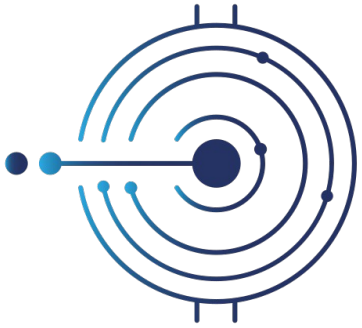


DARTWARS

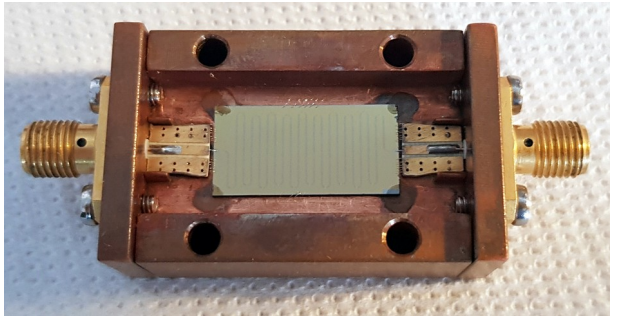
Detector Array Readout with Traveling Wave AmplifieRS

Gain and Noise measurement of short KIT-TWPA prototype

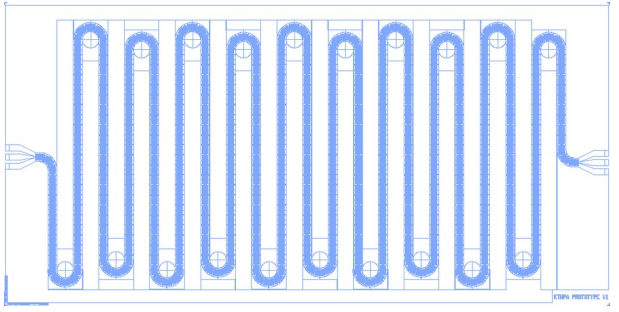
Renato Mezzena & Andrea Vinante - KI-TWPA Mi–Tn Meeting - Jun 15, 2023

CONTENTS

- Measurement Set-up
- Transfer function
- Gain measurements and tuning in 3 wave mixing
- Noise measurements and analysis

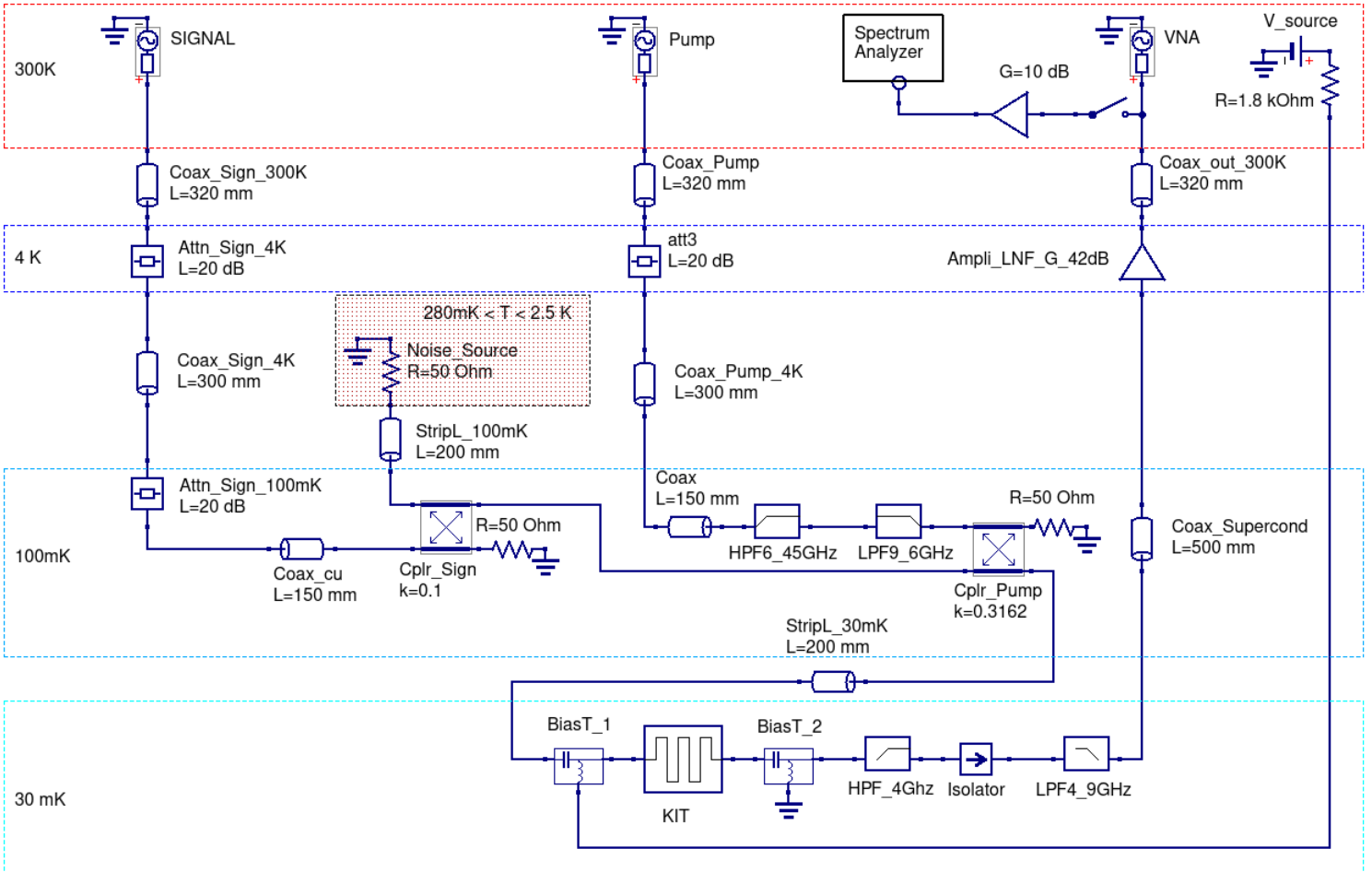


KIT FBK Run Fab. DWD2 – Wafer 2- Chip1

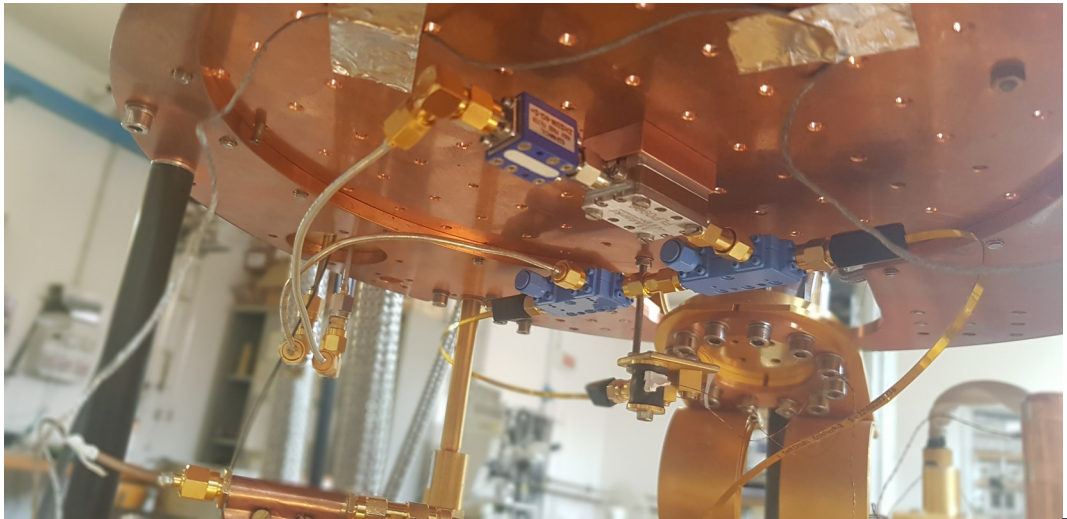


Fish-bone transmission line length = 17.5 cm
Cell number = 523

MEASUREMENT SET-UP

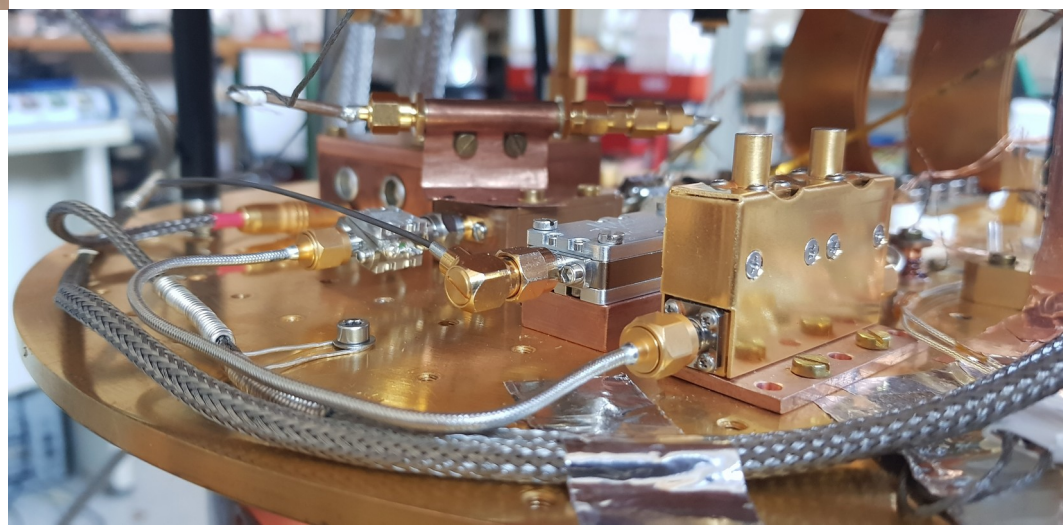


FRIDGE SET-UP

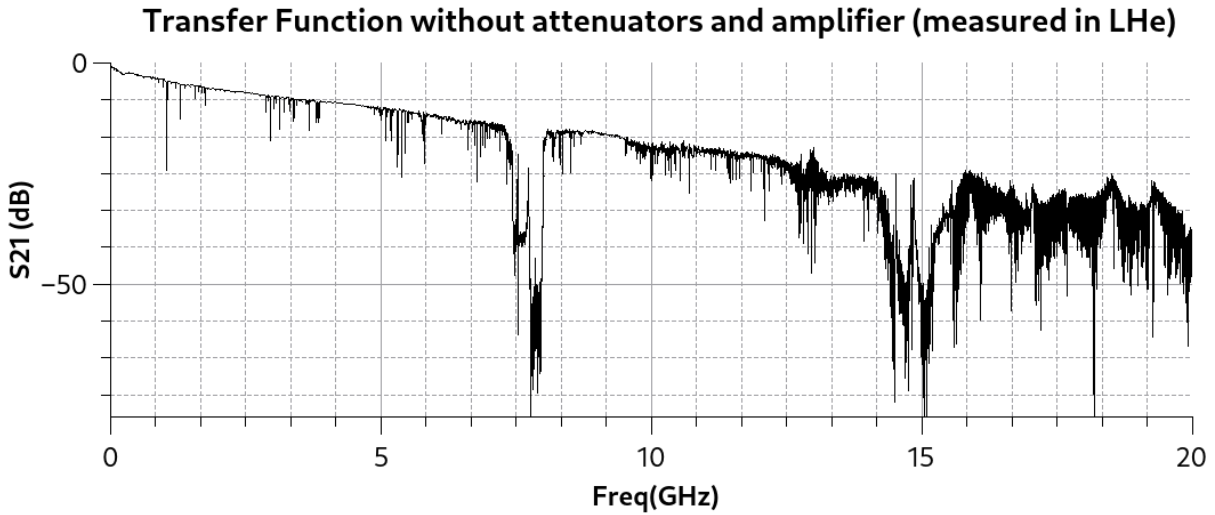


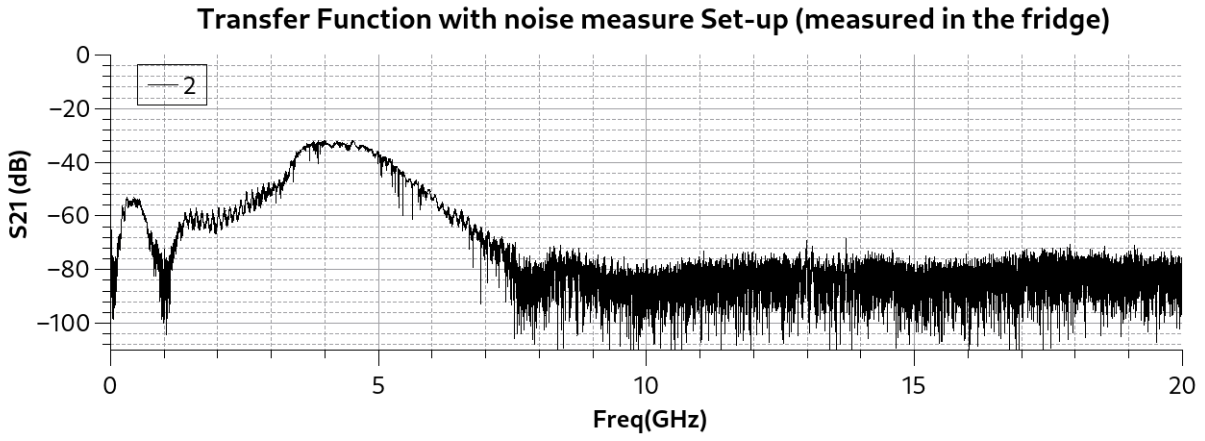
Cold Plate

Mixing Chamber



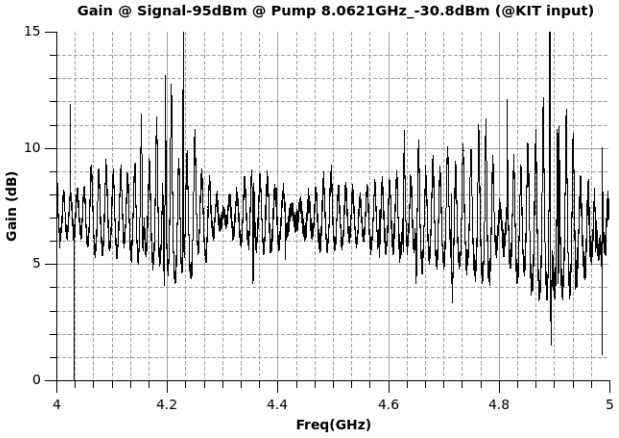
Transfer Function

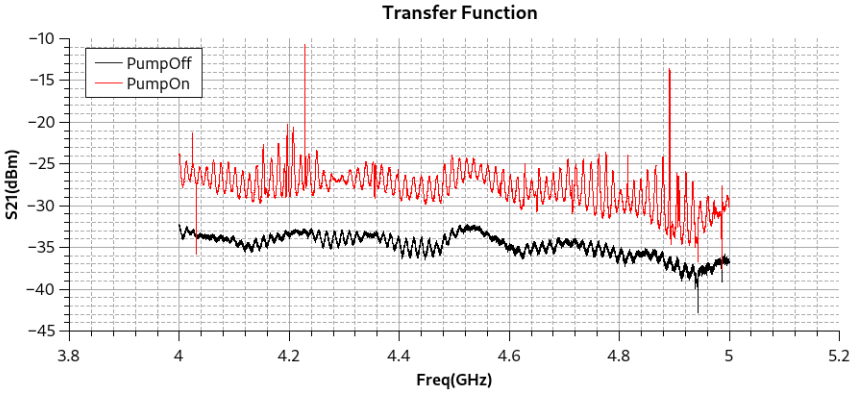




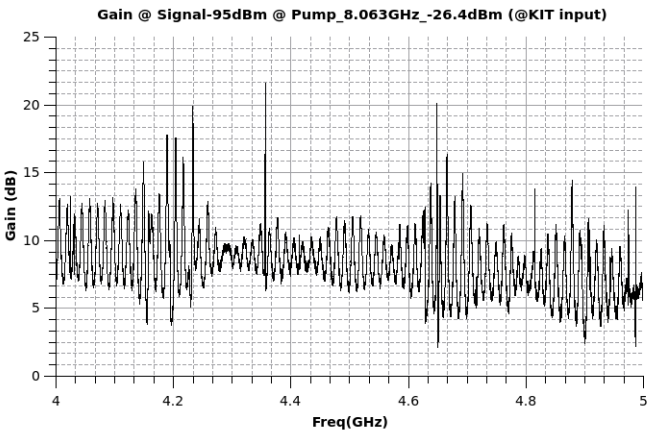
KIT GAIN

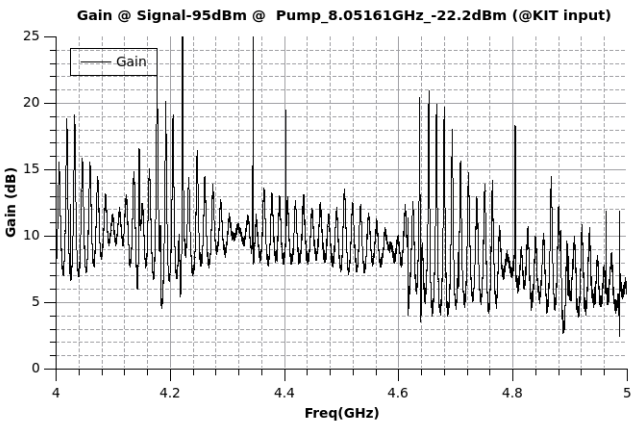
I_{dc}=1.2mA





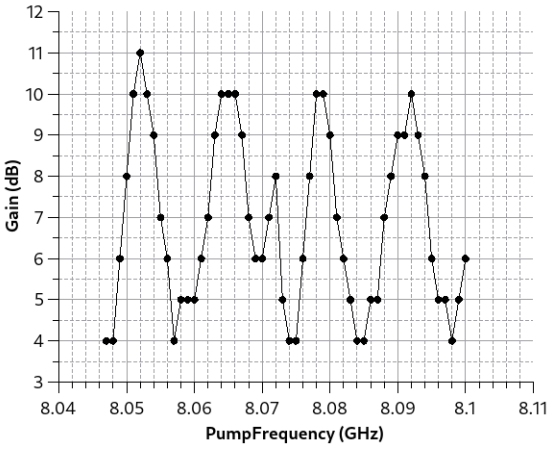
I_{dc}=1 mA

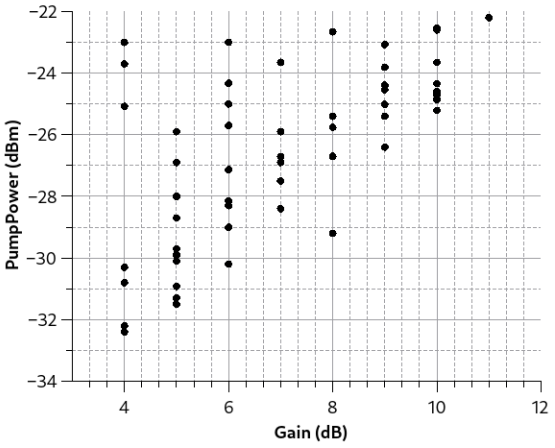


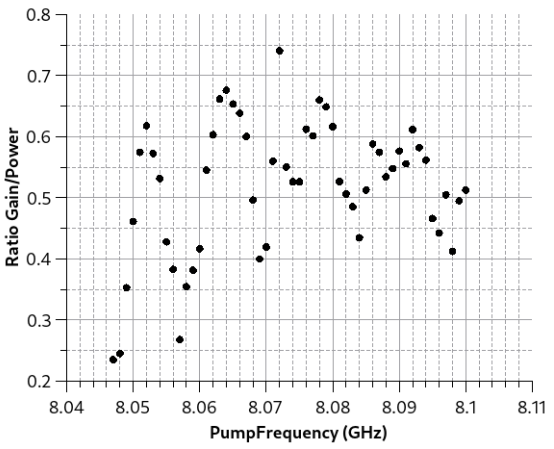


Gain Tuning

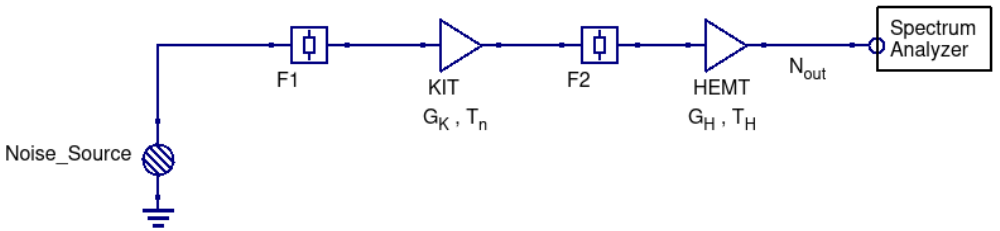
I_{dc} = 1mA







Noise Analysis



$$N_{out} = G_H T_H + (G_K F_2 G_H) T_n + F_1 F_2 G_H (G_k + G_K - 1) T$$

A

Signal

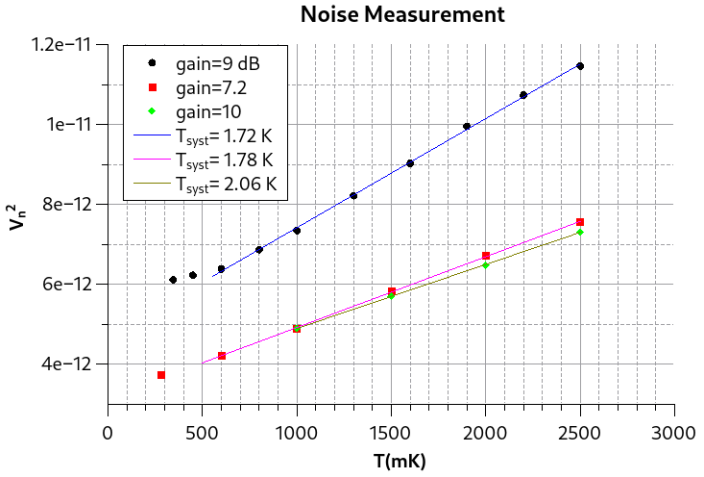
Idler

B

$$N_{out} = A + BT$$

$$\frac{A}{B} = \frac{G_H T_H + (G_K F_2 G_H) T_n}{F_1 F_2 G_H (2G_k - 1)} = T_{system}$$

$$T_n = \frac{A}{B} \frac{(2G_k - 1)}{G_K} F_1 - \frac{1}{G_K F_2} T_H$$



F_1	F_2	T_H	G_H
-4.6dB	-2.7dB	1.8K	42dB

G_k (dB)	7.2	9	10
A/B (K)	1.78	1.72	2.06
T_n (K)	0.5	0.7	1.0
N_q	2.5	3.4	4.9

hν @4GHz → ≒ 200 mK