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**HW 4**

**Computing CA code cross- and auto-correlation:**

In GPS, each satellite’s CA code is created in such a way that it is unique and stands apart from other satellites’ CA codes. Correlation measures the likeness between signals. A larger peak represents a stronger correlation at that index. It can be seen in the figure below that the cross-correlation of PRNs 1 and 2 shows no real relation between the signals. However, the auto-correlation of PRN 1 shows how it is a unique signal that only really matches itself at one index (1 and 5000 are one in the same).



The correlation was computed by shifting one signal, multiplying corresponding indices, and summing them all up.

**Accounting for Doppler Shift in CASamples:**

When dealing with GPS signals, it is important to account for the Doppler frequency of the satellite. To do so, when sampling the CACode, the chip rate must be Doppler shifted. This affects how the time is mapped to code indices. Normal chip rate for CA code is 1.023 MHz. The formula below shows how to account for Doppler frequency when computing the new rate, :

where is the Doppler frequency for the given satellite and is the L1 band carrier frequency, 1.57542 GHz.