1 Statistics and Benchmarks

1.1 Signal to Noise Ratio

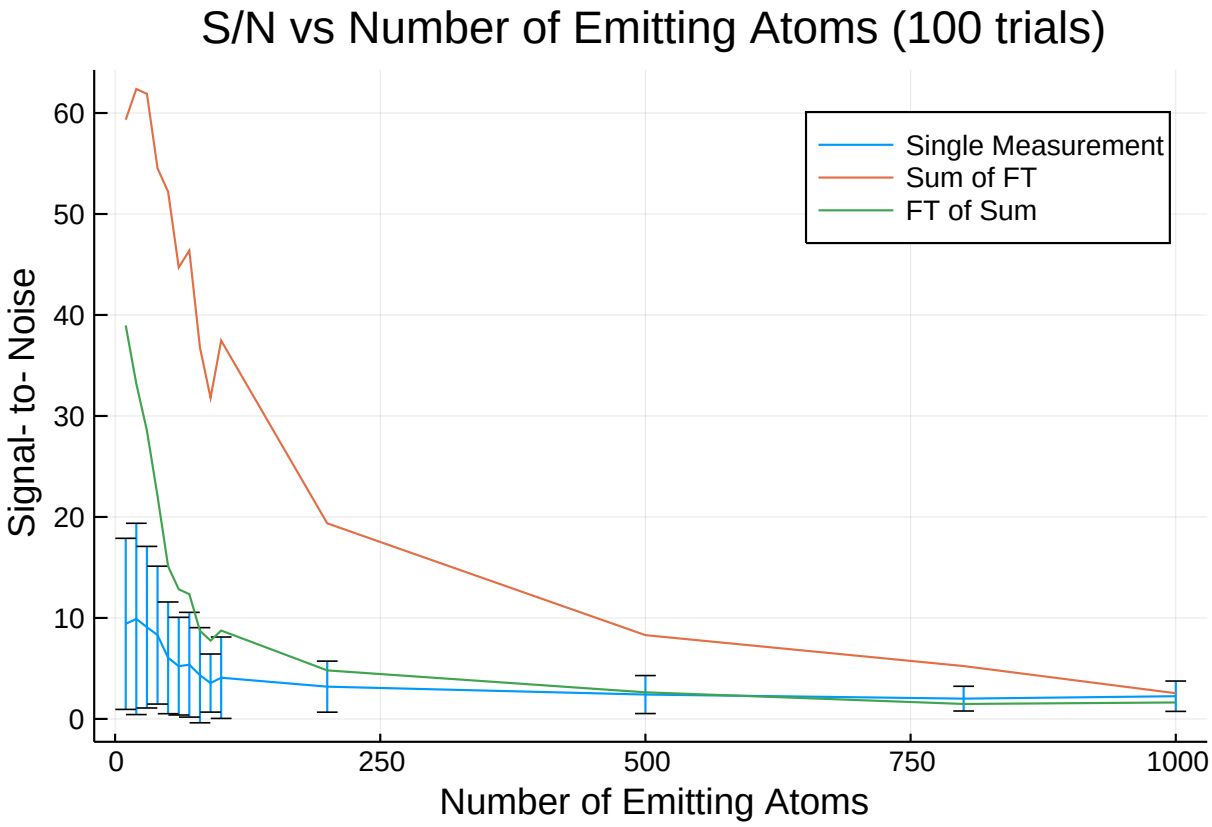
The signal-to-noise ratio calculated in the simulation is a rough estimate. Since the peaks in the Fourier transform seem to be consistently narrow, an arbitrary window is chosen to separate the signal peak from the noise. Signal-to-noise is then calculated by taking the maximum inside each peak window, shifting it downwards by the mean of the noise part, then dividing the resulting value by the variance of the noise part.

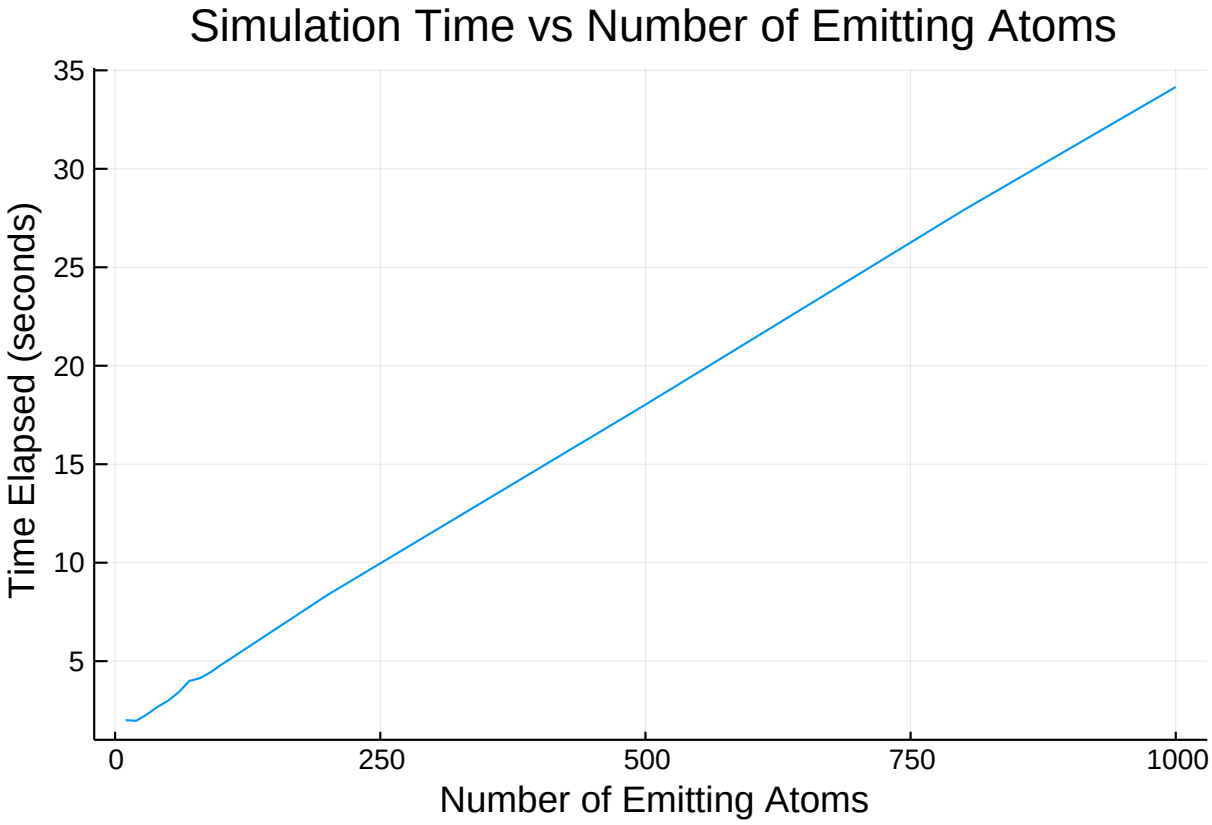
2 Number of Emitting Atoms

2.1 Parameters

Description	Value(s)
mean photon count rate (GHz)	2.0e6
number of atoms	[10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 500, 800, 1000]
randomize each trial	true
dead time (ns)	0.0
resolution (ns)	0.01
line frequencies (GHz)	[456810, 456813]
measurement duration (ns)	20.0
trials	100

2.2 Plots


S/N vs Number of Emitting Atoms (100 trials)
Single Measurement
Sum of FT
FT of Sum
Signal- to- Noise
0
10
20
30
40
50
60
0
250
500
750
1000
Number of Emitting Atoms

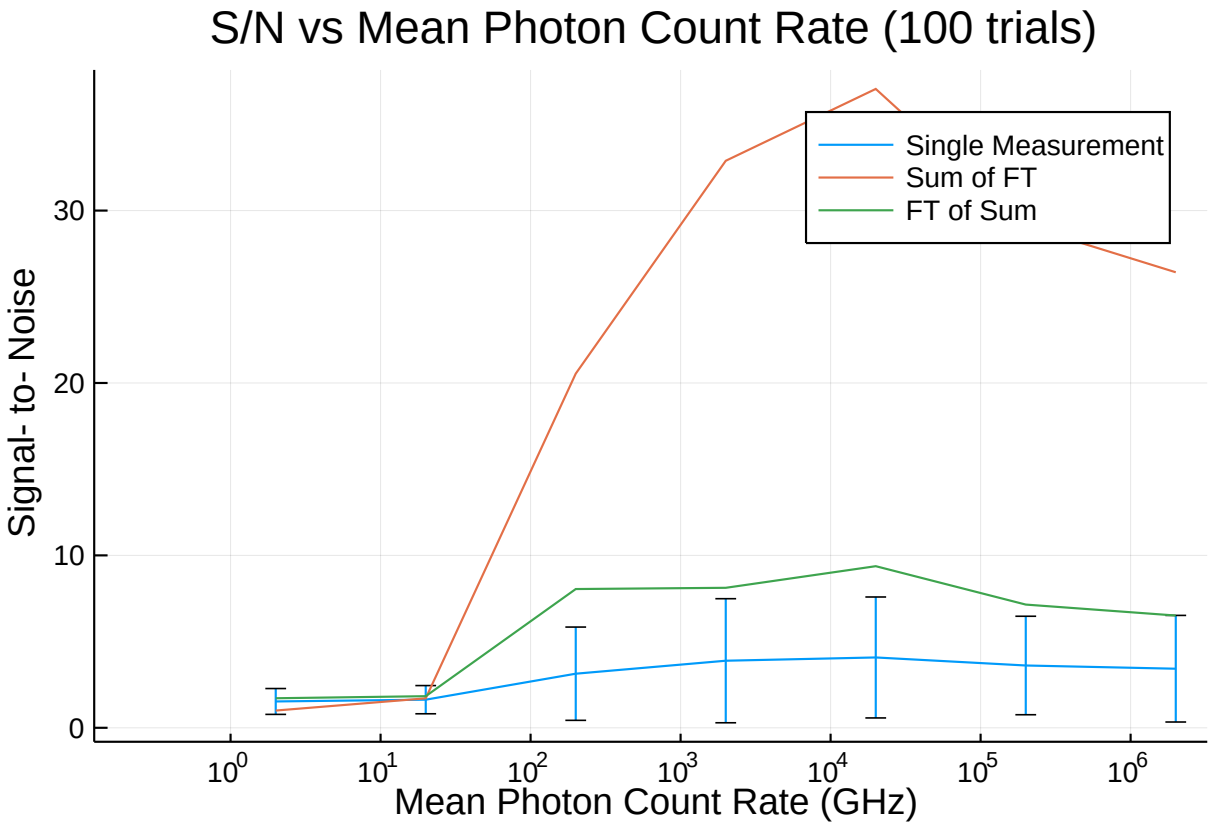

Simulation Time vs Number of Emitting Atoms
Time Elapsed (seconds)
5
10
15
20
25
30
35
0
250
500
750
1000
Number of Emitting Atoms

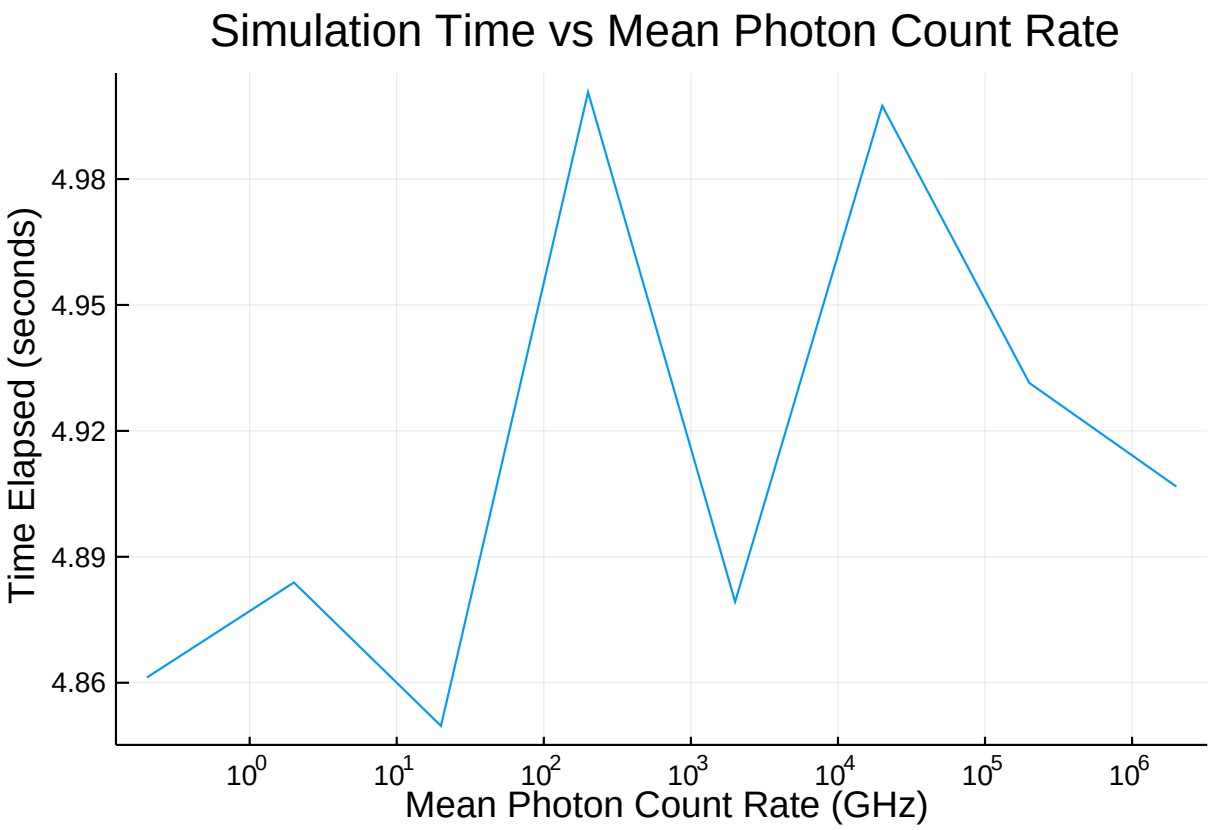
3 Average Photon Count Rate

3.1 Parameters

Description	Value(s)
mean photon count rate (GHz)	[2.0e6, 200000.0, 20000.0, 2000.0, 200.0, 20.0, 2.0, 0.2]
number of atoms	100
randomize each trial	true
dead time (ns)	0.0
resolution (ns)	0.01
line frequencies (GHz)	[456810, 456813]
measurement duration (ns)	20.0
trials	100

3.2 Plots



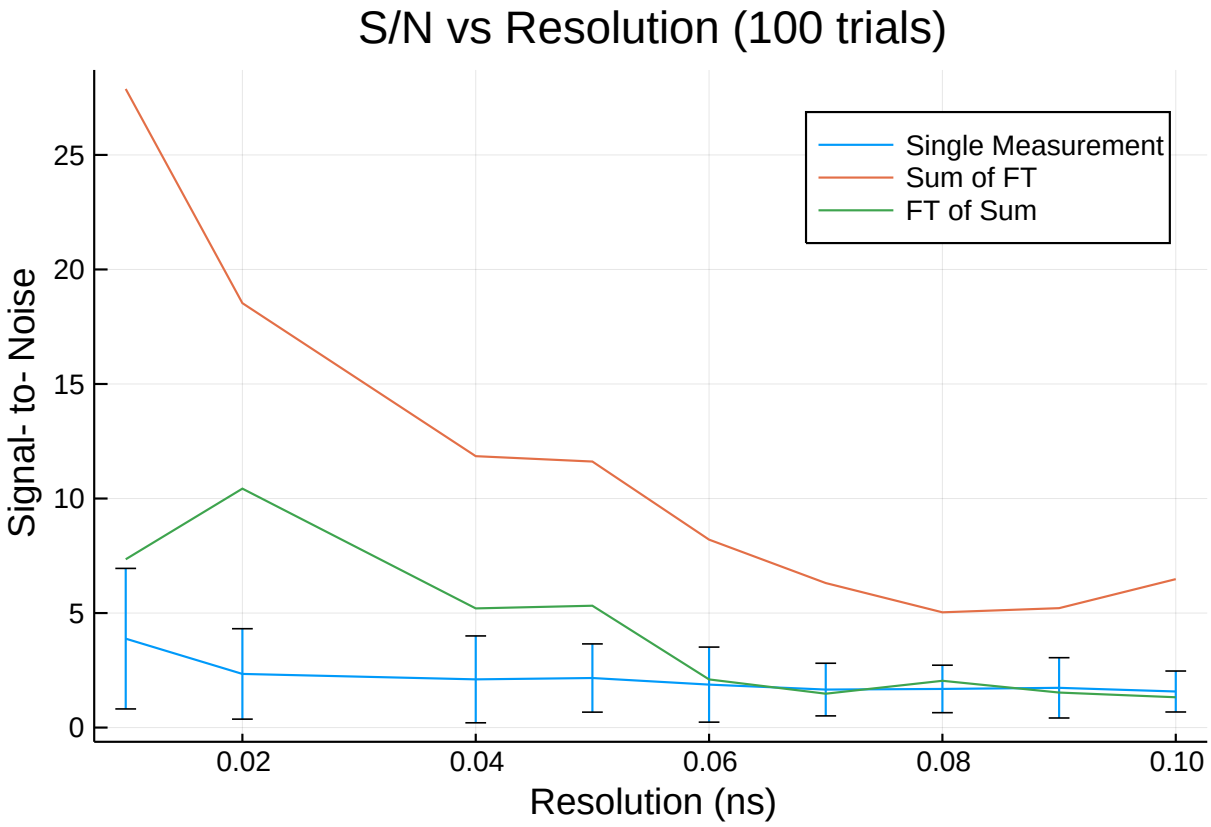


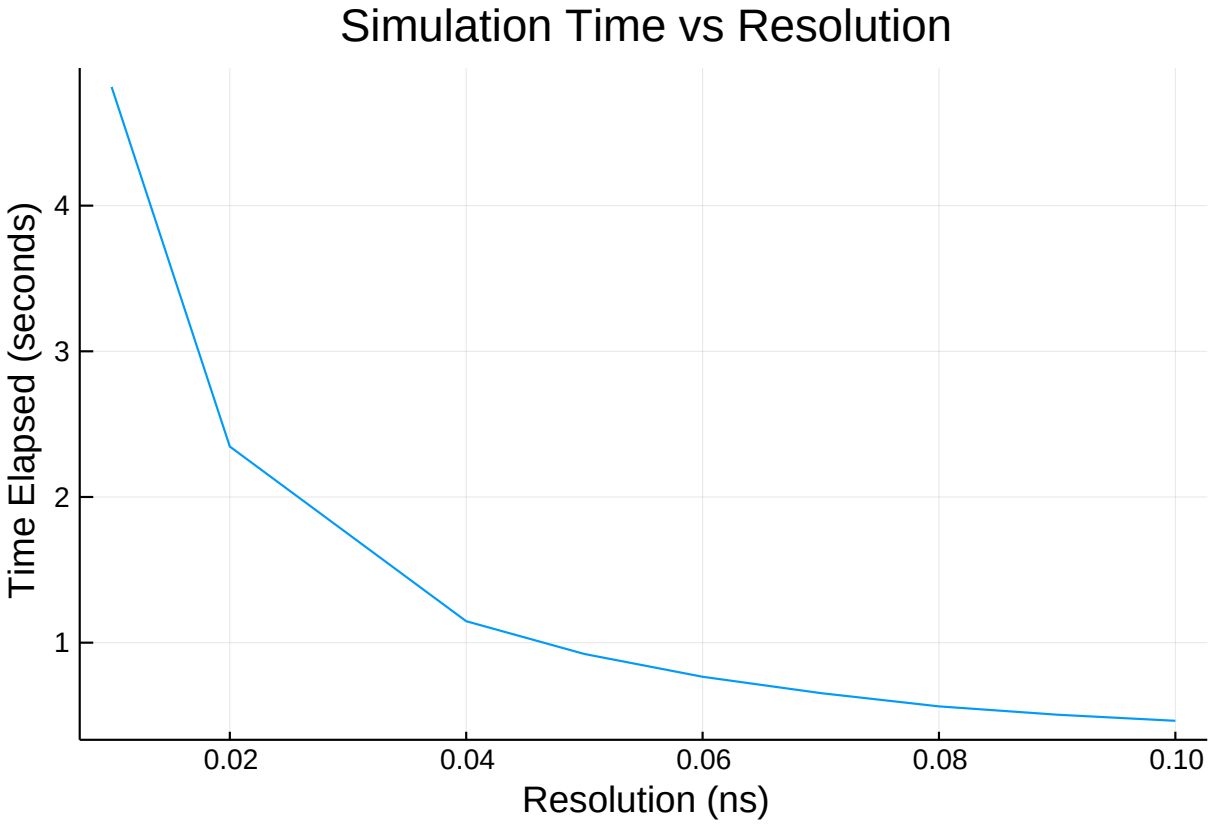
4 Resolution

4.1 Parameters

Description	Value(s)
mean photon count rate (GHz)	2.0e6
number of atoms	100
randomize each trial	true
dead time (ns)	0.0
resolution (ns)	[0.01, 0.02, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1]
line frequencies (GHz)	[456810, 456813]
measurement duration (ns)	20.0
trials	100

4.2 Plots


S/N vs Resolution (100 trials)
Single Measurement
Sum of FT
FT of Sum
Signal- to- Noise
0
5
10
15
20
25
0.02
0.04
0.06
0.08
0.10
Resolution (ns)


Simulation Time vs Resolution
Time Elapsed (seconds)
1
2
3
4
0.02
0.04
0.06
0.08
0.10
Resolution (ns)

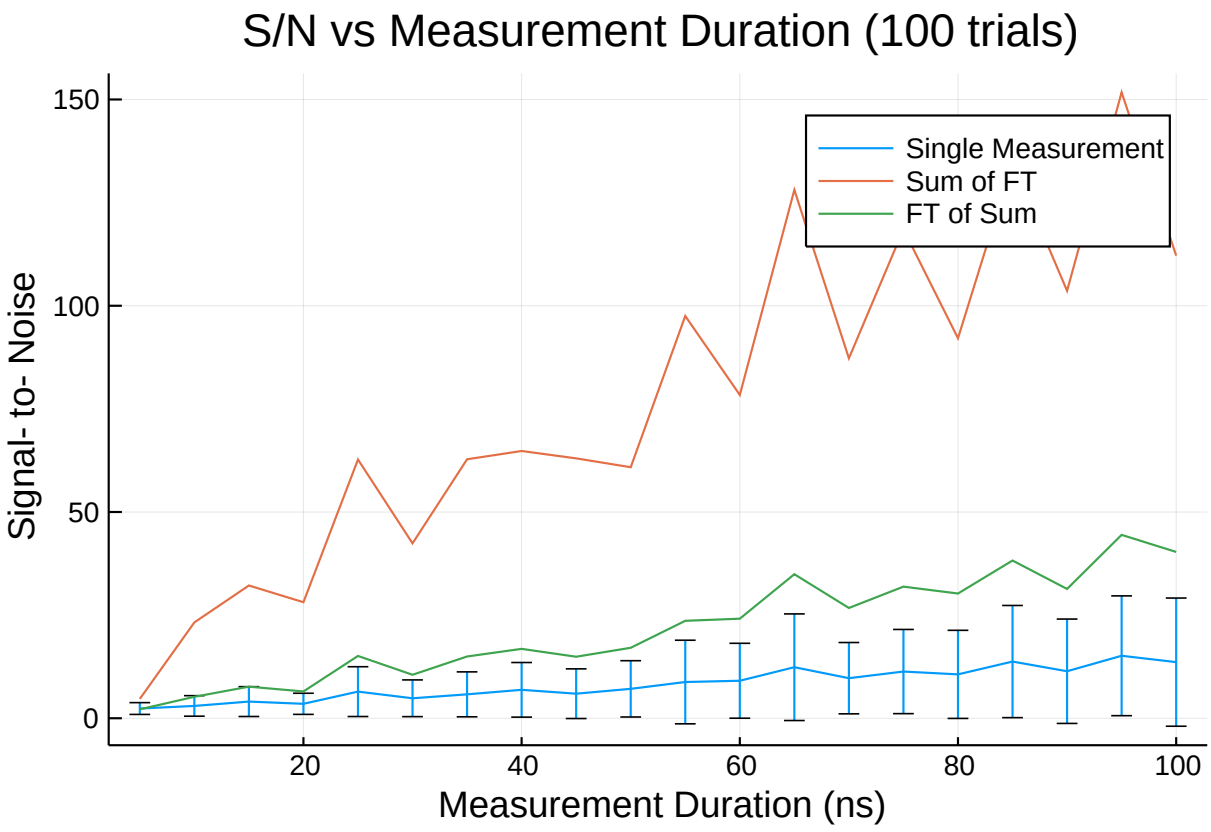
5 Measurement Duration

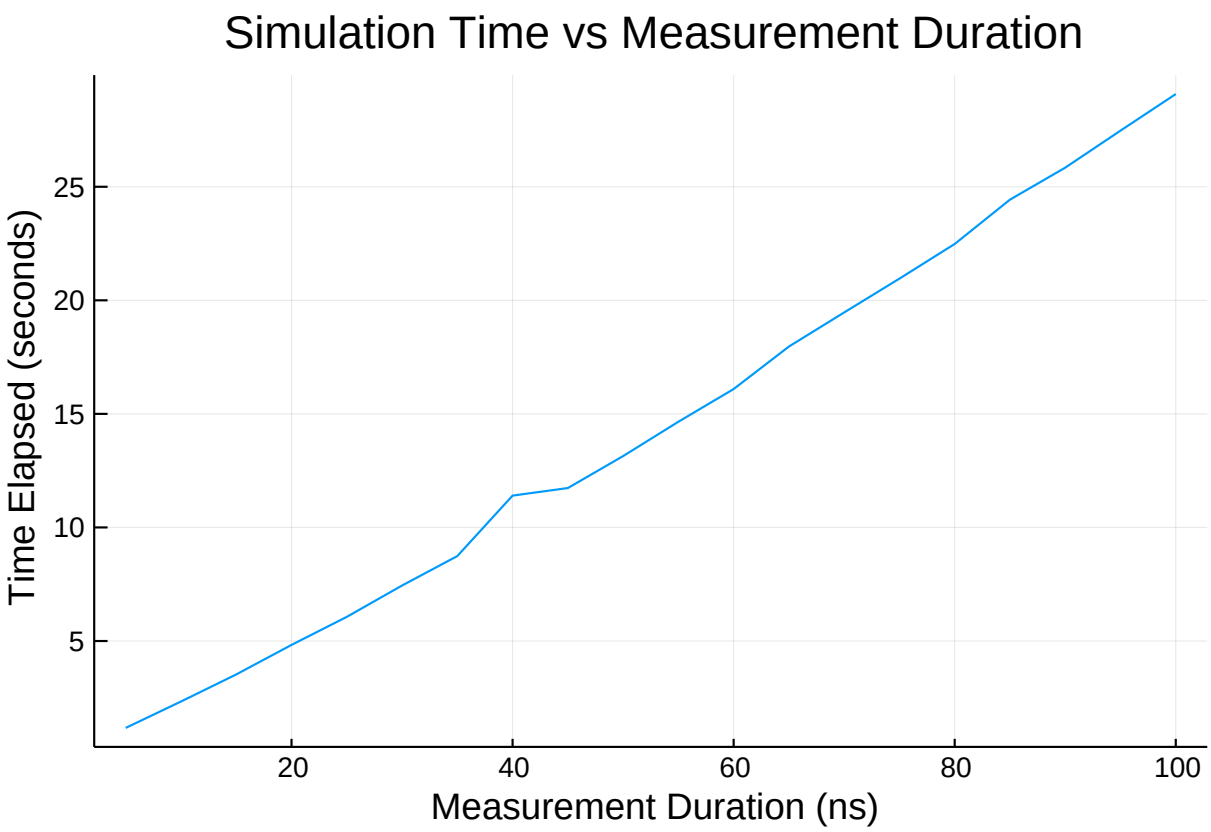
Note: correlation integration time is set to 1/2 the measurement duration for all cases.

5.1 Parameters

Description	Value(s)
mean photon count rate (GHz)	2.0e6
number of atoms	100
randomize each trial	true
dead time (ns)	0.0
resolution (ns)	0.01
line frequencies (GHz)	[456810, 456813]
measurement duration (ns)	[5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, 50.0, 55.0, 60.0, 65.0
trials	100

5.2 Plots



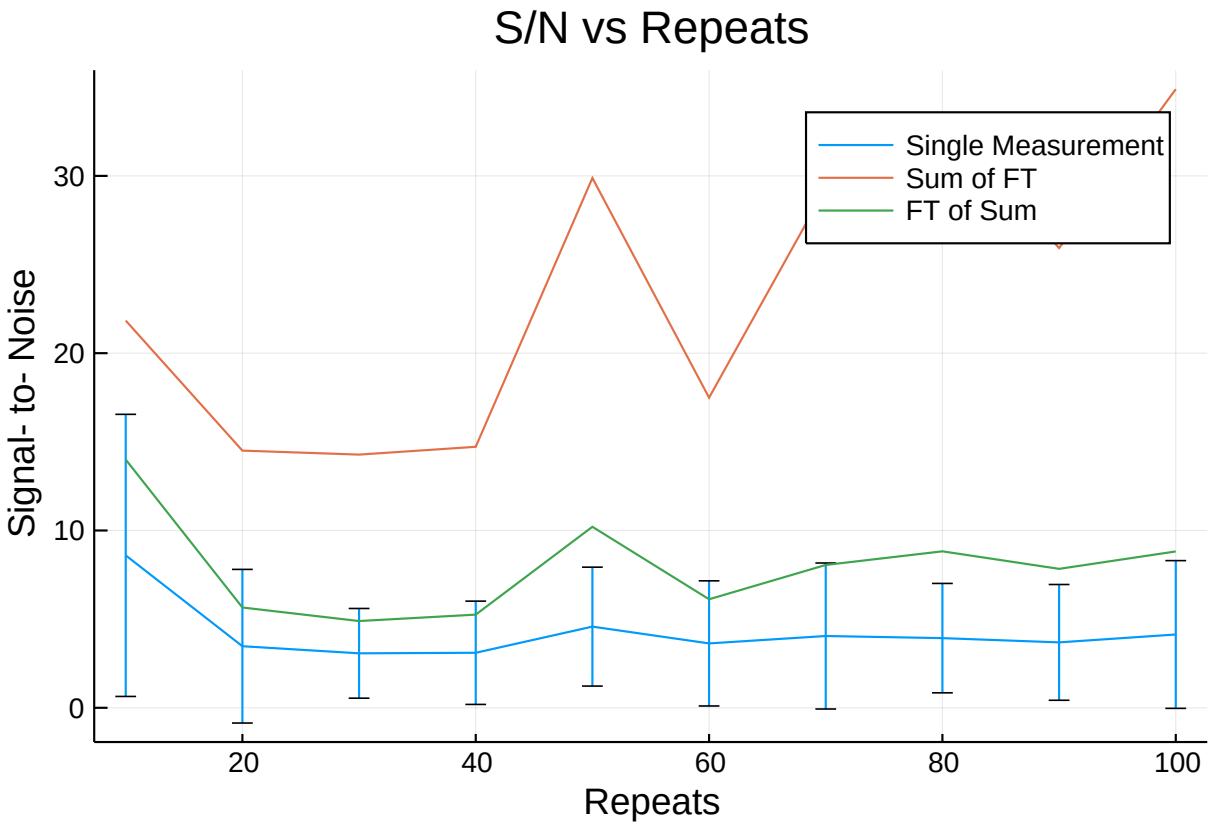


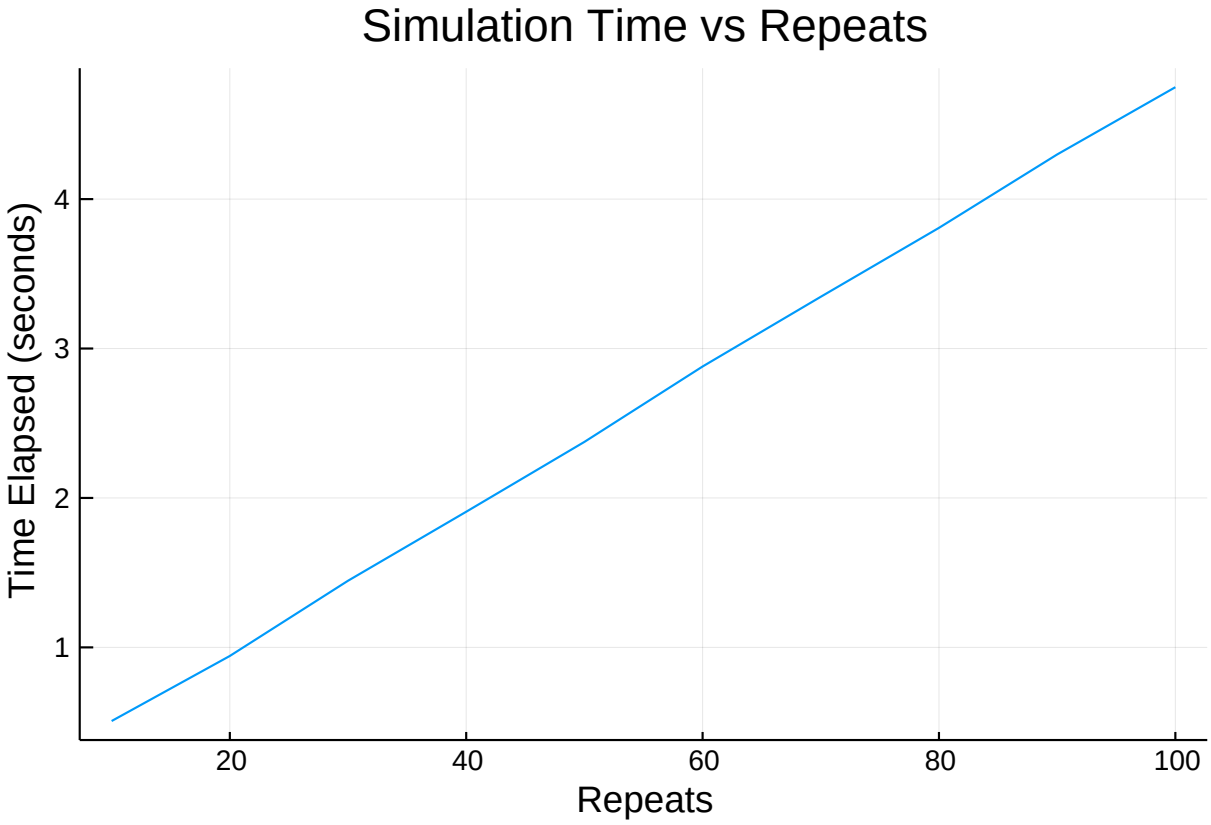
6 Repeated Measurements

6.1 Parameters

Description	Value(s)
mean photon count rate (GHz)	2.0e6
number of atoms	100
randomize each trial	true
dead time (ns)	0.0
resolution (ns)	0.01
line frequencies (GHz)	[456810, 456813]
measurement duration (ns)	20.0
trials	[10, 20, 30, 40, 50, 60, 70, 80, 90, 100]

6.2 Plots


S/N vs Repeats
Single Measurement
Sum of FT
FT of Sum
Signal- to- Noise
0
10
20
30
20
40
60
80
100
Repeats


Simulation Time vs Repeats
Time Elapsed (seconds)
1
2
3
4
20
40
60
80
100
Repeats