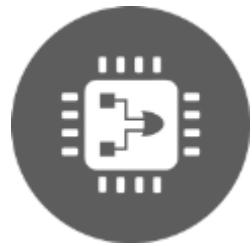


Health Radar

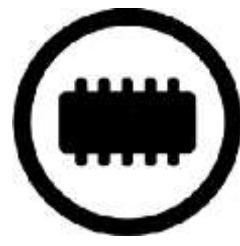
Full spectrum technical capabilities



VLSI



PCB design



Firmware



App



Driver



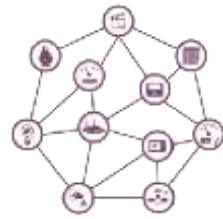
Big data



**Antenna
design**



**Power
optimization**



**Mesh
network**



**Video
processing**



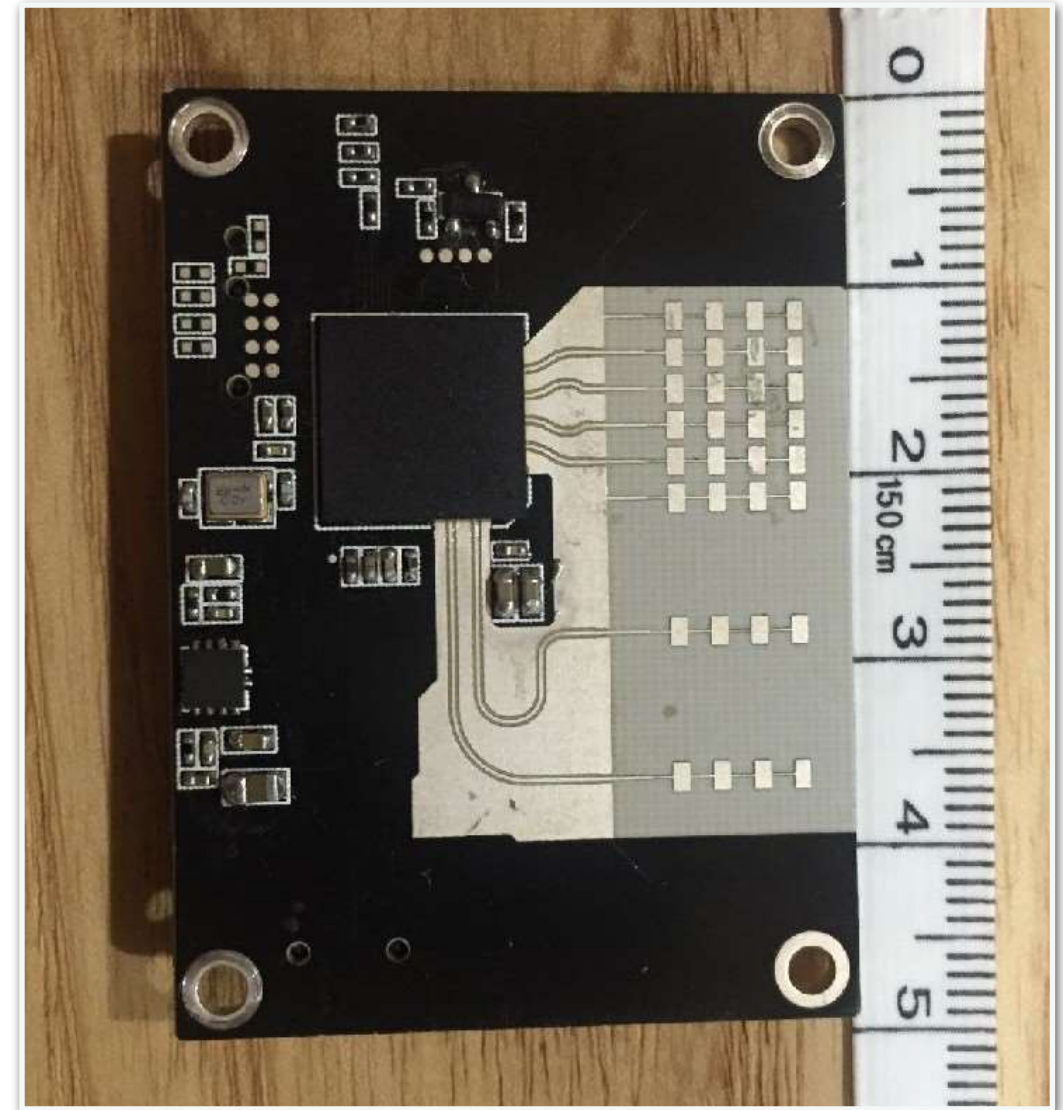
**Signal
processing**



**Data
modeling**

Our product - mmWave RADAR

- Small size, high accuracy
- Lower power, high reliability
- Easy to integrate
- 100% in-house design
- Flexible and customizable



Advantages of RADAR



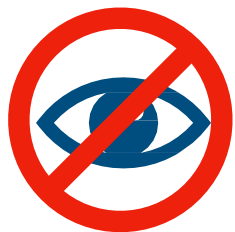
RADAR works best on detecting moving objects, with the same accuracy regardless distance to targets



Different surface textures reflects radio waves differently, ~~it's~~ it's possible to classify and distinguish targets

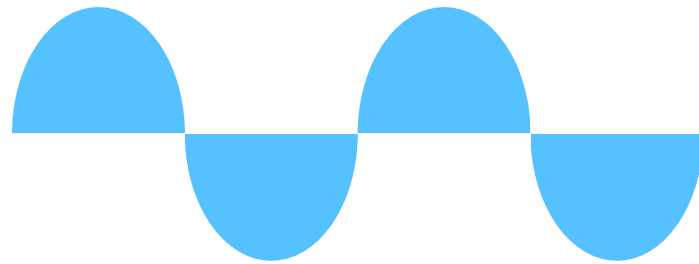


It works under all kinds of weather, light condition, and ambience temperature



Unlike image sensors, RADAR has no privacy concerns, making it more suitable for lots of applications

Why 77GHz?



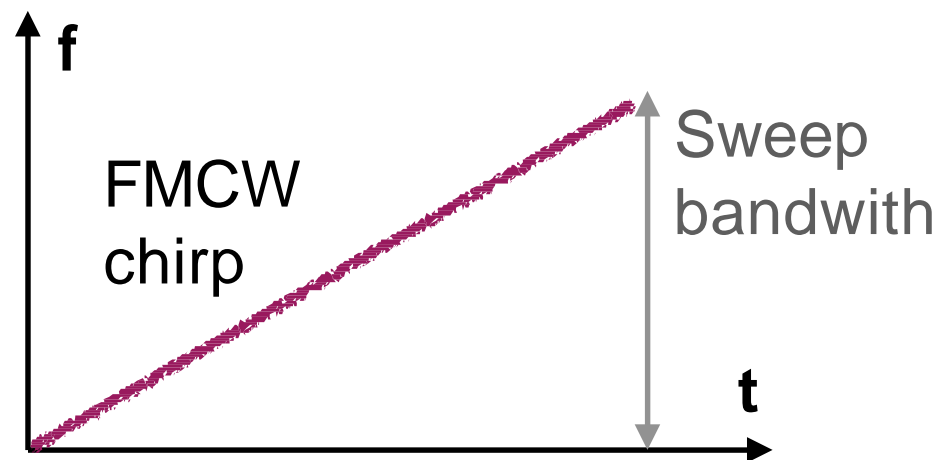
Wavelength (λ)

77GHz

$$\lambda = 300000\text{km} / 77\text{GHz} = \mathbf{3.9\text{mm}}$$

24GHz

$$\lambda = 300000\text{km} / 24\text{GHz} = \mathbf{12.5\text{mm}}$$



77GHz

$$300000\text{km} / (2 * 4\text{GHz}) = \mathbf{3.75\text{cm}}$$

24GHz

$$300000\text{km} / (2 * 0.2\text{GHz}) = \mathbf{75\text{cm}}$$

Why 77GHz?

Smaller
product dimension



~90%
area reduction

Higher
velocity sensitivity

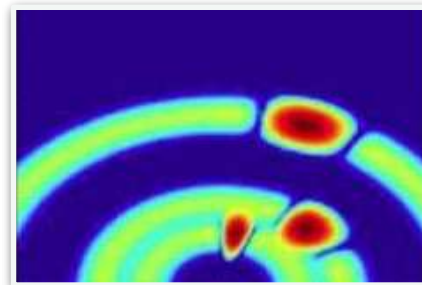
$$1/4\lambda@50\text{ms} = 1.96\text{cm/s}$$

$$1/4\lambda@50\text{ms} = 6.25\text{cm/s}$$

~320%
more sensitive

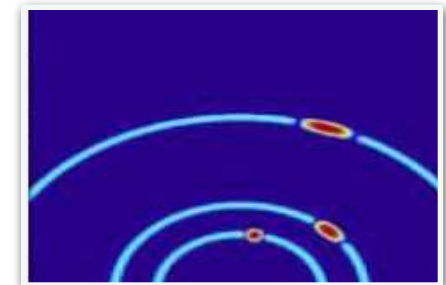
Better
range resolution

200MHz

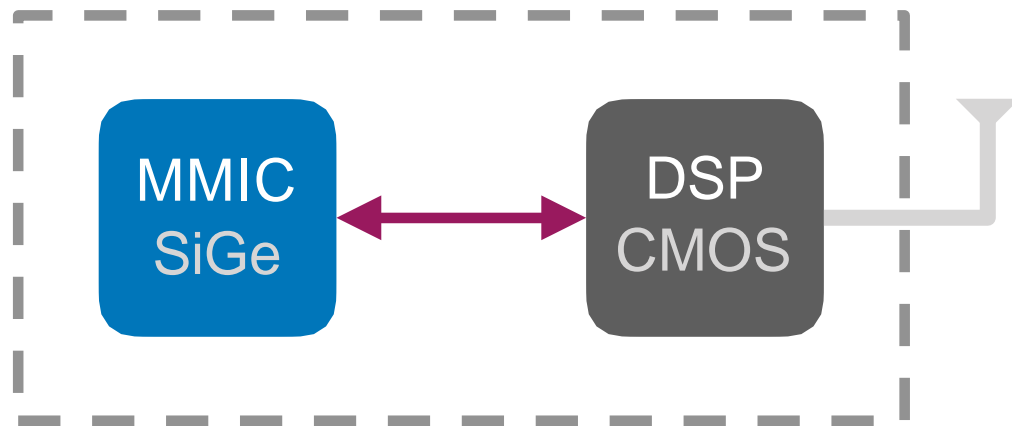


V.S.

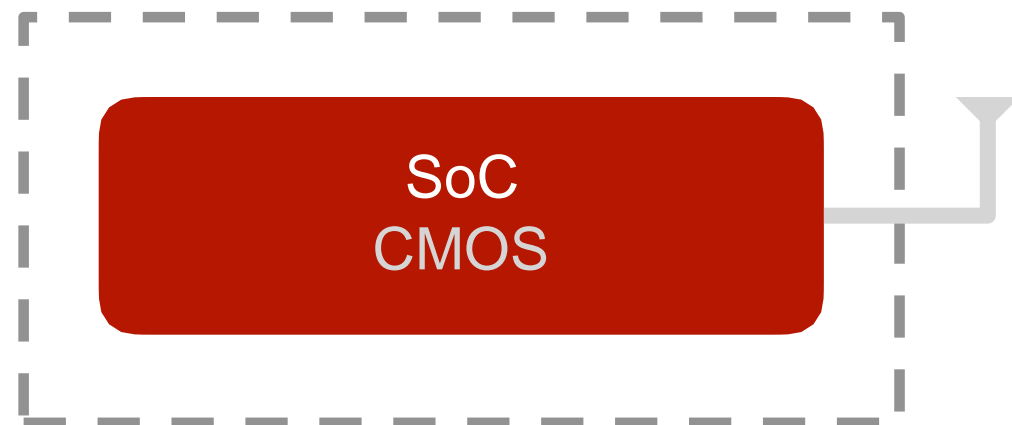
1.5GHz



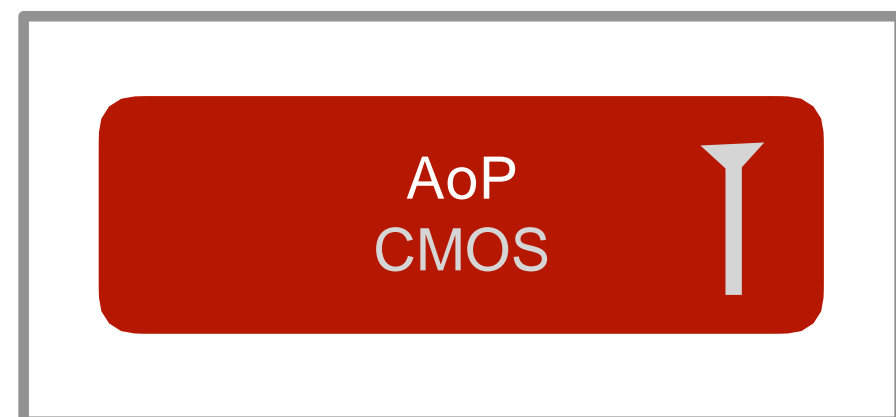
Why SoC?



RADAR IC from other vendors provide RF frontend function only, making integration and development much more difficult



SoC uses unified fab process with all functions on single die, integrate everything into a **lower power** and **lower cost** platform



Next generation SoC also includes **AoP** options, result into a **very small product footprint**

What we achieved



77GHz/60GHz antenna design

More than 8 different antenna options for our customers



Good yield rate

We control every details by ourselves, from PCB fabrication to SMT process



Improved baseband signal processing

Almost every algorithm from the SDK overhauled, from detection method to AoA estimation



Highly accurate vital sign sensing

Our custom VS algorithm can monitor up to 8 targets at once with single SoC



Machine learning

Combine ML and custom models making RADAR into a smart device for edge computing



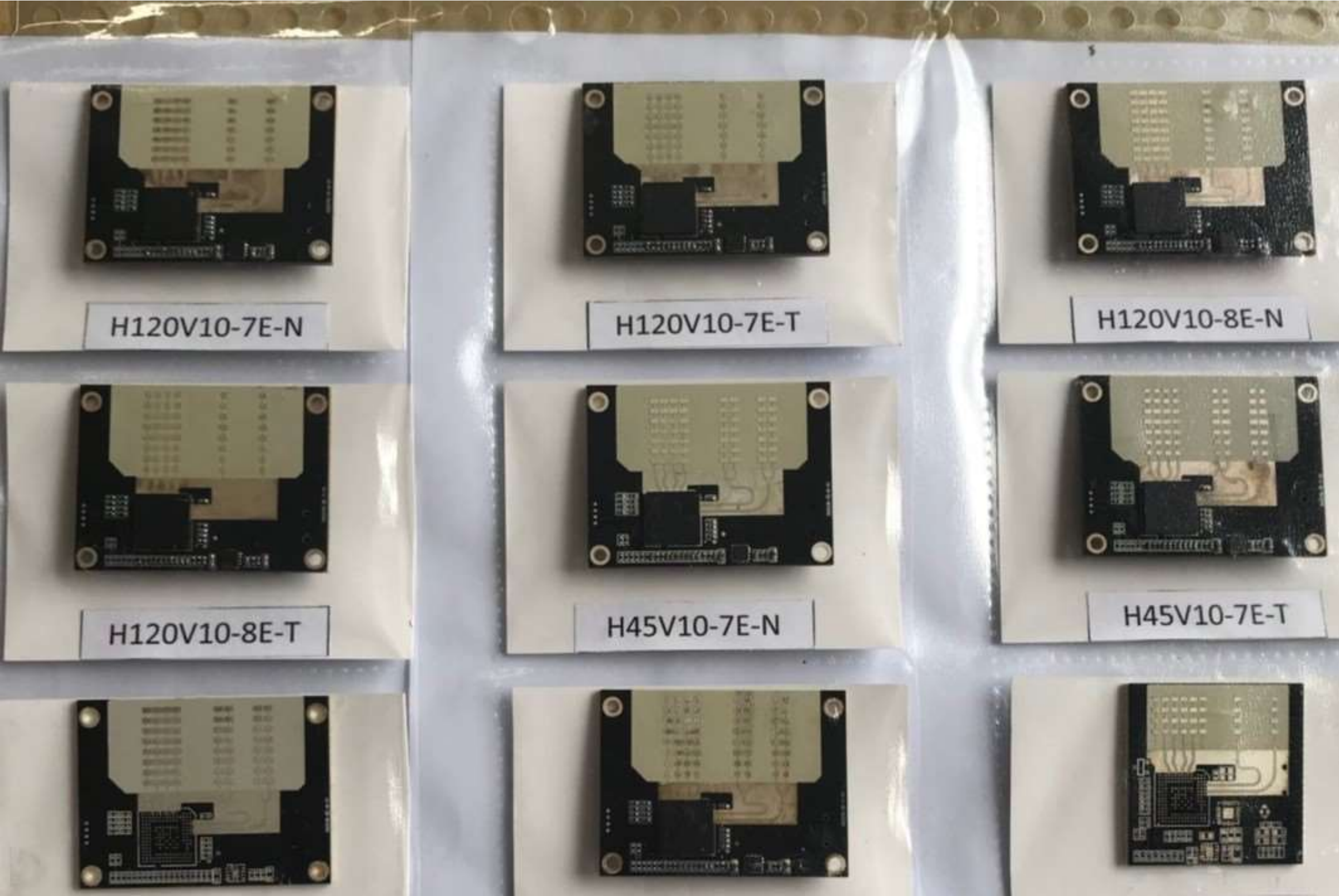
Image RADAR

With cost going down, we can utilize more antennas to get even more details in 3D

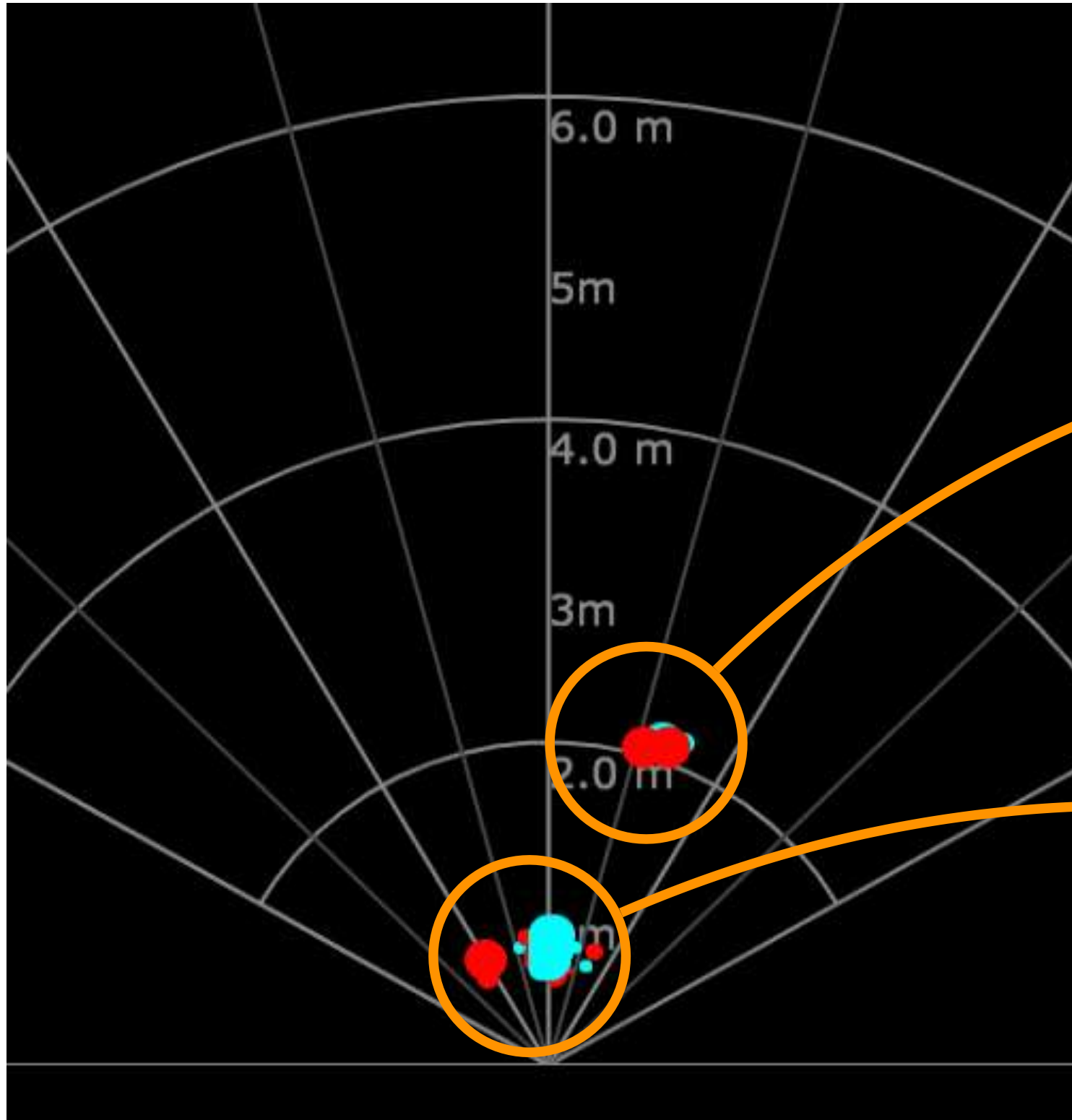
2018

2019

Full array of customized design



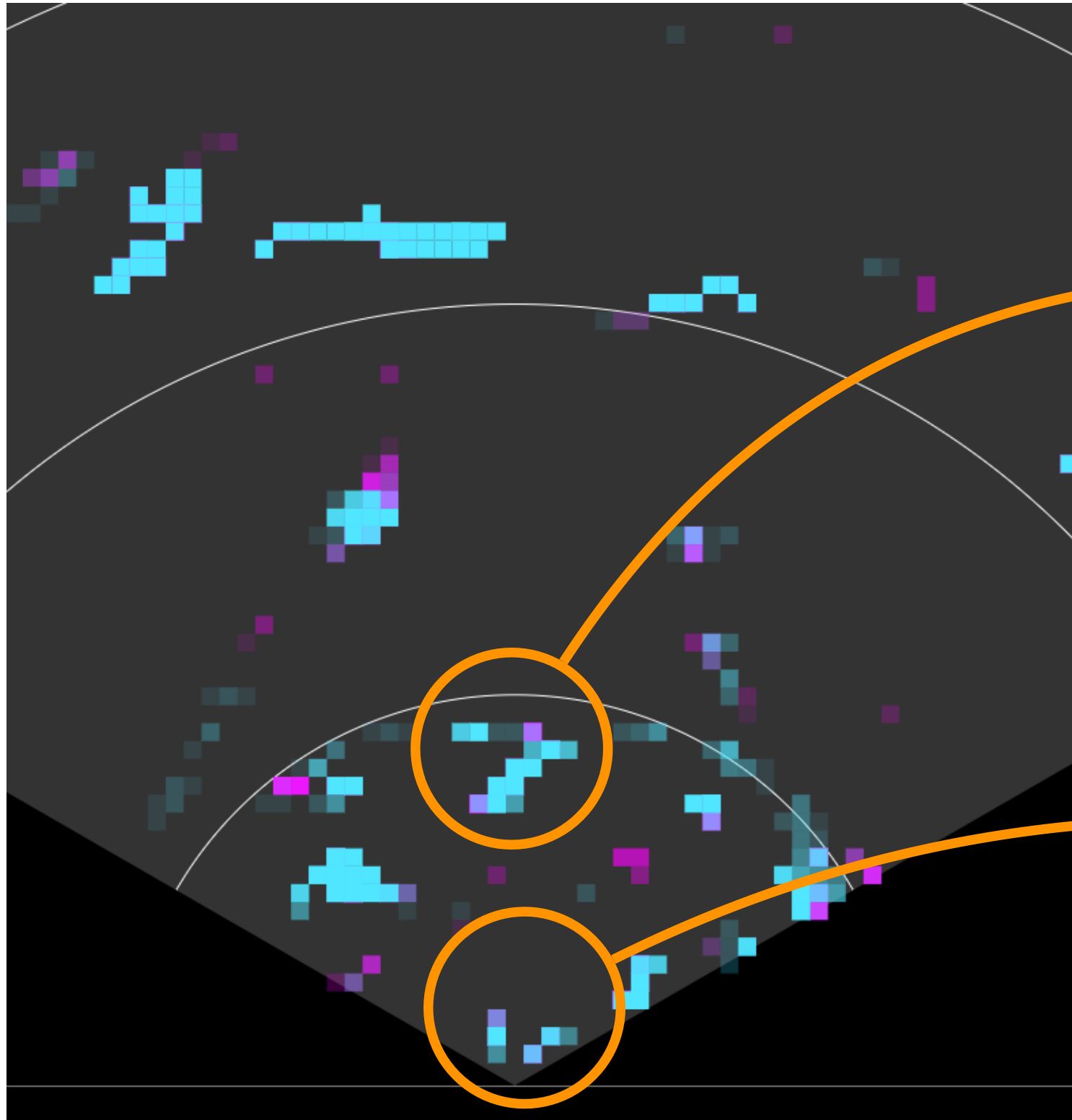
Object detection



Objects with different velocity are still identifiable even with the same distance and angle of arrival

Objects only 30cms from each other are still separable because different AoA and velocity

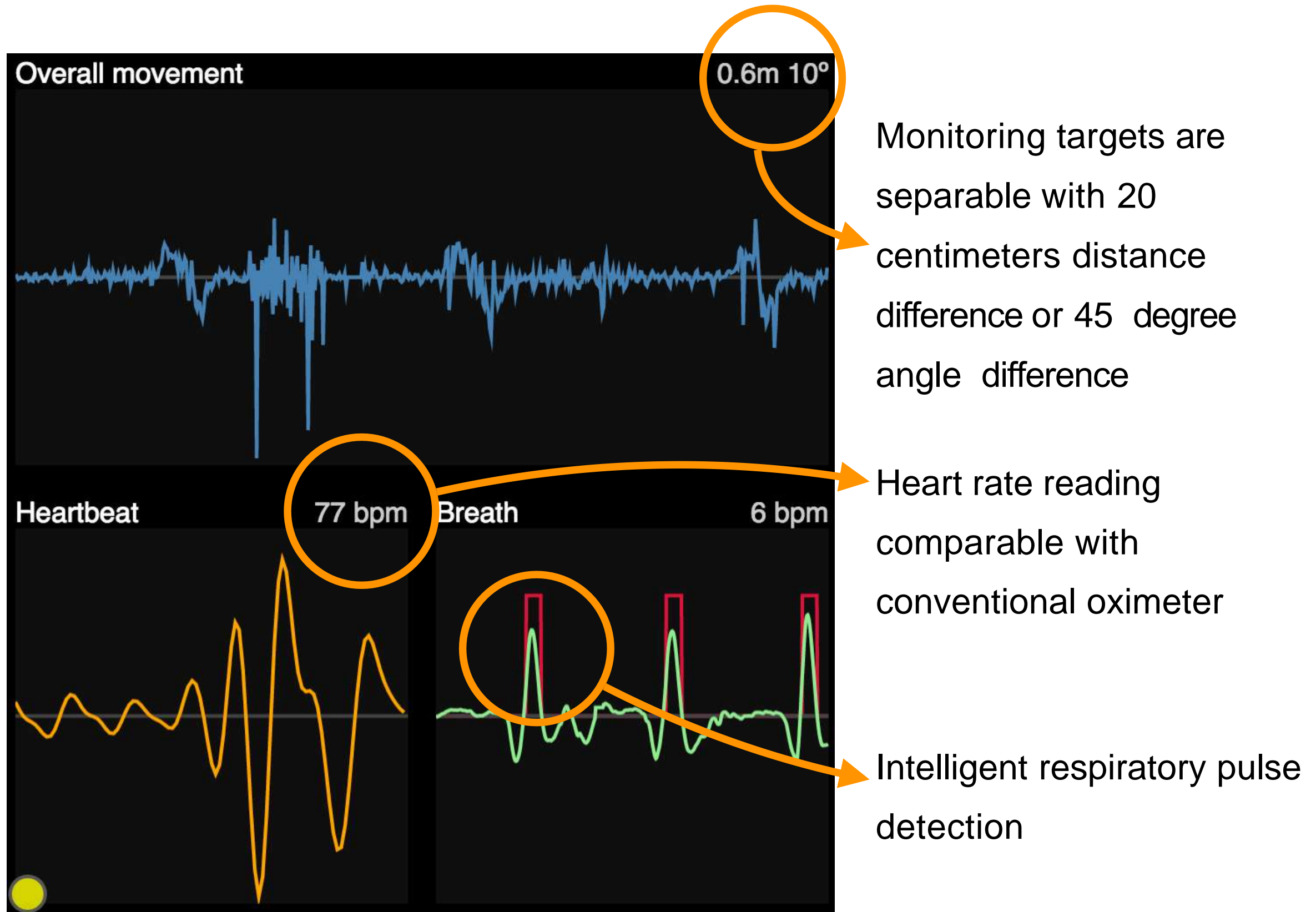
Static object detection



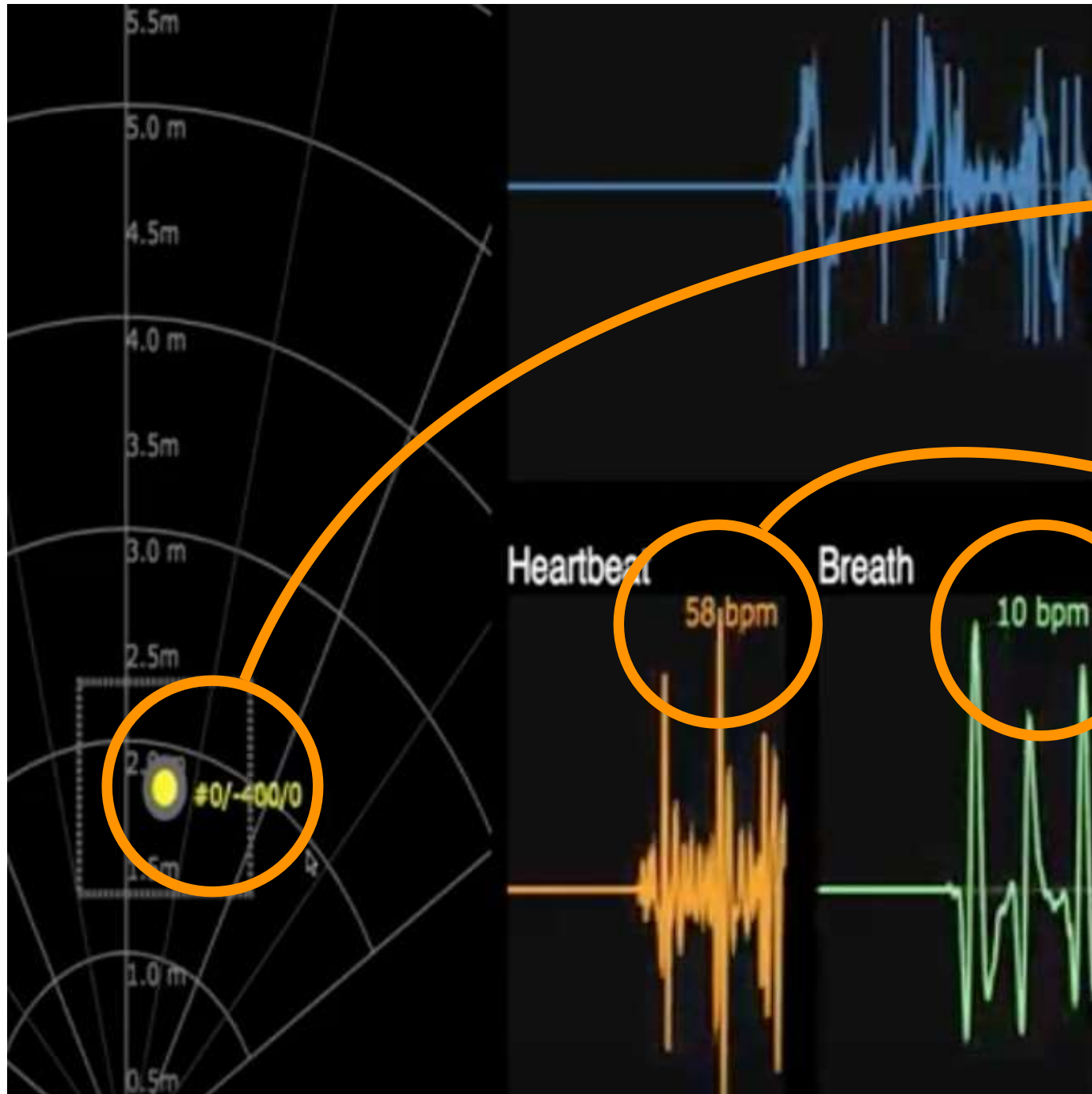
Detect object alignment and angle using beam-forming techniques

Detect small objects as close as a few centimeters away from RADAR

Vital sign monitoring



People tracking and vital sensing

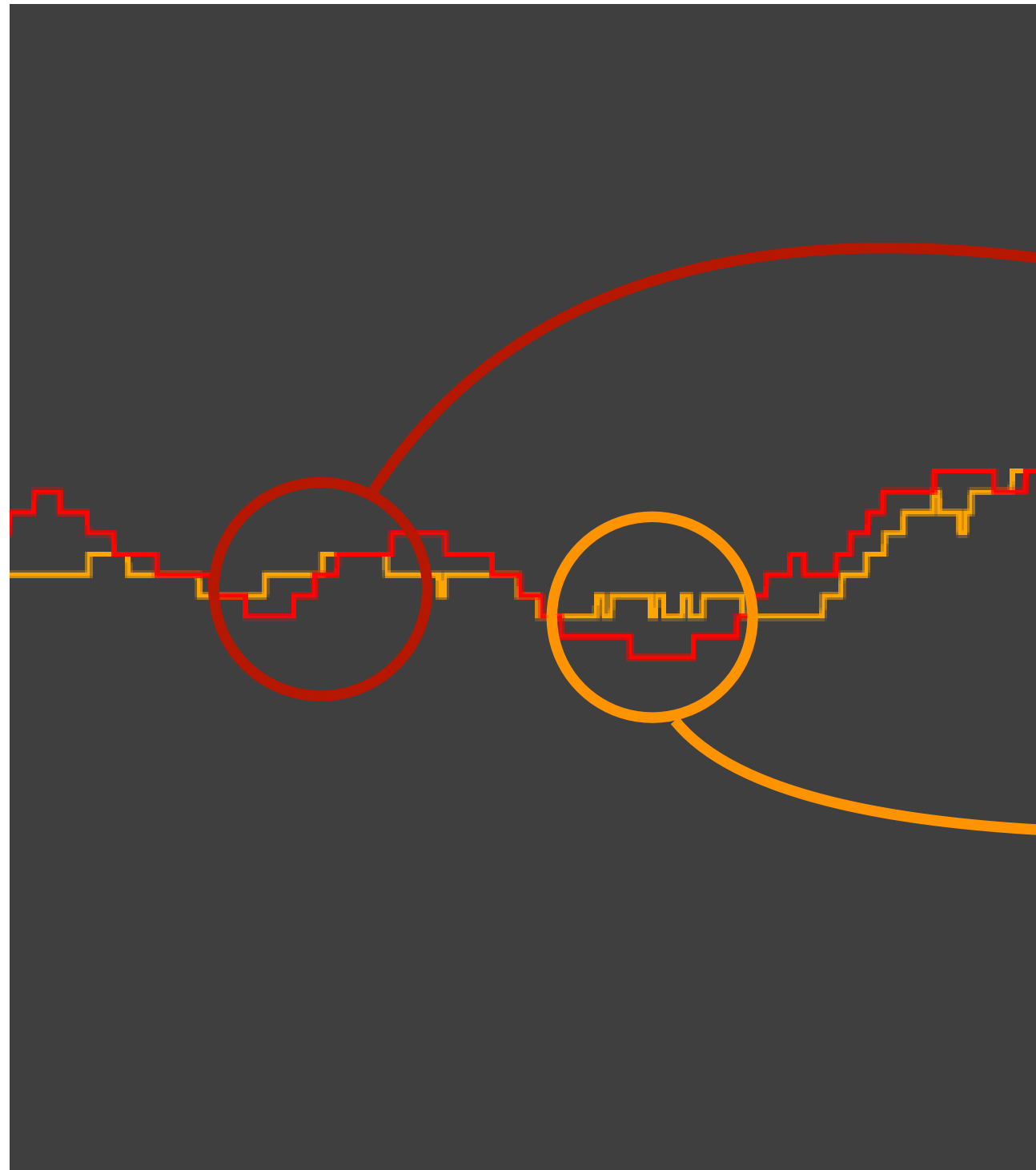


Track moving objects and set up vital sign measurement focus automatically

Heart rate reading comparable with conventional oximeter

Intelligent respiratory pulse detection

In vehicle vital sensing



Heart rate measured by
RADAR calibrated with
our vibration mitigation
algorithms

Heart rate reading recorded
by Garmin HR3 chest strap

Videos

mmWave Radar Vital Sign Detection in Moving Car (Vibration Resistance)

<https://www.youtube.com/watch?v=asG4UbhuaBo>

People Counting & Vital Sign Hybrid

<https://www.youtube.com/watch?v=S5Ajw8fv0D4>

Radar Module FCW Test Movie (High Way)

<https://www.youtube.com/watch?v=we1VS0XafZ4>

Wireless sensing without boundaries



Thank You