PK-4 Flight Data: Plasma Glow Observation

Experiment conditions:

Plasma:
- DC 0.7 mA
- Polarity switching
  - 100 Hz
  - Duty cycle 0.72
- 0.4 mbar neon
- Forces causing drift:
  - Electric force to left
  - Gas drag force (possibly) to the right

Particles:
- 3.38 μm diameter
- Trapped by polarity switching

Video credit: Oct. 2016, Campaign #3, PK-4 ISS
PK-4 Flight Data: PO Camera Observation

70 fps camera frame rate

Video credit: Oct. 2016, Campaign #3, PK-4 ISS
PK-4 Flight Data: Space-time diagram of number density

For a specified frame $t_0$, using data in the red rectangle yields a density profile $n(x, t_0)$.

Repeating for all frames $t$ yields the space-time diagram $n(x, t)$ above.

Image credit: Oct. 2016, Campaign #3, PK-4 ISS
PK-4 Flight Data: Time series of number density

The smoothed experimental time series (symbol) is a result of the averaging of ten time series (see next slide) at ten $x$ positions.

Unlike our ground-based experiment, particles in this flight experiment

- had a overall drift in the $-x$ direction
- exposed to a gas flow in the $+x$ direction
Method:

Each time series is shifted by a time interval $\Delta x/c_s$, to account for:

- a position difference $\Delta x$
- the wave propagation at the speed $c_s$
Breadboard Experiment

Pressure:

372 mtorr

Movie Credit: Flanagan & Goree 2011
Breadboard Experiment

Pressure: 372 mtorr

Cnoidal function

\[ n(t) = \beta_2 + (\beta_3 - \beta_2)cn^2(t, k) \]