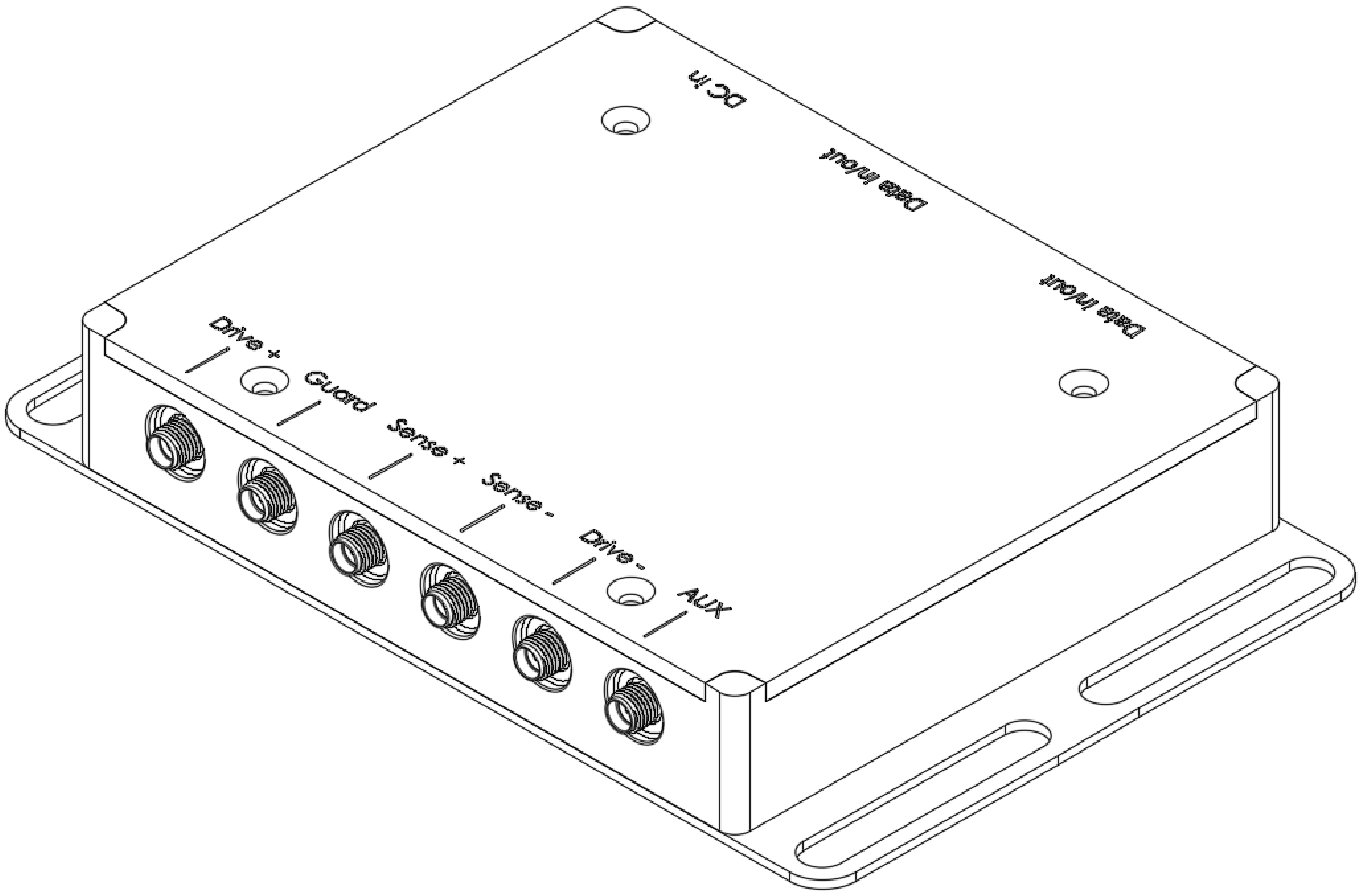
Strix

Source Measure Unit

Alshain Strix model 1 datasheet



alshain

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Made in Finland, EU

Introductions

Alshain Strix is a source-measure unit (SMU) designed & optimised for real world use-cases. A SMU is a truly general purpose DC-measurement instrument as it can both source current and voltage and measure them at the same time. Strix and most other SMUs are designed to work in a fully automated setups and therefore are suitable for testing and quality control of semiconductors and other devices at scale.

Primary design goal for Strix is resource efficiency: compact physical size to reduce lab space requirements, cost efficient performance and ease of use and integration. As these instruments are often used in (semi)automated setups and performing complex measurements, Strix is engineered to have as clear and concise programming interface as possible without imposing any artificial restrictions. And in order to provide flexibility and scaling, Strix units are designed to be daisy-chained together when more channels or capacity is needed.

In addition to daisy-chaining, Strix units have an auxiliary voltage input (±2.5 V) that enables real time monitoring of temperature, laser power, supply voltage etc. It can be used to reduce the amount of instruments needed when doing device characterisation such as LED light output measurements.

For communications Strix uses RS485 and comes with easy-to-use Python and LabView library to interface with the unit. Strix can also be integrated into existing Python 3.x codebases easily. Examples can be found on Strix's Github page.

Safety

Please adhere to the safety guidelines to assure safe and proper use of the unit.

The unit ships with 24 volt DC mains powered power supply. The unit can also be powered through daisy-chaining Strix units or from pre-existing 24 V power rail. Please use only power supplies specified for the unit, to avoid permanent damage.

In order to minimise input leakages and meet the required specifications, inputs of the unit do not have integrated protection circuitry and thus can be damaged in overload and over-range conditions.

The unit contains a heating element which will heat up the device during use. Please use caution and let the device cool after use before picking it up.

Keep the unit away from excess dust, particles, moisture and liquids.

Strix unit is CE marked and is compliant with EEA's safety, health, and environmental protection requirements.

Specifications

Footprint: 130 mm x 110 mm x 30 mm

Max voltage: ±17 V

Max current: ±20 mA

Voltage ranges: ±17 V, ±2.5 V, ±300 mV

For AUX input: ±2.5V, ±300 mV, ±35 mV

Current ranges: ±20 mA, ±100 µA, ±1 µA, ±10 nA

Resolution:

Voltage range			Current		
Range	Measurement	Source	Range	Measurement	Source
±17 V	40 µV	1 mV	±20 mA	20 nA	1 µA
±2.5 V	5 µV	100 µV	±100 µA	250 pA	10 nA
±300 mV	650 nV	10 µV	±1 µA	2.5 pA	100 pA
			±10 nA	25 fA	1 pA

AUX resolution:

Voltage range	Measurement
±2.5 V	2.5 µV
±300 mV	300 nV
±35 mV	40 nV

Typical noise equivalent number of digits: 5 digits (200 ms integration time)

Sub-picoamp current sensitivity at 10 nA range

DC accuracy: 0.02% with factory calibration

Up to 32 Strix units can be daisy-chained together

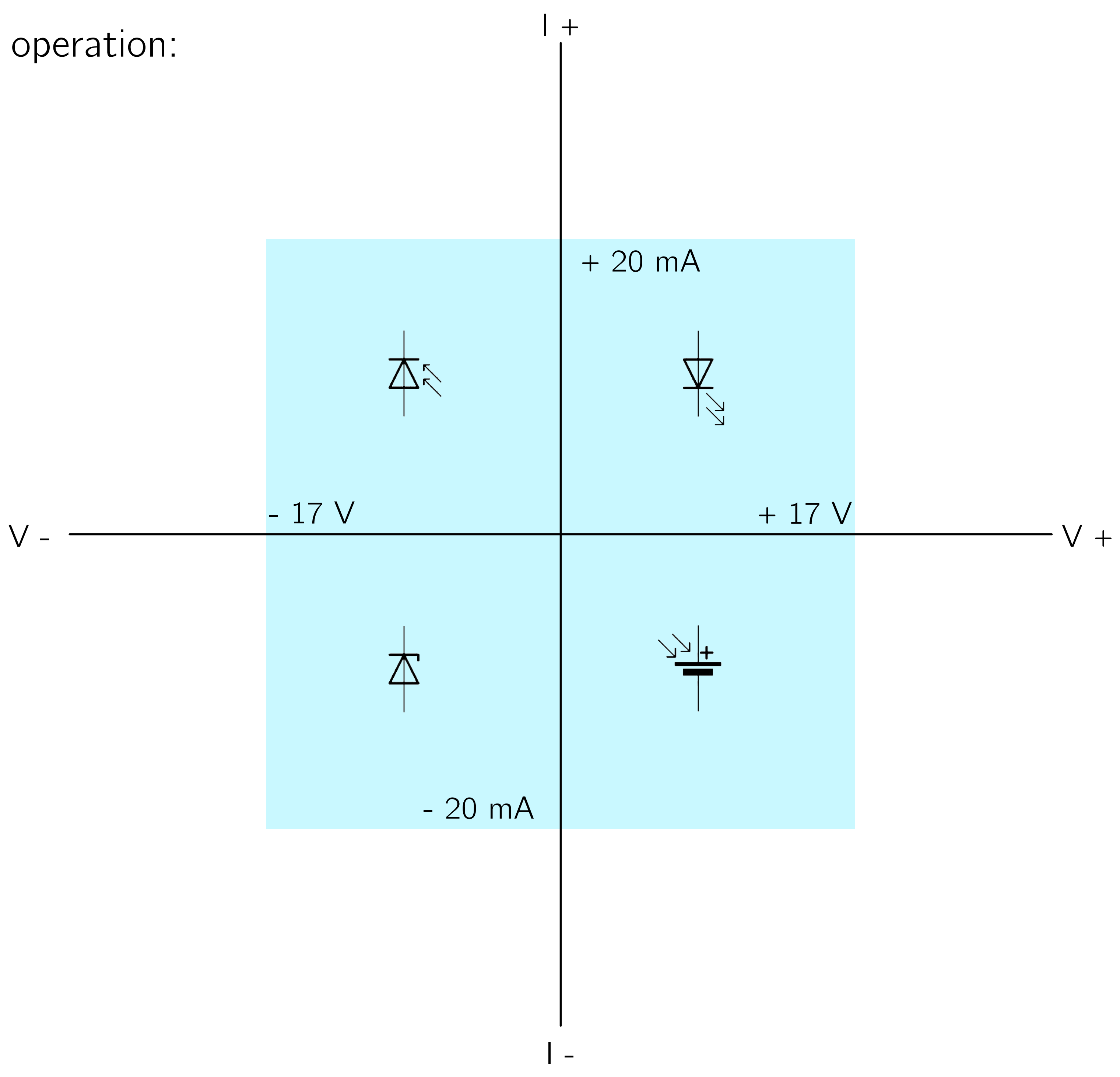
Internally temperature stabilised to minimise drifts and environmental effects

Connectors: 6x SMA (front panel), 1x 2.6mm DC jack, 2x DE9

Power consumption: 24 V and 120 mA

Made in Finland

True four-quadrant operation:



Pinout

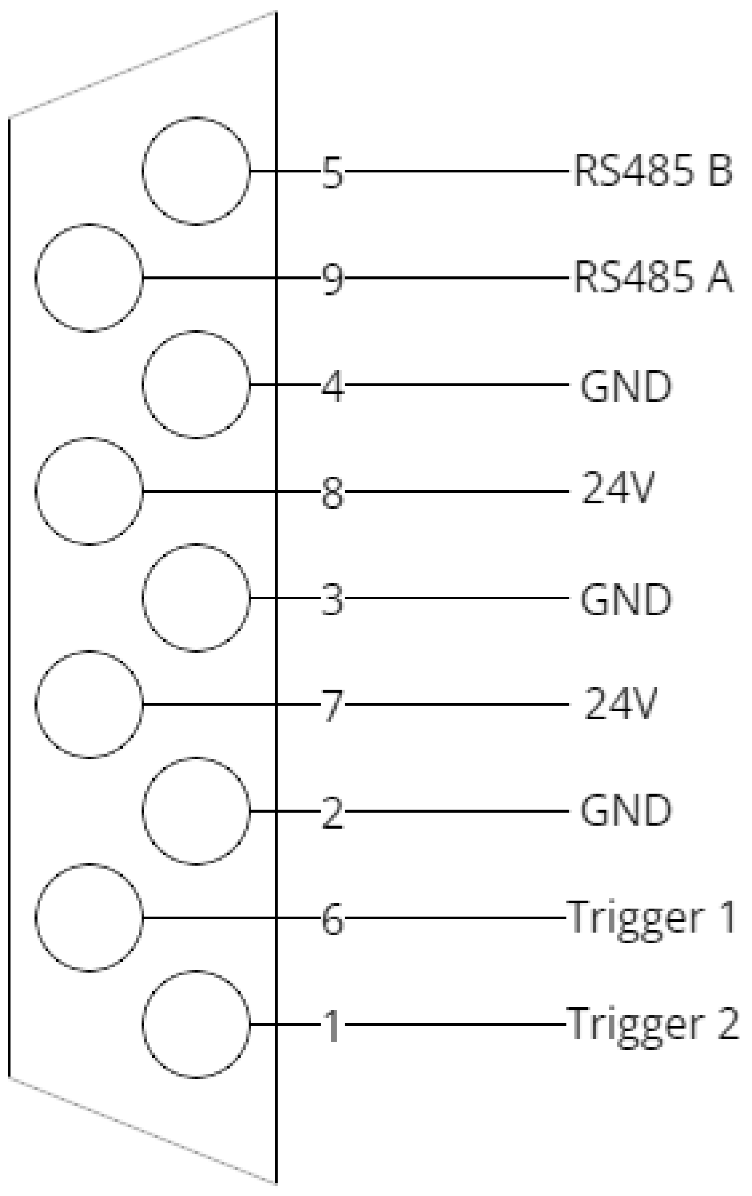
The unit has two sets of connectors: 6x SMA connectors for measurement signals in the front of the unit and data and power connectors in the back.

Back of the unit has a 2.5mm DC jack for 24 V power supply and two DE-9 socket type connectors for communication, daisy-chaining and triggering.

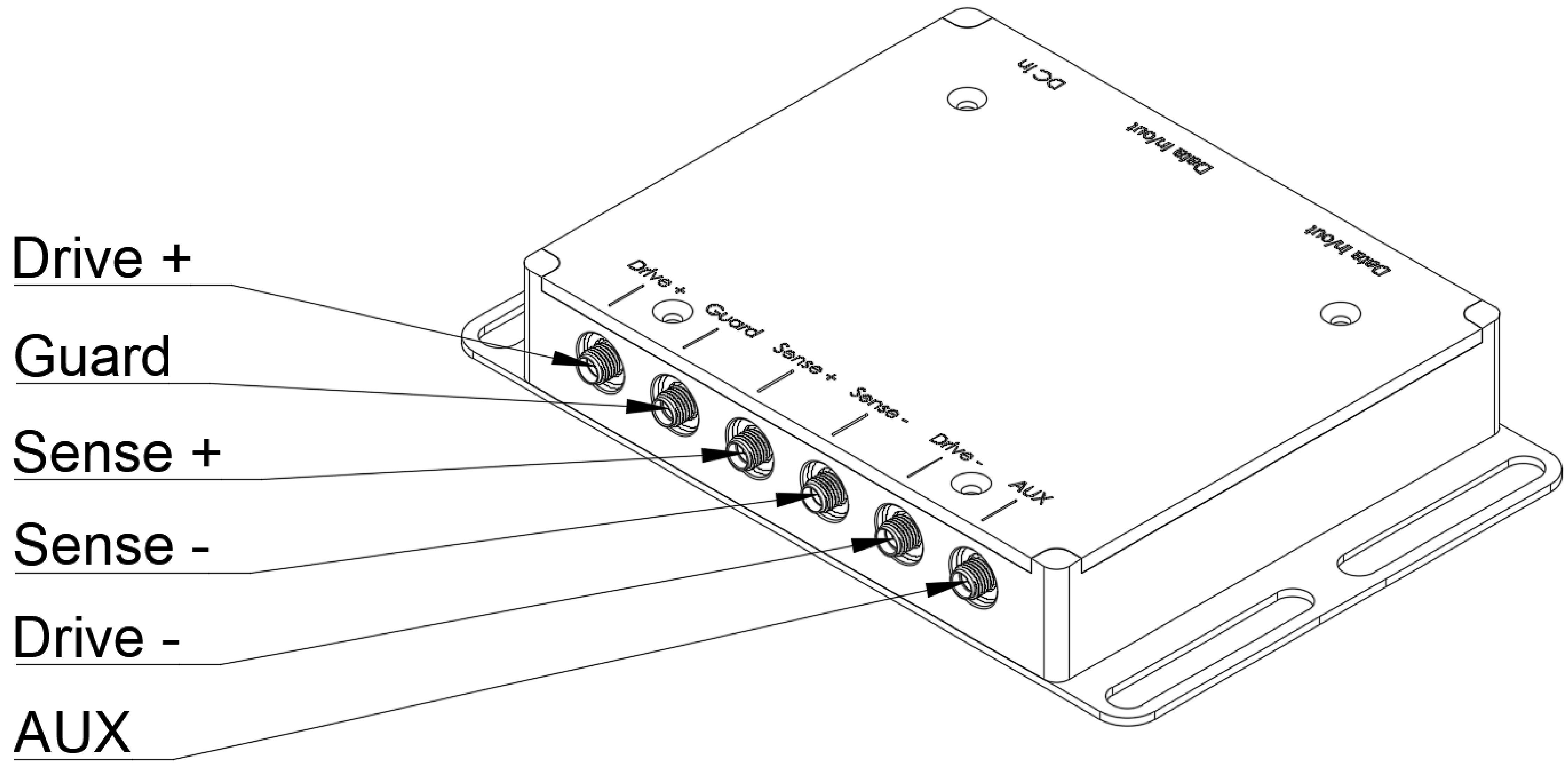
Both *Data* connectors have the same pinout: RS485 bus for communication, power supply pins for either powering the unit or providing power when daisy-chaining units and two trigger lines.

Units can be powered either directly from DC jack or from the *Data* connector. The unit internally selects which provides higher voltage and selects that as the main power supply. When daisy-chaining units, it is advisable to provide external power to every 4th unit in order to minimise supply voltage drops.

Trigger lines are 3.3 V with pull-up resistors in each unit. Units can be programmed to respond to either rising or falling edge on one or both lines.



DE9 Data in/out



Drive+	Positive drive terminal
Guard	Guard voltage output, follows either *Drive+* or differential voltage of *Sense* terminals
Sense+	Positive terminal for 4-wire operation
Sense-	Negative terminal for 4-wire operation
Drive-	Negative drive terminal, current flowing in is measured
AUX	Additional voltage input (range: ±2.5 V)
Grounding	All SMA connector shields are connected to the system ground

Accuracy

Mean measurement errors relative to measurement ranges. Mean deviation denotes the average offset from target value over the range. Mean precision denotes the average variation of measured values at a given target value.

Voltage measurement		
Range	Mean deviation	Mean precision
±17 V	0.0042 %	0.0005 %
±2.5 V	0.026 %	0.0002 %
±300 mV	0.22 %	0.0002 %

Voltage sourcing		
Range	Mean deviation	Mean precision
±17 V	0.0042 %	0.0004 %
±2.5 V	0.026 %	0.0003 %
±300 mV	0.22 %	0.0002 %

Current measurement		
Range	Mean deviation	Mean precision
±20 mA	0.015 %	0.0001 %
±100 µA	0.065 %	0.0003 %
±1 µA	0.065 %	0.0015 %
±10 nA	0.068 %	0.0022 %

Current sourcing		
Range	Mean deviation	Mean precision
±20 mA	0.015 %	0.0001 %
±100 µA	0.065 %	0.0004 %
±1 µA	0.065 %	0.017 %
±10 nA	0.72 %	0.81 %

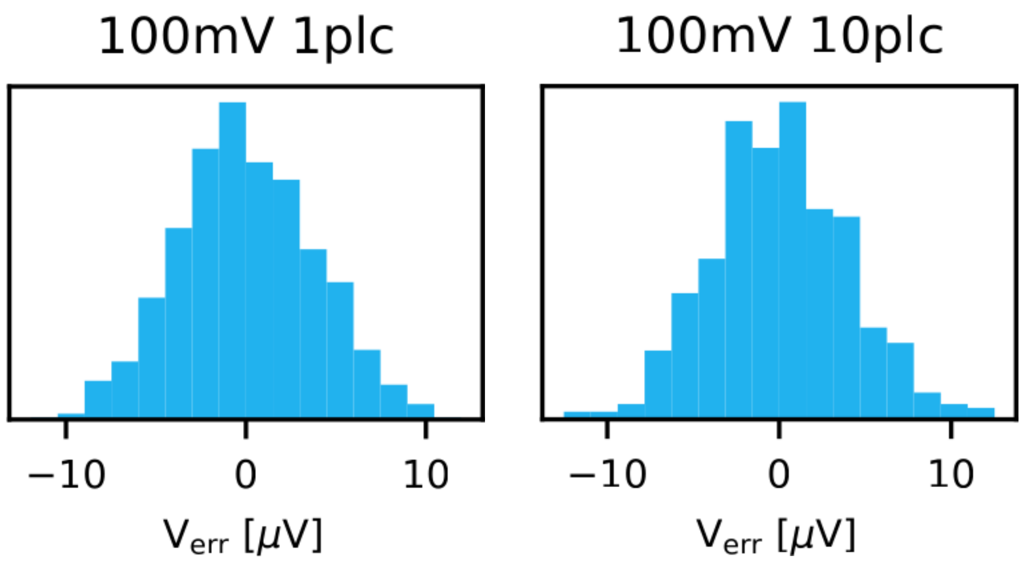
AUX measurement		
Range	Mean deviation	Mean precision
±2.5 V	0.0042 %	0.0005 %
±300 mV	0.026 %	0.0002 %
±35 mV	0.22 %	0.0002 %

Noise performance

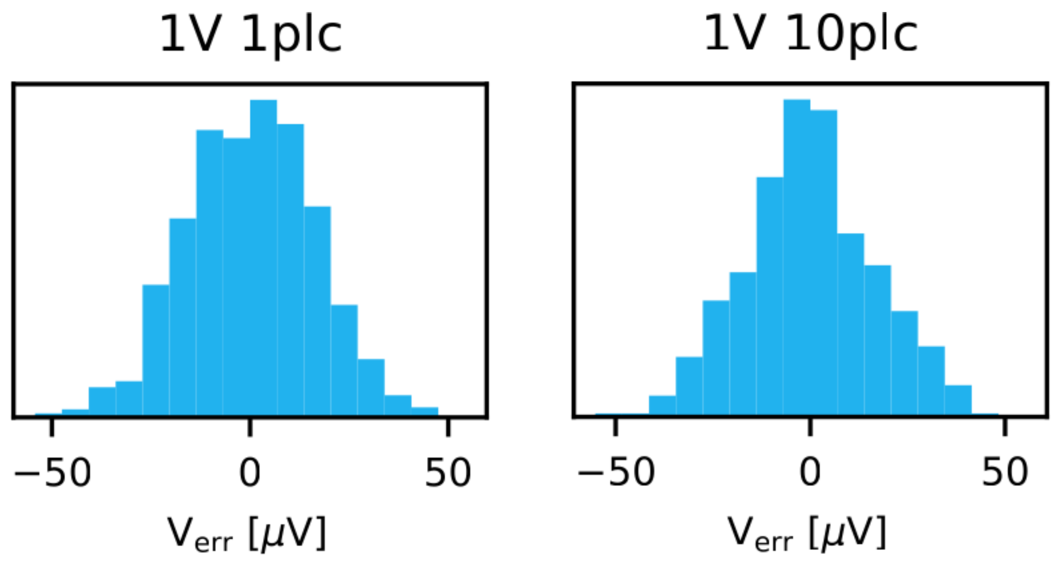
Voltage source

Measurements were done by connecting *Drive+* and *Drive-* to an external DMM. Noise was measured with using 1 and 10 PLC (power line cycle) aperture times.

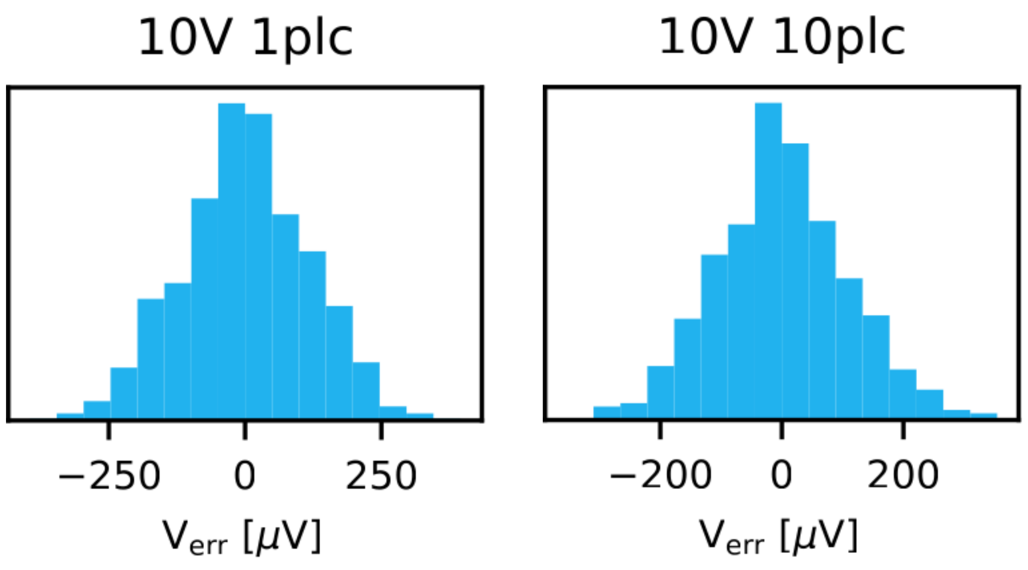
Noise σ	Voltage	Plc
3.783 ± 0.075 µV	100 mV	1
3.97 ± 0.12 µV	100 mV	10



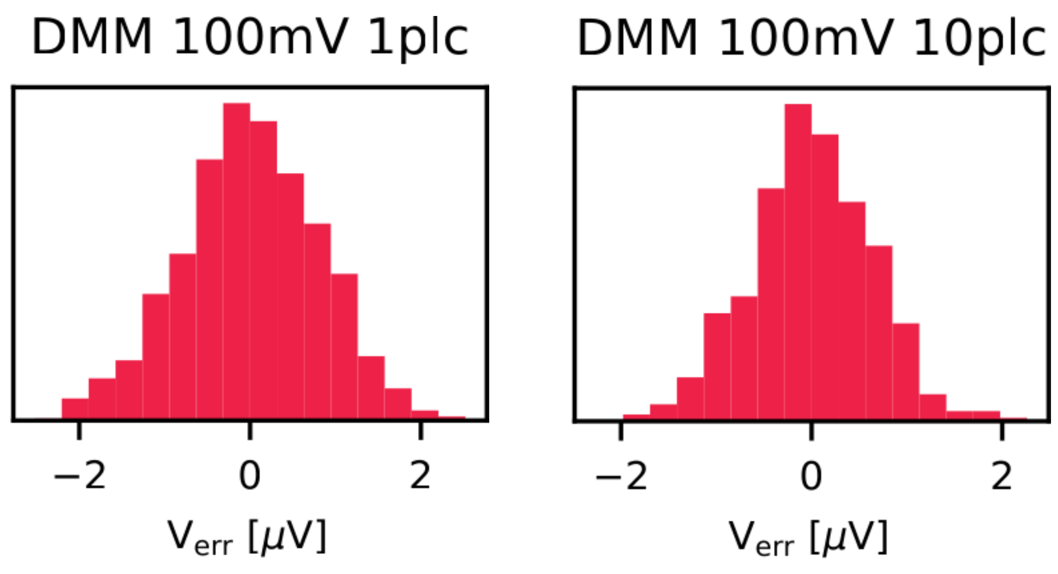
Noise σ	Voltage	Plc
16.23 ± 0.37 µV	1 V	1
16.91 ± 0.47 µV	1 V	10



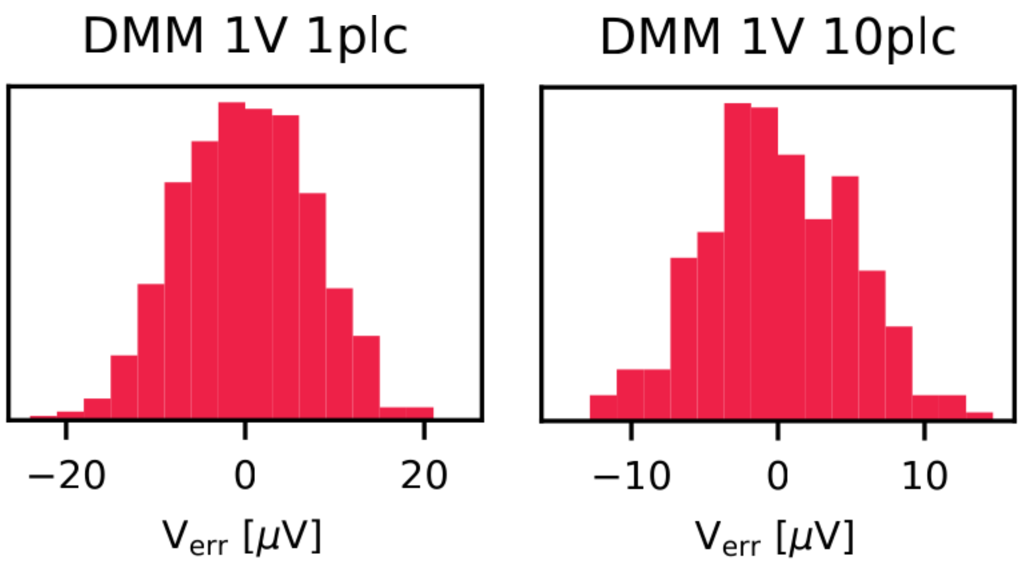
Noise σ	Voltage	Plc
116.2 ± 2.5 µV	10 V	1
109.9 ± 3.5 µV	10 V	10



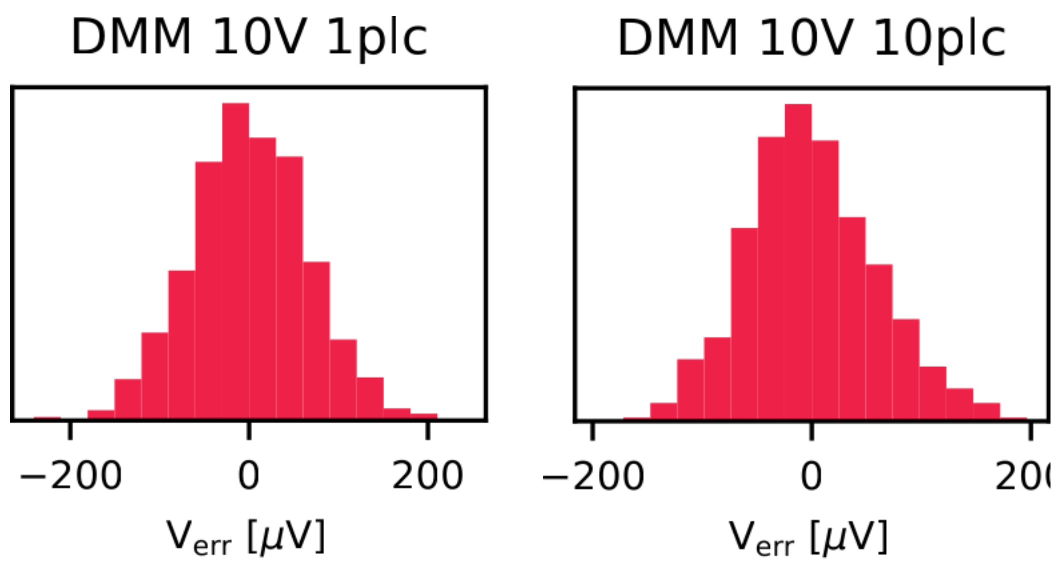
Noise σ	Voltage	Plc
810 ± 16 nV	100 mV	1
643 ± 19 nV	100 mV	10

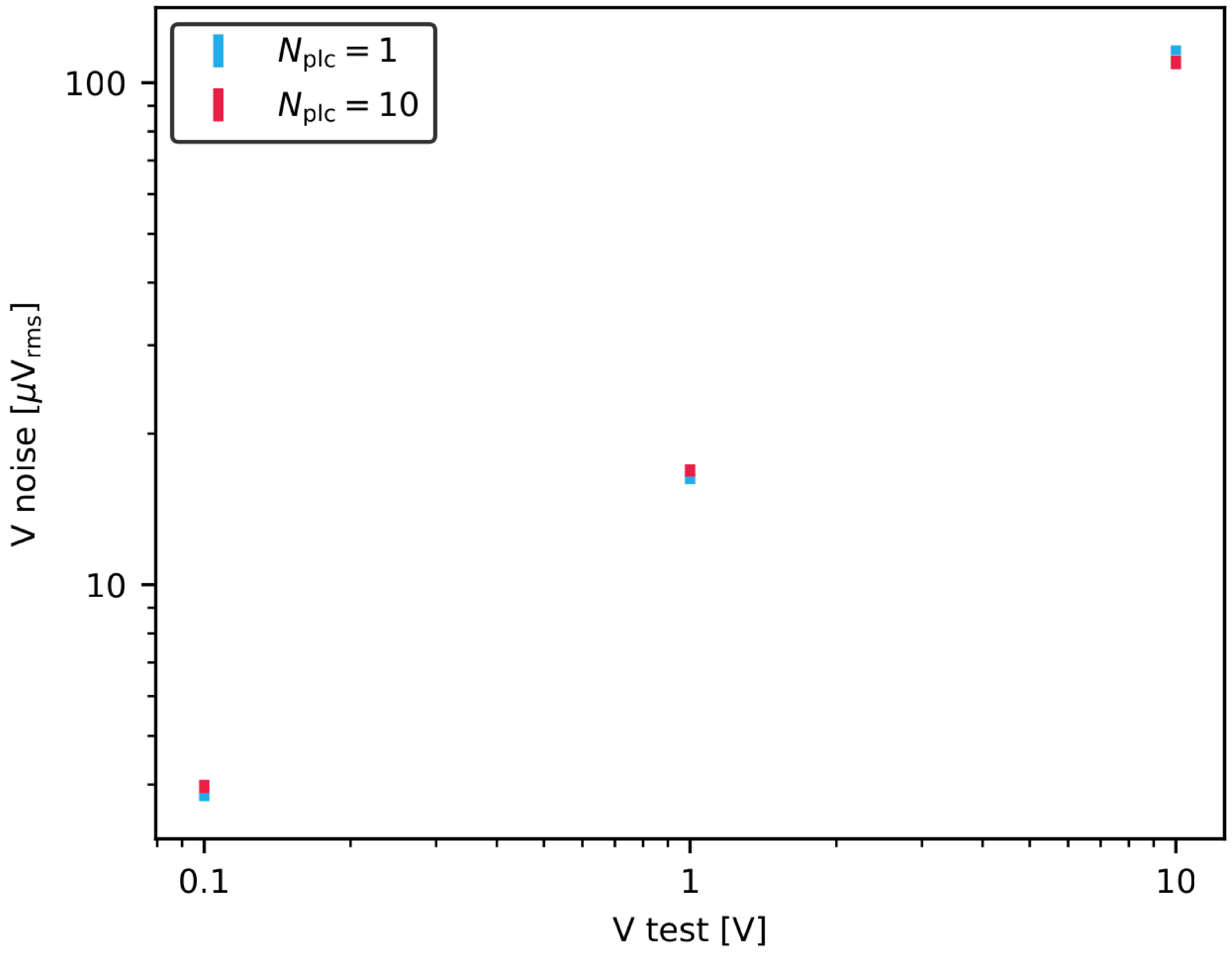


Noise σ	Voltage	Plc
7.25 ± 0.16 µV	1 V	1
4.97 ± 0.14 µV	1 V	10



Noise σ	Voltage	Plc
65.2 ± 1.4 µV	10 V	1
59.4 ± 1.9 µV	10 V	10





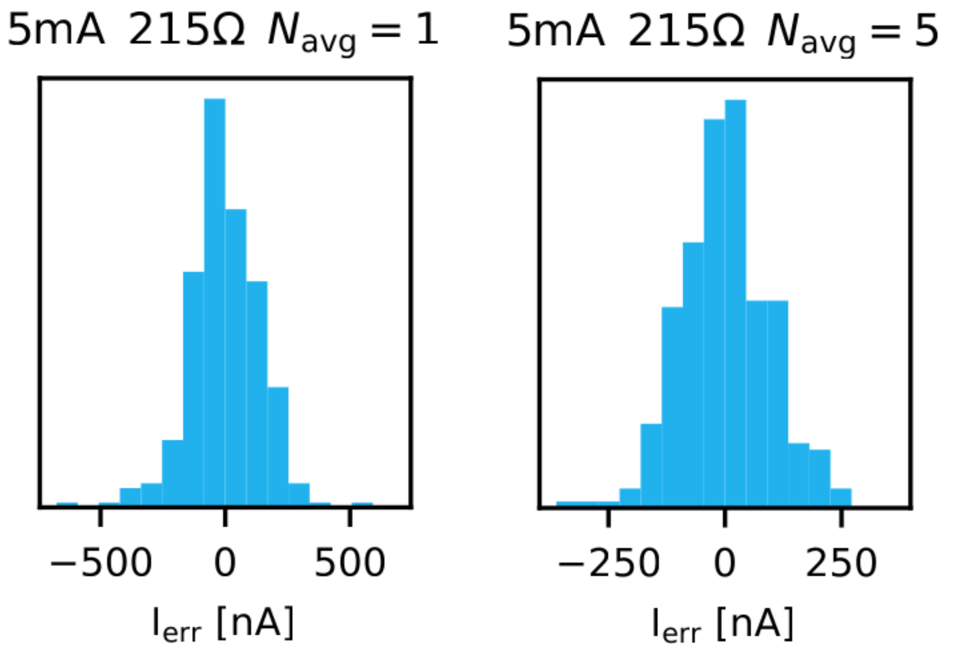
Overview of voltage sourcing noise

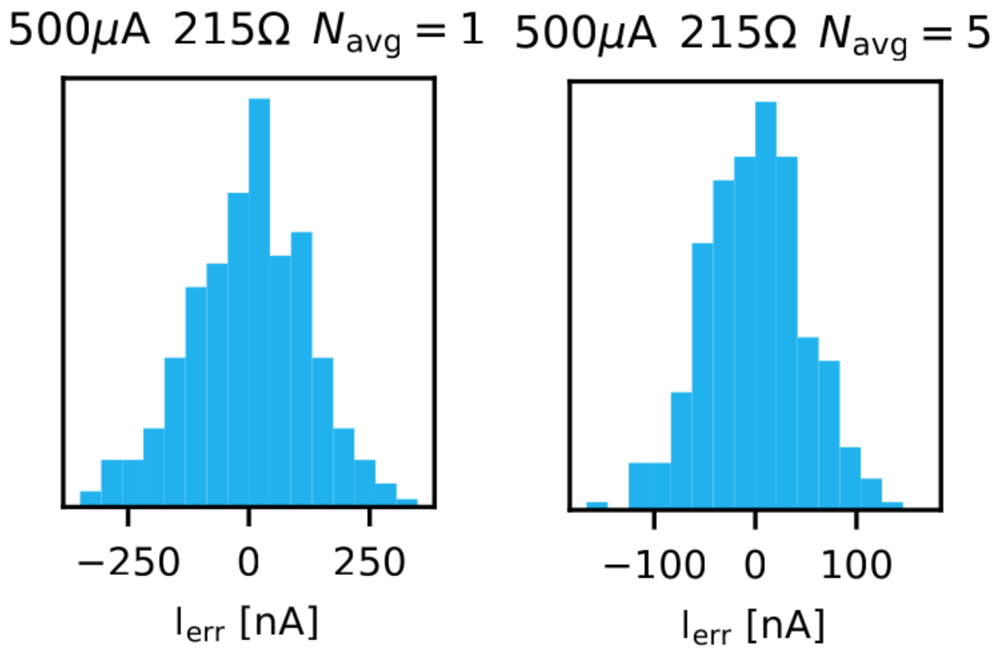
Current source

Measurements were done by placing the load resistor into a shielded box (HP 16055A) and applying a constant current through it. Noise was measured with 20 samples/s sample rate and total integration time was Navg / sample rate.

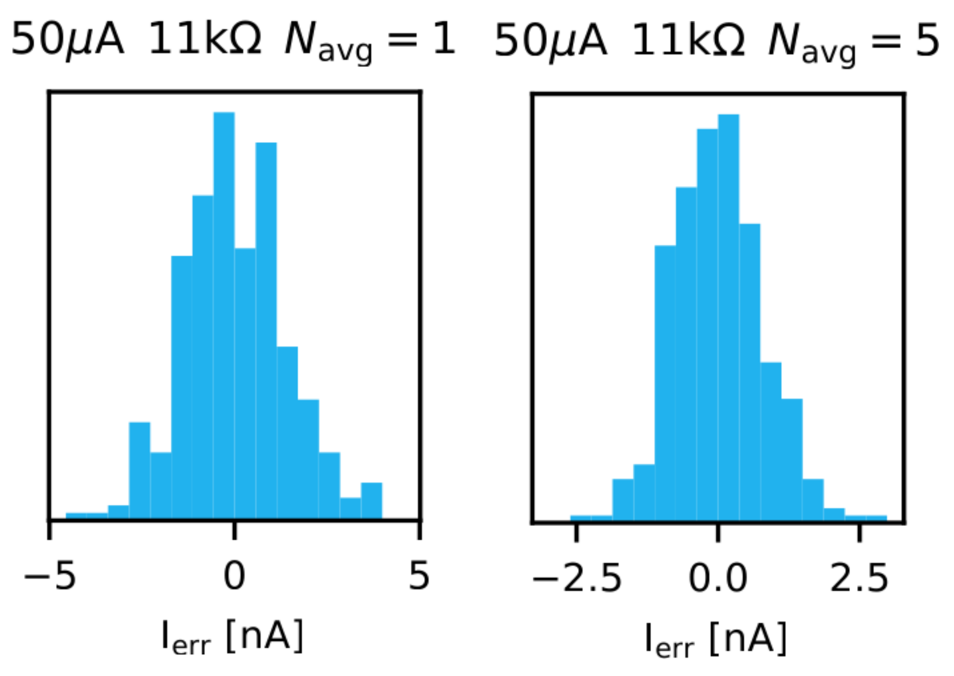
Noise σ	Current	Load	Navg
139.4 ± 8.2 nA	5 mA	215 Ω	1
94.5 ± 4.4 nA	5 mA	215 Ω	5

Noise σ	Current	Load	Navg
120.8 ± 4.9 nA	500 µA	215 Ω	1
49.1 ± 1.9 nA	500 µA	215 Ω	5

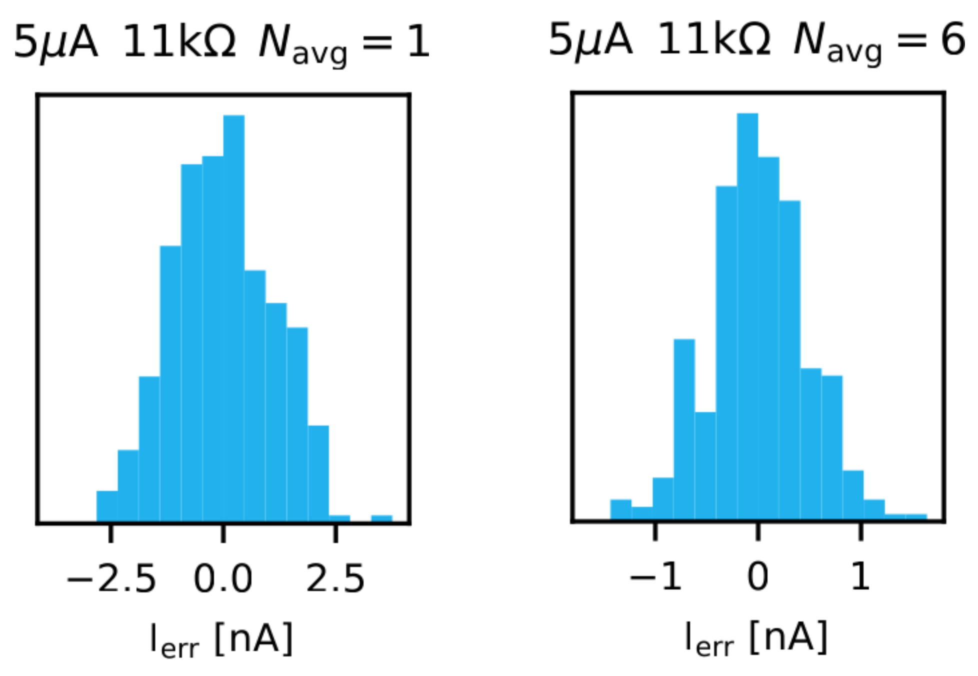




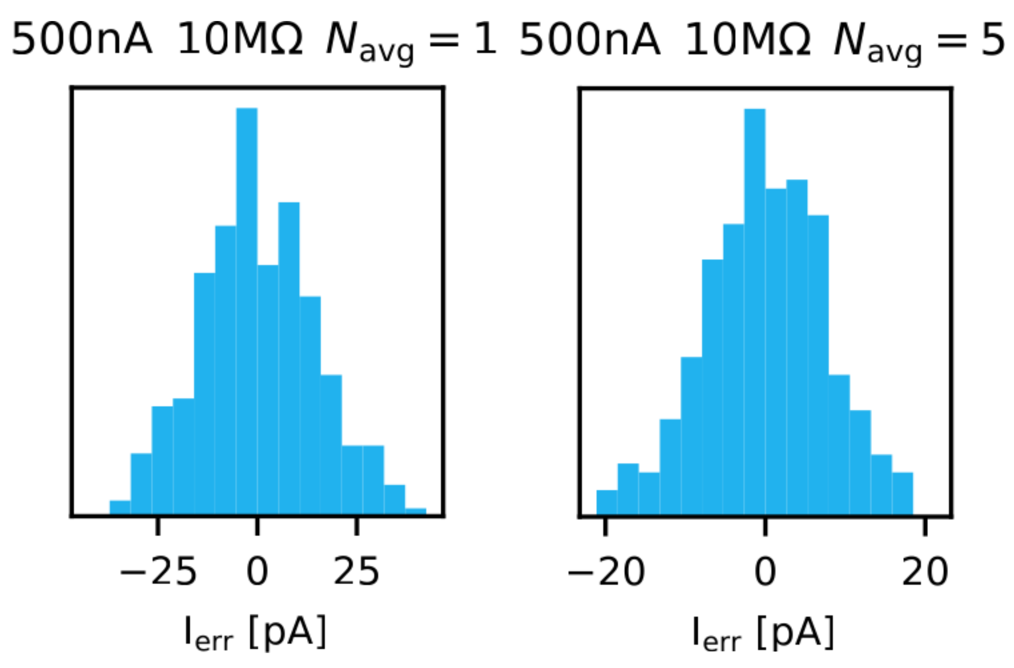
Noise σ	Current	Load	Navg
1.392 ± 0.051 nA	50 µA	11 kΩ	1
799 ± 38 pA	50 µA	11 kΩ	5



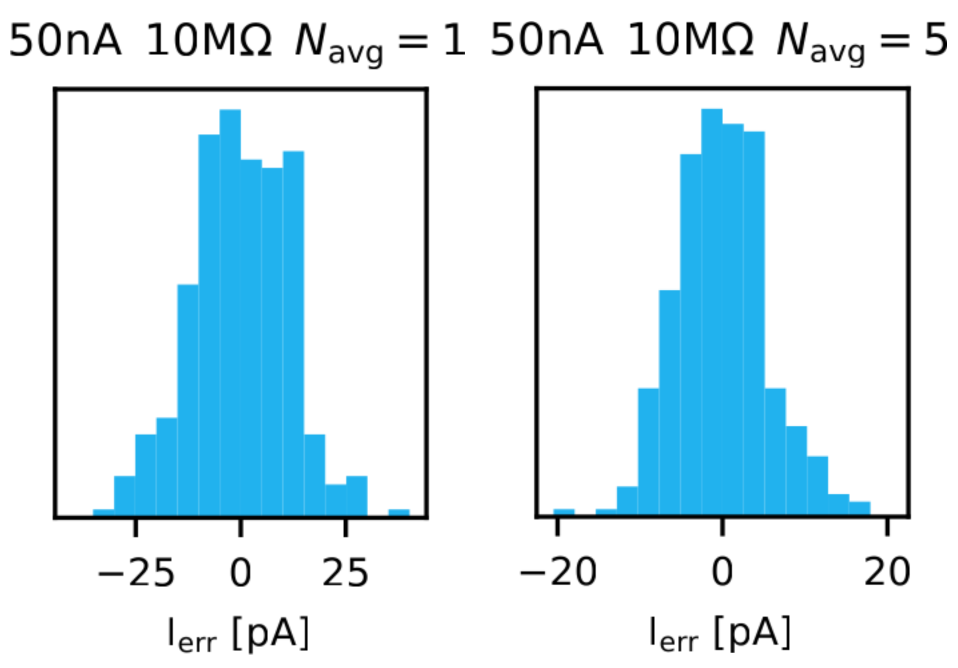
Noise σ	Current	Load	Navg
1.117 ± 0.039 nA	5 µA	11 kΩ	1
481 ± 19 pA	5 µA	11 kΩ	6



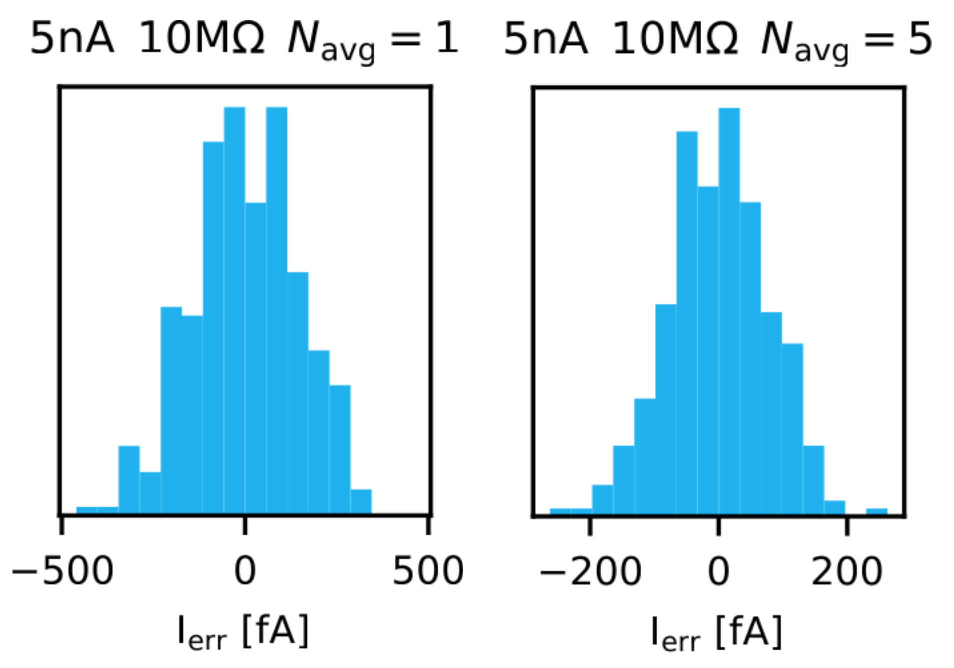
Noise σ	Current	Load	Navg
14.50 ± 0.63 pA	500 nA	10 MΩ	1
7.50 ± 0.37 pA	500 nA	10 MΩ	5



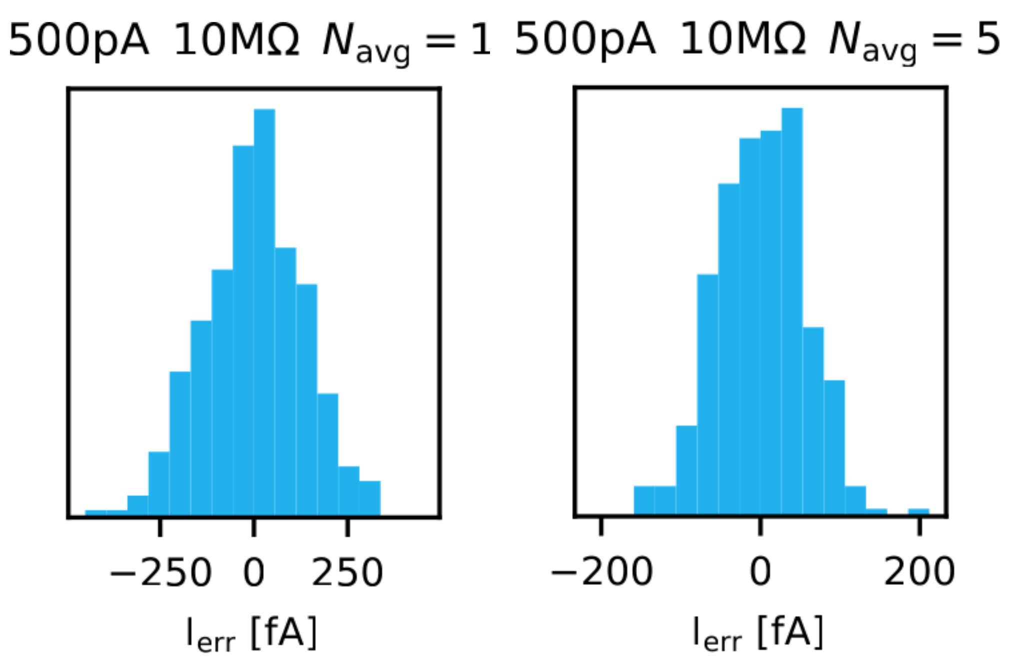
Noise σ	Current	Load	Navg
11.50 ± 0.49 pA	50 nA	10 MΩ	1
5.52 ± 0.23 pA	50 nA	10 MΩ	5



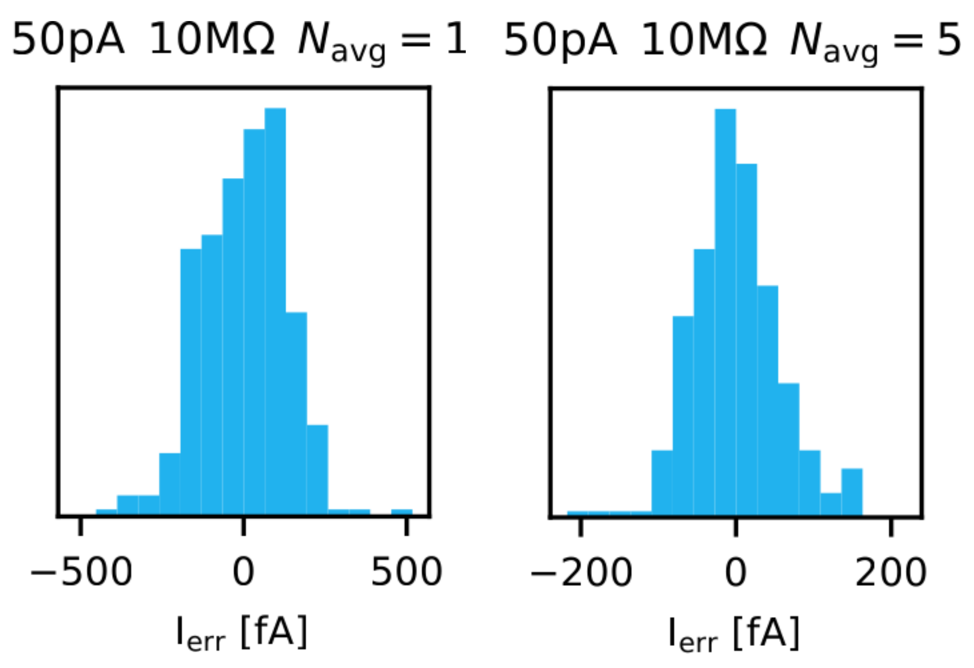
Noise σ	Current	Load	Navg
143.7 ± 5.3 fA	5 nA	10 MΩ	1
78.8 ± 3.5 fA	5 nA	10 MΩ	5

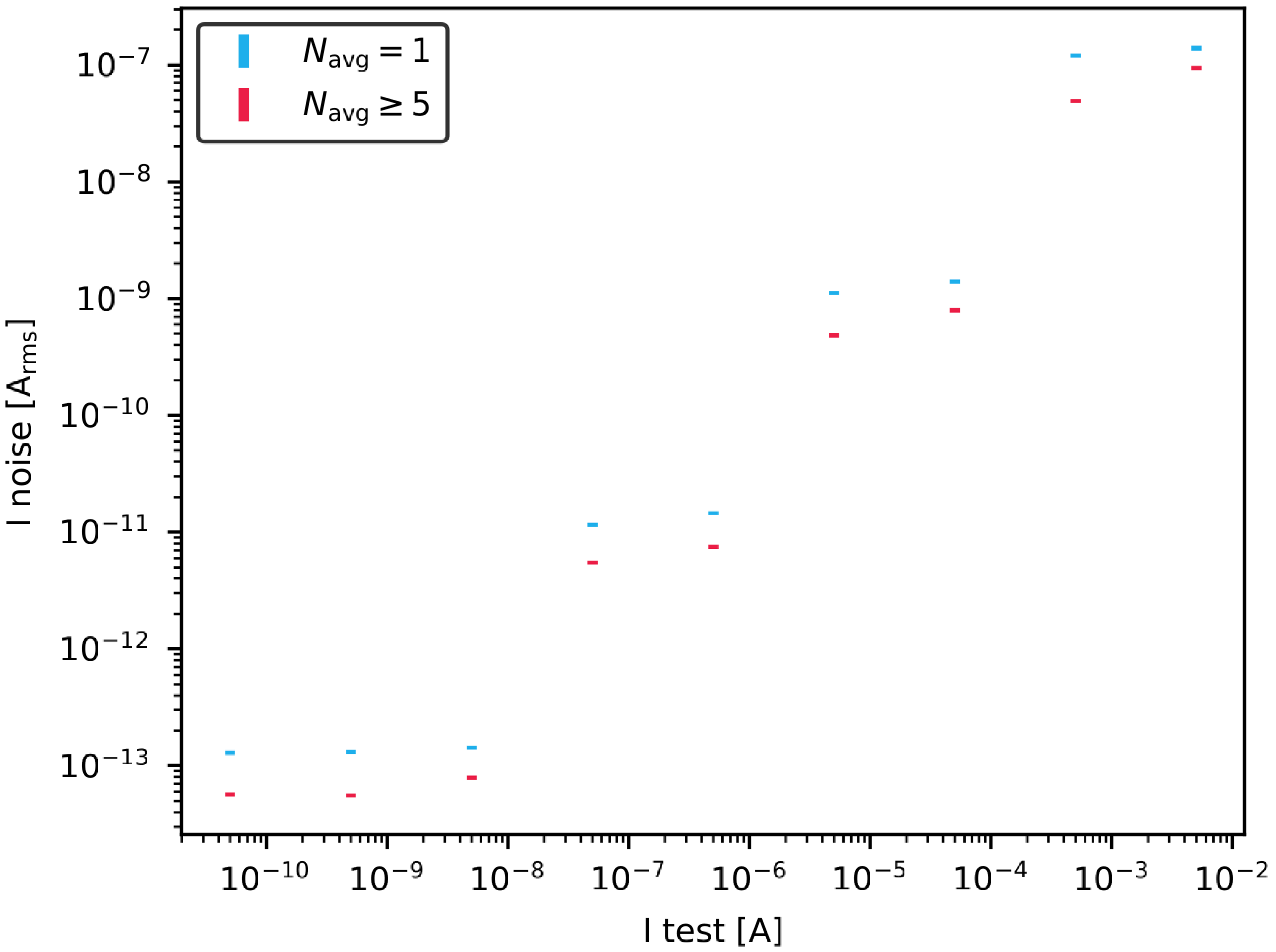


Noise σ	Current	Load	Navg
132.2 ± 5.3 fA	500 pA	10 MΩ	1
55.8 ± 2.3 pA	500 pA	10 MΩ	5



Noise σ	Current	Load	Navg
129.6 ± 6.1 fA	50 pA	10 MΩ	1
56.9 ± 2.8 fA	50 pA	10 MΩ	5



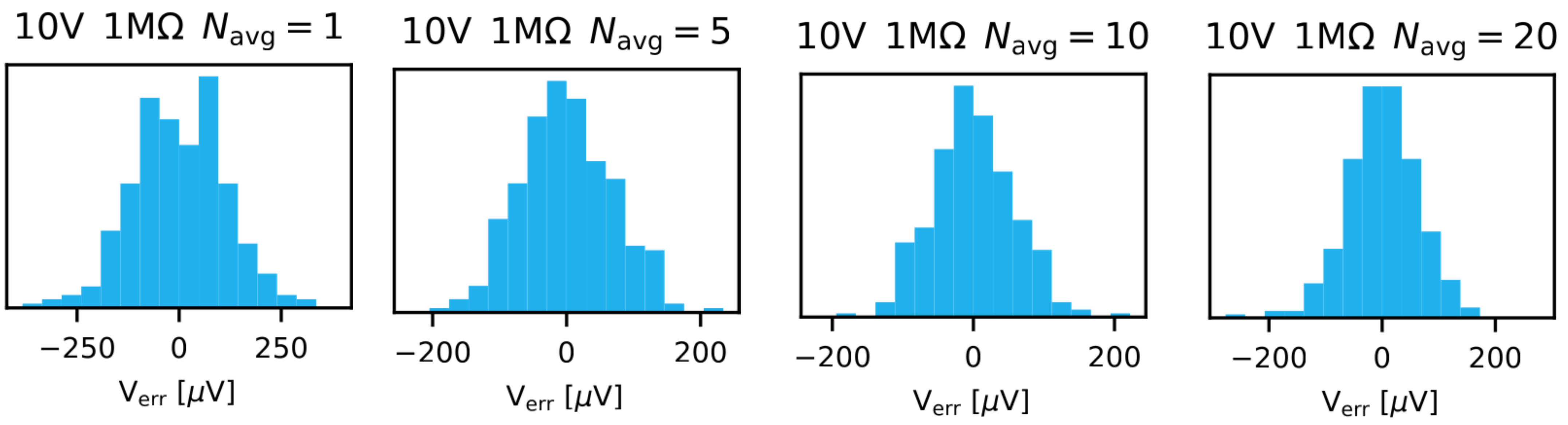


Overview of current sourcing noise

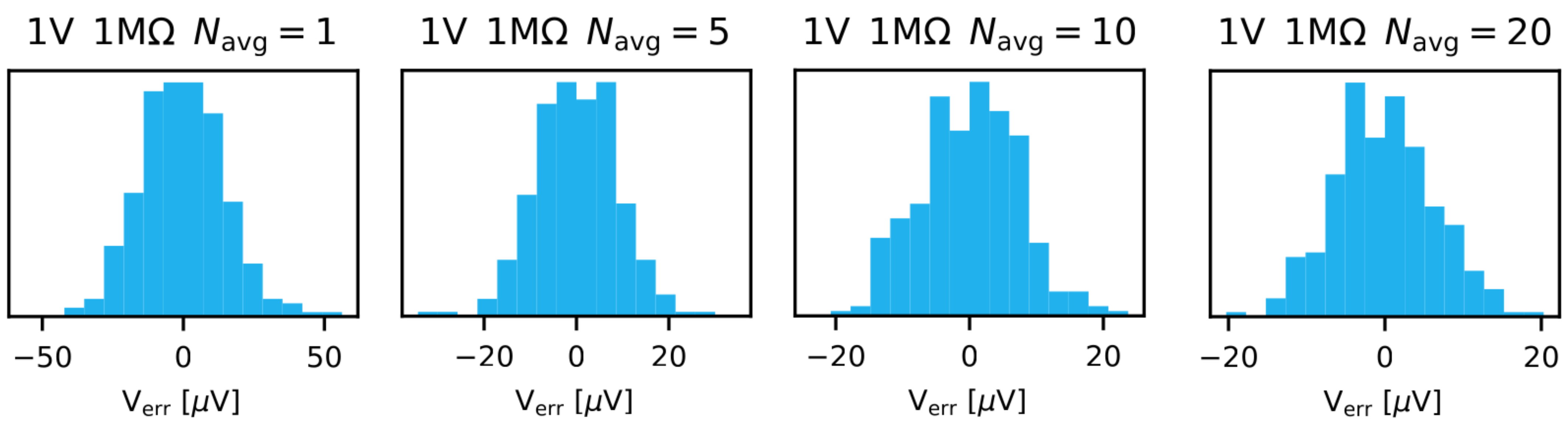
Voltage measurement noise

Measurements were done by placing the load resistor (1 MΩ) into a shielded box (HP 16055A) and applying a constant voltage over it. Noise was measured with 20 samples/s sample rate and total integration time was Navg / sample rate.

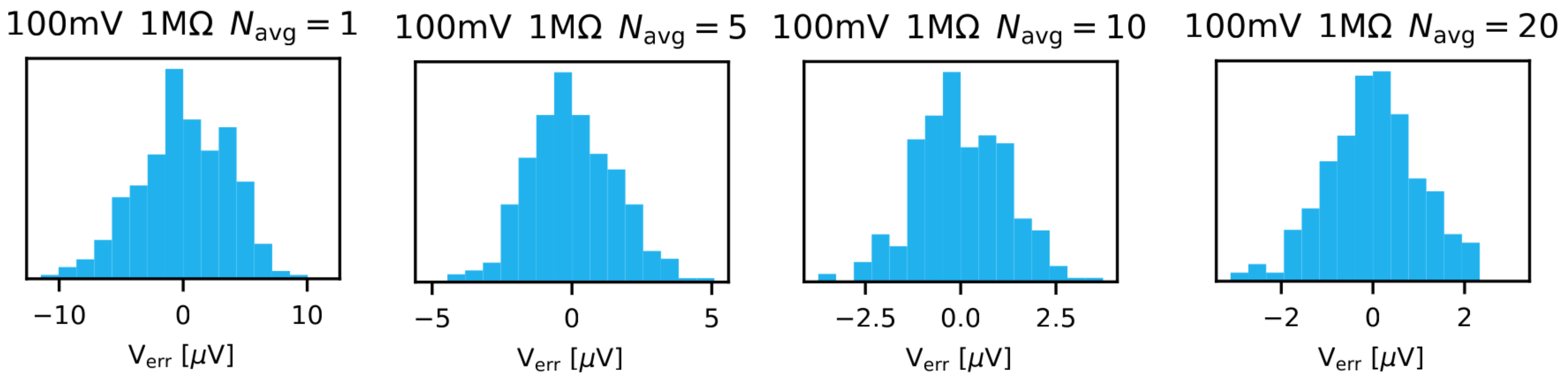
Noise σ	Voltage	Navg
112.8 ± 3.9 µV	10 V	1
69.0 ± 2.6 µV	10 V	5
57.6 ± 2.5 µV	10 V	10
62.9 ± 2.9 µV	10 V	20

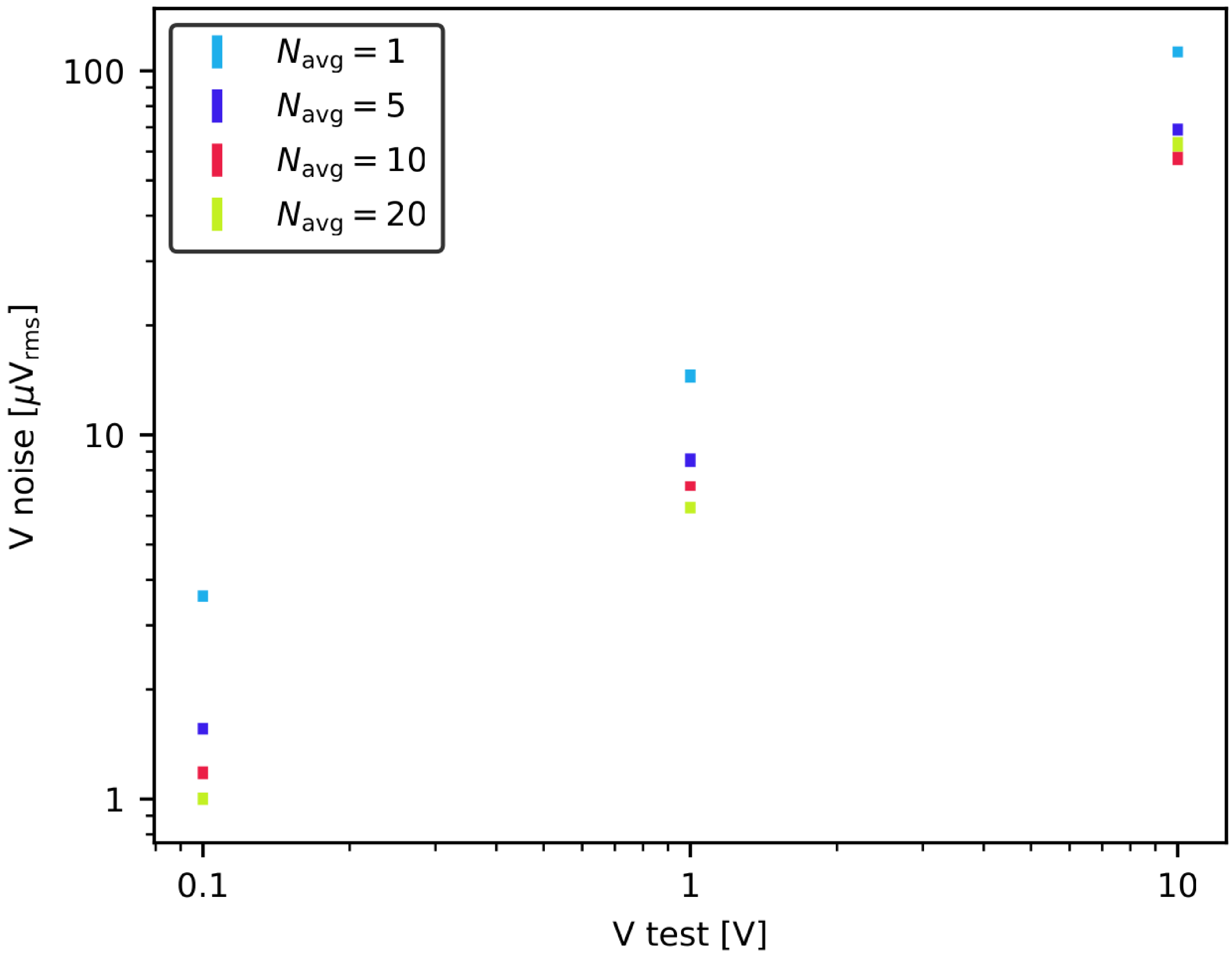


Noise σ	Voltage	Navg
14.52 ± 0.60 µV	1 V	1
8.53 ± 0.37 µV	1 V	5
7.24 ± 0.22 µV	1 V	10
6.32 ± 0.23 µV	1 V	20



Noise σ	Voltage	Navg
3.61 ± 0.13 µV	100 mV	1
1.562 ± 0.057 µV	100 mV	5
1.182 ± 0.047 µV	100 mV	10
1.003 ± 0.039 µV	100 mV	20



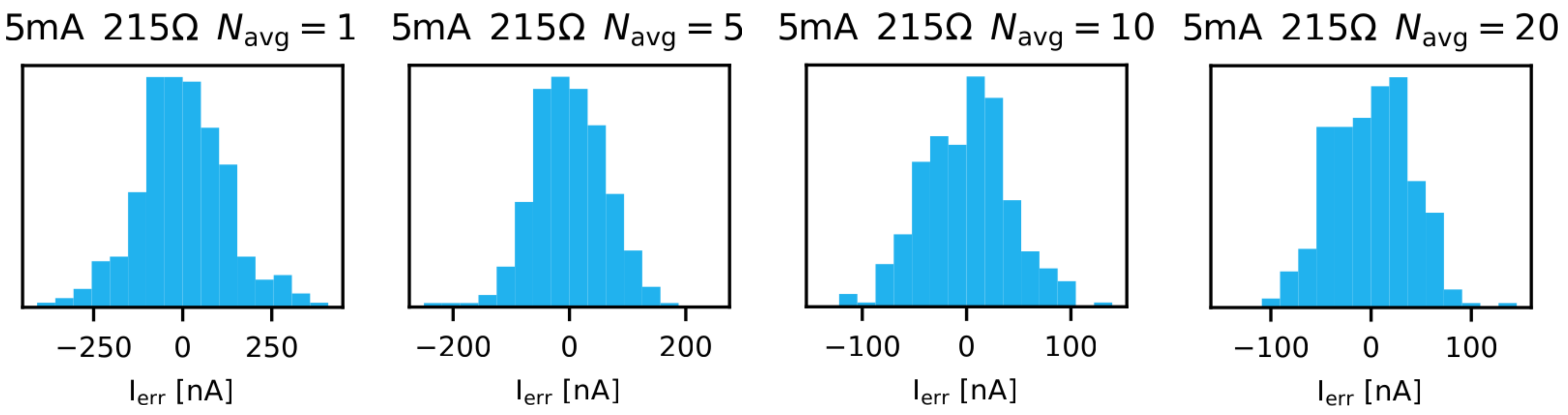


Overview of voltage measurement noise

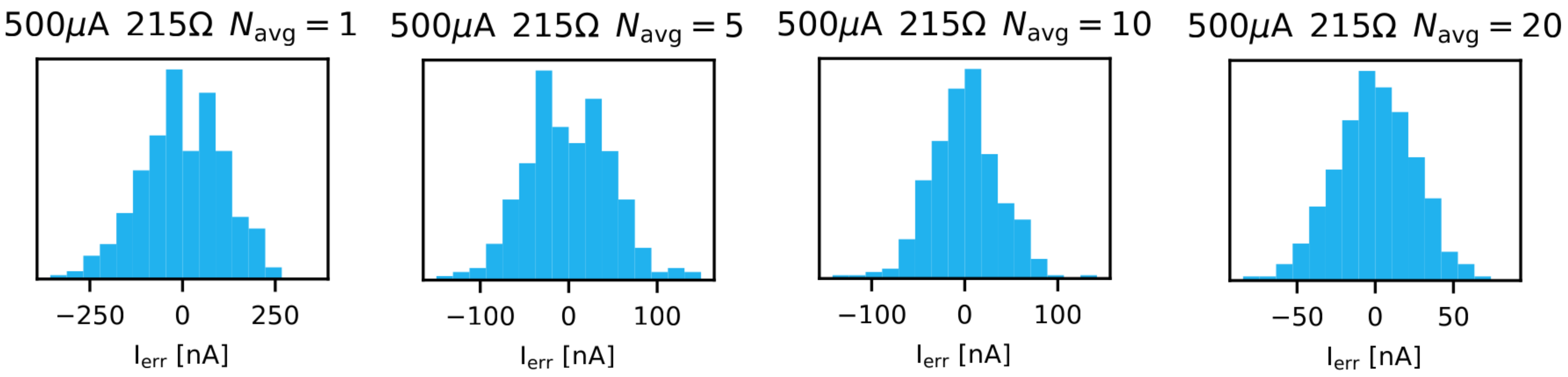
Current measurement noise

Measurements were done by placing the load resistor into a shielded box (HP 16055A) and applying a constant current through it. Noise was measured with 20 samples/s sample rate and total integration time was Navg / sample rate.

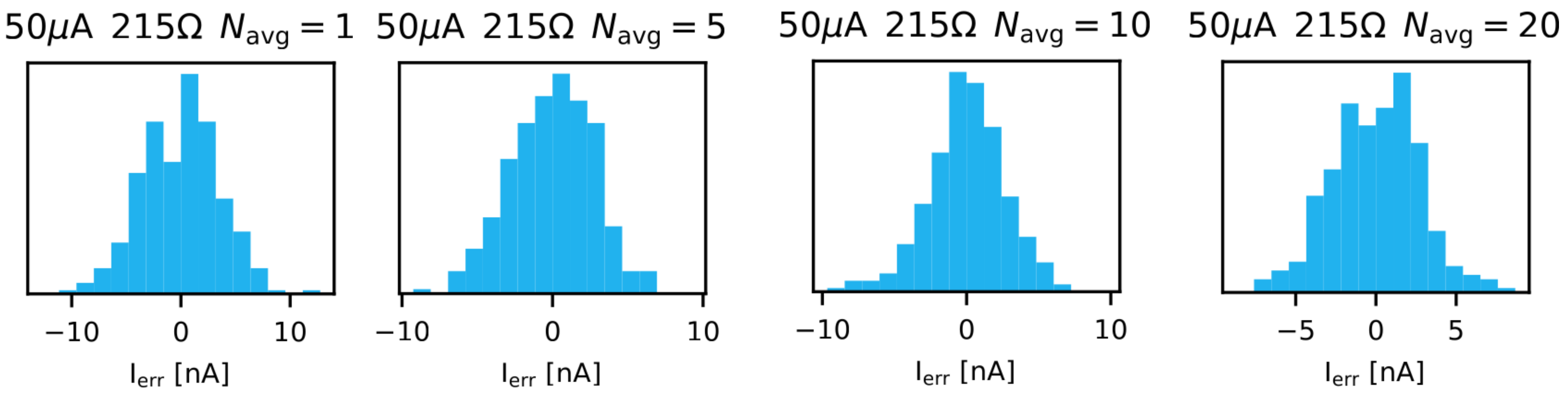
Noise σ	Current	Load	Navg
124.8 ± 5.5 nA	5 mA	215 Ω	1
62.0 ± 2.7 nA	5 mA	215 Ω	5
41.5 ± 1.8 nA	5 mA	215 Ω	10
39.8 ± 1.4 nA	5 mA	215 Ω	20



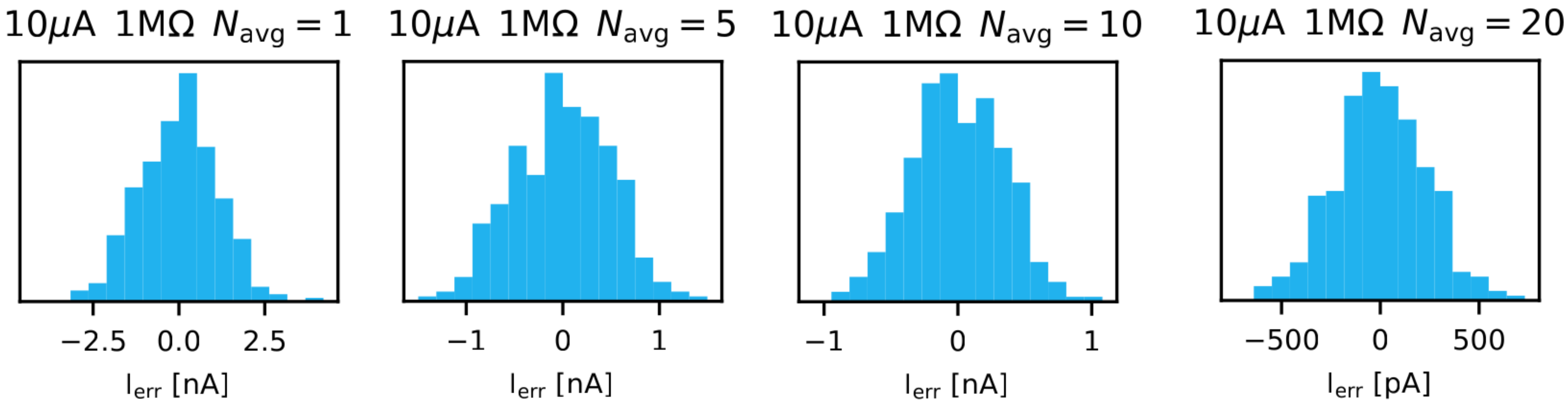
Noise σ	Current	Load	Navg
111.2 ± 4.2 nA	500 µA	215 Ω	1
47.5 ± 2.0 nA	500 µA	215 Ω	5
36.9 ± 1.5 nA	500 µA	215 Ω	10
25.3 ± 1.1 nA	500 µA	215 Ω	20



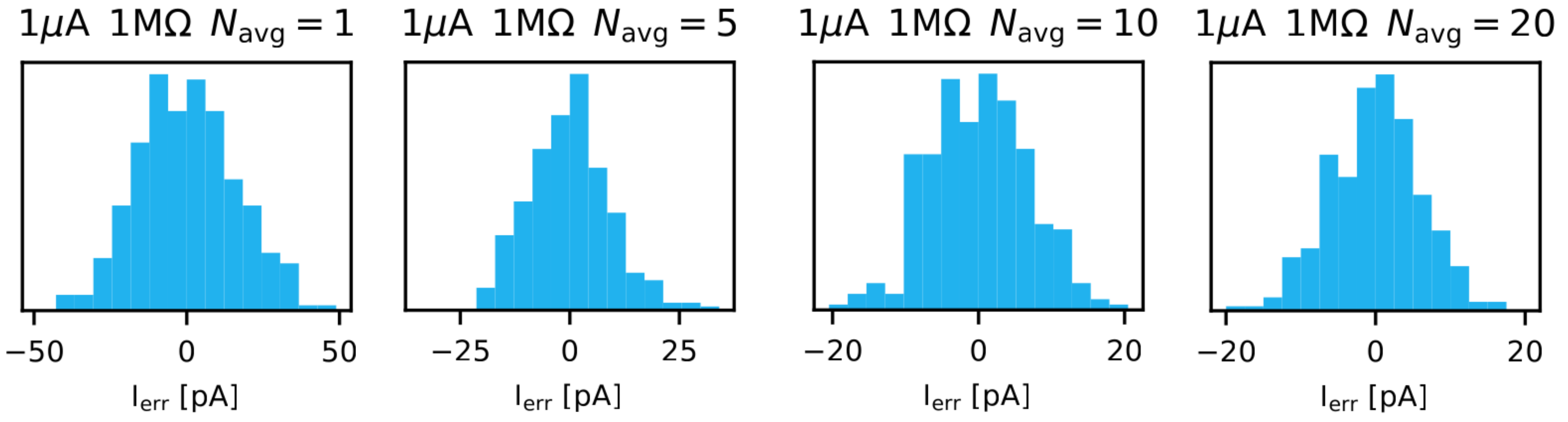
Noise σ	Current	Load	Navg
3.52 ± 0.14 nA	50 µA	215 Ω	1
2.72 ± 0.11 nA	50 µA	215 Ω	5
2.68 ± 0.13 nA	50 µA	215 Ω	10
2.67 ± 0.10 nA	50 µA	215 Ω	20



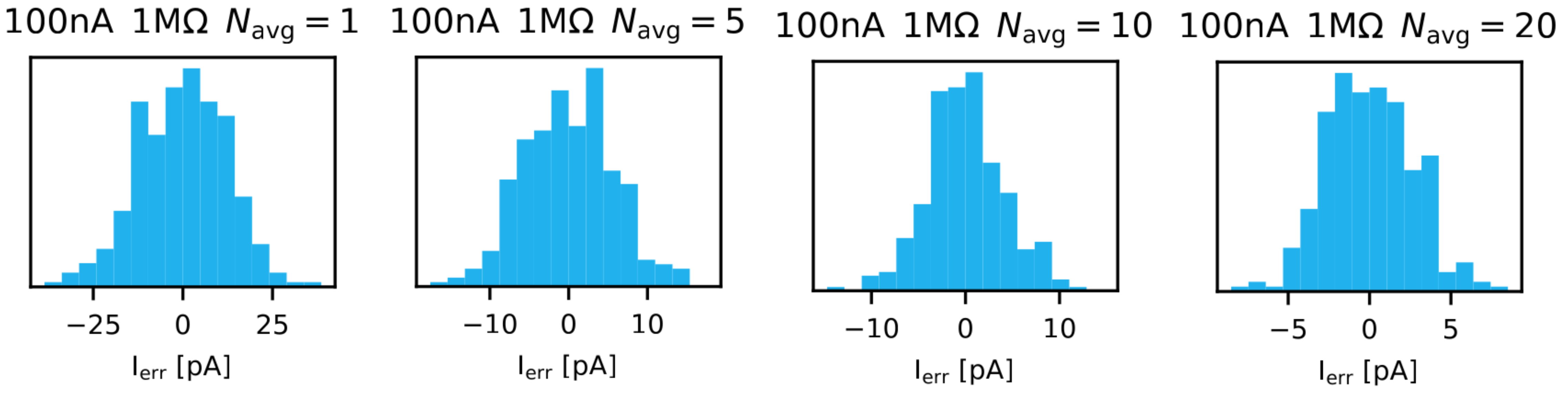
Noise σ	Current	Load	Navg
1.145 ± 0.042 nA	10 µA	1 MΩ	1
504 ± 19 pA	10 µA	1 MΩ	5
335 ± 13 pA	10 µA	1 MΩ	10
230.2 ± 9.1 pA	10 µA	1 MΩ	20



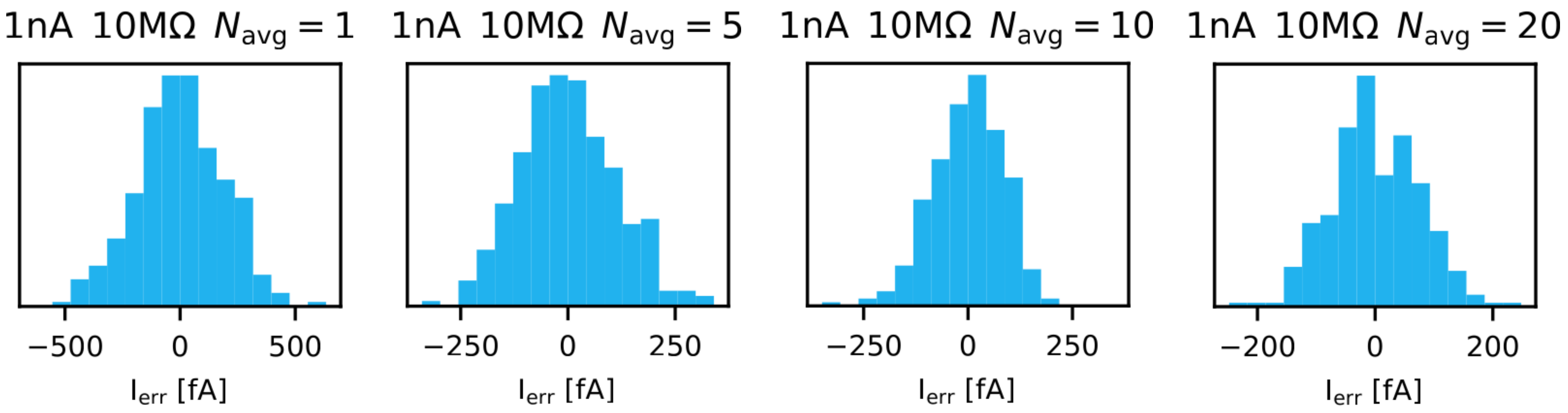
Noise σ	Current	Load	Navg
16.01 ± 0.66 pA	1 µA	1 MΩ	1
9.13 ± 0.37 pA	1 µA	1 MΩ	5
6.75 ± 0.27 pA	1 µA	1 MΩ	10
5.94 ± 0.24 pA	1 µA	1 MΩ	20

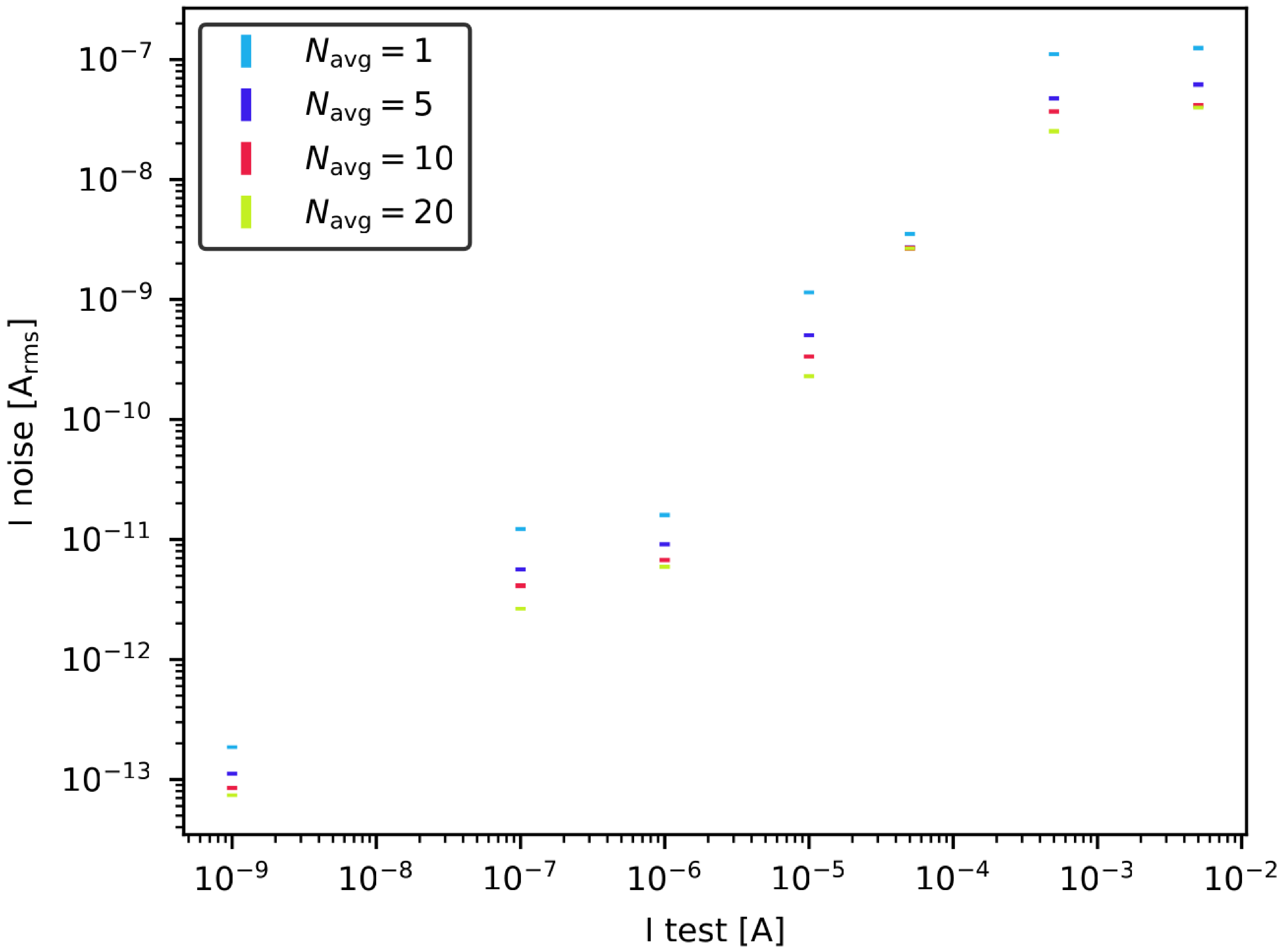


Noise σ	Current	Load	Navg
12.25 ± 0.47 pA	100 nA	1 MΩ	1
5.64 ± 0.22 pA	100 nA	1 MΩ	5
4.12 ± 0.20 pA	100 nA	1 MΩ	10
2.652 ± 0.093 pA	100 nA	1 MΩ	20



Noise σ	Current	Load	Navg
186.2 ± 6.4 fA	1 nA	10 MΩ	1
112.0 ± 4.3 fA	1 nA	10 MΩ	5
85.1 ± 3.5 fA	1 nA	10 MΩ	10
74.0 ± 2.6 fA	1 nA	10 MΩ	20



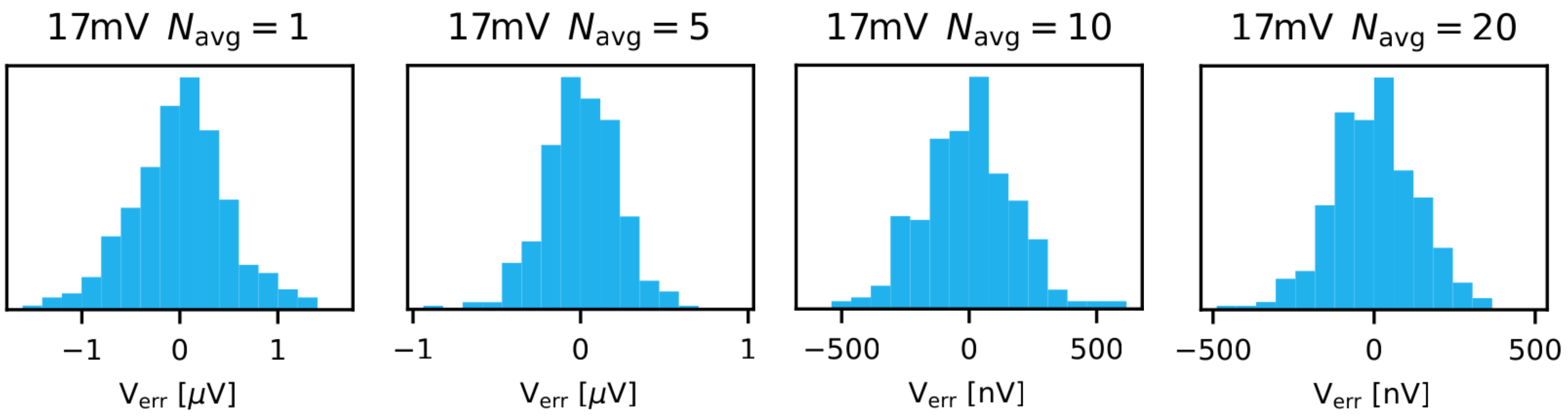


Overview of current measurement noise

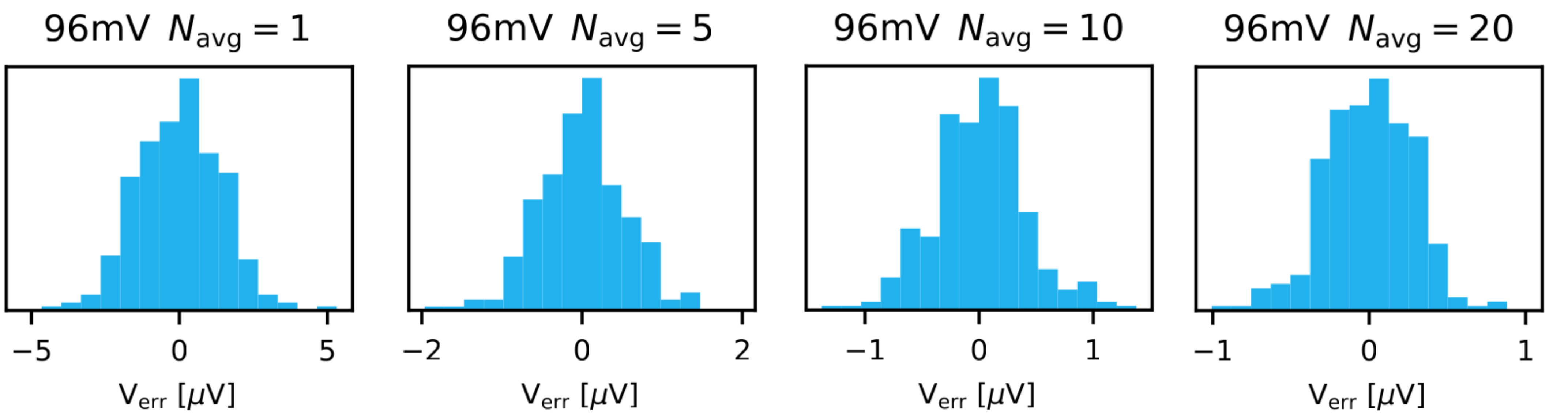
AUX input noise

Measurements were done by applying a constant voltage to AUX input. Noise was measured with 20 samples/s sample rate and total integration time was Navg / sample rate.

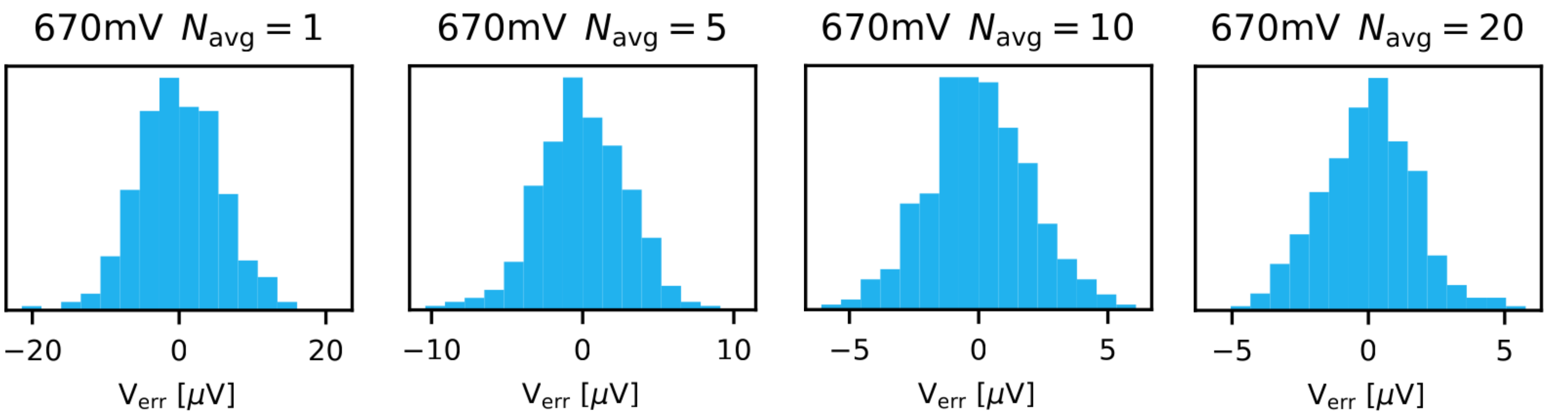
Noise σ	Voltage	Navg
487 ± 22 nV	17 mV	1
217 ± 11 nV	17 mV	5
183.1 ± 7.5 nV	17 mV	10
133.2 ± 6.2 nV	17 mV	20

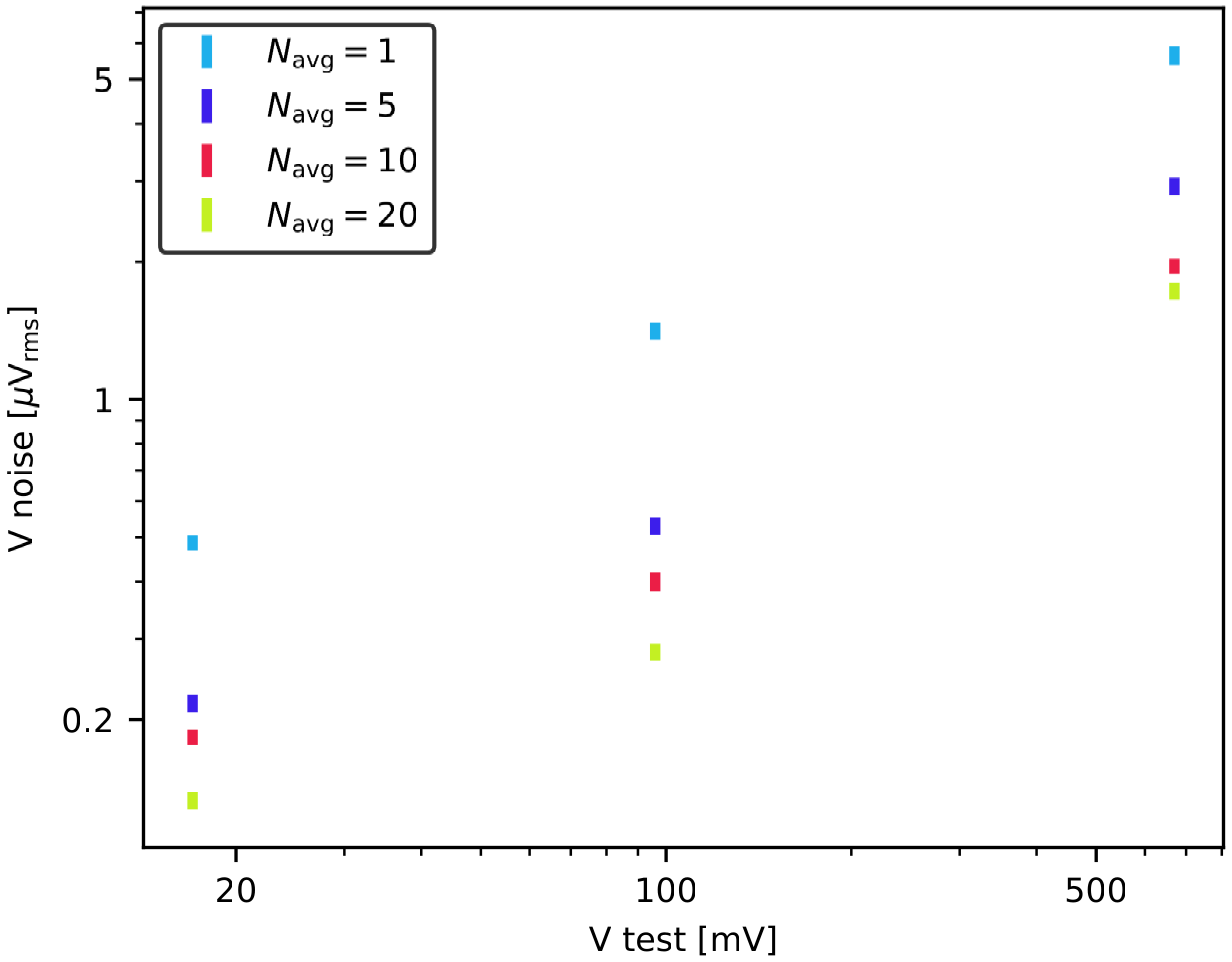


Noise σ	Voltage	Navg
1.411 ± 0.060 µV	96 mV	1
529 ± 23 nV	96 mV	5
400 ± 17 nV	96 mV	10
281 ± 11 nV	96 mV	20



Noise σ	Voltage	Navg
5.640 ± 0.230 µV	670 mV	1
2.920 ± 0.130 µV	670 mV	5
1.954 ± 0.089 µV	670 mV	10
1.725 ± 0.075 µV	670 mV	20





Overview of AUX voltage measurement noise

Integration

Strix has libraries for Python 3.x and LabView, with witch you can use and communicate with the unit. These libraries are available at Strix's Github page.

The programming interface is minimalist and streamlined, and examples for common measurements are available as well at Strix's Github page.

For physical integration, you can daisy-chain up to 32 Strix units together, and with SMA connectors you can connect a Strix unit in to most probe cards. The Strix unit also does not have LEDs, so it can be used inside dark boxes and other light sensitive areas.

Internal thermal stabilisation

Most common source for measurement drift is temperature (either internal or external) and to alleviate this drift the whole Strix unit is thermally stabilised with two heater circuits, one for the drive and one for the measurement subsystems.

The small size of the unit enables it to be essentially oven stabilised, causing the internal temperature to fluctuate in nominal conditions only ± 0.15 °C. The small size of the unit also reduces the warm-up time after a cold start to 5-8 minutes.

For inquiries and sales visit alshain.fi or contact sales at: contact@alshain.fi