Spoofing Aspects at Receiver Start-Up

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WGC – Resilience Subgroup
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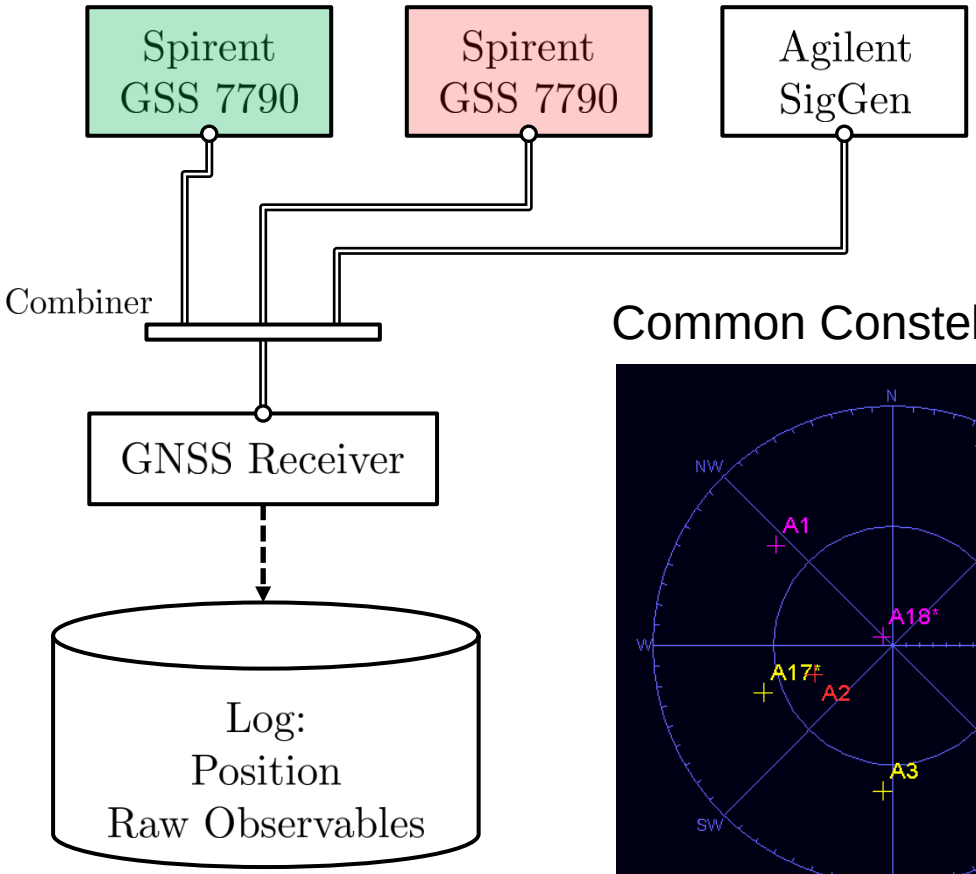
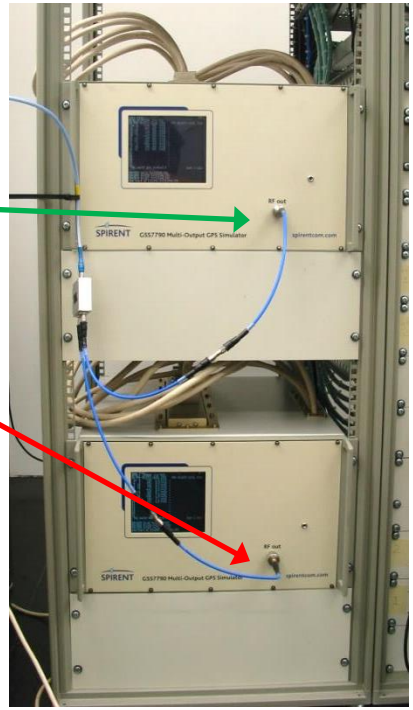
Simulations

Lab Setup



Nominal Signal

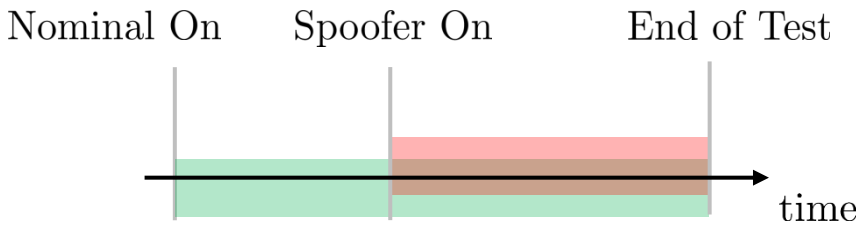
Spoofer



Common Constellation:

Simplistic Setup (unsynchronized)

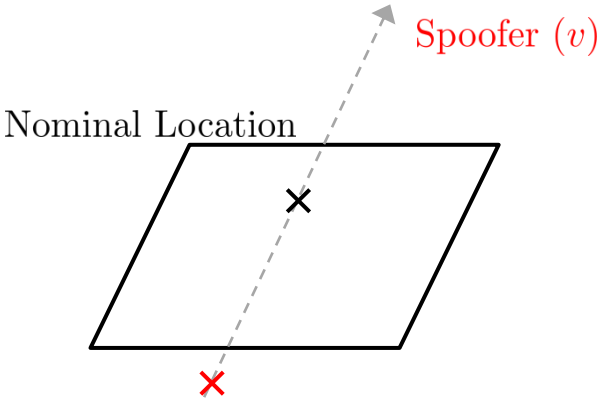
Timing

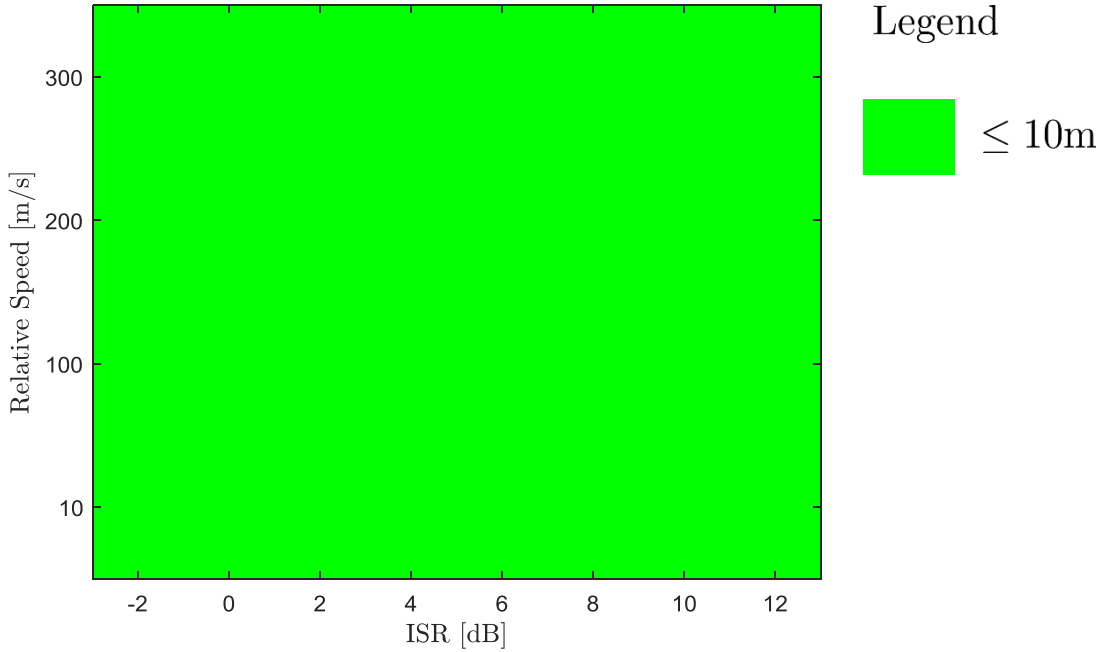


Bunch of different runs:

- Different speed
- Different Power

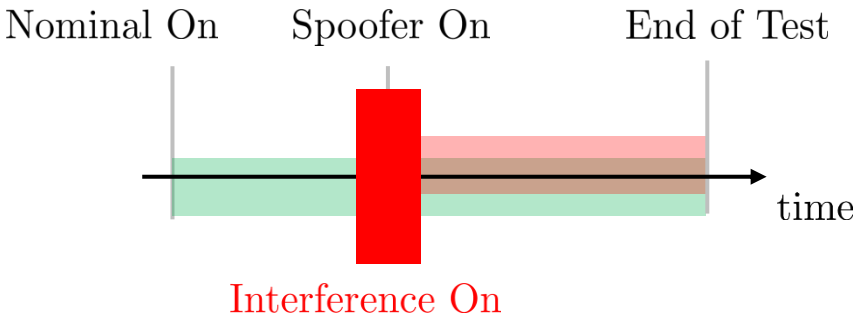
Location

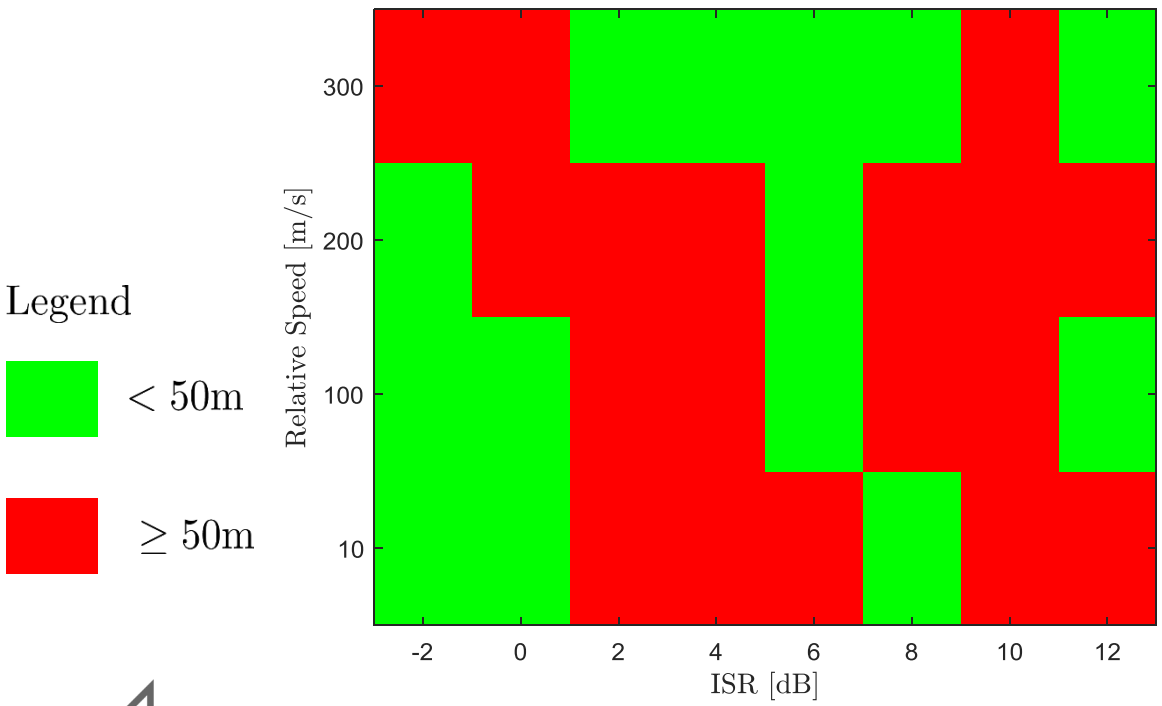




Simplistic Setup (unsynchronized) – with RFI Depends on Receiver

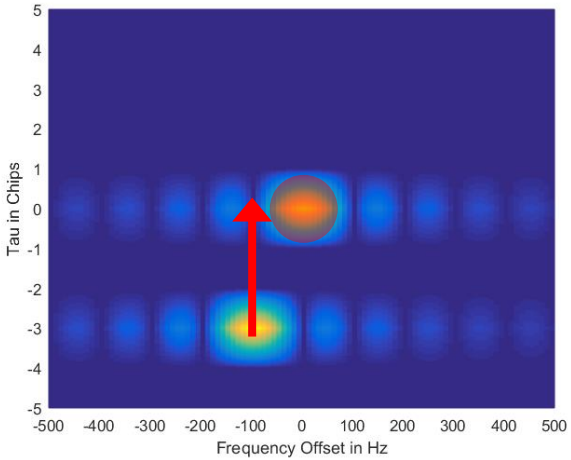
Timing with “knock-out”



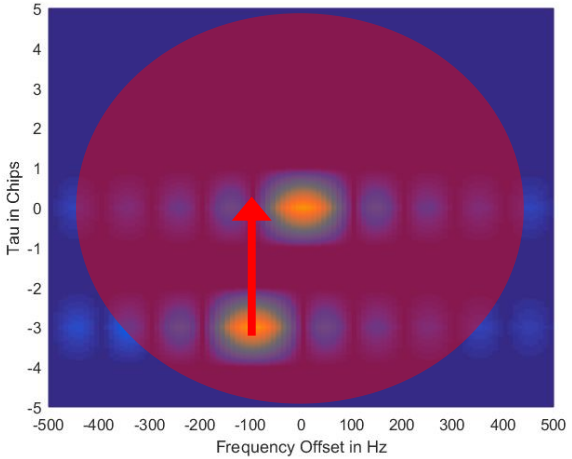


No Pattern

Explanation



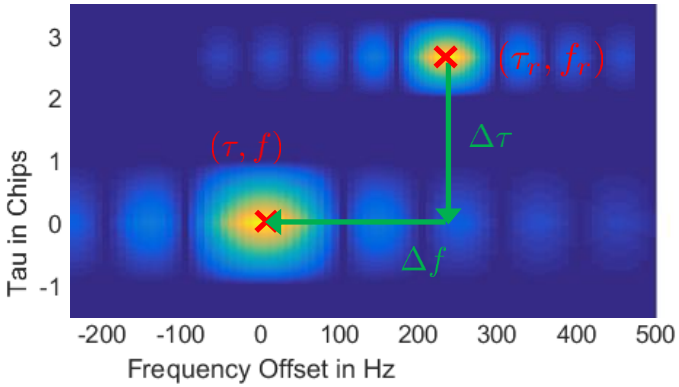
Knock out Interference



Interference forces receiver into reacquisition.

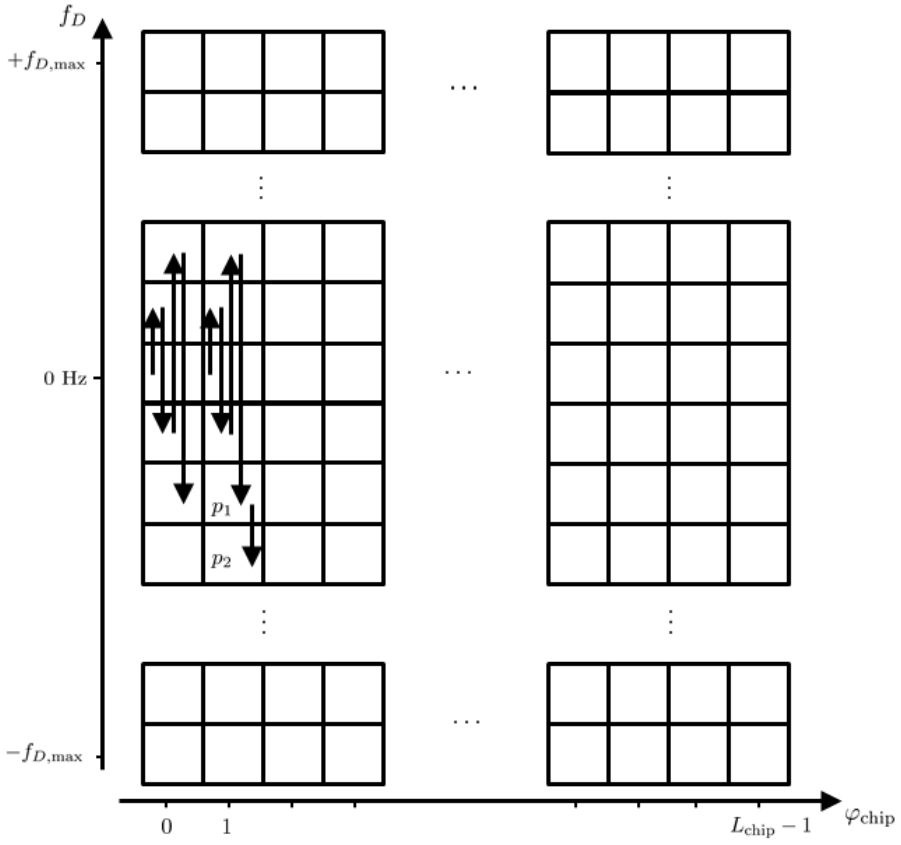
Dependent on search strategy, either authentic or fake peak is found first and tracked.

Synchronization

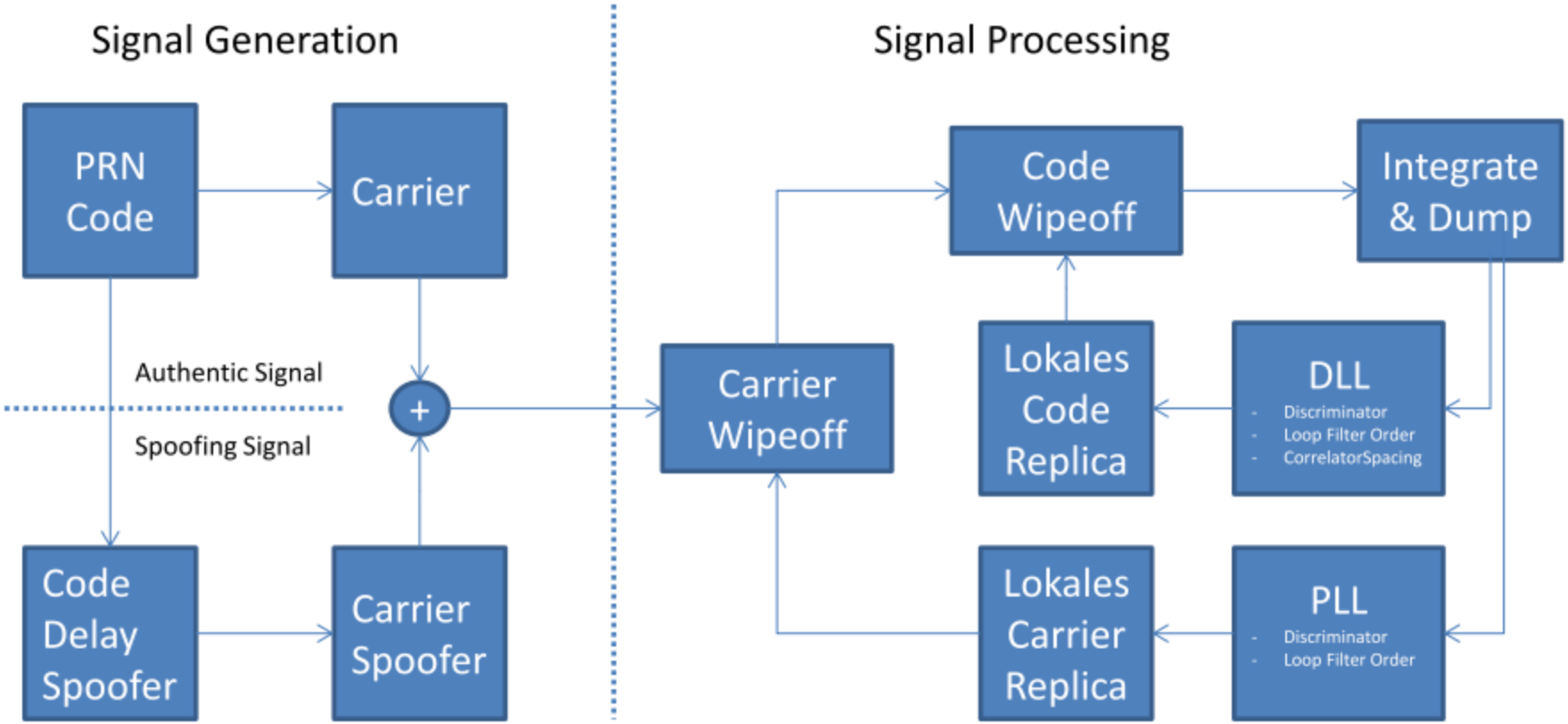


Receiver Aspects – Startup, Acquisition

- Search strategy (in Acq. or Reacq.) in 2D-grid if serial search is implemented
- Search method (either serial or parallel FFT-based)
- Noise floor estimation at startup



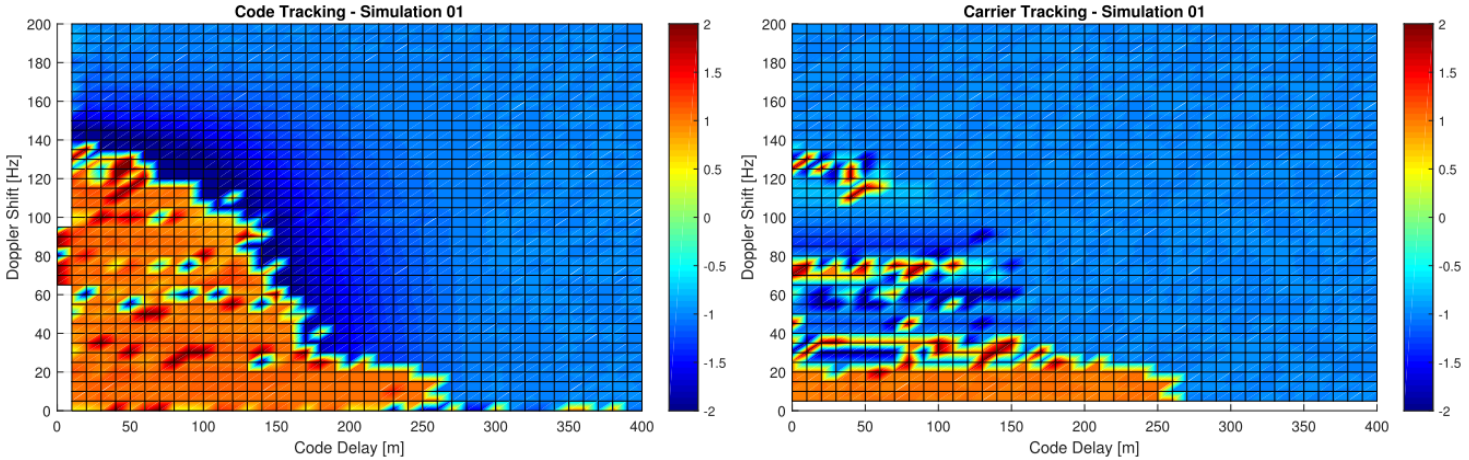
Receiver Aspects - Tracking (1)



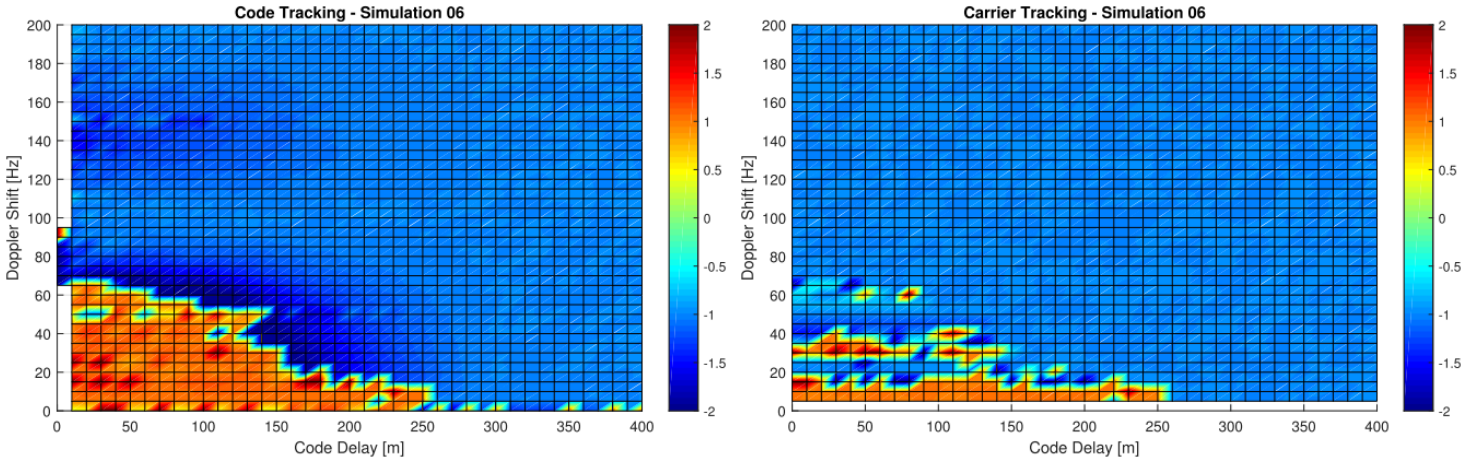
Receiver Aspects - Tracking (2)

Effect of loop parametration on spoofing sync (peaks overlap!)

Setting 1



Setting 2



Feasibility Issues (1)

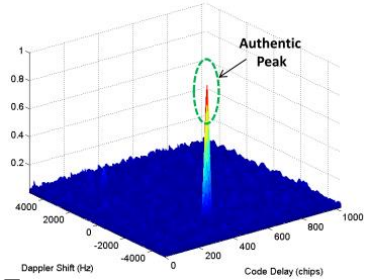
- Since no synchronization is necessary, feasibility is given by using commercial hardware
- Either signal simulators or SDR Platforms will be enough (software on Github)

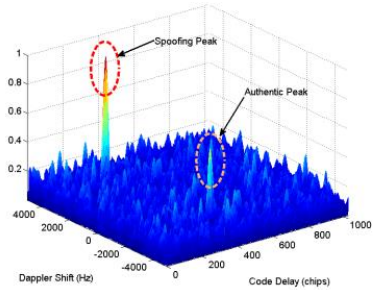
bladeRF DEFCON23 (~600€)

HackRF (for Pokemon) (~500 €)

R&S (SMBVA100A) (~30 k€)

- Very unlikely that correlation functions overlap, i.e. only one peak per PRN will be tracked.

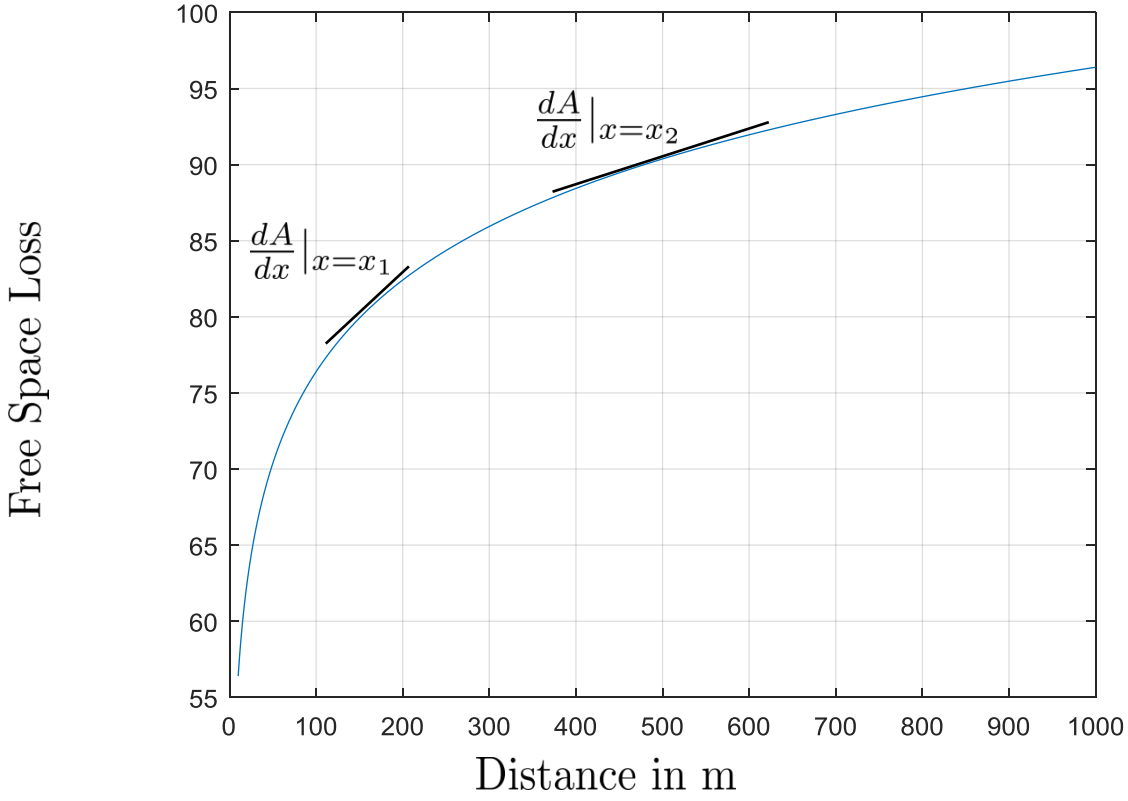




A. Broumandan, A. Jafarnia Jahromi, S. Daneshmand, and L. Gérard, “GNSS Vulnerability to Spoofing Threats and a Review of Anti-Spoofing Techniques,” presented at the ION Alberta Meeting, Alberta?, 24-Jan-2014.

Feasibility Issues (2)

Issue: Power calibration of spoofer to match nominal power



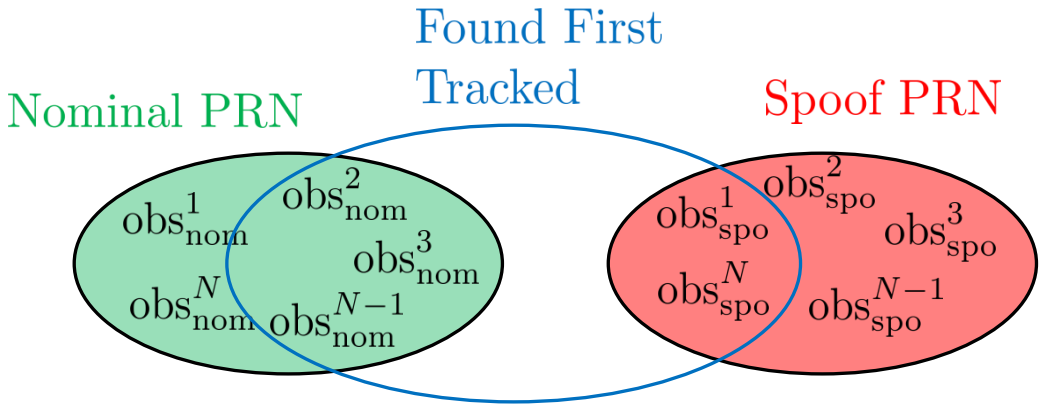
Easier (for spoofer) if farer away!

Possible Occurrences

Every time the victim is “parked” and navigation is turned on or restarted

Examples:

- Airport
- Parked train, train passing tunnel
- Harbor



If mix is found/tracked: Allows for ARAIM based detection

Questions to the group

- How does this fit in the current threat model? (see threat_notes_v0.9)
- Are ARAIM methods (would be a link to the other subgroup) useful? Which ones?
- How to deal with receiver implementation aspects?
- Possible defend strategies?

Countermeasure proposals:

- Second peak constant search/acquisition
- Second peak tracking if overlapped
- Recommendation for loop implementation (Tobias Bamberg)