WiBAR: Wideband Autocorrelation Radiometry

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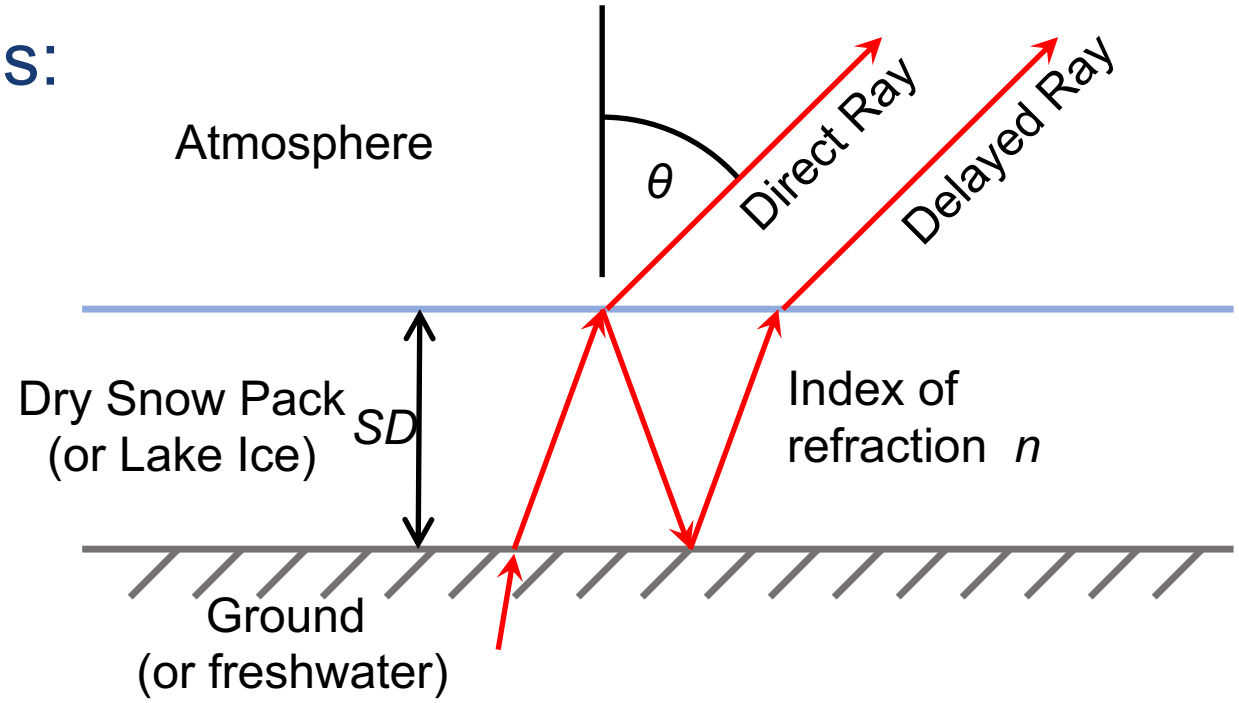
How much water is stored in the seasonal snow pack?

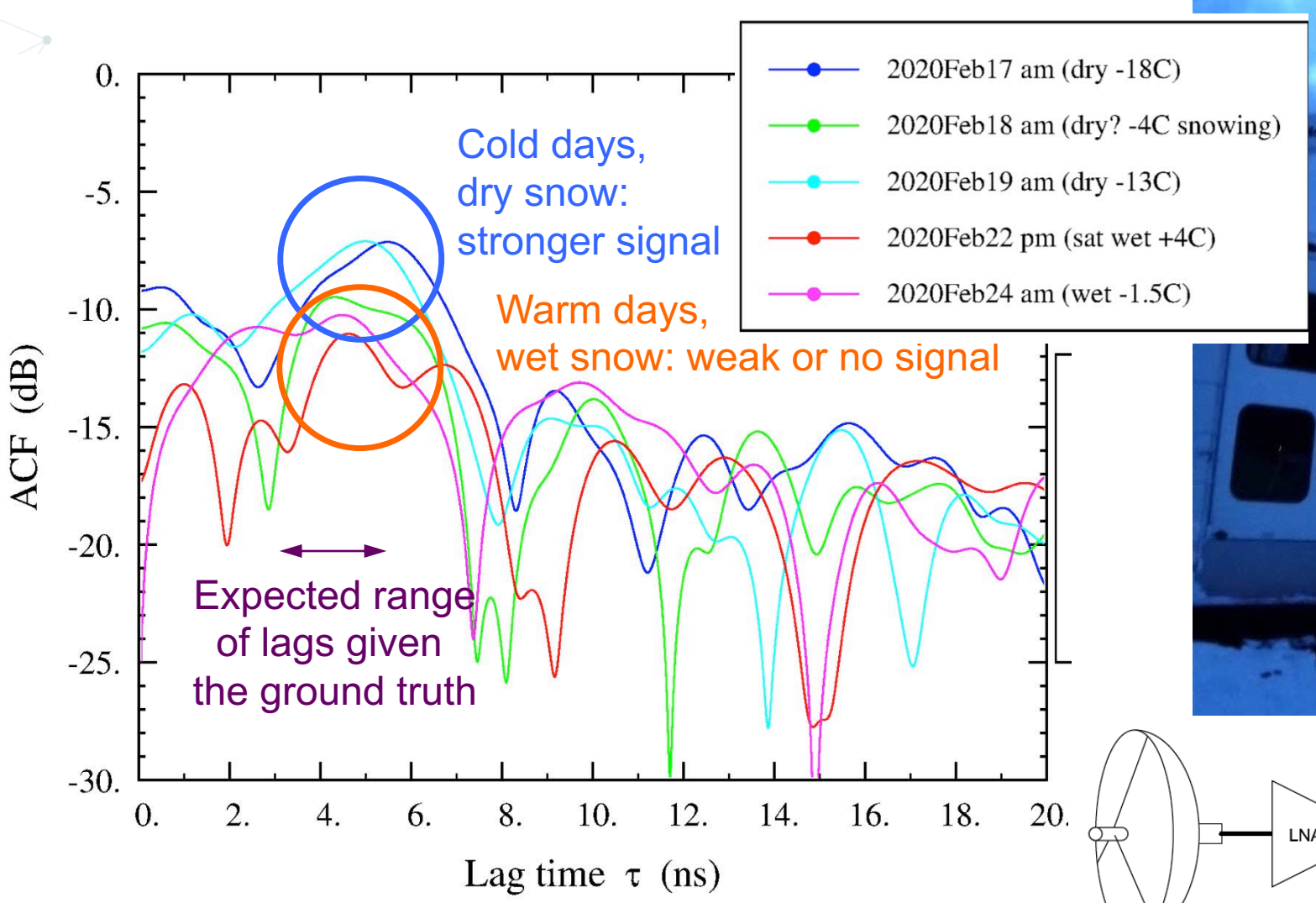
- Billions of people around the world depend on snowmelt for their water
- We don’t yet have a reliable way to measure the storage of water in the snow pack globally
- The remote sensing community has not yet settled on the optimal combination of approaches for this problem (eg. NASA SnowEx)
- WiBAR is another tool:
  - -microwave, so all-weather
  - -passive, so low power, thus low cost
  - -deterministic, so no algorithm calibration

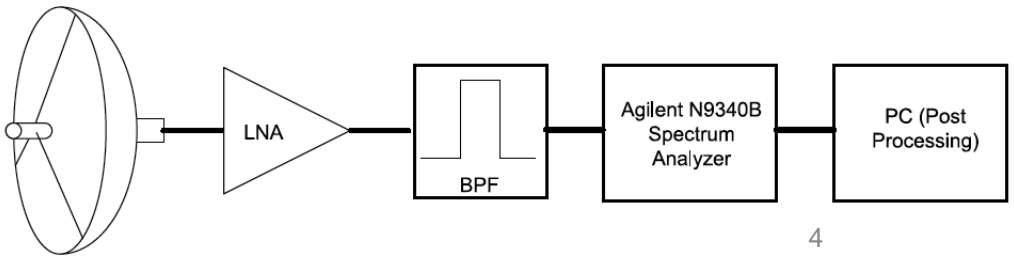
WiBAR measures Planck coherency

- WiBAR measures coherent effects of microwave emission, which reveals the thickness of low-loss slabs, such as snow on the ground or lake ice.
- This project demonstrates:
  - that the coherent signal exists for snow (ice already proven)
  - a novel receiver architecture for rapid measurement



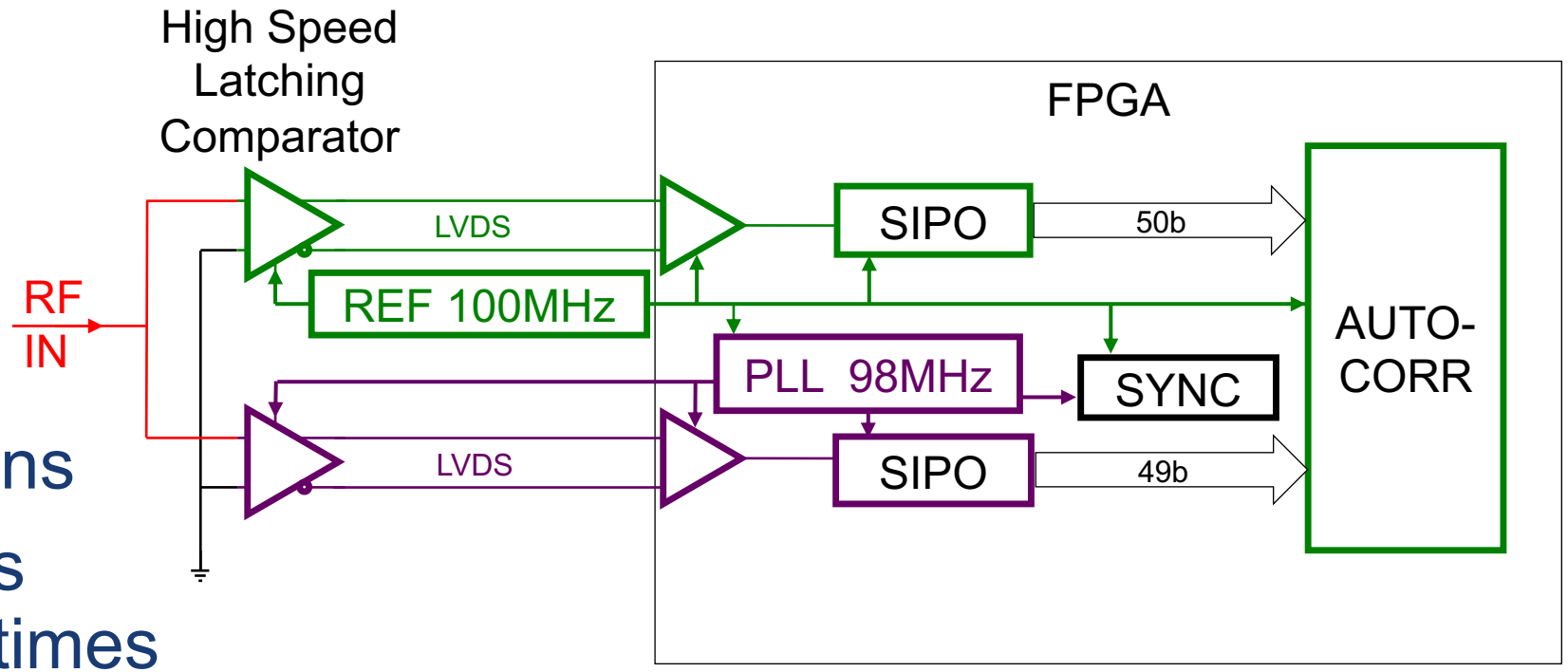
Evidence of coherent emission from snow

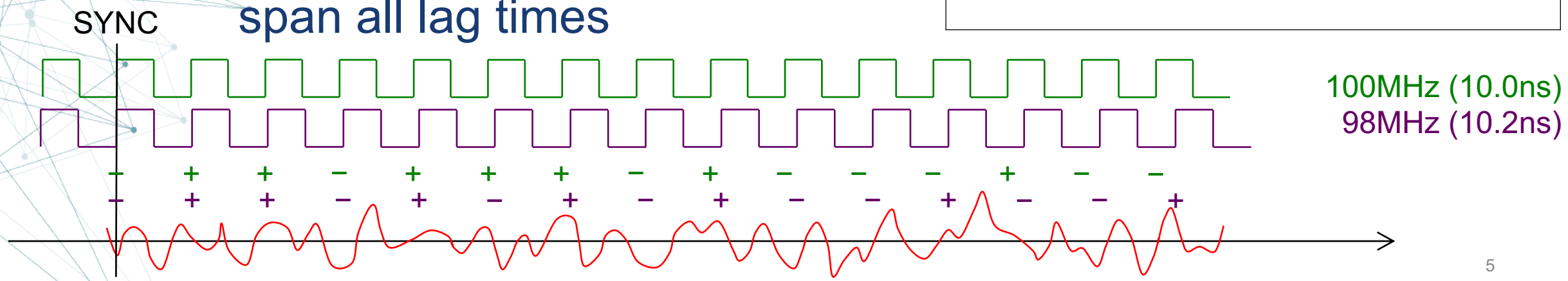




One bit autocorrelator w/ 0.2 ns resolution

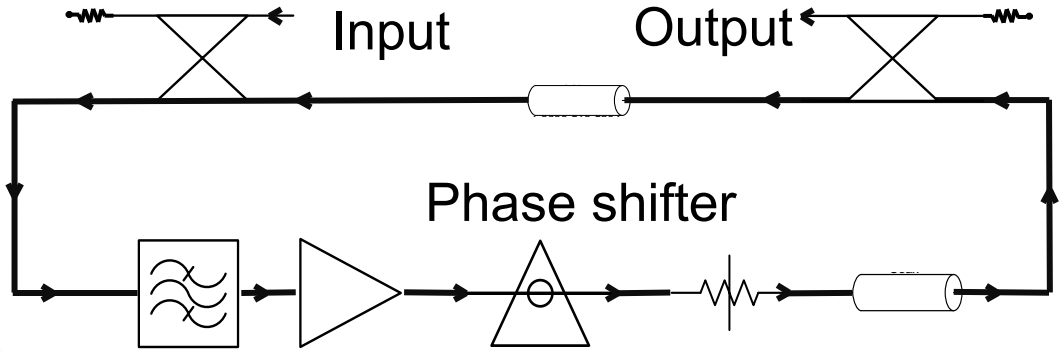
- Sub-Nyquist sampling w/ two clocks
- Clock periods differ by 0.2 ns
- Sample pairs span all lag times

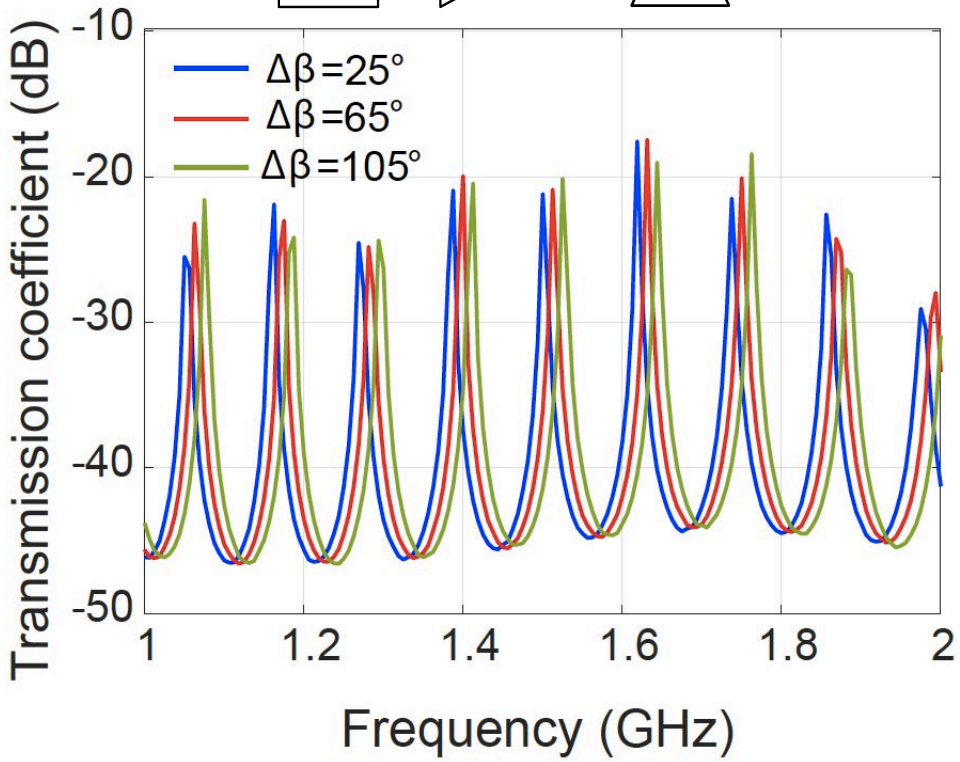




A tunable comb filter for RFI mitigation

- WiBAR needs a wide frequency range, but not much bandwidth
- microwave circuit of a Fabry-Perot interferometer
  - MW couplers serve as F-P mirrors
  - MW electronic phase shifter serves as F-P mirror spacing





Contributions

- Novel microwave receiver architecture for passive measurement of snow and ice accumulation that is sensitive to its macroscopic, not microscopic, properties

Next Steps

- Final integration and test of rapid acquisition hardware
- Validate RFI mitigation effectiveness
- Develop reduced SWAP receiver
- Go airborne, produce images & attempt disaggregation

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