Computational exercise: Density and Speed distribution of a system of hard disks

This exercise explores the density and speed distribution of a system of hard disks confined to a square box. A system of disks is evolved using the event-based algorithm, and a 'snapshot' of the system is taken at fixed intervals (not events, the time between which varies). This snapshot involves gathering data about the system (this could be an actual image, or data about positions and velocities of the disks). To take such snapshots, fix an interval of time dt, estimated to be a fraction of an estimated mean free time between collisions. Given an initial configuration, a snapshot is taken, and the time upto the next event, Δt_{next} is calculated. If $dt < \Delta t_{next}$, a certain number n of snapshots fit within the duration Δt_{next} (with some remainder). The system is evolved freely n times, and each time, the snapshot is taken. After this, the system is evolved to the next event (at which the snapshot is *not* taken). If however $dt > \Delta t_{next}$, the system is evolved freely upto the next event without taking any snapshots. At this point, the velocities are changed according to the collision algorithm, and the system evolved furthur till the next snapshot instant, and a snapshot taken. This process is repeated.

Density Distribution:
Take 10 disks and density of about 0.2. Generate a random distribution of disks within the box (no overlaps). Furthur, fix the speed of each disk to be $\sqrt{2}$ (for reasons that will be clear later) and generate randome velocity directions. Fix the total number of events (a few hundered thousand or more). Start with an empty list to store data. At each snapshot event, store the $x-$ coordinates of all the disks, and keep appending these at different snapshot events. Finally, plot a histogram of the data.

Speed Distribution:
Do everything as above, except that at each snapshot event, store the speeds of all the particles and plot a histogram of speeds at the end.