

International Meteor Conference

September 21–24, 2017
Petnica – Serbia



Using a small phased array for meteor observations

A. Martínez Picar and C. Marqué

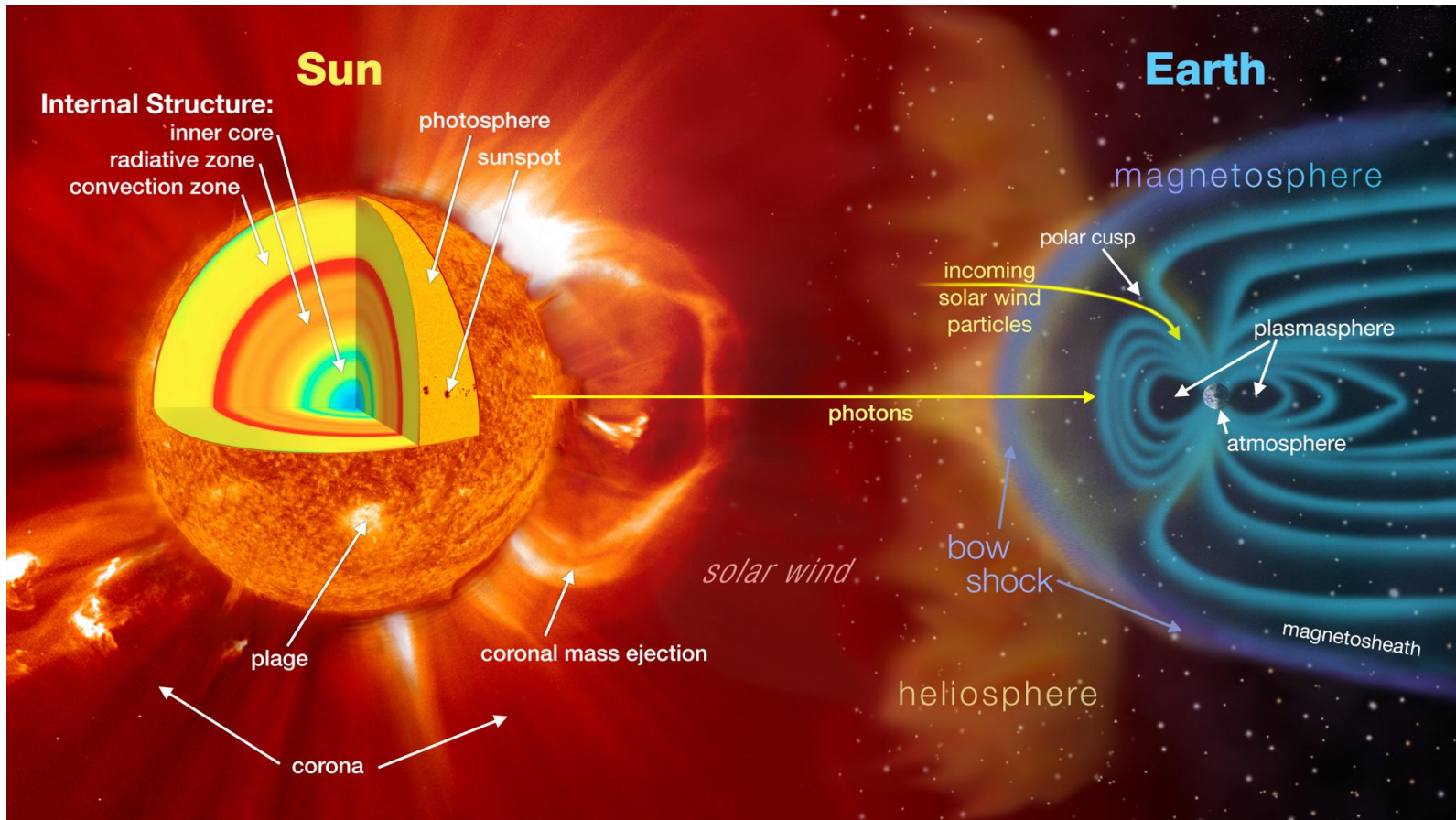


**Solar-Terrestrial
Centre of
Excellence**

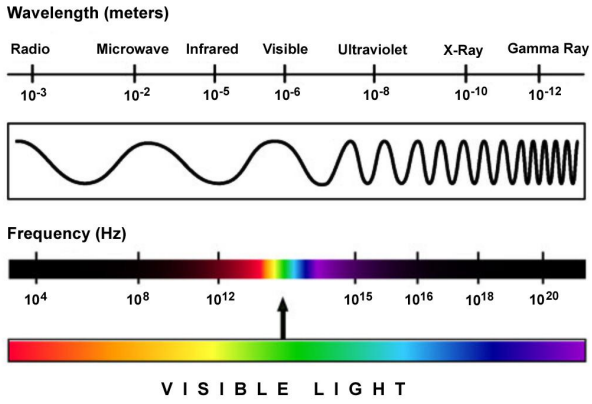
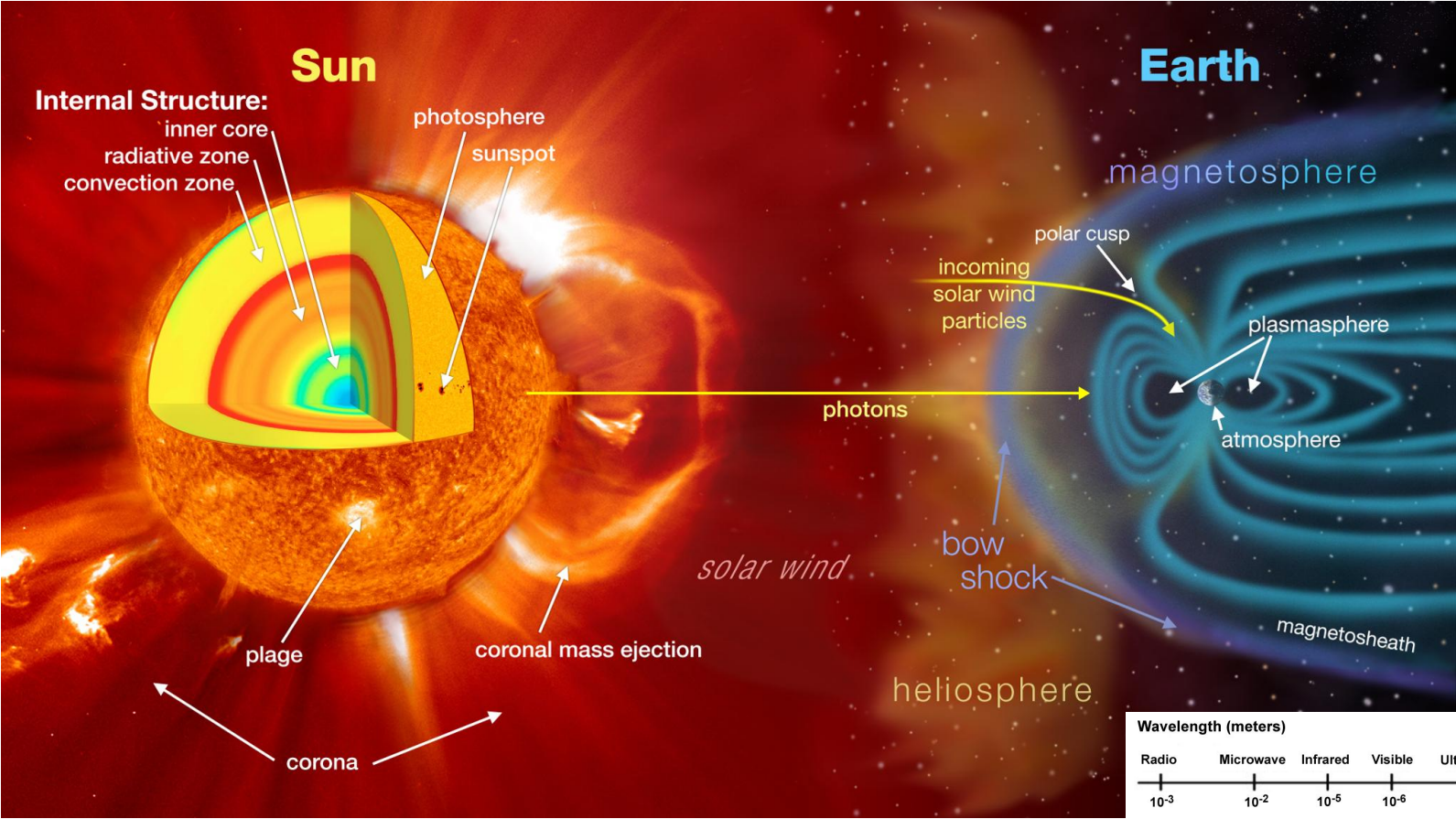


**Royal Observatory
of Belgium**

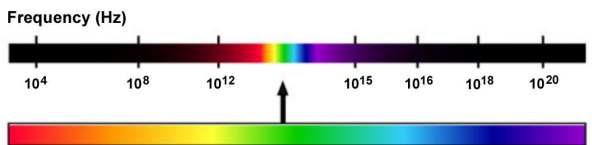
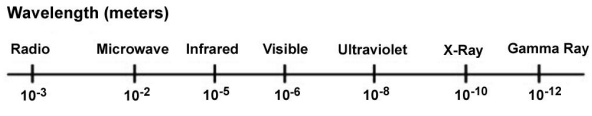
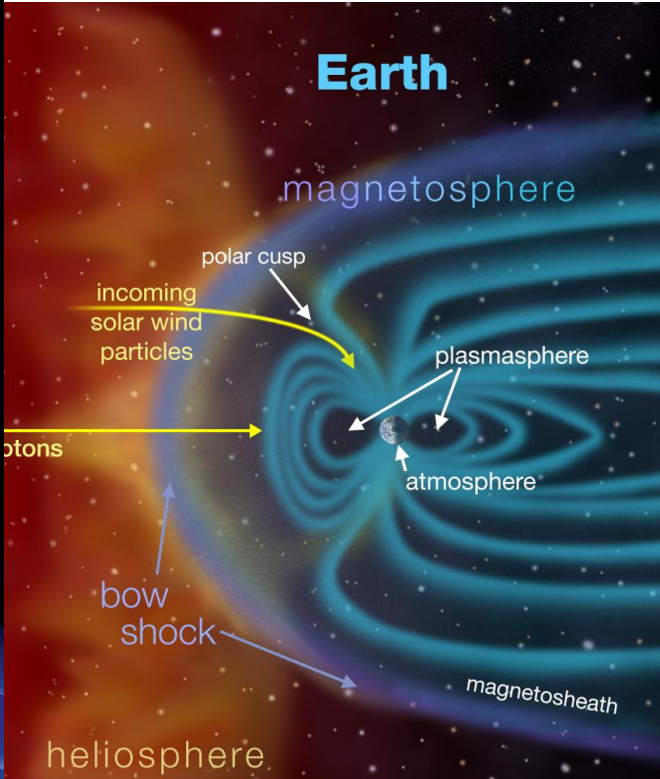
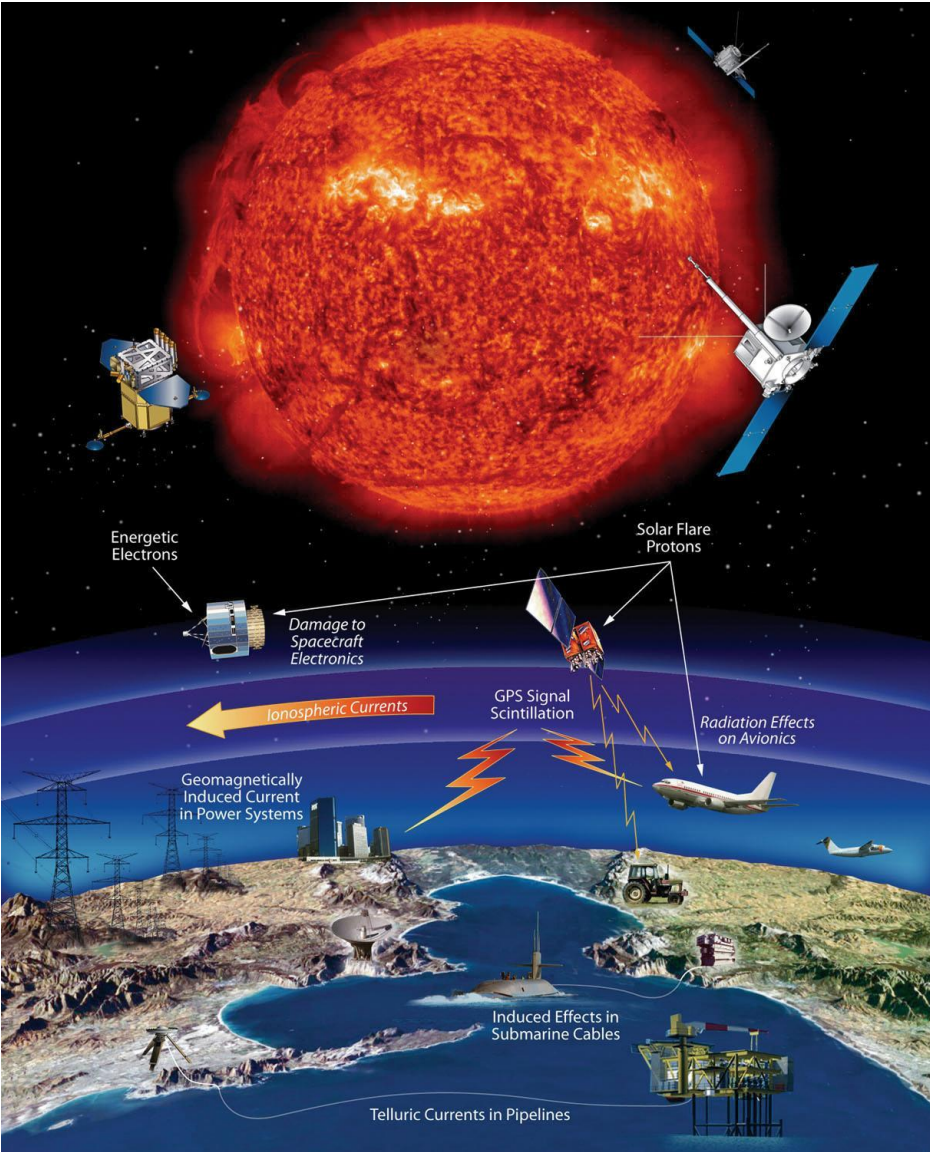
Sun – Earth Interaction



Sun – Earth Interaction



Sun – Earth Interaction



VISIBLE LIGHT

ROB / Solar Influences Data Center



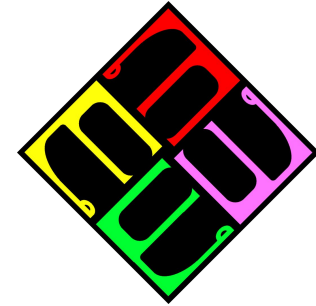
ROB / Solar Influences Data Center



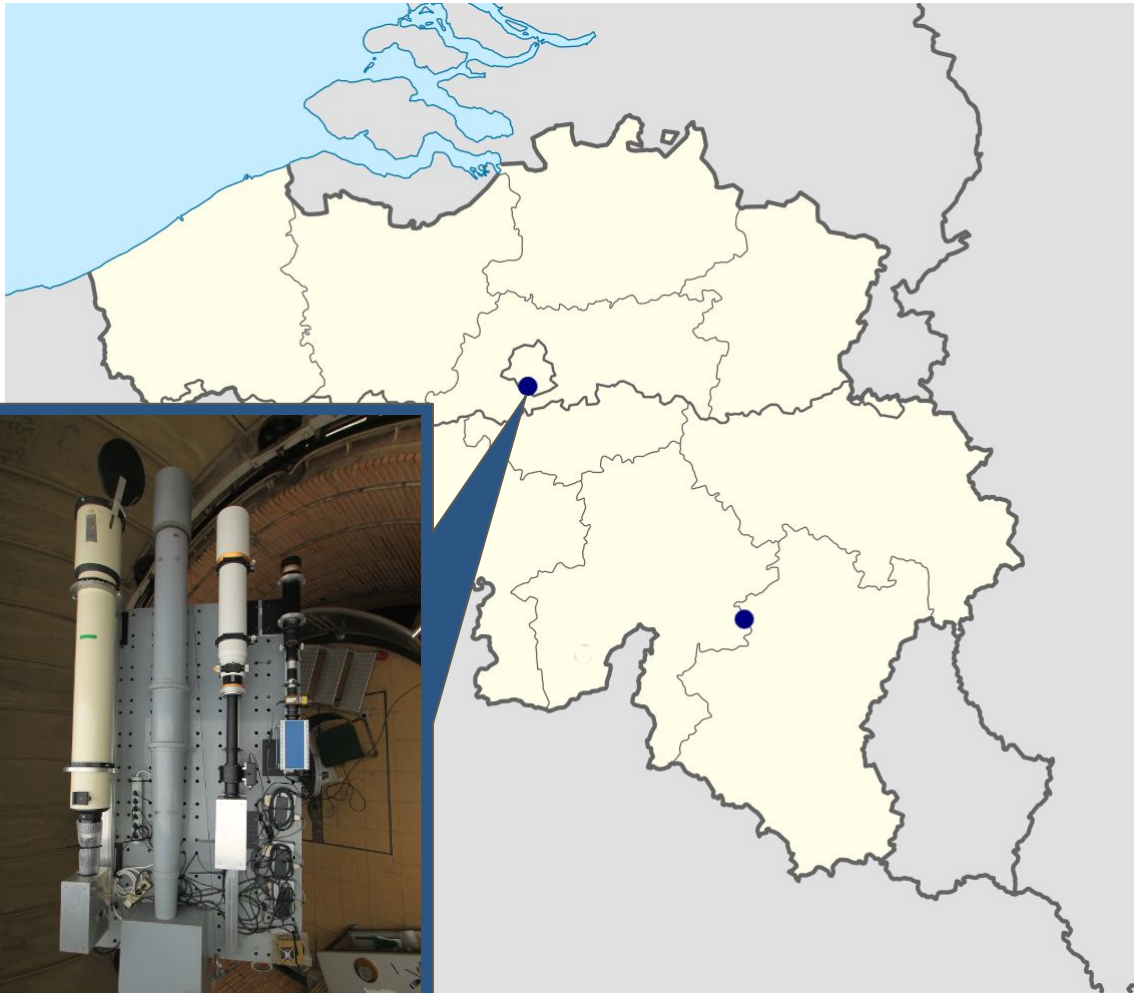
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Space Instruments



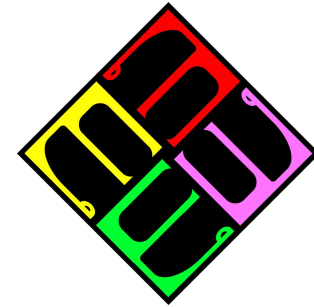
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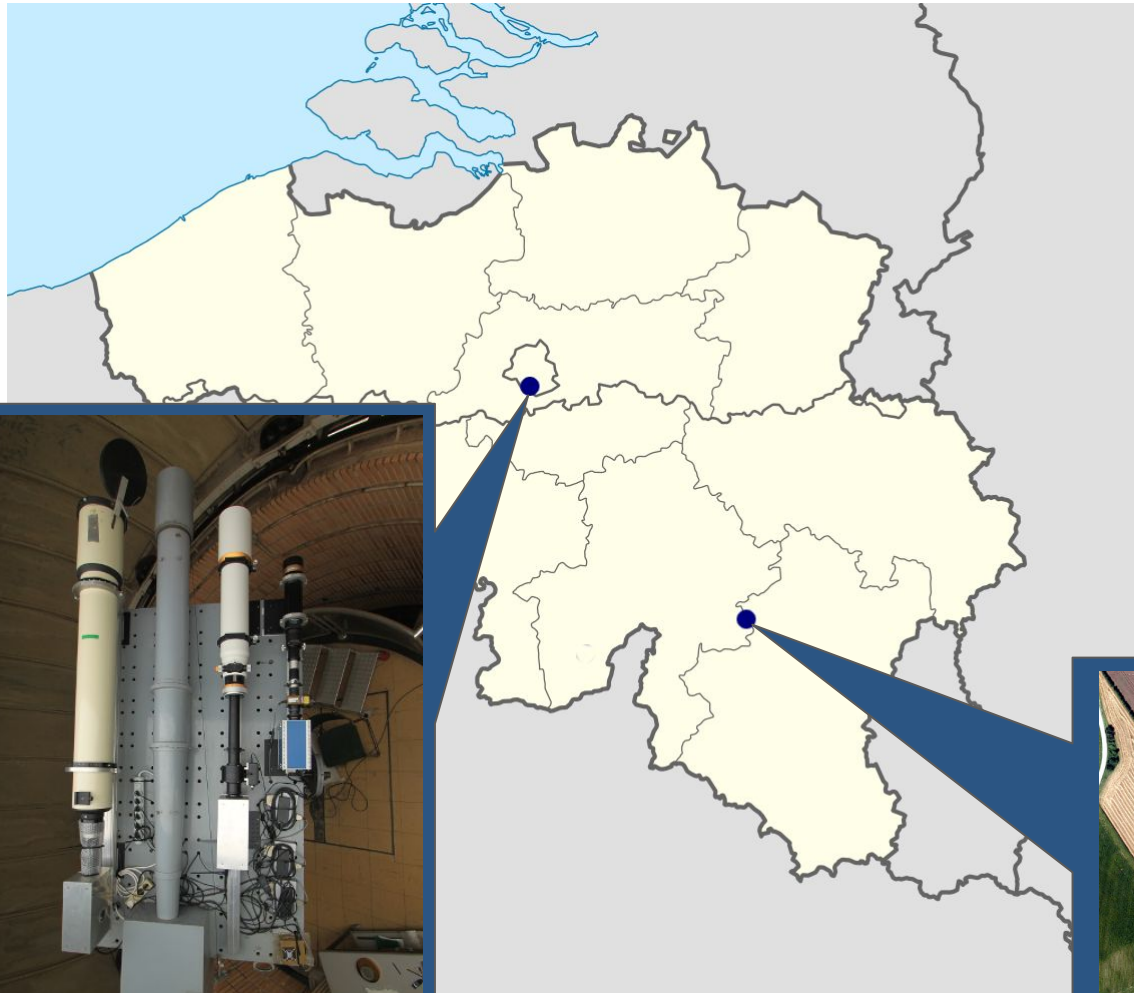
USET

Ground-Based
Facilities

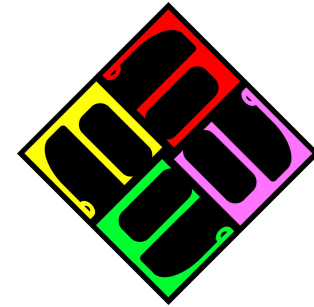
Space Instruments



ROB / Solar Influences Data Center

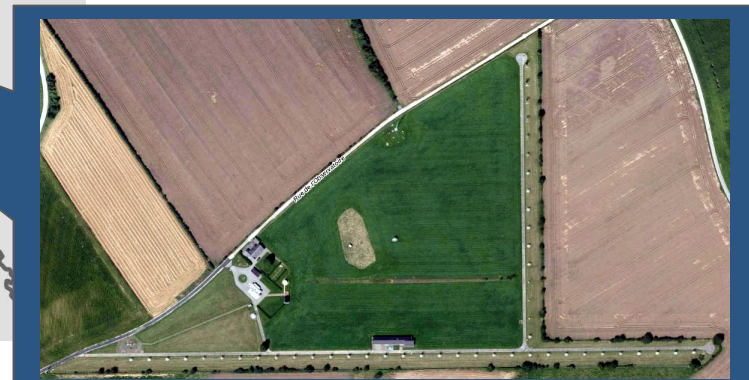


Space Instruments



USET

**Ground-Based
Facilities**

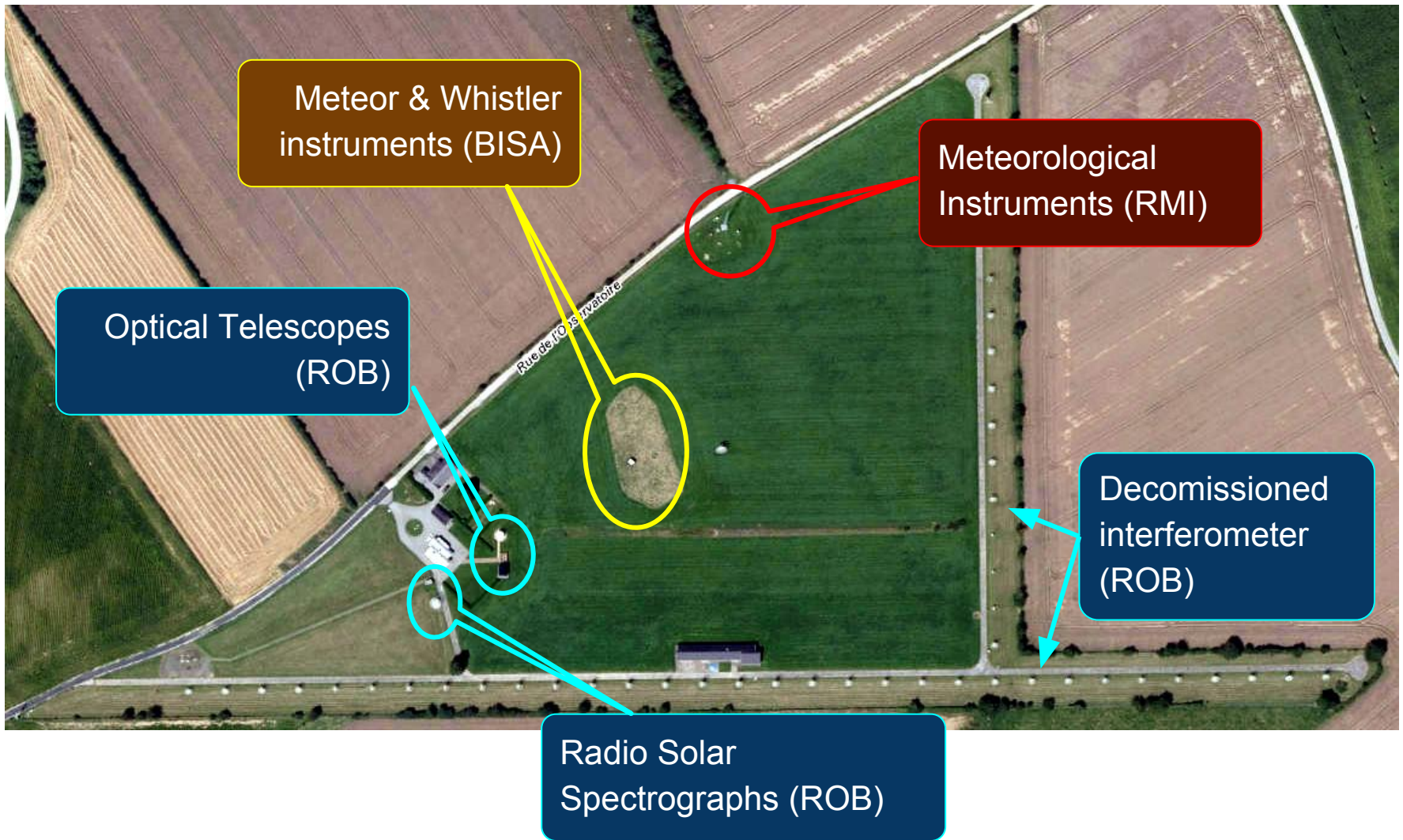


**Human Radio-Astronomy
Station**

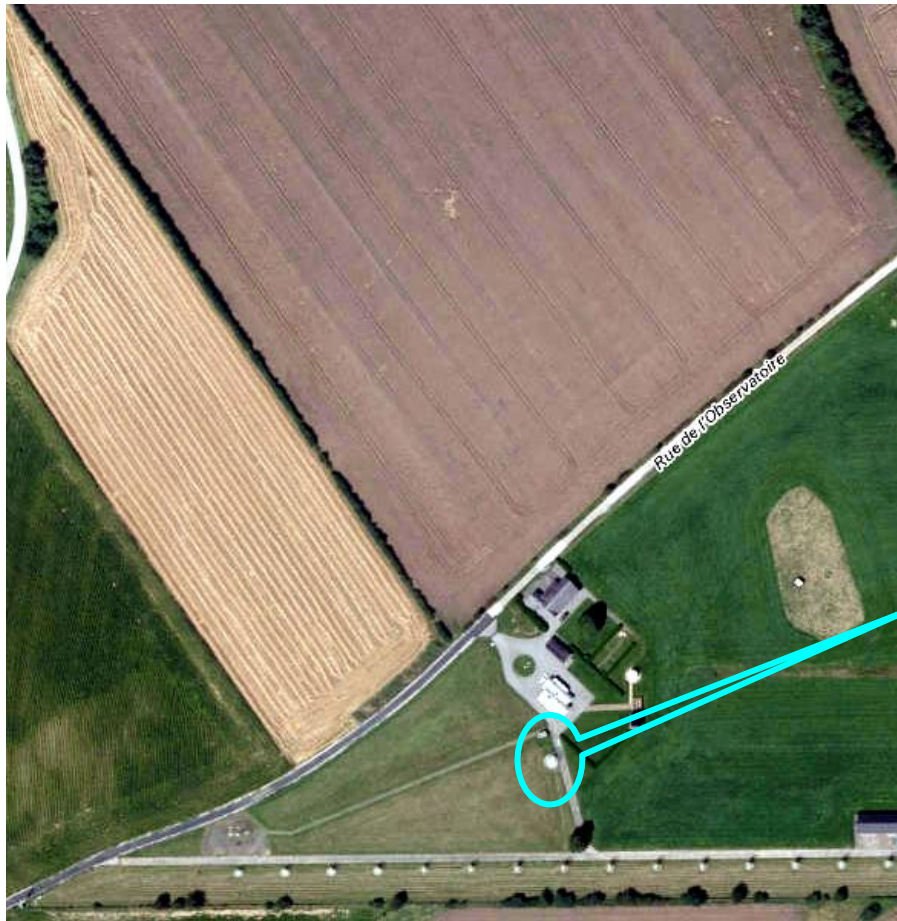
Humain Radio–Astronomy Station



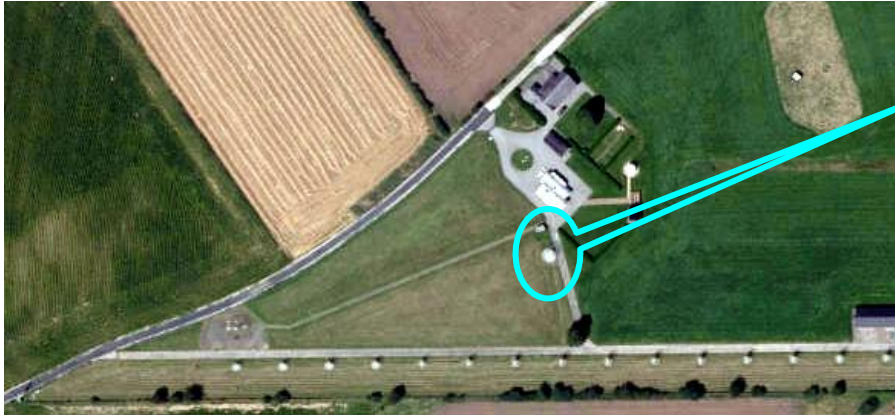
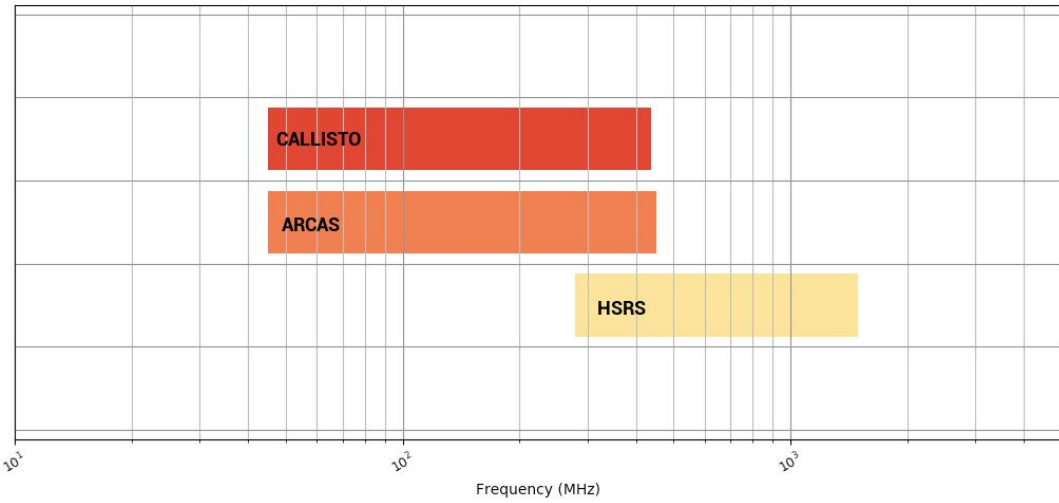
Humain Radio–Astronomy Station



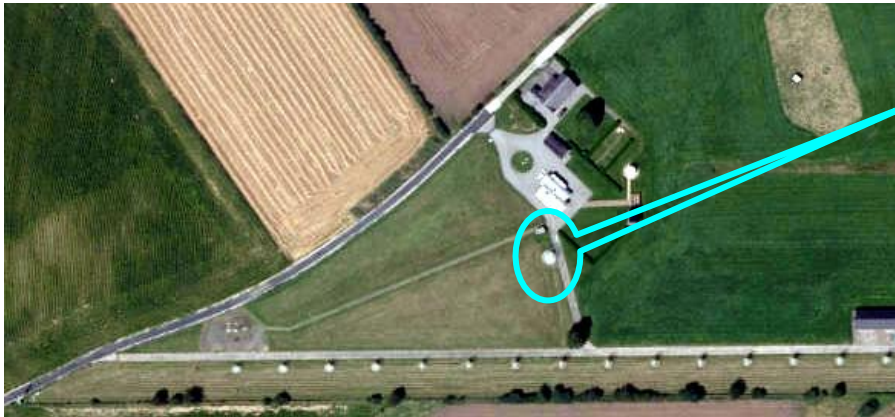
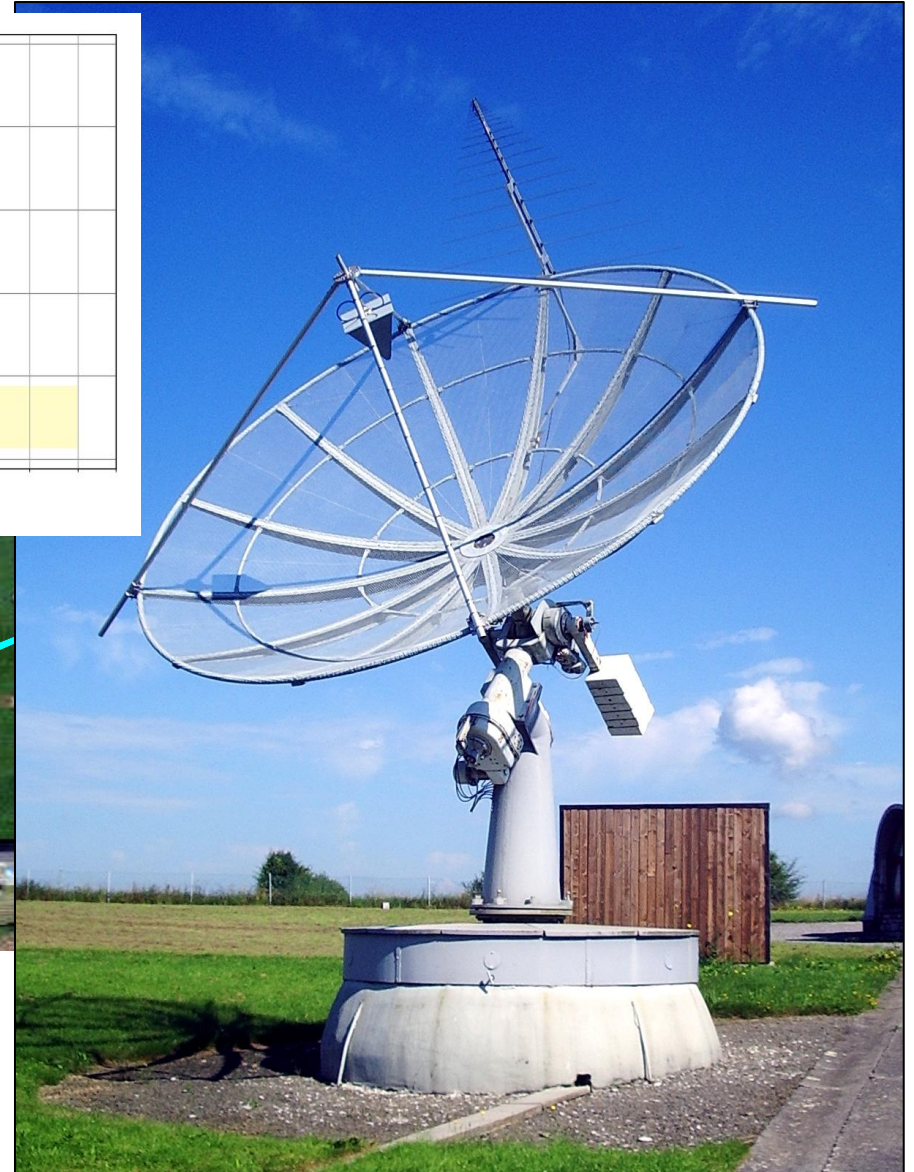
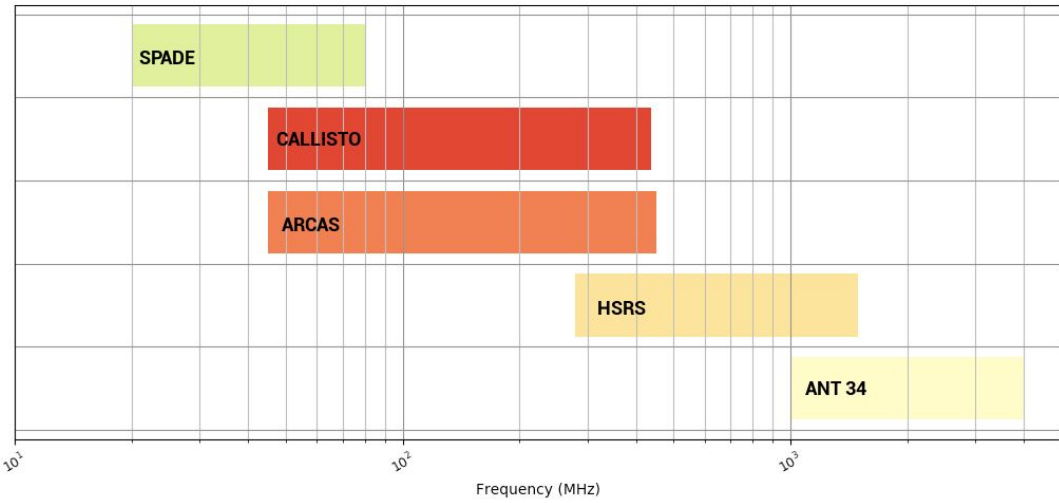
Humain Radio–Astronomy Station



Human Radio–Astronomy Station



Human Radio–Astronomy Station

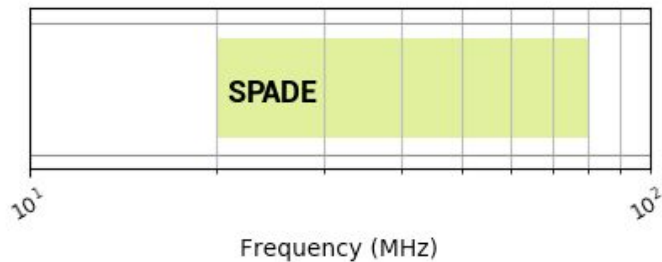


SPADE: Small Phased Array Demonstrator

- Small Array of 8 elements
- Software Defined Radio
based receivers → Digital beamforming
- Main goal: Dynamic spectra (not imaging)
- Frequency Range: 20 – 80 MHz



Kick-off: January 2016



- No mechanical parts
- Digital post-processing allows high flexibility
- Near-realtime dynamic spectrum observations

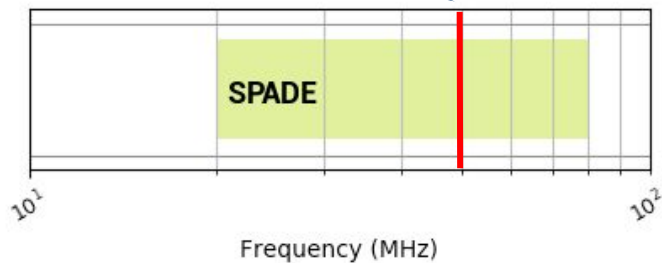
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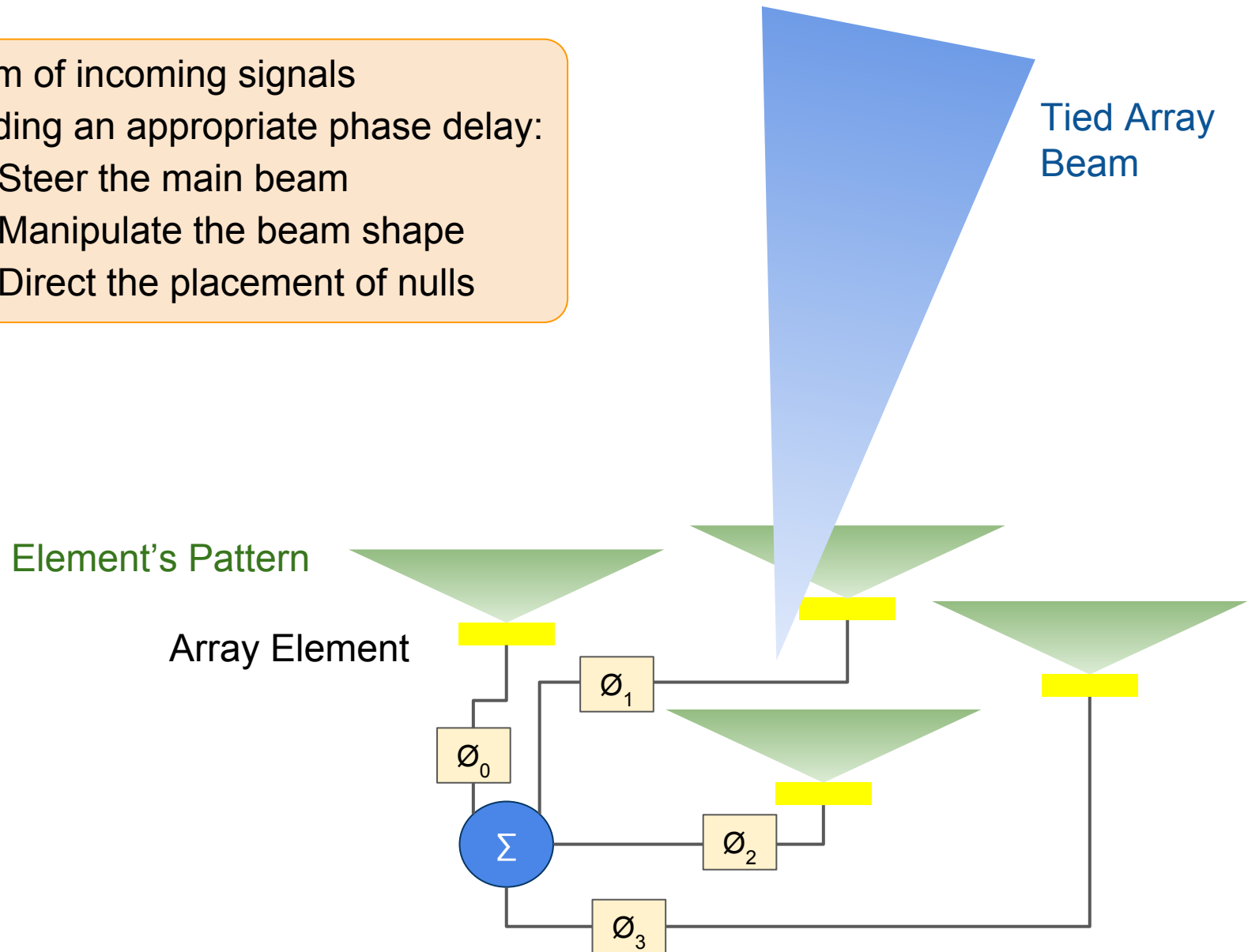
Kick-off: January 2016

**BRAMS
beacon**



Phased Array

- Sum of incoming signals
- Adding an appropriate phase delay:
 - Steer the main beam
 - Manipulate the beam shape
 - Direct the placement of nulls

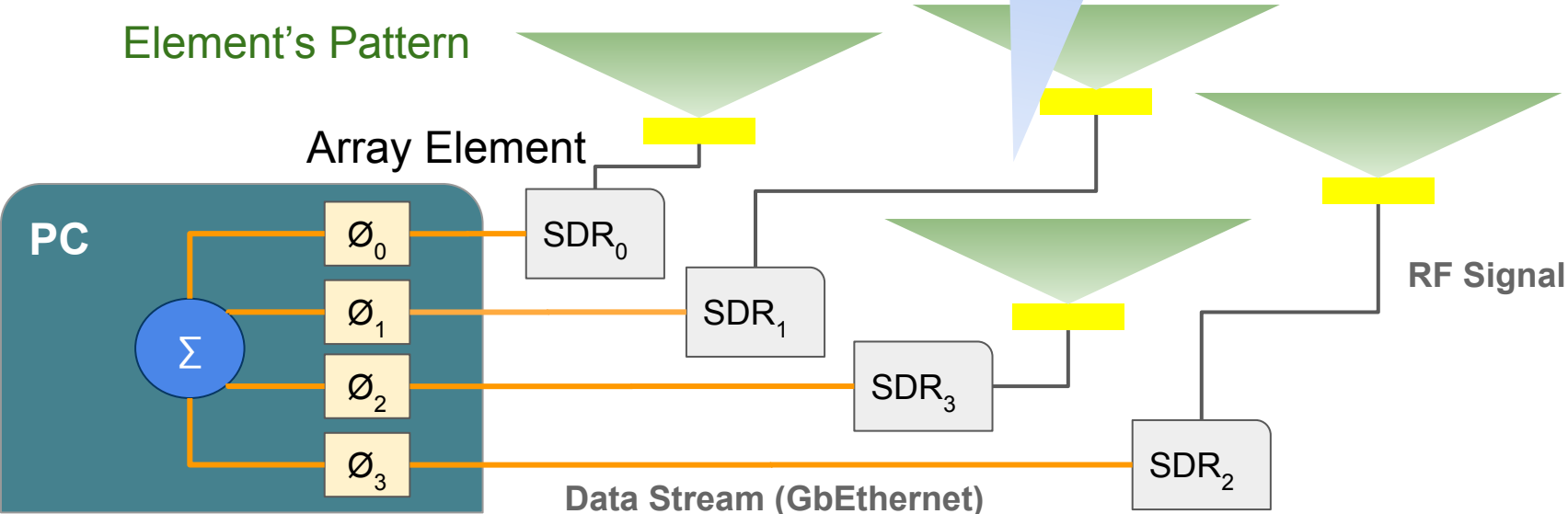


Phased Array – Digital Beamforming



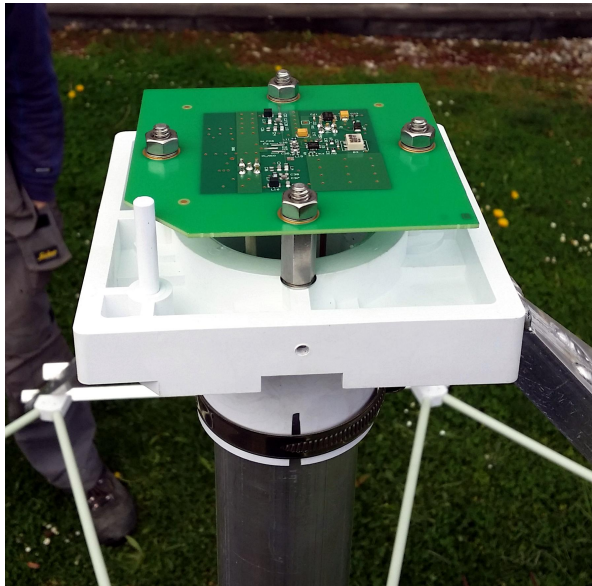
Tied Array Beam

Element's Pattern



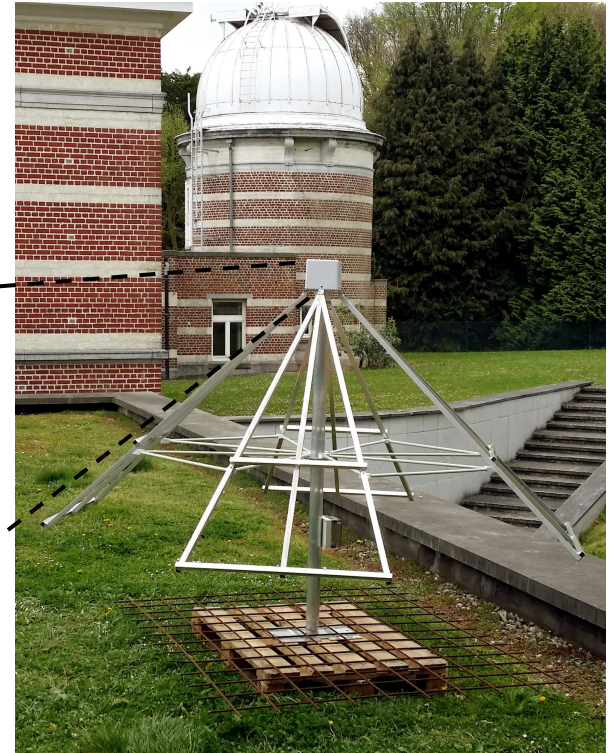
Array Element

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



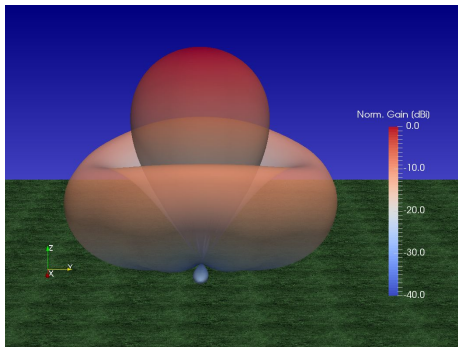
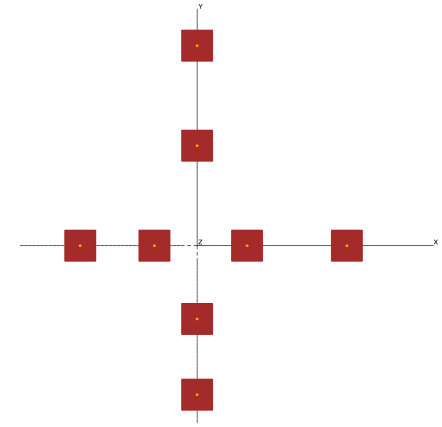
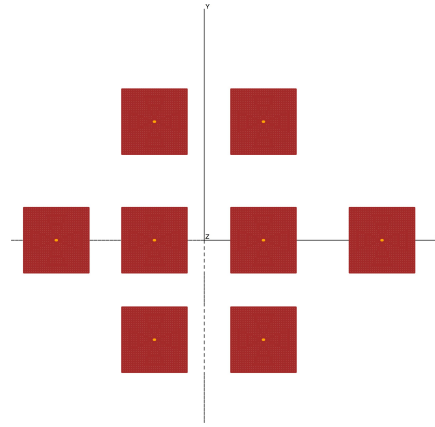
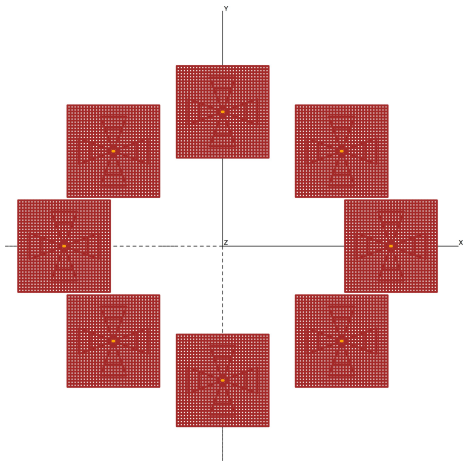
Front End Electronics

Antenna

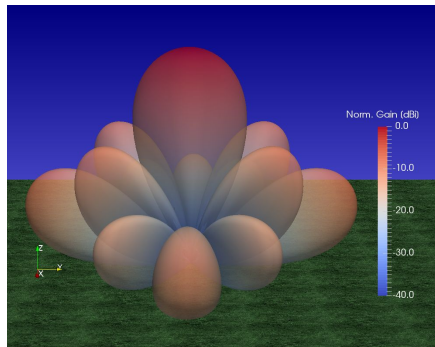


Array Configuration

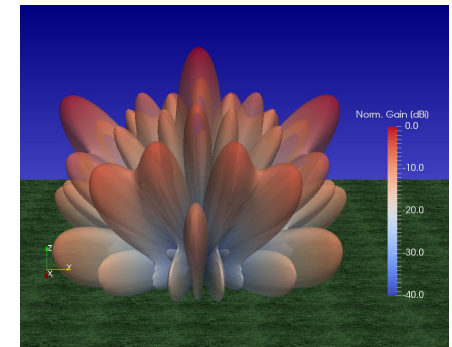
The layout of the array must provide a symmetric beam with low sidelobe levels



Elliptical



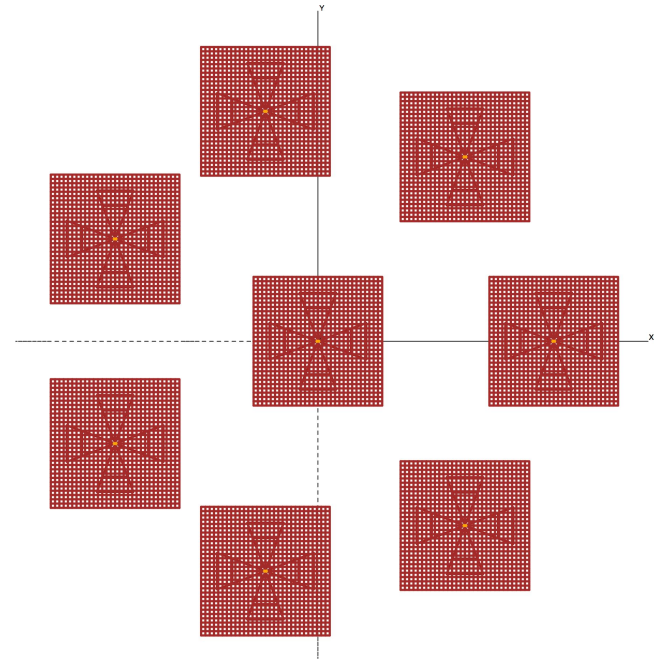
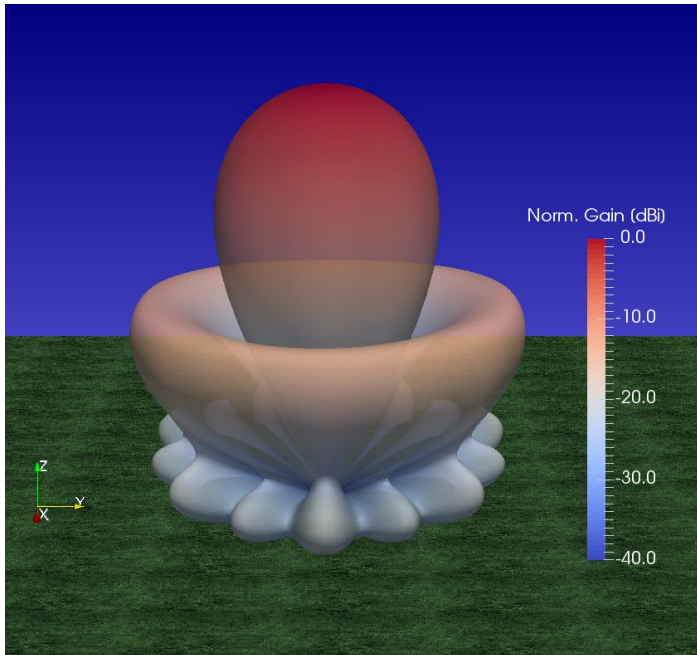
"Fat Cross"



Double Spiral

Array Configuration

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



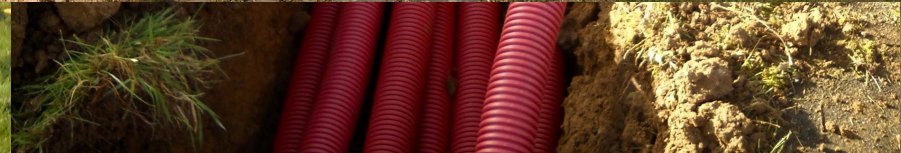
Building SPADE



Building SPADE



Building SPADE



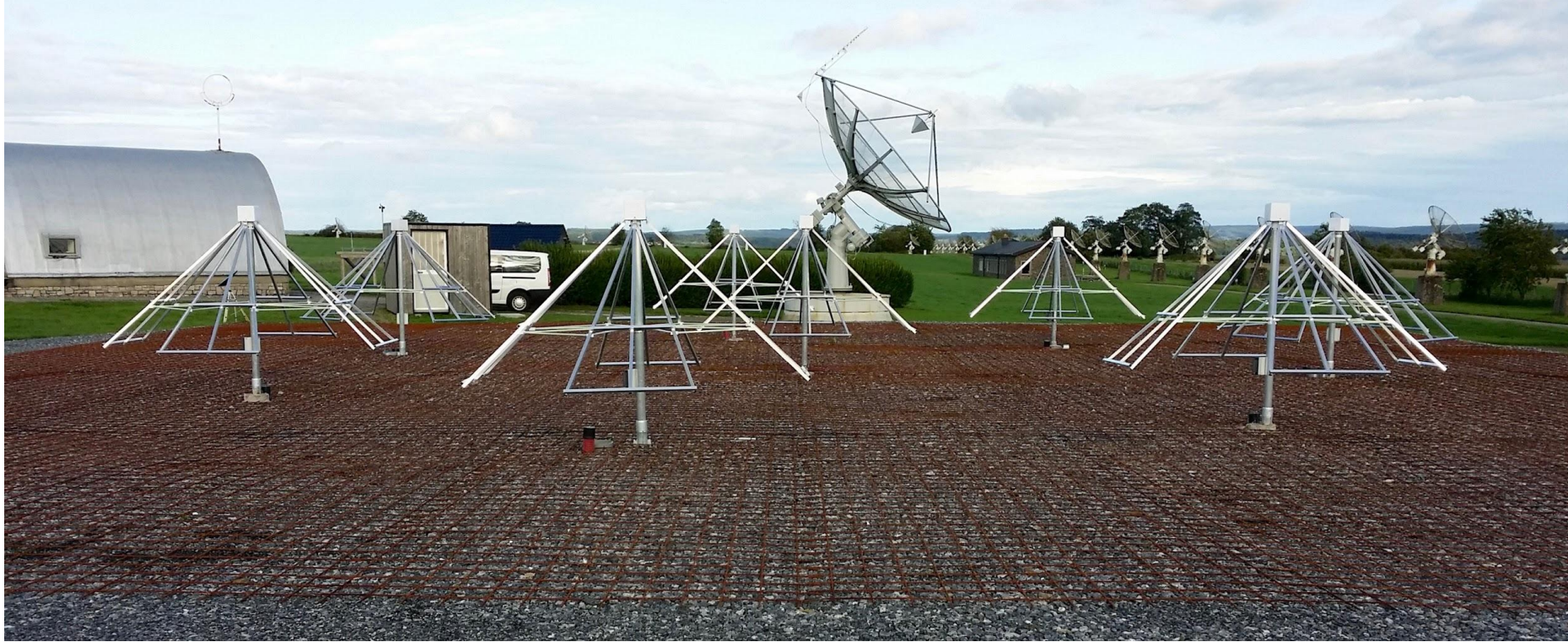
Building SPADE



Building SPADE



So... when?



First Light scheduled for December 2017