

Time of Flight Trajectories

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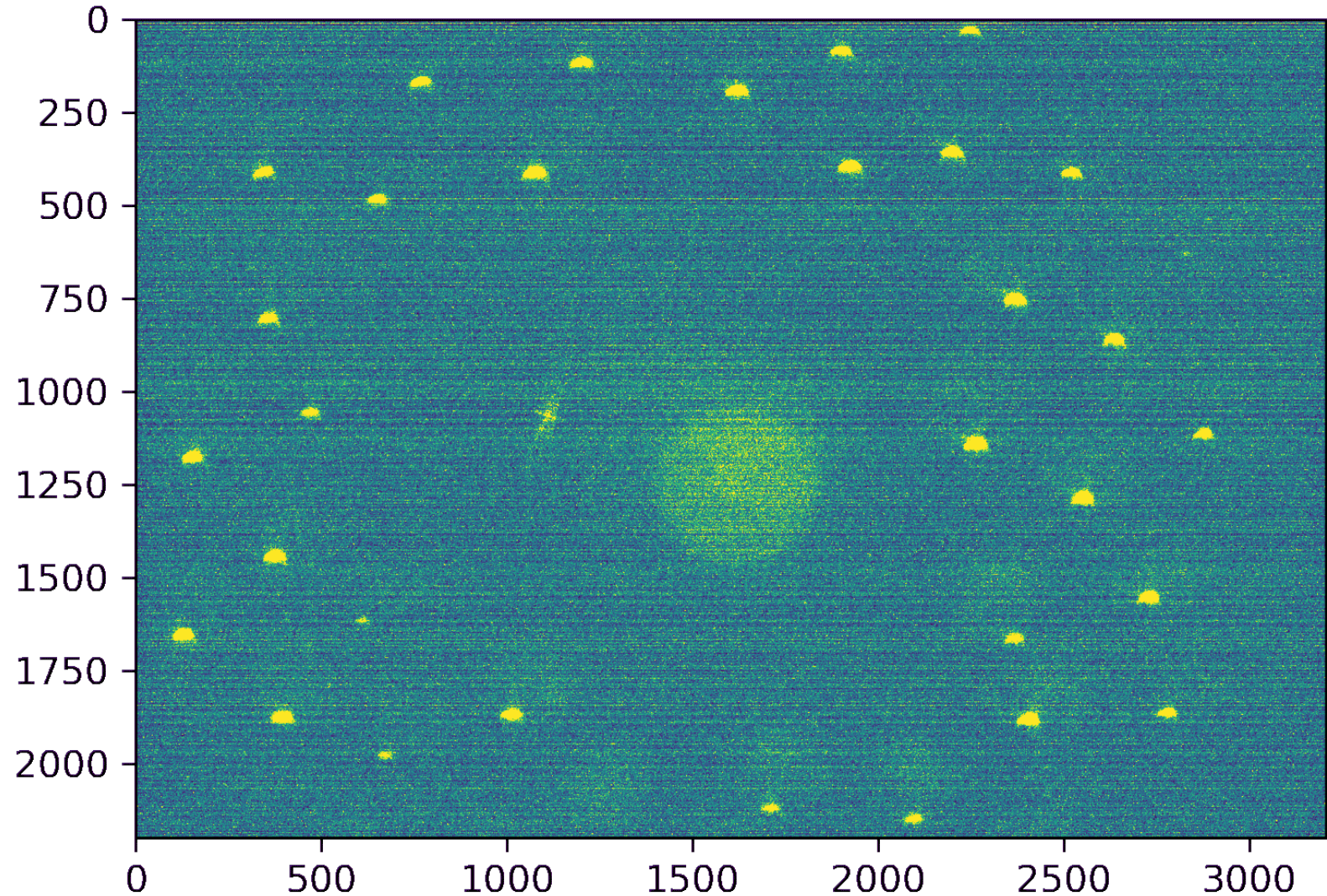
July 17th, 2023

Calibration Dataset: Time of Flight

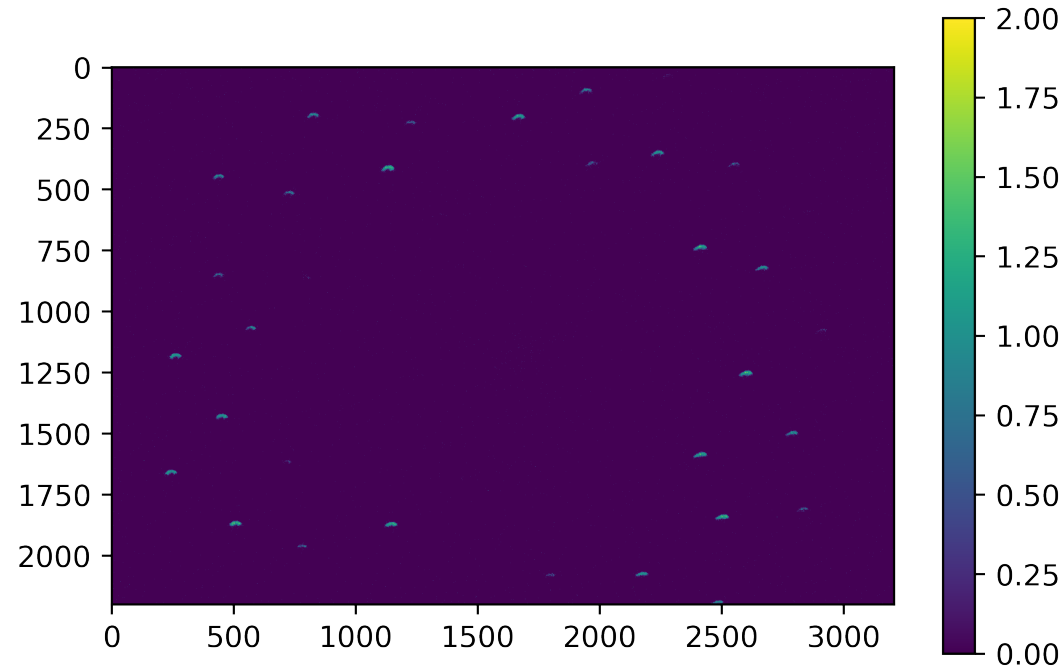
Multiple position measurements with known deltas can help with calibration

- Start cloud at rest
- Drop and capture images every 5ms

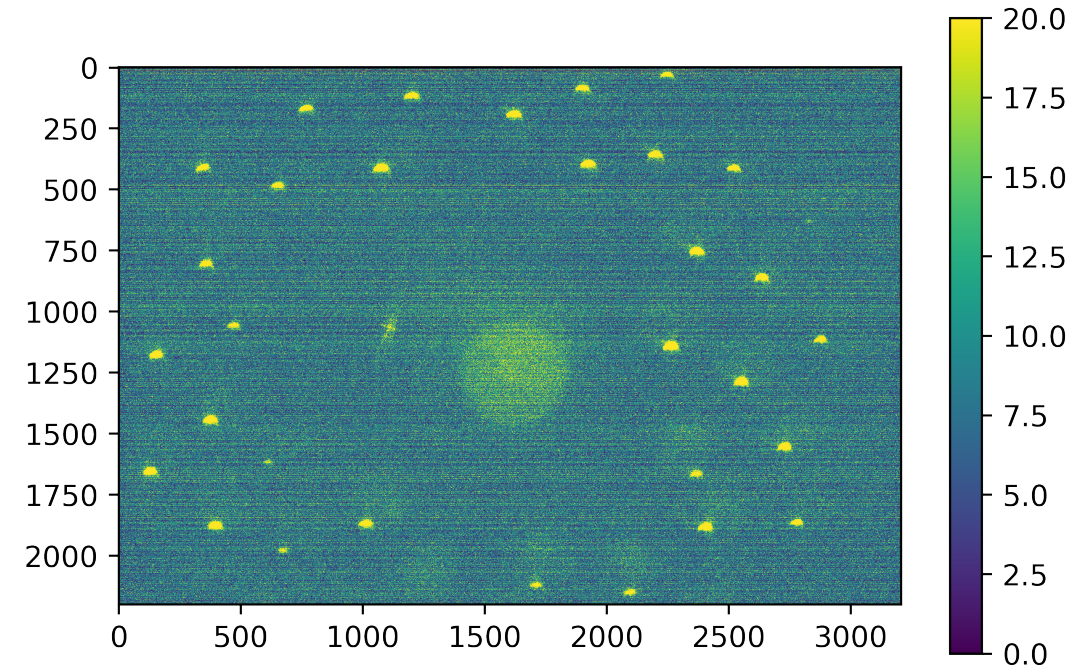
$$\Delta z = -\frac{1}{2}gt^2$$



Calibration Dataset: Time of Flight



Initial dataset limited by low gain —
very low pixel intensities => only a
few possible grayscale values

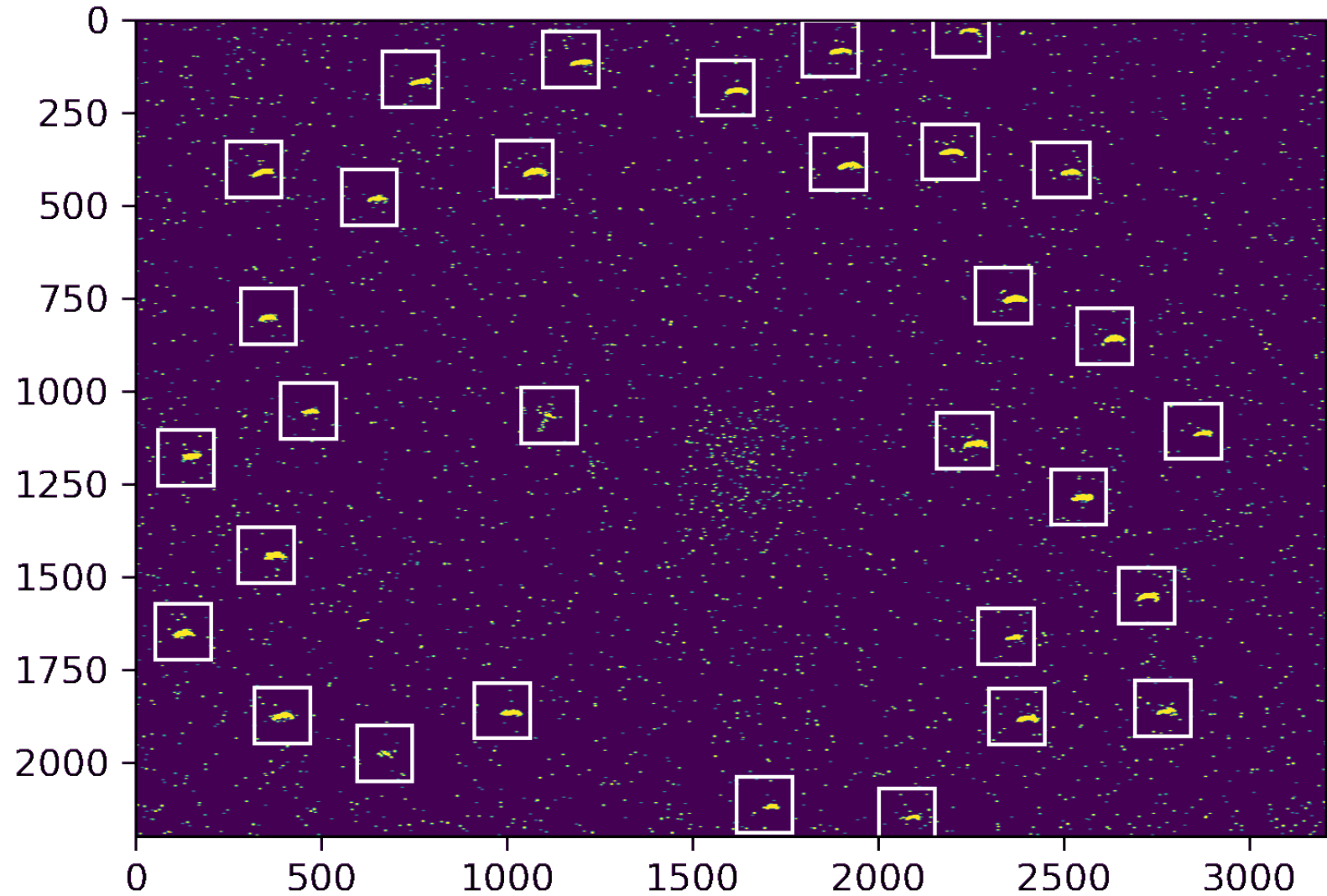


Turning up the gain means more
signal — but also more noise

Calibration Dataset: Time of Flight

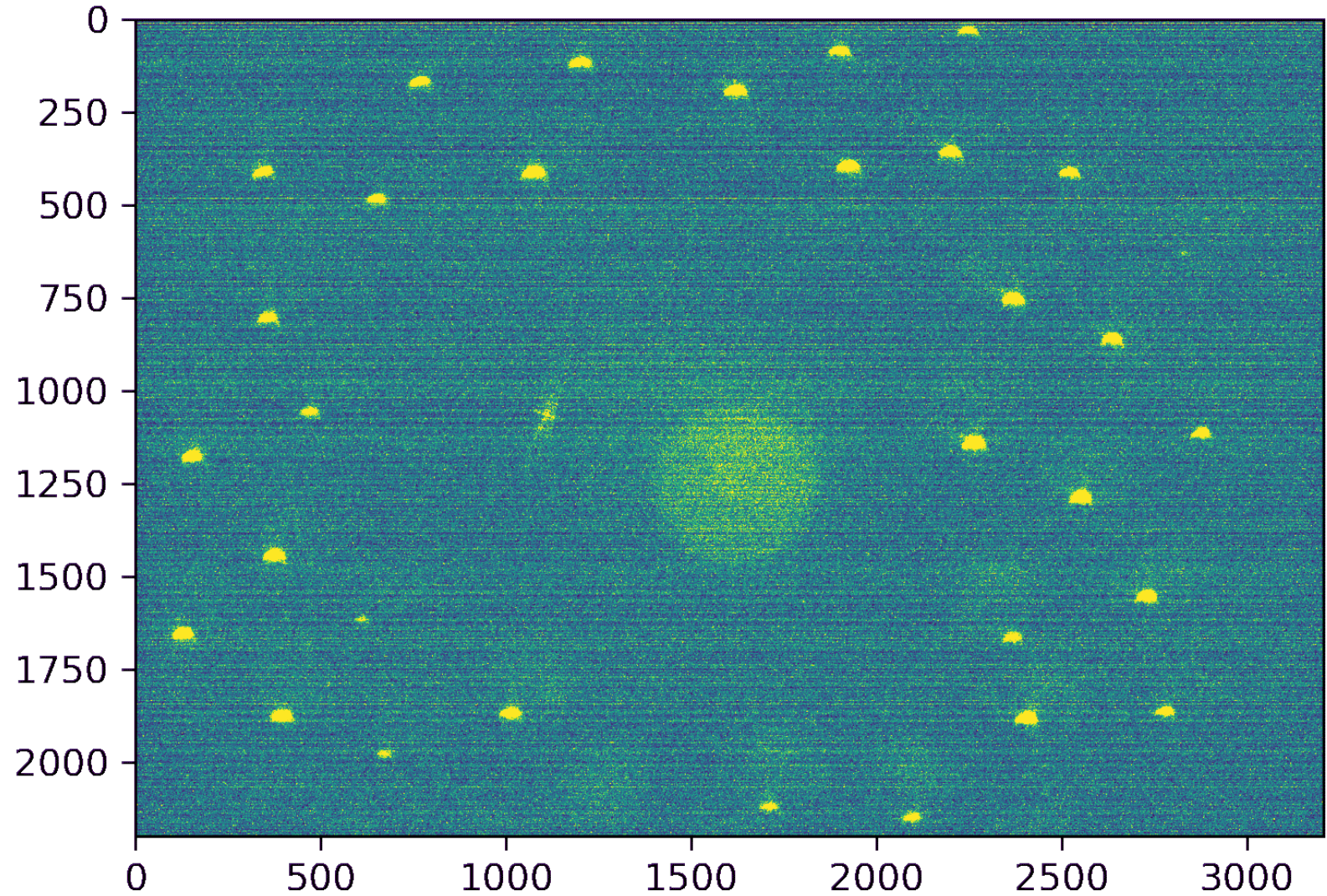
Higher noise makes bounding box finding difficult

- Apply a Gaussian-Laplace filter to find boxes to get clear signals
- **Only for bounding box finding!**



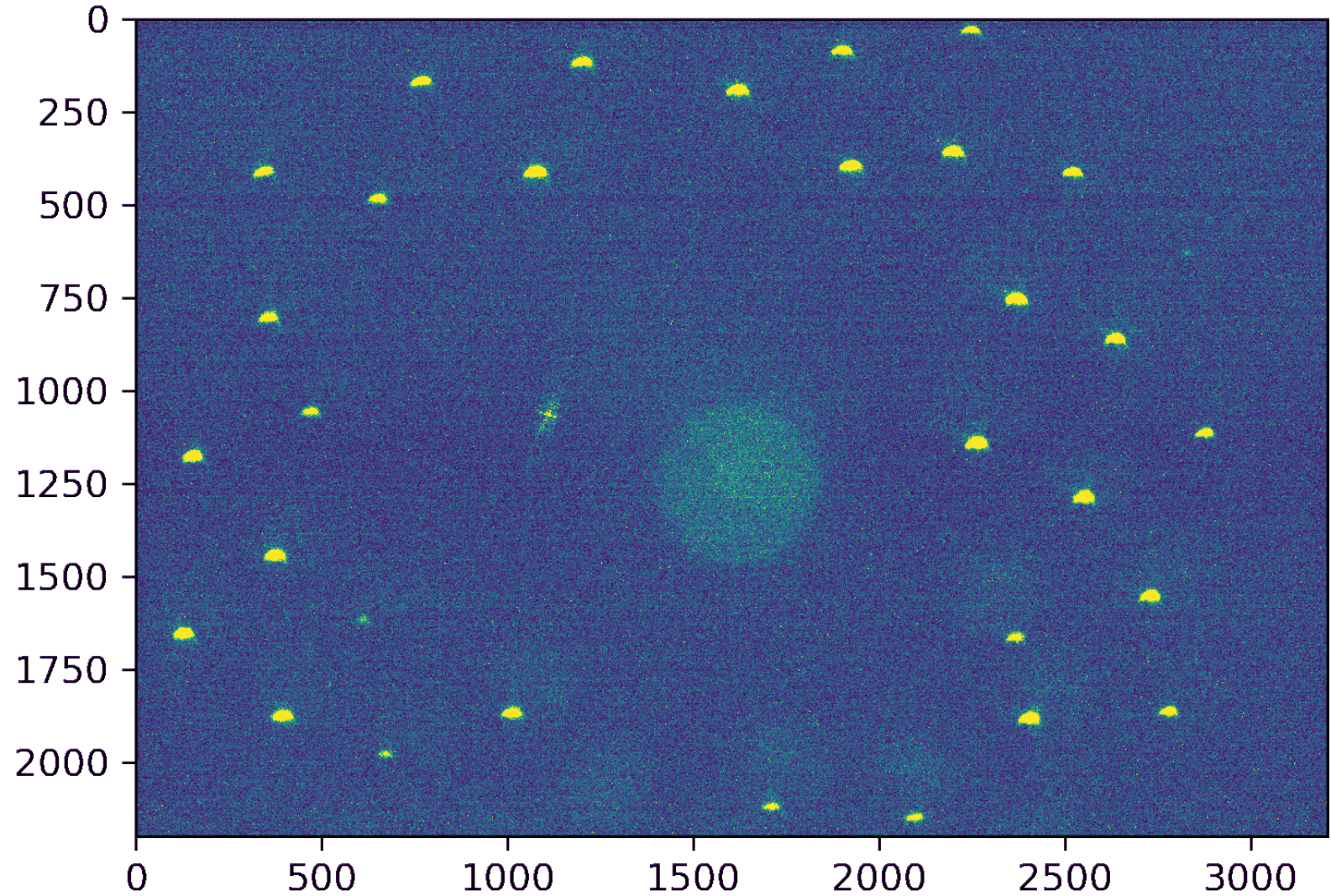
Calibration Dataset: Time of Flight

Line artifacts from column read noise



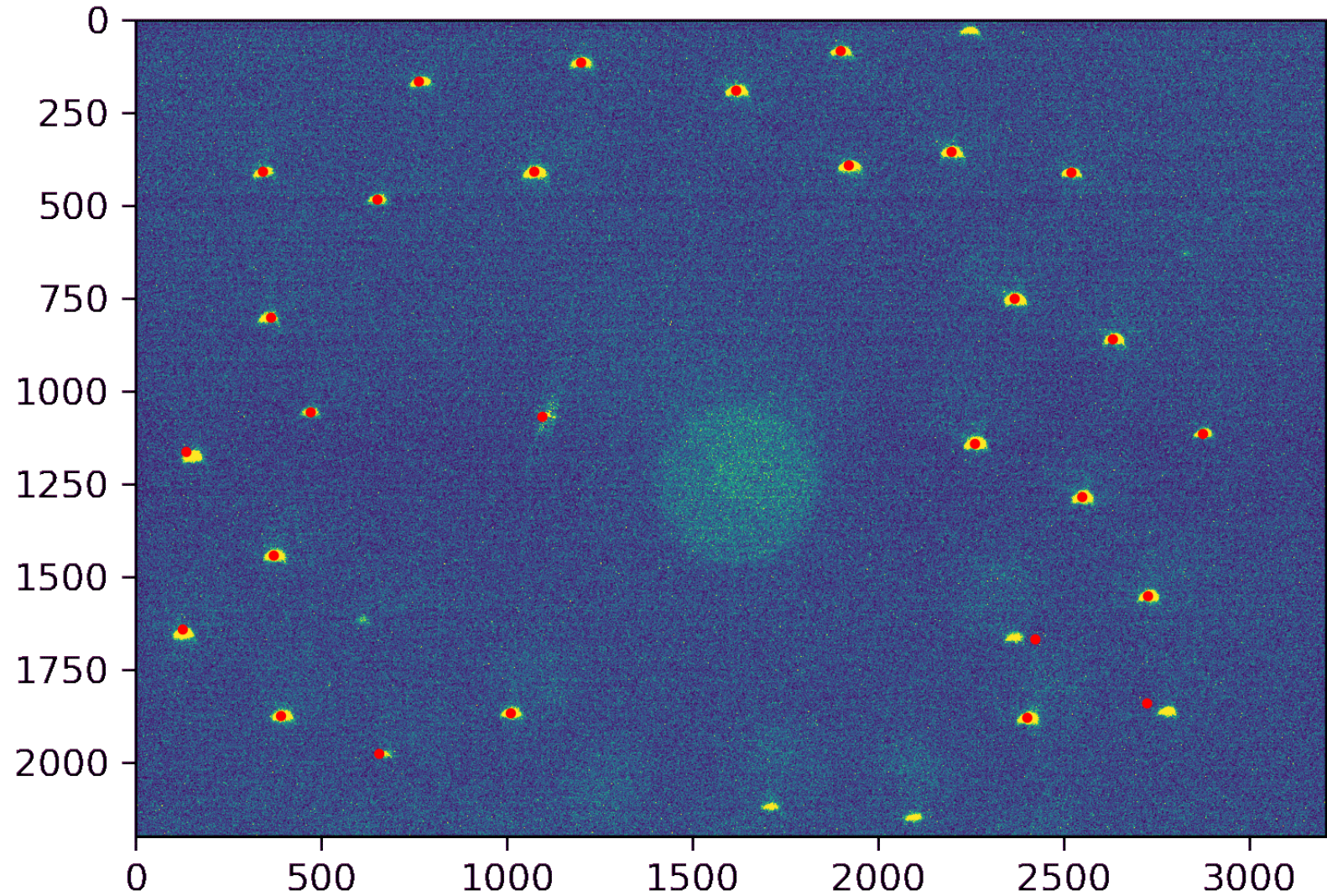
Calibration Dataset: Time of Flight

Correct artifacts by subtracting
using median of columns,
excluding extracted signal
boxes



Calibration Dataset: Time of Flight

Get positions of blobs from
found centroids



Calibration Dataset: Time of Flight

Associate frame-to-frame and match with simulation

- Colored dots are trajectories with more than one trajectory point following time of flight kinematics

