PRYSTINE will realize Fail-operational Urban Surround perception (FUSION) which is based on robust Radar and LiDAR sensor fusion and control functions to enable safe automated driving in urban and rural environments.

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Demo 1.4 Presentation – Higher-Resolution Radar
2nd year review

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17.07.2020

ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

AGENDA

Demo 1.4 – [Higher-Resolution Radar]

Agenda

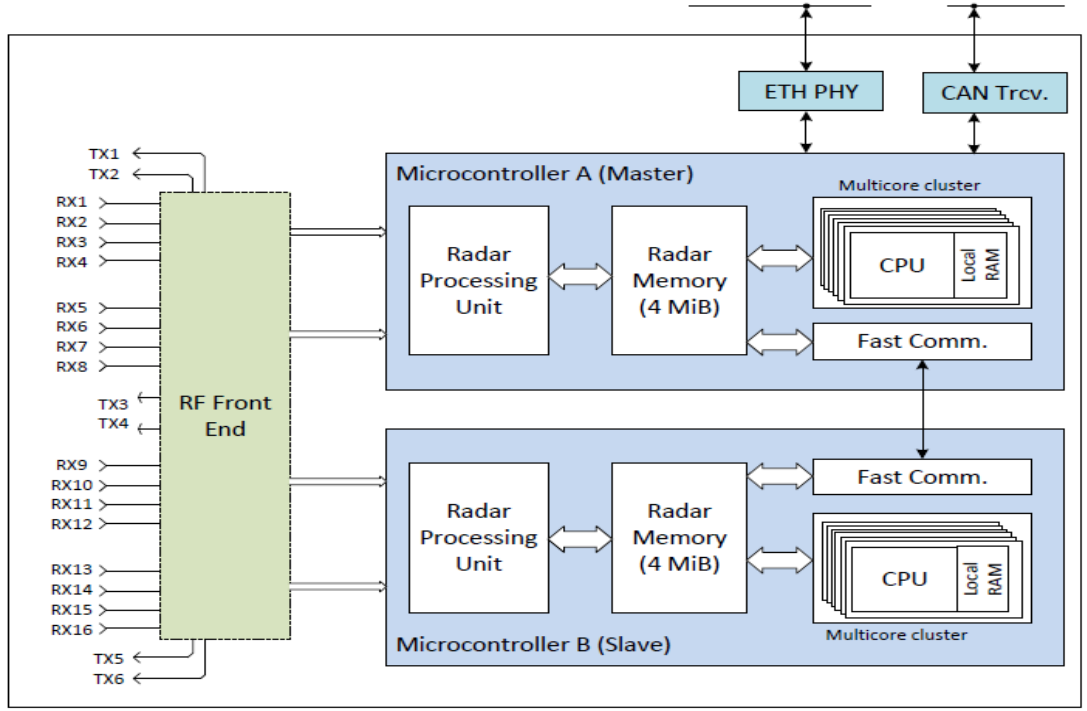
- Motivation
- Status
- Year 2 Demo

Place in PRYSTINE

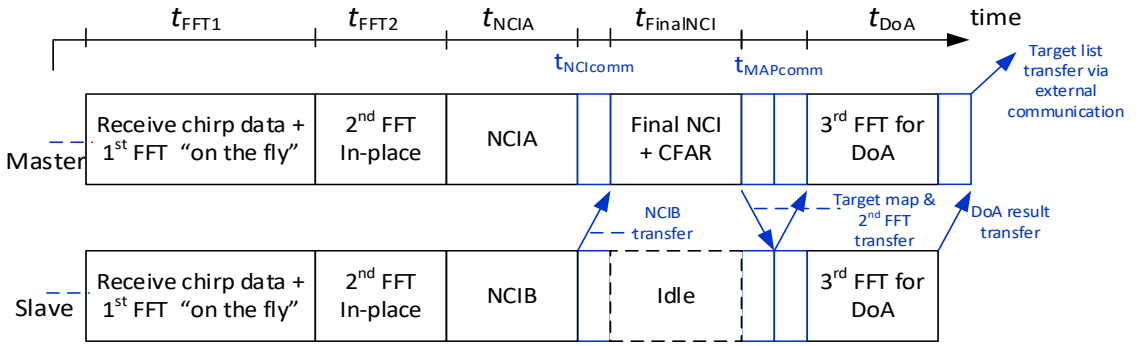
- This work is executed by IFAG, DICE, EPOS through SC1 in Year 1 & 2
- Obtained components from DICE & EPOS integrated in the demo.
- Next step: more SW functional integration and validation in Year 3 (T8.1).

Motivation

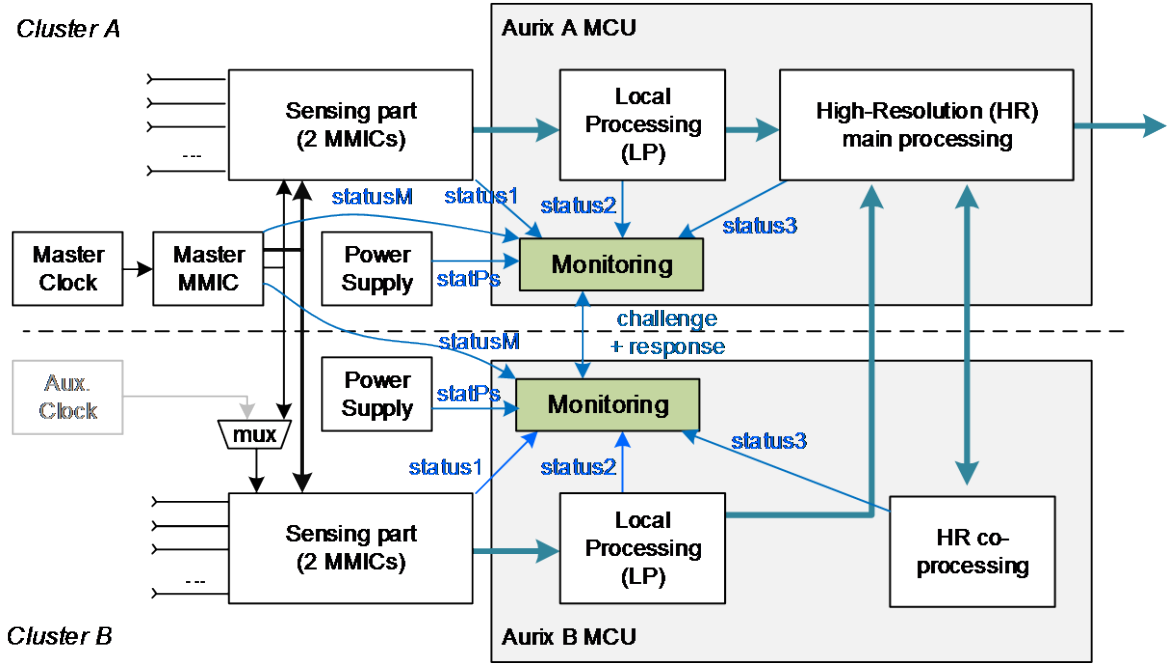
- Existing higher-resolution radar (HRR) concept in iFUSE funded project:
  - Distributed processing with dual AURIX microcontroller
  - 4 transceiver MMICs with 1 master MMIC



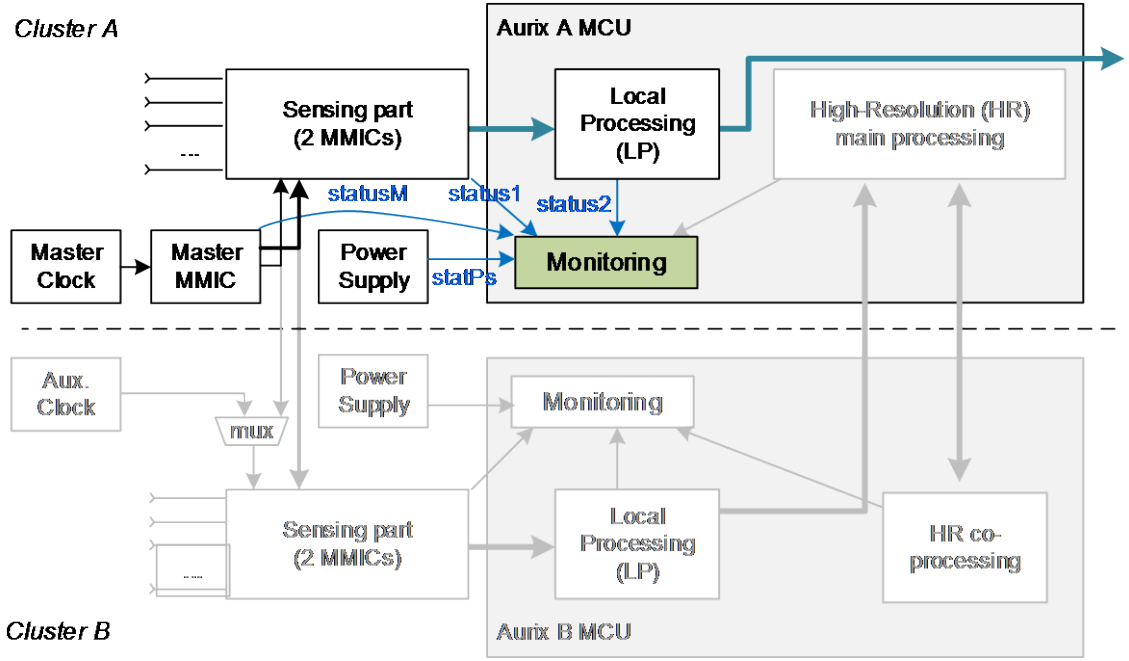
- In Prystine, we address the sensor availability on the occurrence of fault.



High-level concept



(MODE 1) NORMAL OPERATION (ON POWERED-ON).



(MODE 2) OPERATION WHEN CLUSTER B FAIL.

- Fault monitoring is implemented
- Mode 2 is demonstrable at Year 2.

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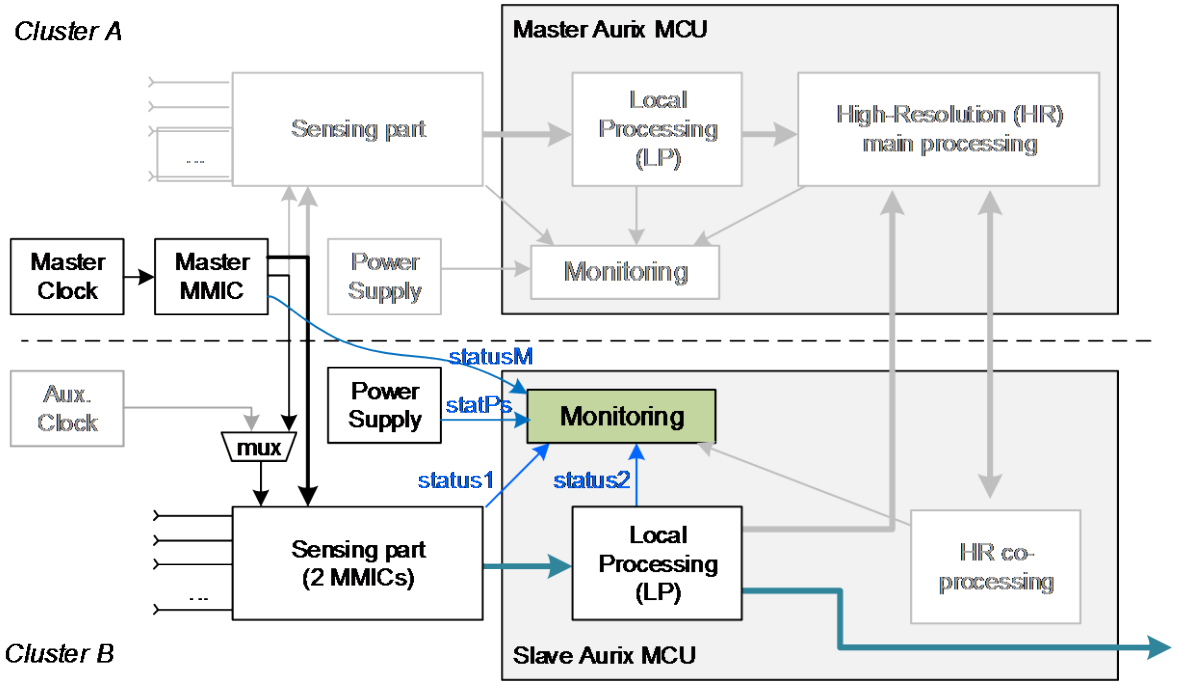
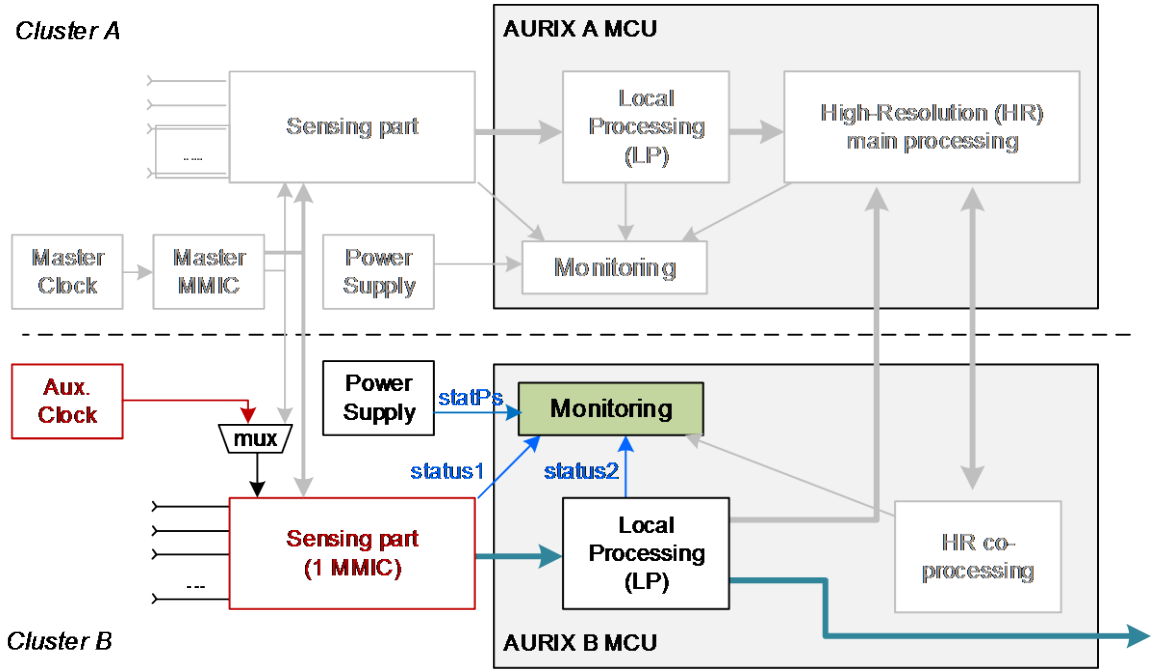
High-level concept



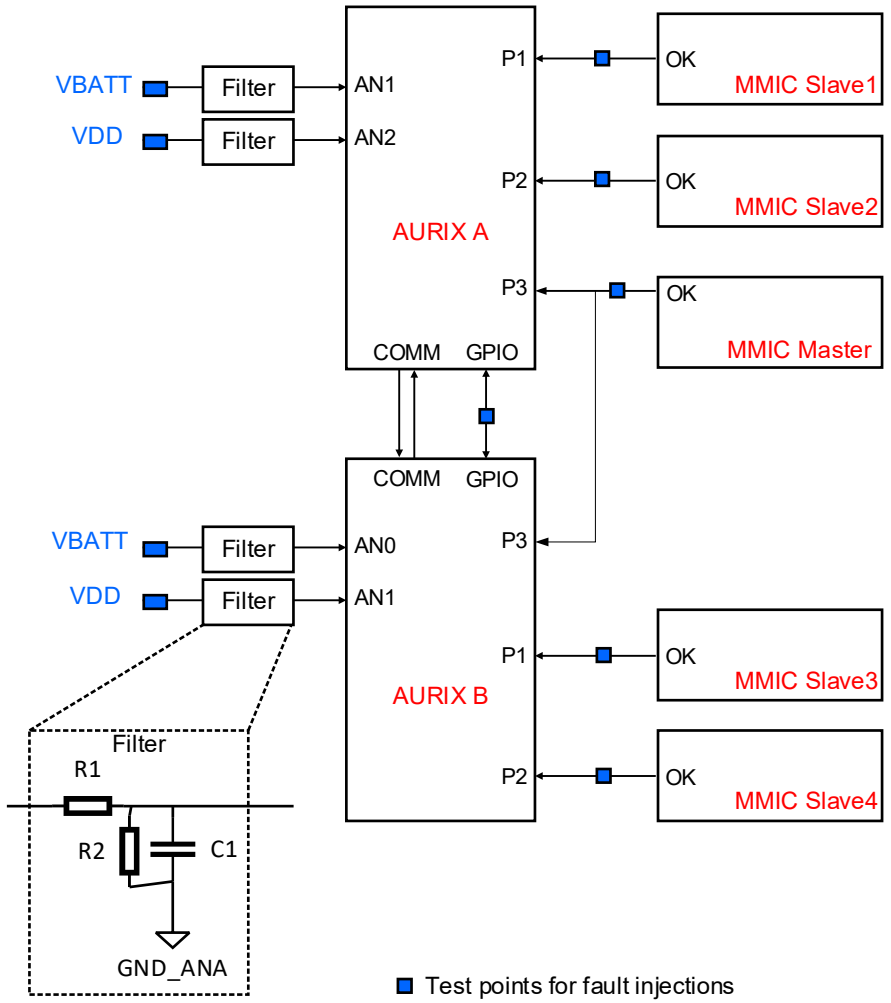
(MODE 3) OPERATION WHEN CLUSTER A FAIL, EXCEPT MASTER MMIC.



(MODE 4) OPERATION WHEN MASTER MMIC FAIL

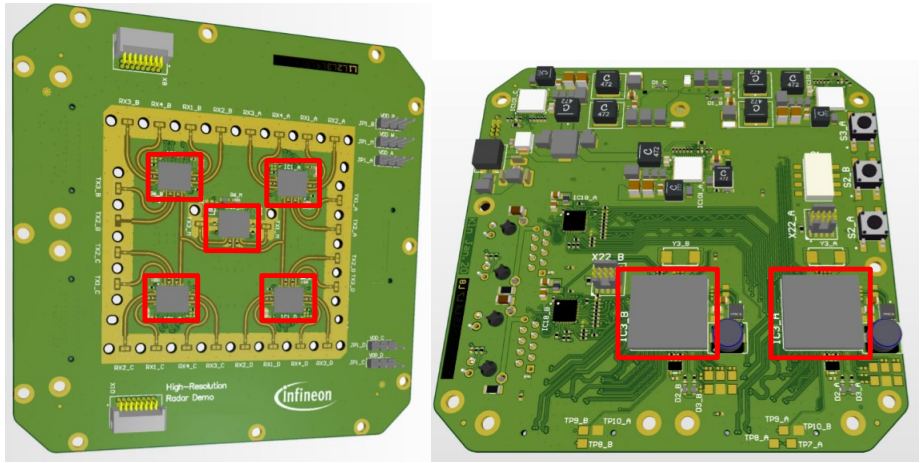
- Mode 3 function to be implemented and validated in Year 3.
- For Mode 4, internal MUX proposed for next generation MMIC.

Fault injection and monitoring for demonstration (Year 2)

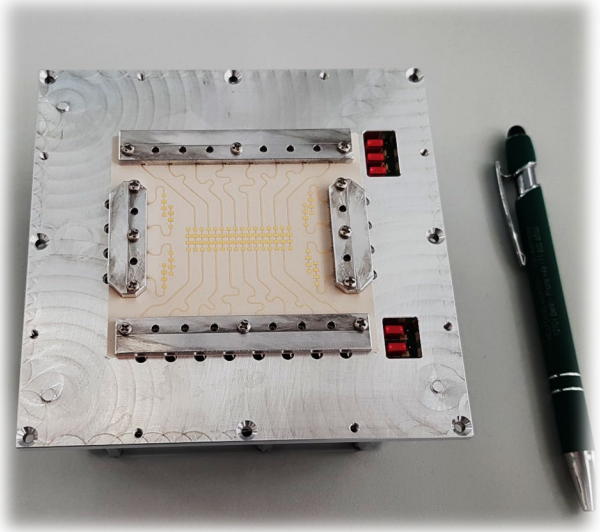


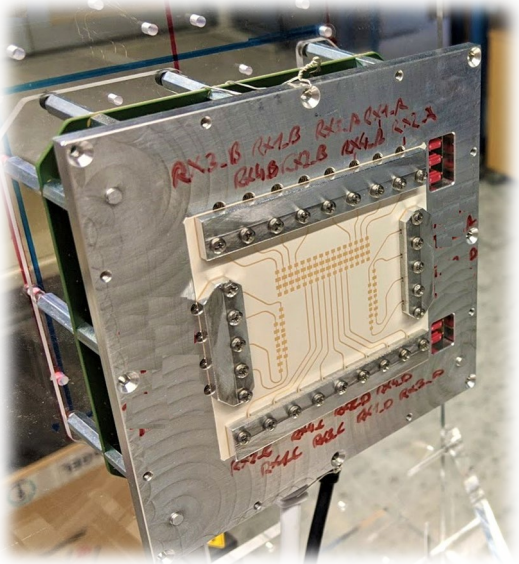
- AURIX M ADC channels:
  - Battery voltage monitoring
  - AURIX M supply monitoring
- AURIX S ADC channels
  - Battery voltage monitoring
  - AURIX S supply monitoring
- OK status pin to AURIX M
  - From MMIC A,B
  - From MMIC M
- OK status pin to AURIX S
  - From MMIC C,D
  - From MMIC M

Hardware Integration (Year 2)



LEFT: RF-BOARD WITH 5 MMICS (ENCLOSED WITH RECTANGLES), RIGHT: MCU-BOARD WITH 2 AURIX MICROCONTROLLERS (ENCLOSED WITH RECTANGLES)





- Three board partitioning: MCU board (+ power supply), RF (MMIC) board, and Antenna Board.
  - Different antenna concept is possible.

- Full resolution:
  - 32 virtual antenna elements in azimuth ➔ 3.7° resolution (± 1.85°)
  - 4 virtual antenna elements in elevation ➔ 19° resolution (± 9.5°)
  - Field of view:
    - Azimuth ± 90°
    - Elevation ± 30°

- Reduced resolution:
  - 8 virtual antenna elements in azimuth
  - 2 virtual antenna elements in elevation

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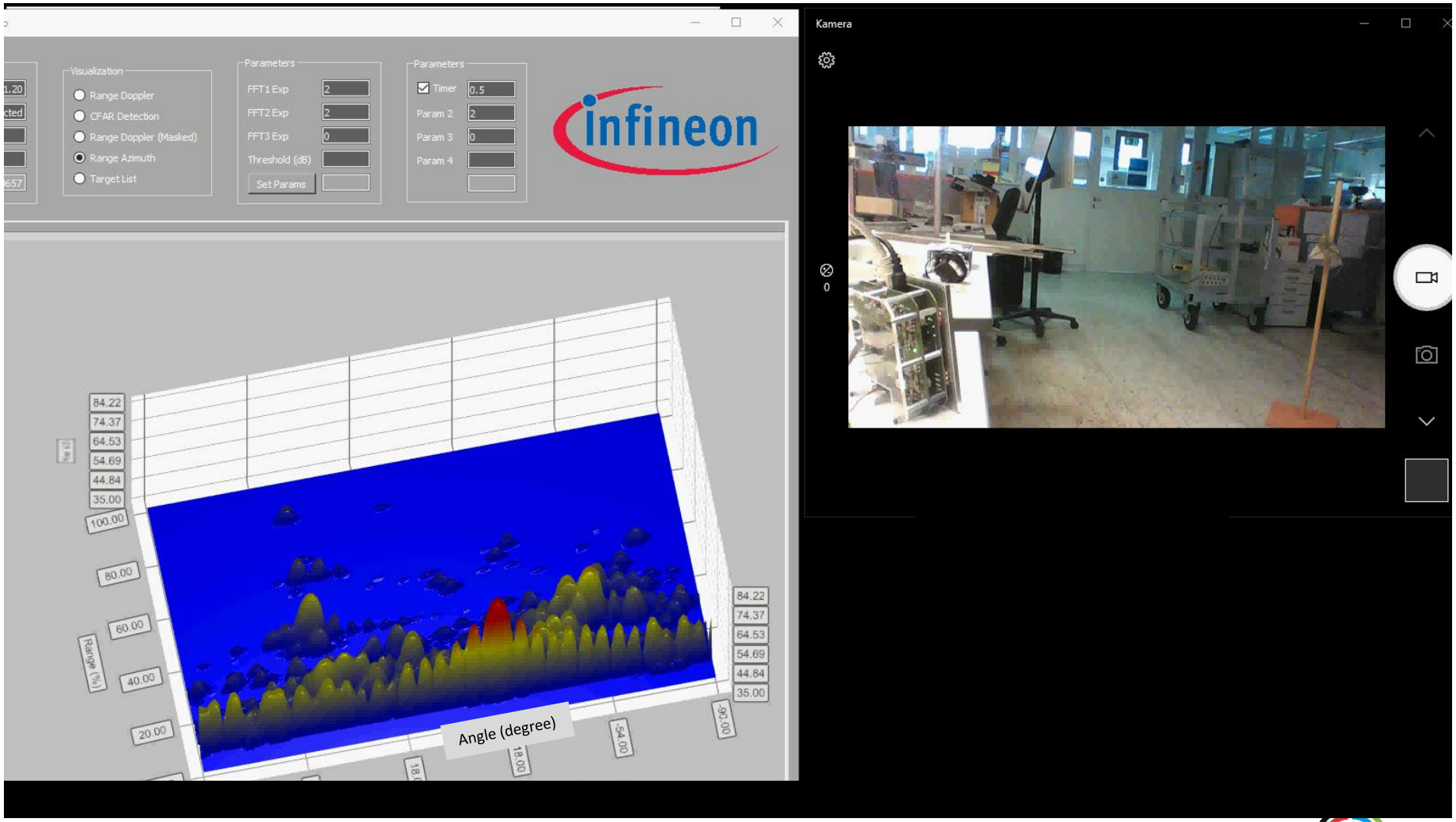
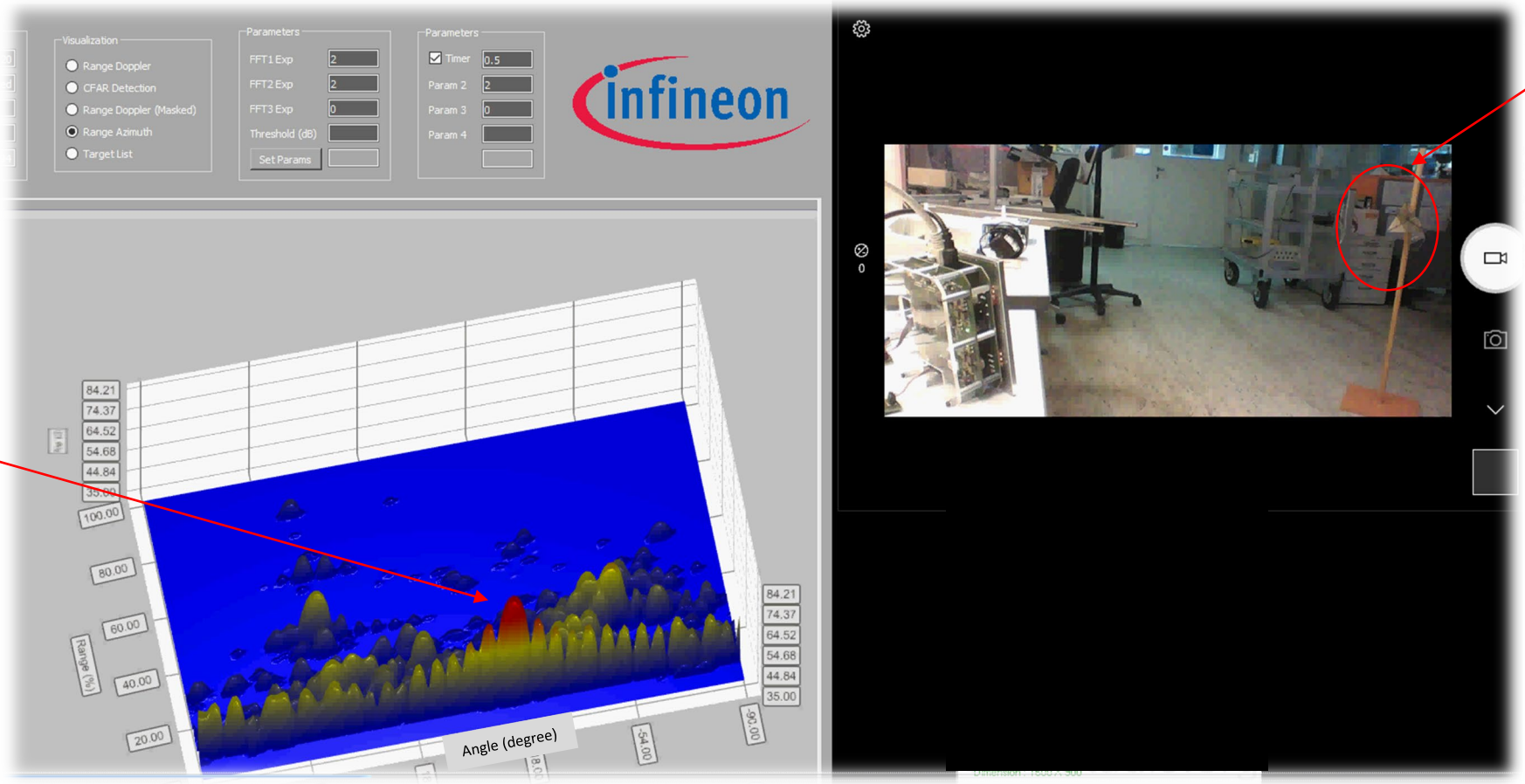
Fault-injection Demo (Mode 1 ➔ Mode 2)



Fault-injection Demo (Mode 1 ➔ Mode 2)

Cone target

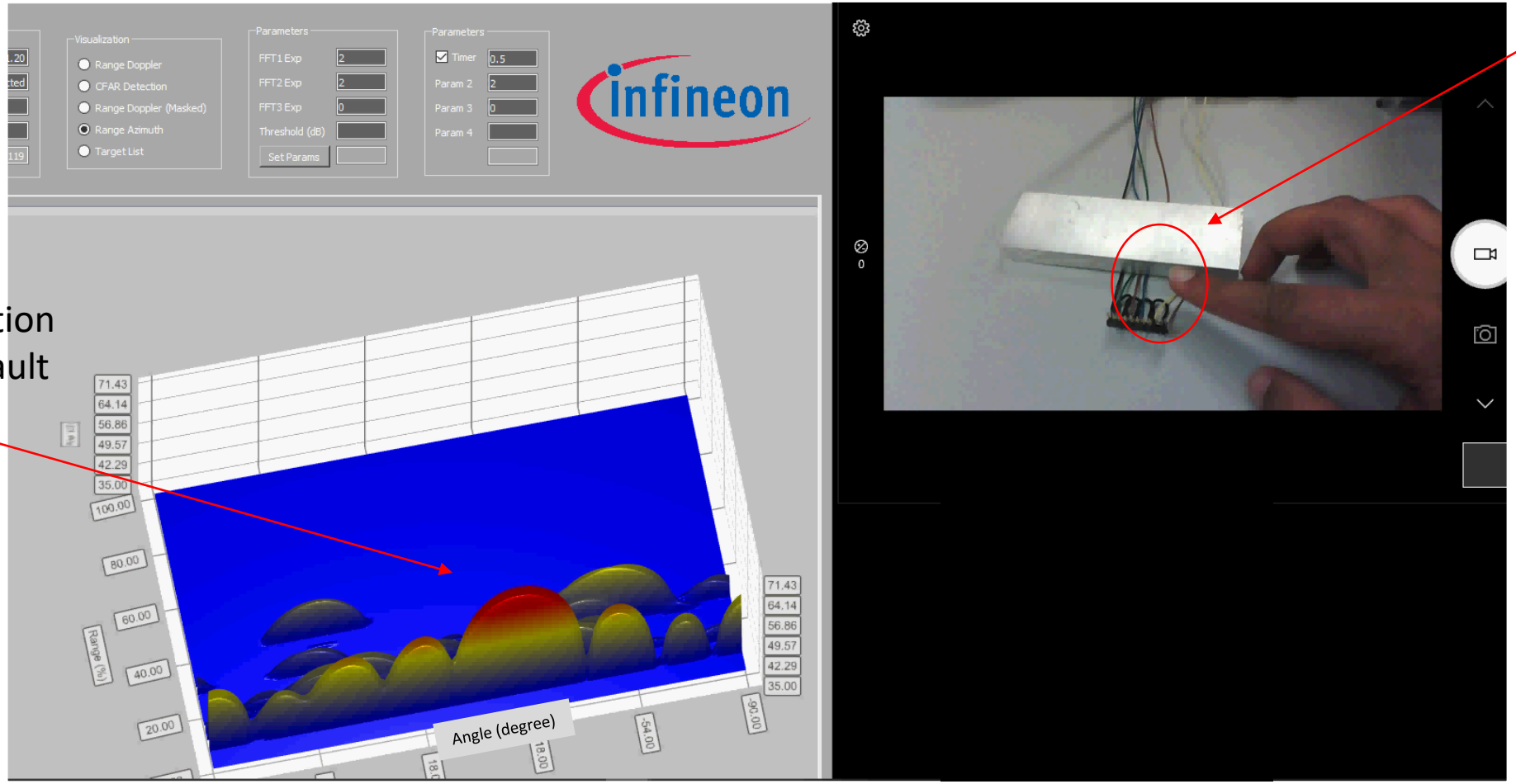
Full resolution



Fault-injection Demo (Mode 1 ➔ Mode 2)

Fault injection test points

Reduced resolution with detected fault



Summary

With this demonstrator, we address the Prystine's KPI:

- By the clustering of components, operating non-affected clusters when fault occurs in the other cluster provides higher availability.
  - KPI_1.3: Fail operational sensor compound vs. fail silent individual sensing approaches

Next step:

- Mode 3 function to be implemented and validated in Year 3.

PRYSTINE will deliver
(a) fail-operational sensor-fusion framework on component level
(b) dependable embedded E/E architectures
(c) safety compliant integration of AI approaches for object recognition, scene understanding, and decision making

PRYSTINE has been accepted for funding within the Electronic Components and Systems For European Leadership Joint Undertaking in collaboration with the European Union's H2020 Framework Programme (H2020/2014-2020) and National Authorities, under grant agreement n° 783190.

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