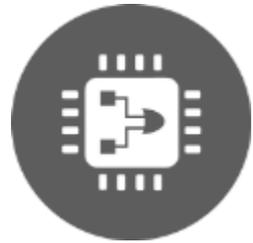


# Health Radar

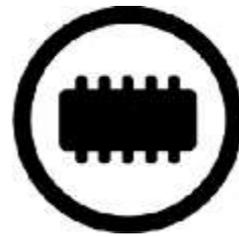
# Full spectrum technical capabilities



**VLSI**



**PCB design**



**Firmware**



**App**



**Driver**



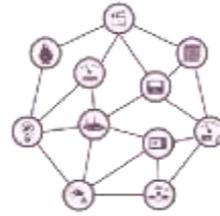
**Big data**



**Antenna  
design**



**Power  
optimization**



**Mesh  
network**



**Video  
processing**



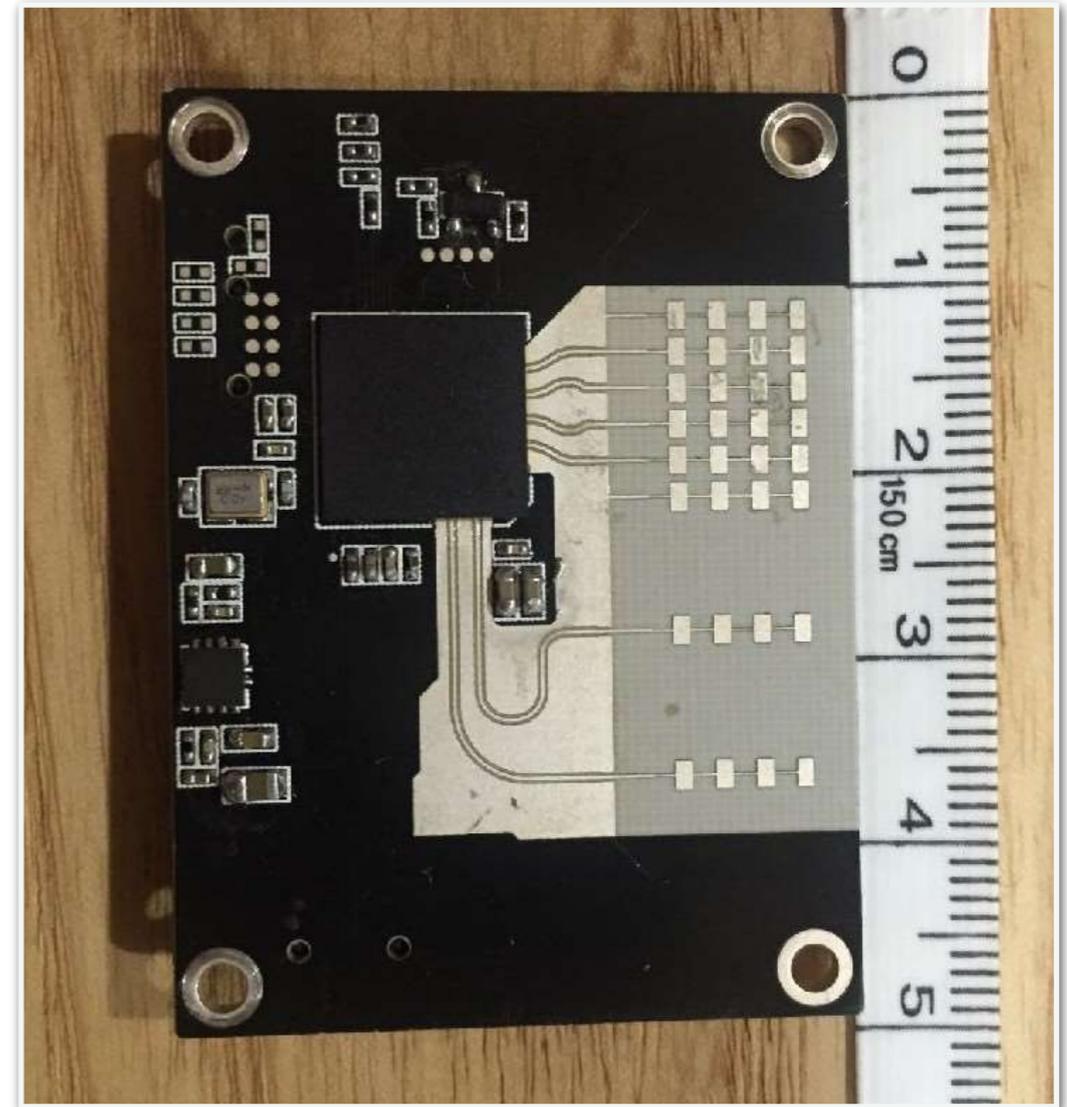
**Signal  
processing**



**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

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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

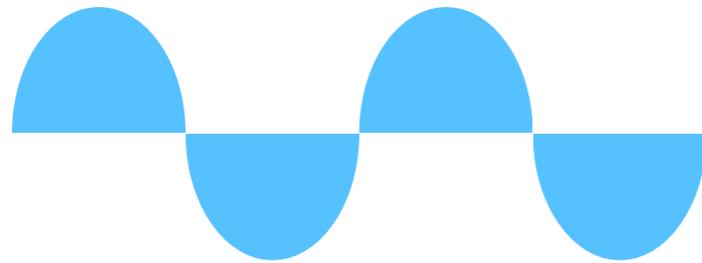


It works under all kinds of weather, light condition, and ambience temperature



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

# Why 77GHz?



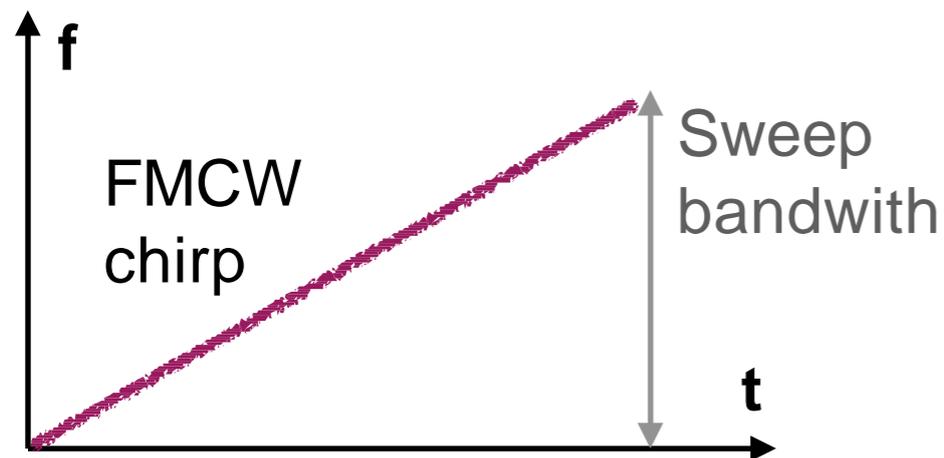
Wavelength ( $\lambda$ )

**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

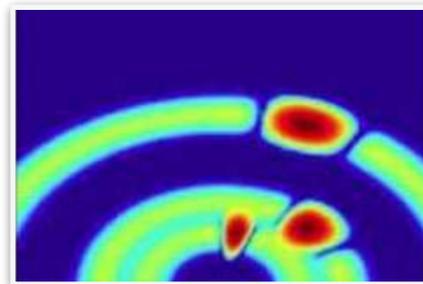
$$1/4\lambda@50\text{ms} = 1.96\text{cm/s}$$

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

**~320%**  
more sensitive

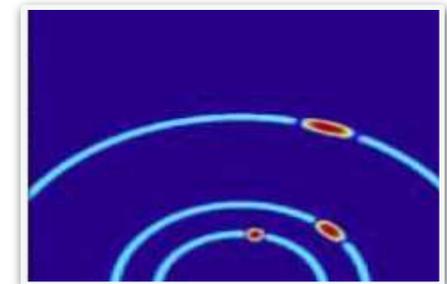
**Better**  
range resolution

200MHz

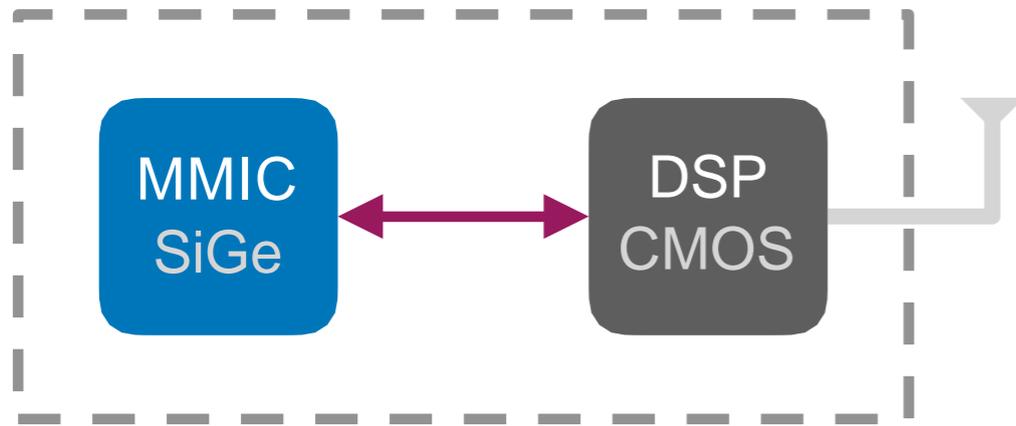


**V.S.**

1.5GHz



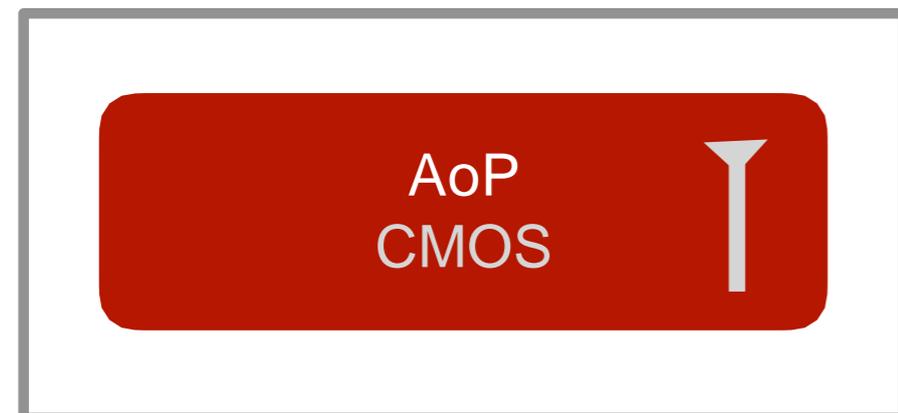
# Why SoC?



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



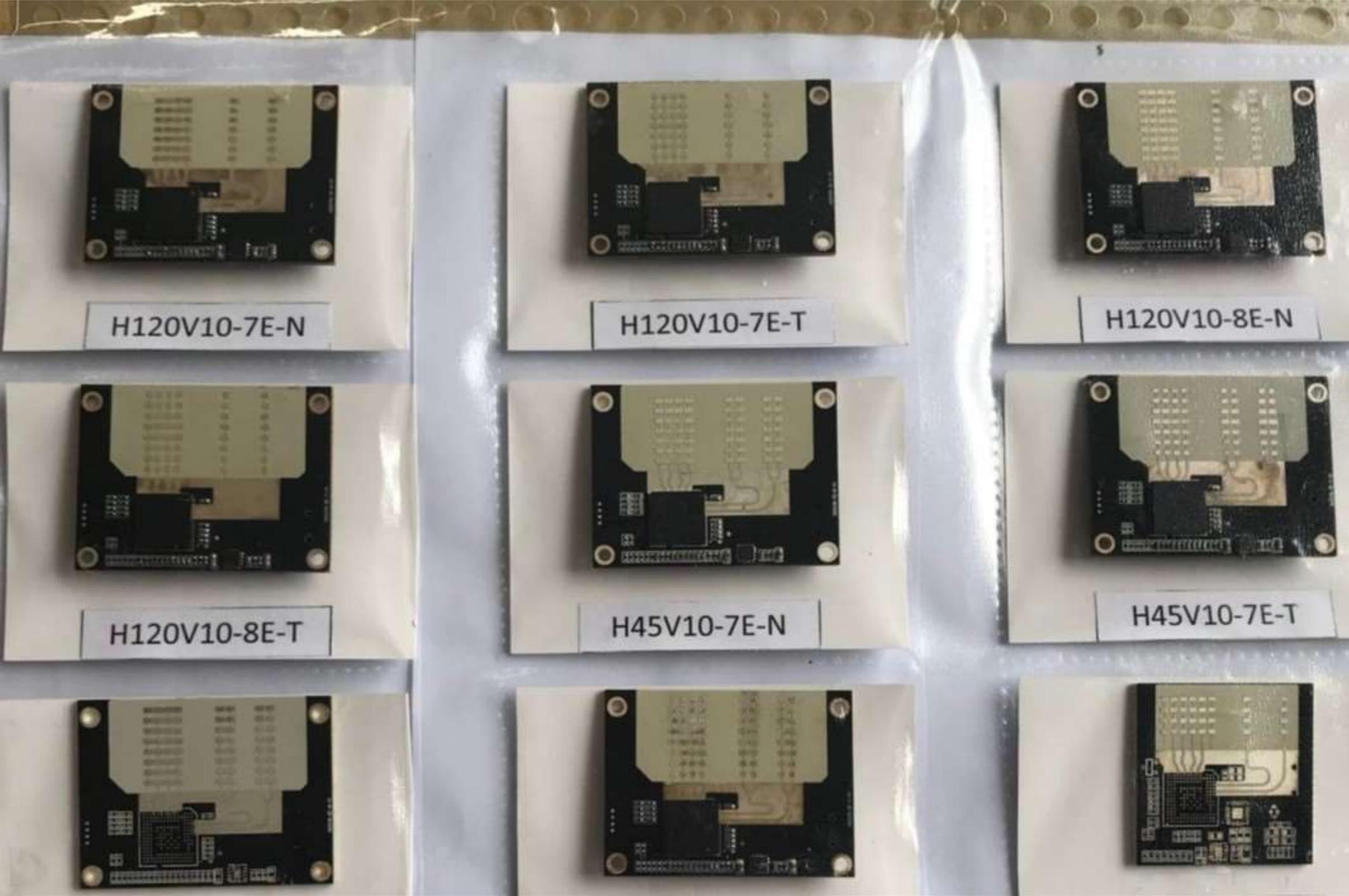
## **Image RADAR**

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

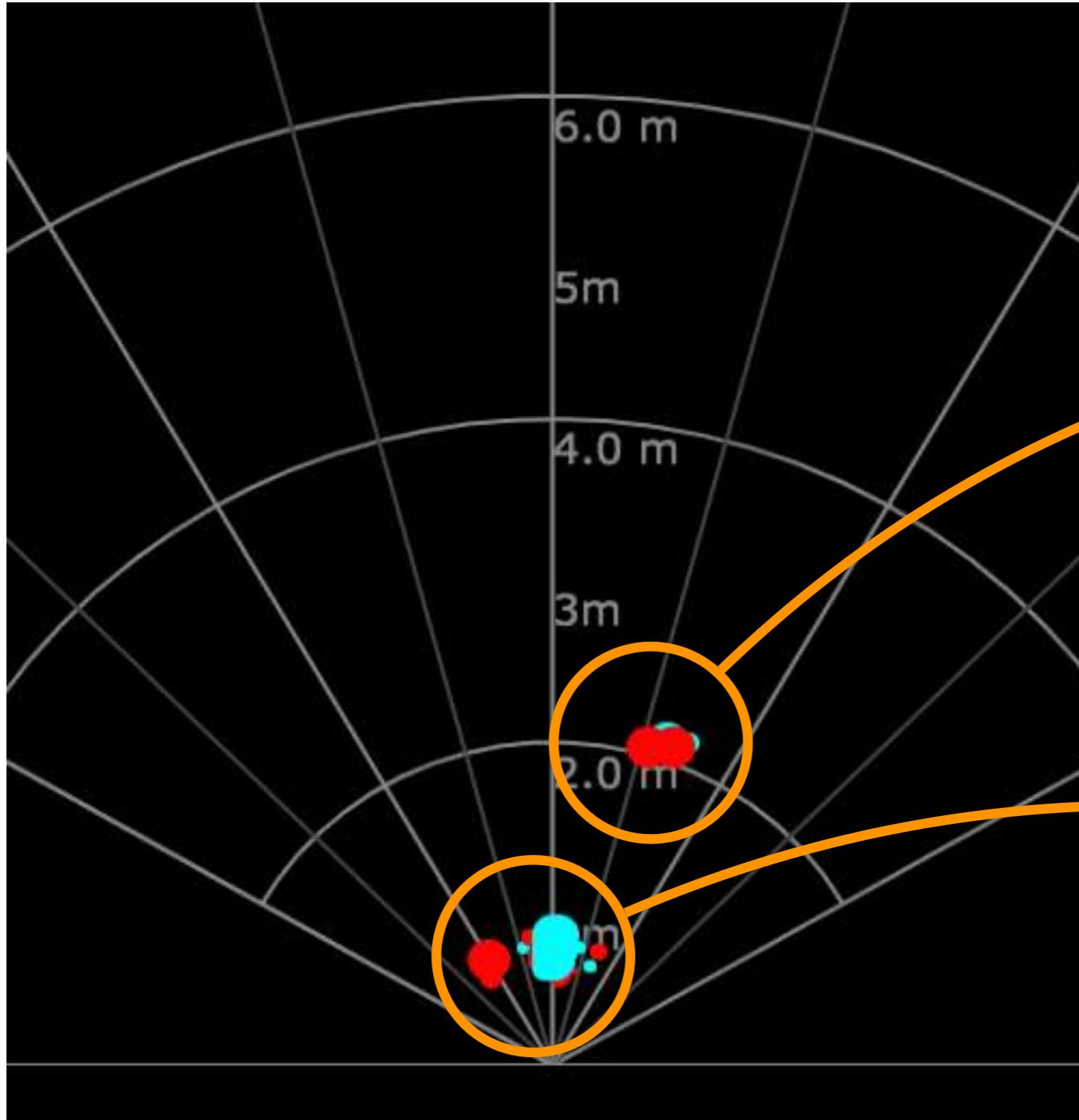
2018

2019

# Full array of customized design



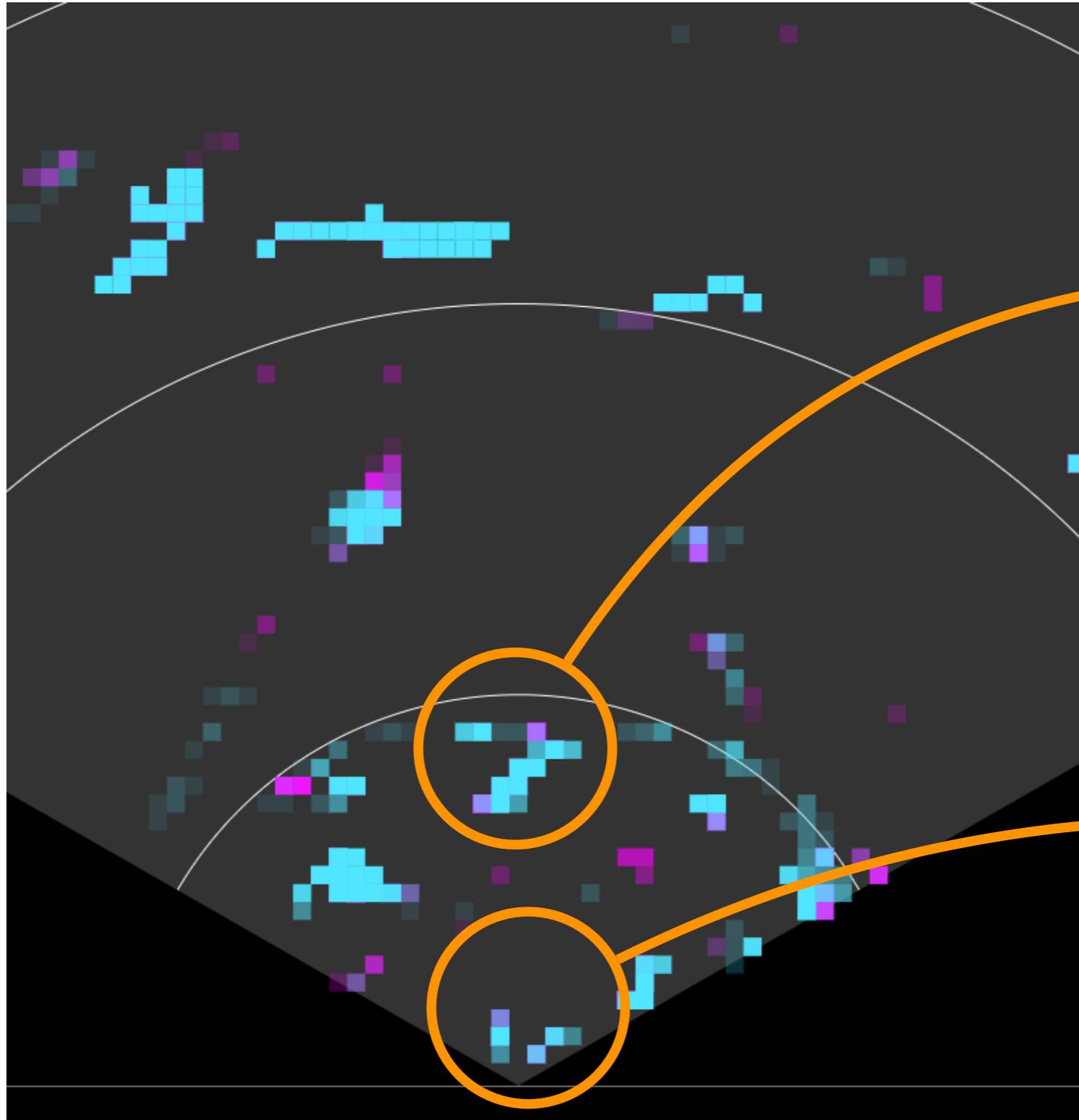
# Object detection



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

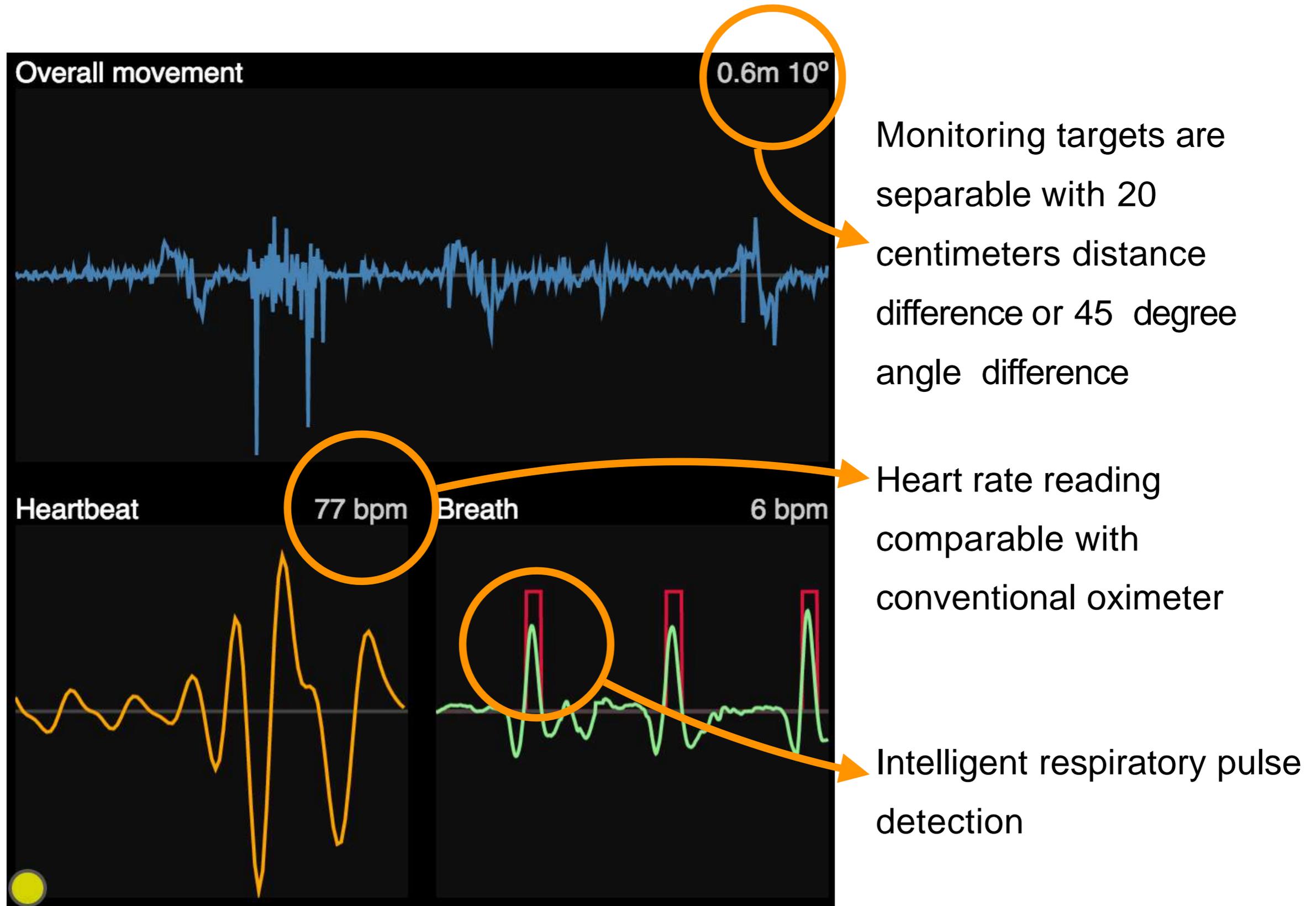
# Static object detection



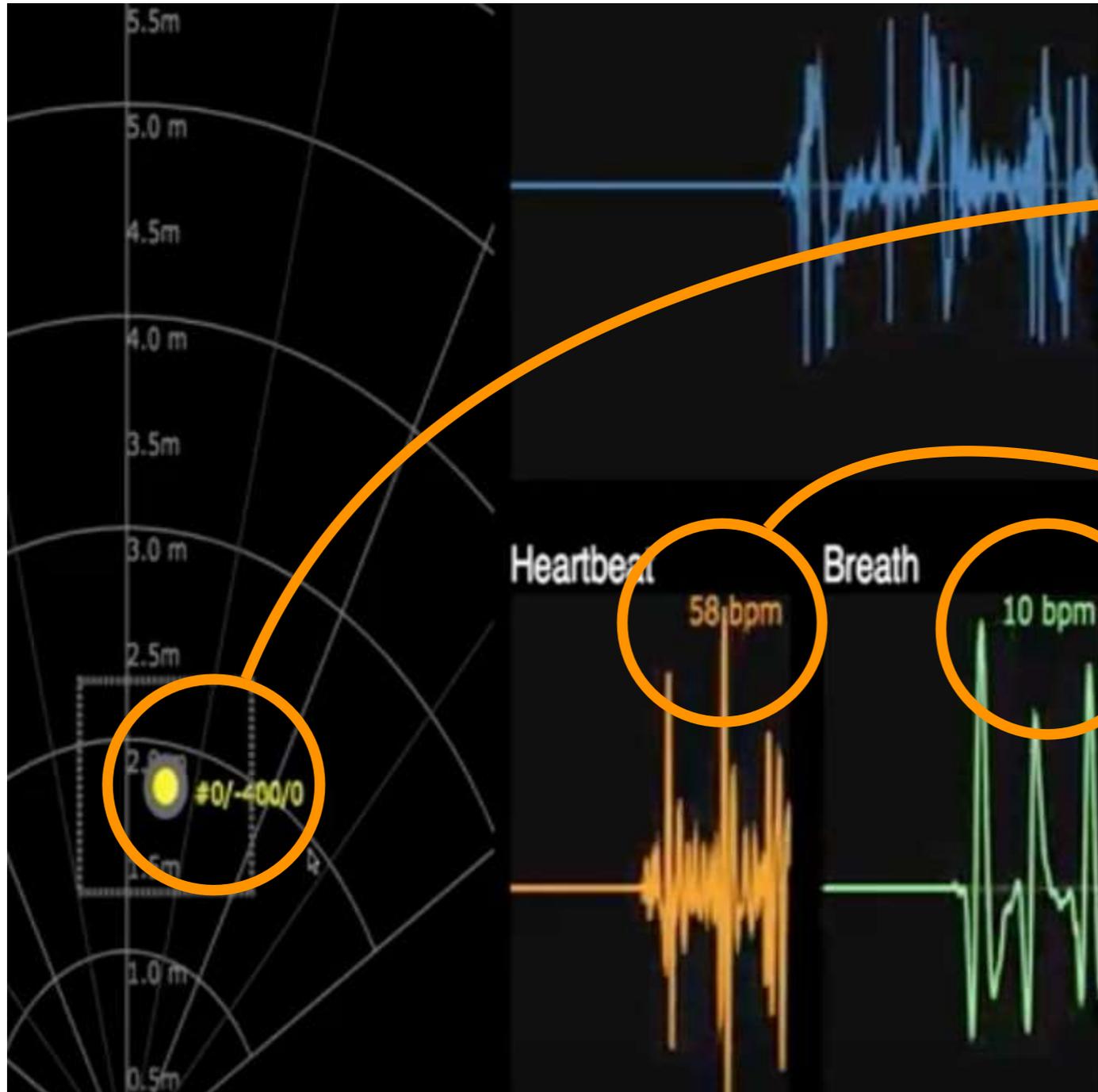
Detect object alignment and angle using beam-forming techniques

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

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**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**