Projects in Electrical & Computer Engineering 2007-2008

Signal Processing Methods for Mitigating Effects of GPS Interference

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Sponsor: USCG Research and Development Center

Outline of Talk

- Project Objective
- What is Multipath
- Solution
- Testing
- Results

The Project Objective

Find signal processing methods to mitigate the effects of multipath

Multipath Causes Fading or Phase Changes

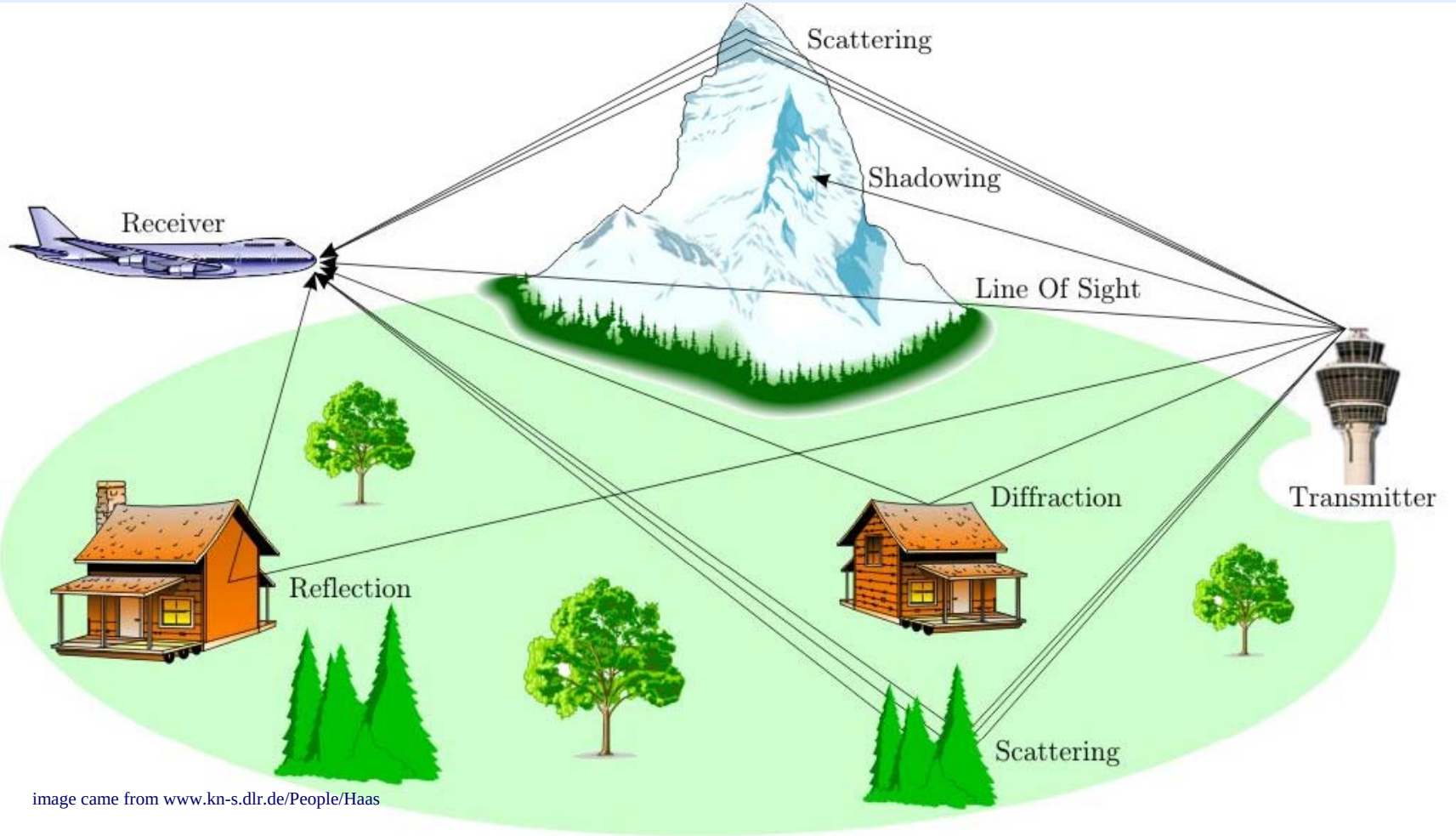
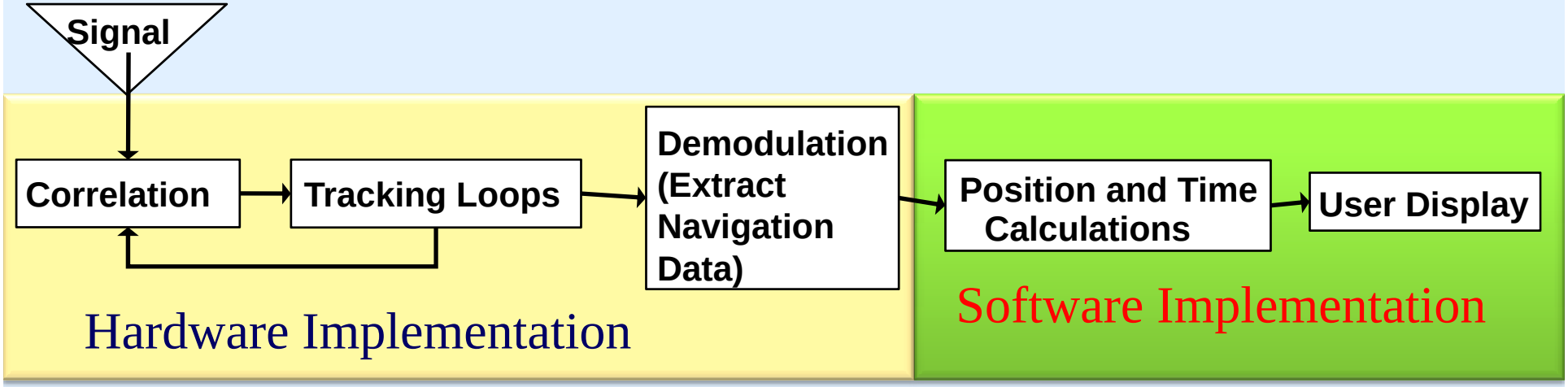


image came from www.kn-s.dlr.de/People/Haas

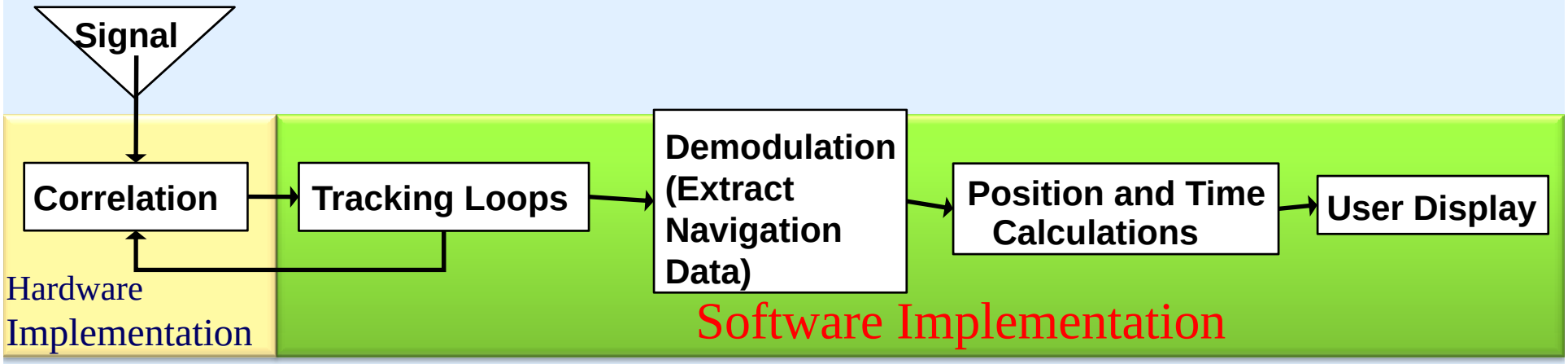
Typical GPS Receiver

- Able to do calculations in real time



Block Diagram of a Software Receiver

- Flexible
- Easy to experiment with different signal processing methods

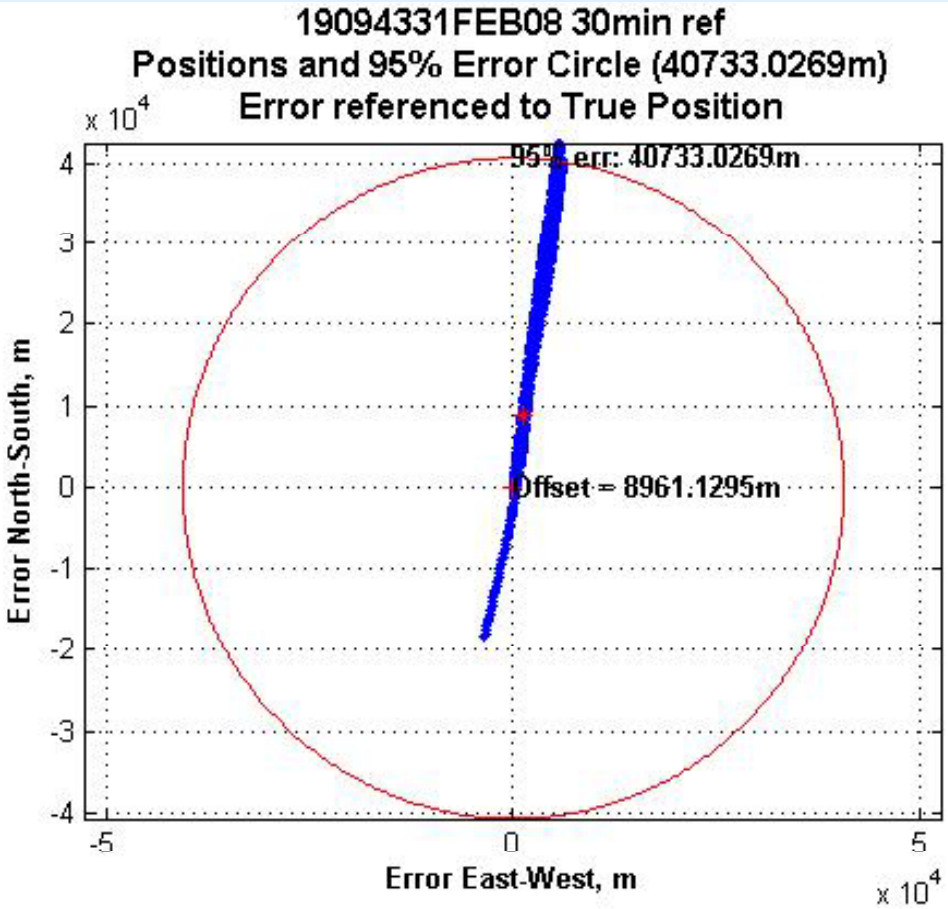


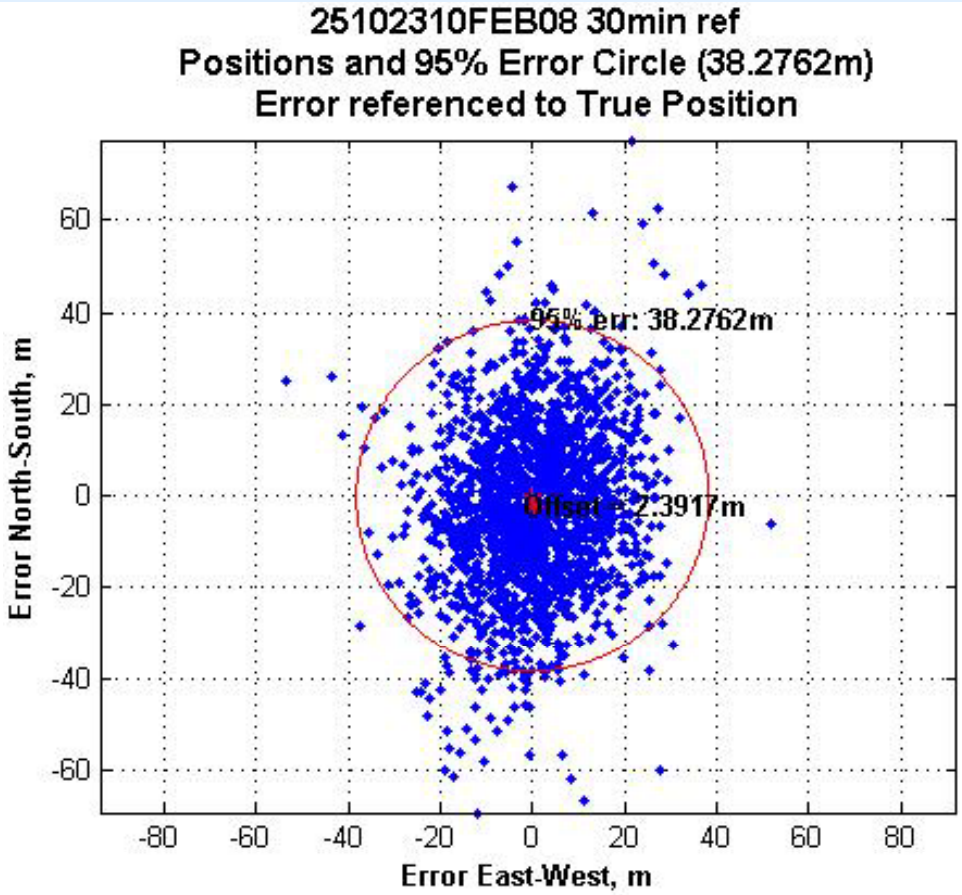
What is OpenSource GPS?

OpenSource GPS is a freeware software GPS receiver developed by Clifford Kelley and available for customization.

Image from http://www.gpscreations.com/Products_GPS1005.html

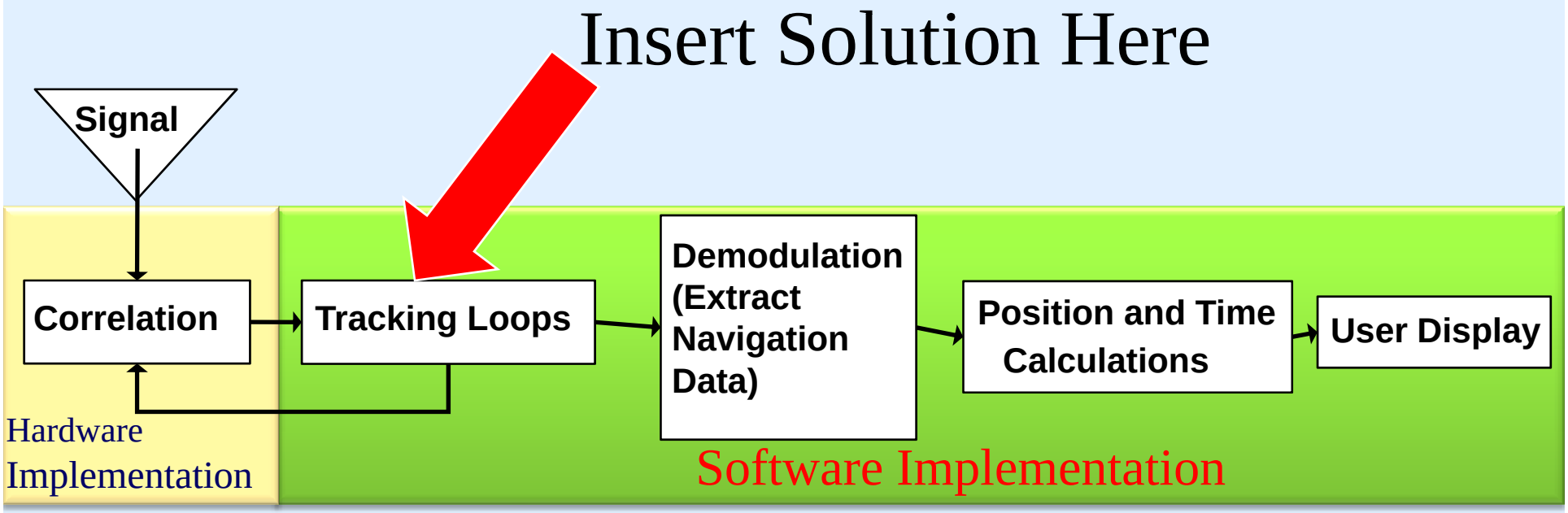
OpenSource GPS Results





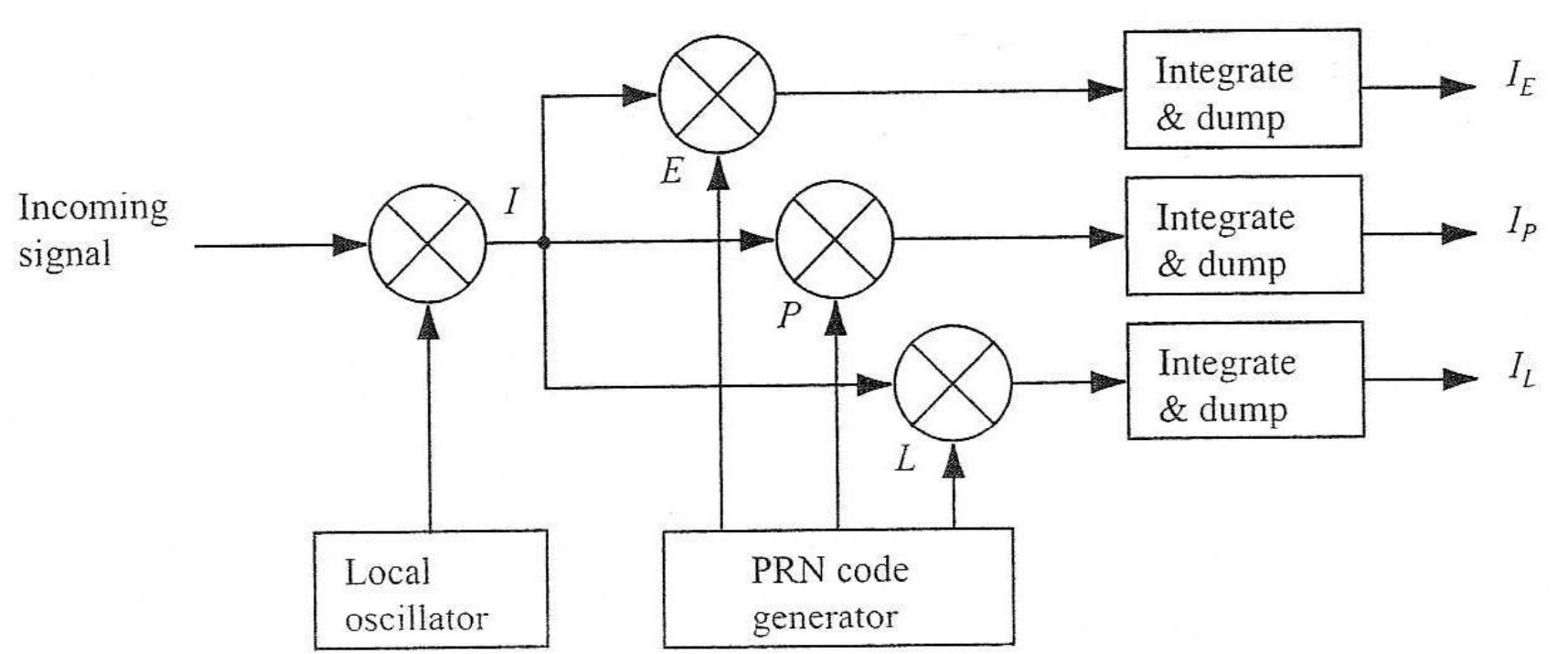
Solution: Decrease the Correlator Spacing

- Done in the Code Tracking Loop



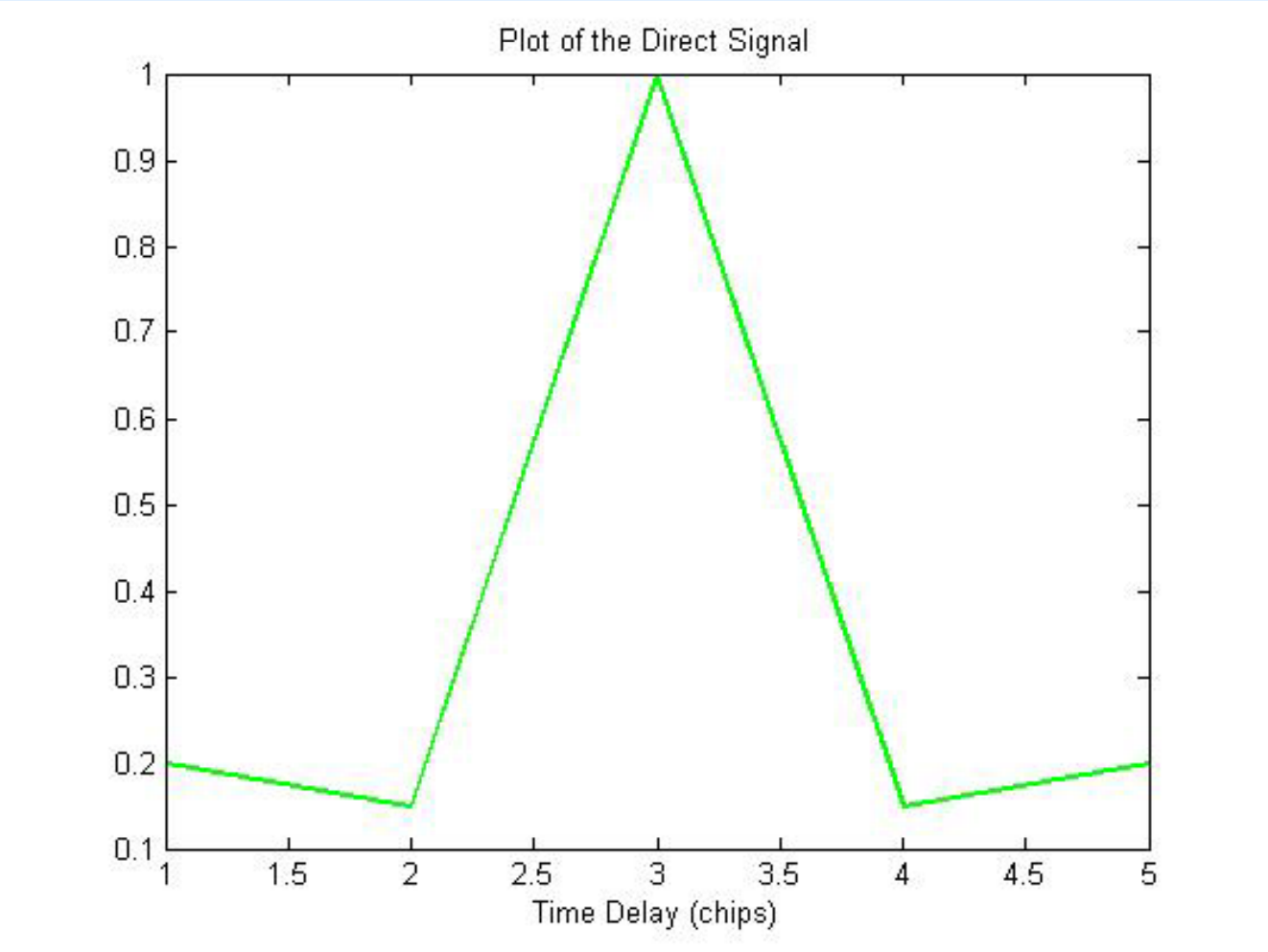
Code Tracking Loop

- Calculate a precise estimate of the phase of the PRN code

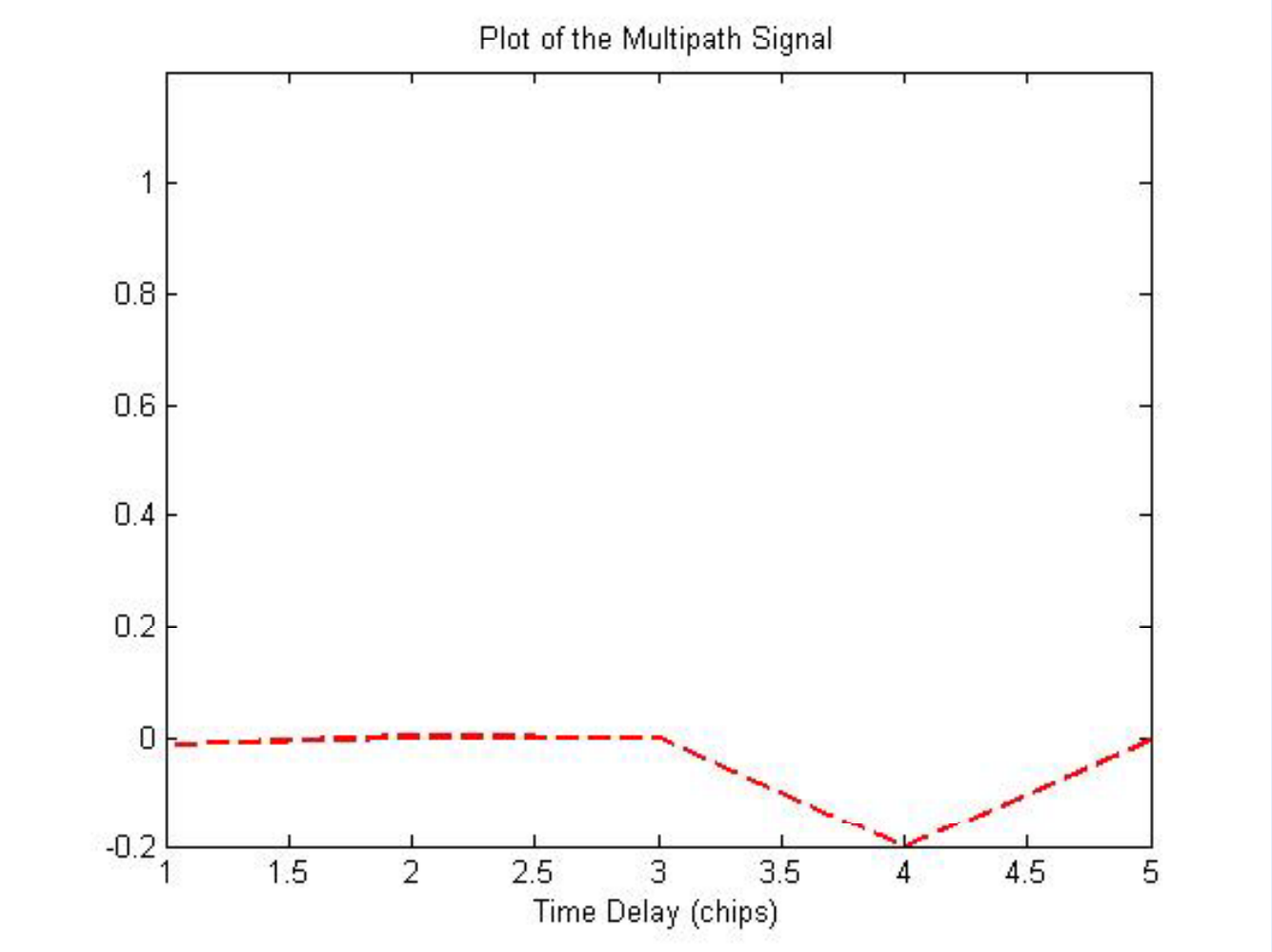


Akos, Dennis M., et al. A Software-Defined GPS and Galileo Receiver: A Single-Frequency Approach. Boston: Birkhäuser, 2007

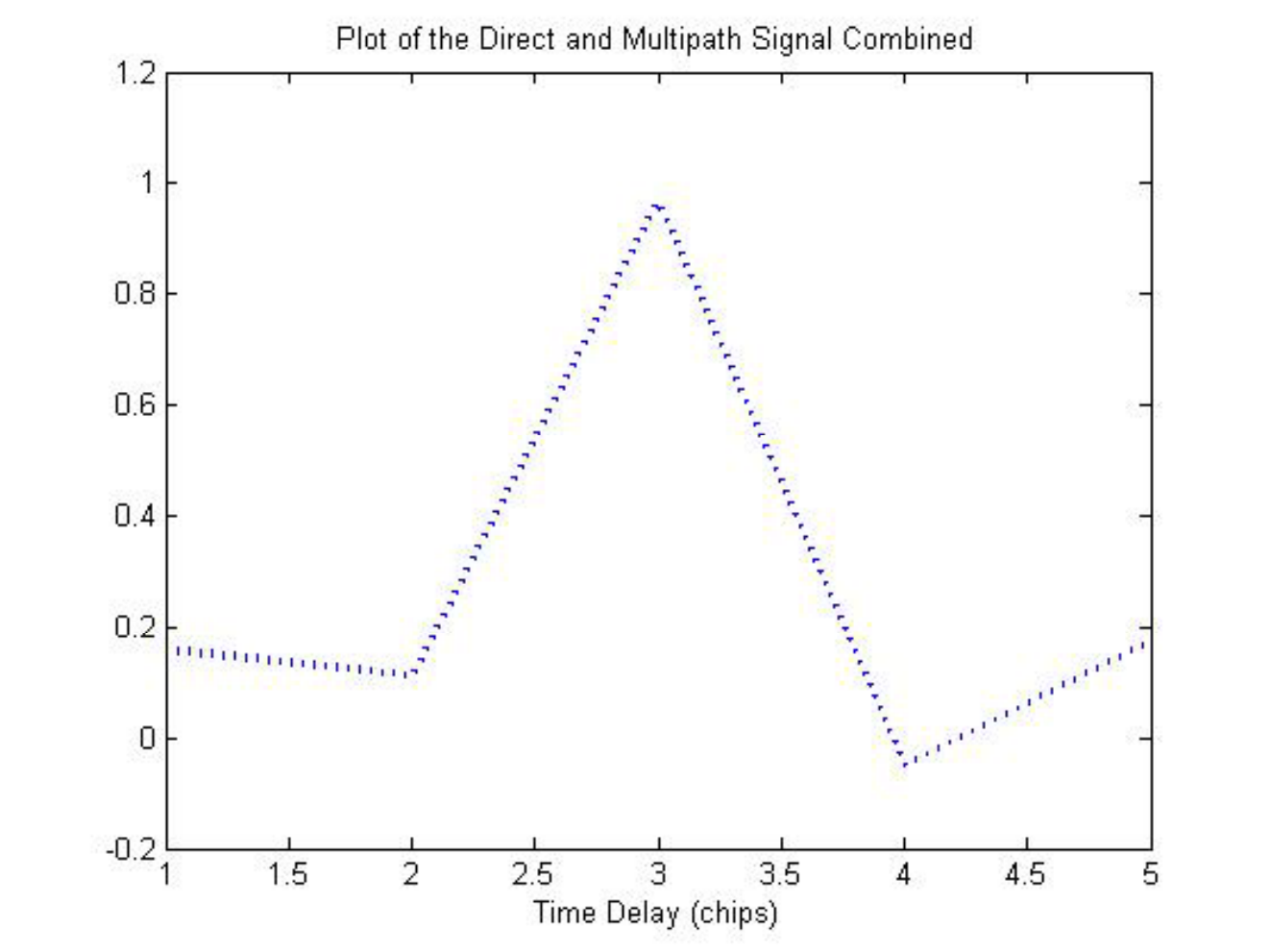
The Direct Signal Correlated



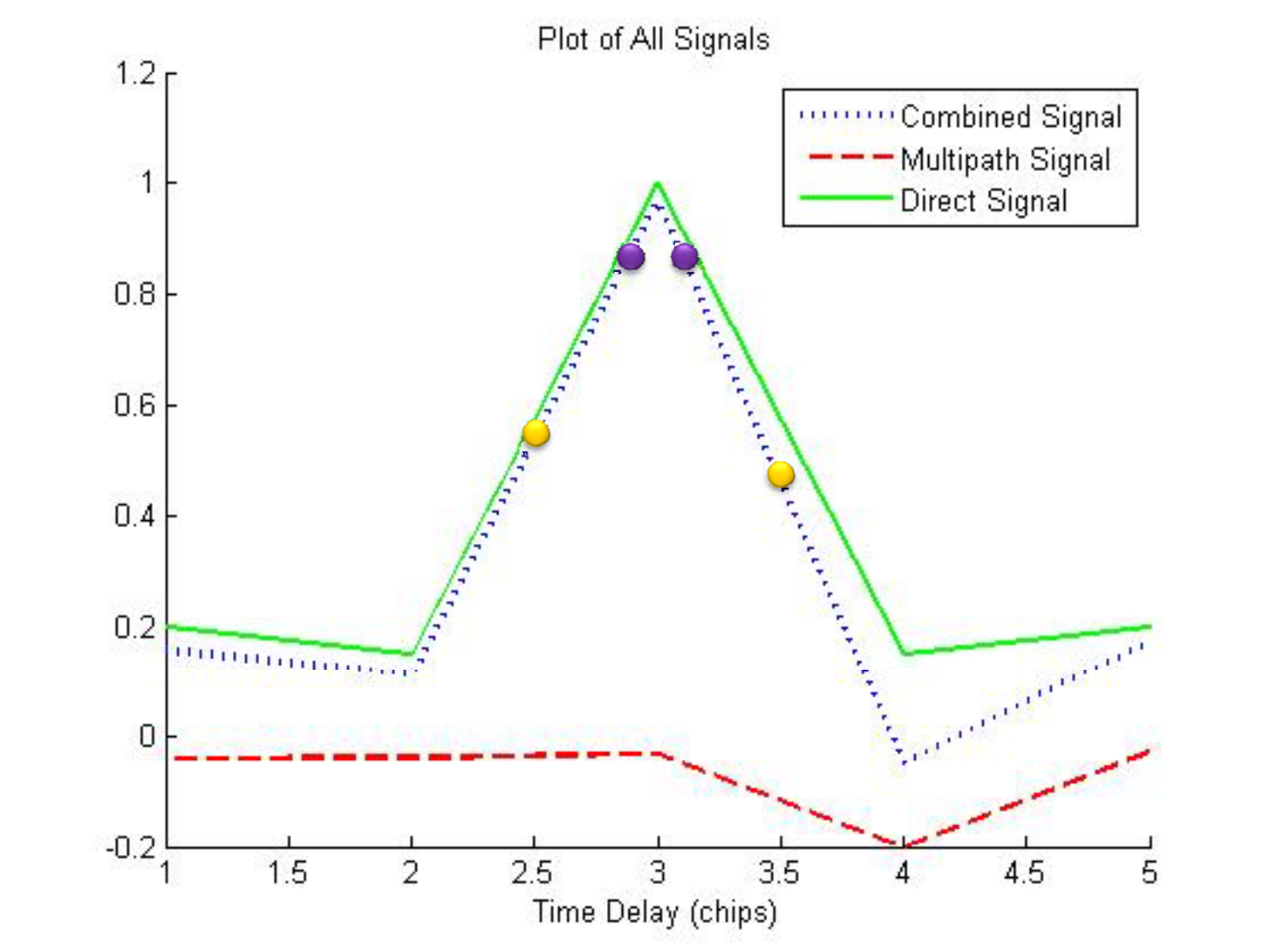
The Multipath Signal Correlated



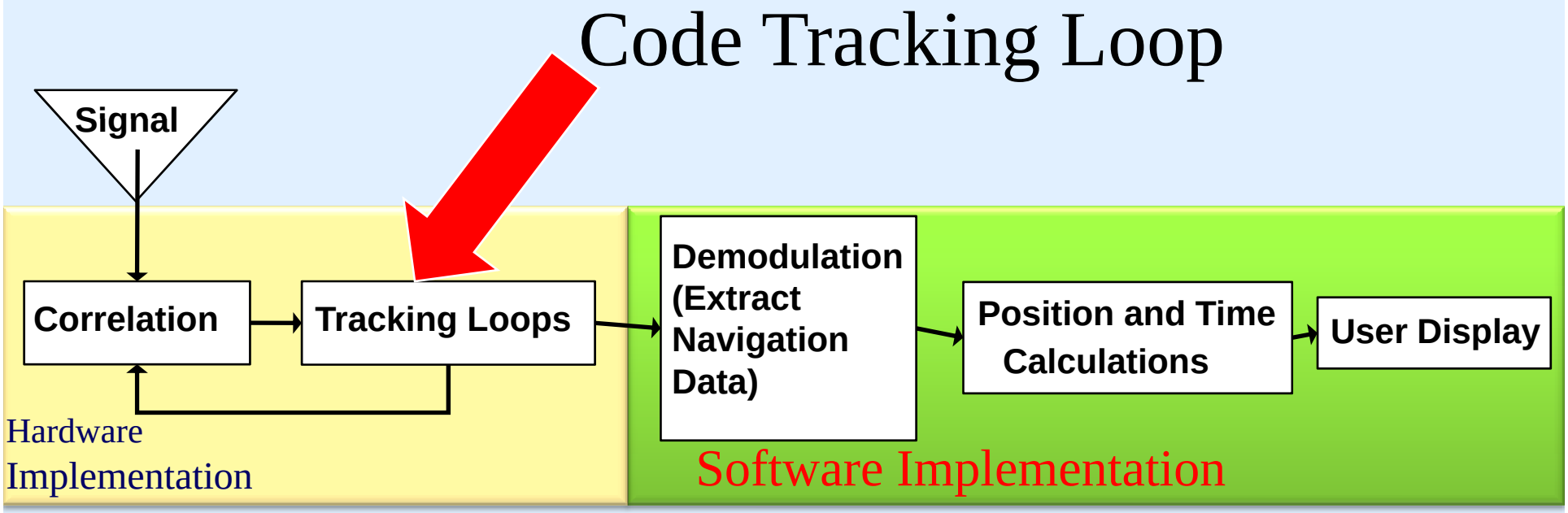
Direct and Multipath Signal Combined



All of the Signals

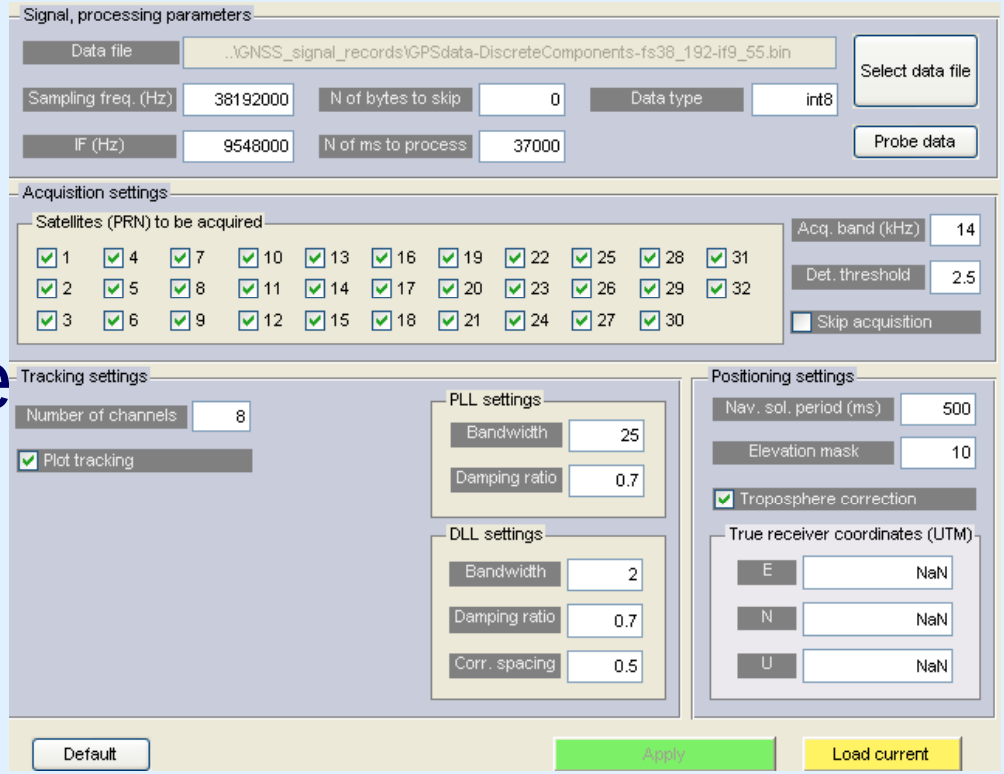


OpenSource GPS



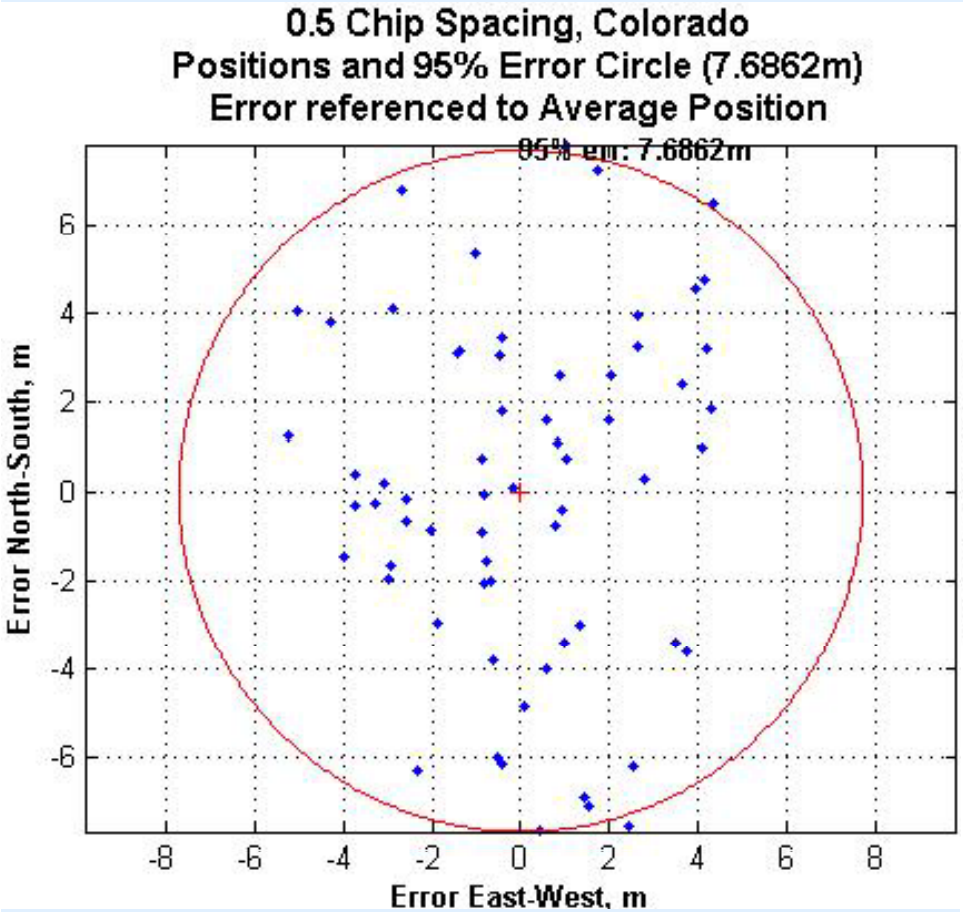
SoftGNSS 3.0

- Full software receiver
- Processing of GPS signal is post processing
- Graphic interface for settings

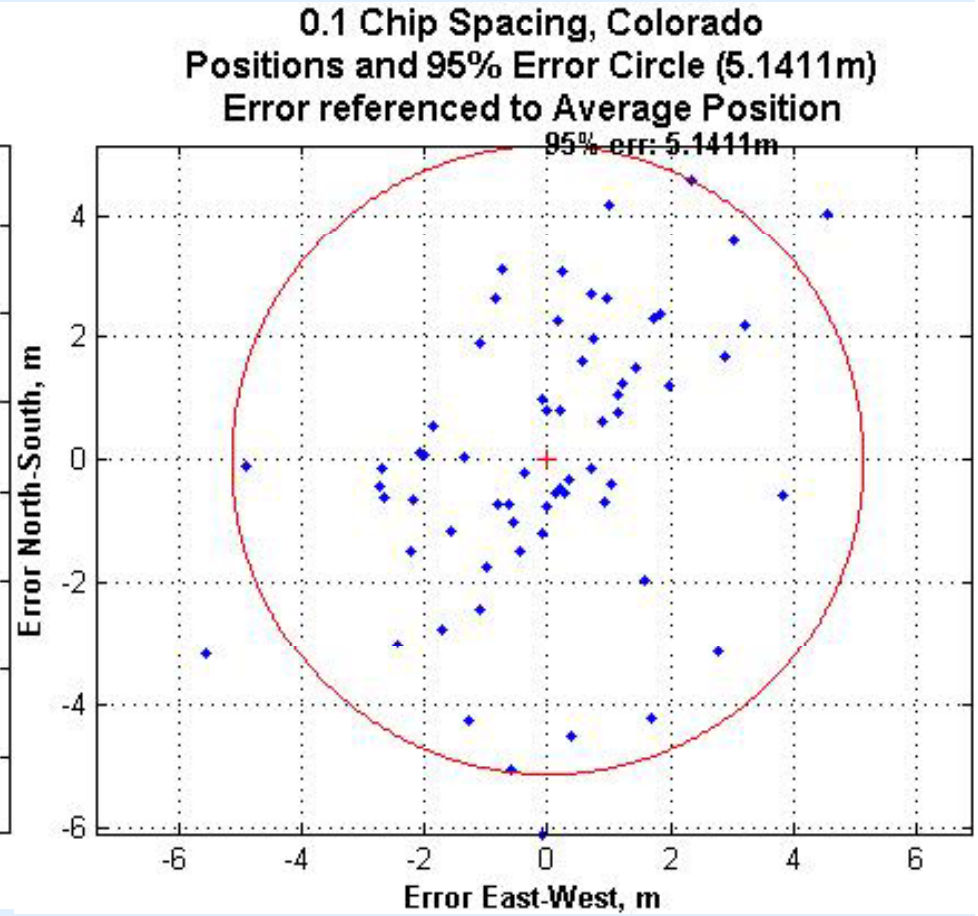


Results

0.5 Chip Spacing



0.1 Chip Spacing



Conclusion

- Began work on 2 Software GPS receivers
- Proved a narrow correlator spacing improve GPS accuracy
- With a compatible Front-end receiver the continued use of SoftGNSS is recommended

Acknowledgments

To the Coast Guard Research and Development Center and LT Seals,

Thank you for your support and help in this project.