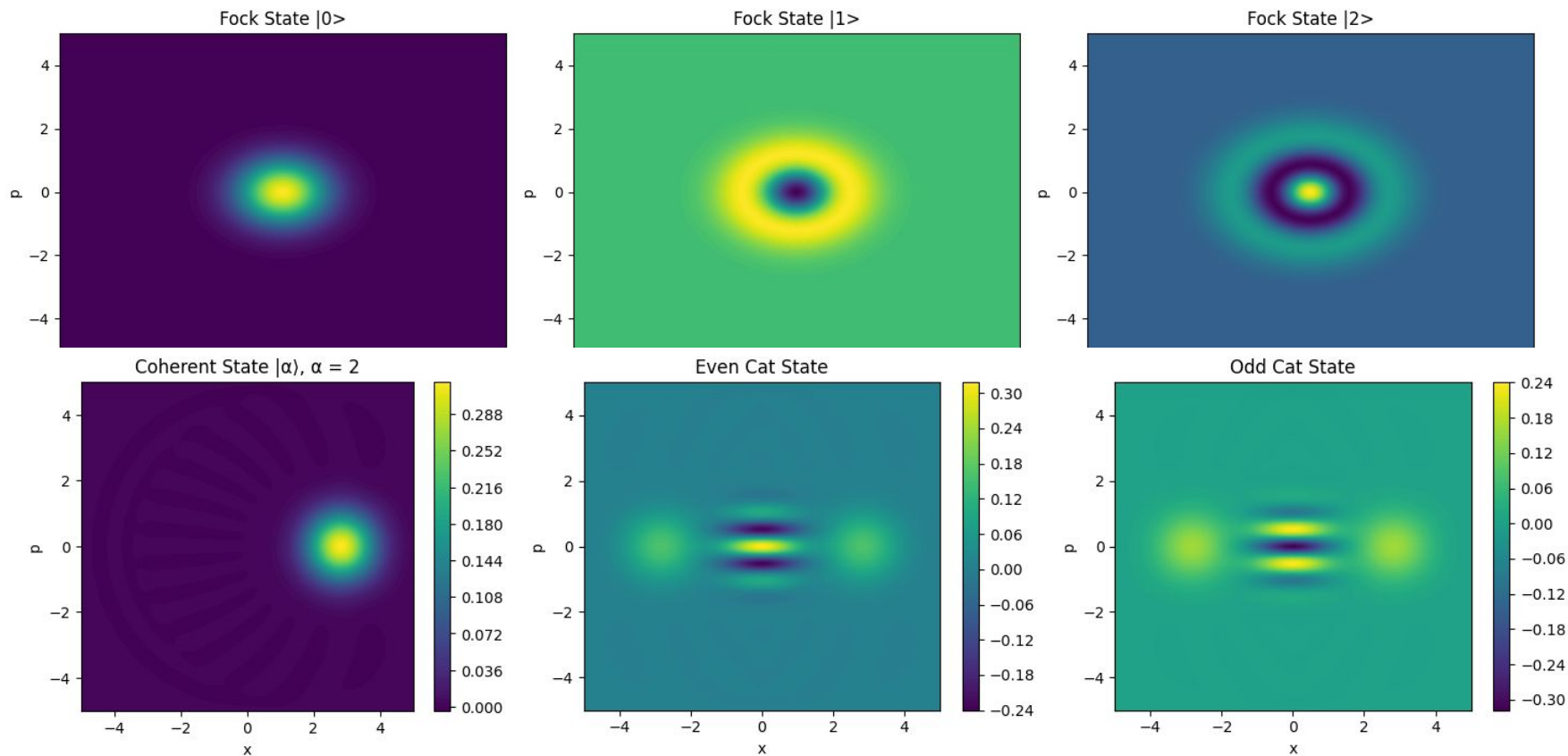


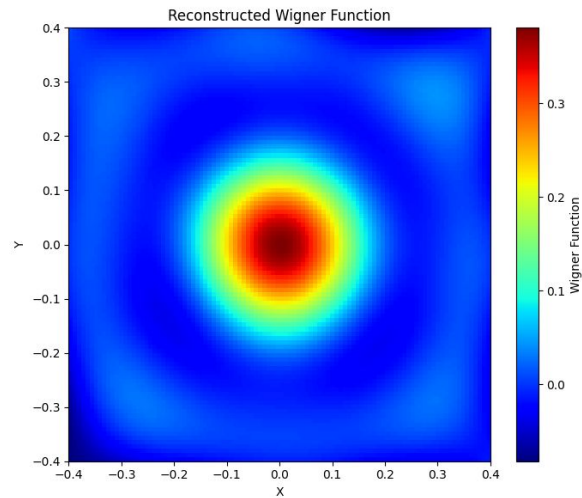
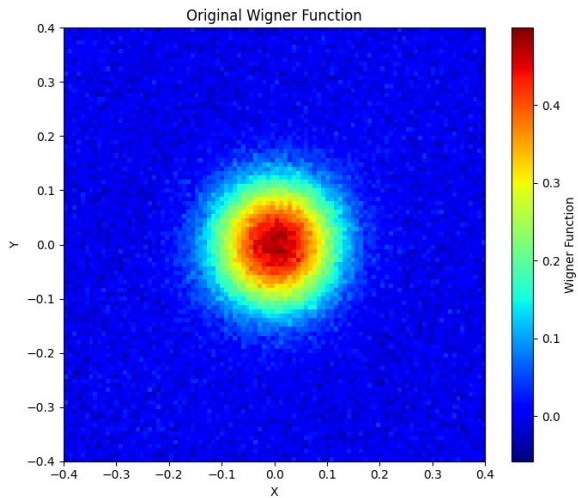
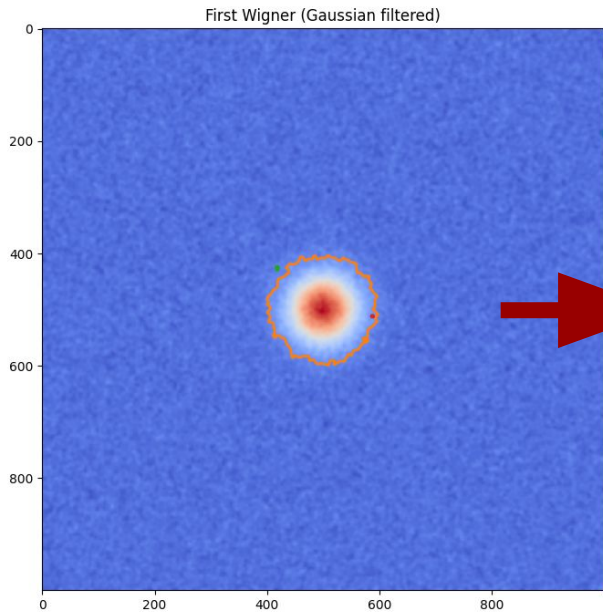
# Alice & Bob Challenge

By Alice and the Bobs

# Task 1A: generating states

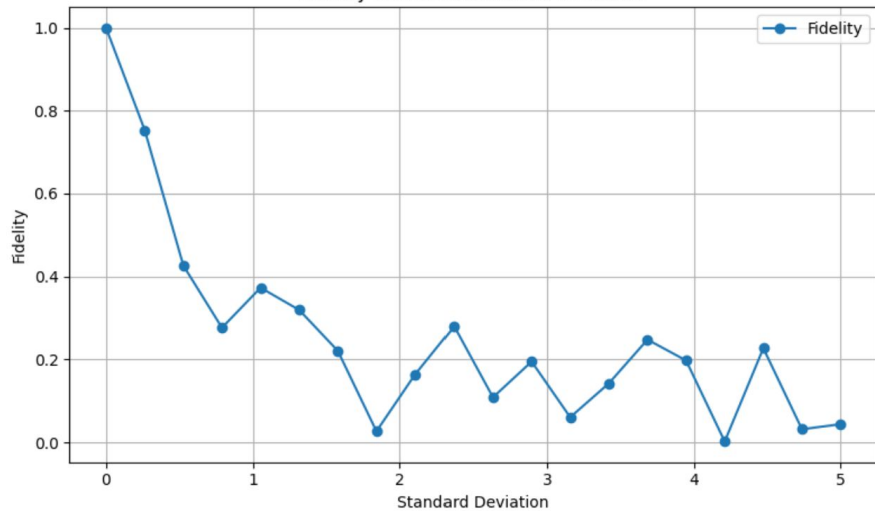


# Task 1B: fitting noiseless Wigner functions

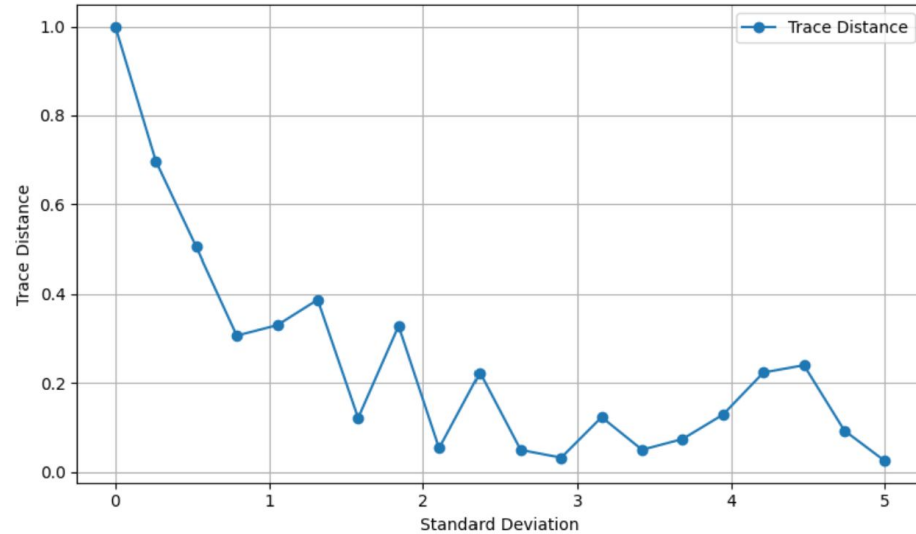


# Task 1C: Robustness of the fit

Fidelity vs. Noise Standard Deviation

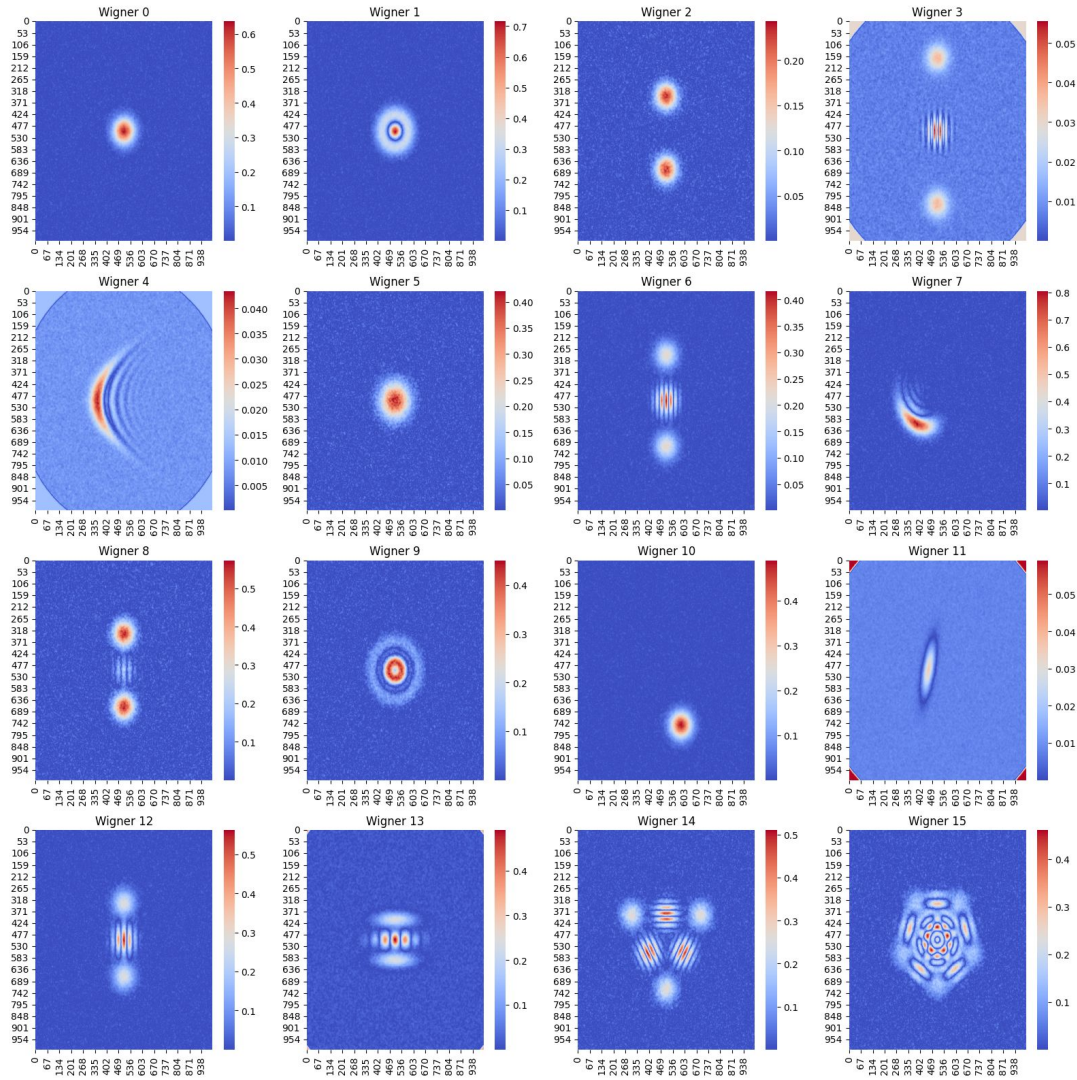


Trace Distance vs. Noise Standard Deviation



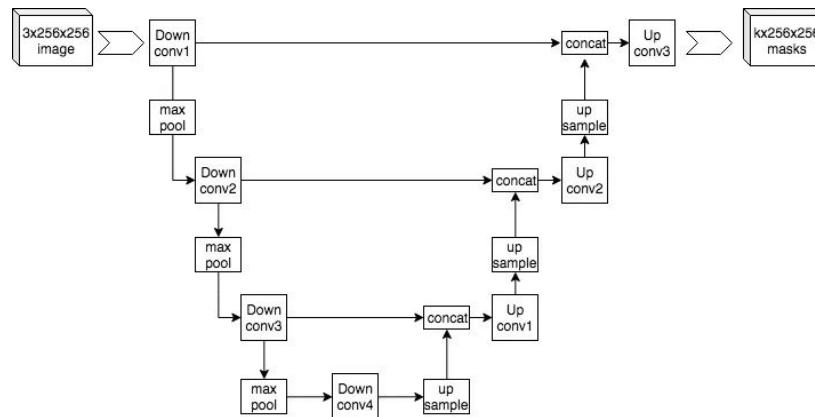
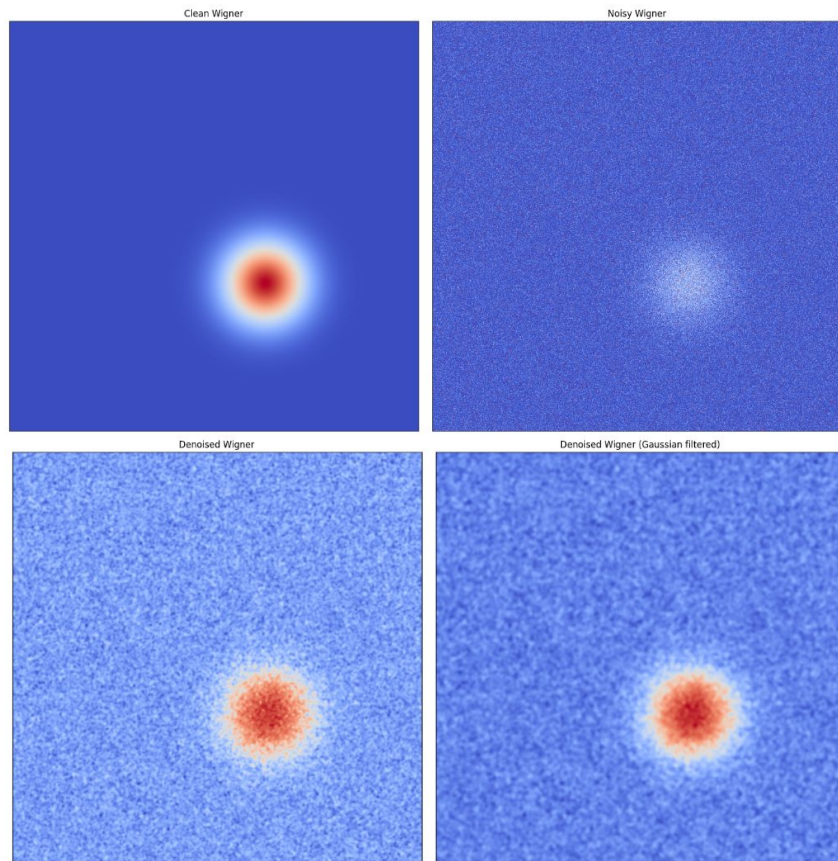
# Task 2A: Correcting affine noise

| Index | Noisy Fidelity         | Denoised Fidelity      |
|-------|------------------------|------------------------|
| 0.0   | 0.6327064704261506911  | 0.31932509958396781968 |
| 1.0   | 0.27891756832921704712 | 0.31855823647652981023 |
| 2.0   | 0.17411377223016430427 | 0.44183777551487635193 |
| 3.0   | 0.4941418143790090034  | 0.44770113401833372402 |
| 4.0   | 0.14662393115125441079 | 0.21547227618552389217 |
| 5.0   | 0.32421091135545276884 | 0.3170469263714710828  |
| 6.0   | 0.19967010588799696813 | 0.31065100368380255125 |
| 7.0   | 0.29641272890719727595 | 0.31755255667962245525 |





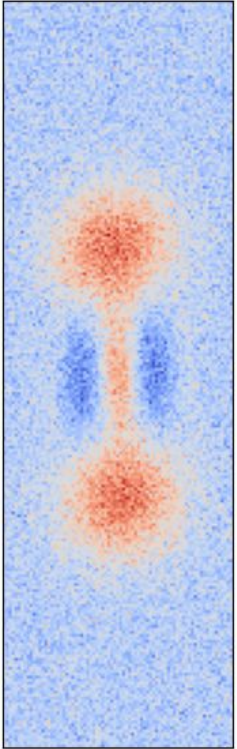
# Task 2B: Machine learning with U-Net



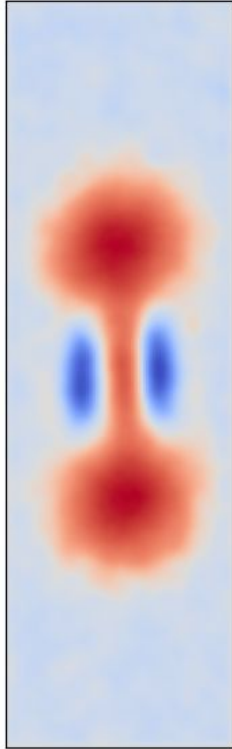
```
Epoch [1/10], Batch [10/13], Loss: 0.0013
Epoch [1/10] completed, Average Loss: 0.0022
Epoch [2/10], Batch [10/13], Loss: 0.0006
Epoch [2/10] completed, Average Loss: 0.0006
Epoch [3/10], Batch [10/13], Loss: 0.0004
Epoch [3/10] completed, Average Loss: 0.0004
Epoch [4/10], Batch [10/13], Loss: 0.0003
Epoch [4/10] completed, Average Loss: 0.0002
Epoch [5/10], Batch [10/13], Loss: 0.0002
Epoch [5/10] completed, Average Loss: 0.0002
...
Epoch [9/10] completed, Average Loss: 0.0001
Epoch [10/10], Batch [10/13], Loss: 0.0001
Epoch [10/10] completed, Average Loss: 0.0002
Training finished!
```

## Task 2B: Machine learning with U-Net

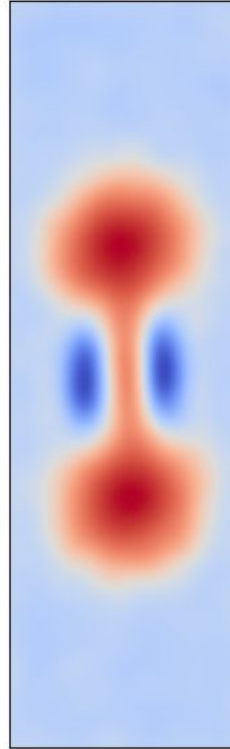
Experimental Wigner



Denoised Wigner



Denoised Wigner (Gaussian filtered)



## Task 2C: Improving performance w/ multithreading

- Used the CBC solver (instead of the SCS solver) for convex optimization.
- 8 threads was best for our use case → 30x speedup across our reconstruction