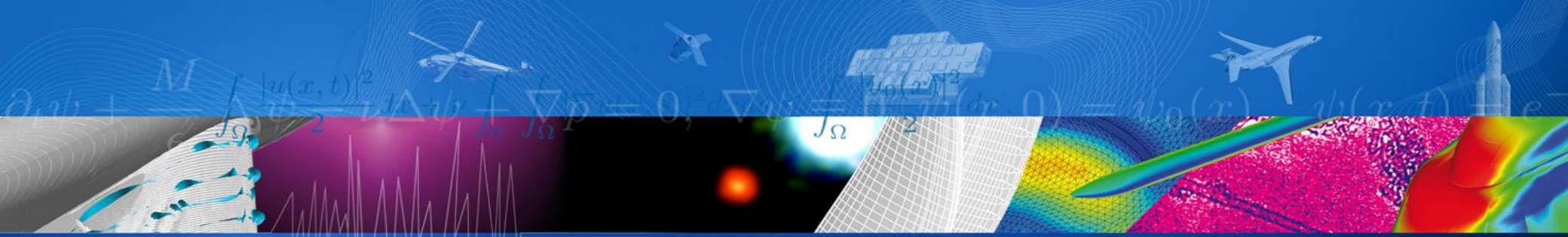

ONERA

THE FRENCH AEROSPACE LAB

retour sur innovation

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PASSIVE DVB RADAR : UAV detection and localisation

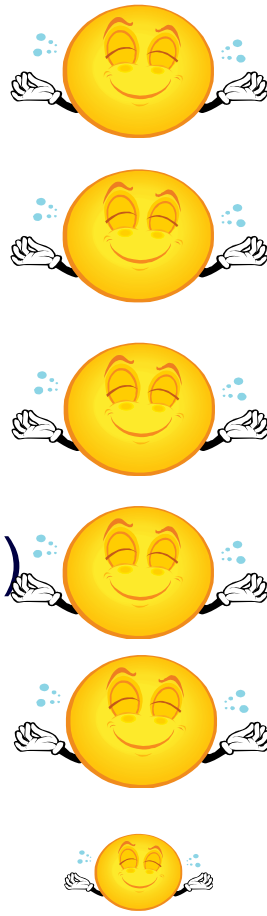
- INTRODUCTION
- DVB INTEREST (against UAV)
- EXPERIMENTAL RESULTS
  - 5 BISTATIC CONFIGURATIONS
  - INCLUDING SFN (Single Frequency Network)
- CONCLUSION

PASSIVE DVB RADAR against UAV
INTRODUCTION

DVB

REQUIREMENTS (UAV detection)

- LOW ALTITUDE COVERAGE
- SMALL TARGETS
- SLOW AND MANOEUVERING TARGETS
- CONTINUOUS DETECTIONS (from “0” to a few kilometres)
- DETECTION 24h/24h
- DISCRIMINATION CAPABILITIES



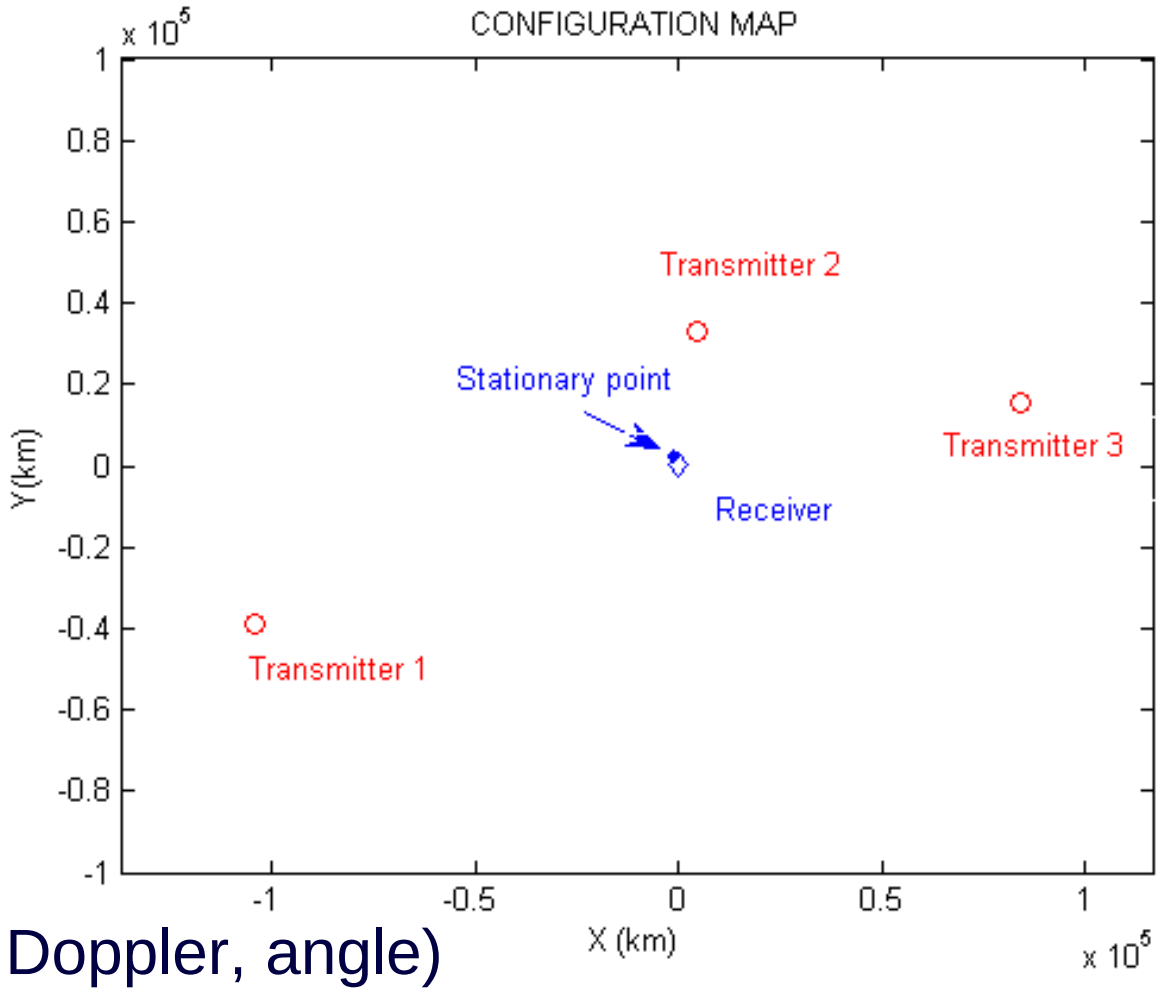
PASSIVE DVB RADAR against UAV
CONFIGURATION

SYSTEM

- 8 Log-P antennas
- target and reference
- Frequency : UHF
- Polarisation : H

PROCESSING

- CIT = 0.5 s
- Reference estimation
- Clutter cancellation
- Matched filter (range, Doppler, angle)



TARGET generally at 3 kilometres from the receiver

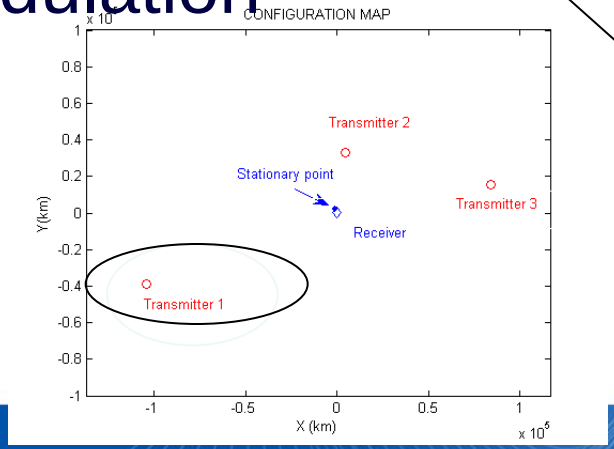
PASSIVE DVB RADAR
Blade modulation

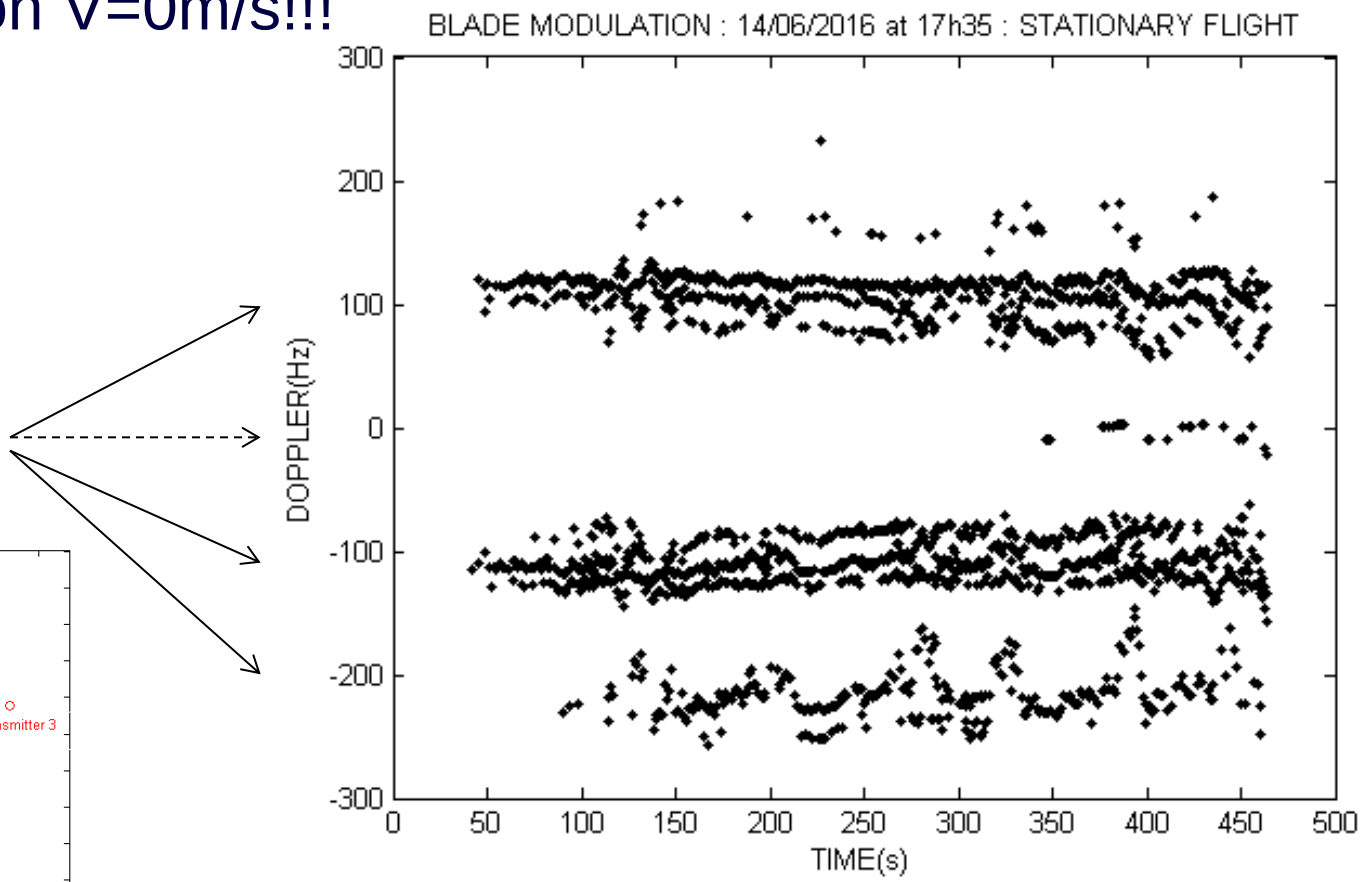
Target

- Multirotor at 3 kilometres from the receiver
- Sationary position V=0m/s!!!

DETECTION

Due to the blade modulation





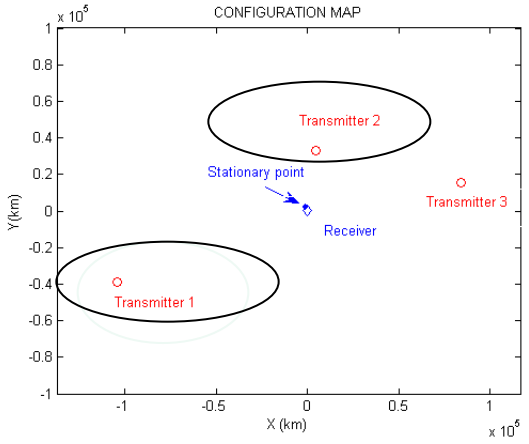
PASSIVE DVB RADAR
SFN DETECTION

Target

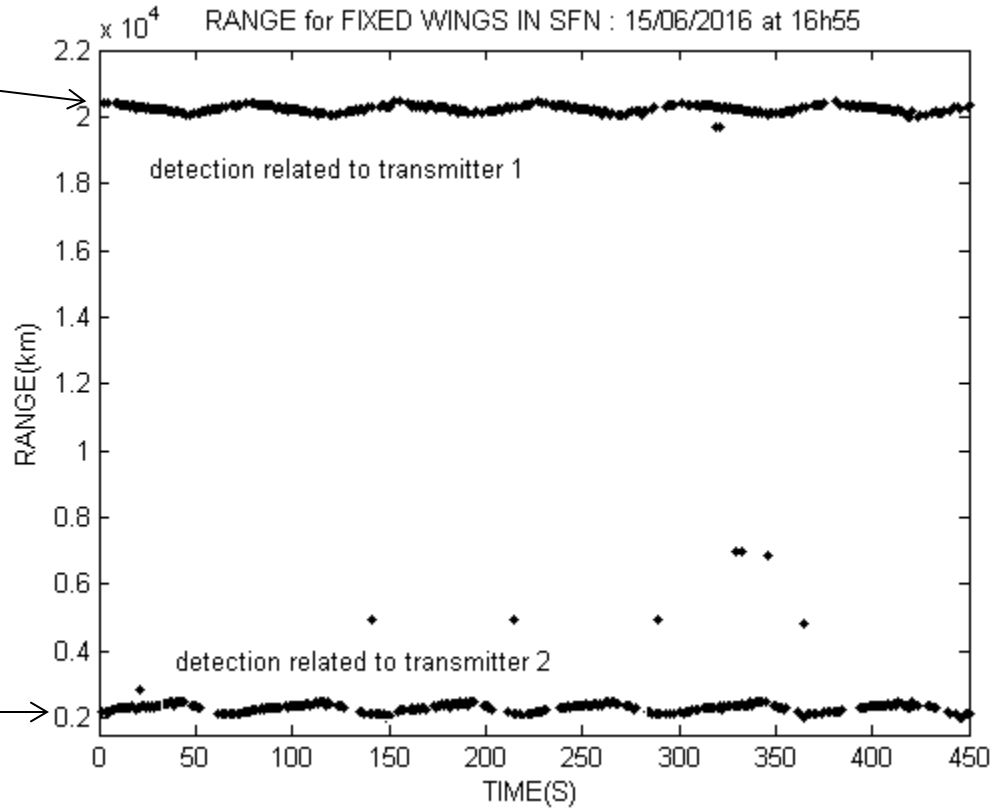
Fixed wing at 3 kilometres from the receiver

Circular(periodic) flight close to stationary point

TRANSMITTER 1



TRANSMITTER 2



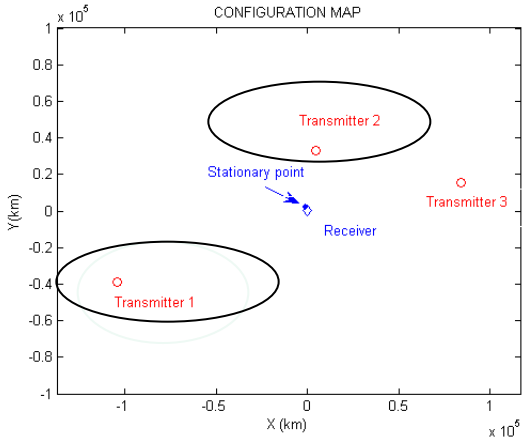
PASSIVE DVB RADAR
SFN DETECTION : angle estimation

Target

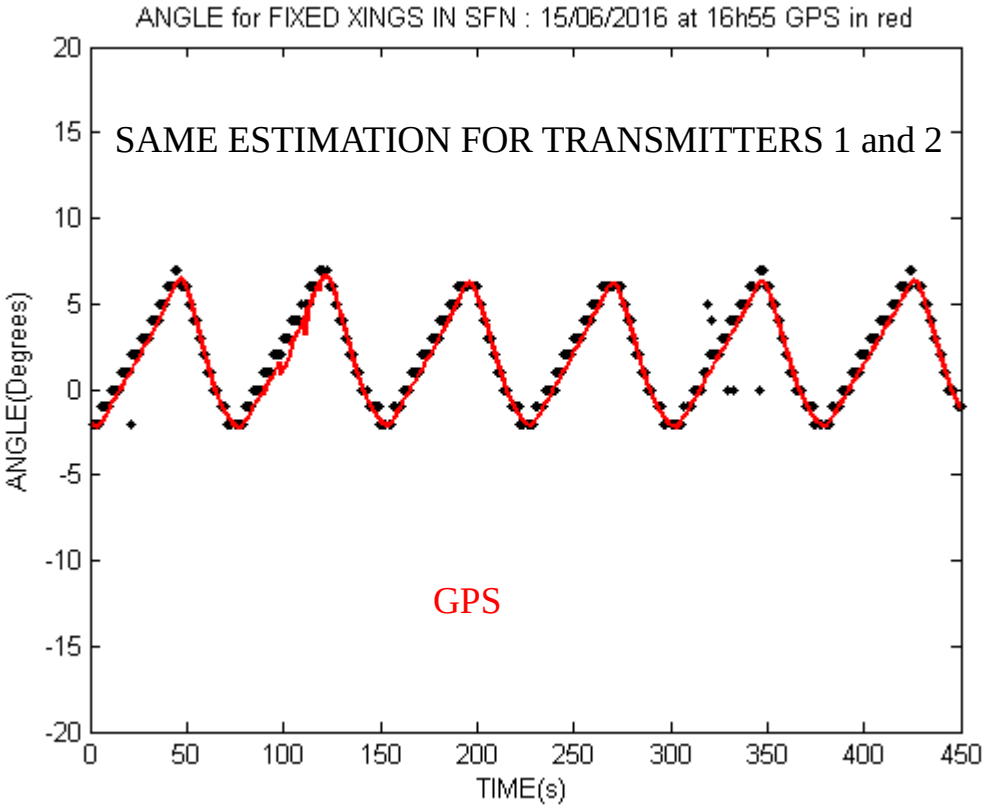
Fixed wing at 3 kilometres from the receiver

Circular(periodic) flight close to stationary point

TRANSMITTER 1



TRANSMITTER 2



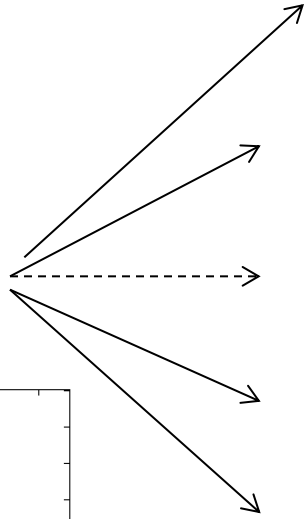
PASSIVE DVB RADAR
TRANSMITTER 3 : blade detection

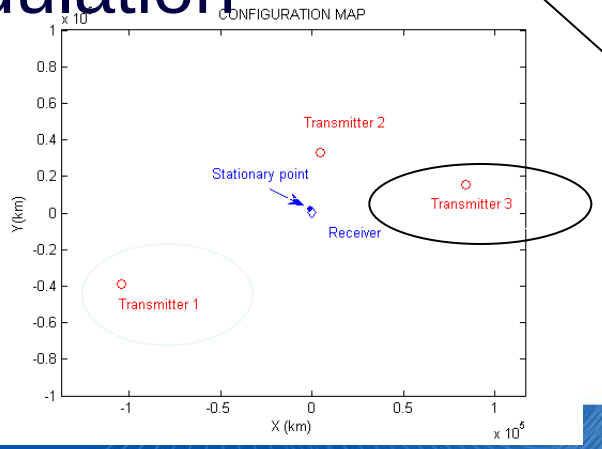
Target

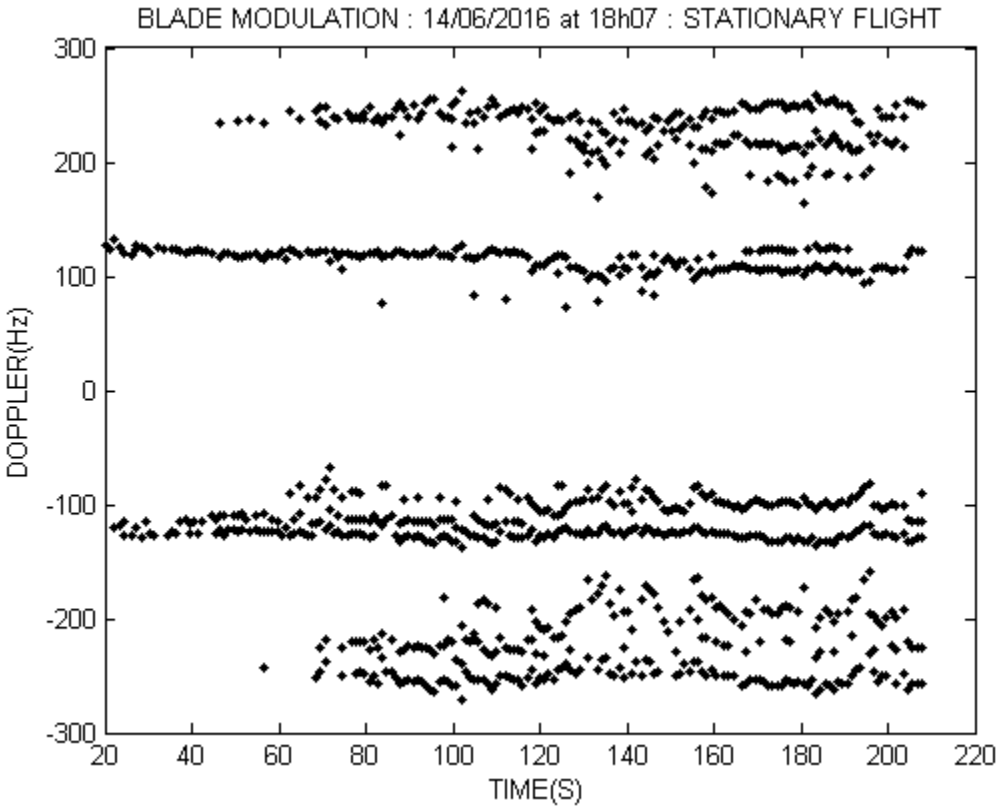
- Multirotor at 3 kilometres from the receiver
- Sationary position

DETECTION

Due to the blade modulation





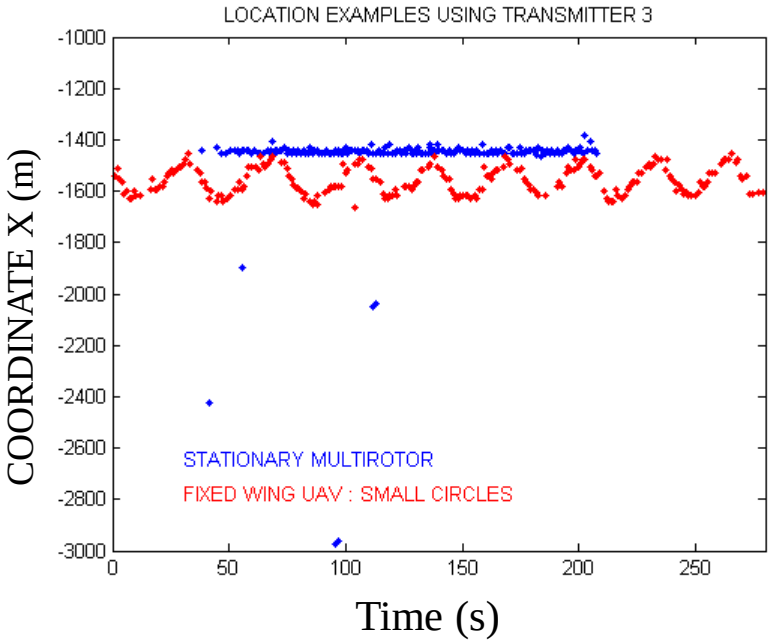


PASSIVE DVB RADAR
TRANSMITTER 3 : direct localisation

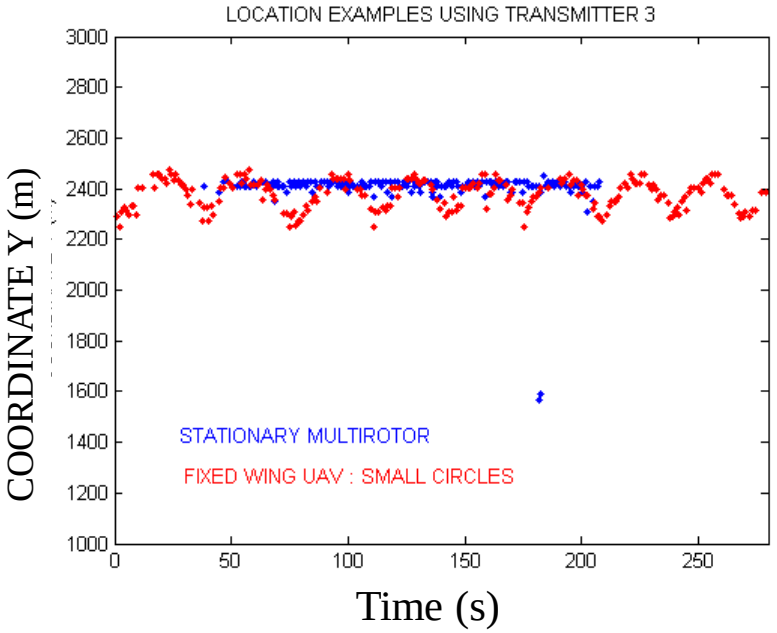
Target

Multirotor (Sationary position) and fixed wings : superimposed

(X,Y) = f (range, azimuth)



X COORDINATE

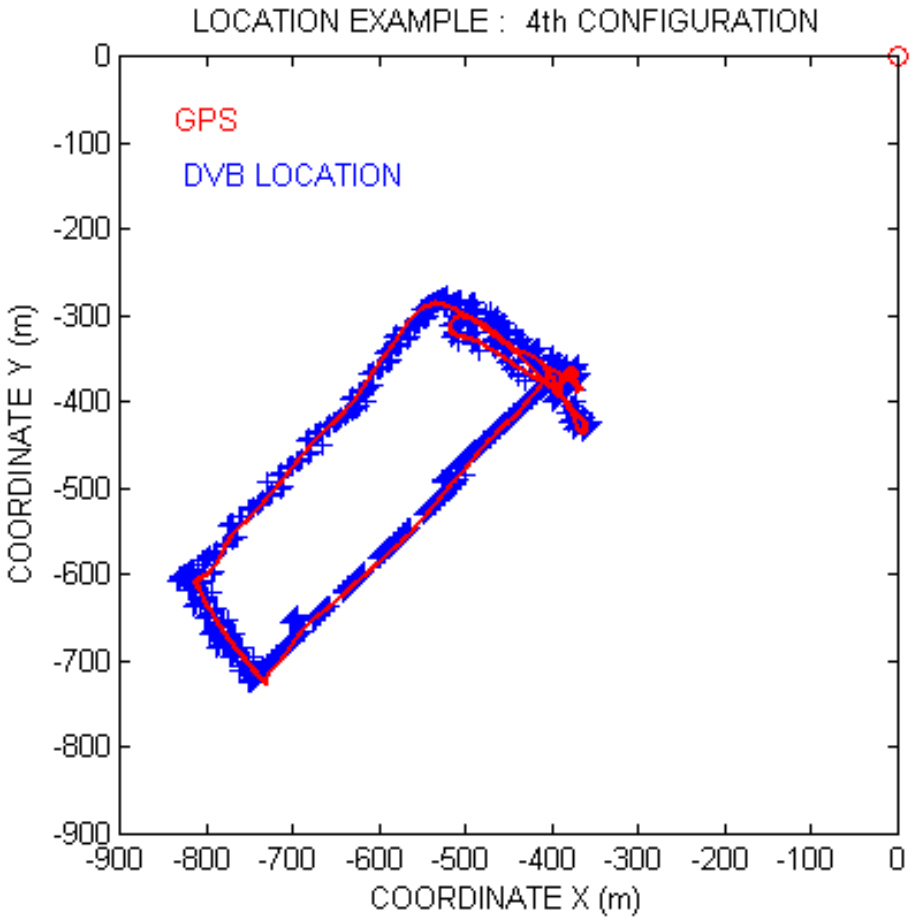


Y COORDINATE

PASSIVE DVB RADAR
4th CONFIGURATION: direct localisation

Target

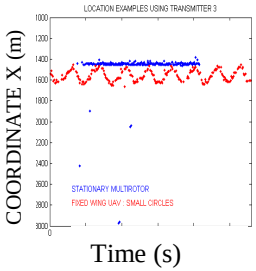
- Multirotor with manoeuvers
- Transmitter at « 30 » kilometres from the receiver

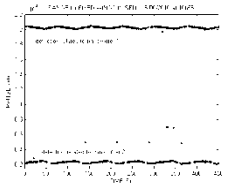


CARTESIAN MAP

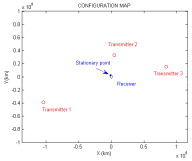
PASSIVE DVB RADAR against UAV
CONCLUSION

UAV DETECTION (MULTISTATIC)



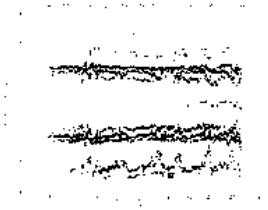


up to 3 kilometres (or equivalent) and more



over 5 +2 configurations (including SFN)

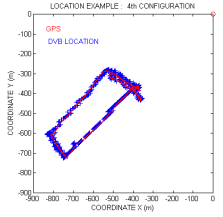
UAV CLASSIFICATION



Blade modulation detection (for multi-rotors)

UAV LOCALISATION

Accurate localisation even under bistatic configuration



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PASSIVE DVB RADAR against UAV
FOLLOW-ON

POSSIBLE ENHANCEMENTS

TRACKING implementation

DISCRIMINATION studies

Interpretation of blades modulation???