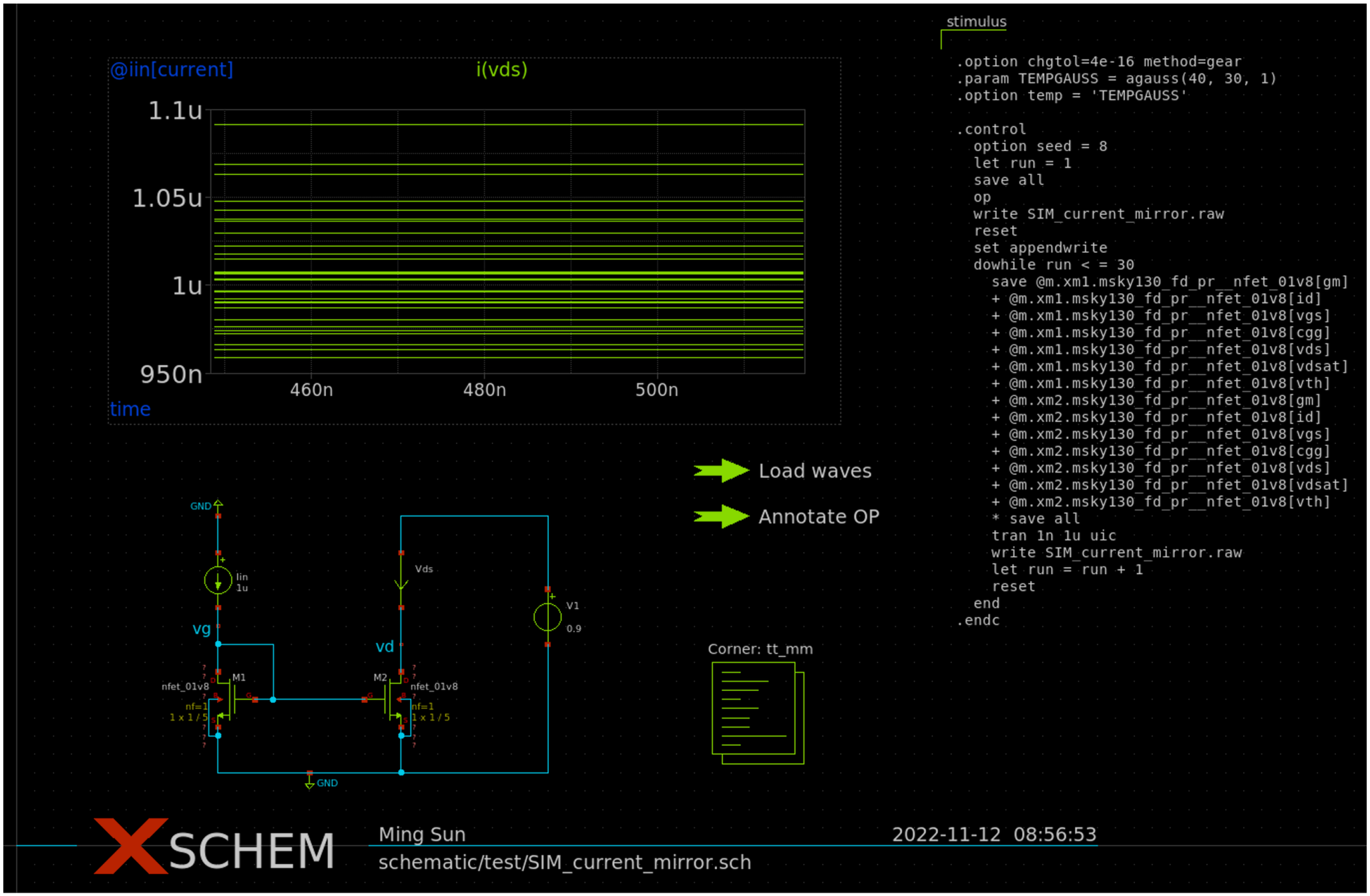
Simulation environment

- PDK: Skywater130
- Schematic capture tool: Xschem
- Simulator: Ngspice
- Waveform viewer: Xschem built-in waveform graph
- Test bench: SIM_current_mirror.sch

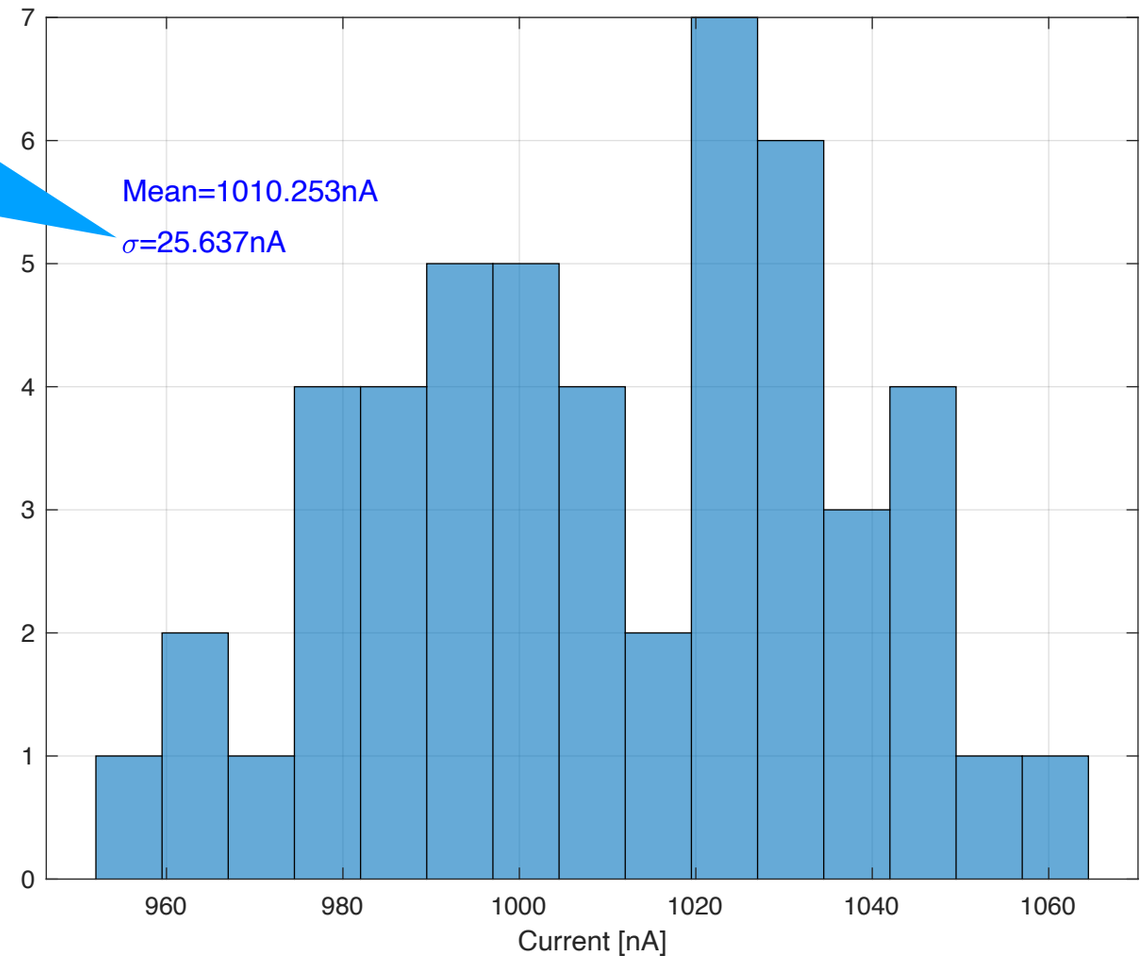
Current Mirror Mismatch Monte Carlo Test Bench



1.8V NMOS Monte Carlo sim result

- W=1μm, L=5μm

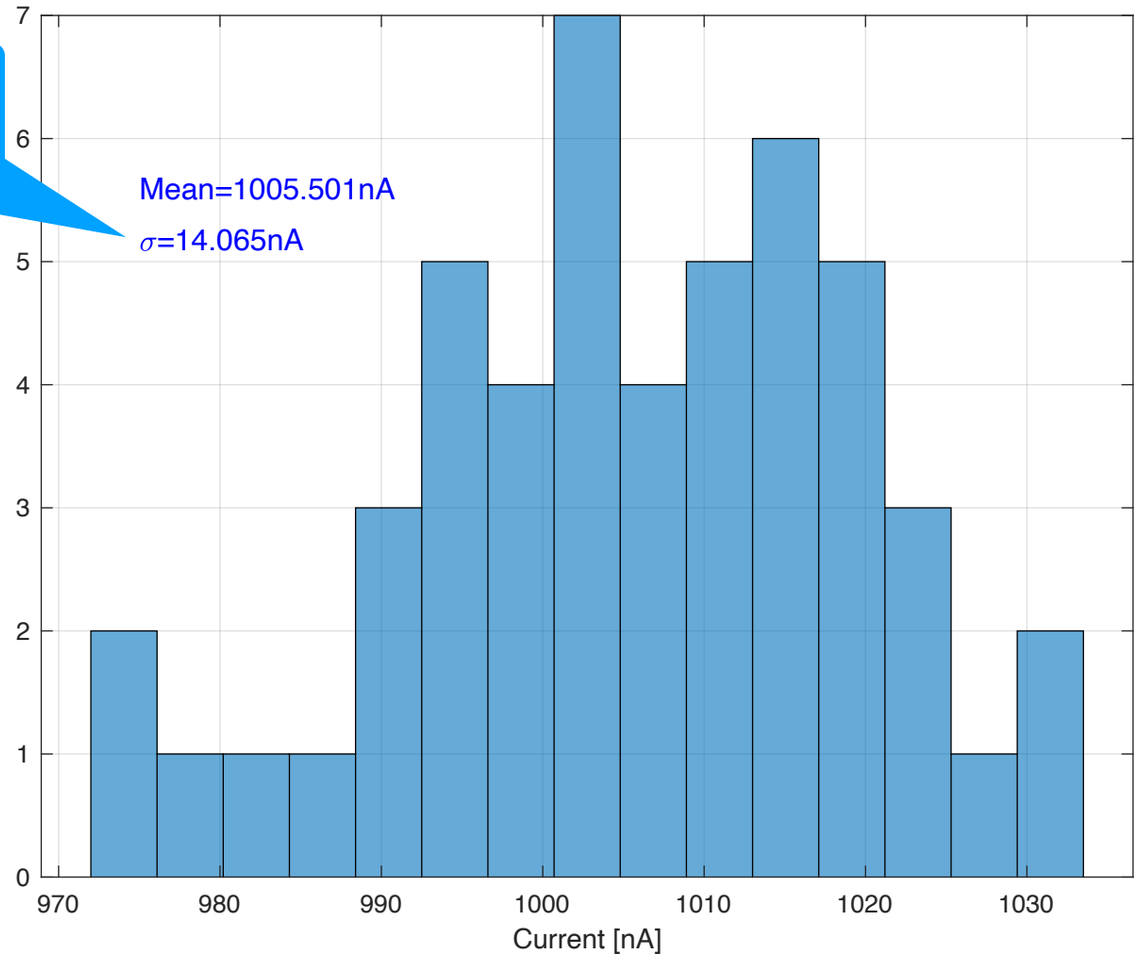
$$6sigma = \frac{6 * 25.637nA}{1010.253nA} = 15.2\,\%$$



1.8V NMOS Monte Carlo sim result

- W=2µm, L=10µm → area 4x, mismatch improves by ~2x

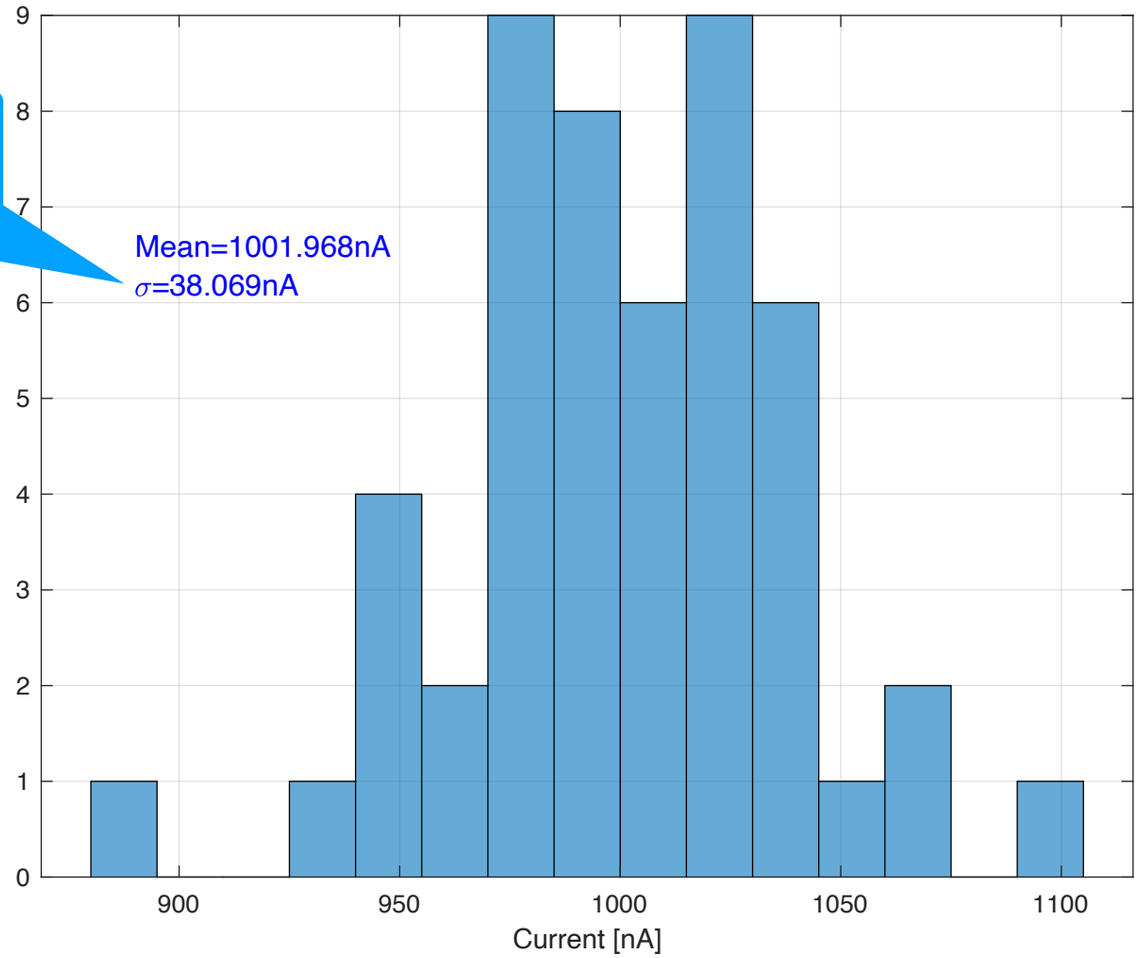
$$6sigma = \frac{6 * 14.065nA}{1005.501nA} = 8.4\,\%$$



1.8V NMOS Monte Carlo sim result

- W=0.5µm, L=5µm

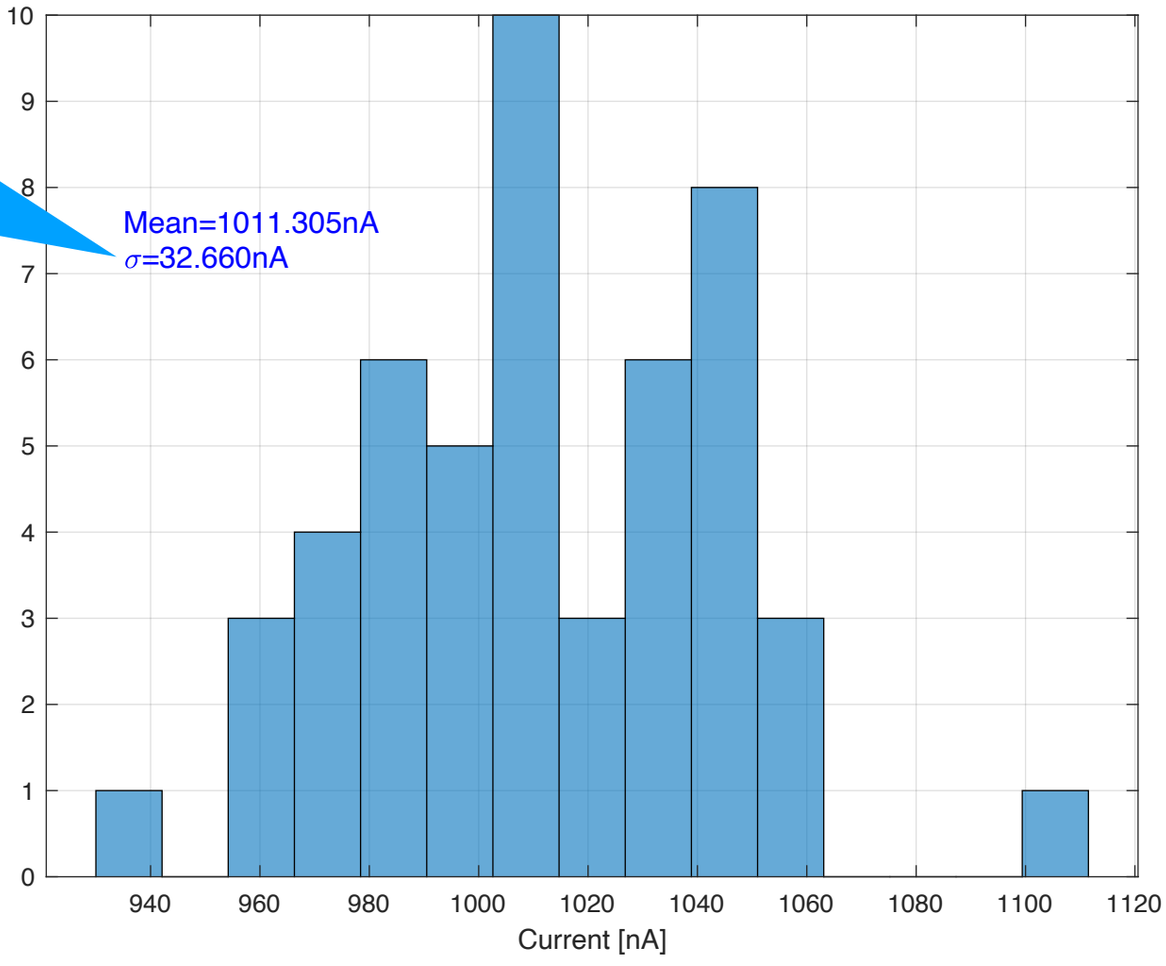
$$6sigma = \frac{6 * 38.069nA}{1001.968nA} = 22.8\,\%$$



1.8V NMOS Monte Carlo sim result

- W=1μm, L=4μm

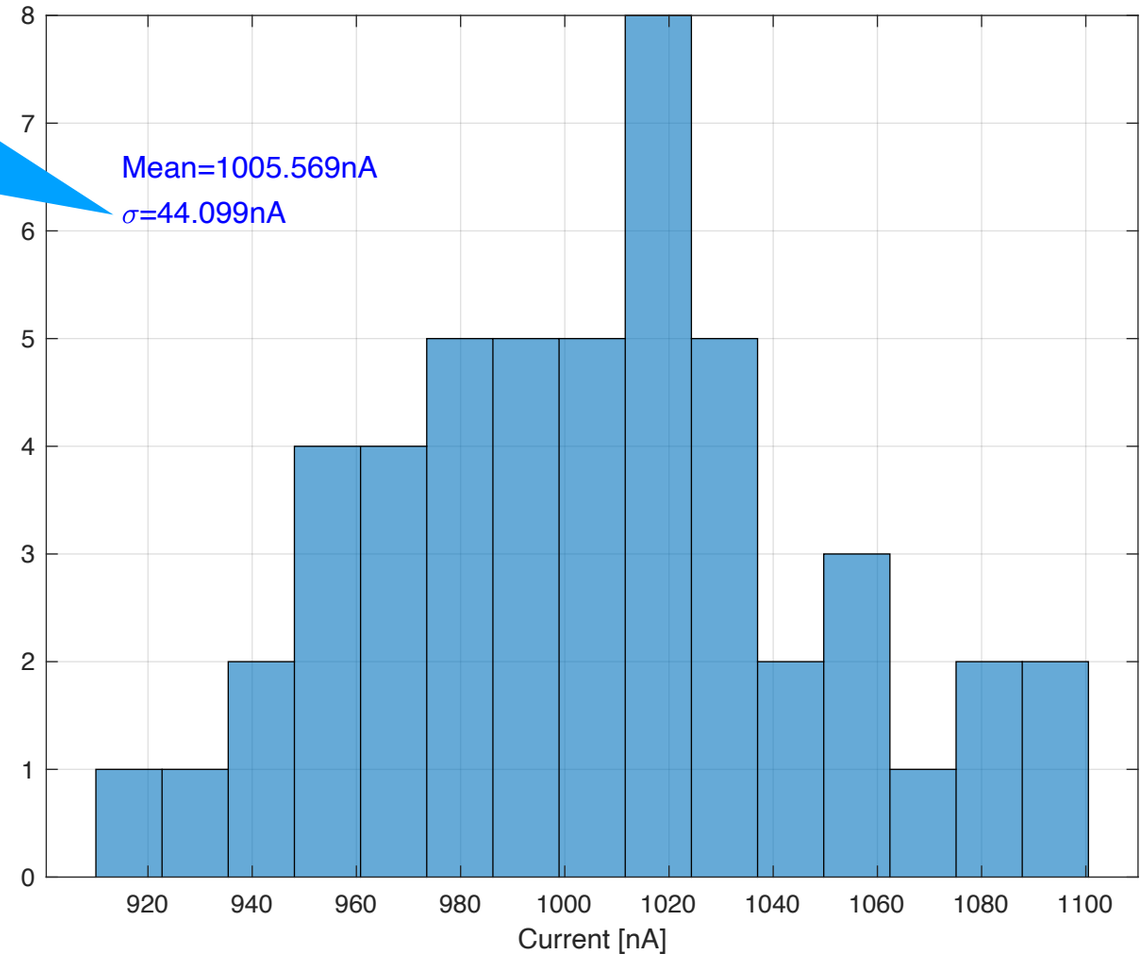
$$6sigma = \frac{6 * 32.66nA}{1011.305nA} = 19.4\,\%$$



1.8V LVT NMOS Monte Carlo sim result

- W=1μm, L=4μm

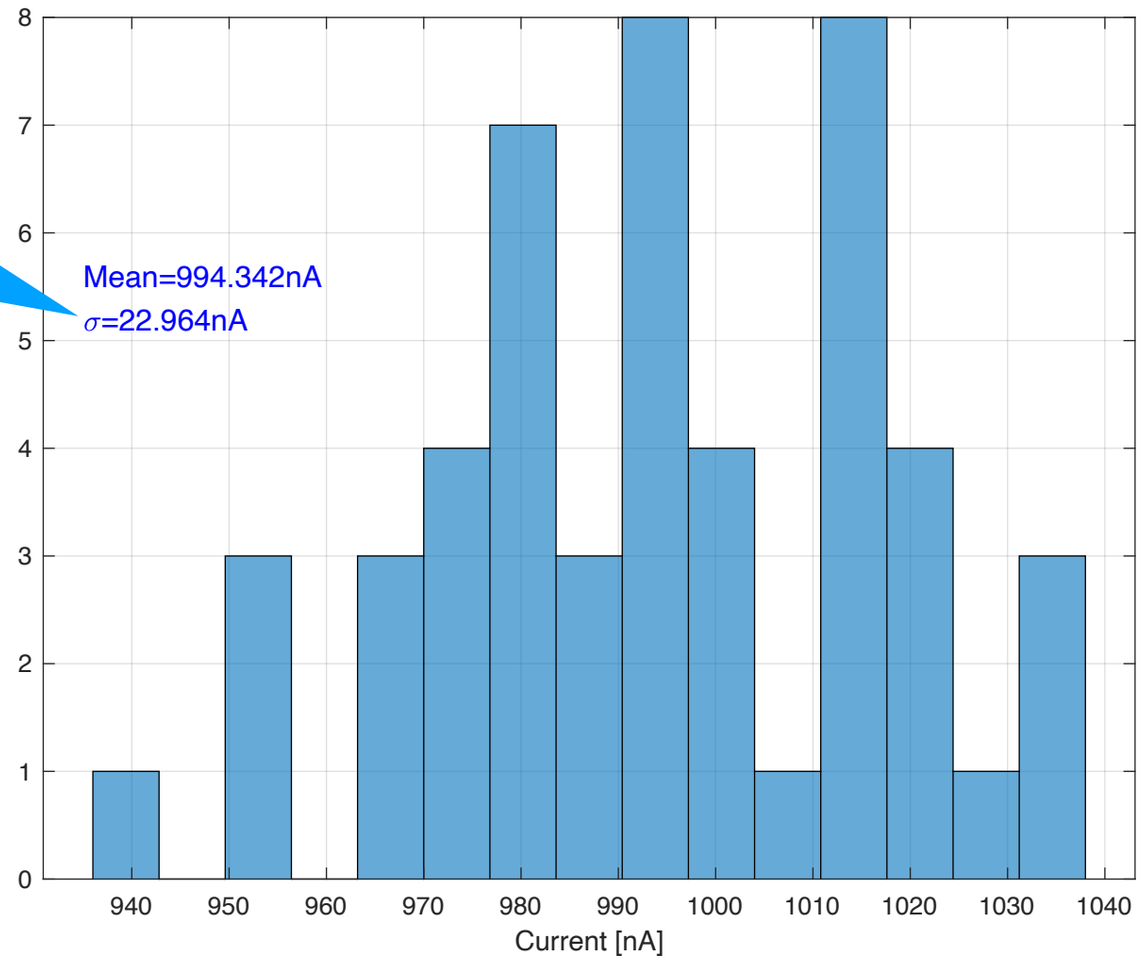
$$6sigma = \frac{6 * 44.099nA}{1005.569nA} = 26.3\,\%$$



1.8V PMOS Monte Carlo sim result

- W=1μm, L=4μm

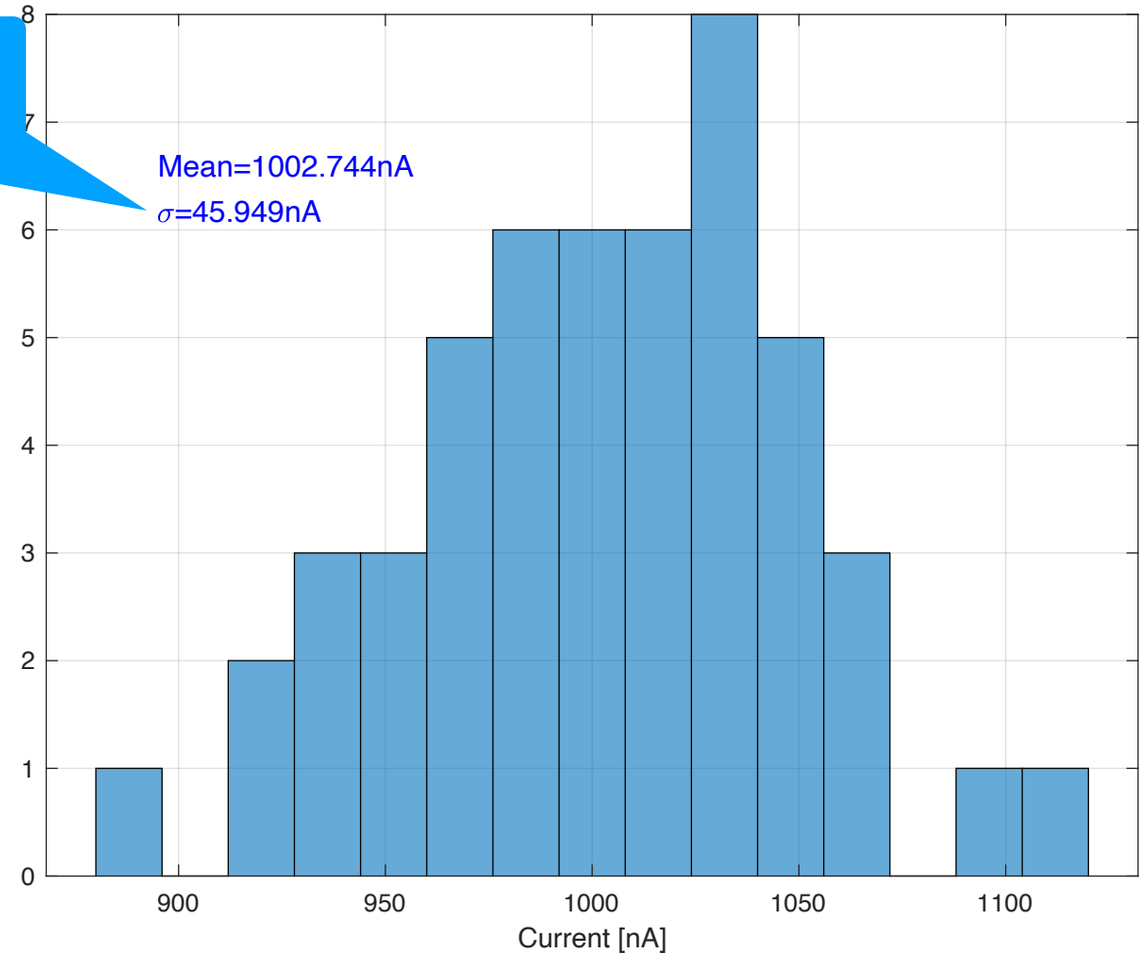
$$6sigma = \frac{6 * 22.964nA}{994.342nA} = 13.9\%$$



1.8V PMOS Monte Carlo sim result

- W=2μm, L=2μm

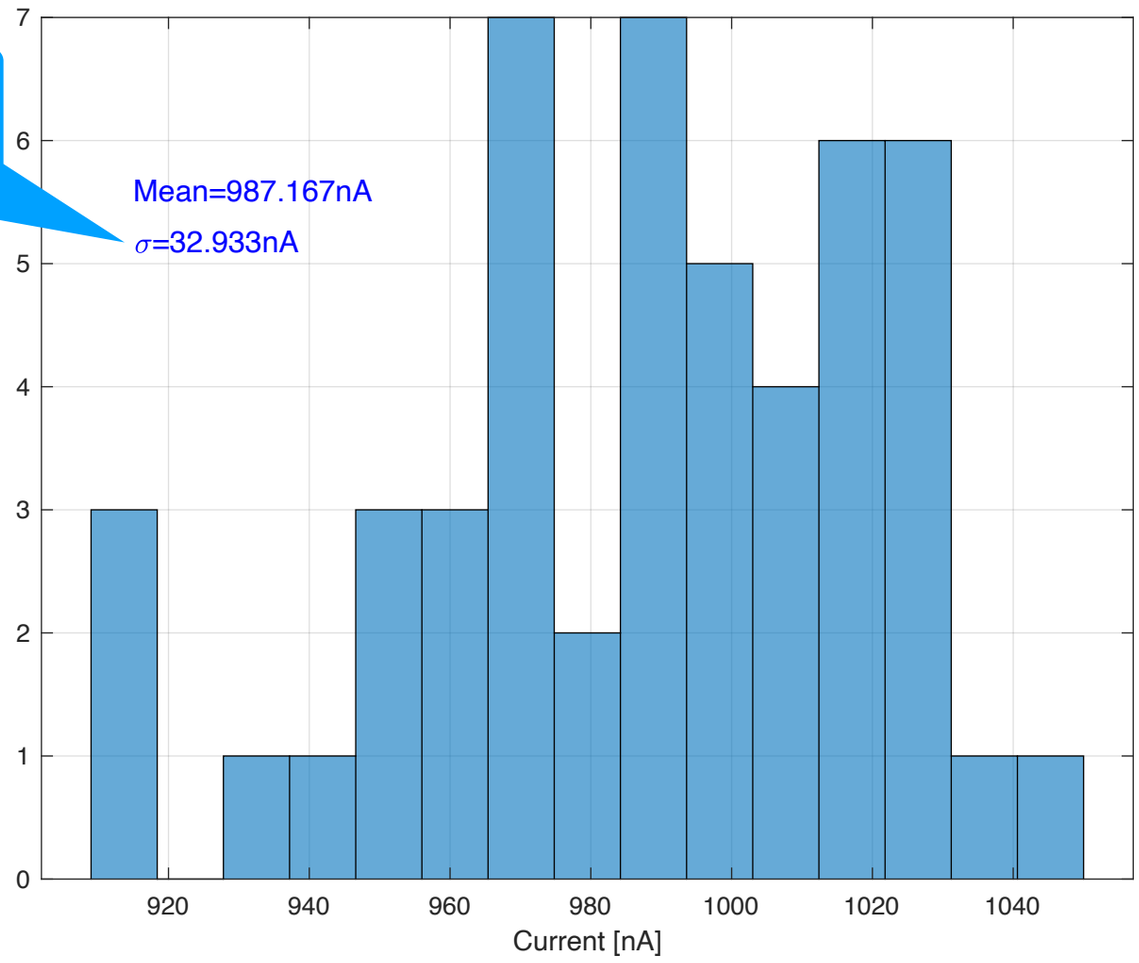
$$6sigma = \frac{6 * 45.949nA}{1002.744nA} = 27.5\,\%$$



1.8V PMOS Monte Carlo sim result

- W=1μm, L=3μm

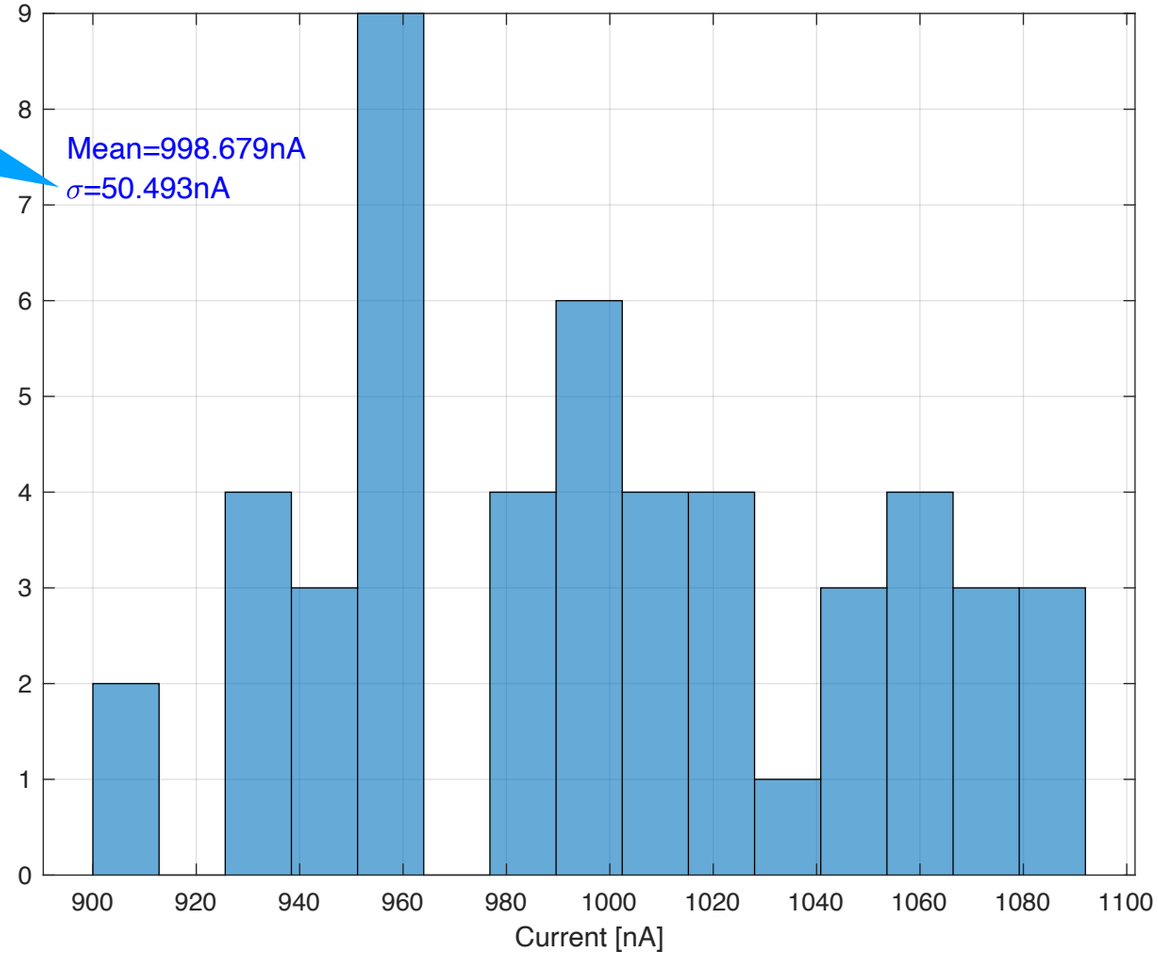
$$6sigma = \frac{6 * 32.933nA}{987.167nA} = 20\%$$



1.8V LVT PMOS Monte Carlo sim result

- W=1μm, L=3μm

$$6sigma = \frac{6 * 50.493nA}{998.679nA} = 30.3\,\%$$



Summary

Bias=1μA					
Device	W	L	Vdsat	Vth	6 sigma
1.8V NMOS	1μm	5μm	~203mV	~539mV	15.2%
	2μm	10μm	~167mV	~567mV	8.4%
	0.5μm	5μm	~310mV	~502mV	22.8%
	1μm	4μm	~198mV	~509mV	19.4%
1.8V LVT NMOS	1μm	4μm	~160mV	~458mV	26.3%
1.8V PMOS	1μm	4μm	~327mV	~912mV	13.9%
	2μm	2μm	~176mV	~962mV	27.5%
1.8V LVT PMOS	1μm	3μm	~306mV	~435mV	30.3%