Teststand data

General measurement information

Setup name	tes01
period	7
run	1-10
Location	UTokyo, building 9, room 9-210
Date of measurement (yyyy-mm-dd)	2025-07-02~13
Operators	Ryutaro Matsumoto, Dr.Yuki Mitsuya
Goal of measurement	Readout of TES both timing and PNR Signal at O(1) level photons w/ hybrid setup. w/ 1 amp in the Fridge. w/ large data for averaging (timing signal)

Experimental setup description

Used 100mK for TES. HBT amp **CMTLF1S** was set in 3K chamber and touched tight to the Cu for thermal release.
Long Ni-Ti cabling deployed between TES and HBT amps, also tightly fixed on the 3K stage with Cu boards.
Wave length of the light source was 1547nm and 1310nm.
With Variable Optical Attenuator, ranging from 0dB to -45dB, number of photons was controlled.
For better PNR and speed of reaction, new TES(12nm thickness) was introduced by Nagahara-san.
2nd stage amp was ejected for better PNR (contamination from amp to SQUID signal (**need to confirm**) For now, 2nd amp was not deployed, but in the near future, we are trying to put it in the housing of LN(77K) outside of the ADR for better Nt and gain.

TES detector

Type	Ir TES 12nm thickness (from Daizo Nagahara)
Name	NA
Size	10μm square
Bias Current(Ib)	Various Values
FLL Resistance(Rf)	100kΩ
GBW	0.55–0.23GHz

SQUID

Name	F39 A
Ib	10.364μA
Vb	173.03μV

Phib	16.48μA

Electronics

Name	Vd(V)	Id(A)	datasheet Gain(Roomtemp)	Band Width
CMTLF1S	3.0	0.01	20 dB(@1GHz)	1MHz–10GHz
Room temp amp	15.0	0.128	40dB	1kHz–2GHz

DAQ

Oscilloscope LECROYHDO6104B. detail data is in: ./../hardware/scope/p07

Runs

First, we conducted IV curve measurement at 100mK for this TES.
All runs in this period are taken with voltage signal from **TES(w/ SQUID)** amplified by the **CMTLF1S + AE-ADL** SiGe HBTs (same as p02) and **NAMEOFAMP**(3rd Amp at room temperture). Swept OAT value.

runs	Target	waveforms	Tb	Ib(TES)	WL	OAT	Amps	Format	Short description
r001	Timing	10,000	150mK	70μA	1547nm	45dB	ON	20μs/50ps	data not found
r002	Timing	10,000	150mK	70μA	1547nm	45dB	ON	20μs/50ps	O(1) level photon for timing, delay was 175ns from the trigger
r003	Timing	5,000	150mK	70μA	1547nm	35dB	ON	20μs/50ps	O(5) level signal for timing reference
r004	Timing	5,000	150mK	70μA	1547nm	--dB	ON	20μs/50ps	Noise measurement for timing
r005	PNR	3,000	150mK	70μA	1547nm	--dB	ON	20μs/20ns	Noise for PNR
r006	PNR	10,000	150mK	70μA	1547nm	45dB	ON	20μs/20ns	O(1) level PNR
r007	PNR	10,000	150mK	70μA	1547nm	35dB	ON	20μs/20ns	O(5) level PNR reference

r008	PNR	10,000	175mK	40μA ?	1547nm	45dB	ON	20μs/20ns	O(1) level PNR, in search for better PNR
r009	PNR	3,000	175mK	40μA ?	1547nm	--dB	ON	20μs/20ns	Noise for PNR
r010	PNR	10,000 ?	200mK	45μA	1310nm	40dB	ON	20μs/4ns	O(1) level PNR, in search for better PNR
r011	PNR	10,000 ?	200mK	37.6μA	1310nm	40dB	ON	20μs/4ns	O(1) level PNR, in search for better PNR
r012	PNR	10,000 ?	200mK	37.6μA	1310nm	37.5dB	ON	20μs/4ns	O(5)? level PNR, in search for better PNR
r013	PNR	5,000	200mK	37.6μA	1310nm	--dB	ON	20μs/4ns	Noise for PNR
r014	Timing	30,000	200mK	37.6μA	1310nm	37.5dB	ON	20μs/50ps	Timing data @ same condition
r015	PNR	15,000	260mK	55μA	1310nm	40dB	ON	20μs/5ns	O(2)? level PNR, in search for better PNR
r016	PNR	3,000	260mK	55μA	1310nm	--dB	ON	20μs/5ns	Noise for PNR
r017	PNR	10,000	300mK	35.9μA	1310nm	40dB	ON	20μs/20ns	O(2) level PNR, Operated by Dr.Mitsuya
r018	PNR	3,000	300mK	35.9μA	1310nm	40dB	ON	20μs/20ns	Noise for PNR, Operated by Dr.Mitsuya
r019	PNR	10,000	300mK	35.9μA	1310nm	40dB	ON	20μs/20ns	O(2) level PNR, Operated by Matsumoto, confirmation exp

r020	PNR	3,000	300mK	35.9µA	1310nm	40dB	ON	20µs/20ns	Noise for PNR, Operated by Matsumoto, confirmation exp
r021	Timing	6,000	300mK	35.9µA	1310nm	40dB	ON	20µs/50ps	Timing for condition above. Relatively small data point
r022	Timing	30,000	300mK	35.9µA	1310nm	40dB	ON	20µs/50ps	Timing for condition above.
r023	Timing	30,000	300mK	35.9µA	1310nm	32.5dB	ON	20µs/50ps	Reference data w/ O(10) level photons

Remarks and comments

After struggling with 300kHz noise, we concluded that was coming from outside of the room, apparently magnetic noise. So we added a Pb (super conducting material) shield around TES and SQUID, cooled down to 100mK, but we couldn't properly keep down to 100mK. We suggested it was because of Pb shield superconductivity, even it was covered with Cu tape. At 293K and 3K, 300kHz noise was not observed.
After this failure, we conducted this measurement just to clarify the insufficient cool down was because of Pb shield or the fridge. During this using the original cupper housing for TES, the stage was cooled down properly, so we concluded the Pb shield was the cause. We assumed without the magnetic shield 300kHz noise would be visible again, but it didn't appear. It seemed like a temporary noise from other experiment in the building.
With new TES and w/o magnet shielding, we got timing data properly, and went for PNR check. Then with contamination from SiGe amplifier, SQUID signal was poor at PNR. So, we searched a num of configs and found 300mK(close to Tc) and relatively low TES bias(35µA) was◊ suitable. This is because Ib vibration and thermal loss from TES to the bath were supressed we guess.

However with TES(24nm thickness) and without 2nd amp, gain had been insufficient for O(1) photons level, this time with TES(12ns thickness), we got timing signal with 2.4 photons just with SiGe amp in 3K stage.