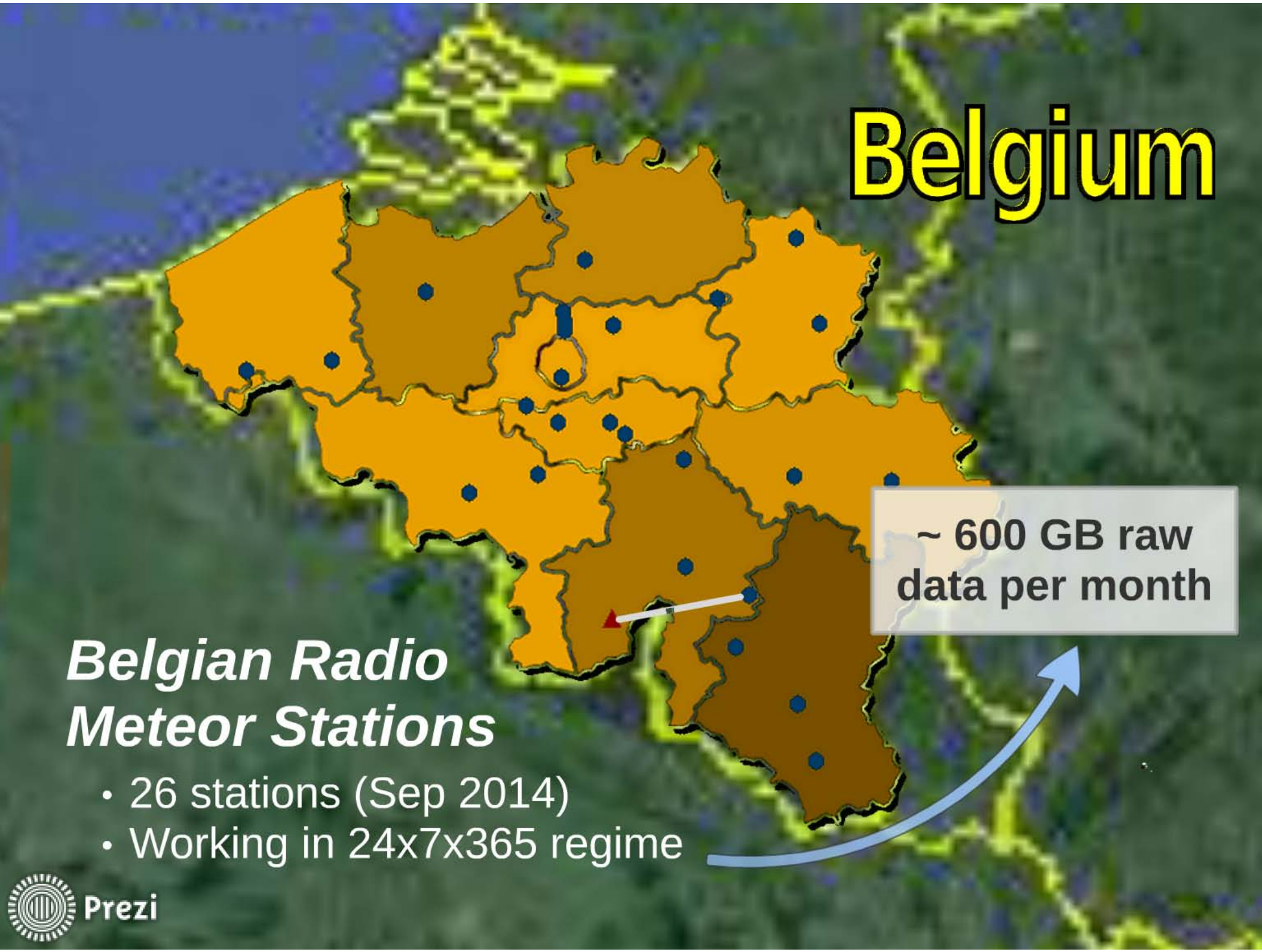
International Meteor Conference 2014

18 - 21 September, Giron - France

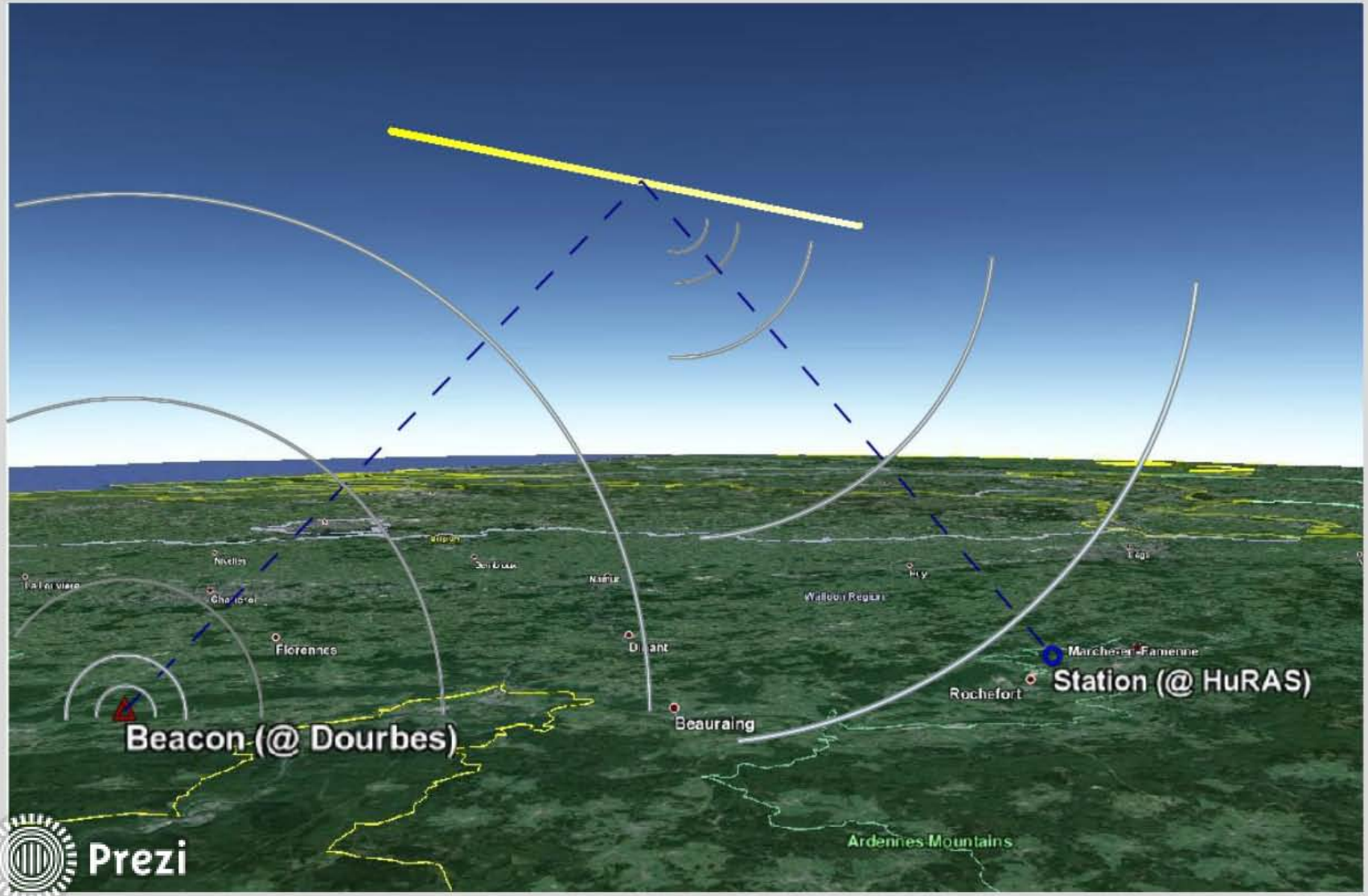
Modeling and Calibration of BRAMS antenna systems

Antonio Martínez Picar

BRAMS – Background


Belgium
~ 600 GB raw data per month
Belgian Radio Meteor Stations
• 26 stations (Sep 2014)
• Working in 24x7x365 regime
Prezi

Forward Scatter



We need more data!

BRAMS **Raw Data**

Processing Machine

- ***Meteoroid Flux Density***
- ***Mass Index***

Some Extra Inputs....

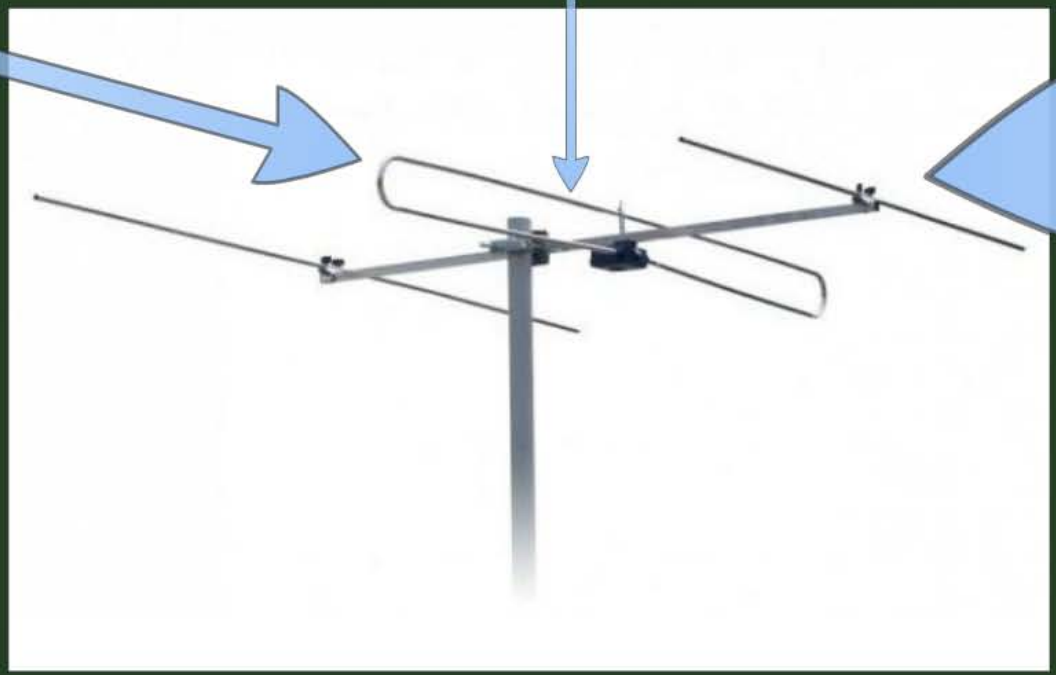
- **Distances**
- **Angles**
- **Gains of the Antennas**

Antennas

- Bidirectional Interfaces
- Guided medium ↔ Unguided medium
- Non constant gain (*3D sensitivity*)

Even lower sensitivity

Low sensitivity

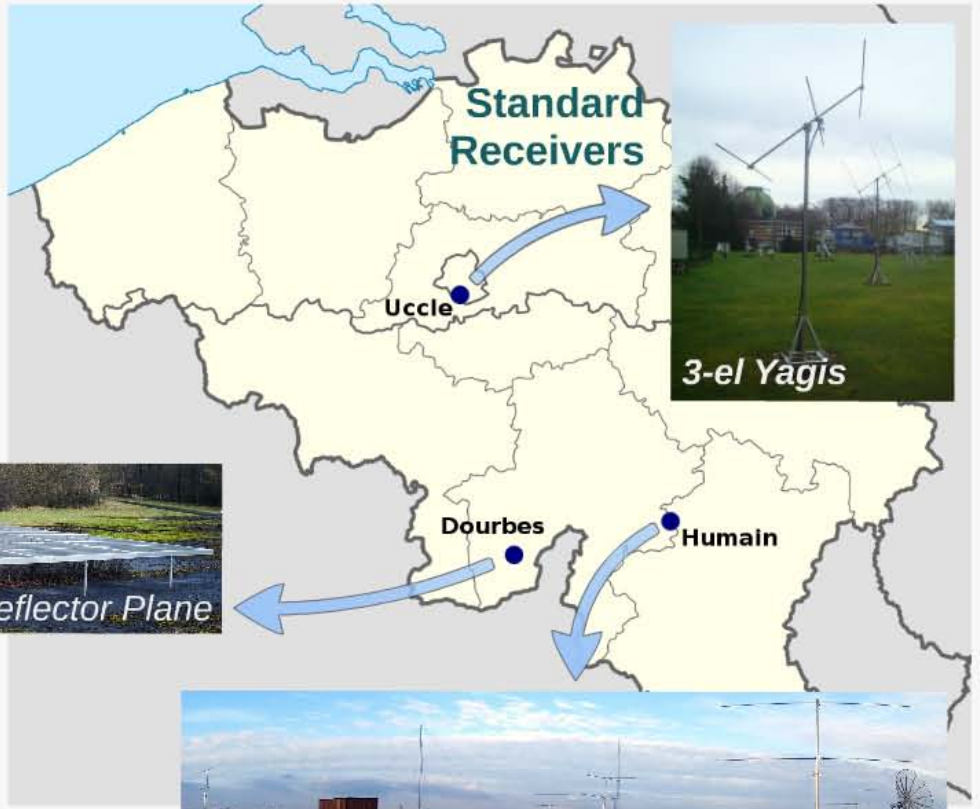


High sensitivity

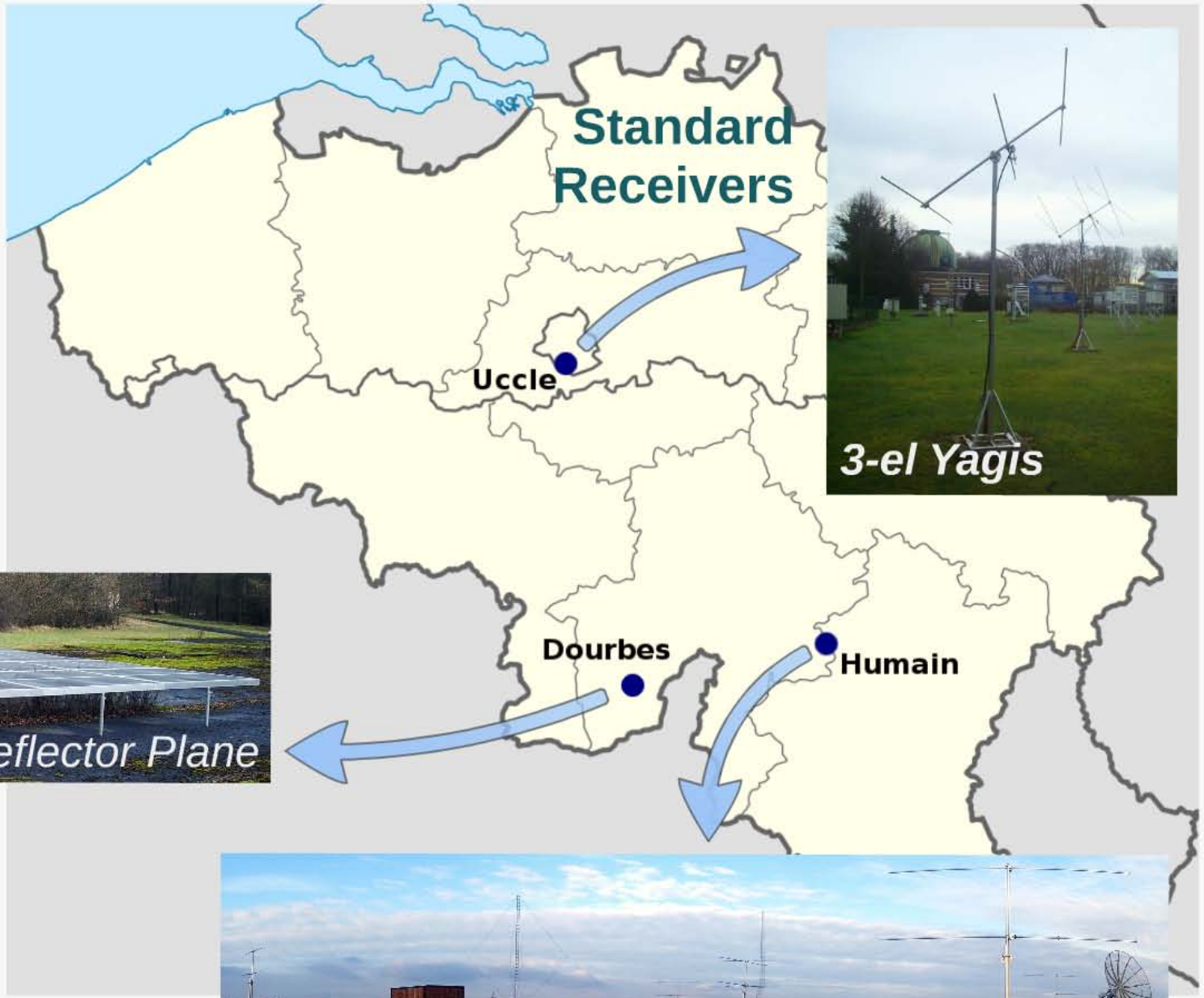
The Project – Antenna Patterns

Main Objective: To obtain a reliable description of the BRAMS antenna patterns

Scope: Stations directly managed by BISA



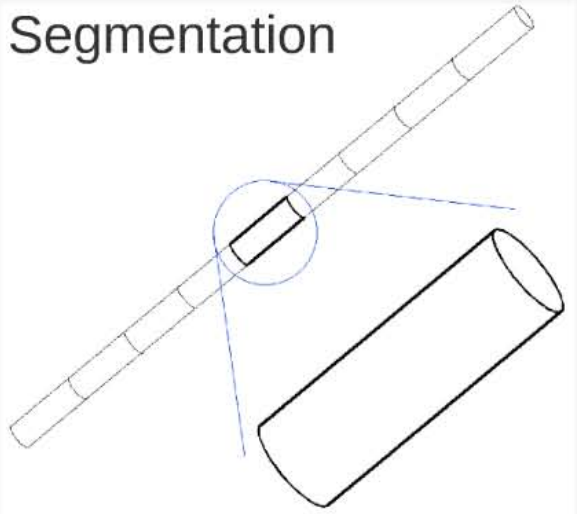
Stations directly managed by BISA

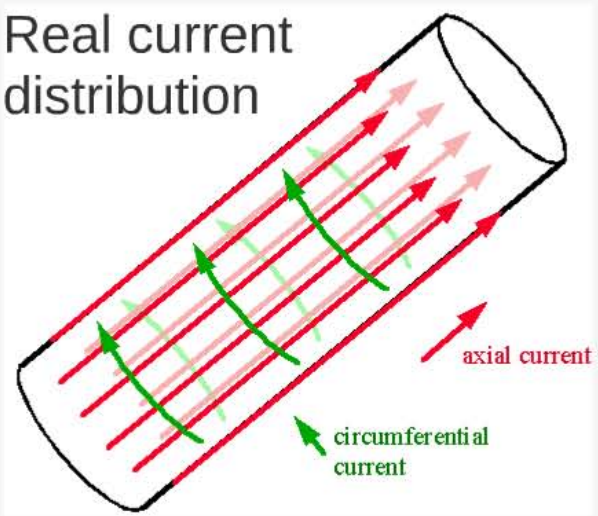


Beacon

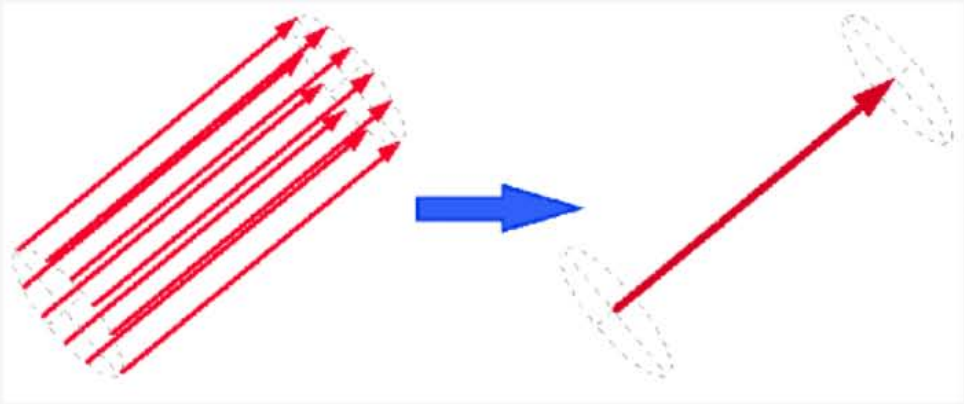
Future Interferometer

NEC { Numerical Electromagnetics Code }

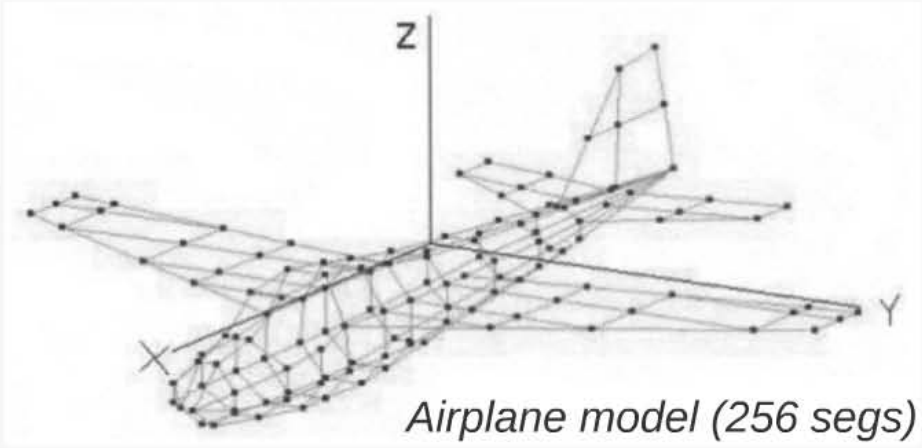




- Based on Method of Moments (**MoM**)
- NEC**2** (1981): Public Domain
- NEC2**C**: Fortran → **C**



"Thin wire" assumption



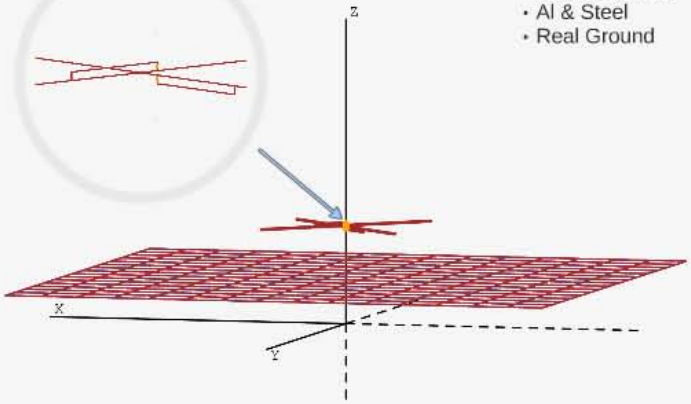
Airplane model (256 segs)

Models

BRAMS Transmitting Antenna @ Dourbes

f = 49.97 MHz

- Y-match adjust.
- 1028 segments
- Al & Steel
- Real Ground

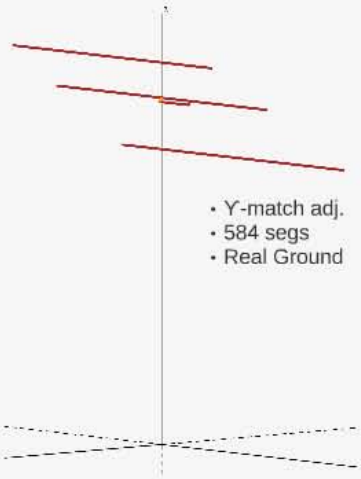


BRAMS Receiving Antennas @ Uccle

f = 49.97 MHz

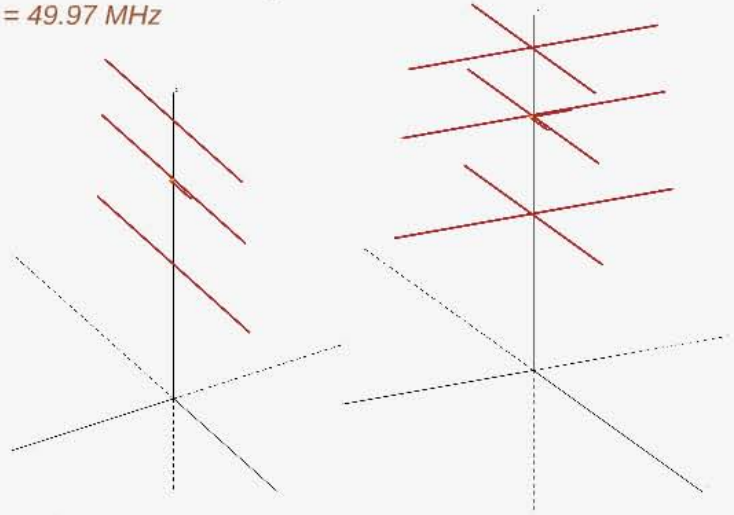
- Y-match adj.
- 1168 segs
- Real Ground

- Y-match adj.
- 584 segs
- Real Ground



BRAMS Receiving Antennas @ Humain

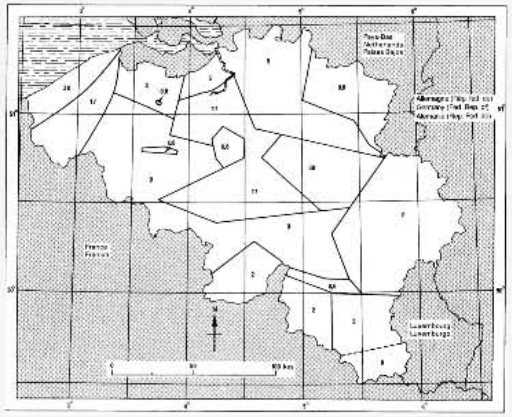
f = 49.97 MHz



Criteria and parameters

- *Segment length ≤ λ/20*
- *Segment length ≤ 8r (radius)*
- *Resistivity of materials*
- *Ground σ and ε*

ITU-R P.832-1



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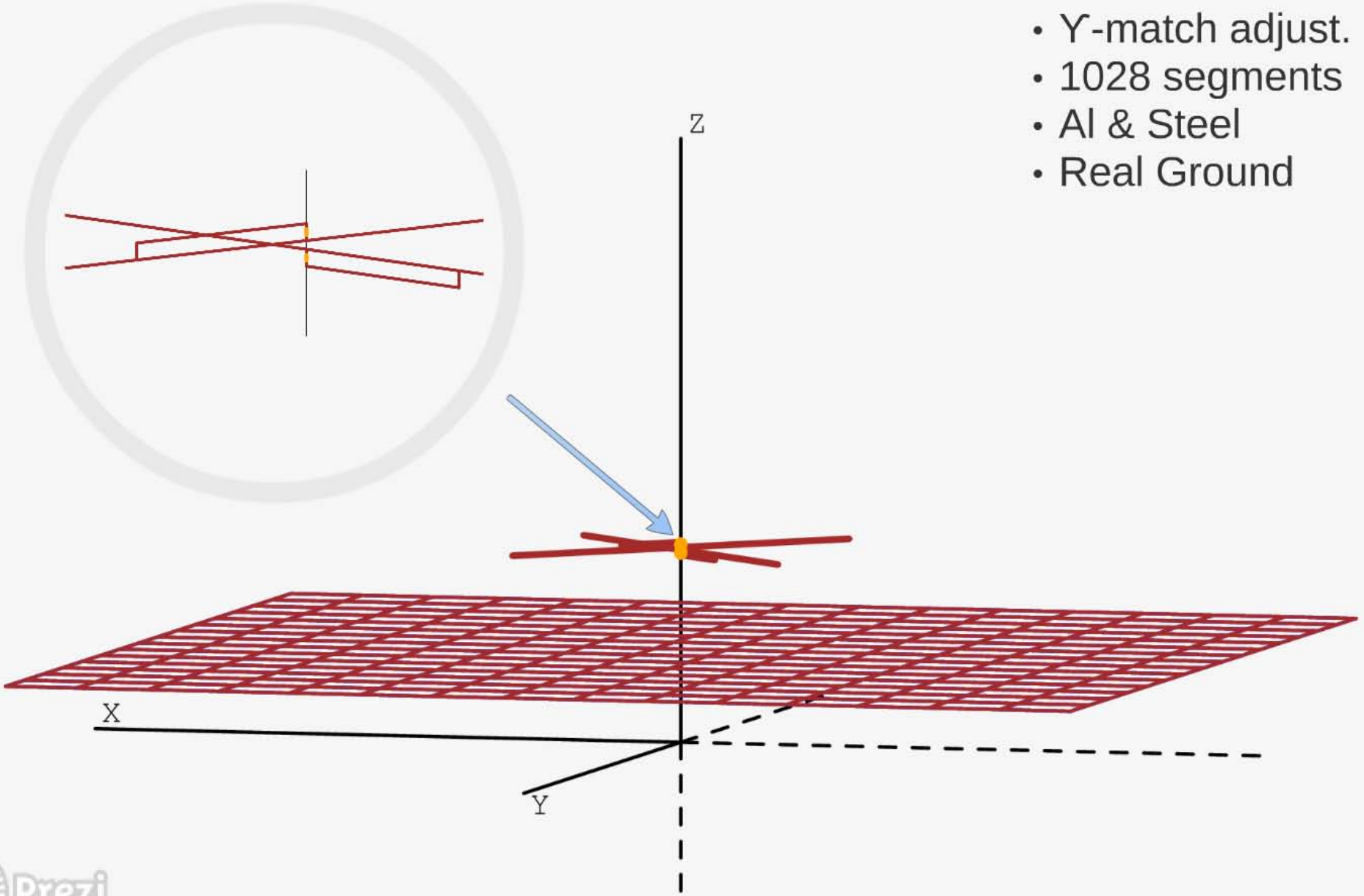

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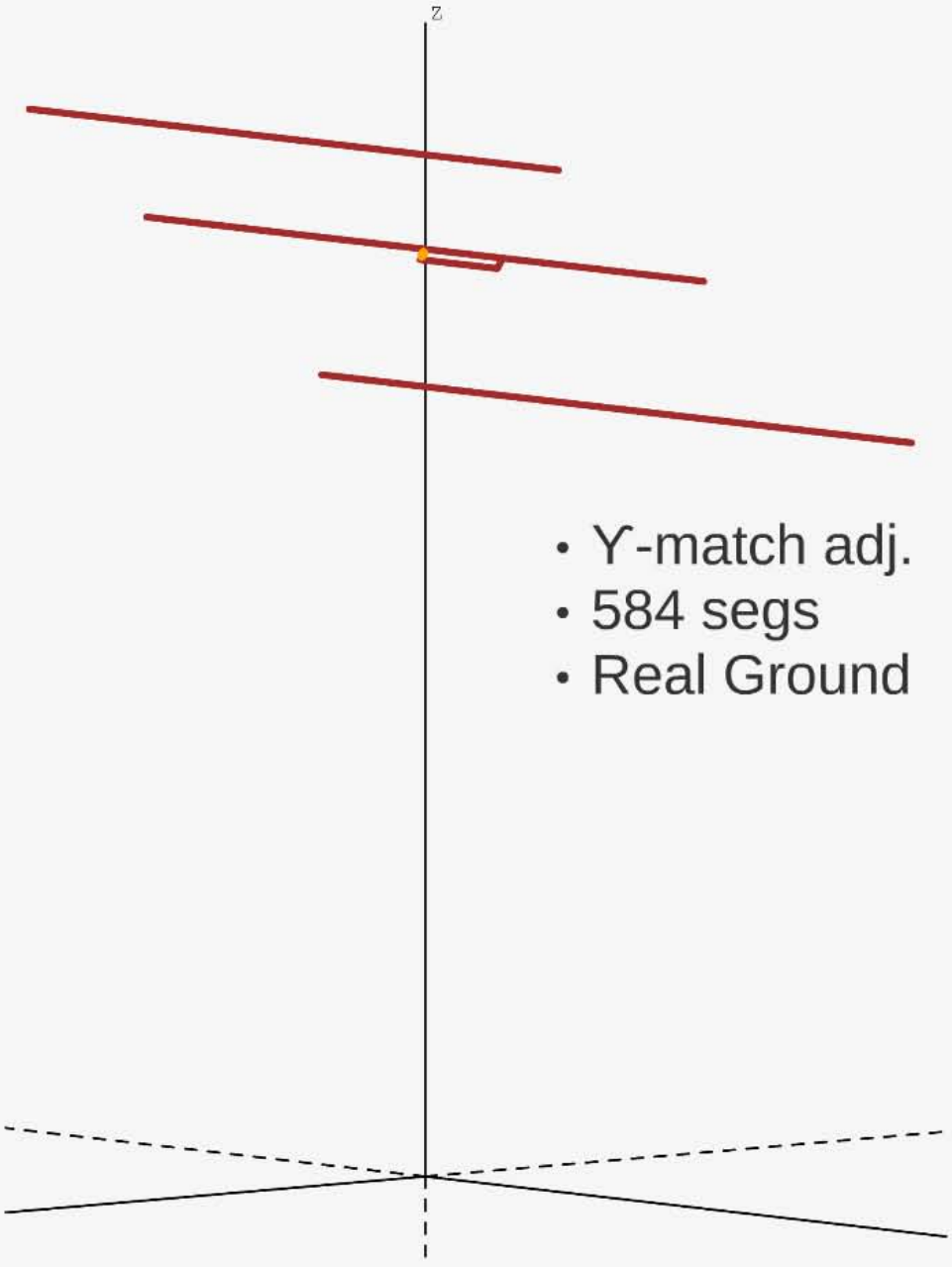

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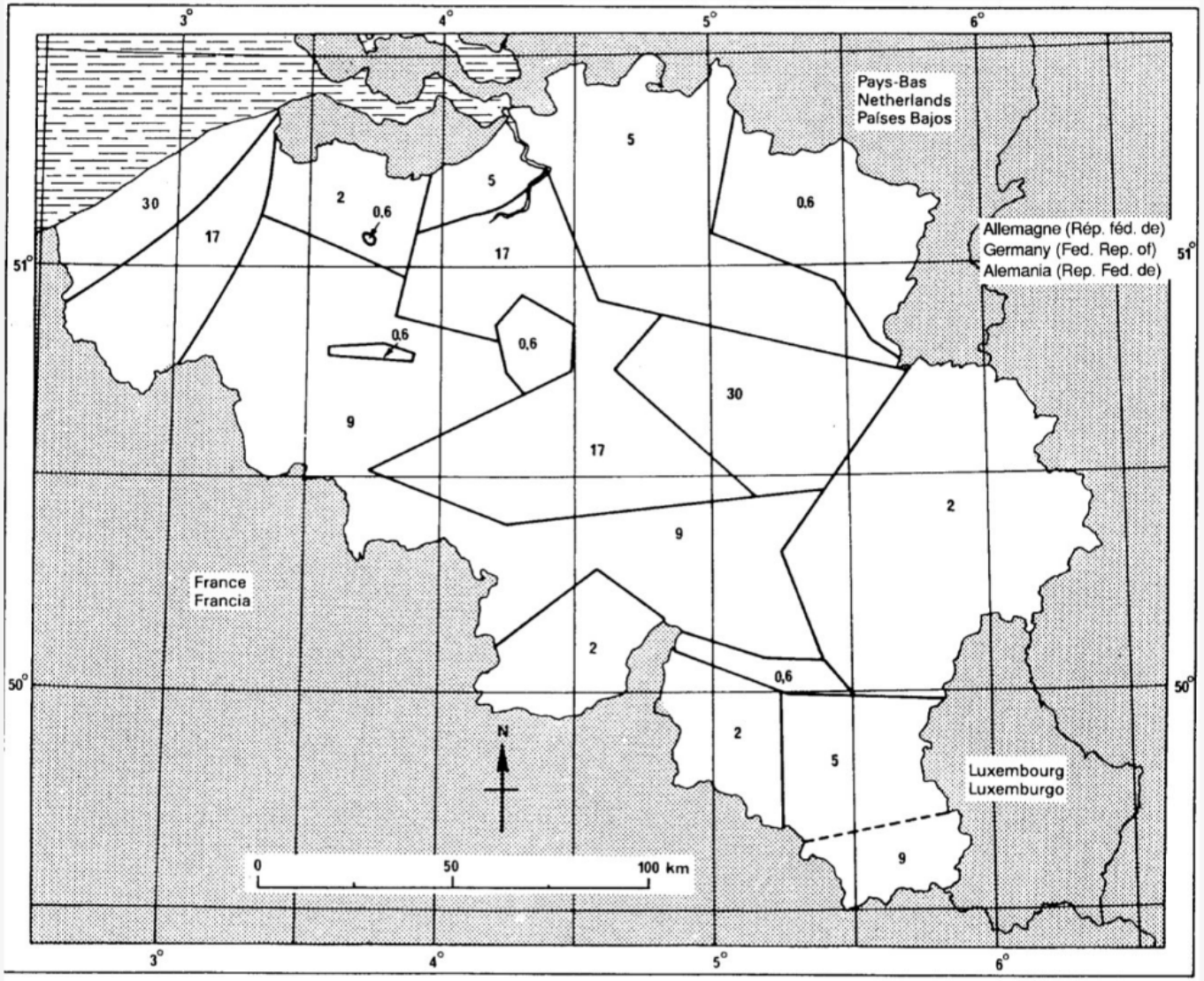
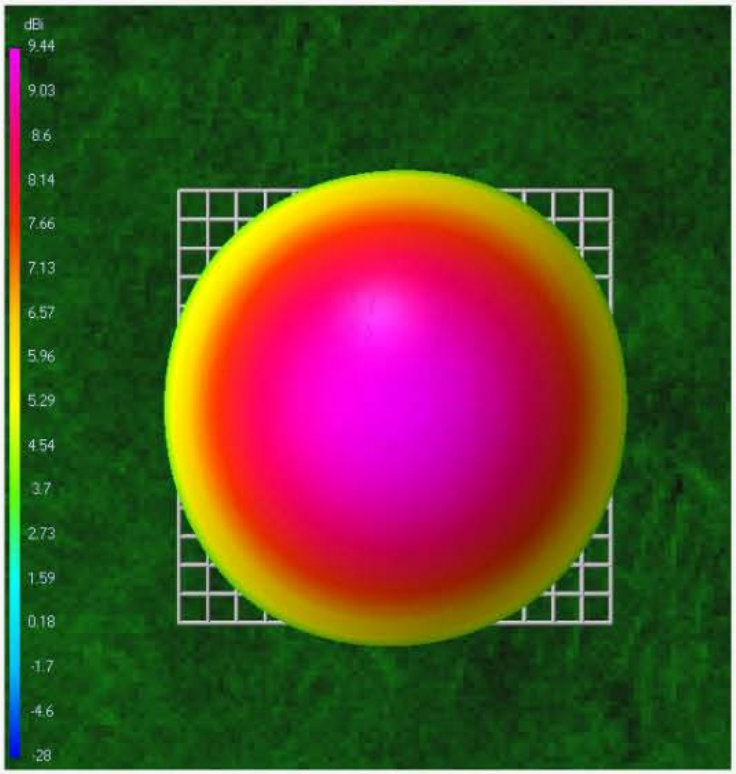
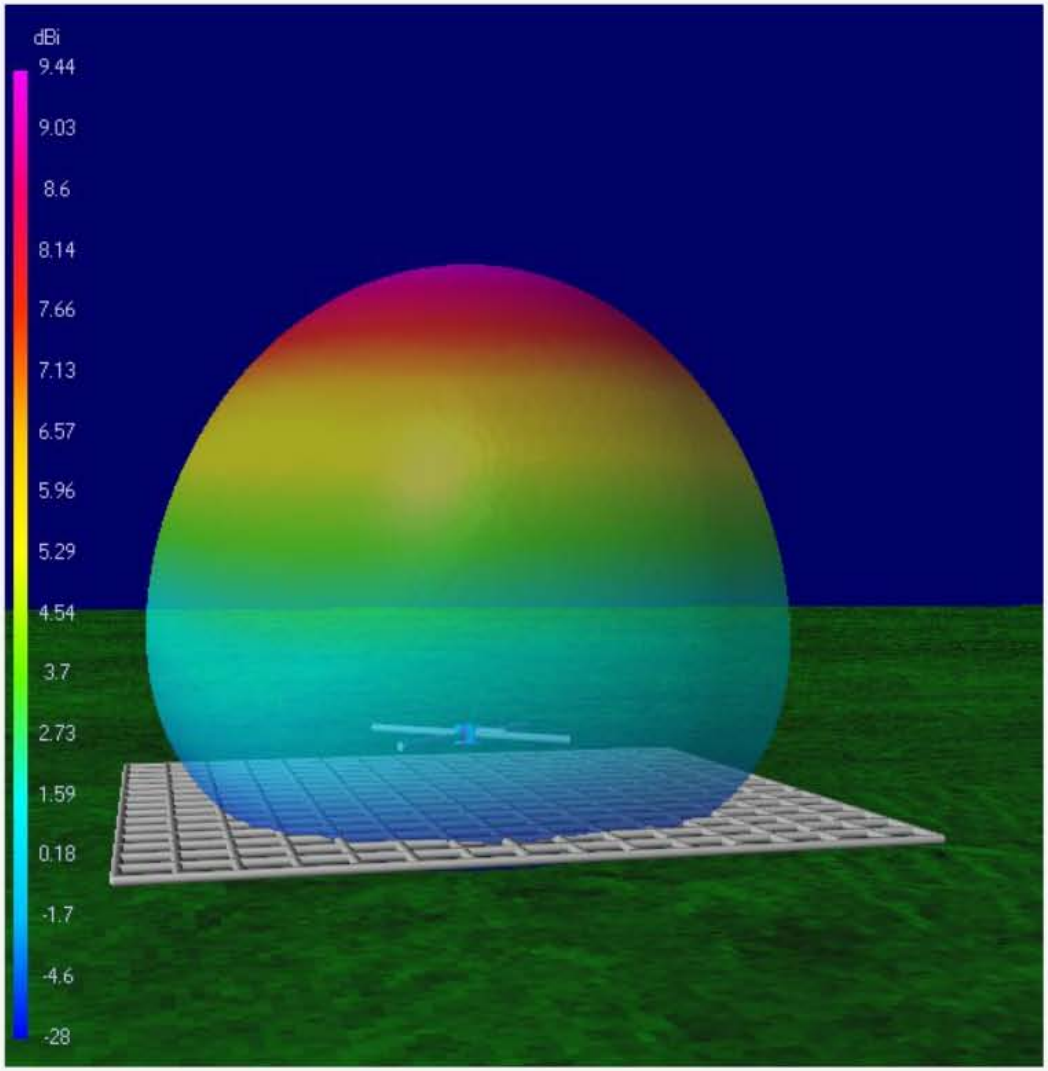


ITU-R P.832-1

Runs

BRAMS Transmitting Antenna
@ Dourbes

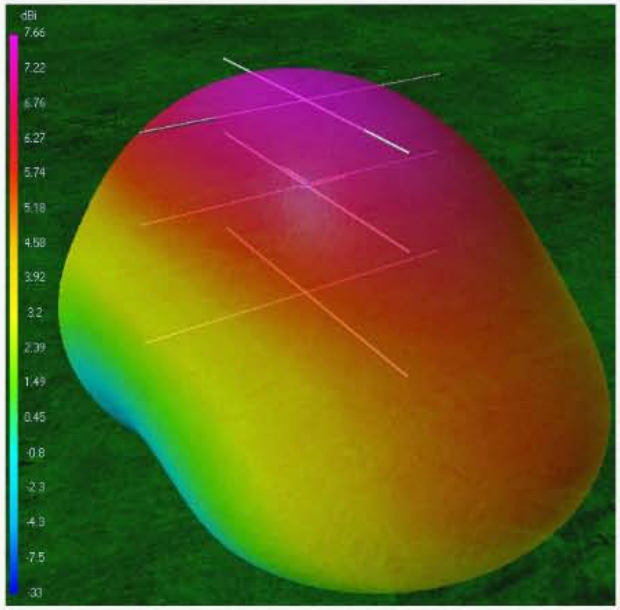




Quality Check:

- Convergence
- Average Gain Test (Free Space)

Receiving Antenna - Yagi Double
@ Humain



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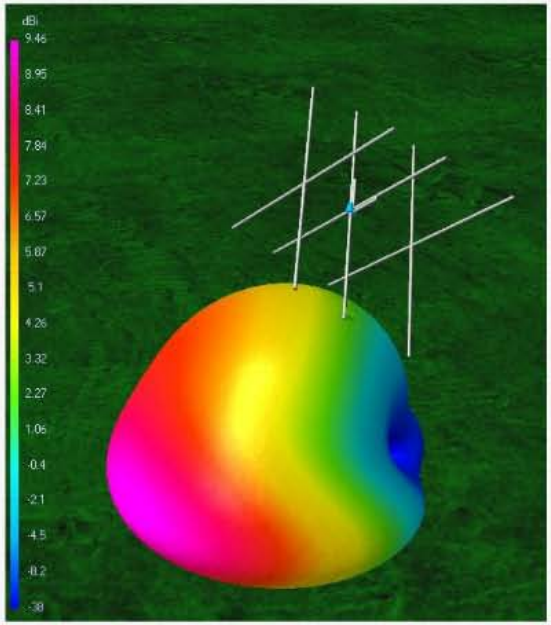
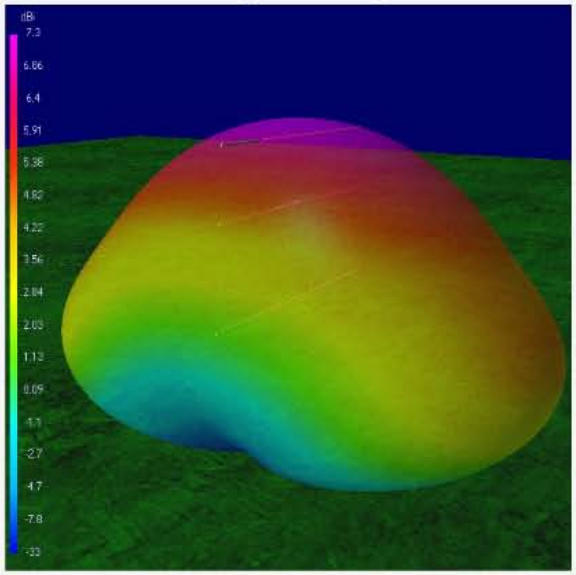
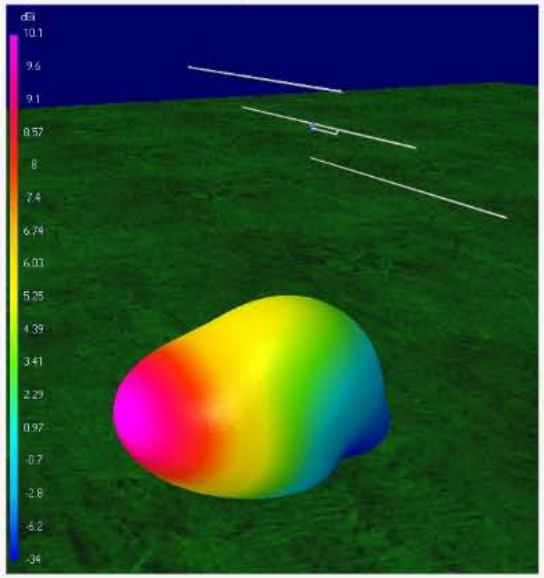


Receiving Antenna - Yagi Single
@ Humain



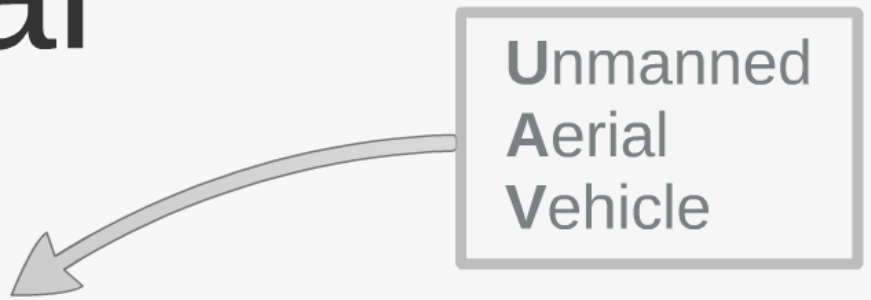
Receiving Antenna - Yagi Single
@ Uccle



Options

{ 3 m ≤ *Far Field Dist.* ≤ 43 m }

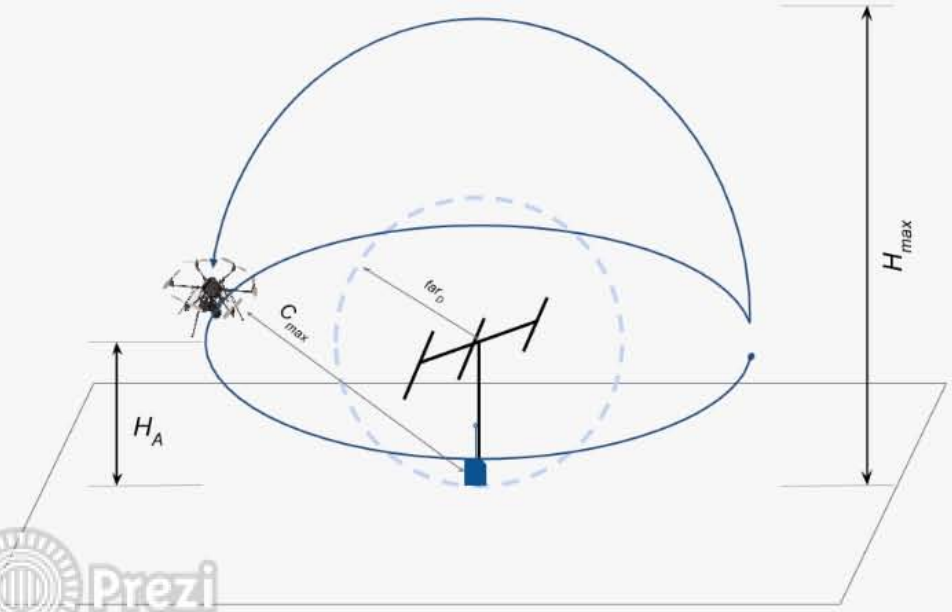
- Pulley system
- Telescopic mast
- Classical
- Balloon
- UAV

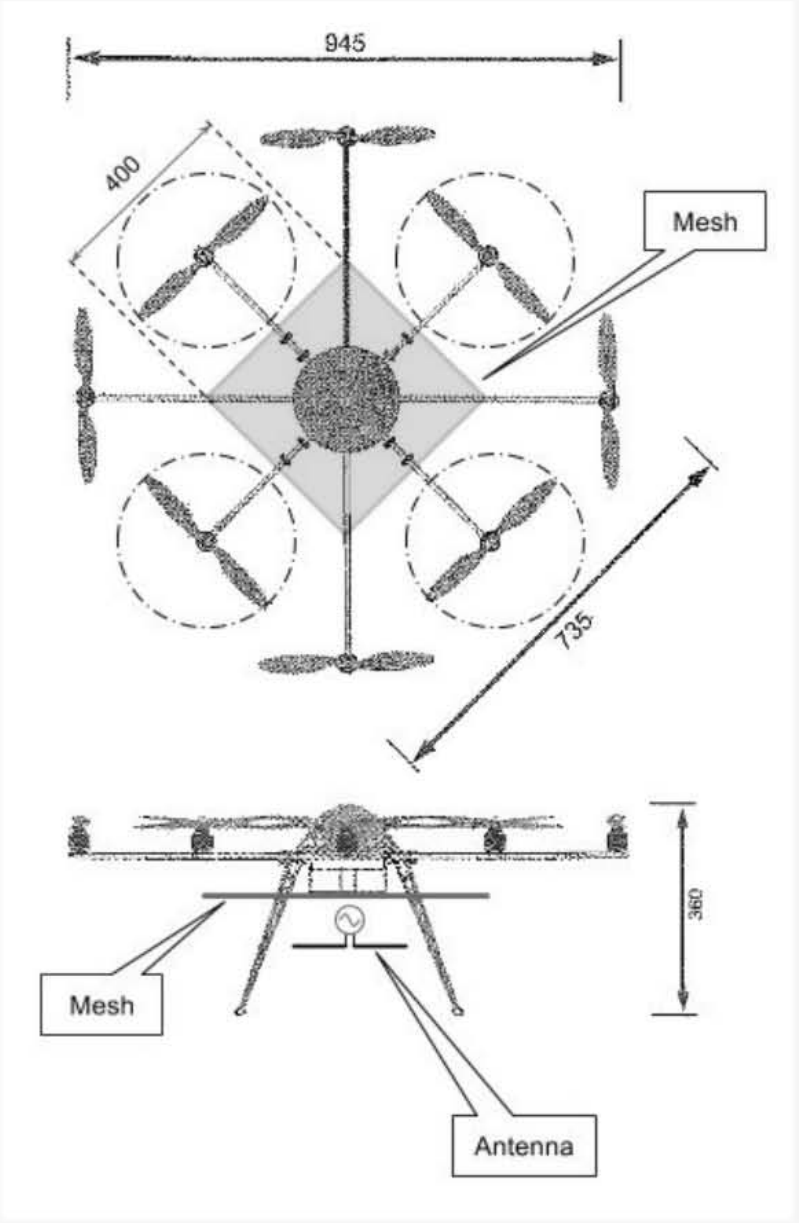


· UAV

OktoXL (Mikrokopter)

- Max Payload: 2.5 kg
- GPS
- Range: 500 m

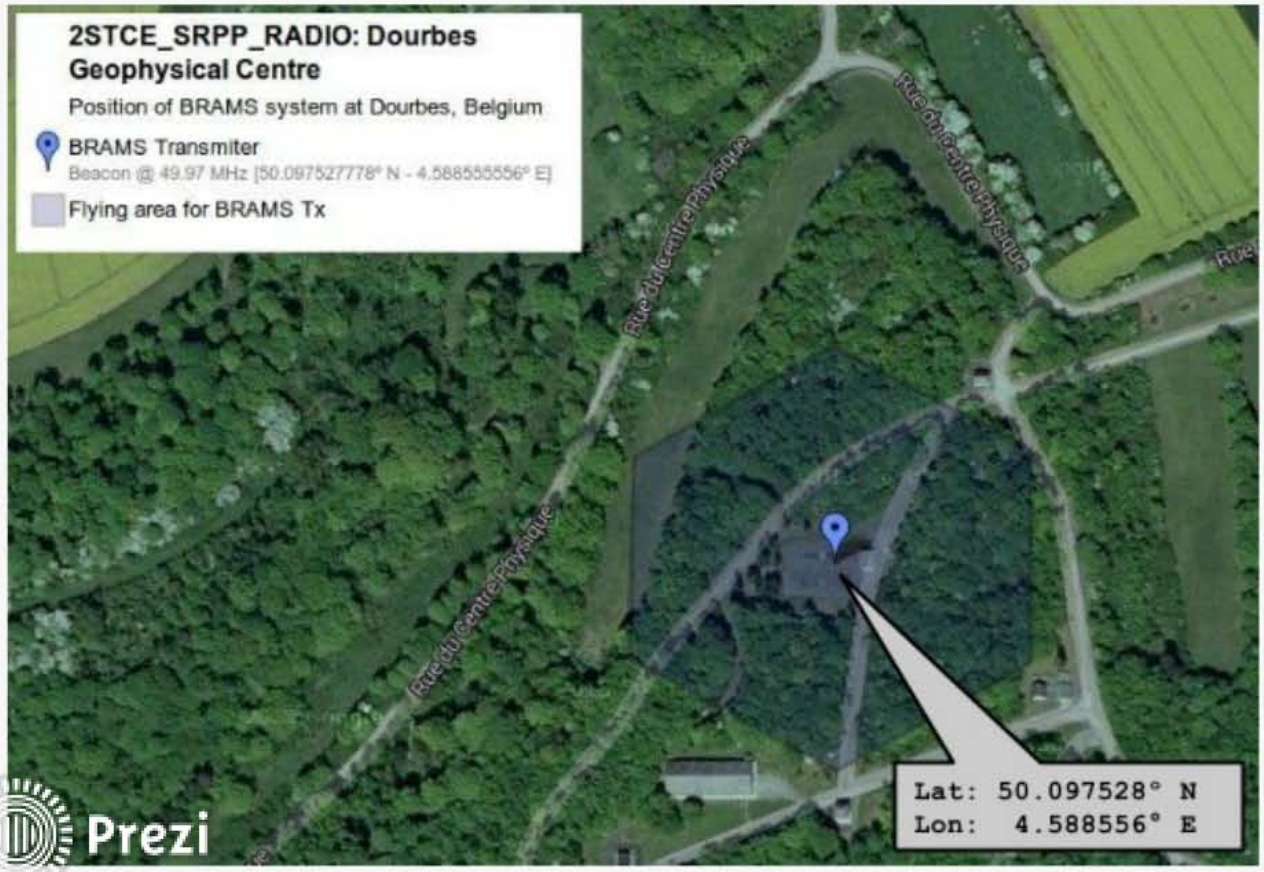




Regulations

Special Flight Permission: R&D

Belgocontrol



- Liability insurance
- Safety procedures
- Training

Final Assembly

EM isolating mesh

Tx + Battery

Legs Extensions

Antenna

First Flights

- Way–point flight
- Testing/tuning
- Wind influence

To Do

- Calibrate the UAV's Tx antenna
- Start long-stay measurement campaigns (more efficient)
- Apply statistical approach and/or Differential GPS (increase on the accuracy in positioning)

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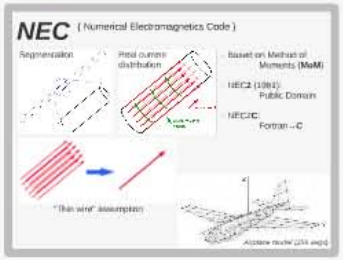
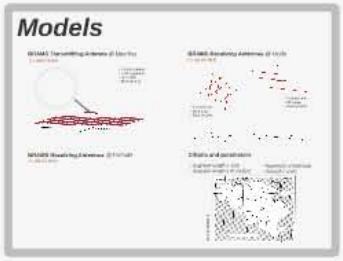
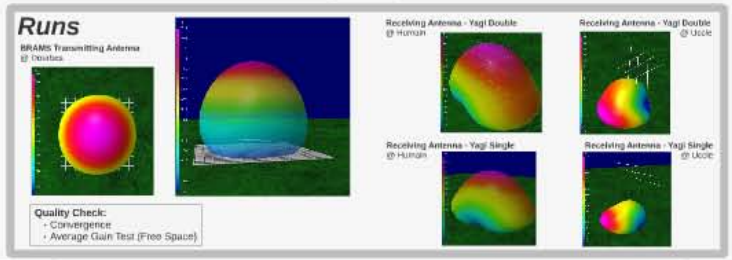


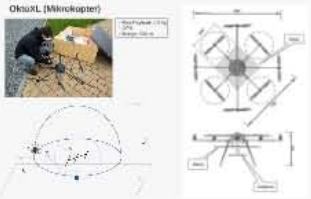




Stage 2 – Measurements

Options (5 m ≤ Far Field Dist. ≤ 43 m)

- Pulley system
- Telescopic mast
- Classical
- Balloon
- UAV



Regulations

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