

# **The Spanish-Portuguese contribution to GGOS**

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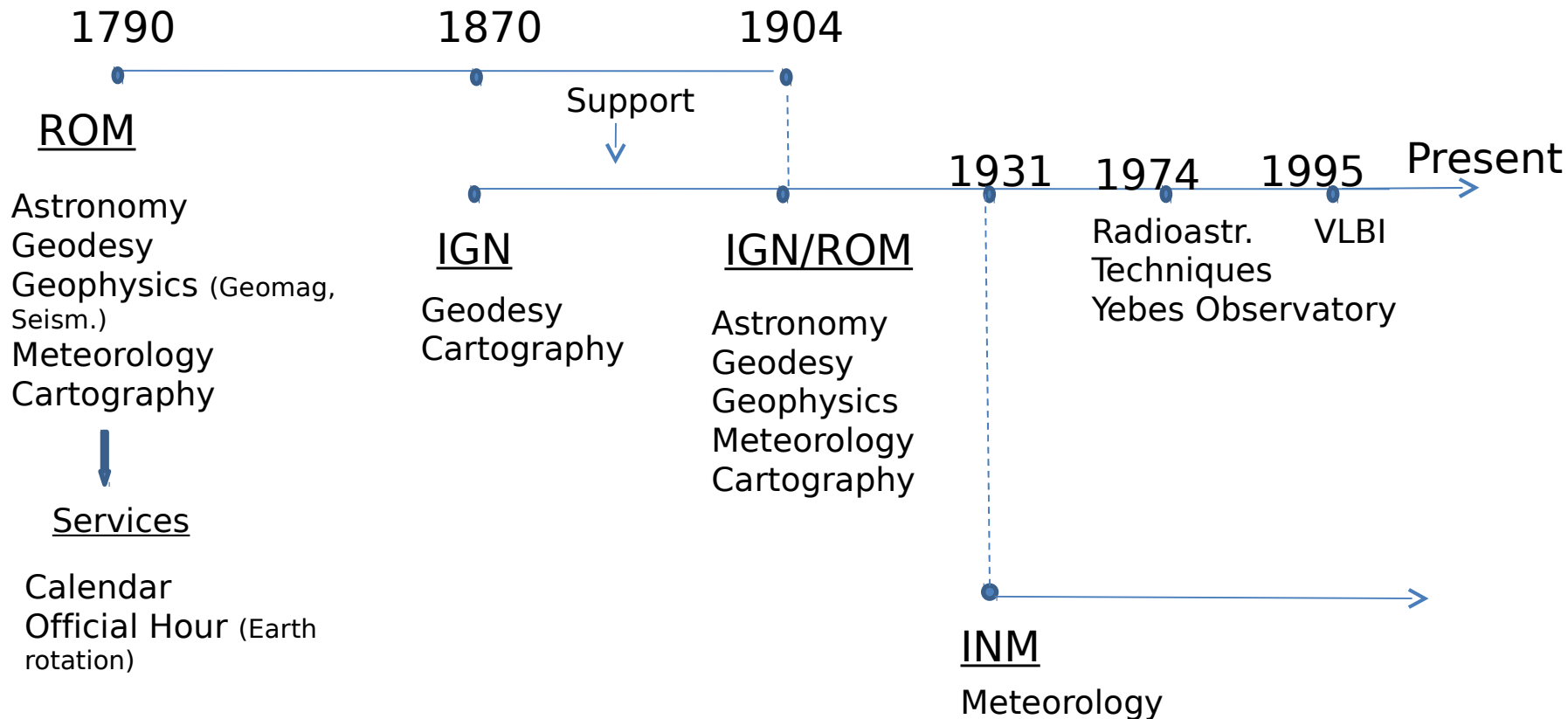
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  - IGN / DRCTC
  - GGOS (in connection with IGN/DRCTC)
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## Goal of this presentation:

To show you the scientific, technical and political reasons which have moved the National Geographic Institute of Spain (IGN) and the Directorate for Science, Technology and Communications (DRCTC) of the Regional Government of Açores (Portugal) to launch the project RAEGE, in the frame of GGOS.

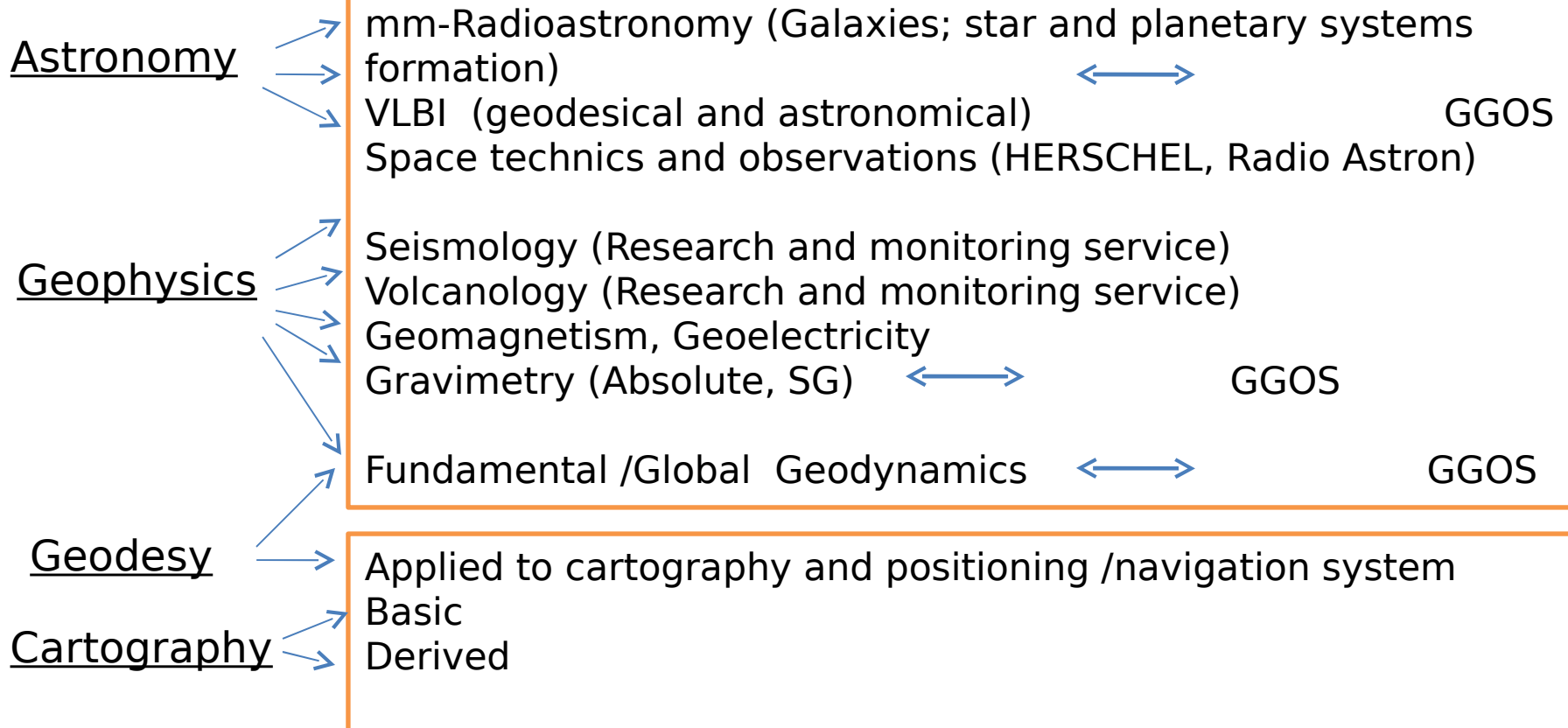
# National Geographic Institute (IGN) / Royal Observatory of Madrid (ROM)



# IGN

## Present activities and projects

### **Dept. Astronomy and Geophysics**



### **Dept. Geodesy and Cartography**

# Directorate of Science, Technology and Communications (DRCTC) of the Regional Government of Azores (Portugal)

- Misions and responsibilities:
  - *Cartography*
  - *Geodesy*
  - *Seismic hazards*
  - *Volcanic hazards*

# **Global Geodetic Observing System (GGOS)**

(Officially adopted by the Global Geodetic Observing System  
Steering Committee 21st Meeting, on July 2, 2011)

## Vision

Advancing our understanding of the dynamic  
Earth system by quantifying our planet's  
changes in space and time

# Mission

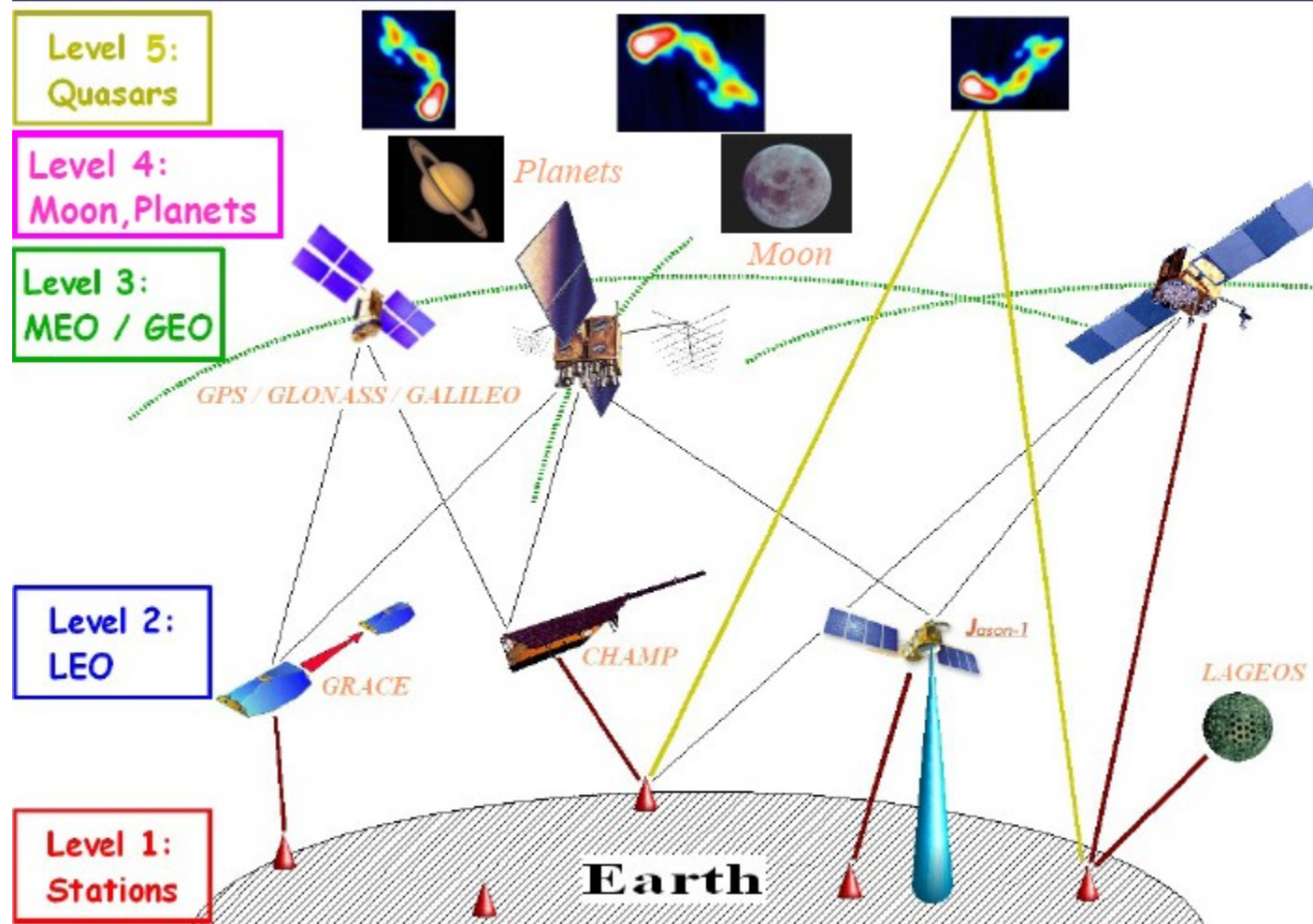
1. To provide the observations needed to monitor, map and understand changes in the Earth's shape, rotation and mass distribution.
2. To provide the global frame of reference that is the fundamental backbone for measuring and consistently interpreting key global change processes and for many other scientific and societal applications.
3. To benefit science and society by providing the foundation upon which advances in Earth and planetary system science and applications are built.



# Goals

1. To be primary source for all global geodetic information and expertise serving society and Earth system science.
2. To actively promote, sustain, improve and evolve the global geodetic infrastructure needed to meeting Earth science and societal requirements.
3. To coordinate the international geodetic Services that are the main source of key parameters needed to realize a stable global frame of reference and to observe and study changes in the dynamic Earth system.
4. To communicate and advocate the benefits of GGOS to user communities, policy makers, funding organizations, and society.

# GGOS Instrumentation: 5 Levels of Objects



Rothacher M., Neilan R. and Plag H-P.  
(2008)

# Level 1: Ground-Based Component



Rothacher M., Neilan R. and Plag H-P.  
(2008)

# Future Core Ground-Based Infrastructure

## Core Network (~ 40 Stations):

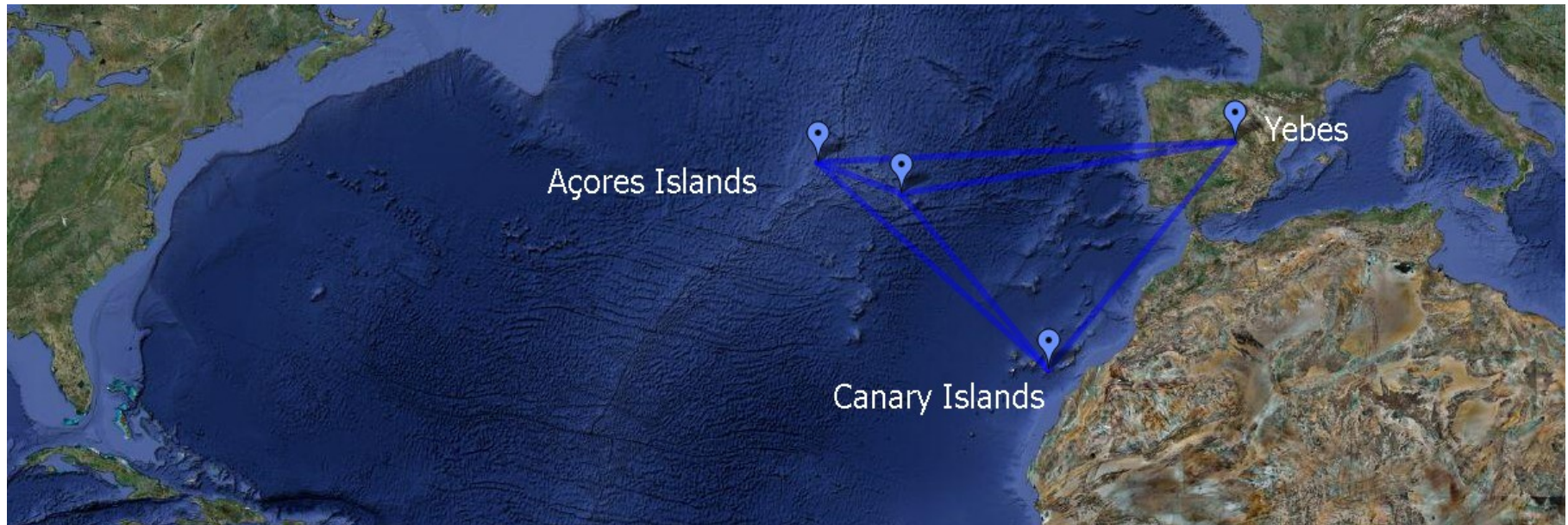
- **2-3 VLBI telescopes** for continuous observations
- **SLR/LLR telescope** for tracking of all major satellites
- **At least 3 GNSS antennas and receivers** (controlled equipment changes)
- **DORIS beacon** of the most recent generation
- **Ultra-stable oscillator** for time and frequency keeping and transfer
- **Terrestrial survey instruments** for permanent/automated local tie monitoring
- **Superconducting and absolute gravimeter** (gravity missions, geocenter)
- **Meteorological sensors** (pressure, temperature, humidity)
- **Seismometer** for combination with deformation from space geodesy and GNSS seismology
- **Additional sensors:** water vapor radiometer, tilt-meters, gyroscopes, ground water sensors, ...

**General Characteristics:** highly automated, 24-hour/365 days, latest technologies

# The RAEGE project

Establishment of an Spanish-Portuguese Network of Geodynamical and Space Geodesy Stations (*RAEGE*) by the installation and operation of four fundamental geodetic stations provided with radio telescopes fulfilling the VLBI 2010 project specifications: Yebes (1), Canary Islands (1) and Açores Islands (2).





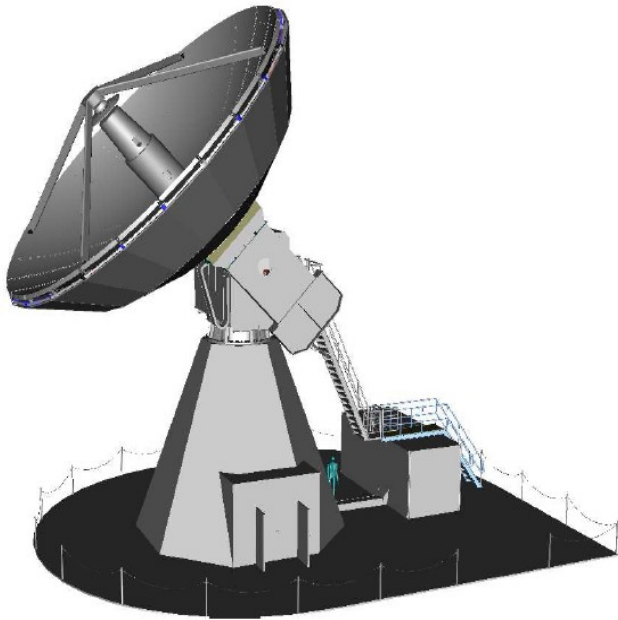
## Baselines:

- Yebes – Tenerife : 1800 km
- Yebes – Santa María : 2000 km
- Yebes – Flores : 2400 km
- Tenerife – Flores : 2000 km
- Santa María – Flores : 540 km

## Initial equipment to be installed at each RAEGE station

- Geodetic VLBI 2010 radio telescope:
  - Diameter  $> 13$  m, freq  $> 45$  GHz
- Gravimeter.
- Permanent GNSS station.
- Satellite Laser Ranging (Yebes).

# New VLBI2010 RAEGE radio telescope by MT Mechatronics including geodetic capabilities set by IGN

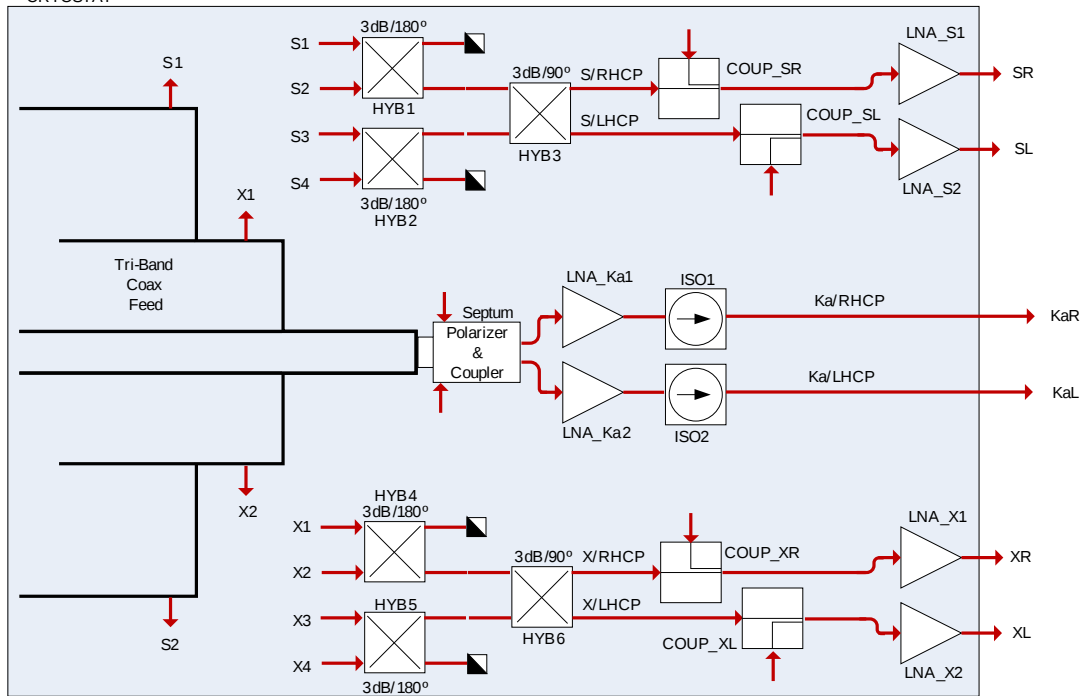


## **Characteristics:**

- 13.2 m RT, ring focus,  $\nu > 45$  GHz (90 GHz)
- S/X and (future) wide band feeds
- $12^\circ/\text{sec}$  (az) &  $6^\circ/\text{sec}$  (el) slew speeds

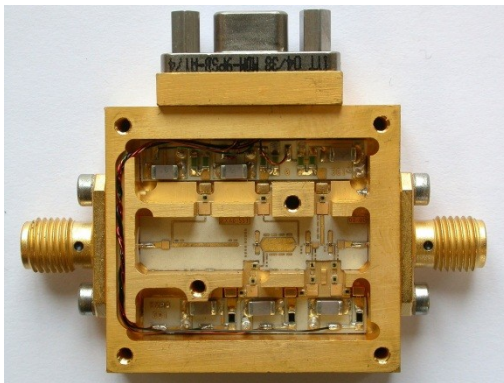
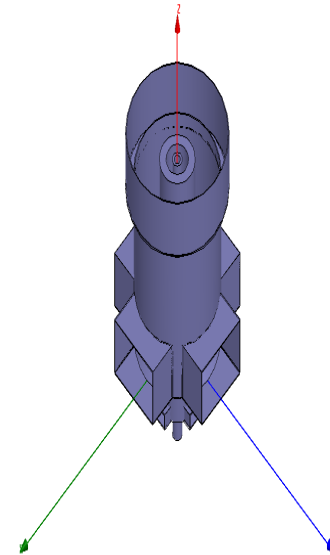


CRYOSTAT



## VLBI2010 developments

- Receivers
- Optics and feeds (S/X/Ka)



# Scientific, technical and political reasons for RAEGE

- Scientific reasons:

IGN / DRCTC are in charge of services in the fields of:

- Geodesy / Cartography
- Seismic hazards
- Volcanic hazards

Better service  Scientific studies and research

# Scientific studies and research of interest

## . **VLBI**

- \_ Global Geodynamics
- \_ Earth rotation
- \_ ITRF
- \_ Sea level change (continent, islands)

## . **GNSS**

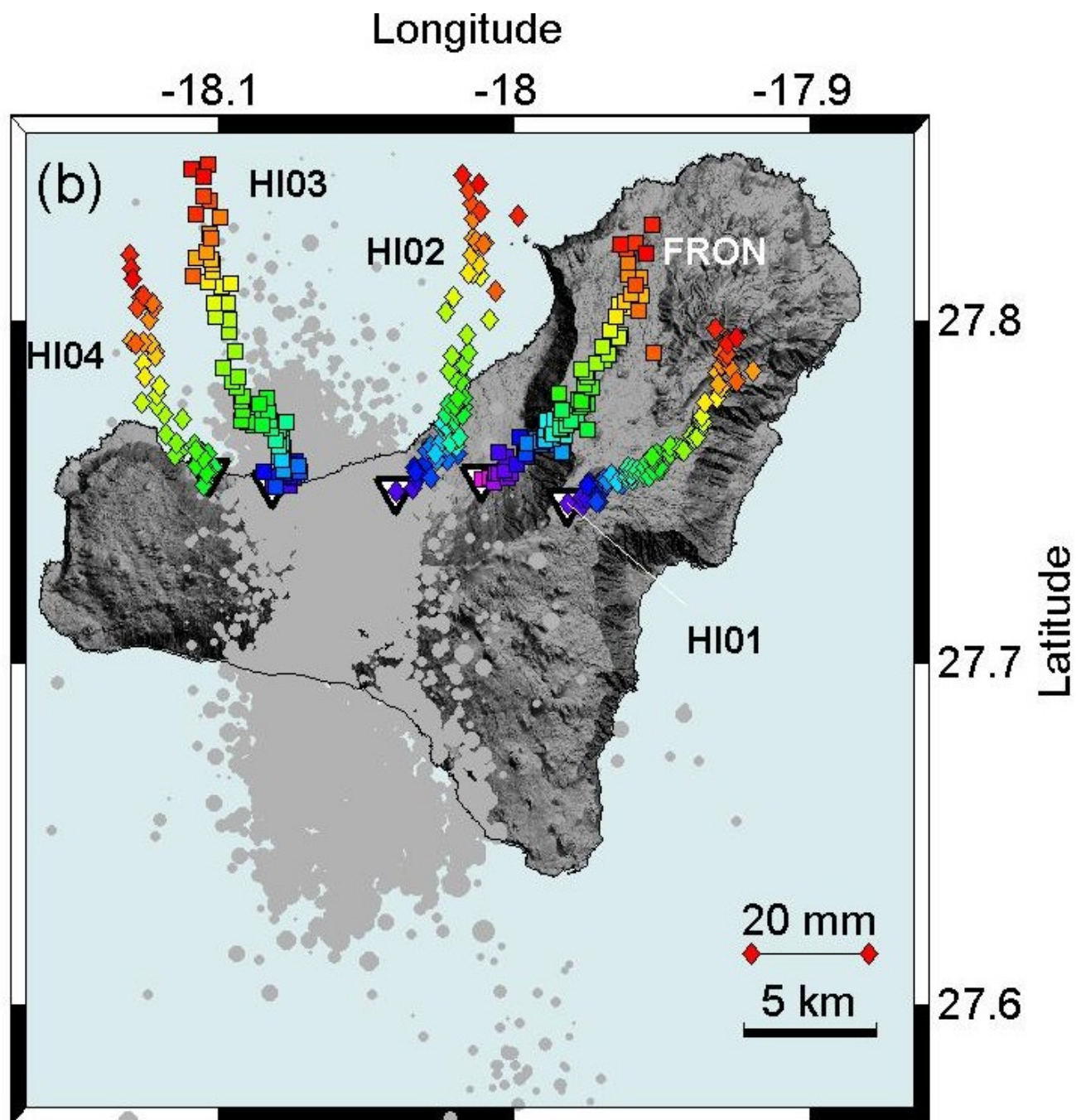
- \_ Regional Geodynamics (Azores, Canaries)
- \_ Volcanic monitoring and warning.

## . **Gravimetry**

- \_ Absolute
- \_ Superconducting

## . **SLR**

- \_ Yebes. Geodetic Fundamental Station



# RAEGE

- Technical reasons:

## Development of Technology / Instrumentacion

### Ø Radioastronomical techniques

- Antennas (radio telescopes, feeds, holography,....)
- Receivers (front-ends, back-ends, components)

### Ø Techniques of electronics, microwaves, informatics, communications.

# RAEGE

- Political reasons:

- ø Economical development through Scientific Research & Technical Development.

- High qualified engineers and scientists for society
  - Technology transfer to companies

- ø Iberic (Spain-Portugal) cooperation / European cooperation.

- ø International cooperation at a global level

- ø Special projection to Iberoamerica

# The frame of GGOS (VLBI2010)

## Interest for RAEGE

1. Added value to our works and activities  
(because of the integration in a global project)
3. Advantages in development of instrumentation.
  - Better prices (ex. RAEGE antennas in connection with the Twin Telescope Wettzell)
  - Know-how transfer between institutions
  - Possibility of coordination in the technical developments.

# The frame of GGOS (VLBI2010)

## Interest for RAEGE

3. Advantages in operation
  - Regional operation of installations (Wettzell, Yebes, TIGO...)
4. Greater guarantee for the continuity of activities  
(financing compromise of Governments, ...?)
6. Broadening of the Scientific activities field.



**NOVEMBER 5,  
2011**



**THANKS.**