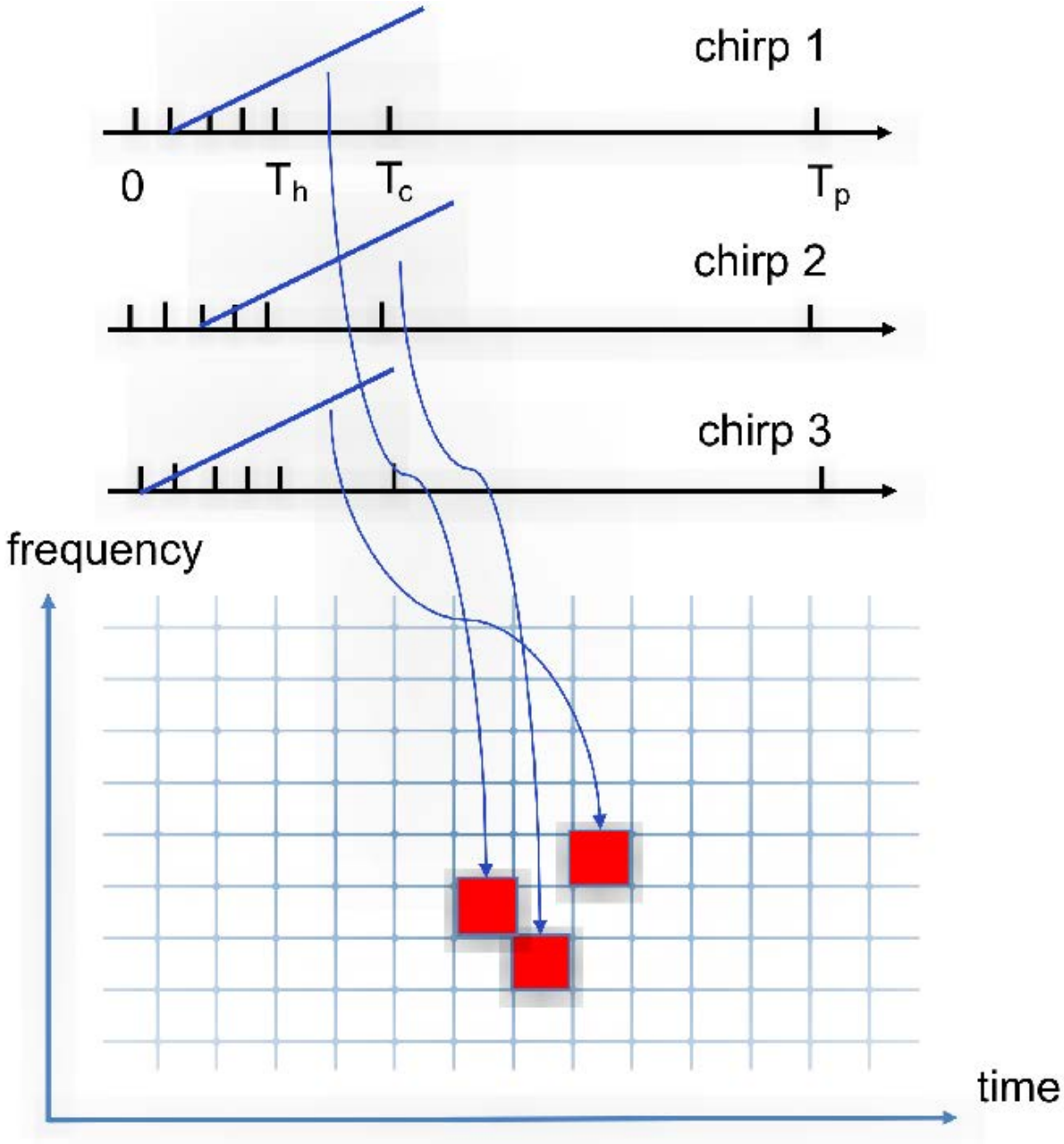
Ghost Image Due to mmWave Radar Interference: Experiment, Mitigation and Leverage

- demonstrate the existence of ghost image.
- Ghost image properties:
    - narrow frequency spread
    - abnormal Doppler estimation
    - possible negative distance.
- Setup: AWR1243/1642
- Synchronization:
    - hardware trigger initiated by a square wave from an Arduino zero board with a period of 51ms (15ms high + 36ms low).
    - In the experiment, the trigger signal to the two radars may be different. When the phase of interfer radar is ahead of the other radar (receiver), negative frequency (slope) can show up.
- Modulation:
    - the varying time in the chirps, similar to the pulse position modulation (PPM). (Dividing the interval of successive chirps into N pieces and modulate the symbol on the time varing.)
    - two successive chirp can modulate 8 bits (256 symbols) in the ideal case with a setting of dis=100m, fs=256 points, interval=1.7us.



- Shortcoming:
  - 利用同一个trigger信号进行硬件同步，限制其真正的使用场景（两车之间有距离）

Communications via Frequency-Modulated Continuous-Wave Radar in Millimeter Wave Band

- Basic idea:
  - modulated the symbol on the slope, each chirp = one information symbol; demodulated the symbol by 2^N predefined slopes (symbols) and choose the max (using matched filter)
- need extra local signal generators (N generators for N order generation) to demodulate the communication signal (matched filter based method).
- The interval T of two successive chirp pulse is fixed.
- shortcoming
  - modulate symbols on slopes and demodulate it with the specific local slope.
- Setup:

    - TI AWR1243BOOST Pack and TSW1400EVM (how they generate the 2^N local slopes for modulation in the experiments?)

1. [2020Multi-functional Coexistence of Radar-Sensing and Communication Waveforms]

- a scheme to serve radar-sensing and communication objectives at the same time and allocate bandwidth.
- transmit two different waveforms: FMCW for sensing and OFDM for communication.
- Only numerically evaluated.

2. [2020Leveraging Sensing at the Infrastructure for mmWave Communication]

- motivate the use of infrastructure mounted sensors (which will be part of future smart cities) to aid establishing and maintaining mmWave vehicular communication links.

3. [2020Cooperative Detection for mmWave Radar-Communication Systems]

- propose a novel cooperative detection technique in the context of millimeter-wave (mmWave) RadCom systems, under a constant false alarm constraint.
- Existing detection techniques assign a single base station (BS) operating in radar mode (RM) for the detection of a target. In contrast, our proposed technique performs joint target detection through multiple cooperative RMenabled BSs (RBSs).
- Numerical results

4.2020Toward Millimeter-Wave Joint Radar Communications

- provides a signal processing perspective of mm-wave JRC systems with an emphasis on waveform design.

5.2019On Unified Vehicular Communications and Radar Sensing in Millimeter-Wave and Low Terahertz Bands

- propose a concept of unified channel access over millimeter-wave and higher frequencies.
- Time-domain duplex and Telecom messages over radar transmissions

6.Multibeam for Joint Communication and Radar Sensing Using Steerable Analog Antenna Arrays

- propose a novel multibeam framework using steerable analog antenna arrays, which allows seamless integration of communication and sensing
- providing fixed subbeam for communication and packet-varying scanning subbeam for sensing

7.FMCW Implementation of Phase-Attached Radar-Communications (PARC)

8.A mmWave Automotive Joint Radar-Communications System

- propose a millimeter-wave joint radar-communications (JRC) system comprising a bi-static automotive radar and vehicle-tovehicle communications

9.Radar Aided Beam Alignment in MmWave V2I Communications Supporting Antenna Diversity

- propose a set of algorithms to perform the beam alignment task in a vehicleto-infrastructure (V2I) scenario, from extracting information from the radar signal to configuring the beams that illuminate the different antennas in the vehicle.

10.Millimeter-Wave Vehicular Communication to Support Massive Automotive Sensing

- A high-level solution to one key challenge — the overhead of mmWave beam training — is proposed. The critical feature of this solution is to leverage information derived from the sensors or DSRC as side information for the mmWave communication link configuration.

11.LTE-V: A TD-LTE-Based V2X Solution for Future Vehicular Network

- propose long-term evolution (LTE)-V as a systematic and integrated V2X solution based on time-division LTE (TD-LTE) 4G.
- Comparing to IEEE 802.11p, LTE-V-direct is a new decentralized architecture which modifies TD-LTE physical layer and try to keep commonality as possible to provide short range direct communication, low latency, and high reliability improvements

12.2010Radar and Radio Data Fusion Platform for Future Intelligent Transportation System

- We present a software-defined data fusion system which integrates both radar (sensing) function and radio (communication) function within a single transceiver platform. (up-chirp, contant-frequency, down-chirp)
- A low-frequency prototype for the 5.9-GHz dedicated short range communication (DSRC) system was designed and prototyped. Both system simulation results and preliminary measurement results have proved the proposed concept.