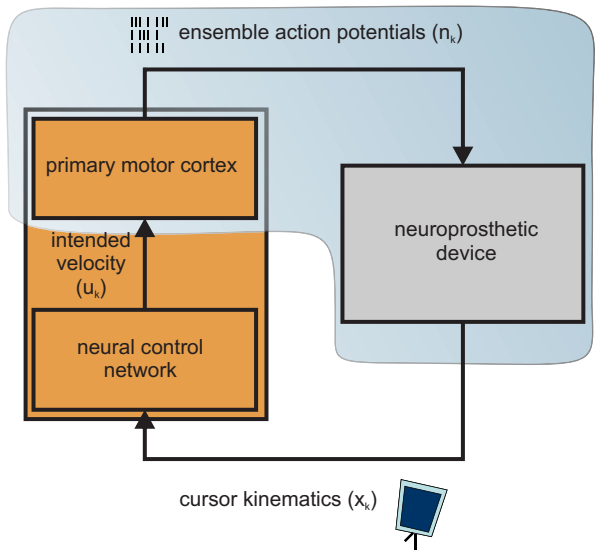
Figure 1

1A



1B

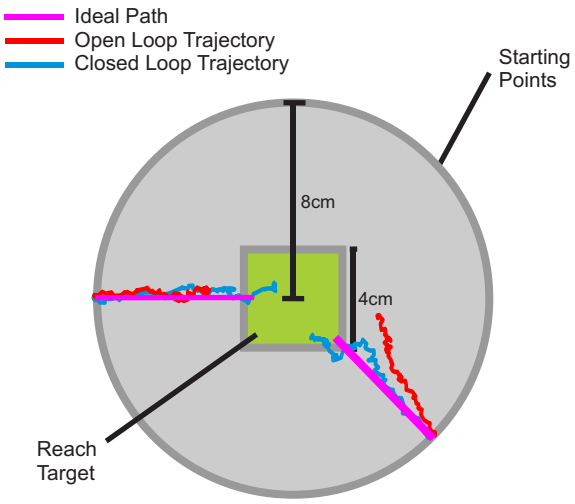


Figure 2

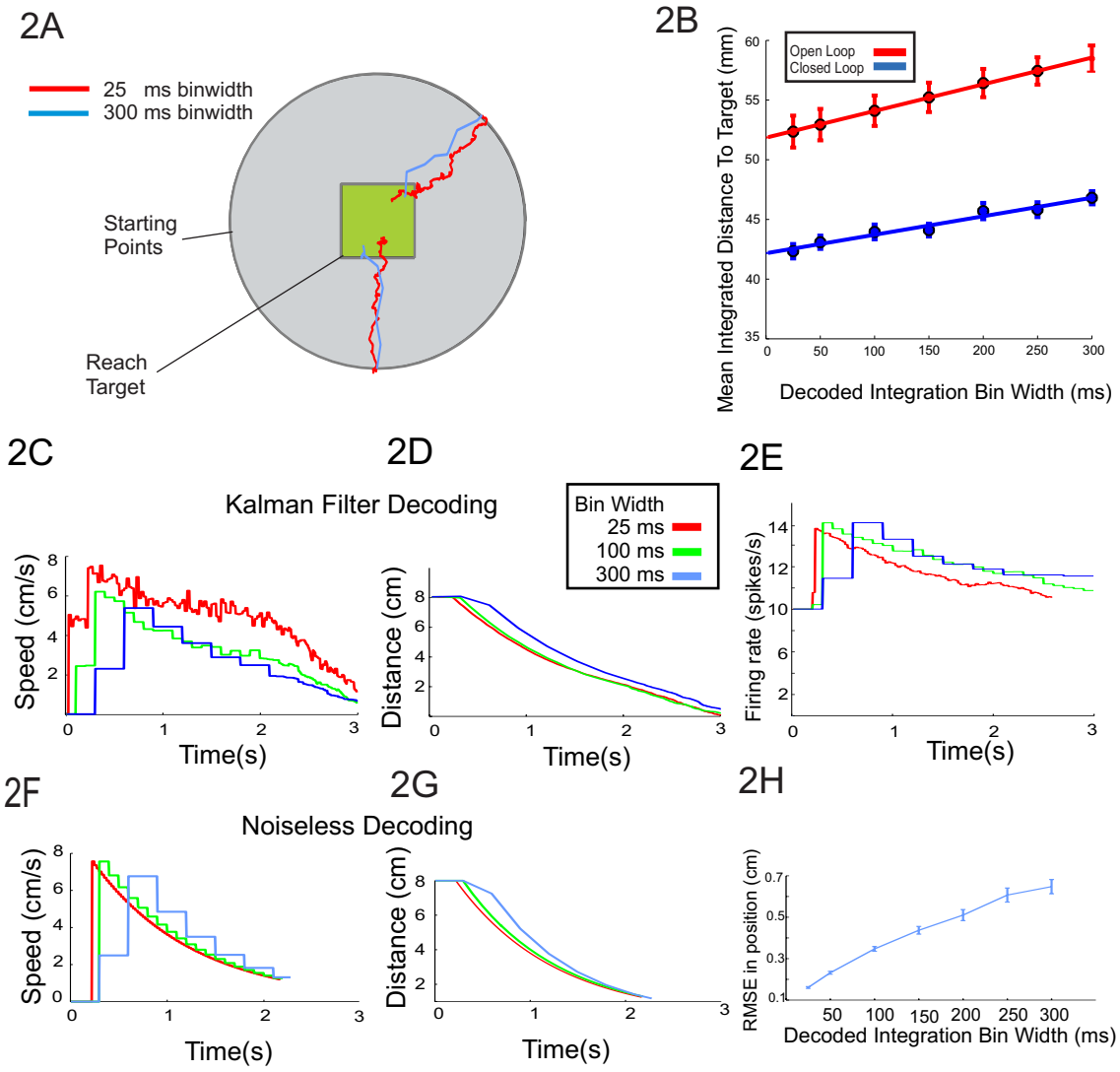
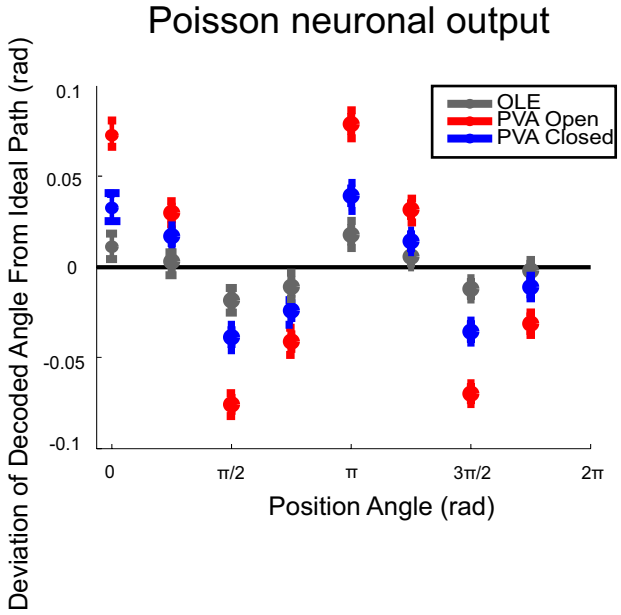
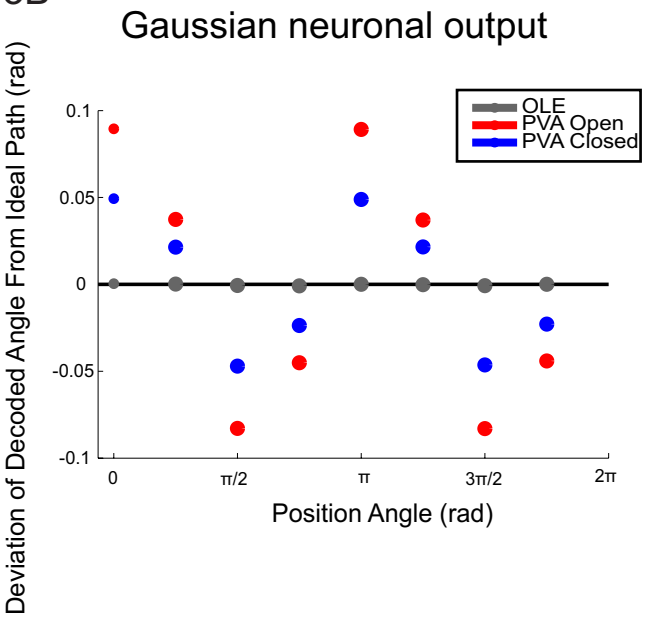

2A
25 ms binwidth
300 ms binwidth
Starting Points
Reach Target
2B
Open Loop
Closed Loop
Mean Integrated Distance To Target (mm)
Decoded Integration Bin Width (ms)
2C
2D
Kalman Filter Decoding
Bin Width
25 ms
100 ms
300 ms
Speed (cm/s)
Distance (cm)
Time(s)
2E
Firing rate (spikes/s)
Time(s)
2F
2G
Noiseless Decoding
Speed (cm/s)
Distance (cm)
Time(s)
2H
RMSE in position (cm)
Decoded Integration Bin Width (ms)

Figure 3

3A



3B



3C

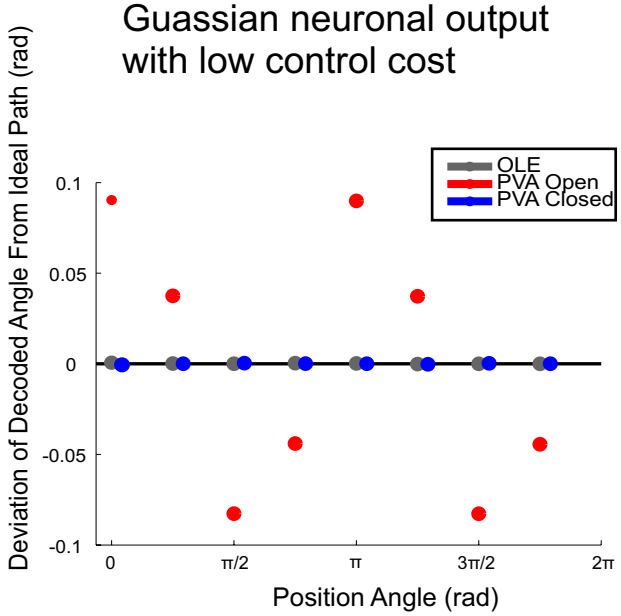


Figure 4

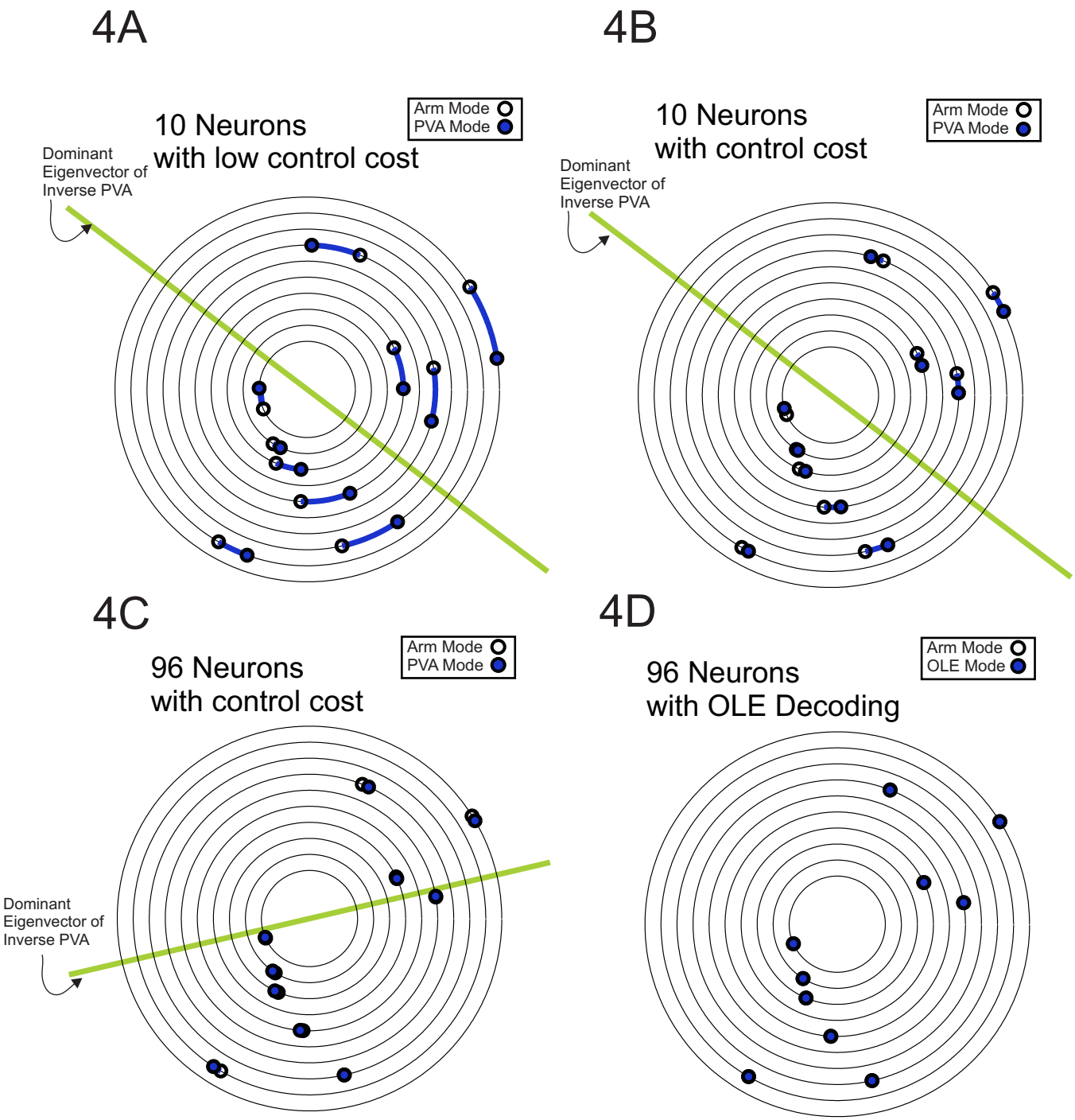
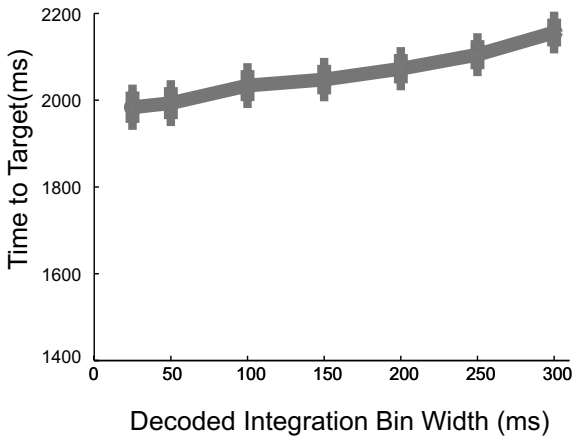
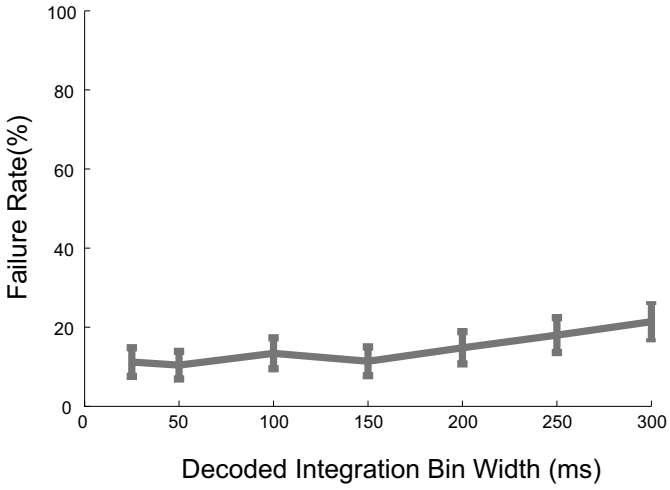

4A
10 Neurons
with low control cost
Arm Mode
PVA Mode
Dominant
Eigenvector of
Inverse PVA
4B
10 Neurons
with control cost
Arm Mode
PVA Mode
Dominant
Eigenvector of
Inverse PVA
4C
96 Neurons
with control cost
Arm Mode
PVA Mode
Dominant
Eigenvector of
Inverse PVA
4D
96 Neurons
with OLE Decoding
Arm Mode
OLE Mode

Figure 5

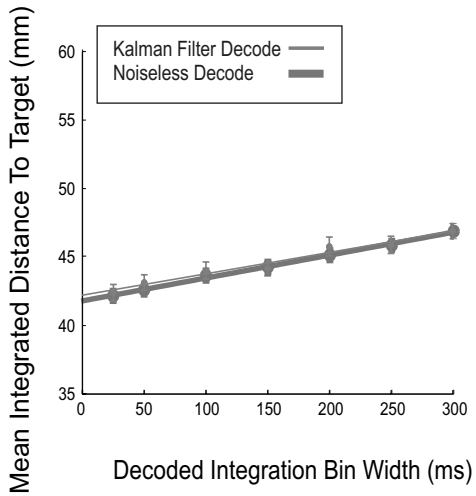
5A



5B



5C



5D

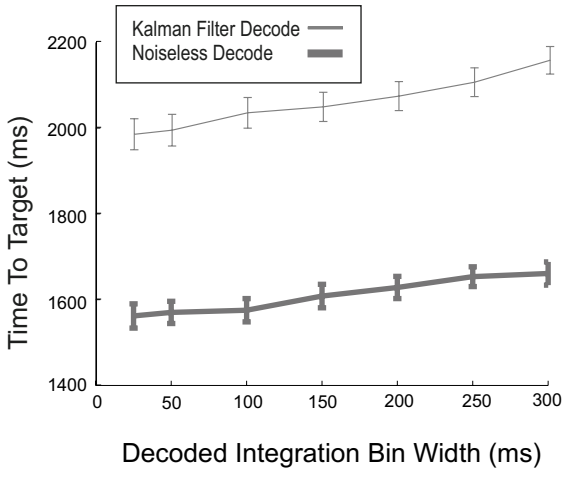
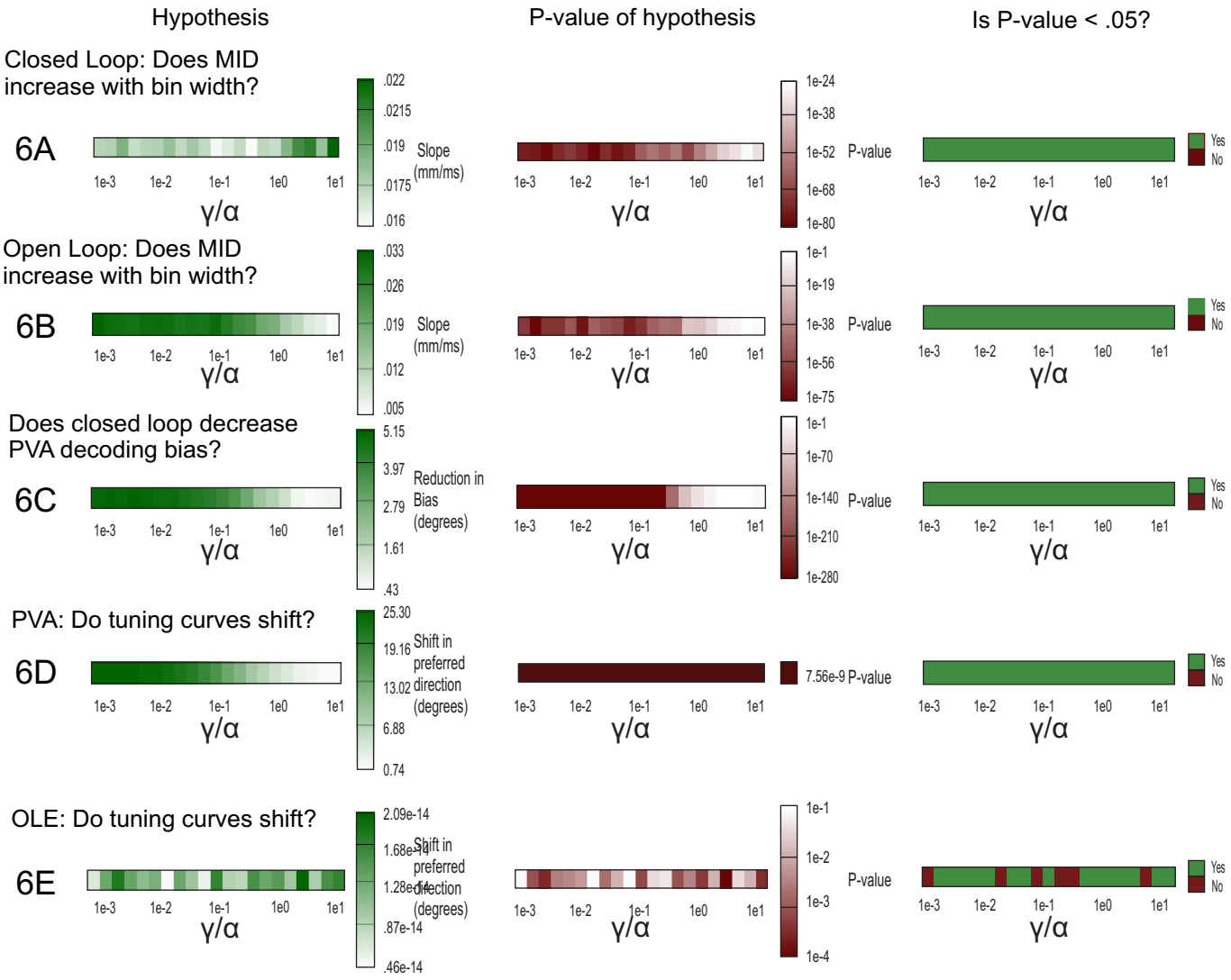
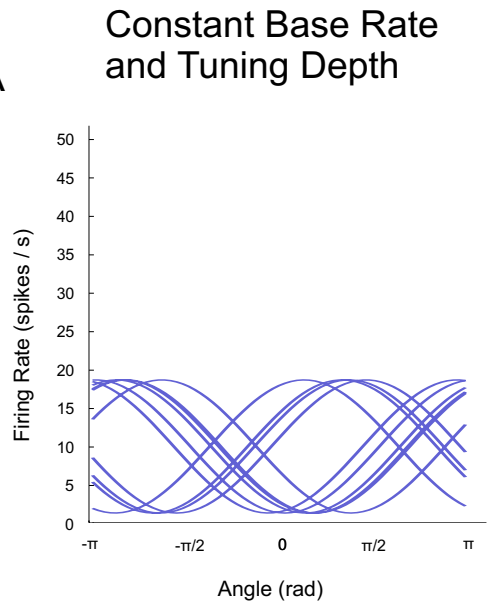


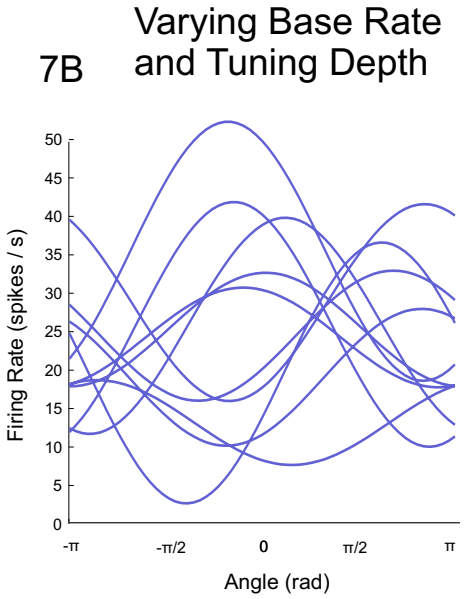
Figure 6


Hypothesis
P-value of hypothesis
Is P-value < .05?
Closed Loop: Does MID increase with bin width?
6A
Open Loop: Does MID increase with bin width?
6B
Does closed loop decrease PVA decoding bias?
6C
PVA: Do tuning curves shift?
6D
OLE: Do tuning curves shift?
6E
1e-3
1e-2
1e-1
1e0
1e1
γ/α
.022
.0215
.019
.0175
.016
Slope (mm/ms)
.033
.026
.019
.012
.005
5.15
3.97
2.79
1.61
.43
Reduction in Bias (degrees)
25.30
19.16
13.02
6.88
0.74
Shift in preferred direction (degrees)
2.09e-14
1.68e-14
1.28e-14
.87e-14
.46e-14
Shift in preferred direction (degrees)
1e-24
1e-38
1e-52
1e-68
1e-80
1e-1
1e-19
1e-38
1e-56
1e-75
1e-70
1e-140
1e-210
1e-280
7.56e-9
1e-2
1e-3
1e-4
P-value
Yes
No

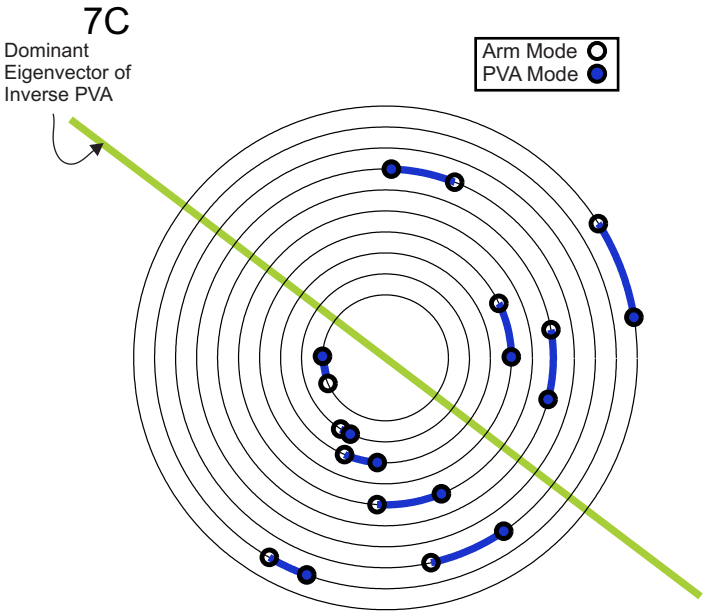
7A


Constant Base Rate
and Tuning Depth
Firing Rate (spikes / s)
50
45
40
35
30
25
20
15
10
5
0
-π
-π/2
0
π/2
π
Angle (rad)

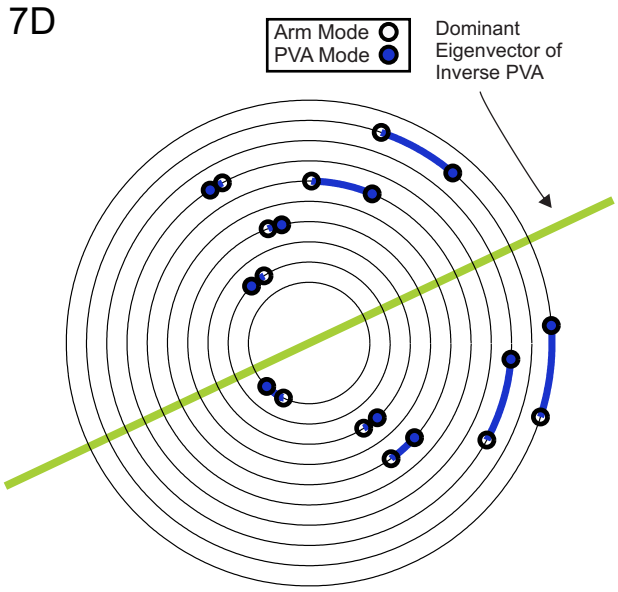
7B


Varying Base Rate
and Tuning Depth
Firing Rate (spikes / s)
50
45
40
35
30
25
20
15
10
5
0
-π
-π/2
0
π/2
π
Angle (rad)

7C


Dominant
Eigenvector of
Inverse PVA
Arm Mode
PVA Mode

7D


Arm Mode
PVA Mode
Dominant
Eigenvector of
Inverse PVA