

International Meteor Conference

Aug 30 – Sep 2, 2018

Pezinok – Modra, Slovakia



Using SPADE for radio meteor observations

A. Martínez Picar and C. Marqué

Additional help from ROB colleagues:
A. Ergen, M. De Knijf, V. Honet, P. Motte



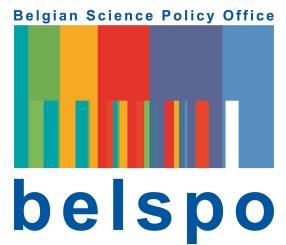
Solar-Terrestrial
Centre of Excellence



Solar Influences
Data analysis Center

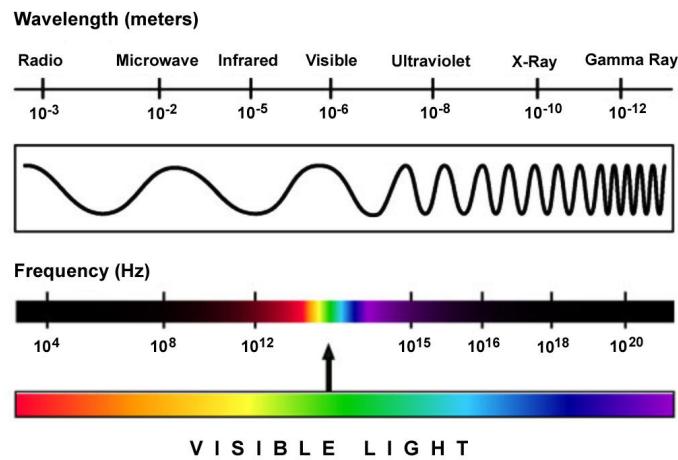
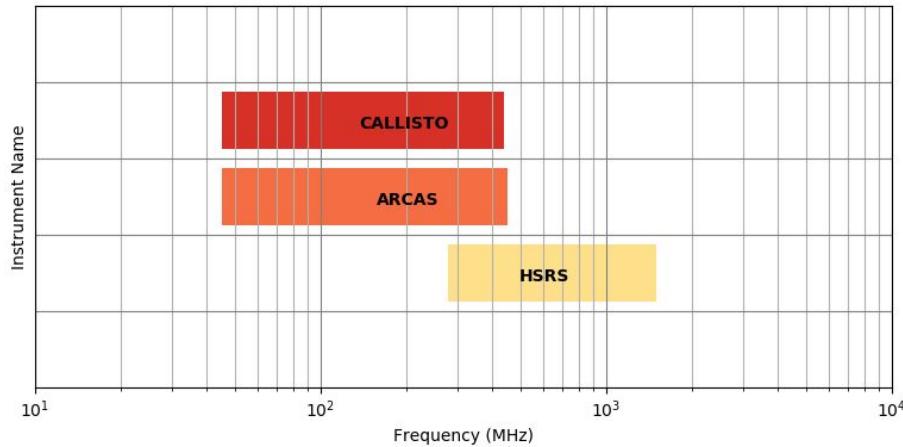


Royal Observatory
of Belgium



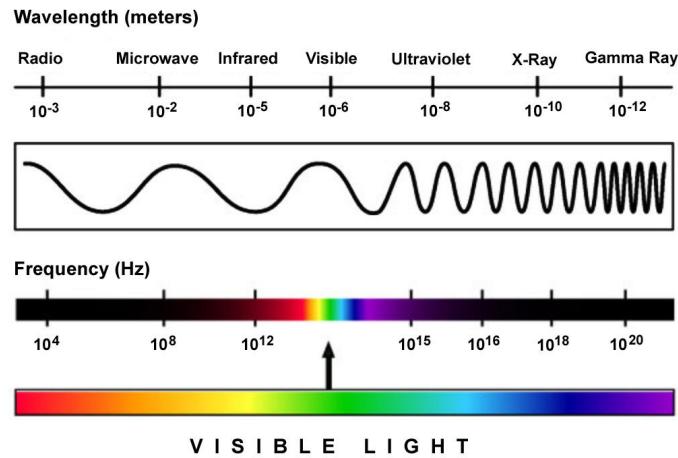
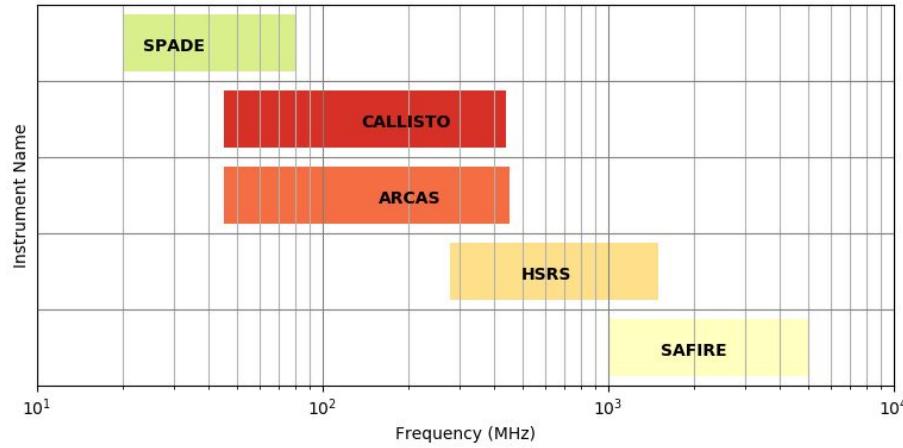
SPADE – The Project

A new radio-telescope for low-frequencies



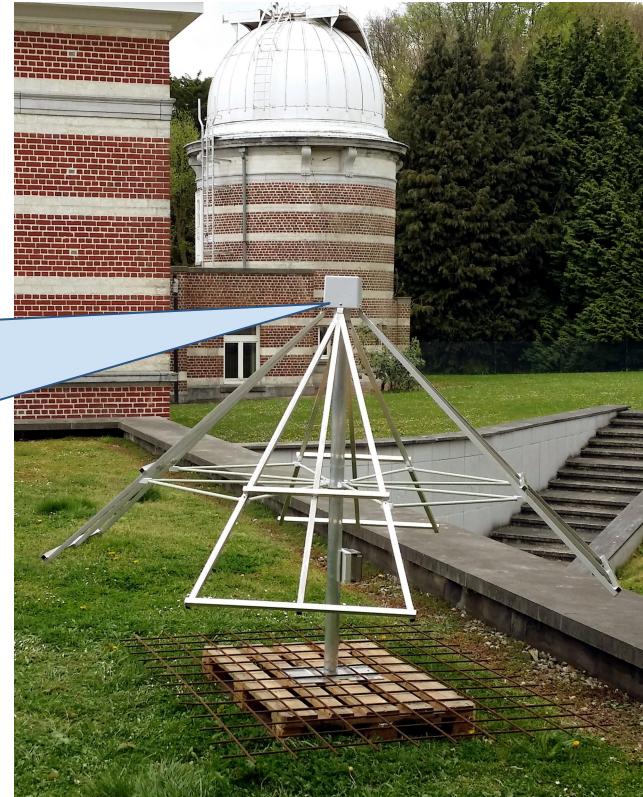
SPADE – The Project

A new radio-telescope for low-frequencies

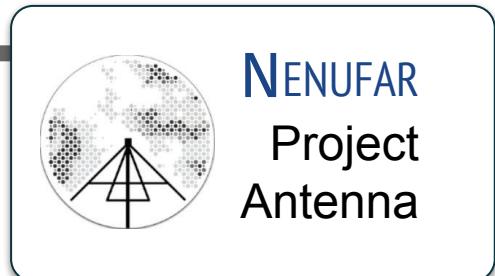
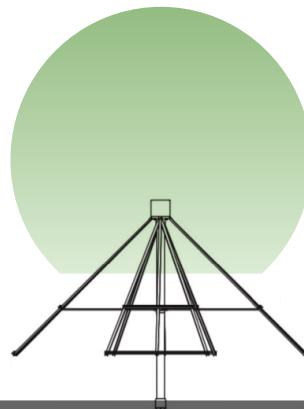


Beamforming technique

Principle



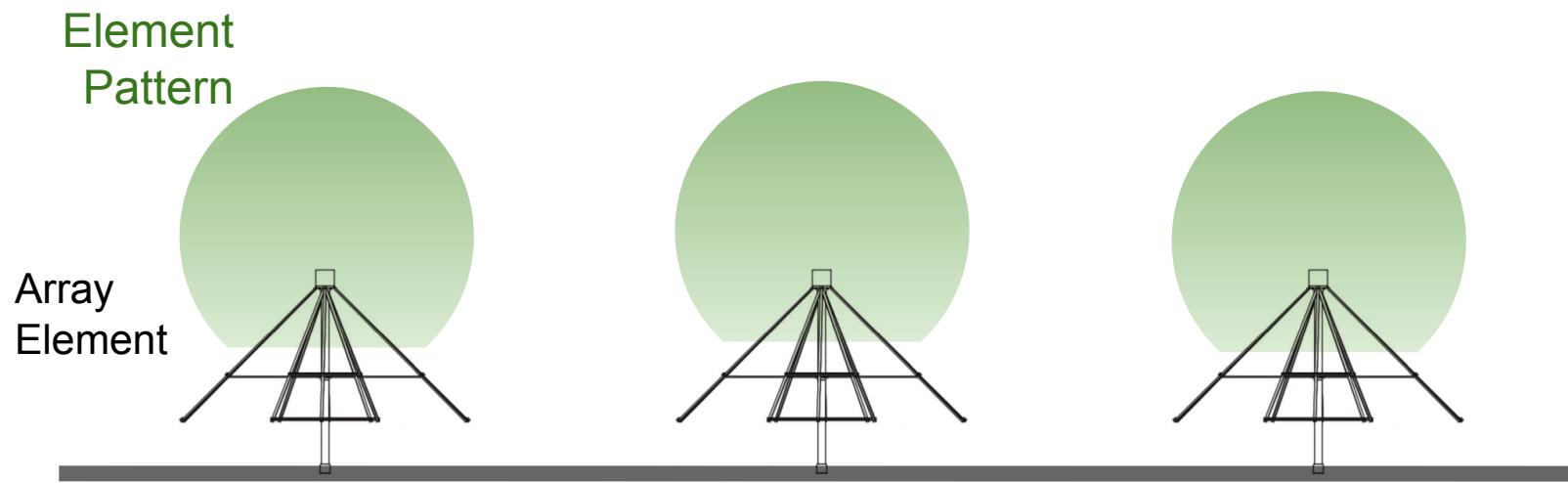
Antenna
Pattern
 $G_{max} = 0.8 \text{ dBi}$



- Cross *thick inverse vee*
- Additional conductive grid underneath
- Dual polarisation available

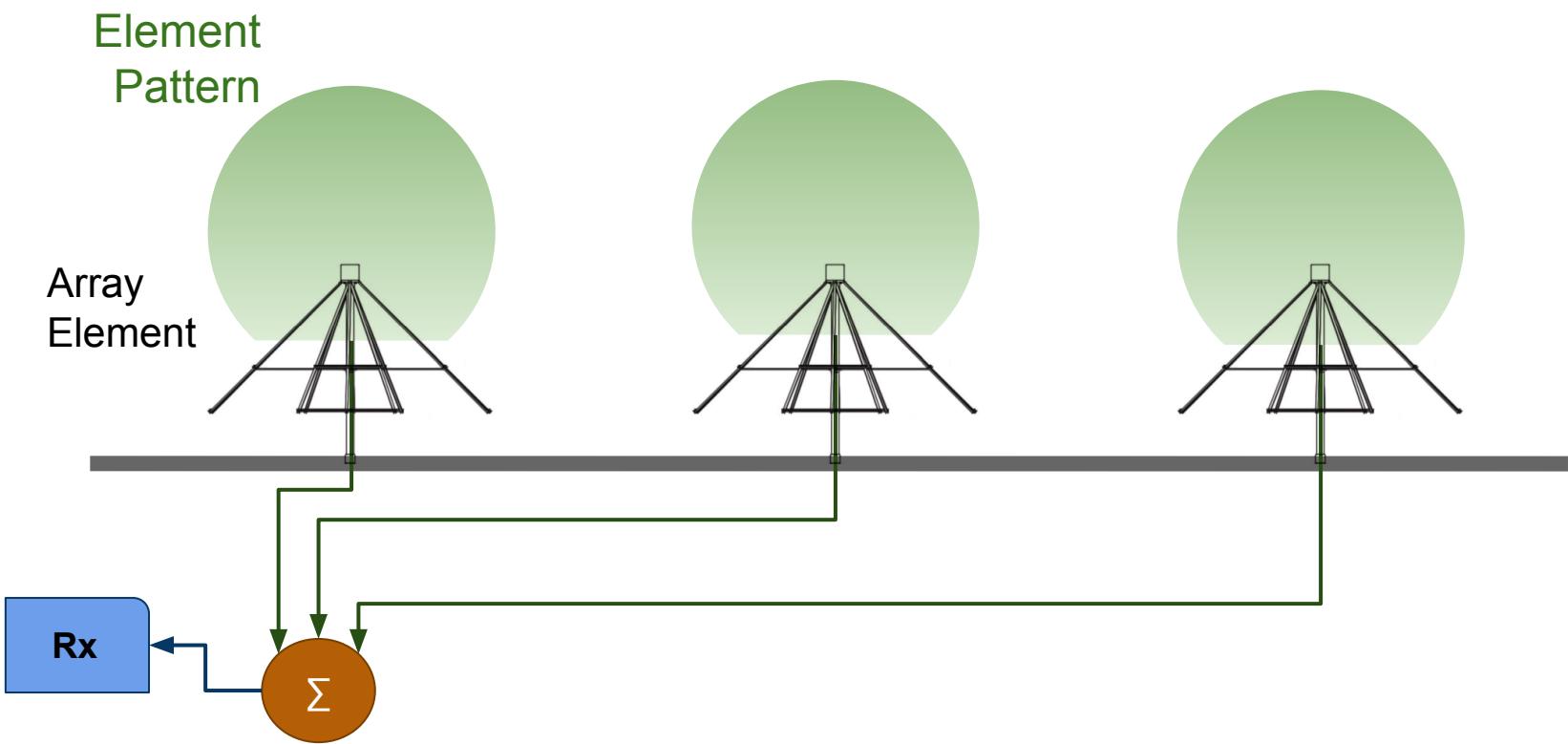
Beamforming technique

Principle



Beamforming technique

Principle



Beamforming technique

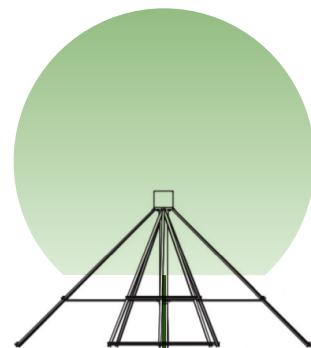
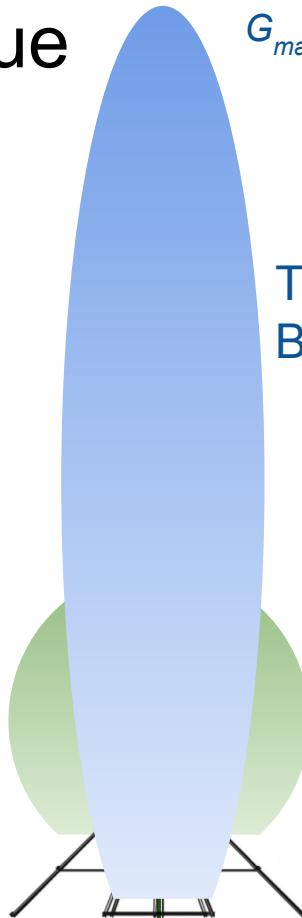
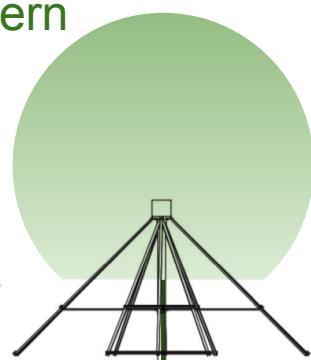
Principle

$$G_{max} = 9 \text{ dBi}$$

Tied Array Beam

Element Pattern

Array Element



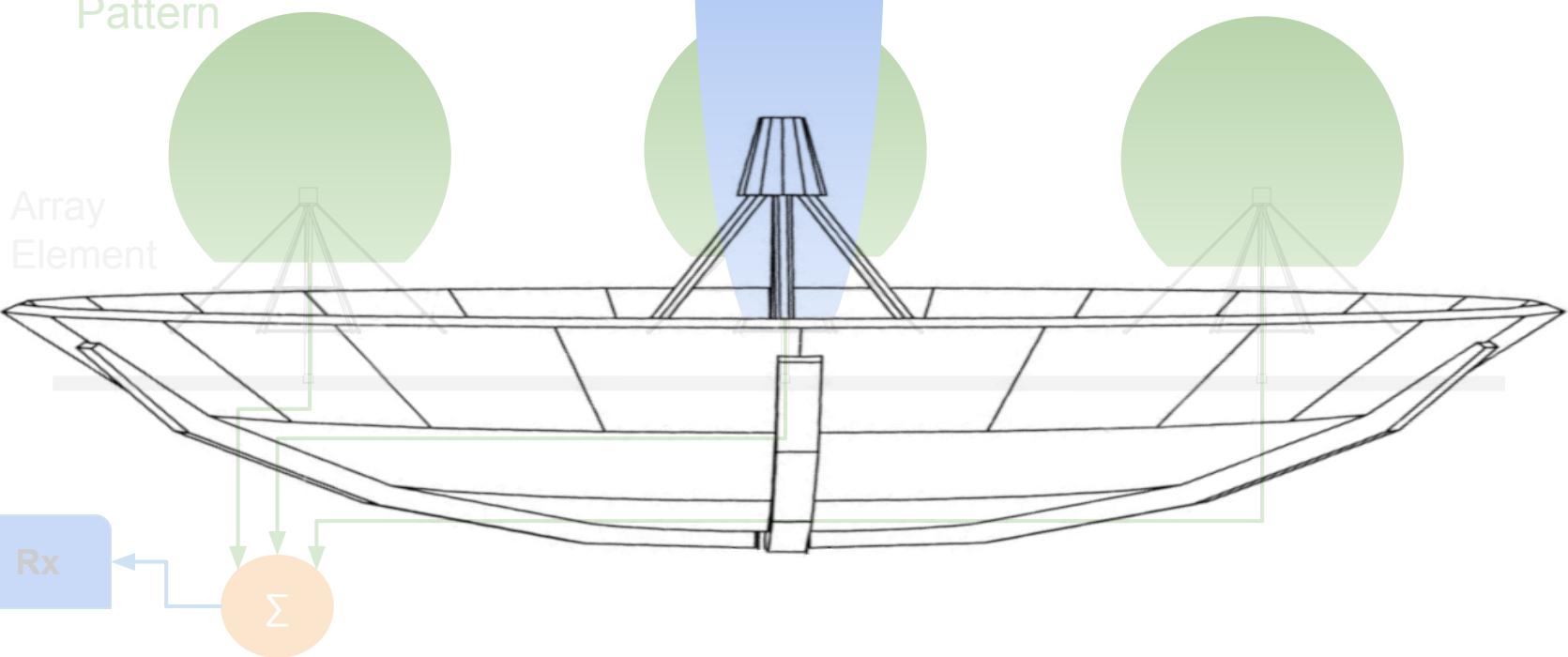
Beamforming technique

Principle

$$G_{max} = 9 \text{ dBi}$$

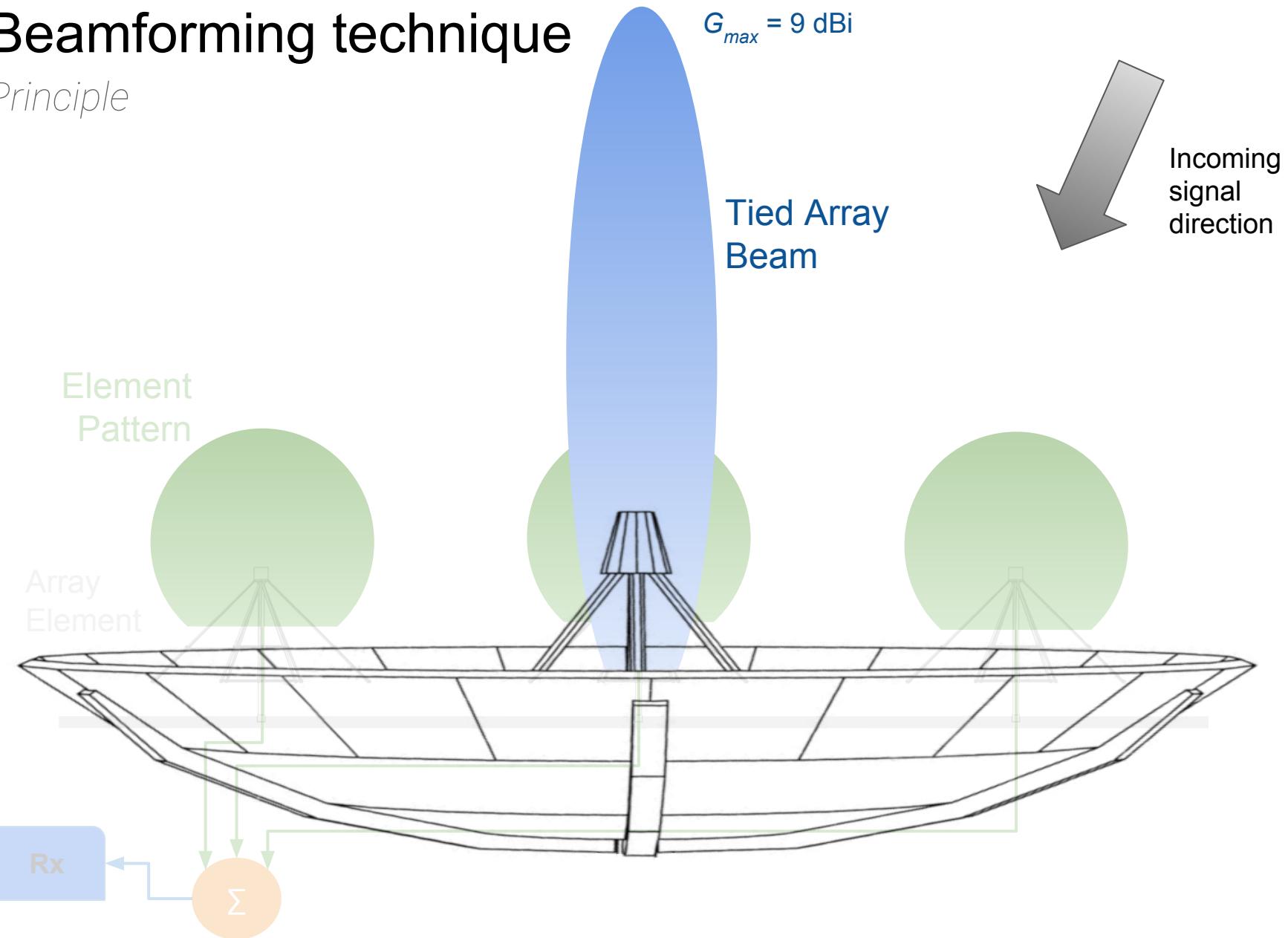
Tied Array Beam

Element Pattern



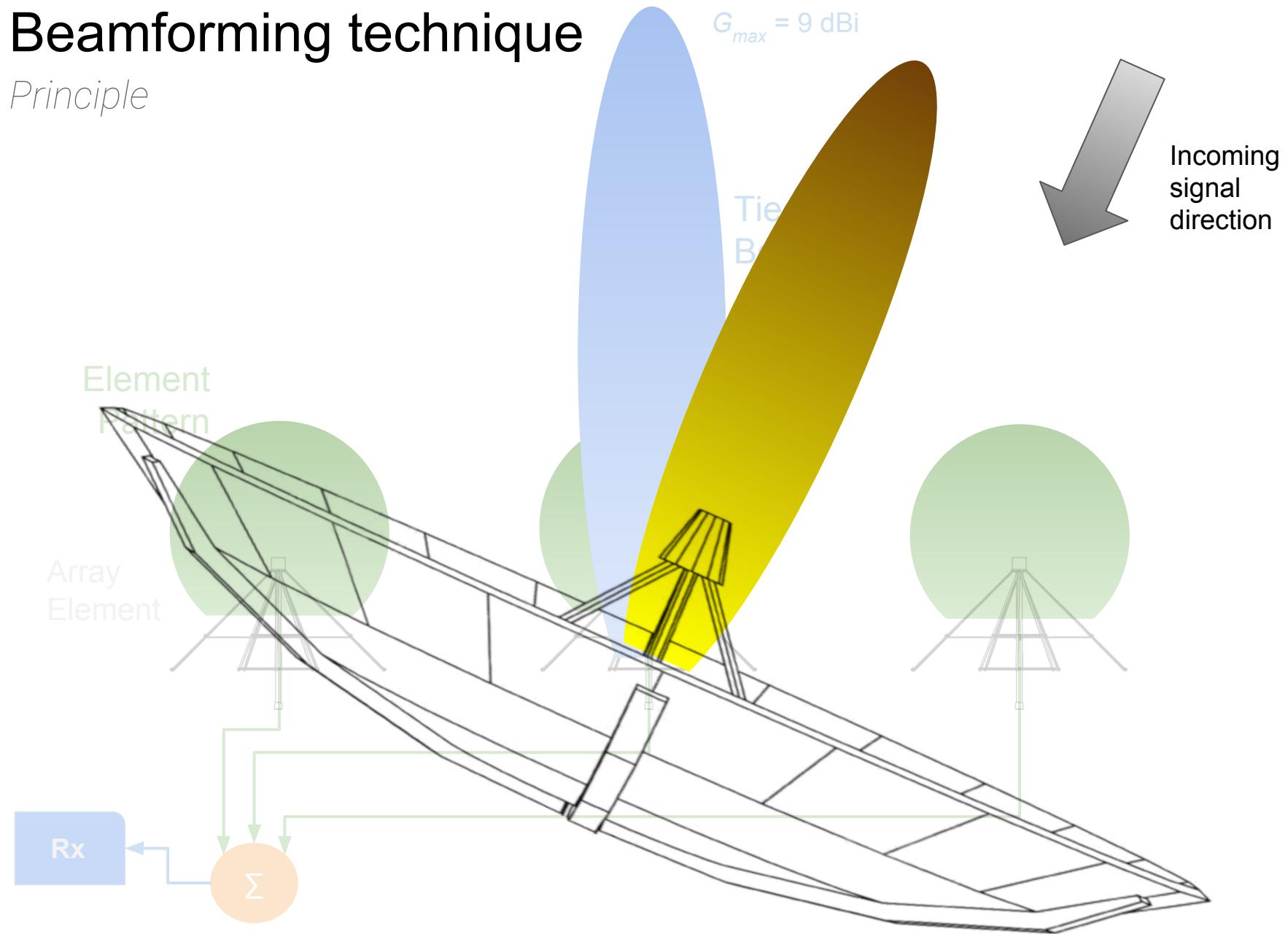
Beamforming technique

Principle



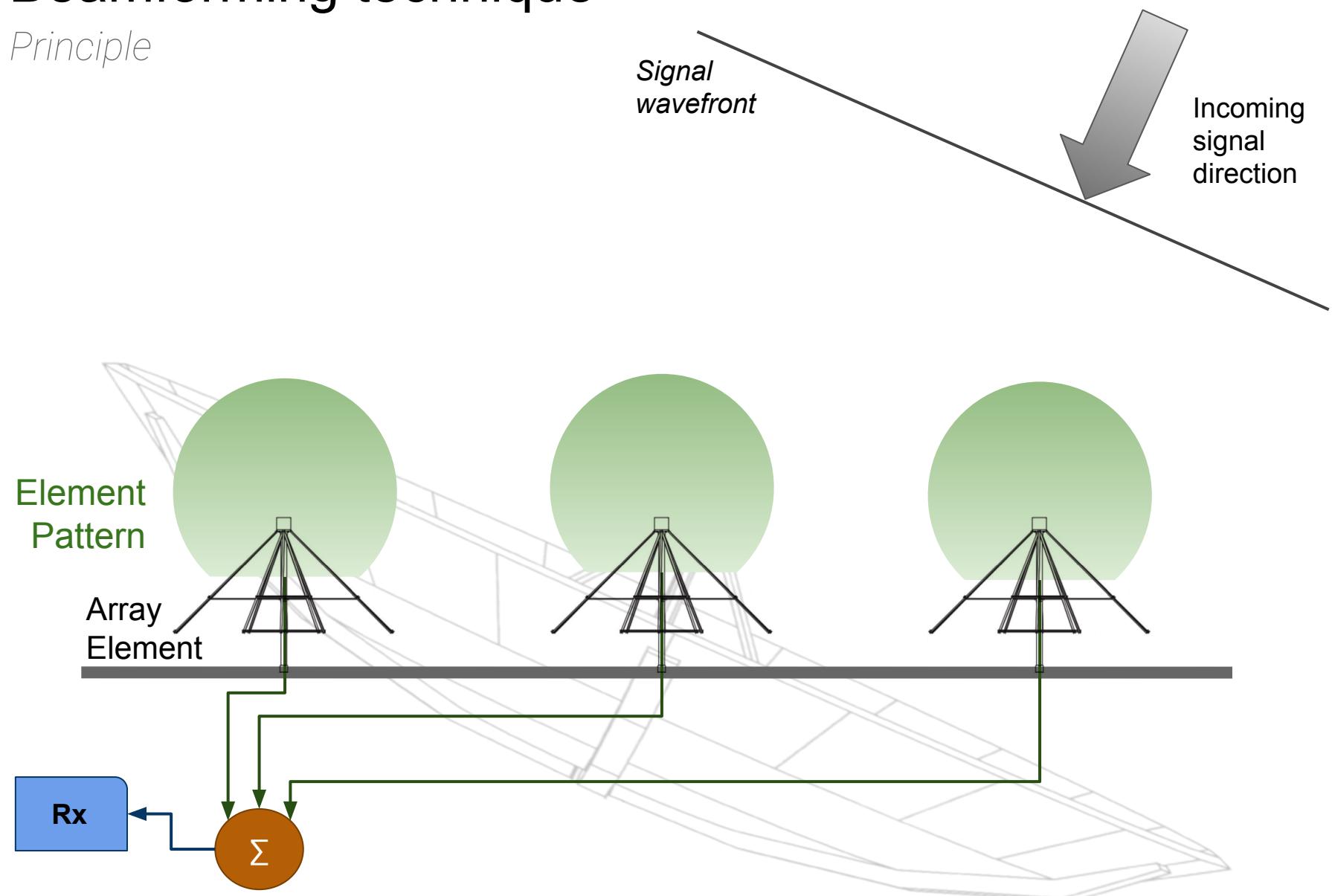
Beamforming technique

Principle



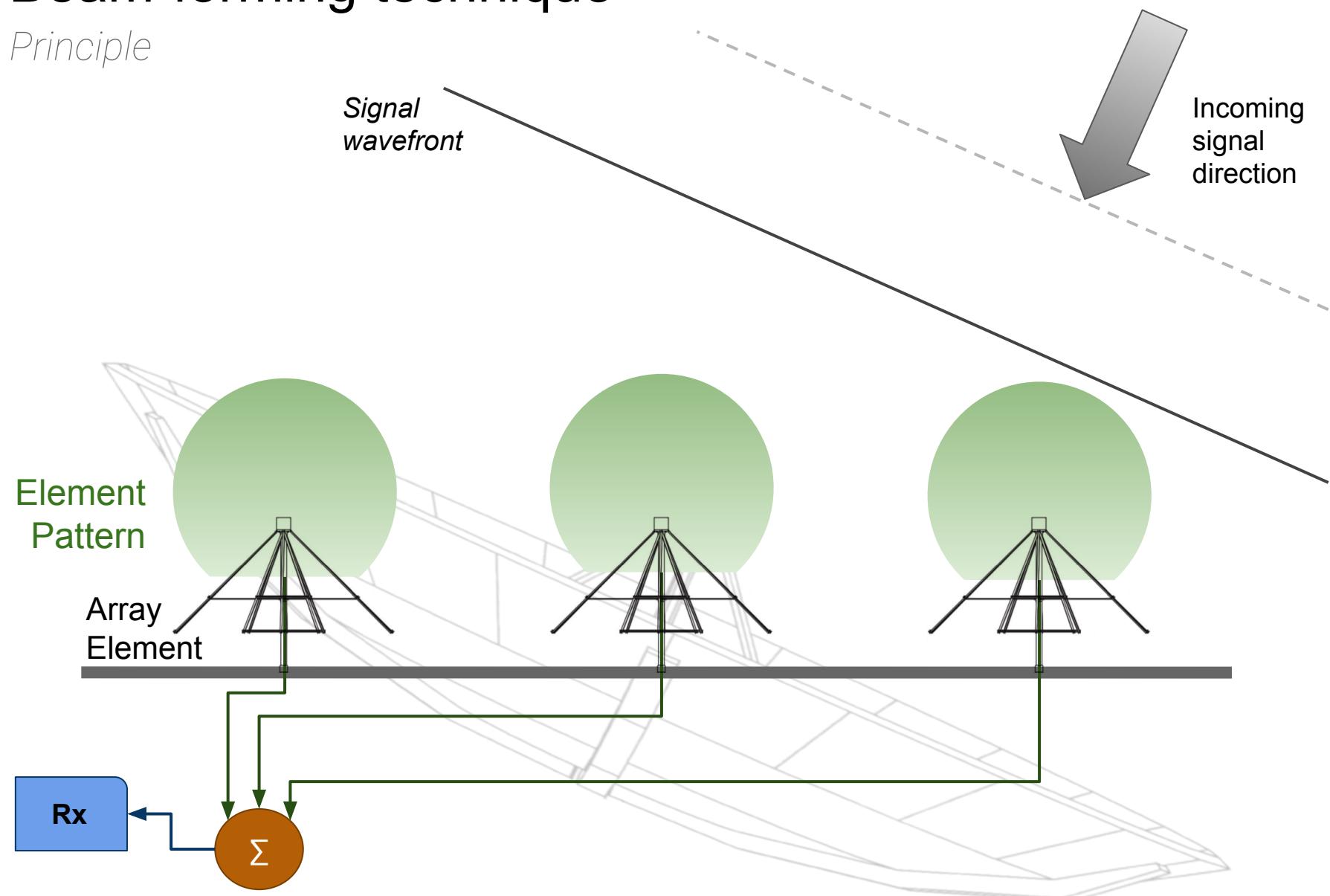
Beamforming technique

Principle



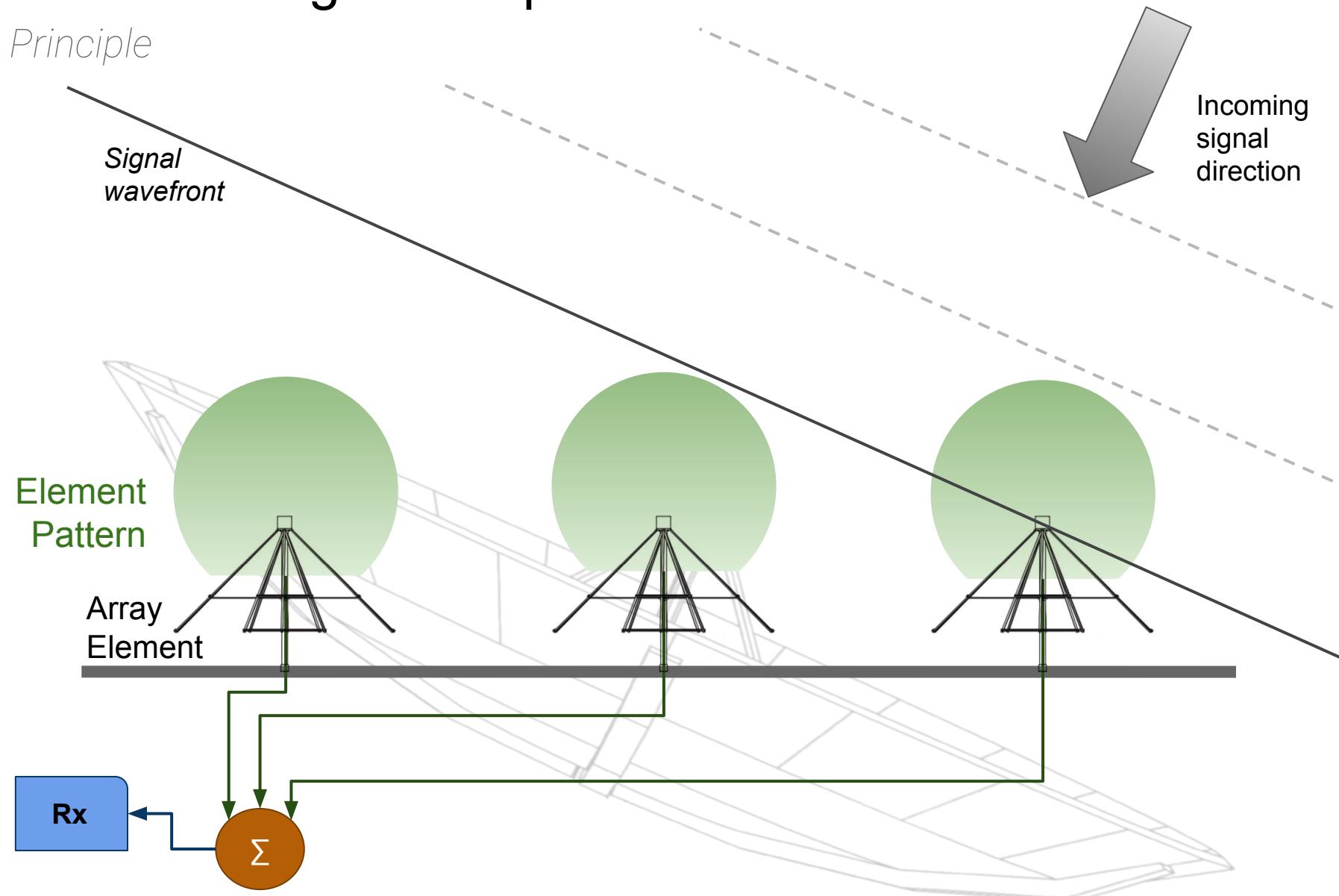
Beam-forming technique

Principle



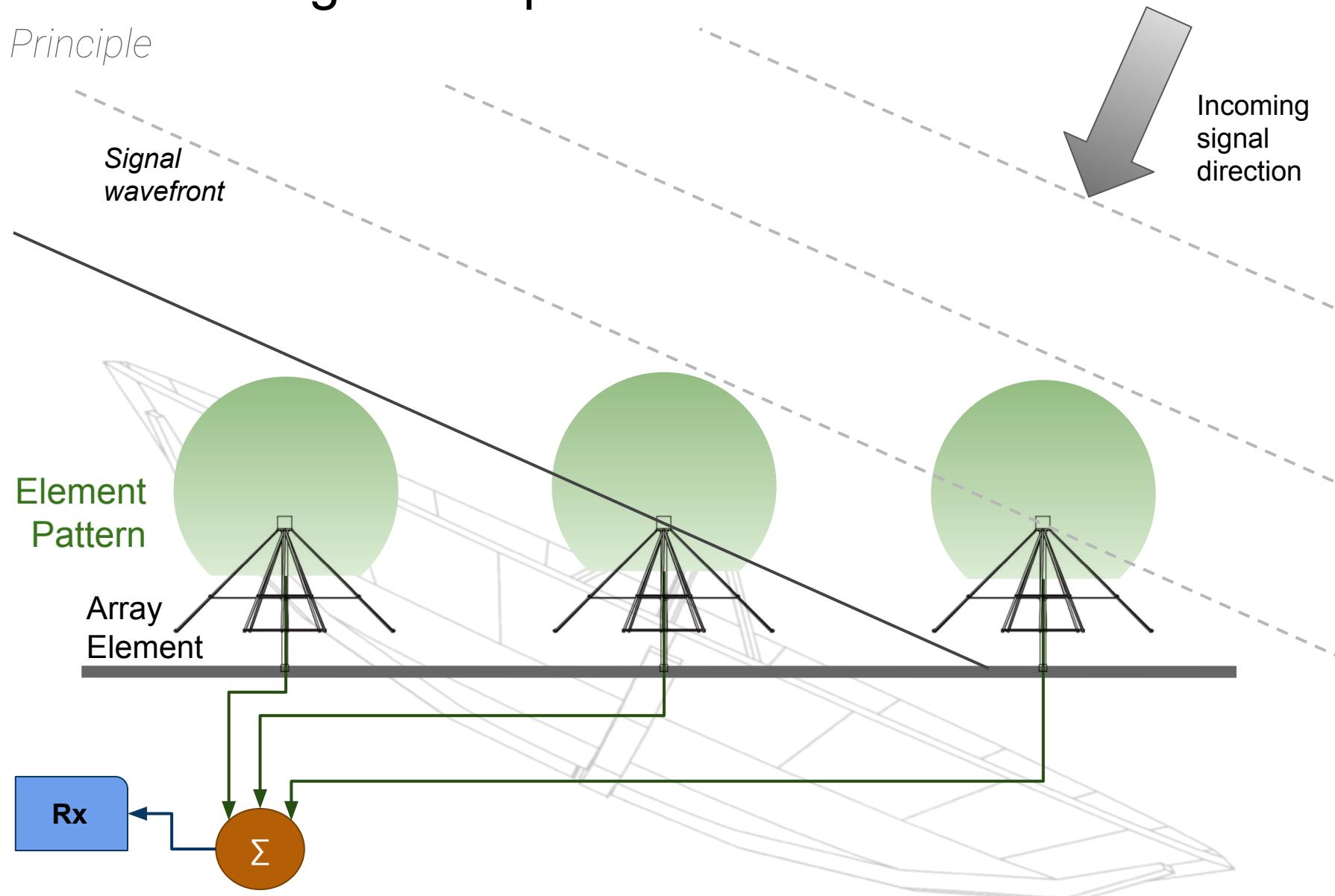
Beamforming technique

Principle



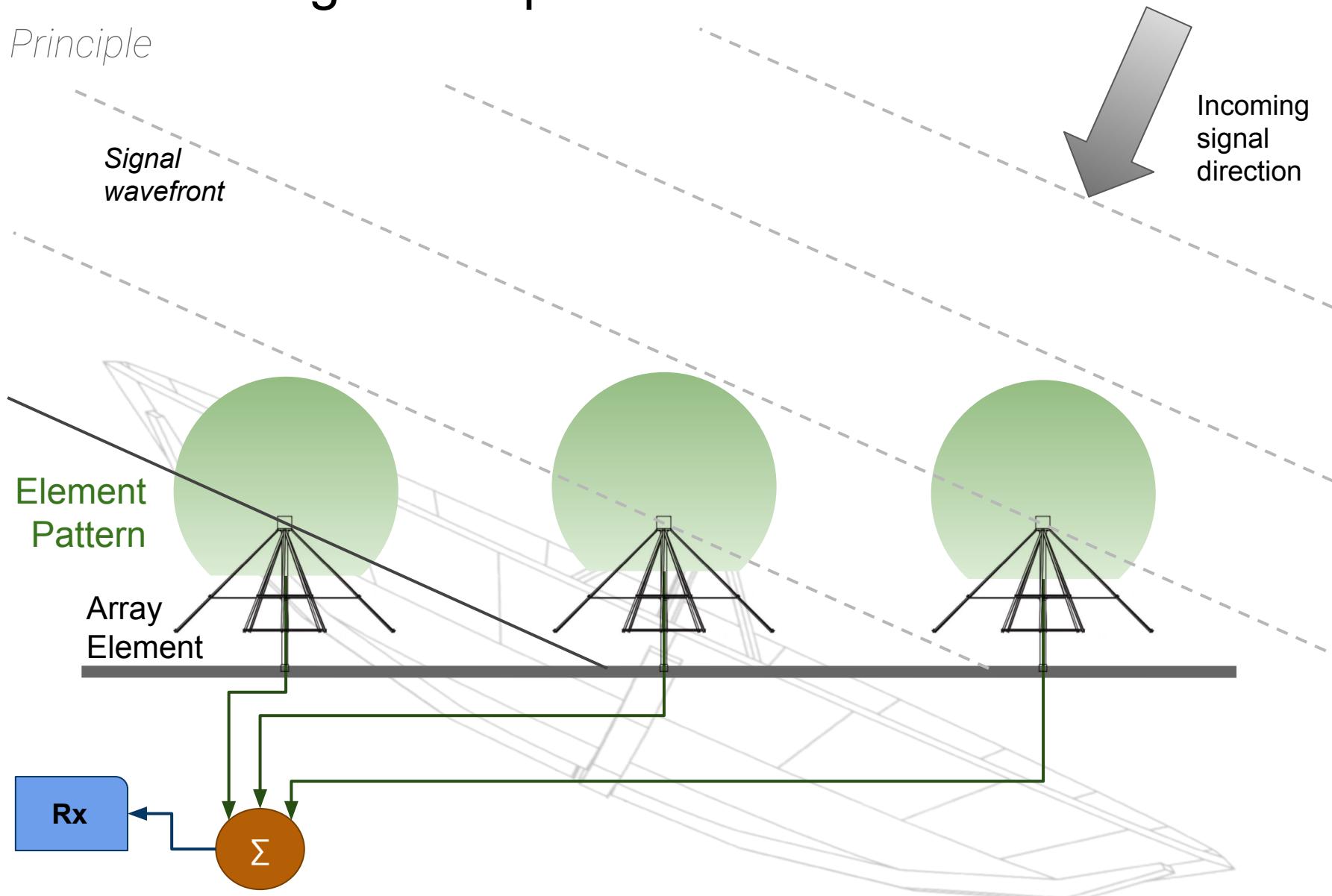
Beamforming technique

Principle



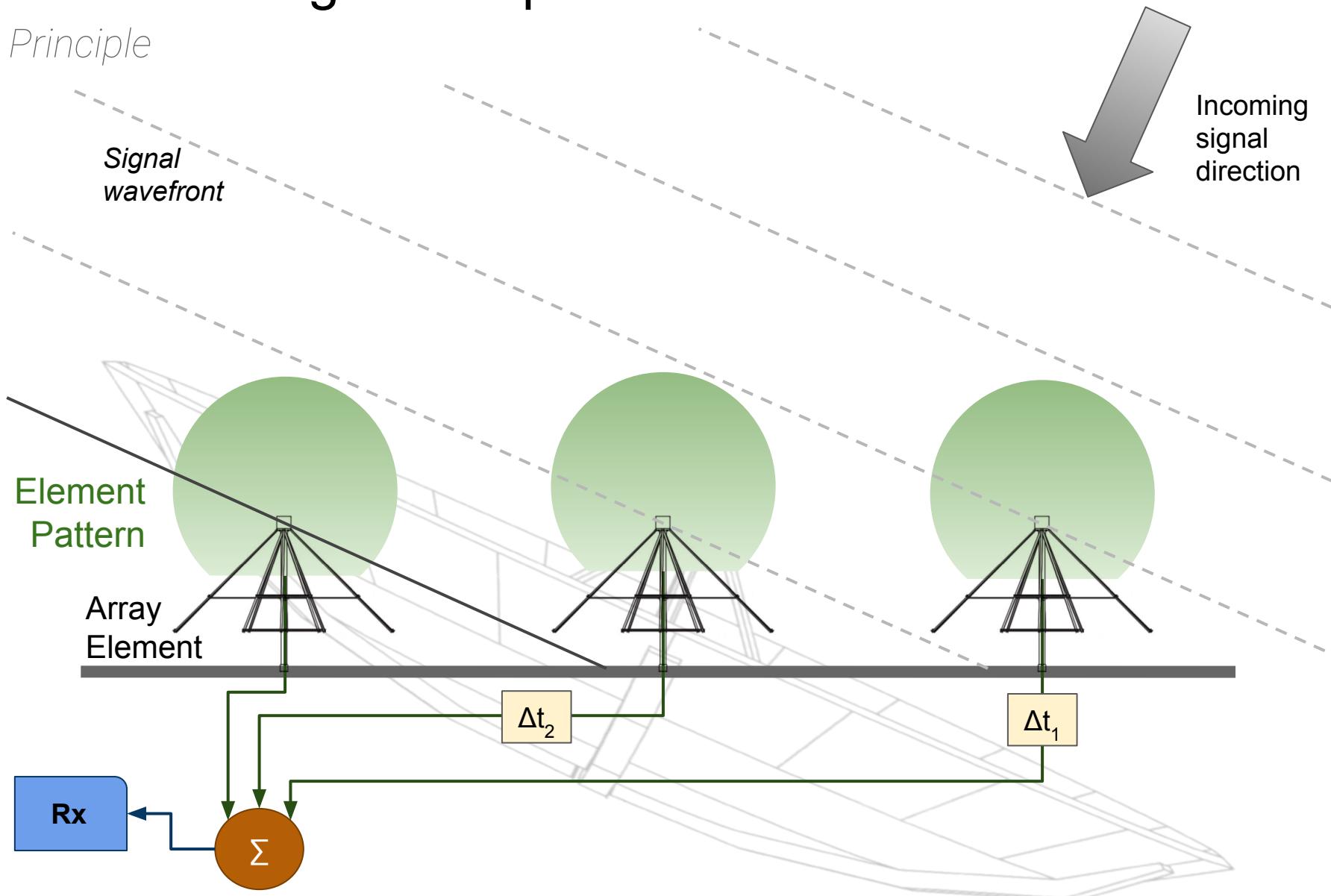
Beamforming technique

Principle



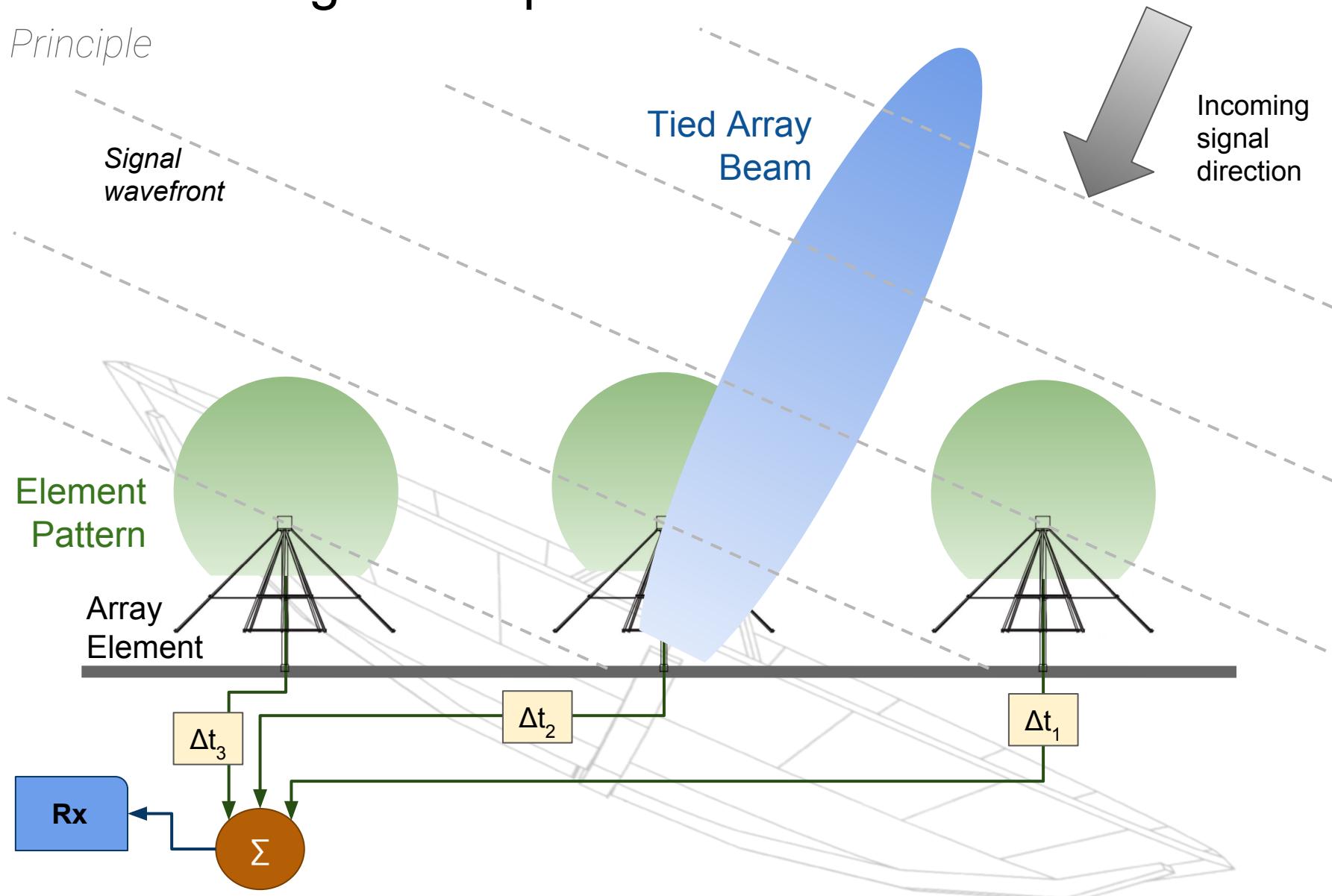
Beamforming technique

Principle



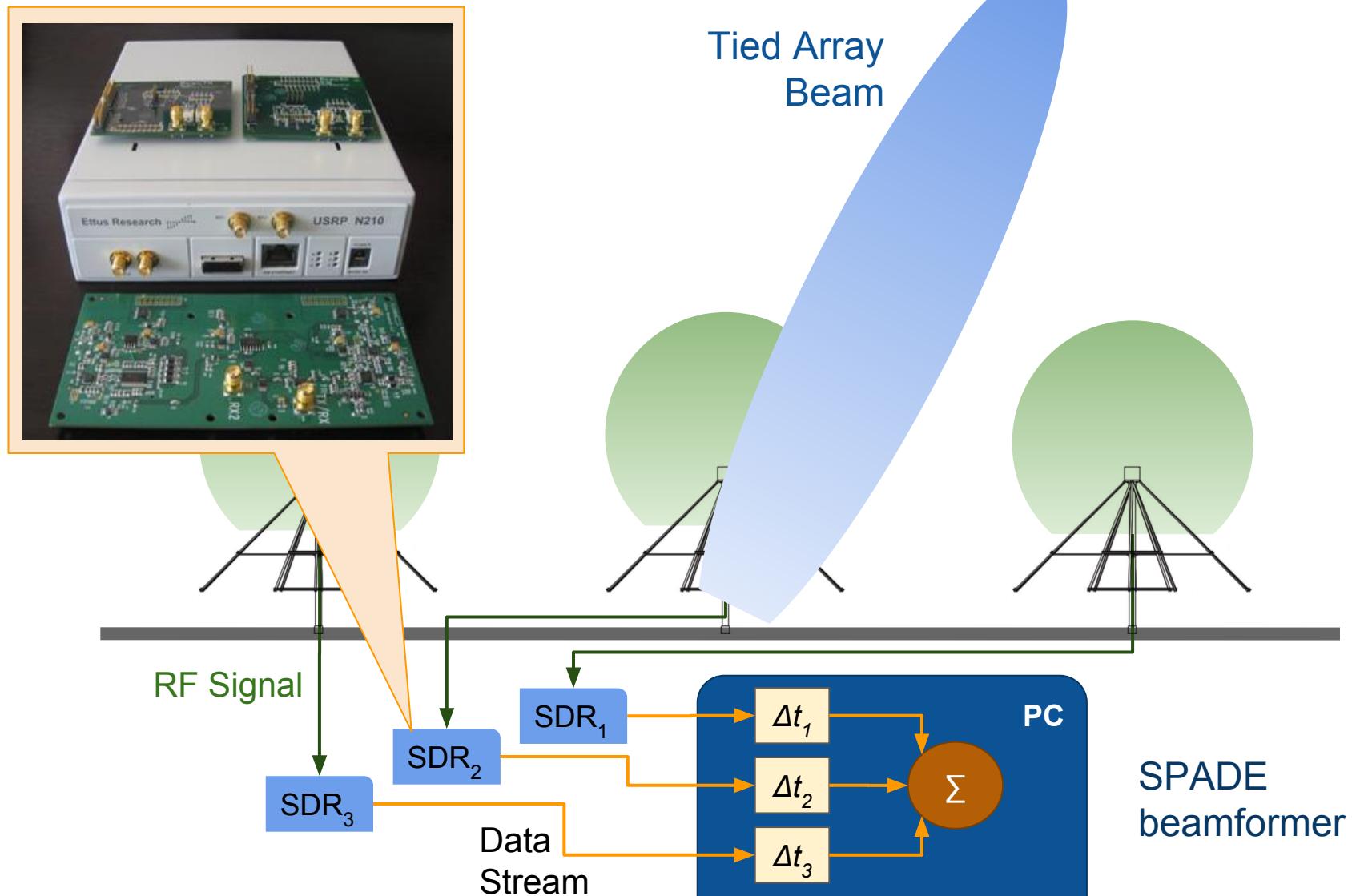
Beamforming technique

Principle



Beamforming technique

Principle



Building SPADE

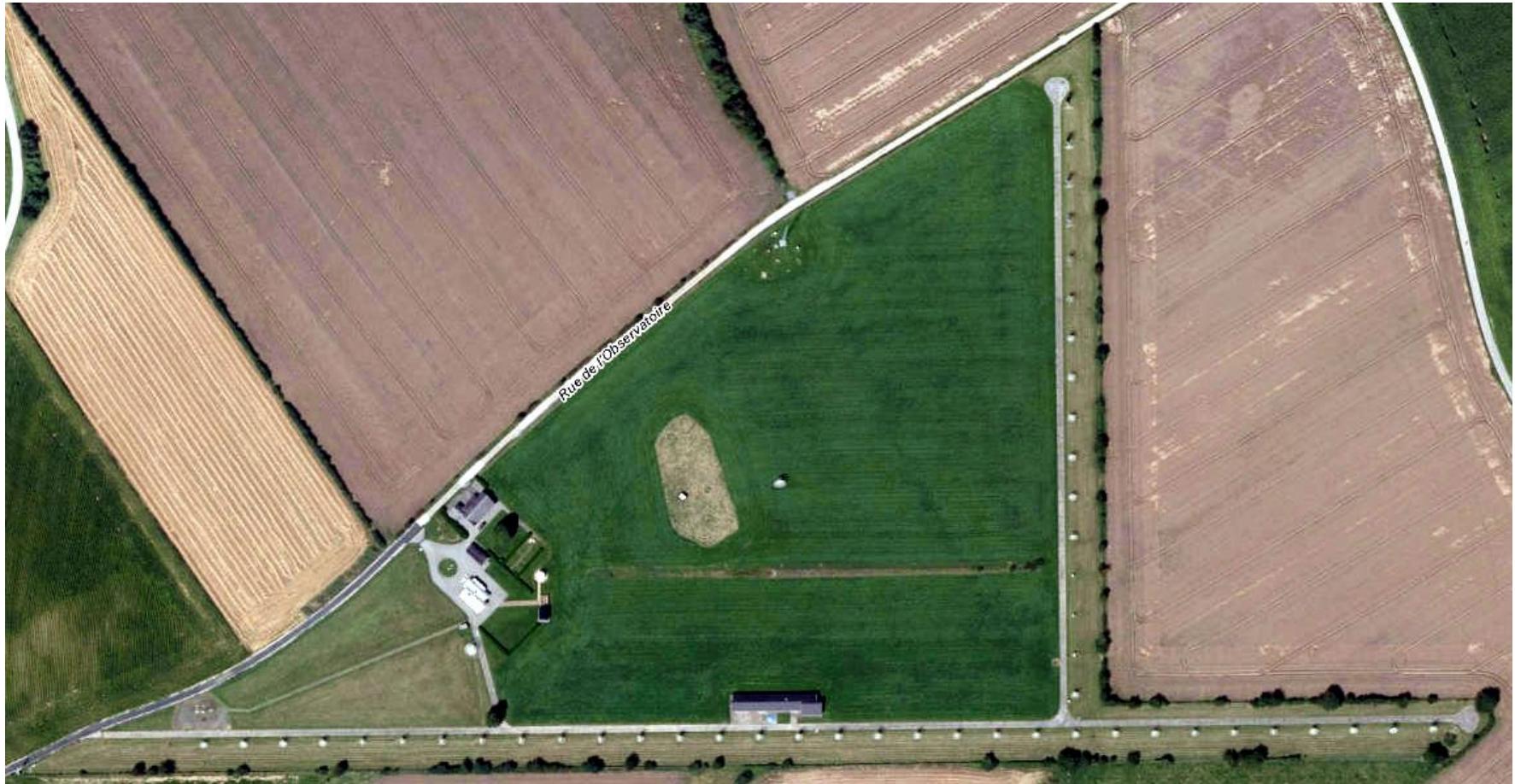
Location



Humain Radio–Astronomy
Station

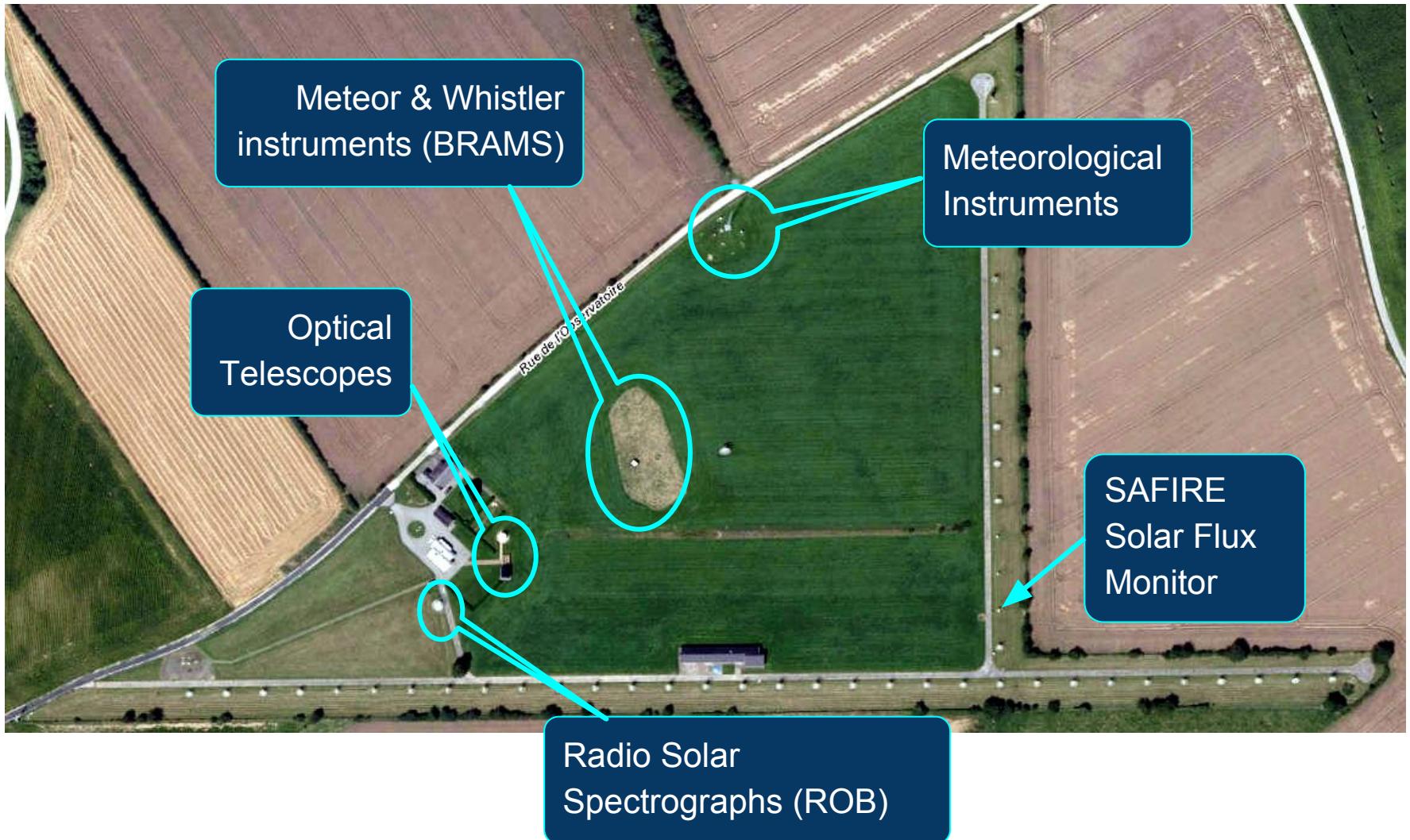
Building SPADE

Humain Radio–Astronomy Station



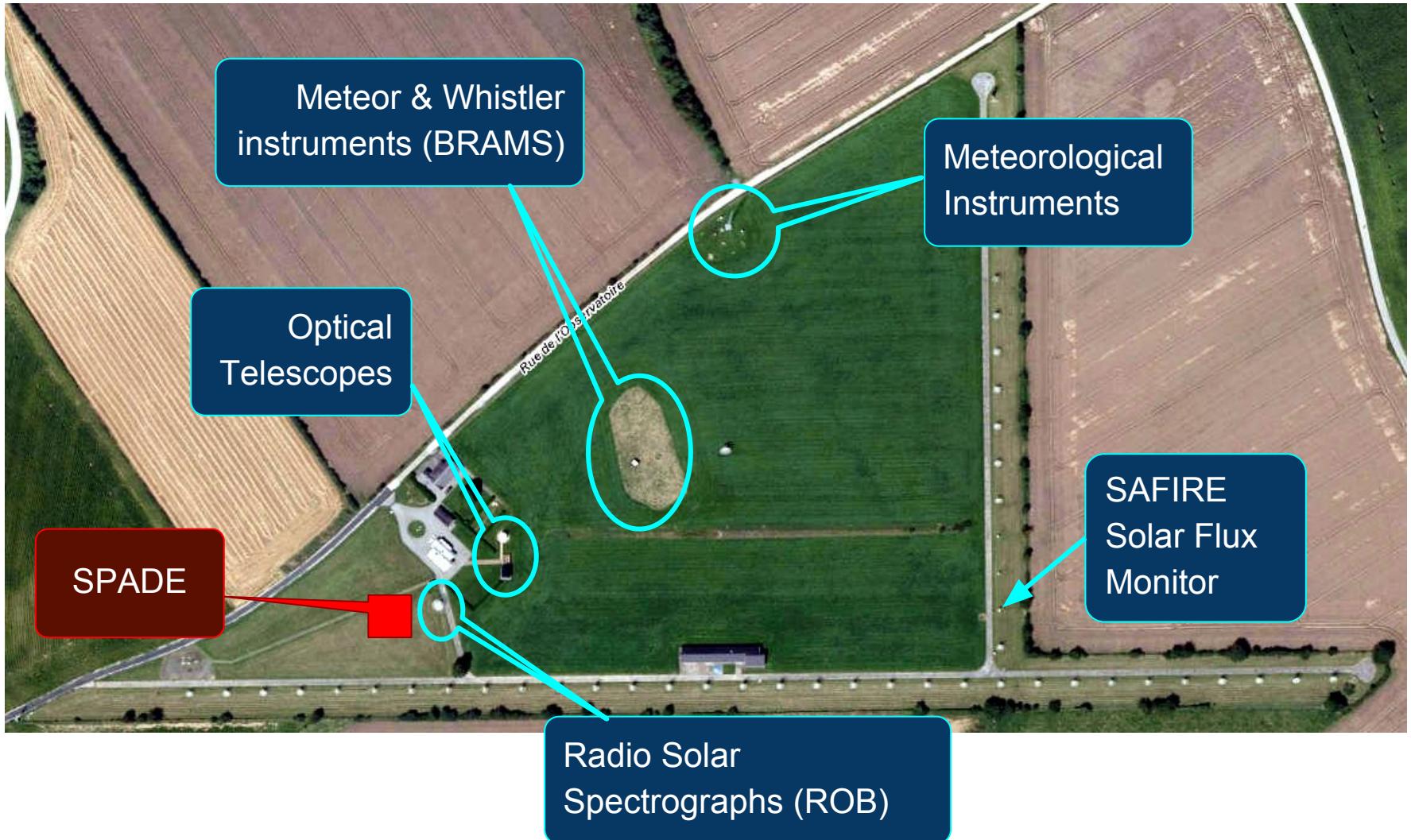
Building SPADE

Humain Radio–Astronomy Station



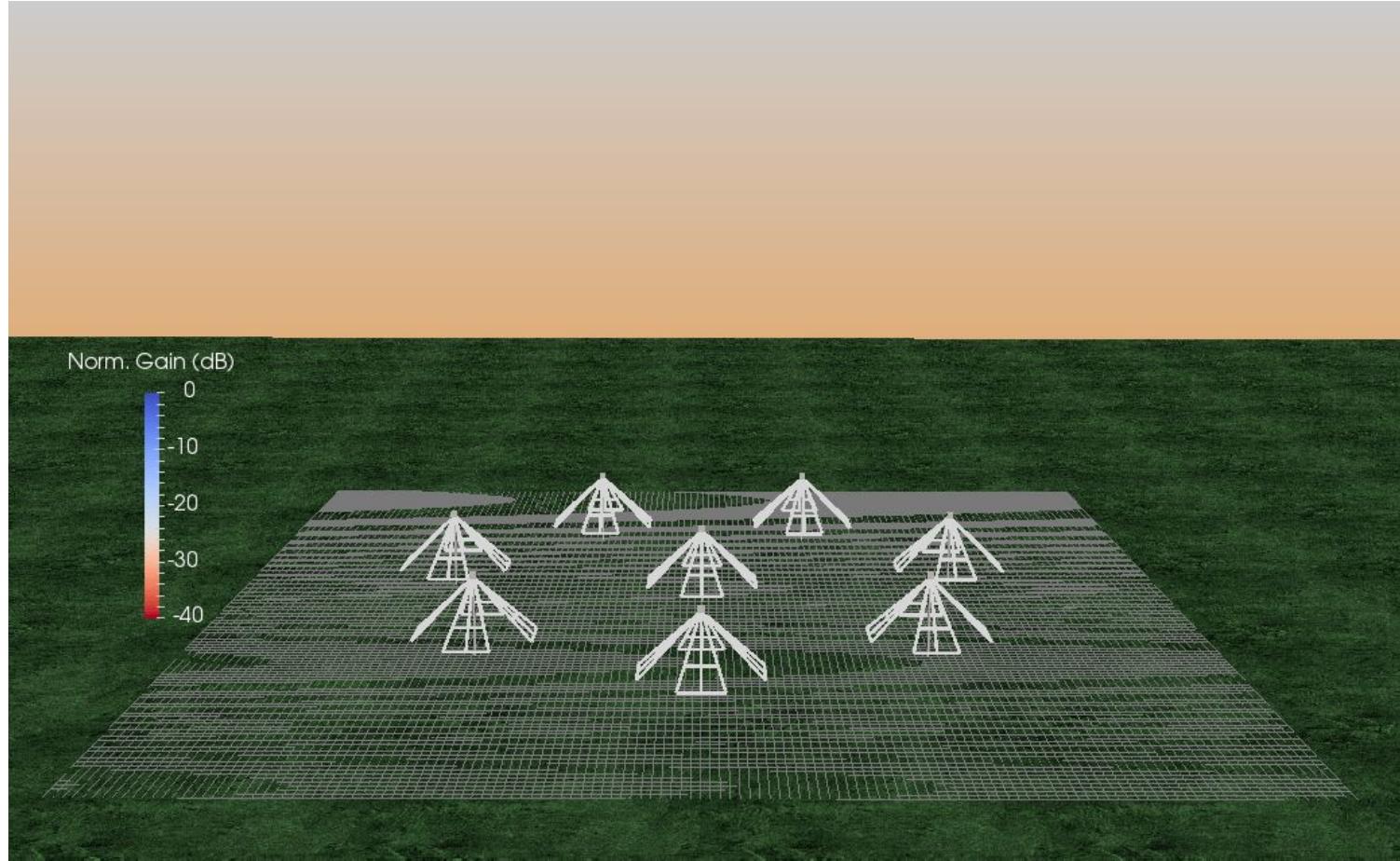
Building SPADE

Humain Radio–Astronomy Station



Building SPADE

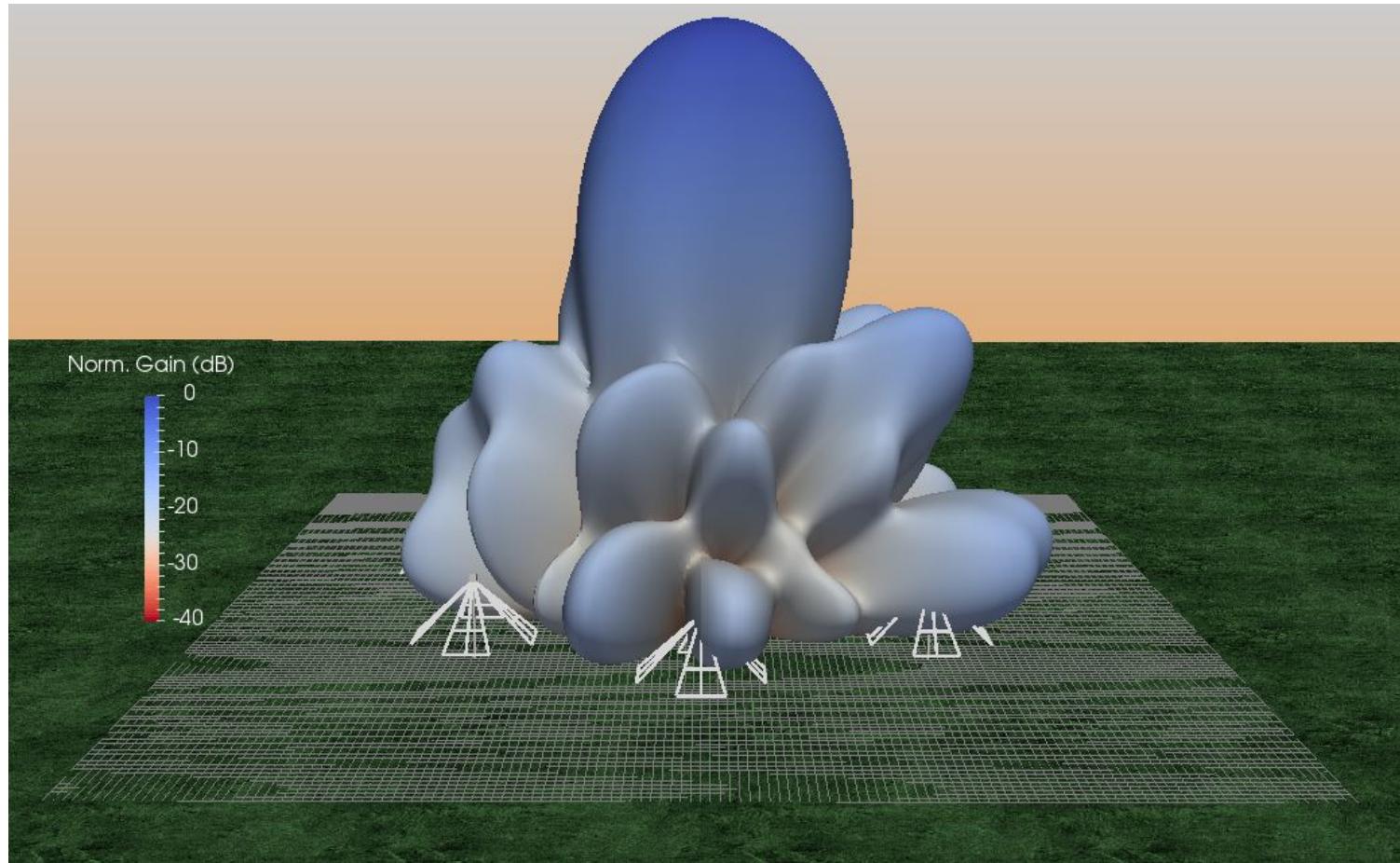
Array Configuration



The layout of the array must provide a symmetric beam with low sidelobe levels

Building SPADE

Array Configuration



The layout of the array must provide a symmetric beam with low sidelobe levels

Building SPADE

Terrain preparation



Building SPADE

Terrain preparation



Building SPADE

Terrain preparation



Building SPADE

Terrain preparation



Building SPADE

Array Field



Building SPADE

Array Field



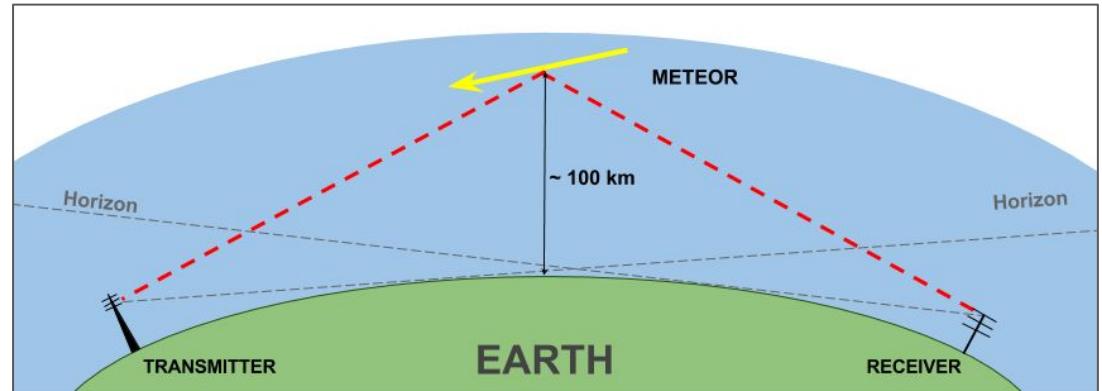
Building SPADE

Array Field



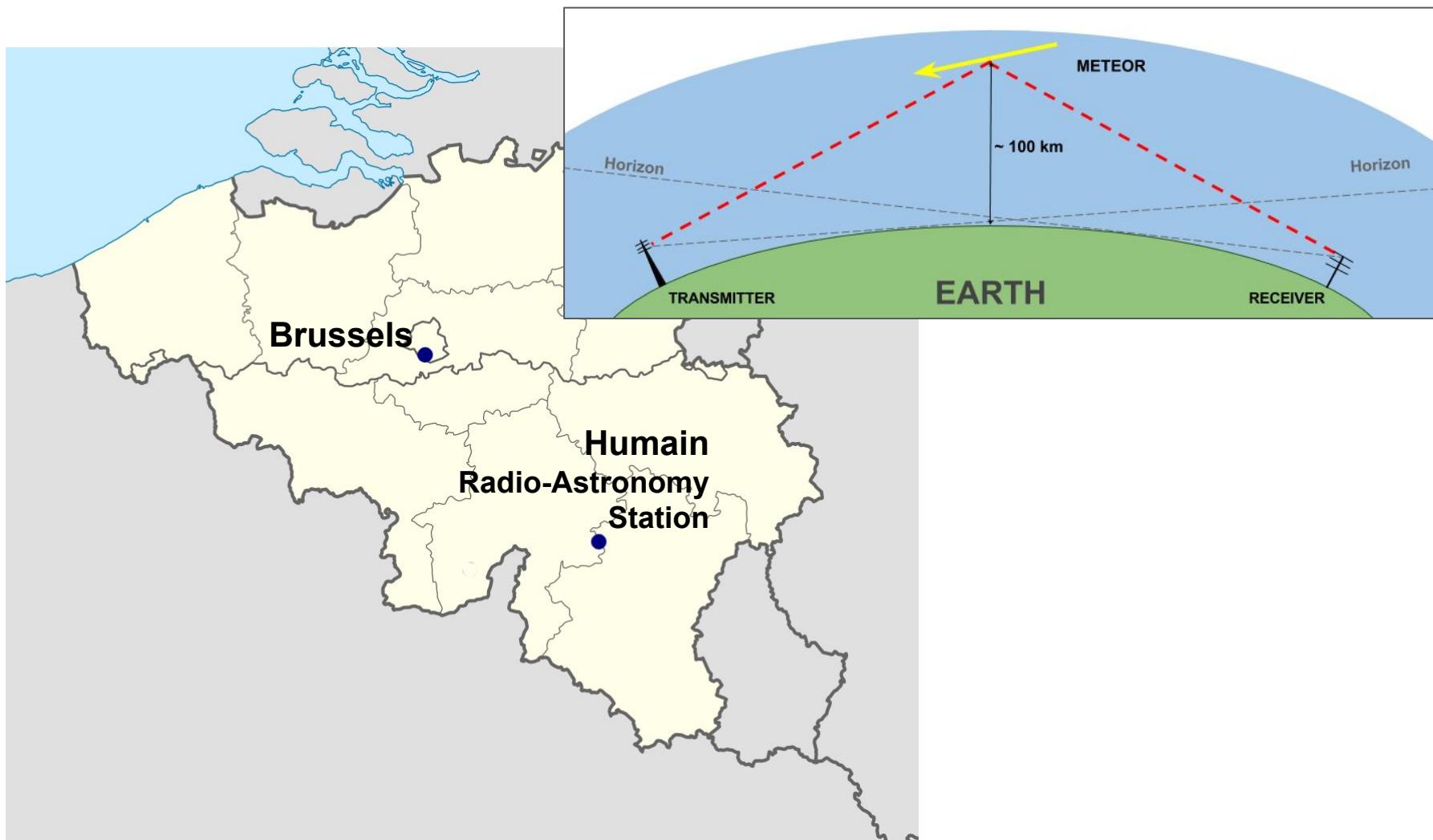
Building SPADE

Forward-scattering



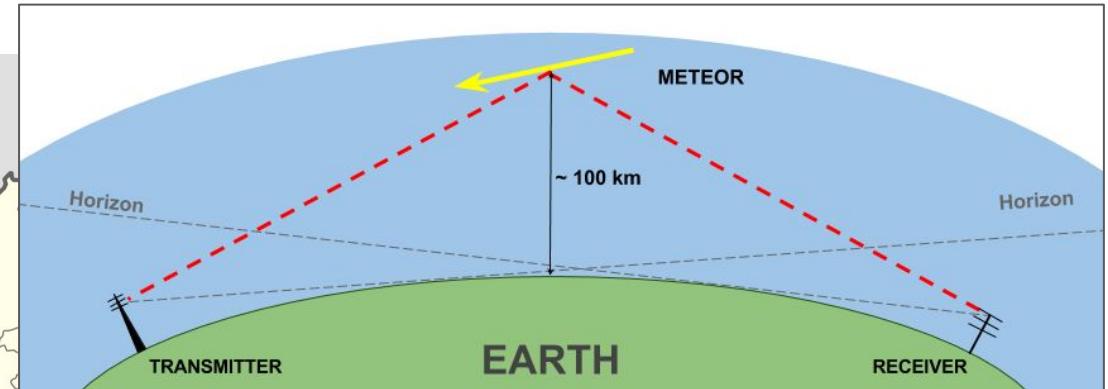
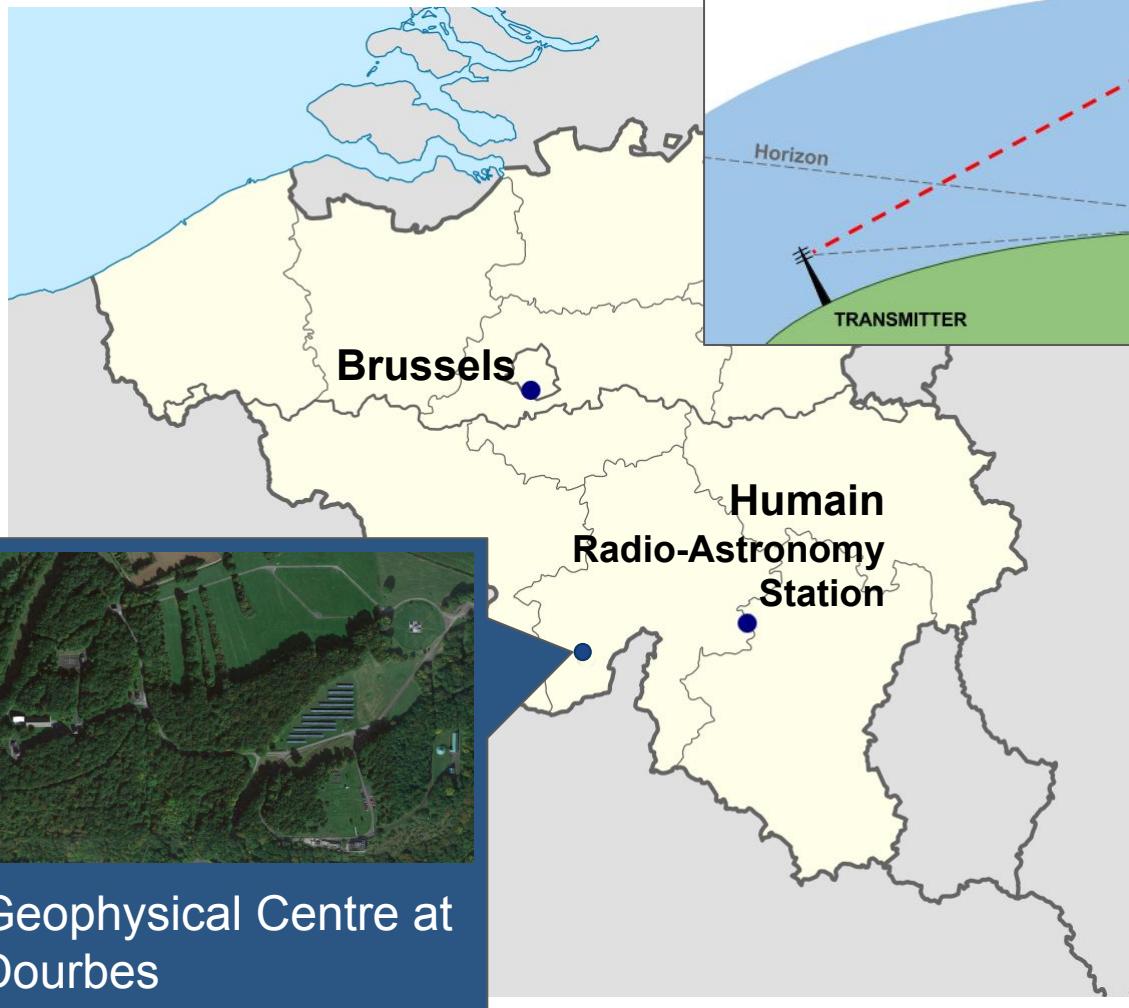
Building SPADE

Forward-scattering in Belgium



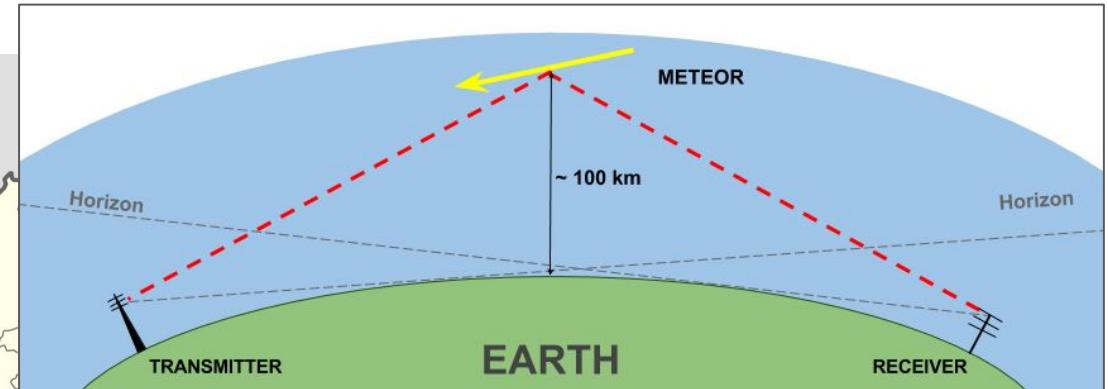
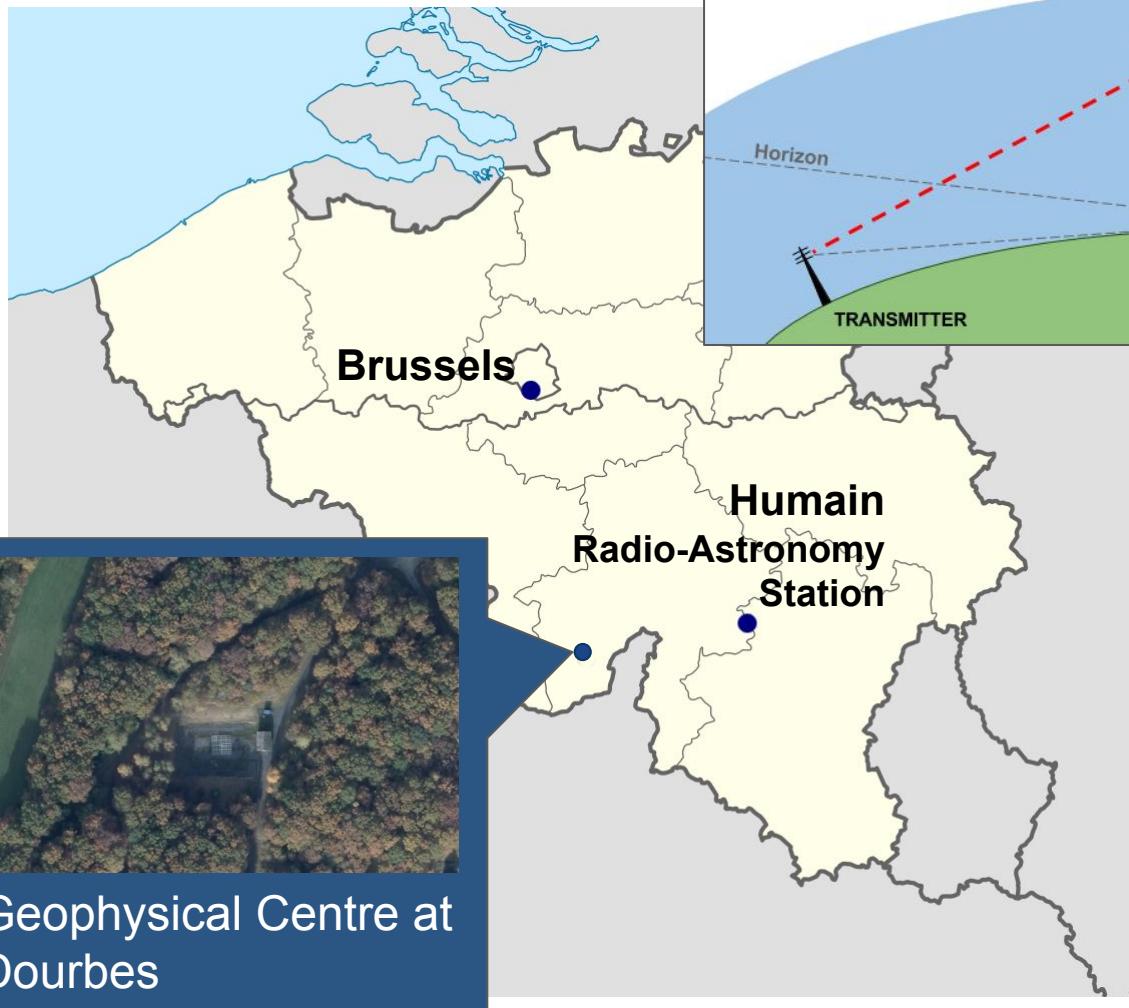
Building SPADE

Forward-scattering in Belgium



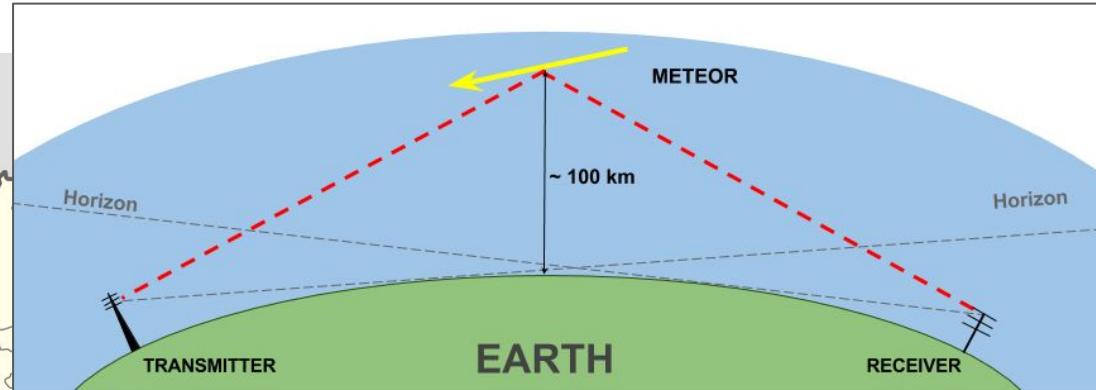
Building SPADE

Forward-scattering in Belgium



Building SPADE

Forward-scattering in Belgium



Geophysical Centre at
Dourbes

Humain
Radio-Astronomy
Station

BRAMS Transmitter – $f \sim 50$ MHz



Testing SPADE

August 2018



*Front End Electronics
(preamplifiers+baluns)
of SPADE antennas*

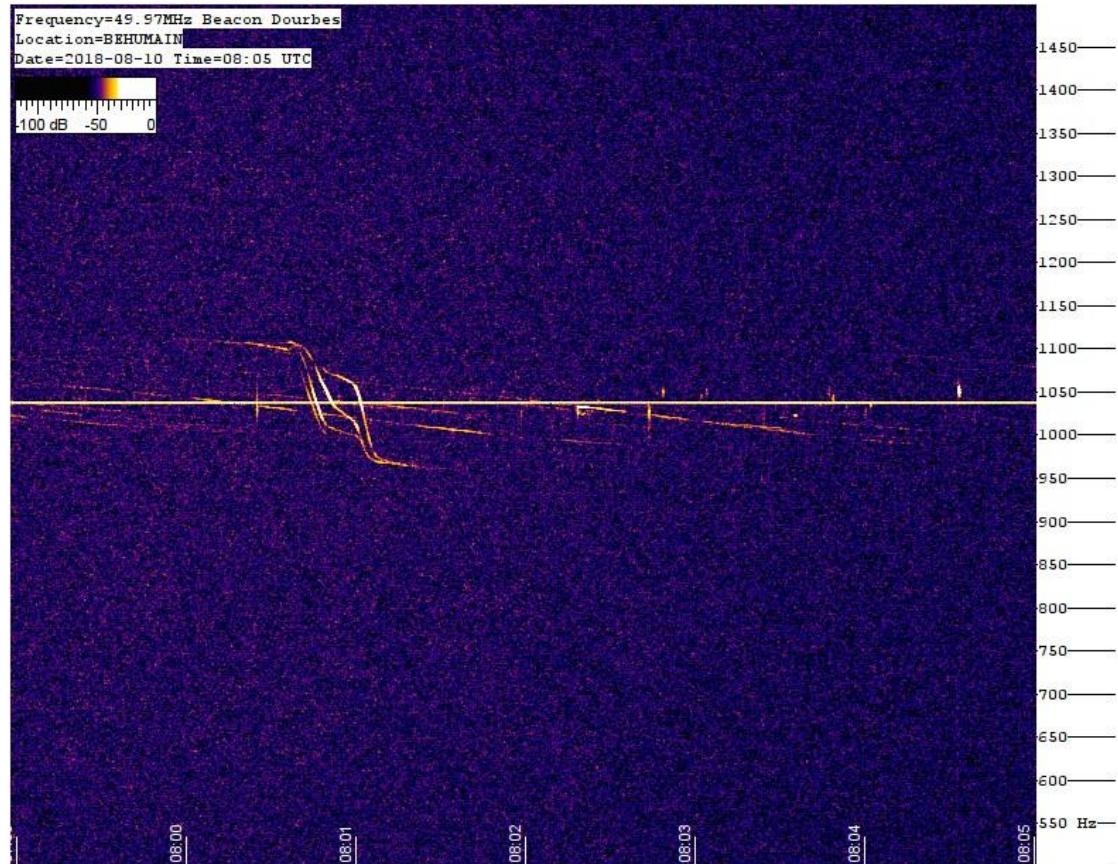
Analog Receiver
Icom PCR1500

SDR Rx
Fun Cube Dongle



Testing SPADE

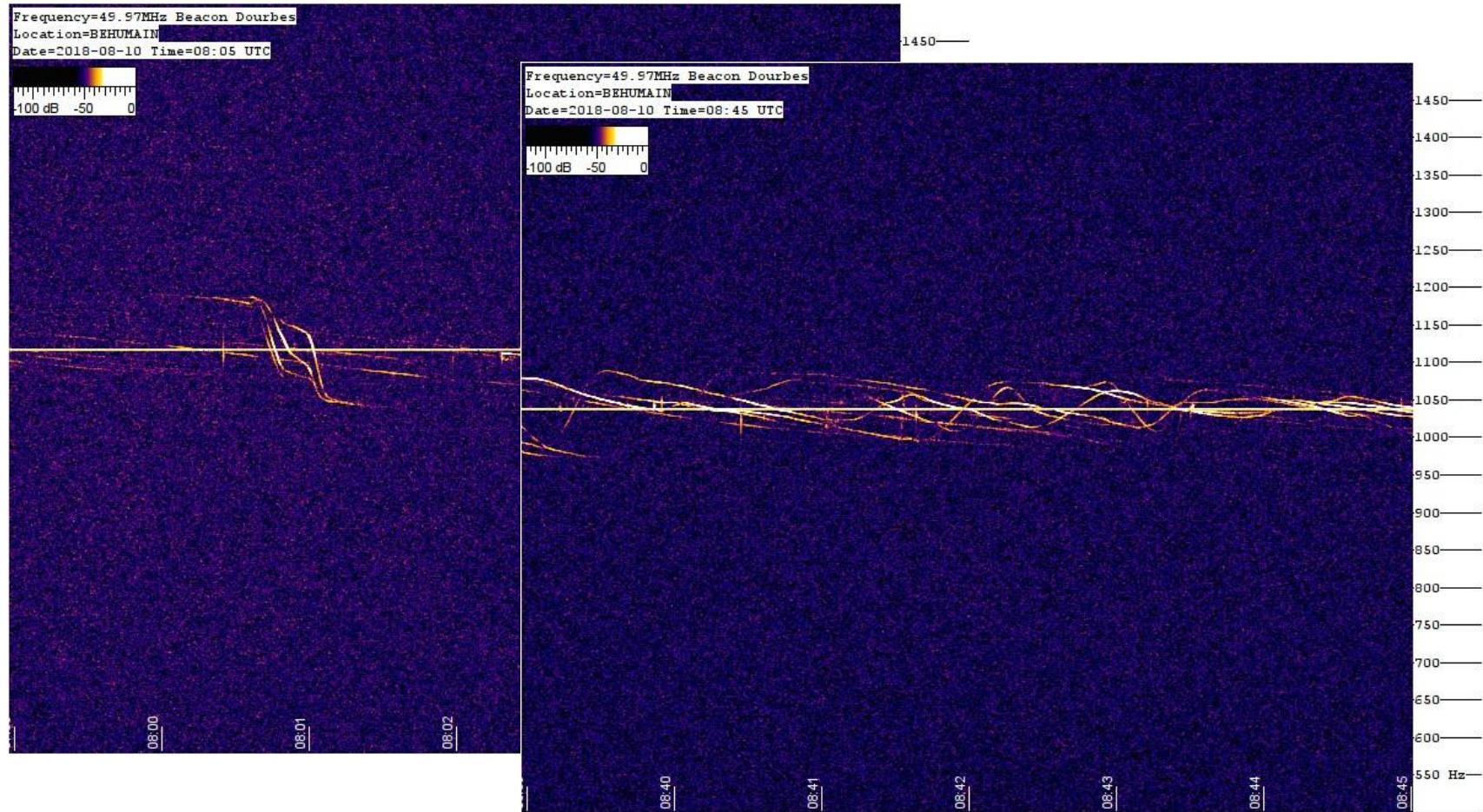
Some Results



We got planes!

Testing SPADE

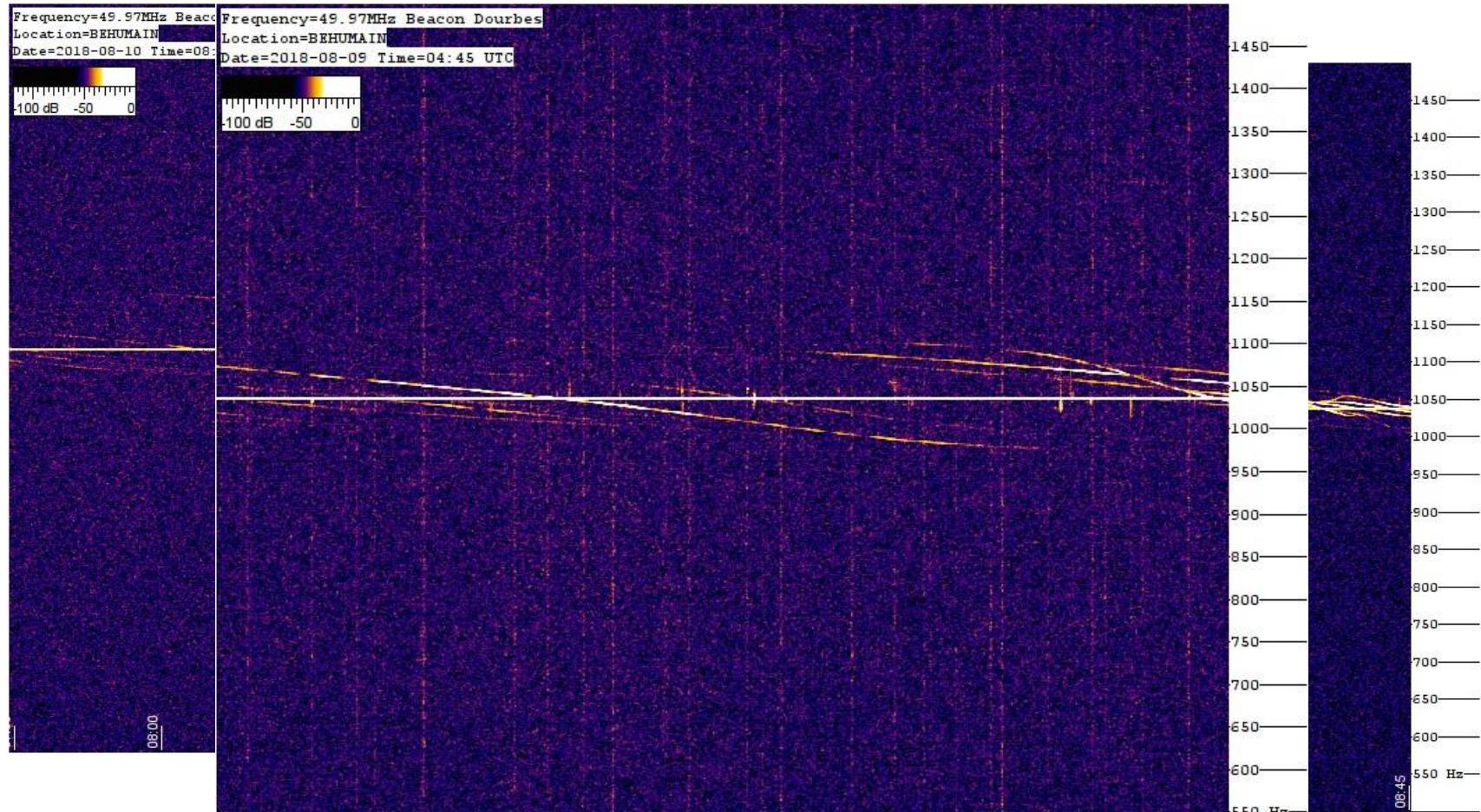
Some Results



A LOT of planes...

Testing SPADE

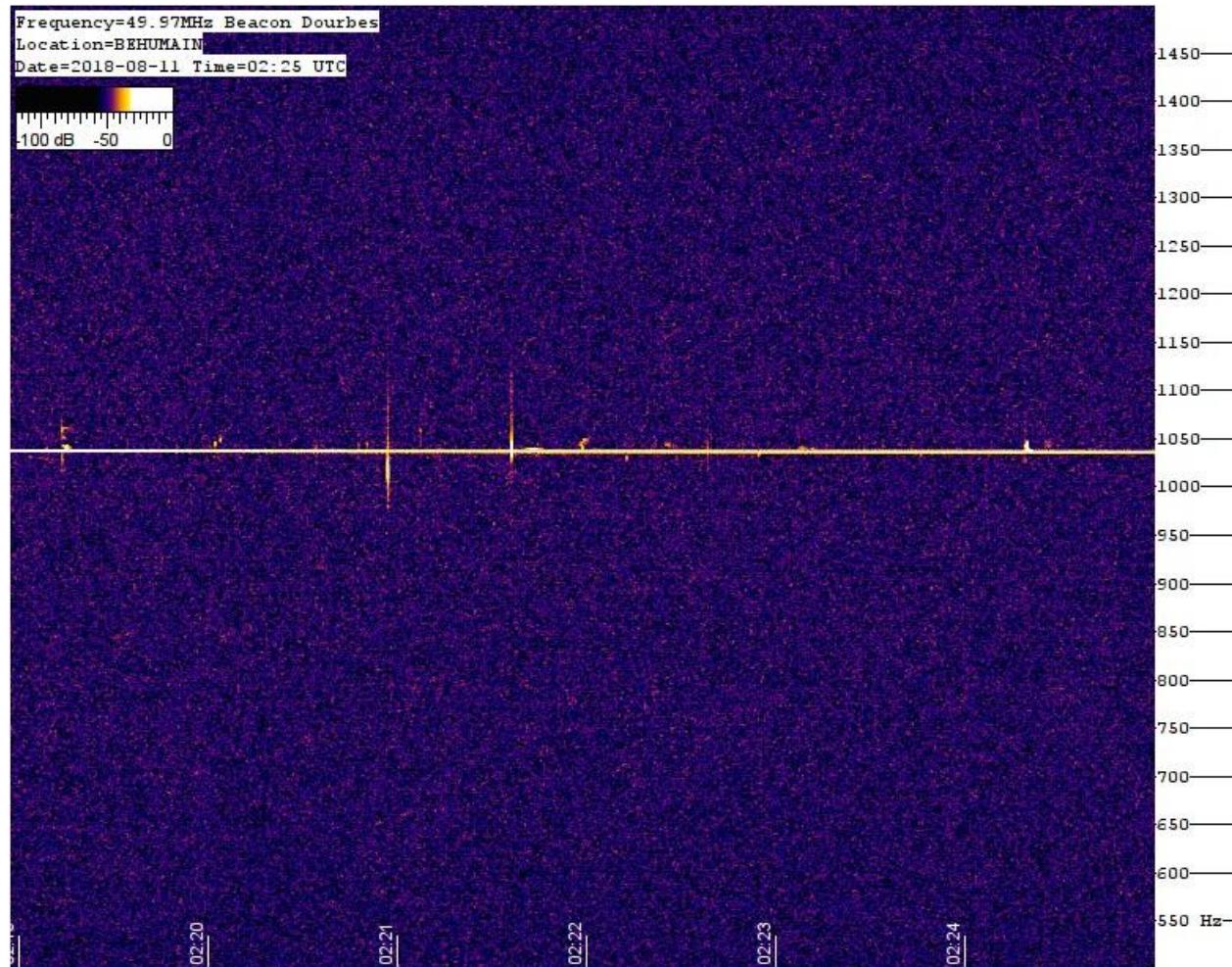
Some Results



... and even thunderstorms

Testing SPADE

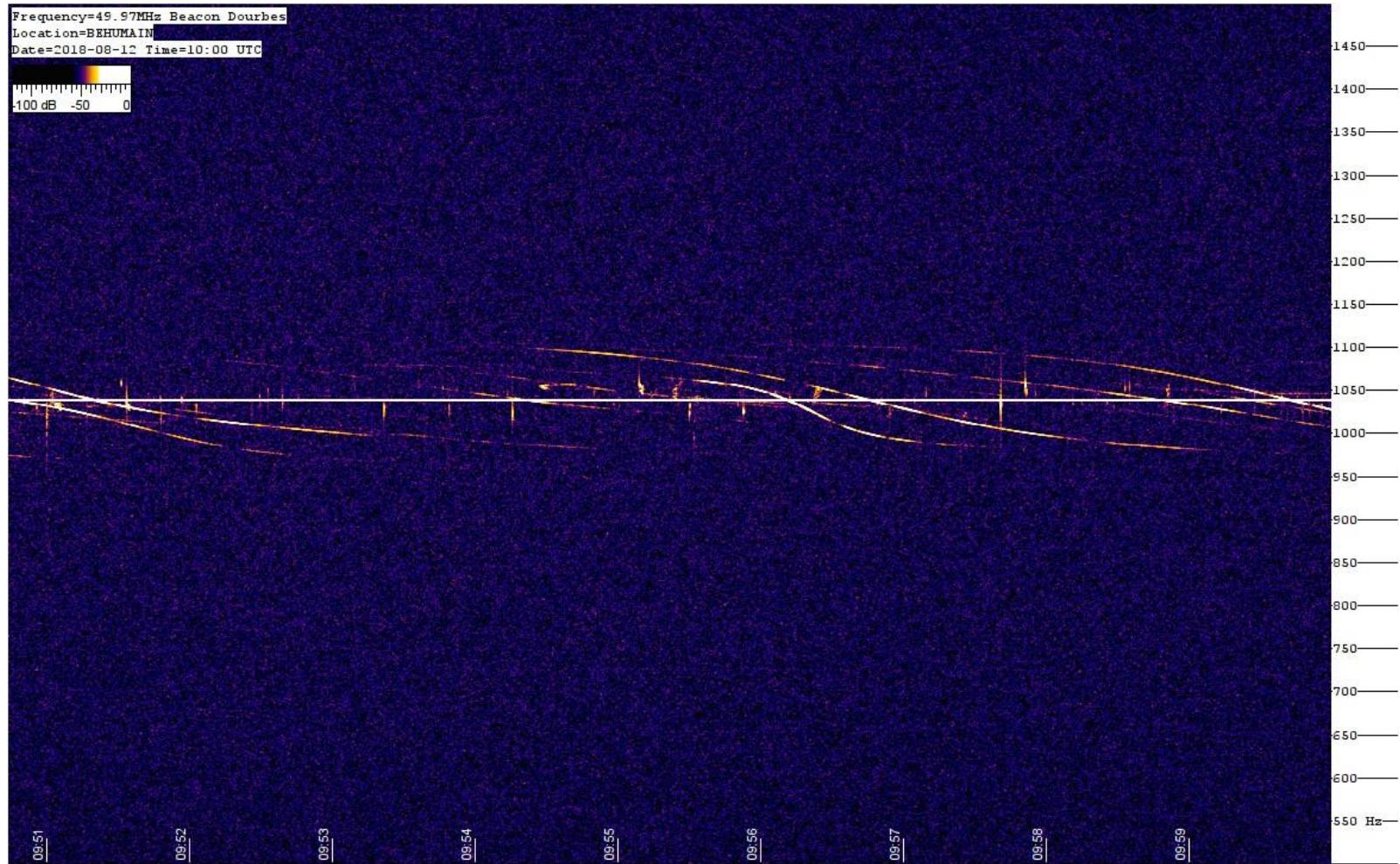
Some Results



Finally, some meteor echoes

Testing SPADE

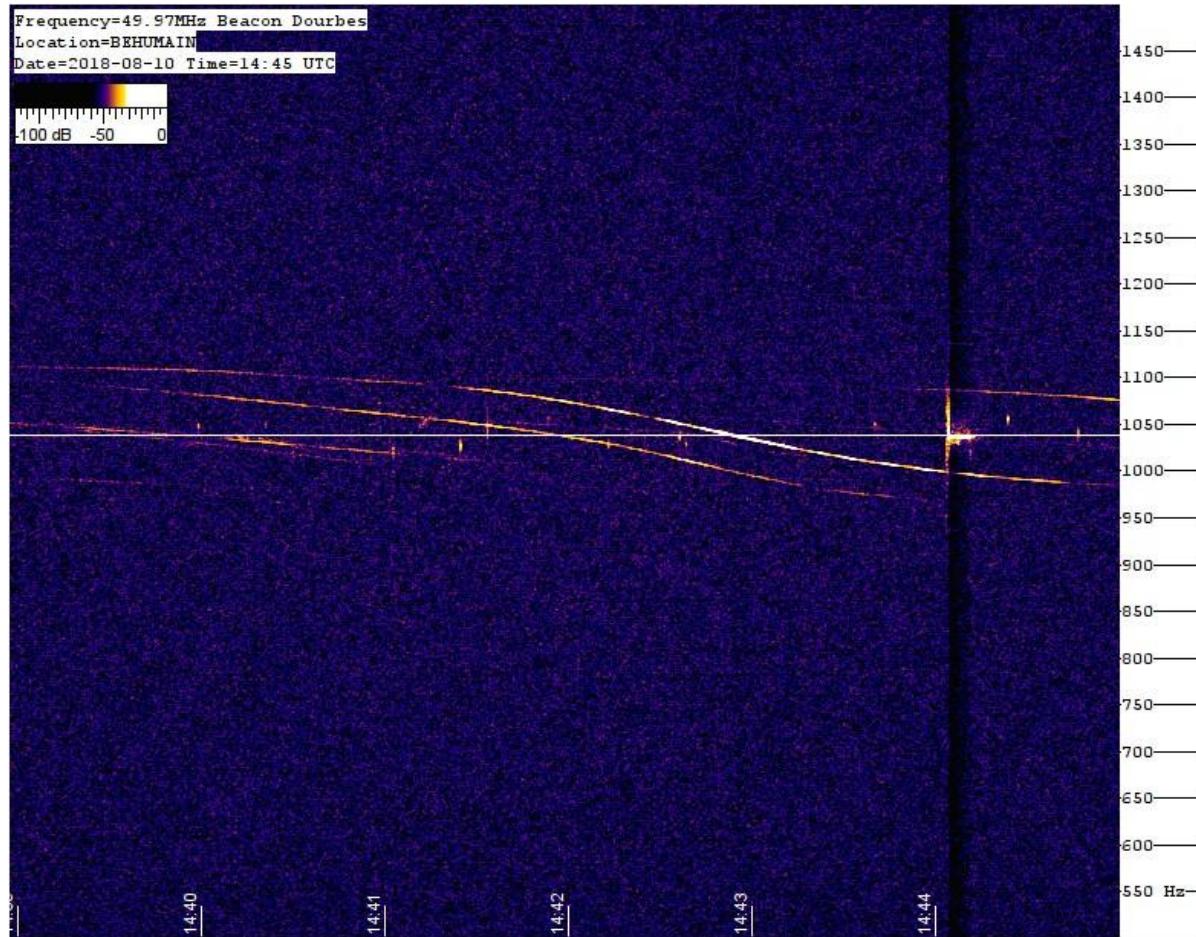
Some Results



Even underdense meteor echoes

Testing SPADE

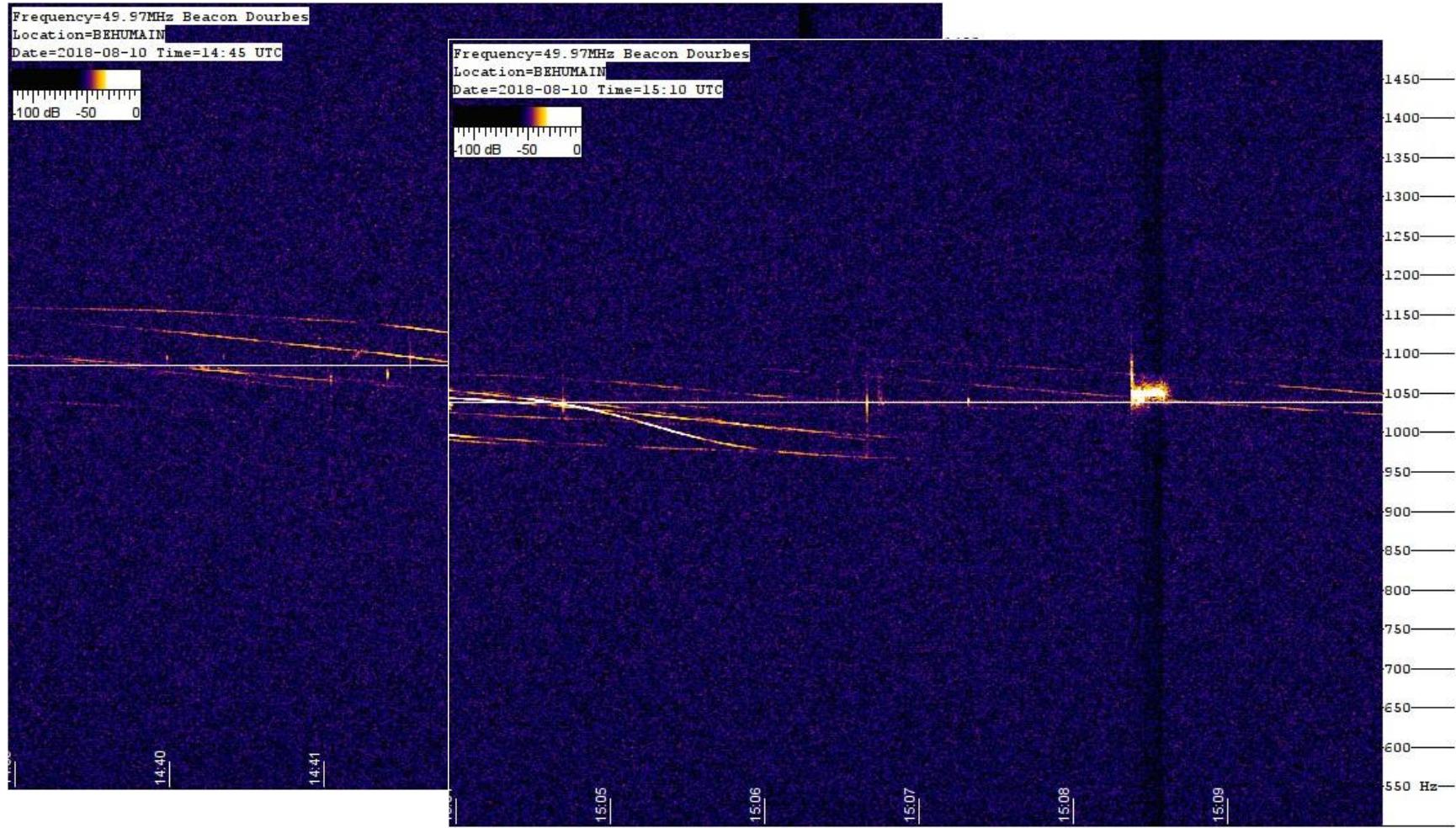
Some Results



Overdense meteor echoes as well

Testing SPADE

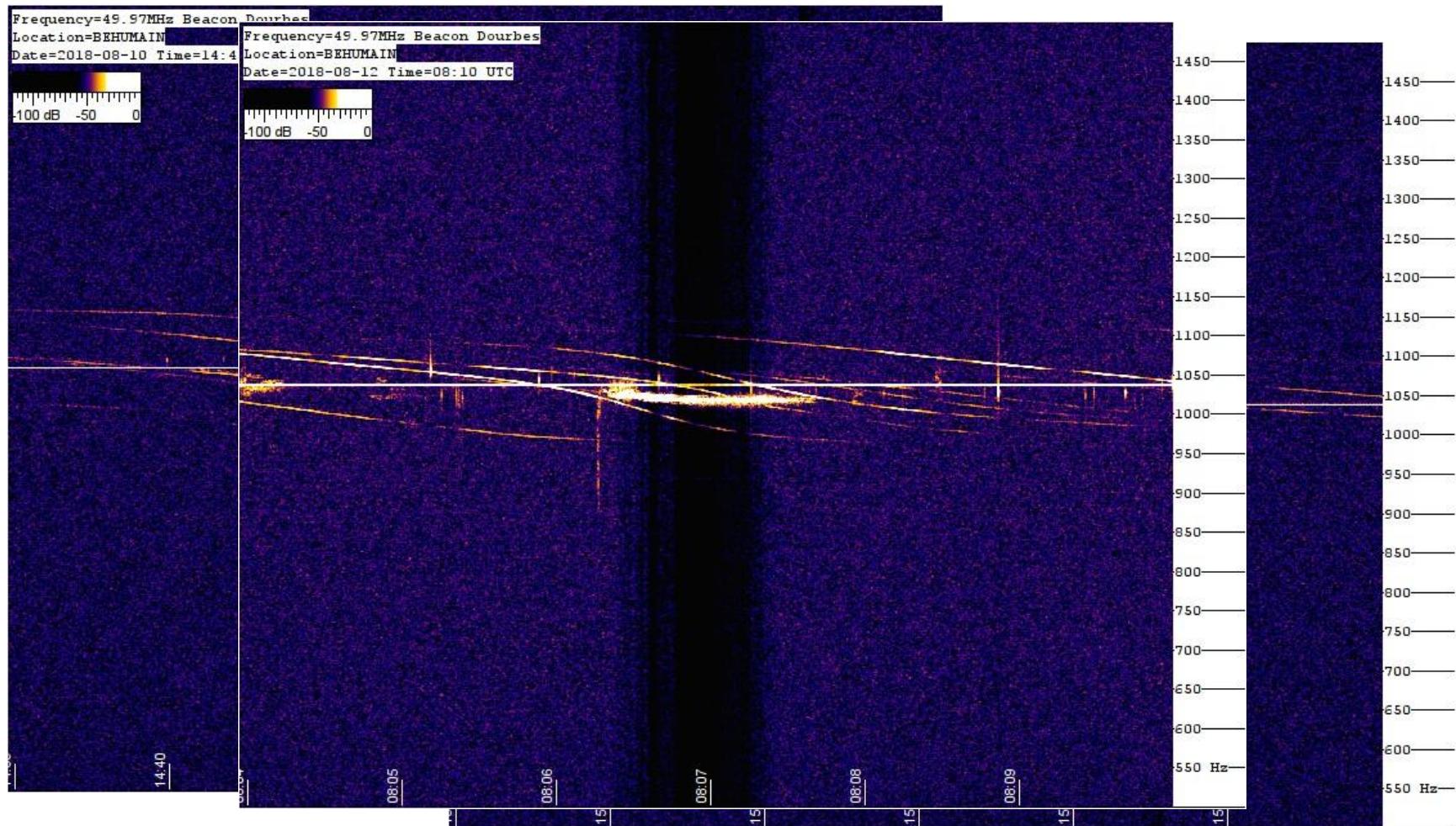
Some Results



Overdense meteor echoes as well

Testing SPADE

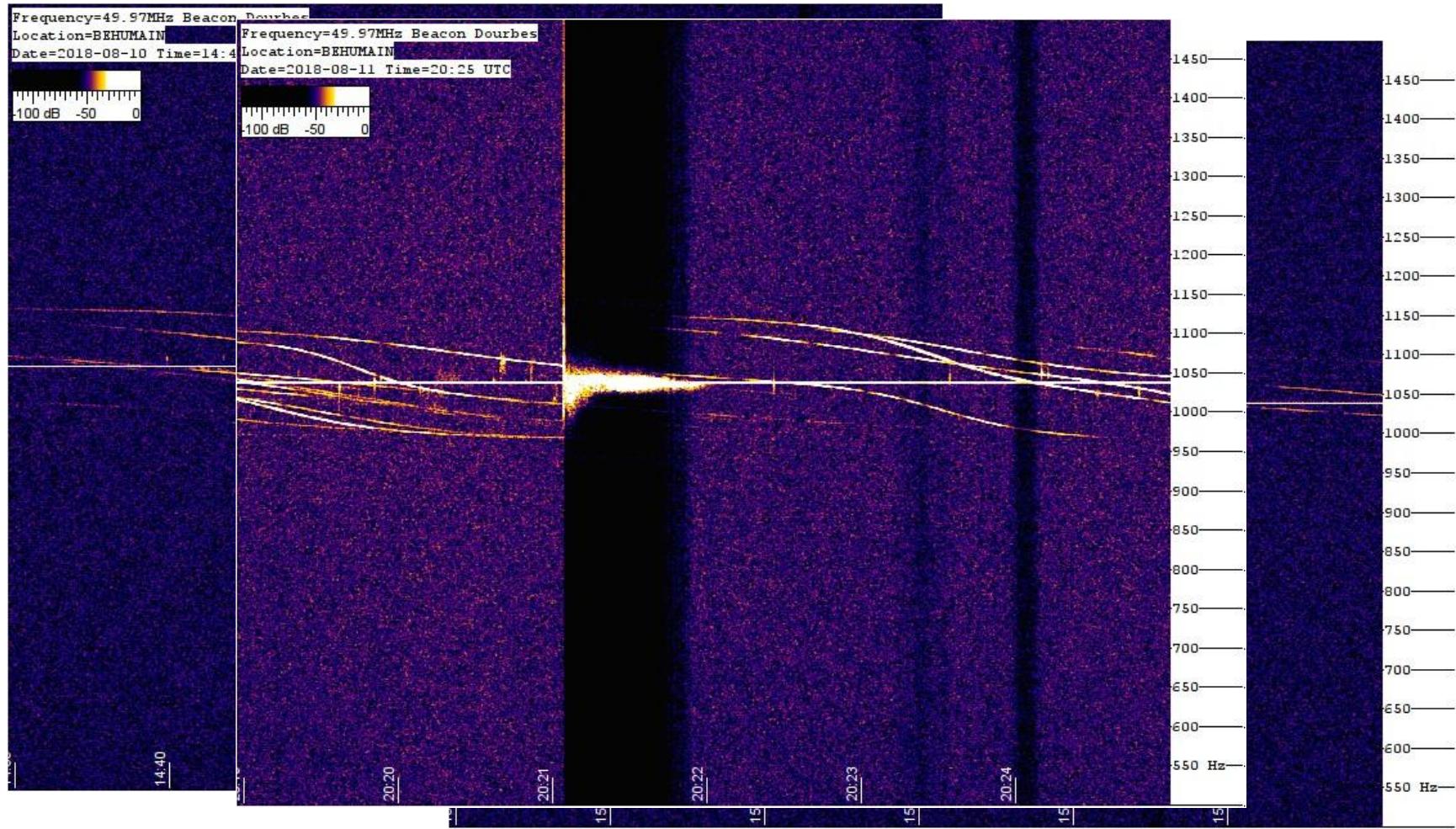
Some Results



Overdense meteor echoes as well

Testing SPADE

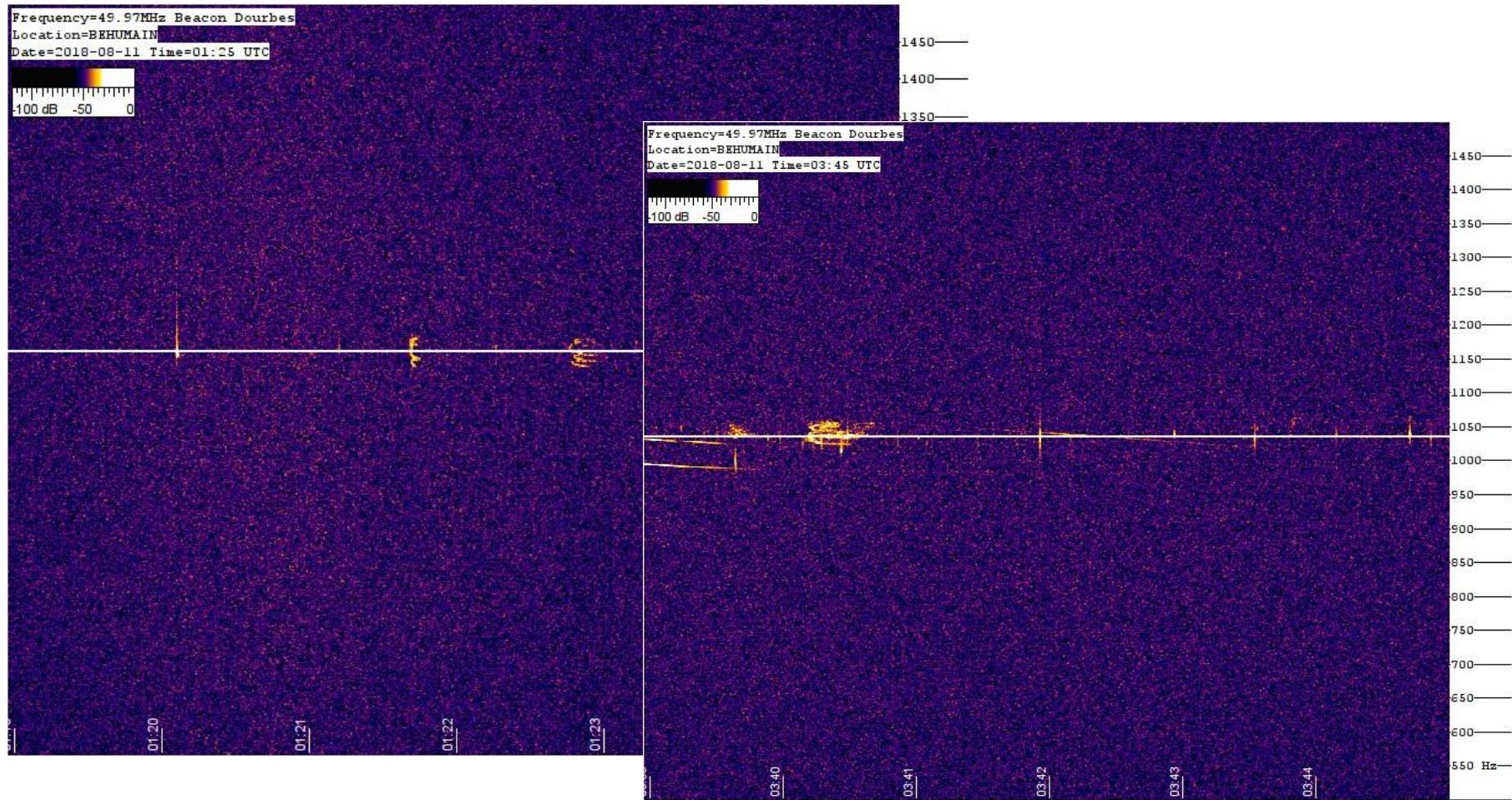
Some Results



Overdense meteor echoes as well

Testing SPADE

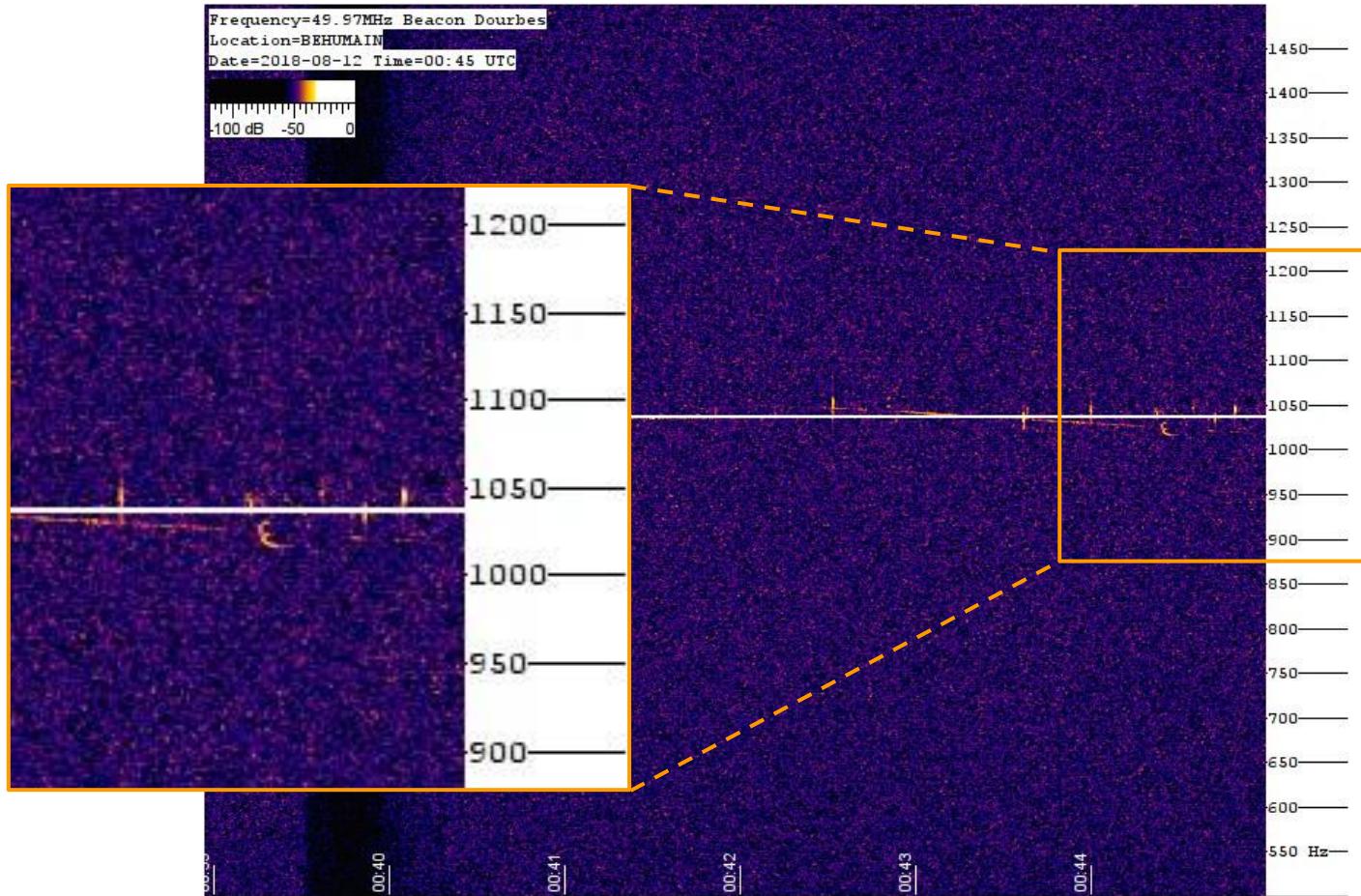
Some Results



Epsilons.... Present!

Testing SPADE

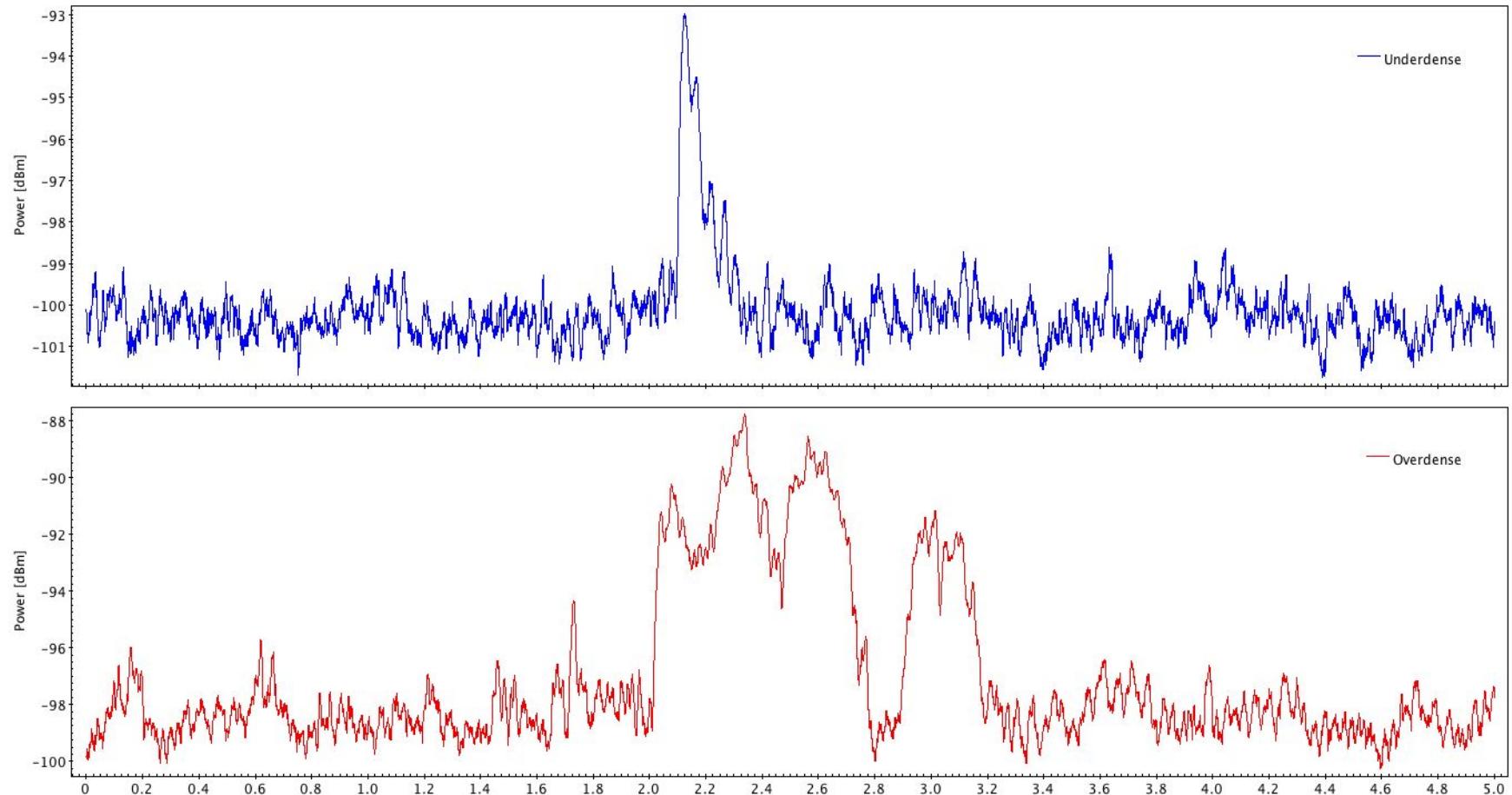
Some Results



Do not forget the baby-epsilon!

Testing SPADE

Some Results



Meteor echoes profiles

~~First~~ Light (not quite yet)

... but maybe it is the last appointment with the obstetrician!

