

Boris_plots_

January 1, 2026

```
[46]: import numpy as np
import h5py
import matplotlib.pyplot as plt
```

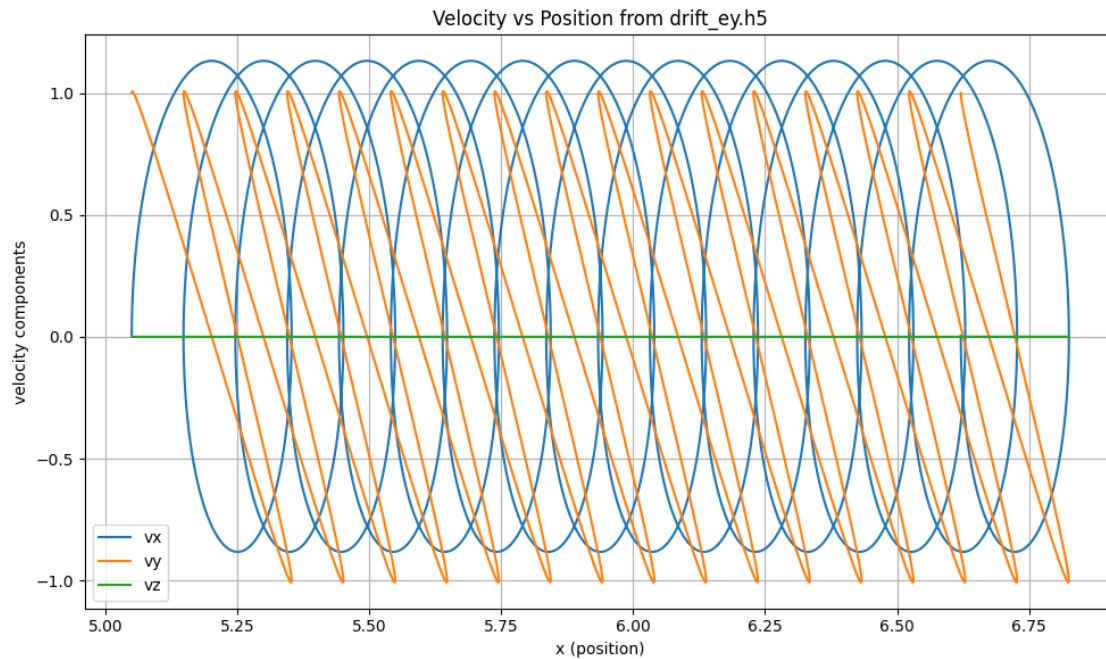
```
[47]: # Load the HDF5 file
with h5py.File("/home/localuser/Documents/M2/HPC/build/drift_ey.h5", "r") as f:
    print("Available keys:", list(f.keys()))

    x = f["x"][:]
    vx = f["vx"][:]
    vy = f["vy"][:]
    vz = f["vz"][:]
```

Available keys: ['vx', 'vy', 'vz', 'x']

```
[48]: # Plot velocity components as a function of position
plt.figure(figsize=(10, 6))
plt.plot(x, vx, label="vx")
plt.plot(x, vy, label="vy")
plt.plot(x, vz, label="vz")

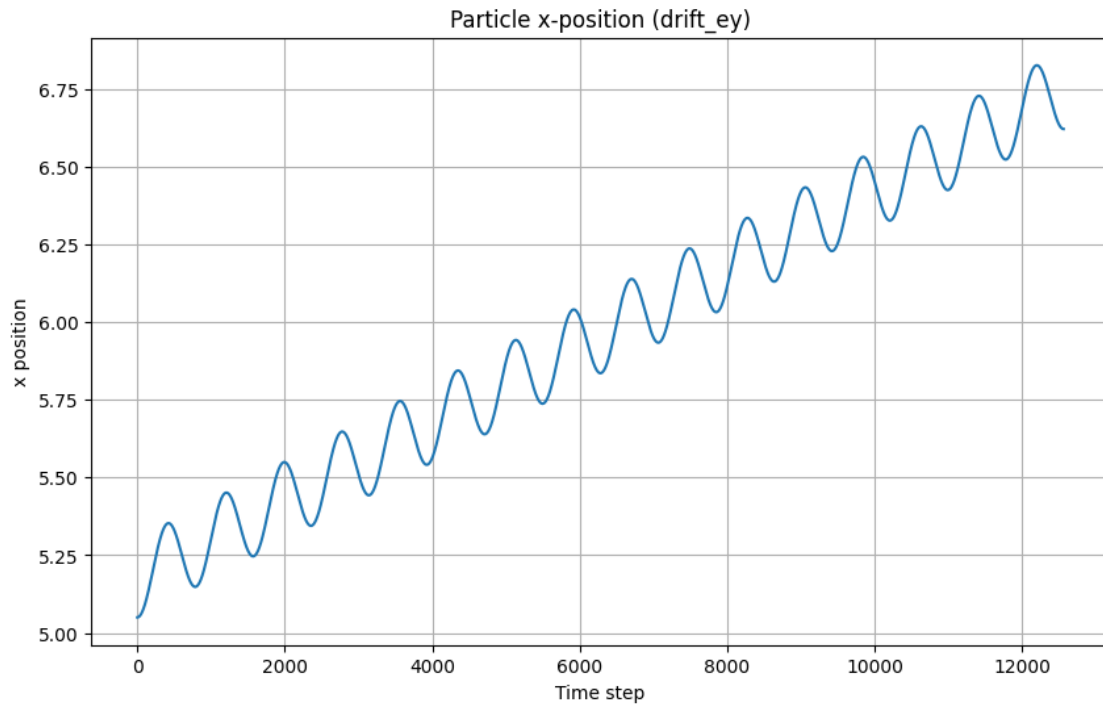
plt.xlabel("x (position)")
plt.ylabel("velocity components")
plt.title("Velocity vs Position from drift_ey.h5")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.savefig("vel_vs_position_drift_ey_plot.png", dpi=300)
plt.show()
```



```
[49]: plt.figure(figsize=(10, 6))
plt.plot(x)
plt.xlabel("Time step")
plt.ylabel("x position")
plt.title("Particle x-position (drift_ey)")
plt.grid(True)
plt.savefig("x_position_drift_ey_plot.png", dpi=300)
plt.show()

v_drift_num = np.mean(vx)

print("Numerical drift velocity:", v_drift_num)
print("Theoretical drift velocity:", v_drift_theory)
print("Absolute error:", abs(v_drift_num - v_drift_theory))
```



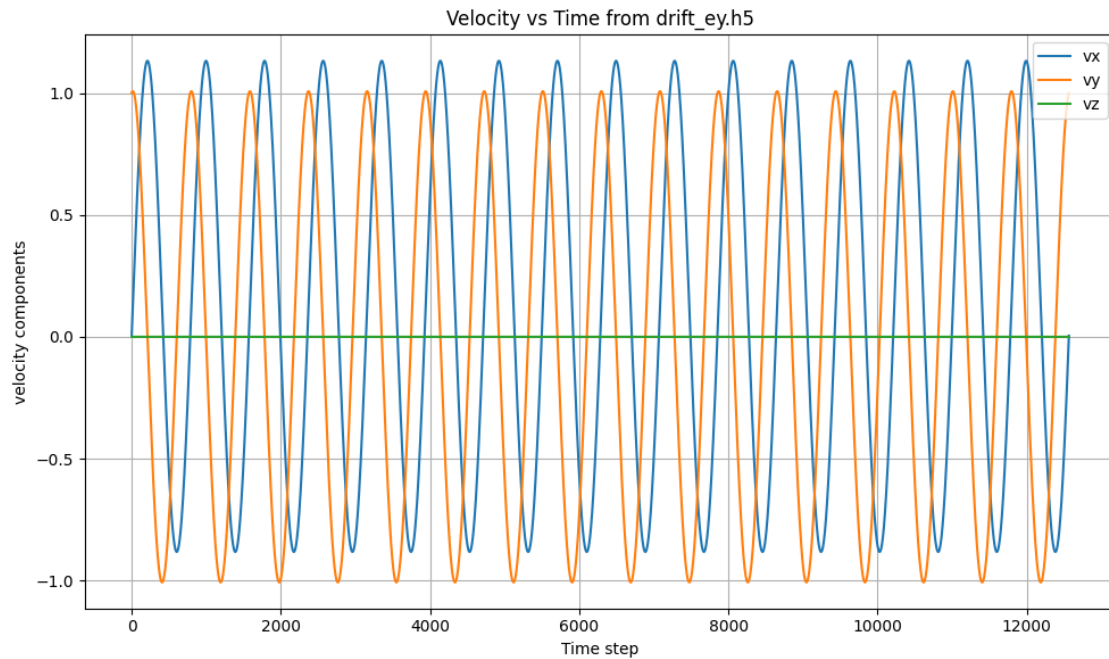
Numerical drift velocity: 0.12499468608488541

Theoretical drift velocity: 0.125

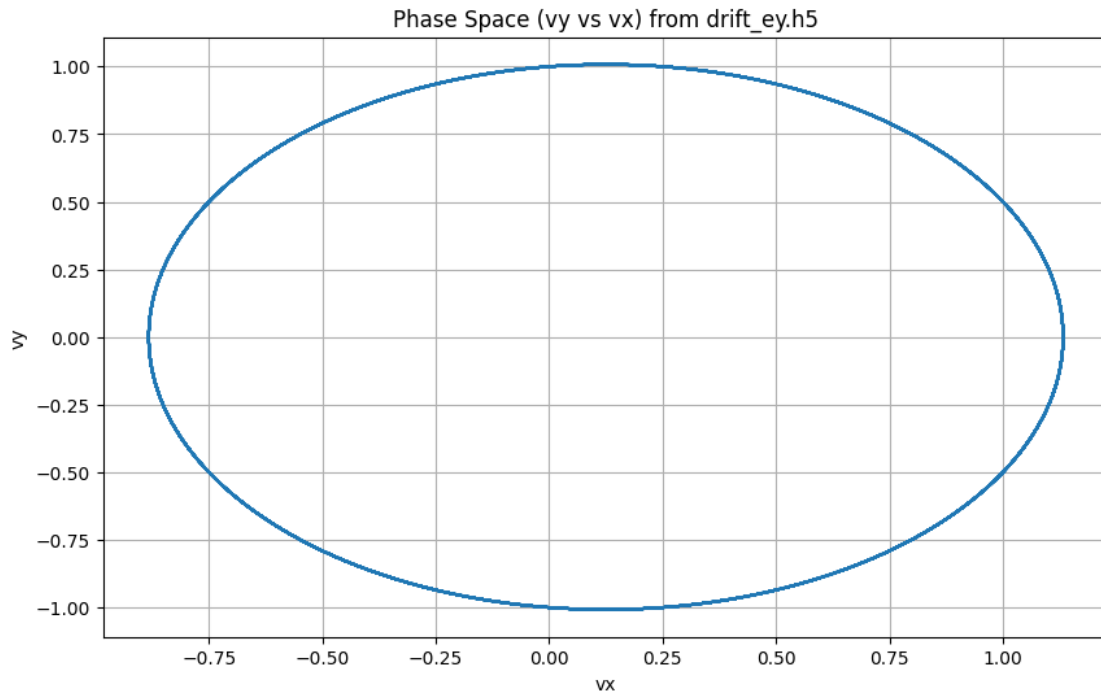
Absolute error: 5.313915114588119e-06

```
[50]: # Plot velocity components as a function of time
plt.figure(figsize=(10, 6))
plt.plot(vx, label="vx")
plt.plot(vy, label="vy")
plt.plot(vz, label="vz")

plt.xlabel("Time step")
plt.ylabel("velocity components")
plt.title("Velocity vs Time from drift_ey.h5")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.savefig("vel_vs_time_drift_ey_plot.png", dpi=300)
plt.show()
```



```
[51]: # phase-space signature
plt.figure(figsize=(10, 6))
plt.plot(vx, vy)
plt.xlabel("vx")
plt.ylabel("vy")
plt.title("Phase Space (vy vs vx) from drift_ey.h5")
plt.grid(True);
plt.savefig("phase_space_drift_ey.png", dpi=300)
plt.show()
```



0.1

0.2 ##

```
[52]: # Load the HDF5 file
with h5py.File("/home/localuser/Documents/M2/HPC/build/uniform_bz.h5", "r") as f:
    print("Available keys:", list(f.keys()))

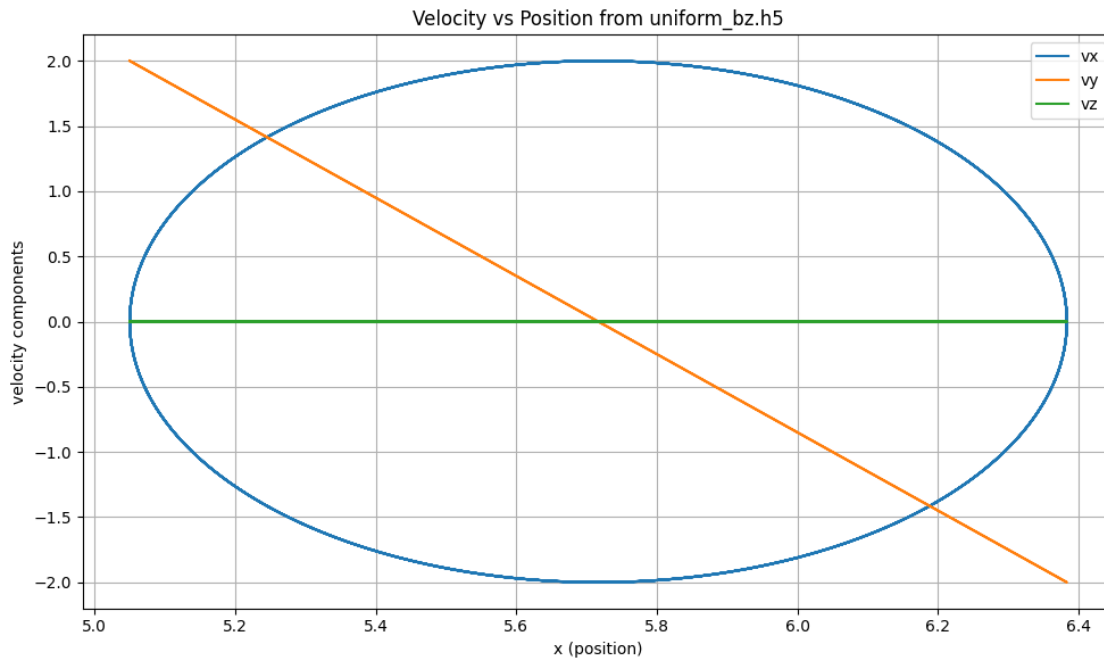
    # Read datasets
    x = f["x"][:]
    vx = f["vx"][:]
    vy = f["vy"][:]
    vz = f["vz"][:]
```

Available keys: ['vx', 'vy', 'vz', 'x']

```
[53]: # Plot velocity components as a function of position
plt.figure(figsize=(10, 6))
plt.plot(x, vx, label="vx")
plt.plot(x, vy, label="vy")
plt.plot(x, vz, label="vz")

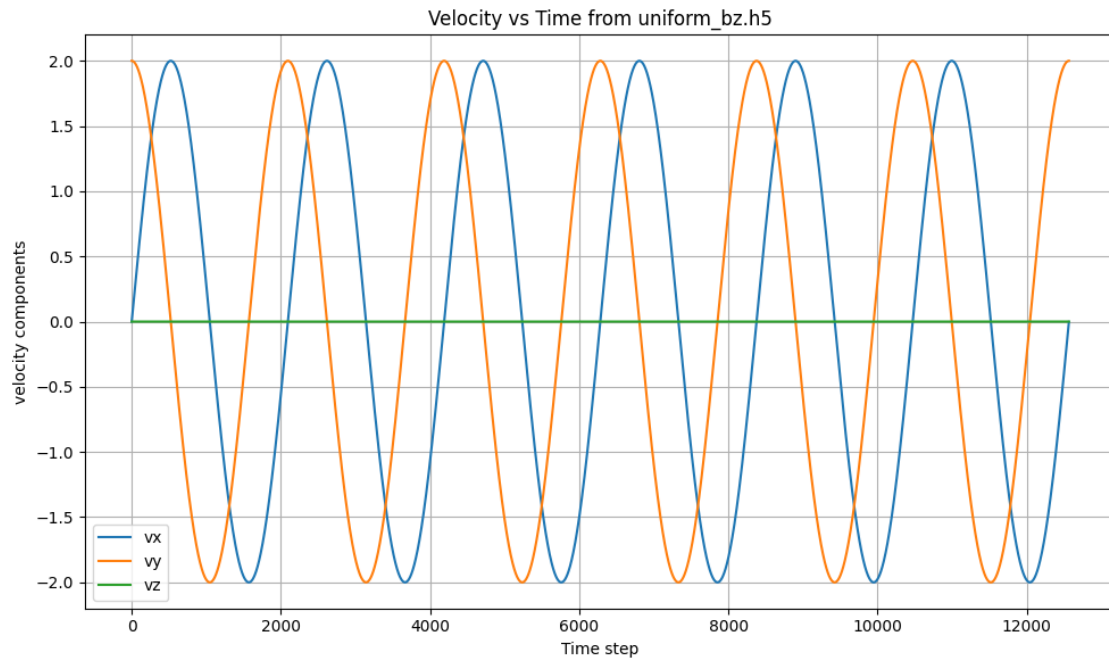
plt.xlabel("x (position)")
plt.ylabel("velocity components")
```

```
plt.title("Velocity vs Position from uniform_bz.h5")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.savefig("vel_vs_position_uniform_bz_plot.png", dpi=300)
plt.show()
```

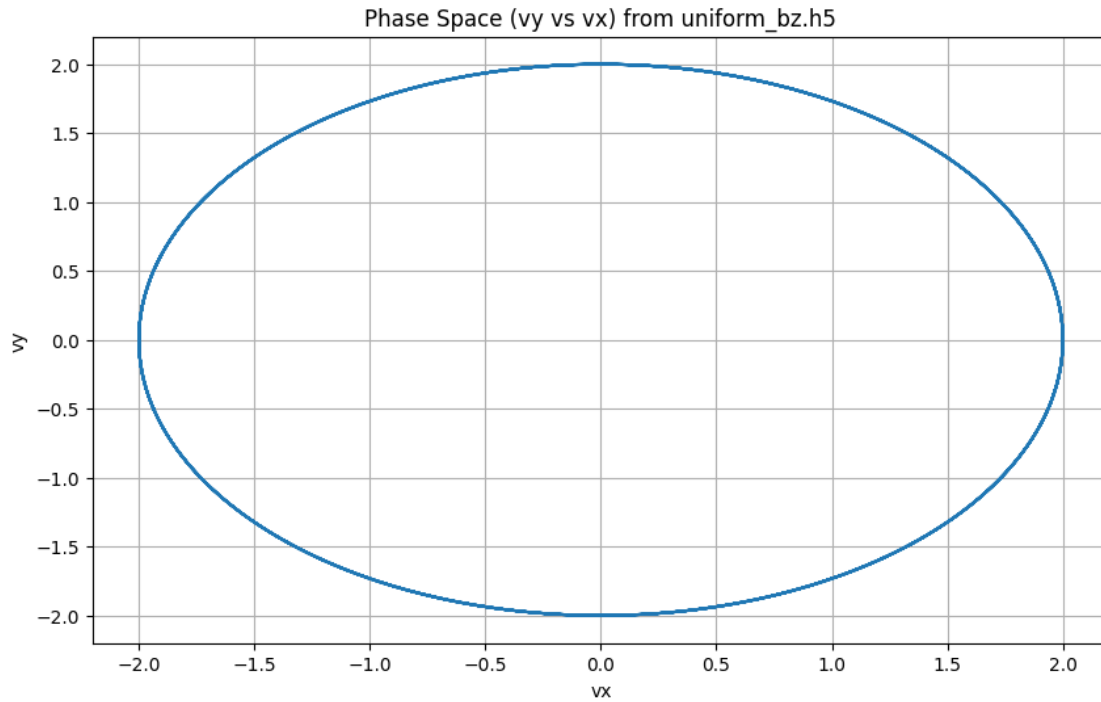


```
[54]: # Plot velocity components as a function of time
plt.figure(figsize=(10, 6))
plt.plot(vx, label="vx")
plt.plot(vy, label="vy")
plt.plot(vz, label="vz")

plt.xlabel("Time step")
plt.ylabel("velocity components")
plt.title("Velocity vs Time from uniform_bz.h5")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.savefig("vel_vs_time_uniform_bz_plot.png", dpi=300)
plt.show()
```



```
[55]: # phase-space signature
plt.figure(figsize=(10, 6))
plt.plot(vx, vy)
plt.xlabel("vx")
plt.ylabel("vy")
plt.title("Phase Space (vy vs vx) from uniform_bz.h5")
plt.grid(True);
plt.savefig("phase_space_uniform_bz.png", dpi=300)
plt.show()
```



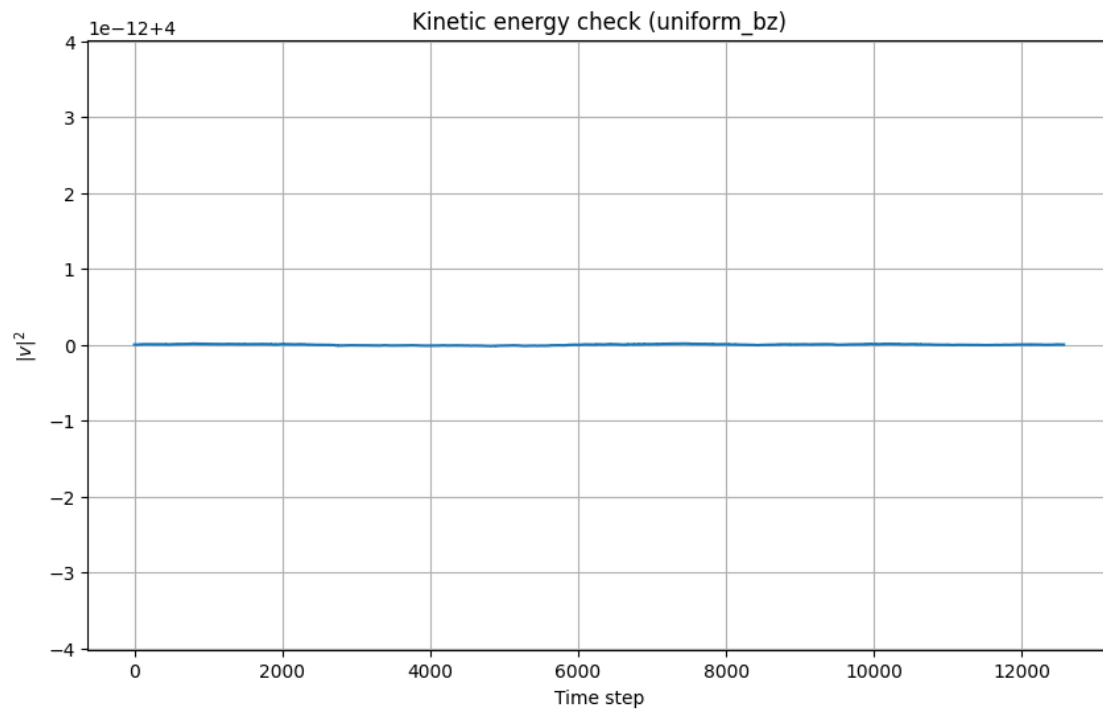
```
[56]: # KE should be conserved as work done in B field = 0

print("Max |vz|:", np.max(np.abs(vz)))

mean_speed = vx**2 + vy**2 + vz**2
plt.figure(figsize=(10, 6))
plt.plot(mean_speed)
plt.xlabel("Time step")
plt.ylabel(r"$|v|^2$")
plt.title("Kinetic energy check (uniform_bz)")
plt.grid(True)
plt.savefig("ke_conservation_check.png", dpi=300)
plt.show()

print("Max deviation in |v|^2:", np.max(np.abs(mean_speed - mean_speed[0])))
```

Max |vz|: 0.0



Max deviation in $|v|^2$: 1.9539925233402755e-14

[]: