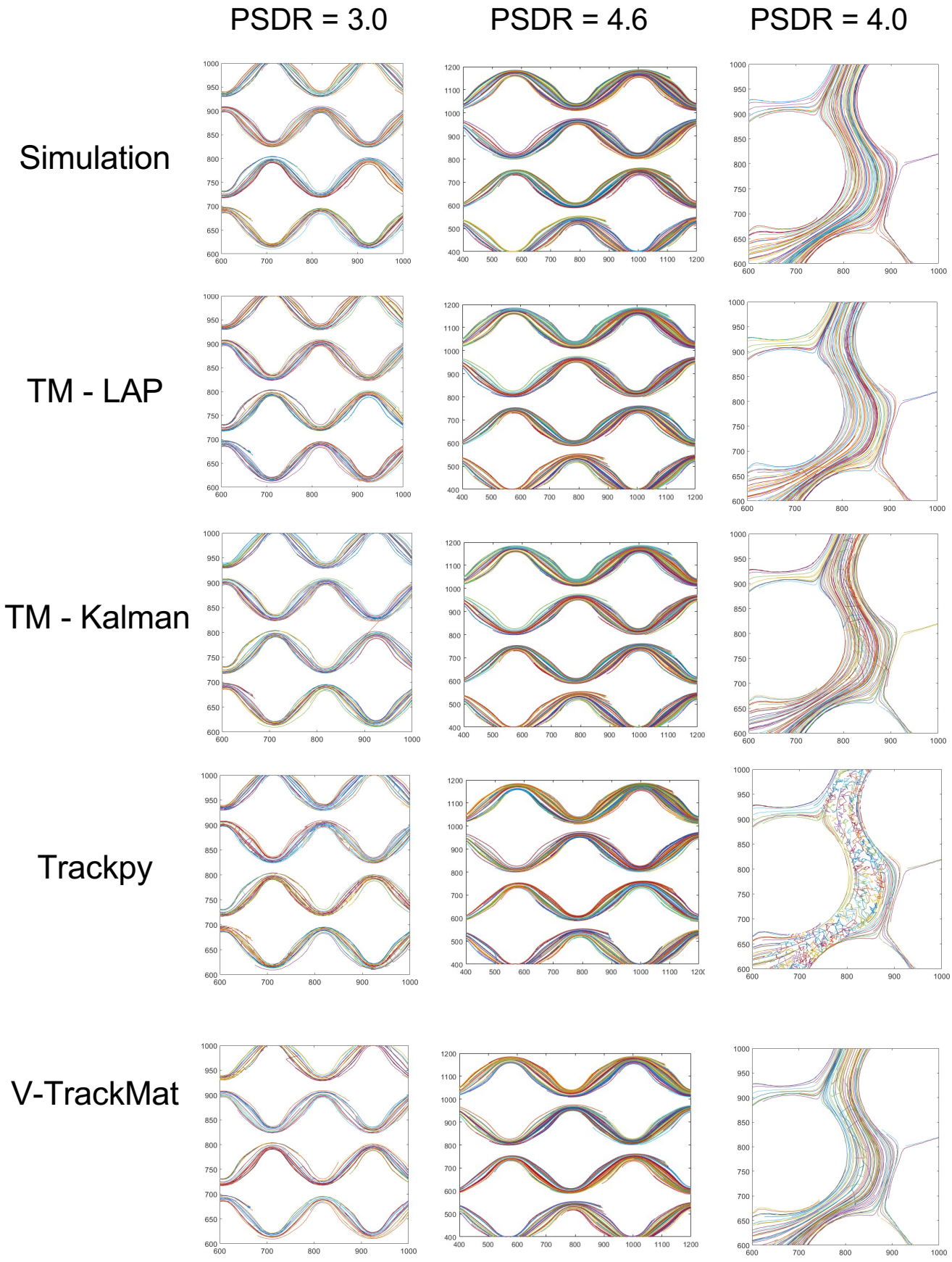
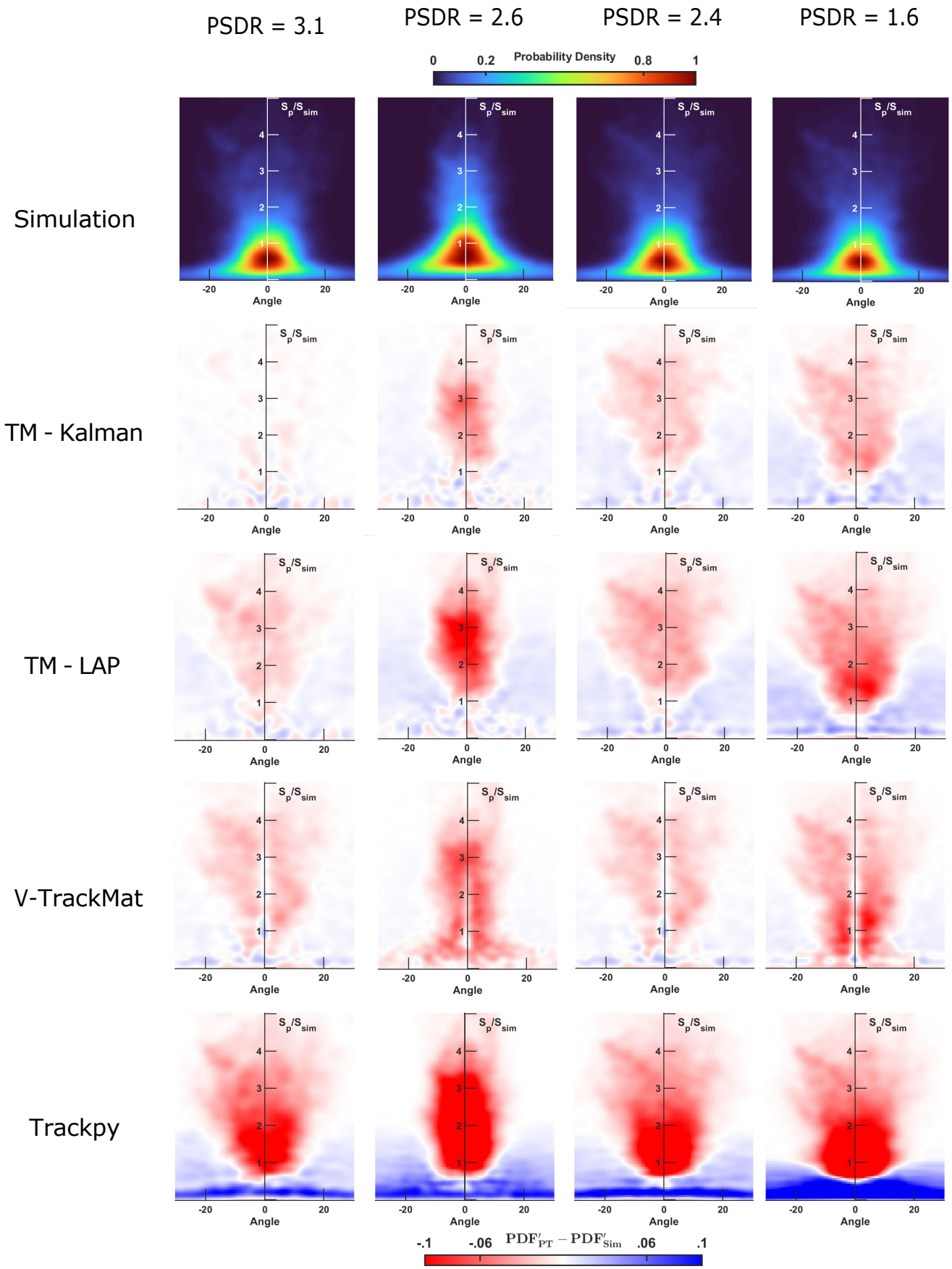
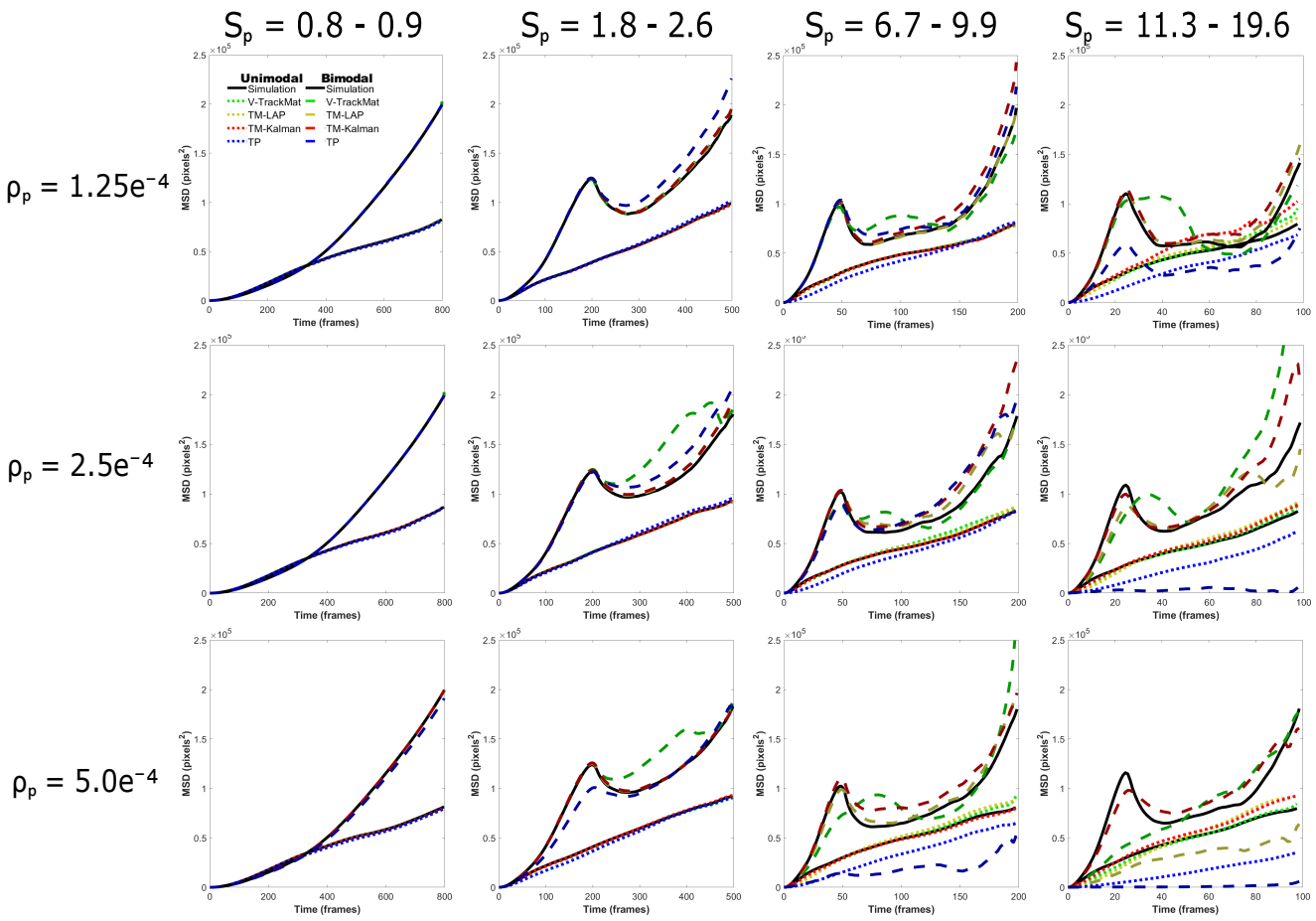


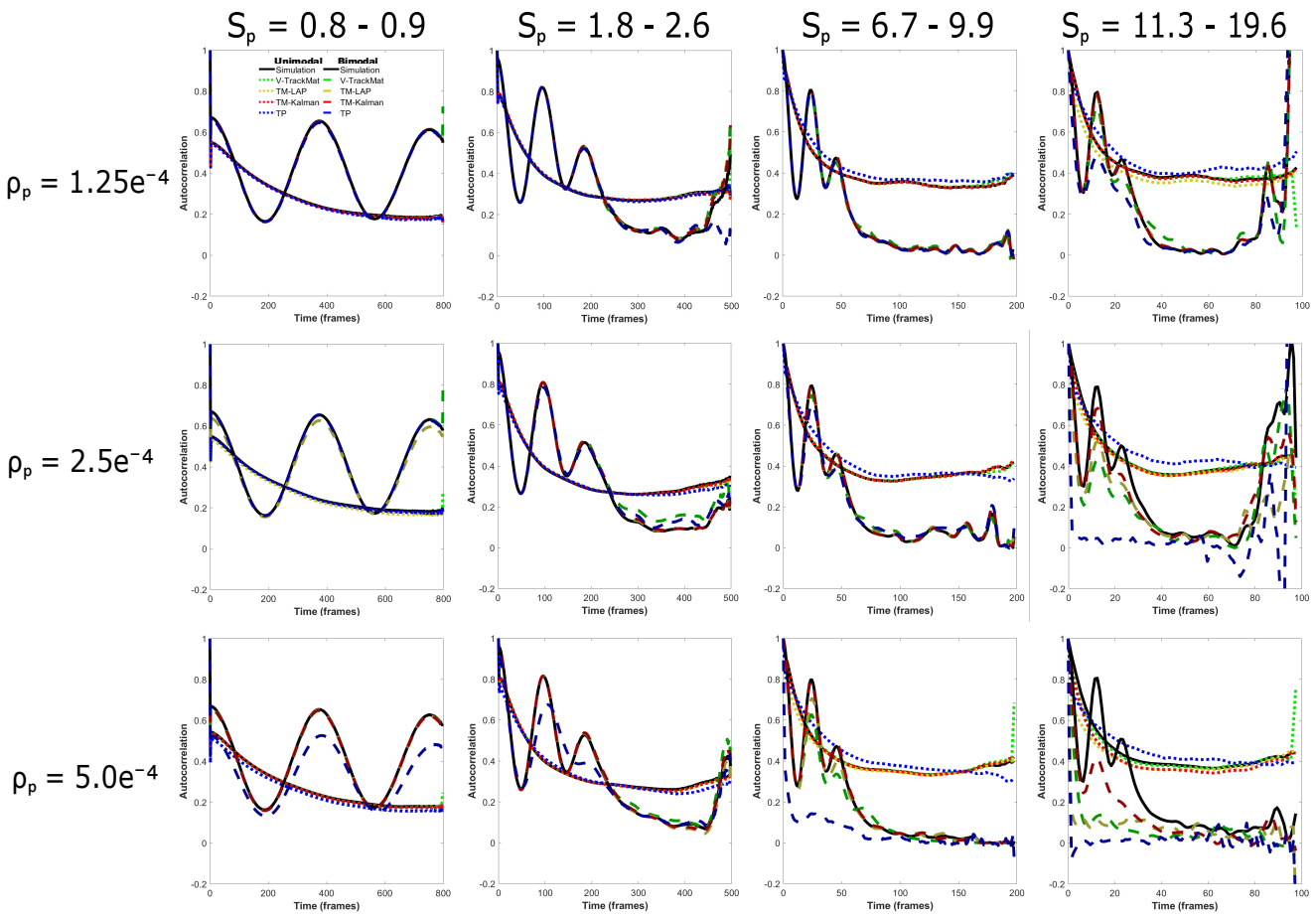
Supplementary Figure 1. Sample trajectories for all PT codes for selected high-PSDR bimodal and unimodal simulations. Each line corresponds to a unique trajectory (with random colors used to show the contrast between individual trajectories). For these high-PSDR simulations, all PT codes besides TP show near-perfect replication of the ground truth trajectories.



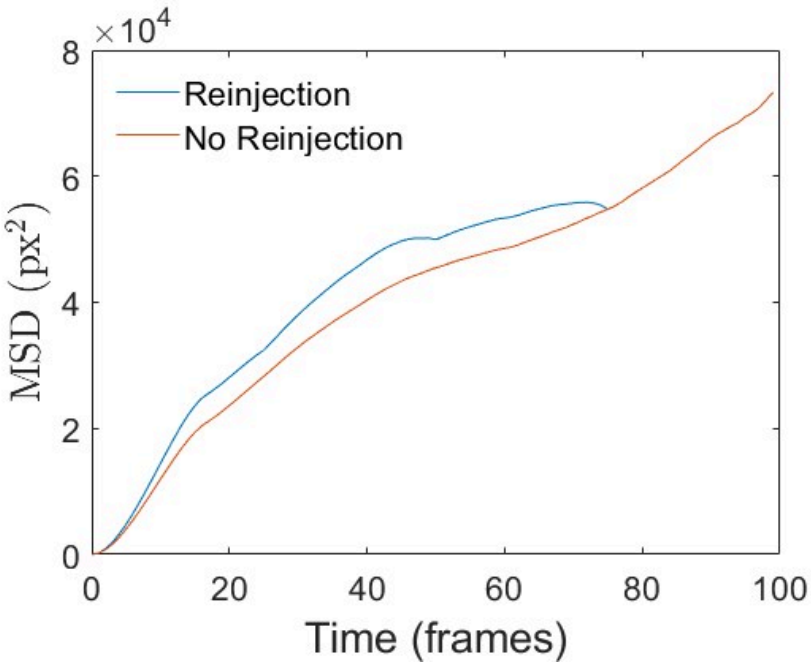
Supplementary Figure 2. Speed-angle joint probability density difference heatmaps for the unimodal simulation. Speeds determined from particle tracking (S_p) are normalized by the mean speed of the respective simulation (S_{sim}). Red corresponds to an underprediction of probability density, blue corresponds to an overprediction of probability density, and white corresponds to an accurate probability density prediction within the speed-angle feature space. These results show strong performance for TM-Kalman and V-TrackMat, slightly weaker performance for TM-LAP, and bad performance for TP.



Supplementary Figure 3. All MSDs. Simulated particle speeds increase going from left to right, and particle densities increase going from top to bottom. The bottom right corner represents the lowest-PSDR simulation. The speed values for each column are given as a range because the unimodal simulations always have lower mean speeds than the bimodal simulations. The bimodal MSDs are shown by dashed lines, and the unimodal MSDs are shown by dotted lines. These figures confirm trends present in the other results - TP performs the worst, and other algorithms start to fail at $S_p \geq 11.3$.



Supplementary Figure 4. All C_v. Simulation speed increases from left to right, and particle density increases from top to bottom. The bottom right corner represents the lowest-PSDR simulation. Autocorrelations from the heterogenous simulations are dotted and slightly brighter colored than the bimodal simulations. The bimodal simulations show a periodicity in autocorrelation that is generated due to the periodic converging and diverging flowpaths of the bimodal geometry. The unimodal simulations show a clear trend of decorrelation over time. All PT codes show better performance for the unimodal simulations, although this is potentially due to differences in the mean speeds of the simulations. In terms of PT performance, these results follow the same general trends as the MSDs.



Supplementary Figure 5: MSD for a low-PSDR simulation with and without reinjection. Every 25 frames, the original particles are reinjected, resulting in a fresh supply of fast-moving particles. This results in a slightly larger MSD when reinjection is used. However, for the first 40 frames, the slopes in both cases are nearly identical.