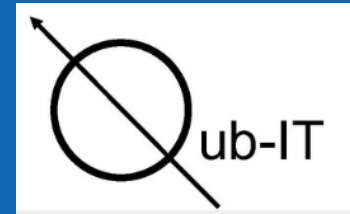


Qub-IT meeting – May 2024



# JPA @ FBK

Characterization of  
a Josephson  
Parametric  
Amplifier fabricated  
at FBK



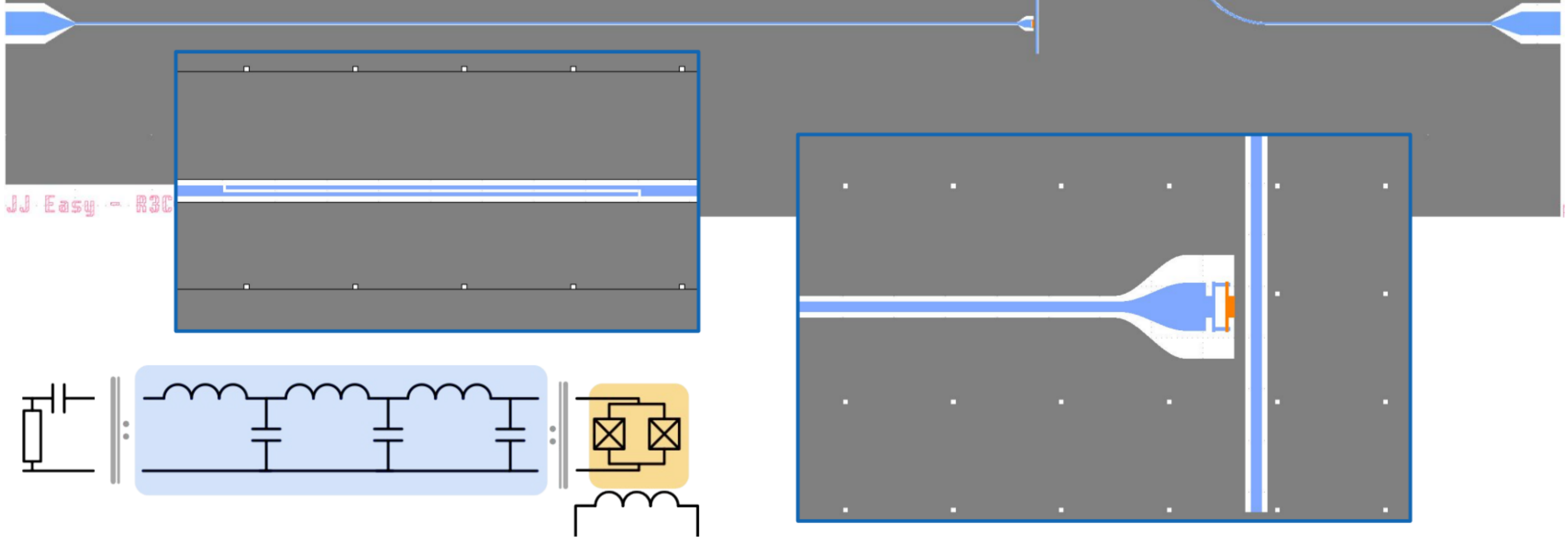
Grant PE0000023

A. Irace, F. Ahrens, N. Crescini, P. Falferi, A. Giachero, B. Margesin,  
R. Mezzena, A. Nucciotti, A. Vinante, F. Mantegazzini



# Design

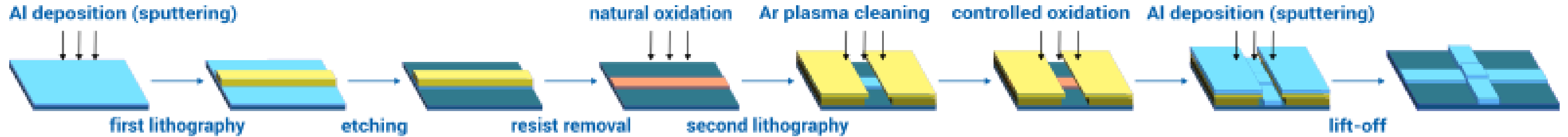
IPB v0.3  
Ln 4800  
JJ 3x3  
SQUID 10x10



More designs are ready and will be tested in the future



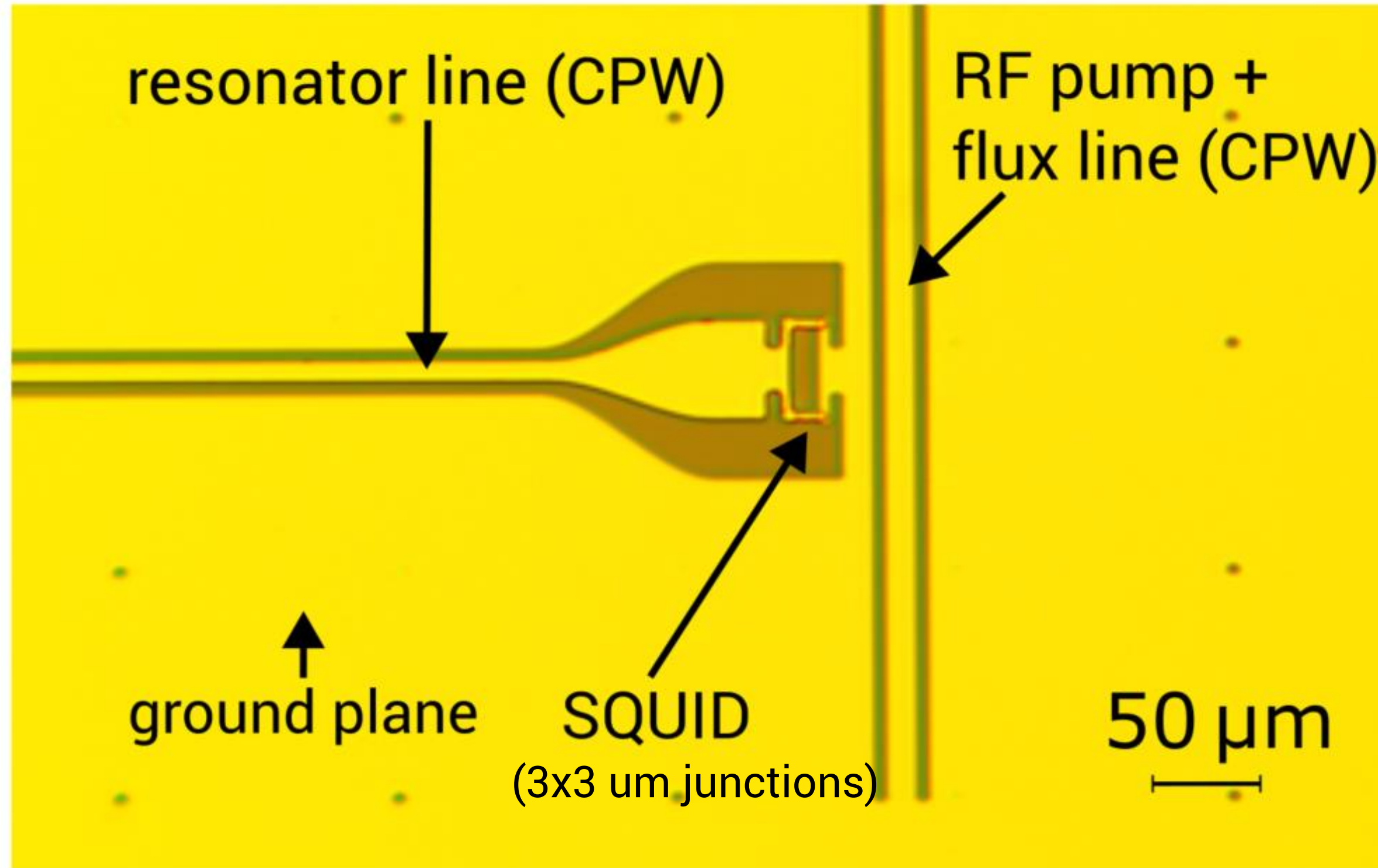
# Microfabrication



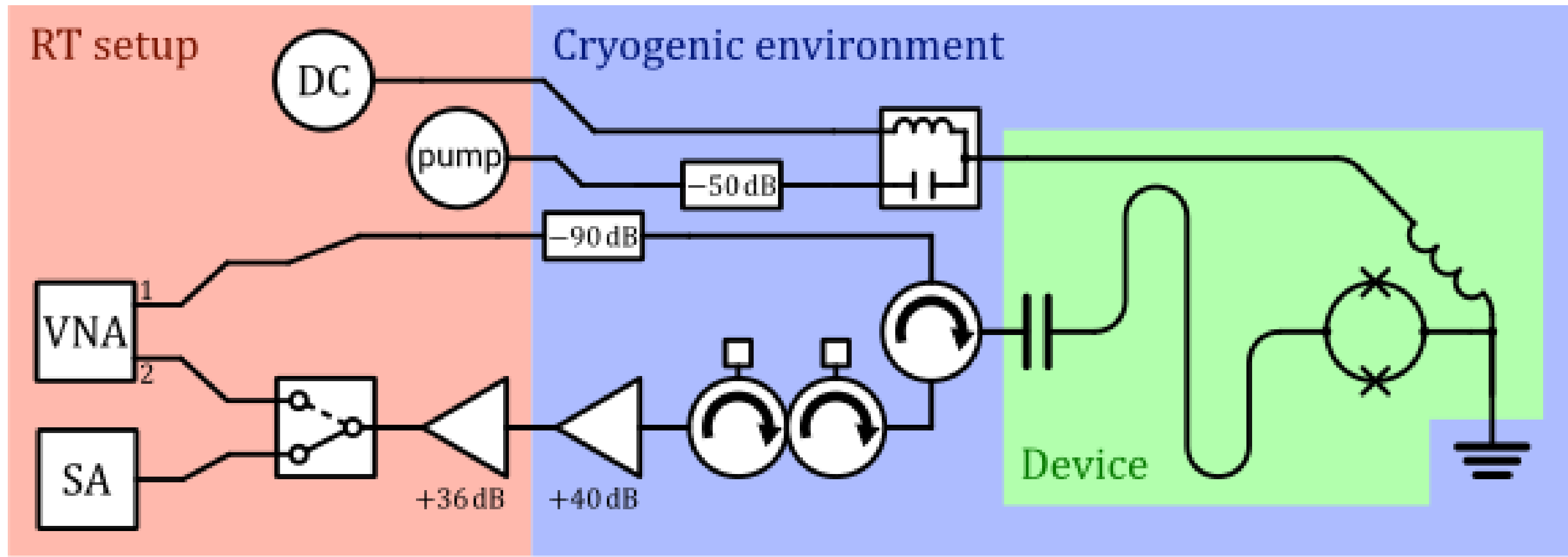
- |                  |                   |
|------------------|-------------------|
| ■ Silicon        | ■ Photoresist     |
| ■ Aluminum       | ■ Lift-off resist |
| ■ Aluminum Oxide |                   |

- Optical lithography  
*UV light mask aligner*
- Sputtering  
*DC Magnetron @ RT*
- Etching  
*Al-selective acids bath*
- Lift-off  
*Lift-off resist-selective solvent bath*

## Device picture

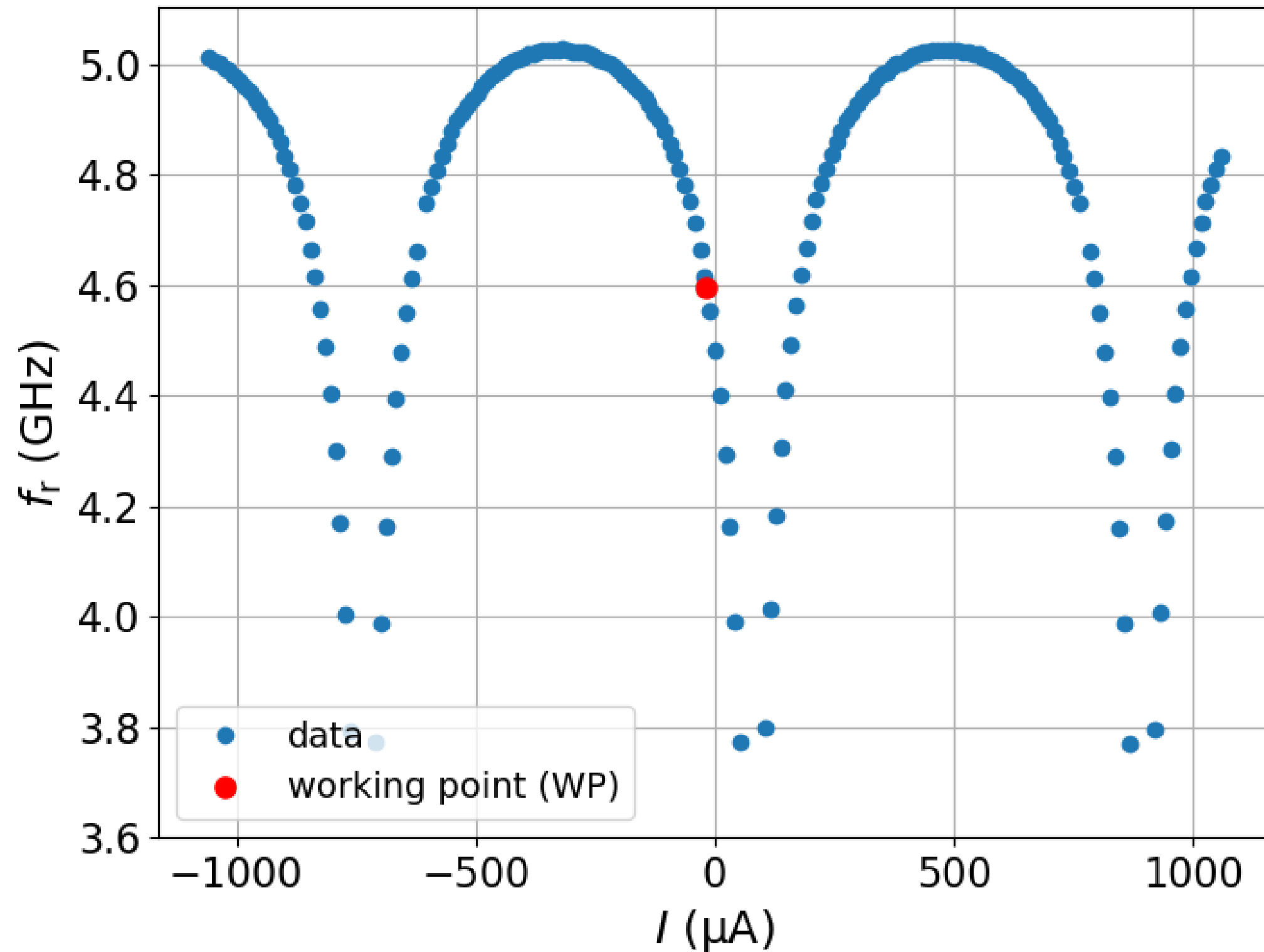


# Measurements - Setup

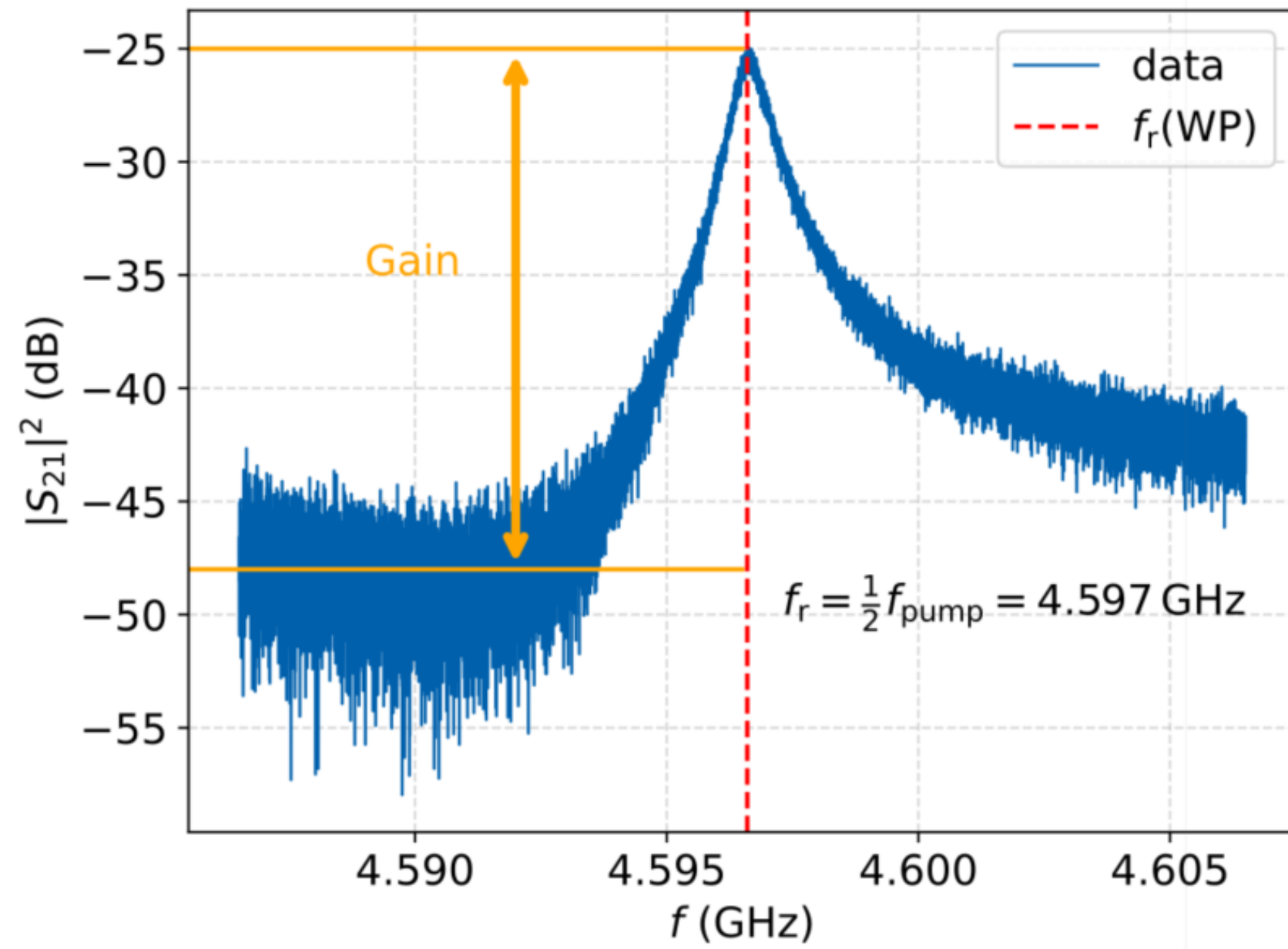


# Measurements - Characterization

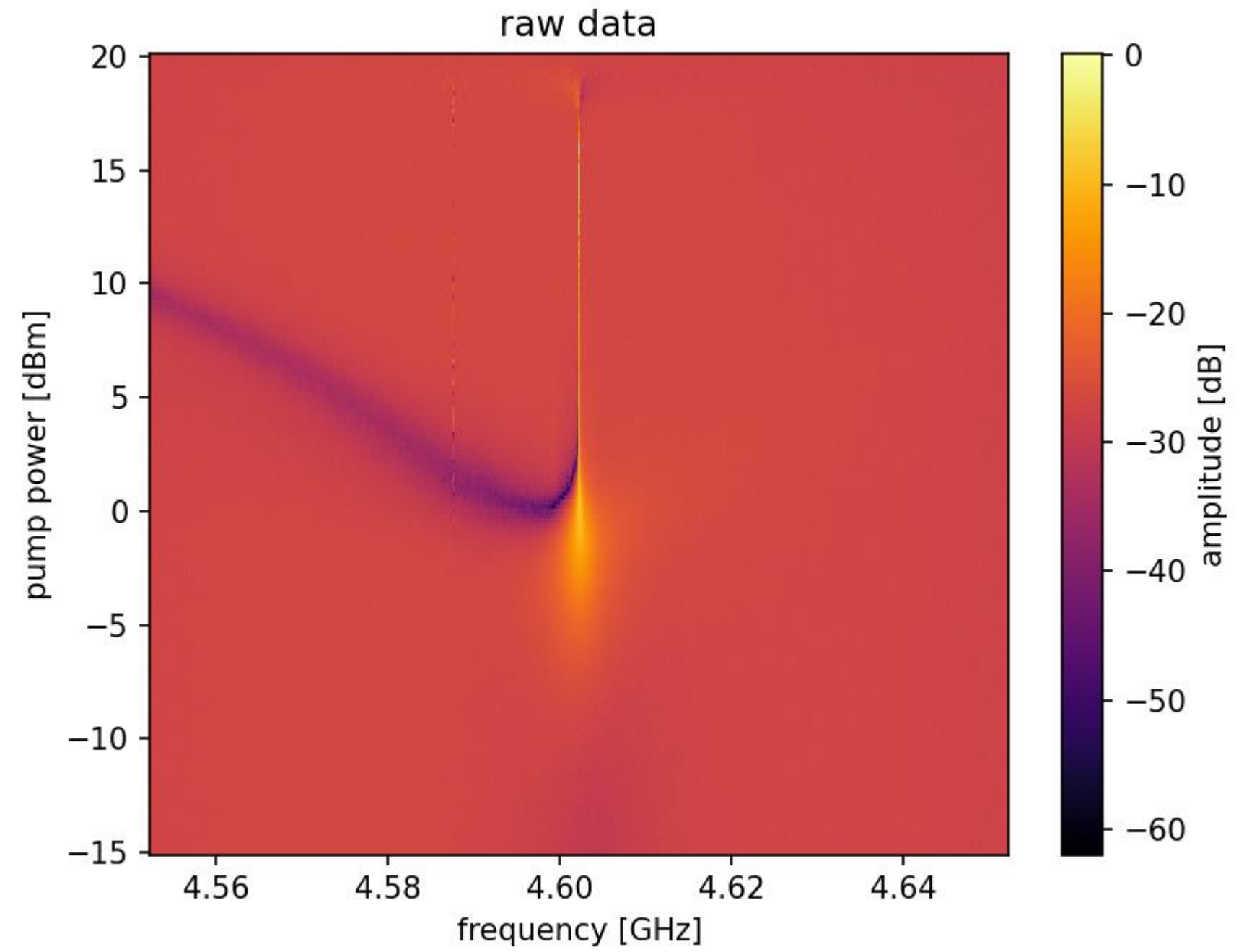
Frequency modulation Vs. bias current in the flux line



VNA trace



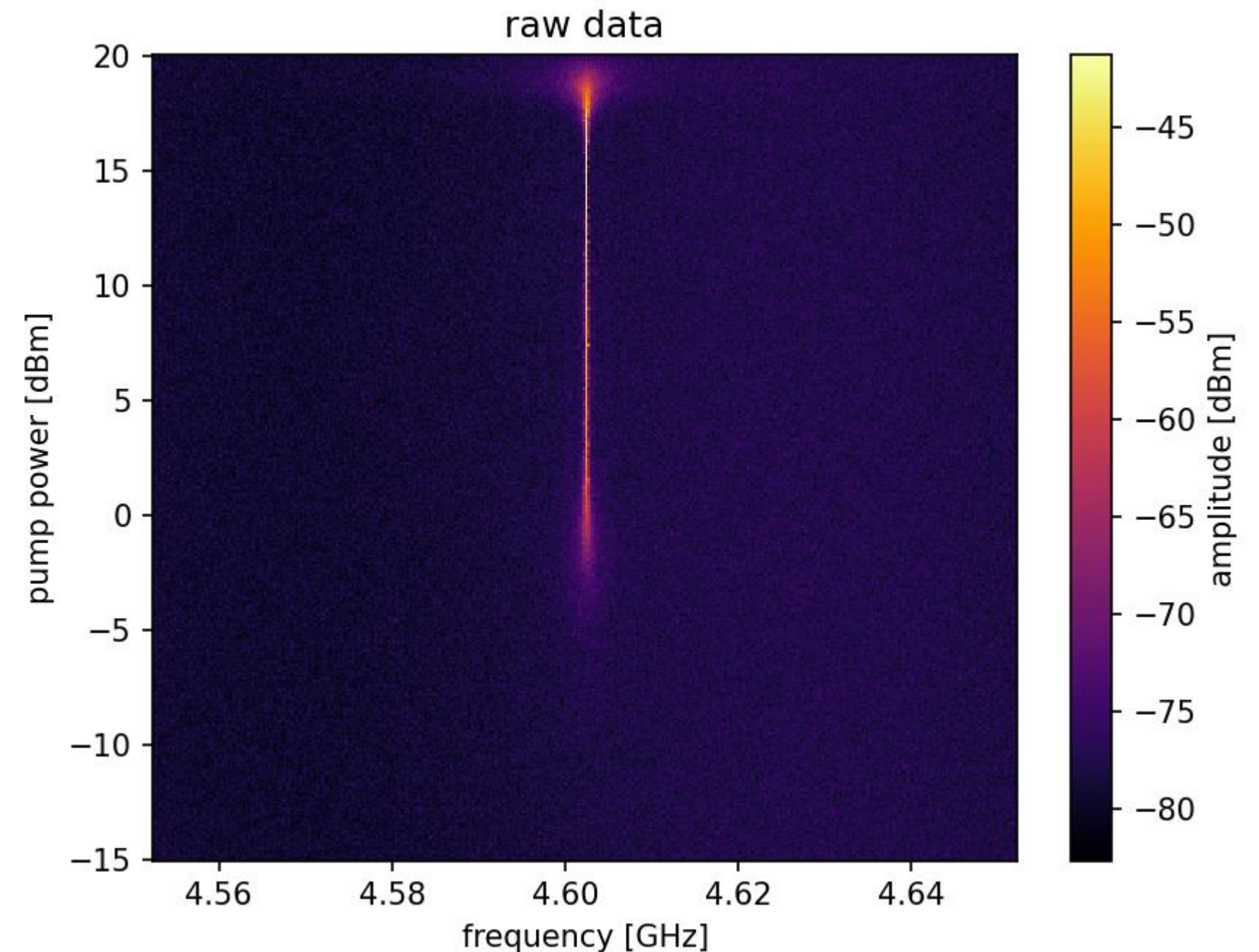
VNA pump power sweep – fixed pump frequency



# Measurements - Characterization

By assuming a noise temperature of 2 K for the HEMT and an attenuation of 1 dB for the line between the JPA and the HEMT we can estimate a noise temperature for the JPA at 790 mK corresponding to about 3 quanta

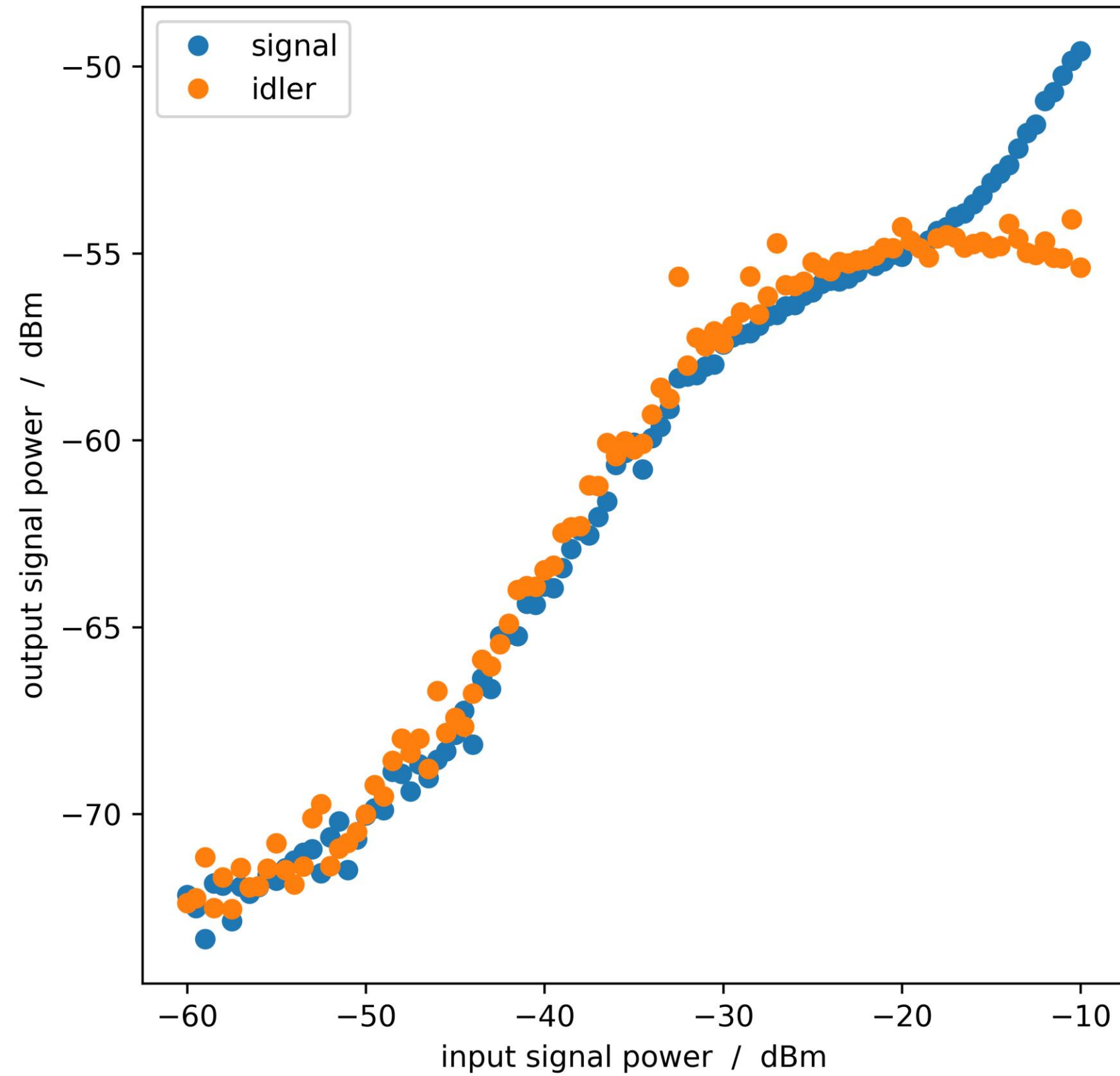
Spectrum Analyzer pump power sweep – fixed pump frequency





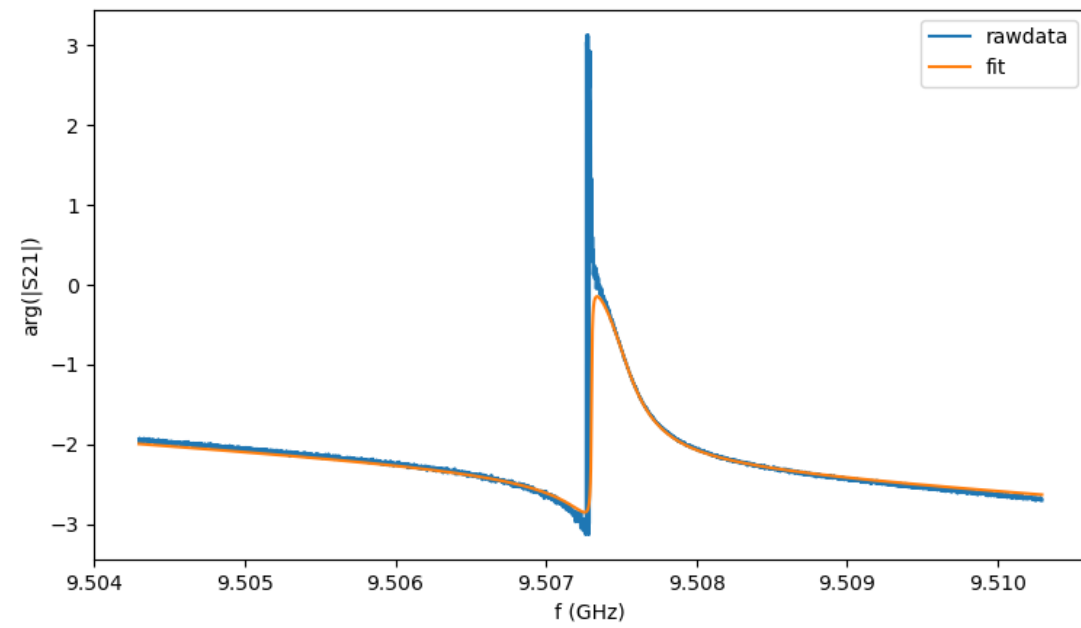
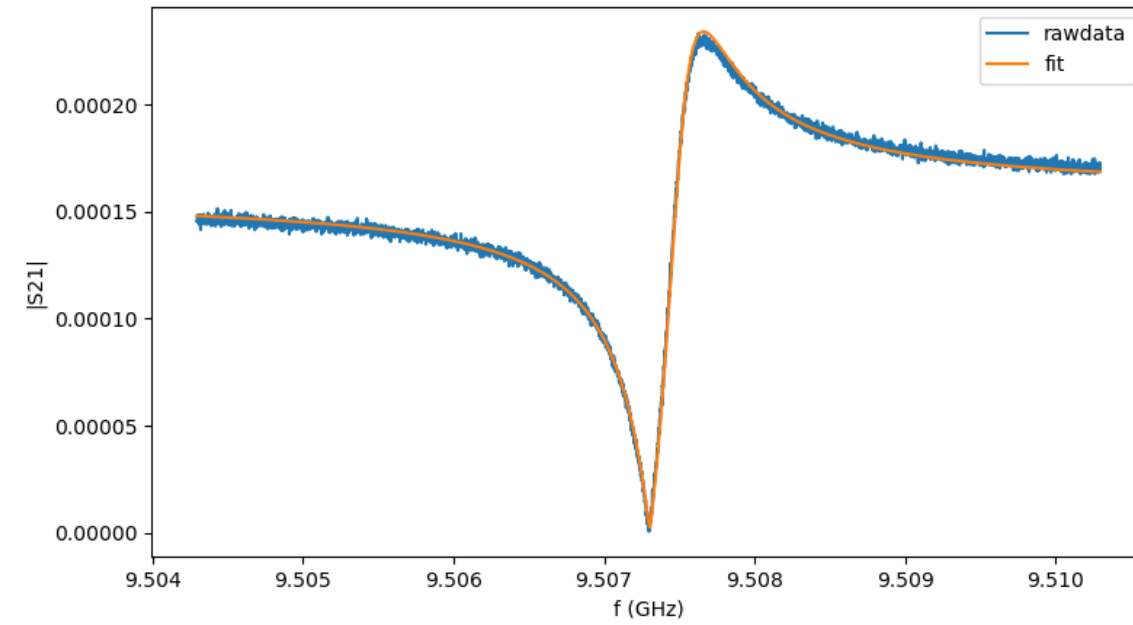
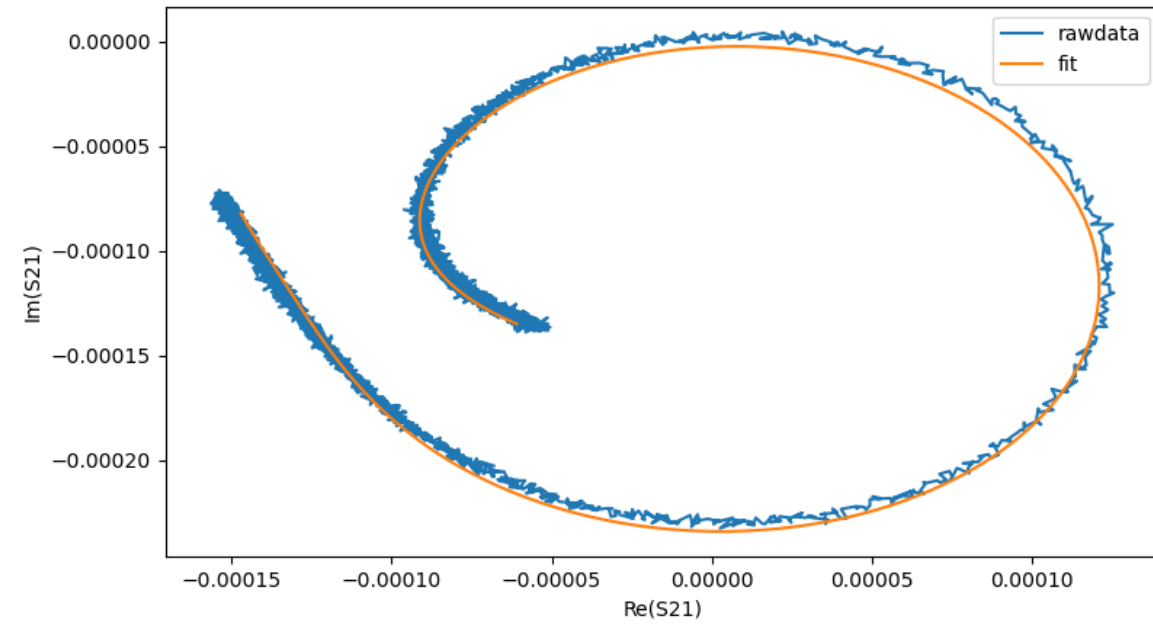
# Measurements – Characterization

1 dB compression point – input at -135dBm at the device level





# Resonators



$Q_i = 1$  million...

Other design tests soon