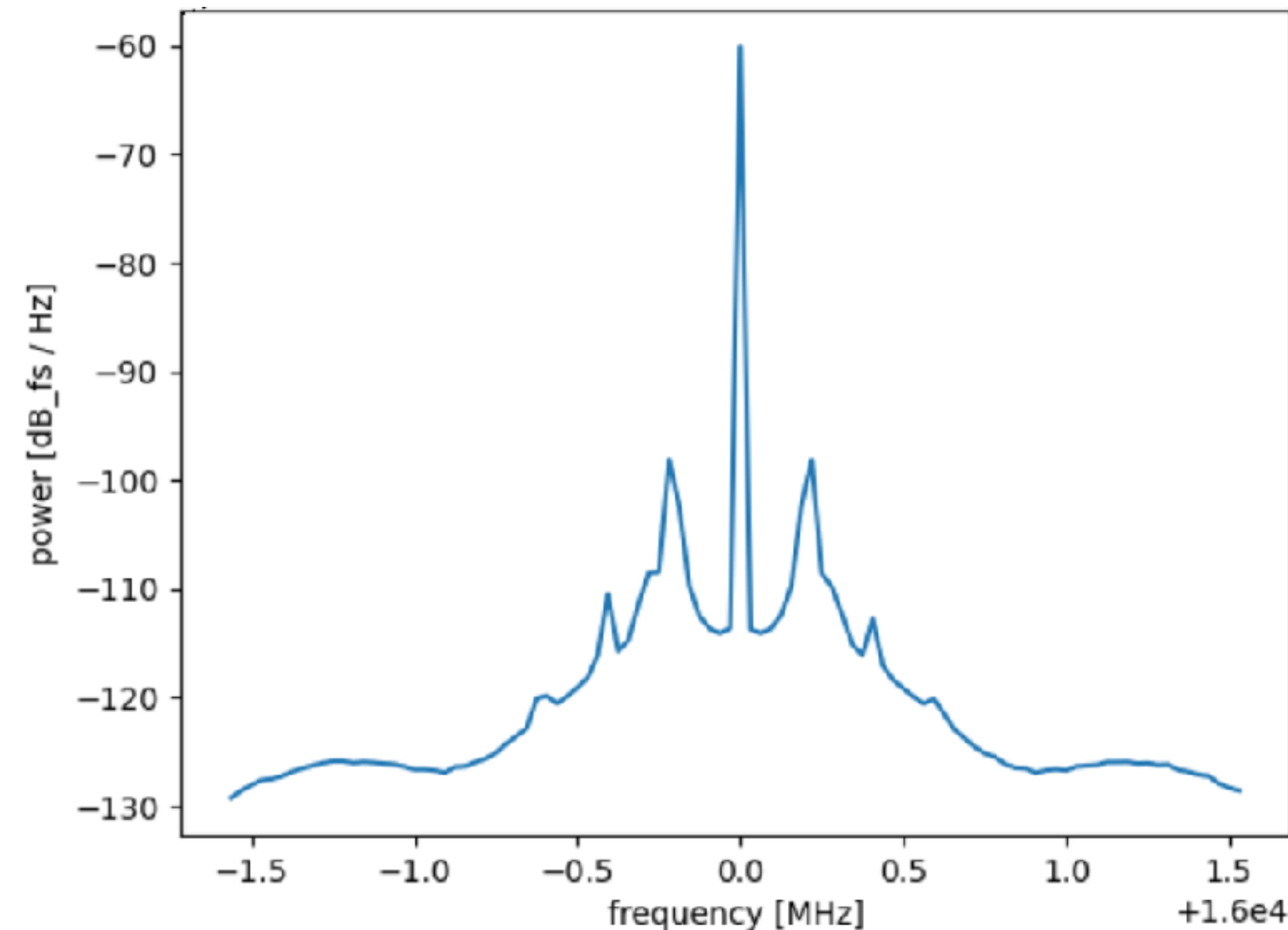
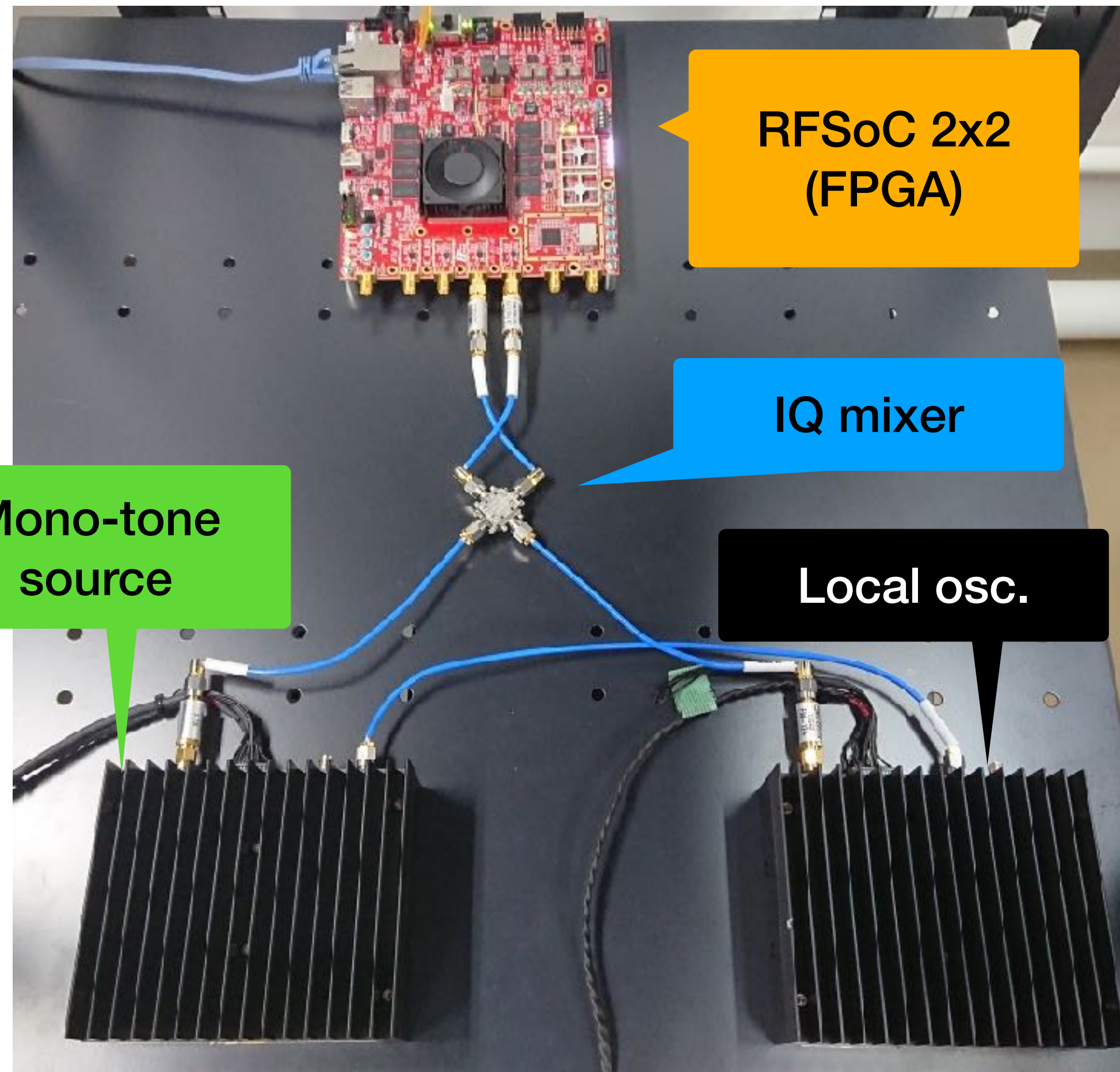


- **Narrow bandwidth, 99% overhead**
- Blackbox inside
- Incredibly expensive
- **GHz bandwidth, dead-time free**
- Open source
- ~ 300 k JPY (digitizer)

Implementation

Band width	4 GHz
FFT length	2^{17}

- Utilization of **RFSoc** (SoC w/ RF ADC)
- Pipelined Fourier transformation



Test setup w/ mono-tone source.

Result of pipelined FFT on RFSoc agrees with expectation 👍

Next to do / Future prospect



dSpec
system

Liquid Nitrogen
(77 K source)

- Final test with noise source ongoing
- Preparing for publication
- Codes / firmware will be publicly available soon!
- Almost all work owing to

Please visit
JPS 24pT3
for my talk!

M1 Hiroki
Takeuchi

